GE Medical Systems

Technical Publications

DIRECTION 2138868–100

Revision 31

Advantx–E® Calibration Users Guide VOLUME 1

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ATTENTION

LES APPAREILS À RAYONS X SONT DANGEREUX À LA FOIS POUR LE PATIENT ET POUR LE MANIPULATEUR SI LES MESURES DE PROTECTION NE SONT PAS STRICTEMENT APPLIQUEES

Bien que cet appareil soit construit selon les normes de sécurité les plus sévères, la source de rayonnement X représente un danger lorsque le manipulateur est non qualifié ou non averti. Une exposition excessive au rayonnement X entraîne des dommages à l'organisme.

Par conséquent, toutes les précautions doivent être prises pour éviter que les personnes non autorisées ou non qualifiées utilisent cet appareil créant ainsi un danger pour les autres et pour elles–mêmes.

Avant chaque manipulation, les personnes qualifiées et autorisées à se servir de cet appareil doivent se renseigner sur les mesures de protection établies par la Commission Internationale de la Protection Radiologique, Annales 26 : Recommandations de la Commission Internationale sur la Protection Radiologique et les normes nationales en vigueur.

WARNING

X–RAY EQUIPMENT IS DANGEROUS TO BOTH PATIENT AND OPERATOR UNLESS MEASURES OF PROTECTION ARE STRICTLY OBSERVED

Though this equipment is built to the highest standards of electrical and mechanical safety, the useful x–ray beam becomes a source of danger in the hands of the unauthorized or unqualified operator. Excessive exposure to x–radiation causes damage to human tissue.

Therefore, adequate precautions must be taken to prevent unauthorized or unqualified persons from operating this equipment or exposing themselves or others to its radiation.

Before operation, persons qualified and authorized to operate this equipment should be familiar with the Recommendations of the International Commission on Radiological Protection, contained in Annals Number 26 of the ICRP, and with applicable national standards.

ATENCION

LOS APARATOS DE RAYOS X SON PELIGROSOS PARA EL PACIENTE Y EL MANIPULADOR CUANDO LAS NORMAS DE PROTECCION NO ESTAN OBSERVADAS

Aunque este aparato está construido según las normas de seguridad más estrictas, la radiación X constituye un peligro al ser manipulado por personas no autorizadas o no cualificadas. Una exposición excesiva a la radiación X puede causar lesiones al organismo.

Por consiguiente, se deberán tomar todas las precauciones necesarias para evitar que las personas no cualificadas o no autorizadas utilicen este aparato, lo que sería un peligro para los demás y para sí mismas.

Antes de efectuar las manipulaciones, las personas habilitadas y competentes en el uso de este aparato, deberán informarse sobre las normas de protección fijadas por la Comisión Internacional de la Protección Radiológica, Anales No 26: Recomendaciónes de la Comisión Internacional sobre la Protección Radiológica y otras normas nacionales.

ACHTUNG

RÖNTGENAPPARATE SIND EINE GEFAHR FÜR PATIENTEN SOWIE BEDIENUNGSPERSONAL, WENN DIE GELTENDEN SICHERHEITSVORKEHRUNGEN NICHT GENAU BEACHTET WERDEN

Dieser Apparat entspricht in seiner Bauweise strengsten elektrischen und mechanischen Sicherheitsnormen, doch in den Händen unbefugter oder unqualifizierter Personen wird er zu einer Gefahrenquelle. Übermäßige Röntgenbestrahlung ist für den menschlichen Organismus schädlich.

Deswegen sind hinreichende Vorsichtsmaßnahmen erforderlich, um zu verhindern, daß unbefugte oder unqualifizierte Personen solche Geräte bedienen oder sich selbst und andere Personen deren Bestrahlung aussetzen.

Vor Inbetriebnahme dieses Apparats sollte sich das qualifizierte und befugte Bedienungspersonal mit den geltenden Kriterien für den gefahrlosen Strahleneinsatz durch sorgfältiges Studium des Hefts Nr. 26 der Internationalen Kommission für Strahlenschutz (ICRP) vertraut machen: Empfehlungen der Internationalen Kommission für Strahlenschutz und nationale Normenbehörden.

WARNING



DO NOT ATTEMPT TO SERVICE THE EQUIPMENT UNLESS THIS SERVICE MANUAL HAS BEEN CONSULTED AND IS UNDERSTOOD

If a customer's service provider requires a language other than English, it is the customer's responsibility to provide translation services.

This Service Manual is available in English only.

Failure to heed this warning may result in injury to the service provider, operator or patient from electric shock, mechanical or other hazards.

ATTENTION



NE PAS TENTER D'INTERVENIR SUR LES ÉQUIPEMENTS TANT QUE LE MANUEL SERVICE N'A PAS ÉTÉ CONSULTÉ ET COMPRIS

Ce Manuel de service n'est disponible qu'en anglais.

Si le technicien du client a besoin de ce manuel dans une autre langue que l'anglais, c'est au client qu'il incombe de le faire traduire.

Le non-respect de cet avertissement peut entraîner chez le technicien, l'opérateur ou le patient des blessures dues à des dangers électriques, mécaniques ou autres.

ATENCION



NO SE DEBERÁ DAR SERVICIO TÉCNICO AL EQUIPO, SIN HABER CONSULTADO Y COMPRENDIDO ESTE MANUAL DE SERVICIO.

Este Manual de Servicio sólo existe en inglés.

Si algún proveedor de servicios ajeno a GEMS solicita un idioma que no sea el inglés, es responsabilidad del cliente ofrecer un servicio de traducción.

La no observancia del presente aviso puede dar lugar a que el proveedor de servicios, el operador o el paciente sufran lesiones provocadas por causas eléctricas, mecánicas o de otra naturaleza.

WARNUNG



ERSUCHEN SIE NICHT DIESE ANLAGE ZU WARTEN, OHNE DIESE SERVICEANLEITUNG GELESEN UND VERSTANDEN ZU HABEN.

Diese Serviceanleitung existiert nur in englischer Sprache.

Falls ein fremder Kundendienst eine andere Sprache benötigt, ist es Aufgabe des Kunden für eine entsprechende Übersetzung zu sorgen.

Wird diese Warnung nicht beachtet, so kann es zu Verletzungen des Kundendiensttechnikers, des Bedieners oder des Patienten durch Stromschläge, mechanische oder sonstige Gefahren kommen.

ATENÇAO

NÃO TENTE REPARAR O EQUIPAMENTO SEM TER CONSULTADO E COMPREENDIDO ESTE MANUAL DE ASSISTÊNCIA TÉCNICA

Este Manual de Assistência Técnica só se encontra disponível em Inglês.

Se qualquer outro serviço de assistência técnica, que não a GEMS, solicitar estes manuais noutro idioma, é da responsabilidade do cliente fornecer os serviços de tradução.

O não cumprimento deste aviso pode por em perigo a segurança do técnico, operador ou paciente devido a‘ choques elétricos, mecânicos ou outros.

AVVERTENZA

SI PROCEDA ALLA MANUTENZIONE DELL’APPARECCHIATURA SOLO DOPO AVER CONSULTATO IL PRESENTE MANUALE ED AVERNE COMPRESO IL CONTENUTO

Il presente manuale di manutenzione è disponibile soltanto in inglese.

Se un addetto alla manutenzione esterno alla GEMS richiede il manuale in una lingua diversa, il cliente è tenuto a provvedere direttamente alla traduzione.

Non tenere conto della presente avvertenza potrebbe far compiere operazioni da cui derivino lesioni all’addetto alla manutenzione, all’utilizzatore ed al paziente per folgorazione elettrica, per urti meccanici od altri rischi.

警告

・このサービスマニュアルには英語版しかありません。
・ＧＥＭＳ以外でサービスを担当される業者が英語以外の言語を要求される場合、翻訳作業はその業者の責任で行うものとさせていただきます。
・このサービスマニュアルを熟読し理解せずに、装置のサービスを行わないで下さい。
・この警告に従わない場合、サービスを担当される方、操作員あるいは患者さんが、感電や機械的又はその他の危険により負傷する可能性があります。

注意:

- 本维修手册仅存有英文本。
- 非 GEMS 公司的维修员要求非英文本的维修手册时，客户需自行负责翻译。
- 未详细阅读和完全了解本手册之前，不得进行维修。
- 忽略本注意事项会对维修员，操作员或病人造成触电，机械伤害或其他伤害。

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Advantx-E Calibration Users Guide

IMPORTANT! . . . X-RAY PROTECTION



X-ray equipment if not properly used may cause injury. Accordingly, the instructions herein contained should be thoroughly read and understood by everyone who will use the equipment before you attempt to place this equipment in operation. The General Electric Company, Medical Systems Group, will be glad to assist and cooperate in placing this equipment in use.

Although this apparatus incorporates a high degree of protection against x-radiation other than the useful beam, no practical design of equipment can provide complete protection. Nor can any practical design compel the operator to take adequate precautions to prevent the possibility of any persons carelessly exposing themselves or others to radiation.

It is important that everyone having anything to do with x-radiation be properly trained and fully acquainted with the recommendations of the National Council on Radiation Protection and Measurements as published in NCRP Reports available from NCRP Publications, 7910 Woodmont Avenue, Room 1016, Bethesda, Maryland 20814, and of the International Commission on Radiation Protection, and take adequate steps to protect against injury.

The equipment is sold with the understanding that the General Electric Company, Medical Systems Group, its agents, and representatives have no responsibility for injury or damage which may result from improper use of the equipment.

Various protective material and devices are available. It is urged that such materials or devices be used.

CAUTION: United States Federal law restricts this device to use by or on the order of a physician.

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If you have any comments, suggestions or corrections to the information in this document, please write them down, include the document title and document number, and send them to:

GENERAL ELECTRIC COMPANY MEDICAL SYSTEMS
MANAGER – INFORMATION INTEGRATION,
AMERICAS W–622
P.O. BOX 414
MILWAUKEE, WI 53201–0414

CERTIFIED ELECTRICAL CONTRACTOR STATEMENT



All electrical installations that are preliminary to positioning of the equipment at the site prepared for the equipment shall be performed by licensed electrical contractors. In addition, electrical feeds into the Power Distribution Unit shall be performed by licensed electrical contractors. Other connections between pieces of electrical equipment, calibrations, and testing shall be performed by qualified GE Medical personnel. The products involved (and the accompanying electrical installations) are highly sophisticated, and special engineering competence is required. In performing all electrical work on these products, GE will use its own specially trained field engineers. All of GE's electrical work on these products will comply with the requirements of the applicable electrical codes.

The purchaser of GE equipment shall only utilize qualified personnel (i.e., GE's field engineers, personnel of third-party service companies with equivalent training, or licensed electricians) to perform electrical servicing on the equipment.

DAMAGE IN TRANSPORTATION

All packages should be closely examined at time of delivery. If damage is apparent, have notation "**damage in shipment**" written on **all** copies of the freight or express bill **before** delivery is accepted or "signed for" by a General Electric representative or a hospital receiving agent. Whether noted or concealed, damage **MUST** be reported to the carrier **immediately** upon discovery, or in any event, within **14** days after receipt, and the contents and containers held for inspection by the carrier. A transportation company will not pay a claim for damage if an inspection is not requested within this **14** day period.

Call Traffic and Transportation, Milwaukee, WI (414) 827−3449 / 8*285−3449 **immediately** after damage is found. At this time be ready to supply name of carrier, delivery date, consignee name, freight or express bill number, item damaged and extent of damage.

Complete instructions regarding claim procedure are found in Section "S" of the Policy & Procedure Bulletins.

6/17/94

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SECTION 1 – INTRODUCTION

1 DIRECTION OVERVIEW

Application This direction is intended as a supplement to the software driven calibration procedures required for accomplishing an Advantx–E system calibration.

Note: References to LFX do not apply to these systems.

Purpose This direction describes how to; initiate system calibration, use the system console controls to enter data and instructions, and communicate with the Service Mode software to perform calibration procedures. Graphic representations of console screen displays, test setups, oscilloscope waveforms, etc. are provided to support the text.

Organization The following is a synopsis of each section of this direction:

Section 1 – Introduction – This section provides general information relating to the Service Mode Operating System (SMOS). The section provides an overview of the service mode software, a block diagram of a typical Advantx system, a description of the system calibration Smart Sequencer, and generic illustrations/descriptions of the type of console screen presentations that will be encountered when running service mode calibration. The section also provides an overall list of tools and equipment that may be required to accomplish a system calibration.

Section 2 – Service Mode Calibration – This section provides step by step instructions for initiating and performing the system calibration. The instructions cover system power up, system power down, booting of the system as well as general instructions covering calibration.

Section 3 – Sequences – This section illustrates the Service Mode Calibration sequence screens and the logical order of presenting the individual calibration units comprising a sequence. Sequences are identified with a letter “S”and numerical values less than 100.

Section 4 – Tool Units – This section presents Tool Units. The Tool Units are unique software driven units that are used to perform special functional checks and tests of a system during calibration. The tool units are identified with a letter “T”and numerical values less than 100.

Section 5 – Radiation Calibration Units – This section presents the calibration units that are associated with the system power unit and applicable X–ray tube or tubes. The radiation calibration units are identified with a letter “R” and numerical values less than 100.

Section 6 – Image Module Calibration Units – This section presents the calibration units that are used to calibrate either an Imageur Module or VIC Image Module video system. The VIC calibration units are identified with a letter "V" and numerical values less than 100. For systems configured with an Imageur Imaging Module video system, the section presents a calibration steering/info unit identified as I001.

Section 7 – Positioner Calibration Units – This section presents the calibration units that are associated with RAD, R&F, and Vascular positioners. The units are identified with the letter "P" and numerical values 100 – 500.

Section 8 – General System Calibration – This section presents the calibration units that are associated with miscellaneous procedures such as x–ray tube warmup and tube run–in and stability. The units are identified with the letter "X" and numerical values less than 100.

Section 9 – Automatic Brightness Control Calibration Units – This section presents the calibration units that are associated with the Automatic Brightness Control function. The units are identified with the letter "X" and numerical values 100 – 199.

Section 10 – Automatic Exposure Control Calibration Units – This section presents the calibration units that are associated with the Automatic Exposure Control function. The units are identified with the letter "X" and numerical values 200 – 299.

Section 11 – Digital Fluoro and Cine Calibration Units – This section presents the calibration units that are associated with the DX/DLX or DRS Console and Cine option. The units for digital fluoro are identified with the letter "D" and numerical values less than 100. The units for cine are identified with the letter "F" and numerical values less than 100.

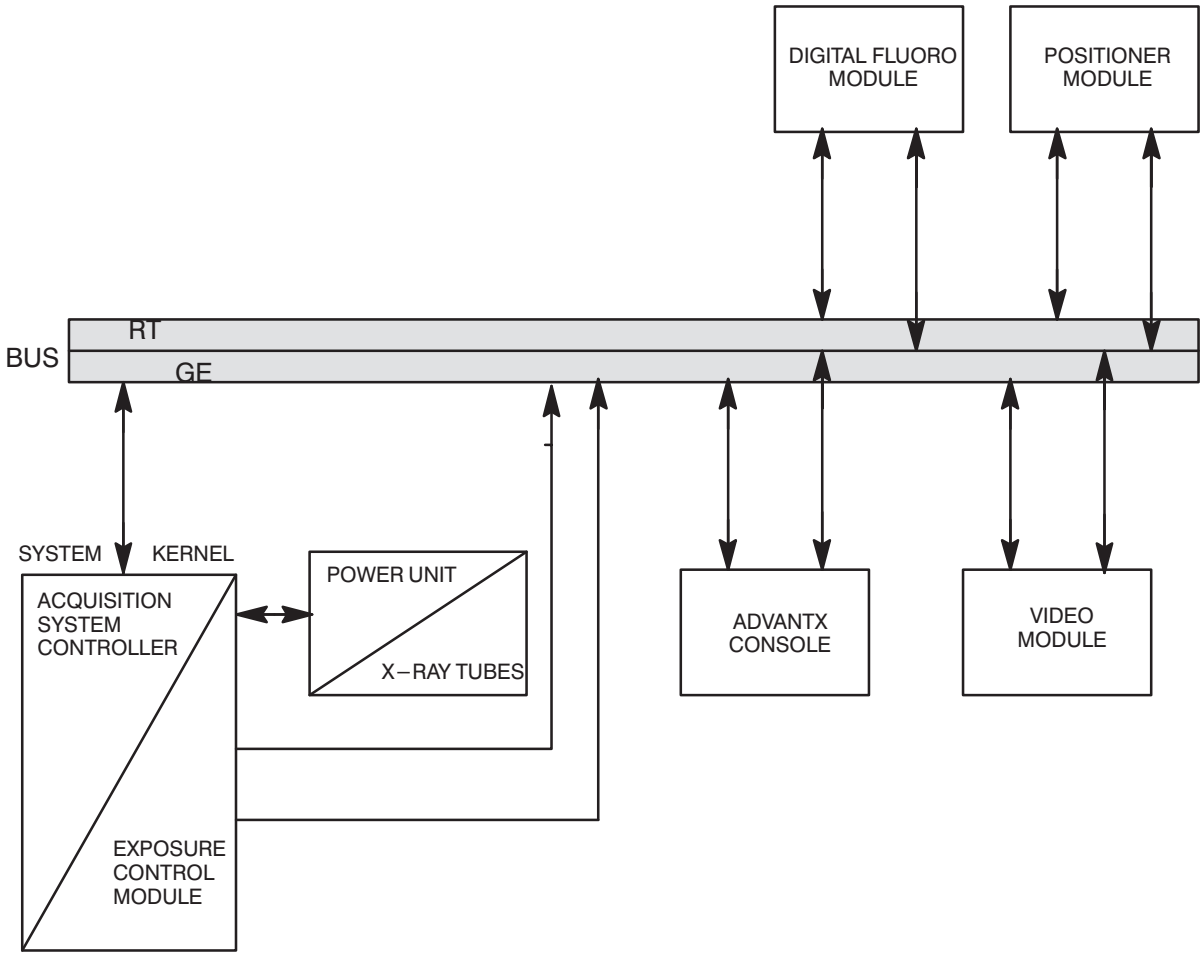
Section 12 – Configuration Units – This section presents the configuration units that are required to change or alter configuration parameters after replacement of expendable parts such as x–ray tubes, image intensifier tubes and TV pickup tubes. The units are identified with the letter "C" and numerical values less than 100.

Note: A **notepad** for making special comments or noting specific changes in calibration parameters pertaining to the system installed is provided at the end of Sections 4 through 12**.**

2 ADVANTX TYPICAL SYSTEM BLOCK DIAGRAM

A typical Advantx System block diagram illustrating module and equipment bus interconnections (GE Bus and RT Bus) is shown in Illustration 1.

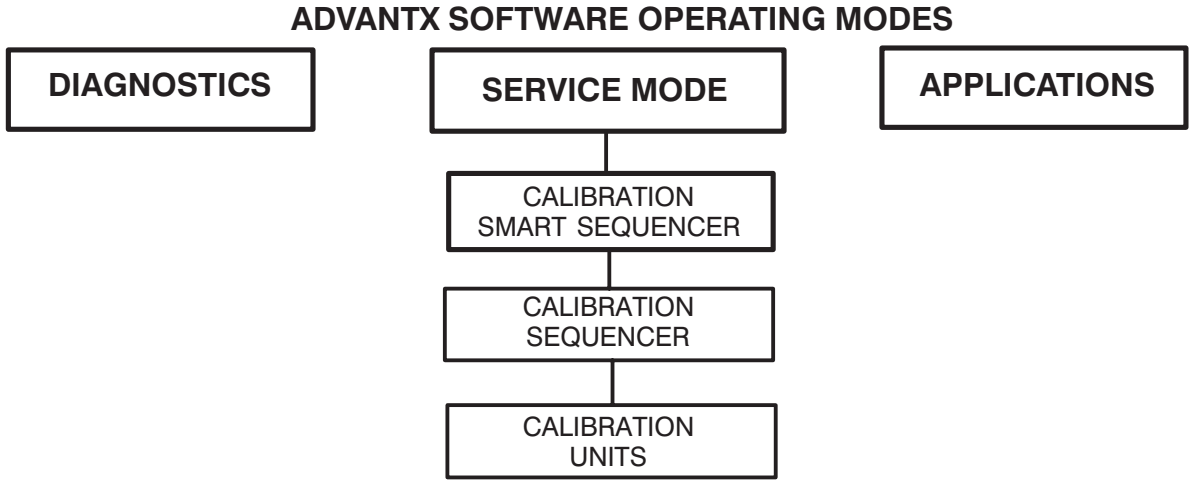
Illustration 1 – Typical System Block Diagram



3 SERVICE MODE CALIBRATION OVERVIEW

The Advantx System is capable of operating in three software modes; i.e. Diagnostics Mode, Service Mode, and Applications Mode. This Direction covers the operation of the Service Mode (See Illustration 2).

Illustration 2 – Service Mode



The Service Mode consists of software driven calibration procedures that are designed to eliminate as many manual adjustments as possible when calibrating an Advantx system. Service Mode calibration allows most Advantx modules and sub–assemblies to be calibrated by performing software instructions displayed on the Advantx system console. Most adjustments are entered into the system using softkeys displayed on the Advantx console screen and/or through the use of the console dial.

Advantx Service Mode software is loaded into the blank hard disk of the system ASC (also known as the Titan Kernel), **at the factory**. All software required to operate the system is contained on this internal hard disk. Software is automatically loaded and accessed, as needed, from the internal hard disk. A personal computer with an installed Ethernet adaptor connected to the ASC system Ethernet port provides the necessary communication link between the two systems to perform system calibration.

Note: The IBM–compatible personal computer and 4X CD–ROM drive and associated adaptor must be supplied by the customer. The computer must either:

- Have WINDOWS version 3.1 loaded with at least 4MB RAM available;
- Have WINDOWS 95 loaded.

The suggested laptop adaptor is an LineSys Adaptor kit. There are three different kits available: Part No. 2128794 for international distribution, Part No. 2119797 for domestic use, and Part No. 2128796 for non-GE use with TCP/IP software.

Note: An internal CD–ROM drive is preferred. External (paralell port) CD–ROM drives have experienced software incompatiblilities.

NOTICE **WINDOWS 3.11 (WINDOWS for Workgroups) is incompatible with the Advantx calibration software and will not operate properly.**

Calibration consist of numerous software packages called **Units** that are grouped into **Sequences**. **Units** are individual calibration routines used for specific adjustments. Some units are not dedicated to anyone Calibration sequence but may be used for several different sequences. **Sequences** are the organized method of performing a system calibration using sequentially listed **Units**. It is the **Sequence** software that determines the proper time and order for performing the **Unit** routines. The appropriate sequences and units required to calibrate a specific Advantx system configuration are generated by a function called the *Smart Sequencer*.

4 SERVICE MODE SMART SEQUENCER

The Service Mode Smart Sequencer automatically generates the appropriate sequences and unit menu's in the correct logical order for performing the calibration of a particular Advantx system. In addition to generating the sequences and unit menu's, the Smart Sequencer also controls the screen displays, menu highlighting, and sequence processing of a system calibration (unit execution and status).The sequences and logical order of the individual calibration units comprising a sequence are illustrated in Section 3 of this manual. The sequences and unit menu's shown are typical and all inclusive and do not relate to any specific system configuration. The actual presentation of the sequences and the unit sequence menu's on the console screen will depend on the specific configuration of the system installed. The Smart Sequencer only displays a list of those menu's and calibration units that are required to calibrate a particular system configuration.

Smart Screens

Main Sequence Menu Screen

The main sequence menu screen lists all of the sequences that must be accomplished in order to calibrate a specific system. The actual sequences listed on the main sequence menu screen is determined by the function of the Smart Sequencer and is directly related to the system configuration and associated parameters. A unique main sequence menu is generated for each system configuration that is installed (for each system in each room for Multiroom installations). During initial calibration of a system, the main sequence menu also controls execution and status of the sequences listed by highlighting the sequences to be accomplished and unhighlighting the sequences that are properly completed.

Sequence Menu Screens

The sequence menu screens identify the individual calibration units that must be accomplished in order to complete the calibration of a specific system feature. A unique sequence menu exists for each sequence listed on the main sequence menu screen. Similar to the main sequence menu, the actual units listed on a sequence menu screen is determined by the function of the Smart Sequencer and is directly related to the system configuration and associated parameters. During initial calibration of a system, the sequence menu screens also control execution and status by highlighting the calibration units that must be accomplished for a given sequence and unhighlighting the units that are properly completed.

Unit Screens

Unit screens are the lowest level screens generated by the Smart Sequencer and cover the calibration of a specific function as related to a sequence menu.

Highlighting

At initial calibration of a system, the sequences on the main sequence menu and calibration units on the unit sequence menu's that must be accomplished to complete a system calibration are highlighted on the respective console screen display (Main sequence menu screen and unit sequence menu screens).

Upon successful completion of a highlighted unit calibration or sequence menu, that unit or sequence will be unhighlighted by the Smart Sequencer. A unit or sequence will remain highlighted if the Smart Sequencer determines that the calibration was not successfully completed. Successful completion of all highlighted calibration units and sequences indicates that the system calibration is also complete.

Some individual calibration units, such as the units that are listed on sequence menu's relating to VIC calibration, are pre–calibrated in the factory. At initial calibration of a system, these calibration units are unhighlighted on the sequence menu to indicate that they have been completed. The calibration data for these previously calibrated units is normally recovered in the field before proceeding with a system calibration.

Menu highlighting is only controlled by the Smart Sequencer at the time of initial calibration of a system. Once the calibration is completed, the highlighting feature of the Smart Sequencer is disabled and will remain disabled unless a database initialization requires a complete recalibration of the system. However, unhighlighted units may still be accessed to view or make changes to unit parameters if required.

5 SERVICE MODE SOFTWARE KIT

A Basic Service Mode Software Kit is required to perform a system calibration and is shipped with each Advantx–E system.

6 SCREEN DESCRIPTIONS

The Service Mode uses three basic console screen formats to steer, control, and present the instructions and data required to perform an Advantx System calibration. The three screen formats are listed below:

1. Main Sequence Menu
2. Unit Sequence Menu.
3. Unit Screen

Each of the three screen formats contain a number of fields that are common (Generic) to all screen presentations.

Generic Screen Illustration 3 identifies the location and function of the fields that are Generic to all screen formats.

Screen Title This area identifies the type of screen being presented. Examples of titles are:

- CAL / CONFIG SEQUENCE MENU
- CAL / CONFIG UNIT MENU
- CAL / CONFIG UNIT SCREEN

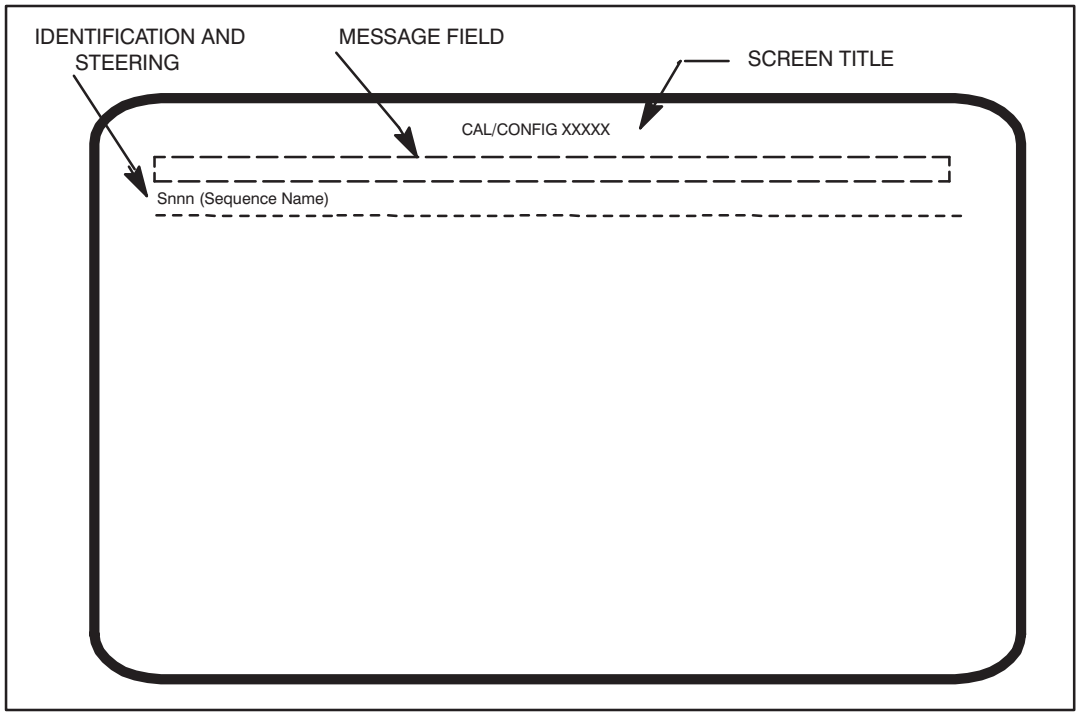
Messages This area will display any operational messages or error messages regarding the function of the Service Mode Calibration. Examples of operational messages and error messages are:

- SYSTEM READY
- COMMUNICATION ERROR

Steering This field provides steering information between sequences and unit screen presentations. The sequence number and name on which a cal unit resides is identified in this area. Examples of steering are:

- S002 GENERATOR INITIAL SETUP
- S003 GENERATOR CAL TUBE 1

Illustration 3 – Generic Screen



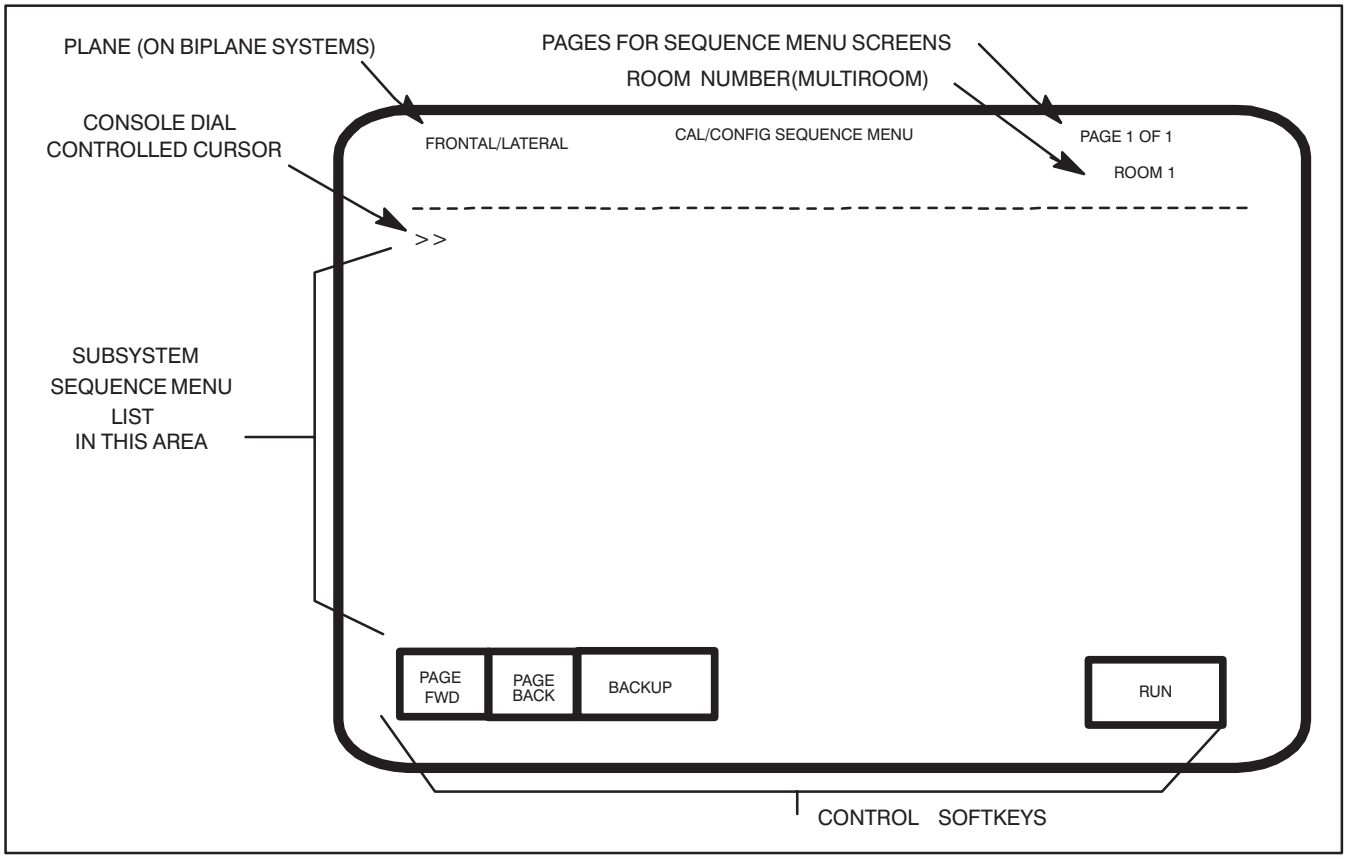
Main Sequence The Main Sequence Menu screen provides a selection of Sequence Menu's (unit menus), each of which performs the calibration of a system feature. The location and identification of the fields and control functions that are unique to the Main Sequence Menu screen are shown in Illustration 4.

Sequence Selection Sequence selection is initiated by using the console dial to position the cursor opposite the selected Sequence Menu and then touching the RUN softkey.

Controls The following control functions are provided on the Main Sequence Menu screen.

- RUN – Touching the softkey will increment to the Sequence Menu screen for the subsystem sequence selected above. The softkey will light momentarily when selected.
- BACKUP – Touching the softkey will access backup and restore functions. The softkey will light momentarily when selected. Refer to Section 2 for instructions covering backup and restore procedures.
- PAGE FWD / PAGE BACK – Controls paging through the Main Sequence Menu if the menu consists of multiple pages. The applicable softkey will light momentarily when selected.

Illustration 4 – Main Sequence Menu Screen



Sequence Screens Sequence Menu screens provide a selection of individual calibration units that are required to calibrate a system function. The calibration units are presented in the order in which they are generally to be accomplished. The location and identification of the fields and control functions that are unique to the Sequence Menu screens are shown in Illustration 5.

Unit Selection Unit selection is initiated by using the console dial to position the cursor opposite the selected calibration unit and then touching the RUN softkey.

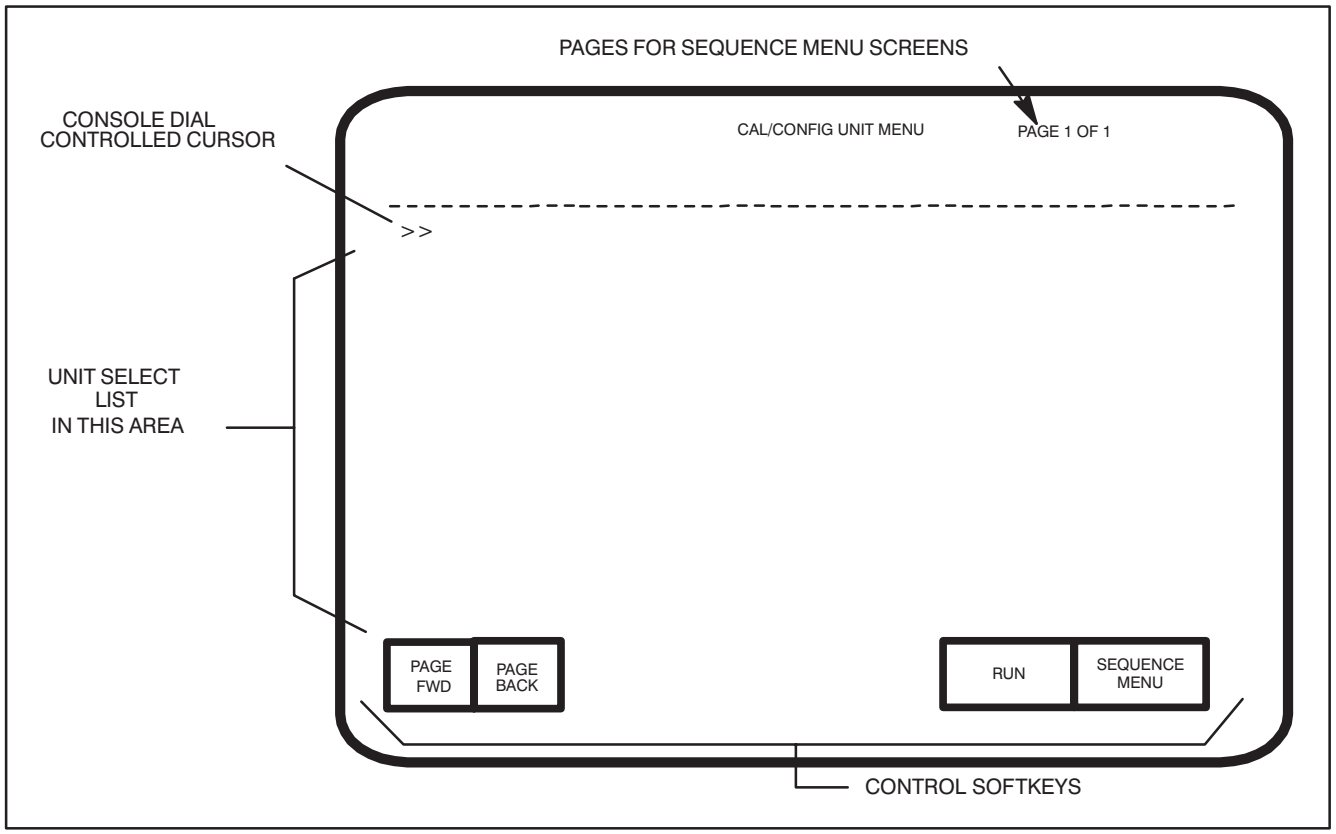
Controls The following control functions are typical for Sequence Menu, screens.

- RUN – Touching the softkey will increment to the screen display for the unit selected. The softkey will light momentarily when selected.

Note: The system may pause to load software. A “PROCESSING” message will be displayed until the selected calibration unit screen appears.

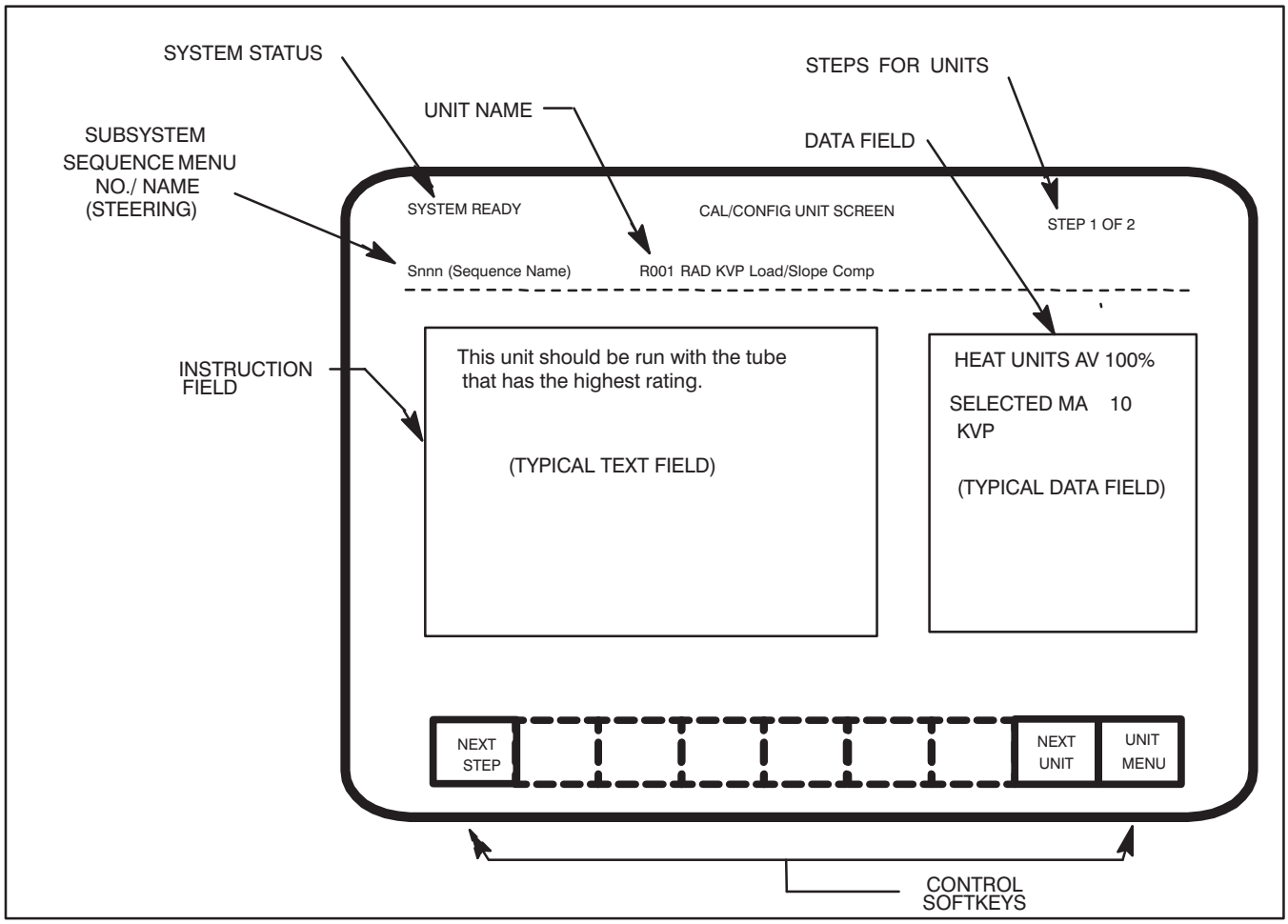
- SEQUENCE MENU – Touching the softkey will return the operator to the Main Sequence Menu screen. The softkey will light momentarily when selected.
- PAGE FWD / PAGE BACK – Controls paging through the Sequence Menu if the menu consists of multiple pages. The applicable softkey will light momentarily when selected.

Illustration 5 – Subsystem Sequence Menu Screen



Unit Screens Unit screens display individual calibration units. The units are the lowest level of calibration accessible to an operator. A unit may consist of one or more steps with only one screen display or each step may present a separate screen display. The location and identification of the text and data fields and control functions that are unique to unit screens are shown in Illustration 6.

Illustration 6 – Typical Unit Screen



System Status This area indicates the system condition or operational state. Examples of system state messages are:

- SYSTEM READY
- X–RAYS ON
- PROCESSING – PLEASE WAIT
- WAITING FOR POSITIONER

NOTICE

When running a calibration unit that displays the messages "WAITING FOR POSITIONER" or "PROCESSING – PLEASE WAIT" while proceeding to a next step in a calibration unit, do not touch any part of the console screen. Touching an active part of the screen during this time delay may cause the system to automatically execute a function immediately after the text and softkeys are displayed for the next step.

Instruction Field — This area provides instructional text that directs the user in performing a calibration unit.

Data Field — This area provides a data readout and/or data input field as required by the specific calibration unit. When required, input data is entered into this area with the console dial. The area may also contain special softkey functions which are normally linked to the instructional text.

Controls — The following control softkey functions are typical of the types of softkeys that may be displayed on unit screens. Special control softkeys may also be presented in this area of the screen when required by a calibration unit.

- NEXT STEP – Touching the softkey will increment to the next step of a unit. In multi–step calibration units, the softkey can also be used to scan through the steps prior to performing the calibration. This is called a “Browse” mode. When in the Browse mode, a “VIEWING” message is displayed at each step. When the last step is reached, touching the NEXT STEP softkey returns the unit to the first step. If any action is initiated while in the browse mode, the browse function will be disabled and the unit will enter the active state. The calibration must then be completed to exit the unit.
- NEXT UNIT – Touching the softkey will increment to the next calibration unit to be performed in a unit sequence menu without returning to the sequence menu to make the selection.
- UNIT MENU – Touching the softkey will return the operator to the Sequence Menu screen.
- MORE INFO – Touching the softkey will increment to a screen on which supplemental or alternate calibration instructions are presented.
- BACK – This softkey is displayed only when iterative action requires return to a preceding screen.
- RECAL – This softkey is displayed on verification step screens. When a verification is performed and the test fails, touching the softkey will return the calibration to the appropriate step for recalibration.
- SELECT – This softkey operates in conjunction with the console dial when the dial is used to select an item from a list or menu. When touched, both the softkey and the selected item are highlighted in reverse video.
- JOG Controls – This softkey group consists of four softkeys (arranged in a quad group as shown below) that are used to control and position various system functions such as collimator blades, cassettes, masks and grids etc. Touching the upper left softkey activates the softkey (highlighted in reverse video) and allows the operator to use the console dial to scroll through the valid functions that may be selected for the particular Calibration Unit entered. Once a function is selected, the remaining three softkeys are used to control the position of the function. The SLOW softkey can be toggled between SLOW and FAST to set the speed of positioning as desired. The CLOSE JOG and OPEN JOG softkeys are then used to position the selected function as required by the calibration unit screen text/procedure.

COLLIMATOR TRANSVERSE	SLOW
CLOSE JOG	OPEN JOG

7 SERVICE TOOLS AND EQUIPMENT REQUIRED

The special service tools, test equipment, and materials required to perform a system calibration are identified in the following list. The list of tools and equipment is presented in alphabetical order and is intended as an overview of the total equipment that may be required to perform an Advantx system calibration. The exact equipment required will depend on the configuration of the system. Each individual calibration unit identifies the specific equipment required to perform the calibration covered by that unit.

Adaptor IQ (for use with any IBM compatible Laptop computer)

A.I.D. Ball

Alignment Washer (46–262350P1)

Angleometer or Protractor Level

Alignment Tool for IDD (2165666)

Bleeder, External (46–154966G1)

BNC T Connector

Case Assembly (46–262707G1). Consists of:
- Absorber, X–ray (46–173683G1)
- CV Phantom, 8 inch (46–262576G1)
- D.A.S.I. Assembly (46–193456G1)
- Magnifier, 10X (46–262700P1)
- Magnifier, 20X (46–262700P2)
- Mesh Pattern, Copper, 60 wire (46–187636P1)
- Mesh Pattern, Copper, 150 wire (46–187635P1)
- X–ray Test Wedge (46–197871P4)
- Phantom Wedge (46–262703P1)
- Test Pattern (46–262704P1)
- Star Pattern (46–193546P1)

Cassette, 9.5 inch

Cassette, 14 x 14 inch

Cassette, 14 x 17 inch

Cassette, Test (46–205884G1–A)

Cassette, Test (2129776)

CFM/AFM Centering Kit (45259499)

Cine Film (as used at the site)

Collimator Alignment Tool (CAT) (46–166390G2)

Computer, Laptop, (any IBM compatible, 380 SX)

Console Extension Cable, 40 ft. length (46–289388G1)

CV Phantom Kit, 12 inch (46–156797G1) required for calibration of 40 cm II systems. Consists of:
Filtration, 1/4 inch Aluminum (46–156796P2)
Filtration, 1/32 inch Copper (46–156796P1)
CV Phantom, 12 inch (46–156780G1)
X–ray Test Wedge (46–197871P4)

Dark Cloth Cover

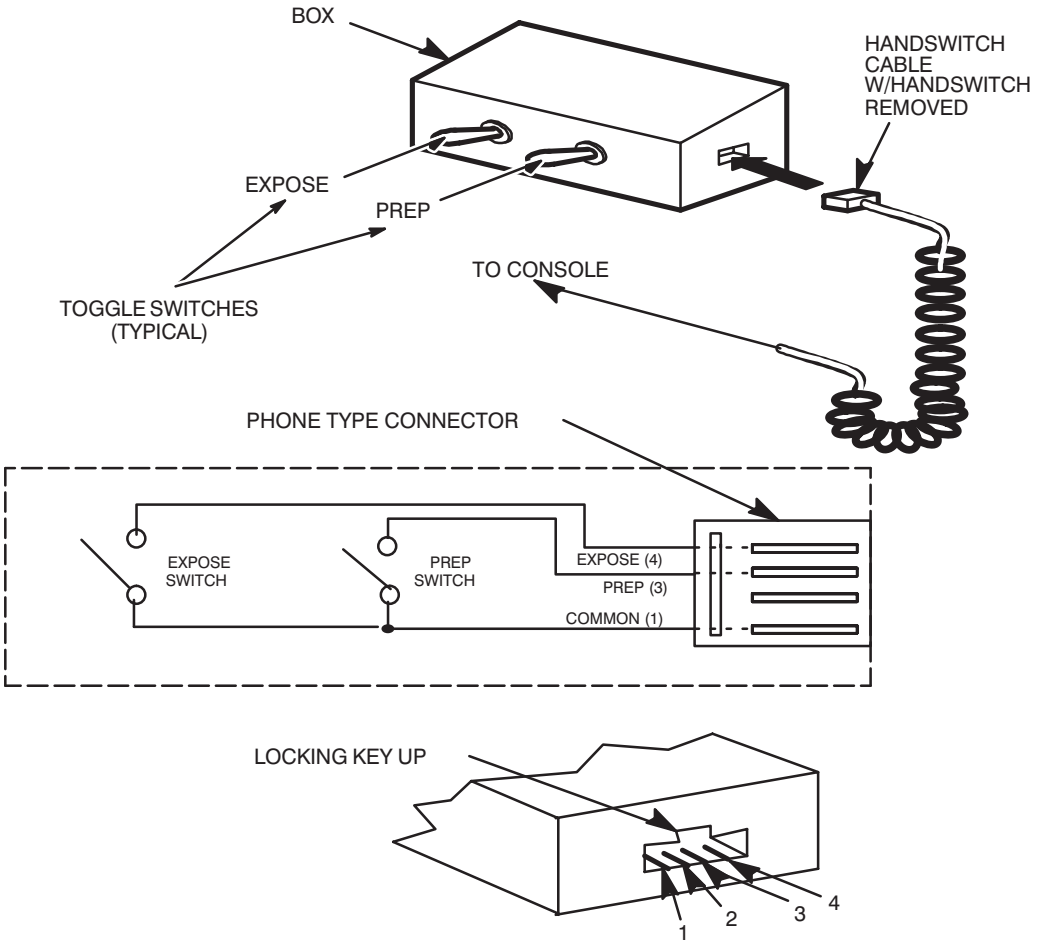
Densitometer (X–rite 301 or equivalent)

Digital Multimeter (Fluke 8000A or equivalent)

Note: The exposure control service tool is an optional exposure control device that is intended for use in place of the handswitch on the Advantx console when calibration procedures require lengthy and/or sequential X–ray exposures. The service tool is not supplied with a system but can be fabricated in the field using parts that can be obtained locally.

Exposure Control Service Tool (See Illustration 7)

Illustration 7 – Exposure Control Service Tool



Field Sizing Gauge for 9” II Tube (46–286485P1)

Field Sizing Gauge for 12” II Tube (46–286486P1)

Field Sizing Gauge for 16” (40 cm) II Tube (46–302601P1)

Film Changer Alignment Pattern (46–223021P1)

Fluorescent Screen

Focaligner

Grease Pencil, Black

Image Evaluation Tool (46–232388G2)

Laser Alignment Tool (46–216640G1)

LACH Tool, Image Intensifier

Masking Tape

Non–Metallic Trim Pot Adjusting Tool

Oscilloscope (Dual Trace, Storage Type)

Oscilloscope Leads w/ x10 Probe

Extender Board for Printed Circuit Boards

Photospot Film (as used at the site)

Radiation Meter (accuracy to 5%) w/standard probe stand or w/ Ion Chamber Positioning Tool 2208874 delivered with the latest vascular systems. Radiation Meter models are as follows:

MDH Model 1015
MDH Model 2025 (46–194427P42)
MDH Model 2026
Capintec Model 192A
Capintec Model 174
Probes 20x5–3, 20x5–60, 20x5–180 or 20x6–3, 20x6–60, 20x6–180

Note: **For Vascular Systems**: The probes to be used are 20x5–3 (or 20x6–3) for HVL or Tapers and 20x5–180 or 20x6–180 for dosimetry calibration. The 20x5–60 (or 20x6–60) is not compatible with the maintenance of a vascular system.

Resolution Wedge (46–162456P1)

Reticule Lens, Clear (46–302883P1)

Reticule Lens, Sizing (46–262308P2)

Ruler, Steel, Metric (450 mm)

Sensitometer, Green Light

Service Mode Software Kit

Sheet Film (as used at the site)

SFD Alignment Pin (46–262043P1)

Standard Tool Kit (Metric and Unified)

Straight Edge

Stopwatch

Tape Measure, Steel, (Metric)

Test Pattern (46–262704P1)

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SECTION 2 – SERVICE MODE

1 SYSTEM POWER UP LEVELS

Level I Level I power up occurs when the facility main power circuit breaker is set to ON. Power is applied to the input terminals of the power unit

Level II Level II power up occurs when the circuit breaker on the power unit is set to ON. Power is now applied to the power unit, system cabinets, and Advantx console.

Level III Level III power up occurs when the circuit breakers on the system cabinets are set to ON and the STANDBY pushbutton on the system electronic cabinet is set to ON. (See Illustration 9.)

Note: With the system in the STANDBY mode, the system is ready to operate within 10 seconds after pressing the green ON/OFF pushbutton on the Advantx console. In STANDBY, power to certain system components (i.e. vascular system table locks, etc.) is maintained.

Level IV Level IV power up occurs when the green ON/OFF pushbutton switch on the Advantx Console is pressed. Button illuminates when ON.

2 SYSTEM POWER DOWN LEVELS

Level III To return the system to STANDBY, press the green ON/OFF pushbutton switch on the Advantx console to OFF.

Level I To return the system to a level I power condition, press the green ON/OFF pushbutton switch on the Advantx console to OFF, the STANDBY OFF pushbutton switch on the system electronic cabinet to OFF, and set the power unit circuit breaker to OFF.

3 LOCKOUT/TAGOUT PROCEDURES

Perform the following Lockout/Tagout procedures whenever it is necessary to shutdown the system before starting any calibration/service procedure that may place the service person in danger of an accidental release of Energy.

Disable System Power

- Prepare the equipment for lockout/tagout procedure by first checking the site to locate and identify all energy isolating devices which apply to the equipment. More than one energy source may be involved.
- Notify affected personnel of imminent power lockout/tagout.
- Turn–off power at the Advantx system console.
- Press the STANDBY OFF pushbutton on the Advantx Electronic Cabinet.
- Set circuit breaker on power unit to OFF
- Turn–off or disconnect power at the main facility power disconnect
- Turn–off any remaining energy sources that have not already been described but apply to the system/equipment.

- Install padlock at the main power disconnect and attach a personal identification warning tag identifying yourself.

Enable System Power

- Remove all lockout/tagout devices and notify affected personnel that power will be restored.
- Enable power, i. e. at main power disconnect, power unit circuit breaker, and Advantx system console.

4 POWER UP SEQUENCE

- Set the main circuit breaker located on the front panel of the power unit to the ON position. Verify that the LINE ON indicator lamp is illuminated. See Illustration 8.
- Set POWER circuit breakers on the system cabinets/modules to ON.
- Set STANDBY ON pushbutton switch on the systems Electronic Cabinet to ON position. See Illustration 9. The STANDBY ON switch indicator lamp on the Electronic Cabinet and the SYSTEM ON indicator lamp on the power unit will light.

CAUTION **For Biplane Systems: System will not function correctly with STANDBY switches in opposite positions. STANDBY switches on both frontal and lateral systems cabinets must be in the same position.**

Illustration 8 – Power Unit Main Circuit Breaker

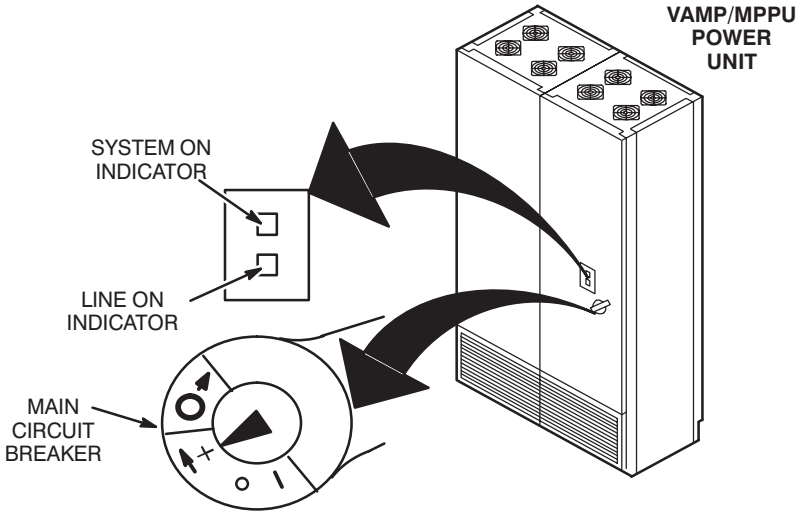
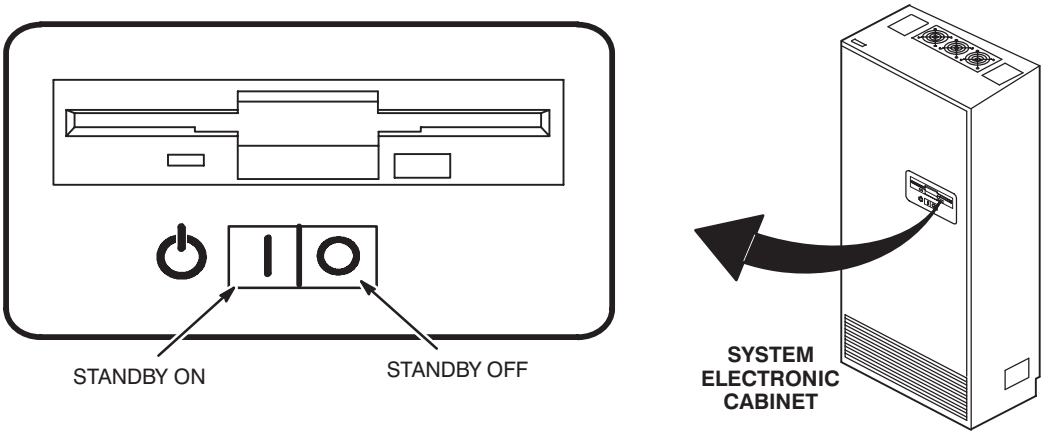


Illustration 9 – STANDBY ON/OFF Pushbutton


STANDBY ON
STANDBY OFF
SYSTEM
ELECTRONIC
CABINET

5 BOOTING THE SYSTEM

- Open the system Electronic Cabinet door.
- Connect the Service Laptop Tool via the IQ Adaptor to the ETHERNET connector on the front panel of the ASC (Titan Module). See Illustration 10.
- Place Basic Service Mode CD–ROM (from the Software Kit supplied with the system) into the Service Mode Laptop Tool.
- Press RESET pushbutton switch on ASC front panel (See Illustration 10) or Advantx console (See Illustration 11).
- Press the green ON/OFF pushbutton switch on the Advantx console. See Illustration 11.

Note: With system power ON or other reset condition initiated, the system ASC (Titan Kernel) will always cause the system to automatically enter the Applications Mode. Once the system has completed the boot process to Applications Mode, transition to the Service Mode is accomplished via the Service Laptop Tool.

Illustration 10 – ASC Front Panel

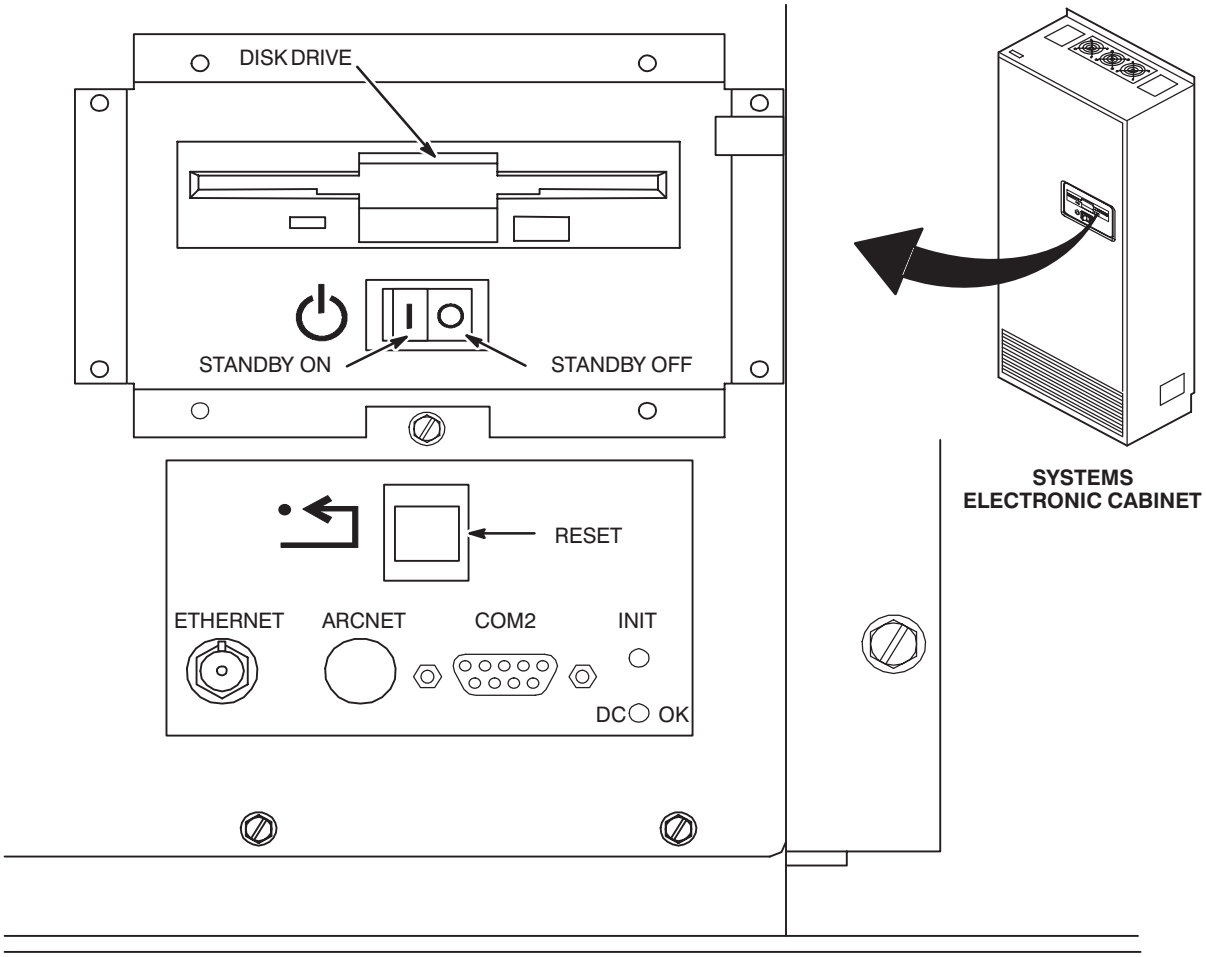
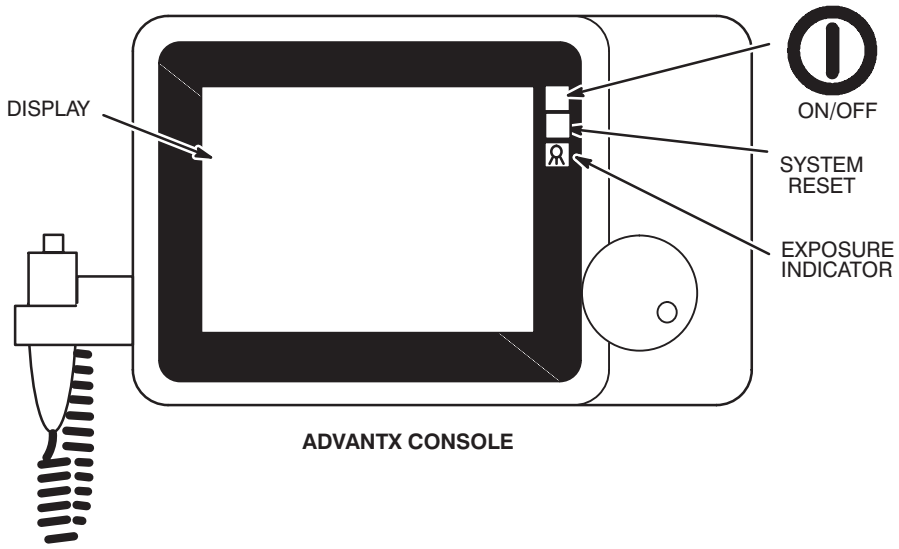


Illustration 11 – Advantx System Console



- On Service Laptop Tool screen display, select SERVICE MODE function to enter the Service Mode Operating System (SMOS).
- Service mode screen is displayed on the Advantx console. See Illustration 12.
- Touch RUN button on Service Mode screen.
- Copyright Notice screen is displayed. See Illustration 13.
- Touch lower left–hand corner of Copyright Notice screen.
- Main Sequence Menu is displayed on the console screen. See Illustration 14.

Note: The calibration sequence menu's listed on the Main Sequence Menu screen are generated by the system Smart Sequencer. The Smart Sequencer only displays a list of the sequence menu's required to calibrate the type of system being installed.

6 CALIBRATION STEERING

Because the configuration of the system being installed dictates the **specific** sequence in which a calibration is performed, the appropriate system installation steering direction must be followed to accomplish the initial system calibration. The steering direction is intended for use with this direction, the *Advantx–E Calibration Users Guide*. The appropriate installation steering direction is provided as part of the documentation package shipped with each Advantx–E system.

Note: Although the system Smart Sequencer presents the calibration sequences and calibration units in logical order, it is important to follow the steering instructions for supplementary information, special notes, cautions, warnings etc. when performing an initial system calibration.

In addition to the appropriate Installation Steering Guide, the following replacement procedures are also provided in the Advantx documentation package The procedures provide step by step instructions for re–calibrating a system after replacement of major components such as X–ray tubes, II tubes and TV camera tubes.

- Direction 2132483–100, *Advantx–E X–Ray Tube Replacement Sequence LCA, LC+, LCV+*

- Direction 2132493–100, *Advantx–E Image Intensifier Replacement Sequence LCA, LC+, LCV+*
- Direction 2132484–100, *Advantx–E TV Camera Replacement Sequence LCA, LC+, LCV+*
- Direction 2132492–100, *Advantx–E VIC Electronics Module Replacement Sequence LCA, LC+, LCV+*
- Direction 2128082–100, *Advantx X–Ray Tube Replacement Sequence for Legacy, Tilt–C and Tilt–C Vascular Systems*
- Direction 2124776–100, *Advantx Image Intensifier Replacement Sequence for Legacy, Tilt–C and Tilt–C Vascular Systems*
- Direction 2124775–100, *Advantx TV Camera Replacement Sequence for Legacy, Tilt–C and Tilt–C Vascular Systems*

Illustration 12 – Service Mode Screen typical

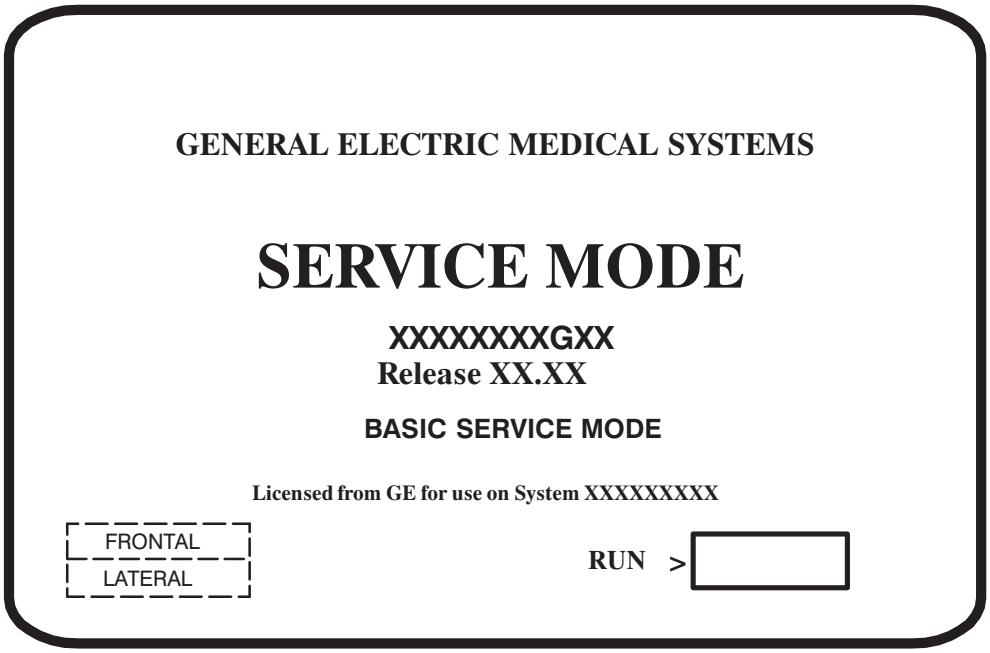


Illustration 13 – Service Mode Copyright Notice Screen

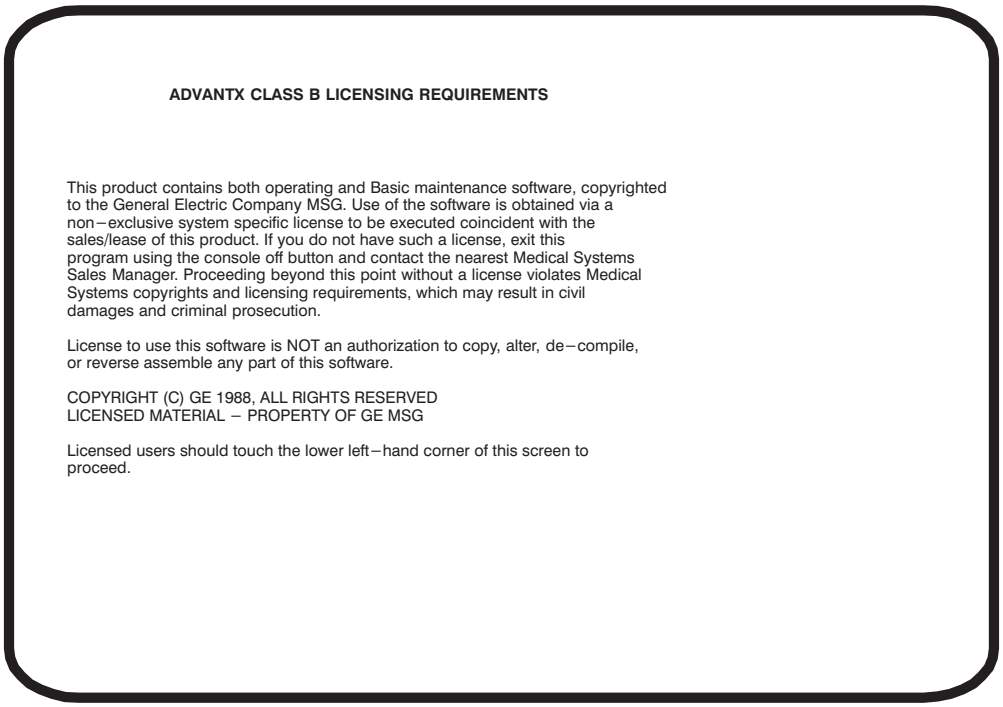
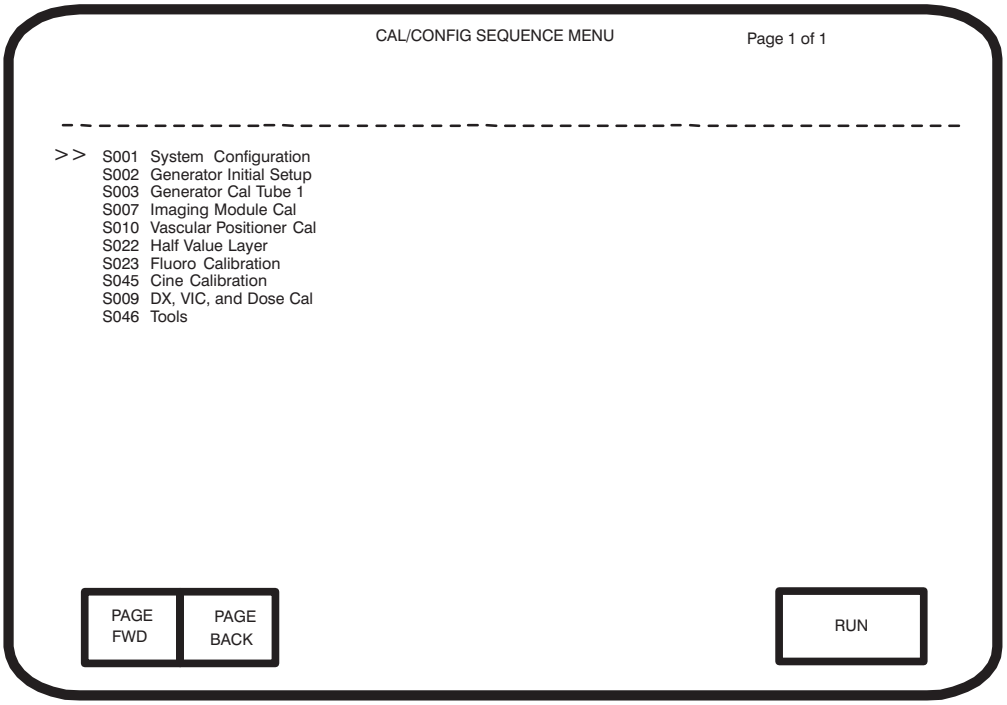


Illustration 14 – Service Mode Main Sequence Menu (Example)



7 CAL PROCEDURE

Follow the general procedures given below and the step by step instructions given in of the appropriate system installation steering direction to perform a system calibration.

- Run Service Laptop Tool programs as instructed on laptop screen
- Select the first Sequence Menu on the Main Sequence Menu screen display by using the console dial to position the cursor opposite the desired selection. Touch the RUN softkey. The selected Sequence Menu will be displayed. Typical Sequence Menu screens are illustrated in Section 3 of this Direction.

NOTICE

If your Advantx system is configured with a DLX module, calibration of the system is accomplished using DX sequences and calibration units. Although the DLX is not indicated on the console screens or text of the sequences or calibration units, the DX module and DLX module use the same database parameters and therefore executing the sequence menu and calibration units specified for DX will also properly calibrate a system configured with DLX.

- Following the steering direction, select the appropriate calibration unit on the selected Sequence Menu by positioning the cursor opposite the desired calibration unit with the console dial. Touch the RUN softkey. The selected Calibration Unit will be displayed. Refer to the calibration unit descriptions in this manual and the instructions on the unit screen display and perform the unit calibration.
- Touch the NEXT UNIT softkey to proceed directly to the next calibration unit listed on the Sequence Menu being run. It is not necessary to return to the Sequence Menu to select the next calibration unit. However, if you wish to return to the Sequence Menu, touch the UNIT MENU softkey.
- Continue to follow the instructions in the Installation Steering Direction and the sequences listed on the main sequence menu until the system calibration sequences and units have been completed.

8 SPECIAL FUNCTIONS

The Service Mode Software also provides the following special functions that may be accessed when performing a system calibration. Some of the special functions can only be initiated and accessed using the Service Laptop Tool while others can be accessed via a Service Mode Sequence Menu. Descriptions of these special functions are given below:

- BACKUP/RESTORE – These functions refer to the saving and restoring of the system database These functions are performed using the Service Laptop Tool.
  - *Backup* Backup is accomplished when the Service Laptop Tool copies all the database files from the system ASC hard disk to a laptop backup floppy.
  - *Restore* Restore is accomplished when the Service Laptop Tool transfers all the database files from a backup floppy on the laptop to the system ASC hard disk.
  - S046 TOOL SEQUENCE – Accessing Tool Sequence S046, on the main sequence menu provides a list of special Tool Units. The tool units do not perform calibration of a system, but are supplemental units that can be accessed at random by the Service person when necessary to assist in calibrating a system. For descriptions of the Tool Units, their function, and how to use them, refer to Section 4 of this Direction.

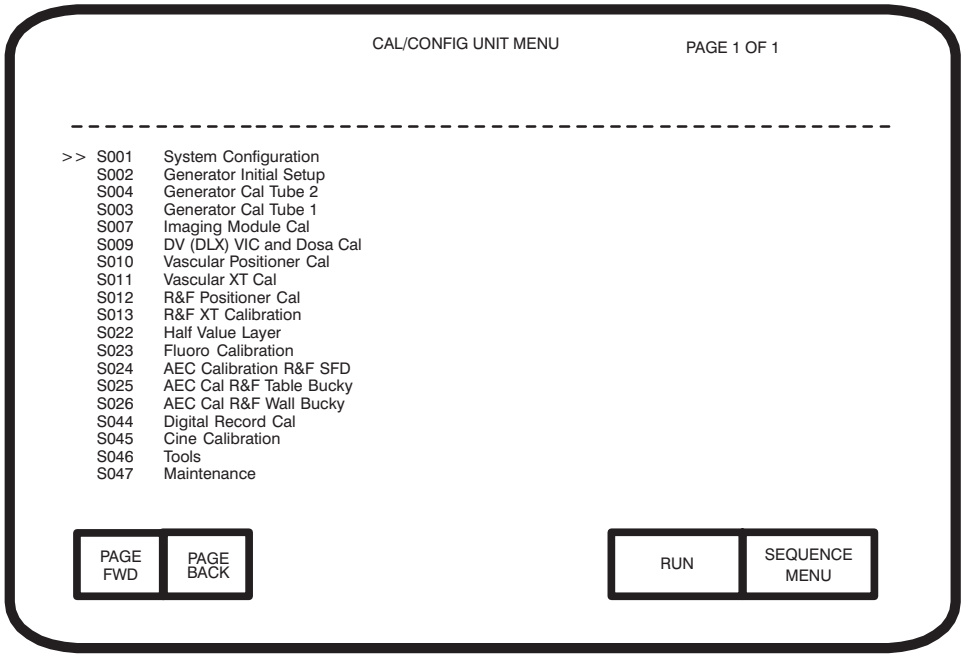
SECTION 3 – SMART SEQUENCES

1 SEQUENCE MENUS

The system Smart Sequencer generates the applicable sequence menus that must be accomplished in order for an Advantx System to be fully calibrated. Section 3 illustrates the sequence menu screens and associated calibration units comprising a sequence menu that may be observed when performing a system calibration. The sequence menus shown are generic and all inclusive of the units that can comprise the sequence. The presentations are only examples. The “actual” sequence menus presented on the console screen depend on the specific configuration of the system installed.

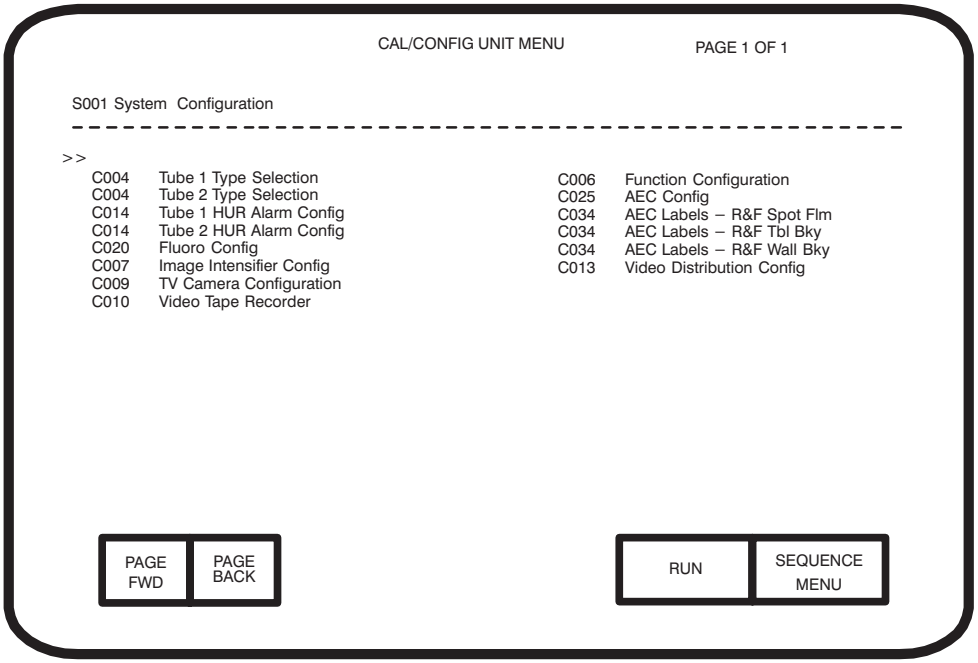
2 MAIN SEQUENCE SCREEN

MAIN SEQUENCE MENU SCREEN DISPLAY



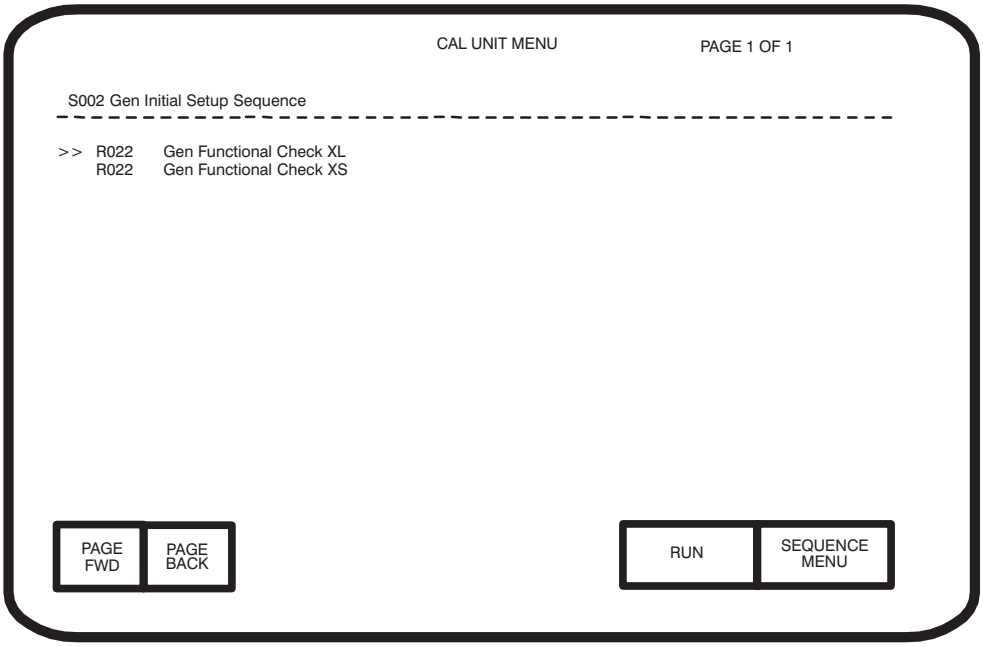
2-1 S001, System Configuration

S001 SCREEN DISPLAY



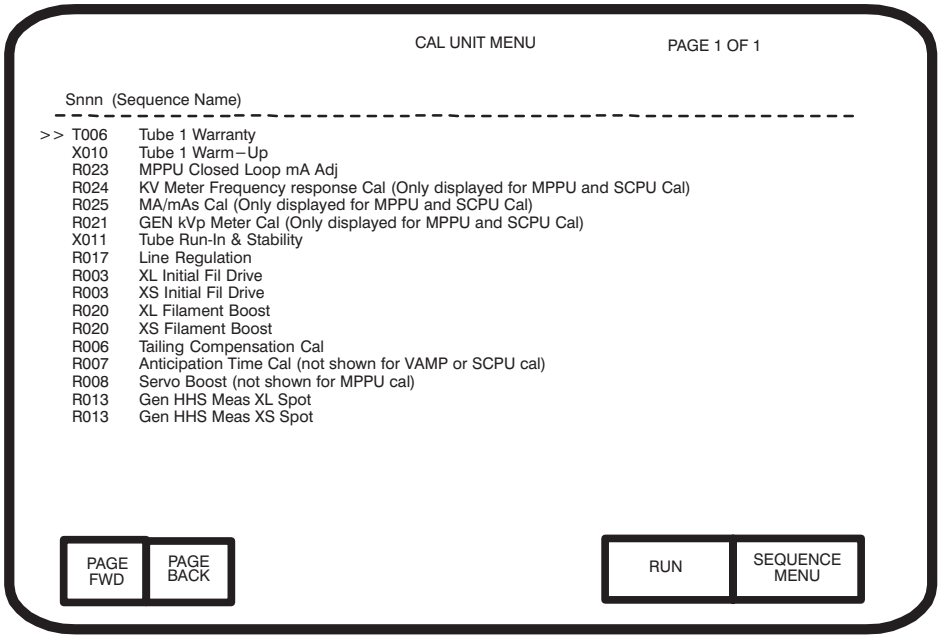
2-2 S002, Gen Initial Setup Sequence

S002 TYPICAL SCREEN DISPLAY



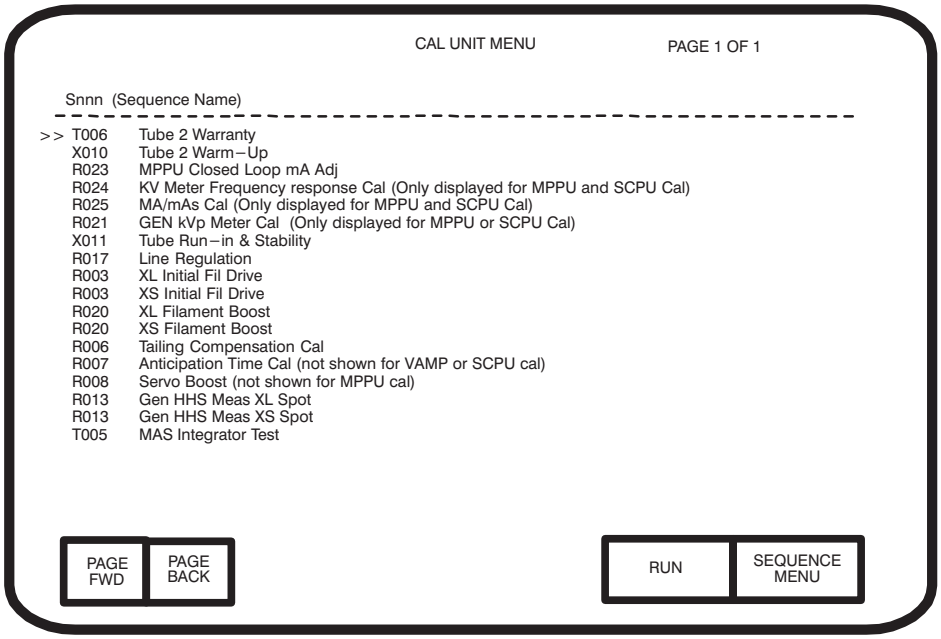
2-3 S003 – Generator Tube 1 Cal Sequence – MPPU

S003 MPPU SCREEN DISPLAY



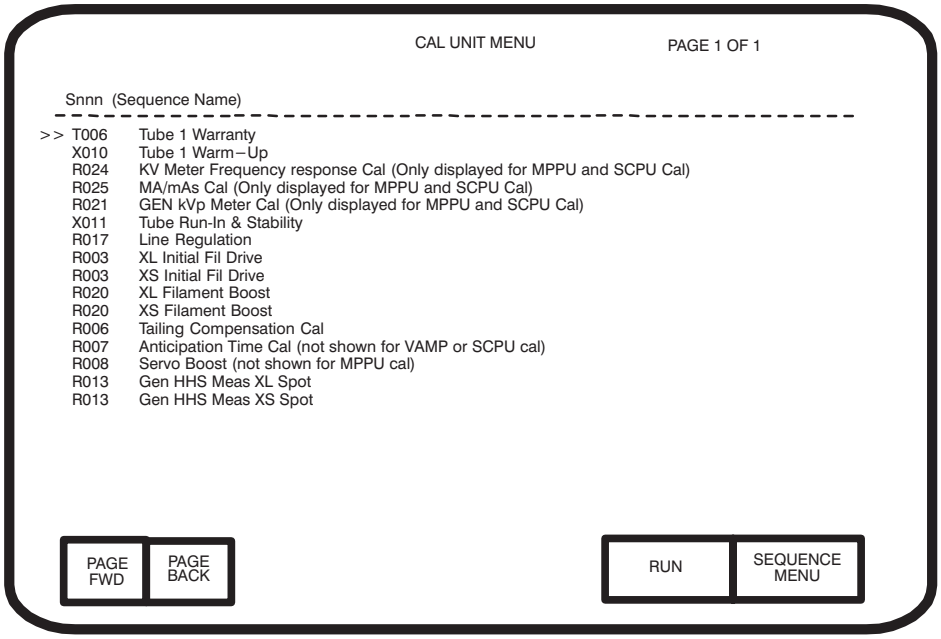
2-4 S004 – Generator Tube 2 Cal Sequence – MPPU

S004 MPPU SCREEN DISPLAY



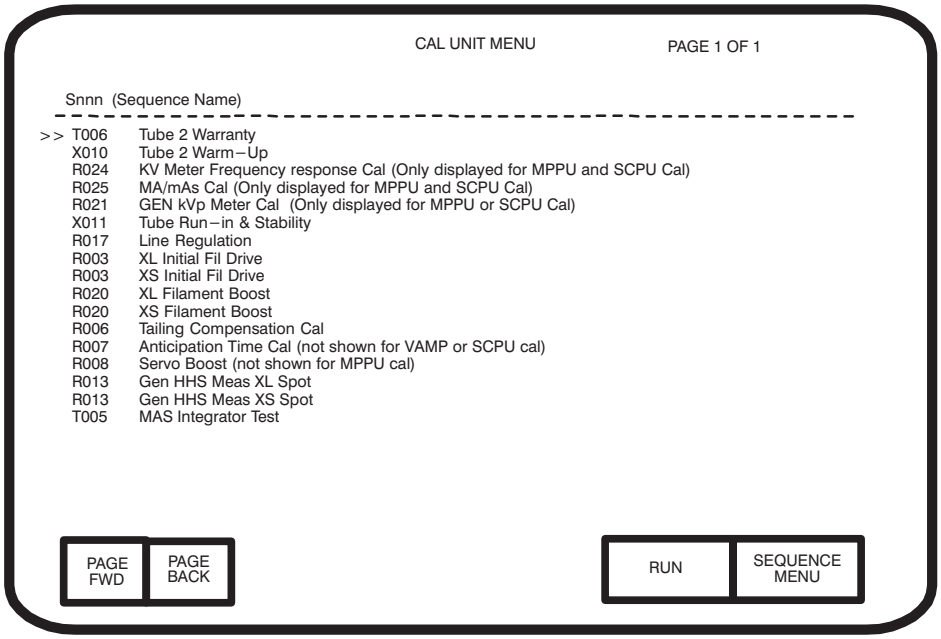
2-5 S003 – Generator Tube 1 Cal Sequence – SCPU

S003 SCPU SCREEN DISPLAY



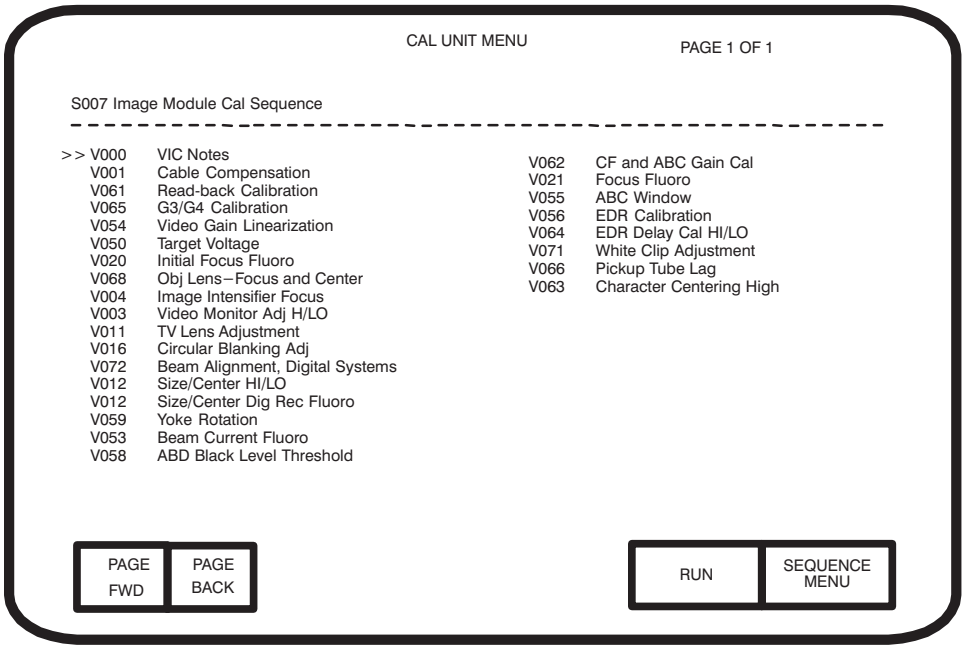
2-6 S004 – Generator Tube 2 Cal Sequence – SCPU

S004 SCPU SCREEN DISPLAY

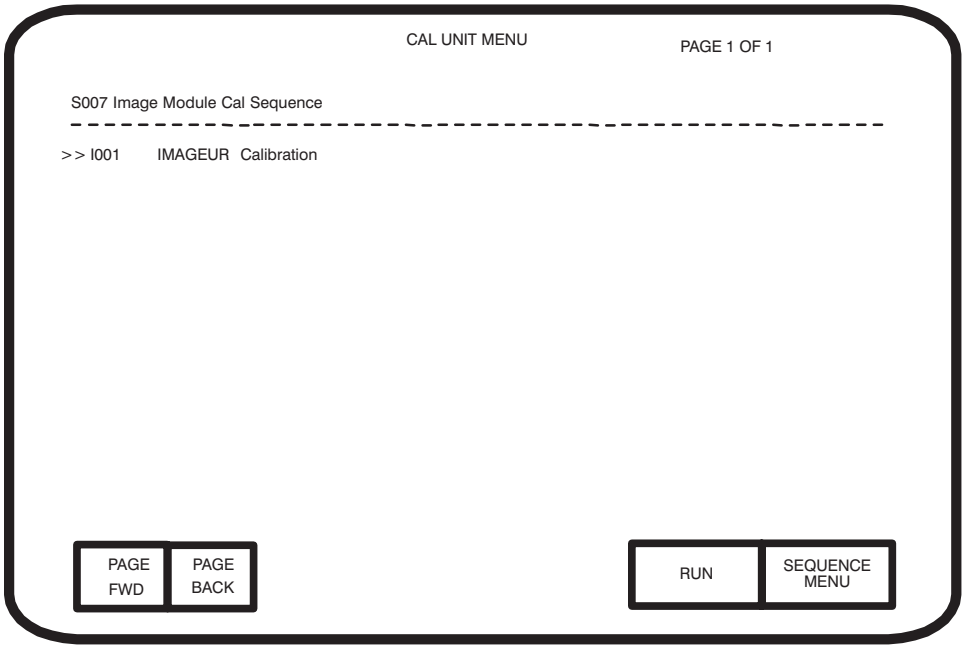


2-7 S007, Imaging Module Calibration Sequence

S007 TYPICAL VIC SCREEN DISPLAY

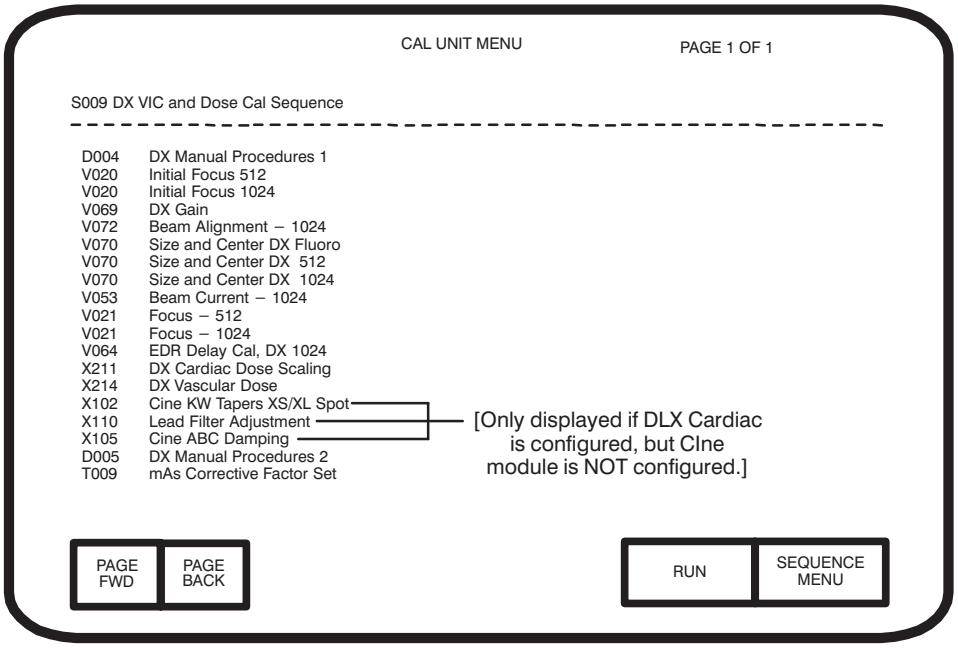


S007 TYPICAL IMAGEUR SCREEN DISPLAY



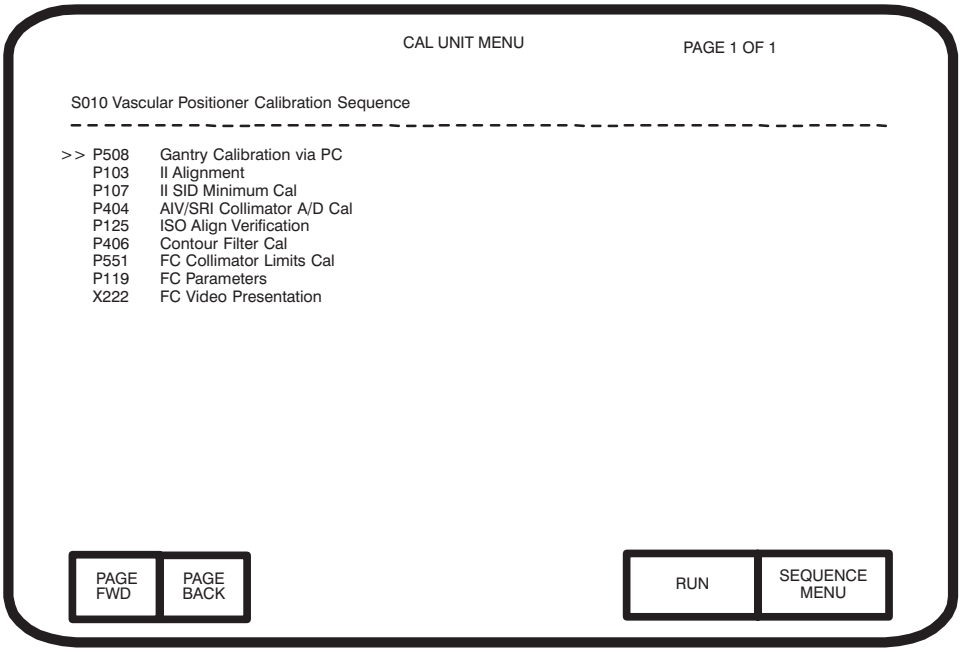
2-8 S009, DX (DLX) VIC and Dose Cal Sequence

S009 TYPICAL SCREEN DISPLAY



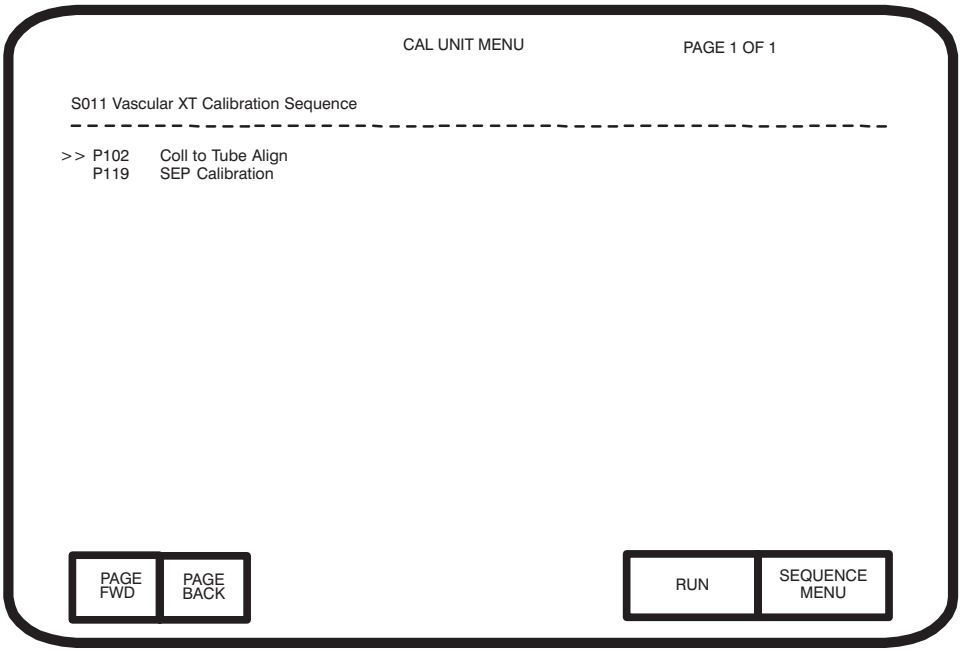
2-9 S010, Vascular Positioner Calibration Sequence

S010 TYPICAL SCREEN DISPLAY



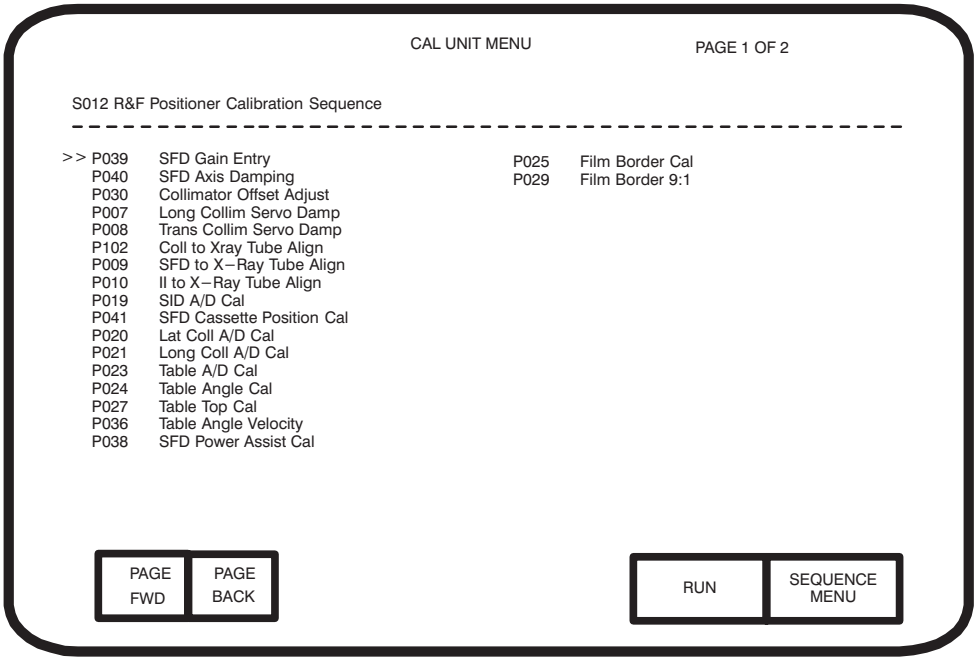
2-10 S011, Vascular XT Calibration Sequence

S011 TYPICAL SCREEN DISPLAY



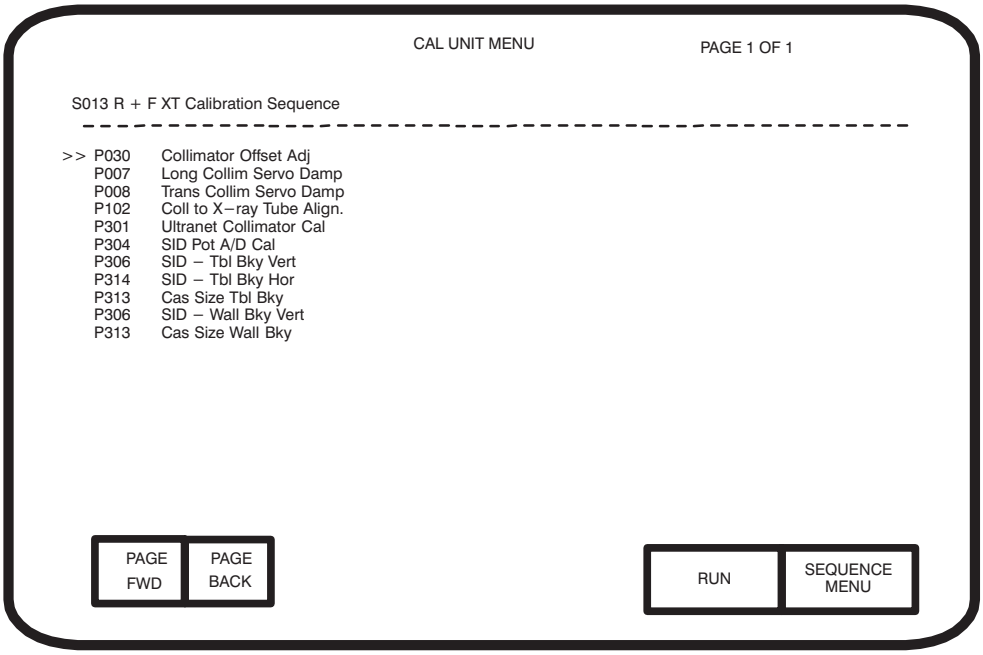
2-11 S012 R&F Positioner Calibration Sequence

S012, TYPICAL SCREEN DISPLAY



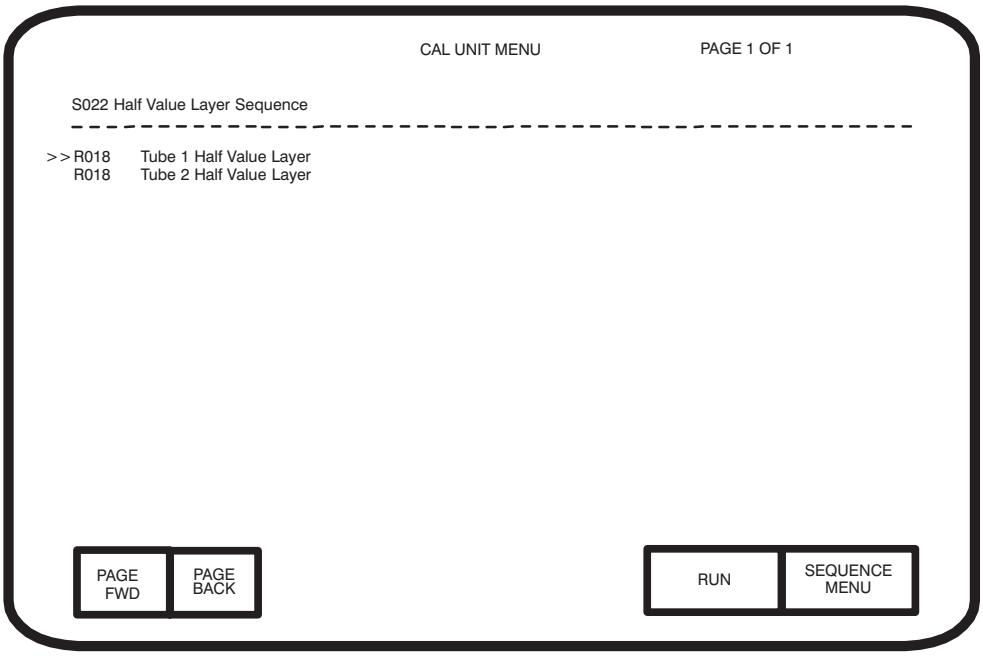
2-12 S013 R&F XT Calibration Sequence

S013 TYPICAL SCREEN DISPLAY



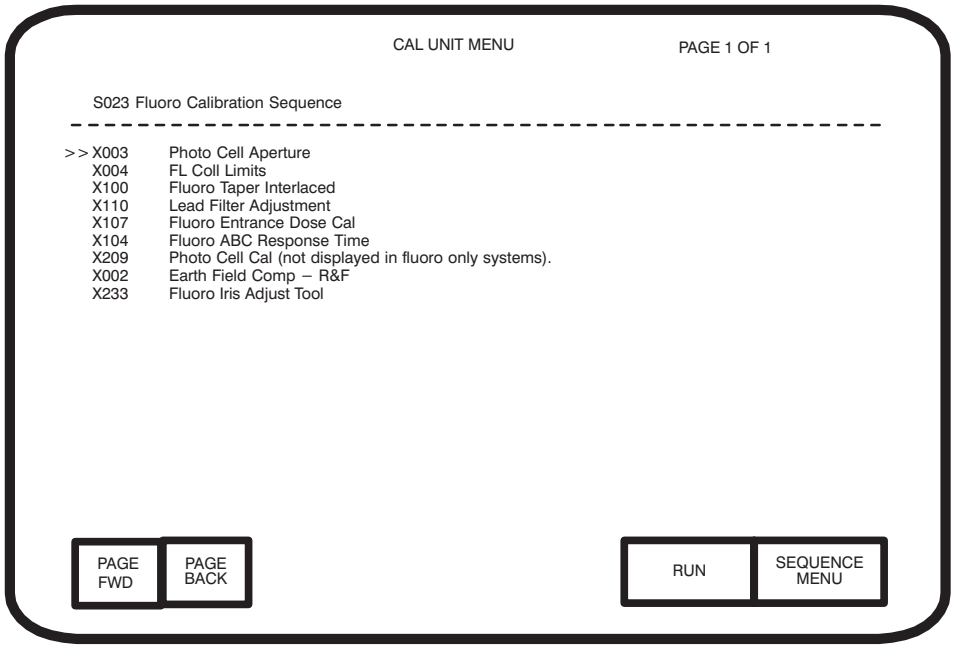
2-13 S022 Half Value Layer Sequence

S022 TYPICAL SCREEN DISPLAY



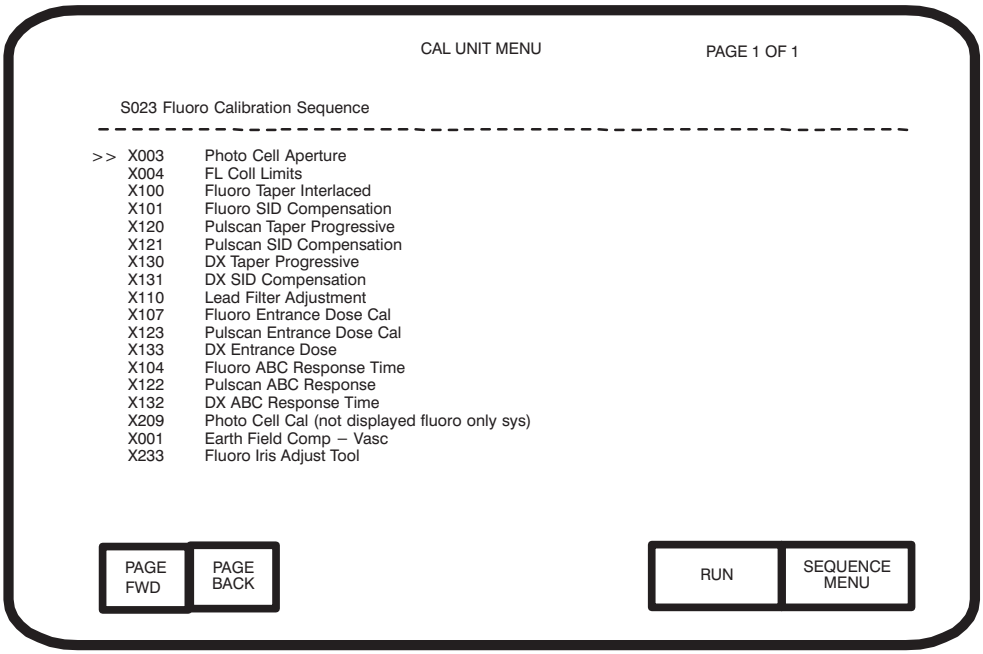
2-14 S023 R&F Fluoro Calibration Sequence

S023 TYPICAL LEGACY/LEGACY–D R&F SYSTEM SCREEN DISPLAY



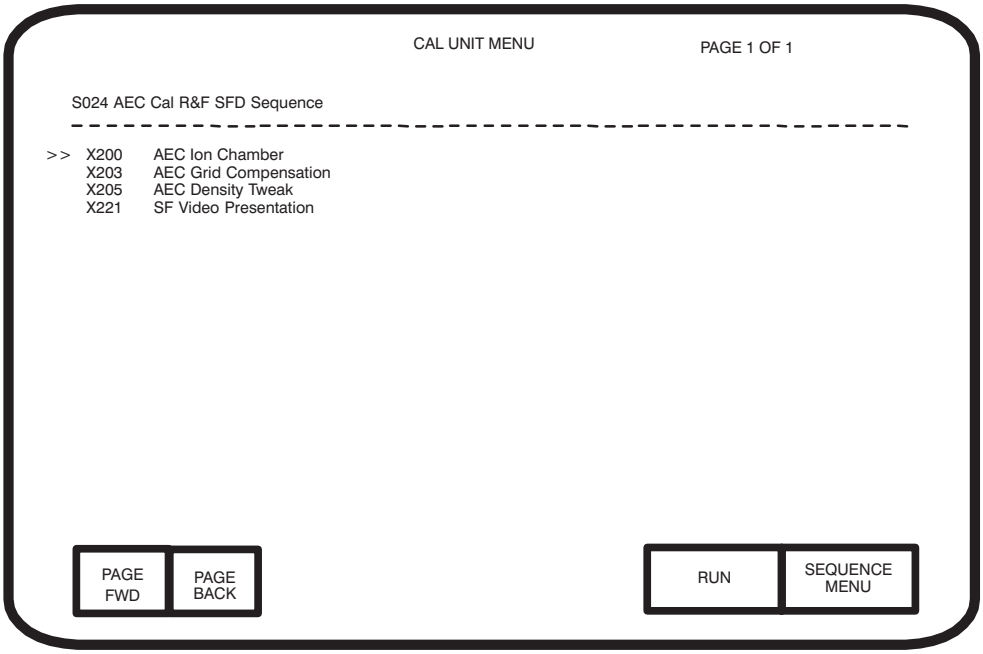
2-15 S023 Vascular Fluoro Calibration Sequence

S023 TYPICAL LCA SYSTEM SCREEN DISPLAY



2-16 S024 AEC Calibration R&F SFD Sequence

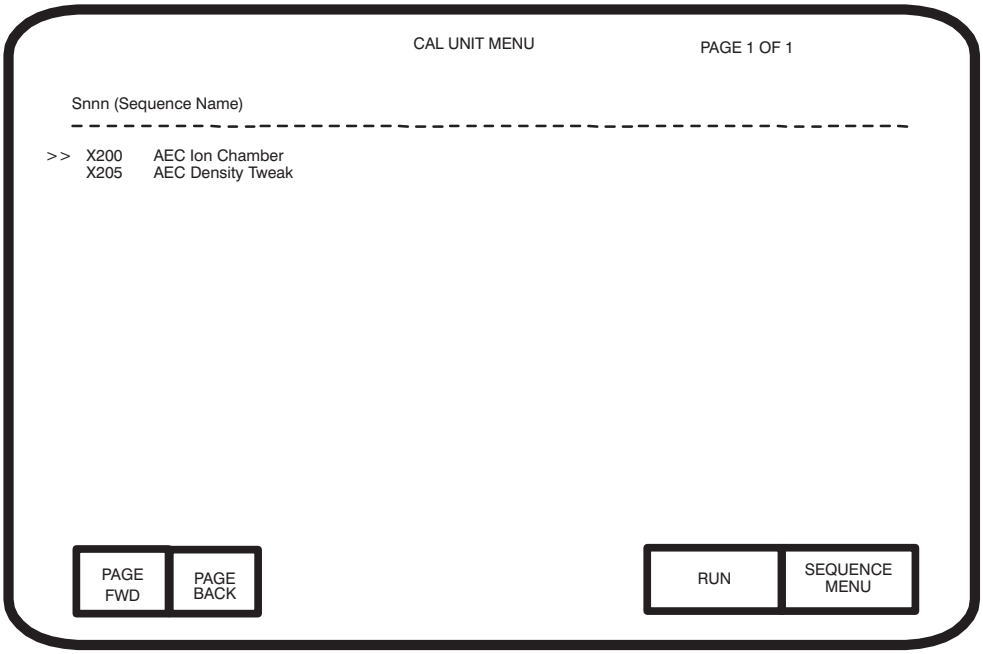
S024 TYPICAL SCREEN DISPLAY



2-17 S025 and S026 AEC Calibration R&F Bucky Sequences

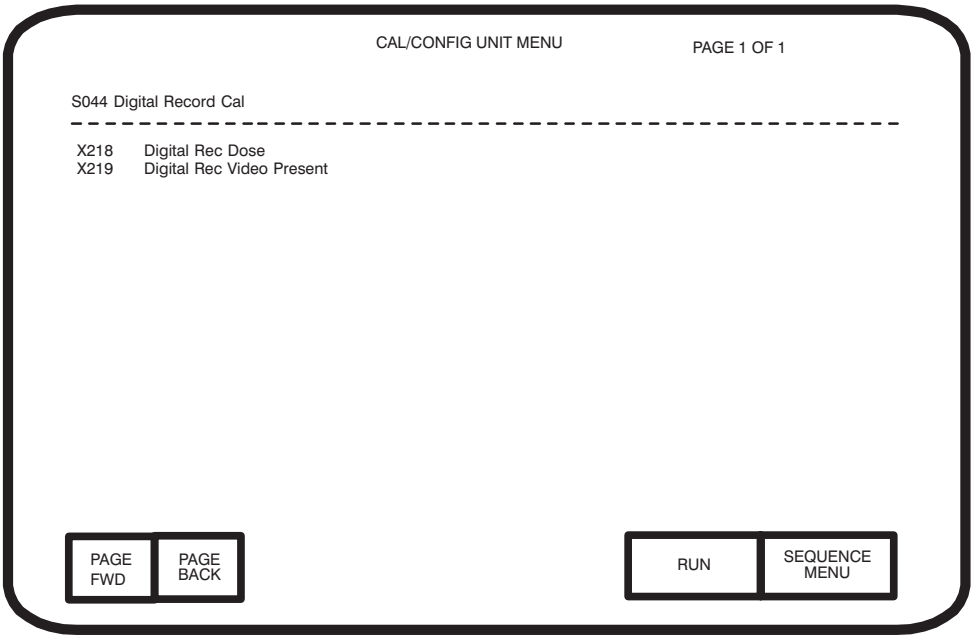
S025 AEC Calibration R&F Table Bucky Sequence
S026 AEC Calibration R&F Wall Bucky Sequence

S025 – S026 TYPICAL SCREEN DISPLAY



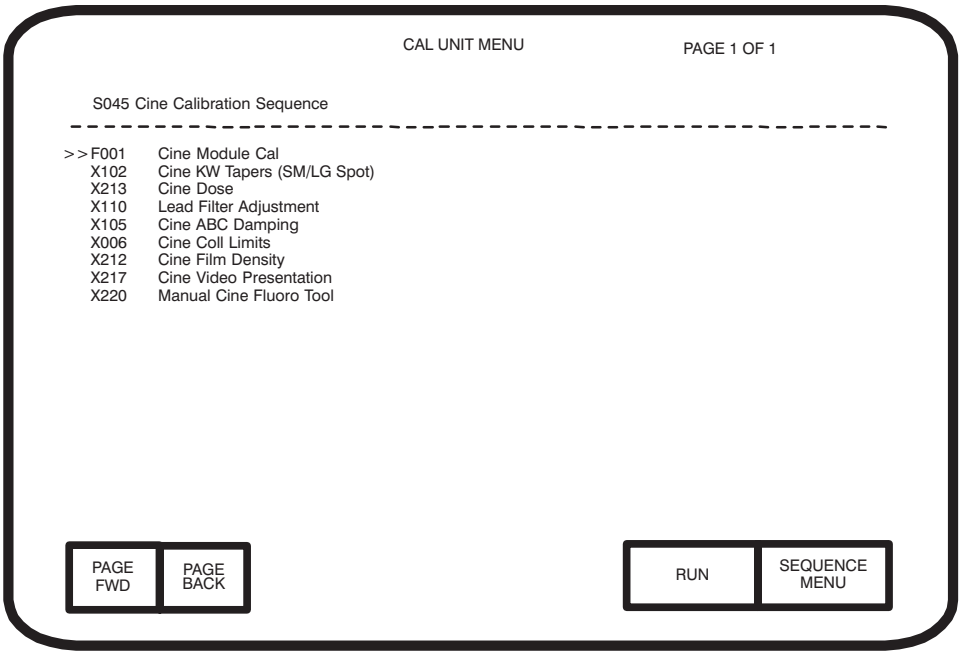
2-18 S044 Digital Record Calibration Sequence

S044 SCREEN DISPLAY



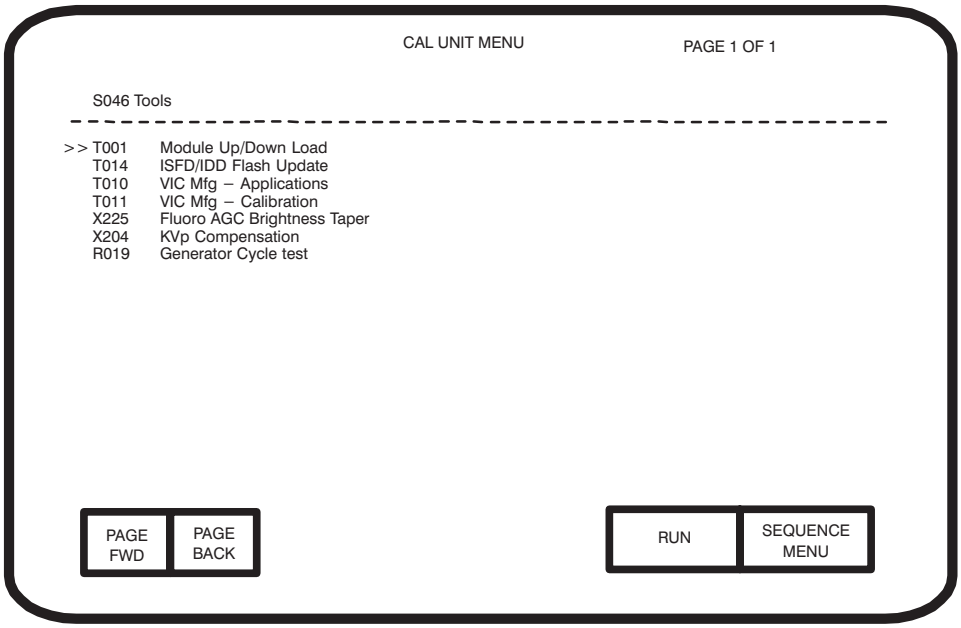
2-19 S045 Cine Calibration Sequence

S045 TYPICAL SCREEN DISPLAY



2-20 S046 Tools

S046 TYPICAL SCREEN DISPLAY



SECTION 4 – TOOL UNITS

Unit	Title	Page
T001	Module Up/Download	53
T005	mAs Integrator Test	55
T006	Tube n Warranty	57
T009	Corrective Factor Setting	61
T010	VIC Mfg – Applications	71
T011	VIC Mfg – Calibration	73
T014	ISFD / IDD Flash Update	75
T015	Ion Chamber Positioning Tool 2236707 Mounting Instructions	77

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UNIT T001 – Module Up/Download

Time: x h xx min – Personnel: 1 field engineer

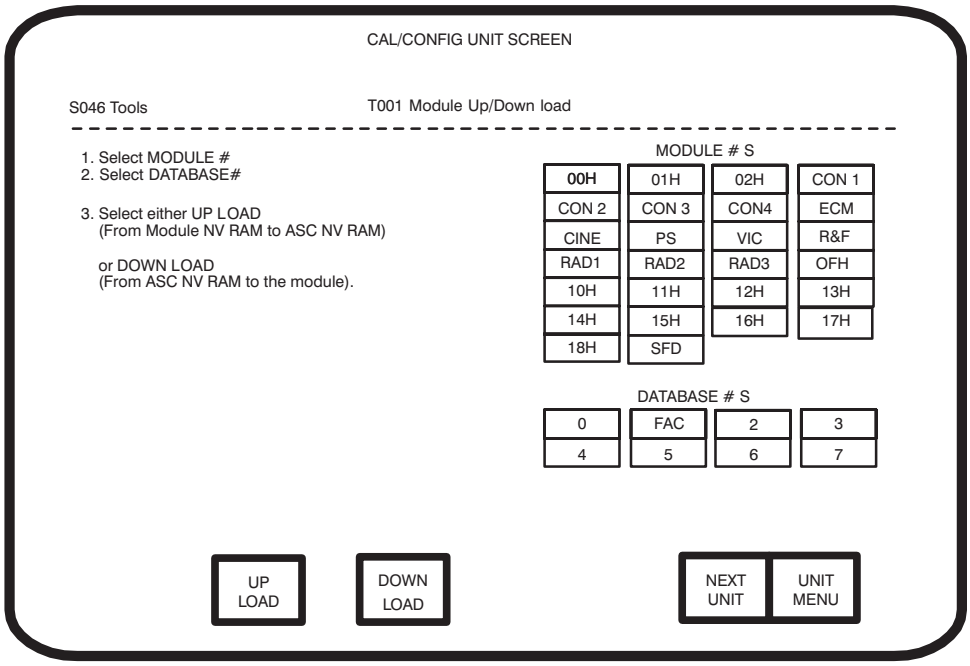
1 DESCRIPTION

Calibration Tool Unit T001 is used to transfer data between the ASC NV RAM and other module NV RAM's. This transfer is important for modules that store data in "local" NV RAM during calibration.

NOTICE

The only module currently using this data transfer capability is the SFD. Do not select R&F.

T001 MODULE UPLOAD/DOWNLOAD SCREEN DISPLAY



2 PROCEDURE

Select S046 Tools Sequence Menu on the Main Sequence Menu. Then, select Tool Unit T001, Module Up/Download, on the S046 Tools Menu.

3 SFD PROCEDURE

For the SFD Database, use the following procedure.

SFD Database Upload:

1. Select [SFD] module
2. Select [FAC] data base
3. Select [UP LOAD]

When the data transfer has been completed, touch NEXT UNIT or UNIT MENU softkey to exit the tool unit.

UNIT T005 – mAs Integrator Test

Time: x h xx min – Personnel: 1 field engineer

1 DESCRIPTION

Calibration Tool Unit T005 provides a functional check of the backup mAs integrator in accordance with the requirements of HHS (Refer to Direction 13894, Tab 3). The test verifies that the backup mAs integrator limits exposure time to 550 mAs. The unit automatically configures the system for exposures at 70 kVp, minimum mA (per applicable X–ray tube focal spot size), and maximum expose time. This Calibration Tool Unit does not calibrate values.

2 EQUIPMENT REQUIRED

None.

3 TEST PROCEDURE

Perform the Test as follows:

- Press the PREP and EXPOSE switches on the console handswitch to take an AEC primary timed exposure. For systems configured with an LFX or MP power unit, the exposure will be terminated with error code 4260 displayed on the console followed by other error messages, e.g. 422D.
- After the exposure, the measured expose time and calculated mAs will be displayed on the console screen. The backup mAs integrator is set to 550 mAs. If the calculated mAs is outside the range of 540 to 560 mAs, touch the BACKUP mAs GAIN softkey and use the console dial to adjust for proper mAs value. (A change in gain of 0.01 is equivalent to 4.0 mAs).

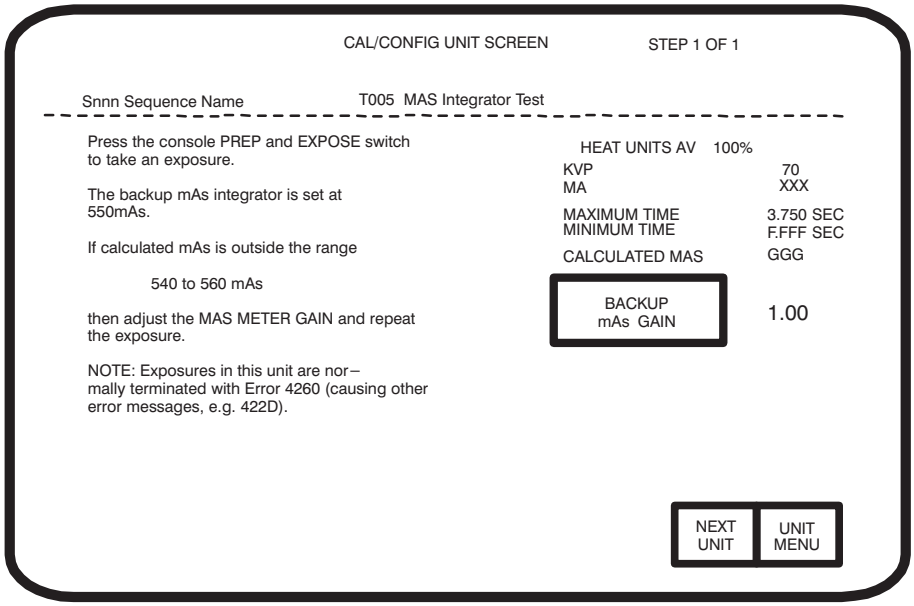
Note: If after the exposure, the calculated mAs is greater than 600 mAs error code A12C ”BACKUP MAS, INTEGRATOR TEST HAS FAILED” will appear on the console screen. To correct for this indication, touch BACKUP MAS GAIN softkey and use the console dial to adjust for proper mAs value.

- Repeat the exposure and readjust if necessary until mAs is within 540 to 560 mAs.

Note: If T005 test fails but other units work and you can take exposures, run the backup MAS meter diagnostic test. If the other units also fail and/or you can still take exposures, run the power unit and safety contactor diagnostic tests.

- Touch NEXT UNIT or UNIT MENU to exit the unit.

T005 BACKUP MAS INTEGRATOR TEST SCREEN DISPLAY



UNIT T006 – Tube n Warranty

Time: x h xx min – Personnel: 1 field engineer 1 of 3

Note: To exit this unit and unhighlight it in the sequence without affecting tube warranty data: 1) select RESET TOTAL, 2) DO NOT select EXECUTE, 3) then EXIT the unit.

1 DESCRIPTION

Calibration Tool Unit T006 provides a method of tracking and recording X–ray tube warranty data for each tube used in an Advantx System. The unit tracks a variety of usage parameters. The actual parameters displayed on the unit screen will vary according to the type of system for which the tube is configured. Two numbers are tracked for each usage parameter. The first number tracks total time since the system was first configured. The second number is a reference value that tracks total usage time since the last tube replacement. This number will be saved when a service person changes tubes and performs a warranty reset. The unit does not calibrate values.

2 EQUIPMENT REQUIRED

None.

Note: A database initialization will reset all tube warranty data. If the warranty data is to be retained, manually record the warranty parameters before proceeding with the database initialization.

3 RESET PROCEDURE

If a tube warranty reset is required, proceed as follows:

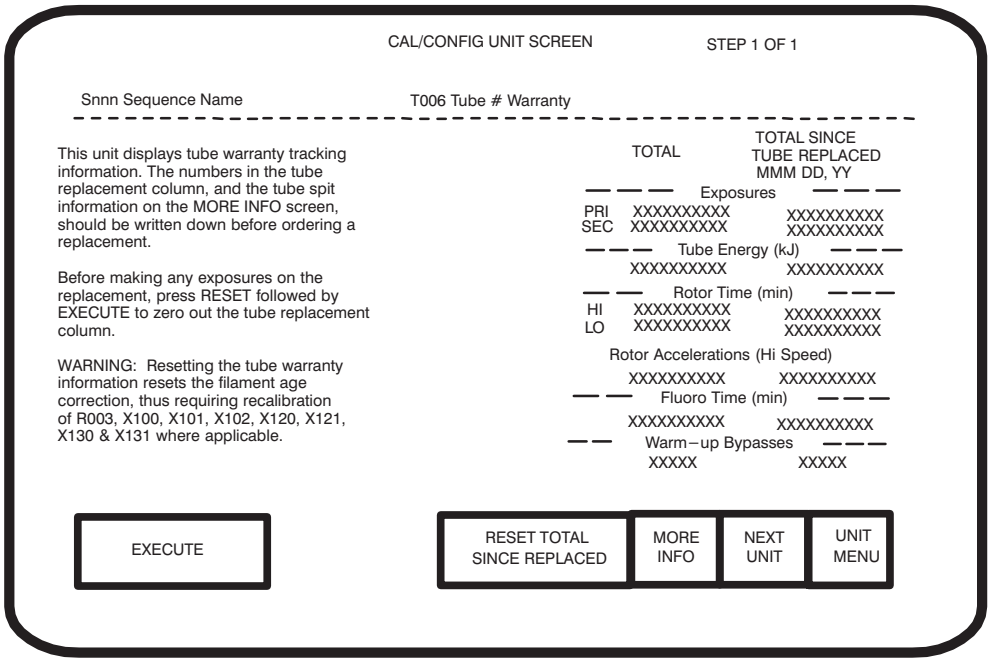
- Record the usage times displayed in the TOTAL SINCE TUBE REPLACED column for each parameter listed for the X–ray tube being replaced. FLUORO TIME and ROTOR TIME–LO are only displayed if the tube is configured for Fluoro. SEC is only displayed if Cine is configured. **Include this data with the tube being returned to the factory.**
- After a new X–ray tube is installed, touch the RESET TOTAL SINCE REPLACED softkey. When enabled the softkey is highlighted in reverse video. Then touch the EXECUTE softkey. All usage values in the TOTAL SINCE TUBE REPLACED column are reset to zero.

Note: Resetting the tube warranty also resets the tube Filament age correction parameters (Filament Aging and Fil Age (Last Cal)). This requires a recalibration of R003, X100, X101, X102, X120, X121, X130, X131, X150 and X151

Note: as applicable to the system configuration. For DRS systems, recalibration is also required for X140 and X141, even if these cal units are not specifically listed in the warning in the T006 screen display.

- Touch NEXT UNIT or UNIT MENU softkey to exit.

T006 READ TUBE WARRANTY SCREEN DISPLAY



PRI is the number of primary timed (i.e., radiographic) exposures (excluding tube warmups).

SEC is the number of secondary timed (i.e., cine) exposures.

TUBE ENERGY is the number of kilojoules input to the X–ray tube in primary timed, secondary timed, and secondary continuous modes.

HI is the time (in minutes) that the rotor has been at high speed.

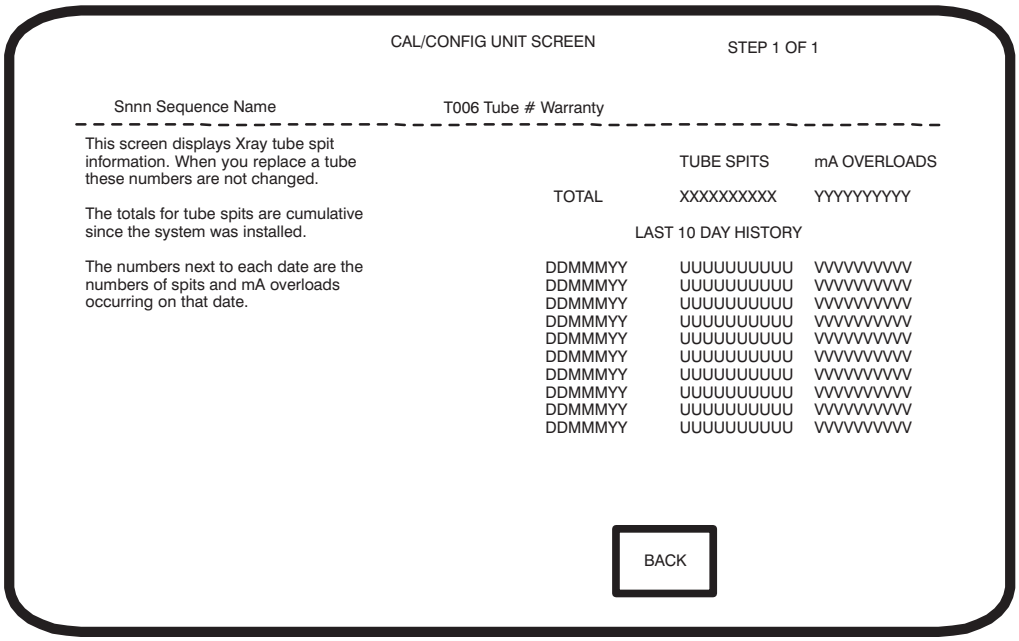
LO is the time (in minutes) that the rotor has been at low speed.

ROTOR ACCELERATIONS is the number of times that the rotor has been accelerated to high speed (0 minus HI) plus (LO minus HI).

FLUORO TIME is the number of minutes of fluoro.

WARM–UP BYPASSES is the number of times that a recommended tube warmup has been bypassed.

T006 "MORE INFO" SCREEN DISPLAY



YYYYYYYYYY is the number of mA overloads since systems installation.

DDMMMYY is the date associated for each value of UUUUUUUUUU and VVVVVVVVVV. The dates are displayed in descending order with today's date on top.

UUUUUUUUU is the number of spits for each day of operation for the last ten days.

VVVVVVVVVV is the number of mA overloads for each day of operation for the last ten days.

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UNIT T009 – Corrective Factor Setting

Time: x h xx min – Personnel: 1 field engineer

1 DESCRIPTION

This unit is used to set the value of a gain correction to compensate camera build up of an acquisition without scrub. The unit updates the data base data with the user selected value.

2 CAL PROCEDURE

Upon entry into the T009 Tool Unit, the operator shall be presented with a screen which displays the current selection of the Iris Gain Corrective Factor. If the current database value is outside the legal range, an error message shall be displayed notifying the operator that the database will be changed on normal exit.

The iris step value displayed is calculated based on the Iris Correction Factor. The iris step value displayed at that time has a precision of $\pm$ 1 iris step, i.e., $\pm$ 1% .

The entry value is given in number of iris step, and the selectable range is from 0 to 40 while the iris step range is 0 to 440.

Note: Do not confuse the different kinds of iris step. There are two ranges of iris step which are 0 to 44 for fluoro and 0 to 440 for graphy. We consider in this unit only ‘graphy steps’ (range 0 to 440), where one step changes the light intensity by 1%. In other units (fluoro calibration), ‘fluoro steps’ are used. In this last case, one step changes the light intensity by 10%.

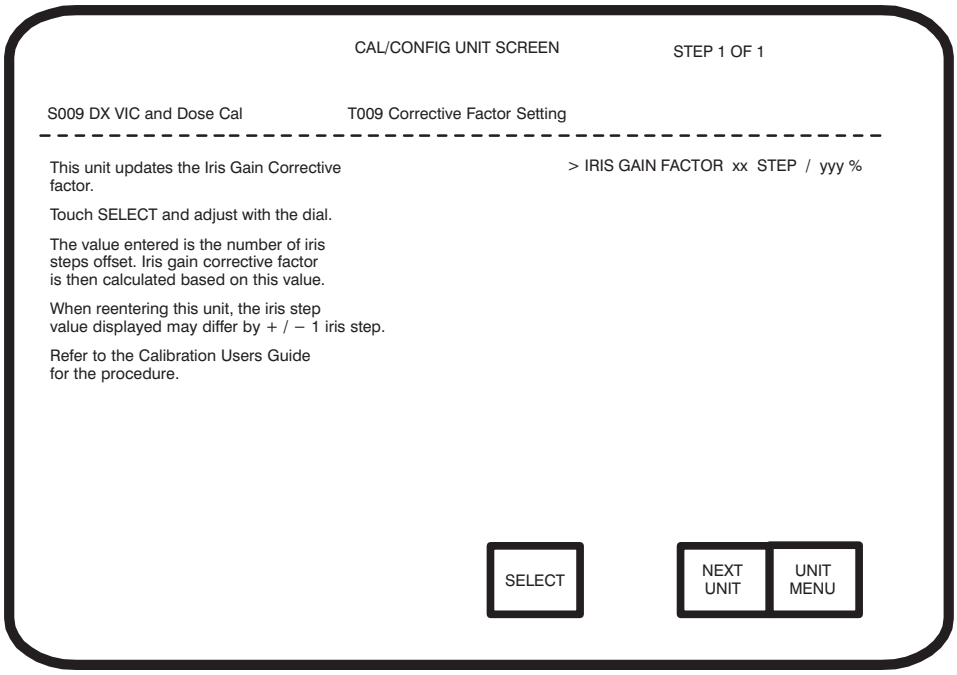
Based on the iris step value entered, the Iris Gain Correction Factor value is calculated and the database parameter NV_G_dv_iris_gn_cor_fctr_US is set.

$$\textit{Iris Gain Correction Factor in \%} = 100 \times (0.99)^{\textit{number of iris step}}$$

To change the Iris Gain Corrective Factor value displayed at unit entry, the operator shall touch the SELECT softkey, use the slew knob to adjust to the desired value, and then touch the SELECT softkey again when the desired value is displayed.

To exit the unit the operator touches NEXT UNIT or UNIT MENU. The NVRAM shall be updated with a new value if the selection was made prior to exit. If the current database value was outside its legal range, the value will be updated with a value of 100% (default value).

T009 CORRECTIVE FACTOR SETTING



In this screen, xx is the value of number of iris step, and yyy is the value of the iris gain corrective factor in %.

3 PRESENTATION

The purpose of this corrective factor is to compensate for brightness differences induced by acquisition rate.

Correction is done by closing the iris by a number of *steps* when the acquisition sequence contains a *fast segment*, i.e. at 3.1(3.8) or 6.2 (7.5) fps for respectively 50 (60) Hz line frequency. This applies to DSA, as well as to spin mode (1024 and 512), where it allows to get same levels in High Speed Spin and Regular speed.

Closing the iris by one step multiplies the image sensor illuminance by 0.99; changing the iris by N steps will *multiply* the image sensor illuminance by 0.99^N (N>0 means *closing* the iris; N <0 means *opening* the iris. The screen displays both the gain factor resulting from the iris change and corresponding number of steps.

In this procedure, the iris change can be programmed from 0 steps (100%) to 40 steps (64%).

Note: An incertitude of 1 step can be observed in conversions between gain and iris due to number rounding.

It is important to ensure the system is fully calibrated before you start the procedure. In particular, the DSA 1024 mode must be well adjusted and pass all standard DLX Image Quality Tests. The system should not exhibit Offset or Black Level Problems.

It is also extremely important that DSA Iris calibration has been carefully done previously, **using a frame rate ≤ 1.6 (1.9) fps in 1024 matrix size (including single shots).** Never use faster frame rates. In addition, it is **essential to do these calibrations on an image in steady state, i.e., third or fourth image. Never calibrate iris on a single shot image.**

Note: It is known that in rare cases the verification fails. This is due to measurement uncertainties and differences between iris running point during calibration and verification. That is why a fifth step has been added to this unit. This step allows the operator through a calculation to let the verification be correct.

4 PROCEDURE

4-1 Step 1

1. In Service mode, first initialize IRIS CORRECTIVE FACTOR. Start the calibration with a correction close to minimum (i.e., 0).
2. Note carefully this initial value in Table 1, Column 1.

4-2 Step 2

Load Advantx Application software and set–up the system as follows (valid for all the procedure):

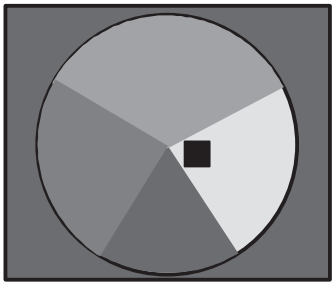
II Field of view:	22 cm (9”)
Dose:	C
Focal Spot:	Large
Matrix:	1024
High Voltage:	80kVp
Tube Current:	640 mA
Table top:	at isocenter
Test Object:	CV II on table top, centered carefully in the beam.
II Position:	300 mm (≈12”)above table top
Collimator:	AUTO mode
DLX:	NOSUB

4-3 Step 3

1. Prepare following Multi-segment Sequence (further designated as SLOW sequence) on Advantx Console:

	1.6 (1.9) fps	0.0s	1.6 (1.9) fps	0.0s	1.6 (1.9) fps
0.5 s	8.0 s		0.0 s		0.0 s

2. Enter DLX Technical Menu.
3. Enter the LEVEL ADJUST mode with 10 bit sampling.
4. After doing a PREP, note IRIS value resulting from previous calibration in Table 1, Column 2.
5. Acquire an image.



6. Adjust size and position of a measuring BOX on the CV phantom LUNG Region, close to the center (see figure).

   Be sure NOT TO MOVE the box between this and following sequences.

7. Set AEC ON in order to execute sequences programmed through Advantx console.
8. Adjust IRIS in order to get a PEAK level of 240 ± 5. (Acquire full sequence and measure PEAK value on last image). Record PEAK and MEAN values.
9. This operation mimics the trial.
   This value is named IRIS_SLOW.

Note: In order to ensure perfect repeatability, it is recommended to carefully decompose PREP and EXPOSE (5 seconds in between), and avoid repeated multiple PREP before EXPOSE.

10. Record Iris value and corresponding MEAN and PEAK values in Table 1, Column (3);
11. Temporarily store this iris value (STORE IRIS).
12. Prepare following Multi-segment Sequence (further designated as FAST sequence) on Advantx Console:

	3.1 (3.8) fps	0.0s	1.6 (1.9) fps	0.0s	1.6 (1.9) fps
0.5 s	5.0 s		0.0 s		0.0 s

Note: Iris correction with speed of fastest segment is active in Tech Menu. Therefore, values of Iris Aperture displayed when a fast rate is selected are not those effectively used. They are offset by the number of steps displayed in T009.

13. **Adjust Iris Aperture to the value (IRIS_FAST) giving a PEAK level in FAST sequence as close as possible to the PEAK level obtained previously in SLOW sequence when using IRIS_SLOW. Do not switch the NDF. If it is impossible to obtain the same level as in slow sequence, switch the NDF and perform again the step so that both slow and fast calibration are performed with the NDF in the same state.**
    - by repeated adjustment/measurement
    - or by:
      – applying following computation:

        IRIS_FAST = IRIS_SLOW + IRIS_DIFFERENCE
        with: IRIS_DIFFERENCE = Log(Slow/Fast) / Log(0.99).
        Example: iris 145 gave level 235 in SLOW, and level 207 in FAST.
        This indicates that initial correction is too strong, since level in fast sequence is lower than in slow sequence.
        New iris is:
        145 + [LOG(235/207) /LOG(0.99)] = 145 + [0.05509/(–0.004364)]
        = 145 –12.6
        = 132

      – loading this iris value,
      – making a new acquisition to check result, and fine tuning if needed.

14. Record in Table 1, Column (4) the new iris setting (IRIS_FAST), and corresponding MEAN and PEAK values obtained with this new iris.
15. Record in Table 1, Column (5) the value of IRIS_DIFFERENCE equal to the difference (IRIS_FAST – IRIS_SLOW).
16. Compute new IRIS CORRECTIVE FACTOR by adding same IRIS_DIFFERENCE to initial number of steps of IRIS GAIN FACTOR.

    Example: if initial value was 32 steps and difference (–12) as above, new value is 32–12=20.
17. Restore IRIS opening to its calibrated value (from Table 1 Column 2) by typing the number and performing a STORE IRIS.

4-4 Step 4

1. Go into Service Mode.
2. Enter unit T009.
3. Dial new value of IRIS GAIN FACTOR reading the STEP indication.

4-4-1 Verification

4-4-1-1 Fast Run

1. Reset Titan in Application mode.
2. Open a new examination on DLX.
3. Keep Test Object and acquisition conditions the same as above.
4. Set following sequence:

	6.3 (7.5) fps	0.0s	3.1 (3.8)fps	0.0s	1.6 (1.9) fps
0.5 s	3.0 s		5.0 s		5.0 s

5. Perform a TRIAL using default ROI, with no manual adjustment of SIZE, POSITION, or LEVEL.
6. Acquire the sequence.
7. Enter Advanced Processing/Region Stats/Dilution Curve on DLX.
8. Adjust size and position of box as above.
9. On dilution curve, measure levels on images corresponding approximately to times of 3, 7 and 12 s and the level of which is representative of the steady state in the segment.

Note: Levels should be strictly less than 250. If MEAN>250, calibration of iris values should be checked.

10. Complete Table 2.

4-4-1-2 Slow Run

1. In same conditions, set following sequence:

	2.1 (2.5) fps	0.0s	1.6 (1.9) fps	0.0s	1.1 (1.3) fps
0.5 s	8.0 s		8.0 s		10.0 s

2. Perform a TRIAL using default ROI, with no manual adjustment of SIZE, POSITION, or LEVEL.
3. Acquire the sequence.
4. Enter Advanced Processing/Region Stats/Dilution Curve on DLX.
5. Adjust size and position of box as above.
6. On dilution curve, measure levels on images corresponding approximately to times of 7, 14 and 24 s, and the level of which is representative of the steady state in the segment.

Note: Levels should be less than 250. If MEAN>250, calibration of iris values should be checked.

7. Complete Table 3.

Note: The effectiveness of this procedure is judged according to relative difference (7) in Table 3, which compares same frame rate in presence of a fast segment or not. If result is not satisfactory, acquire new verification fast and slow sequences. If the results (mean levels in Table 2 and Table 3) are confirmed with other verification sequences, then proceed with Step 5. It is known that because of measurement uncertainties both in calibration and verification, the result of the verification can vary from one set verification sequence to another.

4-5 Step 5

If the calibrated iris correction factor does not pass the verification, execute the following steps:

1. Calculate the ratio C=log((5)/(2))/log(0.99) where (2) and (5) are the mean values of Table 2 Cell (2) and Table 3 Cell (5). Record it in Table 4 Column (2).
2. Add this number C to the calibrated iris correction factor and record the obtained value in Table 4 Column (3). This value is the new iris correction factor.
3. Go in service mode.
4. Enter unit T009.
5. Dial the new value of IRIS GAIN FACTOR reading the STEP indication.
6. Perform the verification again.

Table 1 – Adjustments

		1.6 (1.9) fps	3.1 (3.8) fps		
INITIAL Value for IRIS CORRECTIVE FACTOR (in STEPS) (1)	Initial Value for IRIS in DOSE C (2)	IRIS_SLOW (3)	IRIS_FAST (4)	IRIS DIFFERENCE (5) = (4)–(3)	NEW Value for IRIS CORRECTIVE FACTOR = INITIAL + DIFFERENCE (6) = (1)+(5)
		Corresponding MEAN LEVEL	Corresponding MEAN LEVEL		

Table 2 – Verification (Fast Run)

Approximate Time (s)	3	7	12
Image Number			
MEAN LEVEL	(1)	(2)	(3)
Relative Difference vs. 1.6(1.9)fp (%)	$=100 \times \frac{(1)-(3)}{(3)}$	$=100 \times \frac{(2)-(3)}{(3)}$	N/A
Max Difference	± 4%	± 4%	N/A

Table 3 – Verification (Slow Run)

Approximate Time (s)	7	14	24
Image Number			
MEAN LEVEL	(4)	(5)	(6)
Relative Difference vs. 1.6(1.9)fp (%)	$=100 \times \frac{(4)-(5)}{(5)}$	N/A	$=100 \times \frac{(6)-(5)}{(5)}$
Max Difference	± 5%	N/A	± 4%
FAST to SLOW	$=100 \times \frac{(1)-(5)}{(5)}$	$=100 \times \frac{(2)-(5)}{(5)}$	$=100 \times \frac{(3)-(5)}{(5)}$
Relative Difference vs. 1.6(1.9)fp (%)			(7)
Max Difference	± 4%	± 4%	± 3%

Table 4 – Correction (Only if First Verification didn't Work)

CALIBRATED IRIS CORRECTION FACTOR (1)= Table 1(6)	C=log(Table 3 (5)/ Table 2 (2))/log(0.99) (2)	NEW value for IRIS CORRECTION FACTOR=calibrated value+C (3)=(1)+(2)

Table 5 – Second Verification (Fast Run) if step 5 was performed

Approximate Time (s)	3	7	12
Image Number			
MEAN LEVEL	(1)	(2)	(3)
Relative Difference vs. 1.6(1.9)fp (%)	$= 100 \times \frac{(1)-(3)}{(3)}$	$= 100 \times \frac{(2)-(3)}{(3)}$	N/A
Max Difference	± 4%	± 4%	N/A

Table 6 – Second Verification (Slow Run) if step 5 was performed

Approximate Time (s)	7	14	24
Image Number			
MEAN LEVEL	(4)	(5)	(6)
Relative Difference vs. 1.6(1.9)fp (%)	$= 100 \times \frac{(4)-(5)}{(5)}$	N/A	$= 100 \times \frac{(6)-(5)}{(5)}$
Max Difference	± 5%	N/A	± 4%
FAST to SLOW	$= 100 \times \frac{(1)-(5)}{(5)}$	$= 100 \times \frac{(2)-(5)}{(5)}$	$= 100 \times \frac{(3)-(5)}{(5)}$
Relative Difference vs. 1.6(1.9)fp (%)			(7)
Max Difference	± 4%	± 4%	± 3%

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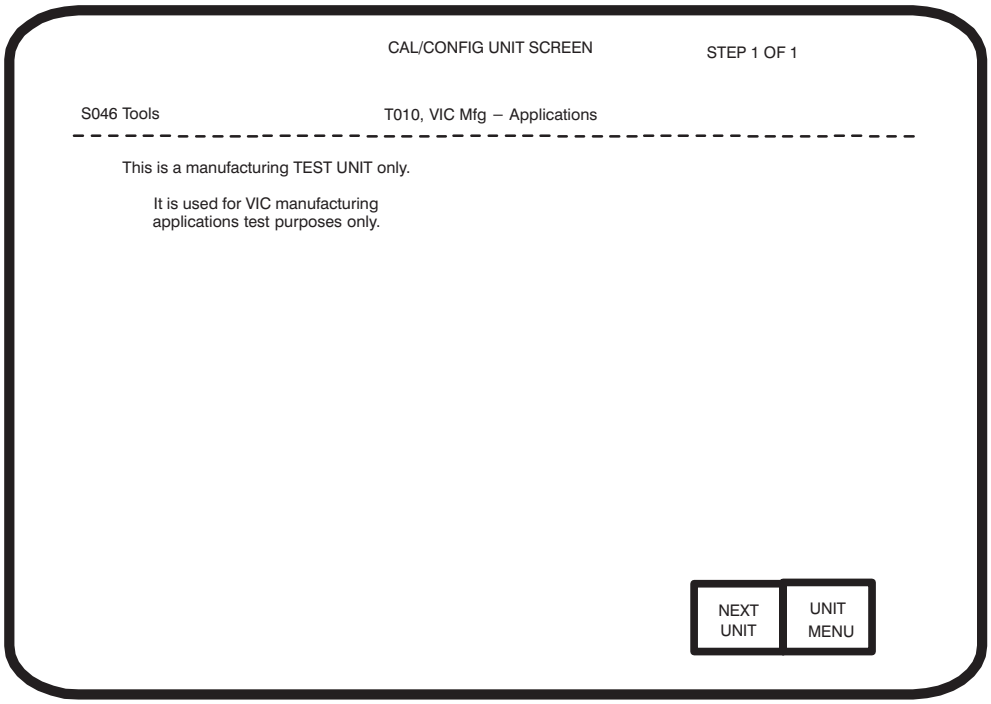
UNIT T010 – VIC Mfg – Applications

Time: x h xx min – Personnel: 1 field engineer

1 DESCRIPTION

Tool Unit T010 is a test unit intended for GE factory use only. The unit provides test functions for VIC manufacturing application purposes and is not required for field calibration of an Advantx system.

T010 SCREEN DISPLAY



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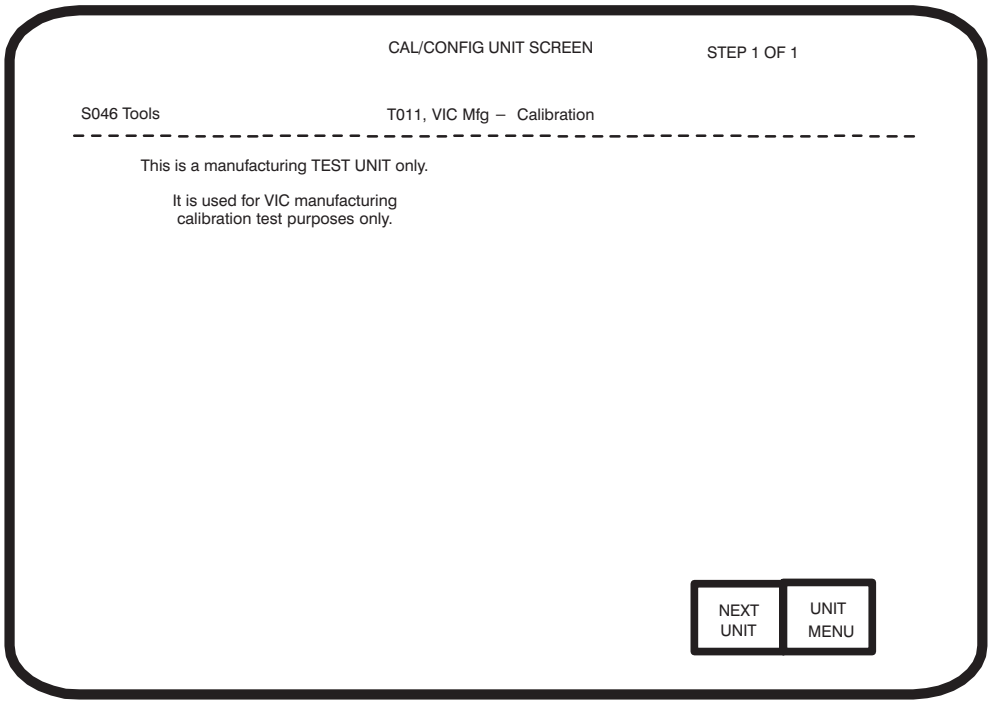
UNIT T011 – VIC Mfg – Calibration

Time: x h xx min – Personnel: 1 field engineer

1 DESCRIPTION

Tool Unit T011 is a test unit intended for GE factory use only. The unit provides test functions for VIC manufacturing calibration purposes and is not required for field calibration of an Advantx system.

T011 SCREEN DISPLAY



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UNIT T014 – ISFD / IDD Flash Update

Time: x h xx min – Personnel: 1 field engineer

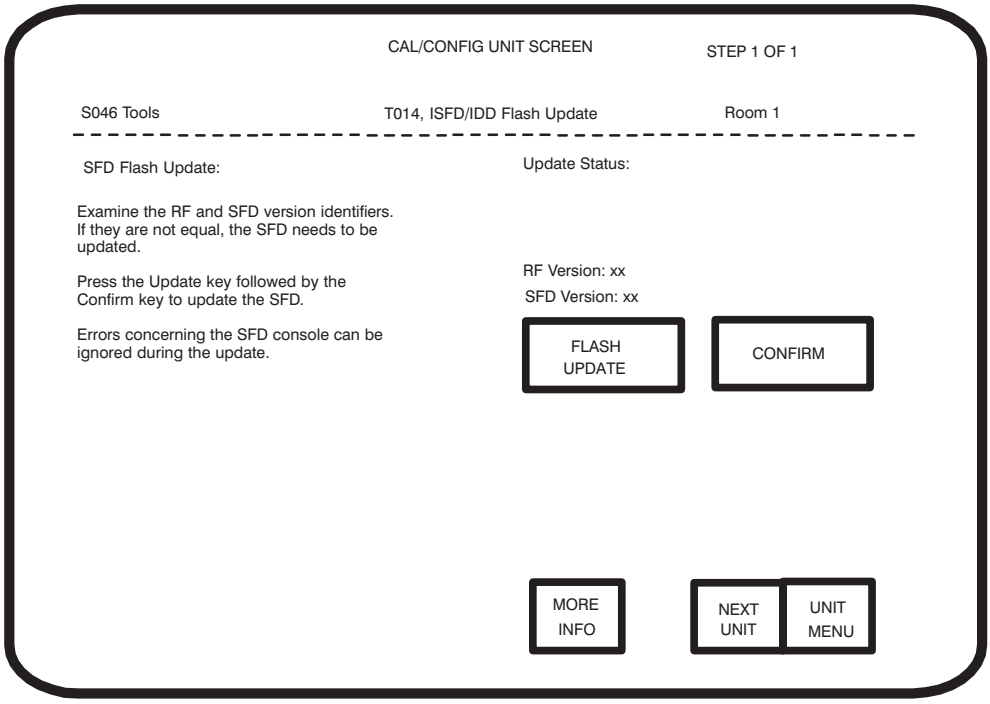
1 DESCRIPTION

Tool Unit T014 provides a method of updating the spot film device firmware by means of a flash memory update.

CAUTION

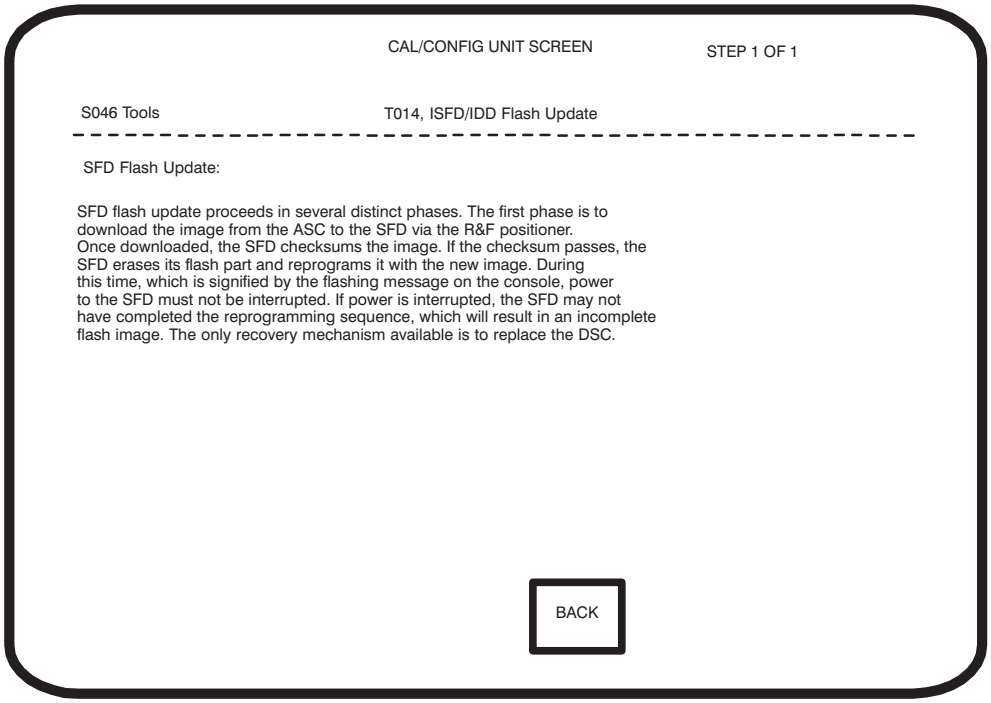
During the time that the spot film device is erasing and updating its firmware, which is signified by the flashing message on the console, DO NOT interrupt power to the spot film device. If power is interrupted, the spot film device may not have completed the reprogramming sequence which will result in an incomplete flash image. The only recovery mechanism available is to replace the DSC.

T014 SCREEN DISPLAY



UNIT T014 – ISFD / IDD Flash Update 2 of 2

T014 SCREEN DISPLAY



UNIT T015 – Ion Chamber Positioning Tool 2236707 Mounting Instructions

Time: x h xx min – Personnel: 1 field engineer

1 COMPATIBILITY

This tool is used to PRECISELY position the dosimeter's Ion Chamber, which is used to calibrate the Vascular systems.

1-1 Systems

This tool is only compatible with the LCA, LCA+, LCV+, LC+, LCN+ and LCLP+ systems. For other systems, use the positioning tool that is provided in the dosimeter case.

The tool is designed to be mounted on the II. with or without its covers. However, the 22 cm spacer (Illustration 16, item 7) is needed to mount the tool on a 22 cm II without covers.

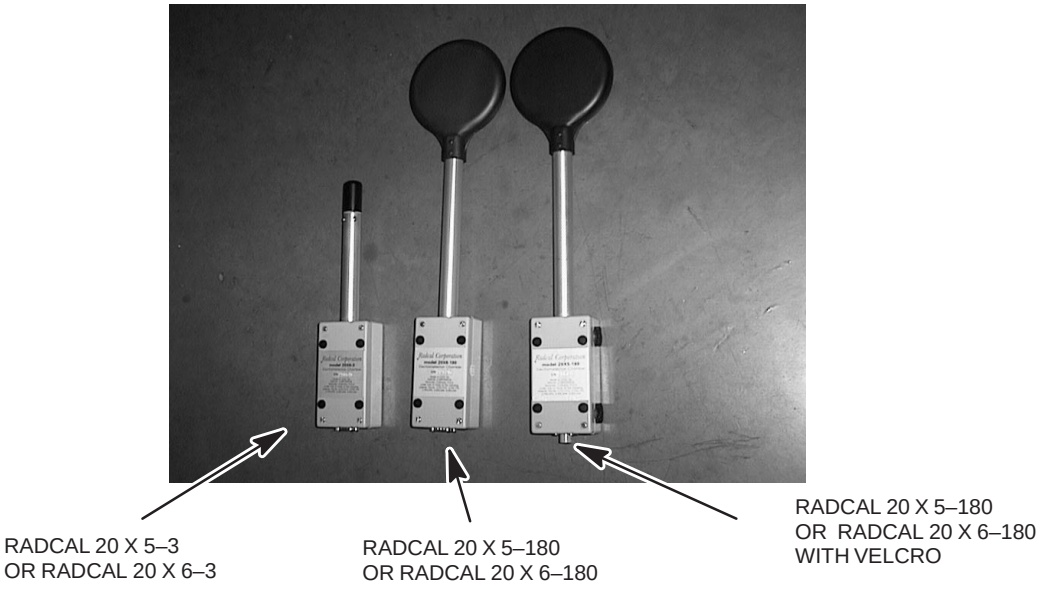
Likewise, the UIH40 spacer (Illustration 16, item 6) is needed to mount the tool on a UIH40 II.

1-2 Dosimeters

This tool is only compatible with two types of ion chambers as shown in Illustration 15.

Note: It is possible that chamber type 20 x 5–180 or 20 x 6–180 has a Velcro patch attached on one side. This does not interfere with the usage of the tool.

Illustration 15 – Ion chambers compatible with the tool

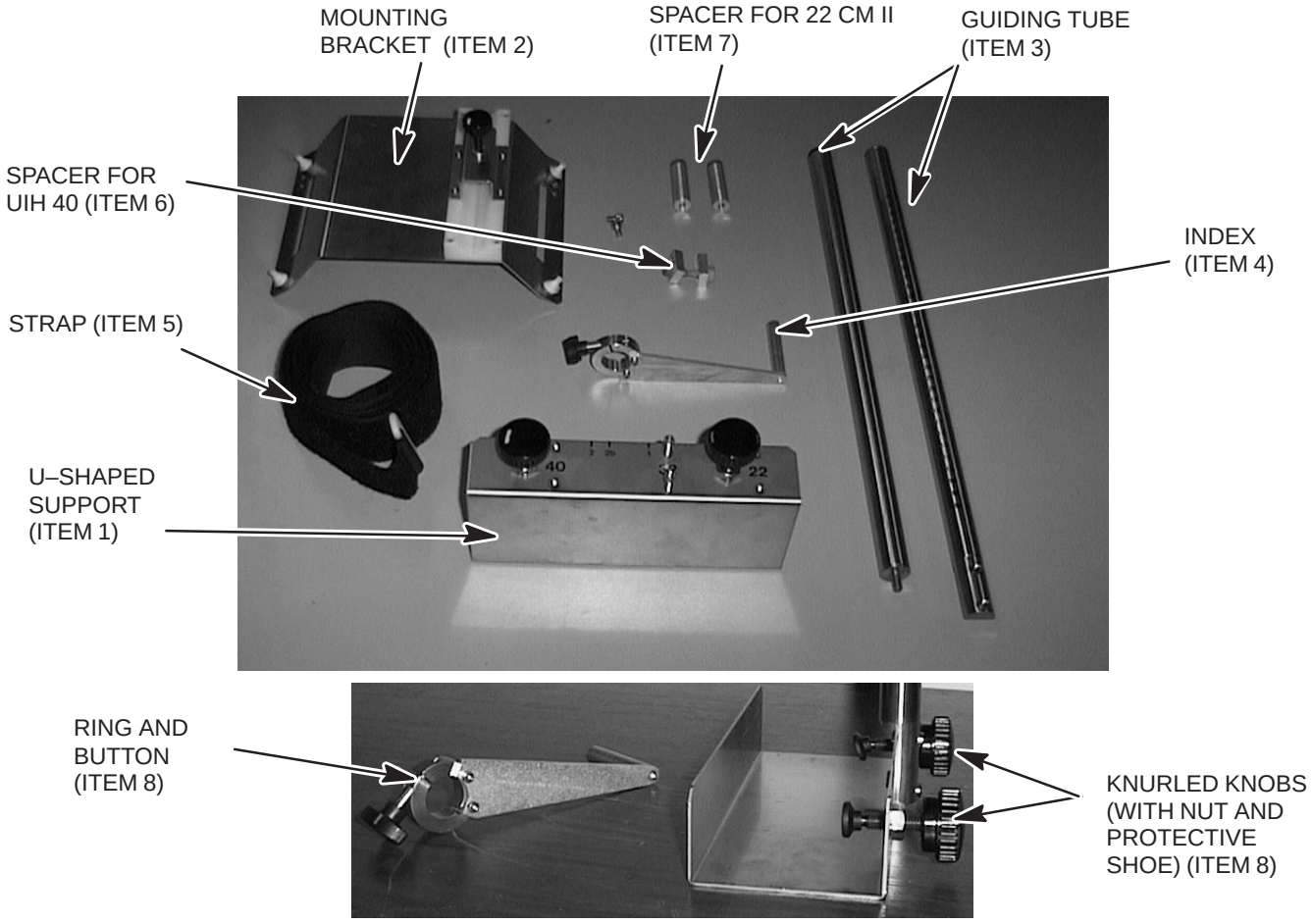


2 HOW TO USE TOOL

The tool is composed of 8 elements, 4 of them are spare parts. See Illustration 16.

Item No.	Part Number	FRU	REP	Description
–	2236707			ION CHAMBER POSITIONING TOOL
2	• 2212699	2	Y	MOUNTING BRACKET
3	• 2225572	2	Y	GUIDING TUBE
5	• 2212700	2	Y	STRAP
8	• 2212698	2	Y	RING, BUTTON AND KNURLED KNOBS

Illustration 16 – Tool composition



2-1 Assembling

1. Assemble the two half tubes (Illustration 16 Item 3).
2. Mount the guiding tube on the U–shaped support (see Illustration 18.) There are three fixation points corresponding to each II diameter (see Table 7 and Illustration 17).

Note: **For LCV+/LCN+ only**: Some countries may have 20*50–180 (or 20*60–180) probes, which length is different from the usual probes provided with 2025/2026 dosimeters. In this case, the ion chamber positioning tool can still be used, but a specific mechanical adjustment shall be performed: **Adjust the U–shape support position so that the tube is fixed on Mark 22 (instead of Mark 32)**.

3. For the 22 cm II , **if the II is not equipped with its covers**, fix the 22 cm spacer (Illustration 16 Item 7) on the mounting bracket as shown in Illustration 19.
4. For the UIH40, fix the UIH40 spacer (Illustration 16 Item 6) on the mounting bracket as shown in Illustration 20.

Illustration 17 – Fixation points for the tube

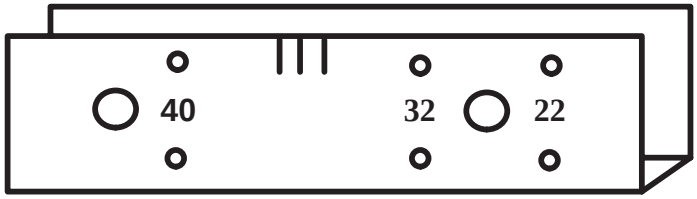


Table 7 – Mounting tube on U–shaped suppoRt configurations

	Tube positioning
22 cm II	Mark 22
32 cm II	Mark 32
40 cm II	Mark 40

Illustration 18 – Tube attached on the U–shaped support

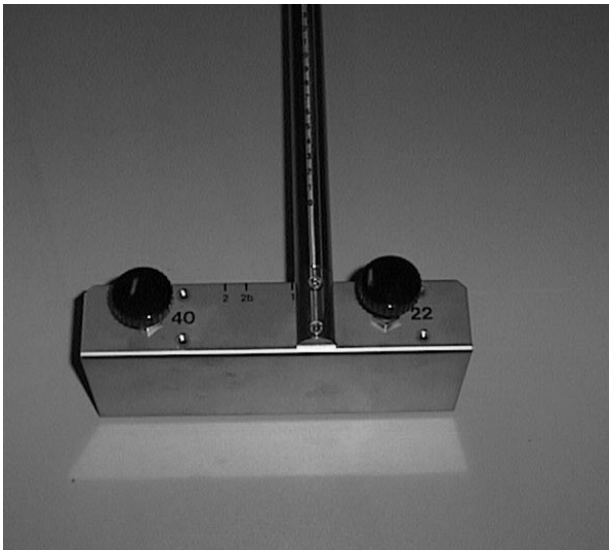


Illustration 19 – 22 cm spacer fixed on mounting bracket

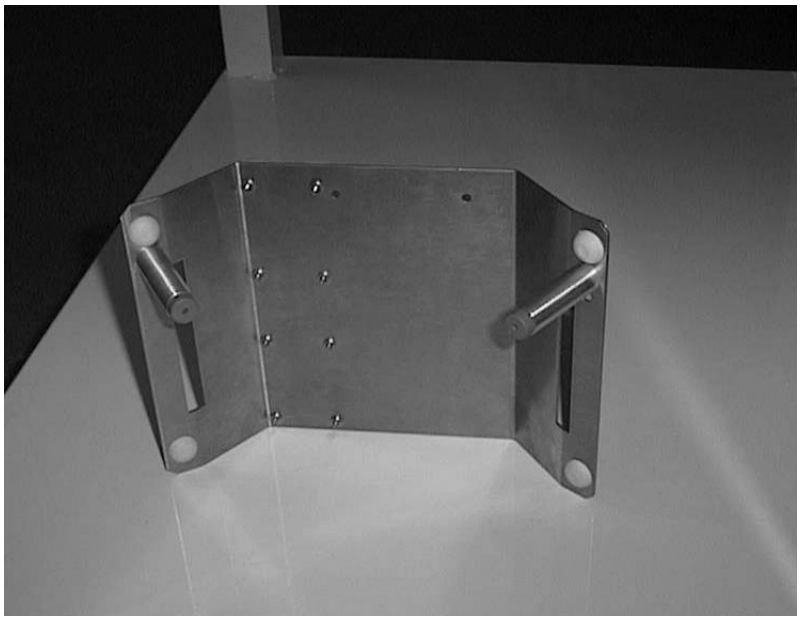
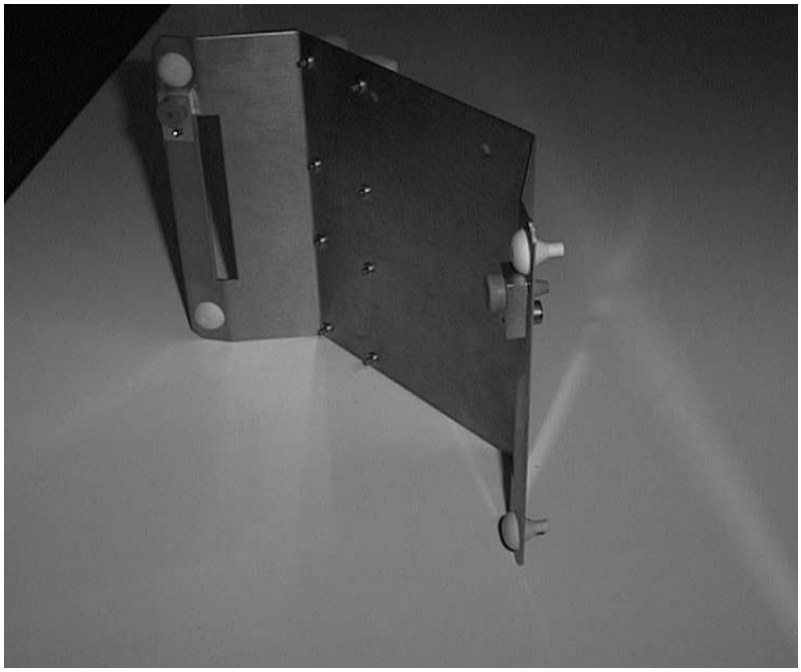


Illustration 20 – 40 cm spacer fixed on mounting bracket



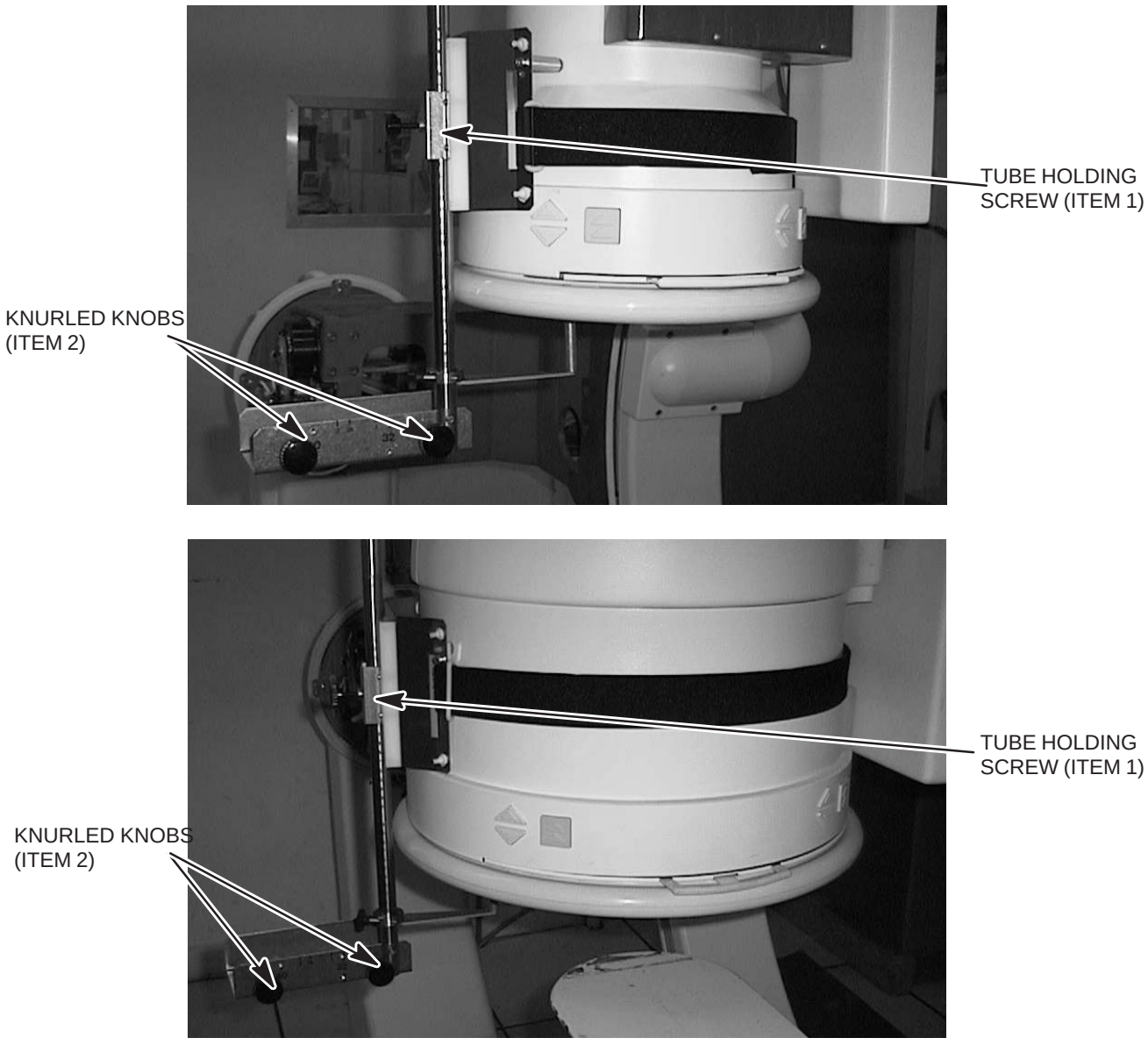
2-2 Mounting the Tool on the II

1. Route the strap (Illustration 16, item 5) in the opening of the mounting bracket, apply the four rubber feet on the II surface and secure the strap firmly. Make sure that the strap does not cover the switch ring buttons.
2. Introduce the guiding tube into the mounting bracket and secure it with the tube holding screw (Illustration 21, item 1).

Note: The bracket should be oriented so that the tube guide and the knurled knobs (Illustration 21, item 2) are on the right as shown in Illustration 21.

3. Orient the axis of the U–shaped bracket perpendicular to the anode/cathode axis of the X–ray tube. If needed, loosen the strap, rotate the assembly around the II and secure again.

Illustration 21 – Assembly view



2-3 Measurement process

1. Insert the ion chamber upside down (with the four rubber black feet (Illustration 24, item 2) under the ion chamber facing up) in the U–shaped support and align the chamber box to the mark corresponding to the right chamber type/II size configuration (Illustration 22 or Illustration 23).
2. There are three marks on the U–shaped support used according to the II diameter and configuration (with cover or not). Choose the correct one according to Table 8.

Table 8 – Ion chamber positioning marks

	Mark #
22 cm II w/o cover	1
22 cm II w/ cover	1
32 cm II w/o cover	2
32 cm II w/ cover	2b
40 cm II	2
UIH40	2

3. For ion chamber 20 x 5–3, position ion chamber on the right of the mark according to Illustration 22.
4. For ion chamber 20 x 5–180 (with or without Velcro), position ion chamber on the left of the mark according to Illustration 23.

Note: **For LCV+/LCN+ only**: Some countries may have 20*50–180 (or 20*60–180) probes, which length is different from the usual probes provided with 2025/2026 dosimeters. In this case, the ion chamber positioning tool can still be used, but a specific mechanical adjustment shall be performed: **Position the ion chamber while moving it freely within the U–shape support without taking into account the position marks of the support. Fix the ion chamber as usual)**.

5. Secure the ion chamber in the U–shaped bracket with the corresponding knurled knob (see Illustration 24 item 1).
6. Remove table panel from the beam and adjust SID according to cal unit requirement.

Illustration 22 – Positioning of ion chamber 20 x 5–3

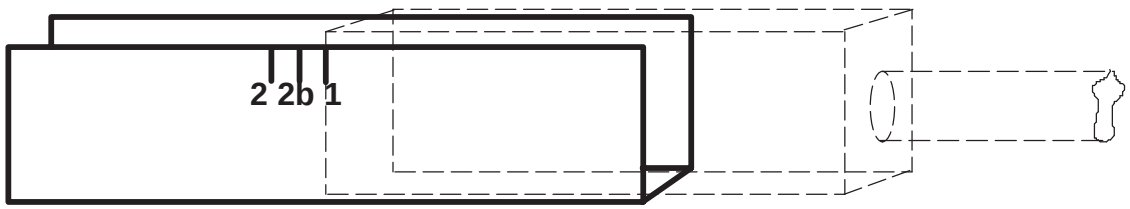


Illustration 23 – Positioning of ion chamber 20 x 5–180 (with or without velcro)

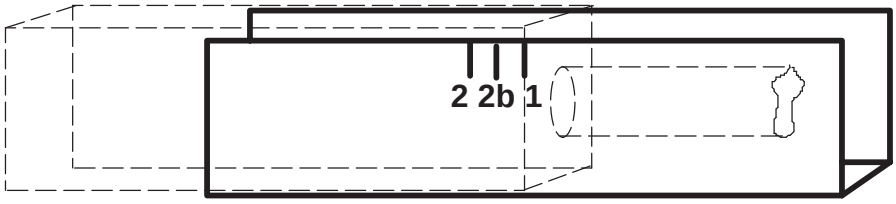
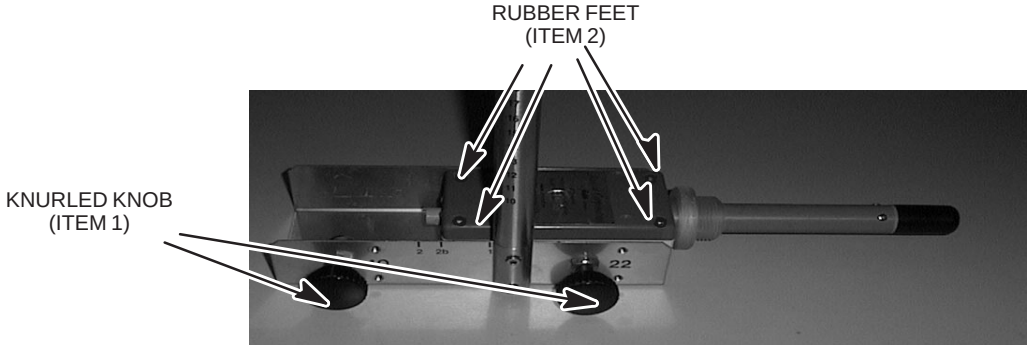


Illustration 24 – Alignment of ion chamber on u–shaped support

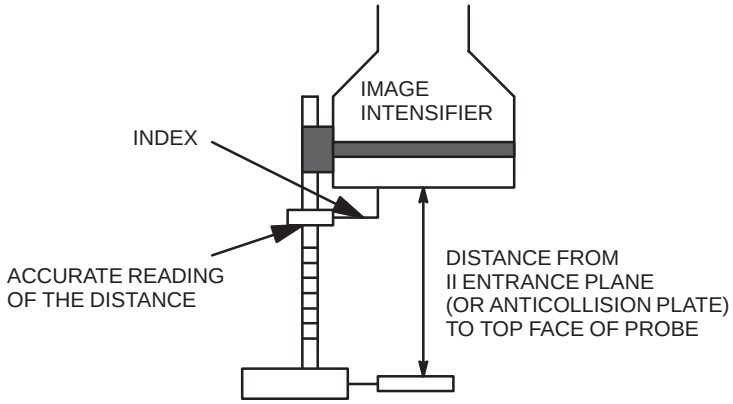


2-4 Ion Chamber Height Adjustment

Note: The cal units and job cards using the dosimeter usually specify the ion chamber height adjustment with a distance from the ion chamber center to the ”lowest point of II”, to the isocenter or to the focal spot. When using this tool, height adjustment will be given in Table 9 (Top Face of Ion Chamber – II Entrance Plane Distance) if antilcollision plane is NOT in place, or in Table 10 (Top Face of Ion Chamber – Anticollision Plate Distance) if anticollision plate is in place.

1. Slide the height index on the tube to the desired height (refer to Table 9 or Table 10 for distance and tolerance). Make sure to use the accurate reading point (**below** the ring) as shown in Illustration 25.

Illustration 25 – Ion chamber height adjustment



2. Loosen the tube holding screw (Illustration 21, item 1), slide the tube into the guide to have the index in contact with the II entrance plane (or anticollision plate), and then secure it again. **Do not try to center the chamber in the beam at this time.**

Note: Ion chamber mechanical dispersion may lead to a 2 or 3mm error in the “ion chamber – II entrance plane (or anticollision plate) distance”. To correct it, proceed as follows:

a. Measure this distance with a ruler.

b. Adjust the position of the index accordingly.

c. Re–slide the tube to put the index in contact with the II entrance plane (or anticollision plate).

For the same ion chamber, always apply the same correction factor to all the height adjustments.

3. Center the ion chamber in the beam: release the tube holding screw, rotate around the tube axis and secure. If needed, also translate the ion chamber along its axis.
4. Adjust centering in Fluoro with a precision of less than +/–1 mm (+/–10 pixel) in the plane perpendicular to the X–ray beam.
5. Measure it with the DLX in DX fluoro in the smallest FOV using the technical menu and the camera centering tool (refer to Section 3, Annex: Ion Chamber Centering Procedure Using the DLX).

CAUTION **Make sure to center the ion chamber as accurately as possible, as described above.**

Improper centering may lead to inaccurate dose measurement resulting in the following:

– dose measurement could be out of spec while the true dose was in fact correct (meaning long re–calibration)
– dose measurement could be within spec while the true dose was in fact incorrect (meaning bad IQ in the end)

The ion chamber is now in position for a measurement.

Note: It is possible to temporarily reposition the chamber in case another movement needs to be performed and you do not want to completely remove the chamber. The chamber is shown in its retracted position in Illustration 26. However, by doing this, centering will be lost and must be precisely readjusted. The “height index” helps in adjusting the height instantaneously.

Illustration 26 – Retracting the ion chamber

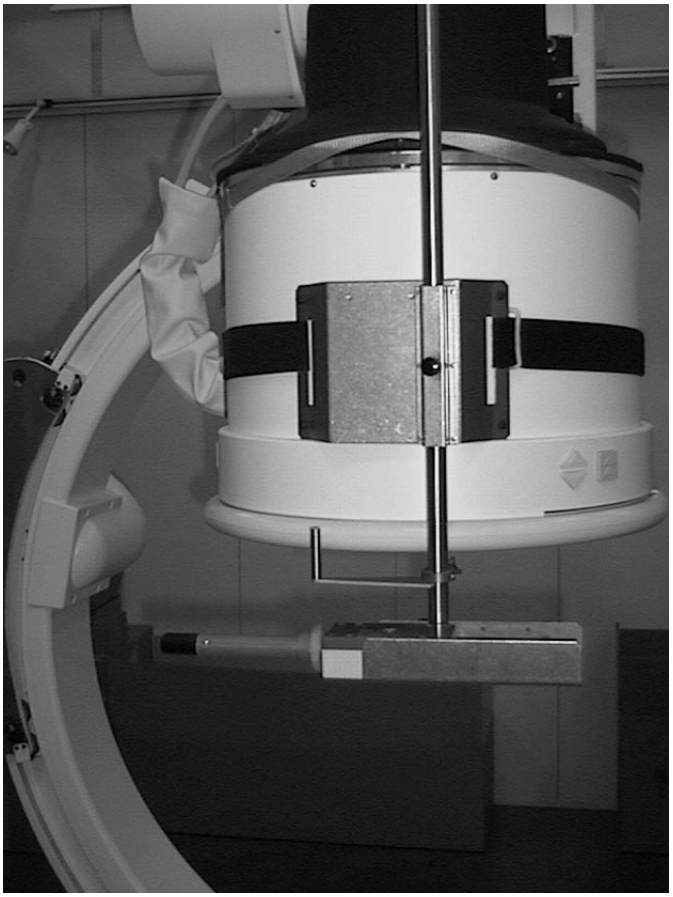


Table 9 – Top face of Ion chamber – II entrance plane distance for various cal units and system configurations

Cal units or Image Quality Job Cards	Test Conditions	Ion Chamber Size	Top face of Ion Chamber – II entrance plane distance (in mm)						Tolerance
			40cm II	UIH40	32 cm II Frontal	22 cm II Frontal	32 cm II Lateral	22 cm II Lateral	
R018	max SID	20 x 5–3 or 20 x 6–3	534.5	531.5	537.5	537.5	766	721.3	+/– 10mm
X100	min SID	20 x 5–3 or 20 x 6–3	334	337	336	339	336	339	+/– 1 mm
X101	max SID	20 x 5–3 or 20 x 6–3	334	337	336	339	336	339	+/– 1 mm
X107	II at 30 cm from table top and ISO	20 x 5–180 or 20 x 6–180	(See Note 1)	(See Note 1)	(See Note 1)	(See Note 1)	(See Note 1)	(See Note 1)	–0/+2mm
X120	min SID	20 x 5–3 or 20 x 6–3	334	337	336	339	336	339	+/– 1 mm
X121	max SID	20 x 5–3 or 20 x 6–3	334	337	336	339	336	339	+/– 1 mm
X130	min SID	20 x 5–3 or 20 x 6–3	334	337	336	339	336	339	+/– 1 mm
X131	max SID	20 x 5–3 or 20 x 6–3	334	337	336	339	336	339	+/– 1 mm
X233	II at 30 cm from table top and ISO	20 x 5–180 or 20 x 6–180	(See Note 1)	(See Note 1)	(See Note 1)	(See Note 1)	(See Note 1)	(See Note 1)	–0/+2mm
Job Card 001	SID = 1 meter	20 x 5–3 or 20 x 6–3	279	279	279	279	279	279	+/– 10mm
Job Card 002	SID = 1 meter	20 x 5–3 and 20 x 5–180 or 20 x 6–3 and 20 x 6–180	279	279	279	279	279	279	+/– 10mm
Job Card 006 step 5 / step 6	min SID / max SID	20 x 5–3 or 20 x 6–3	334	337	336	339	336	339	+/– 1 mm
Job Card 006 step 7	II at 30 cm from table top and ISO	20 x 5–3 or 20 x 6–3	334	337	336	339	336	339	+/– 1 mm
Job Card 007	II at 30 cm from table top and ISO	20 x 5–180 or 20 x 6–180	(See Note 1)	(See Note 1)	(See Note 1)	(See Note 1)	(See Note 1)	(See Note 1)	–0/+2mm
Job Card 008	II at 30 cm from table top and ISO	20 x 5–180 or 20 x 6–180	(See Note 1)	(See Note 1)	(See Note 1)	(See Note 1)	(See Note 1)	(See Note 1)	–0/+2mm
Job Card 009	II at 30 cm from table top and ISO	20 x 5–180 or 20 x 6–180	(See Note 1)	(See Note 1)	(See Note 1)	(See Note 1)	(See Note 1)	(See Note 1)	–0/+2mm

Note 1: Remove the index.
Position the dosimeter probe just close to the II anti–collision plate in the center of the FOV.
The probe should be as close as possible from this plate and be parallel to it, without pressure on the probe itself.

Table 10 – Top face of Ion chamber – anticollision plate distance for various cal units and system configurations

Cal units or Image Quality Job Cards	Test Conditions	Ion Chamber Size	Top face of Ion Chamber–Anticollision plate distance (in mm)						Tolerance
			40cm II	UIH40	32cm II Frontal	22 cm II Frontal	32cm II Lateral	22 cm II Lateral	
R018	max SID	20 x 5–3 or 20 x 6–3	488	482	494	491	722.5	674.8	±10mm
X100	min SID	20 x 5–3 or 20 x 6–3	287.5	287.5	292.5	292.5	292.5	292.5	± 1 mm
X101	max SID	20 x 5–3 or 20 x 6–3	287.5	287.5	292.5	292.5	292.5	292.5	± 1 mm
X107	II at 30 cm from table top and ISO	20 x 5–180 or 20 x 6–180	(See Note 1)	(See Note 1)	(See Note 1)	(See Note 1)	(See Note 1)	(See Note 1)	–0/+2 mm
X120	min SID	20 x 5–3 or 20 x 6–3	287.5	287.5	292.5	292.5	292.5	292.5	± 1 mm
X121	max SID	20 x 5–3 or 20 x 6–3	287.5	287.5	292.5	292.5	292.5	292.5	±1 mm
X130	min SID	20 x 5–3 or 20 x 6–3	287.5	287.5	292.5	292.5	292.5	292.5	±1 mm
X131	max SID	20 x 5–3 or 20 x 6–3	287.5	287.5	292.5	292.5	292.5	292.5	± 1 mm
X233	II at 30 cm from table top and ISO	20 x 5–180 or 20 x 6–180	(See Note 1)	(See Note 1)	(See Note 1)	(See Note 1)	(See Note 1)	(See Note 1)	–0/+2 mm
Job Card 001	SID = 1 meter	20 x 5–3 or 20 x 6–3	232.5	229.5	235.5	235.5	235.5	235.5	±10mm
Job Card 002	SID = 1 meter	20 x 5–3 and 20 x 5–180 or 20 x 6–3 and 20 x 6–180	232.5	229.5	235.5	235.5	235.5	235.5	± 10mm
Job Card 006 step 5 / step 6	min SID / max SID	20 x 5–3 or 20 x 6–3	287.5	287.5	292.5	292.5	292.5	292.5	± 1 mm
Job Card 006 step 7	II at 30 cm from table top and ISO	20 x 5–3 or 20 x 6–3	287.5	287.5	292.5	292.5	292.5	292.5	–0/+2 mm
Job Card 007	II at 30 cm from table top and ISO	20 x 5–180 or 20 x 6–180	(See Note 1)	(See Note 1)	(See Note 1)	(See Note 1)	(See Note 1)	(See Note 1)	–0/+2 mm
Job Card 008	II at 30 cm from table top and ISO	20 x 5–180 or 20 x 6–180	(See Note 1)	(See Note 1)	(See Note 1)	(See Note 1)	(See Note 1)	(See Note 1)	–0/+2 mm
Job Card 009	II at 30 cm from table top and ISO	20 x 5–180 or 20 x 6–180	(See Note 1)	(See Note 1)	(See Note 1)	(See Note 1)	(See Note 1)	(See Note 1)	–0/+2 mm

Note 1: Remove the index.
Position the dosimeter probe just close to the II anti–collision plate in the center of the FOV.
The probe should be as close as possible from this plate and be parallel to it, without pressure on the probe itself.

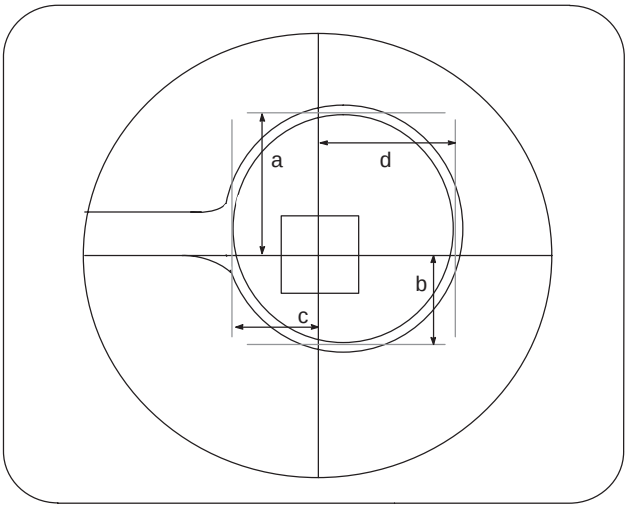
3 ANNEX: ION CHAMBER CENTERING PROCEDURE USING THE DLX

3-1 Ion Chamber 20 x 5–180 Centering

Note: Make sure the ion chamber axis is parallel or perpendicular to the table axis.

1. Manually center the ion chamber in the beam, as best as possible.
2. Perform a Fluoro in DLX mode, with the LIH option selected.
3. In DLX technical menu, select camera centering tool (“Cam. Center.” box), cross appears on DLX monitor.
4. Still in the DLX technical menu, select the “Statistics” Menu and select “Segment Stat.”
5. Use those segments to measure a, b, c and d in pixels (see Illustration 27).

Illustration 27 – Ion chamber 20 x 5–180 centering



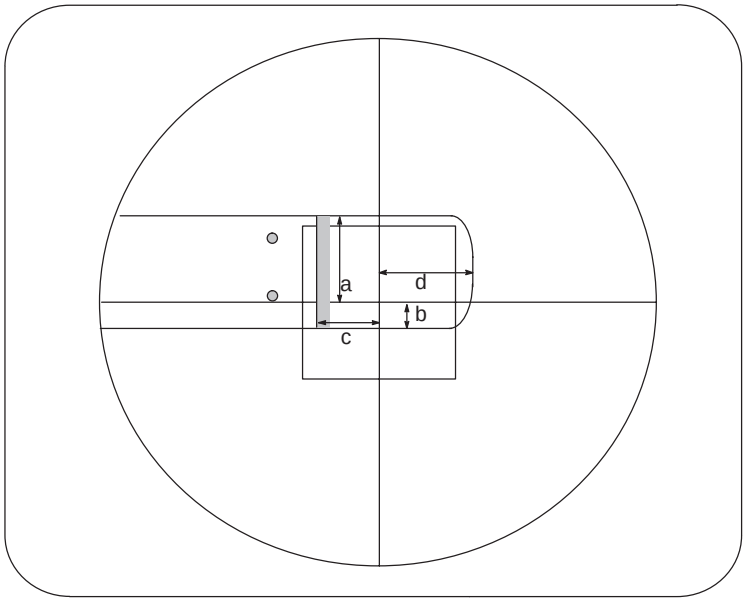
6. Compute a–b and c–d (in absolute value); make sure you refer to the inner circle of the ion chamber.
7. Check that both calculation are lower than 20 pixels.

3-2 Ion Chamber 20 x 5–3 Centering

Perform exactly the same procedure with a, b, c and d distances as shown in Illustration 28:

- If both are lower than 20, the ion chamber is accurately centered in the beam (at ±10 pixels).
- If one of them (or both) are larger than 20 pixels, ion chamber needs to be more accurately centered. Move the ion chamber accordingly, and re–iterate the previous Fluoro/calculation cycle until the ion chamber is correctly centered.

Illustration 28 – Ion chamber 20 x 5–3 centering



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Tool Units

Notepad

Unit T015

Unit	Note

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SECTION 5 – RADIATION CALIBRATION UNITS

Unit	Title	Page
R003	Tube n XS, XM, or XL Initial Filament Drive Calibration	95
R005	Biasable Focal Spot Calibration	101
R006	Tailing Compensation Calibration	111
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R009	mA Meter Calibration–Fluoro Range	115
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R022	Generator Functional Check	173
R023	MPPU Closed Loop mA Adjust	179
R024	Kv Meter Frequency Response Calibration	181
R025	mA/mAs Calibration	187

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UNIT R003 – Tube n XS, XM, or XL Initial Filament Drive Calibration

Time: x h xx min – Personnel: 1 field engineer

1 DESCRIPTION

Calibration Unit R003 calibrates the initial filament drive at each mA stations of each focal spot size (small, XS; medium, XM; large, XL; or concentrated (i.e. 0.3c) focal spots) for each x–ray tube in an Advantx system. An Automatic Cal Mode or Manual Cal Mode can be selected to perform the calibration. Normally, the Automatic Cal Mode (the default mode) is used to calibrate initial filament drive and the Manual Cal Mode is only used when calibration of initial filament drive for an mA station cannot be obtained in the Automatic Cal Mode or a verification of an mA station is required. If the Manual Cal Mode is selected, the time to perform the calibration is much longer.

2 EQUIPMENT REQUIRED

Exposure control service tool (optional, see Illustration 7) and an external bleeder, PN 46–154966G1, (only if the system is configured with an LFX power unit that does not contain an internal bleeder or the internal bleeder is not working).

3 TEST SETUP

3-1 Systems with an LFX power unit:

- If the LFX power unit does not contain an internal bleeder or the internal bleeder is not working, connect an external bleeder as shown in Illustration 29.
- Set bleeder selector switch LFX1 A1 A4 S203 to appropriate position:
  UP – External Bleeder; DOWN – Internal Bleeder.
- Connect exposure control service tool (optional) to the console in place of handswitch.

3-2 Systems with an MPPU/VAMP/SCPU power unit:

- Connect exposure control service tool (optional) to the console in place of the console handswitch.

4 SPECIAL INSTRUCTIONS

The following special requirements should be observed when running this unit.

- The Filament Age and Fil Age (Last Cal) parameters displayed on the Step 1 screen provide a visual indication of the filament aging characteristics of the system X–ray tube.

Filament Age: Tracks and displays a continuous record of changes in filament aging (in HEX value) since X–ray tube installation (initial value of 0010H).

Fil Age (Last Cal): Displays the Hex value of filament aging set in the last calibration (initial value when a tube is installed is FFFFH). The Fil Age (Last Cal) parameter will be set equal to the Filament Age parameter after a calibration is completed.

As the X–ray tube ages, changes in the Filament Age value may be observed. If the difference between the Filament Age value and Fil Age (Last Cal) value reaches a delta limit of 3BH, a “recal required” message is displayed. This warning message is displayed upon entering either the Applications or Service Mode to indicate to the user that a mandatory recalibration of the system dose rate is required (Ref recal instructions in Cal Unit X100).

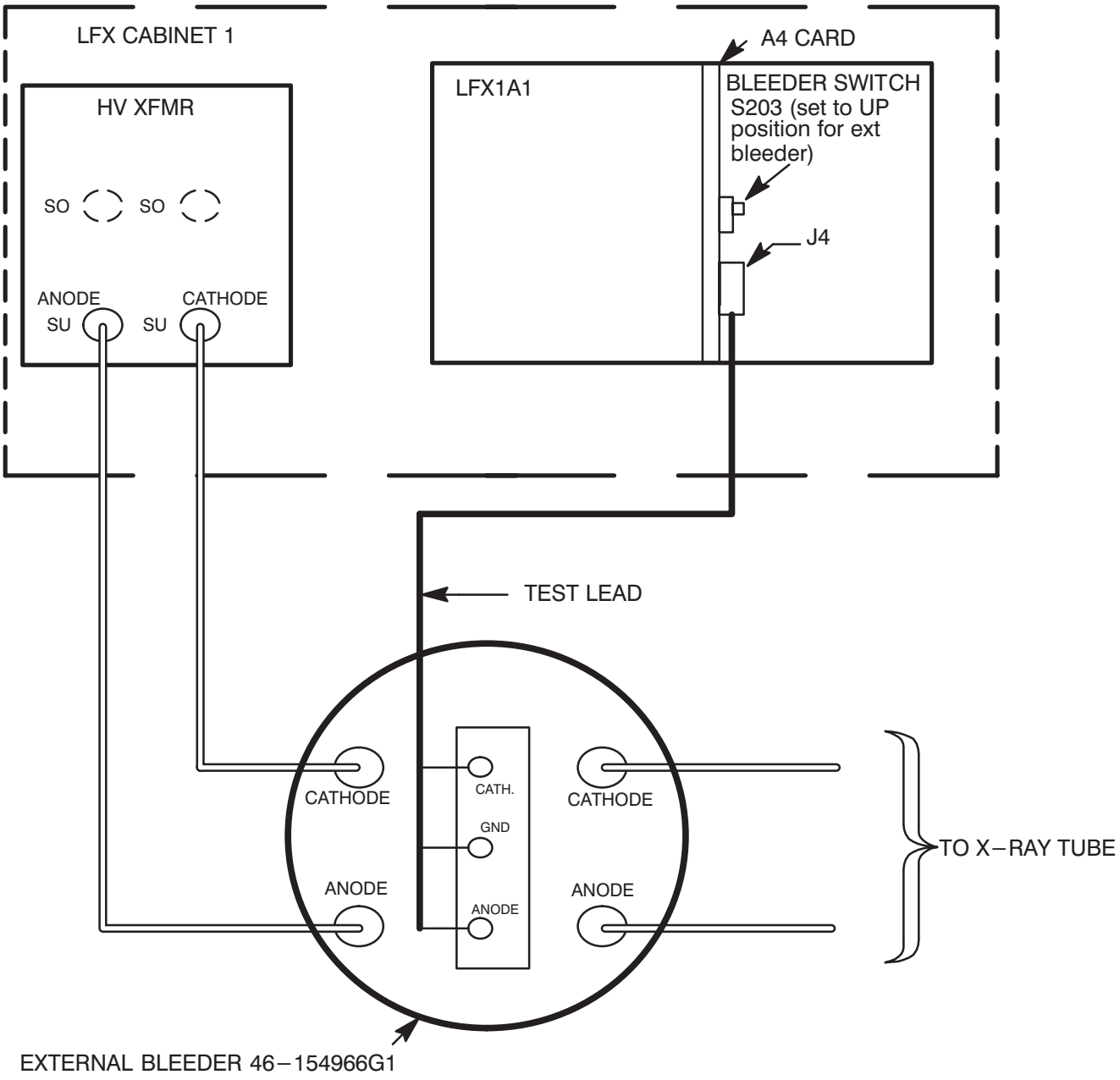
Note: When doing R003 for the concentrated focal spot (0.3C), the parameters “FILAMENT AGE” and “FIL AGE (LAST CAL)” are not displayed for newer software versions.

- Allow at least 15 minutes of cooling time before repeating this unit on any focal spot of the tube under test.
- The Filament Current and Filament Correction values displayed on the unit screen during the running of this unit are not actual values and require the application of engineering scale factors to achieve the actual value.
- If a HEAT WAIT occurs during the calibration, leave the PREP and EXPOSE switches on the exposure control service tool in the ON position. When the tube cools, the exposures will continue.
- If you release the PREP and EXPOSE switch when running in the Automatic Cal Mode, you will return to Step 1 in the calibration procedure.
- When running this unit be aware of situations where the FILAMENT CORRECTION value indicated on the console screen is always zero (0) since this indicates an LFX I/O board failure. This may cause calibration unit R003 to run to completion taking only one x–ray exposure at each step.



When running this unit, you can exit at any step in the calibration (if required) with the unit part way complete and the steps completed will update NV RAM accordingly. However, since you did not complete “all” of the calibration, the G5 database parameter will not be updated and the unit will not be un-highlighted on the sequence menu. Therefore, ensure that you return to the point of exit and complete the Calibration Unit before proceeding with the calibration of the system.

Illustration 29 – LFX Test setup with external bleeder



NOTE: The connection shown is for Tube 1. Connect to SO terminals on HV XFMR for Tube 2.

5 CAL PROCEDURE

An Automatic Cal Mode or Manual Cal Mode may be used to calibrate the initial filament drive Using the Automatic Cal Mode, the unit will automatically calibrate each mA station of the selected focal spot size of an x–ray tube starting at the smallest mA station and ending at the largest mA station. Each mA station is a Step in the calibration. Exposures are automatically taken at each step until the filament drive is calibrated. The unit Manual Cal Mode permits a calibration (or a verification) of any individual mA station.

5-1 Automatic Cal Mode

- Upon entering the unit, the Automatic Cal Mode is the default mode and the AUTO softkey on the console screen is highlighted.
- Take and maintain exposures.The unit will automatically calibrate the initial filament drive for each mA station.

NOTICE Each station has a 20 exposure limit and a 6.5 A filament current limit If either of these conditions are encountered, the unit will switch to the Manual Cal Mode and the error message “EXPOSURE OUTSIDE CALIBRATION LIMITS” is displayed. Refer to Manual Cal Procedure.

- Perform a manual calibration of the mA station at which the switch to the Manual Cal Mode occurred. After completing a manual calibration of the mA station, return to the Automatic Cal Mode by touching the AUTO softkey on the Manual Cal Mode screen display.

Note: Depending on the point at which the switch to the Manual Cal Mode occurred, it may be advantageous to complete the calibration in the Manual Cal Mode rather than to incur additional switching between the Automatic and Manual Cal Modes.

- Continue the calibration in the Automatic Cal Mode. The unit will pickup the calibration at the mA station (step) at which the switch to Manual Cal Mode occurred. When all mA stations have been properly calibrated, a CAL COMPLETE message will be displayed. Terminate exposures.
- Touch the NEXT UNIT or UNIT MENU softkey to exit.

5-2 Manual Cal Mode

- To enter the Manual Cal Mode (other than from a mode switch encountered when running the Automatic Cal Mode), touch the MANUAL softkey on the screen display. The Manual Cal Mode screen will be displayed and the MANUAL softkey is highlighted.
- Press SELECT STATION to select desired mA or kVp stations using the console dial. SELECT STATION is active when either (a) station cal is complete or, (b) Filament Demand is above 7.0 volts (b needs HHS verification with R013).
- Using the PREP/EXPOSE switches, take manual exposures one at a time. Allow about 5 seconds between activation of PREP and EXPOSE on the handswitch to permit filament temperature to stabilize. The software will automatically enter a value of FILAMENT CORRECTION after each exposure. If the filament correction is not within acceptable limits an “EXPOSURE OUTSIDE CALIBRATION LIMITS” message will be displayed.

Note: It is recommended that you first allow the Calibration Unit software to calculate and change the FILAMENT CORRECTION on it's own before making filament corrections using the console dial.

- If dialed–in filament corrections are required, touch the APPLIED FILAMENT CURRENT softkey and enter a FILAMENT CORRECTION value with the console dial. Dial in 1/2 the FILAMENT CORRECTION value for each new exposure to get fastest convergence. For large focal spots, the amount of filament correction is between 1/3 and 1/2 of the filament correction displayed (Example: If filament correction is 0.030, dial in 0.010).
- Touch the APPLIED FILAMENT CURRENT softkey again to enter the correction before continuing with exposures.
- Repeat taking exposures and making corrections until the "STEP COMPLETE" message appears on the screen or the maximum allowable filament current limit (6.5 A) is reached. If the maximum allowable filament current limit is reached and the filament correction is still not within allowable limits, the message "MAX FILAMENT CURRENT" is displayed. When either the "STEP COMPLETE" message or the "MAX FILAMENT CURRENT" message is displayed, the NEXT STEP softkey is enabled to permit return to the Automatic Cal Mode for completion of the remaining steps in the calibration.

NOTICE

You must proceed with the initial filament drive calibration until all mA stations (steps in the calibration) are completed even if the "MAX FILAMENT CURRENT" message is displayed again for another mA station. If all steps in the calibration are not completed and you attempt to exit the unit, the unit will remain highlighted on the sequence menu to indicate an incomplete calibration.

CAUTION

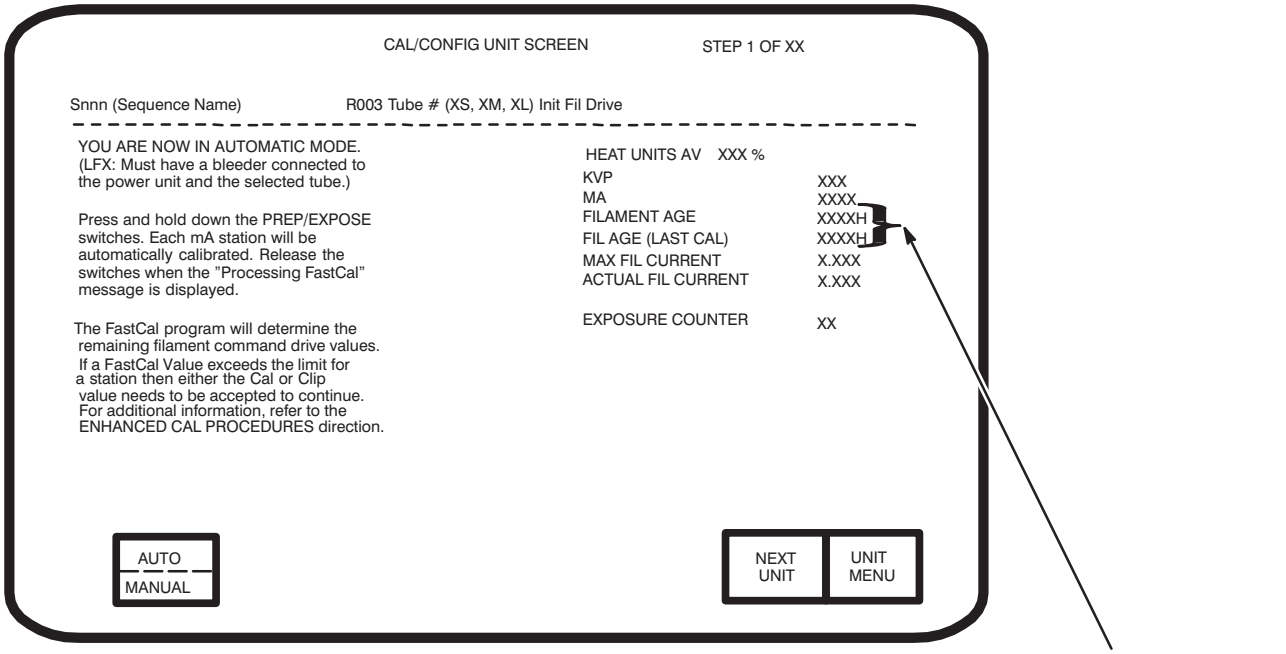
The "MAX FILAMENT CURRENT" message indicates that an acceptable limit cannot be obtained for the mA station being calibrated and that the mA station may not meet the requirements of HHS. In this case, you must run Service Unit R013 and verify HHS compliance for that mA station.

- Touch the NEXT STEP softkey to return to the Automatic Cal Mode and complete the calibration of the remaining mA stations in that mode. **All steps must be completed in order to de-highlight the unit on the sequence menu.**

OR

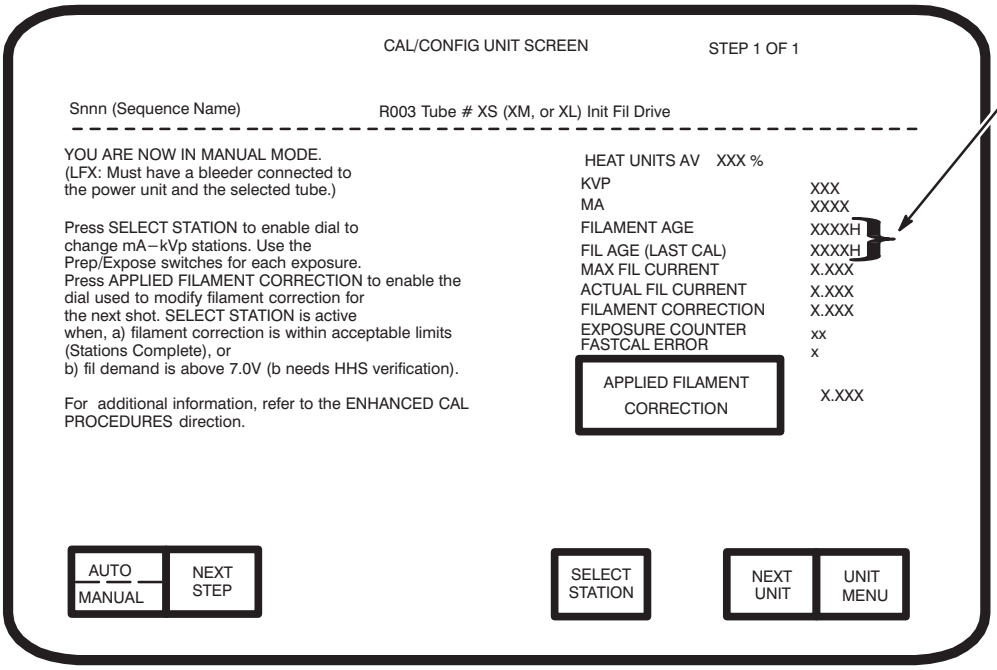
- If the Manual Cal Mode was **initially selected** as the calibration method to be used for the **entire** calibration, and all mA stations have been properly calibrated, touch the NEXT UNIT or UNIT MENU softkey on the Manual Cal Mode screen display to exit the unit.

R003, AUTO MODE SCREEN DISPLAY



For concentrated focal spot (0.3C), "FILAMENT AGE" and "FIL AGE (LAST CAL)" are not displayed for newer software versions.

R003, MANUAL MODE SCREEN DISPLAY



UNIT R005 – Biasable Focal Spot Calibration

Time: x h xx min – Personnel: 1 field engineer

1 DESCRIPTION

Calibration Unit R005 is designed to calibrate bias command and filament command for x–ray tubes such as the MX125 pentafocus, MX125 hexafocus, MX135, and MX150. The calibration establishes a matrix of values for bias command for each biasable focal spot size of each tube. The number of steps required to complete the calibration depends on the number of bias focal spots being calibrated. For one bias focal spot, five steps are required. For Three Bias focal spots (pentafocus and hexafocus) nine steps are required.

Note: For x–ray tubes that have factory calibration stickers (such as the MX150), the unit allows setting the bias without calibration.

2 EQUIPMENT REQUIRED

One degree star pattern (Nuclear Assoc. 07–542), metric ruler, densitometer (X–rite 301 or equivalent), collimator alignment fixture (46–166390G1), film (10 inch by 12 inch) and 7X magnifier. An external bleeder, PN 46–154966G1, may also be required if your system is configured with an LFX power unit.

3 TEST SETUP

Systems with LFX power unit, only.

- If the LFX power unit does not contain an internal bleeder or if the internal bleeder is not working, connect an external bleeder as shown in Illustration 29, Calibration Unit R001.
- Set Bleeder Selector switch LFX1 A1 A4 S203 to appropriate position:
  UP – External Bleeder; DOWN – Internal Bleeder

4 SPECIAL INSTRUCTIONS

Special Instructions The small focal spot must be centered before proceeding with R005 or an error will be induced when performing the biased focal spot calibration. Verify/align the small focal spot image using Calibration Unit P102 (Calibration Unit P554 for AFM/CFM systems). Unit P102 is not available for systems with a MX 150 tube unit. A MX 150 cannot be adjusted because the collimator interface plate is fixed. After verification or alignment, return to Cal Unit R005.

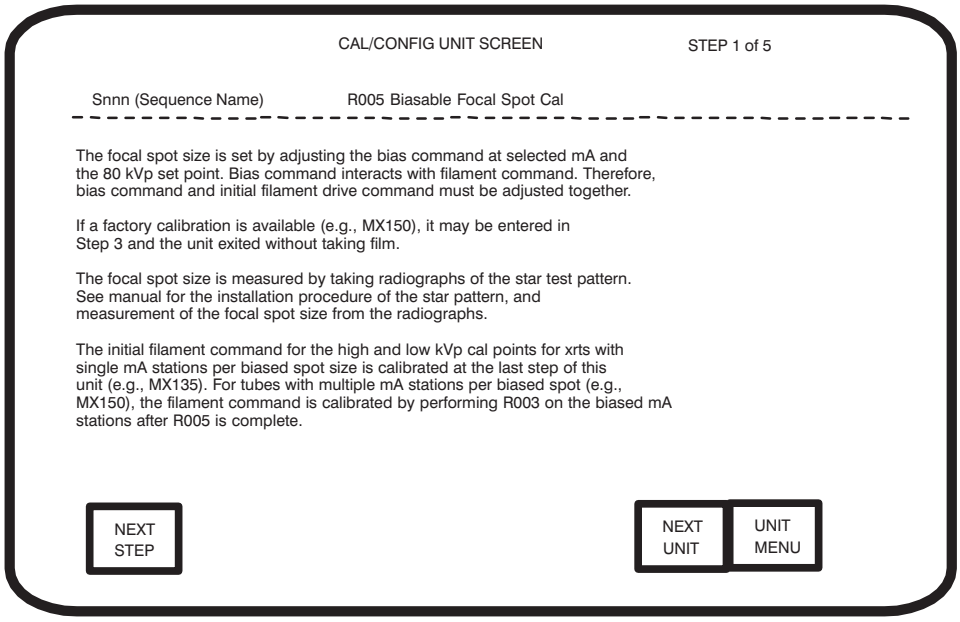
Note: **For Vascular Systems Only:** Before system calibration, verify that additional filter (copper–aluminum filter) is not installed on top of collimator. (Open sensor hinge assembly to verify.) If installed, remove before performing calibration.

5 CAL PROCEDURE

5-1 Step 1. General Instructions

- Read the instructions presented on the Step 1 screen display to become familiar with the sequence and procedures for calibrating the biasable focal spots.
- Touch the NEXT STEP softkey when ready to proceed to Step 2.

R005 STEP 1 SCREEN DISPLAY



Note: This step requires the VIC to be calibrated to allow fluoro images in order to position a test pattern and move the collimator blades in place. In rare situations where a database initialization was performed and a VIC factory calibration floppy was not available for up-loading, a VIC calibration must be performed for this step to operate properly.

5-2 Step 2. Star Pattern Centering (See Illustration 30)

- Place star pattern on collimator window.
- Center the star pattern on the bulls eye of the collimator window. Position two of the radii line segments (displaced by 180 degrees) so that the center radii are parallel to the anode–cathode axis of the x–ray tube. Secure the star pattern in place with masking tape.
- Initiate and maintain a fluoro exposure. Use the collimator JOG softkeys on the console screen to adjust the collimator transverse and lateral blades until the blades just start to cover the outer edges of the centered star pattern.
- Place a mark or piece of solder at the outer periphery of the anode side of the star pattern to permit identification of the anode–cathode axis of the x–ray tube on the x–ray film.
- For Legacy and Legacy–D systems, adjust SID to 55 inches (1400 mm). For LCA, LCV+, LC+, Tilt–C, Tilt–C Vascular systems, adjust SID to maximum.
- Tape a cardboard x–ray film holder box to the input of II tube. This will provide sufficient magnification to perform the film resolution checks that are required in the following steps of this unit.
- Touch NEXT STEP softkey to proceed to Step 3.

R005 STEP 2 SCREEN DISPLAY

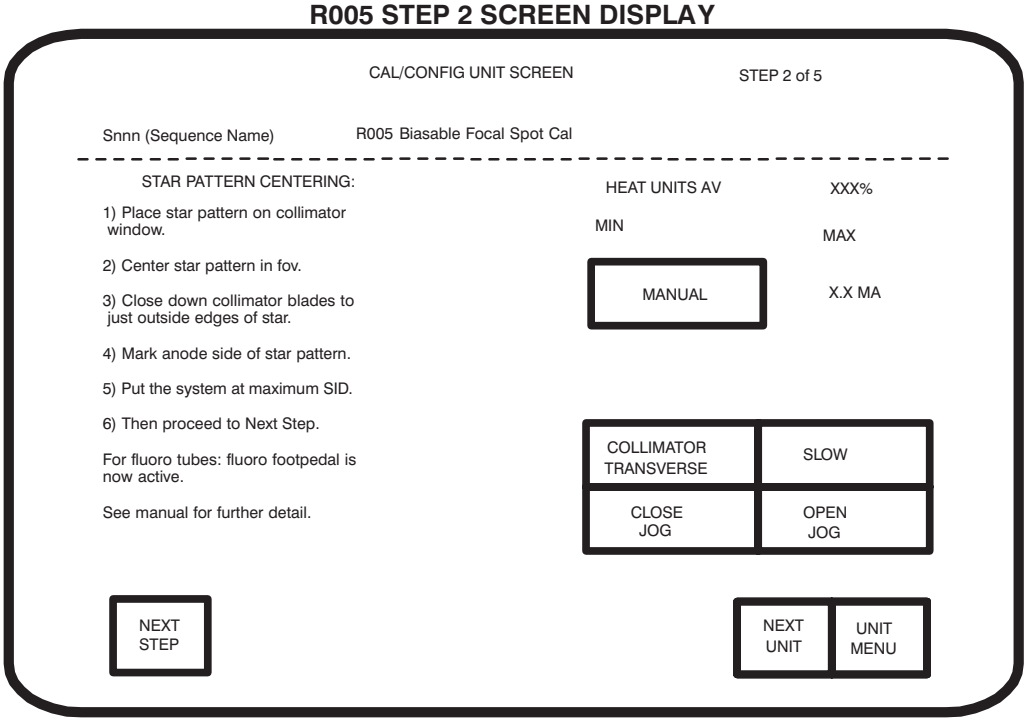
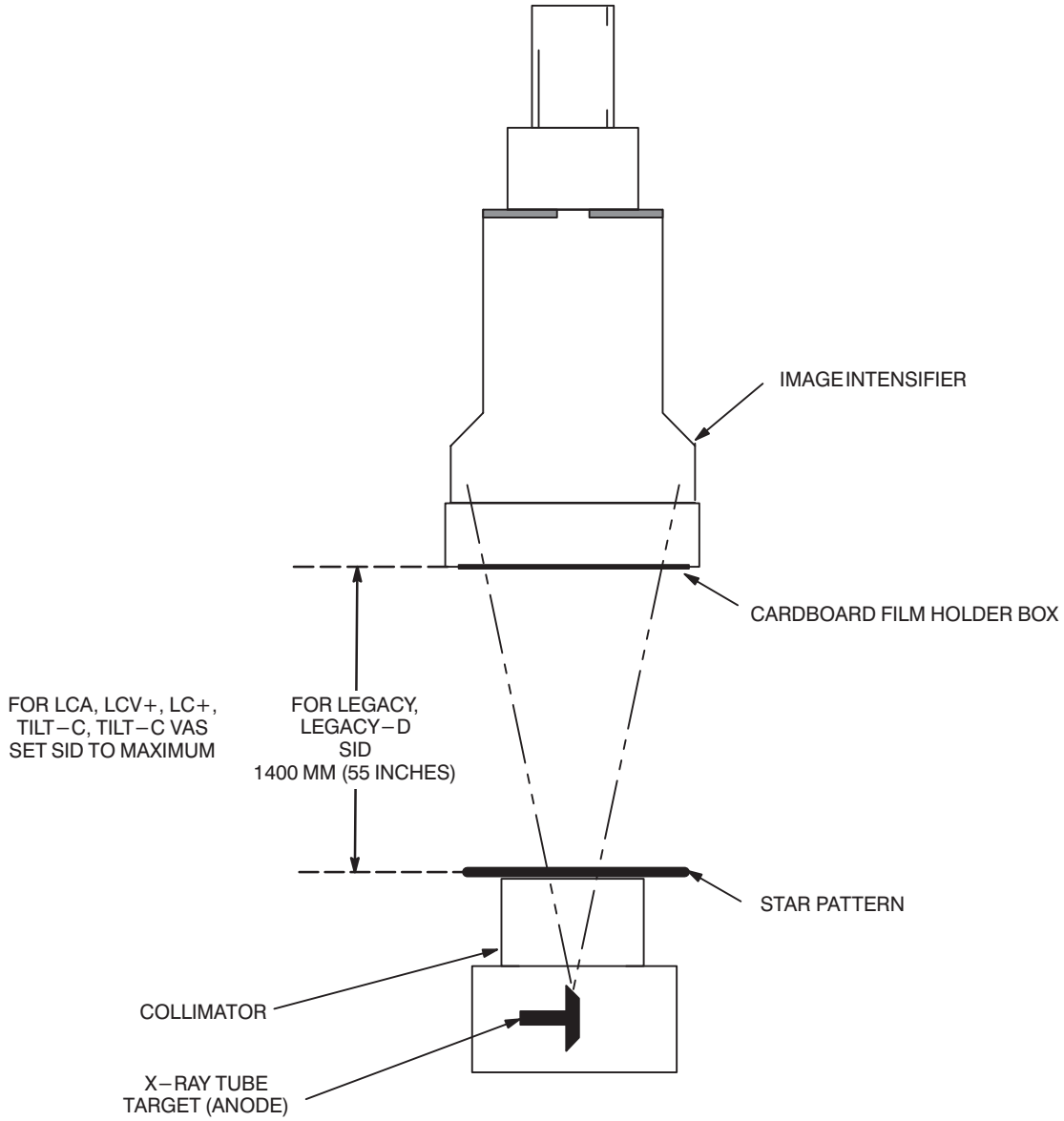


Illustration 30 – R005 Star Pattern CAL Setup



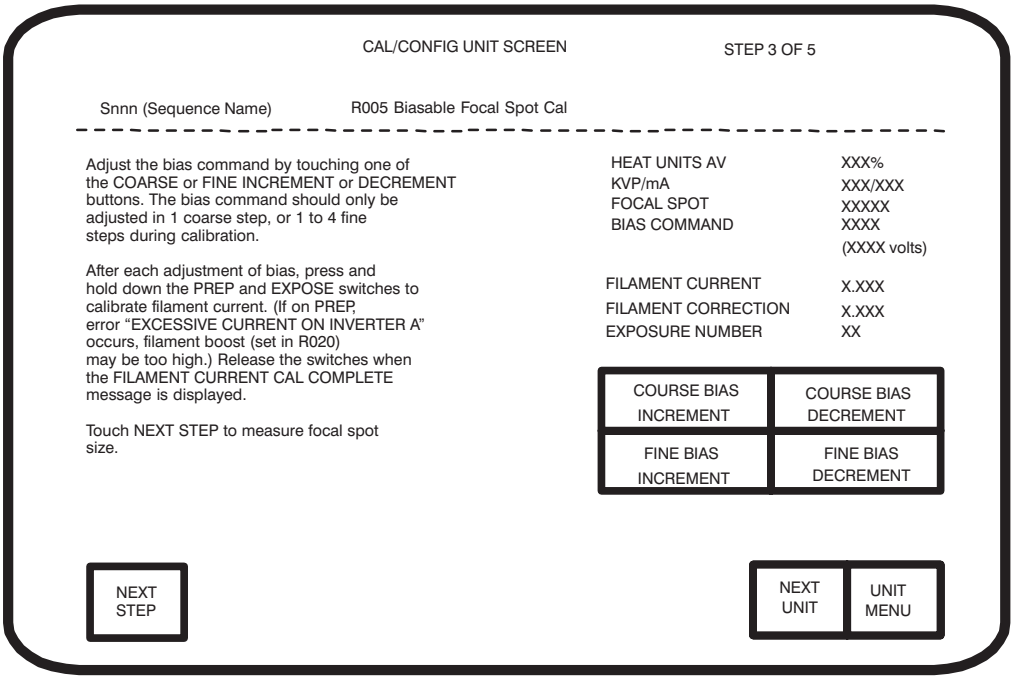
5-3 Step 3. Bias Adjustment for .3c Focal Spot

- Start the bias adjustment by touching one of the four softkeys: COARSE BIAS INCREMENT, COARSE BIAS DECREMENT, FINE BIAS INCREMENT, or FINE BIAS DECREMENT to adjust the BIAS COMMAND parameter. The BIAS COMMAND value is displayed on the console screen.The BIAS COMMAND should be adjusted in one course step or one–to–four fine steps.
- After each BIAS COMMAND adjustment, take and maintain an exposure. The system will calibrate the filament current. Maintain the exposure until the “FILAMENT CURRENT CALIBRATION COMPLETE” message is displayed.

Note: If the error message “EXCESSIVE CURRENT ON INVERTER A” occurs, the filament boost value may be set too high. Use Cal Unit R020 to temporarily set the filament boost to some minimum value. Then, return to Cal Unit R005 and complete this step.

- Touch NEXT STEP softkey to proceed to Step 4.

R005 STEP 3 SCREEN DISPLAY



Note: In some power unit board failure modes, the error feedback is always zero (0). This may cause calibration unit R005 to run to completion taking only one x–ray exposure at each step. When running this unit be aware of situations where the FILAMENT CORRECTION value indicated on the console screen is always zero (0) since this indicates an power unit board failure.

5-4 Step 4. Measure .3c Focal Spot Size

This step requires that two separate functions be performed in the sequence indicated. The functions are: Exposures and calculation of spot size.

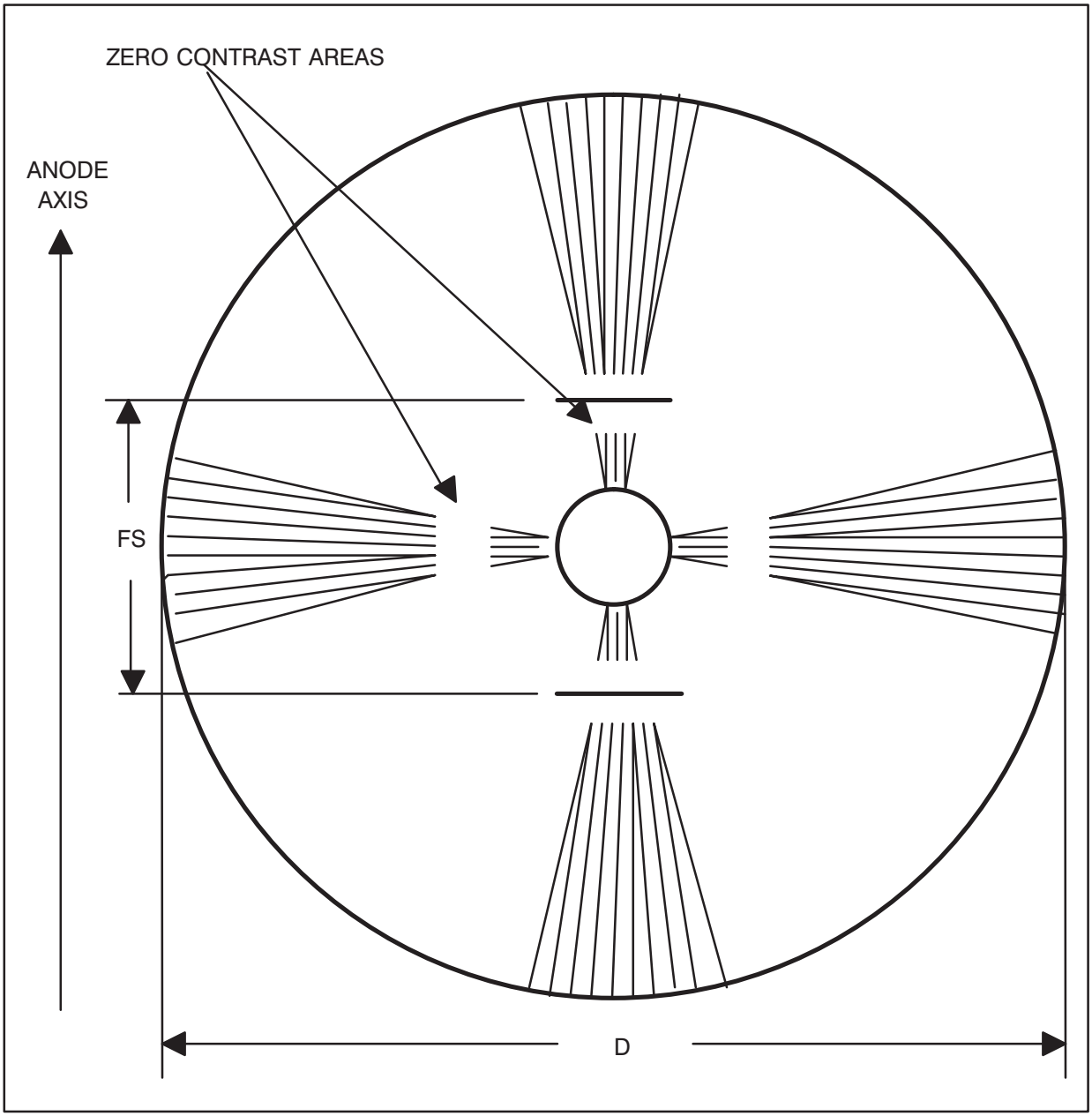
5-4-1 Exposures

1. Use 10 inch by 12 inch x–ray film without intensifying screens. Align the film in the x–ray beam.
2. Make an exposure (.3 spot, 80 KV, 100 mA, 20 mAs, open loop) to obtain a film density of 1.2 $\pm$ 0.2. Multiple exposures may be required to obtain this density or you may have to adjust mAs using the DECR MAS or INCR MAS softkey. Allow sufficient cooling time between exposures.
3. Touch MORE INFO softkey. Read the instructions on the MORE INFO screen display to become familiar with the procedures for determining focal spot size.

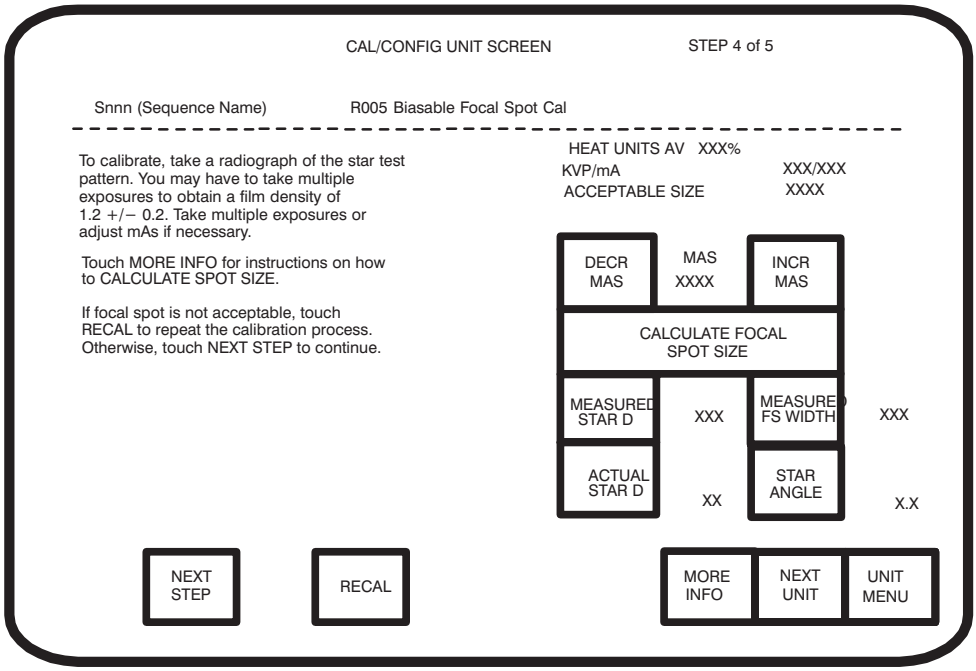
5-4-2 Calculate Spot Size

1. For each film, measure the diameter of the star pattern on the film (in millimeters).
2. Touch MEASURED STAR D softkey and using the console dial enter the diameter of the star pattern (in millimeters).
3. Touch ACTUAL STAR D softkey and using the console dial enter the actual diameter of the star pattern
4. Touch STAR ANGLE softkey and using the console dial enter the angle of the star pattern in degrees.
5. Measure the width of the focal spot (FS) on the film. Make the measurement along the anode axis in which the image sectors disappear. Use a 7X magnifier to enhance definition and measurement. Measure from the centers of zero contrast along the axis. See Illustration 31.
6. Touch MEASURED FS WIDTH softkey and using the console dial enter the width of the focal spot as measured on the film (in millimeters).
7. Touch the CALCULATE FOCAL SPOT SIZE softkey. The system will automatically calculate the focal spot size and display the results on the console screen (in millimeters).
8. Compare the CALCULATED FOCAL SPOT SIZE value with the ACCEPTABLE SIZE limitations indicated on the console screen. If within specification, touch NEXT STEP softkey to proceed to Step 5. If unacceptable, touch RECAL softkey to return to the previous step. Repeat the procedure.

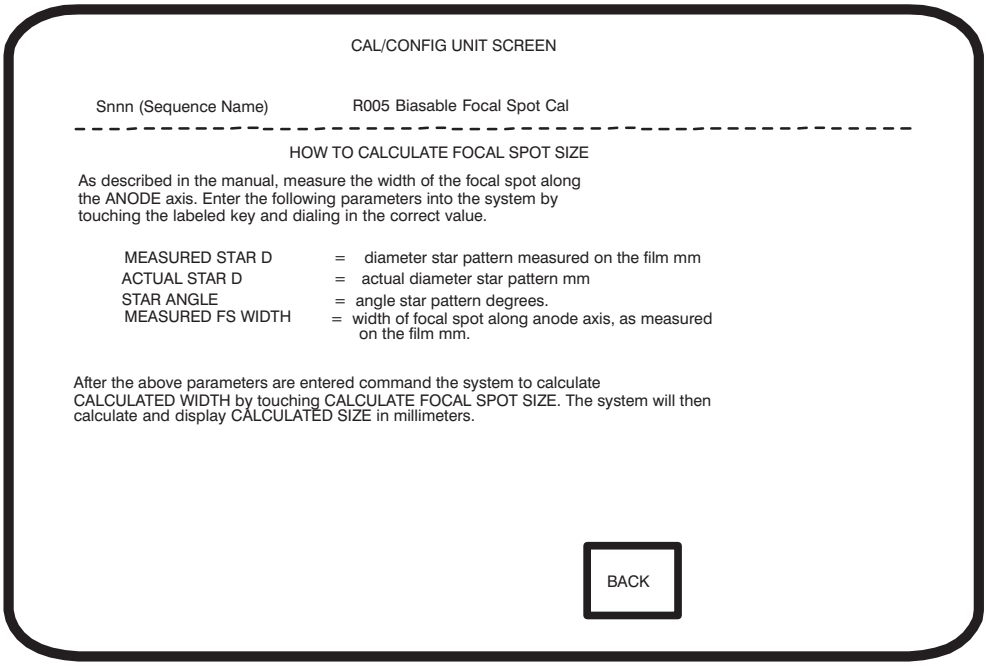
Illustration 31 – Image of Test Pattern



R005 STEP 4 SCREEN DISPLAY



R005 STEP 4, MORE INFO SCREEN



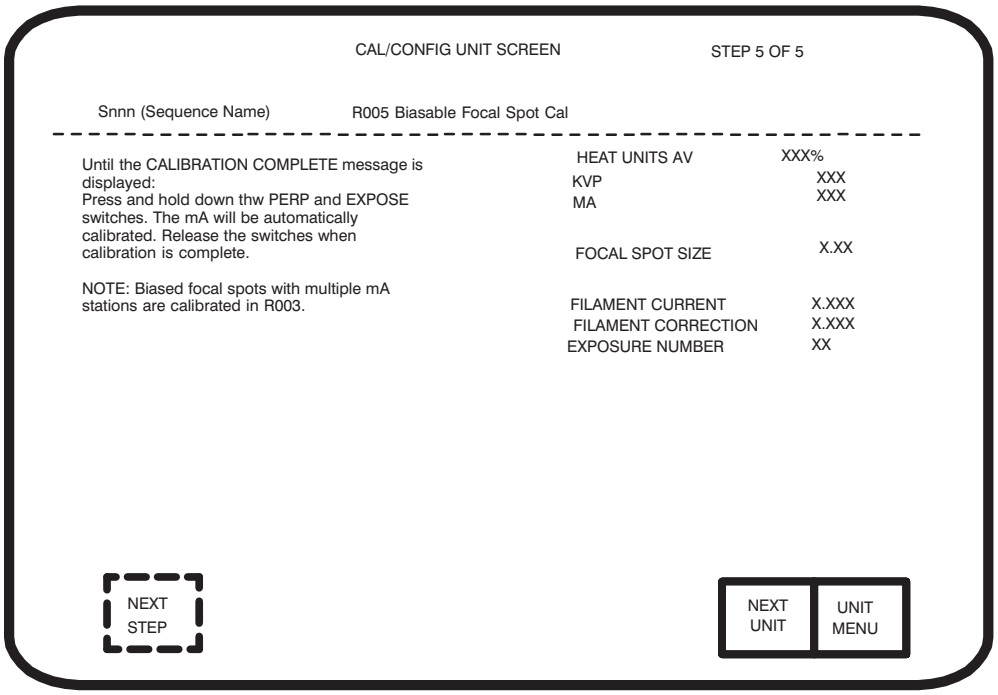
5-5 Step 5. Bias Adjustment for .2c Focal Spot

- Press and hold the PREP and EXPOSE switches on the console handswitch. The mA will be automatically calibrated. Release the PREP and EXPOSE switches when the “CALIBRATION COMPLETE” message is displayed.

Note: Biased spots with multiple mA stations are calibrated in R003, Initial Filament Drive Calibration. If any focal spots are not calibrated in Step 9, then R003 for that focal spot will be rehighlighted (set to incomplete) and R003 must be re–run.

- Touch NEXT UNIT or UNIT MENU softkey to exit the calibration unit.

R005 STEP 5 SCREEN DISPLAY



Note: The NEXT STEP softkey is only displayed in the view (Browse) mode to permit return to Step 1.

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UNIT R006 – Tailing Compensation Calibration

Time: x h xx min – Personnel: 1 field engineer

1 DESCRIPTION

Calibration Unit R006 adjusts the x–ray exposure window to compensate for the HV decay time after termination of an exposure. The calibration unit is a prerequisite to AEC calibration. Only one step is required to complete the calibration.

2 EQUIPMENT REQUIRED

External bleeder, PN 46–154966G1, (if the system is configured with an LFX power unit that does not contain an internal bleeder or the internal bleeder is not working).

3 TEST SETUP

3-1 Systems with LFX power unit

- If the LFX power unit does not contain an internal bleeder or the internal bleeder is not working, connect an external bleeder.
- Set bleeder selector switch LFX1 A1 A4 S203 to appropriate position:
  UP – External Bleeder; DOWN – Internal Bleeder.

3-2 Systems with MPPU or SCPU power unit:

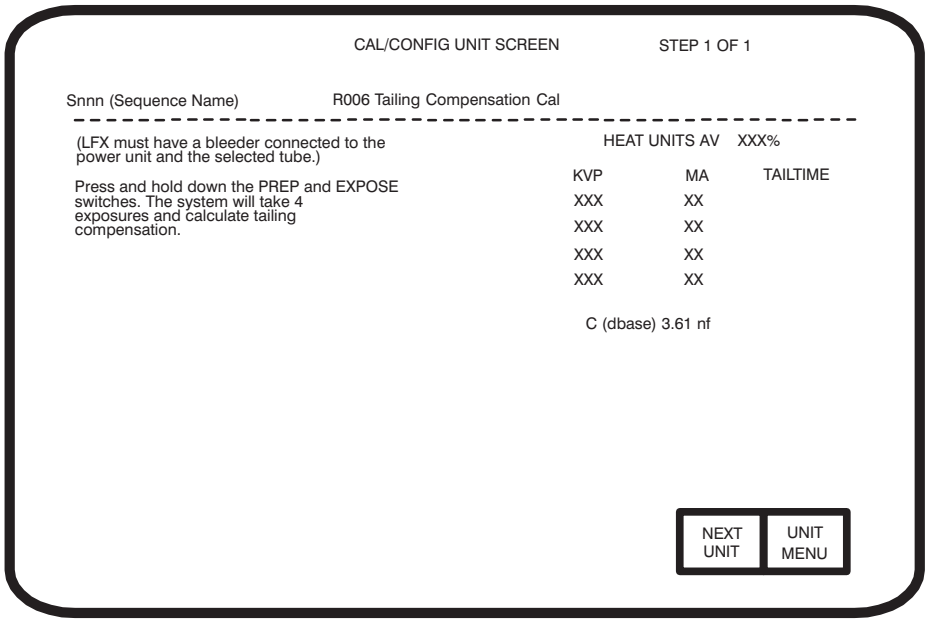
(No special test setup is required).

4 CAL PROCEDURE

Perform the calibration as follows:

- Press the PREP and EXPOSE switches. The system will step through four calibration points taking an exposure at each point. After each exposure, the unit will compute the tail time for each calibration point and display this value on the console screen. The tail time for each point in the calibration is calculated using a capacitance value stored in the database and displayed as ”C(dbase) X.XX nf” on the console screen. A “CAL COMPLETE” message is displayed after completion of all tail time calculations.
- Touch the NEXT UNIT or UNIT MENU softkey to exit the unit. An “Updating NV database” message is displayed while the calibration data is being loaded into the system.

R006 SCREEN DISPLAY



UNIT R007 – Anticipation Time Calibration

Time: x h xx min – Personnel: 1 field engineer

1 DESCRIPTION

Calibration Unit R007 adjusts exposure time to compensate for the delay between the x–ray command and the actual exposure window. Anticipation time is calibrated at each mA station from 200 mA through the highest mA of the selected tube. For multi–tube systems, anticipation time is calibrated for the x–ray tube with the highest mA rating. The calibration unit is a prerequisite to AEC calibration.

2 EQUIPMENT REQUIRED

External bleeder, PN 46–154966G1, (if the system is configured with an LFX power unit that does not contain an internal bleeder or the internal bleeder is not working).

3 TEST SETUP

3-1 Systems with LFX power unit

- If the LFX does not contain an internal bleeder or the internal bleeder is not working, connect an external bleeder.
- Set bleeder selector switch LFX1 A1 A4 S203 to appropriate position: UP –External Bleeder; DOWN – Internal Bleeder.

3-2 Systems with MPPU or SCPU power unit

(No special test setup is required.)

4 CAL PROCEDURE

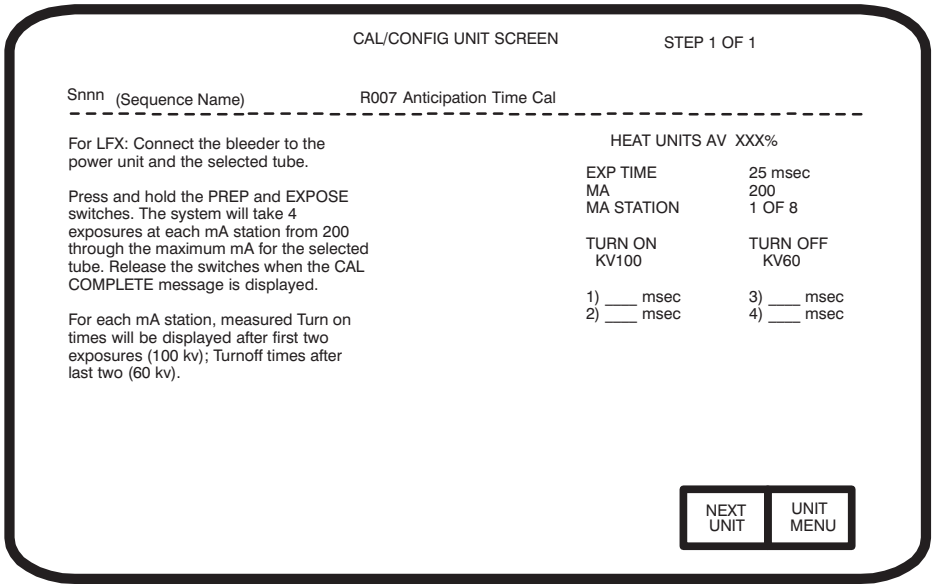
Perform the calibration as follows:

- Press and hold the PREP and EXPOSE switches. The unit will automatically take four exposures at each mA station starting at the 200 mA station and ending at the maximum mA station for the selected tube. After each exposure, the system will calculate anticipation time and store the results in NVRAM. Measured turn–on times are displayed after the first two exposures. Turn–off times are displayed after the last two exposures. A “CAL COMPLETE” message is displayed after completion of exposures at the last mA station.

Note: Premature release of the PREP or EXPOSE switches, will terminate the calibration. Wait for a READY message and restart the calibration.The calibration will start over at Step 1.

- Touch NEXT UNIT or UNIT MENU softkey to exit the unit.

R007 SCREEN DISPLAY



UNIT R009 – mA Meter Calibration–Fluoro Range

Time: x h xx min – Personnel: 1 field engineer

1 DESCRIPTION

Calibration Unit R009 selects the Fluoro tube **only** to calibrate the internal mA meter for the Fluoro range. The calibration establishes a meter constant that is stored in system NV RAM. The constant is applied whenever an mA meter measurement is required in the fluoro operating mode. Two steps are required to accomplish the calibration. A screen display is provided for each step.

2 EQUIPMENT REQUIRED

Digital multimeter (DMM), and an external bleeder, PN 46–154966G1, (only required if the system power unit is an LFX that is not configured with an internal bleeder or the internal bleeder is not working).

Note: In this Service Mode SW release, R009 no longer requires the use of an oscilloscope to measure kVp. The demand kVp value is now indicated on the R009 screen display.

3 TEST SETUP

3-1 Systems configured with LFX power unit:

- Connect DMM in series with the mA+ lead of the HV transformer harness and set to 20 mA DC scale. See Illustration 30 in Cal Unit R002.

Note: On systems configured with a Cine Pulse and Bias Tank, a second wire is connected to the mA+ terminal on the HV transformer. This wire is the mA+ wire of the MIS #353B cable run between the HV transformer and bias tank. Do not connect the DMM in series with this lead.

- Verify bleeder setup between power unit and the selected tube.

Note: If the LFX does not contain an internal bleeder or the internal bleeder is not working, connect an external bleeder.

- Set bleeder selector switch LFX1 A1 A4 S203 to appropriate position:
  UP – External Bleeder, DOWN – Internal Bleeder

3-2 Systems configured with MPPU power unit:

- Remove jumper from XJ3 on MPPU1 A1 A1, Measure and Commutation board on HV transformer.
- Connect DMM to XJ3 on MPPU1 A1 A1, Measure and Commutation board
- Set DMM to measure mA DC.

4 SPECIAL REQUIREMENT

The unit requires the entry of X–ray tube mA values in Steps 1 and 2. On systems with LFX power unit, the measured mA values must be corrected according to the offset calculations provided in the applicable Compensation Matrix (Table 11 or Table 12) before being entered. On systems with the MPPU power unit, the offset calculation is given in the procedure. Because some systems do not compensate for bleeder current, entering the offset mA value ensures that the mA calibration is accurate.

Note: Bleeder Impedance

Internal – The impedance of either anode to ground or cathode to ground is 150 megohms which results in a total anode to cathode leakage of 0.0033 mA/kV (Refer to Table 11).

External – The impedance of either anode to ground or cathode to ground is 100 megohms which results in an anode to cathode leakage of 0.005 mA/kV (Refer to Table 12).

Table 11 – Compensation Matrix 1: Internal Bleeder

HIGH VOLTAGE XFMR P/N	OFFSET mA
46–262544G1	0
46–262544G2/G3/G4/G5/G6	(0.0033 x kVp)

Table 12 – Compensation Matrix 2: External Bleeder

HIGH VOLTAGE XFMR P/N	OFFSET mA
46–262544G1	(0.005 x kVp)
46–262544G2/G3/G4/G5/G6	(0.0083 x kVp)

WARNING **WHEN RUNNING THIS UNIT ON R&F SYSTEMS CONFIGURED WITH AN IMAGEUR MODULE, PROTECT THE IMAGE INTENSIFIER BY PLACING A LEAD SHEET IN THE X–RAY BEAM.**

5 CAL PROCEDURE

5-1 Step 1. Measure MA, First Pass

- Take a fluoro exposure (The MA softkey is activated after the exposure).
- Record the mA value indicated on the DMM and the kVp value indicated on the R009 console screen display.

  DMM mA _____.

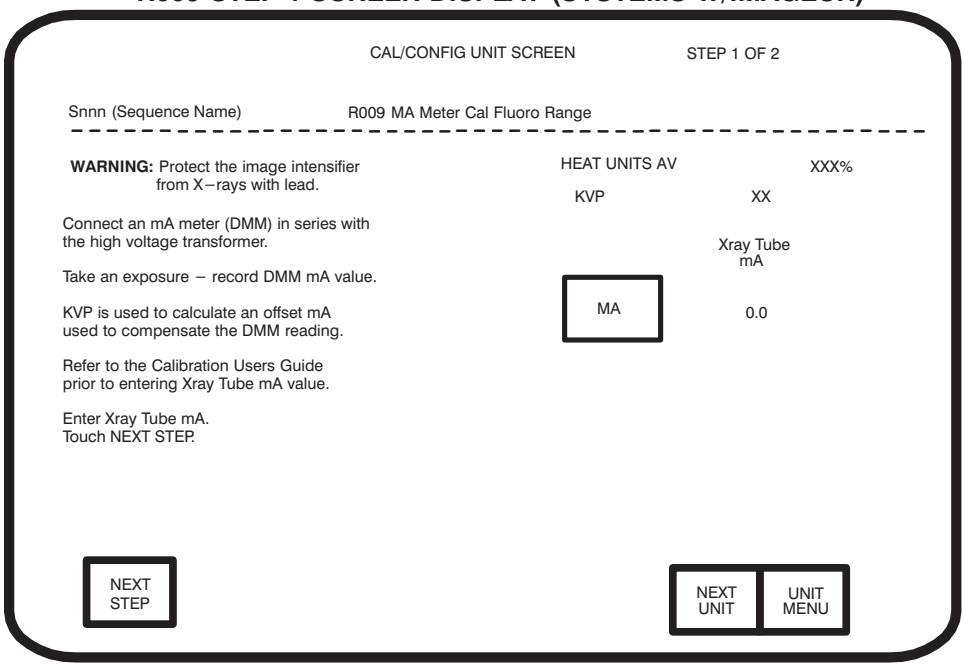
  Console kVp _____.
- Determine offset mA.

  LFX Power Unit – The offset is specified in the appropriate compensation matrix (See Special Requirements paragraph and Table 11 and Table 12).

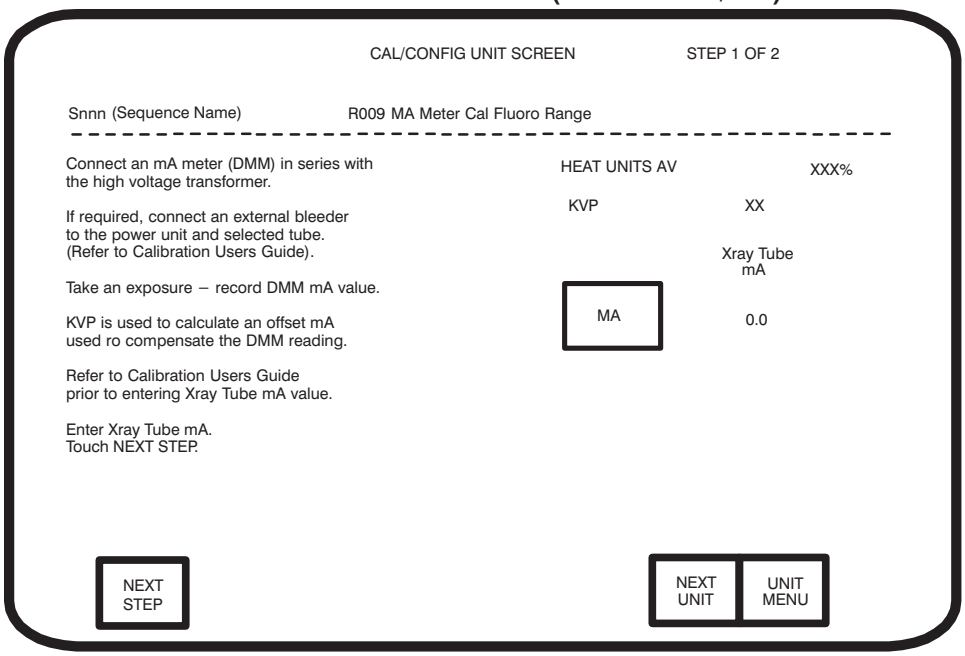
  MPPU Power Unit – The offset value is (0.0025 x kVp).
- Calculate X–ray tube mA value:

  (X–ray tube mA = DMM mA – Offset mA)
- Enter the X–ray tube mA value with the console dial.
- Touch NEXT STEP softkey to proceed to Step 2.

R009 STEP 1 SCREEN DISPLAY (SYSTEMS W/IMAGEUR)



R009 STEP 1 SCREEN DISPLAY (SYSTEMS W/VIC)



5-2 Step 2. Measure MA, Second Pass

- Take another fluoro exposure (The MA softkey is activated after the exposure).
- Record the mA value indicated on the DMM and the kVp value indicated on the Advantx console.

  DMM mA_____.

  Console kVp_____.
- Determine offset mA.

  LFX – The offset is specified in the appropriate compensation matrix (See Special Requirements paragraph and Table 11 and Table 12).

  MPPU – The offset value is (0.0025 x kVp).
- Calculate X–ray tube mA value:

  (X–ray tube mA = DMM mA – Offset mA)
- Enter the X–ray tube mA value with the console dial.

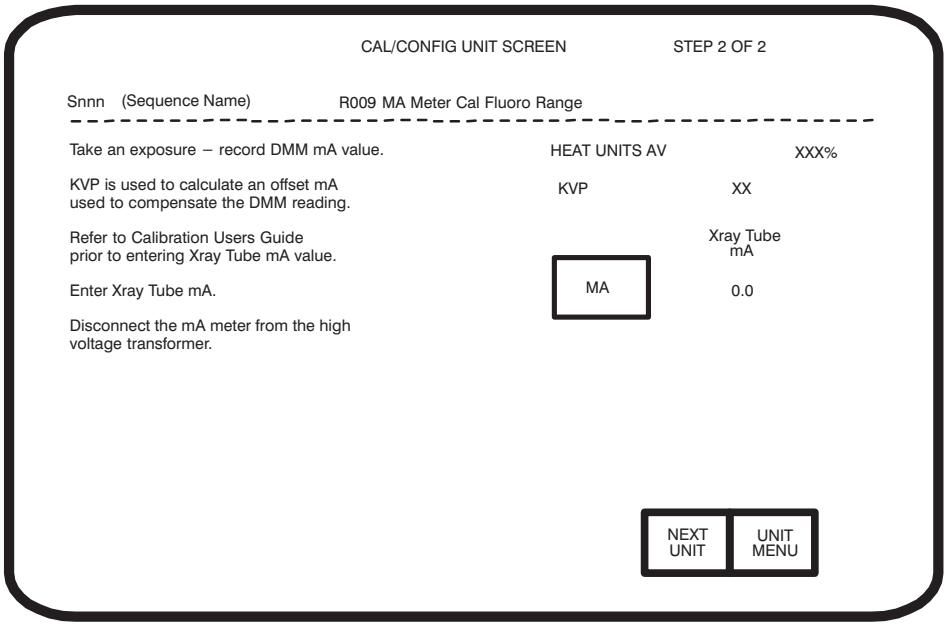
Note: The mA indication entered in Step 2 should be greater than the mA entered in Step 1.

- If the calibration does not meet acceptable values, the message “CALCULATED METER GAIN IS OUT OF RANGE” is displayed. **Repeat the calibration.**

  OR
- If the calibration is within specification, an “UPDATING NV DATABASE” message is displayed while the calibration data is being entered into NVRAM.

- Disconnect the DMM.
- On systems with MPPU, reinstall jumper on XJ3, MPPU1 A1 A1, Measure and Commutation board.
- Touch NEXT UNIT or UNIT MENU softkey to exit.

R009 STEP 2 SCREEN DISPLAY



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UNIT R010 – mAs Meter Calibration

Time: x h xx min – Personnel: 1 field engineer

1 DESCRIPTION

Calibration Unit R010 calibrates a gain constant for the internal mAs meter in the system power unit (generator). The constant is applied whenever an mAs measurement is required. The internal mAs meter allows a check of the power unit for compliance with HHS requirements.

2 EQUIPMENT REQUIRED

Digital multimeter (DMM), and external bleeder, PN 46–154966G1, (only required if the system power unit is an LFX that is not configured with an internal bleeder or the internal bleeder is not working).

Note: In this Service Mode SW release, R010 no longer requires the use of an oscilloscope to measure kVp. The actual readback kVp value is now indicated on the R010 screen display after each exposure.

3 TEST SETUP

3-1 Systems configured with an LFX power unit

- Connect DMM in series with the mA+ lead of the HV transformer harness and set to 2000 mA, DC scale.

Note: On systems configured with a Cine Pulse and Bias Tank, a second wire is connected to the mA+ terminal on the HV transformer. This wire is the mA+ wire of MIS #353B cable run between the HV transformer and bias tank. Do not connect the DMM in series with this lead.

- Verify bleeder setup between power unit and the selected tube.

Note: If the LFX does not contain an internal bleeder or the internal bleeder is not working, connect an external bleeder.

- Set bleeder selector switch LFX1 A1 A4 S203 to appropriate position:
  UP – External Bleeder, DOWN – Internal Bleeder

3-2 Systems configured with an MPPU power unit

- Remove jumper from XJ3 on MPPU1 A1 A1, Measure and Commutation board.
- Connect DMM to XJ3 on MPPU1 A1 A1, Measure and Commutation board.
- Set DMM to measure mA DC.

4 SPECIAL REQUIREMENT

The unit requires the entry of X–ray tube mA values. On systems with LFX power unit, the measured mA values must be corrected according to the offset calculations provided in the applicable Compensation Matrix (Table 13 or Table 14) before being entered. On systems with the MPPU power unit, the offset calculation is provided in the procedure. Because some systems do not compensate for bleeder current, entering the offset mA value ensures that the mA calibration is accurate.

Note: Bleeder Impedance

Internal – The impedance of either anode to ground or cathode to ground is 150 megohms which results in a total anode to cathode leakage of 0.0033 mA/kV (Refer to Table 13).

External – The impedance of either anode to ground or cathode to ground is 100 megohms which results in an anode to cathode leakage of 0.005 mA/kV (Refer to Table 14).

Table 13 – Compensation Matrix 1: Internal Bleeder

HIGH VOLTAGE XFMR P/N	OFFSET mA
46–262544G1	0
46–262544G2/G3/G4/G5/G6	(0.0033 x kVp)

Table 14 – Compensation Matrix 2: External Bleeder

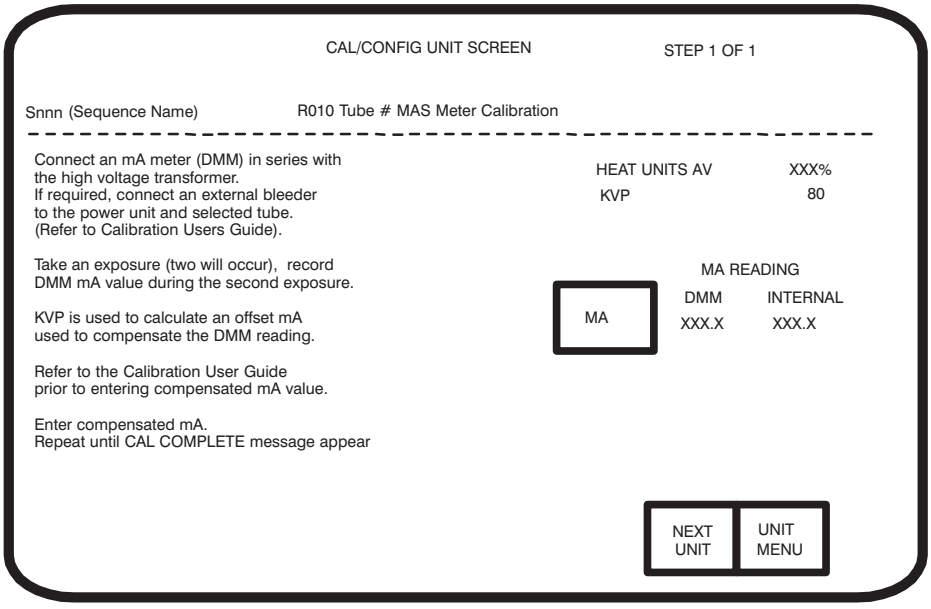
HIGH VOLTAGE XFMR P/N	OFFSET mA
46–262544G1	(0.005 x kVp)
46–262544G2/G3/G4/G5/G6	(0.0083 x kVp)

5 CAL PROCEDURE

Perform the mAs meter calibration as follows:

- Take an exposure. Two will occur.
- Record the mA value indicated on the DMM and the kVp value indicated on the console screen.
  DMM mA _____.
  Console kVp _____.
- Determine offset mA.
  LFX Power Unit – The offset is specified in the appropriate compensation matrix (See Special Requirements paragraph).
  MPPU Power Unit – The offset value is (0.0025 x kVp).
- Calculate X–ray tube mA value:
  (X–ray tube mA = DMM mA – Offset mA)
- Touch MA softkey and enter the X–ray tube mA value with the console dial.
- Disconnect the DMM and on systems with MPPU power unit, reinstall jumper on XJ3, MPPU1 A1 A1, Measure and Commutation board.
- Touch the NEXT UNIT or UNIT MENU softkey to exit.

R010 SCREEN DISPLAY



Blank page.

UNIT R013 – Generator HHS Measurements

Time: x h xx min – Personnel: 1 field engineer

1 DESCRIPTION

Calibration Unit R013 is used to verify that the X–ray system meets the requirements of HHS. The calibration unit provides measurement of kVp, mA, mAs, and exposure time to verify that the power unit meets the HHS requirements pertaining to reproducibility, linearity, and accuracy.

2 EQUIPMENT REQUIRED

Keithley non–invasive kVp meter.

3 TEST SETUP

3-1 Systems with an MPPU power unit

- If viewing of kV waveform is desired, connect oscilloscope to MPPU1 A1 A1TP7 or XJ4. The scale factor is 8 kV/volt (1.0 V/8 kV).

3-2 Systems with an SCPU power unit

- If viewing of kV waveform is desired, connect oscilloscope to SCPU A4 A1 TP26 (kVp). Reference gnd5. The scale factor is 8 kV/volt (1.0 V/8 kV).

4 SPECIAL INSTRUCTIONS

The following special instructions relate to the running of this unit.

Note: **For Vascular Systems Only:** Before system calibration, verify that additional filter (copper–aluminum filter) is not installed on top of collimator. (Open sensor hinge assembly to verify.) If installed, remove before performing calibration.

Note: If any measured mA value is outside the tolerance range, rerun R003 for that focal spot. Then, recalibrate and retest all stations for that focal spot.

- Upon entry into the unit, the collimator blades on systems configured with auto–collimators are in the fully closed position. Adjust blades to desired open position by touching POSITION COLLIMATOR softkey. The unit will proceed to a Step 2 screen that provides controls for adjusting blade position.

Note: If a manual collimator is configured, the POSITION COLLIMATOR softkey does not appear on the screen. Field size must be adjusted at the collimator.

- If this unit is used to perform “functional tests” other than HHS measurements, the power unit should be set to the CLOSED loop operating mode and the INITIAL KVP function must be disabled or the x–ray tube may be damaged.

- To check the accuracy of systems configured with Photospot, Film Changer or Digital Fluoro, the line contacting mode should be set to (SYNC or NONSYNC) as indicated in Summary of Config, Unit C006, Function Configuration.

Note: Additional information on the operation of this unit is provided on a “MORE INFO” screen that can be accessed by touching the MORE INFO softkey on the Step 1 screen display.

5 CAL PROCEDURE

5-1 Step 1. Perform the measurements as follows

- Set the CLOSED/OPEN softkey to CLOSED.
- Set SYNC/NONSYNC to SYNC. (Refer to unit special instructions.)

CAUTION **If INITIAL KVP is enabled when running this unit, erratic values for the Initial KVP parameter may be displayed on the console screen (can indicate zero) at low mAs or short exposure times.**

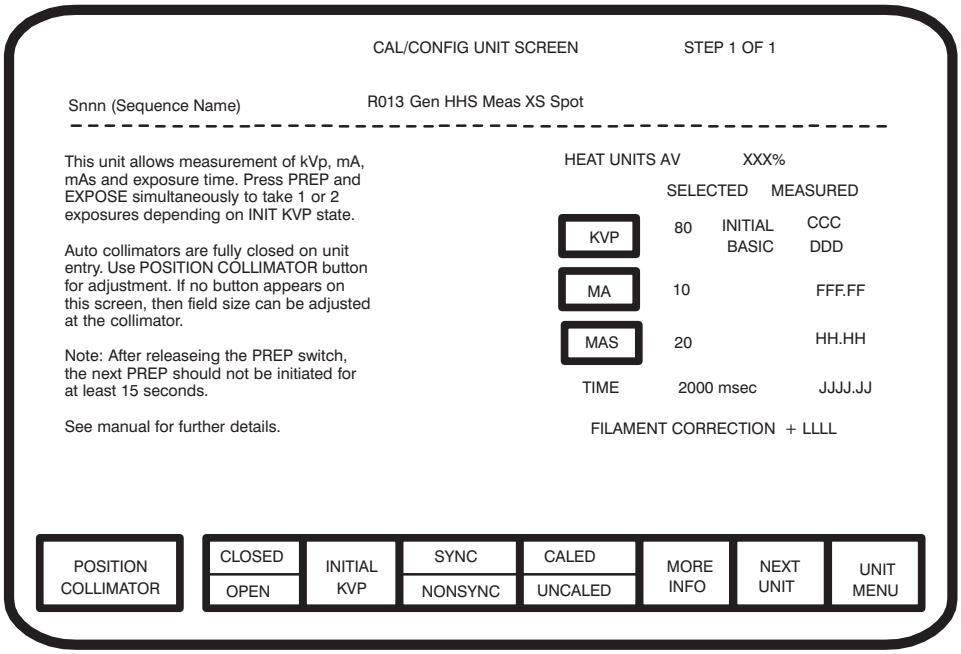
- Set INITIAL KVP to off.
- Set the CALED/UNCALED softkey to CALED if the x–ray tube filament drive has been calibrated (Ref. Cal Unit R003, Init. Filament Drive Cal).
- Refer to *Direction 46–013894 System Field Test for HHS* and perform the required tests at the kVp, mA, and mAs values specified.
- Use the console dial and appropriate softkeys (KVP, MA and MAS) to enter the parameters to be measured.
- Press the PREP and EXPOSE switches to take measurements. The unit displays all measured mAs values.

Note: When INITIAL KVP is enabled, and the selected exposure time is less than or equal to 10 msec, only one exposure is taken and the measured value of kVp is displayed as both INITIAL and BASIC. The measured value of mAs and exposure time is also displayed.

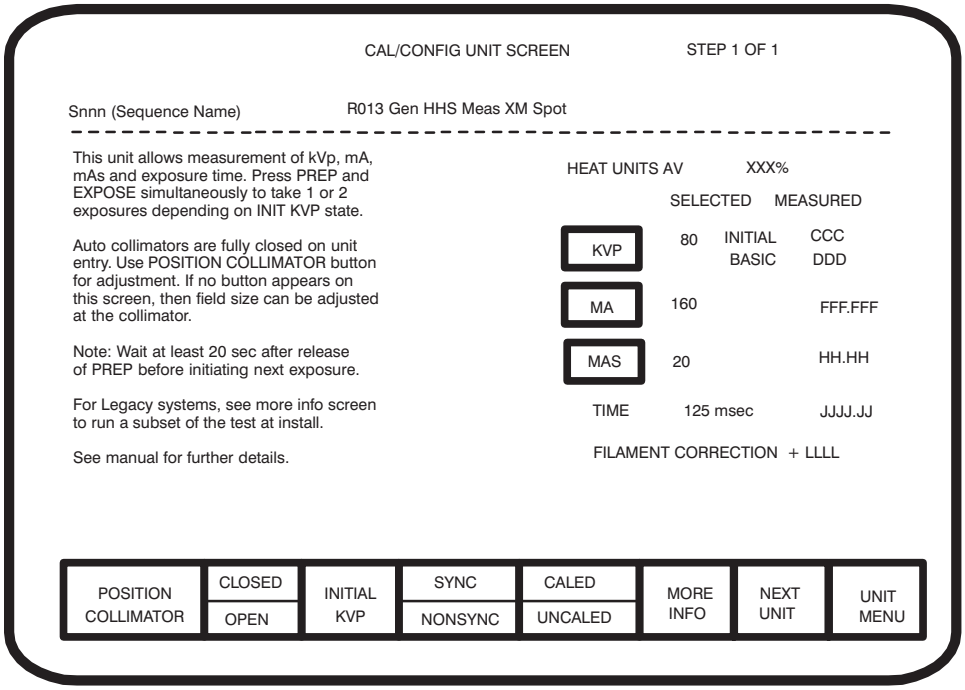
Note: Wait at least 20 seconds after release of PREP before initiating the next exposure.

- Record measurements on the Accuracy Charts supplied in *Direction 46–013894, System Field Test for HHS.*
- Continue taking measurements and recording results of tests specified until all HHS requirements are completed.
- Touch NEXT UNIT or UNIT MENU to exit.

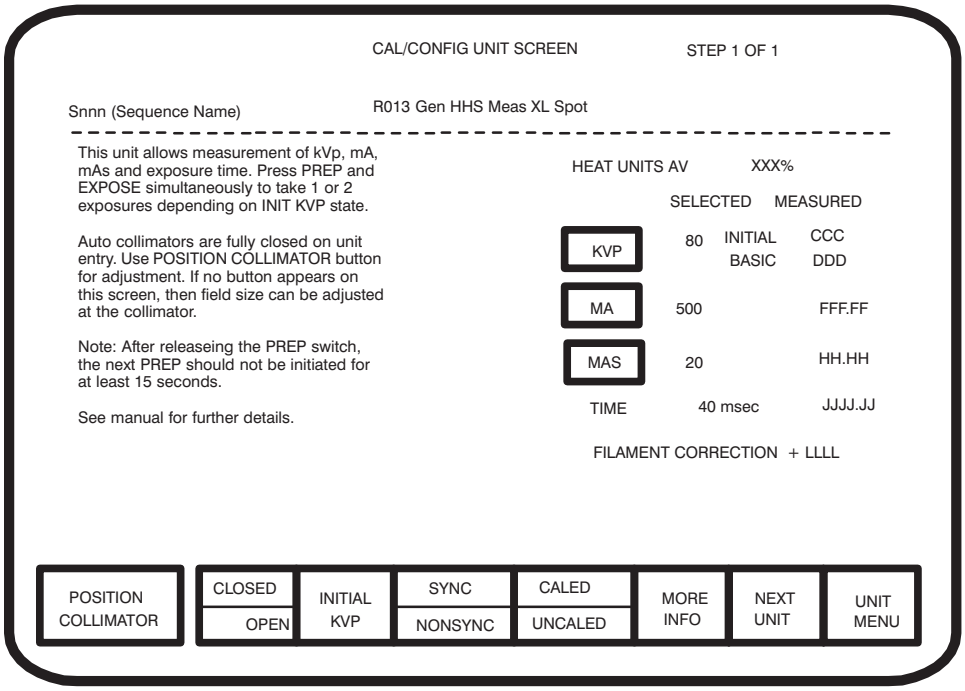
R013 XS SPOT SCREEN DISPLAY



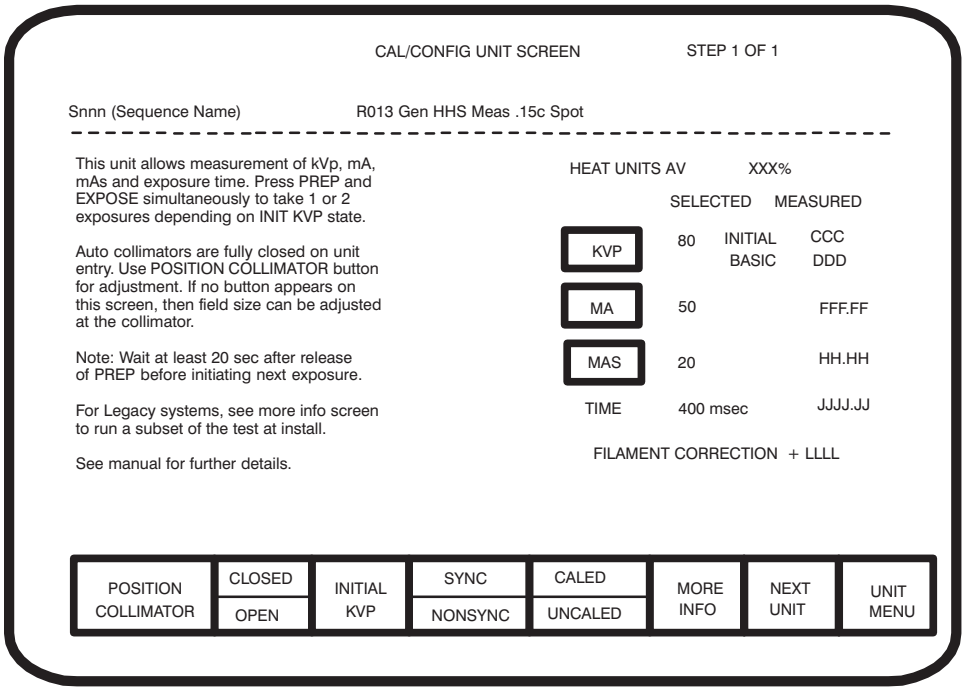
R013 XM SPOT SCREEN DISPLAY



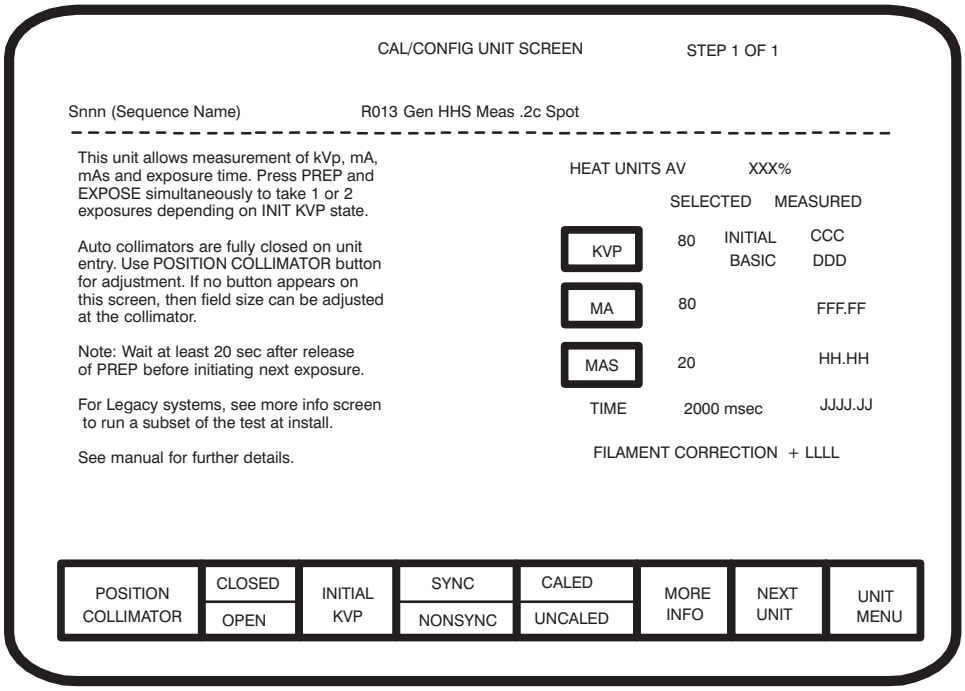
R013 XL SPOT SCREEN DISPLAY



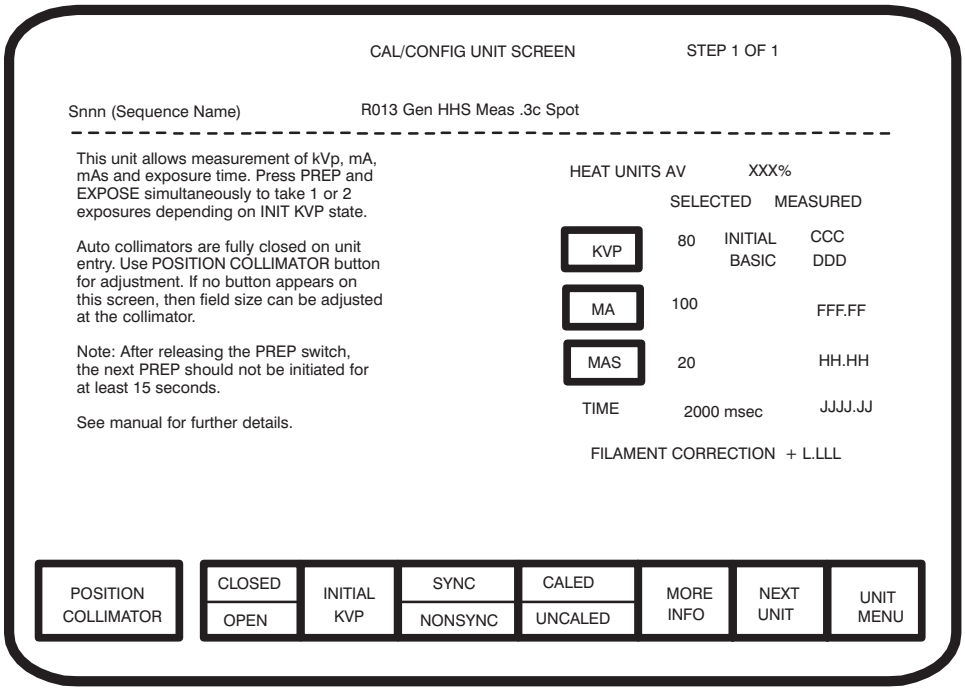
R013 .15 C SPOT SCREEN DISPLAY



R013 .2 C SPOT SCREEN DISPLAY



R013 .3 C SPOT SCREEN DISPLAY



R013 "MORE INFO" SCREEN DISPLAY

CAL/CONFIG UNIT SCREEN STEP 1 OF 1

Snnn (Sequence Name) R013 Gen HHS Meas

Page 1 of 2

BUTTON	FUNCTION OF BUTTON
OPEN/CLOSED	Controls whether exposures are taken with open or closed−loop mA control. Application uses CLOSED loop.
INIT KVP	Controls whether initial kVp will be measured with a short exposure before the selected exposure.
SYNC/NONSYNC	Controls whether exposures will be taken in SYNC or NON−SYNC line contacting mode. LFX power limitations are worse in NONSYNC mode. Film changer and photospot are normally configured to NONSYNC.
CALED/UNCALED	Is used to signal the software if the x−ray tube filament drive (R003) has been calibrated.
KVP, MA, MAS	Are used with the dial to select kVp, mA, and mAs.

BACK

R013, COLLIMATOR ADJUST SCREEN DISPLAY

CAL/CONFIG UNIT SCREEN STEP 1 OF 1

Snnn (Sequence Name) R013 Gen HHS Measurement ROOM X

HEAT UNITS XXX%

In this step fluoro (through the handswitch) and collimators are enabled for positioning object (e.g., dosimeters) in the field of view.

0.0 MA

Return to Step 1 via the STEP BACK key for radiographic measurements when finished.

NOTE: Fluoro is disabled if the imaging module is VIC and the Fluoro Target Voltage is at its C000 initialized value (i.e., V050 has not been run).

COLLIMATOR TRANSVERSE	SLOW
CLOSE JOG	OPEN JOG

STEP BACK

UNIT R017 – Line Regulation

Time: x h xx min – Personnel: 1 field engineer

1 DESCRIPTION

Calibration Unit R017 is used to measure the percent of line regulation (variation) from a no–load to a max–load condition to ensure that the power unit used in the system operates within HHS specifications. The unit is run on systems configured with either an LFX, MPPU or SCPU power unit. In order to cover the variations in power units that may be configured on an Advantx system, two separate screen driven Cal Procedures are provided for R017. One for systems with LFX or MPPU power unit and one for systems with SCPU power unit. The appropriate R017 unit screen presentations are automatically displayed as a function of the system Smart Sequencer.

- Cal Procedure 1 (4–step procedure) is run on systems configured with either an LFX or MPPU power unit. Step 0 is an introductory screen. Step 1 calibrates initial filament drive for a full power exposure. Step 2 measures the ratio of current line voltage to nominal line voltage and Step 3 verifies proper operation under full power exposure.
- Cal Procedure 2 (2–step procedure) is run on systems configured with an SCPU power unit. Step 1 calibrates initial filament for a full power exposure. Step 2 verifies proper operation under full power exposure.

Note: This calibration unit must be re–run whenever the existing x–ray tube is replaced with a tube of a higher kV rating.

2 EQUIPMENT REQUIRED

Oscilloscope (dual channel, storage type) w/X10 probe, digital voltmeter (DVM), and appropriate test leads (For LFX and MPPU power unit tests only).

3 CAL PROCEDURE 1

3-1 Step 1. Test Setup

CAUTION **AVOID ELECTRICAL SHOCK HAZARD. Turnoff system power BEFORE performing the test setup for running Cal Procedure 1.**

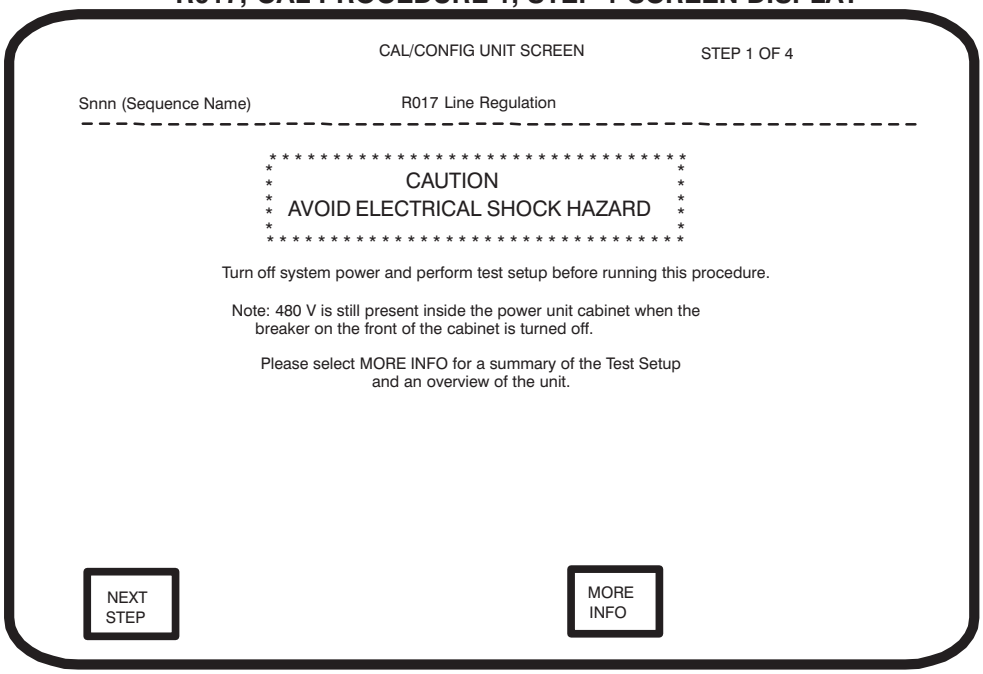
3-1-1 Test setup for Systems Configured with an LFX Power Unit

- Turnoff system power.
- Connect DVM to LFX2 A3 TS3 L1 – L2
- Set up the oscilloscope as indicated below:
  1. Time base: 10 ms/div
  2. Storage mode: Trigger from Channel B
  3. Channel A:
     – Set Vertical Ampl to 100 V/div.
     – Connect probe to one side (yellow wire) of line contactor coil (LFXK1) and ground to other side of coil (purple wire).
  4. Channel B:
     – Set Vertical Ampl to 1.0 V/div.
     – Connect probe to KVP OUTPUT (LFX1 A1 A4 J9).
- Turn on system power.

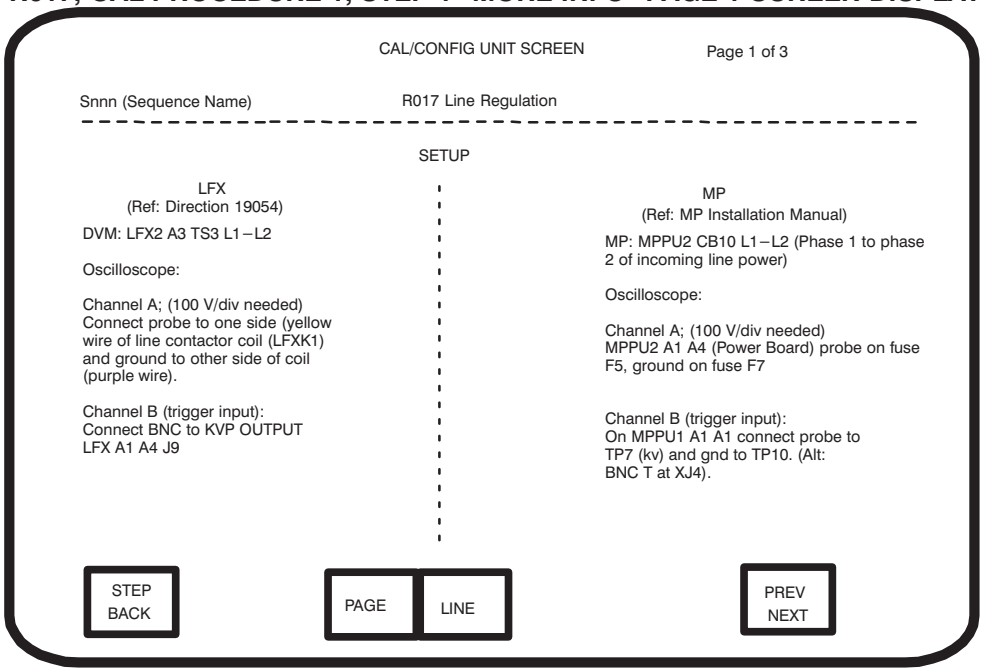
3-1-2 Test setup for Systems Configured with an MPPU Power Unit

- Turnoff system power.
- Connect DVM to MPPU2 CB10 L1 – L2 (Phase 1 to phase 2 of incoming line power)
- Set up the oscilloscope as indicated below:
  1. Time base: 10 ms/div
  2. Channel A:
     – Set Vertical Ampl to 100 V/div.
     – Connect probe to fuse F5 and ground to fuse F7 on MPPU2 A1 A4 (Power Board). CAUTION: The F5 and F7 measurement points ARE NOT the wires marked F5 and F7 in the TIRC.
  3. Channel B:
     – Set Vertical Ampl to 5.0 V/div.
     – Connect probe to TP7 and ground to TP10 on MPPU1 A1 A1.
- Turn on system power.

R017, CAL PROCEDURE 1, STEP 1 SCREEN DISPLAY



R017, CAL PROCEDURE 1, STEP 1 "MORE INFO" PAGE 1 SCREEN DISPLAY



3-2 Step 2. Calibrate Highest mA Station of Tube

NOTICE

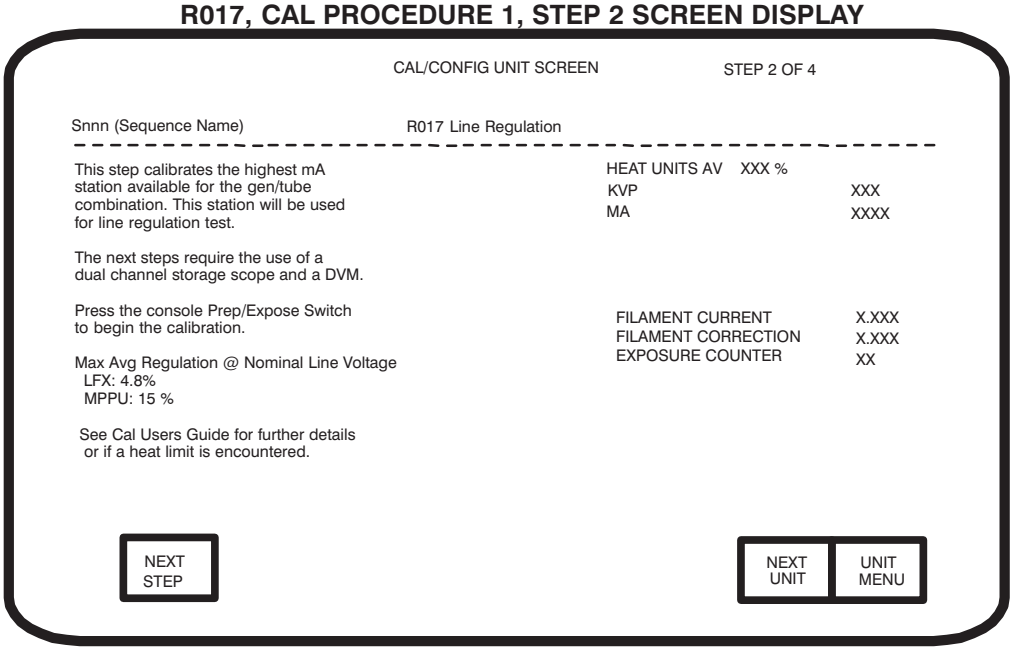
In some power unit board failure modes, the error feedback is always zero (0). This may cause calibration unit R017 to run to completion taking only one x–ray exposure at each step. When running this unit be aware of situations where the FILAMENT CORRECTION value indicated on the console screen is always zero (0) since this indicates a power unit board failure.

- Take and maintain an exposure. The system will automatically take successive exposures and calibrate the initial filament drive for the highest mA station of the x–ray tube under test at selected kVp's of 80 kVp, minimum kVp, and maximum kVp. Only one mA station is calibrated. Terminate the exposure when the "STEP IS COMPLETE" message is displayed

Note: If the tube heat limit is reached, continue to hold the PREP and EXPOSE switches. The calibration will restart and continue after the tube cools.

- Touch NEXT STEP softkey to proceed to Step 2.

R017, CAL PROCEDURE 1, STEP 2 SCREEN DISPLAY



3-3 Step 3. Determine Nominal/Maximum Line Voltage

- Upon entering Step 2 the default value of 480 is displayed for NOMINAL LINE VOLTAGE and ACTUAL LINE VOLTAGE and the percent line ratio is set to 100.
- Touch NOMINAL LINE VOLTAGE softkey and, using the console dial, enter the value of nominal line volts corresponding to the input tap selections on the applicable power unit transformer.

  LFX: LFX2 A5 (Refer to Direction 46–019054)

  MPPU: MPPU2 A1 (Refer to MPPU Service Manual)
- Measure the actual line voltage indicated on the DVM.

  LFX: LFX2 A3 TS3 L1–L2

  MPPU: MPPU2 CB10 L1–L2 (Phase 1 to phase 2 of incoming line power)

  RECORD VALUES:

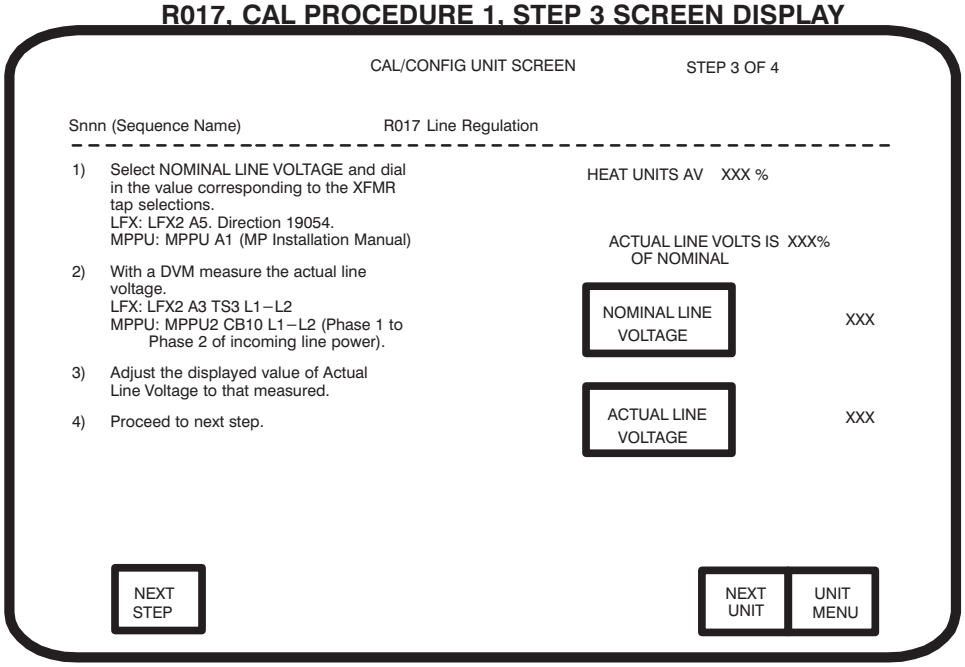
  NOMINAL LINE VOLT_____

  ACTUAL LINE VOLTS _____
- Touch ACTUAL LINE VOLTAGE softkey and use the console dial to adjust the value displayed for Actual Line Voltage to the measured value.

Note: If either the NOMINAL LINE VOLTS or ACTUAL LINE VOLTS value is changed, a new percent line ratio is automatically computed and displayed.

- Touch NEXT STEP softkey to proceed to Step 3.

R017, CAL PROCEDURE 1, STEP 3 SCREEN DISPLAY



3-4 Step 4. Determine Percent Line Regulation.

Note: Touch MORE INFO softkey for additional instructions covering the function of the softkeys on the Step 3 screen and a summary of the procedure.

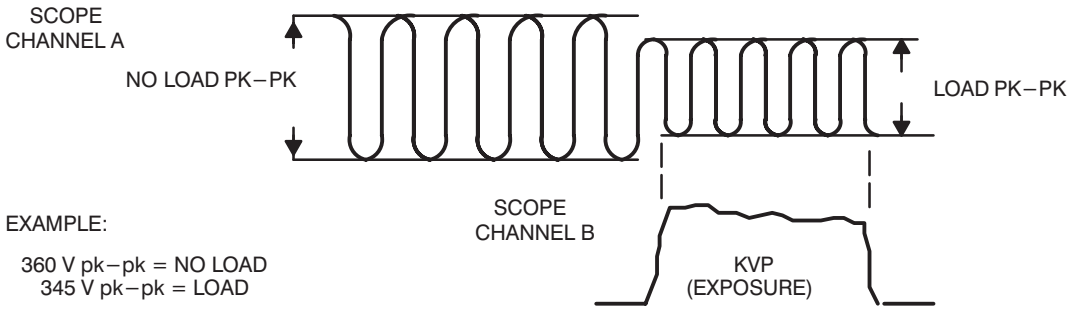
- Upon entering Step 3, the default value for LOAD VOLTS and NO LOAD VOLTS is the value of actual line voltage from Step 2.

CAUTION **A small ground difference potential (leakage current) exists between the oscilloscope Channel A and Channel B signal sources. However, after connection to the oscilloscope, the difference potential is nulled out without causing damage to the oscilloscope or equipment.**

- Touch INIT softkey to reset measurements for AVERAGE to zero.

NOTICE **Suggested Oscilloscope measurement technique: Since the relative magnitude is all that is important for the LOAD and NO LOAD measurements, adjust the volts/div for full scale peak/peak measurement of the no load AC waveform. Use this value for the NO LOAD entry on the console. Measure the peak/peak voltage during the exposure and use this value for the LOAD VOLT entry on the console. See Illustration 32.**

Illustration 32 – Load/No Load Waveform



- Take an exposure. Measure and record the load voltage (voltage indicated during exposure) and no load voltage displayed on Channel A of scope.

  MEASURED VALUES: LOAD VOLTAGE _____

  NO LOAD VOLTAGE _____

- Touch LOAD VOLT softkey and, using the console dial, enter the measured value. Touch NO LOAD VOLT softkey and, using the console dial, enter the measured value. The percent of regulation will be computed from the measurements entered and displayed as the CURRENT percent value for REGULATION FOR NOMINAL LINE.
- Take a minimum of three exposures to establish the AVERAGE percent value for REGULATION FOR NOMINAL LINE.

- Verify that the maximum average percent regulation at nominal line voltage indicated on the console screen is as specified below:

  LFX power unit: 4.8%

  MPPU power unit: 15%

Note: The line regulation limit displayed in this unit is computed in a manner to ensure that the proper line regulation is maintained over the allowed range of input line voltages (e.g., a system having a 4.8% line regulation at nominal line voltage would have 6% line regulation at a line voltage 10% below nominal).

- If the line regulation test passes, exit the unit by touching the NEXT UNIT or UNIT MENU softkey.

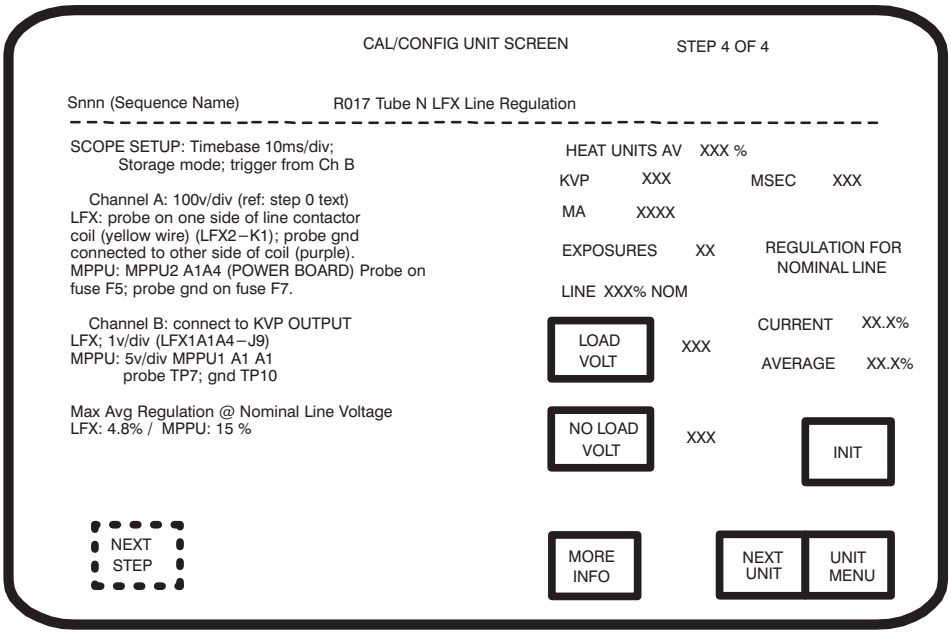
  OR

- If the line regulation test fails, the following options should be reviewed to determine corrective action.

  1. Recheck the line regulation of the main power input to the system. On systems with LFX, refer to Direction 46–019372, Advantx Jumper and Switch Positions, for power line tap selections.
  2. Continue with the calibration. It may be possible to complete the RAD calibration at the current percent line regulation without derating the system.
  3. As a final option, it may be necessary to derate the power unit maximum kW parameter in order to pass the line regulation test. If derating is required, it is recommended that you contact your authorized GE Service Representative since the derating requires the re–running of Configuration Units C003 and C004.

NOTICE **If derating of the power unit is required, ensure that the hospital is informed of any derated mA stations.**

R017, CAL PROCEDURE 1, STEP 4 SCREEN DISPLAY



Note: The NEXT STEP softkey is only displayed in the view (Browse) mode to permit return to Step 1.

R017, CAL PROCEDURE 1, STEP 4 "MORE INFO" SCREEN DISPLAY

CAL/CONFIG UNIT SCREEN STEP 4 OF 4

Snnn (Sequence Name) R017 Line Regulation

BUTTON	FUNCTION OF BUTTON
INIT	Initializes number of measurements for average computation to zero.
LOAD	When highlighted, dial controls load voltage
NOLOAD	When highlighted, dial controls noload voltage

Percent Regulation at Nominal Line Voltage=
100 * [1.0 – (Vload/Vnoload)] * [Vline/Vnominal) ** 2]

PROCEDURE: Take exposures; measure Vload & Vnoload from scope trace; these are peak to peak values. Use dial & LOAD, NOLOAD buttons to input correct values; % Reg at 90% Nominal line Voltage will be displayed. An average of at least three measurements is required.

BACK

4 CAL PROCEDURE 2

4-1 Systems with an SCPU Power Unit.

Note: No special test setup is required when running R017 on systems configured with an SCPU power unit. The unit automatically measures effective line regulation and displays the results of full load and no load comparisons as LED indications (Ref DS1 and DS2 on MAIN PS board). When LED's are lighted they indicate line regulation is acceptable.

4-2 Step 1. Calibrate Highest mA Station of Tube

- Take and maintain an exposure. The system will automatically take successive exposures and calibrate the initial filament drive for the highest mA station of the generator/tube combination under test. Terminate the exposure when the "STEP IS COMPLETE" message is displayed.

Note: If the tube heat limit is reached, continue to hold the PREP and EXPOSE switches. The calibration will restart and continue after the tube cools.

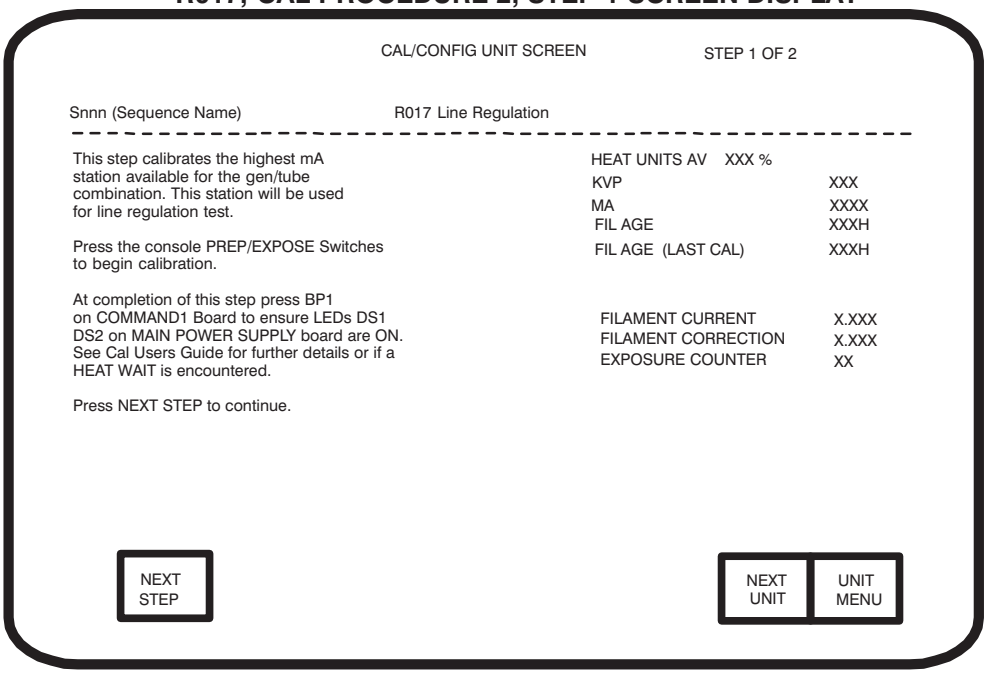
- At completion of this step, press BP1 on COMMAND 1 board and verify that DS1 (80 kW) and DS2 (64 kW) LED's on MAIN POWER SUPPLY board are ON.

NOTICE

During calibration of initial filament drive it is possible for the LED's to turn off even when the line regulation is acceptable. If this condition occurs, pressing BP1 on the Command board should reset the LED's.

- Touch NEXT STEP softkey to proceed to Step 2.

R017, CAL PROCEDURE 2, STEP 1 SCREEN DISPLAY



4-3 Step 2. Verify Line Regulation

Note: This Step verifies that line regulation is within acceptable limits at the highest mA station available for the power unit/x–ray tube Combination. Touch the MORE INFO softkey on the Step 2 screen display for a summary of the SCPU power unit line regulation calibration procedure.

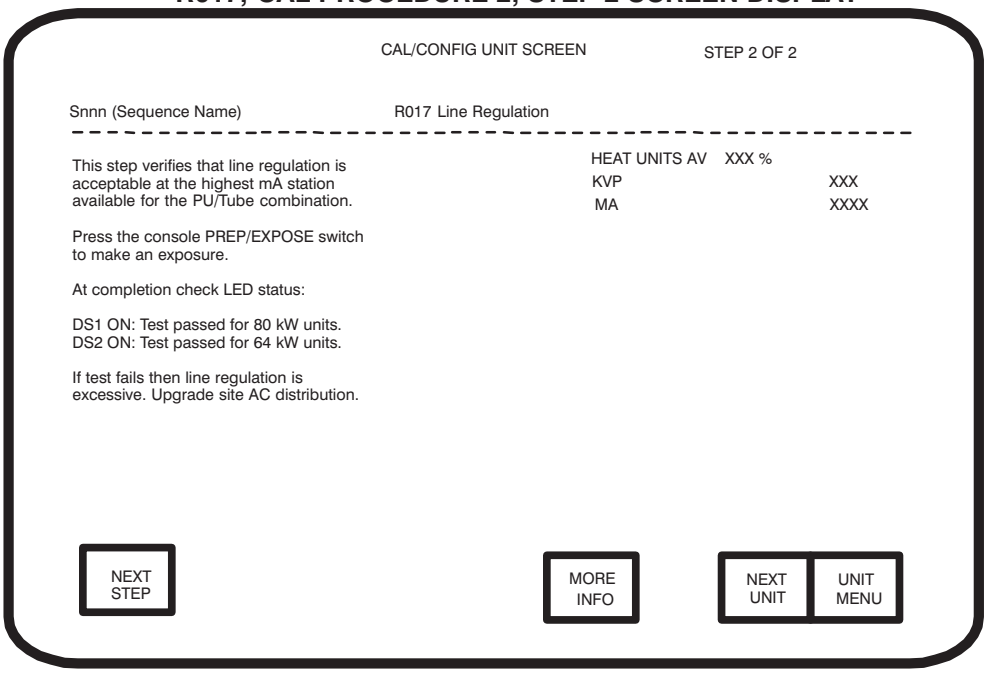
- Press the console PREP/EXPOSE switches to take an exposure.
- After the exposure, check LED status on the MAIN PS board as follows:
  DS1 ON: Test passed for 80 kW units.
  DS2 ON: Test passed for 64 kW units.

NOTICE

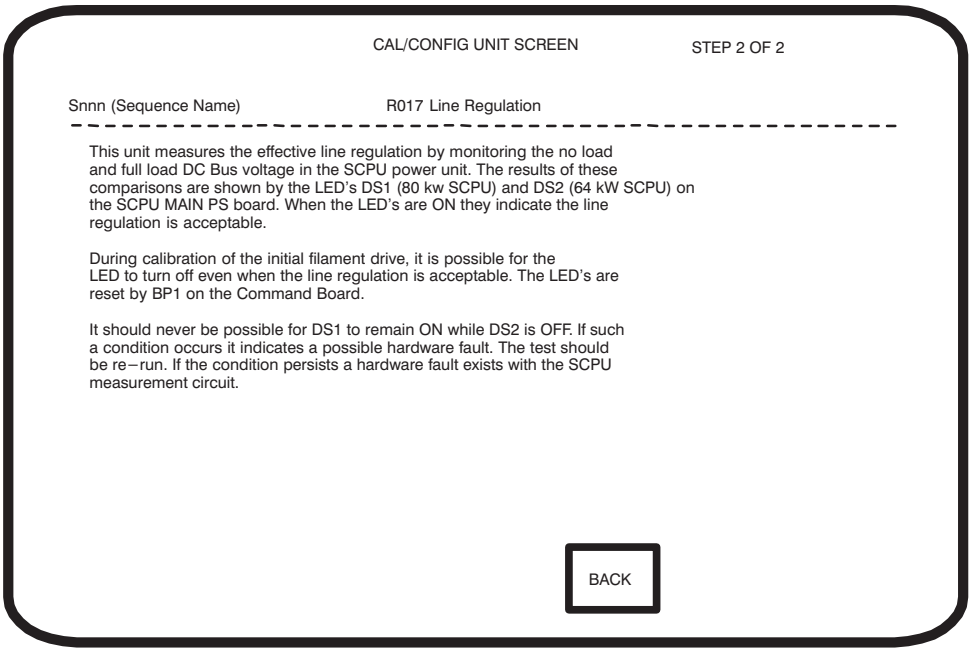
A condition where DS1 is ON and DS2 is OFF indicates a possible hardware fault. Re–run the calibration test. If the condition still exists, a hardware fault with the SCPU measurement circuit is indicated.

- IF test failed, the line impedance is excessive. You must upgrade the site AC distribution system. Then re–run R017.

R017, CAL PROCEDURE 2, STEP 2 SCREEN DISPLAY



R017, CAL PROCEDURE 2 STEP 2 “MORE INFO” SCREEN DISPLAY



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UNIT R018 – Tube n Half–Value Layer

Time: x h xx min – Personnel: 1 field engineer

1 DESCRIPTION

Calibration Unit R018 is used to measure the half value layer radiation parameter to ensure system compliance with HHS requirements. The unit is automatically configured for fixed exposures at 80 kVp, 100 mA, 0.5 seconds for the Tube selected. Two steps are required to accomplish the verification. They allow to set up and perform the kVp measurement with an RMI 230 kVp meter. Step 1 sets up the system for measurement. Step 2 performs the HVL test measurement.

2 EQUIPMENT REQUIRED

Dosimeter, small chamber 20 x 5–3 (46–173632G1) or 20 x 6–3, Ion Chamber Positioning Tool 2236707 if available (see Cal Unit T015), absorber plate (3.5 x 4 x 2.5 mm of 1100 aluminum) and Direction 46–013894*, System Field Test for HHS.*

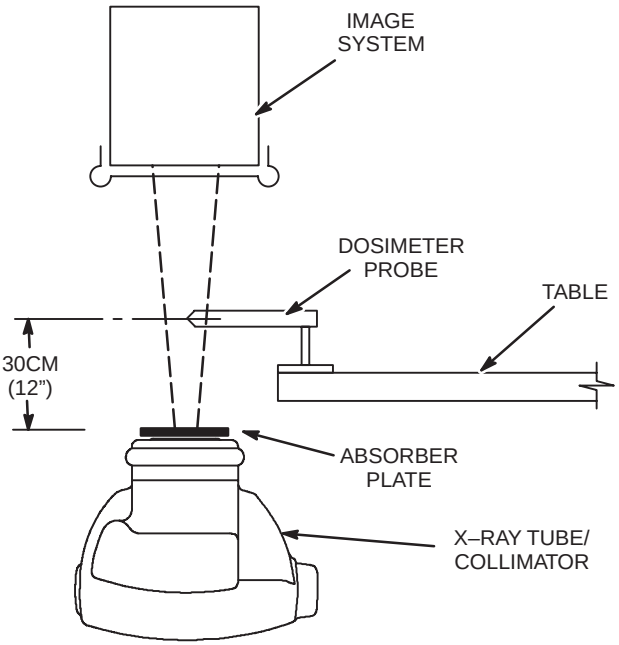
3 SPECIAL INSTRUCTIONS

Note: **For Vascular Systems Only:** Before system calibration, verify that additional filter (copper–aluminum filter) is not installed on top of collimator. (Open sensor hinge assembly to verify.) If installed, remove before performing calibration.

3-1 Step 1. Setting up the System

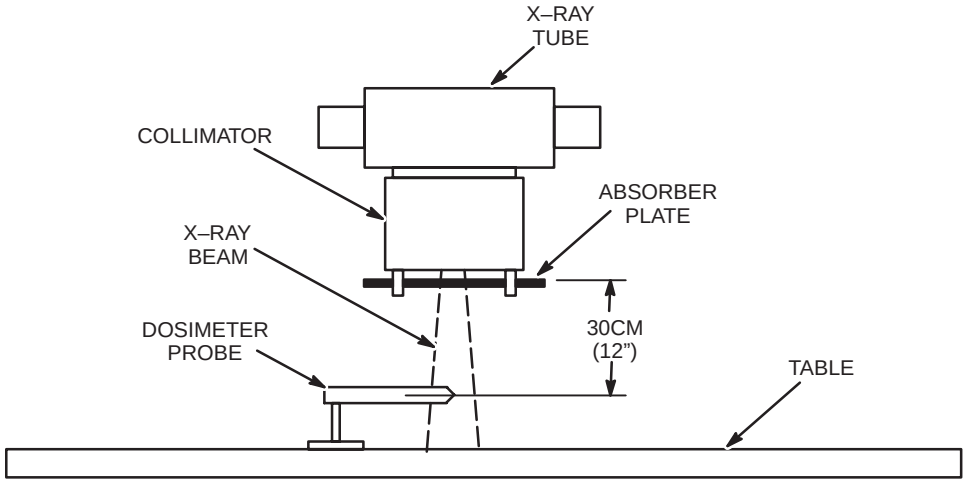
1. Vascular Tubes:
   - Place the absorber plate on the cover of the collimator in center of x–ray beam (or in the collimator rails if accessible). See Illustration 33.
   - Move the table top just out of the beam.
   - Put the image intensifier at maximum SID.
   - Take a fluoro exposure. Touch the MANUAL softkey and use the console dial to adjust mA for a good image on the monitor.
   - When using Ion Chamber Positioning Tool 2236707, ignore Illustration 33 and the instructions on the screen display for Step 3; instead, refer to mounting/positioning instructions in Cal Unit T015. Check for probe top/II entrance plane distance in Table 9 of Cal Unit T015 if anticollision plate is NOT in place; check for probe top/anticollision plate distance in Table 10 of Cal Unit T015 if anticollision plate is in place.
   - If not using the Ion Chamber Positioning Tool, position dosimeter probe on table top 30 cm (12 inches) from absorber plate. See Illustration 33.
   - Take a fluoro exposure to center the dosimeter probe in the x–ray field.
   - Remove all operator selectable filters from the x–ray field.
   - Remove any other objects to ensure at least 4 inches (10.2 cm) of free space around the dosimeter probe.
   - Touch NEXT STEP to proceed to Step 2.

Illustration 33 – Vascular tubes



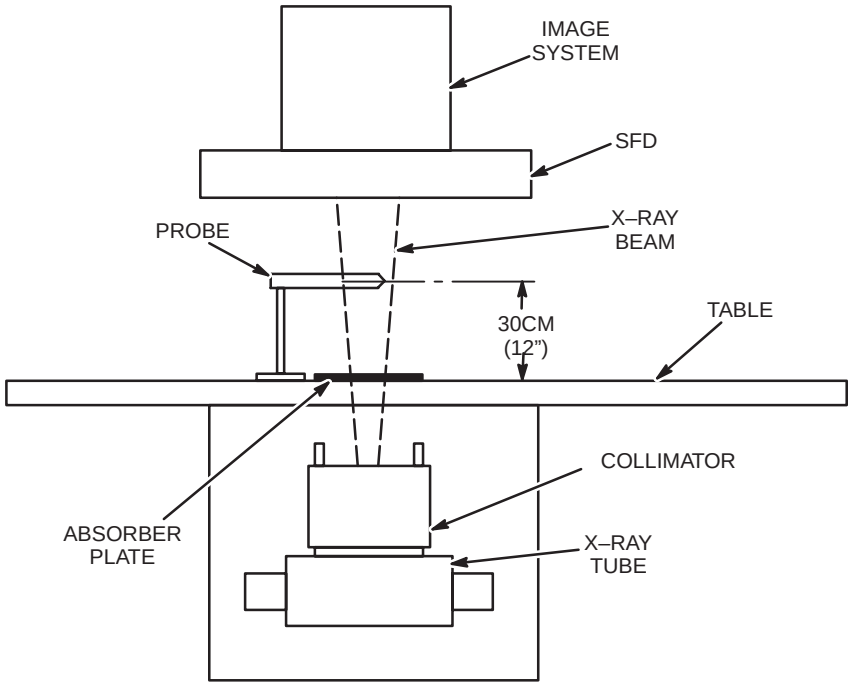
2. Overhead Rad Tubes:
   - Place the absorber plate into the slots of the collimator rails in center of x–ray beam. See Illustration 34.
   - Position dosimeter probe on table top 30 cm (12 inches) from absorber plate in center of x–ray beam. See Illustration 34.
   - Using the collimator field light, adjust the collimator blades for an 8cm x 8cm x–ray field size at the probe.
   - Remove all operator selectable filters from the x–ray field.
   - Remove any other objects to ensure at least 4 inches (10.2 cm) of free space around the dosimeter probe.
   - Touch NEXT STEP to proceed to Step 2.

Illustration 34 – Overhead rad tubes

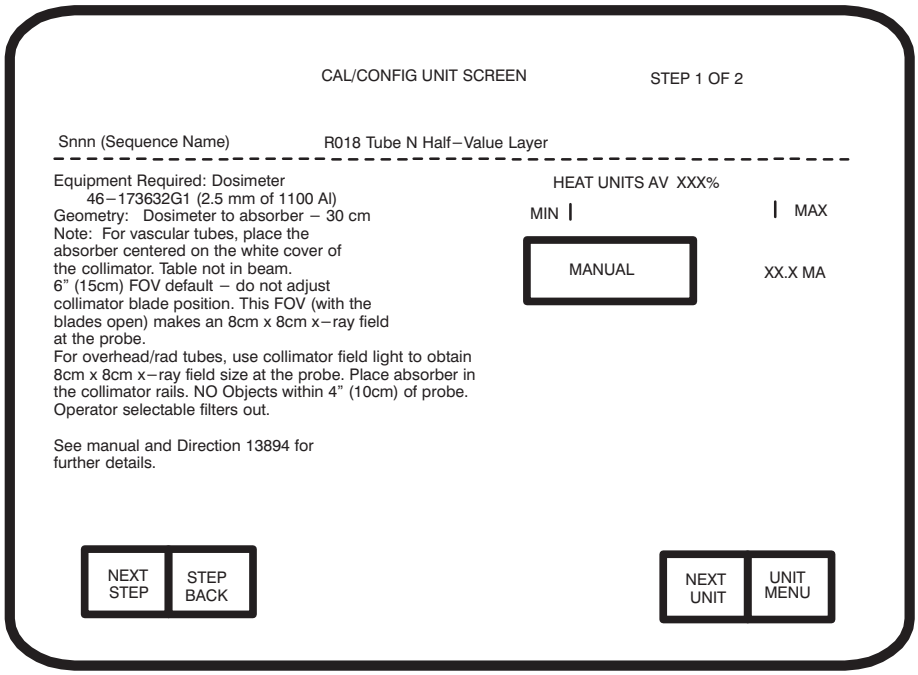


3. R&F Tubes:
   - Place the absorber plate on the table top in center of x–ray beam. See Illustration 35.
   - Position dosimeter probe on table top 30 cm (12 inches) from absorber plate in center of x–ray beam. See Illustration 35.
   - Take a fluoro exposure. Touch the MANUAL softkey and use the console dial to adjust mA for a good image on the monitor.
   - Remove all operator selectable filters from the x–ray field.
   - Remove any other objects to ensure at least 4 inches (10.2 cm) of free space around the dosimeter probe.
   - Using fluoro, adjust the collimator blades for an x–ray field that is slightly larger than the dosimeter probe.
   - Touch NEXT STEP to proceed to Step 2.

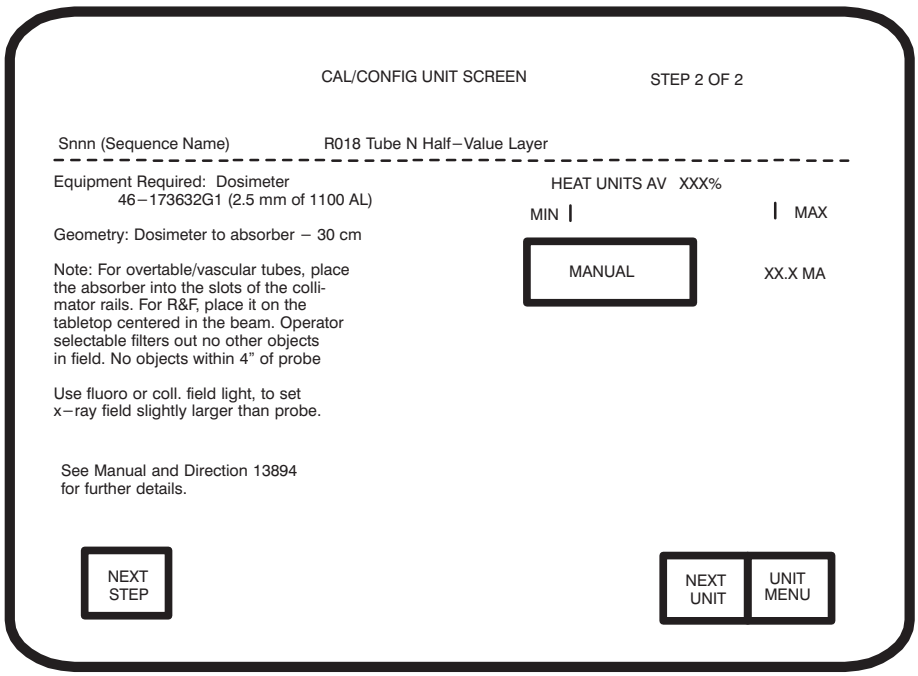
Illustration 35 – R&F Systems



R018 STEP 1 VASCULAR and RAD SCREEN DISPLAY



R018 STEP 1 R&F SCREEN DISPLAY



3-2 Step 2. Exposure Ratio Measurement

- Verify CDRH button is selected to make the measurement at 80 kVp setpoint.
- Remove absorber plate from beam path and take an exposure. The indication on the dosimeter should be a three digit value. If not, touch MAS softkey and adjust the exposure time (valid expose times are between 200 msec and 2 seconds). Take another exposure. Record the dosimeter indication in the data block given below.

Note: Do not adjust MAS between exposures.

- Place the absorber plate in the X–ray beam path. Take an exposure. Record the dosimeter indication in the data block given below.

NOTICE

On systems configured with Digital Record (DR), perform the Exposure Ratio Measurement as indicated above. However, for DR systems with copper filter, the exposure ratio must be greater than 0.50 but may also be greater than 0.57.

- Calculate the EXPOSURE RATIO by dividing the dosimeter value recorded with the absorber in place by the dosimeter value recorded w/o the absorber.

DOSIMETER INDICATION W/O ABSORBER: _____

DOSIMETER INDICATION W/ABSORBER: _____

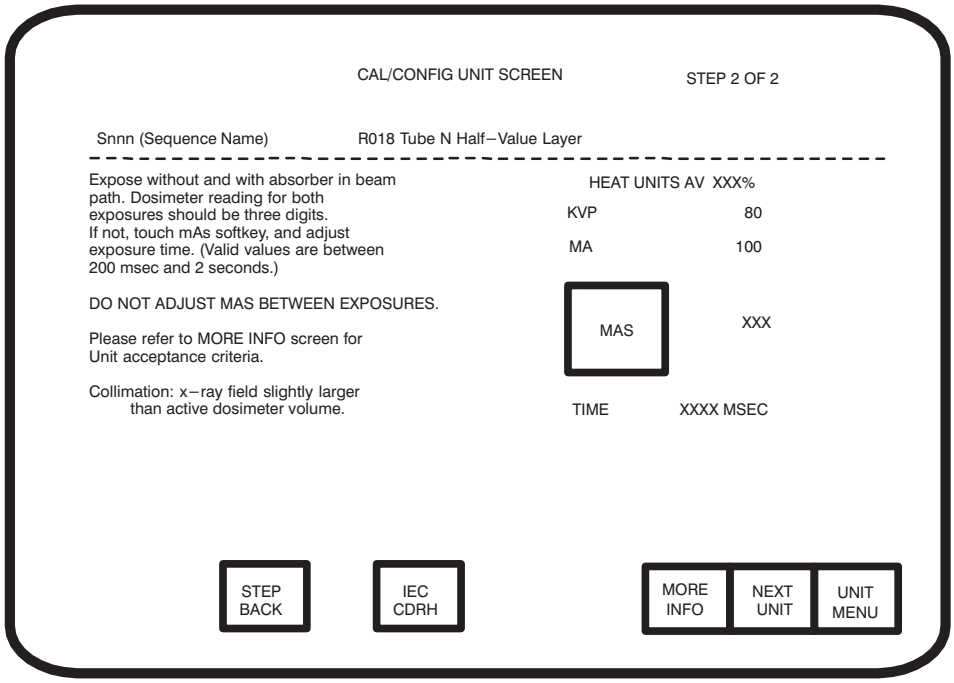
$$\text{EXPOSURE RATIO} = \frac{\text{DOSIMETER INDICATION W/ ABSORBER}}{\text{DOSIMETER INDICATION W/O ABSORBER}}$$

3-2-1 Acceptance criteria:

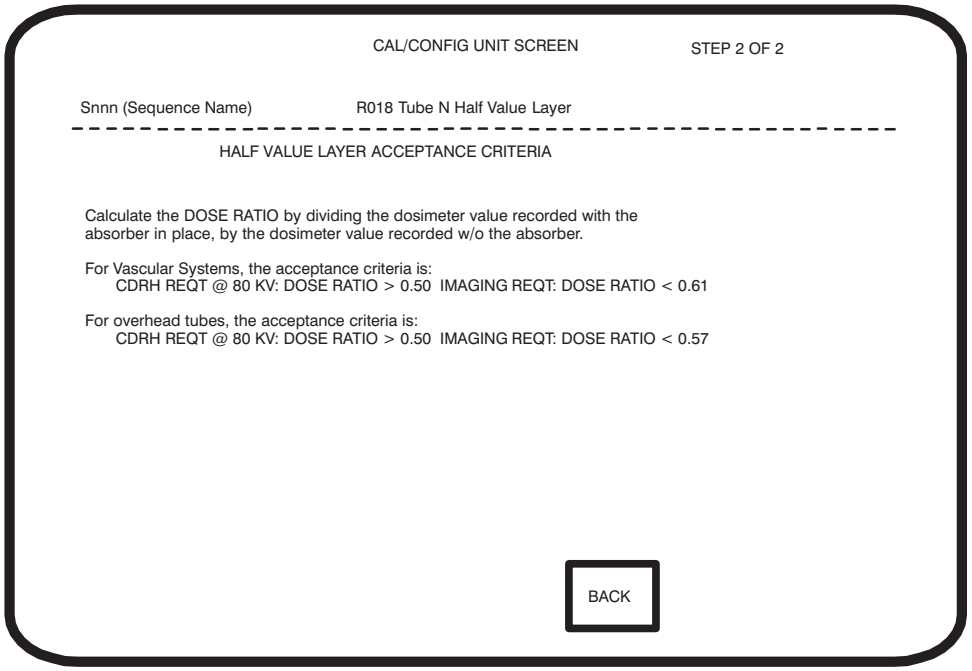
1. For Vascular Tubes:
   CDRH Requirement @ 80 kV: Dose Ratio > 0.50
   Imaging Requirement: Dose Ratio < 0.61
2. For Overhead Rad Tubes and R&F Tubes: The EXPOSURE RATIO must be > 0.50 and < 0.57. If necessary, add aluminum filtration to collimator to achieve an exposure ratio > 0.50. The 0.50 ratio corresponds to the regulation of a minimum of 2.5 mm aluminum equivalent filtration at 80 kVp.

Note: If you change the amount of filtration, you must rerun Fluoro Calibration Units (X100, X101, X120, X121, X130, X131, X140, X141) as applicable to your system configuration.

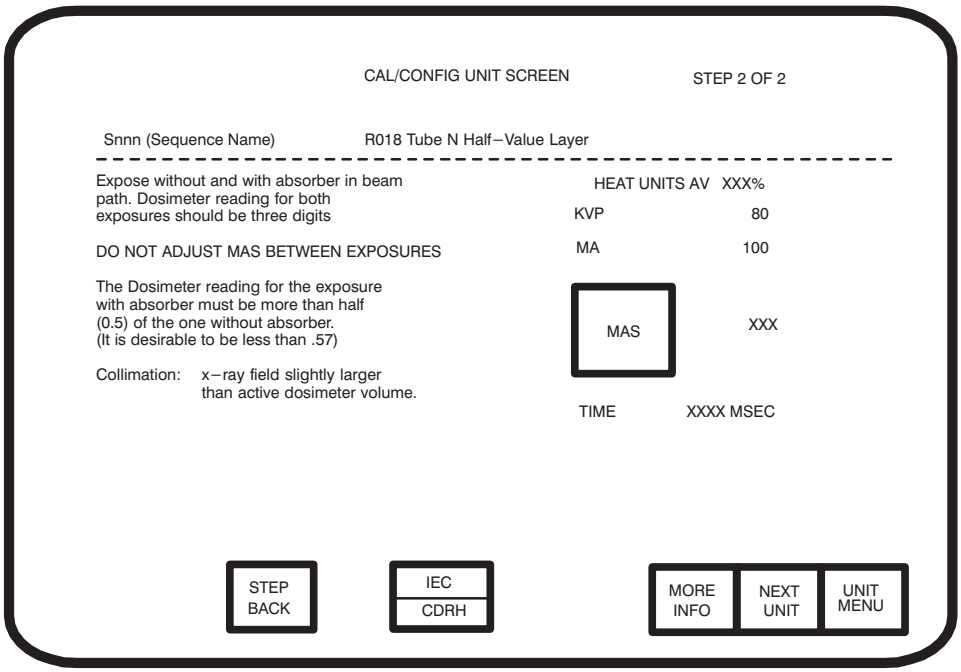
R018 STEP 2 VASCULAR and RAD SCREEN DISPLAY



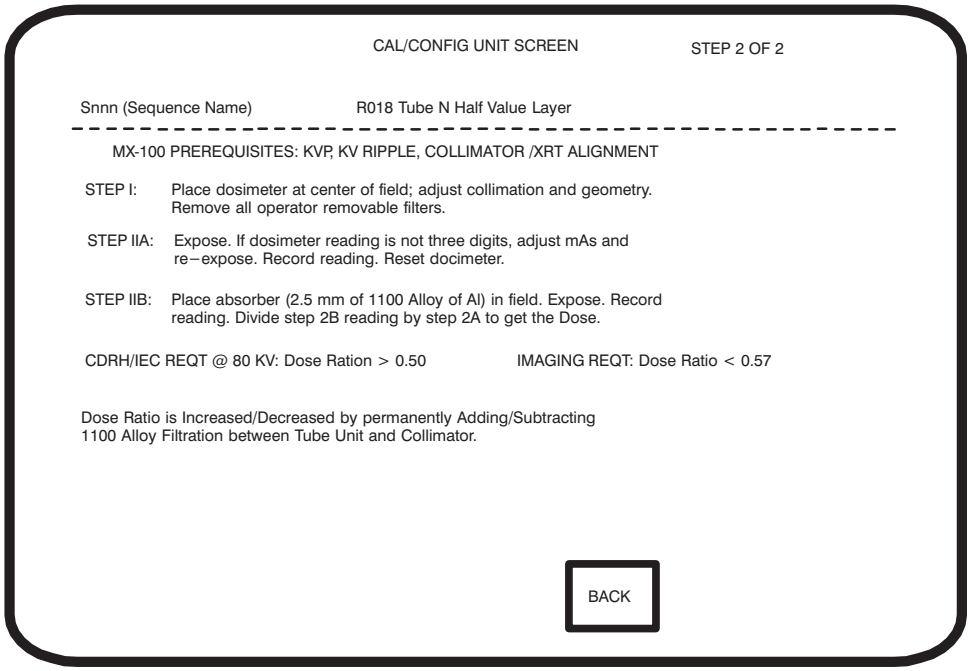
R018 STEP 2 VASCULAR and RAD "MORE INFO" SCREEN DISPLAY



R018 STEP 2 R&F UNDERTABLE SCREEN DISPLAY



R018 STEP 2 R&F UNDERTABLE “MORE INFO” SCREEN DISPLAY



UNIT R019 – Generator Cycle Test

Time: x h xx min – Personnel: 1 field engineer

1 DESCRIPTION

Calibration Unit R019 provides a method of subsystem testing the Fluoro/Cine/Rad capabilities of the system power unit and the x–ray tube without the requirement for a VIC, POSITIONER, or CINE module. The unit uses a repeat cycle of Fluoro, followed by Cine or Rad, followed by a tube cooling delay to perform a variety of measurements to validate that the power unit and x–ray tube are operating properly. Exposures are taken at techniques selected by the operator.

2 EQUIPMENT REQUIRED

None.

3 SPECIAL REQUIREMENTS

The kVp meter, mAs meter, and x–ray tube must be fully calibrated before running this unit.

Note: Descriptions of the unit softkey functions are provided on a “MORE INFO” screen that can be accessed by touching the MORE INFO softkey on the Step 1 screen. Become familiar with the softkey functions before proceeding with the cycle test.

4 CAL PROCEDURE

4-1 Select FLUORO Parameters

- Touch the KVP softkey and use the console dial to enter the desired kVp.
- Touch the MA softkey and use the console dial to enter the desired mA.
- Touch the ON TIME softkey and use the console dial to enter the desired exposure time.

4-2 Select CINE Parameters

- Touch the KVP softkey and use the console dial to enter the desired kVp.
- Touch the MSEC softkey and use the console dial to enter the desired pulse width for Cine operation.
- Touch the RATE softkey and use the console dial to enter the desired pulse rate (pulses/second) at which Cine exposures are made.
- Touch the EXP TIME softkey and use the console dial to enter the desired Cine runtime.
- Touch the SPOT softkey and use the console dial to enter the selected spot size for Cine operation.
- Touch the FR/SEC softkey and use the console dial to enter the desired frames/second operation.

4-3 Select RAD Parameters

- Touch the KVP softkey and use the console dial to enter the desired kVp.
- Touch the MA softkey and use the console dial to enter the desired mA.
- Touch the ON TIME softkey and use the console dial to enter the desired exposure time.

Note: After the desired x–ray technique has been entered, the system ASC will set tube protect limits based on the selections.

4-4 Select MODE

- Touch the MODE softkey and use the console dial to enter the desired exposure sequence; FLUORO+CINE+WAIT, FLUORO+RAD+WAIT, FLUORO+ WAIT, RAD+WAIT, or CINE + WAIT. If Fluoro , Cine or Rad is disabled by the mode selection function, the corresponding parameters become non- selectable and the values are not displayed on the screen.
- Touch the WAIT softkey and use the console dial to enter the desired time delay (in seconds) between the end of the Fluoro, Cine or Rad sequence and the repetition of the sequence.

4-5 Initiate Generator Cycle Test

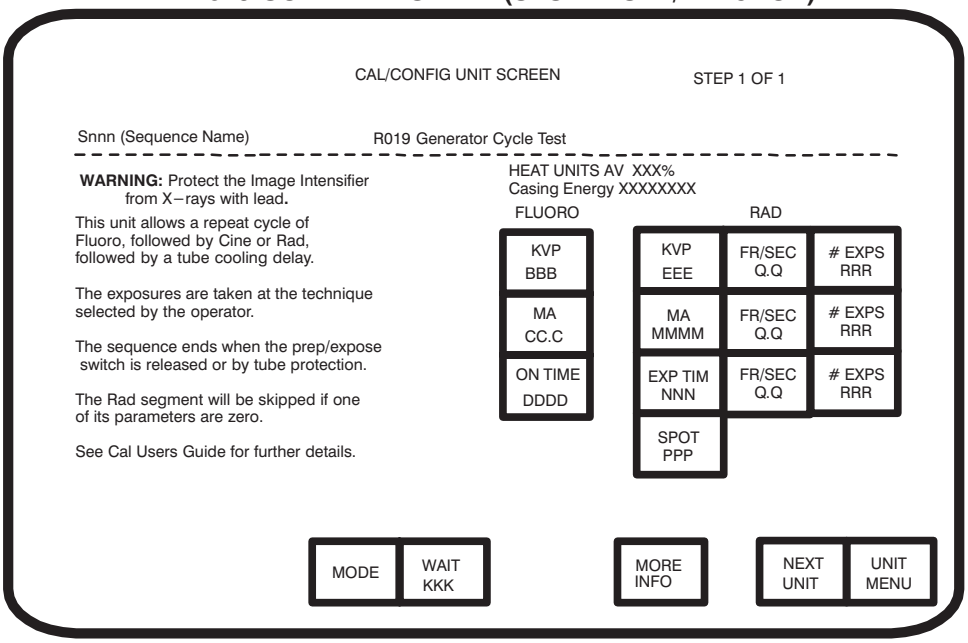
WARNING **WHEN RUNNING THIS UNIT ON R&F SYSTEMS CONFIGURED WITH AN IMAGEUR MODULE, PROTECT THE IMAGE INTENSIFIER BY PLACING A LEAD SHEET IN THE X–RAY BEAM.**

- Press and hold the PREP and EXPOSE switches on the console handswitch to take exposures. The unit will take exposures at the selected Mode sequence and technique entered by the operator.

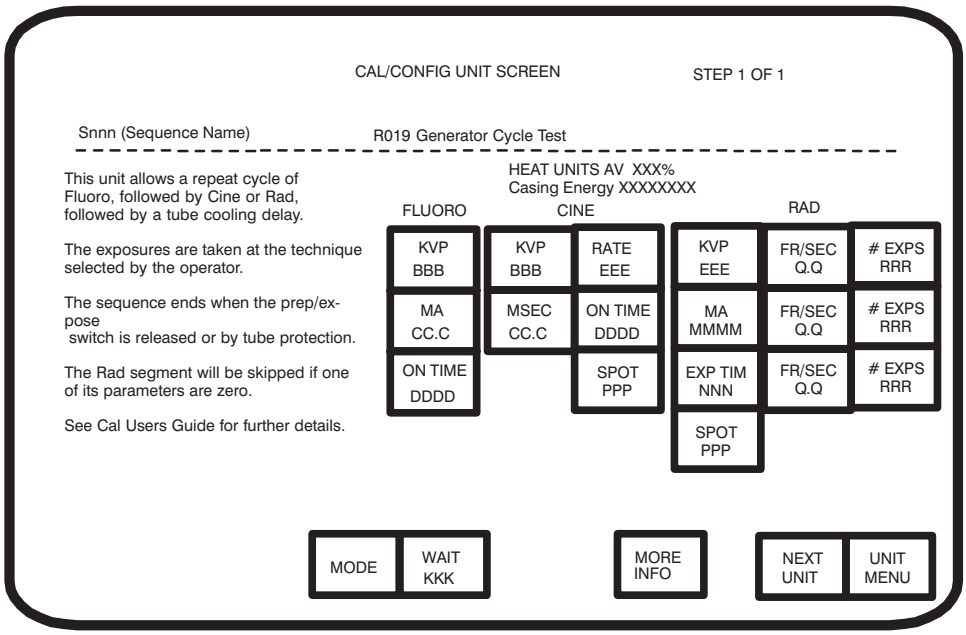
Note: The Rad sequence will be skipped if one of the Rad parameters is zero.

- After the last exposure in the selected sequence Mode, the unit will pause for the delay time established by the WAIT softkey function (tube cooling delay) and then repeat the selected MODE sequence.
- Terminate the cycle test by releasing the the PREP and EXPOSE switches.

R019 SCREEN DISPLAY (SYSTEMS W/IMAGEUR)

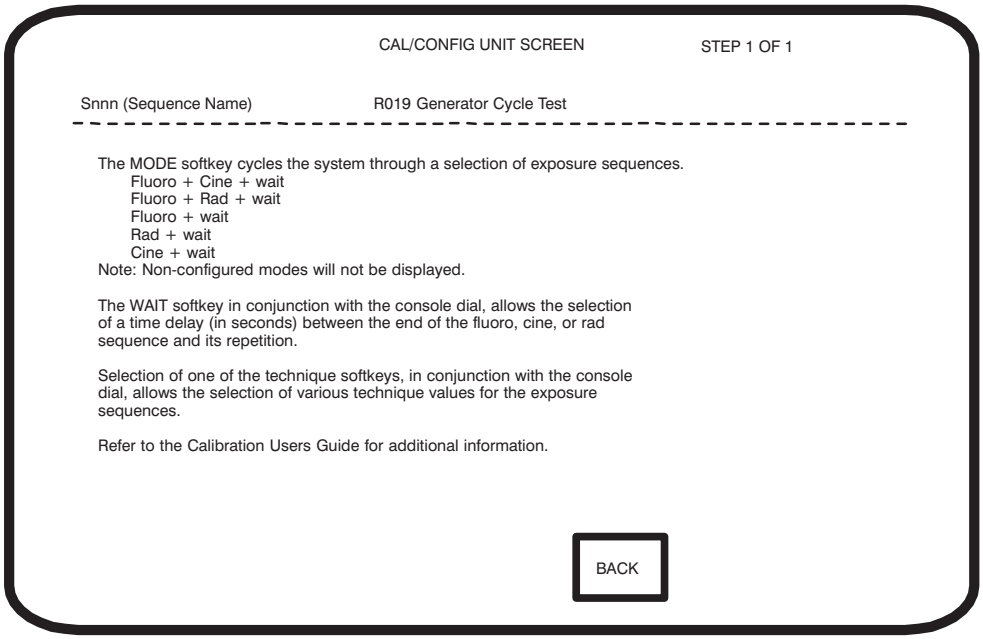


R019 GENERIC SCREEN DISPLAY (SYSTEMS W/VIC)



Note: The generic screen shown above illustrates all of the softkeys that may be displayed on R019 when configured with a VIC. However, this softkey presentation will never be observed. Only those softkeys pertaining to the actual system configuration will appear.

R019 "MORE INFO" SCREEN DISPLAY



UNIT R020 – Tube n Filament Boost

Time: x h xx min – Personnel: 1 field engineer

1 DESCRIPTION

Calibration Unit R020 adjusts filament boost current to ensure that maximum current is applied to the filament of the x–ray tube at the end of the 400 msec PREP cycle. The adjustment minimizes variations in mAs between exposures, taken with and without delay, by momentarily boosting the filament current to speed heating of the filament to the proper emission level. The calibration unit is divided into several separate units each of which is used to adjust the filament boost for a specific tube focal spot size. The applicable unit (s) are automatically displayed on the appropriate Rad Cal sequence menu by the system Smart Sequencer. The units that may be displayed on the sequence menu are listed below.

R020 – Tube(n) XS Fil Boost R020 – Tube(n) .2c Fil Boost
R020 – Tube(n) XM Fil Boost R020 – Tube(n) .3c Fil Boost
R020 – Tube(n) XL Fil Boost R020 – Tube(n) .15c Fil Boost

The unit name on the console screen indicates the focal spot size to be calibrated. The sequence name indicates the tube number. Each calibration unit consists of a number of steps to accomplish the adjustment. Each step is supported by a screen display that automatically presents a tube related setpoint (MA/KVP) for adjusting boost current.

Note: Additional information pertaining to the running of this unit is presented on a “MORE INFO” screen that may be accessed by touching the MORE INFO softkey on the Step 1 screen.

2 CAL PROCEDURE OVERVIEW

The procedure requires that you take three different exposures at each step (mA/kV setpoint) presented on the selected tube filament boost unit and obtain waveforms of mA and kV at the first and third exposures. The first exposure waveform (called the Reference Exposure) and third exposure waveform (called the Calibration Exposure) are saved on the scope and then compared and evaluated to see if a filament boost adjustment is required. The second exposure is only required to advance the primary contactor so that waveform measurements are made on the same contacting phase of the line (no waveforms are saved on second exposure). The difference between the first and third exposure is that the first exposure is taken with a 5 second delay between PREP and EXPOSE switch activation to permit the filament to reach maximum temperature. The third exposure is taken without a delay between PREP and EXPOSE. The waveform comparison should indicate that the filament boost is high enough so that the mA and kV waveforms are the same for an exposure with no delay and an exposure with delay.

Note: It may not always be necessary to monitor kV in addition to mA on the oscilloscope. It is however, highly recommended to monitor kV in addition to mA when the mA is less than 50 mA.

3 EQUIPMENT REQUIRED

Oscilloscope (dual trace, storage type) and associated test leads.

4 TEST SETUP

Connect oscilloscope to power unit as follows:

- Systems with LFX power unit:
  1. Connect Channel A scope probe to MA I/O test point LFX1A1A4TP7 (Ref TP10).
  2. Connect Channel B scope probe to KV OUTPUT test point LFX1A1A4J9. Scale factor at this point is 20 kV/volt (0.05V/1 kV).
- Systems with MPPU power unit:
  1. Connect Channel A scope probe to MA test point MPPU1A1A1XJ6. (mA $\geq$ 100, 200 mA/volt) (mA<100,20 mA/volt)
  2. Connect Channel B scope probe to KV test point MPPU1A1A1TP7 (or XJ4) (GND Ref TP10). Scale factor at this point is 8 kV/volt (1.0V/8 kV).
- Systems with SCPU power unit:
  1. Connect Channel A scope probe to MEAS_MA test point SCPU A4A1TP15. (mA $\geq$ 100, 200 mA/volt) (mA<100,20 mA/volt)
  2. Connect Channel B scope probe to MEAS_KV test point SCPU A4A1TP2. The scale factor at this point is 16 kV/volt (1.0V/16 kV).
- Set scope controls as follows:

  VERT AMPL: 2 volts/div (both channels)
  TIME BASE: 2 msec/div (both channels)
  Chopped Mode
  Channel 1 Trigger, Positive slope
  Single sweep, Storage Mode

5 CAL PROCEDURE

5-1 Reference Exposure – Delay

- Take a “Reference Exposure” by pressing the PREP switch on the console handswitch. Hold for 5 seconds or more before pressing EXPOSE switch (to allow filament to be boosted to maximum temperature) and observe waveform on oscilloscope. Press SAVE REF pushbutton on the oscilloscope to store the waveforms. These waveforms are considered to be the “reference Exposure” for mA and kV which is to be used later for comparison with a “Cal Exposure.” Take another exposure to advance contacting phase. (Do not store the second waveforms).

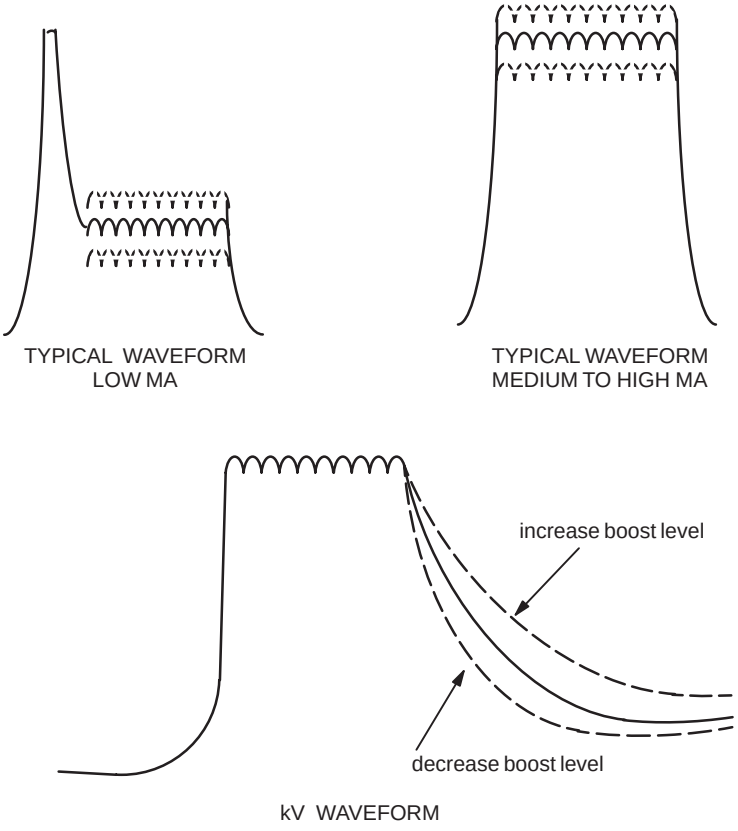
5-2 Calibration Exposure – No Delay

- Wait 15 to 20 seconds to allow filament to cool down. Then, take a “Cal Exposure” by pressing the PREP and EXPOSE switches with **no** delay after PREP. Press SAVE on oscilloscope to retain waveforms before releasing the exposure switch.

5-3 Measurement (See Illustration 36)

- Compare the mA and kV “Ref Exposure” to “Cal Exposure.”
  1. The amplitude of the mA waveform in the “Ref Exposure” and “Cal Exposure” should be the same.
  2. The decay time of the kV waveform in the “Ref Exposure” and “Cal Exposure” should be the same (kV comparison is preferred when the mA is below 50 mA).

Illustration 36 – R020 mA/kV Waveforms



- If the waveforms do not match, touch the FILAMENT BOOST softkey and use the console dial to make adjustments to the boost level. Increasing the boost level will increase the amplitude of mA waveform and decrease the decay time of the KV waveform. Repeat as required to match waveforms. Boost limitations are as follows:

  1. Maximum Boost Adj – Each filament level has an associated maximum filament boost level. If the maximum filament boost level is reached during calibration without matching the Reference and Calibration waveforms, accept the results and proceed to the next step in the calibration unit. The maximum boost level is intended to prevent excessive current on inverters A and B. However, some systems may still sense an overcurrent condition and indicate either of the following error messages:

     "EXCESSIVE CURRENT ON INVERTER A"
     "EXCESSIVE CURRENT ON INVERTER B"

     If either error condition occurs, wait 5–10 seconds for the system to settle. Then use the console dial to adjust FILAMENT BOOST to a lower value.

  2. Error code 4296 may occasionally appear during the execution of this unit. This indicates that a hardware limit correction has been exceeded. Decrease the filament drive correction until it is at least 0.2 A below the trip point of the error. Take several exposures to verify that no error code is displayed. The proper adjustment of filament boost will be a compromise in this case

Note: The error code 4296 inhibits exposures in Applications. This presents a greater problem than a slight under correction of filament boost.

- Touch NEXT STEP softkey to proceed to the next filament setpoint and repeat the filament boost procedure.

Note: When the last setpoint in the filament boost is displayed, the NEXT STEP softkey is replaced by a RECAL softkey. The RECAL softkey permits a return to Step 1 for re–calibration of setpoints.

- When all filament setpoints have been properly adjusted, touch NEXT UNIT or UNIT MENU softkey to exit. There is no "Cal Complete" message display for this unit.

NOTICE

MPPU Power Unit Systems:

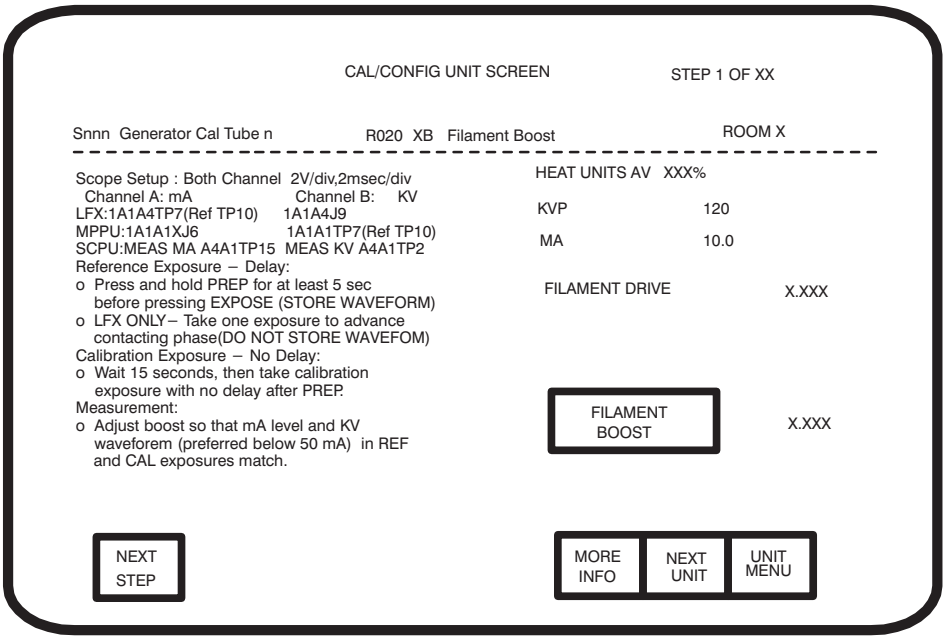
Using Calibration Unit R013 to verify radiographic calibrations can yield mA readings that are out of calibration tolerance even if R020, Filament Boost, is properly calibrated. Refer to Service Note: SN 3609 for additional details.
If R020 has been properly calibrated and the mA readings are out of tolerance in unit R013, then:

- Select and run R020, Filament Boost, for the focal spot being tested in unit R013.
- In Step 1, touch the FILAMENT BOOST softkey and increase the boost value by 0.1 amperes.
- Touch the NEXT STEP softkey to move to the next step and repeat the procedure, increasing the boost value by 0.1 amperes.
- Repeat for all steps in R020.

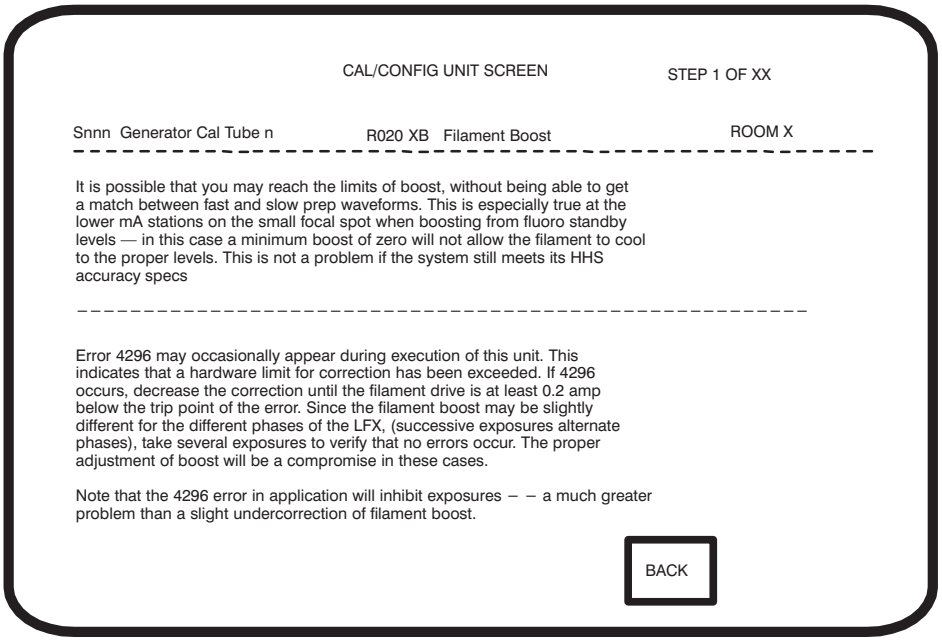
Note: No exposures are required in R020 while increasing the filament boost values for this adjustment.

- After the filament boost value in the last step has been increased, touch the UNIT MENU softkey to exit the unit and update the NVRAM database.
- Rerun unit R013 to recheck the calibration values.

R020 SCREEN DISPLAY



R020 "MORE INFO" SCREEN DISPLAY



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UNIT R021 – Generator kVp Meter Calibration

Time: x h xx min – Personnel: 1 field engineer

1 DESCRIPTION

Calibration Unit R021 is used to calibrate the kVp meter of the MPPU, VAMP and SCPU power unit. The cal procedure consists of two steps. Step 1 automatically calibrates mA. Step 2 takes exposures in either an automatic or manual mode and performs calibration calculations. Step 2 also allows the operator to view and adjust the calibration data using a VERIFY/ADJUST screen display. A data viewing screen allows the operator to view the collected data to determine whether further calibration/adjustment is required.

2 THEORY

The power unit contains a D/A converter that generates an analog voltage for closed loop kV control and an A/D converter that provides a digital output from the analog voltage representing the kV. The value loaded into the D/A and a measured value are considered one set of measurements while the value returned from the A/D and a measured value are considered another set of measurements. The unit uses a least squares fit of data to a straight line to perform the conversions between the digital value loaded into the system and the actual kVp read back.

3 EQUIPMENT REQUIRED

Keithley kVp Divider with filter packs (Model 35080A), oscilloscope and test leads.

4 TEST SETUP

Setup the system for calibration as follows: (See Illustration 37 and Illustration 38 for typical test setup).

- Install filter pack (P/N 37617C) on Keithley.
- Position Keithley on table top so that filter pack is centered and facing the X–ray beam. Recommended distance from X–ray tube focal spot to table top is 22 inches (558mm).
- Position table top 22 inches (558mm) from x–ray tube focal spot. On systems with a MX 150 x–ray tube and SRI collimator, the distance from the x–ray tube focal spot to the top of the collimator is 11.25 inches (286mm).
- Using coaxial test lead, connect the Keithley to the oscilloscope.
- Set oscilloscope controls as follows:

  TRIGGER: Internal
  VERT AMPL: 2 volts/div
  TIME BASE: 20 ms/div

5 SPECIAL INSTRUCTIONS

The following special instructions relate to the operation of this calibration unit.

Note: **For Vascular Systems Only:** Before system calibration, verify that additional filter (copper–aluminum filter) is not installed on top of collimator. (Open sensor hinge assembly to verify.) If installed, remove before performing calibration.

- A functional description of the unit is provided on a “MORE INFO” screen that can be accessed by touching the MORE INFO softkey on the Step 2 screen display. Read the “MORE INFO” screen to become familiar with the unit and softkey functions before proceeding with the calibration.
- A View Mode can be entered **before taking any exposures in Step 2** by touching the VERIFY/ADJUST softkey on the Step 2 screen. This allows the operator to proceed directly to a VIEW/ADJUST screen display to view and adjust the existing database values without taking exposures.

Note: One of the peculiarities of this unit is that once you enter the Verify/Adjust screen in the View Mode, you must exit and re–enter the unit to get to the Cal Mode.

- Refer to Keithley operator manual (supplied with the instrument) for instructions pertaining to the application of correction factors associated with a filter pack. You must take filtration effects and linearity corrections into consideration to ensure accuracy of this calibration. Refer to paragraph 4.7 and 4.8 in Keithley manual.

Illustration 37 – Typical Legacy R&F R021 Test Sstup

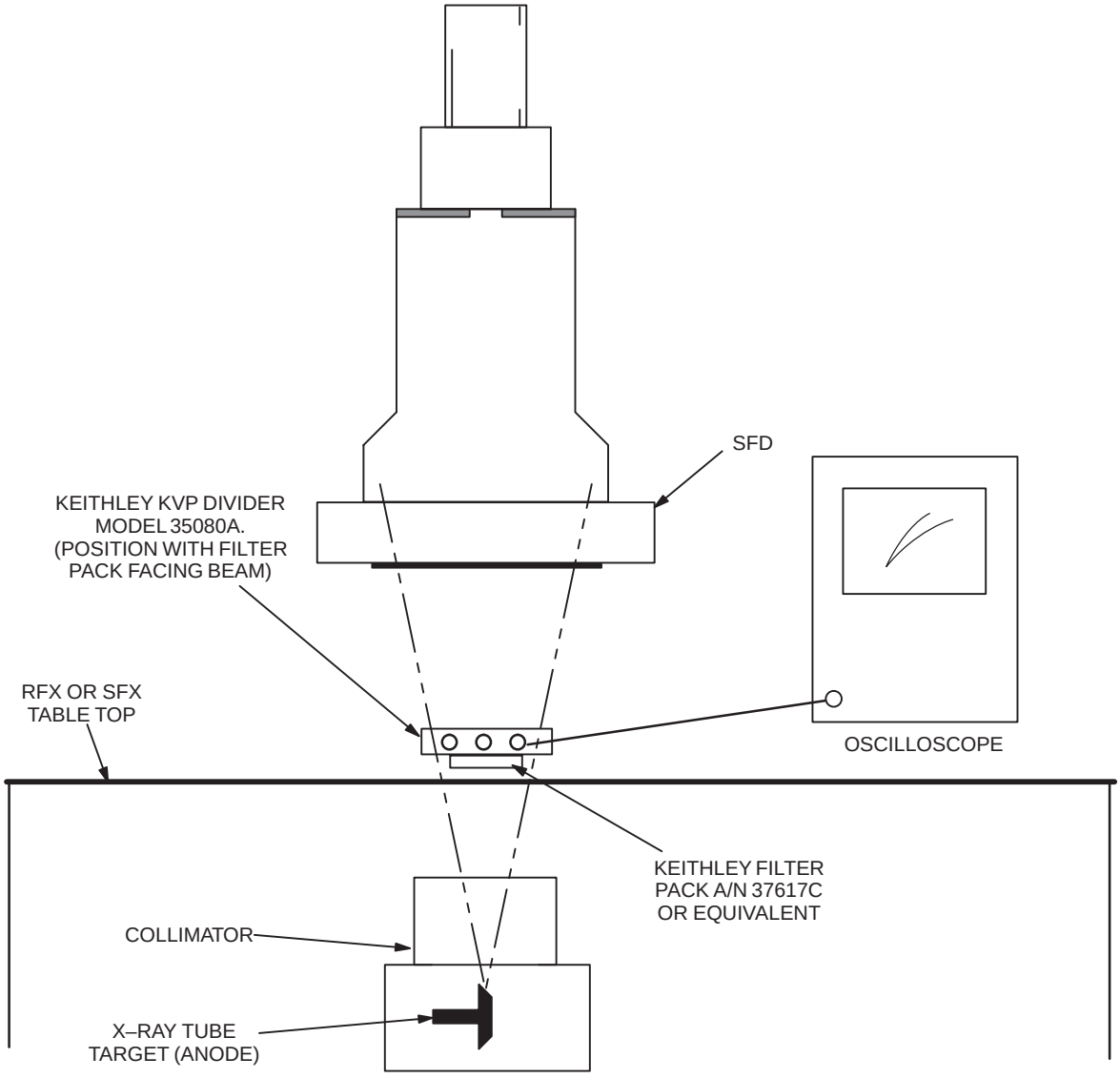
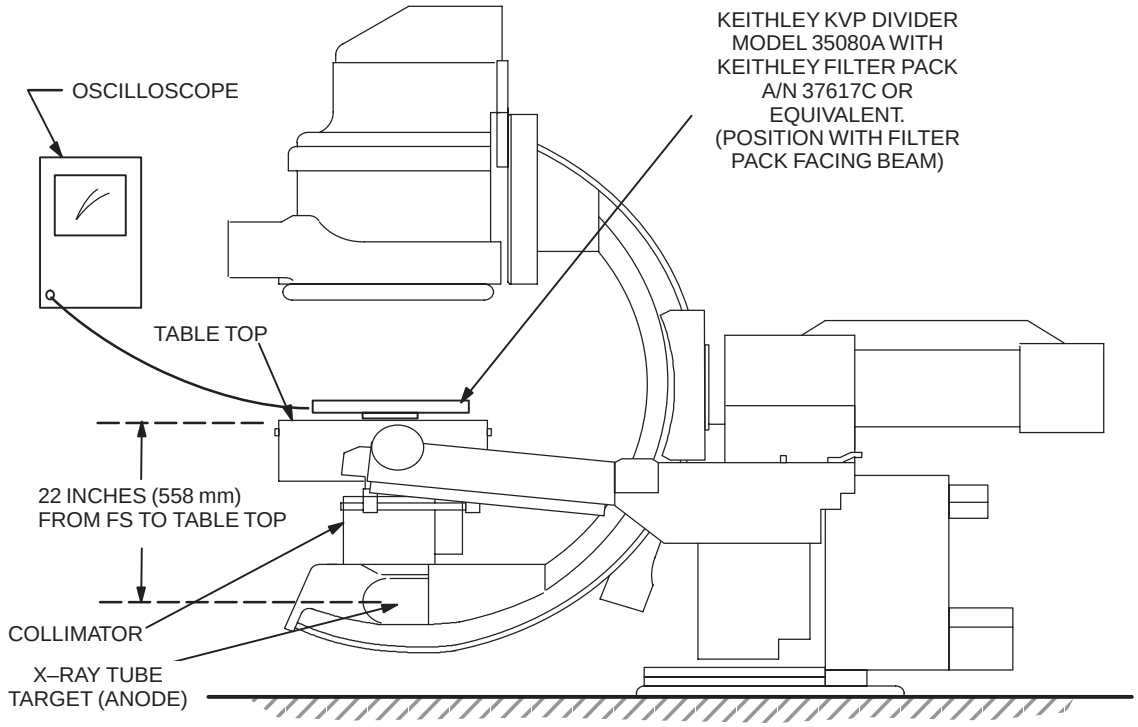


Illustration 38 – Typical Tilt–C R021 Test Setup



(TILT–C SYSTEM SHOWN)

6 CAL PROCEDURE

6-1 Step 1. Calibrate mA

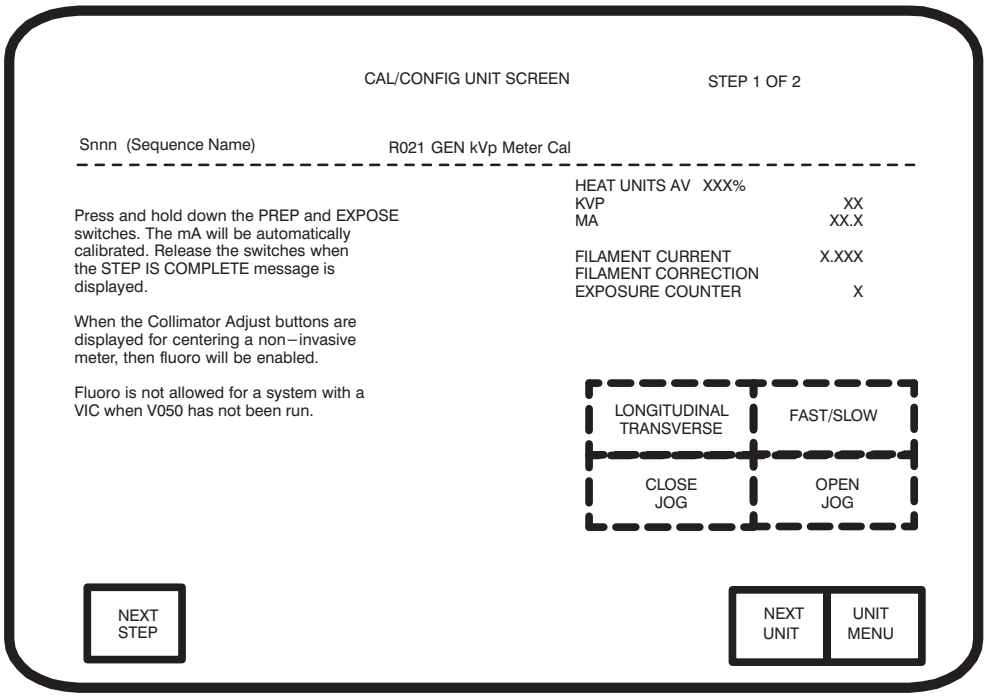
- Press the PREP and EXPOSE switches. The unit will automatically calibrate mA.
- When the message “STEP IS COMPLETE” is displayed, release the PREP and EXPOSE switches.
- Make sure that the collimator blades are full open so that the sensor area of Keithley filter pack is fully exposed when performing Step 2.

Note: If the collimator is an over table Ultranet collimator, blade adjustment is accomplished at the collimator.

- Touch NEXT STEP softkey to proceed to Step 2.

Note: When the collimator adjust buttons are displayed on the screen for centering a non–invasive meter, fluoro will be enabled. Fluoro is not enabled for systems configured with a VIC unless Cal Unit V050, Target Voltage, has been run.

R021 STEP 1 SCREEN DISPLAY



6-2 Step 2. KV Meter Calibration.

Step 2 can be set to operate in either an automatic or manual mode by touching the AUTO/MANUAL softkey on the Step 2 screen. However, upon entering the unit, Step 2 is automatically set to the AUTO (default) mode. The automatic mode is normally used when performing the calibration unit for the first time. The manual mode is normally used to make recal exposures.

6-3 Step 2. Auto Exposure Mode.

- In the AUTO Mode, the unit is automatically configured to take exposures of 100 msec at 100 mA and highest kVp (based on tube type). The mA is set for closed loop operation and the power unit is set to measure kVp after a 25 msec time delay from the start of an exposure. In the AUTO Mode the system will alternate taking single exposures at high kVp and low kVp until data for at least two exposures at each of the kVp values is obtained. The KVP DEMAND softkey is inactive in the AUTO mode. Perform the AUTO Mode calibration as follows:

Note: If your Keithley Kit does not contain a 37617C Filter Pack (50–150 kVp range) you must change the filter pack to conform to the kVp of the exposure being taken (60 kVp or 120 kVp). Note that 115 kVp is used for the MX 150 x–ray tube. Not all filter packs cover the entire kVp range. Ensure the proper filter pack is in place on Keithley for each exposure.

- Take an exposure and measure the kVp indicated on the oscilloscope. Ignore the first 25 msec of the waveform when taking the measurement. The exposure counter on the Step 2 screen is incremented. After the first exposure is taken, the NEXT UNIT, UNIT MENU, and VERIFY/ADJUST softkeys are disabled until the required number of exposures are taken.
- Touch the KVP softkey and use the console dial to enter the measured kVp value.

Note: If desired, a previous exposure can be cancelled by touching the CANCEL LAST MEASUREMENT softkey. The number of exposures indicated on the screen will be decremented by one and the values from the previous exposure will be re-displayed on the screen.

- Take another exposure (the unit is automatically set at 60 kVp). Measure the kVp on the oscilloscope. Ignore the first 25 msec of the waveform when taking the measurement.

Note: The software allows the operator to take exposures with modified kVp values (using the console dial). However, this causes the software to accept the value displayed and results in an error in the database calculations.

- Touch the KVP softkey and use the console dial to enter the measured kVp value.
- Continue taking exposures and entering the measured value at the alternate kVp values until the required number of exposures have been obtained (two at high kVp and two at low kVp). The number of exposures is indicated on the Step 2 screen.
- Exposures at the same kV are expected to be repeatable. Differences of as much as 1 kV should be viewed with suspicion.

- Exit from Step 2 is accomplished as follows:

  1. Touch the NEXT UNIT or UNIT MENU softkey. The unit will automatically perform a data verification. If the verification is successful, exit from the unit is accomplished

  OR

  2. If the data verification fails, an error message “DATA OUT OF RANGE” is displayed on the console and exiting the unit from Step 2 is prohibited. Touch VERIFY/ADJUST softkey on the Step 2 screen to proceed to the VERIFY/ADJUST screen display.

6-4 Step 2. Manual Exposure Mode

- Touch the AUTO/MANUAL softkey to set the unit to the manual mode.
- Touch the DEMAND KVP softkey and use the console dial to enter the kVp selected for the first exposure. The range of adjustment is in 1 kV steps between the minimum and maximum kVp allowed for the x–ray tube and selected focal spot size.

Note: If your Keithley Kit does not contain a 37617C Filter Pack (50–150 kVp range) you must change the filter pack to conform to the exposure being taken (60 kVp or 120 kVp). Note that 115 kVp is used for the MX 150 x–ray tube. Not all filter packs cover the entire kVp range. Ensure the proper filter pack is in place on Keithley for each exposure.

- Take an exposure and measure the kVp indicated on the oscilloscope. Ignore the first 25 msec of the waveform when taking the measurement. The exposure counter on the Step 2 screen is incremented. After the first exposure is taken, the NEXT UNIT, UNIT MENU, and VERIFY/ADJUST softkeys are disabled until the required number of exposures are taken.
- Touch the KVP softkey and use the console dial to enter the measured kVp value.

Note: If desired, a previous exposure can be cancelled by touching the CANCEL LAST MEASUREMENT softkey. The number of exposures indicated on the screen will be decremented by one and the values from the previous exposure will be re-displayed on the screen.

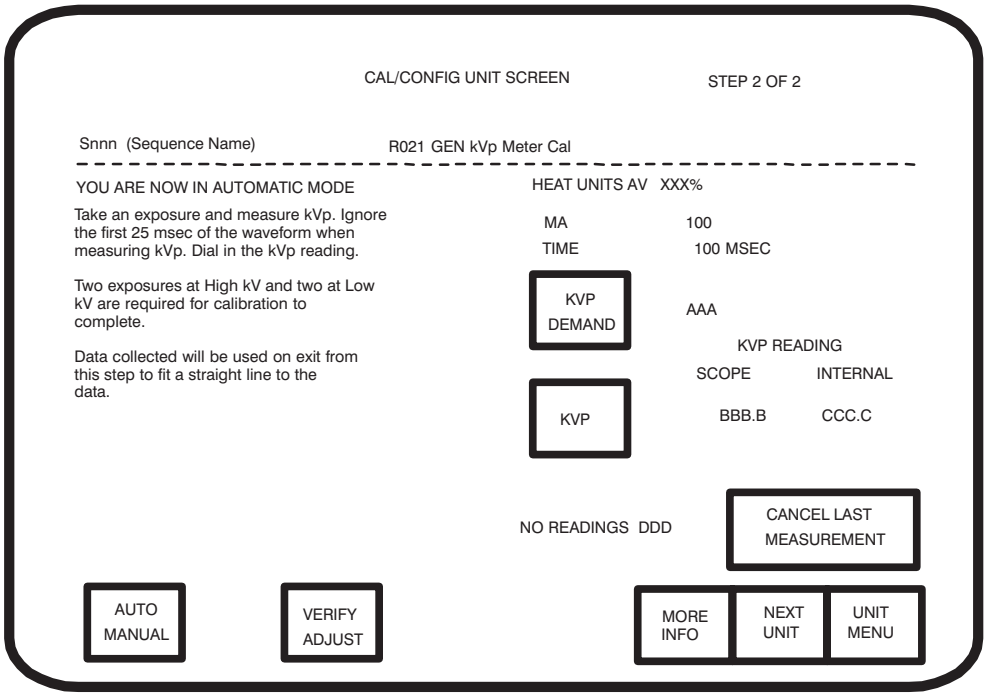
- Continue taking exposures and entering the measured value until at least two exposures 50 kVP apart have been taken. The number of exposures is indicated on the Step 2 screen.
- Exit from Step 2 is accomplished as follows:

  1. Touch the NEXT UNIT or UNIT MENU softkey. The unit will automatically perform a data verification. If the verification is successful, exit from the unit is permitted.

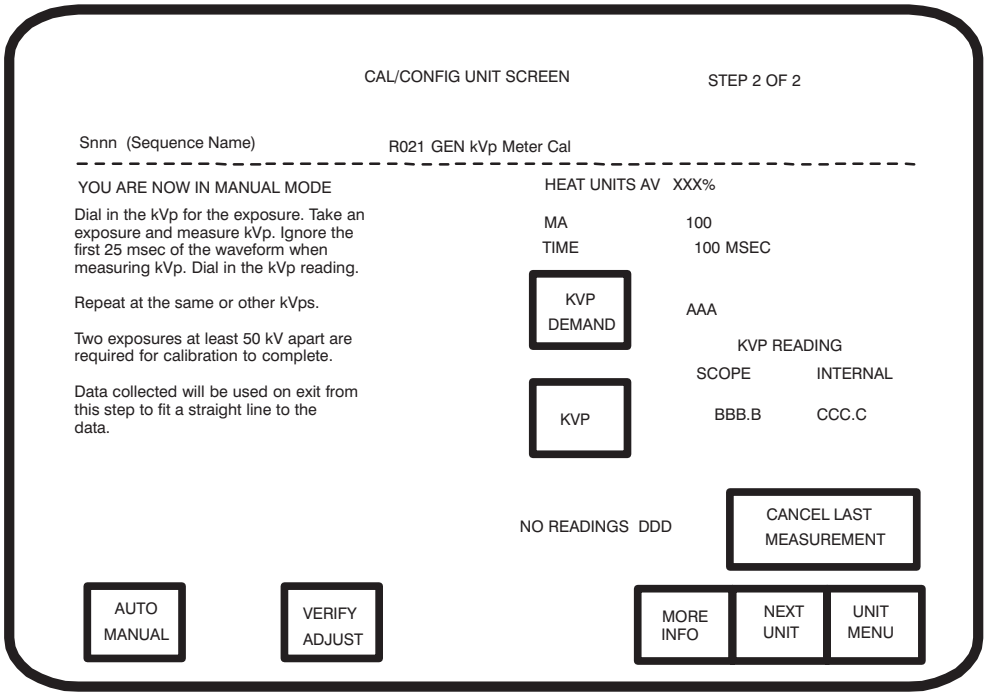
  OR

  2. If the data verification fails, an error message “DATA OUT OF RANGE” is displayed on the console and exiting the unit from Step 2 is prohibited. Touch VERIFY/ADJUST softkey on the Step 2 screen to proceed to the VERIFY/ADJUST screen display.

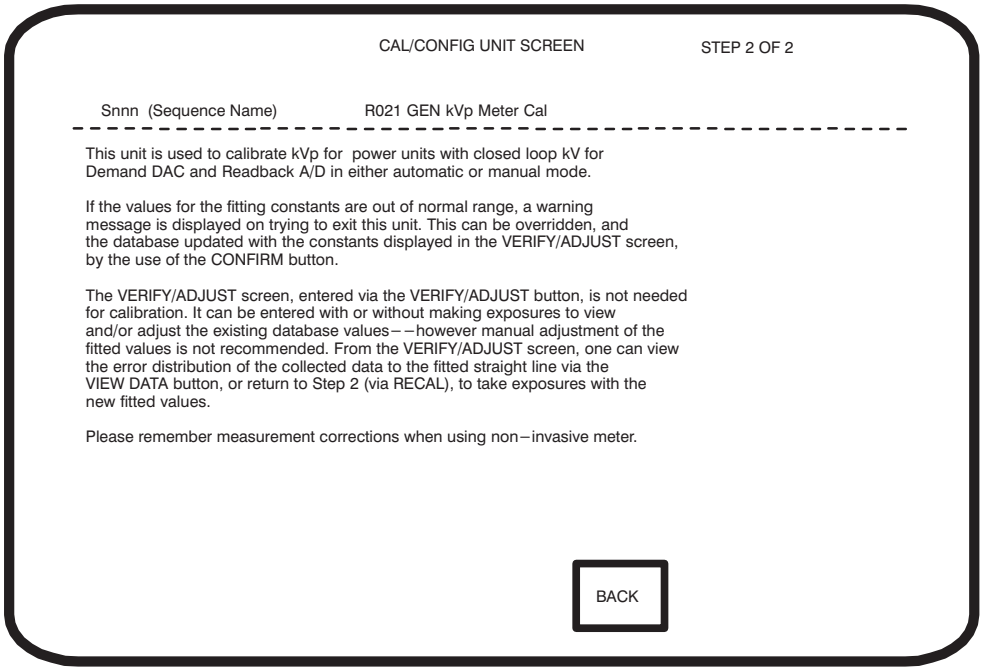
R021 STEP 2 AUTOMATIC MODE SCREEN DISPLAY



R021 STEP 2 MANUAL MODE SCREEN DISPLAY



R021 STEP 2 "MORE INFO" SCREEN DISPLAY



6-5 Verify/Adjust Screen Display

Note: If you could not exit the unit in Step 2 due to a "DATA OUT OF RANGE" error, you can exit from this screen and save the data (after viewing the values you are storing) in the database. This should only be used as a temporary measure, until such time as the hardware can be repaired.

- This screen display can be used to view and modify the Demand and Readback kVp constants **currently** stored in the database without taking exposures (entered in the View Mode) or to view and modify the **new** values for Demand and Readback kVp constants obtained in Step 2. The following error messages may be displayed upon entering the VERIFY/ADJUST screen.
  1. "KVP SLOPE OUT OF RANGE" is displayed if either the Demand or Readback slope values are outside the range 0.85 – 1.15.
  2. "MAXIMUM DEVIATION GREATER THAN 2 KV" is displayed if the maximum deviation of the computed reading is more than 2 kV from the actual reading.

Note: The OFFSET and SLOPE softkeys are always active whether the VERIFY/ADJUST screen was entered from the View Mode or from Step 2 after exposures were taken.

- Adjust the KVP DEMAND and KVP READBACK values displayed on the screen as required to meet specification. Touch the applicable kVp Demand or kVp Readback OFFSET and/or SLOPE softkey and use the console dial to enter adjustments.

Note: It is recommended that you do not make changes to the OFFSET and SLOPE values, but always use the calibration unit software to calculate new values.

OFFSET: An increase in offset will move values for all kVP by an equal amount.

SLOPE: An increase of slope will affect higher kVp more than lower kVp

- Exit from the VERIFY/ADJUST screen can be accomplished using one of the following methods.

1. To exit the Cal Unit, touch the NEXT UNIT or UNIT MENU softkey. The unit will again perform a data verification. If the values of the fitting constants are out of normal range, a warning message, “DATA OUT OF RANGE” is displayed and a CONFIRM softkey appears on the VERIFY/ADJUST screen. To override this condition, touch the CONFIRM softkey. Touching the softkey, will permit exit from the unit and the database will be updated with the constants displayed on the VERIFY/ADJUST screen.

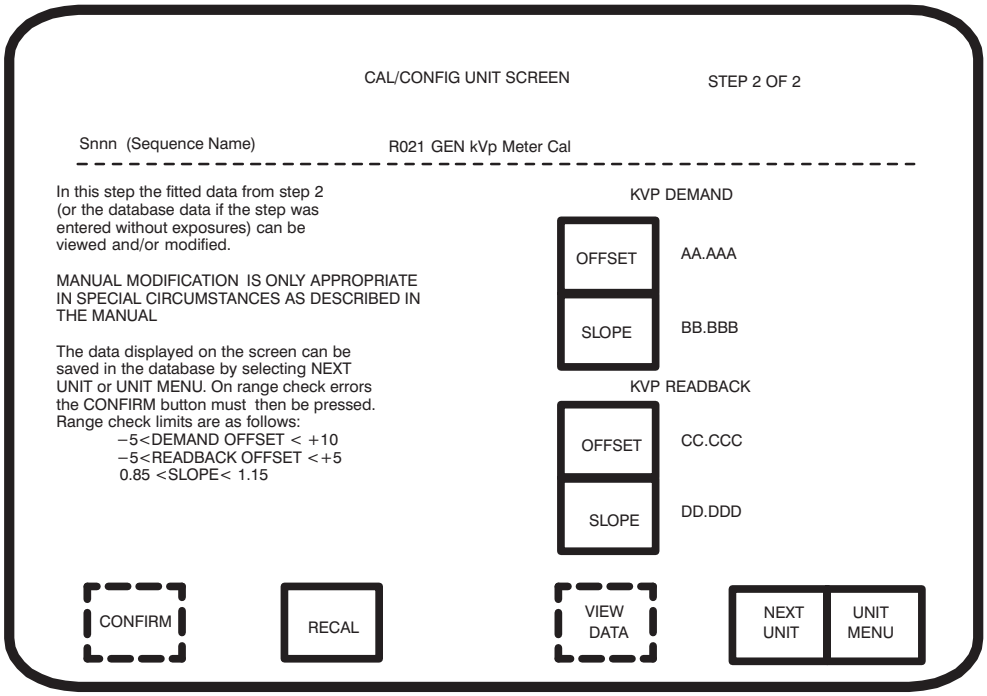
OR

2. Touch the RECAL softkey to return to Step 2 to take another set of exposures with new fitted values.

OR

3. Touch the VIEW DATA softkey to proceed to VIEW DATA screen (remember, the VIEW DATA softkey is not displayed in the View Mode). On exit from VERIFY /ADJUST screen, the standard deviation of the mean for both Demand and Readback is computed and the results are displayed on the VIEW DATA screen.

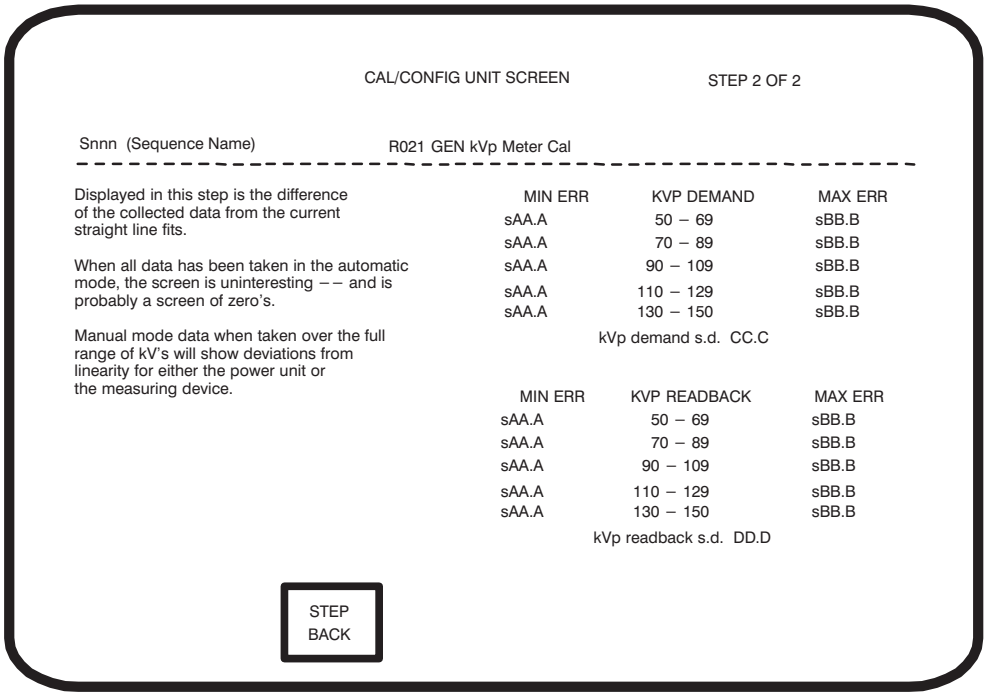
R021 VERIFY/ADJUST SCREEN DISPLAY



6-6 View Data Screen

- The VIEW DATA screen shows how well the constants fit the data acquired in Step 2. The Data displayed can be used as a guide for modifications to the constants established in the VERIFY/ADJUST screen.
- Review the difference of each reading from the straight line fit for both KVP Demand and KVP Readback. The MIN ERR and MAX ERR for each of the five ranges is displayed on the screen.
- If you have taken exposures in the AUTO mode, you should observe errors of less than 0.1 if the system is operating properly. If this is not the case, a complete recalibration may be in order.
- Touch the STEP BACK softkey to return to the VERIFY/ADJUST screen. Modify the constants as required or exit the unit from the VERIFY/ADJUST screen.

R021 VIEW DATA SCREEN DISPLAY



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UNIT R022 – Generator Functional Check

Time: x h xx min – Personnel: 1 field engineer

1 DESCRIPTION

Calibration Unit R022 is used to verify generator (Power Unit) functionality. The unit is run at the time of initial system installation and any time thereafter that a preventive maintenance check of the generator is desired. When run at the time of initial system installation, the unit provides a quick test of the generator to determine that exposures can be taken before proceeding with a full RAD calibration sequence. After a full RAD calibration has been accomplished, the unit can then be used as a preventive maintenance tool to provide a quick check of generator performance at selected mA stations.

NOTICE

Do not attempt to use this unit for X–ray tube checks. R022 is only intended for generator functional checks (Cal Unit R013 performs X–ray tube checks). For multi–tube systems (two tube R&F systems or multi–room Rad systems) R022 only selects tube 1.

2 EQUIPMENT REQUIRED

None.

Note: When entering R022, the collimator blades may not always close automatically and error codes 4E02, 4A6B and 7001 may be displayed on the screen. If this condition occurs, touch POSITION COLLIMATOR softkey. The unit will display a collimator adjust screen that contains the quad controls for adjusting collimator blade position. On AFM or CFM systems, use the CLOSE button on the PVC console to adjust blades.

3 SPECIAL INSTRUCTIONS

The following special instructions relate to the running of this unit.

- Upon entry into the unit, the collimator blades (on systems configured with auto–collimators) are automatically moved to a fully closed position.

Note: On systems configured with a manual collimator, the POSITION COLLIMATOR softkey does not appear on the unit screen display. Field size (blade position) must be adjusted manually at the collimator.

- Descriptions of the unit softkey functions are provided on a “MORE INFO” screen accessed by toughing the MORE INFO softkey on the Step 1 screen.

4 FUNCTIONAL CHECK

Perform generator initial functional check as follows:

- Touch the UNCALED softkey. This signals the system that x–ray tube filament drive has not been calibrated (Ref. Cal Unit R003) and sets the unit to default values that will permit a functional check to verify that exposures can be taken without damaging the x–ray tube.
- Verify that the following screen functions are set as follows:
  CLOSED/OPEN – Set to CLOSED
  INITIAL KVP – Disabled
  SYNC/NON–SYNC – Set to Sync
- Press the PREP and EXPOSE switches to verify that exposures can be taken. If exposures can be taken, exit the unit and proceed with RAD calibration. If exposures cannot be taken, perform diagnostics to determine problem before proceeding with any additional calibration.

Note: After releasing the PREP switch, the next PREP should not be initiated for at least 15 seconds.

5 MAINTENANCE CHECK

Perform generator preventive maintenance check as follows:

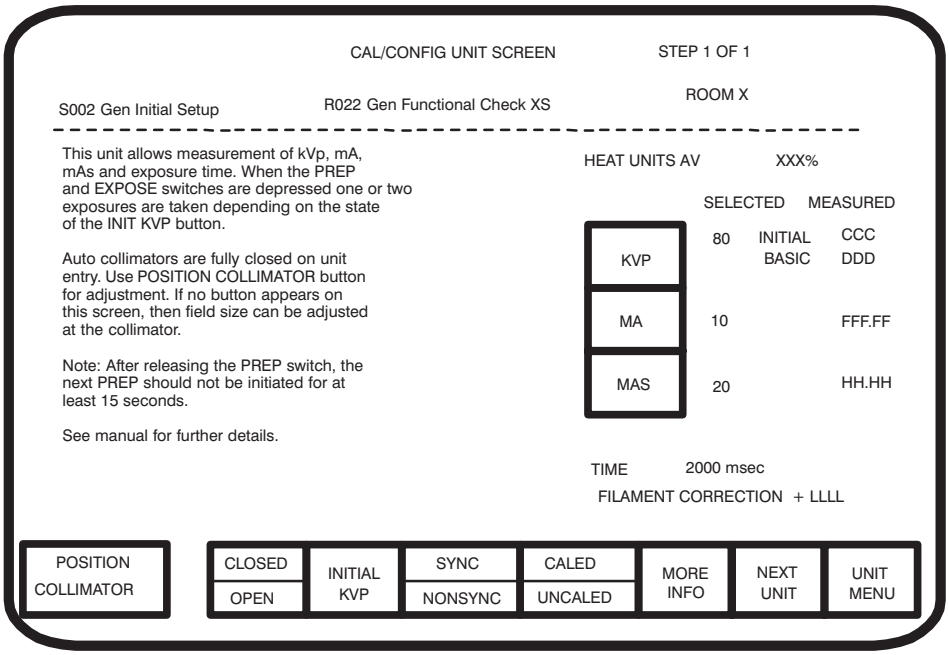
- Touch the CALED softkey. This signals the system that the X–ray tube filament drive has been calibrated (Ref. R003). The unit softkey functions can be set as required by the system configuration to perform a functional check.
- Set the function softkeys to the function required by the system configuration.
- Use the appropriate softkey selection (KVP, MA, and MAS) and the console dial to enter the desired kVp, mA, and mAs parameters.
- Press the PREP and EXPOSE switches. if INITIAL KVP was enabled, the system will first take an exposure of 10 msec to measure INITIAL KVP, a second exposure, at the selected exposure time, will then measure BASIC kVp, mAs, and exposure time.

Note: When INITIAL KVP is selected and the selected exposure time is equal to or less than 10 msec, only one exposure is taken and the measured value of kVp is displayed as both INITIAL and BASIC kVp.

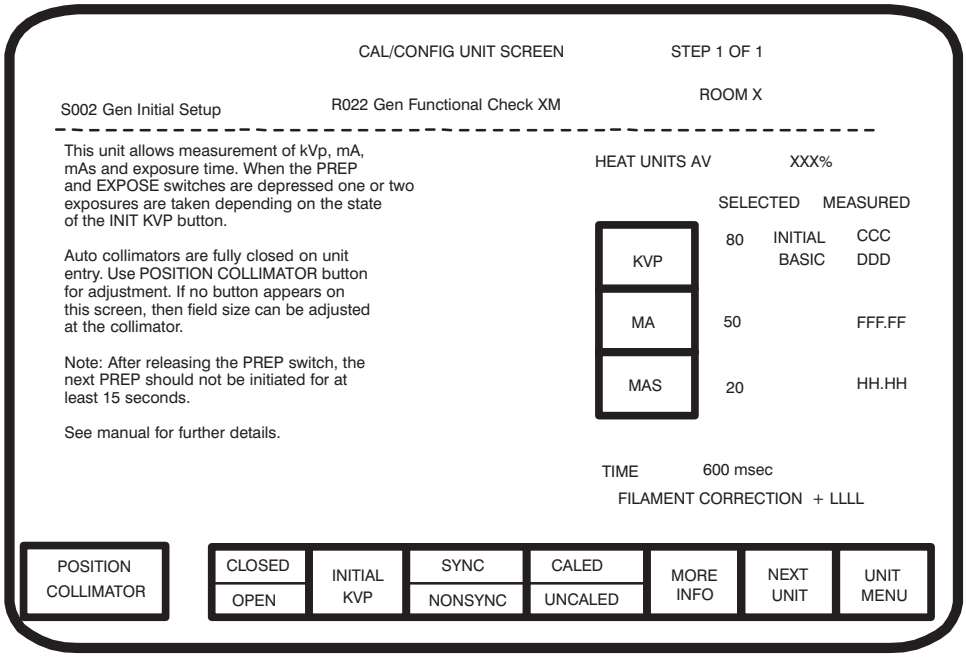
Note: After releasing the PREP switch, the next PREP should not be initiated for at least 15 seconds.

- Repeat taking exposures at selected MA stations to verify proper operation of the power unit.
- Touch NEXT UNIT or UNIT MENU softkey to exit.

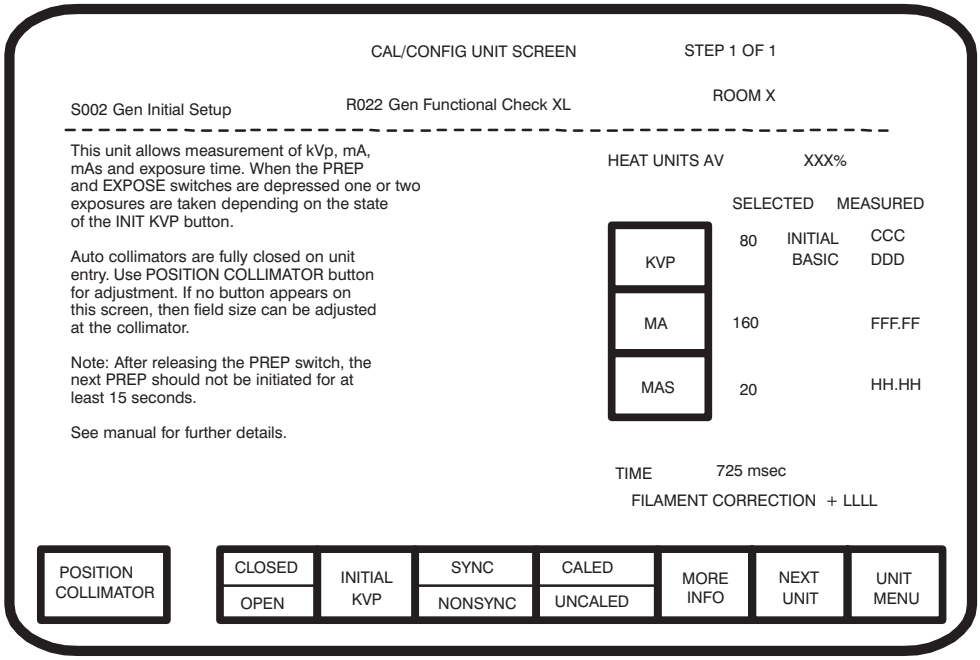
R022 XS SPOT SCREEN DISPLAY



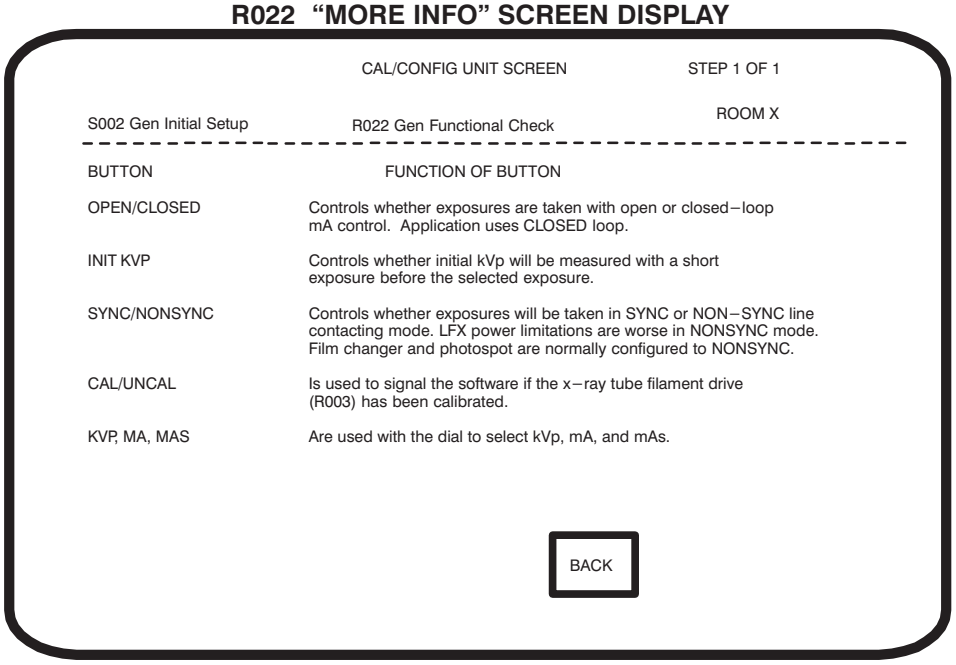
R022 XM SPOT SCREEN DISPLAY



R022 XL SPOT SCREEN DISPLAY



R022 “MORE INFO” SCREEN DISPLAY

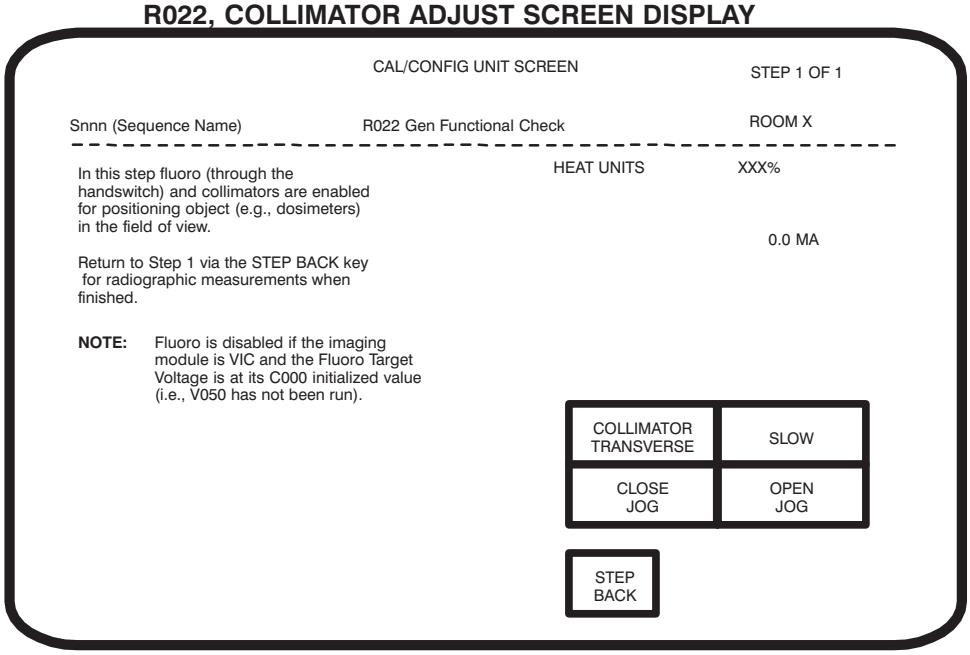


6 COLLIMATOR BLADE ADJUSTMENT

Note: Fluoro is disabled if the imaging module is VIC and the Fluoro Target Voltage is at its C000 initialized value (i.e., V050 has not been run).

- Take and maintain an exposure. Use the quad softkeys on the collimator adjust screen to position the collimator blades to the desired position.
- Terminate the exposure and touch STEP BACK softkey to return to Step 1 screen and perform the appropriate radiographic measurements.

R022, COLLIMATOR ADJUST SCREEN DISPLAY



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UNIT R023 – MPPU Closed Loop mA Adjust

Time: x h xx min – Personnel: 1 field engineer

1 DESCRIPTION

Calibration Unit R023 is used to calibrate the mA meter controls for the closed loop gain function of systems configured with the MPPU or VAMP power unit. The calibration requires adjustment to a board located potentiometer. The unit only needs to be run on one X–ray tube in multi–tube systems. Only one step is required to accomplish the calibration. A “MORE INFO” screen accessed through the Step 1 screen provides additional instructions pertaining to the operation of this calibration unit.

2 EQUIPMENT REQUIRED

Digital multimeter (DMM), test leads, exposure control tool, and extender board.

3 TEST SETUP

Setup the system for calibration as follows:

- Remove jumper from XJ3 on MPPU1 A1 A1, Measure and Commutation board.
- Connect DMM to XJ3.
- Set DMM to measure amperes (DC).

Note: The Rad mA meter gain potentiometer (P1) is factory adjusted and normally does not require adjustment in the field. Check first before making adjustments.

4 CAL PROCEDURE

4-1 Step 1. Closed Loop mA Adjust

The unit uses a fixed exposure technique of 80 kVp, minimum mA, and an exposure time of 1.0 sec in closed loop mode. Collimator blades are automatically set to the closed position.

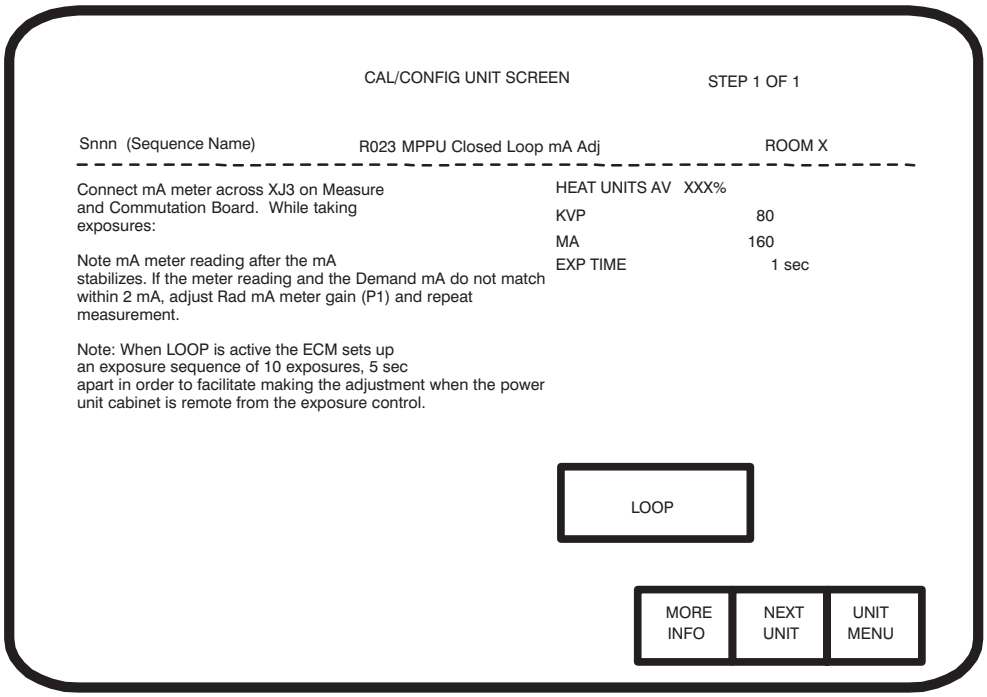
- Touch the LOOP softkey to set to active or inactive. The softkey is highlighted when active. When set to active, the system Exposure Control Module is configured to take a sequence of ten exposures with a 5.0 sec interval between each exposure. When set to inactive, the system Exposure Control Module is configured to take single exposures.

Note: Setting the LOOP to active (10 exposure sequence) and substituting an exposure control tool for the console handswitch permits the service person to leave the console to perform measurement and adjustments.

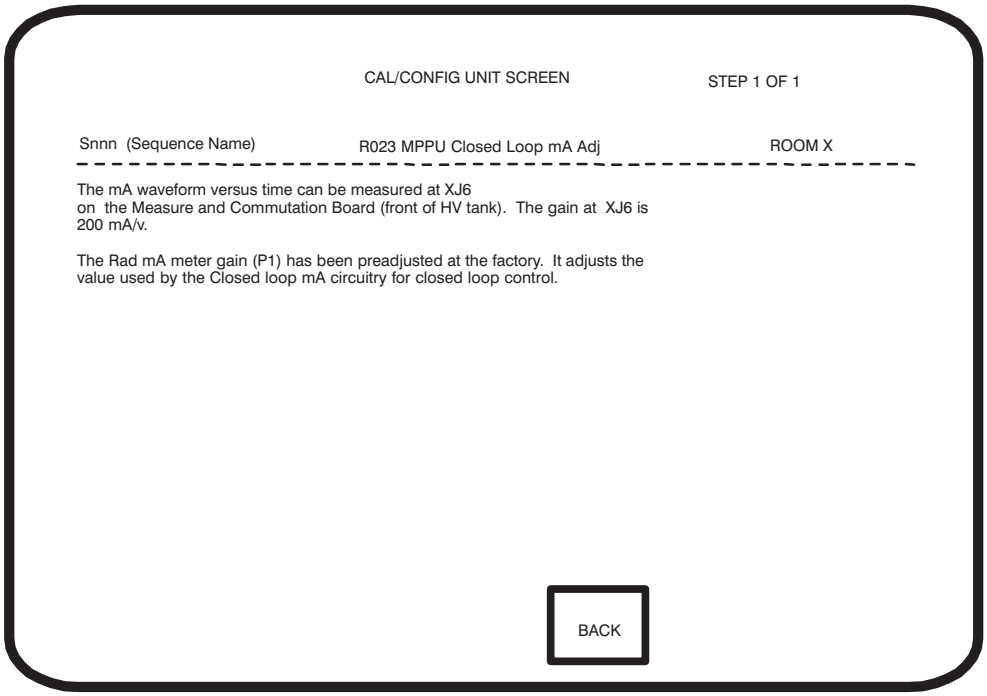
- Take exposures.
- MA meter should indicate 160 mA $\pm$ 1.0 mA.
- If required, adjust Rad mA meter gain potentiometer (P1) on Interface 2 board (Slot 25) until the mA meter reading and the Demand mA match within 2 mA. Use extender board to access P1 on Interface 2 board.

- Disconnect DMM and reinstall jumper on XJ3 on MPPU1 A1 A1, Measure and Commutation board.
- Touch NEXT UNIT or UNIT MENU softkey to exit.

R023 SCREEN DISPLAY



R023 "MORE INFO" SCREEN DISPLAY



UNIT R024 – kV Meter Frequency Response Calibration

Time: x h xx min – Personnel: 1 field engineer

1 DESCRIPTION

Calibration Unit R024 is used to adjust the kVp response for two metering channels within the power unit kVp metering subsystem.

- Step 1 places a Keithley meter in the x–ray beam and allows fluoro to center and collimate down to the active area of the Keithley.
- Step 2 performs the adjustment by first calibrating the Positive kV metering channel and then the Negative kV metering channel. Test exposures are automatically set to 120 kVp at 100 ms (100 kVp 160 mA for MX 150). The adjustment procedure uses the output from the Keithley as the stored display on the oscilloscope. The resultant kV metering waveforms are then analyzed for best response.
- Best response is considered to be a kV waveform with a rising edge that is as square as possible without any overshoot or undershoot If observation indicates the need for adjustment on either the positive or negative kV metering channels, adjust the appropriate potentiometer on the Cmd 1 board after each successive test exposure.

Note: Because only one kV metering channel can be adjusted at a time, the opposite channel is disabled. A kV reference signal is automatically applied to the disabled channel when either the NEGATIVE KV METER or POSITIVE KV METER softkey is enabled.

- When activated, the NORMAL OPERATION softkey removes the kV reference voltage and permits the metering circuit to meter the actual kV inputs from the cathode and anode input from the internal bleeder.

NOTICE

This calibration is performed in the factory. Check setup first before proceeding with a full calibration

2 EQUIPMENT REQUIRED

Keithley kVp Divider with filter packs (Model 35080A), dual channel storage oscilloscope and test leads.

3 SPECIAL INSTRUCTIONS

The following special instructions relate to the operation of this calibration unit.

Note: **For Vascular Systems Only:** Before system calibration, verify that additional filter (copper–aluminum filter) is not installed on top of collimator. (Open sensor hinge assembly to verify.) If installed, remove before performing calibration.

- A functional description of the unit is provided on a “MORE INFO” screen that can be accessed by touching the MORE INFO softkey on the Step 2 screen display. Read the “MORE INFO” screen to become familiar with the operation of the unit and softkey functions on the screens before proceeding with the calibration.

- Refer to Keithley operator manual (supplied with the instrument) for instructions pertaining to the application of correction factors associated with a filter pack. You must take filtration effects and linearity corrections into consideration to ensure accuracy. Refer to paragraph 4.7 and 4.8 in Keithley manual.

Note: This unit must be re–run whenever the power unit high voltage tank is replaced.

4 CAL PROCEDURE

4-1 Step 1. Set up the system

- Install filter pack P/N 37617C (50 kV – 150 kV) on Keithley.
- Position Keithley on table top so that filter pack is centered and **facing** X–ray beam. Recommended distance from X–ray tube is 22 inches (558 mm). See Illustration 39 and Illustration 40.
- Using coaxial test lead, connect the Keithley to the oscilloscope.
- Take fluoro exposures or use the collimator field light to center the Keithley in the X–ray beam.

R024 STEP 1 SCREEN DISPLAY

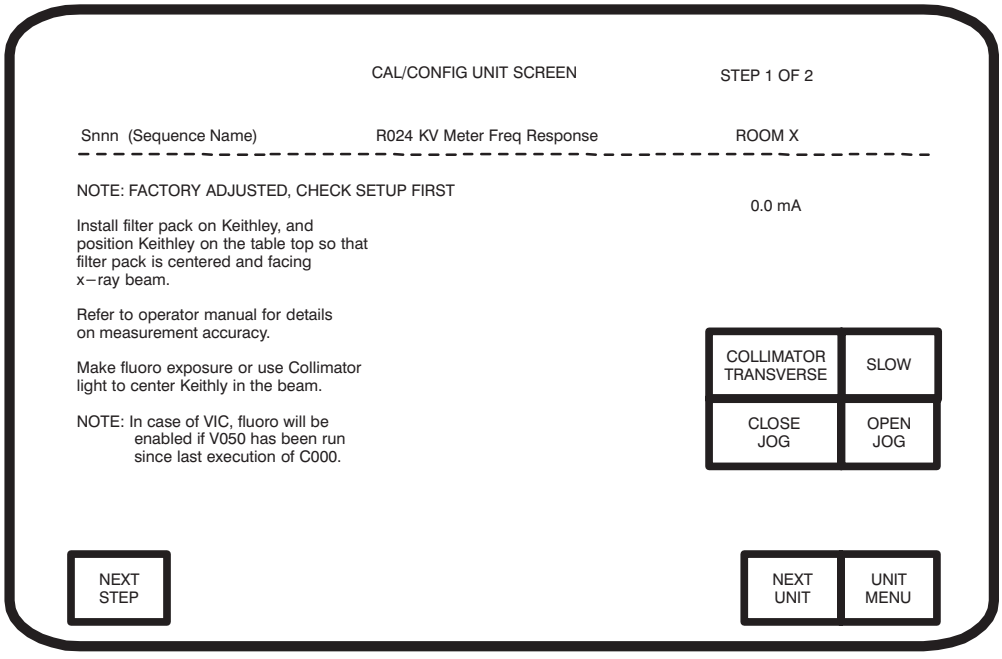


Illustration 39 – Typical Legacy R&F R024 Test Setup

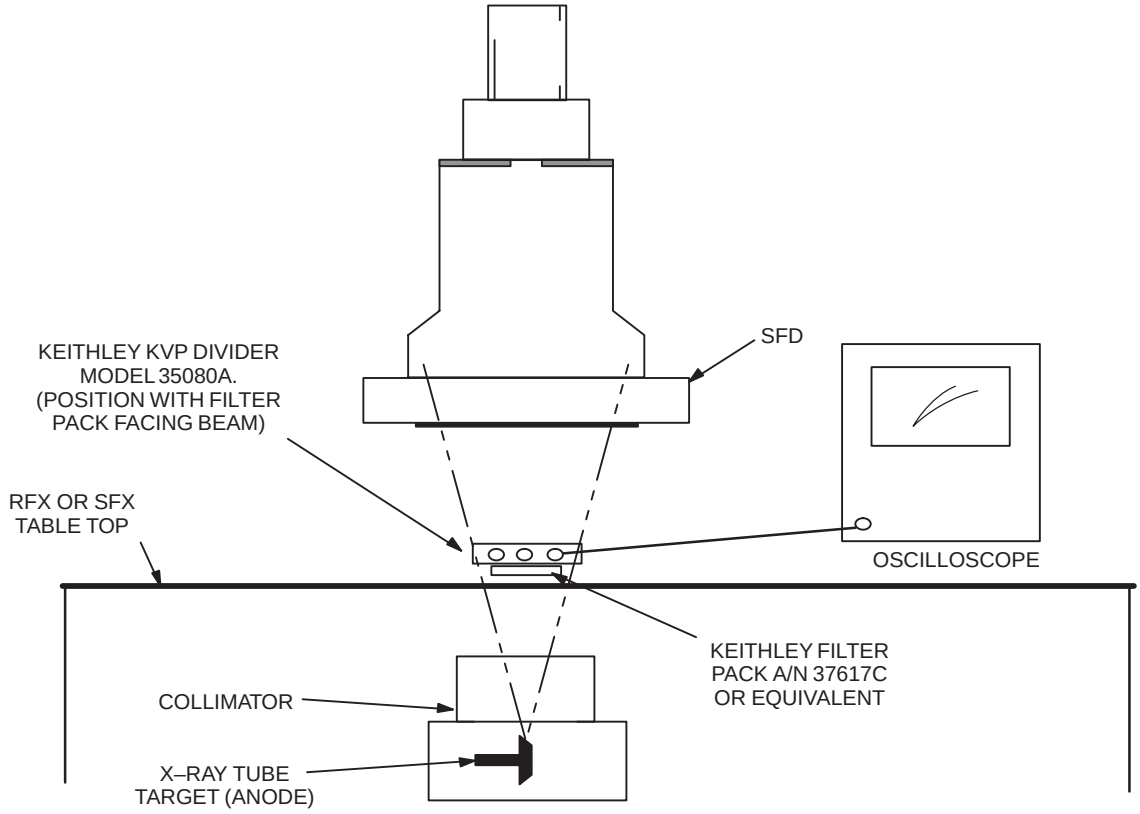
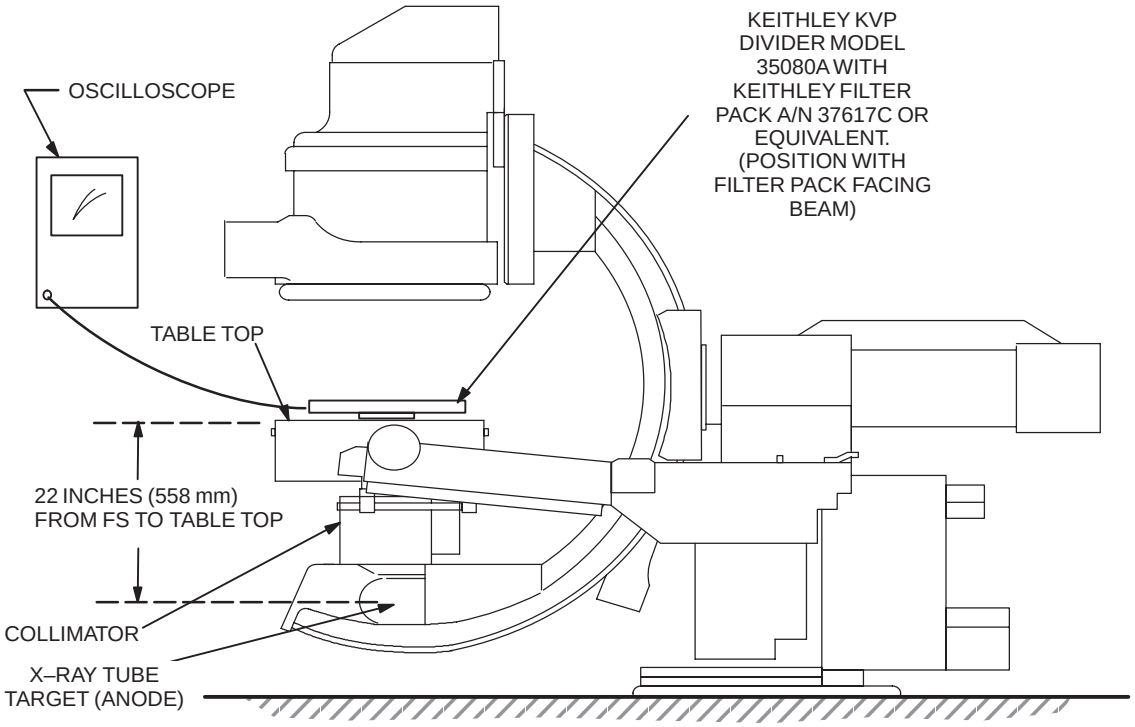


Illustration 40 – Typical Tilt–C R024 Test Setup

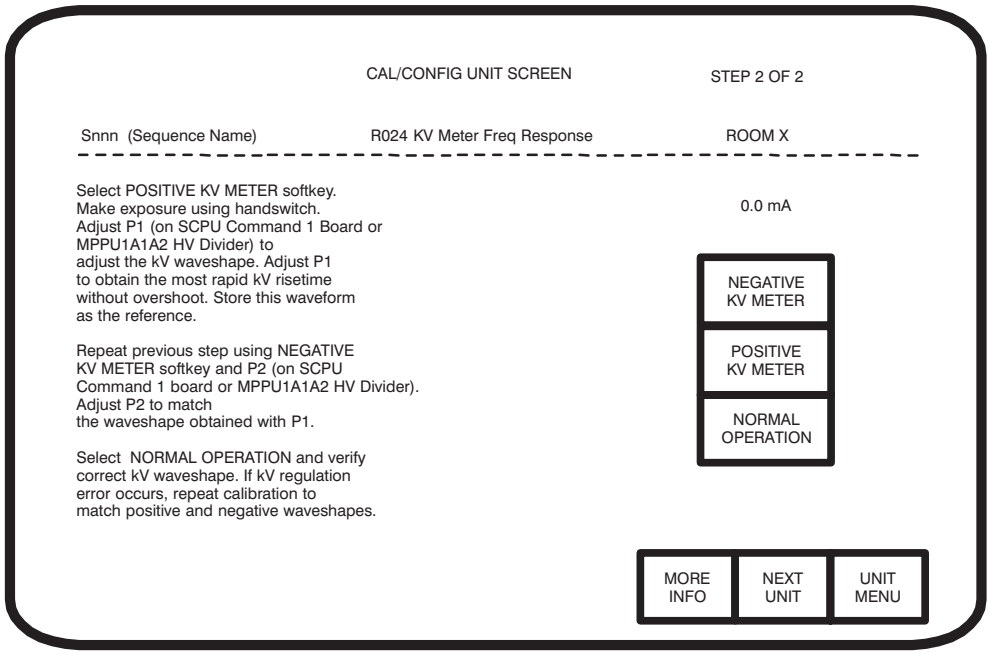


(TILT–C SYSTEM SHOWN)

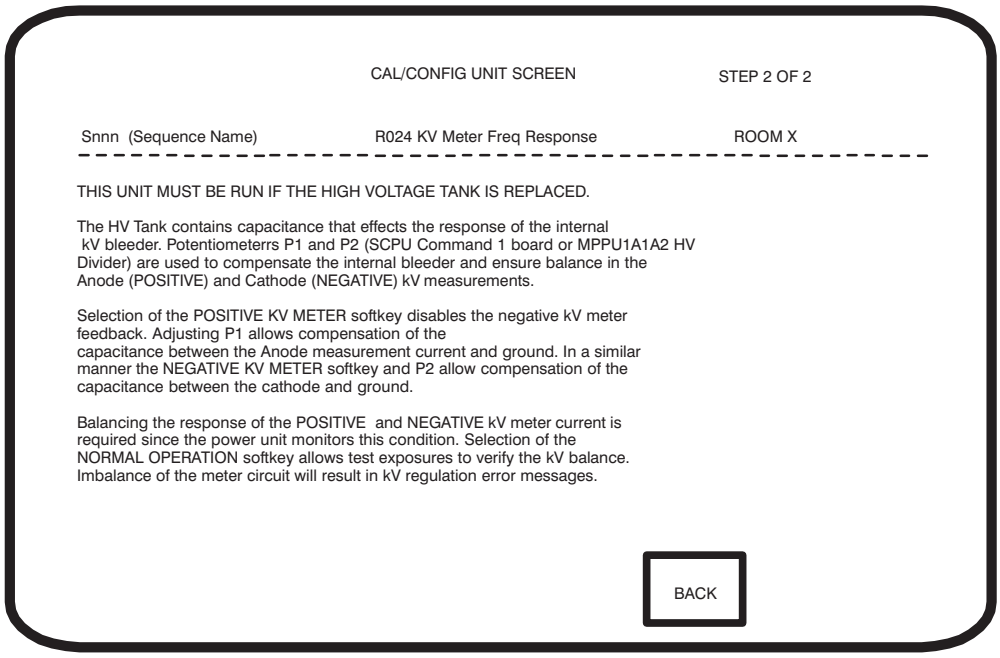
4-2 Step 2. Perform Calibration

- Touch the POSITIVE KV METER softkey.
- Press the PREP and EXPOSE switches on the handswitch to take and maintain an exposure.
- While maintaining the exposure, adjust potentiometer P1 (CW reduces overshoot) on the SCPU Command 1 board or on the MPPU1A1A2 HV Divider to obtain a kV waveshape on the oscilloscope that has the most rapid risetime without overshoot or undershoot. Store this kV waveshape on the oscilloscope as a reference waveshape.
- Touch the NEGATIVE KV METER softkey.
- Press the PREP and EXPOSE switches on the handswitch to take and maintain an exposure.
- While maintaining the exposure, adjust potentiometer P2 (CW reduces overshoot) on the SCPU Command 1 board or on the MPPU1A1A2 HV Divider to match the negative kV waveshape on the oscilloscope to the positive kV waveshape obtained with P1 adjustment (Reference waveform stored on scope).
- Touch the NORMAL OPERATION softkey.
- Verify that the correct kV waveshape is displayed on the oscilloscope. If a kV regulation error occurs, you must repeat the calibration to obtain a better match of the positive and negative waveshapes.

R024 STEP 2 SCREEN DISPLAY



R024 MORE INFO SCREEN DISPLAY



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UNIT R025 – mA/mAs Calibration

Time: x h xx min – Personnel: 1 field engineer

1 DESCRIPTION

Calibration Unit R025 is used to calibrate the mA meter gain of systems configured with the SCPU, MPPU or VAMP power unit. The mAs meter is calibrated at the same time by integrating the reference mA over a 400 ms time period. The unit only needs to be run on one X–ray tube in multi–tube systems. Only one step is required to accomplish the calibration.

2 EQUIPMENT REQUIRED

Digital Multimeter (DMM w/ammeter function)

3 SPECIAL INSTRUCTIONS

- A functional description of the unit is provided on a “MORE INFO” screen that can be accessed by touching the MORE INFO softkey on the Step 1 screen display. Read the “MORE INFO” screen to become familiar with the unit and softkey functions before proceeding with the calibration.
- When an mA measurement has been completed, you cannot repeat the measurement without re–running the unit.
- The VIEW DBASE softkey is always active, i.e., before making any measurements and after all measurements have been made.

4 TEST SETUP

On systems with MPPU or VAMP power unit:

- Remove jumper from XJ3 on MPPU1 A1 A1, Measure and Commutation board. Then, set DMM to measure amperes (DC) and insert ammeter in mA feedback circuit (XJ3).

On systems with SCPU power unit:

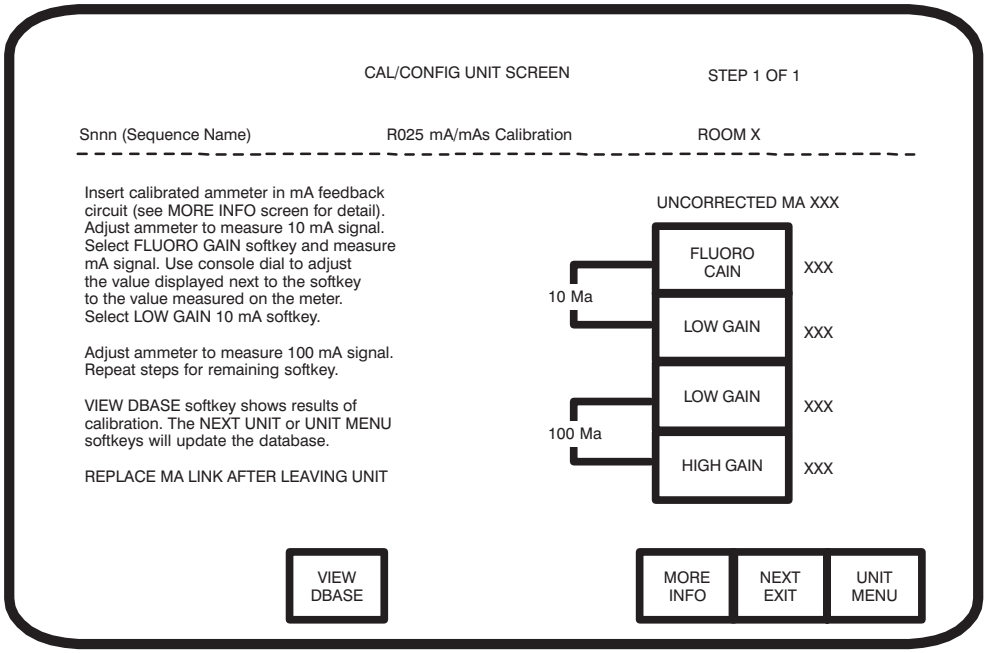
- Remove mA link from SCPU A4 A1, Command 1 board. Then, set DMM to measure amperes (DC) and insert DMM across ST1A–ST1B on SCPU A4 A1, Command 1 board.

5 CAL PROCEDURE

5-1 Step 1.

- Set ammeter to measure 10 mA signal.
- Touch the 10 mA FLUORO GAIN softkey and note the mA indicated on the ammeter. Use the console dial to adjust the value displayed next to the softkey to the value measured on the ammeter.
- Touch the 10 mA LOW GAIN softkey and note the mA indicated on the ammeter. Use the console dial to adjust the value displayed next to the softkey to the value measured on the ammeter.
- Set ammeter to measure 100 ma signal.
- Touch the 100 mA LOW GAIN softkey and note the mA indicated on the ammeter. Use the console dial to adjust the value displayed next to the softkey to the value measured on the ammeter.
- Touch the 100 mA HIGH GAIN softkey and note the mA indicated on the ammeter. Use the console dial to adjust the value displayed next to the softkey to the value measured on the ammeter.
- Touch the VIEW DBASE softkey to examine results of the calibration.
- Disconnect DMM from power unit.
- Touch the NEXT UNIT or UNIT MENU softkey to exit
- On MPPU and VAMP replace jumper on XJ3. On SCPU replace the mA link on Command 1 board after exiting the unit.

R025 STEP 1 SCREEN DISPLAY



R025, MORE INFO SCREEN DISPLAY

CAL/CONFIG UNIT SCREEN STEP 1 OF 1

Snnn (Sequence Name) R025 mA/mAs Calibration

Insert ammeter on MPPU1 A1 A1 (Measure and Commutation Board) across XJ3 or on SCPU A4 A1 (Command1) across ST1A–ST1B.

The internal mA measurement (with no correction factor applied) is displayed as Uncorrected mA above the softkeys.
Three mA measurement scales are required by the power unit: Fluoro Scale, Low Scale (10–100 mA), High Scale (100–1500 mA).
The meter gain (slopes) and offsets are calculated based on the measurements made with the four softkeys and are interactive.

The mAs meter is calibrated at the same time by integrating the reference mA over a 400 millisecond period.

When a measurement has been completed it cannot be repeated unless the unit is rerun. The VIEW DBASE softkey is active before making any measurements and after all four measurements have been completed.

BACK

R025 STEP 1 (REVIEW DATABASE) SCREEN DISPLAY

System Ready CAL/CONFIG UNIT SCREEN STEP 1 OF 1

Snnn (Sequence Name) R025 mA/mAs Calibration ROOM X

The existing database values are shown on the right side of the screen. The results of the new calibration (if it has been completed) are shown in parenthesis.

Press BACK to return tp Step 1 screen.

Press MORE INFO for an explanation of the calibration theory.

Press NEXT UNIT or UNIT MENU to update the database and exit the unit.

	Current NVRAM Values (New Calibration Values)	
	mA	mAs
OFFSET	XXX (X.XX)	XXX (X.XX)
FLUORO GAIN	XXX (X.XX)	XXX (X.XX)
LOW GAIN	XXX (X.XX)	XXX (X.XX)
HIGH GAIN	XXX (X.XX)	XXX (X.XX)

BACK MORE INFO NEXT EXIT UNIT MENU

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Radiation Calibration Units

Notepad

Units R001 – R025

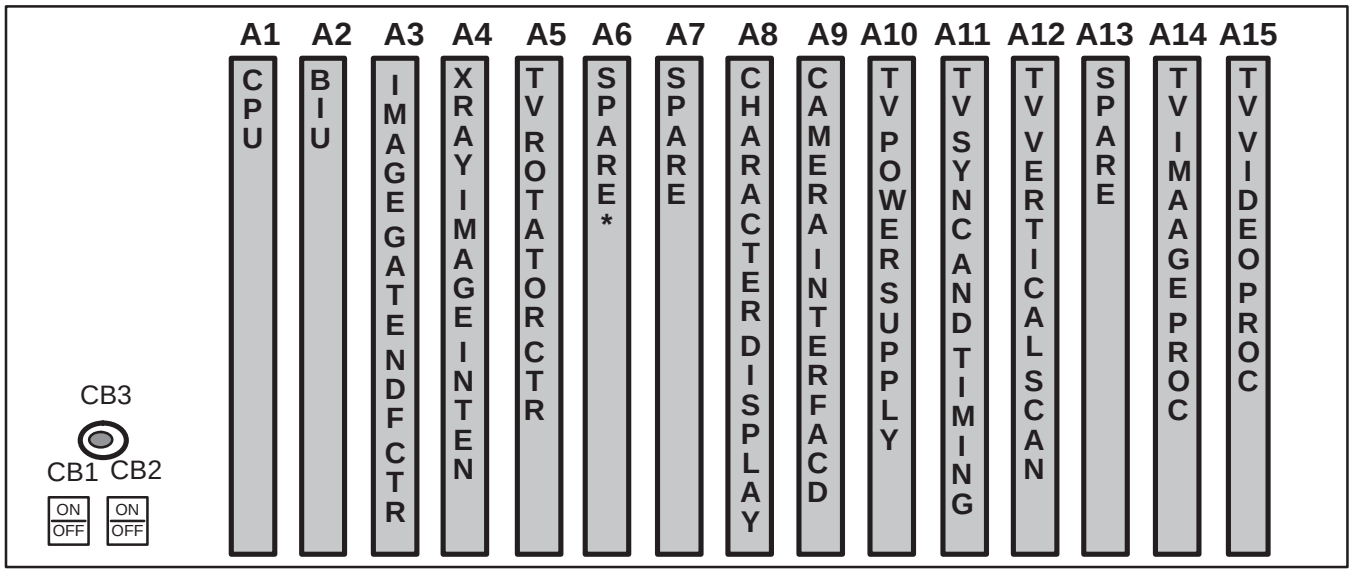
Unit	Note

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SECTION 6 – VIDEO AND INTENSIFIER CALIBRATION UNITS

VIC VIDEO INTENSIFIER CARDRACK

PWB LOCATION



* EXPOSURE MONITOR DVP IS LOCATED IN THIS SLOT WHEN CONFIGURED.

Unit	Title	Page
I001	Image Calibration	195
V000	VIC Notes	197
V001	Cable Compensation	201
V003	Video Monitor Adjustments (High or Low Line Rate Interlace)	207
V004	Image Intensifier Focus	219
V011	TV Lens Adjustment	245
V012	Size and Center	253
V016	Circular Blanking Adjustments	273
V020	Initial Focus	277
V021	Focus Fluoro/512/1024	281
V050	Target Voltage	293
V051	Beam Alignment	297
V053	Beam Current	301
V054	Video Gain Linearization	309
V055	ABC Window	311
V056	EDR Calibration	313
V058	ABD Black Level Threshold	325
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V061	Readback Calibration	333
V062	CF and ABC Gain Calibration	339
V063	Character Centering (HI and LO interlace)	343
V064	EDR Delay Calibration	345
V065	G4/G3 Calibration	355
V066	Pickup Tube Lag Compensation	359
V067	DF Gain Adjustment	363
V068	Objective Lens–Focus and Center	365
V069	DX (DLX) Gain Calibration	375
V070	DX (DLX) Size and Center	381
V071	White Clip Adjustment	391
V072	Beam Alignment	395

UNIT I001 – Image Calibration

Time: x h xx min – Personnel: 1 field engineer

1 DESCRIPTION

Calibration Unit I001 is used as a steering unit to direct the service person to the appropriate procedures for performing Imageur adjustments and calibration.

Note: The Imageur Module is calibrated at the factory and normally does not require a full calibration in the field.

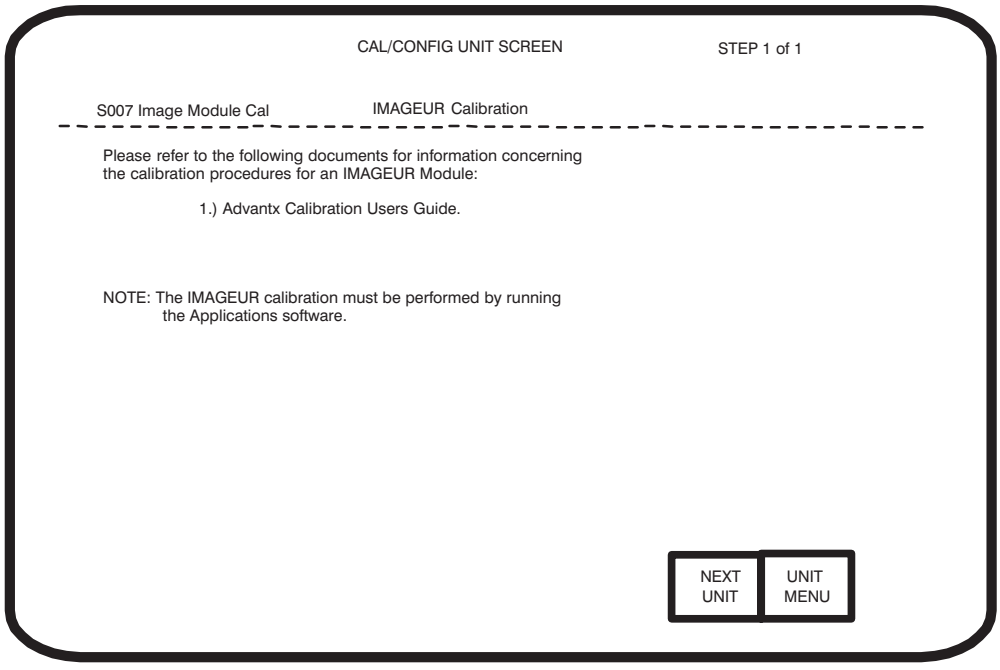
2 EQUIPMENT REQUIRED

None.

3 CAL PROCEDURE

The calibration of an Imageur module is performed according to the procedures given in Direction 36003150, *Advantx Imageur Adjustments.* The procedures given in the direction are presented in a calibration “tree” format using Job Cards. For installed (working) systems you may enter the calibration “tree” at any point to accomplish specific adjustments provided prerequisite adjustments have been determined to be satisfactory. If an Imageur has to be completely re-calibrated, all steps in the calibration “tree” must be performed in the sequence presented. After the calibration is completed, touch NEXT UNIT or UNIT MENU softkey to exit and un-highlight the unit.

I001 STEP 1 SCREEN DISPLAY



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UNIT V000 – VIC Notes

Time: x h xx min – Personnel: 1 field engineer

1 DESCRIPTION

Calibration Unit V000 is an instruction unit that provides special information pertaining to the running of VIC Calibration Units. The unit does not perform calibration functions. Two steps are required to access the special text screen displays. Step 1 provides information relating to the VIC GAMMA function. Step 2 provides instructions relating to the VIC White Clip function.

Note: Ensure that the instructions presented are fully understood before proceeding with any VIC calibration.

2 EQUIPMENT

None.

3 SPECIAL INSTRUCTIONS

3-1 Step 1. White Clip Level

If a database initialization (C000) was performed and recalibration of the VIC is required, perform one of the following:

- Use an IET to perform initial calibration before running V012, Size and Center.

OR

- Run V012, Size and Center, before starting a VIC calibration and then run V012 again in the normal calibration sequence.

The White Clip function is used to set the video signal to the proper operating level depending on whether the EDR function is enabled or disabled. However, the White Clip function can cause interference when attempting to run certain VIC calibration units. To eliminate this problem, the White Clip potentiometer located on the Video Processor PWB (A15 R418) must be set fully clockwise before proceeding with any VIC calibration. After performing the required VIC calibration, re-adjust the white clip to the proper operating level using White Clip Calibration Unit (V071).

3-2 Step 2. GAMMA Function

Note: The GAMMA function is not used for LCA, LC+, and LCV+ or for Legacy R&F systems.

The GAMMA function is used to increase image quality for Advantx R&F systems configured with the Digital Record feature. Operation of the GAMMA function is controlled by the position of jumper JP14 on Video Processor PWB A15 (see Table 15).

Table 15 – Gamma Function

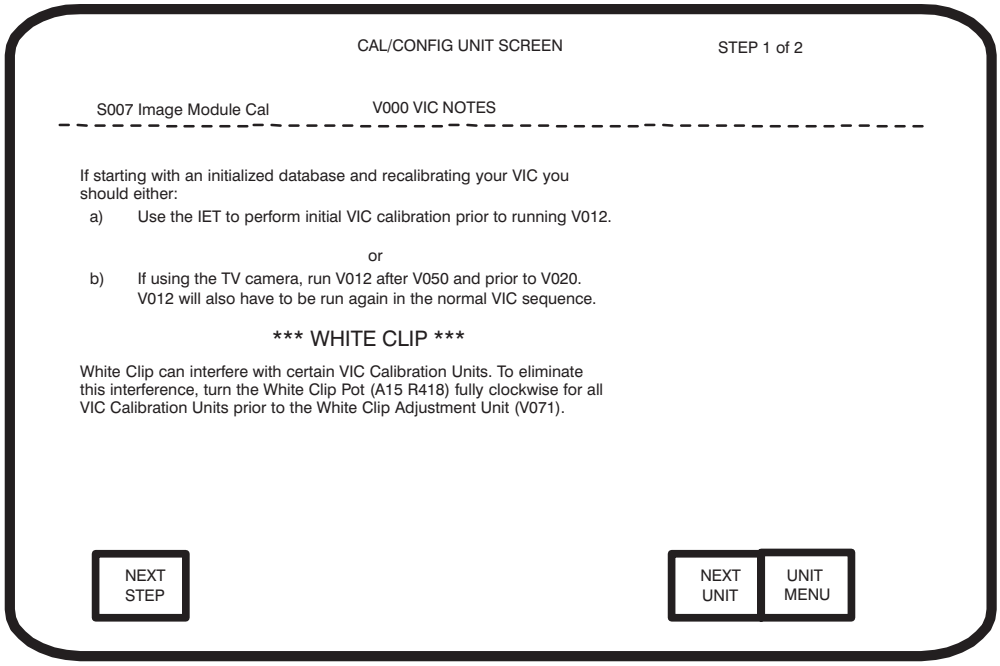
PWB	JUMPER REF DES	POSITION
Video Processor PWB A15	JP14	Position A (For future use)
		Position B (GAMMA function enabled (ON)
		Position C (GAMMA function disabled (OFF)

The GAMMA function must be disabled when running all VIC Calibration Units with the exception of EDR calibration (V056). The GAMMA function itself is calibrated when running EDR Calibration (V056) and therefore must be enabled when running portions of that unit. (See EDR Cal, V056.)

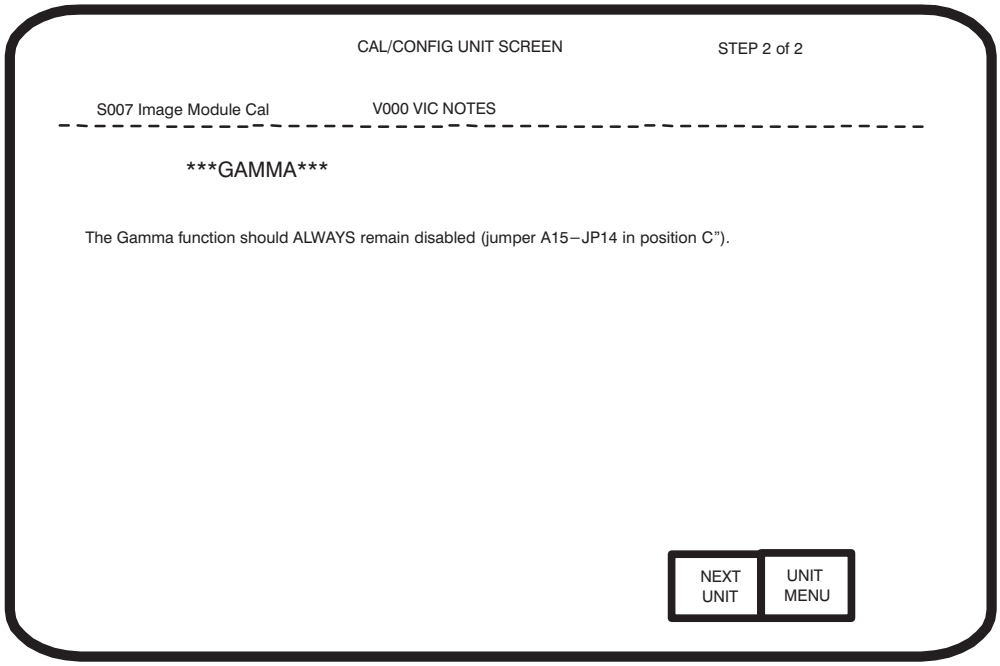
When all VIC units have been calibrated, jumper A15–J14 must then be set to the position appropriate to the configuration of the system.

- For LCA, LC+, LCV+ and Legacy R&F systems: Set to position C (OFF).

V000 STEP 1 SCREEN DISPLAY



V000 STEP 2 SCREEN DISPLAY



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UNIT V001 – Cable Compensation

Time: x h xx min – Personnel: 1 field engineer

1 DESCRIPTION

Calibration Unit V001 is used to provide varying compensation of the TV Camera video signal as external cable length changes. The Cable Compensation circuit board also provides a Humbucker circuit which is included to reject 50/60 Hz common mode hum in the video signal, and a low–pass filter circuit to satisfy a different frequency response requirement for systems with a DRS digital box. The service unit consists of two screens. Screen 1 contains instructions about how to find the total cable length and how to make the selection on the Cable Compensation module. Screen 2 contains instructions on how to make the proper jumper selections to select the bandwidth limitation circuit required by Tilt–C and R&F systems with DRS. Screen 2 will only be displayed if the system is configured for DRS.

2 CAL PROCEDURE

2-1 Step 1

The purpose of this step is to calculate the TOTAL CABLE LENGTH of the TV1 cable from the VIC module to the TV camera head. There are two methods to calculate the total length of the TV1 cable: using on–screen automatic calculation, or using the cable lengths in Table 16.

Note: The default cable length value of 39 feet is displayed on entry to the unit. The selected value is not saved for future executions of the unit.

- To calculate the total cable length, find the length of the TV1 cable (2155865). Look at either end of this cable and find the length listed on the label.
- **Using on–screen TOTAL CABLE LENGTH calculation:** Select the VAR CABLE LENGTH softkey. With the console dial, select the cable length closest to the value found on the TV1 cable. Based upon how the system is configured, the unit now converts the length in feet to meters, adds the system cabinet and positioner cable lengths, and displays the TOTAL CABLE LENGTH.
- **Using Table 16 TOTAL CABLE LENGTH calculation:** Look up the TV1 cable part number in Table 16. In the “System Type” column in Table 16, find the “Total Cable Length” in meters. The Total Cable Length includes the internal cabinet and positioner cable lengths per system type.
- Record the TOTAL CABLE LENGTH and set Switches S1 and S2 on the cable compensation box to this length. The cable compensation box is located on the back of the VIC module.
  TOTAL CABLE LENGTH: _____ Meters

2-1-1 Typical Example of Cable Compensation Settings

As an example, suppose an LCA system with a 39 foot (12 meter) variable cable: This results in a total cable length of 21 meters. In this example, set switch S2 for 20 meters and set switch S1 for 1 meter. (Refer to Illustration 41 for settings of S1 and S2 on the back of the VIC module.)

V001 CABLE COMPENSATION STEP 1 SCREEN DISPLAY

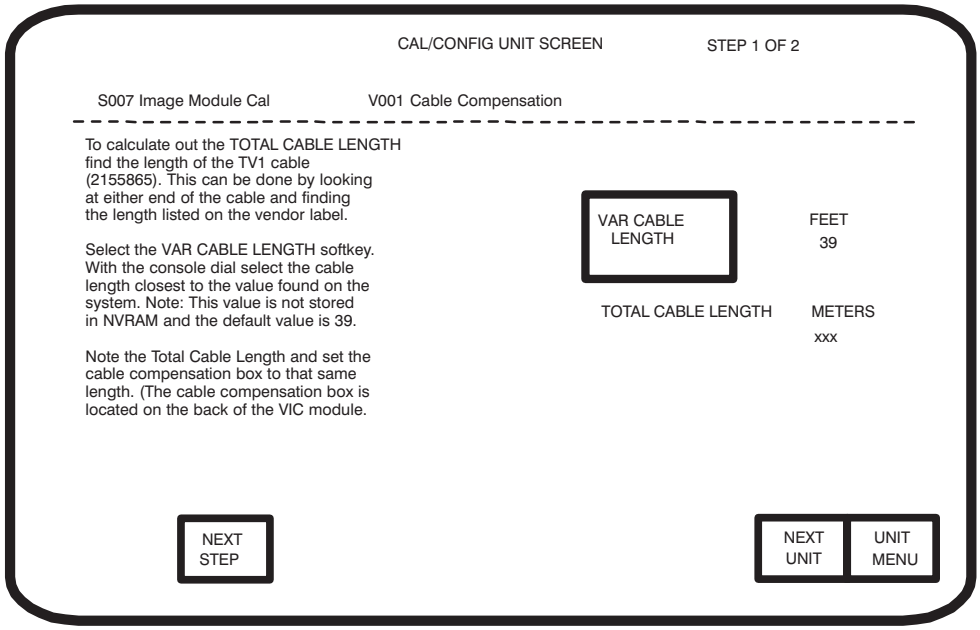
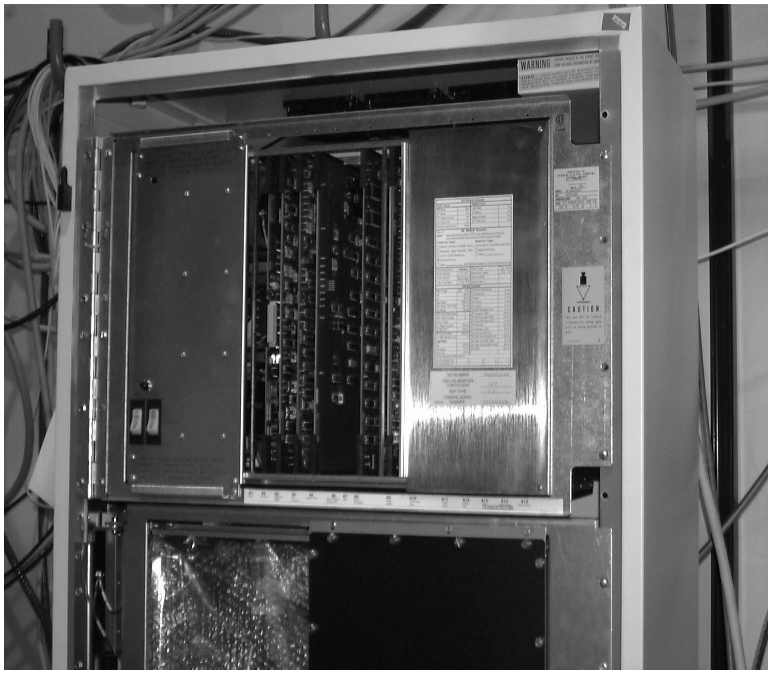


Table 16 – Total Cable Length

VARIABLE CABLE LENGTHS			TOTAL CABLE LENGTH PER SYSTEM TYPE			
Cable Part Number	Feet	Meters	LCA 40 (Meters)	LCA 32 LC+ LCV+ Biplane Frontal, Biplane Lateral (Meters)	TILT–C (Meters)	R&F (Meters)
2155865–3	20	6	14	15	20	8
2155865–6	39	12	20	21	26	14
2155865–7	49	15	23	24	29	17
2155865–8	59	18	26	27	32	20
2155865–9	69	21	29	30	35	23
2155865–10	79	24	32	33	38	26
2155865–11	89	27	35	36	41	29
2155865–12	98	30	38	39	44	32

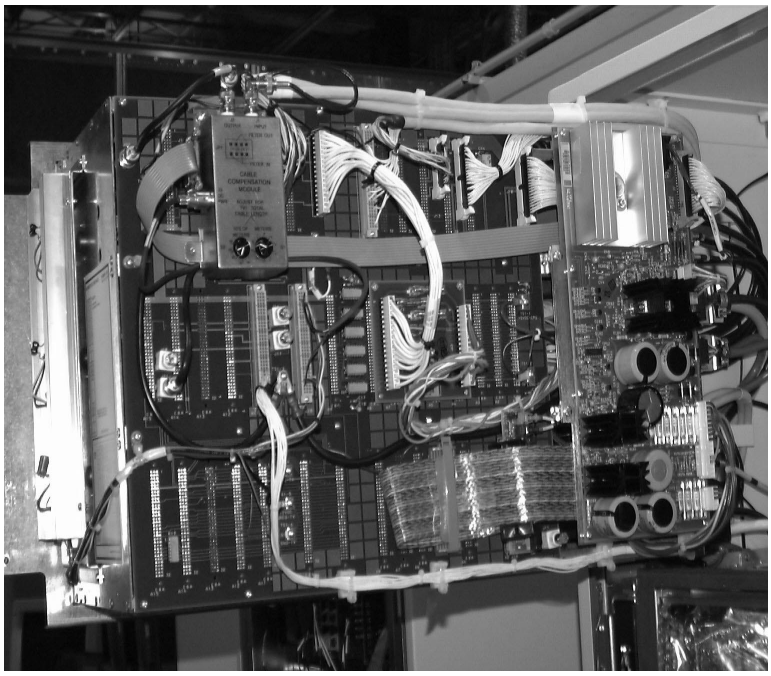
- To change the Cable Compensation Module setting, turn off the system console and power down the VIC module.

Illustration 41 – System Console



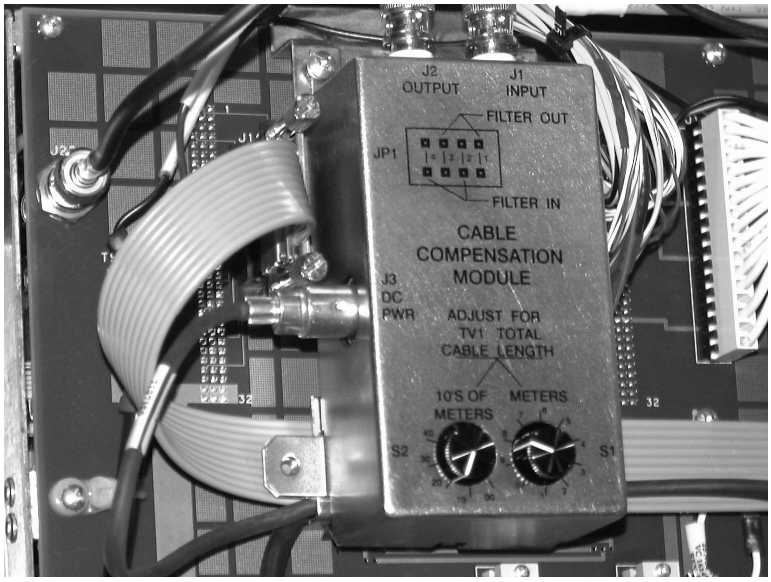
- Open the door to the Cable Compensation Module.

Illustration 42 – Inside View of Module



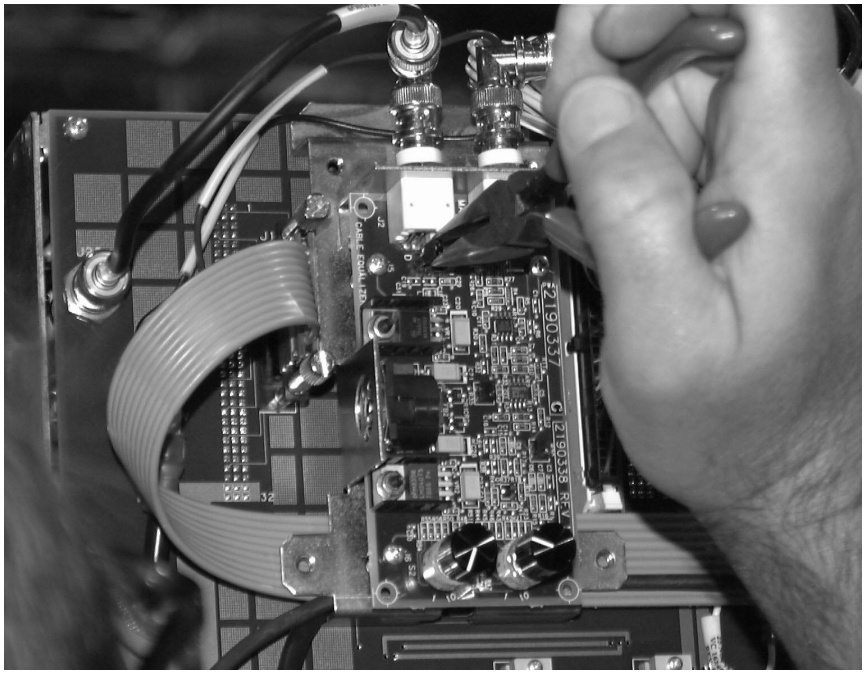
- Remove the power plug from the Cable Compensation Module. See Illustration 43, Cable Compensation Module.
- Remove the four screws that hold on the cover**.** See Illustration 43, Cable Compensation Module.

Illustration 43 – Cable Compensation Module



- Adjust the JP1 filter. (See the cover for poistion.). See Illustration 44, InsideView of Cable Compensation Module.

Illustration 44 – Inside View of Cable Compensation Module



- Replace the cover, screw, and plug. Then power up the system.

2-2 Step 2

The purpose of this step is to tell the service person how to set the JP1 jumpers in the cable compensation module. This step will only be displayed if the system is configured for DRS. This step is normally performed in the factory. However, it will have to be performed in the field if a system is upgraded with a DRS.

- If the system has a DRS, remove the cover from the cable compensation box located on the back of the VIC module.
- Verify that the two JP1 jumpers are in positions 2 and 4. Positions 2 and 4 use the output filter. Positions 1 and 3 bypass the output filter.

V001 CABLE COMPENSATION STEP 2 SCREEN DISPLAY

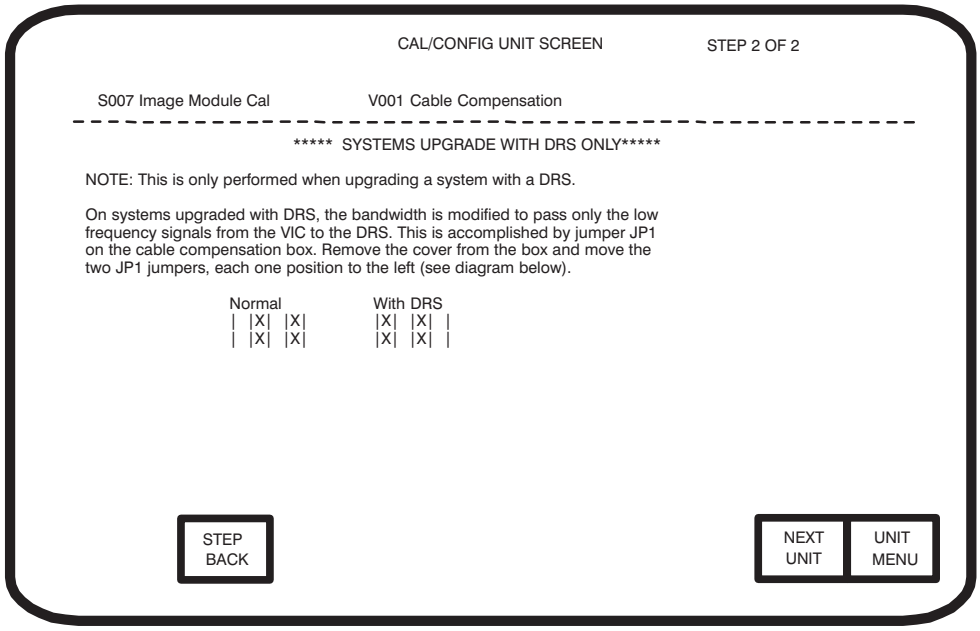
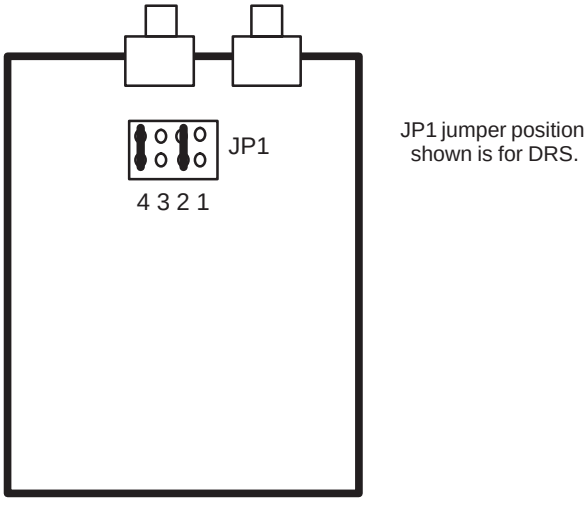


Illustration 45 – Cable Compensation Circuit Board JP1 Positions



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UNIT V003 – Video Monitor Adjustments (High or Low Line Rate Interlace)

Time: x h xx min – Personnel: 1 field engineer

1 DISTAR TV MONITOR CALIBRATION

Note: There are two types of TV Monitors covered by cal unit V003: Distar and Distar–M. Section 1 covers the Distar calibration procedure. Section 2 covers the Distar–M calibration procedure.

1-1 Description

Calibration Unit V003 is used to adjust the Vertical Size and Center, Horizontal Size and Center, Brightness, and Contrast of the Video Monitor. The vertical and horizontal adjustments also set the raster to the proper aspect ratio (height/width). Brightness sets the gain of the total signal displayed on the monitor. Contrast sets the gain of the input video signal. The monitor adjustments are performed at the factory and normally only digital systems require further adjustment of the monitor in the field. The unit is sub–divided into the following two procedures to provide adjustment of both HI and LO video line rate interlace configurations.

Cal Procedure 1. V003 Video Monitor Adj HI

Cal Procedure 2. V003 Video Monitor Adj LO

Presentation of the appropriate unit (HI, LO) on the calibration sequence menu is a function of the system Smart Sequencer.

NOTICE

When a monitor boom installation is required, it is recommended that the calibration be performed before mounting the monitor to the boom. Access to the monitor adjustments is difficult once the monitor is on the boom.

1-2 Equipment Required

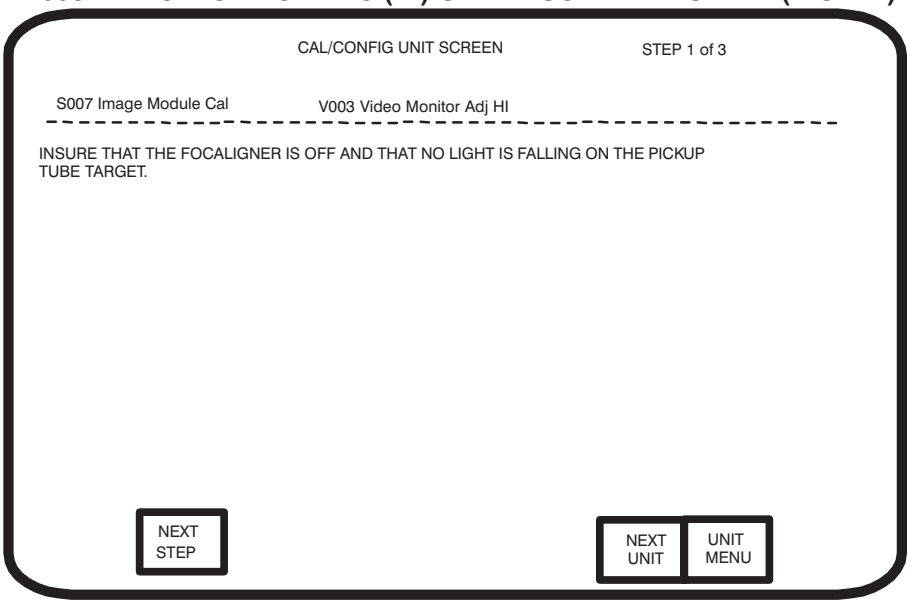
Dark cloth cover, black grease pencil, and non–metallic trimpot adjusting tool.

1-3 Cal Procedure 1 – Monitor Adjustment, HI Video Line Rate Interlace

1-3-1 Step 1. Setup the Equipment

- Ensure that Focaligner is turned off and that camera is covered with a dark cloth.
- Using a fine grease pencil, trace the inside edge of the monitor framing mask onto the tube face.
- Remove monitor framing mask to permit aspect ratio measurements on the monitor screen and access to the monitor controls**.**
- Touch NEXT STEP softkey to proceed to Step 2.

V003 VIDEO MONITOR ADJ (HI) STEP 1 SCREEN DISPLAY (DISTAR)



1-3-2 Step 2. Adjust Vertical and Horizontal Size and Center (Illustration 46)

NOTICE

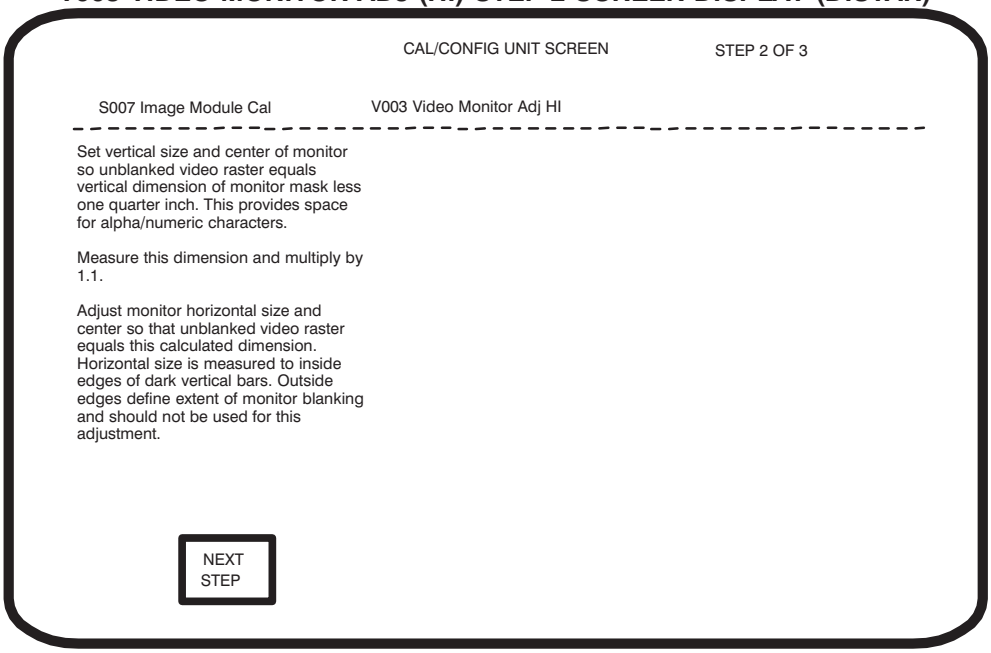
The aspect ratio adjustments performed in this step are critical adjustments and must be done properly to ensure circular blanking roundness when running V011, TV Lens Adjustment.

- Adjust the monitors vertical and horizontal size and center.
- Adjust monitor brightness and contrast so that both the monitor raster (outer) and camera raster (inner) are visible.
- Adjust monitor vertical size and center so that the camera raster just fills the vertical dimension of the framing mask outlined by the grease pencil less 1/8 inch at the **top** and **bottom** of mask (vertical dimension of monitor mask less 1/4 inch).

Note: It is recommended that you view the monitor from a typical doctors position (standing across the table) and make the adjustments accordingly.

- Measure vertical size of camera raster. Record dimension_____.
- Multiply measurement by 1.1. Record dimension_____.
- Adjust horizontal size and center so that the unblanked video raster equals the calculated dimension. The horizontal dimension is measured to inside edges of vertical bars. Do not use outside edges of the vertical bars to determine horizontal size.
- Position the camera raster vertically and horizontally so that the raster is centered in the framing mask. (If necessary, use the yoke tabs to make this adjustment.)
- Touch NEXT STEP softkey to proceed to Step 3.

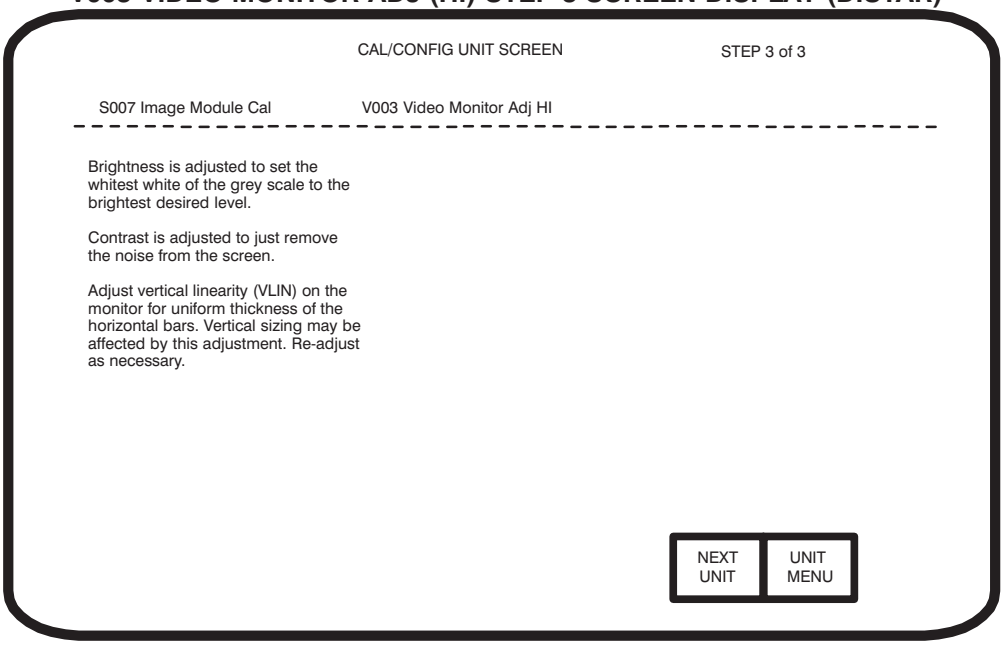
V003 VIDEO MONITOR ADJ (HI) STEP 2 SCREEN DISPLAY (DISTAR)



1-3-3 Step 3. Adjust Brightness and Contrast

- Upon entering Step 3, a VIC generated grey scale bar pattern is displayed on the monitor. See Illustration 47.
- Adjust monitor brightness potentiometer to set the whitest white bar on the grey scale pattern to the desired brightness level. See Illustration 47.
- Adjust monitor contrast potentiometer to just remove noise from the screen.
- Measure the thickness of each horizontal gray scale bar. The thickness of the horizontal bars should be the same. If not, adjust vertical linearity potentiometer (VLIN) on the monitor for uniform thickness of the horizontal bars. Vertical sizing may be affected by this adjustment. Re-adjust as necessary.
- Reinstall the monitor framing mask and close the monitor control panel.
- Touch NEXT UNIT or UNIT MENU softkey to exit the calibration unit.

V003 VIDEO MONITOR ADJ (HI) STEP 3 SCREEN DISPLAY (DISTAR)

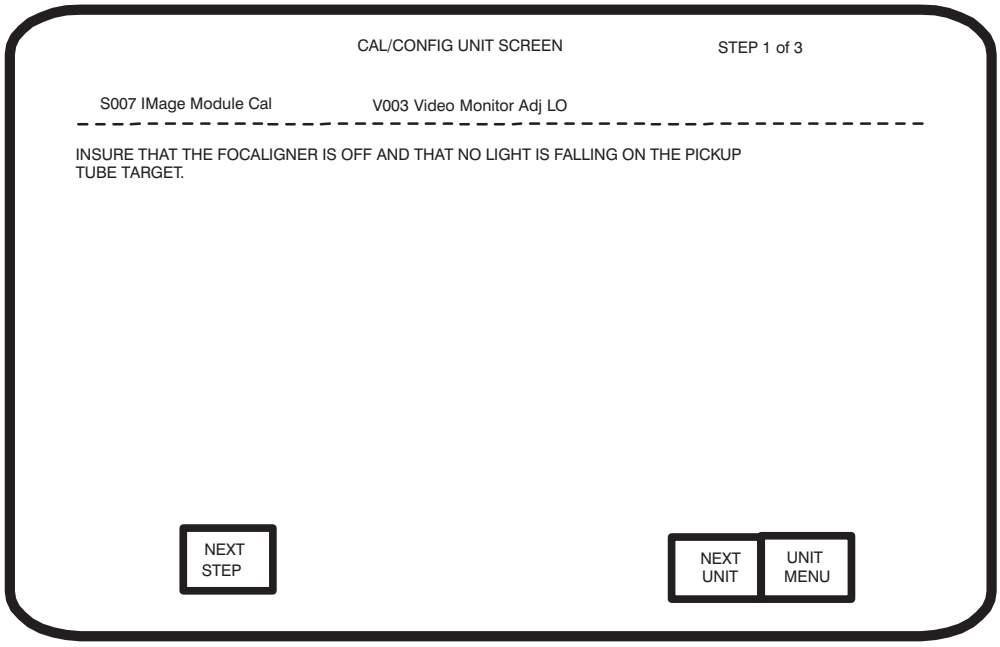


1-4 Cal Procedure 2 – Monitor Adjustment, LO Video Line Rate Interlace

1-4-1 Step 1. Setup the Equipment

- Ensure that Focaligner is turned off and that camera is covered with a dark cloth.
- Using a fine grease pencil, trace the inside edge of the monitor framing mask onto the tube face.
- Remove monitor framing mask to permit aspect ratio measurements on the monitor screen and access to the monitor controls**.**
- Touch NEXT STEP softkey to proceed to Step 2.

V003 VIDEO MONITOR ADJ (LO) STEP 1 SCREEN DISPLAY (DISTAR)



1-4-2 Step 2. Adjust Vertical and Horizontal Size and Center (Illustration 46)

NOTICE

The aspect ratio adjustments performed in this step are critical adjustments and must be done properly to ensure circular blanking roundness when running V011, TV Lens Adjustment.

- Adjust the monitors vertical and horizontal size and center.
- Adjust monitor brightness and contrast so that both the monitor raster (outer) and camera raster (inner) are visible.
- Adjust monitor vertical size and center so that the camera raster just fills the vertical dimension of the framing mask outlined by the grease pencil less 1/8 inch at the **top** and **bottom** of the mask (vertical dimension of monitor mask less 1/4 inch).

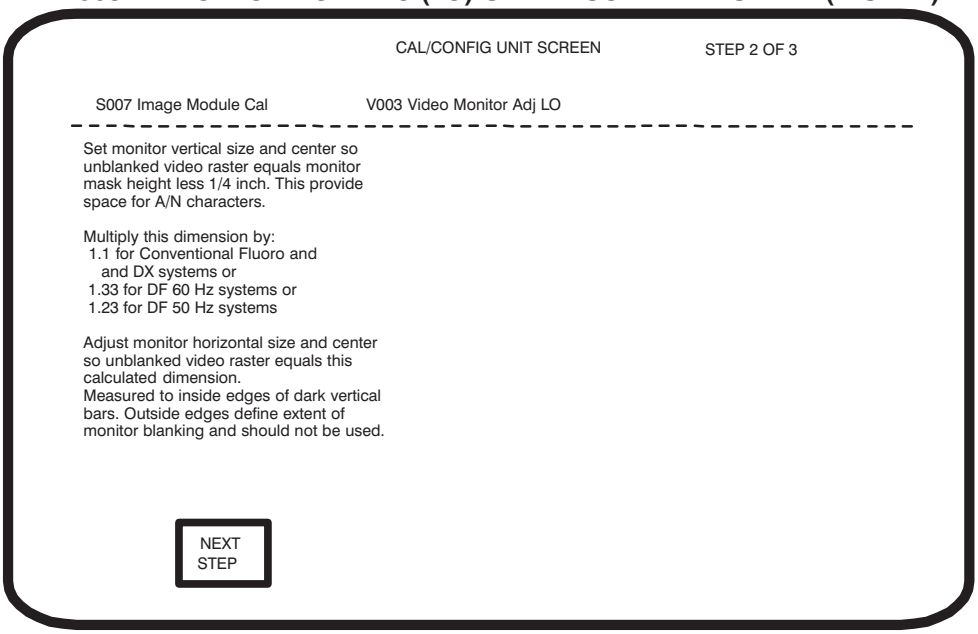
Note: It is recommended that you view the monitor from a typical doctor's position (standing across the table) and make the adjustments accordingly.

- Measure vertical size of camera raster. Record dimension_____.
- Multiply the recorded dimension by:

  1.1 for Conventional Fluoro and DLX configured Systems

- Adjust horizontal size and center so that the unblanked video raster equals the calculated dimension. The horizontal dimension is measured to inside edges of vertical bars. Do not use outside edges of the vertical bars to determine horizontal size.
- Position the camera raster vertically and horizontally so that the raster is centered in the framing mask. (If necessary, use the yoke tabs to make this adjustment.)
- Touch NEXT STEP softkey to proceed to Step 3.

V003 VIDEO MONITOR ADJ (LO) STEP 2 SCREEN DISPLAY (DISTAR)



1-4-3 Step 3. Adjust Brightness and Contrast

- Upon entering Step 3, a VIC generated grey scale bar pattern is displayed on the monitor. See Illustration 47.
- Adjust monitor brightness potentiometer to set the whitest white bar on the grey scale pattern to the desired brightness level. See Illustration 47.
- Adjust monitor contrast potentiometer to just remove noise from the screen.
- Measure the thickness of each horizontal gray scale bar. The thickness of the horizontal bars should be the same. If not, adjust vertical linearity potentiometer (VLIN) on the monitor for uniform thickness of the horizontal bars. Vertical sizing may be affected by this adjustment. Re-adjust as necessary.
- Reinstall the monitor framing mask and close the monitor control panel.
- Touch NEXT UNIT or UNIT MENU softkey to exit the calibration unit.

V003 VIDEO MONITOR ADJ (LO) STEP 3 SCREEN DISPLAY (DISTAR)

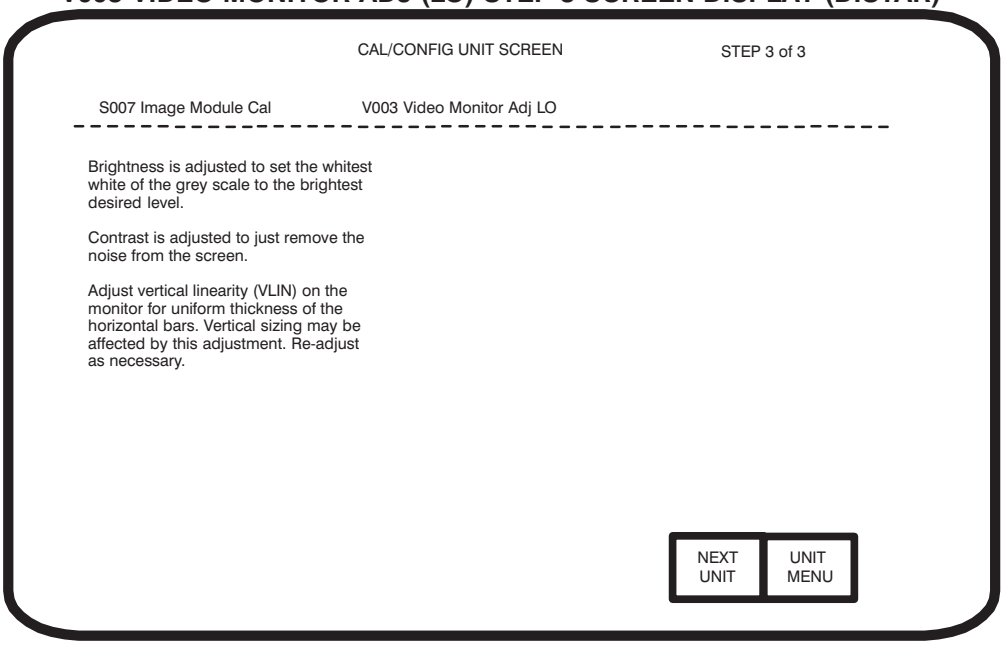
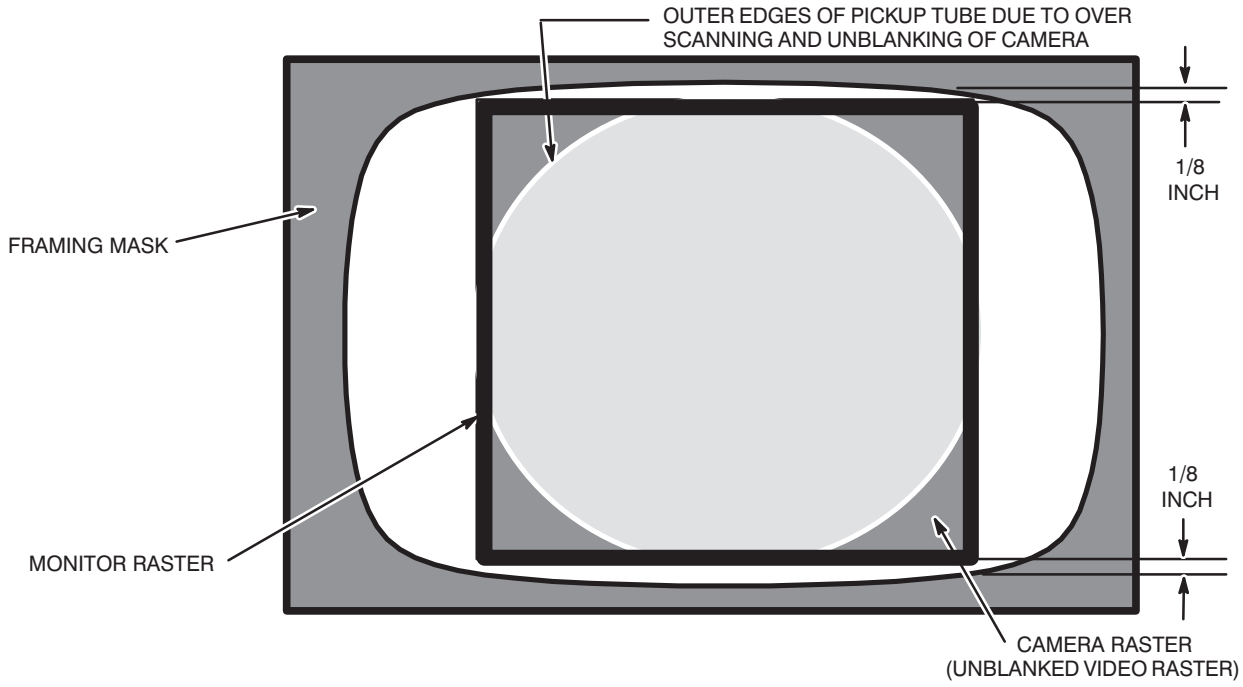


Illustration 46 – V003, Step 2, Monitor Adjustment (HI and LO)



Note: Be sure to use the inner most raster for sizing.

Note: If the camera raster is not round, the aspect ratio (set in Step 2) may be improperly adjusted and/or TV lens cal (Ref V011) may be in error.

2 DISTAR–M TV MONITOR CALIBRATION

Note: There are two types of TV Monitors covered by cal unit V003: Distar and Distar–M. Section 1 covers the Distar calibration procedure. Section 2 covers the Distar–M calibration procedure.

2-1 Description

Calibration Unit V003 is used to adjust the Brightness and Contrast of the Video Monitor. The Vertical Size and Center and Horizontal Size and Center are factory adjusted and should not need readjustment. Brightness sets the gain of the total signal displayed on the monitor. Contrast sets the gain of the input video signal. The following calibration procedure covers both the HI and LO video line rate interlace configurations.

Presentation of the appropriate unit (HI, LO) on the calibration sequence menu is a function of the system Smart Sequencer.

NOTICE

When a monitor boom installation is required, it is recommended that the calibration be performed before mounting the monitor to the boom. Access to the monitor adjustments is difficult once the monitor is on the boom.

2-2 Equipment Required

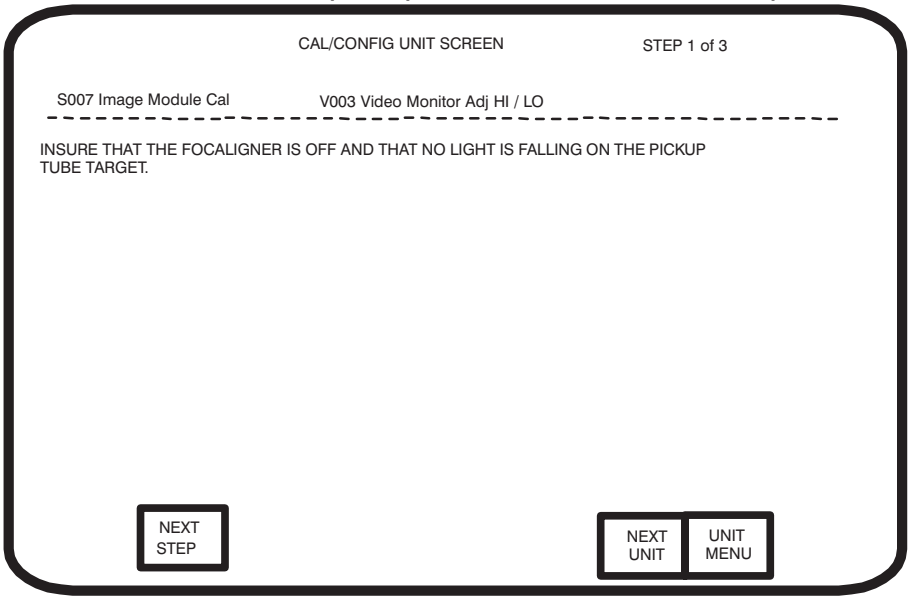
Dark cloth cover.

2-3 Cal Procedure 1 – Monitor Adjustment, HI and LO Video Line Rate Interlace

2-3-1 Step 1. Setup the Equipment

- Ensure that Focaligner is turned off and that camera is covered with a dark cloth.
- Touch NEXT STEP softkey to proceed to Step 2.

V003 VIDEO MONITOR ADJ (HI/LO) STEP 1 SCREEN DISPLAY (DISTAR–M)

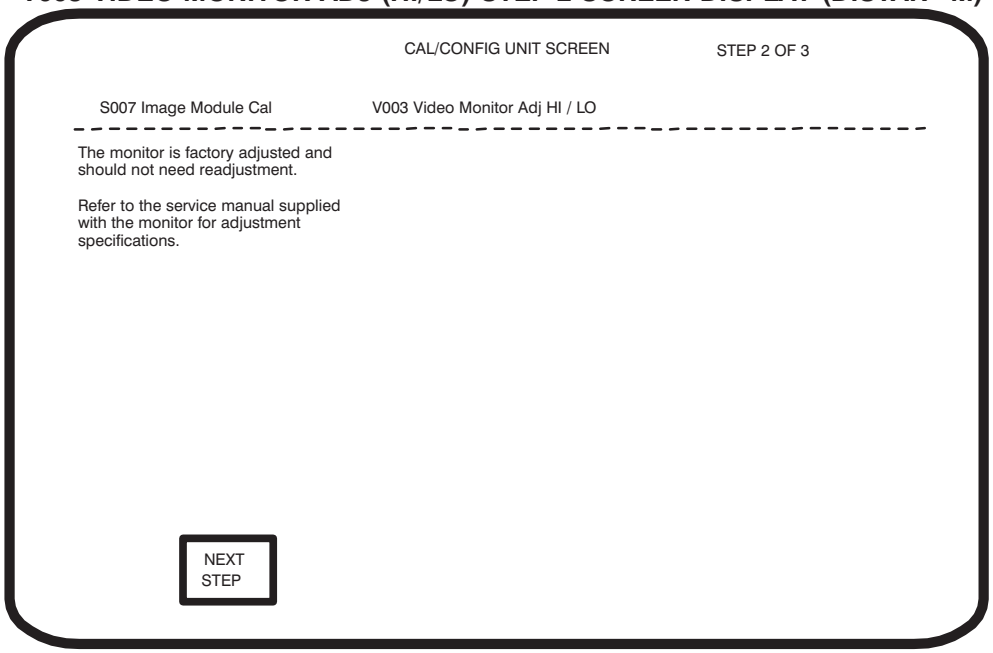


2-3-2 Step 2. Vertical and Horizontal Size and Center

Note: For systems with early software releases, the Step 2 Advantx–E console screen text may be different than the following screen illustration. In this case, ignore the screen text on the console (which contains information not relevant to Distar–M). Instead, read the text in the following screen illustration.

- The monitor is factory adjusted and should not need readjustment. Refer to the service manual supplied with the monitor for adjustment specifications.
- Touch NEXT STEP softkey to proceed to Step 3.

V003 VIDEO MONITOR ADJ (HI/LO) STEP 2 SCREEN DISPLAY (DISTAR–M)



2-3-3 Step 3. Adjust Brightness and Contrast

Note: For systems with early software releases, the Step 3 Advantx–E console screen text may be different than the following screen illustration. In this case, ignore the screen text on the console (which contains information not relevant to Distar–M). Instead, read the text in the following screen illustration.

- Upon entering Step 3, a VIC generated grey scale bar pattern is displayed on the monitor. See Illustration 47.
- Adjust monitor brightness potentiometer to set the whitest white bar on the grey scale pattern to the desired brightness level. See Illustration 47.
- Adjust monitor contrast potentiometer to just remove noise from the screen.
- Close the monitor control panel.
- Touch NEXT UNIT or UNIT MENU softkey to exit the calibration unit.

V003 VIDEO MONITOR ADJ (HI/LO) STEP 3 SCREEN DISPLAY (DISTAR–M)

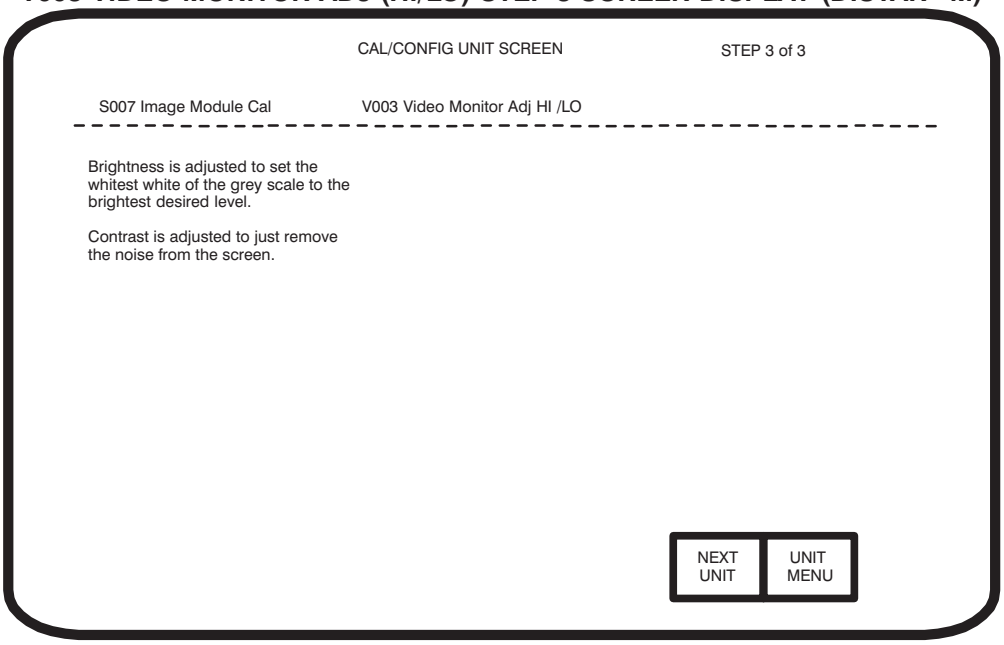
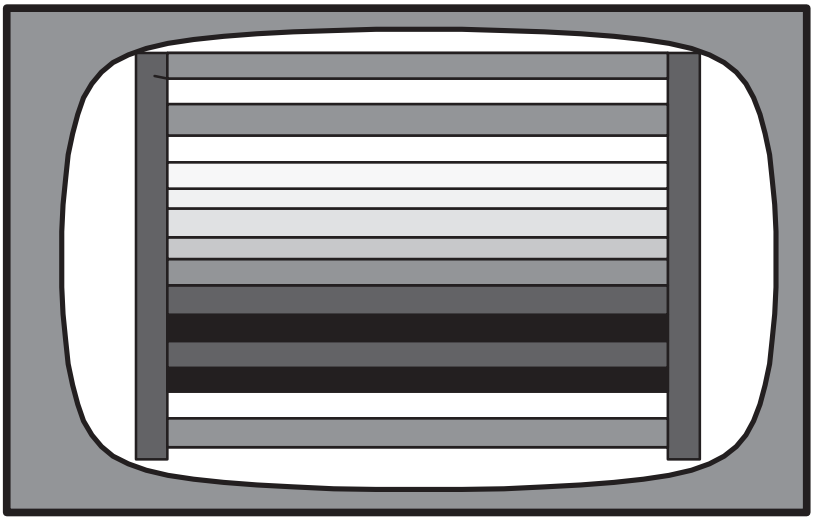


Illustration 47 – V003, Step 3, Monitor Adjustment (HI and LO)



UNIT V004 – Image Intensifier Focus

Time: x h xx min – Personnel: 1 field engineer

1 DESCRIPTION

Calibration Unit V004 is used to adjust Image Intensifier focus (G2 grid voltage) and sizing (G3 grid voltage). The G2 grid voltage adjustment alters focus while the G3 adjustment sizes the input phosphor to the output phosphor. The adjustments are interactive. All Mag Modes are calibrated by this unit.

On vascular systems configured with a Digital Image Processor, two adjustment methods are proposed for the Image Intensifier focus adjustment: Digital Calibration and Conventional Calibration. However the adjustment method for the size is still the same.

On vascular systems configured without Digital Image Processor, only one adjustment method is proposed; it is the Conventional Calibration.

Four steps are required to accomplish the calibration for either method. A screen display is provided for each step.

NOTICE

The Digital Calibration method is NOT available for single plane LCA/LCV/LC+ systems with ASC software OLDER than G4.XX; for these systems the Conventional Calibration method MUST be used.

1-1 Digital Calibration

Digital Calibration should be chosen each time it is possible: this method is more accurate, faster and less subjective than the Conventional Calibration, and allows to optimize the II focus (G2 grid voltage) at the best. It is also safer regarding the X–Ray exposure to the user. No IET or Focaligner, but only a field sizing gauge and a resolution wedge are needed. The system configures the VIC camera in DLX Fluoro and DLX in Technical Menu in order to measure the standard deviation in a Region Of Interest (ROI). This ROI is positioned on the resolution wedge image at some spatial frequency. Then the user adjusts mA to have the desired level in the ROI, and then he adjusts the II G2 grid voltage so that the standard deviation is maximum. At this point the Image Intensifier MTF is maximum and the image is the sharpest.

Note: For using this Digital Calibration method, the Digital Image processor must be calibrated, and the VIC Digital Calibration units which are normally calibrated before this unit must have been run (i.e., video gains, size and center, beam current). Refer to DX VIC and Dose Cal Sequence in Advantx Calibration User's Guide.

1-2 Conventional Calibration

Conventional Calibration is the only one available method on systems without Image Processor, or could be chosen on vascular systems with Image Processor, when you cannot use the TV camera or the Image Processor, or when you want to make a diagnosis on the Image Intensifier. This method uses Conventional Fluoro and the user can choose either to observe the image on the II using an IET or Focaligner, or to observe the image on the monitor through the TV camera; it is sure this last choice is much less accurate for the II focus adjustment (G2 grid voltage) than the choice of using the IET.

Note: Advantx systems may be equipped with either an older type “metal–input” II tube identified as an (F) tube or a newer type “all–metal” II tube identified as an (F1, HP or HX) tube.The newer (F1, HP or HX) type tubes are currently the only type tube being supplied. The calibration method provided in V004 is intended for use on systems equipped with either the older (F) type tube or the newer (F1, HP or HX) type tube. In some cases, when running V004 on (F) type tubes, the fixed input phosphor size of the older (F) type tube may limit the input size below the size specified in the size adjustment table. If this situation is encountered, the largest possible input size should be sized to the largest possible output size.

1-3 II Differences

The (F) type “metal–input” II tubes are designed with a variable output and a fixed input. The (F1, HP or HX) type “all–metal” II tubes are designed with a fixed output and variable input. See Illustration 48 and Illustration 49. The (F1, HP or HX) tubes permit full illumination of the output phosphor by using a variable input. The advantage of this feature of the (F1, HP or HX) tube is that it provides a fixed output size for consistent film image sizes. Also, the output phosphor tolerance is less for the (F1, HP or HX) type tubes as shown in Table 17.

NOTICE

All systems configured with a 12–inch II tube are equipped with a 12″L (FFOV) II tube. The Image Tube Data Label normally indicates the type of tube supplied. However, when doing system upgrades standard 12″ II tubes may be encountered. Some later HP tubes were 12″L while all of the HX tubes are 12″L. One way to tell the difference between a 12″ standard II and a 12″L II is to measure the diameter of the input lead ring. The diameter of the 12″ is 272 mm, while the diameter of the 12″L is 290 mm. Another way to check is to look at the G3 Voltage value indicated on the Image Tube Data label. The 12″ G3 value is 3.6 kV, while the 12″L G3 value is 2.6 kV.

Table 17 – II Comparison Table

II SIZE	II TYPE	ENTRANCE PLANE	OUTPUT PHOSPHOR (MM)	OUTPUT MASK (MM)
9–inch	F1	212 ± 2.0	20.0 ± 0.15	20.0 ± 0.15
	HP	212 ± 2.0	20.0 ± 0.20	20.0 ± 0.20
	HX	212 ± 2.0	25.2 ± 0.20	25.2 ± 0.20
	F	212 ± 2.0	20.0 ± 0.50	21.0 ± 0.10
12–inch (Standard)	F1	272 ± 2.0	25.2 ± 0.20	25.2 ± 0.20
	F	272 ± 2.0	25.2 ± 0.50	25.2 ± 0.10
	HP	272 ± 2.0	25.2 ± 0.20	25.2 ± 0.20
12–inch L (FFOV)	HX	290 ± 2.0	25.2 ± 0.20	25.2 ± 0.20
	HP	290 ± 2.0	25.2 ± 0.20	25.2 ± 0.20
16 inch (40 cm)	F1	360 ± 2.0	30.0 ± 0.20	30.0 ± 0.20

Illustration 48 – F1 Type Image Intensifier

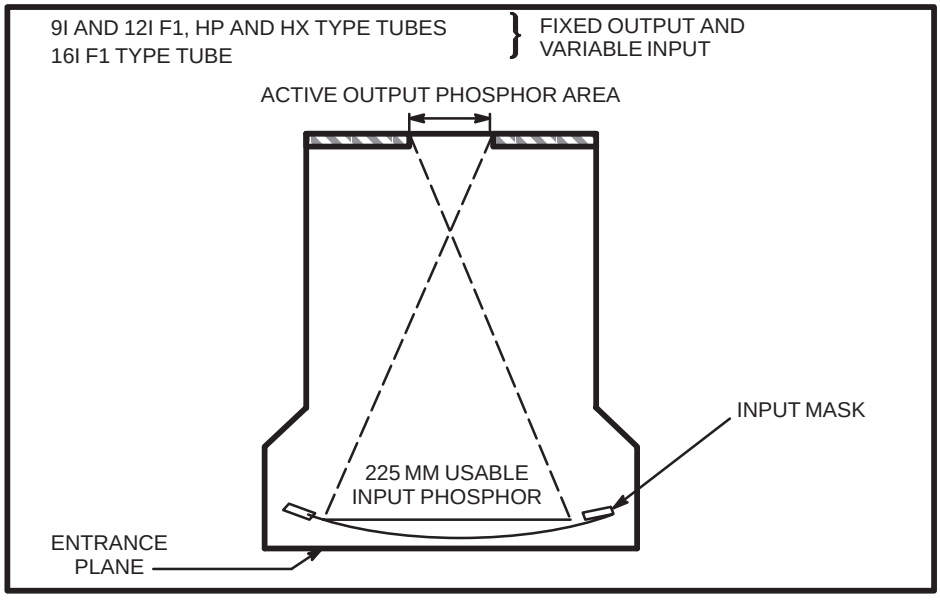
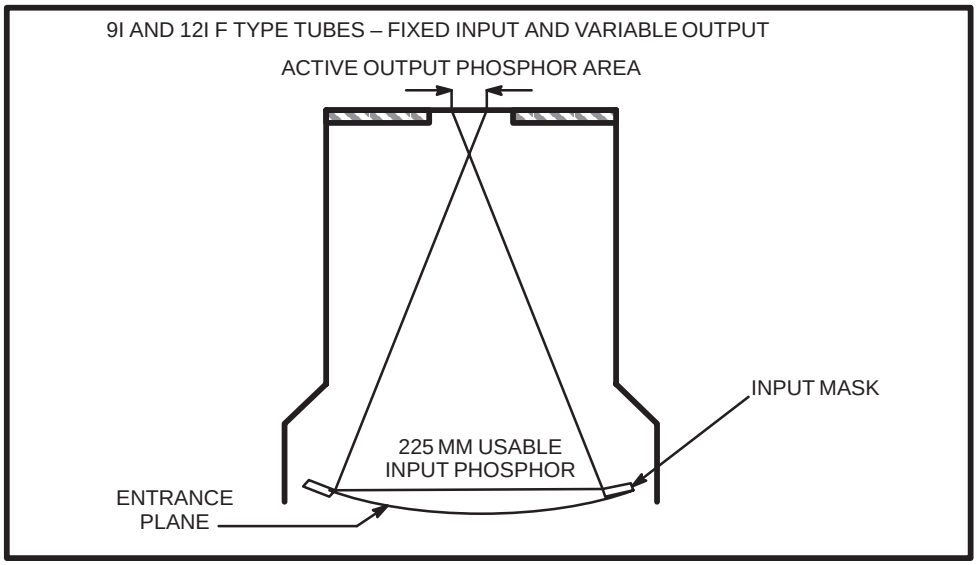


Illustration 49 – F Type Image Intensifier



2 EQUIPMENT REQUIRED

The equipment required to perform the calibration is listed below:

Note: The **Conventional Calibration** can be performed using the image on the TV monitor as the only viewing object when making adjustments. However, for optimum results, (particularly on systems equipped with Cine or DRS) an Image Evaluation Tool or Focaligner should be used for the final adjustments.

Note: On single plane LCA/LCV+/LC+ systems with NEWER ASC software (i.e., beginning with G4.XX) configured with Digital Image Processor, and on all biplane vascular systems configured with Digital Image Processor it is requested to use the **Digital Calibration** since it is more accurate for the II focus adjustment than the resolution limit method on the monitor. It is also more accurate than the resolution limit method using the IET or Focaligner and avoids X–ray exposure to the user.

IET, P/N 46–232388G1 or Focaligner (for other than biplane vascular systems with digital image processor)

Resolution Wedge, 46–197871P2 (for all systems)

Field Sizing Gauges (for all systems)

For 9–inch II Tube: 46–286485P1
For 12–inch II Tube: 46–286486P1
For 12–inch L II Tube: 46–286486P2
For 16–inch (40 cm) II Tube: 46–302601P1

CAUTION **Wear protective clothing and observe standard radiation safety practices while performing this calibration unit when using IET or Focaligner.**

3 SYSTEM SETUP

Setup the system as follows (see Illustration 50):

Note: SRI collimator does not have rails. Measure to the top of the collimator instead.

- The sizing gauges identified in the Equipment Required list have been developed to accurately set the image size at the output phosphor to a predefined (and consistent) input dimension for 9 inch II tubes, 12 inch II tubes, and 16 inch (40 cm) II tubes. The most accurate location to mount the applicable sizing gauge is to the bottom of the Image Intensifier, centered within the lead ring. For calibration of a system equipped with a Spot Film Device (SFD), the applicable gauge can be centered on the input to the SFD. The sizing adjustment requires a SID setting of 100 cm.
- Systems configured with the SFD introduce geometric magnification (because of the additional distance from the II input to the bottom of the SFD). It is mandatory that the system be set to a 100 cm SID or the sizing gauge number corrections for geometric magnification will be in error.
- On systems configured with the SFD, move the grid on the SFD out of the field of view to permit proper viewing of the image while making adjustments.

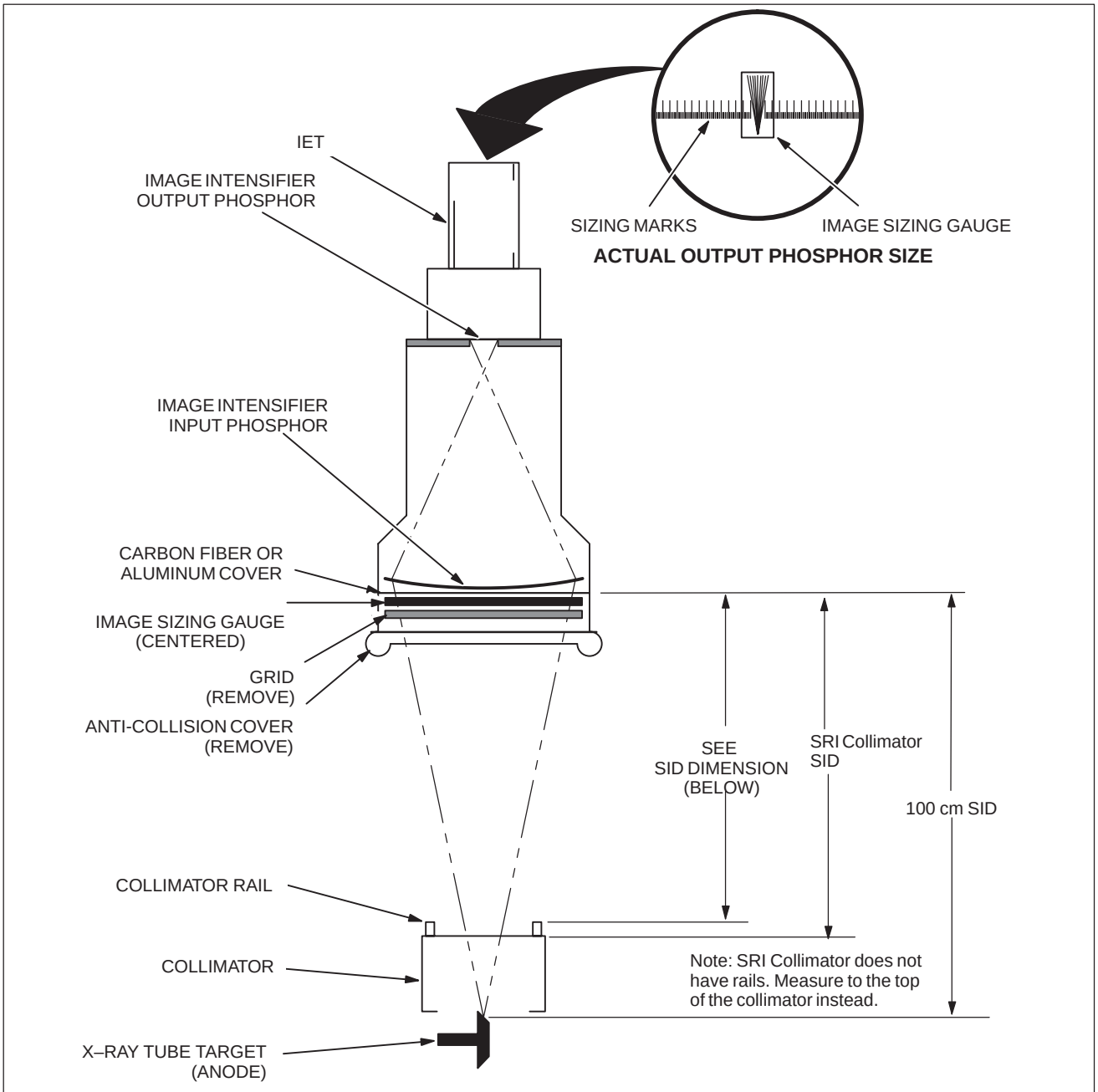
Note: On systems configured with Intelligent Spot Film Device, the collimator jog function works at the ISFD console. It is not necessary to return to the jog control softkeys displayed on the console screen to position the collimator blades. In addition, the jog function at the ISFD controls the ISFD Mask, Cone and Grid positions when running this unit.

- On systems without a SFD, remove the grid from the II to permit proper viewing of the image while making adjustments. On LCA, LCV+, LC+, LCN+, LCLP+, Tilt–C, and Tilt–C Vascular systems, you must first remove the anti–collision collar from the face of the II and then the grid.
- To establish correct SID on LCA, LCV+, LC+, LCN+, LCLP+, Tilt–C, and Tilt–C Vascular systems, you must remove the contour filters and anti–collision collar from the SRI collimator in order to accurately measure the distance from the face of the II tube to the collimator.

4 SPECIAL INSTRUCTIONS

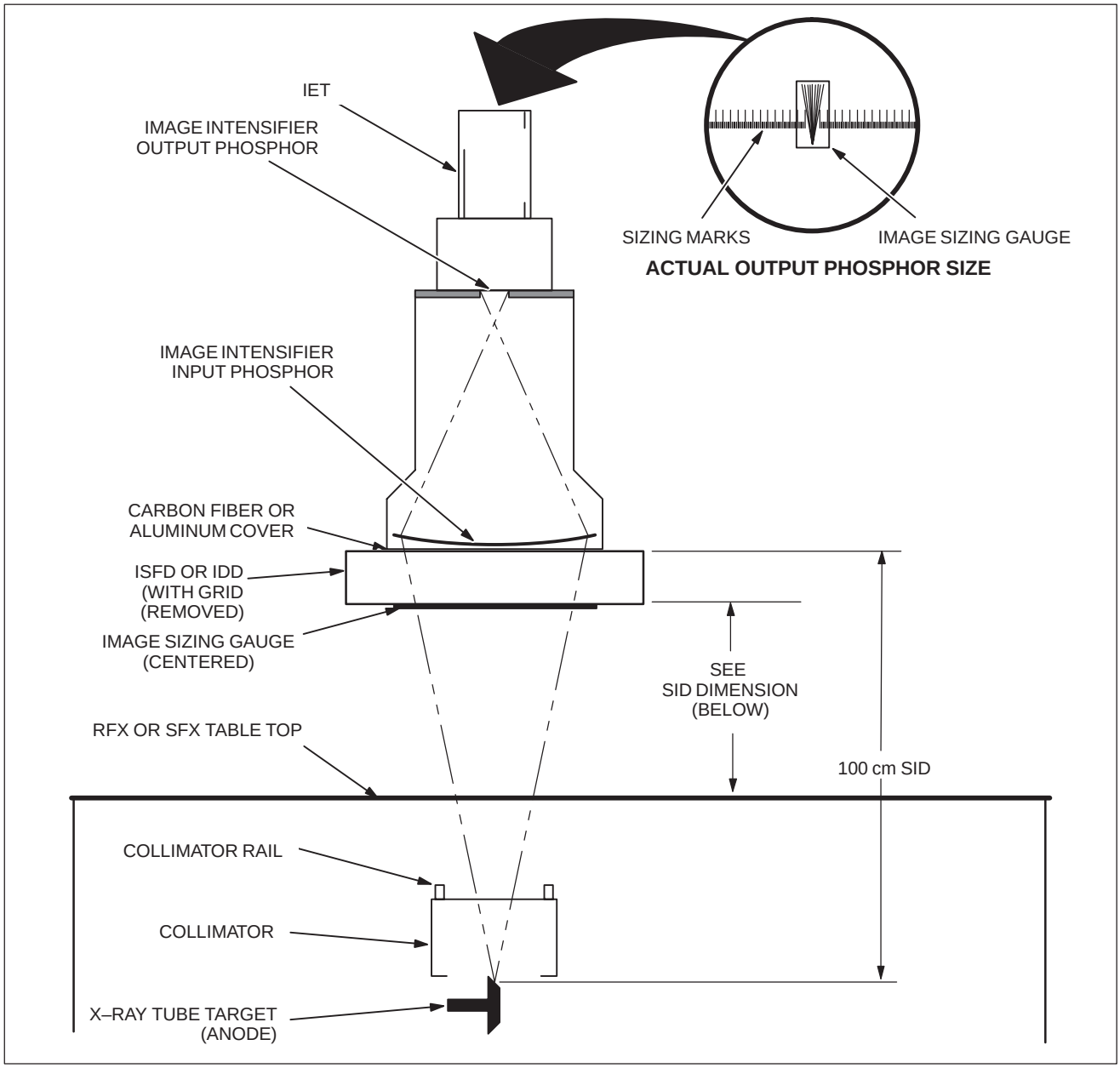
Note: **For Vascular Systems Only:** Before system calibration, verify that additional filter (copper–aluminum filter) is not installed on top of collimator. (Open sensor hinge assembly to verify.) If installed, remove before performing calibration.

Illustration 50 – SID and Sizing Gauge Positioning



SID DIMENSIONS	
COLLIMATOR TYPE	**SID**
SRI or AIV	708 mm (27.8 inches)
Sentry III	695 mm (27.3 inches)
Circular	712 mm (28.0 inches)

Illustration 51 – SID and Sizing Gauge Positioning W/ISFD or IDD



SID DIMENSIONS		
	Table Top–to–Image Sizing Gauge	
IMAGE INTENSIFIER TYPE	ISFD (Intelligent Spot Film Device)	IDD (Intelligent Digital Device)
22 CM (9 INCH)	39.51 cm (15.56 inches)	46.61 cm (18.35 inches)
32 CM (12/12L INCH)	39.51 cm (15.56 inches)	47.31 cm (18.63 inches)
40 CM (16 INCH)	38.41 cm (15.12 inches)	45.71 cm (18.00 inches)

5 CAL PROCEDURE 1

5-1 Conventional Calibration

Note: If the system is a vascular one and configured with a digital image processor, you may choose to use Conventional Calibration for some special reason or need. However, it is requested to use the Digital Calibration for a normal adjustment procedure, because it is more accurate, less user dependent and safer with regard to X–ray exposure. In that case refer to **Cal Procedure 2.**

NOTICE

The Digital Calibration method is NOT available for single plane LCA/LCV/LC+ systems with ASC software OLDER than G4.XX; for these systems the Conventional Calibration method MUST be used.

5-2 Step 1. Select Conventional Calibration and Image Gate Port

- Touch Conventional Calibration softkey if available (this softkey is not available when the system is configured without digital image processor).
- Select an image gate port for installation of the Focaligner or Image Evaluation Tool (IET). If possible, select a port other than the one assigned to the TV Camera. If the TV Camera port must be used, the Focaligner or IET will have to be exchanged with the TV Camera at various steps in the calibration procedure. Typical port assignments are as follows:

PORT	SINGLE PLANE VASCULAR SYSTEM	BIPLANE VASCULAR SYSTEM	R&F SYSTEM
1 FRONT	N/A	N/A	N/A
2 RIGHT	CINE	TV (FOR LATERAL)	N/A
3 TOP	TV	N/A	N/A
0 LEFT	PHOTOSPOT	TV (FOR LATERAL)	TV

- Remove the cover from an unused port. If the TV Camera port is used, remove the camera from the port.
- Install the Focaligner or Image Evaluation Tool (IET) on the selected port.

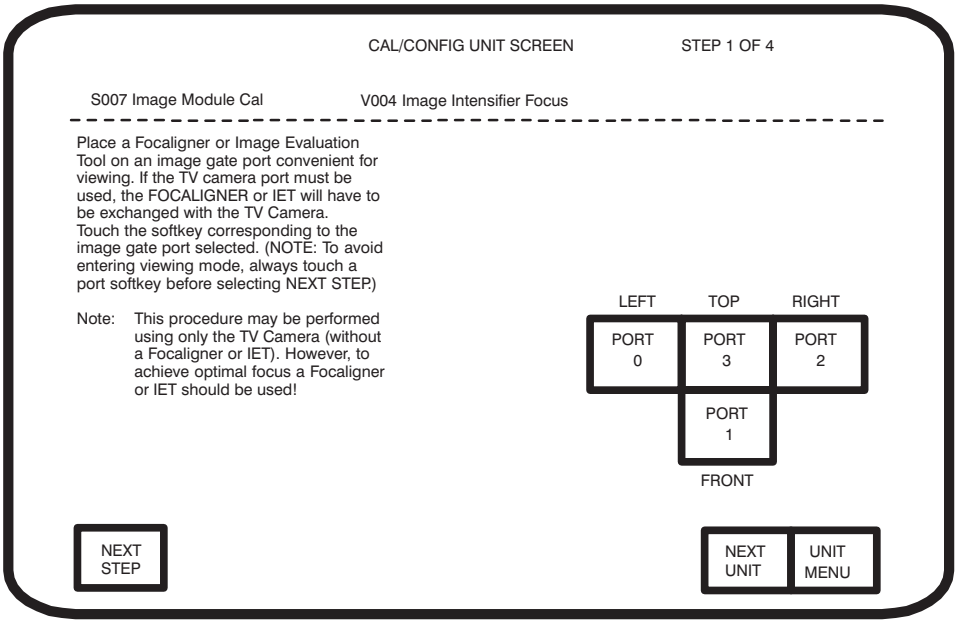
Note: You must select a port even if a focaligner or IET is not used. Select any port or the port that you would select if you were using a focaligner or IET.

- Touch the applicable softkey for the selected port.
- Touch NEXT STEP softkey to proceed to Step 2.

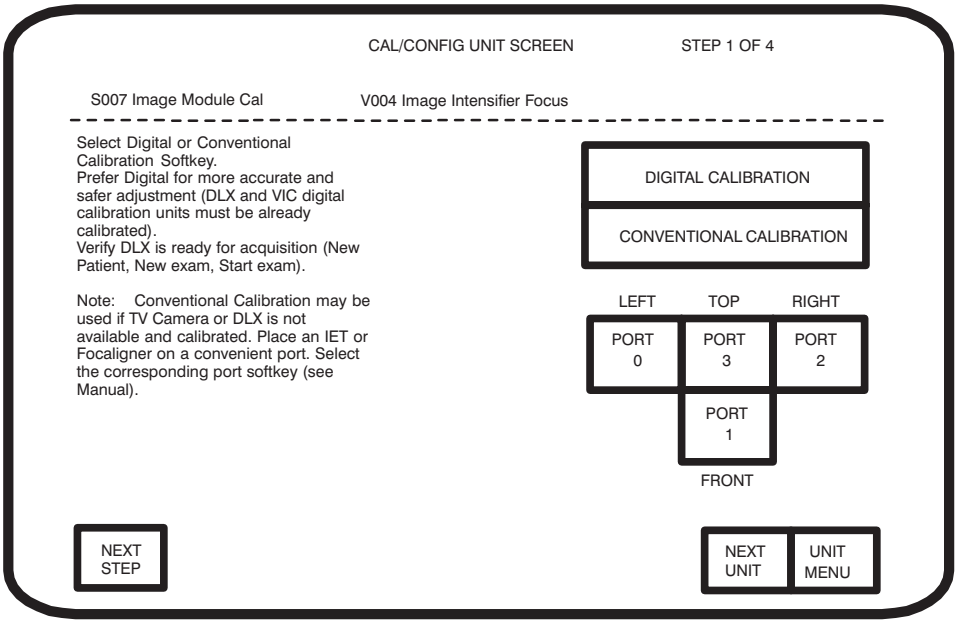
NOTICE

Do not touch the screen while the message “WAITING FOR POSITIONER” is displayed. Touching a part of the unpainted screen at this time may activate invisible softkeys that will cause the unit to execute a function immediately after the message is removed.

V004 STEP 1 SCREEN DISPLAY WITHOUT DIGITAL CONFIGURATION



V004 STEP 1 SCREEN DISPLAY WITH DIGITAL CONFIGURATION



Note: When Digital Calibration softkey is highlighted, PORT 0,1,2,3 softkeys are not displayed. They are displayed when Conventional Calibration softkey is highlighted.

5-3 Step 2. Setup the System for Conventional Calibration

- Tape the resolution wedge (P/N 46–197871P2) to the back of the applicable sizing gauge using the alignment marks provided on the front of the gauge. See Illustration 52. Orient the resolution wedge so that the high–resolution end is toward the center of the field.
- Tape the sizing gauge/resolution wedge to the bottom surface of the II tube (centered within the lead ring). Mount perpendicular to the TV raster lines. On systems equipped with the 8835/8535 SFD or ISFD, the sizing gauge/resolution wedge must be taped to the bottom of the SFD in the exact center.
- Touch TV CAMERA on the split softkey. Initiate and maintain a fluoro exposure. A fixed technique of 60 kVp is used. Touch the MANUAL softkey and use the console dial to adjust mA for a good fluoro image as seen on the TV monitor. Verify that the field sizing gauge and resolution wedge are centered.

Note: Setup the system for operator safety. Before viewing the image through the Focaligner or IET, use the JOG softkeys on the console (or ISFD console) to position the collimator blades into the field of view until only one half of the field is visible on the monitor. Readjust mA if necessary.

- Touch FOCALIGNER/IET on the split softkey if a Focaligner or IET is used. Initiate and maintain a fluoro exposure. A fixed technique of 60 kVp is used. Touch the MANUAL softkey and use the console dial to adjust mA for a good fluoro image as seen on the Focaligner or IET. Verify that the field sizing gauge and resolution wedge are centered.
- The FOCALIGNER/IET and TV CAMERA split softkey can now be used to toggle between viewing the image on the Focaligner/IET or the TV Camera.

  With Focaligner/IET activated:

  1. The TV Camera is blanked.
  2. VIC is configured in Conventional Fluoro.
  3. The image gate is moved to view Focaligner/IET.
  4. The system remembers the mA value set for viewing the Focaligner/IET.

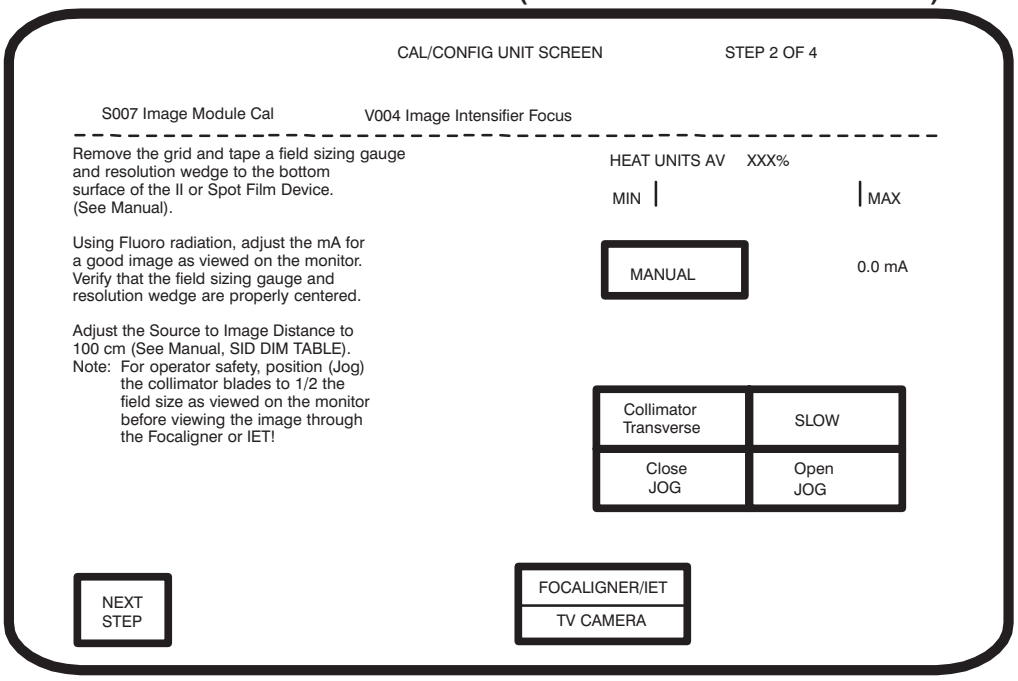
  With TV Camera activated:

  1. The TV Camera is unblanked.
  2. VIC is configured in Conventional Fluoro.
  3. The image gate is moved to view the TV Camera.
  4. The system remembers the mA value set for viewing the TV Camera.
- Adjust the Source to Image Distance (SID). The distance between the x–ray tube target (anode) and II tube must be 100 cm (39.4 inches). Because the 100 cm SID is difficult to measure in the field, the distance between the face of the II tube (or Lexan face of the SFD) and the rails of the type of collimator installed in the system are used to establish SID. See Illustration 50 for SID positioning data.

Note: On LCA, LCV+, LC+, LCN+, LCLP+, Tilt–C, and Tilt–C Vascular systems, you must remove the contour filters and anti-collision collar from the SRI collimator in order to accurately measure the distance from the face of the II tube to the collimator.

- Touch NEXT STEP softkey to proceed to Step 3.

V004 STEP 2 SCREEN DISPLAY (CONVENTIONAL CALIBRATION)



V004 STEP 3 SCREEN DISPLAY (CONVENTIONAL CALIBRATION)

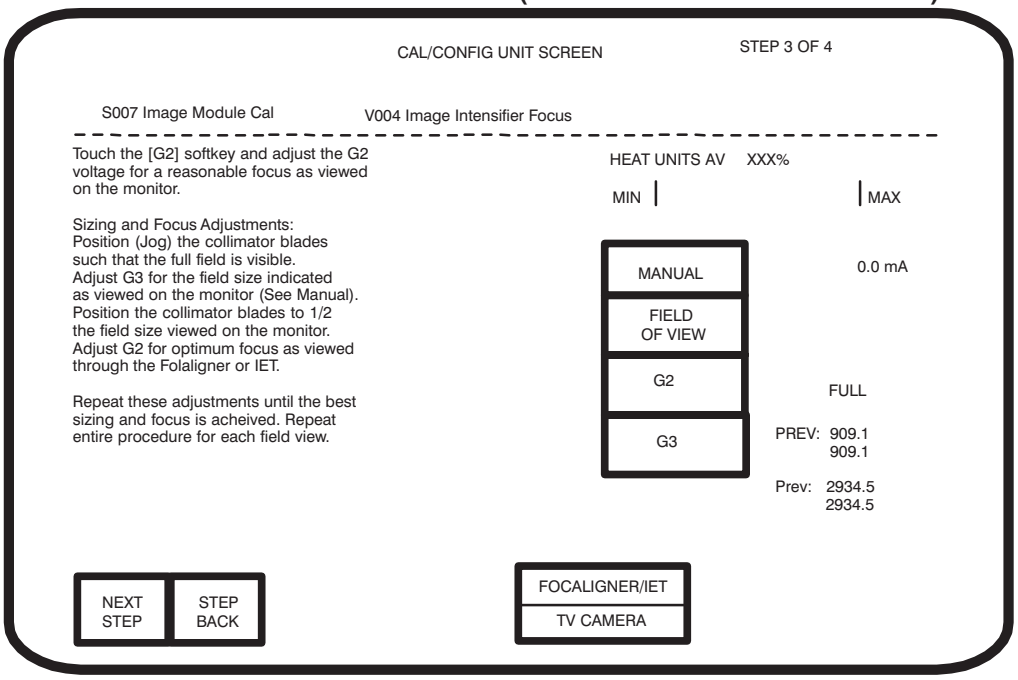
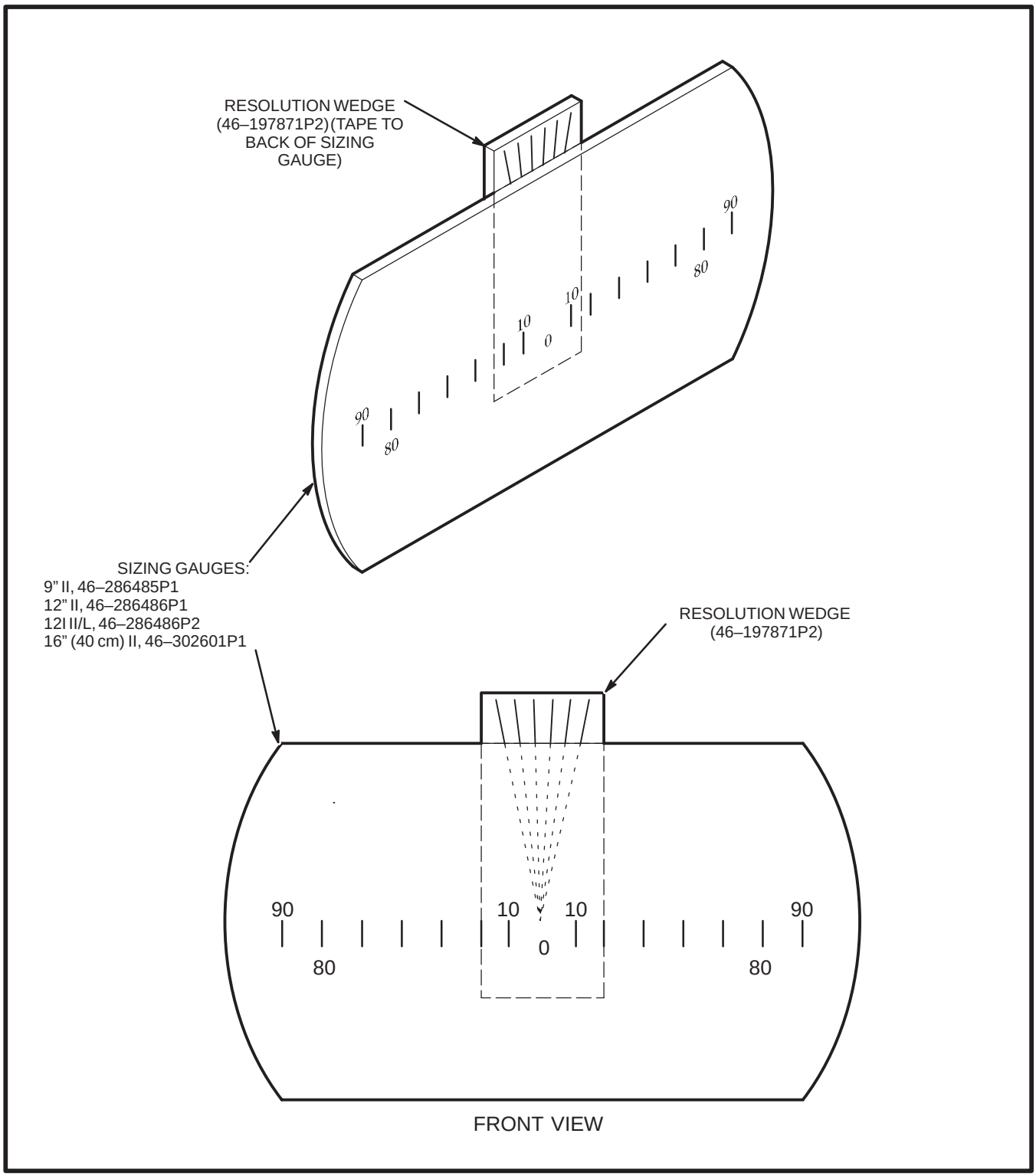


Illustration 52 – Wedge Positioning for Conventional Calibration



5-4 Step 3. Focus/Size Adjustment for Conventional Calibration

- Touch the FIELD OF VIEW softkey and use the console dial to select FULL or the applicable Mag mode (MAG 1, MAG 2, MAG 3) field of view.
- Touch the TV CAMERA split softkey. Take and maintain a fluoro exposure. If necessary, touch the MANUAL softkey and use the console dial to re–adjust mA for a good fluoro image on the TV monitor.
- Touch the G2 softkey and use the console dial to adjust the G2 voltage for a reasonable focus as viewed on the TV monitor. Terminate the exposure.
- Touch the STEP BACK softkey to return to the Step 2 screen display for access to the collimator jog functions. Position (Jog) the collimator blades to a position that allows the **full field size** to be visible on the TV monitor.
- Take and maintain a fluoro exposure. Touch G3 softkey. Use the console dial to adjust the field size of the image as viewed on the TV monitor to the dimension indicated in the applicable image size adjustment tables. The sizing gauge starts with “0” in the center of the FOV. To correctly read the gauge, adjust until the sum of the two sides meet the specifications indicated in the appropriate size adjustment tables. See Table 18, Table 19 and Table 20).

EXAMPLE: When sizing a 9″ II tube in MAG 2 mode with sizing gauge at II input, 118 mm is the desired size. Either of the following measurements is correct:

1. You measure 59 mm on the left edge of the II tube and 59 mm on the right edge of the II tube. The sum is 118 mm.
2. You measure 55 mm on the left edge of the II tube and 63 mm on the right edge of the II tube. The sum is still 118 mm.

Table 18 – Size Adjustment – 9″ II Tube

	WITH GAUGE AT II INPUT	WITH GAUGE AT ISFD INPUT	WITH GAUGE AT IDD INPUT
NORMAL	212 MM +/–2 MM	189 MM +/–2 MM	204 MM +/–2 MM
MAG 1	158 MM +/–2 MM	141 MM +/–2 MM	152 MM +/–2 MM
MAG 2	118 MM +/–2 MM	105 MM +/–2 MM	113 MM +/–2 MM

Table 19 – Size Adjustment – 12″ & 12″ L II Tube

	WITH GAUGE AT II INPUT		WITH GAUGE AT ISFD INPUT		WITH GAUGE AT IDD INPUT
	12″	12″ L	12″	12″ L	12″ L
NORMAL	272 MM +/–2 MM	290 MM +/–2 MM	244 MM +/–2 MM	258 MM +/–2 MM	281 MM +/–2 MM
MAG 1	215 MM +/–2 MM	215 MM +/–2 MM	193 MM +/–2 MM	191 MM +/–2 MM	208 MM +/–2 MM
MAG 2	160 MM +/–2 MM	160 MM +/–2 MM	143 MM +/–2 MM	142 MM +/–2 MM	155 MM +/–2 MM
MAG 3	120 MM +/–2 MM	120 MM +/–2 MM	108 MM +/–2 MM	107 MM +/–2 MM	116 MM +/–2 MM

Table 20 – Size Adjustment – 16″ (40 CM) II Tube

	WITH GAUGE AT II INPUT	WITH GAUGE AT ISFD INPUT	WITH GAUGE AT IDD INPUT
NORMAL	360 MM +/–2 MM	316 MM +/–2 MM	343 MM +/–2 MM
MAG 1	290 MM +/–2 MM	255 MM +/–2 MM	276 MM +/–2 MM
MAG 2	215 MM +/–2 MM	189 MM +/–2 MM	205 MM +/–2 MM
MAG 3	160 MM +/–2 MM	141 MM +/–2 MM	152 MM +/–2 MM

Note: For Normal FOV the fixed values are minimum values (i .e min = 360 mm, max = 362 mm).

The G2 and G3 adjustments are interactive. A warning message will appear on the screen if more than a five percent change is made to either adjustment value from its previous value.

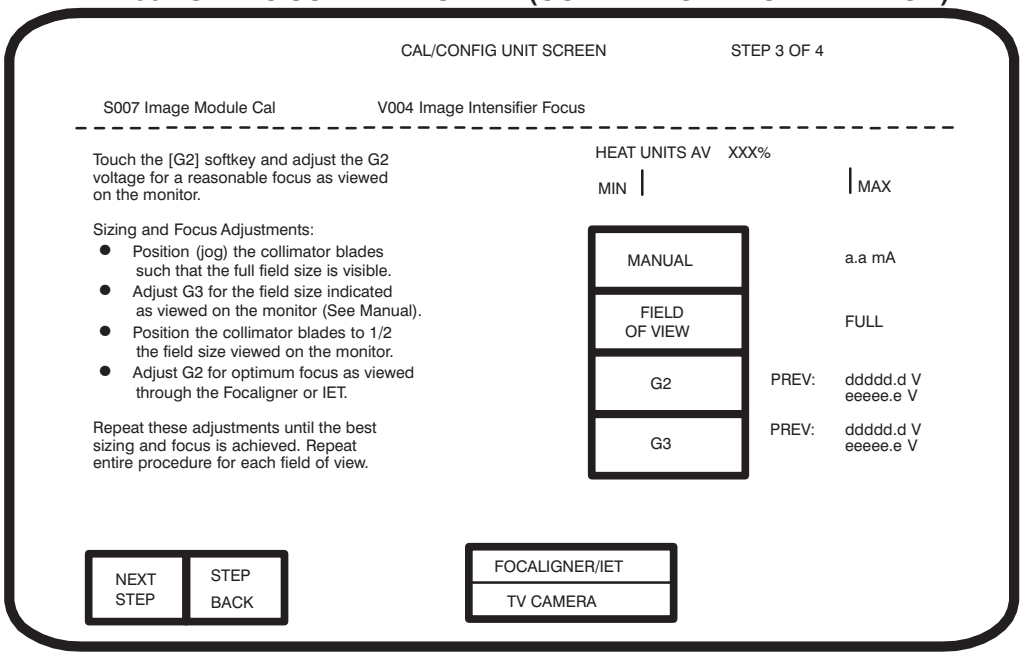
- Terminate the exposure.
- Setup the system for operator safety. Before viewing the image through the Focaligner or IET, use the JOG softkeys on the console (or SFD) to position the collimator blades into the field of view until only one half of the field is visible on the monitor. Readjust mA if necessary.
- Take and maintain a fluoro exposure. Touch the G2 softkey and use the console dial to adjust the G2 voltage for optimum focus as viewed through the IET or Focaligner.



Wear protective clothing and observe standard radiation safety practices while performing this calibration unit when using IET or Focaligner.

- Terminate the exposure.
- Repeat the G2 and G3 adjustments as necessary to achieve optimum focus and sizing. Verify that for the optimal focus reached, the sizing remains in the specification of Table 18, Table 19 and Table 20.
- Touch FIELD OF VIEW softkey and using the console dial enter the next field of view to be adjusted. Repeat the Step 3 adjustments. Then, select another field of view and repeat adjustments until all fields of view have been calibrated.
- Touch NEXT STEP softkey to proceed to Step 4.

V004 STEP 3 SCREEN DISPLAY (CONVENTIONAL CALIBRATION)

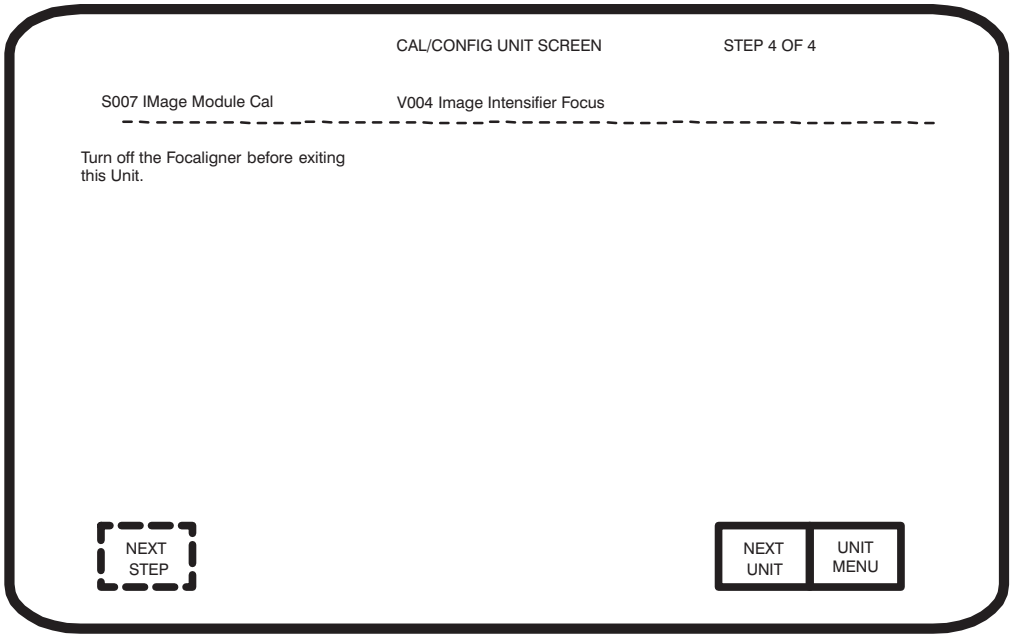


5-5 Step 4. Secure Equipment

- Remove the Focaligner or IET from the image gate and replace the port cover (or camera) that belongs on that port.
- Replace II grid, anti-collision covers, and contour filter.
- Touch NEXT UNIT or UNIT MENU softkey to exit the calibration unit. Exiting the unit loads the command values for the respective grids and fields of view into NV RAM.

Note: After completing the calibration, use Calibration Unit V068, Objective Lens – Focus and Centering to check the focus of the Objective lens. If necessary, rerun Calibration Unit V068 and retouch the focus.

V004 STEP 4 SCREEN DISPLAY (CONVENTIONAL CALIBRATION)



Note: The NEXT STEP softkey is only displayed during the viewing (Browse) mode to permit return to Step 1 screen display.

6 CAL PROCEDURE 2

6-1 Digital Calibration

Note: If the system is a vascular one and is configured with a digital image processor, you are requested to use the Digital Calibration because it is more accurate, less user dependent and safer with regard to X–ray exposure. However, in some cases you could prefer to use the other available calibration method, for example when you cannot use the TV camera or the Image Processor, or when you want to make a diagnosis on the Image Intensifier. In that case refer to **Cal Procedure 1.**

NOTICE

The Digital Calibration method is NOT available for single plane LCA/LCV/LC+ systems with ASC software OLDER than G4.XX; for these systems the Conventional Calibration method MUST be used.

Note: For using this Digital Calibration method, the Digital Image processor must be calibrated, and the VIC Digital Calibration units which are normally calibrated before this unit must have been run (i.e., video gains, size and center, beam current). Refer to DX VIC and Dose Cal Sequence in Advantx Calibration User's Guide.

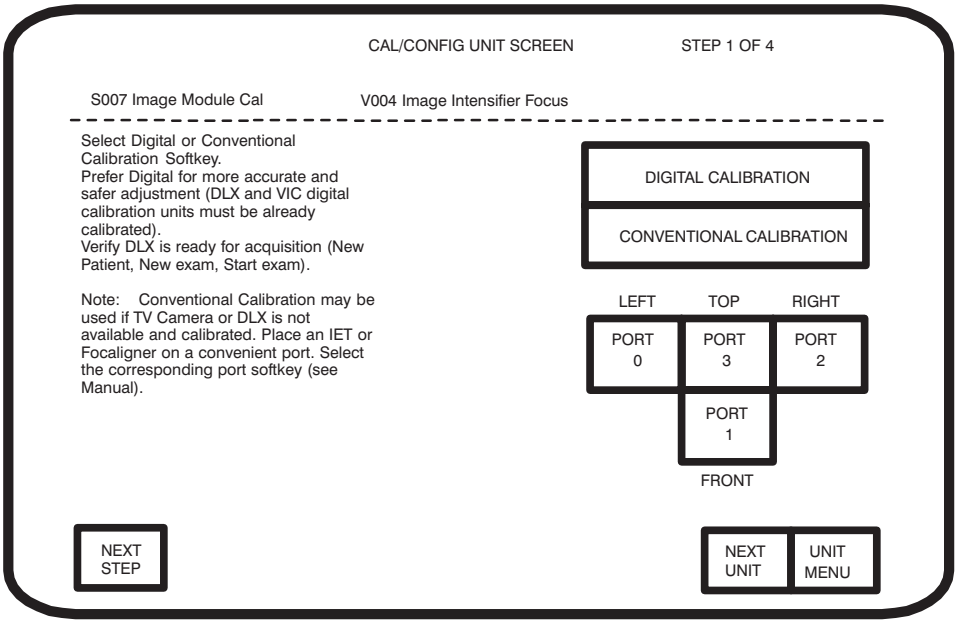
6-2 Step 1. Select Digital Calibration

- At the "DLX LOGIN" prompt on the DLX console, type "DLX" and press the RETURN key.
- Verify that the ACQUISITION screen is displayed on the DLX console. If the ACQUISITION screen is not displayed, press the following keys to continue:
  - NEW EXAM
  - NEW PATIENT (you must also enter a patient name and ID number or the DLX will not be enabled.)
  - START EXAM
- Touch Digital Calibration softkey.
- Touch NEXT STEP softkey to proceed to Step 2.

NOTICE

Do not touch the screen while the message "WAITING FOR POSITIONER" is displayed. Touching a part of the unpainted screen at this time may activate invisible softkeys that will cause the unit to execute a function immediately after the message is removed.

V004 STEP 1 SCREEN DISPLAY WITH DIGITAL CONFIGURATION



Note: When Digital Calibration softkey is highlighted, PORT 0,1,2,3 softkeys are not displayed. They are displayed when Conventional Calibration softkey is highlighted.

6-3 Step 2. Setup the System for Digital Calibration

- Verify DLX console displays Technical Menu screen.
- Remove the grid.
- Tape the sizing gauge to the bottom surface of the II tube (centered within the lead ring). Mount its long axis parallel to the TV raster lines (see Illustration 53 and Illustration 54).
- Tape the resolution wedge (P/N 46–197871P2) to the back of the applicable sizing gauge using the alignment marks provided on the front of the gauge. Orient the resolution wedge so that the high–resolution end is toward the bottom of the field. The resolution wedge must be positioned so that the following spatial frequency is centered in the image, for each FOV to adjust (see Illustration 53 and Illustration 54).

Table 21 – Resolution Wedge Positioning

	40 cm (16”) II (lp/mm)	32 cm (12”) II (lp/mm)	22 cm (9”) II (lp/mm)
NORMAL	0.5	0.6	0.9
MAG 1	0.6	0.9	1.2
MAG 2	0.9	1.2	1.5
MAG 3	1.2	1.5	N/A

- Adjust the Source to Image Distance (SID). The distance between the x–ray tube target (anode) and II tube must be 100 cm (39.4 inches). Because the 100 cm SID is difficult to measure in the field, the distance between the face of the II and the top of the collimator installed in the system is used to establish SID. See Illustration 50 for SID positioning data.

Note: On LCA, LCV+, LC+, LCN+ and LCLP+ systems, you must remove the contour filters and anti-collision collar from the SRI collimator in order to accurately measure the distance from the face of the II tube to the collimator.

- Initiate and maintain a fluoro exposure. A fixed technique of 60 kVp is used. Touch the MANUAL softkey and use the console dial to adjust mA for a good fluoro image as seen on the TV monitor. Verify that the field sizing gauge and the right value of spatial frequency on the resolution wedge are centered.
- Adjust collimator blades slightly larger than the field of view so that the field sizing gauge is entirely visible. Use the JOG softkeys on the Advantx console to position the collimator blades. Readjust mA if necessary..

- When entering into that step, the system is automatically configured so that:
  1. The TV Camera is unblanked.
  2. The image gate is moved to view the TV Camera.
  3. The system is configured in pulsed fluoro, low line rate.
  4. VIC is configured in low gain path, without EDR.
  5. Image Processor is is configured in DLX fluoro.
  6. Image Processor TV image is displayed on the monitor.
  7. Image Processor is configured in Technical Menu, without Circular Shutter and with LIH (Last Image Hold).
  8. The system remembers the mA value set for viewing the TV Camera.
- Touch NEXT STEP softkey to proceed to Step 3.

V004 STEP 2 SCREEN DISPLAY (DIGITAL CALIBRATION)

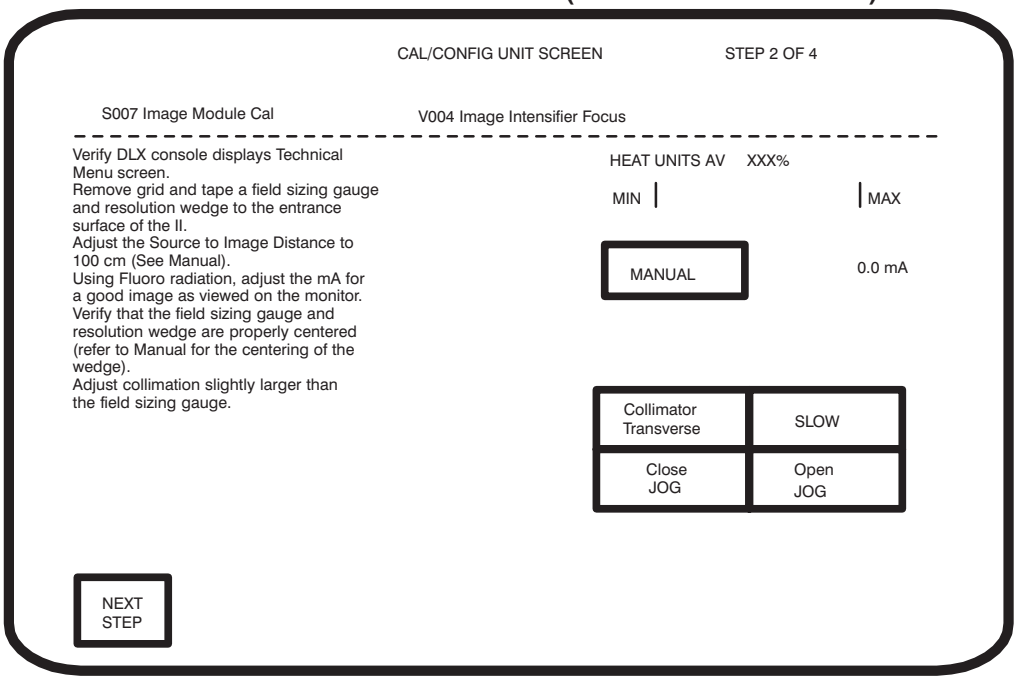
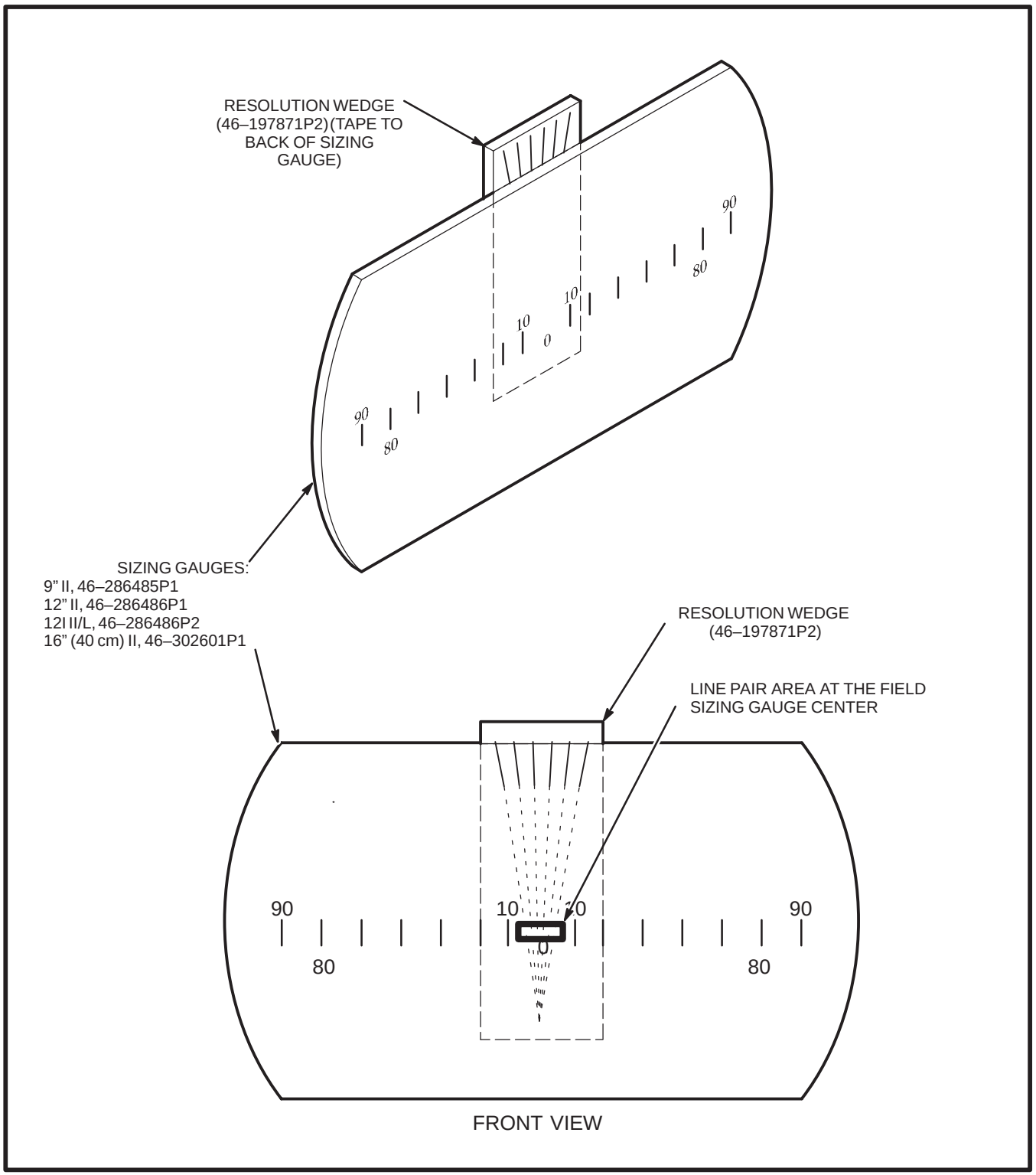


Illustration 53 – Wedge Positioning for Digital Calibration



6-4 Step 3. Focus/size Adjustment for Digital Calibration

- Touch the FIELD OF VIEW softkey and select FULL or the applicable Mag mode (MAG1, MAG2, MAG3) field of view.
- Take and maintain a fluoro exposure. Touch the MANUAL softkey and use the console dial to re–adjust mA for a good fluoro image on the TV monitor.
- Touch the G2 softkey and use the console dial to adjust the G2 voltage for a reasonable focus as viewed on the TV monitor. Terminate the exposure.
- If necessary, touch the STEP BACK softkey to return to the Step 2 screen display for access to the collimator jog functions. Position (Jog) the collimator blades to a position that allows the **full field size** to be visible on the TV monitor.
- Take and maintain a fluoro exposure. Touch G3 softkey. Use the console dial to adjust the field size of the image as viewed on the TV monitor to the dimension indicated in the applicable image size adjustment tables. The sizing gauge starts with “0” in the center of the FOV. To correctly read the gauge, adjust until the sum of the two sides equals the distance indicated in the appropriate size adjustment tables. See Table 18, Table 19 and Table 20).

EXAMPLE: When sizing a 9I II tube in MAG 2 mode with sizing gauge at II input, 118 mm is the desired size. Either of the following measurements is correct:

1. You measure 59 mm on the left edge of the II tube and 59 mm on the right edge of the II tube. The sum is 118 mm.
2. You measure 55 mm on the left edge of the II tube and 63 mm on the right edge of the II tube. The sum is still 118 mm.

Note: The G2 and G3 adjustments are interactive. A warning message will appear on the screen if more than a five percent change is made to either adjustment value from its previous value.

- Terminate the exposure.
- On DLX technical Menu, select Camera Centering function.
- Using fluoro, position the line pair area of the resolution wedge corresponding to the FOV on the image center (see Table 21).
- On DLX console, position a Region of Interest (ROI) on the Last Image Hold (LIH image) on the same line pair area of the resolution wedge (see Illustration 54).

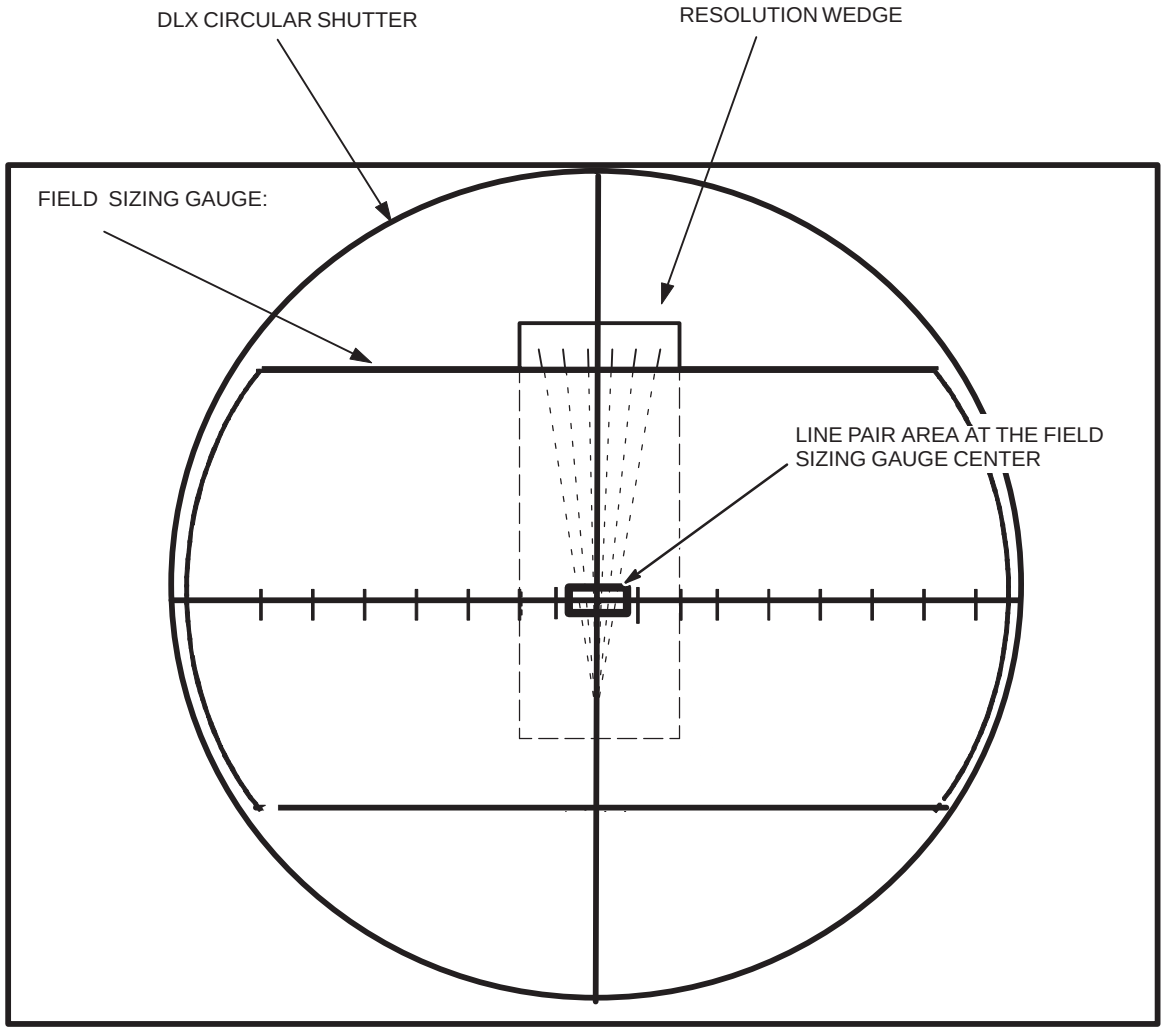
Note: This ROI should be positioned only on the line pair area without extending beyond the lead area. Its width should be between 3 and 5 times its height, so that the ROI measures the levels at the desired spatial frequency.

- On DLX console, select LEVEL ADJUST and 10 BITS functions.
- Take and maintain a fluoro exposure and read the **mean value** in the ROI on the monitor. Touch MANUAL softkey and adjust mA with the console dial so that the **mean value** in the ROI is between 100 and 120 lsb.
- Read the **standard deviation** value in the ROI on the monitor. Touch the G2 softkey. Use the console dial to adjust the G2 voltage for the **maximum standard deviation**.

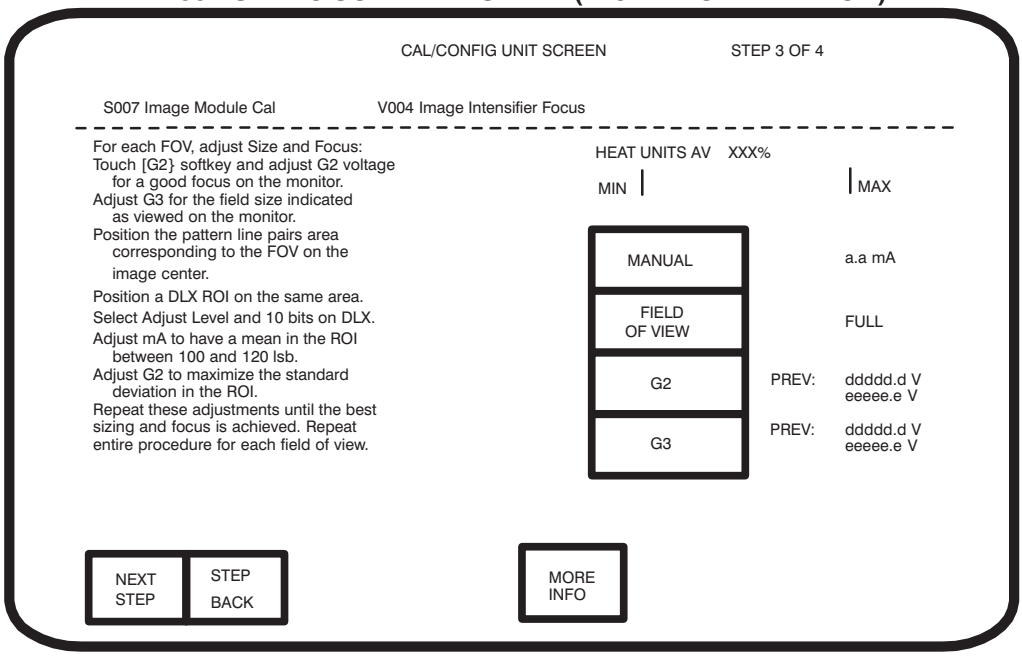
Note: Do not adjust G2 voltage too fast with the console dial, especially when it is close to the final optimized value. There is a delay between the actual G2 voltage in the Image Intensifier and the dialed voltage at the console during the adjustment; thus slowly increase or decrease II G2 voltage when optimizing the standard deviation.

- Terminate the exposure.
- Repeat the G2 and G3 adjustments as necessary to achieve optimum focus and sizing. Verify that for the optimal focus reached, the sizing remains in the specification of Table 18, Table 19 and Table 20.
- Touch FIELD OF VIEW softkey, and using the console dial enter the next field of view to be adjusted. Repeat the Step 3 adjustments. Then, select another field of view and repeat adjustments until all fields of view have been calibrated.
- Touch NEXT STEP softkey to proceed to Step 4.

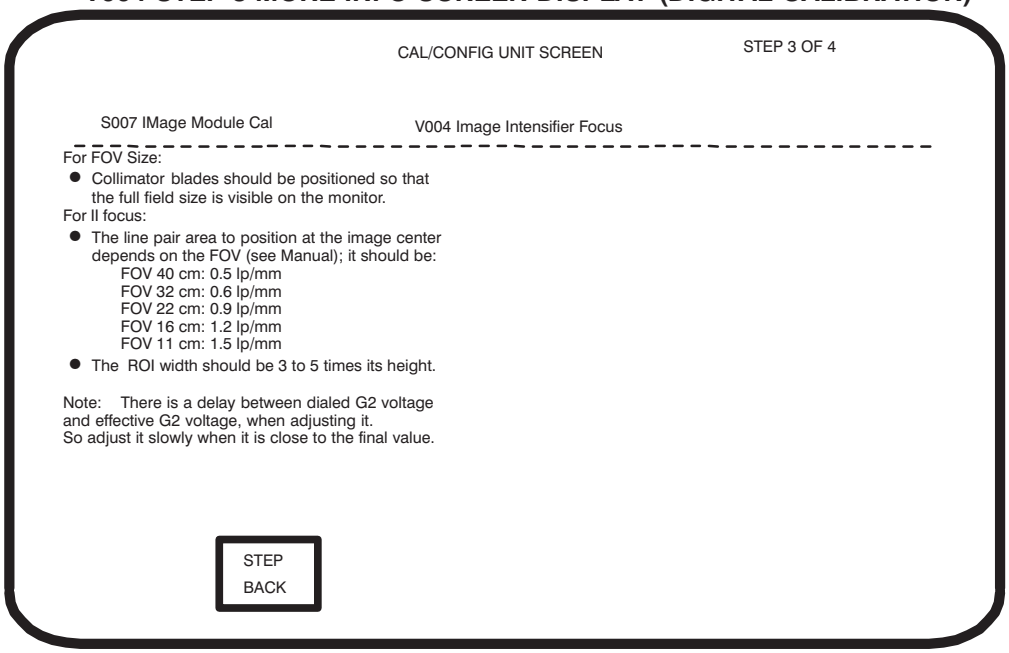
Illustration 54 – Wedge Positioning on the Monitor Image for Digital Calibration



V004 STEP 3 SCREEN DISPLAY (DIGITAL CALIBRATION)



V004 STEP 3 MORE INFO SCREEN DISPLAY (DIGITAL CALIBRATION)

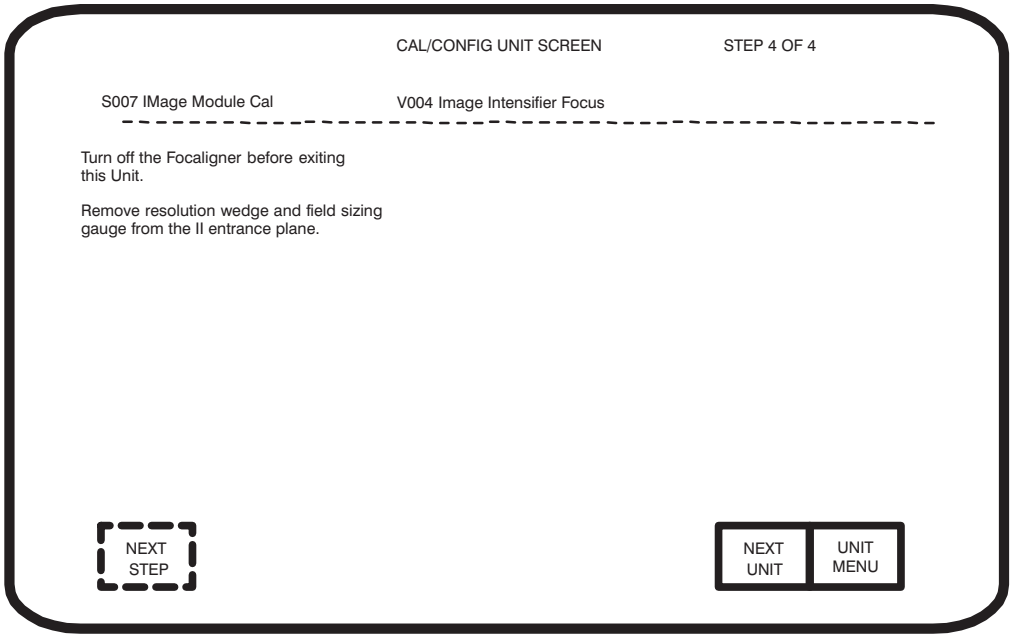


6-5 Step 4. Secure Equipment

- Switch off the Focaligner or IET (if it has been used).
- Remove it from the image gate and replace the port cover (or camera) that belongs on that port.
- Remove the resolution wedge and the field sizing gauge from the Image Intensifier entrance plane.
- Replace II grid, anti-collision covers, and contour filter.
- Touch NEXT UNIT or UNIT MENU softkey to exit the calibration unit. Exiting the unit loads the command values for the respective grids and fields of view into NV RAM.

Note: After completing the calibration, use Calibration Unit V068, Objective Lens – Focus and Centering to check the focus of the Objective lens. If necessary, rerun Calibration Unit V068 and retouch the focus.

V004 STEP 4 SCREEN DISPLAY (DIGITAL CALIBRATION)



Note: The NEXT STEP softkey is only displayed during the viewing (Browse) mode to permit return to Step 1 screen display.

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UNIT V011 – TV Lens Adjustment

Time: x h xx min – Personnel: 1 field engineer

1 DESCRIPTION

Calibration Unit V011 centers the image, projected through the lens, onto the target of the pickup tube and mechanically focuses the TV lens by adjusting the level of the lens parallel to the pickup tube. The calibration is accomplished using an Image Evaluation Tool or Focaligner. Four steps are required to accomplish the adjustment. Each step is supported by a screen display.

2 EQUIPMENT REQUIRED

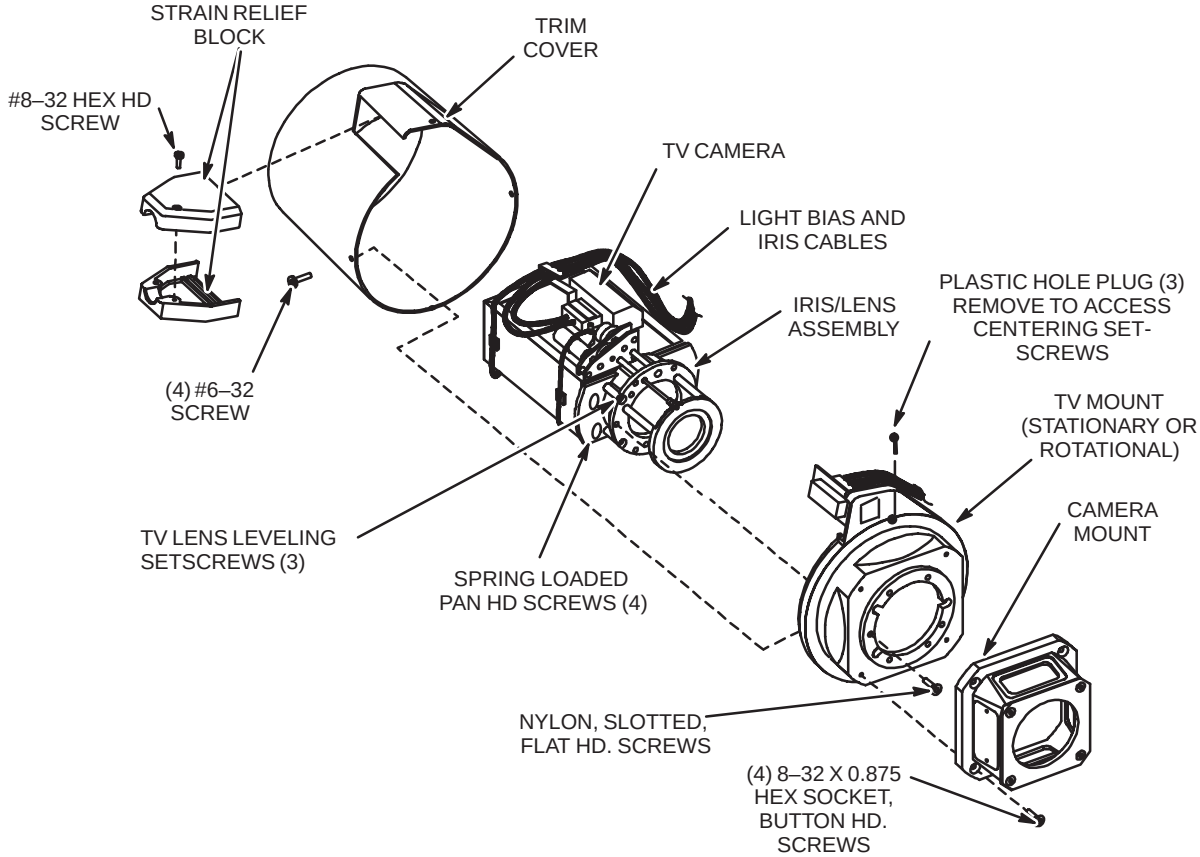
Image Evaluation Tool (IET) P/N 46–232388G1 or Focaligner and standard tool kit.

3 CAL PROCEDURE

3-1 Step 1. Setup the Equipment

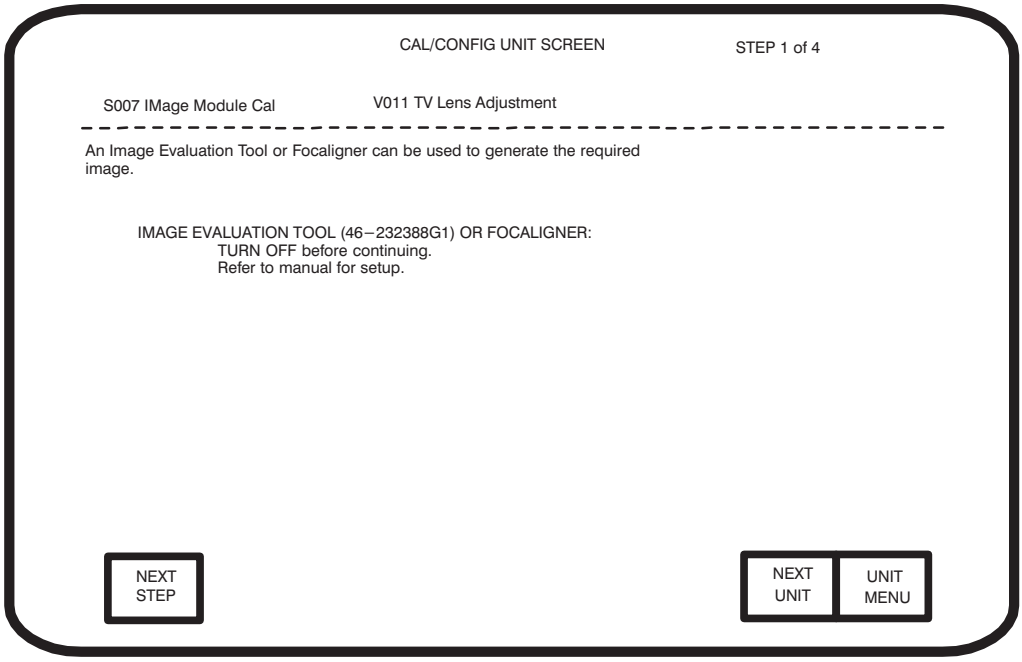
- Setup Image Evaluation Tool or Focaligner on a table or other flat surface that is in close proximity to the system II and TV Camera Assembly.
- Disassemble TV camera cable strain relief block by removing one #8–32 hex head screw (see Illustration 55). Do not disconnect cable from TV camera assembly.

Illustration 55 – TV Camera Assembly



- Remove TV camera assembly outside trim cover by removing four #6–32 retaining screws. (See Illustration 55).
- Loosen two #10 setscrews located on the Image Gate Port flange and carefully remove TV camera assembly.
- Attach TV camera assembly to Image Evaluation Tool or Focaligner. DO NOT TURN ON IMAGE EVALUATION TOOL OR FOCALIGNER AT THIS TIME.
- Touch NEXT STEP softkey and proceed to Step 2.

V011 STEP 1 SCREEN DISPLAY



3-2 Step 2. Size and Center Target Image

Step 2 is used to size and center the target image to a position that is tangent to the camera raster(un-blanked video raster) at the top, bottom and sides. See Illustration 56. Perform the adjustment as follows:

- Turn on the IET or Focaligner and set the intensity for a clear image on the room monitor (without blooming).
- Touch the VERTICAL/NORMAL softkey and adjust the vertical size and center of the target image with the applicable SIZE CENTER softkey. Next, touch HORIZONTAL/NORMAL softkey and adjust the horizontal size and center of the target image with the applicable SIZE CENTER softkey.
- Touch the VERTICAL/REVERSE softkey and make adjustments to the vertical size and center of the target image with the applicable SIZE CENTER softkey. Next, touch the HORIZONTAL/REVERSE softkey and make the necessary adjustments to the horizontal size and center of the target image with the applicable SIZE CENTER softkey.

Note: Exit from the step is not permitted until NORMAL and REVERSE softkeys have been selected for both VERTICAL and HORIZONTAL sizing and centering of the target image.

- Repeat the adjustments once more to verify the settings.

Note: If roundness of the target image cannot be achieved when sizing and centering the image, the aspect ratio set in Cal Unit V003 may be incorrect and/or the pickup tube size and center set in V012 may be mis-adjusted. Recheck these Units. Then, repeat V011.

- Touch NEXT STEP softkey and proceed to Step 3.

V011 STEP 2 SCREEN DISPLAY

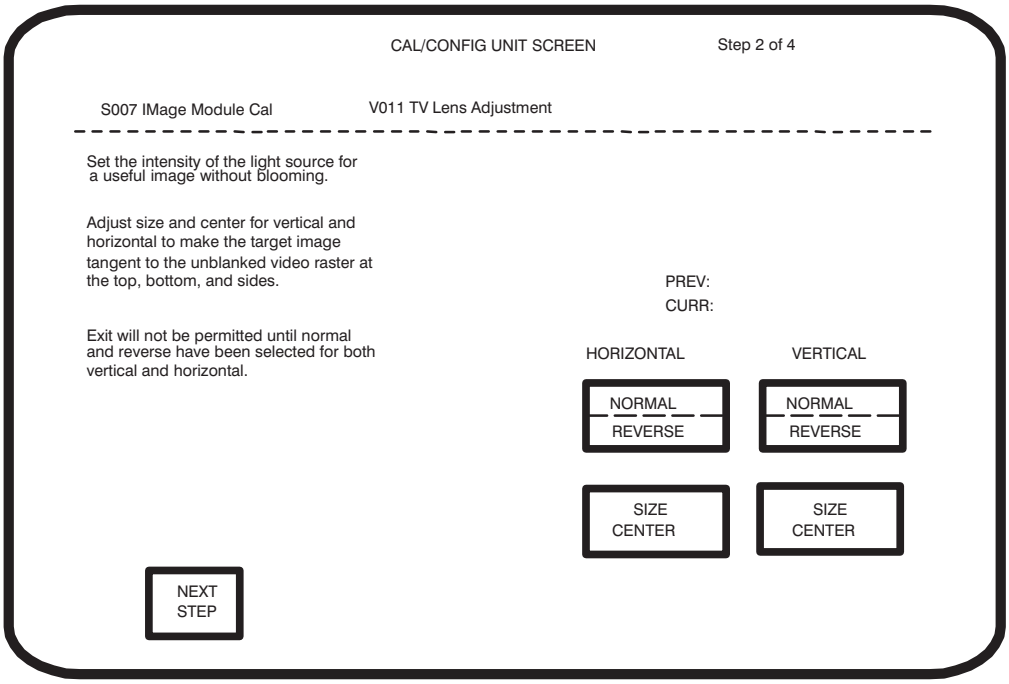
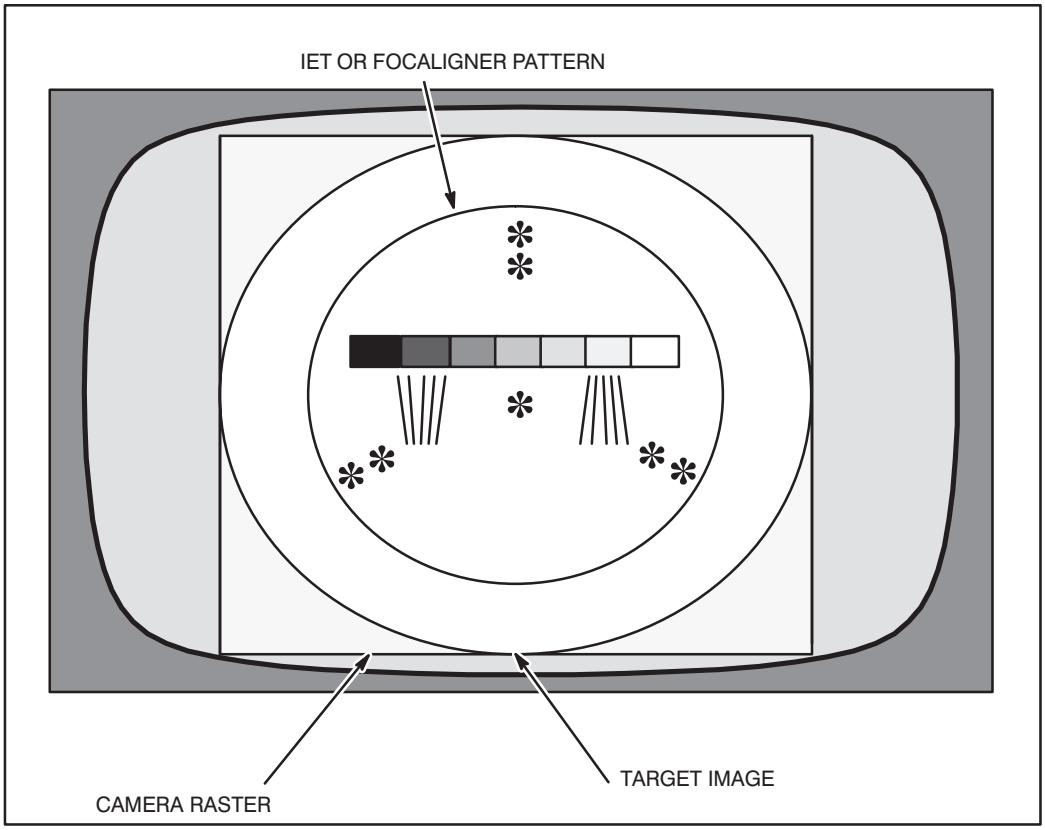


Illustration 56 – V011, Lens Adjustment



3-3 Step 3. Adjust TV Camera Lens

- Maintain light intensity of IET or Focaligner.
- Remove three plastic hole plugs from sides of TV mount in order to access three Allen head lens centering setscrews (See Illustration 55 and Illustration 57).
- Loosen the three lens centering setscrews a few turns to allow adjustment starting point.
- Adjust centering setscrews so that the central region of the image pattern does not shift more than ± 1/16 inch while toggling sweep reversals with the HORIZONTAL and VERTICAL softkeys.

Note: If target centering is lost when toggling sweep reversals, perform Size and Center Calibration V012 first and then repeat V011.

- After centering adjustment is completed, check for equal focus of the outer star patterns on the monitor. If necessary, use the lens leveling screws to set the lens parallel to the pickup tube (equal focus of the outer star patterns). See Illustration 55 and Illustration 58 for location of leveling setscrews. Perform the adjustment as follows:
  1. Remove four cover plates from camera mount (one on each side of mount).
  2. Check that spring loaded pan head screws provide some tension on the lens leveling springs. (see Illustration 58).
  3. Adjust 1/8″ Allen head lens leveling setscrews. Select one leveling setscrew to not adjust. Then, adjust the other two setscrews to obtain the same focus (equal focus of the outer stars on the pattern) as exists next to the leveling setscrew not being adjusted.
- Touch NEXT STEP softkey to proceed to Step 4.

V011 STEP 3 SCREEN DISPLAY

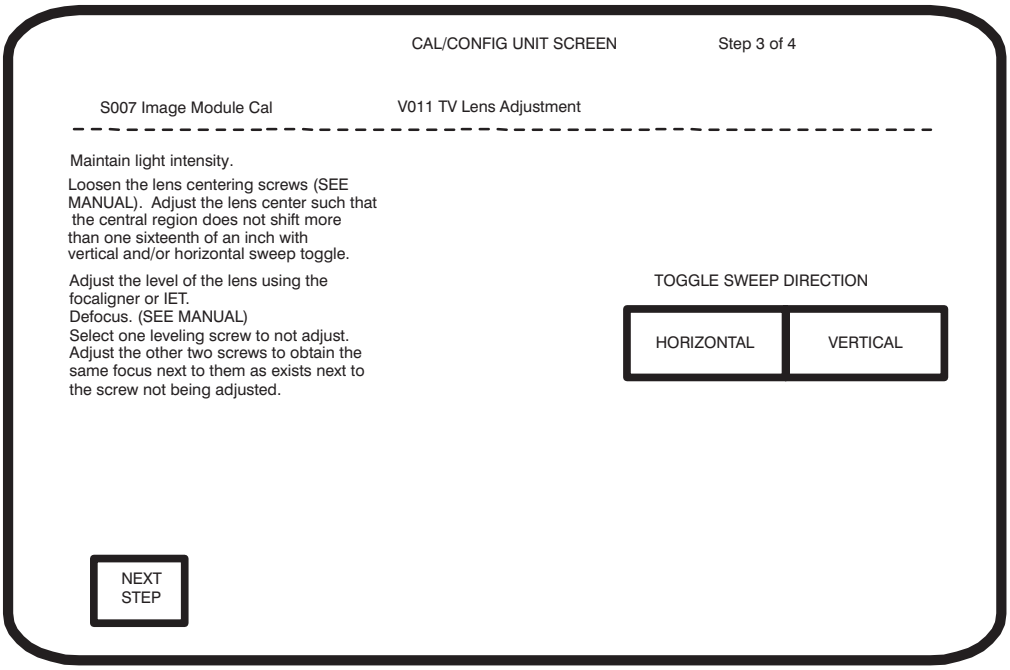


Illustration 57 – V011, TV Lens Centering Adjustment

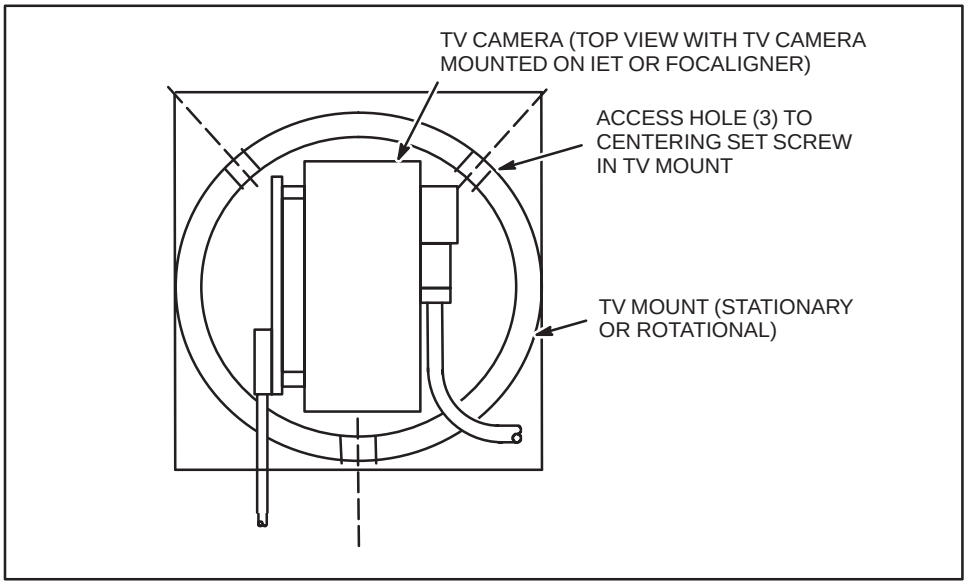
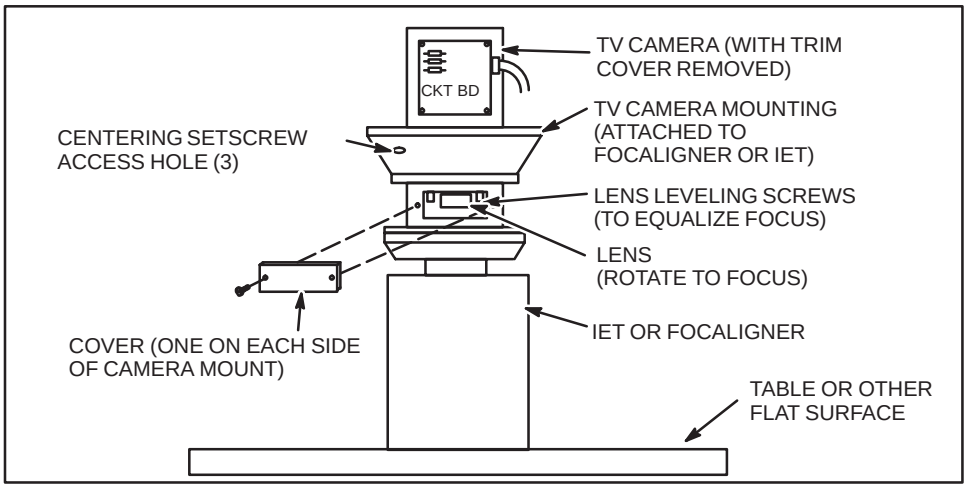


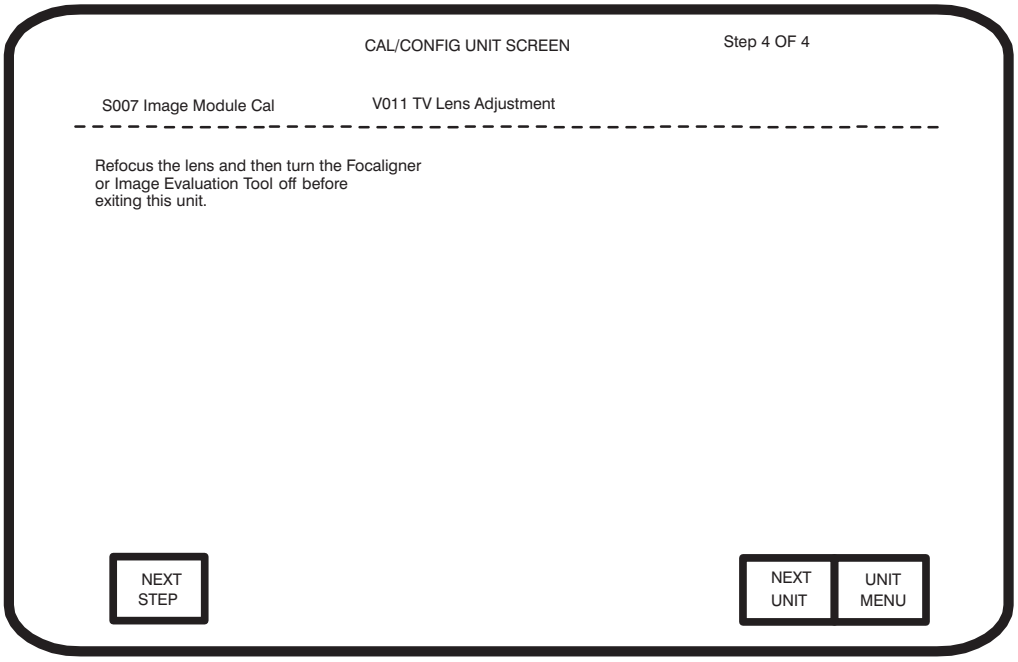
Illustration 58 – V011, TV Lens Leveling Adjustment



3-4 Step 4. Exit Unit

- Refocus the TV camera lens for best focus.
- Replace the four lens covers on the camera mount.
- Turn off the Image Evaluation Tool or Focaligner.
- If not proceeding with sequential VIC calibration units, remove TV camera assembly from Image Evaluation Tool or Focaligner and re–install on Image Gate Port.
- Replace trim cover and cable strain relief blocks on TV camera assembly.
- Touch NEXT UNIT or UNIT MENU softkey to exit.

V011 STEP 4 SCREEN DISPLAY



Note: The NEXT STEP softkey is only displayed in the view (Browse) mode to permit return to Step 1.

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UNIT V012 – Size and Center

Time: x h xx min – Personnel: 1 field engineer

1 DESCRIPTION

Calibration Unit V012 is used to adjust the TV Camera Pickup Tube raster scan for proper size and centering on the video monitor. The calibration unit is subdivided into 6 calibration procedures to provide appropriate instructions for size and centering of the TV Camera Pickup Tube raster in the following system configurations:

- Cal Procedure 1 – Size and Center HI Conventional Fluoro
- Cal Procedure 2 – Size and Center LO Conventional Fluoro
- Cal Procedure 3 – Size and Center HI Pulscan (Camtronics)
- Cal Procedure 4 – Size and Center LO Pulscan
- Cal Procedure 5 – Size and Center LO DF
- Cal Procedure 6 – Size and Center Digital Record Fluoro

2 EQUIPMENT REQUIRED

Focaligner or Image Evaluation Tool, 46–232388G1, (Optional).

3 SPECIAL INSTRUCTIONS

Note: **For Vascular Systems Only:** Before system calibration, verify that additional filter (copper–aluminum filter) is not installed on top of collimator. (Open sensor hinge assembly to verify.) If installed, remove before performing calibration.

4 CAL PROCEDURE 1 – SIZE AND CENTER HI CONVENTIONAL FLUORO

4-1 Step 1. Setup the Equipment

- Select one of the following calibration methods to generate an image for observing adjustment of size and center.

Note: Final adjustment must be accomplished using radiation.

4-1-1 Image Evaluation Tool or Focaligner

Remove the TV camera from the Image Intensifier assembly. Attach the TV camera to the Image Evaluation Tool or Focaligner. Do not turn on the Image Evaluation Tool or Focaligner at this time.

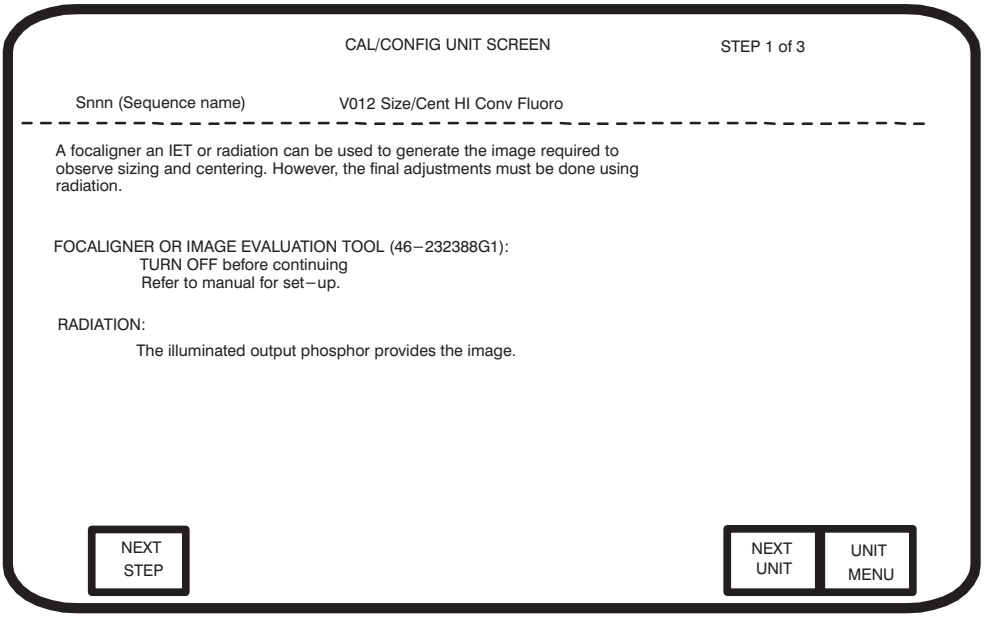
OR

4-1-2 Radiation

The illuminated output phosphor provides the image for adjusting size and center when a fluoro exposure is made.

- Touch NEXT STEP softkey and proceed to Step 2.

V012 CONV FLUORO (HI) STEP 1 SCREEN DISPLAY



4-2 Step 2. Size and Center

- Continue the adjustment according to the image generating method selected in Step 1 (IET/Focaligner or Radiation).

4-2-1 Image Evaluation Tool or Focaligner

1. Turn on the Image Evaluation Tool or Focaligner. Set intensity for a good image. See Illustration 59.
2. Touch HORIZONTAL/NORMAL split softkey and adjust horizontal size and center using HORIZ SIZE CENTER softkeys. Set horizontal dimension to minimum.
3. Touch VERTICAL/NORMAL split softkey and adjust vertical size and center using the VERT SIZE CENTER softkeys. Size and center vertically to be even with the circle blanking.
4. Touch the HORIZONTAL/NORMAL split softkey and adjust horizontal size to be even with circle blanking.
5. Repeat the adjustment using the VERTICAL/REVERSE and HORIZONTAL/REVERSE split softkeys. Cycle through the adjustments once more to verify the settings.
6. After making adjustments using an IET or Focaligner, use the Radiation method given below to verify and/or make final adjustment of size and center.

4-2-2 Radiation

1. Take and maintain a Fluoro exposure. Touch MANUAL softkey. Use the console dial to adjust mA for a good image. See Illustration 60.
2. Touch HORIZONTAL/NORMAL split softkey and adjust horizontal size and center using HORIZ SIZE CENTER softkeys. Set horizontal dimension to minimum.
3. Touch VERTICAL/NORMAL split softkey and adjust vertical size and center using the VERT SIZE CENTER softkeys. Size and center vertically to be even with the circle blanking.
4. Touch the HORIZONTAL/NORMAL split softkey and adjust horizontal size to be even with circle blanking.

NOTICE

On 50 Hz systems configured with Digital Record (DR/DRS), when running V012, Size and Center HI Conventional Fluoro calibration, record horizontal and vertical size/center data (both normal and reverse sweeps). This data will be required when running follow-up unit V012, Size and Center Digital Record calibration (Refer to S007 Sequence Menu).

5. Repeat the adjustment using the VERTICAL/REVERSE and HORIZONTAL/REVERSE split softkeys. Cycle through the adjustments once more to verify the settings.

   Horizontal Data:_____

   Vertical Data:_____

- Touch NEXT STEP softkey and proceed to Step 3.

V012 CONV FLUORO (HI) STEP 2 SCREEN DISPLAY

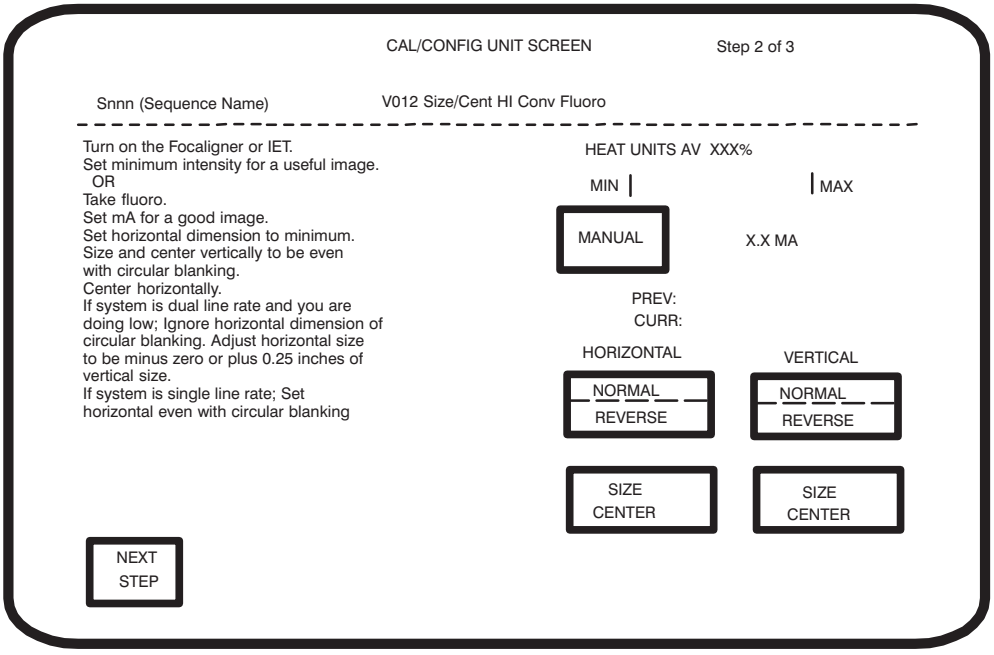


Illustration 59 – V012, Size and Centering using Focaligner Image

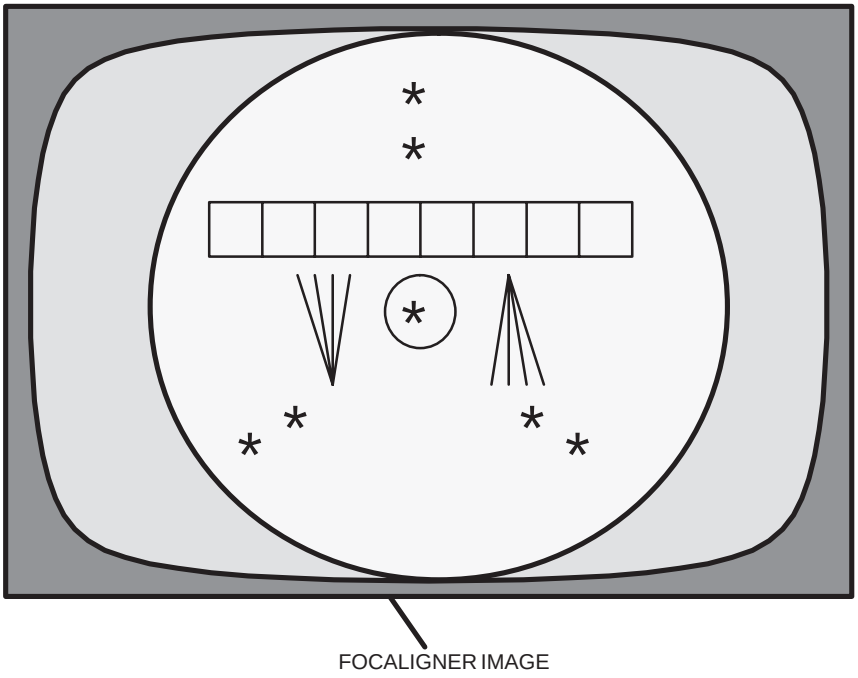
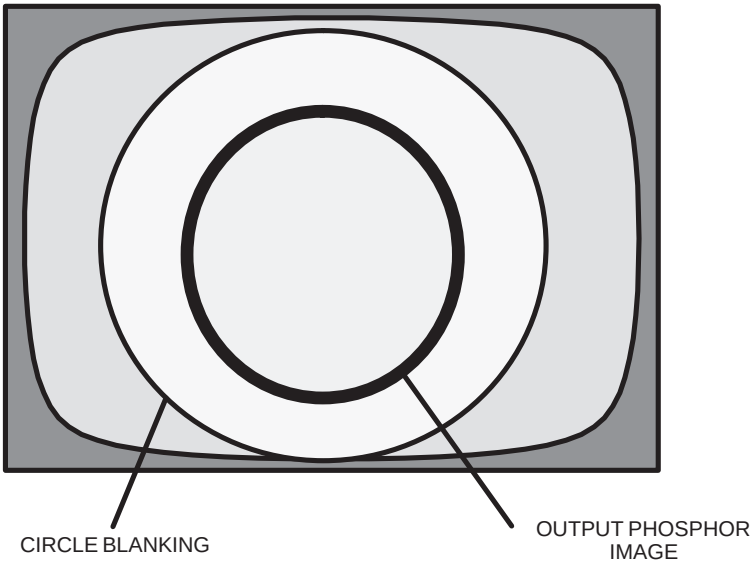


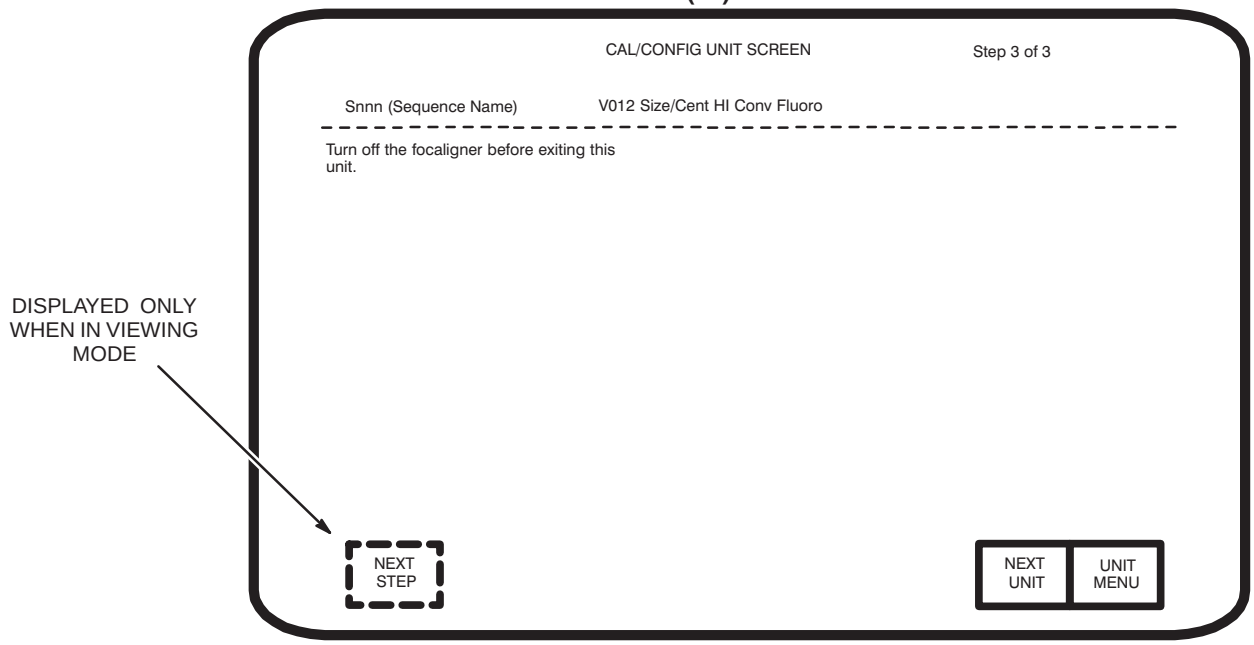
Illustration 60 – V012, Size and Centering using Output Phosphor Image



4-3 Step 3. Exit Unit

- Turnoff the Focaligner or Image Evaluation Tool (if that calibration method was used).
- Touch NEXT UNIT or UNIT MENU softkey to exit the calibration unit. Exiting the unit initiates loading of the calibration data into NV RAM. An “Updating NV database” message is displayed while the calibration data is loaded into NV RAM.

V012 CONV FLUORO (HI) STEP 3 SCREEN DISPLAY



5 CAL PROCEDURE 2 – SIZE AND CENTER LO CONVENTIONAL FLUORO

5-1 Step 1. Setup the Equipment

- Select one of the following calibration methods to generate an image for observing adjustment of size and center.

Note: Final adjustment must be accomplished using radiation.

5-1-1 Image Evaluation Tool or Focaligner

Remove the TV camera from the Image Intensifier assembly. Attach the TV camera to the Image Evaluation Tool or Focaligner. Do not turn on the Image Evaluation Tool or Focaligner at this time.

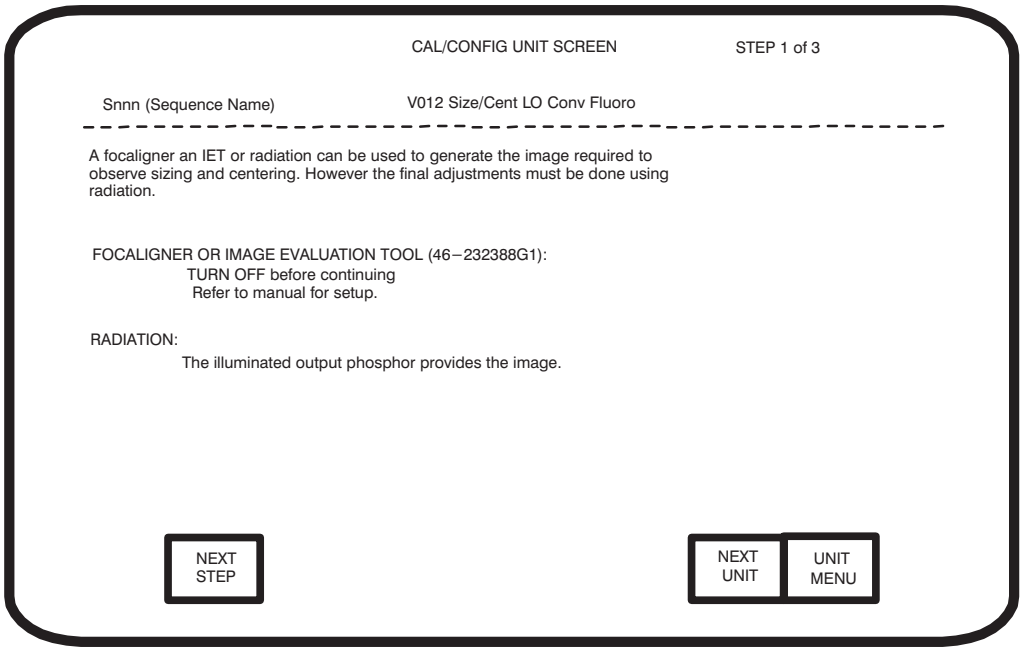
OR

5-1-2 Radiation

The illuminated output phosphor provides the image for adjusting size and center when a fluoro exposure is made.

- Touch NEXT STEP softkey and proceed to Step 2.

V012 CONV FLUORO (LO) STEP 1 SCREEN DISPLAY



5-2 Step 2. Size and Center

- Continue the adjustment according to the image generating method selected in Step 1 (IET/Focaligner or Radiation).

5-2-1 Image Evaluation Tool or Focaligner

1. Turn on the Image Evaluation Tool or Focaligner. Set intensity for a good image. See Illustration 59.
2. Touch HORIZONTAL/NORMAL split softkey and adjust horizontal size and center using HORIZ SIZE CENTER softkeys. Set horizontal dimension to minimum.

NOTICE

If the system is a dual line rate configuration and you are in low, ignore the horizontal dimension of circle blanking. Set horizontal size –0.00/+0.25 inch of vertical size. If the system is a single line rate configuration, set horizontal size even with circle blanking.

3. Touch VERTICAL/NORMAL split softkey and adjust vertical size and center using the VERT SIZE CENTER softkeys. Size and center vertically to be even with the circle blanking
4. Touch the HORIZONTAL/NORMAL split softkey and adjust horizontal size to be even with circle blanking.
5. Repeat the adjustment using the VERTICAL/REVERSE and HORIZONTAL/REVERSE split softkeys. Cycle through the adjustments once more to verify the settings.
6. After making adjustments using an IET or Focaligner, use the Radiation method given below to verify and/or make final adjustment of size and center.

5-2-2 Radiation

1. Take and maintain a Fluoro exposure. Touch MANUAL softkey. Use the console dial to adjust mA for a good image. See Illustration 60.
2. Touch HORIZONTAL/NORMAL split softkey and adjust horizontal size and center using HORIZ SIZE CENTER softkeys. Set horizontal dimension to minimum.

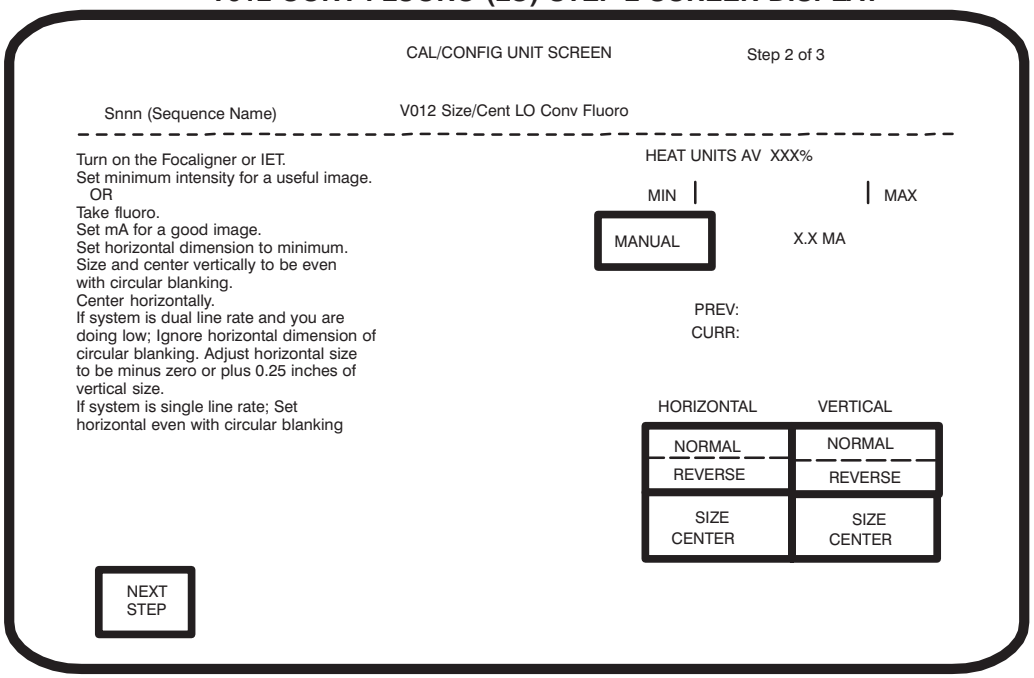
NOTICE

If the system is a dual line rate configuration and you are in low, ignore the horizontal dimension of circle blanking. Set horizontal size –0.00/+0.25 inch of vertical size. If the system is a single line rate configuration, set horizontal size even with circle blanking.

3. Touch VERTICAL/NORMAL split softkey and adjust vertical size and center using the VERT SIZE CENTER softkeys. Size and center vertically to be even with the circle blanking.
4. Touch the HORIZONTAL/NORMAL split softkey and adjust horizontal size to be even with circle blanking.
5. Repeat the adjustment using the VERTICAL/REVERSE and HORIZONTAL/REVERSE split softkeys. Cycle through the adjustments once more to verify the settings.

- Touch NEXT STEP softkey to proceed to Step 3.

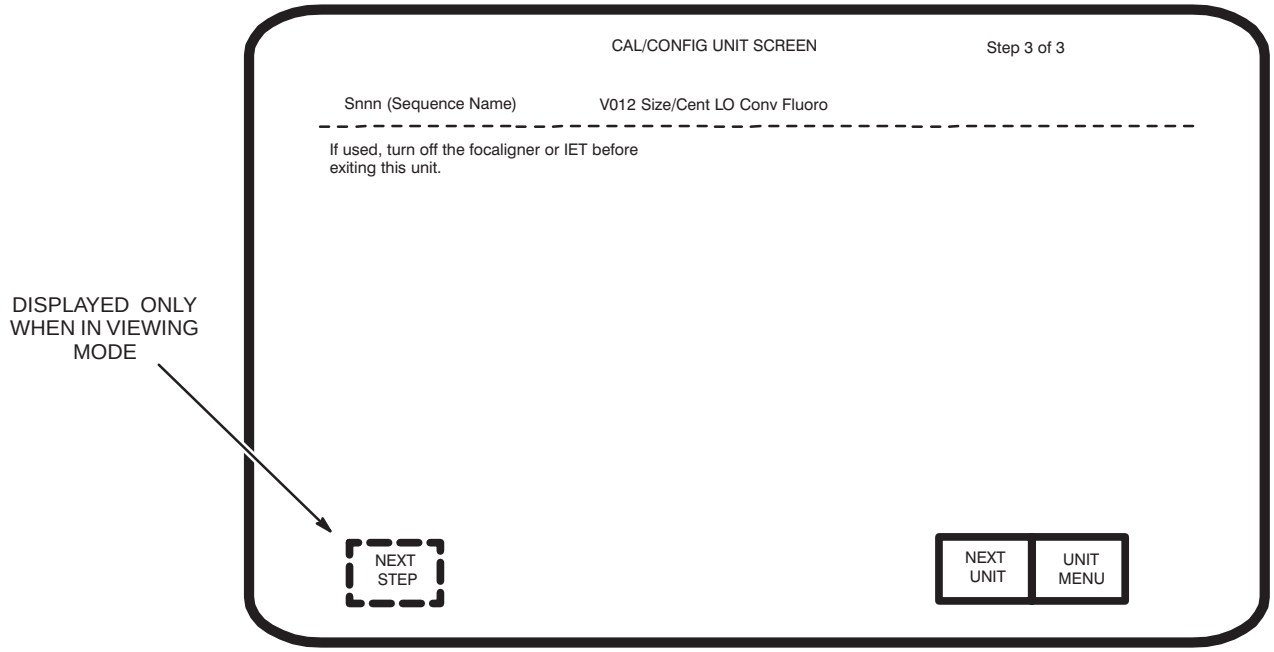
V012 CONV FLUORO (LO) STEP 2 SCREEN DISPLAY



5-3 Step 3. Exit Unit

- Turn off the Focaligner or Image Evaluation Tool (if that calibration method was used).
- Touch NEXT UNIT or UNIT MENU softkey to exit the calibration unit. Exiting the unit initiates loading of the calibration data into NV RAM. An “Updating NV database” message is displayed while the calibration data is loaded into NV RAM.

V012 CONV FLUORO (LO) STEP 3 SCREEN DISPLAY



6 CAL PROCEDURE 3 – SIZE AND CENTER HI PULSCAN (CAMTRONICS)

6-1 Step 1. Setup the Equipment

Note: Refer also to Service Manual 89999–203 “Camtronics Video Plus GE/Advantx–E Configuration Calibration Manual” Chapter 5, “V012 Size/Center”.

- Select one of the following calibration methods to generate an image for observing adjustment of size and center.

Note: Final adjustment must be accomplished using the radiation method.

6-1-1 Image Evaluation Tool or Focaligner

Remove the TV camera from the Image Intensifier assembly. Attach the TV camera to the Image Evaluation Tool or Focaligner. Do not turn on the Image Evaluation Tool or Focaligner at this time.

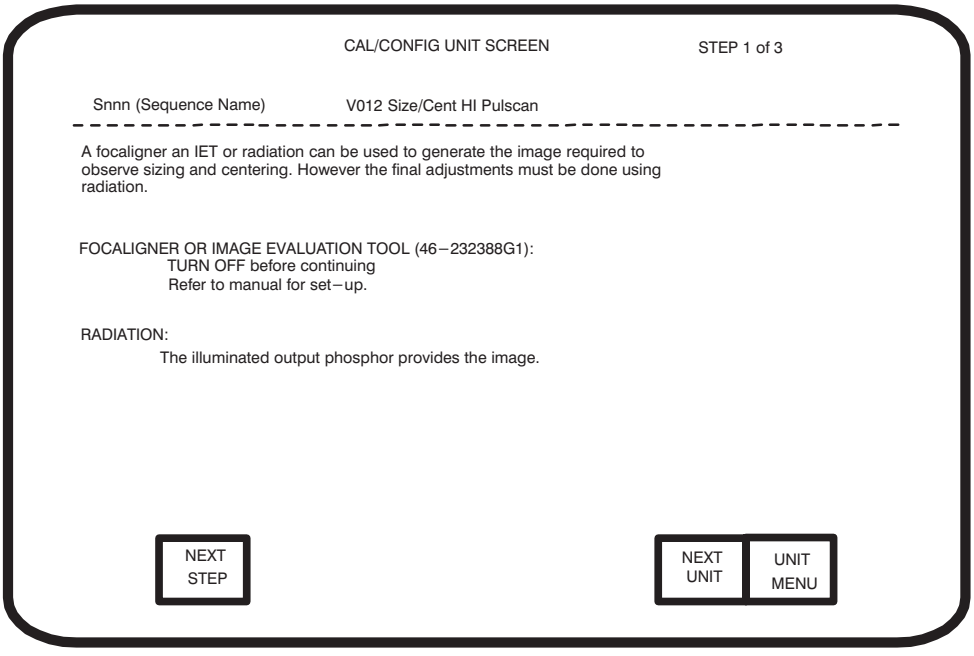
OR

6-1-2 Radiation

The illuminated output phosphor provides the image for adjusting size and center when a fluoro exposure is made.

- Touch NEXT STEP softkey to proceed to Step 2.

V012 PULSCAN (HI) STEP 1 SCREEN DISPLAY



6-2 Step 2. Size and Center

- Continue the adjustment according to the image generating method selected in Step 1 (IET/Focaligner or Radiation).

6-2-1 Image Evaluation Tool or Focaligner

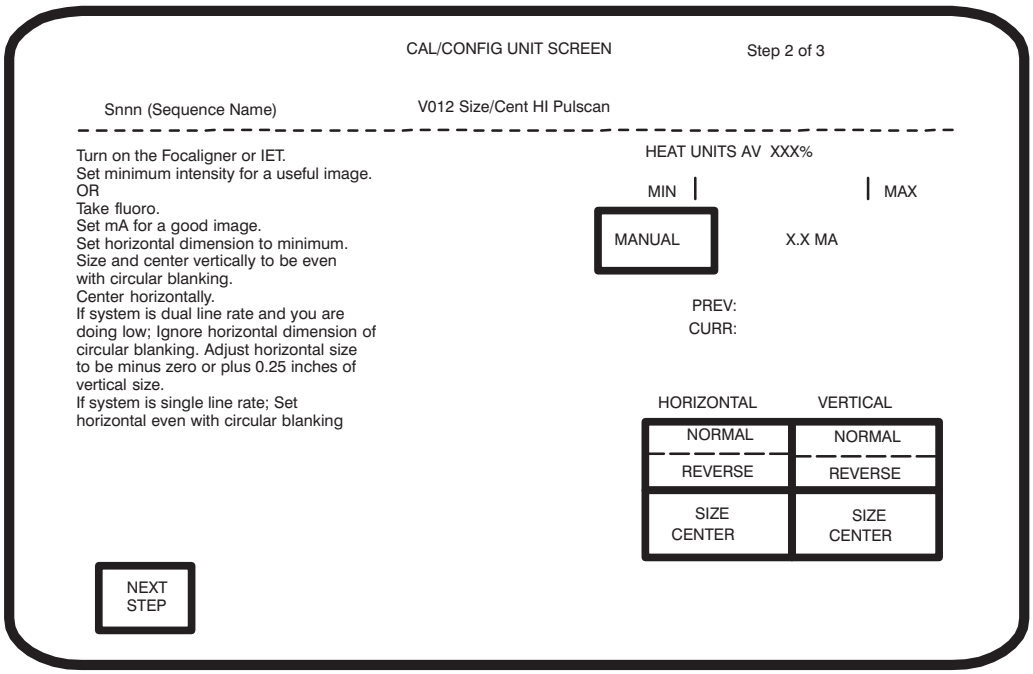
1. Turn on the Image Evaluation Tool or Focaligner. Set intensity for a good image. See Illustration 59
2. Touch HORIZONTAL/NORMAL split softkey and adjust horizontal size and center using HORIZ SIZE CENTER softkeys. Set horizontal dimension to minimum.
3. Touch VERTICAL/NORMAL split softkey and adjust vertical size and center using the VERT SIZE CENTER softkeys. Size and center vertically to be even with the circle blanking
4. Touch the HORIZONTAL/NORMAL split softkey and adjust horizontal size to be even with circle blanking.
5. Repeat the adjustment using the VERTICAL/REVERSE and HORIZONTAL/REVERSE split softkeys. Cycle through the adjustments once more to verify the settings.
6. After making adjustments using an IET or Focaligner, use the Radiation method given below to verify and/or make final adjustment of size and center.

6-2-2 Radiation

1. Take and maintain a Fluoro exposure. Touch MANUAL softkey. Use the console dial to adjust mA for a good image. See Illustration 60.
2. Touch HORIZONTAL/NORMAL split softkey and adjust horizontal size and center using HORIZ SIZE CENTER softkeys. Set horizontal dimension to minimum.
3. Touch VERTICAL/NORMAL split softkey and adjust vertical size and center using the VERT SIZE CENTER softkeys. Size and center vertically to be even with the circle blanking.
4. Touch the HORIZONTAL/NORMAL split softkey and adjust horizontal size to be even with circle blanking.
5. Repeat the adjustment using the VERTICAL/REVERSE and HORIZONTAL/REVERSE split softkeys. Cycle through the adjustments once more to verify the settings.

- Touch NEXT STEP softkey to proceed to Step 3.

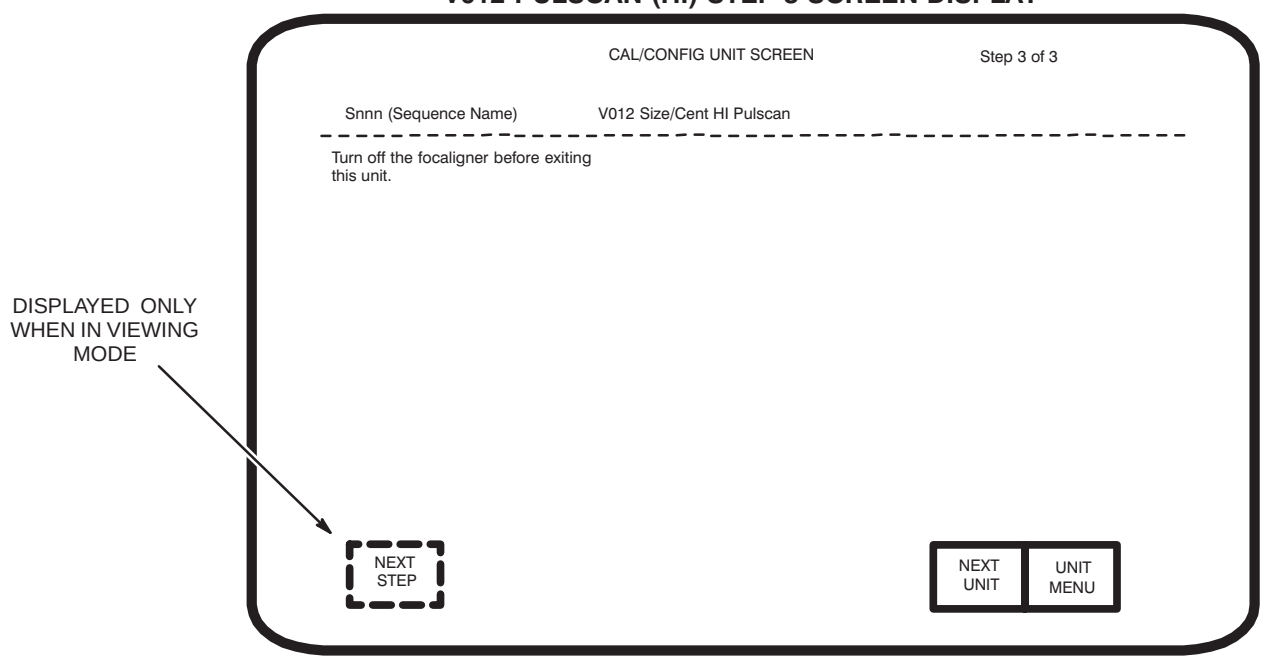
V012 PULSCAN HI STEP 2 SCREEN DISPLAY



6-3 Step 3. Exit Unit

- Turnoff the Focaligner or Image Evaluation Tool (if that calibration method was used).
- Touch NEXT UNIT or UNIT MENU softkey to exit the calibration unit. Exiting the unit initiates loading of the calibration data into NV RAM. An “Updating NV database” message is displayed while the calibration data is loaded into NV RAM.

V012 PULSCAN (HI) STEP 3 SCREEN DISPLAY



7 CAL PROCEDURE 4 – SIZE AND CENTER LO PULSCAN

7-1 Step 1. Setup the Equipment

- Select one of the following calibration methods to generate an image for observing adjustment of size and center.

Note: Final adjustment must be accomplished using the radiation method.

7-1-1 Image Evaluation Tool or Focaligner

Remove the TV camera from the Image Intensifier assembly. Attach the TV camera to the Image Evaluation Tool or Focaligner. Do not turn on the Image Evaluation Tool or Focaligner at this time.

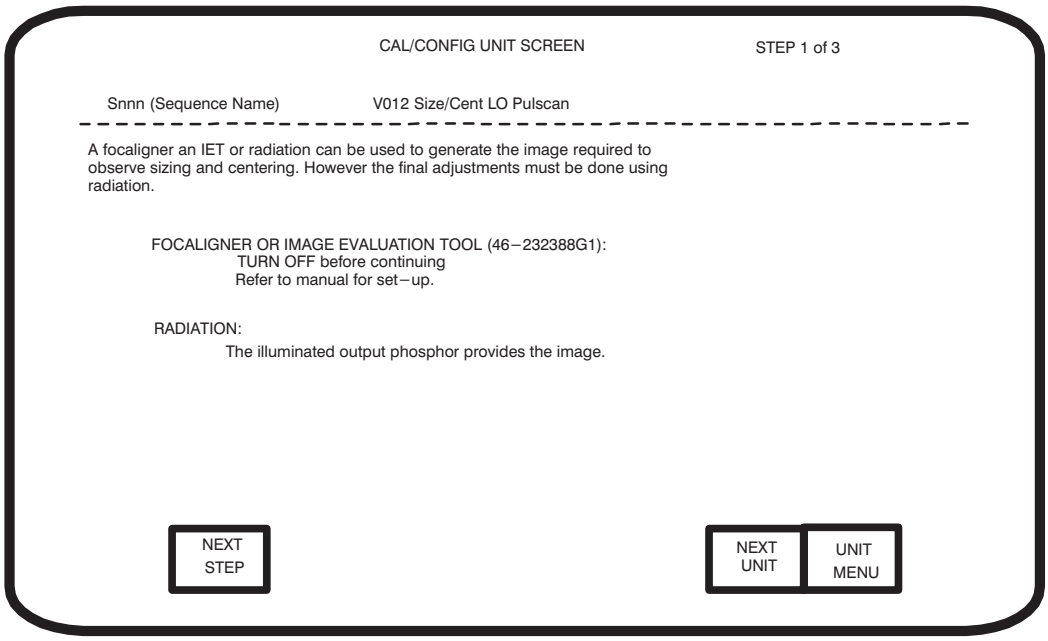
OR

7-1-2 Radiation

The illuminated output phosphor provides the image for adjusting size and center when a fluoro exposure is made.

- Touch NEXT STEP softkey to proceed to Step 2.

V012 PULSCAN (LO) STEP 1 SCREEN DISPLAY



7-2 Step 2. Size and Center

- Continue the adjustment according to the image generating method selected in Step 1 (IET/Focaligner or Radiation).

7-2-1 Image Evaluation Tool or Focaligner

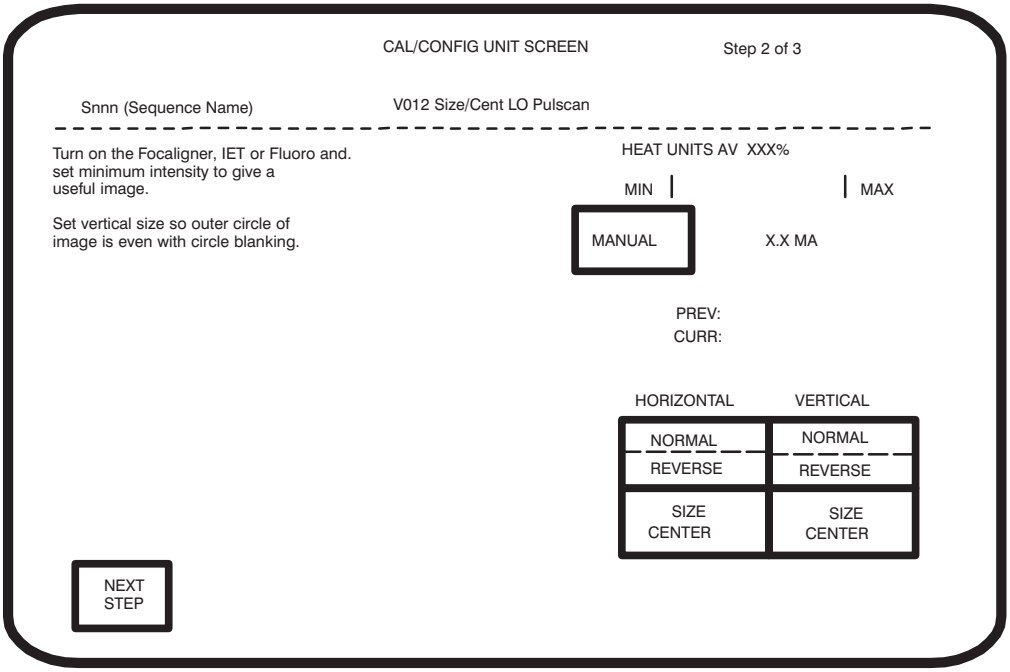
1. Turn on the Image Evaluation Tool or Focaligner. Set intensity for a good image. See Illustration 59.
2. Touch HORIZONTAL/NORMAL split softkey and adjust horizontal size and center using HORIZ SIZE CENTER softkeys. Set horizontal dimension to minimum.
3. Touch VERTICAL/NORMAL split softkey and adjust vertical size and center using the VERT SIZE CENTER softkeys. Size and center vertically to be even with the circle blanking
4. Touch the HORIZONTAL/NORMAL split softkey and adjust horizontal size to be even with circle blanking.
5. Repeat the adjustment using the VERTICAL/REVERSE and HORIZONTAL/REVERSE split softkeys. Cycle through the adjustments once more to verify the settings.
6. After making adjustments using an IET or Focaligner, use the Radiation method given below to verify and/or make final adjustment of size and center.

7-2-2 Radiation

1. Take and maintain a Fluoro exposure. Touch MANUAL softkey. Use the console dial to adjust mA for a good image. See Illustration 60.
2. Make the vertical and horizontal adjustments using the same softkey procedure as described for the Image Evaluation Tool or Focaligner calibration method above.

- Touch NEXT STEP softkey to proceed to Step 3.

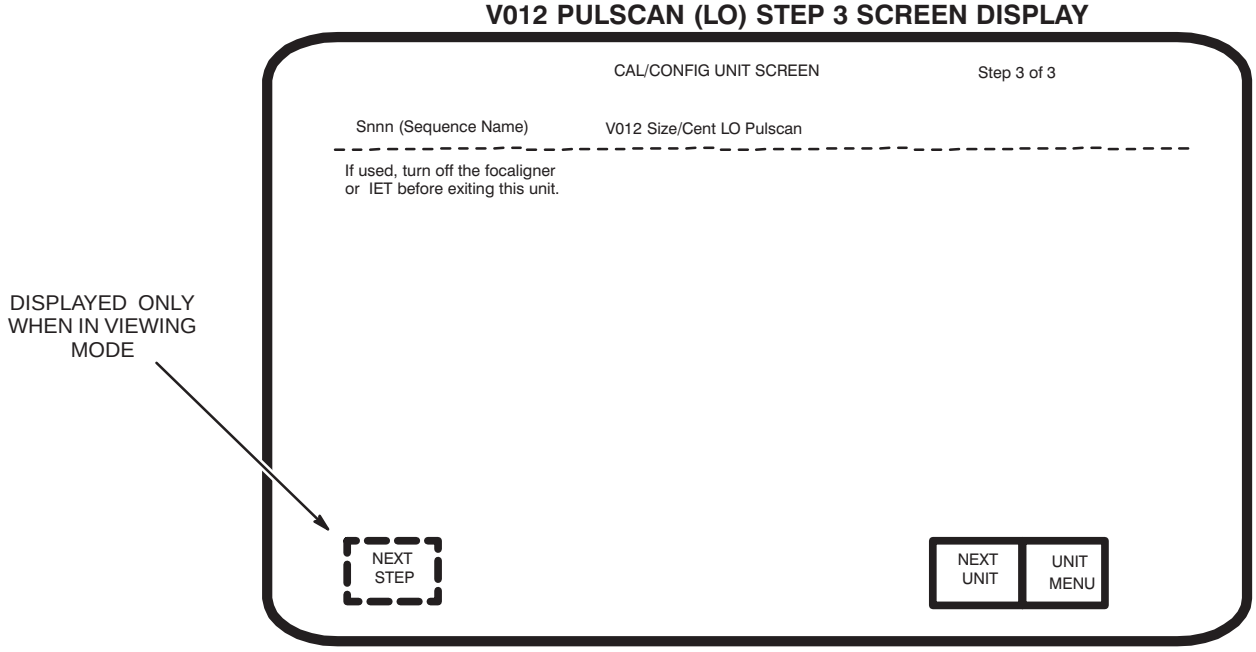
V012 PULSCAN LO STEP 2 SCREEN DISPLAY



7-3 Step 3. Exit Unit

- Turnoff the Focaligner or Image Evaluation Tool (if that calibration method was used).
- Touch NEXT UNIT or UNIT MENU softkey to exit the calibration unit. Exiting the unit initiates loading of the calibration data into NV RAM. An “Updating NV database” message is displayed while the calibration data is loaded into NV RAM.

V012 PULSCAN (LO) STEP 3 SCREEN DISPLAY



8 CAL PROCEDURE 5 – SIZE AND CENTER LO DF

8-1 Step 1. Setup the Equipment

- Select one of the following calibration methods to generate an image for observing adjusting size and center.

Note: Final adjustment must be accomplished using radiation.

8-1-1 Image Evaluation Tool or Focaligner

Remove the TV camera from the Image Intensifier assembly. Attach the TV camera to the Image Evaluation Tool or Focaligner. Do not turn on the Image Evaluation Tool or Focaligner at this time.

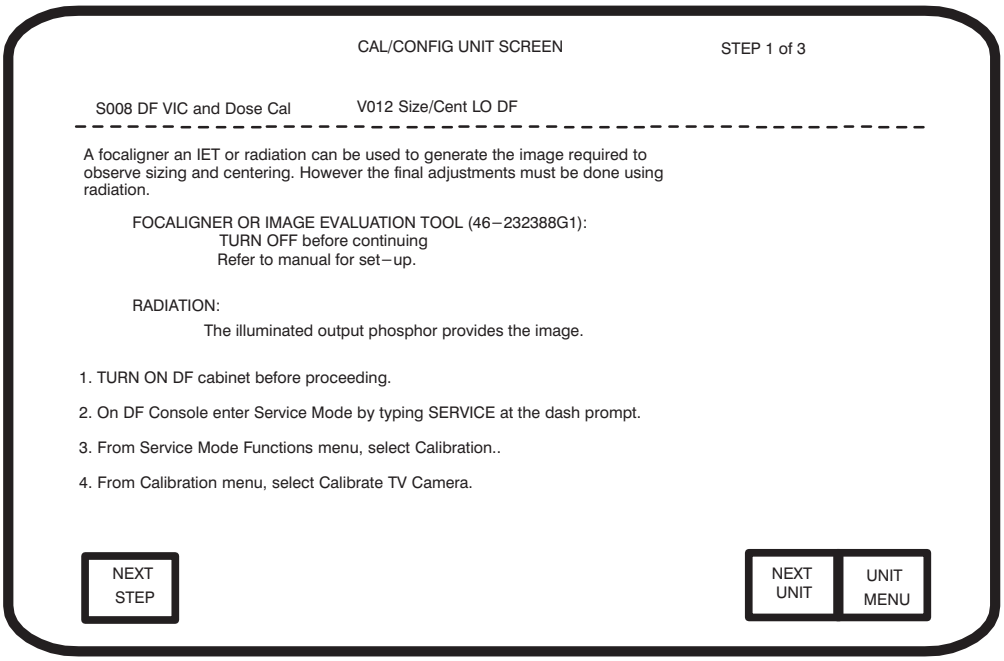
OR

8-1-2 Radiation

The illuminated output phosphor provides the image for adjusting size and center when a fluoro exposure is made.

- After selecting the calibration method, perform the following preliminary procedure:
  1. Turn on the DF
  2. On the DF console enter the Service Mode by typing SERVICE after the dash prompt. The Service Mode Function menu will be displayed on the DF console.
  3. On the Service Mode Function menu, select Calibrate. The Calibration menu will be displayed.
  4. On the Calibration menu, select Calibrate TV Camera.
- Return to the Advantx system console and touch NEXT STEP softkey to proceed to Step 2.

V012 LO DF STEP 1 SCREEN DISPLAY



8-2 Step 2. Size and Center

- Select Adjust Window/Level from TV Calibration menu on the DF console. Set the window to 1536. This will permit viewing of the digital circle on the video monitor.
- Select Progressive TV Size and Center from TV Calibration menu.
- Continue the adjustment according to the image generating method selected in Step 1 (IET/Focaligner or Radiation).

8-2-1 Image Evaluation Tool or Focaligner

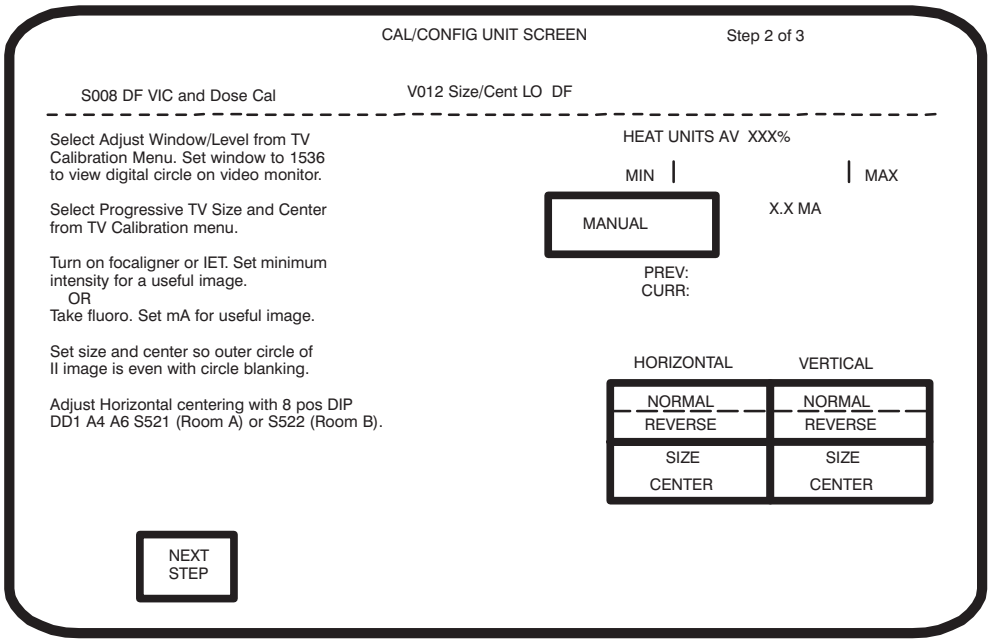
1. Turn on the Image Evaluation Tool or Focaligner. Set intensity for a useful image. See Illustration 59.
2. Use the HORIZONTAL/VERTICAL softkeys on the system console to set size and center so that the outer circle of the IET or Focaligner image is tangent to the circle blanking on the monitor.
3. After making adjustments using an IET or Focaligner, use the Radiation method given below to verify and/or make final adjustment of size and center.

8-2-2 Radiation

1. Take and maintain a Fluoro exposure. Touch MANUAL softkey. Use the console dial to adjust mA for a useful image. See Illustration 60.
2. Use the HORIZONTAL/VERTICAL softkeys on the system console to set size and center so that the illuminated II image is tangent to the circle blanking on the monitor.

- Adjust horizontal/center by setting positions of switches on two, 8–position, DIP switches The switches are located on DF DVP Input Processor board DD1 A4 A6. Adjust DD1 A4 A6 S521 (Room A) or DD1 A4 A6 S520 (Room B).
- Touch CENTER softkey on system console and use the console dial to make a fine center adjustment.
- Touch NEXT STEP softkey to proceed to Step 3.

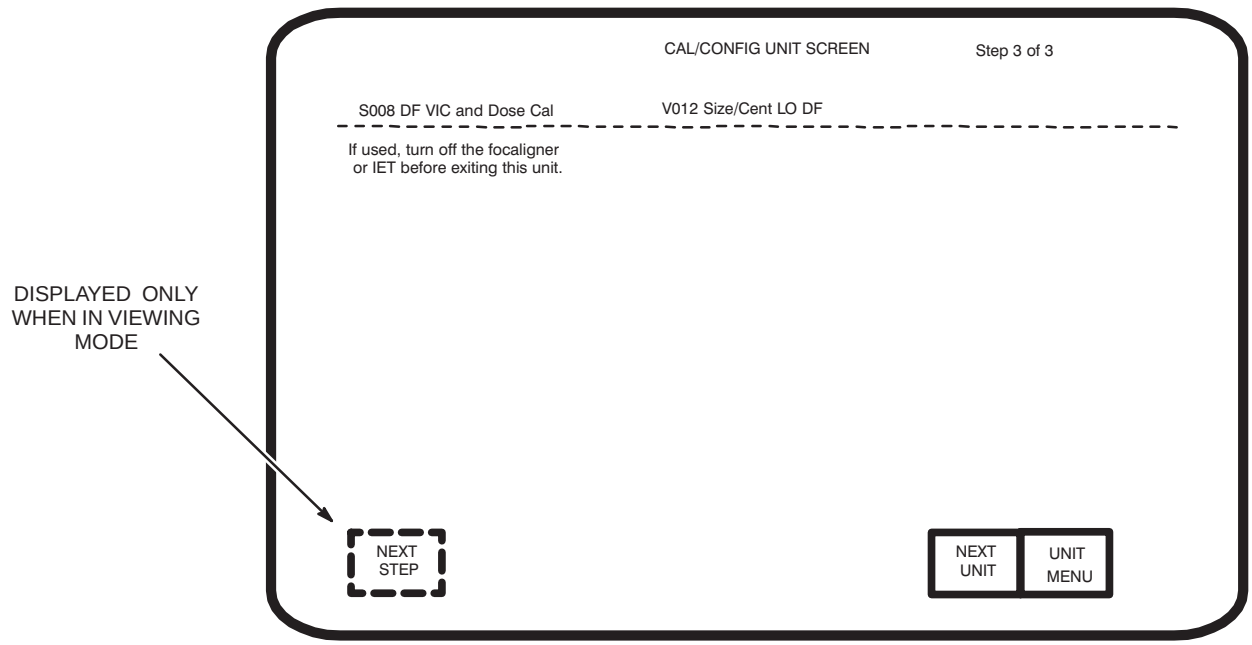
V012 LO DF STEP 2 SCREEN DISPLAY



8-3 Step 3. Exit Unit

- Turnoff the Focaligner or Image Evaluation Tool (if that calibration method was used).
- Touch NEXT UNIT or UNIT MENU softkey to exit the calibration unit. Exiting the unit initiates loading of the calibration data into NV RAM. An “Updating NV database” message is displayed while the calibration data is loaded into NV RAM.

V012 LO DF STEP 3 SCREEN DISPLAY

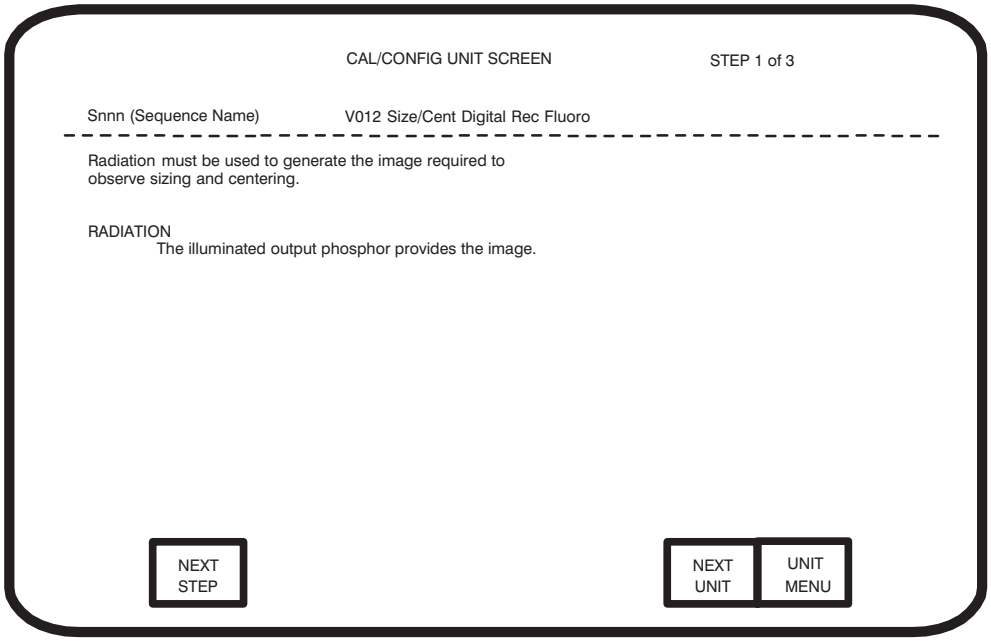


9 CAL PROCEDURE 6 – SIZE AND CENTER DIGITAL RECORD FLUORO

9-1 Step 1. Setup the Equipment

- Use the radiation method to generate an image for performing the calibration. The illuminated output phosphor provides the image for adjusting size and center when a fluoro exposure is made.
- Touch NEXT STEP softkey and proceed to Step 2.

V012 DIGITAL RECORD FLUORO STEP 1 SCREEN DISPLAY



9-2 Step 2. Size and Center

NOTICE

On 50 Hz systems with Digital Record, dial in data recorded when V012, Size and Center HI Conventional Fluoro calibration was run. Do not re-adjust size. Touch up vertical centering (normal & reverse sweep). The right side of the image will have some cutoff due to the image extending past the Digital Record digital square. Ignore VIC circular blanking and adjust image horizontally so that right edge of image is tangent to DR digital square (both sweeps). Left side of image will be covered by the VIC circle. This is ok. In applications the VIC circle is disabled for Digital Record fluoro and record.

- Continue the adjustment using radiation.
- Take and maintain a Fluoro exposure. Touch MANUAL softkey. Use the console dial to adjust mA for a good image. See Illustration 61.
- Touch HORIZONTAL/NORMAL split softkey and adjust horizontal size and center using HORIZ SIZE CENTER softkeys. Set horizontal dimension to minimum.

NOTICE

If the system is a dual line rate configuration and you are in low, ignore the horizontal dimension of circle blanking. Adjust horizontal size –0.00/+0.25 inch of vertical size. If the system is a single line rate configuration, set horizontal size even with circle blanking.

- Touch VERTICAL/NORMAL softkey and adjust vertical size and center using the VERT SIZE CENTER softkeys. Size and center vertically to be even with the circle blanking.
- Repeat the adjustment using the VERTICAL/REVERSE and HORIZONTAL/REVERSE softkeys. Cycle through the adjustments once more to verify the settings.
- Touch NEXT STEP softkey to proceed to Step 3.

V012 DIGITAL RECORD FLUORO STEP 2 SCREEN DISPLAY

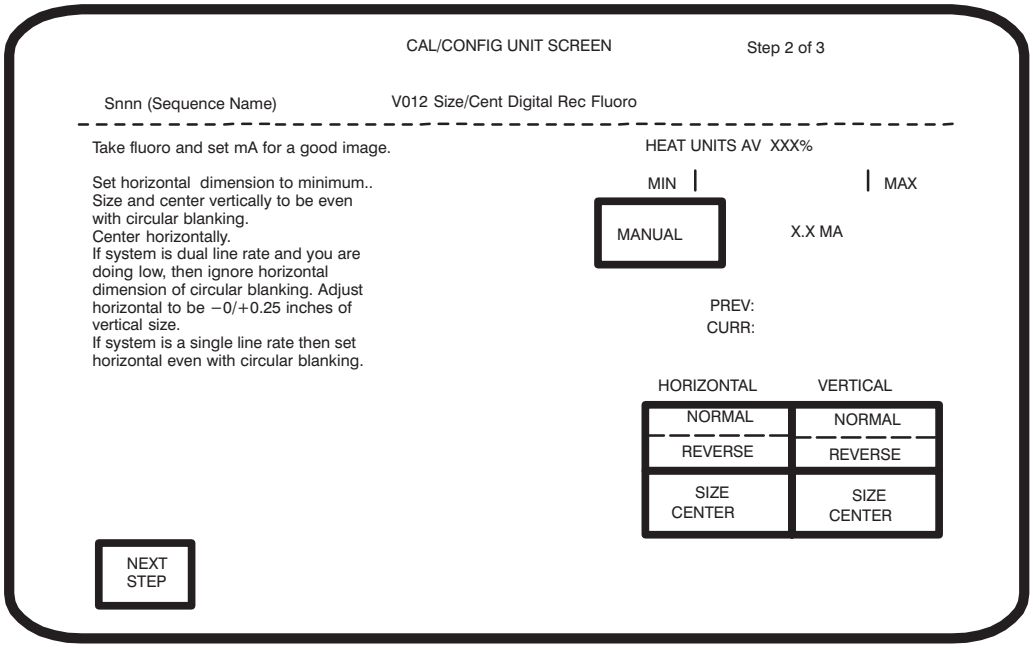
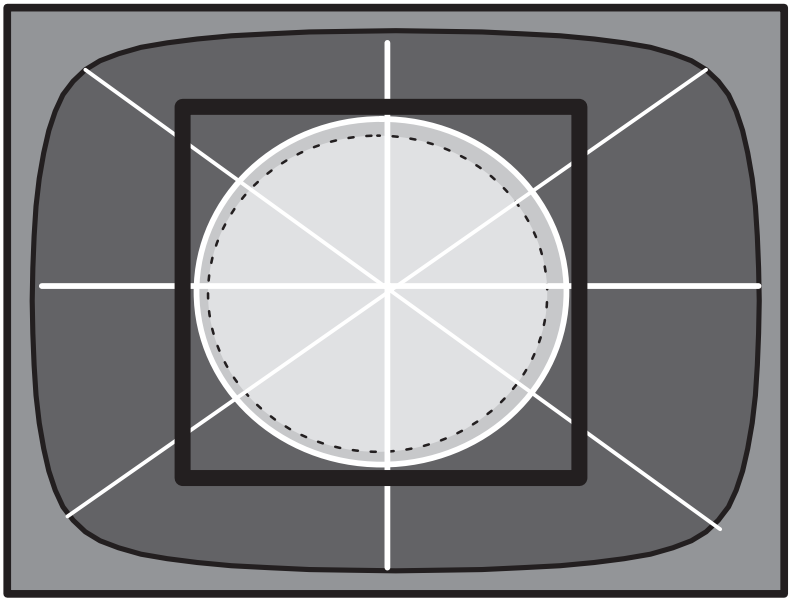


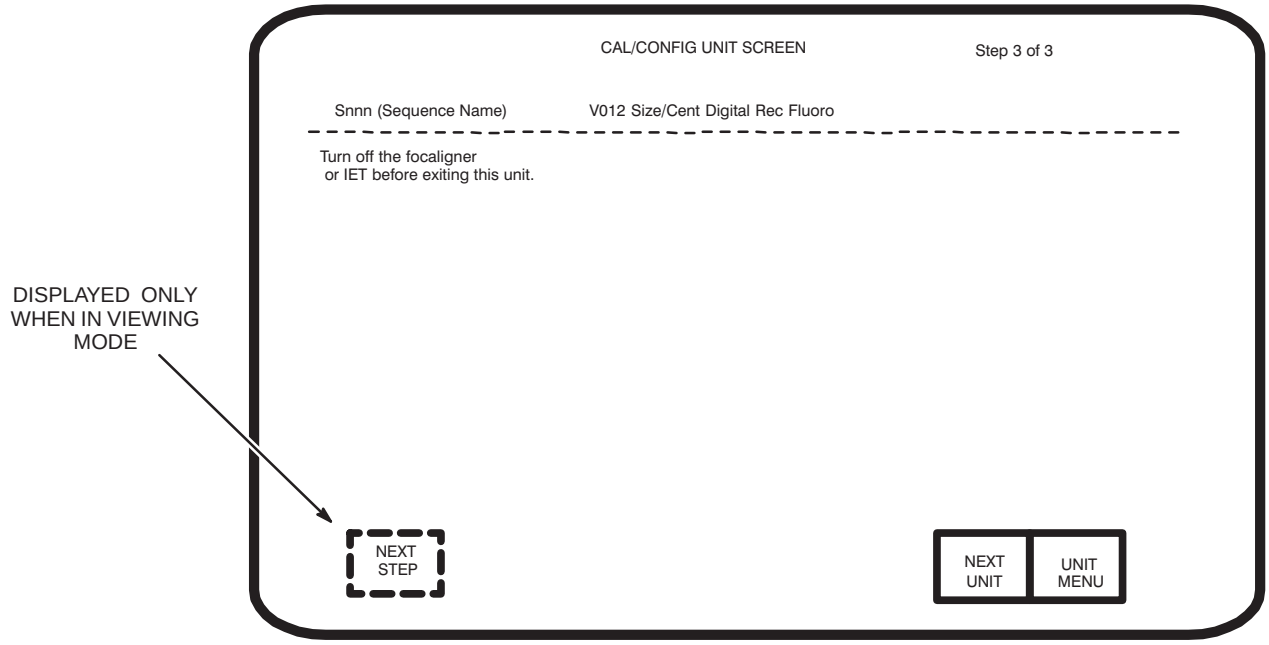
Illustration 61 – V012, Size and Centering, Digital Record



9-3 Step 3. Exit Unit

- Touch NEXT UNIT or UNIT MENU softkey to exit the calibration unit. Exiting the unit initiates loading of the calibration data into NV RAM. An “Updating NV database” message is displayed while the calibration data is loaded into NV RAM.

V012 DIGITAL RECORD FLUORO STEP 3 SCREEN DISPLAY



UNIT V016 – Circular Blanking Adjustments

Time: x h xx min – Personnel: 1 field engineer

1 DESCRIPTION

Calibration unit V016 adjusts the circle blanking controls of the camera electronics for correct size and symmetry. Adjustments made in this unit set the roundness and size of the blanking mask (circle blanking) placed on the output video signal. Two steps are required to perform the calibration. Each step is supported by a screen presentation.

2 EQUIPMENT REQUIRED

Non–metallic adjusting tool and dark cloth cover.

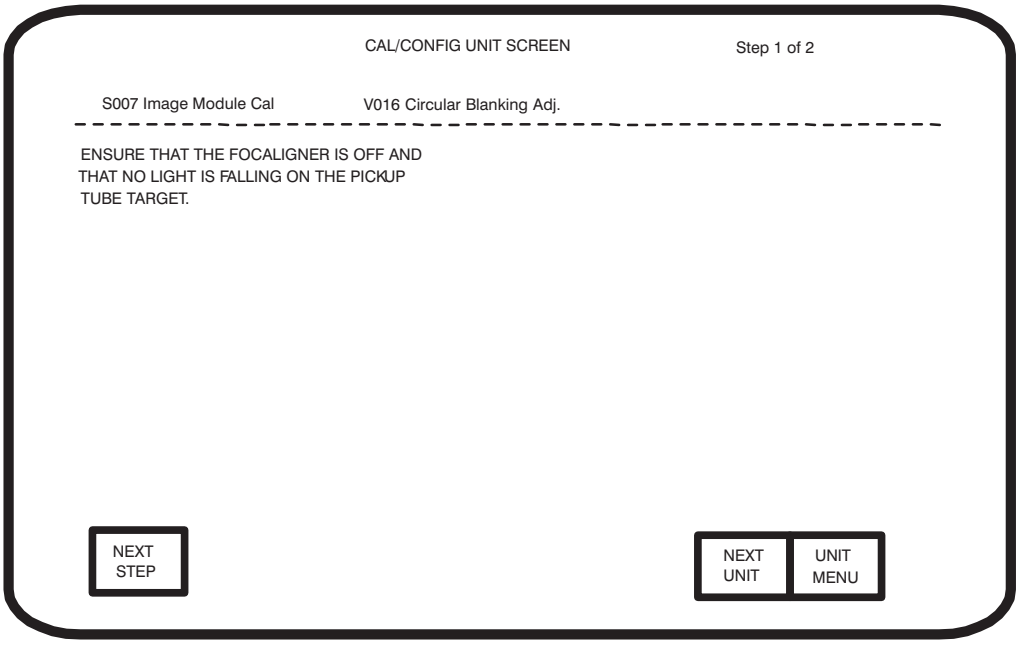
3 CAL PROCEDURE

3-1 Step 1. Setup the equipment

- Cover the camera with a dark cloth.
- Touch NEXT STEP softkey to proceed to Step 2.

Note: If the camera was installed on an Image Evaluation Tool or Focaligner in a previous calibration unit, make sure that the Image Evaluation Tool or Focaligner is turned off before proceeding to Step 2.

V016 STEP 1 SCREEN DISPLAY



3-2 Step 2. Adjust Circle Blanking

- Perform Circle Blanking adjustments. See Illustration 62. The adjustments are located on TV Video Processor board A15 located in the VIC card rack.The circle blanking is set slightly smaller than the vertical dimension of the camera raster. Adjust as follows:
  1. Adjust CIRCLE SIZE potentiometer (VIC1 A15 R328) for a completely visible circle.
  2. Adjust CIRCLE ROUNDNESS potentiometer (VIC1 A15 R255) to obtain a round circle.
  3. Adjust CIRCLE SIZE potentiometer (VIC1 A15 R328) to place the circle tangent to the top of the camera raster.
- Touch NEXT UNIT or UNIT MENU softkey to exit the unit. Exiting the unit initiates loading of the calibration data into NV RAM.

V016 STEP 2 SCREEN DISPLAY

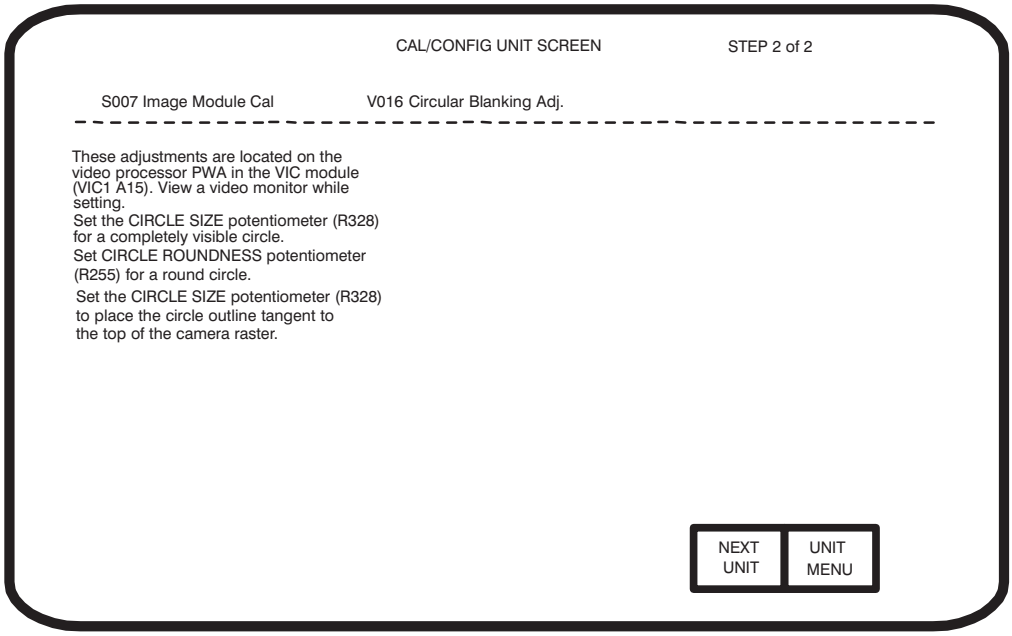
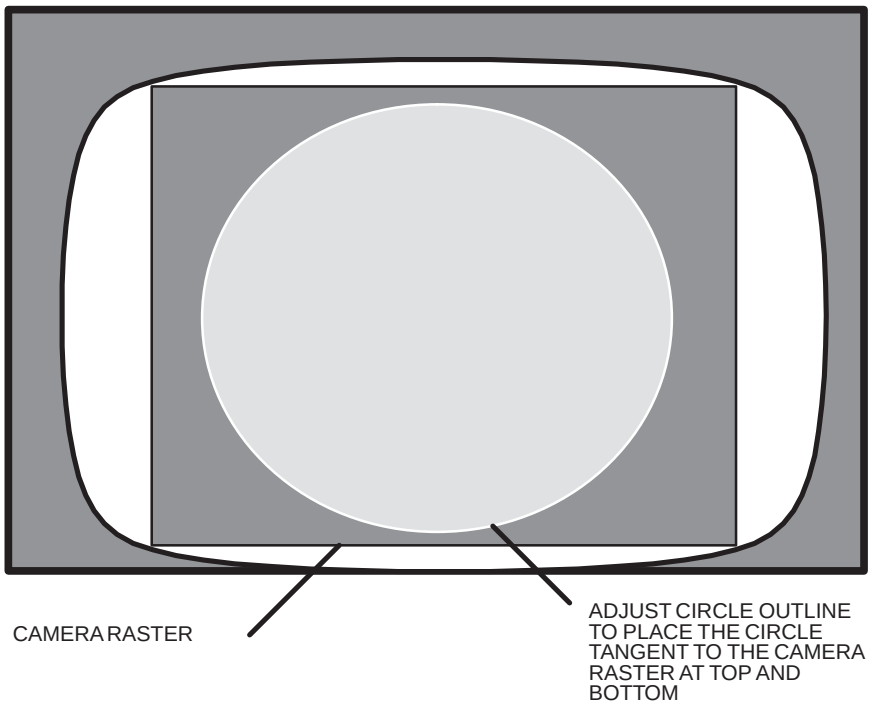


Illustration 62 – V016, Circle Blanking Adjustment



Note: On systems with a 20” monitor the circle size is approximately 11.5” in diameter.
On systems with a 15” monitor the circle size is approximately 8.0” in diameter.

Blank page.

UNIT V020 – Initial Focus

Time: x h xx min – Personnel: 1 field engineer

1 DESCRIPTION

Calibration Unit V020 is used to make initial focus adjustments on the camera . An image displaying a resolution pattern is required to observe focus. Three steps are required to accomplish the calibration. A screen display is provided for each step.

2 EQUIPMENT REQUIRED

Image Evaluation Tool or Focaligner, or Focus Phantom (high contrast resolution test tool or wedge pattern).

3 SPECIAL INSTRUCTIONS

Note: **For Vascular Systems Only:** Before system calibration, verify that additional filter (copper–aluminum filter) is not installed on top of collimator. (Open sensor hinge assembly to verify.) If installed, remove before performing calibration.

4 CAL PROCEDURE

4-1 Step 1. Setup the Equipment

Note: If V020 is being run for the first time in each camera mode, the appropriate “Size and Center” calibration unit (V012 for fluoro or V070 for DX/DLX) must be run first. V070 and V012 must also be run again in their normal calibration sequence.

- Start the focus adjustment using one of the calibration methods given below.

Note: If the Image Intensifier has not been focused before, the initial focus adjustment must be accomplished using a Focaligner or Image Evaluation Tool.

4-1-1 Image Evaluation Tool or Focaligner (Initial Focus)

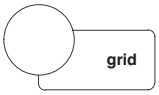
Remove the TV camera from the Image Intensifier assembly. Attach the TV camera to the Image Evaluation Tool or Focaligner. Do not turn on the Image Evaluation Tool or Focaligner at this time.

OR

4-1-2 Radiation (Final Focus)

Place a high contrast resolution test tool or wedge pattern at the input to the Image Intensifier or SFD. Touch NEXT STEP softkey.

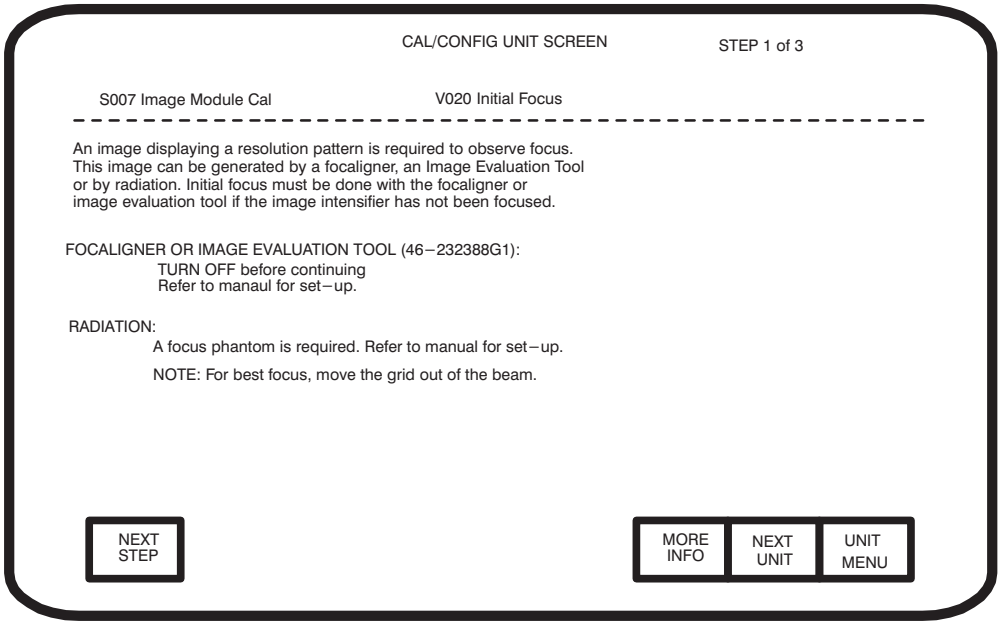
Note: Intelligent Spot Film Device Systems: To permit proper viewing of the image when using RADIATION, the grid of the SFD must be in the out position.



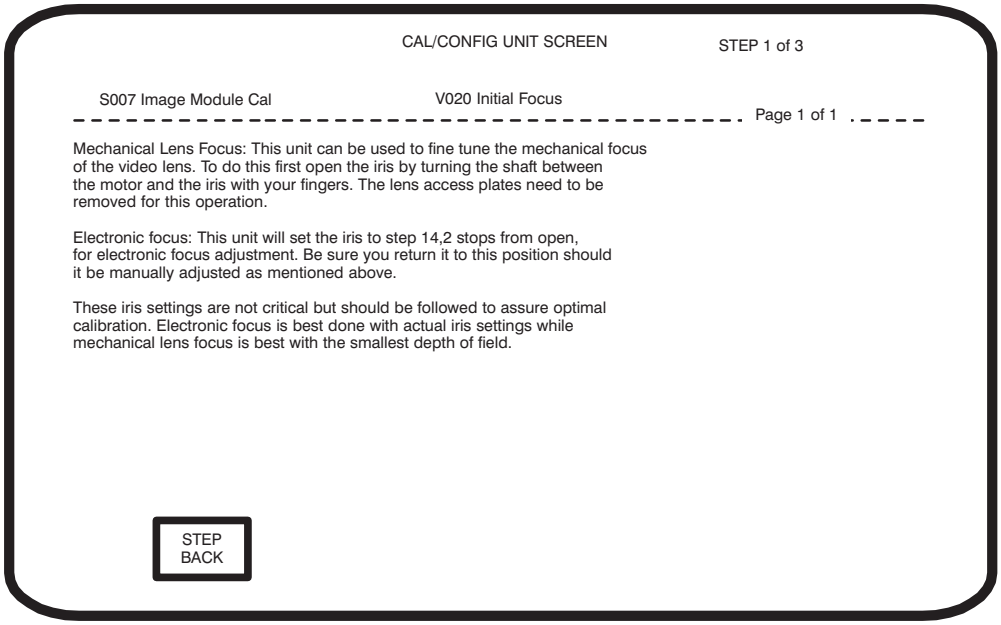
- Press the GRID button on the spot film device to move the ISFD grid to the “out” position.

- Touch NEXT STEP softkey. A “PROCESSING” message is displayed while the system up-loads the Step 2 screen presentation.

V020 STEP 1 SCREEN DISPLAY



V020 STEP 1 “MORE INFO” SCREEN DISPLAY



4-2 Step 2. Adjust Focus

- Continue the adjustment according to the calibration method selected in Step 1. However, use the Step 2 radiation method as the final adjustment.

4-2-1 Image Evaluation Tool or Focaligner

1. Turn on the Image Evaluation Tool or Focaligner and set the intensity for proper monitor brightness.
2. Touch SET ACTUAL softkey and use the console dial to adjust for optimum focus.

OR

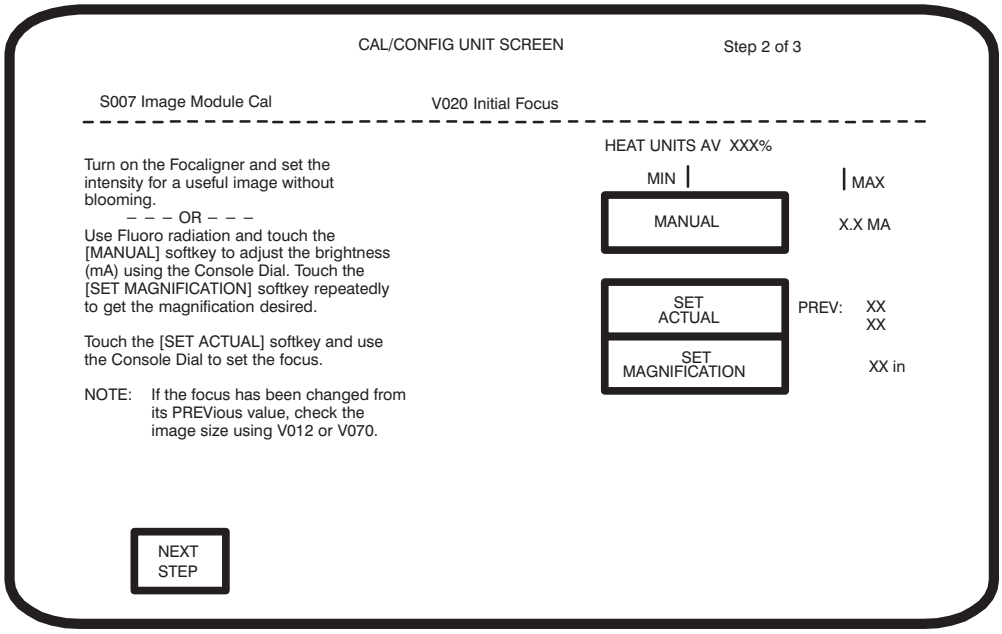
4-2-2 Radiation

1. Take a fluoro exposure, Touch MANUAL softkey and using console dial, adjust mA for proper monitor brightness.
2. Touch SET MAGNIFICATION softkey repeatedly to achieve desired magnification for focusing. The SET MAGNIFICATION softkey is only activated after the MANUAL softkey is selected.
3. Touch SET ACTUAL softkey and use the console dial to adjust for optimum focus. Terminate the exposure.

- Touch NEXT STEP softkey to proceed to Step 3.

Note: If the SET ACTUAL “PREV” focus value is changed from the previous value indicated, re–run Size and Center, Calibration Unit V012, to check image size.

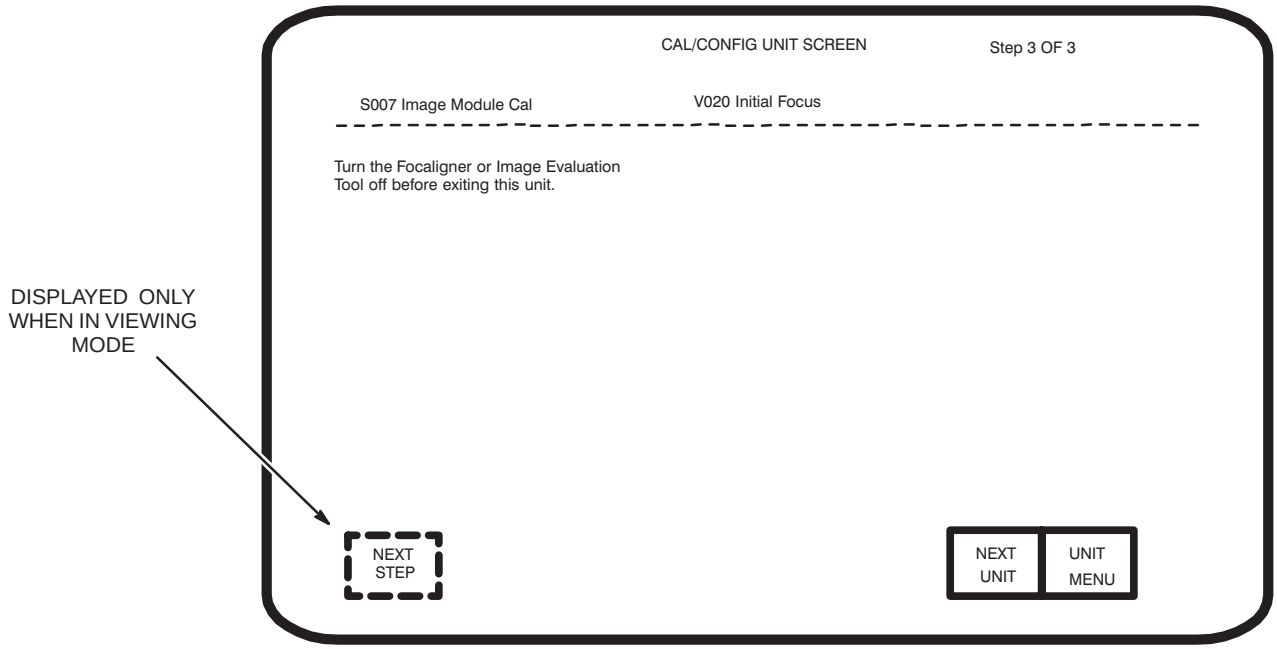
V020 STEP 2 SCREEN DISPLAY



4-3 Step 3. Exit Unit

- Turnoff the Focaligner or Image Evaluation Tool (if that calibration method was used).
- Touch NEXT UNIT or UNIT MENU softkey to exit the calibration unit. Exiting the unit initiates loading of the calibration data into NV RAM. An “Updating NV database” message is displayed while the calibration data is loaded into the system.

V020 STEP 3 SCREEN DISPLAY



UNIT V021 – Focus Fluoro/512/1024

Time: x h xx min – Personnel: 1 field engineer

1 DESCRIPTION

Calibration Unit V021 is used to provide final focus adjustment of the TV camera for conventional fluoro, DLX fluoro, DLX 512 and DLX 1024. The appropriate calibration procedure/screen presentation will be automatically displayed on the console based on sequence menu/unit menu selection.

There are two calibration methods to adjust TV camera focus:

- **Conventional Calibration:** This method looks for the best resolution limit seen on a resolution wedge image on the monitor. It is used for focus adjustment for all acquisition modes of all non–vascular systems and for conventional fluoro and 1024 acquisition mode of vascular systems.
- **Digital Calibration:** This method looks for the best standard deviation in a Region of Interest (ROI), measured at some spatial frequency on a resolution wedge image on the DLX monitor. This method is also used to more accurately adjust the camera lens focus with the iris fully opened. It is designed for only for 512 acquisition modes (that includes DLX fluoro) of vascular systems.

NOTICE

The Digital Calibration method is NOT available for single plane LCA/LCV/LC+ systems with ASC software OLDER than G4.XX; for these systems the Conventional Calibration method MUST be used.

Three steps are required to accomplish the applicable calibration for either method.

2 EQUIPMENT REQUIRED

For Focus Fluoro/512/1024 for other than biplane vascular Systems: Image Evaluation Tool/Focaligner or Resolution wedge pattern (P/N 46–197871P2).

For Focus 512 for biplane vascular Systems: Resolution wedge pattern (P/N 46–197871P2).

3 SPECIAL INSTRUCTIONS

Note: **For Vascular Systems Only:** Before system calibration, verify that additional filter (copper–aluminum filter) is not installed on top of collimator. (Open sensor hinge assembly to verify.) If installed, remove before performing calibration.

4 CAL PROCEDURE 1 – CONVENTIONAL CALIBRATION

For all Non–Vascular Systems and Focus Fluoro/Focus 1024 of Vascular Systems.

NOTICE

The Digital Calibration method is NOT available for single plane LCA/LCV/LC+ systems with ASC software OLDER than G4.XX; for these systems the Conventional Calibration method MUST be used for Focus Fluoro, Focus 512, and Focus 1024.

4-1 Step 1. Setup the System

- Set up the system for focus adjustment using one of the calibration methods given below. If the II has not been focused before, an initial focus must first be accomplished using a focaligner or IET.

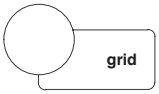
4-1-1 Image Evaluation Tool (IET)or Focaligner (Initial Focus)

1. Remove the TV camera from the Image Intensifier assembly.
2. Attach the TV camera to the IET or Focaligner. Do not turn on the IET or Focaligner at this time.

4-1-2 Radiation (Final Focus)

1. Tape a focus phantom or wedge pattern at the input to the Image Intensifier. **Ensure that the area of the pattern you will be concentrating on is positioned at the center of the II.**
2. For best viewing of focus, the grid must be out of the beam.

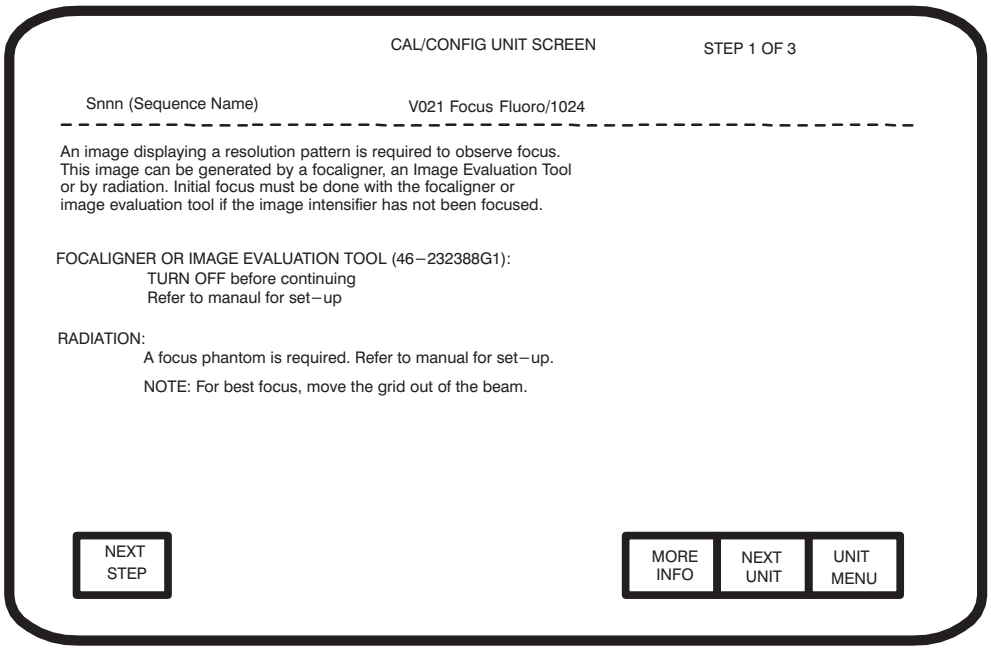
Note: Intelligent Spot Film Device Systems: To permit proper viewing of the image when using RADIATION, the grid of the SFD must be in the out position.



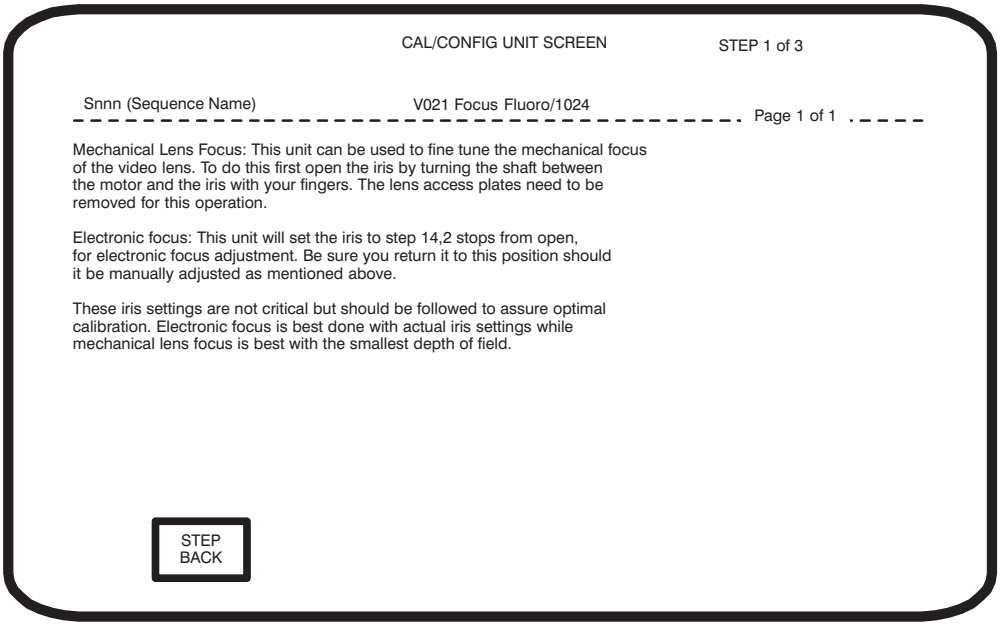
- Press the GRID button on the spot film device to move the ISFD grid to the out position.

- Touch NEXT STEP softkey to proceed to Step 2.

V021 STEP 1 SCREEN DISPLAY (CONVENTIONAL CALIBRATION)



V021 STEP 1 “MORE INFO” SCREEN DISPLAY (CONVENTIONAL CALIBRATION)



4-2 Step 2. Adjust Focus

- Continue the adjustment according to the calibration method selected in Step 1.

Note: If a Focaligner or IET is used, it is essential that the center of the image is used for focus because the electronic TV focus can significantly effect the subtraction uniformity. Since the Focaligner radiation wedge is off center, the preferred method of adjusting focus is using radiation.

4-2-1 Image Evaluation Tool (IET) or Focaligner

1. Turn on the IET or Focaligner and set the intensity for proper monitor brightness.
2. Touch SET ACTUAL softkey and use the console dial to adjust for optimum focus.

4-2-2 Radiation

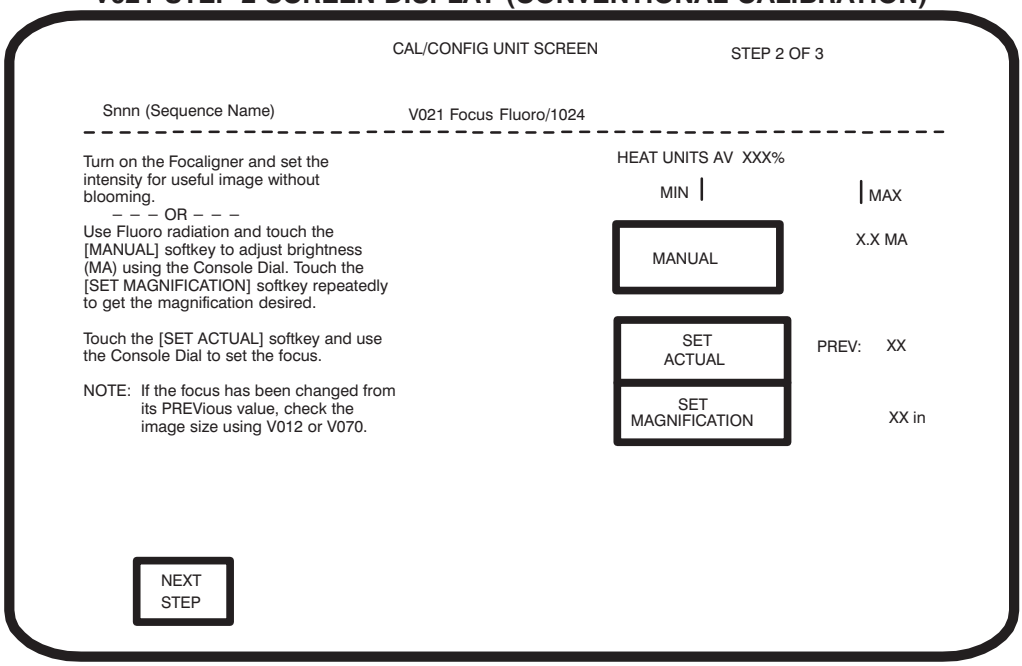
1. Take a fluoro exposure. Touch MANUAL softkey and using the console dial, adjust mA for proper monitor brightness.
2. Touch SET MAGNIFICATION softkey repeatedly to achieve the desired magnification for focusing. The SET MAGNIFICATION softkey is only activated after the MANUAL softkey is selected.
3. Touch SET ACTUAL softkey and use the console dial to adjust for optimum focus. Start at the conventional fluoro focus value. (This value is displayed on the console as CF FOCUS VALUE.)

Note: If severe shading is seen when doing DLX subtraction uniformity tests, rerun this unit and raise the SET ACTUAL in a positive direction one or two counts over the CF FOCUS VALUE. Verify that the system still passes the Artery Test.

4. Terminate the exposure.

- Touch NEXT STEP softkey to proceed to Step 3.

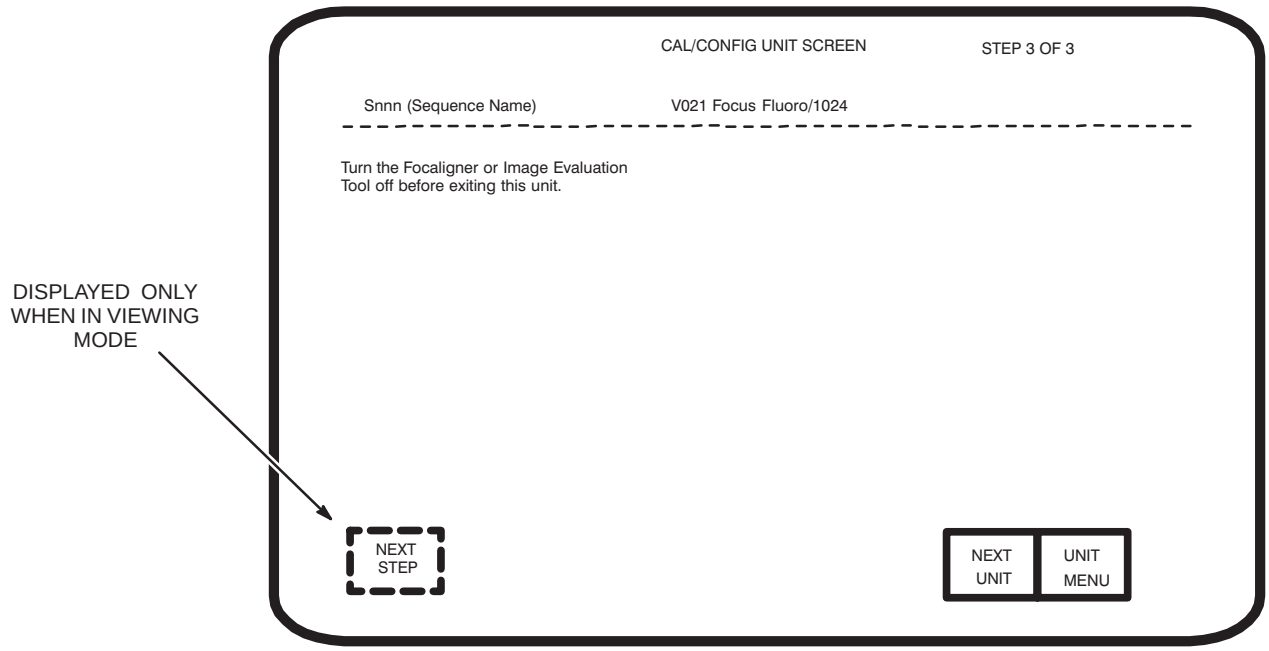
V021 STEP 2 SCREEN DISPLAY (CONVENTIONAL CALIBRATION)



4-3 Step 3. Exit Unit

- Turnoff the Focaligner or IET (if that calibration method was used).
- Touch NEXT UNIT or UNIT MENU softkey to exit the calibration unit. Exiting the unit initiates loading of the calibration data into NV RAM. An “Updating NV database” message is displayed while the calibration data is loaded into the system.

V021 STEP 3 SCREEN DISPLAY (CONVENTIONAL CALIBRATION)



5 CAL PROCEDURE 2 – DIGITAL CALIBRATION

Focus 512 for Vascular systems.

NOTICE **The Digital Calibration method is NOT available for single plane LCA/LCV/LC+ systems with ASC software OLDER than G4.XX; for these systems the Conventional Calibration method MUST be used.**

Note: For using this Digital Calibration method, the Digital Image processor must be calibrated, and the VIC Digital Calibration units which are normally calibrated before this unit must have been run (i.e., video gains, size and center, beam current). Refer to DX VIC and Dose Cal Sequence in Advantx Calibration User's Guide.

This unit is used to fine tune the PUT electronic focus and the camera lens mechanical focus.

- The PUT electronic focus is adjusted by optimization of the standard deviation in a Region Of Interest (ROI) on the DLX monitor image. This ROI is measured at the 0.6 lp/mm spatial frequency in 22 cm FOV on a resolution wedge. This method is more accurate, less user dependent and faster than the resolution limit method.
- The camera lens focus is also adjusted by the same optimization on the same ROI. In order to adjust it more accurately, the iris is fully opened so that the depth of field is the minimum. By that way the lens focus is the best whatever the acquisition conditions are, especially in fluoro when the patient thickness is high and the FOV small, and the iris opens because the kVp is overridden.
- Otherwise this method needs only a resolution wedge to perform both adjustments.

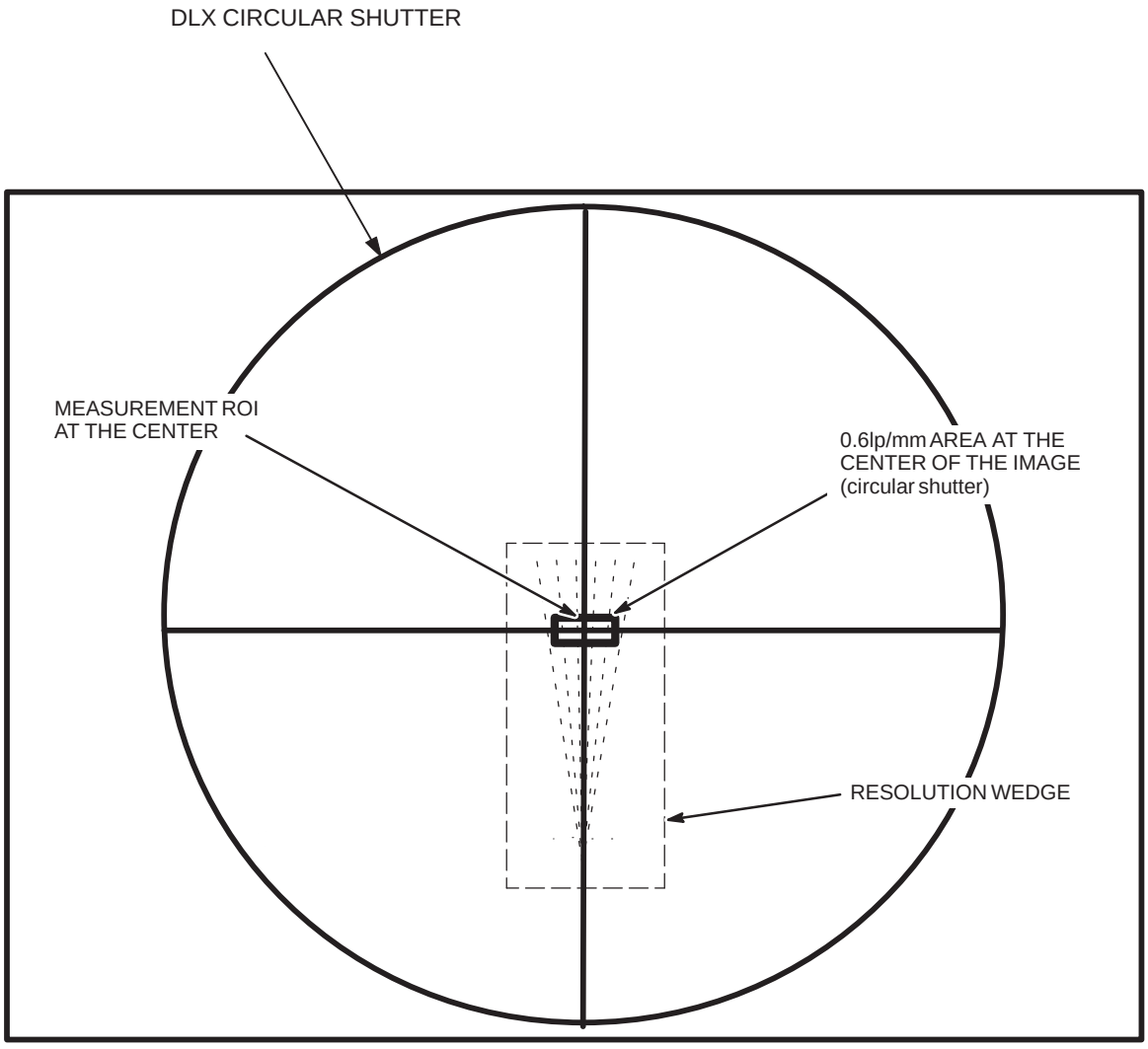
5-1 Step 1. Setup the System

Set up the system for focus adjustment using the digital calibration method given below. If the II has not been focused before, an initial focus must first be accomplished.

- At the "DLX LOGIN" prompt on the DLX console, type "DLX" and press the RETURN key.
- Verify that the ACQUISITION screen is displayed on the DLX console. If the ACQUISITION screen is not displayed, press the following keys to continue:
  - NEW EXAM
  - NEW PATIENT (you must also enter a patient name and ID number or the DLX will not be enabled.)
  - START EXAM
- Remove the grid.
- Tape the resolution wedge pattern (P/N 46–197871P2) on the anticollision plate at the Image Intensifier input. Orient the resolution wedge so that the high–resolution end is toward the bottom of the field. The **0.6 lp/mm area** of the resolution pattern should be at the center of the II entrance plane (see Illustration 63).

Note: If V004 unit has just been run and its field sizing gauge is already in place, you can still keep it and place the resolution wedge as described above, and then continue to run this V021 unit. There will be no impact from the field sizing gauge.

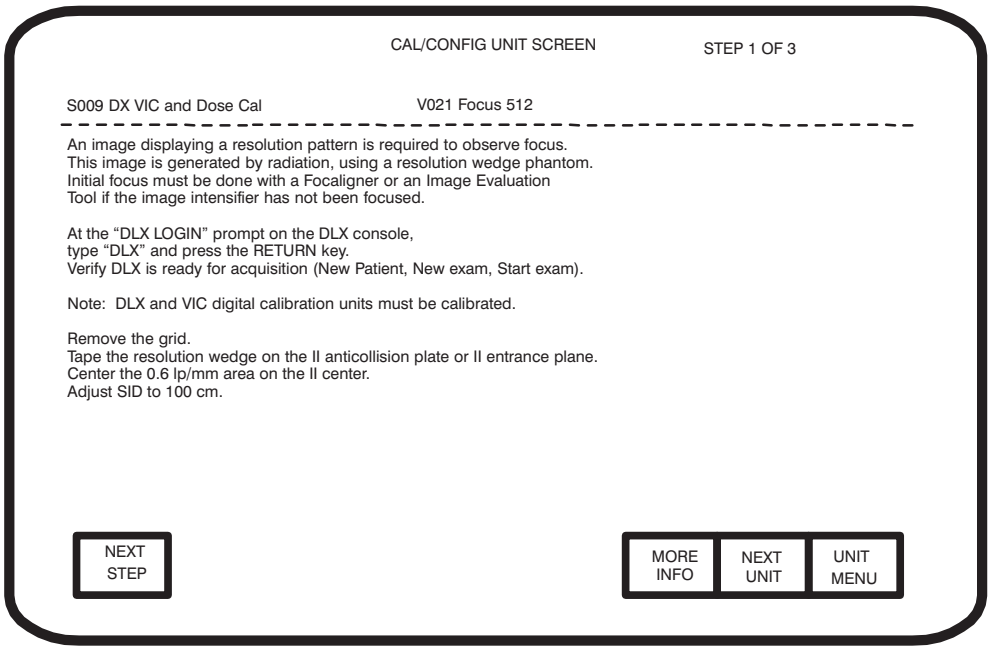
Illustration 63 – Wedge Positioning seen on the Monitor Image



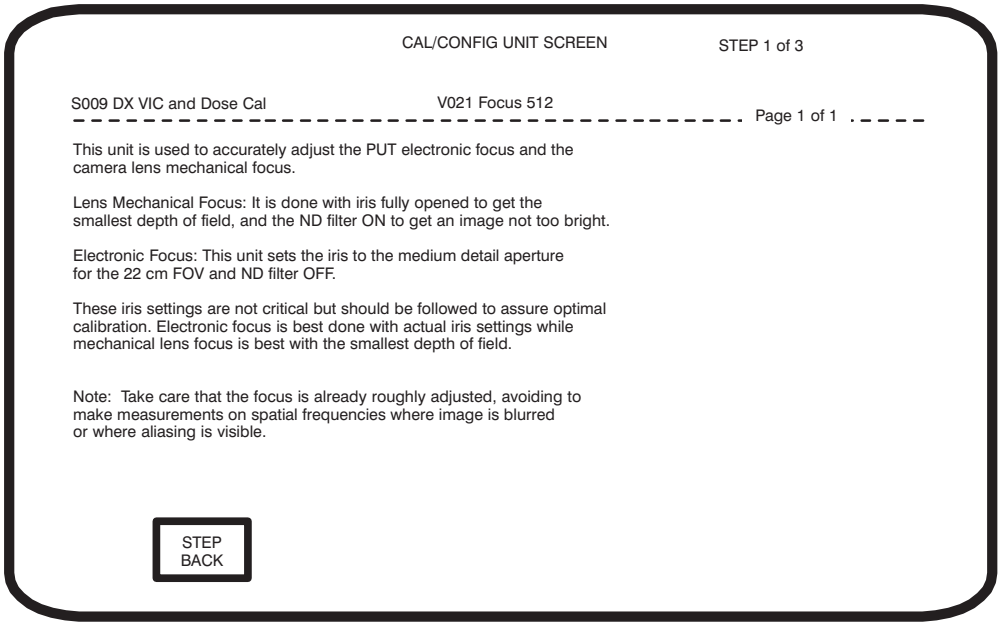
Note: If the anticollision device is already removed, tape the resolution wedge pattern at the Image Intensifier entrance plane.

- Adjust the Source to Image Distance (SID) to about 100 cm.
- Touch NEXT STEP softkey to proceed to Step 2.

V021 STEP 1 SCREEN DISPLAY (DIGITAL CALIBRATION)



V021 STEP 1 “MORE INFO” SCREEN DISPLAY (DIGITAL CALIBRATION)



5-2 Step 2. Adjust Electrical and Mechanical Focus

When entering into this step, the system is automatically configured so that:

1. The TV Camera is unblanked.
2. The image gate is moved to view the TV Camera.
3. The Image Intensifier FOV is initialized to 22 cm.
4. The system is configured in pulsed fluoro, low line rate.
5. VIC is configured in low gain path, without EDR.
6. Image Processor is is configured in 512 acquisition mode.
7. Image Processor TV image is displayed on the monitors.
8. Image Processor is configured in Technical Menu, without Circular Shutter and with LIH (Last Image Hold).
9. The system remembers the mA value set for viewing the TV Camera.

Set up the measurement conditions :

- Verify DLX console displays Technical Menu screen.
- Touch the SET MAGNIFICATION softkey and use the console dial to select the Mag mode which gives a **22 cm FOV**.
- On DLX Technical Menu, select Camera Centering function.
- Initiate and maintain a fluoro exposure. A fixed technique of 60 kVp is used. Touch the MANUAL softkey and use the console dial to adjust mA for a good fluoro image as seen on the TV monitor.
- Verify that the 0.6 lp/mm spatial frequency area of the resolution wedge is centered.
- On DLX Technical Menu, deselect Camera Centering function.
- Using DLX Technical Menu, position a Region of Interest (ROI) on the Last Image Hold (LIH image) on this 0.6 lp/mm spatial frequency area.

Note: This ROI should be positioned only on the line pair area without extending beyond the lead area. Its width should be between 3 and 5 times its height, so that the ROI measures the levels at the desired spatial frequency.

- On DLX console, select LEVEL ADJUST and 10 BITS functions.

5-2-1 Adjust Electrical Focus

- Touch ELECTRICAL FOCUS softkey on Advantx console. The iris opens to the aperture for fluoro medium detail and the Neutral Density Filter is set to OFF.
- Take and maintain a fluoro exposure and read the **mean value** in the ROI on the DLX console monitor. Touch MANUAL softkey and adjust mA with the console dial so that the **mean value** in the ROI is between 100 and 120 lsb.
- Read the **standard deviation** value in the ROI on the monitor. Touch the SET ACTUAL softkey. Use the console dial to adjust the PUT focus for the **maximum standard deviation**.

Note: DLX measures the ROI content about two times per second; since the fluoro image is noisy, the standard deviation value changes slightly from one measurement to the other. When adjusting the PUT focus, let the system stabilize before the reading of the standard deviation value.

- Terminate the exposure.

5-2-2 Adjust Mechanical Focus

- Remove two cover plates from the camera mount in order to get access to the lens (see Illustration 64).
- Touch MECHANICAL FOCUS softkey. The iris opens fully and the Neutral Density Filter is set to ON to compensate for a too bright image.

CAUTION **Wear protective clothing and observe standard radiation safety practices while performing this calibration unit when adjusting camera lens focus.**

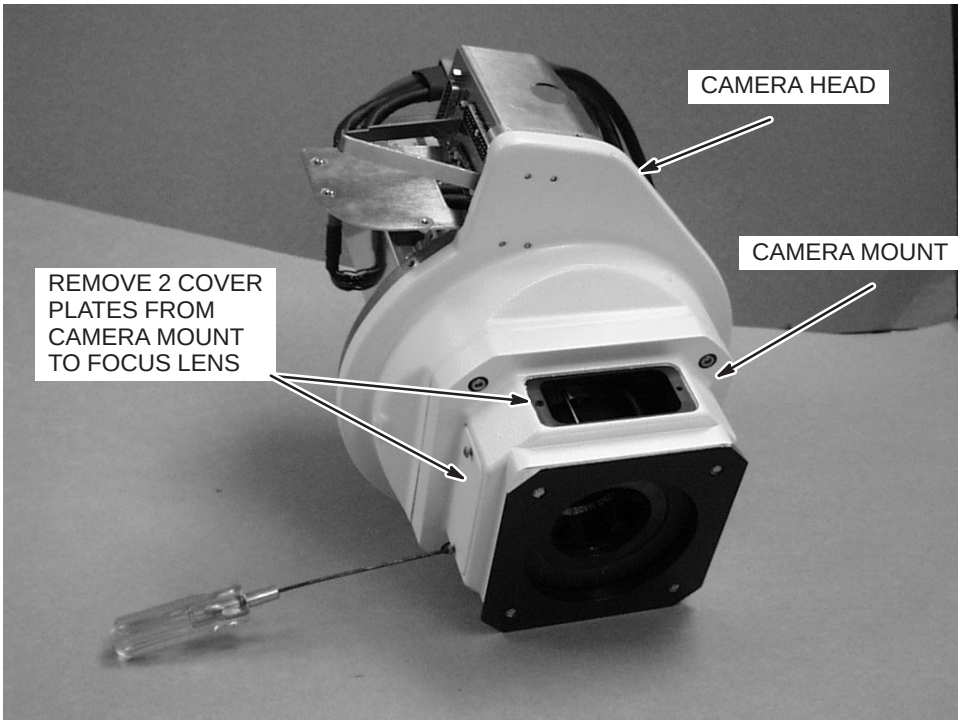
- Take and maintain a fluoro exposure and read the **mean value** in the ROI on the DLX console monitor. Touch MANUAL softkey and adjust mA with the console dial so that the **mean value** in the ROI is between 100 and 120 lsb.
- Read the **standard deviation** value in the ROI on the In–room monitor. Rotate the VIC camera lens until you get the **maximum standard deviation** (see Illustration 64).

Note: DLX measures the ROI content about two times per second. Since the fluoro image is noisy, the standard deviation value changes slightly from one measurement to the other. When adjusting the lens focus, let the system stabilize before the reading of the standard deviation value.

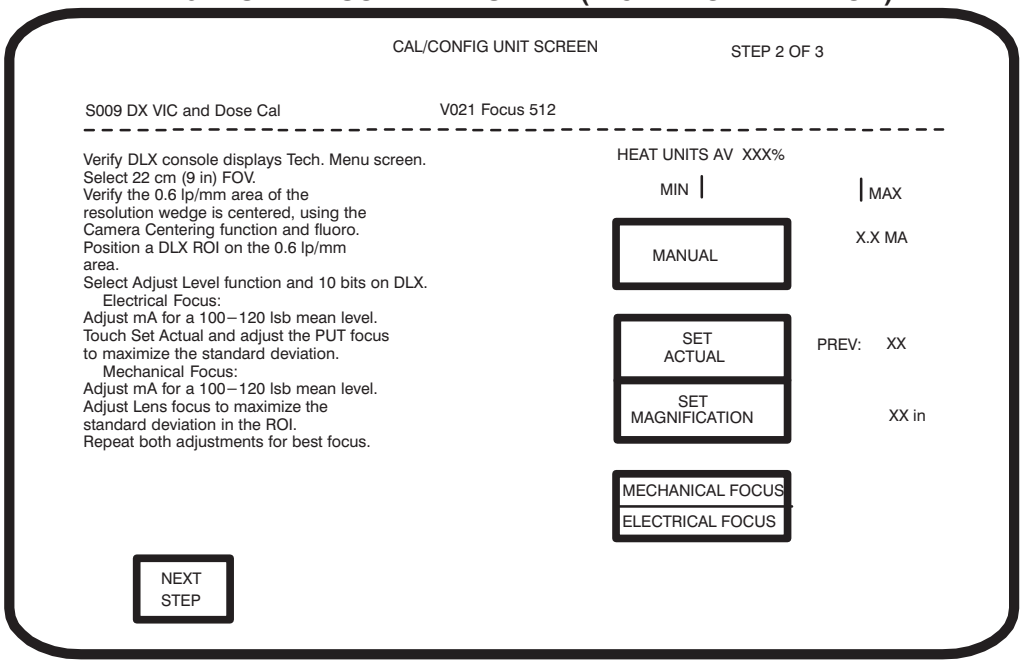
- Terminate the exposure.

Note: PUT Electrical Focus and Lens Mechanical Focus are not interdependent, but you may repeat these two adjustments in order to achieve the best focus for both.

Illustration 64 – TV Camera Assembly



V021 STEP 2 SCREEN DISPLAY (DIGITAL CALIBRATION)

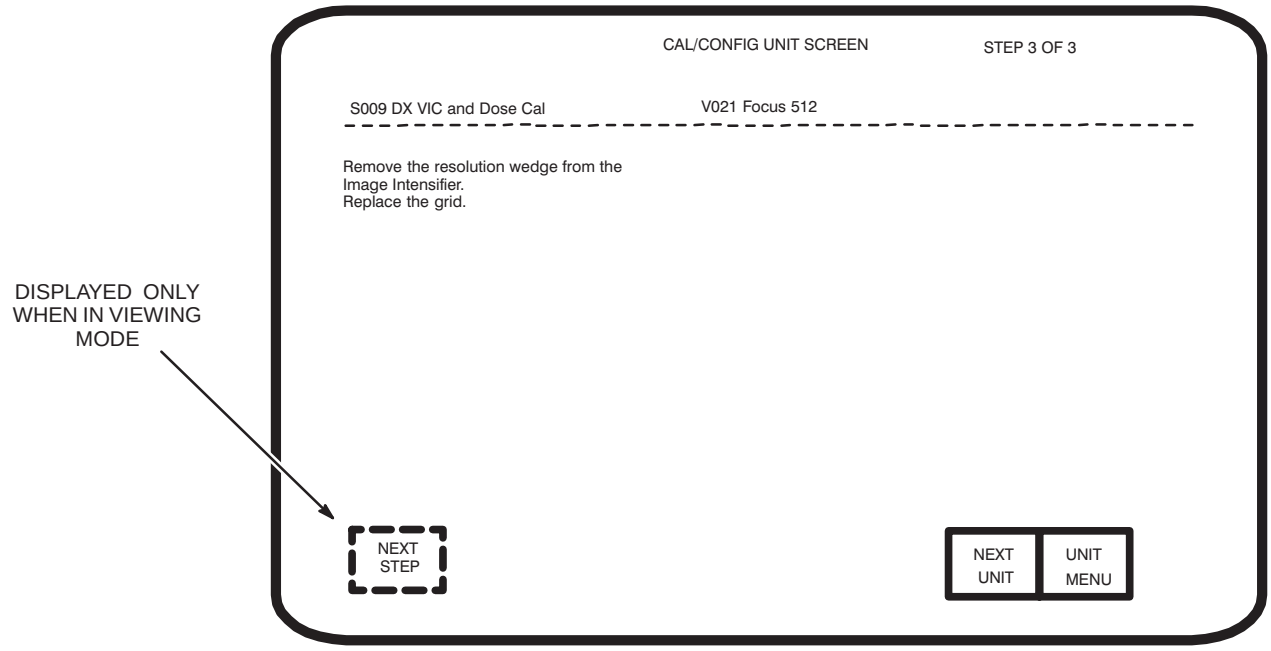


5-3 Step 3. Exit Unit

- Remove the resolution wedge from the Image Intensifier entrance plane.
- Replace II grid.
- Touch NEXT UNIT or UNIT MENU softkey to exit the calibration unit. Exiting the unit loads the command values for the respective grids and fields of view into NV RAM.

Note: The NEXT STEP softkey is only displayed during the viewing (Browse) mode to permit return to Step 1 screen display.

V021 STEP 3 SCREEN DISPLAY (DIGITAL CALIBRATION)



UNIT V050 – Target Voltage

Time: x h xx min – Personnel: 1 field engineer

1 DESCRIPTION

Calibration Unit V050 sets the maximum target voltage for the pickup tube type installed in the system. Table 22 indicates the maximum target voltage ratings according to tube type/model number. Two steps are required to accomplish the calibration.

Table 22 – Maximum Target Voltage Ratings

TUBE TYPE	MODEL NO.	MAX TARGET VOLTAGE
SATICON A, TRIODE	TH9951, XQ1560	80 V
SATICON B, TRIODE	TH9957, XQ1565/XQ1570	50 V
SATICON C, TRIODE	XQ1585	40 V
CZICON, TRIODE	XQ1440X	50 V
PLUMBICON, DIODE	XQ2182/03X	50 V
SATICON A, DIODE	TH9956	80 V
VIDICON, TRIODE	XQ1240	75 V

Note: The TUBE MAXIMUM target voltage displayed on the console screen should match the value indicated in the above table for the type of pickup tube installed.

2 EQUIPMENT REQUIRED

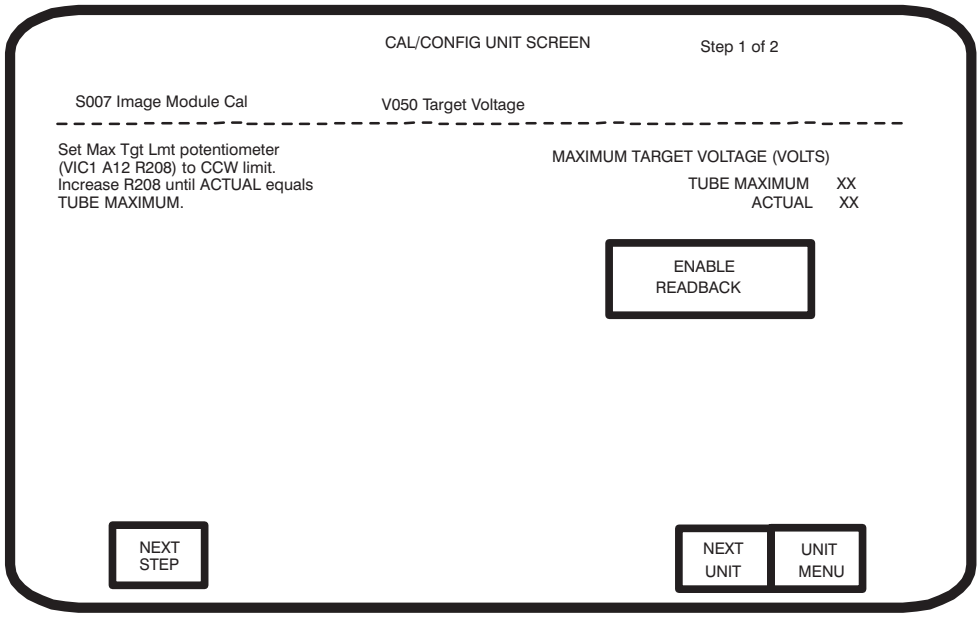
Non-metallic trimpot adjusting tool.

3 CAL PROCEDURE

3-1 Step 1.

- Touch the ENABLE READBACK softkey.
- Set Maximum Target Limit potentiometer (VIC1 A12 R208) to fully CCW position.
- While observing the console screen, adjust Maximum Target Limit potentiometer (VIC1 A12 R208) CW until the ACTUAL target voltage is equal to the TUBE MAXIMUM value indicated. If adjusted beyond the tube maximum, an error message is displayed. Re-adjust as necessary.
- Touch NEXT STEP softkey to proceed to Step 2.

V050 STEP 1 SCREEN DISPLAY

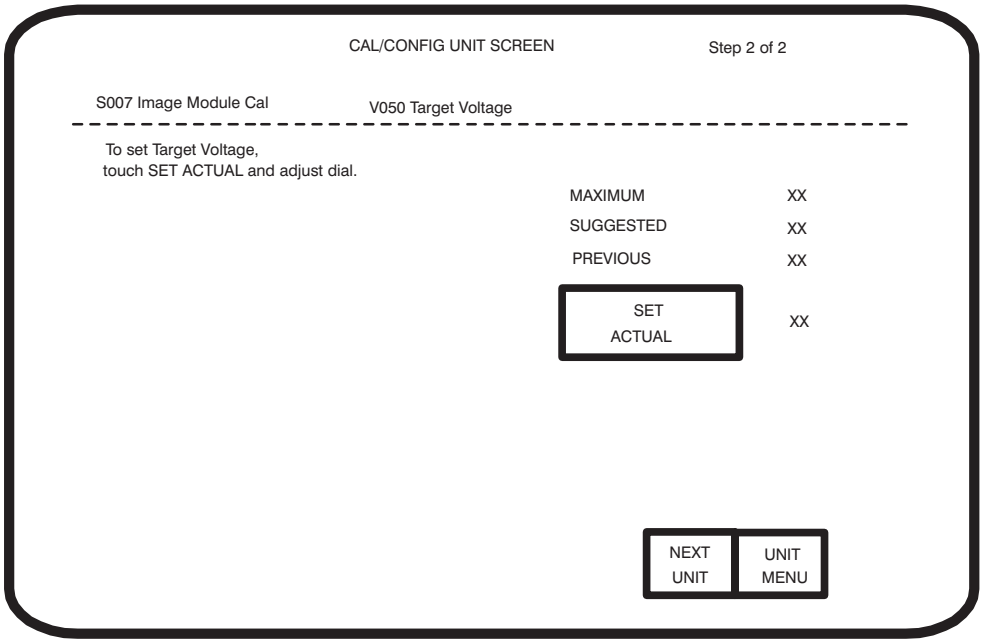


3-2 Step 2.

- Touch SET ACTUAL softkey and, using the console dial, enter the SUGGESTED target voltage value as the SET ACTUAL value.
- After the SET ACTUAL value is entered, touch NEXT UNIT or UNIT MENU softkey to exit the unit. Exiting the calibration unit initiates loading of the calibration data into NV RAM. A “Updating NV database” message is displayed while the calibration data is being loaded into the system.

Note: The suggested target voltage is listed on the pickup tube specification label. If the SUGGESTED value indicated on the screen is different than the value indicated on the pickup tube specification label, have your authorized GE Service Representative correct the system configuration database.

V050 STEP 2 SCREEN DISPLAY



Blank page.

UNIT V051 – Beam Alignment

Time: x h xx min – Personnel: 1 field engineer

1 DESCRIPTION

Calibration unit V051 adjusts the horizontal and vertical alignment coils of the TV camera pickup tube to provide a fine tuning of the electron beam. The calibration can be accomplished using a Focaligner or radiation. A flickering of the monitor is normal during this calibration procedure. Two steps are required to accomplish the calibration. Each step is supported by a screen presentation.

Note: If the system is configured with a VIDICON tube, the dark spot used to align the beam will be visible on the monitor without using a focaligner or making a Fluoro exposure.

2 EQUIPMENT REQUIRED

Focaligner and dark cloth cover (Optional).

NOTICE

If default values are loaded (Reference C000 Database Initialization), the circle blanking image observed on the monitor will be misaligned and you must run Cal Unit V012, Size and Center, before running this Cal Unit. Cal Unit V051 is interactive with Cal Unit V012.

3 SPECIAL INSTRUCTIONS

Note: **For Vascular Systems Only:** Before system calibration, verify that additional filter (copper–aluminum filter) is not installed on top of collimator. (Open sensor hinge assembly to verify.) If installed, remove before performing calibration.

4 CAL PROCEDURE

4-1 Step 1. Set Up the Equipment

- Start the adjustment using one of the calibration methods listed below:

4-1-1 Focaligner

Attach the camera to the Focaligner and cover the assembly with a dark cloth. Do not turn on focaligner at this time.

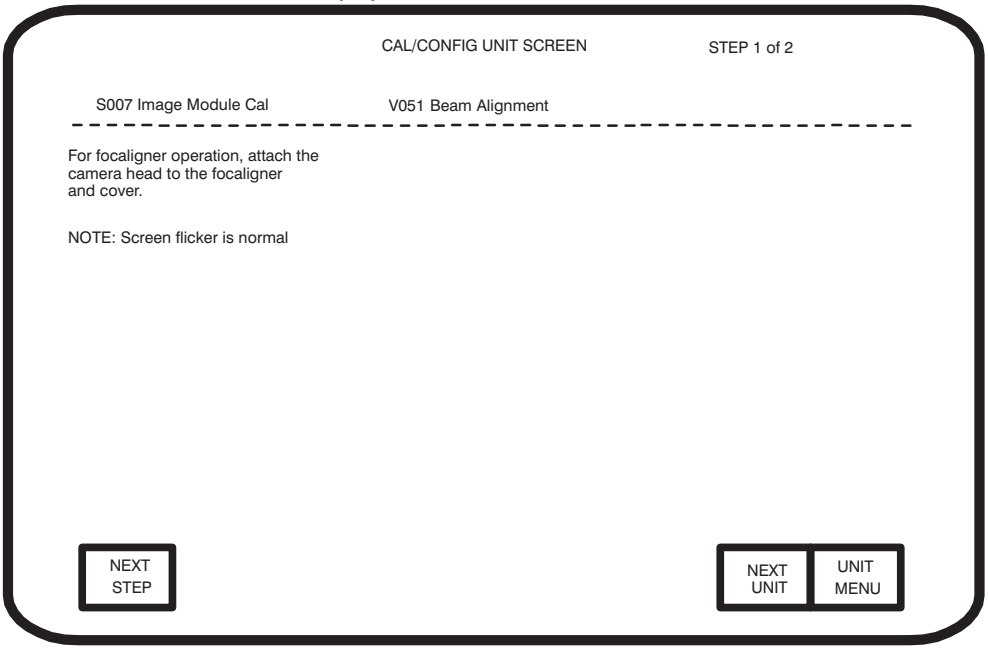
OR

4-1-2 Radiation

The illuminated output phosphor provides the image when a fluoro exposure is made.

- Touch NEXT STEP softkey to proceed to Step 2.

V051 (HI) STEP 1 SCREEN DISPLAY



4-2 Step 2. Align Beam

- Continue beam alignment using the calibration method selected in Step 1.

Note: This calibration unit de-focuses the pickup tube. This may cause a rotation of the image and the horizontal and vertical adjustments may not move the dark spot in the expected direction.

WARNING **INCREASE BRIGHTNESS SLOWLY. EXCESS BRIGHTNESS WILL CAUSE A BURN ON THE PICKUP TUBE.**

4-2-1 Focaligner

Turn on the Focaligner and set the intensity for proper monitor brightness. If the dark spot is not visible, use the HORIZONTAL and VERTICAL softkeys to position the dark spot into view. Then, center on the monitor screen. See Illustration 65. Turn off the focaligner before exiting the unit.

OR

4-2-2 Radiation

Take a fluoro exposure. Touch MANUAL softkey and using console dial, adjust mA for proper monitor brightness. If the dark spot is not visible, use the HORIZONTAL and VERTICAL softkeys to position the dark spot into view. Then, center on the monitor screen. See Illustration 65.

- After the adjustment is completed, touch NEXT UNIT or UNIT MENU softkey. Exiting the calibration unit initiates loading of the calibration data into NV RAM. An “UPDATING DATABASE” message is displayed while the database is being updated.

V051 STEP 2 SCREEN DISPLAY

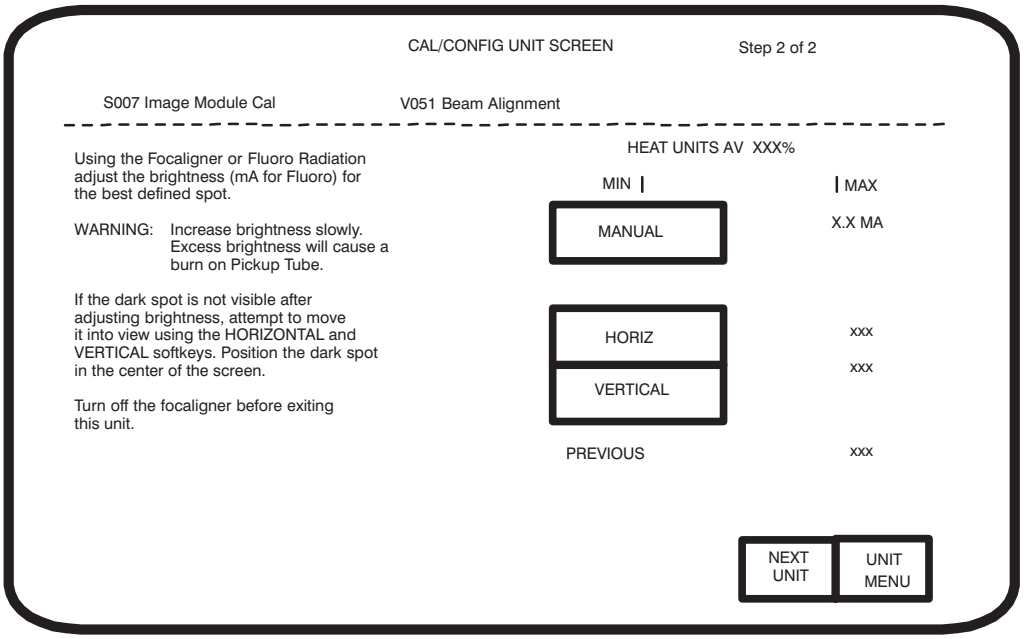
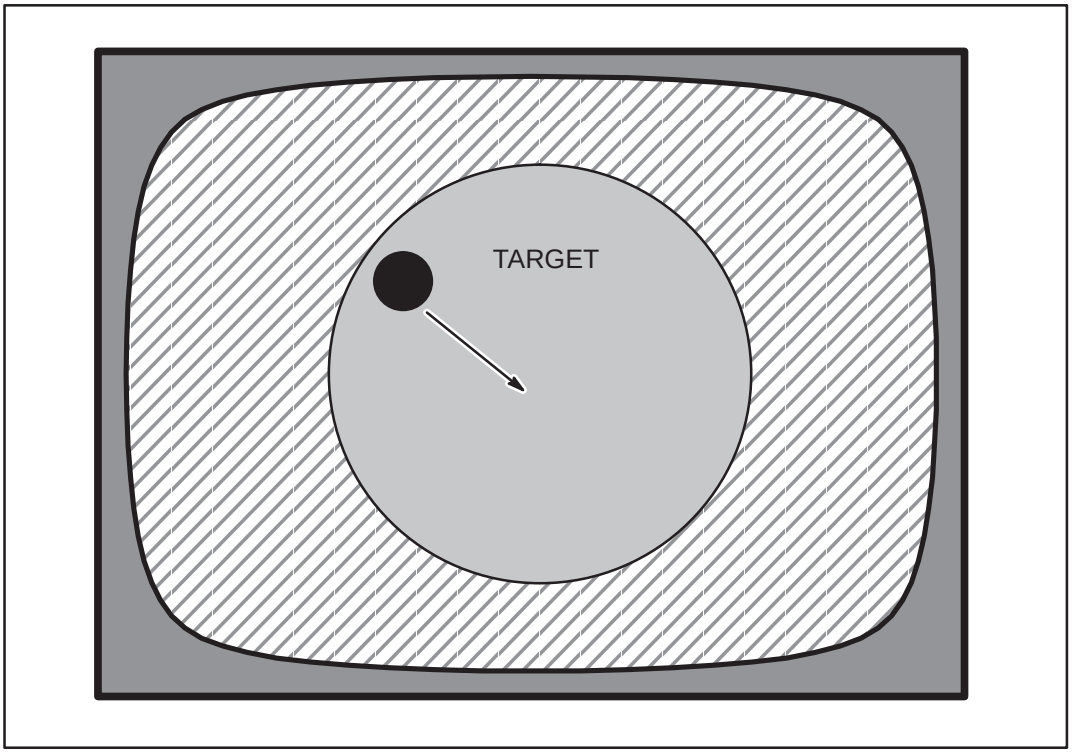


Illustration 65 – V051, Beam Alignment



UNIT V053 – Beam Current

Time: x h xx min – Personnel: 1 field engineer

1 DESCRIPTION

Calibration unit V053 sets the video camera target signal current for minimum and maximum beam current levels. Minimum Beam Current is the signal current used in the idle mode. Maximum Beam Current is the absolute signal current value not to be exceeded. The minimum and maximum Beam Current values set into the system depend upon the type of camera tube used in the system.

The Camera Tube Reference Table given below lists the minimum and maximum beam current values and calibration offset values that may be set into an Advantx system according to tube type.

The calibration offset (specified in Table 23) is required in order to force the beam current to a higher than normal operating level so that as the algorithm for the unit is executed, the G1 beam current drive can be decreased to the “Maximum Signal Ref.” without triggering a condition that would produce video waveform bounce.

Table 23 – Camera Tube Ref

TUBE TYPE	MODEL NO	BEAM CURRENT MIN	BEAM CURRENT MAX (See Note 1)	CALIBRATION OFFSET
SATICON A, TRIODE	TH9951, XQ1560	750 nA	1800 nA	50 nA
SATICON B, TRIODE	TH9957, XQ1565/XQ1570	750 nA	1800 nA	50 nA
SATICON C, TRIODE	XQ1585	750 nA	1800 nA	50 nA
CZICON, TRIODE	XQ1440	300 nA	1200 nA	50 nA
PLUMBICON, DIODE	XQ2182/03X	750 nA	1800 nA	50 nA
SATICON A, DIODE	TH9956	750 nA	1800 nA	50 nA
VIDICON, TRIODE	XQ1240	300 nA	1100 nA	300 nA
Note 1: When running this unit in DLX Cal Sequence S009 for systems with DLX 1024, Max Beam current is 700 nA (+ 50/–0) in 1024 Progressive Mode regardless of tube type.				

NOTICE

In order to cover variations in system configurations the unit presentation is divided into two separate calibration procedures. The procedures are as follows:

Cal Procedure 1.
Used to calibrate beam current on conventional fluoro systems when performing V053 on Sequence Menu S007, Imaging Module Cal. This is a 3 step procedure.
Cal Procedure 2.
Used to calibrate beam current on DLX 1024 systems when performing V053 on Sequence Menu S009, DX (DLX) VIC and Dose Cal. This is a 2 step procedure.
Perform the procedure applicable to your system. The appropriate screen presentation is automatically displayed in accordance with previously entered configuration data.

2 EQUIPMENT REQUIRED

Filtration (1/4 inch of aluminum).

NOTICE

If the system is configured with a Neutral Density Filter (NDF) ensure that the NDF is not positioned in front of the TV camera and that the SFD grid and masks are retracted from a position in the field of view. This is required to eliminate any effect on the intensity of the output image when performing this unit. If the NDF is correctly configured the NDF should not be in front of the camera when running this unit. If it is necessary, move the SFD grid or masks out of the field of view.

- **8835/8875/8885 Spot Film Device Systems: Use Tool Unit T012, SFD Jog Utility to reposition.**
- **Intelligent Spot Film Device Systems: Press GRID and MASK buttons on ISFD control panel.**

Note: A blank cassette needs to be inserted into the Intelligent Spot Film Device to drive the carriage back to rear position during fluoro.

3 SPECIAL INSTRUCTIONS

Note: For Vascular Systems Only: Before system calibration, verify that additional filter (copper–aluminum filter) is not installed on top of collimator. (Open sensor hinge assembly to verify.) If installed, remove before performing calibration.

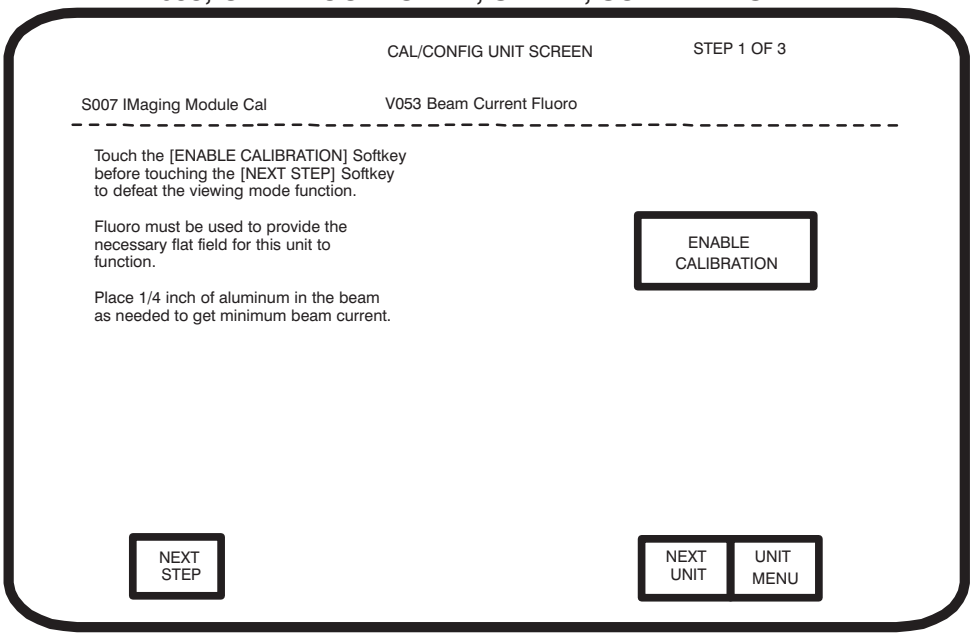
4 CAL PROCEDURE 1 – CONVENTIONAL FLUORO

4-1 Step 1. Setup the Equipment

Note: The illuminated output phosphor provides the image when a fluoro exposure is made.

- Touch the ENABLE CALIBRATION softkey.
- Place 1/4 inch of aluminum filtration in the x–ray beam to get minimum beam current when using Fluoro.
- Touch NEXT STEP softkey to proceed to Step 2.

V053, CAL PROCEDURE 1, STEP 1, SCREEN DISPLAY



4-2 Step 2. Set Minimum Beam Current

- Touch MANUAL softkey.
- Take and maintain a fluoro exposure.
- While taking fluoro, adjust MA with the console dial to set the SIGNAL CURRENT indicated on the console screen to within +50/–0 nA of the MINIMUM SIGNAL REF plus the calibration OFFSET pertaining to the camera tube type used in the system.

Note: Refer to the Camera Tube Reference Table at the beginning of this unit for the applicable **CALIBRATION OFFSET** value.

- Maintain exposure during adjustment to permit the system to calculate beam current. An interrupted exposure will cause the system to load an incorrect beam current setpoint.

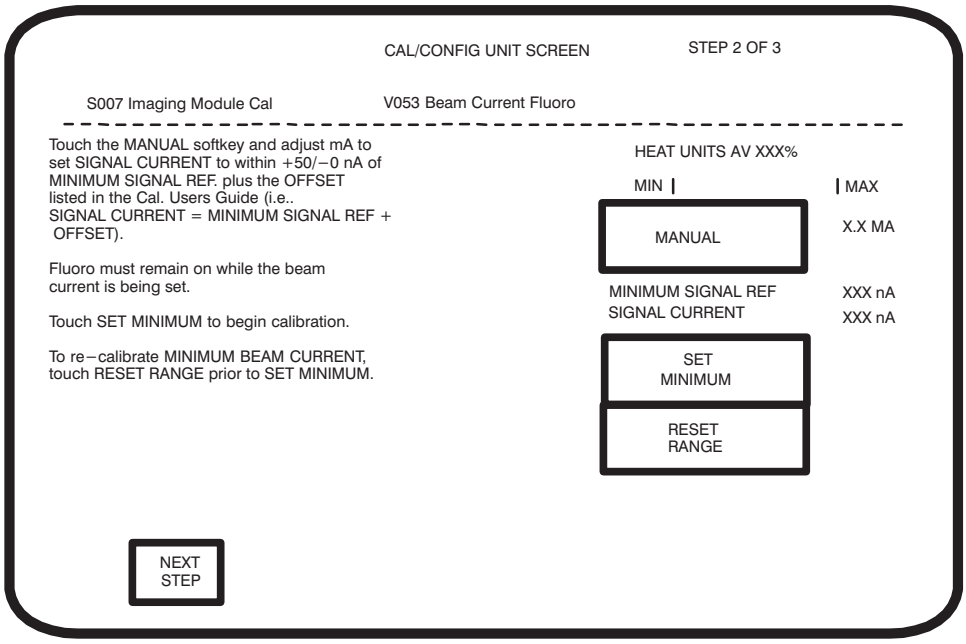
Note: Touch RESET RANGE softkey prior to touching SET MINIMUM softkey if a recalibration is required.

- Touch SET MINIMUM softkey to begin calibration.

Note: When performing the V053 unit, it could occur that the calculation of the beam current is too fast (15 to 30 s), so that the system loads an incorrect beam current setpoint in the database.

- Touch NEXT STEP softkey to proceed to Step 3

V053, CAL PROCEDURE 1, STEP 2, SCREEN DISPLAY



4-3 Step 3. Set Maximum Beam Current

- Touch MANUAL softkey.
- Take and maintain a fluoro exposure.
- While taking fluoro, adjust MA with the console dial to set the SIGNAL CURRENT indicated on the console screen to within +50/–0 nA of MAXIMUM SIGNAL REF plus the OFFSET pertaining to the camera tube type used in the system.

Note: Refer to the Camera Tube Reference Table at the beginning of this unit for the applicable **CALIBRATION OFFSET** value.

- Maintain exposure during adjustment to permit the system to calculate beam current. An interrupted exposure will cause the system to load an incorrect beam current setpoint.

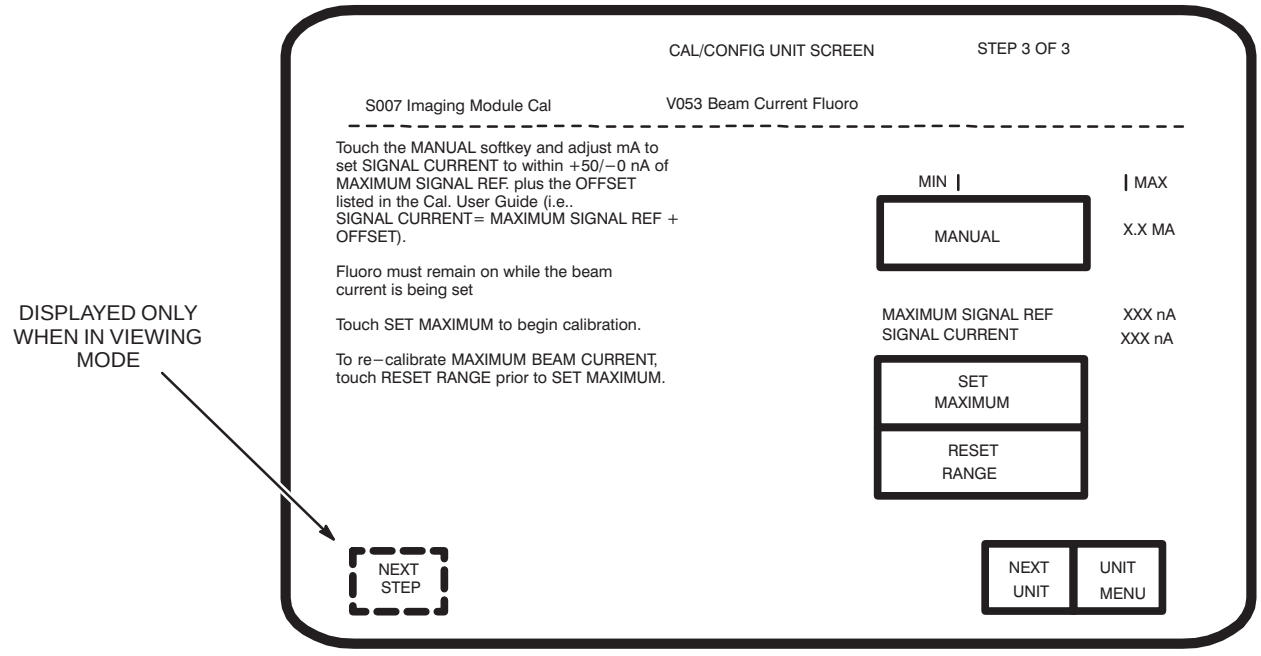
Note: Touch RESET RANGE softkey prior to touching SET MAXIMUM softkey if a recalibration is required.

- Touch SET MAXIMUM softkey to begin calibration.

Note: When performing the V053 unit, it could occur that the calculation of the beam current is too fast (15 to 30 s), so that the system loads an incorrect beam current setpoint in the database.

- Touch NEXT UNIT or UNIT MENU softkey to exit. Exiting the unit updates NV RAM.

V053, CAL PROCEDURE 1, STEP 3, SCREEN DISPLAY



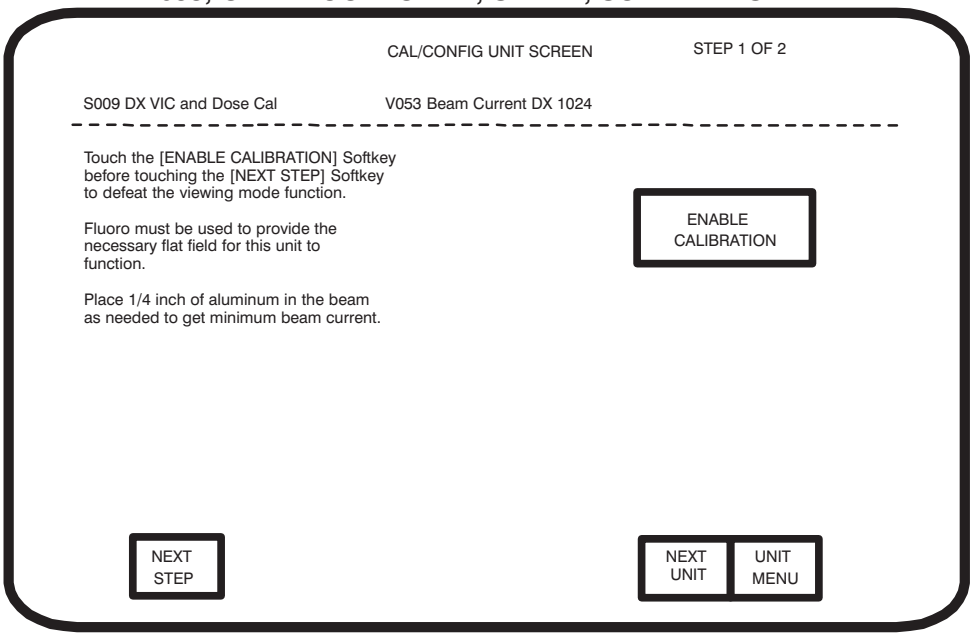
5 CAL PROCEDURE 2 – DLX 1024

5-1 Step 1. Setup the Equipment

Note: The illuminated output phosphor provides the image when a fluoro exposure is made.

- Touch the ENABLE CALIBRATION softkey.
- Place 1/4 inch of aluminum filtration in the x–ray beam to get minimum beam current when using fluoro.
- Touch NEXT STEP softkey to proceed to Step 2.

V053, CAL PROCEDURE 2, STEP 1, SCREEN DISPLAY



5-2 Step 2. Set Maximum Beam Current.

- Touch MANUAL softkey.
- Take and maintain a fluoro exposure.
- While taking fluoro, adjust MA with the console dial to set the SIGNAL CURRENT indicated on the console screen to within +50/–0 nA of MAXIMUM SIGNAL REF plus the OFFSET pertaining to the camera tube type used in the system.

Note: Refer to the Camera Tube Reference Table at the beginning of this unit for the applicable **CALIBRATION OFFSET** value.

- Maintain exposure during adjustment to permit the system to calculate beam current. An interrupted exposure will cause the system to load an incorrect beam current setpoint.

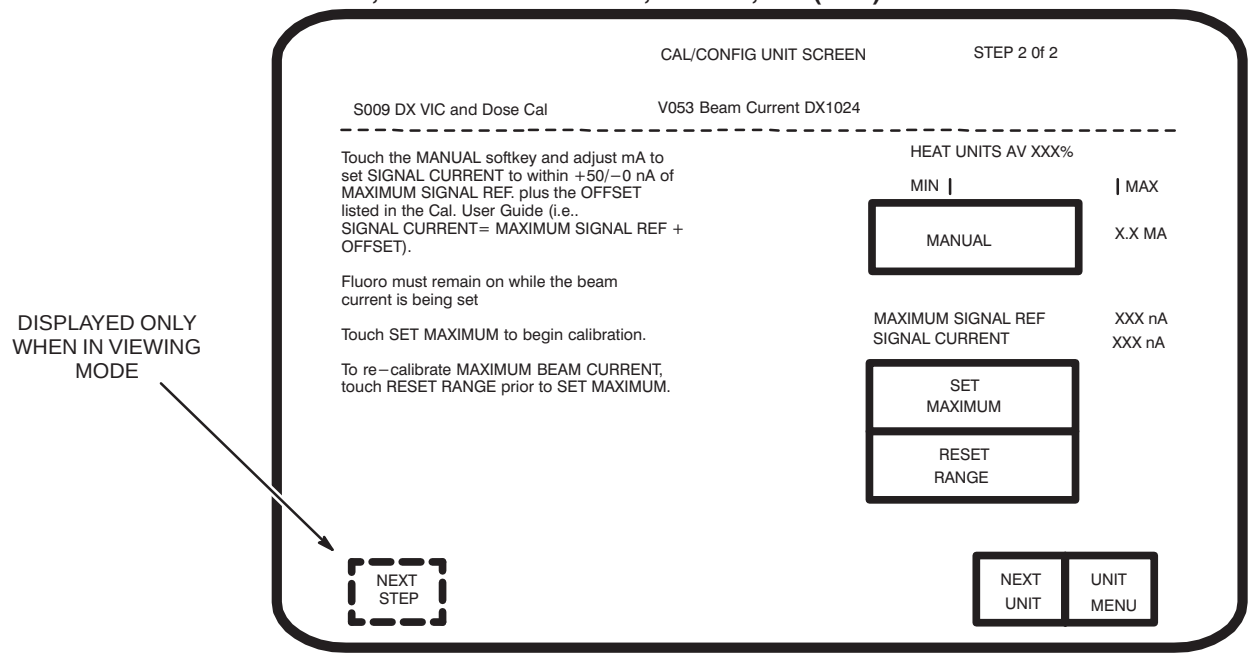
Note: Touch RESET RANGE softkey prior to touching SET MAXIMUM softkey if a recalibration is required.

- Touch SET MAXIMUM softkey to begin calibration.

Note: When performing the V053 unit, it could occur that the calculation of the beam current is too fast (15 to 30 s), so that the system loads an incorrect beam current setpoint in the database.

- Touch NEXT UNIT or UNIT MENU softkey to exit. Exiting the unit updates NV RAM.

V053, CAL PROCEDURE 2, STEP 2, DX (DLX) 1024 SCREEN DISPLAY



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UNIT V054 – Video Gain Linearization

Time: x h xx min – Personnel: 1 field engineer

1 DESCRIPTION

Calibration unit V054 generates a software lookup table to linearize the electronic video gain with respect to the video gain control signal. The software samples 10 varying video levels and determines the video gain required to maintain a constant video output. Only one step is required to accomplish the calibration.

2 EQUIPMENT REQUIRED

Non–metallic trimpot adjusting tool.

CAUTION

Ensure that white clip potentiometer VIC1 A15 R418 on Video Processor PWB VIC1 A15 is set fully clockwise before running this unit in the normal VIC calibration sequence or anytime it is necessary to rerun this unit.

3 CAL PROCEDURE

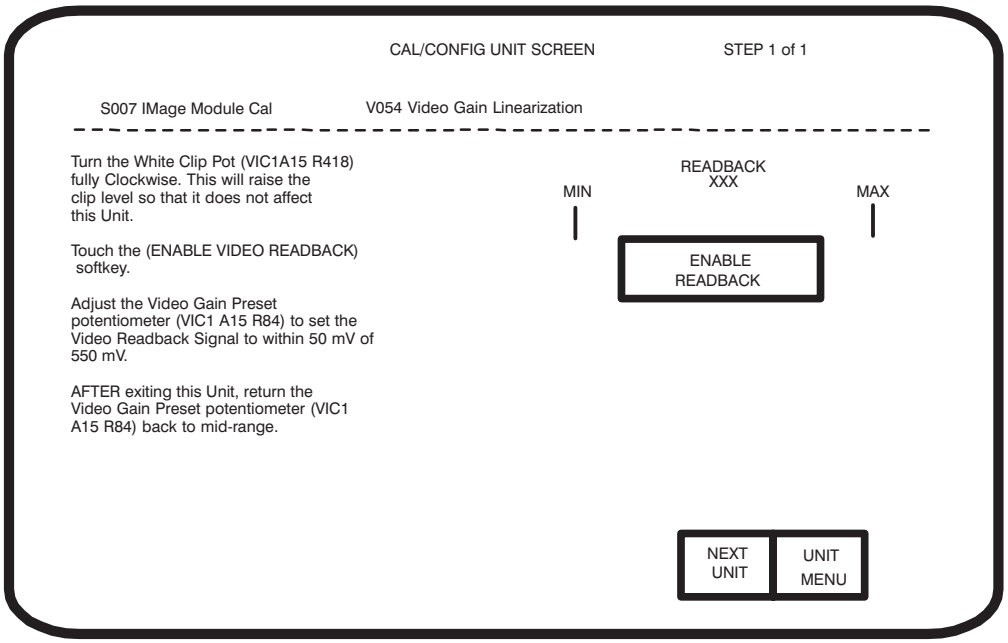
Perform the calibration as follows:

- Touch the ENABLE VIDEO READBACK softkey.
- Adjust Video Gain Preset potentiometer (VIC1 A15 R84) until the READBACK value indicated on the console screen is approximately 550 mV, ± 50 mV.
- Turn CCW to reduce video level. Turning CW may cause a “VIDEO OUT OF RANGE” error.
- Touch NEXT UNIT or UNIT MENU softkey. Exiting the calibration unit initiates software generation of a lookup table. **A “PROCESSING” message is displayed for approximately 2 to 3 minutes while the values for the lookup table are calculated.** The “PROCESSING” message is then followed by an “Updating NV database”message while the calibration data is being loaded into the system.
- After exiting the unit, ensure that the Video Gain Preset potentiometer (VIC1 A15 R84) is reset to mid-range **(12 turn pot for systems with VIC1 A15 board 46–321426; or 30 turn pot for systems with VIC1 A15 board 46–232770, 46–264614, or 46–321060)**. Final adjustment of the potentiometer will be accomplished in Calibration Unit V062.

NOTICE

If this unit is run out of normal calibration sequence, run White Clip Adjustment Calibration Unit, V071, after running this unit to reset white clip potentiometer (VIC1 A15 R418) to proper level.

V054 SCREEN DISPLAY



UNIT V055 – ABC Window

Time: x h xx min – Personnel: 1 field engineer

1 DESCRIPTION

Calibration Unit V055 is used to center the ABC window in the circle blanking of the TV monitor.

2 EQUIPMENT REQUIRED

Non-metallic adjusting tool.

3 CAL PROCEDURE

- Adjust Window Center potentiometer (VIC1 A9 R290) for horizontal centering of the ABC window in the circle blanking on the monitor. See Illustration 66.
- After the adjustment is completed, touch NEXT UNIT or UNIT MENU softkey to exit.

V055 SCREEN DISPLAY

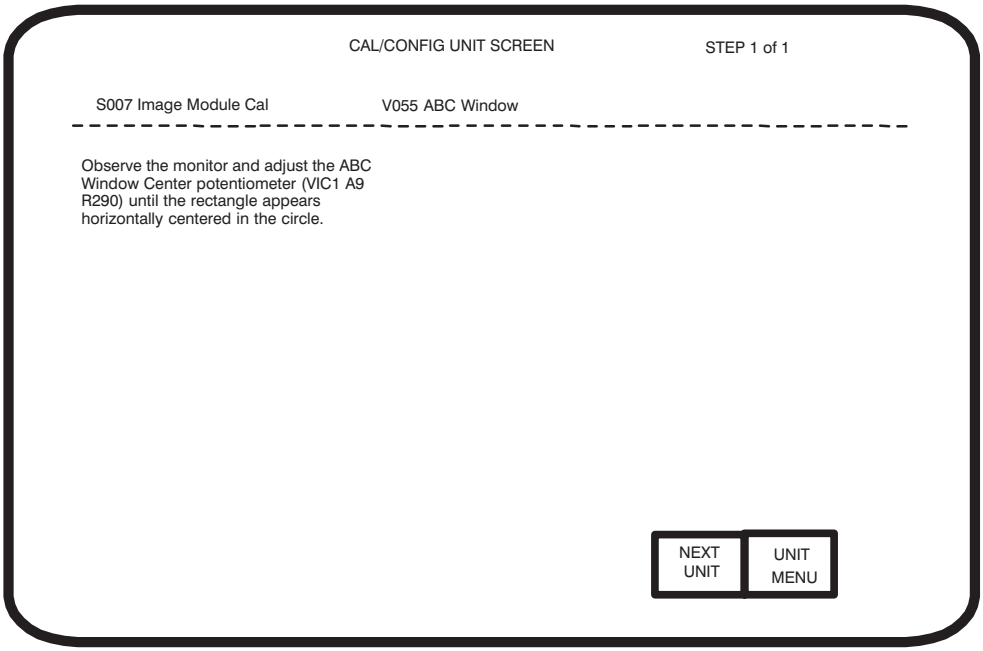
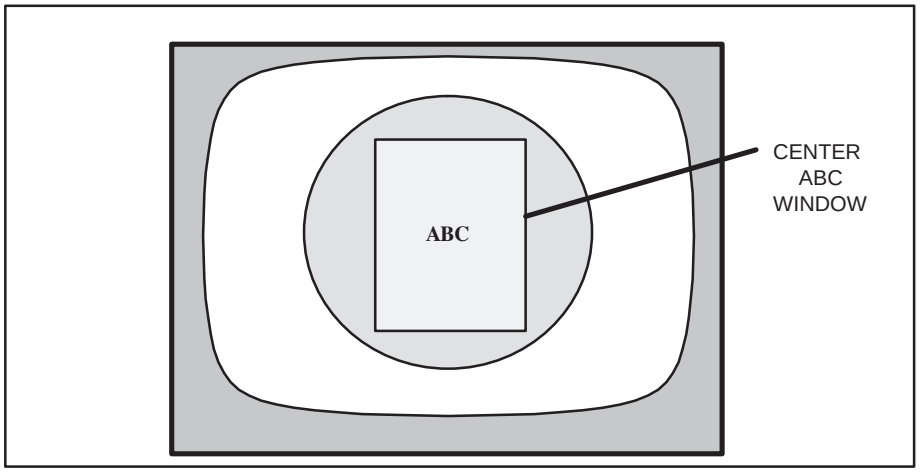


Illustration 66 – V055, ABC Window Centering



UNIT V056 – EDR Calibration

Time: x h xx min – Personnel: 1 field engineer

1 DESCRIPTION

Calibration Unit V056 adjusts the parameters related to the operation of the Extended Dynamic Range (EDR) function. The calibration consists of four or five steps depending on the design version of the EDR function that is installed in the system. The original design is known as EDR–1. Redesigned versions are known as EDR–2 and EDR–2+. The EDR–2 and EDR–2+ versions apply to LCA, LC+, LCV+, Legacy, Tilt–C and Tilt–C Vascular. EDR–1 is not applicable to Advantx–E. EDR is identified as follows:

- EDR–1 VIC1A14, Image Processor board – P/N 46–288426 or earlier
  (any VIC1A15, Video Processor board)
- EDR–2 VIC1A14, Image Processor board – P/N 46–321098
  VIC1A15, Video Processor board – P/N 46–321060 or later
- EDR–2+ VIC1A14, Image Processor board – P/N 2128214 or later
  VIC1A15, Video Processor board – P/N 46–321060 or later

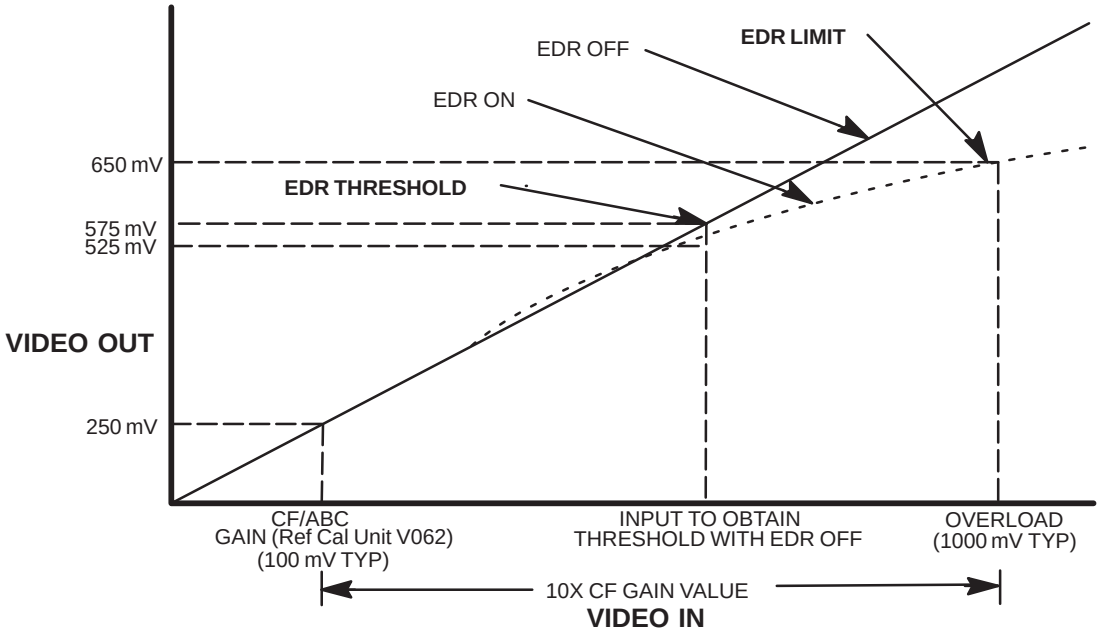
Calibration of the EDR–1 and EDR–2 configurations consists of five steps. Calibration of the EDR–2+ configuration consists of four steps. The appropriate number of steps will be displayed after the EDR circuit board version is identified in Step 1 of the unit.

2 EQUIPMENT REQUIRED

Oscilloscope, dark cloth cover, non-metallic trimpot adjusting tool and circuit board extender (not required with EDR–2+ boards; adjustments are accessible without extender).

3 THEORY

The EDR function should come in at the peak video level established with no EDR when viewing the apex of the lung of a centered CVII Phantom. This is the EDR Threshold Level and is typically set to 525 mV (575 mV with EDR off). Setting the EDR level too low can cause a complaint of “noisy” looking images. This occurs because the EDR acts on the quantum noise as well as the video signal and therefore can give an artificial appearance to noise when the EDR becomes active. The EDR Limit (overload) set point is directly related to the signal current value established in prerequisite Cal Unit, V062, CF and ABC Gain Cal. The recommended setting for the EDR Limit is 10 times the CF gain value set for the CF and ABC gain adjustment. The EDR limit adjustment determines how much signal current from the pre–amp will be compressed to 650 mV at the video monitor. Typically, for a Primicon tube that was set for a 100 mV input video level, the EDR Limit (overload) would be set to 1000 mV. The following graph illustrates the effect of the EDR function on the Video signal.



4 CAL PROCEDURE

4-1 Step 1. Setup the System for Calibration

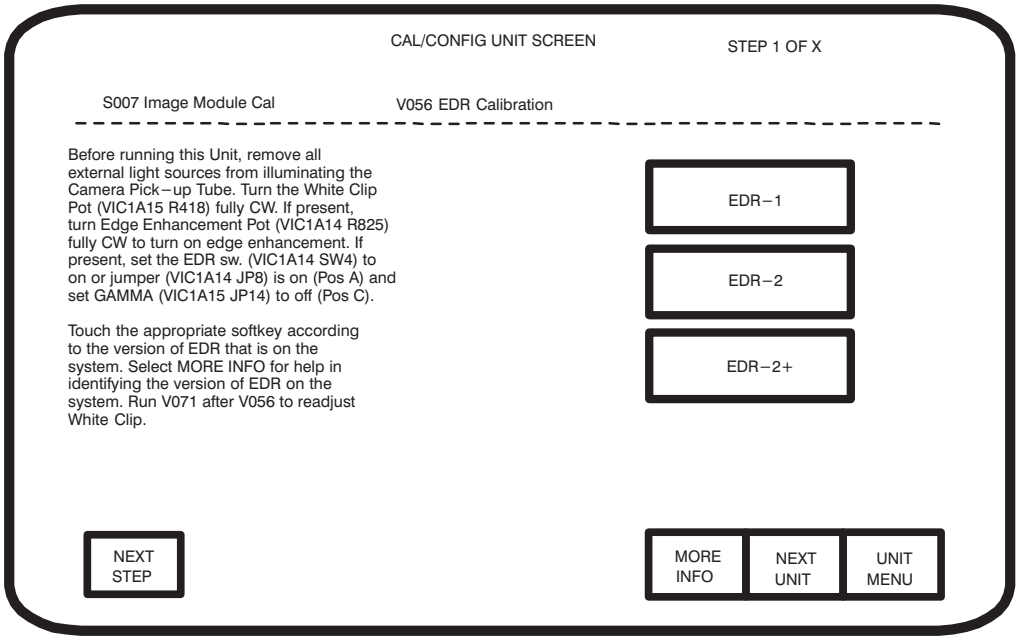
- If your system is configured with EDR–1 or EDR–2, use an extender board to extend Image Processor board A14 from the VIC card rack. Board extension is required in order to access the potentiometer adjustments. The EDR–2+board does not require extension to access adjustments.
- Cover the camera with a dark cloth to ensure that no external light sources illuminate the camera pickup tube.
- Turn the White Clip potentiometer VIC1A15R418 fully CW. This sets the white clip function to a level that will not effect the running of this unit.
- If present, set Edge Enhancement potentiometer VIC1A14R825 fully CW to turn on the Edge Enhancement function.
- If present, set the EDR switch (VIC1A14 SW4) to ON or jumper (VIC1A14 JP8) to position A and set GAMMA function to OFF (VIC1A15 JP14 to Position C).

Note: For LCA, LC+, and LCV+, **always** have GAMMA function set to OFF (VIC1 A15 JP14 to Position C).

- Touch the [EDR] softkey that is applicable to the EDR version installed in the system, i.e. EDR–1, EDR–2 or EDR–2+. Touching the {MORE INFO} softkey will access a “MORE INFO” screen that provides information for identifying the EDR version installed in your system.
- Touch [NEXT STEP] softkey to proceed to Step 2

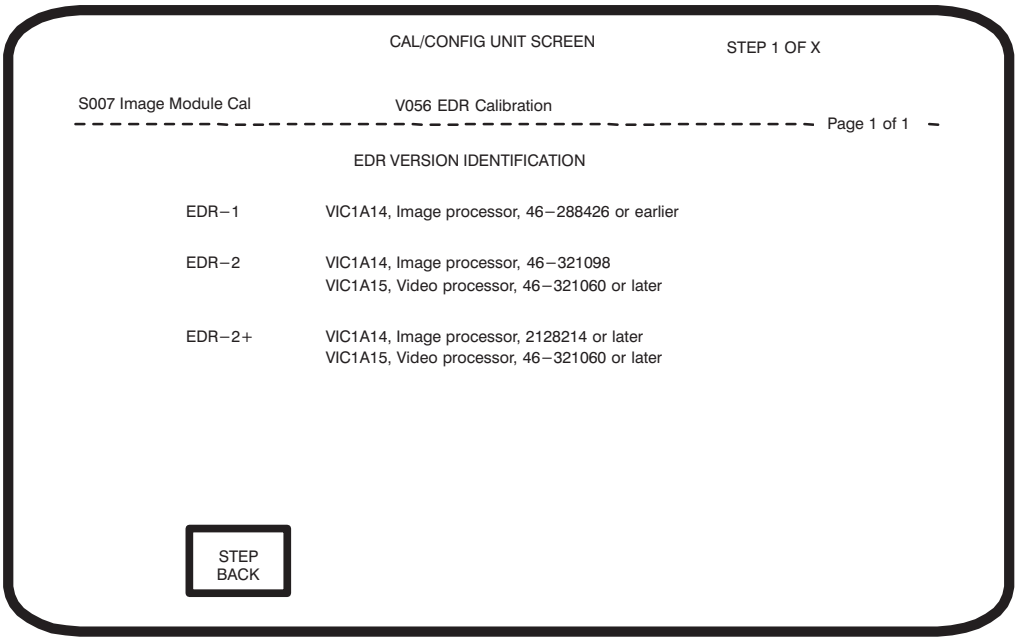
NOTICE **Be sure to perform White Clip Adjustment (V071) after EDR Calibration (V056) to complete EDR Calibration.**

V056 STEP 1 SCREEN DISPLAY



Note: For LCA, LC+, and LCV+, **always** have GAMMA function set to OFF (VIC1 A15 JP14 to Position C).

V056 STEP 1 "MORE INFO" SCREEN



Note: EDR–1 does not apply to LCA, LC+, LCV+, Tilt–C and Tilt–C Vascular systems.

Note: Step 2 sets an EDR Threshold Level. A Threshold Value other than the SUGGESTED VALUE can be set into the system. However, before making any changes in threshold value, ensure that you understand the implications of a change before proceeding with Step 2 (Refer to unit theory explanation at the beginning of this unit and Table 24 and Table 25).

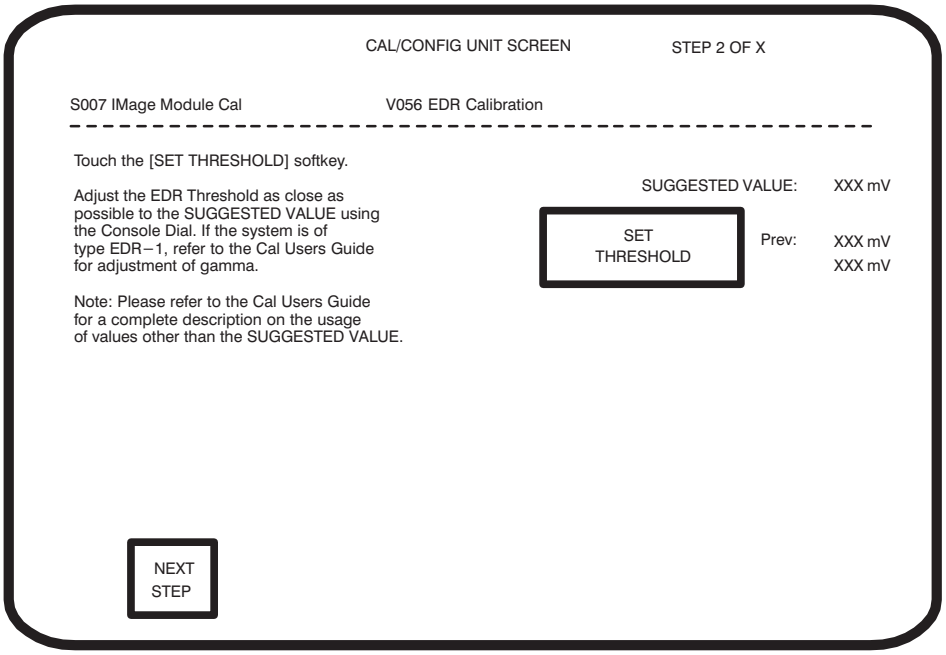
4-2 Step 2. Set Threshold Level

- Touch [SET THRESHOLD] softkey.
- Using the console dial, adjust the EDR Threshold as close as possible to the SUGGESTED VALUE indicated on the console screen. The suggested value is given as a guide. Refer to Table 24 and Table 25 for the usage of values other than the suggested value.
- If your system is configured with an EDR–1 board and Gamma is desired, move jumper VIC1A1A15JP14 to position B. Adjust GAMMA potentiometer VIC1 A15 R555 to obtain a readback on the console as indicated in Table 24. This sets the GAMMA function.

Note: Move jumper (VIC1 A15 JP14) on the Video Processor board, back to position “C” to disable the GAMMA function while running the remainder of the VIC calibration units. After all VIC calibration is completed and before running Applications Software, ensure that jumper (VIC1 A15 JP14) is reset to position B to re-enable the GAMMA function.

- Touch NEXT STEP softkey. The unit determines the input voltage equivalent to the point at which the threshold value has been set.

V056 STEP 2 SCREEN DISPLAY



Note: EDR–1 does not apply to LCA, LC+, LCV+, Tilt–C and Tilt–C Vascular systems.

Table 24 – Threshold, Limit, & Gamma Values EDR–1

FUNCTION TO ADJUST	VASCULAR/CARD SYSTEMS		R&F SYSTEMS			
	WITH GAMMA	W/O GAMMA	DR SYSTEMS W/CU FILTERS	DR SYSTEMS W/O CU FILTERS	NO DR SYSTEMS W/GAMMA (See Note)	NO DR SYSTEMS W/O GAMMA (See Note)
THRESHOLD	575 mV	575 mV	650 mV	650 mV	575 mV	575 mV
LIMIT	1000 mV	1000 mV	820 mV	820 mV	1000 mV	1000 mV
GAMMA	550 mV	N/A	500 mV	500 mV	DISABLED	N/A
Note: The with or without GAMMA refers to earlier versions of systems that may or may not have the GAMMA circuitry.						

Table 25 – EDR–2 and EDR–2+

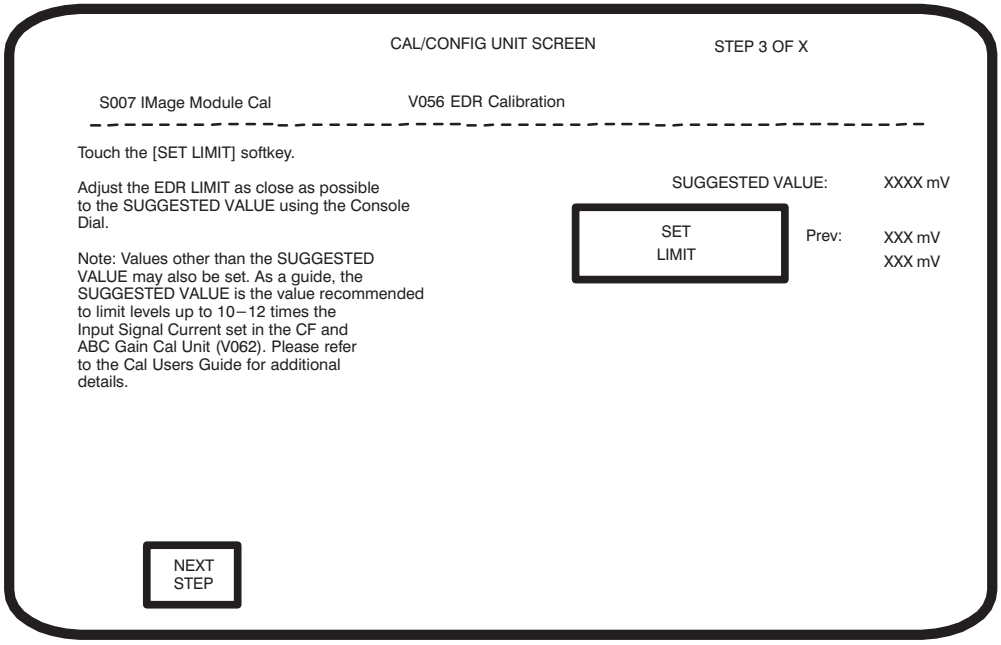
FUNCTION TO ADJUST	VASCULAR/ CARD SYSTEMS	R&F SYSTEMS				
	WITH OR WITHOUT DLX SYSTEM	DR SYSTEMS W/CU FILTERS	DR SYSTEMS W/O CU FILTERS	DRS SYSTEMS W/CU FILTERS	DRS SYSTEMS W/O CU FILTERS	NON DR/DRS SYSTEMS
THRESHOLD	500 mV	500 mV	500 mV	500 mV	500 mV	500 mV
LIMIT	1200 mV	1000 mV	1000 mV	1500 mV	1500 mV	1200 mV
GAMMA	N/A	N/A	N/A	N/A	N/A	N/A

Note: The SUGGESTED VALUE for the Set Limit parameter is given as a guide. This value is recommended to limit levels to 10 times the input signal current value set in Cal Unit V062, CF and ABC Gain Cal. A Set Limit value other than the SUGGESTED VALUE can be entered into the system. However, before making any changes, refer to the Unit Theory explanation and Table 24 and Table 25 to ensure that you understand the implications of a change in this value.

4-3 Step 3. Set Limit Level

- Touch [SET LIMIT] softkey.
- Using the console dial, adjust EDR Limit level as close as possible to the SUGGESTED VALUE.
- Touch NEXT STEP softkey. The unit determines the input voltage equivalent to the point at which the Set Limit value has been set.

V056 STEP 3 SCREEN DISPLAY

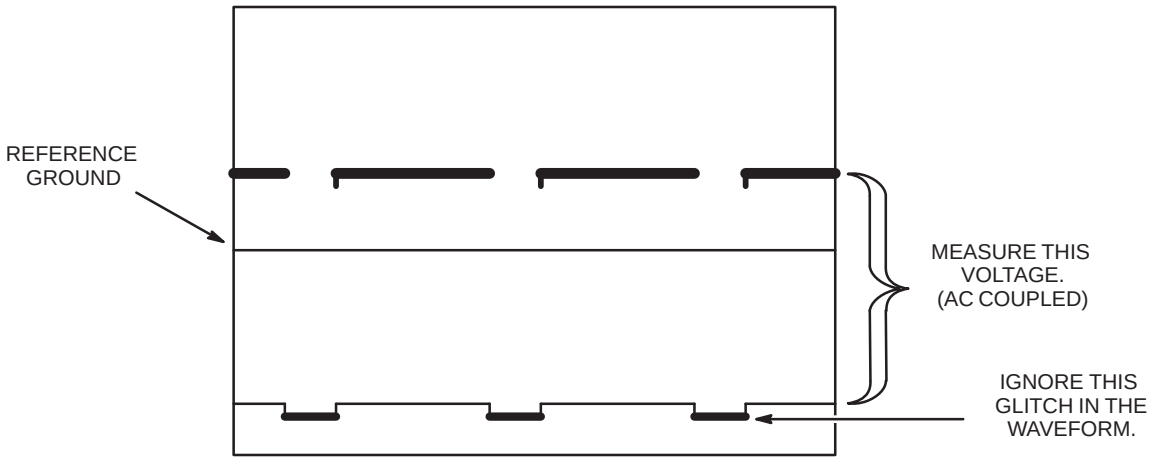


Note: Step 4 (Linearity Adjustment) is only performed on systems equipped with EDR–1 or EDR–2 circuit boards. On systems equipped with EDR–2+circuit boards, the unit will skip the linearity adjustment and proceed directly to the last step (Final Adjustment).

4-4 Step 4. Linearity Adjust

- All adjustments are on the Image Processor board VIC1 A14. Set potentiometer (R352), (R405), (R496), and (R459) to a fully clockwise (CW) position. R459 is a 30 turn pot.
- Touch [ENABLE LINEARITY] softkey and adjust potentiometer (R459) CCW to center the video level on the bargraph.
- Adjust potentiometer (R352) CCW for a minimum video level. If the video level goes below the bargraph, re–adjust (R459) CW to re–center video level on the bargraph. Continue to adjust potentiometer (R352) CCW for a minimum video level.
- After potentiometer (R352) is set, use an oscilloscope to measure the voltage above black level between test point TP11 and GND (Ref TP16). See Illustration 67.

Illustration 67 – V056 Step 4 Linearity Adjust Waveform

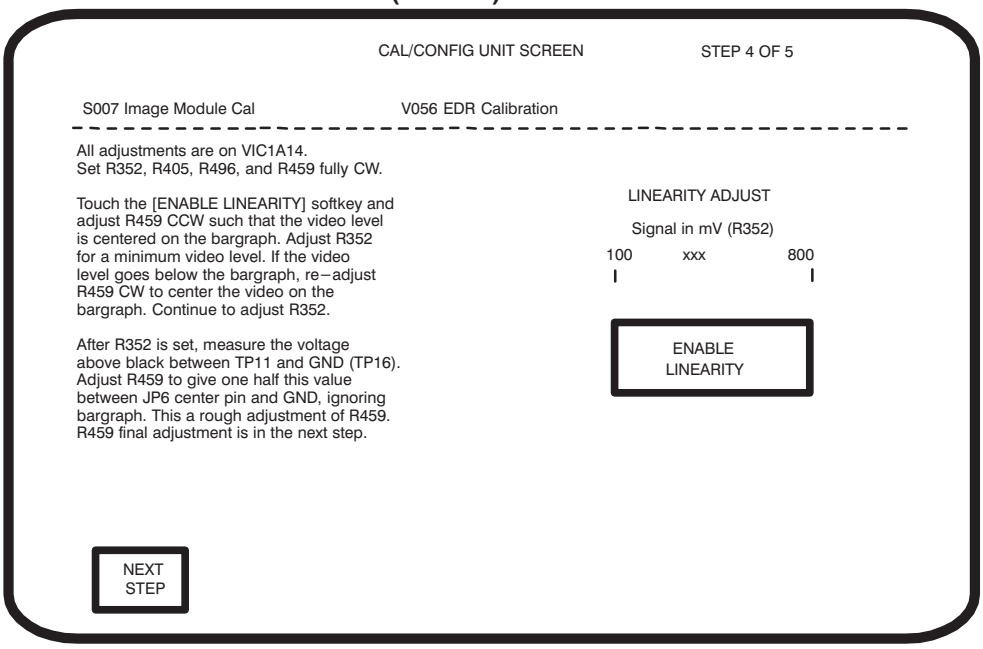


- Record voltage above black level at TP11 _____.
- Now, connect oscilloscope to measure the voltage between JP6 center pin and GND (Ref TP16). **(TP13 can be used as an alternate test point for convenience).** Adjust (R459) until the voltage indicated is one half the value measured and recorded at TP11. Ignore any changes in the video level indicated on the bargraph. This is a rough adjustment of R459. Final adjustment of R459 will be accomplished in the next step.

Note: **Note: This adjustment is critical for proper operation of EDR.** Adjusting R459 ensures that the threshold value at which EDR becomes active, remains the same during AGC operation. If R459 is not properly trimmed, the EDR threshold may not track with variations in video gain.

- Touch NEXT STEP softkey to proceed to Step 5.

V056 STEP 4 (EDR–2) SCREEN DISPLAY



Note: This step is not displayed when calibrating EDR on systems equipped with the EDR–2+ circuit boards.

4-5 Step 5. Final Adjustment

- Touch [ENABLE THRESHOLD/LIMIT] softkey. When activated (highlighted), the video level into the A14 Video Processor board will be toggled between the THRESHOLD and LIMIT adjustment. Subsequent touches to the [ENABLE THRESHOLD/LIMIT] softkey will turn the toggling action on and off while leaving the bargraph readback active.

NOTICE

If you leave the toggling action OFF for a period of time and then reset the toggling action to ON, a 4724 error message “VIC: Camera A/D converter took too long” may be displayed. Disregard the error message – it does not effect the calibration.

- Set R825 fully CCW.
- Alternately adjust the Threshold potentiometer (R405) and Limit potentiometer (R496) as close as possible to the suggested values. Refer to Table 26.
- Touch the [MORE INFO] softkey and perform a final adjustment of Gain potentiometer (R459) and Edge Enhancement potentiometer (R825) per the instructions given on the “MORE INFO” screens.

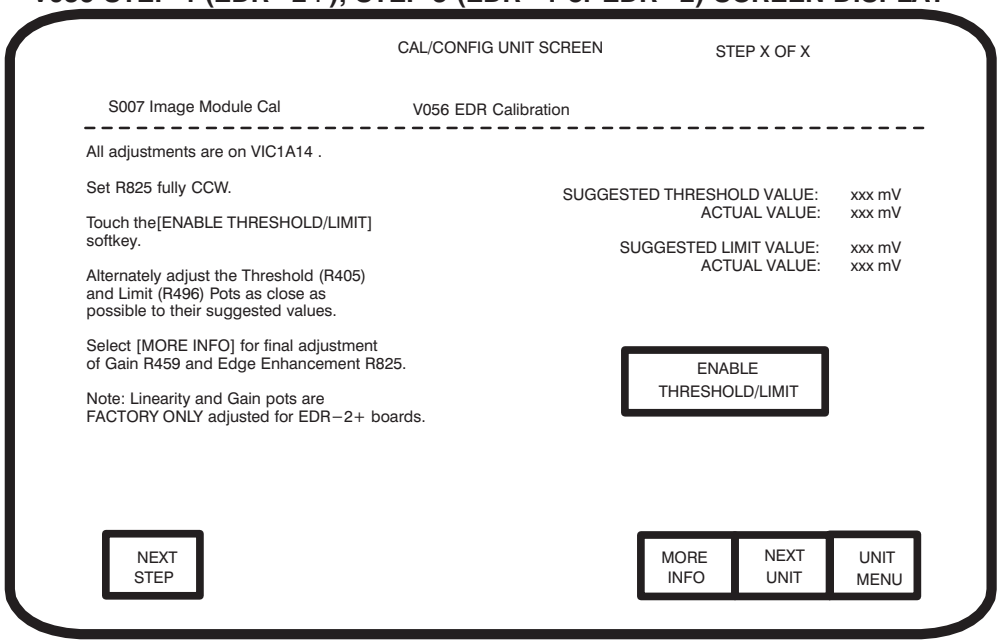
Note: On systems equipped with the EDR–2+ circuit boards, the Linearity and Gain potentiometers are factory adjusted and do not require adjustment in the field.

- If EDR–1 or EDR–2, remove extender board and replace the A14 board in VIC cabinet
- Touch NEXT UNIT or UNIT MENU softkey to exit.

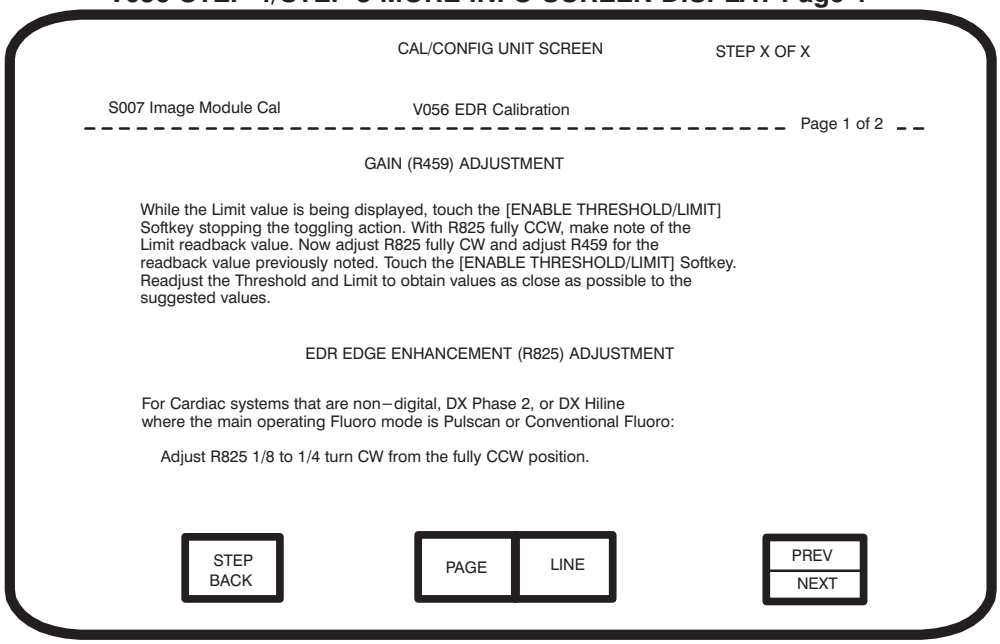
Table 26 – Threshold & Limit Suggested POT Adjustment Values EDR–2 and EDR–2+

FUNCTION TO ADJUST	NON-DRS SYSTEMS (includes LCA, LC+, & LCV+ systems)	DRS SYSTEMS (N/A to LCA, LC+, & LCV+ systems)
THRESHOLD	460 mV	450 mV
LIMIT	630 mV	630 mV

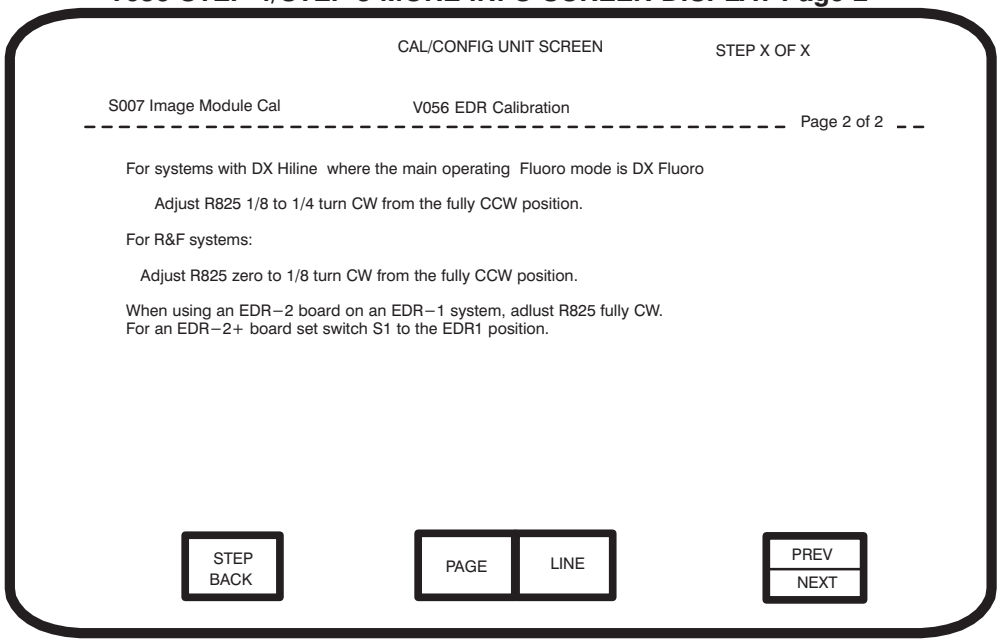
V056 STEP 4 (EDR−2+), STEP 5 (EDR−1 or EDR−2) SCREEN DISPLAY



V056 STEP 4/STEP 5 MORE INFO SCREEN DISPLAY Page 1



V056 STEP 4/STEP 5 MORE INFO SCREEN DISPLAY Page 2



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UNIT V058 – ABD Black Level Threshold

Time: x h xx min – Personnel: 1 field engineer

1 DESCRIPTION

Calibration Unit V058 sets the reference level of the Black Level Comparator in the Automatic Brightness Detection (ABD) circuit so that only the video signal level that is above the set reference level is included in the integrated brightness detector function. The Black Level Threshold reference voltage is set according to the pickup tube type installed in the system. Typical Black Level Reference voltages are listed in Table 27.

Table 27 – Black Level

SYSTEM TYPE	TYPE TYPE	BLACK LEVEL THRESHOLD
R&F	PLUMBICON	350 mV
R&F	SATICON	270 mV
R&F	VIDICON	270 mV
R&F	CZICON	270 mV
OTHER	PLUMBICON	270 mV
OTHER	SATICON	220 mV
OTHER	VIDICON	220 mV
OTHER	CZICON	220 mV
Tilt–C Vascular with DLX	PRIMICON A	210 mV
Tilt–C and Tilt–C Vascular with DRS	PRIMICON A	210 mV

2 EQUIPMENT REQUIRED

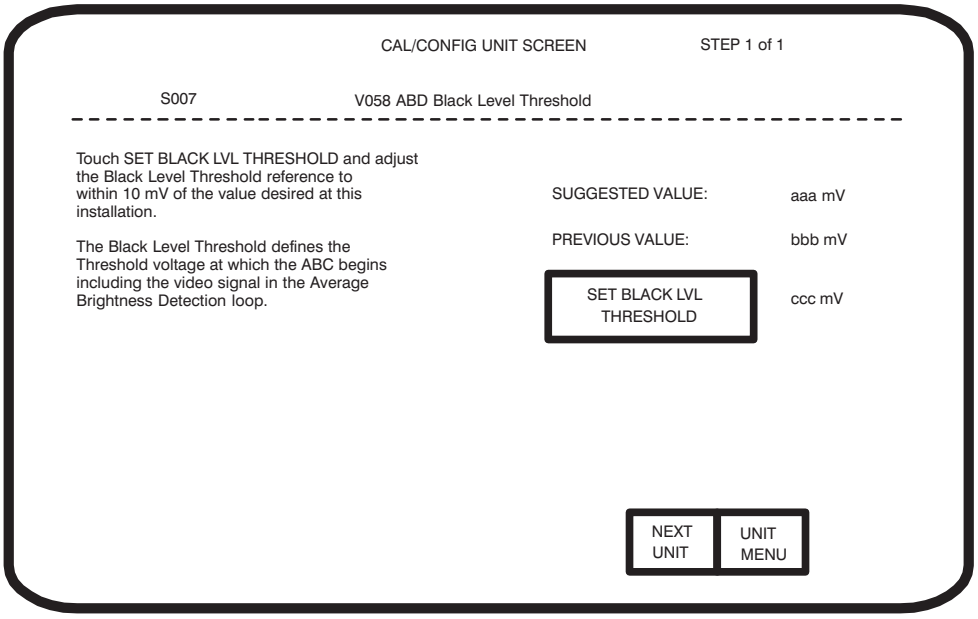
None.

3 CAL PROCEDURE

Perform the Calibration as follows:

- Touch SET BLACK LVL THRESHOLD softkey. Use the console dial to enter the SUGGESTED VALUE indicated on the screen or the appropriate Black Level Threshold voltage from the above table.
- Touch SET BLACK LVL THRESHOLD softkey again to enter the data.
- Touch NEXT UNIT or UNIT MENU softkey to exit the unit. A “PROCESSING” message is displayed while the database is being updated. If the reference level cannot be set within specification, an error message will be displayed indicating suggested corrective action.

V058 SCREEN DISPLAY



UNIT V059 – Yoke Rotation

Time: x h xx min – Personnel: 1 field engineer

1 DESCRIPTION

Calibration Unit V059 is used to adjust the mechanical position of the pickup tube yoke to prevent image rotation during sweep reversals. The calibration is accomplished using a Focaligner, Image Evaluation Tool (IET), or radiation. Three steps are required to complete the adjustment. A screen display is provided for each step.

2 EQUIPMENT REQUIRED

Focaligner or Image Evaluation Tool (46–232388G1)), dark cloth cover, and non-conducting screwdriver.

3 SPECIAL INSTRUCTIONS

Note: **For Vascular Systems Only:** Before system calibration, verify that additional filter (copper–aluminum filter) is not installed on top of collimator. (Open sensor hinge assembly to verify.) If installed, remove before performing calibration.

4 CAL PROCEDURE

4-1 Step 1. Setup the Equipment

Initiate the yoke adjustment using one of the calibration methods given below.

4-1-1 Focaligner or Image Evaluation Tool

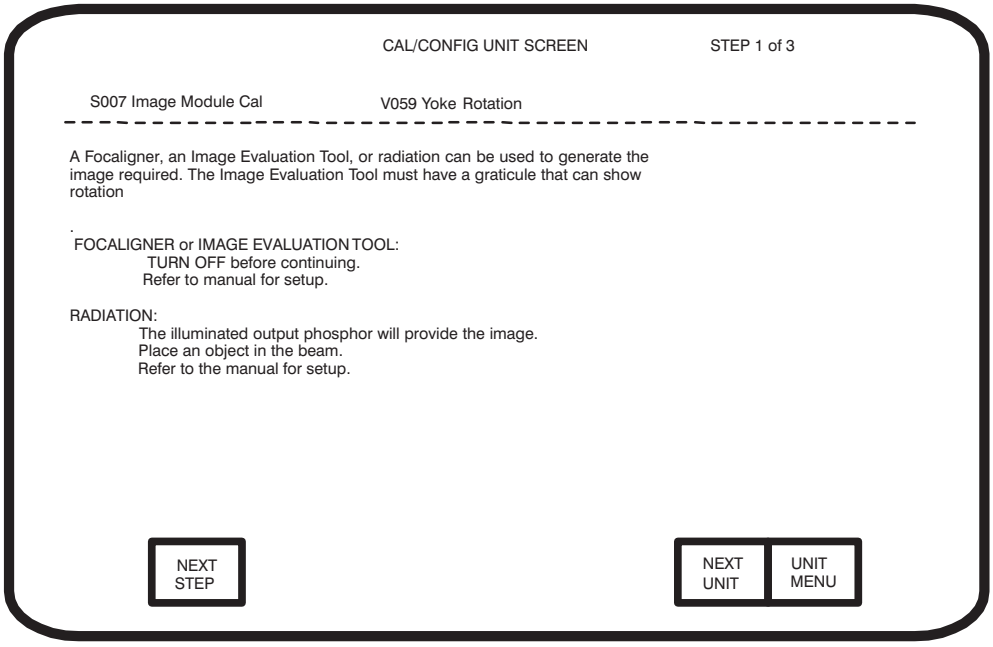
Remove the TV camera from the Image Intensifier assembly. Attach the TV camera to the Focaligner or Image Evaluation Tool and cover the assembly with a dark cloth. Ensure that the Focaligner or Image Evaluation Tool is turned off. Touch NEXT STEP softkey to proceed to Step 2.

4-1-2 Radiation

The illuminated output phosphor provides the image when a fluoro exposure is made. Place an object in the beam. Touch NEXT STEP softkey to proceed to Step 2.

Note: A mis-adjusted earth magnetic field compensation may effect the calibration if the radiation method is used to adjust yoke rotation. It may be necessary to repeat this calibration after performing the Earth Compensation Calibration (Vascular) Unit X001 or (R&F) Unit X002.

V059 STEP 1 SCREEN DISPLAY



4-2 Step 2. Adjust Yoke

Continue the yoke adjustment using the calibration method selected in Step 1.

Note: Ensure that TV rotator is centered before attempting yoke rotation. Verify by checking that lower lens centering adjustment hole in camera mount and TV rotator 1/4 inch alignment hole are in–line with each other.

4-2-1 Focaligner or Image Evaluation Tool

- Turn on the Focaligner or Image Evaluation Tool and adjust the intensity for proper monitor brightness. **Make sure that the assembly is covered with a dark cloth.**
- Touch either the HORIZONTAL or VERTICAL softkey. The test pattern observed on the monitor will rotate as the horizontal or vertical sweep reverses direction. Estimate the amount of rotation (one half of the angle). If the rotation is greater than three degrees, touch the MORE INFO softkey. Perform the yoke adjustment procedures indicated on the MORE INFO screen.

OR

- If the rotation is less than three degrees, touch NEXT STEP softkey and proceed to Step 3.

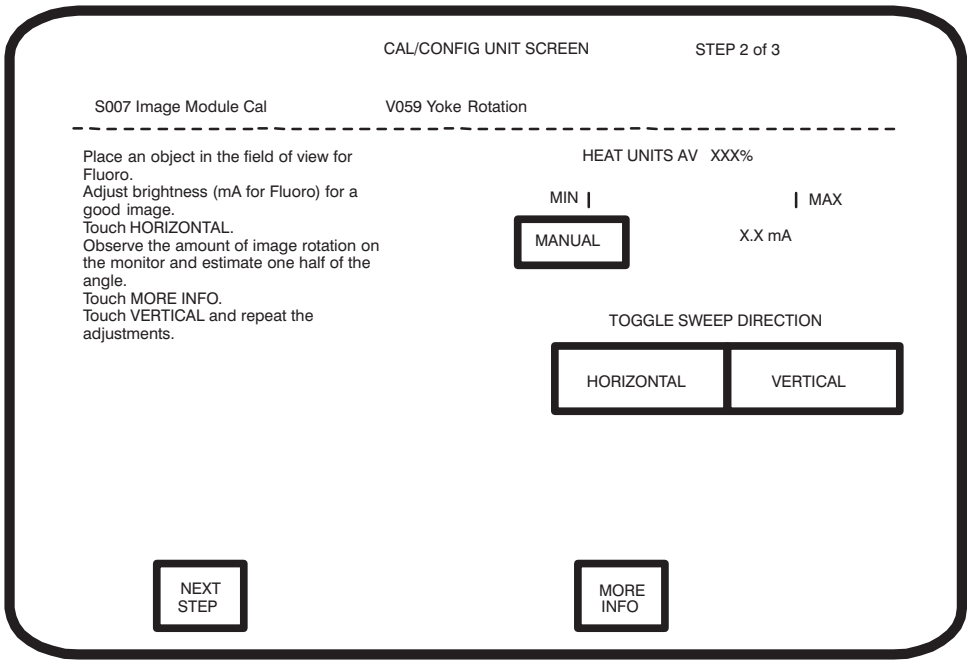
4-2-2 Radiation

- Place an object in the field of view for fluoro. The object must be placed parallel or perpendicular to the horizontal raster lines or the image will rotate with the sweep reversals. Place the object parallel or perpendicular to the mask or grid on the SFD and horizontal or perpendicular to the L–arm of the LU.
- Take and maintain a fluoro exposure.
- Touch MANUAL softkey, and using the console dial, adjust mA for proper monitor brightness.
- Touch either the HORIZONTAL or VERTICAL softkey. The image observed on the monitor will rotate as the horizontal or vertical sweep reverses direction. Estimate the amount of rotation (one half of the angle) and terminate the exposure. If the rotation is greater than three degrees, touch the MORE INFO softkey. Perform the yoke adjustment procedures indicated on the MORE INFO screen.

OR

- If the rotation is less than three degrees, touch NEXT STEP softkey to proceed to Step 3.

V059 STEP 2 SCREEN DISPLAY



4-3 Step 2A. More Info.

Adjust the yoke according to the procedure given on the MORE INFO screen. Refer to Illustration 68 for location of yoke screws. After the adjustment is completed, touch BACK softkey to return to Step 2 screen display.

WARNING **TURN OFF POWER AND WAIT TWO MINUTES FOR THE HIGH VOLTAGE TO BLEED DOWN. ROTATE YOKE WITH A NON-CONDUCTIVE TOOL.**

V059 MORE INFO SCREEN DISPLAY

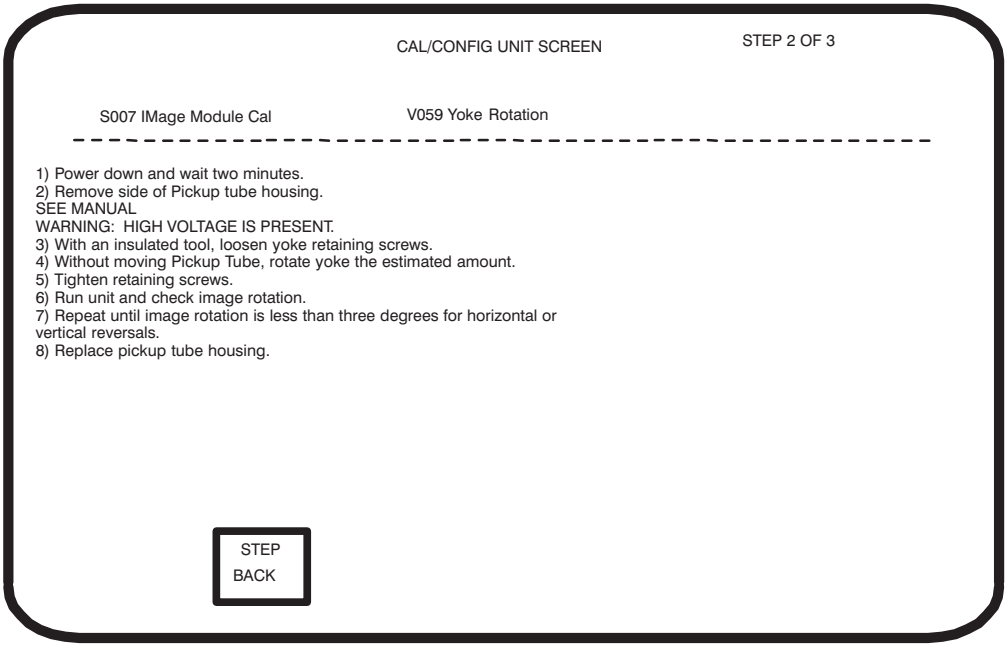
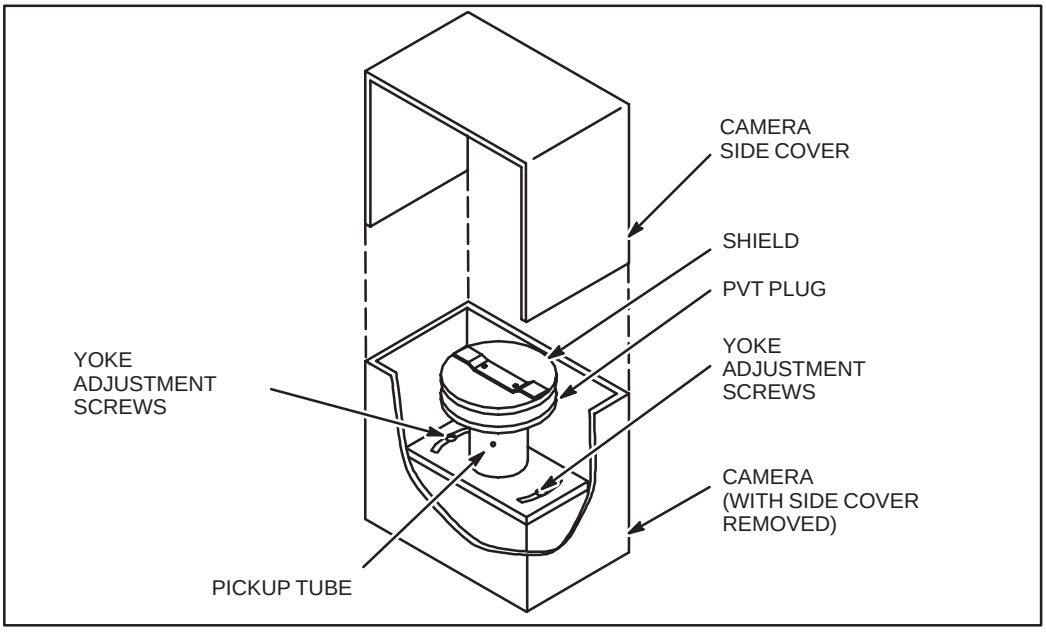


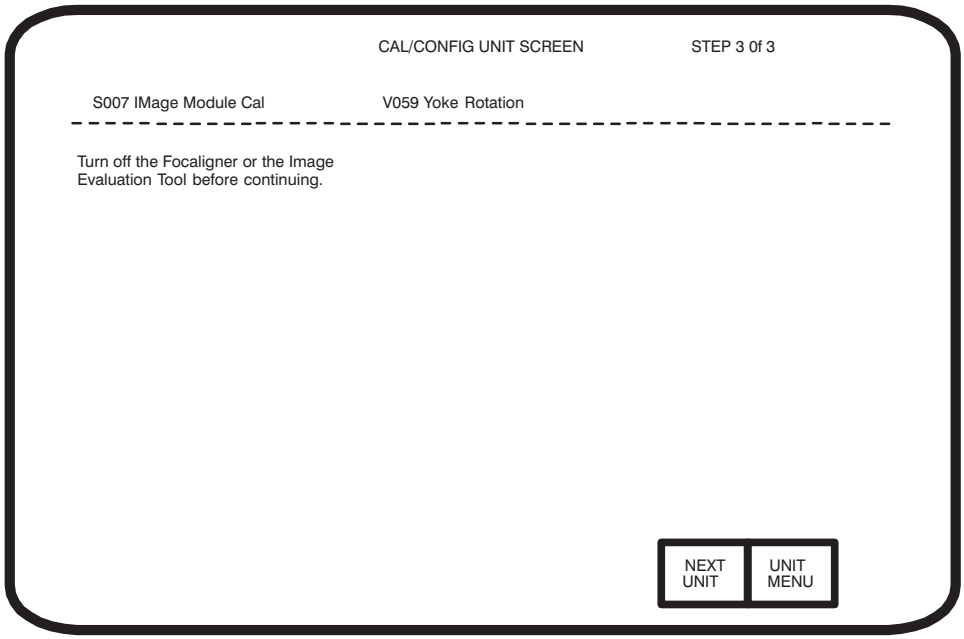
Illustration 68 – V059, Yoke Adjustment



4-4 Step 3. Turn Off Equipment

- Turn off the Focaligner or Image Evaluation Tool (if that calibration method was used).
- Touch NEXT UNIT or UNIT MENU softkey to exit the calibration unit.

V059 STEP 3 SCREEN DISPLAY



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UNIT V061 – Readback Calibration

Time: x h xx min – Personnel: 1 field engineer

1 DESCRIPTION

Calibration unit V061 calibrates the low and high range video readback circuit of the VIC A15 board. This readback circuit is capable of reading low levels of video (less than approximately 200 mV) with great precision and high levels of video (greater than approximately 200 mV) with less precision. The unit calculates the mV/bit conversion factor needed for each range. The adjustment is critical to the operation of other VIC calibration units. Three steps are required to accomplish the calibration. A screen display is provided for each step.

2 EQUIPMENT REQUIRED

Oscilloscope, BNC “T” connector, 75 ohm coax termination, and test leads.

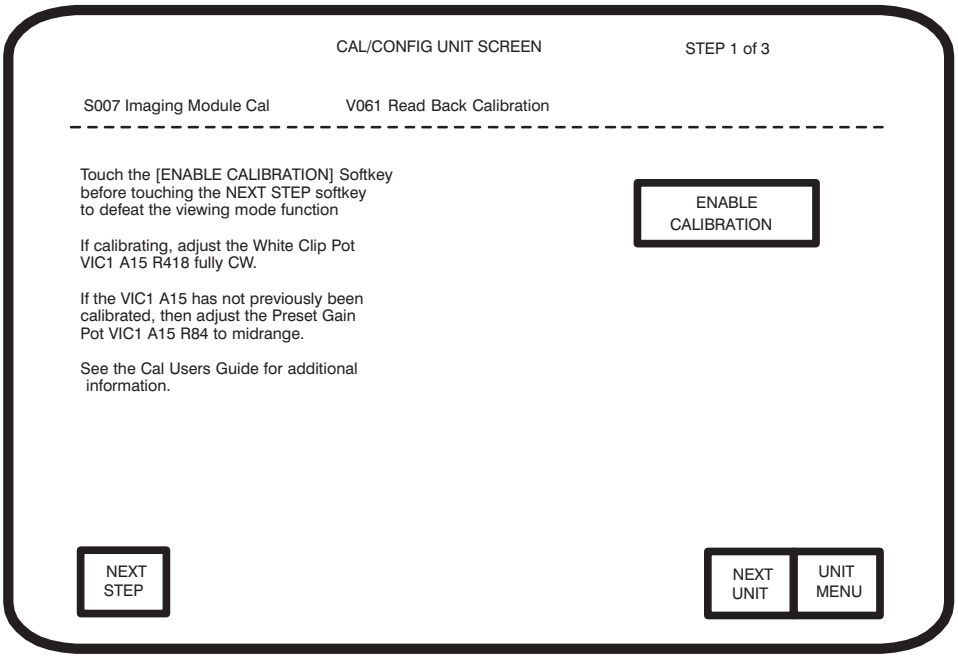
CAUTION **Ensure that white clip potentiometer VIC1 A15 R418 on Video Processor PWB VIC1 A15 is set fully clockwise before running this unit in the normal VIC calibration sequence or anytime it is necessary to rerun this unit.**

3 CAL PROCEDURE

3-1 Step 1. Enable Calibration

- If the VIC1 A15, TV Video Processor PWB, has not been previously calibrated, adjust the Preset Gain potentiometer, VIC1 A15 R84, to midrange **(12 turn pot for systems with VIC1 A15 board 46–321426; or 30 turn pot for systems with VIC1 A15 board 46–232770, 46–264614, or 46–321060)**.
- Touch the [ENABLE CALIBRATION] Softkey.
- Touch [NEXT STEP] softkey to proceed to Step 2.

V061, STEP 1 SCREEN DISPLAY



3-2 Step 2. Low Range Adjustment

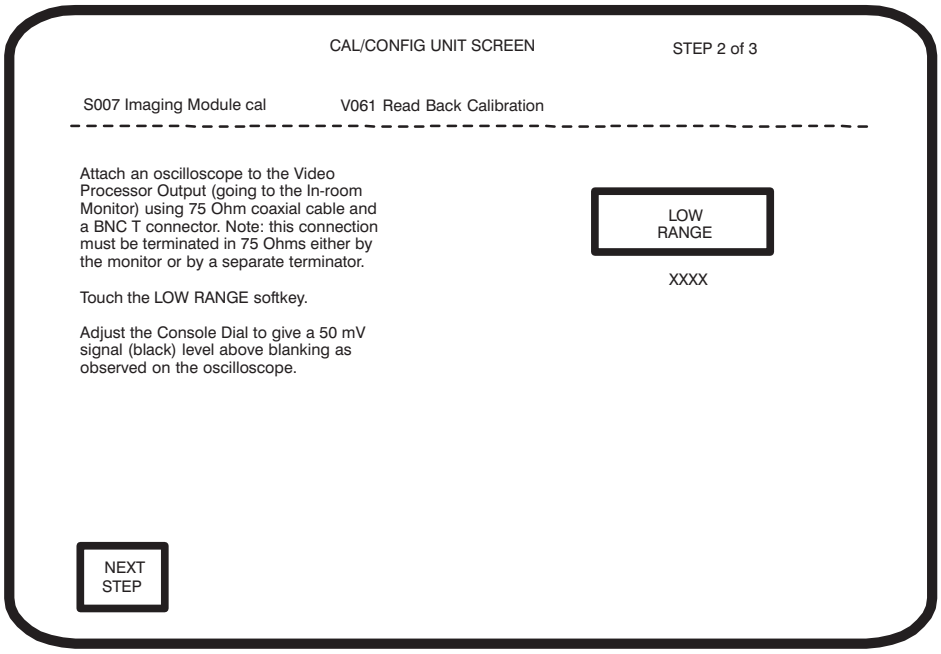
- Connect an oscilloscope to the Video Processor Output (VIC1 A21 J6) using a 75 ohm termination. A suggested test setup is shown in Illustration 69.

Note: When making the LOW RANGE adjustment, use a 5.0 msec/div time base to ensure best observation of the 50 mV signal level on the scope.

- Touch the [LOW RANGE] softkey.
- While observing the oscilloscope, use the console dial to adjust the signal level on the oscilloscope to 50 mV above blanking. See Illustration 70 for typical waveform presentation.
- Touch [NEXT STEP] softkey to proceed to Step 3.

Note: The message “UNIT ERROR: INVALID VIDEO LEVEL” will be displayed if the 50 mV signal level (Ref. step 2) or the 600 mV video level (Ref. step 3) is reduced to zero.

V061, STEP 2 SCREEN DISPLAY



3-3 Step 3. High Range Adjustment

- Touch the [HIGH RANGE] softkey and while observing the oscilloscope, use the console dial to adjust the video signal level on the oscilloscope to 600 mV above the black level set in Step 2. See Illustration 71 for typical waveform presentation.

Note: It may be necessary to make adjustments to the Gain Preset potentiometer, VIC1 A15 R84, to achieve a 600 mV video indication on the oscilloscope. The Gain Preset potentiometer will be readjusted when running Calibration Unit V062, CF and ABC Gain Calibration, which occurs later in VIC Cal Sequence Menu.

- After the HIGH RANGE has been properly adjusted, touch the [NEXT UNIT] or [UNIT MENU] softkey to exit the calibration unit.
- Disconnect the oscilloscope test setup and reset the termination jumper at the rear of the monitor to the “75 ohm” position.

NOTICE

If this unit is run out of the normal VIC calibration sequence, run White Clip Adjustment Calibration Unit V071 after running this unit to reset the white clip potentiometer (VIC1 A15 R418) to proper level. If running a full VIC cal, the white clip adjustment will be run as part of the normal VIC Cal Sequence (Ref S007).

V061, STEP 3 SCREEN DISPLAY

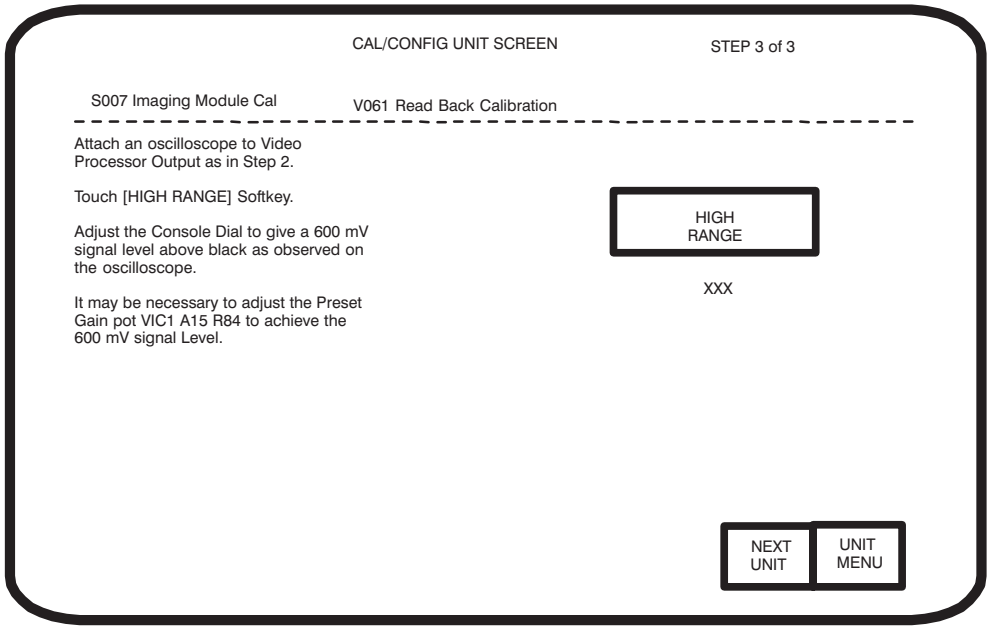


Illustration 69 – V061 Test Setup

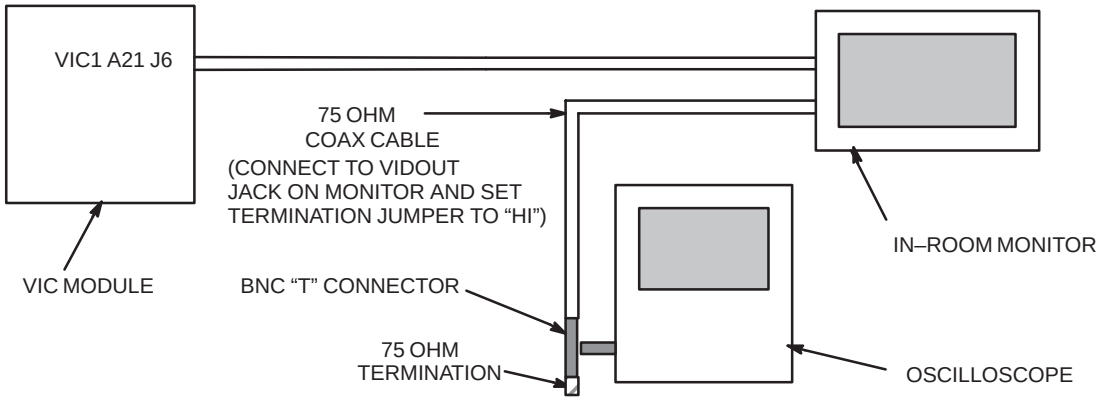


Illustration 70 – V061, Low Range Scope Display

SCOPE SETTINGS

VERT AMPL
50 mV/div
TIME BASE
5 msec/div

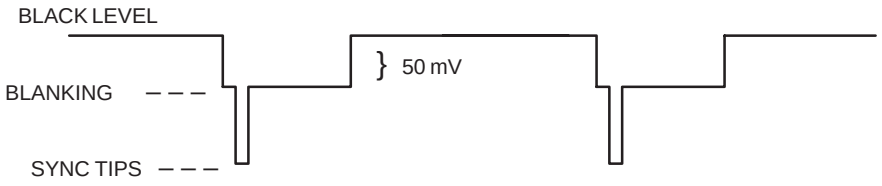
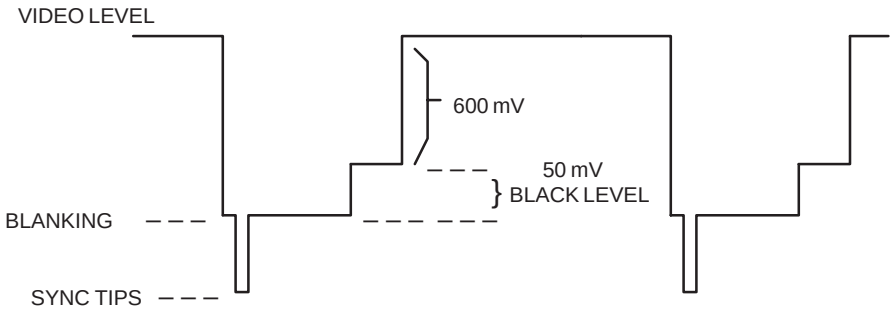


Illustration 71 – V061, High Range Scope Display

SCOPE SETTINGS

VERT AMPL
0.2 volt/div
TIME BASE
5 msec/div



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UNIT V062 – CF and ABC Gain Calibration

Time: x h xx min – Personnel: 1 field engineer

1 DESCRIPTION

Calibration Unit V062 sets the Conventional Fluoroscopic (CF) Gain Preset potentiometer for nominal signal current according to pickup tube type/model and then adjusts the gain of the Automatic Brightness Correction (ABC) amplifier to provide an output signal that is proportional to the CF gain setting (Table 28).

Note: 1 Do not deviate from the recommended input signal current values unless you understand the full impact of the change.

2. For systems configured with DRS, set Input Signal Current for 150 nA.

Table 28 – ABC Gain Adjustments

TUBE TYPE	MODEL NO	INPUT SIG CURRENT	OUTPUT VIDEO LEVEL
SATICON A, TRIODE	TH9951, XQ1560	100 nA	250 mV
SATICON B, TRIODE	TH9957, XQ1565/XQ1570	100 nA	250 mV
SATICON C, TRIODE	XQ1585	100 nA	250 mV
CZICON, TRIODE	XQ1440	100 nA	250 mV
PLUMBICON, DIODE	XQ2182/03X	100 nA	250 mV
SATICON A, DIODE	TH9956	100 nA	250 mV
VIDICON, TRIODE	XQ1240	100 nA	275 mV
Note: The test point for checking signal current is A15TP3.			

2 EQUIPMENT REQUIRED

Filtration (1/4″ Al and 1/32″ Cu) and non-metallic trimpot adjusting tool.

3 SPECIAL INSTRUCTIONS

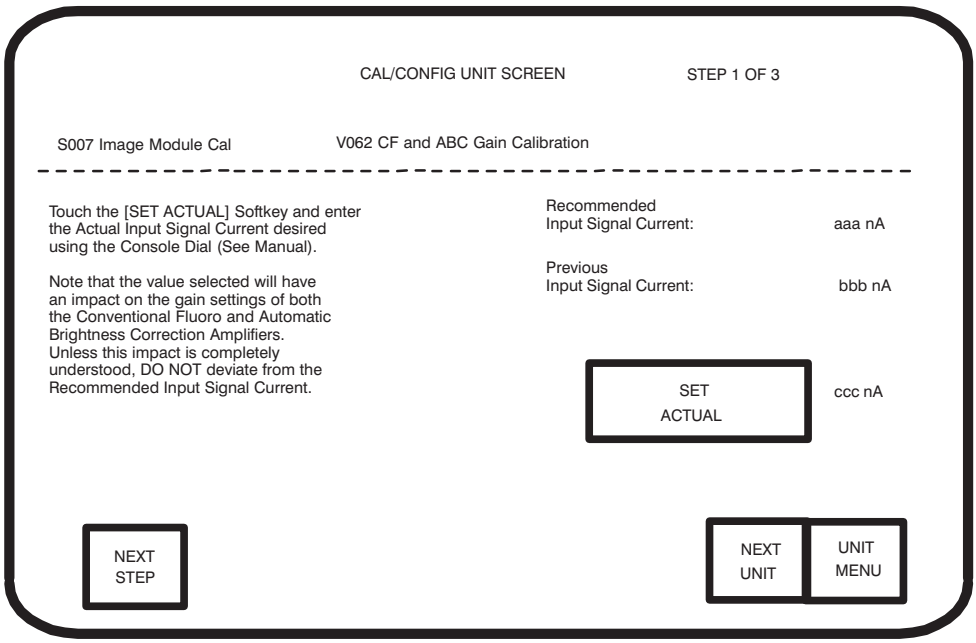
Note: **For Vascular Systems Only:** Before system calibration, verify that additional filter (copper–aluminum filter) is not installed on top of collimator. (Open sensor hinge assembly to verify.) If installed, remove before performing calibration.

4 CAL PROCEDURE

4-1 Step 1. Set Actual Signal Current

- Touch [SET ACTUAL] softkey and use the console dial to enter the recommended input signal current for the pickup tube type/model installed (See above table). If the [SET ACTUAL] softkey is not activated, the value of previous input signal current will be used in the calibration and no value will be displayed for SET ACTUAL parameter.
- Touch [SET ACTUAL] softkey again.
- Touch [NEXT STEP] softkey to proceed to Step 2.

V062 STEP 1 SCREEN DISPLAY



4-2 Step 2. Set Readback Voltage

- Upon entering Step 2, the following message is displayed while the calibration unit sends the value for nominal signal current for Video Calibration to the VIC module.
- Remove all external light sources from illuminating the TV camera pickup tube.
- Touch [ENABLE READBACK] softkey.

PROCESSING

Note: Do not deviate from the recommended video output signal level unless you understand the full impact of the change.

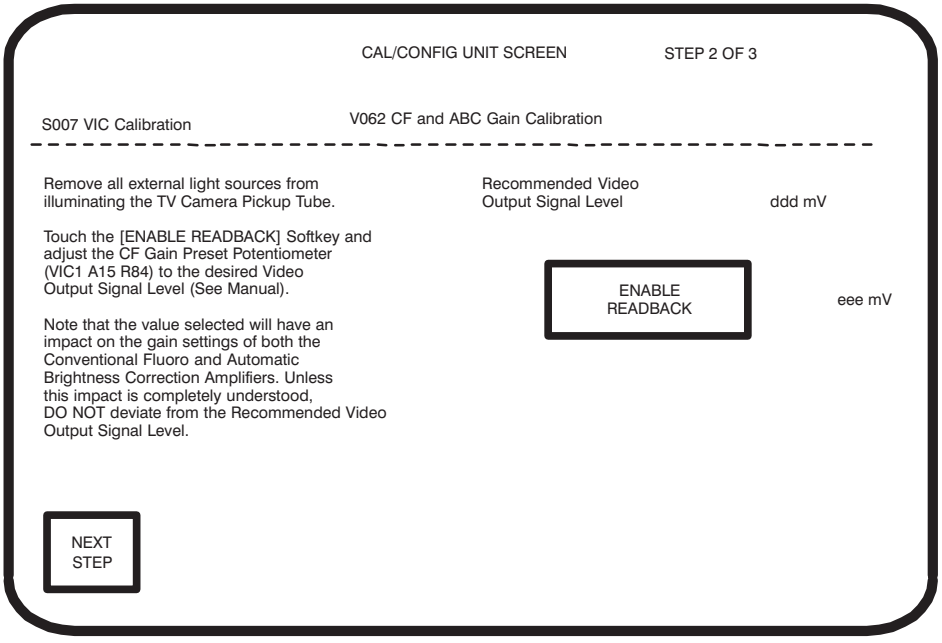
- Adjust CF Gain Preset potentiometer (VIC1 A15 R84) for a readback voltage indication on the console screen that is equal to the voltage value indicated for Recommended Video Output Signal Level or the desired Video Output Signal Level.

NOTICE

When performing this calibration on systems equipped with Digital Record and a Saticon B pickup tube, set the Video Output Signal Level to 250 mV. The 250 mV value applies to both Digital Record systems without copper filter (adults) and with copper filter (Pediatrics).

- Touch the [ENABLE READBACK] softkey again to store the value until exit.
- Touch [NEXT STEP] softkey to proceed to Step 3.

V062 STEP 2 SCREEN DISPLAY



4-3 Step 3. Set ABC Gain

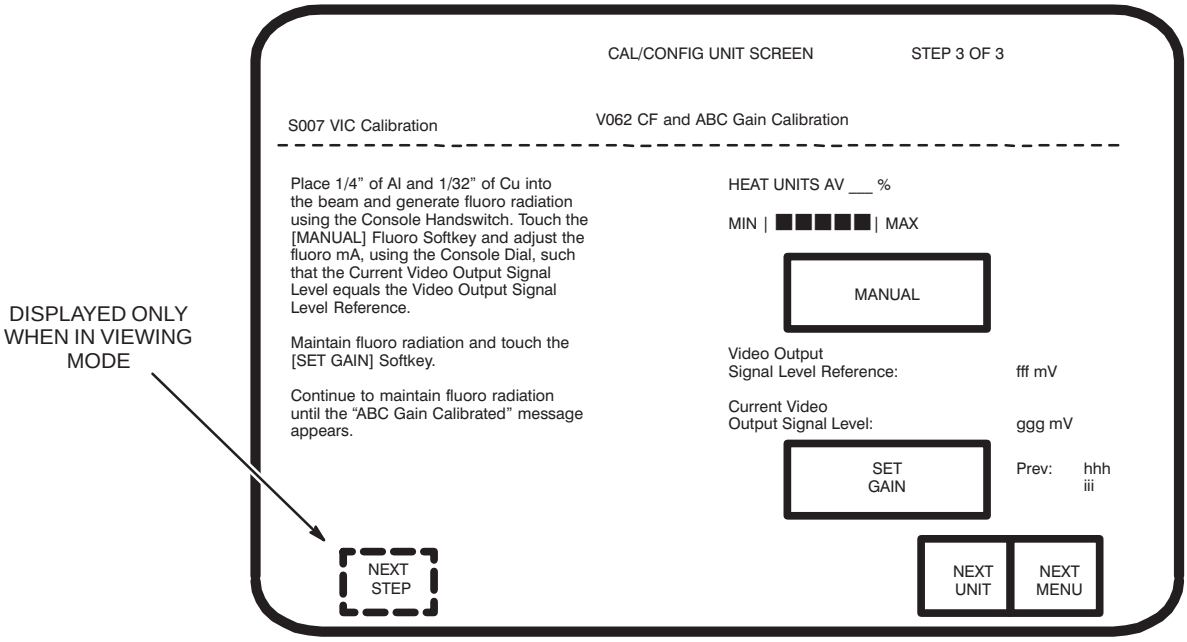
- Place 1/4″ Aluminum and 1/32″ Copper filtration into the X–ray beam.
- Take and maintain a fluoro exposure with the console handswitch.
- Touch [MANUAL] softkey and using the console dial, adjust fluoro mA until the Current Video Output Signal Level is as close as possible to the Video Output Signal Reference Level, ±10.0 mV.
- Touch [SET GAIN] softkey. A flashing “MAINTAIN FLUORO OPERATION ... ABC GAIN IS BEING CALIBRATED” message is displayed while the unit determines the correct ABC Gain setting.
- Continue to maintain fluoro until the following messages is displayed:

ABC GAIN CALIBRATED

- Terminate fluoro exposure.
- Touch [NEXT UNIT] or [UNIT MENU] softkey to exit. Exiting the unit loads the calibration data in NV database.

Note: If the error message “UNABLE TO SET ABC GAIN, RUN DIAGNOSTICS” is displayed, exit from the unit is prevented until corrective action is accomplished and the unit is run to successful completion.

V062 STEP 3 SCREEN DISPLAY



UNIT V063 – Character Centering (HI and LO Interlace)

Time: x h xx min – Personnel: 1 field engineer

1 DESCRIPTION

Calibration Unit V063 establishes a centering command for positioning the alpha–numeric (A/N) character display on the video monitor on systems equipped with the character generator function. The unit is sub–divided into the following two units to provide adjustment on both HI and LO video line rate interlace configurations.

V063 Character Centering – LO
V063 Character Centering – HI

Selection of the appropriate unit is accomplished on the VIC Calibration sequence menu presented by the Smart Sequencer.

2 EQUIPMENT REQUIRED

None.

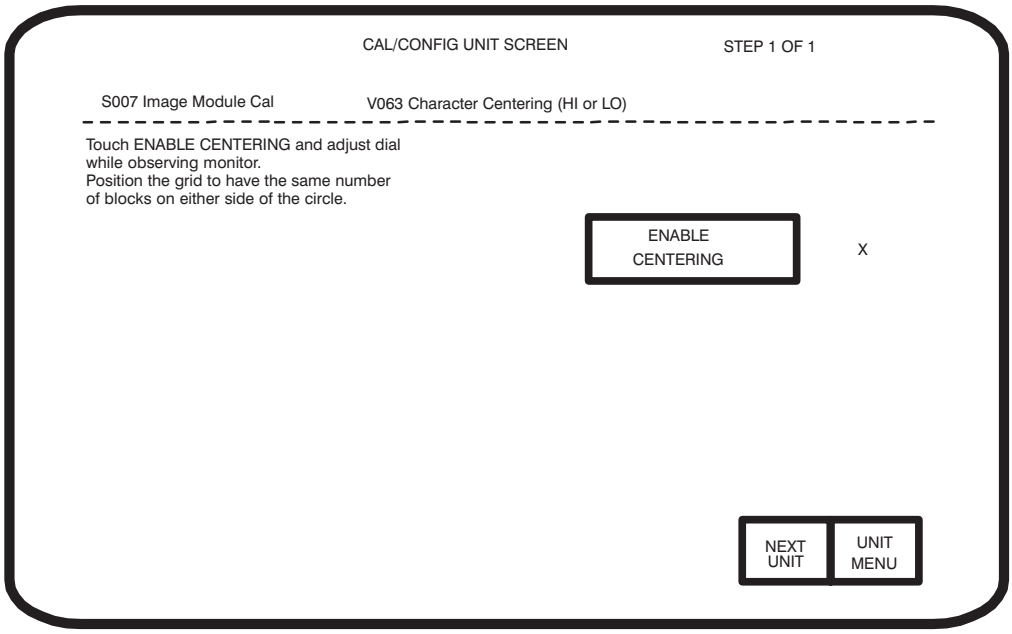
3 CAL PROCEDURE

Upon entering the unit, the system automatically displays a calibrating grid on the video monitor. The existing value of the centering command (relative to line rate) is displayed on the console screen unless the unit is being run for the first time. Perform the calibration as follows:

- Touch the ENABLE CENTERING softkey. The softkey is illuminated when activated.
- Use the console dial to shift the position of the grid on the video monitor until the grid is symmetrically positioned around the circle.
- Touch NEXT UNIT or UNIT MENU softkey to exit the calibration unit. Exiting the unit loads the centering command value into NV RAM.

Note: If the image is not blanked from the video monitor after exiting this unit, re–select unit and then exit unit without updating NV RAM. This will remove the image from the monitor.

V063 STEP 1 SCREEN DISPLAY



UNIT V064 – EDR Delay Calibration

Time: x h xx min – Personnel: 1 field engineer

1 DESCRIPTION

Calibration unit V064 is used to adjust the fine delay of the Extended Dynamic Range (EDR) function (Ref: Cal Unit V056, EDR Cal). Because of the variations in VIC systems, the unit is subdivided into three calibration procedures and their associated screen displays. Each procedure provides instructions for performing the EDR delay calibration on a specific system configuration. The procedures are as follows:

Cal Procedure 1. V064, EDR Delay Cal, Low Interlace

Cal procedure 2. V064, EDR Delay Cal, High Interlace

Cal Procedure 3. V064, EDR Delay Cal, DX (DLX) 1024

The applicable V064 unit (or units) are automatically presented on the appropriate calibration sequence menus according to the configuration of the system. V064 EDR Delay Cal, High and Low Interlace, are displayed on Sequence Menu S007, Image Module Cal Sequence. V064 EDR Delay Cal, DX (DLX) 1024, is displayed on Sequence Menu S009, DX (DLX) VIC and Dose Cal Sequence.

2 EQUIPMENT REQUIRED

PWB extender board, non–metallic trimpot adjusting tool and oscilloscope. An Image Evaluation Tool (46–232388G1) and grid (46–257762P1) may also be required if the method used to perform the calibration does not use fluoro radiation.

NOTICE

Ensure that white clip potentiometer VIC1 A15 R418 on Video Processor PWB VIC1 A15 is set fully clockwise before running. If this unit is run out of the normal VIC calibration sequence, run White Clip Adjustment Calibration Unit V071 after running the unit to reset the white clip potentiometer (VIC1 A14 R418) to proper level.

3 SPECIAL INSTRUCTIONS

Note: **For Vascular Systems Only:** Before system calibration, verify that additional filter (copper–aluminum filter) is not installed on top of collimator. (Open sensor hinge assembly to verify.) If installed, remove before performing calibration.

4 CAL PROCEDURE 1 – EDR DELAY CAL, LOW INTERLACE

4-1 Step 1. Setup System for Calibration

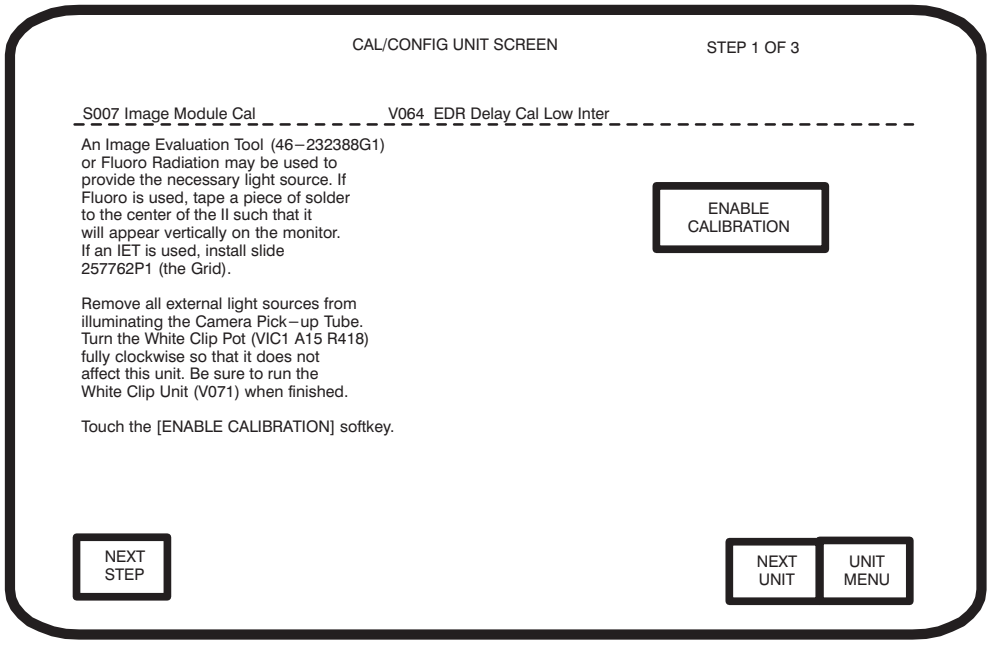
Note: An Image Evaluation Tool (IET) or fluoro radiation may be used to provide the required light source for calibration.

- Using a PWB extender board, extend the TV Image Processor board VIC1 A14 from the VIC card rack. Board extension is required in order to access the required adjustments and test points called out in later steps of the calibration.
- If fluoro is going to be the light source used to provide an image, tape a piece of solder to the center of the II tube. Orient the solder so that the solder image will appear vertically on the monitor.

OR

- If an Image Evaluation Tool (IET) is to be used to provide the light source, install Grid P/N 46–257762P1.
- Remove all external light sources from illuminating the Camera Pickup Tube.
- Touch ENABLE CALIBRATION softkey.
- Touch NEXT STEP to proceed to Step 2.

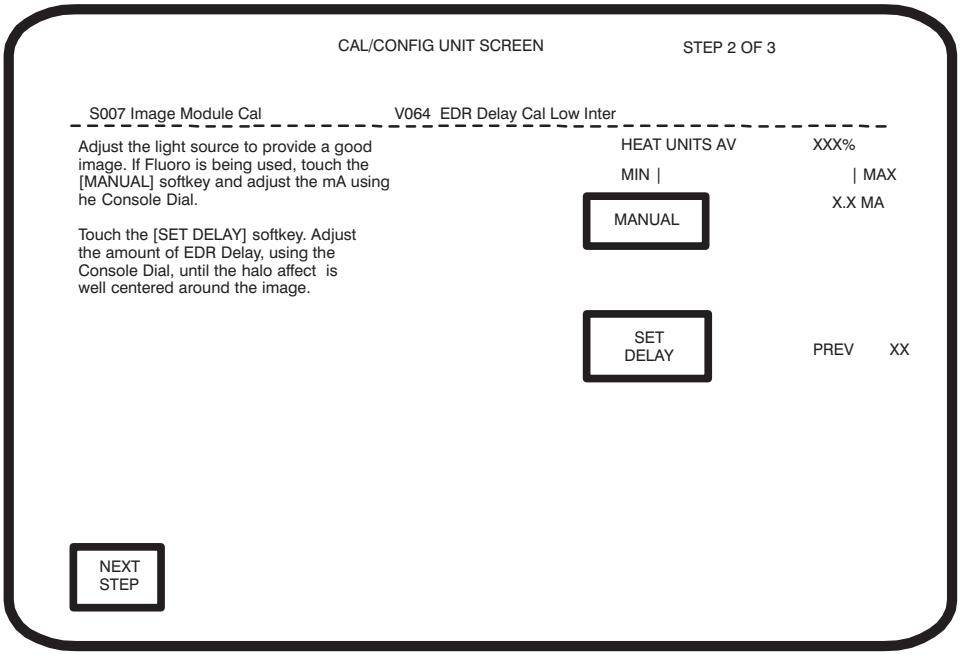
V064 STEP 1 LOW INTER SCREEN DISPLAY



4-2 Step 2. Set Delay

- Adjust light source to provide a good image. If fluoro is being used to perform the calibration, take a fluoro exposure and touch MANUAL softkey. Then, use the console dial to adjust mA for image brightness.
- Touch SET DELAY softkey and use the console dial to adjust the amount of EDR delay until a white halo or blooming effect is roughly centered around the image (the EDR delay is active when the halo or blooming effect is observed around the solder image).
- If using fluoro, terminate the exposure.
- If not proceeding with a full VIC calibration, remove PWB extender board and replace A14 board in VIC cabinet.
- Touch NEXT STEP softkey to proceed to Step 3.

V064 STEP 2 LOW INTER SCREEN DISPLAY



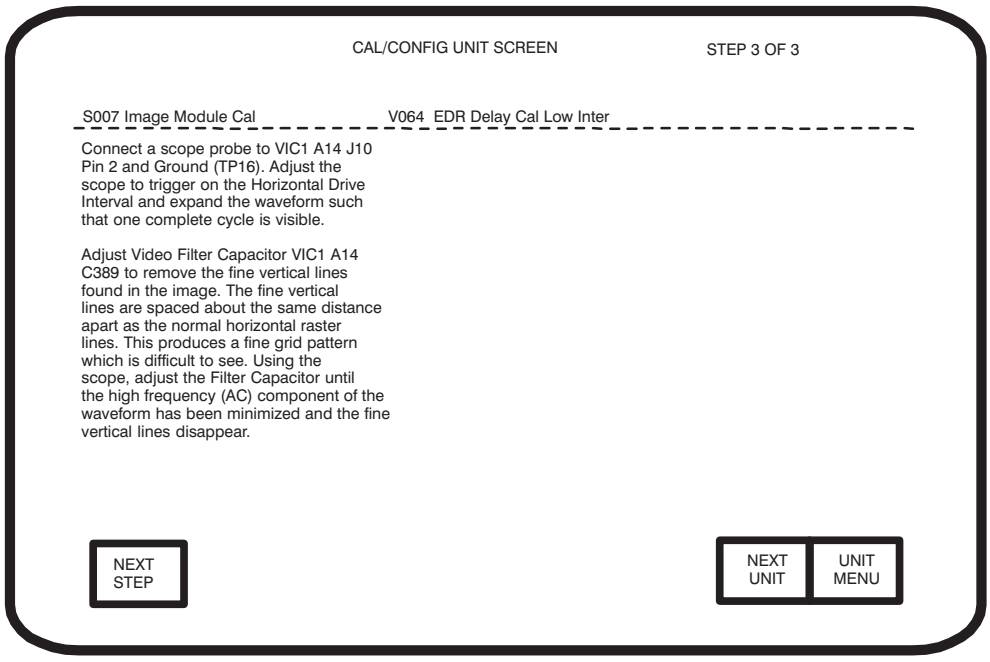
4-3 Step 3. Adjust Video Filter Capacitor

- Connect the oscilloscope probe to VIC1 A14 J10, Pin 2 and ground (TP16). (Pin 2 of J10 is the top pin located toward the edge connector of the board).
- Set oscilloscope controls to trigger on the Horizontal Drive Interval and expand the waveform displayed so that one complete cycle is visible.
- Adjust video filter capacitor VIC1 A14 C389 until the fine vertical lines are removed from the image on the monitor. The fine vertical lines are spaced about the same distance apart as the horizontal raster lines and are difficult to see. **Adjust the capacitor until the grid effect is minimized.**

Note: It may be easier to see the vertical lines if the monitor brightness is turned down.

- Then, observe the waveform on oscilloscope and fine adjust video filter capacitor VIC1 A14 C389 until the high frequency (AC) component of the waveform is minimized and the fine vertical lines on the monitor disappear.
- If not proceeding with a full VIC calibration, remove PWB extender board and replace A14 board in VIC cabinet.
- Touch NEXT UNIT or UNIT MENU softkey to exit.

V064 STEP 3 LOW INTER SCREEN DISPLAY



5 CAL PROCEDURE 2 – EDR DELAY CAL, HIGH INTERLACE

5-1 Step 1. Setup system for Calibration

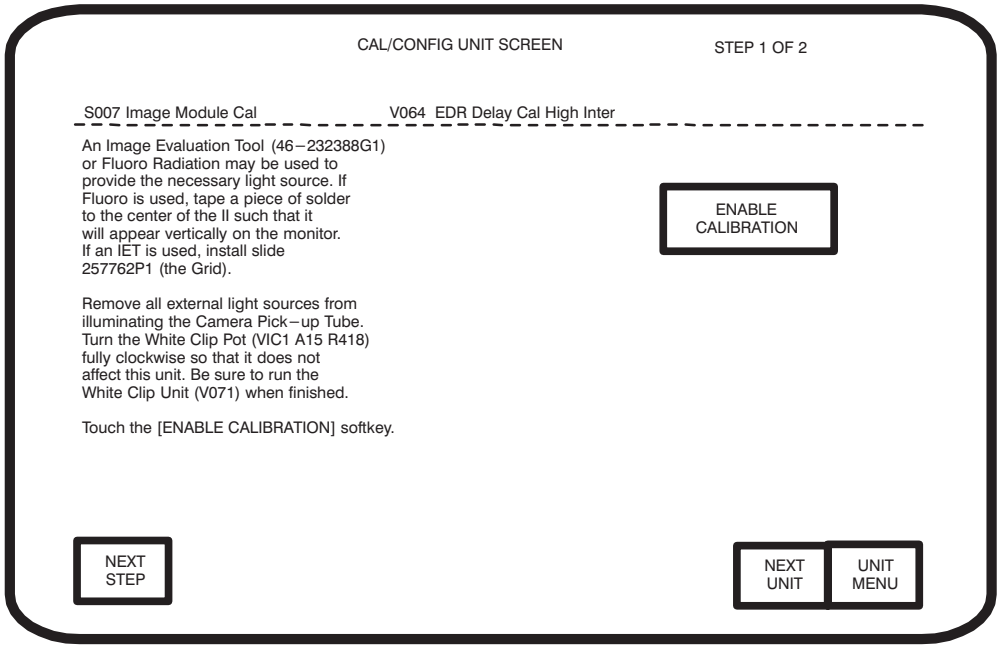
Note: An Image Evaluation Tool (IET) or fluoro radiation may be used to provide the required light source for calibration.

- Using a PWB extender board, extend the TV Image Processor board VIC1 A14 from the VIC card rack. Board extension is required in order to access the required adjustments and test points called out in later steps of the calibration.
- If fluoro is going to be the light source used to provide an image, tape a piece of solder to the center of the II tube. Orient the solder so that the solder image will appear vertically on the monitor.

OR

- If an Image Evaluation Tool (IET) is used to provide the light source, install Grid, P/N 46–257762P1.
- Remove all external light sources from illuminating the Camera Pickup Tube.
- Touch ENABLE CALIBRATION softkey.
- Touch NEXT STEP to proceed to Step 2.

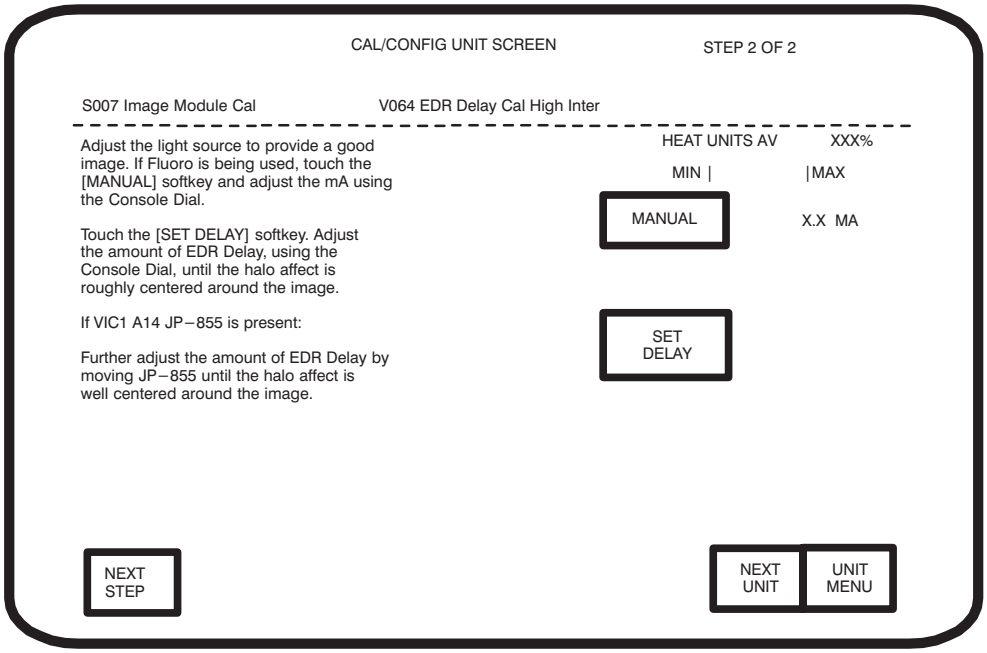
V064 STEP 1 HIGH INTER SCREEN DISPLAY



5-2 Step 2. Set Delay

- Adjust light source to provide a good image. If fluoro is being used to perform the calibration, take a fluoro exposure and touch MANUAL softkey. Then, use the console dial to adjust mA for image brightness.
- Touch SET DELAY softkey and use the console dial to adjust the amount of EDR delay until a white halo or blooming effect is roughly centered around the image (the EDR delay is active when the halo or blooming effect is observed around the solder image).
- If jumper JP–855 is present on the A14 board supplied with your VIC system, continue with a fine adjustment of the EDR delay by repositioning jumper VIC1 A14 JP 855 (10 position jumper) until the halo effect is centered around the image.
- If not proceeding with a full VIC cal, remove PWB extender board and replace A14 board in VIC cabinet.
- Touch NEXT UNIT or UNIT MENU softkey to exit.

V064 STEP 2 HIGH INTER SCREEN DISPLAY



6 CAL PROCEDURE 3 – EDR DELAY CAL, DX (DLX) 1024

6-1 Step 1. Setup the System for Calibration

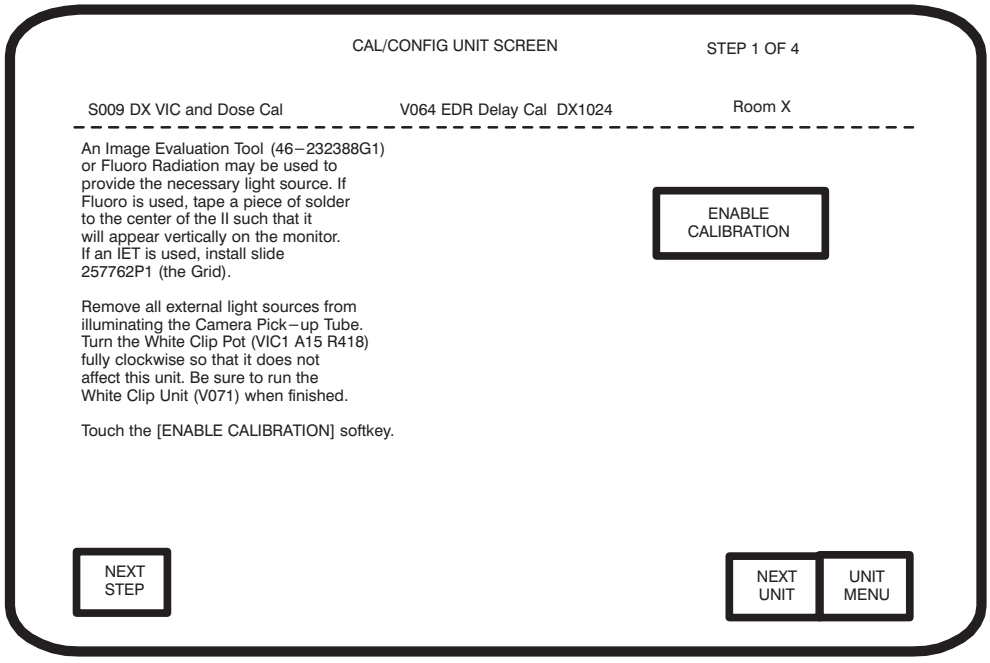
Note: An Image Evaluation Tool (IET) or fluoro radiation may be used to provide the required light source for calibration.

- Using a PWB extender board, extend the TV Image Processor board VIC1 A14 from the VIC card rack. Board extension is required in order to access the required adjustments and test points called out in later steps of the calibration.
- If fluoro is going to be the light source used to provide an image, tape a piece of solder to the center of the II tube. Orient the solder so that the solder image will appear vertically on the monitor.

OR

- If an Image Evaluation Tool (IET) is going to be used to provide the image, install Grid, P/N 46–257762P1.
- Remove all external light sources from illuminating the Camera Pickup Tube.
- Touch ENABLE CALIBRATION softkey.
- Touch NEXT STEP to proceed to Step 2.

V064 STEP 1 DX (DLX) 1024 SCREEN DISPLAY



6-2 Step 2. Enable DLX

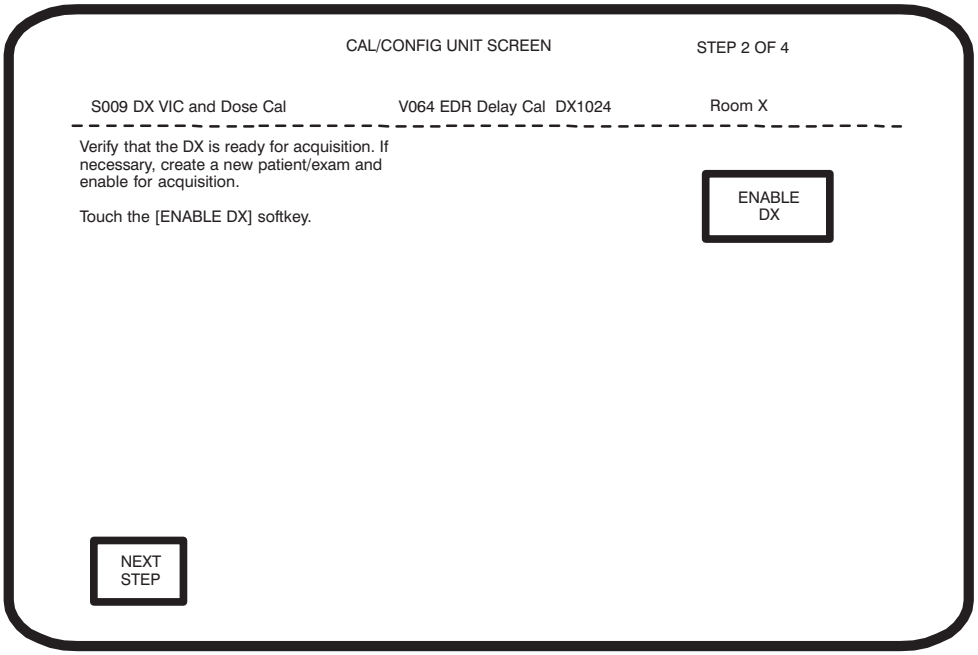
- Check that DLX is in the acquisition mode (the ACQUISITION screen is displayed on the DLX console). If not, press the following keys on the DLX console to access acquisition mode.

  NEW PATIENT (You must also enter a patient name and ID number or the DLX will not be enabled.)

  NEW EXAM.

- Touch ENABLE DLX softkey.
- Touch NEXT STEP softkey to proceed to Step 3.

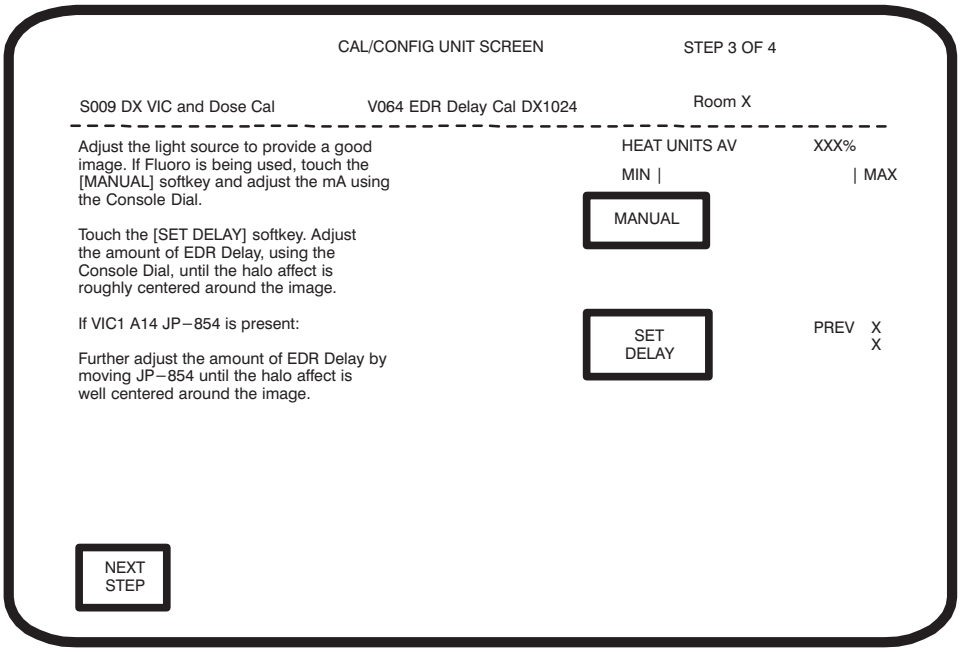
V064 STEP 2 DX (DLX) 1024 SCREEN DISPLAY



6-3 Step 3. Set Delay

- Adjust light source to provide a good image. If fluoro is being used, take a fluoro exposure and touch MANUAL softkey. Then, use the console dial to adjust mA for image brightness.
- Touch SET DELAY softkey and use the console dial to adjust EDR delay until a white halo or blooming effect is roughly centered around the image (the EDR delay is active when the halo or blooming effect is observed around the solder image).
- If jumper JP–854 is present on the A14 board supplied with your VIC system, continue with a fine adjustment of the EDR delay by repositioning jumper VIC1 A14 JP 854 (10 position jumper) until the halo effect is centered around the image.
- Touch NEXT UNIT or UNIT MENU softkey to exit.

V064 STEP 3 DX (DLX) 1024 SCREEN DISPLAY



Note: On VIC systems configured with an earlier A14 PWA (P/N 46–232768), capacitor VIC1 A14 C491 is not present for adjustment.

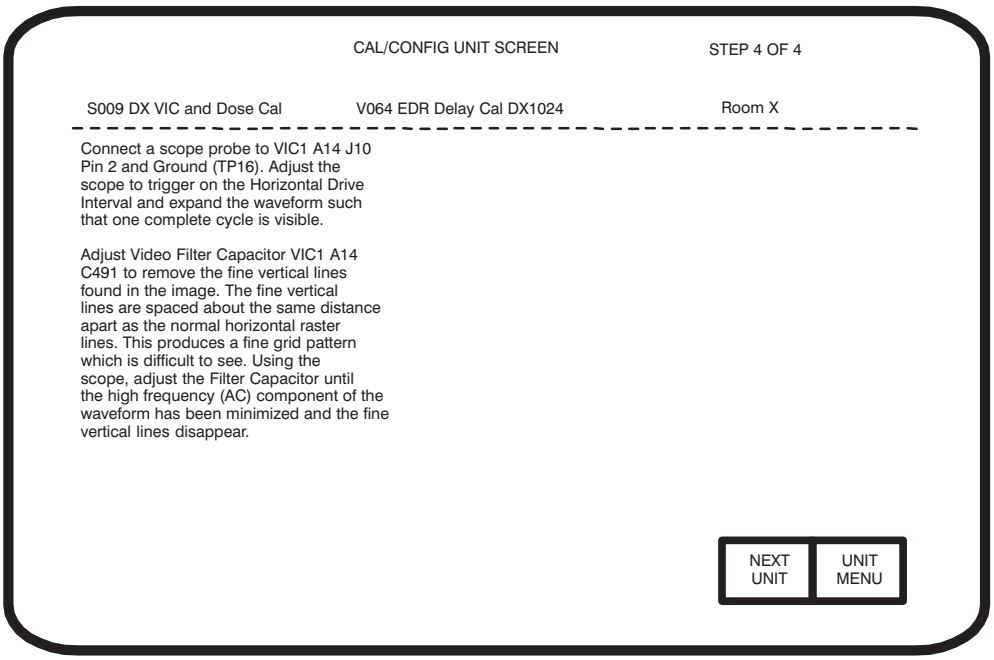
6-4 Step 4. Adjust Video Filter Capacitor

- Connect the oscilloscope probe to VIC1 A14 J10, Pin 2 and ground (TP16). (Pin 2 of J10 is the top pin located toward the edge connector of the board).
- Set oscilloscope controls to trigger on the Horizontal Drive Interval and expand the waveform displayed until one complete cycle is visible.
- Adjust video filter capacitor VIC1 A14 C491 until the fine vertical lines are removed from the image on the monitor. The fine vertical lines are spaced about the same distance apart as the horizontal raster lines and are difficult to see. **Adjust the capacitor until the grid effect is minimized.**

Note: It may be easier to see the vertical lines if the monitor brightness is turned down.

- Then, observe waveform on oscilloscope and fine adjust video filter capacitor VIC1 A14 C491 until the high frequency (AC) component of the waveform is minimized and the fine vertical lines on the monitor disappear.
- Terminate the exposure.
- Touch NEXT UNIT or UNIT MENU softkey to exit.

V064 STEP 4 DX (DLX) 1024 SCREEN DISPLAY



UNIT V065 – G4/G3 Calibration

Time: x h xx min – Personnel: 1 field engineer

1 V065, G4/G3 CALIBRATION NEW PROCEDURE FOR SETTING G4/G3 PUT VOLTAGE

Note: The New Procedure is used for Legacy Phase 3 R&F Systems, for ALL biplane systems, and for NEWER software (i.e., ASC SW beginning with G4.XX) single plane LCA/LCV+/LC+ systems.

(For Tilt–C systems, pre–Legacy Phase 3 R&F systems, and older software single plane LCA/LCV+/LC+ systems, go to Old Procedure in Section 2.)

1-1 Description

Calibration Unit V065 is used to verify and/or set the G4 and G3 voltages of the TV camera. Both G4 and G3 voltage values are set according to the TV pickup tube type/model installed in the system. Refer to the VIC label, attached to the VIC cabinet, for the applicable G4/G3 voltage ratings.

Note: The G4 and G3 voltage values for a pickup tube are also listed on the label packaged with the pickup tube.

1-2 Equipment Required

- Digital multimeter capable of measuring up to 1000 VDC.
- PWB extender board.

Table 29 – G4/G3 Voltage Ratings

TUBE TYPE	MODEL NO	G3 VOLTAGE	G4 VOLTAGE
SATICON A, TRIODE	XQ1560	See VIC Label	See VIC Label
SATICON B, TRIODE	XQ1565/XQ1570	See VIC Label	785 V
SATICON C, TRIODE	XQ1585	See VIC Label	785 V
SATICON A, TRIODE	TH9951	550 V	785 V
SATICON B, TRIODE	TH9957	550 V	785 V
CZICON, TRIODE	XQ1440X	550 V	810 V
PLUMBICON, DIODE	XQ2182/03X	675 V	785 V
SATICON A, DIODE	TH9956		785 V
VIDICON, TRIODE	XQ1240		810 V

1-3 Cal Procedure

Set up as follows:

- Turn power off on the Advantx console and on the VIC card rack.

- Connect the A10 board from the VIC card rack to the PWB extender board, and turn power back on.
- Set the digital multimeter to measure Volts DC and maximum voltage.
- Connect the voltmeter leads between test points TP–6 (G3) and TP–16 (gnd) on the VIC A10 board.

Perform the G4 calibration as follows:

- Touch the SET ACTUAL G4 softkey. When activated, the softkey is highlighted in reverse video.
- Use the console dial to enter the G4 voltage value, for the pickup tube type/model installed in the system, as specified on the VIC label.
- Pressing the SET ACTUAL G4 again de-activates the softkey/console dial and sends the D/A command to update the G4 voltage.

Note: The G4 voltage can be verified with the digital voltmeter by measuring the DC voltage between test points TP–12 (G4) and TP–16 (gnd) on the VIC A10 board.

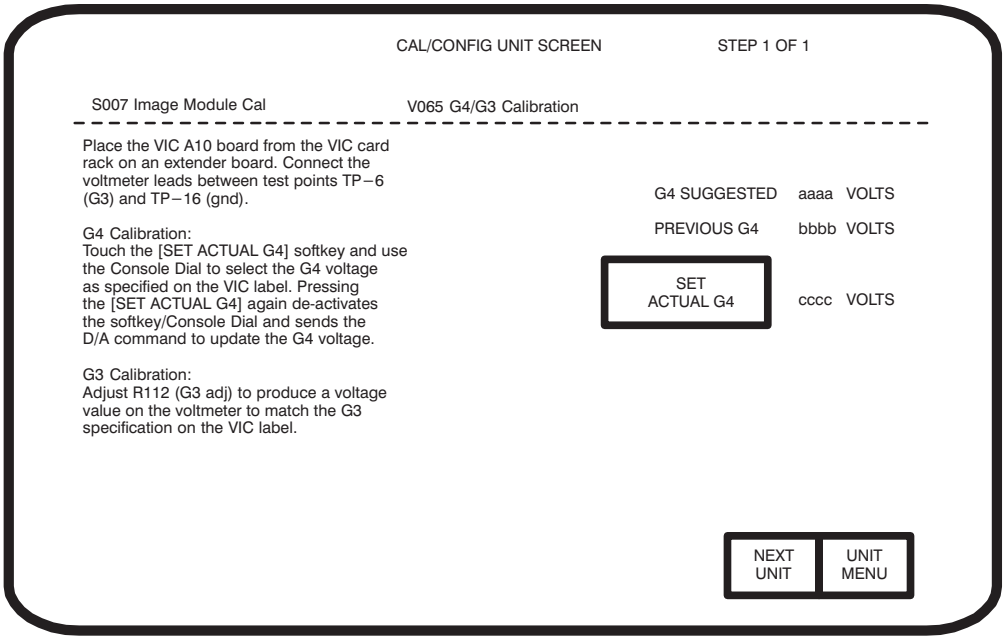
Perform the G3 calibration as follows:

- Adjust R112 (G3) to produce a voltage on the digital voltmeter that matches the G3 specification on the VIC label.

Note: If R112 potentiometer is glued, the seal may need to be broken.

- Touch the NEXT UNIT or UNIT MENU softkey to exit the unit. Exiting the unit loads the G4 voltage value into NV RAM.

V065 SCREEN DISPLAY
(LEGACY PHASE 3 R&F, BIPLANE &
<u>NEWER</u> SW SP LCA/LCV+/LC+ SYSTEMS)



2 V065, G4/G3 CALIBRATION OLD PROCEDURE FOR SETTING G3/G4 PUT VOLTAGE

Note: The Old Procedure is used for all Tilt–C systems, for pre–Legacy Phase 3 R&F systems, and for OLDER software (i.e., ASC SW prior to G4.XX) single plane LCA/LCV+/LC+ systems.

(For Legacy Phase 3 R&F systems, biplane systems, and newer software single plane LCA/LCV+/LC+ systems, go to New Procedure in Section 1.)

2-1 Description

Calibration Unit V065 is used to verify and/or set the G3 and G4 voltages of the TV camera. Both, G3 and G4 voltage values are set according to the TV pickup tube type/model installed in the system. Refer to the VIC label, attached to the VIC cabinet, for the applicable G3/G4 voltage ratings.

Note: The G3 and G4 voltage values for a pickup tube are also listed on the label packaged with the pickup tube.

2-2 Equipment Required

- Digital multimeter capable of measuring up to 1000 VDC.
- PWB extender board.

Table 30 – G3/G4 Voltage Ratings

TUBE TYPE	MODEL NO	G3 VOLTAGE	G4 VOLTAGE
SATICON A, TRIODE	XQ1560	See VIC Label	See VIC Label
SATICON B, TRIODE	XQ1565/XQ1570	See VIC Label	785 V
SATICON C, TRIODE	XQ1585	See VIC Label	785 V
SATICON A, TRIODE	TH9951	550 V	785 V
SATICON B, TRIODE	TH9957	550 V	785 V
CZICON, TRIODE	XQ1440X	550 V	810 V
PLUMBICON, DIODE	XQ2182/03X	675 V	785 V
SATICON A, DIODE	TH9956		785 V
VIDICON, TRIODE	XQ1240		810 V

2-3 Cal Procedure

Perform the G3 calibration as follows:

- Turn power off on the Advantx console and on the VIC card rack.
- Connect the A10 board from the VIC card rack to the PWB extender board, and turn power back on.

- Set the digital multimeter to measure Volts DC and maximum voltage.
- Connect the voltmeter leads between test points TP–6 (G3) and TP–16 (gnd) on the VIC A10 board.
- Adjust R112 (G3) to produce a voltage on the digital voltmeter that matches the G3 specification on the VIC label.

Note: If R112 potentiometer is glued, the seal may need to be broken.

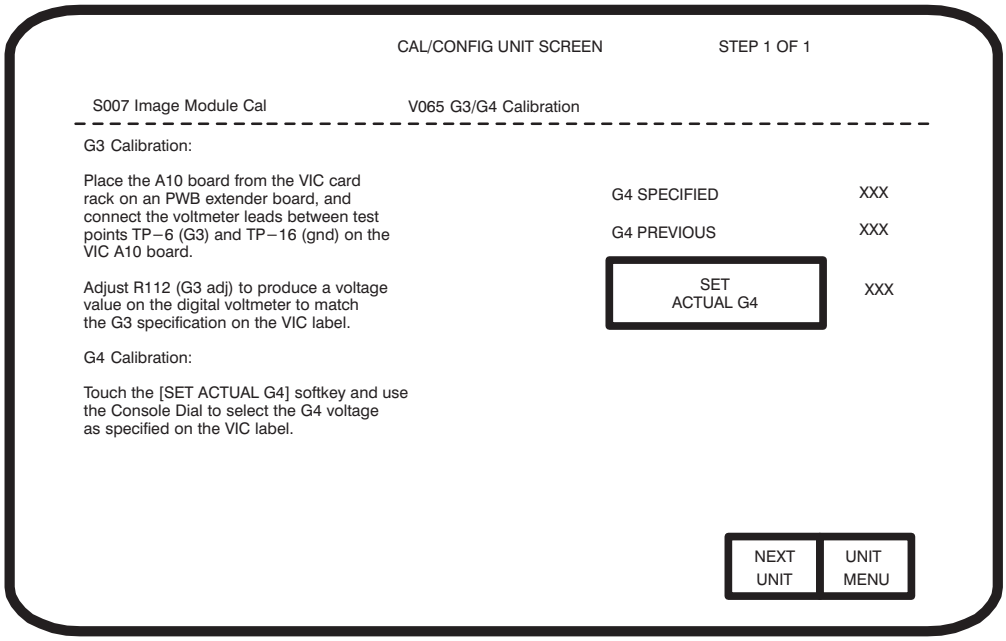
2-4 Cal Procedure

Perform the G4 calibration as follows:

- Touch the SET ACTUAL G4 softkey. When activated, the softkey is highlighted in reverse video.
- Use the console dial to enter the G4 voltage value, for to the pickup tube type/model installed in the system, as specified on the VIC label.
- Touch the NEXT UNIT or UNIT MENU softkey to exit the unit. Exiting the unit loads the G4 voltage value into NV RAM.

Note: The G4 voltage can be verified with the digital voltmeter by measuring the DC voltage between test points TP–12 (G4) and TP–16 (gnd) on the VIC A10 board. This step, however, requires leaving V065 unit menu.

V065 SCREEN DISPLAY
(TILT–C, PRE–LEGACY PHASE 3 R&F,
& <u>OLDER</u> SW SP LCA/LCV+/LC+)



UNIT V066 – Pickup Tube Lag Compensation

Time: x h xx min – Personnel: 1 field engineer

1 DESCRIPTION

Calibration Unit V066 is used to adjust the lag compensation whenever a pickup tube is changed. The adjustment matches the automatic gain control (AGC) response to the new pickup tube and the effect of the iris.Three steps are required to accomplish the calibration. A screen display is provided for each step.

2 EQUIPMENT REQUIRED

Focaligner or Image Evaluation Tool (46–232388G1), oscilloscope, test leads, and non-metallic trimpot adjusting tool.

3 SPECIAL INSTRUCTIONS

Note: **For Vascular Systems Only:** Before system calibration, verify that additional filter (copper–aluminum filter) is not installed on top of collimator. (Open sensor hinge assembly to verify.) If installed, remove before performing calibration.

4 CAL PROCEDURE

4-1 Step 1. Setup the system

- Setup the system for calibration using one of the following methods:

4-1-1 Focaligner or Image Evaluation Tool (IET).

1. Remove the TV Camera from the Image Intensifier Assembly and place on a flat work surface.
2. Attach the TV Camera to the Focaligner or IET.

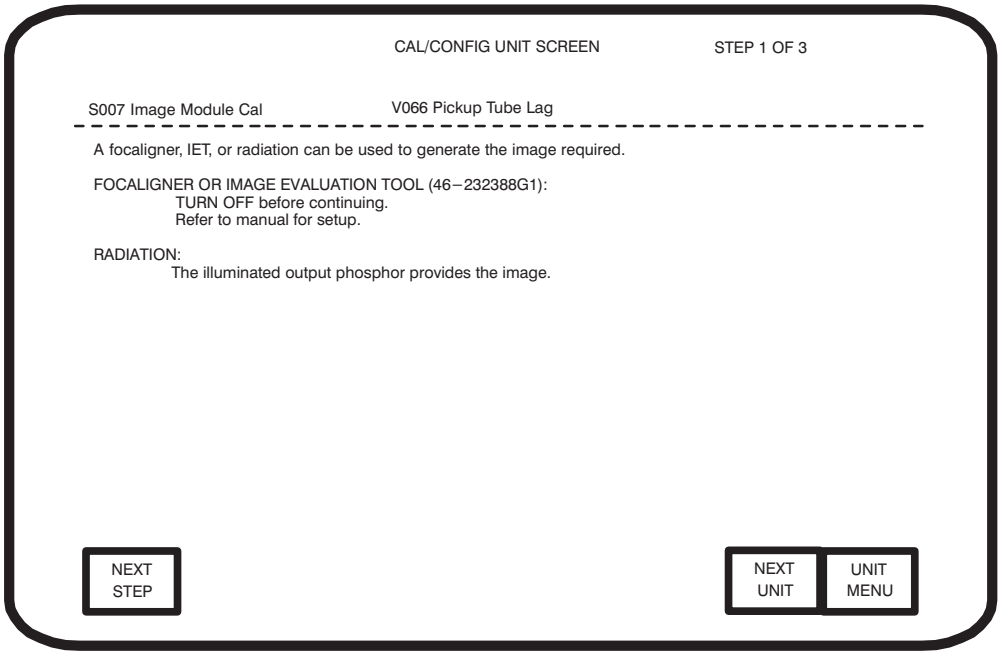
Note: Do not turn on the Focaligner or IET at this time.

4-1-2 Radiation (Fluoro Exposure).

1. The illuminated output phosphor provides the necessary image to make the pickup tube lag compensation adjustment.

- Touch NEXT STEP softkey to proceed to Step 2.

V066 STEP 1 SCREEN DISPLAY



4-2 Step 2. Adjust Lag

- Setup the oscilloscope as follows:
  - Connect scope probe to SKL A2 TP1 and chassis (ground).
  - Set VERT AMPL: 0.5 V/div, Set TIME BASE: 500 ms/div.
- Make the adjustment using the calibration method selected in Step 1.

4-2-1 Image Evaluation Tool or Focaligner

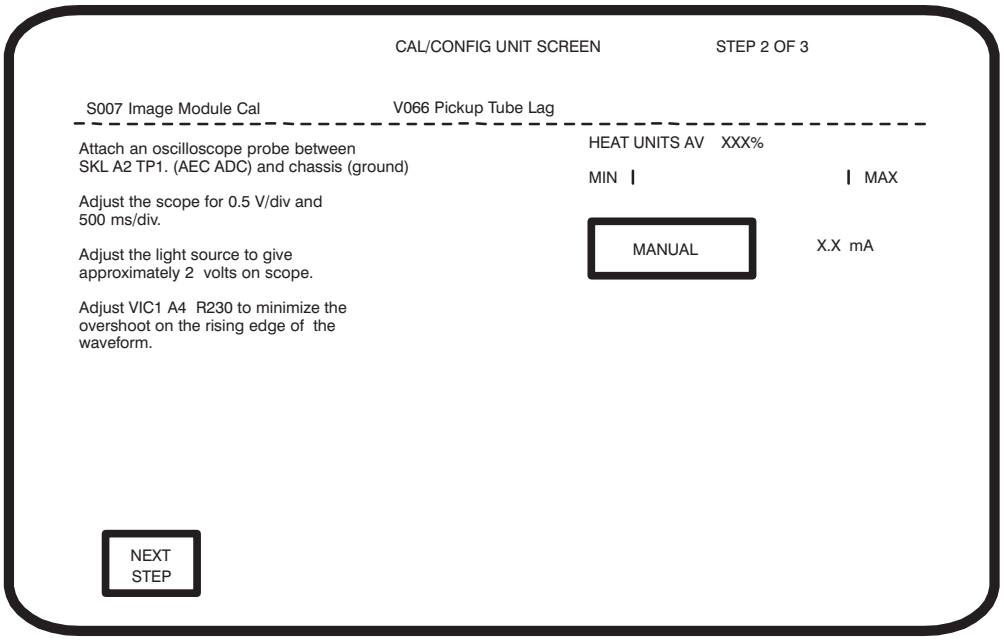
1. Turn on the Image Evaluation Tool or Focaligner.
2. Adjust the light source until a signal amplitude of approximately 2.0 volts (pk–pk) is observed on the oscilloscope.
3. Adjust LAG COMPENSATION potentiometer, VIC1 A4 R230 to minimize the decay time of the overshoot on the rising edge of the square wave. **The adjustment does not effect the rise and fall time of the square wave itself but only the fall time of the overshoot.**

4-2-2 Radiation

1. Touch the MANUAL softkey.
2. Take a fluoro exposure and using the console dial, adjust mA for a signal amplitude of 2.0 volts (pk–pk) on the oscilloscope.
3. Adjust LAG COMPENSATION potentiometer, VIC1 A4 R230 to minimize the decay time of the overshoot on the rising edge of the square wave. **The adjustment does not effect the rise and fall time of the square wave itself but only the fall time of the overshoot.**

- Touch NEXT STEP softkey to proceed to Step 3.

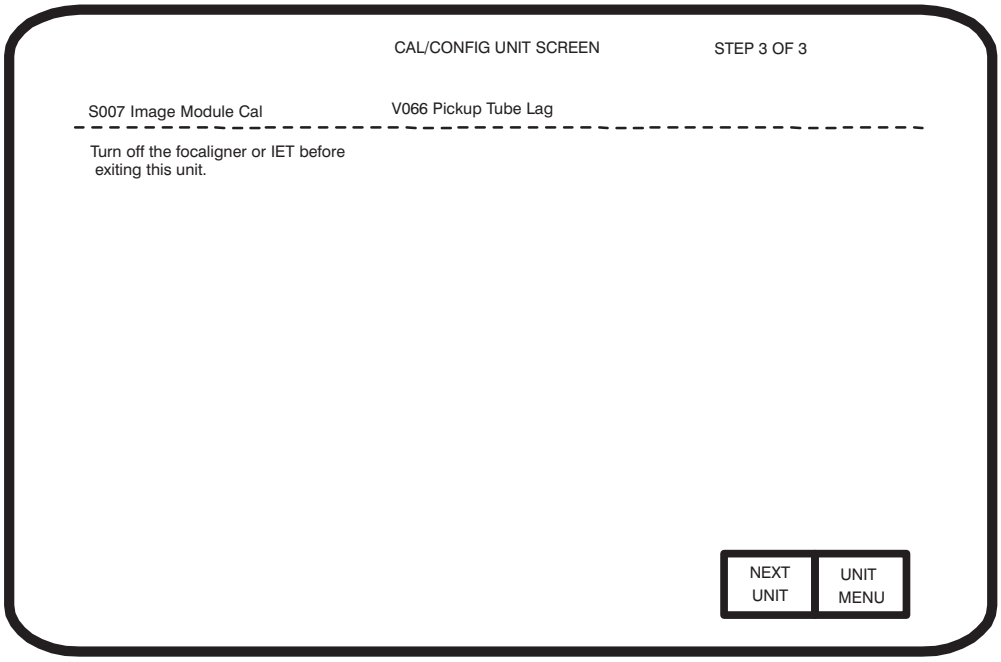
V066 SCREEN DISPLAY



4-3 Step 3. Exit the Unit

- Turn off the Focaligner or Image Evaluation Tool (if that calibration method was used).
- Touch NEXT UNIT or UNIT MENU softkey to exit the calibration unit.

V066 STEP 3 SCREEN DISPLAY



UNIT V067 – DF Gain Adjustment

Time: x h xx min – Personnel: 1 field engineer

1 DESCRIPTION

Calibration Unit V067 adjusts the DF Gain potentiometer in the VIC cabinet to establish the proper signal level between the video output of the TV camera preamp and the video input to the DF analog video processor. Two steps are required to accomplish the calibration. A screen display is provided for each step.

2 EQUIPMENT REQUIRED

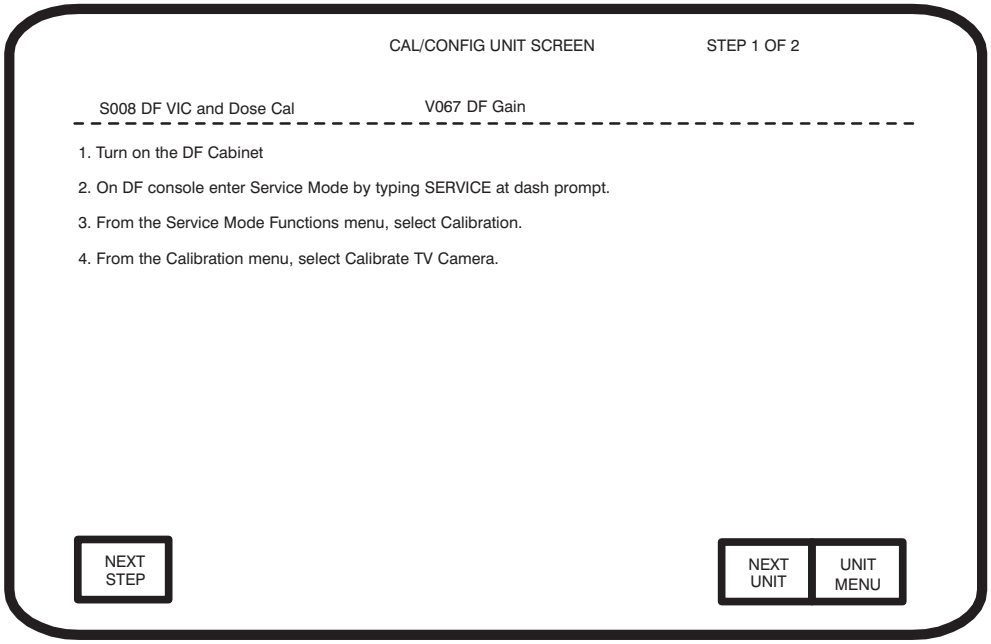
Oscilloscope, test leads, PWB extender board, and non–metallic adjusting tool.

3 CAL PROCEDURE

3-1 Step 1. Setup DF Calibration Function

- Turn on the power to the DF Cabinet.
- When the dash prompt is displayed on the DF console screen, type the word SERVICE. The DF service mode function menu is displayed.
- Select item 6, Calibration, from the menu. The Calibration menu is displayed.
- Select item 1, Calibrate TV Camera, from the menu. The Calibrate TV Camera menu is displayed.
- Return to the system console and touch NEXT STEP softkey to proceed to Step 2.

V067 STEP 1 SCREEN DISPLAY



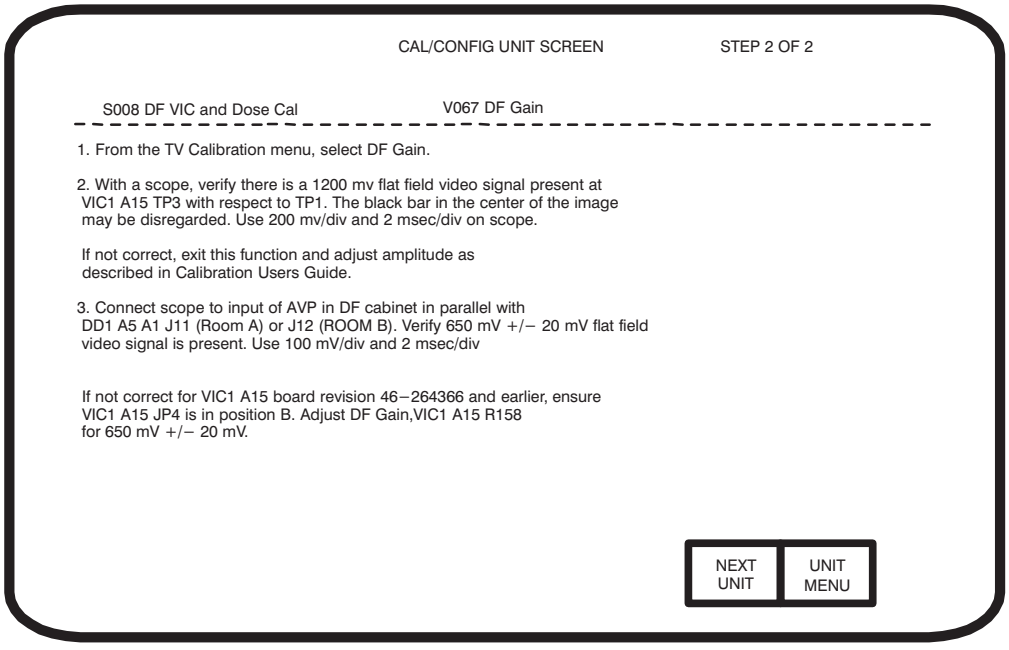
3-2 Step 2. Adjust DF Gain

- Type **"4" (DF Gain)** at the *Select Function* prompt on the TV Camera Calibration menu screen.
- Connect an oscilloscope to VIC1 A15 TP3 and TP1 (signal gnd). Use 200 mV/div and 2 msec/div. Verify that a 1200 mV flat field video signal is present. Disregard the black bar in the center of the image.
- If not correct, press **DONE** to exit this function and then adjust amplitude as follows:
  1. Type **"6" (Edit Video Output Level)** at the *Select Function* prompt on the TV Camera Calibration menu screen.
  2. Using the **ERASE ENTRY** or **BACKSPACE** keys and the numerical keys of the DF Console keyboard, edit the *Video Output Level* field value to reflect desired signal amplitude as viewed on VIC1 A15 TP3.
  3. Record the Video Output Level: _____mV. (This value will be used when running Cal Unit D001, AVP Cal.)
  4. Press **DONE** to terminate *Edit Video Output Level* function.
  5. Type **"4" (DF Gain)** at the *Select Function* prompt on the TV Camera Calibration menu screen.
- Connect the oscilloscope to the input of the AVP (in DF Cabinet) in parallel with DD1 A5 A1 J11 (Room A) or J12 (Room B). Use 100 mV/div and 2 msec/div. Verify that 650 mV $\pm$ 20 mV signal is present.

Note: If not correct for VIC1 A15 board revision 46–264366 and earlier, verify that VIC1 A15 JP4 is in position B. Then, adjust DF Gain potentiometer VIC1 A15 R158 for a 650 mV $\pm$ 20 mV indication on the oscilloscope.

- Press **DONE** to terminate *DF Gain* function.
- Return to the system console and touch the NEXT UNIT or UNIT MENU softkey to exit the unit.

V067 STEP 2 SCREEN DISPLAY



UNIT V068 – Objective Lens–Focus and Center

Time: x h xx min – Personnel: 1 field engineer

1 DESCRIPTION

Calibration Unit V068 is used to adjust the focus and centering of the Image Intensifier objective lens. The unit screen presentations are primarily steering instructions. Use the step by step procedures given in Step 2 of this Calibration Unit to perform focus and centering of the objective lens. Because of variations in system configurations, two different calibration procedures are provided to cover the adjustments. Cal Procedure 1 applies to systems configured with a 9 inch (22 cm) or 12 inch (30 cm) II tube. Cal Procedure 2 is applicable to systems configured with a 16 inch (40 cm) II tube. Use the procedure that applies to your system configuration.

CAUTION **Observe standard radiation safety practices while performing this calibration unit.**

2 EQUIPMENT REQUIRED

The following tools and equipment are required:

- Image Evaluation Tool (IET) (46–232388G2)
  OR
- Focaligner – Alternate tool. Only used on systems configured with a 9 inch (22 cm) or 12 inch (30 cm) II tube and multi–port image gates.
- Clear Reticule Lens, 46–302883P1
- Centering Reticule Lens, 46–262308P2
- Resolution Wedge, 5LP/mm, 46–197871P2
- Resolution Phantom, 46–162456
- 10X Magnifier, 46–262700P1
- 20X Magnifier, 46–262700P2, (Systems with 16 inch II only)
- Wrench, 3/16 Allen head, minimum 5–1/2 inches long
- Wrench, Metric, M5, Allen head, (Systems with 16 inch II only)
- Wrench, 5/16, Allen head
- Screwdriver, flat blade

Note: If this calibration unit is being performed out of the normal VIC Image Module calibration sequence (Ref S007), Calibration Unit V020 must be run as a prerequisite to this unit.

3 SPECIAL INSTRUCTIONS

Note: **For Vascular Systems Only:** Before system calibration, verify that additional filter (copper–aluminum filter) is not installed on top of collimator. (Open sensor hinge assembly to verify.) If installed, remove before performing calibration.

4 CAL PROCEDURE 1 – LENS ADJUSTMENT ON SYSTEMS WITH 9 INCH (22 CM) OR 12 INCH (30 CM) II TUBES.

4-1 Step 1. Setup the Equipment for Calibration

- Install the selected calibration tool (Focaligner or Image Evaluation Tool) on the image gate of the II as follows:

  1. Systems configured with a multi–port image gate.
     - Install Focaligner or IET on the left–side port of the image gate if possible. If this port is used, use the right–side port. Try to choose a port other than the one assigned to the TV.
     - Remove the top port cover from the image gate. This allows access to the objective lens adjustment drive screw from the top when performing the adjustments required in Step 2. See Illustration 72.

Note: On multi–port image gates configured with a TV rotator or when the left–side port of the image gate cannot be used (some vascular systems), remove the TV camera from the top port and install the Focaligner or IET on this port. Access to the objective lens adjustment drive screw is then accomplished by removing the cover from a side port

  2. Systems configured with a single port image gate.
     - Remove the TV camera from the image gate and install an IET on the image gate port where the TV was located.
     - Remove 5/16 Allen head dust cover screw from access port in the top cover of the image gate (See Illustration 73, Configuration 1). This provides access to the lens adjustment required in Step 2 by inserting a 3/16 inch Allen head wrench (at least 5–1/2 inches in length) straight down to engage the lens drive screw.

Note: On systems equipped with a single port image gate, two types of top covers may be encountered in the field, i. e., top covers with an access port for adjusting the lens focus and top covers w/o an access port. See Illustration 73. If you have a top cover w/o an access port, you must remove a side or front port cover to gain access to the objective lens adjustment drive screw.

- On the Step 1 screen, touch the appropriate PORT softkey on which the Focaligner or IET was installed. The softkey is highlighted when activated.
- Touch NEXT STEP softkey to proceed to Step 2.

Illustration 72 – Objective Lens Alignment, Multi–port Image Gates on 9” or 12” II

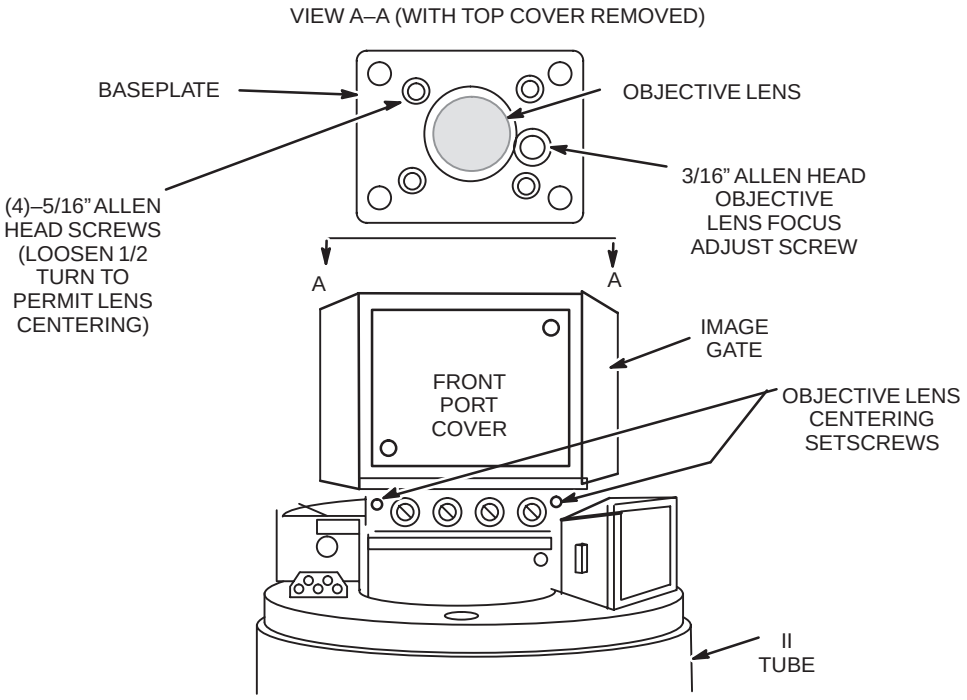
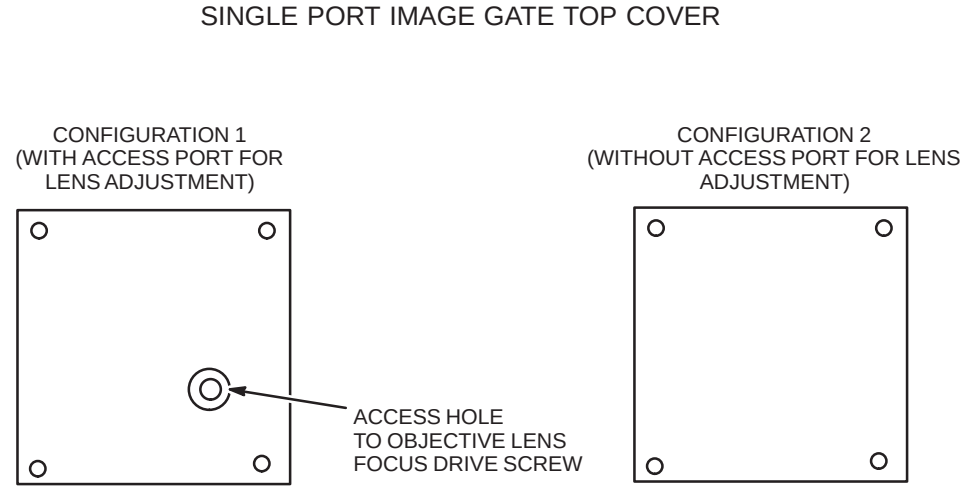


Illustration 73 – Objective Lens Alignment Single Port Image Gates on 9” or 12” II



Note: Step 2 of Cal Procedure 1 provides instructions for making the lens focus and centering adjustments using either a Focaligner or Image Evaluation Tool.

4-2 Step 2. Lens Focus and Centering (See Illustration 72 and Illustration 73)

- **Using a Focaligner Tool**

1. *Objective Lens Focus:*
   - Turn Focaligner ON.
   - Set lamp intensity to maximum.
   - Set Focaligner reticule diffuser to minimum (CCW).
   - Mount 10X magnifier (46–262700P1) in carrier plate and install on strip magnets at readout surface.
   - Adjust the eyepiece to focus on the dark ring at the center of the readout reticule.
   - Using a 3/16” Allen head wrench (at least 5–1/2″ long), adjust the objective lens all the way down by turning the lens focus drive screw to maximum CCW without forcing beyond the limit stop. Then, turn the objective lens out (CW) until the image in the Focaligner is at optimum focus.

Note: As many as four images may be seen at various focal settings. Only one of these is the image formed on the output phosphor (brightest and sharpest). The other images are formed when the lens is incorrectly focused on the glass surfaces that are located between the lens and output phosphor. The “true” image is the first one that appears when the lens drive screw is rotated CW from maximum CCW.

2. *Objective Lens Centering:*
   - Turn Focaligner ON.
   - Set lamp intensity to minimum.
   - Slowly turn Focaligner reticule diffuser control to produce a diffusing focal surface upon which the output phosphor outline can be clearly seen at the edges.
   - Take and maintain a fluoro exposure. Observe the image area of output phosphor at Focaligner readout surface. Check centering. If off center, continue to Step e. Otherwise, proceed to Final Adjustment, Paragraph 3, below.
   - Loosen four 5/16” Allen head screws 1/2 turn to permit the base plate of the light distributor to slide when the lens centering setscrews are adjusted. Do not loosen more than is necessary to slide the plate or the plate may tip under unbalanced focaligner weight.
   - Loosen four centering setscrews (See Illustration 72 for the location of centering setscrews).
   - Take a fluoro exposure and adjust the centering setscrews to position the objective lens so that the output phosphor and largest framing circle of the Focaligner readout reticule are concentric (See Illustration 74).
   - Tighten the four 5/16” Allen head base plate retaining screws.
   - Verify alignment. If tightening the base plate screws shifted the image, repeat centering adjustment as necessary.
   - Tighten the four centering setscrews.

3. *Final Adjustment:*
   - Place the resolution phantom (46–162456) or resolution wedge (46–197871P4) in the center of the x–ray beam. Set the ocular to focus on output of Focaligner.
   - Turn the Focaligner lamp off.
   - Take and maintain a fluoro exposure. Then, touch the MANUAL softkey and use the console dial to adjust mA for a good fluoro image as seen through the Focaligner.
   - Use the collimator JOG softkeys to position the collimator blades into the field of view until only one half of the field is visible. Readjust mA if necessary and manually adjust the lens for optimum focus of the resolution phantom/wedge.

Note: On systems configured with a Spot–Film Device (SFD or ISFD), the jog function works at the SFD. It is not necessary to return to the jog control softkeys displayed on the console screen to position collimator blades.

   - Terminate the exposure.
   - Touch NEXT STEP softkey to proceed to Step 3.

- **Using an Image Evaluation Tool (IET)**

1. *Objective Lens Focus:*
   - Install a clear reticule lens (46–302883P1) on the IET. A tag indicating THIS SIDE OUT is secured to the glass.
   - Take a fluoro exposure and use the collimator jog softkeys to position the collimator blades into the field of view until only one–half of the field is visible.

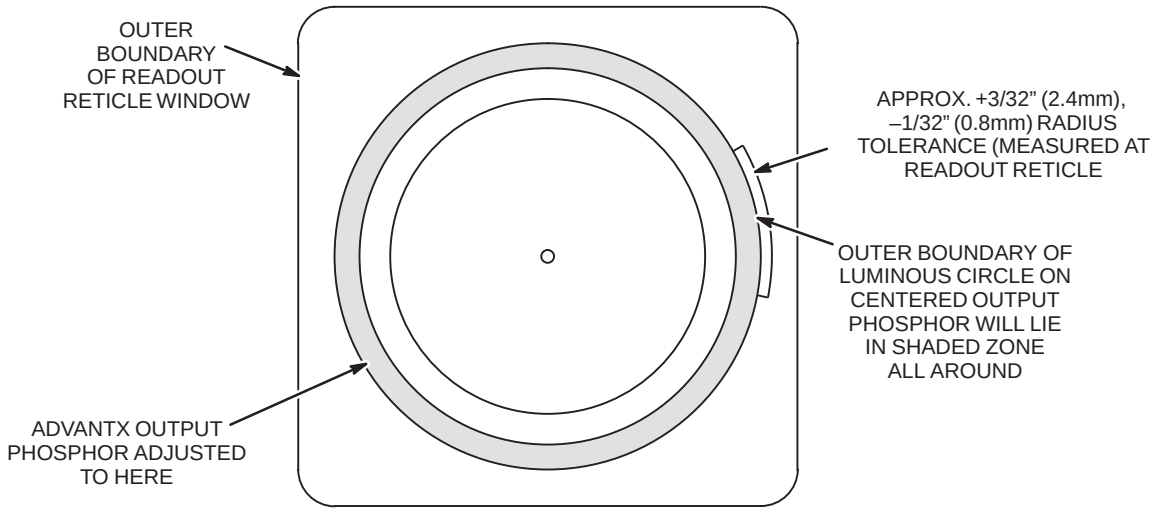
Note: On systems configured with a Spot–Film Device (SFD or ISFD), the jog function works at the SFD. It is not necessary to return to the jog control softkeys displayed on the console screen to position collimator blades.

   - Focus the 10X magnifier (46–262700P1). Do not readjust the focus as you move to a clear area of the reticule.
   - Using a 3/16″ Allen head wrench (at least 5–1/2″ long), position the objective lens all the way down by turning the lens focus drive screw maximum CCW without forcing beyond the limit stop.
   - Continue taking fluoro and turn the objective lens out (CW) until the image on the IET is at optimum focus.

Note: As many as four images may be seen at various focal settings. Only one of these is the image formed on the output phosphor (brightest and sharpest). The other images are formed when the lens is incorrectly focused on the glass surfaces that are located between the lens and output phosphor. The “true” image is the first one that appears when the lens drive screw is rotated CW from maximum CCW.

2. *Objective Lens Centering:*
   - Install the centering reticule in the IET in order to display the image.
   - Take and maintain a fluoro exposure. Observe the image area of output phosphor at the IET. Check centering. If off center continue to Step c. Otherwise, proceed to Final Adjustment, Paragraph 3, below.
   - Loosen four 5/16” Allen–head screws 1/2 turn to permit the base plate of the light distributor to slide when the lens centering setscrews are adjusted. Do not loosen more than is necessary to slide the plate or the plate may tip under unbalanced IET weight.
   - Loosen four centering setscrews, (See Illustration 72 for the location of the centering setscrews
   - Take a fluoro exposure and adjust the centering setscrews to position the objective lens so that the output phosphor and largest framing circle of the sizing reticule are concentric (See Illustration 74).
   - Tighten the four 5/16” Allen–head base plate retaining screws.
   - Verify alignment. If tightening of base plate screws shifted image, repeat centering adjustment as necessary.
   - Tighten the four centering setscrews.
3. *Final Adjustment:*
   - Place a resolution phantom (46–162456) or resolution wedge (46–197871P4) in the center of the x–ray beam.
   - Insert clear reticule lens in IET and focus the ocular.
   - Take and maintain a fluoro exposure. Then, touch the MANUAL softkey and use the console dial to adjust mA for a good fluoro image as seen through the IET.
   - Manually adjust the objective lens for optimum focus of the resolution phantom/wedge.
   - Terminate the exposure.
   - Touch NEXT STEP softkey to proceed to Step 3.

Illustration 74 – 9” and 12” II Lens Centering



4-3 Step 3. Exit the Unit

- Remove the Focaligner or Image Evaluation Tool (IET) and replace the cover plate or TV camera on the image gate port.
- Touch the NEXT UNIT or UNIT MENU softkey to exit.

5 CAL PROCEDURE 2 – LENS ADJUSTMENT ON 16 INCH (40 CM) II TUBES.

Note: When performing lens adjustment on systems with a 16” II, use an IET to make the adjustments. Do not use a Focaligner.

5-1 Step 1. Setup the Equipment for calibration

- Install Image Evaluation Tool (IET) on the right–side port (Port 2) of the Image Gate. TV Camera is on the left–side port (Port 0) on AFM and Legacy systems.
- Remove II grid.
- Touch the PORT 2 (right–side) softkey (or PORT 0, left–side, for Legacy systems). The softkey is highlighted when activated.
- Touch NEXT STEP softkey to proceed to Step 2.

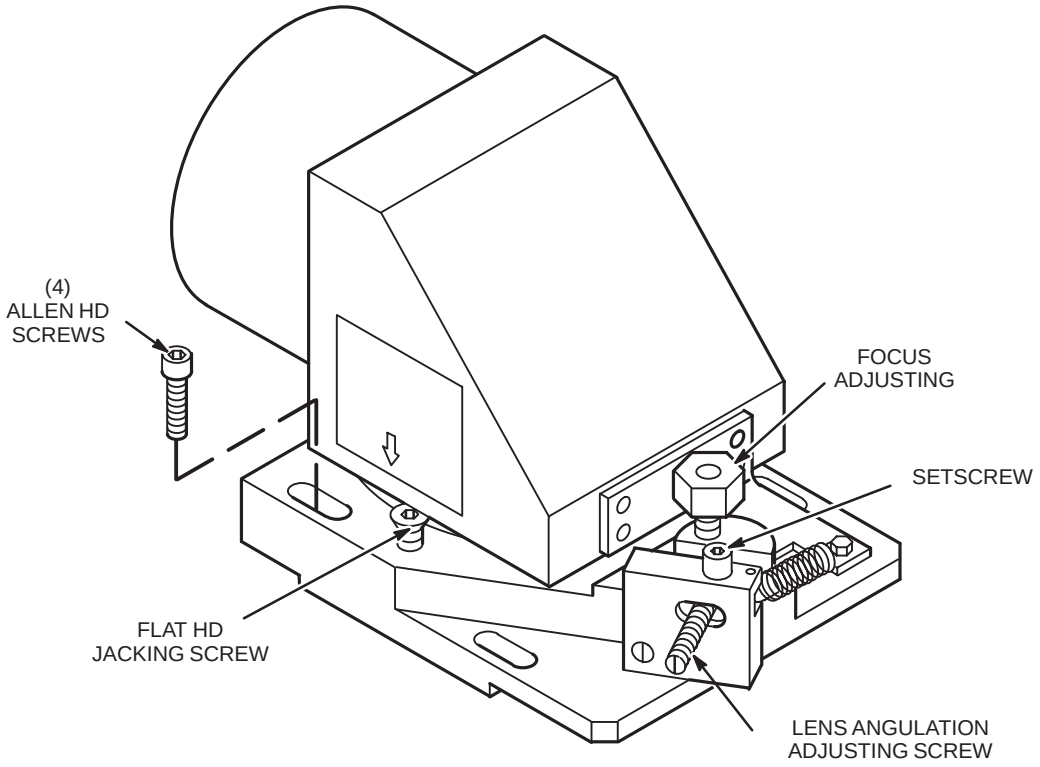
5-2 Step 2. Lens Focus and Centering (See Illustration 75.)

- **Use the Image Evaluation Tool**

  1. *Objective Lens Focusing:*
     - Check that the lens is properly seated in a flat position on top of II housing. The lens is spring loaded and is seated in position on the II by turning in a jacking screw located on each side of the lens housing. If lens is not seated, use M5 Allen head wrench and tighten jacking screws.
     - Turn focus adjusting knob fully clockwise (CW) until snug.
     - Install clear reticule lens (46–302883P1) on IET. A tag indicating “THIS SIDE OUT” is secured to the glass.
     - Use the collimator jog softkeys to position the collimator blades into the field of view until only one–half of the field is visible.
     - Install and focus a 20X magnifier. Do not readjust the focus as you move to a clear area of the reticule.
     - Take fluoro and adjust objective lens by turning lens adjusting nut until the image on the IET is in optimum focus.

2. *Objective Lens Centering:*
   - Remove clear reticule lens from IET and replace with centering reticule lens.
   - Loosen four Allen head, lens housing, mounting screws and setscrew securing lens angulation adjusting screw in place.
   - Take and maintain a fluoro exposure. Observe the image area of the output phosphor at the IET. Center lens by sliding assembly in and out and by adjusting angulation screw until the outer edges of the fluoro image are centered to one of the rings on the centering reticule.
   - Tighten setscrew to secure angulation adjusting screw in place.
   - Tighten four Allen head screws to secure lens housing in place.
   - Recheck fluoro image to ensure that image is still centered. Repeat centering adjustments if necessary.
3. *Final Adjustment:*
   - Place the resolution wedge (46–197871P4) in the center of the x–ray beam.
   - Insert the clear reticule lens in the IET and focus the ocular.
   - Take and maintain a fluoro exposure. Then, touch the MANUAL softkey and use the console dial to adjust mA for a good fluoro image as seen through the IET.
   - Manually adjust the lens for optimum focus of the resolution wedge.
   - Terminate the exposure.
   - Touch NEXT STEP softkey to proceed to Step 3.

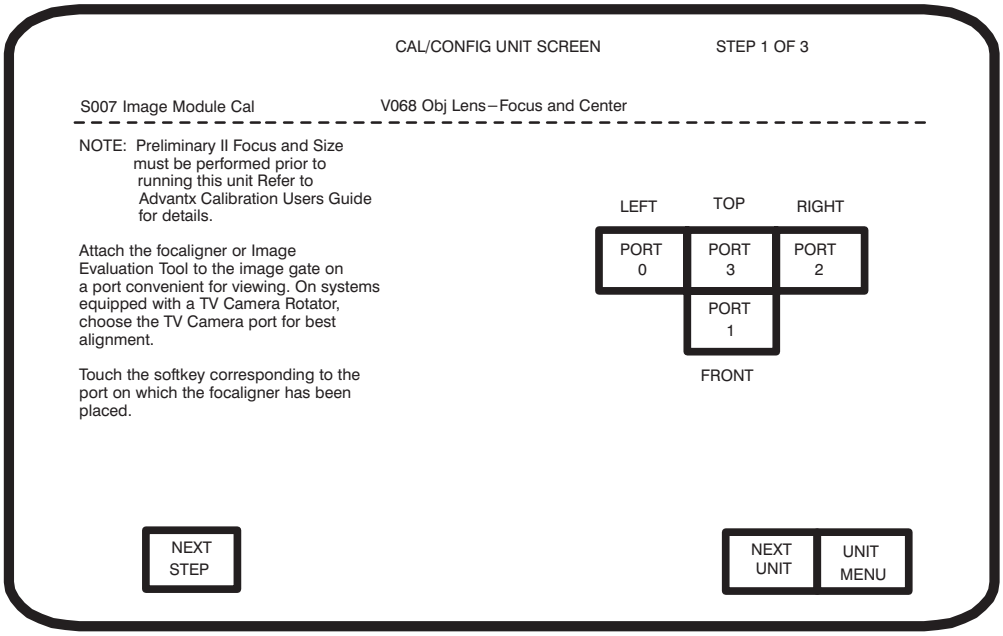
Illustration 75 – 16 inch (40 cm) II Lens Alignment



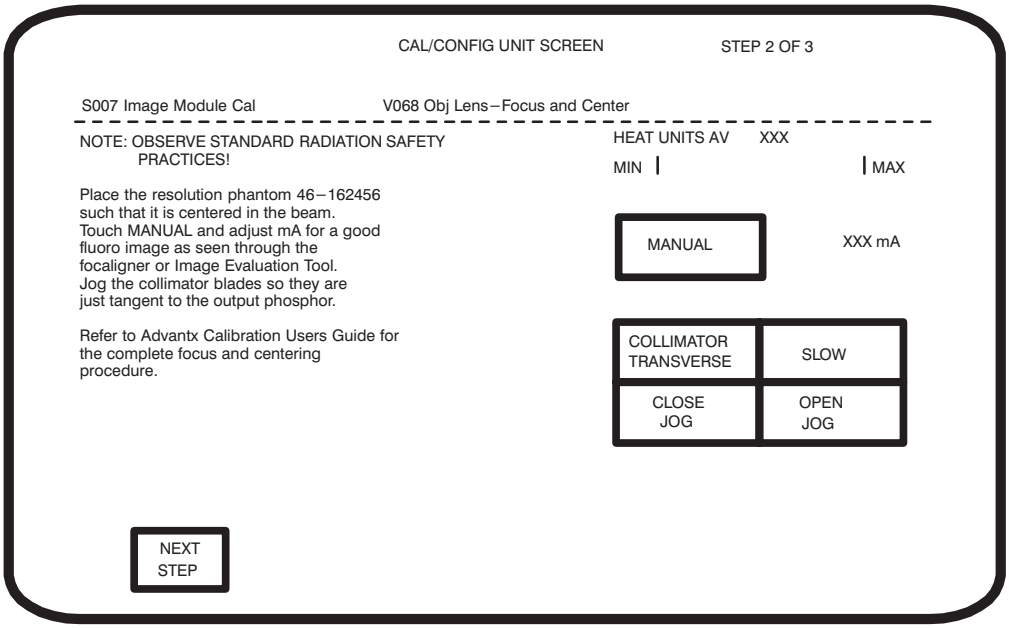
5-3 Step 3. Exit the Unit

- Remove the Image Evaluation Tool (IET) and replace the right–side cover plate on the image gate port.
- Touch the NEXT UNIT or UNIT MENU softkey to exit.

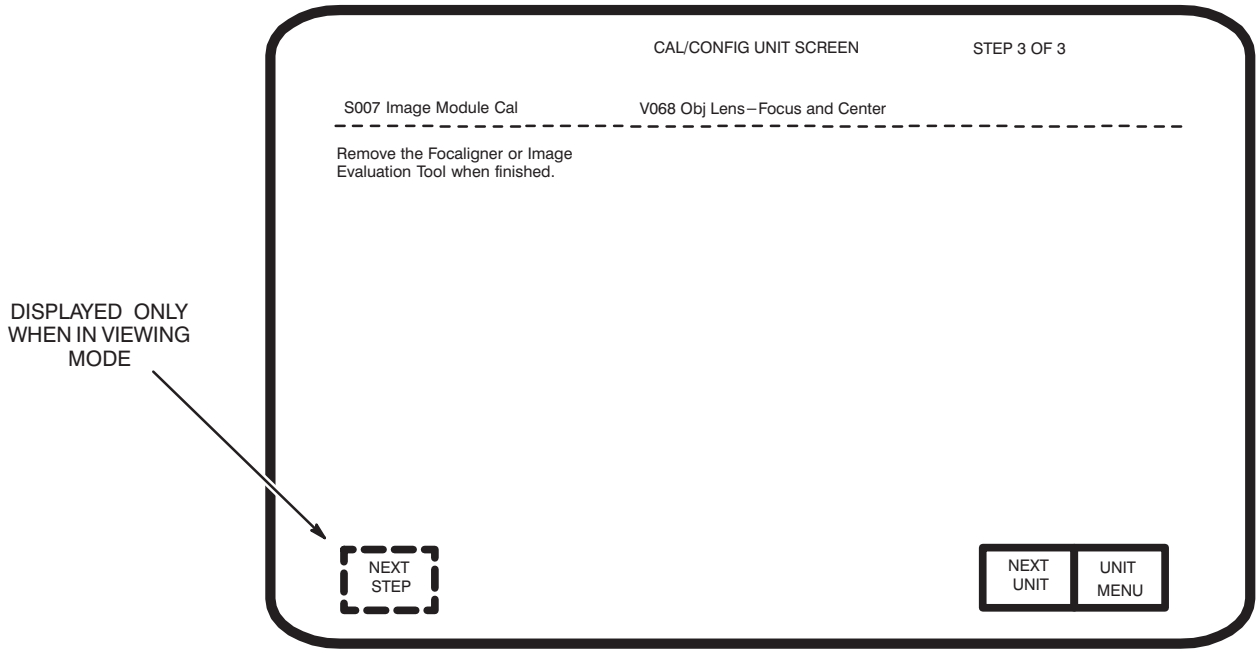
V068 STEP 1 SCREEN DISPLAY



V068 STEP 2 SCREEN DISPLAY



V068 STEP 3 SCREEN DISPLAY



UNIT V069 – DX (DLX) Gain Calibration

Time: x h xx min – Personnel: 1 field engineer

1 DESCRIPTION

Calibration Unit V069 is used to adjust the video signal gain potentiometers located on the VIC1 A15 PWB to the gain level required for proper operation of the DLX Module (DLX512, DLX1024). Two steps are required to accomplish the calibration A screen display is provided for each step. Step 1 verifies that the DLX is ready for acquisitions. Step 2 adjusts video gain. The unit provides a separate Step 2 screen display for systems configured with DLX512 and an alternate Step 2 screen display for systems configured with DLX1024. The Service Mode Smart Sequencer displays the appropriate Step 2 screen based on configuration data residing in system memory.

2 EQUIPMENT REQUIRED

Oscilloscope, coax BNC “T” connector, test leads, and a non–metallic trimpot adjusting tool.

3 CAL PROCEDURE

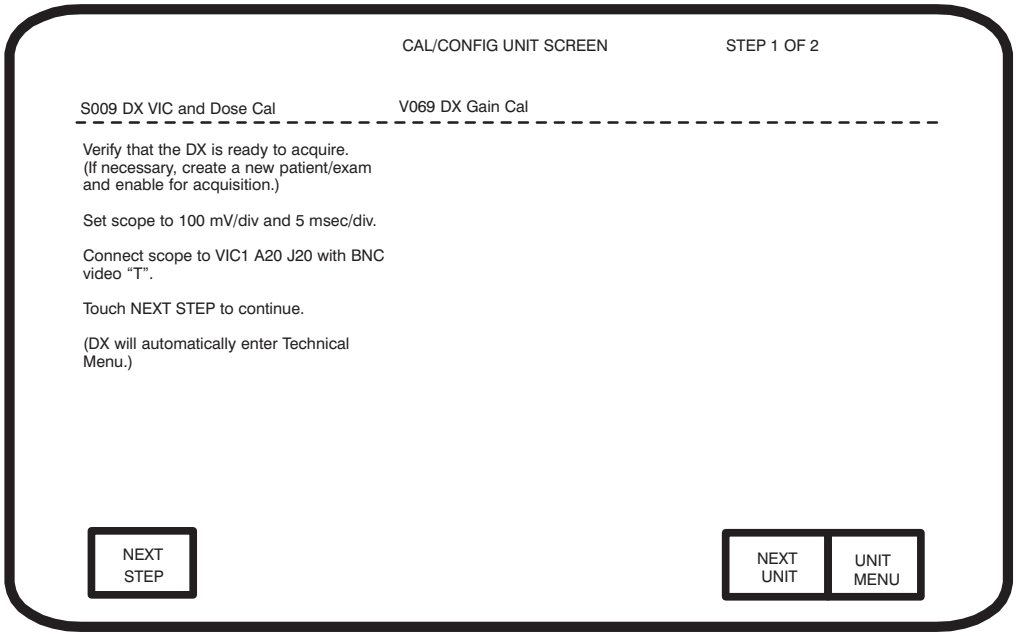
3-1 Step 1. Enter DLX Acquisition Acquire Screen

- Verify that the DLX displays ACQUISITION SCREEN. If the ACQUISITION screen is not displayed, press the following keys:

  NEW PATIENT (You must also enter a patient name and ID number or the DLX will not be enabled.)

  NEW EXAM
- Return to the system console and touch the NEXT STEP softkey to proceed to Step 2.

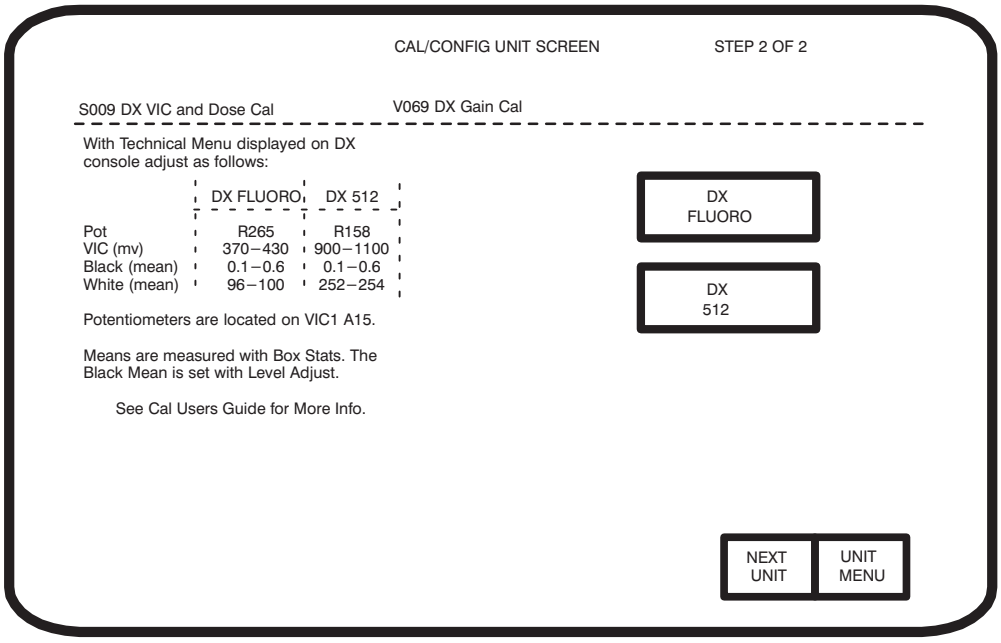
V069 STEP 1, SCREEN DISPLAY



3-2 Step 2. DLX Gain Adjustment for 512 Systems

- Upon entering Step 2, the message “PROCESSING” is displayed while the DLX is transitioning to the technical menu.
- Using a BNC “T” connector, connect oscilloscope to VIC1 A20 J20.
- Set oscilloscope controls as follows:
  Vert Ampl: 100 mV/div.
  Time Base: 5 ms/div.
- Touch the DLX FLUORO softkey.
  1. Initially adjust potentiometer VIC1 A15 R265 for a 390 mV ±20 mV video signal indication on the oscilloscope.
  2. In the DLX Technical Menu, select Box Stats under Statistics. Position the box so that it is centered in the black band on the monitor. Widen the box to approximately 10 mm, and keep the height of the box within the black band. Exit Box Stats.
  3. Select Level Adjust to On in the Technical Menu. Slowly increase Offset Increment in the Technical Menu to obtain a mean value of 0.1 to 0.6 in the black band.
  4. Reselect Box Stats and position the box in the white area. Exit Box Stats.
  5. The white mean level must be 98.00 (±2.00). If not, adjust VIC1 A15 R265 as necessary. A mean level of 1.00 = approximately 4 mV at VIC1 A20 J20.
  6. Verify that VIC1 A20 J20 is 400 mV ±30 mV.
  7. Reselect Box Stats and position the box to the center of the black band.
- Touch DLX 512 softkey.
  1. Initially adjust potentiometer VIC1 A15 R158 for a 1000 mV ±100 mV video signal indication on the oscilloscope.
  2. In the DLX Technical Menu, select Box Stats under Statistics. Position the box so that it is centered in the black band on the monitor. Widen the box to approximately 10 mm, and keep the height of the box within the black band. Exit Box Stats.
  3. Select Level Adjust to On in the Technical Menu. Slowly increase Offset Increment in the Technical Menu to obtain a mean value of 0.1 to 0.6 in the black band.
  4. Reselect Box Stats and position the box in the white area. Exit Box Stats.
  5. The white mean level must be 253.00 (±1.00). If not, adjust VIC1 A15 R158 as necessary. A mean level of 1.00 = approximately 4 mV at VIC1 A20 J20.
  6. Verify that VIC1 A20 J20 is 1000 mV ±100 mV.
  7. Reselect Box Stats and position the box to the center of the black band.
- After all adjustments have been accomplished, touch the NEXT UNIT or UNIT MENU softkey to exit.

V069 STEP 2, DX (DLX) 512 SCREEN DISPLAY

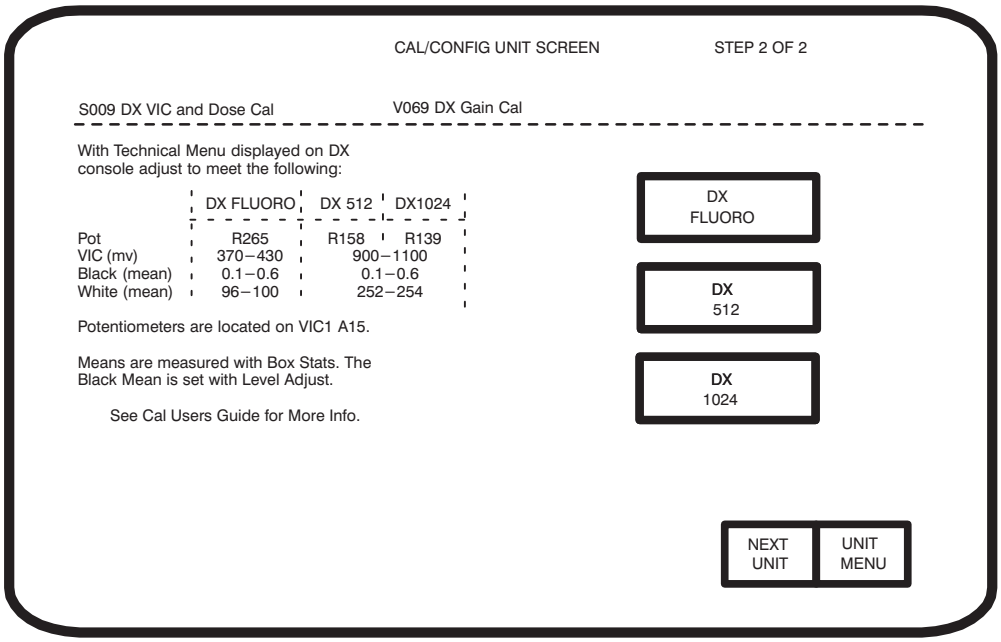


3-3 Step 2. DLX Gain Adjustment for 1024 Systems

- Upon entering Step 2, the message “PROCESSING” is displayed while the DLX is transitioning to the technical menu.
- Using a BNC “T” connector, connect oscilloscope to VIC1 A20 J20.
- Set oscilloscope controls as follows:
  Vert Ampl: 100 mV/div.
  Time Base: 5 ms/div.
- Touch the DLX FLUORO softkey.
  1. Initially adjust potentiometer VIC1 A15 R265 for a 390 mV ±20 mV video signal indication on the oscilloscope.
  2. In the DLX Technical Menu, select Box Stats under Statistics. Position the box so that it is centered in the black band on the monitor. Widen the box to approximately 10 mm, and keep the height of the box within the black band. Exit Box Stats.
  3. Select Level Adjust to On in the Technical Menu. Slowly increase Offset Increment in the Technical Menu to obtain a mean value of 0.1 to 0.6 in the black band.
  4. Reselect Box Stats and position the box in the white area. Exit Box Stats.
  5. The white mean level must be 98.00 (±2.00). If not, adjust VIC1 A15 R265 as necessary. A mean level of 1.00 = approximately 4 mV at VIC1 A20 J20.
  6. Verify that VIC1 A20 J20 is 400 mV ±30 mV.
  7. Reselect Box Stats and position the box to the center of the black band.
- Touch DLX 512 softkey.
  1. Initially adjust potentiometer VIC1 A15 R158 for a 1000 mV ±100 mV video signal indication on the oscilloscope.
  2. In the DLX Technical Menu, select Box Stats under Statistics. Position the box so that it is centered in the black band on the monitor. Widen the box to approximately 10 mm, and keep the height of the box within the black band. Exit Box Stats.
  3. Select Level Adjust to On in the Technical Menu. Slowly increase Offset Increment in the Technical Menu to obtain a mean value of 0.1 to 0.6 in the black band.
  4. Reselect Box Stats and position the box in the white area. Exit Box Stats.
  5. The white mean level must be 253.00 (±1.00). If not, adjust VIC1 A15 R158 as necessary. A mean level of 1.00 = approximately 4 mV at VIC1 A20 J20.
  6. Verify that VIC1 A20 J20 is 1000 mV ±100 mV.
  7. Reselect Box Stats and position the box to the center of the black band.

- Touch DLX 1024 softkey.
  1. Initially adjust potentiometer VIC1 A15 R139 for a 1000 mV ±100 mV video signal indication on the oscilloscope.
  2. In the DLX Technical Menu, select Box Stats under Statistics. Position the box so that it is centered in the black band on the monitor. Widen the box to approximately 10 mm, and keep the height of the box within the black band. Exit Box Stats.
  3. Select Level Adjust to On in the Technical Menu. Slowly increase Offset Increment in the Technical Menu to obtain a mean value of 0.1 to 0.6 in the black band.
  4. Reselect Box Stats and position the box in the white area. Exit Box Stats.
  5. The white mean level must be 253.00 (±1.00). If not, adjust VIC1 A15 R139 as necessary. A mean level of 1.00 = approximately 4 mV at VIC1 A20 J20.
  6. Verify that VIC1 A20 J20 is 1000 mV ±100 mV.
  7. Reselect Box Stats and position the box to the center of the black band.
- After all adjustments have been accomplished, touch the NEXT UNIT or UNIT MENU softkey to exit.

V069 STEP 2, DX (DLX) 1024 SCREEN DISPLAY



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UNIT V070 – DX (DLX) Size and Center

Time: x h xx min – Personnel: 1 field engineer

1 DESCRIPTION

Calibration Unit V070 aligns the TV Camera raster scan for proper size and centering in systems configured with DLX. The unit is automatically sequenced to provide calibration of size and centering for DLX Fluoro, DLX 512, or DLX 1024 configurations. The appropriate screens are automatically displayed based on sequence menu selection. Three Steps are required to accomplish the calibration.

2 EQUIPMENT REQUIRED

Focaligner or Image Evaluation Tool (46–232388G1), optional.

3 SPECIAL INSTRUCTIONS

Note: **For Vascular Systems Only:** Before system calibration, verify that additional filter (copper–aluminum filter) is not installed on top of collimator. (Open sensor hinge assembly to verify.) If installed, remove before performing calibration.

4 CAL PROCEDURE 1 – DLX FLUORO

4-1 Step 1. Setup the system

- Setup the system for calibration using one of the following methods, however, final adjustment must be accomplished with radiation:

4-1-1 Focaligner or Image Evaluation Tool (IET)

1. Remove the TV Camera from the Image Intensifier Assembly.
2. Attach the TV Camera to the Focaligner or IET. Do not turn on the Focaligner or IET at this time.

4-1-2 Radiation (Fluoro Exposure)

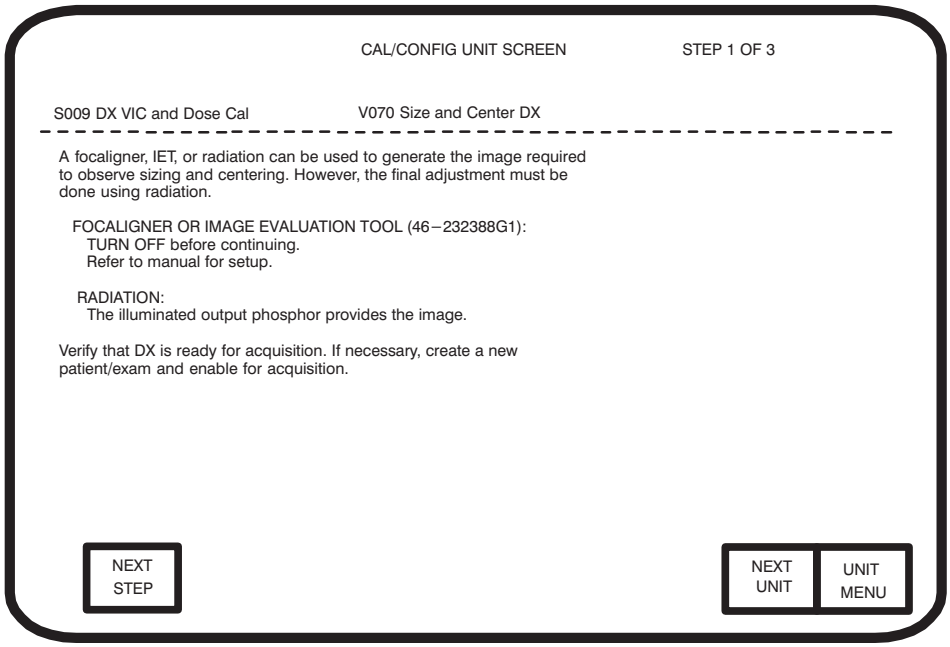
The illuminated output phosphor provides the image.

- At the “DLX LOGIN” prompt on the DLX console, type “DLX” and press the RETURN key.
- Verify that the ACQUISITION screen is displayed on the DLX console. If the ACQUISITION screen is not displayed, press the following keys to continue:

  NEW PATIENT (You must also enter a patient name and ID number or the DLX will not be enabled.)

  NEW EXAM
- Touch NEXT STEP softkey to proceed to Step 2.

V070, DX (DLX) FLUORO, STEP 1 SCREEN DISPLAY



NOTICE **Do not touch any Step 2 console softkey functions while the “PROCESSING” and “PLEASE WAIT” messages are displayed on the console screen.**

4-2 Step 2. Set Size and Center

- Continue the adjustment according to the calibration method selected in Step 1, however, use the Step 2 **radiation** method as the final adjustment

4-2-1 Image Evaluation Tool or Focaligner

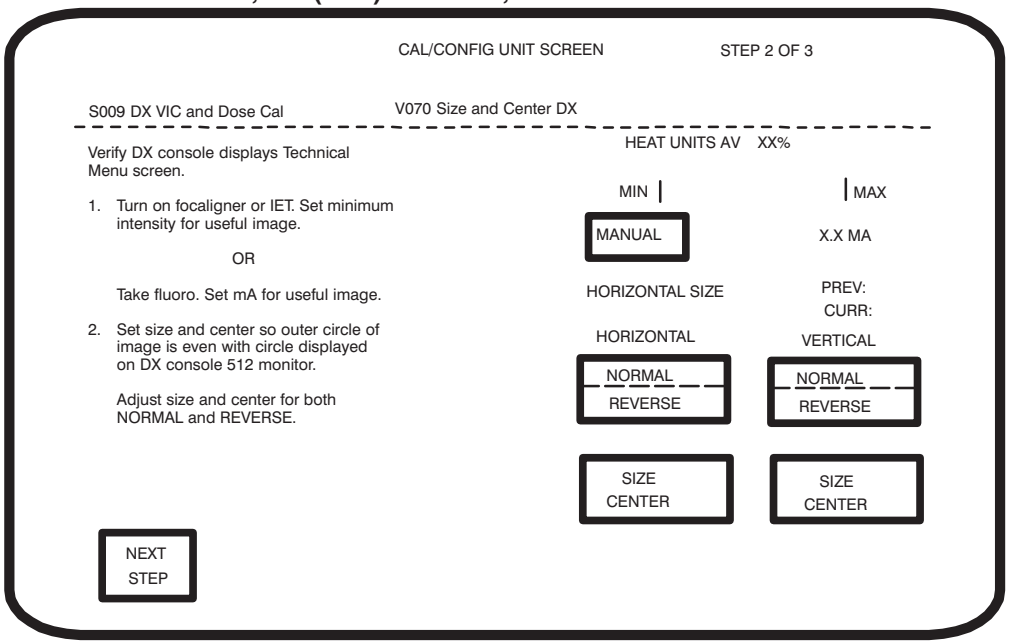
1. Turn on the Image Evaluation Tool or Focaligner.
2. Touch HORIZONTAL/NORMAL split softkey and adjust horizontal size and center using HORIZ SIZE CENTER softkey.
3. Touch VERTICAL/NORMAL softkey and adjust vertical size and center using the VERT SIZE CENTR softkey. Adjust so that the outer circle of the image is even with the circle displayed on the DLX Console monitor.
4. Repeat the adjustment using the VERTICAL/REVERSE and HORIZONTAL/REVERSE softkeys. Cycle through the adjustments once more to verify the settings.

4-2-2 Radiation

1. Take an exposure.
2. Touch the MANUAL softkey and use the console dial to adjust mA for proper monitor brightness.
3. Make the vertical and horizontal adjustments using the same procedure as described for the Image Evaluation Tool or Focaligner calibration method above.

- Touch NEXT STEP softkey and proceed to Step 3.

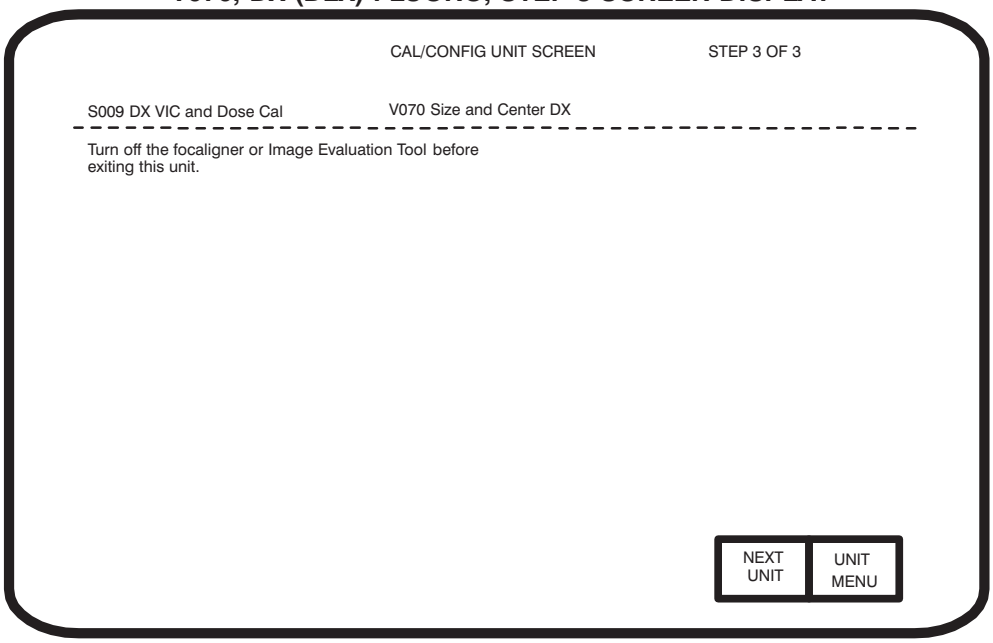
V070, DX (DLX) FLUORO, STEP 2 SCREEN DISPLAY



4-3 Step 3. Exit the Unit

- Turn off the Focaligner or Image Evaluation Tool (if that calibration method was used).
- Touch NEXT UNIT or UNIT MENU softkey to exit the calibration unit. Exiting the unit initiates loading of the calibration data into NV RAM. An “Updating NV database” message is displayed while the calibration data is loaded into the system.

V070, DX (DLX) FLUORO, STEP 3 SCREEN DISPLAY



5 CAL PROCEDURE 2 – DLX 512

5-1 Step 1. Setup the system

- Setup the system for calibration using one of the following methods, however, final adjustment must be accomplished with radiation:

5-1-1 Focaligner or Image Evaluation Tool (IET)

1. Remove the TV Camera from the Image Intensifier Assembly.
2. Attach the TV Camera to the Focaligner or IET. Do not turn on the Focaligner or IET at this time.

5-1-2 Radiation (Fluoro Exposure)

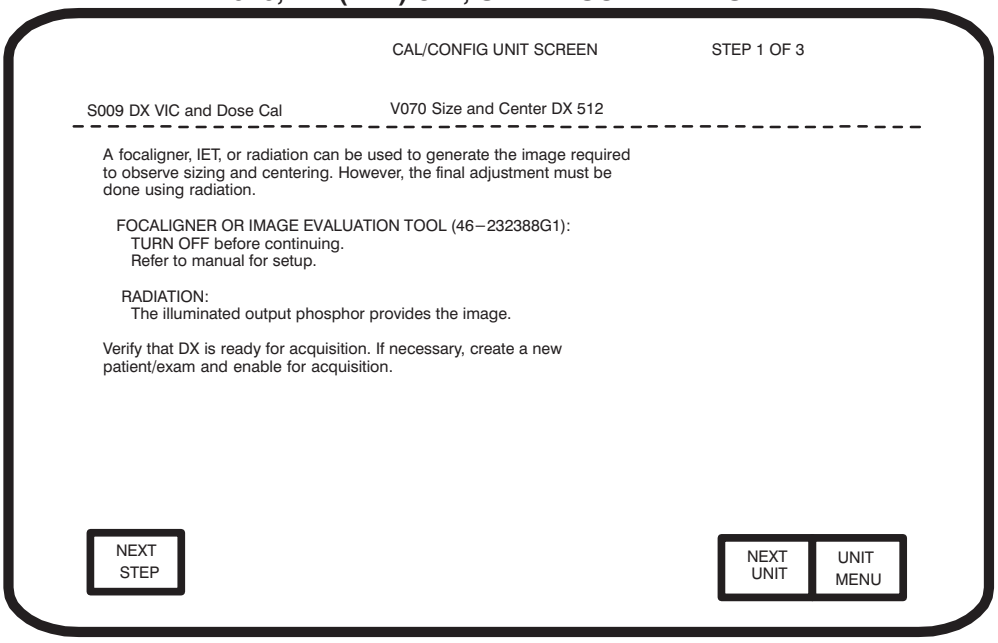
The illuminated output phosphor provides the image.

- At the “DLX LOGIN” prompt on the DLX console, type “DLX” and press the RETURN key.
- Verify that the ACQUISITION screen is displayed on the DLX console. If the ACQUISITION screen is not displayed, press the following keys to continue:

  NEW PATIENT (You must also enter a patient name and ID number or the DLX will not be enabled.)

  NEW EXAM
- Touch NEXT STEP softkey to proceed to Step 2.

V070, DX (DLX) 512, STEP 1 SCREEN DISPLAY



NOTICE **Do not touch any Step 2 console softkey functions while the “PROCESSING” and “PLEASE WAIT” messages are displayed on the console screen.**

5-2 Step 2. Set Size and Center

- Continue the adjustment according to the calibration method selected in Step 1, however, use the Step 2 **radiation** method as the final adjustment.

5-2-1 Image Evaluation Tool or Focaligner

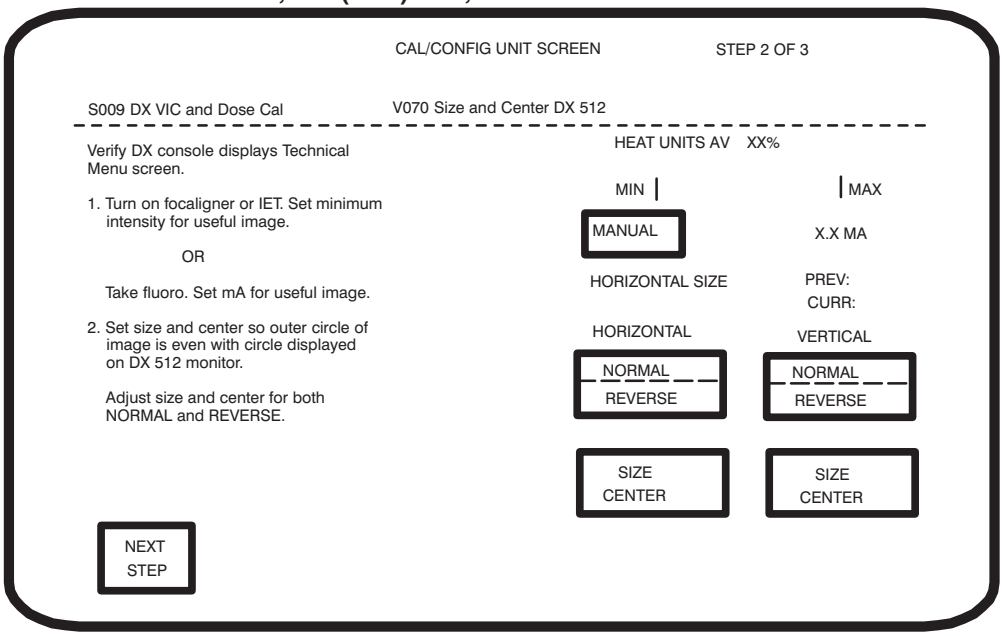
1. Turn on the Image Evaluation Tool or Focaligner.
2. Touch HORIZONTAL/NORMAL split softkey and adjust horizontal size and center using HORIZ SIZE CENTER softkey.
3. Touch VERTICAL/NORMAL softkey and adjust vertical size and center using the VERT SIZE CENTR softkey. Adjust so that the outer circle of the image is even with the circle displayed on the DLX Console monitor.
4. Repeat the adjustment using the VERTICAL/REVERSE and HORIZONTAL/REVERSE softkeys. Cycle through the adjustments once more to verify the settings.

5-2-2 Radiation

1. Take an exposure.
2. Touch the MANUAL softkey and use the console dial to adjust mA for proper monitor brightness.
3. Make the vertical and horizontal adjustments using the same procedure as described for the Image Evaluation Tool or Focaligner calibration method above.

- Touch NEXT STEP softkey and proceed to Step 3.

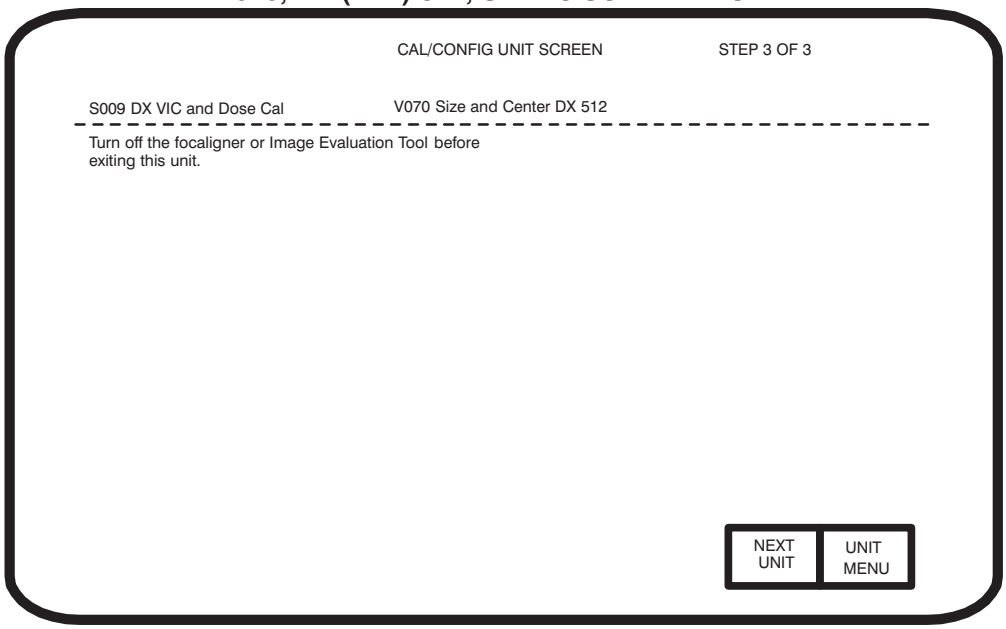
V070, DX (DLX) 512, STEP 2 SCREEN DISPLAY



5-3 Step 3. Exit the Unit

- Turn off the Focaligner or Image Evaluation Tool (if that calibration method was used).
- Touch NEXT UNIT or UNIT MENU softkey to exit the calibration unit. Exiting the unit initiates loading of the calibration data into NV RAM. An “Updating NV database” message is displayed while the calibration data is loaded into the system.

V070, DX (DLX) 512, STEP 3 SCREEN DISPLAY



6 CAL PROCEDURE 3 – DLX 1024

6-1 Step 1. Dynamic Disable Driver Current Adjustment

- Setup the system for calibration using one of the following methods, however, final adjustment must be accomplished with radiation:

6-1-1 Focaligner or Image Evaluation Tool (IET)

1. Remove the TV Camera from the Image Intensifier Assembly.
2. Attach the TV Camera to the Focaligner or IET. Do not turn on the Focaligner or IET at this time.

6-1-2 Radiation (Fluoro Exposure)

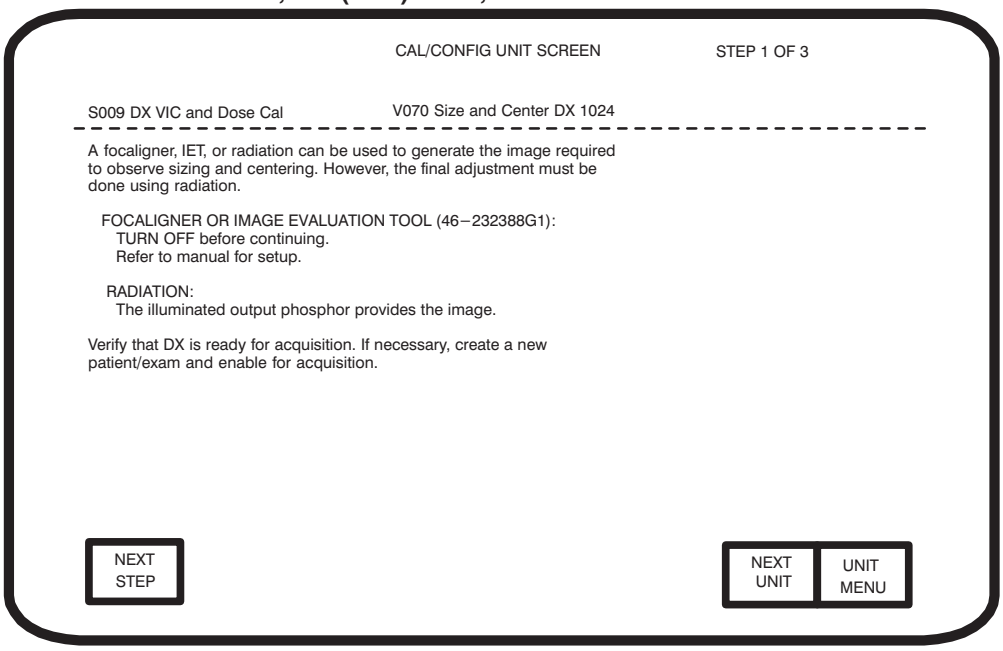
The illuminated output phosphor provides the image.

- At the “DLX LOGIN” prompt on the DLX console, type “DLX” and press the RETURN key.
- Verify that the ACQUISITION screen is displayed on the DLX console. If the ACQUISITION screen is not displayed, press the following keys to continue:

  NEW PATIENT (You must also enter a patient name and ID number or the DX will not be enabled.)

  NEW EXAM.
- Touch NEXT STEP softkey to proceed to Step 2.

V070, DX (DLX) 1024, STEP 1 SCREEN DISPLAY



NOTICE **Do not touch any Step 2 console softkey functions while the “PROCESSING” and “PLEASE WAIT” messages are displayed on the console screen.**

6-2 Step 2. Set Size and Center

- Continue the adjustment according to the calibration method selected in Step 1, however, use the Step 2 **radiation** method as the final adjustment.

6-2-1 Image Evaluation Tool or Focaligner

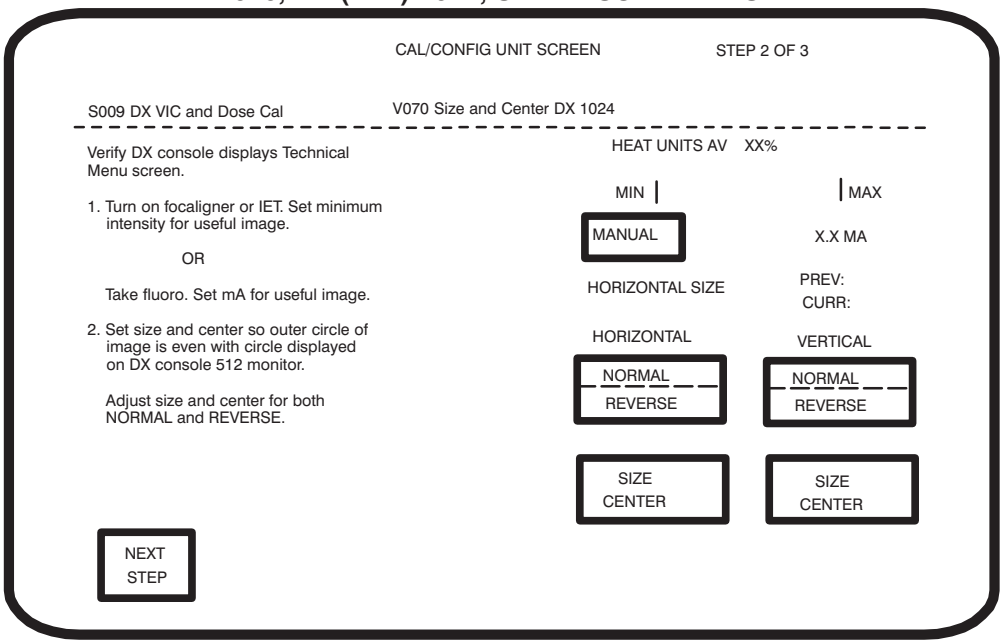
1. Turn on the Image Evaluation Tool or Focaligner.
2. Touch HORIZONTAL/NORMAL split softkey and adjust horizontal size and center using HORIZ SIZE CENTER softkey.
3. Touch VERTICAL/NORMAL softkey and adjust vertical size and center using the VERT SIZE CENTR softkey. Adjust so that the outer circle of the image is even with the circle displayed on the DLX Console monitor.
4. Repeat the adjustment using the VERTICAL/REVERSE and HORIZONTAL/REVERSE softkeys. Cycle through the adjustments once more to verify the settings.

6-2-2 Radiation

1. Take an exposure.
2. Touch the MANUAL softkey and use the console dial to adjust mA for proper monitor brightness.
3. Make the vertical and horizontal adjustments using the same procedure as described for the Image Evaluation Tool or Focaligner calibration method above.

- Touch NEXT STEP softkey and proceed to Step 3.

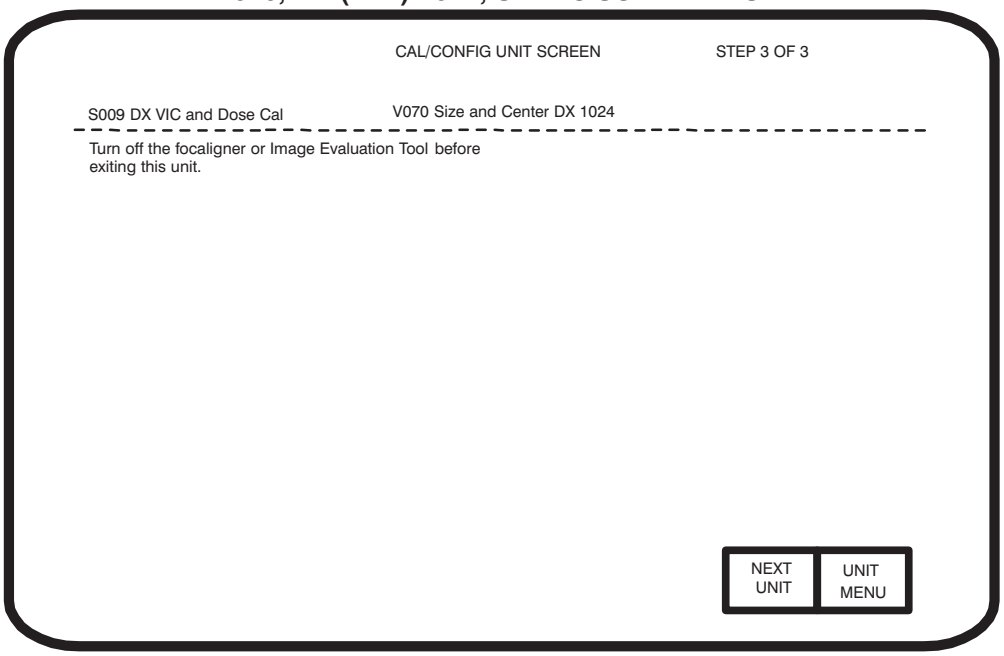
V070, DX (DLX) 1024, STEP 2 SCREEN DISPLAY



6-3 Step 3. Exit the Unit

- Turn off the Focaligner or Image Evaluation Tool (if that calibration method was used).
- Touch NEXT UNIT or UNIT MENU softkey to exit the calibration unit. Exiting the unit initiates loading of the calibration data into NV RAM. An “Updating NV database” message is displayed while the calibration data is loaded into the system.

V070, DX (DLX) 1024, STEP 3 SCREEN DISPLAY



UNIT V071 – White Clip Adjustment

Time: x h xx min – Personnel: 1 field engineer

1 DESCRIPTION

Calibration Unit V071 is used to set the white clip level circuit to a recommended operating level. The specific level at which the circuit is set is dependent on whether the VIC EDR function is configured ON or OFF. The adjustment uses the video signal output to the in–room monitor as an oscilloscope test point for observing and setting the white clip level to the appropriate value.

Note: If the White Clip cannot be adjusted, verify that the Video Cal Generator on the VIC1 A1 A11, TV Sync and Timing PWB, is producing the proper output.

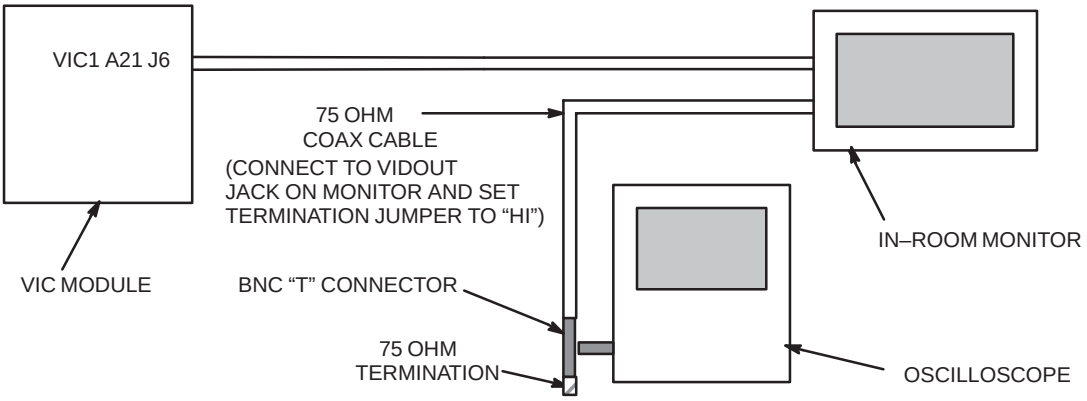
2 EQUIPMENT REQUIRED

Oscilloscope, BNC “T” connector, 75 ohm termination, test leads, and non–metallic trimpot adjusting tool.

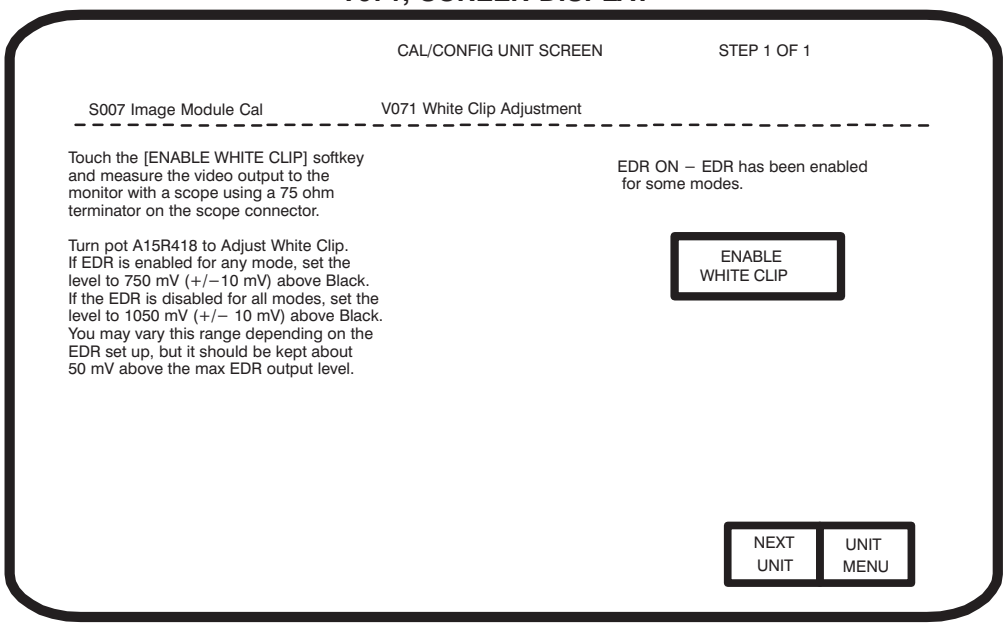
3 TEST SETUP

Connect an oscilloscope to Video Processor Output (VIC1 A21 J6) using a 75 ohm termination A suggested test setup is shown in Illustration 76.

Illustration 76 – V071 Test Setup



V071, SCREEN DISPLAY



4 CAL PROCEDURE

Set the white clip level as follows:

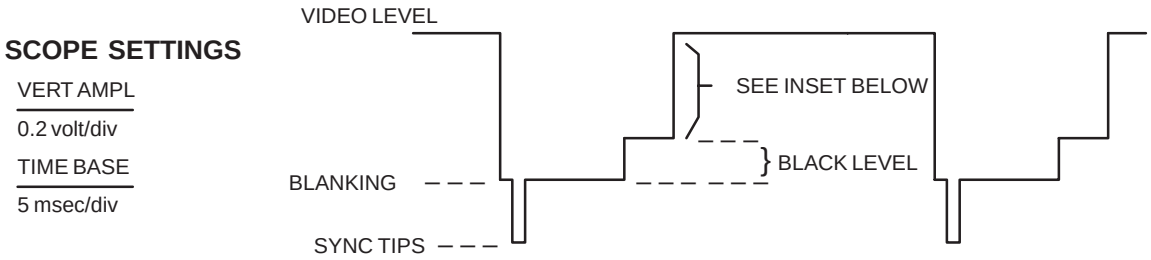
- Touch the ENABLE WHITE CLIP softkey.

NOTICE

For better imaging when EDR is enabled for any mode, set the White Clip for 750 mV +50/–0 mV. This keeps the White Clip at the high end.

- If EDR is enabled for any mode, adjust White Clip potentiometer (VIC1 A15 R418) for a 750 mV, ± 10 mV, video signal level above the black level indicated on the oscilloscope. See Illustration 77. A CCW rotation of R418 will set the clip point to a lower level.
- If EDR is disabled for all modes, adjust White Clip potentiometer (VIC1 A15 R418) for a 1050 mV, ± 10 mV, video signal level above the black level indicated on the oscilloscope. See Illustration 77.

Illustration 77 – V071 White Clip Adjustment



A15R418 ADJUSTMENT	
WITH EDR ENABLED	750 mV, ± 10 mV ABOVE BLACK LEVEL
WITH EDR DISABLED	1050 mV, ± 10 mV ABOVE BLACK LEVEL

NOTICE

Disregard the instructions given in the last paragraph on the unit screen display regarding the adjustment of VIC1 A14 R825 on VIC systems configured with an EDR–2 board. This adjustment is unnecessary when performing V071. The adjustment of VIC1 A14 R825 is accomplished in Cal Unit V056.

- Touch NEXT UNIT or UNIT MENU softkey to exit.

Blank page.

UNIT V072 – Beam Alignment

Time: x h xx min – Personnel: 1 field engineer

1 V072, BEAM ALIGNMENT, NEW PROCEDURE

Note: The New Procedure is used for Legacy Phase 3 R&F systems, for ALL biplane systems, and for NEWER software (i.e., ASC SW beginning with G4.XX) single plane LCA/LCV+/LC+ systems.

(For Tilt–C Vascular systems and older software single plane LCA/LCV+/LC+ systems, go to Old Procedure in Section 2.)

1-1 Description

Calibration Unit V072 is used to adjust the horizontal and vertical alignment coils of the TV camera pick–up tube to provide a fine tuning of the electron beam. The unit is subdivided into two calibration procedures. Calibration Procedure 1 applies to fluoro for all systems. Calibration Procedure 2 applies to systems configured with DLX and a 1024 line rate. Three steps are required to accomplish each calibration procedure. A screen display is provided for each step. The appropriate calibration procedure/screen presentation will be automatically displayed on the console based on sequence/unit menu selection.

1-2 Equipment Required

1/4” aluminum from CV phantom kit.

1-3 Special Instructions

Note: **For Vascular Systems Only:** Before system calibration, verify that additional filter (copper–aluminum filter) is not installed on top of collimator. (Open sensor hinge assembly to verify.) If installed, remove before performing calibration.

1-4 Cal Procedure 1 – Beam Alignment, Fluoro

1-4-1 Step 1. Setup the System

The purpose of this step is to transition the system from Viewing mode to Calibration mode.

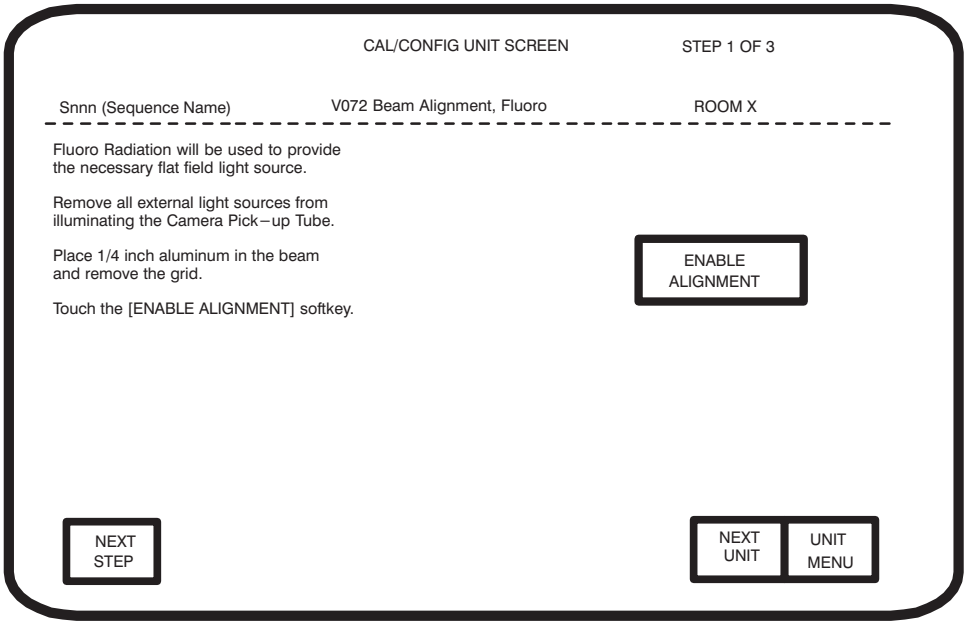
- Radiation will be used to provide the necessary flat field light source.

1-4-1-1 Radiation

The illuminated output phosphor provides the image when a fluoro exposure is made.

- Place 1/4” aluminum in the beam and remove the grid.
- Touch the ENABLE ALIGNMENT softkey.
- Touch the NEXT STEP softkey to proceed to Step 2.

V072, FLUORO, STEP 1 SCREEN DISPLAY
(LEGACY PHASE 3 R&F, BIPLANE &
NEWER SW SP LCA/LCV+/LC+ SYSTEMS)



1-4-2 Step 2. Size and Center

- The purpose of this step is to adjust the image size and center such that it is equal to circular blanking or to the DLX displayed circle. This is done in both the normal and reverse sweep mode.

1-4-2-1 Radiation

1. Take and maintain a fluoro exposure. Touch MANUAL softkey and using the console dial, adjust mA for proper monitor brightness and a useful image.
2. Adjust the vertical size and center to be even with circular blanking in the normal sweep mode. For an R&F system that is configured as dual line rate, ignore the horizontal dimension and size the horizontal to the same size vertical is set to. See Illustration 78.
3. Adjust the horizontal size and center to be even with circular blanking in the normal sweep mode. See Illustration 78.
4. Repeat the previous two steps until all sweep modes are adjusted for proper size and center.

- Touch the NEXT STEP softkey to proceed to Step 3.

V072, FLUORO, STEP 2 SCREEN DISPLAY
(LEGACY PHASE 3 R&F, BIPLANE &
NEWER SW SP LCA/LCV+/LC+ SYSTEMS)

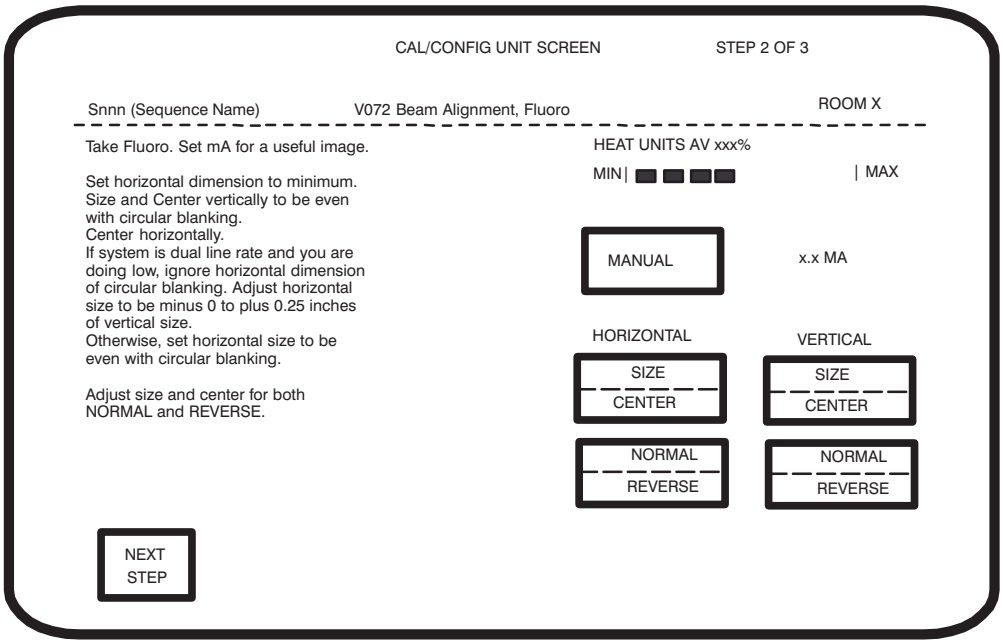
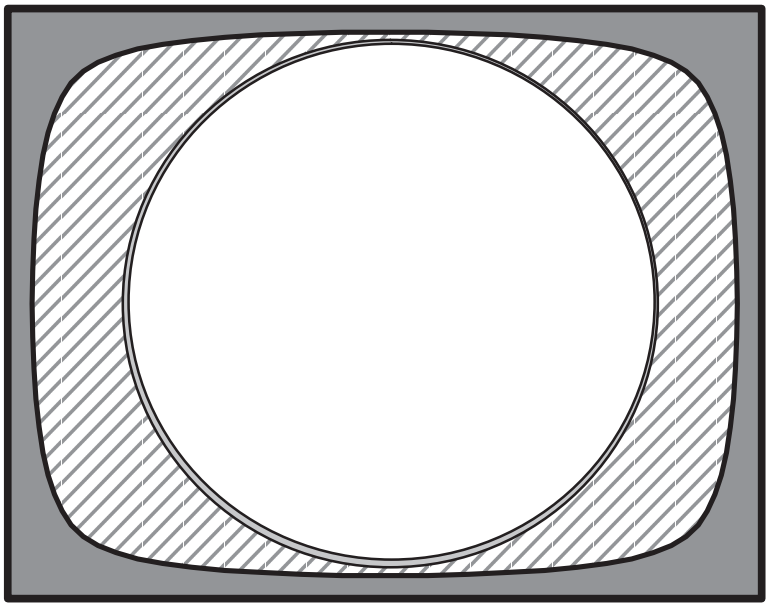


Illustration 78 – V072, Beam Alignment, Fluoro step 2 – Size and Center



ROOM MONITOR

1-4-3 Step 3. Adjust Beam Alignment Coils

- The purpose of this step is to adjust the electron beam such that the spot on the monitor does not shift as the sweep is toggled from normal to reverse.

1-4-3-1 Radiation

1. Take and maintain a fluoro exposure. Touch MANUAL softkey and using the console dial, adjust manual mA for a useful image on the monitor (spot visible on monitor). See Illustration 79.
2. Touch the HORIZONTAL softkey and adjust the horizontal beam alignment such that the spot on the monitor does not move as the sweep is toggled between normal and reverse.
3. Touch the VERTICAL softkey and adjust the vertical beam alignment such that the spot on the monitor does not move as the sweep is toggled between normal and reverse.
4. Touch the NEXT UNIT or UNIT MENU softkey to exit. The NVRAM database is updated if not in the viewing mode.

Note: The NEXT STEP softkey is only displayed in the viewing mode to permit return to the Step 1 screen.

V072, FLUORO, STEP 3 SCREEN DISPLAY
(LEGACY PHASE 3 R&F, BIPLANE &
<u>NEWER</u> SW SP LCA/LCV+/LC+ SYSTEMS)

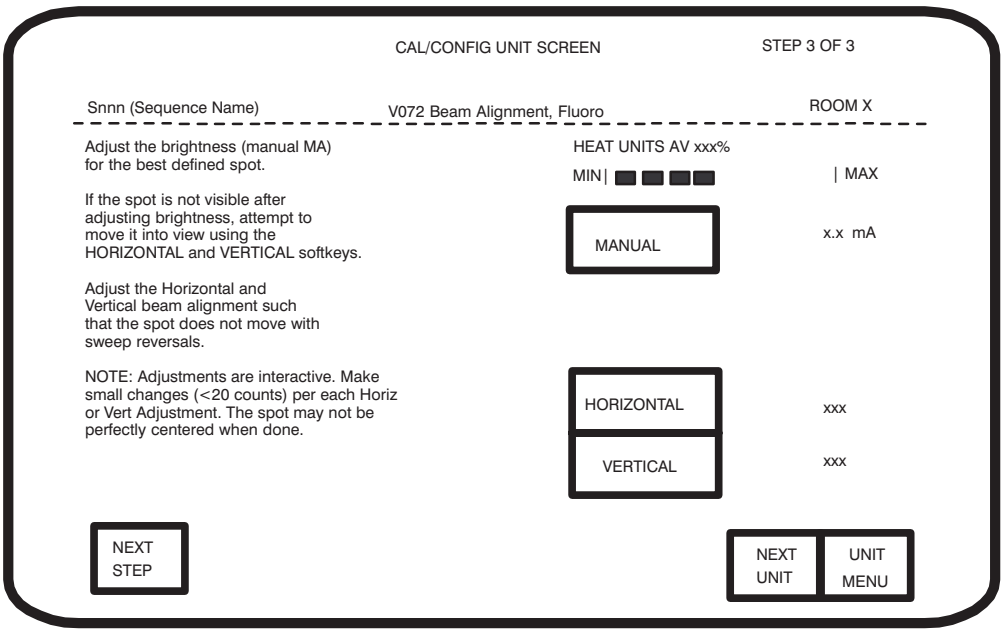
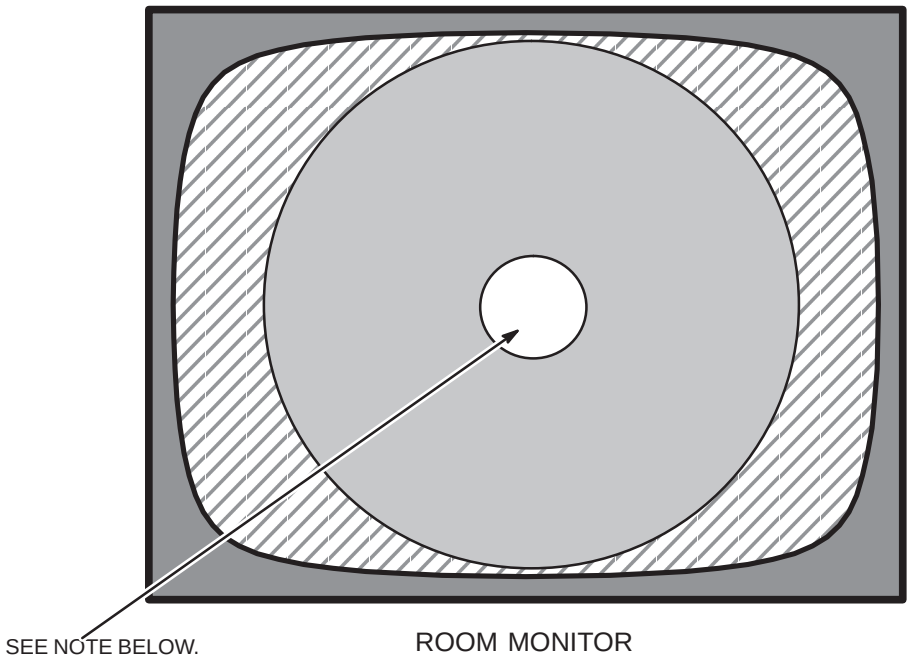


Illustration 79 – V072, Beam Alignment, Fluoro step 3 – Adjust Beam Alignment Coils



Note: The bright area observed inside the spot is produced by the residual ions in the tube. This can be viewed just as a small white area or a half white / half dark area inside the spot.

The size of the spot can be interpreted as an image of the vacuum quality of the tube. The vacuum is never perfect. As the ions are positive, they are attracted to the cathode, the more negative electrode of the tube. There are other phenomena which also add ions. During the time when voltage is not supplied (e.g. storage), the cathode releases gas which becomes ionized when re–applying voltage to the tube.

Even though some PUT's exhibit this phenomena, the tubes have passed all tests in receiving/inspection, and their performance is considered acceptable.

1-5 Cal Procedure 2 – Beam Alignment, DLX 1024

1-5-1 Step 1. Setup the System

The purpose of this step is to transition the system from Viewing mode to Calibration mode.

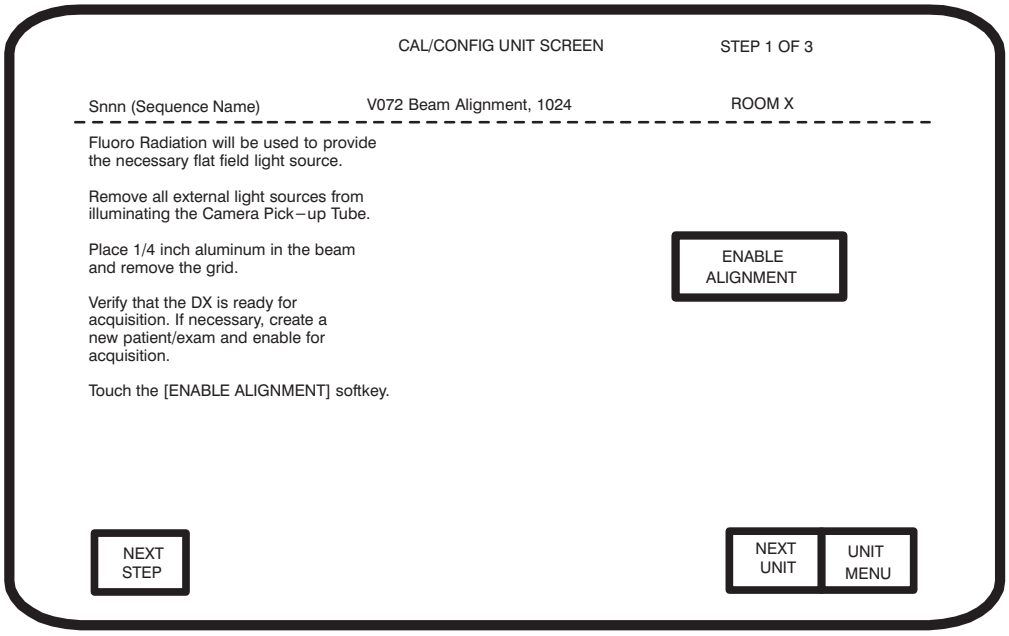
- Radiation will be used to provide the necessary flat field light source for the adjustment.

1-5-1-1 Radiation

The illuminated output phosphor provides the image when a fluoro exposure is made.

- Place 1/4 inch aluminum in the beam and remove the grid.
- Verify that DLX is ready for acquisition (acquisition screen is displayed on DLX console). If not, press the NEW PATIENT and ENABLE ACQUISITION keys on the DLX console.
- Touch the ENABLE ALIGNMENT softkey on the system console.
- Touch the NEXT STEP softkey to proceed to Step 2.

V072, DX (DLX) 1024, STEP 1 SCREEN DISPLAY
(BIPLANE & NEWER SW SP LCA/LCV+/LC+ SYSTEMS)



1-5-2 Step 2. Size and Center

- The purpose of this step is to adjust the image size and center such that it is equal to circular blanking or to the DLX displayed circle. This is done in both the normal and reverse sweep mode.

1-5-2-1 Radiation

1. Take and maintain a fluoro exposure. Touch MANUAL softkey and using the console dial, adjust mA for proper brightness and a useful image on the DLX monitor.
2. Adjust the vertical size and center to be even with the displayed circle for the DLX 1024 mode. See Illustration 80.
3. Adjust the horizontal size and center to be even with circular blanking in the normal sweep mode (or the displayed circle for the DLX 1024 mode). See Illustration 80.
4. Repeat the previous two steps until all sweep modes are adjusted for proper size and center.

- Touch the NEXT STEP softkey to proceed to Step 3.

V072, DX (DLX) 1024, STEP 2 SCREEN DISPLAY
(BIPLANE & NEWER SW SP LCA/LCV+/LC+ SYSTEMS)

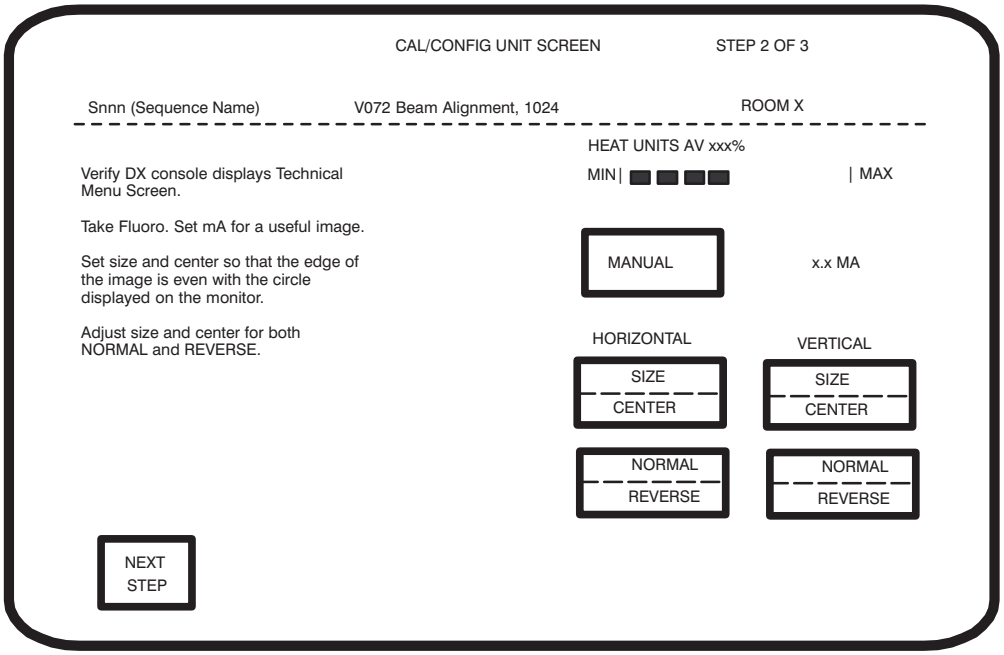
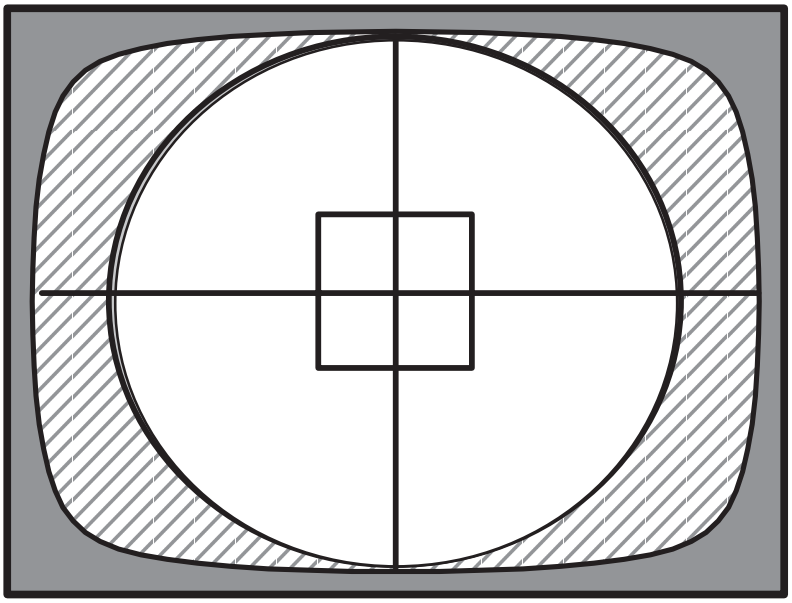


Illustration 80 – V072, Beam Alignment, DLX 1024 step 2 – Size and Center



MONITOR ON DLX CONSOLE

1-5-3 Step 3. Adjust Beam Alignment Coils

- The purpose of this step is to adjust the electron beam such that the spot on the monitor does not shift as the sweep is toggled from normal to reverse.

1-5-3-1 Radiation

1. Take and maintain a fluoro exposure. Touch MANUAL softkey and using the console dial, adjust manual mA for a useful image on the monitor (spot visible on monitor). See Illustration 81.
2. Touch the HORIZONTAL softkey and adjust the horizontal beam alignment such that the spot on the monitor does not move as the sweep is toggled between normal and reverse.
3. Touch the VERTICAL softkey and adjust the vertical beam alignment such that the spot on the monitor does not move as the sweep is toggled between normal and reverse.
4. Touch the NEXT UNIT or UNIT MENU softkey to exit. The NVRAM database is updated if not in the viewing mode.

Note: The NEXT STEP softkey is only displayed in the viewing mode to permit return to the Step 1 screen.

V072, DX (DLX) 1024, STEP 3 SCREEN DISPLAY
(BIPLANE & <u>NEWER</u> SW SP LCA/LCV+/LC+ SYSTEMS)

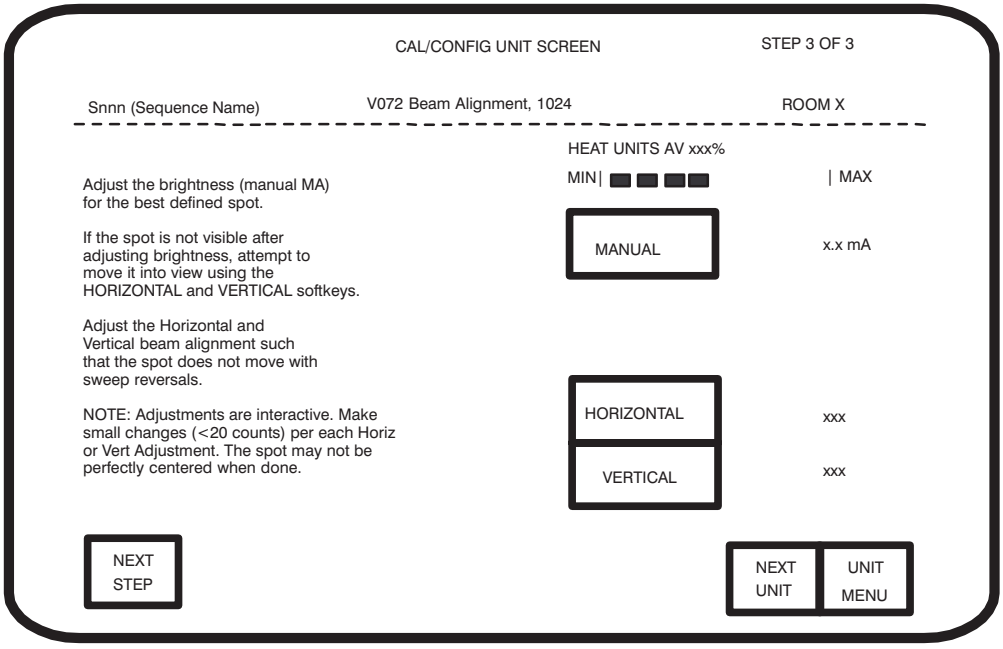
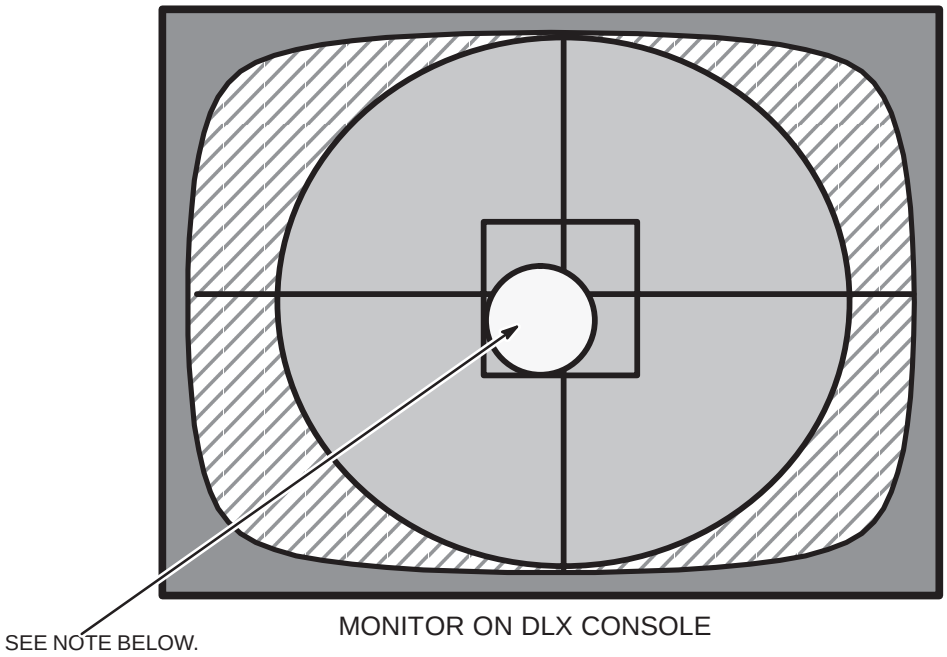


Illustration 81 – V072, Beam Alignment, DLX 1024 step 3 – Adjust Beam Alignment Coils



Note: The bright area observed inside the spot is produced by the residual ions in the tube. This can be viewed just as a small white area or a half white / half dark area inside the spot.

The size of the spot can be interpreted as an image of the vacuum quality of the tube. The vacuum is never perfect. As the ions are positive, they are attracted to the cathode, the more negative electrode of the tube. There are other phenomena which also add ions. During the time when voltage is not supplied (e.g. storage), the cathode releases gas which becomes ionized when re–applying voltage to the tube.

Even though some PUT's exhibit this phenomena, the tubes have passed all tests in receiving/inspection, and their performance is considered acceptable.

2 V072, BEAM ALIGNMENT, OLD PROCEDURE

Note: The Old Procedure is used for all Tilt–C Vascular systems and for OLDER software (i.e., ASC SW prior to G4.XX) single plane LCA/LCV+/LC+ systems.

(For Legacy Phase 3 R&F systems, biplane systems, and newer software single plane LCA/LCV+/LC+ systems, go to New Procedure in Section 1.)

2-1 Description

Calibration Unit V072 is used to adjust the horizontal and vertical alignment coils of the TV camera pick–up tube to provide a fine tuning of the electron beam in systems configured with DLX. The unit is subdivided into two calibration procedures. Calibration Procedure 1 applies to fluoro for all DLX systems. Calibration Procedure 2 applies to systems configured with DLX and a 1024 line rate. Three steps are required to accomplish each calibration procedure. A screen display is provided for each step. The appropriate calibration procedure/screen presentation will be automatically displayed on the console based on sequence/unit menu selection.

2-2 Equipment Required

Oscilloscope, BNC “T” connector, Image Evaluation Tool (optional), dark cloth cover, and test leads.

2-3 Special Instructions

Note: **For Vascular Systems Only:** Before system calibration, verify that additional filter (copper–aluminum filter) is not installed on top of collimator. (Open sensor hinge assembly to verify.) If installed, remove before performing calibration.

2-4 Cal Procedure 1 – Beam Alignment, Fluoro

2-4-1 Step 1. Setup the System

- An Image Evaluation Tool or radiation may be used to provide the necessary flat field light source.

2-4-1-1 Image Evaluation Tool

Attach the camera to the IET and cover the assembly with a dark cloth. Do not turn on IET at this time.

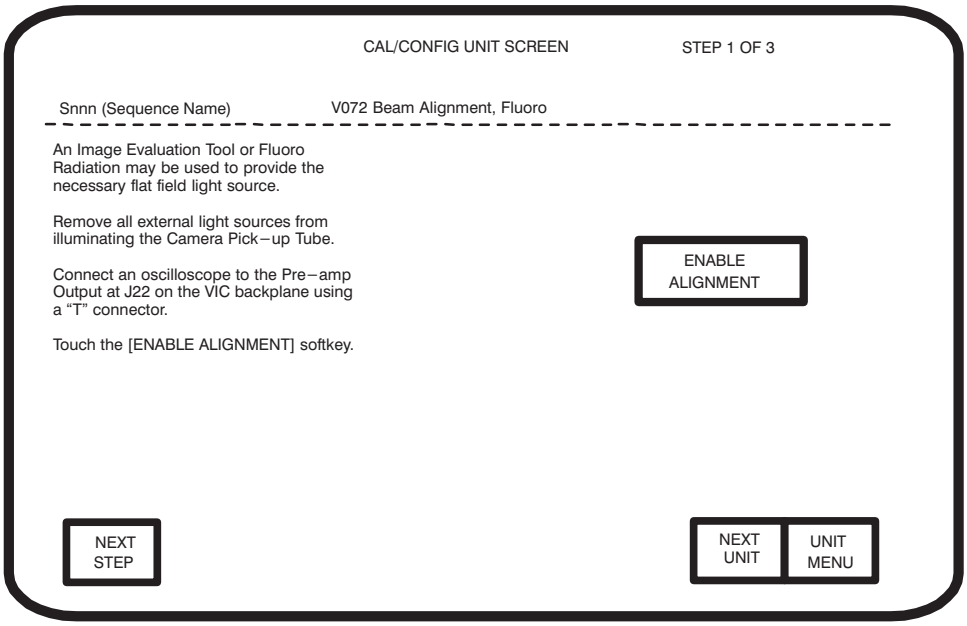
OR

2-4-1-2 Radiation

The illuminated output phosphor provides the image when a fluoro exposure is made.

- Connect an oscilloscope to the Pre–amp Output of the VIC at J22 using a BNC “T” connector. J22 is located on VIC1A20 backplane.
- Touch the ENABLE ALIGNMENT softkey.
- Touch the NEXT STEP softkey to proceed to Step 2.

V072, FLUORO, STEP 1 SCREEN DISPLAY
(TILT–C VASCULAR & OLDER SW SP LCA/LCV+/LC+)



2-4-2 Step 2. Size and Center

- Continue the alignment using the calibration method selected in Step 1.

2-4-2-1 Image Evaluation Tool

1. Turn on the IET and set the intensity for proper monitor brightness and a well defined image.
2. Use the HORIZONTAL and VERTICAL [SIZE /CENTER] softkeys and console dial to size and center the image on the monitor screen. See Illustration 82.

2-4-2-2 Radiation

1. If fluoro radiation is the method being used to view the image, place 1/4 inch of aluminum in the beam and remove the grid.
2. Take and maintain a fluoro exposure. Touch MANUAL softkey and using the console dial, adjust mA for proper monitor brightness and a well defined image.
3. Use the HORIZONTAL and VERTICAL [SIZE /CENTER] softkeys and console dial to size and center the image on the monitor screen. Ensure that the entire image is centered within the circle by at least 1 cm. See Illustration 82.

- Touch the NEXT STEP softkey to proceed to Step 3.

V072, FLUORO, STEP 2 SCREEN DISPLAY
(TILT–C VASCULAR & <u>OLDER</u> SW SP LCA/LCV+/LC+)

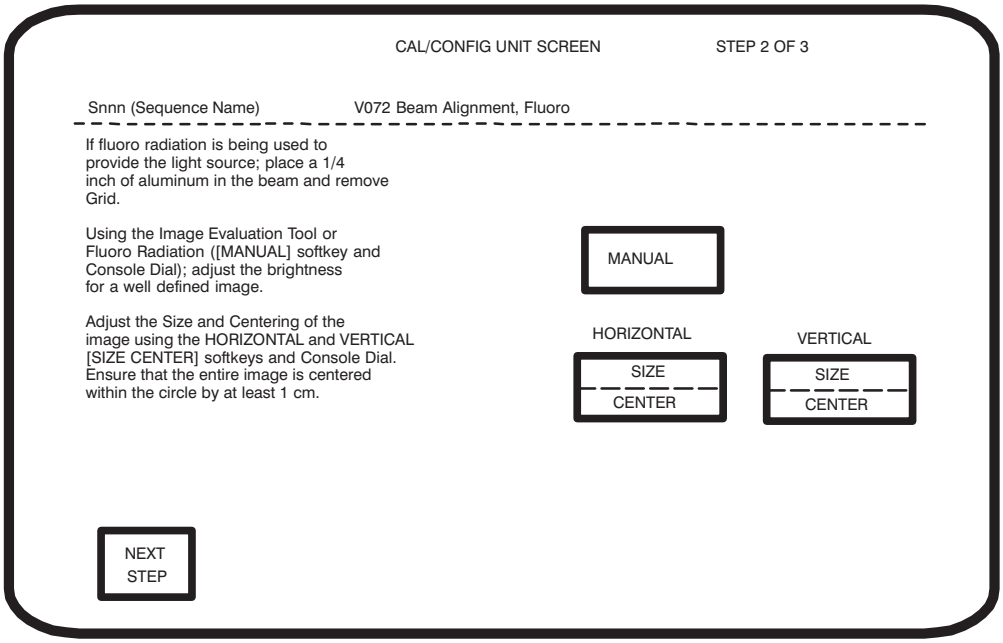
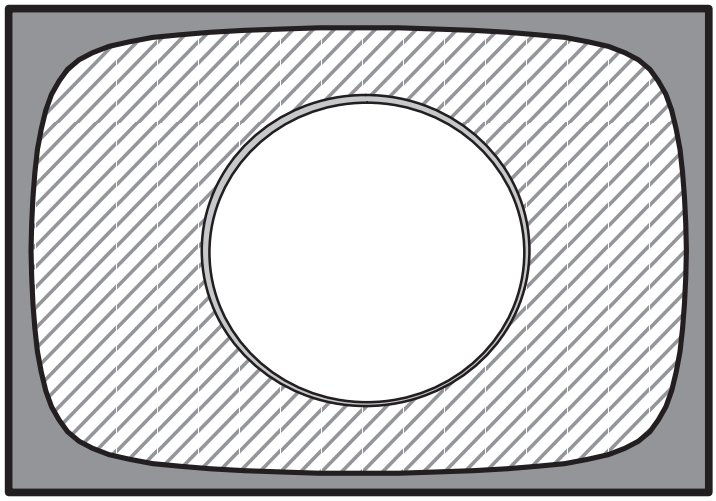


Illustration 82 – V072, Beam Alignment, Fluoro



ROOM MONITOR

2-4-3 Step 3. Adjust Beam Alignment Coils

- Touch the REDUCED TARGET VOLTAGE softkey and using the console dial slowly set the target voltage to the value indicated in Table 31 for the pickup tube type installed (The default value for target voltage is 15 volts).

Table 31 – Target Voltage

PICKUP TUBE TYPE	MODEL NO	REDUCED TARGET VOLTAGE
Saticon A	TH9951, XQ1560	15 Volts
Saticon B	TH9957, XQ1565/XQ1570	15 Volts
Saticon C	XQ1585	15 Volts
Czicon	XQ1440X	15 Volts
Plumbicon	XQ2182/03X	15 Volts
Vidicon	XQ1240	15 Volts

- Continue the alignment using the calibration method selected in Step 1.

2-4-3-1 Image Evaluation Tool

1. Adjust IET brightness for the greatest amount of shading within the circular image. Shading is faint. In case of a dim or no image, it may be necessary to increase the REDUCED TARGET VOLTAGE. If no shading is visible after adjusting the brightness use the HORIZONTAL and VERTICAL softkeys in conjunction with the console dial to move the shading into view.
2. Use the HORIZONTAL and VERTICAL softkeys and console dial to center the shaded area on the circular image.

2-4-3-2 Radiation

1. Take and maintain a fluoro exposure. Touch MANUAL softkey and using the console dial, adjust brightness for the greatest amount of shading within the circular image. Shading is faint. In case of a dim or no image, it may be necessary to increase the REDUCED TARGET VOLTAGE.
2. If no shading is visible after adjusting the brightness, use the HORIZONTAL and VERTICAL softkeys in conjunction with the console dial to move the shading into view.
3. Use the HORIZONTAL and VERTICAL softkeys and console dial to center the shaded area on the circular image.

- Set oscilloscope controls as indicated below:

  Vert Ampl: 50 mV/div
  Time Base: 10 usec/div (When observing Horizontal)
  5 msec/div (When observing Vertical)

- Perform a fine adjustment of the horizontal and vertical alignment coils using radiation and the oscilloscope.
  1. Take and maintain a fluoro exposure.
  2. Touch the HORIZONTAL softkey and while observing the oscilloscope use the console dial to adjust the waveform for optimum symmetry. See Illustration 83.
  3. Touch VERTICAL softkey and while observing the oscilloscope use the console dial to adjust the waveform for optimum symmetry. See Illustration 84.

Note: The adjustments are interactive. Repeat horizontal and vertical adjustments for optimum results. A vertical adjustment will effect the horizontal adjustment more than a horizontal adjustment will effect the vertical adjustment.

- If large changes were made to the PREV horizontal or vertical values (displayed on the console screen), touch the STEP BACK softkey to return to Step 2 and touch up size and centering.
- Touch the HORIZONTAL and VERTICAL softkeys to verify that the shaded area remains centered on the circular image before exiting the unit.
- Touch the NEXT UNIT or UNIT MENU softkey to exit.

Note: The NEXT STEP softkey is only displayed in the viewing mode to permit return to the Step 1 screen.

V072, FLUORO, STEP 3 SCREEN DISPLAY
(TILT–C VASCULAR & <u>OLDER</u> SW SP LCA/LCV+/LC+)

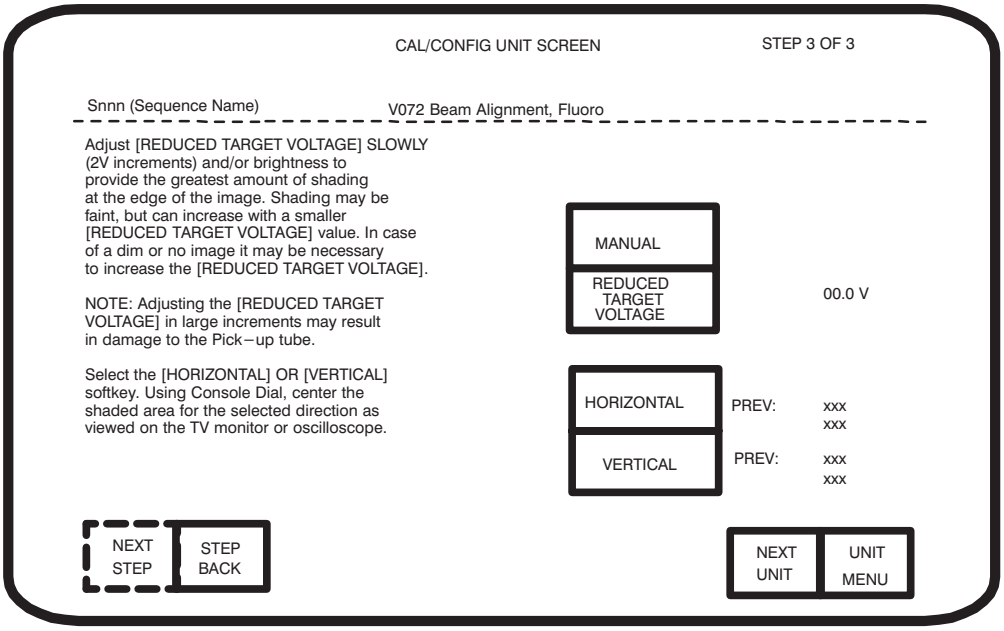


Illustration 83 – V072 Horizontal Beam Adjustment Waveform

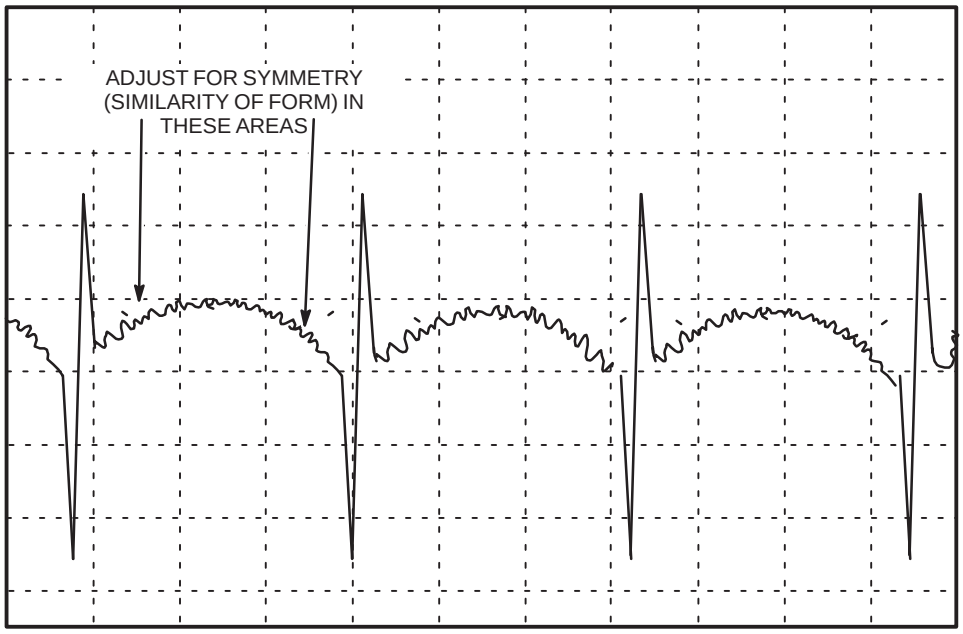
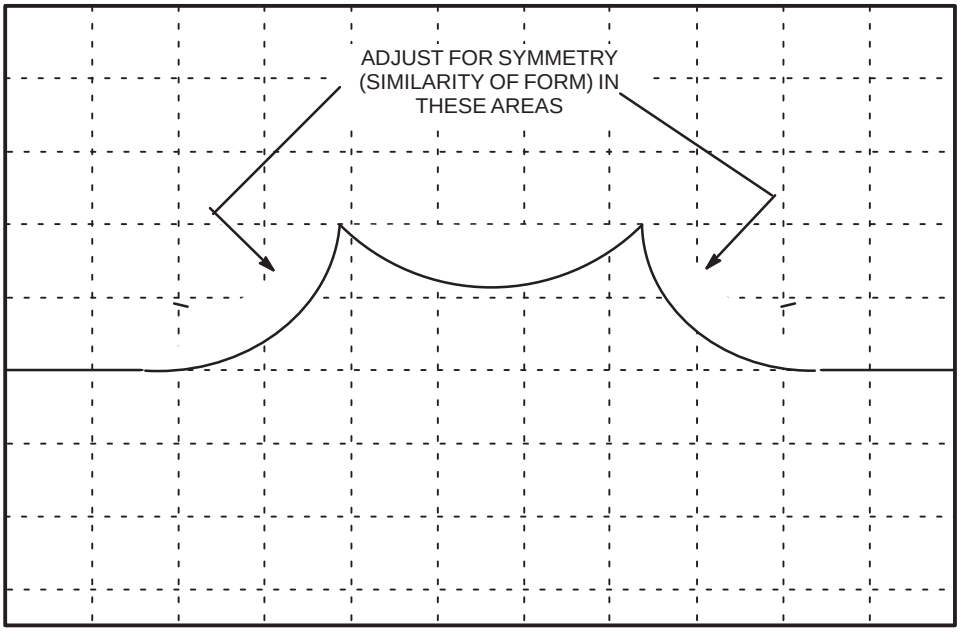


Illustration 84 – V072 Vertical Beam Adjustment Waveform



2-5 Cal Procedure 2 – Beam Alignment, DLX 1024

2-5-1 Step 1. Setup the System

- An Image Evaluation Tool or radiation may be used to provide the necessary flat field light source for the adjustment.

2-5-1-1 Image Evaluation Tool

Attach the camera to the IET and cover the assembly with a dark cloth. Do not turn on IET at this time.

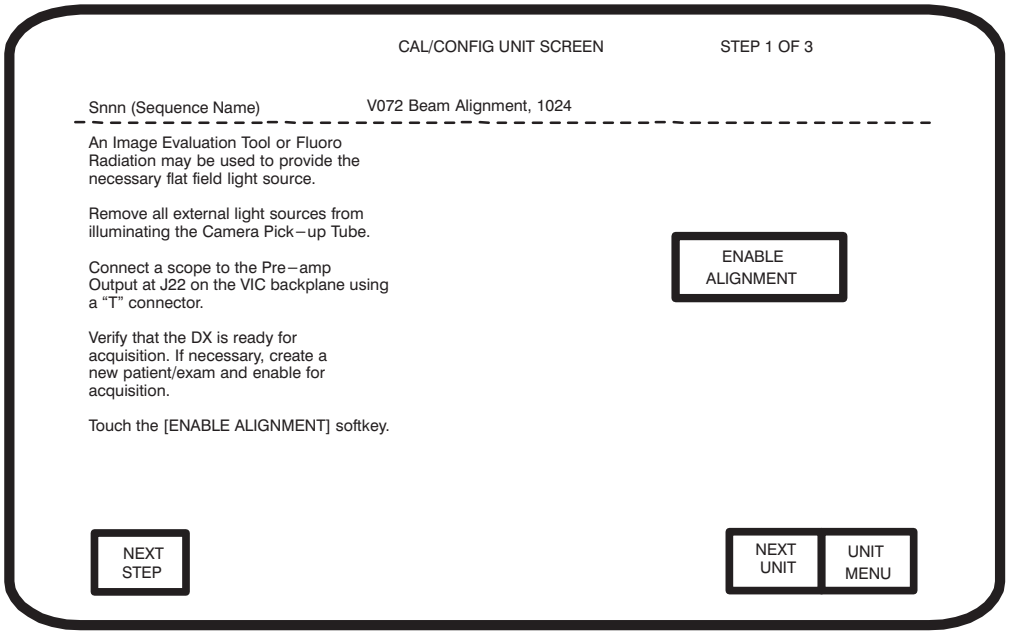
OR

2-5-1-2 Radiation

The illuminated output phosphor provides the image when a fluoro exposure is made.

- Connect an oscilloscope to the Pre–amp Output of the VIC at J22 using a BNC “T” connector. J22 is located on VIC1A20 backplane.
- Verify that DLX is ready for acquisition (acquisition screen is displayed on DLX console). If not, press the NEW PATIENT and ENABLE ACQUISITION keys on the DLX console.
- Touch the ENABLE ALIGNMENT softkey on the system console.
- Touch the NEXT STEP softkey to proceed to Step 2.

V072, DX (DLX) 1024, STEP 1 SCREEN DISPLAY
(TILT–C VASCULAR & OLDER SW SP LCA/LCV+/LC+)



2-5-2 Step 2. Size and Center

- Continue the alignment using the calibration method selected in Step 1.

2-5-2-1 Image Evaluation Tool

1. Turn on the IET and set the intensity for proper brightness and a well defined image on the DLX monitor.
2. Use the HORIZONTAL and VERTICAL [SIZE /CENTER] softkeys and console dial to size and center the image on the DLX monitor. See Illustration 85.

2-5-2-2 Radiation

1. If fluoro radiation is the method being used to view the image, place 1/4 inch of aluminum in the beam and remove the grid.
2. Take and maintain a fluoro exposure. Touch MANUAL softkey and using the console dial, adjust mA for proper brightness and a well defined image on the DLX monitor.
3. Use the HORIZONTAL and VERTICAL [SIZE /CENTER] softkeys and console dial to size and center the image on the DLX monitor screen. Ensure that the entire image is centered in the circle by at least 1 cm. See Illustration 85.

- Touch the NEXT STEP softkey to proceed to Step 3.

V072, DX (DLX) 1024, STEP 2 SCREEN DISPLAY
(TILT–C VASCULAR & <u>OLDER</u> SW SP LCA/LCV+/LC+)

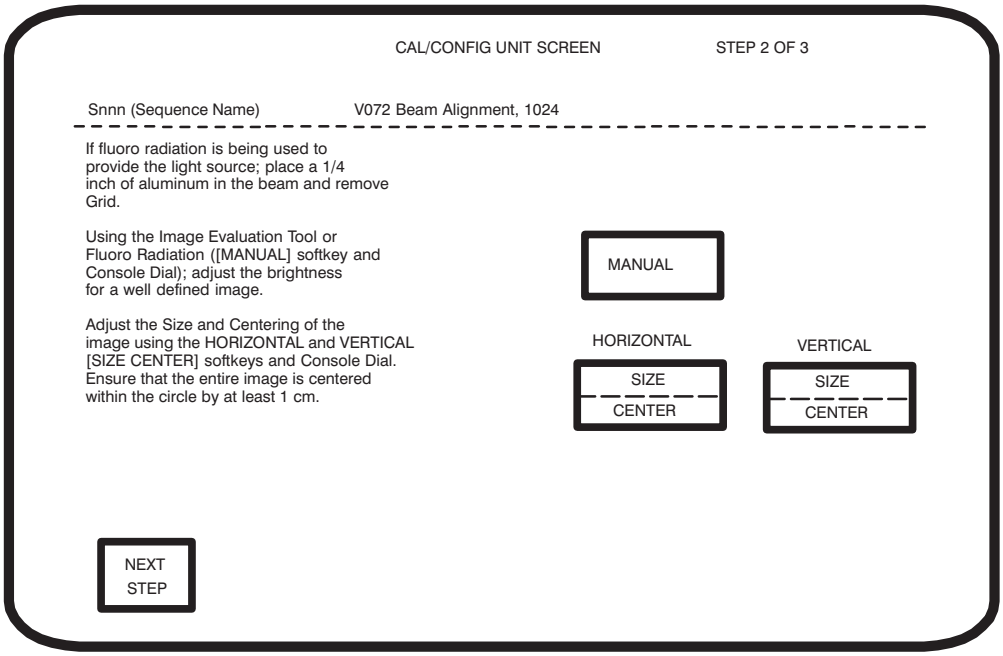
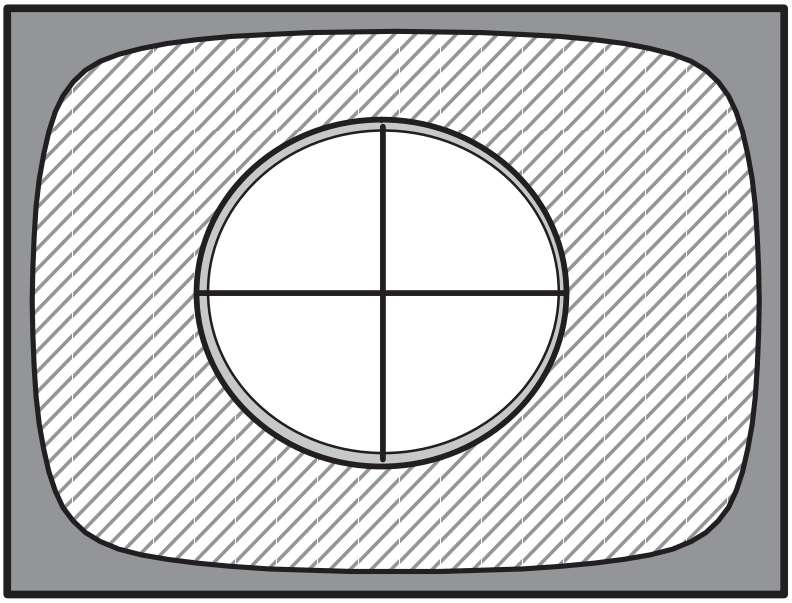


Illustration 85 – V072, Beam Alignment, DLX 1024



MONITOR ON DLX CONSOLE

2-5-3 Step 3. Adjust Beam Alignment Coils

- Touch the REDUCED TARGET VOLTAGE softkey and using the console dial slowly set the target voltage to the value indicated in the Table 32 for the pickup tube type installed (The default value for target voltage is 15 volts).

Table 32 – Target Voltage

PICKUP TUBE TYPE	MODEL NO	REDUCED TARGET VOLTAGE
Saticon A	TH9951, XQ1560	15 Volts
Saticon B	TH9957, XQ1565/ XQ1570	15 Volts
Saticon C	XQ1585	15 Volts
Czicon	XQ1440X	15 Volts
Plumbicon	XQ2182/03X	15 Volts
Vidicon	XQ1240	15 Volts

- Continue the alignment using the calibration method selected in Step 1.

2-5-3-1 Image Evaluation Tool

1. Adjust IET brightness for the greatest amount of shading within the circular image on the DLX monitor. Shading is faint. In case of a dim or no image, it may be necessary to increase the REDUCED TARGET VOLTAGE. If no shading is visible after adjusting the brightness, use the HORIZONTAL and VERTICAL softkeys in conjunction with the console dial to move the shading into view.
2. Use the HORIZONTAL and VERTICAL softkeys and console dial to center the shaded area on the circular image.

2-5-3-2 Radiation

1. Take and maintain a fluoro exposure. Touch MANUAL softkey and using the console dial, adjust brightness for the greatest amount of shading within the circular image. Shading is faint. In case of a dim or no image, it may be necessary to increase the REDUCED TARGET VOLTAGE. If no shading is visible after adjusting the brightness, use the HORIZONTAL and VERTICAL softkeys in conjunction with the console dial to move the shading into view.
2. Use the HORIZONTAL and VERTICAL softkeys and console dial to center the shaded area on the circular image.
3. The black level offset for 1024 in the DLX technical menu can be increased if desired for better viewing of the image. Position the cursor at the 1024 offset (labeled VOS VS 512/1024) using the arrow keys on the right hand keypad of the DLX console. The offset can now be varied with knob “C” on the DLX console.

- Set oscilloscope controls as indicated below:

  Vert Ampl: 50 mV/div
  Time Base: 20 usec/div (When observing Horizontal)
  20 msec/div (When observing Vertical)

- Using radiation and the oscilloscope, perform a fine adjustment of the horizontal and vertical alignment coils as follows:
  1. Take and maintain a fluoro exposure.
  2. Touch the HORIZONTAL softkey and while observing the oscilloscope use the console dial to adjust the waveform for optimum symmetry. See Illustration 83.
  3. Touch VERTICAL softkey and while observing the oscilloscope use the console dial to adjust the waveform for optimum symmetry. See Illustration 84.

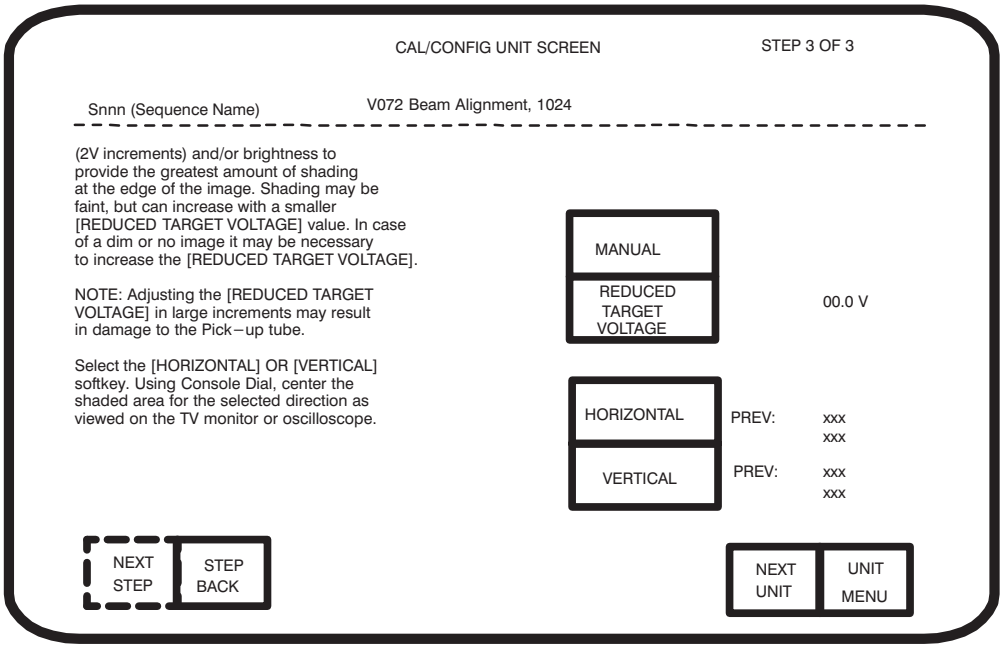
Note: The adjustments are interactive. Repeat horizontal and vertical adjustments for optimum results. A vertical adjustment will effect the horizontal adjustment more than a horizontal adjustment will effect the vertical adjustment.

- If large changes were made to the PREV horizontal or vertical coil values (displayed on the console screen), touch the STEP BACK softkey to return to Step 2 and touch up size and centering.
- Touch the HORIZONTAL and VERTICAL softkeys to verify that the shaded area remains centered on the circular image before exiting the unit.

Note: The NEXT STEP softkey is only displayed in the viewing mode to permit return to the Step 1 screen.

- Touch the NEXT UNIT or UNIT MENU softkey to exit.

V072, DX (DLX) 1024, STEP 3 SCREEN DISPLAY
(TILT–C VASCULAR & <u>OLDER</u> SW SP LCA/LCV+/LC+)



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Video and Intensifier Calibration Units

Notepad

Units I001, V000 – V072

Unit	Note

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SECTION 7 – POSITIONER CALIBRATION UNITS

GENERAL NOTES FOR R&F POSITIONER CALIBRATION UNITS

Note: If the servos on a Spot–Film Device (SFD) fail to drive while performing any of the R&F positioner calibration units, and the message “SERVO STALL” is indicated on the system console, first check to see if the circuit breakers in the positioner cabinet have opened and reset if necessary.

Unit	Title	Page
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P008	Transverse Collimator Servo Damping	427
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P009	SFD to X–Ray Tube Alignment Procedure 2: IDD (Intelligent Digital Device) Configuration	431
P010	Image Intensifier Tube to X–Ray Tube Alignment Procedure 1: ISFD (Intelligent Spot Film Device) Configuration	435
P010	Image Intensifier Tube to X–Ray Tube Alignment Procedure 2: IDD (Intelligent Digital Device) Configuration	439
P019	SID Pot A/D Calibration	443
P020	Lateral Collimator A/D Calibration Procedure 1: ISFD (Intelligent Spot Film Device) Configuration	447
P020	Lateral Collimator A/D Calibration Procedure 2: IDD (Intelligent Digital Device) Configuration	453
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P025	Film Border Calibration	477
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P038	Spot Film Power Assist Calibration	505
P039	Spot Film Gain Entry	511
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P041	Cassette Position Calibration	521
P102	Collimator to X–ray Tube Alignment	525

Unit	Title	Page
P103	Image Intensifier Alignment	529
P107	II SID Minimum Calibration	531
P119	FC Parameters	533
P124	XRT Alignment	543
P125	ISO Alignment Verification	545
P126	LP Isocenter/Mech Alignment	547
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P304	SID Pot A/D Calibration	555
P306	SID – Receptor (XX) Vertical	559
P313	Cassette Size Receptor (XX)	561
P314	SID – Receptor (XX) Horizontal	567
P404	SRI/AIV Collimator A/D Calibration	573
P406	Contour Filter Calibration (SRI)	581
P508	Gantry Positioner Calibration via PC	583
P551	FC Collimator Limits Calibration	585

UNIT P007 – Longitudinal Collimator Servo Damping

Time: x h xx min – Personnel: 1 field engineer

1 DESCRIPTION

Calibration Unit P007 is used to adjust Longitudinal Collimator Servo Damping. The unit automatically drives the collimator blades to a good starting position for performing the damping adjustment. The adjustment is performed while observing the servo motor drive signal on an oscilloscope. On multi–tube systems, the calibration is accomplished on each collimator.

Note: New R&F systems have factory adjusted undertable collimators, verify adjustments first before re-calibrating.

2 EQUIPMENT REQUIRED

Oscilloscope, test leads, and non–metallic trimpot adjusting tool.

3 TEST SETUP

Refer to the following table for the location of test points and adjustments. Connect the oscilloscope to the applicable test point.

COLLIMATOR	TEST POINTS	ADJUSTMENT
UNDERTABLE	RFP1 A1 A7 TP2 (REF TP9)	RFP1 A1 A7 R31
2ND XRT	RFP1 A1 A8 TP2 (REF TP9)	RFP1 A1 A8 R31
FRONTAL	VP1 A1 A4 TP2 (REF TP9)	VP1 A1 A4 R31

Set oscilloscope controls as follows:

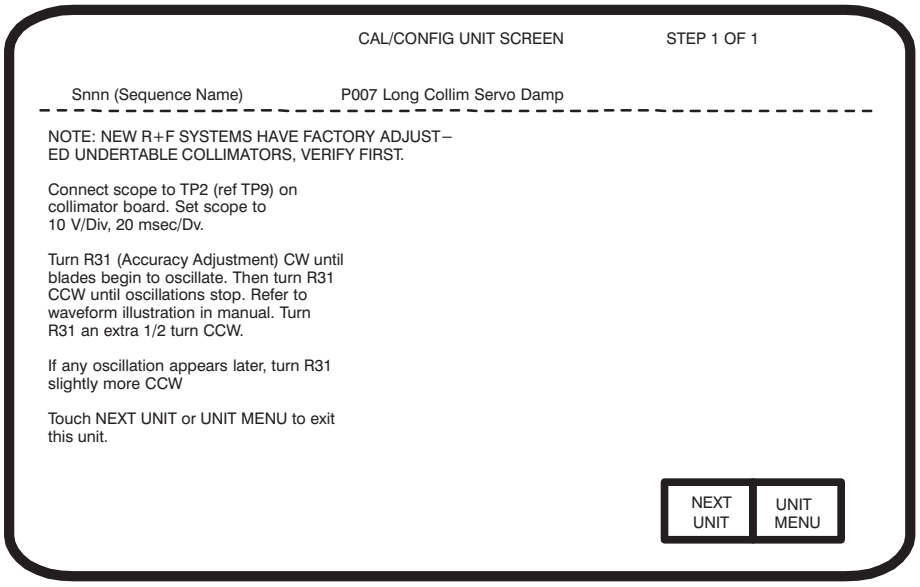
VERT AMPL: 10V/div. Auto Trigger
TIME BASE: 20 msec./div. DC Coupled

4 CAL PROCEDURE

Perform the adjustment as follows:

- Turn Accuracy Adjustment potentiometer R31 clockwise (CW) until the collimator blades just begin to oscillate and the waveform observed on the oscilloscope is as indicated in Illustration 86.
- Slowly turn R31 counterclockwise (CCW) until the collimator blades stop oscillating and the waveform observed on the oscilloscope is as indicated in Illustration 87. Then, adjust R31 an extra 1/2 turn CCW. If oscillations still appear, turn R31 slightly more CCW.
- Touch the NEXT UNIT or UNIT MENU softkey to exit the calibration unit.

P007 SCREEN DISPLAY



Note: The waveform illustrations shown are theoretical waveforms. The actual stabilized signal waveform is not a flat line but consists of low amplitude spikes.

Illustration 86 – Servo Oscillating

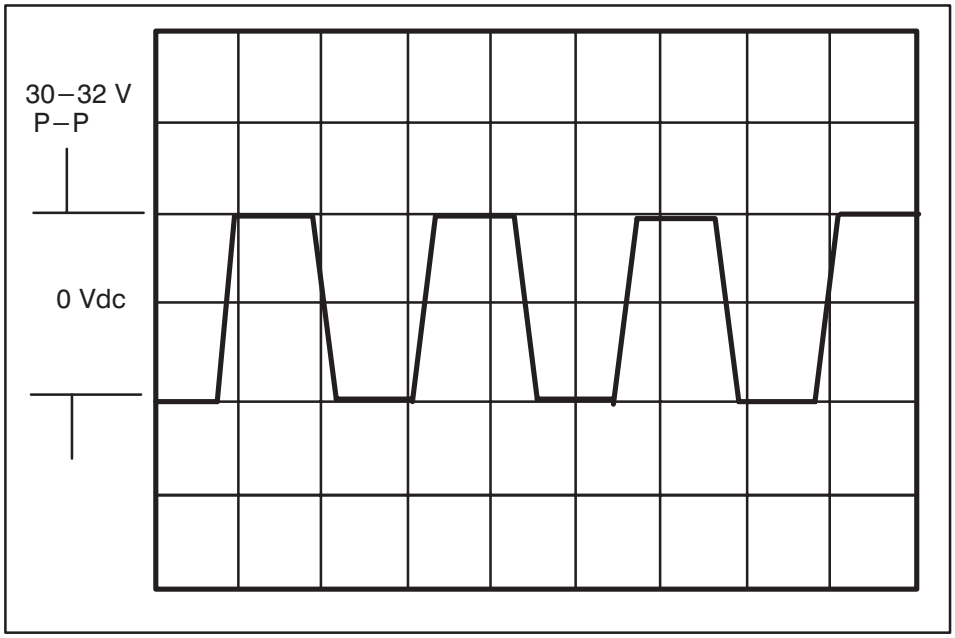
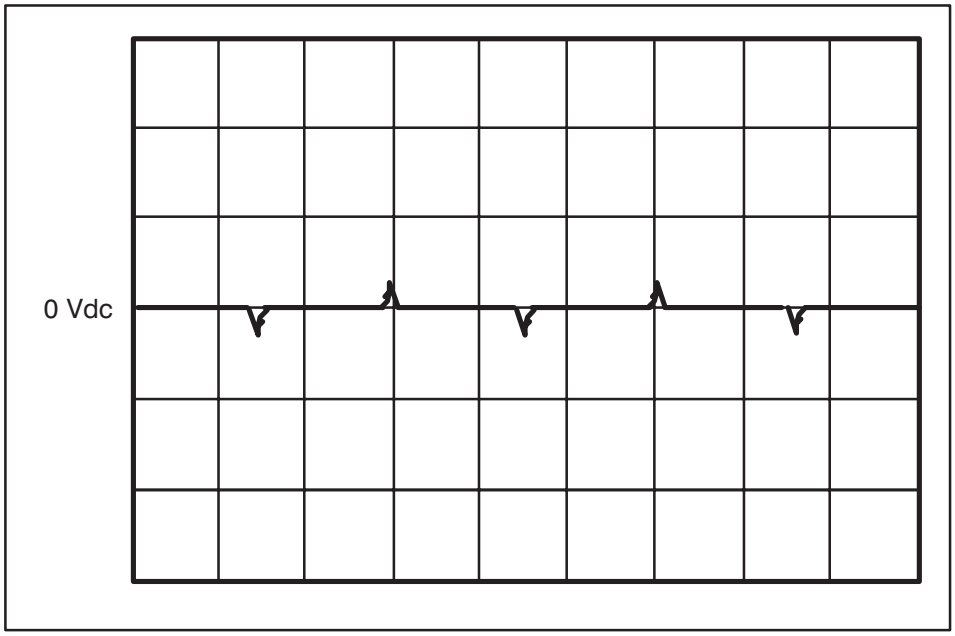


Illustration 87 – Signal Stabilized



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UNIT P008 – Transverse Collimator Servo Damping

Time: x h xx min – Personnel: 1 field engineer

1 DESCRIPTION

Calibration Unit P008 is used to adjust Transverse Collimator Servo Damping. The calibration unit automatically drives the collimator blades to a good starting position for performing the damping adjustment. The adjustment is performed while observing the servo motor drive signal on an oscilloscope. On multi–tube systems, the calibration is accomplished on each collimator.

Note: New R&F systems have factory adjusted undertable collimators, verify adjustments first before re-calibrating.

2 EQUIPMENT REQUIRED

Oscilloscope, test leads, and non–metallic trimpot adjusting tool.

3 TEST SETUP

Refer to the following table for the location of test points and adjustments. Connect the oscilloscope to the applicable test point.

COLLIMATOR	TEST POINTS	ADJUSTMENT
UNDERTABLE	RFP1 A1 A7 TP1 (REF TP9)	RFP1 A1 A7 R30
2ND XRT	RFP1 A1 A8 TP1 (REF TP9)	RFP1 A1 A8 R30
FRONTAL	VP1 A1 A4 TP1 (REF TP9)	VP1 A1 A4 R30

Set oscilloscope controls as follows:

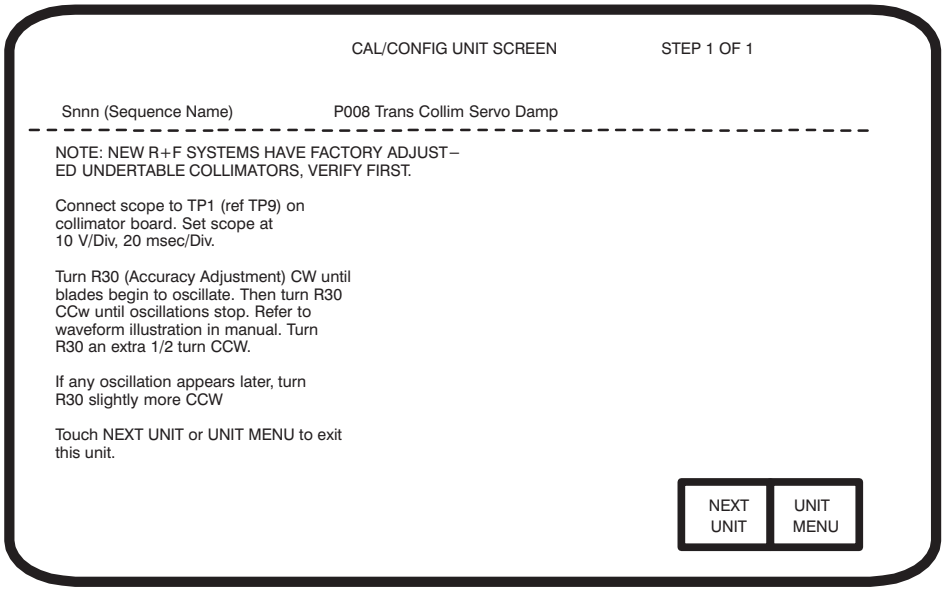
VERT AMPL: 10V/div. Auto Trigger
TIME BASE: 20 msec./div. DC Coupled

4 CAL PROCEDURE

Perform the procedure as follows:

- Turn Accuracy Adjustment potentiometer R30 clockwise until the collimator blades just begin to oscillate and the waveform observed on the oscilloscope is as indicated in Illustration 86, Calibration Unit P007.
- Slowly turn R30 counterclockwise until the collimator blades stop oscillating and the waveform observed on the oscilloscope is as indicated in Illustration 87, Calibration Unit P007. Then, adjust R30 an extra 1/2 turn counterclockwise. If oscillations still appear, turn R30 slightly more CCW.
- Touch the NEXT UNIT or UNIT MENU softkey to exit the calibration unit.

P008 SCREEN DISPLAY



UNIT P009 – ISFD/IDD to X–Ray Tube Alignment
Procedure 1: ISFD (Intelligent Spot Film Device) Configuration

Time: x h xx min – Personnel: 1 field engineer

1 DESCRIPTION

Calibration Unit P009 aligns the film plane center of the SFD to the focal spot of the X–ray tube. The alignment uses the position of the collimator blades to represent the position of the X–ray tube since the collimator was previously aligned to the tube with pre–requisite Cal Unit P102. Only one step is required to accomplish the alignment.

2 EQUIPMENT REQUIRED

Alignment washer (46–262350P1)

Note: The ISFD is calibrated at the factory and normally does not require re–alignment in the field. Check first before proceeding with a re–alignment.

3 PRELIMINARY CHECK

Check as follows:

- Attach the alignment washer to the center of the Lexan window on the bottom of the ISFD.
- Touch the FOV softkey and use the console dial to enter MAG 2 field of view.
- Move the ISFD to the middle SID position.

Note: Upon entering the unit, the COLLIMATOR TRANSVERSE and SLOW softkeys are the default jog functions displayed on the console screen.

- If necessary, use the jog softkeys on the console screen or the jog controls on the ISFD control panel to move the cone, grid etc. from the ISFD window area.
- Take a fluoro exposure and use the jog controls (console screen or ISFD control panel) to position the transverse and longitudinal collimator blades until they just touch the inner circle of the alignment washer.
- If all blades just touch the inner circle, the ISFD is properly aligned to the X–ray tube. Touch the NEXT UNIT or UNIT MENU softkey to exit.

Note: The blades must touch the inner circle of the alignment washer or the system may fail HHS testing when the table is angulated.

OR

4 CAL PROCEDURE

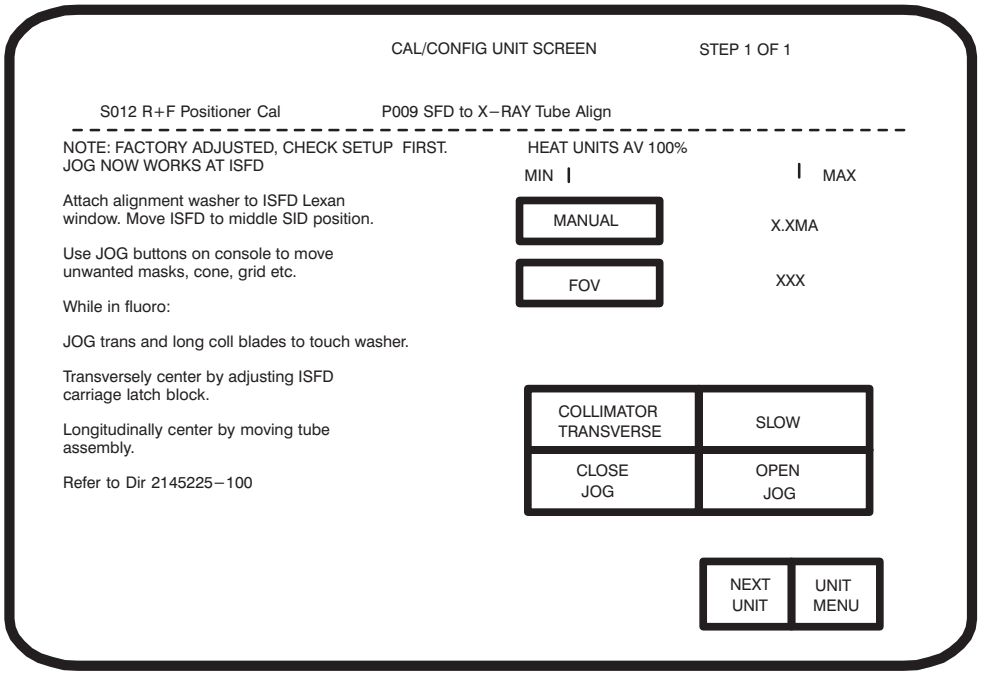
Perform alignment as follows:

- If the blades cannot be positioned tangent to the inner circle of the alignment washer, manual alignment is required.
- If transverse centering is required, center by adjusting ISFD carriage latch block.
- If longitudinal centering is required, center by moving the tube assembly.

Note: Refer to Direction 2145225–100 for procedures covering the manual alignment of the ISFD carriage to the X–ray tube.

- After manual adjustment has been accomplished, return to Cal Unit P009 to verify alignment. Then, exit the unit by touching the NEXT UNIT or UNIT MENU softkey.

P009 SCREEN DISPLAY



UNIT P009 – SFD to X–Ray Tube Alignment
Procedure 2: IDD (Intelligent Digital Device) Configuration

Time: x h xx min – Personnel: 1 field engineer

1 DESCRIPTION

Calibration Unit P009 transversely aligns the film plane center of the IDD to the focal spot of the X–ray tube. The alignment uses the position of the collimator blades to represent the position of the X–ray tube since the collimator was previously aligned to the tube with pre–requisite Cal Unit P102. Only one step is required to accomplish the alignment.

2 EQUIPMENT REQUIRED

Alignment tool 2165666

Note: The IDD is calibrated at the factory and normally does not require re–alignment in the field. Check first before proceeding with a re–alignment.

3 PRELIMINARY CHECK

Check as follows:

- Attach the alignment tool to the bottom of the IDD. See Illustration 88 and Illustration 89.
- Touch the FOV softkey and use the console dial to enter MAG 2 field of view.
- Move the IDD to the middle SID position.

Note: Upon entering the unit, the COLLIMATOR TRANSVERSE and SLOW softkeys are the default jog functions displayed on the console screen.

- If necessary, use the jog softkeys on the console screen or the jog controls on the IDD control panel to move the cone, grid etc. from the IDD window area.
- Take a fluoro exposure and use the jog controls (console screen or IDD control panel) to position the transverse collimator blades until they just touch the small box of the alignment tool.
- If the transverse blades just touch the small box, the IDD is properly aligned to the X–ray tube. Touch the NEXT UNIT or UNIT MENU softkey to exit.

Note: The blades must touch the small box of the alignment tool or the system may fail HHS testing when the table is angulated.

OR

4 CAL PROCEDURE

Perform alignment as follows:

- If the blades cannot be positioned centered about the small box of the alignment tool, manual alignment is required.
- If transverse centering is required, center by adjusting IDD carriage latch block.

Note: Refer to Direction 2145225–100 for procedures covering the manual alignment of the IDD carriage to the X–ray tube.

- After manual adjustment has been accomplished, return to Cal Unit P009 to verify alignment. Then, exit the unit by touching the NEXT UNIT or UNIT MENU softkey.

P009 SCREEN DISPLAY

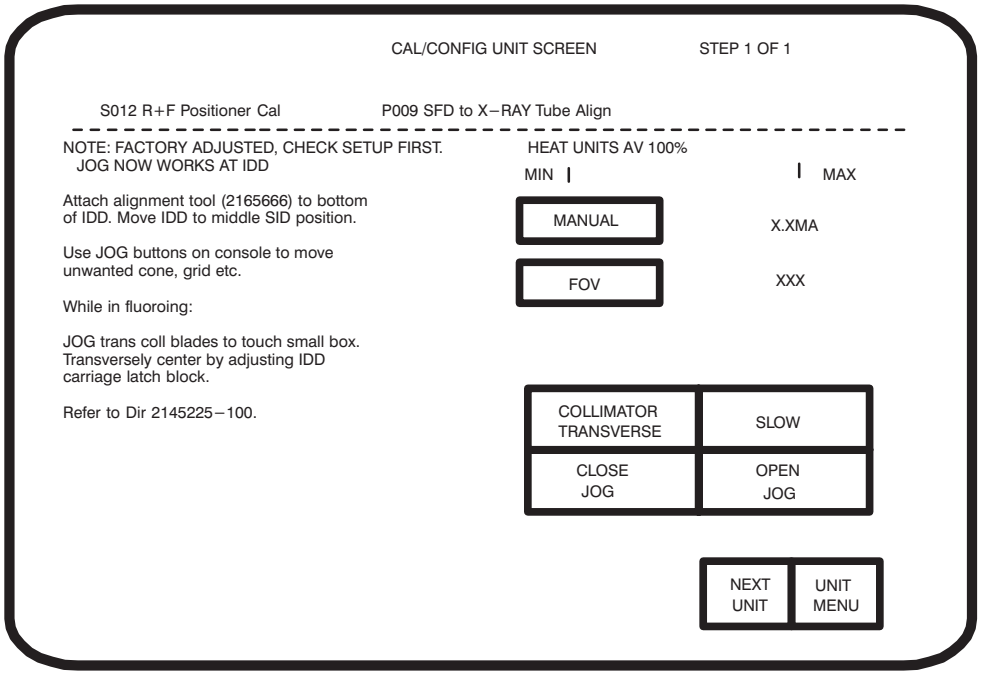


Illustration 88 – Alignment Tool 2165666

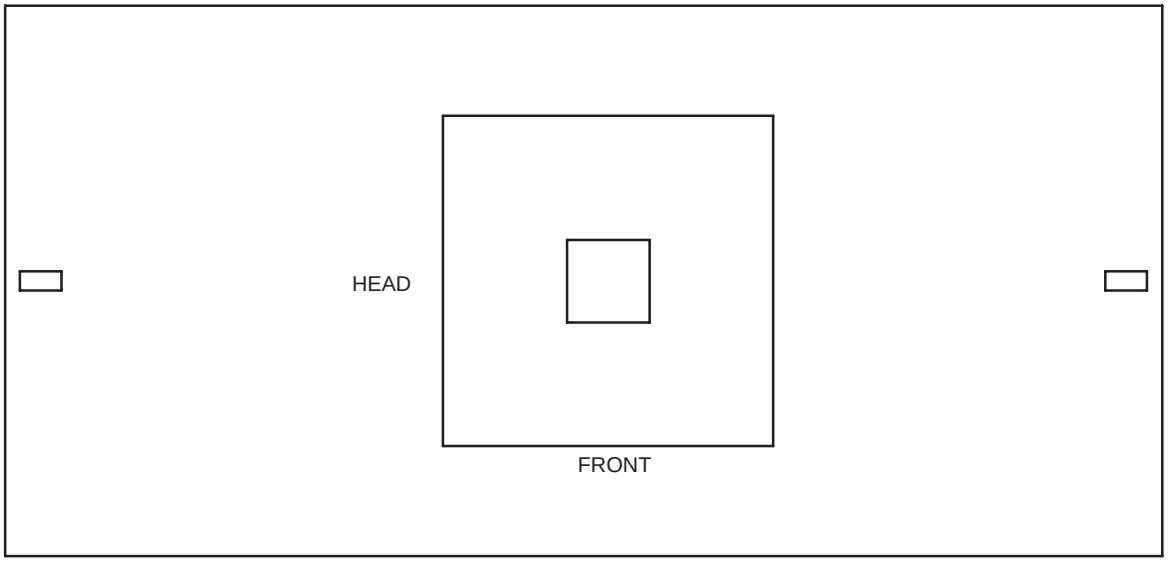
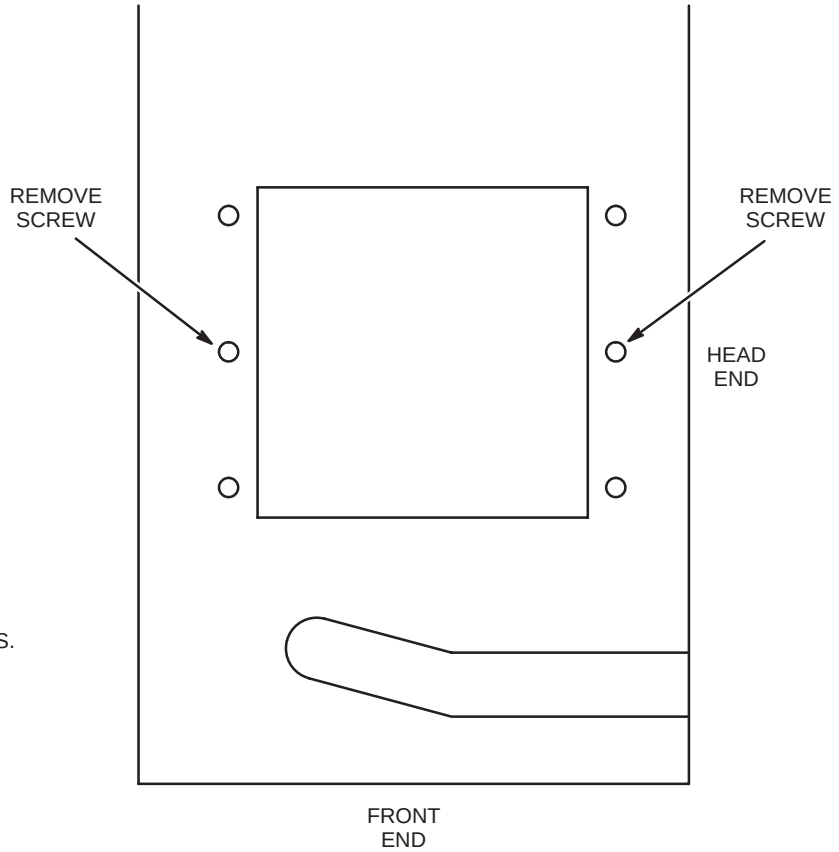


Illustration 89 – Alignment Tool Installation



REMOVE THE INDICATED SCREWS. MOUNT THE ALIGNMENT TOOL TO THESE HOLES USING THE LONG SCREWS FROM THE IDD GRASP HANDLES.

ALIGNMENT TOOL IS MARKED WITH HEAD AND FRONT ORIENTATION.

BOTTOM VIEW OF IDD

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UNIT P010 – Image Intensifier Tube to X–Ray Tube Alignment Procedure 1: ISFD (Intelligent Spot Film Device) Configuration

Time: x h xx min – Personnel: 1 field engineer

1 DESCRIPTION

Calibration Unit P010 sets up the system to accept alignment of the image intensifier tube to the X–ray tube. Because the collimator was previously aligned to the tube (Ref Cal Unit P102), the alignment uses the position of the collimator blades to represent the position of the X–ray tube.

2 EQUIPMENT REQUIRED

None.

Note: The ISFD is calibrated at the factory. Check alignment first before proceeding with a re–alignment.

3 CHECK ALIGNMENT

Check as follows:

Note: This unit should be performed at MID SID to be consistent with Cal Unit P009. Setting the ISFD to MID SID position averages out any errors caused by any “walking effects” encountered between MIN to MAX SID.

- Set ISFD to MID SID.
- Take a fluoro exposure and use the jog softkeys on the console screen or the jog controls on the ISFD to drive the collimator transverse blades until one or both of the blades are tangent to the circular image on the TV monitor.
- Select COLLIMATOR LONGITUDINAL function and use the jog softkeys on the console screen or the jog controls on the ISFD to drive the collimator longitudinal blades tangent to the circular image on the TV monitor.
  1. Transverse movement is along the front–to–back axis of the table with a left–to–right presentation on the TV monitor.
  2. Longitudinal movement is along the head–to–foot axis of the table with a top–to–bottom presentation on the TV monitor.
- If the following two conditions are met after positioning the collimator blades, the II tube is properly aligned to the x–ray tube:
  1. Both sets of blades can be driven tangent to the circular image on the TV monitor and enter into the field of view within 1/6 inch (See Illustration 90, Image A).
  2. Collimator blades are parallel to the TV monitor image blanking.

- Touch the NEXT UNIT or UNIT MENU softkey to exit.

OR

- If one blade of either set is within the circular image while the other is tangent (See Illustration 90, Image B), the II tube must be aligned.

4 CAL PROCEDURE

Perform alignment as follows:

- Remove top cover from ISFD to access II mounting bridge.
- Loosen nuts holding washers and four slotted spacers (eccentrics) on each side of II mounting bridge.
- Move II bridge position on ISFD casting until alignment is achieved.
- Tighten nuts to secure II bridge in place on ISFD casting.
- Verify that II tube mounting bridge is parallel to the ISFD carriage casting to ensure that camera ports/camera are perpendicular or parallel to the table axis. II mounting plate is square with the ISFD casting (See Illustration 91).
- Return to Calibration Unit P010 and perform alignment check.

P010 SCREEN DISPLAY

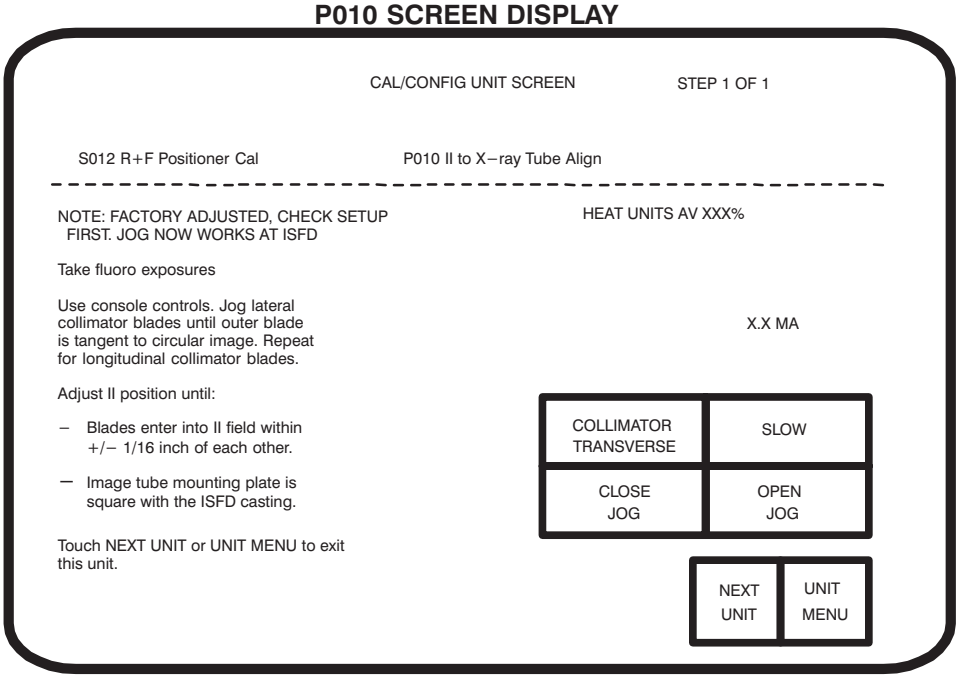


Illustration 90 – P010 Collimator Blade Positions

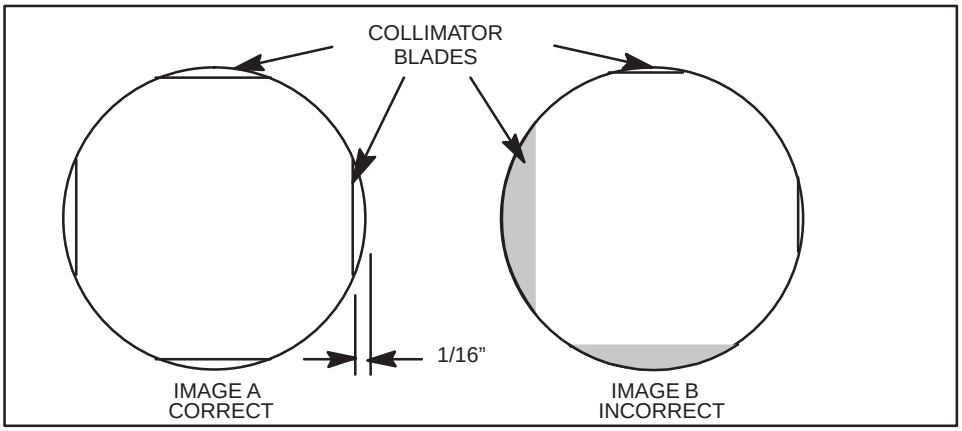
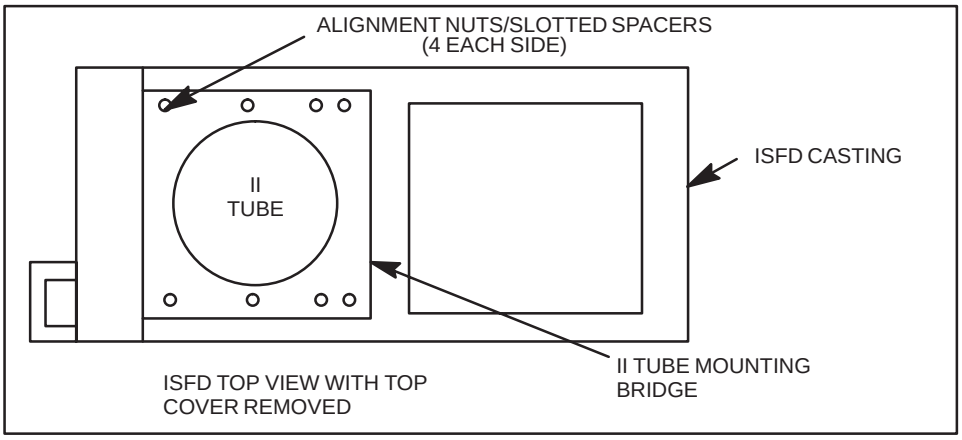


Illustration 91 – P010 Image Intensifier/XRT Alignment



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UNIT P010 – Image Intensifier Tube to X–Ray Tube Alignment Procedure 2: IDD (Intelligent Digital Device) Configuration

Time: x h xx min – Personnel: 1 field engineer

1 DESCRIPTION

Calibration Unit P010 sets up the system to accept alignment of the image intensifier tube to the X–ray tube. Because the collimator was previously aligned to the tube (Ref Cal Unit P102), the alignment uses the position of the collimator blades to represent the position of the X–ray tube.

2 EQUIPMENT REQUIRED

None.

Note: The IDD is calibrated at the factory. Check alignment first before proceeding with a re–alignment.

3 CHECK ALIGNMENT

Check as follows:

Note: This unit should be performed at MID SID to be consistent with Cal Unit P009. Setting the IDD to MID SID position averages out any errors caused by any “walking effects” encountered between MIN to MAX SID.

- Set IDD to MID SID.
- Take a fluoro exposure and use the jog softkeys on the console screen or the jog controls on the IDD to drive the collimator transverse blades until one or both of the blades are tangent to the circular image on the TV monitor.
- Select COLLIMATOR LONGITUDINAL function and use the jog softkeys on the console screen or the jog controls on the IDD to drive the collimator longitudinal blades tangent to the circular image on the TV monitor.
  1. Transverse movement is along the front–to–back axis of the table with a left–to–right presentation on the TV monitor.
  2. Longitudinal movement is along the head–to–foot axis of the table with a top–to–bottom presentation on the TV monitor.
- If the following two conditions are met after positioning the collimator blades, the II tube is properly aligned to the x–ray tube:
  1. Both sets of blades can be driven tangent to circular image on TV monitor and enter into field of view within 1/6 inch (See Illustration 92, Image A).
  2. Collimator blades are parallel to the TV monitor image blanking.

- Touch the NEXT UNIT or UNIT MENU softkey to exit.

OR

- If one blade of either set is within the circular image while the other is tangent (See Illustration 92, Image B), the II tube must be aligned.

4 CAL PROCEDURE

Perform alignment as follows:

- Lateral Adjustment:
  1. Remove IDD rear cover to access II mounting bridge.
  2. Loosen four hex head bolts on each side of II mounting bridge.
  3. Move II bridge laterally on IDD casting until alignment is achieved. Only lateral adjustment is possible. See Illustration 93.
  4. Tighten hex head bolts to secure II bridge in place on IDD casting.
- Longitudinal Adjustment:
  1. Align longitudinally by moving the x–ray tube/collimator assembly.

Note: Refer to Direction 2145225–100 for procedures covering the adjustment of x–ray tube/collimator assembly.

P010 SCREEN DISPLAY

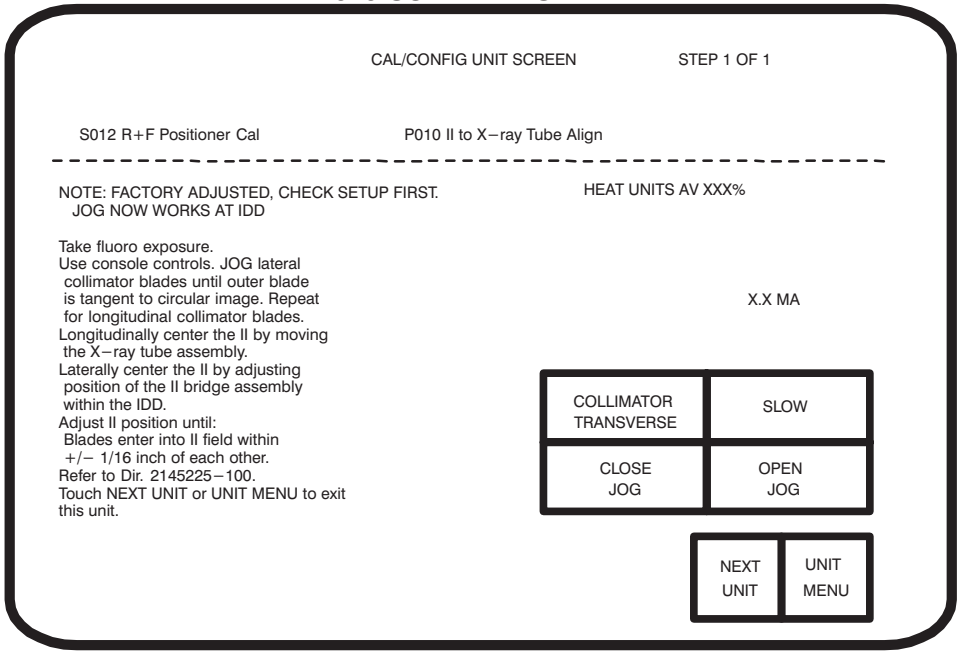


Illustration 92 – P010 Collimator Blade Positions

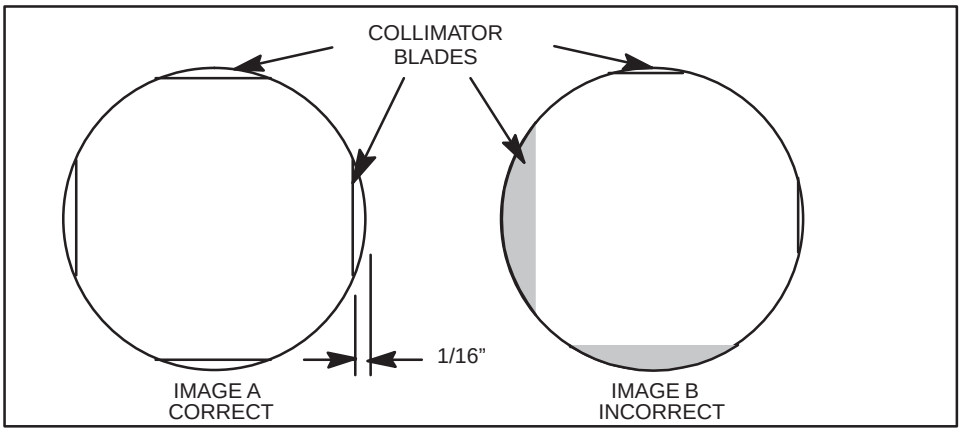
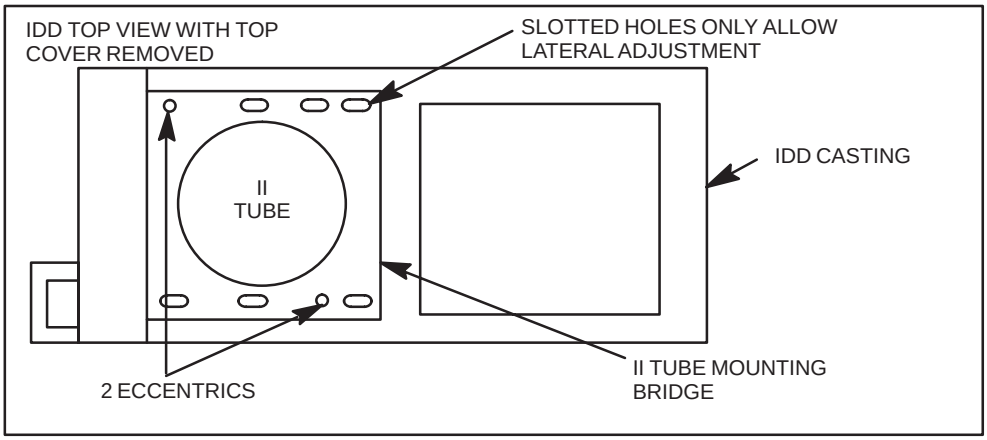
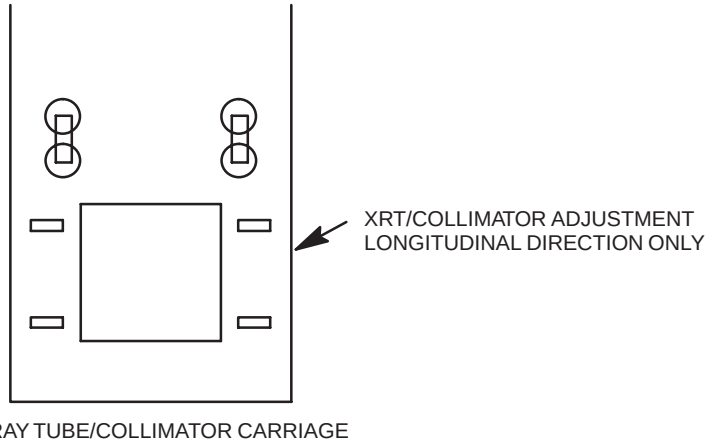


Illustration 93 – P010 Image Intensifier/XRT Alignment

LATERAL ALIGNMENT



LONGITUDINAL ALIGNMENT



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UNIT P019 – SID Pot A/D Calibration

Time: x h xx min – Personnel: 1 field engineer

1 DESCRIPTION

Calibration Unit P019 is used to perform Source to Image Distance (SID) A/D Calibration. Three steps are required to accomplish the calibration. Step 1 permits the software to determine the minimum SID position. Step 2 permits the software to determine the maximum SID position. Step 3 allows verification of the SID A/D Pot. A screen display is provided for each step.

Note: The SFD is factory calibrated. Check the setup first before proceeding with a recalibration.

2 EQUIPMENT REQUIRED

Metric Ruler.

3 SPECIAL INSTRUCTIONS

The following special instructions pertain to the running of this unit.

- This calibration unit requires that you reposition the SFD at each step. Make sure that the SFD remains in the position specified (or hold the SFD in proper position) to prevent drift. Any drift in the position of the SFD during calibration will produce errors in the calibration data. SFD locks are not active.

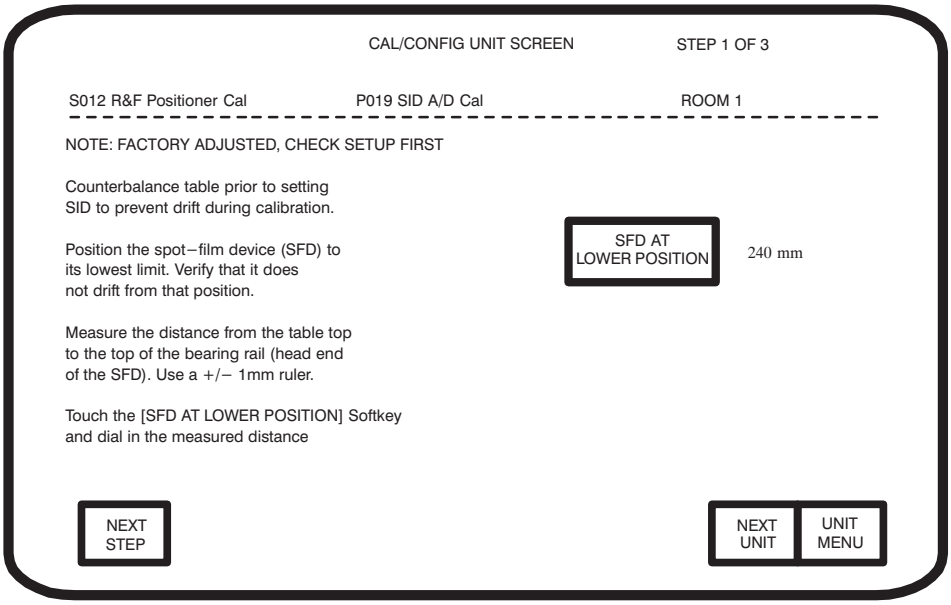
4 CAL PROCEDURE

4-1 Step 1. Set Lower Limit

- Counterbalance table to prevent drift. Maintain in position.
- Move the SFD to the minimum SID position. Verify that the SFD does not drift from this position.
- Using a metric ruler, measure the actual distance from the table top to the top of the bearing rail. Measure at the head end of the SFD.

  Measured Distance _____mm.
- Touch the SFD AT LOWER POSITION softkey and use the console dial to enter the measured distance.
- Touch NEXT STEP softkey to proceed to Step 2.

P019 STEP 1 SCREEN DISPLAY

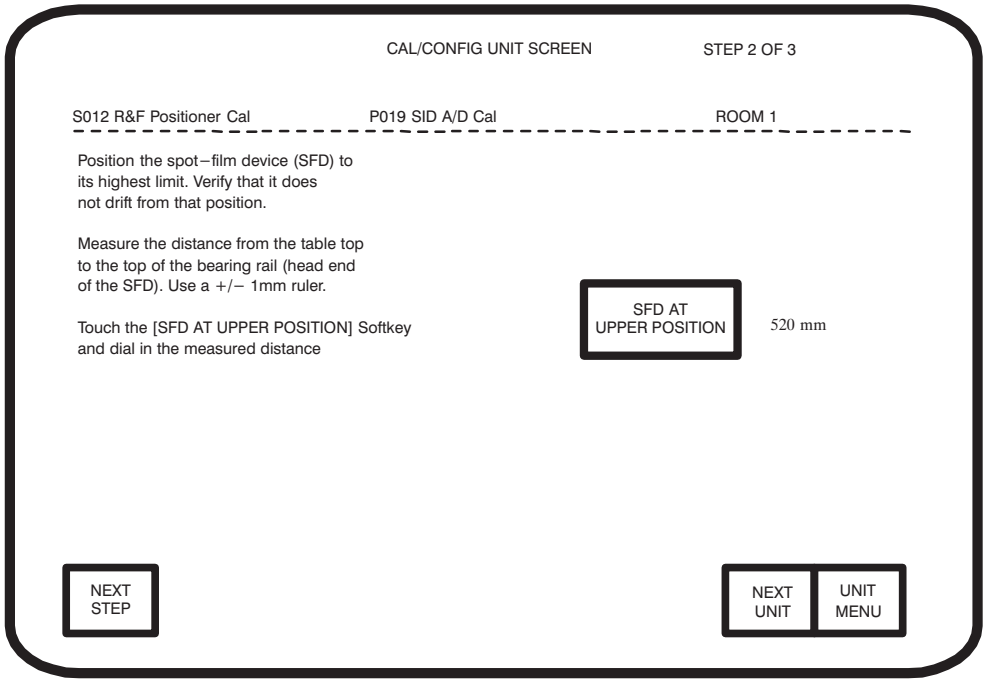


4-2 Step 2. Set Upper Limit

- Move the SFD to the maximum SID position. Verify that the SFD does not drift from this position.
- Using a metric ruler, measure the actual distance from the table top to the top of the bearing rail. Measure at the head end of the SFD.

  Measured Distance _____mm.
- Touch the SFD AT UPPER POSITION softkey and use the console dial to enter the measured distance.
- Touch NEXT STEP softkey to proceed to Step 3.

P019 STEP 2 SCREEN DISPLAY

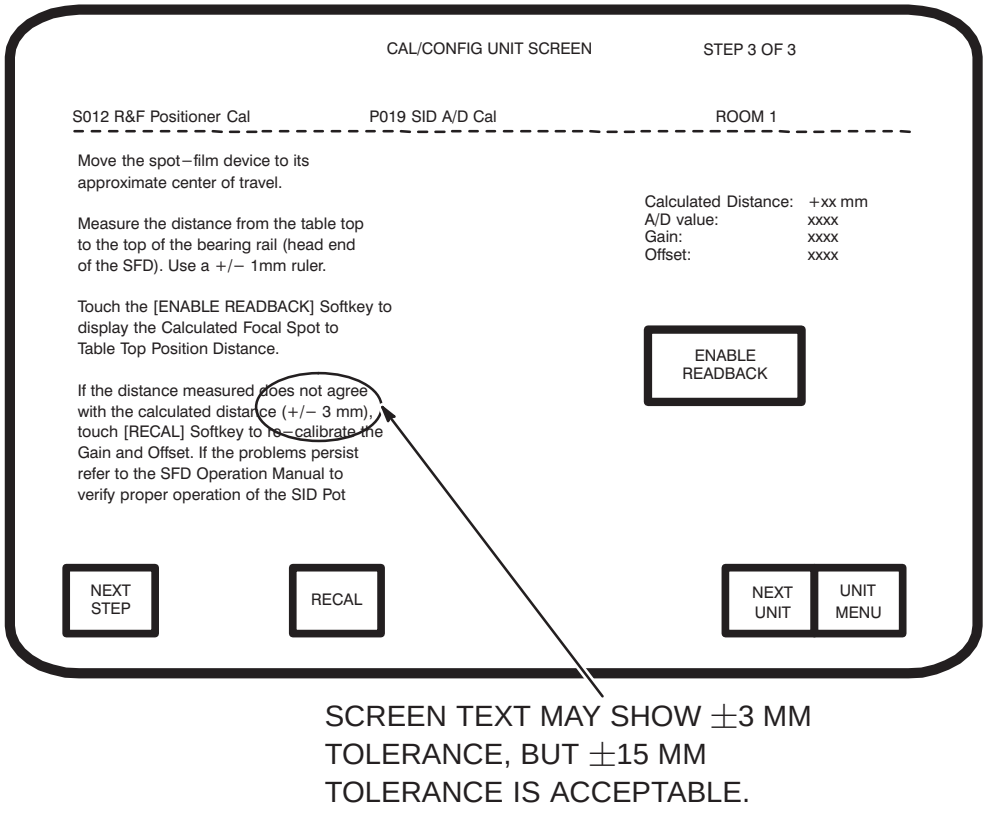


4-3 Step 3. Verify A/D Cal

- Position the SFD to approximately the vertical center of travel.
- Using a metric ruler, measure the actual distance from the Table Top to the Top of the Bearing Rail. Measure at the head end of the SFD.

  Measured Distance _____mm.
- Touch the ENABLE READBACK softkey. The calculated table top to the top of the bearing rail distance will be displayed on the console screen.
- If the actual distance measured does not agree with the calculated distance displayed on the console screen ±15 mm (screen text may show ±3 mm tolerance, but ±15 mm tolerance is acceptable), a recalibration is required. Touch the RECAL softkey and recalibrate the gain parameter.
- If the actual distance measured agrees with the calculated distance displayed on the console screen ±15 mm (screen text may show ±3 mm tolerance, but ±15 mm tolerance is acceptable), touch the NEXT UNIT or UNIT MENU softkey to exit. Exiting the unit loads the SID A/D positional data established in Step 1 and Step 2 into the system. An “Updating NV database” message is displayed while the data is being loaded.

P019 STEP 3 SCREEN DISPLAY



UNIT P020 – Lateral Collimator A/D Calibration
Procedure 1: ISFD (Intelligent Spot Film Device) Configuration

Time: x h xx min – Personnel: 1 field engineer

1 DESCRIPTION

Calibration Unit P020 is used to perform Lateral (Transverse) collimator blade A/D Calibration. Four steps are required to accomplish the calibration. A screen display is provided for each step.

2 EQUIPMENT REQUIRED

Test cassette (P/N 2129776) and alignment washer (P/N 46–262350P1).

Note: This is a factory calibration. Check blade positions first before proceeding with a recalibration. Insert test cassette if not already in place. Position ISFD at Min SID. Touch the VERIFY softkey. Unit will proceed to Step 4, Verification. Verify blade positions. If not correct return to Step 1 and perform recalibration.

3 CAL PROCEDURE

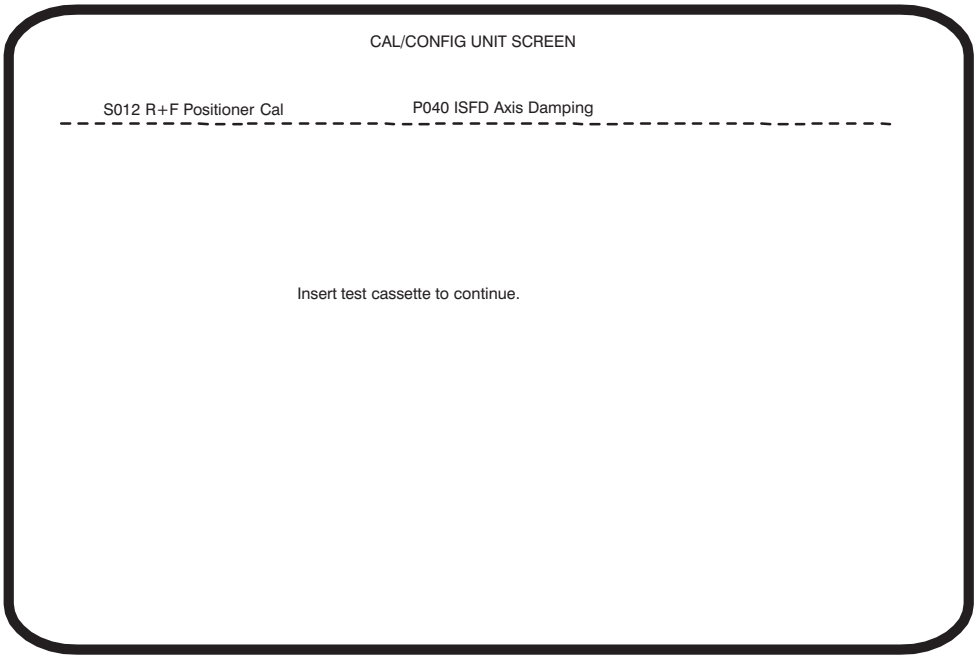
3-1 Step 1. Center Test Cassette Position

- Upon entering the unit the Collimator Transverse and SLOW softkeys are the default jog functions on the console screen.
- Verify that test cassette is in place in ISFD and that alignment washer is centered on ISFD window. If not, install.
- Position ISFD at minimum SID. Maintain in position. Any drift in position, will produce errors in the calibration data. ISFD locks are not active.
- For proper visualization of collimator limits, ensure that variable mask is moved out of the field of view.
- Use hand, foot or ISFD expose switch to take X–rays. Touch FOV softkey to select appropriate MAG mode for fine adjustment.
- If the test cassette center is OUTSIDE the alignment washer inner circle, repeat Calibration Unit P041, ISFD Cassette Position Cal.

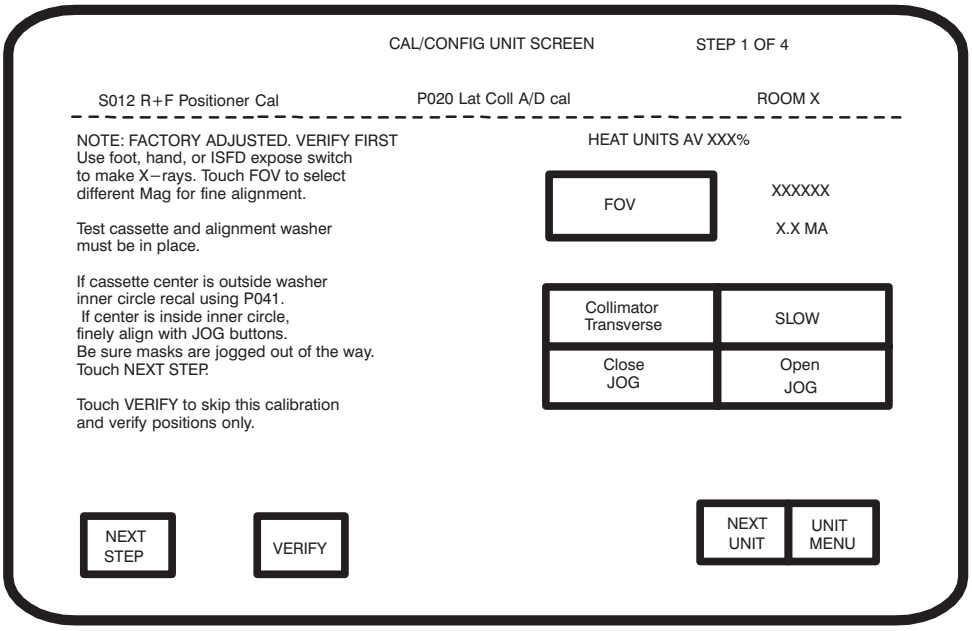
  If test cassette center is INSIDE the alignment washer inner circle, make a fine adjustment with the JOG softkeys.
- Use the jog softkeys on the console screen display or the jog controls on the ISFD to position the cassette.
- Touch the VERIFY softkey after fluoroing to proceed to Step 4 to check cassette positions before performing a full calibration.
- Touch the NEXT STEP softkey after fluoroing to proceed to Step 2 to begin calibration.

- Touch the NEXT STEP softkey before fluoroing to enter viewing mode. Viewing mode allows the service personnel to cycle through the displays without doing a calibration.

P020 INITIAL SCREEN DISPLAY



P020 STEP 1 SCREEN DISPLAY



3-2 Step 2. Set Transverse Collimator Blade to Closed Position

- Use the jog softkeys on the console to move the transverse collimator blades until they just touch the left and right outside edges of the graticule between the crosses in quadrants 1, 4, and 2, 3 of the test cassette pattern. See Illustration 94.

Note: Always jog the collimator blades from the outside toward the center to avoid tolerance problems.

- Touch POSITION 1 softkey to enter the calibration value into memory.
- Touch the NEXT STEP softkey to proceed to Step 3.

P020 STEP 2 SCREEN DISPLAY

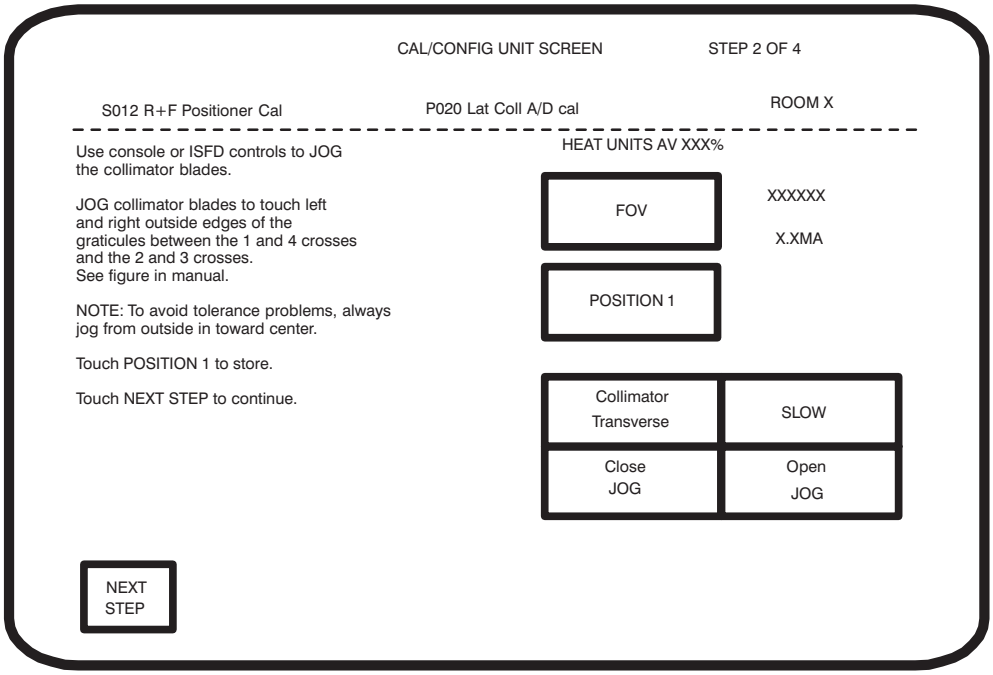
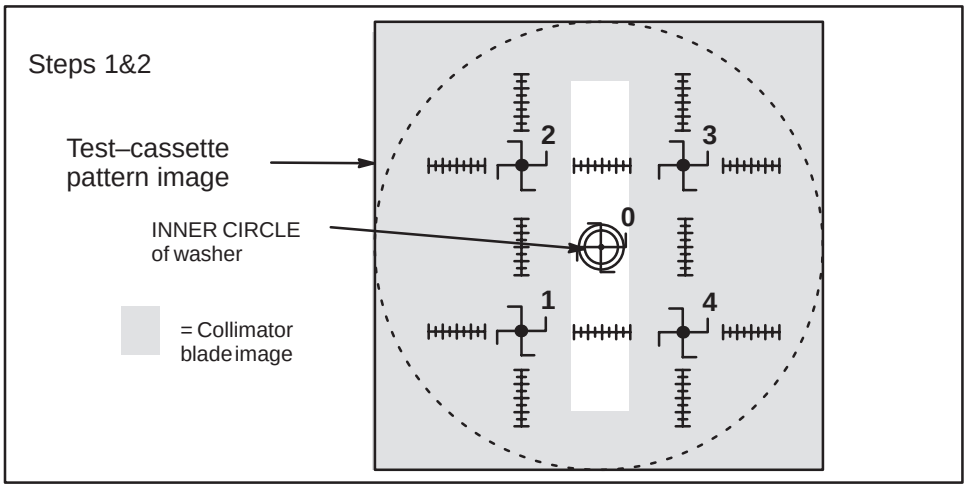


Illustration 94 – P020 Step 1 and 2 Test Pattern



3-3 Step 3. Set Transverse Collimator Blade to Open Position

- Use the jog softkeys on the console to move the transverse collimator blades until they just touch the left and right outside edges of the crosses in quadrants 1, 2, and 3, 4 of the test cassette pattern. See Illustration 95.

Note: Always jog the collimator blades from the center toward the outside to avoid tolerance problems.

- Touch POSITION 2 softkey to enter the calibration value into memory.
- Touch the NEXT STEP softkey to proceed to Step 4.

P020 STEP 3 SCREEN DISPLAY

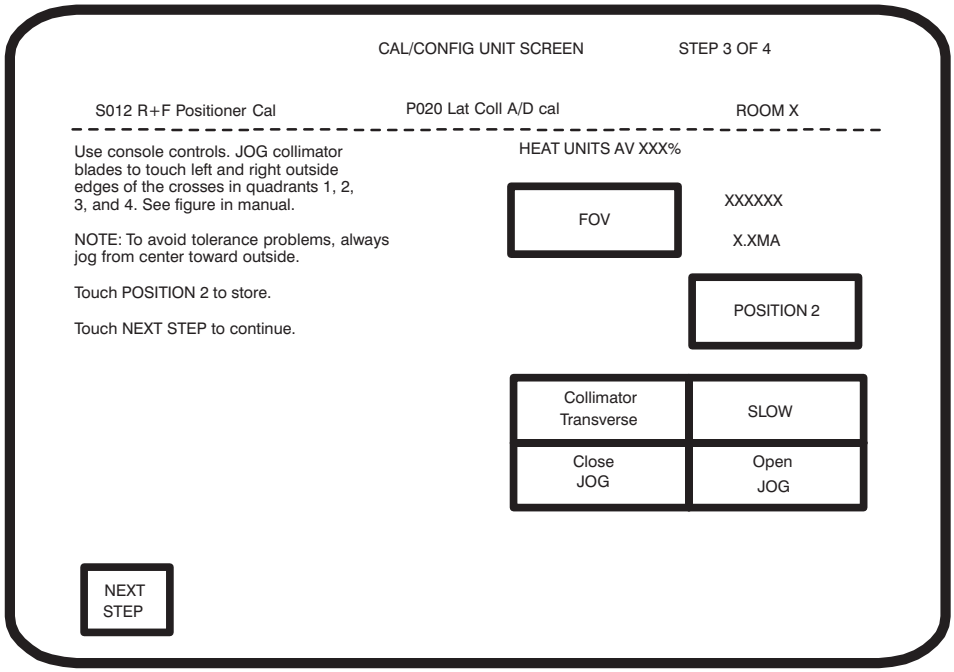
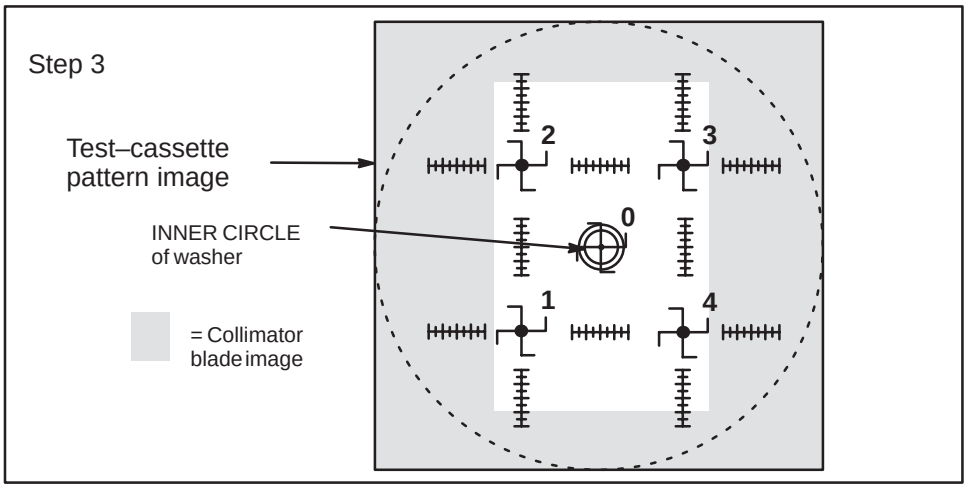


Illustration 95 – P020 Step 3 Test Pattern



3-4 Step 4. Verify Calibration

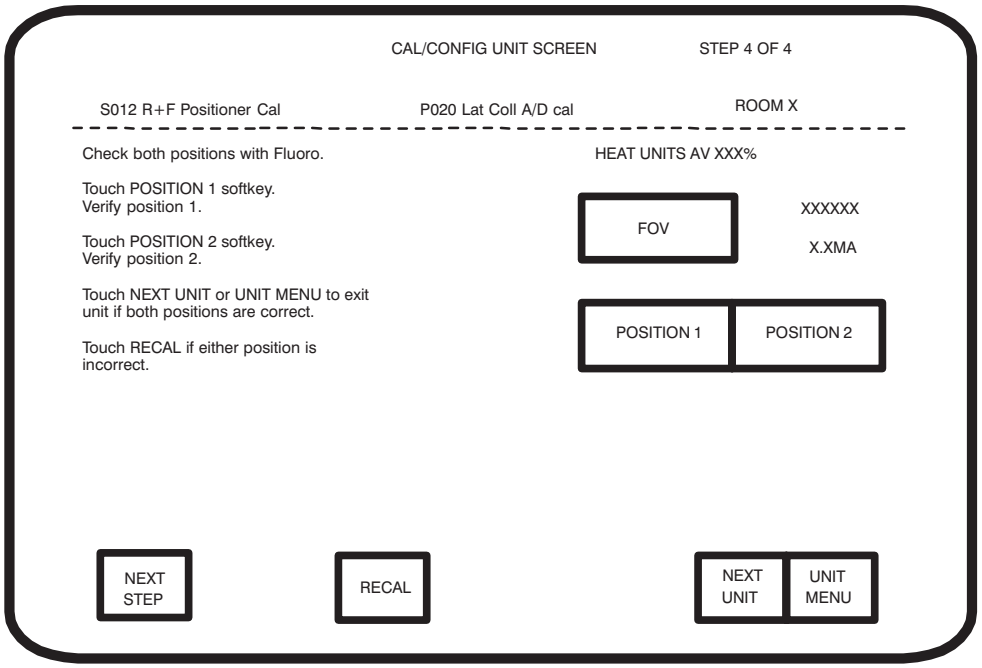
- Take and maintain a fluoro exposure.
- Touch POSITION 1 softkey and verify that the collimator blades move to the correct **closed position** (collimator blades just touch the left and right outside edges of the graticule between the crosses in quadrants 1, 4, and 2, 3 of the test cassette pattern).
- Touch POSITION 2 softkey and verify that the collimator blades move to the correct **open position** (collimator blades just touch the left and right outside edges of the crosses in quadrants 1, 2, and 3, 4 of the test cassette pattern).
- If both positions are correct, touch NEXT UNIT or UNIT MENU softkey to exit the calibration unit. An “Updating NV database” message is displayed while the position data is being loaded into the system.

OR

- If one position or both positions are incorrect, touch RECAL softkey and repeat the calibration.

Note: The NEXT STEP softkey is used to return to Step 1 when in the viewing (browse) mode.

P020 STEP 4 SCREEN DISPLAY



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UNIT P020 – Lateral Collimator A/D Calibration
Procedure 2: IDD (Intelligent Digital Device) Configuration

Time: x h xx min – Personnel: 1 field engineer

1 DESCRIPTION

Calibration Unit P020 is used to perform Lateral (Transverse) collimator blade A/D Calibration. Four steps are required to accomplish the calibration. A screen display is provided for each step.

2 EQUIPMENT REQUIRED

Alignment tool (P/N 2165666).

Note: This is a factory calibration. Check blade positions first before proceeding with a recalibration. Install alignment tool if not already in place (see Illustration 96 and Illustration 97). Position IDD at Min SID. Touch the VERIFY softkey. Unit will proceed to Step 4, Verification. Verify blade positions. If not correct return to Step 1 and perform recalibration.

3 CAL PROCEDURE

3-1 Step 1. Initial Setup

- Upon entering the unit the Collimator Transverse and SLOW softkeys are the default jog functions on the console screen.
- Verify that the alignment tool is installed. If not, install.
- Position IDD at minimum SID. Maintain in position. Any drift in position, will produce errors in the calibration data. IDD locks are not active.
- Use hand, foot or IDD expose switch to take X–rays. Touch FOV softkey to select appropriate MAG mode for fine adjustment.
- If collimator blades are not centered about the small box on the alignment tool, repeat P009.
- Touch the VERIFY softkey after fluoroing to proceed to Step 4 to check calibration before performing a full calibration.
- Touch the NEXT STEP softkey after fluoroing to proceed to Step 2 to begin calibration.
- Touch the NEXT STEP softkey before fluoroing to enter viewing mode. Viewing mode allows the service personnel to cycle through the displays without doing a calibration.

Illustration 96 – Alignment Tool 2165666

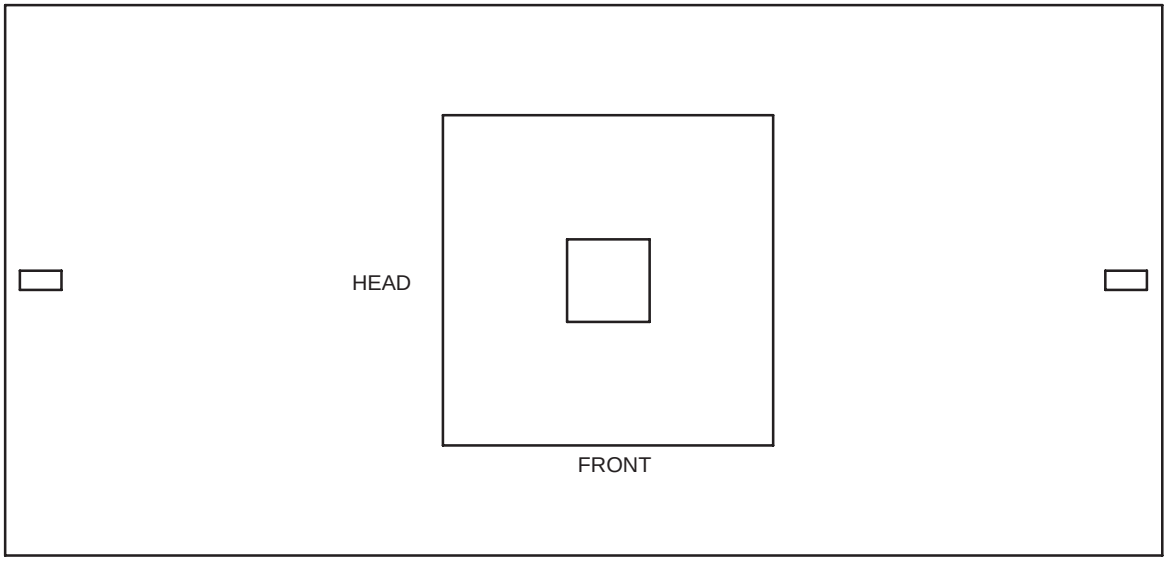
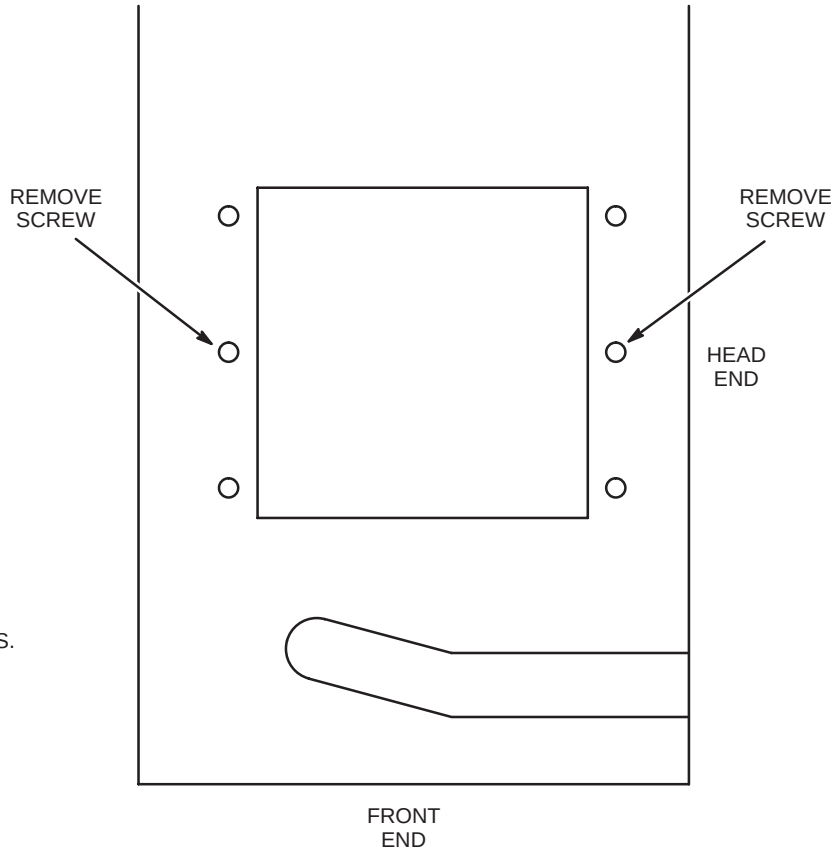


Illustration 97 – Alignment Tool Installation

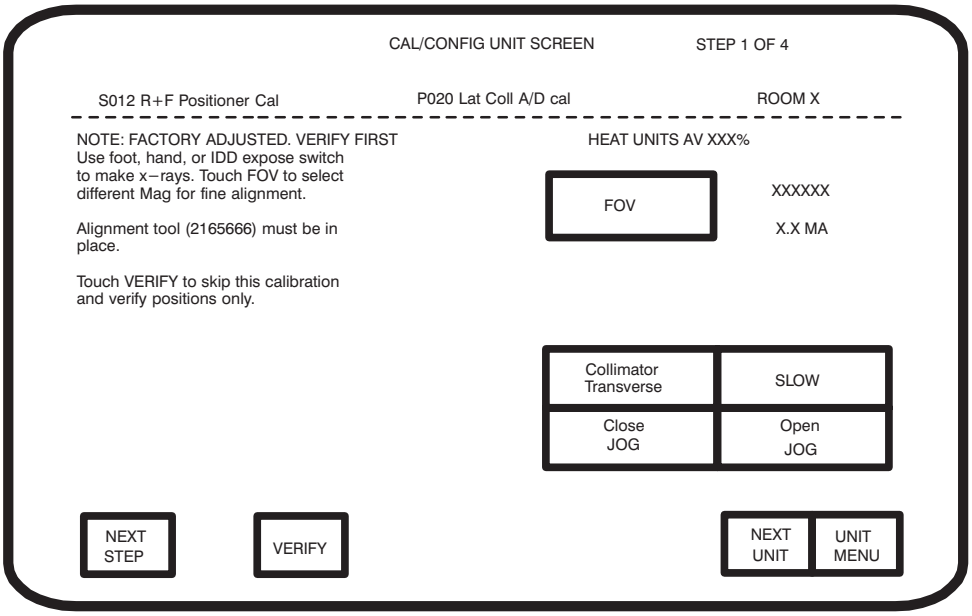


REMOVE THE INDICATED SCREWS. MOUNT THE ALIGNMENT TOOL TO THESE HOLES USING THE LONG SCREWS FROM THE IDD GRASP HANDLES.

ALIGNMENT TOOL IS MARKED WITH HEAD AND FRONT ORIENTATION.

BOTTOM VIEW OF IDD

P020 STEP 1 SCREEN DISPLAY



3-2 Step 2. Set Transverse Collimator Blade to Closed Position

- Use the jog softkeys on the console to move the transverse collimator blades until they just touch the left and right outside edges of the small box on the alignment tool. See Illustration 98.

Note: Always jog the collimator blades from the outside toward the center to avoid tolerance problems.

- Touch POSITION 1 softkey to enter the calibration value into memory.
- Touch the NEXT STEP softkey to proceed to Step 3.

P020 STEP 2 SCREEN DISPLAY

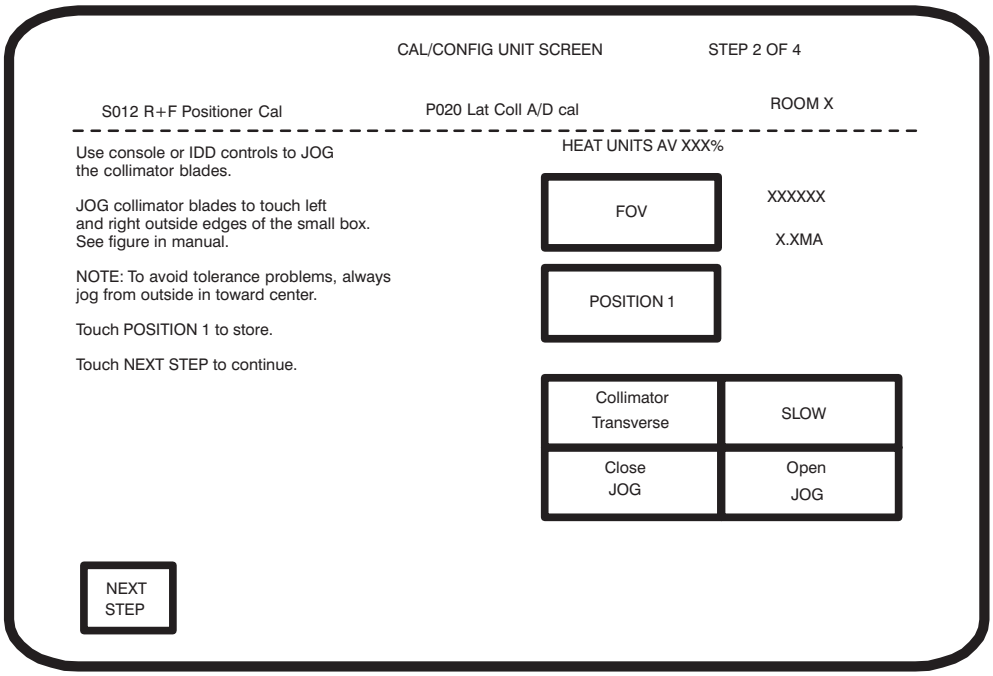
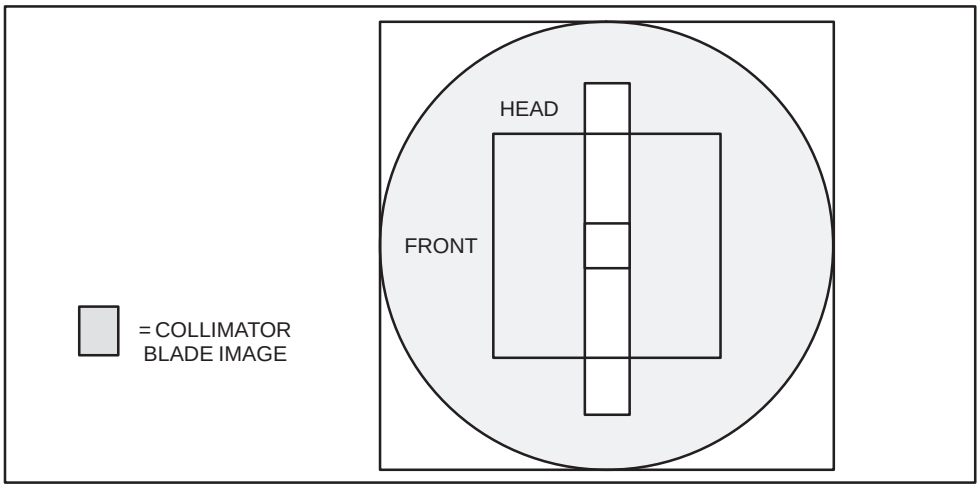


Illustration 98 – P020 Step 2 Test Pattern



3-3 Step 3. Set Transverse Collimator Blade to Open Position

- Use the jog softkeys on the console to move the transverse collimator blades until they just touch the left and right outside edges of the large box on the alignment tool. See Illustration 99.

Note: Always jog the collimator blades from the center toward the outside to avoid tolerance problems.

- Touch POSITION 2 softkey to enter the calibration value into memory.
- Touch the NEXT STEP softkey to proceed to Step 4.

P020 STEP 3 SCREEN DISPLAY

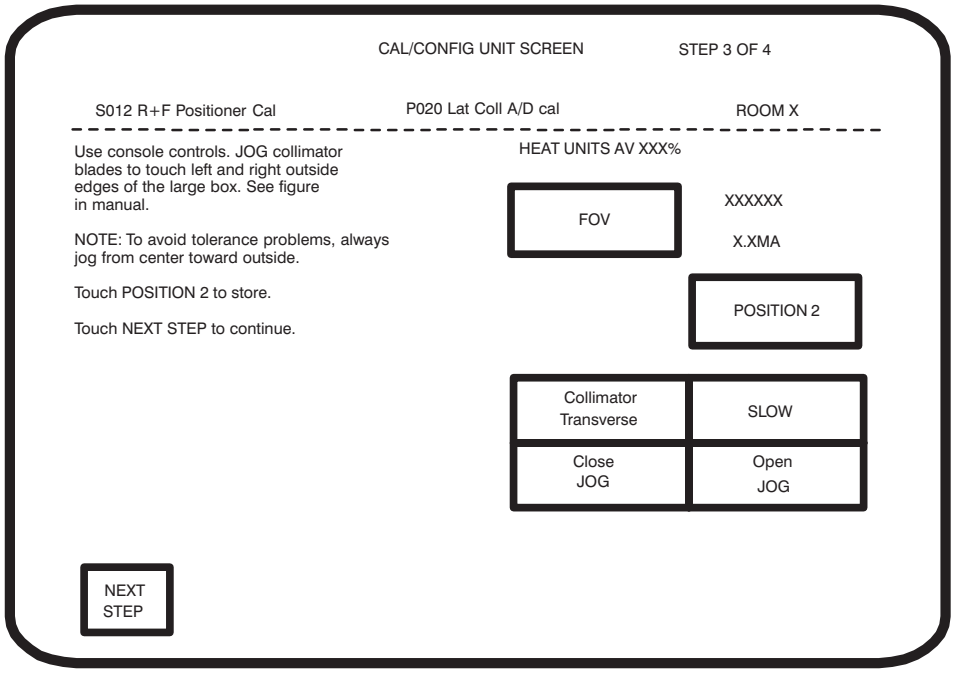
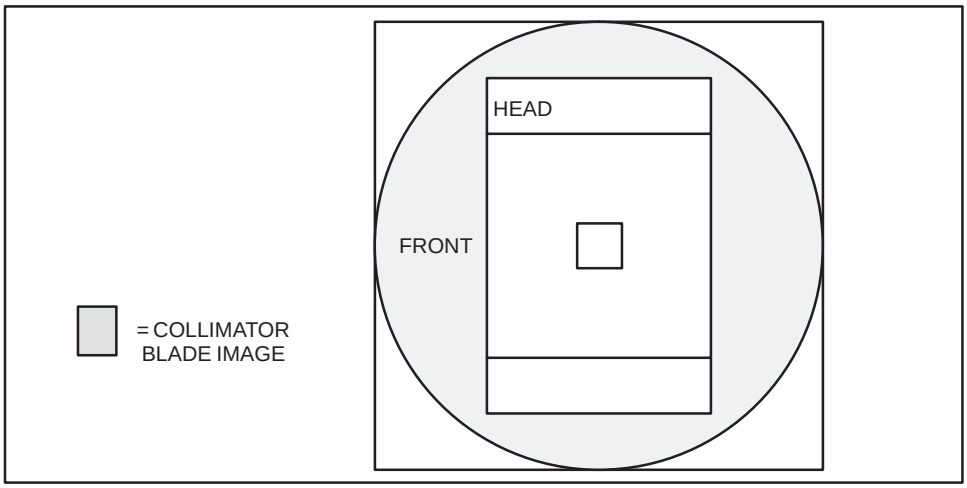


Illustration 99 – P020 Step 3 Test Pattern



3-4 Step 4. Verify Calibration

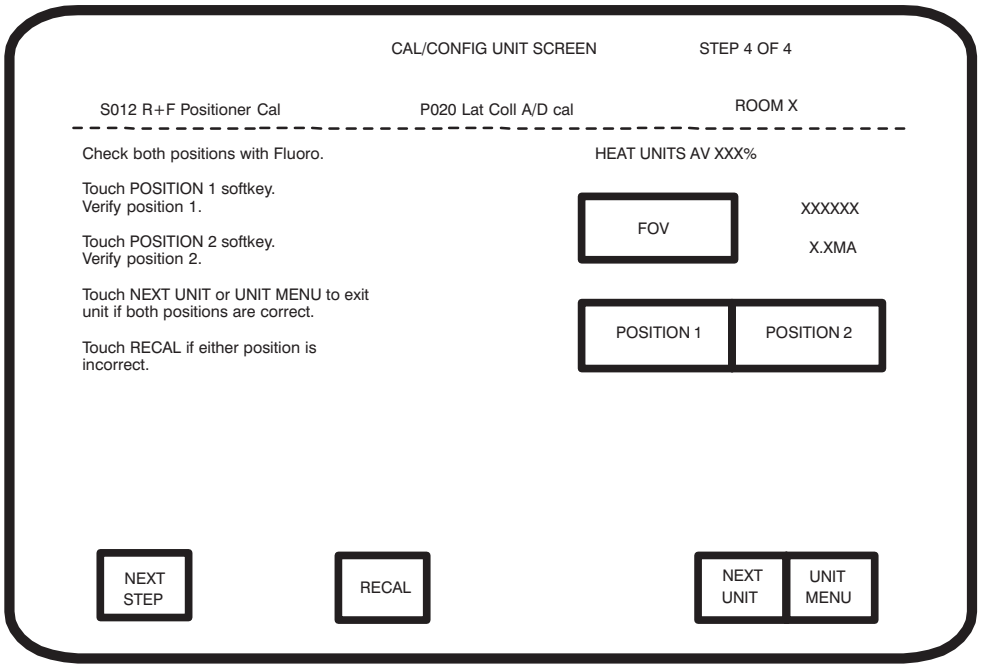
- Take and maintain a fluoro exposure.
- Touch POSITION 1 softkey and verify that the collimator blades move to the correct **closed position** (collimator blades just touch the left and right outside edges of the small box).
- Touch POSITION 2 softkey and verify that the collimator blades move to the correct **open position** (collimator blades just touch the left and right outside edges of the large box)**.**
- If both positions are correct, touch NEXT UNIT or UNIT MENU softkey to exit the calibration unit. An “Updating NV database” message is displayed while the position data is being loaded into the system.

OR

- If one position or both positions are incorrect, touch RECAL softkey and repeat the calibration.

Note: **Note:** The NEXT STEP softkey is used to return to Step 1 when in the viewing (browse) mode.

P020 STEP 4 SCREEN DISPLAY



UNIT P021 – Longitudinal Collimator A/D Calibration
Procedure 1: ISFD (Intelligent Spot Film Device) Configuration

Time: x h xx min – Personnel: 1 field engineer

1 DESCRIPTION

Calibration Unit P021 is used to perform Longitudinal collimator blade A/D Calibration. Four steps are required to accomplish the calibration. A screen display is provided for each step.

Note: This is a factory calibration. Insert test cassette if not already in place. Touch the VERIFY softkey on the Step 1 screen to proceed to Step 4, Verification. Check blade positions before proceeding with a recalibration.

2 EQUIPMENT REQUIRED

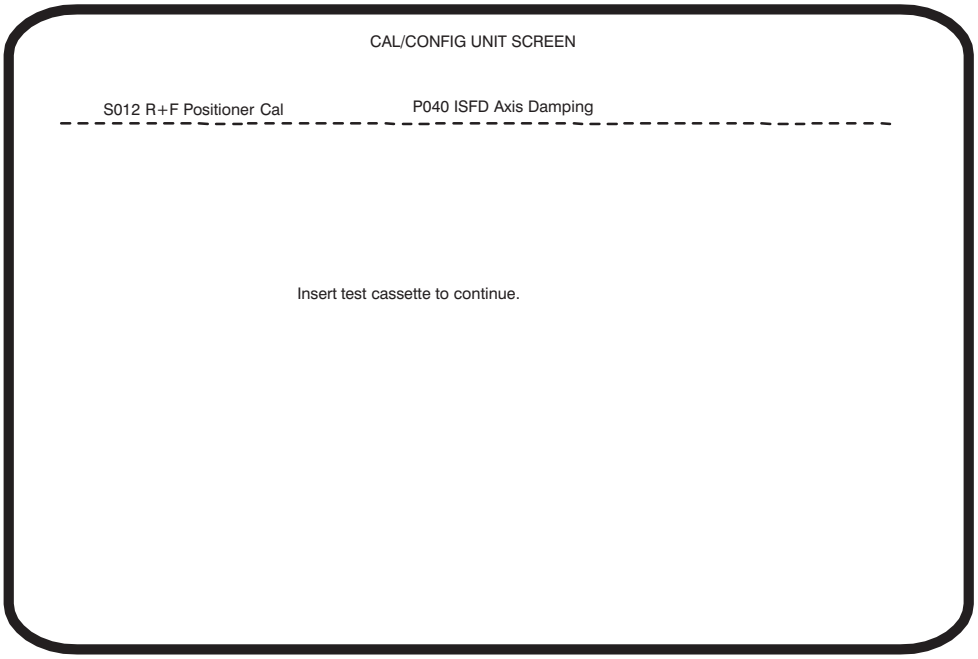
Test cassette (P/N 2129776), and alignment washer (P/N 46–262350P1).

3 CAL PROCEDURE

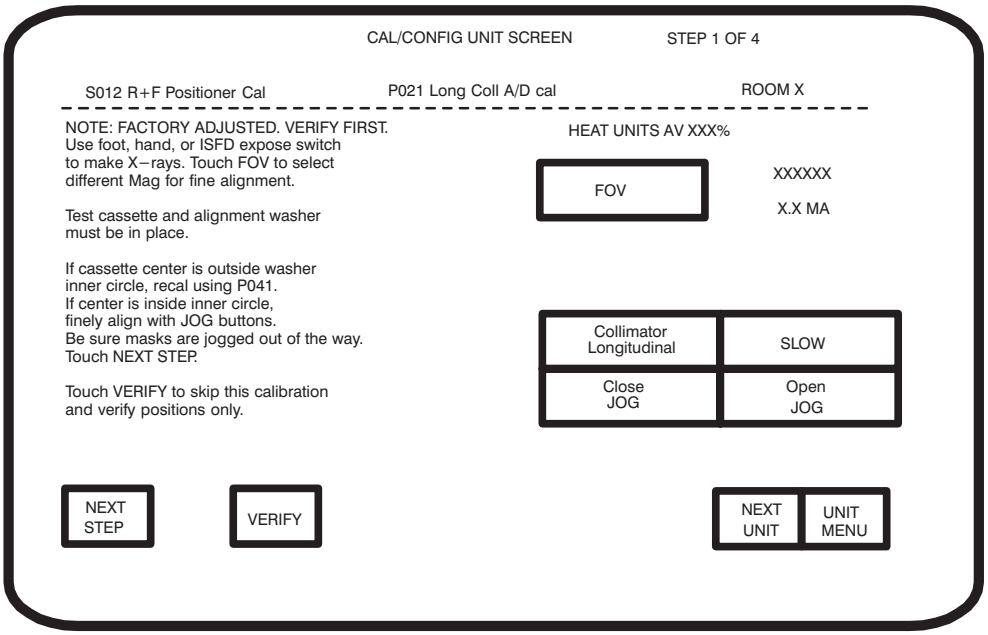
3-1 Step 1. Center Test Cassette Position

- Upon entering the unit the Collimator Longitudinal and SLOW softkeys are the default jog functions on the console screen.
- Verify that test cassette is in place in ISFD and that alignment washer is centered on ISFD window. If not, install.
- Position ISFD at minimum SID. Maintain in position. Any drift in position, will produce errors in the calibration data. ISFD locks are not active.
- For proper visualization of collimator limits, ensure that variable mask is moved out of the field of view.
- Use hand, foot or ISFD expose switch to take X–rays. Touch FOV softkey to select appropriate MAG mode for fine adjustment.
- If the test cassette center is OUTSIDE the alignment washer inner circle, repeat Calibration Unit P041, ISFD Cassette Position Cal.
- If test cassette center is INSIDE the alignment washer inner circle, make a fine adjustment with the JOG softkeys.
- Touch the VERIFY softkey after fluoroing to proceed to Step 4 to check cassette positions before performing a full calibration.
- Touch the NEXT STEP softkey after fluoroing to proceed to Step 2 to begin calibration.
- Touch the NEXT STEP softkey before fluoroing to enter viewing mode. Viewing mode allows the service personnel to cycle through the displays without doing a calibration.

P021 INITIAL SCREEN DISPLAY



P021 STEP 1 SCREEN DISPLAY



3-2 Step 2. Set Longitudinal Collimator Blade to Closed Position

- Use the jog softkeys on the console to move the longitudinal collimator blades until they just touch the top and bottom outside edges of the graticule between crosses in quadrants 2, 3, and 1, 4 of the test cassette pattern. See Illustration 100.

Note: Always jog the collimator blades from the outside toward the center to avoid tolerance problems.

- Touch POSITION 1 softkey to enter calibration value into memory.
- Touch the NEXT STEP softkey to proceed to Step 3.

P021 STEP 2 SCREEN DISPLAY

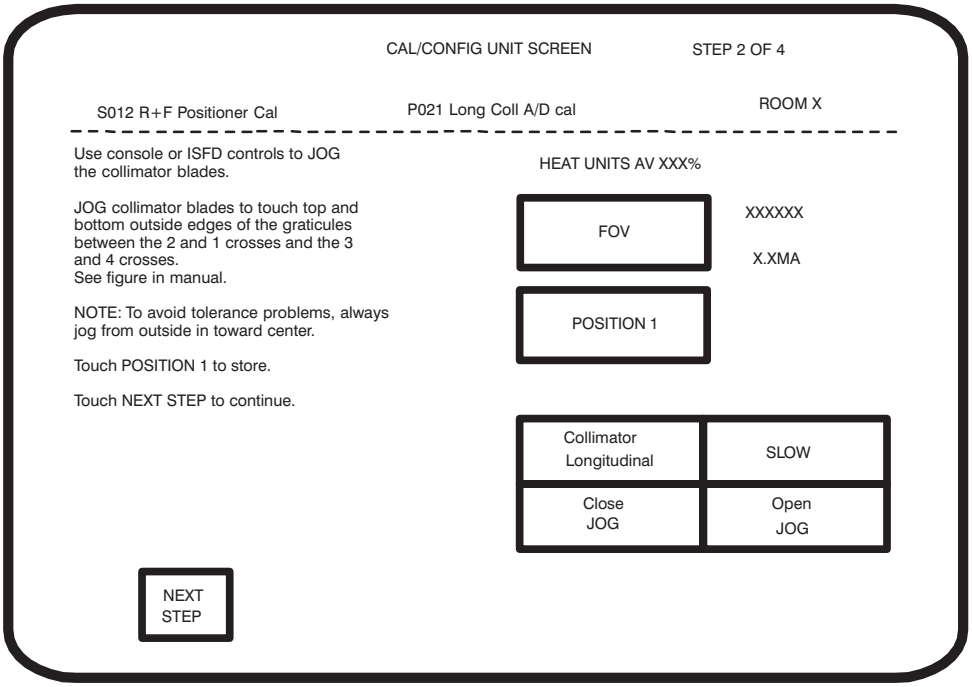
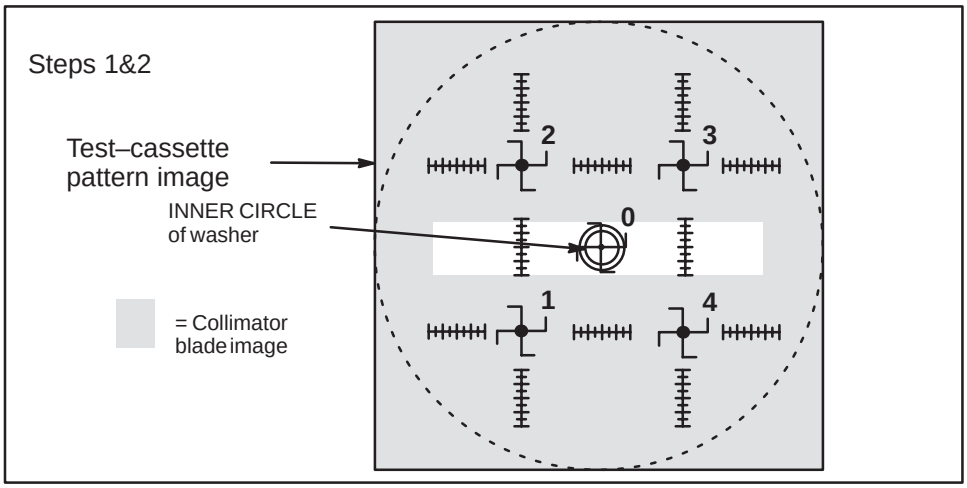


Illustration 100 – P021 Step 1 and 2 Test Pattern



3-3 Step 3. Set Longitudinal collimator Blade to Open Position

- Use the jog softkeys on the console to move the collimator blades until they just touch the top and bottom outside edges of the crosses in quadrants 2, 3, and 1, 4 of the test cassette pattern. See Illustration 101.

Note: Always jog the collimator blades from the center toward the outside to avoid tolerance problems.

- Touch POSITION 2 softkey to enter the calibration value into memory.
- Touch the NEXT STEP softkey to proceed to Step 4.

P021 STEP 3 SCREEN DISPLAY

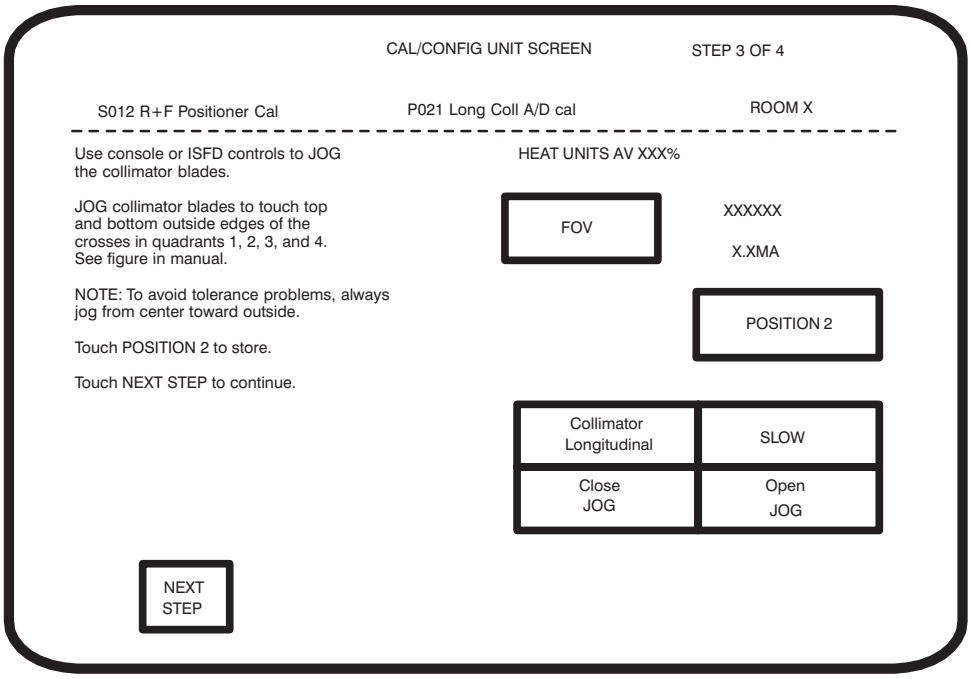
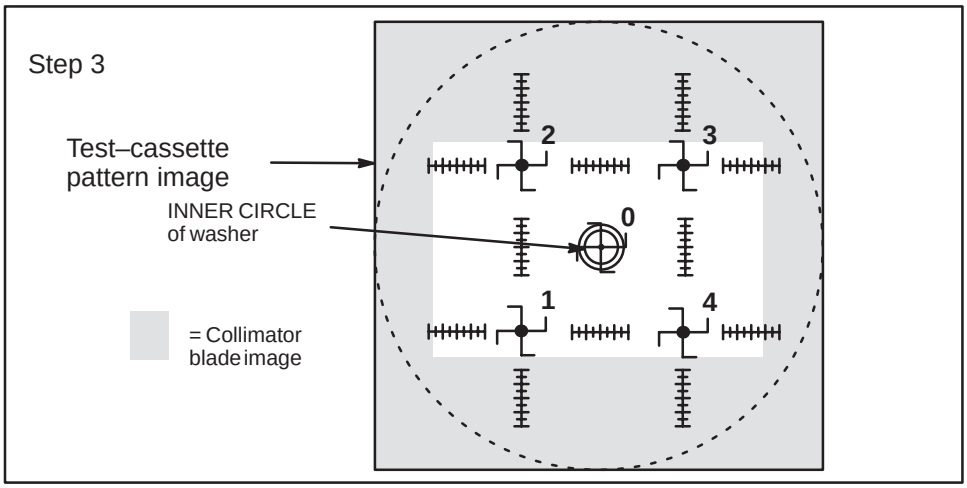


Illustration 101 – P021 Step 3 Test Pattern



3-4 Step 4. Verify Calibration

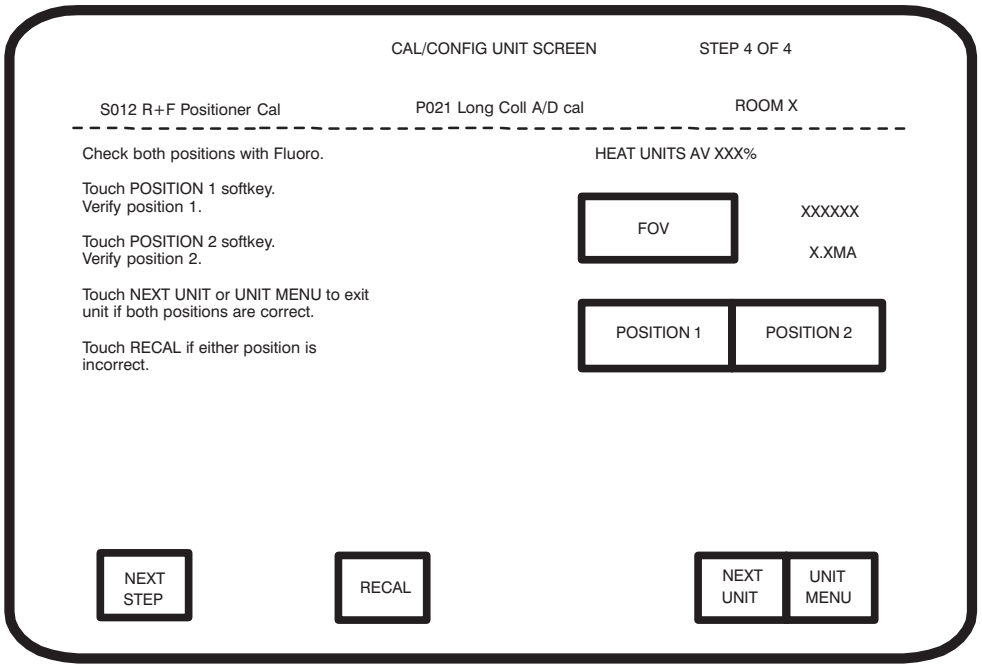
- Take and maintain a fluoro exposure.
- Touch POSITION 1 softkey and verify that the collimator blades move to the correct **closed position** (collimator blades just touch the top and bottom outside edges of the graticule between crosses in quadrants 2, 3, and 1, 4 of the test cassette pattern).
- Touch POSITION 2 softkey and verify that the collimator blades move to the correct **open position** (collimator blades just touch the top and bottom outside edges of the graticule between crosses in quadrants 2, 3, and 1, 4 of the test cassette pattern).
- If both positions are correct, touch NEXT UNIT or UNIT MENU softkey to exit the calibration unit. An “Updating NV database” message is displayed while the position data is loaded into the system.

OR

- If one position or both positions are incorrect, touch RECAL softkey and repeat the calibration.

Note: The NEXT STEP softkey is used to return to Step 1 when in the viewing (browse) mode.

P021 STEP 4 SCREEN DISPLAY



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UNIT P021 – Longitudinal Collimator A/D Calibration
Procedure 2: IDD (Intelligent Digital Device) Configuration

Time: x h xx min – Personnel: 1 field engineer

1 DESCRIPTION

Calibration Unit P021 is used to perform Longitudinal collimator blade A/D Calibration. Four steps are required to accomplish the calibration. A screen display is provided for each step.

Note: This is a factory calibration. Install alignment tool (2165666) if not already in place (see Illustration 102 and Illustration 103). Touch the VERIFY softkey on the Step 1 screen to proceed to Step 4, Verification. Check blade positions before proceeding with a recalibration.

2 EQUIPMENT REQUIRED

Alignment tool (P/N 2165666).

3 CAL PROCEDURE

3-1 Step 1. Initial Setup

- Upon entering the unit the Collimator Longitudinal and SLOW softkeys are the default jog functions on the console screen.
- Verify that the alignment tool is installed. If not, install.
- Position IDD at minimum SID. Maintain in position. Any drift in position, will produce errors in the calibration data. IDD locks are not active.
- Use hand, foot or IDD expose switch to take X–rays. Touch FOV softkey to select appropriate MAG mode for fine adjustment.
- Loosen screws holding alignment tool. Using X–rays, longitudinally center the small box on the alignment tool to the longitudinal collimator blades.
- Touch the VERIFY softkey after fluoroing to proceed to Step 4 to check calibration before performing a full calibration.
- Touch the NEXT STEP softkey after fluoroing to proceed to Step 2 to begin calibration.
- Touch the NEXT STEP softkey before fluoroing to enter viewing mode. Viewing mode allows the service personnel to cycle through the displays without doing a calibration.

Illustration 102 – Alignment Tool 2165666

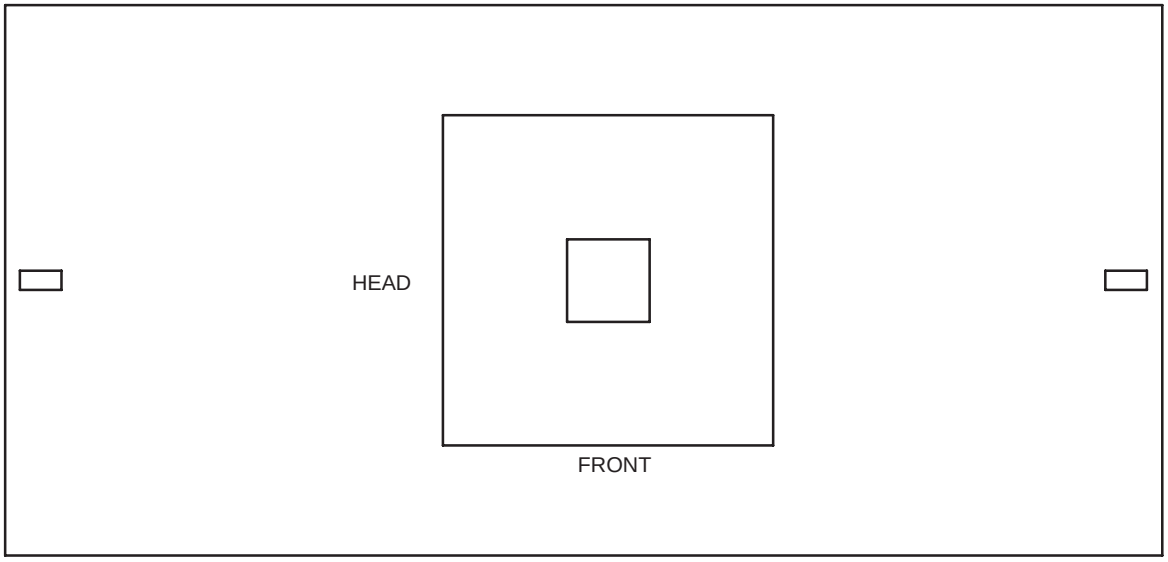
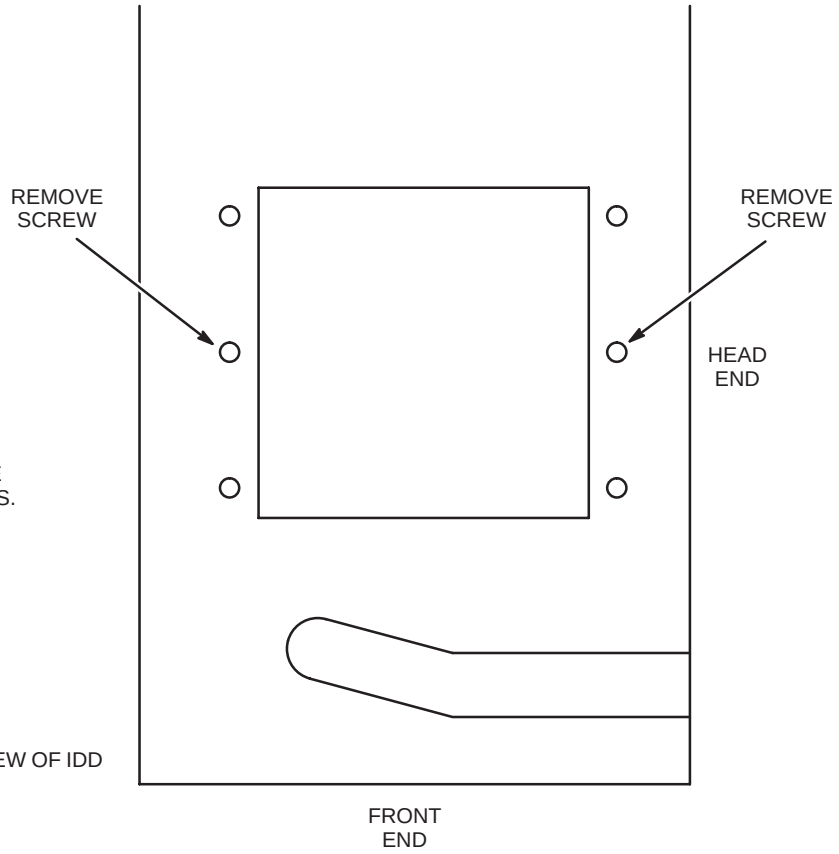


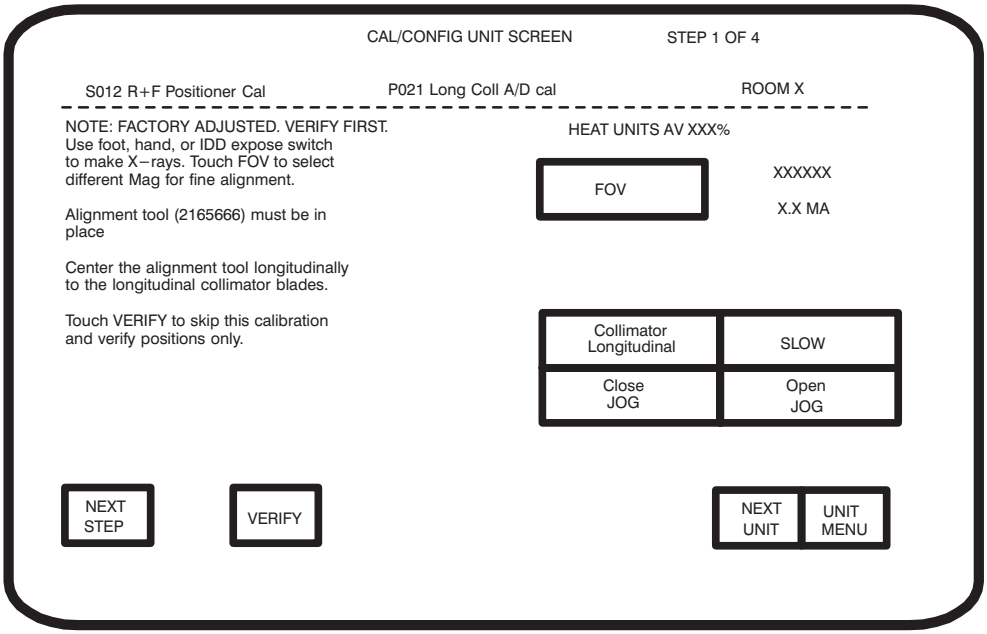
Illustration 103 – Alignment Tool Installation



REMOVE THE INDICATED SCREWS. MOUNT THE ALIGNMENT TOOL TO THESE HOLES USING THE LONG SCREWS FROM THE IDD GRASP HANDLES.

ALIGNMENT TOOL IS MARKED WITH HEAD AND FRONT ORIENTATION.

P021 STEP 1 SCREEN DISPLAY



3-2 Step 2. Set Longitudinal Collimator Blade to Closed Position

- Use the jog softkeys on the console to move the longitudinal collimator blades until they just touch the top and bottom outside edges of the small box of the alignment tool. See Illustration 104.

Note: Always jog the collimator blades from the outside toward the center to avoid tolerance problems.

- Touch POSITION 1 softkey to enter calibration value into memory.
- Touch the NEXT STEP softkey to proceed to Step 3.

P021 STEP 2 SCREEN DISPLAY

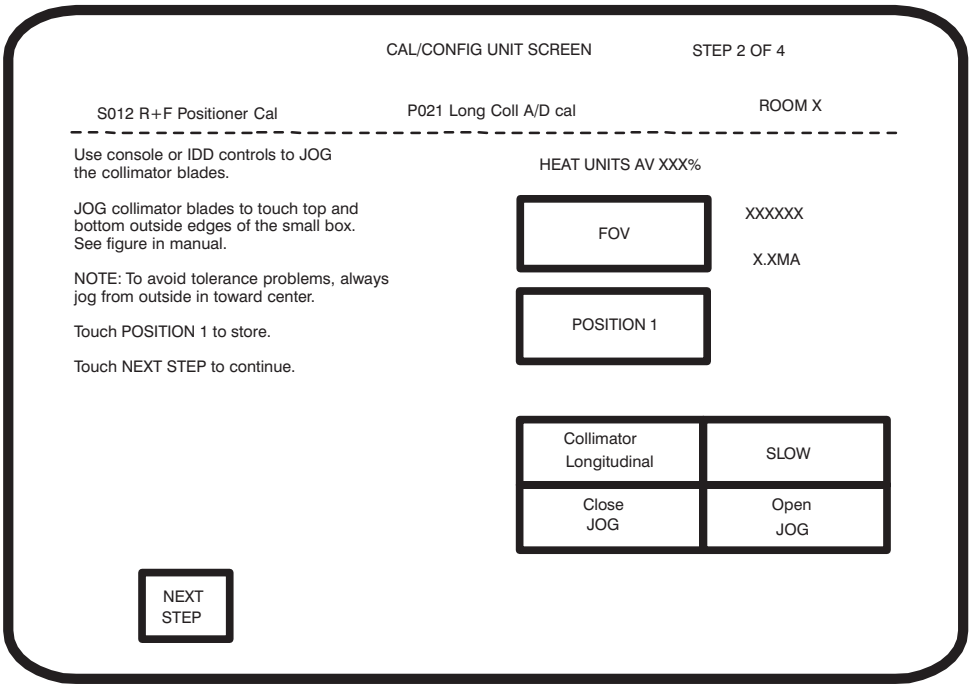
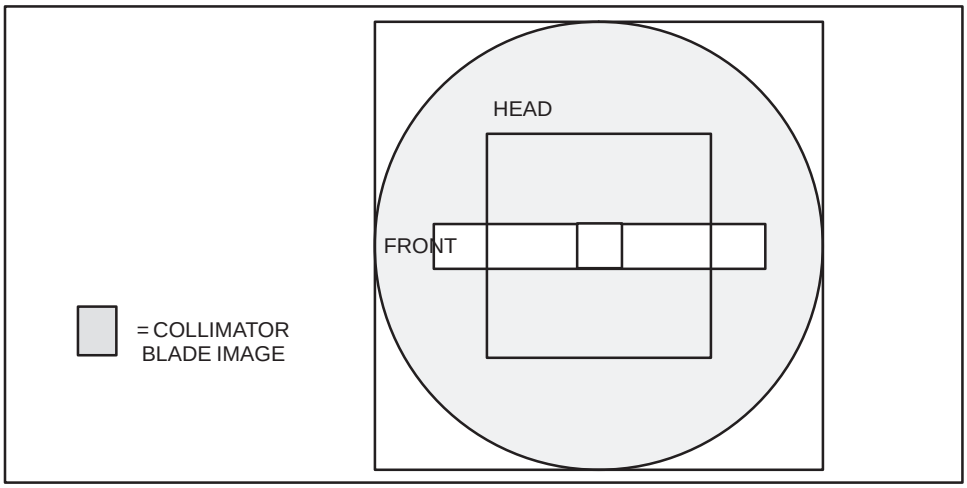


Illustration 104 – P021 Step 1 and 2 Test Pattern



3-3 Step 3. Set Longitudinal collimator Blade to Open Position

- Use the jog softkeys on the console to move the collimator blades until they just touch the top and bottom outside edges of the large box of the alignment tool. See Illustration 105.

Note: Always jog the collimator blades from the center toward the outside to avoid tolerance problems.

- Touch POSITION 2 softkey to enter the calibration value into memory.
- Touch the NEXT STEP softkey to proceed to Step 4.

P021 STEP 3 SCREEN DISPLAY

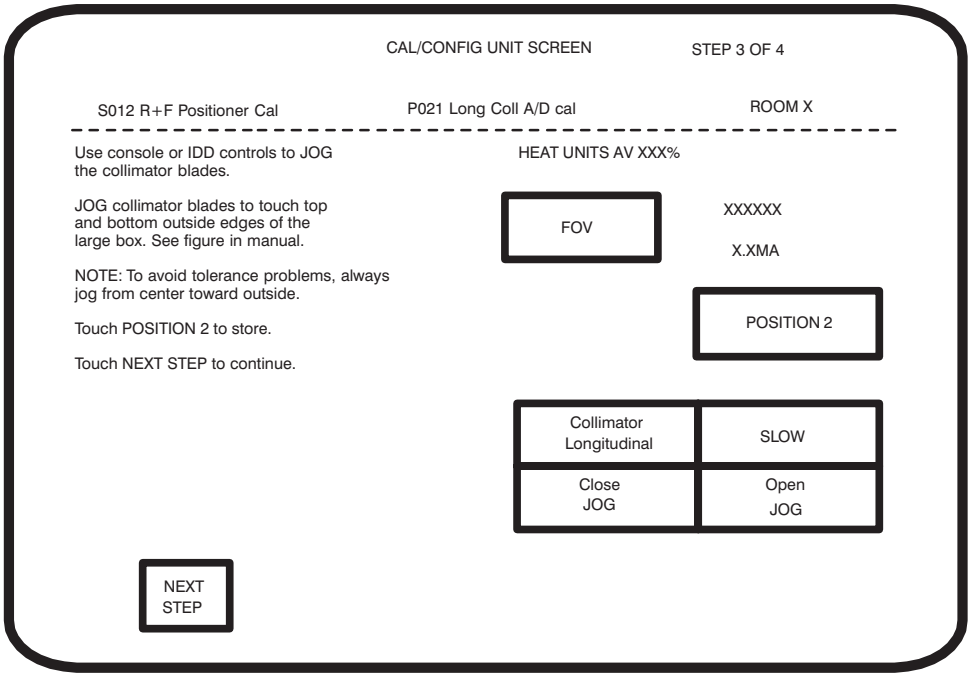
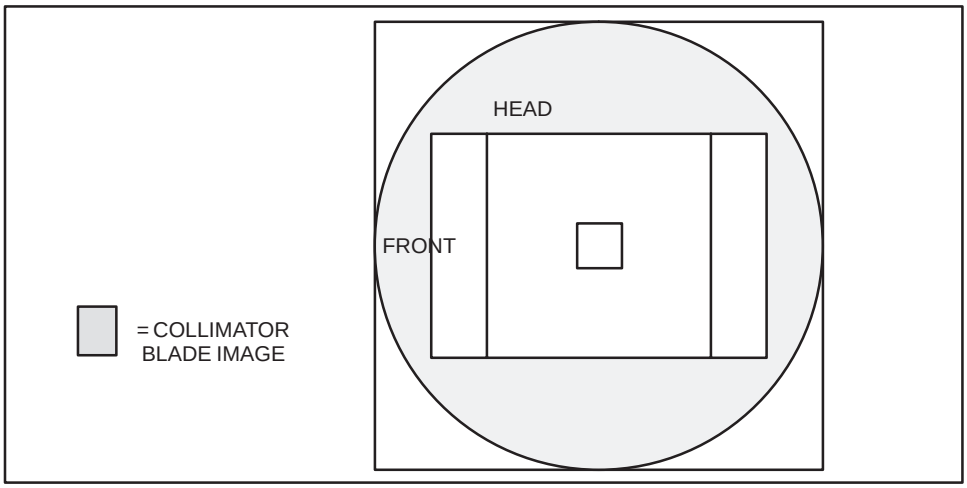


Illustration 105 – P021 Step 3 Test Pattern



3-4 Step 4. Verify Calibration

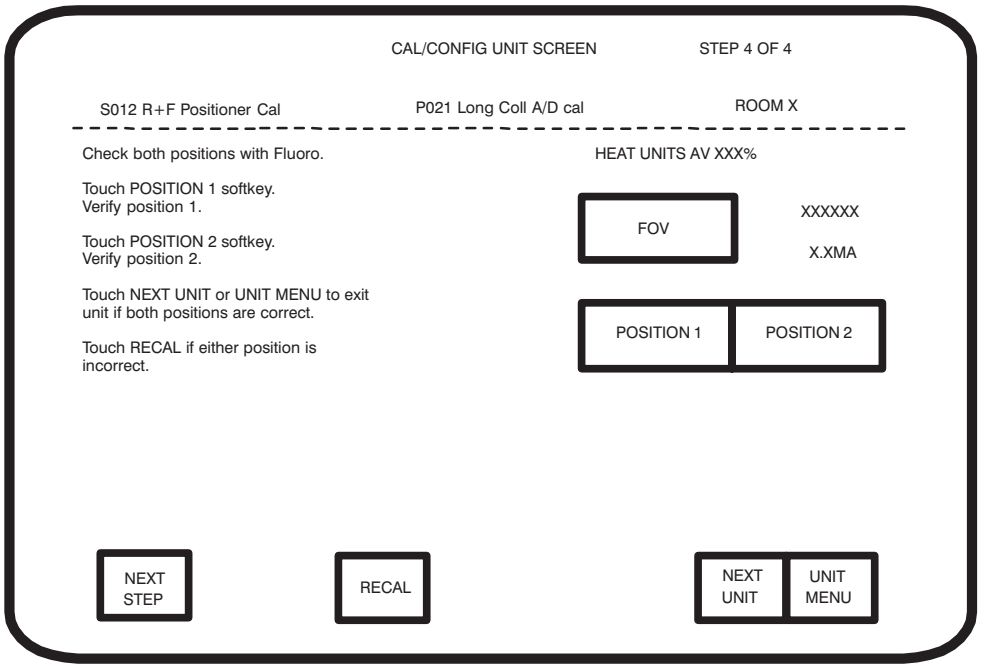
- Take and maintain a fluoro exposure.
- Touch POSITION 1 softkey and verify that the collimator blades move to the correct **closed position** (collimator blades just touch the top and bottom outside edges of the small box).
- Touch POSITION 2 softkey and verify that the collimator blades move to the correct **open position** (collimator blades just touch the top and bottom outside edges of the large box).
- If both positions are correct, touch NEXT UNIT or UNIT MENU softkey to exit the calibration unit. An “Updating NV database” message is displayed while the position data is loaded into the system.

OR

- If one position or both positions are incorrect, touch RECAL softkey and repeat the calibration.

Note: The NEXT STEP softkey is used to return to Step 1 when in the viewing (browse) mode.

P021 STEP 4 SCREEN DISPLAY



UNIT P023 – Table A/D Calibration

Time: x h xx min – Personnel: 1 field engineer

1 DESCRIPTION

Calibration Unit P023 is used to establish the A/D scale for the Trendelenburg and vertical positions of the table. Only one step is required to perform the calibration. The unit calibrates both non-stepping and stepping tabletop configurations.

Note: The Table A/D is factory adjusted. Check positions in Cal Unit P025, P029 or Applications before proceeding with a recalibration.

2 EQUIPMENT REQUIRED

Protractor level, masking tape, grease pencil.



Automatic tabletop limits are not active. Do not overdrive table or damage to the tabletop may occur by hitting the floor or other type of obstruction.

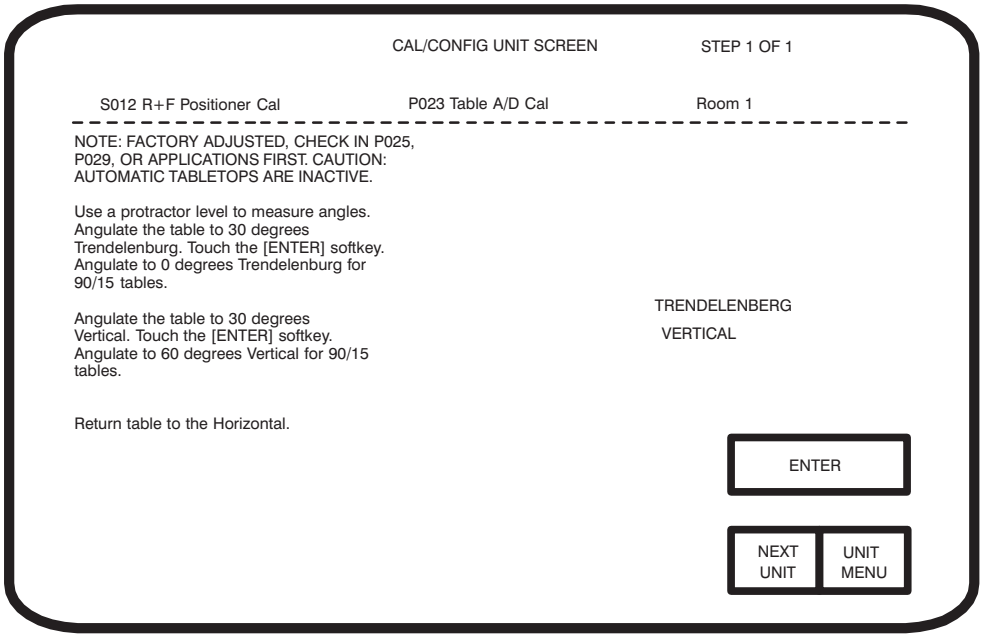
3 CAL PROCEDURE – SET A/D SCALE AND OFFSET.

- Measure 42 inches (1066 mm) from the head end of the table and mark the measurement on the table top using masking tape and a pencil. Make matching mark on table side rail to establish center mark (Rail Center).
- Drive table to center mark.

Note: If the system is configured with an 90/15 Table, substitute 0 degrees for the Trendelenburg position and 60 degrees for the vertical position.

- Using a protractor level to verify angle position, angulate the table to the 30 degree Trendelenburg position (0 degrees for 90/15 tables).
- Touch ENTER softkey.
- Angulate the table to the 30 degrees vertical position (60 degrees for 90/15 tables).
- Touch ENTER softkey.
- Return the table to the horizontal position and touch NEXT UNIT or UNIT MENU softkey to proceed to the next Cal Unit.

P023 SCREEN DISPLAY



UNIT P024 – Table Angle Calibration

Time: x h xx min – Personnel: 1 field engineer

1 DESCRIPTION

Calibration Unit P024 is used to set various angulation positions to establish angulation limits for the table. Under certain conditions, such as small rooms, the unit allows the set points to be further defined to avoid collisions during angulation. Only one screen step is required to perform the calibration. The unit covers the calibration of 90/90 tables, 90/30 tables, 90/45 tables and 90/15 tables. The appropriate unit screen will be automatically displayed according to the configuration installed. The unit calibrates both non-stepping and stepping tabletop configurations.

2 EQUIPMENT REQUIRED

Protractor level and chain block (Stepping Table only)



Automatic tabletop limits are not active. Do not overdrive table or damage to the tabletop may occur by hitting the floor or other type of obstruction.

3 CAL PROCEDURE – SET TABLE ANGULATION POSITIONS

3-1 Stepping and Non–stepping Tables

- Position table top on center mark.

Note: If the table angle positions have been previously calibrated, the console dial may be used to select any position for verification and/or recalibration.

- Use the console dial to select a position. Start at the first position indicated on the console screen if this is the first time the calibration unit is being run.
- Using the jog controls on the table and a protractor level to determine angulation, drive the table to the angle indicated for the position selected. The table must be positioned to within ± 1.0 degree of the angle indicated.

Note: If positions indicated cannot be obtained due to obstructions in the room, move the table to the closest safe position. Alternate positions can be used if necessary to match the table to the room geometry. Allow 1–2 degrees in Applications for stopping position.

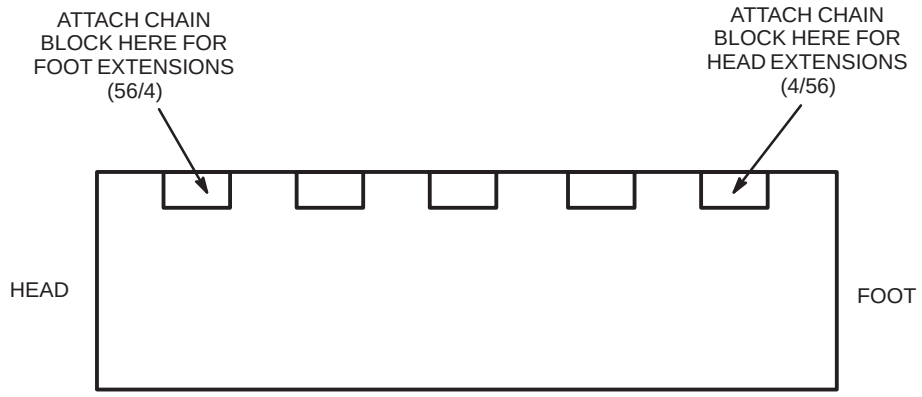
- Touch the ENTER softkey.
- If this is the first time the unit is being run, repeat the procedure for each of the remaining positions indicated on the console screen.
- After all angulation positions have been entered or verified, return the table to the horizontal position and center mark.
- If the table being calibrated is a non–stepping table top, touch NEXT UNIT or UNIT MENU softkey to exit and proceed to the next calibration unit. If the table being calibrated is a stepping table top, proceed as follows:

3-2 Stepping Table Top Only

- Attach a chain block to the tabletop as appropriate to the table extension desired (foot extension or head extension). See Illustration 106. The chain block will permit the tabletop to be fully extended (foot or head extension to 56 inches (1422 mm).
- Extend the table to 56 inches (1422 mm) and install the footrest on the extended end.

CAUTION **Do not calibrate with a table extension greater than 56 inches (1422 mm) or overtravel may occur which will allow the table top to be driven to the mechanical limits.**

Illustration 106 – Stepping Table Chain Block Location



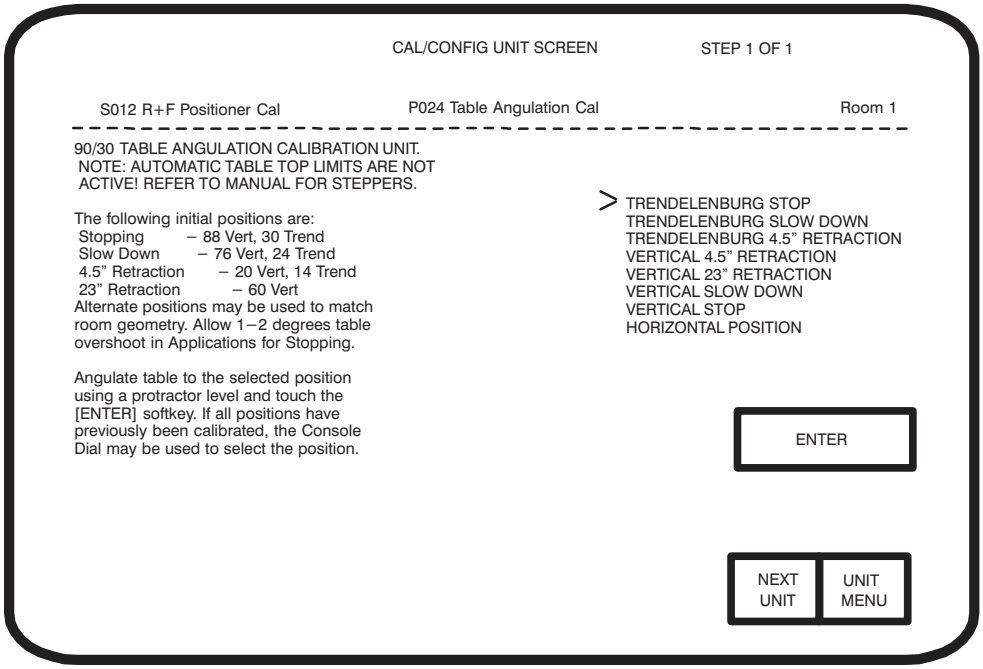
- With the tabletop extended in the desired direction (foot or head extension), recalibrate the 23 inch retraction angulation according to the table type/extension/angle positions indicated in Table 33. Use the table jog controls and a protractor to position the table to the appropriate angle, then, touch ENTER softkey.

Table 33 – Stepping Table Angulation

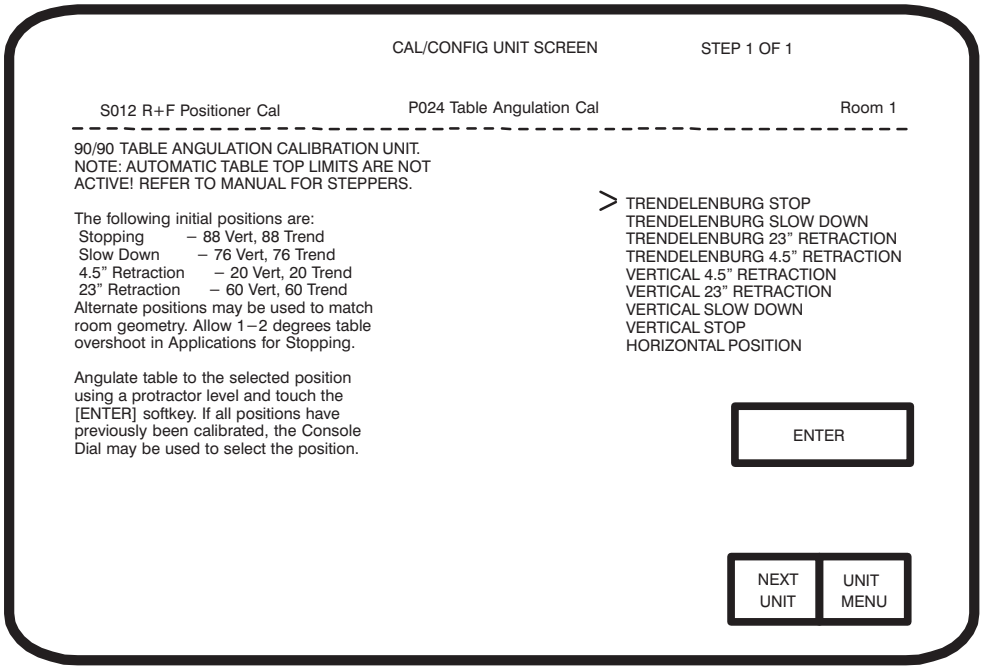
TABLE TYPE	FOOT EXTENSIONS	HEAD EXTENSIONS
SFX 15	20 VERT, N/A	15 TREND, 60 VERT
SFX 30	20 VERT, 30 TREND	15 TREND, 60 VERT
SFX 90	20 VERT, 60 TREND	20 TREND, 60 VERT
RFX 45	20 VERT, 30 TREND	20 TREND, 60 VERT
RFX 90	20 VERT, 60 TREND	20 TREND, 60 VERT

- After the appropriate stepping top angulation positions have been entered, touch NEXT UNIT or UNIT MENU softkey to exit.

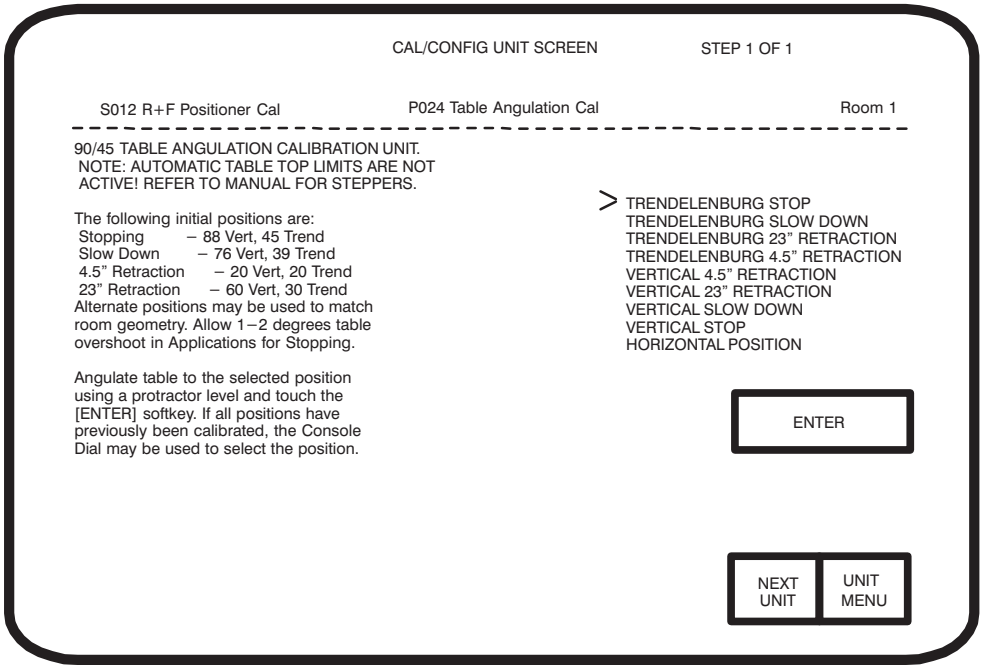
P024 90/30 TABLE SCREEN DISPLAY



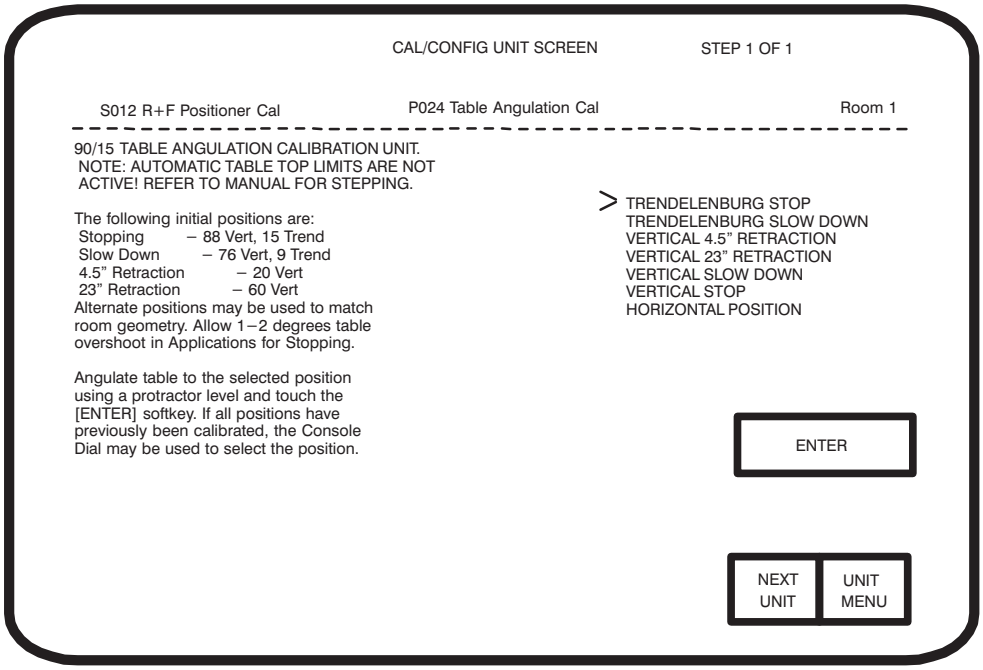
P024 90/90 TABLE SCREEN DISPLAY



P024 90/45 TABLE SCREEN DISPLAY



P024 90/15 TABLE SCREEN DISPLAY



UNIT P025 – Film Border Calibration

Time: x h xx min – Personnel: 1 field engineer

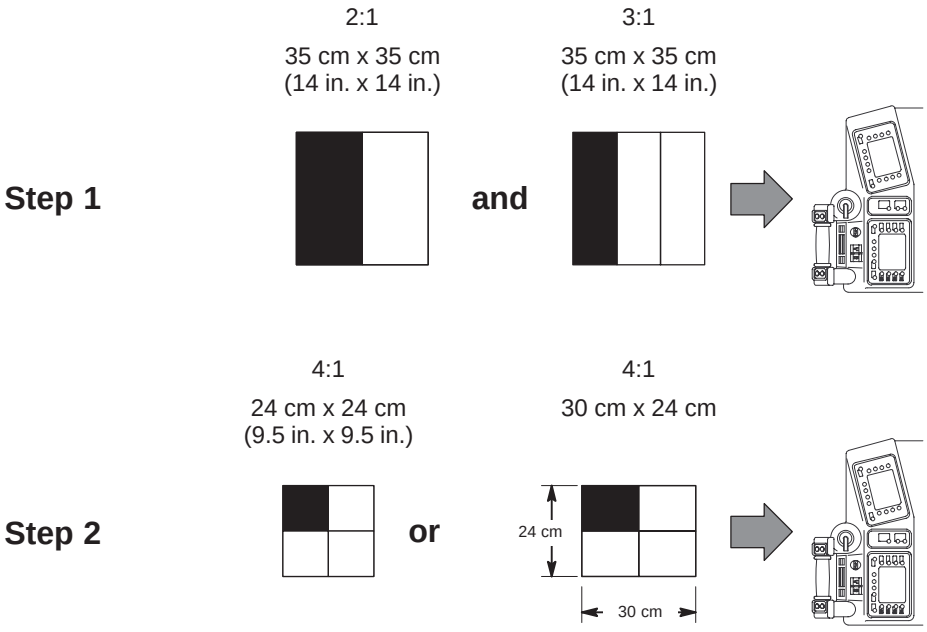
1 DESCRIPTION

Calibration Unit P025 performs Film Border Calibration. The calibration unit uses a fixed exposure technique of 80 kVp, 50 mA, 50 msec. Four steps are required to accomplish the calibration. A screen display is provided for each step. Step 1 exposes two 35 cm x 35 cm (14 in. x 14 in.) film cassettes and then measures the borders of a 2:1 and 3:1 film format. Step 2 exposes a 24 cm x 24 cm (9.5 in. x 9.5 in.) or a 30 cm x 24 cm film cassette with 4:1 format. Step 3 measures the 4:1 format and makes adjustments if necessary. Step 4 is a verification step.

See Illustration 107 for film orientation.

Note: This is a factory calibration. Verify first before re-calibrating.

Illustration 107 – P025 Cassette Orientation



2 SPECIAL INSTRUCTIONS

The following special instructions apply to the running of this unit.

- The fixed technique used in this cal unit was established by using a 400 film/screen system with 1/4” aluminum and 1/32” copper from the CV phantom. With the SFD at maximum SID, film density should be close; adjust filtration as necessary. At minimum SID you will have to add additional filtration (i.e. Plexiglas).

3 EQUIPMENT REQUIRED

Cassettes:

- Two 24 cm x 24 cm (9.5 in. x 9.5 in.), or two 30 cm x 24 cm
- Two 35 cm x 35 cm (14 in. x 14 in.)

Film (as used at the site)

Filtration (from CV Phantom):

- 1/4 inch aluminum
- 1/32 inch copper
- Plexiglas (various thicknesses)

4 CAL PROCEDURE

4-1 Step 1. Expose 35 cm x 35 cm (14 in. x 14 in.) Film Cassettes

- Insert a film loaded 35 cm x 35 cm (14 in. x 14 in.) cassette into the SFD.



- Select FULL FORMAT and set the system to minimum SID.
- Touch the CASSETTE READY softkey. When the CASSETTE READY softkey is activated, the unit automatically sets the system to a 2:1 format and the fixed technique parameters are displayed on the console screen.

Note: If the NEXT STEP softkey is pressed instead of the CASSETTE READY softkey, viewing (browse) mode will be entered. This will allow the service personnel to cycle through the P025 unit screens without doing a calibration by pressing the NEXT STEP softkey.

- Place filtration on table top. Use appropriate amount of filtration to give a film density of 1.2 to 1.5 using the fixed exposure technique.
- Take two exposures and remove cassette.

Note: To avoid introducing an error when setting up film borders, ensure that the cassette returns to the park position between exposures.

- Insert the second film loaded 35 cm x 35 cm (14 in. x 14 in.) cassette into the SFD.
- Touch the CASSETTE READY softkey to set the system to a 3:1 format.
- Take three exposures and remove cassette.
- Set the system to maximum SID.
- Repeat taking 2:1 and 3:1 films at maximum SID.
- Develop the films in all four cassettes.
- Check borders of the films for sharpness (no fuzziness) and size (Illustration 109).

- If the borders are acceptable, touch NEXT STEP softkey to proceed to Step 2.

OR

- If borders are not acceptable, check for the following conditions:

  1. Fuzzy Borders: Either x–ray tube alignment or improper adjustment of the collimator A/D calibration can cause the collimator, rather than the SFD mask, to define the edges of the x–ray field. Refer to Illustration 108, Inset A and B. If the borders are fuzzy, exit the unit and repeat Calibration Unit P020, Lateral Collimator A/D Cal. Then, repeat Calibration Unit P025.

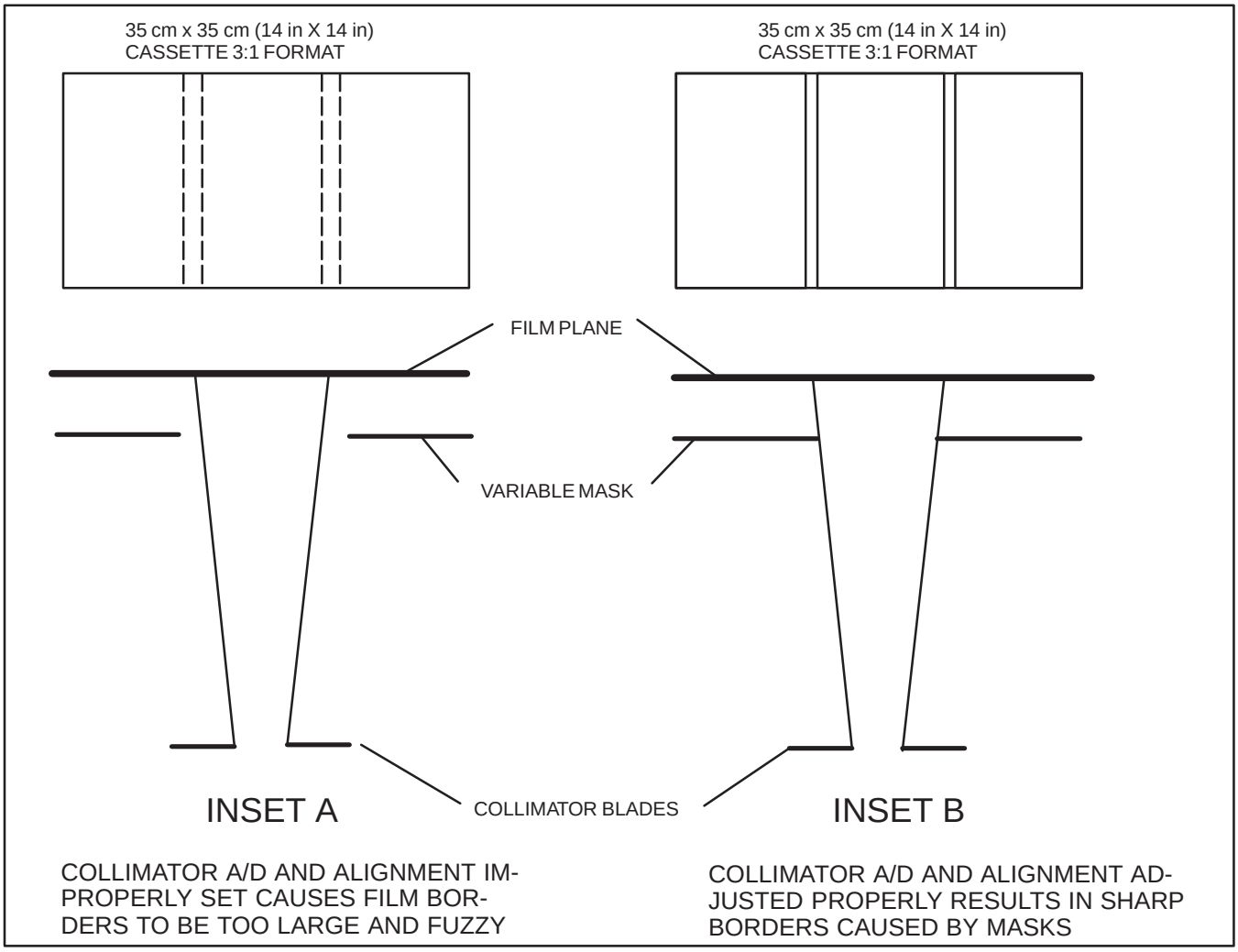
     Partly Fuzzy Borders: Collimator blades not parallel to the variable mask may cause just a portion of the film border edge to be fuzzy. This will also cause spot–to–spot misalignment in 6:1 and 9:1 mini–spot borders. Slight rotation of the collimator (taking advantage of mounting screw clearance hole tolerances) solves this problem.

  2. If borders on the 2:1 format are not equal to the borders on the 3:1 format or they overlap, repeat Cal Unit P039, SFD Gain Entry. Then, repeat P025.

  3. If both borders on the 3:1 format are not of equal size, exit the unit and repeat Calibration Unit P041, SFD Cassette Position Cal, to make borders of equal size. Then, repeat Calibration Unit P025.

Note: Final borders are adjusted during 4:1 calibration (24 cm x 24 cm [9.5 in. x 9.5 in.] or a 30 cm x 24 cm cassette).

Illustration 108 – P025, Collimator – Mask Relationship to Film Borders



P025 STEP 1 SCREEN DISPLAY

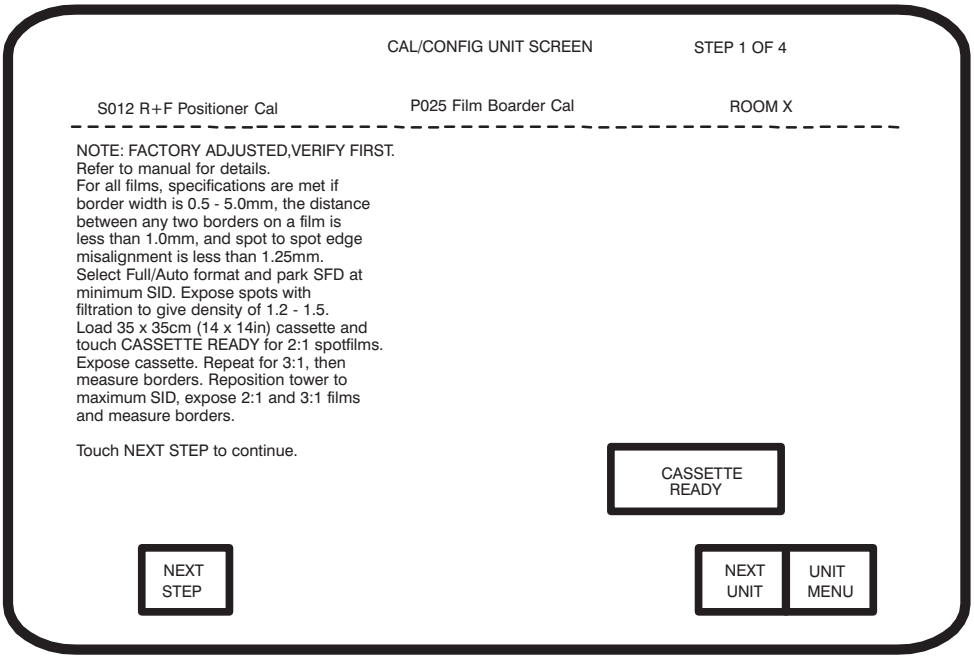
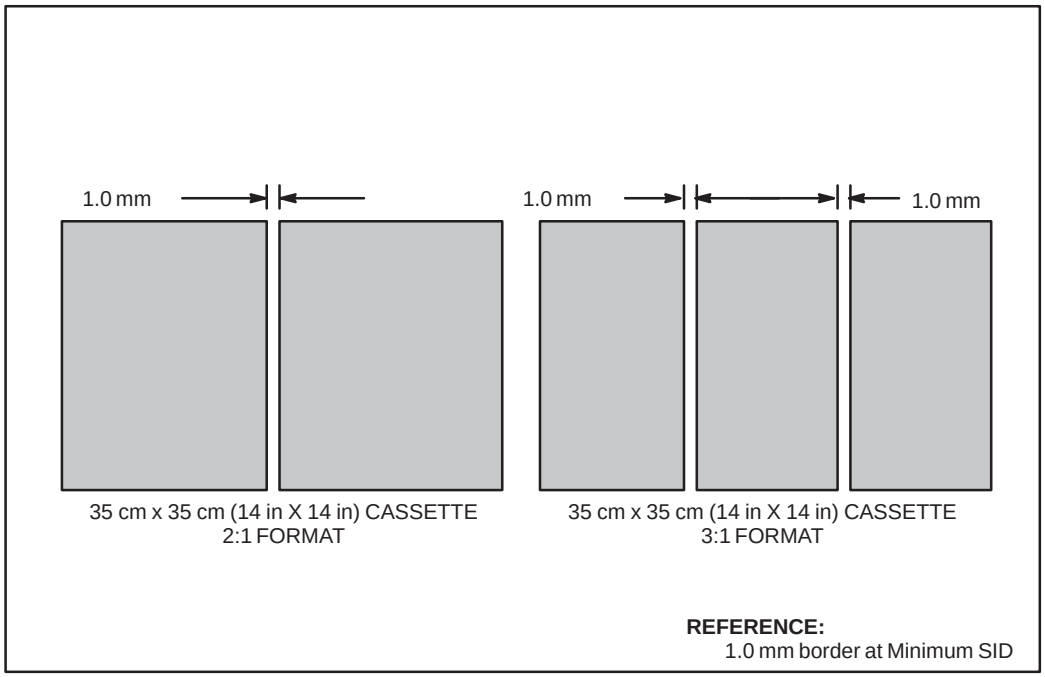


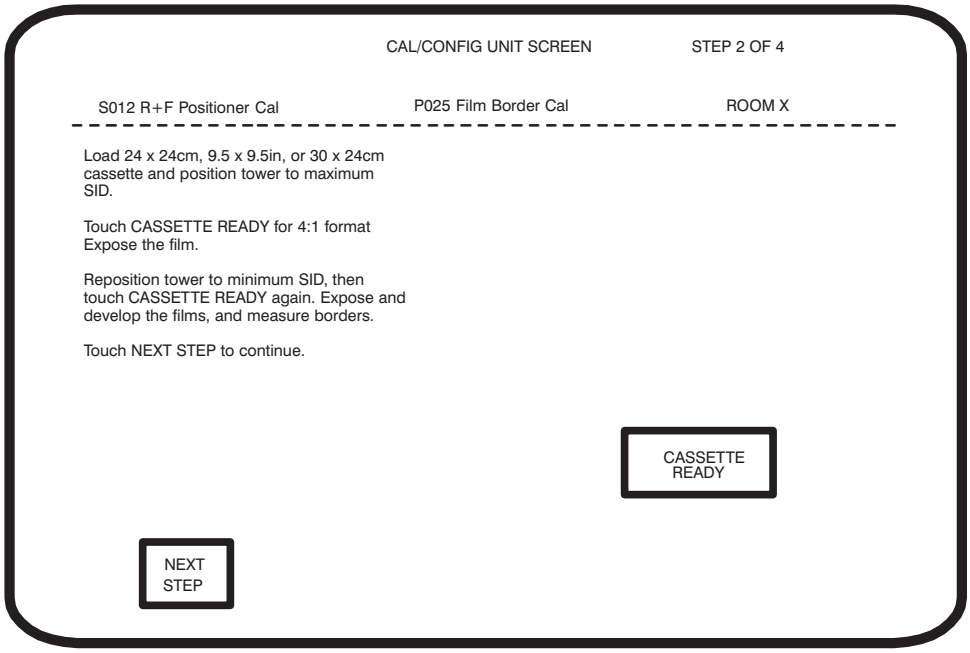
Illustration 109 – P025, Step 1, Film Border Measurement



4-2 Step 2. Expose 24 cm x 24 cm (9.5 in x 9.5 in) or 30 cm x 24 cm Film Cassette

- Insert a film loaded with either a 24 cm x 24 cm (9.5 in x 9.5 in) or a 30 cm x 24 cm cassette into the SFD.
- Set the system to maximum SID.
- Touch the CASSETTE READY softkey. When the CASSETTE READY softkey is activated, the unit automatically sets the system to a 4:1 film format and the fixed technique parameters are displayed on the console screen.
- Expose the film.
- Insert a film loaded with either a 24 cm x 24 cm (9.5 in x 9.5 in) or a 30 cm x 24 cm cassette into the SFD.
- Set the system to minimum SID.
- Touch the CASSETTE READY softkey. When the CASSETTE READY softkey is activated, the unit automatically sets the system to a 4:1 film format and the fixed technique parameters are displayed on the console screen.
- Expose the film.
- Develop the film.
- Measure borders.
- Touch NEXT STEP softkey to proceed to Step 3.

P025 STEP 2 SCREEN DISPLAY



4-3 Step 3. Measure 4:1 Film Borders

- Measure the inner borders of the film. See Illustration 110. The border width target dimension is 1.0 mm at minimum SID. If the borders are in spec, touch NEXT STEP softkey to proceed to Step 4.

OR

- If the borders are out of specification, touch the applicable border softkey (LAT BORDER and/or LONG BORDER) and use the console dial to enter a CHANGE. A positive change will increase the border size. A negative change will decrease the border size.
- Then, touch the RECAL softkey to return to Step 2. Repeat Step 2. to retake films.

P025 STEP 3 SCREEN DISPLAY

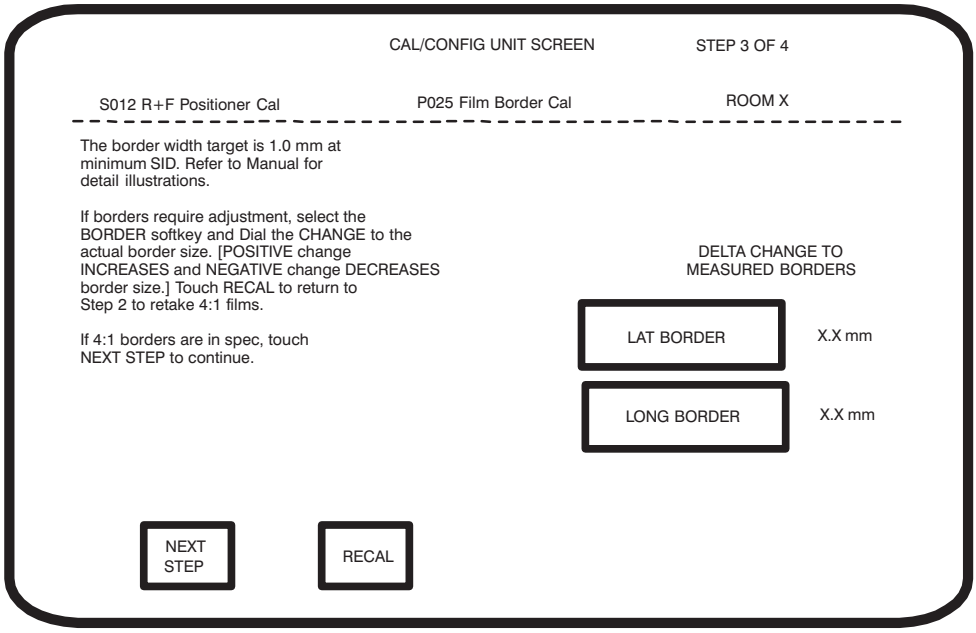
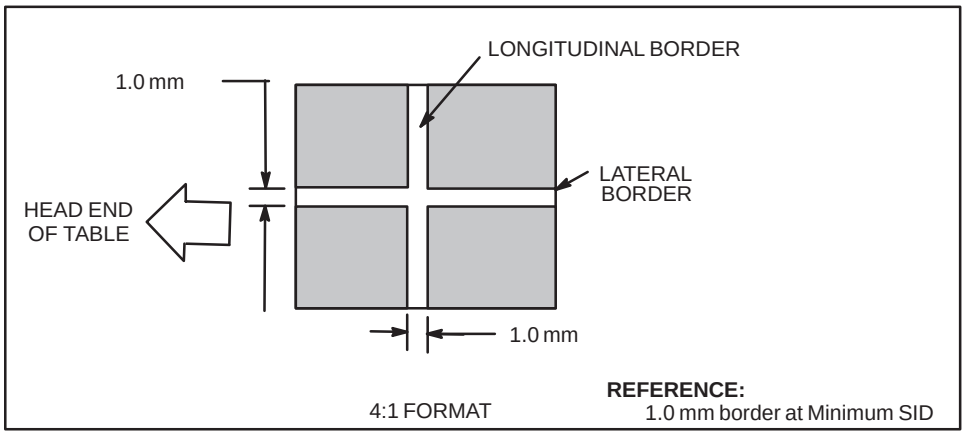


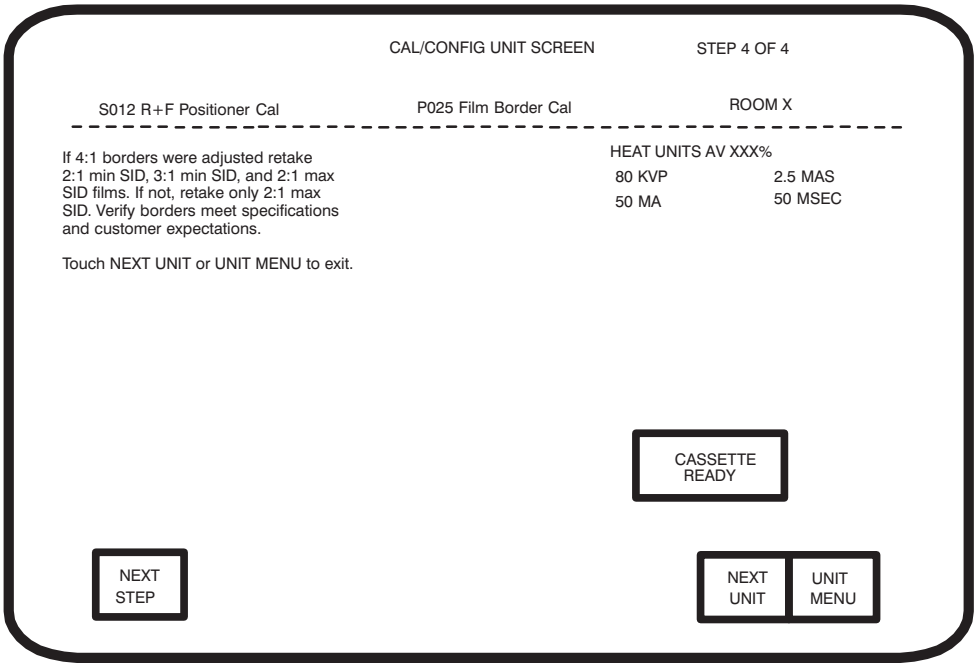
Illustration 110 – P025, Step 3, Film Border Measurement



4-4 Step 4. Verify Borders

- Verify border dimensions. For all films, specifications are met if the border is 0.5 to 5.0 mm, the distance between any two borders on a film is less than 1.0 mm, and spot to spot edge alignment is less than 1.25 mm. If the border dimensions still do not meet specification, repeat the entire calibration procedure.
- If the border dimensions meet specification, touch NEXT UNIT or UNIT MENU softkey to exit the calibration unit.

P025 STEP 4 SCREEN DISPLAY



UNIT P027 – Table Top Calibration

Time: x h xx min – Personnel: 1 field engineer

1 DESCRIPTION

Calibration Unit P027 is used to calibrate the longitudinal table top travel limits. The unit sets the positions for center, 4.5, 23, and 30 inches left and right of center. Only one screen step is required to perform the calibration. The unit calibrates both non–stepping and stepping table top configurations.

2 EQUIPMENT REQUIRED

Straight edge ruler, masking tape, grease pencil.

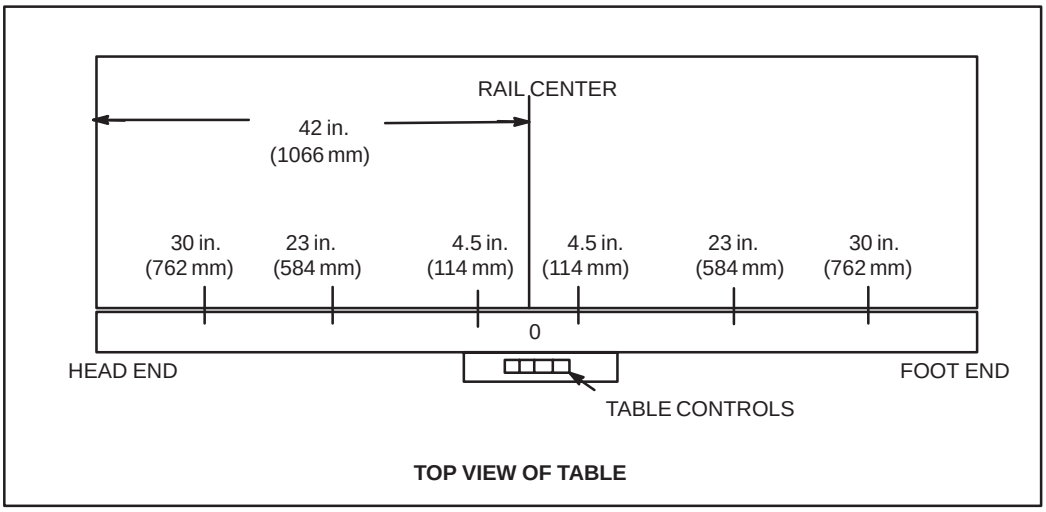
CAUTION **Automatic tabletop limits are not active. Do not overdrive table or damage to the tabletop may occur by hitting the floor or other type of obstruction.**

3 CAL PROCEDURE – SET TABLE TOP TRAVEL LIMITS

3-1 Non–Stepping Tables

- Measure 42 inches (1066 mm) from the head end of the table and mark the measurement on the table top using masking tape and a grease pencil. Make matching mark on table side rail to establish center mark (Rail Center). See Illustration 111.
- Measure and mark the tabletop at the following distances to the left (head end) of the center mark:
  4.5 inches (114 mm)
  23 inches (584 mm)
  30 inches (762 mm)
- Measure and mark the tabletop at the following distances to the right of the center mark:
  4.5 inches (114 mm)
  23 inches (584 mm)
  30 inches (762 mm)
- Use the table controls to drive the table to the center mark.

Illustration 111 – Non–Stepping Table Top Measurements



Note: If the table top longitudinal travel limits have been previously calibrated, the console dial may be used to select a position for verification and/or recalibration.

- Use the table controls to position the table top to the positions indicated on the screen. Touch the ENTER softkey at each position. The 4.5 inch and center position must be exact (center position for RFX tables only).
- If the extreme positions cannot be obtained due to obstructions in the room, modify the limits according to the following example:

EXAMPLE: 30 inch position – vertical angulation

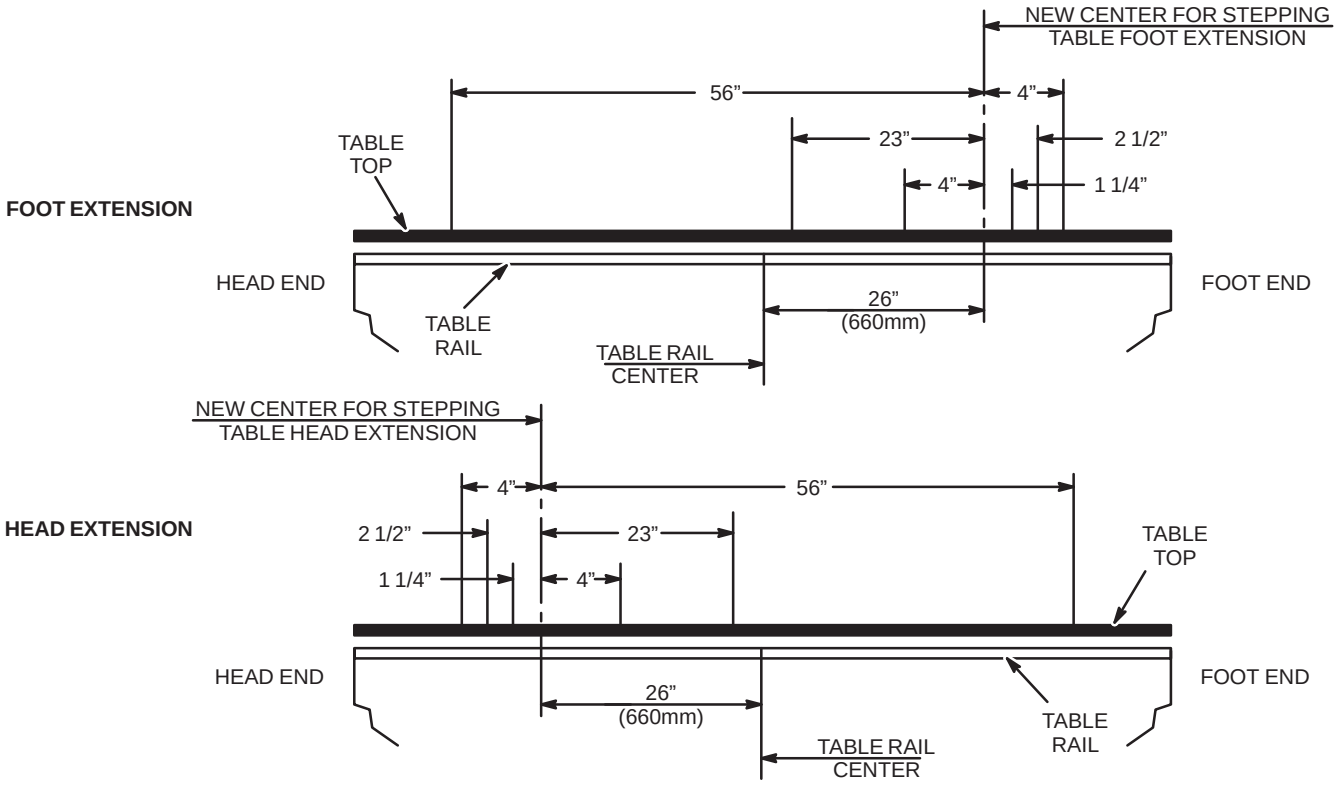
1. Drive tabletop left to 30 inch mark.
2. Slowly angulate table vertical and drive tabletop extension so that the tabletop will clear the obstruction by a minimum of 12 inches.
3. Measure distance from center position to 30 inch mark. Extension will be less than 30 inches. Use this distance when setting the 30 inch limit.

- After all table positions have been set, touch NEXT UNIT or UNIT MENU softkey to exit.

3-2 Stepping Tables

- Establish table rail center by measuring 42 inches (1066 mm) from head end of table. Mark with masking tape and a grease pencil.
- Locate and mark a stepping table top center by measuring 26 inches (660 mm) to the left or right (depending on foot or head extension) of the rail center mark established in the previous step. See Illustration 112.

Illustration 112 – Stepping Table Top Measurements



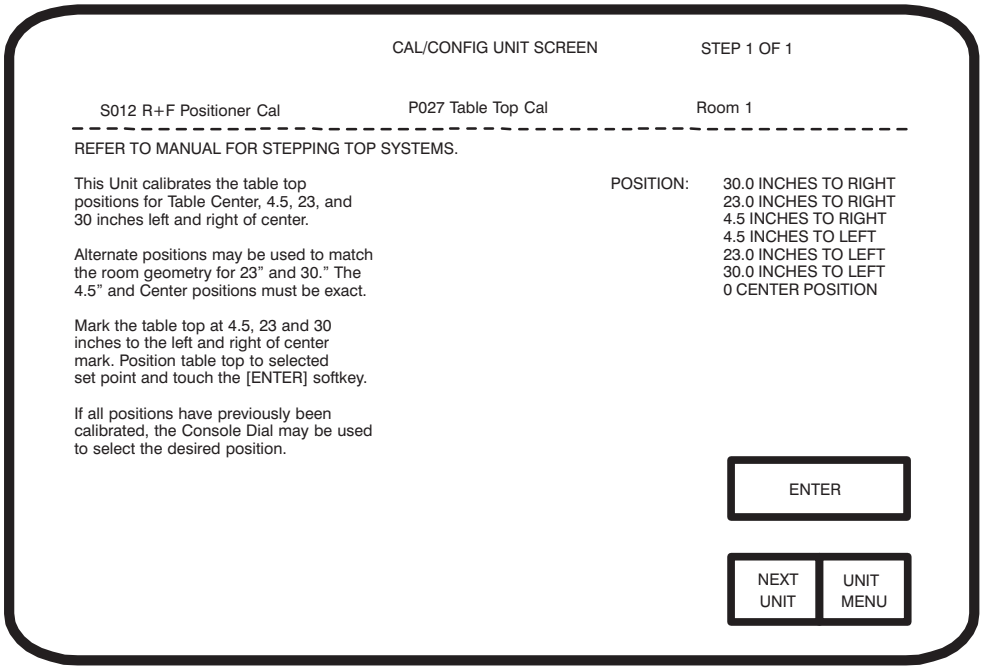
- Measure and mark the table top at the distances to the left and right of the stepping table top center mark indicated in Table 34 for either foot or head extension.
- Use the table controls to drive the table to the stepping table top center mark.
- Use the table controls to position the table top to the positions (foot or head extension) indicated in Table 34. Touch the ENTER softkey at each position.
- Check the table top retraction to ensure that the table will retract to clear floor and overhead obstructions. Re-adjust 23T or 23VT as required to clear obstructions.

Table 34 – Stepping Table Top Extension

CAL POSITIONS	FOOT EXTENSION INCHES (mm)	HEAD EXTENSION INCHES (mm)	COMMENTS
30 RT	56 (1422)	4.00 (102)	Max Extension Foot End
23 RT	23 (584)	2.50 (64)	Overhead Clearance Foot End
4.5 RT	4.5 (114)	1.25 (32)	Floor Clearance Foot End
CENTER	TOP CENTERED	TOP CENTERED	(RFX ONLY)
4.5 LEFT	1.25 (32)	4.5 (114)	Floor Clearance Head End
23 LEFT	2.50 (64)	23 (584)	Overhead Clearance Head End
30 LEFT	4.00 (102)	56 (1422)	Max Extension Head End

- Touch NEXT UNIT or UNIT MENU softkey to exit the unit.

P027 SCREEN DISPLAY



Note: A CENTER softkey is only displayed on the console screen if the system is configured with an RFX table.

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UNIT P029 – Film Border 9:1

Time: x h xx min – Personnel: 1 field engineer

1 DESCRIPTION

Calibration Unit P029 is used to calibrate 9:1 film border formats. The calibration is accomplished by adjusting the collimator blades to establish the exposed area on the film. The variable and adjustable masks are not used. The lateral and longitudinal borders are changed only by moving the cassette tray. The unit uses a fixed exposure technique (80 kVp, 50 mA, 50 msec). Two steps are required to accomplish the calibration.

Note: This is a factory calibration. Verify first before re-calibrating.

2 SPECIAL INSTRUCTIONS

The following special instructions apply to the running of this unit.

- The fixed technique used in this cal unit was established by using a 400 film/screen system with 1/4” aluminum and 1/32” copper from the CV phantom. With the SFD at maximum SID, film density should be close; adjust filtration as necessary. At minimum SID you will have to add additional filtration (i.e. Plexiglas).
- If any exposure fails, you must re–run the unit.

3 EQUIPMENT REQUIRED

Cassette:

- One 24 cm x 24 cm (9.5 in. x 9.5 in.), or one 30 cm x 24 cm

Film (as used at the site)

Filtration (from CV Phantom):

- 1/4 inch aluminum
- 1/32 inch copper
- Plexiglas (various thicknesses)

4 CAL PROCEDURE

4-1 Step 1. Expose Film

- Place filtration on table top. Use appropriate amount of filtration to give a film density of 1.2 to 1.5 using the fixed exposure technique. Remember that film density will increase at minimum SID vs. maximum SID because the technique is fixed, so adjust filtration accordingly to maintain density within spec.
- Place an object in the X–ray beam for latitude and longitude positional reference.
- Insert a film loaded 24 cm x 24 cm (9.5 in x 9.5 in) or a 30 cm x 24 cm cassette into the SFD.



- Select FULL FORMAT.
- Set the system to minimum SID.
- Touch the CASSETTE READY softkey. The unit sets up the 9:1 mini–spot format and the fixed exposure technique is displayed on the console screen

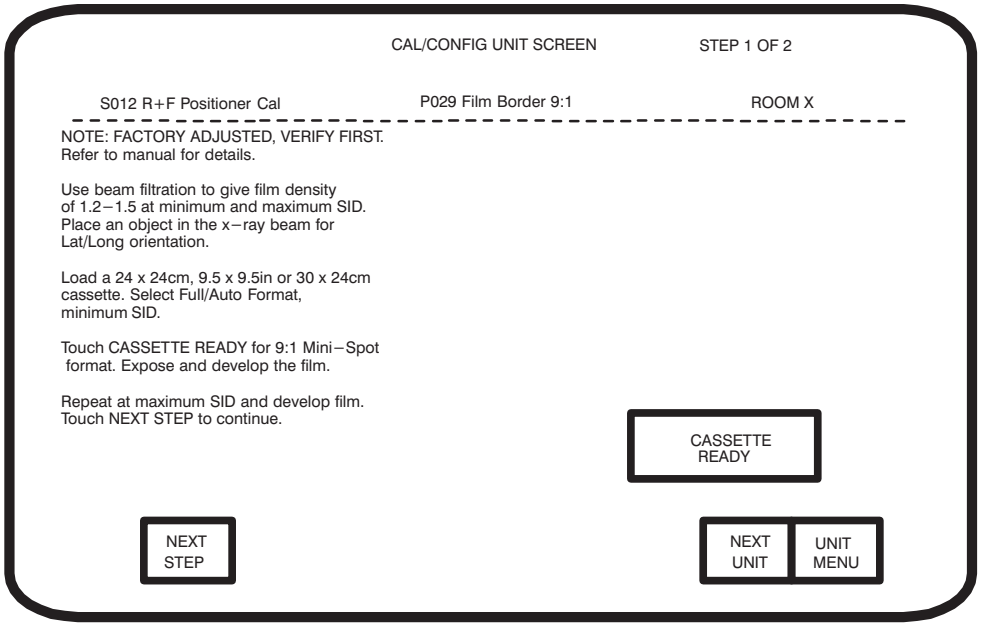
Note: If the NEXT STEP softkey is pressed instead of the CASSETTE READY softkey, viewing (browse) mode will be entered. This will allow the service personnel to cycle through the P029 unit screens with out doing a calibration by pressing NEXT STEP.

- Take exposures and develop the film.

Note: To avoid introducing an error when setting up film borders, ensure that the cassette returns to the park position between exposures.

- Repeat the procedure at maximum SID.
- Develop the film.
- Touch NEXT STEP to proceed to Step 2.

P029 STEP 1 SCREEN DISPLAY



4-2 Step 2. Measure Borders

- Measure the borders of the film. See Illustration 113.
- The border target width is 1.0 mm. For both films, specifications are met if border width is between 0.5 mm and 5.0 mm, the difference between any two borders is less than 1.0 mm, and spot/spot edge misalignment is less than 1.25 mm.
- If all specifications are met at both minimum and maximum SID, touch the NEXT UNIT or UNIT MENU softkey to exit. Exiting the unit enters the new values into NVRAM.

OR

- If the borders require adjustment, touch the LAT BORDER and/or LONG BORDER softkey.
- Use the console dial to enter a DELTA CHANGE. A negative value will decrease the border dimension. A positive value will increase the border dimension.
- Then, touch RECAL softkey and repeat Steps 1 and 2. Cycle blades to 1:1 and back to 9:1 before filming.

P029 STEP 2 SCREEN DISPLAY

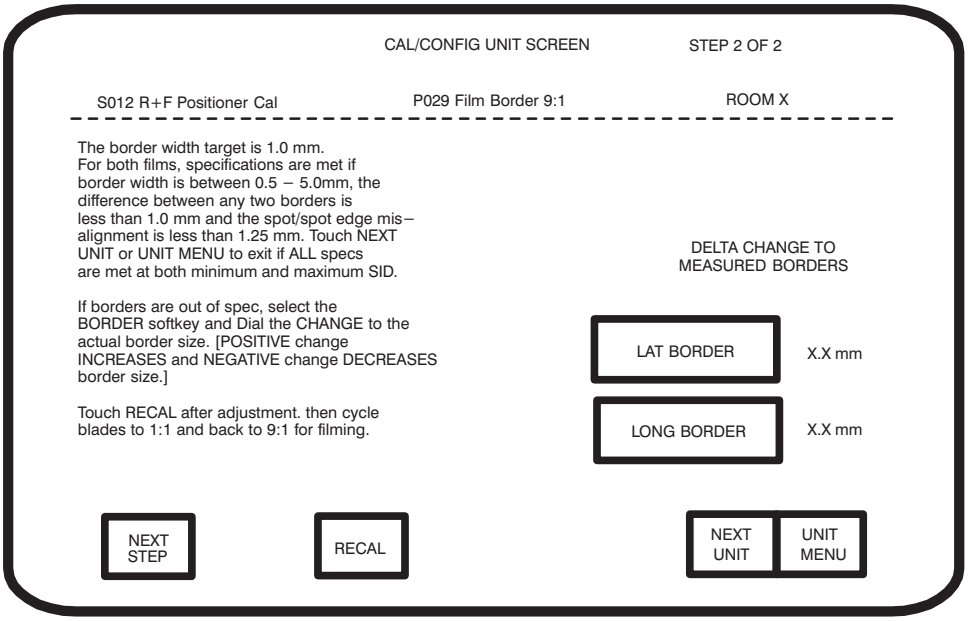
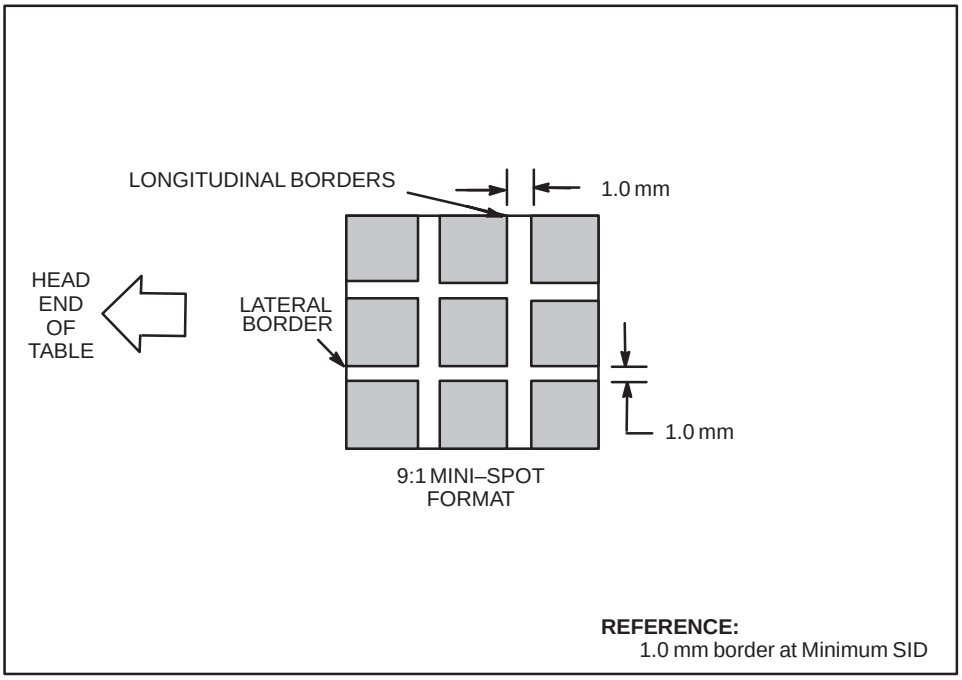


Illustration 113 – P029, Film Border Measurement



UNIT P030 – Collimator Offset Adjustment

Time: x h xx min – Personnel: 1 field engineer

1 DESCRIPTION

Calibration Unit P030 is used to check/adjust the longitudinal and transverse feedback voltage for the Sentry III or Ultranet collimators. The feedback voltage is measured when the blades are in the closed position. On Sentry III collimators the feedback voltage must be –0.50 Vdc $\pm$ 0.06 Vdc. On Ultranet collimators the feedback voltage must be –0.75 Vdc $\pm$ 0.09 Vdc. An audible test tone at the console indicates the point at which the applicable feedback voltage is within specification. Two steps are required to accomplish the calibration. A console screen display is provided for each step.

Note: This is a factory calibration. Verify first before re-calibrating.

2 EQUIPMENT REQUIRED

Standard tool kit and digital voltmeter (DVM).

Note: If it is necessary to adjust the longitudinal and/or transverse feedback potentiometers, make adjustments slowly to prevent over adjustment before the tone is heard.

3 CAL PROCEDURE

3-1 Step 1. Check/Adjust Longitudinal Feedback Voltage

- Touch the ENABLE TONE softkey. The unit automatically positions the collimator blades to the closed position and disables the servos for both blades. If an audible tone is present at the console, the longitudinal feedback voltage is within specification and adjustment is not required.
- Touch NEXT STEP softkey to proceed to Step 2, Check/Adjust Transverse Feedback Voltage.

OR

- If no tone is heard, adjustment of the longitudinal feedback potentiometer is required. Perform the adjustment according to the applicable procedure given below:

3-1-1 Sentry III Undertable Collimator

1. Move the table top to a position that allows access to the collimator.
2. Turnoff console power to ensure safety while working inside table. Perform Lockout/Tagout procedure (Ref. Appendix B).
3. Remove radiation shields from front and rear of collimator (two screws each).
4. Cut cable ties and disconnect collimator cable plug at head end of tube mount.
5. Remove three screws securing collimator base to tube adapter using 9/64” T–handle, hex key wrench, supplied. Carefully lift and move collimator out of back side of tube mount. Set collimator down near head end of tube mount.

6. Connect collimator cable plug to collimator.
7. Turn on console power and return to Cal Unit P030.
8. Connect DVM to RFP1 A1 A7 TP6 (Ref TP9). This corresponds to tube 1.
9. Touch the ENABLE TONE softkey. Collimator blades will close.
10. Using a 0.050” hex key wrench, loosen setscrew that holds brass gear to longitudinal feedback potentiometer shaft.
11. Insert screwdriver through center of brass gear into slot end of potentiometer shaft and slowly rotate shaft until a tone is heard at the console.
12. Verify that the DVM indicates –0.50 Vdc $\pm$ 0.06 Vdc to ensure that adjustment is correct.
13. Secure brass gear to potentiometer shaft. Ensure that tone is still heard at the console and that DVM indication is still correct.
14. Touch ENABLE TONE softkey to disable tone.

3-1-2 Ultranet Undertable Collimator

1. Do not remove collimator from X–ray tube for feedback voltage adjustment.

CAUTION **If collimator must be removed for any reason, ensure that you do not damage the lead “fingers.” Tube must be lowered at least 1–1/2 inches (3.8 cm) to obtain adequate clearance.**

2. Move the table top to a position that allows access to the collimator.
3. Turnoff console power to ensure safety while working inside table. Perform Lockout/Tagout procedure (Ref. Appendix B).
4. Remove radiation shields from collimator (2 screws each).
5. Using a screwdriver, turn the slotted end of the large brass gear shaft to open blades. (The large brass gear meshes with a smaller gear on the longitudinal feedback potentiometer shaft).
6. Determine which of two setscrews in the large brass gear is least accessible when the collimator blades are in the **closed** position. Using a 1.5 mm hex key wrench, loosen this setscrew only.
7. Turn on console power and return to Cal Unit P030.
8. Connect DVM to RFP1 A1 A7 TP6 (Ref TP9). This corresponds to tube 1.
9. Touch the ENABLE TONE softkey. After the collimator blades have closed, loosen the second setscrew in the large brass gear. Then, slowly rotate large gear until a tone is heard at the console.
10. Verify that the DVM indicates –0.75 Vdc $\pm$ 0.09 Vdc to ensure that the adjustment is correct.
11. Tighten one setscrew to lock position of large brass gear. Ensure that the tone is still heard and that the DVM indication is still correct.
12. Remove power to collimator blade drive by turning off console.
13. Using a screwdriver, turn the slotted end of the large brass gear shaft to open blades. Then, tighten second setscrew in large brass gear.
14. Touch ENABLE TONE softkey to disable tone.

3-1-3 Sentry III Over Table and Vascular Collimators

1. Remove two screws securing front operator panel to collimator.
2. Carefully remove front operator panel to expose feedback potentiometers.
3. Loosen four screws securing longitudinal feedback potentiometer in place.
4. Connect DVM as indicated below:
   Vasc Systems: to VP1 A1 A4 TP6 (Ref TP9)
   R&F Systems: Tube 1, RFP1 A1 A7 TP6 (Ref TP9)
   Tube 2, RFP1 A1 A8 TP6 (Ref TP9)
   RAD Systems: Tube 1, RP1 A1 A7 TP6 (Ref TP9)
   Tube 2, RP1 A1 A8 TP6 (Ref TP9)
5. Carefully rotate longitudinal feedback potentiometer until a tone is heard at the console.
6. Verify that DVM indicates –0.50 Vdc ± 0.06 Vdc to ensure that adjustment is correct.
7. Tighten four screws to secure longitudinal feedback potentiometer in place. Ensure that tone is still heard and that DVM indicates –0.50 Vdc ± 0.06 Vdc.
8. Touch ENABLE TONE softkey to disable tone.

3-1-4 Ultranet Over Table and Vascular Collimators

1. Remove rear connector cover from collimator.
2. To expose feedback potentiometers, remove six screws securing main cover to collimator. Then, pull off cover in a direction opposite that of the x–ray tube port.
3. Connect DVM as indicated below:
   Vasc Systems: to VP1 A1 A4 TP6 (Ref TP9)
   R&F Systems: Tube 1, RFP1 A1 A7 TP6 (Ref TP9)
   Tube 2, RFP1 A1 A8 TP6 (Ref TP9)
   RAD Systems: Tube 1, RP1 A1 A7 TP6 (Ref TP9)
   Tube 2, RP1 A1 A8 TP6 (Ref TP9)

Note: Steps 4.a thru 4.c only apply to over table collimators. Steps 5.a thru 5.d only apply to vascular collimators.

4. Over table collimators only.
   a. Deactivate ENABLE TONE softkey.
   b. Turn knob to open blades. While opening blades, observe large brass gear that engages with smaller brass gear on shaft of longitudinal feedback potentiometer.
   c. Determine which of two setscrews in the large brass gear is least accessible when the collimator blades are in the **closed** position. Using a 1.5 mm hex key wrench, loosen this setscrew only.
5. Vascular collimators only.
   a. Remove power to collimator blade drive by turning off console.
   b. Using a screwdriver, turn the slotted end of the large brass gear shaft to open blades. (The large brass gear meshes with a smaller gear on the longitudinal feedback potentiometer shaft).

c. Determine which of two setscrews in the large brass gear is least accessible when the collimator blades are in the **closed** position. Using a 1.5 mm hex key wrench, loosen this setscrew only.

d. Turn on console power and return to Cal Unit P030.

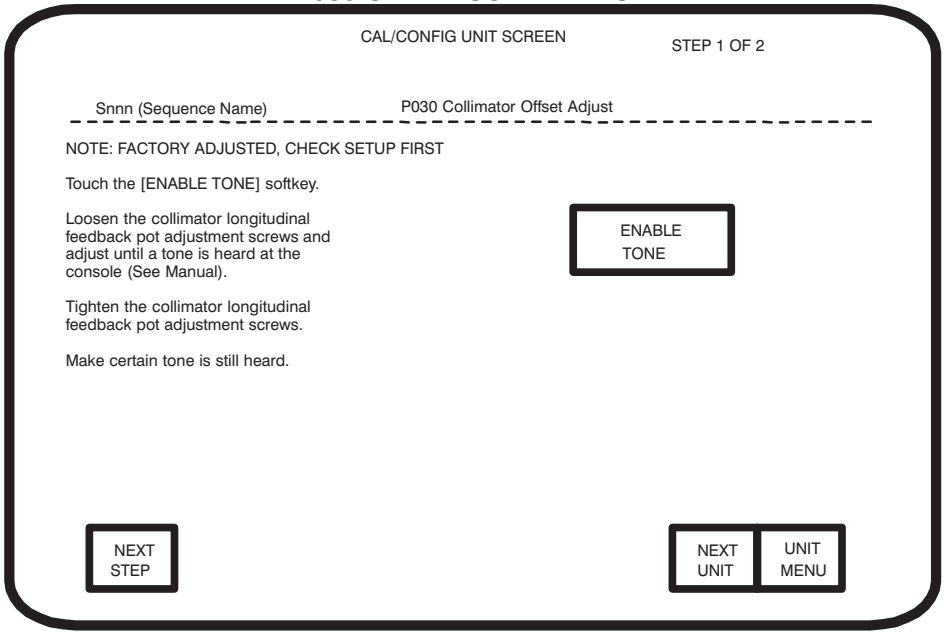
6. Touch the ENABLE TONE softkey. After the collimator blades have closed, loosen the second setscrew in the large brass gear. Then, slowly rotate large gear until a tone is heard at the console.
7. Verify that the DVM indicates –0.75 Vdc $\pm$ 0.09 Vdc to ensure that the adjustment is correct.
8. Tighten one setscrew to lock position of large brass gear. Ensure that the tone is still heard and that the DVM indication is still correct.
9. Over table only:
   a. Turn knob to open blades.
   b. Tighten second setscrew in large brass gear.
10. Vascular only:
   a. Remove power to collimator blade drive by turning off console.
   b. Using a screwdriver, turn the slotted end of the large brass gear shaft to open blades.
   c. Tighten second setscrew in large brass gear.

Note: Touch ENABLE TONE softkey to disable tone.

Note: Perform Step 2 checks before reassembling the collimator since it may also be necessary to make adjustments to the transverse feedback voltage potentiometer.

- After the applicable longitudinal feedback voltage adjustment is completed, touch the NEXT STEP softkey to proceed to Step 2, Check/Adjust Transverse Feedback Voltage.

P030 STEP 1 SCREEN DISPLAY



3-2 Step 2. Adjust Transverse Feedback Voltage

- Touch the ENABLE TONE softkey. If an audible tone is present at the console, the transverse feedback voltage is within specification and adjustment is not required.

Note: If the longitudinal feedback voltage was adjusted in Step 1, reassemble the collimator before exiting the unit.

- Touch NEXT UNIT or UNIT MENU softkey to exit.

OR

- If no tone is heard, adjustment of the transverse feedback potentiometer is required. Perform the adjustment according to the applicable procedure given below:

3-2-1 Sentry III Undertable Collimator

1. Move the table top to a position that allows access to the collimator.
2. Turnoff console power to ensure safety while working inside table. Perform Lockout/Tagout procedure (Ref. Appendix B).
3. Remove radiation shields from front and rear of collimator (two screws each).
4. Cut cable ties and disconnect collimator cable plug at head end of tube mount.
5. Remove three screws securing collimator base to tube adapter using 9/64” T–handle, hex key wrench, supplied. Carefully lift and move collimator out of back side of tube mount. Set collimator down near head end of tube mount.
6. Re–connect collimator cable plug.
7. Turn on console power and return to Cal Unit P030.
8. Connect DVM to RFP1 A1 A7 TP5 (Ref TP9). This corresponds to tube 1.
9. Touch the ENABLE TONE softkey. Collimator blades will close.
10. Using a 0.050” hex key wrench, loosen setscrew that holds brass gear to transverse feedback potentiometer shaft.
11. Insert screwdriver through center of brass gear into slot end of potentiometer shaft and slowly rotate shaft until a tone is heard at the console.
12. Verify that the DVM indicates –0.50 Vdc $\pm$ 0.06 Vdc to ensure that adjustment is correct.
13. Secure brass gear to potentiometer shaft. Ensure that tone is still heard at the console and that DVM indication is still correct.
14. Turn off console power. Perform Lockout/Tagout procedure.
15. Re-assemble collimator to x–tube.
16. Re-attach radiation shields to collimator.
17. Turn on console power and re–enter Service Mode.

3-2-2 Ultranet Undertable Collimator

1. Do not remove collimator from x–ray tube for feedback voltage adjustment.

CAUTION **If collimator must be removed for any reason, ensure that you do not damage the lead "fingers." Tube must be lowered at least 1–1/2 inches (3.8 cm) to obtain adequate clearance.**

2. Move the table top to a position that allows access to the collimator.
3. Turnoff console power to ensure safety while working inside table. Perform Lockout/Tagout procedure (Ref. Appendix B).
4. Remove radiation shields from collimator (2 screws each).
5. Using a screwdriver, turn the slotted end of the large brass gear shaft to open blades. (The large brass gear meshes with a smaller gear on the transverse feedback potentiometer shaft).
6. Determine which of two setscrews in the large brass gear is **least** accessible when the collimator blades are in the closed position. Using a 1.5 mm hex key wrench, loosen this setscrew only.
7. Turn on console power and return to Cal Unit P030.
8. Connect DVM to RFP1 A1 A7 TP5 (Ref TP9). This corresponds to tube 1.
9. Touch the ENABLE TONE softkey. After the collimator blades have closed, loosen the second setscrew in the large brass gear. Then, slowly rotate large gear until a tone is heard at the console.
10. Verify that the DVM indicates –0.75 Vdc $\pm$ 0.09 Vdc to ensure that the adjustment is correct.
11. Tighten one setscrew to lock position of large brass gear. Ensure that the tone is still heard and that the DVM indication is still correct.
12. Remove power to collimator blade drive by turning off console.
13. Using a screwdriver, turn the slotted end of the large brass gear shaft to open blades. Then, tighten second setscrew in large brass gear.
14. Attach radiation shields to collimator.
15. Turn on console power and re–enter Service Mode.

3-2-3 Sentry III Over table and Vascular Collimators

1. Remove two screws securing front operator panel to collimator.
2. Carefully remove front operator panel to expose feedback potentiometers.
3. Loosen four screws securing transverse feedback potentiometer in place.
4. Connect DVM as indicated below:

Vasc Systems:	to VP1 A1 A4 TP5 (Ref TP9)
R&F Systems:	Tube 1, RFP1 A1 A7 TP5 (Ref TP9)
	Tube 2, RFP1 A1 A8 TP5 (Ref TP9)
RAD Systems:	Tube 1, RP1 A1 A7 TP5 (Ref TP9)
	Tube 2, RP1 A1 A8 TP5 (Ref TP9)

5. Carefully rotate transverse feedback potentiometer until a tone is heard at the console.

6. Verify that DVM indicates –0.50 Vdc ± 0.06 Vdc to ensure that adjustment is correct.
7. Tighten four screws to secure transverse feedback potentiometer in place. Ensure that tone is still heard and that DVM indicates –0.50 Vdc ± 0.06 Vdc.
8. Install front operator panel on collimator.

3-2-4 Ultranet Over table and Vascular Collimators

1. Remove rear connector cover from collimator.
2. To expose feedback potentiometers, remove six screws securing main cover to collimator. Then, pull off cover in a direction opposite that of the x–ray tube port.
3. Connect DVM as indicated below:

Vasc Systems:	to VP1 A1 A4 TP5 (Ref TP9)
R&F Systems:	Tube 1, RFP1 A1 A7 TP5 (Ref TP9)
	Tube 2, RFP1 A1 A8 TP5 (Ref TP9)
RAD Systems:	Tube 1, RP1 A1 A7 TP5 (Ref TP9)
	Tube 2, RP1 A1 A8 TP5 (Ref TP9)

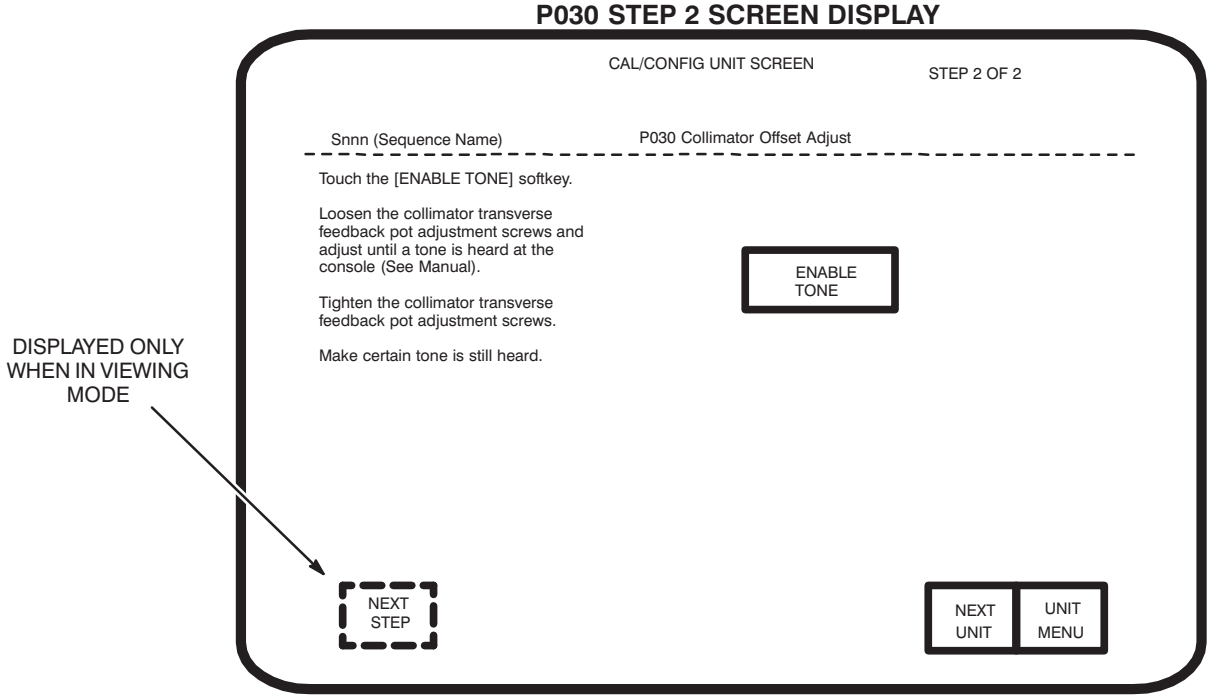
Note: Steps 4.a thru 4.c only apply to over table collimators. Steps 5.a thru 5.d only apply to vascular collimators.

4. Over table collimators only.
   a. Deactivate ENABLE TONE softkey.
   b. Turn knob to open blades. While opening blades, observe large brass gear that engages with smaller brass gear on shaft of transverse feedback potentiometer.
   c. Determine which of two setscrews in the large brass gear is **least** accessible when the collimator blades are in the closed position. Using a 1.5 mm hex key wrench, loosen this setscrew only.
5. Vascular collimators only.
   a. Remove power to collimator blade drive by turning off console.
   b. Using a screwdriver, turn the slotted end of the large brass gear shaft to open blades. (The large brass gear meshes with a smaller gear on the transverse feedback potentiometer shaft).
   c. Determine which of two setscrews in the large brass gear is **least** accessible when the collimator blades are in the closed position. Using a 1.5 mm hex key wrench, loosen this setscrew only.
   d. Turn on console power and return to Cal Unit P030.
6. Touch the ENABLE TONE softkey. After the collimator blades have closed, loosen the second setscrew in the large brass gear. Then, slowly rotate large gear until a tone is heard at the console.
7. Verify that the DVM indicates –0.75 Vdc ± 0.09 Vdc to ensure that the adjustment is correct.
8. Tighten one setscrew to lock position of large brass gear. Ensure that the tone is still heard and that the DVM indication is still correct.

9. Over table only:
   a. Turn knob to open blades.
   b. Tighten second setscrew in large brass gear.
10. Vascular only.
   a. Remove power to collimator blade drive by turning off console.
   b. Using a screwdriver, turn the slotted end of the large brass gear shaft to open blades.
   c. Tighten second setscrew in large brass gear.
11. Install main cover and rear cover on collimator.

- After the applicable transverse feedback voltage adjustment is completed, touch the NEXT UNIT or UNIT MENU softkey to exit the unit.

P030 STEP 2 SCREEN DISPLAY



UNIT P036 – Table Angle Velocity

Time: x h xx min – Personnel: 1 field engineer

1 DESCRIPTION

Calibration Unit P036 is used to set the angulation speed of the SFD angulation dial to match the table angulation speed of the table control. The adjustment is performed according to the manual Cal Procedure given below.

Note: The table angle velocity is factory adjusted and normally does not require adjustment in the field. Verify angulation times and speed before proceeding with a recalibration.

2 EQUIPMENT REQUIRED

Stopwatch and non–metallic trimpot adjusting tool.

3 CAL PROCEDURE

3-1 Step 1. Gain Adjustment

- With the SFD angulation dial full CCW or CW, angulate the table in the vertical or Trendelenberg direction and measure the transition time with a stopwatch. Angulation transition times must be within the following limits:
  - 90 degrees – 25 sec $\pm$ 3 sec
  - 45 degrees – 13 sec $\pm$ 2 sec
  - 30 degrees – 9 sec $\pm$ 2 sec
  - 15 degrees – 5 sec $\pm$ 1 sec
- If necessary, re-adjust GAIN potentiometer R81 located on Angulation and Tabletop I/F PWB RFP1 A1 A5 to obtain the specified positional transition times. A CW rotation of the potentiometer increases angulation speed (decreases time).
- Record the transition times for matching SFD to table performance.
- Return table to horizontal position.

3-2 Step 2. Speed Adjustment

Use the angulation switch on the table control panel to angulate the table in the vertical or Trendelenberg direction. Adjust Angulation and Tabletop I/F PWB (RFP1 A1 A5) VERTICAL and TREND potentiometers to match SFD sweep times within ±1 second, as specified.

- Vertical Speed Adjustment.

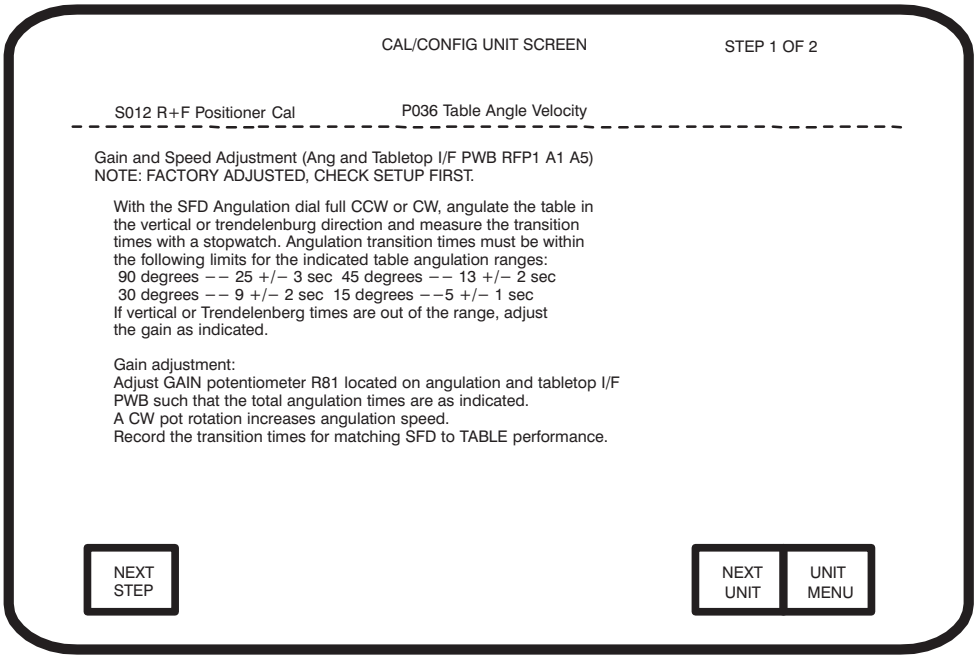
  Adjust potentiometer R105 (Ref I/F PWB RFP1 A1 A5) to set VERTICAL tableside sensitivity. A CW rotation of the potentiometer increases angulation speed (decreases time).

- Trendelenberg Speed Adjustment.

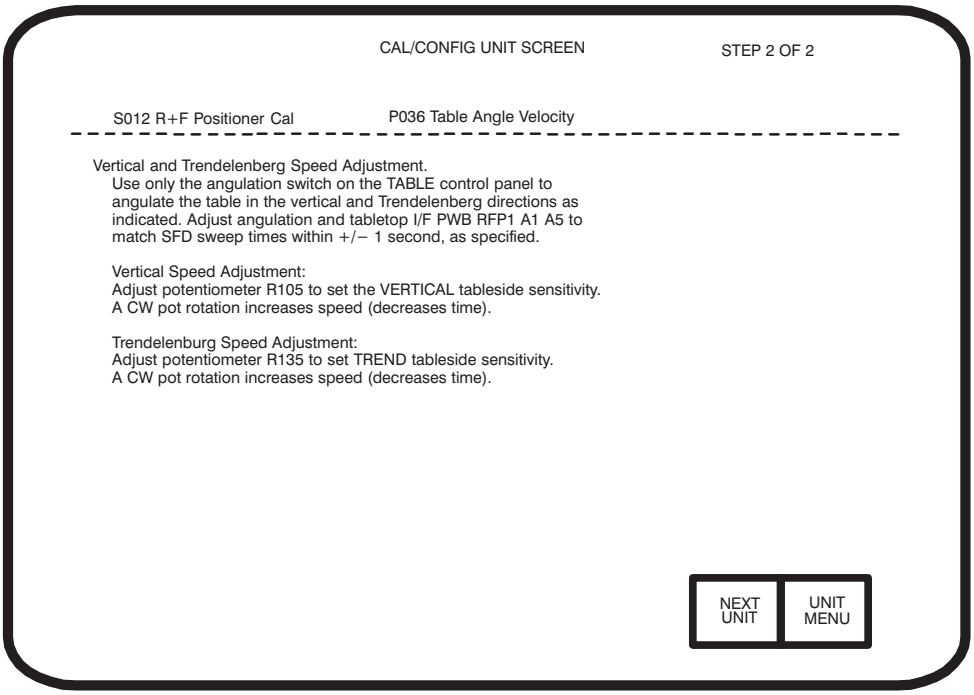
  Adjust potentiometer R135 (Ref I/F PWB, RFP1 A1 A5) to set TREND tableside sensitivity. A CW rotation of the potentiometer increases angulation speed (decreases time).

- After Gain and Speed adjustments have been properly set, touch NEXT UNIT or UNIT MENU softkey to exit the calibration unit.

P036 STEP 1 SCREEN DISPLAY



P036 STEP 2 SCREEN DISPLAY



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UNIT P038 – Spot Film Power Assist Calibration

Time: x h xx min – Personnel: 1 field engineer

1 DESCRIPTION

The spotfilm device power assist handle utilizes hall effect sensors which when activated produce an output proportional to the force applied to the handle. Sensors are placed to monitor longitudinal or vertical forces only. The output of these sensors is fed into hardware circuitry which controls the power assist speed and velocity of the spotfilm tower. This calibration unit covers the procedure (text) to properly adjust the hardware.

2 CAL PROCEDURE – OFFSET ADJUSTMENT

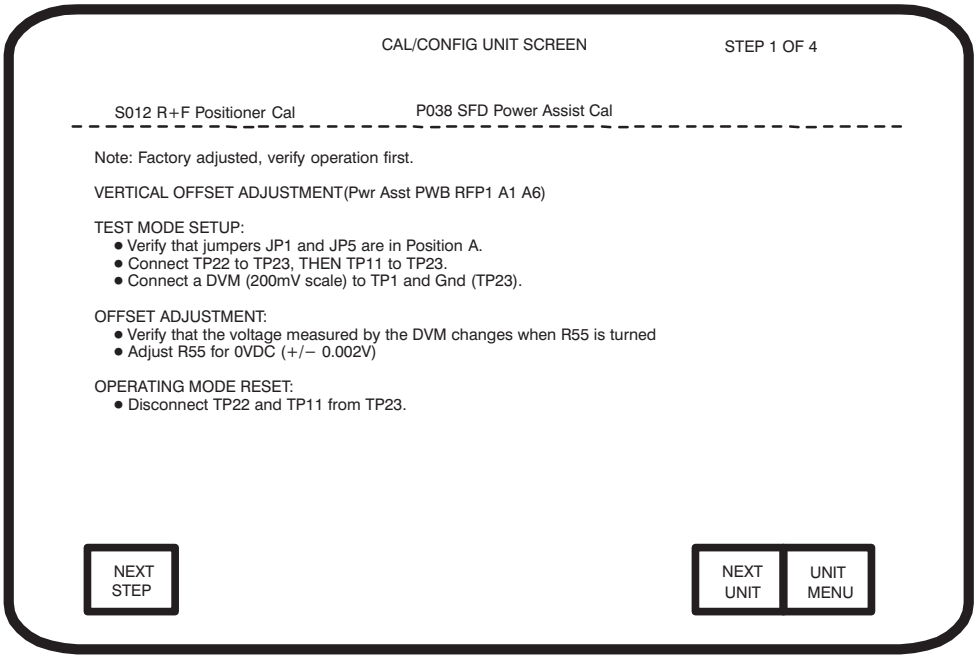
Perform this procedure on systems configured with Power Assist PWB (RFP1A1 A6) identified as P/N 46–288142.

Note: The jumpers, test points, and potentiometer adjustments referred to in the calibration procedure below are located on Power Assist PWB, RFP1 A1 A6, P/N 46–288142.

2-1 Step 1. Vertical Offset Adjustment

- Test Mode Setup.
  1. Verify that jumper JP1 and JP5 are in Position A.
  2. Connect TP22 to TP23, then TP11 to TP23.
  3. Connect a DVM (200 mV scale) to TP1 and Gnd (TP23).
- Offset Adjustment.
  1. Verify that the voltage measured by the DVM changes when R55 is turned
  2. Adjust potentiometer R55 for 0Vdc $\pm$ 0.002 Vdc
- Operating Mode Reset.
  1. Disconnect TP22 and TP11 from TP23.

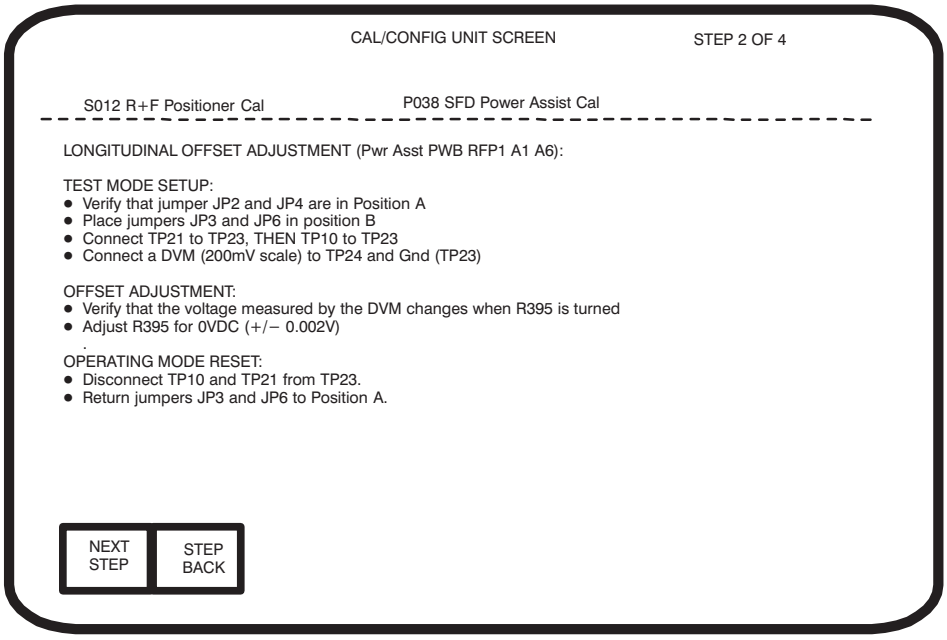
P038 STEP 1 SCREEN DISPLAY



2-2 Step 2. Longitudinal Offset Adjustment

- Test Mode Setup.
  1. Verify that jumper JP2 and JP4 are in Position A.
  2. Place jumper JP3 and JP6 in position B.
  3. Connect TP21 to TP23, then TP10 to TP23.
  4. Connect a DVM (200 mV scale) to TP24 and Gnd (TP23).
- Offset Adjustment.
  1. Verify that the voltage measured by the DVM changes when R395 is turned
  2. Adjust potentiometer R395 for 0Vdc ± 0.002 Vdc
- Operating Mode Reset.
  1. Disconnect TP10 and TP21 from TP23.
  2. Return jumpers JP3 and JP6 to Position A.
- Disconnect DVM.
- Touch NEXT STEP.

P038 STEP 2 SCREEN DISPLAY



2-3 Step 3.

2-3-1 Vertical Compression/Velocity Adjustment

Note: Set OFFSETS to 0 Vdc before setting velocity.

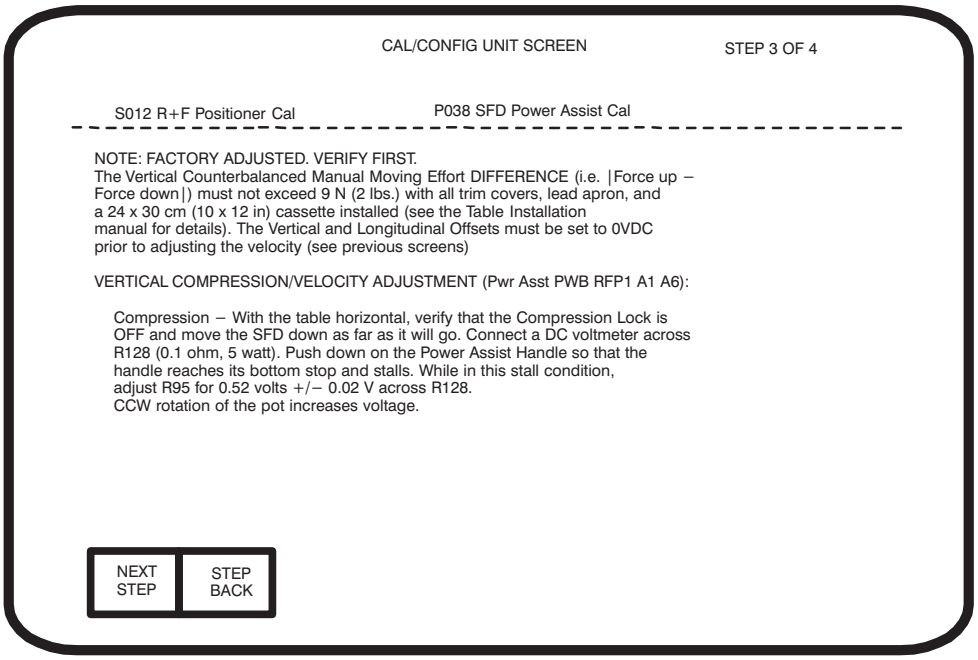
The Vertical Counterbalanced Manual Moving Effort DIFFERENCE (i.e. |Force up – Force down|) must not exceed 9 N (2 lbs) with all trim covers, lead apron, and a 24 x 30 cm (10 x 12 in) cassette installed (see the RFX/SFX Table Installation manual for details). The Vertical and Longitudinal Offsets must be set to 0VDC prior to adjusting the Velocity (see previous screens).

2-3-2 Vertical Compression Adjustment

- With the table horizontal, verify that the Compression Lock is OFF and move the SFD down as far as it will go.
- Connect a DC voltmeter across R128 (0.1 ohm, 5 watt).
- Push down, or place a weight, on the Power Assist Handle so that the handle reaches its bottom stop and stalls.
- While in this stall condition, adjust R95 for 0.52 volts ±0.02 V across R128.

Note: A CCW rotation of the pot will increase the voltage

P038 STEP 3 SCREEN DISPLAY



2-4 Step 4.

2-4-1 Vertical Velocity Adjustment

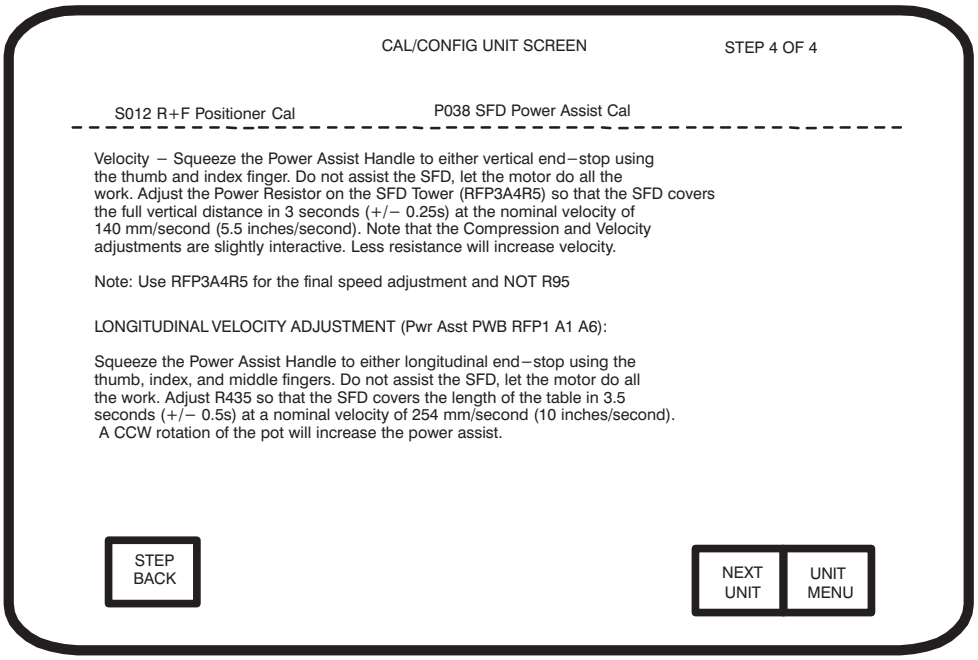
- Squeeze the Power Assist Handle to either vertical end–stop using the thumb and index finger. Do not assist the SFD, let the motor do all the work.
- Adjust the Power Resistor on the SFD Tower (RFP3A4R5) so that the SFD covers the full vertical distance in 3 seconds (±0.25 s) at a nominal velocity of 140 mm/second (5.5 inches/second). Note that the Compression and Velocity adjustments are slightly interactive. Less resistance will increase velocity.

Note: Use RFP3A4R5 for final speed adjustment and NOT R95

2-4-2 Longitudinal Velocity Adjustment

- Squeeze the Power Assist Handle to either longitudinal end–stop using the thumb, index, and middle fingers. Do not assist the SFD, let the motor do all the work.
- Adjust R435 so that the SFD covers the length of the table in 3.5 seconds (±0.5s) at a nominal velocity of 254 mm/second (10 inches/second). A CCW rotation of the pot will increase the power assist.

P038 STEP 4 SCREEN DISPLAY



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UNIT P039 – Spot Film Gain Entry

Time: x h xx min – Personnel: 1 field engineer

1 DESCRIPTION

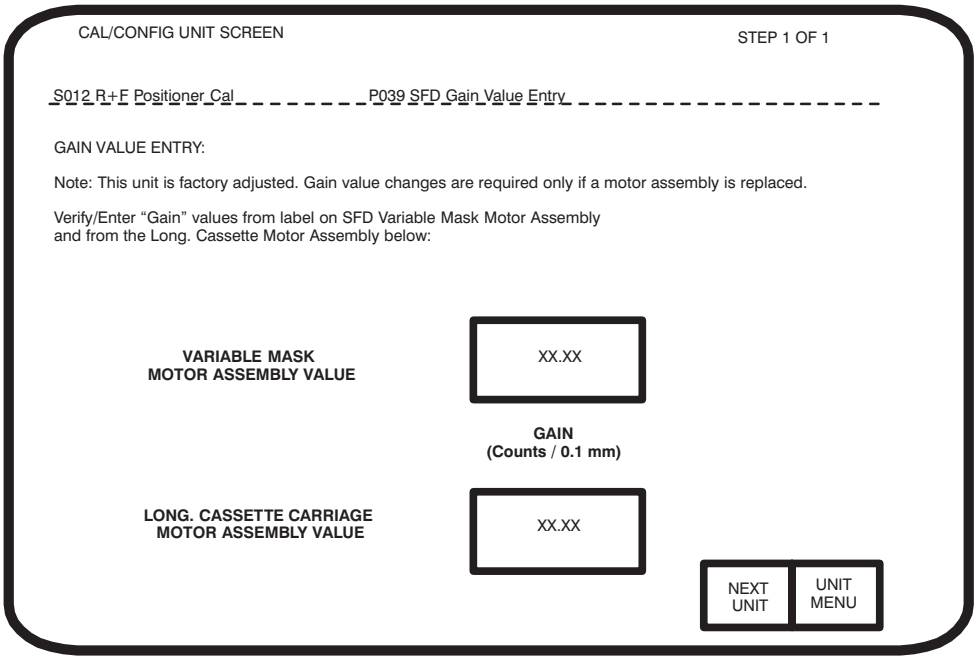
This unit allows input to the Advantx Positioner module of gain values of the Longitudinal Cassette Carriage Motor Assembly and the Variable Mask Motor Assembly. These values are used by the SFD Positioner module code to determine the correct counts needed to move the cassette carriage longitudinally or the variable mask into position.

2 CAL PROCEDURE

2-1 Step 1. Screen

1. Verify (or enter) Variable Mask Motor Assembly Gain Value.
   a. Touch the **Variable Mask Motor Assembly Value** softkey to highlight softkey and display default or factory entered value..
   b. If required, enter the value from the SFD Variable Mask Motor Assembly using the console dial.
   c. Touch the **Variable Mask Motor Assembly Value** softkey to de-highlight softkey.
2. Verify (or enter) Longitudinal Cassette Carriage Motor Assembly Gain Value.
   a. Touch the **Long. Cassette Carriage Motor Assembly Value** softkey to highlight softkey and display default or factory entered value..
   b. If required, enter the value from the SFD Longitudinal Cassette Carriage Motor Assembly using the console dial.
   c. Touch the **Long. Cassette Carriage Motor Assembly Value** softkey to de-highlight softkey.
3. Touch NEXT UNIT or UNIT MENU softkey to exit the calibration unit. The system displays an "Updating NV database" message while the Gain Values are being loaded into the system.

P039 STEP 1 SCREEN DISPLAY



UNIT P040 – Spot Film Damping Calibration

Time: x h xx min – Personnel: 1 field engineer

1 DESCRIPTION

This Unit is used to adjust the damping of the various motor driven component. The unit first positions the component to be adjusted in a safe region so that no collision situation or hard limit point is reached. Then a square wave input is given to the device so that it oscillates between safe open and close positions. Adjustments are made until the output resembles the illustration shown for each axis.

The lateral axis uses a 35 cm x 35 cm cassette to ensure accurate calibration. The longitudinal axis uses the test cassette to allow adequate travel of the cassette.

Note: For ISFD (Intelligent Spot Film Device) Configuration, calibration requires all six steps.

For IDD (Intelligent Digital Device) Configuration, only Steps 5 and 6 are required. Step 5 is automatically selected upon entry to P040.

Note: These is a factory calibration unit. Verify all calibration *first* before entering any calibration data.

Note: The STEP BACK softkey is available on the Step 2 through Step 6 screens to allow the technician to backup to the previous step screen without affecting the calibration data already completed.

2 TEST EQUIPMENT

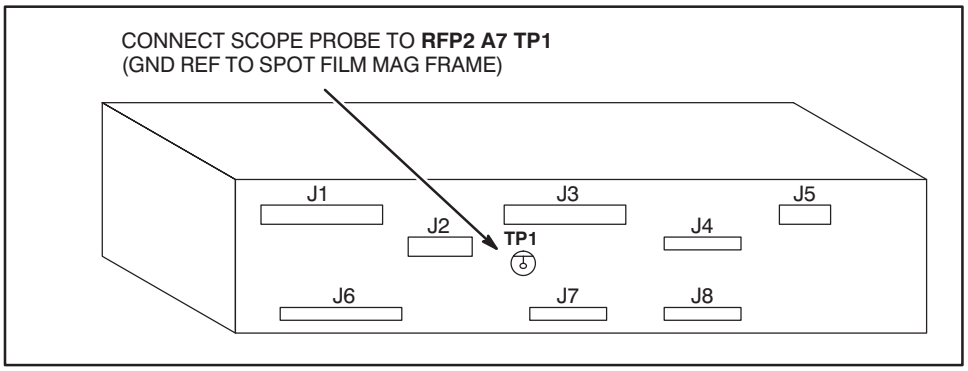
- Oscilloscope and test leads.
- Test cassette (P/N 2129776)

3 TEST SETUP

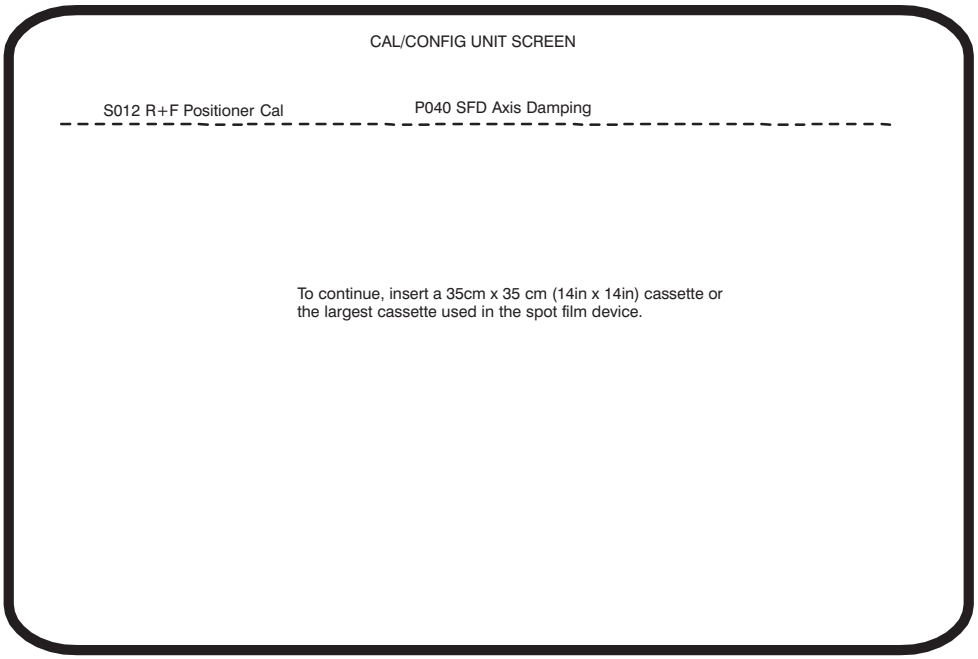
See Illustration 114.

1. Remove Spot Film Device top trim cover to gain access to RFP2 A7, ISFD Digital Servo Controller Module.
2. Setup the oscilloscope as follows:
   VERT AMPL: 2.0 V/cm
   TIME BASE: 0.5 sec/cm
   Connect probe to **RFP2 A7 TP1** (Ground reference to Spot Film Mag frame).
3. Load the 35cm x 35cm (14in x 14in) cassette, or the largest cassette used in the Spot Film Device.

Illustration 114 – P040 Test Setup – RFP2 A7 ISFD Digital Servo Controller Module



P040 INITIAL SCREEN DISPLAY



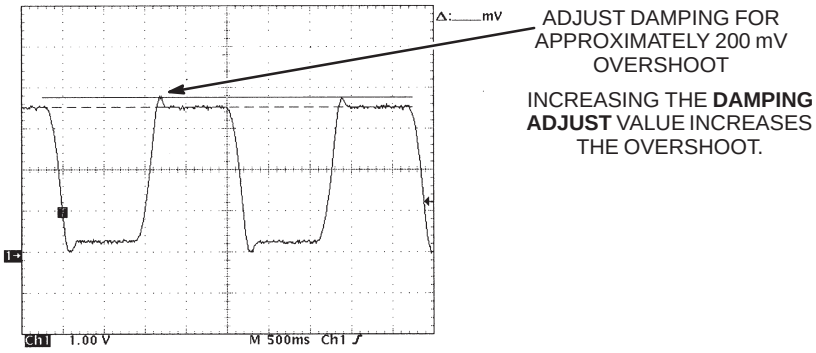
4 CAL PROCEDURE

4-1 Step 1. Lateral Cassette Damping Adjustment

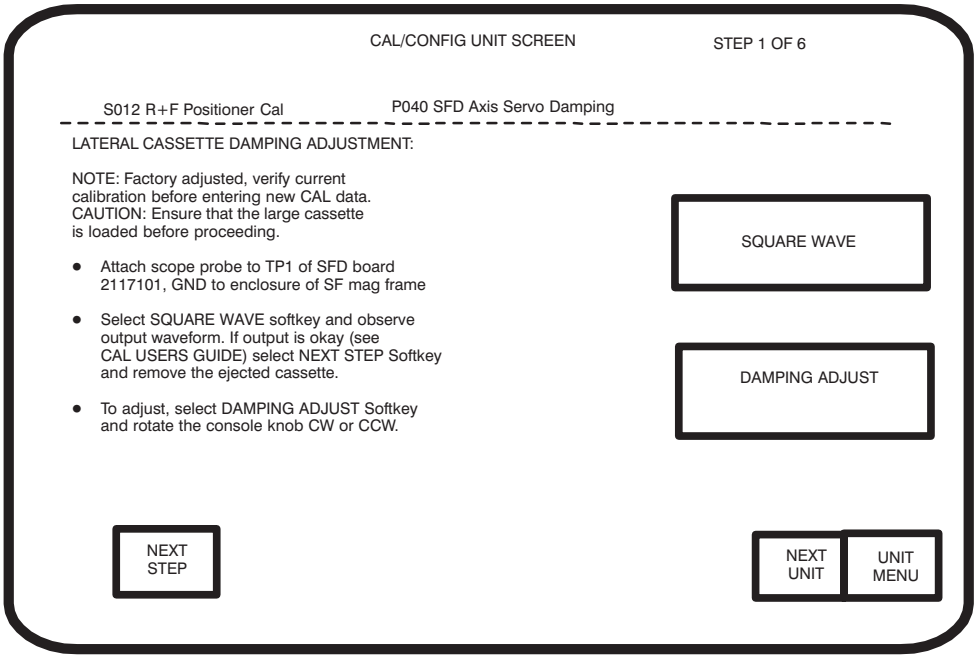
Note: Ensure that the 35cm x 35cm cassette (or largest used in the Spot Film Device) is inserted before calibrating this step.

1. Touch SQUARE WAVE softkey and observe output waveform.
   The system automatically drives the lateral cassette servo to a safe position prior to injecting the square wave input. During this positioning time the system displays a “Wait For Position” message.
2. Verify waveform appears as shown in Illustration 115. The waveform should display a slight overshoot.
   - If correct, touch NEXT STEP softkey and remove the ejected cassette.
   - If not correct, touch DAMPING ADJUST softkey and adjust waveform display using the console dial. Then, press NEXT STEP softkey and remove the ejected cassette.

Illustration 115 – P040 – Step 1 Lateral Cassette Damping Square Wave Requirements



P040 STEP 1 SCREEN DISPLAY



4-2 Step 2. Longitudinal Cassette Damping Adjustment

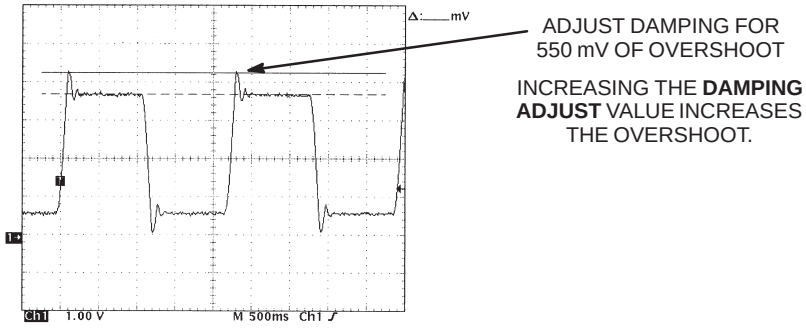
Note: Ensure that the test cassette is inserted before calibrating this step.

1. Touch SQUARE WAVE softkey and observe output waveform.

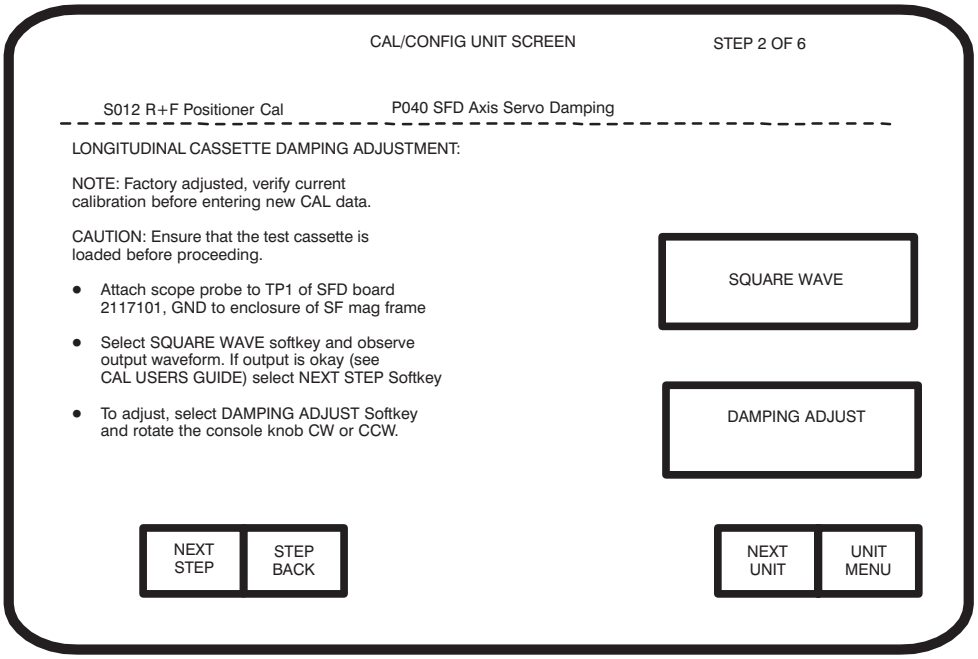
   The system automatically drives the longitudinal cassette servo to a safe position prior to injecting the square wave input. During this positioning time the system displays a “Wait For Position” message.

2. Verify waveform appears as shown in Illustration 116. The waveform should display a slight overshoot.
   - If correct, touch NEXT STEP softkey (or STEP BACK to return to previous screen).
   - If not correct, touch DAMPING ADJUST softkey and adjust waveform display using the console dial. Then, press NEXT STEP softkey.

Illustration 116 – P040 – Step 2 Longitudinal Cassette Damping Square Wave Requirements



P040 STEP 2 SCREEN DISPLAY



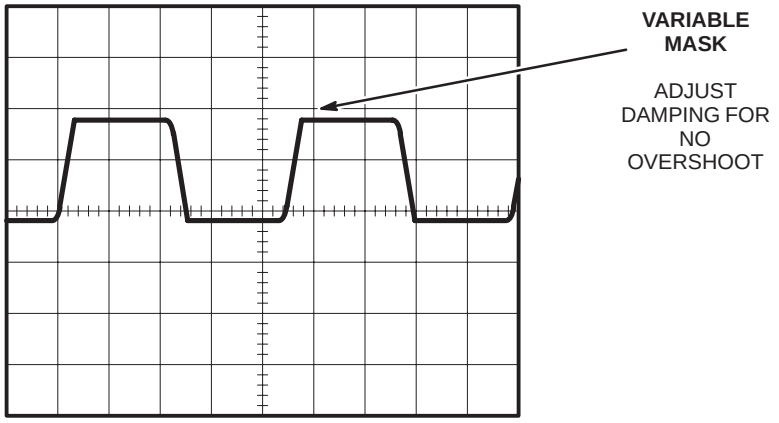
4-3 Step 3. Variable Mask Damping Adjustment

1. Touch SQUARE WAVE softkey and observe output waveform.

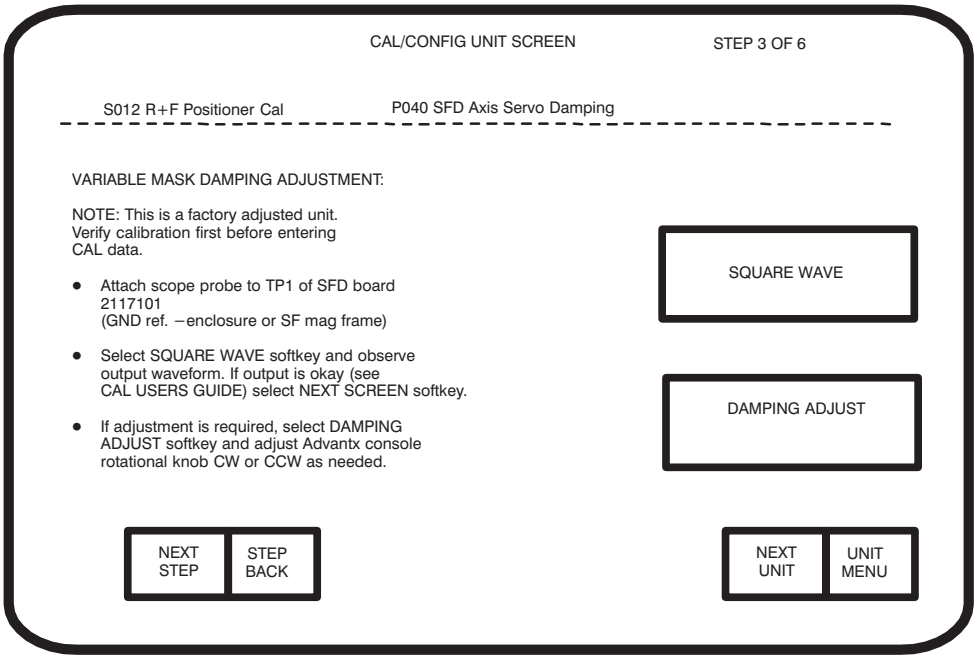
   The system automatically drives the Variable Mask servo to a safe position prior to injecting the square wave input. During this positioning time the system displays a “Wait For Position” message.

2. Verify waveform appears as shown in Illustration 117. The waveform should not display any overshoot.
   - If correct, touch NEXT STEP softkey (or STEP BACK to return to previous screen).
   - If not correct, touch DAMPING ADJUST softkey and adjust waveform display using the console dial. Then, press NEXT STEP softkey.

Illustration 117 – P040 – Step 3 Variable Mask Damping Square Wave Requirements



P040 STEP 3 SCREEN DISPLAY



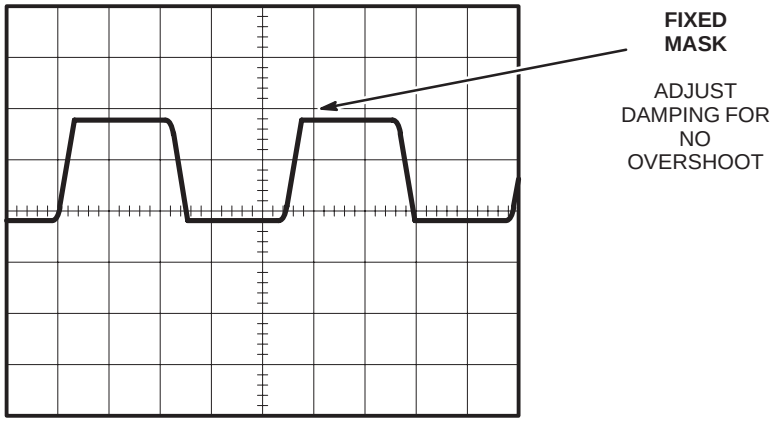
4-4 Step 4. Fixed Mask Damping Adjustment

1. Touch SQUARE WAVE softkey and observe output waveform.

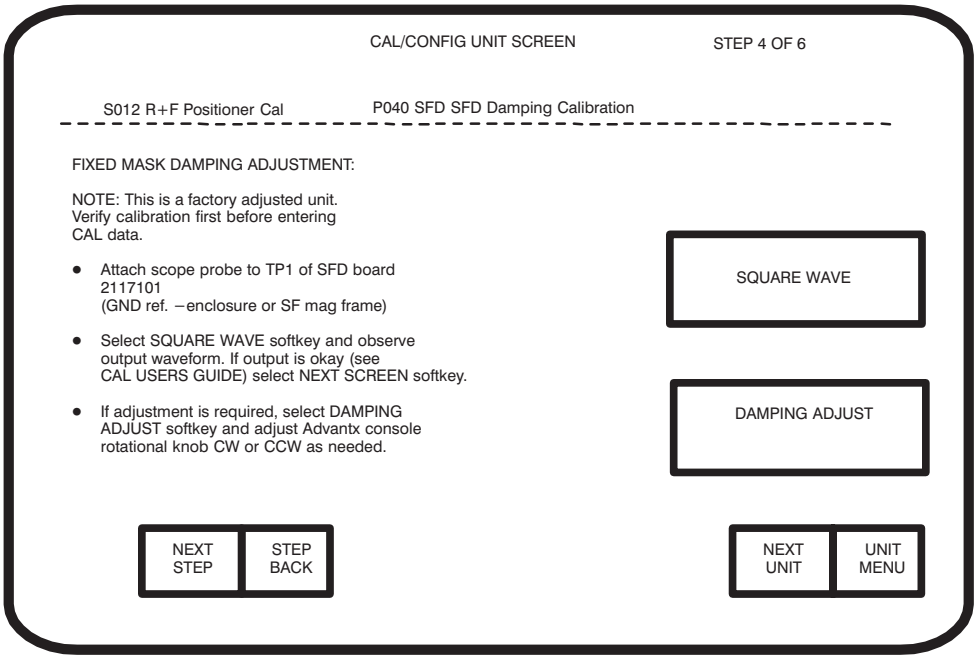
   The system automatically drives the Fixed Mask servo to a safe position prior to injecting the square wave input. During this positioning time the system displays a “Wait For Position” message.

2. Verify waveform appears as shown in Illustration 118. The waveform should not display any overshoot.
   - If correct, touch NEXT STEP softkey (or STEP BACK to return to previous screen).
   - If not correct, touch DAMPING ADJUST softkey and adjust waveform display using the console dial. Then, press NEXT STEP softkey.

Illustration 118 – P040 – Step 4 fixed Mask Damping Square Wave Requirements



P040 STEP 4 SCREEN DISPLAY



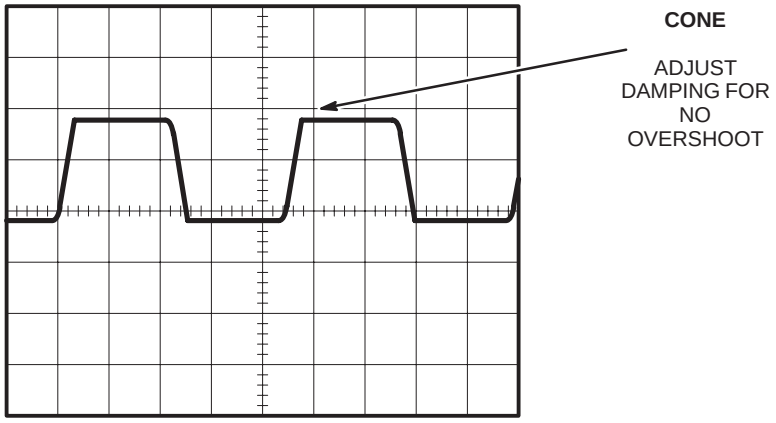
4-5 Step 5. Cone Damping Adjustment

1. Touch SQUARE WAVE softkey and observe output waveform.

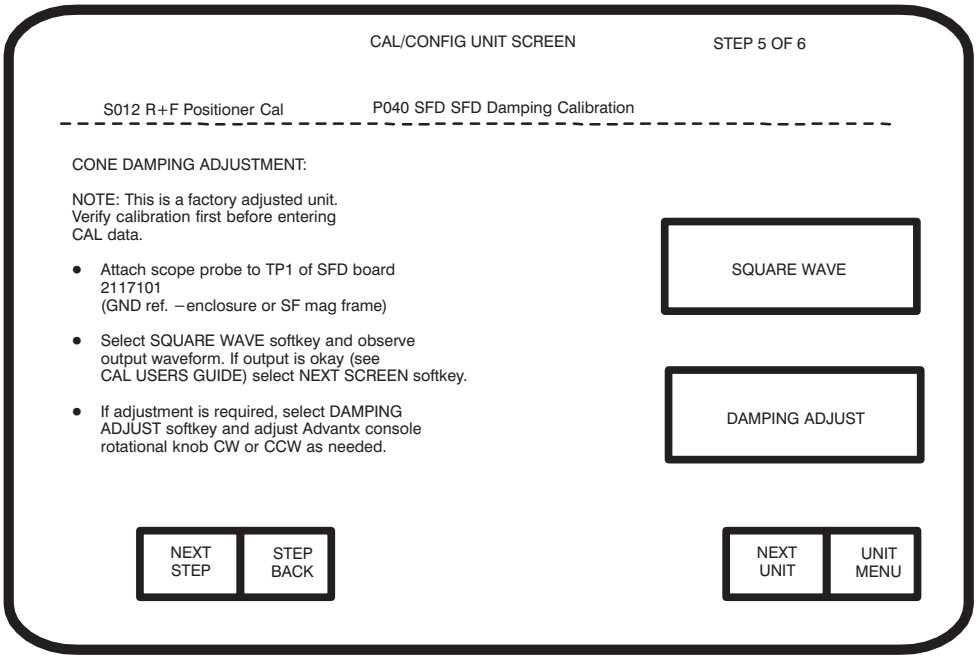
   The system automatically drives the Cone servo to a safe position prior to injecting the square wave input. During this positioning time the system displays a “Wait For Position” message.

2. Verify waveform appears as shown in Illustration 119. The waveform should not display any overshoot.
   - If correct, touch NEXT STEP softkey (or STEP BACK to return to previous screen).
   - If not correct, touch DAMPING ADJUST softkey and adjust waveform display using the console dial. Then, press NEXT STEP softkey.

Illustration 119 – P040 – Step 5 Cone Damping Square Wave Requirements



P040 STEP 5 SCREEN DISPLAY

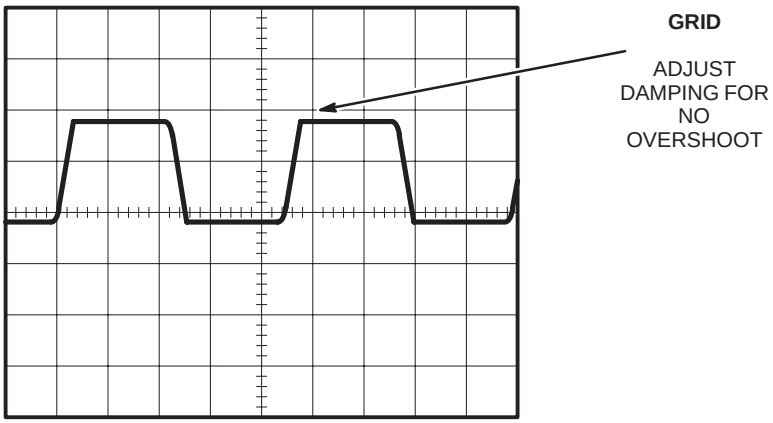


4-6 Step 6. Grid Damping Adjustment

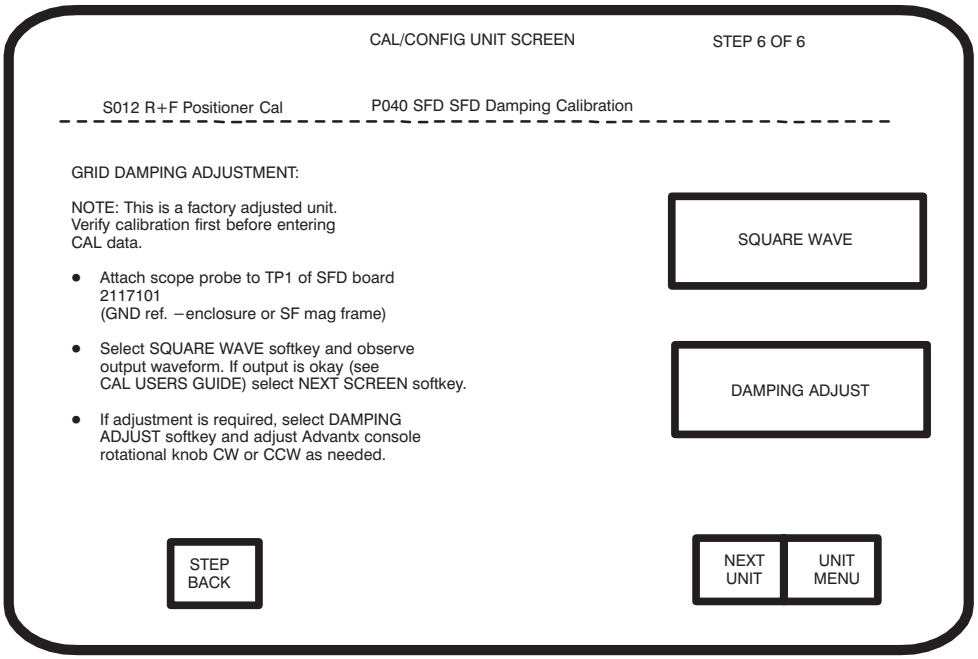
1. Touch SQUARE WAVE softkey and observe output waveform.

   The system automatically drives the Grid servo to a safe position prior to injecting the square wave input. During this positioning time the system displays a “Wait For Position” message.
2. Verify waveform appears as shown in Illustration 120. The waveform should not display any overshoot.
   - If not correct, touch DAMPING ADJUST softkey and adjust waveform display using the console dial. Then, press NEXT STEP softkey.
   - If correct, touch NEXT UNIT or UNIT MENU softkey to exit the calibration unit. An “Updating NV database” message is displayed while the position data is being loaded into the system.

Illustration 120 – P040 – Step 6 Grid Damping Square Wave Requirements



P040 STEP 6 SCREEN DISPLAY



UNIT P041 – Cassette Position Calibration

Time: x h xx min – Personnel: 1 field engineer

1 DESCRIPTION

The SFD cassette position calibration unit, P041, sets the cassette center “expose” position (LAT and LONG) data into system memory. Upon entering the unit the system automatically sets the image intensifier magnification mode to the maximum.

Note: This is a factory calibration. Check cassette position first before proceeding with a recalibration.

2 CAL PROCEDURE

1. Verify Alignment.
   a. Insert the test cassette in the SFD with the alignment washer centered on SFD window.
   b. Move SFD to minimum SID.
   c. Touch VERIFY softkey.
   d. Using Flouro radiation, verify that Cassette Center Mark falls within, or is just touching the first (inner) Alignment Washer Ring. See Illustration 121.
      – If within specifications, touch NEXT UNIT or UNIT MENU softkeys.
      – If not, continue with step 2.
2. Adjust Alignment.
   a. Touch RECAL softkey.
   b. During Fluoro radiation, use the JOG softkeys on the console screen display to position the cassette to meet specifications. See Illustration 121.
   c. When alignment is within specifications, touch DONE softkey to exit the calibration unit. An “Updating NV database” message is displayed while the position data is being loaded into the system.

P041 STEP 1 SCREEN DISPLAY

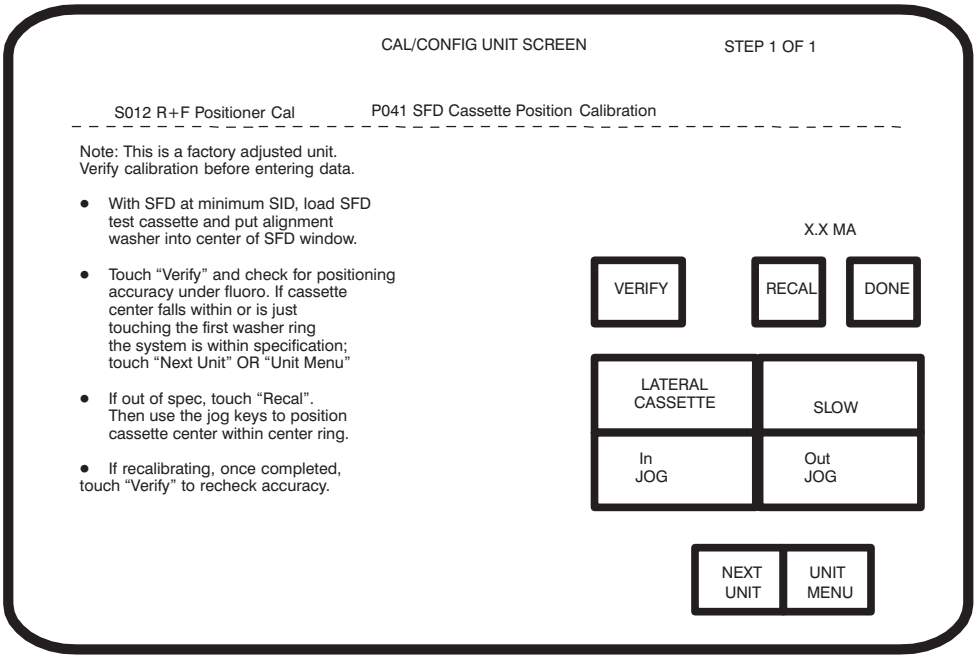
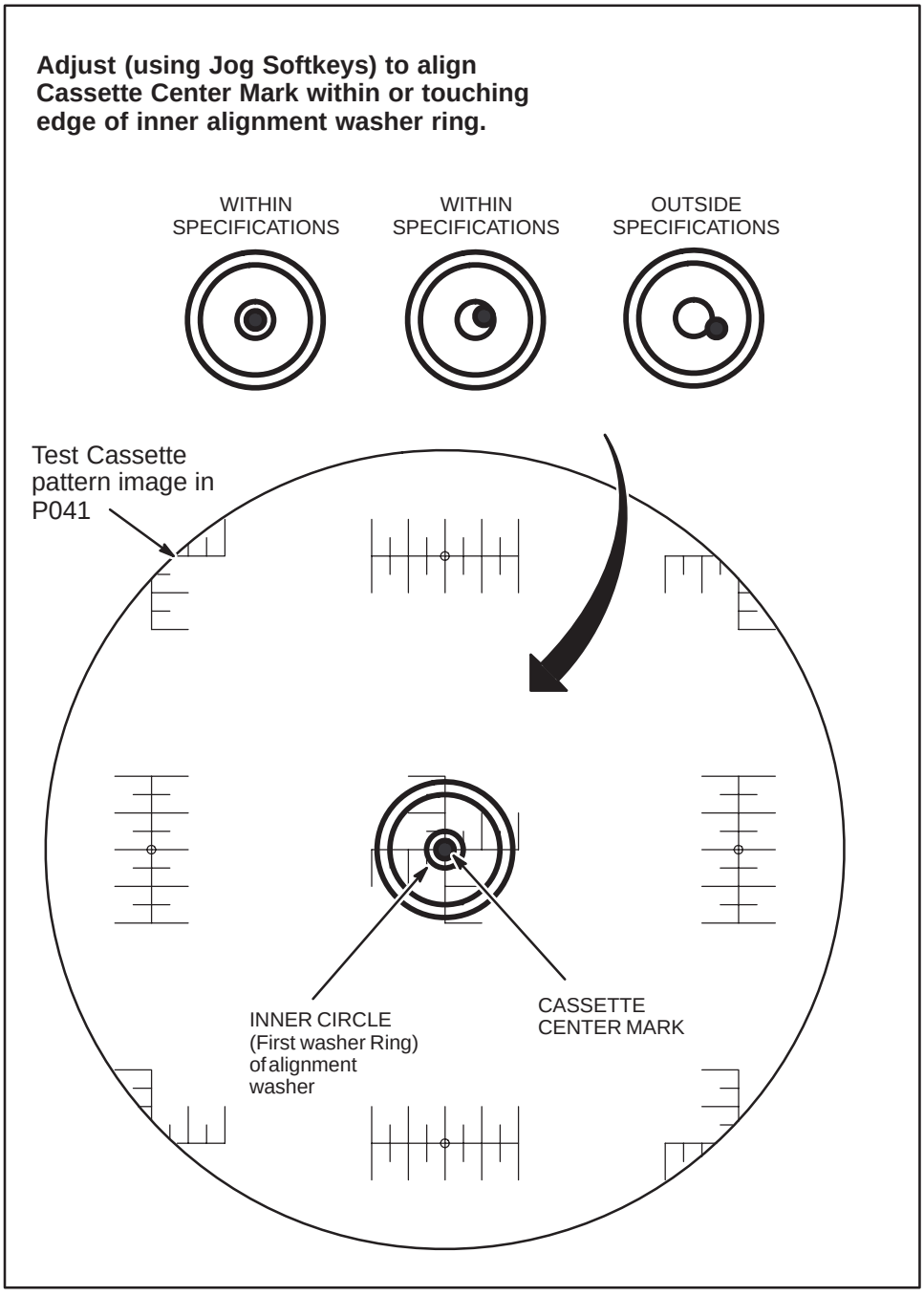


Illustration 121 – P041 SFD Test Cassette with Alignment Washer Pattern



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UNIT P102 – Collimator to X–Ray Tube Alignment

Time: x h xx min – Personnel: 1 field engineer

Note: The MX150/SRI collimator is factory aligned and needs no field adjustment. Therefore, P102 is required only for an overhead tube or an auxiliary tube. R&F Undertable and R&F/RAD XT Collimators are factory aligned and should only be adjusted when x–ray tube is replaced. Tilt–C and Tilt–C Vascular collimators are pinned and have no alignment available.

1 DESCRIPTION

Calibration Unit P102 is used to locate the center position of the collimator mounting ring with respect to the focal spots of an X–ray tube. The unit determines the correct position of the ring before securing it to an X–ray tube. The alignment is accomplished using manual procedures (no software driven functions are provided).

2 EQUIPMENT REQUIRED

Collimator Alignment Tool (CAT) (P/N 46–166390G2), and Standard tool kit.

3 SPECIAL INSTRUCTIONS

Note: **For Vascular Systems Only:** Before system calibration, verify that additional filter (copper–aluminum filter) is not installed on top of collimator. (Open sensor hinge assembly to verify.) If installed, remove before performing calibration.

CAUTION **OBSERVE STANDARD RADIATION SAFETY PRACTICES.**

4 CAL PROCEDURE

4-1 Collimator Alignment

- If the system is an LU configuration position U–arm to vertical. Tie lower end of U–arm to L–arm to prevent the U–arm from tipping when collimator is removed.
- Remove the collimator from the collimator mounting ring by loosening the collimator retaining screws and attach the CAT to the mounting ring.

Note: The FOCAL SPOT softkey and last paragraph of text shown on the screen display for P102 are only displayed if the system is configured with a multiple focal spot tube.

- If the system is configured with a multiple focal spot tube, select the SMALL FOCAL SPOT before proceeding with exposures.
- Take an exposure and view the output of the CAT (best viewed with room lights off). See Illustration 122.
- After the exposure, adjust collimator adapter plate to align the focal spot image to the CAT crosshairs as indicated below.

– LU, LC, LP Systems:
The requirement is to center the small focal spot on the crosshairs of the CAT. See Illustration 123. It is not necessary to repeat the alignment by selecting other focal spots. This applies to hexafocus tubes also. Only the small focal spot needs to be centered on the crosshairs of the CAT to ensure proper alignment.

– RAD and XT:
The requirement is to center the focal spots symmetrically about the crosshairs of the CAT. See Illustration 124. Use the FOCAL SPOT softkey to toggle between the small and large focal spots. Align to equalize the difference between the two spots. That is, the distance of the center of the small spot with respect to the crosshairs of the CAT (distance X1) should be equal to the distance between the center of the large spot and the crosshairs of the CAT (distance X2). A compromise setting may be necessary.

- Touch NEXT UNIT or UNIT MENU softkey to exit the unit.

P102 SCREEN DISPLAY

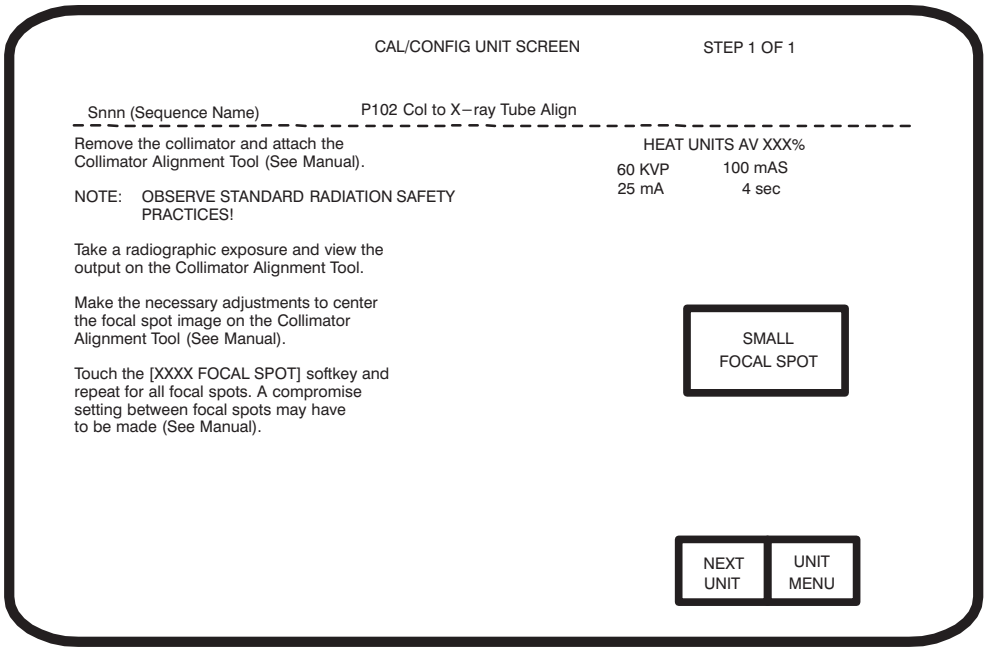


Illustration 122 – Typical Alignment Setup

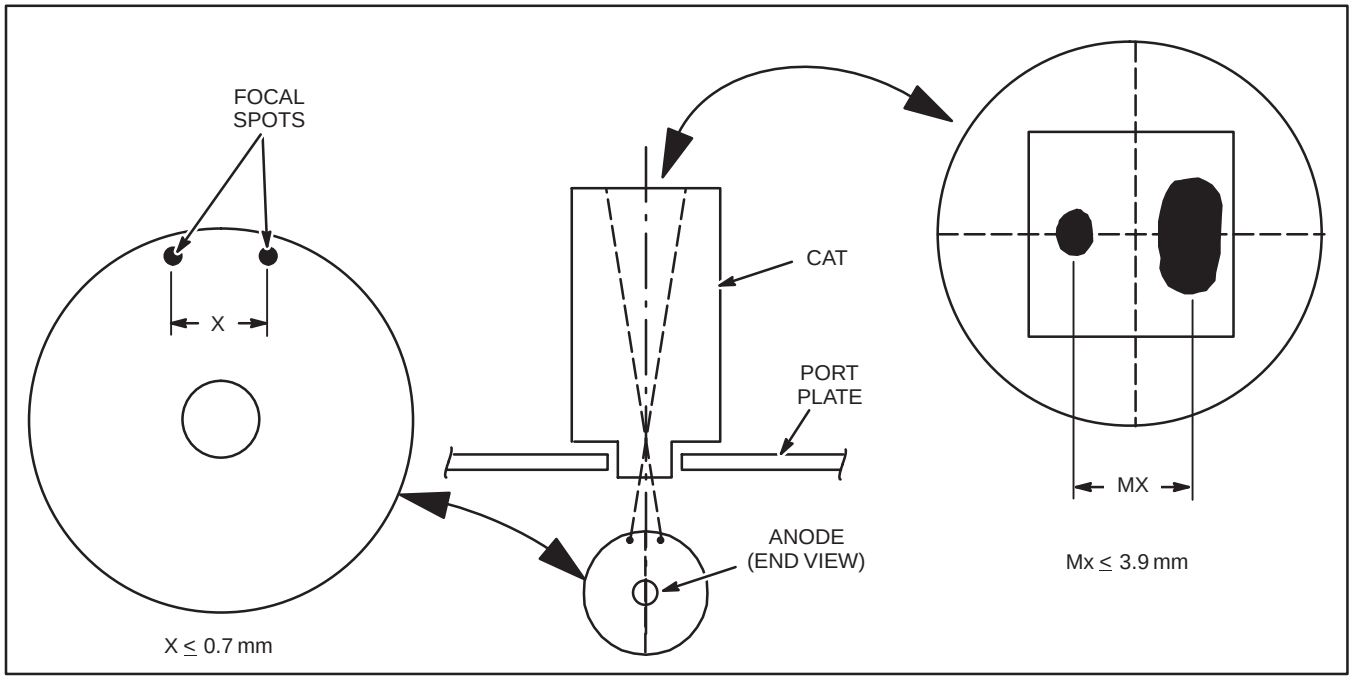


Illustration 123 – CAT Output Image Alignment, LU, LC, LP

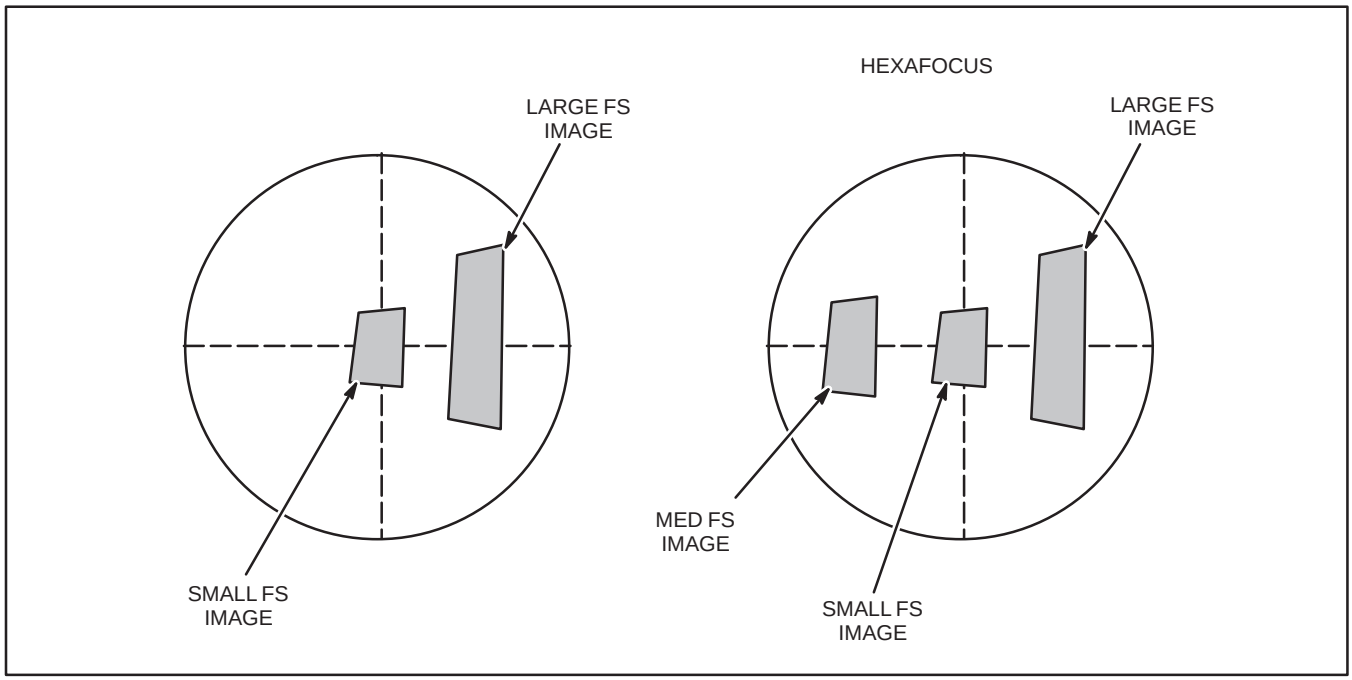
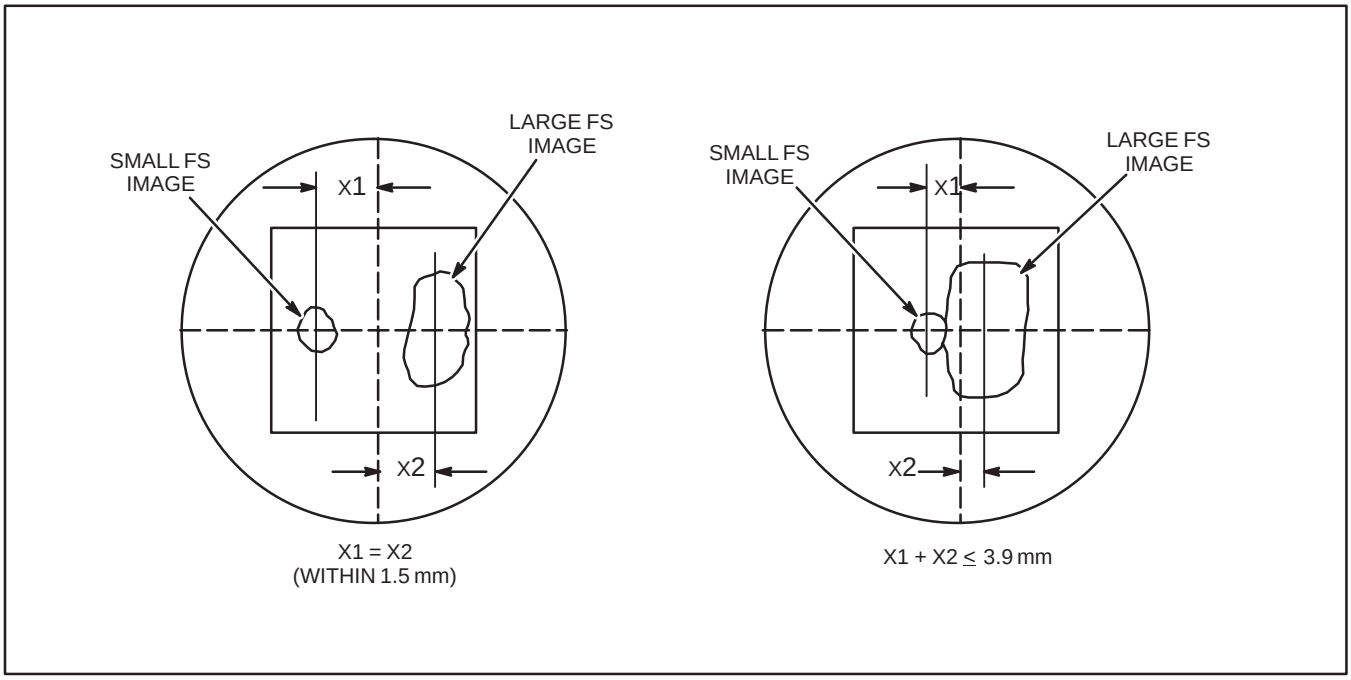


Illustration 124 – CAT Output Image Alignment, RAD, and R&F XT



UNIT P103 – Image Intensifier Alignment

Time: x h xx min – Personnel: 1 field engineer

1 DESCRIPTION

Calibration Unit P103 provides instructions for aligning the system Image Intensifier (II) with the lateral/vertical collimator blades. The unit is a steering unit and does not provide any software driven calibration functions. The unit display is only intended to direct the service person to the calibration procedure applicable to the system being calibrated. Cal Procedure applies to the alignment of the II on systems configured with an LCA, LCV+, or LC+ Positioner, and on *both* the frontal and lateral planes for an LCN+ or LCLP+ Positioner.

2 EQUIPMENT REQUIRED

LCA/LCV+/LC+/LCN+/LCLP+ Systems

Shims
Field Sizing Gauge (40 cm, 32 cm, or 22 cm, as appropriate for II) with millimeter scale.

3 SPECIAL INSTRUCTIONS

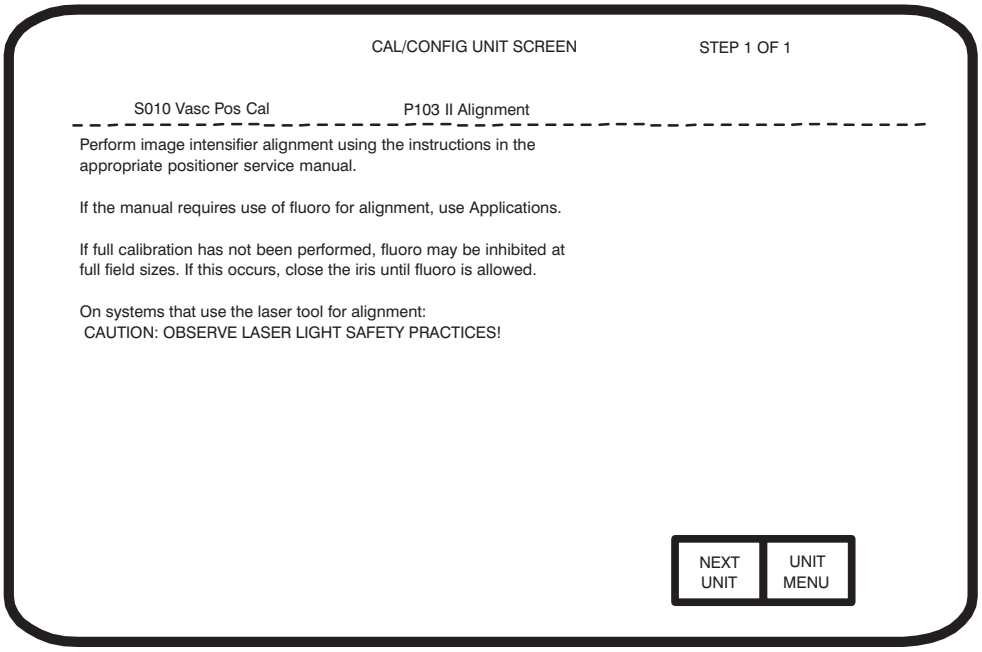
Note: **For Vascular Systems Only:** Before system calibration, verify that additional filter (copper–aluminum filter) is not installed on top of collimator. (Open sensor hinge assembly to verify.) If installed, remove before performing calibration.

4 CAL PROCEDURE

4-1 II Alignment on LCA, LCV+, LC+, LCN+, and LCLP+ Systems

- Refer to the appropriate positioner service manual for procedure.
- After the calibration is completed, touch NEXT UNIT or UNIT MENU softkey to exit.

P103 SCREEN DISPLAY



UNIT P107 – II SID Minimum Calibration

Time: x h xx min – Personnel: 1 field engineer

1 DESCRIPTION

Calibration Unit P107 is used to position the host gantry II and x–ray tube to minimum SID. The unit then reads the host link data SID position for the associated positioner (LCA, LCV+, LC+, LP+, or Tilt–C) depending on the plane the service mode is in and then displays this SID value on the console screen. Upon exit from the unit, the minimum SID value is stored in the database. Only one step is required to accomplish the calibration.

2 EQUIPMENT REQUIRED

None.

3 CAL PROCEDURE

3-1 Step 1.

- Position the II and x–ray tube (if required) to minimum SID.
- Touch [MINIMUM SID] softkey.

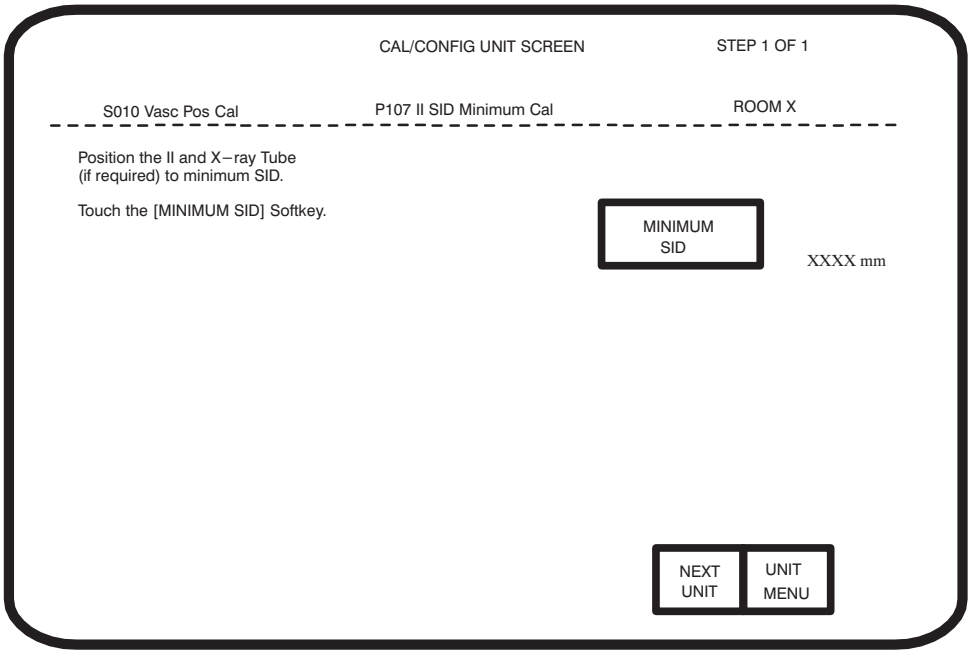
Note: The SID (image) displayed on the P107 screen display is the mechanical SID plus the II offset. The II offset is the distance between the mechanical II entrance and the II image plane.

Note: Mag on Table Side Control may change to **3**.

CAUTION **During the calibration do not attempt to change the magnification level. If the magnification level is changed an incorrect calibration will result.**

- Touch [NEXT UNIT] or [UNIT MENU] softkey to exit the unit. Exiting the unit automatically loads the minimum SID value into NV RAM.

P107 SCREEN DISPLAY



UNIT P119 – FC Parameters

Time: x h xx min – Personnel: 1 field engineer

1 DESCRIPTION

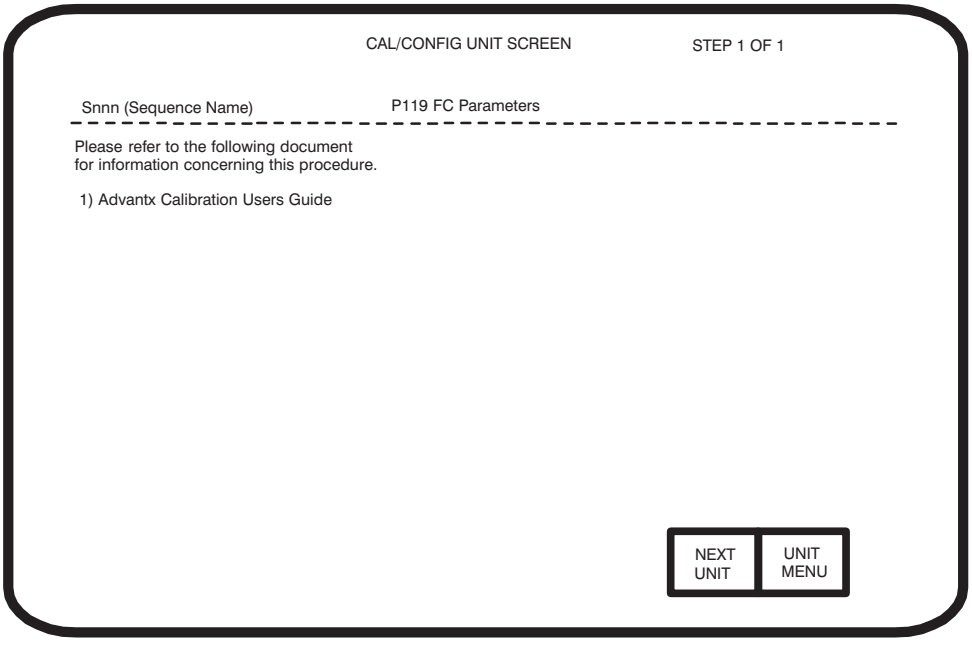
Calibration Unit P119 is used as a steering unit (reference screen only) to direct the user to the appropriate procedures for programming FC parameters. At installation, specific parameter information (such as; individual rated speed values of film changers, zero times for generators, delay and pulse times for injectors, table top movement, etc.) must be programmed into SEP memory in order to permit proper operation of the x–ray system hardware. The unit provides step by step instructions for programming a SEP 1, SEP 3 or SEP 90 Film Changer configuration.

Refer to the applicable programming procedure (SEP 1, SEP 3 or SEP 90) and follow the instructions accordingly.

2 EQUIPMENT REQUIRED

None.

P119 SCREEN DISPLAY



3 SEP 1 PROGRAMMING

The recommended programming of the SEP 1 parameters is indicated in Table 35. Perform the following steps in order to program all the data from Table 35 into the appropriate SEP 1 memory locations.

- Move SW25 on D103 board to the service enable position.
- On the SEP 1, simultaneously depress the CTRL I key (the left unmarked key) and numeric key 4 in order to enter the installation program.
- Use the keyboard to enter an address from Table 35. The address will appear on the “ENTRY” line of the input field.
- Depress the 1.5 key (ADDR) to place the address on the “ADDR” line of the input field and to allow data to be entered onto the “DATA” line.
- Enter the data (from Table 35) for the address shown. This data will appear on the “DATA” line of the input field.

Note: If necessary, the “ENTRY” position can be reset by pressing the CL key (clear).

- It is possible to step back and forth to consecutive memory locations by using the – key and the + key, respectively.
- To store new data at a selected address, select desired value on the “ENTRY” line and then press the W key (DATA) to place this value on the “DATA” line of the input field.
- Enter all of the data from Table 35 (Biplane has two film changers on the system).
- Depress program key to exit the installation program.
- Touch the NEXT UNIT or UNIT MENU softkey on the calibration unit screen to exit the unit. No parameters are stored in NV RAM upon exiting this unit.

Table 35 – SEP 1 Programming

ADDRESS	CODE	ADDRESS	CODE
0420	09	0444	01
0421	0A (biplane), 00 (single plane)	0445	00
0422	00	0446	01
0423	0A (biplane), 00 (single plane)	0447	00
0424	09 (biplane), 00 (single plane)	0448	42
0425	00	0449	10
0426	05	044A	0A
0427	06 (biplane), 00 (single plane)	044B	00 (SEP M1), 08 (SEP U1)
0428	00	044C	00
0429	06 (biplane), 00 (single plane)	044D	00
042A	05 (biplane), 00 (single plane)	044E	42
042B	00	044F	10
042C	83	0450	0A
042D	33, 83 (with table top stepper)	0451	00 (SEP M1) 08 (SEP U1)
042E	00	0452	00
042F	80	0453	00 (SEP M1), 04 (SEP U1)
0430	80	0454	00 (SEP M1), 04 (SEP U1)
0431	00	0455	00 (SEP M1), 04 (SEP U1)
0432	80	0462	00
0433	80	0463	7E (For SEP1/M–1), 4E (For SEP U1)
0434	81 (biplane), 00 (single plane)	0464	7E (For SEP1/M–1), 4E (For SEP U1)
0435	00 (FB, SEP M1 up to S/N 1200)	0465	7E (For SEP1/M–1), 4E (For SEP U1)
0436	00 (FB, SEP M1 up to S/N 1200)	0466	00
0437	00	0467	00
0438	07	0468	00
0439	00	0469	BB (For SEP1/M–1), 72 (For SEP U1)
043A	FE	046A**	BB (For SEP1/M–1), 72 (For SEP U1)
0438	32	046B	BB (For SEP1/M–1), 72 (For SEP U1)
043C	00	046C	00
043D	01	046D	00
043E	01	046E	00
043F	01	046F	97 (For SEP U1), 00 (SEP M1)
0440	00	0470**	97 (For SEP U1), 00 (SEP M1)
0441	03	0471	97 (For SEP U1), 00 (SEP M1)
0442	00 (single plane), 03 (biplane)	047C (01)	
0443	01		

** Preliminary speed adjustment data. Data may vary.

4 SEP 3 PROGRAMMING

Refer to the SEP 3 Service Manual, Installation Programming Section, for explanations of the parameters and instructions on how to program the parameters and/or make changes to the parameters if there is a problem or the customer desires a change.

- The recommended installation programming of the SEP 3 parameters is indicated in Table 36 (N=No, Y=Yes).

Note: PUCK C/CM film changer exposures are initiated at the Advantx console using the console handswitch.

- After all recommended parameters have been entered, continue to follow the procedures in the SEP 3 Service Manual. Ensure that the following procedures are performed:
  1. Erasure of Examination Program Memory.
  2. Erasure of Fixed Information.
  3. Clock Initiation.
  4. Installation of Maintenance Counters.
- Touch the NEXT UNIT or UNIT MENU softkey on the calibration unit screen display to exit the unit.

Table 36 – SEP 3 Installation Programming Parameters

CHANGER 1 INSTALLED	Y	(Frontal Film Changer)
RUN SPEED ADJUSTMENT	N	
ENABLE SYSTEM READY SIGNAL	N	
PUCK SERIAL NO.	1 or 2	<3000=1; >3001=2 (See Note 4)
CHANGER 2 INSTALLED	Y	(Lateral Film Changer)
RUN SPEED ADJUSTMENT	N	
ENABLE SYSTEM READY SIGNAL	N	
PUCK SERIAL NO.	1 or 2	<3000=1; >3001=2 (See Note 4)
CHANGER 3 INSTALLED	N	
RUN SPEED ADJUSTMENT	—	
ENABLE SYSTEM READY SIGNAL	—	
GENERATOR A INSTALLED	Y	(Frontal Generator)
CHANGER 1 ALLOWED	Y	
CHANGER 2 ALLOWED	N	
CHANGER 3 ALLOWED	N	
MAX EXPOSURE TIME AT 1 f/s (ms)	640	
MAX EXPOSURE TIME AT 2 f/s (ms)	320	
MAX EXPOSURE TIME AT 3 f/s (ms)	160	
MAX EXPOSURE TIME AT 4 f/s (ms)	100	(See Note 1)
ZERO TIME (ms)	5	(See Note 3)
EXPOSURE TURN OFF TIME (ms	0	

Table 36 (Cont'd) – SEP 3 Installation Programming Parameters

PRE–EXPOSURE SIGNAL TIME (ms)	10	(See Note 3)
PREP TIMEOUT (s)	2	
ENABLE READY SIGNAL	N	
ENABLE PREP READY SIGNAL	N	
GENERATOR B INSTALLED	Y	(Lateral Generator)
CHANGER 1 ALLOWED	N	
CHANGER 2 ALLOWED	Y	
CHANGER 3 ALLOWED	N	
MAX EXPOSURE TIME AT 1 f/s (ms)	640	
MAX EXPOSURE TIME AT 2 f/s (ms)	320	
MAX EXPOSURE TIME AT 3 f/s (ms)	160	
MAX EXPOSURE TIME AT 4 f/s (ms)	100	(See Note 1)
ZERO TIME (ms)	5	
EXPOSURE TURN OFF TIME (ms)	0	
PRE–EXPOSURE SIGNAL TIME (ms)	10	
PREP TIMEOUT (s)	2	
ENABLE READY SIGNAL	N	
ENABLE PREP READY SIGNAL	N	
INJECTOR INSTALLED	Y	
ENABLE WAIT FUNCTION	N	
ENABLE READY SIGNAL	N	
(These parameters work for Medrad Mark IV, Mark V, Angiomat 3000, 6000 injectors)		
STEPPING DEVICE INSTALLED	Y	
ENABLE WAIT FUNCTION	Y	
REVERSE MOTION INSTALLED	N	
DELAY TIME (ms)	300	(See Note 2)
PULSE TIME (ms/WAIT)	WAIT	
STAB TIME (ms)	400	
ENABLE READY SIGNAL	N	(See Note 5)
(These parameters work for Omega III stepping top)		
PAG INSTALLED	N	(See Note 4)
STAND INTERFACE INSTALLED	N	
AUXILIARY INSTALLED	N	
ENABLE WAIT FUNCTION	—	
EXT CONTROLLED EXPOSURE	—	
PULSE TIME (ms/WAIT/INFI)	—	
ENABLE READY SIGNAL	—	

Table 36 (Cont'd) – SEP 3 Installation Programming Parameters

SYSTEM PARAMETERS	—	
CHANGER SELECTION/STATUS(0–4)	0	
BELL SOUND EACH SECOND	Y	
FILMS BEFORE CLEANING(0–1000)		
MODE (MONO=0, BIPLANE 1, 2 or 3)	2	1=ALT, 2–SIM, 3=BOTH (See Note 4)
ENABLE READY KEY	N	(See Note 4)
ENABLE CONFIRM OF PAT I.D.	N	(See Note 4)

Note:

1. The error message "Selected Exposure Time Greater Than Device Will Allow" may appear after taking a 100 ms exposure at 4 f/s with a Puck film changer. This happens because the exposure window of the Puck varies slightly. A maximum exposure time of 80 ms is recommended at 4 f/s. Exposures times of 100 ms may be possible depending on the individual characteristics of the Puck film changer used.
2. The maximum exposure time should be limited to 300 msec because of the stepping table top "delay time". The "delay time" is the time from the start of the last exposure to the start of the table step command. The "delay time" is normally set to 300 msec. The "delay time" can be programmed up to 400 msec. This would permit a longer maximum exposure time.
3. On systems with Exposure Monitoring, set ZERO TIME and PRE-EXPOSURE SIGNAL TIME as follows:

Table 37 – Exposure Times

PARAMETER	Without Exposure Monitoring	With Video Flash or Field Grabber		With Pulscan	
		50 Hz	60 Hz	50 Hz	60 Hz
ZERO TIME	5 ms	32 ms	28 ms	52 ms	45 ms
PRE-EXPOSURE SIGNAL TIME	10 ms	37 ms	33 ms	57 ms	50 ms

4. This parameter is only provided with the SEP 4.1 firmware.

5 SEP 90 PROGRAMMING

Refer to the SEP 90 Service Manual, Installation Programming Section, for explanations of the parameters and instructions on how to program the parameters and/or make changes to the parameters if there is a problem or the customer desires a change.

To enter Service Mode for the PUCK 90, refer to the SEP 90 Service Manual on how to change parameters when using the PUCK 90 without films or cassettes.

NOTICE

Before performing the installation programming, the base installation should be performed. This is done by pressing CTRL–R in the initial menu of the installation program.

- The recommended installation programming of the SEP 90 parameters is indicated in Table 38 (N=No, Y–Yes).

Note: PUCK 90, PUCK C/CM film changer exposures are initiated at the Advantx console using the console handswitch.

- After all recommended parameters have been entered, continue to follow the procedures in the SEP 90 Service Manual. Ensure that the following procedures are performed:
  1. Erasure of Examination Program Memory.
  2. Erasure of Fixed Information.
  3. Clock Initiation.
  4. Installation of Maintenance Counters.
- Touch the NEXT UNIT or UNIT MENU softkey on the calibration unit screen display to exit the unit.

Table 38 – SEP 90 Installation Programming Parameters

CHANGER 1 INSTALLED	Y	(Frontal Film Changer)
RUN SPEED ADJUSTMENT	N	
ENABLE SYSTEM READY SIGNAL	N	
PUCK SERIAL NO.	1 or 2	–4000=1, 2=4001–
EXPOSURE START DELAY 1 f/s (ms)	000	
EXPOSURE START DELAY 2 f/s (ms)	000	
EXPOSURE START DELAY 3 f/s (ms)	000	
EXPOSURE START DELAY 4 f/s (ms)	000	
CHANGER 2 INSTALLED	Y	(Lateral Film Changer)
RUN SPEED ADJUSTMENT	N	
ENABLE SYSTEM READY SIGNAL	N	
PUCK SERIAL NO.	1 or 2	–4000=1, 2=4000–
EXPOSURE START DELAY 1 f/s (ms)	000	
EXPOSURE START DELAY 2 f/s (ms)	000	

Table 38 (Cont'd) – SEP 90 Installation Programming Parameters

EXPOSURE START DELAY 3 f/s (ms)	000	
EXPOSURE START DELAY 4 f/s (ms)	000	
CHANGER 3 INSTALLED	N	
RUN SPEED ADJUSTMENT	—	
ENABLE SYSTEM READY SIGNAL	—	
GENERATOR A INSTALLED	Y	(Frontal Generator)
CHANGER 1 ALLOWED	Y	
CHANGER 2 ALLOWED	N	
CHANGER 3 ALLOWED	N	
MAX EXPOSURE TIME AT 1 f/s (ms)	640	
MAX EXPOSURE TIME AT 2 f/s (ms)	320	
MAX EXPOSURE TIME AT 3 f/s (ms)	160	
MAX EXPOSURE TIME AT 4 f/s (ms)	100	(See Note 1)
ZERO TIME (ms)	5	(See Note 3)
EXPOSURE TURN OFF TIME (ms	0	
PRE–EXPOSURE SIGNAL TIME (ms)	10	(See Note 3)
PREP TIMEOUT (s)	2	
ENABLE READY SIGNAL	N	
ENABLE PREP READY SIGNAL	N	
GENERATOR B INSTALLED	Y	(Lateral Generator)
CHANGER 1 ALLOWED	N	
CHANGER 2 ALLOWED	Y	
CHANGER 3 ALLOWED	N	
MAX EXPOSURE TIME AT 1 f/s (ms)	640	
MAX EXPOSURE TIME AT 2 f/s (ms)	320	
MAX EXPOSURE TIME AT 3 f/s (ms)	160	
MAX EXPOSURE TIME AT 4 f/s (ms)	100	(See Note 1)
ZERO TIME (ms)	5	
EXPOSURE TURN OFF TIME (ms)	0	
PRE–EXPOSURE SIGNAL TIME (ms)	10	
PREP TIMEOUT (s)	2	
ENABLE READY SIGNAL	N	
ENABLE PREP READY SIGNAL	N	
INJECTOR INSTALLED	Y	
ENABLE WAIT FUNCTION	Y	
ENABLE READY SIGNAL	N	
(These parameters work for Medrad Mark IV, Mark V, Angiomat 3000, 6000 injectors)		

Table 38 (Cont'd) – SEP 90 Installation Programming Parameters

STEPPING DEVICE INSTALLED	Y	
ENABLE WAIT FUNCTION	Y	
REVERSE MOTION INSTALLED	N	
DELAY TIME (ms)	300	(See Note 2)
PULSE TIME (ms/WAIT)	WAIT	
STAB TIME (ms)	400	
ENABLE READY SIGNAL	N	(See Note 5)
(These parameters work for Omega III stepping top)		
PAG INSTALLED	N	
EXTERNAL INTERFACE SIGNAL	N	
AUXILIARY INSTALLED	N	
PRINTER INSTALLED	N	(See Note 4)
SYSTEM PARAMETERS	—	
CHANGER SELECTION/STATUS(0–4)	0	
BELL SOUND EACH SECOND	Y	
FILMS BEFORE CLEANING(0–1000)		
MODE (MONO=0, BIPLANE 1, 2 or 3)	2	1=ALT, 2–SIM, 3=BOTH
ENABLE READY KEY	N	
ENABLE CONFIRM OF PAT I.D.	N	
LANGUAGE (ENG=1, GER=2)	1	

Note:

1. The error message "Selected Exposure Time Greater Than Device Will Allow" may appear after taking a 100 ms exposure at 4 f/s with a Puck film changer. This happens because the exposure window of the Puck varies slightly. A maximum exposure time of 100 ms is recommended at 4 f/s. If the above error message appears during exposures, then the maximum recommended exposure time is 80 ms.
2. The maximum exposure time should be limited to 300 msec because of the stepping table top "delay time". The "delay time" is the time from the start of the last exposure to the start of the table step command. The "delay time" is normally set to 300 msec. The "delay time" can be programmed up to 400 msec. This would permit a longer maximum exposure time.

3. On systems with Exposure Monitoring, set ZERO TIME and PRE–EXPOSURE SIGNAL TIME as follows:

Table 39 – Exposure Times

PARAMETER	Without Exposure Monitoring	With Video Flash or Field Grabber		With Pulscan	
		50 Hz	60 Hz	50 Hz	60 Hz
ZERO TIME	5 ms	32 ms	28 ms	52 ms	45 ms
PRE-EXPOSURE SIGNAL TIME	10 ms	37 ms	33 ms	57 ms	50 ms

4. If printer installed is YES, enter label size appropriate to customer requirements.

UNIT P124 – XRT Alignment

Time: x h xx min – Personnel: 1 field engineer

Note: P124 does not apply to a MX150 tube. It is required only for an overhead tube or an auxiliary tube.

1 DESCRIPTION

Calibration Unit P124 provides instructions for mechanically aligning the system X–ray tube to the L–axis isocenter on systems configured with either an LC positioner. The unit is a steering unit and does not provide any software driven calibration functions. The unit display is only intended to direct the service person to the calibration procedure applicable to the system being calibrated. Cal Procedure applies to the alignment of the X–ray tube in systems configured with the LC positioner.

2 EQUIPMENT REQUIRED

LC Systems

Laser alignment tool (46–216640G1)
Mounting plate shims
Standard tool kit
Level



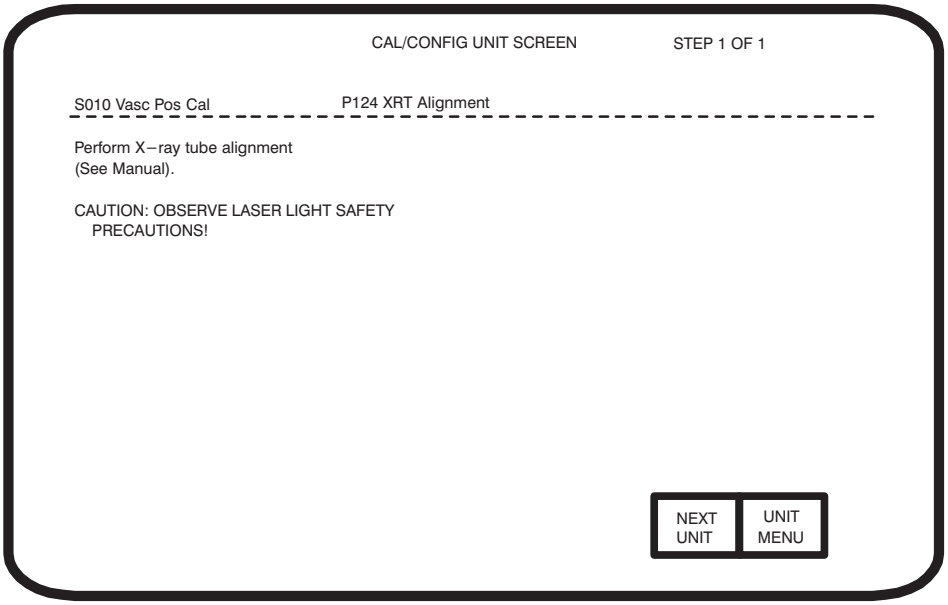
OBSERVE LASER LIGHT SAFETY PRACTICES WHEN PERFORMING THIS UNIT.

3 CAL PROCEDURE

3-1 XRT Alignment on LC

- Refer to the appropriate positioner service manual for procedure:
- Touch NEXT UNIT or UNIT MENU softkey to exit the calibration unit.

P124 SCREEN DISPLAY



UNIT P125 – ISO Alignment Verification

Time: x h xx min – Personnel: 1 field engineer

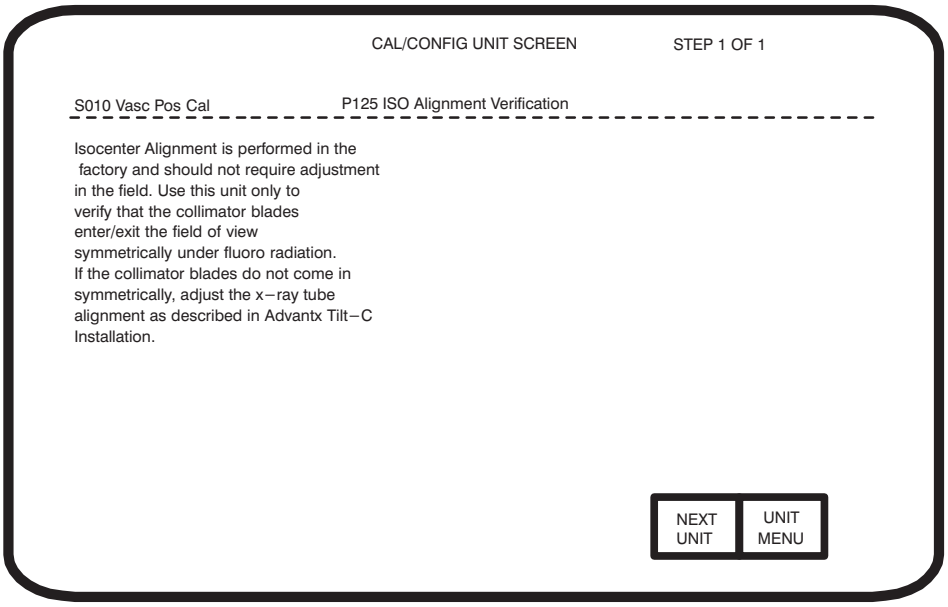
1 DESCRIPTION

Calibration Unit P125 is used to check the x–ray tube to isocenter alignment on TILT–C systems using radiation. For TILT–C systems, the unit is only used as a steering unit to direct the service person to the appropriate procedures.

NOTICE

<u>TILT–C Systems Only.</u> Isocenter alignment is performed in the factory and should not require adjustment in the field. Use this unit only to verify that the rectangular collimator blades enter/exit the field of view symmetrically under fluoro radiation. If the collimator blades do not come in symmetrically, adjust the x–ray tube alignment as described in Direction 2106453–100, *Advantx Tilt–C Installation*.

P125 SCREEN DISPLAY



Blank page.

UNIT P126 – LP Isocenter/Mech Alignment

Time: x h xx min – Personnel: 1 field engineer

1 DESCRIPTION

Calibration Unit P126 is a steering unit that directs the user to the appropriate manual procedures covering the LP3 isocenter/mechanical alignment. The unit screen display is a reference screen only. The alignment is performed according to the instructions referenced below.

2 EQUIPMENT REQUIRED

Standard tool kit, radius rods (P/N 45 204 201), carriage shaft wrench (P/N 45 438 213), level, isocenter fixture (P/N 45 438 209), plumb bob, and laser tool with special mounting piece for LP3.

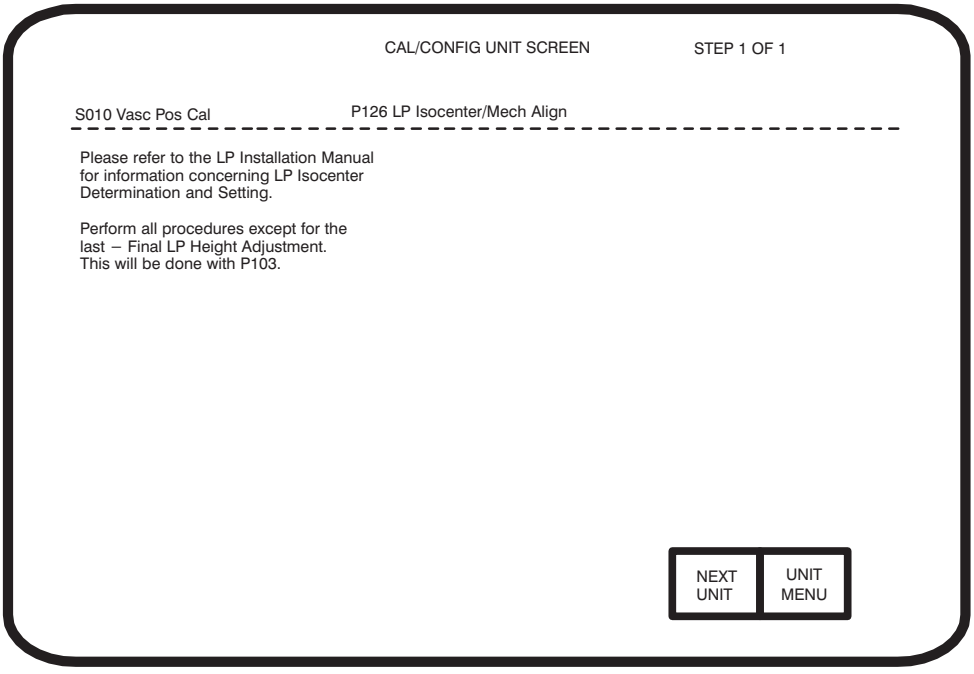
3 CAL PROCEDURE

Perform LP3 isocenter alignment as follows:

- Refer to the LP3 installation manual SM 2198149–100, and perform the procedure given in IST010.
- Exit the unit by touching the NEXT UNIT or UNIT MENU softkey.

Note: The final LP3 height adjustment will be accomplished after running Image Intensifier Alignment Verification Unit P103 which follows P126.

P126 SCREEN DISPLAY



Blank page.

UNIT P301 – Ultranet Collimator Calibration

Time: x h xx min – Personnel: 1 field engineer

1 DESCRIPTION

Calibration Unit P301 is used to set the gain and offset values for the open and closed positions of the longitudinal and transverse blades of the Ultranet Over table (RAD) Collimator. Six steps are required to accomplish the calibration. A screen display is provided for each step.

2 EQUIPMENT REQUIRED

Film Cassette (14 inch x 14 inch or 14 inch x 17 inch), steel ruler (metric), and film (type used at the site).

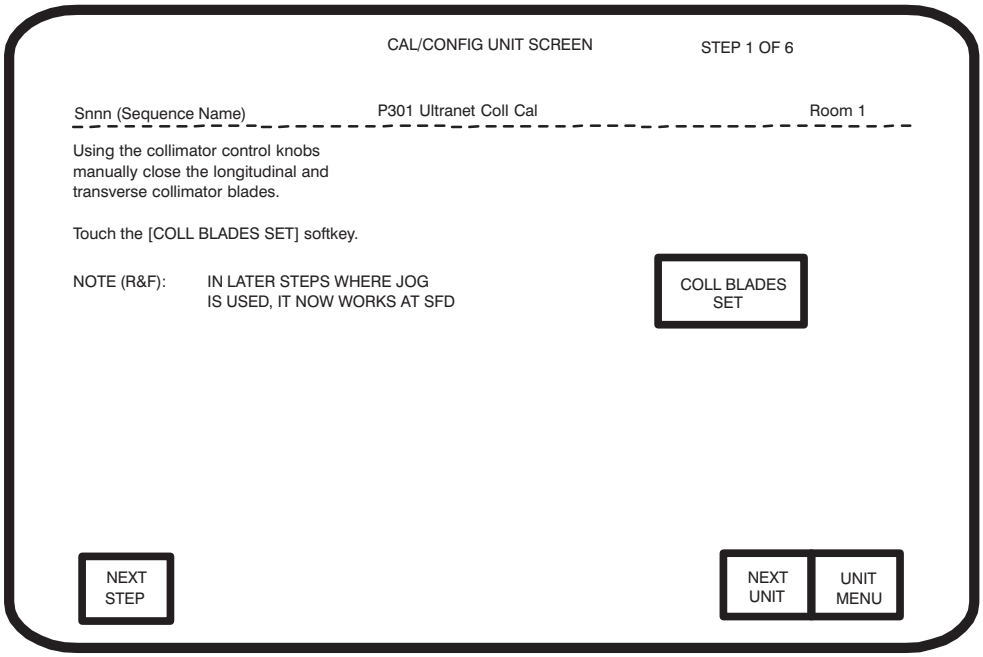
Note: This calibration unit uses a fixed technique of 60 kVp, 50 mA, 50 msec for exposures. For best results, use screens with film speeds less than 200.

3 CAL PROCEDURE

3-1 Step 1. Set Blade Closed Position

- Using the control knobs located on the collimator, manually set the longitudinal and transverse blades to the closed position.
- Touch the COLL BLADES SET softkey to enter the blade position data.
- Touch NEXT STEP softkey to proceed to Step 2.

P301 STEP 1 SCREEN DISPLAY



3-2 Step 2. Adjust Blade Position

- Rotate the collimator in either direction from 0 degree park position and place in 90 degree position. See Illustration 125.
- Place a loaded film cassette (14 inch x 14 inch or 14 inch x 17 inch) diagonally on the table top or floor. See Illustration 125.
- Adjust the source (XRT focal spot) to image (cassette film plane) distance to the SOURCE–IMAGE DIST indicated on the Step 2 screen (±1 mm).
- Turn on the field light. Use the jog softkeys on the screen to position the transverse and longitudinal blades to the image size indicated on the Step 2 screen (±5 mm). If the anode cutoff mask interferes with the long light pattern, measure half the size from the crosshair to the blade which is not affected by the mask.

Note: If the system is configured with a Spot–Film Device (SFD), control of the jog functions can be accomplished directly from the SFD control panel. It is not necessary to return to the jog control softkeys displayed on the console screen to position functions. Refer to General Notes at the beginning of Section 7 i n this manual for instructions covering the jog controls on the SFD front panel.

- Touch the COLL BLADE SET softkey to enter the blade position data.
- Touch NEXT STEP softkey to proceed to Step 3.

P301 STEP 2 SCREEN DISPLAY

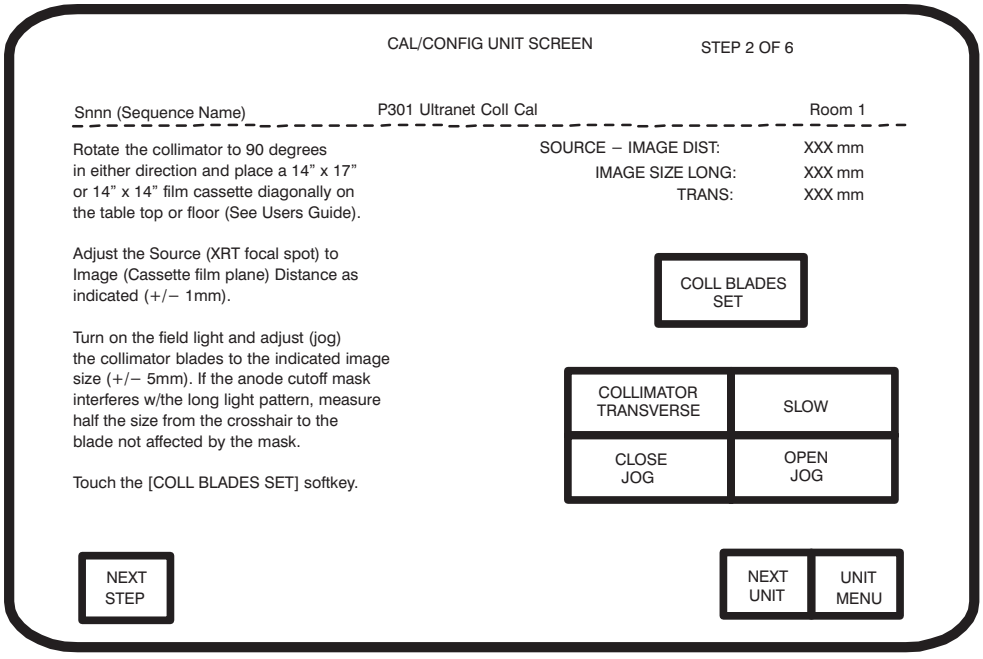
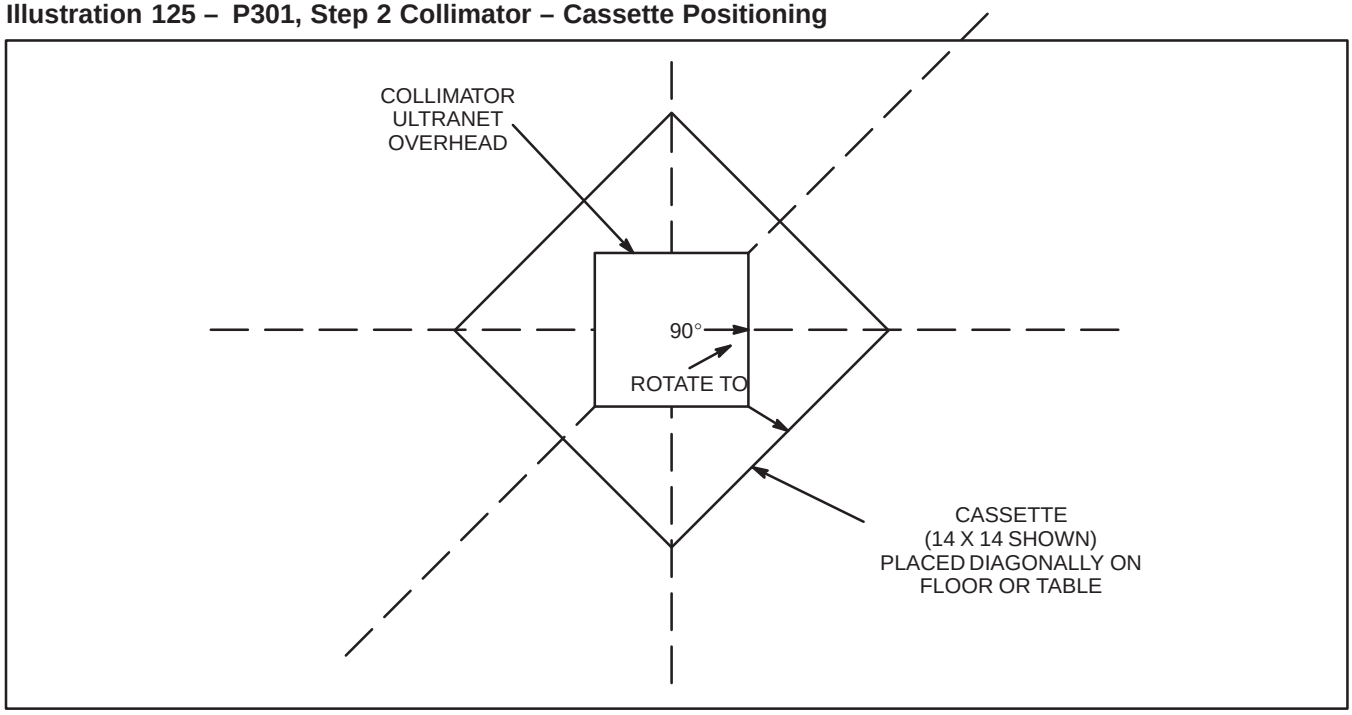


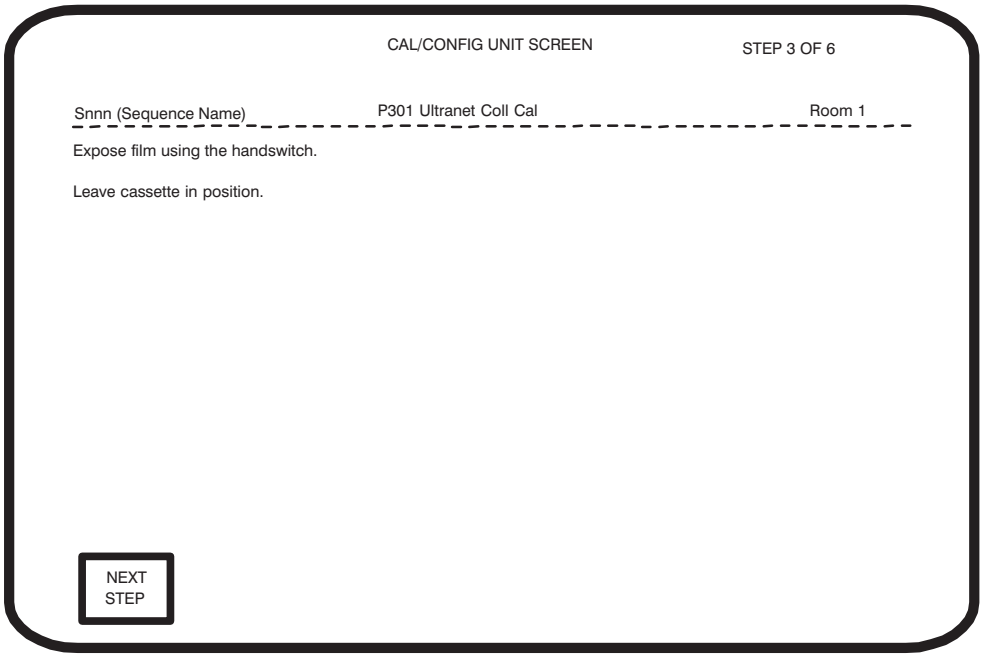
Illustration 125 – P301, Step 2 Collimator – Cassette Positioning



3-3 Step 3. Expose Film

- Take an exposure by pressing the PREP and EXPOSE switches on the console handswitch.
- Leave the cassette in position. Do not develop film at this step.
- Touch NEXT STEP softkey to proceed to Step 4.

P301 STEP 3 SCREEN DISPLAY



3-4 Step 4. Adjust Blade Position

- Rotate the collimator to the 0 degree position. See Illustration 126.
- Rotate the film cassette 90 degrees. See Illustration 126.
- Maintain source to image distance as set in Step 2.
- Turn on the collimator light and using the jog softkeys on the screen, position the transverse and longitudinal blades to the image size indicated on the Step 4 screen (± 5 mm).
- Touch the COLL BLADE SET softkey to enter the blade position data.
- Touch NEXT STEP softkey to proceed to Step 5.

P301 STEP 4 SCREEN DISPLAY

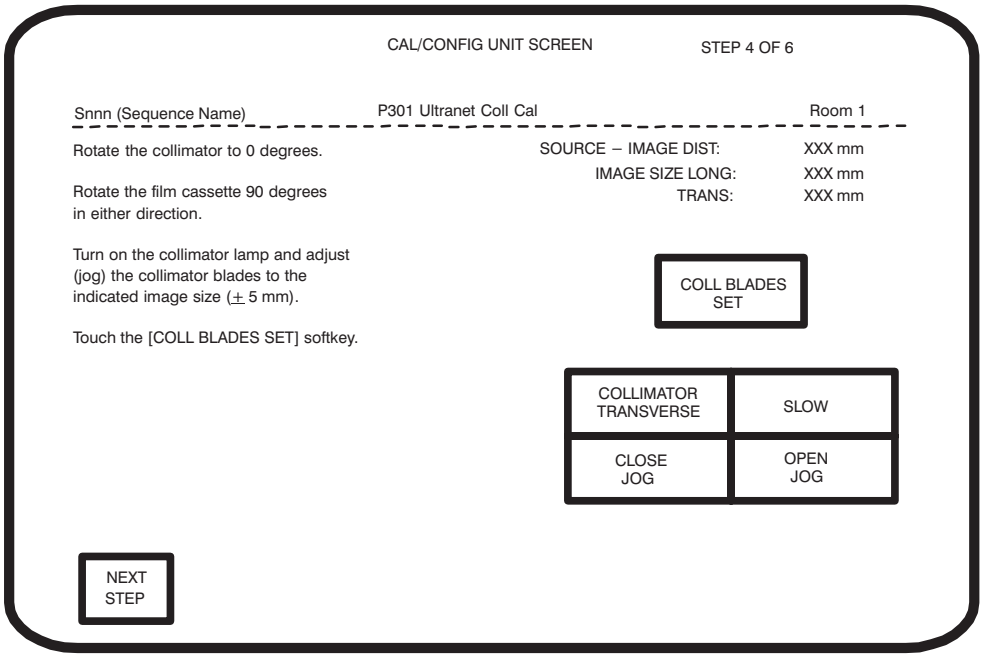
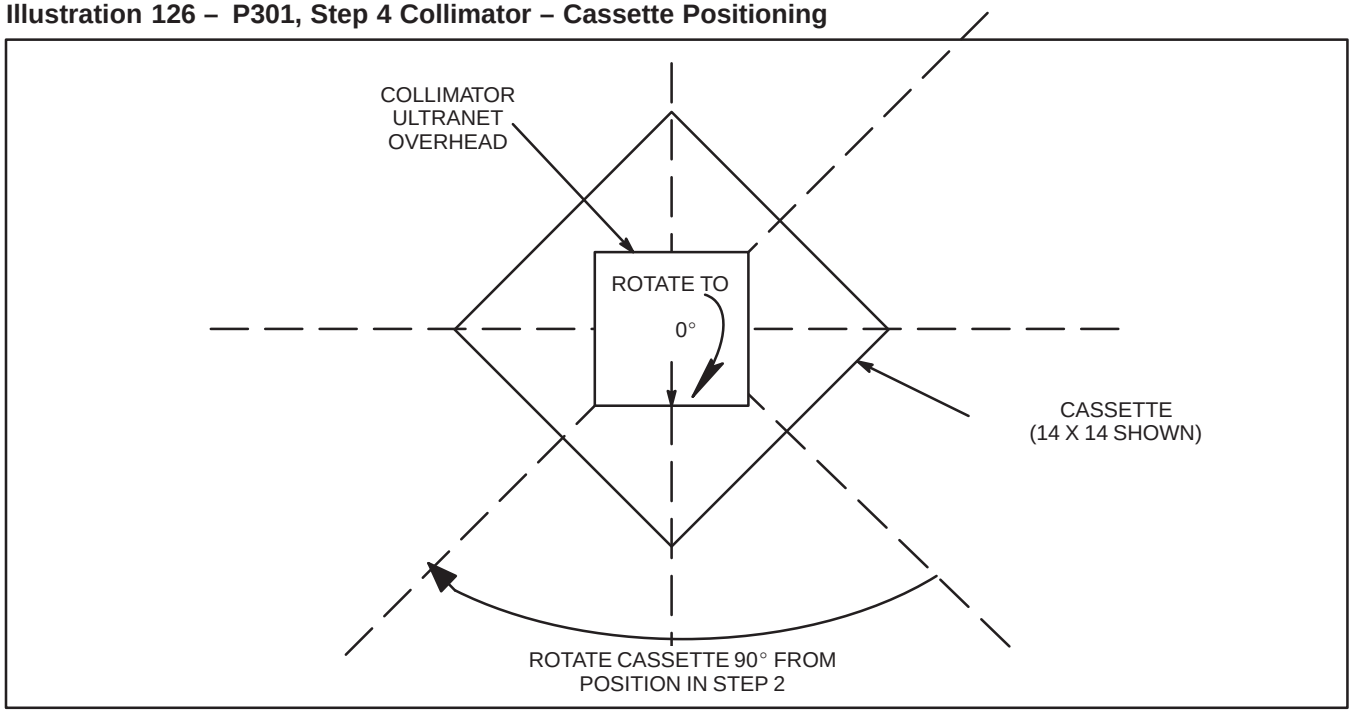


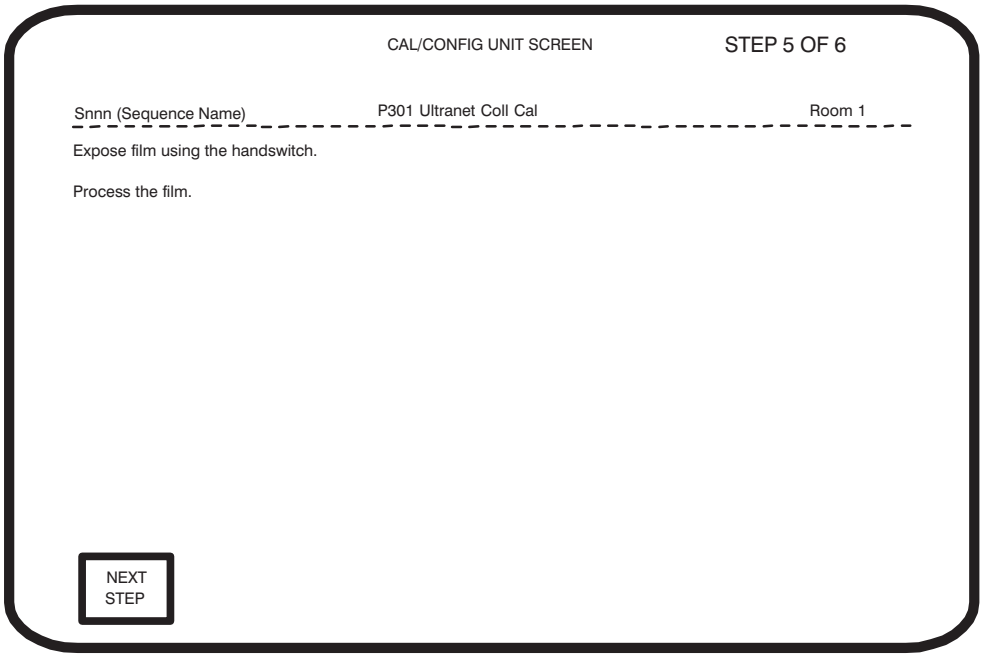
Illustration 126 – P301, Step 4 Collimator – Cassette Positioning



3-5 Step 5. Expose Film

- Take an exposure by pressing the PREP and EXPOSE switch on the console handswitch.
- Remove the cassette from the table or floor and process the film.
- Touch NEXT STEP softkey to proceed to Step 6.

P301 STEP 5 SCREEN DISPLAY



3-6 Step 6. Measure Rectangles on Film

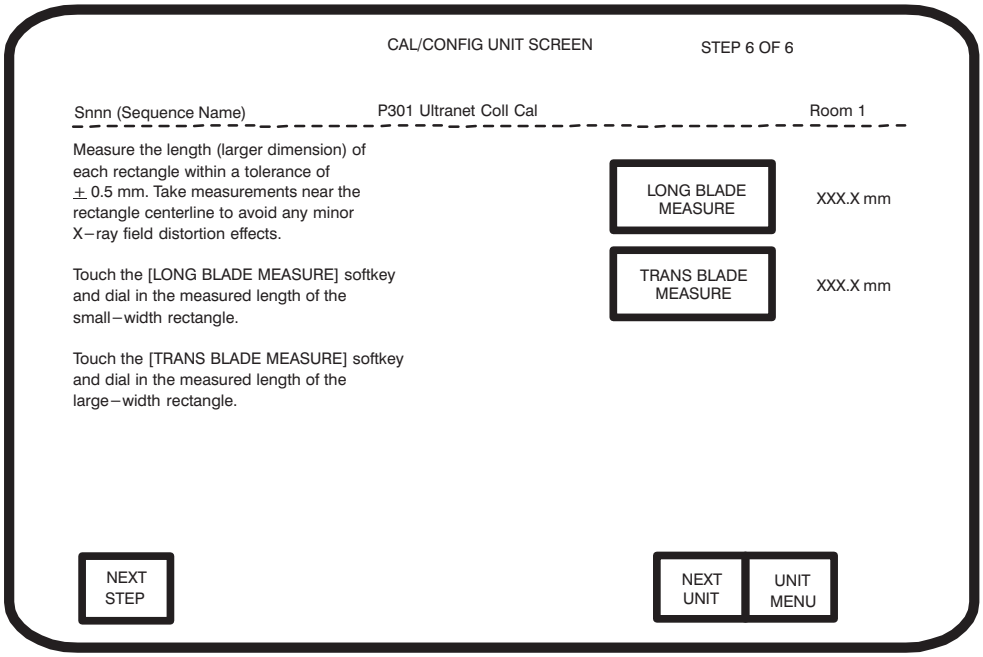
- Using a metric steel ruler measure the length (largest dimension) of each rectangle on the developed film within a tolerance of ± 5 mm. Take the measurements near the center–line of the rectangles to avoid errors that may be introduced by the effects of X–ray field distortion. Record the measurements.

  Longitudinal Blade Measurement
  (Small Rectangle)_____ ± 5 mm

  Transverse Blade Measurement
  (Large Rectangle)_____ ± 5 mm

- Touch the LONG BLADE MEASURE softkey and use the console dial to enter the measured length of the small–width rectangle.
- Touch the TRANS BLADE MEASURE softkey and use the console dial to enter the measured length of the large–width rectangle.
- Touch the NEXT UNIT or UNIT MENU softkey to exit.

P301 STEP 6 SCREEN DISPLAY



UNIT P304 – SID Pot A/D Calibration

Time: x h xx min – Personnel: 1 field engineer

1 DESCRIPTION

Calibration Unit P304 adjusts the X–ray tube source to image distance (SID) potentiometer to establish the A/D parameters required for automatic collimator sizing calculations to the horizontal film plane. The unit is run once for each X–ray tube suspension/tube support on a system. Three steps are required to accomplish the calibration. A screen display is provided for each step.

2 EQUIPMENT REQUIRED

None.

3 SPECIAL INSTRUCTIONS

The following special instructions pertain to the running of this unit.

- Verify that XT SID potentiometer is functioning properly before setting upper and lower limit or horizontal–receptor film size errors will result.
- Anything can be used as a reference platform (chair, bench, etc.) if table top is not available as long as the distance to the object used is about equal to the table top distance of 1150 mm (1100 mm for systems with Compax 400/400T).

4 CAL PROCEDURE

4-1 Step 1. Set Upper Limit

- Position the X–ray tube Focal Spot to a minimum of 1150 mm above the table top reference position.

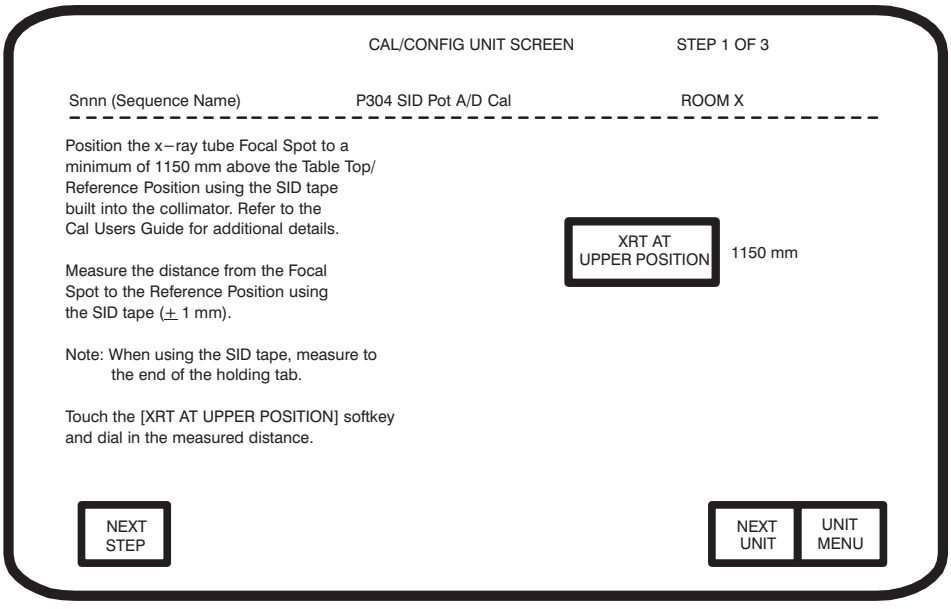
Note: For systems configured with Compax 40E, position the elevating table top to the lowest point of travel. For systems configured with Compax 400/400T, set X–ray tube focal spot to minimum. of 1100 mm.

- Using the SID tape built into the collimator, measure the actual distance from the Focal Spot to the reference position. Measure to the end of the tab on the SID tape.

  Measured Distance _____mm.

- Touch the XRT AT UPPER POSITION softkey and use the console dial to enter the measured distance.
- Touch NEXT STEP softkey to proceed to Step 2.

P304 STEP 1 SCREEN DISPLAY



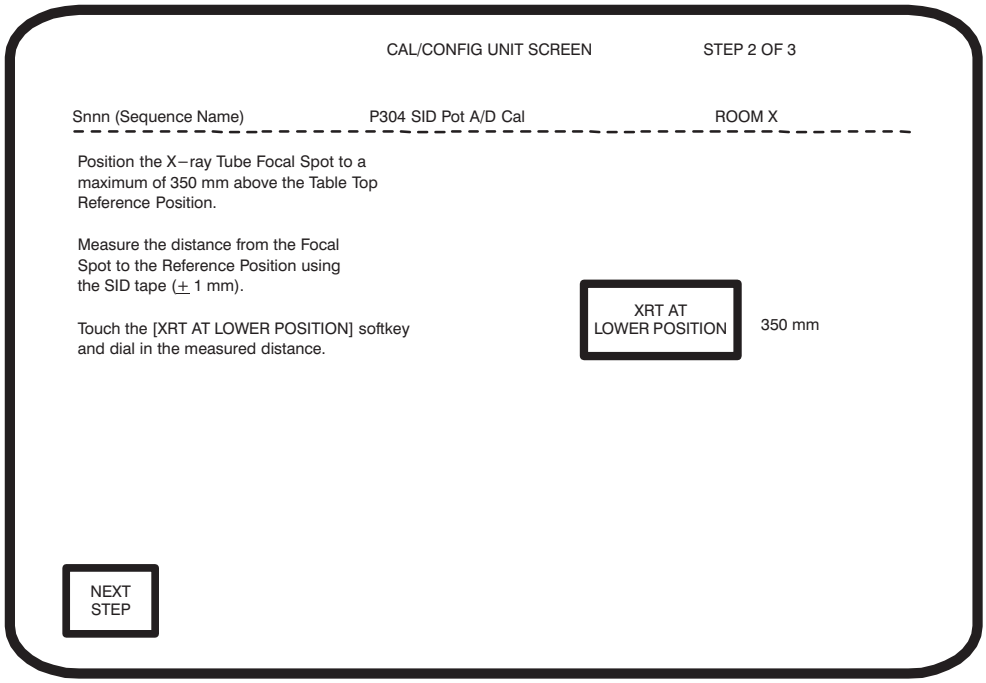
4-2 Step 2. Set Lower Limit

- Position the X–ray tube Focal Spot to a minimum (less than 350 mm) above the table top reference position.

Note: For systems configured with Compax 40E, position the X–ray tube so that the collimator rails are in contact with the table top.

- Using the SID tape built into the collimator, measure the actual distance from the X–ray tube Focal Spot to the reference position. Measure to the end of the tab on the SID tape.
  Measured Distance _____mm.
- Touch the XRT AT LOWER POSITION softkey and use the console dial to enter the measured distance.
- Touch NEXT STEP softkey to proceed to Step 3.

P304 STEP 2 SCREEN DISPLAY



4-3 Step 3. Verify A/D Cal

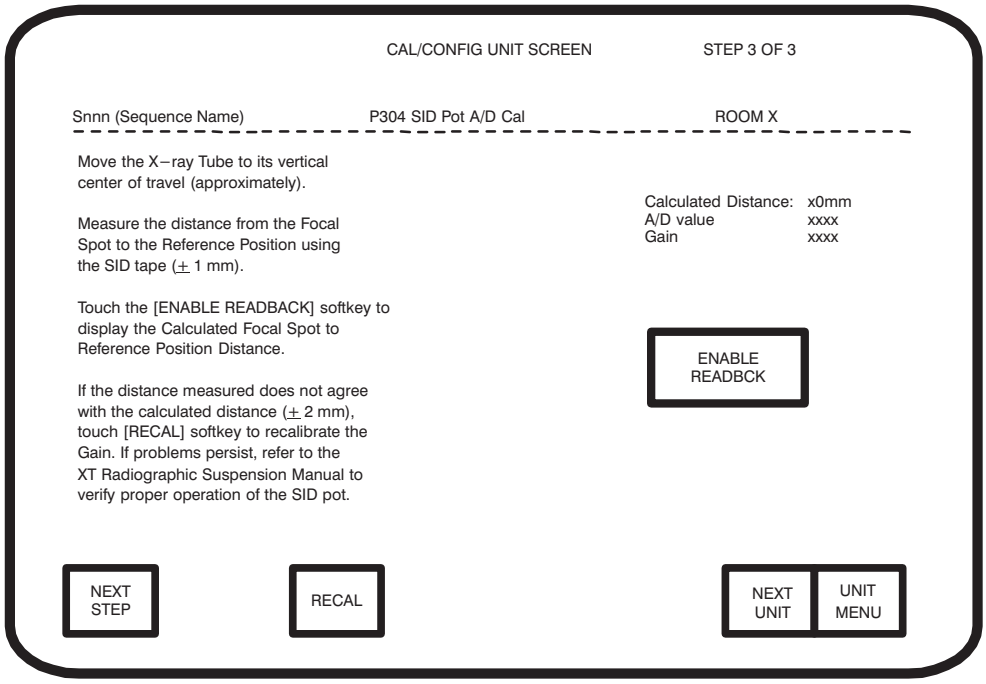
- Position the X–ray tube to approximately the vertical center of travel.
- Using the SID tape built into the collimator, measure the actual distance from the X–ray tube Focal Spot to the reference position. Measure to the end of the tab on the SID tape.
  Measured Distance _____mm.
- Touch the ENABLE softkey. The calculated X–ray tube Focal Spot to reference position distance will be displayed on the console screen.
- If the actual distance measured does not agree with the calculated distance displayed on the console screen (±2 mm) a recalibration is required. Touch the RECAL softkey and recalibrate the gain parameter.

Note: Refer to the XT Radiographic Suspension or Tube Support Service Manual for information regarding the operation of the SID pot.

OR

- If the actual distance measured agrees with the calculated distance displayed on the console screen (±2 mm), touch the NEXT UNIT or UNIT MENU softkey to exit.

P304 STEP 3 SCREEN DISPLAY



UNIT P306 – SID – Receptor (XX) Vertical

Time: x h xx min – Personnel: 1 field engineer

1 DESCRIPTION

Calibration Unit P306 establishes the x-ray tube to receptor SID parameters that are used by the system to set collimator limits for the vertical receptors on the system. The unit sets up to three SID positions. SID position 1 is closest to the receptor. SID position 3 is the farthest from the receptor. For R&F Systems equipped with a 40 cm (16 inch) Image Intensifier, the minimum SID is 120 cm (48 in.) for upright table bucky radiography. The unit is run once for each vertical receptor (Table Bucky or Wall Bucky) on a system. A “more info” screen provides additional instructions for running this unit.

2 EQUIPMENT REQUIRED

None.

NOTICE **The new cable concealments use magnets instead of detent ramps.**

3 CAL PROCEDURE

3-1 Set SID Positions

- Select a SID position with the console dial. SID position 1 should be closest to the receptor and SID position 3 farthest from the receptor.
- Move the x-ray tube suspension to a position that activates the applicable SID switch. Approach the switch from the largest to smallest SID direction. Stop when the switch is activated. The following switch states are indicated on the console screen.

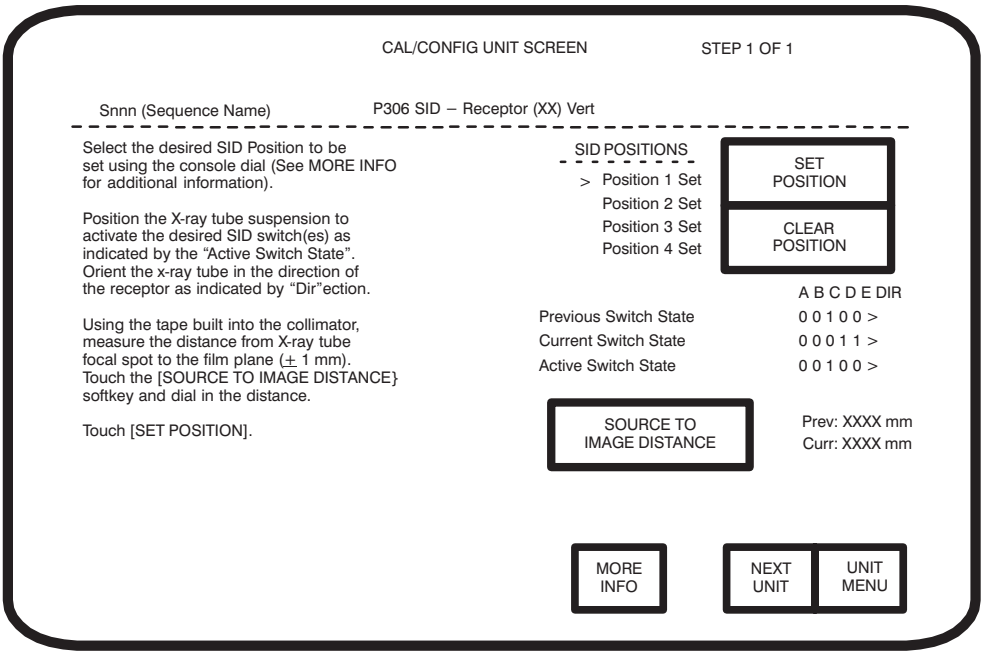
  PREVIOUS SWITCH STATE – Present state in database.
  CURRENT SWITCH STATE – State set with softkey.
  ACTIVE SWITCH STATE – Live display of switch state.

Note: A tone is emitted at the console each time the ACTIVE SWITCH STATE changes.

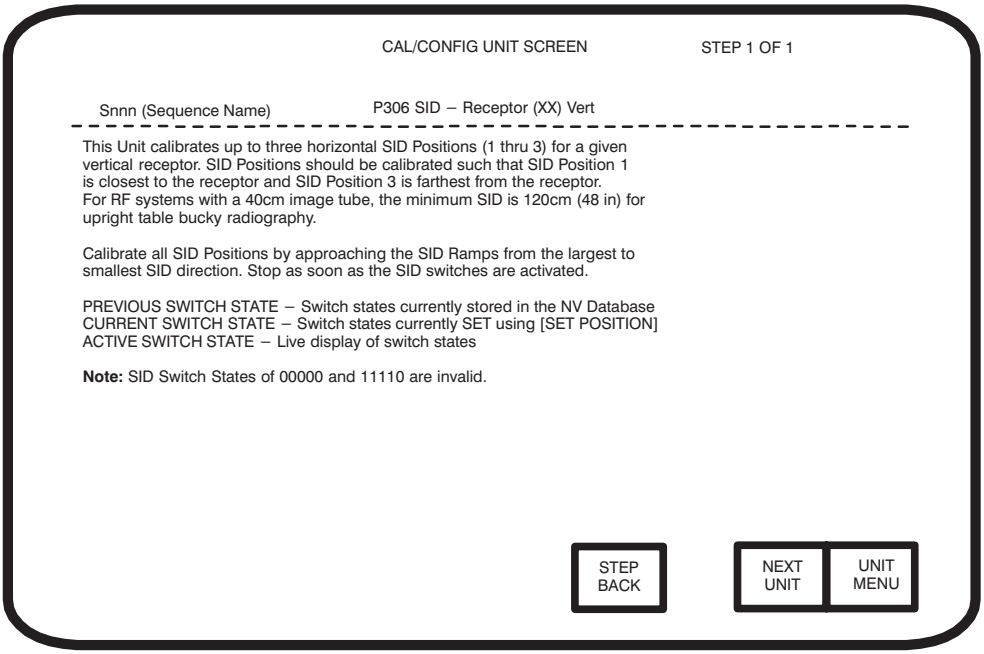
- Orient the x-ray tube/collimator in the direction of the receptor. The symbol under the DIR column on the screen indicates the direction the collimator is pointing.
- Using the tape measure built into the collimator, measure the distance from the x-ray tube focal spot to the receptor film plane ($\pm$1 mm).
- Touch the SOURCE TO IMAGE DISTANCE softkey and use the console dial to enter the measured distance.
- Touch the SET POSITION softkey. A SET indication is displayed on the screen next to the applicable SID position. A CLEAR POSITION softkey allows the operator to clear the SET indication on the screen if reset of a switch state is desired.
- Repeat the above procedures for each SID position to be set.

- After the appropriate SID positions have been set, touch the NEXT UNIT or UNIT MENU softkey to exit.

P306 STEP 1 SCREEN DISPLAY



P306 "MORE INFO" SCREEN DISPLAY



UNIT P313 – Cassette Size Receptor (XX)

Time: x h xx min – Personnel: 1 field engineer

1 DESCRIPTION

Calibration Unit P313 establishes the gain and offset parameters for cassette size sensing. The unit is run once for each receptor (Table Bucky or Wall Bucky) on a system. Five steps are required to accomplish the calibration.

Note: This Cal unit is interactive with Cal unit P315.

2 EQUIPMENT REQUIRED

Cassettes (Smallest and Largest used at the site).

3 SPECIAL INSTRUCTIONS

The following special instructions pertain to the running of this unit.

- The cassettes used during the calibration or verification should be of the same type/manufacturer (Kodak, etc.).
- Always place the cassette into the cassette tray with the metal or plastic edge of the cassette oriented in the same direction.

4 CAL PROCEDURE

4-1 Step 1. Set Smallest Longitudinal Cassette Size

- Determine the largest and smallest cassette sizes the customer will use for the receptor being calibrated.

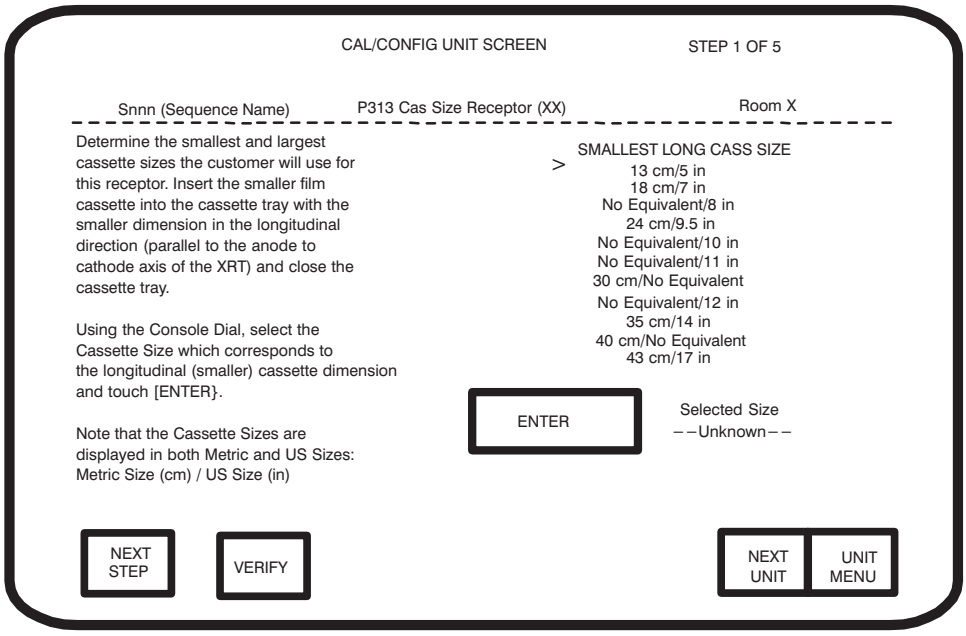
Note: Ensure that you consistently use the metal or plastic side of the cassette when inserting the cassette into the cassette tray. Switching from the metal to plastic side between steps may cause errors.

- Insert the smallest film cassette into the cassette tray with smallest dimension in the longitudinal direction (Parallel to the anode–to–cathode axis of the X–ray tube. Then, close the cassette tray.

Note: For Multiple Vertical Cassette Holder (MVCH), select the cassette size with the smallest longitudinal dimension.

- Using the console dial and cursor, select the cassette size with the cursor that corresponds to the longitudinal (smaller) dimension of the cassette that was inserted. Then, touch the [ENTER] softkey.
- Touch NEXT STEP softkey to proceed to Step 2.

P313 STEP 1 SCREEN DISPLAY



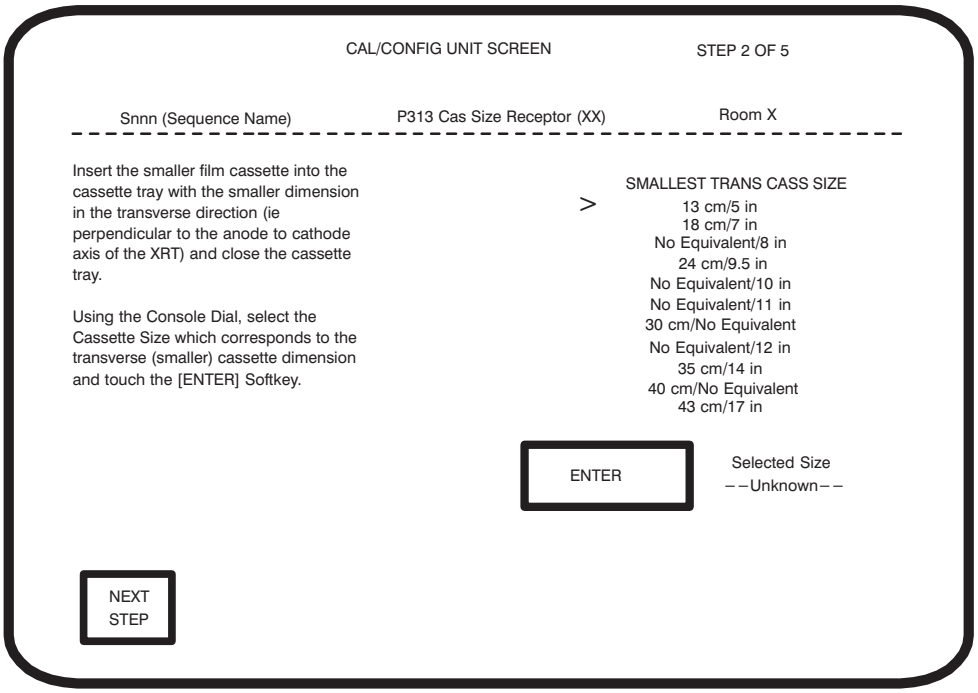
4-2 Step 2. Set Smallest Transverse Cassette Size

- Insert the smallest cassette into the cassette tray with smallest dimension in the transverse direction (Perpendicular to the anode–to–cathode axis of the X–ray tube). Then, close the cassette tray.

Note: For the Multiple Vertical Cassette Holder (MVCH), select the cassette size with the smallest transverse dimension.

- Using the console dial and cursor, select the cassette size that corresponds to the transverse (smaller) dimension of the cassette that was inserted. Then, touch the [ENTER] softkey.
- Touch NEXT STEP softkey to proceed to Step 3.

P313 STEP 2 SCREEN DISPLAY



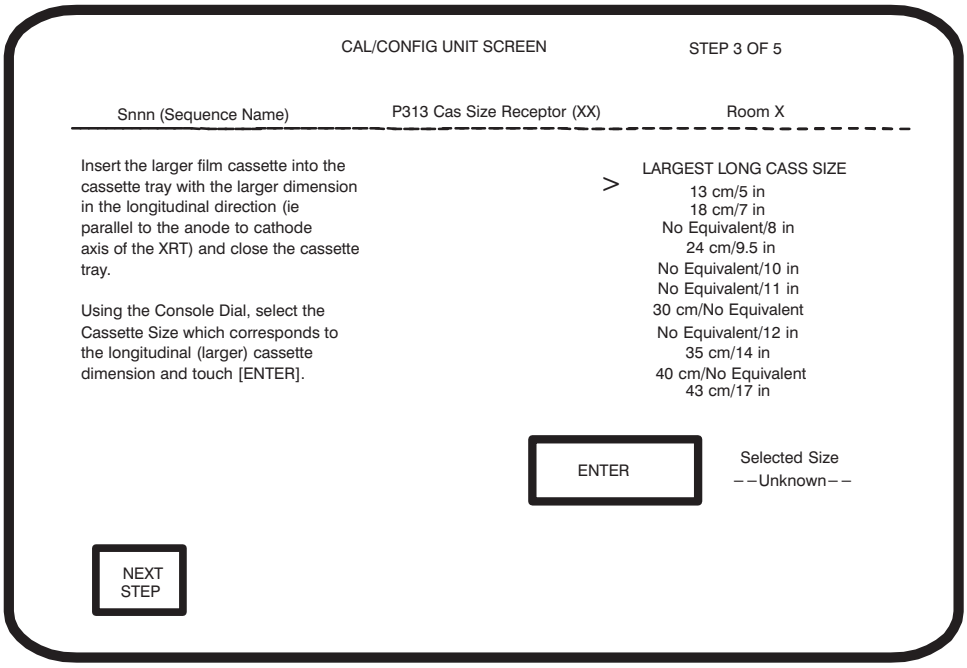
4-3 Step 3. Set Largest Longitudinal Cassette Size

- Insert the largest film cassette into the cassette tray with the largest dimension in the longitudinal direction (Parallel to the anode–to–cathode axis of the X–ray tube). Then, close the cassette tray.

Note: For the Multiple Vertical Cassette Holder (MVCH), select the cassette size with the largest longitudinal dimension.

- Using the console dial and cursor, select the cassette size that corresponds to the longitudinal (larger) dimension of the cassette that was inserted. Then, touch the [ENTER] softkey.
- Touch NEXT STEP softkey to proceed to Step 4.

P313 STEP 3 SCREEN DISPLAY



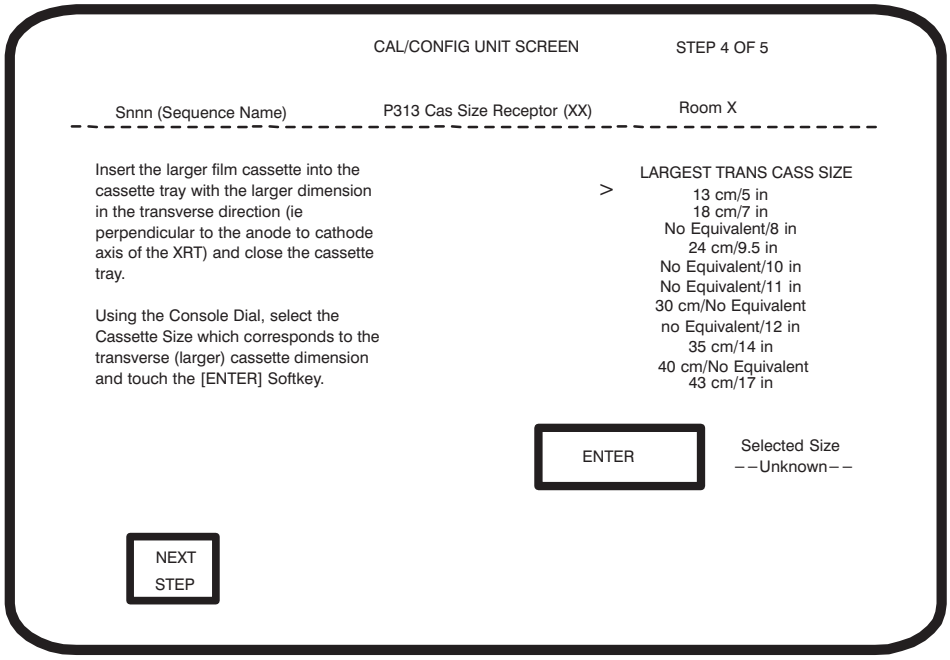
4-4 Step 4. Set Largest Transverse Cassette Size

- Insert the largest cassette size into the cassette tray with the largest dimension in the transverse direction (Perpendicular to the anode–to–cathode axis of the X–ray tube). Then, close the cassette tray.

Note: For the Multiple Vertical Cassette Holder (MVCH), select the cassette size with the largest transverse dimension.

- Using the console dial and cursor, select the cassette size that corresponds to the transverse (larger) dimension of the cassette that was inserted. Then, touch the [ENTER] softkey.
- Touch NEXT STEP softkey to proceed to Step 5.

P313 STEP 4 SCREEN DISPLAY



RECORD THE ACTUAL CASSETTE SIZES USED IN THE CALIBRATION

	Table Bucky	Wall Bucky
Smallest Type Cassette	_____	_____
Largest Type Cassette	_____	_____

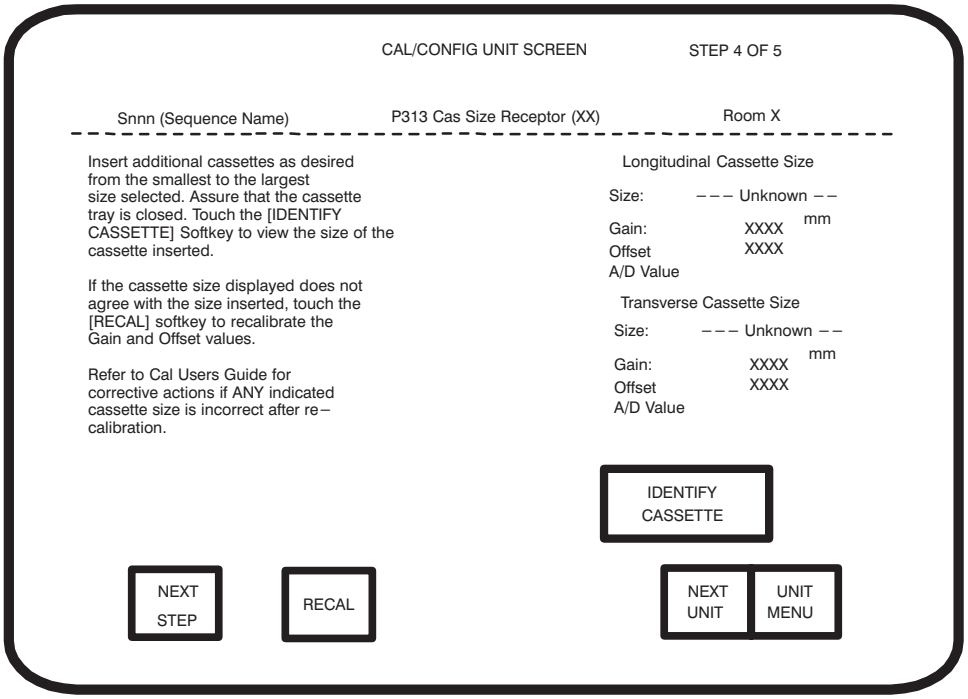
4-5 Step 5. Identify Cassette Sizes

- Insert additional cassettes as desired from the smallest to largest size selected. Make sure the cassette tray is properly closed.
- Touch the [IDENTIFY CASSETTE] softkey. The size of the cassette will be indicated on the console screen.

Note: If the cassette size indicated on the console screen does not agree with the size of the cassette that was inserted, touch [RECAL] softkey and recalibrate the Gain and Offset values.

- If any cassette size is still incorrect after recalibration, check the following:
  1. Same type of cassette (Manufacturer) was used in all steps of the calibration.
  2. The metal or plastic edge of the cassette used was oriented in the same direction in each step of the calibration.
- If all additional cassette sizes are correctly identified, touch NEXT UNIT or UNIT MENU softkey to exit the unit.

P313 STEP 5 SCREEN DISPLAY



UNIT P314 – SID – Receptor (XX) Horizontal

Time: x h xx min – Personnel: 1 field engineer

1 DESCRIPTION

Calibration Unit P314 establishes the SID offset parameter for each position (up to two) for each receptor (Table Bucky or Wall Bucky) that uses an X–ray tube suspension for taking exposures. The unit is run once for each receptor on a system. Two procedures are provided. Cal Procedure 1 applies to systems configured with a table Bucky. Cal procedure 2 applies to systems configured with a wall Bucky. Cal Procedure 1 is a two step procedure. Cal Procedure 2 is a three step procedure. The appropriate unit screens are presented as a function of the Smart Sequencer.

2 EQUIPMENT REQUIRED

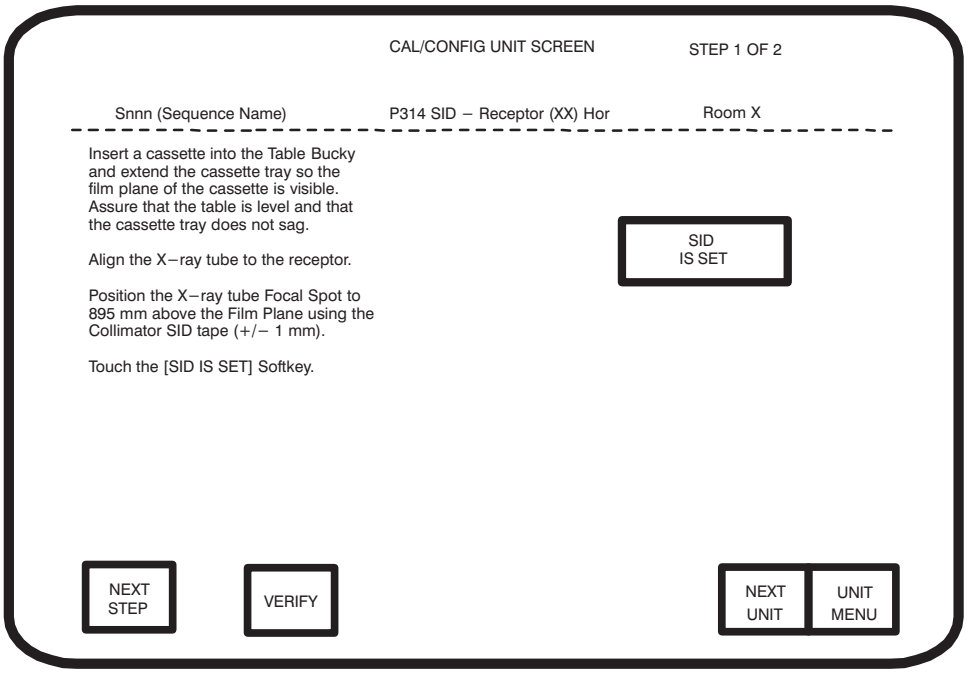
None.

3 CAL PROCEDURE 1 – SYSTEMS WITH TABLE BUCKY

3-1 Step 1. Set Low Position

- Insert a cassette into the Table Bucky and extend the cassette tray so that the film plane of the cassette is visible. Make sure that the table is level and that the cassette tray does not sag.
- Align the X–ray tube to the table Bucky.
- Using the tape measure built into the collimator, position the X–ray tube focal spot 895 mm (±1 mm) above the film plane.
- Touch the [SID IS SET] softkey.
- Touch [NEXT STEP] softkey to proceed to Step 2.

P314, CAL PROCEDURE 1, STEP 1 SCREEN DISPLAY



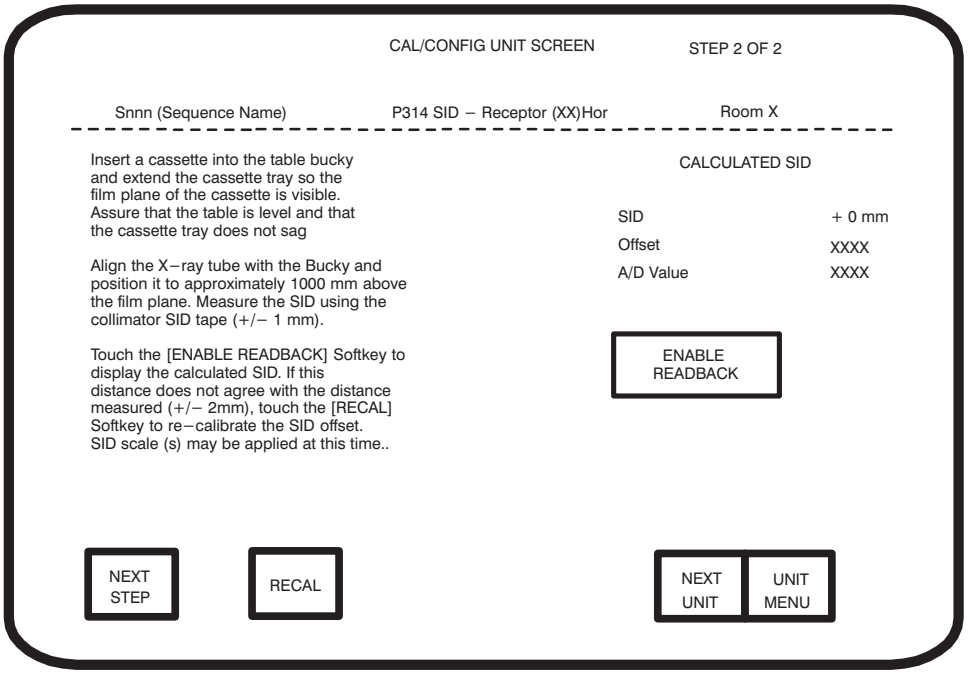
3-2 Step 2. Set Upper Position

- Insert a cassette into the Table Bucky and extend the cassette tray so that the film plane of the cassette is visible. Make sure that the table is level and that the cassette tray does not sag.
- Align the X–ray tube to the table Bucky.
- Using the tape built into the collimator, position the X–ray tube above the table Bucky so the measured distance to film plane is 1000 mm (±1 mm)
- Touch the [ENABLE READBACK] softkey. The calculated SID will be displayed on the unit screen.
- If the SID distance displayed does not agree with the SID distance measured (±2 mm), touch the [RECAL] softkey and recalibrate the SID offset

OR

- If the SID distance displayed on the unit screen agrees with the SID distance measured (±2 mm), touch the NEXT UNIT or UNIT MENU softkey to exit.

P314, CAL PROCEDURE 1, STEP 2 SCREEN DISPLAY

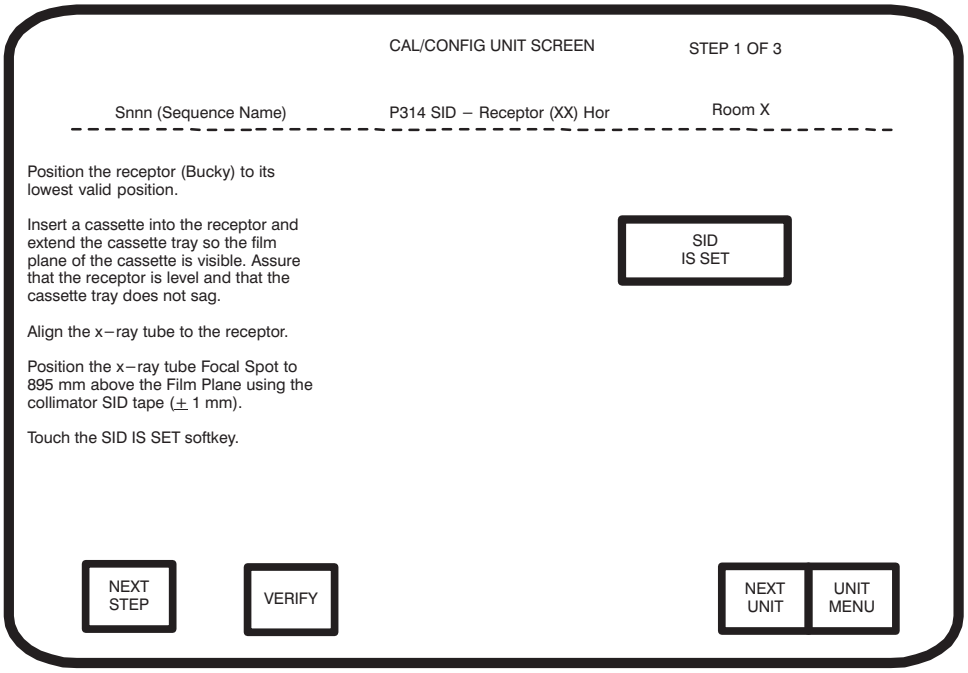


4 CAL PROCEDURE 2 – SYSTEMS WITH WALL BUCKY

4-1 Step 1. Set Low Position

- Position the receptor (Bucky) to to it's lowest valid position.
- Insert a cassette into the receptor and extend the cassette tray so that the film plane of the cassette is visible. Make sure that the receptor is level and that the cassette tray does not sag.
- Align the X–ray tube to the receptor.
- Using the tape measure built into the collimator, position the X–ray tube focal spot to a distance that is 895 mm (±1 mm) above the film plane.
- Touch the [SID IS SET] softkey.
- Touch the [NEXT STEP] softkey to proceed to Step 2.

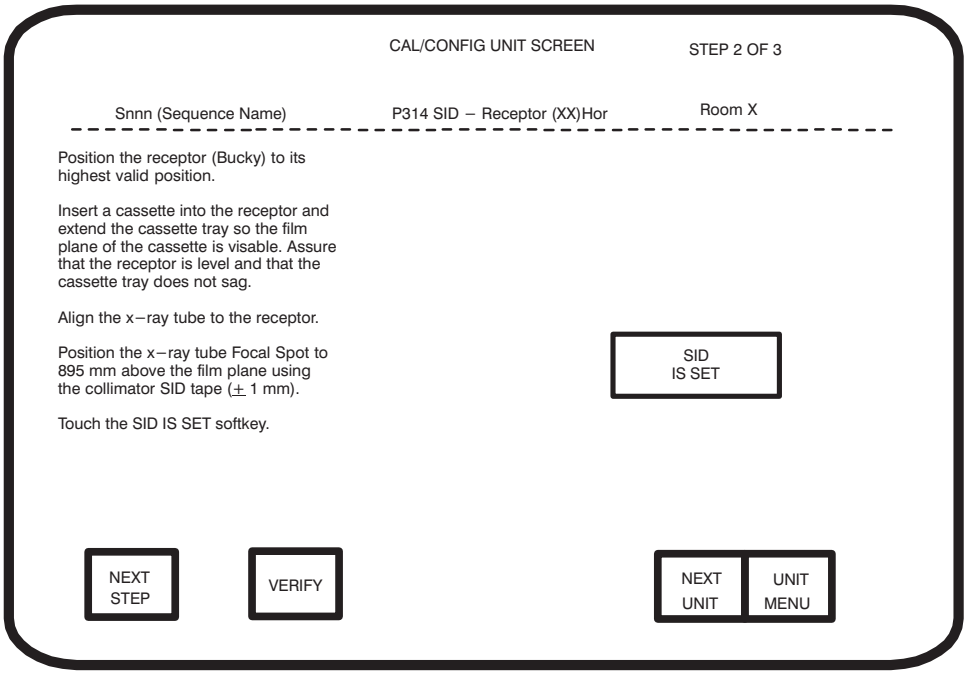
P314, CAL PROCEDURE 2, STEP 1 SCREEN DISPLAY



4-2 Step 2. Set High Position

- Position the receptor (Bucky) to its highest valid position.
- Insert a cassette into the receptor and extend the cassette tray so that the film plane of the cassette is visible. Make sure that the receptor is level and that the cassette tray does not sag.
- Align the X–ray tube to the receptor.
- Using the tape measure built into the collimator, position the X–ray tube focal spot to a distance that is 895 mm (±1 mm) above the film plane.
- Touch the [SID IS SET] softkey.
- Touch the [NEXT STEP] softkey to proceed to Step 2.

P314, CAL PROCEDURE 2, STEP 2 SCREEN DISPLAY



4-3 Step 3.Verify Calibration

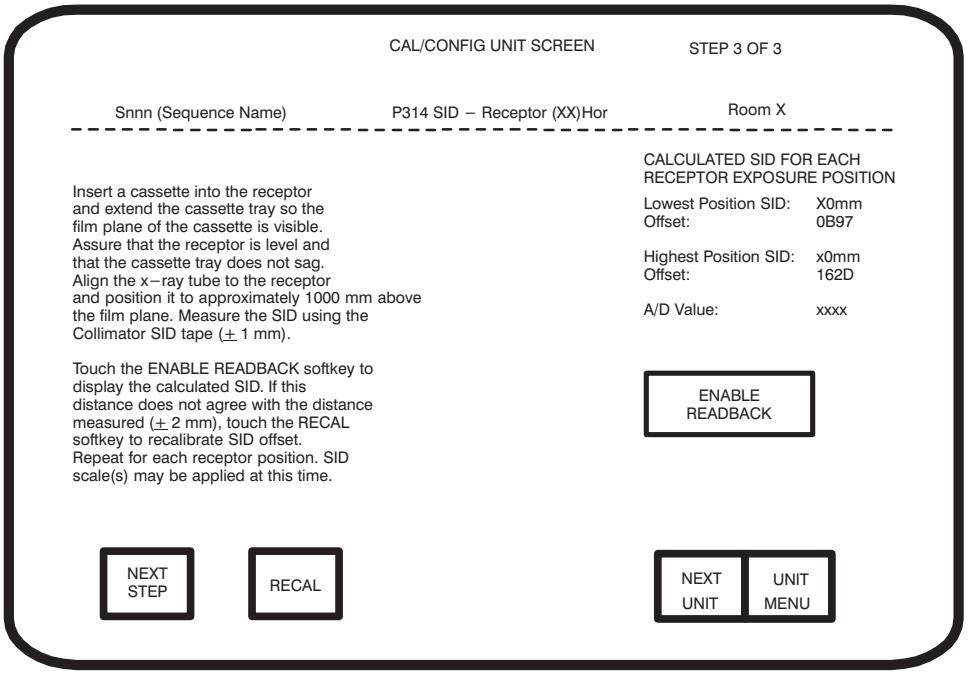
- Insert a cassette into the receptor and extend the cassette tray so that the film plane of the cassette is visible. Make sure that the receptor is level and that the cassette tray does not sag.
- Align the X–ray tube to the receptor.
- Using the tape measure built into the collimator, position the X–ray tube focal spot to a distance that is approximately 1000 mm (±1 mm) above the film plane.
- Touch the [ENABLE READBACK] softkey. The calculated SID will be displayed on the unit screen.
- If the SID distance displayed on the unit screen does not agree with the SID distance measured (±2 mm), touch the [RECAL] softkey and re–calibrate the SID offset

OR

- If the SID distance displayed on the unit screen agrees with the SID distance measured (±2 mm), touch the NEXT UNIT or UNIT MENU softkey to exit.

Note: Repeat calibration for each receptor position. SID scales may be applied at this time.

P314, CAL PROCEDURE 2, STEP 3 SCREEN DISPLAY



UNIT P404 – SRI/AIV Collimator A/D Calibration

Time: x h xx min – Personnel: 1 field engineer

1 DESCRIPTION

Calibration Unit P404 calibrates the SRI or AIV collimator rectangular and circular blade opening at the collimator output to establish database parameters that permit the positioner to drive the applicable blades to a specified dimension during patient acquisition. The unit sets the gain and offset values related to the open and closed positions of the longitudinal, transverse and circular blades of the SRI or AIV collimator. Seven steps are required to accomplish the calibration. A screen display is provided for each step.

2 EQUIPMENT REQUIRED

Field sizing gauge (millimeter scale).



Do not attempt to exit this unit once the calibration has been started. Attempting to exit the unit before completing all calibration steps will result in the loading of erroneous data and cause a system malfunction.

3 CAL PROCEDURE

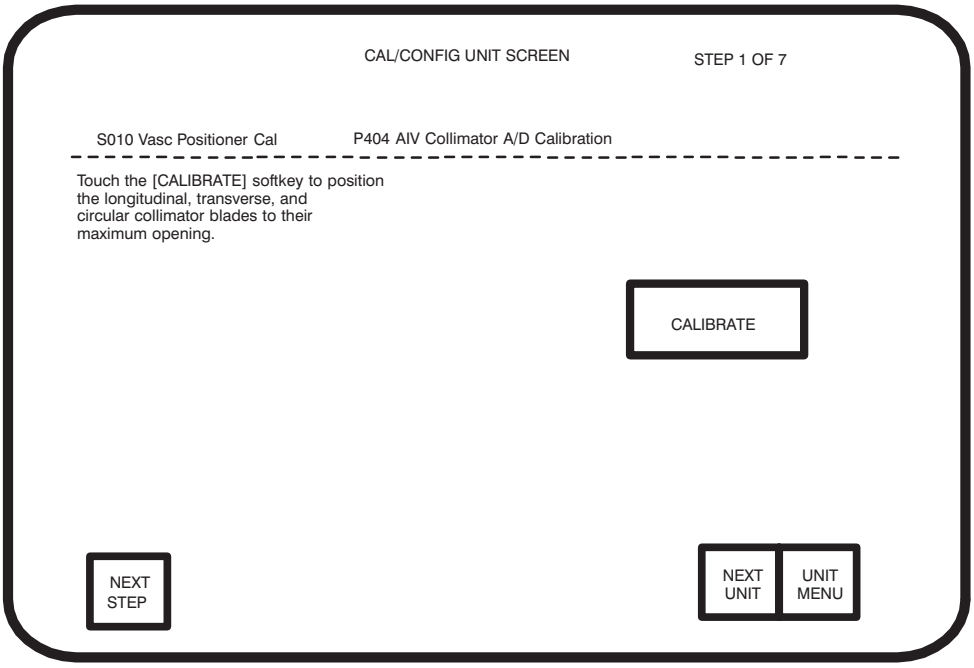
3-1 Step 1. Set All Blades to Open Position

- Initiate the calibration by touching the CALIBRATE softkey. The softkey is high–lighted when activated. The system will automatically drive the collimator longitudinal, transverse and circular blades to close and then full open positions. The system will read the feedback voltage at the minimum and maximum mechanical positions and enter the applicable A/D values into ASC.

Note: If the message “A512 UNIT ERROR – COLLIMATOR NOT CALIBRATED” appears, the feedback potentiometers for collimator blade positions are out of calibration. Refer to SRI Service Manual and recalibrate feedback potentiometers accordingly.

- When the CALIBRATE softkey is extinguished, the open blade position has been set.
- Touch the NEXT STEP softkey to proceed to Step 2.

P404 STEP 1 SCREEN DISPLAY



Note: Earth field compensation does not operate when performing this calibration unit. Therefore, images may appear distorted when viewing monitor.

3-2 Step 2. Set Longitudinal Blades to Large Size

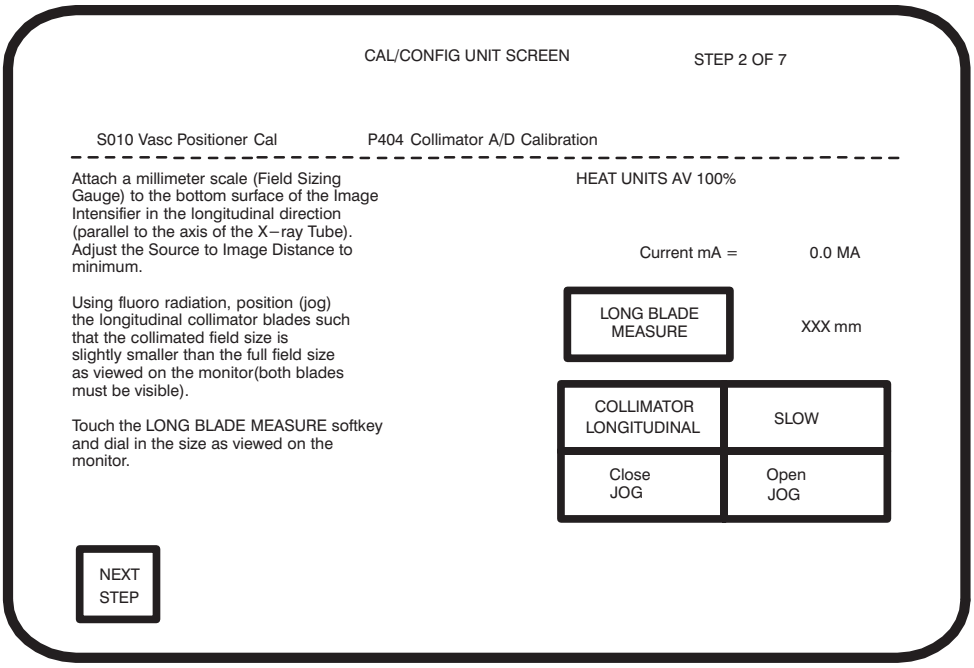
- Attach the field sizing gauge (millimeter scale) to the bottom surface of the Image Intensifier tube in the longitudinal direction (parallel to the axis of the X–ray tube).
- Set the Source to Image Distance (SID) to minimum.
- Take a fluoro exposure and use the jog controls to position the collimator longitudinal blades so that the collimated field size is slightly smaller than the full field size as viewed on the monitor.

Note: Both longitudinal blades must be visible.

Note: On systems with a 40 cm image intensifier, the collimator blades cannot open to full field size at minimum SID. The final position of the blades may therefore be somewhat smaller than optimally desired.

- Touch the LONG BLADE MEASURE softkey and use the console dial to enter the size as viewed on the scale of the sizing gauge shown on the monitor.
- Touch NEXT STEP softkey to proceed to Step 3.

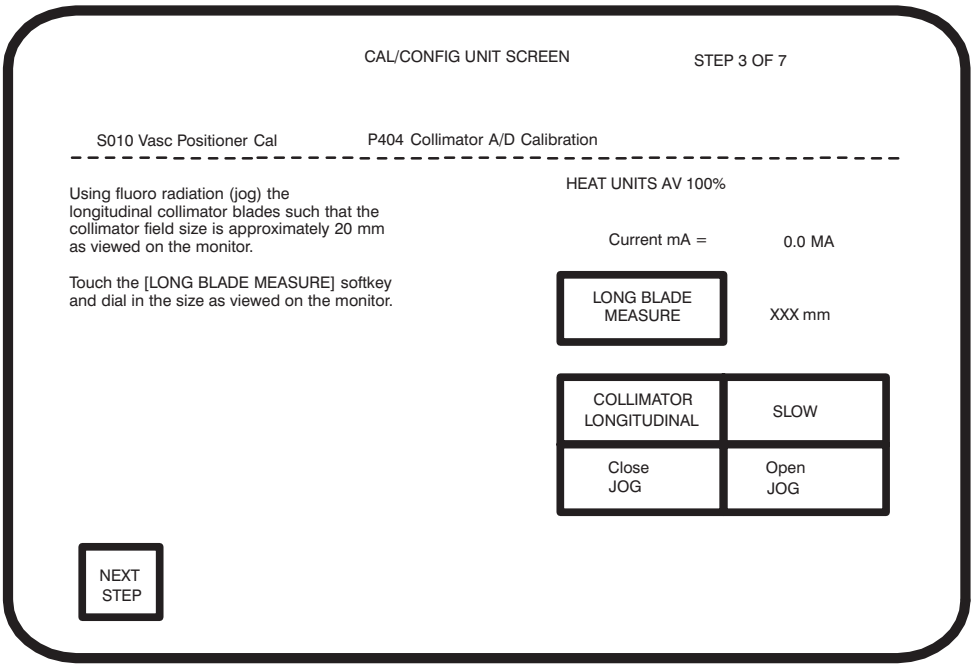
P404 STEP 2 SCREEN DISPLAY



3-3 Step 3. Set Longitudinal Blades to Small Size (20 mm)

- Take a fluoro exposure and use the jog controls to position the collimator longitudinal blades so that the collimated field size is approximately 20 mm as viewed on the monitor.
- Touch the LONG BLADE MEASURE softkey and use the console dial to enter the size as viewed on the scale of the sizing gauge shown on the monitor.
- Touch NEXT STEP softkey to proceed to Step 4.

P404 STEP 3 SCREEN DISPLAY



3-4 Step 4. Set Transverse Blades to Large Size

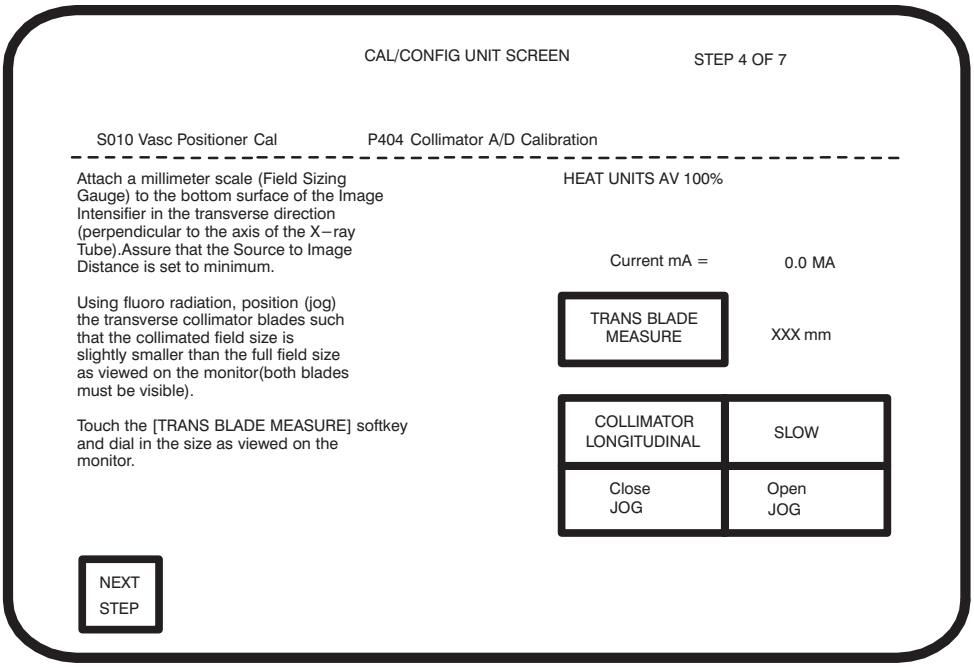
- Attach the field sizing gauge (millimeter scale) to the bottom surface of the Image Intensifier tube in the transverse direction (perpendicular to the axis of the X–ray Tube).
- Ensure that SID is set to minimum.
- Take a fluoro exposure and use the jog controls to position the collimator transverse blades so that the collimated field size is slightly smaller than the full field size as viewed on the monitor.

Note: Both transverse blades must be visible.

Note: On systems with a 40 cm image intensifier, the collimator blades cannot open to full field size at minimum SID. The final position of the blades may therefore be somewhat smaller than optimally desired.

- Touch the TRANS BLADE MEASURE softkey and use the console dial to enter the size as viewed on the scale of the sizing gauge shown on the monitor.
- Touch NEXT STEP softkey to proceed to Step 5.

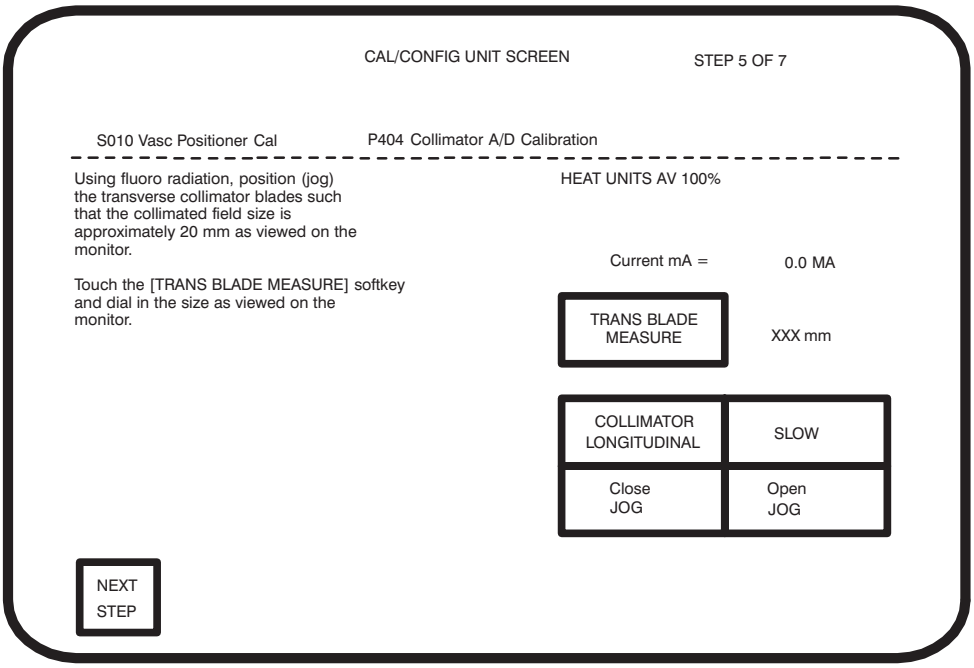
P404 STEP 4 SCREEN DISPLAY



3-5 Step 5. Set Transverse Blades to Small size (20 mm)

- Take a fluoro exposure and use the jog controls to position the collimator transverse blades so that the collimated field size is approximately 20 mm as viewed on the monitor.
- Touch the TRANS BLADE MEASURE softkey and use the console dial to enter the size as viewed on the scale of the sizing gauge shown on the monitor.
- Touch NEXT STEP softkey to proceed to Step 6.

P404 STEP 5 SCREEN DISPLAY



3-6 Step 6. Set Circular Blades to Large Size

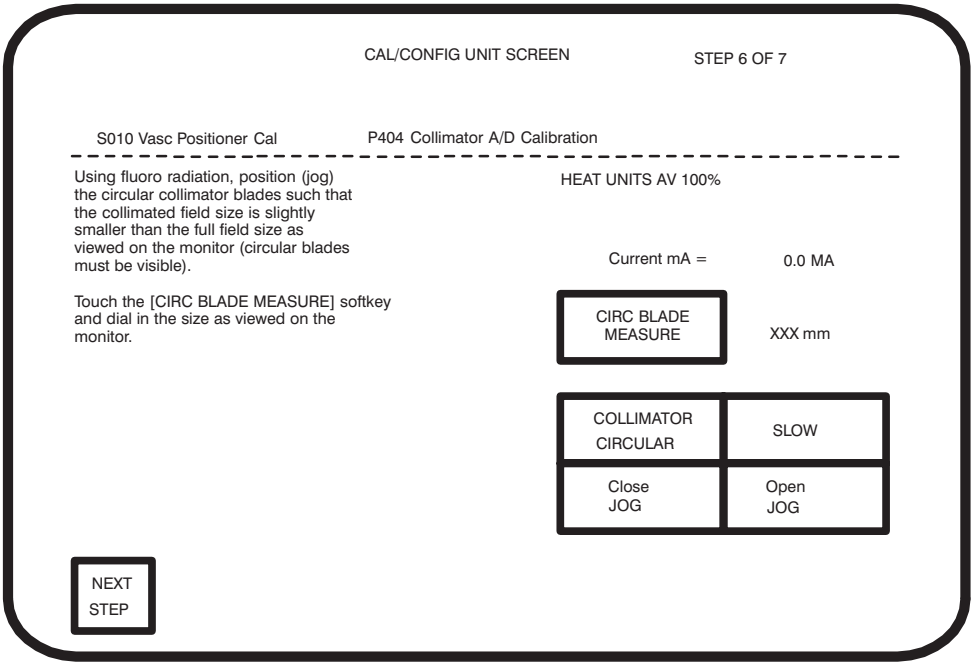
- Ensure that SID is set to minimum.
- Take a fluoro exposure and use the jog controls to position the collimator circular blades so that the collimated field size is slightly smaller than the full field size as viewed on the monitor.

Note: Circular blades must be visible.

Note: On systems with a 40 cm image intensifier, the collimator blades cannot open to full field size at minimum SID. The final position of the blades may therefore be somewhat smaller than optimally desired.

- Touch the CIRC BLADE MEASURE softkey and use the console dial to enter the size as viewed on the scale of the sizing gauge shown on the monitor.
- Touch NEXT STEP softkey to proceed to Step 7.

P404 STEP 6 SCREEN DISPLAY

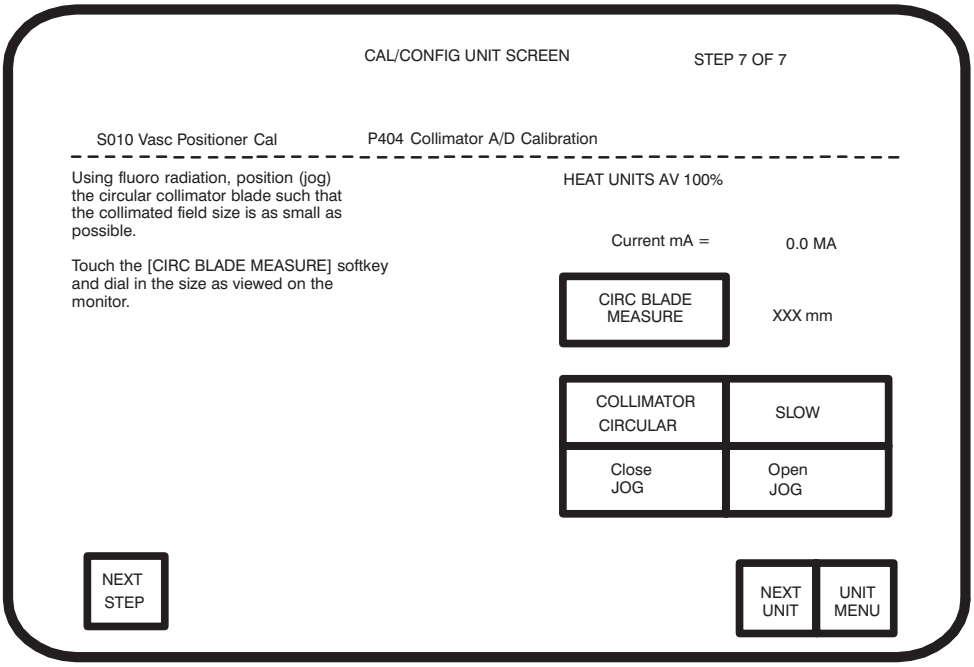


3-7 Step 7. Set Circular Blades to Small size

- Take a fluoro exposure and use the jog controls to position the collimator circular blades to the smallest field size possible as viewed on the monitor.
- Touch the CIRC BLADE MEASURE softkey and use the console dial to enter the size as viewed on the scale of the sizing gauge shown on the monitor.
- Touch NEXT UNIT or UNIT MENU to exit the unit. Upon exiting the unit, the gain and offset are calculated and the data values are stored in NVRAM.

Note: The NEXT STEP softkey is only displayed when in the viewing (browse) mode to permit return to Step 1.

P404 STEP 7 SCREEN DISPLAY



UNIT P406 – Contour Filter Calibration (SRI)

Time: x h xx min – Personnel: 1 field engineer

1 DESCRIPTION

Calibration Unit P406 is used to calibrate the left and right blade openings of the collimator contouring filters. The unit sets the database values for the blade openings when the blades are fully opened and the rotation motor is at zero reference. Once set, the positioner can then drive the blades to specified dimensions. Only one step is required to accomplish the calibration.

2 EQUIPMENT REQUIRED

None.

CAUTION **Do not attempt to exit this unit once the calibration has been started. Attempting to exit the unit before completing all calibration steps will result in the loading of erroneous data and cause a system malfunction.**

3 CAL PROCEDURE

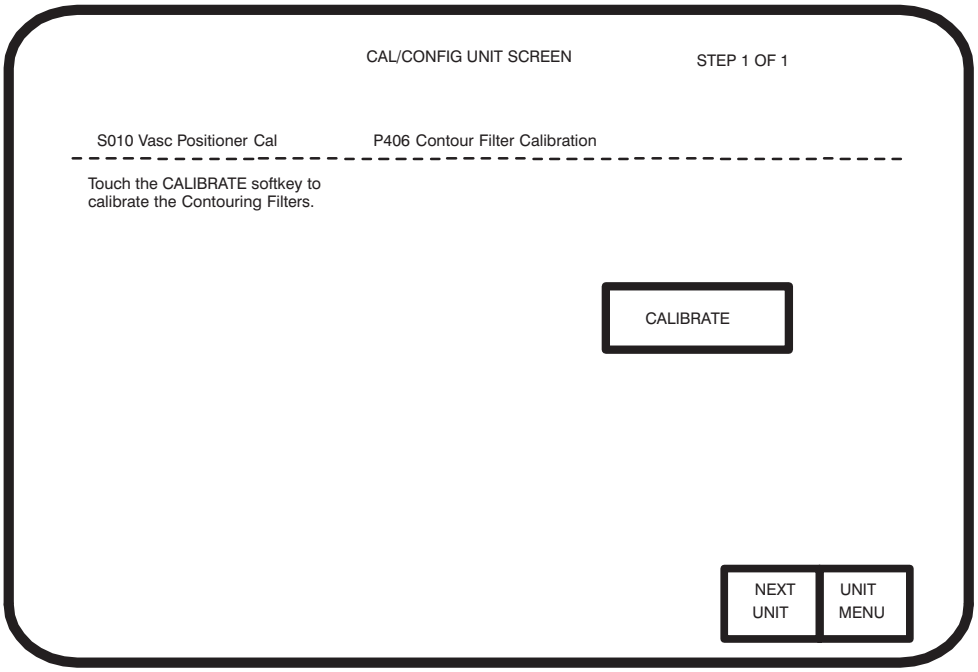
Perform the contouring filter calibration as follows:

- Ensure that the contouring filters are properly installed and positioned on the collimator.
- Touch the CALIBRATE softkey. The softkey is highlighted when activated. When activated, the A/D values of the contouring filter blade positions are automatically read and stored in RAM. When the softkey is unhighlighted, the calibration is complete.

Note: If the contouring filters cannot reach the calibrated positions, the message “CONTOURING FILTERS NOT CALIBRATED” is displayed on the console screen. Exit unit, check contour filter installation and then repeat the calibration.

- Touch NEXT UNIT or UNIT MENU softkey to exit the unit. Upon exit the A/D values are stored in NVRAM.

P406 SCREEN DISPLAY



UNIT P508 – Gantry Positioner Calibration via PC

Time: x h xx min – Personnel: 1 field engineer

1 DESCRIPTION

Calibration Unit P508 is used as a steering unit to direct the user to the appropriate procedures for aligning the gantry on systems configured with Tilt–C, Tilt–C Vascular, LCA, LCV+, LC+, LCLP+, or LCN+. The unit itself does not provide any software driven calibration functions. Two positioner specific calibration procedures are referenced.

2 EQUIPMENT REQUIRED

Laptop Computer.

3 CAL PROCEDURE

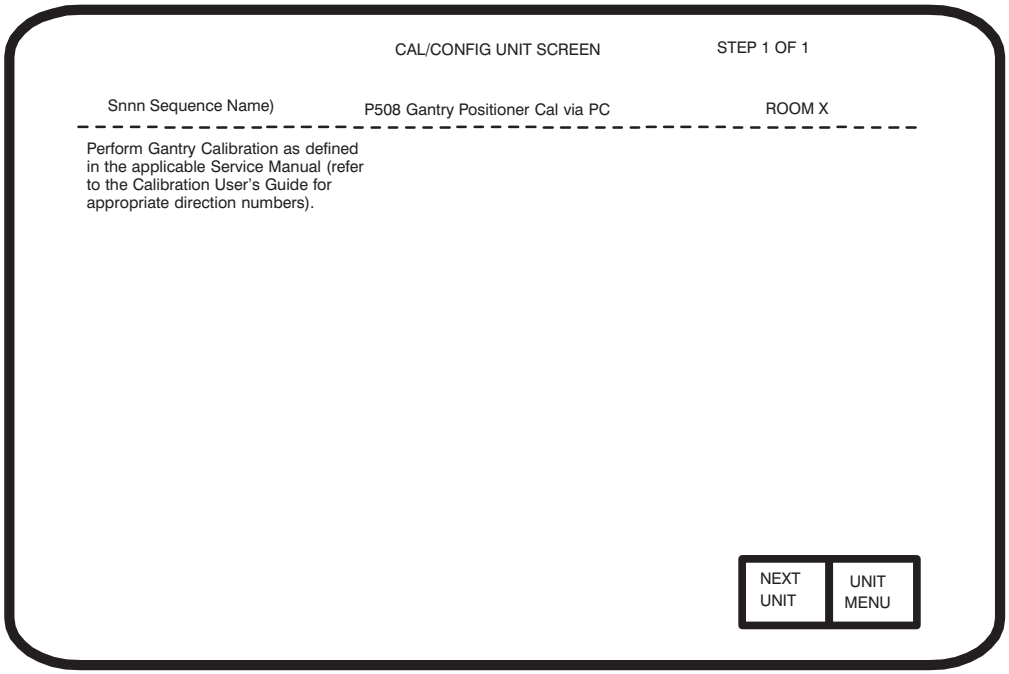
Calibration of a Tilt–C, Tilt–C Vascular, LCA, LCV+, LC+, LCLP+, or LCN+ Positioner is performed according to the procedures given in the appropriate service manual listed below. After the calibration is completed, touch the NEXT UNIT or UNIT MENU softkey to exit the unit and dehighlight Cal Unit P508 on the sequence menu.

For the LCA, LCV+, or LC+ single plane positioner, refer to SM 2109636, SM 2198160–100, or SM 2218863–100.

For the LCLP+ or LCN+ frontal positioner, refer to SM 2198160–100 or SM 2218863–100. For the LCLP+ or LCN+ lateral positioner, refer to SM 2198154–100.

For the Tilt–C or Tilt–C Vascular positioner, refer to Direction 2108151–100, *Tilt–C Calibration*.

P508 SCREEN DISPLAY



UNIT P551 – FC Collimator Limits Calibration

Time: x h xx min – Personnel: 1 field engineer

1 DESCRIPTION

Calibration Unit P551 is used to calibrate the collimator limits for a CFC on an LCA/LCV+ positioner. The unit sets the positional limits of the collimator blades in accordance with the size of a film cassette. The unit uses a fixed RAD technique to take exposures. Two steps are required to accomplish the calibration. A console screen display is provided for each step.

2 EQUIPMENT REQUIRED

Film Cassette, 14″ x 14″ (33 cm x 33 cm) and Film (type used at site or screenless film)

3 PROCEDURE

3-1 Step 1. Take exposures

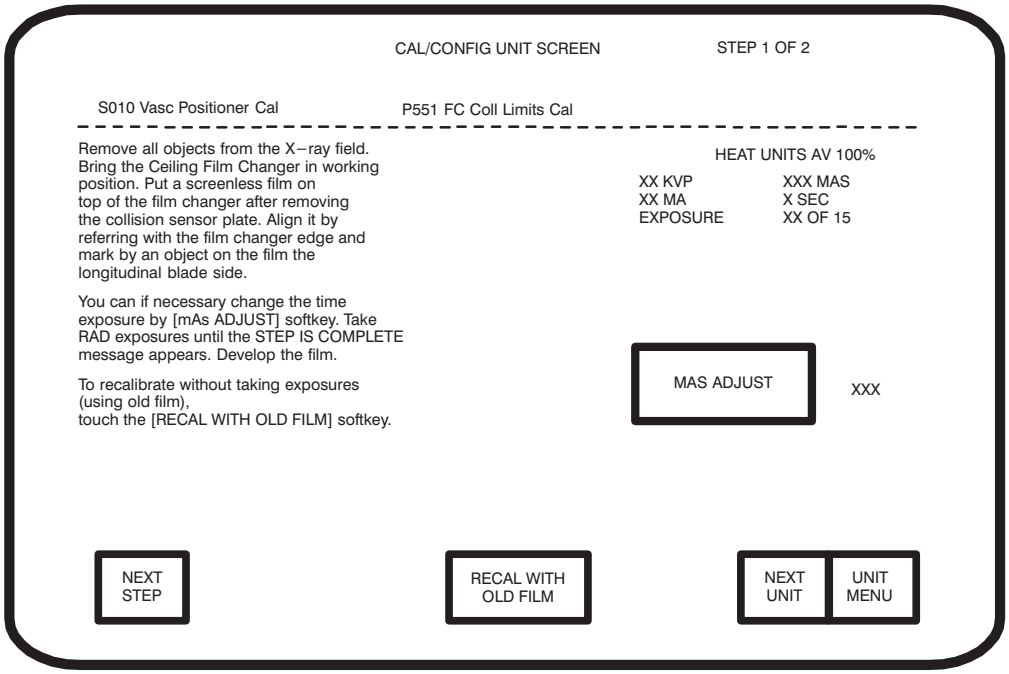
Note: To recalibrate without taking exposures (using old film), touch the RECAL WITH OLD FILM softkey. Then proceed to Step 2.

- Load a 14″ x 14″ (33 cm x 33 cm) Film Cassette with the appropriate film, if not already loaded (use screenless film for LCA/LCV+).
- Remove all objects from the X–ray field.
- Set the source to image distance to maximum, and put the CFC in working position (i.e., against entrance to the II). Note that unlike application mode, the II motion is not available in service mode.
- Remove collision sensor plate from film changer.
- Place film or cassette on the film changer and align it in a center position relative to film changer edges.
- Mark the side of the cassette or the film pertaining to the longitudinal blades of the collimator by placing an object (such as a piece of solder, etc.) on the appropriate side of the cassette.

Note: Before taking exposures, the exposure time can be adjusted for use with other film speeds to obtain a good quality image (not too dark or bright). If necessary, touch MAS ADJUST softkey and set the desired exposure time with the console dial.

- Take RAD exposures until the STEP IS COMPLETE message is displayed on the consoled.
- Develop the film.
- Touch the NEXT STEP softkey to proceed to Step 2.

P551 STEP 1 SCREEN DISPLAY



3-2 Step 2. Enter Blade Exposure Number

- Examine the developed film. Determine the numbers on the film that most accurately conform to the dimensions of the film in the longitudinal and transverse directions indicated on the screen. See Illustration 127. Pick the correct image size by comparing the edges of each image. Collimation begins where the edge of the image is just blurred by the collimator blades.
- Touch LONG BLADE EXPOSURE NUMBER softkey and dial in the number of the exposure that best corresponds to a 33 cm x 33 cm image in the direction indicated.
- Touch TRANS BLADE EXPOSURE NUMBER softkey and dial in the number of the exposure that best corresponds to a 33 cm x 33 cm image in the direction indicated.

CAUTION **Do not touch console dial after entering exposure numbers even if the LONG BLADE EXPOSURE NUMBER and TRANS BLADE EXPOSURE NUMBER softkeys are un-highlighted. The console dial remains active for these adjustments until the unit is exited.**

- Remove cassette from atop film changer.
- Re–install collision sensor plate on film changer.
- Rotate gantry to place x–ray tube at bottom position.
- Touch NEXT UNIT or UNIT MENU softkey to exit.

P551 STEP 2 SCREEN DISPLAY

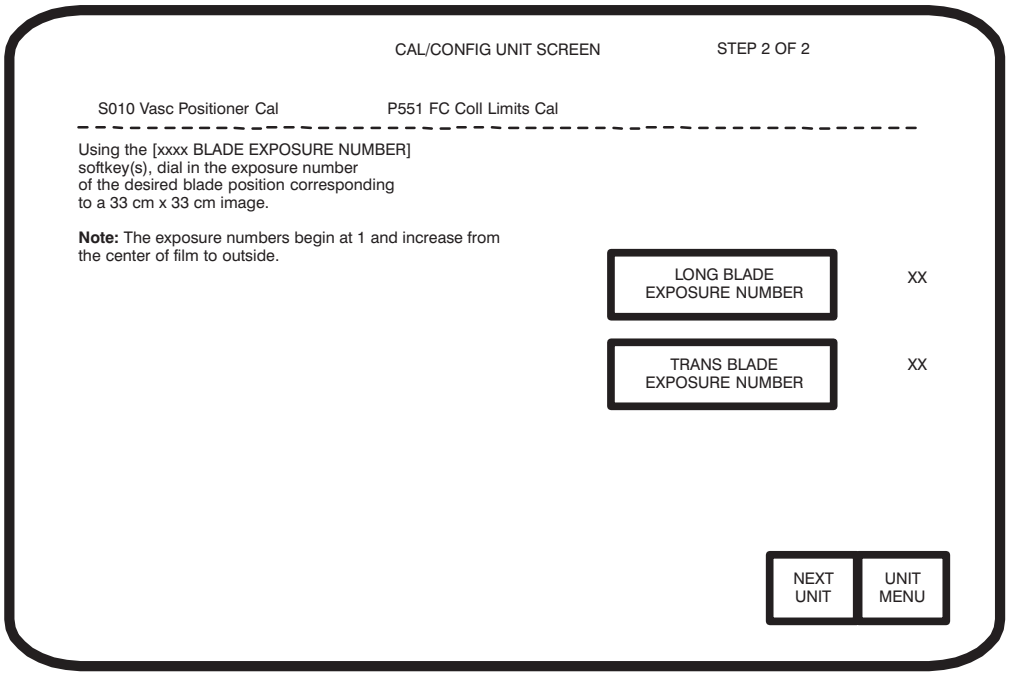
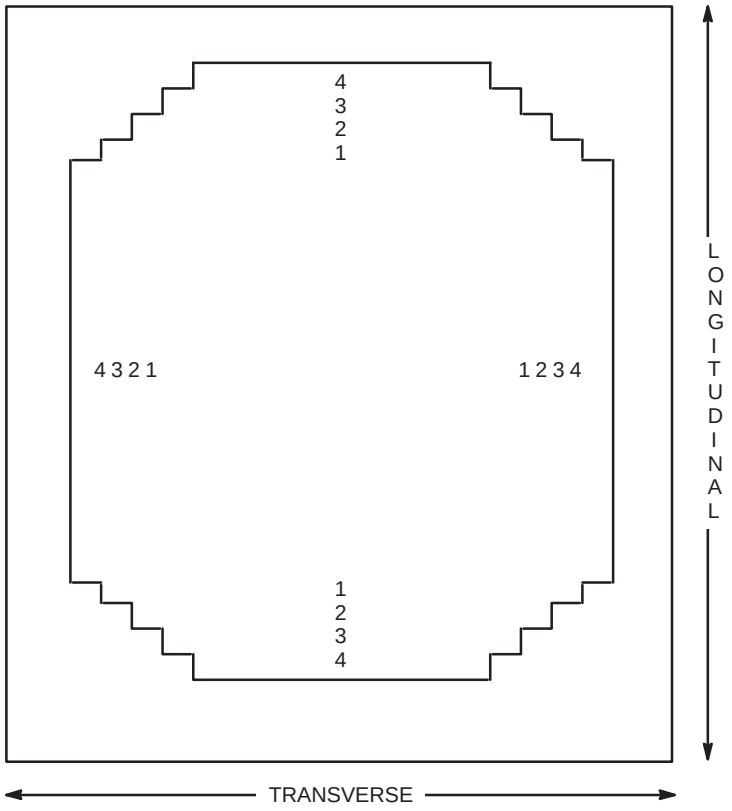


Illustration 127 – Film Exposure Numbering



Positioner Calibration Units

Notepad

Units P007 – P551

Unit	Note

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REVISION HISTORY

REV	DATE	REASON FOR CHANGE	PAGES
0	Aug. 25, 1995	Initial product release.	
1	Dec 15, 1995	Includes SPR fixes from pilot lot SCAT.	
2	Jan. 19, 1996	Added kV waveforms to R020.	
3	Apr. 12, 1996	Updated cal units R003, R020, V056, V069, X006, X102, X110, and X220.	
4	Oct. 17, 1996	Carmen M4 release.	
5	Feb. 6, 1997	Updated X011 and C004 for MX150 TH.13 (V3) x–ray tube.	
6	Feb. 21, 1997	Revised to include combined software for LCA, LCV+, LC+, Tilt–C, Tilt–C Vascular, and Legacy R&F systems. This revision combines the units from calibration users guides 2138868–100 (Legacy) and 2120227–100 (Tilt–C).	
7	May 5, 1997	Updated C006, C007, C009, C010, C013, D005, P119, P404, P551, R013, R022, T006, T009, V050, V053, V062, V063, V072, X100, X104, X107, X120, X123, X130, X133 and X140 for LC+.	
8	July 21, 1997	Updated C004, C006, C009 (Corrected CF Input Signal for Saticon A), C013, P019, R017, V056, X105, X107, X120, X121, X122, X123, X130, X131, X140, X141, and X233.	
9	Nov. 26, 1997	Release for Carmen M5. Updated C013, C020, R003, R013, X011, X101, X107, X121, X123, X131, X133, X141, X143, X233, P107, P313, and V072. Added new unit V001. Resolved SPR's BUCge24574, BUCge26450, BUCge28581, BUCge29001, BUCge29330, BUCge32007, and XRYge24655.	
10	Feb. 27, 1998	Release for LCN+/LCLP+ M3 and Legacy Phase 3 M3. Updated T009, T014, R005, R013, R018, R021, R024, P102, P103, P313, P508, X001, X004, X006, X011, X100, X101, X102, X104, X105, X107, X110, X120, X121, X122, X123, X130, X131, X132, X133, X140, X141, X143, X200, X209, X212, X217, X220, X222, X225, X233, S007, V001, V004, V012, V020, V021, V051, V053, V059, V062, V064, V065, V066, V068, V070, V072, C006, C020. Added new units P126 and T015. Resolved sprs BUCge21604, BUCge30393, XRYge23162, XRYge25470, XRYge25756.	

REV	DATE	REASON FOR CHANGE	PAGES
11	June 12, 1998	Release for LCN+/LCLP+ M4 and Legacy Phase 3 M4. Updated requirements for PC tool (Section 1–3), resolving CQA981871. Updated Section 2–4 Power Up Sequence. Resolved SPR XRYge25829. Updated T015, R005, R013, R017, R018, R021, R024, R025, P102, P103, P508, X001, X004, X006, X100, X101, X104, X105, X107, X110, X120, X121, X122, X130, X131, X132, X200, X209, X212, X217, X220, X222, X225, X233, V001, V003, V004, V012, V020, V021, V051, V053, V059, V062, V064, V065, V066, V068, V070, V072, C020.	
12	July 29, 1998	Added XQ1585 PUT to V050, V053, V062, V065, V072 and C009.	
13	Nov. 12, 1998	Updated for ASC software G4.XX. Updated Section 1–7. Updated R003, V004, V021, V065, V072, P508, X101, X107, X121, X123, X131, X133, X143, X233, C006, C020.	
14	April 15, 1999	Updated for positioning tool (Section 4–8), Secton 9 (Taper and SID: X1xx), Section 12–5 and 12–8.	
15	July 7, 1999	Updated per SPR BUCge 41758 for Fluoro values in Secton 9 (X100, X101, X120, X121), per SPR BUCge 40231 for changed tolerance (DX130, DX131) and Table 12–12 in Section 12. Added text on X152 screen display.	
16	November 15, 1999	Updated V056, R013, C020, X131, V001.	
17	January 17, 2000	Updated as per SPRs XRYge29444 and XRYge29439.	
18	April 26, 2000	New scope ZID1M4. T015, X107, X123, X133, X213, X214, X233. Also BUCge48910: T015 added FRU list.	
19	May 10, 2000	Updated X107, X233, X209, T015 per BUCge53732.	
20	May 24, 2000	Updated X107, X123, X133, X233 per BUCge54246 (Dose levels for Germany).	
21	June 5, 2000	Corrected P038, Step 2, in Sec. 7 per CQA 1003532.	
22	June 13, 2000	Updated T015, X107, X123, X133, X209, X211, X214 and X233 as per SPR BUCge54771	
23	Sept. 20, 2000	Updated P040, Lateral and Longitudinal Cassette Damping Adjustment.	
24	January 2001	Updated for ZID2 Program with Integration of IQSO changes. Updated X225 as per SPR BUCge46243	
25	February 2001	– C020: default fluoro values updated with SPR B60564 – Texts updated with SPR BUCge61923/61120 for new japanese regulation	

REV	DATE	REASON FOR CHANGE	TOTAL PAGES
26	June 2001	New presentation: Creation of a Jobcard for each Cal Unit.	Volume 1 (594) and Volume 2 **1200**
27	January 2002	C020: default fluoro values updated to be compliant to IEC.	Volume 1 (594) and Volume 2 **1200**
28	March, 2004	Values in tables and text modified	Volume 1 (594) and Volume 2 **1200**
29	April, 2004	Values updated in X101, X130, X150 screen display. Screenprint errors corrected.	Volume 1 (594) and Volume 2 **1200**
30	December, 2004	Notice added in X107, X123, X133 and X233	Volume 1 (594) and Volume 2 **1200**
31	March 2006	Note added in X225 (SPR EURge 40357)	Volume 1 (594) and Volume 2 **1200**

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GE Medical Systems

Technical Publications

DIRECTION 2138868–100

Revision 31

Advantx–E® Calibration Users Guide VOLUME 2

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ATTENTION

LES APPAREILS À RAYONS X SONT DANGEREUX À LA FOIS POUR LE PATIENT ET POUR LE MANIPULATEUR SI LES MESURES DE PROTECTION NE SONT PAS STRICTEMENT APPLIQUEES

Bien que cet appareil soit construit selon les normes de sécurité les plus sévères, la source de rayonnement X représente un danger lorsque le manipulateur est non qualifié ou non averti. Une exposition excessive au rayonnement X entraîne des dommages à l'organisme.

Par conséquent, toutes les précautions doivent être prises pour éviter que les personnes non autorisées ou non qualifiées utilisent cet appareil créant ainsi un danger pour les autres et pour elles–mêmes.

Avant chaque manipulation, les personnes qualifiées et autorisées à se servir de cet appareil doivent se renseigner sur les mesures de protection établies par la Commission Internationale de la Protection Radiologique, Annales 26 : Recommandations de la Commission Internationale sur la Protection Radiologique et les normes nationales en vigueur.

WARNING

X–RAY EQUIPMENT IS DANGEROUS TO BOTH PATIENT AND OPERATOR UNLESS MEASURES OF PROTECTION ARE STRICTLY OBSERVED

Though this equipment is built to the highest standards of electrical and mechanical safety, the useful x–ray beam becomes a source of danger in the hands of the unauthorized or unqualified operator. Excessive exposure to x–radiation causes damage to human tissue.

Therefore, adequate precautions must be taken to prevent unauthorized or unqualified persons from operating this equipment or exposing themselves or others to its radiation.

Before operation, persons qualified and authorized to operate this equipment should be familiar with the Recommendations of the International Commission on Radiological Protection, contained in Annals Number 26 of the ICRP, and with applicable national standards.

ATENCION

LOS APARATOS DE RAYOS X SON PELIGROSOS PARA EL PACIENTE Y EL MANIPULADOR CUANDO LAS NORMAS DE PROTECCION NO ESTAN OBSERVADAS

Aunque este aparato está construido según las normas de seguridad más estrictas, la radiación X constituye un peligro al ser manipulado por personas no autorizadas o no cualificadas. Una exposición excesiva a la radiación X puede causar lesiones al organismo.

Por consiguiente, se deberán tomar todas las precauciones necesarias para evitar que las personas no cualificadas o no autorizadas utilicen este aparato, lo que sería un peligro para los demás y para sí mismas.

Antes de efectuar las manipulaciones, las personas habilitadas y competentes en el uso de este aparato, deberán informarse sobre las normas de protección fijadas por la Comisión Internacional de la Protección Radiológica, Anales No 26: Recomendaciónes de la Comisión Internacional sobre la Protección Radiológica y otras normas nacionales.

ACHTUNG

RÖNTGENAPPARATE SIND EINE GEFAHR FÜR PATIENTEN SOWIE BEDIENUNGSPERSONAL, WENN DIE GELTENDEN SICHERHEITSVORKEHRUNGEN NICHT GENAU BEACHTET WERDEN

Dieser Apparat entspricht in seiner Bauweise strengsten elektrischen und mechanischen Sicherheitsnormen, doch in den Händen unbefugter oder unqualifizierter Personen wird er zu einer Gefahrenquelle. Übermäßige Röntgenbestrahlung ist für den menschlichen Organismus schädlich.

Deswegen sind hinreichende Vorsichtsmaßnahmen erforderlich, um zu verhindern, daß unbefugte oder unqualifizierte Personen solche Geräte bedienen oder sich selbst und andere Personen deren Bestrahlung aussetzen.

Vor Inbetriebnahme dieses Apparats sollte sich das qualifizierte und befugte Bedienungspersonal mit den geltenden Kriterien für den gefahrlosen Strahleneinsatz durch sorgfältiges Studium des Hefts Nr. 26 der Internationalen Kommission für Strahlenschutz (ICRP) vertraut machen: Empfehlungen der Internationalen Kommission für Strahlenschutz und nationale Normenbehörden.

WARNING



DO NOT ATTEMPT TO SERVICE THE EQUIPMENT UNLESS THIS SERVICE MANUAL HAS BEEN CONSULTED AND IS UNDERSTOOD

If a customer's service provider requires a language other than English, it is the customer's responsibility to provide translation services.

This Service Manual is available in English only.

Failure to heed this warning may result in injury to the service provider, operator or patient from electric shock, mechanical or other hazards.

ATTENTION



NE PAS TENTER D'INTERVENIR SUR LES ÉQUIPEMENTS TANT QUE LE MANUEL SERVICE N'A PAS ÉTÉ CONSULTÉ ET COMPRIS

Ce Manuel de service n'est disponible qu'en anglais.

Si le technicien du client a besoin de ce manuel dans une autre langue que l'anglais, c'est au client qu'il incombe de le faire traduire.

Le non-respect de cet avertissement peut entraîner chez le technicien, l'opérateur ou le patient des blessures dues à des dangers électriques, mécaniques ou autres.

ATENCION



NO SE DEBERÁ DAR SERVICIO TÉCNICO AL EQUIPO, SIN HABER CONSULTADO Y COMPRENDIDO ESTE MANUAL DE SERVICIO.

Este Manual de Servicio sólo existe en inglés.

Si algún proveedor de servicios ajeno a GEMS solicita un idioma que no sea el inglés, es responsabilidad del cliente ofrecer un servicio de traducción.

La no observancia del presente aviso puede dar lugar a que el proveedor de servicios, el operador o el paciente sufran lesiones provocadas por causas eléctricas, mecánicas o de otra naturaleza.

WARNUNG



ERSUCHEN SIE NICHT DIESE ANLAGE ZU WARTEN, OHNE DIESE SERVICEANLEITUNG GELESEN UND VERSTANDEN ZU HABEN.

Diese Serviceanleitung existiert nur in englischer Sprache.

Falls ein fremder Kundendienst eine andere Sprache benötigt, ist es Aufgabe des Kunden für eine entsprechende Übersetzung zu sorgen.

Wird diese Warnung nicht beachtet, so kann es zu Verletzungen des Kundendiensttechnikers, des Bedieners oder des Patienten durch Stromschläge, mechanische oder sonstige Gefahren kommen.

ATENÇAO

NÃO TENTE REPARAR O EQUIPAMENTO SEM TER CONSULTADO E COMPREENDIDO ESTE MANUAL DE ASSISTÊNCIA TÉCNICA

Este Manual de Assistência Técnica só se encontra disponível em Inglês.

Se qualquer outro serviço de assistência técnica, que não a GEMS, solicitar estes manuais noutro idioma, é da responsabilidade do cliente fornecer os serviços de tradução.

O não cumprimento deste aviso pode por em perigo a segurança do técnico, operador ou paciente devido a‘ choques elétricos, mecânicos ou outros.

AVVERTENZA

SI PROCEDA ALLA MANUTENZIONE DELL’APPARECCHIATURA SOLO DOPO AVER CONSULTATO IL PRESENTE MANUALE ED AVERNE COMPRESO IL CONTENUTO

Il presente manuale di manutenzione è disponibile soltanto in inglese.

Se un addetto alla manutenzione esterno alla GEMS richiede il manuale in una lingua diversa, il cliente è tenuto a provvedere direttamente alla traduzione.

Non tenere conto della presente avvertenza potrebbe far compiere operazioni da cui derivino lesioni all’addetto alla manutenzione, all’utilizzatore ed al paziente per folgorazione elettrica, per urti meccanici od altri rischi.

警告

・このサービスマニュアルには英語版しかありません。
・ＧＥＭＳ以外でサービスを担当される業者が英語以外の言語を要求される場合、翻訳作業はその業者の責任で行うものとさせていただきます。
・このサービスマニュアルを熟読し理解せずに、装置のサービスを行わないで下さい。
・この警告に従わない場合、サービスを担当される方、操作員あるいは患者さんが、感電や機械的又はその他の危険により負傷する可能性があります。

注意:

- 本维修手册仅存有英文本。
- 非 GEMS 公司的维修员要求非英文本的维修手册时，客户需自行负责翻译。
- 未详细阅读和完全了解本手册之前，不得进行维修。
- 忽略本注意事项会对维修员，操作员或病人造成触电，机械伤害或其他伤害。

Direction DIRECTION 2138868−100

Revision 31

Advantx-E Calibration Users Guide

IMPORTANT! . . . X-RAY PROTECTION



X-ray equipment if not properly used may cause injury. Accordingly, the instructions herein contained should be thoroughly read and understood by everyone who will use the equipment before you attempt to place this equipment in operation. The General Electric Company, Medical Systems Group, will be glad to assist and cooperate in placing this equipment in use.

Although this apparatus incorporates a high degree of protection against x-radiation other than the useful beam, no practical design of equipment can provide complete protection. Nor can any practical design compel the operator to take adequate precautions to prevent the possibility of any persons carelessly exposing themselves or others to radiation.

It is important that everyone having anything to do with x-radiation be properly trained and fully acquainted with the recommendations of the National Council on Radiation Protection and Measurements as published in NCRP Reports available from NCRP Publications, 7910 Woodmont Avenue, Room 1016, Bethesda, Maryland 20814, and of the International Commission on Radiation Protection, and take adequate steps to protect against injury.

The equipment is sold with the understanding that the General Electric Company, Medical Systems Group, its agents, and representatives have no responsibility for injury or damage which may result from improper use of the equipment.

Various protective material and devices are available. It is urged that such materials or devices be used.

CAUTION: United States Federal law restricts this device to use by or on the order of a physician.

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If you have any comments, suggestions or corrections to the information in this document, please write them down, include the document title and document number, and send them to:

GENERAL ELECTRIC COMPANY MEDICAL SYSTEMS
MANAGER – INFORMATION INTEGRATION,
AMERICAS W–622
P.O. BOX 414
MILWAUKEE, WI 53201–0414

CERTIFIED ELECTRICAL CONTRACTOR STATEMENT



All electrical installations that are preliminary to positioning of the equipment at the site prepared for the equipment shall be performed by licensed electrical contractors. In addition, electrical feeds into the Power Distribution Unit shall be performed by licensed electrical contractors. Other connections between pieces of electrical equipment, calibrations, and testing shall be performed by qualified GE Medical personnel. The products involved (and the accompanying electrical installations) are highly sophisticated, and special engineering competence is required. In performing all electrical work on these products, GE will use its own specially trained field engineers. All of GE's electrical work on these products will comply with the requirements of the applicable electrical codes.

The purchaser of GE equipment shall only utilize qualified personnel (i.e., GE's field engineers, personnel of third-party service companies with equivalent training, or licensed electricians) to perform electrical servicing on the equipment.

DAMAGE IN TRANSPORTATION

All packages should be closely examined at time of delivery. If damage is apparent, have notation "**damage in shipment**" written on **all** copies of the freight or express bill **before** delivery is accepted or "signed for" by a General Electric representative or a hospital receiving agent. Whether noted or concealed, damage **MUST** be reported to the carrier **immediately** upon discovery, or in any event, within **14** days after receipt, and the contents and containers held for inspection by the carrier. A transportation company will not pay a claim for damage if an inspection is not requested within this **14** day period.

Call Traffic and Transportation, Milwaukee, WI (414) 827−3449 / 8*285−3449 **immediately** after damage is found. At this time be ready to supply name of carrier, delivery date, consignee name, freight or express bill number, item damaged and extent of damage.

Complete instructions regarding claim procedure are found in Section "S" of the Policy & Procedure Bulletins.

6/17/94

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UNIT X001 – Earth Field Compensation – Vascular

Time: x h xx min – Personnel: 1 field engineer

1 DESCRIPTION

Calibration Unit X001 adjusts the earth field compensation parameters in a vascular system to eliminate image distortion on the room monitor caused by the earth's magnetic field. The adjustment sets the field strength of a compensation coil in the image intensifier to a level that negates the effect of earth's magnetic field at the site at which the system is installed. The unit is run for systems equipped with either a rectangular collimator or circular collimator.

2 EQUIPMENT REQUIRED

None.

3 SPECIAL INSTRUCTIONS

Note: **For Vascular Systems Only:** Before system calibration, verify that additional filter (copper–aluminum filter) is not installed on top of collimator. (Open sensor hinge assembly to verify.) If installed, remove before performing calibration.

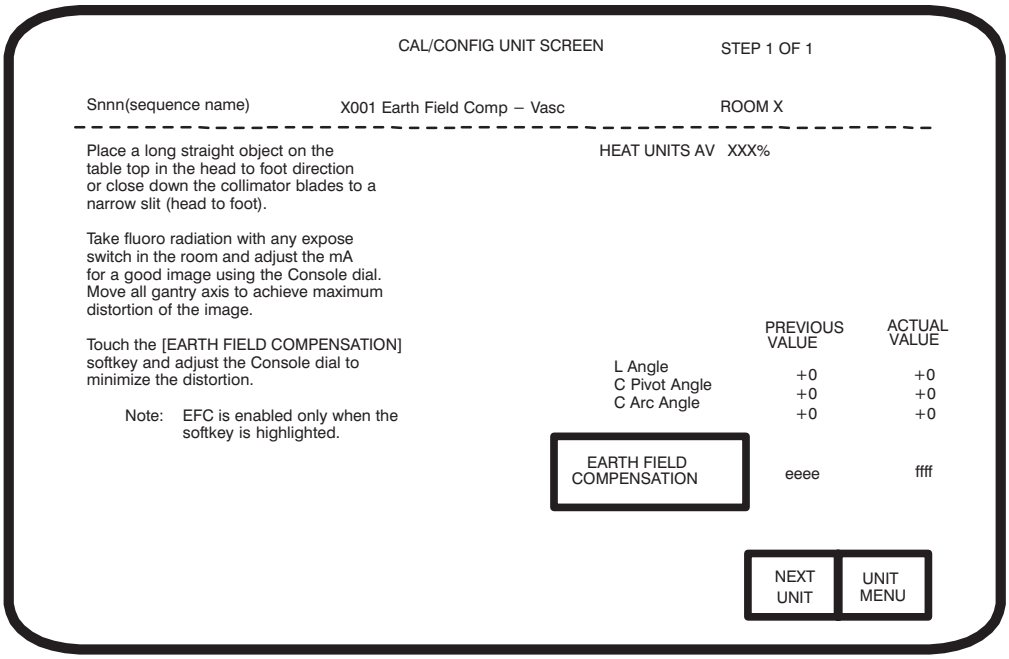
4 CAL PROCEDURE

4-1 Adjust Earth Field Compensation Coil

- Place a long straight object on the table top in the head to foot direction or close down the collimator blades to a narrow slit (head to foot).
- Take and maintain a fluoro exposure. Use the console dial to adjust mA for a good image.
- While maintaining the exposure, move the positioner axis to a point at which maximum image distortion is observed on the room monitor.
- Touch the EARTH FIELD COMPENSATION softkey. Use the console dial to adjust the strength of the compensating field until minimum distortion is observed on the room monitor.
- Terminate the exposure. Touch NEXT UNIT or UNIT MENU softkey to exit the unit. An “Updating NV Database” message is displayed while the calibration data is being loaded into the system.

Note: On LP systems, the L–Angle and U–Angle parameters displayed on the screen are changed to PIV and ARC, respectively, for the LP side.

X001 SCREEN DISPLAY



UNIT X002 – Earth Field Compensation – R&F

Time: x h xx min – Personnel: 1 field engineer

1 DESCRIPTION

Calibration Unit X002 adjusts the earth field compensation parameters in an R&F system to eliminate image distortion caused by the earth's magnetic field. The adjustment sets the field strength of a compensation coil in the image intensifier to a level that negates the effect of the earth's magnetic field at the site at which the system is installed.

2 EQUIPMENT REQUIRED

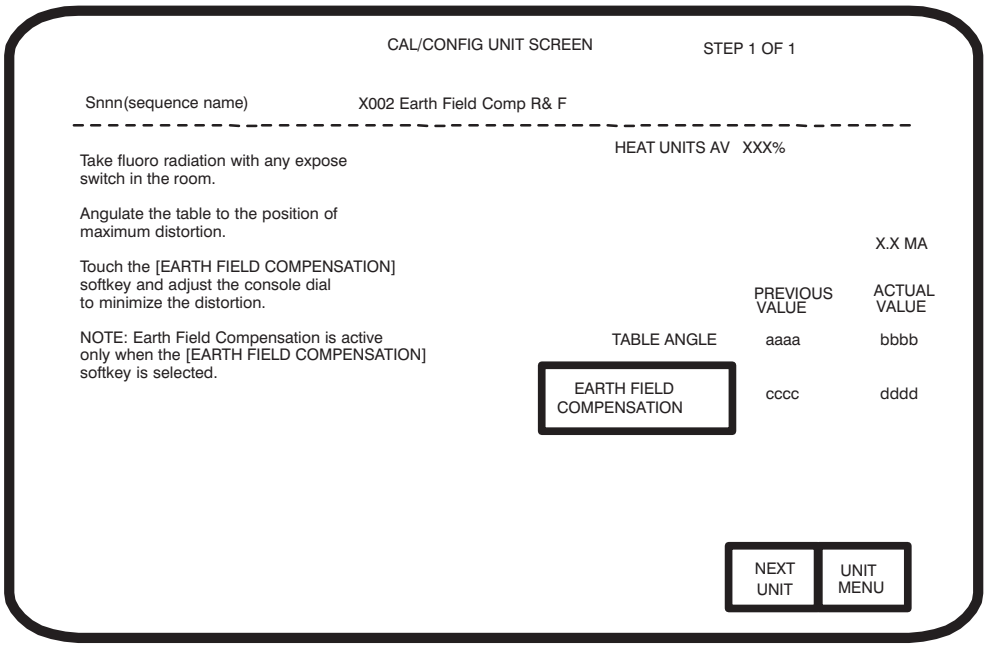
None.

3 CAL PROCEDURE

3-1 Adjust Earth Field Compensation Coil

- Place a long straight object on the table top in the head to foot direction or close down the collimator blades to a narrow slit (head to foot).
- Take and maintain a fluoro exposure. Use the console dial to adjust mA for a good image.
- While maintaining the exposure, angulate the table to a point at which maximum image distortion is observed on the room monitor.
- Touch the EARTH FIELD COMPENSATION softkey. Use the console dial to adjust the strength of the compensating field until minimum distortion is observed on the room monitor.
- Terminate the exposure. Touch NEXT UNIT or UNIT MENU softkey to exit the unit. An “Updating NV Database” message is displayed while the calibration data is being loaded into the system.

X002 SCREEN DISPLAY



If compensation is inadequate following this procedure, angulate the table to a position approximately halfway between horizontal and the position of maximum image distortion (as observed on the room monitor). Then adjust the system for minimum distortion. This produces better results for some systems.

UNIT X003 – Photo Cell Aperture

Time: x h xx min – Personnel: 1 field engineer

1 DESCRIPTION

Calibration Unit X003 is used to verify that the proper photo cell aperture is installed in the system. The type of aperture installed is directly related to the system type. The calibration unit does not calibrate values.

Note: Execution of this calibration unit is required at initial installation of a system and during a system upgrade that adds a film camera to the image system.

2 EQUIPMENT REQUIRED

Standard tool kit.

3 CAL PROCEDURE

3-1 Check Aperture

- Remove the image head covers and visually check the aperture installed in front of the photo cell. Refer to Direction 46–019070, for procedures covering the removal and installation of the image head covers. Table 40 indicates the correct aperture rating for the system/collimator type installed.

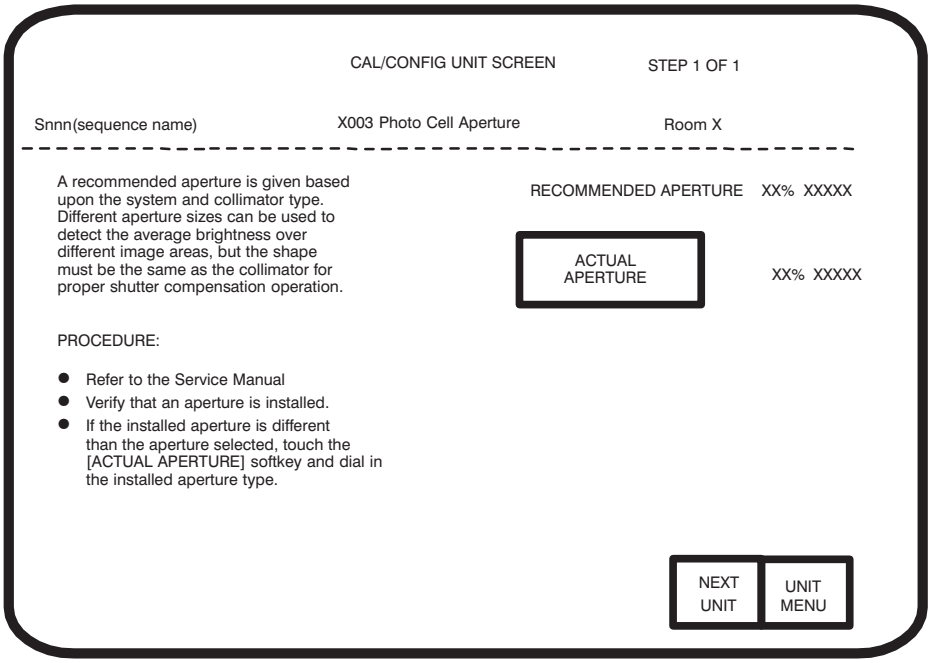
Table 40 – Aperture Rating/Size

	RECTANGULAR COLL		CIRCULAR COLL		SRI or AIV COLL	
	SQUARE APER		CIRCULAR APER		SQUARE APER	
SYSTEM TYPE	OPENING	SIZE (mm)	OPENING	SIZE (mm) dia	OPENING	SIZE (mm)
R&F	64%	5.7 X 5.7	N/A	N/A	N/A	N/A
LU–A	32%	4.0 X 4.0	N/A	N/A	N/A	N/A
LU–C	32%	4.0 X 4.0	32%	4.6	N/A	N/A
LC or LP	32%	4.0 X 4.0	32%	4.6	32%	4.0 X 4.0
AFM or CFM	N/A	N/A	N/A	N/A	32%	4.0 X 4.0
LC or LCA					32%	4.0 X 4.0
Tilt–C R&F					64%	8.0 X 8.0
Tilt–C Vascular					32%	4.0 X 4.0

- If the actual aperture installed in the system is different than the ACTUAL APERTURE indicated on the console screen display, touch ACTUAL APERTURE softkey and use the console dial to enter the appropriate type.

- After verification or correction is completed, install the covers on the image head. Touch NEXT UNIT or UNIT MENU softkey to exit the calibration unit.

X003 SCREEN DISPLAY



UNIT X004 – FL Collimator Limits

Time: x h xx min – Personnel: 1 field engineer

1 DESCRIPTION

Calibration Unit X004 sets the positional blade limits of rectangular and circular collimators relative to the fields of view (FOV's) applicable to the system. The collimator blade limit is normally set so that the blade position just touches the edge of the applicable field of view (can just be seen infringing in the image on the room monitor).

The unit can also be used to set the blade limits of a collimator according to customer preference. The blade position can be adjusted for a desired amount of blade infringement on the image on the room monitor.

The unit is sub–divided into three separate adjustment procedures in order to cover the collimator types that may be configured on an Advantx system.

Procedure 1 covers Rectangular Collimators.
Procedure 2 covers Circular Collimators.
Procedure 3 covers SRI and AIV Collimators.

Note: SRI and AIV collimators are equipped with both rectangular blades and circular iris blades. If necessary, refer to SRI or AIV Collimator Service Manual for instructions covering alignment of the circular field to the rectangular field.

2 EQUIPMENT REQUIRED

None.

NOTICE

If this is the first time Unit X004 is being run, the collimator blades must be set for all applicable field of view sizes. Otherwise, only the field of view requiring blade adjustment may be selected.

3 SPECIAL INSTRUCTIONS

Note: **For Vascular Systems Only:** Before system calibration, verify that additional filter (copper–aluminum filter) is not installed on top of collimator. (Open sensor hinge assembly to verify.) If installed, remove before performing calibration.

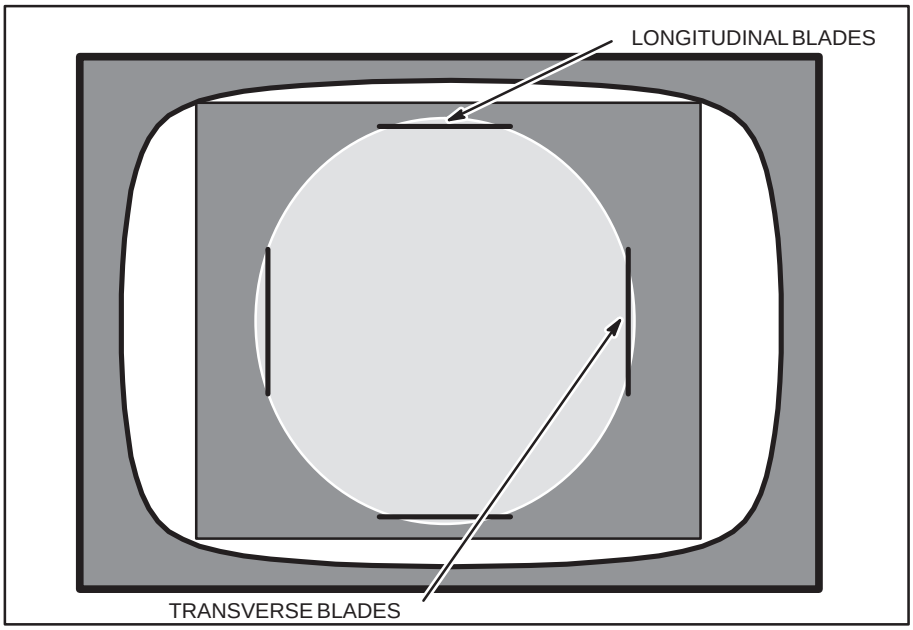
4 CAL PROCEDURE 1 – RECTANGULAR COLLIMATOR

- Set SID to minimum.
- Select FOV with console dial.
- Take and maintain a fluoro exposure.
- Using the tableside controls, position the rectangular blades until they just infringe on the image displayed on the room monitor (See Illustration 128) or to a customer acceptable position. The blade position must be set while the blades are being moved to a “close” position. If the blades are set while moving to the “open” position, an FOV sizing error will occur.

Note: The database values may be corrupted if just one set of the rectangular blades is adjusted. If only one set of blades requires adjustment, adjust the applicable blade set and then momentarily select the other blade set on the tableside control before touching the COLL BLADE SET softkey.

- Touch NEXT UNIT or UNIT MENU softkey to exit. An “Updating NV Database” message is displayed while the calibration data is being loaded into NVRAM.

Illustration 128 – Rectangular Collimator Blade Adjustment



5 CAL PROCEDURE 2 – CIRCULAR COLLIMATOR

- Set SID to minimum.
- Select FOV with console dial.
- Take and maintain a fluoro exposure.
- Using the tableside controls, position the iris blades so that all of the circular iris blades just infringe on the image displayed on the room monitor (See Illustration 129) or to a customer acceptable position.
- Touch the COLL BLADE SET softkey. Database values are determined from the position of the blades.
- Touch NEXT UNIT or UNIT MENU softkey to exit. An “Updating NV Database” message is displayed while the cal data is being loaded into NVRAM.

6 CAL PROCEDURE 3 – SRI AND AIV COLLIMATORS

6-1 SRI Collimators

- For LCV+ (32 cm II), LC+ (22 cm II), Tilt–C, and Tilt–C Vascular systems, set SID to minimum. For LCA (40 cm II), set SID to 100 cm, that is 109 cm on digital display.
- Select FOV with console dial.
- Take and maintain a fluoro exposure.
- Using the tableside controls, position the iris and rectangular blades until they just infringe on the image displayed on the room monitor (See Illustration 129). Position the iris blades first. The blade position must be set while the blades are being moved to a “closed” position. If the blades are set while moving to the “open” position, an FOV sizing error will occur.

Note: The database values may be corrupted if just one set of the rectangular blades is adjusted. If only one set of blades requires adjustment, adjust the applicable blade set and then momentarily select the other blade set on the tableside control before touching the COLL BLADE SET softkey.

- Touch the COLL BLADE SET softkey. Database values are determined from the position of the rectangular blades and iris blades.
- Touch NEXT UNIT or UNIT MENU softkey to exit. An “Updating NV Database” message is displayed while the calibration data is being loaded into NVRAM.

WARNING

TO BE COMPLIANT WITH THE NEW IEC 601–2–43 REGULATION, AN OVERLAP OF AT LEAST 80% BETWEEN THE PRIMARY X–RAY BEAM AND THE USEFUL IMAGE DISPLAYED ON THE MONITOR IS MANDATORY (IN THE WORST CASE, YOU REACH THE 80% VALUE IN THE FOLLOWING CONFIGURATION: SMALLEST FOV–MAXIMUM SID).

INTERNAL MEASUREMENTS HAVE SHOWN THAT THIS 80% VALUE IS ALWAYS ACHIEVED WHEN THE IRIS BLADES ARE VISIBLE ON THE IMAGE. THEREFORE, WHEN CALIBRATING IRIS COLLIMATOR BLADES, MAKE SURE THAT THE BLADES ARE SLIGHTLY VISIBLE ON THE DISPLAYED IMAGE (CLOSE TO THE EDGES OF THE IMAGE).

NOTICE

After performing the SRI or AIV collimator limit adjustments, it is recommended that you boot Applications software and check that x–rays are not switched off by the safety regulations control (CDRH) during movement of the Image Intensifier. Perform the check as follows:

1. **Boot Applications software.**
2. **While taking x–rays at full field of view (Mag 0), move Image Intensifier from minimum to maximum SID several times.**
3. **If the SRI or AIV collimator limits are properly adjusted, the x–rays should not be switched off during movement of the Image Intensifier and the error message 4AB4H “Collimator Problem, Install the safety mask and call service” should not be displayed.**

Note: If this problem appears, re–run Calibration Unit P404 (SRI/AIV Collimator A/D Calibration), and then perform Calibration Unit X004 again.

6-2 AIV Rectangular Blades

- Select rectangular blade function.
- Set SID to minimum.
- Select FOV with console dial.
- Take and maintain a fluoro exposure.
- Using the tableside controls, position the rectangular blades until they just infringe on the image displayed on the room monitor (See Illustration 128). The blades position must be set while the blades are being moved to a “close” position. If the blades are set while moving to the “open” positron, an FOV sizing error will occur.

Note: The database values may be corrupted if just one set of the rectangular blades is adjusted. If only one set of blades requires adjustment, adjust the applicable blade set and then momentarily select the other blade set on the tableside control before touching the COLL BLADE SET softkey.

6-3 AIV Circular Blades

- Select circular iris function.
- Using the tableside controls, position the iris blades so that all of the circular iris blades just infringe on the image displayed on the room monitor (See Illustration 129).

WARNING

TO BE COMPLIANT WITH THE NEW IEC 601–2–43 REGULATION, AN OVERLAP OF AT LEAST 80% BETWEEN THE PRIMARY X–RAY BEAM AND THE USEFUL IMAGE DISPLAYED ON THE MONITOR IS MANDATORY (IN THE WORST CASE, YOU REACH THE 80% VALUE IN THE FOLLOWING CONFIGURATION: SMALLEST FOV–MAXIMUM SID).

INTERNAL MEASUREMENTS HAVE SHOWN THAT THIS 80% VALUE IS ALWAYS ACHIEVED WHEN THE IRIS BLADES ARE VISIBLE ON THE IMAGE. THEREFORE, WHEN CALIBRATING IRIS COLLIMATOR BLADES, MAKE SURE THAT THE BLADES ARE SLIGHTLY VISIBLE ON THE DISPLAYED IMAGE (CLOSE TO THE EDGES OF THE IMAGE).

Note: If circular iris control is not available from the tableside control, manually position the circular iris as follows:

1. Turn locking key (Item 1, Illustration 130) and open front cover of AIV collimator.
2. Turn circular iris control knob (Item 2, Illustration 130) to adjust iris blades to proper position. A counterclockwise (CCW) rotation closes the iris blades.

- Touch the COLL BLADE SET softkey. Database values are determined from the position of the rectangular blades and iris blades.
- Touch NEXT UNIT or UNIT MENU softkey to exit. An “Updating NV Database” message is displayed while the calibration data is being loaded into NVRAM.

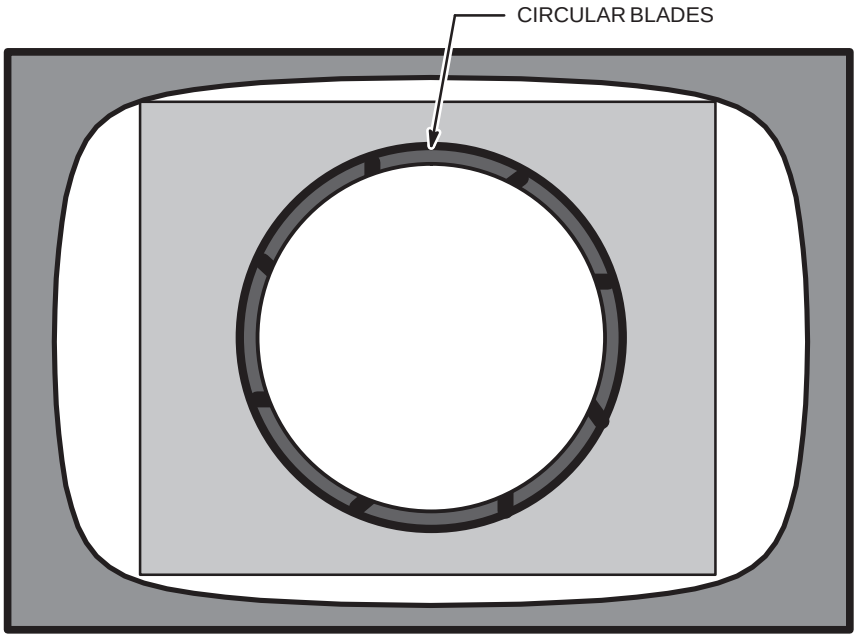
NOTICE

After performing the SRI or AIV collimator limit adjustments, it is recommended that you boot Applications software and check that x–rays are not switched off by the safety regulations control (CDRH) during movement of the Image Intensifier. Perform the check as follows:

1. **Boot Applications software.**
2. **While taking x–rays at full field of view (Mag 0), move Image Intensifier from minimum to maximum SID several times.**
3. **If the SRI or AIV collimator limits are properly adjusted, the x–rays should not be switched off during movement of the Image Intensifier and the error message 4AB4H “Collimator Problem, Install the safety mask and call service” should not be displayed.**

Note: If this problem appears, re–run Calibration Unit P404 (SRI/AIV Collimator A/D Calibration), and then perform Calibration Unit X004 again.

Illustration 129 – Circular Collimator Iris Adjustment



X004 STEP 1 SCREEN DISPLAY

CAL/CONFIG UNIT SCREEN STEP 1 OF 1

S023 Fluoro Cal X004 FL Collimator Limits ROOM X

Using the table side controls and fluoro radiation, position the collimator blades (and iris for AIV collimator) to a customer−acceptable position. Touch the [COLL BLADES SET] softkey.

Repeat for each field of view.

NOTE: If no iris control is available, manually position iris per cal users guide.

NOTE: If performing this Unit for the first time, all field sizes must be set. Otherwise, the desired field of view may be selected using the console dial.

HEAT UNITS AV XXX%

Current mA = 0.0 mA

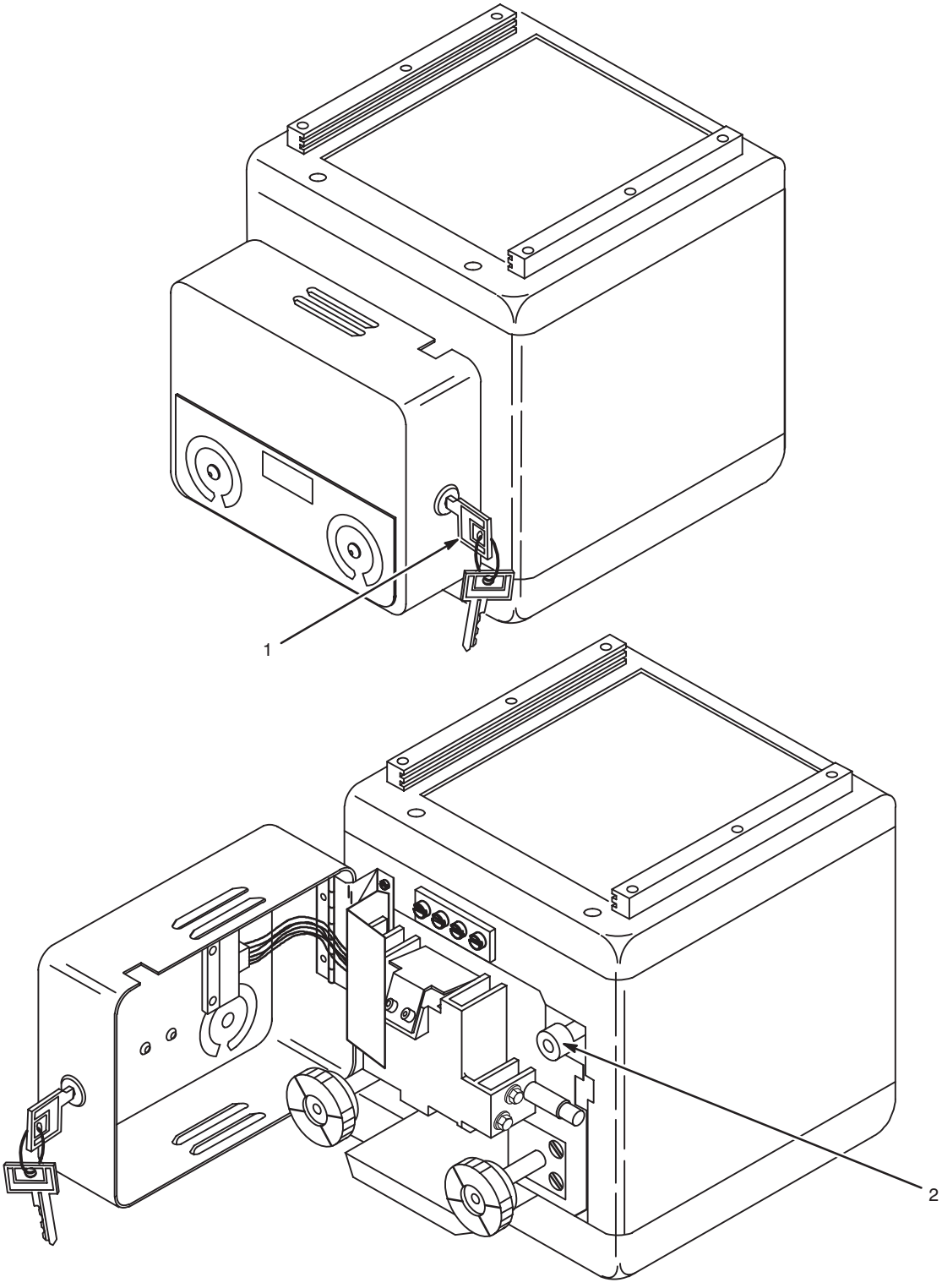
Fluoro Field of View

Full Field of View
Magnification 1
Magnification 2
Magnification 3

COLL BLADES SET

NEXT UNIT | UNIT MENU

Illustration 130 – AIV Circular Collimator Alignment



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UNIT X006 – Cine Collimator Limits

Time: x h xx min – Personnel: 1 field engineer

1 DESCRIPTION

Calibration Unit X006 sets the positional limits of the collimator blades in accordance with the size of the rectangular film format of the Cine camera (see Table 41). The unit is run on systems configured with either rectangular or circular collimators. The unit uses a fixed exposure technique. Three steps are required to accomplish the calibration. A separate Step 3 screen is presented for square and circular collimators.

Note: As indicated in Table 41, the large dimension for square collimators is dependent on the size of the lens. The 83 mm lens will yield a slightly smaller dimension than the 100 mm lens.

Table 41 – Cine Image Size

SIZE OF IMAGE			
	SQUARE COLLIMATOR		CIRC COLLIMATOR
LENS SIZE	LARGE DIMENSION	SMALL DIMENSION	DIAG DIMENSION
100 mm	24 mm	18 mm	24 mm
83 mm	22 mm	18 mm	22 mm

2 EQUIPMENT REQUIRED

Cine Film

Note: For Advantx–E MP Phase 4 systems: Plexiglass, Copper, and Aluminum filter from CV PHANTOM must be used in cine exposure.

3 SPECIAL INSTRUCTIONS

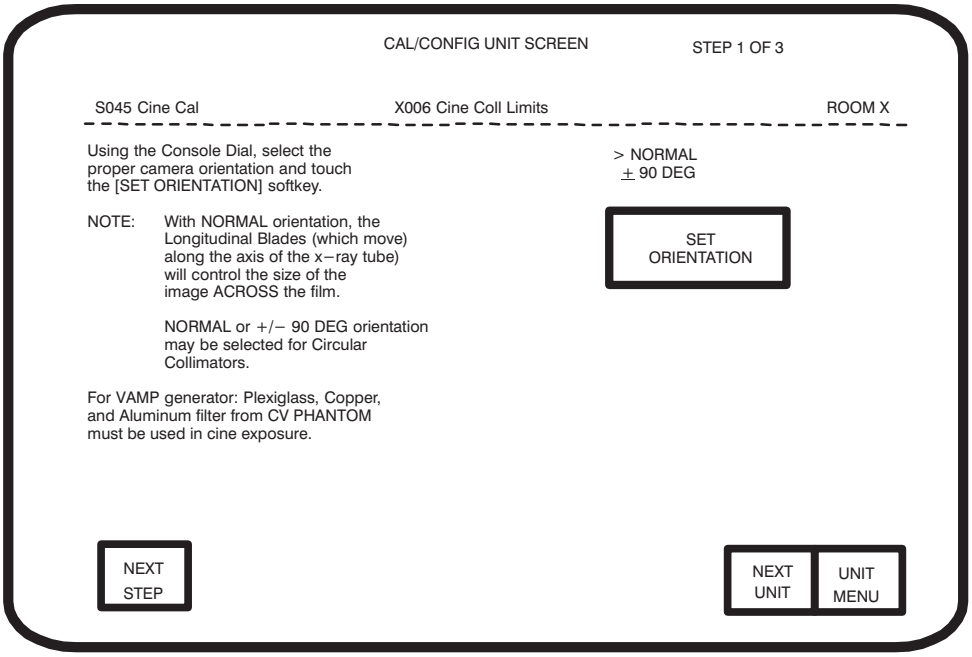
Note: **For Vascular Systems Only:** Before system calibration, verify that additional filter (copper–aluminum filter) is not installed on top of collimator. (Open sensor hinge assembly to verify.) If installed, remove before performing calibration.

4 CAL PROCEDURE

4-1 Step 1. Set Camera Orientation

- Use the console dial to select the camera orientation on the image gate housing:
  NORMAL – LU–C, LP (The longitudinal collimator blades control the size of the image across the film)
  ± 90 DEG – LC (This orientation may be selected for circular collimator Ref. SRI collimators).
- Touch SET ORIENTATION softkey.
- Touch NEXT STEP softkey to proceed to Step 2.

X006 STEP 1 SCREEN DISPLAY



4-2 Step 2. Take Cine Exposures

- Load the Cine camera with appropriate film and advance the film 10 frames.
- Remove all objects from the X–ray field.
- Use the handswitch or footswitch to take and maintain a Cine exposure for the first Field of View. Maintain the exposure until the rotor begins to brake. Then. release the Prep and Expose switches.
- Re-initiate exposures for the next Field of View. Repeat taking exposures at remaining Fields of View until the “STEP IS COMPLETE” message appears.

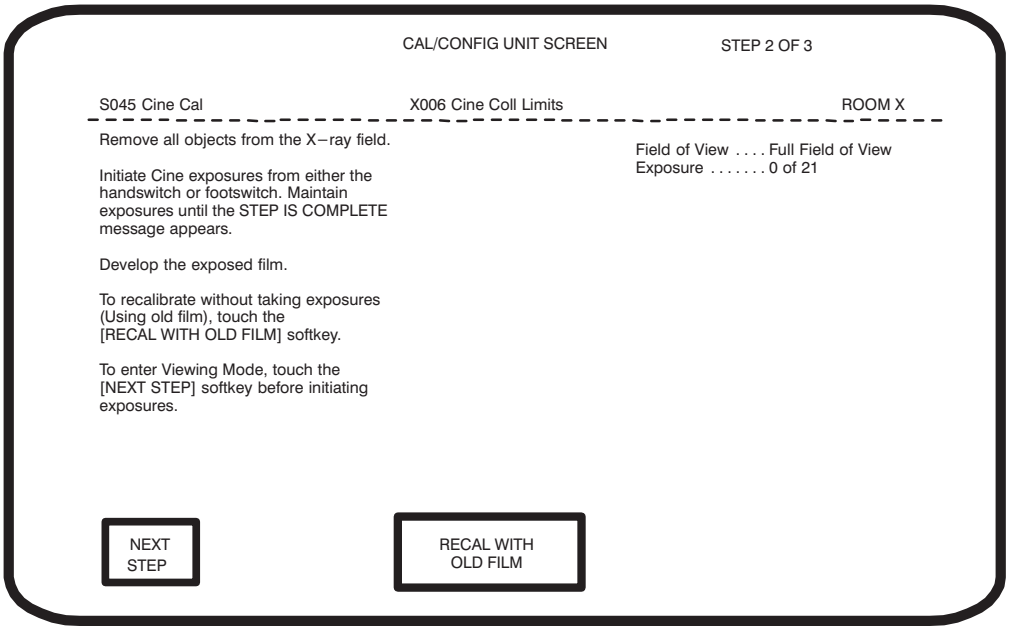
Note: On systems configured with an SRI collimator, the circular blades will not appear on film in the 4.5 inch FOV mode.

- Advance the film 10 frames. Then, develop the exposed film.

Note: To recalibrate without taking exposures with new film, touch the RECAL WITH OLD FILM softkey. Do not select this option when recalibrating with a different camera orientation.

- Touch NEXT STEP softkey to proceed to Step 3.

X006 STEP 2 SCREEN DISPLAY



4-3 Step 3. Square Collimator Image Set

- Examine the developed film. Determine the number of the image set that most accurately conforms to the dimension of the film (best fit) in the direction indicated on the screen.

Note: The first set of images is longer than the others and corresponds to image set number one. Best fit occurs at the point where collimation begins, which is the point where the edge of the image is blurred by the collimator blades. See Illustration 131.

- Touch ALONG FILM EXPOSURE NUMBER softkey and use the console dial to enter the number of the image that best fits in the direction indicated.
- Touch ACROSS FILM EXPOSURE NUMBER softkey and use the console dial to enter the number of the image that best fits in the direction indicated.

Note: If this is the first time this unit is being run, all field sizes must be set. Otherwise, only the field of view you wish to calibrate may be selected with the console dial.

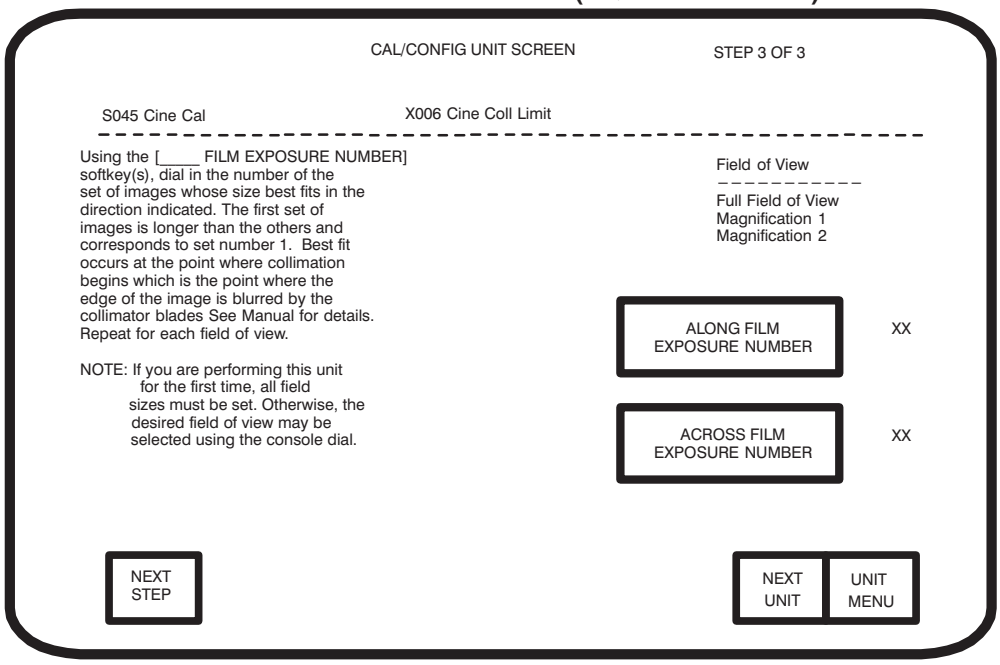
- Repeat for each field of view.
- If after calibration, the image set still does not conform to the dimension of the film, return to Step 2 and perform a recalibration.

NOTICE

If, after recalibration, the films are still not uniformly collimated, perform Collimator A/D Cal (Unit P303). It may also be necessary to recalibrate II sizing if the middle FOV is not of uniform size.

- Touch NEXT UNIT or UNIT MENU softkey. Exiting the calibration unit loads the collimator limit data into NV RAM.

X006 STEP 3 SCREEN DISPLAY (SQUARE BLADES)



4-4 Step 3. Circular Collimator Image Set

- Examine the developed film. Determine the number of the image set that most accurately conforms to the dimension of the film (best fit) in the direction indicated on the screen.

Note: The first set of images is longer than the others and corresponds to image set number one. Best fit occurs at the point where collimation begins, which is the point where the edge of the image is blurred by the collimator blades. See Illustration 132.

- Touch DIAGONAL EXPOSURE NUMBER softkey and use the console dial to enter the number of the image that best fits in the direction indicated.

Note: If this is the first time this unit is being run, all field sizes must be set. Otherwise, only the field of view you wish to calibrate may be selected with the console dial.

- Repeat for each field of view.
- If after calibration, the image set still does not conform to the dimension of the film, return to Step 2 and perform a recalibration.

NOTICE

If, after recalibration, the films are still not uniformly collimated, perform Collimator A/D Cal (Unit P303). It may also be necessary to recalibrate II sizing if the middle FOV is not of uniform size.

- Touch NEXT UNIT or UNIT MENU softkey. Exiting the calibration unit loads the collimator limit data into NV RAM.

X006 STEP 3 SCREEN DISPLAY (CIRCULAR BLADES)

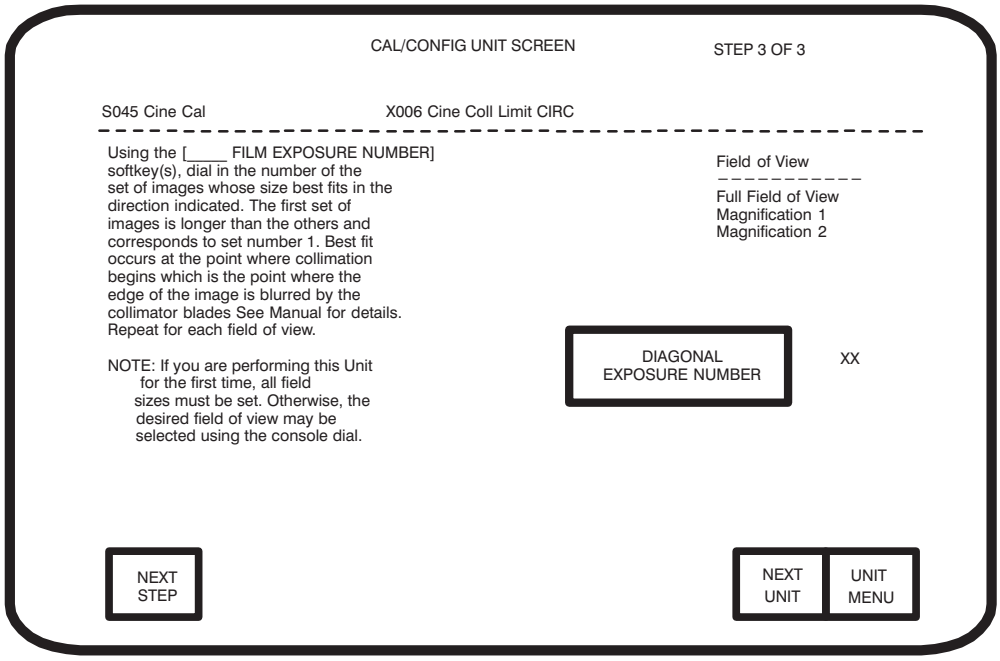


Illustration 131 – Rectangular Collimator Film Frame

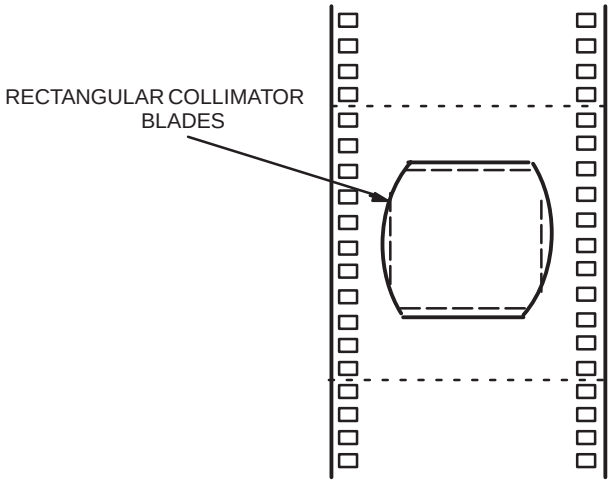
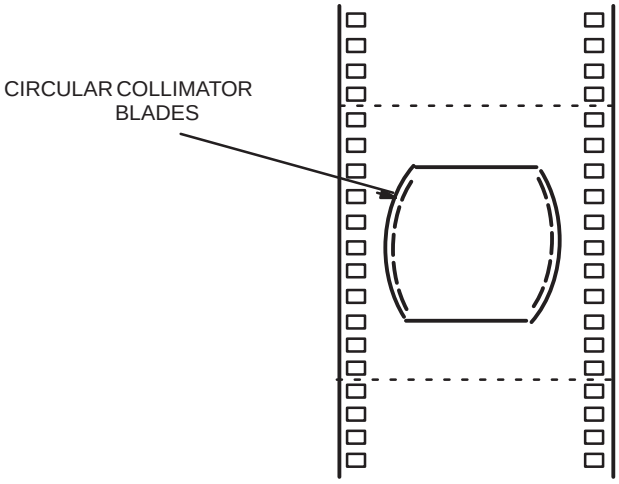


Illustration 132 – Circular Collimator Film Frame



UNIT X010 – Tube n Warmup

Time: x h xx min – Personnel: 1 field engineer

1 DESCRIPTION

Calibration Unit X010 provides a system controlled method of accomplishing an X–ray tube warmup. The unit is semi–automated; parameters are automatically set according to the tube type. Only one step is required to accomplish a tube warmup.

Note: The calibration unit should be run whenever an X–ray tube has been out of use for two or more hours.

2 EQUIPMENT REQUIRED

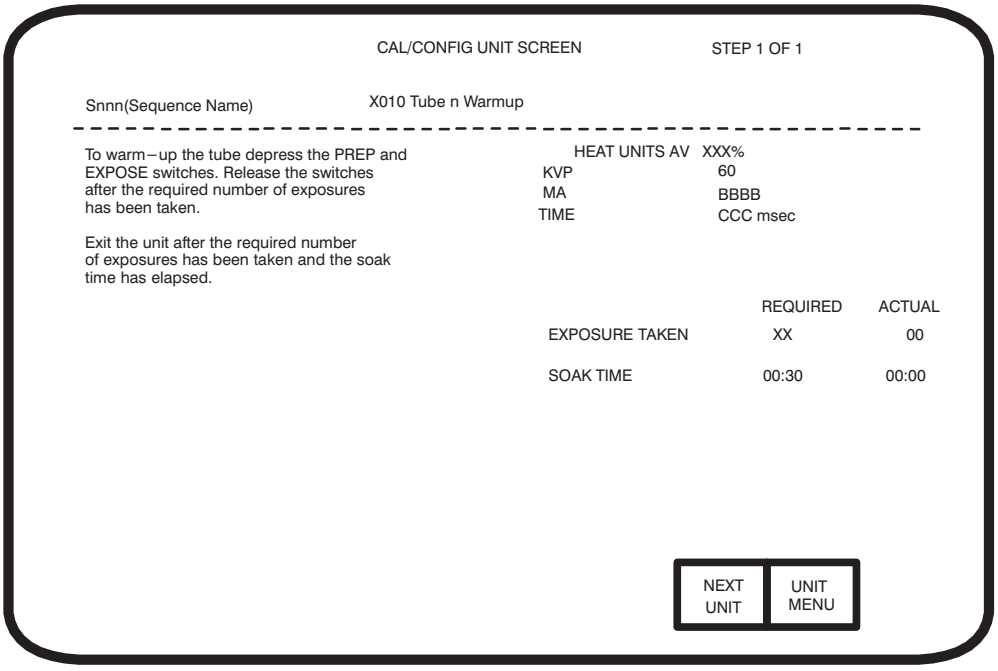
None.

3 CAL PROCEDURE

Perform tube warm-up as follows:

- Initiate the X–ray tube warmup by pressing the PREP and EXPOSE switches on the console handswitch. The unit will take a series of primary timed exposures at the values indicated on the console screen.
- Release the switches after the required number of exposures have been taken. The unit will enter a soak time period.
- After the SOAK TIME has elapsed, the console will emit a short audio tone and the message “TUBE WARM-UP COMPLETE” will be displayed.
- Touch NEXT UNIT or UNIT MENU softkey to exit the unit.

X010 SCREEN DISPLAY



Blank page.

UNIT X011 – Tube Run–in and Stability

Time: x h xx min – Personnel: 1 field engineer

1 DESCRIPTION

Calibration Unit X011 is used to perform run–in, stability, and high voltage seasoning on new X–ray tubes. The unit uses a software driven routine that is performed in conjunction with the unit console screen presentation. The procedure is semi–automated; parameters are automatically set, timing delays are controlled, exposures are counted, etc. There are three steps to the procedure. Step 1 calibrates the required mA stations. Step 2 performs run–in procedures to de–gas the tube and heat soak the tube anode. Step 3 performs stability (high voltage seasoning) procedures to evenly distribute charges in the tube to prevent “tube spits.” The Step 1 screen also permits access to a “More Info” screen that provides additional information regarding the running of the unit if tube spits are encountered in Step 1.

2 EQUIPMENT REQUIRED

Storage oscilloscope, test probe (times 10), and test leads, and an external bleeder, PN 46–154766G1 (Only if the system power unit is an LFX that does not contain an internal bleeder or if the internal bleeder is not working).

3 SPECIAL INSTRUCTIONS

The following special instructions pertain to the running of this unit.

- The following prerequisites must be performed before running this unit.
  1. The X–ray tube is properly warmed–up.
  2. The Image Intensifier (II) input phosphor is protected from X–rays (collimator is closed and lead apron is used to shroud the II).
- In some generator board failure modes, the error feedback is always zero (0). This may cause calibration unit X011 to run to completion taking only one X–ray exposure at each step. When running this unit be aware of situations where the FILAMENT CORRECTION value indicated on the console screen is always zero (0) since this indicates a generator board failure.
- A “CASING Rem” parameter is displayed on Steps 1 thru 3 of the unit screens. This parameter indicates the amount of heat units remaining on the tube casing as measured in kilojoules. If the “CASING Rem” value decreases to 0, exposures are automatically terminated until the tube casing cools.

4 TEST SETUP

Setup the system as follows:

- Systems configured with an LFX Power Unit:
  - If the LFX does not contain an internal bleeder or the internal bleeder is not working, connect an external bleeder as shown in Illustration 133.
  - Set bleeder selector switch LFX1 A1 A4 S203 to appropriate position: UP – External Bleeder; DOWN – Internal Bleeder
  - Connect oscilloscope probe to test point LFX1 A1 A4 J9 (KV OUT). The scale factor at J9 is 20 kV/volt (0.05 v/1 kV).
- Systems configured with an MP generator:
  - Connect the oscilloscope to kV output, TP7 (Ref TP10), on MPPU1 A1 A1, Measure and Commutation board. The scale factor at TP7 is 1.0 volt/8 kV, with a 10 volt offset. Use a X10 probe.

Note: In some cases when running this unit, it may be more convenient to connect oscilloscope probe to test point TP13 on the same board. The scale factor is about 1 volt/20 kV, without any offset. Use a X10 probe.

- Systems configured with an SCPU generator:
  - Connect oscilloscope Channel 1 to SCPU A4 A1 TP26 (kVp) and Channel 2 to SCPU A4 A1 TP25 (kVn). REF GND at TP5. The scale factor is 1.0 volt/8kv.

5 CAL PROCEDURE

5-1 Step 1. Calibrate mA Stations.

- Press and hold the PREP and EXPOSE switches. The unit will automatically step through and calibrate the mA stations required for tube run–in and stability.
- Terminate the exposure when the “STEP IS COMPLETE” message is displayed on the console screen.

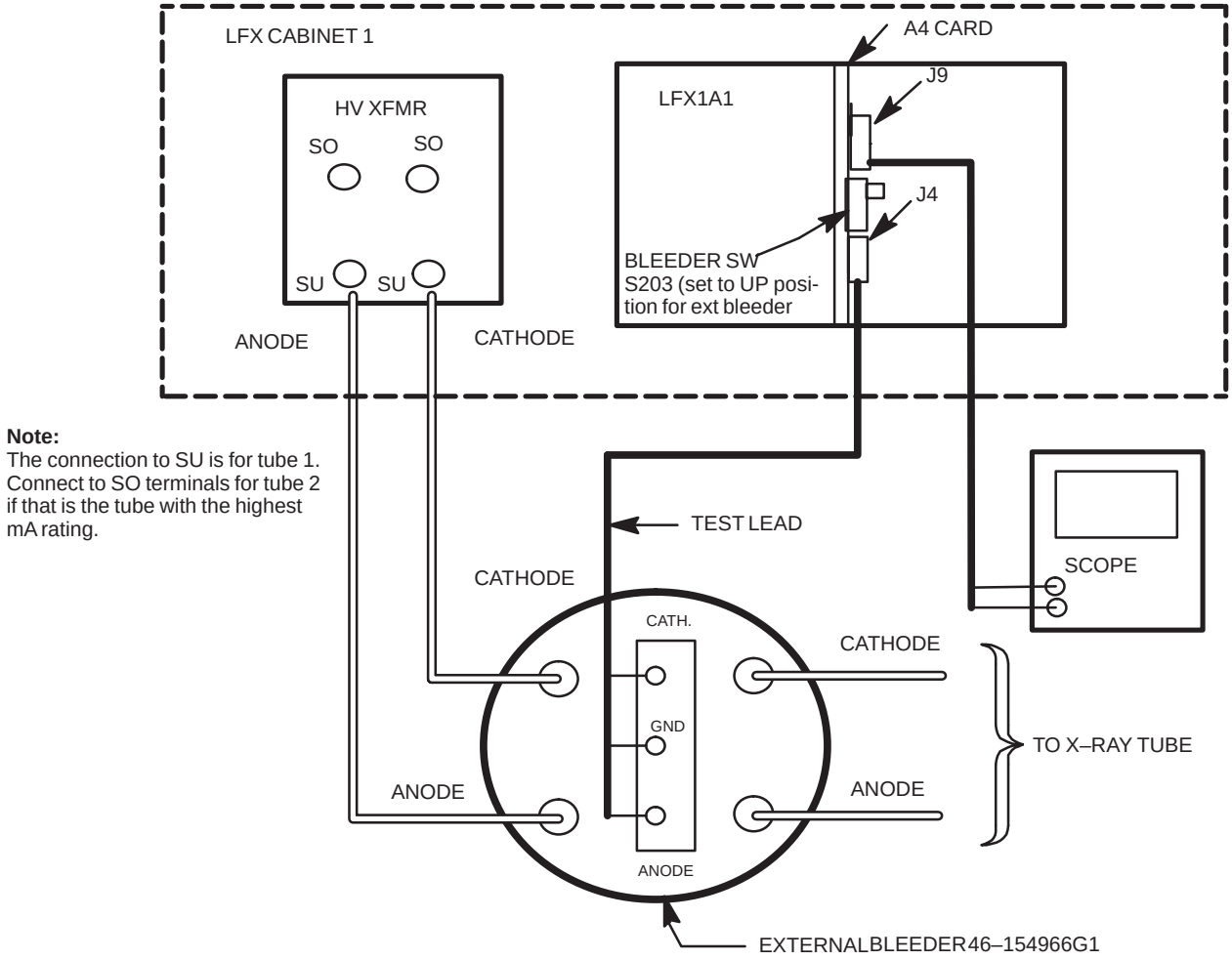
Note: If tube spits prevent you from finishing Step 1 of the calibration, touch the “MORE INFO” softkey to access a More Info screen. Perform the procedure indicated on the More Info screen before attempting XRT replacement. Tube spits should not be confused with an mA overload condition which occurs when filament emission limits are exceeded.

- Allow the X–ray tube to cool for 10 to 15 minutes before proceeding to Step 2.
- Touch NEXT STEP softkey to proceed to Step 2.

NOTICE

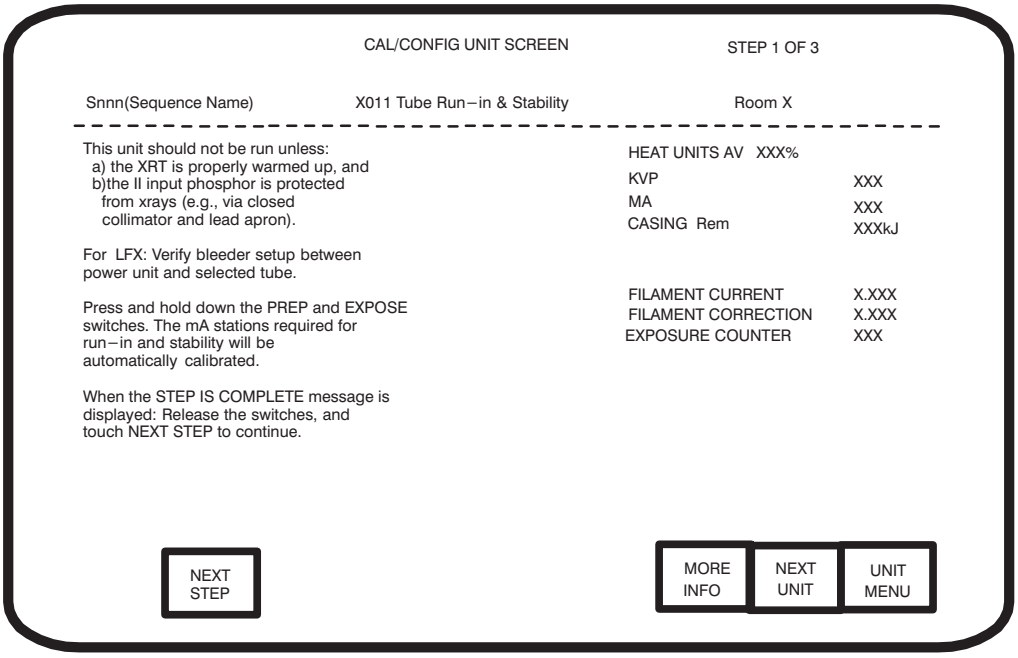
This Unit may display a value of 0 (or near 0) for casing storage even with a hot casing if the casing algorithm was bypassed in C004. If this is the case, verify that the casing is cool before starting Run–In.

Illustration 133 – X011 LFX Test Setup (W/External Bleeder)

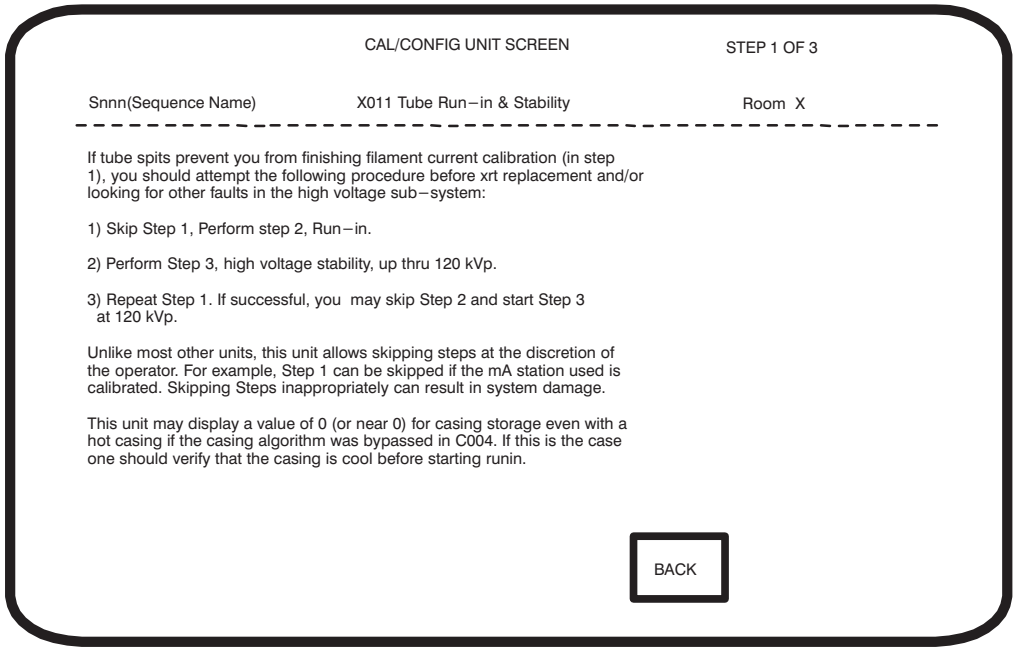


Note:
The connection to SU is for tube 1. Connect to SO terminals for tube 2 if that is the tube with the highest mA rating.

X011 STEP 1 SCREEN DISPLAY



X011 STEP 1 "MORE INFO" SCREEN DISPLAY



5-2 Step 2. Run–in Procedures.

Note: Step 2 automatically configures the system for exposures at database specified values of kVp, mA, and exposure time.

- Press and hold the PREP and EXPOSE switches. The unit automatically takes each required exposure after a required delay time. The data field of the screen display is continually updated with time, heat units, and number of exposures.

  EXPOSURES TAKEN – ACTUAL field is initially set to zero and is incremented after each exposure.

  TIME SINCE LAST EXPOSURE – ACTUAL field is set to zero after each exposure and will up–count at one second intervals.

NOTICE

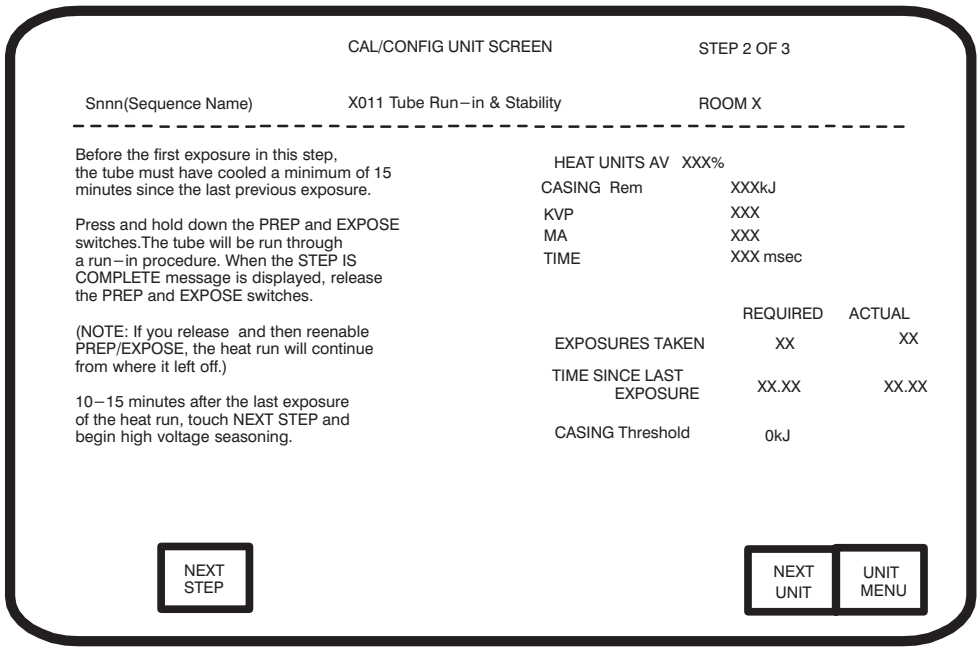
The first exposure is inhibited if the energy stored in the tube casing is greater than the value indicated in the CASING Threshold parameter and the message "CASING COOLING REQUIRED TO INITIATE RUNIN" is displayed on the screen. When the casing cools below the CASING Threshold value, the message is removed from the screen and exposures may be taken.

- When the "STEP IS COMPLETE" message is displayed on the console screen, release PREP and EXPOSE switches.

Note: If you release the PREP and EXPOSE switches while performing the run–in procedure and then re–enable the switches, the heat run–in will continue from the point of interruption.

- Allow the X–ray tube to cool for 10 to 15 minutes before proceeding to Step 3.
- Touch NEXT STEP softkey to proceed to Step 3.

X011 STEP 2 SCREEN DISPLAY



5-3 Step 3. Stability Procedures (High Voltage Seasoning).

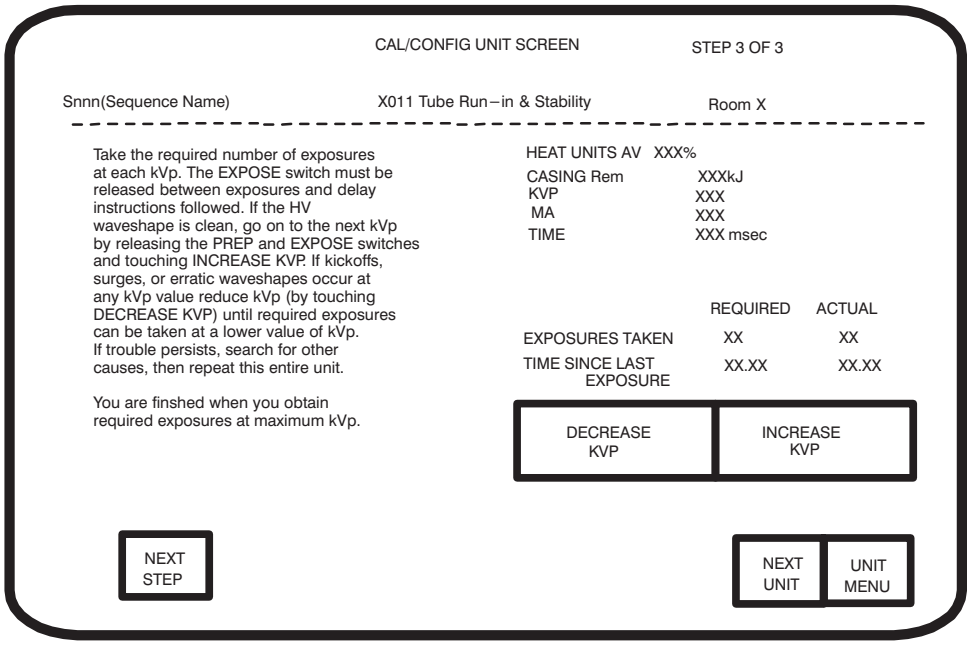
Note: Step 3 automatically configures the system to take exposures at database specified values. The kVp is manually sequenced, from an initial starting value through database configured kVp values to the maximum kVp allowed for the generator/tube combination configured.

- **For Maxiray 150 Only:**
  Press the PREP and EXPOSE switches. The EXPOSURES TAKEN – REQUIRED field indicates the number of exposures required for each kVp step. Take this required number of exposures at each kVp value. The EXPOSE switch must be released between exposures. The EXPOSURES TAKEN – ACTUAL field is initially set to zero and is incremented after each exposure. The TIME SINCE LAST EXPOSURE – REQUIRED field indicates delay between exposures. The TIME SINCE LAST EXPOSURE – ACTUAL field is set to zero and will up–count at 1 second intervals. The field is reset to zero after each exposure.
- **For All Tubes Except Maxiray 150:**
  Press the PREP and EXPOSE switches. Take a minimum of 5 exposures at each kVp value (except at the highest kVp where 15 exposures are required). The EXPOSE switch must be released between exposures. The EXPOSURES TAKEN – REQUIRED field is set to 5 at every kVp value (15 at highest kVp). The EXPOSURES TAKEN – ACTUAL field is initially set to zero and is incremented after each exposure. The TIME SINCE LAST EXPOSURE – REQUIRED field is set to 5 seconds. The TIME SINCE LAST EXPOSURE – ACTUAL field is set to zero and will up–count at 1 second intervals. The field is reset to zero after each exposure.

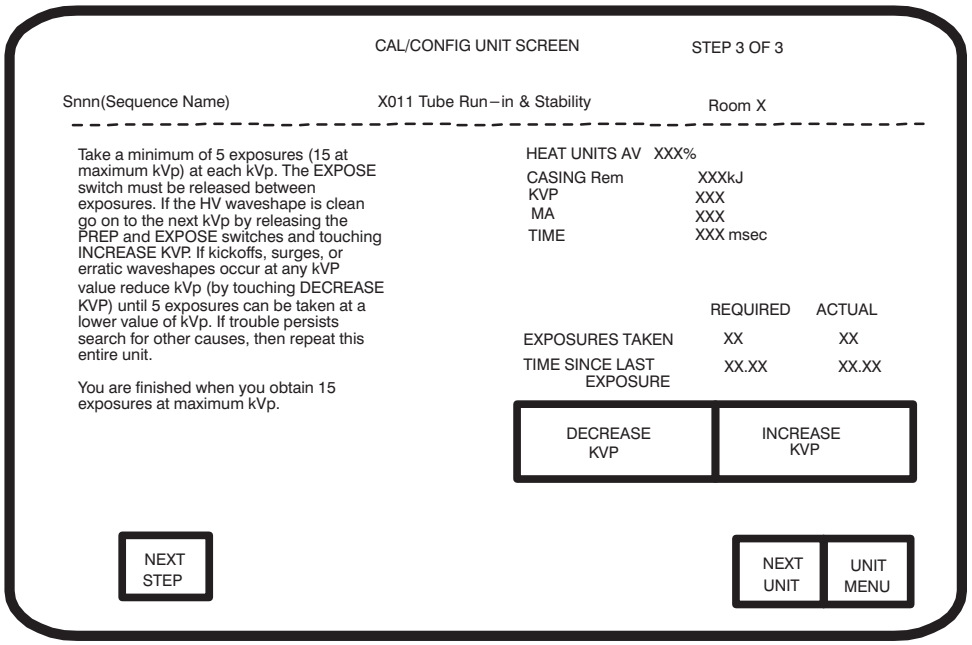
CAUTION **On systems configured with an MX125 (0.3 – 1.2) X–ray tube, do not run the tube above 130 kV(max rating for this tube) even though the unit allows the tube to be run up to 150 kV.**

- If the HV waveform observed on the scope is clean, go on to the next higher kVp value by first releasing the PREP/EXPOSE switches and then touching the INCREASE KVP softkey.
- If kickoffs or erratic waveforms are observed at any kVp value, reduce the kVp to a lower value by touching the DECREASE KVP softkey. Repeat taking exposures at the new lower kVp value until five exposures can be obtained.
- Continue sequencing through the kVp levels until the maximum kVp level is reached. The calibration is complete when fifteen exposures can be taken at maximum kVp without encountering a tube spit. **Allow the tube to cool to 60% heat units before proceeding with the next calibration unit in the sequence.**
- Touch NEXT UNIT or UNIT MENU softkey to exit.

FOR MAXIRAY 150 ONLY
X011 STEP 3 SCREEN DISPLAY



FOR ALL TUBES EXCEPT MAXIRAY 150
X011 STEP 3 SCREEN DISPLAY



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General System Calibration Units

Notepad

Units X001 – X011

Unit	Note

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SECTION 9 – ABC CALIBRATION UNITS

Unit	Title	Page
X100	Fluoro Taper Interlaced	645
X101	Fluoro SID Compensation	669
X102	Cine KW Tapers, Focal Spot Size (XS) and (XL)	697
X104	Fluoro ABC Response Time	703
X105	Cine ABC Damping	715
X107	Fluoro Entrance Dose Calibration	723
X110	ABC Lead Filter Adjustment	747
X120	Pulscan (Camtronics RTDM) Taper Progressive	755
X121	Pulscan (Camtronics RTDM) SID Compensation	765
X122	Pulscan (Camtronics RTDM) ABC Response Time	791
X123	Pulscan (Camtronics RTDM) Entrance Dose Calibration	801
X130	DX (DLX) Taper Progressive	807
X131	DX (DLX) SID Compensation	817
X132	DX (DLX) ABC Response	847
X133	DX (DLX) Entrance Dose	857
X140	DRS Taper Progressive	863
X141	DRS SID Compensation	873
X142	DRS ABC Response	881
X143	DRS Entrance Dose	889
X150	HLC (DX) Taper Progressive	895
X151	HLC DX SID Compensation	905
X152	DX HLC ABC Response	917

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UNIT X100 – Fluoro Taper Interlaced

Time: x h xx min – Personnel: 1 field engineer

1 DESCRIPTION

Calibration Unit X100 adjusts the (constant R) taper in pulsed fluoro systems so that the fluoro table top radiation dose (Entrance Exposure Rate–EER) never exceeds the legal limit of 87.6 mGy/min (10 R/min). The unit is subdivided into the following two calibration procedures:

1-1 Calibration Procedure 1

Calibration Procedure 1 covers pulsed fluoro systems and is used to set the end points of a pre–defined taper curve to correspond with a radiation taper limit. Five steps are required to calibrate the pulsed fluoro (constant R) taper. A screen display is provided for each step.

Note: Advantx–E Vascular Systems uses **pulsed** fluoro **only**.



This unit allows the system to be configured for higher pulsed interlaced fluoro taper limits than shipped. This is not recommended. This is forbidden in the US where the 87.6 mGy/min (10 R/min) regulatory limits applies. While the system will operate at these higher taper limits, the reliability under this condition may suffer; increased maintenance costs should be expected. Only raise the fluoro taper limits after all other methods of improving digital fluoro image quality have been tried and there is still a serious customer issue.

1-2 Calibration Procedure 2

Calibration procedure 2 covers non–pulsed fluoro systems. The calibration is similar to the pulsed fluoro calibration procedure except that besides setting each end point to the radiation taper limit, a minimum radiation value of 0.4 mGy/min (0.05 R/min) is also set for the low end. Six steps are required to calibrate the non–pulsed fluoro (constant R) taper. A screen display is provided for each step.

The appropriate calibration procedure/screen presentation will be automatically presented by the Smart Sequencer according to the configuration of the system (pulsed or non–pulsed).

NOTICE

To recalibrate fluoro tapers after initial system calibration, you must perform the recalibration as indicated below:

1. **Run R021 MPPU kVp Meter Cal (or R105 kVp Meter Cal for LFX power units) to check for kVp meter accuracy.**
2. **Run R009, MA Meter Calibration.**
3. **Run R003, Initial Filament Drive.**
4. **Run X100 and X101 (X100 and X101 must be run as a set with X100 being run first.**
5. **You must also rerun the following units if applicable to your system configuration:**
   X120, Pulscan (Camtronics) Taper Progressive
   X121, Pulscan (Camtronics) SID Compensation
   X130, DX (DLX) Taper Progressive
   X131, DX (DLX) SID Compensation
   X140, DRS Taper Progressive
   X141, DRS SID Compensation
   X150, HLC Taper Progressive
   X151, HLC SID Compensation
6. **If applicable, run X102, Cine kW Tapers.**

2 EQUIPMENT REQUIRED

Dosimeter (MDH/Radcal 2025, 2026 or equivalent) w/probe stand or Ion Chamber Positioning Tool 2236707 (Former ref: 2208874)
For Advantx–E Systems, Ion Chamber Positioning Tool is mandatory (See Cal Unit T015) .
For this Cal Unit, use Model 20x5–3 or 20x6–3 probe.
Metric Tape Measure.

3 SPECIAL INSTRUCTIONS

The following special instructions pertain to the running of both Cal Procedure 1, Pulsed Fluoro systems, and Cal Procedure 2, Non–Pulsed Fluoro systems.

Note: **For Vascular Systems only:** Before system calibration, verify that additional filter (copper–aluminum filter) is not installed on top of collimator. (Open sensor hinge assembly to verify.) If installed, remove before performing calibration.

- Refer to Direction 46–017560, HHS Tools, for an explanation and nomogram regarding corrections/compensations to max taper limit based on room temperature and altitude (barometric pressure above sea level).
- The Filament Age and Fil Age (Last Cal) parameters displayed on the Step 1 screen provide a visual indication of the filament aging characteristics of the system X–ray tube.
  1. **Filament Age:** Tracks and displays a continuous record of changes in filament aging (in HEX) since X–ray tube installation (initial value of 0010H).
  2. **Fil Age (Last Cal):** Displays the Hex value of filament aging set in the last calibration (initial value when a tube is installed is FFFFH). The Fil Age (Last Cal) parameter will be set equal to Filament Age parameter after a calibration is completed.

Note: As the X–ray tube ages, changes in the Filament Age value may be observed. If the difference between the Filament Age value and Fil Age (Last Cal) value reaches a delta limit of 2BH, a “recal required” message is displayed. This warning message is displayed upon entering either the Applications or Service Mode to indicate to the user that a mandatory recalibration of the fluoro tapers is required (Ref recal instructions in Cal Unit X100).

- A bleeder must be connected when performing this Cal Unit on systems configured with an LFX power unit.



Do not use an external bleeder unless absolutely necessary (inoperable internal bleeder). If you must use an external bleeder, connect as shown in Illustration 5–1, Cal Unit R001 in Section 5 of this Direction. Then, after you perform the calibration and disconnect the external bleeder, you will observe an increase in EER when running Applications. This effect can be minimized as follows:

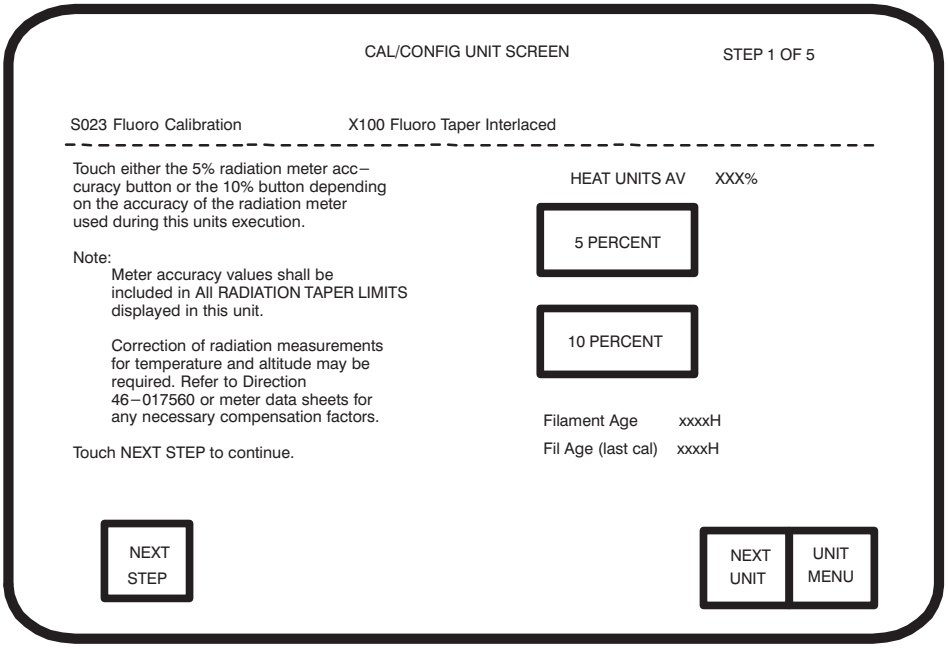
1. **Re–run this Cal Unit and re–adjust the EER by subtracting the amount of increase observed in Applications from the EER value previously set in this unit.**
2. **Ensure that the LFX bleeder selector switch (LFX1 A1 A4 S203) is in the proper position when the external bleeder is connected and also when removed.**

4 CAL PROCEDURE 1 – PULSED FLUORO SYSTEMS

4-1 Step 1. Radiation Meter Accuracy

- Check the accuracy of the radiation meter to be used in the calibration. (Radcal 2025 or 2026 and their probes have a 5% accuracy).
- Touch the 5 PERCENT or 10 PERCENT softkey to enter the rated accuracy of the radiation meter. The meter accuracy value is include in all RADIATION TAPER LIMITS displayed in this unit.
- Check the current values of the Filament Age and Fil Age (Last Cal) parameters. Refer to the Special Instruction paragraph at the beginning of this unit for an explanation of these parameters.
- Touch NEXT STEP softkey to proceed to Step 2.

X100 PULSED FLUORO STEP 1 SCREEN DISPLAY



4-2 Step 2. Radiation Meter (R–Meter) Probe Positioning

CAUTION **Verify that the collision sensor is installed on the collimator, and that the hinged door is closed before proceeding.**

The Step 2 screen display provides instructions for positioning the R–Meter probe in systems employing SID compensation. (All Vascular systems and Tilt–C systems).

Note: Touching the MORE INFO softkey increments to a screen display that provides instructions for positioning the R–Meter probe in R+F systems. This is NOT applicable to vascular systems.

4-2-1 Systems with SID Compensation (Vascular Systems and Tilt–C Systems)

- Move the table top out of the field of the x–ray beam and open the collimator blades to maximum.

Note: For a Tilt–C system, you will have to remove the table top. Refer to the *Advantx Tilt–C Installation* document #2106453–100 for a procedure on how to install and remove the table top.

- Set system to minimum SID (move both x–ray tube and II to min SID).

Note: **For German Advantx–E Vascular Systems with non–removable 0.1 mm copper filter in the beam:** position the II to 95 cm SID (frontal) or 100 cm SID (lateral).

Note: For Advantx–E Vascular Systems, Ion Chamber Positioning Tool is mandatory to get accurate adjustments.

- When using Ion Chamber Positioning Tool 2236707 (Former ref: 2208874), refer to Illustration 135 in Cal Unit X100 and to the instructions on the screen display for Step 2; also, refer to mounting/positioning instructions in Cal Unit T015. Check for probe top/II anticollision plate distance in Table 10 of Cal Unit T015.
- If not using the Ion Chamber Positioning Tool, mount the R–Meter probe stand to the bottom of the II tube (or position the stand on the head end of the table top and extend the R–Meter probe into the x–ray beam). Position the R–meter probe 30 cm from the lowest point on the II tube housing.Refer to Illustration 134 in Cal Unit X100 and to the instructions on the screen display for Step 2.

Note: The positioning of the R–meter probe 30 cm from the lowest point on the II tube housing (with II in overhead position) is an FDA requirement. The FDA assumes that the 30 cm distance corresponds to the average thickness of a patient and therefore establishes a worst case condition for radiation dose.

- Align axis of R–Meter probe perpendicular to anode–cathode axis of x–ray tube.
- Take a fluoro exposure to determine the exact position of the R–Meter probe. Repeat taking exposures and repositioning the probe until the probe is centered in the x–ray beam.

- After the probe is properly positioned, you may perform a quick check of the Radiation Taper Limit before proceeding with a full calibration by activating the VERIFY softkey. Touching the VERIFY softkey will cause the unit to increment to the Step 5, Verification screen. Perform Step 5.

OR

- Touch the NEXT STEP softkey to proceed directly to Step 3 in the calibration sequence.

Illustration 134 – R–Meter Probe Positioning, Vascular Systems other than Avantx–E

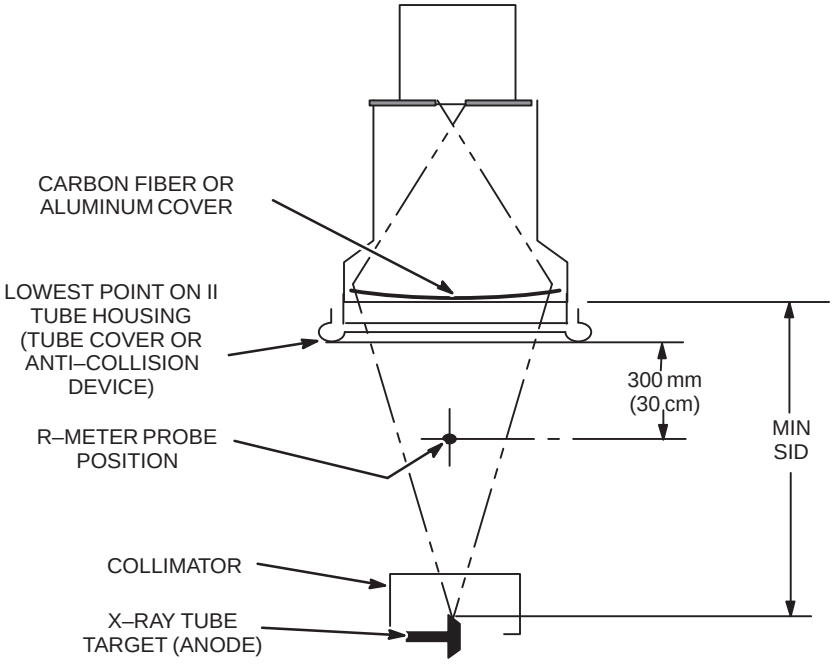
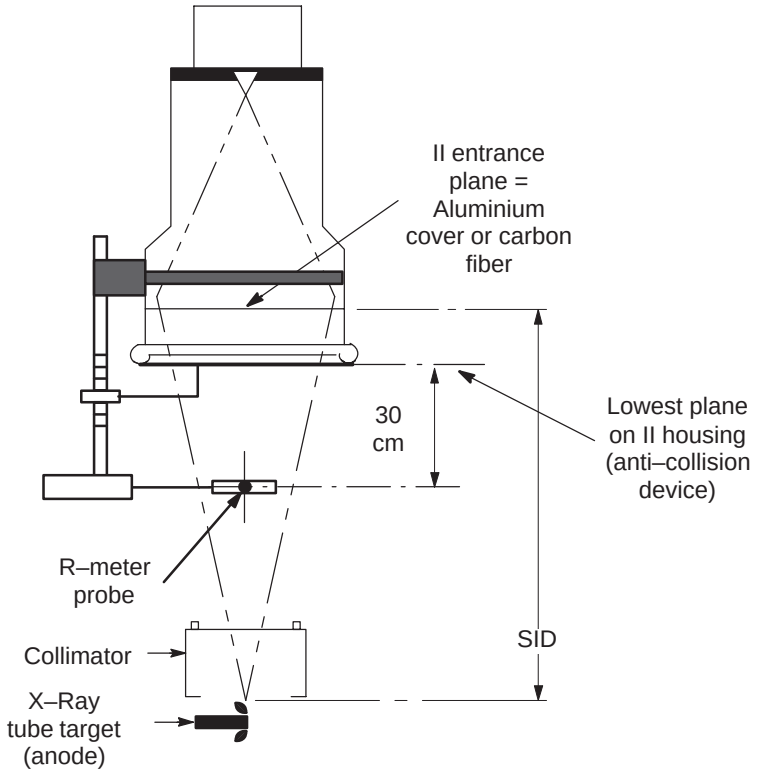


Illustration 135 – R–Meter Probe Positioning using Ion Chamber Positioning Tool, Advantx–E Vascular Systems



4-2-2 R&F Systems

- Position the R–meter probe on the table top. Align the axis of the probe perpendicular to the axis of the x–ray tube. See Illustration 136.
- Position the Spot Film Device to minimum SID.
- Take a fluoro exposure to center the R–Meter probe in the x–ray beam.

NOTICE

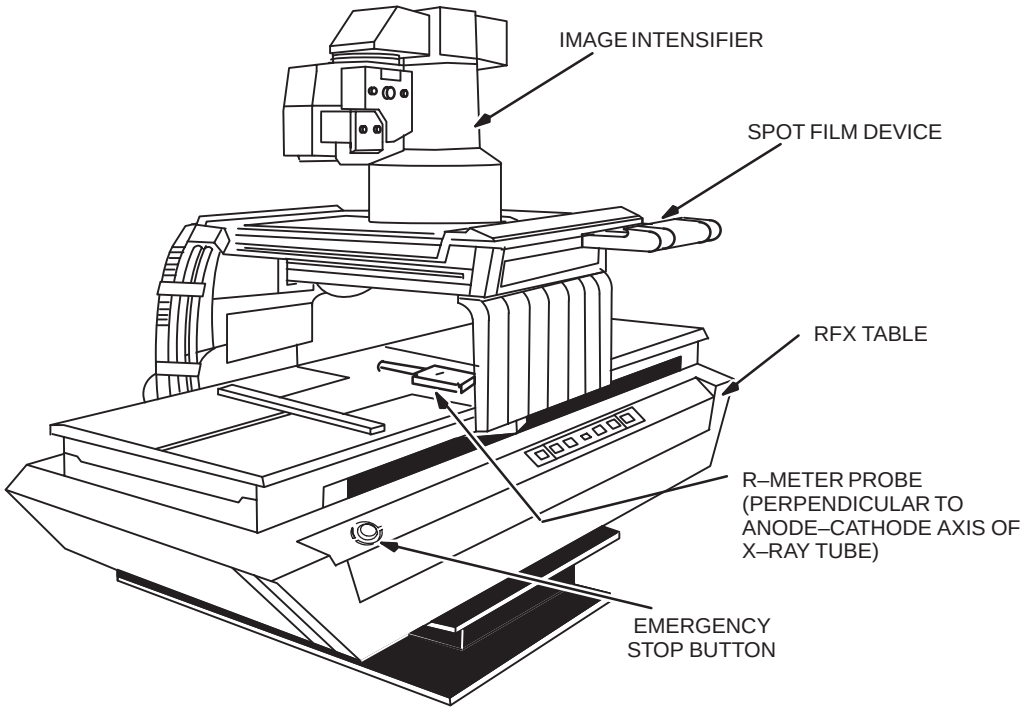
If the system is configured with an Imageur Image Module, disconnect the PL–1 connector on the high voltage power supply (after positioning the probe) to turn off the Image Intensifier. This protects the II while running this unit. Remember to reconnect PL–1 before exiting the unit.

- After the R–Meter probe is properly positioned, you may perform a quick check of the Radiation Taper Limit before proceeding with a full calibration. Touch the BACK softkey to return to the Step 2 screen. Then, touch the VERIFY softkey. Touching the VERIFY softkey will cause the unit to increment to the Step 5, Verification screen. Perform Step 5.

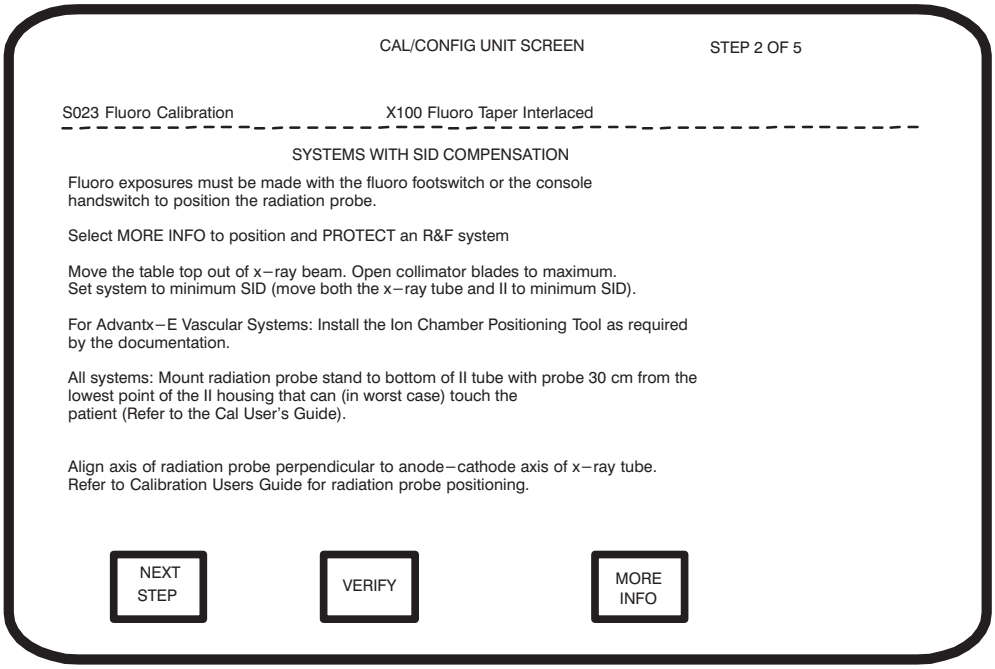
OR

- Touch the NEXT STEP softkey to proceed directly to Step 3 in the calibration sequence.

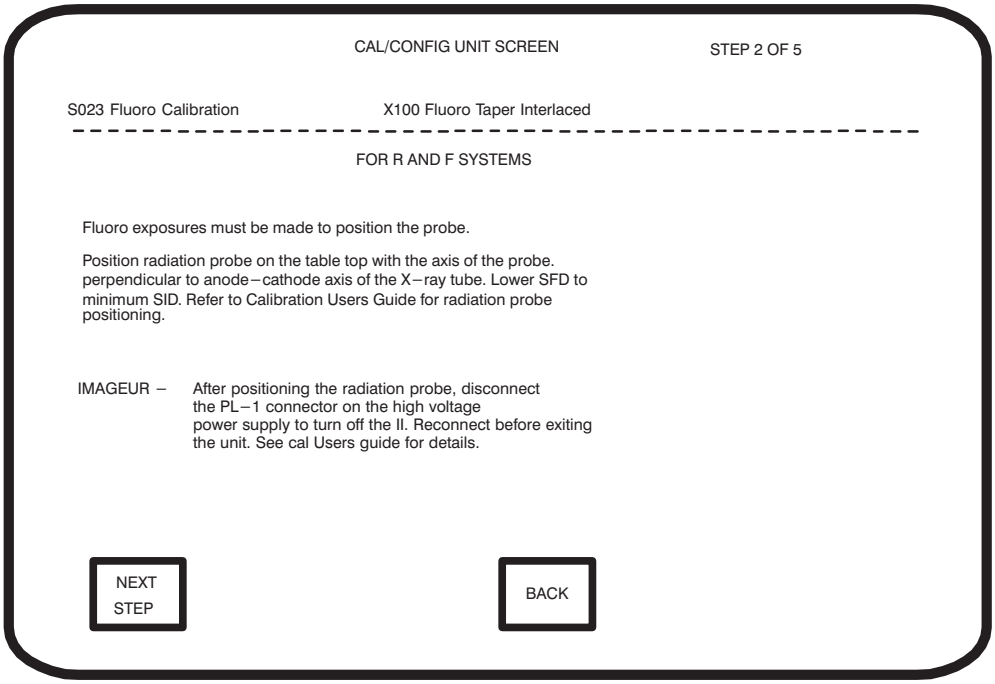
Illustration 136 – R–Meter Probe Positioning, R&F Systems



X100 PULSED FLUORO STEP 2 SCREEN DISPLAY



X100 PULSED FLUORO STEP 2 "MORE INFO" SCREEN



4-3 Step 3. 60 KV FIL DRIVE Adjustment

- Initiate the 60 kV FIL DRIVE adjustment by touching the FIL DRIVE softkey.
- Take and maintain a fluoro exposure.

For German Advantx–E Vascular Systems with non–removable 0.1 mm copper filter in the beam:

- Do not take into account the dose rate value indicated on the console, but adjust FIL DRIVE to get 14.5 mA read on the console at 60 kVp;
- Measure and record the dose value D(minref): this is the reference value **for X100 and X101** adjustment at 60 kVp.
- Position II to minimum SID.
- Adjust FIL DRIVE to get D(minref) at 60 kVp.

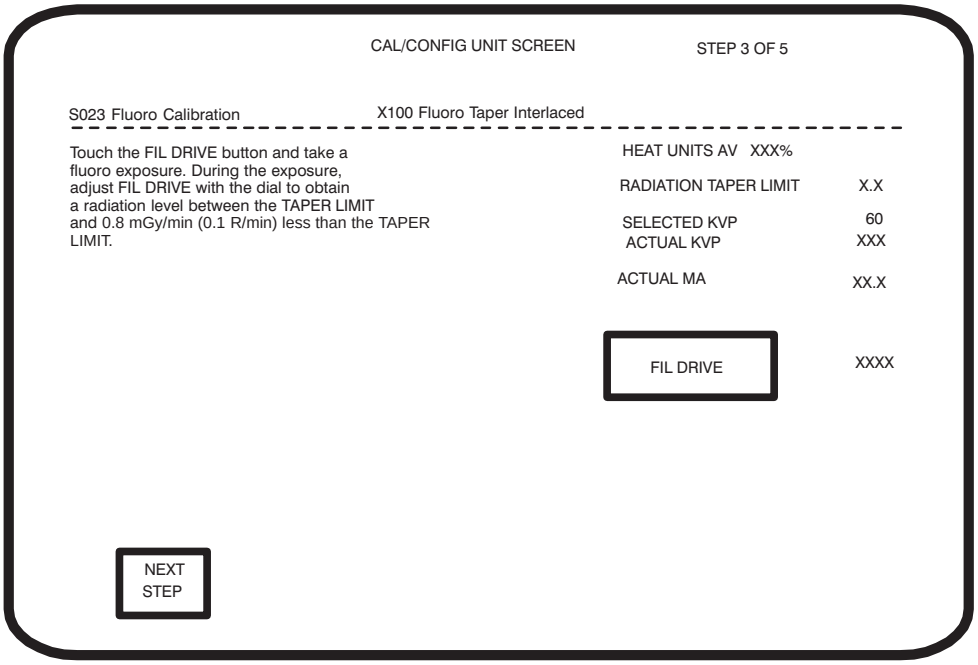
For Other Systems:

- During the exposure, turn the console dial to adjust FIL DRIVE until the dose rate indicated on the radiation meter is within 0.8 mGy/min (0.1 R/min) less than the RADIATION TAPER LIMIT value displayed on the console screen.

CAUTION **During this calibration, the mA must not be set above 14.8 mA to achieve the RADIATION TAPER LIMIT. Stop at 14.8 mA and accept the actual radiation level achieved.**

- When the correct dose rate level is obtained and stable, stop fluoro.
- Touch NEXT STEP softkey to proceed to Step 4.

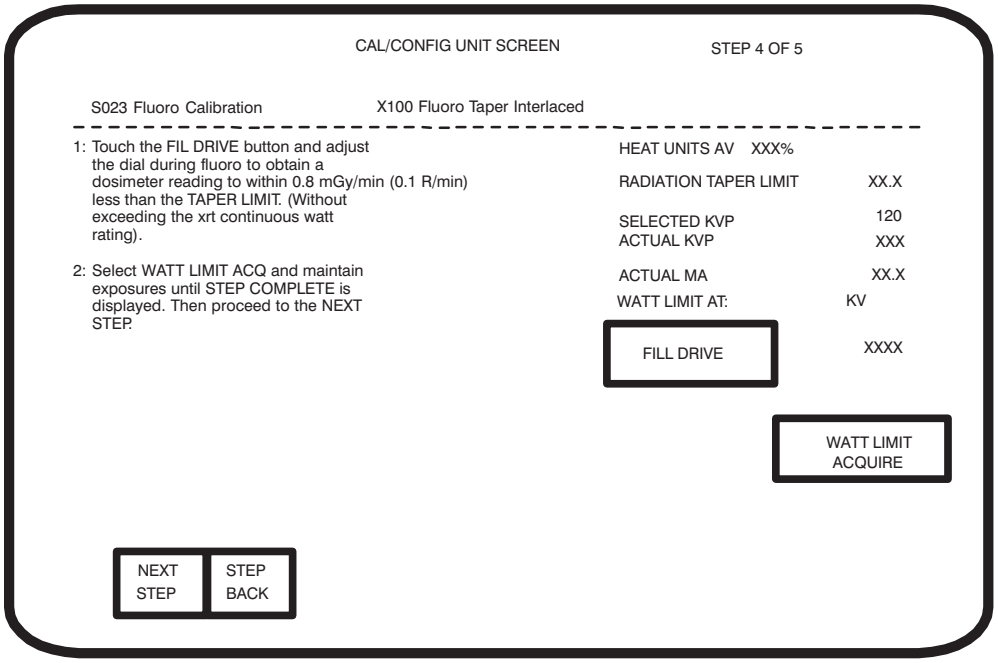
X100 PULSED FLUORO STEP 3 SCREEN DISPLAY



4-4 Step 4. 120 KV FIL DRIVE Adjustment

- Initiate FIL DRIVE adjustment by touching the FIL DRIVE softkey.
- Take and maintain a fluoro exposure. During the exposure, turn the console dial to adjust FIL DRIVE until the dose rate indicated on the radiation meter is within 0.8 mGy/min (0.1 R/min) less than the RADIATION TAPER LIMIT value displayed on the console screen. Do not exceed the x–ray tube continuous watt rating during the adjustment.
- When the correct dose rate level is obtained and stable, stop fluoro.
- Take and maintain another exposure. During the exposure, touch the WATT LIMIT ACQUIRE softkey. The system will calculate wattage and compare against a Continuous Watt Rating limit stored in the data base. Maintain the exposure until the STEP COMPLETE message is displayed. If calculated wattage is higher than the Continuous Watt Rating limit, the message “CONTINUOUS WATT RATING EXCEEDED, PLEASE RECAL TO A LOWER DOSE” will be displayed. Repeat the FIL DRIVE adjustment (Steps 3 and 4).
- Touch NEXT STEP softkey to proceed to Step 5.

X100 PULSED FLUORO STEP 4 SCREEN DISPLAY



4-5 Step 5. Verification

- Initiate Entrance Exposure Rate–EER verification by touching the KVP softkey.
- Take and maintain a fluoro exposure. During the exposure, use the console dial to step from 60 kVp to 120 kVp in 5 kVp increments.Verify the EER level on the radiation meter at each kVp increment.

NOTICE

Rotate console dial slowly when incrementing kVp through the verification values. Because the filament control parameter (G5) is active during this step in the calibration, it is necessary that you allow time for G5 to respond to each new kVp setting before incrementing to the next kVp. If you attempt to step through the kVp increments without allowing the G5 parameter time to respond, information messages 4204H or 4205H may be displayed on the console screen and/or erroneous fluctuations in the dose rate readout may occur.

- Terminate the exposure.

Note: If EER is excessive only at the high kVp increments, lowering FIL DRIVE may be sufficient (Repeat Step 4, FIL DRIVE adjustment).

- If the EER, at any kVp increment, exceeds the RADIATION TAPER LIMIT displayed on the console screen by more than 0.4 mGy/min (0.05 R/min) (for systems with MP generators), or 1.7 mGy/min (0.2 R/min) (for systems with LFX generators), a recalibration at slightly lower radiation levels is required. Touch RECAL softkey and repeat calibration.
- Verify the results of any re-calibrations by repeating Step 5.

Note: Touching the MORE INFO softkey allows the user to access a special screen that displays the values of the database parameters that are calibrated by the unit.

- Touch the NEXT UNIT or UNIT MENU softkey to exit.

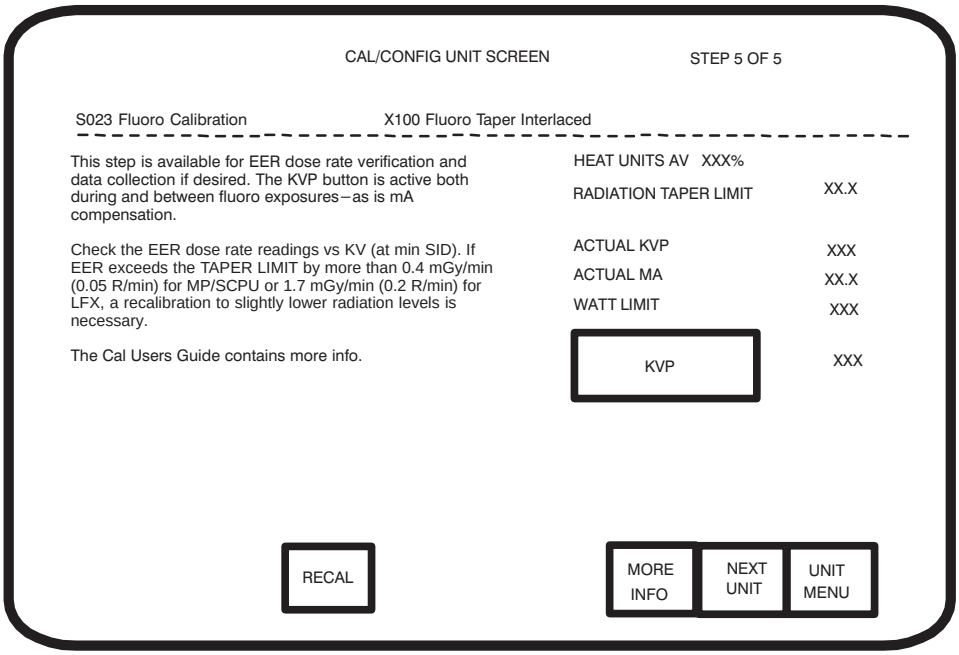
Note: For a Tilt–C system, re–install the table top unless you are also performing unit X101. Then, leave the table top off until after unit X101. Refer to the *Advantx Tilt–C Installation* document #2106453–100 for the top installation procedure.

4-5-1 Special instructions regarding verification

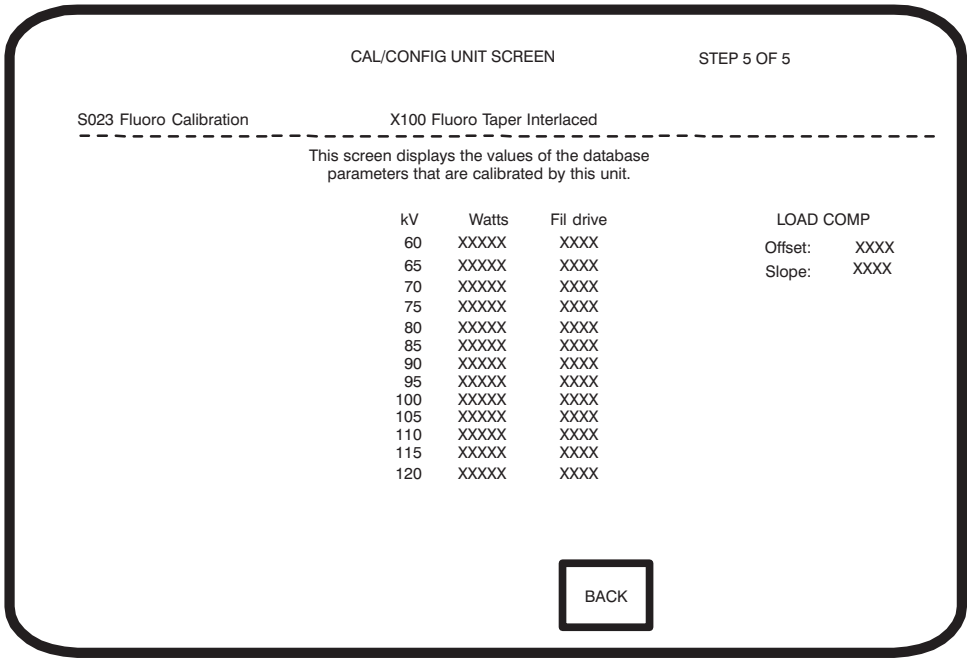
If the table top EER is low, review the following special instructions before proceeding with a recalibration. Do not just recal at a higher dose rate value.

1. In systems configured with an LFX generator, a faulty Volt–Pac motor will cause lower dose rate indications. Replace Volt–Pac motor.
2. In systems configured with an LFX generator, the step size output of the A/D converter can cause a variation in mA compensation that will result in dose rate values that are lower than the dose rate calibrated in the previous step. This low dose rate indication is more predominate when checking the higher kVp increments.
3. MA compensation will compensate for x–ray tube heating and cooling effects as well as filament aging.

X100 PULSED FLUORO STEP 5 SCREEN DISPLAY



X100 PULSED FLUORO STEP 5 "MORE INFO" SCREEN



Note: Step 5 MORE INFO screen:

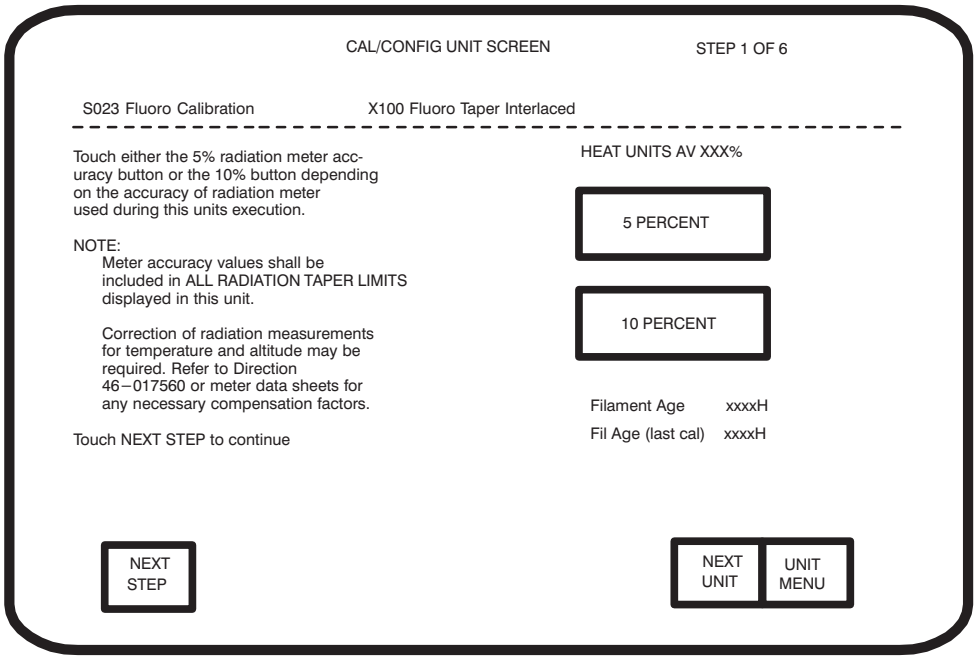
1. Load comp is only displayed for systems with LFX power unit.
2. The list of kV's in the right hand column shows the range of kV's for the 60–120 kV range. The Table is displayed from Min to Max kV.
1. The list of kV's in the left hand column is only displayed if the range of allowed kV's exceeds 13 values.

5 CAL PROCEDURE 2 – NON–PULSED FLUORO SYSTEMS

5-1 Step 1. Radiation Meter Accuracy

- Check the accuracy of the radiation meter to be used in the calibration.
- Touch the 5 PERCENT or 10 PERCENT softkey to enter the rated accuracy of the radiation meter. The meter accuracy value is included in all RADIATION TAPER LIMITS displayed in this unit.
- Check the current values of the Filament Age and Fil Age (Last Cal) parameters. Refer to the Special Instruction paragraph at the beginning of this unit for an explanation of these parameters.
- Touch NEXT STEP softkey to proceed to Step 2.

X100 NON–PULSED FLUORO STEP 1 SCREEN DISPLAY



5-2 Step 2. Radiation Meter (R–Meter) Probe Positioning

The Step 2 screen display provides instructions for positioning the R–Meter probe in systems employing SID compensation (All Vascular systems). Touching the MORE INFO softkey increments to a screen display that provides instructions for positioning the R–Meter probe in R+F systems.

5-2-1 Systems with SID Compensation (Vascular Systems and Tilt–C Systems)

- Move the table top out of the field of the x–ray beam and ensure that collimator blades are open to maximum.

Note: For a Tilt–C system, you will have to remove the table top. Refer to the *Advantx Tilt–C Installation* document #2106453–100 for a procedure on how to install and remove the table top.

- Set the system to minimum SID (move both x–ray tube and II to min SID).
- Mount the R–Meter probe stand to the bottom of the II tube (or position the stand on the head end of the table and extend the R–Meter probe into the x–ray beam). Position the R–meter probe 30 cm from the lowest point on the II tube housing. Refer to Illustration 134 in Cal Unit X100 and to the instructions on the screen display for Step 2.

Note: The positioning of the R–meter probe 30 cm from the lowest point on the II tube housing (with II in overhead position) is an FDA requirement. The FDA assumes that the 30 cm distance corresponds to the average thickness of a patient and therefore establishes a worst case condition for radiation dose.

- Align axis of R–Meter probe perpendicular to the anode–cathode axis of the x–ray tube.
- Take a fluoro exposure to determine the exact position of the probe. Repeat taking exposures and repositioning the R–Meter probe until the probe is centered.
- After the R–Meter probe is properly positioned, you may perform a quick check of the Radiation Taper Limit before proceeding with a full calibration by activating the VERIFY softkey. Touching the VERIFY softkey will cause the unit to increment to the Step 6, Verification screen. Perform Step 6.

OR

- Touch the NEXT STEP softkey to proceed directly to Step 3 in the calibration sequence.

5-2-2 R&F Systems

- Position the R– meter probe on the table top. Align the axis of the probe perpendicular to the axis of the x–ray tube. See Illustration 136.
- Position the Spot Film Device to minimum SID.
- Take a fluoro exposure to center the R–Meter probe in the x–ray beam.

NOTICE

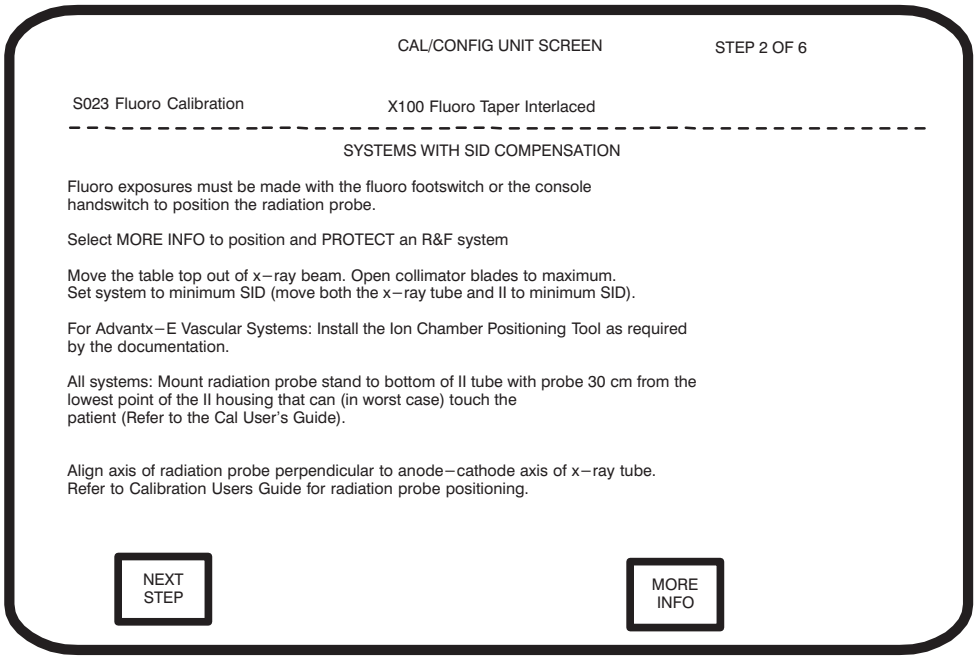
If the system is configured with an Imageur Imaging Module, disconnect the PL–1 connector on the high voltage power supply (after positioning the probe) to turn off the Image Intensifier. This protects the II while running this unit. Remember to reconnect PL–1 before exiting the unit.

- After the R–Meter probe is properly positioned, you may perform a quick check of the Radiation Taper Limit before proceeding with a full calibration. Touch the BACK softkey to return to the Step 2 screen. Then, activate the VERIFY softkey. Touching the VERIFY softkey will cause the unit to increment to the Step 6, Verification screen. Perform Step 6.

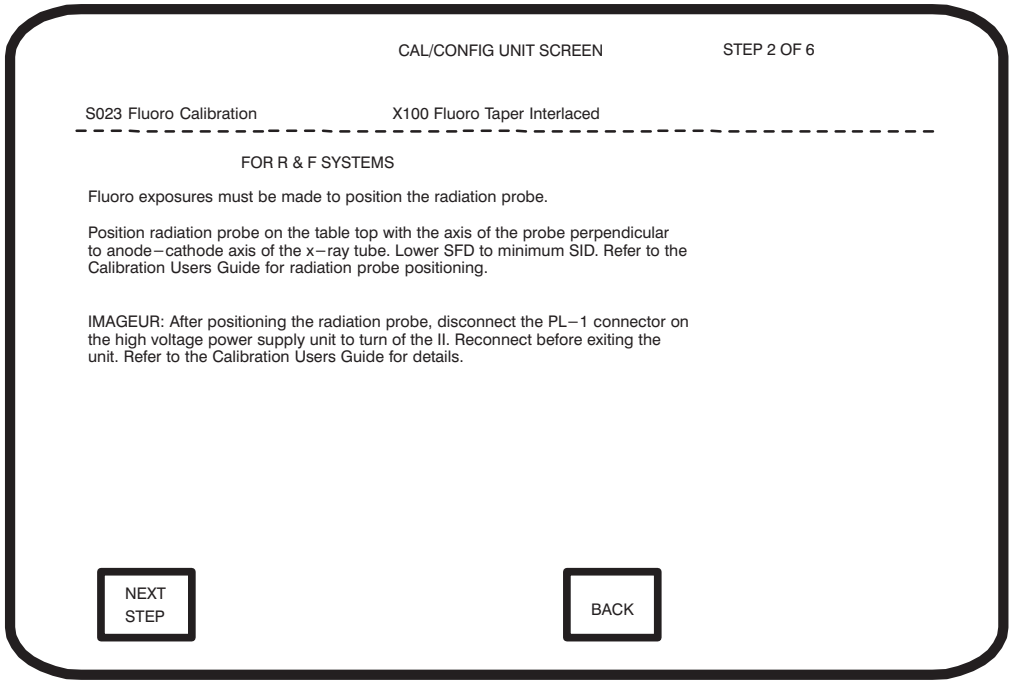
OR

- Touch the NEXT STEP softkey to proceed directly to Step 3 in the calibration sequence.

X100 NON–PULSED FLUORO STEP 2 SCREEN DISPLAY



X100 NON–PULSED FLUORO STEP 2 "MORE INFO" SCREEN



5-3 Step 3. 60 KV FIL DRIVE adjustment

- Initiate Filament Drive adjustment by touching the FIL DRIVE softkey.

NOTICE

On systems configured with Digital Record (DR) and copper filter (pediatrics installation), adjust FIL DRIVE for a value of 35 mGy/min (4.0 R/min) rather than the RADIATION TAPER LIMIT value displayed on the screen.

- Take and maintain a fluoro exposure. During the exposure, turn the console dial to adjust FIL DRIVE until the dose rate indicated on the radiation meter is between the RADIATION TAPER LIMIT value and 0.8 mGy/min (0.1 R/min) less than the RADIATION TAPER LIMIT value indicated on the console screen.

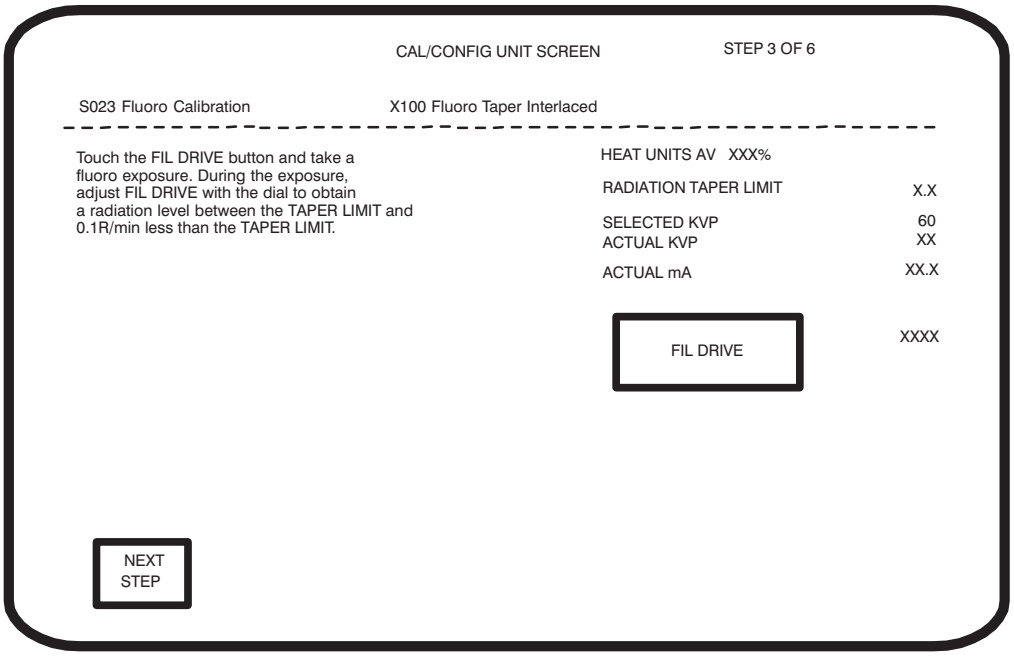
CAUTION

During this calibration, the mA must not be set above 14.8 mA to achieve the RADIATION TAPER LIMIT. Stop at 14.8 mA and accept the actual radiation level achieved.

- When the correct radiation level is obtained and stable, stop fluoro.
- Touch NEXT STEP softkey to proceed to Step 4.

Note: During this step, the Minimum SID kV is set high to compensate for Maximum SID loading effects.

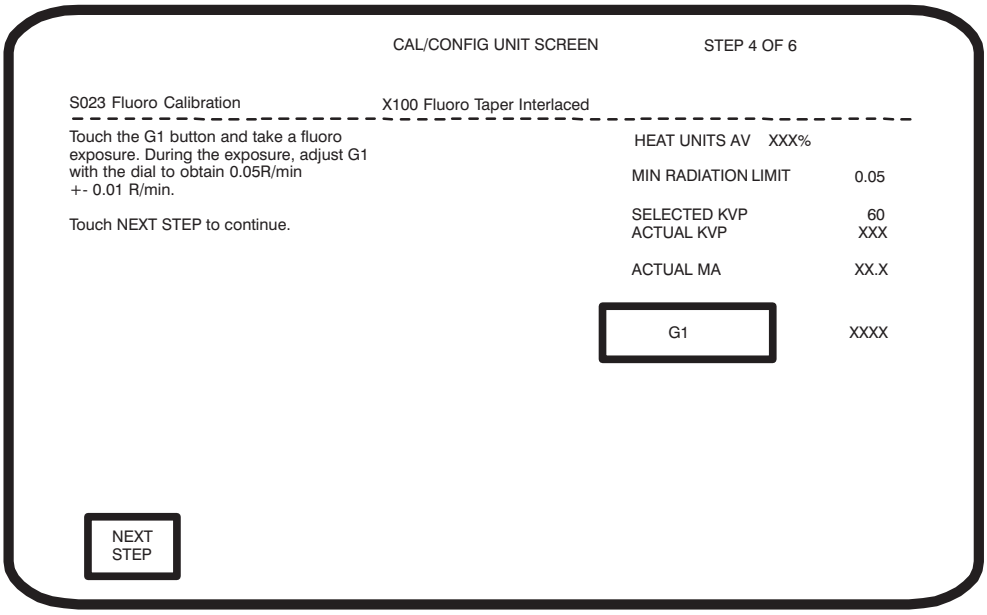
X100 NON–PULSED FLUORO STEP 3 SCREEN DISPLAY



5-4 Step 4. 60 KV G1 (Offset) Adjustment

- Initiate G1 (Offset) adjustment by touching the G1 softkey.
- Take and maintain a fluoro exposure. During the exposure, turn the console dial to adjust G1 until the dose rate indicated on the radiation meter is equal to the MIN RADIATION LIMIT (0.4 ± 0.08 mGy/min or 0.05 R/min ± 0.01 R/min) displayed on the console screen.
- Touch the NEXT STEP softkey to proceed directly to Step 3 in the calibration sequence.

X100 NON–PULSED FLUORO STEP 4 SCREEN DISPLAY



5-5 Step 5. 120 kV Filament Drive Adjustment

- Initiate 120 kV Filament Drive adjustment by touching the FIL DRIVE softkey.

NOTICE

On systems configured with Digital Record (DR) and copper filter (pediatrics installation), adjust FIL DRIVE for a value of 44 mGy/min (5.0 R/min) rather than the RADIATION TAPER LIMIT value displayed on the console screen.

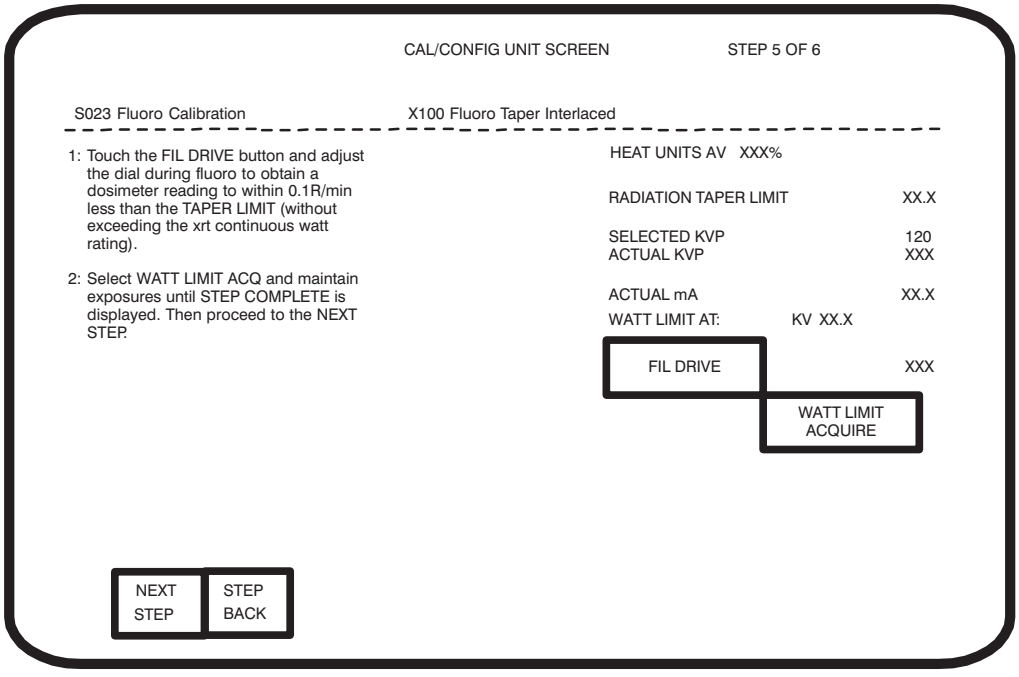
- Take and maintain a fluoro exposure. During the exposure, turn the console dial to adjust FIL DRIVE until the dose rate indicated on the radiation meter is within 0.8 mGy/min (0.1 R/min) less than the RADIATION TAPER LIMIT displayed on the console screen. Do not exceed the x–ray tube continuous watt rating.
- Take and maintain another exposure. During the exposure, touch the WATT LIMIT ACQUIRE softkey. The system will calculate wattage and compare against a Continuous Watt Rating limit stored in the data base. Maintain the exposure until the STEP COMPLETE message is displayed. If calculated wattage is higher than the Continuous Watt Rating limit, the message “CONTINUOUS WATT RATING EXCEEDED, PLEASE RECAL TO A LOWER DOSE” will be displayed. If necessary, repeat the Filament Drive adjustment (steps 3 and 4).

CAUTION

During this calibration, the mA must not be set above 7.5 mA to achieve the RADIATION TAPER LIMIT. Stop at 7.5 mA and accept the actual radiation level achieved.

- When the correct radiation level is obtained and stable, stop fluoro.
- Touch NEXT STEP softkey to proceed to Step 6.

X100 NON–PULSED FLUORO STEP 5 SCREEN DISPLAY



5-6 Step 6. Verification

- Initiate Entrance Exposure Rate–EER verification by touching the kVp softkey.
- Take and maintain a fluoro exposure. During the exposure, use the console dial to step from 60 kVp to 120 kVp in 5 kVp increments. Verify the EER level on the radiation meter at each kVp increment.

NOTICE

Rotate console dial slowly when incrementing kVp through the verification values. Because the filament control parameter (G5) is active during this step in the calibration, it is necessary that you allow time for G5 to respond to each new kVp setting before incrementing to the next kVp. If you attempt to step through the kVp increments without allowing the G5 parameter time to respond, information messages 4204H or 4205H may be displayed on the console screen and/or erroneous fluctuations in the dose rate readout may occur.

- Terminate the exposure.

Note: If EER is excessive only at the high kVp increments, lowering G2 may be sufficient (Repeat Step 4, G2 adjustment).

- If the EER, at any kVp increment, exceeds the RADIATION TAPER LIMIT displayed on the console screen by more than 0.4 mGy/min (0.05 R/min) (for systems with MP or SCPU generators), or 1.7 mGy/min (0.2 R/min) (for systems with LFX generators), a recalibration at slightly lower radiation levels is required. Touch RECAL softkey and repeat calibration.
- Verify the results of any re-calibrations by repeating Step 5.

Note: Touching the MORE INFO softkey allows the user to access a special screen that displays the values of the database parameters that are calibrated by the unit.

- Touch the NEXT UNIT or UNIT MENU softkey to exit.

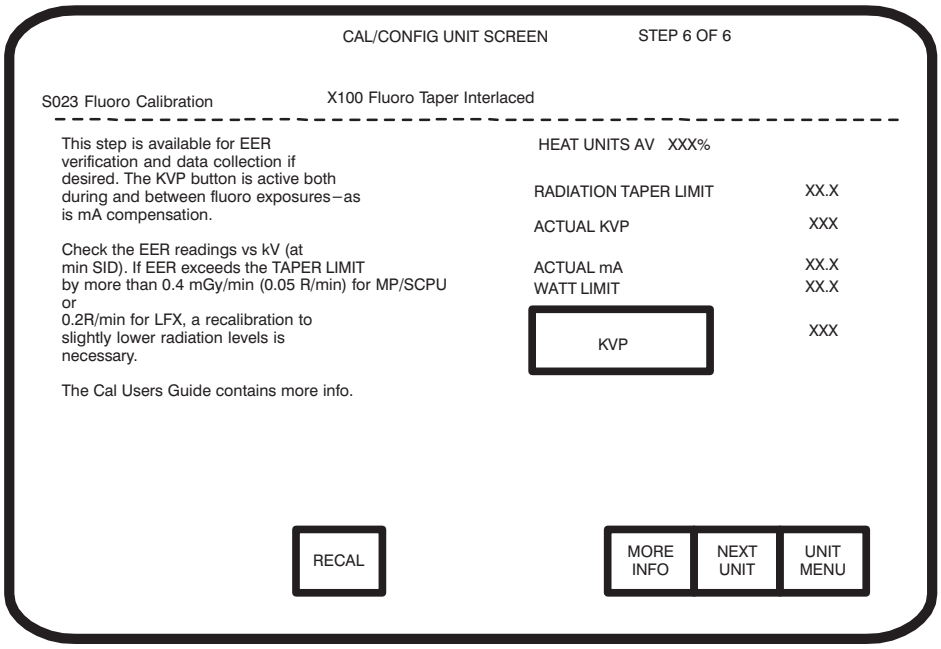
Note: For a Tilt–C system, re–install the table top unless you are also performing unit X101. Then, leave the table top off until after unit X101. Refer to the *Advantx Tilt–C Installation* document #2106453–100 for the top installation procedure.

5-6-1 Special instructions regarding verification

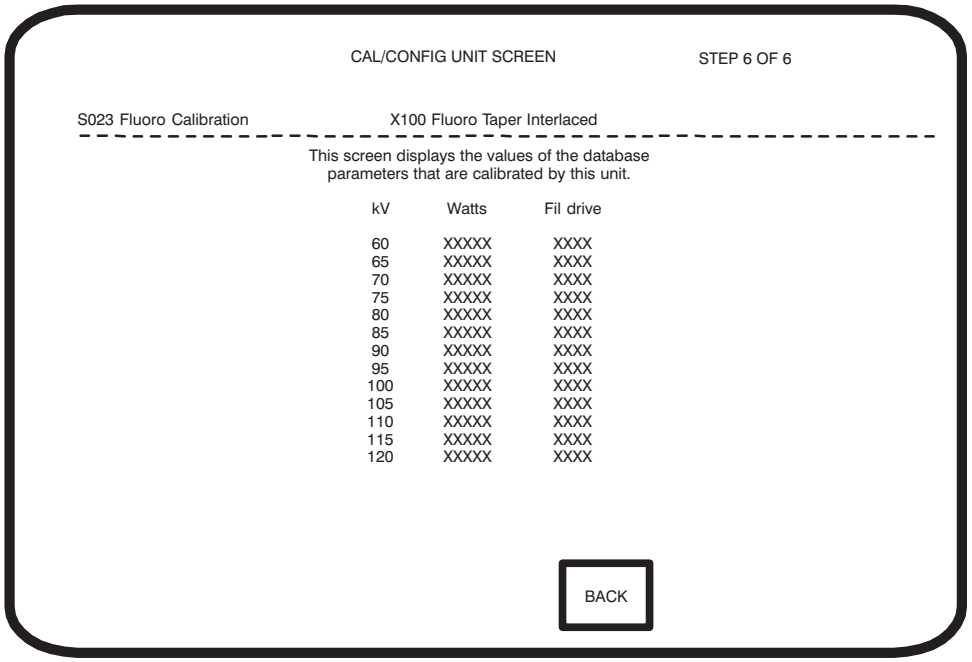
If the table top EER is low, review the following special instructions before proceeding with a recalibration. Do not just recal at a higher EER value.

MA compensation will compensate for x–ray tube heating and cooling effects as well as filament aging.

X100 NON–PULSED FLUORO STEP 6 SCREEN DISPLAY



X100 NON–PULSED STEP 6 "MORE INFO" SCREEN



Note: The Step 6 MORE INFO screen displays a list of Watts and Filament Drive values per each of the 13 kV stations (60 to 120 kVp).

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UNIT X101 – Fluoro SID Compensation

Time: x h xx min – Personnel: 1 field engineer

1 X101, FLUORO SID COMPENSATION, NEW PROCEDURE

Note: The New Procedure is used for ALL biplane systems, and for NEWER software (i.e., ASC SW beginning with G4.XX) single plane LCA/LCV+/LC+ systems.

(For Tilt–C systems and for older software single plane LCA/LCV+/LC+ systems, go to Old Procedure in Section 2.)

When calibrating the frontal plane on a biplane system, the LP must be in parking position, follow the procedure hereunder prior to running X101 Cal unit:

- Select S010 vascular positioner calibration in the Main Menu,
- Select, then run Cal Unit P508,
- Put the LP in parking position using the parking buttons of the TSCC,
- Exit Cal Unit P508.

1-1 Description

Calibration Unit X101 adjusts the fluoro SID compensation parameters so that as SID increases, tube filament current increases, thereby maintaining the fluoro table top dose at a calibrated value. Fluoro SID compensation also prevents increases in fluoro technique from exceeding the fluoro rating of the tube. SID compensation is only active during fluoro exposures. Seven steps are required to calibrate the fluoro SID compensation parameters. A screen display is provided for each step.

CAUTION **This unit allows the system to be configured for higher pulsed interlaced fluoro taper limits than shipped. This is not recommended. This is forbidden in the US where the 87.6 mGy/min (10 R/min) regulatory limits applies. While the system will operate at these higher taper limits, the reliability under this condition may suffer; increased maintenance costs should be expected. Only raise the fluoro taper limits after all other methods of improving digital fluoro image quality have been tried and there is still a serious customer issue.**

Note: This unit must always be run in combination with Cal Unit X100 and X100 must be run first.

1-2 Equipment required

Dosimeter (MDH/Radcal 2025, 2026 or equivalent) w/probe stand or Ion Chamber Positioning Tool 2236707 (Former ref: 2208874)
For Advantx–E Systems, Ion Chamber Positioning Tool is mandatory (See Cal Unit T015) .
For this Cal Unit, use Model 20x5–3 or 20x6–3 probe.
Metric Tape Measure.

1-3 Special Instructions

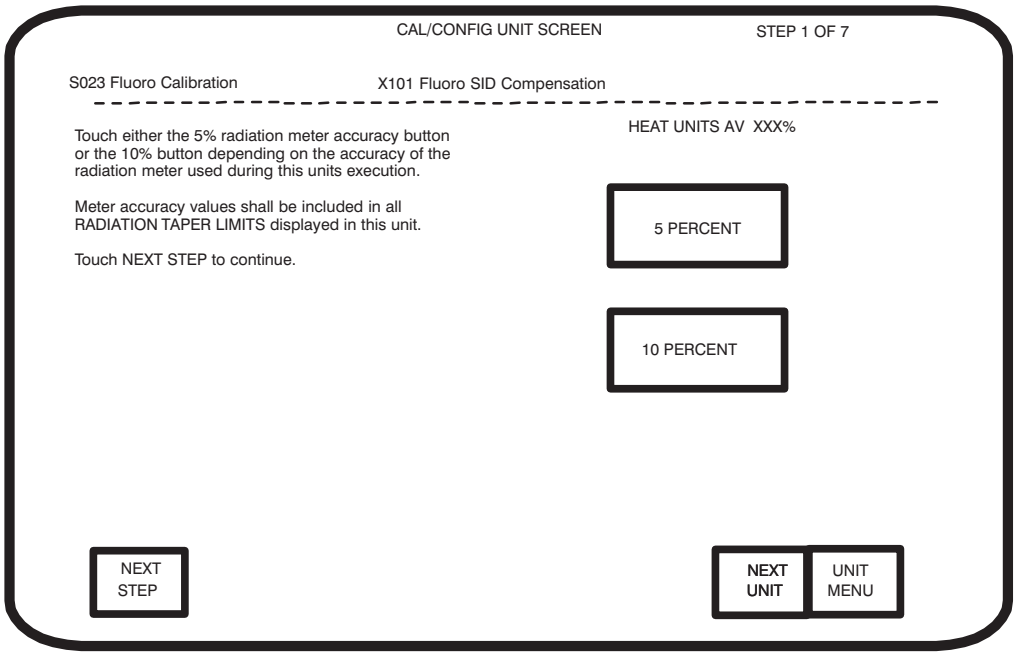
Note: **For Vascular Systems only:** Before system calibration, verify that additional filter (copper–aluminum filter) is not installed on top of collimator. (Open sensor hinge assembly to verify.) If installed, remove before performing calibration.

1-4 Cal Procedure

1-4-1 Step 1. Radiation Meter Accuracy.

- Check the accuracy of the radiation meter to be used in the calibration. (Radcal 2025 or 2026 and their probes have a 5% accuracy).
- Touch the 5 PERCENT or 10 PERCENT softkey to enter the rated accuracy of the radiation meter. The meter accuracy is included in all RADIATION TAPER LIMITS displayed in this unit.
- Touch NEXT STEP softkey to proceed to Step 2.

X101 STEP 1 SCREEN DISPLAY
(BIPLANE & NEWER SW SP LCA+/LCV+/LC+ SYSTEMS)



1-4-2 Step 2. Radiation Meter (R–Meter) Probe Positioning

CAUTION **LP must be at 90 degrees (C90 position on LC position display) to allow positioning of x–ray tube and II tube.**

CAUTION **Verify that the collision sensor is installed on the collimator, and that the hinged door is closed before proceeding.**

- Move the table top out of the field of the x–ray beam and open the collimator blades to maximum.

NOTICE **For Advantx–E Vascular Systems, rotate the table top to 90 degrees vs the longitudinal positioner axis.**

NOTICE **On LC systems configured with an Omega EP table, you must rotate the LC positioner pivot to 90 degrees and lower the table top out of the x–ray beam.**

- Manually set the II tube and x–ray tube to minimum SID.

Note: For Advantx–E Vascular Systems, Ion Chamber Positioning Tool is mandatory to get accurate adjustments.

Note: If you are using the Ion Chamber Positioning Tool and if you have just run X100 unit, the probe should not have moved, so DO NOT CHANGE the positioning of the probe to avoid errors in the calibration.

- When using Ion Chamber Positioning Tool 2236707 (Former ref: 2208874), refer to Illustration 135 in Cal Unit X100 and to the instructions on the screen display for Step 2; also, refer to mounting/positioning instructions in Cal Unit T015. Check for probe top/II anticollision plate distance in Table 10 of Cal Unit T015.
- If not using the Ion Chamber Positioning Tool, mount R–Meter probe stand to bottom of II tube (or position the stand on the head end of the table top and extend the R–Meter probe into the x–ray beam). Position the R–meter probe 30 cm from the lowest point on the II tube housing (See Illustration 134 in Cal Unit X100).

Note: The positioning of the R–meter probe 30 cm from the lowest point on the II tube housing (with II in overhead position) is an FDA requirement. The FDA assumes that the 30 cm distance corresponds to the average thickness of a patient and therefore establishes a worst case condition for radiation dose.

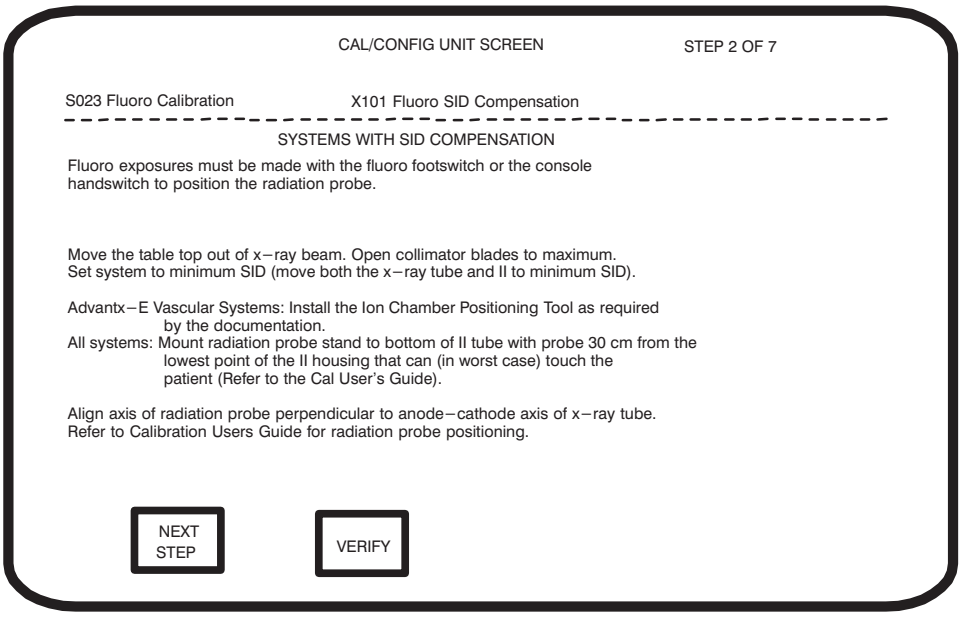
- Align the axis of the probe perpendicular to the anode–cathode axis of the x–ray tube.
- Take a fluoro exposure to determine the exact position of the R–Meter probe in the field of view.
- Repeat taking exposures and repositioning the R–Meter probe until the probe is centered in the x–ray beam.

- After the R–Meter probe is properly positioned, you may perform a quick check of the Radiation Taper Limit before proceeding with a full calibration by touching the VERIFY softkey. Touching the VERIFY softkey will cause the unit to increment to the Step 7, Verification screen. Perform Step 7.

OR

- Touch the NEXT STEP softkey to proceed directly to Step 3 in the calibration sequence.

X101 STEP 2 SCREEN DISPLAY
(BIPLANE & NEWER SW SP LCA+/LCV+/LC+ SYSTEMS)



NOTICE

Before attempting to run SID POS Positioning on LCA+/LCV+/LC+ systems, ensure that the table top rotational position is at 0 degrees or ± 90 degrees for systems with Omega IV tables or at 0 degrees angulation position for systems with Omega EP tables. The SID button on the tableside control is disabled if the table is not at one of these positions.

NOTICE

For frontal calibration on a biplane system, the LP must be parked.

1-4-3 Step 3. SID POS Positioning

- Touch the SIDZERO softkey. The system will process and load SIDZERO data into NVRAM. Upon completion of processing, a “SIDZERO PROCESS COMPLETE” message will be displayed on the console.
- Touch the SID POS softkey.

Note: On LCA/LCV+/LC+ systems, the SID POS softkey does not control the positioning of the Image Intensifier tube. Touch the SID POS softkey on the console and then press and hold the SERVICE button beneath the tableside control until the II reaches the maximum SID position.

On biplane lateral, maintain button activation until the Image Intensifier tube is in position. The SID POS softkey will then display G4. For 120 kV calibration you will have to push button activation again until the x–ray tube is in position (may take 15–20 seconds). The x–ray tube will not start to move until the II is in position.

For German Advantx–E Vascular Systems with non–removable 0.1 mm copper filter in the beam:

- When the message “IMAGE INTENSIFIER AND X–RAY TUBE IN POSITION” is displayed, position the II to 95 cm SID (frontal) or 100 cm SID (lateral) in place of max SID.
- Touch NEXT STEP softkey to proceed to Step 4.

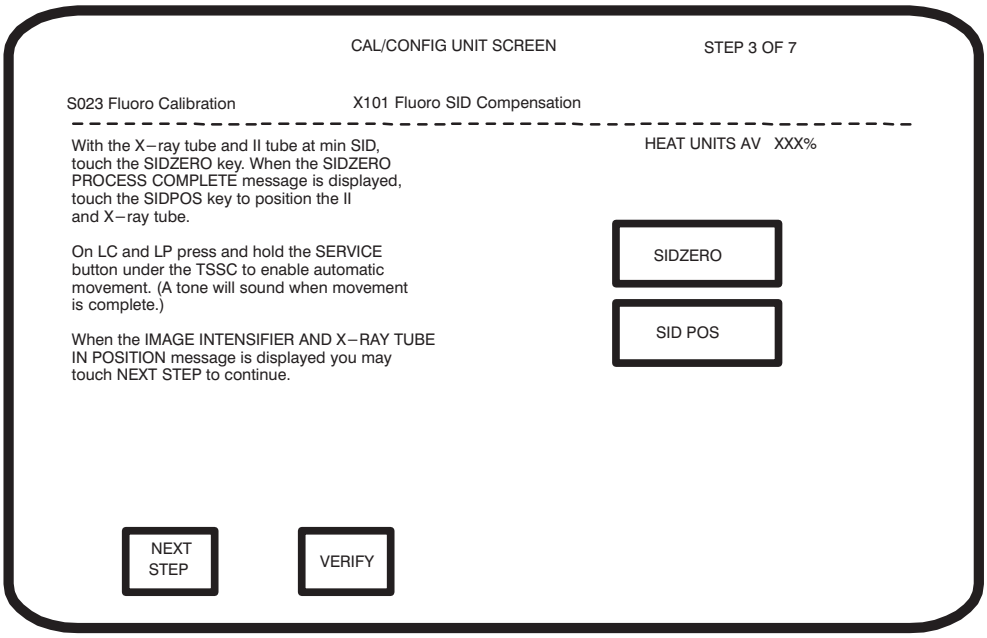
For Other Systems:

- When the message “IMAGE INTENSIFIER AND X–RAY TUBE IN POSITION” is displayed, touch NEXT STEP softkey to proceed to Step 4.

Note: For latest Vascular Advantx–E Systems only, the II is driven to a position which is the maximum SID. It is not the back–out position reachable by the orange button on the II, but by the blue button.

Note: For other systems, the II is driven to a position that uses the chordal diameter of the II as a reference point. Because of the FDA requirement regarding probe positioning, you must now re–adjust the II to isocenter distance as specified in Step 4.

X101 STEP 3 SCREEN DISPLAY (BIPLANE & NEWER SW SP LCA+/LCV+/LC+ SYSTEMS)



1-4-4 Step 4. G3 Adjustment

Before proceeding, touch MORE INFO softkey to access the Step 4 MORE INFO screen for more instructions about the G3 adjustment.

Note: For other than Advantx–E Vascular Systems:

- Using a ruler, set the II to isocenter distance to 300mm (30 cm). Measure to the lowest point on the II tube housing (depending upon the type of system involved, this may be the II tube cover or anti–collision device). See Illustration 137 in Cal Unit X101.
- After the II to isocenter distance is set, mark the distance on the II carriage with a piece of tape. This will provide a reference point for the 300 mm (30 cm) distance to ensure distance is maintained or for easy return to the measured distance, if required.

- Initiate G3 adjustment by touching the G3 softkey.
- Take and maintain a fluoro exposure.

For German Advantx–E Vascular Systems with non–removable 0.1 mm copper filter in the beam:

- Adjust FIL DRIVE to get D(minref) value (found at X100 Step 3) at 60 kVp.

For Other Systems:

- During the exposure, turn the console dial to adjust G3 until the dose rate indicated on the radiation meter is within 0.8 mGy/min (0.1 R/min) less than the RADIATION TAPER LIMIT value displayed on the console screen.

NOTICE

If for some reason, the power unit limit on peak fluoro power at 60 kV is exceeded, the message “mA Exceeds Power Unit Limits, See Manual and MORE INFO” is displayed. Then decrease SID by 3 cm and try again. A decrease of SID will not change the EER.

- Terminate the exposure.

Note: The power unit has limits on peak mA during G3 calibration. Exceeding the limits can cause kV drop during exposures — giving a bad calibration or power unit errors. If the system cannot perform the calibration with a SID of at least 90 cm then the calibration will work properly at smaller SID, but µGy/mAs should be tested, as the value is likely to be below Xray Tube replacement limits.

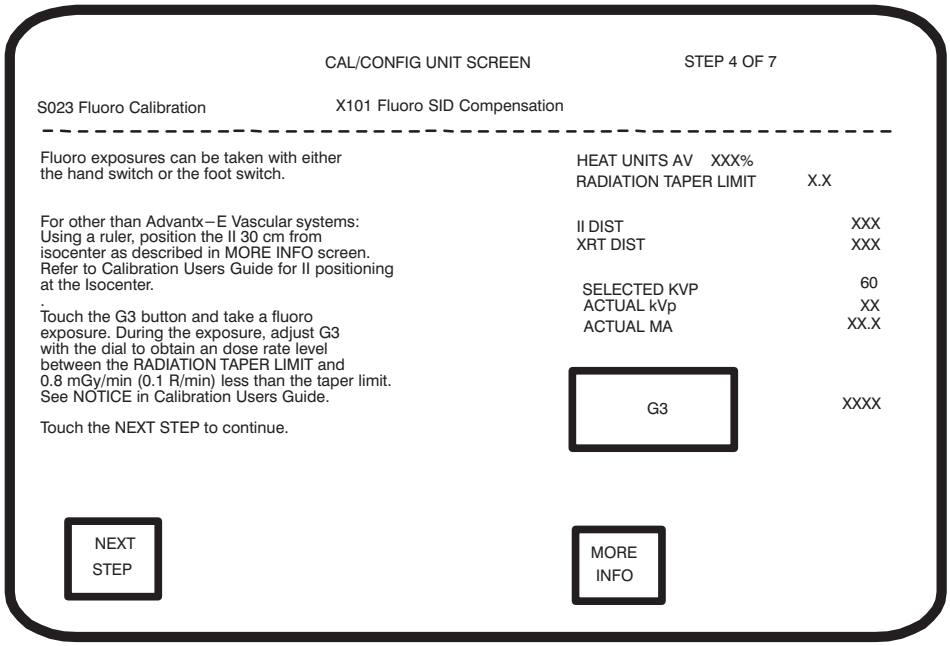
NOTICE

On a system with variable Xray Tube Positioning (LP):

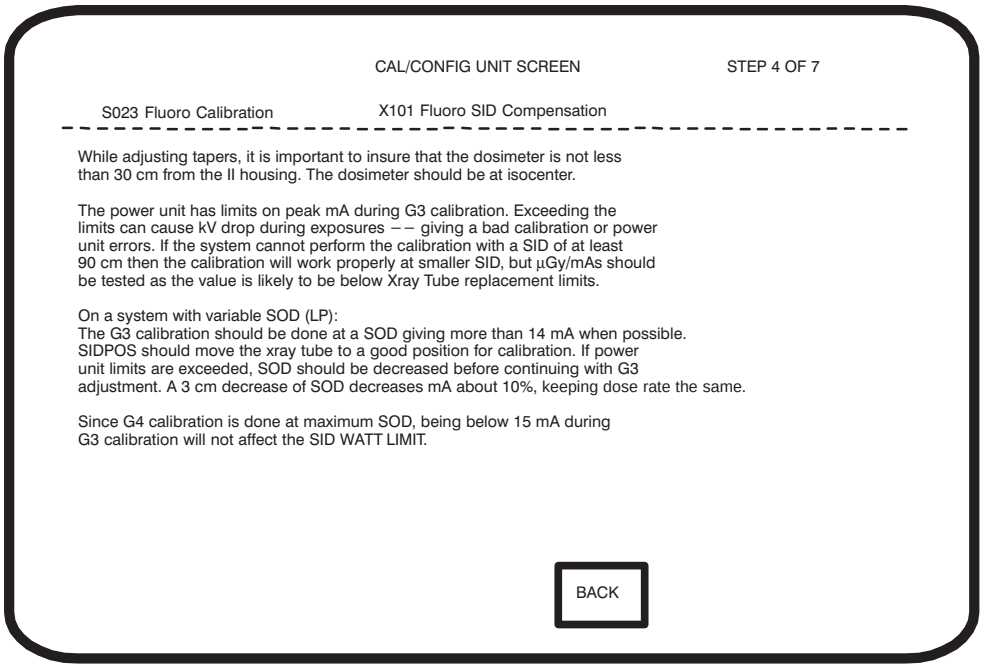
The G3 calibration should be done at a SOD giving more than 14 mA when possible. SIDPOS should move the xray tube to a good position for calibration. If power unit limits are exceeded, SOD should be decreased before continuing with G3 adjustment. A 3 cm decrease of SOD decreases the mA of about 10%, keeping dose rate the same. Since G4 calibration is done at maximum SOD, being below 15 mA during G3 calibration will not affect the SID WATT LIMIT.

- Touch NEXT STEP softkey and proceed to Step 5.

X101 STEP 4 SCREEN DISPLAY
(BIPLANE & NEWER SW SP LCA+/LCV+/LC+ SYSTEMS)



X101 STEP 4 "MORE INFO" SCREEN DISPLAY
(BIPLANE & NEWER SW SP LCA+/LCV+/LC+ SYSTEMS)



1-4-5 Step 5. G4 Adjustment

1-4-5-1 For Lateral Plane only:

- Touch the SIDPOS softkey, then press and hold the SERVICE button under the TSSC while the Xray tube autopositions to maximum SOD. After completion of positioning, a tone sounds and the SIDPOS softkey label changes from “SIDPOS” to “G4”.
- Initiate G4 adjustment by touching the G4 softkey.
- Take and maintain a fluoro exposure.

For German Advantx–E Vascular Systems with non–removable 0.1 mm copper filter in the beam:

- Position the II to max SID (with the blue button on the II anticollision ring) and max SOD (lateral)
- Adjust G4 to get 12.5 mA read on the console at 120 kVp.
- Measure the resulting dose, then call it D(maxSID).
- If D (maxSID) is higher than 79 mGy/min (9.1 R/min), readjust G4 to get 79 mGy/min (9.1 R/min), then touch NEXT STEP softkey and proceed to Step 6.
- If D (maxSID) is lower than 79 mGy/min (9.1 R/min), reduce SOD then SID by a 1 cm step, then readjust G4 to get 12.5 mA read on the console. Measure the resulting dose. If this dose is still lower than 79 mGy/min (9.1 R/min), repeat this action until the resulting dose reaches a value higher than 79 mGy/min (9.1 R/min) (You shall get at the same time 12.5 mA AND a dose higher than 79 mGy/min (9.1 R/min)).
- Re–adjust G4 to get 79 mGy/min (9.1 R/min) at 120 kVp.
- Terminate the exposure.
- Touch NEXT STEP softkey and proceed to Step 6.

For Other Systems:

- During the exposure, turn the console dial to adjust G4 until the dose rate indicated on the radiation meter is within 0.8 mGy/min (0.1 R/min) less than the RADIATION TAPER LIMIT value displayed on the console screen.
- Terminate the exposure.
- Touch NEXT STEP softkey and proceed to Step 6.

NOTICE

If for some reason, the peak power limit of 5.4 kW is exceeded, the message “mA high; Check mR/mAs” is displayed. You may continue with calibration, but check tube efficiency. Reduce SOD by 3 cm steps until the radiation taper can be achieved.

1-4-5-2 For Frontal Plane:

NOTICE **If SID was changed in the previous step, you must return the system to the original SID value (max SID for Advantx–E Vascular systems, SID 30 cm from isocenter for the other systems).**

- Initiate G4 adjustment by touching the G4 softkey.
- Take and maintain a fluoro exposure.

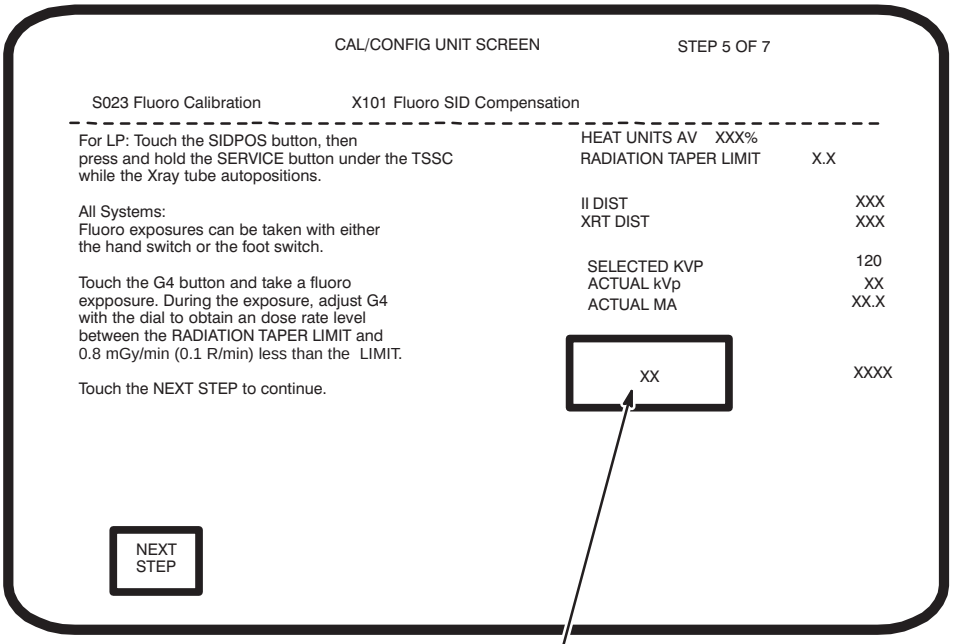
For German Advantx–E Vascular Systems with non–removable 0.1 mm copper filter in the beam:

- Position the II to max SID (with the blue button on the II anticollision ring)
- Adjust G4 to get 12.5 mA read on the console at 120 kVp.
- Measure the resulting dose, then call it D(maxSID).
- If D (maxSID) is higher than 79 mGy/min (9.1 R/min), readjust G4 to get 79 mGy/min (9.1 R/min), then touch NEXT STEP softkey and proceed to Step 6.
- If D (maxSID) is lower than 79 mGy/min (9.1 R/min), reduce SID by a 1 cm step, then readjust G4 to get 12.5 mA read on the console. Measure the resulting dose. If this dose is still lower than 79 mGy/min (9.1 R/min), repeat this action until the resulting dose reaches a value higher than 79 mGy/min (9.1 R/min) (You shall get at the same time 12.5 mA AND a dose higher than 79 mGy/min (9.1 R/min)).
- Re–adjust G4 to get 79 mGy/min (9.1 R/min) at 120 kVp.
- Terminate the exposure.
- Touch NEXT STEP softkey and proceed to Step 6.

For Other Systems:

- During the exposure, turn the console dial to adjust G4 until the dose rate indicated on the radiation meter is within 0.8 mGy/min (0.1 R/min) less than the RADIATION TAPER LIMIT value displayed on the console screen.
- Terminate the exposure.
- Touch NEXT STEP softkey and proceed to Step 6.

X101 STEP 5 SCREEN DISPLAY
(BIPLANE & NEWER SW SP LCA+/LCV+/LC+ SYSTEMS)



For Lateral Plane ONLY: Softkey says “SIDPOS” until after activation and completion of positioning. Then, softkey label changes to say “G4”.

For Frontal Plane: Softkey ALWAYS says “G4”.

1-4-6 Step 6. SID Watt Limiter Adjustment

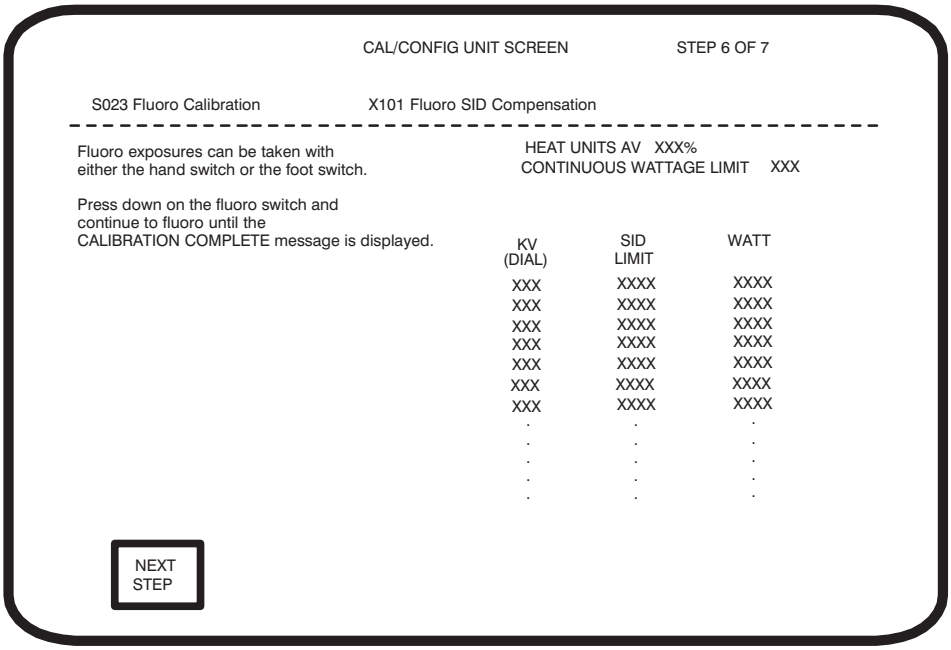
- Take and maintain a fluoro exposure. The system will perform the Watt limiter adjustment while the exposure is being taken.
- Maintain the exposure until the “CALIBRATION COMPLETE” message is displayed on the console screen.

NOTICE

During the automatic wattage calculation, the following message “WATT LIMIT EXCEEDED AT MIN SID. RECAL FLUORO TAPER AND THIS UNIT” may appear on the console. At this point, the calculation is interrupted because the calculated wattage exceeds the wattage upper limit. In this case, switch the system off at the console and recalibrate the taper at the minimum SID, making sure the 1800 watt safety limit is respected.

- Touch NEXT STEP softkey and proceed to Step 7.

X101 STEP 6 SCREEN DISPLAY
(BIPLANE & <u>NEWER</u> SW SP LCA+/LCV+/LC+ SYSTEMS)



1-4-7 Step 7. Verification

Verification should be done at different kVp's and SID's.

- Initiate Entrance Exposure Rate–EER verification by touching the KVP softkey.
- Take and maintain a fluoro exposure. During the exposure, use the console dial to step from 60 kVp to 120 kVp in 5 kVp increments. Verify the EER level on the radiation meter at each kVp increment.

NOTICE

When incrementing kVp through the verification values, rotate the console dial slowly. As the filament control parameter (G5) is active during this step of the calibration, you must allow time for the G5 to respond to each new kVp setting before incrementing to the next kVp. If you try to step through the kVp increments without giving the G5 parameter time to respond, information messages may appear on the console screen and/or erroneous fluctuations may occur in the dose rate readout.

- Terminate the exposure.
- If the EER, at any kVp increment and SID, exceeds the RADIATION TAPER LIMIT displayed on the console screen by more than 1.7 mGy/min (0.2 R/min), a recalibration at slightly lower radiation levels is required.
- If a recalibration is required, touch the RECAL softkey and readjust G3 (Step 4) or G4 (Step 5).
- Verify the results of any re-calibrations by repeating Step 7.
- If the EER at any kVp increment at min SID is different by more than 4.3 mGy/min (0.5 R/min) from that at the SID comp limit, a recalibration is recommended.
- Touch the NEXT UNIT or UNIT MENU softkey to exit.

1-4-7-1 Special instructions regarding verification

If the table top EER is low, review the following special instructions before proceeding with a recalibration. Do not just recal at a higher EER value.

1. MA compensation will compensate for x–ray tube heating and cooling effects as well as filament aging.
2. If the SID is larger than the value calibrated in SID Watt Limiter, then the display of the SID Comp Limit value will be blinking in inverse video. In that case, the EER will be lower than the calibrated values.

X101 STEP 7 SCREEN DISPLAY
(BIPLANE & NEWER SW SP LCA+/LCV+/LC+ SYSTEMS)

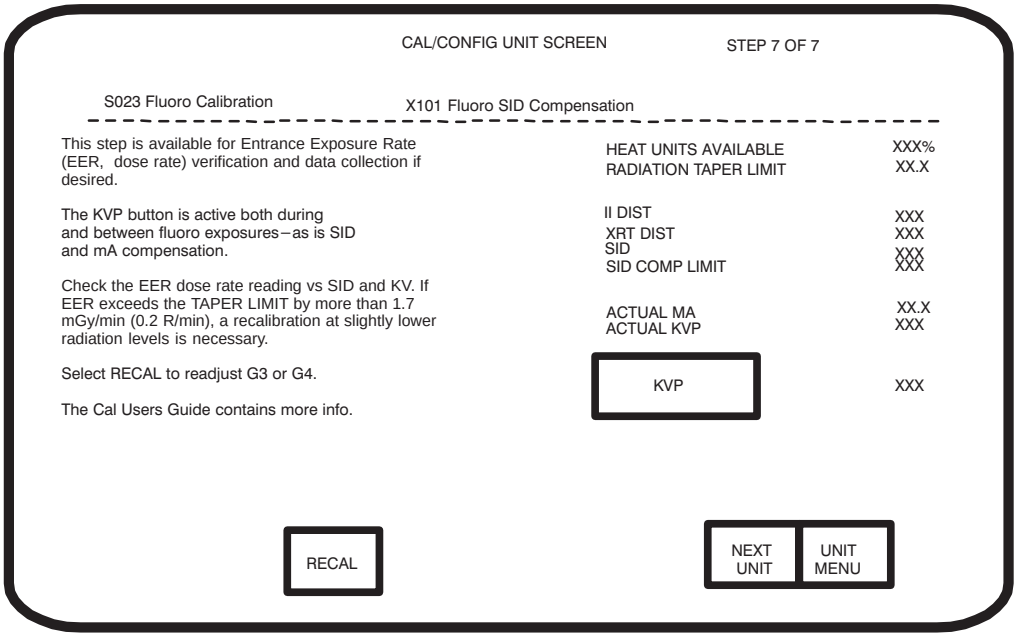
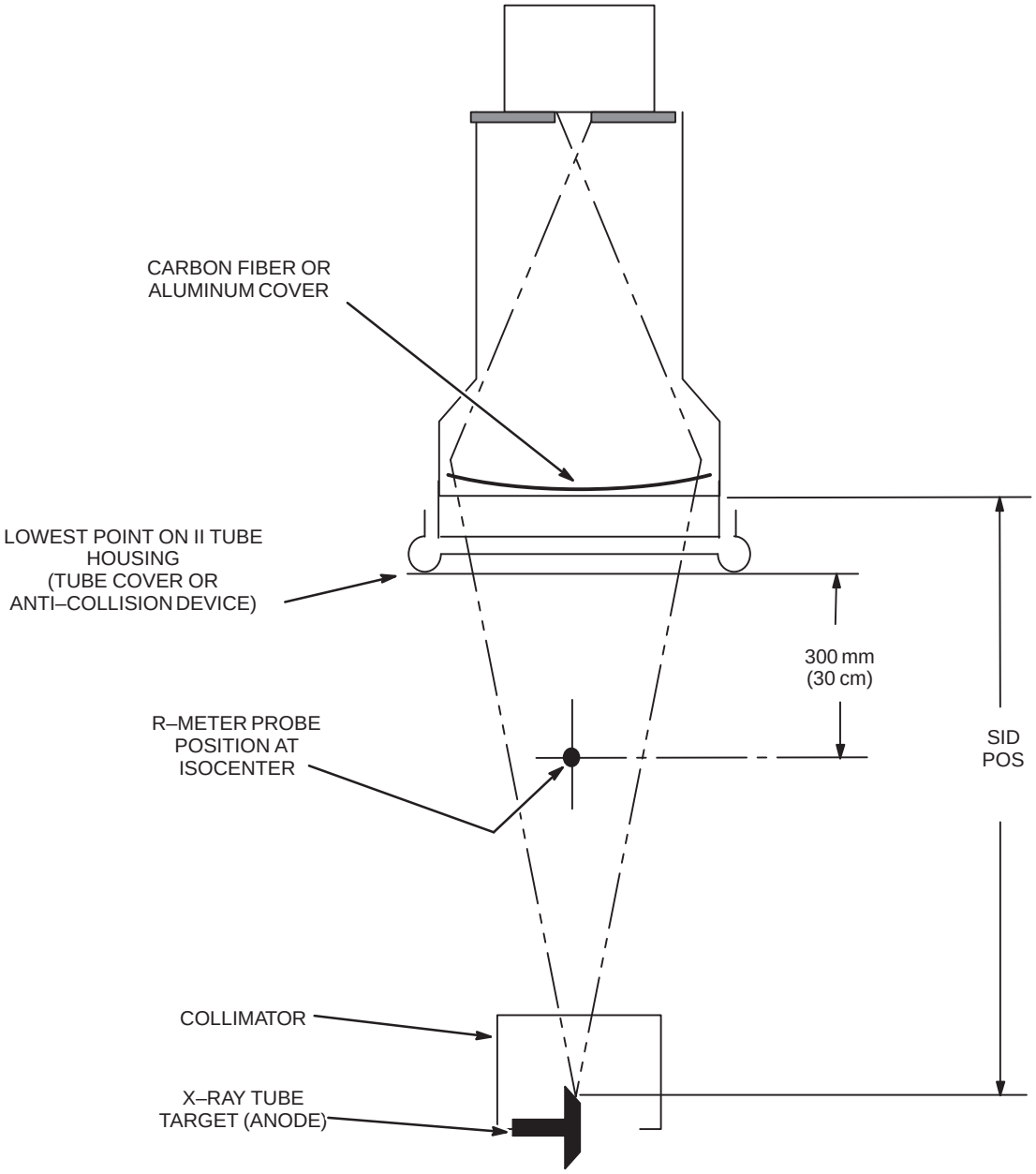


Illustration 137 – Isocenter Positioning



2 X101, FLUORO SID COMPENSATION, OLD PROCEDURE

Note: The Old Procedure is used for Tilt–C systems, and for OLDER software (i.e., ASC SW prior to G4.XX) single plane LCA/LCV+/LC+ systems.

(For biplane systems and for newer software single plane LCA/LCV+/LC+ systems, go to New Procedure in Section 1.)

2-1 Description

Calibration Unit X101 adjusts the fluoro SID compensation parameters so that as SID increases, tube filament current increases, thereby maintaining the fluoro table top dose at a calibrated value. Fluoro SID compensation also prevents increases in fluoro technique from exceeding the fluoro rating of the tube. SID compensation is only active during fluoro exposures. Seven steps are required to calibrate the fluoro SID compensation parameters. A screen display is provided for each step.

CAUTION **This unit allows the system to be configured for higher pulsed interlaced fluoro taper limits than shipped. This is not recommended. This is forbidden in the US where the 87.6 mGy/min (10 R/min) regulatory limits applies. While the system will operate at these higher taper limits, the reliability under this condition may suffer; increased maintenance costs should be expected. Only raise the fluoro taper limits after all other methods of improving digital fluoro image quality have been tried and there is still a serious customer issue.**

Note: This unit must always be run in combination with Cal Unit X100 and X100 must be run first.

2-2 Equipment required

Dosimeter (MDH/Radcal 2025, 2026 or equivalent) w/probe stand or Ion Chamber Positioning Tool 2236707 (Former ref: 2208874)
For Advantx–E Systems, Ion Chamber Positioning Tool is mandatory (See Cal Unit T015) .
For this Cal Unit, use Model 20x5–3 or 20x6–3 probe.
Metric Tape Measure.

2-3 Special Instructions

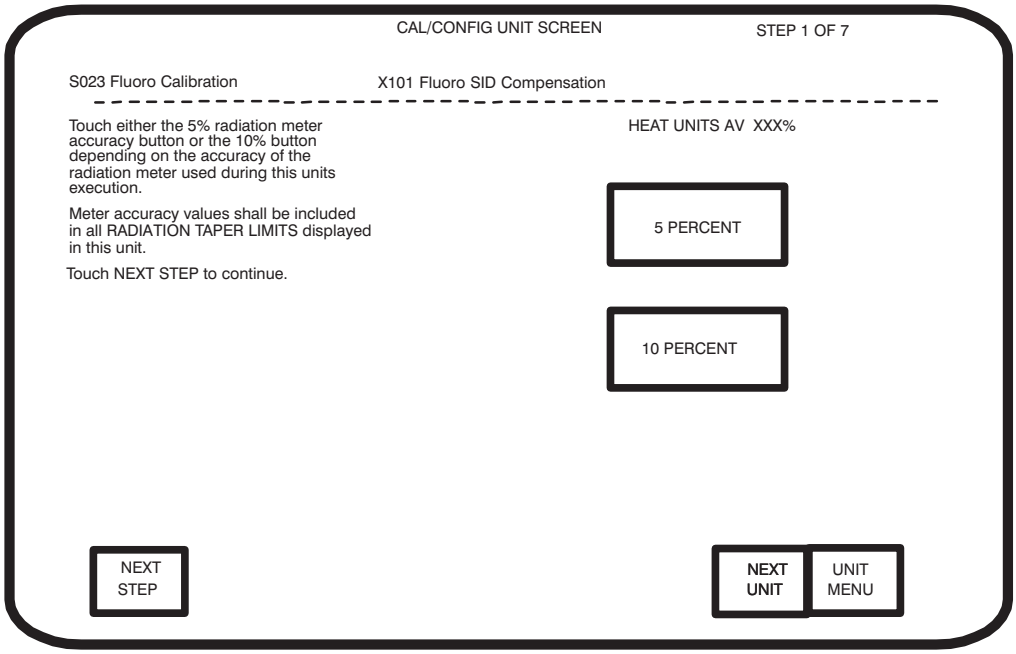
Note: **For Vascular Systems Only**: Before system calibration, verify that additional filter (copper–aluminum filter) is not installed on top of collimator. (Open sensor hinge assembly to verify.) If installed, remove before performing calibration.

2-4 Cal Procedure

2-4-1 Step 1. Radiation Meter Accuracy

- Check the accuracy of the radiation meter to be used in the calibration.
- Touch the 5 PERCENT or 10 PERCENT softkey to enter the rated accuracy of the radiation meter. The meter accuracy is included in all RADIATION TAPER LIMITS displayed in this unit.
- Touch NEXT STEP softkey to proceed to Step 2.

X101 STEP 1 SCREEN DISPLAY
(TILT–C SYSTEMS & <u>OLDER</u> SW SP LCA/LCV+/LC+ SYSTEMS)



2-4-2 Step 2. Radiation Meter (R–Meter) Probe Positioning

CAUTION **Verify that the collision sensor is installed on the collimator, and that the hinged door is closed before proceeding.**

- Move the table top out of the field of the x–ray beam and open the collimator blades to maximum.

Note: For a Tilt–C system, you will have to remove the table top. Refer to the *Advantx Tilt–C Installation* document #2106453–100 for a procedure on how to install and remove the table top.

NOTICE **For Advantx–E Vascular Systems, rotate the table top to 90 degrees vs the longitudinal positioner axis.**

NOTICE **On LC systems configured with an Omega EP table, you must rotate the LC positioner pivot to 90 degrees and lower the table top out of the x–ray beam.**

- Manually set the II tube and x–ray tube to minimum SID.

Note: For Advantx–E Vascular Systems, Ion Chamber Positioning Tool is mandatory to get accurate adjustments.

Note: If you use the Ion Chamber Positioning Tool, and if you have just run X100 unit, the probe should not have moved, so DO NOT CHANGE the positioning of the probe to avoid errors in the calibration.

- When using Ion Chamber Positioning Tool 2236707 (Former ref: 2208874), refer to Illustration 135 in Cal Unit X100 and to the instructions on the screen display for Step 2; also, refer to mounting/positioning instructions in Cal Unit T015. Check for probe top/II anticollision plate distance in Table 10 of Cal Unit T015.
- If not using Ion Chamber Positioning Tool, mount R–Meter probe stand to bottom of II tube (or position the stand on the head end of the table top and extend the R–Meter probe into the x–ray beam). Position the R–meter probe 30 cm from the lowest point on the II tube housing (See Illustration 134 in Cal Unit X100 and to the instructions on the screen display for Step 2).

Note: The positioning of the R–meter probe 30 cm from the lowest point on the II tube housing (with II in overhead position) is an FDA requirement. The FDA assumes that the 30 cm distance corresponds to the average thickness of a patient and therefore establishes a worst case condition for radiation dose.

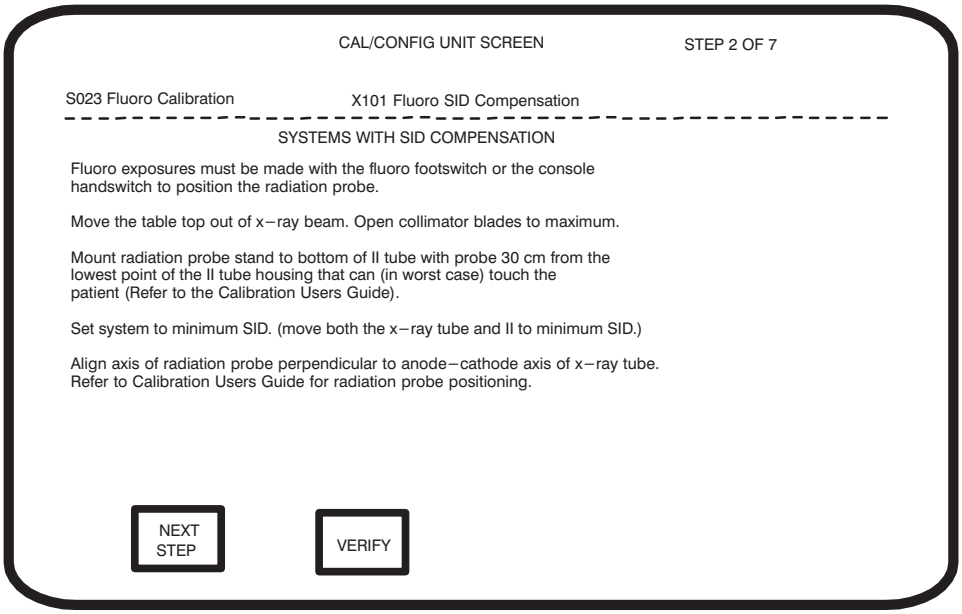
- Align the axis of the probe perpendicular to the anode–cathode axis of the x–ray tube.
- Take a fluoro exposure to determine the exact position of the R–Meter probe.
- Repeat taking exposures and repositioning the R–Meter probe until the probe is centered in the x–ray beam.

- After the R–Meter probe is properly positioned, you may perform a quick check of the Radiation Taper Limit before proceeding with a full calibration by touching the VERIFY softkey. Touching the VERIFY softkey will cause the unit to increment to the Step 7, Verification screen. Perform Step 7.

OR

- Touch the NEXT STEP softkey to proceed directly to Step 3 in the calibration sequence.

X101 STEP 2 SCREEN DISPLAY
(TILT–C SYSTEMS & <u>OLDER</u> SW SP LCA/LCV+/LC+ SYSTEMS)



NOTICE

Before attempting to run SID POS Positioning on LCA/LCV+/LC+ systems, ensure that the table top rotational position is at 0 degrees or ± 90 degrees for systems with Omega IV tables or at 0 degrees angulation position for systems with Omega EP tables. The SID button on the tableside control is disabled if the table is not at one of these positions.

2-4-3 Step 3. SID POS Positioning

- Touch the SIDZERO softkey. The system will process and load SIDZERO data into NVRAM. Upon completion of processing, a “SIDZERO PROCESS COMPLETE” message will be displayed on the console.
- Touch the SID POS softkey.

Note: On LCA/LCV+/LC+ systems, the SID POS softkey does not control the positioning of the Image Intensifier tube. Touch the SID POS softkey on the console and then press and hold the RESET button beneath the tableside control until the II reaches the upper SID position.

Note: On Tilt–C systems, manually position the II to a SID of 106 cm.

For German Advantx–E Vascular Systems with non–removable 0.1 mm copper filter in the beam:

- When the message “IMAGE INTENSIFIER AND X–RAY TUBE IN POSITION” is displayed, position the II to 95 cm SID (frontal) or 100 cm SID (lateral) in place of max SID.
- Touch NEXT STEP softkey to proceed to Step 4.

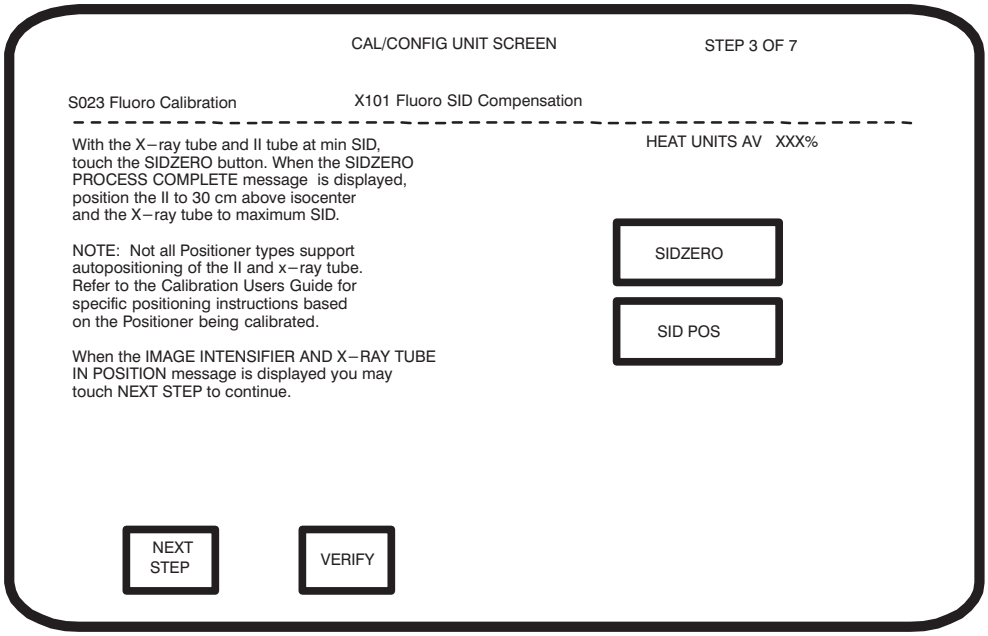
For Other Systems:

- When the message “IMAGE INTENSIFIER AND X–RAY TUBE IN POSITION” is displayed, touch NEXT STEP softkey to proceed to Step 4.

Note: For the latest Advantx–E Vascular Systems only, the II is driven to a position which is the maximum SID. It is not the back–out position reachable by the orange button on the II, but by the blue button.

Note: For other systems, the II is driven to a position that uses the chordal diameter of the II as a reference point. Because of the FDA requirement regarding probe positioning, you must now re–adjust the II to isocenter distance as specified in Step 4.

X101 STEP 3 SCREEN DISPLAY (TILT–C SYSTEMS & OLDER SW SP LCA/LCV+/LC+ SYSTEMS)



2-4-4 Step 4. G3 Adjustment

Note: For other than Advantx–E Vascular Systems:

- Using a ruler, set the II to isocenter distance to 300mm (30 cm). Measure to the lowest point on the II tube housing (depending upon the type of system involved, this may be the II tube cover or anti–collision device). See Illustration 137 in Cal Unit X101.
- After the II to isocenter distance is set, mark the distance on the II carriage with a piece of tape. This will provide a reference point for the 300 mm (30 cm) distance to ensure distance is maintained or for easy return to the measured distance, if required.

- Ensure that the X–ray tube is at maximum SID.
- Initiate G3 adjustment by touching the G3 softkey.
- Take and maintain a fluoro exposure.

For German Advantx–E Vascular Systems with non–removable 0.1 mm copper filter in the beam:

- Adjust G4 to get D(minref) value (found at X100 Step 3) at 60 kVp.

For Other Systems:

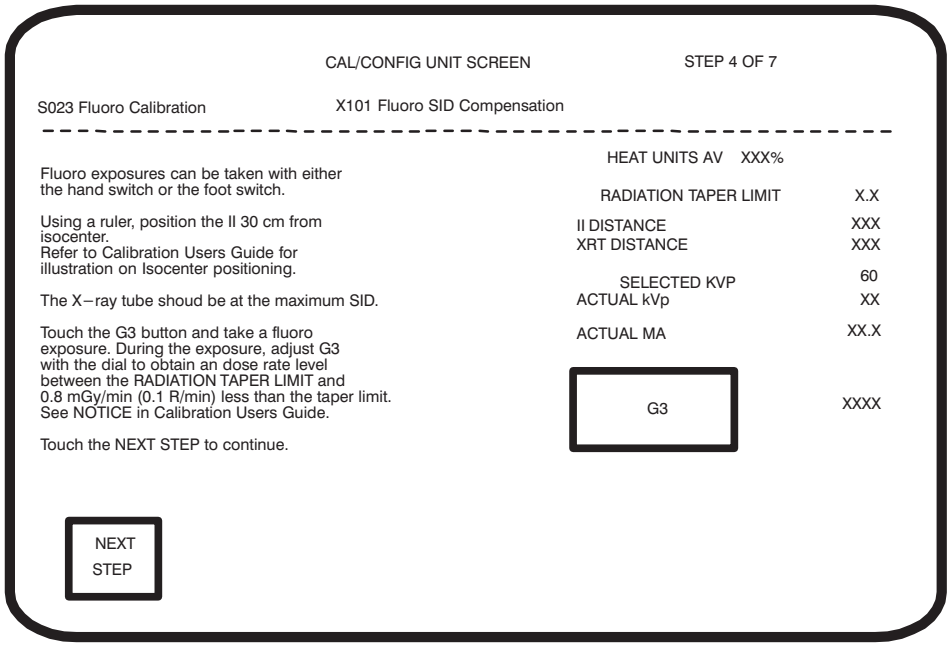
- During the exposure, turn the console dial to adjust G3 until the dose rate indicated on the radiation meter is within 0.8 mGy/min (0.1 R/min) less than the RADIATION TAPER LIMIT value displayed on the console screen.

NOTICE

When adjusting the dose value to 65 mGy/min (7.5 R/min), the actual required mA value may approach 28 mA. Do NOT attempt to limit the mA to 14.8 (as required for X100). Limiting the mA in this unit will not allow the setting of the 65 mGy/min (7.5 R/min) in Step 4 and 78 mGy/ min (9.0 R/min) in Step 5.

- Terminate the exposure.
- Touch NEXT STEP softkey and proceed to Step 5.

X101 STEP 4 SCREEN DISPLAY (TILU–C SYSTEMS & OLDER SW SP LCA/LCV+/LC+ SYSTEMS)



2-4-5 Step 5. G4 Adjustment

- Initiate G4 adjustment by touching the G4 softkey.
- Take and maintain a fluoro exposure.

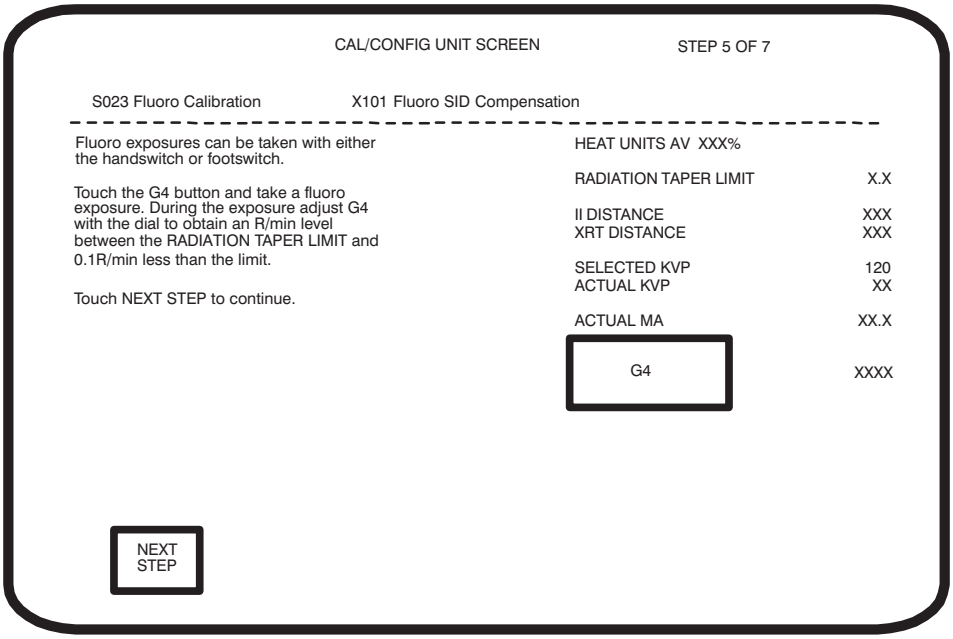
For German Advantx–E Vascular Systems with non–removable 0.1 mm copper filter in the beam:

- Position the II to max SID (with the blue button on the II anticollision ring)
- Adjust G4 to get 12.5 mA read on the console at 120 kVp.
- Measure the resulting dose, then call it D(maxSID).
- If D(maxSID) is higher than 79 mGy/min (9.1 R/min), readjust G4 to get 79 mGy/min (9.1 R/min), then touch NEXT STEP softkey and proceed to Step 6.
- If D(maxSID) is lower than 79 mGy/min (9.1 R/min), reduce SID by a 1 cm step, then readjust G4 to get 12.5 mA read on the console. Measure the resulting dose. If this dose is still lower than 79 mGy/min (9.1 R/min), repeat this action until the resulting dose reaches a value higher than 79 mGy/min (9.1 R/min) (You shall get at the same time 12.5 mA AND a dose higher than 79 mGy/min (9.1 R/min)).
- Re–adjust G4 to get 79 mGy/min (9.1 R/min) at 120 kVp.
- Terminate the exposure.
- Touch NEXT STEP softkey and proceed to Step 6.

For Other Systems:

- During the exposure, turn the console dial to adjust G4 until the dose rate indicated on the radiation meter is within 0.8 mGy/min (0.1 R/min) less than the RADIATION TAPER LIMIT value displayed on the console screen.
- Terminate the exposure.
- Touch NEXT STEP softkey and proceed to Step 6.

X101 STEP 5 SCREEN DISPLAY (TILT–C SYSTEMS & OLDER SW SP LCA/LCV+/LC+ SYSTEMS)



2-4-6 Step 6. SID Watt Limiter Adjustment

- Take and maintain a fluoro exposure. The system will perform the Watt limiter adjustment while the exposure is being taken.
- Maintain the exposure until the “CALIBRATION COMPLETE” message is displayed on the console screen.

Note: The WATT LIMIT is typically 900W.

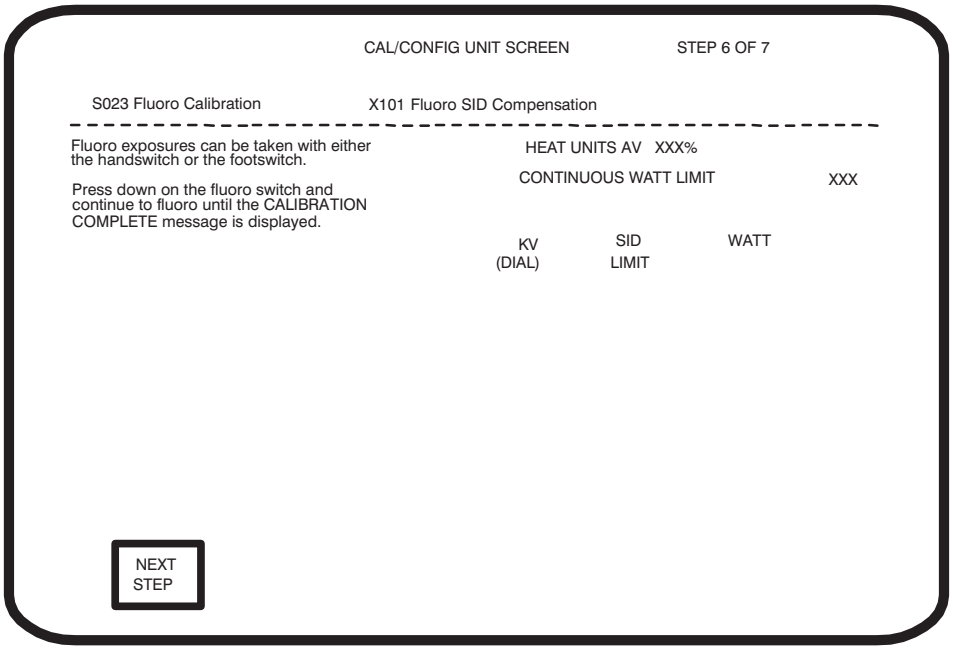
Note: For purpose of verification (Step 7), note any KV’s and SID LIMIT’s for which the WATT value is close to the WATT LIMIT. At those KV’s, the Entrance Exposure Rate–EER will be below the calibrated values for SID’s larger than the SID LIMIT.

NOTICE

During the automatic wattage calculation, the following message “WATT LIMIT EXCEEDED AT MIN SID. RECAL FLUORO TAPER AND THIS UNIT” may appear on the console. At this point, the calculation is interrupted because the calculated wattage exceeds the wattage upper limit. In this case, switch the system off at the console and recalibrate the taper at the minimum SID, making sure the 1800 watt safety limit is respected.

- Touch NEXT STEP softkey and proceed to Step 7.

X101 STEP 6 SCREEN DISPLAY
(TILT–C SYSTEMS & <u>OLDER</u> SW SP LCA/LCV+/LC+ SYSTEMS)



2-4-7 Step 7. Verification

- Initiate Entrance Exposure Rate–EER verification by touching the KVP softkey.
- Take and maintain a fluoro exposure. During the exposure, use the console dial to step from 60 kVp to 120 kVp in 5 kVp increments. Verify the EER level on the radiation meter at each kVp increment.

NOTICE

When incrementing kVp through the verification values, rotate the console dial slowly. As the filament control parameter (G5) is active during this step of the calibration, you must allow time for the G5 to respond to each new kVp setting before incrementing to the next kVp. If you try to step through the kVp increments without giving the G5 parameter time to respond, information messages may appear on the console screen and/or erroneous fluctuations may occur in the dose rate readout.

- Terminate the exposure.
- If the EER, at any kVp increment, exceeds the RADIATION TAPER LIMIT displayed on the console screen by more than 1.7 mGy/min (0.2 R/min), a recalibration at slightly lower radiation levels is required.
- If a recalibration is required, touch the RECAL softkey and readjust G3 (Step 4) or G4 (Step 5).
- Verify the results of any re-calibrations by repeating Step 7.
- Touch the NEXT UNIT or UNIT MENU softkey to exit.

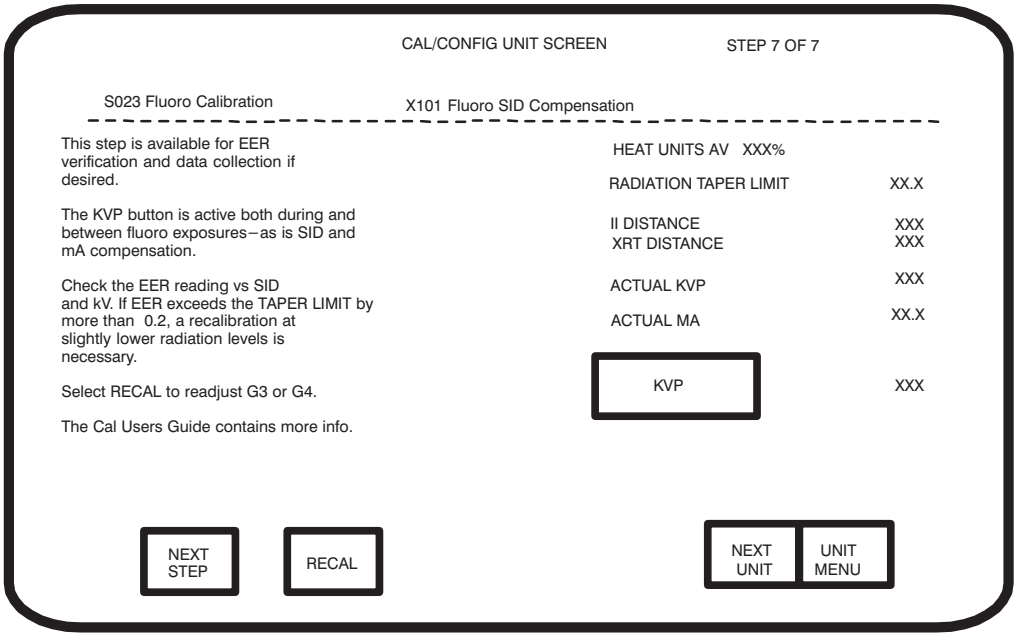
Note: For a Tilt–C system, re–install the table top. Refer to the *Advantx Tilt–C Installation* document #2106453–100 for the top installation procedure.

2-4-7-1 Special instructions regarding verification

If the table top EER is low, review the following special instructions before proceeding with a recalibration. Do not just recal at a higher EER value.

1. MA compensation will compensate for x–ray tube heating and cooling effects as well as filament aging.
2. Do not recalibrate if the cause of a low EER is SID WATT limiting. The LCV+, and LC+ are expected to be SID WATT limited at 60 kV with a 900 watt continuous WATT LIMIT. (See second note in Step 6.)

X101 STEP 7 SCREEN DISPLAY
(TILT–C SYSTEMS & OLDER SW SP LCA/LCV+/LC+ SYSTEMS)



UNIT X102 – Cine KW Tapers, Focal Spot Size (XS) and (XL)

Time: x h xx min – Personnel: 1 field engineer

1 DESCRIPTION

Calibration Unit X102 adjusts the Cine taper (constant kW) and kVp load slope compensation parameters to maintain maximum continuous tube kW for Cine operation at all kVp values. Two steps are required to complete the calibration. Step 1 calculates FILOFFSET, G2, B, and M parameter values that will produce a constant kW taper for the selected focal spot size (small, medium or large). A separate screen display is provided for each focal spot size kW taper calibration. Step 2 calculates the correct values for CINE–WATT–LIMITS for the selected focal spot size. Perform the applicable Cine kW Taper adjustments according to the tube type listed in Table 42.

Table 42 – Tube Type/Focal Spot Matrix

	FOCAL SPOT SIZE		
TUBE TYPE	**XS**	**XM**	**XL**
HTG/HTC	X		X
MX150	X		X
MX125 HEX	X	X	
MX135	X	X	X

2 THEORY

The constant kW taper must be adjusted during Cine operation to obtain the correct kW at MAX and MIN KVP. The kW taper maintains the peak x–ray tube current necessary to produce the maximum kW limit, +/– 5%, at all kVp values. Cine exposures are taken at maximum continuous peak tube kW value to ensure the best exposures with out tube damage. The calibration unit provides fine tuning of FILOFFSET parameter at minimum kVp and G2 parameter at maximum kVp. Calibration of FILOFFSET and G2 determine the end points of a pre–defined taper curve to correspond with the proper kW limit. Both adjustments are performed with the system operating at 30 frames per second (25 frames per /second on 50 Hz systems) with a 5 ms pulse width.

3 EQUIPMENT REQUIRED

None.

4 SPECIAL INSTRUCTIONS

- The Filament Age and Fil Age (Last Cal) parameters displayed on the Step 1 screen provide a visual indication of the filament aging characteristics of the system X–ray tube.
  1. **Filament Age:** Tracks and displays a continuous record of changes in filament aging (in HEX) since x–ray tube installation (initial value of 0010H).
  2. **Fil Age (Last Cal):** Displays the Hex value of filament aging set in the last calibration (initial value when a tube is installed is FFFFH). The Fil Age (Last Cal) parameter will be set equal to Filament Age parameter after a calibration is completed.

Note: As the x–ray tube ages, changes in the Filament Age value may be observed. If the difference between the Filament Age value and Fil Age (Last Cal) value reaches a delta limit of 2BH, a “recal required” message is displayed. This warning message is displayed upon entering either the Applications or Service Mode to indicate to the user that a mandatory recalibration of the system dose rate is required (Ref recal instructions in Cal Unit X100).

5 CAL PROCEDURE

5-1 Step 1. Cine Taper/Load Comp Determination, (XS or XL)

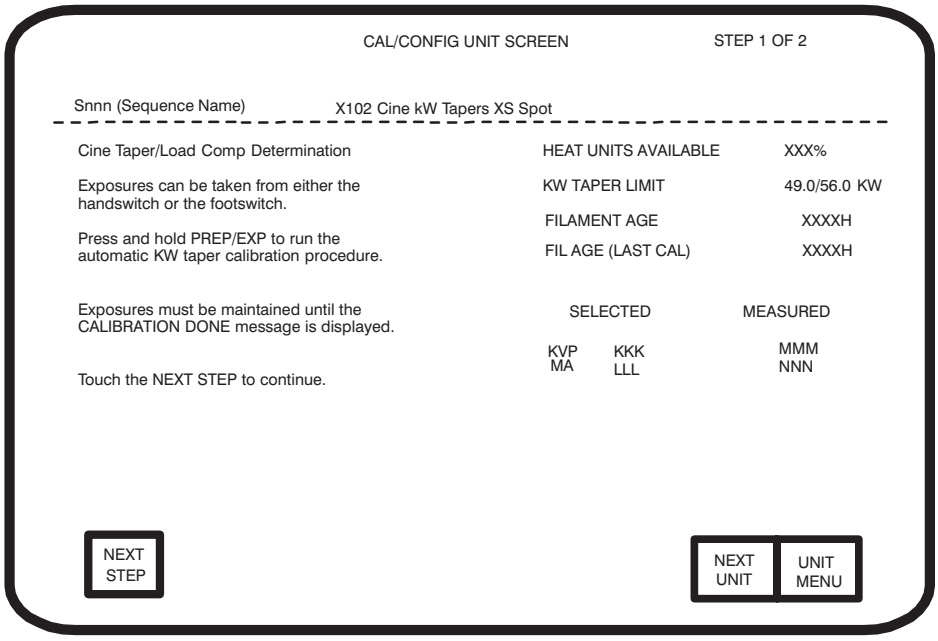
- Take an exposure using the handswitch or the footswitch.
- The system will take exposures at technique values appropriate to the selected focal spot size (XS or XL). The unit will automatically perform loop operations to calculate the parameter values required to obtain the correct kW at minimum and maximum kVp for the applicable focal spot size.
- Upon successful completion of the Kw taper calculations, the exposure is terminated.
- Touch the NEXT STEP softkey to proceed to Step 2.

Note: If the unit cannot calibrate the selected focal spot size kW Taper in fewer than 15 passes, one of the following error messages is displayed.

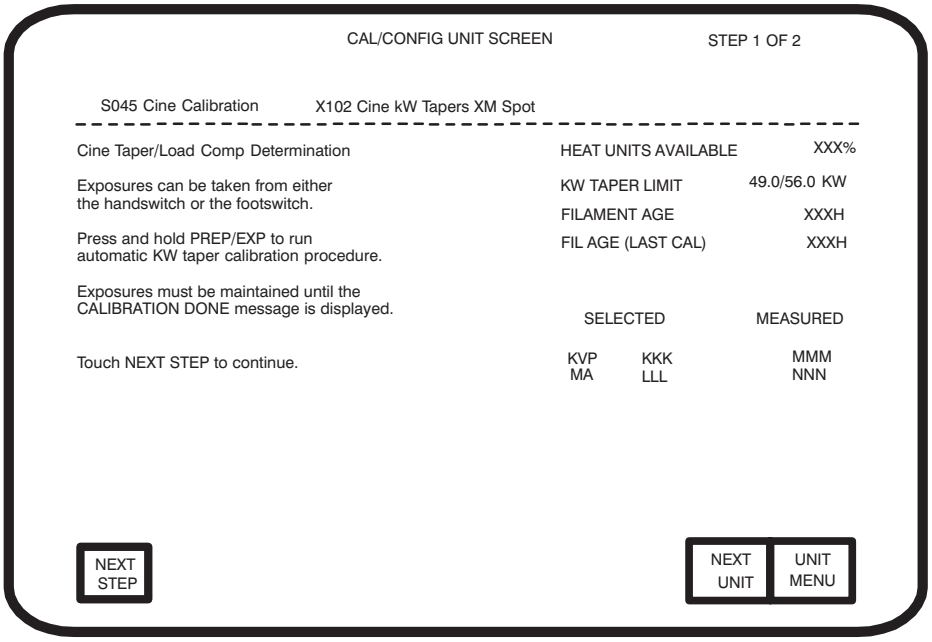
ERROR MA WILL NOT CONVERGE
ERROR KVP WILL NOT CONVERGE
ERROR KVP/MA WILL NOT CONVERGE

Note: If NEXT UNIT or UNIT MENU softkey is selected, the unit parameters are left in the original default state and the unit is flagged as un-calibrated.

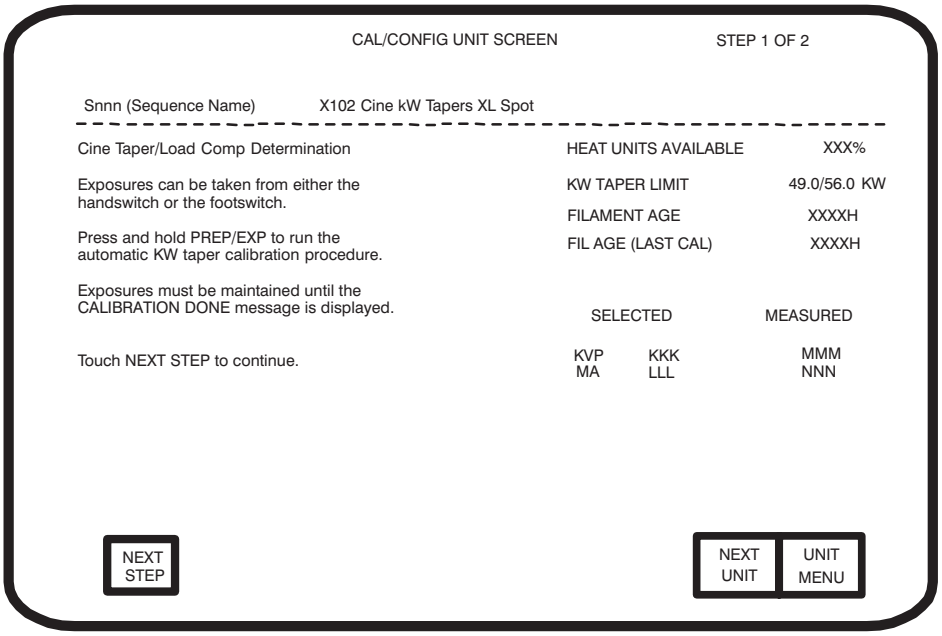
X102 XS SPOT STEP 1 SCREEN DISPLAY



X102 XM SPOT STEP 1 SCREEN DISPLAY



X102 XL SPOT STEP 1 SCREEN DISPLAY



5-2 Step 2. Calibrate Cine Watt Limits

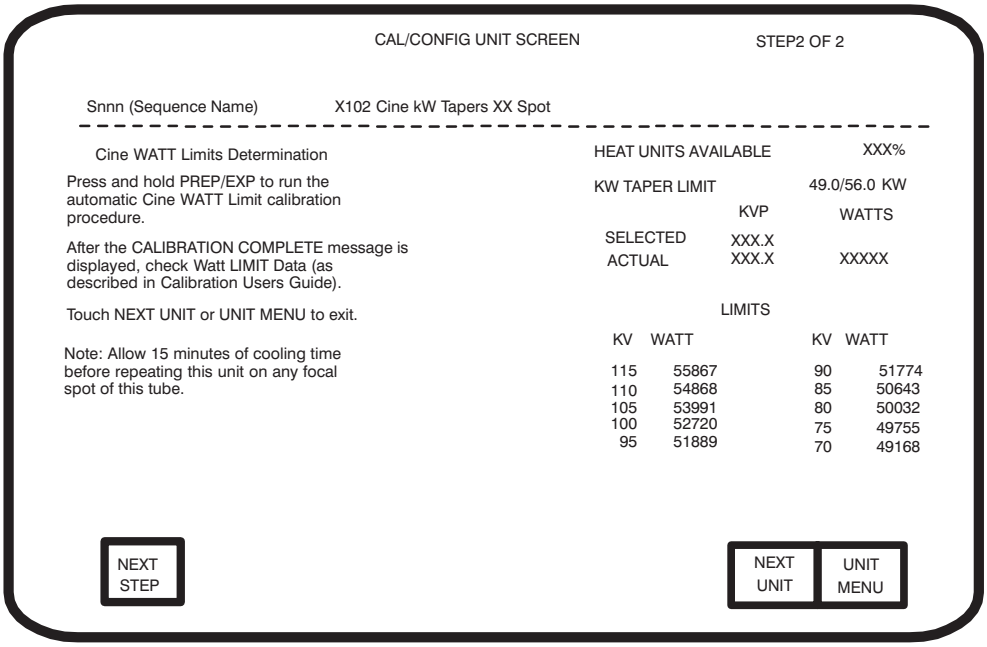
- Take an exposure using the handswitch or the footswitch.
- The unit will automatically perform Cine Watt Limit calibration for the selected focal spot size (XS, XM or XL). After each Cine run (starting at the maximum Cine kV for the selected focal spot size), the average KW for the run is displayed in the limit table on the Step 2 console screen.
- Continue with the exposure until the the CALIBRATION COMPLETE message is displayed.
- Check the kV/Watts Limit Data displayed on the console screen.

NOTICE

The data presented in the LIMITS table on the console screen can be corrupted if x–ray tube spits are encountered. Examine the WATT values presented in the LIMITS table. Look for any WATT values that are considerably different than the others. An example of typical KV/ WATT values for an HTG large spot x–ray tube are shown in the LIMITS table on the Step 2 screen display below. The values shown indicate the typical relativity of values between KV increments that should be observed. If corrupt WATT values are displayed, exit the unit, wait 15 minutes for the X–ray tube to cool, and repeat the calibration.

- Touch NEXT UNIT or UNIT MENU softkey to exit.

X102 STEP 2 SCREEN DISPLAY



Note: The NEXT STEP softkey is only displayed in the Browse Mode to permit return to Step 1.

Blank page.

UNIT X104 – Fluoro ABC Response Time

Time: x h xx min – Personnel: 1 field engineer

1 DESCRIPTION

Calibration Unit X104 adjusts the fluoro automatic brightness control (ABC) parameters to maintain a constant light output from the Image Intensifier tube during fluoroscopy regardless of variations in thickness and density of the object being scanned.

Five steps are required to perform the calibration on pulsed fluoro systems with newer software releases that include Fluoro Filament Standby Reduction.

Four steps are required to perform the calibration on ALL non–pulsed systems, AND on pulsed fluoro systems with older software releases that do not include Fluoro Filament Standby Reduction.

2 EQUIPMENT REQUIRED

Filtration (1/4 inch aluminum, 1/32 inch copper, and 2–1/4 inches acrylic), oscilloscope, and test leads.

3 TEST SETUP

Setup the oscilloscope as follows:

VERT AMPL: 0.5 V/cm
TIME BASE: 0.5 sec/cm
Connect probe to SKL A2 TP1 and chassis (ground).

Note: Normal calibration is accomplished with loop selection in ON position. Turning loop OFF during Damping Adjustment will result in performance viewed different from Applications. this selection allows isolating each loop to view individual performance only.

4 SPECIAL INSTRUCTIONS

Note: **For Vascular Systems Only:** Before system calibration, verify that additional filter (copper–aluminum filter) is not installed on top of collimator. (Open sensor hinge assembly to verify.) If installed, remove before performing calibration.

5 CAL PROCEDURE

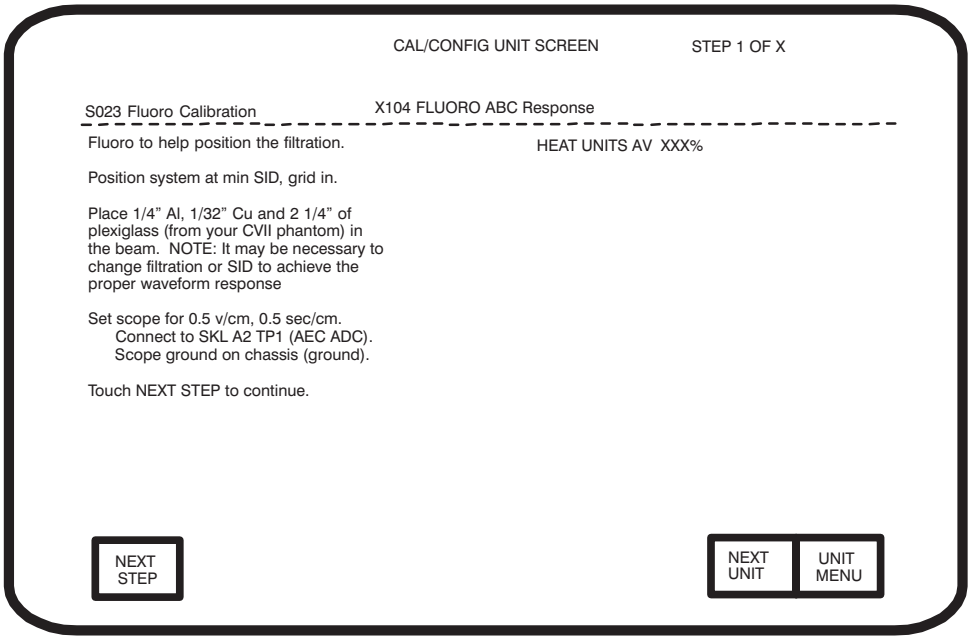
5-1 Step 1. Position Filtration

- Position the Image Intensifier tube and X–ray tube at minimum SID. On LU systems, position the table top 12 inches from the Image Intensifier tube.
- Position the grid in X–ray beam.
- Place 1/32 inch of copper, 1/4 inch of aluminum, and 2–1/4 inches of acrylic on the table (stack with acrylic on the bottom and copper on the top).

Note: The calibration may require varying the filtration thickness or SID in order to achieve the proper square wave response in Step 2.

- Take fluoro exposures and center the filtration in the X–ray beam.
- Touch NEXT STEP softkey to proceed to Step 2.

X104 STEP 1 SCREEN DISPLAY



Note: The adjustments in the following steps of this unit are interactive. After all adjustments have been made, the waveform on the scope will appear more rounded than the square wave shown in Illustration 138.

5-2 Step 2. RADCNTRL Damping Factor Adjustment.

- Take a fluoro exposure.
- While maintaining the exposure, touch RADCNTRL DAMPING FACTOR softkey and use the console dial to adjust the value of the RADCNTRL DAMPING FACTOR until the brightness error signal observed on the oscilloscope is critically damped. See Illustration 138. Increase the damping until the error signal is ringing with one cycle of overshoot. Then, decrease until ringing just disappears. The loop is critically damped when the square wave indicates no overshoot on top and less than 250 mV overshoot on bottom.
- Terminate exposure and touch NEXT STEP softkey to proceed to Step 3.

X104 STEP 2 SCREEN DISPLAY

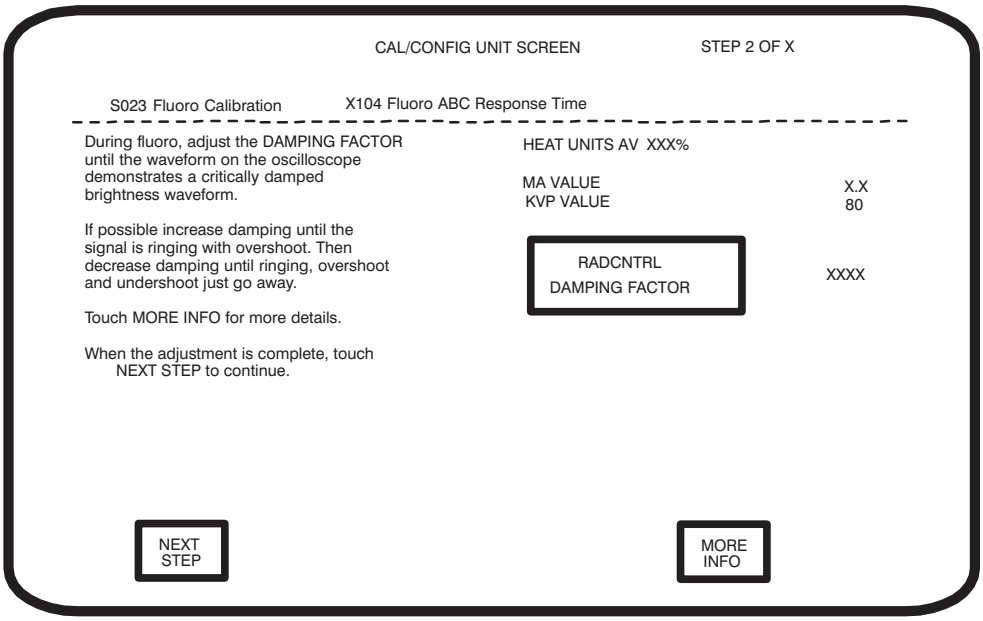
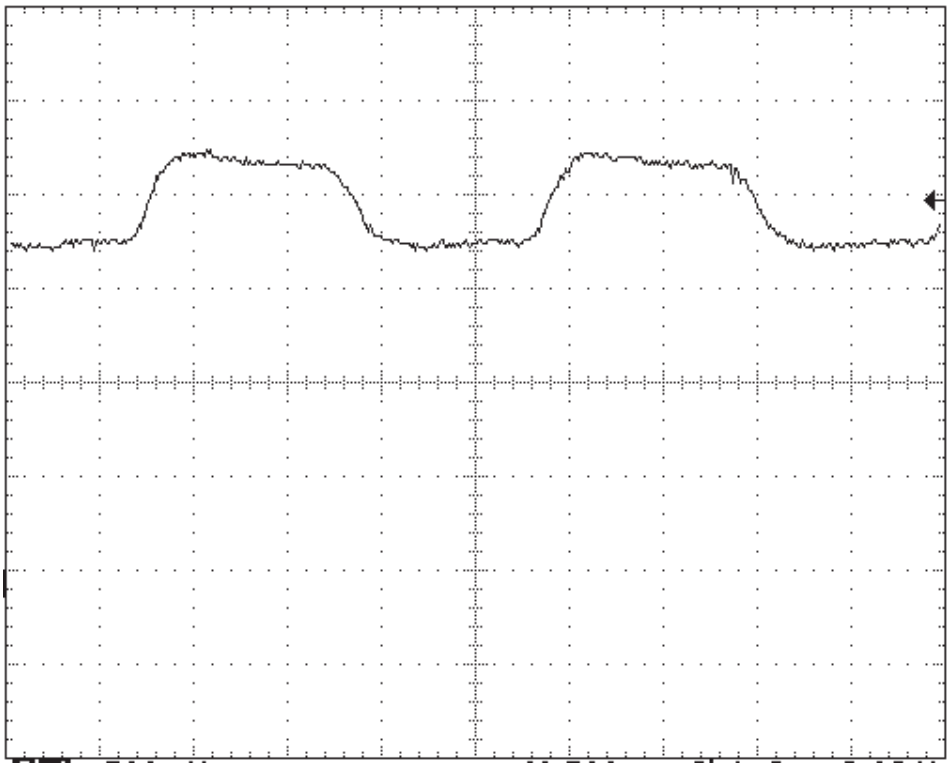


Illustration 138 – X104, RADCNTRL Damping Adjustment



X104 STEPS 2, 3, 4, AND 5 “MORE INFO” PAGE 1 SCREEN DISPLAY

CAL/CONFIG UNIT SCREEN STEP X OF X

S023 Fluoro Calibration X104 Fluoro ABC Response Time Page 1 of 3

ABC DAMPING INFORMATION

Both footswitch and handswitch are active during this unit.

The objective of adjusting ABC Damping is to allow the ABC to adjust to proper brightness as quickly as possible when the amount of xrays reaching the image intensifier changes, but still not have oscillation of brightness when the xray intensity at the II is constant.

In order to accomplish this, the ECM adds a square wave to the output of the brightness pickup. The ABC software then corrects. In a perfect world, the resulting signal at the AEC ABC test point would be a square wave with an average amplitude of 2V. The transfer function of the ABC does not allow this.

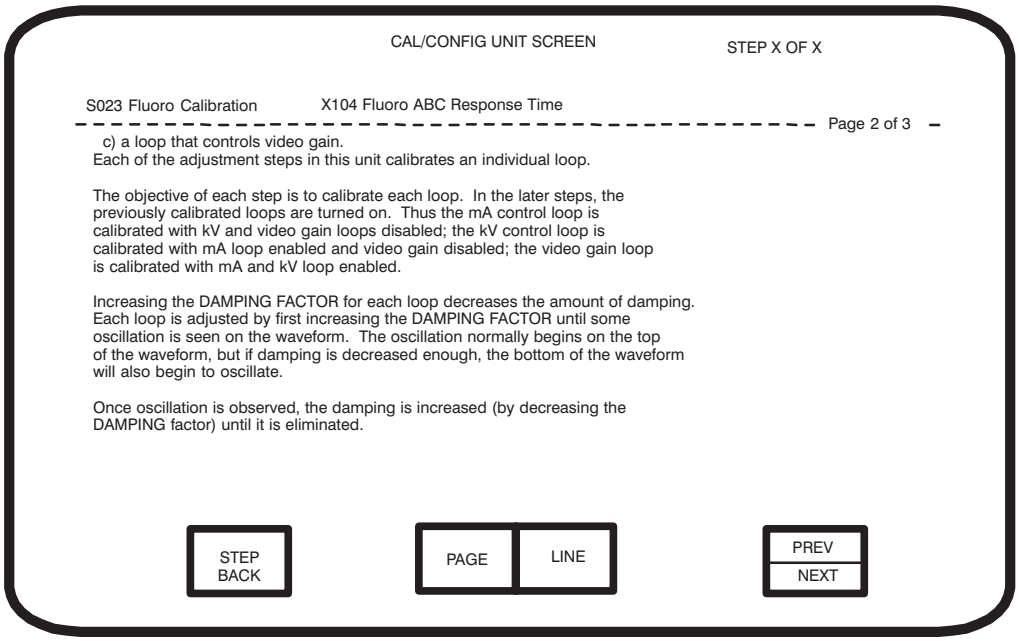
ABC control is composed of three main loops:

a) a loop that controls average mA by adjusting filament drive. On systems with pulsed fluoro, pulse width is also adjusted in this loop.

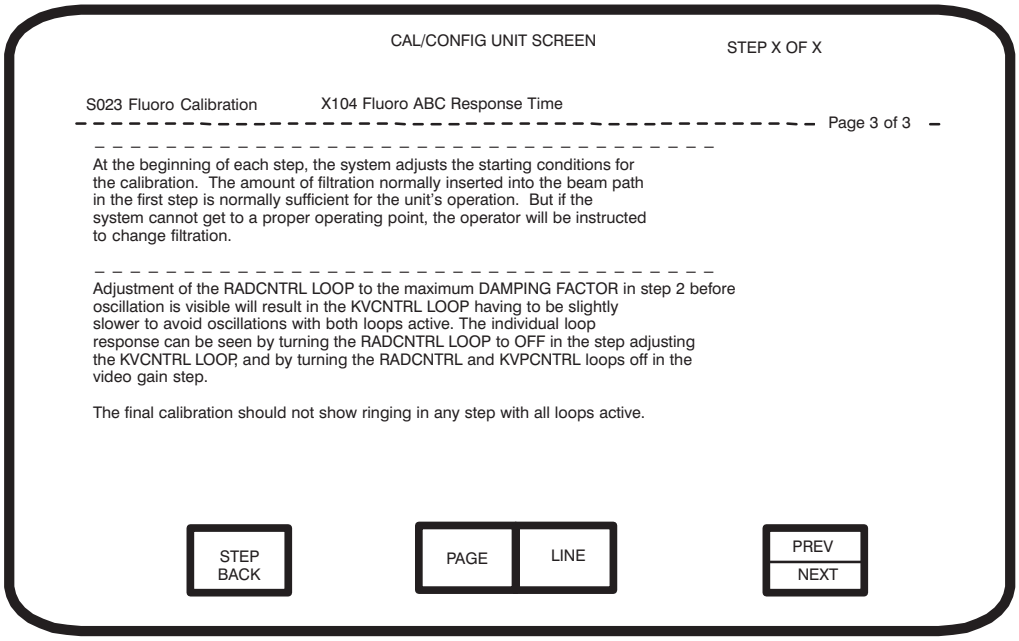
b) a loop that controls kVp.

STEP BACK | PAGE | LINE | PREV | NEXT

X104 STEPS 2, 3, 4, AND 5 “MORE INFO” PAGE 2 SCREEN DISPLAY



X104 STEPS 2, 3, 4, AND 5 “MORE INFO” PAGE 3 SCREEN DISPLAY



5-3 Step 3. KVPCNTRL Damping Factor Adjustment

- Take and maintain a fluoro exposure.
- Maintain the exposure until the “KVP OVERRIDE ADJUSTMENT COMPLETE” message is displayed.

Note: On systems configured with VIC module, an “ADJUSTING APERTURE/FOV FOR KVP OVERRIDE CONDITION” message is displayed while the override adjustment is being accomplished. This message is not displayed for systems with Imageur.

- Touch KVPCNTRL DAMPING FACTOR softkey and, using the console dial, adjust the value of the KVPCNTRL DAMPING FACTOR until the brightness error signal observed on the oscilloscope is critically damped. See Illustration 139.

Note: The KVP loop is slower than the RADCNTRL loop. This may produce an error signal response with more rounded edges.

- Touch NEXT STEP softkey to proceed to Step 4.

X104 STEP 3 SCREEN DISPLAY

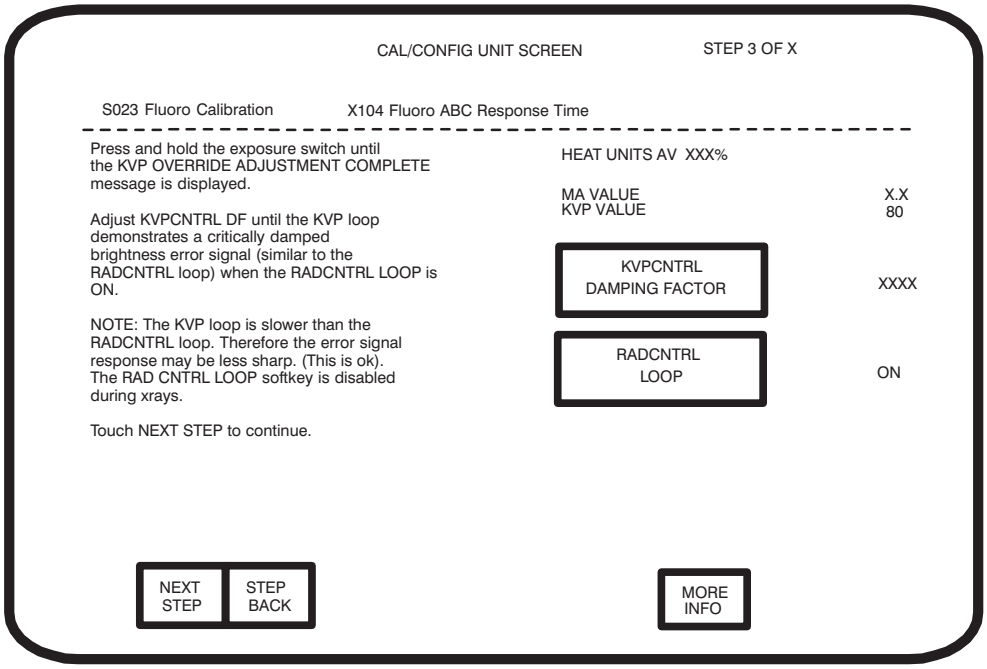
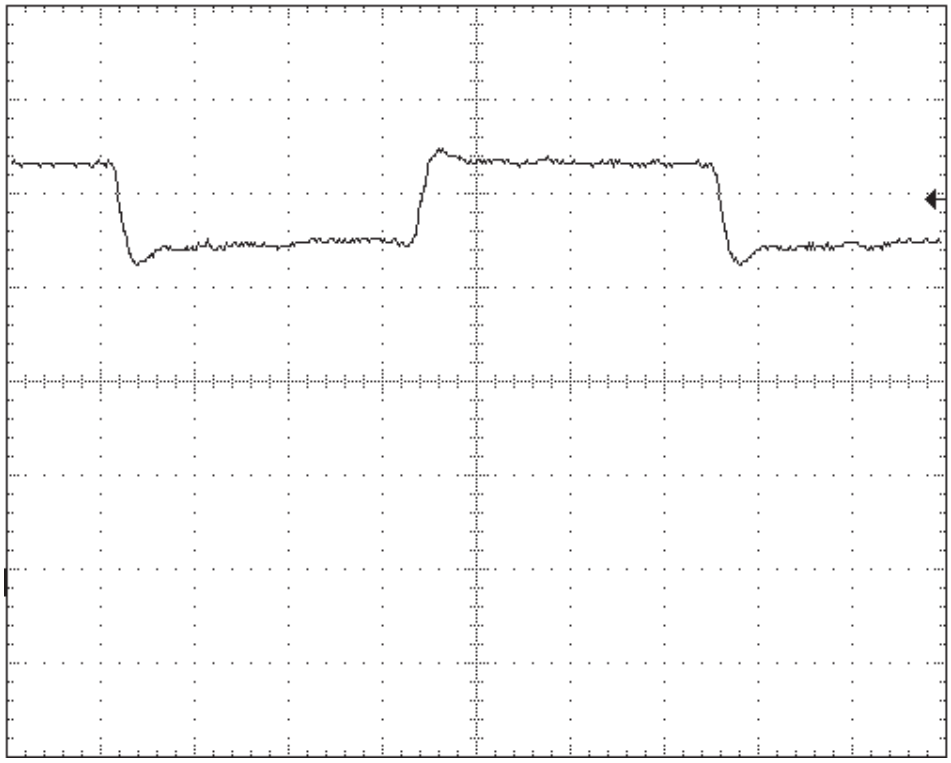


Illustration 139 – X104, KVPCNTRL Damping Adjustment



5-4 Step 4. VGCNTRL Damping Factor Adjustment

- Take a fluoro exposure.
- Maintain the exposure until the “VIDEO GAIN OVERRIDE ADJUSTMENT COMPLETE” message is displayed.

Note: An “ADJUSTING APERTURE FOR VIDEO GAIN OVERRIDE CONDITION” message is displayed while the override adjustment is being accomplished.

- Touch VGCNTRL DAMPING FACTOR softkey and, using the console dial, adjust the value of the VGCNTRL DAMPING FACTOR until the video loop indicates a critically damped brightness error signal on the oscilloscope (similar to RADCNTRL loop damping). See Illustration 140.
- For pulsed fluoro systems with Fluoro Filament Standby Reduction software, touch NEXT STEP softkey to proceed to Step 5.
- For ALL non–pulsed fluoro systems, AND for pulsed fluoro systems without Fluoro Filament Standby Reduction software, touch NEXT UNIT or UNIT MENU softkey to exit the calibration unit.

Note: For ALL non–pulsed fluoro systems, AND for pulsed fluoro systems without Fluoro Filament Standby Reduction software, when in the viewing (browse) mode, a NEXT STEP softkey is displayed to permit return to Step 1.

X104 STEP 4 SCREEN DISPLAY

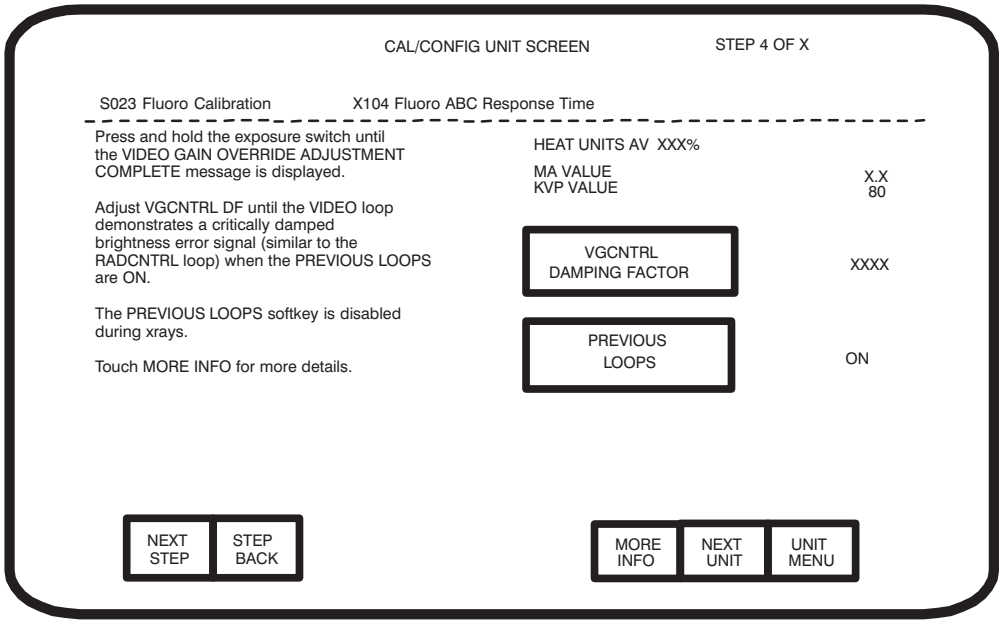
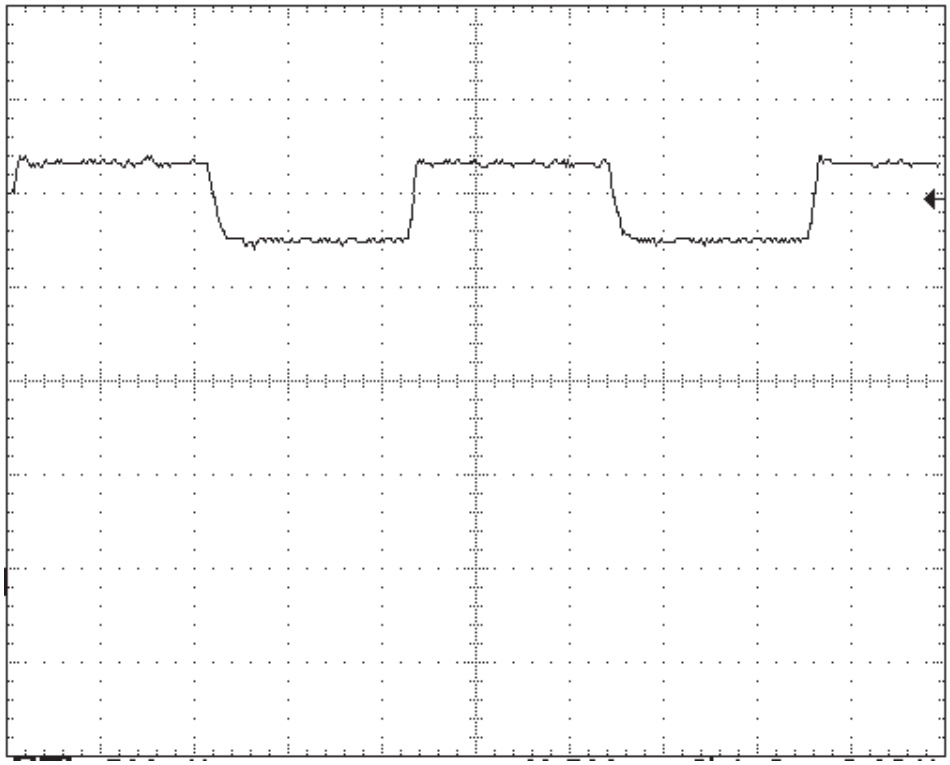


Illustration 140 – X104, VGCNTRL Damping Adjustment



5-5 Step 5. PULSED FLUORO FILAMENT BOOST Adjustment

Note: Step 5 applies ONLY for pulsed fluoro systems with Fluoro Filament Standby Reduction software.

- Take a fluoro exposure and observe the response of the Brightness Signal during the transition into active fluoro.
- Repeat fluoro transitions while adjusting PULSED FLUORO FILAMENT BOOST to obtain a waveform as indicated by acceptable waveforms [1] and [2] shown at top of Illustration 141. Waveform [1] is lower limit for correct boost level adjustment. Waveform [2] is upper limit for correct boost level adjustment. Any boost level adjustment between waveforms [1] and [2] is also acceptable. (Waveforms [3] and [4] at bottom of Illustration 141 are examples of unacceptable boost level adjustment.)

Note: Ignore the waveform obtained for the first fluoro exposure after entering this step, since the ABC has not settled on final value.

- Touch NEXT UNIT or UNIT MENU softkey to exit the calibration unit.

Note: When in the viewing (browse) mode, a NEXT STEP softkey is displayed to permit return to Step 1.

X104 STEP 5 SCREEN DISPLAY

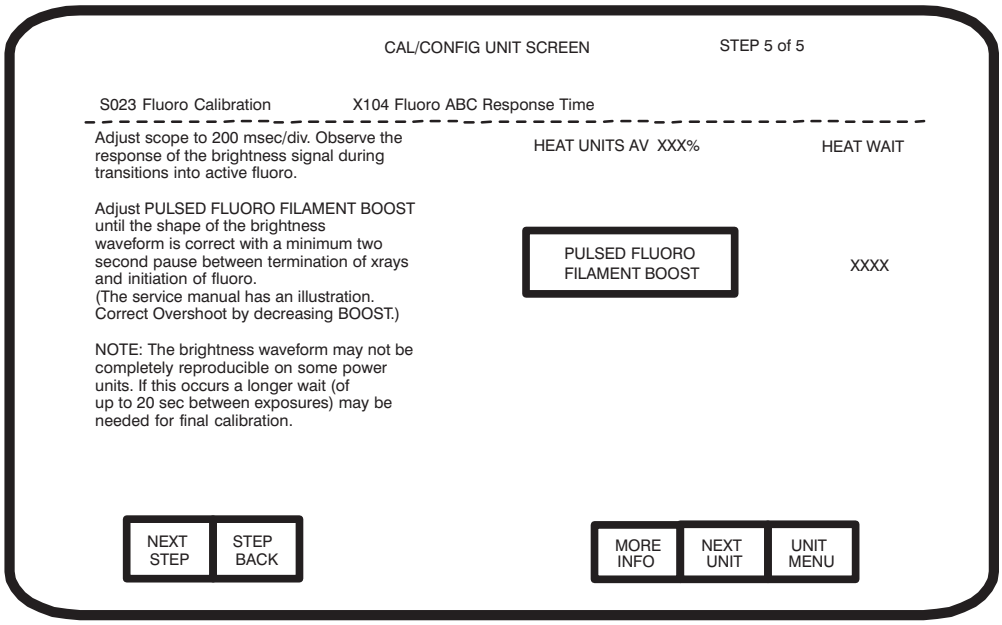
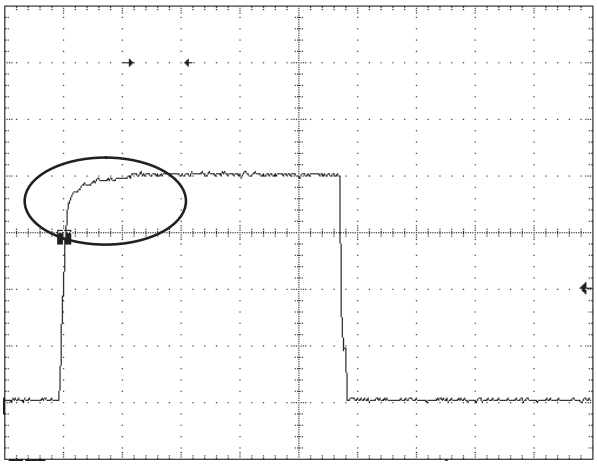
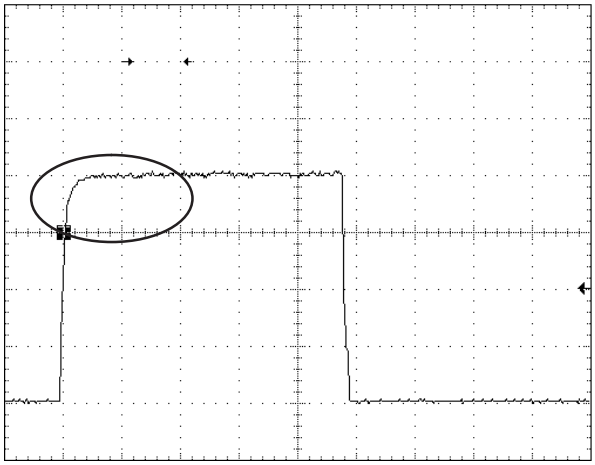


Illustration 141 – X104, Pulsed Fluoro Filament Boost

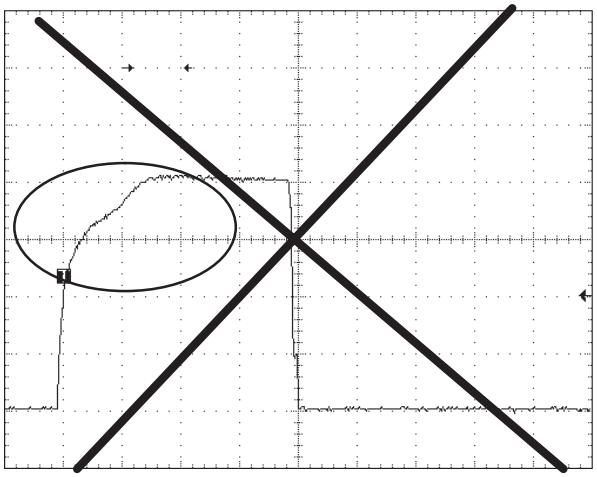
1 EXAMPLE OF ***ACCEPTABLE*** ADJUSTMENT:
LOWER LIMIT FOR CORRECT BOOST LEVEL.



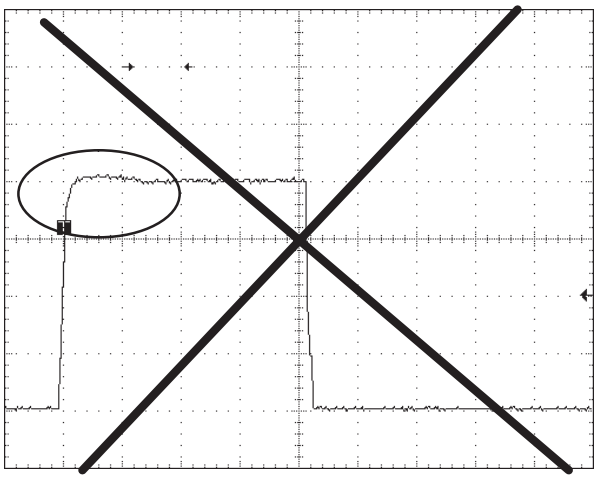
2 EXAMPLE OF ***ACCEPTABLE*** ADJUSTMENT:
UPPER LIMIT FOR CORRECT BOOST LEVEL.



3 EXAMPLE OF ***UNACCEPTABLE*** ADJUSTMENT:
BOOST LEVEL IS TOO LOW.



4 EXAMPLE OF ***UNACCEPTABLE*** ADJUSTMENT:
BOOST LEVEL IS TOO HIGH.



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UNIT X105 – Cine ABC Damping

Time: x h xx min – Personnel: 1 field engineer

1 DESCRIPTION

Calibration Unit X105 adjusts the cine automatic brightness control parameters (RADCNTRL and KVPCNTRL) to maintain a constant light output from the Image Intensifier tube during cine operation regardless of variations in thickness and density of the object being scanned.

2 EQUIPMENT REQUIRED

Filtration (1/4 inch aluminum, 1/32 inch copper, and 2–1/4 inches acrylic), Storage oscilloscope, and test leads.

3 TEST SETUP

Setup the oscilloscope as follows:

Note: Ensure that storage scope is in the envelope mode or signal aliasing may occur.

VERT AMPL: 0.5 V/cm
TIME BASE: 0.5 sec/cm
Connect probe to SKL A2 TP1 and chassis (ground).

Note: Normal calibration is accomplished with loop selection in ON position. Turning loop OFF during Damping Adjustment will result in performance viewed different from Applications. this selection allows isolating each loop to view individual performance only.

4 SPECIAL INSTRUCTIONS

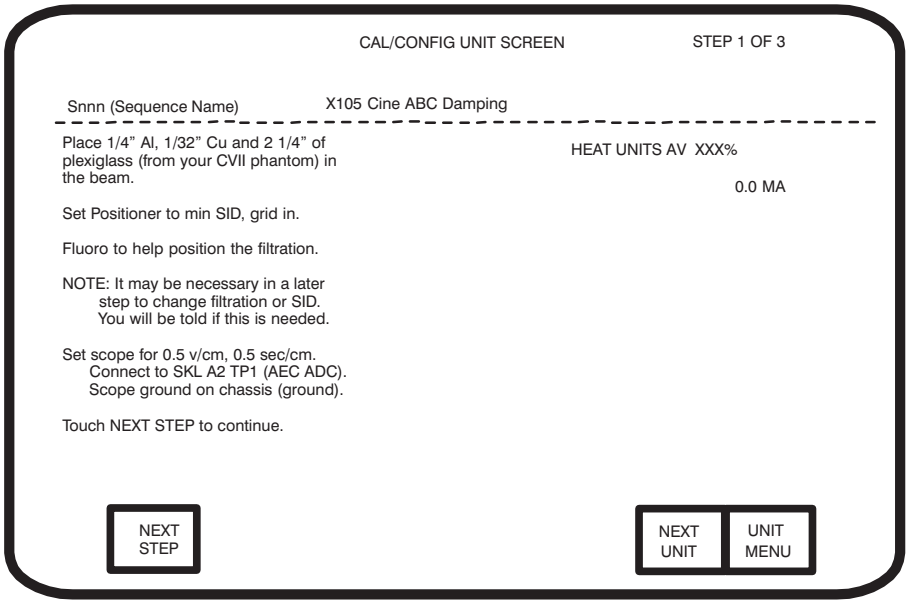
Note: **For Vascular Systems Only:** Before system calibration, verify that additional filter (copper–aluminum filter) is not installed on top of collimator. (Open sensor hinge assembly to verify.) If installed, remove before performing calibration.

5 CAL PROCEDURE

5-1 Step 1. Position Filtration

- Position the Image Intensifier tube and x–ray tube at minimum SID. On TILT–C and LU systems, position the table top 12 inches from the Image Intensifier tube.
- Position the grid in x–ray beam.
- Place 1/32 inch of copper, 1/4 inch of aluminum, and 2–1/4 inches of acrylic on the table (stack with acrylic on the bottom and copper on the top).
- Take fluoro exposures and center the filtration in the x–ray beam.
- Touch NEXT STEP softkey to proceed to Step 2.

X105 STEP 1 SCREEN DISPLAY



Note: The calibration may require varying the filtration thickness or SID in order to achieve the proper square wave response in Step 2.

5-2 Step 2. RADCNTRL Damping Factor Adjustment

- Take and maintain a cine exposure.
- Touch RADCNTRL DAMPING FACTOR softkey and, using the console dial, adjust RADCNTRL DAMPING FACTOR until the brightness error signal observed on the scope is critically damped. See Illustration 142. Adjust RADCNTRL DAMPING FACTOR to optimize square wave response. Adjust for less than 250 mV undershoot.

Note: Cine Radcntrl Damping waveform will not indicate overshoot described in screen text.

- Terminate the exposure and touch the NEXT STEP softkey to proceed to Step 3.

X105 STEP 2 SCREEN DISPLAY

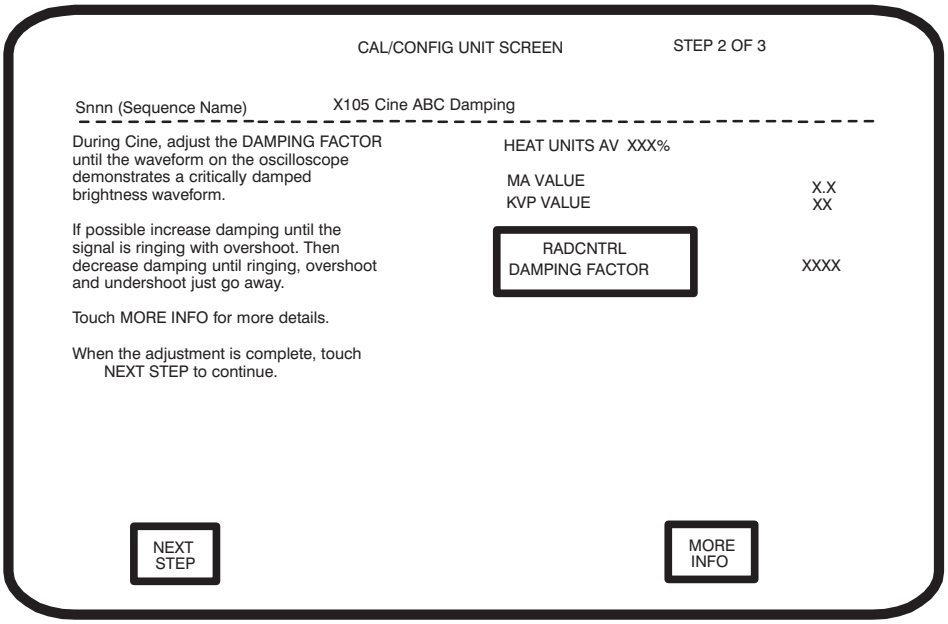
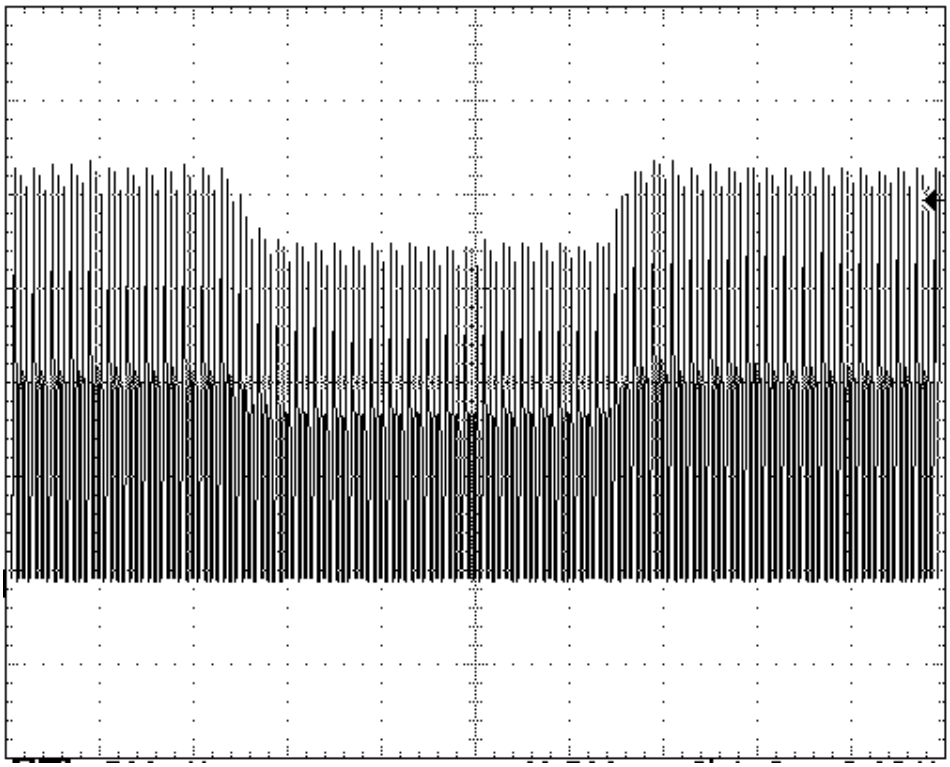


Illustration 142 – X105, Cine RADCNTRL Damping Adjustment



X105 STEPS 2 AND 3 “MORE INFO” PAGE 1 SCREEN DISPLAY

CAL/CONFIG UNIT SCREEN STEP X OF 3

Snnn (Sequence Name) X105 Cine ABC Damping

Page 1 of 3

ABC DAMPING INFORMATION

Both footswitch and handswitch are active during this unit.

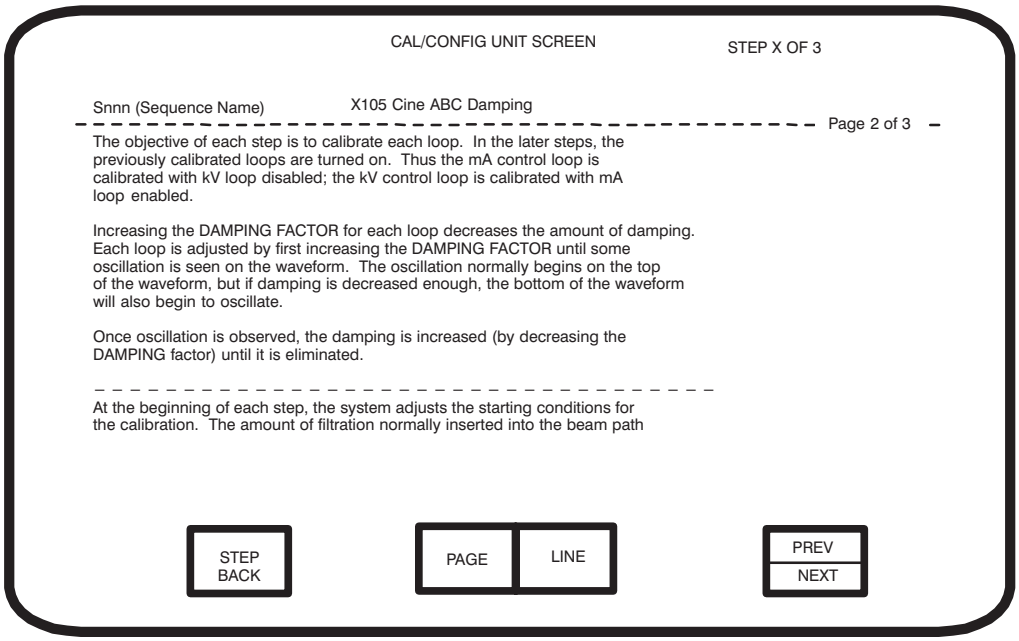
The objective of adjusting ABC Damping is to allow the ABC to adjust to proper brightness as quickly as possible when the amount of xrays reaching the image intensifier changes, but still not have oscillation of brightness when the xray intensity at the II is constant.

In order to accomplish this, the ECM adds a square wave to the output of the brightness pickup. The ABC software then corrects. In a perfect world, the resulting signal at the AEC ABC test point would be a square wave with an average amplitude of 2V. The transfer function of the ABC does not allow this.

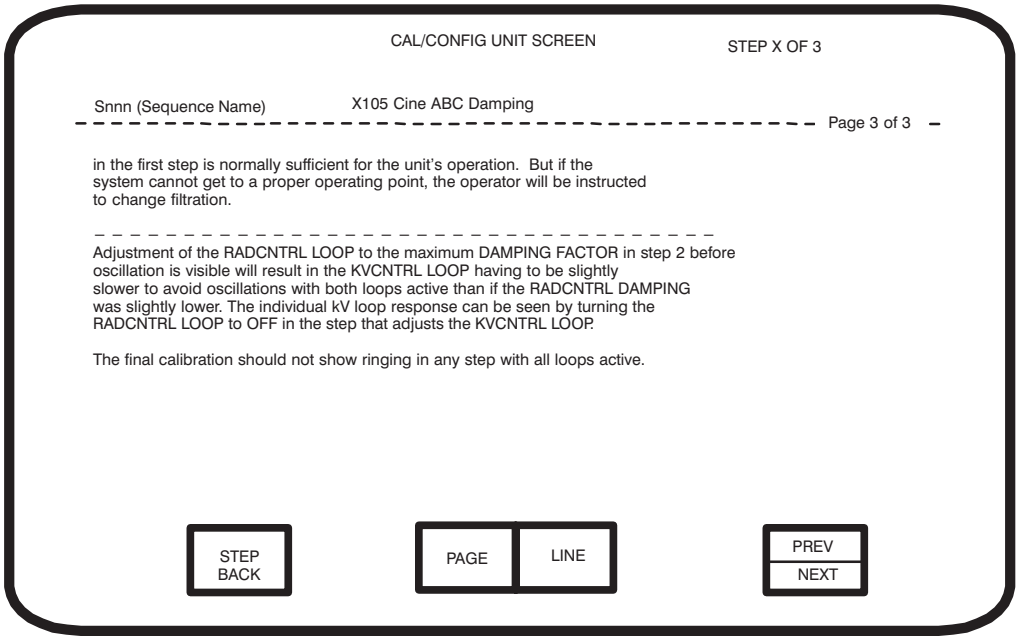
ABC control is composed of two main loops:
a) a loop that controls average mA by adjusting filament drive and pulse width.
b) a loop that controls kVp.

STEP BACK | PAGE | LINE | PREV | NEXT

X105 STEPS 2 AND 3 "MORE INFO" PAGE 2 SCREEN DISPLAY



X105 STEPS 2 AND 3 "MORE INFO" PAGE 3 SCREEN DISPLAY



5-3 Step 3. KVPCNTRL Damping Factor Adjustment

- Take an exposure with the fluoro footswitch or console handswitch. The following message is displayed while the override adjustment is being accomplished.

ADJUSTING BRT INTEGRATOR/FOV FOR KVP OVERRIDE CONDITION

- Maintain the exposure until the following message is displayed.

KVP OVERRIDE ADJUSTMENT COMPLETE

- Touch KVPCNTRL DAMPING FACTOR softkey and, using the console dial, adjust KVPCNTRL DAMPING FACTOR until the kVp loop response observed on the oscilloscope is critically damped. See Illustration 143.

Note: THIS ADJUSTMENT IS CRITICAL. INCREASE DAMPING UNTIL THE SQUARE WAVE ON THE SCOPE IS RINGING WITH ONE CYCLE OF OVERSHOOT. THEN, DECREASE THE DAMPING UNTIL RINGING JUST DISAPPEARS. DO NOT OVER ADJUST WHEN DECREASING THE RINGING OR A DATABASE ERROR MAY BE ENTERED. TO PREVENT OVER ADJUSTMENT, OBSERVE THAT THE KVPCNTRL DAMPING FACTOR VALUE INDICATED ON THE CONSOLE SCREEN NEVER REACHES ZERO (0000) WHILE MAKING THE ADJUSTMENT.

- Touch NEXT UNIT or UNIT MENU softkey to exit the unit. An “Updating NV database” message is displayed while the calibration data is being loaded into the system.

X105 STEP 3 SCREEN DISPLAY

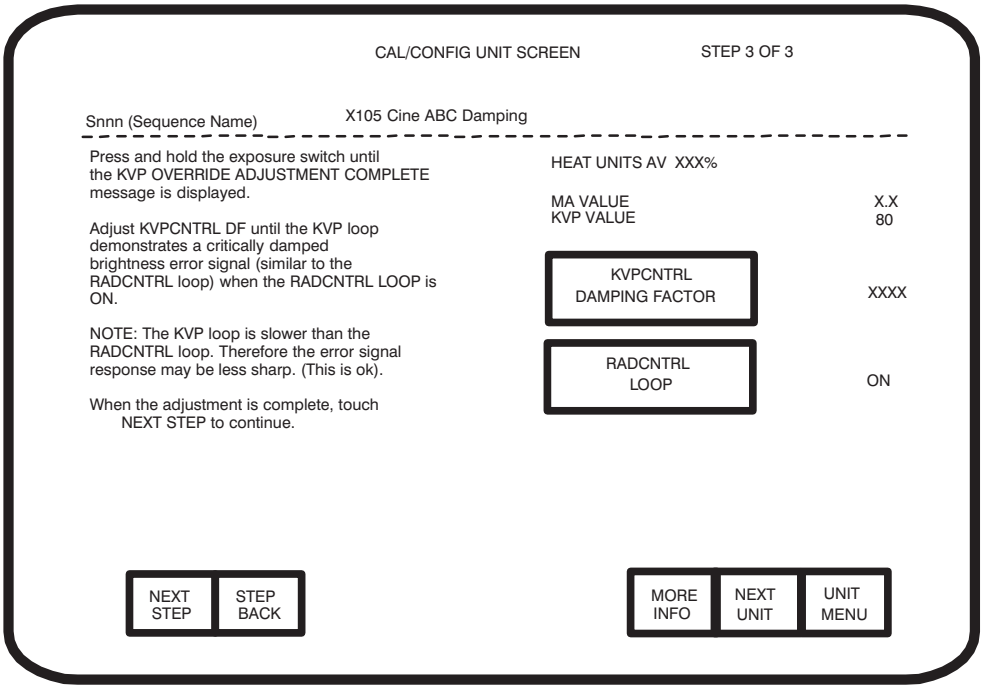
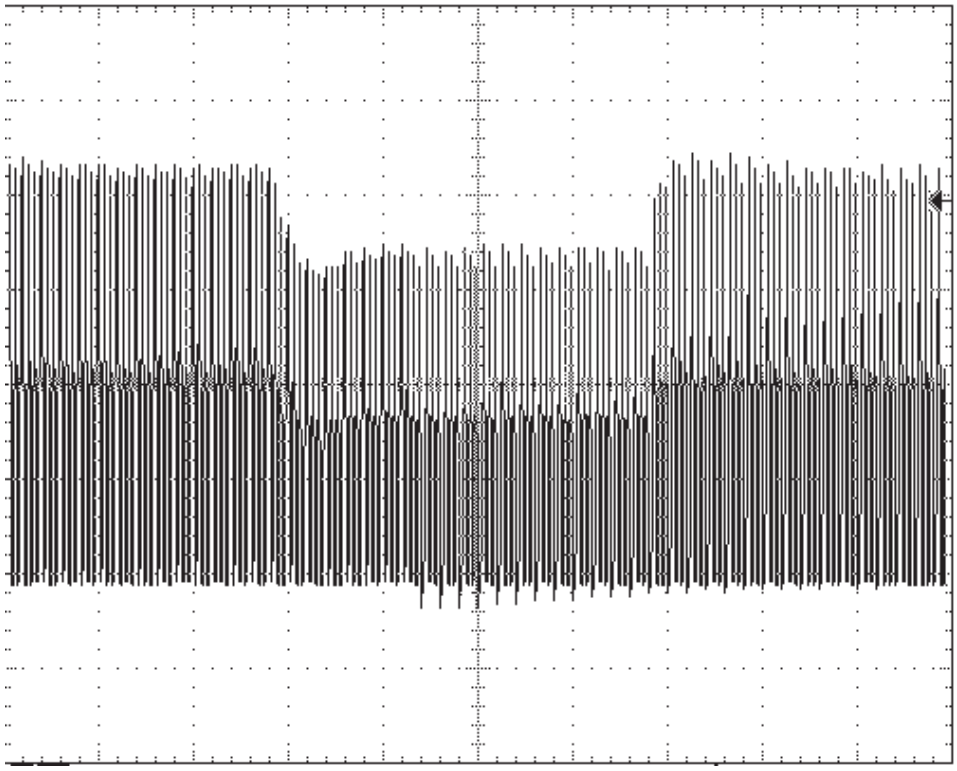


Illustration 143 – X105, KVPCNTRL Damping Adjustment



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UNIT X107 – Fluoro Entrance Dose Calibration

Time: x h xx min – Personnel: 1 field engineer

1 DESCRIPTION

Calibration Unit X107 calibrates the parameters controlling fluoro entrance dose (The rate of radiation entering the entrance plane of the Image Intensifier tube during fluoro exposure). Three entrance dose levels(low, normal, and high) are calibrated. Seven steps may be required to accomplish the calibration depending on verification tests and/or operator experience. Steps 1 through 3 perform an auto–calibration of the entrance dose levels. Steps 4 and 5 are used to perform confidence tests if there is any doubt that the entrance doses are properly set. Steps 6 and 7 provide a manual calibration of the entrance dose rates when the confidence tests indicate dose rates are out of tolerance.

For Advantx–E Vascular Systems, the recommended dose value for the applicable II size are given Table 43 for everywhere EXCEPT Germany and Switzerland. (For Germany use Table 44. For Switzerland use Table 45.)

For all other systems, the recommended dose values for the applicable II size are given Table 46 for everywhere EXCEPT Germany and Switzerland. (For Germany use Table 47. For Switzerland use Table 48.)

WARNING

FOR ADVANTX–E VASCULAR SYSTEMS ONLY:

BEWARE OF THE EXISTENCE OF TWO DIFFERENT TYPES OF DOSES:

II Entrance Doses: doses displayed and dialed on the console in this calibration Unit**.** The **Recommended Entrance Doses** presented in the tables hereafter are the **II Entrance Doses** allowing the best functionning conditions of the system and the ones which should be used**.**

Measured Entrance Doses: result of the measurement procedure, dosimeterprobe close to the anticollision plate and dose reduced by the antiscatter grid.

II Entrance Doses are equal to Measured Entrance doses divided by two.

NOTICE

For 12 inch (30 cm) Image Intensifier, Cardiac corresponds to a configuration including a Plumbicon Pick–Up Tube and Vascular corresponds to a configuration including a Saticon Pick–Up Tube.

NOTICE

VIC cameras on 9 inch (22 cm) Image Intensifiers are equipped either with a Plumbicon or a Saticon. In both cases, Recommended Entrance Dose Levels have the same values and should be calibrated in the same way.

Note: The default displayed values for 12 inch (30 cm) II are the values for Vascular Systems.

Note: The dose values shown in the tables hereafter have been modified to reflect the accuracy of the TV aperture (10% steps). Some software revisions may show/allow dose values finer than 10% steps.

Table 43 – Recommended Entrance Dose Levels (Except for Germany and Switzerland) for Advantx–E Vascular Systems

RECOMMENDED II ENTRANCE DOSE LEVELS				
II TYPE	**FOV**	**DOSE**	**EXPOSURE (mR/min)**	**EXPOSURE (μGy/min)**
9 inch (22 cm)	9	LOW	1.5 mR/min	13.14 μGy/min
9 inch (22 cm)	9	NORM	3.6 mR/min	31.54 μGy/min
9 inch (22 cm)	9	HIGH	4.9 mR/min	42.92 μGy/min
12 inch (30 cm) Cardiac	12	LOW	1.1 mR/min	9.636 μGy/min
12 inch (30 cm) Cardiac	12	NORM	2.7 mR/min	23.65 μGy/min
12 inch (30 cm) Cardiac	12	HIGH	4.1 mR/min	35.92 μGy/min
12 inch (30 cm) Vascular	12	LOW	1.0 mR/min	8.76 μGy/min
12 inch (30 cm) Vascular	12	NORM	2.4 mR/min	21.02 μGy/min
12 inch (30 cm) Vascular	12	HIGH	3.7 mR/min	32.41 μGy/min
16 inch (40 cm)	16	LOW	1.2 mR/min	10.51 μGy/min
16 inch (40 cm)	16	NORM	2.7 mR/min	23.65 μGy/min
16 inch (40 cm)	16	HIGH	4.1 mR/min	35.92 μGy/min

Table 44 – Recommended Entrance Dose Levels for Germany only , for Advantx–E Vascular Systems

RECOMMENDED II ENTRANCE DOSE LEVELS (GERMANY)				
II TYPE	**FOV**	**DOSE**	**EXPOSURE (mR/min)**	**EXPOSURE (μGy/min)**
9 inch (22 cm)	9	LOW	1.5 mR/min	13.14 μGy/min
9 inch (22 cm)	9	NORM	3.6 mR/min (See Note 1.)	31.54 μGy/min (See Note 1)
9 inch (22 cm)	9	HIGH	3.6 mR/min (See Note 1.)	31.54 μGy/min (See Note 1)
12 inch (30 cm) Cardiac	12	LOW	1.1 mR/min	9.636 μGy/min
12 inch (30 cm) Cardiac	12	NORM	2.4 mR/min (See Note 1.)	21.02 μGy/min (See Note 1)
12 inch (30 cm) Cardiac	12	HIGH	2.4 mR/min (See Note 1.)	21.02 μGy/min (See Note 1)
12 inch (30 cm) Vascular	12	LOW	1.1 mR/min	9.636 μGy/min
12 inch (30 cm) Vascular	12	NORM	2.4 mR/min (See Note 1.)	21.02 μGy/min (See Note 1)
12 inch (30 cm) Vascular	12	HIGH	2.4 mR/min (See Note 1.)	21.02 μGy/min (See Note 1)
16 inch (40 cm)	16	LOW	0.6 mR/min	5.256 μGy/min
16 inch (40 cm)	16	NORM	1.4 mR/min (See Note 1.)	12.26 μGy/min (See Note 1)
16 inch (40 cm)	16	HIGH	1.4 mR/min (See Note 1.)	12.26 μGy/min (See Note 1)
Note 1: Maximum allowed value in order to meet local regulations.				

Table 45 – Recommended Entrance Dose Levels for Switzerland only , for Advantx–E Vascular Systems

RECOMMENDED II ENTRANCE DOSE LEVELS (SWITZERLAND)				
II TYPE	**FOV**	**DOSE**	**EXPOSURE (mR/min)**	**EXPOSURE (μGy/min)**
9 inch (22 cm)	9	LOW	1.5 mR/min	13.14 μGy/min
9 inch (22 cm)	9	NORM	3.6 mR/min	31.54 μGy/min
9 inch (22 cm)	9	HIGH	4.9 mR/min	42.92 μGy/min
12 inch (30 cm) Cardiac	12	LOW	1.1 mR/min	9.636 μGy/min
12 inch (30 cm)Cardiac	12	NORM	2.7 mR/min	23.65 μGy/min
12 inch (30 cm) Cardiac	12	HIGH	4.1 mR/min	35.92 μGy/min
12 inch (30 cm) Vascular	12	LOW	1.0 mR/min	8.76 μGy/min
12 inch (30 cm) Vascular	12	NORM	2.4 mR/min	21.02 μGy/min
12 inch (30 cm) Vascular	12	HIGH	3.7 mR/min	32.41 μGy/min
16 inch (40 cm)	16	LOW	1.0 mR/min	8.76 μGy/min
16 inch (40 cm)	16	NORM	2.2 mR/min (See Note 1.)	19.27 μGy/min (See Note 1)
16 inch (40 cm)	16	HIGH	2.2 mR/min (See Note 1.)	19.27 μGy/min (See Note 1)
Note 1: Maximum allowed value in order to meet local regulations.				

Table 46 – Recommended Entrance Dose Levels (Except for Germany and Switzerland), for all other Systems

RECOMMENDED ENTRANCE DOSE LEVELS				
II TYPE	**FOV**	**DOSE**	**EXPOSURE (mR/min)**	**EXPOSURE (μGy/min)**
9 inch (22 cm)	9	LOW	2.2 mR/min	19.27 μGy/min
9 inch (22 cm)	9	NORM	4.5 mR/min	39.42 μGy/min
9 inch (22 cm)	9	HIGH	8.5 mR/min	74.46 μGy/min
12 inch (30 cm)	12	LOW	1.1 mR/min	9.636 μGy/min
12 inch (30 cm)	12	NORM	2.4 mR/min	21.02 μGy/min
12 inch (30 cm)	12	HIGH	4.5 mR/min	39.42 μGy/min
16 inch (40 cm)	16	LOW	1.4 mR/min	12.26 μGy/min
16 inch (40 cm)	16	NORM	2.7 mR/min	23.65 μGy/min
16 inch (40 cm)	16	HIGH	5.1 mR/min	44.68 μGy/min

Table 47 – Recommended Entrance Dose Levels for Germany only, for all other Systems

RECOMMENDED ENTRANCE DOSE LEVELS (GERMANY)				
II TYPE	**FOV**	**DOSE**	**EXPOSURE (mR/min)**	**EXPOSURE (μGy/min)**
9 inch (22 cm)	9	LOW	2.2 mR/min	19.27 μGy/min
9 inch (22 cm)	9	NORM	3.6 mR/min (See Note 1.)	31.54 μGy/min (See Note 1)
9 inch (22 cm)	9	HIGH	3.6 mR/min (See Note 1.)	31.54 μGy/min (See Note 1)
12 inch (30 cm)	12	LOW	1.1 mR/min	9.636 μGy/min
12 inch (30 cm)	12	NORM	2.1 mR/min (See Note 1.)	18.4 μGy/min (See Note 1)
12 inch (30 cm)	12	HIGH	2.1 mR/min (See Note 1.)	18.4 μGy/min (See Note 1)
16 inch (40 cm)	16	LOW	0.6 mR/min (See Note 2.)	5.256 μGy/min (See Note 2)
16 inch (40 cm)	16	NORM	1.4 mR/min (See Note 1.)	12.26 μGy/min (See Note 1)
16 inch (40 cm)	16	HIGH	1.4 mR/min (See Note 1.)	12.26 μGy/min (See Note 1)

Note 1: Maximum allowed value in order to meet local regulations.
Note 2: Or as low as possible.

Table 48 – Recommended Entrance Dose Levels for Switzerland only, for all other Systems

RECOMMENDED ENTRANCE DOSE LEVELS (SWITZERLAND)				
II TYPE	**FOV**	**DOSE**	**EXPOSURE (mR/min)**	**EXPOSURE (μGy/min)**
9 inch (22 cm)	9	LOW	2.2 mR/min	19.27 μGy/min
9 inch (22 cm)	9	NORM	4.5 mR/min	39.42 μGy/min
9 inch (22 cm)	9	HIGH	6.1 mR/min (See Note 1.)	53.44 μGy/min (See Note 1)
12 inch (30 cm)	12	LOW	1.1 mR/min	9.636 μGy/min
12 inch (30 cm)	12	NORM	2.4 mR/min	21.02 μGy/min
12 inch (30 cm)	12	HIGH	3.5 mR/min (See Note 1.)	30.66 μGy/min (See Note 1)
16 inch (40 cm)	16	LOW	1.4 mR/min	12.26 μGy/min
16 inch (40 cm)	16	NORM	2.3 mR/min (See Note 1.)	20.15 μGy/min (See Note 1)
16 inch (40 cm)	16	HIGH	2.3 mR/min (See Note 1.)	20.15 μGy/min (See Note 1)

Note 1: Maximum allowed value in order to meet local regulations.

NOTICE

Throughout this calibration unit, references to "older ASC software versions" apply to ASC softwares for OLDER software (i.e., ASC SW prior to G4.XX) single plane LCA/LCV+/LC+ systems.

Note: ***BROWSE MODE*** allows ***viewing*** of calibration values, but exposures cannot be made. When exiting the unit, NVRAM will not be updated.

CAUTION

For older ASC software versions, it is possible that exposures can be made and that NVRAM may be updated while in *BROWS*E mode. In this case, calibration data cannot be guaranteed as good; therefore calibration must be re–done.

Note: ***VERIFY MODE*** allows subjective viewing of calibration values. Exposures can be made at detail levels (selectable). Calibration values cannot be changed. When exiting the unit, NVRAM will not be updated.

CAUTION **For <u>older</u> ASC software versions, it is possible that NVRAM may be updated while in *VERIFY* mode. In this case, calibration data cannot be guaranteed as good; therefore calibration must be re–done.**

2 EQUIPMENT REQUIRED

Dosimeter (MDH/Radcal 2025, 2026 or equivalent) w/probe stand or Ion Chamber Positioning Tool 2236707 (Former ref: 2208874)
For Advantx–E Systems, Ion Chamber Positioning Tool is mandatory (See Cal Unit T015) .
For this Cal Unit, use Model 20x5–180 or 20x6–180 probe.
Metric Tape Measure.
Filtration (1/4 inch aluminum, 1/32 inch copper, and 2–1/4 inches of Plexiglas) from CV phantom
For a 9 inch (22 cm) II tube, use a 9 inch CV phantom. For a 12 inch (30 cm) or 16 inch (40 cm) II tube, use a 12 inch CV phantom.

3 SPECIAL INSTRUCTIONS

The following special instructions pertain to the running of X107.

Note: **For Vascular Systems Only:** Before system calibration, verify that additional filter (copper–aluminum filter) is not installed on top of collimator. (Open sensor hinge assembly to verify.) If installed, remove before performing calibration.

- The auto–calibration portion of this unit that uses the photo cathode current parameter for entrance dose calibration is only accurate for new Advantx system installations, or for systems with a new image intensifier tube. On all other systems it is necessary to run the manual calibration portion of this unit. This is required because of the inherent gain–fall-off of the image intensifier tube with time.
- If you rerun Cal Unit X107 after initial system calibration and a customized dosimetry profile exists (refer to Cal Unit X233), you must also rerun Cal Unit X233 to re–establish the customized dosimetry profile. If X233 is not rerun after X107, a default dosimetry profile will be established).

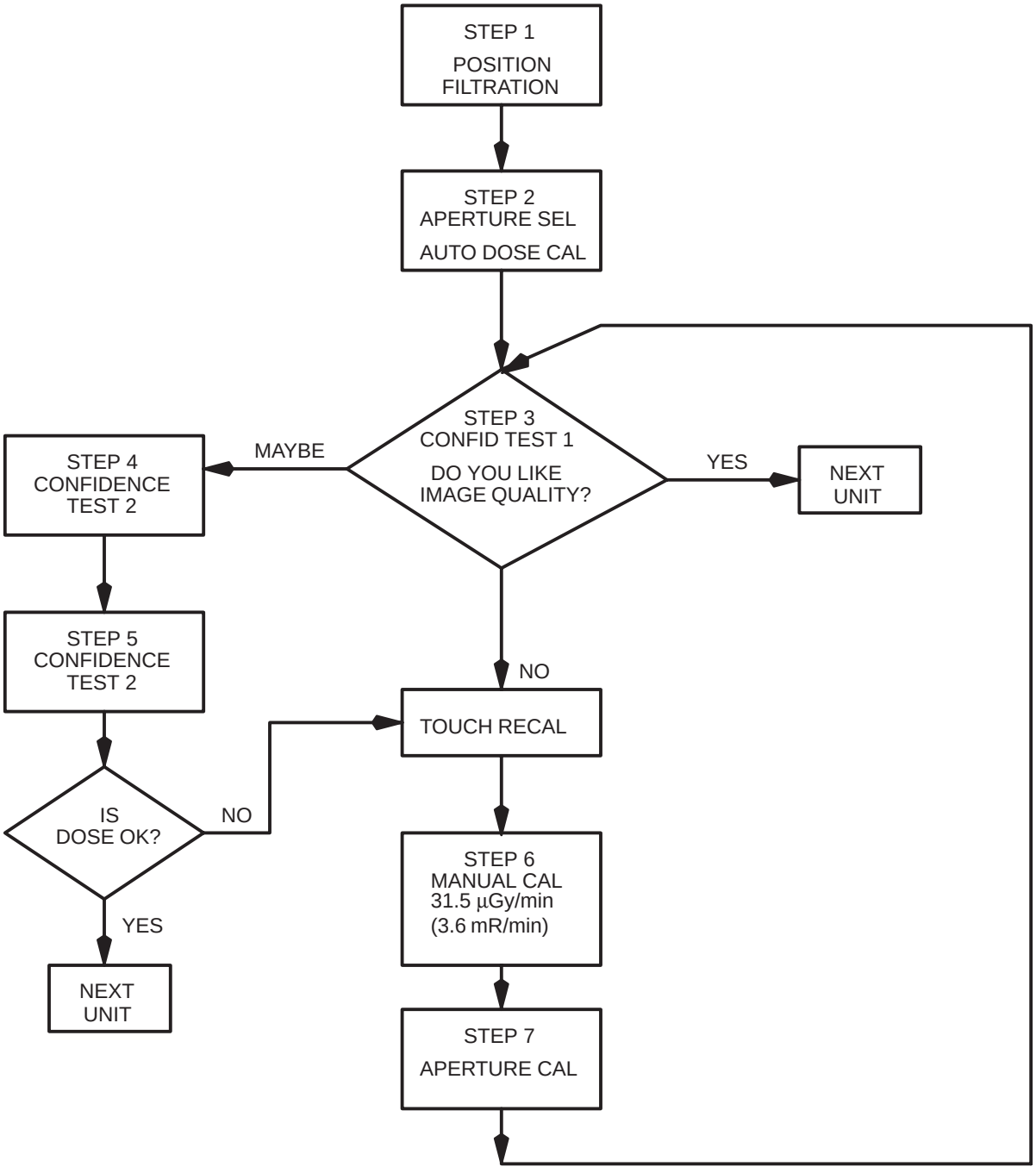
Note: Since a customized dosimetry profile is lost anytime X107 is rerun, it is recommended that you record the aperture values set in X233 so that you can easily re–establish a customized dosimetry profile when it is required.

- If X107 is rerun on systems configured with Photospot, Cine, or Digital Fluoro, you must also rerun Cal Unit X209, Photocell Calibration.

Note: For system configured with New Zealand Tapers (% Dose set to 50%, 50%, 100% for low, normal, and high detail) it is recommended that the entrance doses in Step 2 for normal and high be set to the normal default dose value.

4 PROCEDURE OVERVIEW

The following flow diagram illustrates the steps involved in performing Cal Unit X107.



* This is an arbitrary number used to calibrate dose, and does not refer to what the what the dose is actually set to.

5 CAL PROCEDURE

5-1 Step 1. Position Filtration

For Vascular Advantx–E Systems, refer to Illustration 144:

- Leave the grid in place.
- Position the table top at isocenter.
- Adjust the II anticollision plane at 30 cm +/– 0.5cm from the Table top.

For other Vascular and R&F Systems:

- Remove the grid.
- Position the Table top at isocenter.
- Position the Image Intensifier tube 12 inches (30.5 cm) above the table top for vascular systems and at minimum SID for R&F systems.

For all systems:

- Place 1/32 inch of copper, 1/4 inch of aluminum, and 2–1/4 inches of acrylic on the table (stack with acrylic on bottom and copper on top).
- Take fluoro exposures and center the filtration in the x–ray beam. For 40 cm (16 inches) II, the collimator blades may have to be closed slightly to eliminate raw radiation.
- If this is the first time the unit is being run or if a complete recalibration of dose values is required, touch the NEXT STEP softkey to proceed to Step 2.

OR

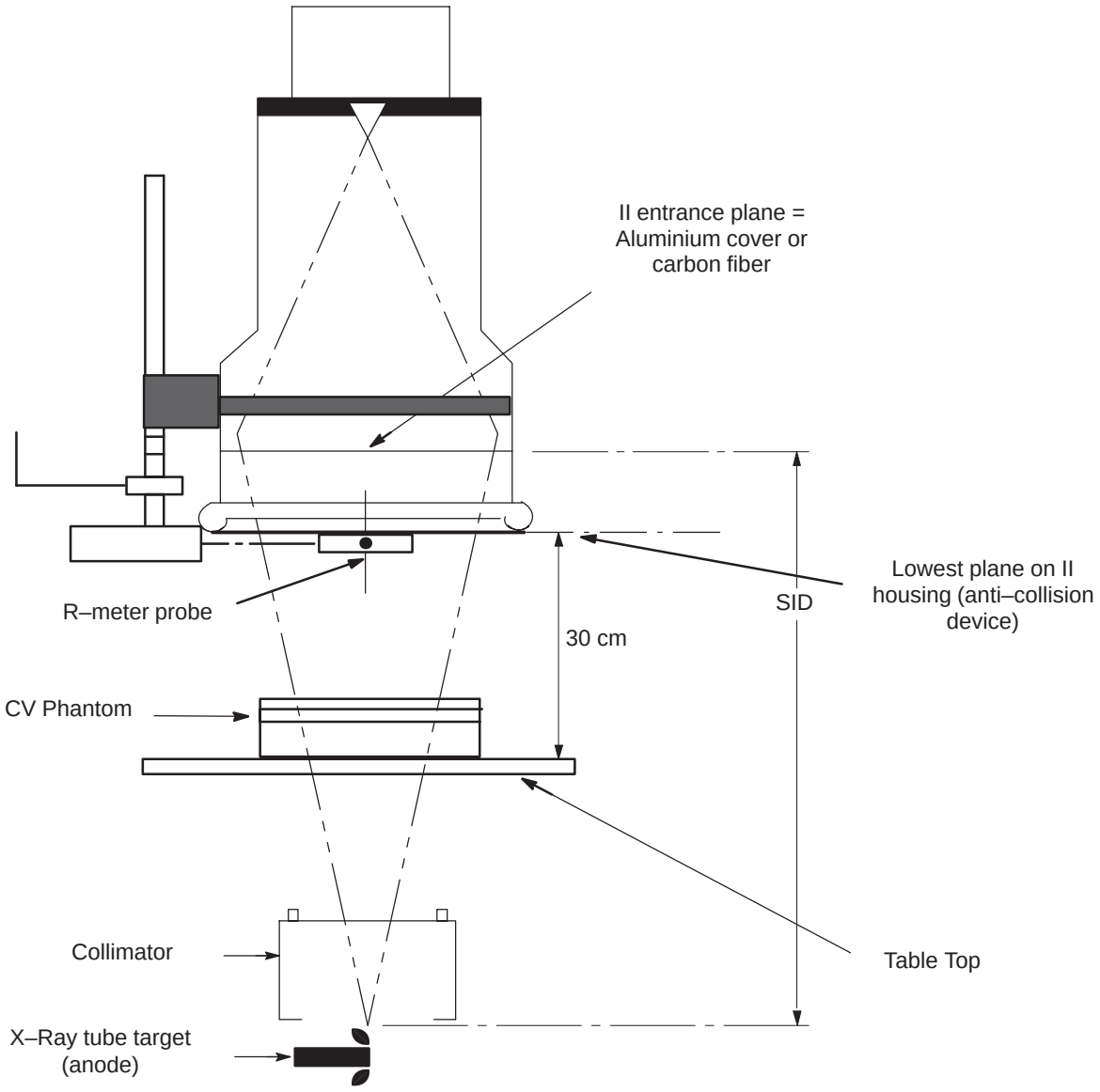
- If the calibration was run previously, the accuracy of the entrance dose can be verified by touching the VERIFY softkey. If the entrance dose has not been calibrated and the VERIFY softkey is activated, the following message is displayed:

NOTE: THIS UNIT HAS NOT BEEN CALIBRATED

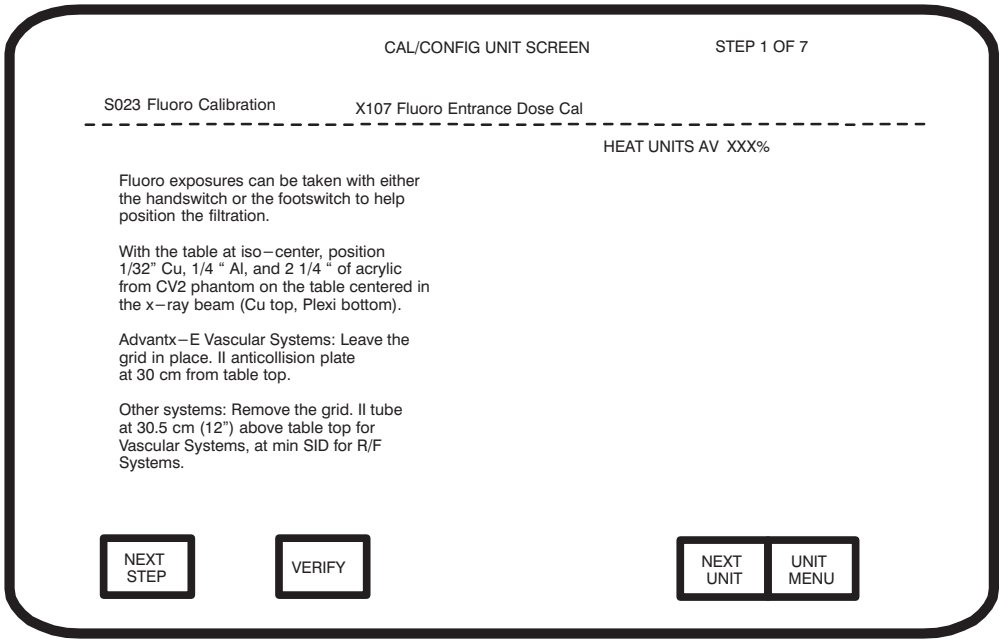
Note: The unit will automatically sequence to the Step 3 screen and display the following message. (For <u>older</u> ASC software versions, the message says instead: “NOTE: TO PERFORM AUTO CALIBRATION YOU MUST EXIT THE UNIT AND START AGAIN”.)

IN VERIFY MODE. EXIT UNIT AND START AGAIN TO CALIBRATE.

Illustration 144 – R–Meter Probe Positioning using Ion Chamber Positioning TooL, for Advantx–E Vascular Systems



X107 STEP 1 SCREEN DISPLAY



5-2 Step 2. Aperture Selection.

- Upon entering Step 2, the following message is flashed on the screen for approximately 10 seconds.

PLEASE WAIT: SYSTEM RECORDING PHOTO CATHODE CURRENT OFFSET

- When the message is turned off, the handswitch and footswitch are enabled. If the message continues flashing after 10 seconds (will not stop flashing), a communications error between the VIC and ASC is indicated. Turn off the console to exit the unit and check for the following conditions:
  1. Bad X–ray II Interface PWB on Image Intensifier Assembly.
  2. Bad GE Bus Line.
- Using the handswitch or footswitch, take and maintain a fluoro exposure. While taking x–rays, the following message is displayed.

PROCESSING PHOTO CATHODE CURRENT

- If after ten iterations of predicting and positioning the TV variable iris, the photo cathode current cannot be adjusted to the correct value corresponding to the normal dose value, the following error message is displayed.

Error Indication

PHOTO CATHODE CURRENT NOT IN WINDOW

- Refer to the following possible causes for the error indication to determine corrective action.
  1. Aperture full open. A fully open aperture is indicated if the APERTURE F NUMBER displayed on the Step 2 screen is 1.2. Check for the following conditions.
     – Low gain on II tube.
     – Improper VIC preset gain. Check VIC gain in Applications or Service Mode (Manual fluoro). The gain should equal the applicable value set up from the Table of values given in Calibration Unit V062, CF and ABC Gain Calibration. If the gain is not correct, re–run Calibration Unit V062.

Note: In order to have a condition of wide open iris, the ratio of (VIC OUTPUT MV)/(VIC INPUT MV) should be low.

– Bad X–ray II Board. Photo Cathode Current value always high (indicates open aperture position).

2. Aperture full closed. A fully closed aperture is indicated if the APERTURE F NUMBER displayed on the Step 2 screen is 12.6. Check for the following conditions:
   – Improper VIC preset gain. Refer to Calibration Unit V054, Video Gain Linearization, and re–adjust if necessary.
   – Improper VIC preset gain. Check VIC gain in Applications or Service Mode (Manual fluoro). The gain should equal the applicable value set up from the Table of values given in Calibration Unit V062, CF and ABC Gain Calibration. If the gain is not correct, re–run Calibration Unit V062.

Note: In order to have a condition of fully closed iris, the ratio of (VIC OUTPUT MV)/(VIC INPUT MV) should be high.

   – Bad X–ray II Board. Photo Cathode Current value always low (indicates closed aperture position).

3. Aperture not at either limit but error message is displayed. Check for the following conditions:
   – Bad Iris Servo Control Board.
   – Bad X–ray II Board.

- If the following error message is displayed while running Step 2:

Error Indication	DIVIDE BY ZERO

1. Check the following for possible cause of error indication:
   – Bad X–ray II Board.
   – Photo Cathode Current value transmitted from the VIC is zero (0).

Note: Test Point TP9 on the x–ray II Board can be used to measure photo cathode current with an oscilloscope. The scale factor at this point is 0.1V/nA. A suggested method of measuring this value with a scope is to trigger the scope off of the FET gate while monitoring TP9.

- If the following error message is displayed while running Step 2:

Error Indication	MATH OVERFLOW

1. Check the following for possible cause of error indication:
   – Bad X–ray II Board.

- If the following error message is displayed while running Step 2:

Error Indication | PHOTO CATHODE CURRENT AT MAXIMUM LIMIT |

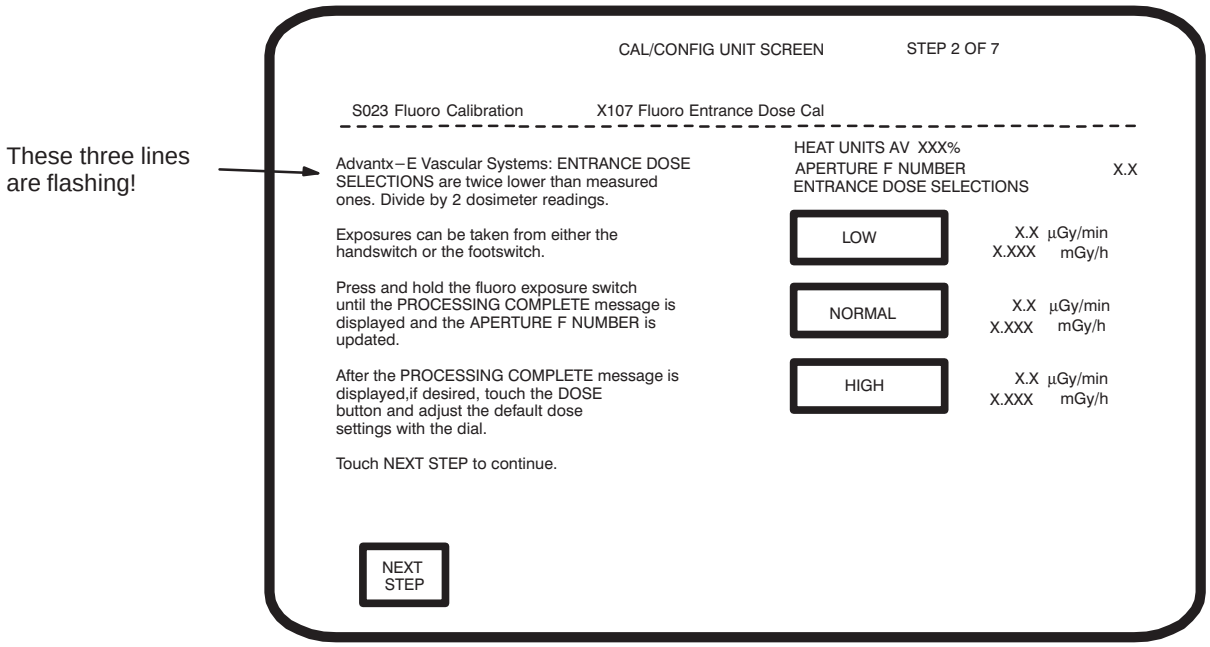
1. Check the following for possible cause of error indication:
   - Aperture is wide open (F# = 1.2) and Photo Cathode Current from the VIC is near maximum limit.
   - Photo Cathode Current sampling circuit on/off FET switch is shorted. Short will cause maximum limit condition. Replace X–ray II Board.
   - This can be caused by the age of the Image Intensifier, where the conversion factor has fallen off. To determine this, exit the unit, re–enter and execute the verification. If the Image Intensifier has aged, the normal fluoro detail aperture may be set to the normal detail. This can either be accepted, or the Image Intensifier can be replaced.

- If no error conditions are encountered while performing Step 2 (or if all error conditions have been corrected to permit completion of Step 2), the following message is displayed.

| PROCESSING COMPLETE |

- The LOW, NORMAL, and HIGH entrance dose softkeys are now enabled. If the site desires other entrance dose values, touch the LOW, NORMAL, or HIGH softkey and use the console dial to change the entrance dose value to the desired value. Exposures can be made.
- Touch NEXT STEP softkey to proceed to Step 3.

X107 STEP 2 SCREEN DISPLAY



5-3 Step 3. Confidence Test 1

This step provides for the first of two verification tests.

Note: In ***BROWSE*** mode, no exposures can be taken, and dose buttons are not selectable. (For older ASC software versions, it is possible that exposures may be made, but dose buttons are not selectable.)

- Take a fluoro exposure and examine each dose value by sequentially touching the LOW DOSE, NORMAL DOSE and HIGH DOSE softkeys. Maintain the exposure at each selected dose level and examine the image on the TV monitor for noise while observing the tube mA levels. For higher doses the noise should be less.

Note: On systems configured with the 12 inch II tube, the LOW fluoro dose value may not be obtainable because of the inherent gain in the system (the aperture is wide open, system is at maximum gain, but the dose is higher than selected). This is a system limitation and should not cause problems.

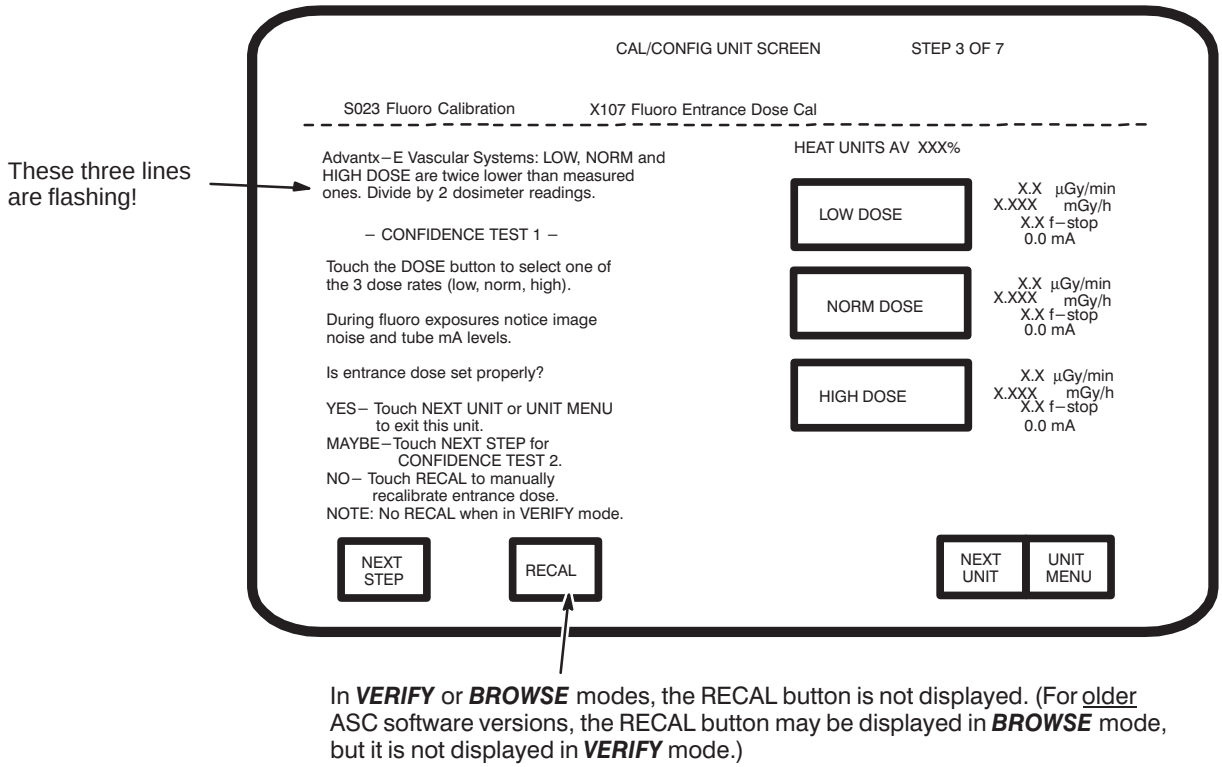
- Based on the examinations and /or experience of the operator in determining image quality and proper entrance dose, make one of the following decisions and proceed accordingly:

  YES – Entrance dose is properly set. Touch NEXT UNIT or UNIT MENU softkey to exit the calibration unit.

  MAYBE – Questionable entrance dose accuracy. Touch NEXT STEP softkey to proceed to Step 4, Confidence Test 2 (part 1).

  NO – Invalid entrance dose rate. Touch RECAL softkey. The unit will automatically sequence to Step 6, Manual Calibration (part 1).

X107 STEP 3 SCREEN DISPLAY



5-4 Step 4. Confidence Test 2

Step 4 initiates Confidence Test 2. The test consists of two parts. Part 1 is covered in Step 4. Part 2 is covered in Step 5. A basic outline of the test is given below:

- RADCNTRL is recorded during ABC operation.
- Recorded RADCNTRL value is used to duplicate the dose seen in ABC operation.
- Measurements are taken. If not within specification, proceed to Step 6.

5-4-1 Part 1

When using Ion Chamber Positioning Tool 2236707 (Former ref: 2208874), refer to the instructions on the MORE INFO screen display for Step 5; also, refer to mounting/positioning instructions in Cal Unit T015. Check for probe top/II anticollision plate distance in Table 10 of Cal Unit T015.

Note: For Vascular Advantx–E Systems, refer to Illustration 144. Do not move the II and set the ion chamber close to the II anticollision plate. The probe shall be parallel to the plate and as close as possible to the II anti–collision plate. The probe shall be centered in the image center.

- Initiate and maintain a fluoro exposure from the footswitch or the handswitch. While the system is recording RADCNTRL for each of the three entrance dose rates, the following message is displayed:

RECORDING MA FOR EACH DOSE LEVEL

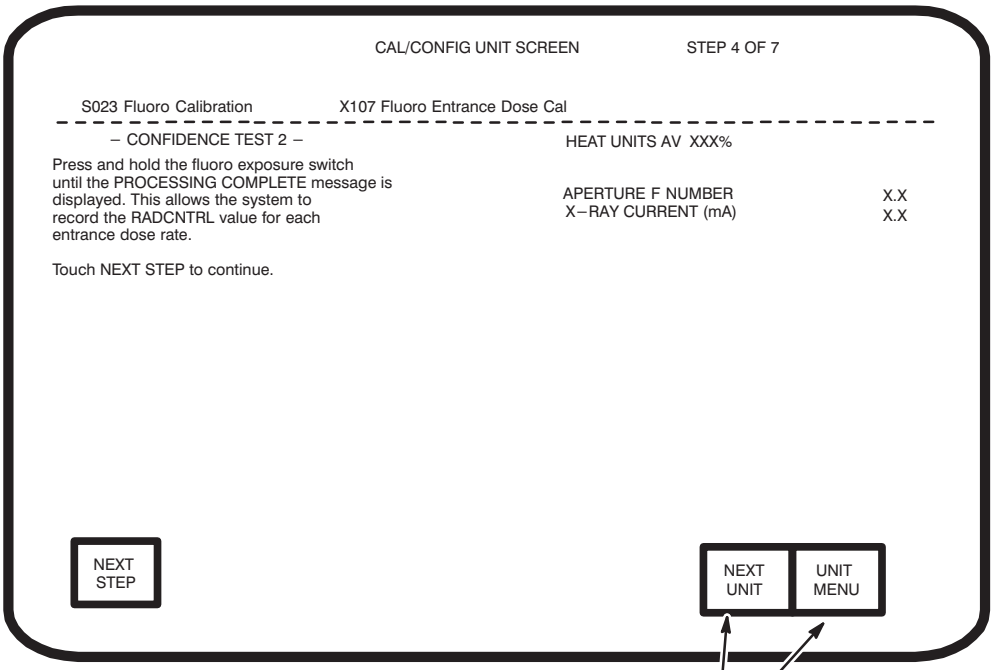
- Maintain the exposure until the following message is displayed:

PROCESSING COMPLETE

- The console screen is updated with current mA values and aperture f numbers. The recorded RADCNTRL values are used in Step 5 (part 2 of Confidence Test 2) to set the dose for measuring.
- Touch NEXT STEP softkey to proceed to Step 5.

Note: NEXT STEP is displayed but inactive prior to “PROCESSING COMPLETE” for ***CAL*** and ***VERIFY*** modes. For ***BROWSE*** mode, exposures cannot be made and NEXT STEP is always displayed and active. (For <u>older</u> ASC software versions, in ***BROWSE*** mode it is possible that exposures may be made, but NEXT STEP is always displayed and active.)

X107 STEP 4 SCREEN DISPLAY



The NEXT UNIT and UNIT MENU buttons are displayed and active in ***BROWSE*** mode, except for <u>older</u> ASC software versions.

5-5 Step 5. Confidence Test 2

Step 5 is the second part of Confidence Test 2. Before proceeding with exposures, touch MORE INFO softkey to access the MORE INFO screen for instructions covering the proper positioning of the radiation probe for manual recording of the actual dose rate at each of the three dose levels.

5-5-1 Part 2

Note: In ***BROWSE*** mode, no exposures can be taken. (For <u>older</u> ASC software versions, it is possible that exposures may be made.)

- Position center line of radiation probe at a distance above the table top as follows:
  - Legacy SFD– Add 4 in. (102 mm) to height measured in previous steps. Set probe to a height above the table top equal to this sum.
  - Legacy Digital – Add 1 in (25mm) to height measured in previous steps. Set probe to a height above the table top equal to this sum.
  - For Vascular Advantx–E Systems, refer to Illustration 144. Do not move the II and set the ion chamber close to the II anticollision plate. The probe shall be parallel to the plate and as close as possible to the II anti–collision plate. The probe shall be centered at the image center.
  - For other Vascular Systems, move II to maximum SID and set probe to the same height than the II tube in Step 1, that is 12 inches (30.5 cm) above the table top .
- Initiate a fluoro exposure with the footswitch or handswitch.
- Maintain the exposure and monitor the radiation meter to verify the three dose levels.

WARNING

FOR ADVANTX–E VASCULAR SYSTEMS ONLY:

<u>BEWARE OF THE EXISTENCE OF TWO DIFFERENT TYPES OF DOSES</u>:

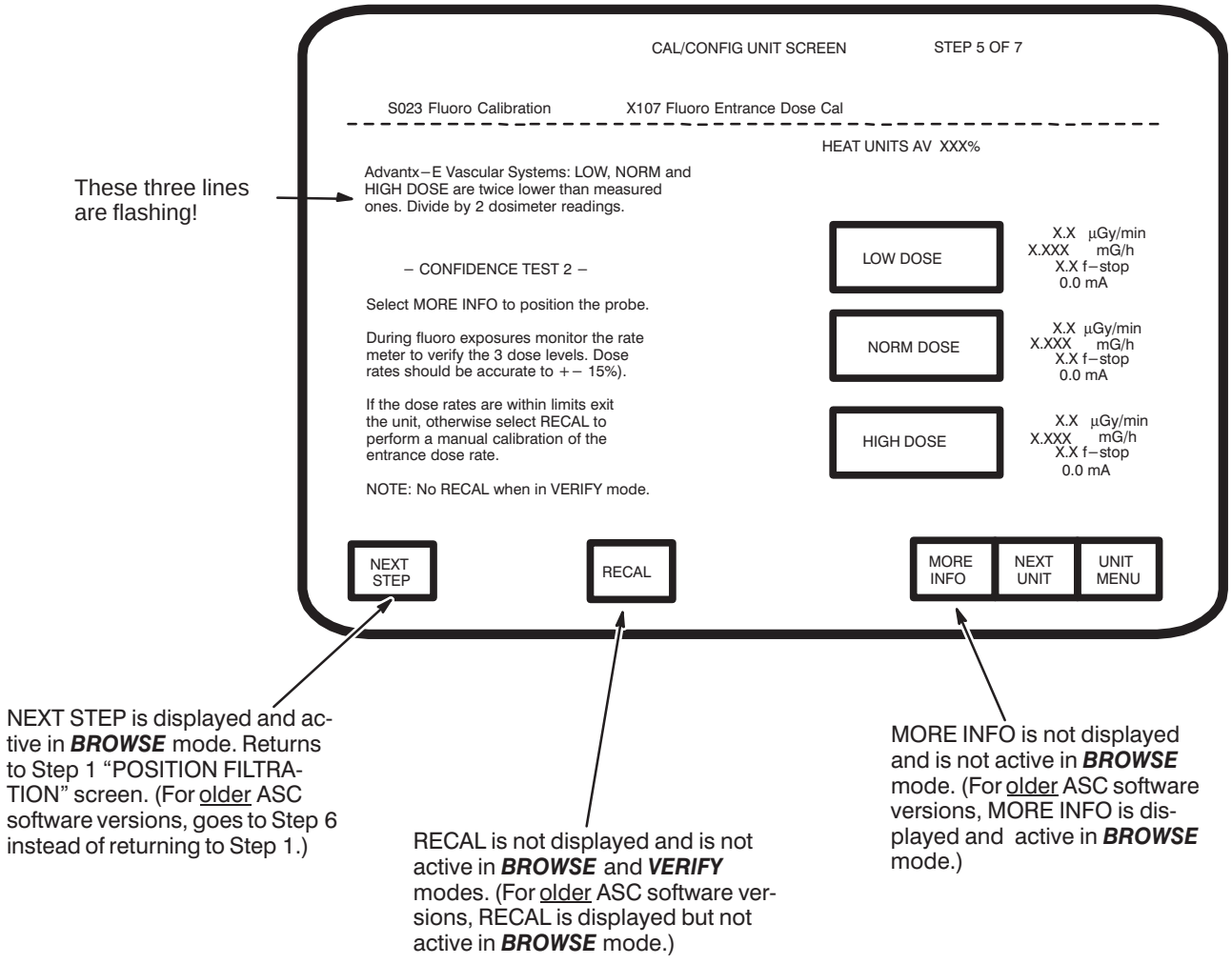
II Entrance Doses: doses displayed and dialed on the console in this calibration Unit**.** **Recommended Entrance Doses** presented in Table 43, Table 44 and Table 45 are the **II Entrance Doses** allowing the best functionning conditions of the System and the ones which should be used**.**

Measured Entrance Doses: result of the measurement procedure, probe close to the anticollission plate and dose reduced by the antiscatter grid.

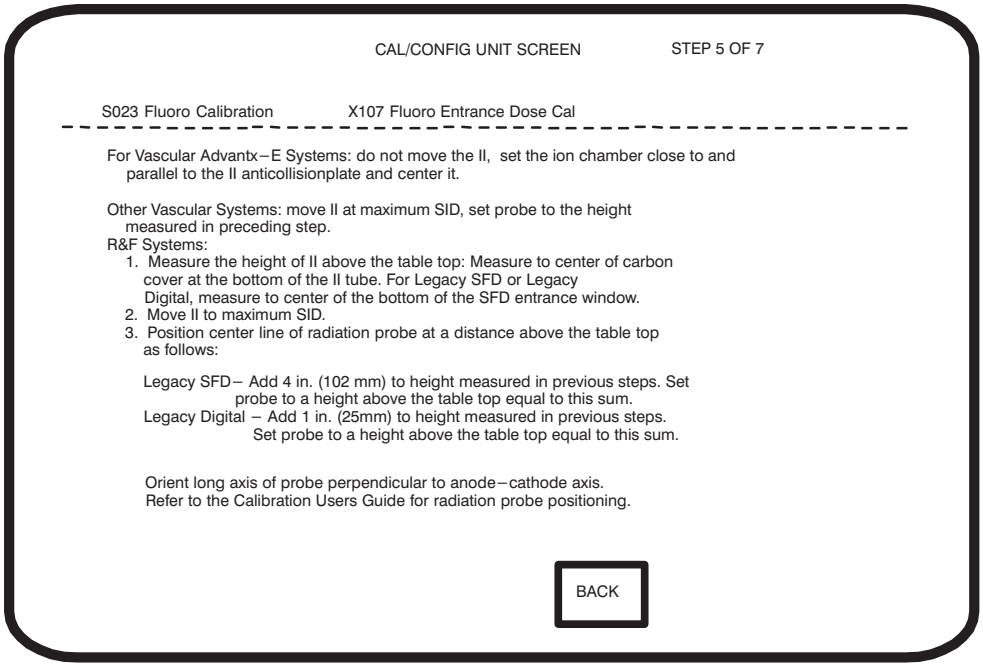
<u>II Entrance Doses are equal to Measured Entrance doses divided by two.</u>

- If the radiation measurement is out of tolerance, touch RECAL softkey and proceed to Step 6, Manual Calibration (part 1).
- If the radiation level is within specified accuracy (± 15%) touch NEXT UNIT or UNIT MENU softkey to exit the calibration.

X107 STEP 5 SCREEN DISPLAY



X107 STEP 5 "MORE INFO" SCREEN DISPLAY



Note: For <u>older</u> ASC software versions, the X107 STEP 5 "MORE INFO" SCREEN DISPLAY, last sentence of 3rd item (Vascular) may say: "Vascular – Set probe equal to the height measured in preceding step plus 1 inch." If you see this, ignore the words "plus 1 inch", and act as if the statement reads "Vascular – Set probe equal to the height measured in preceding step."

5-6 Step 6. Manual Cal (part 1)

Step 6 manually calibrates the RADCNTRL voltage for the NOMINAL dose rate. Touch MORE INFO softkey for instructions covering the proper positioning of the radiation probe. Then, return to the Step 6 screen and proceed as follows:

When using Ion Chamber Positioning Tool 2236707 (Former ref: 2208874), refer to the instructions on the MORE INFO screen display for Step 5; also, refer to mounting/positioning instructions in Cal Unit T015. Check for probe top/II anticollision plate distance in Table 10 of Cal Unit T015.

- For Vascular Advantx–E Systems, refer to Illustration 144. Set the ion chamber close to the II anticollision plate. The probe should be parallel to the plate and touch it. The probe should be centered in the image.
- For other Vascular Systems, move the II to the maximum SID and set the probe the same height than the II tube in Step 1, that is 12 inches (30.5 cm) above the table top.
- For Legacy move the II to the maximum SID and position center line of radiation probe at a distance above the table top as follows:
  - Legacy SFD– Add 4 in. (102 mm) to height measured in previous step. Set probe to a height above the table top equal to this sum.
  - Legacy Digital – Add 1 in (25 mm) to height measured in previous step. Set probe to a height above the table top equal to this sum.

WARNING

FOR ADVANTX–E VASCULAR SYSTEMS ONLY:

BEWARE OF THE EXISTENCE OF TWO DIFFERENT TYPES OF DOSES:

II Entrance Doses: doses displayed and dialed on the console in this calibration Unit**.** **Recommended Entrance Doses** presented in the Table 43, Table 44 and Table 45 are the **II Entrance Doses** allowing the best functionning conditions of the system and the ones which should be used**.**

Measured Entrance Doses: result of the measurement procedure, probe close to the anticollision plate and dose reduced by the antiscatter grid.

II Entrance Doses are equal to Measured Entrance doses divided by two.

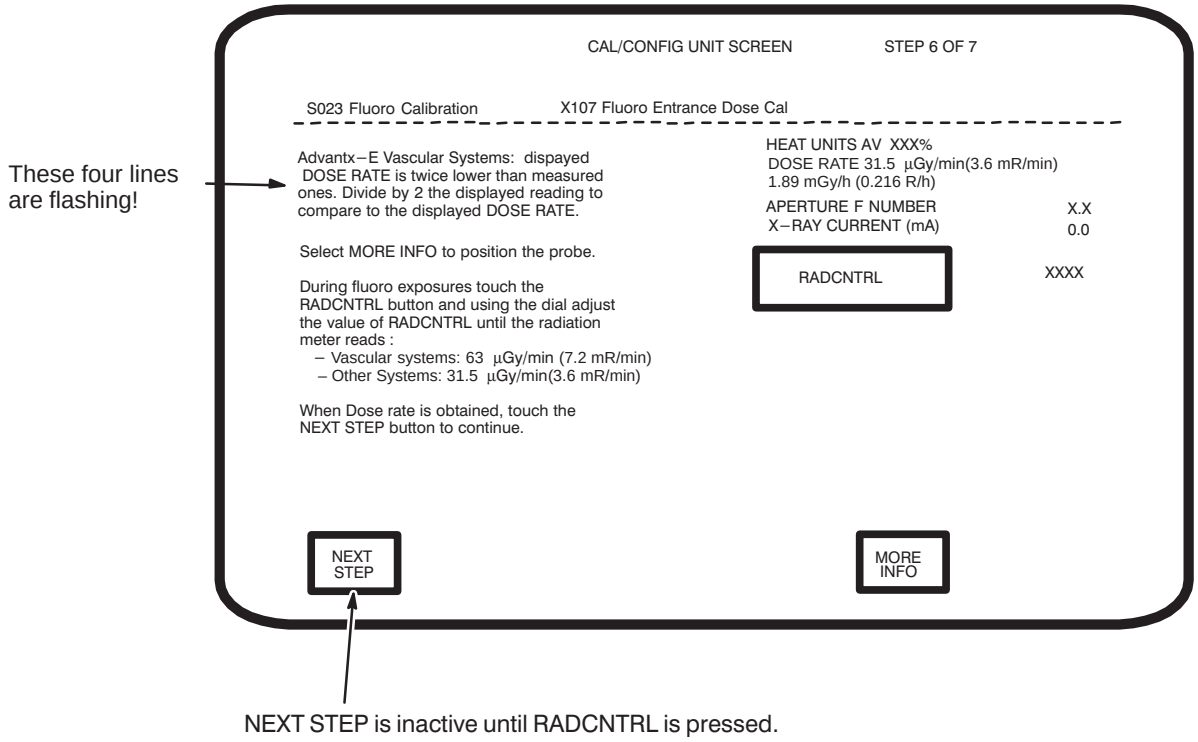
- Initiate and maintain a fluoro exposure. Touch RADCNTRL softkey and using the console dial adjust the value of RADCNTRL until the radiation meter indicates :
  - For Vascular Avantx–E Systems : **63 μGy/min** ± 0.8 (7.2 mR/min ± 0.1) or (0.432 R/hr ± 0.006)
  - For all other systems: **31.5 μGy/min** ± 0.8 (3.6 mR/min ± 0.1) or (0.216 R/hr ± 0.006)

*These are **NOMINAL** dose rates.*

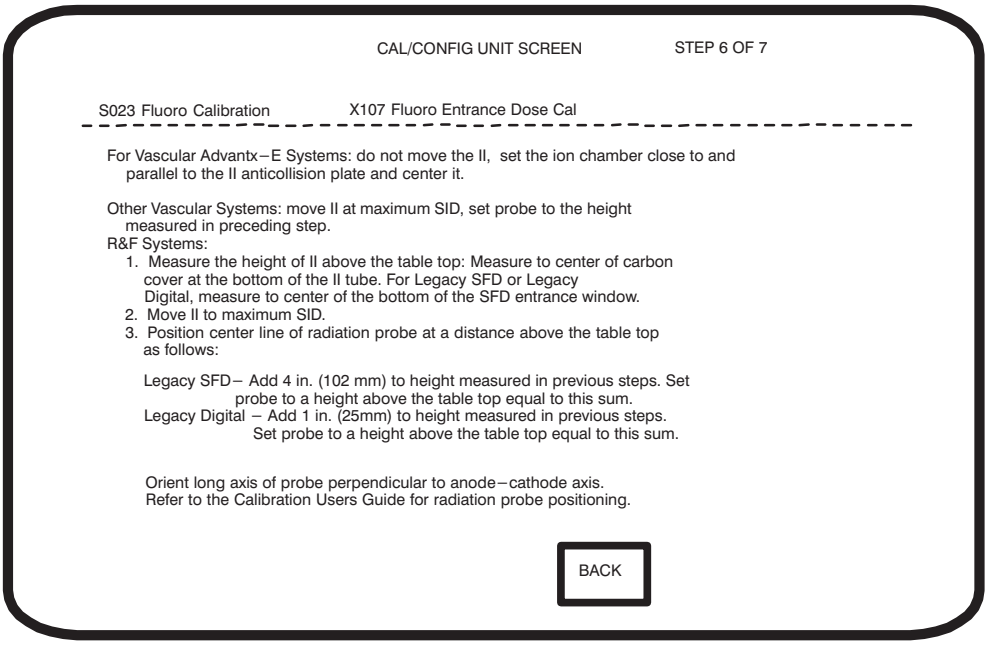
- Touch NEXT STEP softkey to proceed to Step 7.

Note: NEXT STEP is inactive until RADCNTRL is pressed.

X107 STEP 6 SCREEN DISPLAY



X107 STEP 6 "MORE INFO" SCREEN DISPLAY



Note: For <u>older</u> ASC software versions, the X107 STEP 6 "MORE INFO" SCREEN DISPLAY, last sentence of 3rd item (Vascular) may say: "Vascular – Set probe equal to the height measured in preceding step plus 1 inch." If you see this, ignore the words "plus 1 inch", and act as if the statement reads "Vascular – Set probe equal to the height measured in preceding step."

5-7 Step 7. Manual Cal (part 2)

Step 7 automatically calculates the RADCNTRL voltage for the dose rates using the RADCNTRL value established for the NOMINAL dose rate in Step 6.

- For Advantx–E Vascular Systems, leave the radiation probe in place and do not change any positioning.
- For all other systems, remove the radiation probe and reposition the system to its initial SID.
- Take and maintain a fluoro exposure. While taking x–rays, the following message is displayed.

SETTING APERTURE FOR DESIRED RADCNTRL VALUE

- If after ten iterations, the TV variable iris cannot be set to a position corresponding to the previously dialed RADCNTRL value, the following error message is displayed.

Error Indication

RADCNTRL/MA WILL NOT CONVERGE

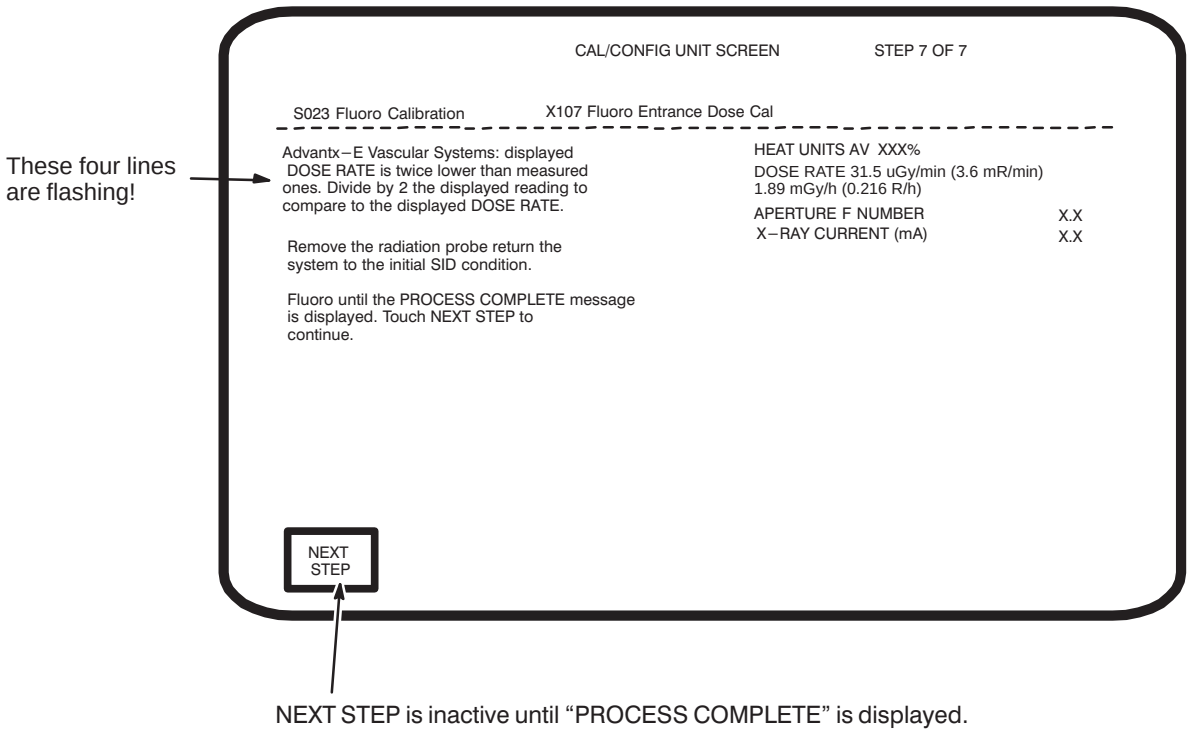
- Refer to the following possible causes for the error condition to determine corrective action.
  1. Low gain on II tube. (Iris cannot be opened enough to bring down RADCNTRL value.
  2. Improper VIC preset gain. Refer to Calibration Unit V054,Video Gain Linearization, and re–adjust if necessary.
  3. Aperture hunts. Bad Iris Servo Control Board.
  4. Mechanically defective iris blades.
- If no error conditions are encountered while performing Step 7 (or if all error conditions have been corrected to permit completion of Step 7), the following message is displayed.

PROCESSING COMPLETE

- Touch NEXT STEP softkey. The unit will automatically return to Step 3 Repeat Step 3 as necessary.

Note: NEXT STEP is inactive until “PROCESS COMPLETE” is displayed.

X107 STEP 7 SCREEN DISPLAY



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UNIT X110 – ABC Lead Filter Adjustment

Time: x h xx min – Personnel: 1 field engineer

1 DESCRIPTION

Calibration Unit X110 is used to adjust the filament response time for system operation in the fluoro and cine modes. An analog lead filter is adjusted on systems configured with an Advantx–E MPPU Ph3/4 power unit. A digital lead filter is adjusted on systems configured with an SCPU power unit. Three steps are required to accomplish the calibration.

2 EQUIPMENT REQUIRED

Filtration, from CVII Phantom Kit (1/4 inch aluminum, 1/32 inch copper, and 2–1/4 inches acrylic), oscilloscope, and non–metallic trimpot adjusting tool.

Note: The calibration may require varying the filtration thickness from that specified.

3 SPECIAL INSTRUCTIONS

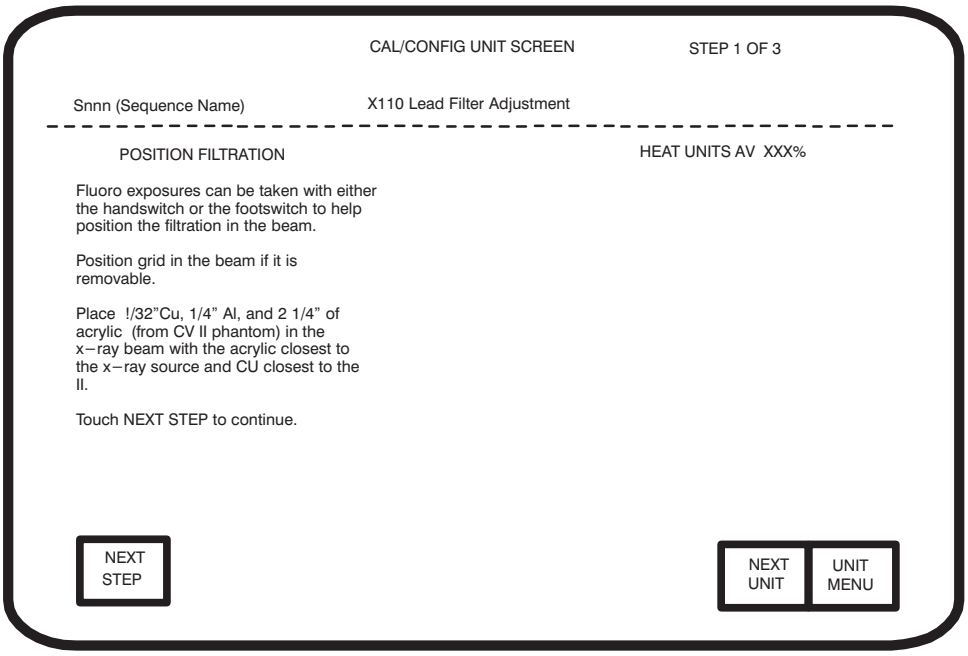
Note: **For Vascular Systems Only:** Before system calibration, verify that additional filter (copper–aluminum filter) is not installed on top of collimator. (Open sensor hinge assembly to verify.) If installed, remove before performing calibration.

4 CAL PROCEDURE

4-1 Step 1. Position Filtration

- Place 1/32 inch of copper, 1/4 inch of aluminum, and 2–1/4 inches of acrylic in the X–ray beam (stack with acrylic closest to the X–ray tube and copper closest to the Image Intensifier.).
- Take fluoro exposures with the fluoro footswitch or console handswitch to help center the filtration in the X–ray beam.
- Position the grid in the beam (if it is removable).
- Touch NEXT STEP softkey to proceed to Step 2.

X110 STEP 1 SCREEN DISPLAY



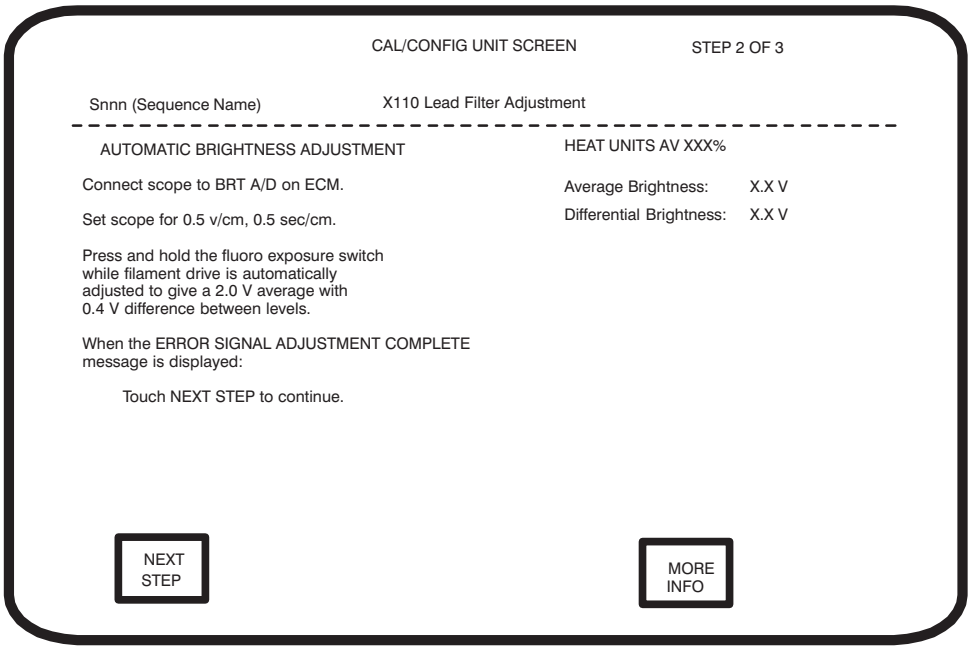
4-2 Step 2. Automatic Brightness Adjustment

- Set oscilloscope controls as follows:
  VERT AMPL: 0.5 V/cm
  TIME BASE: 0.5 sec/cm
- Touch MORE INFO softkey. The Step 2 “More Info” screen provides instructions for connecting the oscilloscope probe to the BRT A/D test point applicable to your system configuration. (Also shown below):
  Dual ETL Boards:
  Connect to SKL1 A3 TP14 (ETL2)
  Ground on TP9 (signal ground)
  Single ETL Board:
  Connect to SKL1 A2 TP13
  Ground on TP7 (logic ground)
  Monoboard ECM:
  Connect to pin TP3 (front panel)
  Ground on shield (signal ground)
- Initiate and maintain a fluoro exposure. The unit will automatically adjust filament drive for a 2.0 volt average with a 0.4 volt difference between levels. An “ADJUSTING THE FILAMENT ERROR SIGNAL” message is displayed while the adjustment is being accomplished.

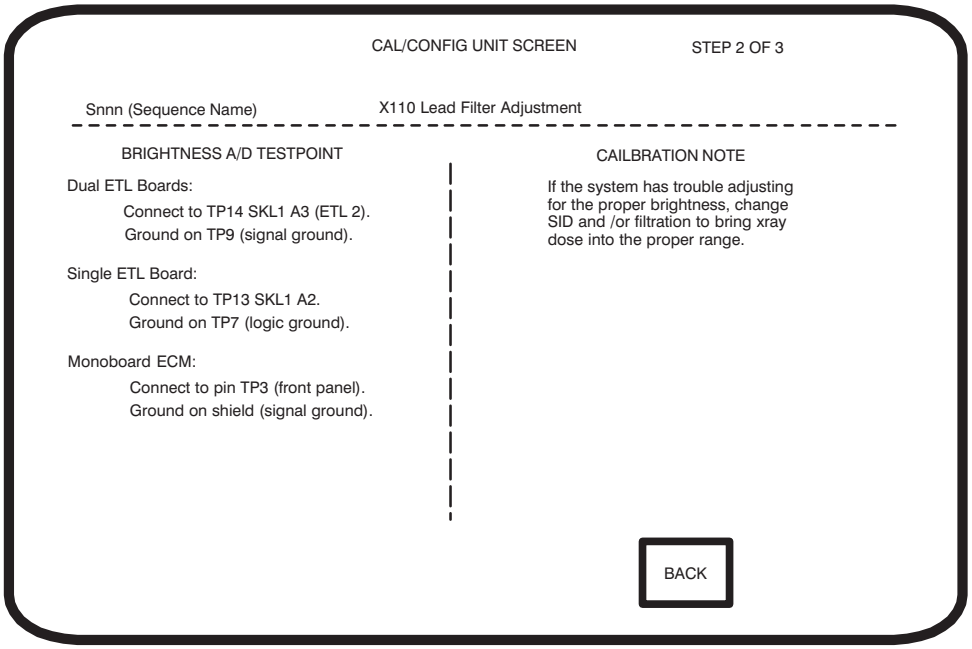
Note: If the system has trouble adjusting for proper brightness, change SID and or filtration to bring X–ray dose into the proper range.

- When the “ERROR SIGNAL ADJUSTMENT COMPLETE” message is displayed, touch NEXT STEP softkey to proceed to Step 3.

X110 STEP 2 SCREEN DISPLAY



X110 STEP 2 "MORE INFO" SCREEN DISPLAY



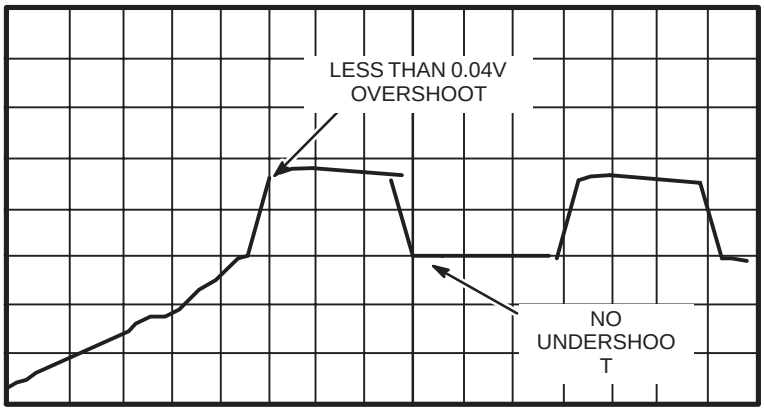
4-3 Step 3. Lead Filter Adjust

Note: A “More Info“ screen, accessed by touching the MORE INFO softkey on the Step 3 screen, provides information regarding the location of the lead filter adjustment on systems configured with either an LFX, MPPU, or SCPU power unit.

4-3-1 Systems w/LFX Power Unit

- Initiate and maintain a fluoro exposure with the footswitch or handswitch.
- Adjust lead filter potentiometer “fil A” on LFX1 A1 A7 for a brightness signal waveform on the oscilloscope that has the fastest response time without any overshoot and less than 0.04 V undershoot. See Illustration 145.
- When properly adjusted, touch NEXT UNIT or UNIT MENU softkey to exit.

Illustration 145 – X110, Lead Filter Adjustment Oscilloscope Display, – LFX Power Unit



4-3-2 Systems w/MPPU Generator

- Initiate and maintain a fluoro exposure with the footswitch or handswitch.
- The Lead Filter adjustment is on Interface 2 board (A6)
  Pre–series: R36
  Phase 1 & 2 series: P2 (fluoro only)
  MPPU Phase 3/4: P2 (XS Lead Filter) for fluoro,
  P3 (XL Lead Filter) for large spot cine
- Adjust applicable lead filter potentiometer (1/2 turn at a time) for a waveform on the oscilloscope that is as square as possible. See Illustration 146. On an MPPU, no overshoot occurs on the brightness signal waveform.

  Overshoot is the percentage of brightness overshoot (A). Refer to Illustration 147. This overshoot is determined in relation to the average of brightness (B) or positive error.

  Undershoot is the percentage of brightness undershoot (C). This undershoot is determined in relation to the average of brightness (D) or the negative error.

  Brightness Step Amplitude: Once the brightness is equal to 2 volts, the ASC increases the RAD GAIN signal until the brightness error waveform has reached a 400 mv peak to peak amplitude.

Note: Ignore the Overshoot and Undershoot readouts on the X110 Step 3 Screen display. These are not valid for an Advantx–E MPPU Ph3/4 Power Unit.

- When properly adjusted, touch NEXT UNIT or UNIT MENU softkey to exit.

4-3-3 Systems w/SCPU Power Unit

- Initiate and maintain a fluoro exposure with the footswitch or handswitch.
- Touch the LEAD FILTER softkey and use the console dial to adjust the lead filter value for the fastest response time without any undershoot and less than 0.04 V overshoot as indicated on the console screen.
- When properly adjusted, touch NEXT UNIT or UNIT MENU softkey to exit.

Illustration 146 – X110, LEAD FILTER ADJUSTMENT oscilloscope display

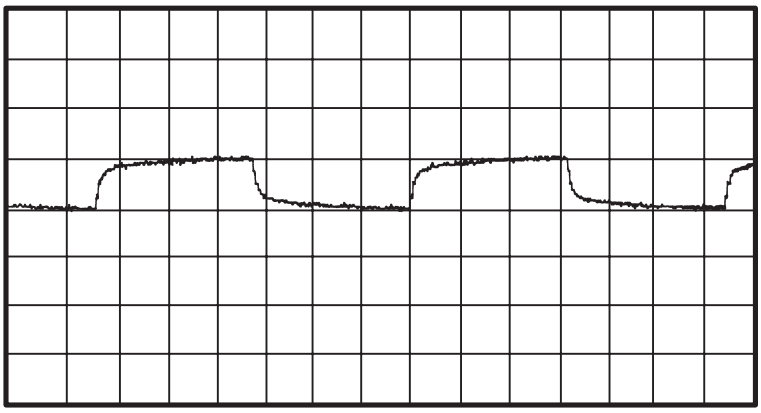
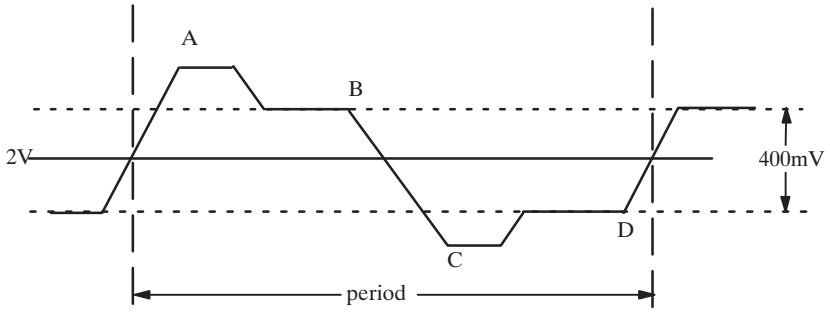
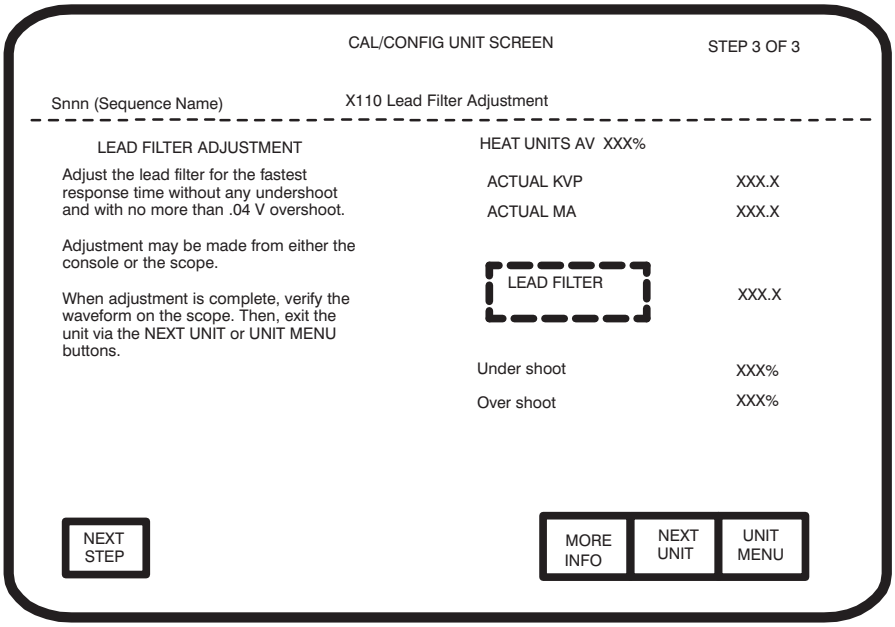


Illustration 147 – Brightness Step Amplitude

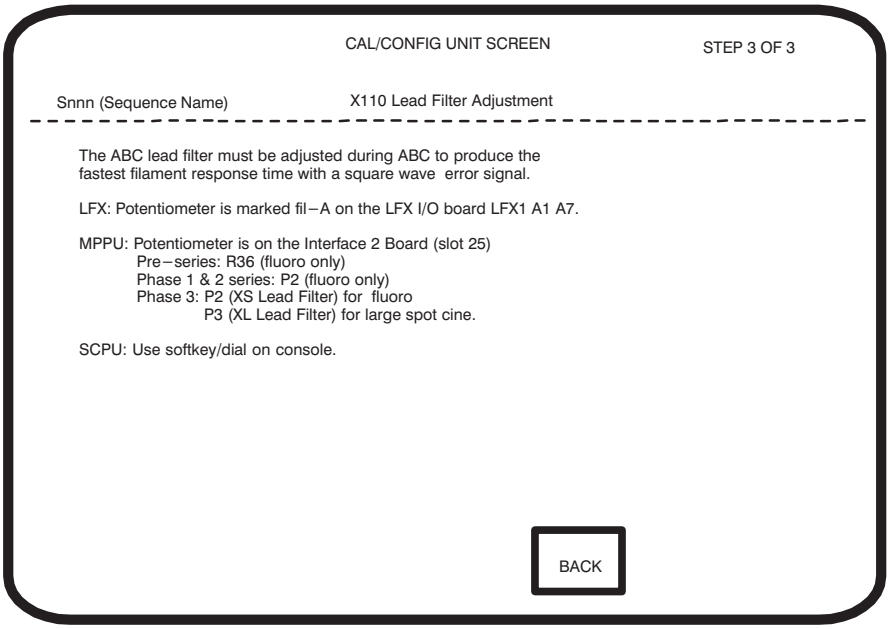


X110 STEP 3 SCREEN DISPLAY



Note: The LEAD FILTER softkey and associated lead filter value only appear on the Step 3 screen when a system is configured with an SCPU power unit.

X110 STEP 3 "MORE INFO" SCREEN DISPLAY



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UNIT X120 – Pulscan (Camtronics RTDM) Taper Progressive

Time: x h xx min – Personnel: 1 field engineer

1 DESCRIPTION

Calibration Unit X120 adjusts the Pulscan taper so that the fluoro table top radiation dose (Entrance Exposure Rate–EER) never exceeds the legal limit of 10R/minute. The calibration sets the end points of a predefined taper curve to correspond with a radiation taper limit. Five steps are required to calibrate the Pulscan taper. A screen display is provided for each step.

CAUTION

This unit allows the system to be configured for higher pulsed progressive fluoro taper limits than shipped. This is not recommended. This is forbidden in the US where the 10 R/mn regulatory limits applies. While the system will operate at these higher taper limits, the reliability under this condition may suffer; increased maintenance costs should be expected. Only raise the fluoro taper limits after all other methods of improving digital fluoro image quality have been tried and there is still a serious customer issue.

NOTICE

If this calibration unit is used to recalibrate Pulscan tapers after initial system calibration, it is mandatory that you also re–run Cal Unit X121, Pulscan SID Comp, or the recalibrated tapers will not be observed when running Applications. Cal Unit X120 and X121 must always be run as a set with X120 run first.

2 EQUIPMENT REQUIRED

Dosimeter (MDH/Radcal 2025, 2026 or equivalent) w/probe stand or Ion Chamber Positioning Tool 2236707 (Former ref: 2208874)
For Advantx–E Systems, Ion Chamber Positioning Tool is mandatory (See Cal Unit T015) .
For this Cal Unit, use Model 20x5–3 or 20x6–3 probe.
Metric Tape Measure.

3 SPECIAL INSTRUCTIONS

Note: **For Vascular Systems only:** Before system calibration, verify that additional filter (copper–aluminum filter) is not installed on top of collimator. (Open sensor hinge assembly to verify.) If installed, remove before performing calibration.

- The Filament Age and Fil Age (Last Cal) parameters displayed on the Step 1 screen provide a visual indication of the filament aging characteristics of the system X–ray tube.

  1. **Filament Age:** Tracks and displays a continuous record of changes in filament aging (in HEX) since x–ray tube installation (initial value of 0010H).
  2. **Fil Age (Last Cal):** Displays the Hex value of filament aging set in the last calibration (initial value when a tube is installed is FFFFH). The Fil Age (Last Cal) parameter will be set equal to Filament Age parameter after a calibration is completed.

Note: As the x–ray tube ages, changes in the Filament Age value may be observed. If the difference between the Filament Age value and Fil Age (Last Cal) value reaches a delta limit of 2BH, a ”recal required” message is displayed. This warning message is displayed upon entering either the Applications or Service Mode to indicate to the user that a mandatory recalibration of the system R/min is required (Ref recal instructions in Cal Unit X100).

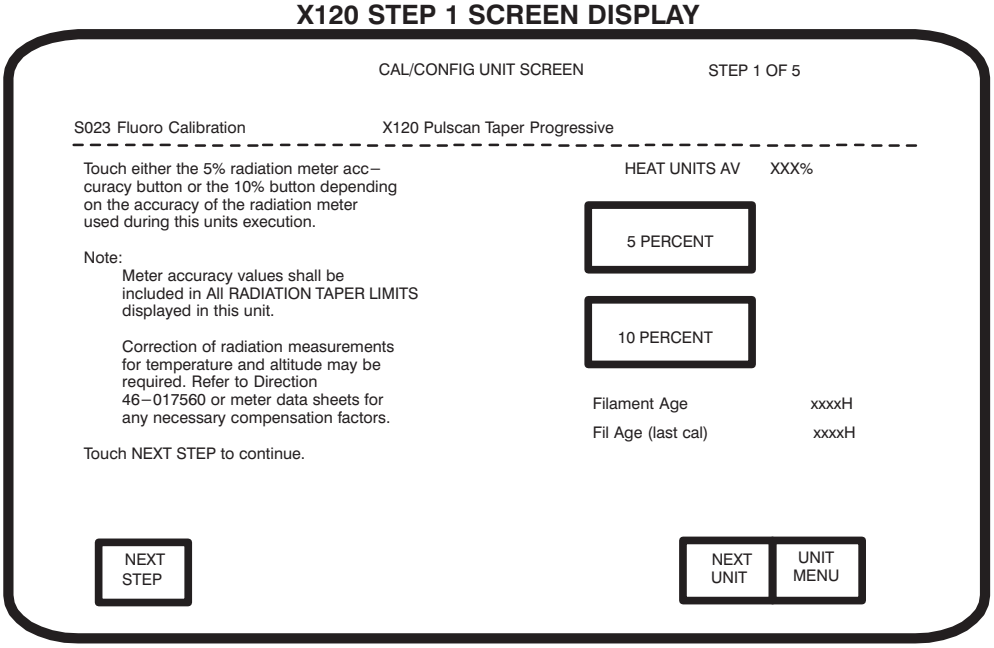
- Re-run this Cal Unit and re-adjust the EER (R–min) by subtracting the amount of increase observed in Applications from the EER (R–min) value previously set in this unit.

4 CAL PROCEDURE

4-1 Step 1. Radiation Meter Accuracy

- Check the rated accuracy of the radiation meter to be used in the calibration. (Radcal 2025 or 2026 and their probes have a 5% accuracy).
- Touch the 5 PERCENT or 10 PERCENT softkey to enter the rated accuracy of the radiation meter. The meter accuracy value is included in all RADIATION TAPER LIMITS displayed in this unit.
- Check the current values (in Hex) of the Filament Age and Fil Age (Last Cal) parameters. Refer to the Special Instructions paragraph at the beginning of this unit for an explanation of these parameters.
- Touch NEXT STEP softkey to proceed to Step 2.

X120 STEP 1 SCREEN DISPLAY



4-2 Step 2. Radiation Meter (R–Meter) Probe Positioning

CAUTION **Verify that the collision sensor is installed on the collimator, and that the hinged door is closed before proceeding.**

The Step 2 screen display provides instructions for positioning the R–Meter probe in systems employing SID compensation (all Vascular systems).

Note: Touching the MORE INFO softkey increments to a screen display that provides instructions for positioning the R–Meter probe in R+F systems. This is NOT applicable to vascular systems.

- Move the table top out of the field of the X–ray beam and open collimator blades to maximum.
- Set the II tube and x–ray tube to minimum SID.

Note: **For German Advantx–E Vascular Systems with non–removable 0.1 mm copper filter in the beam,** position the II to 95 cm SID (frontal) or 100 cm SID (lateral).

Note: For Advantx–E Vascular Systems, Ion Chamber Positioning Tool is mandatory to get accurate adjustments.

- When using Ion Chamber Positioning Tool 2236707 (Former ref: 2208874), refer to Illustration 135 in Cal Unit X100 and to the instructions on the screen display for Step 2; also, refer to mounting/positioning instructions in Cal Unit T015. Check for probe top/II anticollision plate distance in Table 10 of Cal Unit T015.
- If not using the Ion Chamber Positioning Tool, mount the R–Meter probe stand to the bottom of the II tube (or position the stand on the head end of the table top and extend the R–Meter probe into the x–ray beam). Position the R–meter probe 30 cm from the lowest point on the II tube housing. Refer to Illustration 134 in Cal Unit X100 and to the instructions on the screen display for Step 2.

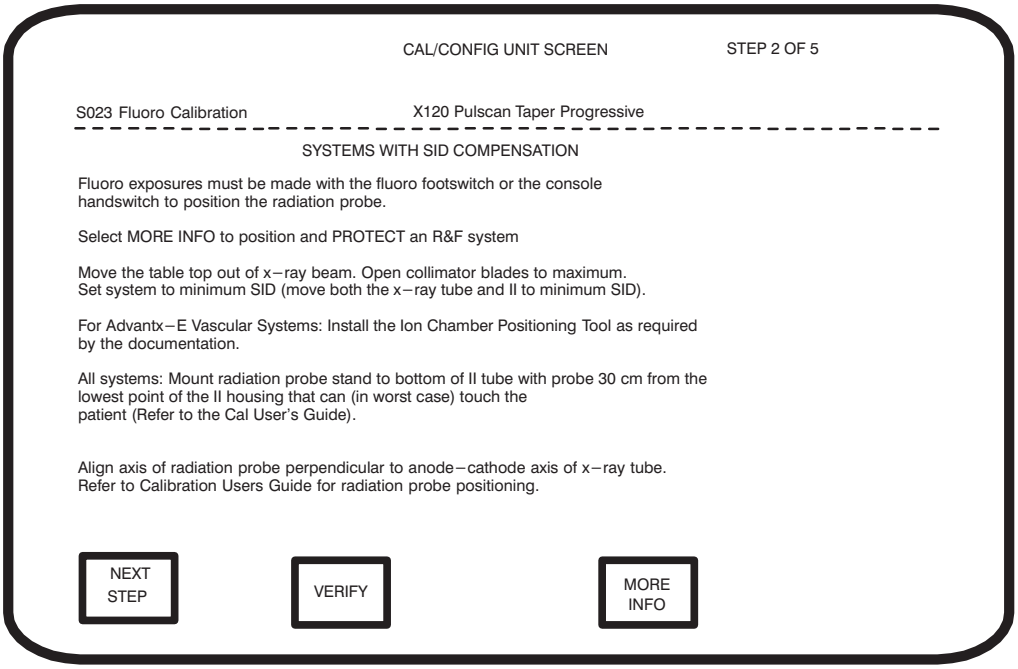
Note: The positioning of the R–meter probe 30 cm from the lowest point on the II tube housing (with II in overhead position) is an FDA requirement. The FDA assumes that the 30 cm distance corresponds to the average thickness of a patient and therefore establishes a worst case condition for radiation dose.

- Align the axis of the R–Meter probe perpendicular to the anode–cathode axis of the x–ray tube.
- Take a fluoro exposure to determine the exact position of the probe. Repeat taking exposures and repositioning the R–Meter probe until the probe is centered in the x–ray beam.
- After the R–Meter probe is properly positioned, you may perform a quick check of the Radiation Taper Limit before proceeding with a full calibration by touching the VERIFY softkey. Touching the VERIFY softkey will cause the unit to increment to the Step 5, Verification screen. Perform Step 5.

OR

- Touch the NEXT STEP softkey to proceed to Step 3 in the calibration sequence.

X120 STEP 2 SCREEN DISPLAY



Note: The X120 Step 2 “MORE INFO” Screen is not applicable to vascular systems.

4-3 Step 3. 60 KV FIL DRIVE Adjustment

- Initiate 60 kV FIL DRIVE adjustment by touching the FIL DRIVE softkey.
- Take and maintain a fluoro exposure.

For German Advantx–E Vascular Systems with non–removable 0.1 mm copper filter in the beam:

- Do not take into account the R/mn rate value indicated on the console, but adjust FIL DRIVE to get 14.5 mA read on the console at 60 kVp;
- Measure and record the dose value D(minref): this is the reference value **for X120 and X121** adjustment at 60 kVp.
- Position II to minimum SID.
- Adjust FIL DRIVE to get D(minref) at 60 kVp.

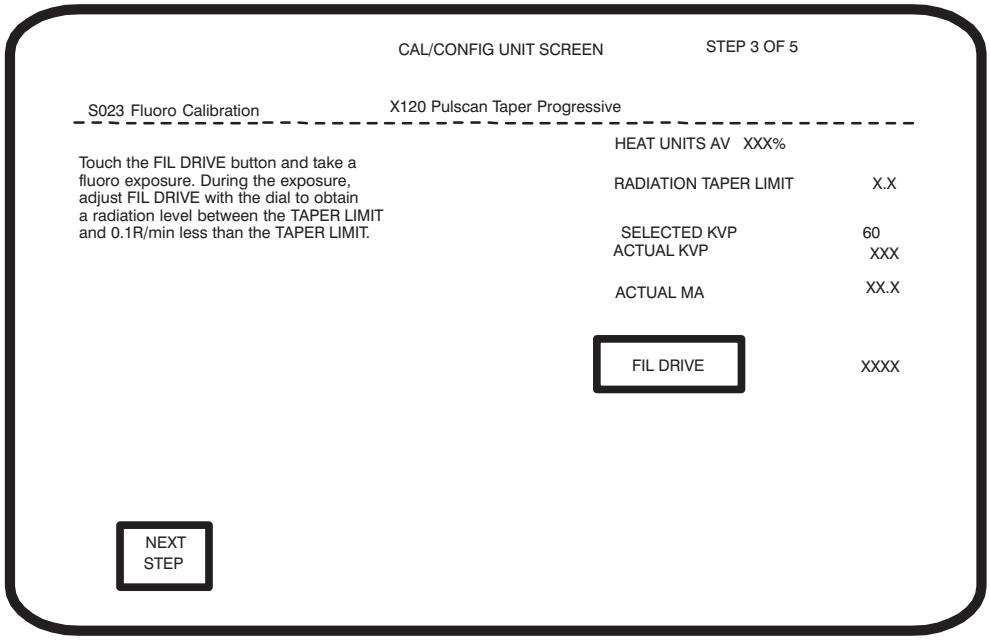
For Other Systems:

- During the exposure, turn the console dial to adjust FIL DRIVE until the R/min rate indicated on the radiation meter is within 0.1 R/min less than the RADIATION TAPER LIMIT value displayed on the console screen.

CAUTION **During the calibration, the mA must not be set above 14.8 mA to achieve the RADIATION TAPER LIMIT. Stop at 14.8 mA and accept the actual radiation level achieved.**

- When the correct R/min level is obtained and stable, stop fluoro.
- Touch NEXT STEP softkey to proceed to Step 4.

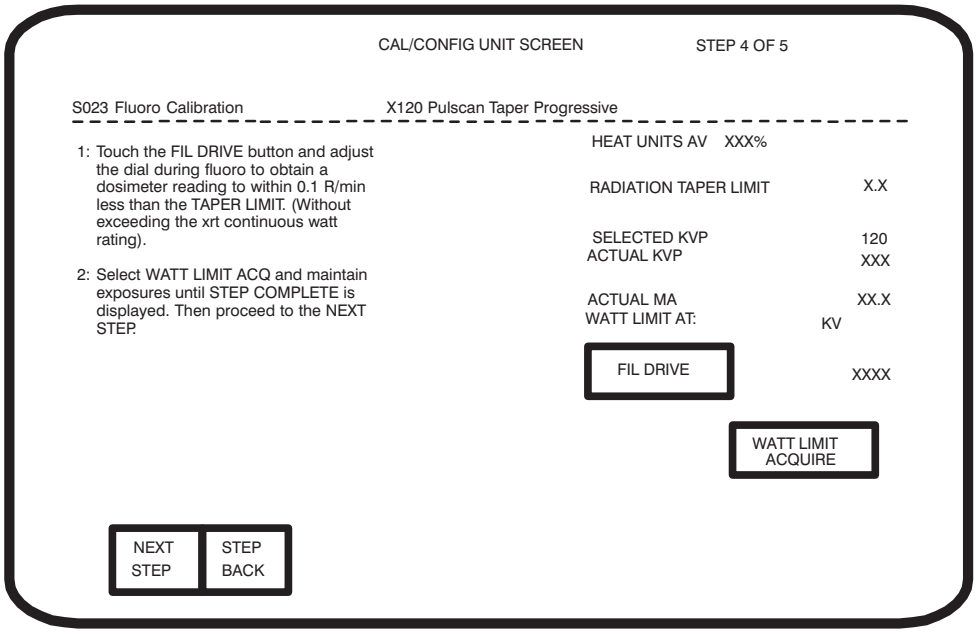
X120 STEP 3 SCREEN DISPLAY



4-4 Step 4. 120 KV FIL DRIVE Adjustment

- Initiate FIL DRIVE adjustment by touching the FIL DRIVE softkey.
- Take and maintain a fluoro exposure. During the exposure, turn the console dial to adjust FIL DRIVE until the R/min rate indicated on the radiation meter is within 0.1 R/min less than the RADIATION TAPER LIMIT value displayed on the console screen. Do not exceed the x–ray tube continuous watt rating during the adjustment.
- When the correct R/min level is obtained and stable, stop fluoro.
- Take and maintain another exposure. During the exposure, touch the WATT LIMIT ACQUIRE softkey. The system will calculate wattage and compare against a Continuous Watt Rating limit stored in the database. Maintain the exposure until the STEP COMPLETE message is displayed. If calculated wattage is higher than the Continuous Watt Rating limit, the message ”CONTINUOUS WATT RATING EXCEEDED, PLEASE RECAL TO A LOWER DOSE” will be displayed. If necessary, repeat the FIL DRIVE adjustment.
- Touch NEXT STEP softkey to proceed to Step 5.

X120 STEP 4 SCREEN DISPLAY



4-5 Step 5. Verification

- Initiate Entrance Exposure Rate–EER (R/min) verification by touching the KVP softkey.
- Take and maintain a fluoro exposure. During the exposure, use the console dial to step from 60 kVp to 120 kVp in 5 kVp increments. Verify the EER (R/min) level on the radiation meter at each kVp increment.

NOTICE

When incrementing kVp through the verification values, rotate the console dial slowly. As the filament control parameter (G5) is active during this step of the calibration, you must allow time for the G5 to respond to each new kVp setting before incrementing to the next kVp. If you try to step through the kVp increments without giving the G5 parameter time to respond, information messages may appear on the console screen and/or erroneous fluctuations may occur in the R/min readout.

- Terminate the exposure.
- If the EER (R/min), at any kVp increment, exceeds the RADIATION TAPER LIMIT displayed on the console screen by more than 0.3 R/min, a recalibration at slightly lower radiation levels is required. Touch RECAL softkey and repeat calibration.

Note: If EER (R/min) is excessive only at the high kVp increments, lowering G2 may be sufficient (Repeat Step 4, G2 adjustment).

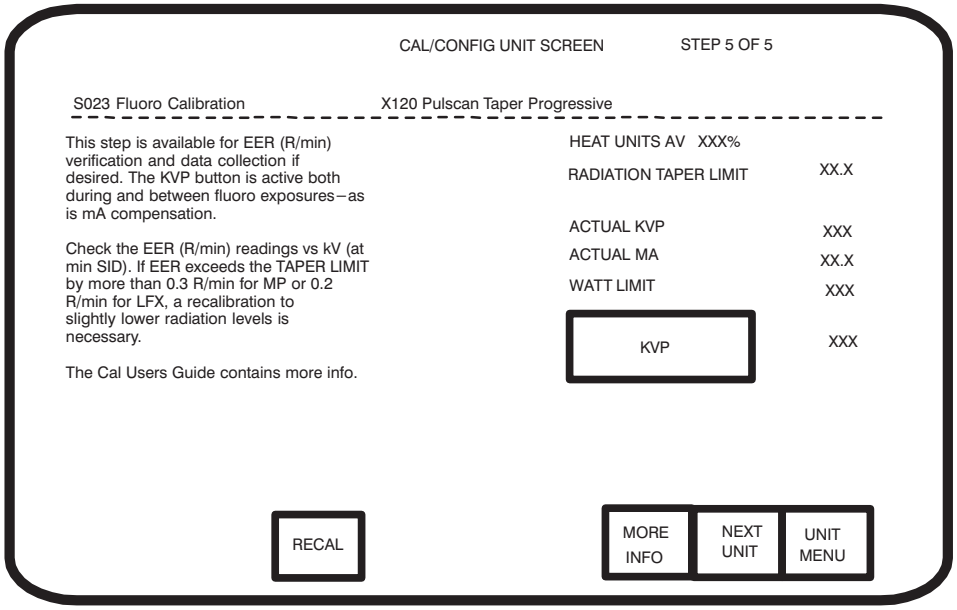
- Verify the results of any re-calibrations by repeating Step 5.
- Touch the NEXT UNIT or UNIT MENU softkey to exit.

4-5-1 Special instructions regarding verification

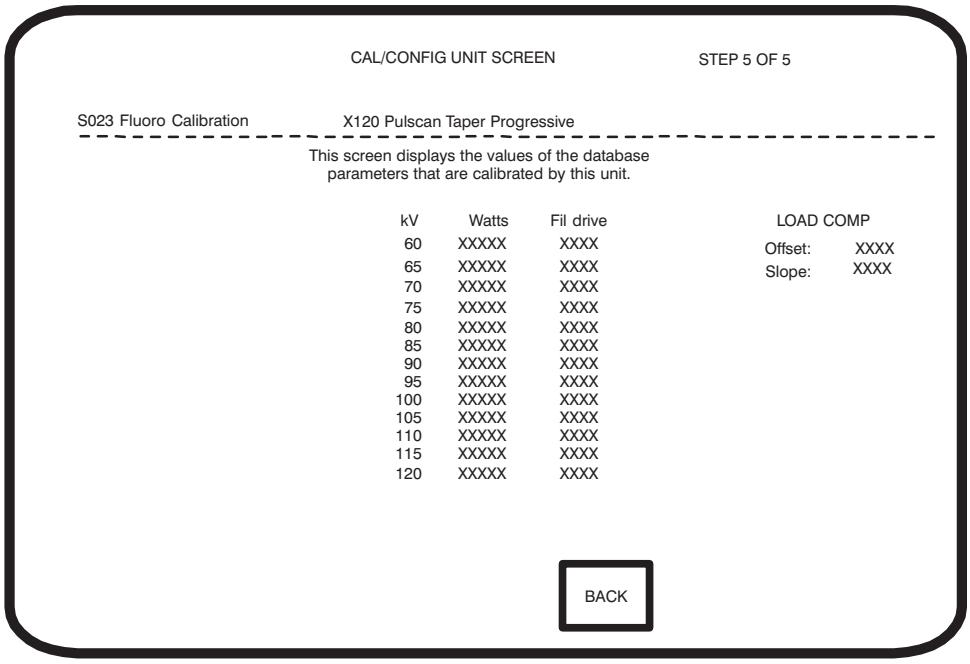
If the table top EER (R/min) is low, review the following special instructions before proceeding with a recalibration. Do not just recal at a higher EER (R/min) value.

MA compensation will compensate for x–ray tube heating and cooling effects as well as filament aging.

X120 STEP 5 SCREEN DISPLAY



X120 STEP 5 "MORE INFO" SCREEN



Note: Step 5 MORE INFO screen:

1. The list of kV's in the right hand column shows the range of kV's for the 60–120 kV range. The Table is displayed from Min to Max kV.
2. The list of kV's in the left hand column is only displayed if the range of allowed kV's exceeds 13 values.

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UNIT X121 – Pulscan (Camtronics RTDM) SID Compensation

Time: x h xx min – Personnel: 1 field engineer

1 X121, PULSCAN (CAMTRONICS RTDM) SID COMPENSATION, NEW PROCEDURE

Note: The New Procedure is used for ALL biplane systems, and for NEWER software (i.e., ASC SW beginning with G4.XX) single plane LCA/LCV+/LC+ systems.

(For older software single plane LCA/LCV+/LC+ systems, go to Old Procedure in Section 2.)

When calibrating the frontal plane on a biplane system, the LP must be in parking position, follow the procedure hereunder prior to running X121 Cal unit:

- Select S010 vascular positioner calibration in the Main Menu,
- Select, then run Cal Unit P508,
- Put the LP in parking position using the parking buttons of the TSCC,
- Exit Cal Unit P508.

1-1 Description

Calibration Unit X121 adjusts the Pulscan SID compensation parameters so that as SID increases, tube filament current increases, thereby maintaining the fluoro table top dose at a calibrated value. Pulscan SID compensation also prevents increases in fluoro technique from exceeding the fluoro rating of the tube. SID compensation is only active during fluoro exposures. Seven steps are required to calibrate the Pulscan SID compensation parameters. A screen display is provided for each step.

CAUTION **This unit allows the system to be configured for higher pulsed progressive fluoro taper limits than shipped. This is not recommended. This is forbidden in the US where the 10 R/mn regulatory limits applies. While the system will operate at these higher taper limits, the reliability under this condition may suffer; increased maintenance costs should be expected. Only raise the fluoro taper limits after all other methods of improving digital fluoro image quality have been tried and there is still a serious customer issue.**

Note: This unit must always be run in combination with Cal Unit X120 and X120 must be run first.

1-2 Equipment required

Dosimeter (MDH/Radcal 2025, 2026 or equivalent) w/probe stand or Ion Chamber Positioning Tool 2236707 (Former ref: 2208874)
For Advantx–E Systems, Ion Chamber Positioning Tool is mandatory (See Cal Unit T015) .
For this Cal Unit, use Model 20x5–3 or 20x6–3 probe.
Metric Tape Measure.

1-3 Special Instructions

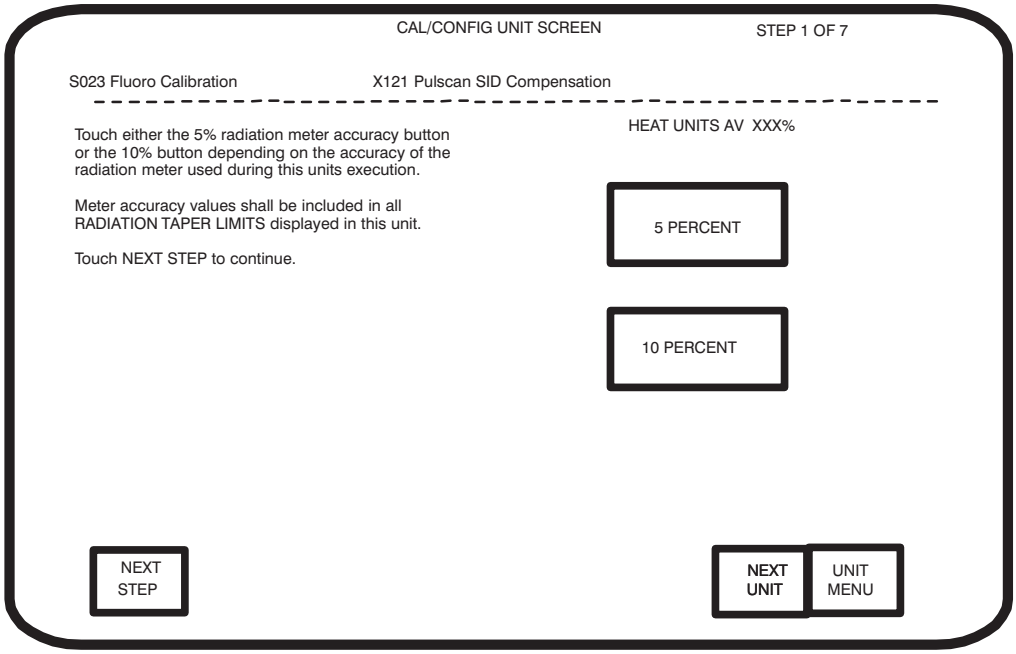
Note: **For Vascular Systems only:** before system calibration, verify that additional filter (copper–aluminum filter) is not installed on top of collimator. (Open sensor hinge assembly to verify.) If installed, remove before performing calibration.

1-4 Cal Procedure

1-4-1 Step 1. Radiation Meter Accuracy.

- Check the accuracy of the radiation meter to be used in the calibration. (Radcal 2025 or 2026 and their probes have a 5% accuracy).
- Touch the 5 PERCENT or 10 PERCENT softkey to enter the rated accuracy of the radiation meter. The meter accuracy is included in all RADIATION TAPER LIMITS displayed in this unit.
- Touch NEXT STEP softkey to proceed to Step 2.

X121 STEP 1 SCREEN DISPLAY
(BIPLANE & NEWER SW SP LCA+/LCV+/LC+ SYSTEMS)



1-4-2 Step 2. Radiation Meter (R–Meter) Probe Positioning

CAUTION **LP must be at 90 degrees (C90 position on LC position display) to allow positioning of x–ray tube and II tube.**

CAUTION **Verify that the collision sensor is installed on the collimator, and that the hinged door is closed before proceeding.**

- Move the table top out of the field of the x–ray beam and open the collimator blades to maximum.

NOTICE **For Advantx–E Vascular Systems, rotate the table top to 90 degrees vs the longitudinal positioner axis.**

NOTICE **On LC systems configured with an Omega EP table, you must rotate the LC positioner pivot to 90 degrees and lower the table top out of the x–ray beam.**

- Manually set the II tube and x–ray tube to minimum SID.

Note: For Advantx–E Vascular Systems, Ion Chamber Positioning Tool is mandatory to get accurate adjustments.

Note: If you are using the Ion Chamber Positioning Tool and if you have just run X120 unit, the probe should not have moved, so DO NOT CHANGE the positioning of the probe to avoid errors in the calibration.

- When using Ion Chamber Positioning Tool 2236707 (Former ref: 2208874), refer to Illustration 135 in Cal Unit X100 and to the instructions on the screen display for Step 2; also, refer to mounting/positioning instructions in Cal Unit T015. Check for probe top/II anticollision plate distance in Table 10 of Cal Unit T015.
- If not using the Ion Chamber Positioning Tool, mount R–Meter probe stand to bottom of II tube (or position the stand on the head end of the table top and extend the R–Meter probe into the x–ray beam). Position the R–meter probe 30 cm from the lowest point on the II tube housing (Refer to Illustration 134 in Cal Unit X100 and to the instructions on the screen display for Step 2).

Note: The positioning of the R–meter probe 30 cm from the lowest point on the II tube housing (with II in overhead position) is an FDA requirement. The FDA assumes that the 30 cm distance corresponds to the average thickness of a patient and therefore establishes a worst case condition for radiation dose.

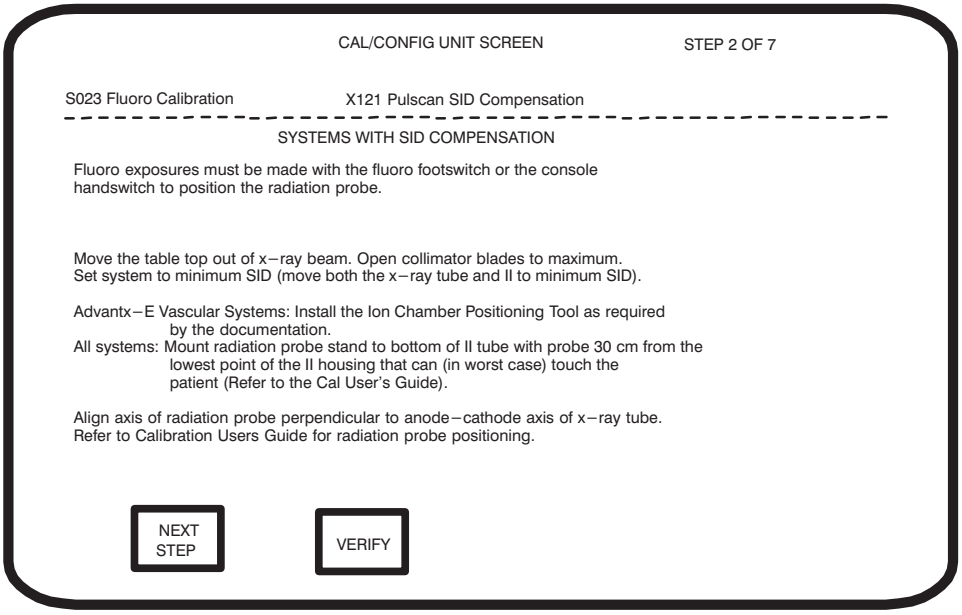
- Align the axis of the probe perpendicular to the anode–cathode axis of the x–ray tube.
- Take a fluoro exposure to determine the exact position of the R–Meter probe in the field of view.
- Repeat taking exposures and repositioning the R–Meter probe until the probe is centered in the x–ray beam.

- After the R–Meter probe is properly positioned, you may perform a quick check of the Radiation Taper Limit before proceeding with a full calibration by touching the VERIFY softkey. Touching the VERIFY softkey will cause the unit to increment to the Step 7, Verification screen. Perform Step 7.

OR

- Touch the NEXT STEP softkey to proceed directly to Step 3 in the calibration sequence.

X121 STEP 2 SCREEN DISPLAY
(BIPLANE & NEWER SW SP LCA+/LCV+/LC+ SYSTEMS)



NOTICE

Before attempting to run SID POS Positioning on LCA+/LCV+/LC+ systems, ensure that the table top rotational position is at 0 degrees or ± 90 degrees for systems with Omega IV tables or at 0 degrees angulation position for systems with Omega EP tables. The SID button on the tableside control is disabled if the table is not at one of these positions.

NOTICE

For frontal calibration on a biplane system, the LP must be parked.

1-4-3 Step 3. SID POS Positioning

- Touch the SIDZERO softkey. The system will process and load SIDZERO data into NVRAM. Upon completion of processing, a “SIDZERO PROCESS COMPLETE” message will be displayed on the console.
- Touch the SID POS softkey.

Note: On LCA/LCV+/LC+ systems, the SID POS softkey does not control the positioning of the Image Intensifier tube. Touch the SID POS softkey on the console and then press and hold the SERVICE button beneath the tableside control until the II reaches the maximum SID position.

On biplane lateral, maintain button activation until the Image Intensifier tube is in position. The SID POS softkey will then display G4. For 120 kV calibration you will have to push button activation again until the x–ray tube is in position (may take 15–20 seconds). The x–ray tube will not start to move until the II is in position.

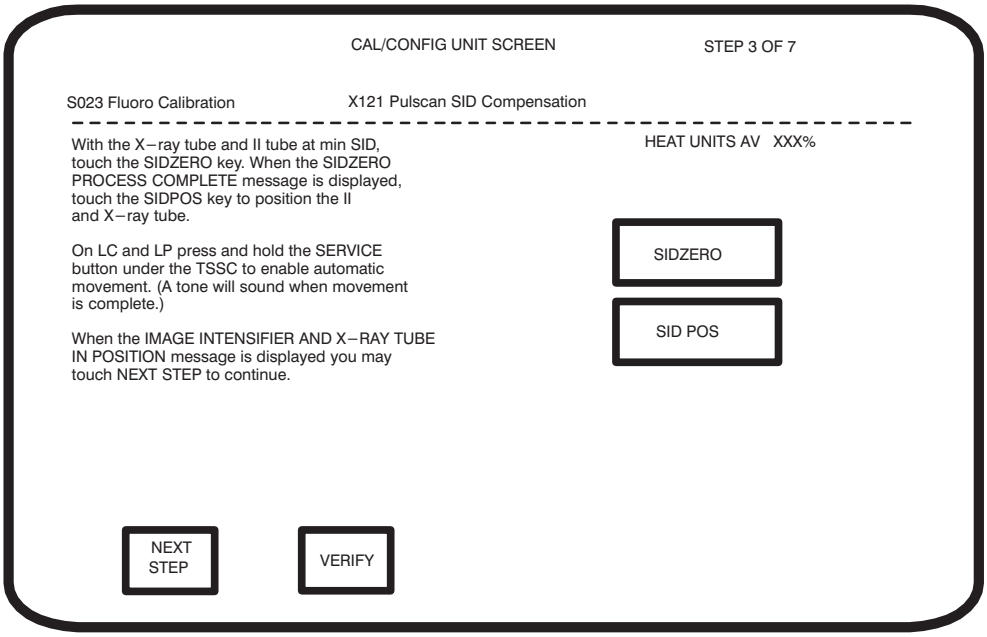
For German Advantx–E Vascular Systems with non–removable 0.1 mm copper filter in the beam:

- When the message “IMAGE INTENSIFIER AND X–RAY TUBE IN POSITION” is displayed, position the II to 95 cm SID (frontal) or 100 cm SID (lateral) in place of max SID.
- Touch NEXT STEP softkey to proceed to Step 4.

For Other Systems:

- When the message “IMAGE INTENSIFIER AND X–RAY TUBE IN POSITION” is displayed, touch NEXT STEP softkey to proceed to Step 4.

X121 STEP 3 SCREEN DISPLAY (BIPLANE & NEWER SW SP LCA+/LCV+/LC+ SYSTEMS)



1-4-4 Step 4. G3 Adjustment

Before proceeding, touch the MORE INFO softkey to access the Step 4 MORE INFO screen for more instructions about the G3 adjustment.

Note: For other than Advantx–E Vascular Systems:

- Using a ruler, set the II to isocenter distance to 300mm (30 cm). Measure to the lowest point on the II tube housing (depending upon the type of system involved, this may be the II tube cover or anti–collision device). See Illustration 137 in Cal Unit X101.
- After the II to isocenter distance is set, mark the distance on the II carriage with a piece of tape. This will provide a reference point for the 300 mm (30 cm) distance to ensure distance is maintained or for easy return to the measured distance, if required.

- Initiate G3 adjustment by touching the G3 softkey.
- Take and maintain a fluoro exposure.

For German Advantx–E Vascular Systems with non–removable 0.1 mm copper filter in the beam:

- Adjust G3 to get D(minref) value (found at X120 Step 3) at 60 kVp.

For Other Systems:

- During the exposure, turn the console to adjust G3 dial until the R/min rate indicated on the radiation meter is within 0.1 R/min less than the RADIATION TAPER LIMIT value displayed on the console screen.

NOTICE

If for some reason, the power unit limit on peak fluoro power at 60 kV is exceeded, the message “mA Exceeds Power Unit Limits, See Manual and MORE INFO” is displayed. Then decrease SID by 3 cm and try again. A decrease of SID will not change the EER.

- Terminate the exposure.

Note: The power unit has limits on peak mA during G3 calibration. Exceeding the limits can cause kV drop during exposures — giving a bad calibration or power unit errors. If the system cannot perform the calibration with a SID of at least 90 cm then the calibration will work properly at smaller SID, but mR/mAs should be tested as the value is likely to be below Xray Tube replacement limits.

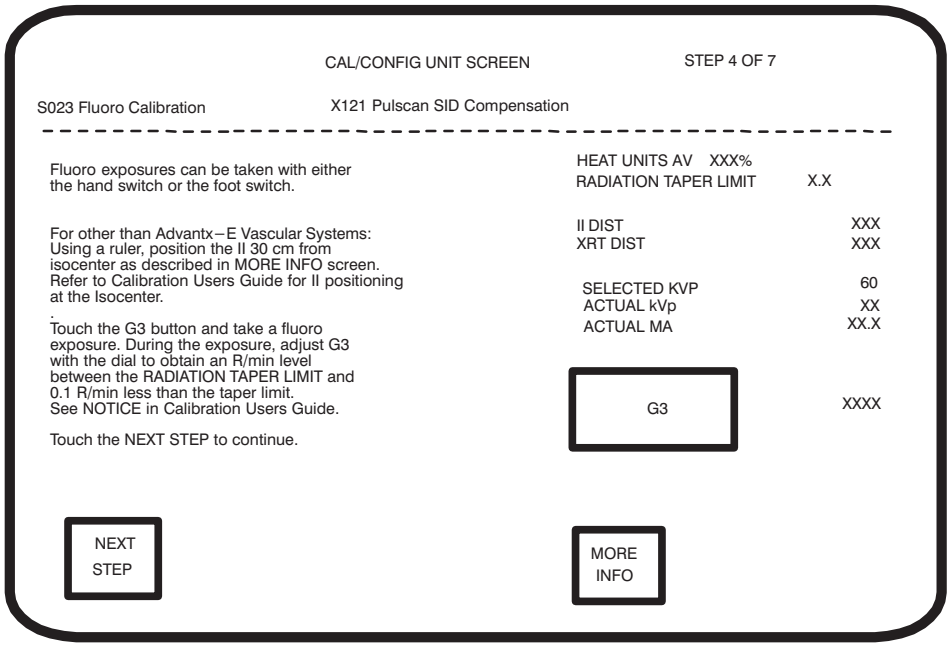
NOTICE

On a system with variable Xray Tube Positioning (LP):

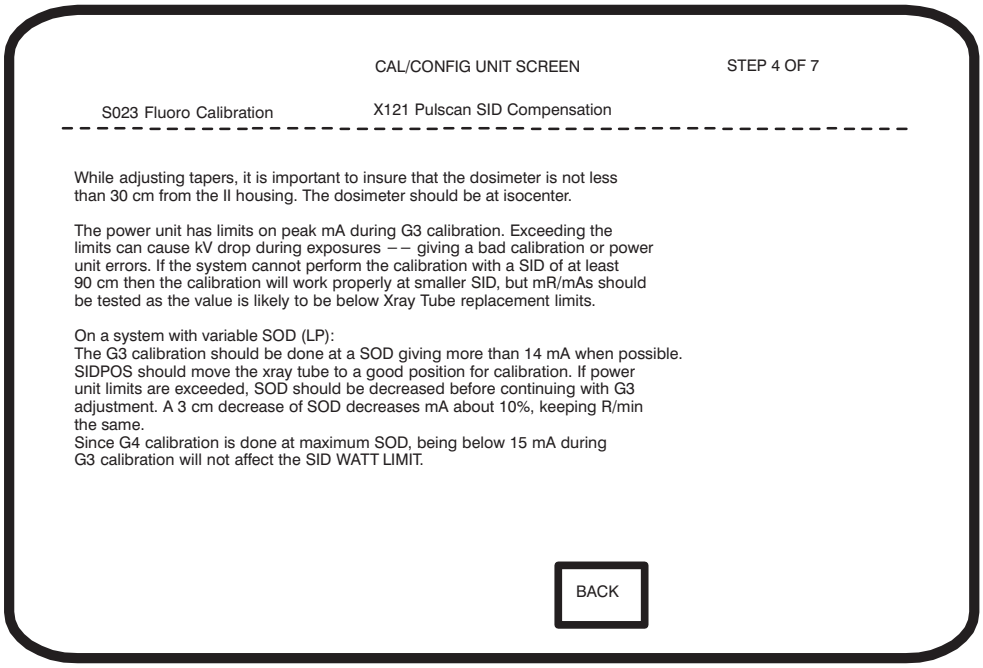
The G3 calibration should be done at a SOD giving when possible more than 14 mA. SIDPOS should move the xray tube to a good position for calibration. If power unit limits are exceeded, SOD should be decreased before continuing with G3 adjustment. A 3 cm decrease of SOD decreases mA of about 10%, keeping R/min the same. Since G4 calibration is done at maximum SOD, being below 15 mA during G3 calibration will not affect the SID WATT LIMIT.

- Touch NEXT STEP softkey and proceed to Step 5.

X121 STEP 4 SCREEN DISPLAY
(BIPLANE & NEWER SW SP LCA+/LCV+/LC+ SYSTEMS)



X121 STEP 4 "MORE INFO" SCREEN DISPLAY
(BIPLANE & NEWER SW SP LCA+/LCV+/LC+ SYSTEMS)



1-4-5 Step 5. G4 Adjustment

1-4-5-1 For Lateral Plane only:

- Touch the SIDPOS softkey, then press and hold the SERVICE under the TSSC while the Xray tube autopositions to maximum SOD. After completion of positioning, a tone sounds and the SIDPOS softkey label changes from “SIDPOS” to “G4”.
- Initiate G4 adjustment by touching the G4 softkey.
- Take and maintain a fluoro exposure.

For German Advantx–E Vascular Systems with non–removable 0.1 mm copper filter in the beam:

- Position the II to max SID (with the blue button on the II anticollision ring) and max SOD (lateral)
- Adjust G4 to get 12.5 mA read on the console at 120 kVp.
- Measure the resulting dose, then call it D(maxSID).
- If D(maxSID) is higher than 9.1 R/mn, readjust G4 to get 9.1 R/mn, then touch NEXT STEP softkey and proceed to Step 6.
- If D(maxSID) is lower than 9.1 R/mn, reduce SOD then SID by a 1 cm step, then readjust G4 to get 12.5 mA read on the console. Measure the resulting dose. If this dose is still lower than 9.1 R/mn, repeat this action until the resulting dose reaches a value higher than 9.1 R/mn (You shall get at the same time 12.5 mA AND a dose higher than 9.1 R/mn).
- Re–adjust G4 to get 9.1 R/mn at 120 kVp.
- Terminate the exposure.
- Touch NEXT STEP softkey and proceed to Step 6.

For Other Systems:

- During the exposure, turn the console dial to adjust G4 until the R/min rate indicated on the radiation meter is within 0.1 R/min less than the RADIATION TAPER LIMIT value displayed on the console screen.
- Terminate the exposure.
- Touch NEXT STEP softkey and proceed to Step 6.

NOTICE

If for some reason, the peak power limit of 5.4 kW is exceeded, the message “mA high; Check mR/mAs” is displayed. You may continue with calibration, but check tube efficiency. Reduce X–ray tube SOD by 3 cm steps until the radiation taper limit can be achieved.

1-4-5-2 For Frontal Plane:

NOTICE **If SID was changed in the previous step, you must return the system to the original SID value (max SID for Advantx–E Vascular systems, SID 30 cm from isocenter for the other systems).**

- Initiate G4 adjustment by touching the G4 softkey.
- Take and maintain a fluoro exposure.

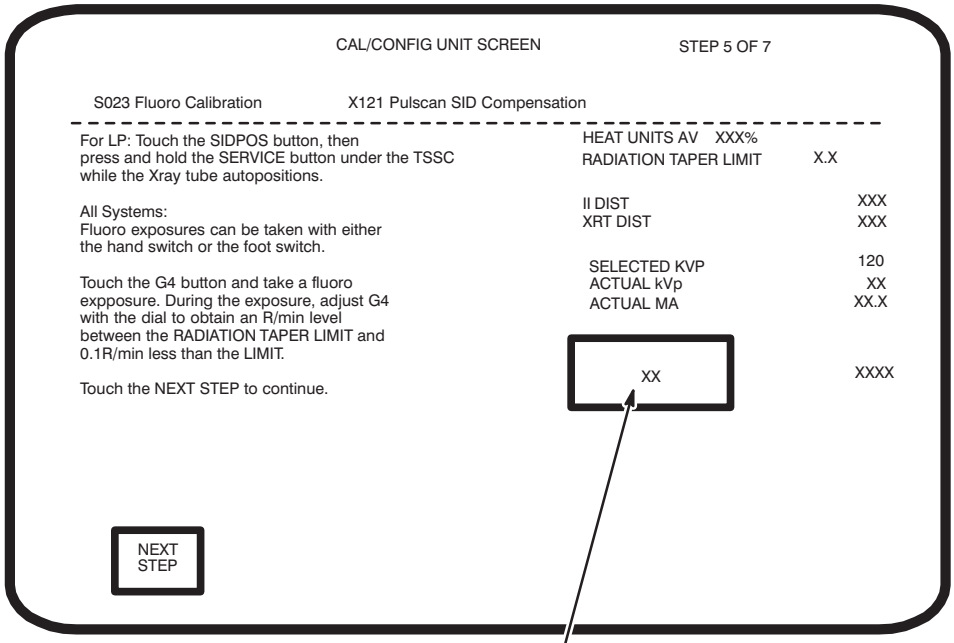
For German Advantx–E Vascular Systems with non–removable 0.1 mm copper filter in the beam:

- Position the II to max SID (with the blue button on the II anticollision ring) and max SOD (lateral)
- AdjustG4 to get 12.5 mA read on the console at 120 kVp.
- Measure the resulting dose, then call it D(maxSID).
- If D(maxSID) is higher than 9.1 R/mn, readjust G4 to get 9.1 R/mn, then touch NEXT STEP softkey and proceed to Step 6.
- If D(maxSID) is lower than 9.1 R/mn, reduce SOD then SID by a 1 cm step, then readjust G4 to get 12.5 mA read on the console. Measure the resulting dose. If this dose is still lower than 9.1 R/mn, repeat this action until the resulting dose reaches a value higher than 9.1 R/mn (You shall get at the same time 12.5 mA AND a dose higher than 9.1 R/mn).
- Re–adjust G4 to get 9.1 R/mn at 120 kVp.
- Terminate the exposure.
- Touch NEXT STEP softkey and proceed to Step 6.

For Other Systems:

- During the exposure, turn the console dial to adjust G4 until the R/min rate indicated on the radiation meter is within 0.1 R/min less than the RADIATION TAPER LIMIT value displayed on the console screen.
- Terminate the exposure.
- Touch NEXT STEP softkey and proceed to Step 6.

X121 STEP 5 SCREEN DISPLAY
(BIPLANE & NEWER SW SP LCA+/LCV+/LC+ SYSTEMS)



For Lateral Plane ONLY: Softkey says “SIDPOS” until after activation and completion of positioning. Then, softkey label changes to say “G4”.

For Frontal Plane: Softkey ALWAYS says “G4”.

1-4-6 Step 6. SID Watt Limiter Adjustment

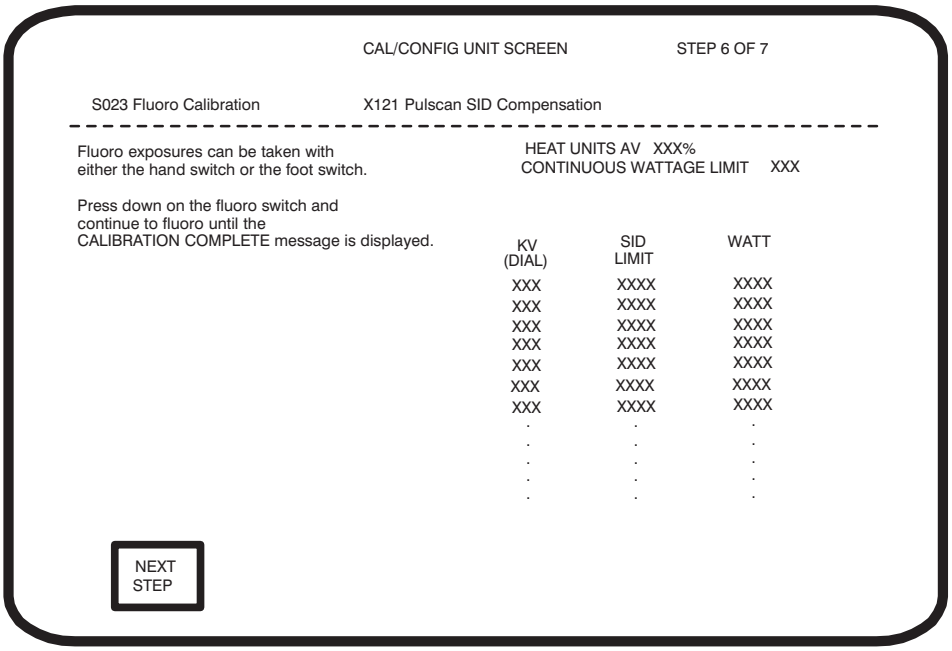
- Take and maintain a fluoro exposure. The system will perform the Watt limiter adjustment while the exposure is being taken.
- Maintain the exposure until the “CALIBRATION COMPLETE” message is displayed on the console screen.

NOTICE

During the automatic wattage calculation, the following message “WATT LIMIT EXCEEDED AT MIN SID. RECAL FLUORO TAPER AND THIS UNIT” may appear on the console. At this point, the calculation is interrupted because the calculated wattage exceeds the wattage upper limit. In this case, switch the system off at the console and recalibrate the taper at the minimum SID, making sure the 1800 watt safety limit is respected.

- Touch NEXT STEP softkey and proceed to Step 7.

X121 STEP 6 SCREEN DISPLAY
(BIPLANE & NEWER SW SP LCA+/LCV+/LC+ SYSTEMS)



1-4-7 Step 7. Verification

Verification should be done at different kVp's and SID's.

- Initiate Entrance Exposure Rate–EER (R/min) verification by touching the KVP softkey.
- Take and maintain a fluoro exposure. During the exposure, use the console dial to step from 60 kVp to 120 kVp in 5 kVp increments. Verify the EER (R/min) level on the radiation meter at each kVp increment.

NOTICE

When incrementing kVp through the verification values, rotate the console dial slowly. As the filament control parameter (G5) is active during this step of the calibration, you must allow time for the G5 to respond to each new kVp setting before incrementing to the next kVp. If you try to step through the kVp increments without giving the G5 parameter time to respond, information messages may appear on the console screen and/or erroneous fluctuations may occur in the R/min readout.

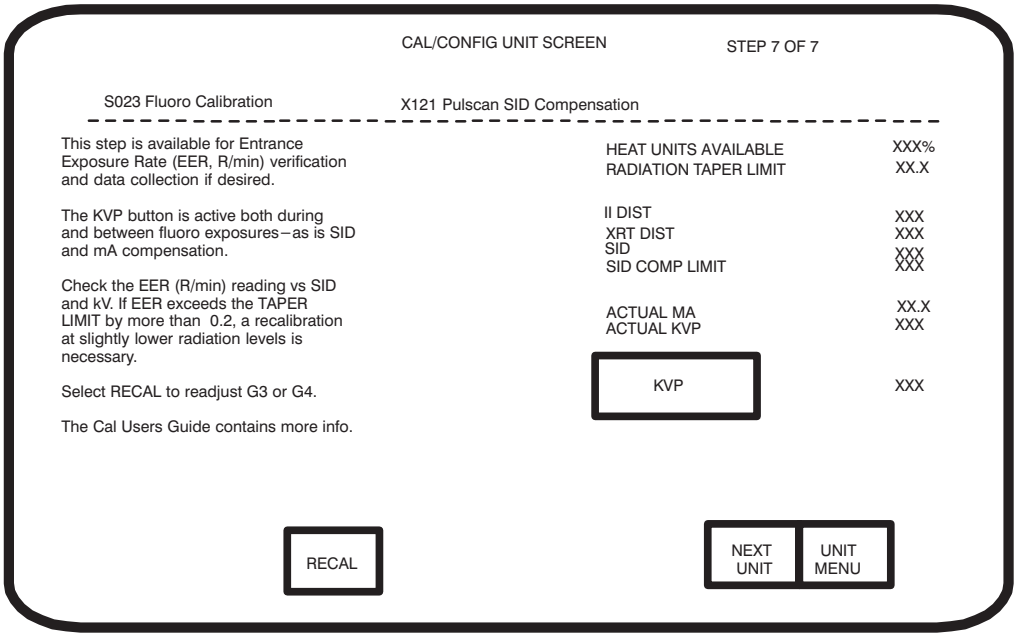
- Terminate the exposure.
- If the EER (R/min), at any kVp increment and SID, exceeds the RADIATION TAPER LIMIT displayed on the console screen by more than 0.2 R/min, a recalibration at slightly lower radiation levels is required.
- If a recalibration is required, touch the RECAL softkey and readjust G3 (Step 4) or G4 (Step 5).
- Verify the results of any re-calibrations by repeating Step 7.
- If the EER (R/min) at any kVp increment at min SID is different by more than 0.5 R/min from that at the SID comp limit, a recalibration is recommended.
- Touch the NEXT UNIT or UNIT MENU softkey to exit.

1-4-7-1 Special instructions regarding verification

If the table top EER (R/min) is low, review the following special instructions before proceeding with a recalibration. Do not just recal at a higher EER (R/min) value.

1. MA compensation will compensate for x–ray tube heating and cooling effects as well as filament aging.
2. If the SID is larger than the value calibrated in SID Watt Limiter, then the display of the SID Comp Limit value will be blinking in inverse video. In that case, the EER will be lower than the calibrated values.

X121 STEP 7 SCREEN DISPLAY
(BIPLANE & NEWER SW SP LCA+/LCV+/LC+ SYSTEMS)



2 X121, PULSCAN (CAMTRONICS RTDM) SID COMPENSATION, OLD PROCEDURE

Note: The Old Procedure is used for OLDER software (i.e., ASC SW prior to G4.XX) single plane LCA/LCV+/LC+ systems.

(For biplane systems and for newer software single plane LCA/LCV+/LC+ systems, go to New Procedure in Section 1.)

2-1 Description

Calibration Unit X121 adjusts the Pulscan SID compensation parameters so that as SID increases, tube filament current increases, thereby maintaining the fluoro table top dose at a calibrated value. Pulscan SID compensation also prevents increases in fluoro technique from exceeding the fluoro rating of the tube. SID compensation is only active during fluoro exposures. Seven steps are required to calibrate the Pulscan SID compensation parameters. A screen display is provided for each step.

CAUTION **This unit allows the system to be configured for higher pulsed progressive fluoro taper limits than shipped. This is not recommended. This is forbidden in the US where the 10 R/mn regulatory limits applies. While the system will operate at these higher taper limits, the reliability under this condition may suffer; increased maintenance costs should be expected. Only raise the fluoro taper limits after all other methods of improving digital fluoro image quality have been tried and there is still a serious customer issue.**

Note: This unit must always be run in combination with Cal Unit X120 and X120 must be run first.

2-2 Equipment required

Dosimeter (MDH/Radcal 2025, 2026 or equivalent) w/probe stand or Ion Chamber Positioning Tool 2236707 (Former ref: 2208874)
For Advantx–E Systems, Ion Chamber Positioning Tool is mandatory (See Cal Unit T015) .
For this Cal Unit, use Model 20x5–3 or 20x6–3 probe.
Metric Tape Measure.

2-3 Special Instructions

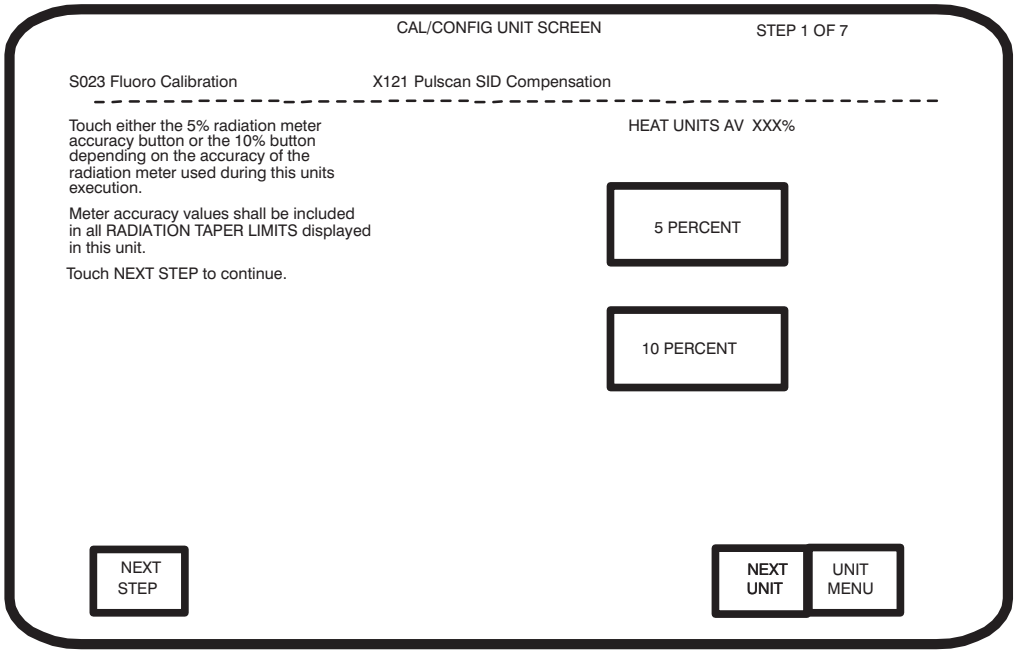
Note: **For Vascular Systems only:** Before system calibration, verify that additional filter (copper–aluminum filter) is not installed on top of collimator. (Open sensor hinge assembly to verify.) If installed, remove before performing calibration.

2-4 Cal Procedure

2-4-1 Step 1. Radiation Meter Accuracy.

- Check the accuracy of the radiation meter to be used in the calibration.
- Touch the 5 PERCENT or 10 PERCENT softkey to enter the rated accuracy of the radiation meter. The meter accuracy is included in all RADIATION TAPER LIMITS displayed in this unit.
- Touch NEXT STEP softkey to proceed to Step 2.

X121 STEP 1 SCREEN DISPLAY
(OLDER SW SP LCA/LCV+/LC+ SYSTEMS)



2-4-2 Step 2. Radiation Meter (R–Meter) Probe Positioning

CAUTION **Verify that the collision sensor is installed on the collimator, and that the hinged door is closed before proceeding.**

- Move the table top out of the field of the x–ray beam and open the collimator blades to maximum.

NOTICE **For Advantx–E Vascular Systems, rotate the table top to 90 degrees vs the longitudinal positioner axis.**

NOTICE **On LC systems configured with an Omega EP table, you must rotate the LC positioner pivot to 90 degrees and lower the table top out of the x–ray beam.**

- Manually set the II tube and x–ray tube to minimum SID.

Note: For Advantx–E Vascular Systems, Ion Chamber Positioning Tool is mandatory to get accurate adjustments.

Note: If you are using the Ion Chamber Positioning Tool and if you have just run X120 unit, the probe should not have moved, so DO NOT CHANGE the positioning of the probe to avoid errors in the calibration.

- When using Ion Chamber Positioning Tool 2236707 (Former ref: 2208874), refer to Illustration 135 in Cal Unit X100 and to the instructions on the screen display for Step 2; also, refer to mounting/positioning instructions in Cal Unit T015. Check for probe top/II anticollision plate distance in Table 10 of Cal Unit T015.
- If not using the Ion Chamber Positioning Tool, mount R–Meter probe stand to bottom of II tube (or position the stand on the head end of the table top and extend the R–Meter probe into the x–ray beam). Position the R–meter probe 30 cm from the lowest point on the II tube housing (Refer to Illustration 134 in Cal Unit X100 and to the instructions on the screen display for Step 2).

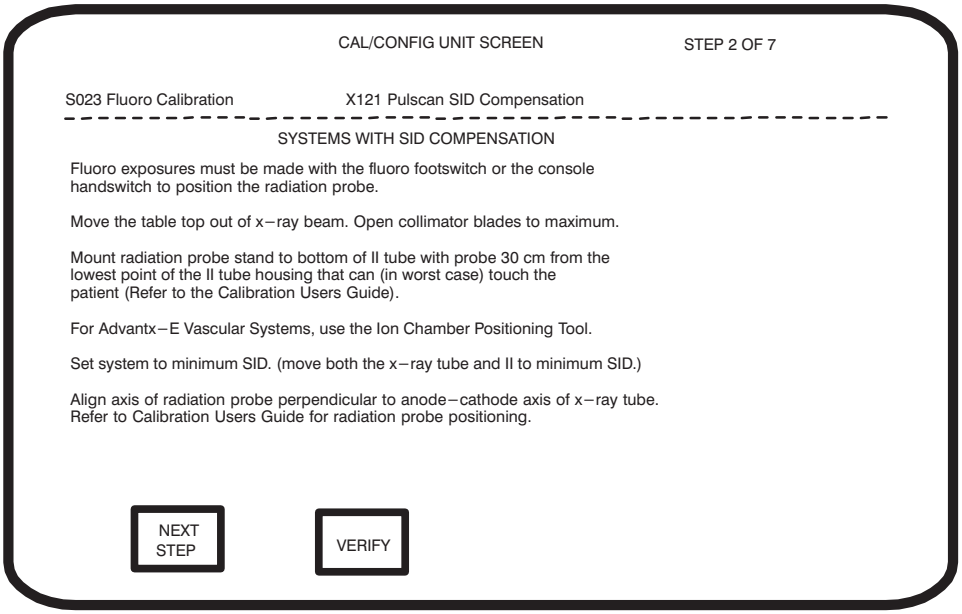
Note: The positioning of the R–meter probe 30 cm from the lowest point on the II tube housing (with II in overhead position) is an FDA requirement. The FDA assumes that the 30 cm distance corresponds to the average thickness of a patient and therefore establishes a worst case condition for radiation dose.

- Align the axis of the probe perpendicular to the anode–cathode axis of the x–ray tube.
- Take a fluoro exposure to determine the exact position of the R–Meter probe.
- Repeat taking exposures and repositioning the R–Meter probe until the probe is centered in the x–ray beam.
- After the R–Meter probe is properly positioned, you may perform a quick check of the Radiation Taper Limit before proceeding with a full calibration by touching the VERIFY softkey. Touching the VERIFY softkey will cause the unit to increment to the Step 7, Verification screen. Perform Step 7.

OR

- Touch the NEXT STEP softkey to proceed directly to Step 3 in the calibration sequence.

X121 STEP 2 SCREEN DISPLAY
(OLDER SW SP LCA/LCV+/LC+ SYSTEMS)



NOTICE

Before attempting to run SID POS Positioning on LCA/LCV+/LC+ systems, ensure that the table top rotational position is at 0 degrees or ± 90 degrees for systems with Omega IV tables or at 0 degrees angulation position for systems with Omega EP tables. The SID button on the tableside control is disabled if the table is not at one of these positions.

2-4-3 Step 3. SID POS Positioning

- Touch the SIDZERO softkey. The system will process and load SIDZERO data into NVRAM. Upon completion of processing, a “SIDZERO PROCESS COMPLETE” message will be displayed on the console.
- Touch the SID POS softkey.

Note: On LCA/LCV+/LC+ systems, the SID POS softkey does not control the positioning of the Image Intensifier tube. Touch the SID POS softkey on the console and then press and hold the RESET button beneath the tableside control until the II reaches the upper SID position.

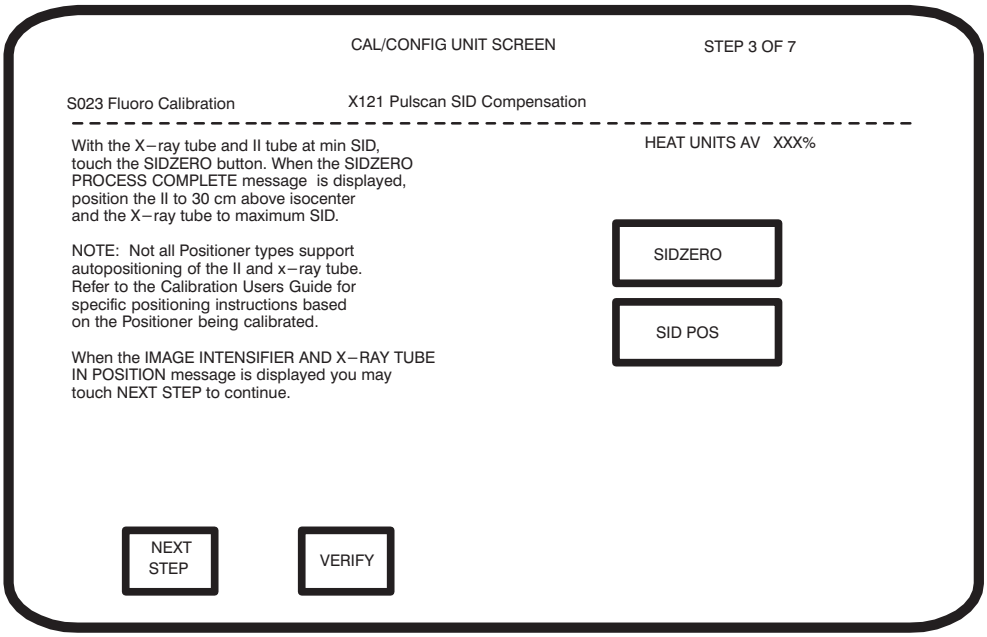
For German Advantx–E Vascular Systems with non–removable 0.1 mm copper filter in the beam:

- When the message “IMAGE INTENSIFIER AND X–RAY TUBE IN POSITION” is displayed, position the II to 95 cm SID (frontal) or 100 cm SID (lateral) in place of max SID.
- Touch NEXT STEP softkey to proceed to Step 4.

For Other Systems:

- When the message “IMAGE INTENSIFIER AND X–RAY TUBE IN POSITION” is displayed, touch NEXT STEP softkey to proceed to Step 4.

X121 STEP 3 SCREEN DISPLAY
(<u>OLDER</u> SW SP LCA/LCV+/LC+ SYSTEMS)



2-4-4 Step 4. G3 Adjustment

Note: For other than Advantx–E Vascular Systems:

- Using a ruler, set the II to isocenter distance to 300mm (30 cm). Measure to the lowest point on the II tube housing (depending upon the type of system involved, this may be the II tube cover or anti–collision device). See Illustration 137 in Cal Unit X101.
- After the II to isocenter distance is set, mark the distance on the II carriage with a piece of tape. This will provide a reference point for the 300 mm (30 cm) distance to ensure distance is maintained or for easy return to the measured distance, if required.

- Ensure that the x–ray tube is at maximum SID.
- Initiate G3 adjustment by touching the G3 softkey.
- Take and maintain a fluoro exposure.

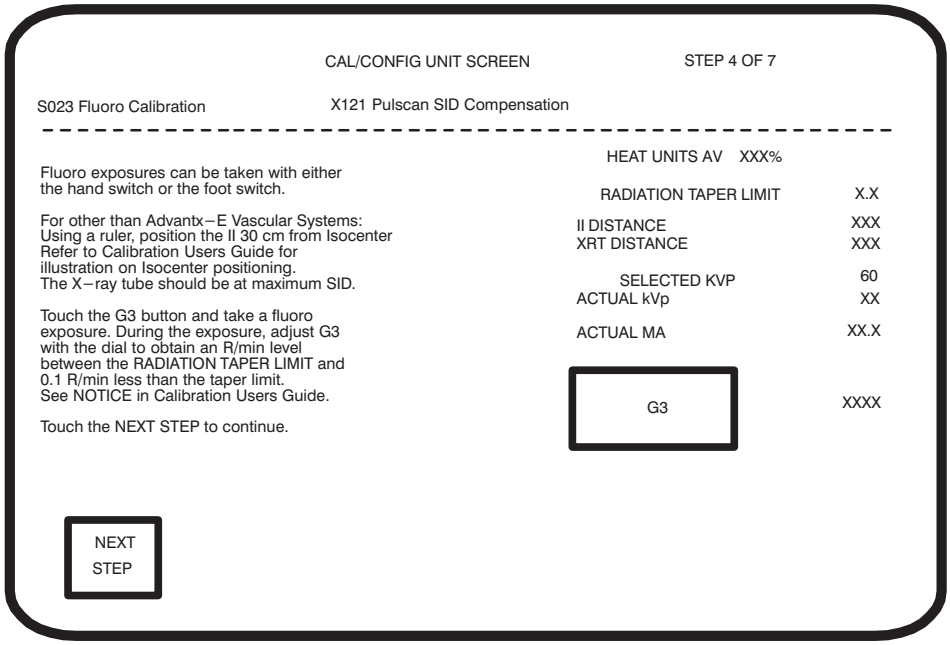
For German Advantx–E Vascular Systems with non–removable 0.1 mm copper filter in the beam:

- Adjust G3 to get D(minref) value (found at X120 Step 3) at 60 kVp.

For Other Systems:

- During the exposure, turn the console dial to adjust G3 until the R/min rate indicated on the radiation meter is within 0.1 R/min less than the RADIATION TAPER LIMIT value displayed on the console screen.
- Terminate the exposure.
- Touch NEXT STEP softkey and proceed to Step 5.

X121 STEP 4 SCREEN DISPLAY
(<u>OLDER</u> SW SP LCA/LCV+/LC+ SYSTEMS)



2-4-5 Step 5. G4 Adjustment

- Initiate G4 adjustment by touching the G4 softkey.
- Take and maintain a fluoro exposure.

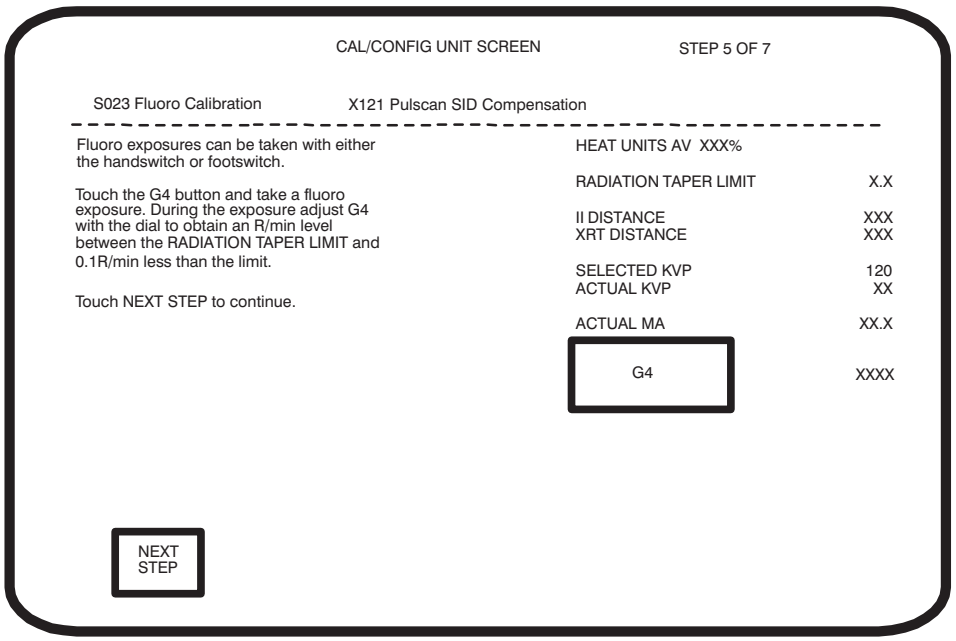
For German Advantx–E Vascular Systems with non–removable 0.1 mm copper filter in the beam:

- Position the II to max SID (with the blue button on the II anticollision ring)
- Adjust G4 to get 12.5 mA read on the console at 120 kVp.
- Measure the resulting dose, then call it D(maxSID).
- If D(maxSID) is higher than 9.1 R/mn, readjust G4 to get 9.1 R/mn, then touch NEXT STEP softkey and proceed to Step 6.
- If D(maxSID) is lower than 9.1 R/mn, reduce SID by a 1 cm step, then readjust G4 to get 12.5 mA read on the console. Measure the resulting dose. If this dose is still lower than 9.1 R/mn, repeat this action until the resulting dose reaches a value higher than 9.1 R/mn (You shall get at the same time 12.5 mA AND a dose higher than 9.1 R/mn).
- Re–adjust G4 to get 9.1 R/mn at 120 kVp.
- Terminate the exposure.
- Touch NEXT STEP softkey and proceed to Step 6.

For Other Systems:

- During the exposure, turn the console dial to adjust G4 until the R/min rate indicated on the radiation meter is within 0.1 R/min less than the RADIATION TAPER LIMIT value displayed on the console screen.
- Terminate the exposure.
- Touch NEXT STEP softkey and proceed to Step 6.

X121 STEP 5 SCREEN DISPLAY (OLDER SW SP LCA/LCV+/LC+ SYSTEMS)



2-4-6 Step 6. SID Watt Limiter Adjustment

- Take and maintain a fluoro exposure. The system will perform the Watt limiter adjustment while the exposure is being taken.
- Maintain the exposure until the “CALIBRATION COMPLETE” message is displayed on the console screen.

Note: The WATT LIMIT is typically 900W.

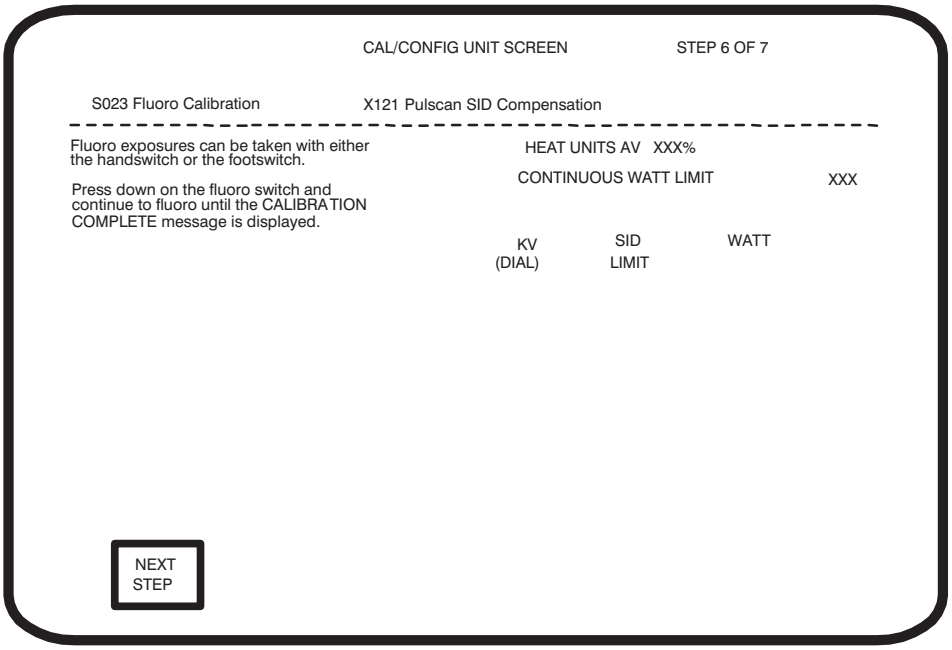
Note: For purpose of verification (Step 7), note any KV’s and SID LIMIT’s for which the WATT value is close to the WATT LIMIT. At those KV’s, the Entrance Exposure Rate–EER will be below the calibrated values for SID’s larger than the SID LIMIT.

NOTICE

During the automatic wattage calculation, the following message “WATT LIMIT EXCEEDED AT MIN SID. RECAL FLUORO TAPER AND THIS UNIT” may appear on the console. At this point, the calculation is interrupted because the calculated wattage exceeds the wattage upper limit. In this case, switch the system off at the console and recalibrate the taper at the minimum SID, making sure the 1800 watt safety limit is respected.

- Touch NEXT STEP softkey and proceed to Step 7.

X121 STEP 6 SCREEN DISPLAY
(<u>OLDER</u> SW SP LCA/LCV+/LC+ SYSTEMS)



2-4-7 Step 7. Verification

- Initiate Entrance Exposure Rate–EER (R/min) verification by touching the KVP softkey.
- Take and maintain a fluoro exposure. During the exposure, use the console dial to step from 60 kVp to 120 kVp in 5 kVp increments. Verify the EER (R/min) level on the radiation meter at each kVp increment.

NOTICE

When incrementing kVp through the verification values, rotate the console dial slowly. As the filament control parameter (G5) is active during this step of the calibration, you must allow time for the G5 to respond to each new kVp setting before incrementing to the next kVp. If you try to step through the kVp increments without giving the G5 parameter time to respond, information messages may appear on the console screen and/or erroneous fluctuations may occur in the R/min readout.

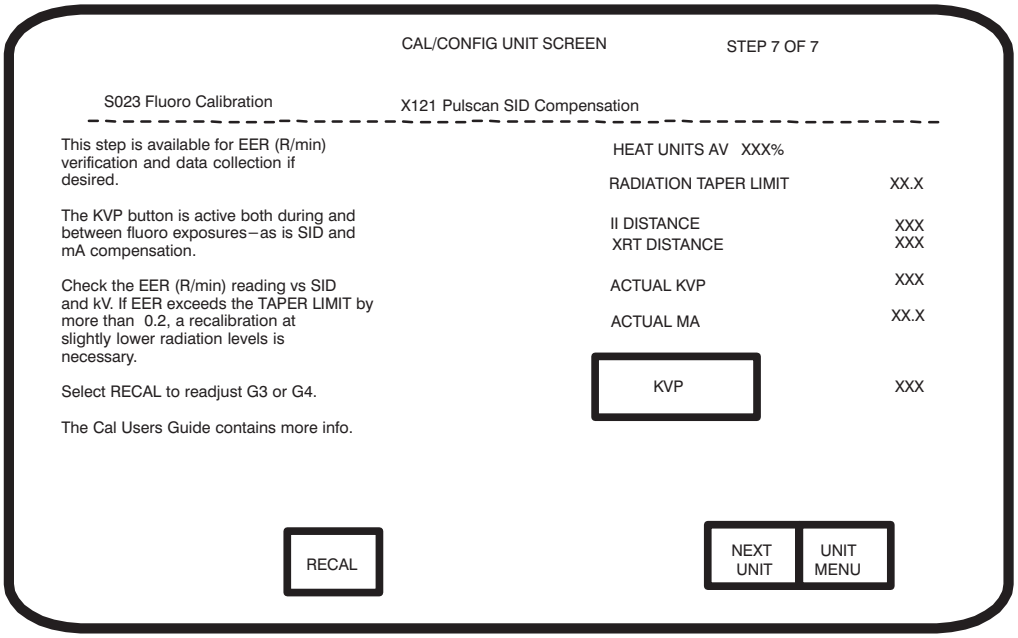
- Terminate the exposure.
- If the EER (R/min), at any kVp increment, exceeds the RADIATION TAPER LIMIT displayed on the console screen by more than 0.2 R/min, a recalibration at slightly lower radiation levels is required.
- If a recalibration is required, touch the RECAL softkey and readjust G3 (Step 4) or G4 (Step 5).
- Verify the results of any re-calibrations by repeating Step 7.
- Touch the NEXT UNIT or UNIT MENU softkey to exit.

2-4-7-1 Special instructions regarding verification

If the table top EER (R/min) is low, review the following special instructions before proceeding with a recalibration. Do not just recal at a higher EER (R/min) value.

1. MA compensation will compensate for x–ray tube heating and cooling effects as well as filament aging.
2. Do not recalibrate if the cause of a low EER is SID WATT limiting. The LCA, LCV+, and LC+ are expected to be SID WATT limited at 60 kV with a 900 watt continuous WATT LIMIT. (See second note in Step 6.)

X121 STEP 7 SCREEN DISPLAY
(OLDER SW SP LCA/LCV+/LC+ SYSTEMS)



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UNIT X122 – Pulscan (Camtronics RTDM) ABC Response Time

Time: x h xx min – Personnel: 1 field engineer

1 DESCRIPTION

Calibration Unit X122 adjusts the Pulscan ABC response time parameters (RADCNTRL, KVPCNTRL, and VGCNTRL) to maintain a light output from the Image Intensifier tube that is constant during Pulscan regardless of variations in system geometry or thickness and density of the object being scanned. Four steps are required to accomplish the calibration.

2 EQUIPMENT REQUIRED

Filtration (1/4 Aluminum, 1/32 inch Copper, 2–1/4 inches Acrylic), oscilloscope, and test leads.

3 TEST SETUP

Setup the oscilloscope as follows:

VERT AMPL: 0.5 V/cm
TIME BASE: 0.5 sec/cm
Connect probe to SKL A2 TP1 and chassis (ground).

Note: Normal calibration is accomplished with loop selection in ON position. Turning loop OFF during Damping Adjustment will result in performance viewed different from Applications. this selection allows isolating each loop to view individual performance only.

4 SPECIAL INSTRUCTIONS

Note: **For Vascular Systems Only:** Before system calibration, verify that additional filter (copper–aluminum filter) is not installed on top of collimator. (Open sensor hinge assembly to verify.) If installed, remove before performing calibration.

5 CAL PROCEDURE

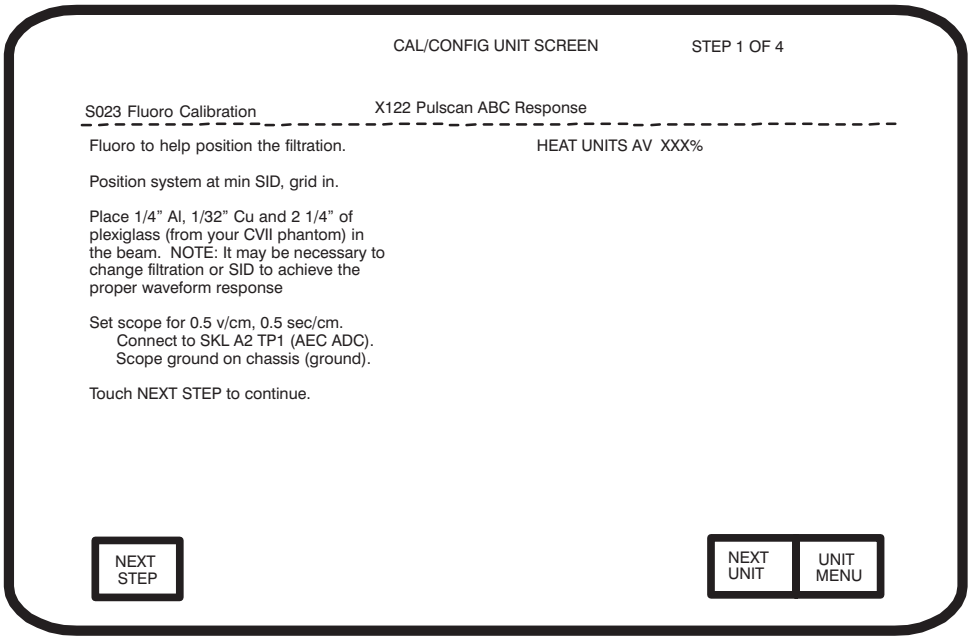
5-1 Step 1. Position Filtration.

- Position the Image Intensifier tube and x–ray tube at minimum SID. On LU systems, position the table top 12 inches from the Image Intensifier tube.
- Position the grid in the x–ray beam.
- Place 1/32 inch of copper, 1/4 inch of aluminum, and 2–1/4 inches of acrylic on the table (stack with acrylic on the bottom and copper on the top).

Note: The calibration may require varying the filtration thickness or SID in order to achieve the proper square wave response in Step 2.

- Take fluoro exposures and center the filtration in the x–ray beam.
- Touch NEXT STEP softkey to proceed to Step 2.

X122 STEP 1 SCREEN DISPLAY



Note: The adjustments in the following steps of this unit are interactive. After all adjustments have been made, the waveform on the scope will appear more rounded than the square wave shown in Illustration 148.

5-2 Step 2. RADCNTRL Damping Factor Adjustment

- Take a fluoro exposure.
- While maintaining the exposure, touch RADCNTRL DAMPING FACTOR softkey and using the console dial, adjust the value of the RADCNTRL DAMPING FACTOR until the brightness error signal observed on the oscilloscope is critically damped. See Illustration 148. Increase the damping until the error signal is ringing with overshoot. Then, decrease until ringing just disappears.

Note: The loop is critically damped when the square wave indicates no overshoot on the top and less than 250 mV overshoot on the bottom.

- Terminate exposure and touch NEXT STEP softkey to proceed to Step 3.

X122 STEP 2 SCREEN DISPLAY

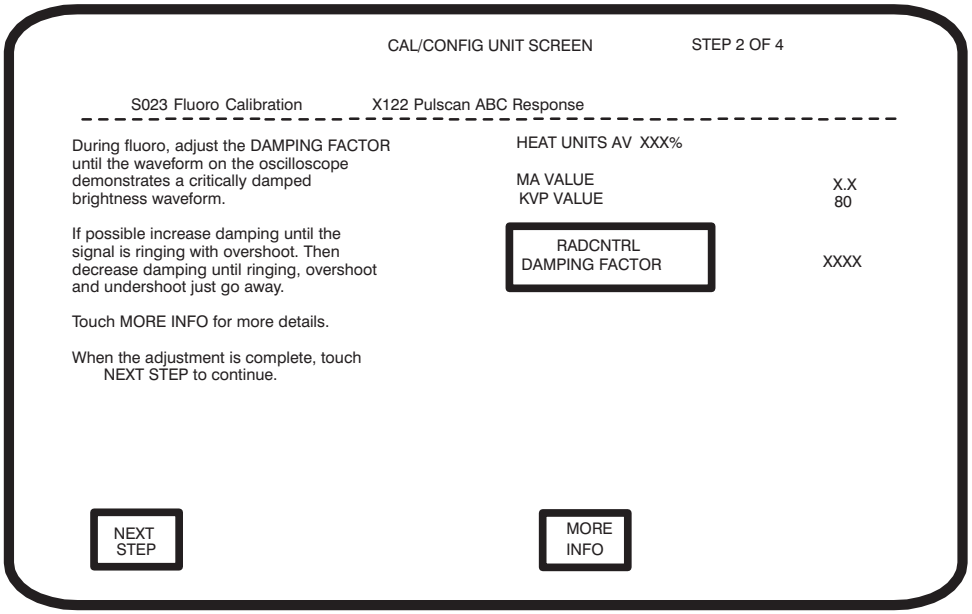
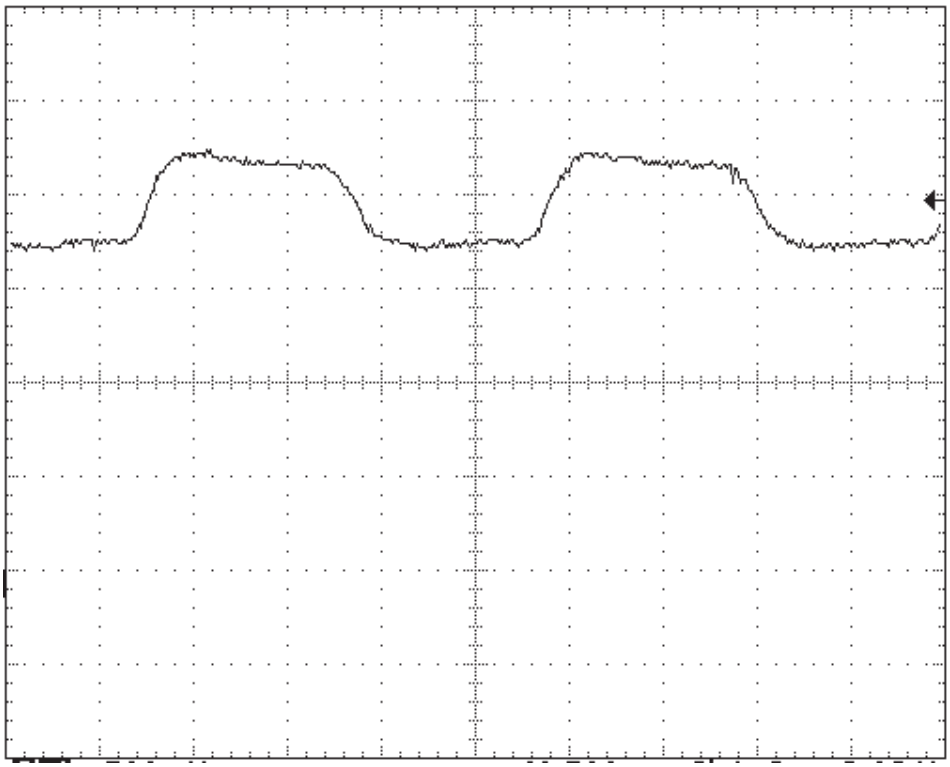


Illustration 148 – X122, Damping Adjustment



X122 STEPS 2, 3, AND 4 "MORE INFO" PAGE 1 SCREEN DISPLAY

CAL/CONFIG UNIT SCREEN STEP X OF 4

S023 Fluoro Calibration X122 Pulscan ABC Response Time

Page 1 of 3

ABC DAMPING INFORMATION

Both footswitch and handswitch are active during this unit.

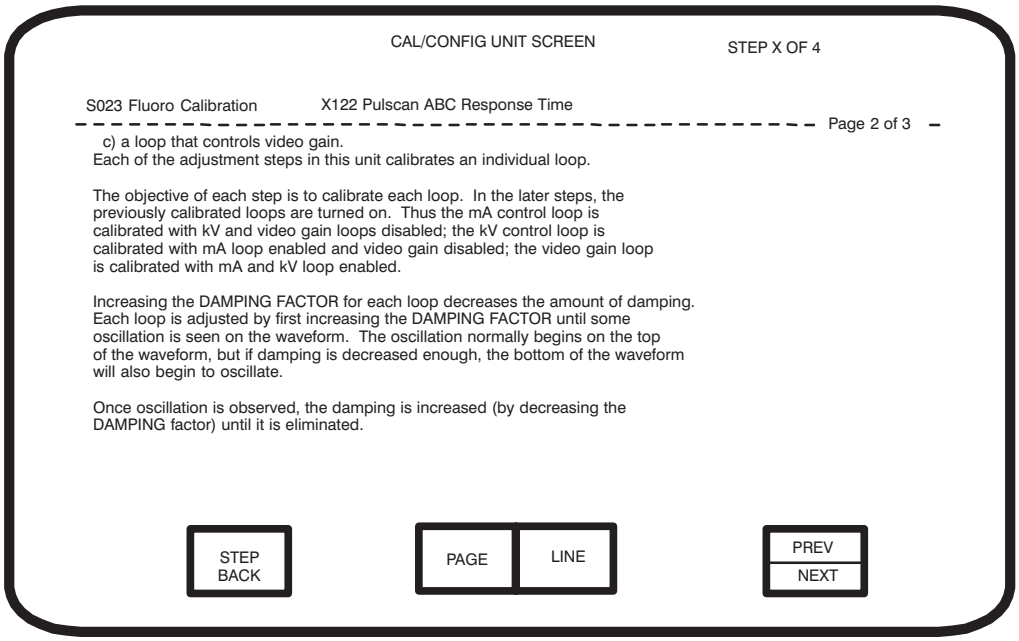
The objective of adjusting ABC Damping is to allow the ABC to adjust to proper brightness as quickly as possible when the amount of xrays reaching the image intensifier changes, but still not have oscillation of brightness when the xray intensity at the II is constant.

In order to accomplish this, the ECM adds a square wave to the output of the brightness pickup. The ABC software then corrects. In a perfect world, the resulting signal at the AEC ABC test point would be a square wave with an average amplitude of 2V. The transfer function of the ABC does not allow this.

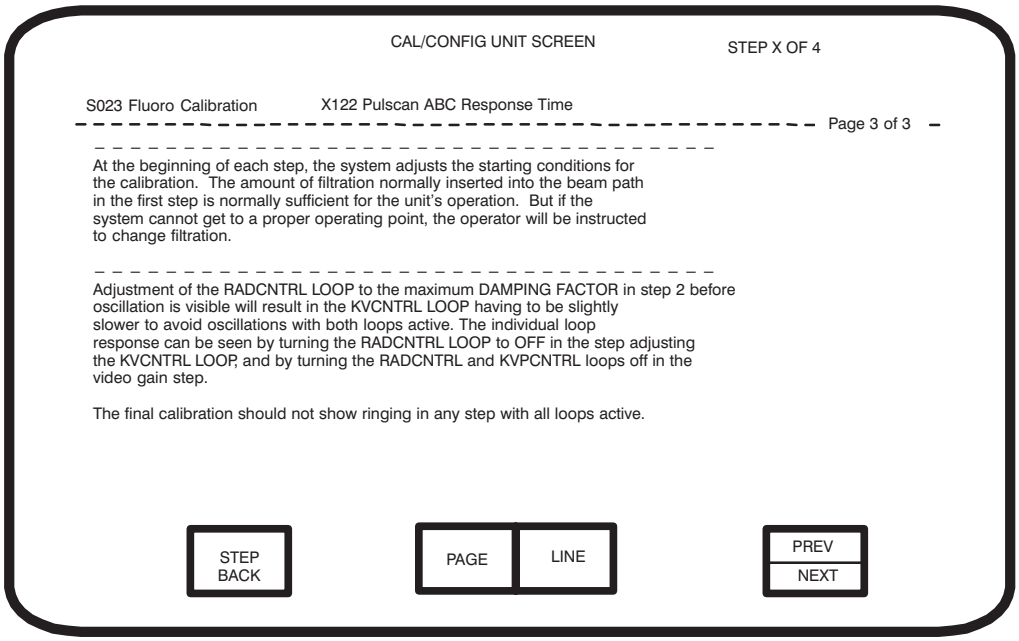
ABC control is composed of three main loops:
a) a loop that controls average mA by adjusting filament drive. On systems with pulsed fluoro, pulse width is also adjusted in this loop.
b) a loop that controls kVp.

STEP BACK | PAGE | LINE | PREV | NEXT

X122 STEPS 2, 3, AND 4 “MORE INFO” PAGE 2 SCREEN DISPLAY



X122 STEPS 2, 3, AND 4 “MORE INFO” PAGE 3 SCREEN DISPLAY



5-3 Step 3. KVPCNTRL Damping Factor Adjustment

- Take and maintain a fluoro exposure.
- Maintain the exposure until the “KVP OVERRIDE ADJUSTMENT COMPLETE” message is displayed.

Note: An “ADJUSTING APERTURE/FOV FOR KVP OVERRIDE CONDITION” message is displayed while the override adjustment is being accomplished.

- Touch KVPCNTRL DAMPING FACTOR softkey and, using the console dial, adjust the value of the KVPCNTRL DAMPING FACTOR until the brightness error signal observed on the oscilloscope is critically damped. See Illustration 149.

Note: The KVP loop is slower than the RADCNTRL loop. This may produce an error signal response with more rounded edges.

- Touch NEXT STEP softkey to proceed to Step 4.

X122 STEP 3 SCREEN DISPLAY

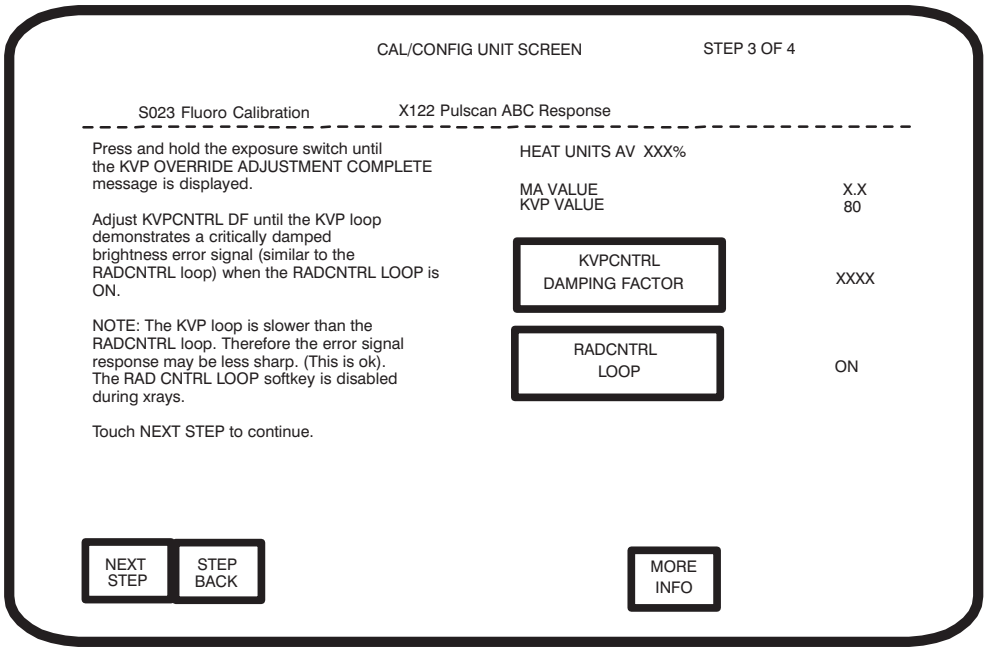
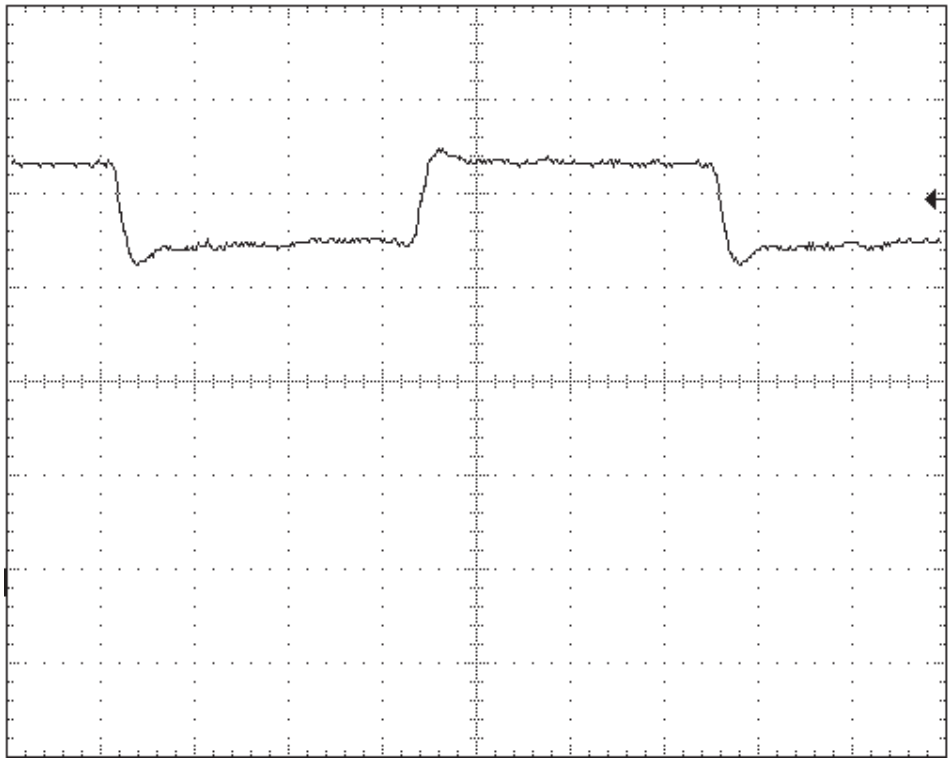


Illustration 149 – X122, KVPCNTRL Damping Adjustment



5-4 Step 4. VGCNTRL Damping Factor Adjustment

- Take a fluoro exposure.
- Maintain the exposure until the “VIDEO GAIN OVERRIDE ADJUSTMENT COMPLETE” message is displayed.

Note: An “ADJUSTING APERTURE FOR VIDEO GAIN OVERRIDE CONDITION” message is displayed while the override adjustment is being accomplished.

- Touch VGCNTRL DAMPING FACTOR softkey and, using the console dial, adjust the value of the VGCNTRL DAMPING FACTOR until the video loop indicates a critically damped brightness error signal on the oscilloscope (similar to the RADCNTRL loop damping). See Illustration 150.
- Touch NEXT UNIT or UNIT MENU softkey to exit the calibration unit.

X122 STEP 4 SCREEN DISPLAY

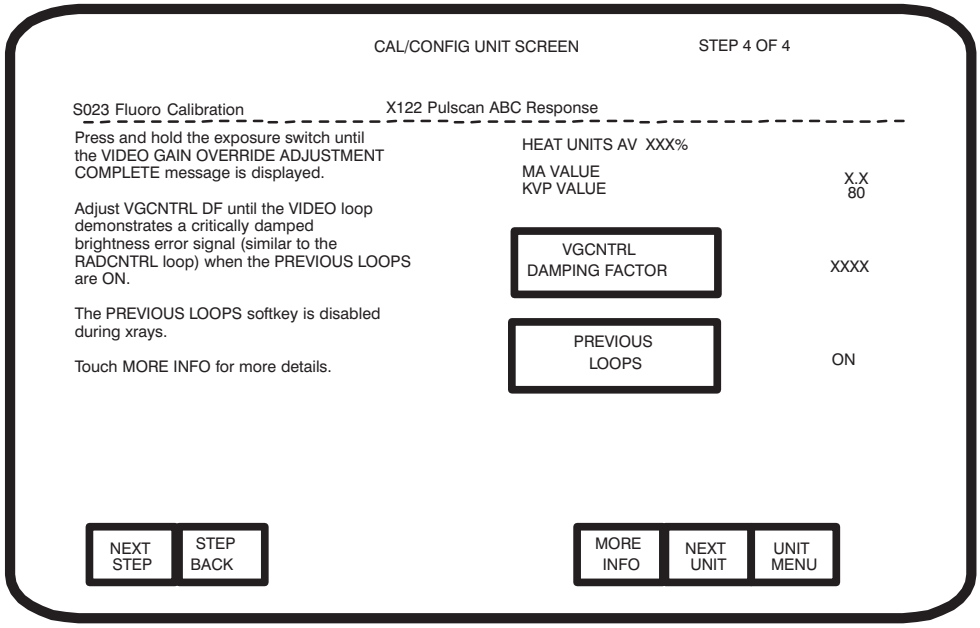
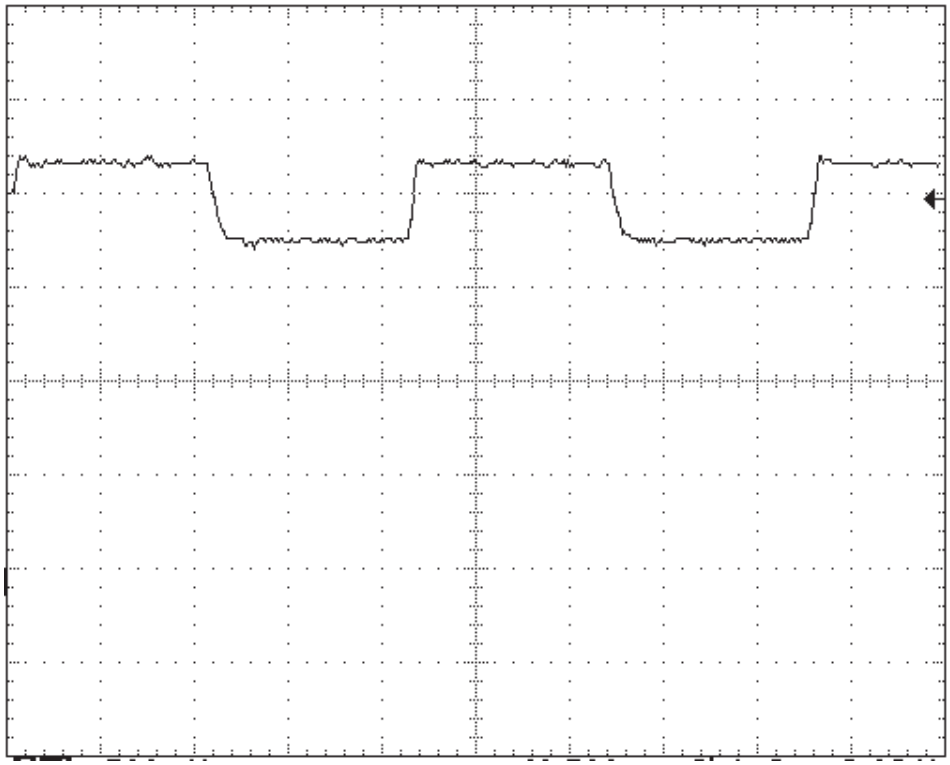


Illustration 150 – X122, VGCNTRL Damping Adjustment



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UNIT X123 – Pulscan (Camtronics RTDM) Entrance Dose Calibration

Time: x h xx min – Personnel: 1 field engineer

1 DESCRIPTION

Calibration Unit X123 is used to adjust the Pulscan entrance dose default parameters established by Calibration Unit X107. Three entrance dose levels(low, normal, and high) can be adjusted as required by Pulscan applications.

NOTICE

Anytime X123 is run after initial system calibration and a customized dosimetry profile exists (Ref. X233), you must also rerun X233 to re-establish the customized dosimetry profile. If X233 is not rerun, a default dosimetry profile will be established (refer to X233). Since a customized dosimetry profile is lost when X123 is rerun, it is important to remember to record the aperture values set in X233 for use when it is necessary to rerun X233.

2 EQUIPMENT REQUIRED

None

3 CAL PROCEDURE

- Upon entering the calibration unit, the default values for LOW, NORMAL, and HIGH entrance dose selections are displayed on the screen. The default values are the recommended dose rates for Pulscan.

  If desired, the dose values displayed can be adjusted for specific Pulscan applications by touching the applicable ENTRANCE DOSE SELECTIONS softkey and dialing in the new value. If questionable, keep the default values indicated.
  For Advantx–E Vascular Systems, the recommended dose value for the applicable II size are given Table 49 for everywhere **EXCEPT** Germany and Switzerland. For Germany use Table 50. For Switzerland use Table 51.

  For all other systems, the recommended dose values for the applicable II size are given Table 52 for everywhere **EXCEPT** Germany and Switzerland. For Germany use Table 53. For Switzerland use Table 54.

- Adjust values or retain default values.
- Touch NEXT UNIT or UNIT MENU softkey to exit the calibration unit. Exiting the unit will load the dose values into NV RAM.

WARNING

FOR ADVANTX–E VASCULAR SYSTEMS ONLY:

BEWARE OF THE EXISTENCE OF TWO DIFFERENT TYPES OF DOSES:

II Entrance Doses: doses displayed and dialed on the console in this calibration Unit**. Recommended Entrance Doses** presented in the tables hereafterare the **II Entrance Doses** allowing the best functionning conditions of the system and the ones which should be used**.**

Measured Entrance Doses: result of the measurement procedure, probe close to the anticollision plate and dose reduced by the antiscatter grid.

II Entrance Doses are equal to Measured Entrance doses divided by two.

NOTICE

For 12 inch (30 cm) Image Intensifier, Cardiac corresponds to a configuration including a Plumbicon Pick–Up Tube and Vascular corresponds to a configuration including a Saticon Pick–Up Tube.

NOTICE

VIC cameras on 9 inch (22 cm) Image Intensifiers are equipped either with a Plumbicon or a Saticon. In both cases, Recommended Entrance Dose Levels have the same values and should be calibrated in the same way.

Note: The default displayed values for 12 inch (30 cm) II are the values for Vascular Systems.

Note: The dose values shown in the tables hereafter have been modified to reflect the accuracy of the TV aperture (10% steps). Some software revisions may show/allow dose values finer than 10% steps.

Table 49 – Recommended Entrance Dose Levels (Except for Germany and Switzerland), for Advantx–E Vascular Systems

RECOMMENDED II ENTRANCE DOSE LEVELS			
II TYPE	**FOV**	**DOSE**	**EXPOSURE**
9 inch (22 cm)	9	LOW	1.5 mR/min
9 inch (22 cm)	9	NORM	3.6 mR/min
9 inch (22 cm)	9	HIGH	4.9 mR/min
12 inch (30 cm) Cardiac	12	LOW	1.1 mR/min
12 inch (30 cm) Cardiac	12	NORM	2.7 mR/min
12 inch (30 cm) Cardiac	12	HIGH	4.1 mR/min
12 inch (30 cm) Vascular	12	LOW	1.0 mR/min
12 inch (30 cm) Vascular	12	NORM	2.4 mR/min
12 inch (30 cm) Vascular	12	HIGH	3.7 mR/min
16 inch (40 cm)	16	LOW	1.2 mR/min
16 inch (40 cm)	16	NORM	2.7 mR/min
16 inch (40 cm)	16	HIGH	4.1 mR/min

Table 50 – Recommended Entrance Dose Levels for Germany only, for Advantx–E Vascular Systems

RECOMMENDED II ENTRANCE DOSE LEVELS (GERMANY)			
II TYPE	**FOV**	**DOSE**	**EXPOSURE**
9 inch (22 cm)	9	LOW	1.5 mR/min
9 inch (22 cm)	9	NORM	3.6 mR/min (See Note 1.)
9 inch (22 cm)	9	HIGH	3.6 mR/min (See Note 1.)
12 inch (30 cm) Cardiac	12	LOW	1.1 mR/min
12 inch (30 cm) Cardiac	12	NORM	2.4 mR/min (See Note 1.)
12 inch (30 cm) Cardiac	12	HIGH	2.4 mR/min (See Note 1.)
12 inch (30 cm) Vascular	12	LOW	1.1 mR/min
12 inch (30 cm) Vascular	12	NORM	2.4 mR/min (See Note 1.)
12 inch (30 cm) Vascular	12	HIGH	2.4 mR/min (See Note 1.)
16 inch (40 cm)	16	LOW	0.6 mR/min
16 inch (40 cm)	16	NORM	1.4 mR/min (See Note 1.)
16 inch (40 cm)	16	HIGH	1.4 mR/min (See Note 1.)
Note 1: Maximum allowed value in order to meet local regulations.			

Table 51 – Recommended Entrance Dose Levels for Switzerland only, for Advantx–E Vascular Systems

RECOMMENDED II ENTRANCE DOSE LEVELS (SWITZERLAND)			
II TYPE	**FOV**	**DOSE**	**EXPOSURE**
9 inch (22 cm)	9	LOW	1.5 mR/min
9 inch (22 cm)	9	NORM	3.6 mR/min
9 inch (22 cm)	9	HIGH	4.9 mR/min
12 inch (30 cm) Cardiac	12	LOW	1.1 mR/min
12 inch (30 cm)Cardiac	12	NORM	2.7 mR/min
12 inch (30 cm) Cardiac	12	HIGH	4.1 mR/min
12 inch (30 cm) Vascular	12	LOW	1.0 mR/min
12 inch (30 cm) Vascular	12	NORM	2.4 mR/min
12 inch (30 cm) Vascular	12	HIGH	3.7 mR/min
16 inch (40 cm)	16	LOW	1.0 mR/min
16 inch (40 cm)	16	NORM	2.2 mR/min (See Note 1.)
16 inch (40 cm)	16	HIGH	2.2 mR/min (See Note 1.)
Note 1: Maximum allowed value in order to meet local regulations.			

Table 52 – Recommended Entrance Dose Levels (Except for Germany and Switzerland), for all other Systems

RECOMMENDED ENTRANCE DOSE LEVELS			
II TYPE	**FOV**	**DOSE**	**EXPOSURE**
9 inch (22 cm)	9	LOW	1.8 mR/min
9 inch (22 cm)	9	NORM	3.6 mR/min
9 inch (22 cm)	9	HIGH	7.2 mR/min
12 inch (30 cm)	12	LOW	0.9 mR/min
12 inch (30 cm)	12	NORM	1.9 mR/min
12 inch (30 cm)	12	HIGH	3.8 mR/min
16 inch (40 cm)	16	LOW	1.1 mR/min
16 inch (40 cm)	16	NORM	2.2 mR/min
16 inch (40 cm)	16	HIGH	4.3 mR/min

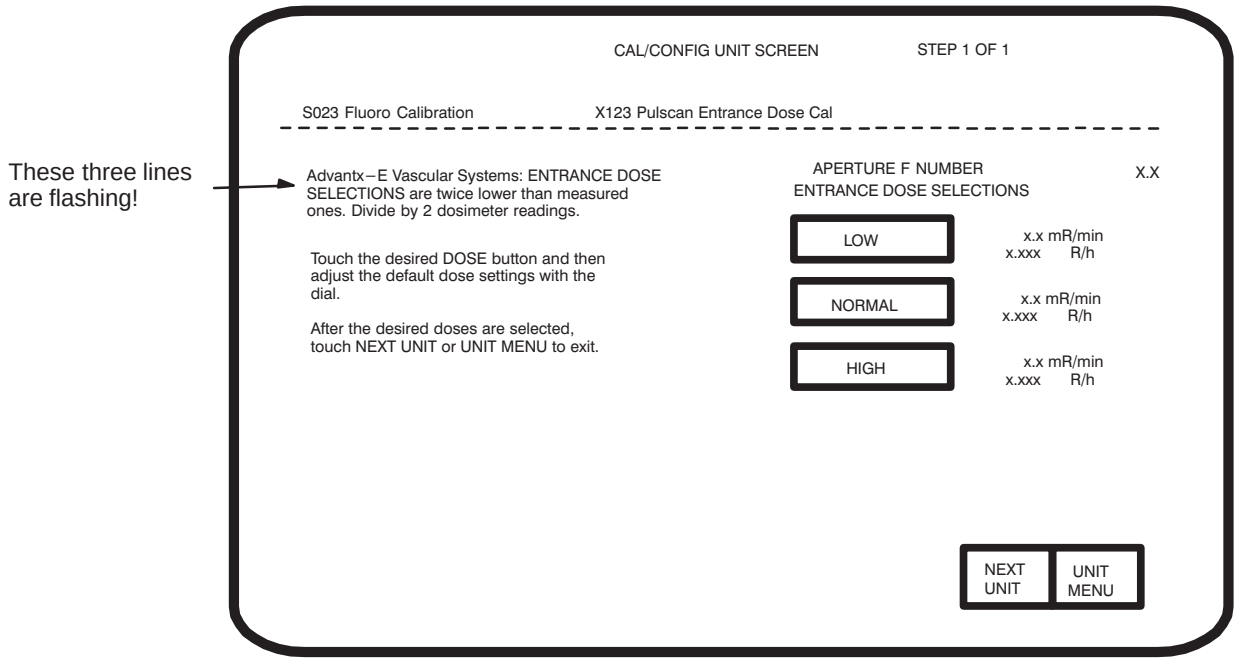
Table 53 – Recommended Entrance Dose Levels for Germany only, for all other Systems

RECOMMENDED ENTRANCE DOSE LEVELS (GERMANY)			
II TYPE	**FOV**	**DOSE**	**EXPOSURE**
9 inch (22 cm)	9	LOW	1.8 mR/min
9 inch (22 cm)	9	NORM	3.6 mR/min (See Note 1.)
9 inch (22 cm)	9	HIGH	3.6 mR/min (See Note 1.)
12 inch (30 cm)	12	LOW	0.9 mR/min
12 inch (30 cm)	12	NORM	1.9 mR/min
12 inch (30 cm)	12	HIGH	2.1 mR/min (See Note 1.)
16 inch (40 cm)	16	LOW	0.6 mR/min (See Note 2.)
16 inch (40 cm)	16	NORM	1.4 mR/min (See Note 1.)
16 inch (40 cm)	16	HIGH	1.4 mR/min (See Note 1.)
Note 1: Maximum allowed value in order to meet local regulations. **Note 2:** Or as low as possible.			

Table 54 – Recommended Entrance Dose Levels for Switzerland only, for all other Systems

RECOMMENDED ENTRANCE DOSE LEVELS (SWITZERLAND)			
II TYPE	**FOV**	**DOSE**	**EXPOSURE**
9 inch (22 cm)	9	LOW	1.8 mR/min
9 inch (22 cm)	9	NORM	3.6 mR/min
9 inch (22 cm)	9	HIGH	6.1 mR/min (See Note 1.)
12 inch (30 cm)	12	LOW	0.9 mR/min
12 inch (30 cm)	12	NORM	1.9 mR/min
12 inch (30 cm)	12	HIGH	3.5 mR/min (See Note 1.)
16 inch (40 cm)	16	LOW	1.1 mR/min
16 inch (40 cm)	16	NORM	2.3 mR/min (See Note 1.)
16 inch (40 cm)	16	HIGH	2.3 mR/min (See Note 1.)
Note 1: Maximum allowed value in order to meet local regulations.			

X123 SCREEN DISPLAY



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UNIT X130 – DX (DLX) Taper Progressive

Time: x h xx min – Personnel: 1 field engineer

1 DESCRIPTION

Calibration Unit X130 adjusts the DLX taper so that the fluoro table top radiation dose (Entrance Exposure Rate–EER) never exceeds 87.6 mGy/min (10 R/min). The calibration sets the end points of a pre–defined taper curve to correspond with a radiation taper limit. Five steps are required to calibrate the DLX taper. A screen display is provided for each step.



This unit allows the system to be configured for higher pulsed progressive fluoro taper limits than shipped. This is not recommended. This is forbidden in the US where the 87.6 mGy/min (10 R/min) regulatory limits applies. While the system will operate at these higher taper limits, the reliability under this condition may suffer; increased maintenance costs should be expected. Only raise the fluoro taper limits after all other methods of improving digital fluoro image quality have been tried and there is still a serious customer issue.



If this calibration unit is used to re-calibrate DLX tapers after initial system calibration, it is mandatory that you also rerun Cal Unit X131, DX (DLX) SID Comp, or the re-calibrated tapers will not be observed when running Applications. Cal Unit X130 and X131 must be run as a set with X130 run first.

2 EQUIPMENT REQUIRED

Dosimeter (MDH/Radcal 2025, 2026 or equivalent) w/probe stand or Ion Chamber Positioning Tool 2236707 (Former ref: 2208874)
For Advantx–E Systems, Ion Chamber Positioning Tool is mandatory (See Cal Unit T015) .
For this Cal Unit, use Model 20x5–3 or 20x6–3 probe.
Metric Tape Measure.

3 SPECIAL INSTRUCTIONS

Note: **For Vascular Systems only:** before system calibration, verify that additional filter (copper–aluminum filter) is not installed on top of collimator. (Open sensor hinge assembly to verify.) If installed, remove before performing calibration.

- Communication with DLX.

Note: Communication must be established with the DLX prior to the display of the Step 1 screen. If that fails, an error message is displayed and the unit will only function in the browse mode. To ensure communication with the DLX, perform the following:

1. On the DLX console, at the “DLX LOGIN” prompt, type “DLX” followed by pressing the RETURN key.
2. Verify DLX console displays the ACQUISITION screen. If not, select the following to continue:
   NEW PATIENT (you must also enter patient name and ID number or the DLX will not be enabled)
   NEW EXAM

- When calibrating a system to meet Japanese regulations, it is required to calibrate the taper so that the x–ray tube current never exceeds 10 mA in Fluoro mode.
- The Filament Age and Fil Age (Last Cal) parameters displayed on the Step 2 screen provide a visual indication of the filament aging characteristics of the system x–ray tube.

1. **Filament Age:** Tracks and displays a continuous record of changes in filament aging (in HEX) since x–ray tube installation (initial value of 0010H).
2. **Fil Age (Last Cal):** Displays the Hex value of filament aging set in the last calibration (initial value when a tube is installed is FFFFH). The Fil Age (Last Cal) parameter will be set equal to Filament Age parameter after a calibration is completed.

Note: As the x–ray tube ages, changes in the Filament Age value may be observed. If the difference between the Filament Age value and Fil Age (Last Cal) value reaches a delta limit of 2BH, a ”recal required” message is displayed. This warning message is displayed upon entering either the Applications or Service Mode to indicate to the user that a mandatory recalibration of the fluoro tapers is required (Ref recal instructions in Cal Unit X100).

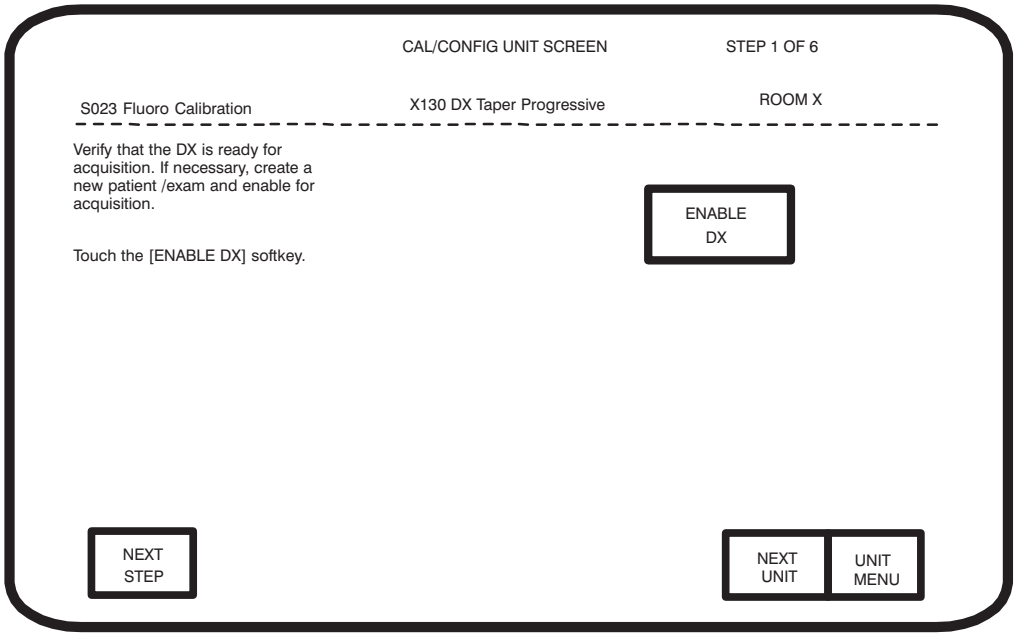
- Re-run this Cal Unit and re-adjust the EER by subtracting the amount of increase observed in Applications from the EER value previously set in this unit.

4 CAL PROCEDURE

4-1 Step 1. Enable DX (DLX)

- Communication must be established with the DX (DLX) prior to selecting the ENABLE DX softkey. Selecting the ENABLE DX softkey puts the DX (DLX) into technical menu. If communication with the DX (DLX) fails, an error message is displayed and the unit will only function in the viewing (browse) mode.
  1. If necessary, create a new patient/exam and enable for acquisition.
  2. Touch the ENABLE DX softkey.
- Touch NEXT STEP softkey to proceed to Step 2. If the NEXT STEP softkey is pressed prior to pressing the ENABLE DX softkey, the viewing mode will be entered. Viewing mode allows cycling through the screen displays without doing a calibration.

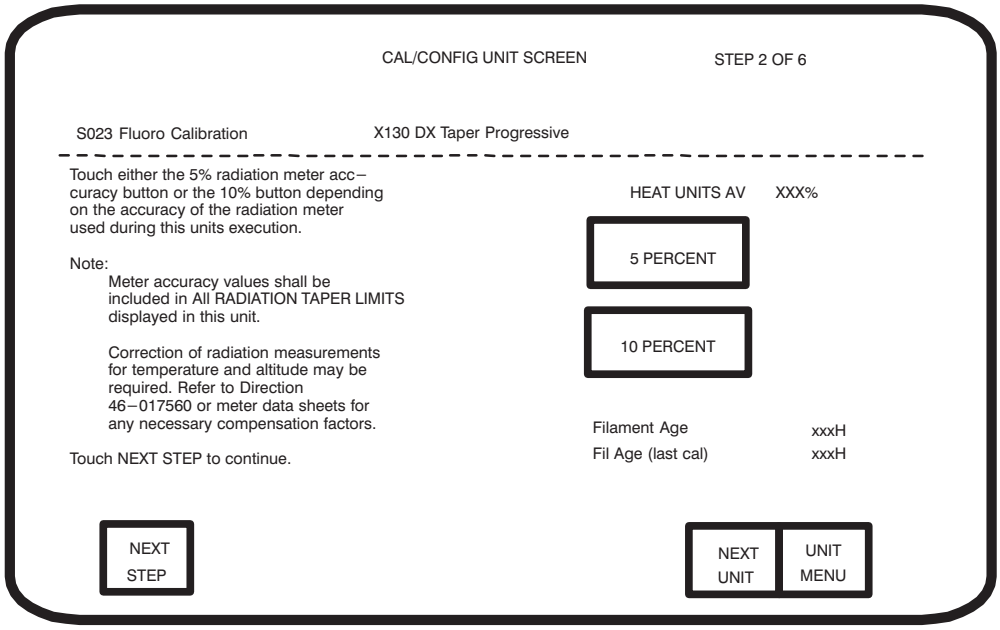
X130 STEP 1 SCREEN DISPLAY



4-2 Step 2. Radiation Meter Accuracy.

- Check rated accuracy of the radiation meter to be used in the calibration. (Radcal 2025 or 2026 and their probes have a 5% accuracy).
- Touch the 5 PERCENT or 10 PERCENT softkey to enter the rated accuracy of the radiation meter. The meter accuracy value is included in all RADIATION TAPER LIMITS displayed in this unit.
- Check the current values (in Hex) of the Filament Age and Fil Age (Last Cal) parameters. Refer to the Special Instruction paragraph at the beginning of this unit for an explanation of these parameters.
- Touch NEXT STEP softkey to proceed to Step 3.

X130 STEP 2 SCREEN DISPLAY



4-3 Step 3. Radiation Meter (R–Meter) Probe Positioning

CAUTION **Verify that the collision sensor is installed on the collimator, and that the hinged door is closed before proceeding.**

The Step 3 screen display provides instructions for positioning the R–Meter probe in systems employing SID compensation (all Vascular systems).

Note: Touching the MORE INFO softkey increments to a screen display that provides instructions for positioning the R–Meter probe in R+F systems. This is NOT applicable to vascular systems.

- Move the table top out of the field of the x–ray beam.
- Set the II tube and x–ray tube to minimum SID.

Note: **For German Advantx–E Vascular Systems with non–removable 0.1 mm copper filter in the beam,** position the II to 95 cm SID (frontal) or 100 cm SID (lateral).

Note: For Advantx–E Vascular Systems, Ion Chamber Positioning Tool is mandatory to get accurate adjustments.

- When using Ion Chamber Positioning Tool 2236707 (Former ref: 2208874), refer to Illustration 135 in Cal Unit X100 and to the instructions on the screen display for Step 3; also, refer to mounting/positioning instructions in Cal Unit T015. Check for probe top/II anticollision plate distance in Table 10 of Cal Unit T015.
- If not using the Ion Chamber Positioning Tool, mount the R–Meter probe stand to the bottom of the II tube (or position the stand on the head end of the table top and extend the R–Meter probe into the x–ray beam). Position the R–meter probe 30 cm from the lowest point on the II tube housing. Refer to Illustration 134 in Cal Unit X100 and to the instructions on the screen display for Step 3.

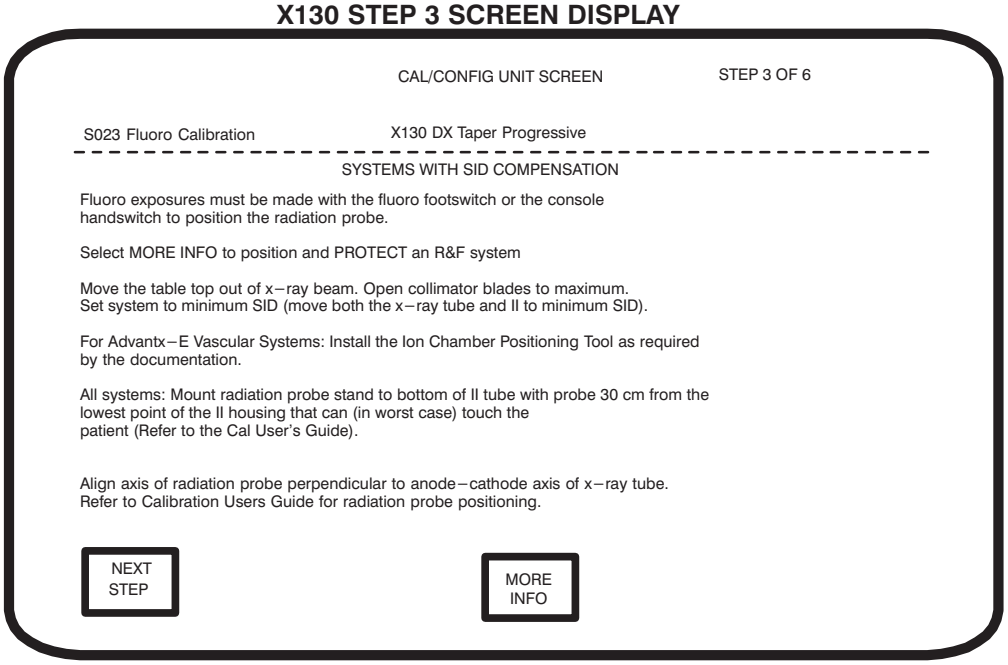
Note: The positioning of the R–meter probe 30 cm from the lowest point on the II tube housing (with II in overhead position) is an FDA requirement. The FDA assumes that the 30 cm distance corresponds to the average thickness of a patient and therefore establishes a worst case condition for radiation dose.

- Align axis of probe perpendicular to anode–cathode axis of x–ray tube.
- Take a fluoro exposure to determine the exact position of the probe. Repeat taking exposures and repositioning the R–Meter probe until the probe is centered in the x–ray beam (See T015 for a detailed procedure using DLX).
- After the R–Meter probe is properly positioned, you may perform a quick check of the Radiation Taper Limit before proceeding with a full calibration by touching the VERIFY softkey. Touching the VERIFY softkey will cause the unit to increment to the Step 6, Verification screen. Perform Step 6.

OR

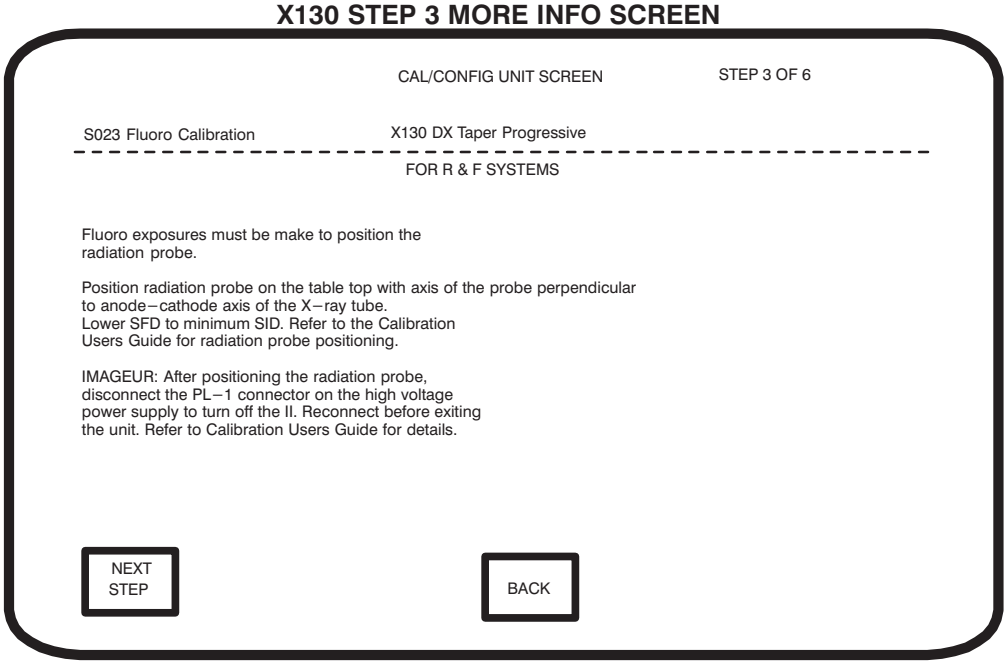
- Touch the NEXT STEP softkey to proceed to Step 4 in the calibration sequence.

X130 STEP 3 SCREEN DISPLAY



Note: The X130 Step 3 "MORE INFO" Screen is not applicable to vascular systems.

X130 STEP 3 MORE INFO SCREEN



4-4 Step 4. 60 KV FIL DRIVE Adjustment

- Initiate FIL DRIVE adjustment by touching the FIL DRIVE softkey.

NOTICE **On systems configured with hexafocus tube and 0.3 focal spot, a RADIATION TAPER LIMIT of 44 mGy/min (5.0 R/min) will be displayed on the console screen.**

- Take and maintain a fluoro exposure.

For German Advantx–E Vascular Systems with non–removable 0.1 mm copper filter in the beam:

- Do not take into account the dose rate value indicated on the console, but adjust FIL DRIVE to get 14.5 mA read on the console at 60 kVp.
- Measure and record the dose value D(minref): this is the reference value **for X130 and X131** adjustment at 60 kVp.
- Position II to minimum SID.
- Adjust FIL DRIVE to get D(minref) at 60 kVp.

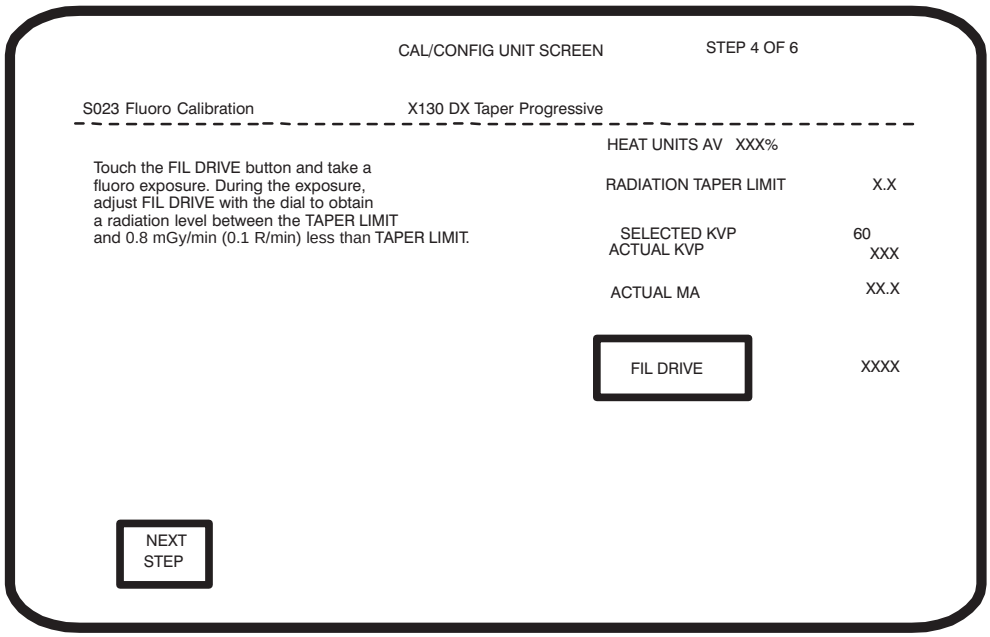
For Other Systems:

- During the exposure, turn the console dial to adjust FIL DRIVE until the dose rate indicated on the radiation meter is within 0.8 mGy/min (0.1 R/min) less than the RADIATION TAPER LIMIT value displayed on the console screen.

CAUTION **During the calibration, the mA must not be set above 14.8 mA to achieve the RADIATION TAPER LIMIT. Stop at 14.8 mA and accept the actual radiation level achieved.**

- When the correct dose rate level is obtained and stable, stop fluoro.
- Touch NEXT STEP softkey to proceed to Step 5.

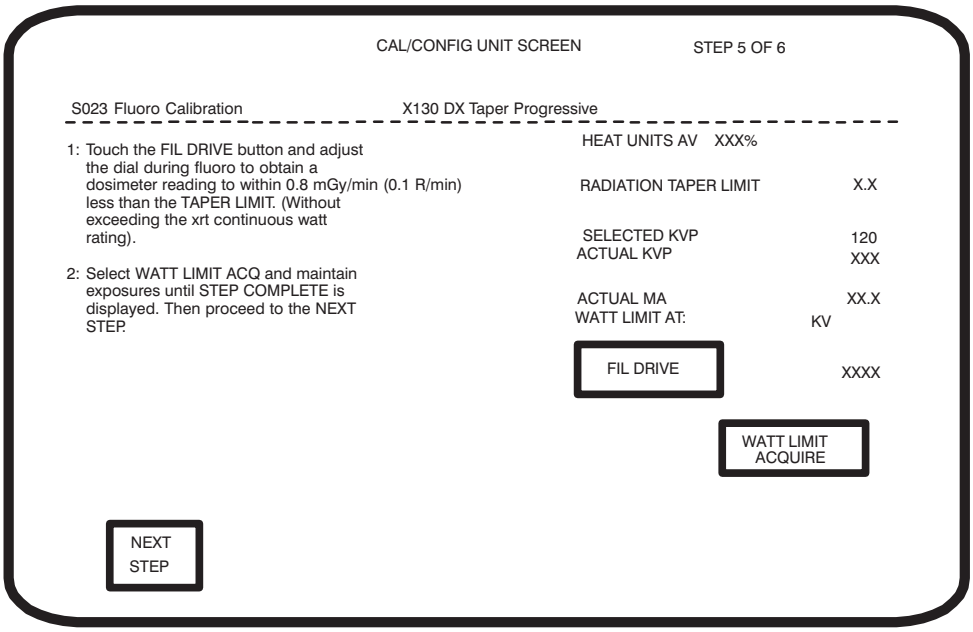
X130 STEP 4 SCREEN DISPLAY



4-5 Step 5. 120 KV FIL DRIVE Adjustment

- Initiate FIL DRIVE adjustment by touching the FIL DRIVE softkey.
- Take and maintain a fluoro exposure. During the exposure, turn the console dial to adjust FIL DRIVE until the dose rate indicated on the radiation meter is within 0.8 mGy/min (0.1 R/min) less than the RADIATION TAPER LIMIT value displayed on the console screen. Do not exceed the x–ray tube continuous watt rating during the adjustment.
- When the correct dose rate level is obtained and stable, stop fluoro.
- Take and maintain another exposure. During the exposure, touch the WATT LIMIT ACQUIRE softkey. The system will calculate wattage and compare against a Continuous Watt Rating limit stored in the database. Maintain the exposure until the STEP COMPLETE message is displayed. If calculated wattage is higher than the Continuous Watt Rating limit, the message ”CONTINUOUS WATT RATING EXCEEDED, PLEASE RECAL TO A LOWER DOSE” will be displayed. If necessary, repeat the FIL DRIVE adjustment (Steps 4 and 5).
- Touch NEXT STEP softkey to proceed to Step 6.

X130 STEP 5 SCREEN DISPLAY



4-6 Step 6. Verification

- Initiate Entrance Exposure Rate–EER verification by touching the KVP softkey.
- Take and maintain a fluoro exposure. During the exposure, use the console dial to step from 60 kVp to 120 kVp in 5 kVp increments. Verify the EER level on the radiation meter at each kVp increment.

NOTICE

When incrementing kVp through the verification values, rotate the console dial slowly. As the filament control parameter (G5) is active during this step of the calibration, you must allow time for the G5 to respond to each new kVp setting before incrementing to the next kVp. If you try to step through the kVp increments without giving the G5 parameter time to respond, information messages may appear on the console screen and/or erroneous fluctuations may occur in the dose rate readout.

- Terminate the exposure.
- If the EER, at any kVp increment, exceeds the RADIATION TAPER LIMIT displayed on the console screen by more than 2.6 mGy/min (0.3 R/min), a recalibration at slightly lower radiation levels is required. Touch RECAL softkey and repeat calibration.

Note: If EER is excessive only at the high kVp increments, lowering FIL DRIVE may be sufficient (Repeat Step 5, FIL DRIVE adjustment).

- Verify the results of any re-calibrations by repeating Step 6.
- Touch the NEXT UNIT or UNIT MENU softkey to exit.

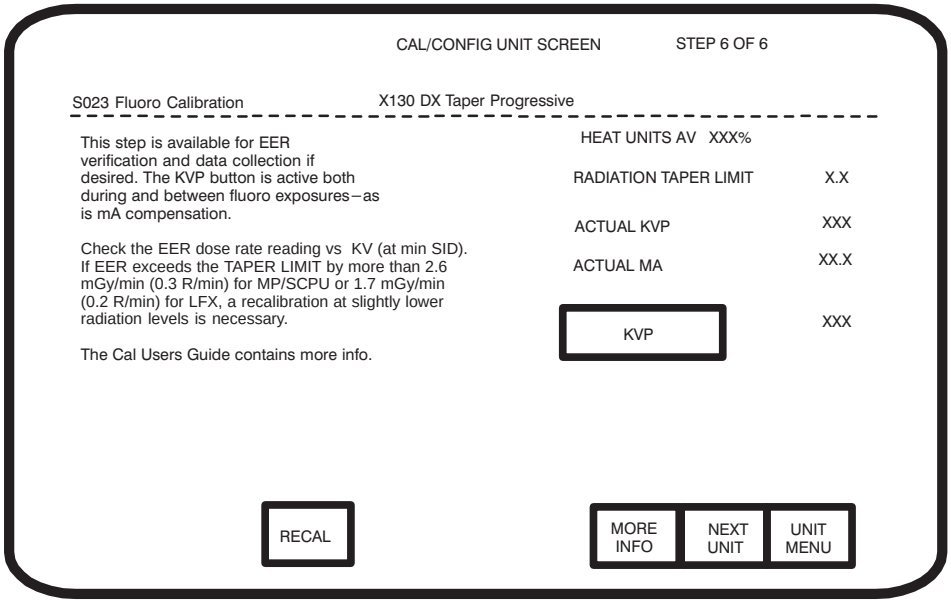
4-6-1 Special instructions regarding verification.

If the table top EER is low, review the following special instructions before proceeding with a recalibration. Do not just recal at a higher EER value.

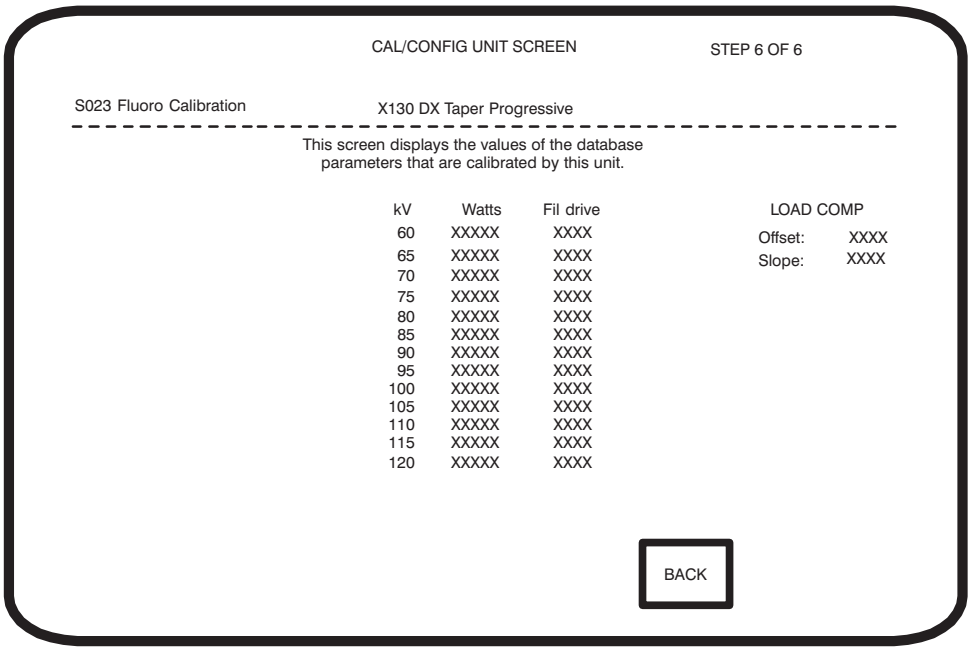
MA compensation will compensate for x–ray tube heating and cooling effects as well as filament aging.

Note: A “More Info” screen, accessed by touching the MORE INFO softkey on the Step 6 screen, displays the values of the database parameters that are calculated by this unit.

X130 STEP 6 SCREEN DISPLAY



X130 STEP 6 "MORE INFO" SCREEN DISPLAY



Note: Step 6 MORE INFO screen:

1. The list of kV's in the right hand column shows the range of kV's for the 60–120 kV range. The Table is displayed from Min to Max kV.
2. The list of kV's in the left hand column is only displayed if the range of allowed kV's exceeds 13 values.

UNIT X131 – DX (DLX) SID Compensation

Time: x h xx min – Personnel: 1 field engineer

1 X131, DX (DLX) SID COMPENSATION, NEW PROCEDURE

Note: The New Procedure is used for ALL biplane systems, and for NEWER software (i.e., ASC SW beginning with G4.XX) single plane LCA/LCV+/LC+ systems.

(For older software single plane LCA/LCV+/LC+ systems, go to Old Procedure in Section 2.)

When calibrating the frontal plane on a biplane system, the LP must be in parking position, follow the procedure hereunder prior to running X131 Cal unit:

- Select S010 vascular positioner calibration in the Main Menu,
- Select, then run Cal Unit P508,
- Put the LP in parking position using the parking buttons of the TSCC,
- Exit Cal Unit P508.

1-1 Description

Calibration Unit X131 adjusts the DLX SID compensation parameters so that as SID increases, tube filament current increases, thereby maintaining the fluoro table top dose at a calibrated value. DLX SID compensation also prevents increases in fluoro technique from exceeding the rating of the tube. SID compensation is only active during exposures. Seven steps are required to calibrate the SID compensation parameters. A screen display is provided for each Step.

CAUTION **This unit allows the system to be configured for higher pulsed progressive fluoro taper limits than shipped. This is not recommended. This is forbidden in the US where the 87.6 mGy/min (10 R/min) regulatory limits applies. While the system will operate at these higher taper limits, the reliability under this condition may suffer; increased maintenance costs should be expected. Only raise the fluoro taper limits after all other methods of improving digital fluoro image quality have been tried and there is still a serious customer issue.**

Note: This unit must always be run in combination with Cal Unit X130 and X130 must be run first.

1-2 Equipment required

Dosimeter (MDH/Radcal 2025, 2026 or equivalent) w/probe stand or Ion Chamber Positioning Tool 2236707 (Former ref: 2208874)
For Advantx–E Systems, Ion Chamber Positioning Tool is mandatory (See Cal Unit T015) .
For this Cal Unit, use Model 20x5–3 or 20x6–3 probe.
Metric Tape Measure.

1-3 Special Instructions

Note: **For Vascular Systems only:** before system calibration, verify that additional filter (copper–aluminum filter) is not installed on top of collimator. (Open sensor hinge assembly to verify.) If installed, remove before performing calibration.

- Communication with DLX.

Note: Communication must be established with the DLX prior to the display of the Step 1 screen. If that fails, an error message is displayed and the unit will only function in the browse mode. To ensure communication with the DLX. perform the following:

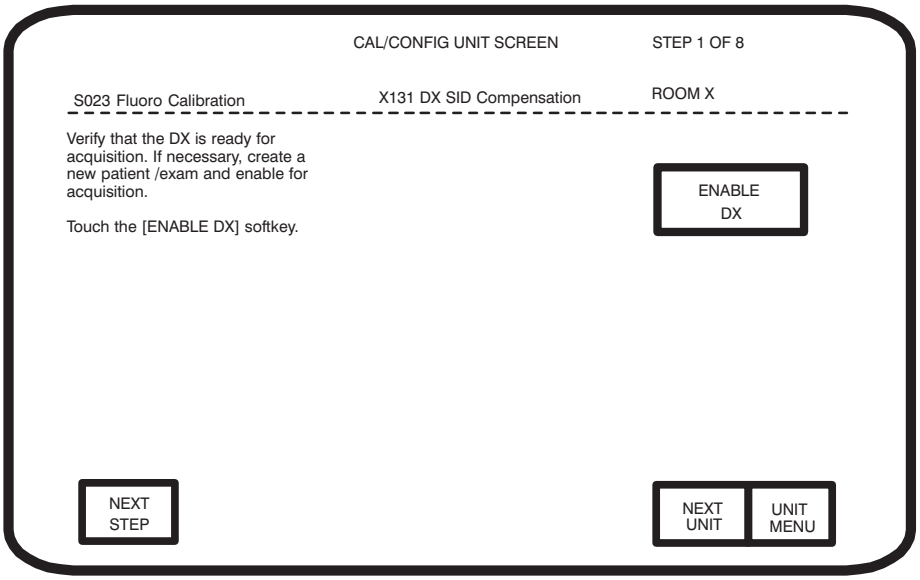
1. On the DLX console, at the “DLX LOGIN” prompt, type “DLX” followed by pressing the RETURN key.
2. Verify DLX console displays the ACQUISITION screen. If not, select the following keys to continue:
   NEW PATIENT (you must also enter patient name and ID number or the DLX will not be enabled)
   NEW EXAM

1-4 Cal Procedure

1-4-1 Step 1. Enable DX (DLX)

- Communication must be established with the DX (DLX) prior to selecting the ENABLE DX softkey. Selecting the ENABLE DX softkey puts the DX (DLX) into technical menu. If communication with the DX (DLX) fails, an error message is displayed and the unit will only function in the viewing (browse) mode.
  1. If necessary, create a new patient/exam and enable for acquisition.
  2. Touch the ENABLE DX softkey.
- Touch NEXT STEP softkey to proceed to Step 2. If the NEXT STEP softkey is pressed prior to pressing the ENABLE DX softkey, the viewing mode will be entered. Viewing mode allows cycling through the screen displays without doing a calibration.

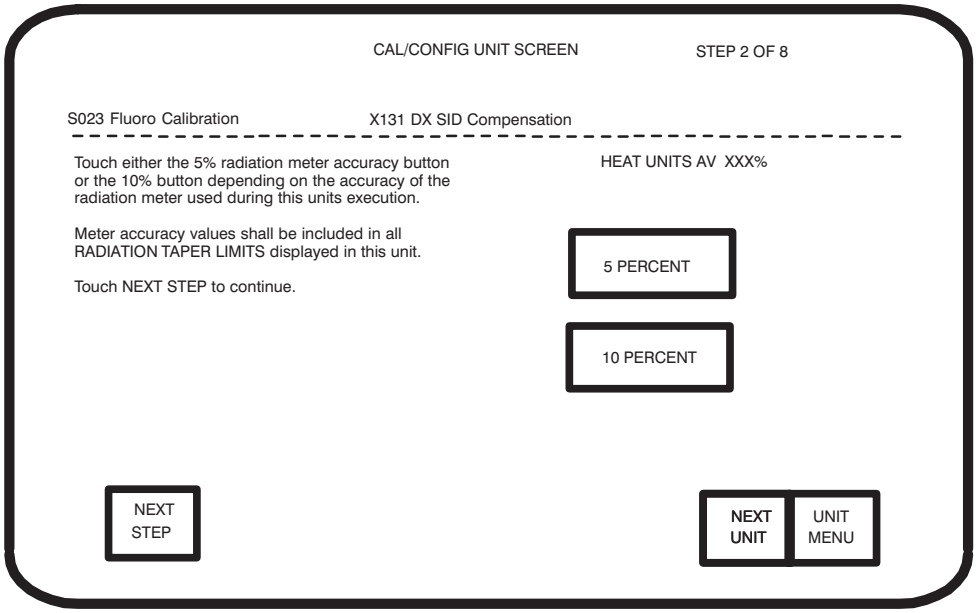
X131 STEP 1 SCREEN DISPLAY
(BIPLANE & <u>NEWER</u> SW SP LCA+/LCV+/LC+ SYSTEMS)



1-4-2 Step 2. Radiation Meter Accuracy.

- Check the rated accuracy of the radiation meter to be used in the calibration. (Radcal 2025 or 2026 and their probes have a 5% accuracy).
- Touch the 5 PERCENT or 10 PERCENT softkey to enter the rated accuracy of the radiation meter. The meter accuracy value is included in all RADIATION TAPER LIMITS displayed in this unit.
- Touch the NEXT STEP softkey to proceed to Step 3.

X131 STEP 2 SCREEN DISPLAY
(BIPLANE & NEWER SW SP LCA+/LCV+/LC+ SYSTEMS)



1-4-3 Step 3. Radiation Meter (R–Meter) Probe Positioning

CAUTION **LP must be at 90 degrees (C90 position on LC position display) to allow positioning of x–ray tube and II tube.**

CAUTION **Verify that the collision sensor is installed on the collimator, and that the hinged door is closed before proceeding.**

- Move the table top out of the field of the x–ray beam and open the collimator blades to maximum.

NOTICE **For Advantx–E Vascular Systems, rotate the table top to 90 degrees vs the longitudinal positioner axis.**

NOTICE **On LC systems configured with an Omega EP table, you must rotate the LC positioner pivot to 90 degrees and lower the table top out of the x–ray beam.**

- Manually set the II tube and x–ray tube to minimum SID.

Note: For Advantx–E Vascular Systems, Ion Chamber Positioning Tool is mandatory to get accurate adjustments.

Note: If you are using the Ion Chamber Positioning Tool and if you have just run X130 unit, the probe should not have moved, so DO NOT CHANGE the positioning of the probe to avoid errors in the calibration.

- When using Ion Chamber Positioning Tool 2236707 (Former ref: 2208874), refer to Illustration 135 in Cal Unit X100 and to the instructions on the screen display for Step 3; also, refer to mounting/positioning instructions in Cal Unit T015. Check for probe top/II anticollision plate distance in Table 10 of Cal Unit T015.
- If not using the Ion Chamber Positioning Tool, mount R–Meter probe stand to bottom of II tube (or position the stand on the head end of the table top and extend the R–Meter probe into the x–ray beam). Position the R–meter probe 30 cm from the lowest point on the II tube housing (Refer to Illustration 134 in Cal Unit X100 and to the instructions on the screen display for Step 3).

Note: The positioning of the R–meter probe 30 cm from the lowest point on the II tube housing (with II in overhead position) is an FDA requirement. The FDA assumes that the 30 cm distance corresponds to the average thickness of a patient and therefore establishes a worst case condition for radiation dose.

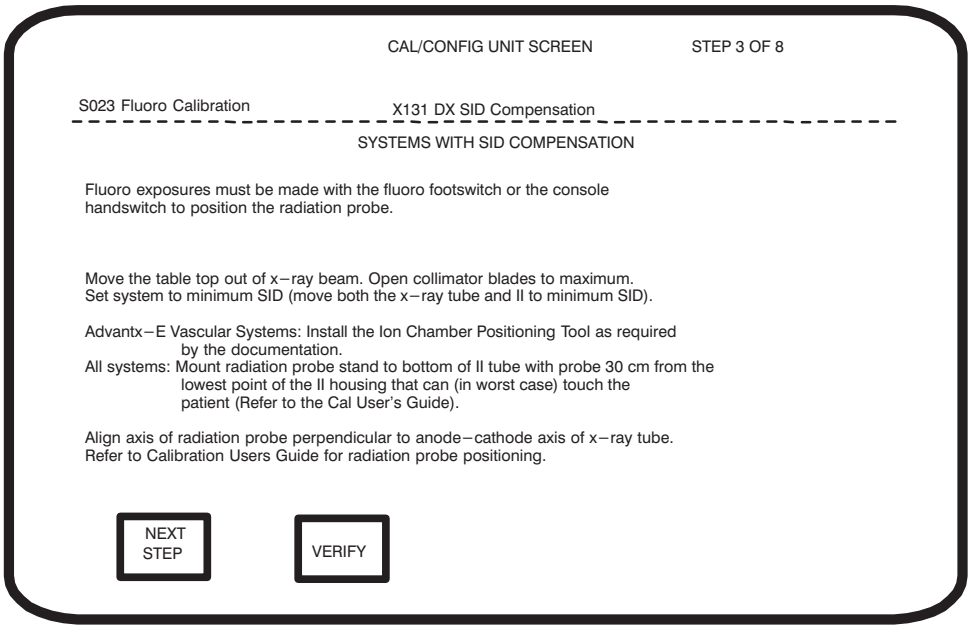
- Align the axis of the probe perpendicular to the anode–cathode axis of the x–ray tube.
- Take a fluoro exposure to determine the exact position of the R–Meter probe in the field of view.
- Repeat taking exposures and repositioning the R–Meter probe until the probe is centered in the x–ray beam.

- After the R–Meter probe is properly positioned, you may perform a quick check of the Radiation Taper Limit before proceeding with a full calibration by touching the VERIFY softkey. Touching the VERIFY softkey will cause the unit to increment to the Step 8, Verification screen. Perform Step 8.

OR

- Touch the NEXT STEP softkey to proceed to Step 4 in the calibration sequence.

X131 STEP 3 SCREEN DISPLAY
(BIPLANE & NEWER SW SP LCA+/LCV+/LC+ SYSTEMS)



NOTICE

Before attempting to run SID POS Positioning on LCA+/LCV+/LC+ systems, ensure that the table top rotational position is at 0 degrees or ±90 degrees for systems with Omega IV tables or at 0 degrees angulation position for systems with Omega EP tables. The SID button on the tableside control is disabled if the table is not at one of these positions.

NOTICE

For frontal calibration on a biplane system, the LP must be parked.

1-4-4 Step 4. SID POS Positioning

- Touch the SIDZERO softkey. The system will process and load SIDZERO data into NVRAM. Upon completion of processing, a “SIDZERO PROCESS COMPLETE” message will be displayed on the console.
- Touch the SID POS softkey.

Note: On LCA+/LCV+/LC+ systems, the SID POS softkey does not control the positioning of the Image Intensifier tube. Touch the SID POS softkey on the console and then press and hold the SERVICE button beneath the tableside control until the II reaches the maximum SID position.

On biplane lateral, maintain button activation until the Image Intensifier tube is in position. The SID POS softkey will then display G4. For 120 kV calibration you will have to push button activation again until the x–ray tube is in position (may take 15–20 seconds). The x–ray tube will not start to move until the II is in position.

Note: On Tilt–C systems, manually position the II to a SID of 106 cm.

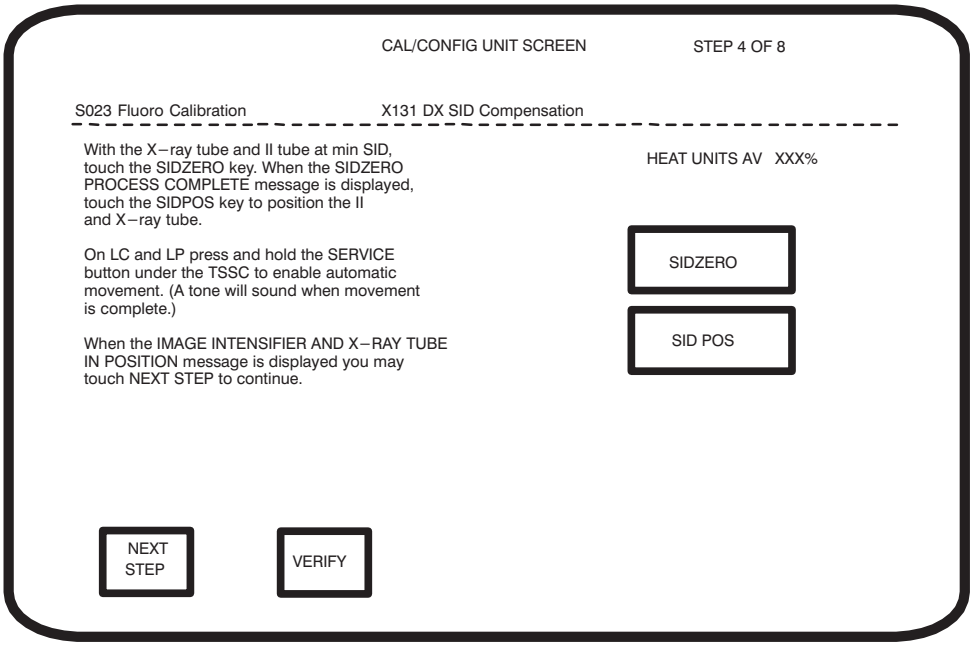
For German Advantx–E Vascular Systems with non–removable 0.1 mm copper filter in the beam:

- When the message “IMAGE INTENSIFIER AND X–RAY TUBE IN POSITION” is displayed, position the II to 95 cm SID (frontal) or 100 cm SID (lateral) in place of max SID.
- Touch NEXT STEP softkey to proceed to Step 5.

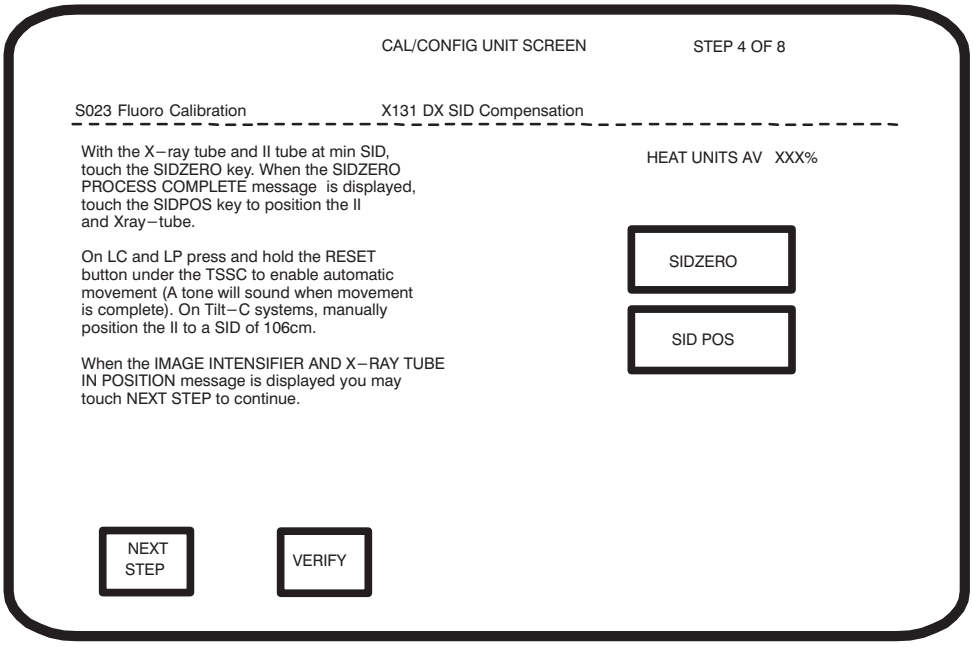
For Other Systems:

- When the message “IMAGE INTENSIFIER AND X–RAY TUBE IN POSITION” is displayed, touch NEXT STEP softkey to proceed to Step 5.

X131 STEP 4 SCREEN DISPLAY (BIPLANE & NEWER SW SP LCA+/LCV+/LC+ SYSTEMS)



X131 STEP 4 SCREEN DISPLAY (TILT−C SYSTEMS)



1-4-5 Step 5. G3 Adjustment

Before proceeding, touch the Step 5 MORE INFO softkey to access the Step 5 MORE INFO screen for more instructions about the G3 adjustment.

Note: For other than Advantx–E Vascular Systems:

- Using a ruler, set the II to isocenter distance to 300mm (30 cm). Measure to the lowest point on the II tube housing (depending upon the type of system involved, this may be the II tube cover or anti–collision device). See Illustration 137 in Cal Unit X101.
- After the II to isocenter distance is set, mark the distance on the II carriage with a piece of tape. This will provide a reference point for the 300 mm (30 cm) distance to ensure distance is maintained or for easy return to the measured distance, if required.

- Initiate G3 adjustment by touching the G3 softkey.
- Take and maintain a fluoro exposure.

For German Advantx–E Vascular Systems with non–removable 0.1 mm copper filter in the beam:

- Adjust G3 to get D(minref) value (found at X130 Step 4) at 60 kVp.

For Other Systems:

- During the exposure, turn the console to adjust G3 dial until the dose rate indicated on the radiation meter is within 0.8 mGy/min (0.1 R/min) less than the RADIATION TAPER LIMIT value displayed on the console screen.

NOTICE

If for some reason, the power unit limit on peak fluoro power at 60 kV is exceeded, the message “mA Exceeds Power Unit Limits, See Manual and MORE INFO” is displayed. Then decrease SID by 3 cm and try again. A decrease of SID will not change the EER.

- Terminate the exposure.

Note: The power unit has limits on peak mA during G3 calibration. Exceeding the limits can cause kV drop during exposures — giving a bad calibration or power unit errors. If the system cannot perform the calibration with a SID of at least 90 cm then the calibration will work properly at smaller SID, but µGy/mAs should be tested as the value is likely to be below Xray Tube replacement limits.

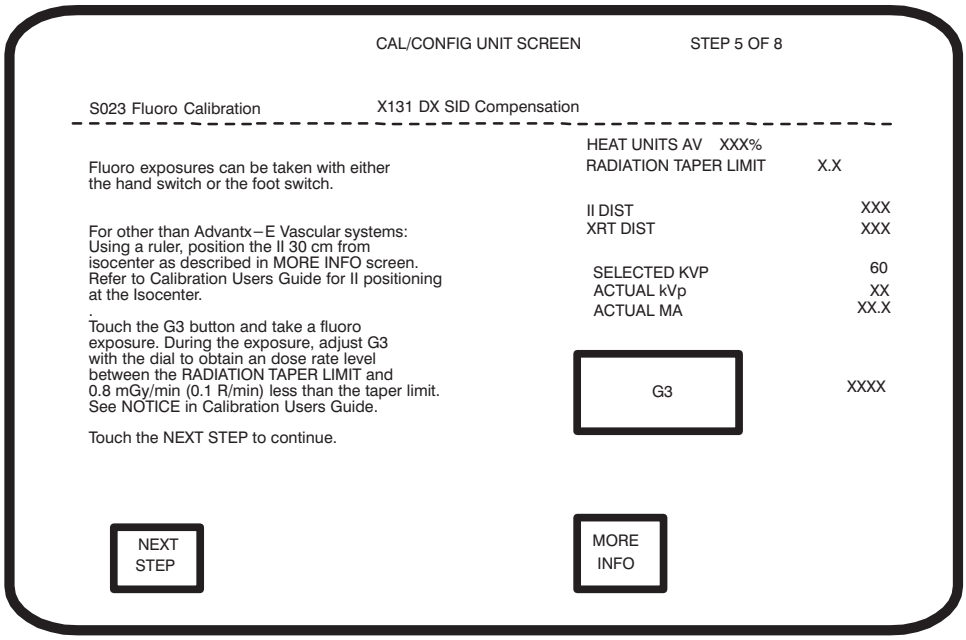
NOTICE

On a system with variable Xray Tube Positioning (LP):

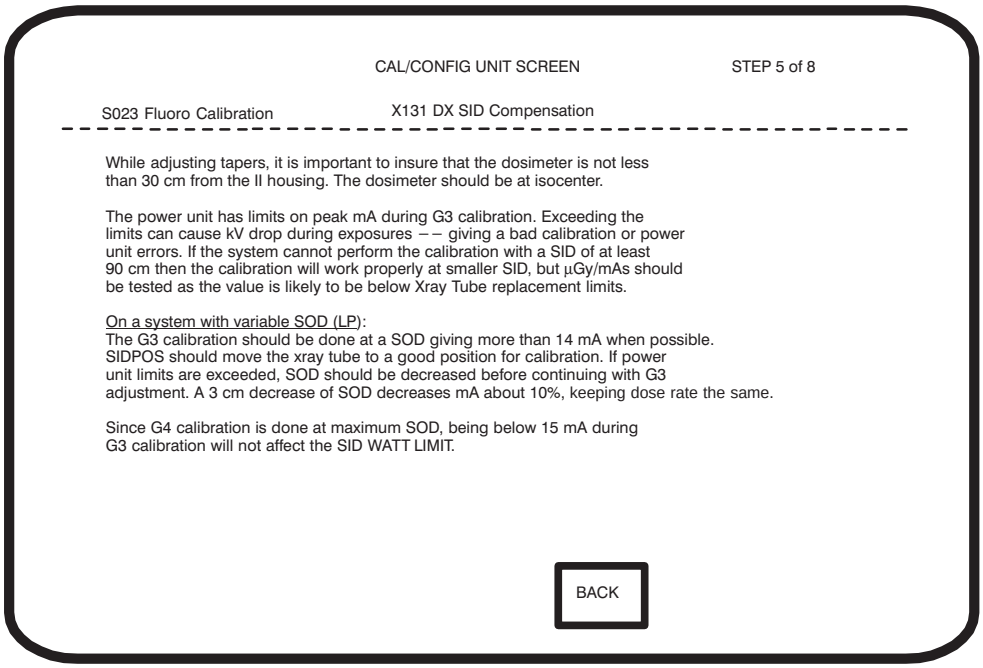
The G3 calibration should be done at a SOD giving when possible more than 14 mA. SIDPOS should move the xray tube to a good position for calibration. If power unit limits are exceeded, SOD should be decreased before continuing with G3 adjustment. A 3 cm decrease of SOD decreases mA of about 10%, keeping dose rate the same. Since G4 calibration is done at maximum SOD, being below 15 mA during G3 calibration will not affect the SID WATT LIMIT.

- Touch NEXT STEP softkey and proceed to Step 6.

X131 STEP 5 SCREEN DISPLAY
(BIPLANE & NEWER SW SP LCA+/LCV+/LC+ SYSTEMS)



X131 STEP 5 "MORE INFO" SCREEN DISPLAY
(BIPLANE & NEWER SW SP LCA+/LCV+/LC+ SYSTEMS)



1-4-6 Step 6. G4 Adjustment

1-4-6-1 For Lateral Plane only:

- Touch the SIDPOS softkey, then press and hold the SERVICE button under the TSSC while the Xray tube autopositions to maximum SOD. After completion of positioning, a tone sounds and the SIDPOS softkey label changes from “SIDPOS” to “G4”.
- Initiate G4 adjustment by touching the G4 softkey.
- Take and maintain a fluoro exposure.

For German Advantx–E Vascular Systems with non–removable 0.1 mm copper filter in the beam:

- Position the II to max SID (with the blue button on the II anticollision ring) and max SOD (lateral)
- Adjust G4 to get 12.5 mA read on the console at 120 kVp.
- Measure the resulting dose, then call it D(maxSID).
- If D(maxSID) is higher than 7.9 mGy/min (9.1 R/min), readjust G4 to get 7.9 mGy/min (9.1 R/min), then touch NEXT STEP softkey and proceed to Step 7.
- If D(maxSID) is lower than 7.9 mGy/min (9.1 R/min), reduce SOD then SID by a 1 cm step, then readjust G4 to get 12.5 mA read on the console. Measure the resulting dose. If this dose is still lower than 7.9 mGy/min (9.1 R/min), repeat this action until the resulting dose reaches a value higher than 7.9 mGy/min (9.1 R/min) (You shall get at the same time 12.5 mA AND a dose higher than 7.9 mGy/min (9.1 R/min)).
- Re–adjust G4 to get 7.9 mGy/min (9.1 R/min) at 120 kVp.
- Terminate the exposure.
- Touch NEXT STEP softkey and proceed to Step 7.

For Other Systems:

- During the exposure, turn the console dial to adjust G4 until the dose rate indicated on the radiation meter is within 0.8 mGy/min (0.1 R/min) less than the RADIATION TAPER LIMIT value displayed on the console screen.
- Terminate the exposure.
- Touch NEXT STEP softkey and proceed to Step 7.

NOTICE

If for some reason, the peak power limit of 5.4 kW is exceeded, the message “mA high; Check mR/mAs” is displayed. You may continue with calibration, but check tube efficiency. Reduce X–ray tube SOD by 3 cm steps until the radiation taper limit can be achieved.

1-4-6-2 For Frontal Plane:

NOTICE **If SID was changed in the previous step, you must return the system to the original SID value (max SID for Advantx–E Vascular systems, SID 30 cm from isocenter for other systems).**

- Initiate G4 adjustment by touching the G4 softkey.
- Take and maintain a fluoro exposure.

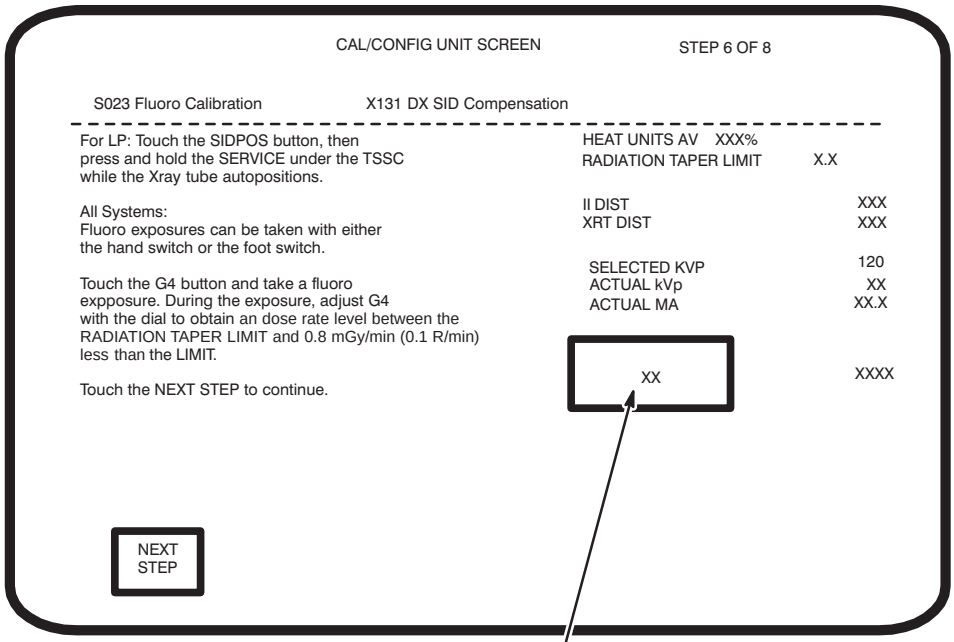
For German Advantx–E Vascular Systems with non–removable 0.1 mm copper filter in the beam:

- Position the II to max SID (with the blue button on the II anticollision ring)
- Adjust G4 to get 12.5 mA read on the console at 120 kVp.
- Measure the resulting dose, then call it D(maxSID).
- If D(maxSID) is higher than 7.9 mGy/min (9.1 R/min), readjust G4 to get 7.9 mGy/min (9.1 R/min), then touch NEXT STEP softkey and proceed to Step 7.
- If D(maxSID) is lower than 7.9 mGy/min (9.1 R/min), reduce SID by a 1 cm step, then readjust G4 to get 12.5 mA read on the console. Measure the resulting dose. If this dose is still lower than 7.9 mGy/min (9.1 R/min), repeat this action until the resulting dose reaches a value higher than 7.9 mGy/min (9.1 R/min) (You shall get at the same time 12.5 mA AND a dose higher than 7.9 mGy/min (9.1 R/min)).
- Re–adjust G4 to get 7.9 mGy/min (9.1 R/min) at 120 kVp.
- Terminate the exposure.
- Touch NEXT STEP softkey and proceed to Step 7.

For Other Systems:

- During the exposure, turn the console dial to adjust G4 until the dose rate indicated on the radiation meter is within 0.8 mGy/min (0.1 R/min) less than the RADIATION TAPER LIMIT value displayed on the console screen.
- Terminate the exposure.
- Touch NEXT STEP softkey and proceed to Step 7.

X131 STEP 6 SCREEN DISPLAY (BIPLANE & NEWER SW SP LCA+/LCV+/LC+ SYSTEMS)



For Lateral Plane ONLY: Softkey says “SIDPOS” until after activation and completion of positioning. Then, softkey label changes to say “G4”.

For Frontal Plane: Softkey ALWAYS says “G4”.

1-4-7 Step 7. SID Watt Limiter Adjustment

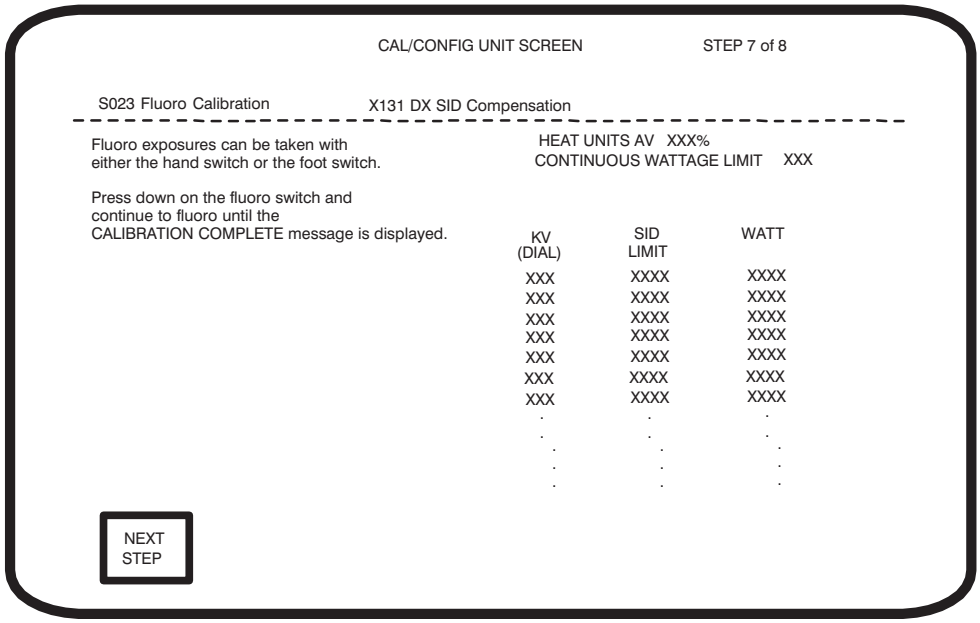
- Take and maintain a fluoro exposure. The system will perform the Watt limiter adjustment while the exposure is being taken.
- Maintain the exposure until the “CALIBRATION COMPLETE” message is displayed on the console screen.

NOTICE

During the automatic wattage calculation, the following message “WATT LIMIT EXCEEDED AT MIN SID. RECAL FLUORO TAPER AND THIS UNIT” may appear on the console. At this point, the calculation is interrupted because the calculated wattage exceeds the wattage upper limit. In this case, switch the system off at the console and recalibrate the taper at the minimum SID, making sure the 1800 watt safety limit is respected.

- Touch NEXT STEP softkey and proceed to Step 8.

X131 STEP 7 SCREEN DISPLAY
(BIPLANE & NEWER SW SP LCA+/LCV+/LC+ SYSTEMS)



1-4-8 Step 8. Verification

Verification should be done at different kVp's and SID's.

- Initiate Entrance Exposure Rate–EER verification by touching the KVP softkey.
- Take and maintain a fluoro exposure. During the exposure, use the console dial to step from 60 kVp to 120 kVp in 5 kVp increments. Verify the EER level on the radiation meter at each kVp increment.

NOTICE

When incrementing kVp through the verification values, rotate the console dial slowly. As the filament control parameter (G5) is active during this step of the calibration, you must allow time for the G5 to respond to each new kVp setting before incrementing to the next kVp. If you try to step through the kVp increments without giving the G5 parameter time to respond, information messages may appear on the console screen and/or erroneous fluctuations may occur in the dose rate readout.

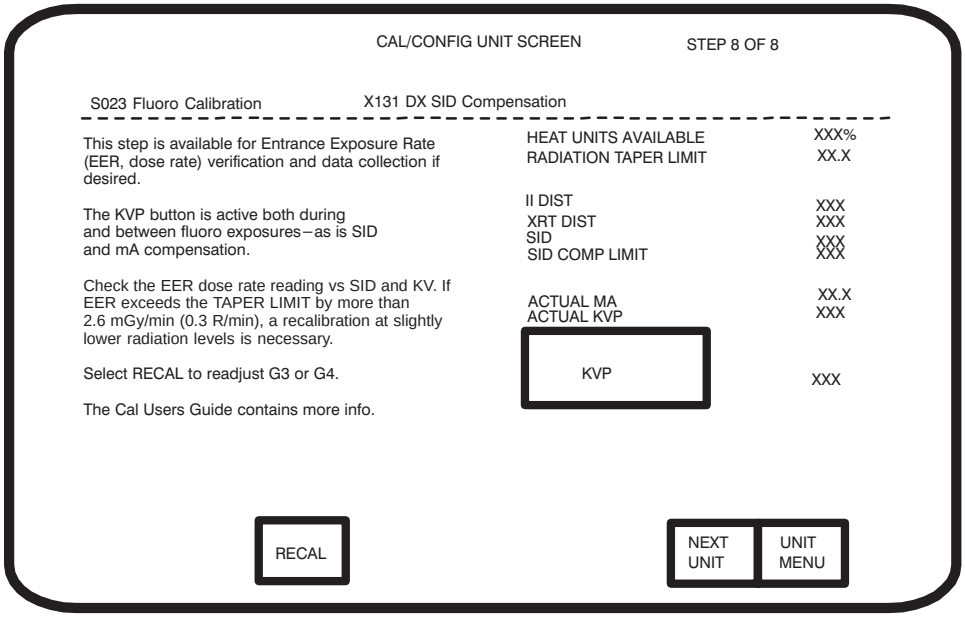
- Terminate the exposure.
- If the EER, at any kVp increment and SID, exceeds the RADIATION TAPER LIMIT displayed on the console screen by more than 2.6 mGy/min (0.3 R/min), a recalibration at slightly lower radiation levels is required.
- If a recalibration is required, touch the RECAL softkey and readjust G3 (Step 5) or G4 (Step 6).
- Verify the results of any re-calibrations by repeating Step 8.
- If the EER at any kVp increment at min SID is different by more than 4.3 mGy/min (0.5 R/min) from that at the SID comp limit, a recalibration is recommended.
- Touch the NEXT UNIT or UNIT MENU softkey to exit.

1-4-8-1 Special instructions regarding verification

If the table top EER is low, review the following special instructions before proceeding with a recalibration. Do not just recal at a higher EER value.

1. MA compensation will compensate for x–ray tube heating and cooling effects as well as filament aging.
2. If the SID is larger than the value calibrated in SID Watt Limiter, then the display of the SID Comp Limit value will be blinking in inverse video. In that case, the EER will be lower than the calibrated values.

X131 STEP 8 SCREEN DISPLAY (BIPLANE & NEWER SW SP LCA+/LCV+/LC+ SYSTEMS)



2 X131, DX (DLX) SID COMPENSATION, OLD PROCEDURE

Note: The Old Procedure is used for OLDER software (i.e., ASC SW prior to G4.XX) single plane LCA/LCV+/LC+ systems.

(For biplane systems and for newer software single plane LCA/LCV+/LC+ systems, go to New Procedure in Section 1.)

2-1 Description

Calibration Unit X131 adjusts the DLX SID compensation parameters so that as SID increases, tube filament current increases, thereby maintaining the fluoro table top dose at a calibrated value. DLX SID compensation also prevents increases in fluoro technique from exceeding the rating of the tube. SID compensation is only active during exposures. Seven steps are required to calibrate the SID compensation parameters. A screen display is provided for each step.

CAUTION **This unit allows the system to be configured for higher pulsed progressive fluoro taper limits than shipped. This is not recommended. This is forbidden in the US where the 87.6 mGy/min (10 R/min) regulatory limits applies. While the system will operate at these higher taper limits, the reliability under this condition may suffer; increased maintenance costs should be expected. Only raise the fluoro taper limits after all other methods of improving digital fluoro image quality have been tried and there is still a serious customer issue.**

Note: This unit must always be run in combination with Cal Unit X130 and X130 must be run first.

2-2 Equipment required

Dosimeter (MDH/Radcal 2025, 2026 or equivalent) w/probe stand or Ion Chamber Positioning Tool 2236707 (Former ref: 2208874)
For Advantx–E Systems, Ion Chamber Positioning Tool is mandatory (See Cal Unit T015) .
For this Cal Unit, use Model 20x5–3 or 20x6–3 probe.
Metric Tape Measure.

2-3 Special Instructions

Note: **For Vascular Systems only:** Before system calibration, verify that additional filter (copper–aluminum filter) is not installed on top of collimator. (Open sensor hinge assembly to verify.) If installed, remove before performing calibration.

- Communication with DLX.

Note: Communication must be established with the DLX prior to the display of the Step 1 screen. If that fails, an error message is displayed and the unit will only function in the browse mode. To ensure communication with the DLX, perform the following:

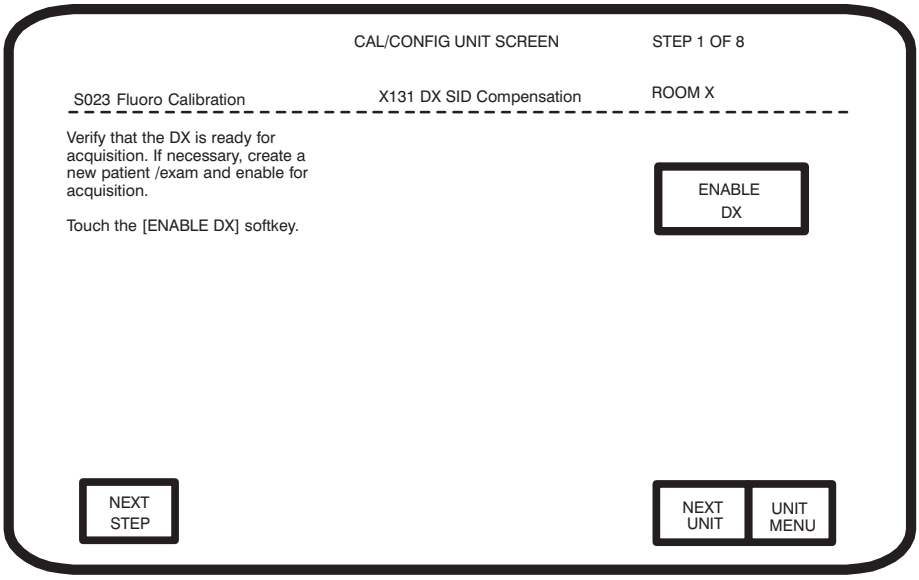
1. On the DLX console, at the “DLX LOGIN” prompt, type “DLX” followed by pressing the RETURN key.
2. Verify DLX console displays the ACQUISITION screen. If not, select the following keys to continue:
   NEW PATIENT (you must also enter patient name and ID number or the DLX will not be enabled)
   NEW EXAM

2-4 Cal Procedure

2-4-1 Step 1. Enable DX (DLX)

- Communication must be established with the DX (DLX) prior to selecting the ENABLE DX softkey. Selecting the ENABLE DX softkey puts the DX (DLX) into technical menu. If communication with the DX (DLX) fails, an error message is displayed and the unit will only function in the viewing (browse) mode.
  1. If necessary, create a new patient/exam and enable for acquisition.
  2. Touch the ENABLE DX softkey.
- Touch NEXT STEP softkey to proceed to Step 2. If the NEXT STEP softkey is pressed prior to pressing the ENABLE DX softkey, the viewing mode will be entered. Viewing mode allows cycling through the screen displays without doing a calibration.

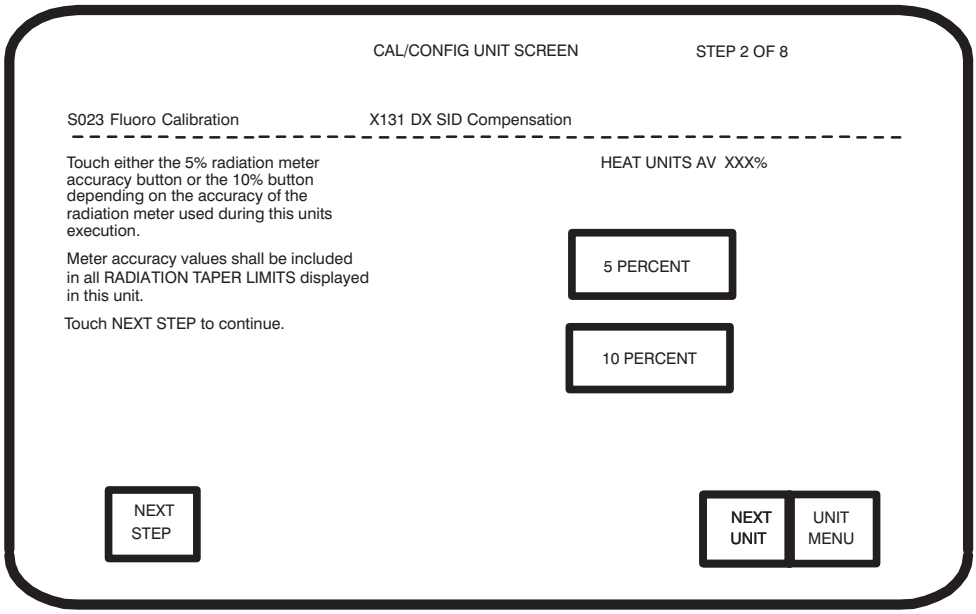
X131 STEP 1 SCREEN DISPLAY
(TILT–C SYSTEMS & <u>OLDER</u> SW SP LCA/LCV+/LC+ SYSTEMS)



2-4-2 Step 2. Radiation Meter Accuracy.

- Check the rated accuracy of the radiation meter to be used in the calibration.
- Touch the 5 PERCENT or 10 PERCENT softkey to enter the rated accuracy of the radiation meter. The meter accuracy value is included in all RADIATION TAPER LIMITS displayed in this unit.
- Touch the NEXT STEP softkey to proceed to Step 3.

X131 STEP 2 SCREEN DISPLAY
(TILT–C SYSTEMS & <u>OLDER</u> SW SP LCA/LCV+/LC+ SYSTEMS)



2-4-3 Step 3. Radiation Meter (R–Meter) Probe Positioning

CAUTION **Verify that the collision sensor is installed on the collimator, and that the hinged door is closed before proceeding.**

- Move the table top out of the field of the x–ray beam and open the collimator blades to maximum.

NOTICE **For Advantx–E Vascular Systems, rotate the table top to 90 degrees vs the longitudinal positioner axis.**

NOTICE **On LC systems configured with an Omega EP table, you must rotate the LC positioner pivot to 90 degrees and lower the table top out of the x–ray beam.**

- Manually set the II tube and x–ray tube to minimum SID.

Note: For Advantx–E Vascular Systems, Ion Chamber Positioning Tool is mandatory to get accurate adjustments.

Note: If you are using the Ion Chamber Positioning Tool and if you have just run X130 unit, the probe should not have moved, so DO NOT CHANGE the positioning of the probe to avoid errors in the calibration.

- When using Ion Chamber Positioning Tool 2236707 (Former ref: 2208874), refer to Illustration 135 in Cal Unit X100 and to the instructions on the screen display for Step 3; also, refer to mounting/positioning instructions in Cal Unit T015. Check for probe top/II anticollision plate distance in Table 10 of Cal Unit T015.
- If not using the Ion Chamber Positioning Tool, mount R–Meter probe stand to bottom of II tube (or position the stand on the head end of the table top and extend the R–Meter probe into the x–ray beam). Position the R–meter probe 30 cm from the lowest point on the II tube housing (Refer to Illustration 134 in Cal Unit X100 and to the instructions on the screen display for Step 3).

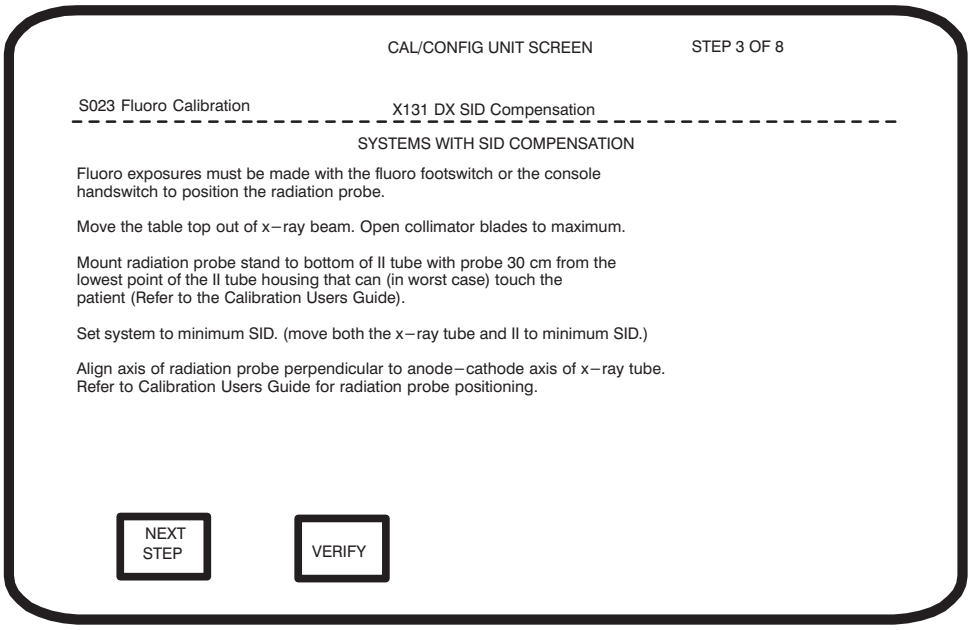
Note: The positioning of the R–meter probe 30 cm from the lowest point on the II tube housing (with II in overhead position) is an FDA requirement. The FDA assumes that the 30 cm distance corresponds to the average thickness of a patient and therefore establishes a worst case condition for radiation dose.

- Align axis of the radiation probe perpendicular to the anode–cathode axis of the x–ray tube.
- Take a fluoro exposure to determine the exact position of the probe.
- Repeat taking exposures and repositioning the R–Meter probe until the probe is centered in the x–ray beam.
- After the R–Meter probe is properly positioned, you may perform a quick check of the Radiation Taper Limit before proceeding with a full calibration by touching the VERIFY softkey. Touching the VERIFY softkey will cause the unit to increment to the Step 8, Verification screen. Perform Step 8.

OR

- Touch the NEXT STEP softkey to proceed to Step 4 in the calibration sequence.

X131 STEP 3 SCREEN DISPLAY
(TILT–C SYSTEMS & OLDER SW SP LCA/LCV+/LC+ SYSTEMS)



NOTICE

Before attempting to run SID POS Positioning on LCA/LCV+/LC+ systems, ensure that the table top rotational position is at 0 degrees or ¿90 degrees for systems with Omega IV tables or at 0 degrees angulation position for systems with Omega EP tables. The SID button on the tableside control is disabled if the table is not at one of these positions.

NOTICE

For frontal calibration on a biplane system, the LP must be parked.

2-4-4 Step 4. SID POS Positioning

- Touch the SIDZERO softkey. The system will process and load SIDZERO data into NVRAM. Upon completion of processing, a “SIDZERO PROCESS COMPLETE” message will be displayed on the console.
- Touch the SID POS softkey.

Note: On LCA/LCV+/LC+ systems, the SID POS softkey does not control the positioning of the Image Intensifier tube. Touch the SID POS softkey on the console and then press and hold the RESET button beneath the tableside control until the II reaches the upper SID position.

Note: On Tilt–C systems, manually position the II to a SID of 106 cm.

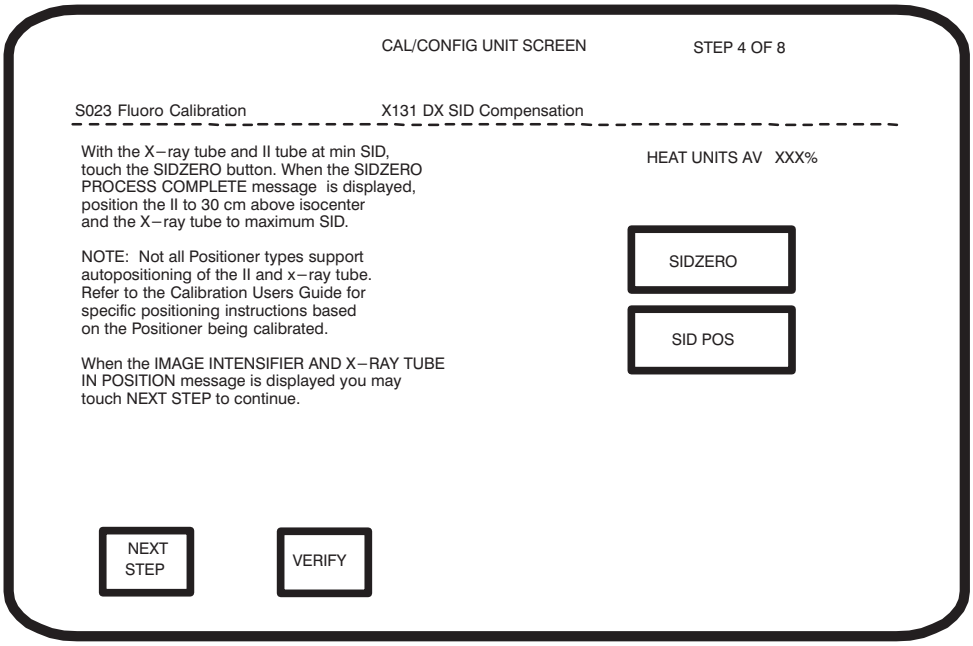
For German Advantx–E Vascular Systems with non–removable 0.1 mm copper filter in the beam:

- When the message “IMAGE INTENSIFIER AND X–RAY TUBE IN POSITION” is displayed, position the II to 95 cm SID (frontal) or 100 cm SID (lateral) in place of max SID.
- Touch NEXT STEP softkey to proceed to Step 5.

For Other Advantx–E Vascular Systems:

- When the message “IMAGE INTENSIFIER AND X–RAY TUBE IN POSITION” is displayed, touch NEXT STEP softkey to proceed to Step 5.

X131 STEP 4 SCREEN DISPLAY
(TILT–C SYSTEMS & OLDER SW SP LCA/LCV+/LC+ SYSTEMS)



2-4-5 Step 5. G3 Adjustment

Note: For other than Advantx–E Vascular Systems:

- Using a ruler, set the II to isocenter distance to 300mm (30 cm). Measure to the lowest point on the II tube housing (depending upon the type of system involved, this may be the II tube cover or anti–collision device). See Illustration 137 in Cal Unit X101.
- After the II to isocenter distance is set, mark the distance on the II carriage with a piece of tape. This will provide a reference point for the 300 mm (30 cm) distance to ensure distance is maintained or for easy return to the measured distance, if required.

- Ensure that the x–ray tube is at maximum SID.
- Initiate G3 adjustment by touching the G3 softkey.
- Take and maintain a fluoro exposure.

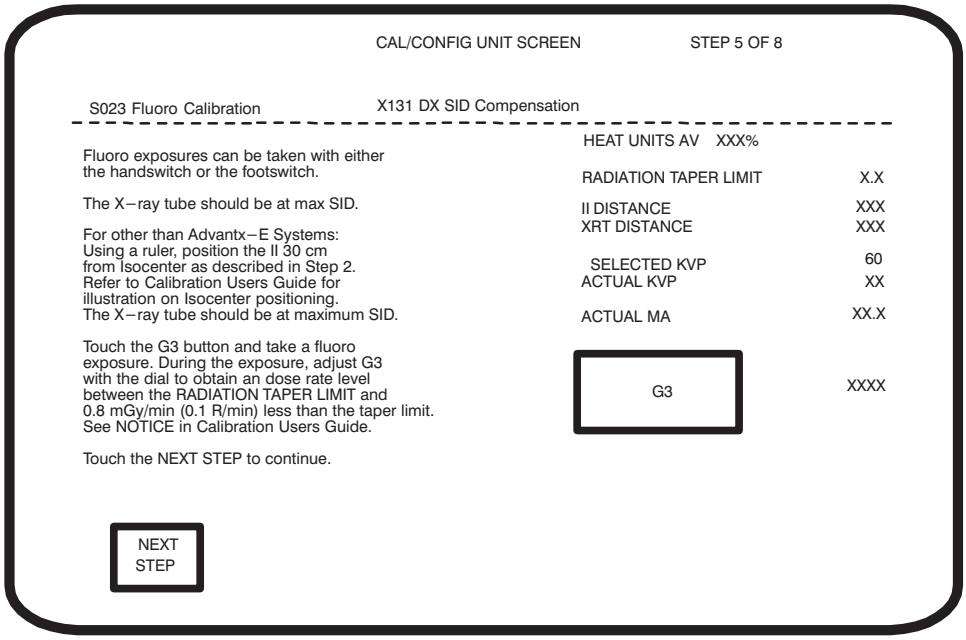
For German Advantx–E Vascular Systems with non–removable 0.1 mm copper filter in the beam:

- Adjust G3 to get D(minref) value (found at X130 Step 4) at 60 kVp.

For Other Systems:

- During the exposure, turn the console dial to adjust G3 until the dose rate indicated on the radiation meter is within 0.8 mGy/min (0.1 R/min) less than the RADIATION TAPER LIMIT value displayed on the console screen.
- Terminate the exposure.
- Touch NEXT STEP softkey and proceed to Step 6.

X131 STEP 5 SCREEN DISPLAY
(TILT–C SYSTEMS & OLDER SW SP LCA/LCV+/LC+ SYSTEMS)



2-4-6 Step 6. G4 Adjustment

- Initiate G4 adjustment by touching the G4 softkey.
- Take and maintain a fluoro exposure.

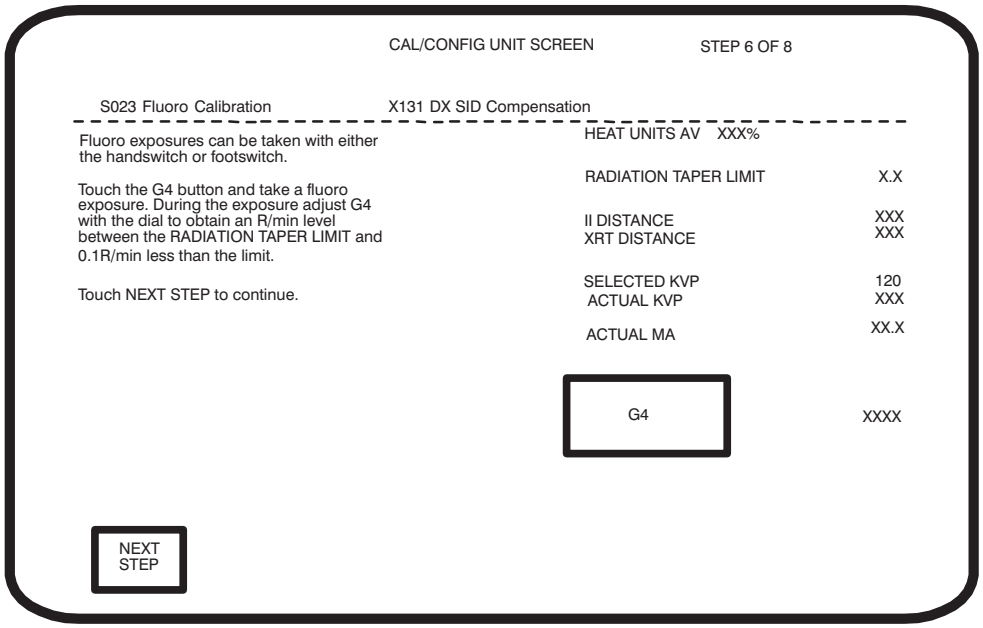
For German Advantx–E Vascular Systems with non–removable 0.1 mm copper filter in the beam:

- Position the II to max SID (with the blue button on the II anticollision ring)
- Adjust G4 to get 12.5 mA read on the console at 120 kVp.
- Measure the resulting dose, then call it D(maxSID).
- If D(maxSID) is higher than 7.9 mGy/min (9.1 R/min), readjust G4 to get 7.9 mGy/min (9.1 R/min), then touch NEXT STEP softkey and proceed to Step 7.
- If D(maxSID) is lower than 7.9 mGy/min (9.1 R/min), reduce SID by a 1 cm step, then readjust G4 to get 12.5 mA read on the console. Measure the resulting dose. If this dose is still lower than 7.9 mGy/min (9.1 R/min), repeat this action until the resulting dose reaches a value higher than 7.9 mGy/min (9.1 R/min) (You shall get at the same time 12.5 mA AND a dose higher than 7.9 mGy/min (9.1 R/min)).
- Re–adjust G4 to get 7.9 mGy/min (9.1 R/min) at 120 kVp.
- Terminate the exposure.
- Touch NEXT STEP softkey and proceed to Step 7.

For Other Systems:

- During the exposure, turn the console dial to adjust G4 until the dose rate indicated on the radiation meter is within 0.8 mGy/min (0.1 R/min) less than the RADIATION TAPER LIMIT value displayed on the console screen.
- Terminate the exposure.
- Touch NEXT STEP softkey and proceed to Step 7.

X131 STEP 6 SCREEN DISPLAY
(TILT–C SYSTEMS & OLDER SW SP LCA/LCV+/LC+ SYSTEMS)



2-4-7 Step 7. SID Watt Limiter Adjustment

- Take and maintain a fluoro exposure. The system will perform the Watt limiter calibration while the exposure is being taken.
- Maintain the exposure until the “CALIBRATION COMPLETE” message is displayed on the console screen.

Note: The WATT LIMIT is typically 900 W.

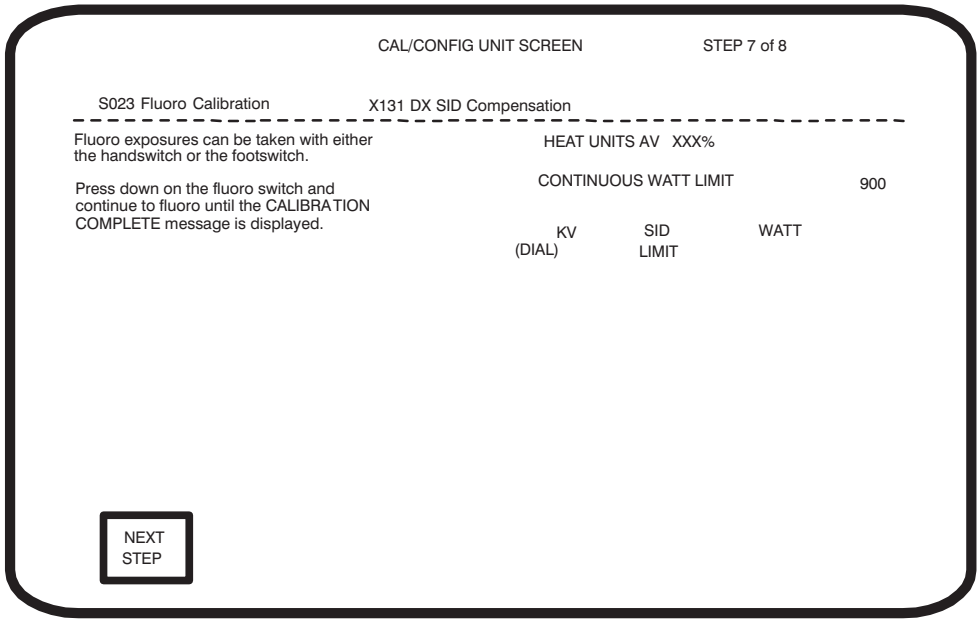
Note: For purpose of verification (Step 8), note any KV’s and SID LIMIT’s for which the WATT value is close to the WATT LIMIT. At those KV’s, the Entrance Exposure Rate–EER will be below the calibrated values for SID’s larger than the SID LIMIT.

NOTICE

During the automatic wattage calculation, the following message “WATT LIMIT EXCEEDED AT MIN SID. RECAL FLUORO TAPER AND THIS UNIT” may appear on the console. At this point, the calculation is interrupted because the calculated wattage exceeds the wattage upper limit. In this case, switch the system off at the console and recalibrate the taper at the minimum SID, making sure the 1800 watt safety limit is respected.

- Touch NEXT STEP softkey and proceed to Step 8.

X131 STEP 7 SCREEN DISPLAY
(TILT–C SYSTEMS & <u>OLDER</u> SW SP LCA/LCV+/LC+ SYSTEMS)



2-4-8 Step 8. Verification

- Initiate Entrance Exposure Rate–EER verification by touching the KVP softkey.
- Take and maintain a fluoro exposure. During the exposure, use the console dial to step from 60 kVp to 120 kVp in 5 kVp increments. Verify the EER level on the radiation meter at each kVp increment.

NOTICE

When incrementing kVp through the verification values, rotate the console dial slowly. As the filament control parameter (G5) is active during this step of the calibration, you must allow time for the G5 to respond to each new kVp setting before incrementing to the next kVp. If you try to step through the kVp increments without giving the G5 parameter time to respond, information messages may appear on the console screen and/or erroneous fluctuations may occur in the dose rate readout.

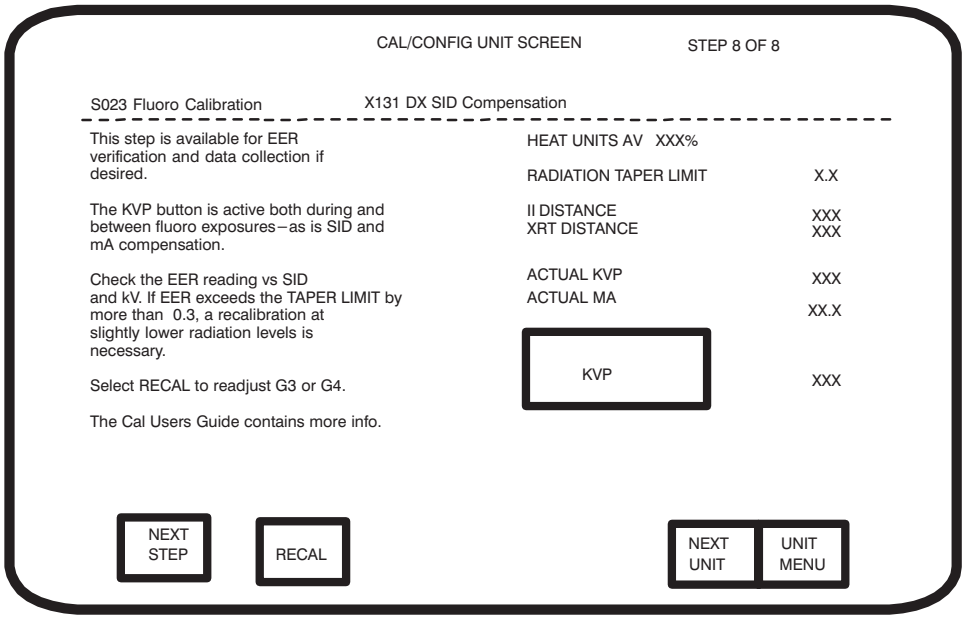
- Terminate the exposure.
- If the EER, at any kVp increment, exceeds the RADIATION TAPER LIMIT displayed on the console screen by more than 2.6 mGy/min (0.3 R/min), a recalibration at slightly lower radiation levels is required.
- If a recalibration is required, touch the RECAL softkey and readjust G3 (Step 5) or G4 (Step 6).
- Verify the results of any re-calibrations by repeating Step 8.
- Touch the NEXT UNIT or UNIT MENU softkey to exit.

2-4-8-1 Special instructions regarding verification

If the table top EER is low, review the following special instructions before proceeding with a recalibration. Do not just recal at a higher EER value.

1. MA compensation will compensate for x–ray tube heating and cooling effects as well as filament aging.
2. Do not recalibrate if the cause of a low EER is SID WATT limiting. The LCV+, and LC+ are expected to be SID WATT limited at 60 kV with a 900 watt continuous WATT LIMIT. (See second note in Step 7.)

X131 STEP 8 SCREEN DISPLAY (TILT–C SYSTEMS & OLDER SW SP LCA/LCV+/LC+ SYSTEMS)



UNIT X132 – DX (DLX) ABC Response

Time: x h xx min – Personnel: 1 field engineer

1 DESCRIPTION

Calibration Unit X132 adjusts the DLX ABC response time parameters (RADCNTRL, KVPCNTRL, and VGCNTRL) to maintain a light output from the Image Intensifier tube that is constant during DLX operation regardless of variations in system geometry or thickness and density of the object being scanned. Four steps are required to accomplish the calibration. A screen display is provided for each step.

2 SPECIAL INSTRUCTIONS

Communication must be established with the DLX prior to the display of the Step 1 screen. If that fails, an error message is displayed and the unit will only function in the browse mode. To ensure communication with the DLX, perform the following:

- On the DLX console, at the “DLX LOGIN” prompt, type “DLX” followed by pressing the RETURN key.
- Verify DLX console displays the ACQUISITION screen. If not, select the following keys to continue:
  NEW PATIENT (you must also enter patient name and ID number or the DLX will not be enabled)
  NEW EXAM

3 EQUIPMENT REQUIRED

Filtration (1/4 aluminum, 1/32 inch copper, 2–1/4 inches acrylic), oscilloscope, and test leads.

4 TEST SETUP

Setup the oscilloscope as follows:

VERT AMPL: 0.5 V/cm
TIME BASE: 0.5 sec/cm
Connect probe to SKL A2 TP1 and chassis (ground).

Note: Normal calibration is accomplished with loop selection in ON position. Turning loop OFF during Damping Adjustment will result in performance viewed different from Applications. this selection allows isolating each loop to view individual performance only.

5 SPECIAL INSTRUCTIONS

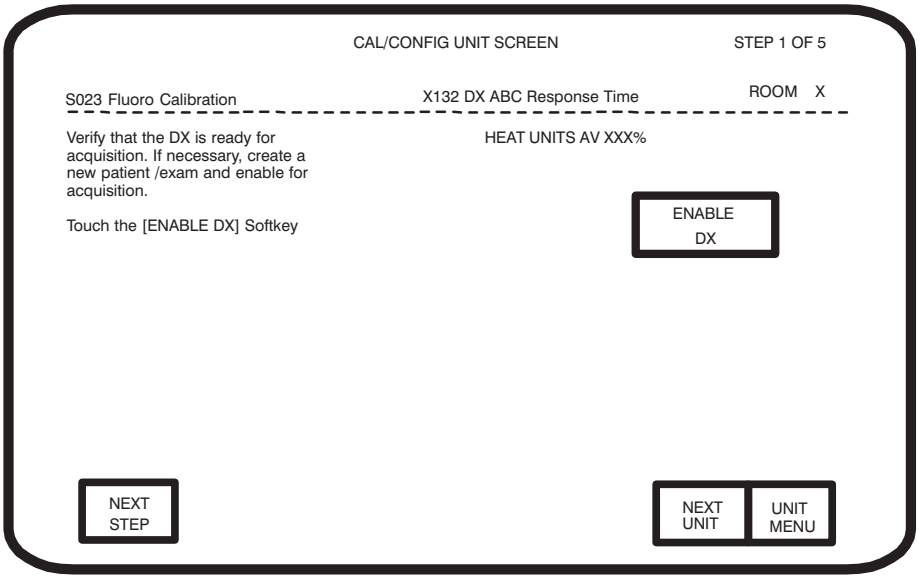
Note: **For Vascular Systems Only:** Before system calibration, verify that additional filter (copper–aluminum filter) is not installed on top of collimator. (Open sensor hinge assembly to verify.) If installed, remove before performing calibration.

6 CAL PROCEDURE

6-1 Step 1. Enable DX (DLX)

- Communication must be established with the DX (DLX) prior to selecting the ENABLE DX softkey. Selecting the ENABLE DX softkey puts the DX (DLX) into technical menu. If communication with the DX (DLX) fails, an error message is displayed and the unit will only function in the viewing (browse) mode.
  1. If necessary, create a new patient/exam and enable for acquisition.
  2. Touch the ENABLE DX softkey.
- Touch NEXT STEP softkey to proceed to Step 2. If the NEXT STEP softkey is pressed prior to pressing the ENABLE DX softkey, the viewing mode will be entered. Viewing mode allows cycling through the screen displays without doing a calibration.

X132 STEP 1 SCREEN DISPLAY



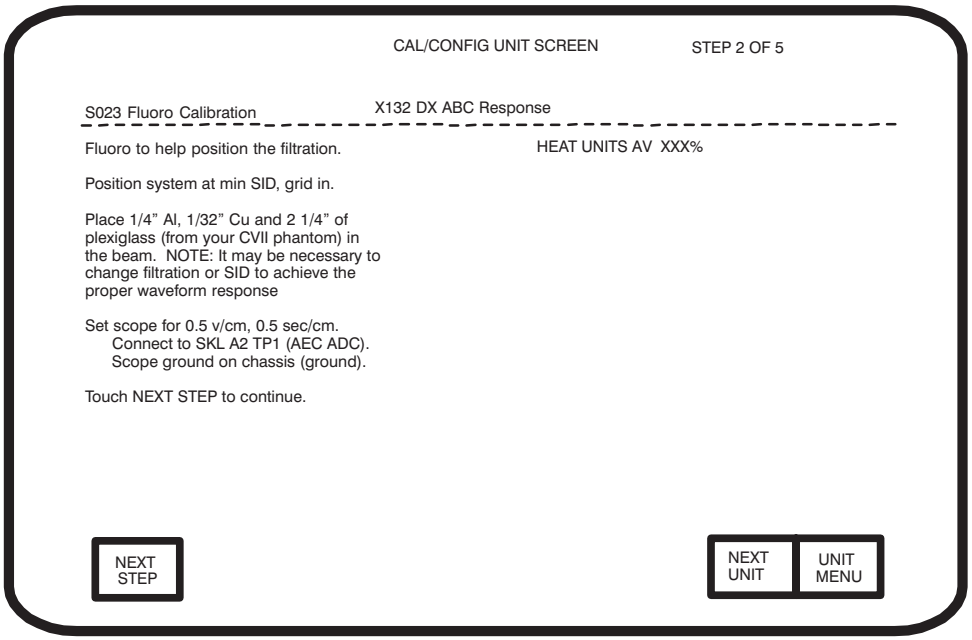
6-2 Step 2. Position Filtration

- Position the Image Intensifier tube and x–ray tube at minimum SID. On LU systems, position the table top 12 inches from the Image Intensifier tube.
- Position the grid in the beam.
- Place 1/32 inch of copper, 1/4 inch of aluminum, and 2–1/4 inches of acrylic on the table (stack with acrylic on the bottom and copper on the top).

Note: The calibration may require varying the filtration thickness or SID in order to achieve the proper square wave response in Step 3.

- Take fluoro exposures with the fluoro footswitch or console handswitch to assist in centering the filtration in the x–ray beam.
- Touch NEXT STEP softkey to proceed to Step 3.

X132 STEP 2 SCREEN DISPLAY



Note: The adjustments in the following steps of this unit are interactive. After all adjustments have been made, the waveform on the scope will appear more rounded than the square wave shown in Illustration 151.

6-3 Step 3. RADCNTRL Damping Factor Adjustment

- Take a fluoro exposure.
- While maintaining the exposure, touch RADCNTRL DAMPING FACTOR softkey and, using the console dial, adjust the value of the RADCNTRL DAMPING FACTOR until the brightness error signal observed on the oscilloscope is critically damped. See Illustration 151. Increase the damping until the error signal is ringing with overshoot. Then, decrease until ringing just disappears.

Note: The loop is critically damped when the square wave indicates no overshoot on the top and less than 250 mV overshoot on the bottom.

- Terminate the exposure and touch NEXT STEP softkey to proceed to Step 4.

X132 STEP 3 SCREEN DISPLAY

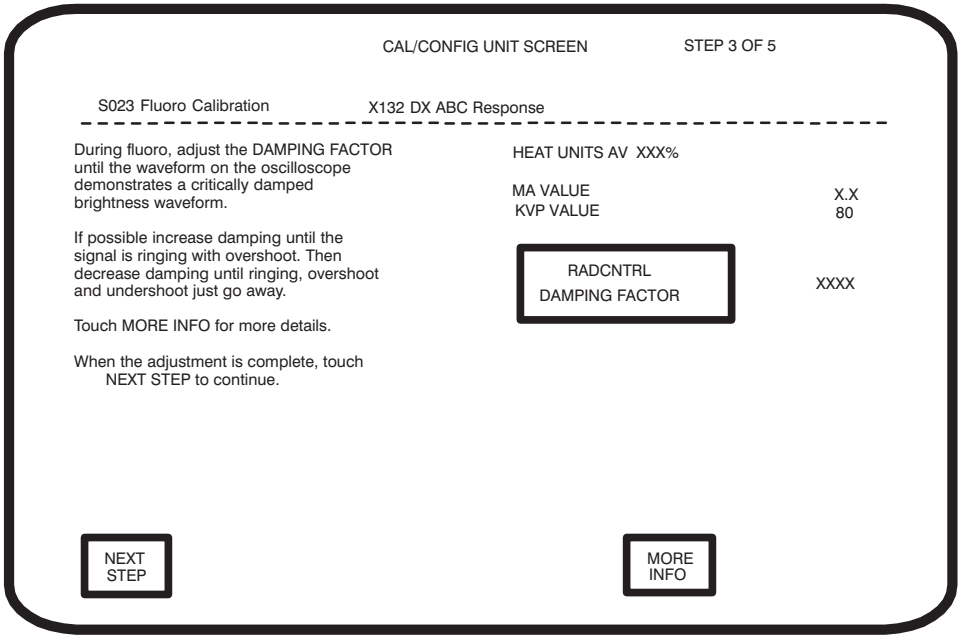
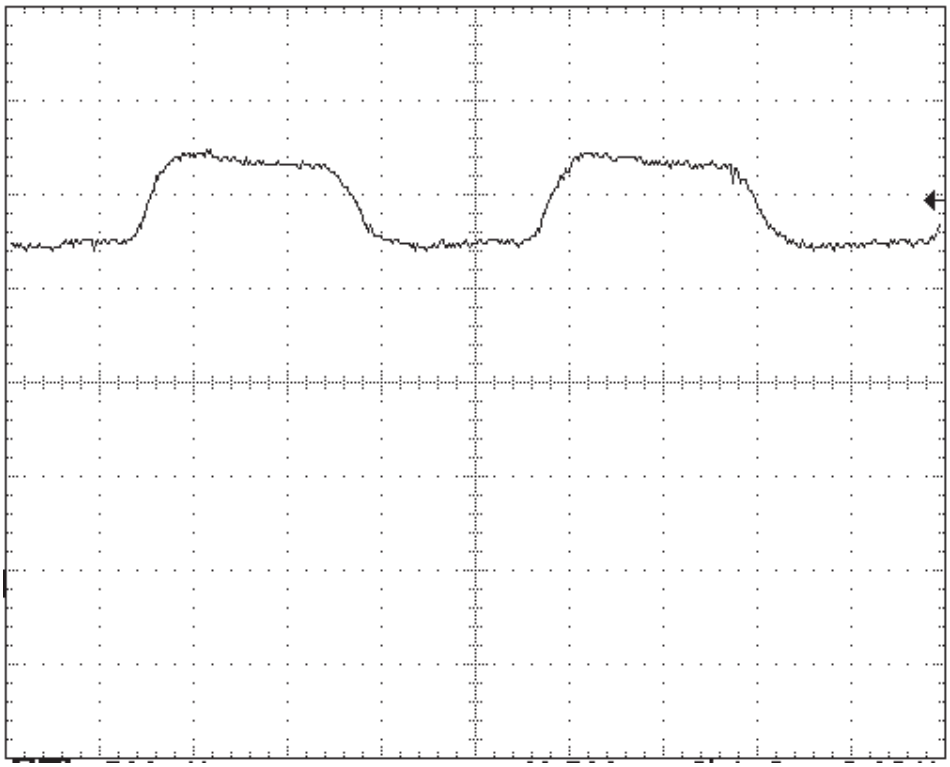


Illustration 151 – X132, Damping Adjustment



X132 STEPS 3, 4, AND 5 "MORE INFO" PAGE 1 SCREEN DISPLAY

CAL/CONFIG UNIT SCREEN STEP X OF 5

S023 Fluoro Calibration X132 DX ABC Response Time

Page 1 of 3

ABC DAMPING INFORMATION

Both footswitch and handswitch are active during this unit.

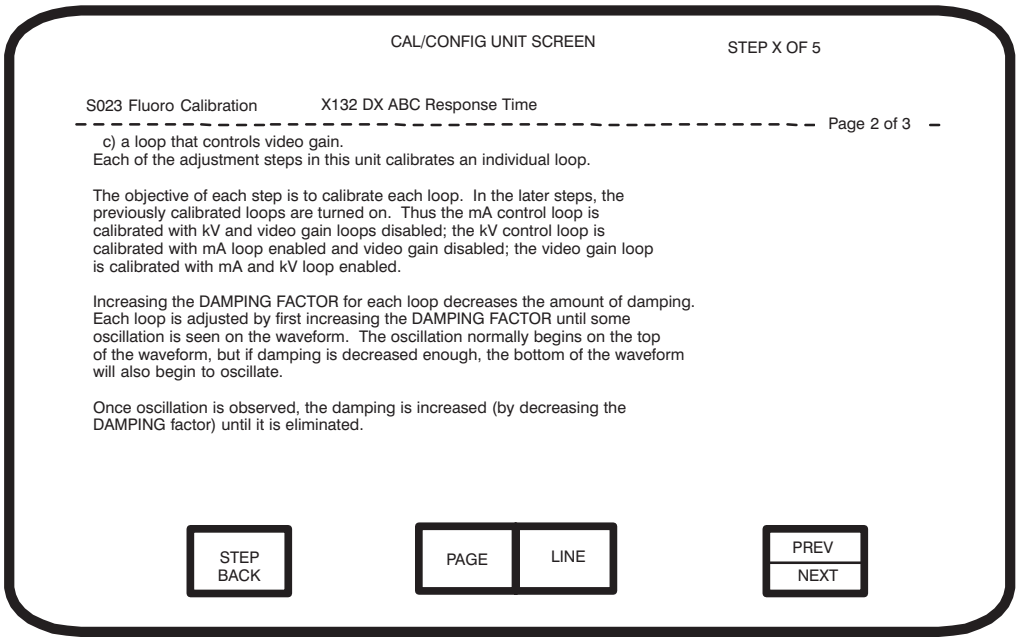
The objective of adjusting ABC Damping is to allow the ABC to adjust to proper brightness as quickly as possible when the amount of xrays reaching the image intensifier changes, but still not have oscillation of brightness when the xray intensity at the II is constant.

In order to accomplish this, the ECM adds a square wave to the output of the brightness pickup. The ABC software then corrects. In a perfect world, the resulting signal at the AEC ABC test point would be a square wave with an average amplitude of 2V. The transfer function of the ABC does not allow this.

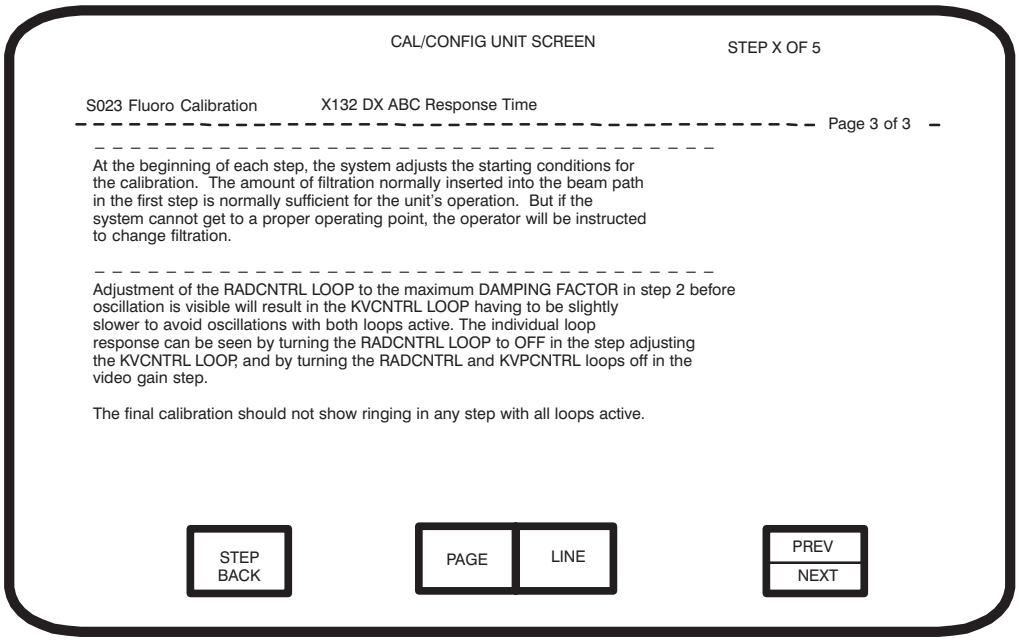
ABC control is composed of three main loops:
a) a loop that controls average mA by adjusting filament drive. On systems with pulsed fluoro, pulse width is also adjusted in this loop.
b) a loop that controls kVp.

STEP BACK | PAGE | LINE | PREV | NEXT

X132 STEPS 3, 4, AND 5 “MORE INFO” PAGE 2 SCREEN DISPLAY



X132 STEPS 3, 4, AND 5 “MORE INFO” PAGE 3 SCREEN DISPLAY



6-4 Step 4. KVPCNTRL Damping Factor Adjustment

- Take and maintain a fluoro exposure.
- Maintain the exposure until the “KVP OVERRIDE ADJUSTMENT COMPLETE” message is displayed.

Note: An ”ADJUSTING APERTURE/FOV FOR KVP OVERRIDE CONDITION” message is displayed while the override adjustment is being accomplished.

- Touch KVPCNTRL DAMPING FACTOR softkey and, using the console dial, adjust the value of the KVPCNTRL DAMPING FACTOR until the brightness error signal observed on the oscilloscope is critically damped. See Illustration 152.

Note: The KVP loop is slower than the RADCNTRL loop. This may produce an error signal response with more rounded edges.

- Touch NEXT STEP softkey to proceed to Step 5.

X132 STEP 4 SCREEN DISPLAY

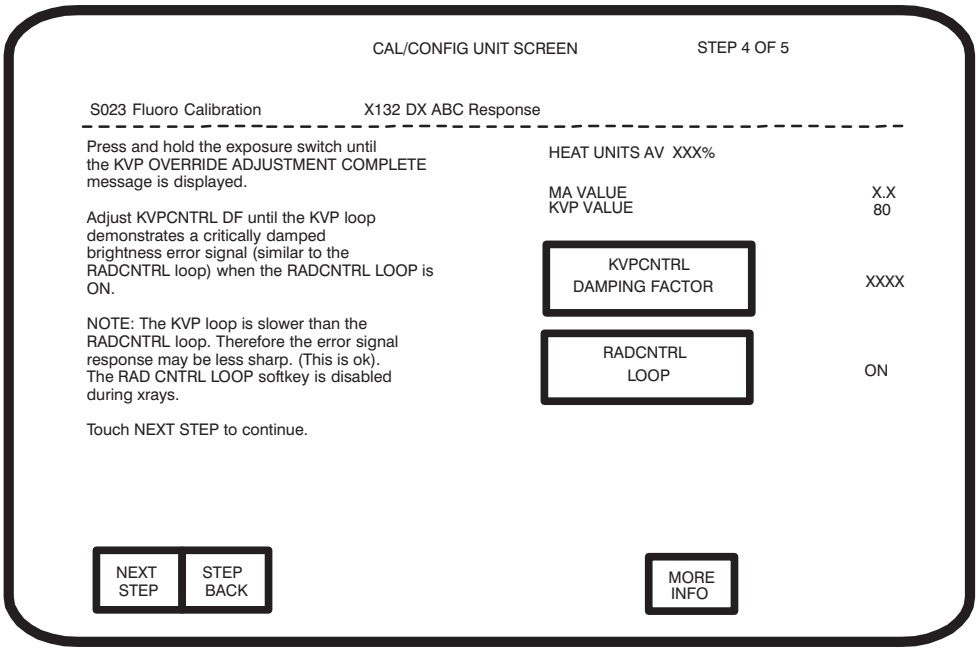
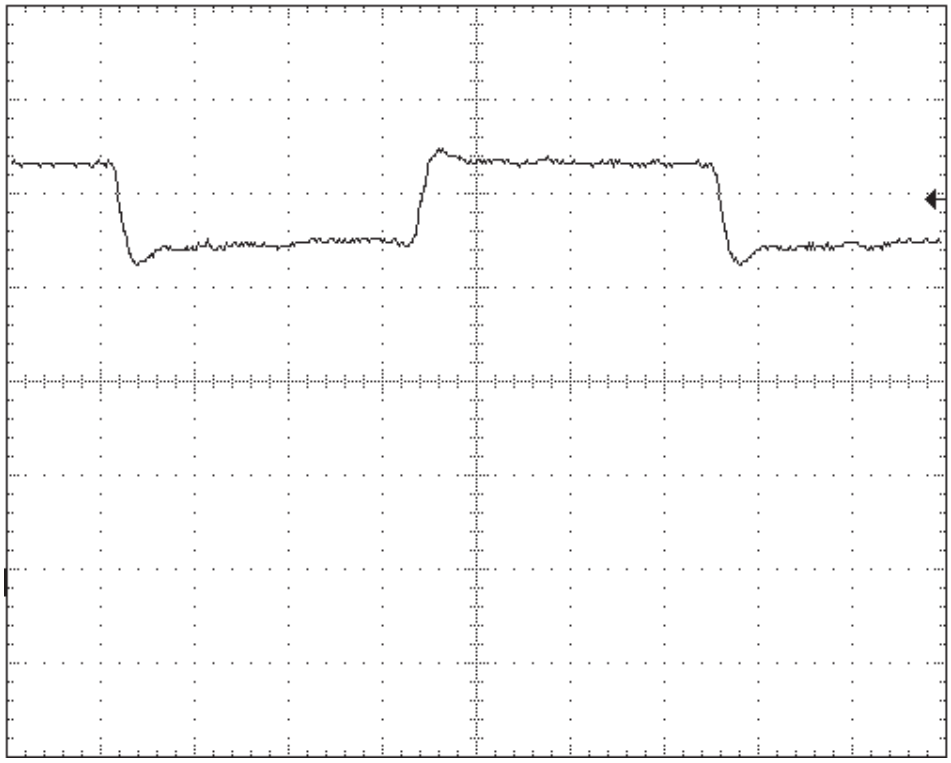


Illustration 152 – X132, KVPCNTRL Damping Adjustment



6-5 Step 5. VGCNTRL Damping Factor Adjustment

- Take a fluoro exposure.
- Maintain the exposure until the message “VIDEO GAIN OVERRIDE ADJUSTMENT COMPLETE” is displayed.

Note: The message “ADJUSTING APERTURE FOR VIDEO GAIN OVERRIDE CONDITION”is displayed while the override adjustment is being accomplished.

- Touch VGCNTRL DAMPING FACTOR softkey and, using the console dial, adjust the value of the VGCNTRL DAMPING FACTOR until the video loop indicates a critically damped brightness error signal on the oscilloscope (Similar to the RADCNTRL loop damping). See Illustration 153.
- Touch NEXT UNIT or UNIT MENU softkey to exit the calibration unit.

X132 STEP 5 SCREEN DISPLAY

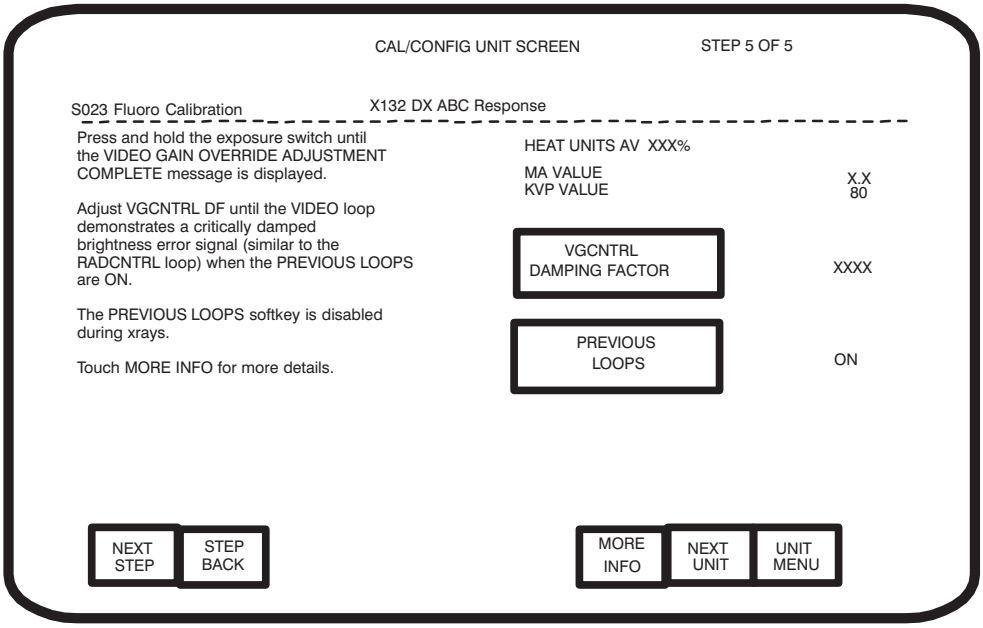
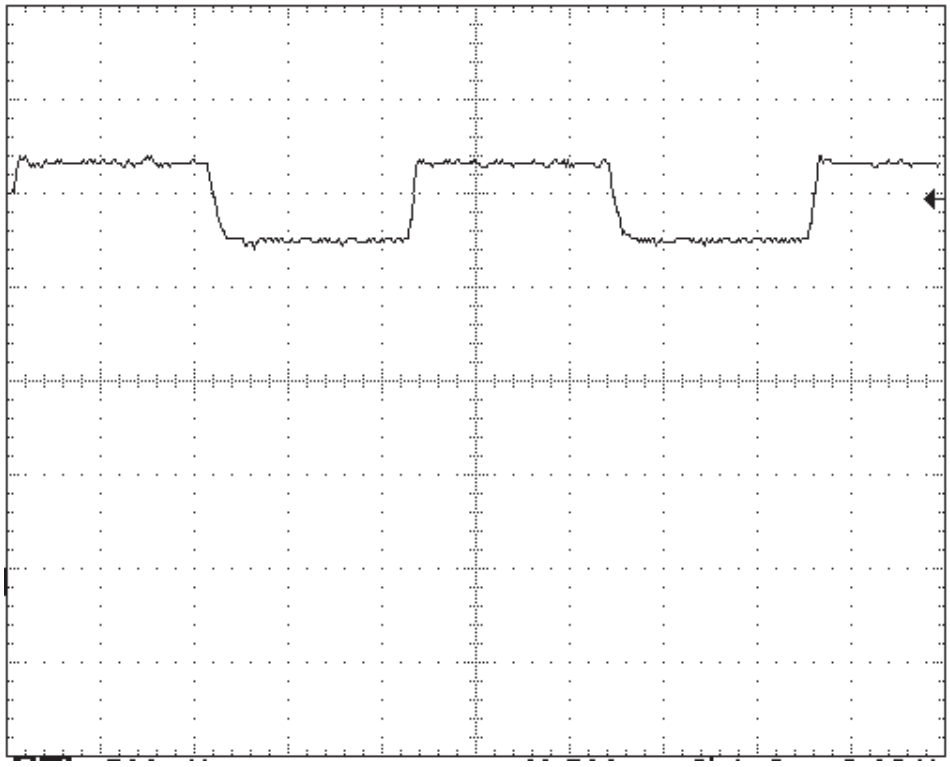


Illustration 153 – X132, VGCNTRL Damping Adjustment



UNIT X133 – DX (DLX) Entrance Dose

Time: x h xx min – Personnel: 1 field engineer

1 DESCRIPTION

Calibration Unit X133 is used to adjust the DLX entrance dose default parameters established by Calibration Unit X107. Three entrance dose levels (low, normal, and high) can be adjusted as required by DLX applications.

2 EQUIPMENT REQUIRED

None.

NOTICE

Anytime X133 is run after initial system calibration and a customized dosimetry profile exists (refer to X233), you must also rerun X233 to re-establish the customized dosimetry profile. If X233 is not rerun, a default dosimetry profile will be established (refer to X233). Since a customized dosimetry profile is lost when X133 is rerun, it is important to remember to record the aperture values set in X233 for use when it is necessary to rerun X233.

WARNING

IF FOR ANY REASON YOU HAVE TO GO BACK TO INITIAL II DOSES VALUES, USE THE VALUES AS SPECIFIED IN THE INITIAL SYSTEM DOCUMENTATION.

3 CAL PROCEDURE

Perform the calibration as follows:

- Upon entering the calibration unit, the default values for LOW, NORMAL, and HIGH entrance dose selections are displayed on the screen. The default values are the recommended dose rates for DLX. If desired, the dose values displayed can be adjusted for specific DLX applications by touching the applicable ENTRANCE DOSE SELECTIONS softkey and dialing in the new value. If questionable, keep the default values indicated.

  For Advantx–E Vascular Systems, the recommended dose value for the applicable II size are given AUCUN LIEN for everywhere **EXCEPT** Germany and Switzerland. For Germany use AUCUN LIEN . For Switzerland use AUCUN LIEN .

  For all other systems, the recommended dose values for the applicable II size are given AUCUN LIEN for everywhere **EXCEPT** Germany and Switzerland. For Germany use AUCUN LIEN . For Switzerland use AUCUN LIEN .

- Touch NEXT UNIT or UNIT MENU softkey to exit the calibration unit. Exiting the unit will load the dose values into NV RAM.

WARNING

FOR ADVANTX–E VASCULAR SYSTEMS ONLY:

BEWARE OF THE EXISTENCE OF TWO DIFFERENT TYPES OF DOSES:

II Entrance Doses: doses displayed and dialed on the console in this calibration Unit**.** The **Recommended Entrance Doses** presented in the tables hereafter are the **II Entrance Doses** allowing the best functionning conditions of the system and the ones which should be used**.**

Measured Entrance Doses: result of the measurement procedure, dosimeterprobe close to the anticollision plate and dose reduced by the antiscatter grid.

II Entrance Doses are equal to Measured Entrance doses divided by two.

NOTICE

For 12 inch (30 cm) Image Intensifier, Cardiac corresponds to a configuration including a Plumbicon Pick–Up Tube and Vascular corresponds to a configuration including a Saticon Pick–Up Tube.

NOTICE

VIC cameras on 9 inch (22 cm) Image Intensifiers are equipped either with a Plumbicon or a Saticon. In both cases, Recommended Entrance Dose Levels have the same values and should be calibrated in the same way.

Note: The default displayed values for 12 inch (30 cm) II are the values for Vascular Systems.

Note: The dose values shown in the tables hereafter have been modified to reflect the accuracy of the TV aperture (10% steps). Some software revisions may show/allow dose values finer than 10% steps.

Table 55 – Recommended Entrance Dose Levels (Except for Germany and Switzerland), for Advantx–E Vascular Systems

RECOMMENDED II ENTRANCE DOSE LEVELS				
II TYPE	**FOV**	**DOSE**	**EXPOSURE (mR/min)**	**EXPOSURE (μGy/min)**
9 inch (22 cm)	9	LOW	1.5 mR/min	13.14 μGy/min
9 inch (22 cm)	9	NORM	3.6 mR/min	31.54 μGy/min
9 inch (22 cm)	9	HIGH	4.9 mR/min	42.92 μGy/min
12 inch (30 cm) Cardiac	12	LOW	1.1 mR/min	9.636 μGy/min
12 inch (30 cm) Cardiac	12	NORM	2.7 mR/min	23.65 μGy/min
12 inch (30 cm) Cardiac	12	HIGH	4.1 mR/min	35.92 μGy/min
12 inch (30 cm) Vascular	12	LOW	1.0 mR/min	8.76 μGy/min
12 inch (30 cm) Vascular	12	NORM	2.4 mR/min	21.02 μGy/min
12 inch (30 cm) Vascular	12	HIGH	3.7 mR/min	32.41 μGy/min
16 inch (40 cm)	16	LOW	1.2 mR/min	10.51 μGy/min
16 inch (40 cm)	16	NORM	2.7 mR/min	23.65 μGy/min
16 inch (40 cm)	16	HIGH	4.1 mR/min	35.92 μGy/min

Table 56 – Recommended Entrance Dose Levels for Germany only, for Advantx–E Vascular Systems

RECOMMENDED II ENTRANCE DOSE LEVELS (GERMANY)				
II TYPE	**FOV**	**DOSE**	**EXPOSURE (mR/min)**	**EXPOSURE (μGy/min)**
9 inch (22 cm)	9	LOW	1.5 mR/min	13.14 μGy/min
9 inch (22 cm)	9	NORM	3.6 mR/min (See Note 1.)	31.54 μGy/min (See Note 1)
9 inch (22 cm)	9	HIGH	3.6 mR/min (See Note 1.)	31.54 μGy/min (See Note 1)
12 inch (30 cm) Cardiac	12	LOW	1.1 mR/min	9.636 μGy/min
12 inch (30 cm) Cardiac	12	NORM	2.4 mR/min (See Note 1.)	21.02 μGy/min (See Note 1)
12 inch (30 cm) Cardiac	12	HIGH	2.4 mR/min (See Note 1.)	21.02 μGy/min (See Note 1)
12 inch (30 cm) Vascular	12	LOW	1.1 mR/min	9.636 μGy/min
12 inch (30 cm) Vascular	12	NORM	2.4 mR/min (See Note 1.)	21.02 μGy/min (See Note 1)
12 inch (30 cm) Vascular	12	HIGH	2.4 mR/min (See Note 1.)	21.02 μGy/min (See Note 1)
16 inch (40 cm)	16	LOW	0.6 mR/min	5.256 μGy/min
16 inch (40 cm)	16	NORM	1.4 mR/min (See Note 1.)	12.26 μGy/min (See Note 1)
16 inch (40 cm)	16	HIGH	1.4 mR/min (See Note 1.)	12.26 μGy/min (See Note 1)
Note 1: Maximum allowed value in order to meet local regulations.				

Table 57 – Recommended Entrance Dose Levels for Switzerland only, for Advantx–E Vascular Systems

RECOMMENDED II ENTRANCE DOSE LEVELS (SWITZERLAND)				
II TYPE	**FOV**	**DOSE**	**EXPOSURE (mR/min)**	**EXPOSURE (μGy/min)**
9 inch (22 cm)	9	LOW	1.5 mR/min	13.14 μGy/min
9 inch (22 cm)	9	NORM	3.6 mR/min	31.54 μGy/min
9 inch (22 cm)	9	HIGH	4.9 mR/min	42.92 μGy/min
12 inch (30 cm) Cardiac	12	LOW	1.1 mR/min	9.636 μGy/min
12 inch (30 cm)Cardiac	12	NORM	2.7 mR/min	23.65 μGy/min
12 inch (30 cm) Cardiac	12	HIGH	4.1 mR/min	35.92 μGy/min
12 inch (30 cm) Vascular	12	LOW	1.0 mR/min	8.76 μGy/min
12 inch (30 cm) Vascular	12	NORM	2.4 mR/min	21.02 μGy/min
12 inch (30 cm) Vascular	12	HIGH	3.7 mR/min	32.41 μGy/min
16 inch (40 cm)	16	LOW	1.0 mR/min	8.76 μGy/min
16 inch (40 cm)	16	NORM	2.2 mR/min (See Note 1.)	19.27 μGy/min (See Note 1)
16 inch (40 cm)	16	HIGH	2.2 mR/min (See Note 1.)	19.27 μGy/min (See Note 1)
Note 1: Maximum allowed value in order to meet local regulations.				

Table 58 – Recommended Entrance Dose Levels (Except for Germany and Switzerland), for all other Systems

RECOMMENDED ENTRANCE DOSE LEVELS				
II TYPE	**FOV**	**DOSE**	**EXPOSURE (mR/min)**	**EXPOSURE (μGy/min)**
9 inch (22 cm)	9	LOW	1.8 mR/min	15.77 μGy/min
9 inch (22 cm)	9	NORM	3.6 mR/min	31.54 μGy/min
9 inch (22 cm)	9	HIGH	7.2 mR/min	63.07 μGy/min
12 inch (30 cm)	12	LOW	0.9 mR/min	7.884 μGy/min
12 inch (30 cm)	12	NORM	1.9 mR/min	16.64 μGy/min
12 inch (30 cm)	12	HIGH	3.8 mR/min	33.29 μGy/min
16 inch (40 cm)	16	LOW	1.1 mR/min	9.636 μGy/min
16 inch (40 cm)	16	NORM	2.2 mR/min	19.27 μGy/min
16 inch (40 cm)	16	HIGH	4.3 mR/min	37.67 μGy/min

Table 59 – Recommended Entrance Dose Levels for Germany only, for all other Systems

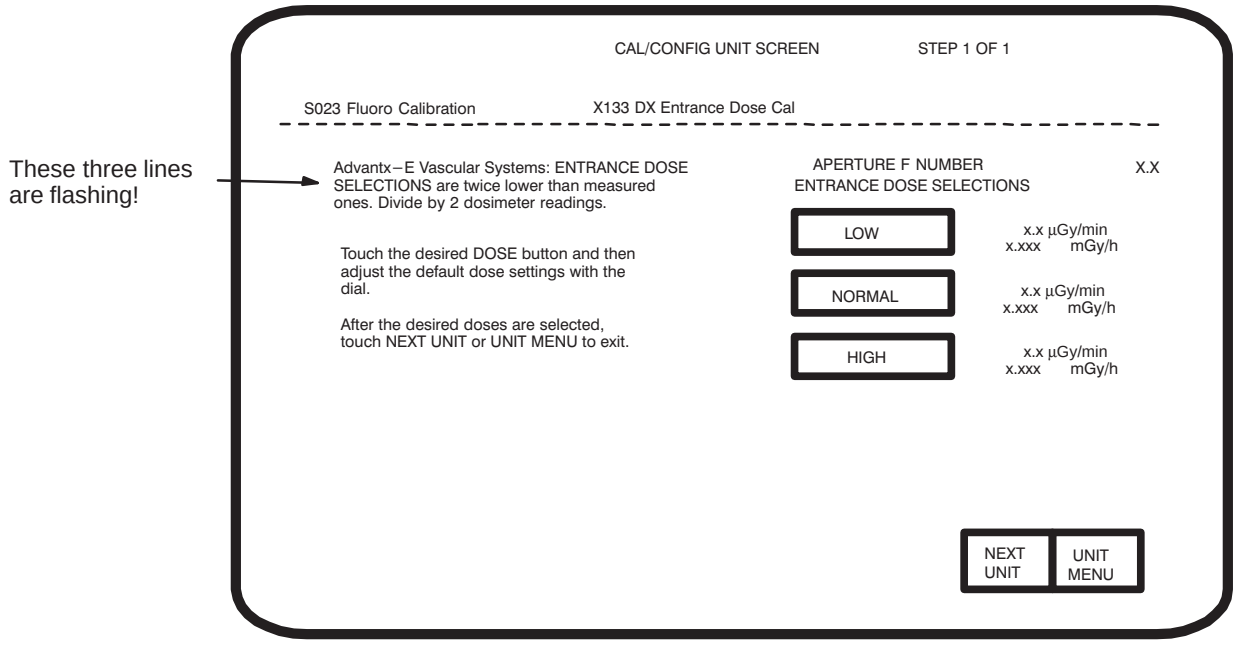
RECOMMENDED ENTRANCE DOSE LEVELS (GERMANY)				
II TYPE	**FOV**	**DOSE**	**EXPOSURE (mR/min)**	**EXPOSURE (μGy/min)**
9 inch (22 cm)	9	LOW	1.8 mR/min	15.77 μGy/min
9 inch (22 cm)	9	NORM	3.6 mR/min (See Note 1.)	31.54 μGy/min (See Note 1)
9 inch (22 cm)	9	HIGH	3.6 mR/min (See Note 1.)	31.54 μGy/min (See Note 1)
12 inch (30 cm)	12	LOW	0.9 mR/min	7.884 μGy/min
12 inch (30 cm)	12	NORM	1.9 mR/min	16.64 μGy/min
12 inch (30 cm)	12	HIGH	2.1 mR/min (See Note 1.)	18.4 μGy/min (See Note 1)
16 inch (40 cm)	16	LOW	0.6 mR/min (See Note 2.)	5.256 μGy/min (See Note 2)
16 inch (40 cm)	16	NORM	1.4 mR/min (See Note 1.)	12.26 μGy/min (See Note 1)
16 inch (40 cm)	16	HIGH	1.4 mR/min (See Note 1.)	12.26 μGy/min (See Note 1)

Note 1: Maximum allowed value in order to meet local regulations.
Note 2: Or as low as possible.

Table 60 – Recommended Entrance Dose Levels for Switzerland only, for all other Systems

RECOMMENDED ENTRANCE DOSE LEVELS (SWITZERLAND)				
II TYPE	**FOV**	**DOSE**	**EXPOSURE (mR/min)**	**EXPOSURE (μGy/min)**
9 inch (22 cm)	9	LOW	1.8 mR/min	15.77 μGy/min
9 inch (22 cm)	9	NORM	3.6 mR/min	31.54 μGy/min
9 inch (22 cm)	9	HIGH	6.1 mR/min (See Note 1.)	53.44 μGy/min (See Note 1)
12 inch (30 cm)	12	LOW	0.9 mR/min	7.884 μGy/min
12 inch (30 cm)	12	NORM	1.9 mR/min	16.64 μGy/min
12 inch (30 cm)	12	HIGH	3.5 mR/min (See Note 1.)	30.66 μGy/min (See Note 1)
16 inch (40 cm)	16	LOW	1.1 mR/min	9.636 μGy/min
16 inch (40 cm)	16	NORM	2.3 mR/min (See Note 1.)	20.15 μGy/min (See Note 1)
16 inch (40 cm)	16	HIGH	2.3 mR/min (See Note 1.)	20.15 μGy/min (See Note 1)
Note 1: Maximum allowed value in order to meet local regulations.				

X133 SCREEN DISPLAY



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UNIT X140 – DRS Taper Progressive

Time: x h xx min – Personnel: 1 field engineer

1 DESCRIPTION

Calibration Unit X140 adjusts the DRS taper so that the fluoro table top radiation dose (Entrance Exposure Rate–EER) never exceeds 10R/minute. The calibration sets the end points of a pre–defined taper curve to correspond with a radiation taper limit. Five steps are required to calibrate the DRS taper. A screen display is provided for each step.



This unit allows the system to be configured for higher pulsed progressive fluoro taper limits than shipped (up to the 10 R/min regulatory limit). This is not recommended. While the system will operate at these higher taper limits, the reliability under this condition may suffer; increased maintenance costs should be expected. Only raise the fluoro taper limits after all other methods of improving digital fluoro image quality have been tried and there is still a serious customer issue.



If this calibration unit is used to re-calibrate DRS tapers after initial system calibration, it is mandatory that you also rerun Cal Unit X141, DRS SID Comp, or the re-calibrated tapers will not be observed when running Applications. Cal Unit X140 and X141 must be run as a set with X140 run first.

2 EQUIPMENT REQUIRED

Radiation meter w/probe stand (MDH1015 or equiv), and standard tool kit.

3 SPECIAL INSTRUCTIONS

- Communication with DRS.

Note: Communication must be established with the DRS prior to the display of the Step 1 screen. If that fails, an error message is displayed and the unit will only function in the browse mode.

- When calibrating a system to meet Japanese regulations, it is required to calibrate the taper so that the x–ray tube current never exceeds 9.8 mA in Fluoro mode.
- The Filament Age and Fil Age (Last Cal) parameters displayed on the Step 1 screen provide a visual indication of the filament aging characteristics of the system x–ray tube.
  1. **Filament Age:** Tracks and displays a continuous record of changes in filament aging (in HEX) since x–ray tube installation (initial value of 0010H).
  2. **Fil Age (Last Cal):** Displays the Hex value of filament aging set in the last calibration (initial value when a tube is installed is FFFFH). The Fil Age (Last Cal) parameter will be set equal to Filament Age parameter after a calibration is completed.

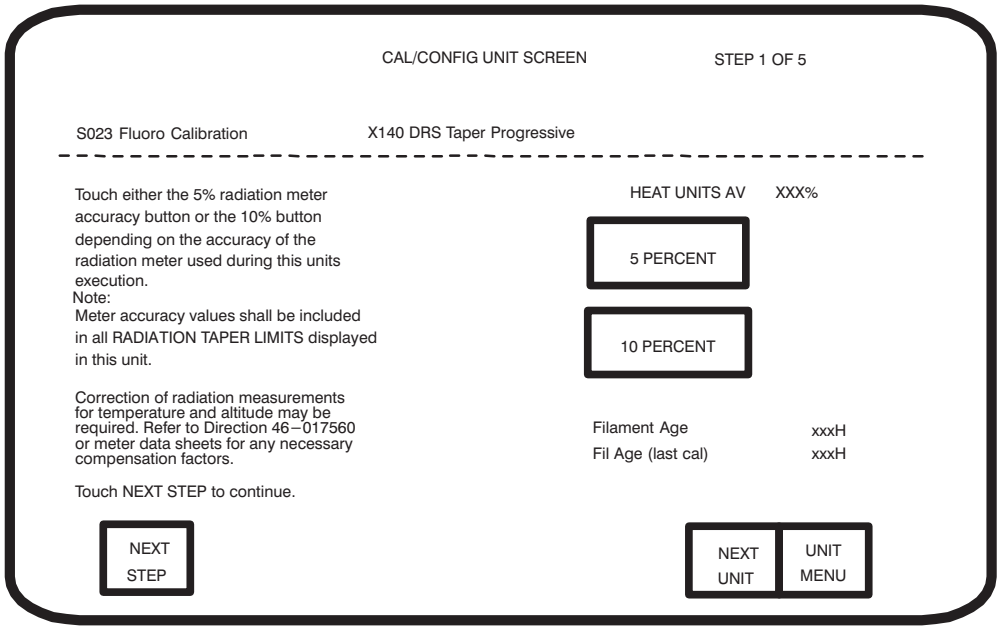
Note: As the x–ray tube ages, changes in the Filament Age value may be observed. If the difference between the Filament Age value and Fil Age (Last Cal) value reaches a delta limit of 2BH, a ”recal required” message is displayed. This warning message is displayed upon entering either the Applications or Service Mode to indicate to the user that a mandatory recalibration of the system R/min is required (Ref recal instructions in Cal Unit X100).

4 CAL PROCEDURE

4-1 Step 1. Radiation Meter Accuracy

- Check rated accuracy of the radiation meter to be used in the calibration.
- Touch the 5 PERCENT or 10 PERCENT softkey to enter the rated accuracy of the radiation meter. The meter accuracy value is included in all RADIATION TAPER LIMITS displayed in this unit.
- Check the current values (in Hex) of the Filament Age and Fil Age (Last Cal) parameters. Refer to the Special Instruction paragraph at the beginning of this unit for an explanation of these parameters.
- Touch NEXT STEP softkey to proceed to Step 2.

X140 STEP 1 SCREEN DISPLAY



4-2 Step 2. Radiation Meter (R–Meter) Probe Positioning

CAUTION **Verify that the collision sensor is installed on the collimator, and that the hinged door is closed before proceeding.**

The Step 2 screen display provides instructions for positioning the R–Meter probe in systems employing SID compensation (all VASCULAR systems).

4-2-1 Systems with SID Compensation

- Move the table top out of the field of the x–ray beam.
- Mount the R–Meter probe stand to the bottom of the II tube (or position the stand on the head end of the table top and extend the R–Meter probe into the x–ray beam). Position the R–meter probe 30 cm (12 inches) from the lowest point on the II tube housing. See Illustration 134 in Cal Unit X100.

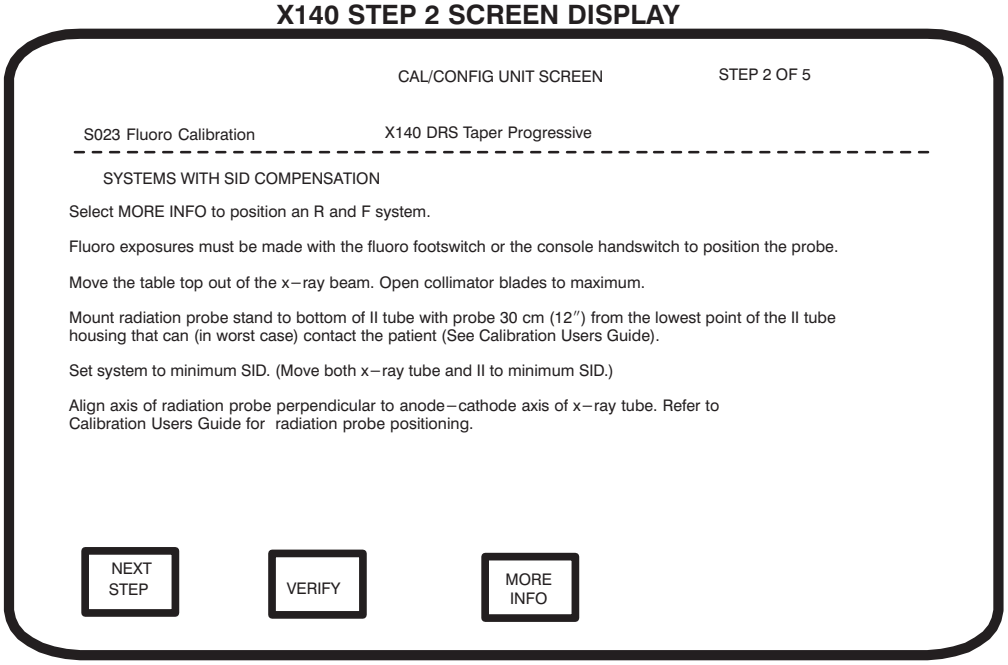
Note: The positioning of the R–meter probe 30 cm from the lowest point on the II tube housing (with II in overhead position) is an FDA requirement. The FDA assumes that the 30 cm distance corresponds to the average thickness of a patient and therefore establishes a worst case condition for radiation dose.

- Align axis of probe perpendicular to anode–cathode axis of x–ray tube.
- Set the II tube and x–ray tube to minimum SID.
- Take a fluoro exposure to determine the exact position of the probe. Repeat taking exposures and repositioning the R–Meter probe until the probe is centered in the x–ray beam.
- After the R–Meter probe is properly positioned, you may perform a quick check of the Radiation Taper Limit before proceeding with a full calibration by touching the VERIFY softkey. Touching the VERIFY softkey will cause the unit to increment to the Step 5, Verification screen. Perform Step 5.

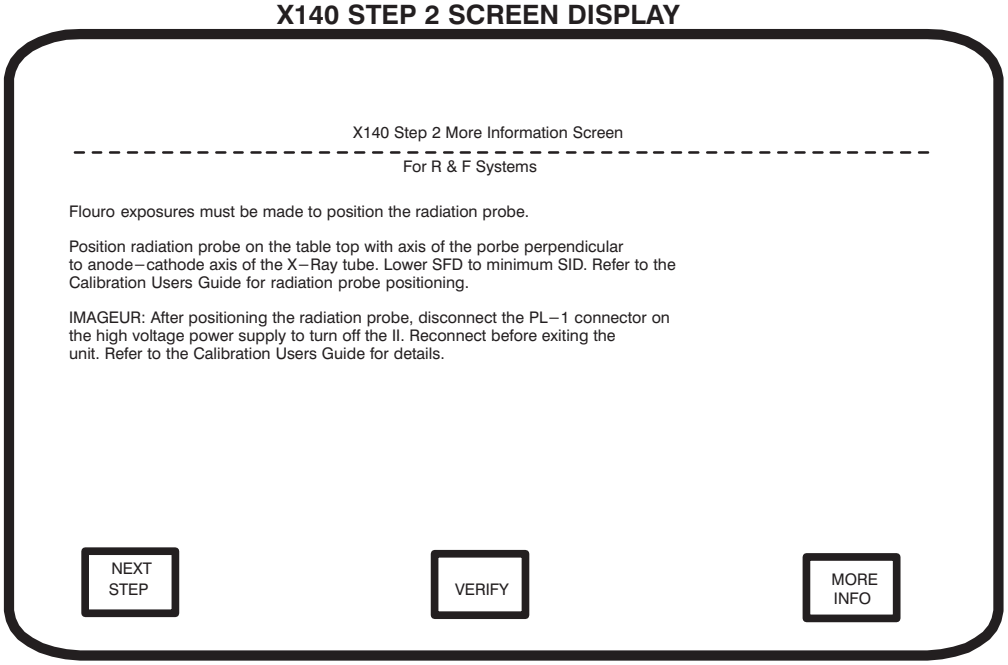
OR

- Touch the NEXT STEP softkey to proceed to Step 3 in the calibration sequence.

X140 STEP 2 SCREEN DISPLAY



X140 STEP 2 SCREEN DISPLAY



4-3 Step 3. 60 KV FIL DRIVE Adjustment

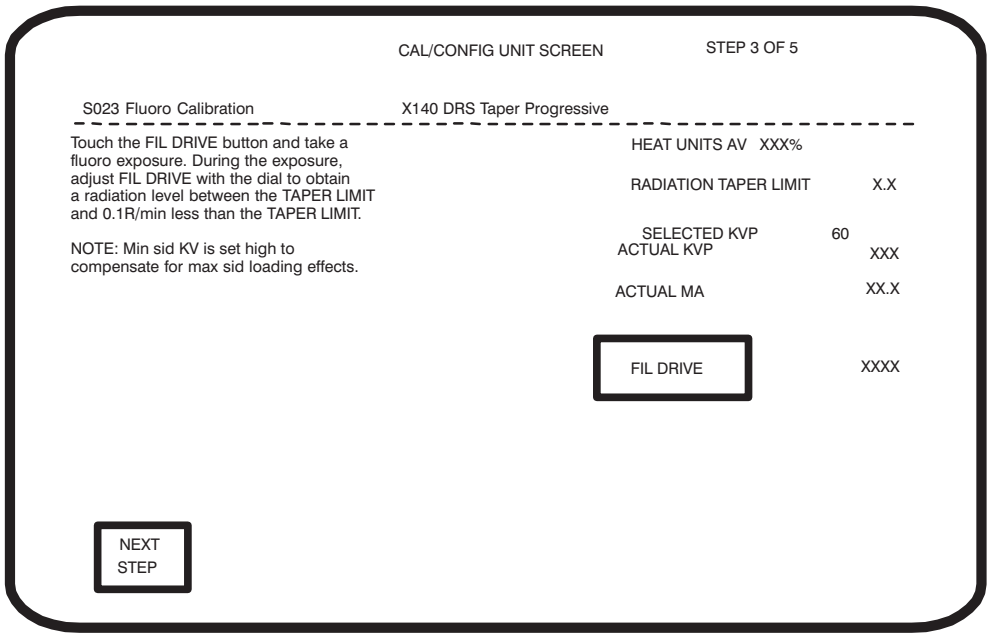
- Initiate FIL DRIVE adjustment by touching the FIL DRIVE softkey.

NOTICE

On systems configured with hexafocus tube and 0.3 focal spot, a RADIATION TAPER LIMIT of 5.0 will be displayed on the console screen.

- Take and maintain a fluoro exposure. During the exposure, turn the console dial to adjust FIL DRIVE until the R/min rate indicated on the radiation meter is within 0.1 R/min less than the RADIATION TAPER LIMIT value displayed on the console screen.
- When the correct R/min level is obtained and stable, stop fluoro.
- Touch NEXT STEP softkey to proceed to Step 4.

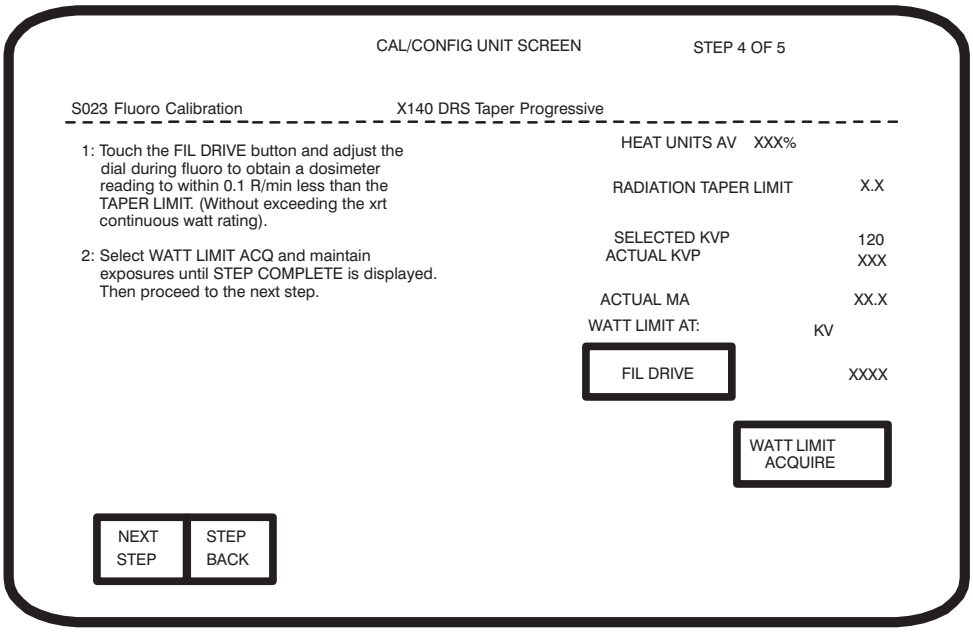
X140 STEP 3 SCREEN DISPLAY



4-4 Step 4. 120 KV FIL DRIVE Adjustment

- Initiate FIL DRIVE adjustment by touching the FIL DRIVE softkey.
- Take and maintain a fluoro exposure. During the exposure, turn the console dial to adjust FIL DRIVE until the R/min rate indicated on the radiation meter is within 0.1 R/min less than the RADIATION TAPER LIMIT value displayed on the console screen. Do not exceed the X–ray tube continuous watt rating during the adjustment.
- When the correct R/min level is obtained and stable, stop fluoro.
- Take and maintain another exposure. During the exposure, touch the WATT LIMIT ACQUIRE softkey. The system will calculate wattage and compare against a Continuous Watt Rating limit stored in the database. Maintain the exposure until the STEP COMPLETE message is displayed. If calculated wattage is higher than the Continuous Watt Rating limit, the message ”CONTINUOUS WATT RATING EXCEEDED, PLEASE RECAL TO A LOWER DOSE” will be displayed. If necessary, repeat the FIL DRIVE adjustment.
- Touch NEXT STEP softkey to proceed to Step 5.

X140 STEP 4 SCREEN DISPLAY



4-5 Step 5. Verification

- Initiate Entrance Exposure Rate–EER (R/min) verification by touching the KVP softkey.
- Take and maintain a fluoro exposure. During the exposure, use the console dial to step from 60 kVp to 120 kVp in 5 kVp increments. Verify the EER (R/min) level on the radiation meter at each kVp increment.

NOTICE

Rotate console dial slowly when incrementing kVp through the verification values. Because the filament control parameter (G5) is active during this step in the calibration, it is necessary that you allow time for G5 to respond to each new kVp setting before incrementing to the next kVp. If you attempt to step through the kVp increments without allowing the G5 parameter time to respond, information messages 4204H or 4205H may be displayed on the console screen and/or erroneous fluctuations in the R/min readout may occur.

- Terminate the exposure.
- If the EER (R/min), at any kVp increment, exceeds the RADIATION TAPER LIMIT displayed on the console screen by more than 0.05 R/min, a recalibration at slightly lower radiation levels is required. Touch RECAL softkey and repeat calibration.

Note: If EER (R/min) is excessive only at the high kVp increments, lowering FIL DRIVE may be sufficient (Repeat Step 4, FIL DRIVE adjustment).

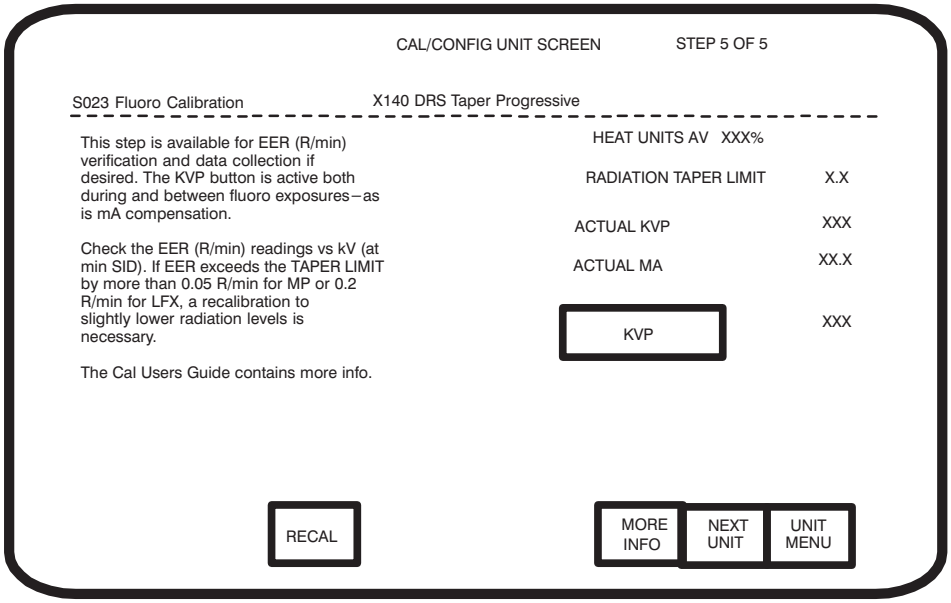
- Verify the results of any re-calibrations by repeating Step 5.
- Touch the NEXT UNIT or UNIT MENU softkey to exit.

4-5-1 Special instructions regarding verification

If the table top EER (R/min) is low, review the following special instructions before proceeding with a recalibration. Do not just recal at a higher EER (R/min) value.

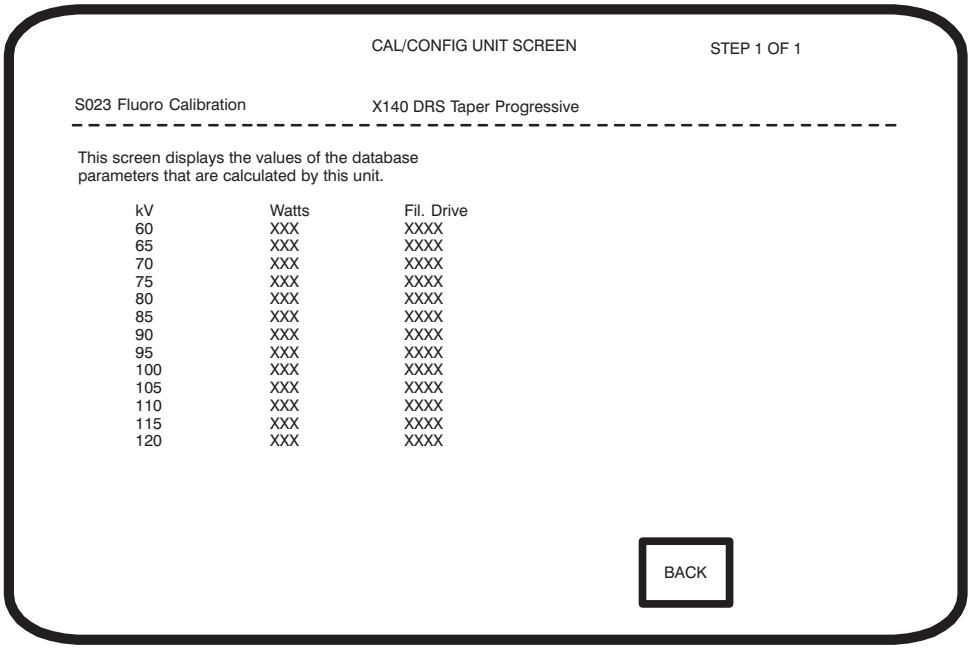
MA compensation will compensate for x–ray tube heating and cooling effects as well as filament aging.

X140 STEP 5 SCREEN DISPLAY



Note: A “More Info” screen, accessed by touching the MORE INFO softkey on the Step 5 screen, displays the values of the database parameters that are calculated by this unit.

X140 STEP 5 “MORE INFO” SCREEN DISPLAY



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UNIT X141 – DRS SID Compensation

Time: x h xx min – Personnel: 1 field engineer

1 DESCRIPTION

Calibration Unit X141 adjusts the DRS SID compensation parameters so that as SID increases, tube filament current increases, thereby maintaining the fluoro table top dose at a calibrated value. DRS SID compensation also prevents increases in fluoro technique from exceeding the rating of the tube. SID compensation is only active during exposures. Seven steps are required to calibrate the SID compensation parameters. A screen display is provided for each step.

CAUTION

This unit allows the system to be configured for higher pulsed progressive fluoro taper limits than shipped (up to the 10 R/min regulatory limit). This is not recommended. While the system will operate at these higher taper limits, the reliability under this condition may suffer; increased maintenance costs should be expected. Only raise the fluoro taper limits after all other methods of improving digital fluoro image quality have been tried and there is still a serious customer issue.

Note: This unit must always be run in combination with Cal Unit X140 and X140 must be run first.

2 EQUIPMENT REQUIRED

Radiation meter w/probe stand (MDH1015 or equiv), and standard tool kit.

3 SPECIAL INSTRUCTIONS

- Communication with DRS.

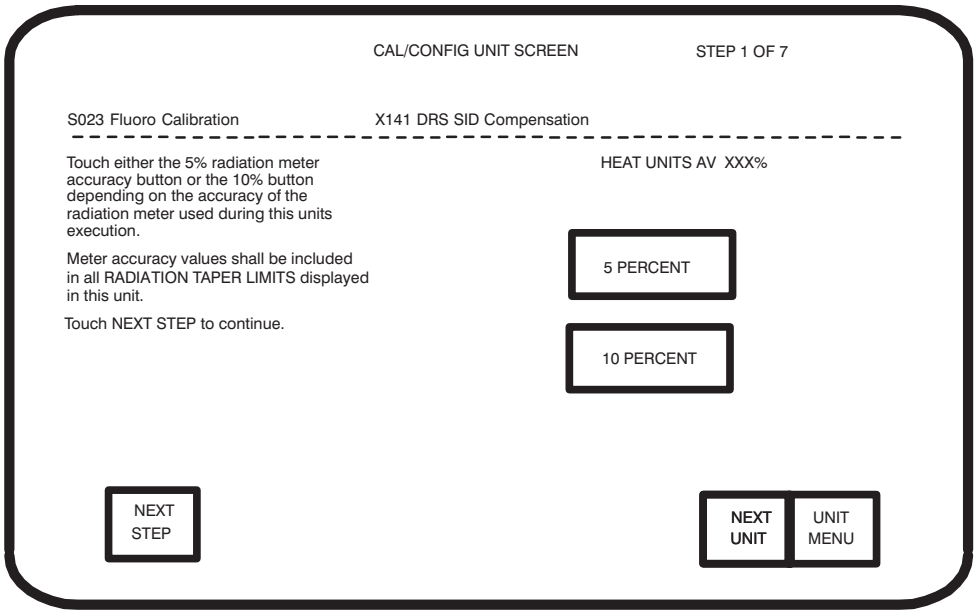
Note: Communication must be established with the DRS prior to the display of the Step 1 screen. If that fails, an error message is displayed and the unit will only function in the browse mode.

4 CAL PROCEDURE

4-1 Step 1. Radiation Meter Accuracy

- Check the rated accuracy of the radiation meter to be used in the calibration.
- Touch the 5 PERCENT or 10 PERCENT softkey to enter the rated accuracy of the radiation meter. The meter accuracy value is included in all RADIATION TAPER LIMITS displayed in this unit.
- Touch the NEXT STEP softkey to proceed to step 2.

X141 STEP 1 SCREEN DISPLAY



4-2 Step 2. Radiation Meter (R–Meter) Probe Positioning

CAUTION **Verify that the collision sensor is installed on the collimator, and that the hinged door is closed before proceeding.**

- Move the table top out of the field of the x–ray beam and open the collimator blades to maximum.
- Mount the R–Meter probe stand to the bottom of the II tube (or position the probe stand on the head end of the table and extend the R–Meter probe into the x–ray beam). Position the probe 30 cm from the lowest point on the II tube housing. See Illustration 134 in Cal Unit X100.

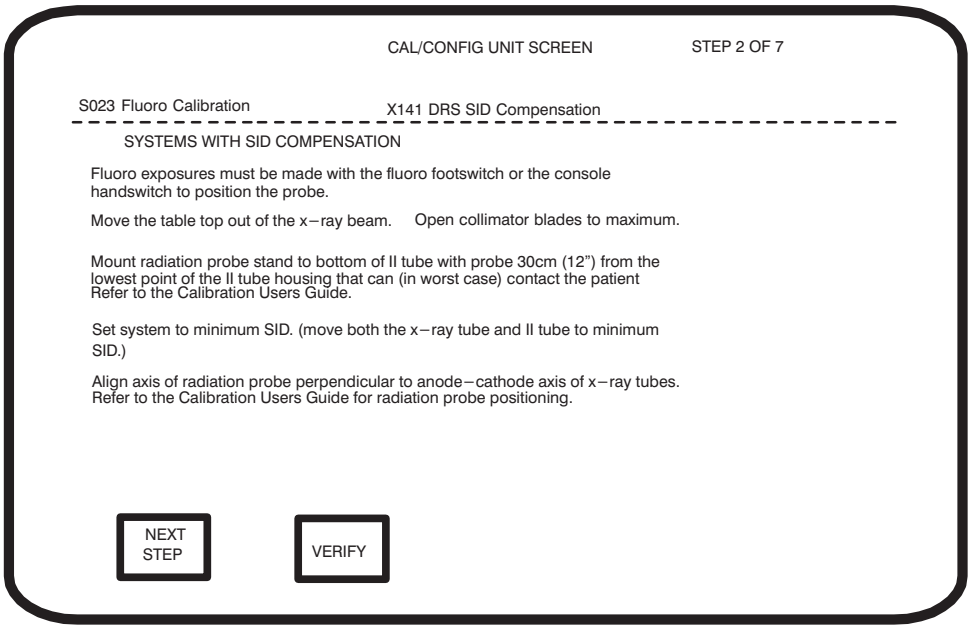
Note: The positioning of the R–meter probe 30 cm from the lowest point on the II tube housing (with II in overhead position) is an FDA requirement. The FDA assumes that the 30 cm distance corresponds to the average thickness of a patient and therefore establishes a worst case condition for radiation dose.

- Set the II tube and x–ray tube to minimum SID.
- Align axis of the radiation probe perpendicular to the anode–cathode axis of the x–ray tube.
- Take a fluoro exposure to determine the exact position of the probe. Repeat taking exposures and repositioning the R–Meter probe until the probe is centered in the x–ray beam.
- After the R–Meter probe is properly positioned, you may perform a quick check of the Radiation Taper Limit before proceeding with a full calibration by touching the VERIFY softkey. Touching the VERIFY softkey will cause the unit to increment to the Step 7, Verification screen. Perform Step 7.

OR

- Touch the NEXT STEP softkey to proceed to Step 3 in the calibration sequence.

X141 STEP 2 SCREEN DISPLAY



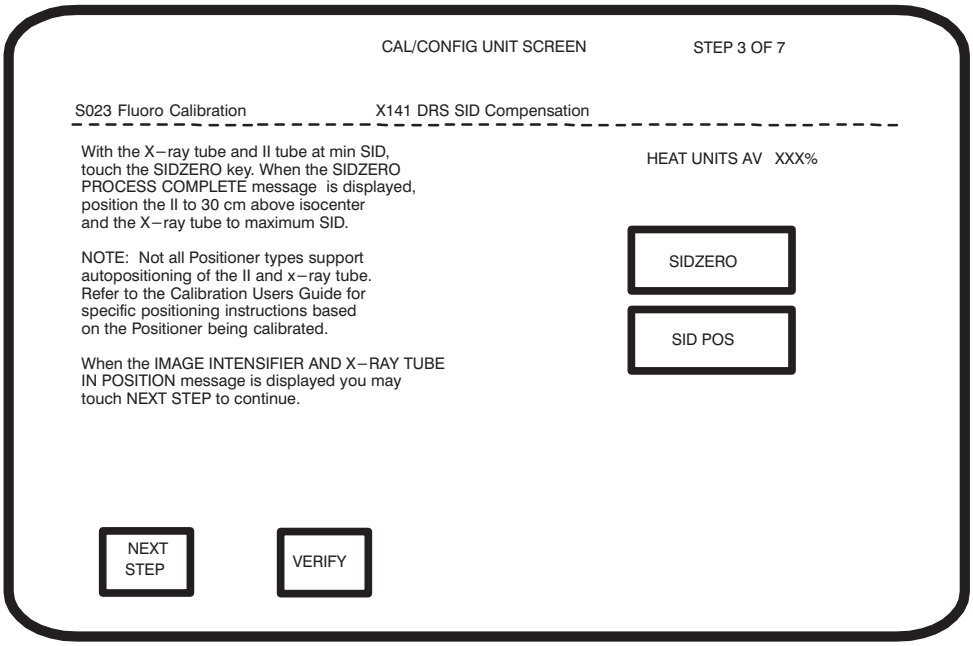
4-3 Step 3. SID POS Positioning

- Initiate the Step 3 adjustment by touching the SIDZERO softkey. The system will process and load SIDZERO data into NVRAM. Upon completion of processing, a “SIDZERO PROCESS COMPLETE” message will be displayed on the console.
- Touch the SID POS softkey.

Note: On Tilt–C systems, manually position the II to a SID of 106 cm.

- When the message “IMAGE INTENSIFIER AND X–RAY TUBE IN POSITION” is displayed, touch NEXT STEP softkey and proceed to Step 4.

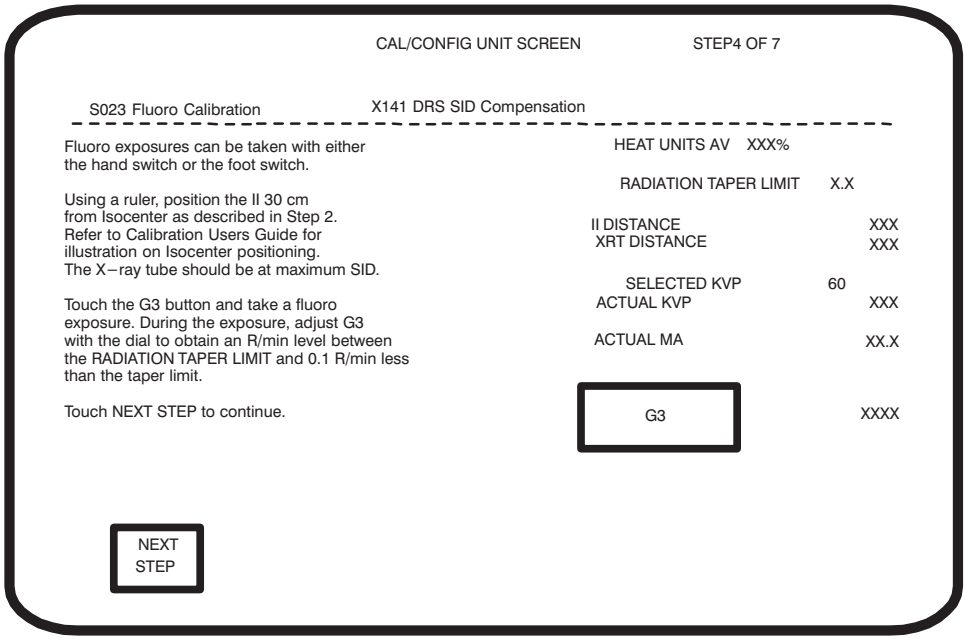
X141 STEP 3 SCREEN DISPLAY



4-4 Step 4. G3 Adjustment

- Using a ruler, set the II to isocenter distance to 300 mm (30 cm). Measure to the lowest point on the II tube housing. See Illustration 137 in Cal Unit X101.
- After the II to isocenter distance is set, mark the distance on the II carriage with a piece of tape. This will provide a reference point for the 30 cm distance to ensure distance is maintained or for easy return to the measured distance, if required.
- Ensure that the x–ray tube is at maximum SID.
- Initiate G3 adjustment by touching the G3 softkey.
- Take and maintain a fluoro exposure.
- During the exposure, turn the console dial to adjust G3 until the R/min rate indicated on the radiation meter is within 0.1R/min less than the RADIATION TAPER LIMIT value displayed on the console screen.
- Touch NEXT STEP softkey and proceed to step 5.

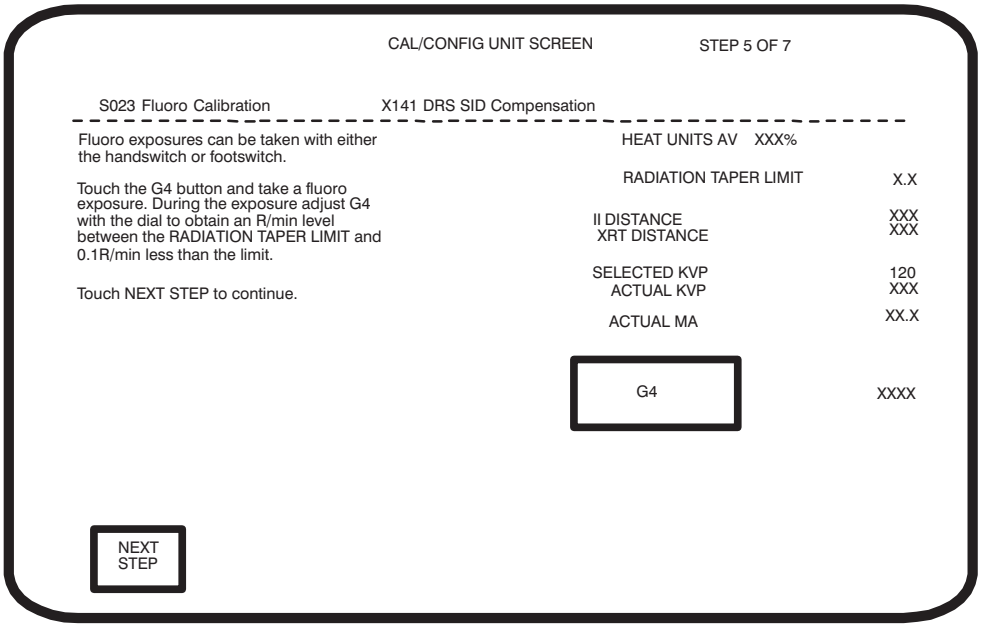
X141 STEP 4 SCREEN DISPLAY



4-5 Step 5. G4 Adjustment

- Initiate G4 adjustment by touching the G4 softkey.
- Take and maintain a fluoro exposure.
- During the exposure, turn the console dial to adjust G4 until the R/min rate indicated on the radiation meter is within 0.1R/min less than the RADIATION TAPER LIMIT value displayed on the console screen.
- Touch NEXT STEP softkey and proceed to step 6.

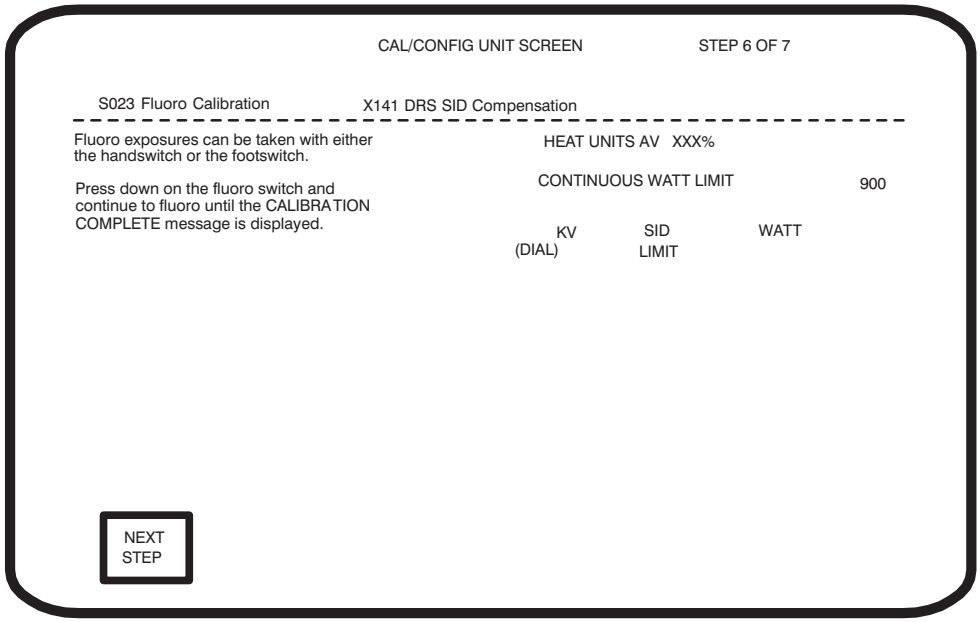
X141 STEP 5 SCREEN DISPLAY



4-6 Step 6. SID Watt Limiter Adjustment

- Take and maintain a fluoro exposure. The system will perform the Watt limiter calibration while the exposure is being taken.
- Maintain the exposure until the “CAL COMPLETE” message is displayed on the console screen.
- Touch NEXT STEP softkey and proceed to step 7.

X141 STEP 6 SCREEN DISPLAY



4-7 Step 7. Verification

- Initiate Entrance Exposure Rate–EER (R/min) verification by touching the KVP softkey.
- Take and maintain a fluoro exposure. During the exposure, use the console dial to step from 60 kVp to 120 kVp in 5 kVp increments. Verify the EER (R/min) level on the radiation meter at each kVp increment.

NOTICE

Rotate console dial slowly when incrementing kVp through the verification values. Because the filament control parameter (G5) is active during this step in the calibration, it is necessary that you allow time for G5 to respond to each new kVp setting before incrementing to the next kVp. If you attempt to step through the kVp increments without allowing the G5 parameter time to respond, information messages 4204H or 4205H may be displayed on the console screen and/or erroneous fluctuations in the R/min readout may occur.

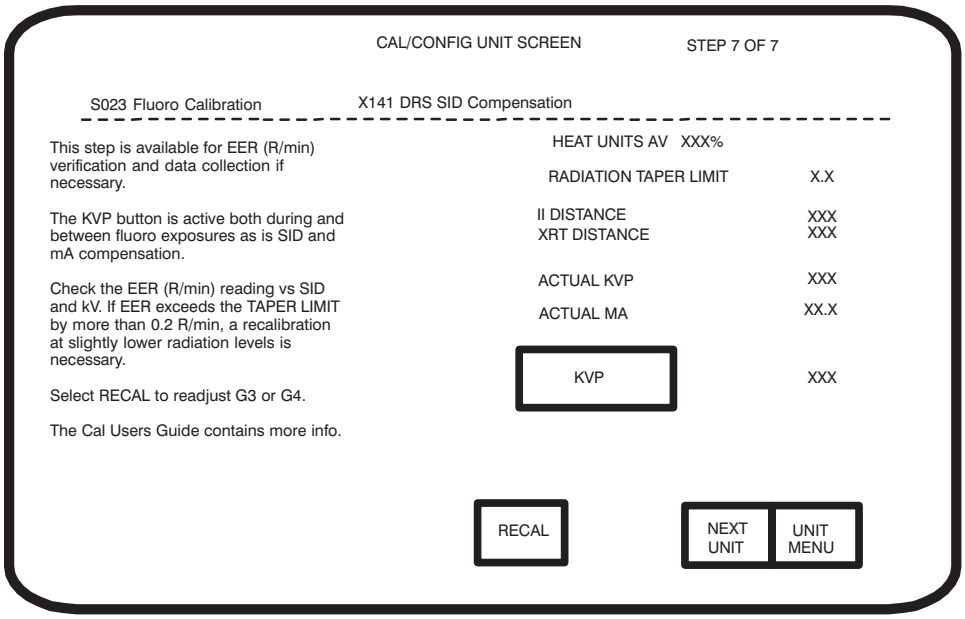
- Terminate the exposure.
- If the EER (R/min), at any kVp increment, exceeds the RADIATION TAPER LIMIT displayed on the console screen by more than 0.2 R/min, a recalibration at slightly lower radiation levels is required.
- If a recalibration is required, touch the RECAL softkey and readjust G3 (Step 4) or G4 (Step 5).
- Verify the results of any re-calibrations by repeating Step 7.
- Touch the NEXT UNIT or UNIT MENU softkey to exit.

4-7-1 Special instructions regarding verification

If the table top EER (R/min) is low, review the following special instructions before proceeding with a recalibration. Do not just recal at a higher EER (R/min) value.

MA compensation will compensate for x–ray tube heating and cooling effects as well as filament aging.

X141 STEP 7 SCREEN DISPLAY



UNIT X142 – DRS ABC Response

Time: x h xx min – Personnel: 1 field engineer

1 DESCRIPTION

Calibration Unit X142 adjusts the DRS ABC response time parameters (RADCNTRL, KVPCNTRL, and VGCNTRL) to maintain a light output from the Image Intensifier tube that is constant during DRS operation regardless of variations in system geometry or thickness and density of the object being scanned. Four steps are required to accomplish the calibration. A screen display is provided for each step.

2 SPECIAL INSTRUCTIONS

Communication must be established with the DRS prior to the display of the Step 1 screen. If that fails, an error message is displayed and the unit will only function in the browse mode.

3 EQUIPMENT REQUIRED

Filtration (1/4 aluminum, 1/32 inch copper, 2–1/4 inches acrylic), oscilloscope, and test leads.

4 TEST SETUP

Setup the oscilloscope as follows:

VERT AMPL: 0.5 V/cm
TIME BASE: 0.5 sec/cm
Connect probe to SKL A2 TP1 and chassis (ground).

5 CAL PROCEDURE

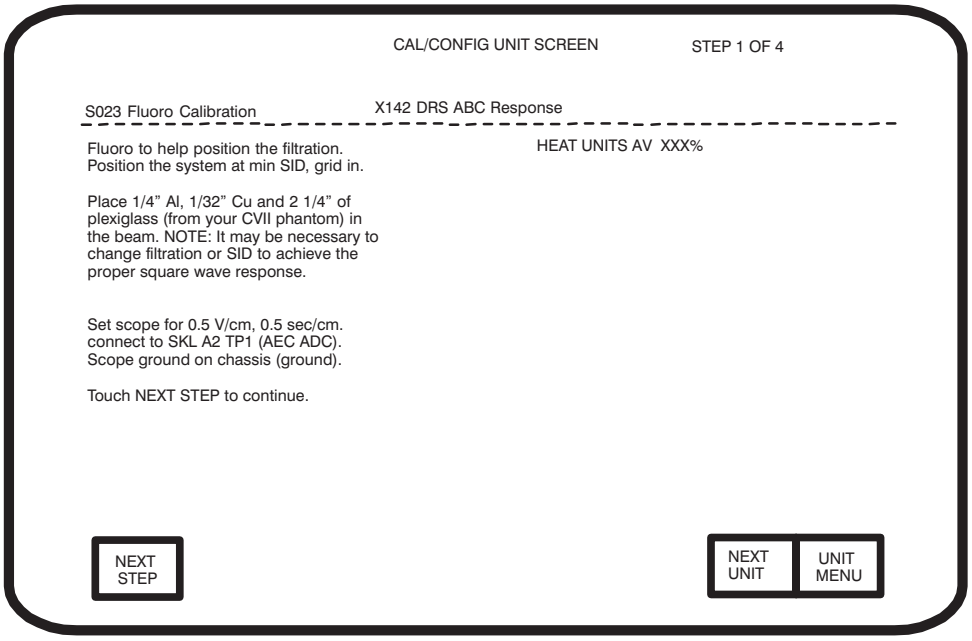
5-1 Step 1. Position Filtration

- Position the Image Intensifier tube and x–ray tube at minimum SID. On TILT–C systems, position the table top 12 inches from the Image Intensifier tube.
- Position the grid in the beam.
- Place 1/32 inch of copper, 1/4 inch of aluminum, and 2–1/4 inches of acrylic on the table (stack with acrylic on the bottom and copper on the top).

Note: The calibration may require varying the filtration thickness or SID in order to achieve the proper square wave response in Step 2.

- Take fluoro exposures with the fluoro footswitch or console handswitch to assist in centering the filtration in the x–ray beam.
- Touch NEXT STEP softkey to proceed to Step 2.

X142 STEP 1 SCREEN DISPLAY



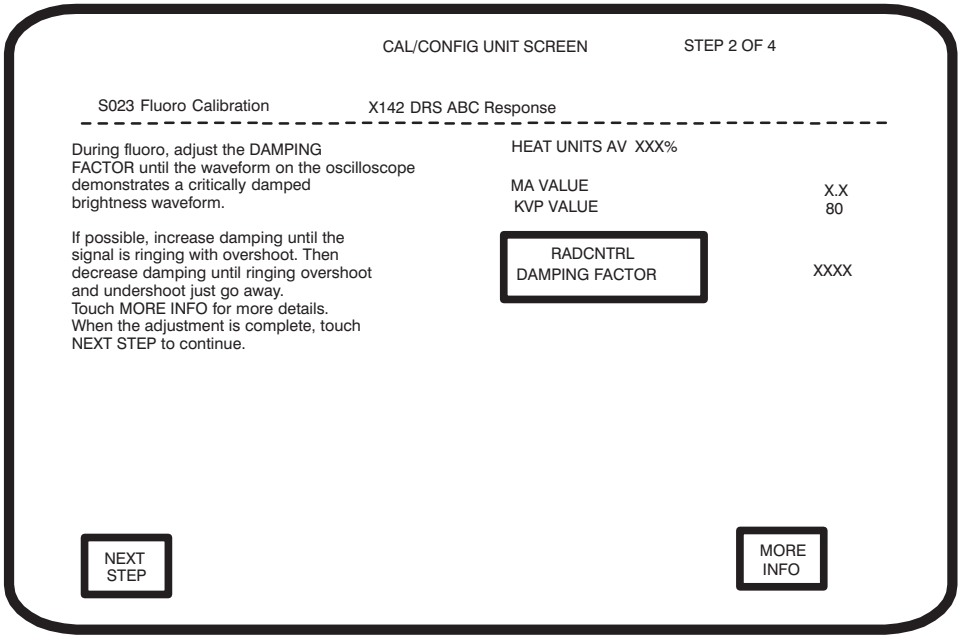
5-2 Step 2. RADCNTRL Damping Factor Adjustment

- Take a fluoro exposure.
- While maintaining the exposure, touch RADCNTRL DAMPING FACTOR softkey and, using the console dial, adjust the value of the RADCNTRL DAMPING FACTOR until the brightness error signal observed on the oscilloscope is critically damped. See Illustration 154. Increase the damping until the error signal is ringing with overshoot. Then, decrease until ringing just disappears.

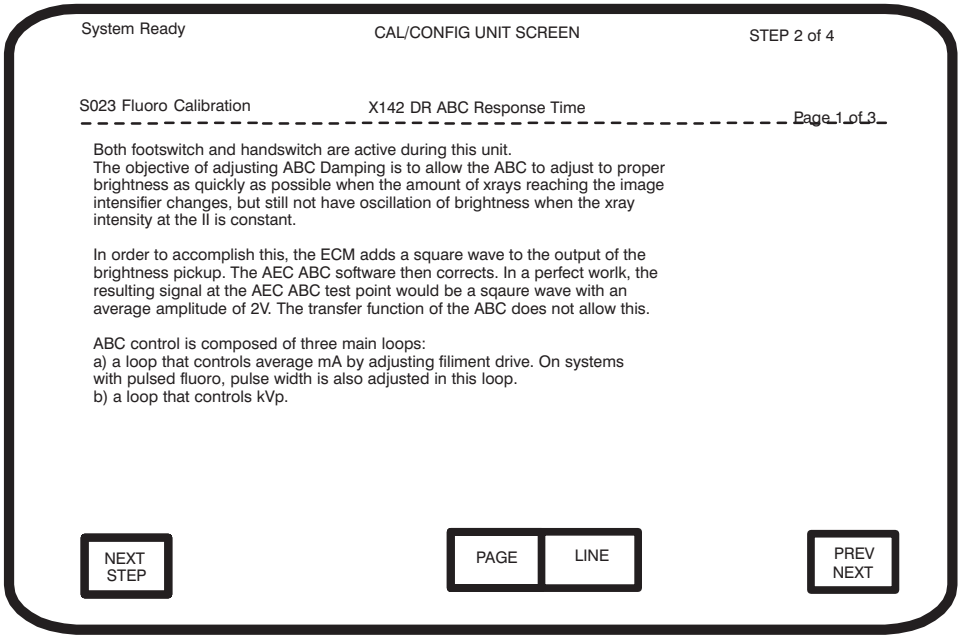
Note: The loop is critically damped when the square wave indicates no overshoot on the top and less than 250 mV overshoot on the bottom.

- Terminate the exposure and touch NEXT STEP softkey.

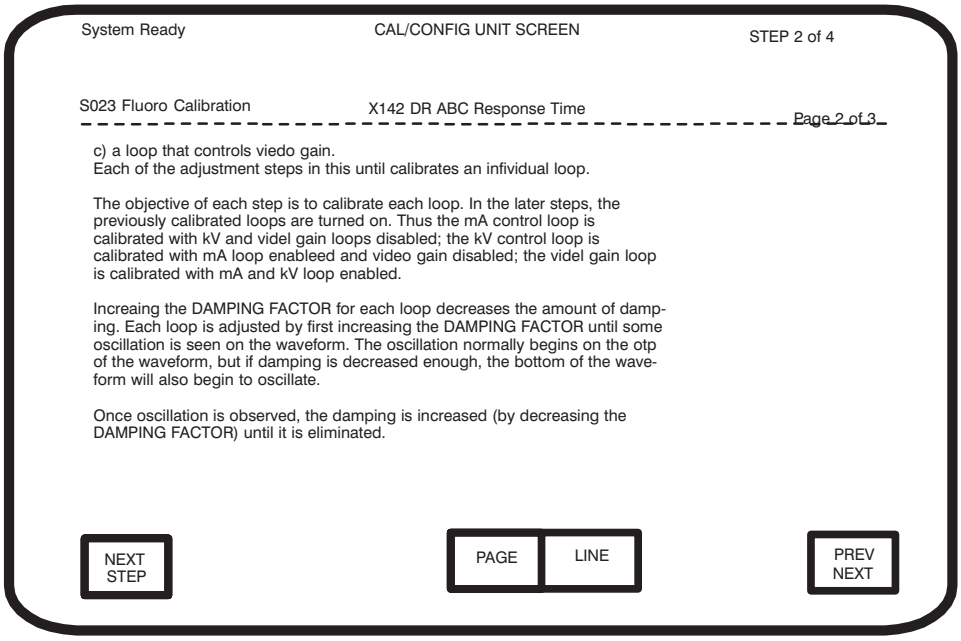
X142 STEP 2 SCREEN DISPLAY



X142 MORE INFO SCREEN DISPLAY



X142 MORE INFO SCREEN DISPLAY



X142 MORE INFO SCREEN DISPLAY

System Ready CAL/CONFIG UNIT SCREEN STEP 2 of 4

S023 Fluoro Calibration X142 DR ABC Response Time Page 3 of 3

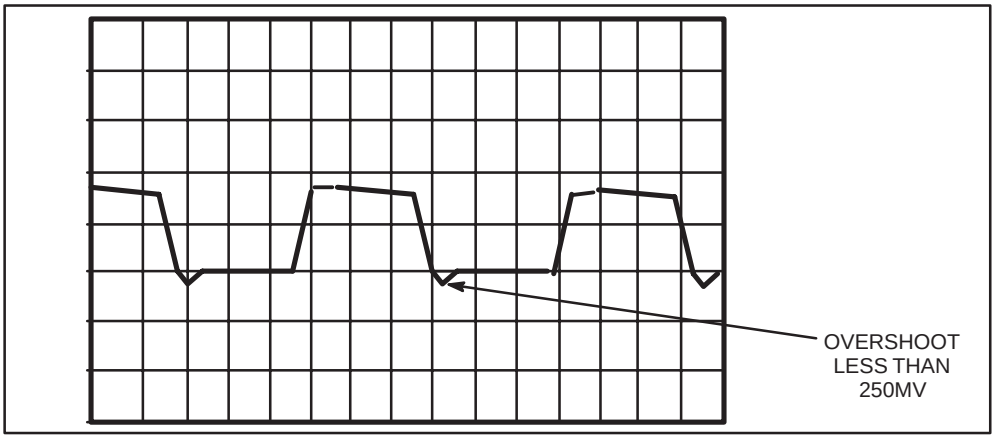
At the beginning of each step, the system adjusts the starting conditions for the calibration. The amount of filtration normally inserted into the beam path in the first step is normally sufficient for the unit's operation. But if the system cannot get to a proper operating point, the operator will be instructed to change filtration.

Adjustment of the RADCNTRL LOOP to the maximum DAMPING FACTOR in step 2 before oscillation is visilbe will result in the KVPCNTRL LOOP having to be slightly slower to avoid oscillations with both loops active. The individual loop response can be seen by turning the RADCNTRL LOOP to OFF in the step adjusting the KVPCNTRL LOOP, and by turning the RADCNTRL and KVPCNTRL loops off in the video gain step.

The final calibration should not show ringing in any step with all loops active.

NEXT STEP | PAGE | LINE | PREV NEXT

Illustration 154 – X142, Damping Adjustment



5-3 Step 3. KVPCNTRL Damping Factor Adjustment

- Take and maintain a fluoro exposure.
- Maintain the exposure until the “KVP OVERRIDE ADJUSTMENT COMPLETE” message is displayed.

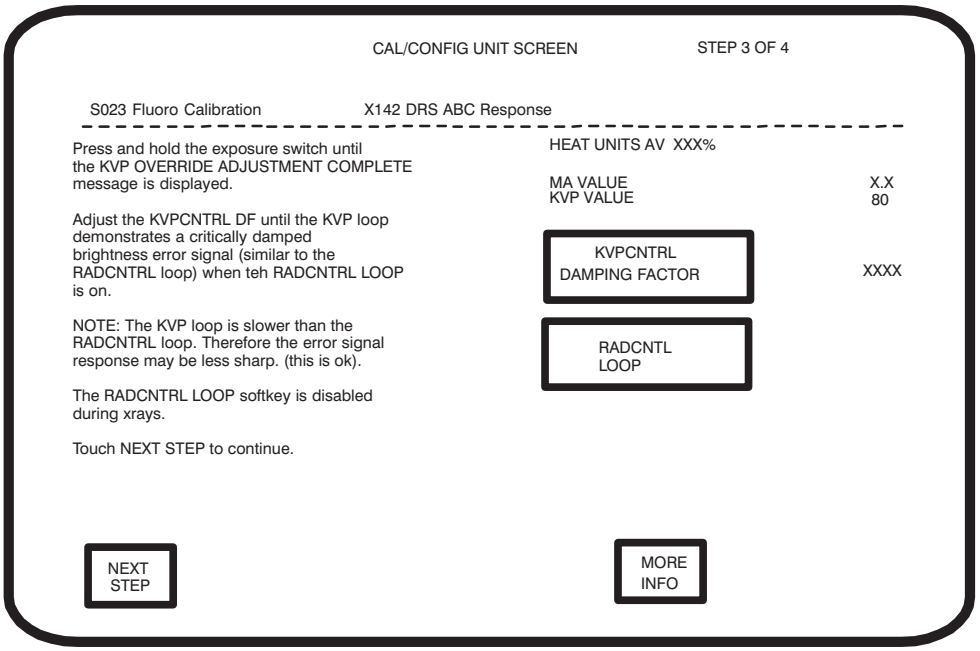
Note: An ”ADJUSTING APERTURE/FOV FOR KVP OVERRIDE CONDITION” message is displayed while the override adjustment is being accomplished.

- Touch KVPCNTRL DAMPING FACTOR softkey and, using the console dial, adjust the value of the KVPCNTRL DAMPING FACTOR until the brightness error signal observed on the oscilloscope is critically damped. See Illustration 154.

Note: The KVP loop is slower than the RADCNTRL loop. This may produce an error signal response with more rounded edges.

- Touch NEXT STEP softkey to proceed to Step 4.

X142 STEP 3 SCREEN DISPLAY



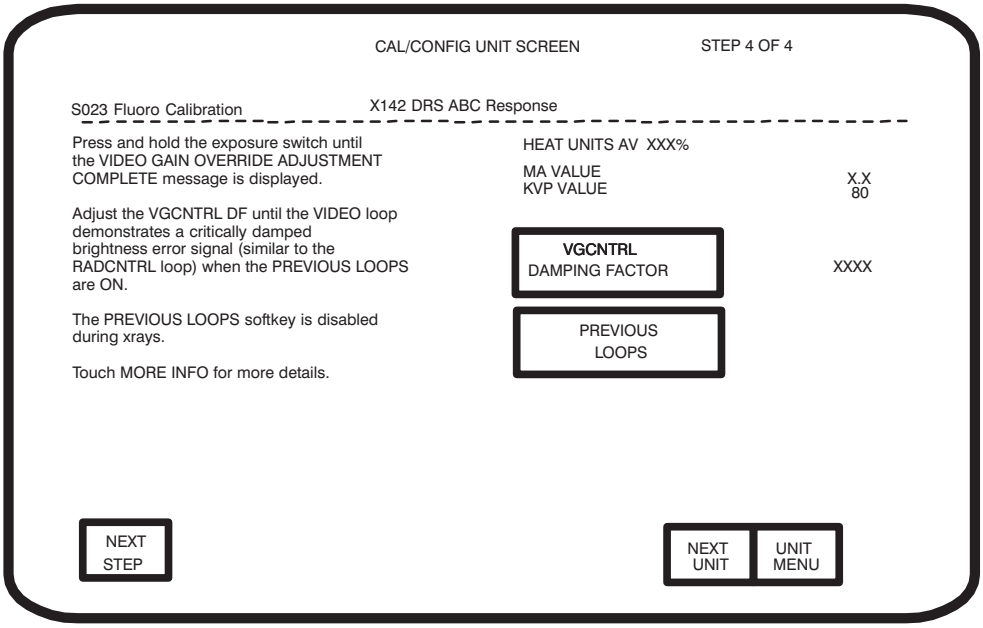
5-4 Step 4. VGCNTRL Damping Factor Adjustment

- Take a fluoro exposure.
- Maintain the exposure until the message “VIDEO GAIN OVERRIDE ADJUSTMENT COMPLETE” is displayed.

Note: The message “ADJUSTING APERTURE FOR VIDEO GAIN OVERRIDE CONDITION”is displayed while the override adjustment is being accomplished.

- Touch VGCNTRL DAMPING FACTOR softkey and, using the console dial, adjust the value of the VGCNTRL DAMPING FACTOR until the video loop indicates a critically damped brightness error signal on the oscilloscope (Similar to the RADCNTRL loop damping). See Illustration 154.
- Touch NEXT UNIT or UNIT MENU softkey to exit the calibration unit.

X142 STEP 4 SCREEN DISPLAY



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UNIT X143 – DRS Entrance Dose

Time: x h xx min – Personnel: 1 field engineer

1 DESCRIPTION

Calibration Unit X143 is used to adjust the DRS entrance dose default parameters established by Calibration Unit X107. Three entrance dose levels(low, normal, and high) can be adjusted as required by DRS applications.

2 EQUIPMENT REQUIRED

None

NOTICE

Anytime X143 is run after initial system calibration and a customized dosimetry profile exists (Ref. X233), you must also rerun X233 to re-establish the customized dosimetry profile. If X233 is not rerun, a default dosimetry profile will be established (refer to X233). Since a customized dosimetry profile is lost when X143 is rerun, it is important to remember to record the aperture values set in X233 for use when it is necessary to rerun X233.

3 CAL PROCEDURE

Perform the calibration as follows:

- Upon entering the calibration unit, the default values for LOW, NORMAL, and HIGH entrance dose selections are displayed on the screen. The default values are the recommended dose rates for DRS. Refer to Table 61 and Table 62 for non–pulsed and pulsed exposure dose rates, respectively for everywhere **EXCEPT** Germany and Switzerland. (For Germany refer to Table 63 and Table 64, respectively. For Switzerland refer to Table 65 and Table 66, respectively.) If desired, the dose values displayed can be adjusted for specific DRS applications by touching the applicable ENTRANCE DOSE SELECTIONS softkey and dialing in the new value. If questionable, keep the default values indicated.
- Adjust values or retain default values.
- Touch NEXT UNIT or UNIT MENU softkey to exit the calibration unit. Exiting the unit will load the dose values into NV RAM.

X143 SCREEN DISPLAY

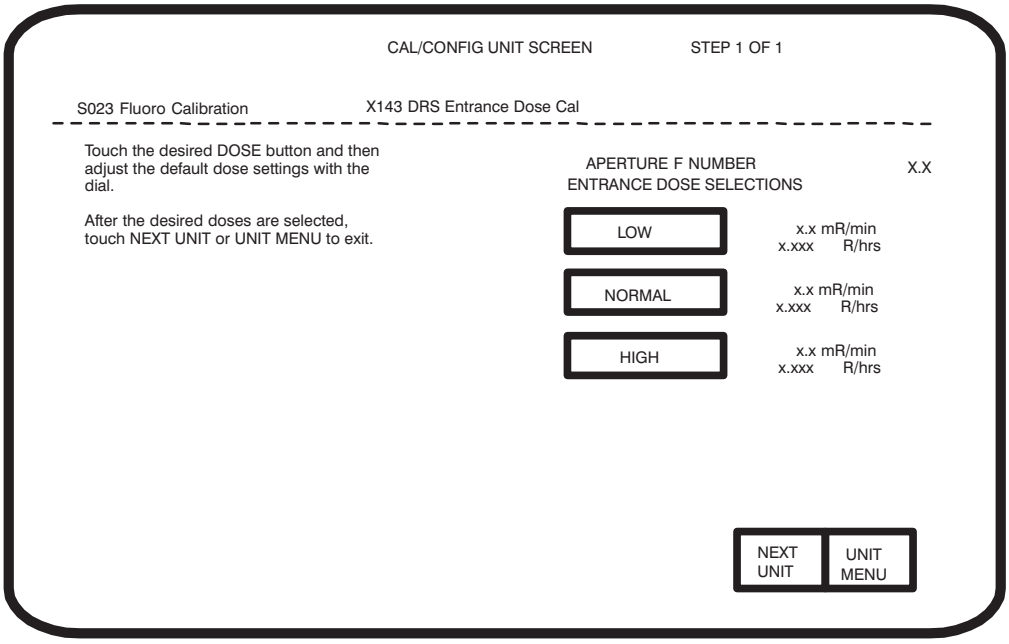


Table 61 – Recommended Entrance Dose Levels for Non–Pulsed Systems (Except for Germany and Switzerland)

RECOMMENDED ENTRANCE DOSE LEVELS FOR NON–PULSED SYSTEMS			
II TYPE	**FOV**	**DOSE**	**EXPOSURE**
9 inch (20 cm)	9	LOW	2.2 mR/min
9 inch (20 cm)	9	NORM	4.5 mR/min
9 inch (20 cm)	9	HIGH	9.4 mR/min
12 inch (30 cm)	12	LOW	1.1 mR/min
12 inch (30 cm)	12	NORM	2.4 mR/min
12 inch (30 cm)	12	HIGH	5.0 mR/min
16 inch (40 cm)	16	LOW	1.3 mR/min
16 inch (40 cm)	16	NORM	2.7 mR/min
16 inch (40 cm)	16	HIGH	5.6 mR/min

Note: The dose values shown in the above table have been modified to reflect the accuracy of the TV aperture (10% steps). Some software revisions may show/allow dose values finer than 10% steps.

Table 62 – Recommended Entrance Dose Levels for Pulsed Systems (Except for Germany and Switzerland)

RECOMMENDED ENTRANCE DOSE LEVELS FOR PULSED SYSTEMS			
II TYPE	**FOV**	**DOSE**	**EXPOSURE**
9 inch (20 cm)	9	LOW	1.7 mR/min
9 inch (20 cm)	9	NORM	3.6 mR/min
9 inch (20 cm)	9	HIGH	7.5 mR/min
12 inch (30 cm)	12	LOW	0.9 mR/min
12 inch (30 cm)	12	NORM	1.9 mR/min
12 inch (30 cm)	12	HIGH	4.0 mR/min
16 inch (40 cm)	16	LOW	1.1 mR/min
16 inch (40 cm)	16	NORM	2.2 mR/min
16 inch (40 cm)	16	HIGH	4.6 mR/min

Note: The dose values shown in the above table have been modified to reflect the accuracy of the TV aperture (10% steps). Some software revisions may show/allow dose values finer than 10% steps.

Table 63 – Recommended Entrance Dose Levels for Non–Pulsed Systems for Germany only

RECOMMENDED ENTRANCE DOSE LEVELS FOR NON–PULSED SYSTEMS (GERMANY)			
II TYPE	**FOV**	**DOSE**	**EXPOSURE**
9 inch (20 cm)	9	LOW	2.2 mR/min
9 inch (20 cm)	9	NORM	3.6 mR/min (See Note 1.)
9 inch (20 cm)	9	HIGH	3.6 mR/min (See Note 1.)
12 inch (30 cm)	12	LOW	1.1 mR/min
12 inch (30 cm)	12	NORM	2.1 mR/min (See Note 1.)
12 inch (30 cm)	12	HIGH	2.1 mR/min (See Note 1.)
16 inch (40 cm)	16	LOW	0.6 mR/min (See Note 2.)
16 inch (40 cm)	16	NORM	1.4 mR/min (See Note 1.)
16 inch (40 cm)	16	HIGH	1.4 mR/min (See Note 1.)
Note 1: Maximum allowed value in order to meet local regulations. **Note 2:** Or as low as possible.			

Note: The dose values shown in the above table have been modified to reflect the accuracy of the TV aperture (10% steps). Some software revisions may show/allow dose values finer than 10% steps.

Table 64 – Recommended Entrance Dose Levels for Pulsed Systems for Germany only

RECOMMENDED ENTRANCE DOSE LEVELS FOR PULSED SYSTEMS (GERMANY)			
II TYPE	**FOV**	**DOSE**	**EXPOSURE**
9 inch (20 cm)	9	LOW	1.7 mR/min
9 inch (20 cm)	9	NORM	3.6 mR/min (See Note 1.)
9 inch (20 cm)	9	HIGH	3.6 mR/min (See Note 1.)
12 inch (30 cm)	12	LOW	0.9 mR/min
12 inch (30 cm)	12	NORM	1.9 mR/min
12 inch (30 cm)	12	HIGH	2.1 mR/min (See Note 1.)
16 inch (40 cm)	16	LOW	0.6 mR/min (See Note 2.)
16 inch (40 cm)	16	NORM	1.4 mR/min (See Note 1.)
16 inch (40 cm)	16	HIGH	1.4 mR/min (See Note 1.)
Note 1: Maximum allowed value in order to meet local regulations. **Note 2:** Or as low as possible.			

Note: The dose values shown in the above table have been modified to reflect the accuracy of the TV aperture (10% steps). Some software revisions may show/allow dose values finer than 10% steps.

Table 65 – Recommended Entrance Dose Levels for Non–Pulsed Systems for Switzerland only

RECOMMENDED ENTRANCE DOSE LEVELS FOR NON–PULSED SYSTEMS (SWITZERLAND)			
II TYPE	**FOV**	**DOSE**	**EXPOSURE**
9 inch (20 cm)	9	LOW	2.2 mR/min
9 inch (20 cm)	9	NORM	4.5 mR/min
9 inch (20 cm)	9	HIGH	6.1 mR/min (See Note 1.)
12 inch (30 cm)	12	LOW	1.1 mR/min
12 inch (30 cm)	12	NORM	2.4 mR/min
12 inch (30 cm)	12	HIGH	3.5 mR/min (See Note 1.)
16 inch (40 cm)	16	LOW	1.3 mR/min
16 inch (40 cm)	16	NORM	2.3 mR/min (See Note 1.)
16 inch (40 cm)	16	HIGH	2.3 mR/min (See Note 1.)
Note 1: Maximum allowed value in order to meet local regulations.			

Note: The dose values shown in the above table have been modified to reflect the accuracy of the TV aperture (10% steps). Some software revisions may show/allow dose values finer than 10% steps.

Table 66 – Recommended Entrance Dose Levels for Pulsed Systems for Switzerland only

RECOMMENDED ENTRANCE DOSE LEVELS FOR PULSED SYSTEMS (SWITZERLAND)			
II TYPE	**FOV**	**DOSE**	**EXPOSURE**
9 inch (20 cm)	9	LOW	1.7 mR/min
9 inch (20 cm)	9	NORM	3.6 mR/min
9 inch (20 cm)	9	HIGH	6.1 mR/min (See Note 1.)
12 inch (30 cm)	12	LOW	0.9 mR/min
12 inch (30 cm)	12	NORM	1.9 mR/min
12 inch (30 cm)	12	HIGH	3.5 mR/min (See Note 1.)
16 inch (40 cm)	16	LOW	1.1 mR/min
16 inch (40 cm)	16	NORM	2.3 mR/min (See Note 1.)
16 inch (40 cm)	16	HIGH	2.3 mR/min (See Note 1.)
Note 1: Maximum allowed value in order to meet local regulations.			

Note: The dose values shown in the above table have been modified to reflect the accuracy of the TV aperture (10% steps). Some software revisions may show/allow dose values finer than 10% steps.

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UNIT X150 – HLC (DX) Taper Progressive

Time: x h xx min – Personnel: 1 field engineer

1 DESCRIPTION

Calibration Unit X150 adjusts the DLX HLC taper so that the fluoro table top radiation dose (Entrance Exposure Rate–EER) never exceeds 175 mGy/min (20 R/min). The calibration sets the end points of a pre–defined taper curve to correspond with a radiation taper limit. Five steps are required to calibrate the DLX HLC taper. A screen display is provided for each step.

CAUTION

This unit allows the system to be configured for higher pulsed progressive fluoro taper limits than shipped (up to the 175 mGy/min (20 R/min) regulatory limit). While the system will operate at these higher taper limits, the reliability under this condition may suffer; increased maintenance costs should be expected. Raising the taper limit above 175 mGy/min (20 R/min) is strictly prohibited.

NOTICE

If this calibration unit is used to re-calibrate DLX tapers after initial system calibration, it is mandatory that you also rerun X100, X101, X130 and X131 Cal Unit prior to X151, HLC SID Comp, or the re-calibrated tapers will not be observed when running Applications. Cal Unit X130, X131, X150 and X151 must be run as a set in the following sequence X100, X101, X130, X131, X150, X151.

2 EQUIPMENT REQUIRED

Dosimeter (MDH/Radcal 2025, 2026 or equivalent) w/probe stand or Ion Chamber Positioning Tool 2236707 (Former ref: 2208874)
For Advantx–E Systems, Ion Chamber Positioning Tool is mandatory (See Cal Unit T015) .
For this Cal Unit, use Model 20x5–3 or 20x6–3 probe.
Metric Tape Measure.

3 SPECIAL INSTRUCTIONS

Note: **For Vascular Systems Only:** Before system calibration, verify that additional filter (copper–aluminum filter) is not installed on top of collimator. (Open sensor hinge assembly to verify.) If installed, remove before performing calibration.

- Communication with DLX.

Note: Communication must be established with the DLX prior to the display of the Step 1 screen. If that fails, an error message is displayed and the unit will only function in the browse mode. To ensure communication with the DLX, perform the following:

1. On the DLX console, at the “DLX LOGIN” prompt, type “DLX” followed by pressing the RETURN key.
2. Verify DLX console displays the ACQUISITION screen. If not, select the following to continue:
   NEW PATIENT (you must also enter patient name and ID number or the DLX will not be enabled)
   NEW EXAM

- The Filament Age and Fil Age (Last Cal) parameters displayed on the Step 2 screen provide a visual indication of the filament aging characteristics of the system x–ray tube.

1. **Filament Age:** Tracks and displays a continuous record of changes in filament aging (in HEX) since x–ray tube installation (initial value of 0010H).
2. **Fil Age (Last Cal):** Displays the Hex value of filament aging set in the last calibration (initial value when a tube is installed is FFFFH). The Fil Age (Last Cal) parameter will be set equal to Filament Age parameter after a calibration is completed.

Note: As the x–ray tube ages, changes in the Filament Age value may be observed. If the difference between the Filament Age value and Fil Age (Last Cal) value reaches a delta limit of 2BH, a ”recal required” message is displayed. This warning message is displayed upon entering either the Applications or Service Mode to indicate to the user that a mandatory recalibration of the fluoro tapers is required (Ref recal instructions in Cal Unit X100).

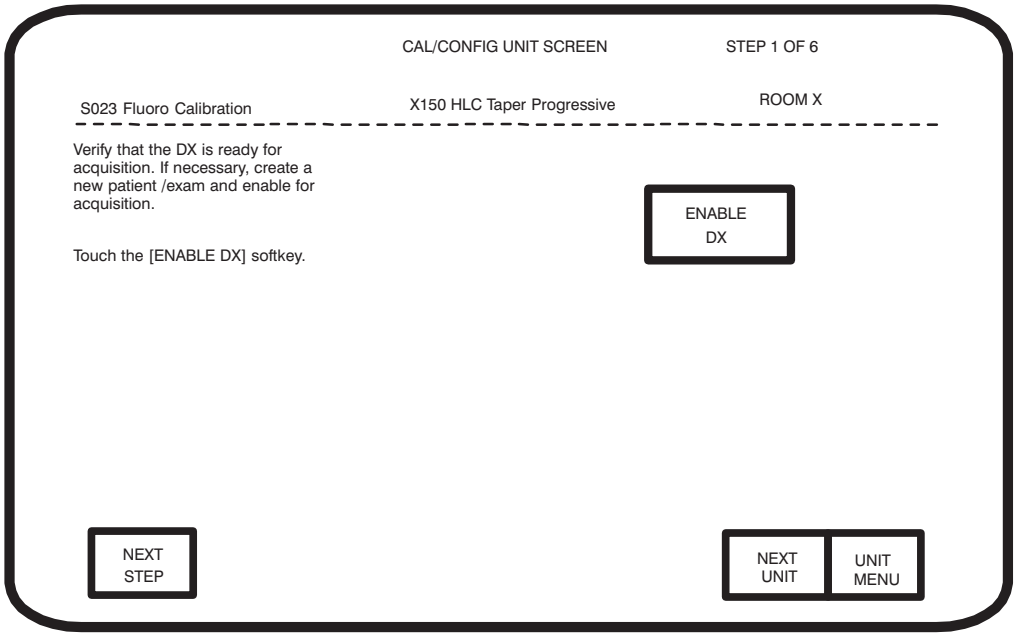
- Re-run this Cal Unit and re-adjust the EER by subtracting the amount of increase observed in Applications from the EER value previously set in this unit.

4 CAL PROCEDURE

4-1 Step 1. Enable DX (DLX)

- Communication must be established with the DX (DLX) prior to selecting the ENABLE DX softkey. Selecting the ENABLE DX softkey puts the DX (DLX) into technical menu. If communication with the DX (DLX) fails, an error message is displayed and the unit will only function in the viewing (browse) mode.
  1. If necessary, create a new patient/exam and enable for acquisition.
  2. Touch the ENABLE DX softkey.
- Touch NEXT STEP softkey to proceed to Step 2. If the NEXT STEP softkey is pressed prior to pressing the ENABLE DX softkey, the viewing mode will be entered. Viewing mode allows cycling through the screen displays without doing a calibration.

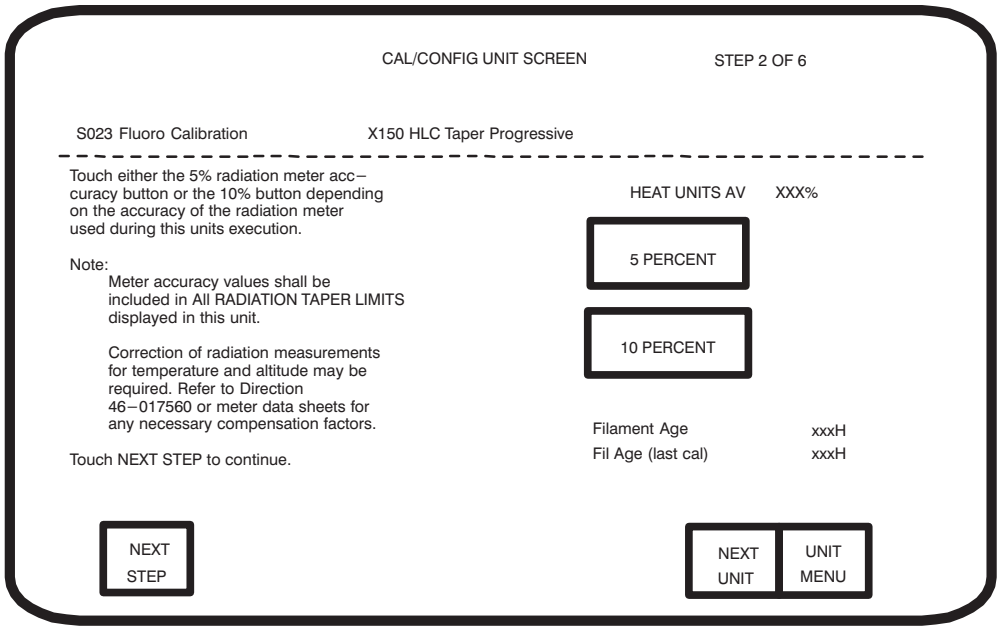
X150 STEP 1 SCREEN DISPLAY



4-2 Step 2. Radiation Meter Accuracy

- Check rated accuracy of the radiation meter to be used in the calibration.
- Touch the 5 PERCENT or 10 PERCENT softkey to enter the rated accuracy of the radiation meter. The meter accuracy value is included in all RADIATION TAPER LIMITS displayed in this unit.
- Check the current values (in Hex) of the Filament Age and Fil Age (Last Cal) parameters. Refer to the Special Instruction paragraph at the beginning of this unit for an explanation of these parameters.
- Touch NEXT STEP softkey to proceed to Step 3.

X150 STEP 2 SCREEN DISPLAY



4-3 Step 3. Radiation Meter (R–Meter) Probe Positioning

CAUTION **Verify that the collision sensor is installed on the collimator, and that the hinged door is closed before proceeding.**

The Step 3 screen display provides instructions for positioning the R–Meter probe in systems employing SID compensation (all Vascular systems).

Note: Touching the MORE INFO softkey increments to a screen display that provides instructions for positioning the R–Meter probe in R+F systems. This is NOT applicable to vascular systems.

- Move the table top out of the field of the x–ray beam.
- Set the II tube and x–ray tube to minimum SID.

Note: For Advantx–E Vascular Systems, Ion Chamber Positioning Tool is mandatory to get accurate adjustments.

- When using Ion Chamber Positioning Tool 2236707 (Former ref: 2208874), refer to Illustration 135 in Cal Unit X100 and to the instructions on the screen display for Step 3; also, refer to mounting/positioning instructions in Cal Unit T015. Check for probe top/II anticollision plate distance in Table 10 of Cal Unit T015.
- If not using the Ion Chamber Positioning Tool, mount the R–Meter probe stand to the bottom of the II tube (or position the stand on the head end of the table top and extend the R–Meter probe into the x–ray beam). Position the R–meter probe 30 cm from the lowest point on the II tube housing. Refer to Illustration 134 in Cal Unit X100 and to the instructions on the screen display for Step 3.

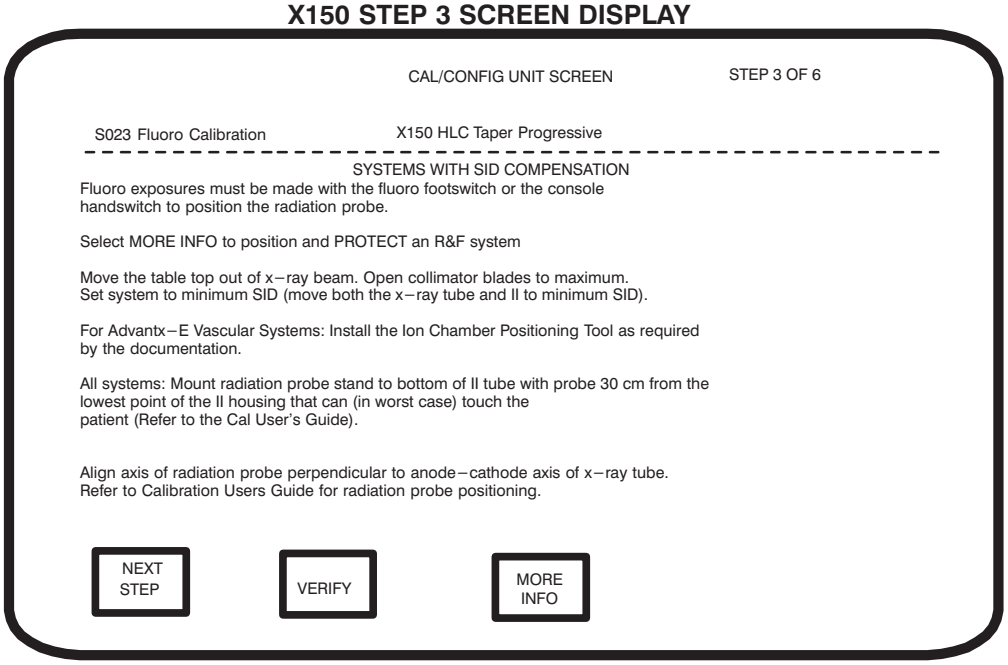
Note: The positioning of the R–meter probe 30 cm from the lowest point on the II tube housing (with II in overhead position) is an FDA requirement. The FDA assumes that the 30 cm distance corresponds to the average thickness of a patient and therefore establishes a worst case condition for radiation dose.

- Align axis of probe perpendicular to anode–cathode axis of x–ray tube.
- Take a fluoro exposure to determine the exact position of the probe. Repeat taking exposures and repositioning the R–Meter probe until the probe is centered in the x–ray beam (See T015 for a detailed procedure using DLX).
- After the R–Meter probe is properly positioned, you may perform a quick check of the Radiation Taper Limit before proceeding with a full calibration by touching the VERIFY softkey. Touching the VERIFY softkey will cause the unit to increment to the Step 6, Verification screen. Perform Step 6.

OR

- Touch the NEXT STEP softkey to proceed to Step 4 in the calibration sequence.

X150 STEP 3 SCREEN DISPLAY

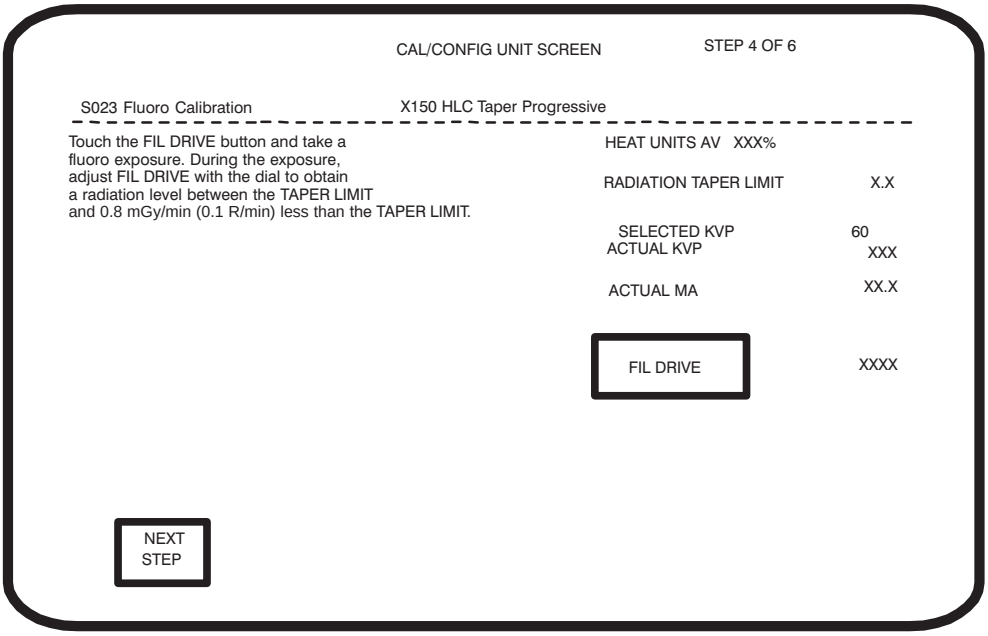


Note: The X150 Step 3 “MORE INFO” Screen is not applicable to vascular systems.

4-4 Step 4. 60 KV FIL DRIVE Adjustment

- Initiate FIL DRIVE adjustment by touching the FIL DRIVE softkey.
- Take and maintain a fluoro exposure. During the exposure, turn the console dial to adjust FIL DRIVE until the dose rate indicated on the radiation meter is within 0.8 mGy/min (0.1 R/min) less than the RADIATION TAPER LIMIT value displayed on the console screen.
- When the correct dose rate level is obtained and stable, stop fluoro.
- Touch NEXT STEP softkey to proceed to Step 5.

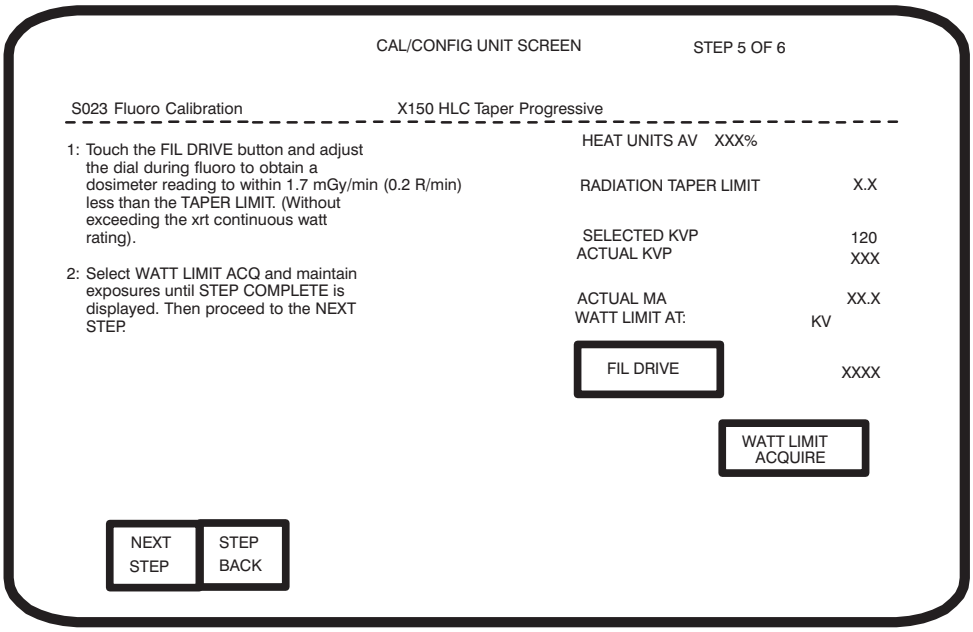
X150 STEP 4 SCREEN DISPLAY



4-5 Step 5. 120 KV FIL DRIVE Adjustment

- Initiate FIL DRIVE adjustment by touching the FIL DRIVE softkey.
- Take and maintain a fluoro exposure. During the exposure, turn the console dial to adjust FIL DRIVE until the dose rate indicated on the radiation meter is within 1.7 mGy/min (0.2 R/min) less than the RADIATION TAPER LIMIT value displayed on the console screen. Do not exceed the X–ray tube continuous watt rating during the adjustment.
- When the correct dose rate level is obtained and stable, stop fluoro.
- Take and maintain another exposure. During the exposure, touch the WATT LIMIT ACQUIRE softkey. The system will calculate wattage and compare against a HLC Continuous Watt Rating limit stored in the database. Maintain the exposure until the STEP COMPLETE message is displayed. If calculated wattage is higher than the Continuous Watt Rating limit, the message ”CONTINUOUS WATT RATING EXCEEDED, PLEASE RECAL TO A LOWER DOSE” will be displayed. If necessary, repeat the FIL DRIVE adjustment (Steps 4 and 5)
- Touch NEXT STEP softkey to proceed to Step 6.

X150 STEP 5 SCREEN DISPLAY



4-6 Step 6. Verification

- Initiate Entrance Exposure Rate–EER verification by touching the KVP softkey.
- Take and maintain a fluoro exposure. During the exposure, use the console dial to step from 60 kVp to 120 kVp in 5 kVp increments. Verify the EER level on the radiation meter at each kVp increment.

NOTICE

When incrementing kVp through the verification values, rotate the console dial slowly. As the filament control parameter (G5) is active during this step of the calibration, you must allow time for the G5 to respond to each new kVp setting before incrementing to the next kVp. If you try to step through the kVp increments without giving the G5 parameter time to respond, information messages may appear on the console screen and/or erroneous fluctuations may occur in the dose rate readout.

- Terminate the exposure.
- If the EER, at any kVp increment, exceeds the RADIATION TAPER LIMIT displayed on the console screen by more than 7.8mGy/min (0.9R/min), a recalibration at slightly lower radiation levels is required. Touch RECAL softkey and repeat calibration.

Note: If EER is excessive only at the high kVp increments, lowering FIL DRIVE may be sufficient (Repeat Step 5, FIL DRIVE adjustment).

- Verify the results of any re-calibrations by repeating Step 6.
- Touch the NEXT UNIT or UNIT MENU softkey to exit.

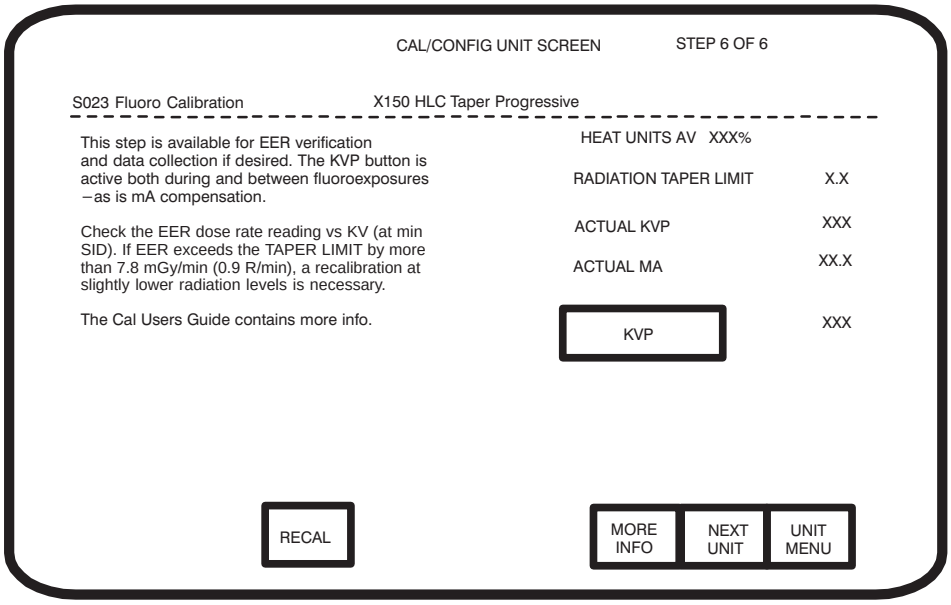
4-6-1 Special instructions regarding verification

If the table top EER is low, review the following special instructions before proceeding with a recalibration. Do not just recal at a higher EER value.

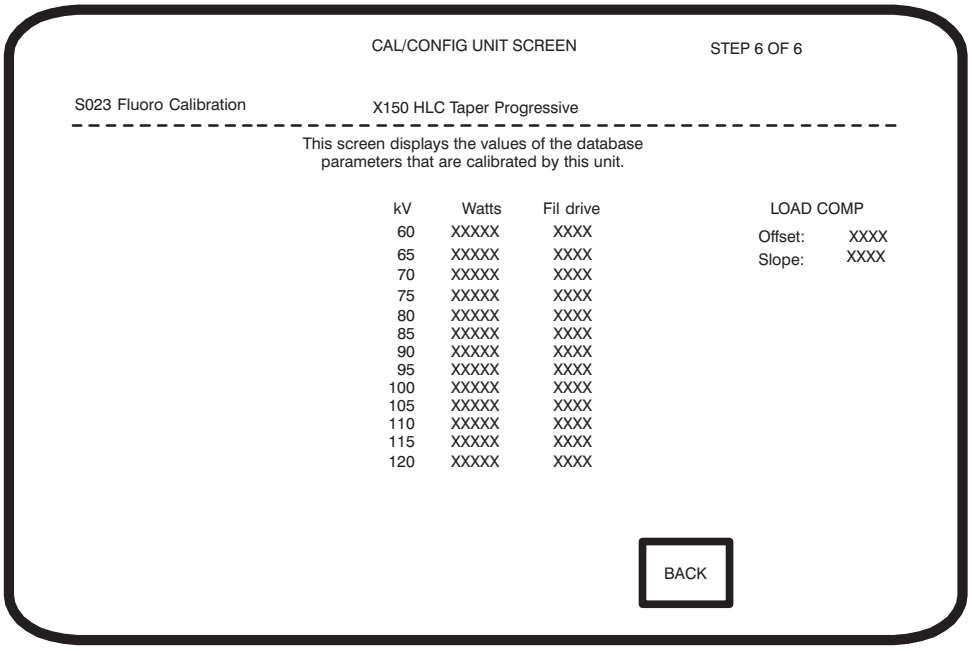
MA compensation will compensate for x–ray tube heating and cooling effects as well as filament aging.

Note: A “More Info” screen, accessed by touching the MORE INFO softkey on the Step 6 screen, displays the values of the database parameters that are calculated by this unit.

X150 STEP 6 SCREEN DISPLAY



X150 STEP 6 "MORE INFO" SCREEN DISPLAY



Note: Step 6 MORE INFO screen:

1. The list of kV's in the right hand column shows the range of kV's for the 60–120 kV range. The Table is displayed from Min to Max kV.
2. The list of kV's in the left hand column is only displayed if the range of allowed kV's exceeds 13 values.

UNIT X151 – HLC DX SID Compensation

Time: x h xx min – Personnel: 1 field engineer

1 DESCRIPTION

Calibration Unit X151 adjusts the HLC SID compensation parameters so that as SID increases, tube filament current increases, thereby maintaining the fluoro table top dose at a calibrated value. HLC SID compensation also prevents increases in fluoro technique from exceeding the rating of the tube. SID compensation is only active during exposures. Seven steps are required to calibrate the SID compensation parameters. A screen display is provided for each Step.

CAUTION **This unit allows the system to be configured for higher pulsed progressive fluoro taper limits than shipped (up to the 175 mGy/min (20 R/min) regulatory limit). While the system will operate at these higher taper limits, the reliability under this condition may suffer; increased maintenance costs should be expected. Raising the Fluoro Taper limit above 175 mGy/min (20 R/min) is strictly prohibited.**

Note: This unit must always be run in combination with Cal Unit X100, X101, X130, X131, X150 must be run X100 first, thenX101, X130, X131, X150 and X151 last.

2 EQUIPMENT REQUIRED

Dosimeter (MDH/Radcal 2025, 2026 or equivalent) w/probe stand or Ion Chamber Positioning Tool 2236707 (Former ref: 2208874)
For Advantx–E Systems, Ion Chamber Positioning Tool is mandatory (See Cal Unit T015) .
For this Cal Unit, use Model 20x5–3 or 20x6–3 probe.
Metric Tape Measure.

3 SPECIAL INSTRUCTIONS

Note: **For Vascular Systems Only:** Before system calibration, verify that additional filter (copper–aluminum filter) is not installed on top of collimator. (Open sensor hinge assembly to verify.) If installed, remove before performing calibration.

- Communication with DLX.

Note: Communication must be established with the DLX prior to the display of the Step 1 screen. If that fails, an error message is displayed and the unit will only function in the browse mode. To ensure communication with the DLX. perform the following:

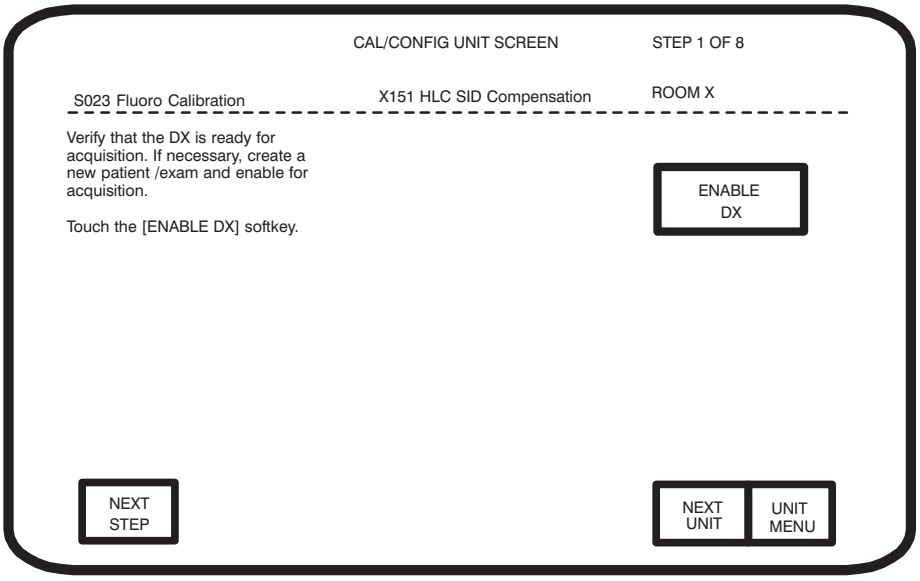
1. On the DLX console, at the “DLX LOGIN” prompt, type “DLX” followed by pressing the RETURN key.
2. Verify DLX console displays the ACQUISITION screen. If not, select the following keys to continue:
   NEW PATIENT (you must also enter patient name and ID number or the DLX will not be enabled)
   NEW EXAM

4 CAL PROCEDURE

4-1 Step 1. Enable DX (DLX)

- Communication must be established with the DX (DLX) prior to selecting the ENABLE DX softkey. Selecting the ENABLE DX softkey puts the DX (DLX) into technical menu. If communication with the DX (DLX) fails, an error message is displayed and the unit will only function in the viewing (browse) mode.
  1. If necessary, create a new patient/exam and enable for acquisition.
  2. Touch the ENABLE DX softkey.
- Touch NEXT STEP softkey to proceed to Step 2. If the NEXT STEP softkey is pressed prior to pressing the ENABLE DX softkey, the viewing mode will be entered. Viewing mode allows cycling through the screen displays without doing a calibration.

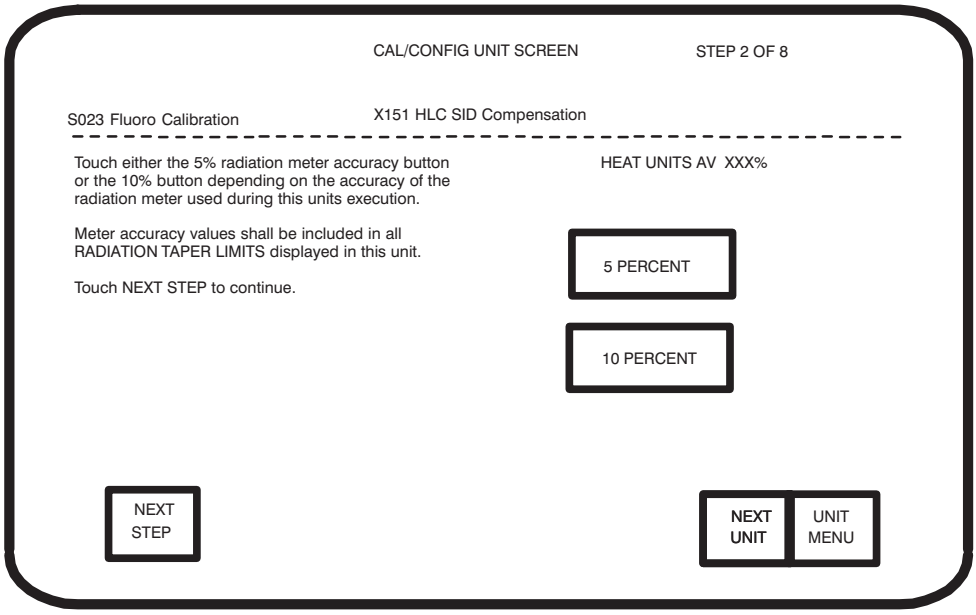
X151 STEP 1 SCREEN DISPLAY



4-2 Step 2. Radiation Meter Accuracy

- Check the rated accuracy of the radiation meter to be used in the calibration.
- Touch the 5 PERCENT or 10 PERCENT softkey to enter the rated accuracy of the radiation meter. The meter accuracy value is included in all RADIATION TAPER LIMITS displayed in this unit.
- Touch the NEXT STEP softkey to proceed to Step 3.

X151 STEP 2 SCREEN DISPLAY



4-3 Step 3. Radiation Meter (R–Meter) Probe Positioning

CAUTION **LP must be at 90 degrees (C90 position on LC position display) to allow positioning of x–ray tube and II tube.**

CAUTION **Verify that the collision sensor is installed on the collimator, and that the hinged door is closed before proceeding.**

- Move the table top out of the field of the x–ray beam and open the collimator blades to maximum.

NOTICE **On LC systems configured with an Omega EP table, you must rotate the LC positioner pivot to 90 degrees and lower the table top out of the x–ray beam.**

- Manually set the II tube and x–ray tube to minimum SID.

Note: For Advantx–E Vascular Systems, Ion Chamber Positioning Tool is mandatory to get accurate adjustements.

Note: If you are using the Ion Chamber Positioning Tool and if you have just run X120 unit, the probe should not have moved, so DO NOT CHANGE the positioning of the probe to avoid errors in the calibration.

- When using Ion Chamber Positioning Tool 2236707 (Former ref: 2208874),refer to Illustration 135 in Cal Unit X100 and to the instructions on the screen display for Step 3; also, refer to mounting/positioning instructions in Cal Unit T015. Check for probe top/II anticollision plate distance in Table 10 of Cal Unit T015.
- If not using the Ion Chamber Positioning Tool, mount R–Meter probe stand to bottom of II tube (or position the stand on the head end of the table top and extend the R–Meter probe into the x–ray beam). Position the R–meter probe 30 cm from the lowest point on the II tube housing (Refer to Illustration 134 in Cal Unit X100 and to the instructions on the screen display for Step 3).

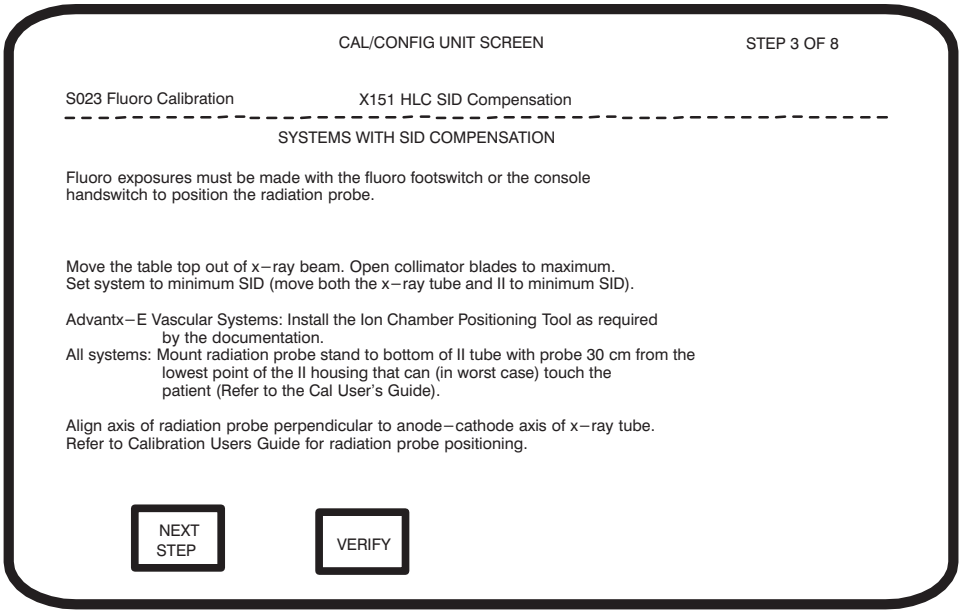
Note: The positioning of the R–meter probe 30 cm from the lowest point on the II tube housing (with II in overhead position) is an FDA requirement. The FDA assumes that the 30 cm distance corresponds to the average thickness of a patient and therefore establishes a worst case condition for radiation dose.

- Align the axis of the probe perpendicular to the anode–cathode axis of the x–ray tube.
- Take a fluoro exposure to determine the exact position of the R–Meter probe in the field of view.
- Repeat taking exposures and repositioning the R–Meter probe until the probe is centered in the x–ray beam.
- After the R–Meter probe is properly positioned, you may perform a quick check of the Radiation Taper Limit before proceeding with a full calibration by touching the VERIFY softkey. Touching the VERIFY softkey will cause the unit to increment to the Step 8, Verification screen. Perform Step 8.

OR

- Touch the NEXT STEP softkey to proceed to Step 4 in the calibration sequence.

X151 STEP 3 SCREEN DISPLAY



NOTICE

Before attempting to run SID POS Positioning on LCA+/LCV+/LC+ systems, ensure that the table top rotational position is at 0 degrees or ±90 degrees for systems with Omega IV tables or at 0 degrees angulation position for systems with Omega EP tables. The SID button on the tableside control is disabled if the table is not at one of these positions.

4-4 Step 4. SID POS Positioning

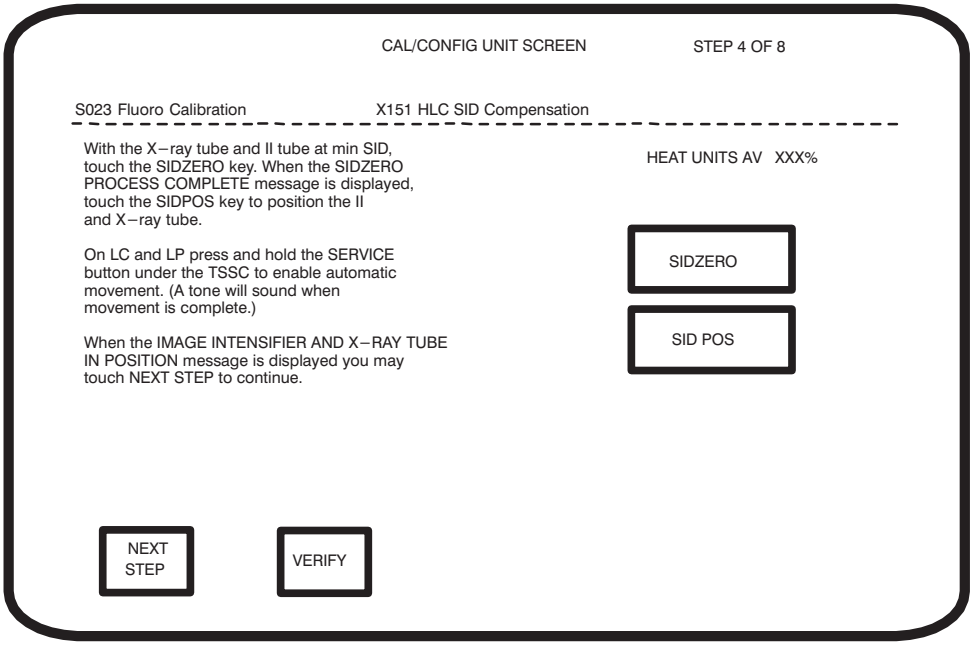
- Touch the SIDZERO softkey. The system will process and load SIDZERO data into NVRAM. Upon completion of processing, a “SIDZERO PROCESS COMPLETE” message will be displayed on the console.
- Touch the SID POS softkey.

Note: On LCA+/LCV+/LC+ systems, the SID POS softkey does not control the positioning of the Image Intensifier tube. Touch the SID POS softkey on the console and then press and hold the SERVICE button beneath the tableside control until the II reaches the upper SID position.

On biplane lateral, maintain button activation until ***both*** the Image Intensifier tube and the x–ray tube are in position (may take 15–20 seconds). The x–ray tube will not start to move until the II is in position. The system will move to a position that has been determined to give close to 900 W at 60 kV. Thus the amount of x–ray tube motion will vary. A tone will sound to indicate that motion is complete.

- When the message “IMAGE INTENSIFIER AND X–RAY TUBE IN POSITION” is displayed, touch NEXT STEP softkey and proceed to Step 5.

X151 STEP 4 SCREEN DISPLAY



4-5 Step 5. G3 Adjustment

Before proceeding, touch the Step 5 MORE INFO softkey to access the Step 5 MORE INFO screen for more instructions about the G3 adjustment.

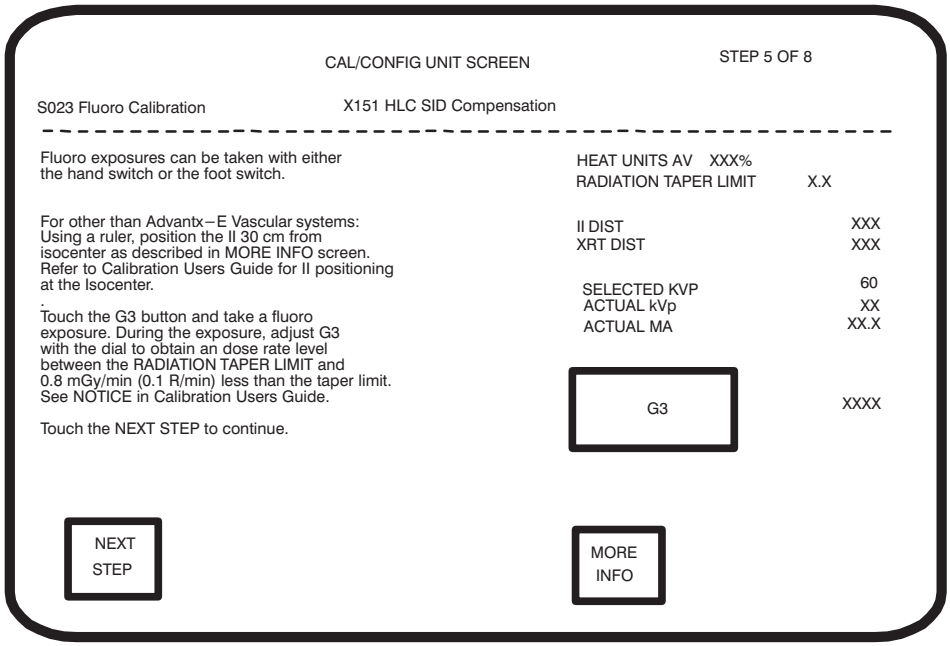
- Initiate G3 adjustment by touching the G3 softkey.
- Take and maintain a fluoro exposure.
- During the exposure, turn the console to adjust G3 dial until the dose rate indicated on the radiation meter is within 0.8 mGy/min (0.1 R/min) less than the RADIATION TAPER LIMIT value displayed on the console screen.

NOTICE

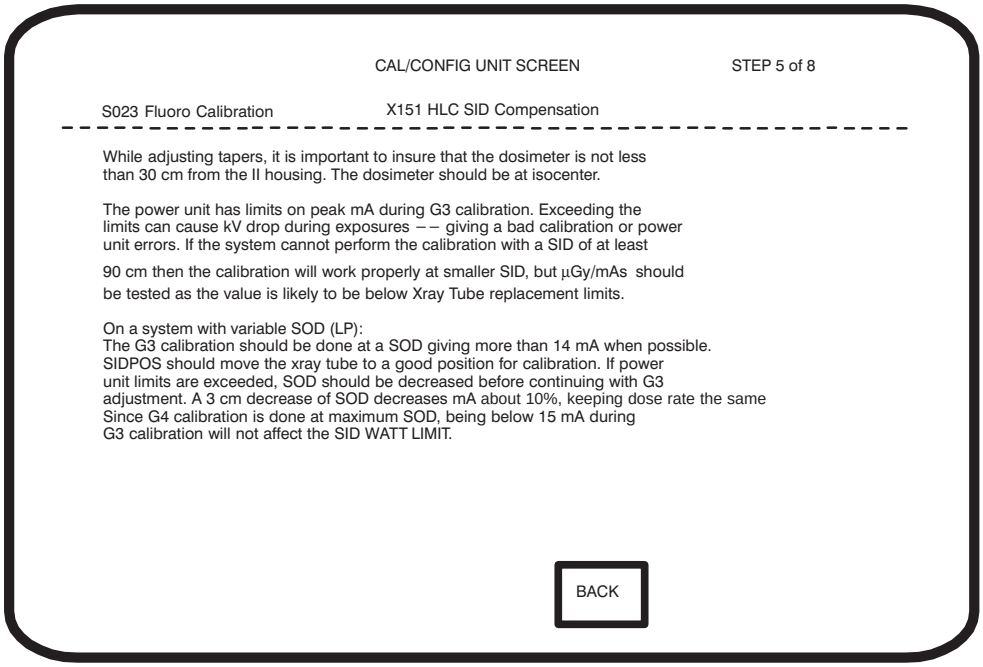
If for some reason, the power unit limit on peak fluoro power at 60 kV is exceeded, the message "mA Exceeds Power Unit Limits, See Manual and MORE INFO" is displayed. Then decrease the SID by 3 cm and try again. A decrease of SID will not change the EER.

- Terminate the exposure.
- Touch NEXT STEP softkey and proceed to Step 6.

X151 STEP 5 SCREEN DISPLAY



X151 STEP 5 "MORE INFO" SCREEN DISPLAY



4-6 Step 6. G4 Adjustment

NOTICE

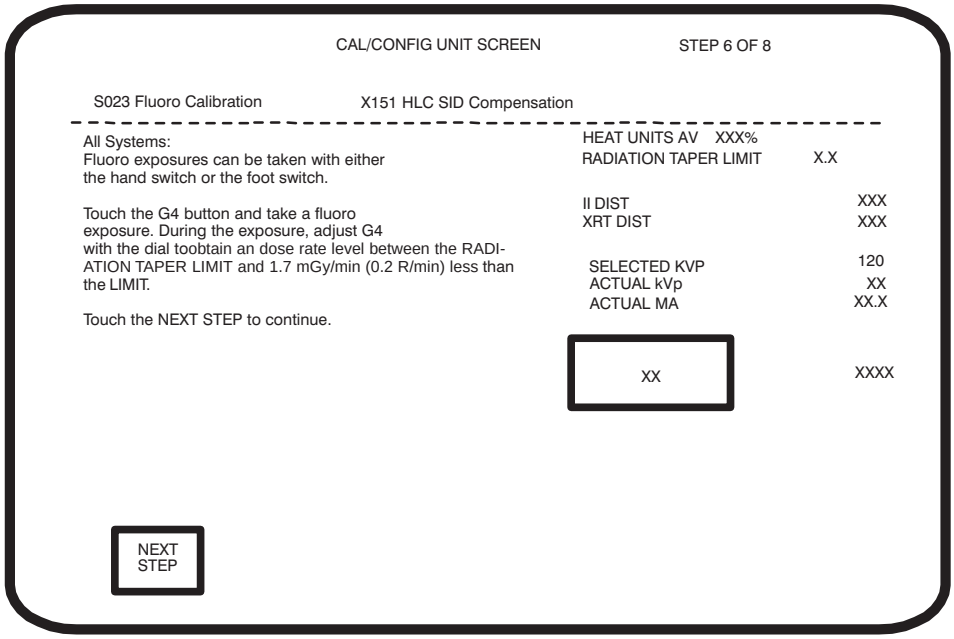
If SID was changed in the previous step, you must return the system to the original SID value.

- Initiate G4 adjustment by touching the G4 softkey.
- Take and maintain a fluoro exposure.
- During the exposure, turn the console dial to adjust G4 until the dose rate indicated on the radiation meter is within 1.7 mGy/min (0.2 R/min) less than the RADIATION TAPER LIMIT value displayed on the console screen.
- Terminate the exposure.
- Touch NEXT STEP softkey and proceed to Step 7.

NOTICE

If for some reason, the peak power limit is exceeded, the message “mA high; Check mR/mAs” is displayed. Decrease SID, by 3 cm steps until the message disappears. You may continue, but check tube efficiency.

X151 STEP 6 SCREEN DISPLAY



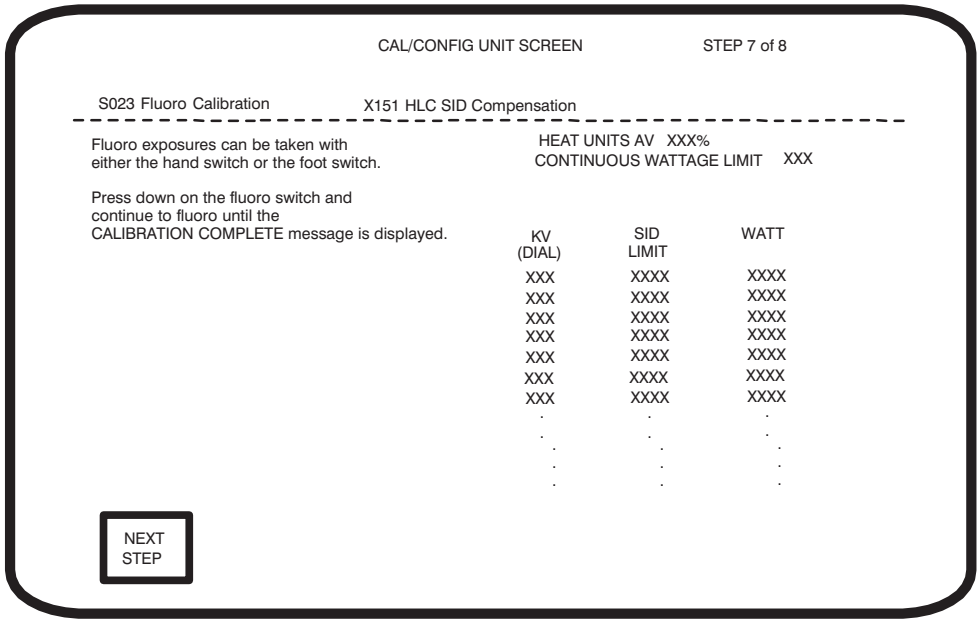
4-7 Step 7. SID Watt Limiter Adjustment

- Take and maintain a fluoro exposure. The system will perform the Watt limiter adjustment while the exposure is being taken.
- Maintain the exposure until the “CALIBRATION COMPLETE” message is displayed on the console screen.

Note: The WATT LIMIT is typically 900 W at 60 kV, going up to 1500 W at120 kV.

- Touch NEXT STEP softkey and proceed to Step 8.

X151 STEP 7 SCREEN DISPLAY



4-8 Step 8. Verification

Verification should be done at different kVp's and SID's.

- Initiate Entrance Exposure Rate–EER verification by touching the KVP softkey.
- Take and maintain a fluoro exposure. During the exposure, use the console dial to step from 60 kVp to 120 kVp in 5 kVp increments. Verify the EER level on the radiation meter at each kVp increment.

NOTICE

When incrementing kVp through the verification values, rotate the console dial slowly. As the filament control parameter (G5) is active during this step of the calibration, you must allow time for the G5 to respond to each new kVp setting before incrementing to the next kVp. If you try to step through the kVp increments without giving the G5 parameter time to respond, information messages may appear on the console screen and/or erroneous fluctuations may occur in the dose rate readout.

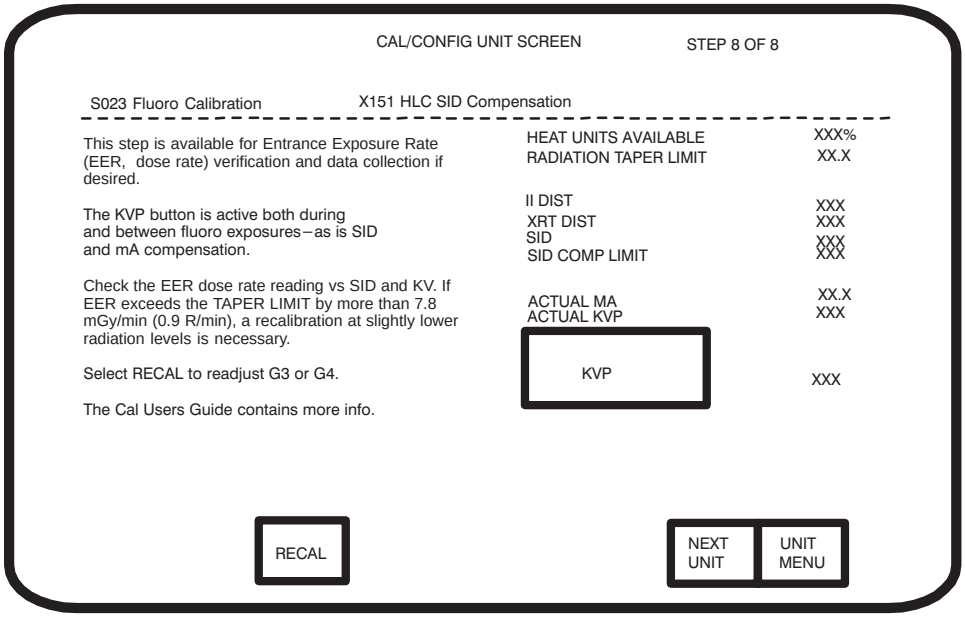
- Terminate the exposure.
- If the EER, at any kVp increment and SID, exceeds the RADIATION TAPER LIMIT displayed on the console screen by more than 7.8 mGy/min (0.9 R/min), a recalibration at slightly lower radiation levels is required.
- If a recalibration is required, touch the RECAL softkey and readjust G3 (Step 5) or G4 (Step 6).
- Verify the results of any re-calibrations by repeating Step 8.
- If the EER at any kVp increment at min SID is different by more than 7.8 μGy/min (0.9 mR/min) from that at the SID comp limit, a recalibration is recommended.
- Touch the NEXT UNIT or UNIT MENU softkey to exit.

4-8-1 Special instructions regarding verification

If the table top EER is low, review the following special instructions before proceeding with a recalibration. Do not just recal at a higher EER value.

1. MA compensation will compensate for x–ray tube heating and cooling effects as well as filament aging.
2. If the SID is larger than the value calibrated in SID Watt Limiter, then the display of the SID Comp Limit value will be blinking in inverse video. In that case, the EER will be lower than the calibrated values.

X151 STEP 8 SCREEN DISPLAY



UNIT X152 – DX HLC ABC Response

Time: x h xx min – Personnel: 1 field engineer

1 DESCRIPTION

Calibration Unit X152 adjusts the DLX ABC response time parameters for HLC (RADCNTRL, KVPCNTRL, and VGCNTRL) to maintain a light output from the Image Intensifier tube that is constant during DLX operation regardless of variations in system geometry or thickness and density of the object being scanned. Four steps are required to accomplish the calibration. A screen display is provided for each step.

2 SPECIAL INSTRUCTIONS

Communication must be established with the DLX prior to the display of the Step 1 screen. If that fails, an error message is displayed and the unit will only function in the browse mode. To ensure communication with the DLX, perform the following:

- On the DLX console, at the “DLX LOGIN” prompt, type “DLX” followed by pressing the RETURN key.
- Verify DLX console displays the ACQUISITION screen. If not, select the following keys to continue:
  NEW PATIENT (you must also enter patient name and ID number or the DLX will not be enabled)
  NEW EXAM

3 EQUIPMENT REQUIRED

Filtration (1/4 aluminum, 1/32 inch copper, 2–1/4 inches acrylic), oscilloscope, and test leads.

4 TEST SETUP

Setup the oscilloscope as follows:

VERT AMPL: 0.5 V/cm
TIME BASE: 0.5 sec/cm
Connect probe to SKL A2 TP1 and chassis (ground).

Note: Normal calibration is accomplished with loop selection in ON position. Turning loop OFF during Damping Adjustment will result in performance viewed different from Applications. this selection allows isolating each loop to view individual performance only.

5 SPECIAL INSTRUCTIONS

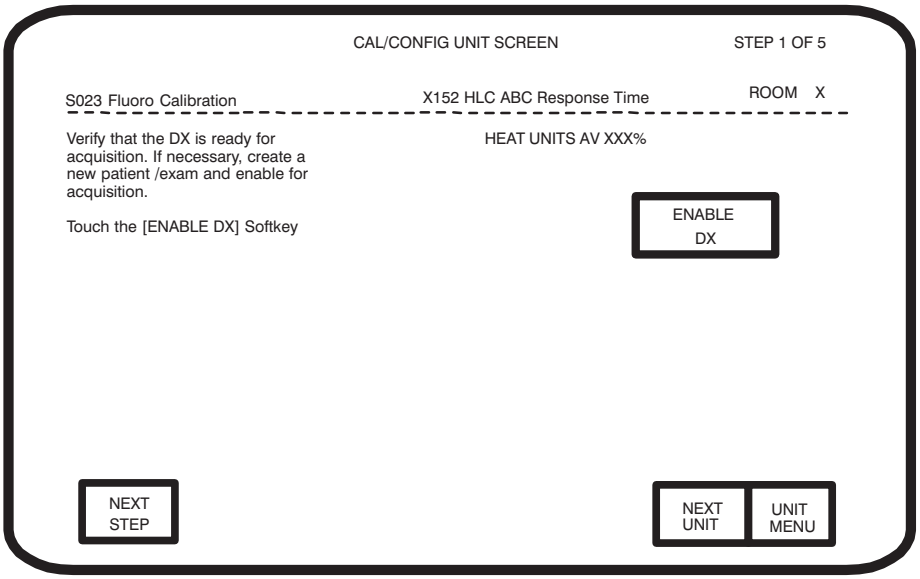
Note: **For Vascular Systems Only:** Before system calibration, verify that additional filter (copper–aluminum filter) is not installed on top of collimator. (Open sensor hinge assembly to verify.) If installed, remove before performing calibration.

6 CAL PROCEDURE

6-1 Step 1. Enable DX (DLX)

- Communication must be established with the DX (DLX) prior to selecting the ENABLE DX softkey. Selecting the ENABLE DX softkey puts the DX (DLX) into technical menu. If communication with the DX (DLX) fails, an error message is displayed and the unit will only function in the viewing (browse) mode.
  1. If necessary, create a new patient/exam and enable for acquisition.
  2. Touch the ENABLE DX softkey.
- Touch NEXT STEP softkey to proceed to Step 2. If the NEXT STEP softkey is pressed prior to pressing the ENABLE DX softkey, the viewing mode will be entered. Viewing mode allows cycling through the screen displays without doing a calibration.

X152 STEP 1 SCREEN DISPLAY



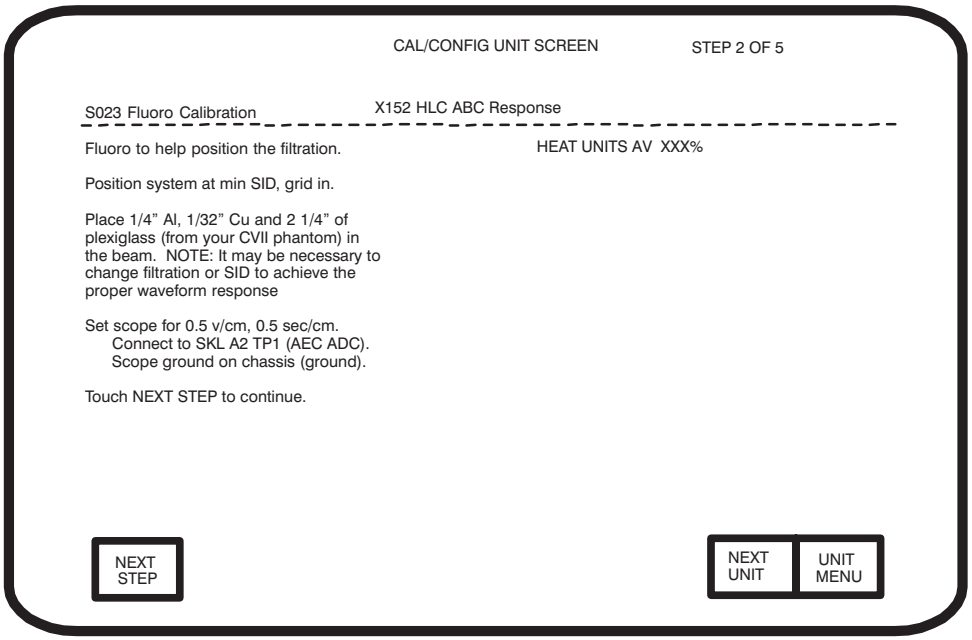
6-2 Step 2. Position Filtration

- Position the Image Intensifier tube and x–ray tube at minimum SID. On LU systems, position the table top 12 inches from the Image Intensifier tube.
- Position the grid in the beam.
- Place 1/32 inch of copper, 1/4 inch of aluminum, and 2–1/4 inches of acrylic on the table (stack with acrylic on the bottom and copper on the top).

Note: The calibration may require varying the filtration thickness or SID in order to achieve the proper square wave response in Step 3.

- Take fluoro exposures with the fluoro footswitch or console handswitch to assist in centering the filtration in the x–ray beam.
- Touch NEXT STEP softkey to proceed to Step 3.

X152 STEP 2 SCREEN DISPLAY



Note: The adjustments in the following steps of this unit are interactive. After all adjustments have been made, the waveform on the scope will appear more rounded than the square wave shown in Illustration 155.

6-3 Step 3. RADCNTRL Damping Factor Adjustment

- Take a fluoro exposure.
- While maintaining the exposure, touch RADCNTRL DAMPING FACTOR softkey and, using the console dial, adjust the value of the RADCNTRL DAMPING FACTOR until the brightness error signal observed on the oscilloscope is critically damped. See Illustration 155. Increase the damping until the error signal is ringing with overshoot. Then, decrease until ringing just disappears.

Note: The loop is critically damped when the square wave indicates no overshoot on the top and less than 250 mV overshoot on the bottom.

- Terminate the exposure and touch NEXT STEP softkey to proceed to Step 4.

X152 STEP 3 SCREEN DISPLAY

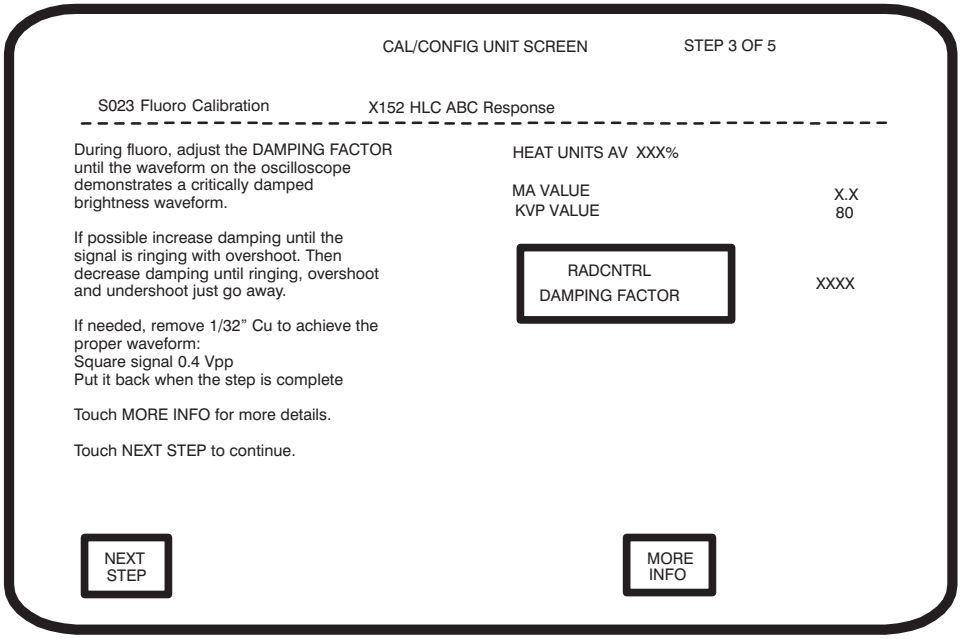
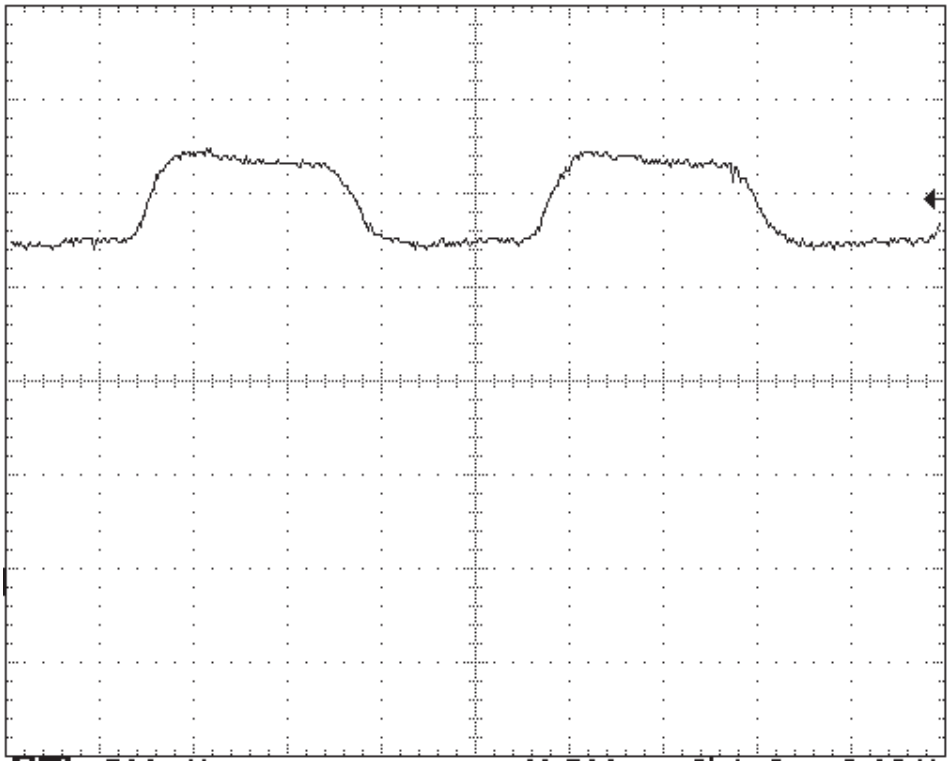


Illustration 155 – X152, Damping Adjustment



X152 STEPS 3, 4, AND 5 "MORE INFO" PAGE 1 SCREEN DISPLAY

CAL/CONFIG UNIT SCREEN STEP X OF 5

S023 Fluoro Calibration X152 HLC ABC Response Time

Page 1 of 3

ABC DAMPING INFORMATION

Both footswitch and handswitch are active during this unit.

The objective of adjusting ABC Damping is to allow the ABC to adjust to proper brightness as quickly as possible when the amount of xrays reaching the image intensifier changes, but still not have oscillation of brightness when the xray intensity at the II is constant.

In order to accomplish this, the ECM adds a square wave to the output of the brightness pickup. The ABC software then corrects. In a perfect world, the resulting signal at the AEC ABC test point would be a square wave with an average amplitude of 2V. The transfer function of the ABC does not allow this.

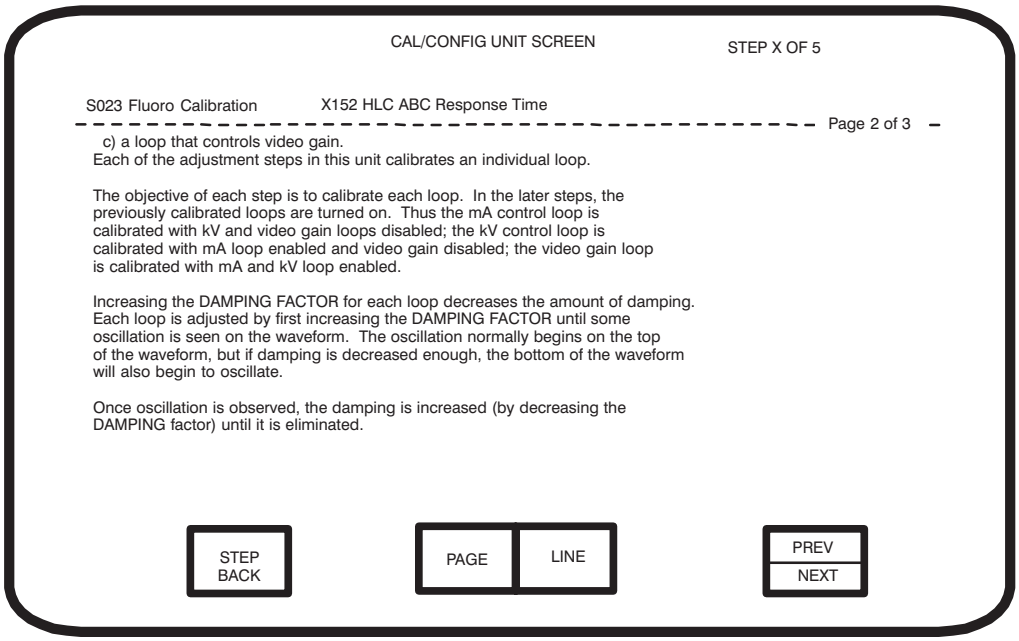
ABC control is composed of three main loops:

a) a loop that controls average mA by adjusting filament drive. On systems with pulsed fluoro, pulse width is also adjusted in this loop.

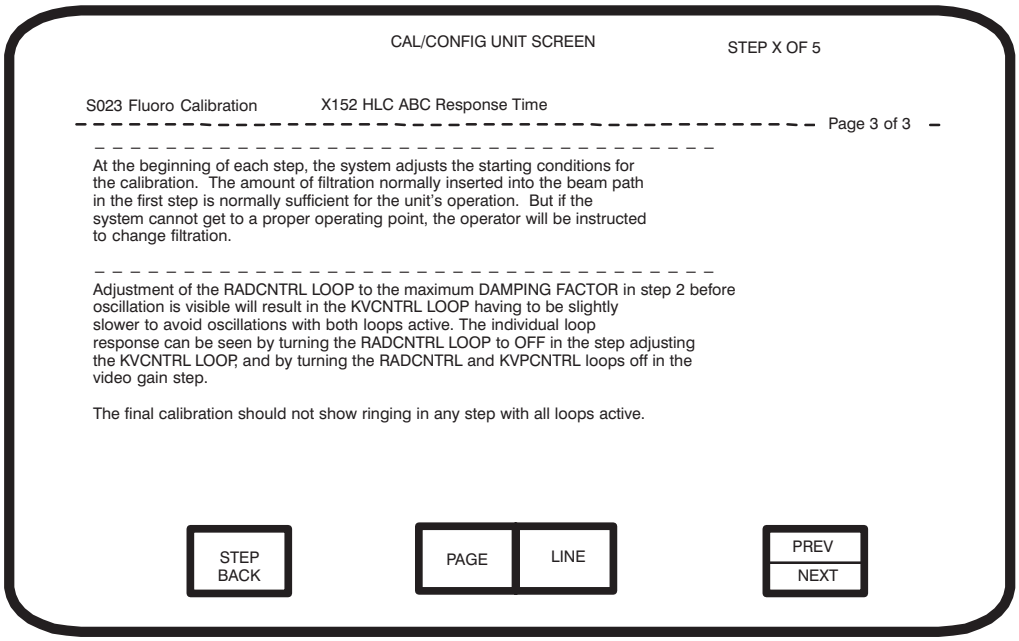
b) a loop that controls kVp.

STEP BACK | PAGE | LINE | PREV | NEXT

X152 STEPS 3, 4, AND 5 “MORE INFO” PAGE 2 SCREEN DISPLAY



X152 STEPS 3, 4, AND 5 “MORE INFO” PAGE 3 SCREEN DISPLAY



6-4 Step 4. KVPCNTRL Damping Factor Adjustment

- Take and maintain a fluoro exposure.
- Maintain the exposure until the “KVP OVERRIDE ADJUSTMENT COMPLETE” message is displayed.

Note: An ”ADJUSTING APERTURE/FOV FOR KVP OVERRIDE CONDITION” message is displayed while the override adjustment is being accomplished.

- Touch KVPCNTRL DAMPING FACTOR softkey and, using the console dial, adjust the value of the KVPCNTRL DAMPING FACTOR until the brightness error signal observed on the oscilloscope is critically damped. See Illustration 156.

Note: The KVP loop is slower than the RADCNTRL loop. This may produce an error signal response with more rounded edges.

- Touch NEXT STEP softkey to proceed to Step 5.

X152 STEP 4 SCREEN DISPLAY

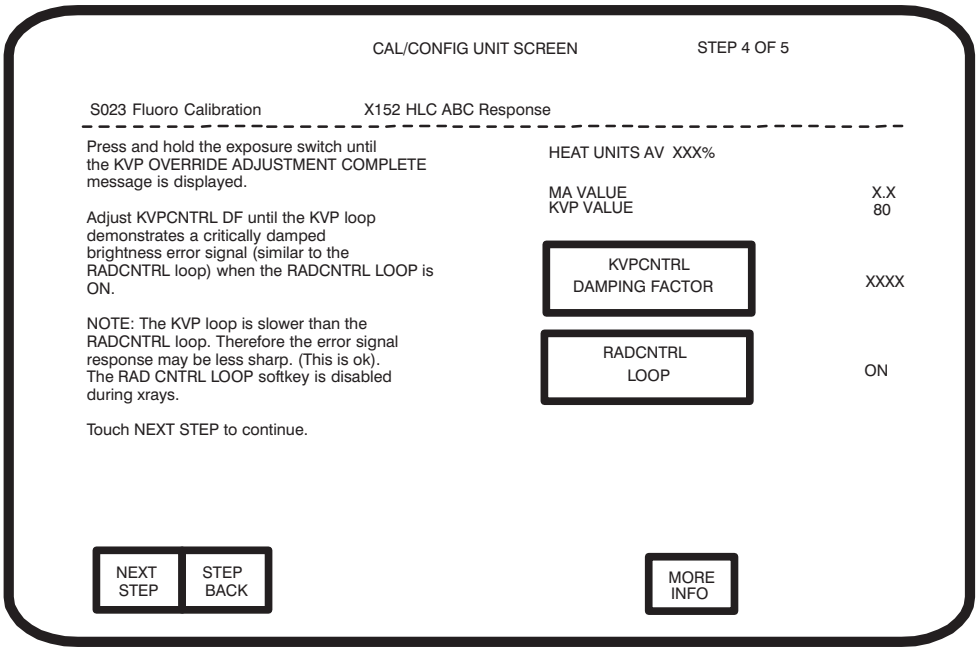
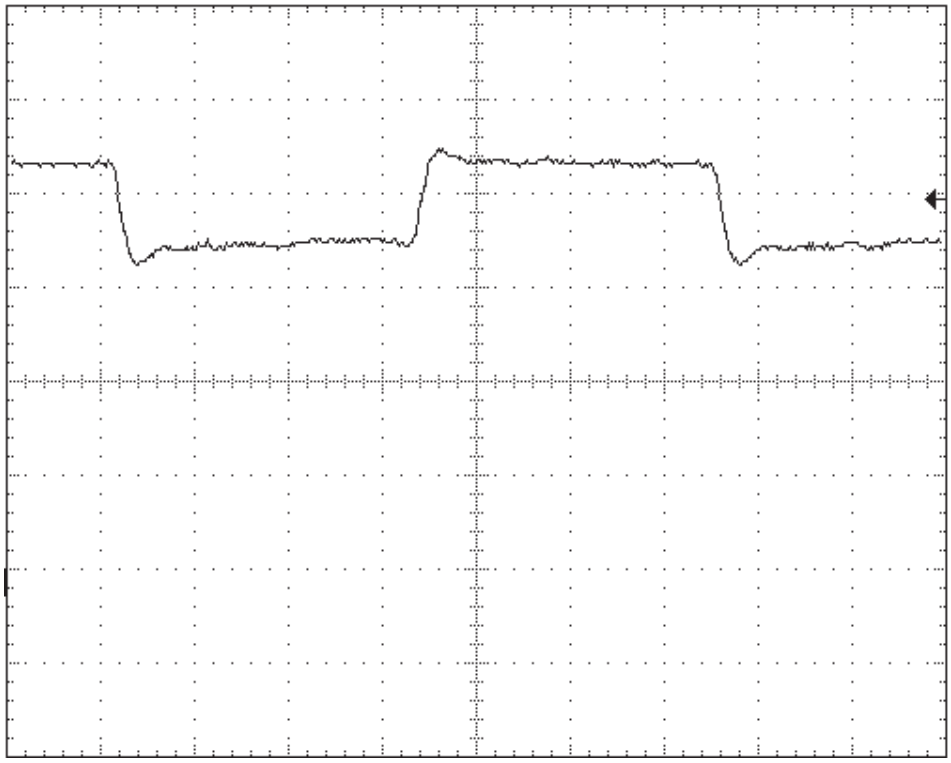


Illustration 156 – X152, KVPCNTRL Damping Adjustment



6-5 Step 5. VGCNTRL Damping Factor Adjustment

- Take a fluoro exposure.
- Maintain the exposure until the message “VIDEO GAIN OVERRIDE ADJUSTMENT COMPLETE” is displayed.

Note: The message “ADJUSTING APERTURE FOR VIDEO GAIN OVERRIDE CONDITION”is displayed while the override adjustment is being accomplished.

- Touch VGCNTRL DAMPING FACTOR softkey and, using the console dial, adjust the value of the VGCNTRL DAMPING FACTOR until the video loop indicates a critically damped brightness error signal on the oscilloscope (Similar to the RADCNTRL loop damping). See Illustration 157.
- Touch NEXT UNIT or UNIT MENU softkey to exit the calibration unit.

X152 STEP 5 SCREEN DISPLAY

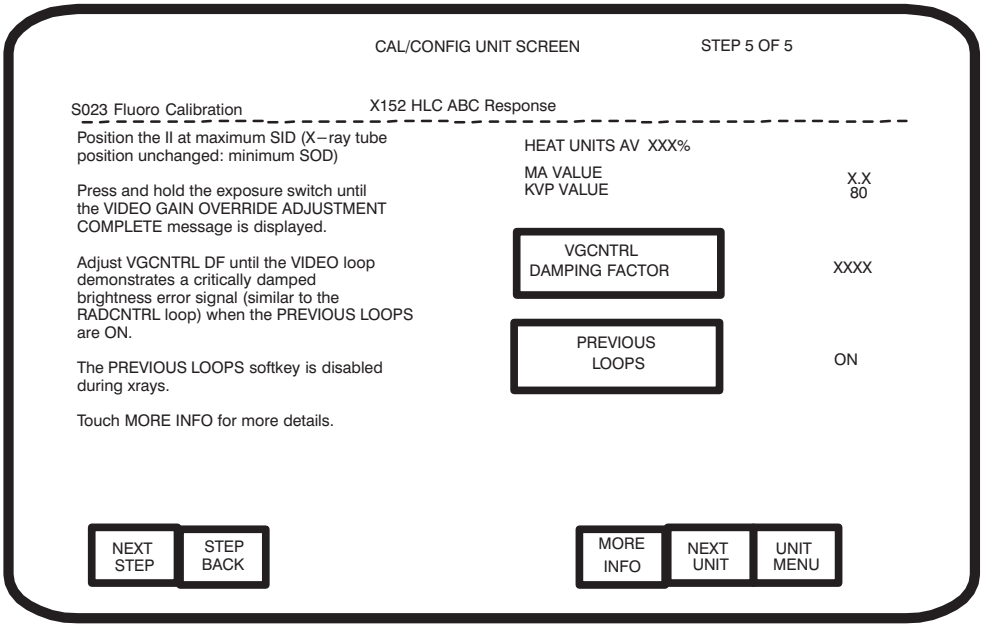
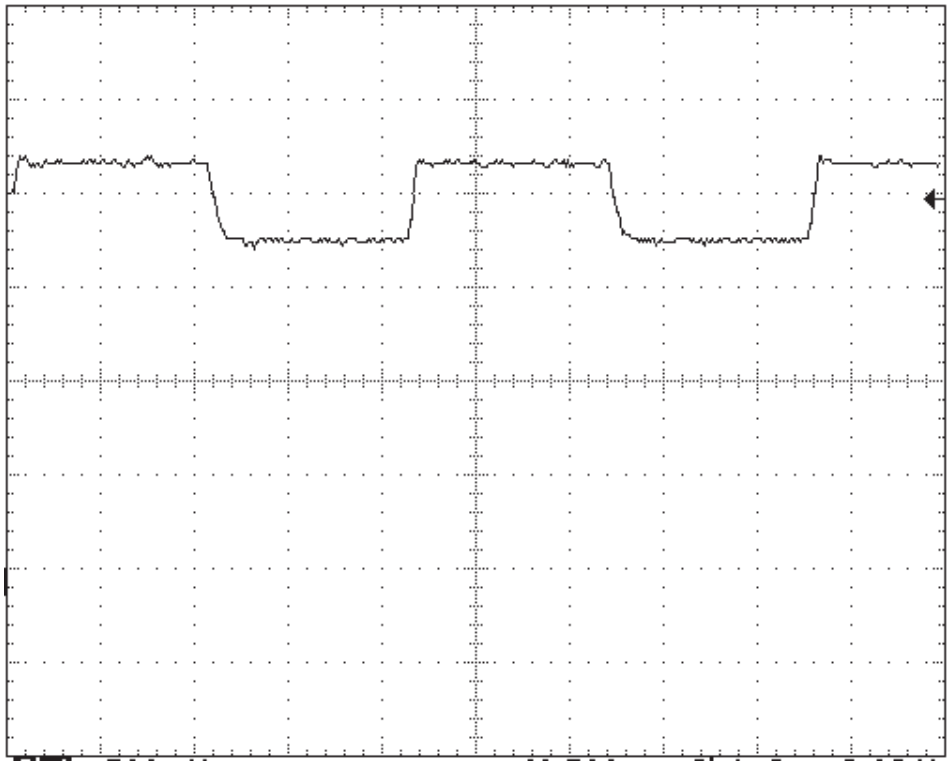


Illustration 157 – X152, VGCNTRL Damping Adjustment



ABC Calibration Units

Notepad

Units X100 – X143

Unit	Note

Blank page.

SECTION 10 – AUTOMATIC EXPOSURE CONTROL CALIBRATION

Unit	Title	Page
X200	AEC ION Chamber Calibration	931
X202	Receptor Master Density Calibration (Slow, Medium, Fast)	987
X203	AEC Grid Compensation	991
X204	kVp Compensation	995
X205	AEC Density Tweak	1001
X209	Photocell Calibration	1003
X211	Dynamic Dose Scaling DX (DLX)	1007
X212	Cine Film Density Calibration	1009
X213	Cine Dose	1021
X214	DX (DLX) Vascular Dose	1023
X217	Cine Video Presentation	1029
X218	Digital Record Dose (DR or DRS)	1033
X219	Digital Record Video Presentation	1037
X220	Manual Cine/Fluoro Tool	1043
X221	Spot Film Video Presentation	1051
X222	Film Changer Video Adjustment	1057
X225	Fluoro AGC Brightness Taper	1063
X233	Fluoro Iris Adjust	1069

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UNIT X200 – AEC Ion Chamber Calibration

Time: x h xx min – Personnel: 1 field engineer

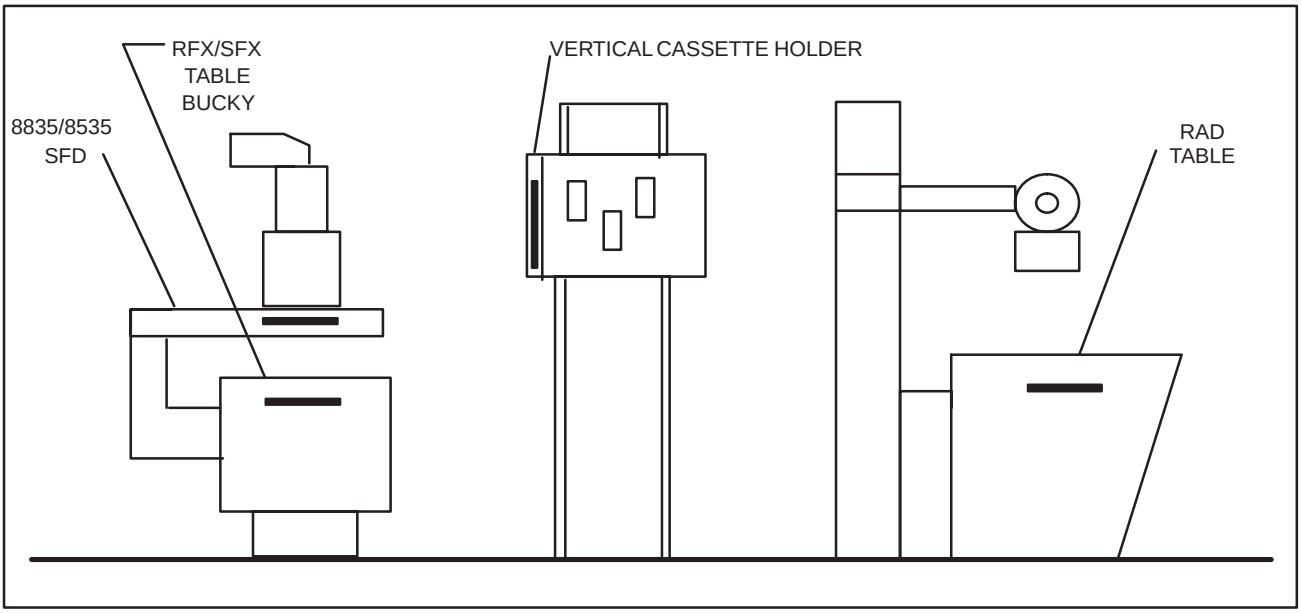
1 X200, AEC ION CHAMBER CALIBRATION (OLD PROCEDURE)

1-1 Description

Calibration unit X200 adjusts each area field detector in an ION Chamber for an output voltage that is proportional to the product of radiation intensity and expose time. Also this unit establishes the correct Master density setting for the slowest screen/film speed combination used in the system (Master density settings for any faster screen/film combinations are set in Cal unit X202). As many as ten steps may be required to accomplish complete calibration. A screen display is provided for each step. **This calibration must be performed on each ION Chamber used in the system.** See Illustration 158.

When calibrating the ION Chambers in the SFD, this unit can be run in two modes: a 35 cm x 35 cm (14″ x 14″) cassette mode and the SFD ALTERNATE CASSETTE SIZE mode. The alternate cassette size mode allows the use of any spotfilm compatible cassette size if your site will never use 35 cm x 35 cm. The SFD ALTERNATE CASSETTE SIZE mode will skip steps 3, 4, 9 and 10 (ion chamber balance) since these steps require the use of a 35 cm x 35 cm cassette and only 35 cm x 35 cm, 1 on 1 format, uses ion chamber fields 1 and 3. Also a unique STEP 6 screen will appear when the SFD ALTERNATE CASSETTE SIZE mode is selected (option available for SFD receptor only).

Illustration 158 – Ion Chamber Locations



1-2 Equipment required

Cassette (SFD: 35 cm x 35 cm or Alternate, Wall or Table receptor: 35 cm x 43 cm or 35 cm x 35 cm), film, non–metallic trimpot adjusting tool, Plexiglas phantom kit (or one 1/32″ copper sheet and one 1/4″ aluminum sheet from the CV phantom may be used as an alternate filtration device), densitometer, and service tool kit.

1-3 Cal Procedure

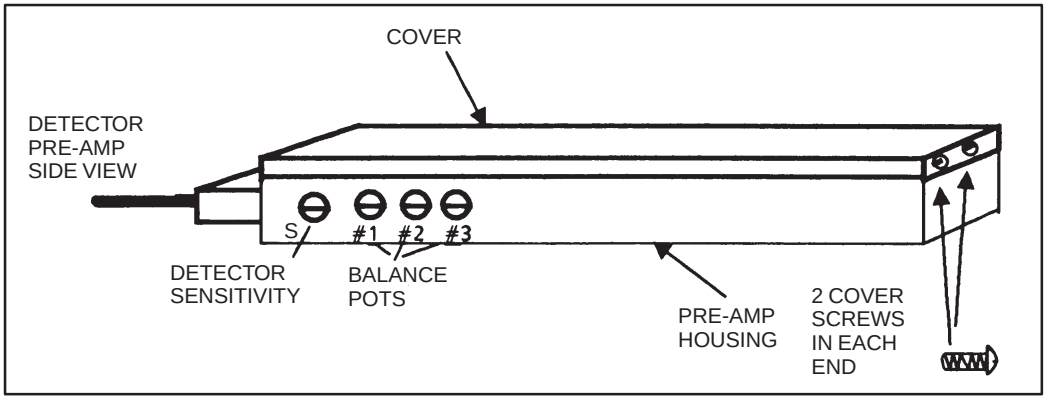
1-3-1 Step 1. Receptor Initialization

- Select the receptor mode at the table if applicable (on VRT configured systems, select RAD MODE at the table controls).
- Load the appropriate cassette size in the receptor selected; for SFD: 35 cm x 35 cm or Alternate, Wall or Table receptor: 35 cm x 43 cm or 35 cm x 35 cm
- Remove four hole plugs (if present) from the SENSITIVITY and BALANCE potentiometer access holes in the ION Chamber. See Illustration 159.

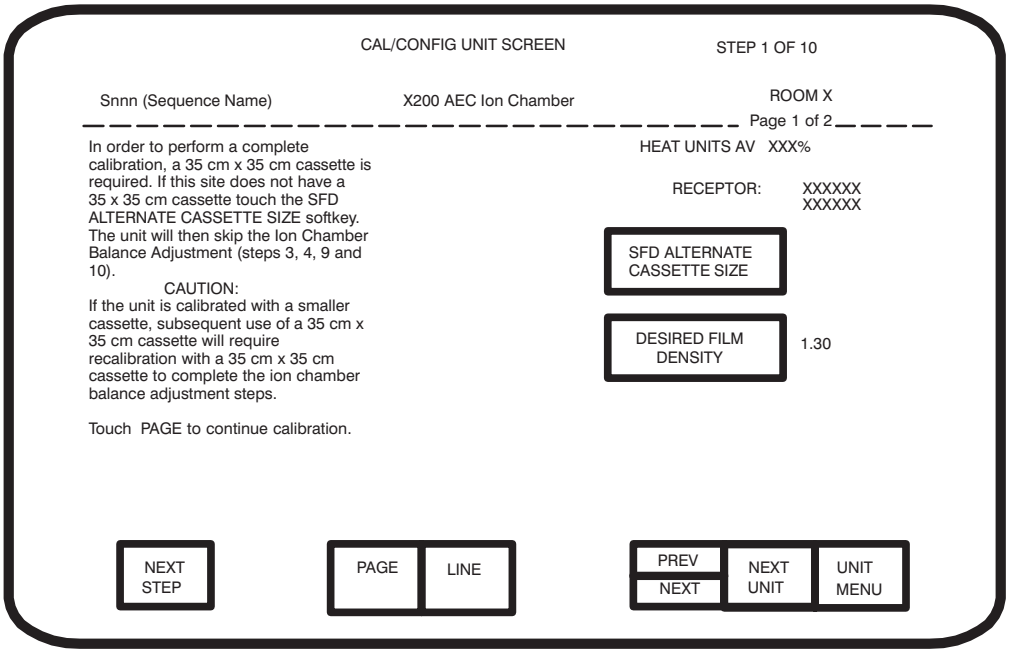
Note: The SENSITIVITY and BALANCE potentiometers are 30 turn pots.

- Set the SENSITIVITY potentiometer (S) fully clockwise and the three BALANCE potentiometers (BAL 1, BAL 2, and BAL 3) to MID RANGE.
- Systems configured with preamp board 46–288266G1, verify or set DIP switch S1 as follows: S1–3 (ON) S1–1, S–2, S– 4 (OFF). All other preamp PWB's, clip out capacitor C7, if present.

Illustration 159 – Ion Chamber Potentiometer Locations



X200 STEP 1 SCREEN DISPLAY, PAGE 1 FOR SFD



- For the SFD Ion Chamber Calibration, a 2 page Step 1 screen is presented. Page 1 informs the service personnel of the SFD ALTERNATE CASSETTE SIZE softkey:
  - Press the SFD ALTERNATE CASSETTE SIZE softkey on page 1 of screen 1 if site does not use a 35 cm x 35 cm cassette.
  - Press the PAGE softkey to go to page 2 of step 1.
- Wall and Table Bucky Ion Chamber Calibration continue to have a 1 page step 1 screen.

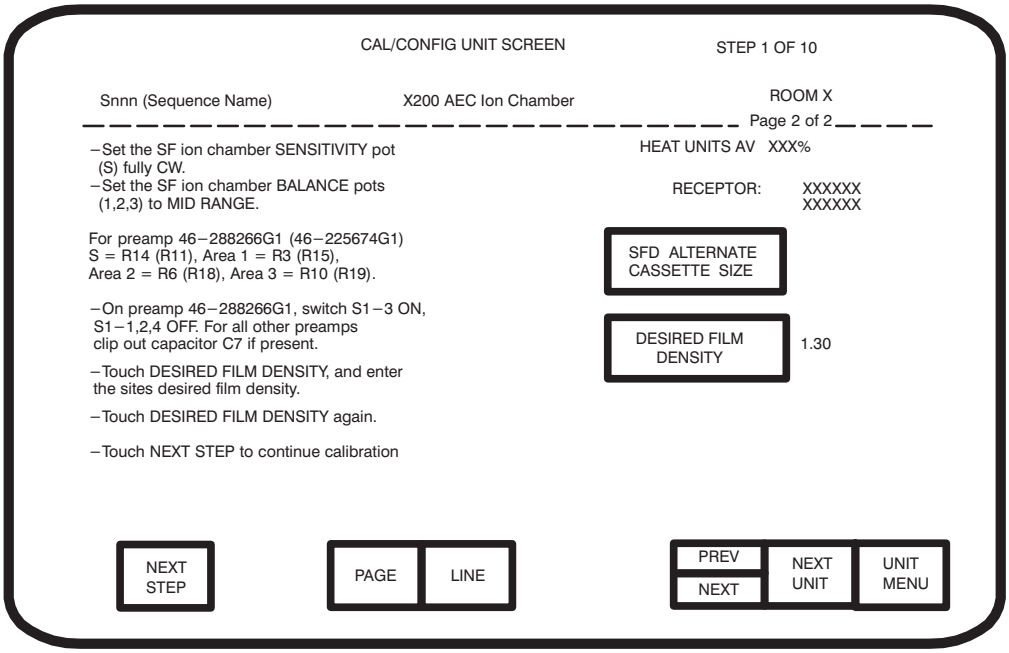
Note: A default film density of 1.3 will appear on the console screen as the DESIRED FILM DENSITY when first entering unit.

- Touch DESIRED FILM DENSITY softkey to highlight key
- Enter value desired via console knob.
- Touch DESIRED FILM DENSITY softkey again to de-highlight key and acknowledge entry.

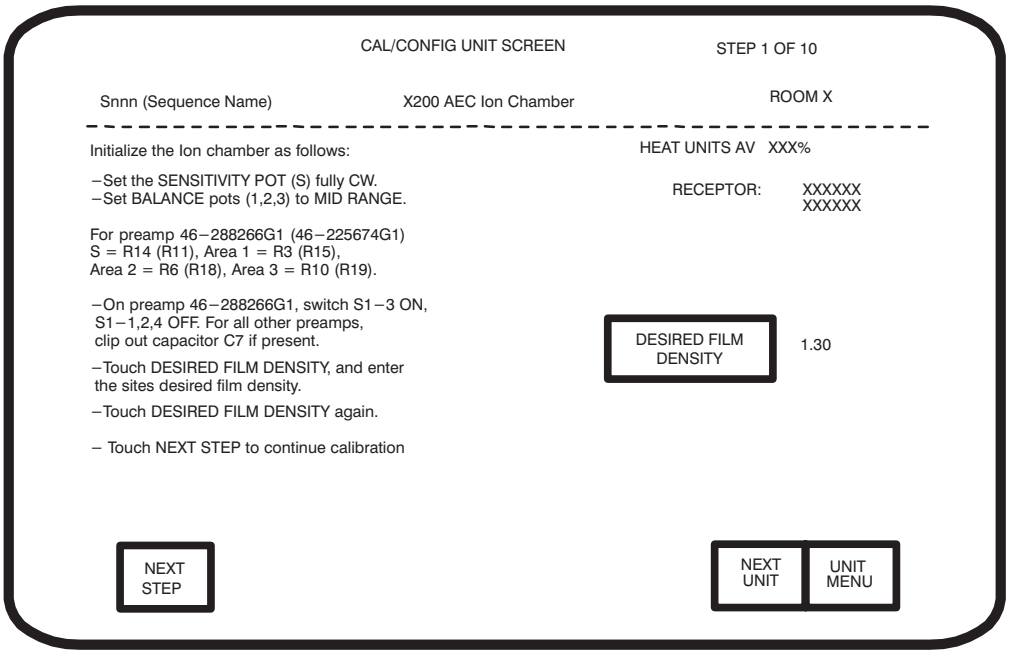
Note: If the DESIRED FILM DENSITY softkey is not selected and then deselected, all future steps will be accessed in the “VIEWING” mode. Screens that do not show the Next Unit and Unit Menu buttons will have them when in viewing mode and not in step 1.

- Touch NEXT STEP softkey to continue to Step 2.

X200 STEP 1 SCREEN DISPLAY, PAGE 2 FOR SFD



X200 STEP 1 SCREEN DISPLAY, NON SFD

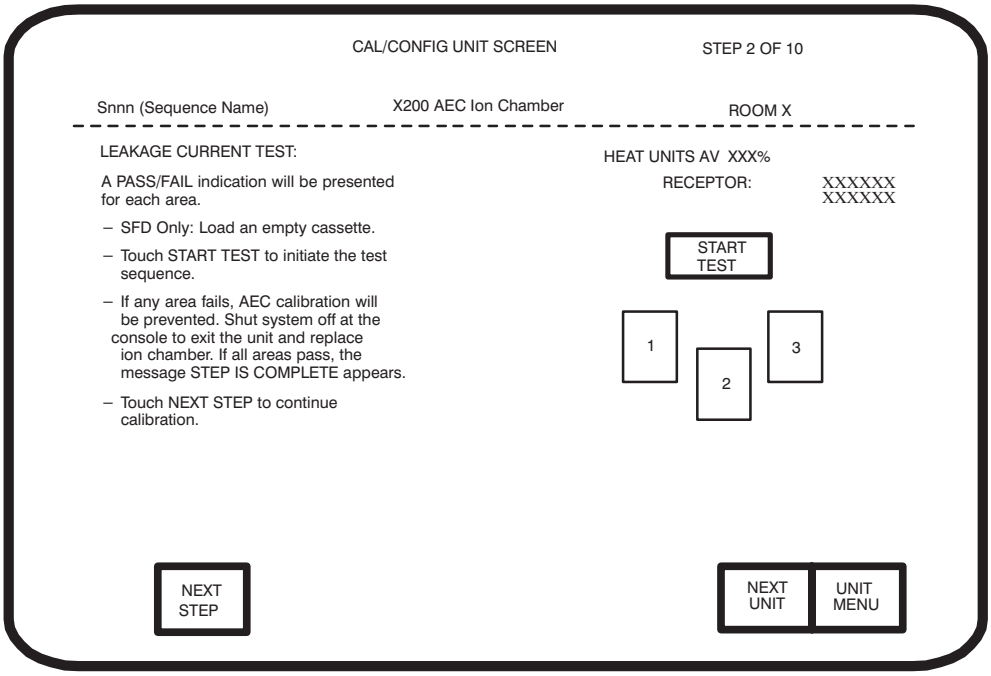


1-3-2 Step 2. Leakage Current Test

- **Spot Film Device Only:** Load an empty cassette into the SFD.
- Touch START TEST softkey. Simulated exposures will be taken to test each detector area of the ION Chamber. For normal operation, these exposures should be terminated by the backup timer, a “PASS” message should appear indicating that leakage is considered to be below the maximum allowed. If any one of the exposures is terminated before the backup time is reached, leakage is considered excessive and a “FAIL” message will appear.
- After each area of the ion chamber is tested, a “PASS” or “FAIL” message will appear directly below the area symbol on the screen. If any area fails, the NEXT STEP softkey is disabled. Replace the ION Chamber and return to Step 1 of the calibration. If all areas pass, the “STEP IS COMPLETE” message will appear.
- Touch NEXT STEP softkey to proceed to Step 3 (or Step 6 if SFD ALTERNATE CASSETTE SIZE softkey had been selected in Step 1 of SFD screen).

Note: The NEXT STEP softkey is disabled until the operator completes this step by touching the START TEST softkey.

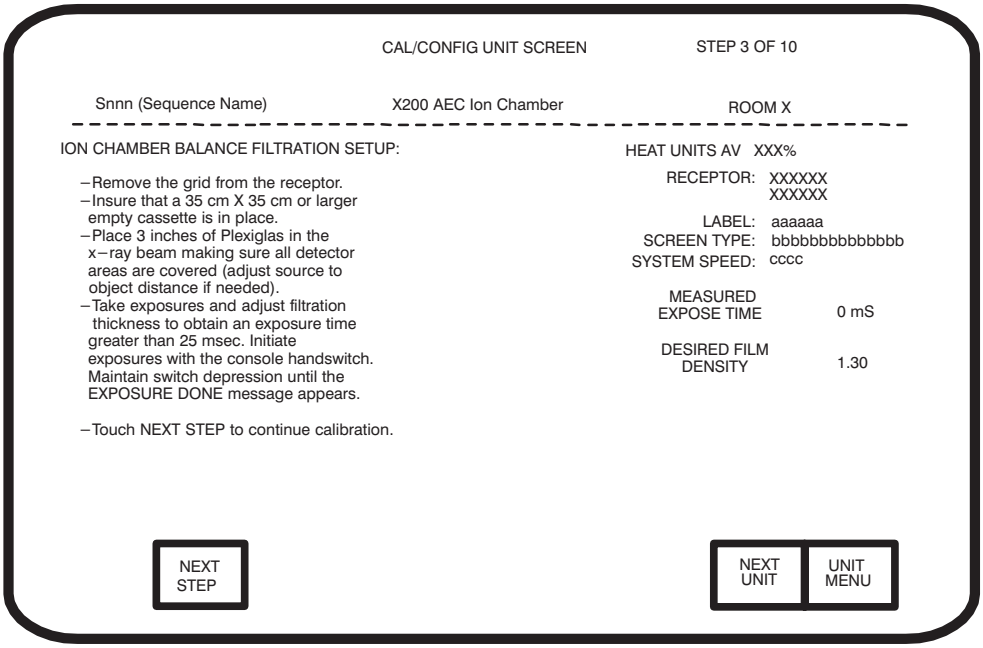
X200 STEP 2 SCREEN DISPLAY



1-3-3 Step 3. Ion Chamber Balance Filtration Setup

- Remove the grid (or deselect the selected grid on a SFD) from the receptor to be calibrated.
- Select Auto collimation mode, if performing this step on a SFD.
- Insure that an empty 35 cm X 35 cm cassette is loaded into the receptor.
- Place three inches of Plexiglas in the center of the x–ray beam (one 1/32″ copper sheet and one 1/4″ aluminum sheet from the CV phantom may be used as an alternate filtration device).
- Take successive exposures and adjust the filtration thickness to obtain an exposure time greater than 25 msec. (Adding more sheets gives you longer exposure times, and vice versa.)
- Press and hold the PREP and EXPOSE switches to initiate an exposure. Release the switches when the “EXPOSURE DONE” message appears.
- Touch NEXT STEP softkey to proceed to Step 4.

X200 STEP 3 SCREEN DISPLAY



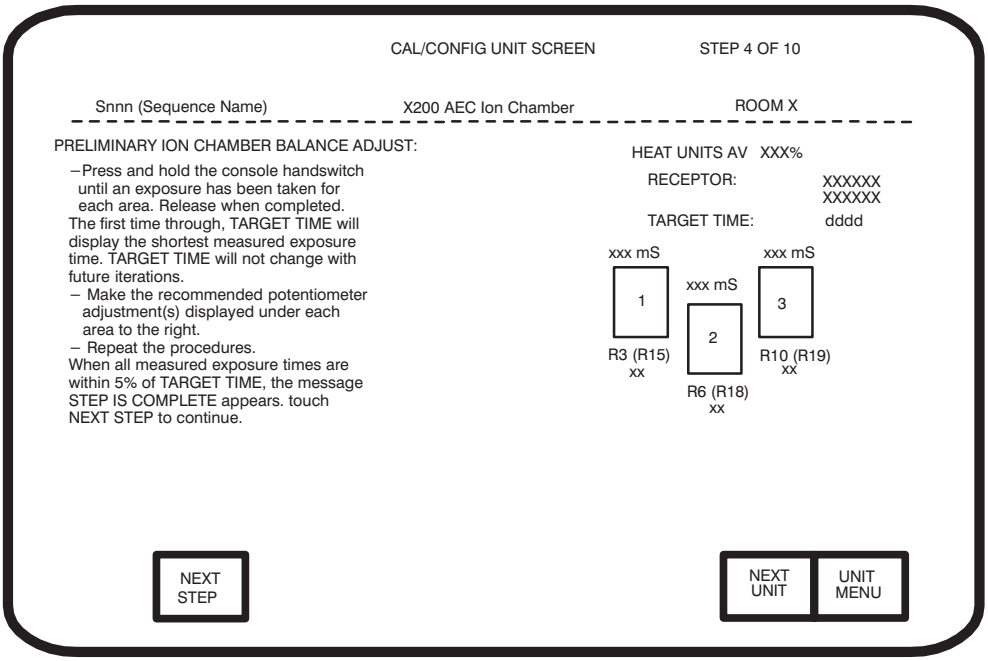
1-3-4 Step 4. Ion Chamber Rough Balance Adjust

- Insure that the filtration from the previous step covers all of of the ion chamber areas.

Note: If one or more of the ion chamber area(s) are exposed to less (or no) filtration, when compared to the other area(s), the time balancing algorithm will predict wrong adjustments. The remedy for this condition is to start the unit over again and insure that all 3 areas are covered by the filtration.

- Press and hold the PREP and EXPOSE switches. Release the switches after an exposure has been taken for each detector area of the ION Chamber and a TARGET TIME is displayed on the screen.
- Adjust BALANCE potentiometers as recommended under each area display on console screen. Each area display will indicate the number of turns and the direction to adjust the applicable potentiometer.
- Repeat taking exposures and adjusting the potentiometers. When the exposure time is within $\pm$ 5 percent of the TARGET TIME, a “STEP IS COMPLETE” message appears.
- Touch NEXT STEP softkey to proceed to Step 5.

X200 STEP 4 SCREEN DISPLAY



1-3-5 Step 5. Setup and Master Density Measurement

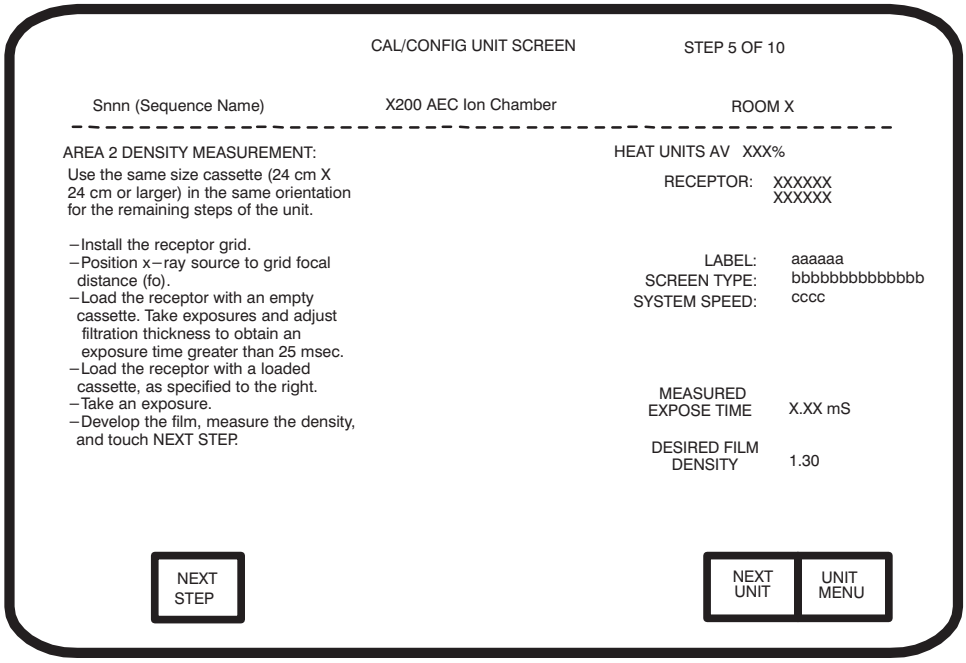
Note: Use the same size cassette (24 cm X 24 cm or larger) in the same orientation for the remaining steps in this calibration unit.

- **Install the grid in the Receptor.**
- **Set the x–ray source to grid distance to the marked focal distance (fo) of the grid.**

Note: The grid (fo) is usually stamped on the edge of a grid and/or will be listed on the grid label in centimeters.

- Load the receptor with an empty cassette.
- Place three inches of Plexiglas in the center of the x–ray beam (one 1/32″ copper sheet and one 1/4″ aluminum sheet from the CV phantom may be used as an alternate filtration device).
- Take successive exposures and adjust the filtration thickness to obtain an exposure time greater than 25 msec. (Adding more sheets gives you longer exposure times, and vice versa.)
- Load the receptor with a loaded cassette (use screen/film combination stated on console screen).
- Press the PREP and EXPOSE switches to take an exposure. Release the switches when the “EXPOSURE DONE” message appears. Develop the film. Measure the film density with a densitometer. Record the density value.
- Touch NEXT STEP softkey to proceed to Step 6.

X200 STEP 5 SCREEN DISPLAY



1-3-6 Step 6. Density Comparison, SFD Screen with Alternative Cassette Size Selected

- Touch ACTUAL FILM DENSITY softkey and use the console dial to enter the density value recorded in step 5.
- Touch ACTUAL FILM DENSITY softkey again to enter the value into the system. The system will compare the ACTUAL FILM DENSITY value to the DESIRED FILM DENSITY value. Continue the calibration as follows:

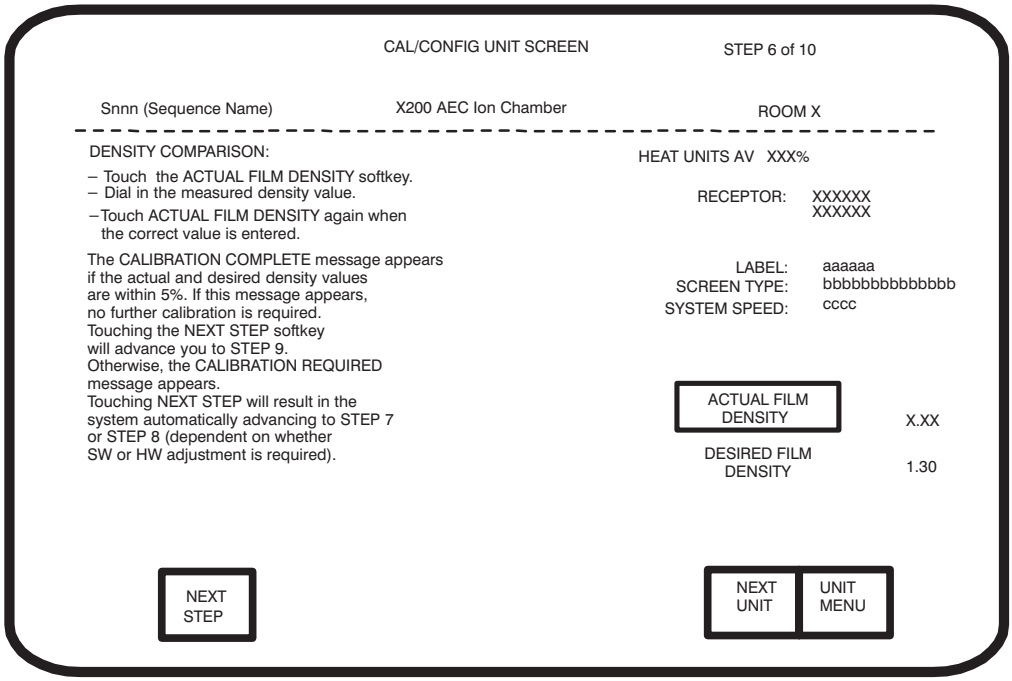
  1. If the ACTUAL FILM DENSITY value is within ± 5 percent of the DESIRED FILM DENSITY value a “CALIBRATION COMPLETE” message is displayed. Touch NEXT UNIT or UNIT MENU sofkeys to exit unit and update NV ram.

- Install hole plug (if provided) in the access hole for the SENSITIVITY potentiometer.

OR

  2. If a “CALIBRATION REQUIRED” message appears, further calibration is necessary. If the initial density was too light, the cal unit will automatically proceed to Step 8 when NEXT STEP softkey is touched. (Step 8 provides SENSITIVITY pot adjustment to increase film density.) If the initial density was too dark, the cal unit will automatically proceed to Step 7 when the NEXT STEP softkey is touched. (Step 7 provides a software gain adjustment to decrease film density.) Once the adjustment step is selected by the unit (hardware, Step 8 or software, Step 7), that procedure must be followed until the density is set and you return to Step 5 and Step 6 and get a “CALIBRATION COMPLETE” message. The procedure will not jump between Step 7 and Step 8.

X200 STEP 6 SCREEN DISPLAY FOR SFD WITH ALTERNATE CASSETTE SIZE SELECTED



1-3-7 Step 6. Density Comparison, Standard SFD and Non SFD Screen

- Touch ACTUAL FILM DENSITY softkey and use the console dial to enter the density value recorded in step 5.
- Touch ACTUAL FILM DENSITY softkey again to enter the value into the system. The system will compare the ACTUAL FILM DENSITY value to the DESIRED FILM DENSITY value. Continue the calibration as follows:

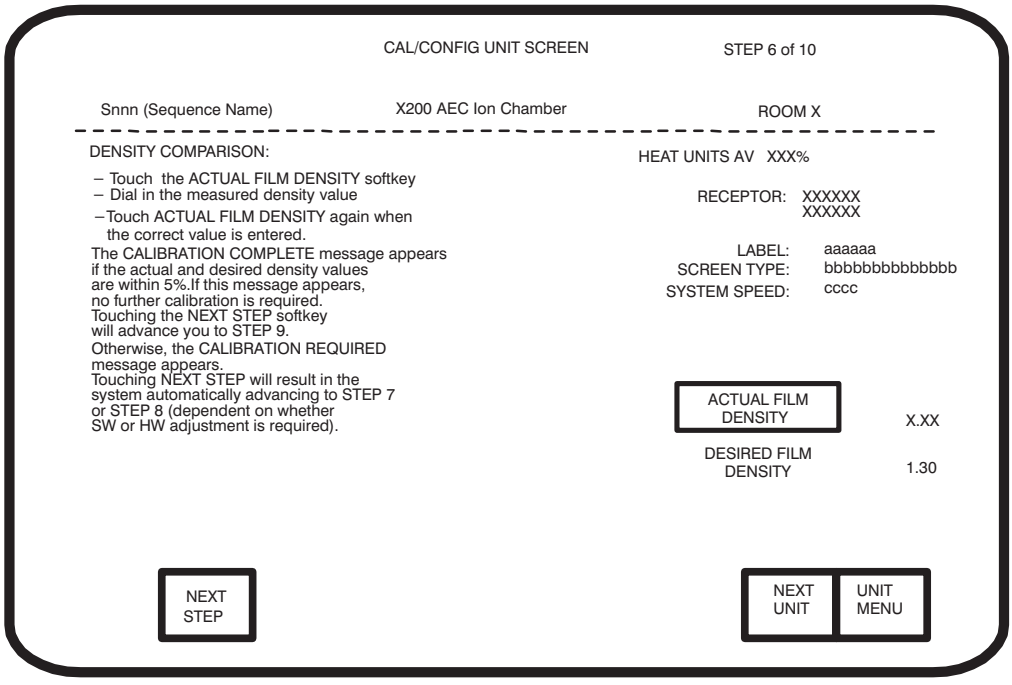
  1. If the ACTUAL FILM DENSITY value is within ± 5 percent of the DESIRED FILM DENSITY value a “CALIBRATION COMPLETE” message is displayed and touching NEXT STEP will send you to STEP 9 of the cal unit.

- Install hole plug (if provided) in the access hole for the SENSITIVITY potentiometer.

OR

  2. If a “CALIBRATION REQUIRED” message appears, further calibration is necessary. If the initial density was too light, the cal unit will automatically proceed to Step 8 when NEXT STEP softkey is touched. (Step 8 provides SENSITIVITY pot adjustment to increase film density.) If the initial density was too dark, the cal unit will automatically proceed to Step 7 when the NEXT STEP softkey is touched. (Step 7 provides a software gain adjustment to decrease film density.) Once the adjustment step is selected by the unit (hardware, Step 8 or software, Step 7), that procedure must be followed until the density is set and you return to Step 5 and Step 6 and get a “CALIBRATION COMPLETE” message. The procedure will not jump between Step 7 and Step 8.

X200 STEP 6 SCREEN DISPLAY
STANDARD SFD AND NON-SFD

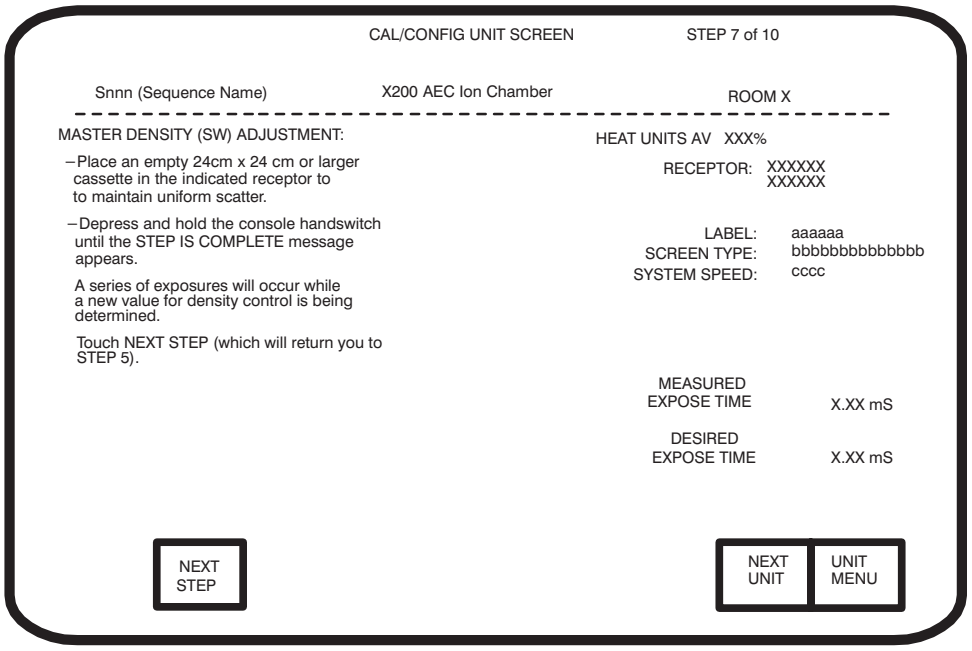


1-3-8 Step 7. Master Density (SW) Adjustment

- Load an empty cassette in the same size and orientation into the receptor to maintain uniform scatter.
- Press and hold the PREP and EXPOSE switches on the console handswitch. A series of exposures will be taken while a new value for density control is being calculated by system software.
- Terminate the exposure when the “STEP IS COMPLETE” message appears.
- Touch NEXT STEP softkey to return to Step 5, Density Comparison, and repeat the step.

Note: Exiting the calibration unit can only be accomplished by looping through Step 5 and 6 until the “CALIBRATION COMPLETE” message appears on the Step 6 screen display.

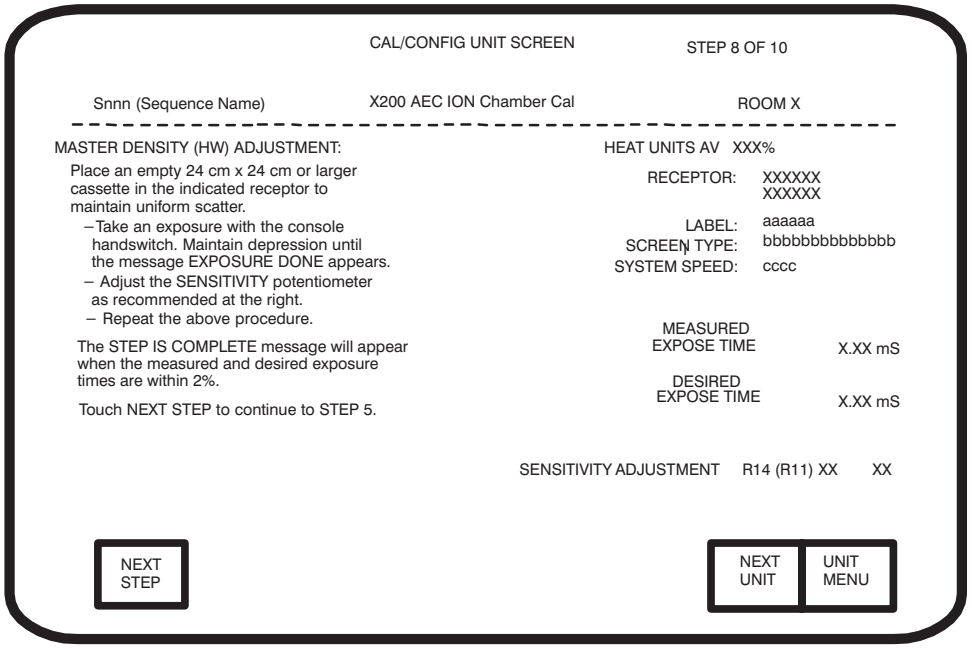
X200 STEP 7 SCREEN DISPLAY



1-3-9 Step 8. Master Density (HW) Adjustment

- Load an empty cassette (24 cm X 24 cm or larger) into the receptor to maintain scatter.
- Press and hold the PREP and EXPOSE switches until “EXPOSURE DONE” message appears.
- Adjust SENSITIVITY potentiometer R14 (or R11 for old preamp board) as recommended by the prompt on the screen.The R14 (R11) prompt will indicate the number of turns and the direction to adjust the potentiometer.
- Repeat taking exposures and adjusting the potentiometer. When the measured and desired exposure times are within ± 2 percent, a “STEP IS COMPLETE” message will appear.
- Touching the NEXT STEP softkey will return the calibration to Step 5. Repeat Step 5 to measure the adjusted film density value and Step 6 for density comparison. If the density is correct, the unit will proceed to STEP 9 when NEXT STEP is selected. If the film density is incorrect, STEP 7 or STEP 8 will be displayed.

X200 STEP 8 SCREEN DISPLAY



1-3-10 Step 9. Final Ion Chamber Balance Adjust

- When exposures are requested, press and hold the PREP and EXPOSE switch for each requested exposure.
- Load a 35 cm x 35 cm cassette with film and install it in the receptor.
- **Make sure that the x–ray source to grid distance matches the marked focal distance (fo) of the grid.**

Note: The grid (fo) is usually stamped on the edge of a grid and/or will be listed on the grid label in centimeters.

- Expose and develop film.
- Enter density measured under AREA 2 detector.
- Touch NEXT STEP softkey to proceed to Step 10.

X200 STEP 9 SCREEN DISPLAY

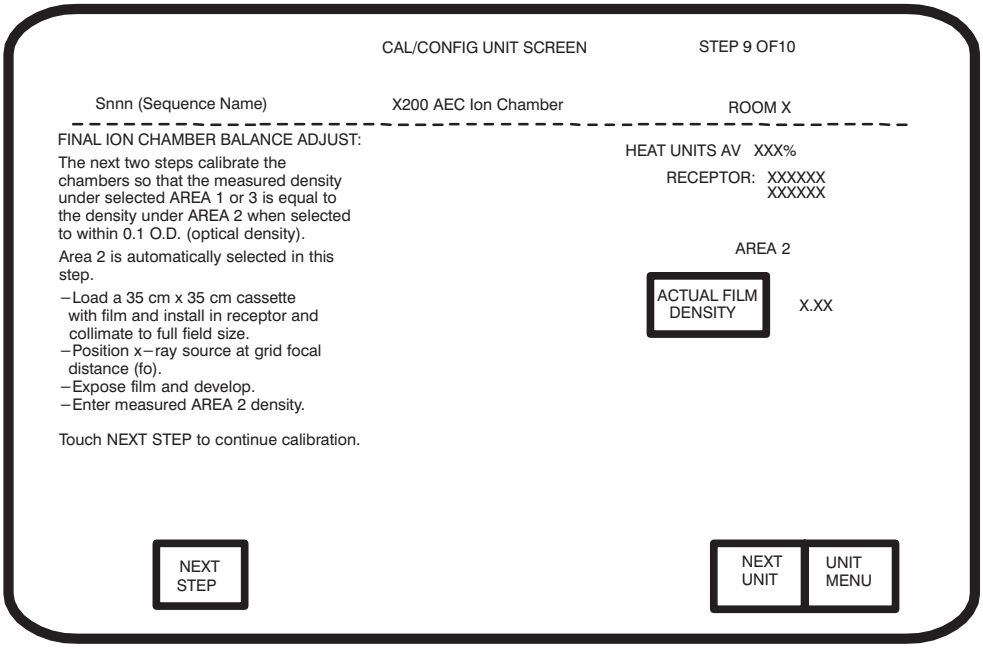
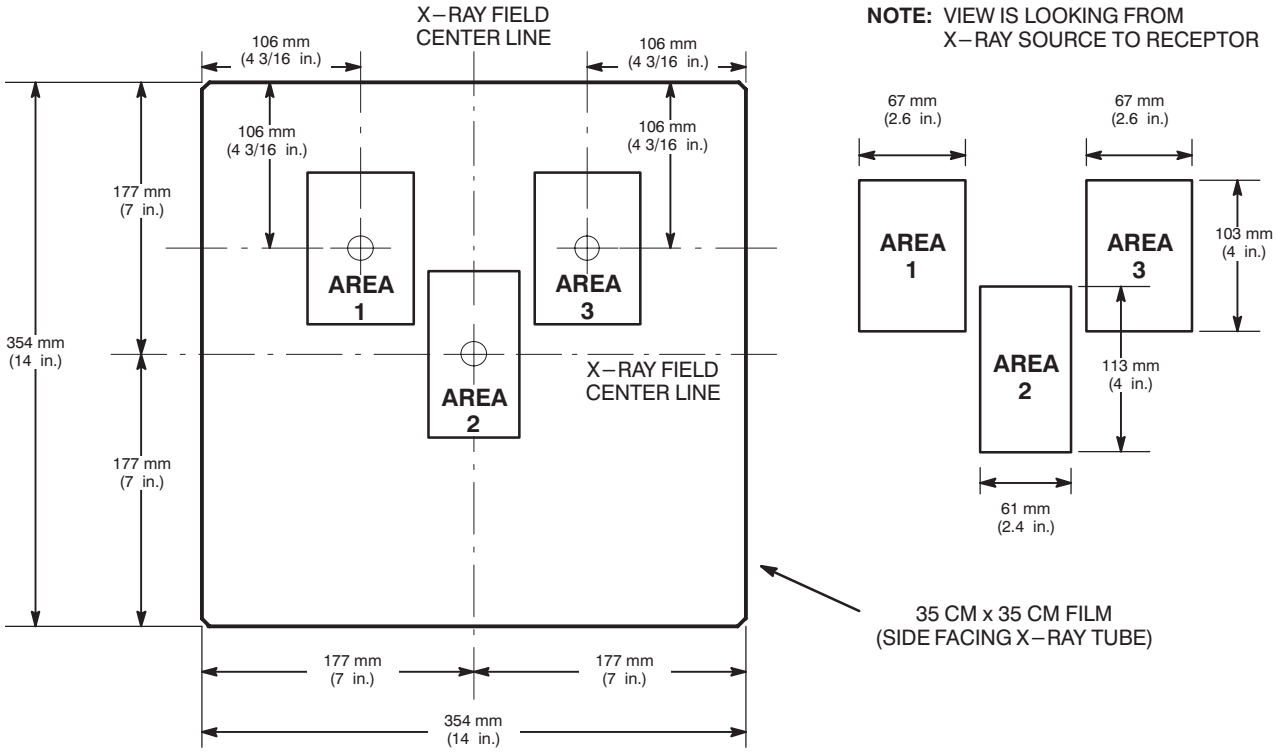


Illustration 160 – Ion Chamber Detector Area Locations on 35cm x 35 cm film (as Viewed from X–Ray Tube Focal Spot)



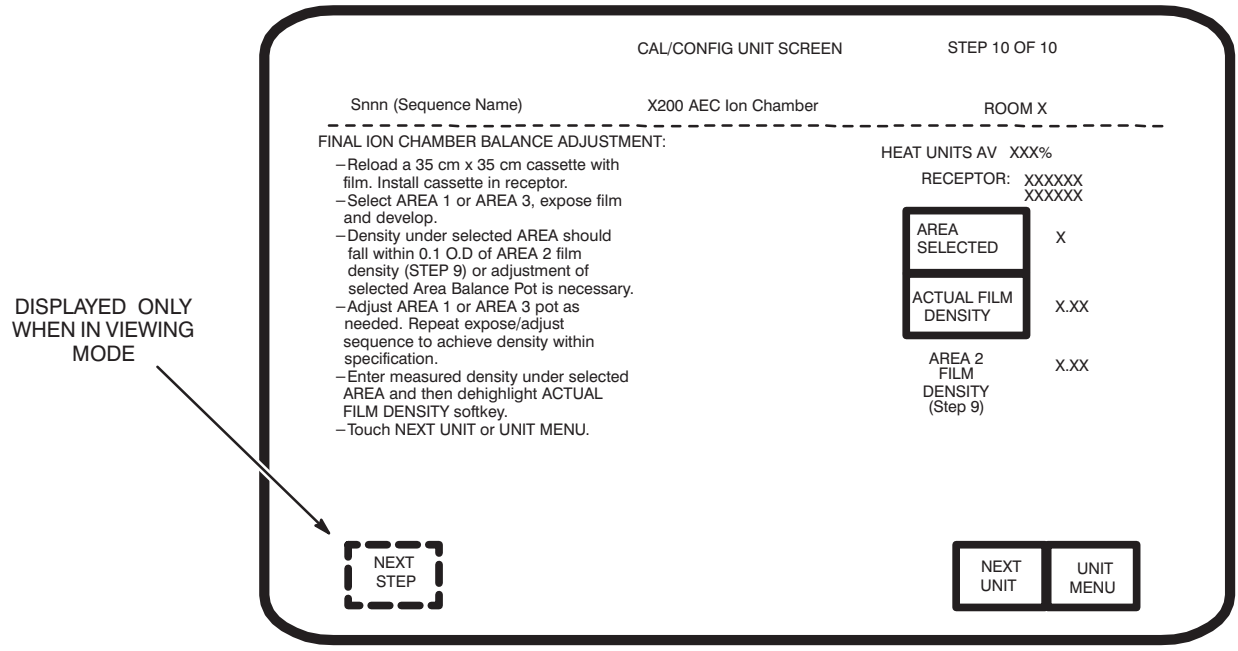
1-3-11 Step 10. Final Ion Chamber Balance Adjust

- When exposures are requested, press and hold the PREP and EXPOSE switch for each requested exposure.
- Re-load a 35 cm x 35 cm cassette with film. Install cassette in the receptor.
- Make sure full field size is selected, exposing AREA 1, AREA 2 and AREA 3.
- Touch AREA SELECT softkey and select AREA 1.
- Expose, develop film and measure the density under AREA 1 detector.
- Adjust AREA 1 BALANCE potentiometer R3 (R15 on older preamp board) as needed to obtain a film density within 0.1 O.D. (Optical Density) of that measured in AREA 2 (STEP 9).
- Repeat expose/adjust sequence until the density of the AREA 1 is within 0.1 O.D. of AREA 2.
- When satisfied, touch the ACTUAL FILM DENSITY softkey and enter value. Deselect softkey so it is de-highlighted after entry is made.
- Touch AREA SELECTED softkey and select AREA 3.
- Expose, develop film and measure the density under AREA 3 detector.
- Adjust AREA 3 BALANCE potentiometer R10 (R19 on older preamp board) as needed to obtain a film density within 0.1 O.D. of that measured in AREA 2 (STEP 9).
- Repeat expose/adjust sequence until the density of the AREA 3 is within 0.1 O.D. of AREA 2.
- When satisfied, touch the ACTUAL FILM DENSITY softkey and enter value. Deselect softkey so it is de-highlighted after entry is made.

Note: The NEXT UNIT or UNIT MENU softkeys will be disabled until both AREA 1 and AREA 3 measured densities match AREA 2 density within 0.1 O.D and the ACTUAL FILM DENSITY softkey is de-highlighted.

- Replace the three hole plugs (if provided) in the access holes for the balance potentiometers.

X200 STEP 10 SCREEN DISPLAY



2 X200, AEC ION CHAMBER CALIBRATION (NEW PROCEDURE)

2-1 Vertical Bucky Stand (VBS) Calibration

2-1-1 Description

This unit establishes the customer desired optical film density by calibrating the ion chamber to produce the same film density across all three areas on film. It uses the slowest screen/film speed combination configured in the system. (Master density settings for any faster screen/film combinations are set in Cal unit X202).

2-1-2 Procedure Summary

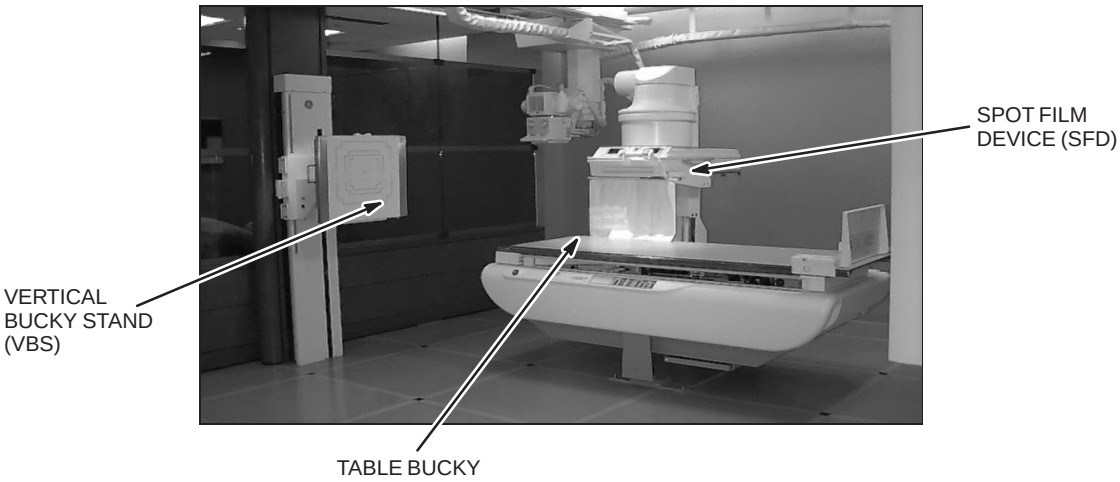
When the customer's desired film optical density for Area 2 is set, the amount of radiation that produced that density is measured using the MDH. Next, the ion chamber Areas 1 and 3 are calibrated by measuring and adjusting the radiation entering the chamber. One confirmation film is taken on each area. This calibration unit must be performed on each ion chamber used in the system. See Illustration 161.

To summarize the procedure for large size cassettes:
Step 1 of 8: Entering desired film optical density
Step 2 of 8: Ion Chamber Leakage Current Test
Step 3 of 8: Receptor set–up and Area 2 Master Density first film measurement
Step 4 of 8: Area 2 Master Density comparison to customer desired density
Step 5 of 8: Master Density software adjust if desired less than actual
Step 6 of 8: Master Density hardware adjust if desired more than actual
Step 7 of 8: Master Density radiation reading
Step 8 of 8: Areas 1 and 3 balance adjustment using radiation measurement

2-1-3 Tools Required

MDH “R” Meter With Large Probe (110 mm) and stand, Tape to hold probe in place, Non–Metallic Trimpot Adjusting Tool, 3” Plexiglass, 1/4” Aluminum (top of CV phantom (you need to provide a homogeneous phantom)), Film, Densitometer.
Use the largest size cassette that the customer uses (or Alternate size cassette for SFD mode only). The cassette used must be at least 9 inches x 9 inches to cover all three ion chamber areas.

Illustration 161 – Ion Chamber Locations



2-1-4 Cal Procedure

2-1-4-1 Step 1 of 8

- Enter Cal Unit: On the Advantx console, select S026 AEC Cal R&F Wall Bucky. Select X200 AEC Ion Chamber and touch the RUN softkey.

Note: The ion chamber Sensitivity pot has been factory set fully clockwise, and Areas 1, 2, and 3 pots have been set to midrange.

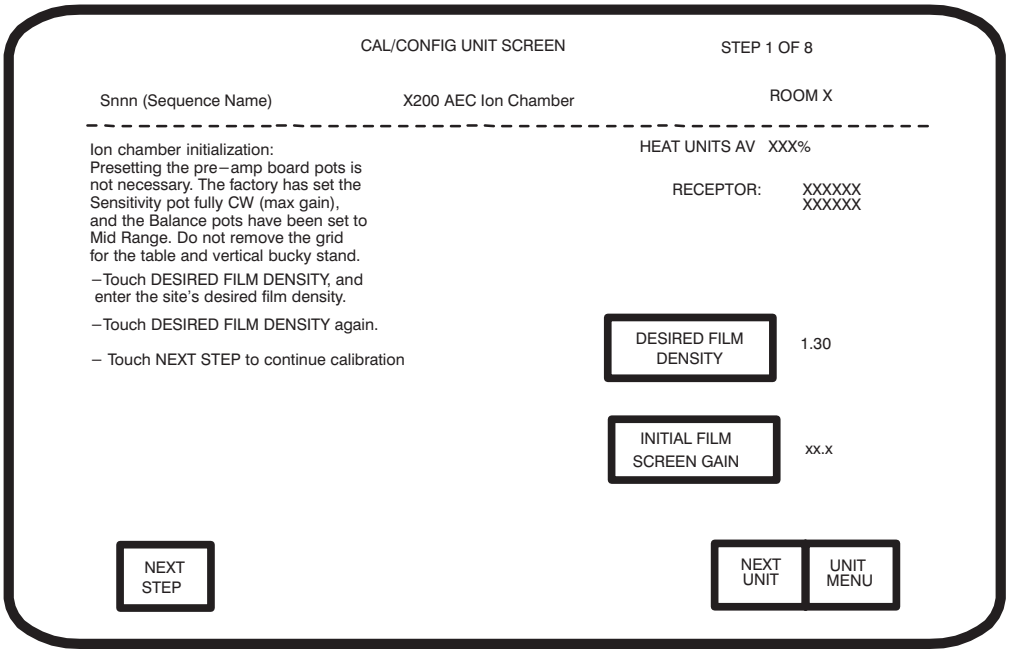
A GAIN FACTOR has been added to Step 1. This gain factor is the initial setpoint of the software gain that Advantx uses when calculating in Step 5 to decrease film density. A default GAIN FACTOR value has been entered to start the calculation closer to what's desired so only one software adjustment is needed, which will result in using only two films to reach the desired Master Film Density. The higher the gain, the greater the decrease in the film density. The value can be changed once you become familiar with how it works, but for now, use the default setting.

- Step 1 of 8, page 2 of 3 and page 3 of 3, Entering Desired Film Density. When first entering the unit, a default film density of 1.3 will appear on the console screen as the DESIRED FILM DENSITY.
  a. Touch DESIRED FILM DENSITY softkey to highlight key.
  b. Enter value desired via console knob.
  c. Touch DESIRED FILM DENSITY softkey again to de–highlight key and acknowledge entry.

Note: If the DESIRED FILM DENSITY softkey is not selected and then deselected, all future steps will be accessed in the "VIEWING" mode. Screens that do not show the Next Unit and Unit Menu buttons will have them when in viewing mode and not in Step 1.

  d. Touch NEXT STEP softkey to continue to Step 2.

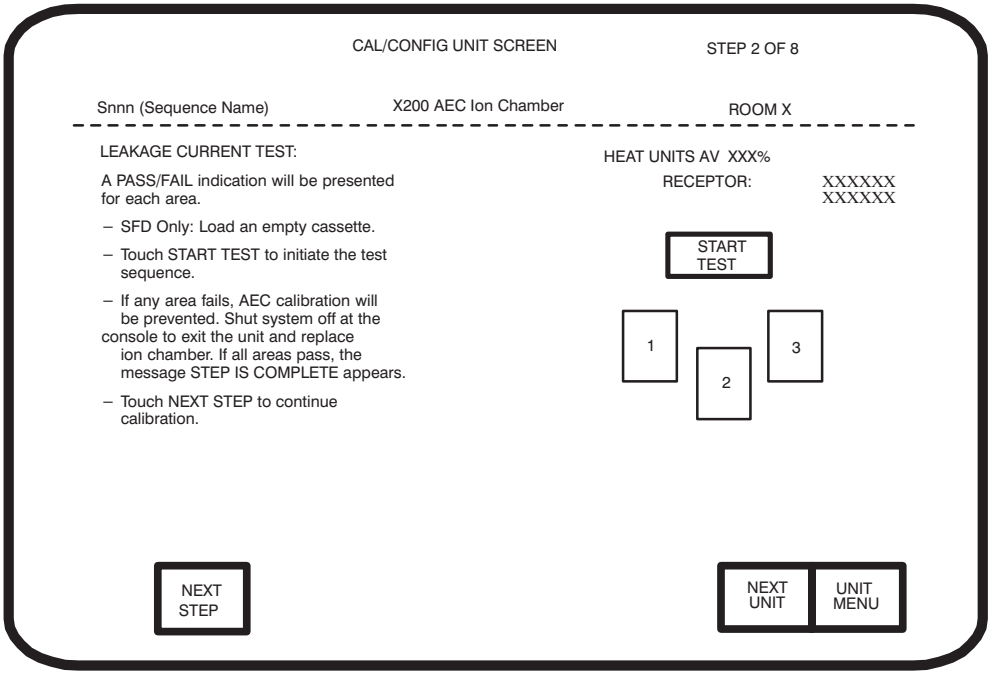
X200 STEP 1 SCREEN DISPLAY, NON SFD



2-1-4-2 Step 2 of 8

- LEAKAGE CURRENT TEST: At step 2 of 8 touch the START TEST softkey. When “STEP IS COMPLETE” message appears, touch NEXT STEP. This test takes 10 to 15 seconds.
- If the ion chamber does not pass the Leakage Current Test, replace the ion chamber. For a Spot–film device only, check the function of RFP1A1A9 board and repeat the test. If the test still fails, replace the ion chamber.

X200 STEP 2 SCREEN DISPLAY

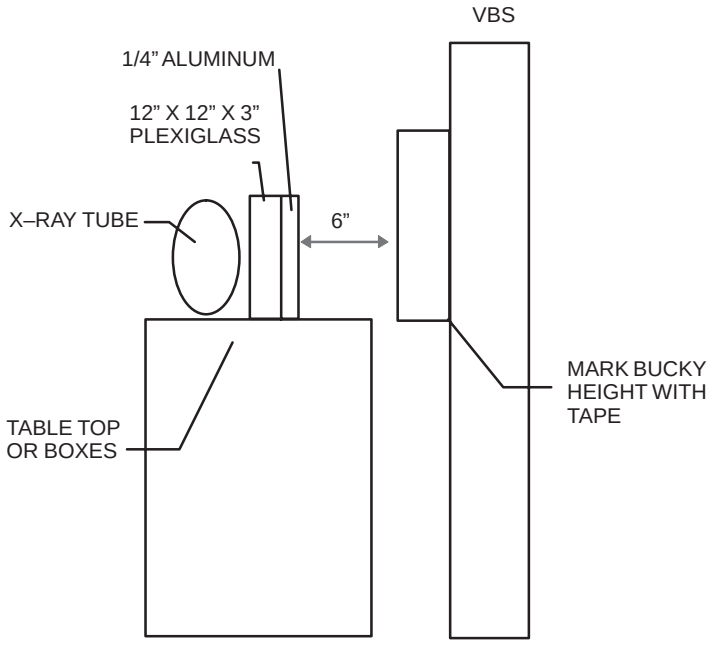


2-1-4-3 Step 3 of 8

- Receptor Set–Up and Area 2 First Film Master Density Measurement.
- Use the same large size cassette in the same orientation for the remaining steps of the unit.
- Set up the wall receptor as follows: (Refer to Illustration 162.)
  a. Rotate the tube toward the VBS. Set the SID at the focal distance of the grid (40” or 100 cm).
  b. Turn on the collimator field lamp and align the light field to the bucky front panel.
  c. Place 3” of plex and 1/4” Al in beam approximately 6” from the front panel. Use the table or boxes to support them in the x–ray beam. Make sure all 3 sense areas are covered by the phantom.
  d. Mark the height of the VBS with tape when everything is aligned so it can be returned to this position if the VBS will be moved to allow easier access to the pre–amp board potentiometers.

Note: You do not need to remove the grid or adjust any potentiometers at this time.

Illustration 162 – AEC VBS Bucky Setup (Side View)



e. Load a large size empty cassette in the wall bucky.

Note: Use the same size, style, screens, and film in your empty cassette as you are using for your loaded cassette. (this will maintain uniform back scatter and give consistent results.)

f. Take an exposure. The exposure time must be between 40 msec and 100 msec. If not, more filtration must be added.
g. Touch next step.
h. Load cassette with film and place in the bucky. Use the screen/film combination stated on the console screen.

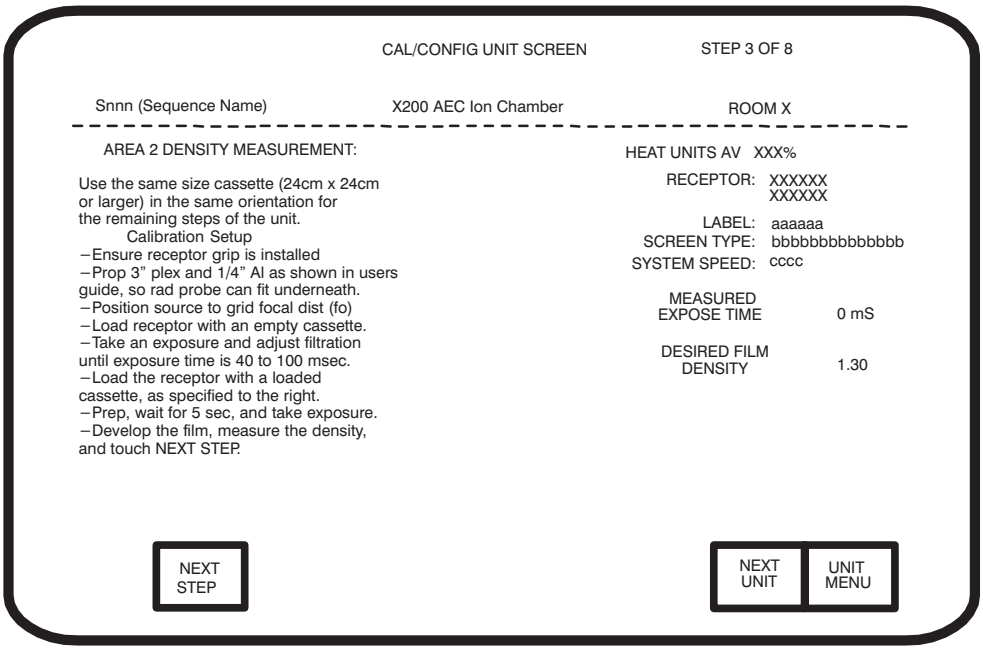
i. Press the PREP and EXPOSE switches to take an exposure. Release the switches when the “EXPOSURE DONE” message appears.

j. Develop the film.

k. Measure the film optical density corresponding to the center of ion chamber Area 2 (near center of the film).

l. Touch NEXT STEP softkey to proceed to Step 4.

X200 STEP 3 SCREEN DISPLAY



2-1-4-4 Step 4 of 8

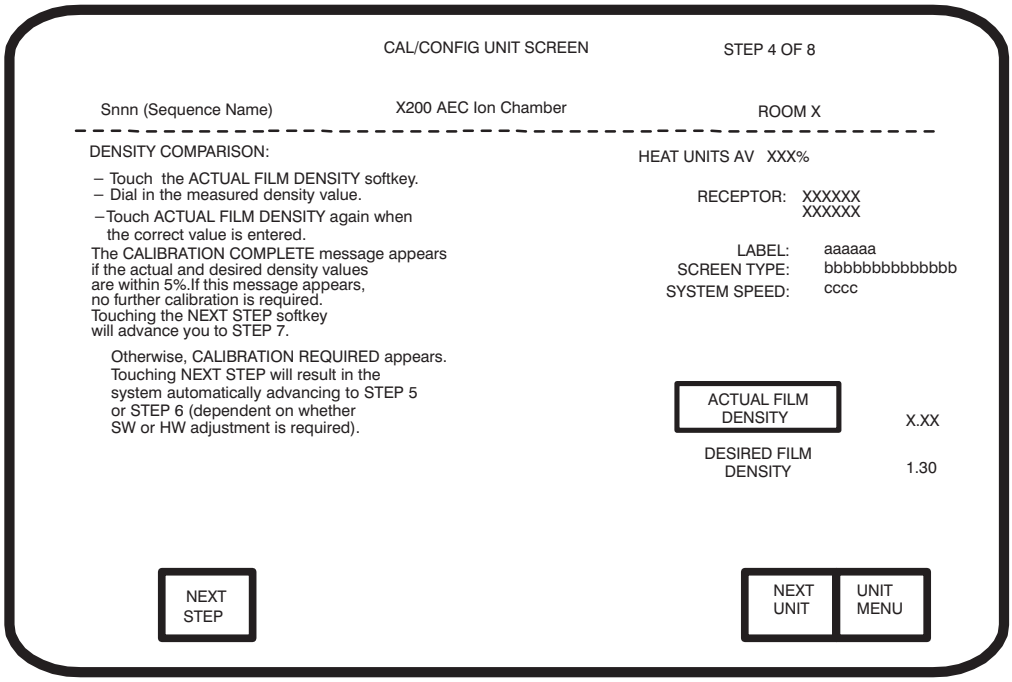
- Area 2 Master Density Comparison
  a. Touch ACTUAL FILM DENSITY softkey and use the console dial to enter the measured film density from Step 3 (k).
  b. Touch ACTUAL FILM DENSITY softkey again to enter the value into the system. The system will compare the ACTUAL FILM DENSITY value to the DESIRED FILM DENSITY value. Continue the calibration as follows:
  c. If the ACTUAL FILM DENSITY value is within 5% of the DESIRED FILM DENSITY value, a "CALIBRATION COMPLETE" message is displayed and touching NEXT STEP will send you to Step 7 of the cal unit.

OR

If a "CALIBRATION REQUIRED" message appears, further calibration is necessary.

Note: If the initial density was too light, the software will go to step 6 when the Next Step softkey is touched. If the initial density was too dark, the cal unit will automatically proceed to Step 5 MASTER DENSITY SOFTWARE ADJUSTMENT when the NEXT STEP softkey is touched. Step 5 provides a software gain adjustment to decrease film density, using the GAIN VALUE from Step 1 as a starting point.

X200 STEP 4 SCREEN DISPLAY
STANDARD SFD AND NON-SFD

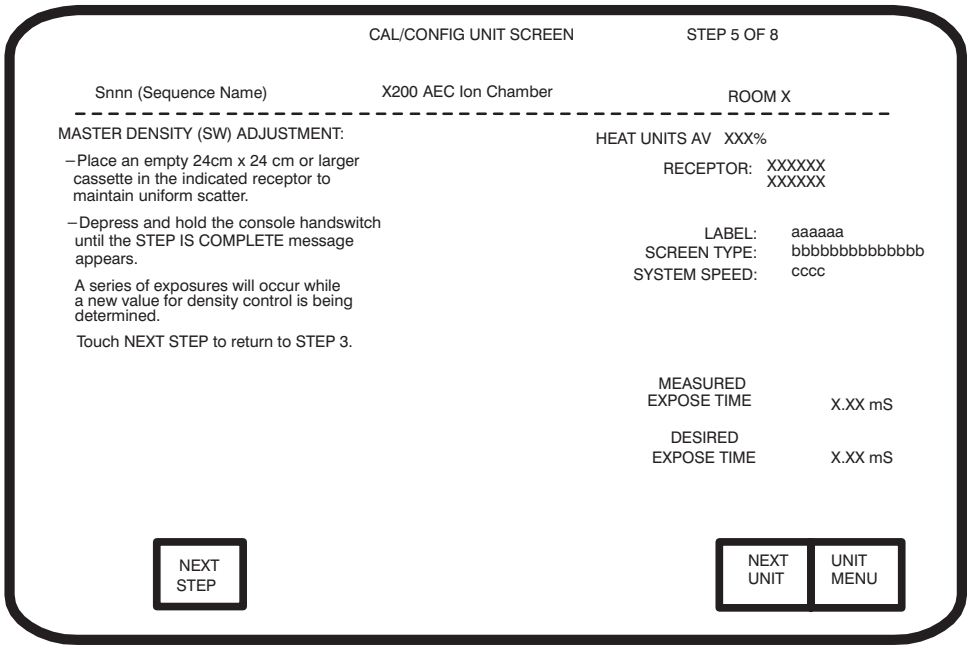


2-1-4-5 Step 5 of 8

- Master Density Software Adjust if Desired is Less than Actual
  a. Load the large size empty cassette into the bucky.
  b. Press and hold the PREP and EXPOSE switches on the console handswitch. A series of exposures will be taken while a new value for density gain is being calculated.
  c. Release the switches when the “STEP IS COMPLETE” message appears.
  d. Touch NEXT STEP softkey to return to Step 3 (h) for density measurement.

Note: The calibration unit can only be accomplished by looping through Steps 3 and 4 until the “CALIBRATION COMPLETE” message appears on the Step 4 screen display.

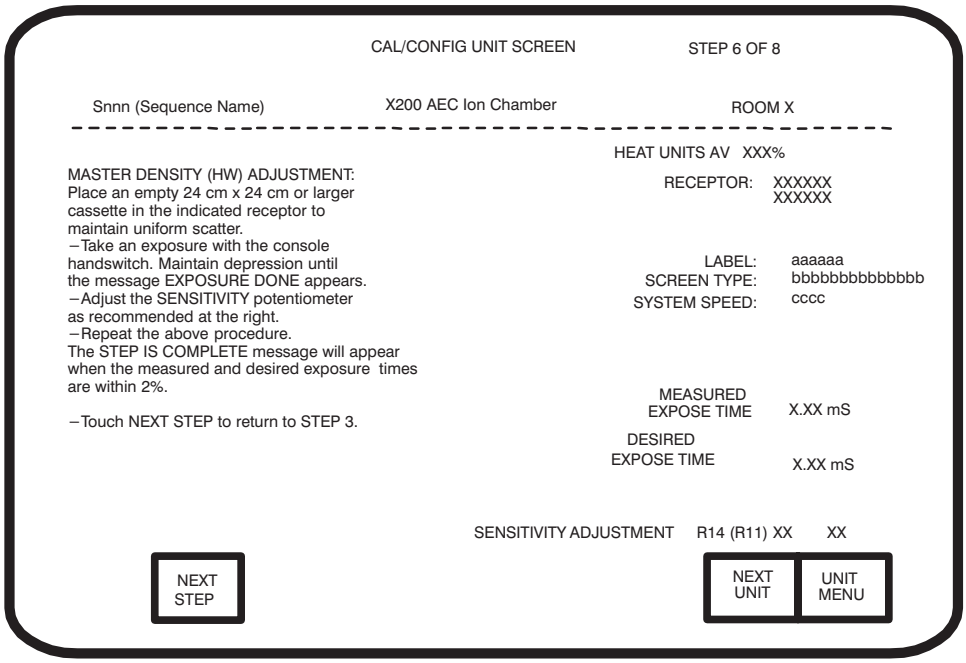
X200 STEP 5 SCREEN DISPLAY



2-1-4-6 Step 6 of 8

- Master Density Hardware Adjust if Desired More Than Actual
  a. If the first film density is less than desired density, Advantx will call for a hardware (ion chamber pre–amp sensitivity potentiometer) adjustment.
- Load a large cassette into the receptor to maintain scatter.
- Press and hold the PREP and EXPOSE switches until “EXPOSURE DONE” message appears.
- Adjust SENSITIVITY potentiometer labeled “S” as recommended by the prompt on the screen. The Sensitivity Adjustment prompt will indicate the number of turns and the direction to adjust the potentiometer.
- Repeat taking exposures and adjusting the potentiometer. When the measured and desired exposure times are within +/– 2 percent, a “STEP IS COMPLETE” message will appear.
- Touching the NEXT STEP softkey will return the calibration to Step 3. Repeat Step 3 to measure the adjusted film density value and Step 4 for density comparison. If the density is correct, the unit will proceed to STEP 7 when NEXT STEP is selected. If the film density is incorrect, STEP 5 or STEP 6 will be displayed.

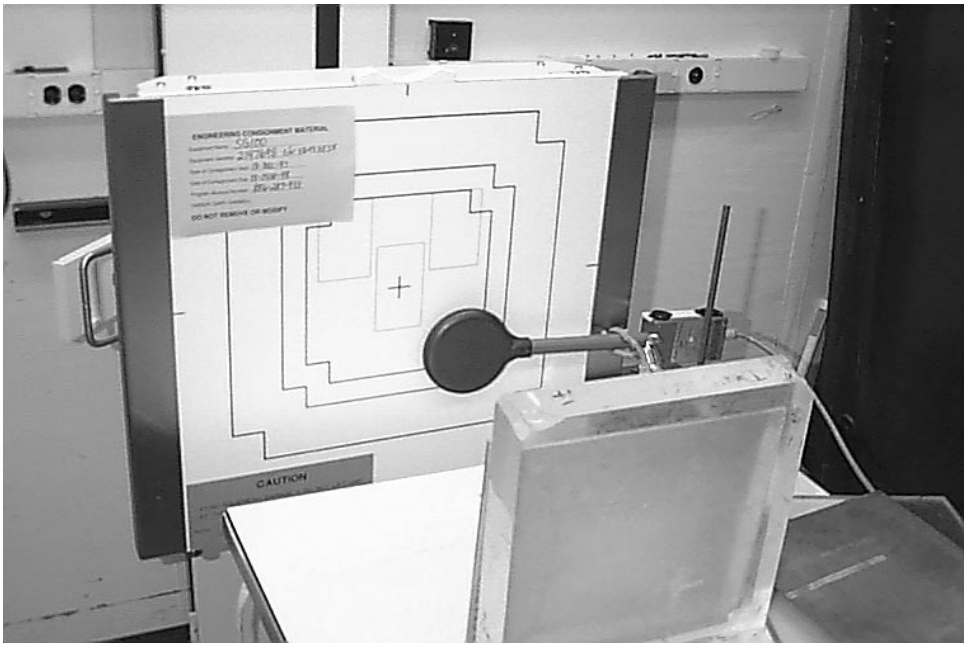
X200 STEP 6 SCREEN DISPLAY



2-1-4-7 Step 7 of 8

- Master Density Radiation Reading
- Areas 1 and 3 of the ion chamber will be adjusted to produce a film Optical Density (O.D.) that is within 0.1 O.D. of Area 2. To accomplish this, a radiation probe will be placed in the X–ray field so as not to cover any ion chamber sense area. In Step 7, one exposure will be taken to establish the amount of radiation Area 2 received when setting the master density. In Step 8, Areas 1 and 3 will be selected sequentially, and the radiation will be set 4% to 6% higher than Area 2 by adjusting the potentiometer for each area. One confirmation film will be taken to make sure the measured density is within 0.1 O.D. of Area 2.
  a. Load the large size empty cassette in the bucky.
  b. Use the probe stand or tape the large probe from the MDH “R” meter onto the front of the VBS so it does not block any of the 3 detector areas. Make sure the probe will not move out of it’s initial position for the remainder of this calibration. See Illustration 163.

Illustration 163 – VBS Ion Chamber Radiation Probe Placement



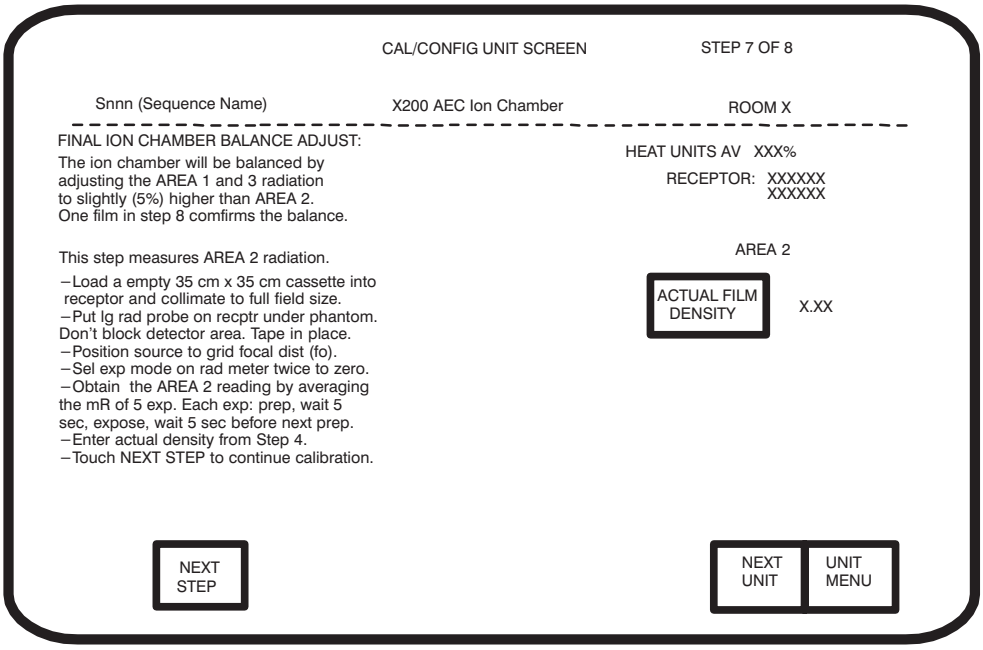
NOTICE

IMPORTANT: Do not move or bump the probe once it is in position for the remainder of steps 7 & 8. Only the bucky will be moved to allow access to the ion chamber pre–amp board potentiometers, and then realigned using the tape that marked the height of the bucky.

  c. Select exposure mode on the MDH. Touch its exposure button again to zero the meter and open the gate.
  d. Take 5 exposures on the empty cassette. Wait 5 seconds between exposures.
  e. Divide the total radiation by 5 to obtain the Area 2 Average Radiation in mR.
  f. Touch the actual film density softkey and enter the **FINAL DENSITY** that was recorded in Step 4c above. Dehighlight actual film density softkey and select NEXT STEP.

g. Reset the “R” meter by touching its Exposure Button twice.

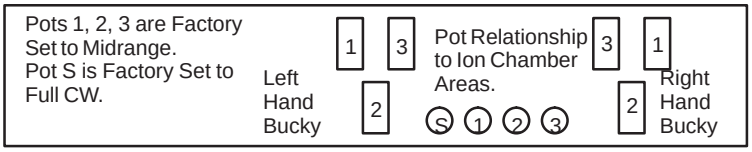
X200 STEP 7 SCREEN DISPLAY



2-1-4-8 Step 8 of 8

- Areas 1 and 3 Balance Adjustment Using Radiation Measurement
  a. Touch AREA SELECTED softkey and select Area 1 (or 3).
  b. With the empty cassette still loaded and the probe in the same position, take 5 exposures on Area 1 (or 3). Wait 5 seconds between exposures.
  c. Divide the total radiation by 5 to obtain the Area 1 (or 3) Average Radiation in mR.
  If the radiation reading on the MDH for Area 1 (or 3) is not 4% to 6% higher than the radiation measured when Area 2 was selected (Step 7), you can move the bucky to allow easier access to the ion chamber pre–amp board which is located on the bottom of the bucky. Make sure you marked the initial position so you can return to it. Remove the cap plugs for access to the ion chamber Area 1 (or 3) potentiometer.

Note: Facing the Bucky, Area 1 is upper left, Area 2 is middle, and Area 3 is upper right. On a right hand load vertical Bucky stand, the Area 1 balance pot actually adjusts Area 3 and the Area 3 balance pot actually adusts Area 1. For a left hand load vertical Bucky stand, Area 1 adjusts Area 1 and Area 3 adjusts Area 3.



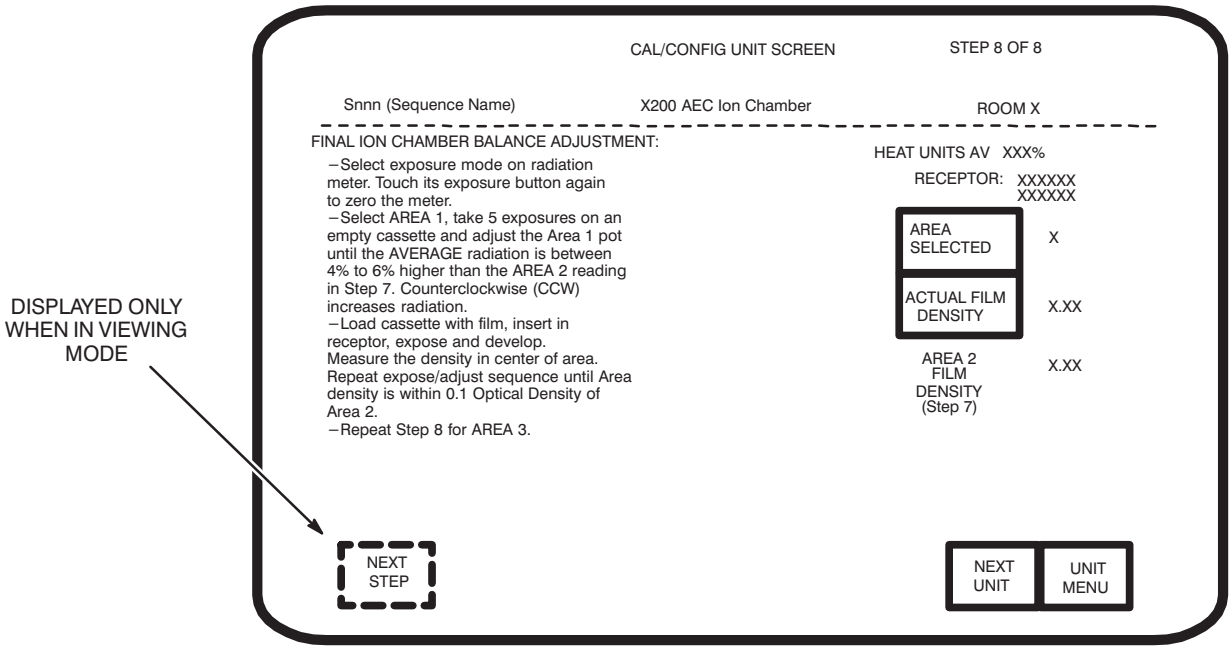
  d. Adjust Area 1 (or 3) balance pot on the pre–amp board. Clock–Wise (CW) on the balance pots will decrease radiation and Counter–Clock–Wise (CCW) will show an increase in radiation on the MDH meter. Return the bucky to the initial position. Continue taking exposures and adjusting the pot until the Average radiation on the MDH for 5 exposures is 4% to 6% higher than what was recorded as the Average Radiation for Area 2 in Step 7e above.
  e. When Area 1 (or 3) radiation reads 4% to 6% higher than Area 2, load the empty cassette with film and take 1 shot with Area 1 (or 3) selected.
  f. Develop the film and measure the density in the center of Area 1 (or 3).
  g. If the density is within 0.1 O.D of that entered for Area 2 touch the actual film density softkey and dial in the density. Dehighlight actual film density softkey.

OR

  If the density of Area 1 (or 3) is not within 0.1 O.D. of Area 2, return to Step 8 (e) and continue taking exposures and adjusting the Area 1 (or 3) potentiometer so the radiation will produce the desired film density on film Area 1 (or 3).

  h. Reset the “R” meter.
  i. Repeat Step 8 on Area 3.
- The Master Density should now be set for all three areas.

X200 STEP 8 SCREEN DISPLAY



2-2 AEC Ion Chamber Table Calibration

2-2-1 Description

This unit establishes the customer desired optical film density by calibrating the ion chamber to produce the same film density across all three areas on film. It uses the slowest screen/film speed combination configured in the system. (Master density settings for any faster screen/film combinations are set in Cal unit X202).

2-2-2 Procedure Summary

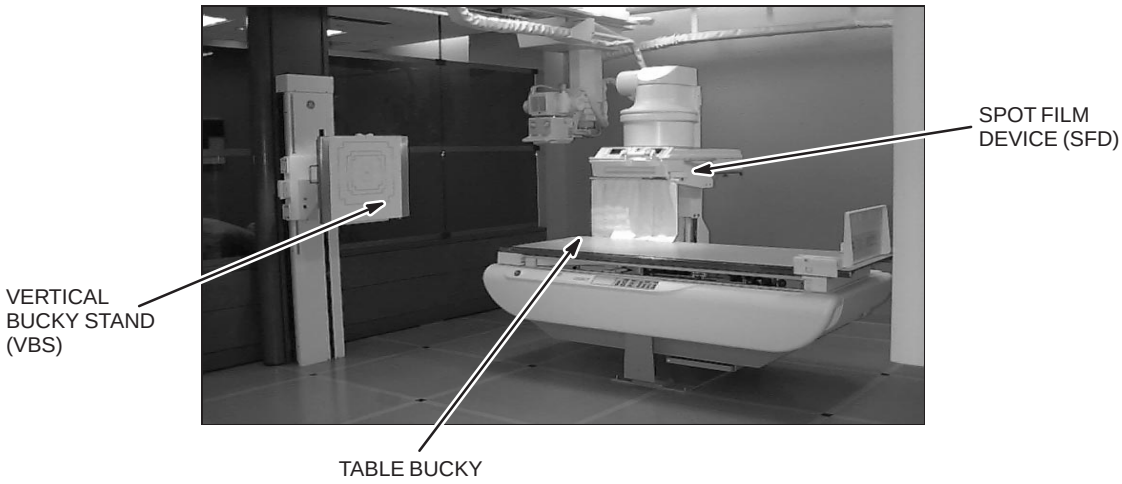
When the customer's desired film optical density for Area 2 is set, the amount of radiation that produced that density is measured using the MDH. Next, the ion chamber Areas 1 and 3 are calibrated by measuring and adjusting the radiation entering the chamber. One confirmation film is taken on each area. This calibration unit must be performed on each ion chamber used in the system. See Illustration 164.

To summarize the procedure for large size cassettes:
Step 1 of 8: Entering desired film optical density
Step 2 of 8: Ion Chamber Leakage Current Test
Step 3 of 8: Receptor set–up and Area 2 Master Density first film measurement
Step 4 of 8: Area 2 Master Density comparison to customer desired density
Step 5 of 8: Master Density software adjust if desired less than actual
Step 6 of 8: Master Density hardware adjust if desired more than actual
Step 7 of 8: Master Density radiation reading
Step 8 of 8: Areas 1 and 3 balance adjustment using radiation measurement

2-2-3 Tools Required

MDH “R” Meter With Large Probe (110 mm) and stand, Tape to hold probe in place, Non–Metallic Trimpot Adjusting Tool, 3” Plexiglass, 1/4” Aluminum (top of CV phantom (you need to provide a homogeneous phantom)), Film, Densitometer. Use the largest size cassette that the customer uses (or Alternate size cassette for SFD mode only). The cassette must be at least 9 inches x 9 inches to cover all three ion chamber areas.

Illustration 164 – Ion Chamber Locations



2-2-4 Cal Procedure

2-2-4-1 Step 1 of 8

- Enter Cal Unit: On the Advantx console, select S025 AEC Cal R&F Table Bucky. Select X200 AEC Ion Chamber and touch the RUN softkey.

Note: The ion chamber Sensitivity pot has been factory set fully clockwise, and Areas 1, 2, and 3 pots have been set to midrange.

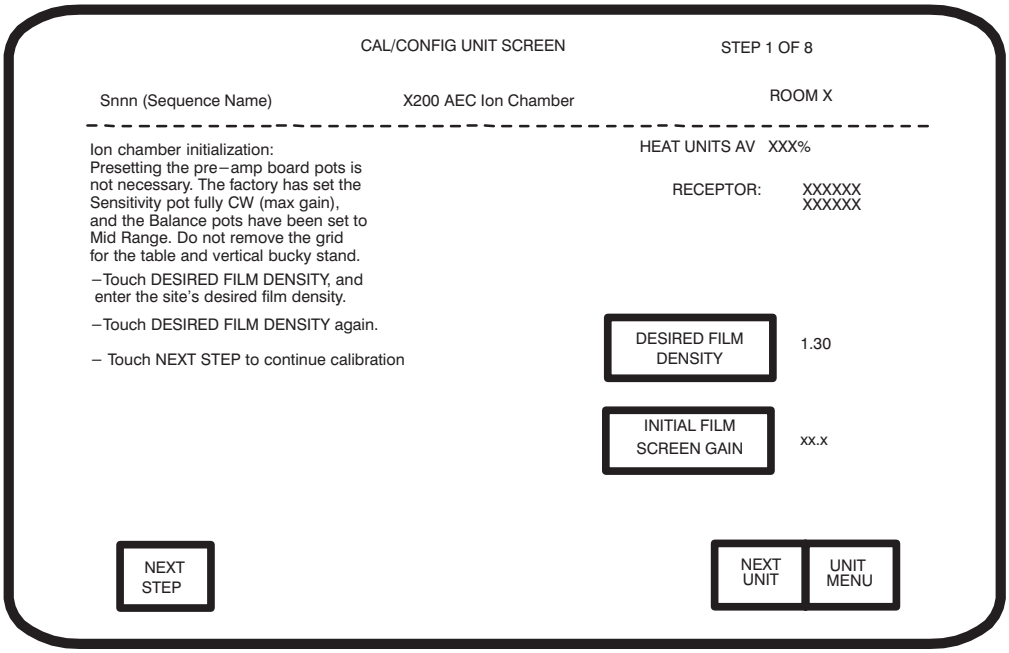
A GAIN FACTOR has been added to Step 1. This gain factor is the initial setpoint of the software gain that Advantx uses when calculating in Step 5 to decrease film density. A default GAIN FACTOR value has been entered to start the calculation closer to what's desired so only one software adjustment is needed, which will result in using only two films to reach the desired Master Film Density. The higher the gain, the greater the decrease in the film density. The value can be changed once you become familiar with how it works, but for now, use the default setting.

- Step 1 of 8, page 2 of 3 and page 3 of 3, Entering Desired Film Density. When first entering the unit, a default film density of 1.3 will appear on the console screen as the DESIRED FILM DENSITY.
  a. Touch DESIRED FILM DENSITY softkey to highlight key.
  b. Enter value desired via console knob.
  c. Touch DESIRED FILM DENSITY softkey again to de–highlight key and acknowledge entry.

Note: If the DESIRED FILM DENSITY softkey is not selected and then deselected, all future steps will be accessed in the "VIEWING" mode. Screens that do not show the Next Unit and Unit Menu buttons will have them when in viewing mode and not in Step 1.

  d. Touch NEXT STEP softkey to continue to Step 2.

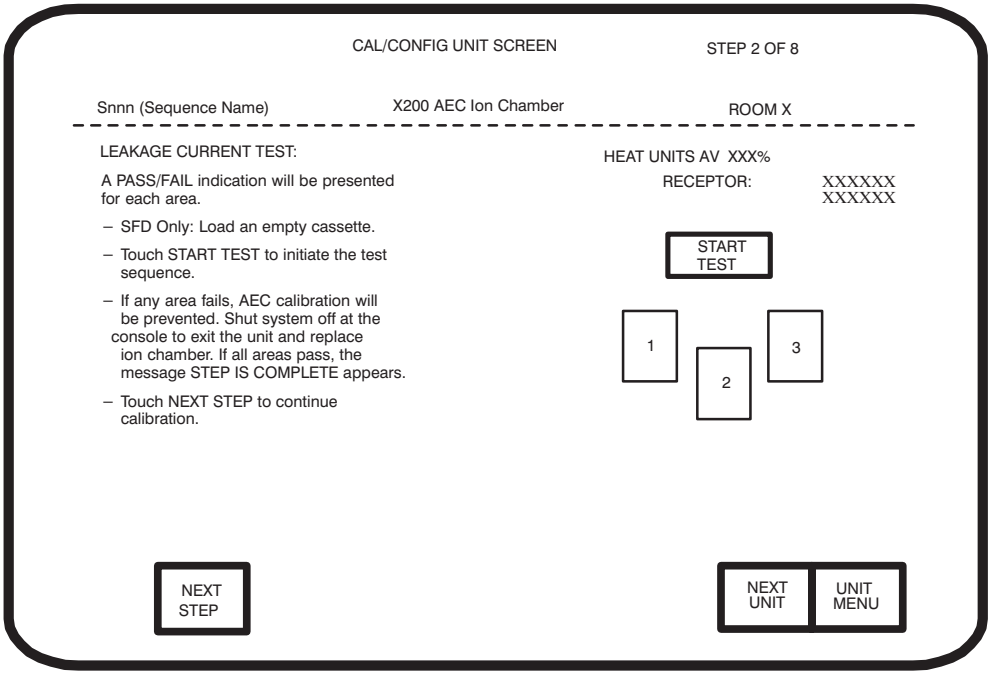
X200 STEP 1 SCREEN DISPLAY, NON SFD



2-2-4-2 Step 2 of 8

- Step 2 of 8, LEAKAGE CURRENT TEST: At step 2 of 8 touch the START TEST softkey. When “STEP IS COMPLETE” message appears, touch NEXT STEP. This test takes 10 to 15 seconds.
- If the ion chamber does not pass the Leakage Current Test, replace the ion chamber. For a Spot–film device only, check the function of RFP1A1A9 board and repeat the test. If the test still fails, replace the ion chamber.

X200 STEP 2 SCREEN DISPLAY



2-2-4-3 Step 3 of 8

- Step 3 of 8: Receptor Set–Up and Area 2 First Film Master Density Measurement.
- Use the same large size cassette in the same orientation for the remaining steps of the unit.
- Set up the Table receptor as follows:
  a. Unlock and park the spot film device at the foot end of the table.
  b. Move the table top so that the head end of the top is 15 1/4” from the head end of the table to just expose the ion chamber pre–amp board.
  c. Detach mylar shield from head end. You do not need to remove the table grid, or adjust any pots at this time. The Sensitivity (S) pot has been factory set fully clockwise, and Areas 1, 2, and 3 pots have been set to midrange.
  d. Center the table top laterally. Position 3” of plexiglass and 1/4” Aluminum (Al) 6” from head end onto table top. Prop up the plexiglass and Al high enough so that all 3 ion chamber sense areas are covered, and so you will be able to slide the radiation probe between the filtration and the receptor during steps 7 & 8 of this procedure. See Illustration 165.

Illustration 165 – Table Setup Showing Propped–up Filtration

Table Head End View



Table Front View



  e. Position XT Suspension at lateral centering detent over plexiglass and set the SID to focal distance (fo) of the grid (usually 40” (100cm) for Legacy. The grid (fo) is usually stamped on the edge of the grid and/or will be listed on the grid label in centimeters). Using collimator lamp; center tube and collimator on plexiglass. Using collimator lamp; move the bucky to align the bucky handle to the tube/collimator. Make sure filtration covers all three ion chamber sense areas, and is in center of X–ray beam. See Illustration 165.

f. Load a large size empty cassette in the table bucky.

Note: Use the same size, style, screens, and film in your empty cassette as you are using for your loaded cassette. (this will maintain uniform back scatter and give consistent results.)

g. Take an exposure. The exposure time must be between 40 msec and 100 msec. If not, more filtration must be added.

h. Touch next step.

i. Load cassette with film and place in table bucky. Use the screen/film combination stated on the console screen.

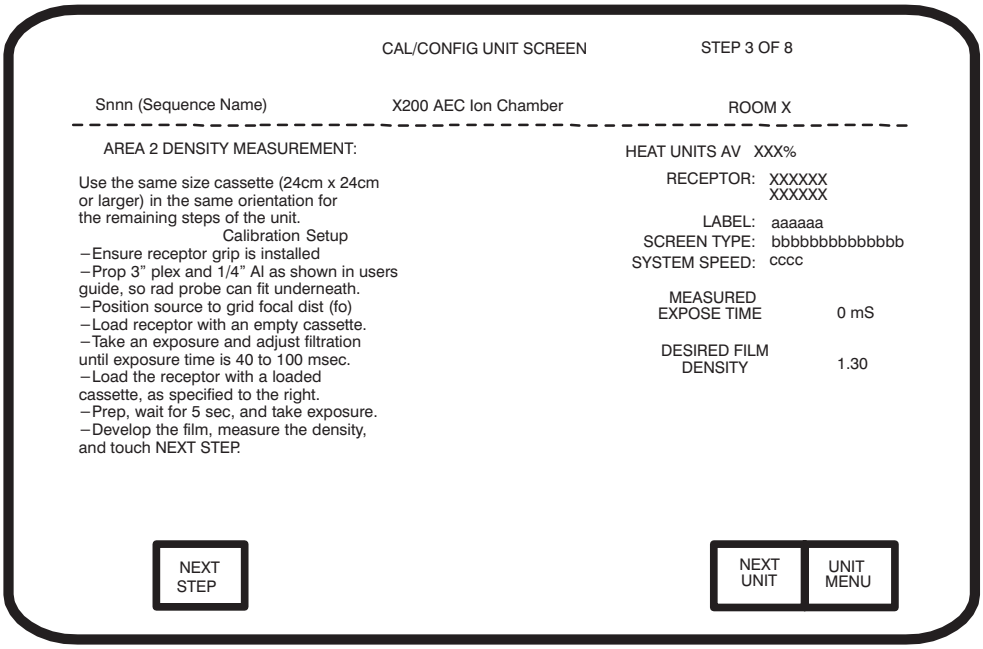
j. Press the PREP and EXPOSE switches to take an exposure. Release the switches when the “EXPOSURE DONE” message appears.

k. Develop the film

l. Measure the film optical density corresponding to the center of ion chamber Area 2 (near center of the film).

m. Touch NEXT STEP softkey to proceed to Step 4.

X200 STEP 3 SCREEN DISPLAY



2-2-4-4 Step 4 of 8

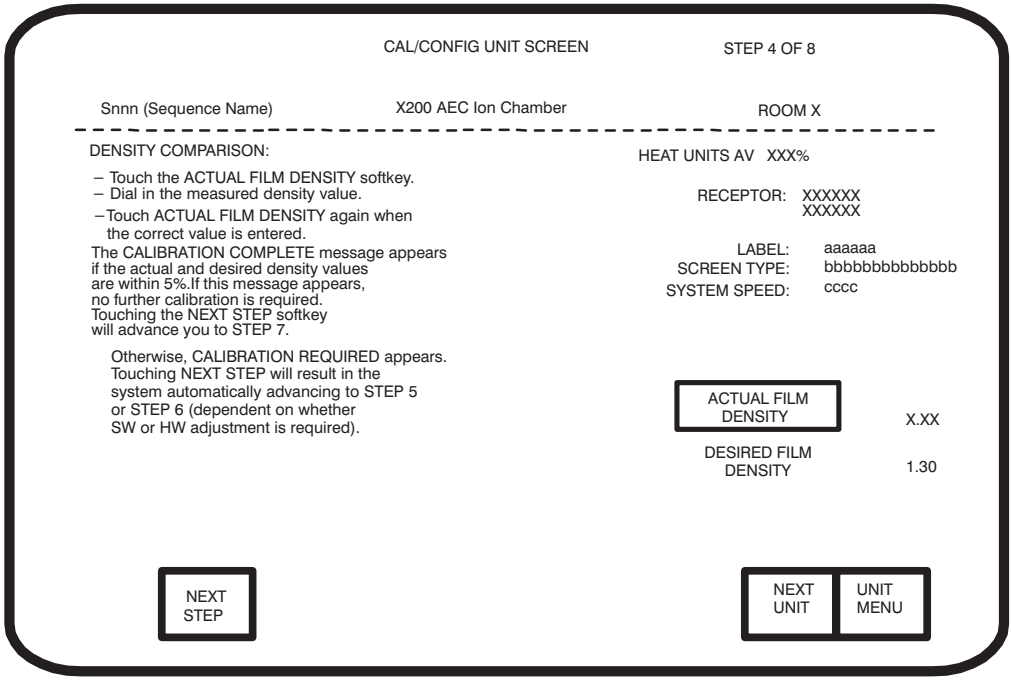
- Step 4 of 8: Area 2 Master Density Comparison
  a. Touch ACTUAL FILM DENSITY softkey and use the console dial to enter the measured film density from Step 3 (l).
  b. Touch ACTUAL FILM DENSITY softkey again to enter the value into the system. The system will compare the ACTUAL FILM DENSITY value to the DESIRED FILM DENSITY value.
  c. If the ACTUAL FILM DENSITY value is within 5% of the DESIRED FILM DENSITY value, a "CALIBRATION COMPLETE" message is displayed and touching NEXT STEP will send you to Step 7 of the cal unit.

OR

If a "CALIBRATION REQUIRED" message appears, further calibration is necessary.

Note: If the initial density was too light, the software will go to step 6 when the Next Step softkey is touched. If the initial density was too dark, the cal unit will automatically proceed to Step 5 MASTER DENSITY SOFTWARE ADJUSTMENT when the NEXT STEP softkey is touched. Step 5 provides a software gain adjustment to decrease film density, using the GAIN VALUE from Step 1 as a starting point.

X200 STEP 4 SCREEN DISPLAY
STANDARD SFD AND NON-SFD

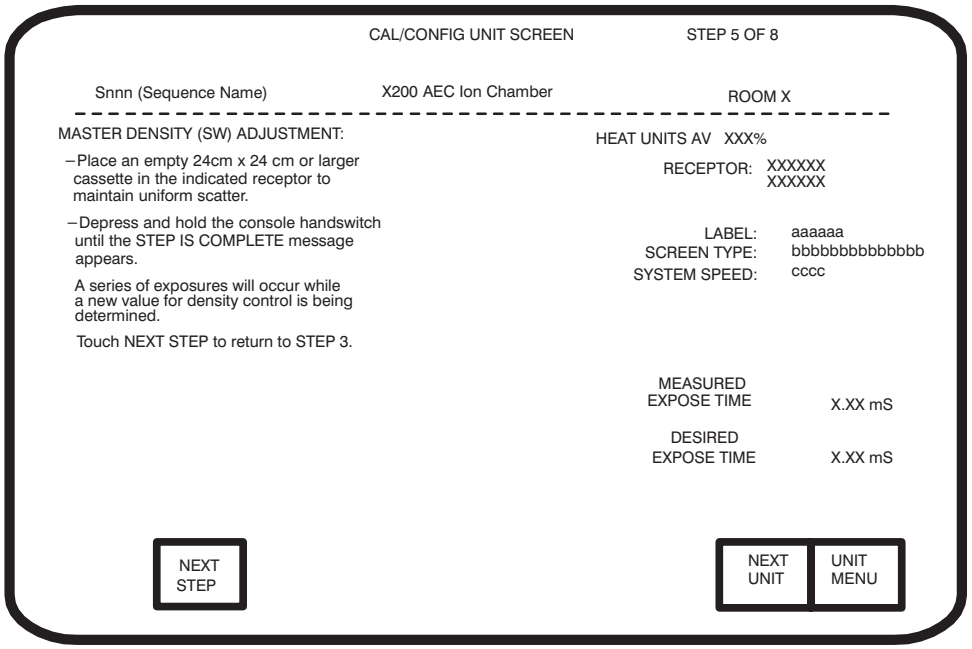


2-2-4-5 Step 5 of 8

- Step 5 of 8: Master Density Software Adjust if Desired is Less than Actual
  a. Load the large size empty cassette into the bucky.
  b. Press and hold the PREP and EXPOSE switches on the console handswitch. A series of exposures will be taken while a new value for density gain is being calculated.
  c. Release the switches when the “STEP IS COMPLETE” message appears.
  d. Touch NEXT STEP softkey to return to Step 3 (f) for density measurement.

Note: The calibration unit can only be accomplished by looping through Steps 3 and 4 until the “CALIBRATION COMPLETE” message appears on the Step 4 screen display.

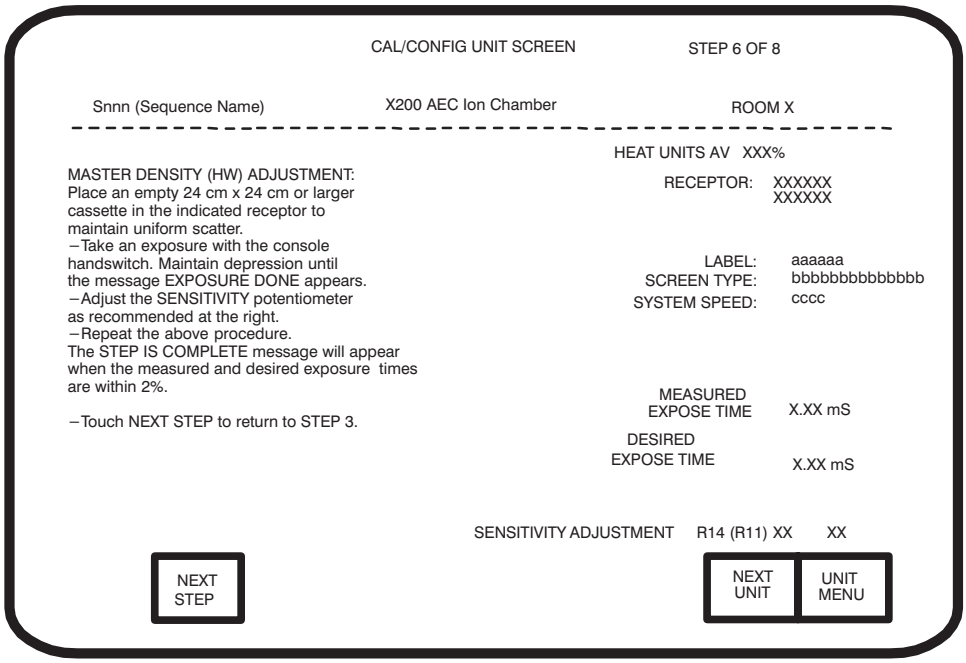
X200 STEP 5 SCREEN DISPLAY



2-2-4-6 Step 6 of 8

- Step 6 of 8: Master Density Hardware Adjust if Desired More Than Actual
  a. If the first film density is less than desired density, Advantx will call for a hardware (ion chamber pre–amp sensitivity potentiometer) adjustment.
- Load a large cassette into the receptor to maintain scatter.
- Press and hold the PREP and EXPOSE switches until “EXPOSURE DONE” message appears.
- Adjust SENSITIVITY potentiometer labeled “S” as recommended by the prompt on the screen. The Sensitivity Adjustment prompt will indicate the number of turns and the direction to adjust the potentiometer.
- Repeat taking exposures and adjusting the potentiometer. When the measured and desired exposure times are within +/– 2 percent, a “STEP IS COMPLETE” message will appear.
- Touching the NEXT STEP softkey will return the calibration to Step 3. Repeat Step 3 to measure the adjusted film density value and Step 4 for density comparison. If the density is correct, the unit will proceed to STEP 7 when NEXT STEP is selected. If the film density is incorrect, STEP 5 or STEP 6 will be displayed.

X200 STEP 6 SCREEN DISPLAY



2-2-4-7 Step 7 of 8

- Step 7 of 8: Master Density Radiation Reading
- Areas 1 and 3 of the ion chamber will be adjusted to produce a film Optical Density (O.D.) that is within 0.1 O.D. of Area 2. To accomplish this, a radiation probe will be placed in the X–ray field so as not to cover any ion chamber sense area. In Step 7, one exposure will be taken to establish the amount of radiation Area 2 received when setting the master density. In Step 8, Areas 1 and 3 will be selected sequentially, and the radiation will be set 4% to 6% higher than Area 2 by adjusting the potentiometer for each area. One confirmation film will be taken to make sure the measured density is within 0.1 O.D. of Area 2.
  a. Load the large size empty cassette in the bucky.
  b. Slide the large probe from the MDH “R” meter under the filtration and onto the table top as shown in Illustration 166. Do not block any of the 3 detector areas with the probe. Illustration 167 shows how to place the radiation probe so it does not cover the ion chamber sense areas. Use tape to hold the probe in position so it does not move for the remainder of this calibration.

NOTICE

Do not move or bump the probe once it is in position for the remainder of steps 7 & 8. Only the bucky will be moved to allow access to the ion chamber pre–amp board potentiometers, and then realigned using the collimator field light and the bucky handle.

Illustration 166 – Table Ion Chamber Radiation Probe Placement

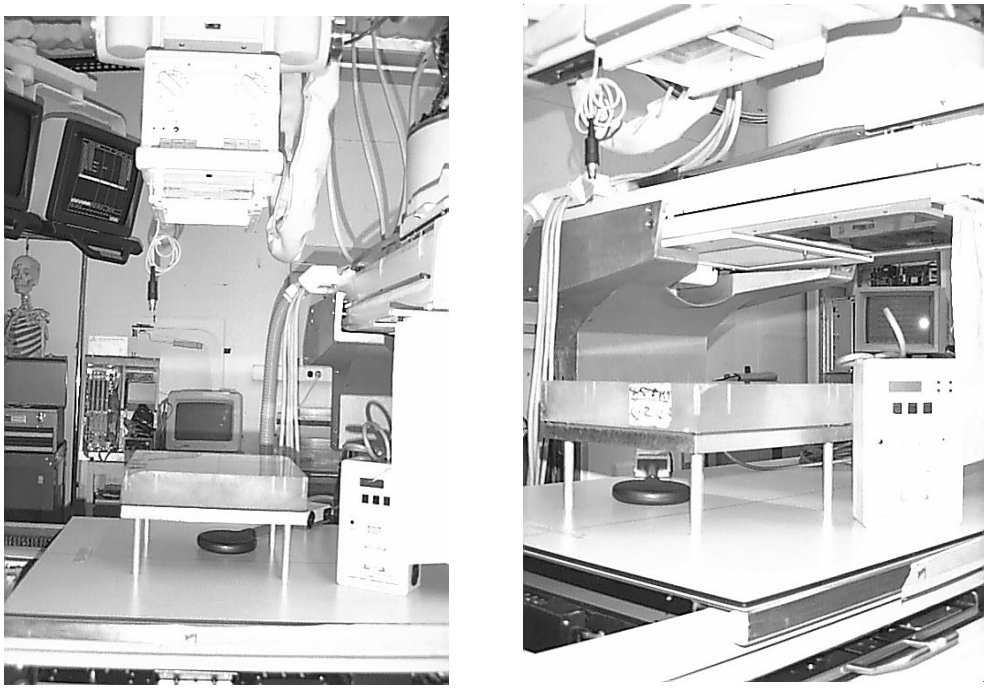
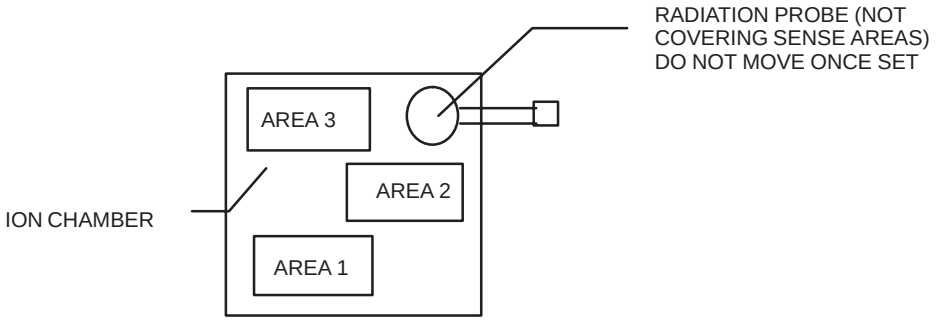


Illustration 167 – Ion Chamber and Radiation Probe Detail



c. Select exposure mode on the MDH. Touch its exposure button again to zero the meter and open the gate.

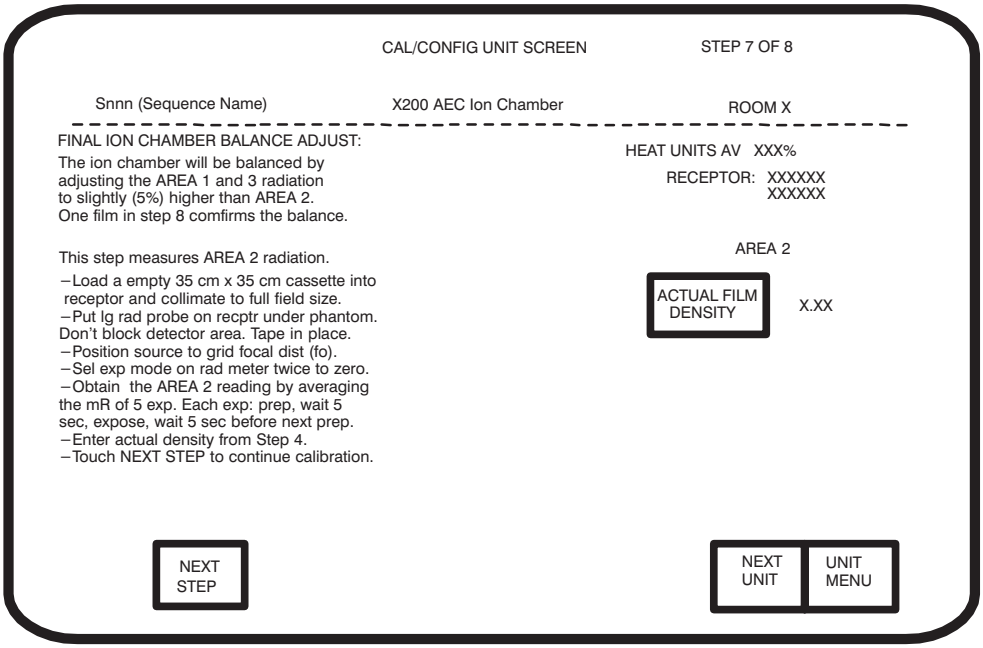
d. Take 5 exposures on the empty cassette. Wait 5 seconds between exposures.

e. Divide the total radiation by 5 to obtain the Area 2 Average Radiation in mR.

f. Touch the actual film density softkey and enter the **FINAL DENSITY** that was recorded in Step 4c above. Dehighlight actual film density softkey and select NEXT STEP.

g. Reset the “R” meter by touching its Exposure Button twice.

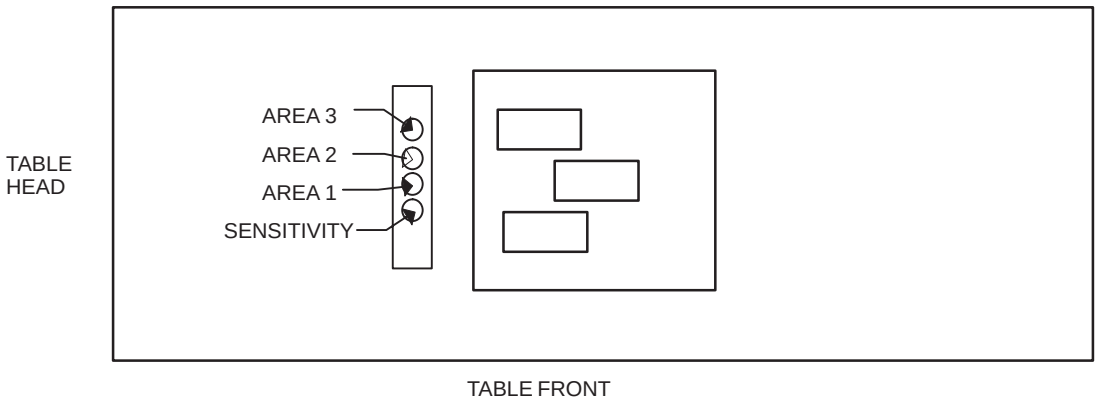
X200 STEP 7 SCREEN DISPLAY



2-2-4-8 Step 8 of 8

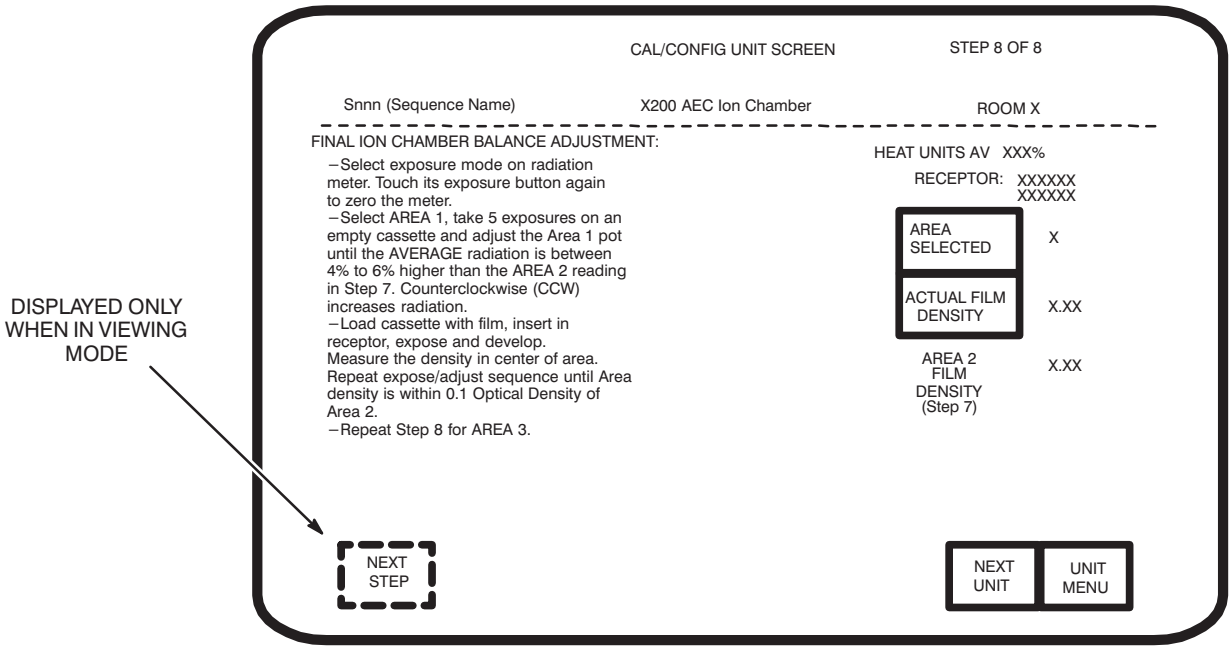
- Step 8 of 8: Areas 1 And 3 Balance Adjustment Using Radiation Measurement
  a. Touch AREA SELECTED softkey and select Area 1 (or 3).
  b. With the empty cassette still loaded and the probe in the same position, take 5 exposures on Area 1 (or 3). Wait 5 seconds between exposures.
  c. Divide the total radiation by 5 to obtain the Area 1 (or 3) Average Radiation in mR.
  d. If the radiation reading on the MDH for Area 1 (or 3) is not 4% to 6% higher than the radiation measured when Area 2 was selected (Step 7), then move the bucky to the head end of the table. Be careful not to damage the mylar shield. Remove the cap plugs for access to the Table ion chamber Area 1 (or 3) potentiometer. Illustration 168 will help you locate the correct pots on the table ion chamber pre–amp board.

Illustration 168 – Table Potentiometer Locations



  e. Adjust Area 1 (or 3) balance pot on the pre–amp board. Clock–Wise (CW) on the balance pots will decrease radiation and Counter–Clock–Wise (CCW) will show an increase in radiation on the MDH meter. Return the bucky to the initial position. Continue taking exposures and adjusting the pot until the Average radiation on the MDH for 5 exposures is 4% to 6% higher than what was recorded as the Average Radiation for Area 2 in Step 7 (e) above.
  f. When Area 1 (or 3) radiation reads 4% to 6% higher than Area 2, load the empty cassette with film and take 1 shot with Area 1 (or 3) selected.
  g. Develop the film and measure the density in the center of Area 1 (or 3).
     – If the density is within 0.1 O.D of that entered for Area 2 touch the actual film density softkey and dial in the density. Dehighlight actual film density softkey.
     – If the density of Area 1 (or 3) is not within 0.1 O.D. of Area 2, return to Step 8 (e) and continue taking exposures and adjusting the Area 1 (or 3) potentiometer so the radiation will produce the desired film density on film Area 1 (or 3).
  h. Reset the “R” meter.
  i. Repeat Step 8 on Area 3.
- The Master Density should now be set for all three areas.

X200 STEP 8 SCREEN DISPLAY



2-3 AEC Ion Chamber Spot Film Device Calibration

2-3-1 Description

This unit establishes the customer desired optical film density by calibrating the ion chamber to produce the same film density across all three areas on film. It uses the slowest screen/film speed combination configured in the system. (Master density settings for any faster screen/film combinations are set in Cal unit X202).

2-3-2 Procedure Summary

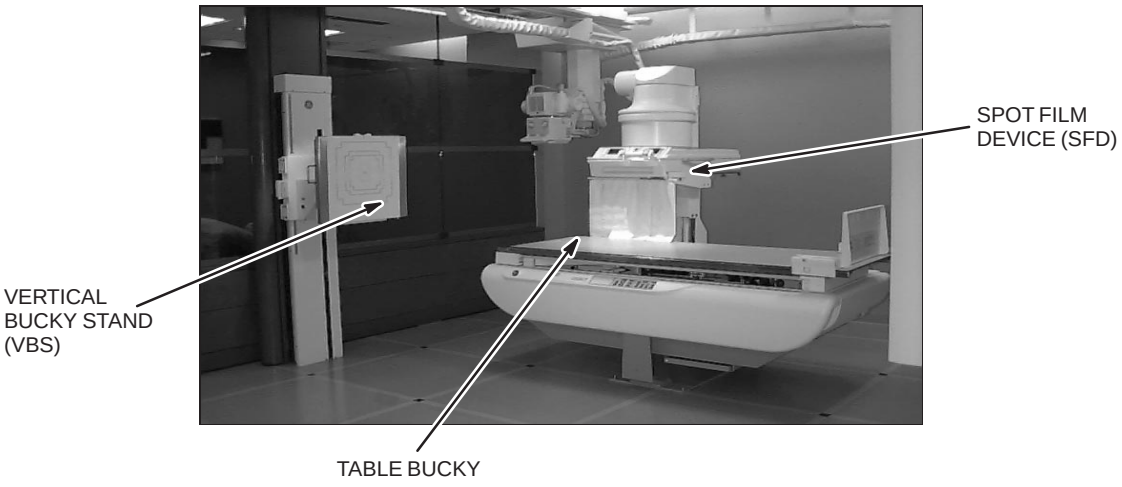
When the desired film optical density for Area 2 is set, the radiation is measured using the MDH meter at the same time. Next, the ion chamber Areas 1 and 3 are calibrated by measuring and adjusting the radiation entering the chamber. One confirmation film is taken on each area. This calibration unit must be performed on each ion chamber used in the system. See Illustration 169.

To summarize the procedure for large size cassettes:
Step 1 of 8: Entering desired film optical density
Step 2 of 8: Ion Chamber Leakage Current Test
Step 3 of 8: Receptor set–up and Area 2 Master Density first film measurement
Step 4 of 8: Area 2 Master Density comparison to customer desired density
Step 5 of 8: Master Density software adjust if desired less than actual
Step 6 of 8: Master Density hardware adjust if desired more than actual
Step 7 of 8: Master Density radiation reading
Step 8 of 8: Areas 1 and 3 balance adjustment using radiation measurement

2-3-3 Tools Required

MDH “R” Meter With Large Probe (110 mm) and stand, Tape to hold probe in place, Non–Metallic Trimpot Adjusting Tool, 3” Plexiglass, 1/4” Aluminum (top of CV phantom (you need to provide a homogeneous phantom)), Film, Densitometer. Use the largest size cassette that the customer uses (or Alternate size cassette for SFD mode only). The cassette must be at least 9 inches x 9 inches to cover all three ion chamber areas.

Illustration 169 – Ion Chamber Locations



2-3-4 Cal Procedure

2-3-4-1 Step 1 of 8

- Enter Cal Unit: On the Advantx console, select S024 AEC Calibration R&F SFD. Select X200 AEC Ion Chamber and touch the RUN softkey.

Note: On a new Spot Film Device equipped with an ion chamber, the factory has set the Sensitivity pot fully clockwise, Area 2 to midrange, and used Cal unit X200 to adjust Areas 1 and 3 to produce a film optical density across all three ion chamber areas to 1.3 +/–0.06 using 400 speed Lanex Regular screens with Kodak T'MAT G film.

You should check the customer's film to see if the factory calibration matches the customer's film and processor system. To do this, take a spot film exposure in applicaiton mode with 3 inches of plexiglass and 1/4 inches Aluminum at 80kVp, 100 mA with a loaded 35cm x 35cm cassette, 1/1 auto collimation, grid in, SID at midrange (15.25 inches from table top to spot film window). Measure the film density at all three areas of the ion chamber. Film density should not vary from one area to another by more than 0.1 optical density units. If a large size cassette is not used, just take the reading at Area 2.

If the customer wants a different film optical density, you can use cal unit X205 to tweak the master density up to +/–50%, otherwise, a full SFD calibration should be run.

- ALTERNATE CASSETTE SIZE Mode (SFD receptor only): For the Spot Film Device (SFD) ion chamber calibration, unit X200 can be run in two modes: (1) a 35 cm x 35 cm (14" x 14") or (2) SFD Alternate Cassette Size mode. The alternate cassette size mode allows the use of any spot film compatible cassette size if your site will NEVER use 35 cm x 35 cm. The SFD Alternate Cassette Size mode skips the ion chamber balance steps 7 & 8, which set the optical film density for areas 1 and 3.

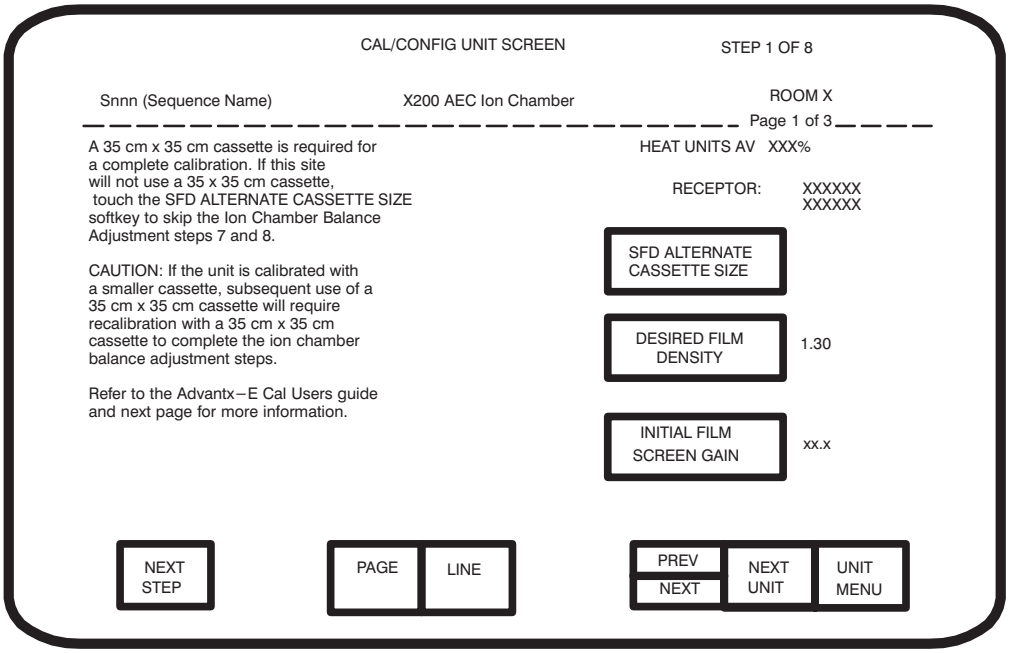
A GAIN FACTOR has been added to Step 1. This gain factor is the initial setpoint of the software gain that Advantx uses when calculating in Step 5 to decrease film density. A default GAIN FACTOR value has been entered to start the calculation closer to what's desired so only one software adjustment is needed, which will result in using only two films to reach the desired Master Film Density. The higher the gain, the greater the decrease in the film density. The value can be changed once you become familiar with how it works, but for now, use the default setting.

- Step 1 of 8, page 2 of 2, Entering Desired Film Density. When first entering the unit, a default film density of 1.3 will appear on the console screen as the DESIRED FILM DENSITY.
  a. Touch DESIRED FILM DENSITY softkey to highlight key.
  b. Enter value desired via console knob.
  c. Touch DESIRED FILM DENSITY softkey again to de–highlight key and acknowledge entry.

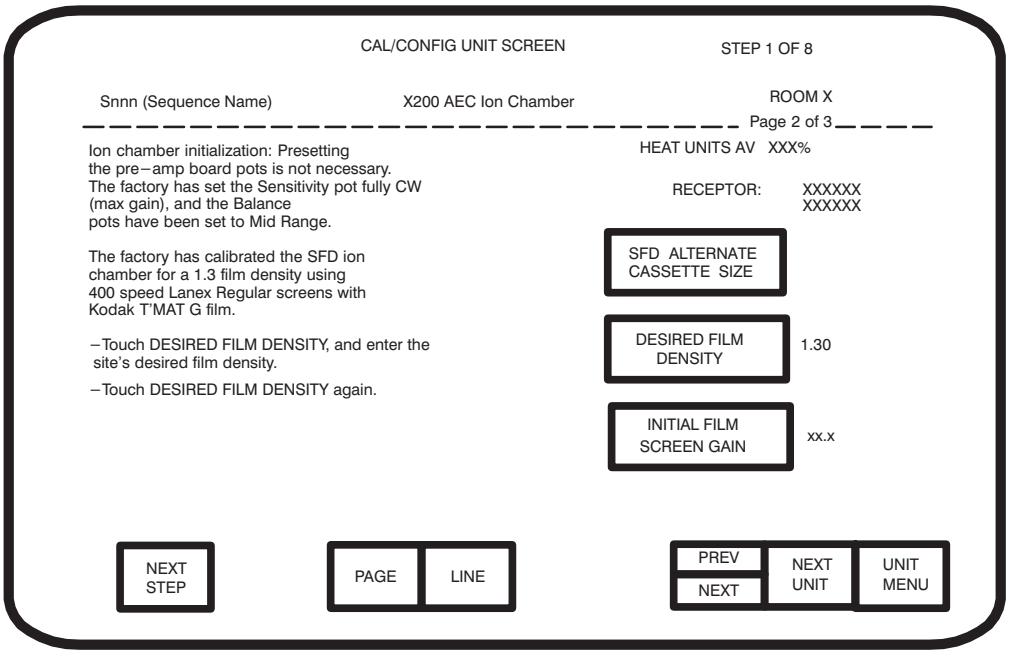
Note: If the DESIRED FILM DENSITY softkey is not selected and then deselected, all future steps will be accessed in the "VIEWING" mode. Screens that do not show the Next Unit and Unit Menu buttons will have them when in viewing mode and not in Step 1.

  d. Touch NEXT STEP softkey to continue to Step 2.

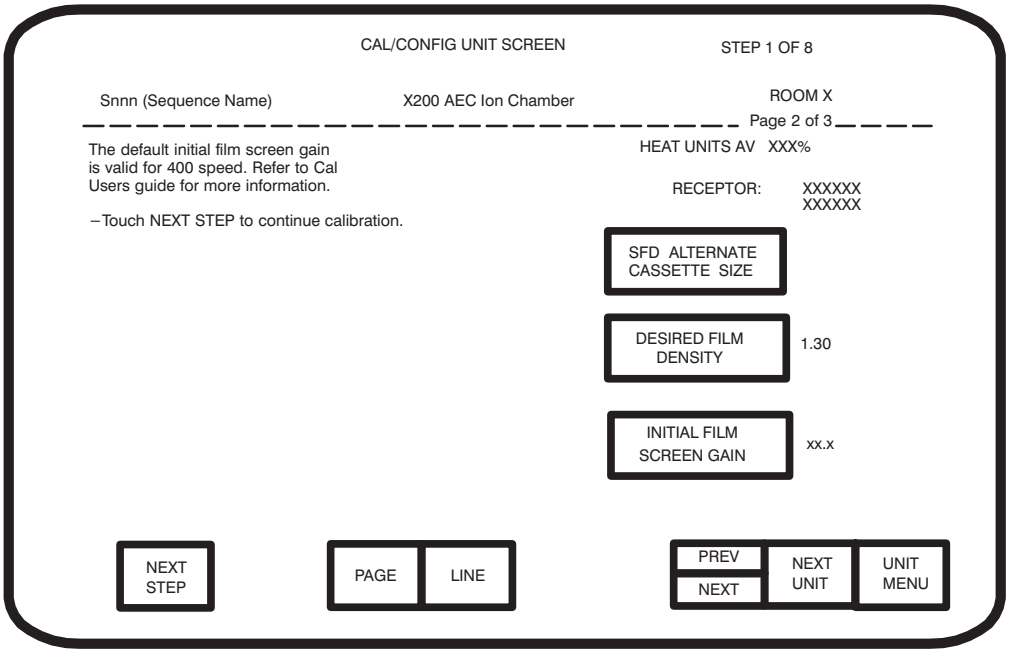
X200 STEP 1 SCREEN DISPLAY, PAGE 1 FOR SFD



X200 STEP 1 SCREEN DISPLAY, PAGE 2 FOR SFD



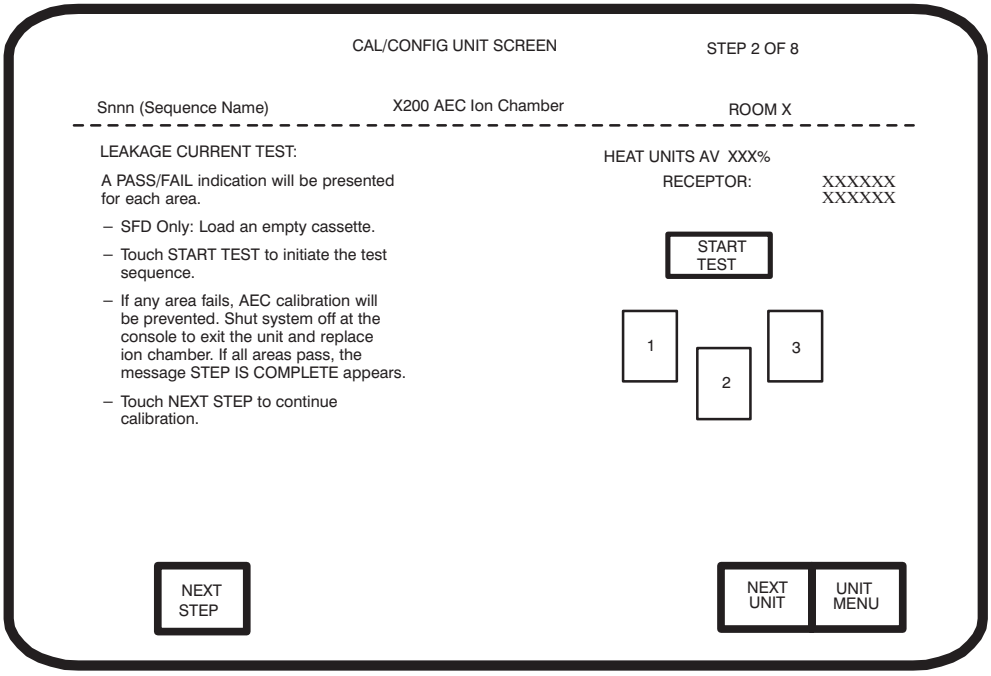
X200 STEP 1 SCREEN DISPLAY, PAGE 3 FOR SFD



2-3-4-2 Step 2 of 8

- Step 2 of 8, LEAKAGE CURRENT TEST: At step 2 of 8 touch the START TEST softkey. When “STEP IS COMPLETE” message appears, touch NEXT STEP. This test takes 10 to 15 seconds.
- If the ion chamber does not pass the Leakage Current Test, replace the ion chamber. For a Spot–film device only, check the function of RFP1A1A9 board and repeat the test. If the test still fails, replace the ion chamber.

X200 STEP 2 SCREEN DISPLAY



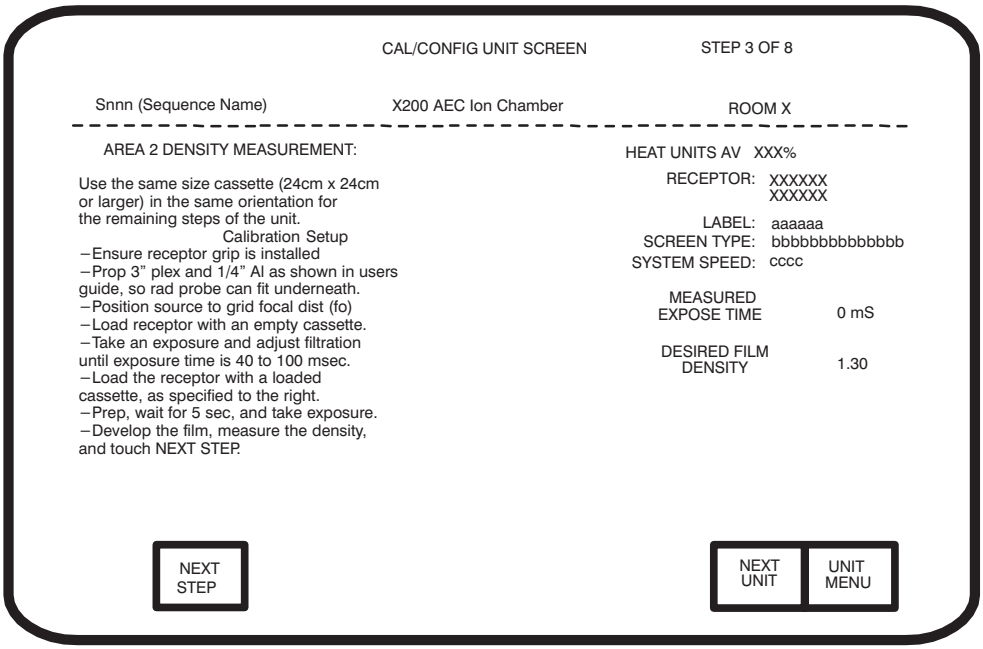
2-3-4-3 Step 3 of 8

- Step 3 of 8: Receptor Set–Up and Area 2 First Film Master Density Measurement.
- Use the same large size cassette in the same orientation for the remaining steps of the unit.
- Set up the SFD receptor as follows:
  a. Position the spot film device near the middle of the table.
  b. Lock SFD at MID SID.
  c. Position 3” of plexiglass and 1/4” Aluminum (Al) onto the table top centered in the X–ray beam.
  d. Make sure grid is IN field of view.
  e. Load a large size empty cassette into the SFD.

Note: Use the same size, style, screens, and film in your empty cassette as you are using for your loaded cassette. (this will maintain uniform back scatter and give consistent results.)

  f. Take an exposure. The exposure time must be between 40 msec and 100 msec. If not, more filtration must be added.
  g. Touch next step.
  h. Load cassette with film and place into the SFD. Use the screen/film combination stated on the console screen.
  i. Press the PREP and EXPOSE switches to take an exposure. Release the switches when the “EXPOSURE DONE” message appears.
  j. Develop the film.
  k. Measure the film optical density corresponding to the center of ion chamber Area 2 (near center of the film).
  l. Touch NEXT STEP softkey to proceed to Step 4.

X200 STEP 3 SCREEN DISPLAY



2-3-4-4 Step 4 of 8

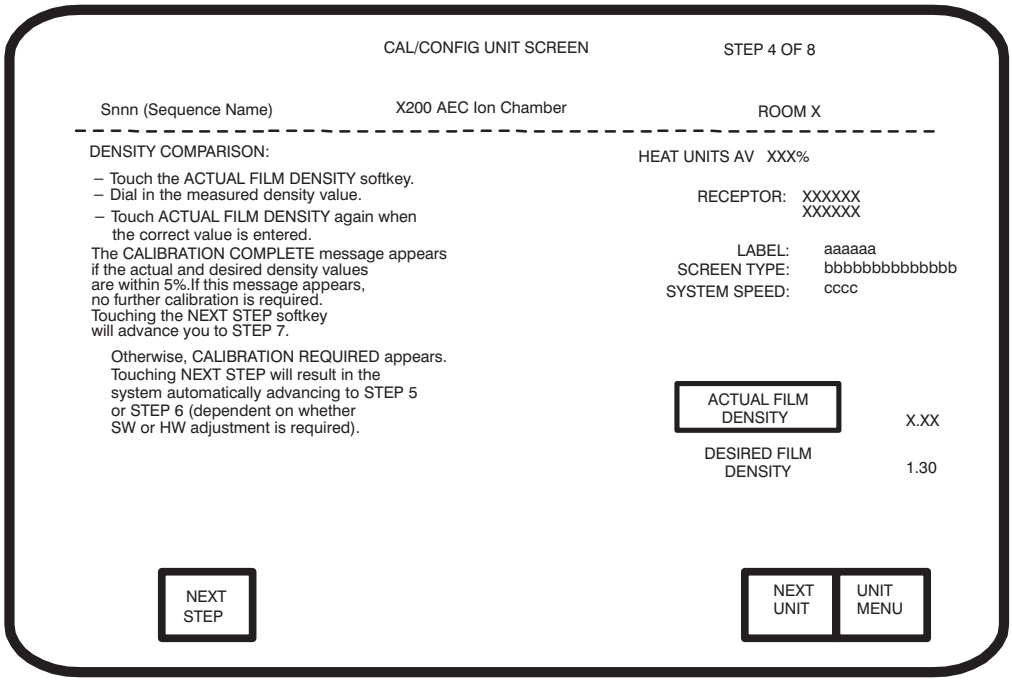
- Step 4 of 8: Area 2 Master Density Comparison
  a. Touch ACTUAL FILM DENSITY softkey and use the console dial to enter the measured film density from Step 3 (l).
  b. Touch ACTUAL FILM DENSITY softkey again to enter the value into the system. The system will compare the ACTUAL FILM DENSITY value to the DESIRED FILM DENSITY value. Continue the calibration as follows:
  c. If the ACTUAL FILM DENSITY value is within 5% of the DESIRED FILM DENSITY value, a "CALIBRATION COMPLETE" message is displayed and touching NEXT STEP will send you to Step 7 of the cal unit.

OR

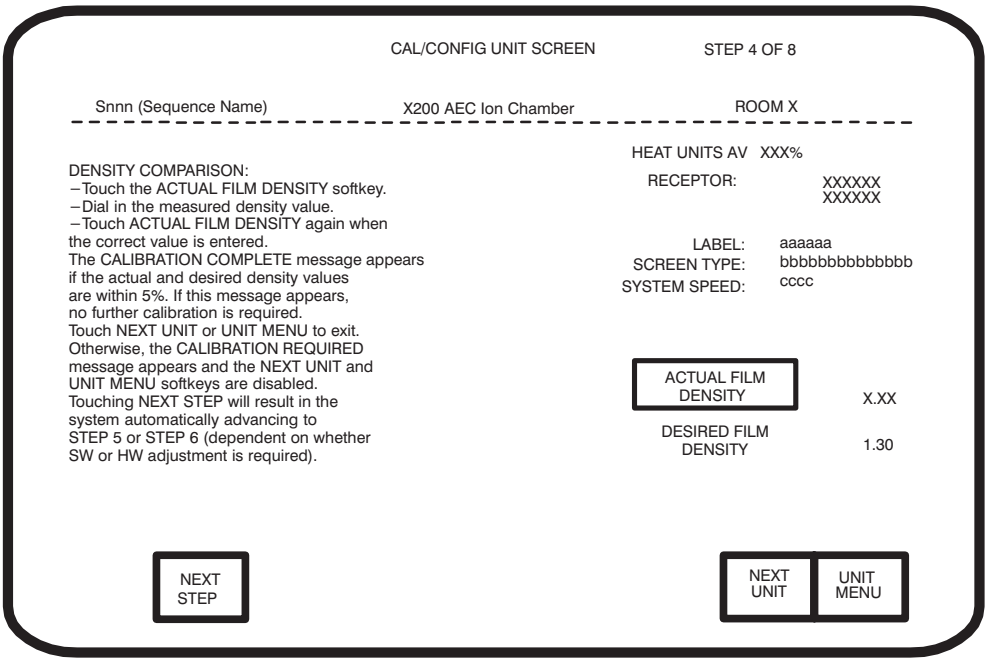
If a "CALIBRATION REQUIRED" message appears, further calibration is necessary.

Note: If the initial density was too light, the software will go to step 6 when the Next Step softkey is touched. If the initial density was too dark, the cal unit will automatically proceed to Step 5 MASTER DENSITY SOFTWARE ADJUSTMENT when the NEXT STEP softkey is touched. Step 5 provides a software gain adjustment to decrease film density, using the GAIN VALUE from Step 1 as a starting point.

X200 STEP 4 SCREEN DISPLAY
STANDARD SFD AND NON-SFD



X200 STEP 4 SCREEN DISPLAY

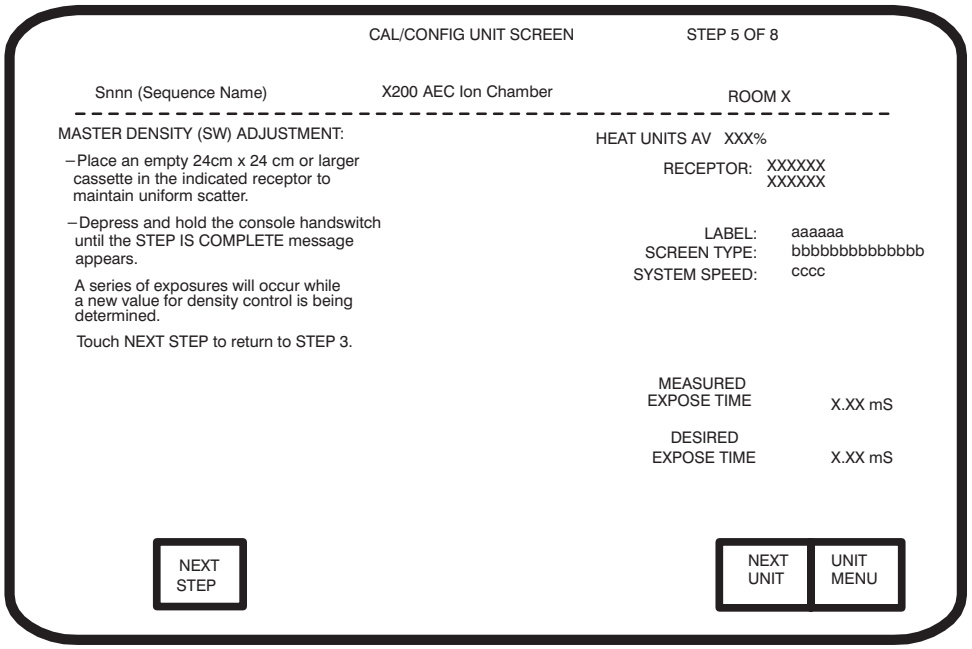


2-3-4-5 Step 5 of 8

- Step 5 of 8: Master Density Software Adjust if Desired is Less than Actual
  a. Load the large size empty cassette into the SFD.
  b. Press and hold the PREP and EXPOSE switches on the console handswitch. A series of exposures will be taken while a new value for density gain is being calculated.
  c. Terminate the exposure when the “STEP IS COMPLETE” message appears.
  d. Touch NEXT STEP softkey to return to Step 3 (h) for density measurement.

Note: The calibration unit can only be accomplished by looping through Steps 3 and 4 until the “CALIBRATION COMPLETE” message appears on the Step 4 screen display.

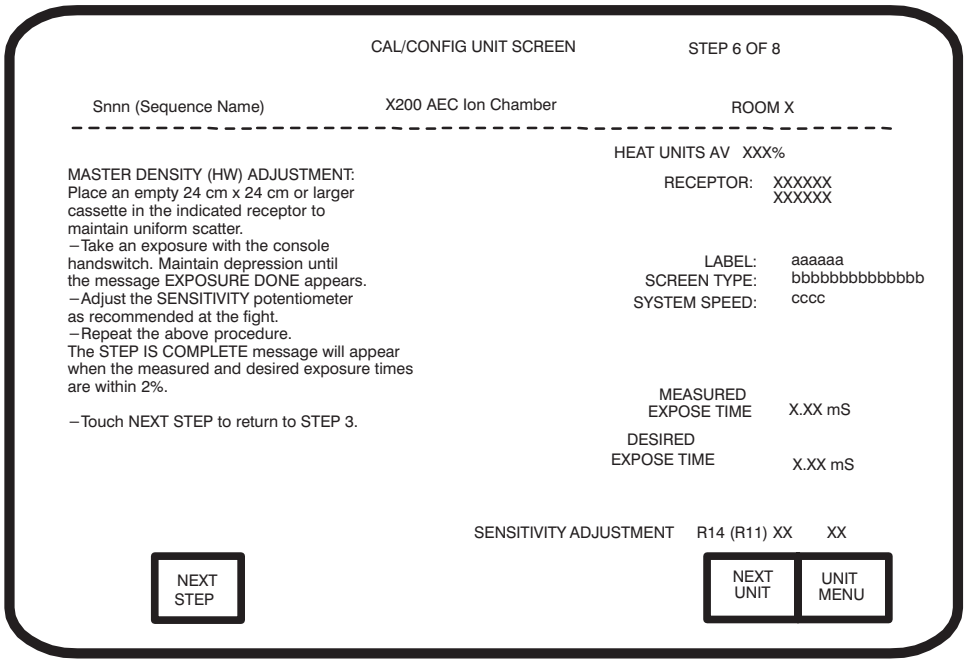
X200 STEP 5 SCREEN DISPLAY



2-3-4-6 Step 6 of 8

- Step 6 of 8: Master Density Hardware Adjust if Desired More Than Actual
  a. If the first film density is less than desired density, Advantx will call for a hardware (ion chamber pre–amp sensitivity potentiometer) adjustment.
- Load a large cassette into the receptor to maintain scatter.
- Press and hold the PREP and EXPOSE switches until “EXPOSURE DONE” message appears.
- Adjust SENSITIVITY potentiometer labeled “S” as recommended by the prompt on the screen. The Sensitivity Adjustment prompt will indicate the number of turns and the direction to adjust the potentiometer.
- Repeat taking exposures and adjusting the potentiometer. When the measured and desired exposure times are within +/– 2 percent, a “STEP IS COMPLETE” message will appear.
- Touching the NEXT STEP softkey will return the calibration to Step 3. Repeat Step 3 to measure the adjusted film density value and Step 4 for density comparison. If the density is correct, the unit will proceed to STEP 7 when NEXT STEP is selected. If the film density is incorrect, STEP 5 or STEP 6 will be displayed.

X200 STEP 6 SCREEN DISPLAY



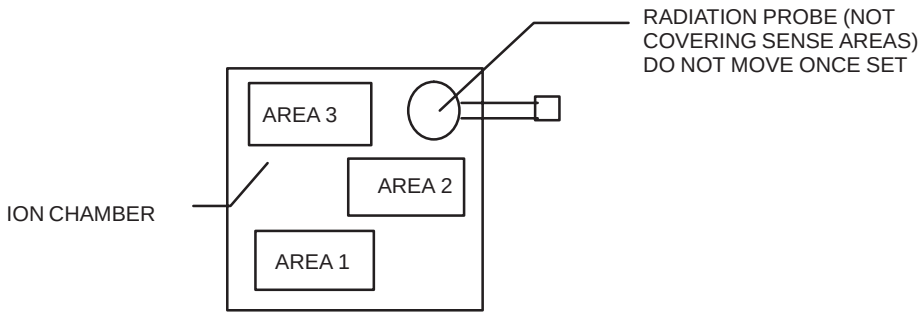
2-3-4-7 Step 7 of 8

- Step 7 of 8: Master Density Radiation Reading
- Areas 1 and 3 of the ion chamber will be adjusted to produce a film Optical Density (O.D.) that is within 0.1 O.D. of Area 2. To accomplish this, a radiation probe will be placed in the X–ray field so as not to cover any ion chamber sense area. In Step 7, one exposure will be taken to establish the amount of radiation Area 2 received when setting the master density. In Step 8, Areas 1 and 3 will be selected sequentially, and the radiation will be set 4% to 6% higher than Area 2 by adjusting the potentiometer for each area. One confirmation film will be taken to make sure the measured density is within 0.1 O.D. of Area 2.
  a. Load the large size empty cassette into the SFD.
  b. Attach the large probe from the MDH “R” meter to the probe stand and slide it next to the bottom of the SFD window as shown in Illustration 170. Do not block any of the 3 detector areas with the probe, as shown in Illustration 171.

Illustration 170 – SFD Ion Chamber Radiation Probe Placement



Illustration 171 – Ion Chamber and Radiation Probe Detail



NOTICE **Do not move or bump the probe once it is in position for the remainder of steps 7 & 8.**

c. Select exposure mode on the MDH. Touch its exposure button again to zero the meter and open the gate.

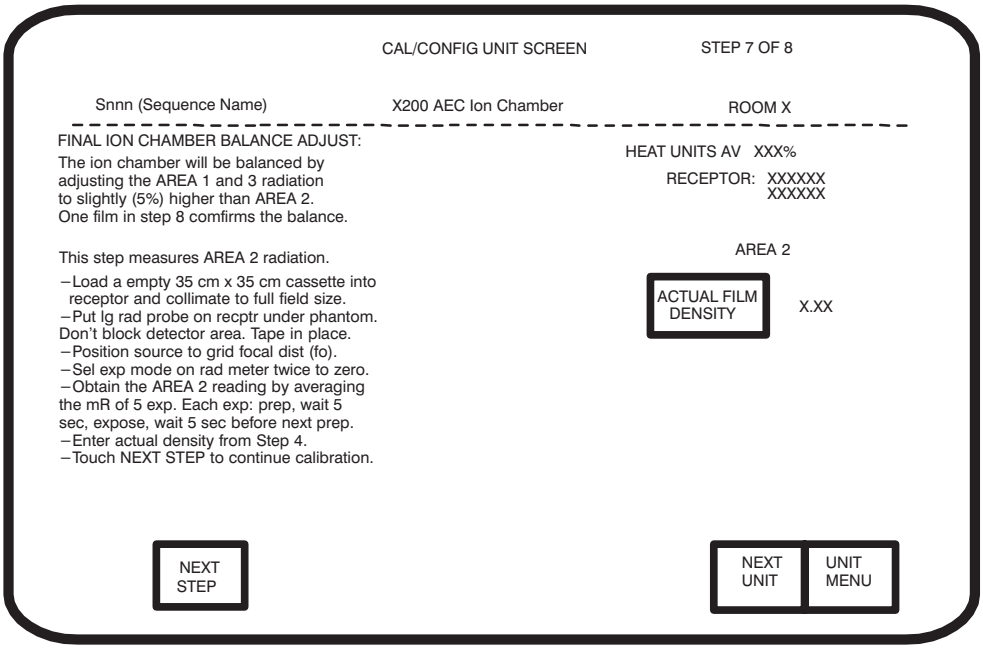
d. Take 5 exposures on the empty cassette. Wait 5 seconds between exposures.

e. Divide the total radiation by 5 to obtain the Area 2 Average Radiation in mR.

f. Touch the actual film density softkey and enter the **FINAL DENSITY** that was recorded in Step 4 (c) above. Dehighlight actual film density softkey and select NEXT STEP.

g. Reset the “R” meter by touching its Exposure Button twice.

X200 STEP 7 SCREEN DISPLAY



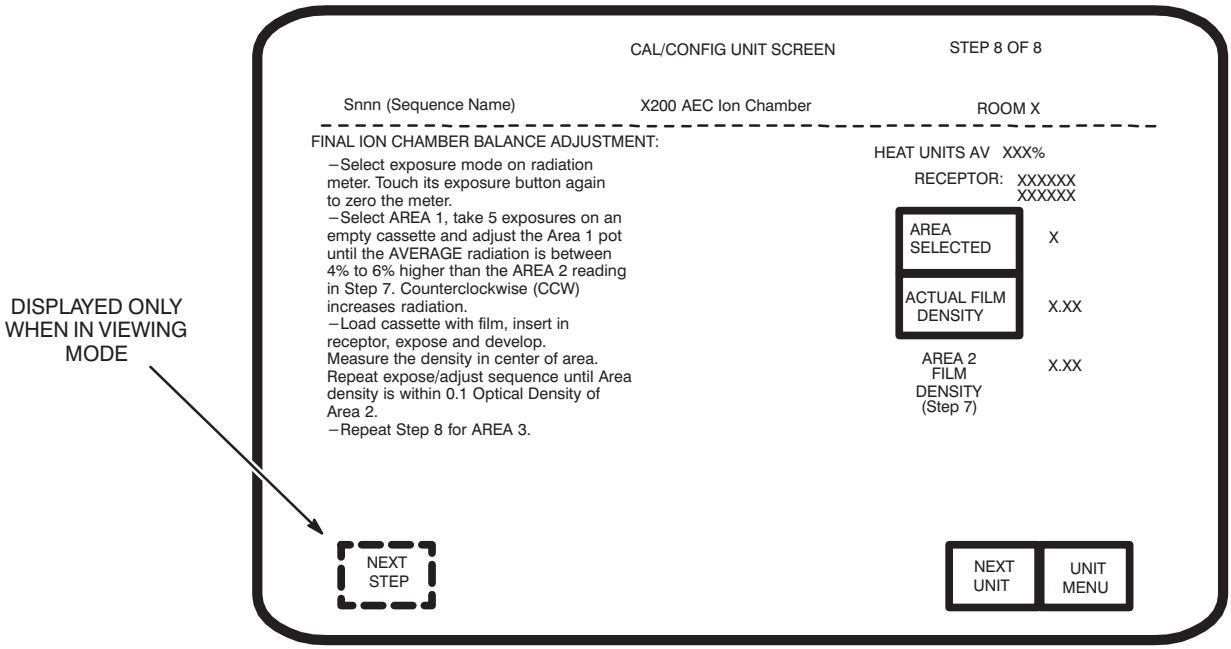
2-3-4-8 Step 8 of 8

- Step 8 of 8: Areas 1 And 3 Balance Adjustment Using Radiation Measurement
  a. Touch AREA SELECTED softkey and select Area 1 (or 3).
  b. With the empty cassette still loaded and the probe in the same position, take 5 exposures on Area 1 (or 3). Wait 5 seconds between exposures.
  c. Divide the total radiation by 5 to obtain the Area 1 (or 3) Average Radiation in mR. If the radiation reading on the MDH for Area 1 (or 3) is not 4% to 6% higher than the radiation measured when Area 2 was selected (Step 7), remove the SFD pre–amp access cover on the right rear corner of the SFD to gain access to the ion chamber Area 1 (or 3) potentiometer.
  d. Adjust Area 1 (or 3) balance pot on the pre–amp board. Clock–Wise (CW) on the balance pots will decrease radiation and Counter–Clock–Wise (CCW) will show an increase in radiation on the MDH meter. Continue taking exposures and adjusting the pot until the Average radiation on the MDH for 5 exposures is 4% to 6% higher than what was recorded as the Average Radiation for Area 2 in Step 7e above.
  e. When Area 1 (or 3) radiation reads 4% to 6% higher than Area 2, load the empty cassette with film and take 1 shot with Area 1 (or 3) selected.
  f. Develop the film and measure the density in the center of Area 1 (or 3).
  g. If the density is within 0.1 O.D of that entered for Area 2 touch the actual film density softkey and dial in the density. Dehighlight actual film density softkey.

  OR

  If the density of Area 1 (or 3) is not within 0.1 O.D. of Area 2, return to Step 8 (e) and continue taking exposures and adjusting the Area 1 (or 3) potentiometer so the radiation will produce the desired film density on film Area 1 (or 3).
  h. Reset the “R” meter.
  i. Repeat Step 8 on Area 3.
- The Master Density should now be set for all three areas.

X200 STEP 8 SCREEN DISPLAY



UNIT X202 – Receptor Master Density Calibration (Slow, Medium, Fast)

Time: x h xx min – Personnel: 1 field engineer

1 DESCRIPTION

Calibration unit X202 adjusts the receptor master density to compensate for the speed of different screen/film combinations and receptor pairs. The calibration must be accomplished on each ION Chamber Receptor comprising a system configuration. The adjustment sets a gain parameter to establish proper film density as measured with a densitometer. The gain parameter must be calibrated for each screen/film combination (SLOW, MEDIUM, and FAST) used with a receptor. Three steps are required to accomplish the calibration. A screen display is provided for each step

Note: Only perform the X202 Calibration Unit that pertains to the system configuration; i.e., If the system uses two screen/film combos and they are programmed as DETAIL and MEDIUM, then only perform MEDIUM (DETAIL is always calibrated by Calibration Unit X200 which is accomplished as a prerequisite to X202).

2 EQUIPMENT REQUIRED

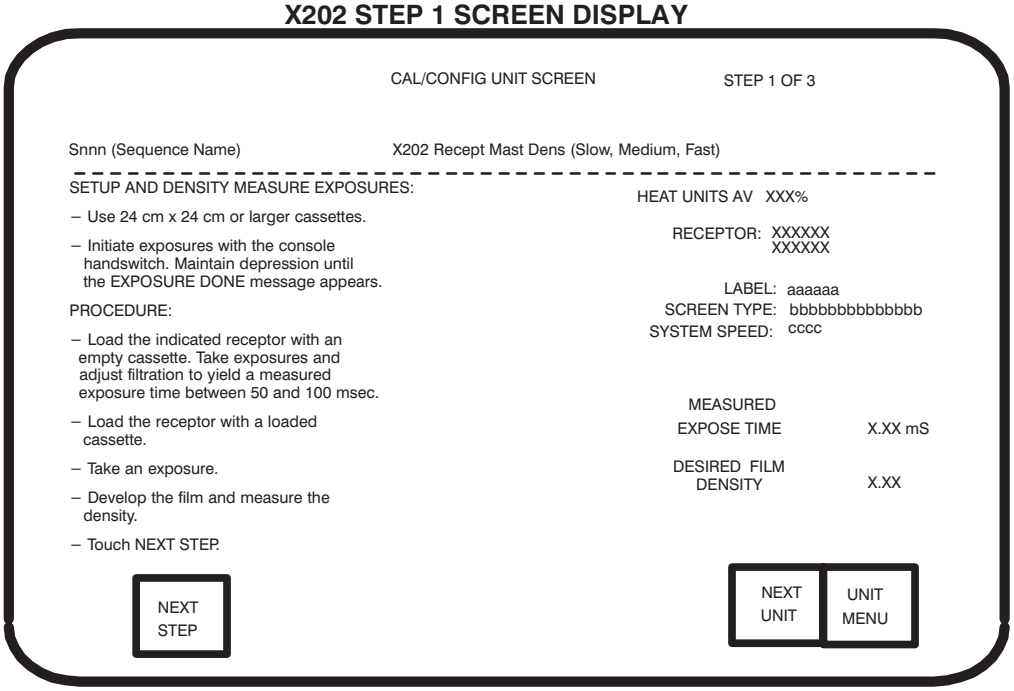
Cassette (24 cm X 24 cm or larger), film, and a densitometer.

3 CAL PROCEDURE

3-1 Step 1, Density Measurement

- Initiate calibration by placing an empty cassette into the receptor to be calibrated.
- Press the PREP and EXPOSE switches to take an exposure. Adjust the filtration to yield a measured expose time between 50 msec and 100 msec.
- Remove the empty cassette and reload the receptor with a cassette containing the film type and speed specified on the console screen.
- Press the PREP and EXPOSE switches to take an exposure. Develop the film. Measure the film density with a densitometer. Record the density value.
- Touch NEXT STEP softkey to proceed to Step 2.

X202 STEP 1 SCREEN DISPLAY



3-2 Step 2, Density Comparison

- Touch the ACTUAL FILM DENSITY softkey and using the console dial, enter the density value measured and recorded in Step 1.
- Touch the ACTUAL FILM DENSITY softkey again to load the measured value into NV RAM. The system will compare the ACTUAL FILM DENSITY value to the DESIRED FILM DENSITY value. Continue the calibration as follows:

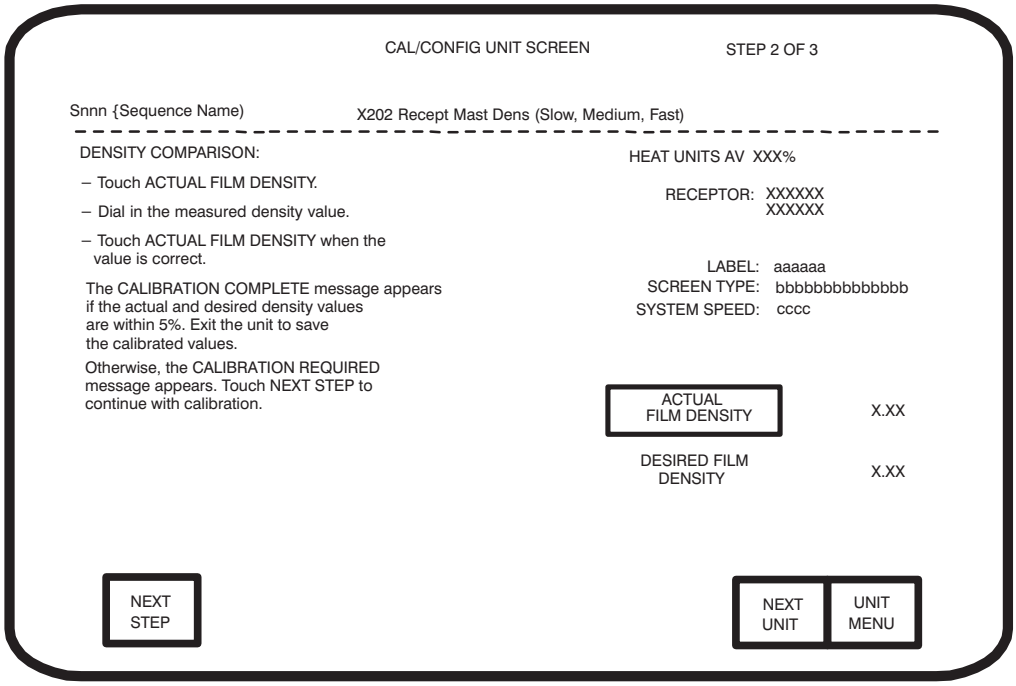
1. If the ACTUAL FILM DENSITY value is within ± 5 percent of the DESIRED FILM DENSITY value a “CALIBRATION COMPLETE” message is displayed and Step 2 of the calibration is the final step. Touch NEXT UNIT or UNIT MENU softkey to exit the unit.

OR

2. If the ACTUAL FILM DENSITY value is not within specification, a “CALIBRATION REQUIRED” message is displayed. Touch NEXT STEP softkey to continue the calibration.

Note: If the “CALIBRATION COMPLETE” message is displayed, the NEXT UNIT and UNIT MENU softkeys are enabled to permit exiting the cal unit and the NEXT STEP softkey is disabled. If further calibration is required, the NEXT UNIT and UNIT MENU softkeys are disabled and the NEXT STEP softkey is enabled.

X202 STEP 2 SCREEN DISPLAY



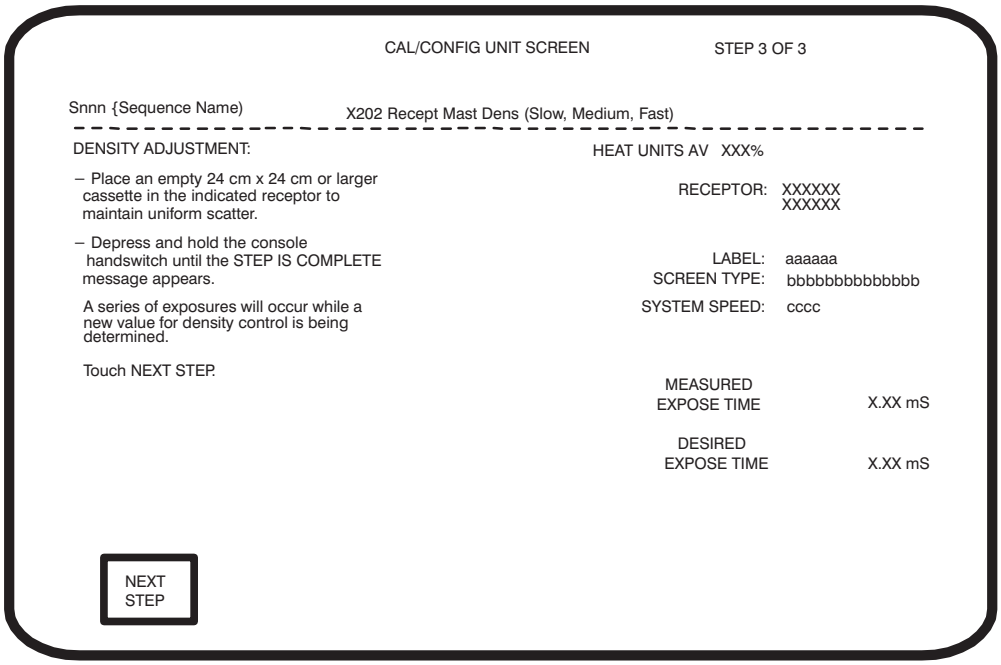
3-3 Step 3, Density Adjustment

- Reload an empty cassette (24 cm X 24 cm or larger) into the receptor to maintain uniform scatter.
- Press and hold the PREP and EXPOSE switches. The system will take a series of exposures and adjust the DESIRED EXPOSE TIME to ± 2 percent of the MEASURED EXPOSE TIME. Release the PREP and EXPOSE switches when the “STEP IS COMPLETE” message is displayed.
- Touch NEXT STEP softkey to return to Step 1. Repeat Step 1 and Step 2.

Note: If termination of the exposures is caused by premature release of the PREP and EXPOSE switches, a backup timer, or backup mAs error, an appropriate error message is displayed. Correct the condition and re–initiate exposures by pressing the PREP and EXPOSE switches. The calibration will restart using the last gain parameter output value calculated.

Note: Exiting the calibration unit can only be accomplished by looping through STEP 2 until the “CALIBRATION COMPLETE” message appears on the STEP 2 screen display.

X202 STEP 3 SCREEN DISPLAY



UNIT X203 – AEC Grid Compensation

Time: x h xx min – Personnel: 1 field engineer

1 DESCRIPTION

Calibration unit X203 adjusts the grid compensation density parameters for a given receptor. The parameter is set to compensate for changes in the relationship between detected radiation and image producing radiation based on grid location. The adjustment is set according to measured film density with the **grid removed.** The calibration must be performed on each receptor in the system that contains a removable grid option and ION Chamber.

Note: On systems equipped with a Spot Film Device (SFD), the unit automatically deselects the grid.

2 EQUIPMENT REQUIRED

Cassette (24 cm x 24 cm or larger), film, and densitometer.

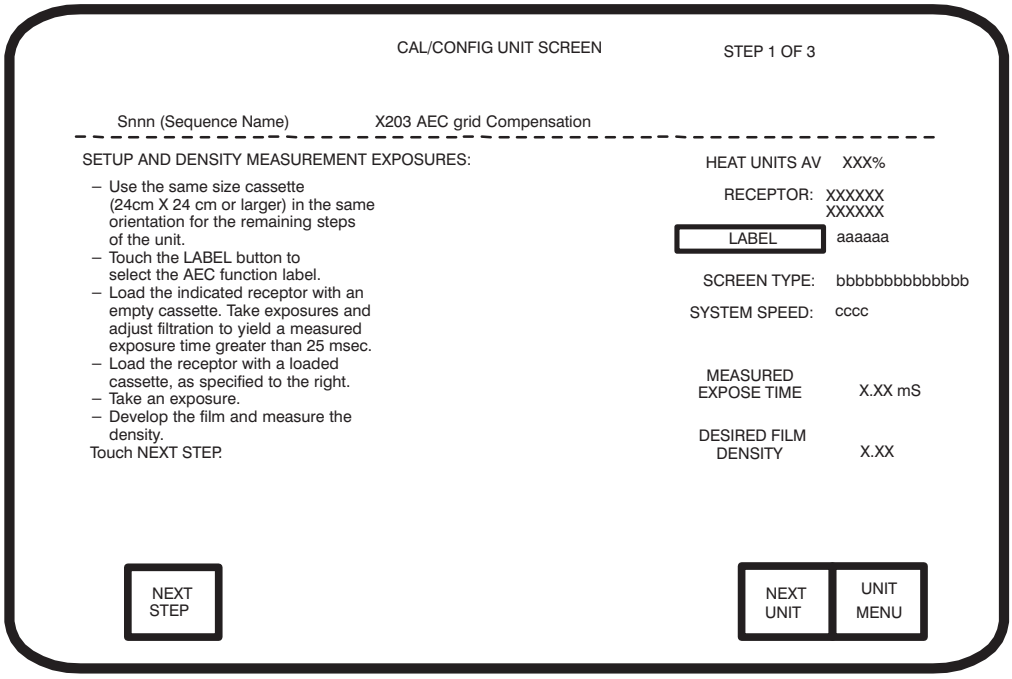
3 CAL PROCEDURE

3-1 Step 1. Setup and Density Measurement

Note: The LABEL softkey is only displayed if more than one film speed was configured in Config Unit C025, AEC Configuration. You must then repeat this unit for each film speed selection being used by the customer.

- If displayed, touch the LABEL softkey. Each time the LABEL softkey is touched the next available AEC function label is displayed on the screen. Continue touching the softkey until the desired name is indicated.
- Load an empty cassette into the receptor to be calibrated.
- Take an exposure. Adjust the filtration to yield a measured expose time greater than 25 msec.
- Remove the empty cassette and reload the receptor with a cassette containing the film type and speed specified on the console screen.
- Take another exposure. Develop the film. Measure the film density with a densitometer. Record the density value.
- Touch NEXT STEP softkey to proceed to Step 2.

X203 STEP 1 SCREEN DISPLAY



Note: A “GAIN LIMIT” error may be indicated when running this unit if the AEC Labels set in Config Unit C034 in are not properly highlighted when exiting that unit.

3-2 Step 2. Density Comparison

- Touch the ACTUAL FILM DENSITY softkey and using the console dial, enter the density value measured and recorded in Step 1.
- Touch the ACTUAL FILM DENSITY softkey again to load the measured value into NV RAM. The system will compare the ACTUAL FILM DENSITY value to the DESIRED FILM DENSITY value. Continue the calibration as follows:

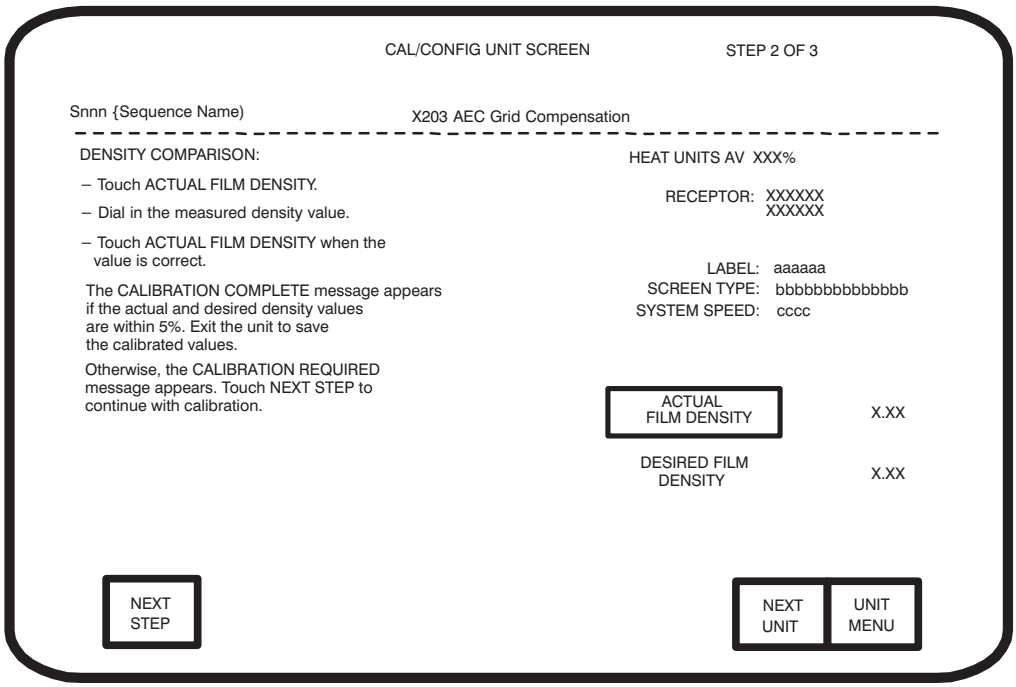
1. If the ACTUAL FILM DENSITY value is within ± 5 percent of the DESIRED FILM DENSITY value a “CALIBRATION COMPLETE” message is displayed and Step 2 of the calibration is the final step. Touch NEXT UNIT or UNIT MENU softkey to exit the unit.

OR

2. If the ACTUAL FILM DENSITY value is not within specification, a “CALIBRATION REQUIRED” message is displayed. Touch NEXT STEP softkey to continue the calibration.

Note: If the “CALIBRATION COMPLETE” message is displayed, the NEXT UNIT and UNIT MENU softkeys are enabled to permit exiting the cal unit and the NEXT STEP softkey is disabled. If further calibration is required, the NEXT UNIT and UNIT MENU softkeys are disabled and the NEXT STEP softkey is enabled.

X203 STEP 2 SCREEN DISPLAY



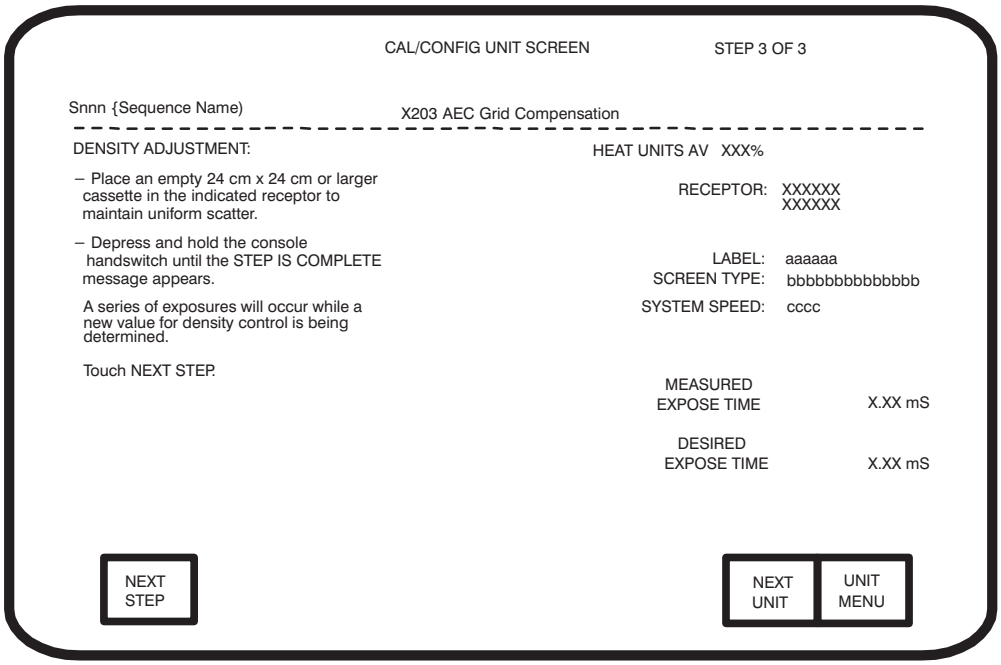
3-3 Step 3, Density Adjustment

- Reload an empty cassette (24 cm X 24 cm or larger) into the receptor to maintain uniform scatter.
- Press and hold the PREP and EXPOSE switches. The system will take a series of exposures and adjust the DESIRED EXPOSE TIME to ± 2 percent of the MEASURED EXPOSE TIME. Release the PREP and EXPOSE switches when the “STEP IS COMPLETE” message is displayed.
- Touch NEXT STEP softkey to return to Step 1. Repeat Step 1 and Step 2.

Note: If termination of the exposures is caused by premature release of the PREP and EXPOSE switches, a backup timer, or backup mAs error, an appropriate error message is displayed. Correct the condition and re–initiate exposures by pressing the PREP and EXPOSE switches. The calibration will restart using the last gain parameter output value calculated.

Note: Exiting the calibration unit can only be accomplished by looping through STEP 2 until the “CALIBRATION COMPLETE” message appears on the STEP 2 screen display.

X203 STEP 3 SCREEN DISPLAY



UNIT X204 – kVp Compensation

Time: x h xx min – Personnel: 1 field engineer

1 DESCRIPTION

Calibration Unit X204 is used to modify or program a film screen/film speed combination kVp compensation curve for each of the following AEC Function Labels; DETAIL, SLOW, MEDIUM, and FAST configured in C025.

2 EQUIPMENT REQUIRED

Sensitometer
Plexiglas Kit 46–270140G1
1/4″ aluminum and 1/32″ copper from CV Phantom

3 CAL PROCEDURE

3-1 Step 1 of 3. Information Screen

This unit allows modification of the kVp compensation curve data for each screen/film combination (DETAIL, SLOW, MEDIUM, and FAST) configured in C025. If a new screen/film combination was created in Step 2 of C025, a default kVp response curve was stored and will probably need to be modified.

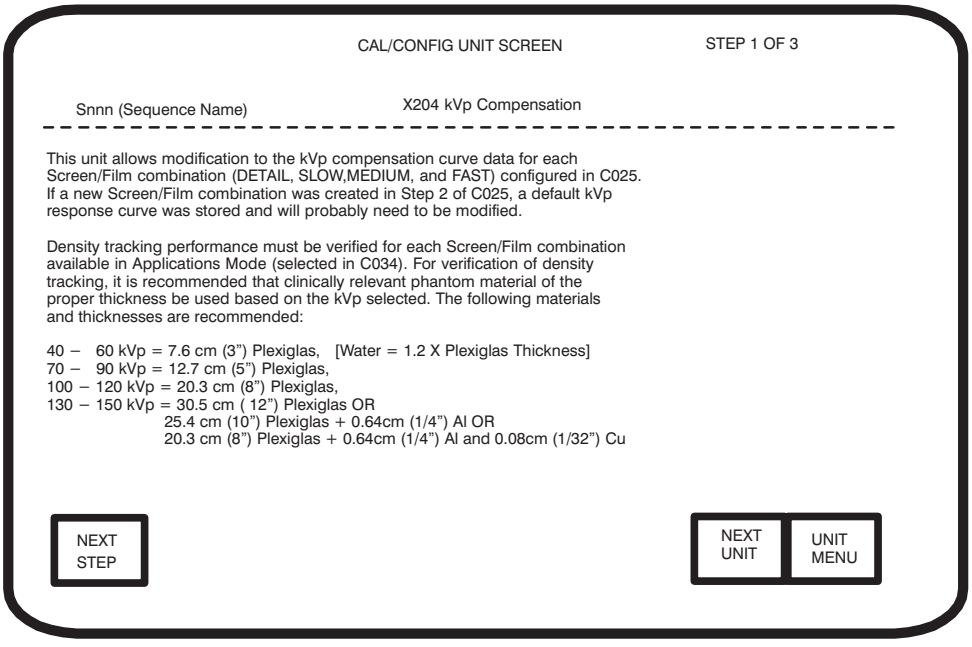
Density tracking performance must be verified for each screen/film combination available in APPLICATIONS MODE (selected on C034).

For verification of density tracking, it is recommended that clinically relevant phantom material (PLEXIGLAS or water) of the proper thickness be used based upon the kVp selected.

The recommendation is as follows:

40 – 60 kVp	=	7.6 cm (3″) Plexiglas
70 – 90 kVp	=	12.7 cm (5″) Plexiglas
100 – 120 kVp	=	20.3 cm (8″) Plexiglas
130 – 150 kVp	=	30.5 cm (12″) Plexiglas OR
		25.4 cm (10″) Plexiglas plus 0.64 cm (1/4″) Al OR
		20.3 cm (8″) Plexiglas plus 0.64 cm (1/4″) Al & 0.08 cm (1/32”) Cu

X204 STEP 1 SCREEN DISPLAY



3-2 Step 2 of 3. kVp Compensation Data Screen

- Touch the kVp softkey of the screen/film type you want to change and select the kVp value to be modified using the Advantx console dial. The data for the selected kVp will be displayed to the right.

Note: 80 kVp data point cannot be modified because it is used as a reference point in calculations.

- Touch the Data softkey and enter the desired data value using the Advantx console dial.

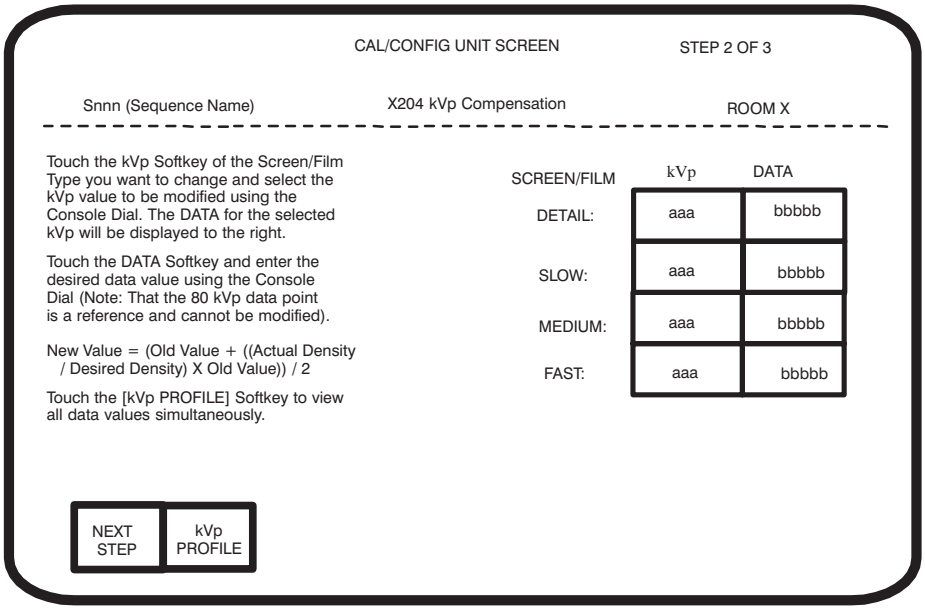
NEW VALUE = [Old Value + ((Actual Density **/** Desired Value) x Old Value))] / 2

- Select/Adjust DATA as needed (increasing value decreases density)

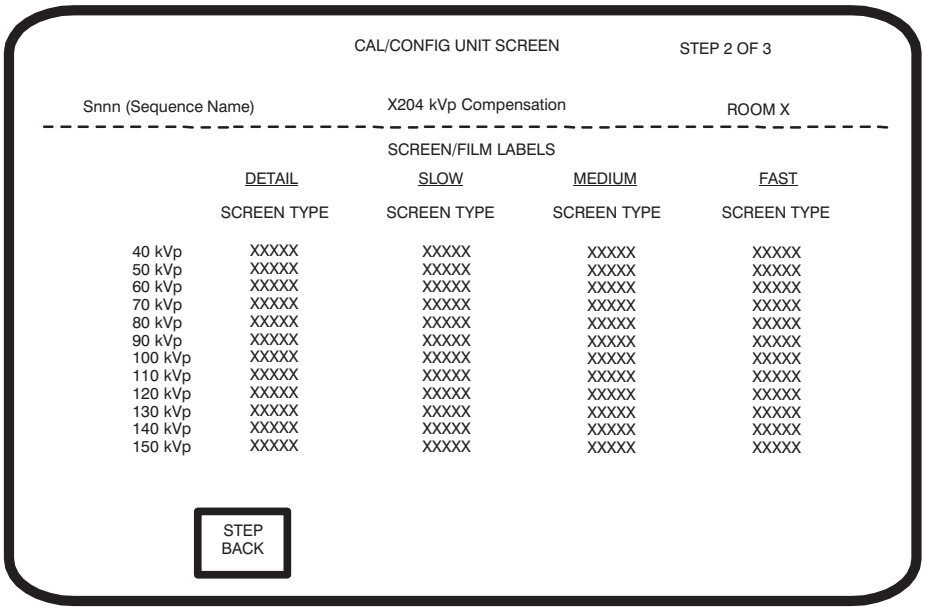
Note: Selecting the kVp PROFILE softkey will take you to an optional STEP 2 screen which will display kVp data tables for all four screen/film labels.

- Select kVp PROFILE softkey to view data table if desired.
- Select NEXT STEP softkey

X204 STEP 2 SCREEN DISPLAY



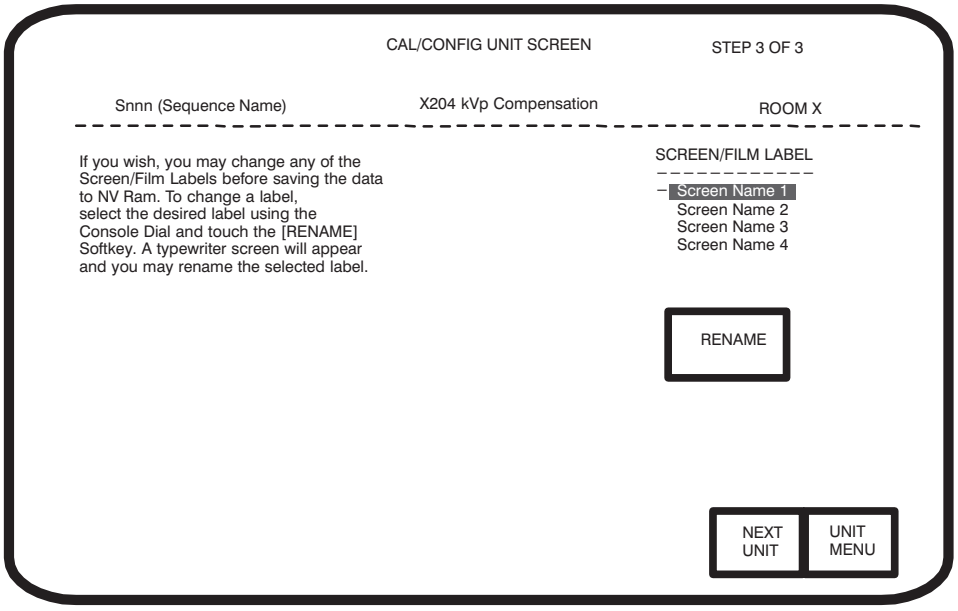
X204 STEP 2 OPTIONAL SCREEN DISPLAY



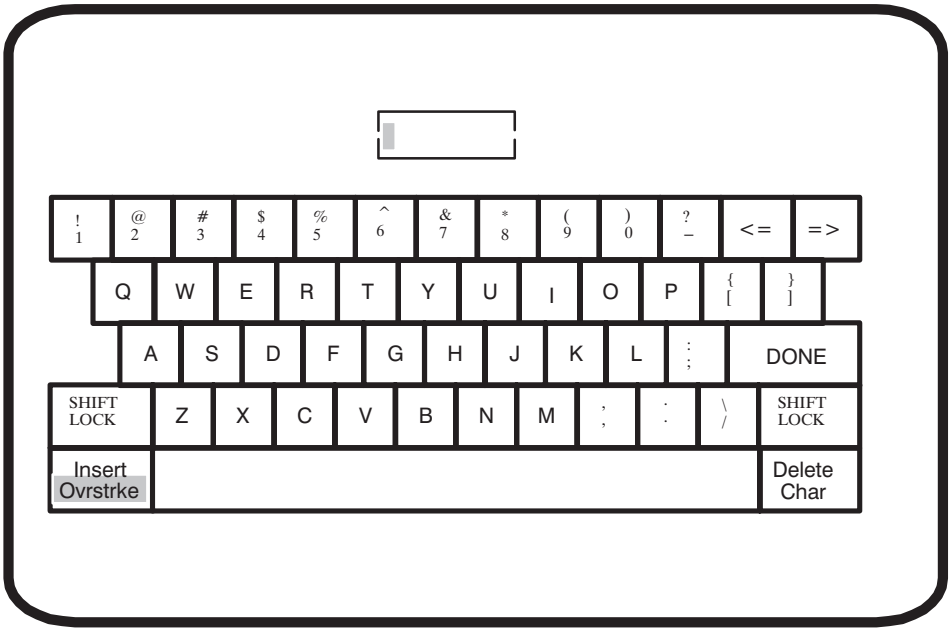
3-3 Step 3 of 3. Renaming/Saving Custom kVp Data

- If you wish, you may change any of the Screen/Film Labels before saving the data to NV ram. To change a label, select the desired label using the Advantx console dial and touch the RENAME softkey. A typewriter screen will appear and you may rename the selected label.
- Select NEXT UNIT or UNIT MENU to save data to NV ram and retest in APPLICATIONS.

X204 STEP 3 INTENSIFIER SCREEN RENAMING DISPLAY



X204 RENAME TYPEWRITER SCREEN DISPLAY



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UNIT X205 – AEC Density Tweak

Time: x h xx min – Personnel: 1 field engineer

1 DESCRIPTION

Calibration Unit X205 is intended for use as a service tool after system installation. The unit provides an easy method of making fine adjustments to the film density parameter of a receptor to a value desired by the hospital. The unit does not have to be run as part of the system initial calibration sequence. It is only necessary to run the unit when a film density change is required by the hospital. The unit can be run on each receptor configured in the system. Only one step is required to perform the adjustment.

Note: All film /screen combinations for the selected receptor will be equally effected by the adjustment.

2 EQUIPMENT REQUIRED

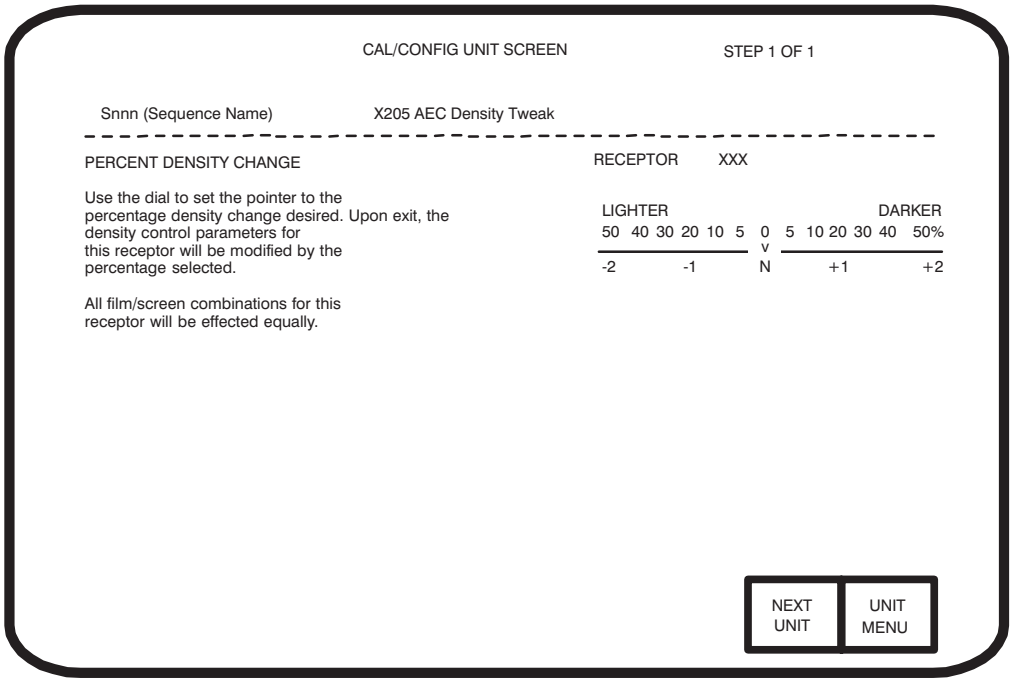
None.

3 CAL PROCEDURE

Upon entering the unit, the console dial is enabled to provide adjustment of the film density of the receptor indicated on the screen. Determine the film density desired at the site for the receptor to be adjusted.

- If the existing film density is too high, use the console dial to set the pointer to the negative percentage density change desired (– percentage).
- If the existing film density is too low, use the console dial to set the pointer to the positive percentage density change desired (+ percentage).
- Repeat, if necessary, until desired film density is obtained.
- Exit the unit by touching the NEXT UNIT or UNIT MENU softkey. Upon exit the density control parameters for the receptor indicated on the screen will be modified by the percentage change selected.

X205 SCREEN DISPLAY



UNIT X209 – Photocell Calibration

Time: x h xx min – Personnel: 1 field engineer

1 DESCRIPTION

Calibration Unit X209 is used to calibrate the voltage output of a photo–cell/brightness integrator function at a known dose rate. The function of the integrator is to maintain the correct input dose level to the image intensifier for imaging modes such as Photospot, Cine, and Digital Fluoro. Two steps are required to accomplish the calibration. Step 1 positions filtration. Step 2 calibrates the brightness integrator. A screen display is provided for each step.

NOTICE

When running this unit on a pulsed system, ensure that "Fil–A" lead filter potentiometer on LFX1 A1 A7 (LFX I/O) is adjusted fully clockwise (cw) or the unit will not reach proper brightness level.

2 EQUIPMENT REQUIRED

Filtration (1/4 inch aluminum, 1/32 inch copper, and 2–1/4 inches of Plexiglas) from CV phantom
For a 9 inch (22 cm) II tube, use a 9 inch CV phantom. For a 12 inch (30 cm) or 16 inch (40 cm) II tube, use a 12 inch CV phantom.

3 SPECIAL INSTRUCTIONS

Note: For Vascular Systems only, before system calibration, verify that additional filter (copper–aluminum filter) is not installed on top of collimator. (Open sensor hinge assembly to verify.) If installed, remove before performing calibration.

4 CAL PROCEDURE

4-1 Step 1. Position Filtration

For Advantx–E Vascular Systems, refer to Illustration 144 in X107 Service Mode unit:

If you just performed X107 unit:

- Leave the grid in place.
- Do not remove the dosimeter probe (centered in the FOV and close to the II anti–collision plane).
- Leave the table top at isocenter.
- Leave the II anti–collision plate at 30 cm from the table top.
- Leave the Plexiglass, Aluminium and Copper filters from the CV phantom in place on the table top.

Otherwise:

- Leave the grid in place
- Set the table top at isocenter.
- Set the II anti–collision plate at 30 cm from the table top.
- Place 1/32 inch copper, 1/4 inch Aluminium and 2–1/4" Plexiglass in the X–Ray beam (stack with copper on the top).

Note: For 40 cm (16 inches) IIs, the collimator blades may have to be slightly closed so as to eliminate raw radiation.

For all other Systems:

- Before proceeding with exposures, remove the grid (if present) and position the Image Intensifier and X–ray tube at minimum SID.
- Place 1/32 inch copper and 1/4 inch aluminum in the x–ray beam (stack with copper on the top).

For all systems:

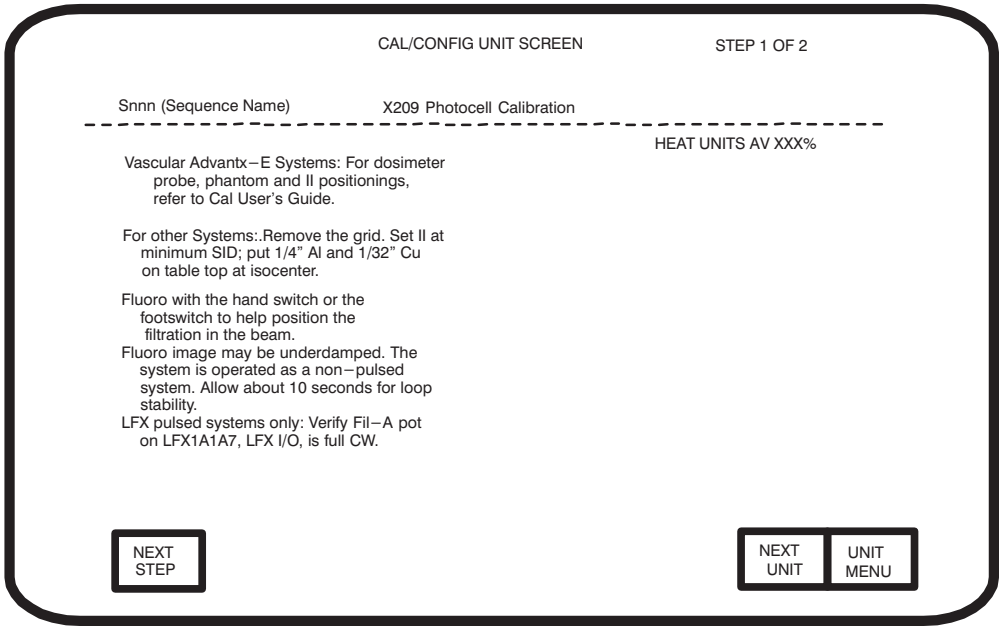
- Take fluoro exposures with the fluoro footswitch or console handswitch to assist in centering the filtration in the beam.

Note: The fluoro image may be under damped because the system is operating in the non–pulsed mode. Wait 10 seconds for loop stability.

Note: Verify that the green LED on the image brightness section of the ECM is on. More filtration may have to be added to accomplish this.

- When the filtration has been properly centered, touch NEXT STEP softkey to proceed to Step 2, Brightness Integrator Calibration.

X209 STEP 1 SCREEN DISPLAY



4-2 Step 2. Brightness Integrator Calibration

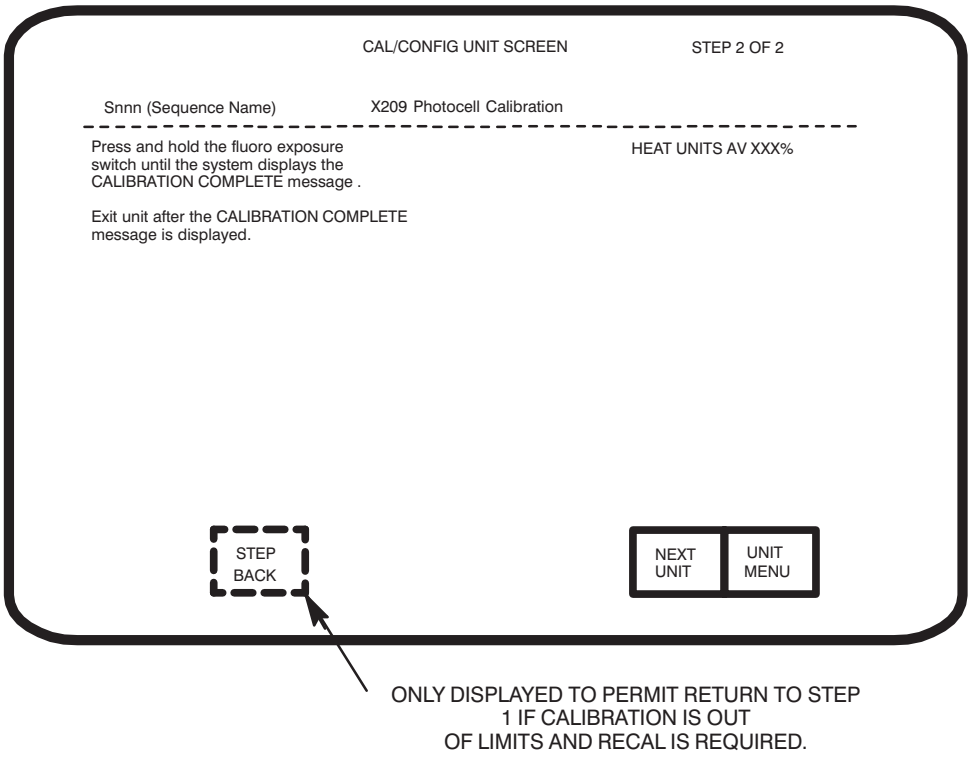
- Initiate and maintain a fluoro exposure with the footswitch or console handswitch. The system will automatically calculate Dose/Volt values and terminate the exposure. Continue the calibration as follows:

1. If the integrated brightness exposure time from the fluoro exposure is within limits, a "CALIBRATION COMPLETE" message is displayed. Touch NEXT UNIT or UNIT MENU softkey to exit the unit.

OR

2. If the calibration is out of limits, the message "PHOTO–CELL INTEGRATOR BRIGHTNESS IS OUT OF RANGE" is displayed and the STEP BACK softkey appears on the screen. Touch the STEP BACK softkey to return to Step 1 and repeat the calibration.

X209 STEP 2 SCREEN DISPLAY



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UNIT X211 – Dynamic Dose Scaling DX (DLX)

Time: x h xx min – Personnel: 1 field engineer

1 DESCRIPTION

Calibration Unit X211 is used to establish the initial Cardiac Dose D value in nGy/Frame (µR/Frame) for the system and then scale dose values for dose C, B, and, A accordingly. The unit must be run at the time of initial system installation and anytime a new dose level is desired. Only one step is required to accomplish the calibration. The calibration unit provides dose scaling for DLX configured systems. The appropriate screen is displayed according to calibration sequence menu selection.

2 EQUIPMENT REQUIRED

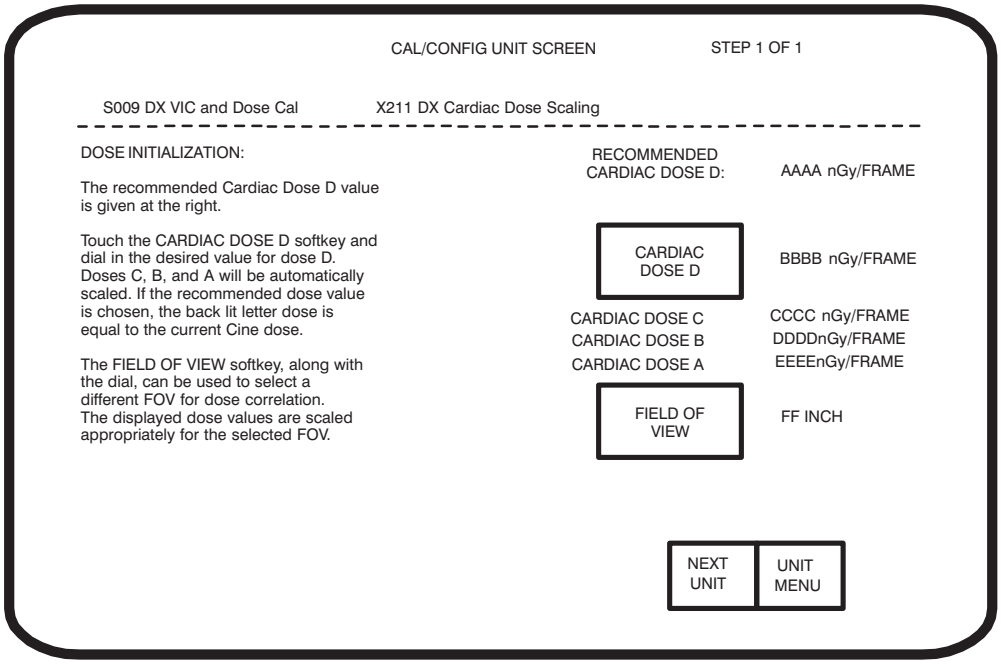
None.

3 CAL PROCEDURE

3-1 Dose Scaling, DLX

- Upon entry into the calibration unit, the recommended value for Cardiac Dose D is indicated on the console screen. If the recommended dose D value is to be used, the dose A, B, or C value that is highlighted in reverse video is equal to the current Cine dose.
- To change the dose D value to another value, touch CARDIAC DOSE D softkey and use the console dial to enter the new dose D value. Dose A, B, and C will be automatically scaled to the proper µGy (µR) value for the new dose D value.
- A field of view change can be accomplished by touching the FIELD OF VIEW softkey and then dialing in the field of view desired with the console dial. The displayed dose values will be automatically scaled to the appropriate values for the selected field of view.

X211 DLX SCREEN DISPLAY



- Touch NEXT UNIT or UNIT MENU softkey to exit the unit. Exiting the unit loads the calibration data into the system.

UNIT X212 – Cine Film Density Calibration

Time: x h xx min – Personnel: 1 field engineer

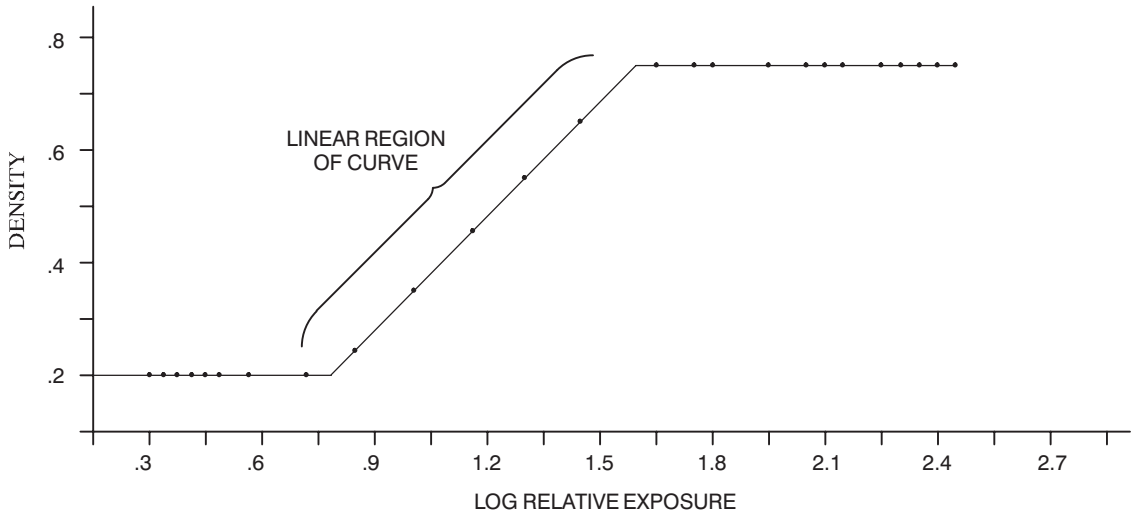
1 DESCRIPTION

Calibration Unit X212 is used to set the proper aperture diameter value and brightness integrator gain required to produce a desired film density. Six steps are required to accomplish the calibration. A screen display is provided for each step. A MORE INFO SCREEN, that can be accessed from Step 1, permits viewing of any previously entered sensitometric data.

2 BASIC THEORY

The unit is used to run cine exposures to measure film density. The test strip of cine film is then exposed to a green light sensitometer to produce a series of sensitometric exposure data. A cine film characteristic curve (H and D Curve) is then developed by plotting the actual film density against the series of known exposures (See Illustration 172). Aperture diameters and brightness integrator gain changes needed to produce the desired film density can then be calculated from the characteristic curve.

Illustration 172 – H–D Characteristic Curve



3 SYSTEM SETUP

Upon entering the unit, the system will be automatically set for operation in the following mode.

- Cine.
- Fluoro.
- Normal FOV.
- Collimator open to FOV limits.
- Default Frame Rate: 30 F/S for 60 Hz systems; 25 F/S for 50 Hz systems.
- Pulse Width 10 msec.
- 80 kVp, dialed.
- Large Focal Spot.

4 EQUIPMENT REQUIRED

CV–II phantom, cine film and green light sensitometer.

NOTICE

A 12 inch phantom must be used on systems with 40 cm II.

5 SPECIAL INSTRUCTIONS

Note: **For Vascular Systems Only:** Before system calibration, verify that additional filter (copper–aluminum filter) is not installed on top of collimator. (Open sensor hinge assembly to verify.) If installed, remove before performing calibration.

6 CAL PROCEDURE

6-1 Step 1. Operator Setup

- Place the CV–II phantom on the table toward the head end.
- Take a fluoro exposure and center the CV–II phantom in the field of view with the heart section towards the head end of the table.
- Position the table top at isocenter.

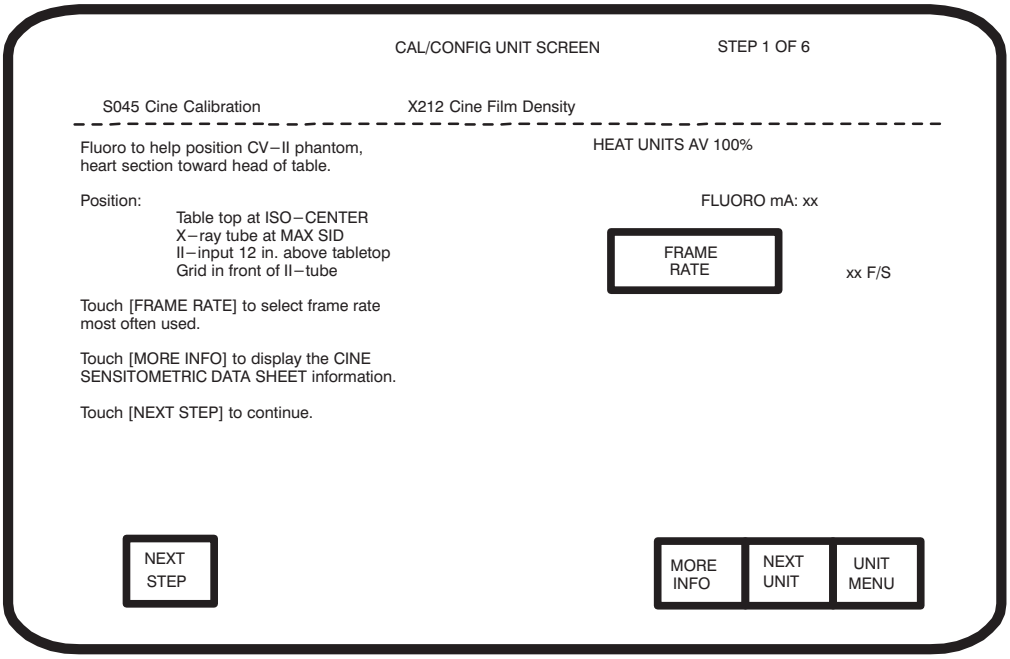
NOTICE

On systems configured with the Omega EP table, the table does not elevate to isocenter. Therefore, elevate the table to maximum height and then add a 20 mm spacer to the bottom of the CV–II phantom to achieve isocenter position.

- Position the x–ray tube at maximum SID and the Image Intensifier 12 inches above isocenter.
- Place grid in front of Image Intensifier.
- If required, touch FRAME RATE softkey to select frame rate most often used at the site. A 30 F/S (the default value) or 60 F/S may be selected for 60 Hz systems. A 25 F/S (the default value) or 50 F/S may be selected for 50 Hz systems.
- Touch NEXT STEP softkey to proceed to Step 2.

Note: Touching the MORE INFO softkey will allow the serviceman to access a “more info” screen that displays a CINE SENSITOMETRIC DATA SHEET that indicates any previously entered cine sensitometric information. Touching the STEP BACK softkey on the “more info” screen will return to Step 1.

X212 STEP 1 SCREEN DISPLAY



X212 "MORE INFO" SCREEN DISPLAY

CAL/CONFIG UNIT SCREEN STEP 1 OF 6

S045 Cine Calibration X212 Cine Film Density

CINE SENSITOMETRIC DATA SHEET AS OF xx/xx/xx

ANATOMY	DENSITY 6"	DENSITY 9"	LOG REL 6"
LUNG	d.dd	d.dd	d.dd
HEART	d.dd	d.dd	d.dd
MEDIA	d.dd	d.dd	d.dd
ABD	d.dd	d.dd	d.dd
B+F+S	d.dd	d.dd	
B+F	d.dd		

LENS FCL LEN: ddd mm
FILM TEMP: ddd deg
FILM TIME: ddd sec
AVE GRADIENT: d.dd
DMAX/DMIN: d.dd/d.dd
FILM TYPE: ttttt ttt

D/H

1) d.dd	8) d.dd	15) d.dd
2) d.dd	9) d.dd	16) d.dd
3) d.dd	10) d.dd	17) d.dd
4) d.dd	11) d.dd	18) d.dd
5) d.dd	12) d.dd	19) d.dd
6) d.dd	13) d.dd	20) d.dd
7) d.dd	14) d.dd	21) d.dd

ANATOMY	% DELTA 6"	DENSITY 9"	REL EXP 6"
LUNG/HEART	ddd	ddd	d.dd
HEART/MEDIA	ddd	ddd	d.dd
MEDIA/ABD	ddd	ddd	d.dd
ABD/B+F+S	ddd	ddd	

STEP BACK

6-2 Step 2. Starting Aperture Diameter

Note: If the system was shipped without an aperture in place, install a starting aperture size that will provide heart densities in the linear region of the H and D characteristic curve. (See Illustration 172.) Take Cine exposures if necessary to help determine the starting aperture size. A recommended starting aperture is 20 mm.

- Touch the STARTING DIAMETER softkey and use the console dial to enter the cine aperture diameter.
- Take a 2 second Cine run.

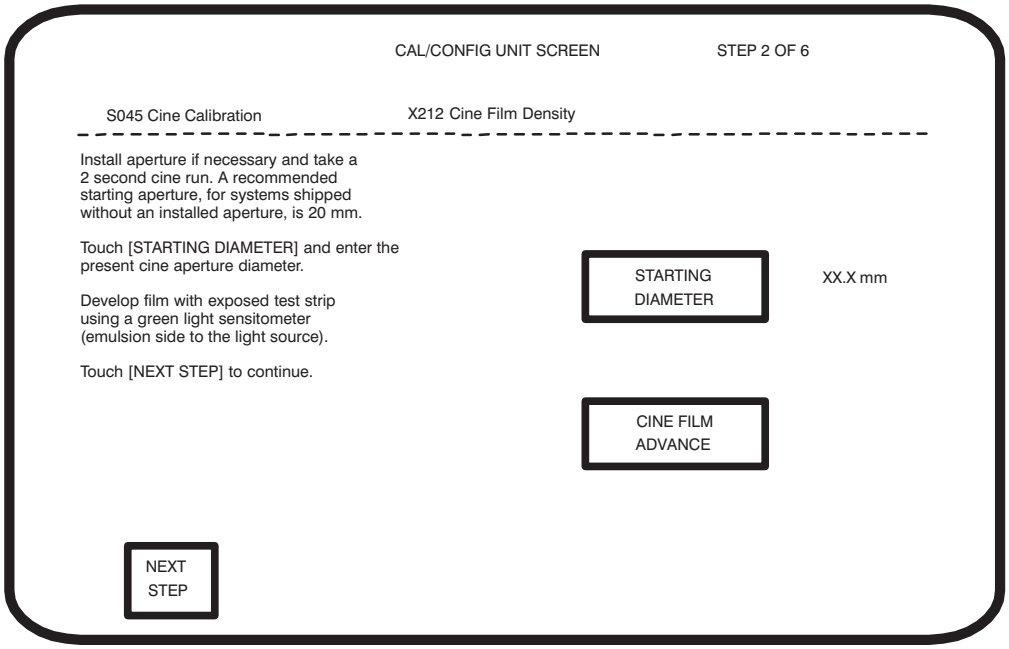
Note: A CINE FILM ADVANCE softkey allows the operator to advance the cine film from the console between test exposures to provide blanks in the film between test strips.

- Develop film with exposed test strip using a green light sensitometer. (Place emulsion side of the film toward light source).
- Measure and record the following densities from the test strip:
  Sensitometric Data (21 Density Steps)

1)_____	8)_____	15)_____
2)_____	9)_____	16)_____
3)_____	10)_____	17)_____
4)_____	11)_____	18)_____
5)_____	12)_____	19)_____
6)_____	13)_____	20)_____
7)_____	14)_____	21)_____

Note: Touch the NEXT STEP softkey to proceed to Step 3.

X212 STEP 2 SCREEN DISPLAY



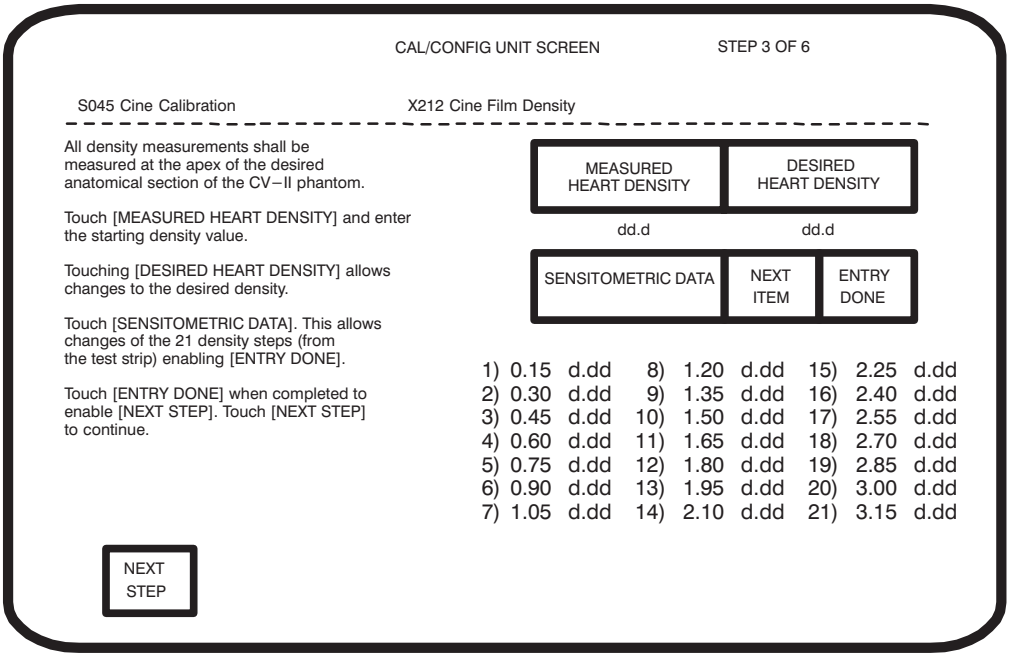
6-3 Step 3. Enter Heart Density

Note: All density measurements must be measured at the apex of the desired anatomical section of the CV–II phantom.

- Touch the MEASURED HEART DENSITY softkey and use the console dial to enter the starting heart density determined in Step 2.
- Touch the DESIRED HEART DENSITY softkey and use the console to dial enter any changes to the desired heart density. This density value is based on the cine projector intensity and any other special requirements of the hospital/doctor.
- Touch the SENSITOMETRIC DATA softkey and using the console dial enter the sensitometric data for item (1). This function allows changes to the 21 density strips as determined from the test strip in Step 2.
- Touch NEXT ITEM softkey to proceed to item (2) and enter the sensitometric data value. Continue to enter the sensitometric data for all 21 items.
- Touch ENTRY DONE softkey after the sensitometric data for item 21 has been entered. This enables the NEXT STEP softkey.
- Touch NEXT STEP to continue to Step 4.

Note: Once the calibration has been started in Step 2, exit from Step 3 will be inhibited until all heart density and sensitometric data has been entered.

X212 STEP 3 SCREEN DISPLAY



Note: Step 4 is used to set the DESIRED HEART DENSITY to a value as close as possible to the MEASURED HEART DENSITY without changing the dose value. Additional information regarding the operation of this step is presented on a “more info” screen that can be accessed by touching the MORE INFO softkey on the Step 4 screen. Review the MORE INFO screen before proceeding.

6-4 Step 4. New Heart Density

- If the starting aperture size set in Step 2 does not result in a MEASURED HEART DENSITY that is equal to the DESIRED HEART DENSITY, install a new aperture diameter size in front of the cine lens.
- Touch ACTUAL DIAMETER SIZE softkey and use the console dial to enter the new aperture size for software predictions.
- Touch CALCULATE softkey to predict proper aperture size. This value is shown as RECOMMENDED APERTURE.
- Take a 2 second cine run. Develop the film and measure the new heart density.

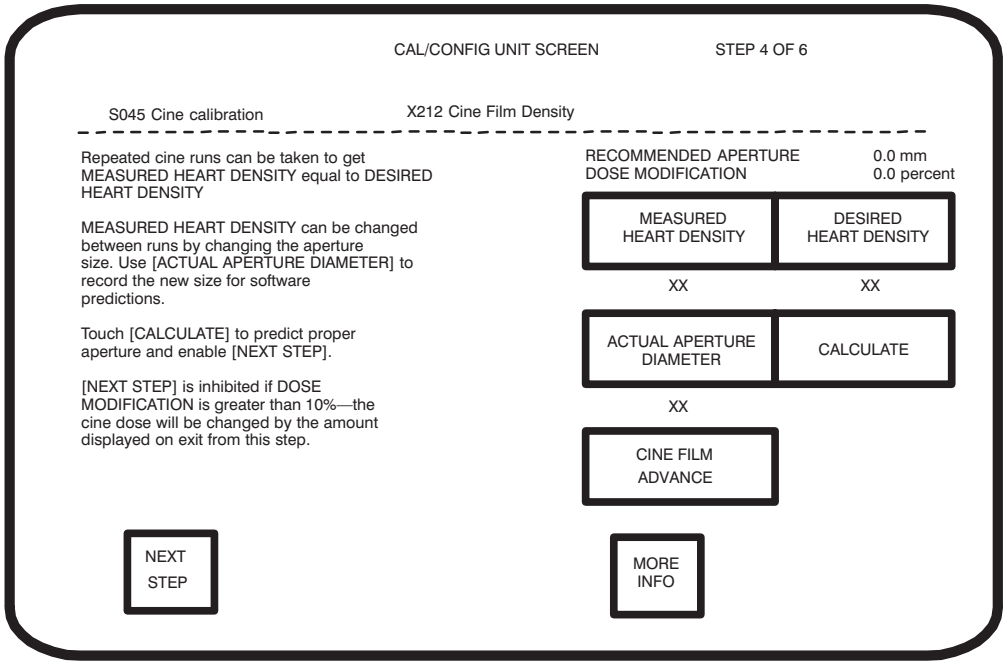
Note: Use the CINE FILM ADVANCE softkey to advance the cine test strip between cine runs to provide blanks in the film between test runs.

- Repeat cine runs and aperture changes as required to get MEASURED HEART DENSITY as close as possible to DESIRED HEART DENSITY. The DOSE MODIFICATION is displayed for each aperture change initiated. This change in dose will be used to fine tune the densities upon exit to Step 5.

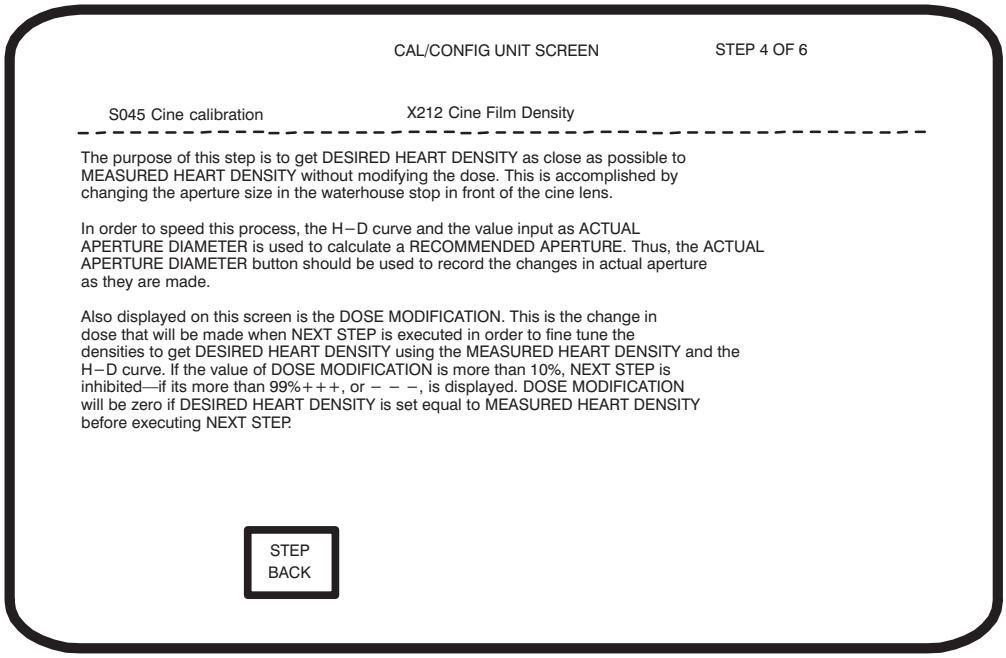
Note: When the aperture adjustment results in a MEASURED HEART DENSITY that is equal to the DESIRED HEART DENSITY, the DOSE MODIFICATION displayed is zero. If an aperture change results in a DOSE MODIFICATION that is greater than 10%, the NEXT STEP softkey will be inhibited. Exit to Step 5 will be prohibited until a change in aperture results in a DOSE MODIFICATION of less than 10%.

- Touch NEXT STEP softkey to proceed to Step 5.

X212 STEP 4 SCREEN DISPLAY



X212 STEP 4 MORE INFO SCREEN DISPLAY



6-5 Step 5. Anatomical Data

Note: Ensure that CV–II phantom is still centered in the x–ray beam.

- Take a 2 second Cine run at the 6 inch field of view (FOV).
- Touch the CINE FILM ADVANCE softkey to advance the 6 inch FOV test strip of film.
- Touch the FIELD OF VIEW softkey to select the 9 inch FOV.
- Take a 2 second cine run at the 9 inch FOV.
- Touch the CINE FILM ADVANCE softkey to advance the 9 inch FOV test strip of film.
- Develop the film and measure the anatomical densities for the cine run at the 6 inch FOV and the cine run for the 9 inch FOV. Record the following density values:

6 inch FOV

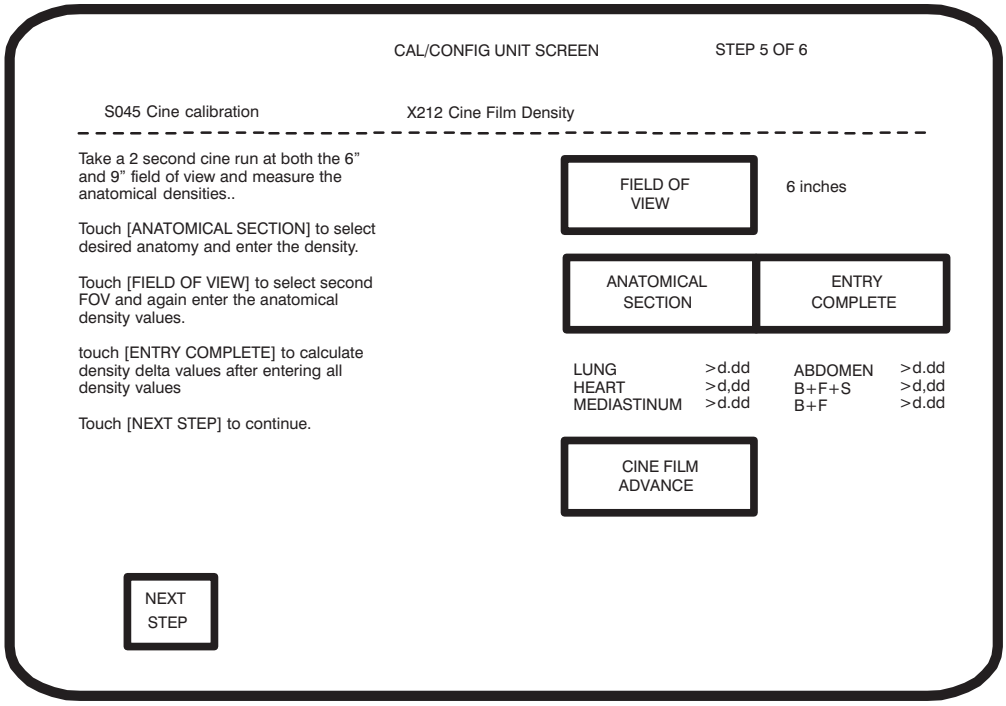
Apex region of lung_____
Apex region of heart_____
Apex region of mediating_____
Apex region of abdomen_____
Base + fog + slug (B+F+S_____
Base + fog (B+F)_____

9 inch FOV

Apex region of lung_____
Apex region of heart_____
Apex region of mediastinum_____
Apex region of abdomen_____
Base + fog + slug (B+F+S_____
Base + fog (B+F)_____

- Touch ANATOMICAL SECTION softkey to select desired anatomy and use the console dial to enter the applicable density value for the FOV indicated on the screens.
- Touch FIELD OF VIEW softkey to select second FOV.
- Touch ANATOMICAL SECTION softkey to select desired anatomy and use the console dial to enter the applicable density value.
- Touch ENTRY COMPLETE softkey after all density values (6 inch FOV and 9 inch FOV) have been entered: Touching the ENTRY COMPLETE softkey will enter the anatomical density data into the system to permit calculation of density delta values.
- Touch NEXT STEP softkey to proceed to Step 6.

X212 STEP 5 SCREEN DISPLAY



6-6 Step 6. Film Processing Data

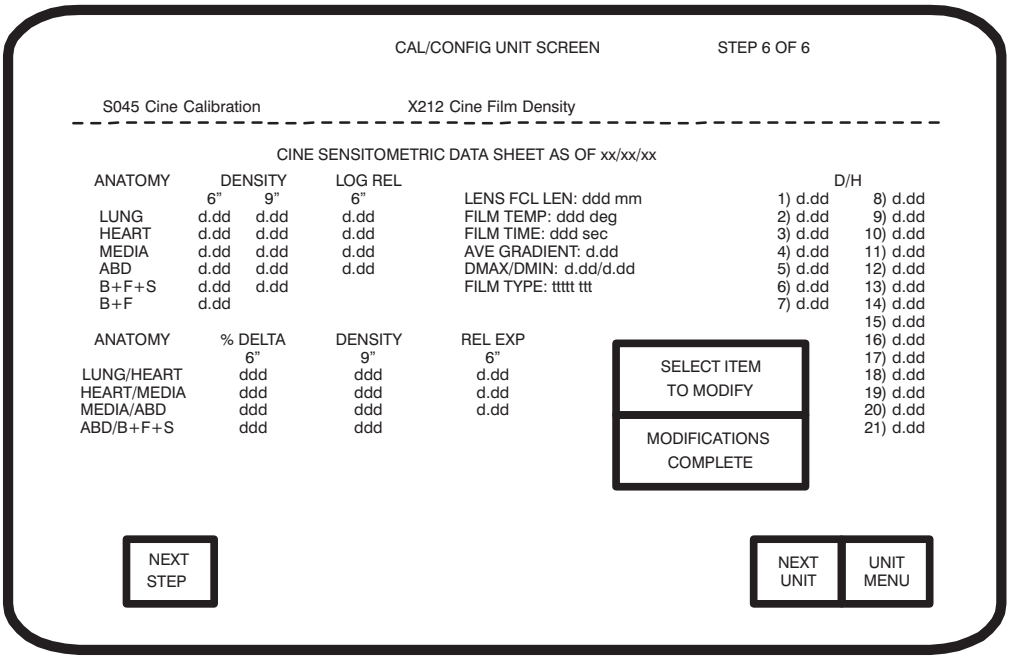
- The following data items may be entered in Step 6.
  LENS FCL LEN
  FILM TEMP
  FILM TIME
  FILM TYPE
  All ANATOMY DENSITY (6 and 9 inch FOV).
- Touch SELECT ITEM TO MODIFY softkey to select the data item to be entered or changed.
- Use the console dial to enter the new valve.
- Touch the MODIFICATIONS COMPLETE softkey to enter the data into the system.

Note: If any ANATOMY DENSITY values are modified, the system will recalculate the following parameters:

DMAX
DMIN
AVG GRADIENT
6” LOG REL
6” and 9” DELTA DENSITY
6” REL EXP.

- Touch the NEXT UNIT or UNIT MENU softkey to exit. Upon exit of the unit, the NVRAM database will be updated.

X212 STEP 6 SCREEN DISPLAY



Blank page.

UNIT X213 – Cine Dose

Time: x h xx min – Personnel: 1 field engineer

1 DESCRIPTION

Calibration Unit X213 establishes the initial entrance dose for the Cine mode. The unit must be run at the time of initial system installation and anytime a new dose level is desired. Only one step is required to accomplish the calibration. Recommended dose levels are given in Table 67 for Advantx–E Vascular Systems and in Table 68 for all other systems.

Table 67 – Cine Dose Values for Advantx–E Vascular Systems

DOSES (in uR/Frame)			
FOV	**9″(22 cm) II**	**12″(32 cm) II**	**16″(40 cm) II**
9 (22 cm)	13	13	13

Table 68 – Cine Dose Values for all other Systems

DOSES (in uR/Frame)			
FOV	**9″(22 cm) II**	**12″(32 cm) II**	**16″(40 cm) II**
16 (40 cm)			9
12 (30 cm)		11	15
9 (22 cm)	13	21	28
6 (16 cm)	24	39	52
4.5 (11 cm)	44	70	

2 EQUIPMENT REQUIRED

None.

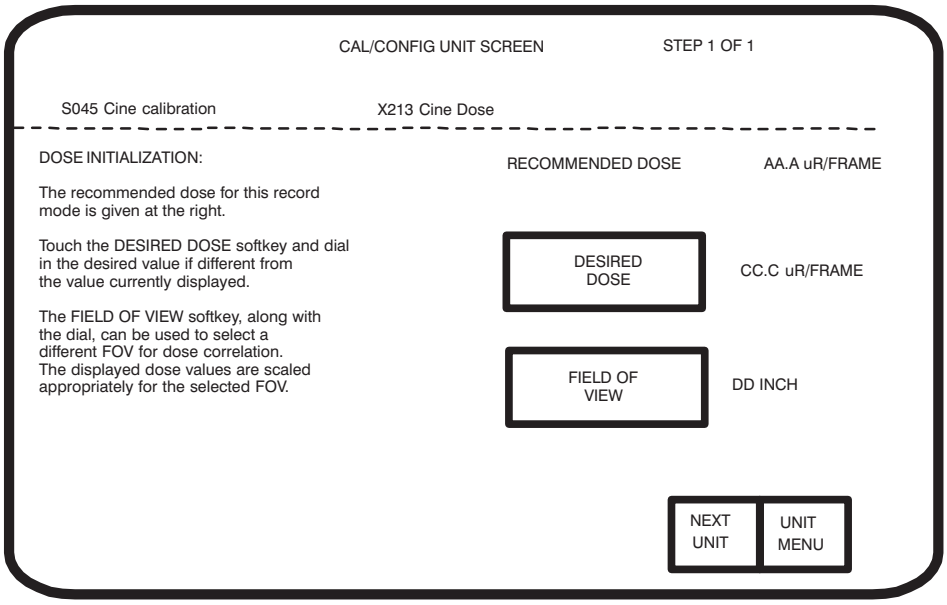
3 CAL PROCEDURE

3-1 Dose Initialization

- Upon entering the unit, the recommended dose value is displayed on the screen. If the desired dose value is different than the recommended value, touch DESIRED DOSE softkey and use the console dial to enter the new value.
- Enter the FOV which is used at the site by touching the FIELD OF VIEW softkey and dialing in the appropriate FOV value. The displayed dose values are correlated to the FOV selected.
- After the appropriate values have been entered, touch NEXT UNIT or UNIT MENU softkey to exit the unit. Exiting the unit loads the dose and FOV values into system NVRAM.

Note: The dialed dose value may not always track exactly with the measured dose rate in applications. Boot applications and check dose rate before exiting this unit. If necessary, rerun X213 and readjust the dose value until the measured dose in applications is at the desired level. A 20 percent to 30 percent tolerance on this dose value is acceptable.

X213 SCREEN DISPLAY



UNIT X214 – DX (DLX) Vascular Dose

Time: x h xx min – Personnel: 1 field engineer

1 DESCRIPTION

Calibration Unit X214 is used to set the initial static entrance dose D value in nGy/Frame (µR/Frame) for the system in the 9 inch field of view and then scale dose values for static dose C, B, and A, accordingly. The unit must be run at the time of initial system installation and anytime a new dose level is desired. Only one step is required to accomplish the calibration. The calibration unit provides static dose scaling for DLX configured systems. The appropriate screen is displayed according to calibration sequence menu selection. Recommended dose values are given in Table 69 for everywhere EXCEPT Switzerland. For Switzerland, use Table 70.

Note: The dialed dose value may not always track exactly with the measured dose rate in applications. Boot applications and check dose rate. If necessary, rerun X214 and readjust the dose value until the measured dose in applications is at the desired level. A 15 percent tolerance vs recommanded dose value is acceptable.

WARNING

FOR ADVANTX–E VASCULAR SYSTEMS ONLY:

BEWARE OF THE EXISTENCE OF TWO DIFFERENT TYPES OF DOSES:

II Entrance Doses: doses displayed and dialed on the console in this calibration Unit**.** The **Recommended Entrance Doses** presented in the tables hereafter are the **II Entrance Doses** allowing the best functionning conditions of the system and the ones which should be used**.**

Measured Entrance Doses: result of the measurement procedure, dosimeterprobe close to the anticollision plate and dose reduced by the antiscatter grid.

II Entrance Doses are equal to Measured Entrance doses divided by two.

Table 69 – Recommended Entrance Dose Values for DLX (Except for Switzerland)

RECOMMENDED II ENTRANCE DOSE VALUES				
STATIC	**II TYPE**	**FOV**	**EXPOSURE (µR/Frame)**	**EXPOSURE (µGy/Frame)**
A	9 inch/12 inch	9 (22 cm)	100 µR/Frame	876 nGy/Frame
B	9 inch/12 inch	9 (22 cm)	250 µR/Frame	1752 nGy/Frame
C	9 inch/12 inch	9 (22 cm)	500 µR/Frame	4380 nGy/Frame
D	9 inch/12 inch	9 (22 cm)	1000 µR/Frame	8760 nGy/Frame

Table 70 – Recommended Entrance Dose Values for DLX for Switzerland only (* means maximum measured in order to meet local regulations)

RECOMMENDED II ENTRANCE DOSE VALUES (SWITZERLAND) (See Note 1)				
STATIC	**II TYPE**	**FOV**	**EXPOSURE (μR/Frame)**	**EXPOSURE (μGy/Frame)**
A	9 inch/12 inch	9 (22 cm)	100 μR/Frame	876 nGy/Frame
B	9 inch/12 inch	9 (22 cm)	250 μR/Frame	1752 nGy/Frame
C	9 inch/12 inch	9 (22 cm)	510 μR/Frame	4467 nGy/Frame
D	9 inch/12 inch	9 (22 cm)	510 μR/Frame	4467 nGy/Frame

Note 1: For Swiss adjustment, refer to Section 4 "X214, DX (DLX) Vascular Dose – Supplement 'A', New X–Ray Dose Requirements for Installed Base Systems in Switzerland". The content of the supplement is an extract from Service Note 4344.

2 EQUIPMENT REQUIRED

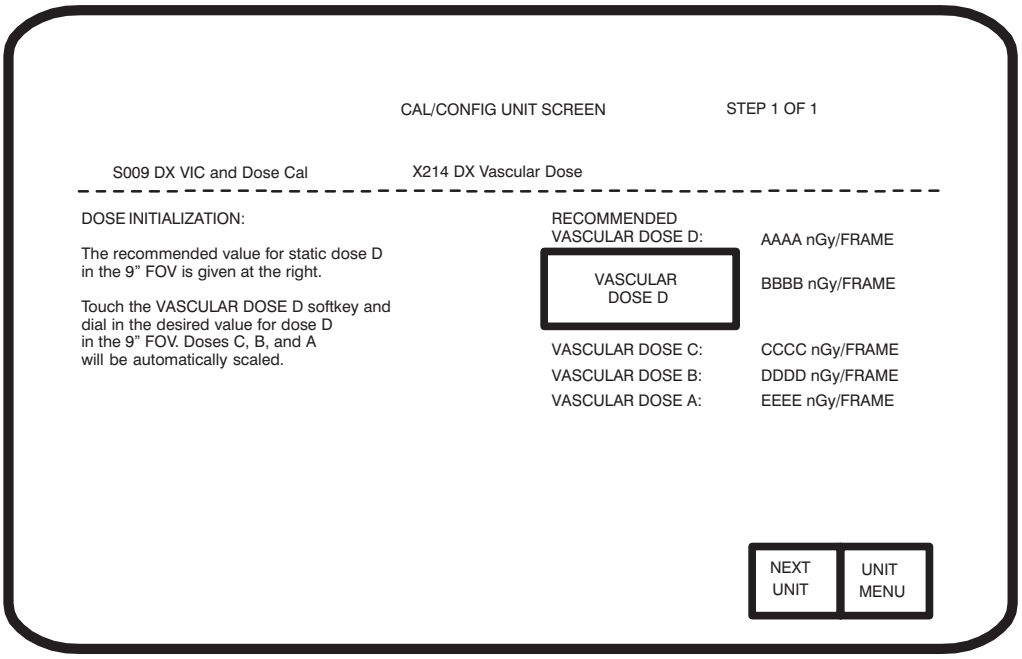
None.

3 CAL PROCEDURE

3-1 Static Dose Scaling, DLX

- Upon entering the unit, the default value for static dose D for the 9–inch FOV is displayed on the screen.
- If the **desired** dose D value in the 9–inch FOV is different than the recommended value, touch VASCULAR DOSE D softkey and use the console dial to enter the new value. Dose A, B, and, C will be automatically scaled according to the new value established for static dose D in the 9–inch FOV.
- Touch NEXT UNIT or UNIT MENU softkey to exit the unit. Exiting the unit loads the dose values into NVRAM.

X214 DX (DLX) STATIC DOSE SCALING SCREEN DISPLAY



4 X214, DX (DLX) VASCULAR DOSE –– SUPPLEMENT "A" NEW X–RAY DOSE REQUIREMENTS FOR INSTALLED BASE SYSTEMS IN SWITZERLAND

4-1 Applies to:

This addendum applies to the Swiss installed base only. It is for Advantx-E Tilt-C Vascular, LCA, LCV+, LC+, LCLP+ and LCN+ Systems.

4-2 Purpose:

This addendum explains how to re-calibrate the systems to be in conformity with the Swiss regulations.

4-3 Problem:

Vascular Installed Base that obtained Swiss approval (OFSP) before April 1st, 1998 should be placed in compliance with the new Swiss dose regulation before January 1st, 2000.

This new regulation requires a dose value at image receptor limited to 5.17 μGy/view (22 cm FOV), obtained through a specific measurement procedure.

C & D Doses in Vascular are above this value and must be consequently re-calibrated.

Moreover, the Swiss specific measurement procedure results in Dose values 3 times inferior to the ones obtained with the standard Measured Entrance Dose procedure for Advantx–E Vascular Systems.

4-4 Solution:

Note: Be sure you have a good copy of your database before starting this procedure. If you don't have it with you or if you are not sure of it, save your database now.

1. Install and verify that the Ethernet connection is correctly installed.
2. Open the IP Select Tool.
3. Select the appropriate room by highlighting the room in the Room Description List box and then selecting the Select Control.
4. Exit the IP Select Tool. (For Windows 95, restart the laptop by selecting the Reset Control.)
5. Open the Advanced Service Tool Application by double clicking on the Advanced Service Tools icon.
6. Double click on Mode Transition.
7. Click on the Service icon.
8. Select Run on the Advantx Console screen.

9. Select S009 DX Vic and Dose Cal, then select run.
10. Select X214 DX Vascular Dose, then select run. (See procedure for X214 in Sub-section AUCUN LIEN of this direction for more details.)
11. Adjust Dose D to 8930 ηGy (1020 μR).
12. Exit X214 unit by selecting Unit Menu.
13. Using Service Laptop, backup ADVANTX-E Cal/Config Database. You will be modifying this file later.
14. Using Service Laptop Database Tool:
    a. Open the ADVANTX-E Database saved above.
    b. Run the Query Parameter(s) menu.
        – Select ID Range for SEARCH OPTIONS value.
        – From : 122 To : 122
        – Click on OK button.
        – Double-click on NV_G_dv_dose_idx_US.
        – Note dose C value : CURR.VALUE column, line [2].
        – Copy dose C value in dose D value.
            – Select line [3].
            – Run Edit Parameter(s) menu.
            – Copy dose C value (noted above) in NEW VALUE.
            – Click on OK button.
    c. Run the Query Parameter(s) menu.
        – Select ID Range for SEARCH OPTIONS value.
        – From : 220 To : 220
        – Click on OK button.
        – Double-click on NV_G_dv_dose_d_|v|_US.
        – Run Edit Parameter(s) menu.
        – Tick off Ignore Valid Values square.
        – Type 510 in NEW VALUE square.
        – Click on OK button.
    d. Exit the ADVANTX-E Database Tool (Run the File Exit menu).
        – Answer Yes to the question: Exit from Advantx Database Analysis Tool?
        – Answer Yes to the question: The present database is modified. Do you want to save it?
        – Type “New Swiss Xray dose requirement” in NEW DATABASE DESCRIPTION.
15. Using Service Laptop, restore this new (saved above) ADVANTX-E Database.

16. Reboot ADVANTX-E system.

CAUTION **Do NOT re-enter X214 Service Mode unit after ADVANTX database update.**

Each time you need to update X–Ray doses (preventive maintenance) for Swiss systems, make sure you follow the requirements of this supplement for X214 of this direction.

Please refer to SM “Advantx-E LCA+/LCV+/LC+/LCN+/LCLP+ Image Quality Procedures” 2142750-100, Job Card 007 “Fluoro Dose Measurement Procedure” and Job Card 009 “DLX Vascular Dose Measurement Procedure”. You should obtain the Recommended II Entrance Dose Values in Table 71 below, with a ±15% tolerance.

Table 71 – Measured Entrance Dose Values for Switzerland

MEASURED ENTRANCE DOSE	mR/exp	µGy/exp
C	1020	8.94
D	1020	8.94

UNIT X217 – Cine Video Presentation

Time: x h xx min – Personnel: 1 field engineer

1 DESCRIPTION

Calibration Unit X217 provides a method of adjusting the VIC apertures for proper video presentation while operating in the Cine mode. The unit adjusts the TV aperture at each selected cine frame rate. Two steps are required to accomplish the adjustment. Step 1 positions filtration. Step 2 adjusts the TV aperture at a selected frame rate. A screen display is provided for each step.

2 EQUIPMENT REQUIRED

Coax BNC “T” connector, oscilloscope, test leads, 2-1/4 inch acrylic, 1/4 inch aluminum and 1/32 inch copper.

3 TEST SETUP

Set up the equipment as follows:

- Insert a coax BNC “T” connector in series with the video signal input to the IN ROOM MONITOR.
- Connect the oscilloscope to the BNC “T” connector.
- Set oscilloscope controls:
  Vert Ampl: 0.2 V/div
  Time Base: 5 msec/div

4 SPECIAL INSTRUCTIONS

Note: **For Vascular Systems Only:** Before system calibration, verify that additional filter (copper–aluminum filter) is not installed on top of collimator. (Open sensor hinge assembly to verify.) If installed, remove before performing calibration.

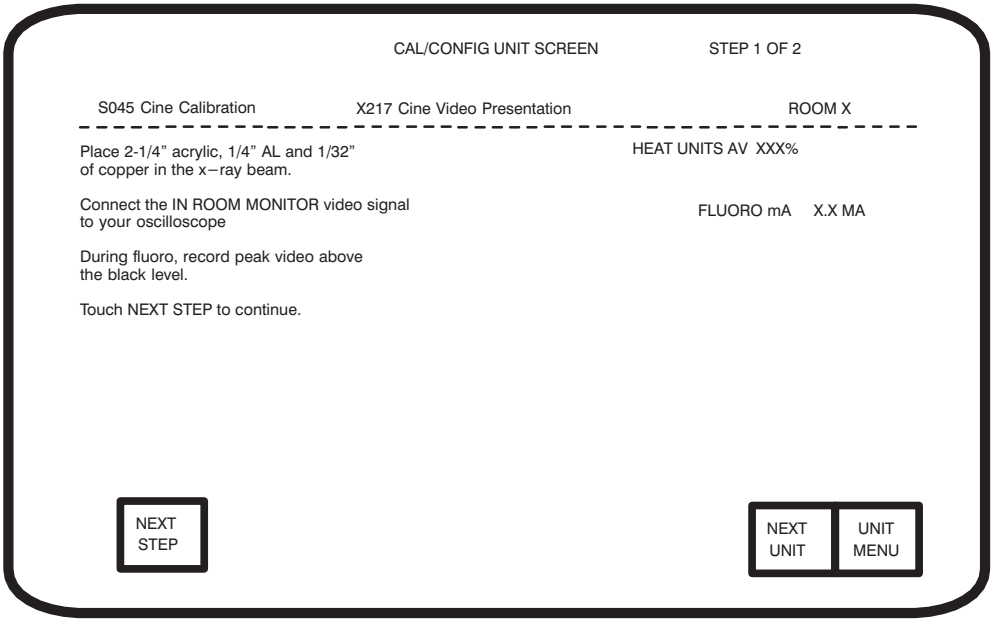
5 CAL PROCEDURE

5-1 Step 1. Position Filtration

- Place 2-1/4 inch acrylic, 1/4 inch aluminum and 1/32 inch of copper in x–ray beam.
- Take fluoro exposures with the console hand switch or footswitch and center the filtration in the X–ray beam.
- During fluoro, observe oscilloscope and record the peak video above black level. See Illustration 173.

  Peak Video _____ mV
- Touch NEXT STEP softkey to proceed to Step 2.

X217 STEP 1 SCREEN DISPLAY



5-2 Step 2. Adjust Video Presentation

Note: Upon entering Step 2, the current values or default values for FRAME RATE and TV APT STEP are displayed on the screen.

- To change a frame rate, touch the FRAME RATE softkey and enter a frame rate with the console dial. Refer to Table 72 for applicable frame rates.

Table 72 – Cine Frame Rates

SYSTEM POWER	FRAME RATES
60 HZ	15, 30, 45, 60, 90, 120, 150
50 HZ	12.5, 25, 37.5, 50, 75, 90, 100, 125, 150

Note: The FRAME RATE softkey is disabled during Cine exposures. The TV APT STEP softkey is always active.

- Take a cine exposure and monitor the video level of the flat field on the scope.
- Touch the TV APT STEP softkey and set the video level for each cine frame rate to the value above black level that was recorded in Step 1.

Note: The TV APT STEP has a minimum resolution of 10 % brightness changes per step.

- Touch the NEXT UNIT or UNIT MENU softkey to exit. An “Updating NV database” message is displayed while new data is being loaded into the system.

X217 STEP 2 SCREEN DISPLAY

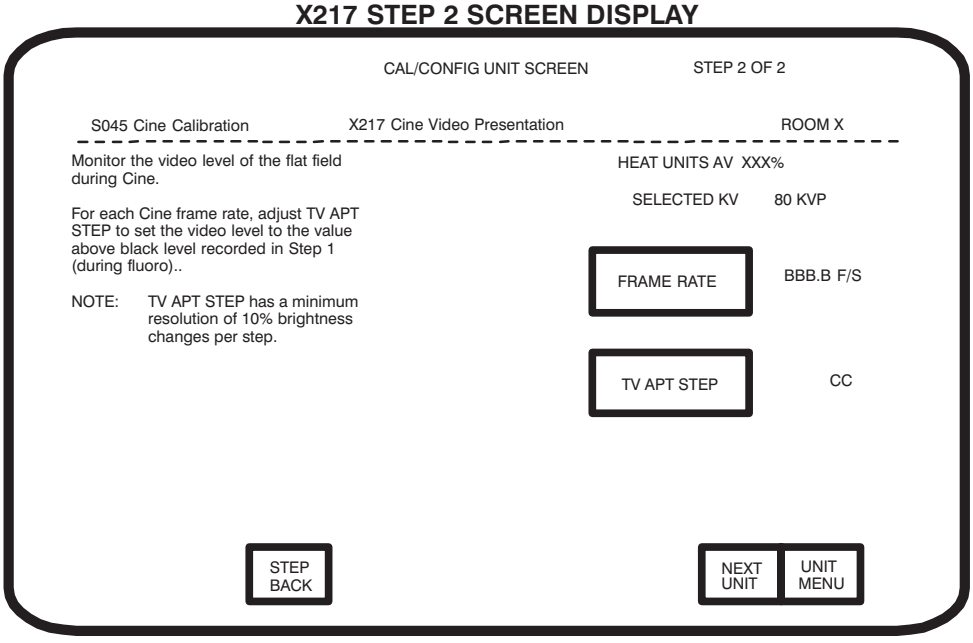
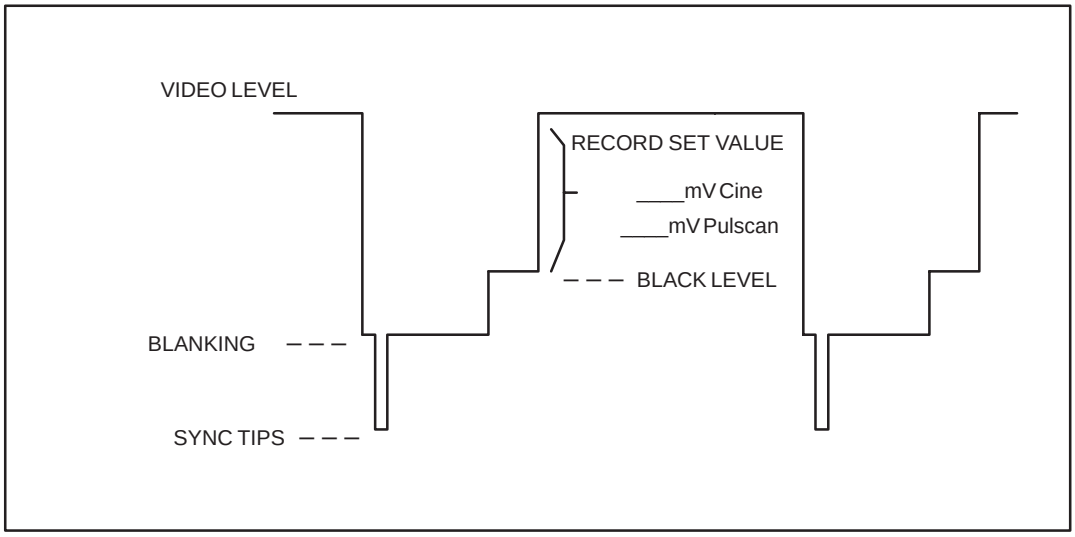


Illustration 173 – X217, Cine Video Level



UNIT X218 – Digital Record Dose (DR or DRS)

Time: x h xx min – Personnel: 1 field engineer

1 DESCRIPTION

Calibration Unit X218 is used to set the initial entrance dose for the Digital Record mode. The unit uses the brightness integrator parameter established in Cal Unit X209 to calculate the value for proper Digital Record dose. The unit sets the dose values for LOW, NORMAL and HIGH record dose.

Note: This unit must be run at the time of initial system installation, anytime a new dose value is desired, and after repair or replacement of an Image Intensifier or Image Head. Anytime this unit is run, X219, Digital Record Video Presentation must also be run.

2 EQUIPMENT REQUIRED

None.

3 CAL PROCEDURE – UNIT INITIALIZATION

- On entering the unit, the RECOMMENDED DOSE is displayed for DR systems. For DRS systems the following RECOMMENDED DOSE values are displayed:

  DRS with subtraction option: XX uR/FRAME

  DRS without Subtraction option: XX uR/FRAME

  DRS with Pediatric applications: XX uR FRAME

Note: The value displayed for RECOMMENDED DOSE for DRS with subtraction, DRS without Subtraction, and DRS with Pediatric applications, are correlated to the FOV size selected (The uR/FRAME value displayed for each Recommended Dose parameter is a system calculated value that depends on the Field of View (FOV) size.

DOSE – Displays the actual dose value in the Advantx–E system database.

FIELD OF VIEW – Largest size available. The value displayed for RECOMMEND DOSE and DOSE are correlated to the FOV size selected. Scaling for each FOV is as shown in Table 73. Pressing the FIELD OF VIEW softkey allows the service personnel to change the FOV.

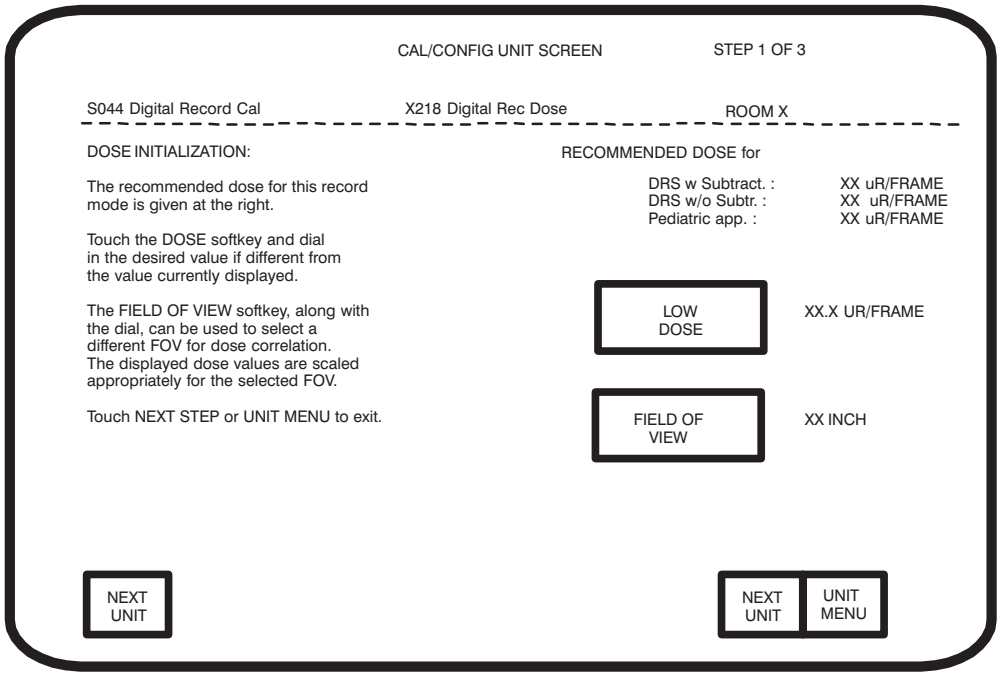
Table 73 – Digital Record Dose Scaling Values

	II SIZE		
FOV	**9″ DOSE SCALING**	**12 L″ DOSE SCALING**	**16″ DOSE SCALING**
16″	N/A	N/A	LARGEST
12″	N/A	LARGEST	16″ VALUE ● 1.62
9″	LARGEST	12″ VALUE ● 1.90	16″ VALUE ● 3.13
6″	9″ VALUE ● 1.86	12″ VALUE ● 3.51	16″ VALUE ● 5.78
4.5″	9″ VALUE ● 3.40	12″ VALUE ● 6.37	N/A

3-1 Step 1. Set LOW DOSE

- If the desired low dose value is different than the LOW DOSE value displayed on the screen, touch the LOW DOSE softkey and use the console dial to enter the desired dose.
- If the field of view used at the site is different than the FOV displayed, touch the FIELD OF VIEW softkey and use the console dial to enter the appropriate FOV.
- If a change to the NORMAL DOSE value is desired, touch NEXT STEP softkey to proceed to Step 2 or touch NEXT UNIT softkey to exit and store the results of Step 1 in the database.

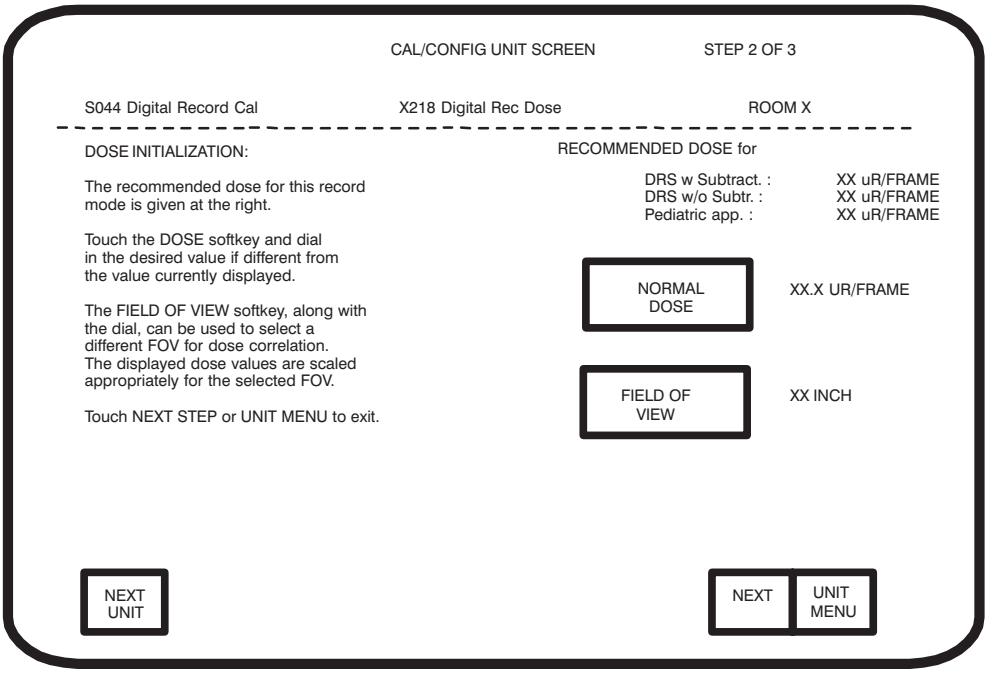
X218 STEP 1 SCREEN DISPLAY



3-2 Step 2. Set NORMAL DOSE

- If the desired normal dose value is different than the NORMAL DOSE value displayed on the screen, touch the NORMAL DOSE softkey and use the console dial to enter the desired dose.
- If the field of view used at the site is different than the FOV displayed, touch the FIELD OF VIEW softkey and use the dial to enter the appropriate FOV.
- If a change to the HIGH DOSE value is also desired, touch the NEXT STEP softkey to proceed to Step 3 or touch the NEXT UNIT softkey to exit and store the results of Step 2 in the database.

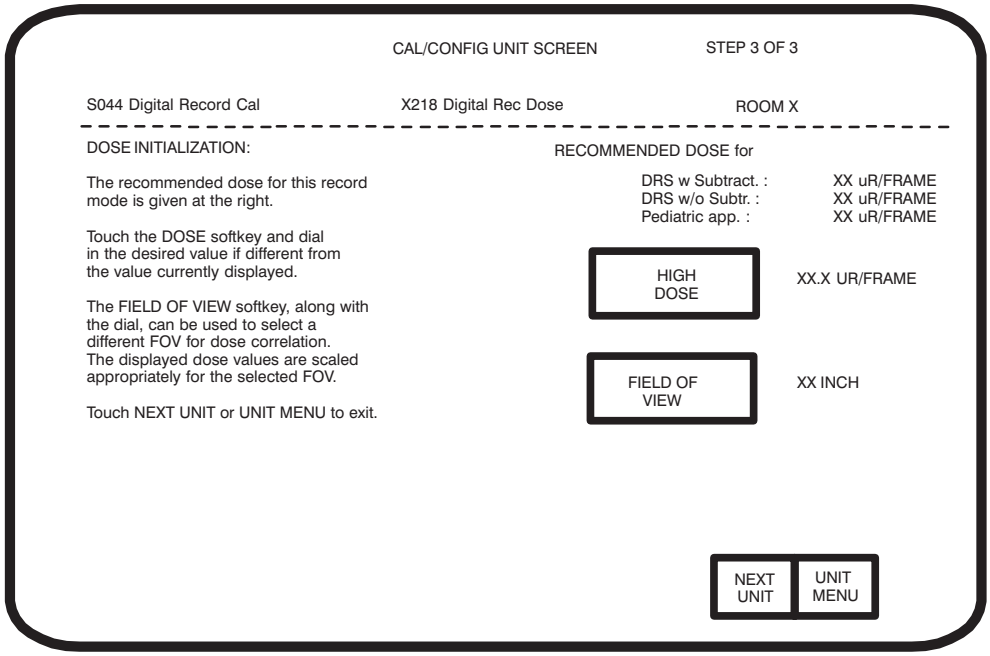
X218 STEP 2 SCREEN DISPLAY



3-3 Step 3. Set HIGH DOSE

- If the desired high dose value is different than the HIGH DOSE value displayed on the screen, touch the HIGH DOSE softkey and use the console dial to enter the desired dose.
- If the field of view used at the site is different than the FOV displayed, touch the FIELD OF VIEW softkey and use the dial to enter the appropriate FOV.
- Touch NEXT UNIT softkey to exit and store all set dose values in the database.

X218 STEP 3 SCREEN DISPLAY



UNIT X219 – Digital Record Video Presentation

Time: x h xx min – Personnel: 1 field engineer

1 DESCRIPTION

Calibration Unit X219 provides adjustment of the VIC aperture for the desired video presentation while operating in the Digital Record Mode. The unit adjusts the TV aperture for the proper video signal level while taking exposures at a frame rate typically used at the site. Two steps are required to accomplish the calibration. Step 1 positions filtration and selects a dose level (LOW, NORMAL or HIGH) at which the TV aperture is adjusted. Step 2 sets the desired frame rate and then adjusts the TV aperture at the dose level established in Step 1. A screen display is provided for each step.

Note: The fluoro dose level does not change with the dose softkeys. The softkeys affect record dose level only. Also, the neutral density filter will be brought in if the correct video cannot be obtained with an aperture value of 36.

2 EQUIPMENT REQUIRED

Coaxial BNC “T” connector, oscilloscope, test leads, 2-1/4 inch acrylic, 1/4 inch aluminum and 1/32 inch copper.

3 TEST SETUP

Set up the equipment as follows:

NOTICE

On systems configured with DRS, access the DRS unit INIT MENU and check that the RAD and FLUORO defaults are set to NORMAL, otherwise the video signal on the oscilloscope may be displayed in inverted video.

- Insert a coaxial BNC “T” connector in series with the video signal input to the IN ROOM DISPLAY monitor.
- Connect oscilloscope to the BNC “T” connector.
- Set oscilloscope controls:
  Vert Ampl: 0.2 V/div
  Time Base: 5 msec/div

CAUTION

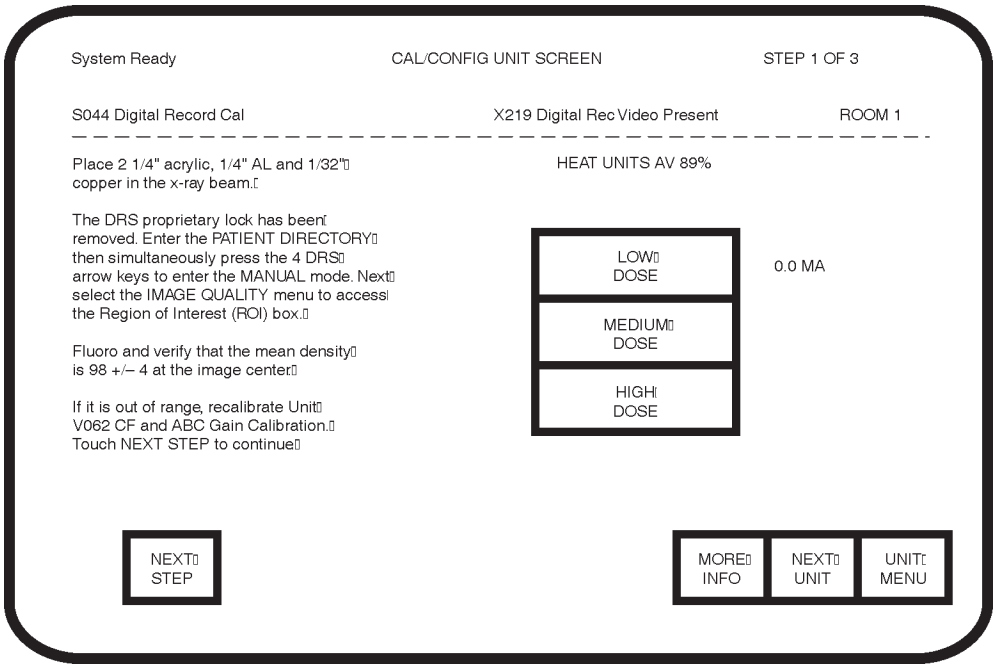
When running this unit, release of the PREP switch results in the immediate braking of the rotor and a subsequent increase in the rotor heat units. Therefore, any rapid successive activation of the PREP switch can add excessive heat units to the rotor and ultimately exceed the rotor thermal limitations. If Error 42DE (Thermal Limit Exceeded) is reported, DO NOT activate PREP for at least 5–minutes before proceeding with the calibration.

4 CAL PROCEDURE

4-1 Step 1. Select Dose Level and Position Filtration

Note: This unit requires you to set the TV aperture (in Step 2) at LOW, NORMAL and HIGH dose levels. Therefore, you must first run Step 1 and 2 of this unit for the LOW DOSE level and then repeat the procedure for the NORMAL DOSE and HIGH DOSE levels.

- Touch the LOW DOSE softkey to set the first dose level at which the TV aperture will be adjusted in Step 2.
- Place 2-1/4 inch acrylic, 1/4 inch aluminum and 1/32 inch of copper in X–ray beam.
- Take fluoro exposures and center the filtration.
- While taking fluoro, measure the peak video level above black level on the oscilloscope and record the value. You will use this value in Step 2 to adjust the TV Aperture. See Illustration 174.
- Touch NEXT STEP softkey to proceed to Step 2.



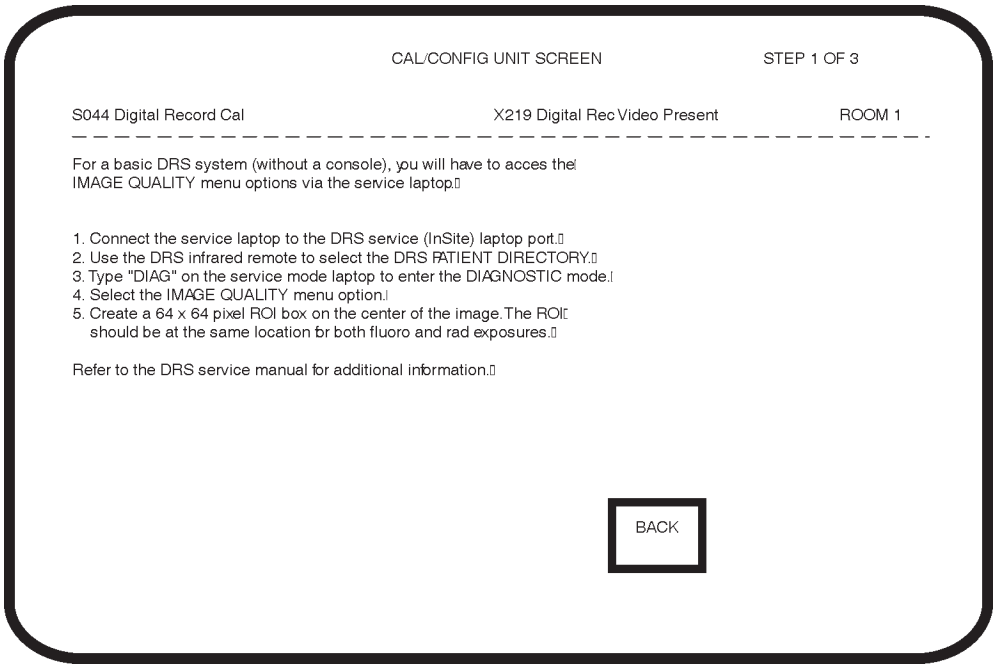
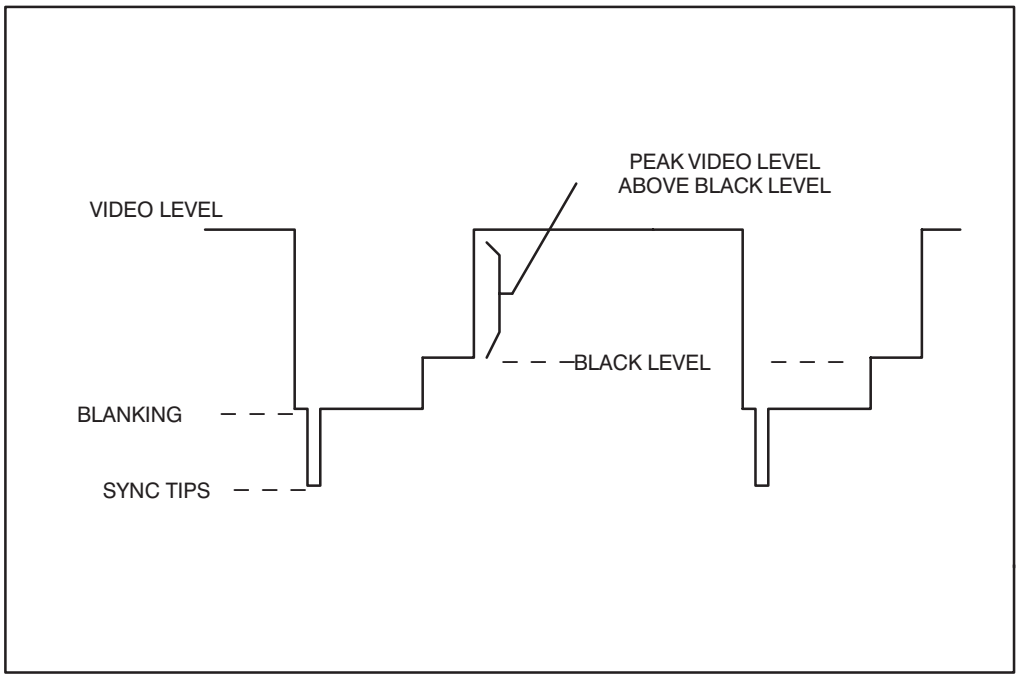


Illustration 174 – X219, Digital Record Video Level



4-2 Step 2. Adjust TV Aperture

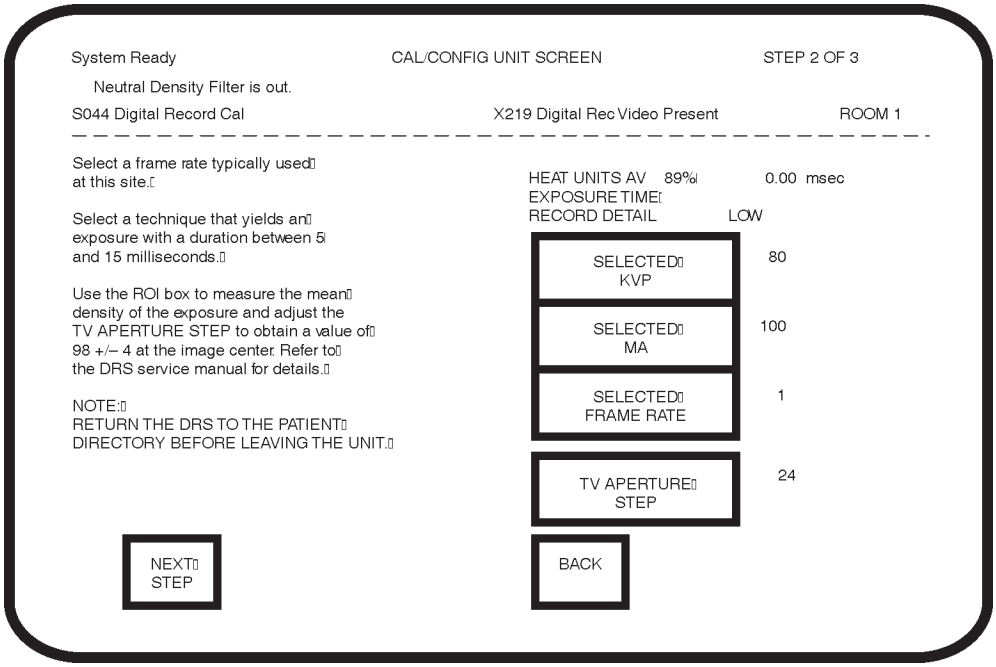
- Touch the SELECTED FRAME RATE softkey and select a frame rate that is typically used at the site. The default value for this parameter is 1 Frame/Sec.

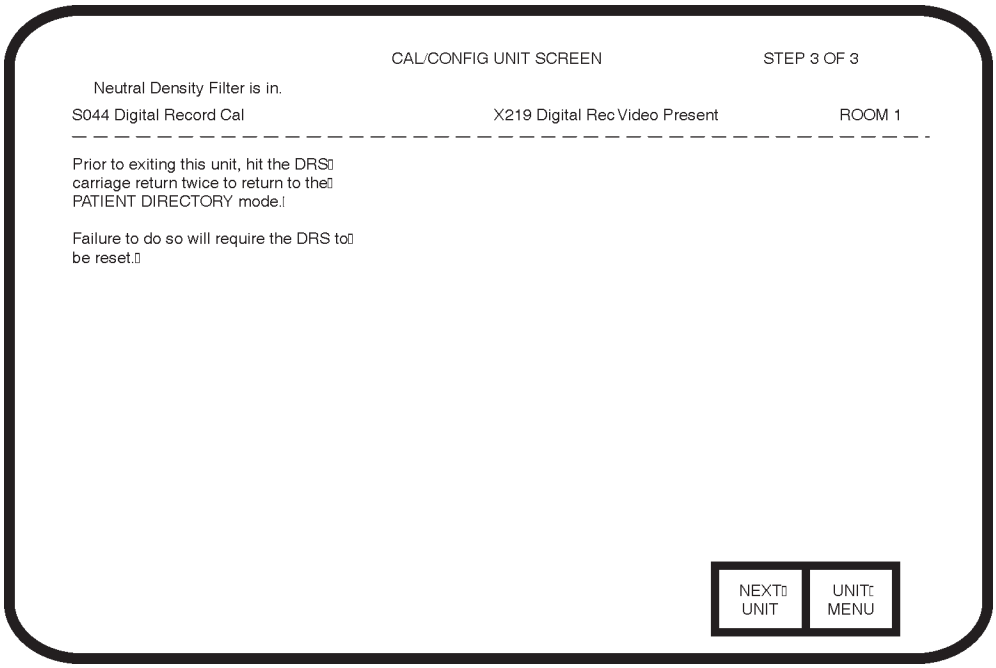
4-2-1 DR Configuration only:

NOTICE

If the selected frame rate is greater than 1 frame/sec and the DR is in the “busy” state when a second run is attempted, the unit will acquire at less than 1 frame/sec. Wait until the DR is no longer in the “busy” state (DR buffers are emptied of previous acquisition data) before attempting a second run at higher frame rates.

- Use the KVP and MA softkeys and the console dial to establish a technique that produces an exposure with a duration between 5 msec and 15 msec.
- Take and maintain an exposure sequence.
- During the exposure sequence, measure the peak video signal level observed on the oscilloscope.
- Touch TV APERTURE STEP softkey and use the console dial to adjust the amplitude of the peak video signal level (for the dose level selected in Step 1) to the value above black level that was recorded in Step 1.
- Touch the BACK softkey to return to Step 1.
- Select another dose level and repeat the TV aperture adjustment procedure.
- After the TV aperture has been adjusted for each of the dose levels (LOW, NORMAL AND HIGH), touch the NEXT UNIT or UNIT MENU softkey to exit.




CAL/CONFIG UNIT SCREEN
STEP 3 OF 3
Neutral Density Filter is in.
S044 Digital Record Cal
X219 Digital Rec Video Present
ROOM 1
Prior to exiting this unit, hit the DRS carriage return twice to return to the PATIENT DIRECTORY mode.
Failure to do so will require the DRS to be reset.
NEXT UNIT
UNIT MENU

Blank page.

UNIT X220 – Manual Cine/Fluoro Tool

Time: x h xx min – Personnel: 1 field engineer

1 DESCRIPTION

Calibration Unit X220 provides a means for manually controlling the ABC Fluoro Loop and Cine functions to permit the same Fluoro and cine exposure capability as in the applications mode. The unit is intended for use in collecting HHS Cine kV accuracy data and for use in troubleshooting ABC loop, dose, and imaging problems. The unit consists of three steps. Step 1 selects the Fluoro or Cine mode of operation. Step 2 is the Cine mode. Step 3 is the Fluoro mode.

Note: A special HHS Cine kV Accuracy Test procedure is provided as part of this unit following Step 3. The test is performed as part of Cine Calibration Sequence S024 and uses the manual Cine function in Calibration Unit X220 (Cine screen presentation) to setup the required Cine parameters.

2 EQUIPMENT REQUIRED

No special equipment is required for performance of this unit other than that which may be required to support standard troubleshooting procedures. The equipment required to perform the HHS Cine kV Accuracy Test is specified in that procedure.

3 SPECIAL INSTRUCTIONS

Note: **For Vascular Systems Only:** Before system calibration, verify that additional filter (copper–aluminum filter) is not installed on top of collimator. (Open sensor hinge assembly to verify.) If installed, remove before performing calibration.

4 CAL PROCEDURE

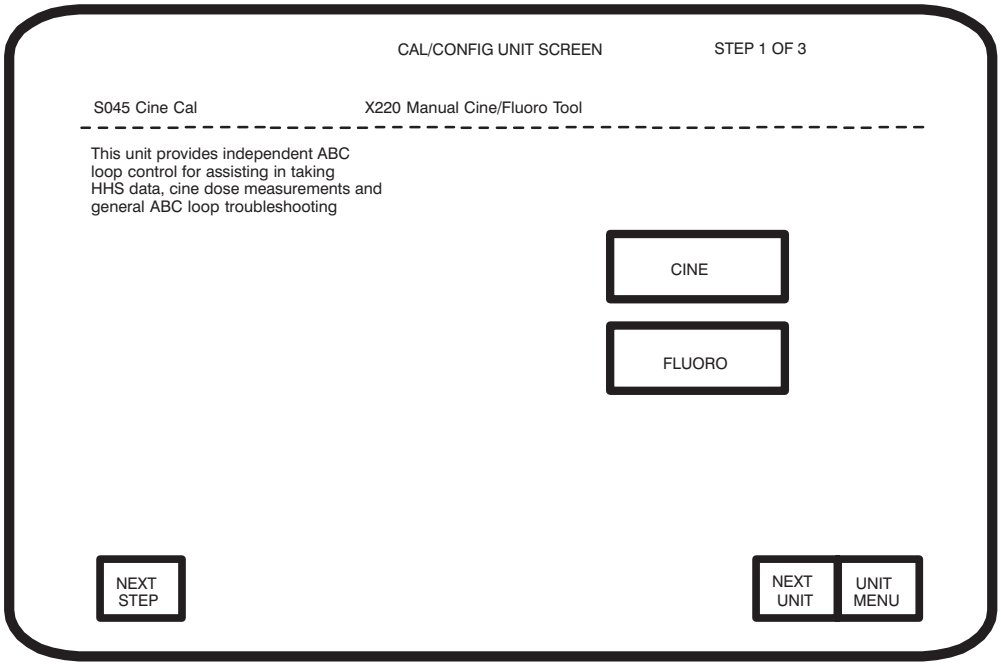
4-1 Step 1. Select Cine or Fluoro

- Touch the CINE or FLUORO softkey to select the desired operating mode. The softkey is highlighted when activated.

Note: The Cine softkey is automatically disabled for non–pulsed systems.

- Touch the NEXT STEP softkey to proceed to the mode selected; Step 2, the Cine screen, or Step 3 the Fluoro screen.

X220 STEP 1 SCREEN DISPLAY



4-2 Step 2. Cine Screen

The Cine screen allows the operator to take exposures similar to the Cine applications mode. The operator may select Cine configurations and techniques. The screen presentation permits the operator to independently configure the pulse width and kVp loops for manual or auto mode of operation. The Cine screen is used to take HHS KV Accuracy Data and measure Cine dose rates.

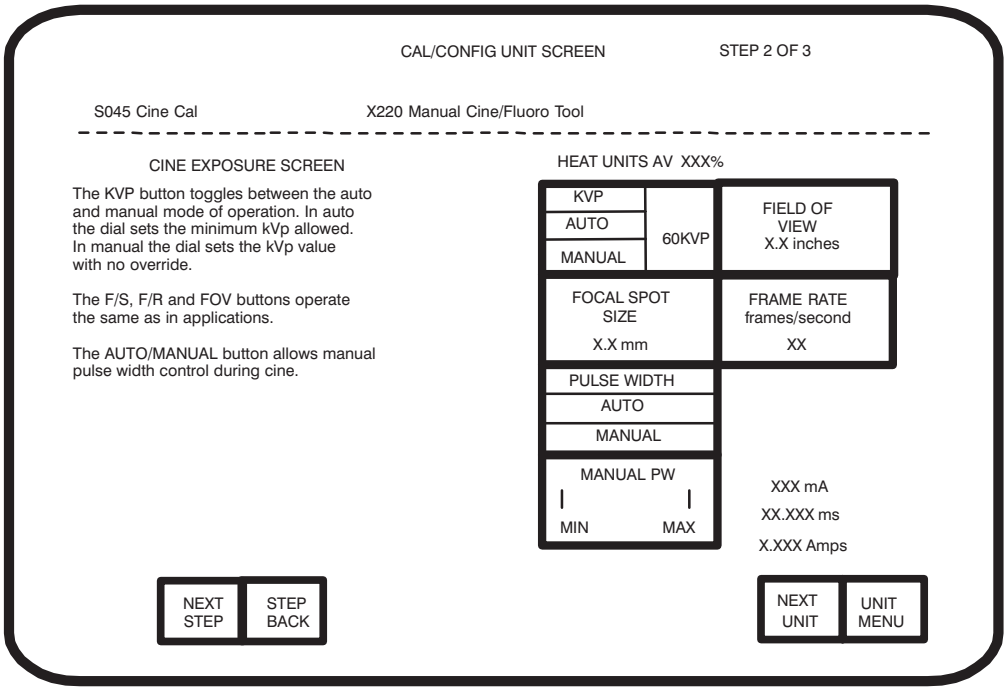
The KVP softkey functions in either one of two modes, AUTO or MANUAL, depending on the the configuration of the kVp loop. In the AUTO mode, the console dial operates similar to applications by setting the minimum kVp value (the real time kVp override value is displayed on the screen while in the AUTO mode). In the manual mode, the console dial sets the actual kVp value without override.

The AUTO/MANUAL softkey when set to MANUAL displays a manual pulse width bar graph indicating a MIN to MAX range. The pulse width in milliseconds and mA are displayed opposite the bar graph display in both AUTO and MANUAL modes. In the AUTO mode, the dialed pulse width is set to 5 ms. This is the pulse width at which the system attempts to maintain operation in the AUTO mode. The kVp override is used to maintain the dialed 5 ms setting. The maximum pulse width is 40 percent of the frame rate or 10 ms whichever is less.

The FOCAL SPOT, FRAME RATE, and FOV softkeys function in the same manner as in the applications mode.

Touch the STEP BACK softkey to return to Step 1 or the NEXT UNIT or UNIT MENU softkey to exit the unit.

X220 STEP 2 SCREEN DISPLAY



4-3 Step 3. Fluoro Screen

The Fluoro screen permits Fluoro exposures similar to that allowed in the Fluoro Applications mode. The operator may select Fluoro configurations and techniques. The screen presentation also allows the operator to independently configure the three ABC loop parameters (mA, kVp, video gain) in either AUTO or MANUAL mode of operation.

The KVP softkey functions in either one of two modes, AUTO or MANUAL, depending on the the configuration of the kVp loop. In AUTO mode, the console dial operates similar to applications by setting the minimum kVp value (the real time kVp override value is displayed on the screen while in the AUTO mode). In the manual mode, the console dial sets the actual kVp value without override.

The VGC softkey also functions in either the AUTO or MANUAL mode depending on how the VGC loop is configured. The softkey function is similar to the KVP softkey, except that in the AUTO mode no value for AGC override is displayed. In the MANUAL mode, the console dial sets the value of video gain. The range of the dial (in steps of 0.5) is from 1.0 to the maximum video gain allowed for the Fluoro detail currently selected.

Note: The VGC softkey is a dual display softkey. A data field for the VGC value is only displayed when the MANUAL mode is selected.

The maximum allowed video gain is equal to the product of the available iris gain and the 5x available electronic gain in the VIC module (limited to a gain of 20x).

THEORY:

The available iris gain is equivalent to the available iris range from the calibrated N# for each dose rate or preset iris position to the full wide open iris position.

Since each N# is equivalent to a 10 percent area change, the available gain from from preset position to full open position can be calculated by taking the reciprocal of 0.9 raised to the N power:

$$\text{IRIS GAIN} = 1(0.9)^{N}$$

Therefore, for an N# equal to 7 the maximum available video gain is (iris gain x electronic gain) or 2 x 5 = 10x gain max.

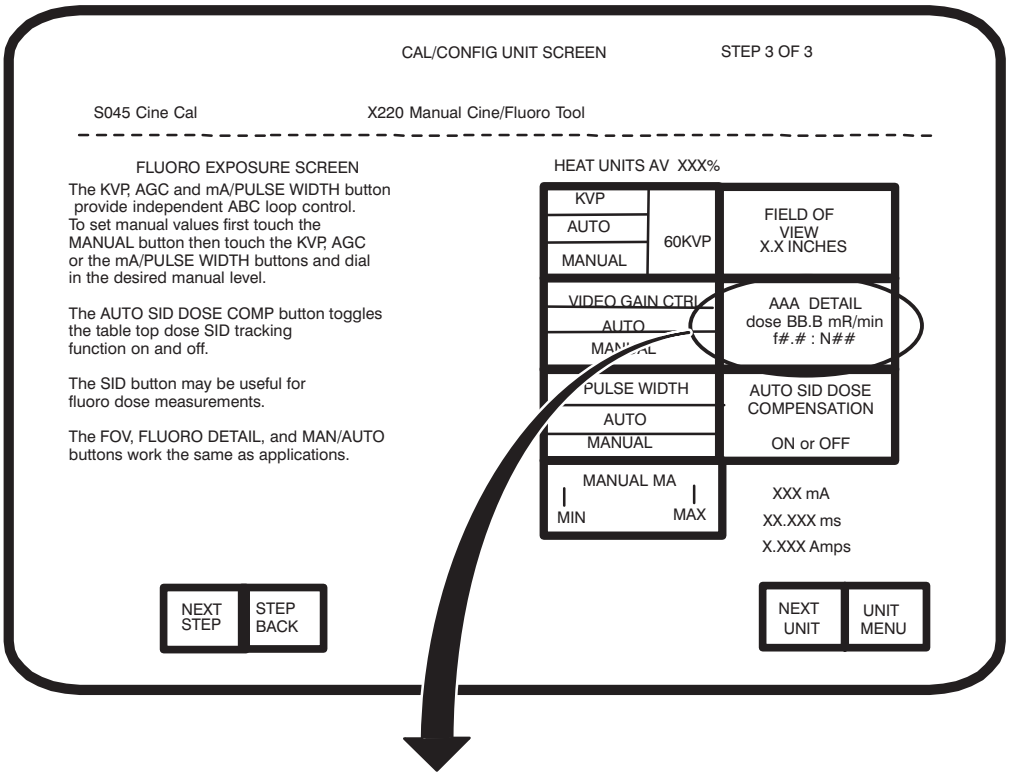
Fluoro dose measurements can be taken from this screen by disabling the SID DOSE COMP softkey. First, record the mA and pulse width in Auto mode. Then, duplicate the technique in MANUAL mode with a dose meter in the FOV (see Calibration Unit X107, Fluoro Entrance Dose Cal, for instructions covering proper positioning and filtration setup).

The AUTO/MANUAL softkey when set to MANUAL displays a manual mA bar graph indicating a MIN to MAX range. The average mA value and pulse width in ms are displayed opposite the bar graph display in both AUTO and MANUAL modes.

The FOV and FLUORO DETAIL softkeys function in the same manner as in the applications mode.

Touch the STEP BACK softkey to return to Step 1 or the NEXT UNIT or UNIT MENU softkey to exit.

X220 STEP 3 SCREEN DISPLAY



AAA = LOW, NORM, HIGH detail
BB.B = dose for selected FOV and fluoro detail
f#.# = aperture setting (F–stop) for selected FOV and fluoro detail
N## = aperture setting (N–stop) for selected FOV and fluoro detail

See Table 74 for ***TYPICAL*** example of Dose (Detail, FOV) matrix.

Table 74 – Typical Example of Dose (Detail, FOV) Matrix

DETAIL	LOW			NORM			HIGH		
FOV	DOSE mR/min	F–STOP	N–STOP	DOSE mR/min	F–STOP	N–STOP	DOSE mR/min	F–STOP	N–STOP
9″	1.7	2.2	11	3.6	3.2	18	7.5	4.6	25
6″	2.2	1.8	8	4.8	2.7	15	10.1	3.9	22
4.5″	3.0	1.6	5	6.5	2.3	12	13.5	3.3	19

4-4 Cine kV Accuracy Test

4-4-1 Equipment required

Dual channel oscilloscope
Two X10 – 10 megohm scope probes
One X1 scope probe

PWB extender card

Service Mode Software Diskette Kit
Direction 46–019357, *Advantx Specifications*.

4-4-2 Cal Procedure

Perform the Cine KV Accuracy test as follows:

4-4-2-1 Install the External Bleeder

1. Use Keithley non-invasive kVp meter.

4-4-2-2 Set up Oscilloscope

2. Set up the oscilloscope so that the 2 channels add together.
3. Set oscilloscope Vertical Ampl. for 20 volts per division.
4. Set the baseline of the scope before prepping the system; otherwise you can expect a 2-3 kV shift when the safety contactor pulls in.
5. Set scope for external trigger, negative edge. Use the RAD PULSE signal to trigger the oscilloscope.
6. Turn on the console.

4-4-2-3 Collect Cine Data

7. Refer to Table 20, Initial Time Interval, in *Direction 46–019357, Advantx Specifications*. Find the "Initial Time Interval" for your system's cable length and type of X-Ray Tube.
8. The "kVp during Initial Interval" should be measured with sweep setting of 0.2 milliseconds per division on scope. The "kVp after Initial Interval" should be measured with sweep setting of 2.0 milliseconds per division on scope.
9. Collect data and fill out Table 75, Cine Accuracy Test Record:

   Find the minimum and maximum value kVp during the Initial Interval. This is the value of kVp from the time the exposure begins (Point "A" below) until the time limit stated in Table 20, Initial Time Interval, in *Direction 46–019357, Advantx Specifications*, for your system (Point "B" below).

   Find the minimum and maximum value kVp after the Initial Interval. This is the value of kVp from the time stated in Table 20, Initial Time Interval, in *Direction 46–019357, Advantx Specifications*, for your system (Point "B" below), until the exposure ends (Point "C" below).

Note: Although the minimum and maximum kVp usually occur at the points shown in Illustration 175, they may occur at other points on the waveform.

10. Verify that the entries meet the specifications in *Direction 46–019357, Advantx Specifications,* Table 23.

Illustration 175 – kV Accuracy Waveform

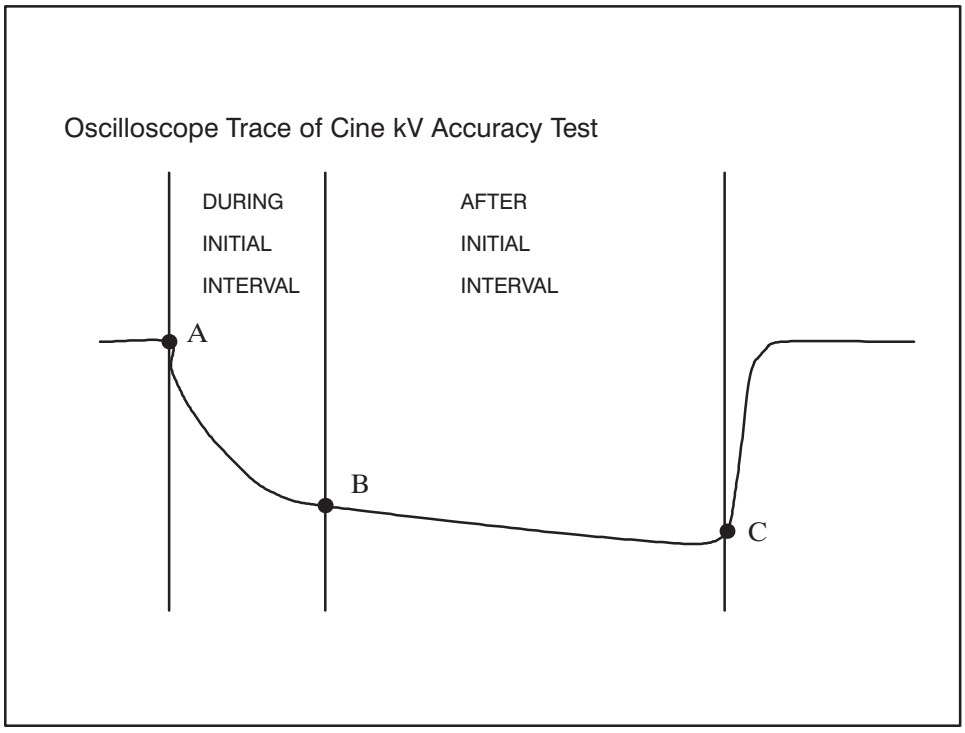


Table 75 – Cine kV Accuracy Test Record

Focal Spot	Frame Rate	kVp	Pulse Width	kVp During Initial Interval		kVp After Initial Interval	
				Min	Max	Min	Max
XS	30	min	10.0				
		90					
		max					
	90	min	4.4				
		90					
		max					
XM	30	min	10.0				
		90					
		max					
	90	min	4.4				
		90					
		max					
XL	30	min	10.0				
		90					
		max					
	90	min	4.4				
		90					
		max					

UNIT X221 – Spot Film Video Presentation

Time: x h xx min – Personnel: 1 field engineer

1 DESCRIPTION

Calibration Unit X221 is used to adjust the video aperture and neutral density filter (if a neutral density filter is installed) for a desired video presentation during Spot Film exposures. An aperture value is determined for each of the fields of view of the Image Intensifier. The unit consists of three steps. Step 1 sets up the system for calibration. Step 2 positions filtration and establishes peak video level during fluoro exposures. Step 3 adjusts the video presentation. A separate screen display is provided for each step in the cal unit.

2 EQUIPMENT REQUIRED

Oscilloscope, BNC “T” connector, 75 ohm termination, test leads, 2-1/4 inch acrylic, 1/4 inch aluminum and 1/32 inch copper filtration.

3 CAL PROCEDURE

3-1 Step 1. Enable Calibration

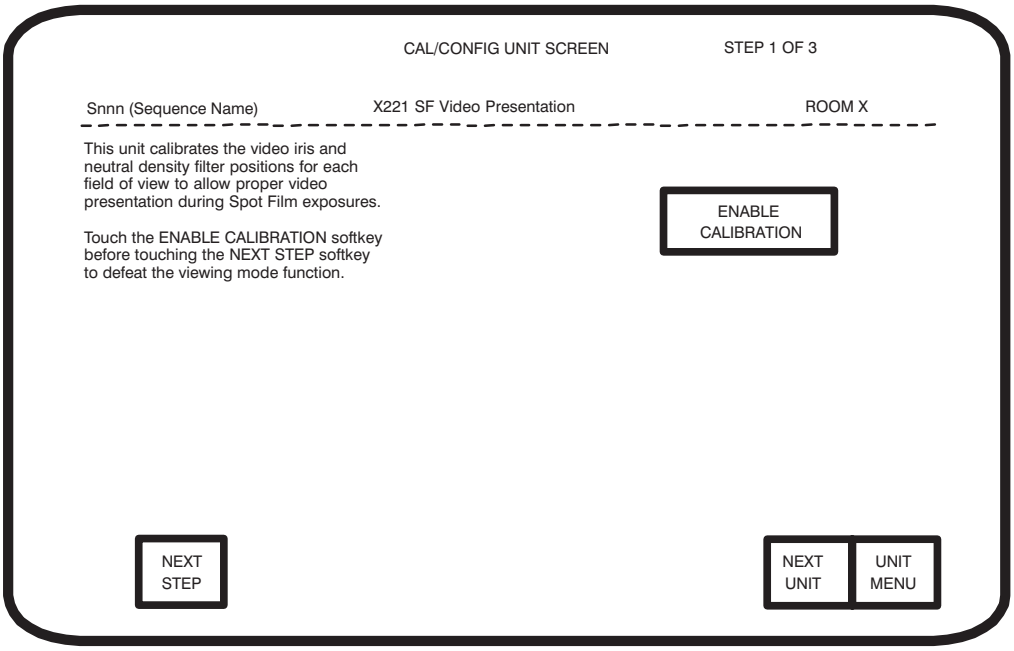
Note: You may enter a viewing mode by touching the NEXT STEP softkey before touching the ENABLE CALIBRATION softkey. The viewing mode allows you to preview each step of the cal procedure before actually performing the calibration.

- Touch the ENABLE CALIBRATION softkey. The unit will automatically calculate the iris/neutral density filter settings for each of the applicable fields of view.
- The unit also checks for a valid receptor for Spot Film and the availability of at least one film speed. If either of these parameters are determined to be invalid, the following messages are displayed and the calibration mode is disabled until receptor is set and at least one film speed is configured.

  ”SELECTED RECEPTOR IS NOT VALID”

  ”NO FILM SPEEDS CURRENTLY CONFIGURED FOR SPOT FILM”
- Touch the NEXT STEP softkey to proceed to Step 2.

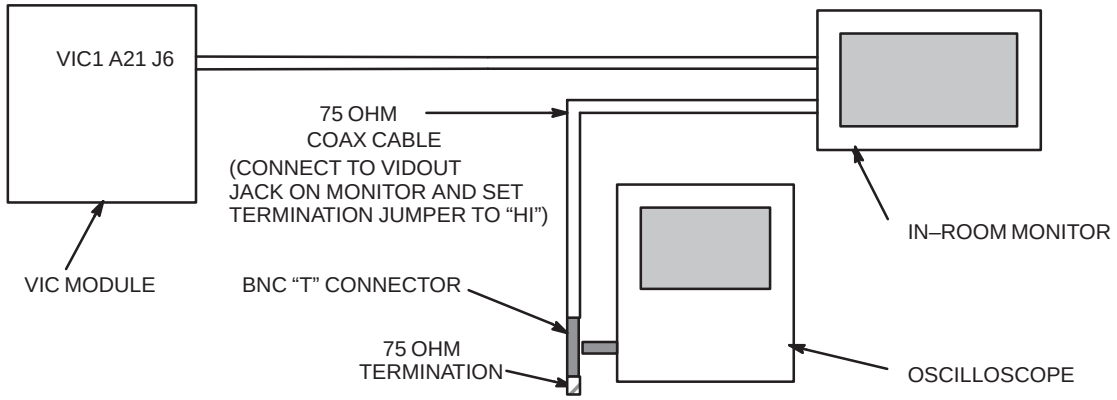
X221 STEP 1 SCREEN DISPLAY



3-2 Step 2. Position Filtration/Determine Video level

- Position 1/4 inch aluminum, 2–1/4 inch Acrylic and 1/32 inch copper filtration in the the X–ray beam. Take fluoro exposures to ensure that filtration is centered in the beam.
- Adjust SID to approximately mid–range.
- Connect video signal to IN ROOM MONITOR to oscilloscope. A suggested test setup is shown in Illustration 176.

Illustration 176 – X221 Test Setup



- Take fluoro exposures and measure the peak video level above black level on the oscilloscope. See Illustration 177.
- Record Peak video level for use in Step 3.
  Peak Video Level:_____
- Touch NEXT STEP softkey to proceed to Step 3.

X221 STEP 2 SCREEN DISPLAY

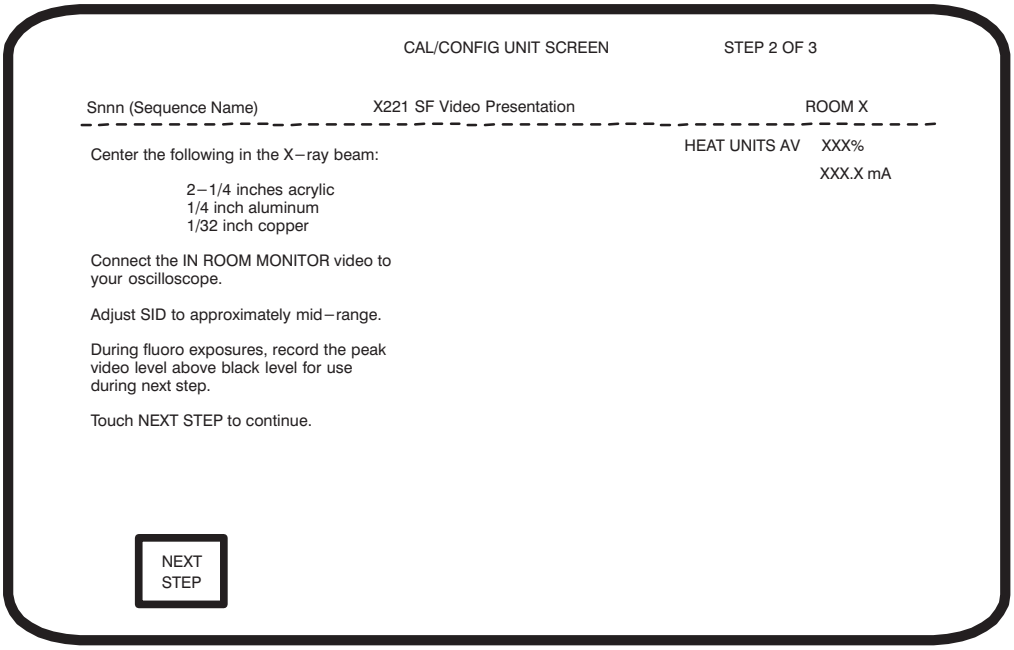
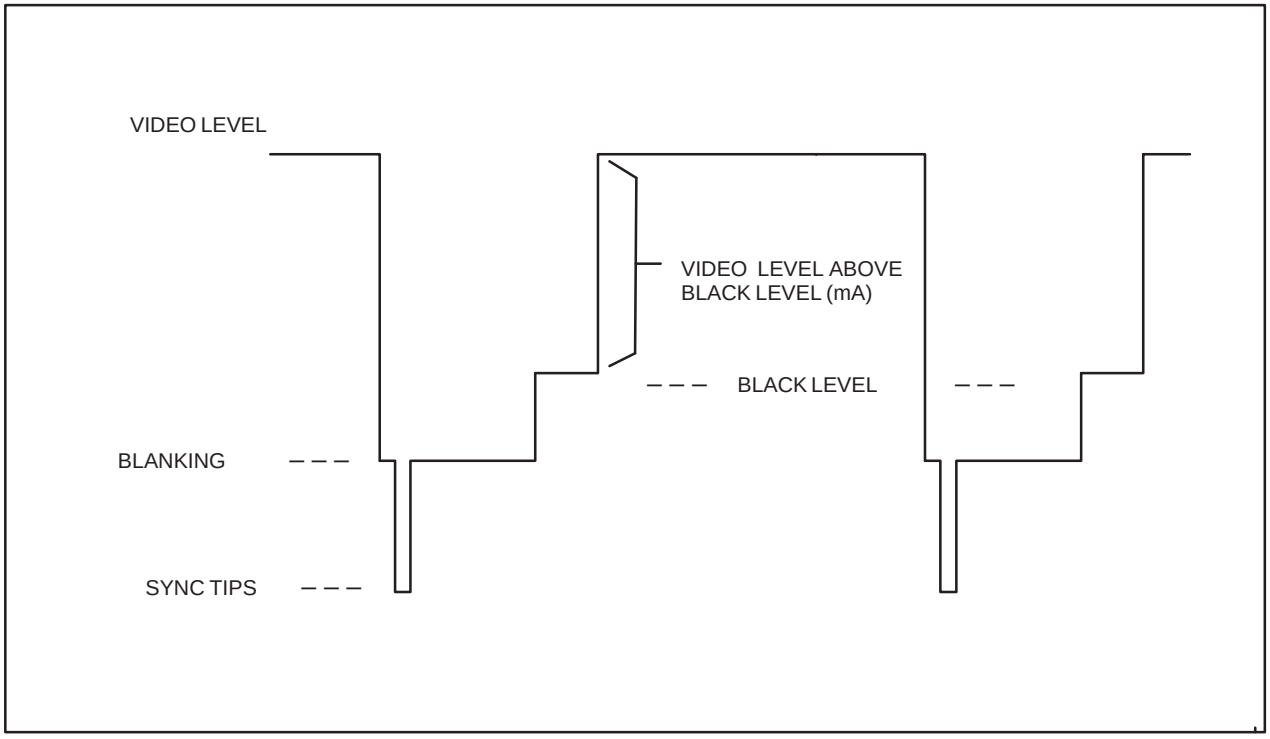


Illustration 177 – X221, Spot Film Video Level



3-3 Step 3. Adjust Video Presentation

- Insert an empty film cassette size normally used at the site. The cassette must be at least a 9 inch by 9 inch size.
- Touch SELECT mA softkey. Take a Spot Film exposure and use the console dial to adjust mA for a fluoro technique that will produce the shortest Spot Film exposure possible that is at least 15 millisecond long (as indicated on screen). If necessary, adjust SID to achieve the exposure time.
- Touch the FILM SPEED softkey to select a film speed. The softkey toggles between the film speeds configured in the database. If all film speeds are configured the selections are; DETAIL, SLOW, MEDIUM, and FAST.

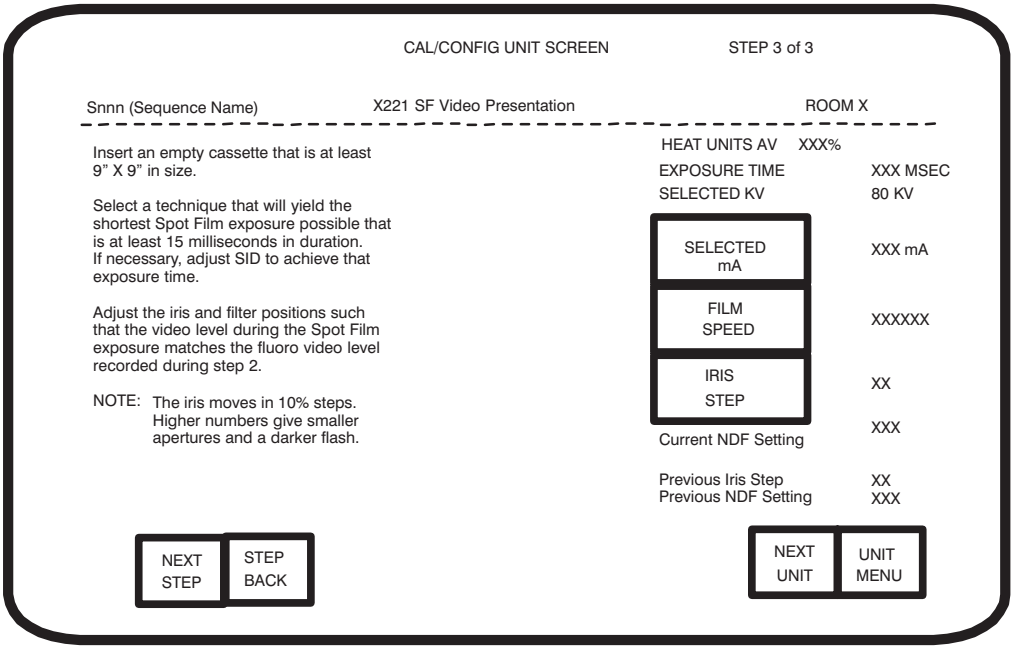
Note: If only one film speed is configured, the message “ONLY ONE FILM SPEED CURRENTLY CONFIGURED FOR SPOT FILM” is displayed when the FILM SPEED softkey is touched.

- Touch the IRIS STEP softkey. Take a Spot Film exposure and adjust the iris position (with console dial) and filter positions so that the video level matches the video level above black level recorded in Step 2. The iris adjustment moves in 10 % steps. Higher numbers give smaller apertures and darker flash. Adjustment range is from 0 to 44. The “Previous Iris Setting” parameter indicates the iris value when the unit was first entered.

Note: If a neutral density filter is not configured on the image system, the screen text pertaining to the neutral density filter (NDF) is not displayed on the screen. If an NDF is configured, the “Current NDF Setting “ parameter indicates IN or OUT. The “Previous NDF Setting” parameter indicates the position of the NDF when the unit was first entered.

- Touch NEXT UNIT or UNIT MENU to exit

X221 STEP 3 SCREEN DISPLAY



Blank page.

UNIT X222 – Film Changer Video Adjustment

Time: x h xx min – Personnel: 1 field engineer

1 DESCRIPTION

Calibration Unit X222 is used to set the TV aperture for the desired video presentation during film changer exposures with the proper entrance dose on film. The unit assists the service person in finding the correct technique to achieve proper density on film and then sets the iris aperture for the technique. Three steps are required to accomplish the calibration. Step 1 centers the CVII Phantom on the video monitor screen. Step 2 establishes a technique for proper film exposure. Step 3 sets the TV aperture to the desired video level for the technique established in Step 2.

Note: This unit must be run at the time of initial installation of the system, after a change in screen/film type is made or after a repair to the image chain is made.

2 EQUIPMENT REQUIRED

Oscilloscope, coax BNC “T” connector, CVII Phantom, and Film Changer film (type used at the site).

NOTICE

A 12 inch phantom must be used on systems with 40 cm II.

3 TEST SETUP

Set up the equipment as follows:

- Insert a coax BNC “T” connector in series with the video signal input to the IN ROOM MONITOR and connect the oscilloscope to the BNC connector.
- Set scope controls: Vert Ampl: 0.2 V/div
  Time Base: 5 msec/div

4 SPECIAL INSTRUCTIONS

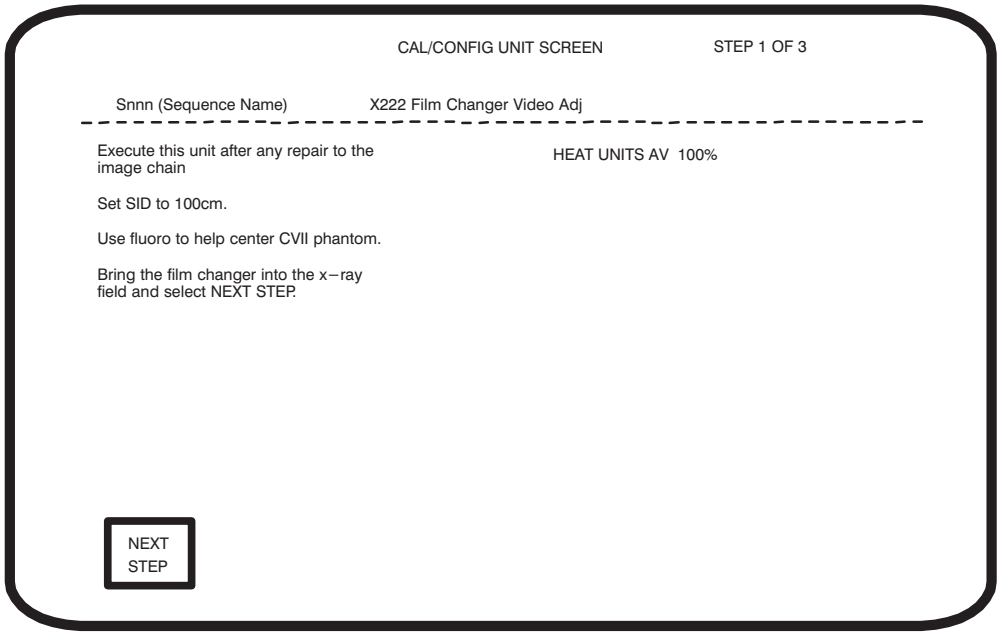
Note: **For Vascular Systems Only:** Before system calibration, verify that additional filter (copper–aluminum filter) is not installed on top of collimator. (Open sensor hinge assembly to verify.) If installed, remove before performing calibration.

5 CAL PROCEDURE

5-1 Step 1. Setup the System

- Set SID to 100 cm.
- Take fluoro exposures to center the CVII Phantom in the X–ray beam.
- Move the Film Changer into the X–ray beam.
- Touch the NEXT STEP softkey to proceed to Step 2.

X222 STEP 1 SCREEN DISPLAY



5-2 Step 2. Set Technique for Proper Film Density

- Load the Film Changer with 5 unexposed films of the type used at the site.
- Touch the FILM/SCREEN SPEED softkey and use the console dial to enter the applicable film/screen speed. Tables of possible film/screen speed combinations are given on the following page for reference purposes. However, the actual manufacturer's film specification sheet should be referred when available to ensure that specifications have not changed.
- Position Image Intensifier in place upon Film Changer.
- Set Starting Technique as follows:
  1. SID = 100 cm.
  2. Film Changer 30 cm from table.
  3. Touch KV softkey and use console dial to enter 80 kV.
  4. Touch MA softkey and use console dial to enter 100 mA.
  5. Expose time (sec) = 20/film–screen speed.
- Program the SEP for one exposure/second.
- Take an exposure and develop the film.
- Measure the film density in the heart area of the CVII phantom.
- Repeat taking exposures, adjusting the technique, and measuring film density until a heart density of 1.4 to 1.5 is achieved.
- Touch NEXT STEP softkey to proceed to Step 3.

X222 STEP 2 SCREEN DISPLAY

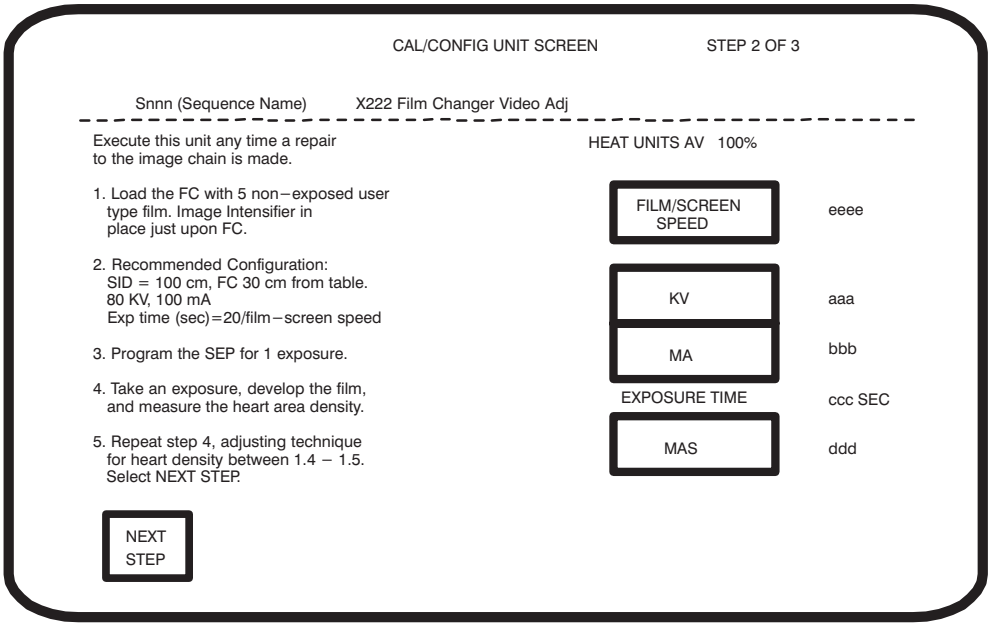


Table 76 – Calibration Unit X222 Film/Screen Speed Tables

DUPONT	QUANTA III	QUANTA III	HI–PLUS	PARA
CRONEX 4	800	400	200	100
CRONEX 2DC	800	400	200	100
CRONEX 6+	800	400	200	100
CRONEX 6	800	400	200	100
CRONEX 7	400	200	100	—

KODAK	X–OMATIC FINE SCREEN	X–OMATIC REGULAR SCREEN	MEDIUM SPEED CAWO4 SCREEN	HIGH SPEED CAWO4 SCREEN
X–OMAT K	30	200	100	250
X–OMAT RP	30	200	100	250
X–OMAT L	30	200	100	250
X–OMAT G	20	100	—	—

KODAK & KRUPPA	KODAK LANEX FINE SCREEN 60 KV	KODAK LANEX FINE SCREEN 80–120 KV	KODAK LANEX MEDIUM SCREEN	KODAK LANEX REGULAR SCREEN GREEN SENSITIVE	KODAK FAST SCREEN	KRUPPA SCREEN BLUE SENSITIVE
T–MAT G	80	100	300	400	600	200
T–MAT L	80	100	300	400	600	200
T–MAT H	—	—	600	800	1200	400
ORTHO G	80	100	250	400	600	200
ORTHO L	80	100	250	400	600	200
ORTHO C	—	—	250	400	—	200
ORTHO M	SINGLE SCREEN 40	—	—	—	—	—
MIN–R	20	—	—	—	—	—
NMB	25	—	—	—	—	—

Note: It is not necessary to expose film in Step 3. Setup the SEP accordingly.

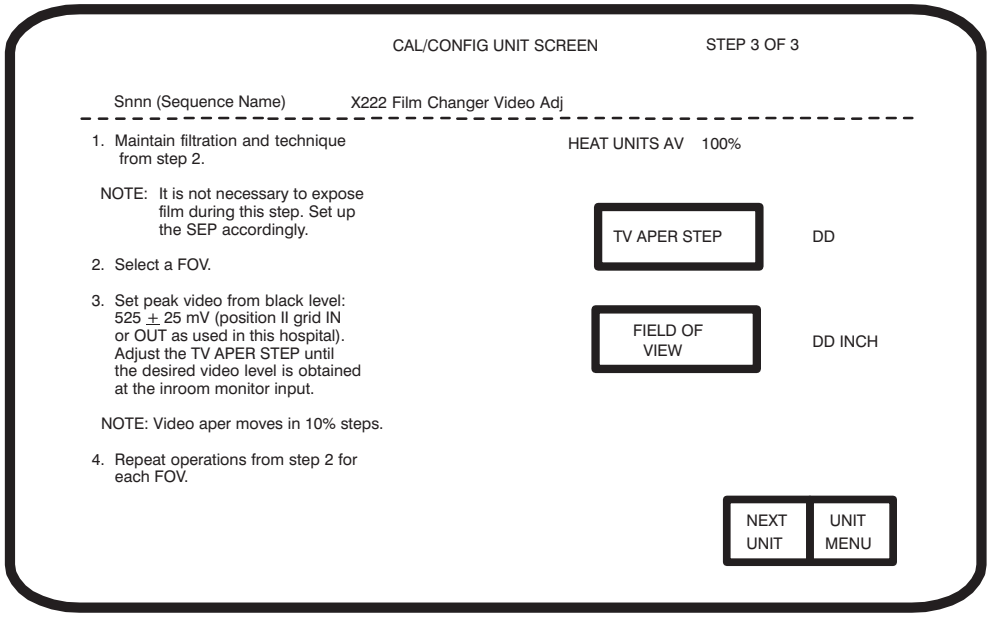
5-3 Step 3. Set Video Presentation

- Maintain the filtration and technique established in Step 2 of this unit.
- Touch FIELD OF VIEW softkey and use the console dial to select an FOV.

Note: Although any FOV may be selected, the standard procedure is to select the NORMAL FOV as the starting FOV for the TV Aperture adjustment.

- Touch TV APER STEP softkey and, using the console dial, set the peak video level observed on the oscilloscope to 525 mV $\pm$ 25 mV above the black level (TV aperture adjustment moves in 10 percent steps). Position the II grid IN or OUT as normally used at the site.
- Select another FOV. Repeat TV Aperture adjustment for selected FOV.
- Repeat selecting FOV's and making TV Aperture adjustments for the remaining FOV's.
- Touch NEXT UNIT or UNIT MENU softkey to exit the unit and load aperture values into the database.

X222 STEP 3 SCREEN DISPLAY



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UNIT X225 – Fluoro AGC Brightness Taper

Time: x h xx min – Personnel: 1 field engineer

1 DESCRIPTION

Calibration Unit X225 is used to adjust both the brightness reduction taper and iris or electronic gain priority levels to reduce the effects of quantum noise on image quality. The unit sets the end–point values of the brightness reduction taper for the normal fluoro detail mode of operation.

Note: This unit should only be run if dictated by site requirements. The unit is not run as a part of any system calibration sequence menu.

2 THEORY

The following paragraphs describe the theory of operation of the Advantx system video gain (AGC) function and the requirement for the brightness reduction taper function.

2-1 ABC Control

Fluoro image brightness is held constant over the full range of the automatic brightness control (ABC) function. The ABC maintains brightness by automatically adjusting kVp, mA, and video gain (AGC). The ABC loop is closed around an average video brightness level that is derived from a constant pickup tube signal current level. The image intensifier entrance dose level is determined by adjusting the variable iris in front of camera pickup tube.

2-2 AGC Control (Model Period 5 and up)

The VIC module uses the video gain command from the ABC loop to control the variable iris and electronic gain (AGC function). The VIC algorithm assigns first priority to the camera electronic gain. The camera gain is first allowed to increase up to the VIC ELECTRONIC GAIN THRESHOLD level established in this unit. Once the video gain reaches the VIC ELECTRONIC GAIN THRESHOLD level, the iris is opened in accordance with any remaining ABC video gain commands. When the iris reaches the maximum open position, the VIC then permits additional increases the camera electronic gain up to the 5x gain allowed for the electronic portion of the video gain.

2-3 Image Presentation

Opening the iris to maintain image brightness increases the quantum noise without increasing the informational content of the image displayed on the monitor [the signal–to–noise ratio (S/N) decreases, thereby producing a noisy image on the monitor]. Lowering the fluoro brightness level is a technique that can produce a better image. Changing the brightness level does not reduce the S/N ratio but does reduce both the noise and signal level to an amplitude that presents the same information in a more desirable manner. This is due to the fact that the human eye is very sensitive to image noise above a specific amplitude level.

2-4 Image Perception

If the image brightness level is maintained with increased video gain override, the Physician does not receive any obvious feedback informing him that he is at the x–ray technique limit. Instead, the Physician sees the image become grainier without an understanding of why image quality is deteriorating. In some applications, not having video gain override at all (letting the image go darker) may prove more understandable and acceptable to the Physician.

3 DESCRIPTION, MP5 AND UP – REFER TO NOTE 2 PAGE 1067

MP5 and up systems have been designed to allow the image brightness to fall off in a controlled (linear taper) manner when the system enters video gain override. Along with the brightness reduction function, the capability to permit the video electronic gain to take priority over iris changes up to a gain of 2x has also been implemented for MP5. In the closed loop fluoro mode, a 2x video gain will cause the camera to operate with one half the signal current level. Decreased signal current levels cause Primicon pickup tubes to exhibit increases in lag. Increased lag reduces quantum noise.

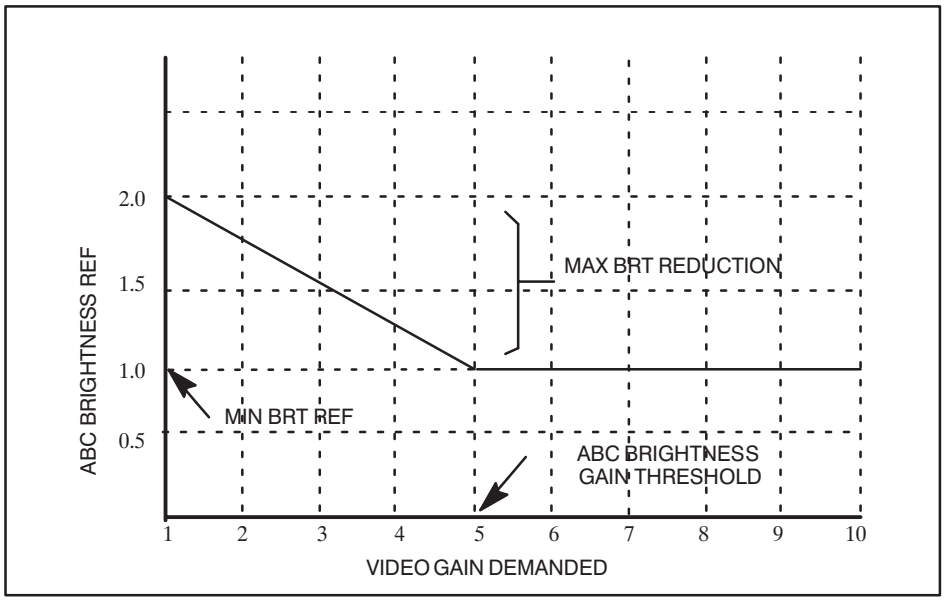
The brightness reduction taper works in conjunction with the Automatic Gain Control (AGC) function of the Automatic Brightness Control (ABC) loop and the video gain commands to provide a capability for reducing the effects of gained–up quantum noise on image quality.

In the Advantx system, full image brightness is equivalent to a 2 volt ABC brightness level. After reaching maximum Fluoro kVp and mA, the ABC loop brightness level is decreased linearly with increasing video gain commands until a calibrated minimum brightness level is reached. Once the minimum brightness level is reached, the system will continue to operate at this brightness level up to the maximum video gain override point. At the maximum video gain override point, the system brightness is allowed to decrease in proportion to patient attenuation.

Illustration 178 shows how the ABC loop brightness reference level is decreased with increasing video gain demands.

Calibration Unit X225 provides the capability of adjusting the minimum brightness reference level and the ABC brightness gain threshold to establish the brightness reduction taper. A final adjustment (VIC Electronic Gain Threshold) sets the amount of electronic gain allowed before the iris is opened.

Illustration 178 – X225, Linear Brightness Reduction Taper



The brightness reduction taper is automatically adjusted for each fluoro mode of operation. The taper is adjusted by calculating a new ABC brightness gain control threshold for both the LOW and HIGH fluoro detail modes. The LOW and HIGH values are calculated from the NORMAL fluoro detail ABC brightness gain threshold value (set in X225) using the same ratios determined from comparing the normal fluoro detail maximum video gain limit to the maximum video gain limits for both the low and high fluoro detail levels.The maximum video gain limits are different for each fluoro detail because of the different variable iris settings for each fluoro detail mode.

Example:

System Parameters

Fluoro Detail

Low 16 µGy/min (1.8 mR/min)
Norm 31.5 µGy/min (3.6 mR/min)
High 63 µGy/min (7.2 mR/min)

Variable Iris

Low N = 0
Norm N = 7
High N =14

(Where N = iris location in 10 percent steps. N = 0 is the wide open position. Seven N numbers are equal to one f/stop and a doubling of light gain.)

Maximum Video Gain

Low 1 x 5 = 5
Norm 2 x 5 = 10
High 4 x 5 = 20

(Where 5 represents maximum electronic gain and 1, 2, 4 represent the available iris gain.)

If, for example, the following values are set using Calibration Unit X225:

- ABC Loop Minimum Brightness Reference = 50% of Maximum
- ABC Brightness Gain Threshold = 6.0

Then, during the normal fluoro detail mode of operation, the image brightness will drop to 1/2 of full brightness when the ABC loop requires video gain commands equal to a gain of 6x. Since the ratio of maximum video gain at LOW fluoro detail to maximum video gain at NORM fluoro detail equals 1/2, the ABC brightness gain threshold for LOW fluoro detail is as follows:

1/2 (6) = 3x gain

Therefore, during LOW fluoro detail mode of operation, the image brightness will drop to 1/2 of full brightness when the ABC loop requires video gain commands equal to a gain of 3x.

During the HIGH fluoro detail mode of operation, the image brightness will equal 1/2 full brightness when the ABC loop requires video gain commands equal to a gain of 12x.

The calculations described above are accomplished automatically in the system ECM each time operation in the fluoro mode is initiated. By proportionally moving the brightness reduction taper, relative to the normal fluoro detail, the image darkness remains about the same for the same iris position and therefore quantum noise graininess.

4 EQUIPMENT REQUIRED

No special equipment is required to run this unit.

5 SPECIAL INSTRUCTIONS

The following special operating instructions are provided as a supplement to the calibration procedure. Read the instructions carefully to become familiar with the parameters before proceeding with any adjustments.

- The values for the brightness reduction taper are defaulted to 50 percent of Low ABC Brightness at an ABC Gain Threshold of 5x gain. The VIC electronic gain is set to a default value of 2x gain to permit the electronic gain to reach 2.0 before the aperture is opened. Once the aperture reaches full open, the electronic gain is allowed to increase up to a maximum of 5x video electronic gain. Normally, the default values do not have to be changed unless the site physician indicates that the image is grainy or to dark when in video gain override and all other possible image adjustments have been properly calibrated.
- The automatic brightness taper function can be disabled by setting the ABC Loop Minimum Brightness Reference parameter equal to 100 percent of maximum and the ABC Brightness Gain Threshold parameter to a 1.0 Gain Command. If the taper function is disabled, AGC is allowed and full monitor brightness is maintained until the video gain maximum limit is reached.
- The AGC part of the ABC loop can be disabled by deselecting the VIDEO GAIN OVERRIDE function in General Configuration Unit C011.

Note 1: **For Vascular Systems Only:** Before system calibration, verify that additional filter (copper–aluminum filter) is not installed on top of collimator. (Open sensor hinge assembly to verify.) If installed, remove before performing calibration.

Note 2: Since Titan release G12.05, VIC Electronic Gain Threshold has been defaulted to 1.5 (in place of 2), and ABC loop Minimum Brightness Reference to 80% (in place of 50%)

6 CAL PROCEDURE

Adjustment of the brightness reduction taper is accomplished according to the following procedure:

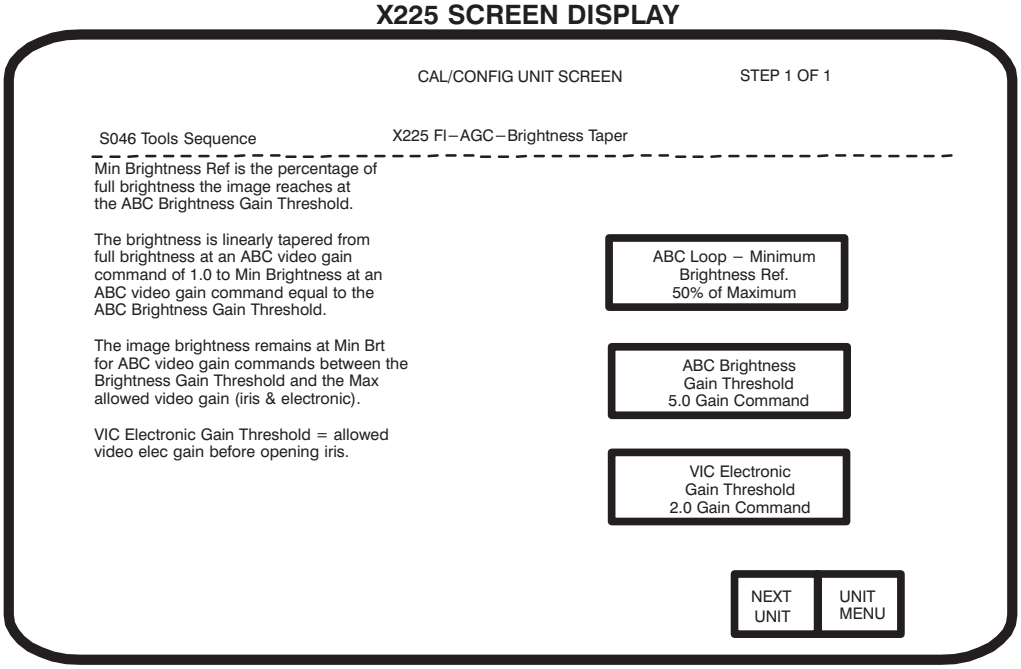
- Touch the ABC Loop Minimum Brightness Ref softkey. Use the console dial to select the maximum amount of brightness reduction desired. Brightness reduction is expressed as a percent of full brightness from 100 percent to 40 percent.

Note: The values shown on the X225 SCREEN DISPLAY are for pulsed systems. For non–pulsed systems (i.e. DRS on Tilt–C or Legacy), the values are the following:
ABC Loop–Minimum Brightness Ref. 75% of Maximum
ABC Brightness Gain Threshold 5.0 Gain Command
VIC Electronic Gain Threshold 1.0 Gain Command

Note: With reference to Illustration 178, 100 percent of full brightness corresponds to an ABC Brightness Ref level of 2 volts and 40 percent of full brightness corresponds to an ABC Brightness Ref level of 0.8 volts.

- Touch the ABC Brightness Gain Threshold softkey. Use the console dial to select the desired video gain level at which the minimum brightness is reached. This is the system video gain demand from the ABC loop.
- Touch the VIC Electronic Gain Threshold softkey. Use the console dial to set the amount of electronic gain allowed before the aperture begins to open. The parameter increments in steps of 0.1 (from 1.0 to 2.0). The setting of this parameter allows the system to reach an electronic gain of up to 2 (1.5 for Titan Relese G12.05 or higher) before opening the iris. This permits the system to run with 1/2 (3/4 for Titan Release G12.05 or higher) of the signal current which causes certain pickup tubes (Primicon) to exhibit increased lag. Increased lag reduces some of the quantum noise, thereby improving the image on the monitor.

X225 SCREEN DISPLAY



UNIT X233 – Fluoro Iris Adjust

Time: x h xx min – Personnel: 1 field engineer

1 DESCRIPTION

Calibration Unit X233 is a tool unit that allows the service person to view and/or modify the fluoro dosimetry profile that has been set up for the system (fluoro mode, fluoro detail and field of view). The unit enables the service person to fine tune the fluoro dosimetry profile of the system to meet the requirements of the user. A slightly different dosimetry profile may be required by a hospital depending on the doctor using the system or on the image intensifier tube and procedure used (cardiac, vascular, etc.). The dosimetry profile of a system is displayed in the form of iris N–numbers for each fluoro mode, each field of view and each corresponding detail (low, normal, high).

NOTICE

Calibration unit X233 can be used when the system is fully calibrated. However, if Calibration Unit X107 (or X123, X133) are rerun for any reason, X233 must also be rerun since the iris offset values for the magnification modes will be reset to default values.

CAUTION

For customers that use Auto Focal Spot on LAC+/LCV+, LC+ systems, modifying the default values is not recommended because the AFS functionality performance will be adversely affected.

2 EQUIPMENT REQUIRED

Dosimeter (MDH/Radcal 2025, 2026 or equivalent) w/probe stand or Ion Chamber Positioning Tool 2236707 (Former ref: 2208874)
For Advantx–E Systems, Ion Chamber Positioning Tool is mandatory (See Cal Unit T015) .
For this Cal Unit, use Model 20x5–180 or 20x6–180 probe.
Metric Tape Measure.
Filtration (1/4 inch aluminum, 1/32 inch copper, and 2–1/4 inches of Plexiglas) from CV phantom
For a 9 inch (22 cm) II tube, use a 9 inch CV phantom. For a 12 inch (30 cm) or 16 inch (40 cm) II tube, use a 12 inch CV phantom.

3 SPECIAL INSTRUCTIONS

Note: **For Vascular Systems Only:** Before system calibration, verify that additional filter (copper–aluminum filter) is not installed on top of collimator. (Open sensor hinge assembly to verify.) If installed, remove before performing calibration.

- A unit “MORE INFO” screen (accessed through Step 2 screen provides a summary of the operation of this unit for quick reference.
- An EXIT NO UPDT (exit no update) softkey on the Step 2 screen can be used to exit the unit without making changes to a system dosimetry profile.
- If DLX Fluoro is configured, the DLX must be in the ACQUISITION READY state or error messages will be displayed when attempting to run this unit. When DLX is entered, the DLX will automatically proceed to the Technical Manual Mode.
- Recommended dose values are given in Cal Unit, X107, Fluoro Entrance Dose Calibration.
- For specific iris configuration for German or Swiss dose adjustment, see X233 Supplement “A” or X233 Supplement “B”, respectively, at the end of the X233 procedure.

4 CONTROLS/DISPLAYS

- FLUORO IRIS TABLE – This table is presented on the Step 2 screen and displays the system’s current dosimetry profile for a selected fluoro mode. Parameters displayed are as follows:

  DOSE: The first row of numbers in the table corresponds to the dose value for the NORMAL FIELD OF VIEW at LOW, NORM, HIGH detail.

  FIELD OF VIEW: The table presents the available fields of view (configuration dependent) along the left side of the table. The selected field of view is highlighted. NORM is the default value when the unit is entered.

  FLUORO DETAIL: Fluoro detail is listed across the top of the table in three columns (LOW, NORMAL, HIGH). The detail selected is highlighted. NORMAL is the default parameter when the unit is entered.

  IRIS NUMBERS: Iris numbers pertaining to a system dosimetry profile are displayed by the row of the selected field of view an the column of the selected fluoro detail. The (PP) values shown for a pair of field of view/detail parameters indicates the present (stored) aperture value. NN indicates a new adjusted value.

- SOFTKEYS – The softkeys displayed on Step 2 screen control the operation of the unit. Softkey functions are as follows:

  FLUORO MODE: Controls selection of the Fluoro Mode dosimetery profile that is displayed on the Fluoro Iris Table. Possible Fluoro Modes are: CONVENTIONAL FLUORO, DX FLUORO, PULSCAN FLUORO, DR FLUORO (DR and Pulscan share the same database). If the system is only configured for Conventional Fluoro, the FLUORO MODE softkey is not displayed.

FIELD OF VIEW: Selects the field of view to be observed on the Fluoro Iris Table. The table will be automatically set to the proper number of magnification modes according to system configuration, i.e. 9″ (22 cm) II (2 mag. modes) and 12″ (30 cm) II (3 mag. modes).

FLUORO DETAIL: Selects the Fluoro Detail (LOW, NORMAL or HIGH) to be displayed on the Fluoro Iris Table.

IRIS ADJUST: Controls the selection of iris values for the selected Field of View and Fluoro Detail pertaining to a Fluoro Mode. When activated, the console dial can be used to increment (cw) or decrement (ccw) the iris aperture value. Range of adjustment is from 0 (wide open iris) to 44 (pin hole aperture).



Although a full range of apertures can be selected for the magnified fields of view, use caution when selecting higher values than for the normal field of view since very large doses could be produced in magnified fields of view. Usually the iris aperture number will be decreasing with magnification mode.

Never set the N–numbers of Mag1, Mag2 and Mag3 at a higher value than the Norm value.

Avoid adjusting N–numbers at a lower value than listed below for each magnification. Adjusting at a lower value will produce an unusable fluoro image.
Mag1N–4
Mag2N–10
Mag3N–15

AUTO/MANUAL: Selects the operational state of the unit. When MANUAL is selected, the mA bargraph is enabled and the console can be used to adjust fluoro brightness. Rad control and mA values are displayed for non–pulsed systems and Rad control and pulse width are displayed for pulsed systems.

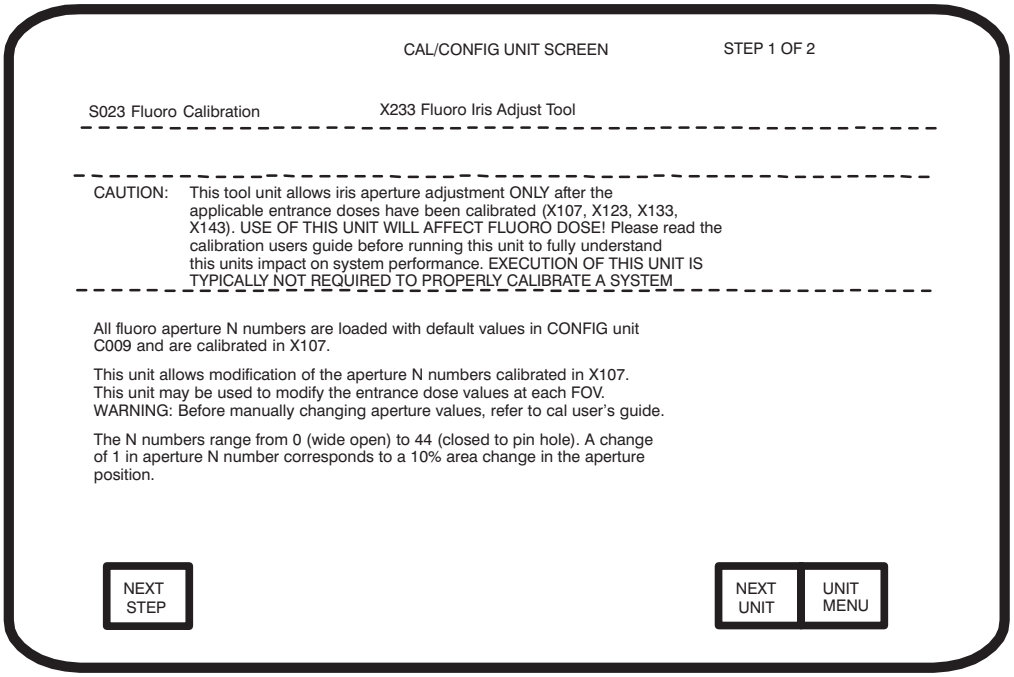
KVP: Provides manual adjustment of kVp. When activated, the console dial can be used to set kVp to values from 60 kVp (or minimum) to 120 kVp (or maximum).

5 CAL PROCEDURE

5-1 Step 1. General Information

- The Step 1 screen display is an informational screen only. It describes the purpose of the unit and precautions to be observed when running this unit.
- After reviewing the instructions, touch NEXT STEP softkey to proceed to Step 2.

X233 STEP 1 SCREEN DISPLAY



5-2 Step 2. Set Iris correction

- Enter settings according to the Recommended Dosimetry Profile (see Table 77 to Table 82) corresponding to the system to be calibrated.

WARNING **THESE RECOMMENDED DOSIMETRY PROFILES HAVE TO BE SET FOR CV, DX AND PULSCAN FLUORO.**

CAUTION **THESE RECOMMENDED DOSIMETRY PROFILES IN Table 77 TO Table 79 ARE THE ONLY IRIS CONFIGURATIONS THAT WILL NOT ADVERSELY AFFECT AUTO FOCAL SPOT FUNCTIONALITY.**

NOTICE **For 12 inch (30 cm) Image Intensifier, Cardiac corresponds to a configuration including a Plumbicon Pick–Up Tube and Vascular corresponds to a configuration including a Saticon Pick–Up Tube.**

NOTICE **VIC cameras on 9 inch (22 cm) Image Intensifiers are equipped either with a Plumbicon or a Saticon. In both cases, Recommended Entrance Dose Levels have the same values and should be calibrated in the same way.**

Table 77 – Recommended Dosimetry Profile for 22 cm (9 inch) Image Intensifier for Advantx–E Vascular Systems (Plumbicon and Saticon)

MAG MODE (FOV)	FLUORO DETAIL		
	LOW	NORM	HIGH
NORM*	N1	N2	N3
MAG 1	N1–2	N2–2	N3–2
MAG 2	N1–4	N2–4	N3–4
* N–number calibrated in X107 (or X123, X133, X143) fluoro dose NORMAL mode.			

Table 78 – Recommended Dosimetry Profile for 32 cm (12 inch) Image Intensifier, for Advantx–E Vascular Systems, for Cardiac Applications (Plumbicon)

MAG MODE (FOV)	FLUORO DETAIL		
	LOW	NORM	HIGH
NORM*	N1	N2	N3
MAG 1	N1–2	N2–2	N3–2
MAG 2	N1–4	N2–4	N3–4
MAG 3	N1–6	N2–6	N3–6
* N–number calibrated in X107 (or X123, X133, X143) fluoro dose NORMAL mode.			

Table 79 – Recommended Dosimetry Profile for 40 cm (16 inch) and 32 cm (12 inch) Image Intensifier, for Advantx–E Vascular Systems, for Vascular Applications (Saticon)

MAG MODE (FOV)	FLUORO DETAIL		
	LOW	NORM	HIGH
NORM*	N1	N2	N3
MAG 1	N1–3	N2–3	N3–3
MAG 2	N1–6	N2–6	N3–6
MAG 3	N1–9	N2–9	N3–9
* N–number calibrated in X107 (or X123, X133, X143) fluoro dose NORMAL mode.			

Table 80 – Recommended Dosimetry Profile for 22 cm (9 inch) Image Intensifier, for all other Systems

MAG MODE (FOV)	FLUORO DETAIL		
	LOW	NORM	HIGH
NORM*	N1	N2	N3
MAG 1	N1–3	N2–3	N3–3
MAG 2	N1–6	N2–6	N3–6
* N–number calibrated in X107 (or X123, X133, X143) fluoro dose NORMAL mode.			

Table 81 – Recommended Dosimetry Profile with 32 cm (12 inch) Image Intensifier, for all other Systems

MAG MODE (FOV)	FLUORO DETAIL		
	LOW	NORM	HIGH
NORM*	N1	N2	N3
MAG 1	N1–3	N2–3	N3–3
MAG 2	N1–6	N2–6	N3–6
MAG 3	N1–9	N2–9	N3–9
* N–number calibrated in X107 (or X123, X133, X143) fluoro dose NORMAL mode.			

Table 82 – Recommended Dosimetry Profile with 40 cm (16 inch) Image Intensifier, for all other Systems

MAG MODE (FOV)	FLUORO DETAIL		
	LOW	NORM	HIGH
NORM*	N1	N2	N3
MAG 1	N1–3	N2–3	N3–3
MAG 2	N1–6	N2–6	N3–6
MAG 3	N1–9	N2–9	N3–9
* N–number calibrated in X107 (or X123, X133, X143) fluoro dose NORMAL mode.			

6 VERIFY/ADJUST DOSIMETRY (IF DESIRED)

Note: Upon entering Step 2 for the first time the unit parameters are set to the following defaults:
AUTO (80 kVp)
NORMAL FIELD OF VIEW
NORMAL DETAIL
CONVENTIONAL FLUORO
IRIS TABLE w/ CURRENT VALUES

- Select desired Fluoro Mode, Field of View and Fluoro Detail.
- Make sure that the collimator blades are fully open.

For Advantx–E Vascular Systems only, refer to Illustration 144 in X107 Service Mode unit:

- Leave the grid in place.
- Set table top at isocenter.
- Adjust II anticollision plane at 30 ±0.5 cm from table top.
- Place 2–1/4″ of Plexiglass, 1/4″ Aluminum, 1/32″ Copper filters in the x–ray beam on the table top.
- Position radiation probe/meter:
  Use Ion Chamber Positioning Tool 2236707. refer to mounting/positioning instructions in Cal Unit T015. Check for probe top/anticollision plate distance in Table 10 of Cal Unit T015.
  Position the dosimeter probe just close to the II anticollision plate in the FOVcenter . The probe should be as close as possible from this plate and be parallel to it, without pressure on the probe itself.
- Orient long axis of radiation probe perpendicular to anode/cathode axis of x–ray tube.

Note: Filtration, Image Intensifier and dosimeter probe positioning must be the same as used when Cal Unit X107 was run.

- Take fluoro exposures in the AUTO mode for the FLUORO MODE, FIELD OF VIEW and FLUORO DETAIL to be verified or adjusted.
- Read dose value on the dosimeter display.
- If needed, compare the dose measurement results with the values given in the X107, X123, X133 Service Mode units.

WARNING

FOR ADVANTX–E VASCULAR SYSTEMS ONLY:

BEWARE OF THE EXISTENCE OF TWO DIFFERENT TYPES OF DOSES:

II Entrance Doses: doses displayed and dialed on the console in this calibration Unit**.** The **Recommended Entrance Doses** presented in the tables hereafter are the **II Entrance Doses** allowing the best functionning conditions of the system and the ones which should be used**.**

Measured Entrance Doses: result of the measurement procedure, dosimeterprobe close to the anticollision plate and dose reduced by the antiscatter grid.

II Entrance Doses are equal to Measured Entrance doses divided by two.

For all systems others than Advantx–E Vascular Systems:

- Remove the grid
- Set table top at isocenter.
- Position Image Intensifier (II):

  TILT–C and Vascular Systems – Set II 12 inches (30.5 cm) above the table top and X–ray tube at maximum SID.

  R&F Systems – Set Image Intensifier at minimum SID.
- Place 2–1/4″ of Plexiglass, 1/4″ Aluminum, 1/32″ Copper filters in the X–ray beam on the table top.

Note: Filtration and Image Intensifier configuration must be the same as used when Cal Unit X107 was run.

- Make sure that kVp is set to 80 kVp.
- Take fluoro exposures in the AUTO mode for the FLUORO MODE, FIELD OF VIEW and FLUORO DETAIL to be verified or adjusted. Record the actual KVP, RADCNTL and MA (or pulse width) obtained at each Field of View and Fluoro Detail selected in a Fluoro Mode.
- On R&F systems configured with an 8535, 8835, or ISFD Spot Film Device, measure and record the height of the II above the table top. Measurement to be made from the external surface of the II to the center of the bottom of the SFD entrance window. Height of II _____mm.
- Move the II to the maximum SID.
- Position radiation probe/meter:

  Vascular Systems: –When using Ion Chamber Positioning Tool 2236707, refer to mounting/positioning instructions in Cal Unit T015. Check for probe top/II entrance plane distance in Table 9 of Cal Unit T015. If not using the Ion Chamber Positioning Tool, position probe at a height equal to 30 cm ¿0.5 above table top.

  TILT–C: – Position probe at a height equal to 30.5 cm (12”) above table top.

  R&F Systems w/ SFD: –Position probe at a height equal to the sum of the II height recorded plus 116 mm.

- Orient long axis of radiation probe perpendicular to anode/cathode axis of x–ray tube.
- Set system to MANUAL by toggling AUTO/MANUAL softkey.
- Touch KVP softkey and use the console dial to set the system at 80 kVp.
- Take fluoro exposures and use the console dial to set the values of Rad control and mA (or pulse width) to each of the mA values previously recorded in the AUTO mode. At each mA, record the entrance dose indicated on the radiation meter.
- If needed, compare the dose measurement results with the values given in the X107, X123, X133, X143 Service Mode units.

Note: For specific iris configuration for German or Swiss dose adjustment, see Section 8, X233 Supplement “A” or Section 9, X233 Supplement “B”, respectively, at the end of the X233 procedure.

- After verification of the fluoro dosimetery profile, be sure to record all fluoro iris aperture numbers before exiting the unit. It is important that you prepare a record of the system dosimetery profile after running X233 since any re–run of Cal Unit X107 (or X123, X133, X143) will reset X233 to default values. The record will allow you to reset X233 to the dosimetery profile previously established in a minimum time.

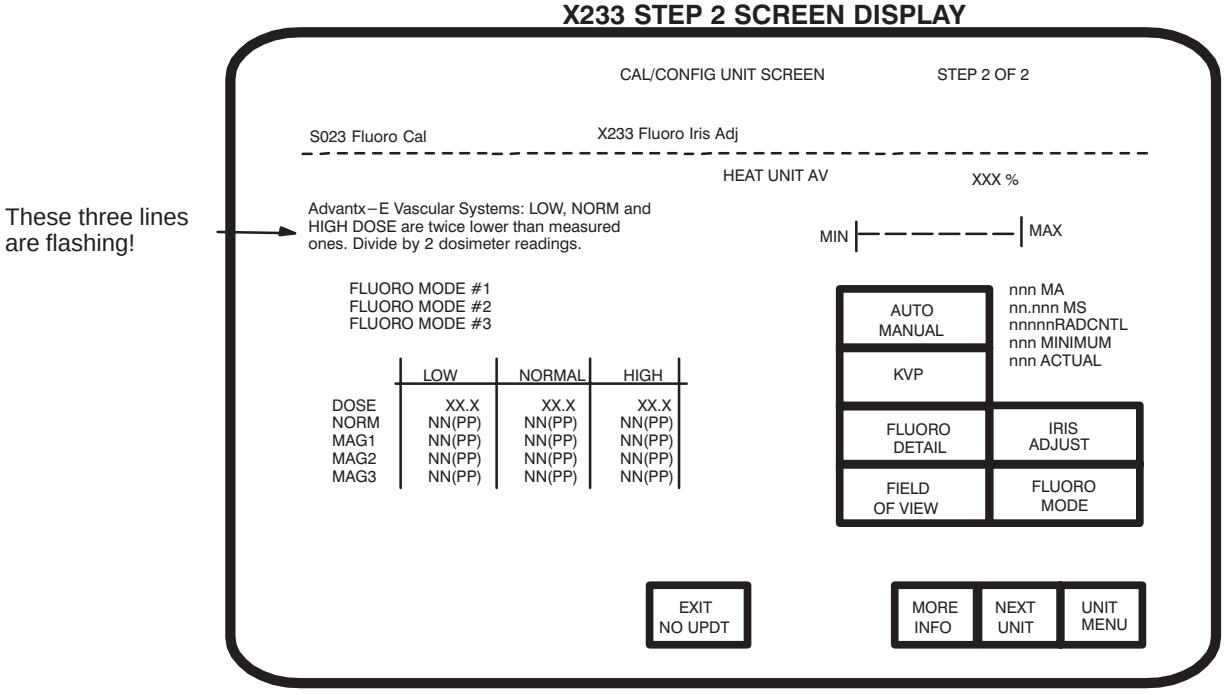
Table 83 – Record Fluoro Iris Aperture

RECORD OF DOSIMETRY PROFILE
FLUORO MODE: _____

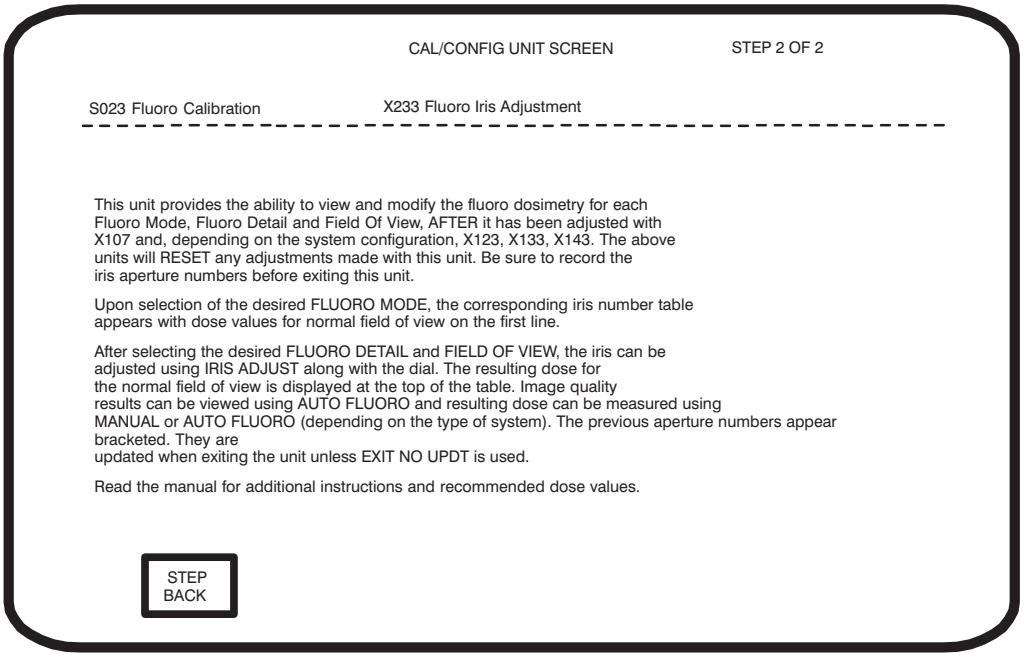
	FLUORO DENSITY		
	LOW	**NORMAL**	**HIGH**
DOSE			
NORMAL			
MAG 1			
MAG 2			
MAG 3			

- Touch NEXT UNIT or UNIT MENU softkey to exit.

X233 STEP 2 SCREEN DISPLAY



X233 STEP 2 "MORE INFO" SCREEN DISPLAY



7 THEORY

Calibration Units X107, X123, X133 and X143 automatically load an iris N–number database structure to provide an iris position for each magnification mode and each fluoro detail. In previous model periods a fluoro N–number database was loaded with only three N–numbers corresponding to low, normal and high fluoro dose levels. In Model Period 9 and up the database structure will be loaded with 12 N–numbers. This corresponds to an N–number for each FOV (4) and each fluoro detail (3). An N–number (iris step) is basically equivalent to a 10 percent area or light change in the iris. Seven N–numbers are equal to one F–stop or 2 times change in the brightness or dose.

The fluoro dose units still calibrate the normal field of view dose rates to determine the iris N–number for the normal field of view. However, when a fluoro dose unit (X107, X123, X133, X143) is exited, offset values are established from the normal field of view N–numbers to permit database structure of the other iris N–numbers. This establishes a default dosimetry profile for the system.

The default dosimetry profile for each type of Image Intensifier and each type of systems is shown in the Table 77 to Table 82.

The default dosimetry profile still provides a slight increase in dose with each magnification mode, but less than encountered in systems using a fixed iris. Instead of allowing the dose rate to increase with a change in area of the image intensifier, the dose rate now increases by a ratio determined by the image diameter and image area.

The image displayed may contain more quantum mottle, but this condition is offset by the benefits gained from being able to operate a fluoro system at lower kVp levels. Lower kVp levels in the high magnification states (for the same size patients) provides more penetration ability and increased image contrast when using fluoro techniques with iodine based contrast solutions. Operating at lower mA levels also helps to reduce X–ray tube overheating.

If the iris values for each magnification mode remain fixed at the normal magnification mode setting, ONLY for systems configured with a 22 (9 inch) image intensifier, the dose will increase above the NORMAL mode dose rate at approximately the following values.

1.8X for MAG 1
3.4X for MAG 2

8 X233, FLUORO IRIS ADJUST –– SUPPLEMENT "A" SPECIFIC IRIS CONFIGURATION FOR GERMAN DOSE ADJUSTMENT

Table 84 – All Fluoro Modes Recommended Dosimetry Profile for Germany only, for Advantx–E Vascular Systems

RECOMMENDED ENTRANCE DOSE LEVELS FOR ALL FLUORO MODES					
II TYPE	**FOV**	**DOSE**	**EXPOSURE (mR/min)**	**EXPOSURE (μGy/min)**	**IRIS CORRECTION**
9 inch (22 cm)	9	LOW	1.5 mR/min	13.14 μGy/min	Apply Table 77
9 inch (22 cm)	9	NORM	3.6 mR/min (See Note 1.)	31.54 μGy/min (See Note 1)	Apply Table 77
9 inch (22 cm)	9	HIGH	3.6 mR/min (See Note 1.)	31.54 μGy/min (See Note 1)	Apply Table 77
12 inch (32 cm) Cardiac (Plumbicon)	12	LOW	1.0 mR/min	8.76 μGy/min	Apply Table 78
12 inch (32 cm) Cardiac (Plumbicon)	12	NORM	2.4 mR/min (See Note 1.)	21.02 μGy/min (See Note 1)	Apply Table 78
12 inch (32 cm) Cardiac (Plumbicon)	12	HIGH	2.4 mR/min (See Note 1.)	21.02 μGy/min (See Note 1)	Apply Table 78
12 inch (32 cm) Vascular (Saticon)	12	LOW	1.0 mR/min	8.76 μGy/min	Apply Table 79
12 inch (32 cm) Vascular (Saticon)	12	NORM	2.4 mR/min (See Note 1.)	21.02 μGy/min (See Note 1)	Apply Table 79
12 inch (32 cm) Vascular (Saticon)	12	HIGH	2.4 mR/min (See Note 1.)	21.02 μGy/min (See Note 1)	Apply Table 79
16 inch (40 cm)	16	LOW	0.6 mR/min	5.256 μGy/min	Apply Table 79
16 inch (40 cm)	16	NORM	1.4 mR/min (See Note 1.)	12.26 μGy/min (See Note 1)	Apply Table 79
16 inch (40 cm)	16	HIGH	1.4 mR/min (See Note 1.)	12.26 μGy/min (See Note 1)	Apply Table 79

Note 1: Maximum measured value in order to meet local regulations.
Note 2: Or as low as possible.

Table 85 – Conventional Fluoro Mode Recommended Dosimetry Profile for Germany only, for all other Systems

RECOMMENDED ENTRANCE DOSE LEVELS CONVENTIONAL FLUORO ((NON–PULSED)					
II TYPE	**FOV**	**DOSE**	**EXPOSURE (mR/min)**	**EXPOSURE (μGy/min)**	**IRIS CORRECTION**
9 inch (22 cm)	9	LOW	2.2 mR/min	19.27 μGy/min	Apply Table 80
9 inch (22 cm)	9	NORM	3.6 mR/min (See Note 1.)	31.54 μGy/min (See Note 1)	Apply Table 80
9 inch (22 cm)	9	HIGH	3.6 mR/min (See Note 1.)	31.54 μGy/min (See Note 1)	No
12 inch (32 cm)	12	LOW	1.1 mR/min	9.636 μGy/min	Apply Table 81
12 inch (32 cm)	12	NORM	2.1 mR/min (See Note 1.)	18.4 μGy/min (See Note 1)	Apply Table 81
12 inch (32 cm)	12	HIGH	2.1 mR/min (See Note 1.)	18.4 μGy/min (See Note 1)	Mag Profile Norm N Mag 1 N Mag 2 N Mag 3 N–3
16 inch (40 cm)	16	LOW	0.6 mR/min (See Note 2.)	5.256 μGy/min (See Note 2)	Mag Profile Norm N Mag 1 N Mag 2 N Mag 3 N–3
16 inch (40 cm)	16	NORM	1.4 mR/min (See Note 1.)	12.26 μGy/min (See Note 1)	Mag Profile Norm N Mag 1 N Mag 2 N Mag 3 N–3
16 inch (40 cm)	16	HIGH	1.4mR/min (See Note 1.)	12.26 μGy/min (See Note 1)	No

Note 1: Maximum measured value in order to meet local regulations.
Note 2: Or as low as possible.

Table 86 – Digital Fluoro Mode Recommended Dosimetry Profile for Germany only, for all other Systems

RECOMMENDED ENTRANCE DOSE LEVELS DIGITAL FLUORO (PULSED)					
II TYPE	**FOV**	**DOSE**	**EXPOSURE (mR/min)**	**EXPOSURE (μGy/min)**	**IRIS CORRECTION**
9 inch (22 cm)	9	LOW	1.8 mR/min	15.77 μGy/min	Apply Table 80
9 inch (22 cm)	9	NORM	3.6 mR/min (See Note 1.)	31.54 μGy/min (See Note 1)	Apply Table 80
9 inch (22 cm)	9	HIGH	3.6 mR/min (See Note 1.)	31.54 μGy/min (See Note 1)	No
12 inch (32 cm)	12	LOW	0.9 mR/min	7.884 μGy/min	Apply Table 81
12 inch (32 cm)	12	NORM	1.9 mR/min	16.64 μGy/min	Apply Table 81
12 inch (32 cm)	12	HIGH	2.1 mR/min (See Note 1.)	18.4 μGy/min (See Note 1)	Mag Profile Norm N Mag 1 N Mag 2 N–3 Mag 3 N–6
16 inch (40 cm)	16	LOW	0.6 mR/min (See Note 2.)	5.256 μGy/min (See Note 2)	Apply Table 82
16 inch (40 cm)	16	NORM	1.4 mR/min (See Note 1.)	12.26 μGy/min (See Note 1)	Apply Table 82
16 inch (40 cm)	16	HIGH	1.4 mR/min (See Note 1.)	12.26 μGy/min (See Note 1)	Mag Profile Norm N Mag 1 N Mag 2 N Mag 3 N–3

Note 1: Maximum measured value in order to meet local regulations.
Note 2: Or as low as possible.

9 X233, FLUORO IRIS ADJUST –– SUPPLEMENT "B" SPECIFIC IRIS CONFIGURATION FOR SWISS DOSE ADJUSTMENT

Table 87 – All fluoro Modes Recommended Dosimetry Profile for Switzerland only, for Advantx–E Vascular Systems

RECOMMENDED ENTRANCE DOSE LEVELS FOR ALL FLUORO MODES					
II TYPE	**FOV**	**DOSE**	**EXPOSURE (mR/min)**	**EXPOSURE (μGy/min)**	**IRIS CORRECTION**
9 inch (22 cm)	9	LOW	1.5 mR/min	13.14 μGy/min	Apply Table 77
9 inch (22 cm)	9	NORM	3.6 mR/min (See Note 1.)	31.54 μGy/min (See Note 1)	Apply Table 77
9 inch (22 cm)	9	HIGH	4.9 mR/min (See Note 1.)	42.92 μGy/min (See Note 1)	Apply Table 77
12 inch (32 cm) Cardiac (Plumbicon)	12	LOW	1.1 mR/min	9.636 μGy/min	Apply Table 78
12 inch (32 cm) Cardiac (Plumbicon)	12	NORM	2.7 mR/min (See Note 1.)	23.65 μGy/min (See Note 1)	Apply Table 78
12 inch (32 cm) Cardiac (Plumbicon)	12	HIGH	4.1 mR/min (See Note 1.)	35.92 μGy/min (See Note 1)	Apply Table 78
12 inch (32 cm) Vascular (Saticon)	12	LOW	1.1 mR/min	9.636 μGy/min	Apply Table 79
12 inch (32 cm) Vascular (Saticon)	12	NORM	2.4 mR/min (See Note 1.)	21.02 μGy/min (See Note 1)	Apply Table 79
12 inch (32 cm) Vascular (Saticon)	12	HIGH	3.7 mR/min (See Note 1.)	32.41 μGy/min (See Note 1)	Apply Table 79
16 inch (40 cm)	16	LOW	1.0 mR/min	8.76 μGy/min	Apply Table 79
16 inch (40 cm)	16	NORM	2.2 mR/min (See Note 1.)	19.27 μGy/min (See Note 1)	Apply Table 79
16 inch (40 cm)	16	HIGH	2.2 mR/min (See Note 1.)	19.27 μGy/min (See Note 1)	Apply Table 79

Note 1: Maximum measured value in order to meet local regulations.
Note 2: Or as low as possible.

Table 88 – Conventional Fluoro Mode Recommended Dosimetry Profile for Switzerland only, for all other Systems

RECOMMENDED ENTRANCE DOSE LEVELS CONVENTIONAL FLUORO (NON–PULSED)					
II TYPE	**FOV**	**DOSE**	**EXPOSURE (mR/min)**	**EXPOSURE (μGy/min)**	**IRIS CORRECTION**
9 inch (22 cm)	9	LOW	2.2 mR/min	19.27 μGy/min	Apply Table 80
9 inch (22 cm)	9	NORM	4.5 mR/min	39.42 μGy/min	Apply Table 80
9 inch (22 cm)	9	HIGH	6.1 mR/min (See Note 1.)	53.44 μGy/min (See Note 1)	Mag Profile Norm N Mag 1 N Mag 2 N–3
12 inch (32 cm)	12	LOW	1.1 mR/min	9.636 μGy/min	Apply Table 81
12 inch (32 cm)	12	NORM	2.4 mR/min	21.02 μGy/min	Apply Table 81
12 inch (32 cm)	12	HIGH	3.5 mR/min (See Note 1.)	30.66 μGy/min (See Note 1)	No
16 inch (40 cm)	16	LOW	1.4 mR/min	12.26 μGy/min	Apply Table 82
16 inch (40 cm)	16	NORM	2.3 mR/min (See Note 1.)	20.15 μGy/min (See Note 1)	Apply Table 82
16 inch (40 cm)	16	HIGH	2.3 mR/min (See Note 1.)	20.15 μGy/min (See Note 1)	Mag Profile Norm N Mag 1 N Mag 2 N Mag 3 N–3
Note 1: Maximum measured value in order to meet local regulations.					

Table 89 – Digital Fluoro Mode Recommended Dosimetry Profile for Switzerland only, for all other Systems

RECOMMENDED ENTRANCE DOSE LEVELS DIGITAL FLUORO (PULSED)					
II TYPE	**FOV**	**DOSE**	**EXPOSURE (mR/min)**	**EXPOSURE (μGy/min)**	**IRIS CORRECTION**
9 inch (22 cm)	9	LOW	1.8 mR/min	15.77 μGy/min	Apply Table 80
9 inch (22 cm)	9	NORM	3.6 mR/min	31.54 μGy/min	Apply Table 80
9 inch (22 cm)	9	HIGH	6.1 mR/min (See Note 1.)	53.44 μGy/min (See Note 1)	Apply Table 80
12 inch (32 cm)	12	LOW	0.9 mR/min	7.884 μGy/min	Apply Table 81
12 inch (32 cm)	12	NORM	1.9 mR/min	16.64 μGy/min	Apply Table 81
12 inch (32 cm)	12	HIGH	3.5 mR/min (See Note 1.)	30.66 μGy/min (See Note 1)	Apply Table 81
16 inch (40 cm)	16	LOW	1.1 mR/min	9.636 μGy/min	Apply Table 82
16 inch (40 cm)	16	NORM	2.3 mR/min (See Note 1.)	20.15 μGy/min (See Note 1)	Apply Table 82
16 inch (40 cm)	16	HIGH	2.3 mR/min (See Note 1.)	20.15 μGy/min (See Note 1)	Mag Profile Norm N Mag 1 N Mag 2 N Mag 3 N–3

Note 1: Maximum measured value in order to meet local regulations.

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AEC Calibration Units

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Units X200 – X233

Unit	Note

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SECTION 11 – DIGITAL FLUORO AND CINE CALIBRATION UNITS

Unit	Title	Page
D004	DX (DLX) Manual Procedures #1	1091
D005	DX (DLX) Manual Procedures #2	1093
F001	Cine Camera Calibration	1095

Blank page.

UNIT D004 – DX (DLX) Manual Procedures #1

Time: x h xx min – Personnel: 1 field engineer

1 DESCRIPTION

Calibration Unit D004 is used as a steering unit to direct the user to the appropriate manual procedures for performing a DLX calibration. The unit screen display is a reference screen only.

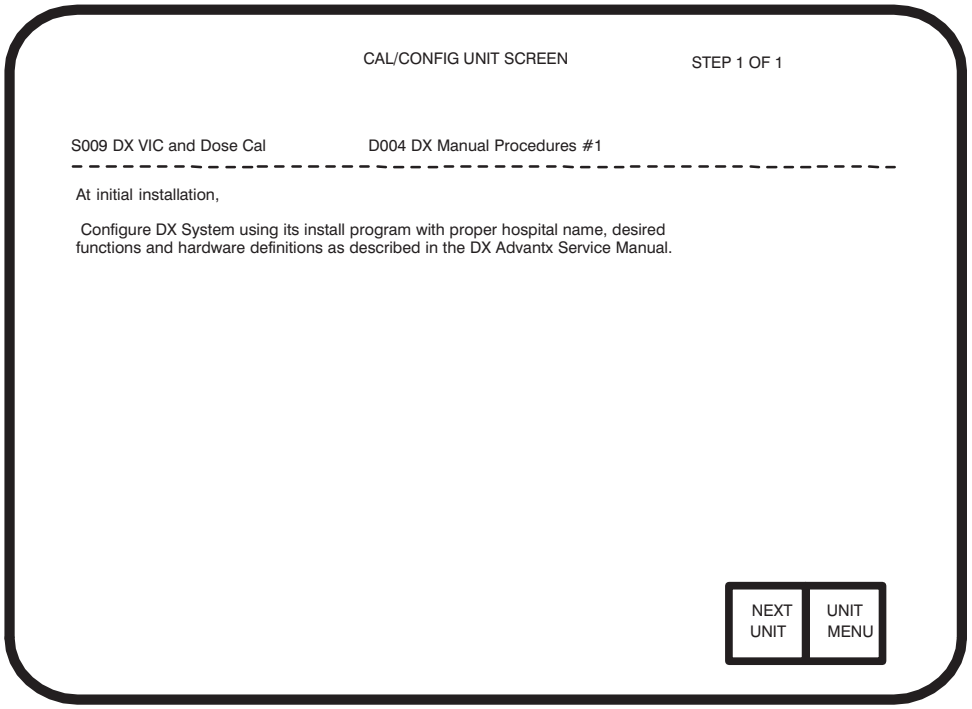
2 EQUIPMENT REQUIRED

DLX Advantx Service Manual.

3 CAL PROCEDURE

The calibration is performed according to the procedures in the DLX Advantx Service Manual. After completion of the calibration, touch NEXT UNIT or UNIT MENU softkey to exit the calibration unit.

D004 SCREEN DISPLAY



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UNIT D005 – DX (DLX) Manual Procedures #2

Time: x h xx min – Personnel: 1 field engineer

1 DESCRIPTION

Calibration Unit D005 is used as a steering unit to direct the user to the appropriate manual procedures for performing a DLX calibration. The unit screen display is a reference screen only.

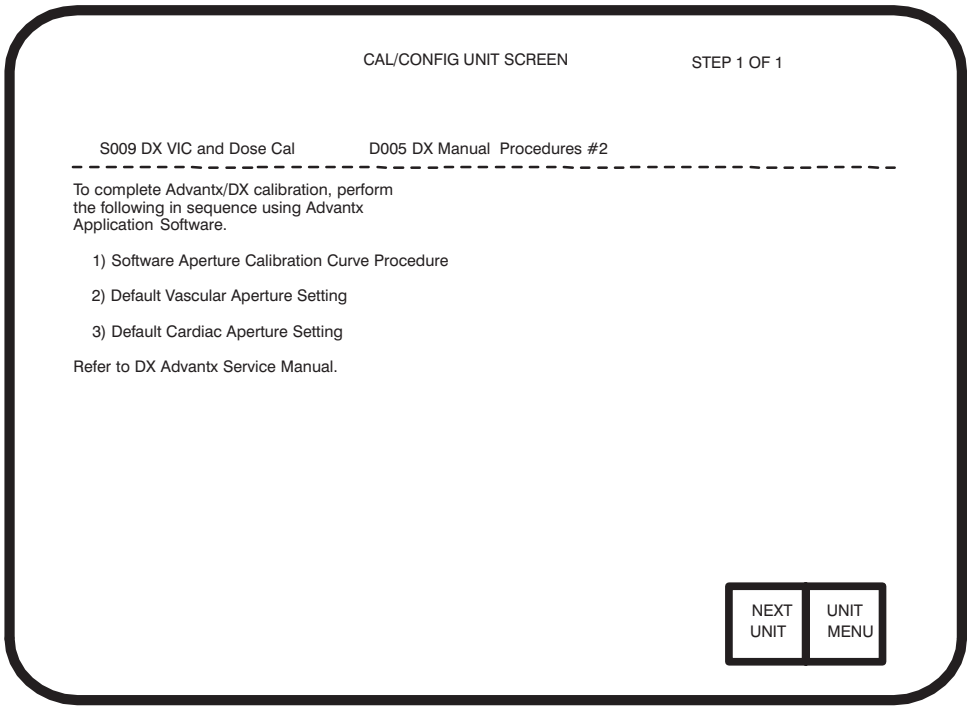
2 EQUIPMENT REQUIRED

DLX Advantx Service Manual.

3 CAL PROCEDURE

The calibration is performed according to the procedures in the DLX Advantx Service Manual. After completion of the calibration, touch NEXT UNIT or UNIT MENU softkey to exit the calibration unit.

D005 SCREEN DISPLAY



Note: FOR LCA, LCV+, LC+:

1. Refer to *Advantx DLX Service Manual*, 2132665–100, calibration steering guide for calibration sequence.
2. Also, refer to *Advantx–E LCA, LCV+, LC+ System Installation Steering*, Direction 2124783–100, Appendix A, for calibration and image quality measurements steering guide.

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UNIT F001 – Cine Camera Calibration

Time: x h xx min – Personnel: 1 field engineer

1 DESCRIPTION

Calibration Unit F001 establishes the database A/D value for the spool size used in the Cine camera. The calibration is accomplished using all variations in camera spool size and shape that may be encountered at a site. The calibration first establishes an empty spool reference point based on the types of film magazines used at the site. Then, the film remaining value on the applications screen can be incremented by a count of ten which will approximate a film remaining value of 20 feet. Film used is determined by counting frames during run time. The count number is displayed on applications screen. Only one step is required to accomplish the calibration.

2 EQUIPMENT REQUIRED

Empty Cine camera spools (types used at the site).

Note: If the unit was run previously, an existing spool size database value is displayed as PREV: on the console screen.

3 CAL PROCEDURE

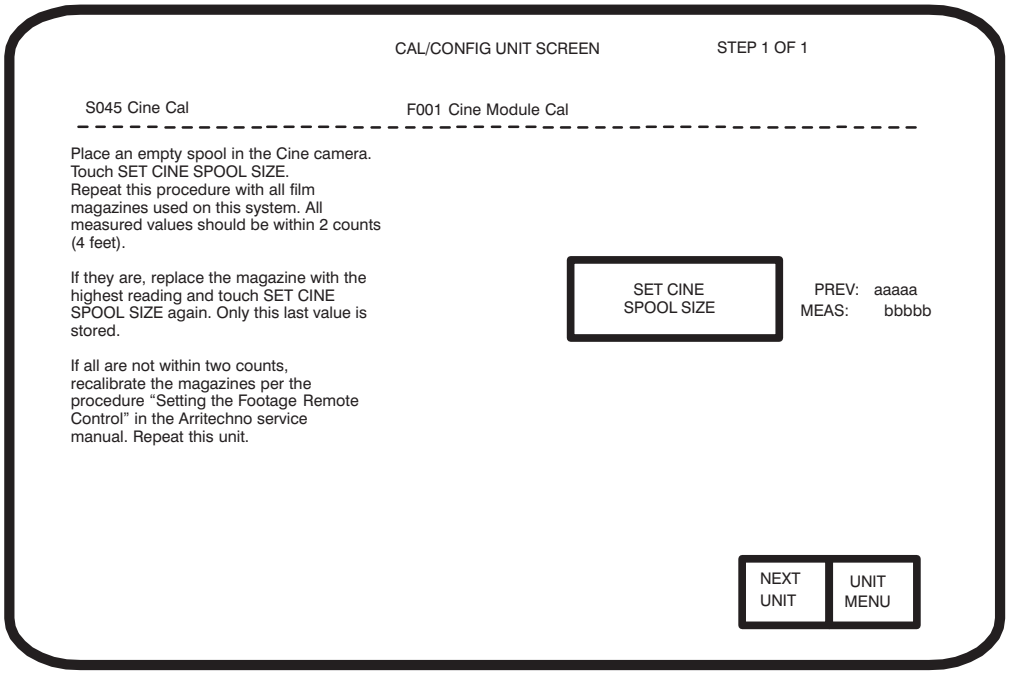
Perform the calibration as follows:

- Install an empty spool in the Cine camera.
- Touch the SET CINE SPOOL SIZE softkey. The value for the empty spool is indicated on the console screen as the MEAS value.
- Repeat the above two steps for all Cine film magazines used at the site. Record MEAS values. Compare values. All measured values should be within 2 counts (equivalent to 4 feet of film).
- If all measured values are within the 2 count specification, select the film magazine that indicated the highest starting count and re–install on the camera.
- Touch the SET CINE SPOOL SIZE softkey again. Only the highest measured value is now stored in the system. This sets the empty spool reference point.

OR

- If all measured values are not within 2 counts, the film magazines must be re-calibrated in accordance with the “Setting the Footage Remote Control” procedures given in Arritechno service manual. After recalibration, repeat calibration unit F001.
- After the calibration has been completed, exit the calibration unit by touching NEXT UNIT or UNIT MENU softkey.

F001 SCREEN DISPLAY



Digital Fluoro Calibration Units

Notepad

Unit D004 – D005 – F001

Unit	Note

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SECTION 12 – CONFIGURATION

Unit	Title	Page
C004	Tube ‘a’ Type Selection	1101
C006	Function Configuration	1117
C007	Image Intensifier Configuration	1125
C009	TV Camera Configuration	1129
C010	Video Tape Recorder	1139
C013	Video Distribution Configuration	1143
C014	HUR Alarm	1173
C020	Fluoro Configuration	1175
C025	AEC Configuration	1187
C034	AEC Labels	1193

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UNIT C004 – Tube 'a' Type Selection

Time: x h xx min – Personnel: 1 field engineer

1 DESCRIPTION

Configuration Unit C004 configures the type of tube or tubes used in the system. On multi–tube systems, the smart–sequencer will present the configuration unit for each tube to be identified. The unit provides selection of tube type, focal spot size, and mA range limits for small focal spot. Three steps are required to configure a tube. A screen display is provided for each step.

Note: Any previous selections are highlighted in reverse video. If the unit has not been run previously, no entries will be highlighted. Refer to FDO (Field Delivered Order form) to determine the type of x–ray tube or tubes that are installed on the system. In R & F systems, the fluoro tube is always considered to be tube number 1.

2 EQUIPMENT REQUIRED

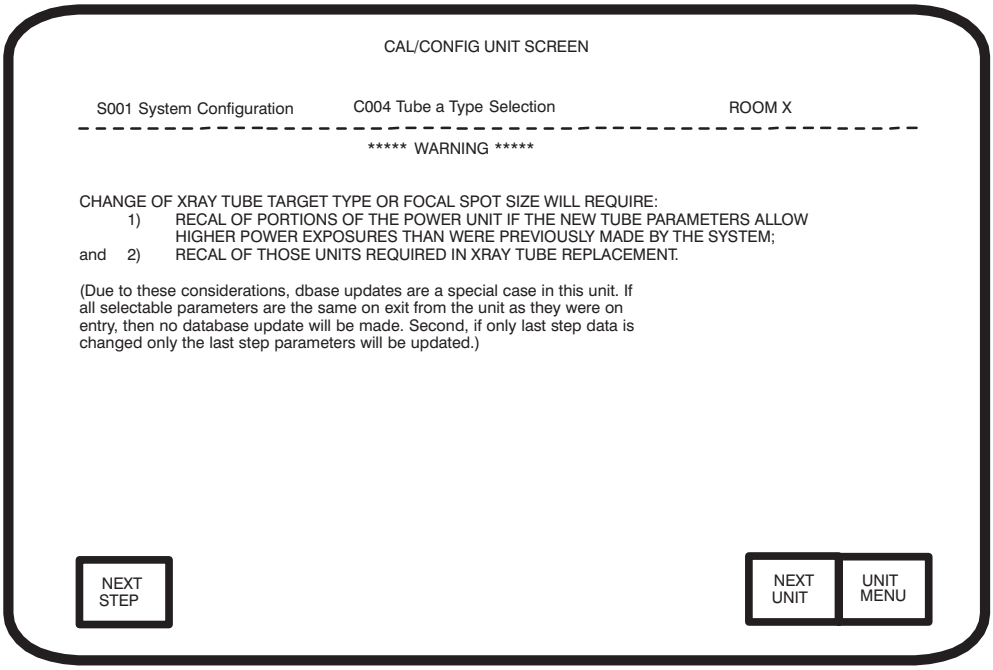
None.

3 CAL PROCEDURE – SET TUBE DATA PARAMETERS

Note: GE is not responsible for non–GE x-ray tubes, and therefore, no special x-ray tube data will be provided for these x-ray tubes.

- Touch NEXT STEP softkey to proceed to Step 1.

C004 TUBE DATA SCREEN DISPLAY



WARNING

CHANGES TO THE X–RAY TUBE TARGET TYPE, OR FOCAL SPOT, WILL REQUIRE THE FOLLOWING ACTION:

1. **RECAL OF PORTIONS OF THE GENERATOR IF THE NEW TUBE PARAMETERS PERMIT HIGHER POWER EXPOSURES THAN WERE PREVIOUSLY MADE.**
2. **RECAL OF THE UNITS REQUIRED IN X–RAY TUBE REPLACEMENT (REF UNIT M002 IN MAINTENANCE SEQUENCE S047).**

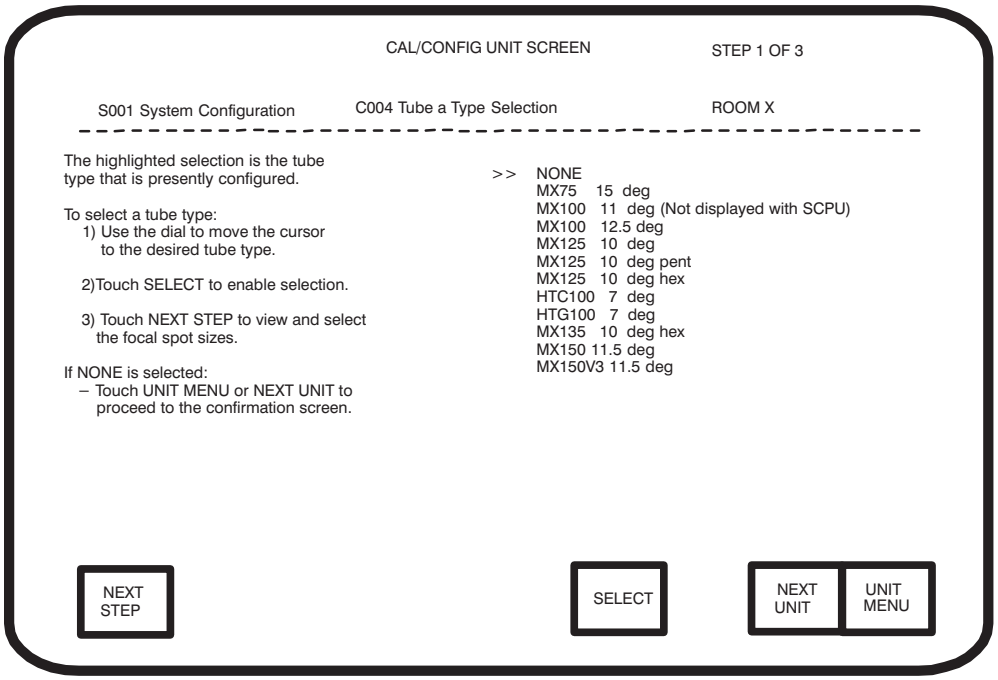
3-1 Step 1. Select Tube Type

- Select the tube type (or none) by positioning the cursor to the left of the desired selection with the console dial. At initial configuration, a tube type must be selected. If the NEXT STEP softkey is touched and no selections have been made, the warning message "MAKE TUBE SELECTION BEFORE PROCEEDING TO NEXT STEP" is displayed.

Note: Selecting NONE provides a method of deleting a previously configured x-ray tube. When NONE is selected, the NEXT STEP softkey is removed from the unit screen display and exit can only be accomplished through a "Confirmation Screen". Touching the NEXT UNIT or UNIT MENU softkey displays the "Confirmation Screen". Make sure that you understand the instructions and softkey functions on this screen display before exiting the unit.

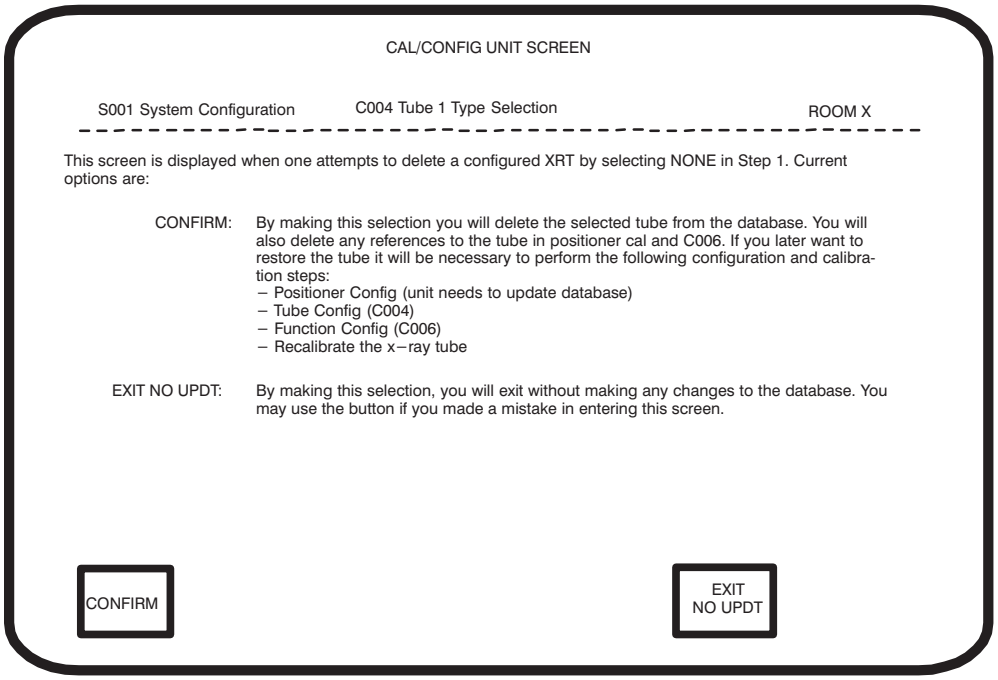
- Touch the SELECT softkey. The selection is highlighted in reverse video.
- Touch NEXT STEP softkey to proceed to Step 2. A "PROCESSING" message is displayed while down loading the applicable x-ray tube data for screen presentation in Step 2.

C004 STEP 1 GENERIC SCREEN DISPLAY



Note: Use "MX150 11.5 deg" selection for MX 150 TH (V1) 11.25 deg and for MX 150 TH.2 (V2) 11.25 deg tubes. Use "MX 150 V3 11.5 deg" selection for MX 150 TH.13 (V3) 11.25 deg tube.

C004 STEP 1 CONFIRMATION SCREEN DISPLAY



3-2 Step 2. Select Focal Spot Size

Step 2 selects the focal spot sizes corresponding to the tube type selected in Step 1. For each of the tube selections listed in Table 90 there is a specific Step 2 screen display. Use the applicable procedure given below to enter the focal spot sizes. If you made a wrong tube selection in Step 1, you may return to Step 1 and correct your selection by touching the STEP BACK softkey.

Table 90 – X–Ray Tube Selections

TUBE TYPE	POSSIBLE FOCAL SPOT COMBINATIONS					
MX75 (15 Degree)	Sm 0.6	Sm 1.0	Lg 1.5	Lg 2.0		
MX100 (11 Degree) See Note:	Sm 0.3	Sm 0.6	Lg 1.0	Lg 1.2	Lg 1.5	
MX100 (12.5 Degree)	Sm 0.3	Sm 0.6	Lg 1.0	Lg 1.2	Lg 1.5	
MX125 (10 Degree) Non–Bias	Sm 0.3	Sm 0.6	Lg 0.9	Lg 1.2		
MX125 (10 Degree) Penta	Sm 0.3		Lg 1.2	0.15 Biased	0.20 Biased	0.30 Biased
MX125 (10 Degree) Hexa	Sm 0.3	Med 0.9	Lg 1.2	0.15 Biased	0.20 Biased	0.30 Biased
HTC100 (7 Degree)	Sm 0.6		Lg 0.9			
HTG100 (7 Degree)	Sm 0.6		Lg 0.9			
MX135 (10 Degree) Hexa	Sm 0.3	Med 0.6	Lg 1.1	0.15 Biased	0.20 Biased	0.30 Biased
MX150 TH (V1) (11.25 Degree)	Sm 0.6		Lg 1.2			0.30 Biased
MX150 TH.2 (V2) (11.25 Degree)	Sm 0.6		Lg 1.2			0.30 Biased
MX150 TH.13 (V3) (11.25 Degree)	Sm 0.6		Lg 1.2			0.30 Biased
Note: Sm=small focal spot; Med=medium focal spot; Lg=large focal spot.						

MX75 (15 deg), MX100 (11 deg), MX100 (12.5 deg), MX125 (10 deg–non bias), and MX125 (10 deg–Pentafocus).

- Selection of both small and large focal spot size is required. Touch SMALL softkey. Use the console dial to enter the applicable small focal spot size. Touch LARGE softkey. Use the console dial to enter the applicable large focal spot size. After making the appropriate selections, touch NEXT STEP softkey to proceed to Step 3.

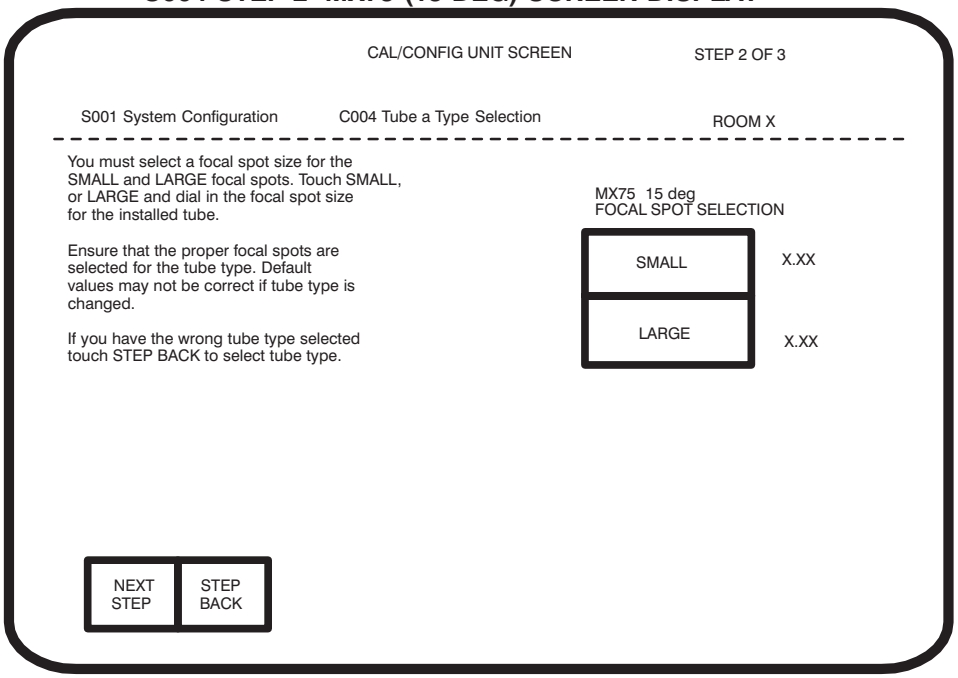
NOTICE

Ensure that the proper focal spots are selected for the tube type. Default values may not be correct if the tube type is changed.

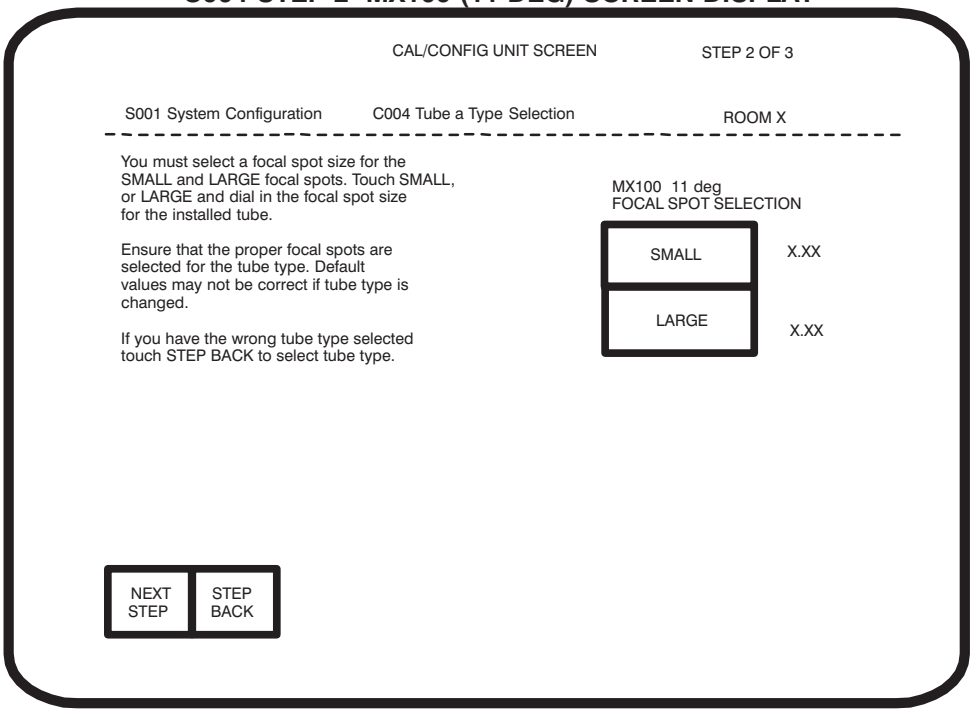
MX125 (10 deg–Hexafocus), MX135 (10 deg–Hexafocus), HTC100 (7 deg) and HTG100 (7deg), MX150 TH (V1) (11.25 deg), MX 150 TH.2 (V2) (11.25 deg), and MX150 TH.13 (V3) (11.25 deg).

- No focal spot size selections are required. The default focal spot sizes are displayed in reverse video to indicate they are selected. The console dial is disabled. Touch NEXT STEP softkey to proceed to Step 3.

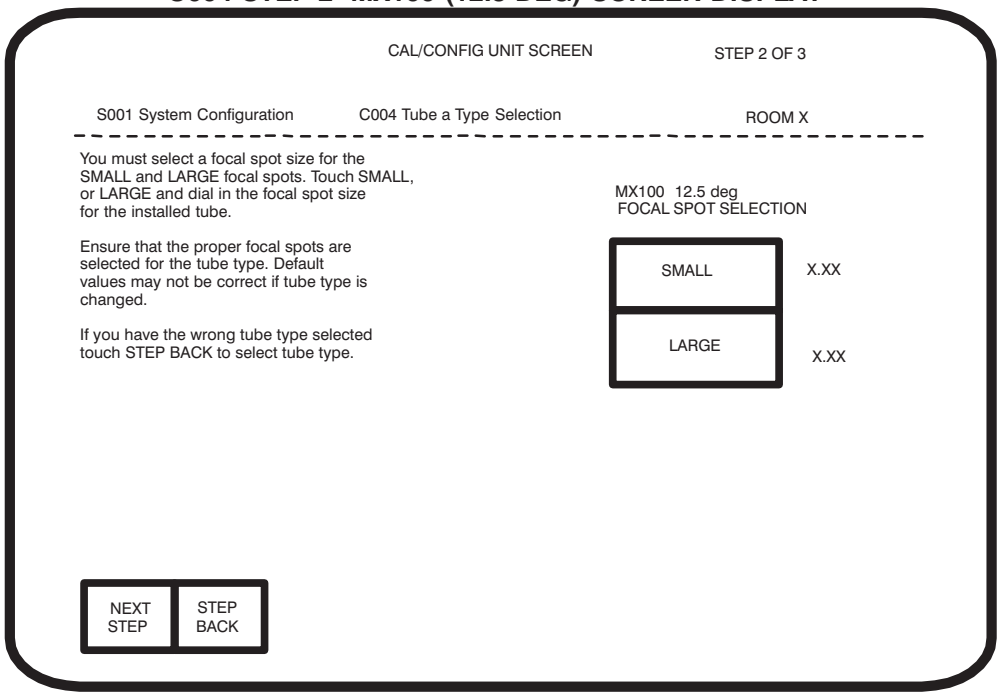
C004 STEP 2 MX75 (15 DEG) SCREEN DISPLAY



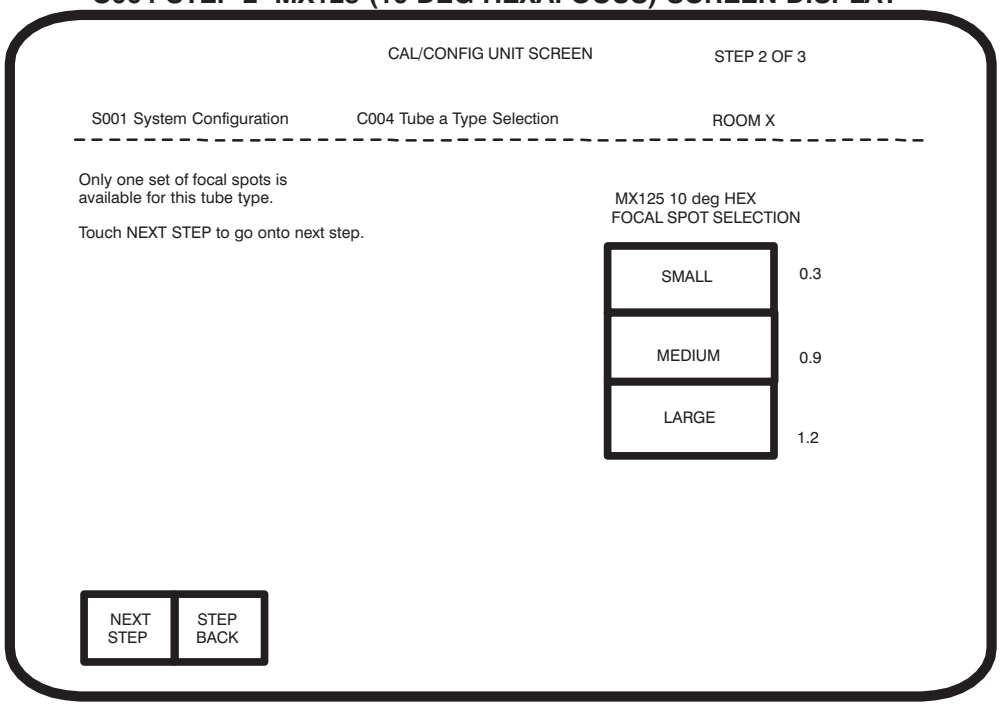
C004 STEP 2 MX100 (11 DEG) SCREEN DISPLAY



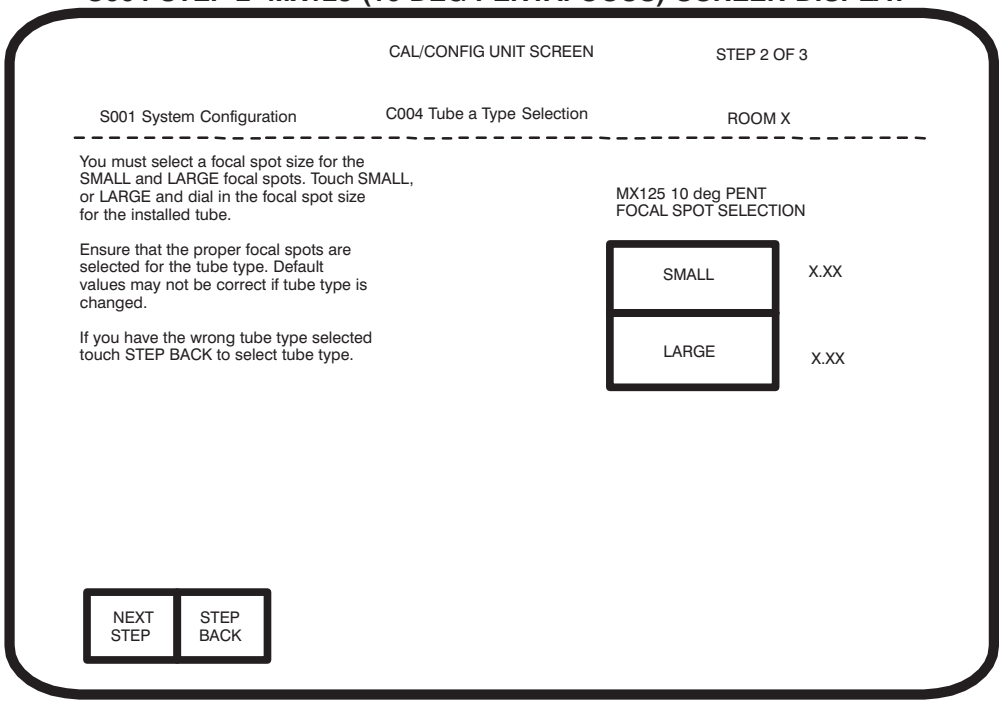
C004 STEP 2 MX100 (12.5 DEG) SCREEN DISPLAY



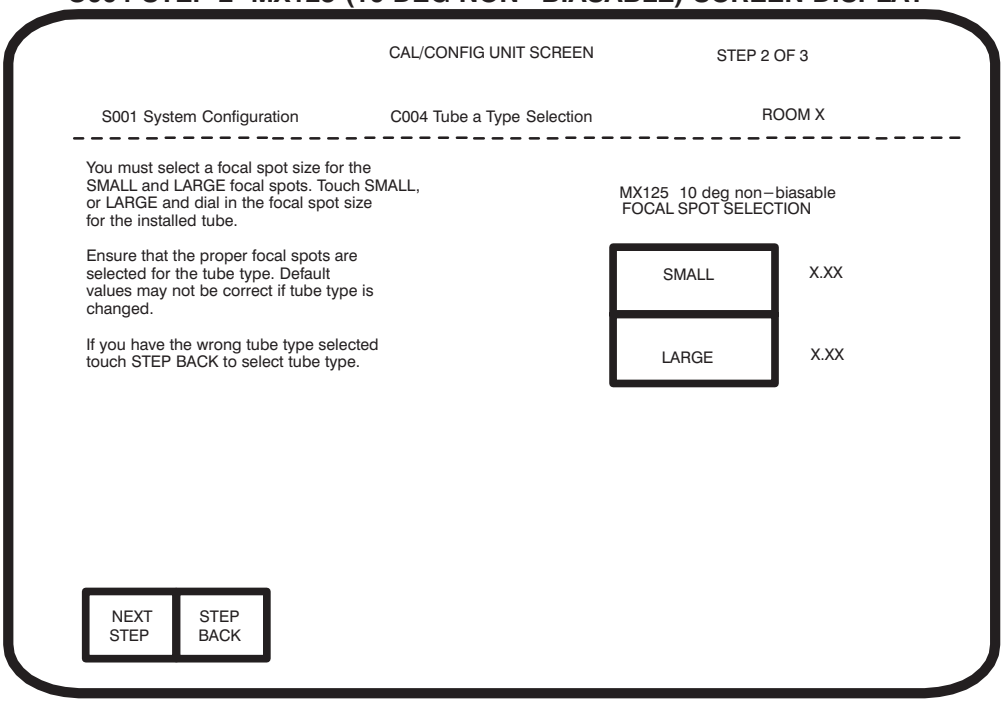
C004 STEP 2 MX125 (10 DEG HEXAFOCUS) SCREEN DISPLAY



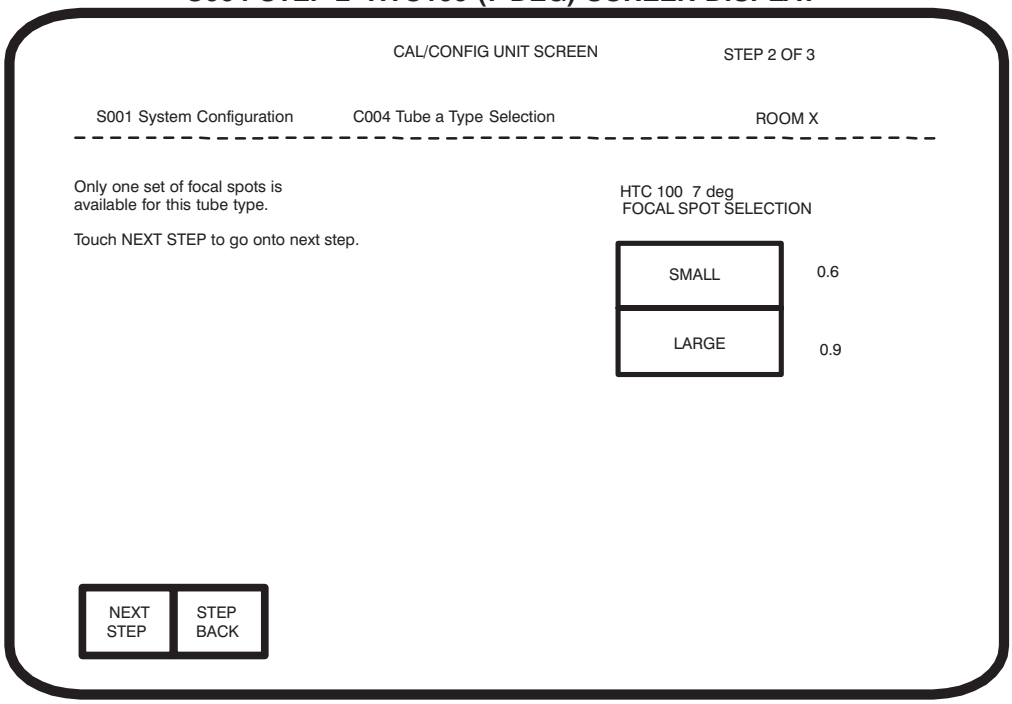
C004 STEP 2 MX125 (10 DEG PENTAFOCUS) SCREEN DISPLAY



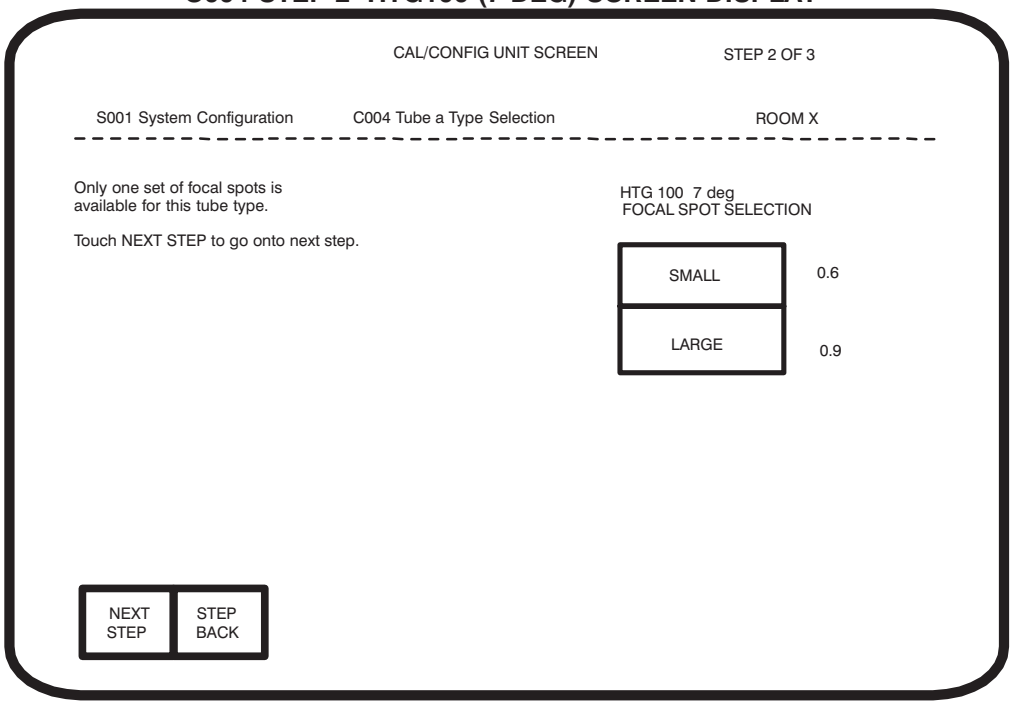
C004 STEP 2 MX125 (10 DEG NON–BIASABLE) SCREEN DISPLAY



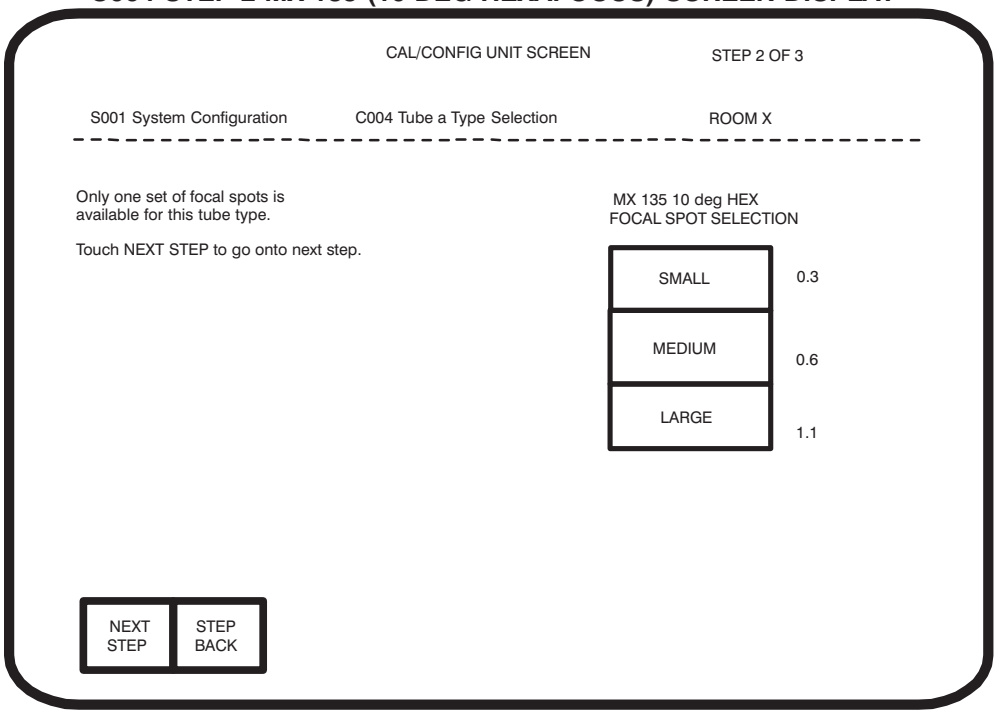
C004 STEP 2 HTC100 (7 DEG) SCREEN DISPLAY



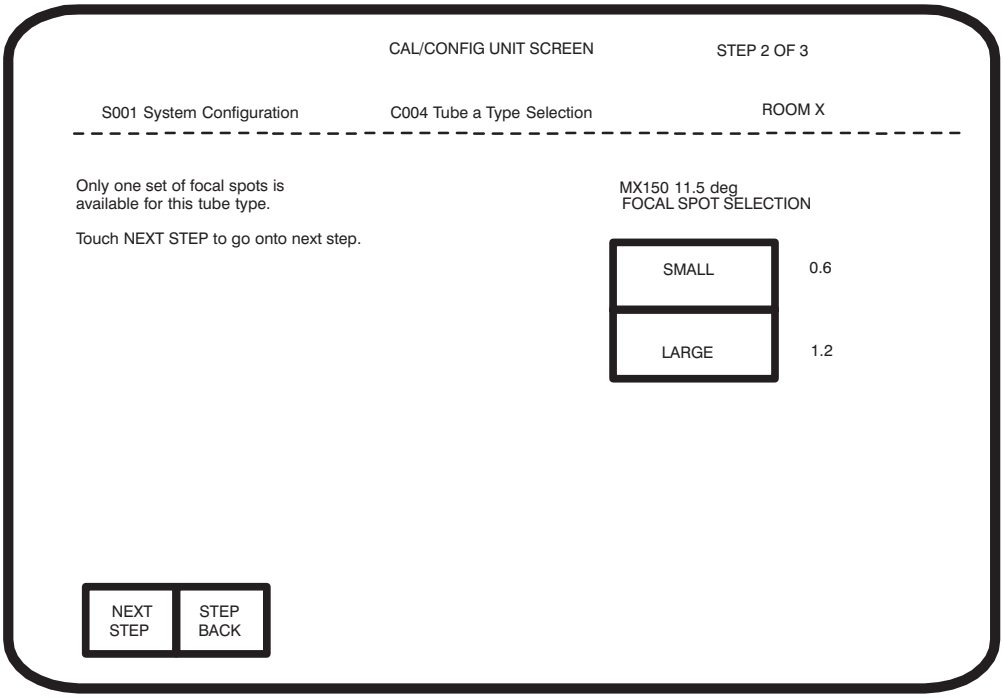
C004 STEP 2 HTG100 (7 DEG) SCREEN DISPLAY



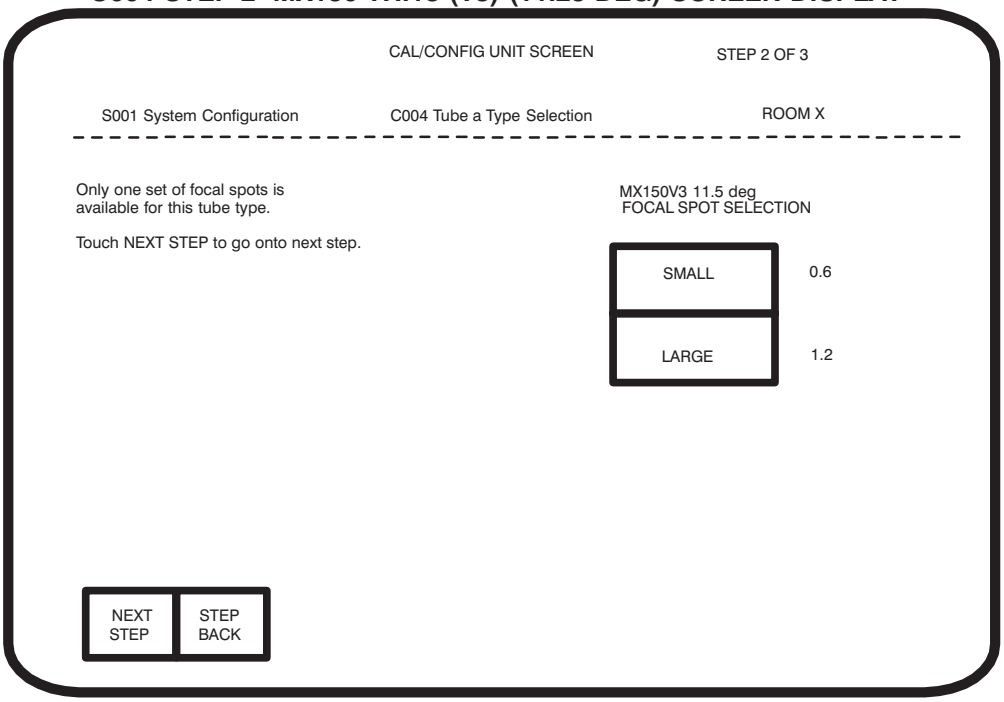
C004 STEP 2 MX 135 (10 DEG HEXAFOCUS) SCREEN DISPLAY



C004 STEP 2 MX150 TH (V1) (11.25 DEG) or MX150 TH.2 (V2) (11.25 DEG) SCREEN DISPLAY



C004 STEP 2 MX150 TH.13 (V3) (11.25 DEG) SCREEN DISPLAY



3-3 Step 3. Set mA Limit, Maximum Anode Heat Storage and Casing

3-3-1 mA Limit

- MA Limit is used to set the minimum mA range limit for the small focal spot size of an x–ray tube if required by applications. To change the minimum mA limit, touch the MINIMUM SMALL SPOT MA softkey and, using the console dial, enter the desired mA value. The range of adjustment is from a minimum of 10 mA to a maximum of 100 mA or the maximum rating of the small focal spot.

NOTICE

When a system is configured to limit the lower mA stations to values other than specified for an Advantx system, it is necessary that you update the specification section of *Direction 46–019357, Advantx Operational Specifications,* and the HHS Record Sheet (F3382 Software on laptop computer or paper copy) to ensure compliance with HHS requirements. Update the document as follows:

1. **Cross out any eliminated small spot mA stations and substitute the customer selected mA stations.**
2. **Add a note to indicate to any user why the eliminated mA stations are not available.**

CAUTION

If any of the eliminated mA stations are re-enabled at some future date, a complete re-calibration and system generator certification is required.

3-3-2 Maximum Anode Heat Storage

- Permits the operator to set the heat capacity of an x–ray tube to a de-rated value. The default value is the fully rated maximum (in kilojoules) of the tube which is indicated on the screen as 100 percent. To adjust the maximum anode heat storage range of the x–ray tube (radiographic modes only), touch the MAX ANODE STORAGE softkey and use the dial to enter the desired de-rating. The range of adjustment is 50 percent to 100 percent of the maximum for the applicable tube type.

3-3-3 Casing Type

- Is used to identify the casing type used in your system when the system is configured with an HTG–100 or HTC–100, 7–degree, x–ray tube.
- For HTG–100 and HTC–100 tube types, the casing selection can be HTG–fr or LP (HTG–fr is the default selection). Refer to Illustration 179 and Illustration 180 to determine the casing type of the tube installed. Then, touch the CASING softkey and use the console dial to enter the correct casing type.

Note: For all other tube types except the MX–135 tube and the MX–150 tubes, the default value for casing type is STANDARD. For systems with an MX–135 tube type, the casing type default is MX–135. For systems with an MX–150 tube type, the casing type default is MX–150. Dial selection of the casing type is inhibited for these tube types.

C004 STEP 3 SMALL SPOT SCREEN DISPLAY

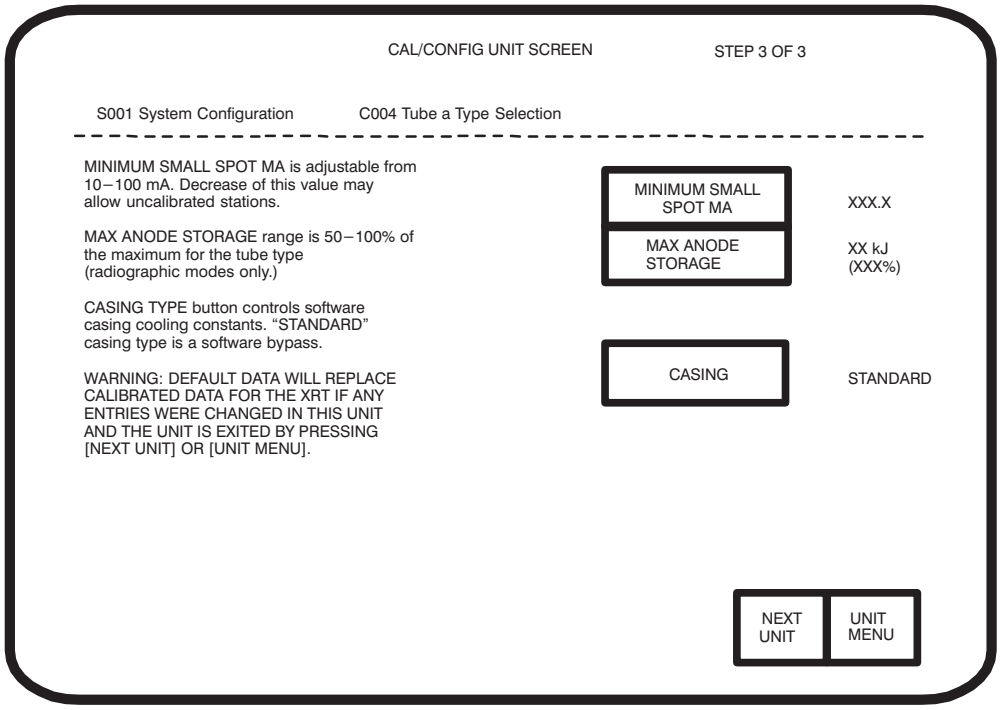


Illustration 179 – HTG–FR Casing (Oil Cooled)

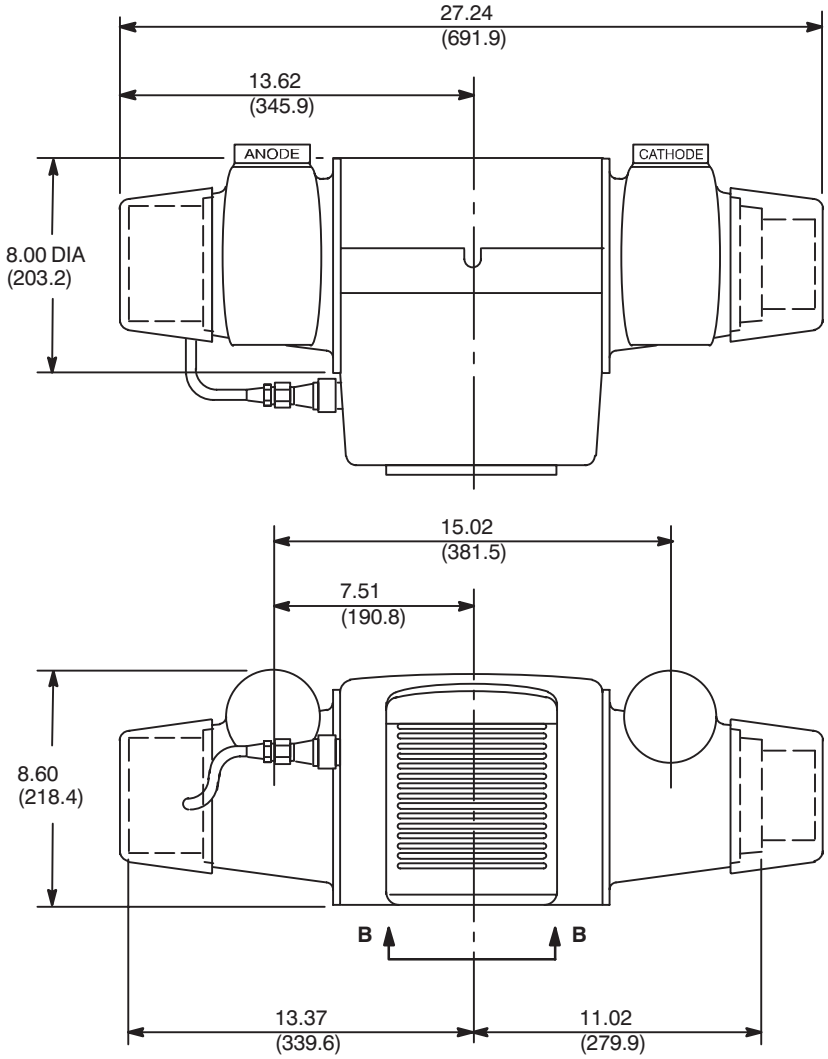
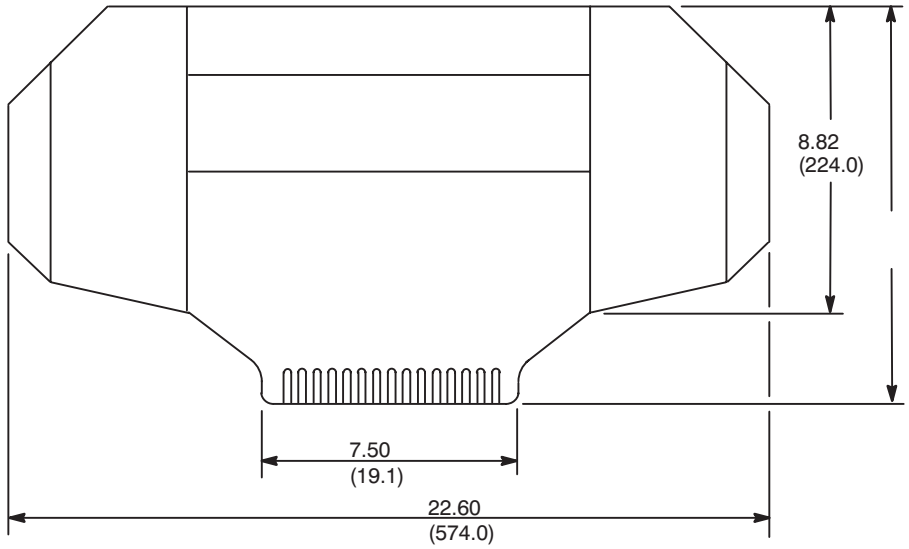
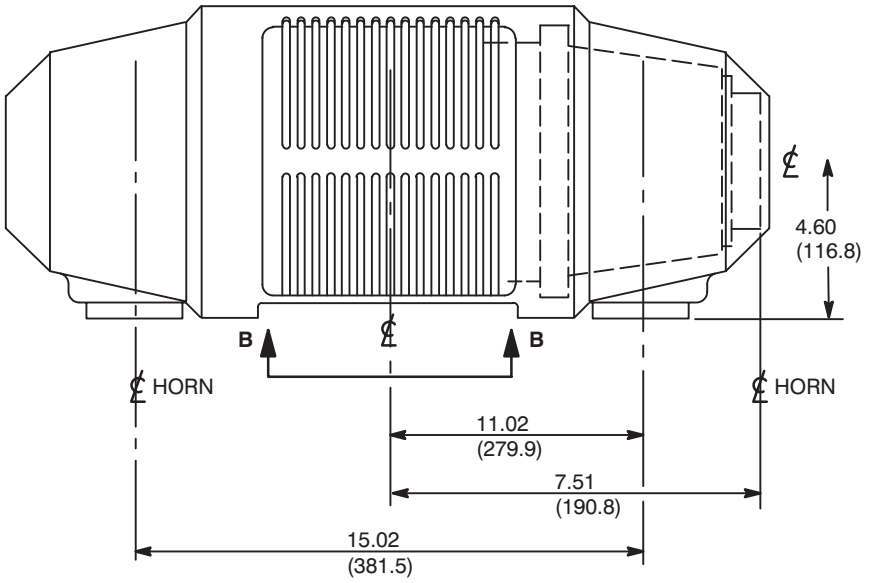


Illustration 180 – LP Casing (Air Cooled)





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UNIT C006 – Function Configuration

Time: x h xx min – Personnel: 1 field engineer

1 DESCRIPTION

Configuration Unit C006 is used to program the parameters of the Function Labels established in Room Configuration Unit C005. The unit is also used to customize a label (button text) if CREATE LABEL was selected in C005. Two steps are required to accomplish the programming. Step 1 selects the Function Label to be programmed. Step 2 programs the selected Function Label. The parameters to be programmed are identified in Table 91.

Table 91 – Function Selections

PARAMETER	DEFINITION
LABEL LINE 1/LABEL LINE 2	Button text (applications softkey)
APPLICATION NAME	Application software to run
BIPLANE	Mode of operation
SYNCH/NON–SYNCH	Contacting mode
TUBE NUMBER	Tube on the power unit
RECEPTOR NUMBER	Positioner hardware to talk to

2 EQUIPMENT REQUIRED

None.

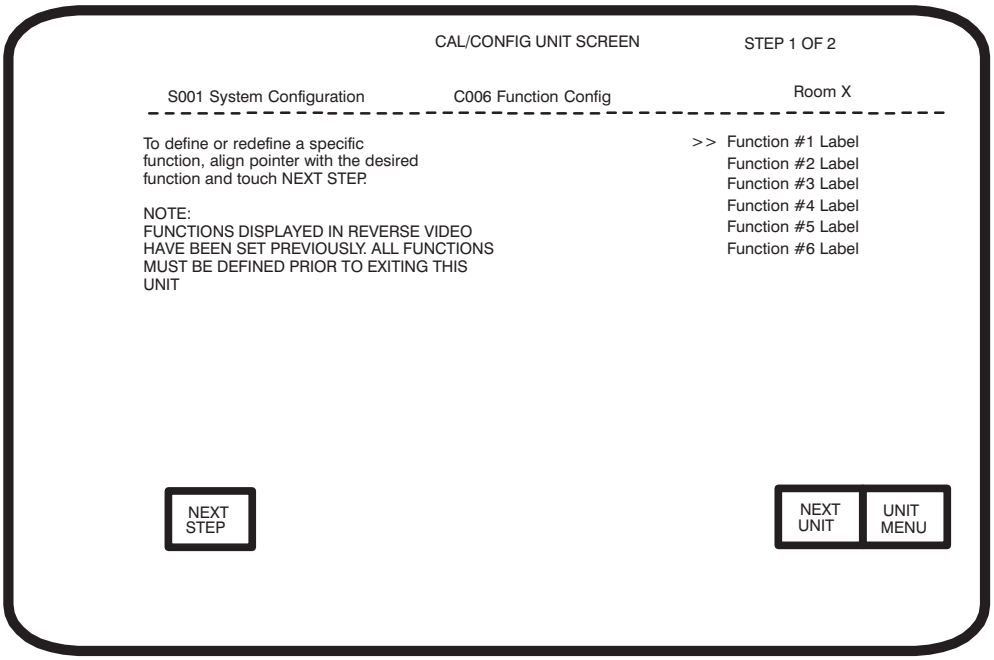
Note: When entering this unit after a Database Initialization, error code/message A811 “APPLICATIONS NOT FULLY DEFINED” may be displayed. Since all applications have not been defined by system configuration at this time, disregard the message. The unit will function properly.

3 CONFIG PROCEDURE

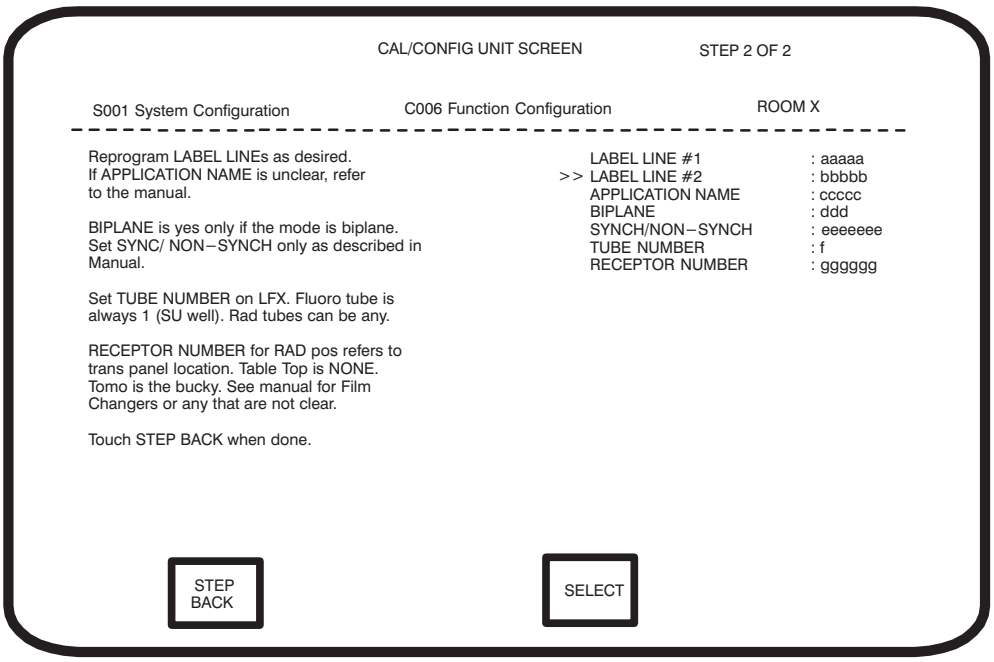
3-1 Step 1. Select Function Label

- Upon entering the configuration unit, the Function Labels established in Room Configuration Unit C005 are displayed in menu form on the Step 1 screen.
- Use the console dial to position the cursor opposite the Function Label to be programmed. Start with the first entry in the menu list. Only one Function Label can be selected at a time. Step 2 must be completed for each selection before another Function Label can be selected in Step 1. Function Labels that are programmed are displayed in reverse video.
- Touch NEXT STEP softkey to enter the selection and proceed to Step 2.

C006 STEP 1 SCREEN DISPLAY



C006 STEP 2 SCREEN DISPLAY



3-2 Step 2. Define Function Labels

General Procedures. The Step 2 screen displays the parameters that are presently stored in NV RAM for the **Function Label** selected in Step 1. To define or redefine a Function Label, perform the following procedure:

NOTICE

For systems configured with DLX, any function labels referring to DX on the applications screens must be changed to DLX. You can change the label to indicate a customer desired title or by your own interpretation, i.e. B/P DLX, etc.

- Use the console dial to position the cursor opposite the parameter to be defined.
- Touch SELECT softkey (the parameter selected is highlighted in reverse video).
- Use the console dial to scroll through the selections pertaining to the parameter until the desired entry is displayed. Refer to “Selection of Parameters” for details regarding selections.
- Touch SELECT softkey again and position the cursor opposite the next parameter to be defined.
- When all the parameters for the Function Label selected in Step 1 have been identified, touch the STEP BACK softkey to return to Step 1. Select another Function Label in Step 1 and repeat Step 2.

Note: The error message “INCOMPLETE CONFIGURATION” may be displayed on the unit screen until all Function Labels are completely configured, i.e.; all Function Labels are displayed in reverse video.

- After all Function Labels have been properly defined, return to Step 1 and exit the unit by touching the NEXT UNIT or UNIT MENU softkey.

Selection of Parameters

Valid parameter selections are as follows:

- LABEL LINE 1: First line of button text
- LABEL LINE 2: Second line of button text

Note: When LABEL LINE 1 or 2 is selected and the SELECT softkey is touched, the unit will display a typewriter screen. Use the keyboard to customize the screen label. If LABEL LINE 2 is not used, the “LABEL” characters must be deleted with the spacebar or they will appear on the application softkey. Touch DONE key on keyboard to return to Step 2.

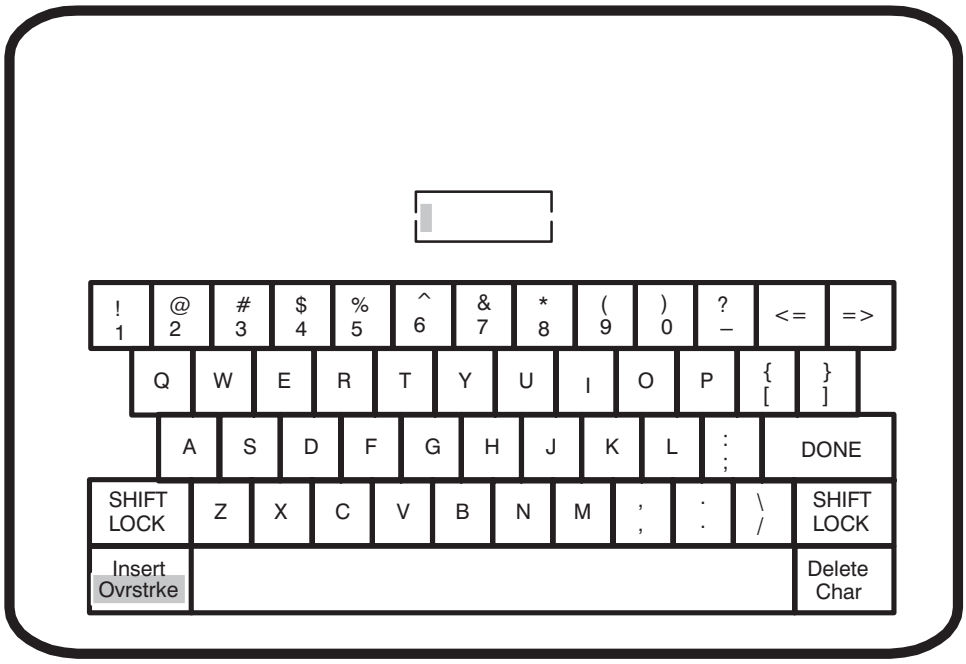
Example: If the customer wants the label to indicate **105 MM** instead of another photospot name, make that type of change here).

NOTICE

The following rules should be observed when entering LABEL text in order to maintain a consistent format on the console screen.

1. **Text should be centered within the borders of the button.**
2. **In cases where there are an uneven number of spaces, the extra spaces should be placed to the right of the text.**
3. **Use upper–case characters (six character limit per line).**

C006 TYPEWRITER SCREEN DISPLAY



- APPLICATION NAME: Selects the software mode to run when the application button (softkey) is touched. The available selections are:
  - CINE – For Cine cameras
  - FLUORO/FLUORO ONLY – For a TV only system, or for the Lateral side with single plane recording mode (Bolus, Spin, 3D Spin, or DLX Photospot).
  - RAD – Use for all Buckys, Chest Units, Auxiliary (cassette on table), on any general radiographic use.
  - TOMO – For running Tomo with VRT, Tomo Link, RTI, etc.
  - SPOT FILM – For SF mode.
  - FILM CHANGER – Use with the FILM CHANGER label selected in C005. Refer to compatibility table in C005.
  - AUX FC – Use with the LEG CHANGER labels selected in C005. Refer to applicable compatibility table in C005.
  - DIG RECORD – For Digital Record (DR/DRS)
  - DSA/DX VASCULAR –Vascular for DLX

– DIGITAL CARDIAC/DX CARDIAC – Pulsed cardiac for DLX

Note: For systems with DYNAMIC ANGIO, select DIGITAL CARDIAC/DX CARDIAC.

– DIGITAL PHTSPOT/DLX PHTSPOT for Vascular with DLX

– BOLUS CHASE – (Applicable to biplane systems, and to NEWER software [i.e., ASC SW beginning with G4.xx] single plane LCA/LCV+/LC+ systems)

– SPIN – (Applicable to biplane systems, and to NEWER software [i.e., ASC SW beginning with G4.xx] single plane LCA/LCV+/LC+ systems)

– 3D SPIN – (Applicable to biplane systems, and to NEWER software [i.e., ASC SW beginning with G4.xx] single plane LCV+ systems)

– DSA STEP – (Not available)

- BIPLANE: Identify whether the mode is single or biplane (not a biplane system).
  – YES – Biplane cine, biplane DSA, biplane DIGITAL CARDIAC or biplane FLUORO.
  – NO – For all single plane systems or single plane (frontal) record applications (Bolus, Spin, 3D Spin, or DLX Photospot).
- SYNCH/NON–SYNCH: Identify whether the contacting mode is synch or non–synch. Select NON–SYNCH for the following applications:
  – FILM CHANGER
  – DIGITAL RECORD (DR/DRS)
  – DSA/DX VASCULAR
  – DIGITAL CARDIAC/DX CARDIAC
  – BOLUS CHASE
  – SPIN
  – 3D SPIN
  – DSA STEP – (Not available)
  – DYNAMIC ANGIO
  – DIGITAL PHTSPOT/DLX PHTSPOT
  – FLUORO/FLUORO ONLY
- TUBE NUMBER: Identify the x–ray tube number on the system. The Fluoro tube is always tube number 1 and is connected in the SU wells.
- RECEPTOR NUMBER
  – RAD positioners:
  Dial in 1A, 1B, 2A, 2B corresponding to the Trans Panel on which the device is connected.
  – R&F and RAD:
  Dial in NONE for auxiliary or table top modes.
  Dial in the Table Bucky used for TOMO mode.
  – R&F:
  Dial in RF WALL BUCKY or RF TABLE BUCKY for Bucky.
  Dial in RF WALL BUCKY for Chest Stands.
  Dial in SPOT FILM for Spot Film device.
  Dial in DIGITAL RECORD for Digital Record device.

– VASCULAR:
  Dial in FILM CHANGER for Film Changer.
  Dial in AUX FILM CHANGER for Leg Changer.
  Dial in CINE for Cine.
  Dial in TV ONLY for Fluoro/Fluoro Only.

– LATERAL:
  Dial in TV ONLY for Fluoro.
  Dial in CINE for Cine.

– DIGITAL RECORD (DLX):
  Dial in DSA/DX VASC for DLX Vascular Configuration.
  Dial in DIGITAL CARDIAC/DX CARD for DLX Cardiac Configuration.
  Dial in DIGITAL CARDIAC/DX CARD for DLX DYNAMIC ANGIO.
  Dial in DIGITAL PHTSPOT/DLX PHTSPOT for Vascular with DLX.
  Dial in BOLUS CHASE for DLX Bolus application.
  Dial in SPIN for Spin application.
  Dial in 3D SPIN for 3D Spin application.
  Dial in DSA STEP for DSA Stepping application. – (Not available)

– DIGITAL RECORD (DR/DRS):
  Dial in DIGITAL RECORD for Digital Record (DR/DRS).

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UNIT C007 – Image Intensifier Configuration

Time: x h xx min – Personnel: 1 field engineer

1 DESCRIPTION

Configuration Unit C007 establishes the parameters pertaining to the Image Intensifier (II) tube used in VIC configured systems. The parameters configured are; size of Image Intensifier tube, number of fields of view, size of fields of view, conversion factor, persistence, cathode current and grid voltages.

2 EQUIPMENT REQUIRED

None.

3 CONFIG PROCEDURE

3-1 Step 1. Parameter Identification

- Check the Image Tube Data Label for Image Intensifier size and parameter data. Replacement II tubes are supplied with a new data label.

Note: The data label is typically located on top of the image gate for 40 cm Image Intensifiers, and inside the HV power supply cover for 32 cm and 22 cm Image Intensifiers.

NOTICE

All Advantx systems configured with a 12 inch II are equipped with a 12L (FFOV) Image Intensifier tube. The Image Tube Data label on these systems indicates this as, 'If 12 inch II, then FFOV".

- Touch the II SIZE softkey and use the console dial to enter the size of the II tube. Verify that the number and size of fields of view displayed on the console screen agree with the FOV data indicated in Table 92.

Table 92 – II/FOV Selections

II SIZE	FIELD OF VIEW SIZES (FOV)				
	4.5	6	9	12	16
9 inch	X	X	X		
12L inch (FFOV)	X	X	X	X	
16 inch (40 cm)		X	X	X	X

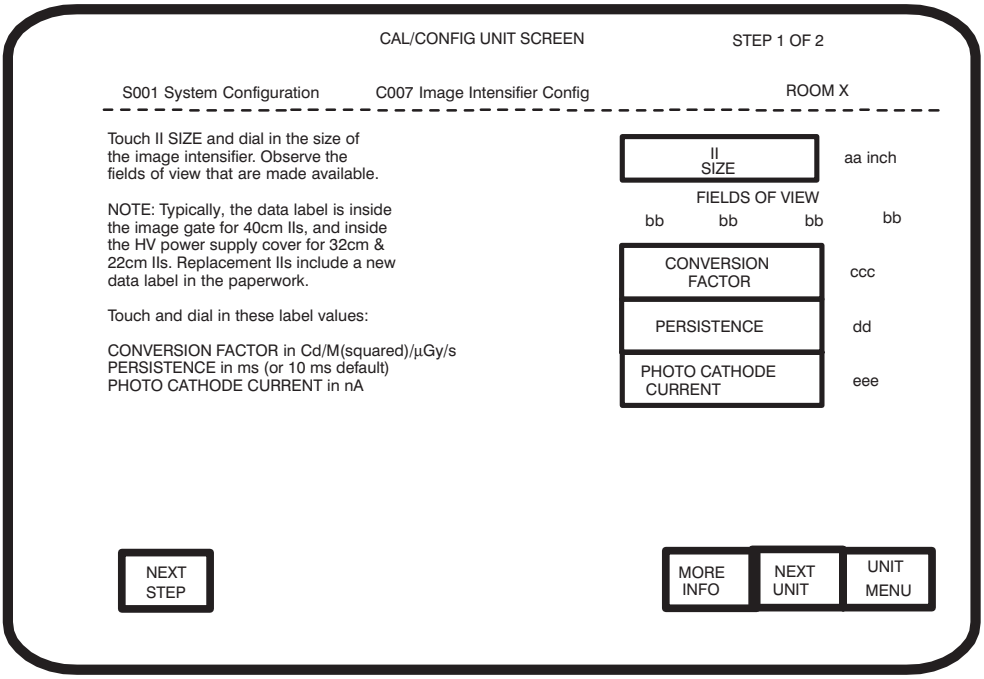
- Touch CONVERSION FACTOR softkey. Use the console dial to enter the conversion factor [in Cd/m(squared)/µGy/s] from the II label.

NOTICE

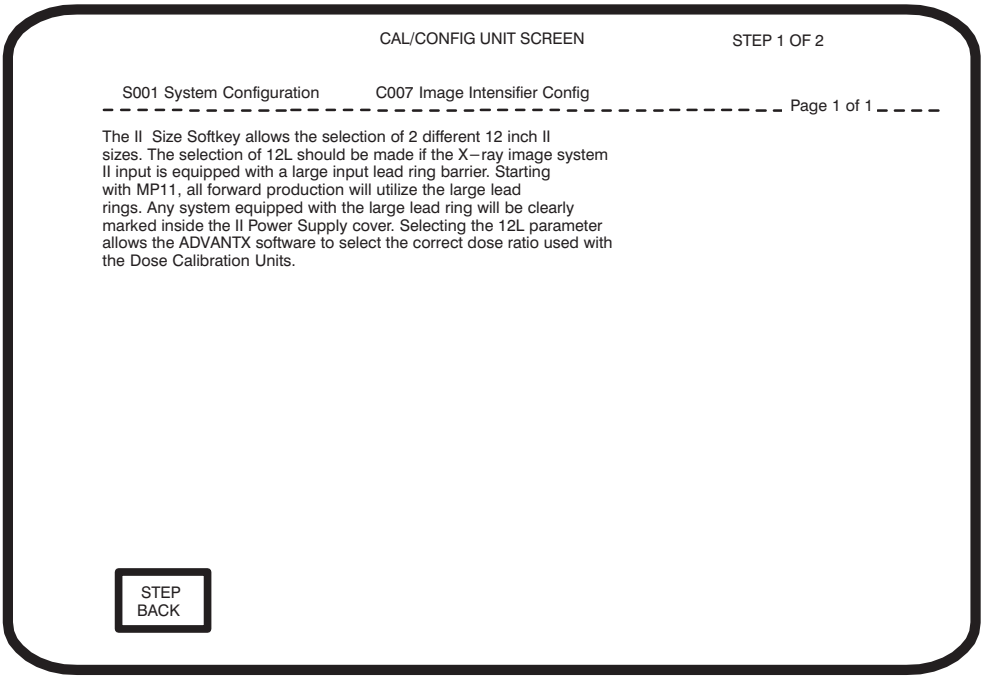
Disregard the screen text for the persistence parameter. The PERSISTENCE value is not provided on the Image Tube Data Label. Use 10 ms default value on all VIC configured systems.

- Touch PERSISTENCE softkey to enter the 10 ms default value.
- Touch PHOTO CATHODE CURRENT softkey. Use the console dial to enter the photo cathode current (in nA) from the II label.
- Touch NEXT STEP softkey to proceed to Step 2.

C007 STEP 1 SCREEN DISPLAY



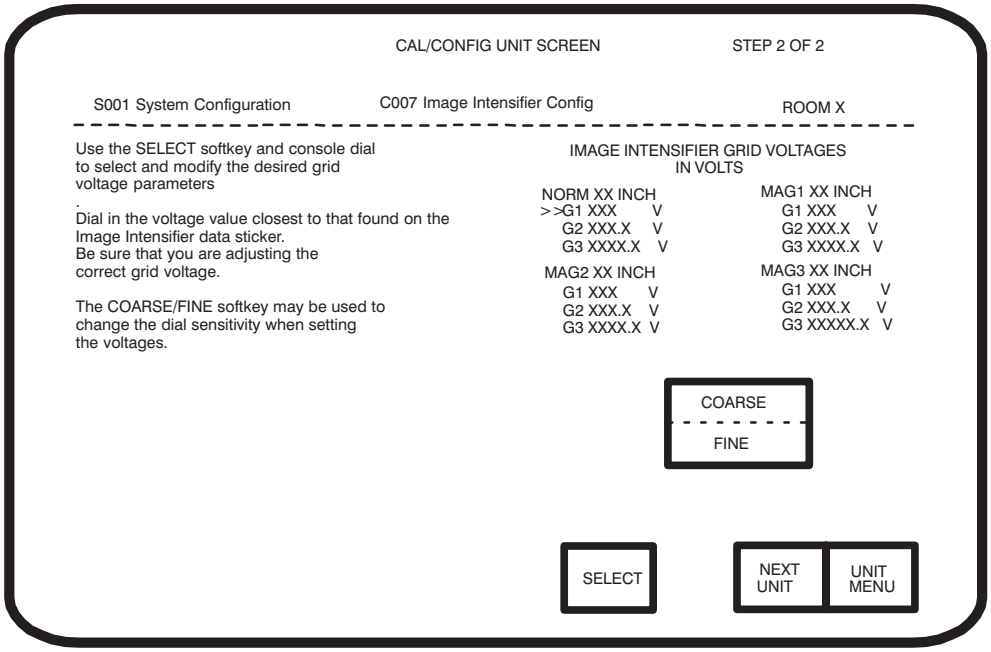
C007 STEP 1 "MORE INFO" SCREEN DISPLAY



3-2 Step 2. Define Grid Voltage

- The console dial is enabled to control the position of the cursor. Position the cursor opposite the parameter to be defined (Start with G1 parameter of the NORM mag mode for the II size selected in Step 1.
- Touch SELECT softkey. Using the console dial, enter the appropriate grid voltage found on the image tube data label. Toggle COARSE or FINE softkey as necessary to make setting of the grid voltage as easy as possible.
- Touch SELECT softkey again and position the cursor opposite the next grid parameter to be defined. Using the same procedure, define the grid voltages for NORM, MAG 1, and MAG 2. Definition of the MAG 3 grid voltages is only required if the system contains a four field image intensifier tube.
- When all grid parameters have been defined, touch NEXT UNIT or UNIT MENU softkey. Exiting the unit loads the data into NV RAM. An “Updating NV database” message is displayed while the configuration data is being loaded into the system.

C007 STEP 2 SCREEN DISPLAY



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UNIT C009 – TV Camera Configuration

Time: x h xx min – Personnel: 1 field engineer

1 DESCRIPTION

Configuration Unit C009 configures the type of TV camera used in an Advantx system at initial installation or after a TV Camera tube replacement. Since there are two types of image modules that can be used with an Advantx system starting with Model Period 10, configuration of the TV Camera varies according to the image module installed. The two image modules that may be used in an Advantx system are the VIC Module and the Imageur Module.

1-1 Imageur Module

The Imageur Module is the low end camera system that is not under software control for calibration. The Imageur Module only requires identification of the type of pickup tube used in the system for later display on the Configuration Summary Screen (Ref Config Unit C038). This unit does not set TV camera parameters for the Imageur Module.

1-2 VIC Module

The VIC Module requires identification of the type of pickup tube used in the system and associated parameters for entry into the ASC database. The entered parameters are then used to calculate the default fluoro dose iris values that are used to provide fluoro dose levels when running VIC calibration sequences and other calibration units such as Calibration Unit X107, Fluoro Entrance Dose, which accurately calibrates the fluoro iris values.

Note: Upon entering this unit, the unit checks the database for improper data and if necessary displays an appropriate error code on the screen.

2 EQUIPMENT REQUIRED

None

3 SPECIAL INSTRUCTIONS

The following special instructions pertain to the running of this unit:

- Two types of Triode pickup tubes are used in VIC Systems: Saticon A (Model TH9951 or XQ1560) and Saticon B (Model TH9957 or XQ1565/XQ1570).
- VIC jumpers are factory set. However, if a pickup tube is being changed from a Diode type to a Triode type or vice versa, the Beam Select jumper, VIC1 A12 JP188, must be reset accordingly. Refer to schematics for details.
- On dedicated cardiac systems, Plumbicon Diode type pick–up tube XQ–2182/03X should be used for better customer satisfaction. So the Beam Select Jumper (VIC1/A12/JP188) shall be positioned on position A, Diode type.

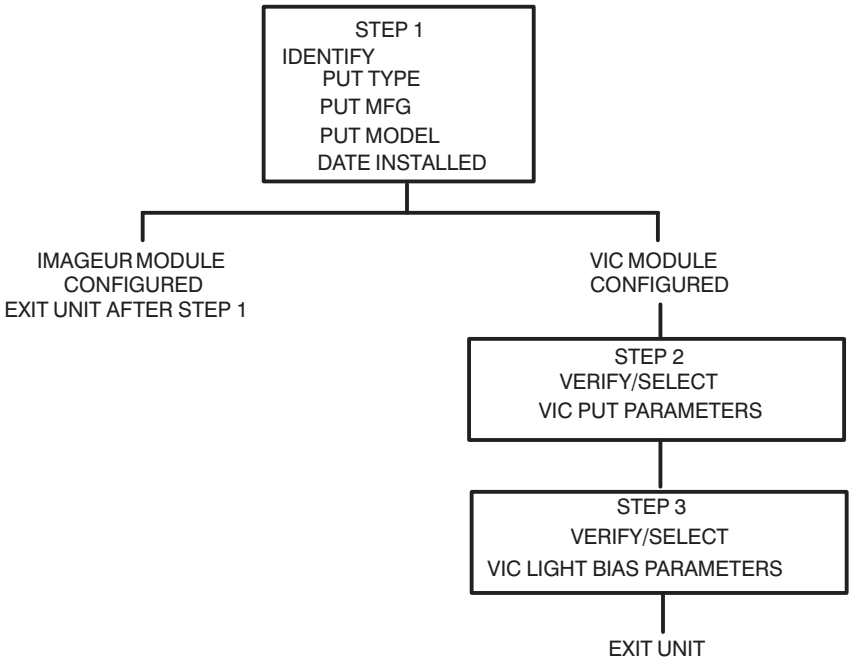
4 PROCEDURE OVERVIEW

In order to configure a TV camera, pickup tube data must be entered in the appropriate steps pertaining to this unit. On Advantx systems configured with an Imageur Module, only one step is required to configure the TV Camera pickup tube. On Advantx systems configured with a VIC Module, three steps are required to configure the TV Camera pickup tube.

Step 1 The purpose of Step 1 is to enter pickup tube type/mfg/model information and date installed. The first time Step 1 is run all parameter values are defaulted with the text “LABEL” Once the parameters on the Step 1 screen have been entered correctly, all other parameter values are set to defaults. For VIC configured systems these default values are displayed on Step 2 and 3 screen displays. The NEXT STEP softkey is locked out until all “LABEL” text has been replaced with valid inputs. Additional instructions concerning the configuring of a pickup tube can be accessed by touching a “MORE INFO” softkey on the Step 1 screen. There are two “More Info” screen displays. One for Imageur configurations and one for VIC configurations.The appropriate “More Info” screen will be automatically displayed based upon the Image Module (Imageur or VIC Module) configured in C001, Module Config. If an Imageur Module is configured, no additional steps are required to configure the TV Camera pickup tube and the NEXT STEP softkey is not displayed on the Step 1 screen.

Step 2 The purpose of Step 2 is to verify that the appropriate tube data is displayed according to the pickup tube label that applies to the pickup tube selected in Step 1 or to enter the appropriate pickup tube parameters if “other” type pickup tube was identified in Step 1. Step 2 is not applicable to systems configured with the Imageur Module.

Step 3 The purpose of Step 3 is to verify that the light bias parameters displayed are in accordance with the pickup tube label that applies to the pickup tube selected in Step 1 or to enter the appropriate light bias parameter if “other” type pickup tube was identified in Step 1. Step 3 is not applicable to systems configured with the Imageur Module.



4-1 Step 1. Pickup Tube Identification

CAUTION **Changing the tube type, manufacturer, or model parameters may require complete recalibration of fluoro doses. For additional information, access "MORE INFO" screen by touching MORE INFO softkey on Step 1 screen display.**

- Using the console dial, select the PUT TYPE parameter (the highlight bar will move up or down as the dial is rotated).
- Touch the SELECT softkey.

NOTICE **If your system is configured with a TH9957 PUT, you must select Saticon B, TTE and TH9957 as the PUT Type, Mfg, and Model. This will set the database to the appropriate values. Do not select "OTHER" as the PUT or you will have to manually enter the applicable tube parameters and all light bias values.**

- Use the console dial to scroll through the pickup tube type selections until the pickup tube type installed in the system is displayed. Typical pickup tube selections and associated default parameter values are given in Table 93.

Note: **For XQ1565 PUT:** Use the XQ1565 selection if available. However, for some early Advantx–E software releases the XQ1565 selection may not be available; for this case use the XQ1570 selection for the XQ1565 PUT.

Note: There are presently only two choices of pickup tubes that are used with an Imageur system. They are:
Heimann Vidicon model number XQ129OR.
Phillips Czicon model number XQ1440X (also identified as Newvicon).

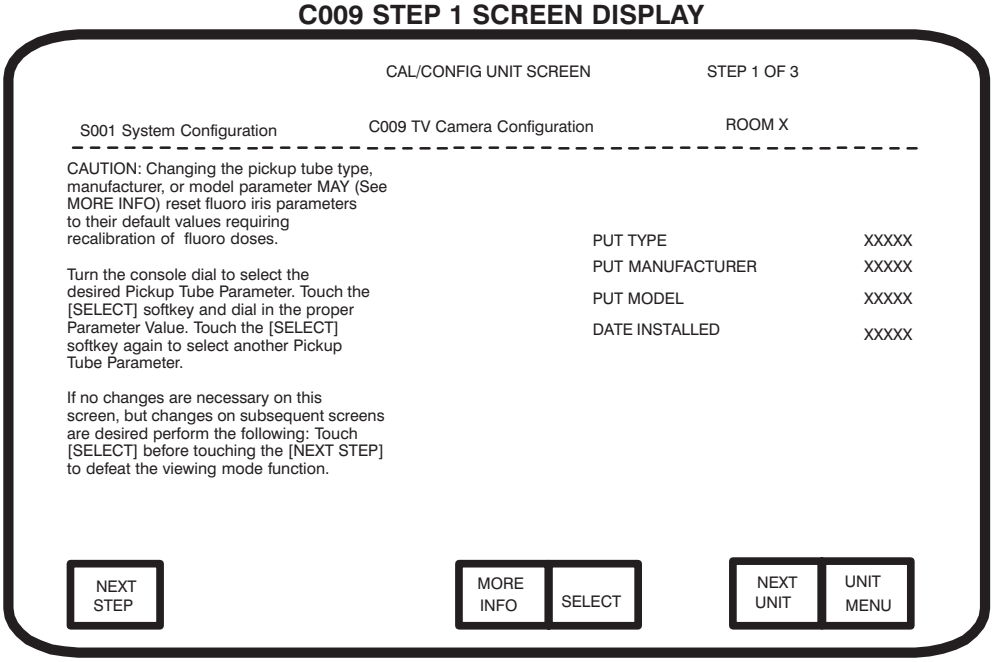
- Touch the SELECT softkey again.
- Repeat the above procedure for entering selections of PUT MANUFACTURER, PUT MODEL and DATE INSTALLED.
- Touch NEXT STEP softkey to proceed to Step 2.

Table 93 – Pickup Tube Parameters (Non Light–Bias Dependent)

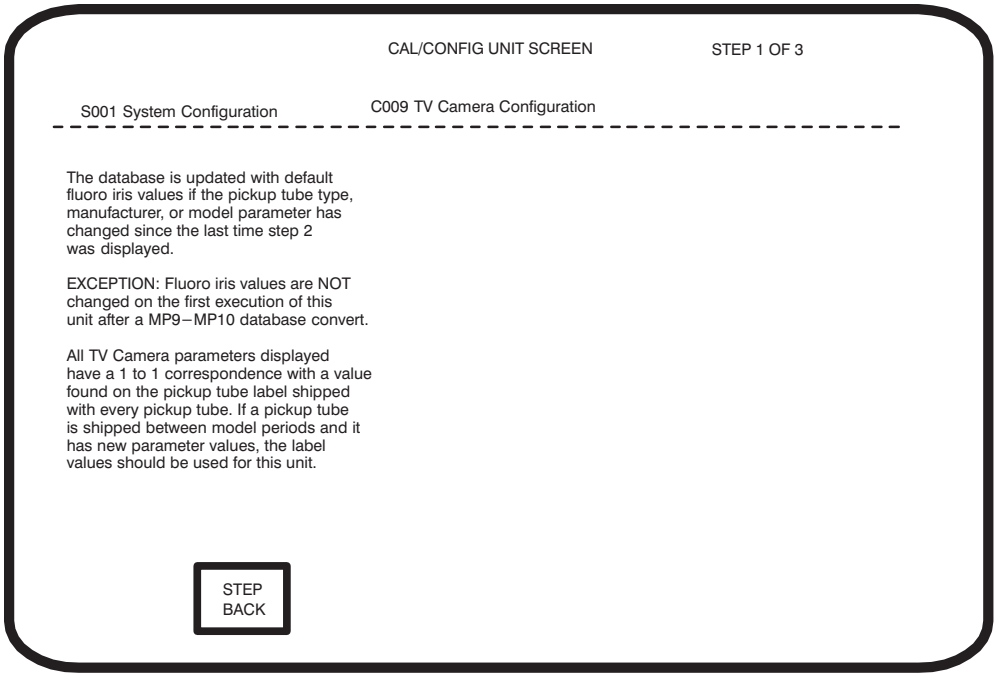
PUT Type	Saticon A **(Note 1)**	Saticon B **(Note 2**)	Saticon A	Saticon B	Saticon C	Czicon **(Note 3)**	Plumbicon
PUT Mfg	TTE	TTE	Heimann	Heimann	Heimann	Philips	Philips
PUT Model	TH9951	TH9957	XQ1560	XQ1565/ XQ1570	XQ1585	XQ1440X	XQ2182/03 X
Sensitivity (nA/lumen)	**(Note 4)**	**(Note 4)**	**(Note 4)**	**(Note 4)**	**(Note 4)**	**(Note 4)**	**(Note 4)**
Max Target Volts (Volts)	80	50	80	**(Note 4)**	**(Note 4)**	50	50
Target Volts (Volts)	75	40	75	**(Note 4)**	**(Note 4)**	**(Note 4)**	45
Max Beam Ref (nA)	1800	1800	1800	1800	1800	1200	1800
Min Beam Ref (nA)	750	750	750	750	750	300	750
1024 Max Beam Ref (nA)	700	700	700	700	700	N/A	700
CF Video Out (nA)	250	250	250	250	250	250	250
CF Input Signal (nA)	**(Note 5)**	**(Note 5)**	**(Note 5)**	**(Note 5)**	**(Note 5)**	100	100
G4 Voltage (Volts)	785	785	785	785	785	810	785
ABC Delay (x50ms)	2 or 6 **(Note 6)**	2 or 6 **(Note 6)**	2 or 6 **(Note 6)**	2 or 6 **(Note 6)**	2 or 6 **(Note 6)**	2 or 6 **(Note 6)**	2 or 6 **(Note 6)**
Diode/Triode (D or T)	T	T	T	T	T	T	D

Note: 1. Manufacturers name for this PUT type is Primicon A.
Note: 2. Manufacturers name for this PUT type is Primicon B.
Note: 3. Manufacturers name for this PUT type is Newvicon.
Note: 4. Refer to the pickup tube data label attached to the VIC Module for the actual parameter values pertaining to the tube.
Note: 5. This value changes based upon DR or DRS. For DRS, it is 150 nA. For DR and all other systems, it is 100 nA.
Note: 6. Set ABC Delay to 2 (100ms) for Non–Pulsed. Set ABC Delay to 6 (300ms) for Pulsed.

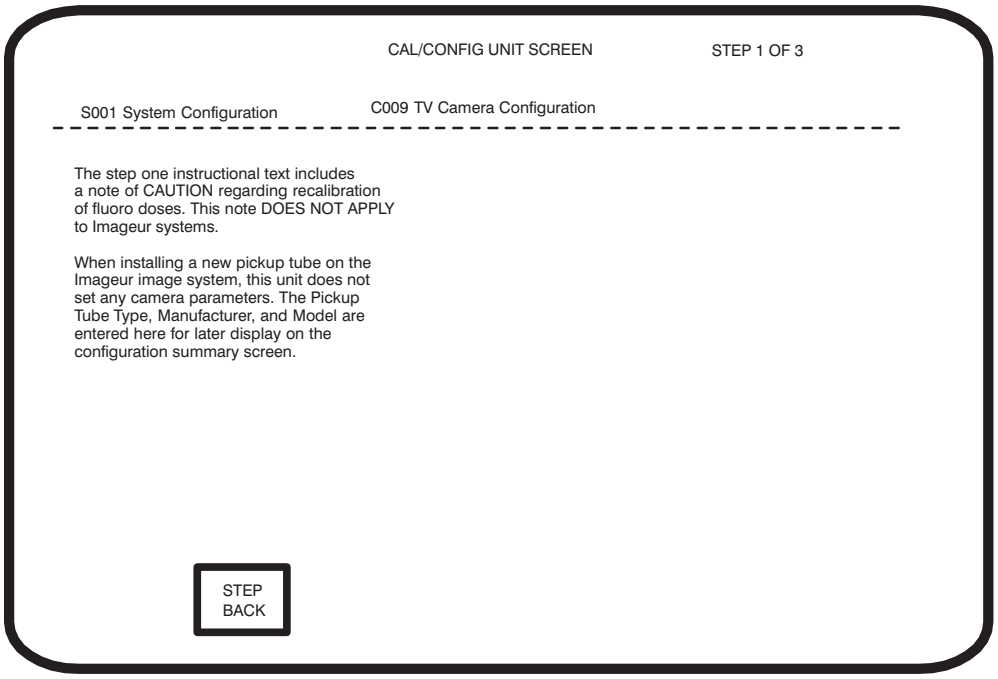
C009 STEP 1 SCREEN DISPLAY



C009 STEP 1 "MORE INFO" VIC MODULE SCREEN DISPLAY



C009 STEP 1 "MORE INFO" IMAGEUR MODULE SCREEN DISPLAY



Note: Pickup tube data is shipped as part of the VIC database. Pickup tube data may also be obtained from a label attached to the VIC module. Refer to the pickup tube label for the parameter values to be verified in Step 2.

4-2 Step 2. Verify/Select VIC Pickup Tube Parameters

- Upon entering Step 2, the screen indicates the default values and actual values for each of the parameters displayed. For all new system installations and pickup tube replacements, verify that the ACTUAL values indicated on the screen are the same as indicated on the pickup tube label.

Note: On systems configured with DRS, set CF Input signal to 150 nA.

- Use the same procedure as in Step 1 to select parameters and enter or change values.

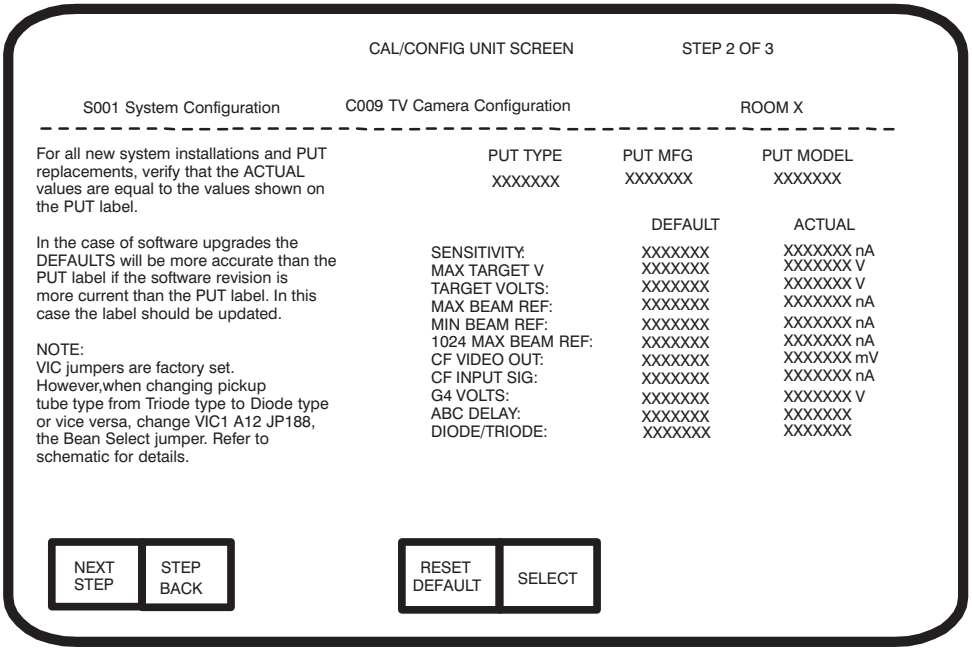
Note: The SENSITIVITY parameter is initially set to “LABEL” since sensitivity is different for every pickup tube. The “LABEL” message is also displayed for TARGET VOLTAGE if the pickup tube type is a Czicon or Vidicon in which case the voltage varies for each tube.

- Check the sensitivity value indicated on the pickup tube label. Select the SENSITIVITY parameter and use the console dial to enter the sensitivity value indicated on the pickup tube label. The dial range for sensitivity is from 50 nA to 5000 nA in steps of 1.0 nA.
- If the pickup tube type is a Czicon or Vidicon, select TARGET VOLTAGE parameter and use the console dial to enter the target voltage indicated on the pickup tube label.

Note: A RESET DEFAULT softkey is provided on the Step 2 screen to permit a reset of all ACTUAL values to the data base recommended values when required. A STEP BACK softkey permits return to Step 1 screen.

- Touch NEXT STEP softkey to proceed to Step 3.

C009 STEP 2 SCREEN DISPLAY



4-3 Step 3. Verify/Select VIC Light Bias Parameters

- Upon entering Step 3, the screen indicates the default values and actual values for the applicable light bias parameters displayed. For all new system installations and pickup tube replacements, verify that the ACTUAL values indicated on the screen are the same as indicated on the pickup tube label. If not, enter the appropriate light bias values found on the pickup tube label.

Note: If the pickup tube manufacturer or model was set to “OTHER” in Step 1, all DEFAULT and ACTUAL fields shall indicate “LABEL” and light bias values must be entered according to the applicable pickup tube label.

- Use the same procedure as in Step 1 to select parameters and enter or change values.

Note: A RESET DEFAULT softkey is provided on the Step 3 screen to permit a reset of all ACTUAL values to the data base recommended values when required. A STEP BACK softkey permits return to Step 2 screen.

- Touch NEXT UNIT or UNIT MENU softkey to exit.

C009 STEP 3 SCREEN DISPLAY

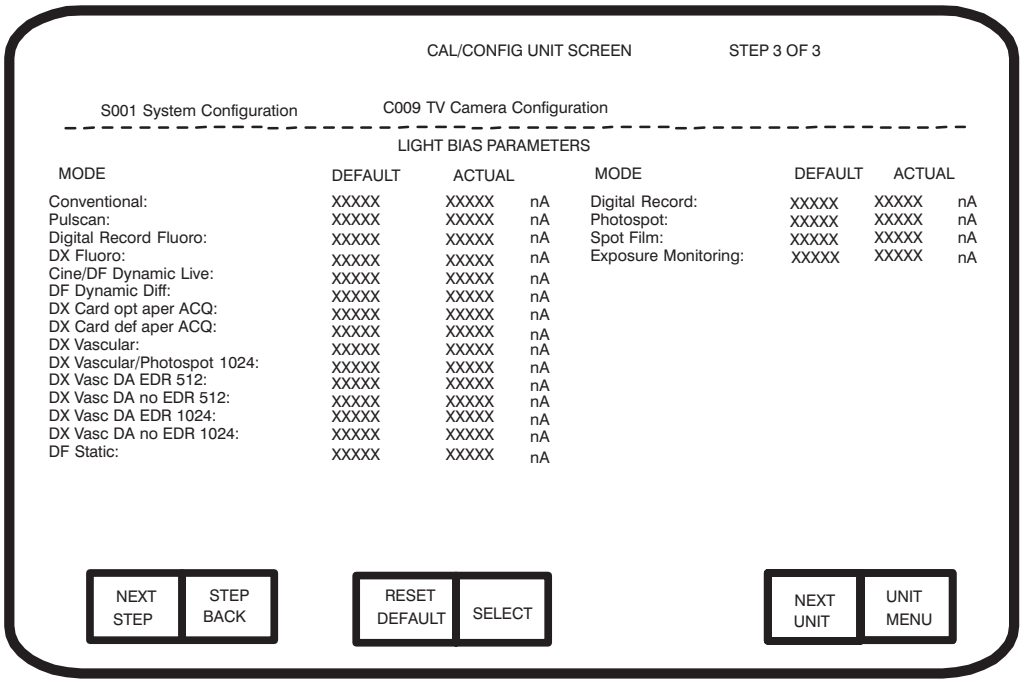


Table 94 – Pickup Tube Parameters (Light–Bias Dependent Values)

PUT Type	Saticon A	Saticon B	Saticon A	Saticon B	Saticon C	Czicon	Plumbicon
PUT Mfg	TTE	TTE	Heimann	Heimann	Heimann	Philips	Philips
PUT Model	TH9951	TH9957	XQ1560	XQ1565/ XQ1570	XQ1585	XQ1440X	XQ2182/03X
Conventional	10	10	10	10	10	0	10
Pulscan/ Camtronics Video Plus (RTDM)	10	10	10	10	10	0	10
Digital Record Fluoro	10	10	10	10	10	0	10
DX Fluoro	10	10	10	10	10	0	10
Cine/DF Dyn Live	10	10	10	10	10	0	10
DF Dynamic Diff	150	150	150	150	150	0	150
DX Card Opt Aper	150	150	150	150	150	0	150
DX Card Def Aper	10	10	10	10	10	0	10
DX Vascular	150	150	150	150	150	0	150
DX Vascular 1024	50	50	50	50	50	0	50
DX Vasc DA EDR 512	10	10	10	10	10	0	10
DX Vasc DA no EDR 512	150	150	150	150	150	0	150
DX Vasc DA EDR 1024	10	10	10	10	10	0	10
DX Vasc DA no EDR 1024	50	50	50	50	50	0	50
DF Static	150	150	150	150	150	0	150
Digital Record	100	100	100	100	100	0	100
Photospot	10	10	10	10	10	0	10
Spot Film	10	10	10	10	10	0	10
Exposure Monitoring	10	10	10	10	10	0	10

Note: **1.** All values are in nA.
Note: **2.** The values are factory recommended.
Note: **3**. Light bias settings between Fluoro and Record (other than the 150 nA or slow scan 50 nA) have been set equal to reduce black level shifts between Fluoro and Record modes.
Note: **4.** Field light bias values may be customized to values other than shown.
Note: **5.** Convert will maintain previous light bias values.

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UNIT C010 – Video Tape Recorder

Time: x h xx min – Personnel: 1 field engineer

1 DESCRIPTION

Configuration Unit C010 selects the type of video tape recorder (VTR) that is used in Imaging Module configured Advantx systems (VIC or Imageur) and then defines the interface parameters pertaining to the selected VTR.

Note: The following error message will be displayed if a VTR was not selected in prerequisite Configuration Unit C011.

NO VTR CONFIGURATION ON SYSTEM: PLEASE EXIT AND RUN C011

2 EQUIPMENT REQUIRED

None.

3 SPECIAL INSTRUCTIONS

The following special instructions apply to this unit when configuring the VTR LINE RATE parameter.

Selection of the VTR LINE RATE parameter controls the display of a VTR ON softkey on the Record and Fluoro Adjust Application Mode console screens. This VTR ON softkey will only be present on these Application Mode screens when the video line rate of the application is equal to the line rate of the VTR. If the selected VTR is a DUAL line rate configuration, then, the VTR ON softkey will be displayed on all Application Mode screens.

Note: On Advantx systems configured with the Imageur module, the VTR ON button is never displayed on the Application Mode screens.

4 CONFIG PROCEDURE

4-1 Step 1. Select Tape Recorder Type

- Touch the VIDEO TAPE RECORDER TYPE softkey. Then, use the console dial to enter the type of VTR used in the system. Recorder types are as follows:

Note: On Advantx systems configured with the Imageur Module, GENERIC is the only choice when selecting VTR type.

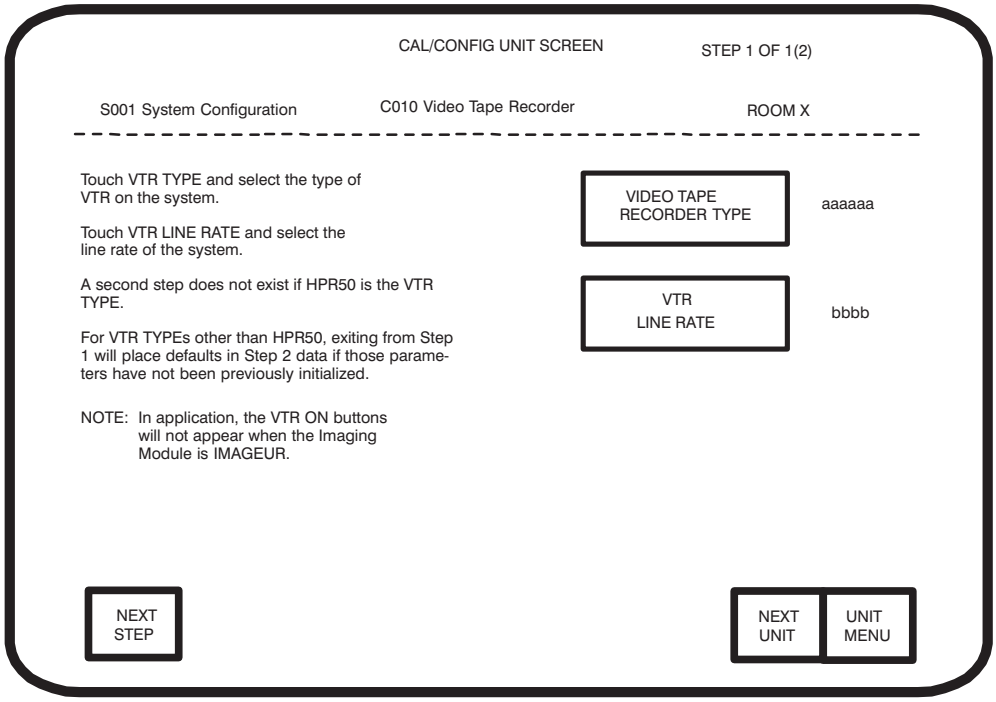
  - HPR-50 – Not applicable for Advantx–E.
  - GENERIC – This is an optional type GE supplied VTR. Interface parameters must be set according to the specifications given in the VTR manual. No VTR PROGRAM softkey is displayed on the applications screen. You must either operate the VTR from the VTR control panel or from a special remote control box (MVS).
  - GENERIC W/REVIEW – Not applicable for Advantx–E.

- Touch the VTR LINE RATE softkey. Then, use the console dial to enter “LOW”, “HIGH” or “DUAL” line rate. Refer to Special Instructions above.
- If a generic review or generic type of video tape recorder is selected, touch NEXT STEP softkey to proceed to Step 2.

NOTICE

When initiating exit from the unit in Step 1, default parameters will be loaded into the Step 2 data fields if those parameters have not been previously initialized.

C010 STEP 1 SCREEN DISPLAY

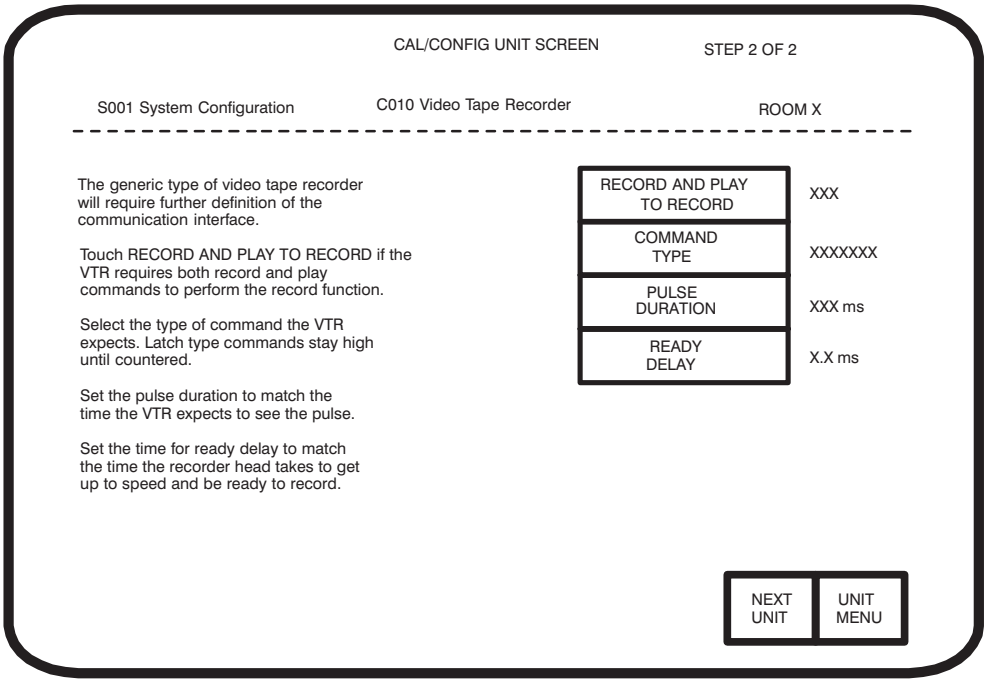


4-2 Step 2. Identify Generic or Generic w/Review VTR Parameters

If GENERIC or GENERIC W/REVIEW is selected, the VTR must be interfaced to the generic interface relays in the VIC by defining the signal characteristic parameters on the Step 2 screen. Refer to appropriate VTR manual for parameter data. To define the applicable parameters, follow the procedures given below:

- If the VTR requires both record and play commands to perform the record function, touch the RECORD AND PLAY TO RECORD softkey and use the console dial to enter YES.
- Touch the COMMAND TYPE softkey and using the console dial enter the type of command (LATCHED or PULSED) that the VTR requires. If LATCH is selected, no pulse duration time parameter is required and the PULSE DURATION softkey is disabled. If PULSED is selected the softkey is enabled.
- If PULSED was selected above, touch the PULSE DURATION softkey and use the console dial to enter the appropriate time duration that the VTR expects to see the pulse (the dial range is from 20 ms to 200 ms).
- Touch READY DELAY softkey and dial in the delay time that matches the time the VTR requires to reach recording speed (the dial range is from 0.0 s to 3.0 s).
- After all parameters have been entered, touch NEXT UNIT or UNIT MENU softkey to exit the unit. Exiting the unit loads the interface data into the system. An “Updating NV database” message is displayed while the configuration data is being loaded.

C010 STEP 2 SCREEN DISPLAY



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UNIT C013 – Video Distribution Configuration

Time: x h xx min – Personnel: 1 field engineer

1 DESCRIPTION

Configuration Unit C013 is used to setup the Video Distribution of an Advantx system. The video devices configured in a system and the configuration software controlled by this configuration unit determine the actual video distribution of an Advantx system. Video Distribution (also known as Video Mapping) is the interconnection of video sources (such as TV, stored digital or VTR images) to video destinations (displays such as in–room monitors or storage devices such as VTR's or digital processing equipment). Illustration 181 shows the various video sources and destinations that can be connected in an Advantx system.

1-1 Video Sources

Advantx Video Distribution sources.

- **In Room Display (IRD)** – IRD originates from a character generator in the VIC. The character generator provides video annotation such as kVp, mA, time, etc. Because the characters are also alphanumeric, this video source is also known as an A/N Display. With reference to Video Distribution, the IRD can be both a video source or destination.
- **Video processor** – This video source originates from the Video Processor PWA in the VIC which in–turn receives video from the TV camera. Video Processor video may be interlaced or progressive, depending on the record application/fluoro mode selected.
- **DX/DLX/DF Video** – DX/DLX video originates from an Advantx DX, DLX or DF. This video signal enters the VIC at transition panel jack J1. DX video is always an interlaced composite video signal.
- **VTR Out** – This video source originates from the output of a video tape recorder and enters the VIC at transition panel jack J2. In the Playback Mode, the VTR output is always an interlaced composite video signal.
- **Aux 1 Out** – Depending on system configuration, AUX 1 Out may originate from Pulscan Channel 1, Camtronics Video Plus (RTDM), or Advantx DR/DRS.

  AUX 1 Out enters the VIC at transition panel jack J3. When Pulscan or Camtronics Video Plus are present, this video source is an interlaced composite video signal. Either live or stored images may be displayed depending on control selections. When DR is present, this video source is always an interlaced composite video signal. May be used for Frame Grabber FC VIDEO IN. If an IDF is configured, this video source is an interlaced composite video. During IDF it is the processed fluoro. During Idle it can be the video from AUX 1 IN.

Note: An AUX 1 output may not be connected to a the AUX 1 input (Software allows this selection but Hardware does not).

- **Aux 2 Out** – If a Pulscan is configured, AUX 2 Out originates from Pulscan Channel 2 (PULSCAN VID OUT 2). AUX 2 Out enters the VIC at transition panel jack J4. This video source is an interlaced composite or stored image, depending on control selections. May be used for DX ROADMAP VIDEO OUT. If a DX (DLX) is configured with Roadmap, AUX 2 Out is an interlaced composite video of a DX (DLX) reference image.

- An AUX 2 output may not be connected to a the AUX 2 input (Software allows this selection but Hardware does not).

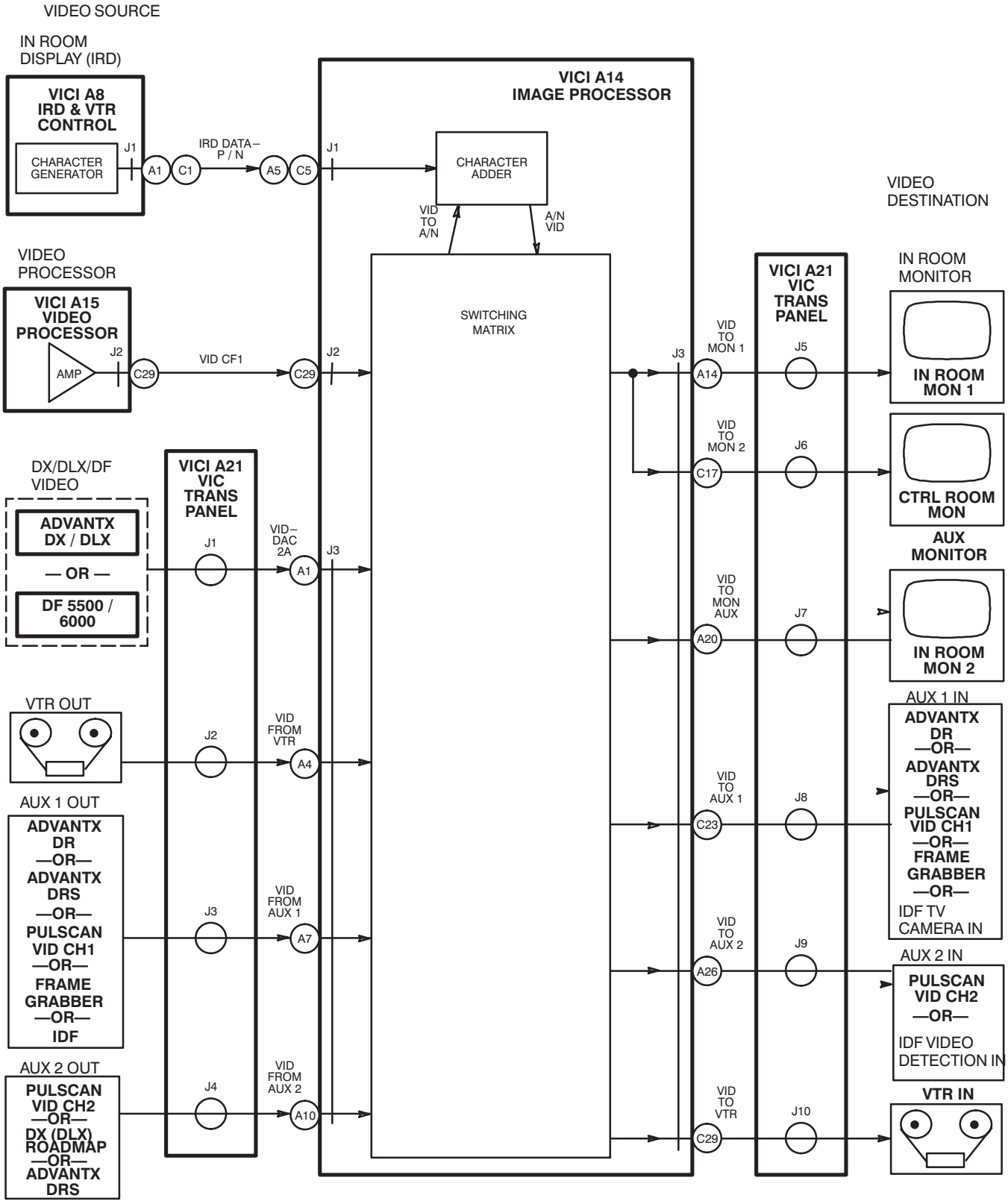
1-2 Video Destinations

Advantx Video Distribution destinations.

- **In Room Monitor** – Video to an In Room Monitor leaves the VIC at transition panel jack J5. The Control Room Monitor receives the same signal as the In Room Monitor but this video signal leaves the VIC at transition panel jack J6.
- **Aux Monitor** – Video to an AUX Monitor (second In Room Monitor) leaves the VIC at transition panel jack J7. If an AUX Monitor is configured, the system is known as a ”two monitor” system because Video Distribution switches two video sources, i.e., one for use on the In Room monitor and one for use on the AUX Monitor.
- **Aux 1 In** – Video to AUX 1 In leaves the VIC at transition panel jack J8. AUX 1 In may go to Pulscan Channel 1 (PULSCAN VID IN 1), Camtronics Video Plus (RTDM) J4 (VID IN), or Advantx DR (DR VIDEO IN), depending on system configuration.

  May be used for Frame Grabber VIDEO IN. When IDF is present, the video is always an interlaced video signal. It is routed through IDF and comes back to AUX 1 In when no fluoro is performed.
- **Aux 2 In** – Video to AUX 2 In leaves the VIC at transition panel jack J9. AUX 2 In goes to Pulscan Channel 2 (PULSCAN VID IN 2).
- **VTR In** – VTR leaves the VIC at transition panel jack J10 and goes to the input of a video tape recorder.

Illustration 181 – VIC Module Video Connections



1-3 Advantx Video Distribution Default Table Logic Selection

There are two types of video distribution tables used by the Advantx system in order to map video sources to video destinations:

1. **Fluoro/Idle Tables** that are used during fluoro exposures or when the system is at idle (i.e., whenever record exposures are not active).
2. **Acquisition Tables** that are used while record exposures are active.

For each possible fluoro type and each possible record acquisition type there exists a set of default video distribution tables that defines the video distribution for every possible system configuration. Some record acquisition types share the same set of tables.

For a given system configuration, only one table from each set of default tables will be chosen as the video map for that particular fluoro or acquisition type.

The selection logic in Illustration 182 graphically shows the configurable parameters that determine which video distribution table, from the set of default tables, will be loaded into NV RAM by the Advantx Service Mode Video Distribution Config Unit.

There currently are 8 configurable (true or false) parameters, they are:

- Pulscan
- DR (EPS)
- VIC A/N Display (IRD)
- Video Tape Recorder (VTR)
- Generic Video Tape Recorder
- Time Base Corrections (TBC)
- DX Roadmap Output (XDG2)
- Dual Monitor

The 8 parameters shown above would yield a possible 2^8 or 256 tables for each fluoro and record mode. However there are interdependencies between the parameters that reduce the number of tables. For example:

- You must have both a Pulscan and VTR in order to use TBC.
- Pulscan and DR are mutually exclusive.
- Two monitors do not make sense unless you have the necessary devices to drive both monitors.
- You cannot have a generic VTR unless you have already defined that there is a VTR on the system. (However, since HPR–50 is not applicable to Advantx–E, don't merely define VTR, as was done on pre–Advantx–E systems with HPR–50.)

Because of the interdependencies shown above, and other restrictions that may apply to specific applications to produce “don’t care” configurations, the actual number of default video distribution tables for each fluoro and acquisition type is much less than 256. The exact number of tables for each of the fluoro and acquisition types depends on the particulars of the type in question.

Illustration 182 – Advantx Video Distribution Default Table Selection Logic

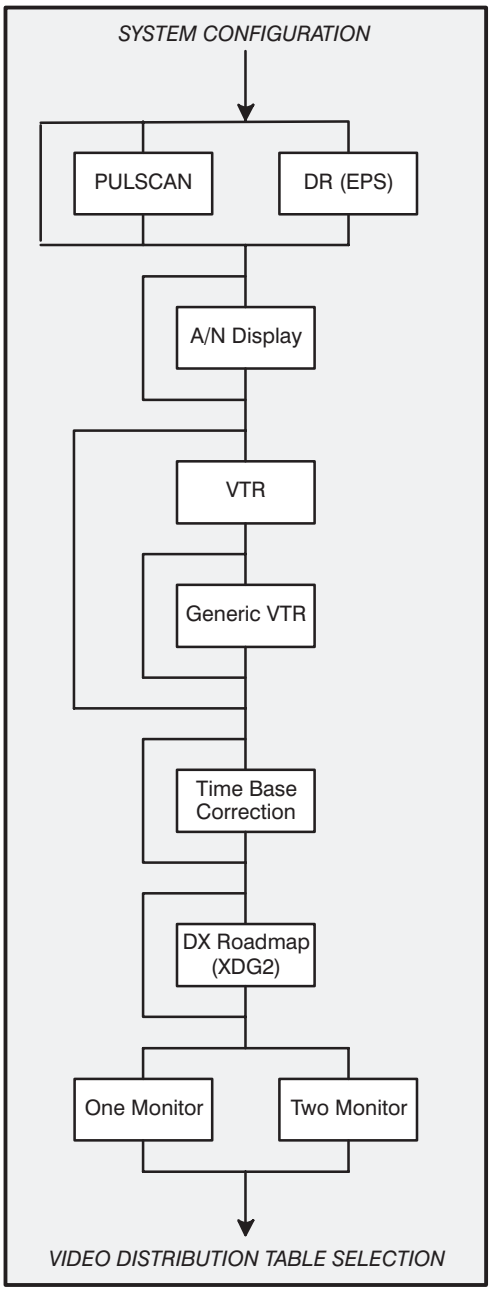


Table 95 shows the 14 states available in the Fluoro/Idle Video Distribution Tables and the logic used to determine which state is active given the current operating environment of the Advantx system. Of the fourteen states in the table, three of them are used when fluoro rays are active (States F, G & N) and eleven are used when the system is at idle. The states will be described in more detail in the following pages.

Table 95 – Advantx Software Fluoro/Idle State Logic Table

0 = False
1 = True
X = Don't Care

Expose Switch On (Fluoro Active)	*Pulscan Roadmap 1 Selected*	*Pulscan Roadmap 2 Selected*	*VTR Playback/Freeze/Shuttle Active*	*DF/DX/DLX Application with A/N*	*DF/DX/DLX Application without A/N*	VIDEO DISTRIBUTION STATE	
0	0	X	0	0	0	Idle, Roadmap # 2	A
0	1	0	0	0	0	Roadmap # 1, Roadmap # 2	B
0	1	1	0	X	X		
0	0	X	1	0	0	Idle, VTR Playback	C
0	0	1	0	0	1	DF (DX or DLX) w/o AN, Roadmap # 2	D
0	0	1	0	1	0	DF (DX or DLX) w/AN, Roadmap # 2	E
1	X	X	0	0	0	Acquisition, Roadmap # 2	F
1	X	1	0	1	0		
1	X	1	0	0	1		
1	X	X	1	X	X	Acquisition, VTR Playback	G
0	1	X	1	X	X	Roadmap # 1, VTR Playback	H
0	1	0	0	1	0	Roadmap # 1, DF (DX or DLX w/ or w/o AN)	I
0	1	0	0	0	1		
0	0	0	0	1	0	DF (DX or DLX) w/AN	J
0	0	X	1	1	0	DF (DX or DLX) w/AN, VTR Playback	K
0	0	0	0	0	1	DF (DX or DLX) w/o AN	L
0	0	X	1	0	1	DF (DX or DLX) w/o AN, VTR Playback	M
1	X	0	0	1	0	Acquisition, DF (DX or DLX w/ or w/o AN)	N
1	X	0	0	0	1		

Table 96 shows the 6 states available in the Acquisition Video Distribution Tables and the logic used to determine which state is active given the current operating environment of the Advantx system. States O, Q and S are only available in the Acquisition Video Distribution Table for the CINE application. (The Acquisition Video Distribution Table for applications other than Cine only have 3 states.)

The Acquisition Video Distribution Table and its associated states are only used when the prep switch is pressed and the system is in a record acquisition sequence.

Table 96 – Advantx Record Acquisition State Logic Table

0 = False
1 = True
X = Don't Care

Cine Application & frame rate <= 30	*VTR Record Active*	*VTR Playback/Freeze/Shuttle Active*	VIDEO DISTRIBUTION STATE	
1	0	0	Acquisition <= 30 fps	O *
0	0	0	Acquisition	P
1	0	1	Acquisition <= 30 fps, VTR Playback	Q *
0	0	1	Acquisition, VTR Playback	R
1	1	0	Acquisition <= 30 fps, VTR Record	S *
0	1	0	Acquisition, VTR Record	T

*These states are only used while in the Cine application at frame rates less than or equal to 30 fps (25 fps @ 50 Hz). These states are required in order to allow for cine frame fill in with Pulscan.

1-3-1 Unit Software

The unit can establish a unique Video Distribution interconnect (Video mapping) for any given user application, based on setting up software controlled Distribution Mode and Distribution State parameters. Refer to Table 97.

1-3-2 Video Dist Modes

Distribution Modes – Distribution Modes are acquisition functions determined during the running of Applications by customer selection of softkey functions at the Advantx console. There are three general classes of Distribution Modes:

1. Fluoro Idle Modes
2. Fluoro Acq Modes
3. Record Acq Modes

1-3-3 Video Dist States

Distribution States – Each Distribution Mode has several possible Distribution States. The selection of a Distribution State is also determined during the running of Applications by customer selection of device controls on equipment such as Pulscan, Camtronics Video Plus (RTDM), VTR, DX (DLX). The valid Distribution States pertaining to each Distribution Mode are shown in Table 97. Descriptions of the Distribution States are given in the following paragraphs.

Table 97 – Video Distribution Modes/States

DISTRIBUTION MODE	DISTRIBUTION STATES
FLUORO IDLE MODE	
Conventional	IDLE, ROADMAP #2
Image Hold or Pulscan or IDF	ROADMAP #1, ROADMAP #2
DF (DX or DLX)	IDLE, VTR PLAYBACK
	DF (DX or DLX) W/O AN, ROADMAP #2
	DF (DX or DLX) W/AN, ROADMAP #2
	ROADMAP #1, VTR PLAYBACK
	ROADMAP #1, DF (DX or DLX)
	DF (DX or DLX) W/AN
	DF (DX or DLX) W/AN, VTR PLAYBACK
	DF (DX or DLX) W/O AN
	DF (DX or DLX) W/O AN, VTR PLAYBACK
FLUORO ACQ MODE	
Conventional	ACQUISITION, ROADMAP #2
Image Hold or Pulscan or IDF	ACQUISITION, VTR PLAYBACK
DF (DX or DLX)	ACQUISITION, DF (DX or DLX)
RECORD ACQ MODES	
Cine < = 30 FPS (see note)	<= 30 FRAMES/SECOND
	< =30 FPS AND VTR PLAYBACK
	<=30 FPS AND VTR RECORD
Cine > 30 FPS	ACQUISITION
Photospot	ACQUISITION VTR PLAYBACK
Spot–Film	ACQUISITION VTR RECORD
Digital	
DR/DRS	
Film Changer	

Note: The distinction between "< = 30 FPS" and "> 30 FPS" is made to allow the slower frame rates to be run with the TV camera in the progressive scan mode with the video output scan converted to interlaced when a Pulscan or Camtronics unit is used in the system.

1-3-4 Camtronics (RTDM) Systems

The video distribution states *are not affected* by operator selections on the Camtronics Control Box on systems equipped with the Camtronics Video Plus (RTDM) option. In contrast, video distribution states *are affected* by operator selections on the Pulscan Control Box. For example: "MON1", "MON2" change states (i.e. Idle, RM1 & RM1, RM2).

1-3-5 Fluoro Idle Mode

Video Distribution State Definition

- **Idle, Roadmap # 2.** This is an Idle State. It is the system state when X–rays are not active. It is not a state used by the DX, DLX, DF application normally, except when DX, DLX, DF is not communicating or on line with the Advantx (or the state of the DX, DLX, DF is not yet known). VTR Playback is not active and Pulscan Roadmap is not selected.
  1. With two monitor systems, the AUX 2 output can be used to drive the Auxiliary Monitor.
  2. The live Monitor is provided with either Video Processor output when the camera is in the interlaced mode or the AUX 1 output when the camera is in the progressive mode.
  3. For two monitor systems with Pulscan, the selection of PULSCAN ROADMAP 2 will have priority over VTR Playback.
- **Roadmap # 1, Roadmap # 2.** This is an Idle State. The system is in this state when Pulscan Roadmap 1 and Pulscan Roadmap 2 is selected and a DF (DX or DLX) application is not selected.
  1. The live Monitor is driven by Pulscan AUX 1 output.
  2. For two monitor systems, the Auxiliary Monitor is driven by the AUX 2 output whether Pulscan Roadmap 2 is or is not selected.
  3. For one Monitor systems with Pulscan, selection of Pulscan Roadmap 1 will have priority over VTR Playback.
- **Idle, VTR PLayback.** This is an Idle State. The system is in this state when Pulscan Roadmap 1 is not selected but VTR Playback is active. It is not a state used by the DX (DLX, DF) application.
  1. For one Monitor systems, the VTR Playback is displayed on the live Monitor.
  2. For two monitor systems, VTR Playback is displayed on the Auxiliary Monitor.
  3. For two monitor systems, the live Monitor will display the Video Processor output when the camera is in the interlaced mode or the AUX 1 output when the camera is in the Progressive mode.
  4. For two monitor systems with Pulscan, selection of VTR Playback will have priority over Pulscan Roadmap 2. In this case, the Pulscan will provide VTR Playback video at the AUX 2 output instead of Pulscan Roadmap 2.

- **DF (DX or DLX) w/o AN (alphanumerics), Roadmap # 2.** This is an Idle State. The system is in this state when Pulscan Roadmap 1 is not selected but Pulscan Roadmap 2 is selected. VTR Playback is not active. DX (DLX, DF) application is selected and is supplying video without alphanumerics.
  1. For one Monitor systems, the AUX 2 video is displayed on the live Monitor and the DF (DX or DLX) is not displayed.
  2. For two monitor systems, DF (DX or DLX) video without alphanumerics is displayed on the live monitor and the AUX 2 video is displayed on the Auxiliary Monitor.
- **DF (DX or DLX) with AN (alphanumerics), Roadmap # 2.** This is an Idle State. The system is in this state when Pulscan Roadmap 1 is not selected but Pulscan Roadmap 2 is selected. VTR Playback is not active. A DF (DX or DLX) application is selected and is supplying video with alphanumerics.
  1. For one Monitor systems, the AUX 2 video is displayed on the live Monitor and the DF (DX or DLX) video is not displayed.
  2. For two monitor systems, DF (DX or DLX) video with alphanumerics is displayed on the live monitor and the AUX 2 video is displayed on the Auxiliary Monitor.
- **Roadmap # 1, VTR Playback.** This is an Idle State. The system is in this state when Pulscan Roadmap 1 is selected and VTR Playback is active.
  1. For one Monitor systems, the live Monitor will display AUX 1 video. The Pulscan AUX 1 video will be either Pulscan Roadmap 1 or VTR Playback.
  2. For two monitor systems, the live Monitor will display Pulscan Roadmap 1 video and the Auxiliary Monitor will display VTR Playback.
- **Roadmap # 1, DF (DX or DLX).** This is an Idle State. The system is in this state when Pulscan Roadmap 1 is selected and a DF (DX or DLX) application is selected.
  1. The live Monitor will display the Pulscan AUX 1 output.
  2. For two monitor systems, the Auxiliary Monitor will display the DF (DX or DLX) video.
- **DF (DX or DLX) with AN (Alphanumerics).** This is an Idle State. The system is in this state when a DF (DX or DLX) application is selected and the video contains alphanumerics. VTR Playback is not active and no Pulscan Roadmaps are selected.
  1. For one Monitor systems, the live Monitor displays DF (DX or DLX) with VIC alphanumerics.
  2. For two monitor systems, the live Monitor is provided with either Video Processor output when the camera is in the interlaced mode or the AUX 1 output when the camera is in the progressive mode.
- **DF (DX or DLX) with AN (Alphanumerics), VTR Playback.** This is an Idle State. The system is in this state when a DF (DX or DLX) application is selected and the video contains alphanumerics. VTR Playback is active. Pulscan Roadmap 1 is not selected.
  1. For one Monitor systems, the VTR Playback is displayed on the live Monitor.
  2. For two monitor systems, the VTR Playback is displayed on the Auxiliary Monitor and the live monitor displays the DF (DX or DLX) video with VIC alphanumerics.
  3. For two monitor systems with Pulscan, the selection of VTR Playback will have priority over Pulscan Roadmap 2 . In this case the Pulscan will provide VTR Playback video at the AUX 2 output instead of Pulscan Roadmap 2.

- **DF (DX or DLX) w/o AN (alphanumerics).** This is an Idle State. The system is in this state when a DF (DX or DLX) application is selected and the video does contain alphanumerics. VTR Playback not is not active and no Pulscan Roadmaps are selected.
  1. For one Monitor systems, the live Monitor displays DF (DX or DLX) without VIC alphanumerics.
  2. For two monitor systems, the Auxiliary Monitor is provided with either Video Processor output when the camera is in the interlaced mode or the AUX 1 output when the camera is in the progressive mode.
  3. For two monitor systems, the live Monitor displays DF (DX or DLX) video without VIC alphanumerics.
- **DF (DX or DLX) w/o AN (Alphanumerics), VTR Playback.** This is an Idle State. The system is in this state when a DF (DX or DLX) application is selected and the video does not contain alphanumerics. VTR Playback is active. Pulscan Roadmap 1 is not selected.
  1. For one Monitor systems, the VTR Playback is displayed on the live Monitor.
  2. For two monitor systems, the VTR Playback is displayed on the Auxiliary Monitor and the live monitor displays the DF (DX or DLX) video without VIC alphanumerics.
  3. For two monitor systems with Pulscan, the selection of VTR Playback will have priority over Pulscan Roadmap 2 . In this case the Pulscan will provide VTR Playback video at the AUX 2 output instead of Pulscan Roadmap 2.

1-3-6 Fluoro Acquisition Mode

Video Distribution State Definition:

- **Acquisition, Roadmap # 2.** This is a Fluoro Acquisition State. The system is always in this state during Fluoro acquisition with a DX (DLX, DF) application not selected (or if the DX (DLX, DF) application is selected and the state of the DX is not yet known). The system may also be in this state during Fluoro acquisition if Pulscan Roadmap 2 is selected and a DX (DLX, DF) application is also selected.
  1. The live Monitor will display the fluoro exposures, regardless of the type of fluoro being performed.
  2. For two monitor systems, the Auxiliary Monitor will display the AUX 2 video, if available.
  3. If Pulscan (or Camtronics Video Plus [RTDM]) Fluoro is being performed, (Pulscan Roadmap 2 is not selected) and Pulscan (or Camtronics Video Plus) is supplying the AUX 2 video, both monitors will be displaying the Fluoro exposures. Pulscan (or Camtronics Video Plus) Module gives Fluoro images priority over a blank image but not over Pulscan Roadmap 2.
  4. If IDF fluoro is being performed, a video is present on the AUX 2 Out.

- **Acquisition, VTR Playback.** This is a Fluoro Acquisition State. The system is always in this state during a Fluoro acquisition if VTR Playback is active.
  1. The live Monitor will display the fluoro exposures, regardless of the type of fluoro being performed.
  2. For one Monitor systems, VTR Playback will not be displayed since Fluoro is active and must be displayed.
  3. For two monitor systems, the VTR Playback will be displayed on the Auxiliary Monitor.
  4. If IDF fluoro is being performed, a video is present on the AUX 2 Out.
- **Acquisition, DF (DX or DLX).** This is a Fluoro Acquisition State. The system is always in this state during a Fluoro acquisition if DF (DX or DLX) application is selected and Pulscan Roadmap 2 is not selected.
  1. The live Monitor will display the fluoro exposures, regardless of the type of fluoro being performed.
  2. For two monitor systems, the Auxiliary Monitor will display the AUX 2 video, if available.
  3. If Pulscan (or Camtronics Video Plus [RTDM]) Fluoro is being performed, (Pulscan Roadmap 2 is not selected) and Pulscan (or Camtronics Video Plus) is supplying the AUX 2 video, both monitors will be displaying the Fluoro exposures. Pulscan (or Camtronics Video Plus) Module gives Fluoro images priority over a blank image but not over Pulscan Roadmap 2.
  4. If IDF fluoro is being performed, a video is present on the AUX 2 Out.

1-3-7 Record Acquisition Mode

Video Distribution State Definition:

- **Cine Acquisition < = 30fps.** This is a Record Acquisition State. This state allows Cine frame fill–in with Pulscan (or Camtronics Video Plus [RTDM]). The system is in this state during a Cine record application at rates less than or equal to 30 fps with VTR Record and VTR Playback not active.
  1. If Pulscan (or Camtronics Video Plus) is configured, the live monitor will display the Pulscan AUX 1 (or Camtronics Video Plus MON 1 OUT) output. The Pulscan AUX 1 (or Camtronics Video Plus VID IN) input will be connected to the Video Processor output. If Pulscan (or Camtronics Video Plus) is not configured, then the live Monitor will display the Video Processor output.
  2. For two monitor systems without DX (DLX) Roadmap configured, the Auxiliary Monitor will display the Pulscan (or Camtronics Video Plus) AUX 2 output. If DX Roadmap is configured do not connect the AUX 2 output to the Auxiliary Monitor because it may be supplying a 4:3 aspect ratio video.
- **Cine Acquisition > 30fps.** This is a Record Acquisition State. The system is in this state during a Cine record application at rates greater than 30 fps with VTR Record and VTR Playback not active.
  1. The live Monitor will display the Video Processor output.
  2. For two monitor systems without DX Roadmap configured, the Auxiliary Monitor will display the Pulscan (or Camtronics Video Plus[RTDM]) AUX 2 output. If DX (DLX) Roadmap is configured do not connect the AUX 2 output to the Auxiliary Monitor because it may be supplying a 4:3 aspect ratio video.

3. For systems equipped with Camtronics Video Plus, the Video Plus unit records direct Video Processor output at >30 frames/second via the AUX 1 (J8) output.

- **Cine Acquisition > 30fps, VTR Playback.** This is a Record Acquisition State. The system is in this state during a Cine record application at rates greater than 30 fps if VTR Playback is active.
  1. The live Monitor will display the Video Processor output.
  2. For two monitor systems, the Auxiliary Monitor will display the VTR video output.
  3. For systems equipped with Camtronics Video Plus (RTDM), the Video Plus unit records direct Video Processor output at >30 frames/second via the AUX 1 (J8) output.
- **Cine Acquisition < = 30fps, VTR Playback** This is a Record Acquisition State. This state allows Cine frame fill–in with Pulscan (or Camtronics Video Plus [RTDM]). The system is in this state during a Cine record application at rates less than or equal to 30 fps if VTR Playback is active.
  1. If Pulscan (or Camtronics Video Plus) is configured, the live monitor will display the Pulscan (or Camtronics Video Plus) AUX 1 output. The Pulscan (or Camtronics Video Plus) AUX 1 input will be connected to the Video Processor output. If Pulscan (or Camtronics Video Plus is not configured, the live Monitor will display the Video Processor output.
  2. For two monitor systems, the Auxiliary Monitor will display the VTR video output.
- **Cine Acquisition < = 30fps, VTR Record.** This is a Record Acquisition State. This state allows Cine frame fill–in with Pulscan (or Camtronics Video Plus [RTDM]). The system is in this state during a Cine record application at rates less than or equal to 30 fps if VTR Record is active.
  1. If Pulscan (or Camtronics Video Plus) is configured, the live monitor will display the Pulscan (or Camtronics Video Plus) AUX 1 output. The Pulscan (or Camtronics Video Plus) AUX 1 input will be connected to the Video Processor output. If Pulscan (or Camtronics Video Plus) is not configured, the live Monitor will display the Video Processor output.
  2. For two monitor systems without DX Roadmap configured, the Auxiliary Monitor will display the Pulscan (or Camtronics Video Plus) AUX 2 output. If DX (DLX) Roadmap is configured do not connect the AUX 2 output to the Auxiliary Monitor because it may be supplying a 4:3 aspect ratio video.
- **Cine Acquisition > 30fps, VTR Record.** This is a Record Acquisition State. The system is in this state during a Cine record application at rates greater than 30 fps if VTR Record is active.
  1. The live Monitor will display the Video Processor output.
  2. For two monitor systems without DX Roadmap configured, the Auxiliary Monitor will display the Pulscan (or Camtronics Video Plus [RTDM]) AUX 2 output. If DX (DLX) Roadmap is configured do not connect the AUX 2 output to the Auxiliary Monitor because it may be supplying a 4:3 aspect ratio video.
  3. For systems equipped with Camtronics Video Plus, the Video Plus unit records direct Video Processor output at >30 frames/second via the AUX 1 (J8) output.
- **Acquisition.** This is a Record Acquisition State. The system is in this state during all record acquisitions (except Cine < or = 30 FPS) with VTR Playback and VTR Record not active.
  1. The live Monitor will display the Video Processor output.
  2. For two monitor systems without DX Roadmap configured, the Auxiliary Monitor will display the Pulscan (or Camtronics Video Plus [RTDM]) AUX 2 output. If DX (DLX) Roadmap is configured do not connect the AUX 2 output to the Auxiliary Monitor because it may be supplying a 4:3 aspect ratio video.

3. For systems equipped with Camtronics Video Plus, the Video Plus unit records direct Video Processor output at >30 frames/second via the AUX 1 (J8) output.

- **Acquisition, VTR Playback.** This is a Record Acquisition State. The system is in this state during all record acquisitions (except Cine < or = 30 FPS) if VTR Playback is active.
  1. The live Monitor will display the Video Processor output.
  2. For two monitor systems, the Auxiliary Monitor will display the VTR video output.
  3. For systems equipped with Camtronics Video Plus (RTDM), the Video Plus unit records direct Video Processor output at >30 frames/second via the AUX 1 (J8) output.
- **Acquisition, VTR Record.** This is a Record Acquisition State. The system is in this state during all record acquisitions (except Cine < or = 30 FPS) if VTR Record is active.
  1. The live Monitor will display the Video Processor output.
  2. For two monitor systems without DX (DLX) Roadmap configured, the Auxiliary Monitor will display the Pulscan (or Camtronics Video Plus [RTDM]) AUX 2 output. If DX (DLX) Roadmap is configured do not connect the AUX 2 output to the Auxiliary Monitor because it may be supplying a 4:3 aspect ratio video.

Table 98 – Possible Video Distribution Configurations Based Upon Hardware Design

VIC1 A14 IMAGE PROCESSOR BOARD LOGIC							
VIDEO SOURCES							
		Video Processor Output	DF/DX Video Output	VTR Video Output	AUX 1 Output	AUX 2 Output	A/N Video Output
VIDEO DESTINATION	In Room Monitor	X	X	X	X	X	X
	Control Room Monitor	X	X	X	X	X	X
	AUX Monitor	X	X	X	X	X	X
	AUX 1 Input	X	X	X	NOT POSSIBLE	X	X
	AUX 2 Input	X	X	X	X	NOT POSSIBLE	X
	VTR Video Input	X	X	NOT POSSIBLE	X	X	X
	A/N Video Input	X	X	NOT POSSIBLE	X	X	NOT POSSIBLE

1-4 General Rules About Video Distribution

The following rules should be followed when creating new or modifying default video distribution tables.

1-4-1 In–Room Monitors

An Advantx system can be configured with one or two in–room monitors. The first monitor is refered to as the 'Main' or Live Monitor. The second monitor is refered to as the Auxiliary Monitor.

- The Advantx in–room monitors are capable of displaying either low or high rate interlaced video.
- The in–room monitors will "go white" if left undriven.
- If a second Auxiliary Monitor is needed (for Control Room monitoring), daisy chain VIC1 A21 J7 output with the In Room Monitor 2 and terminate the monitor at end of chain OR you may use VIC1 A21 J8 or J9 outputs but remember that you can not connect an AUX 1 output to an AUX 1 input or an AUX 2 output to an AUX 2 input (VIC1 A14 board limitation)

Rule 1:
Every in–room monitor must be driven by an interlaced video source.

Rule 2:
Never route progressive video to an in–room monitor.

Rule 3:
The Live Monitor must display active fluoro or record exposures.

1-4-2 Video Processor (Camera)

The Video Processor output contains video from the TV camera. It can be high or low rate, interlaced or progressive video, depending on how the VIC is configured (see Table 99).

Table 99 – Video Processor Output Video Format

Fluoro Type Selected	Fluoro Active	DX State	Camera Line Rate	Video Processor Output Format
Conventional	Yes or No	na	Low	Low Rate, Interlaced
			High	High Rate, Interlaced
			Dual	High Rate, Interlaced
DX	No	off–line	Low	Low Rate, Interlaced
			High	High Rate, Interlaced
			Dual	High Rate, Interlaced
	Yes	on–line	na	Low Rate, Progressive
	No	on–line	na	INDETERMINATE
Pulscan	Yes or No	na	Low	Low Rate, Progressive
			High	High Rate, Progressive
			Dual	High Rate, Progressive
DR (Image Hold)	Yes or No	na	na	High Rate, Progressive

1-5 VIC Alphanumerics Generator (IRD)

The VIC Alphanumerics Generator allows the Advantx system to add textual information to video displayed on the in–room monitor.

- Both low rate and high rate video can be sent to the VIC alphanumerics generator. The Video Distribution Config Unit will configure it for the correct video rate depending on the source of the video.
- The VIC alphanumerics generator output will contain the same line rate video as the input.
- In general, never send video to the VIC alphanumerics generator if the video already has alphanumerics in it.

Rule 1:
Never route progressive video to the VIC alphanumerics generator.

Rule 2:
Never route the VTR output to the VIC alphanumerics generator. A VTR may be capable of outputting low or high rate video, and it also may have alphanumerics in it.

Rule 3:
Never route the DF/DX output to the VIC alphanumerics generator in video distribution states B, E, F, G, H, I, J, K or N; it may already contain alphanumerics.

Rule 4:
Never route the DX AUX2 output to the VIC alphanumerics generator; it already contains alphanumerics.

Rule 5:
Never route the DR AUX1 output to the VIC alphanumerics generator; it already contains alphanumerics.

Rule 6:
By convention, the VIC alphanumerics generator output is never routed to the Auxiliary Monitor.

Rule 7:
Never route the VIC alphanumerics generator output to the Pulscan AUX1 or AUX2 inputs or the DR AUX1 input.

1-5-1 Pulscan

Rule 1:
The Pulscan AUX1 input is used for scan conversion. The Video Processor (camera) output is sent here during Pulscan Fluoro exposures. When the Pulscan stores roadmap images, it captures them from the video supplied at the AUX1 input.

Rule 2:
Never send interlaced video to the Pulscan AUX1 input.

Rule 3:
The Pulscan AUX2 input is used for Time Base Correction (TBC) of VTR video. The only video routed to the Pulscan AUX2 input is the VTR output when doing TBC of VTR playback video.

Rule 4:
Pulscan AUX1 output video content is:

- The interlaced composite video converted from the progressive AUX1 input video during Pulscan fluoro (even if Pulscan Roadmap 1 is selected).
- The interlaced composite video from a stored image when Pulscan Roadmap 1 is selected. (See Rule 6.)
- Interlaced black video when Pulscan fluoro is not active and Pulscan Roadmap 1 is not selected.

Rule 5:
Pulscan AUX2 output video content is:

- The interlaced composite video converted from the progressive AUX1 input video during Pulscan fluoro (unless Pulscan Roadmap 2 is selected).
- The interlaced composite time base corrected video from the interlaced AUX2 input video when TBC is configured during VTR playback.
- The interlaced composite video from a stored image when Pulscan Roadmap 2 is selected. (See Rule 7.)
- Interlaced black video when TBC VTR playback is not active and Pulscan Roadmap 2 is not selected.

Rule 6:
With one monitor and TBC configured, selection of Pulscan Roadmap 1 will stop VTR playback.

Rule 7:
With two monitors and TBC configured, selection of Pulscan Roadmap 2 will stop VTR playback.

Rule 8:
If a Pulscan Roadmap is selected, then the Pulscan module will give Pulscan roadmap images priority over the input video when it is command to do TBC Playback. Refer to Rules 6 and 7.

Rule 9:
The Pulscan module cannot scan convert progressive fluoro exposures and do TBC playback at the same time.

1-5-2 Video Tape Recorder (VTR)

Rule 1:
Never send video to a VTR that does not match the line rate requirements for that VTR.

Rule 2:
While fluoro or record exposures are active, always send the live images to the VTR.

Rule 3:
If the VTR is not in playback, then the VTR output video will be the same as the VTR input video (video pass through).

Rule 4:
When the VTR is in playback, then the VTR output is the interlaced composite video from the recorded video.

Rule 5:
When TBC is configured and VTR playback is active then the VTR output is routed to the Pulscan AUX2 input.

Rule 6:
When TBC is not configured and VTR playback is active, then the VTR output is routed to an in–room monitor.

1-5-3 Generic VTR

Rule 1:
Generic VTRs cannot be put into playback mode via the Advantx system. The Advantx system does not know when a generic VTR is in playback and the VTR playback video distribution states are not used.

Rule 2:
Always route the video to be seen on an in–room monitor through the Generic VTR. The VTR input video will be passed through the VTR when it is not in playback. If the VTR is in playback, then the VTR playback video will be seen on the in–room monitor.

1-5-4 DR

Rule 1:
DR is not compatible with a DF, DX or Pulscan. (If a system has a DR, it will not have a DF, DX or Pulscan)

Rule 2:
The Video Processor (camera) output is sent here during DR Fluoro and record exposures.

Rule 3:
The DR AUX1 output is interlaced composite video which contains DR generated alphanumerics.

Rule 4:
Since the DR output video contains alphanumerics, never send DR AUX1 output to the VIC alphanumerics generator.

1-5-5 DF/DX

Rule 1:
The system will not recognize the DF/DX Receptor selection until the DF/DX has been brought on–line for the first time. This prevents undriven monitors due to the possibility that the Advantx is in a DF/DX application but the DF/DX is not turned on.

Rule 2:
The DF/DX output is interlaced composite video. It may or may not have DF/DX alphanumerics in the output video.

Rule 3:
The DF/DX will send the ASC a GE Bus command to state whether or not the DF/DX output video has alphanumerics in it. This command is used to choose between the DF/DX Receptor w/ AN and the DF/DX Receptor w/o AN selections.

Rule 4:
If the DF/DX output video includes alphanumerics do not send it to the VIC alphanumerics generator.

Rule 5:
When DX Roadmap is configured:

- The Pulscan AUX2 output is not used. Instead, the second video output from the DX (from the XDG2 board) becomes the AUX2 source for video distribution.
- TBC is not available on systems with a DX roadmap output because the it needs the Pulscan AUX2 inputs and outputs.

Rule 6:
The DX XDG2 board is also used to supply 4/3 aspect ratio video for the dedicated DX VCR when DX record acquisitions are active or when the DX is in post–processing. If the DX VCR option is configured on the DX then the DX AUX2 output will be black 4/3 aspect ration video during DX record acquisitions and when the VCR record is turned on while the DX is in post–processing.

1-5-6 Config Methods

The unit provides the following two methods of establishing a system video distribution (Mapping).

- **Default Mapping** – provides an automatic method of setting the video interconnect mappings for a single Distribution Mode or for all possible Distribution Modes. Default means all mappings are setup to a pre–programmed configuration.
- **Customized Mapping** – Provides a selectable entry method of setting up a unique video interconnection mapping for each Distribution State of each Distribution Mode to accommodate customer preference or to meet the requirements of an unusual system configuration. If you choose to customize a Distribution Mode, you must define mappings for all Distribution States pertaining to the selected Distribution Mode.

2 EQUIPMENT REQUIRED

None.

3 CONFIG PROCEDURE

3-1 Step 1. Select Distribution Mode

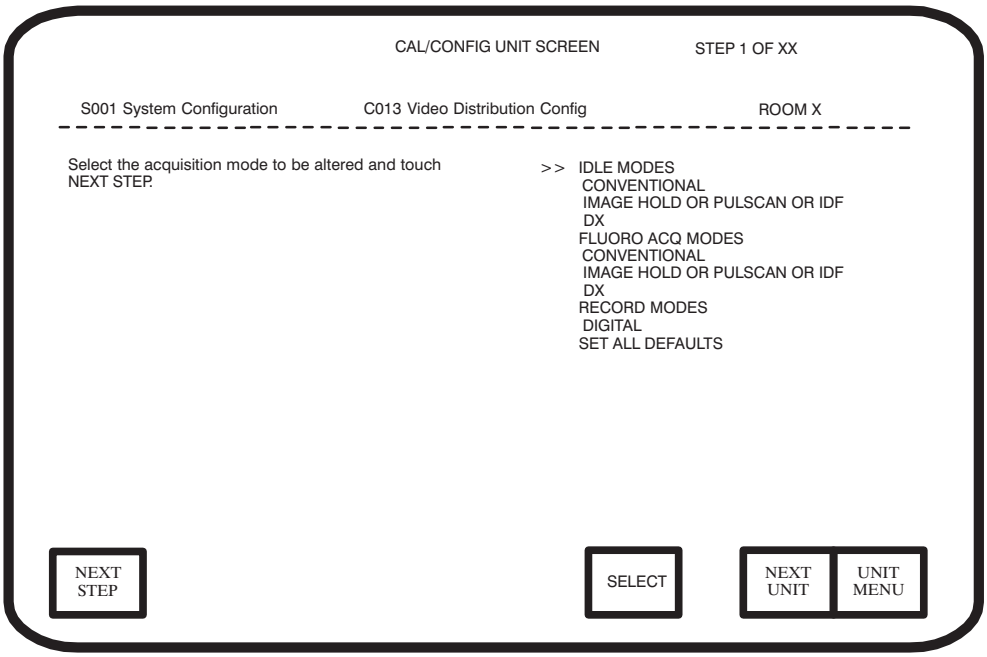
Step 1 selects an individual Distribution Mode for configuration or sets up the unit for default video mapping of all the Distribution Modes listed on the Step 1 screen. Upon entering Step 1, only the video Distribution Modes consistent with the present system configuration are listed in the DISTRIBUTION MODE MENU.

- Using the console dial, position the cursor opposite the video Distribution Mode to be configured.

Note: If the SET ALL DEFAULTS parameter is selected, all of the video Distribution Modes listed in the DISTRIBUTION MODE MENU can be setup for default video mapping in Step 2.

- Touch SELECT softkey. The selected mode will be highlighted in reverse video. If an individual Distribution Mode is selected, all Distribution States pertaining to that mode must be viewed in succeeding steps before return to Step 1 is permitted.
- Touch NEXT STEP softkey to proceed to Step 2.

C013 STEP 1 SCREEN DISPLAY



Note: If there is any doubt about setting a video Distribution Mode or Modes to default mapping, backup the database before proceeding with Step 2.

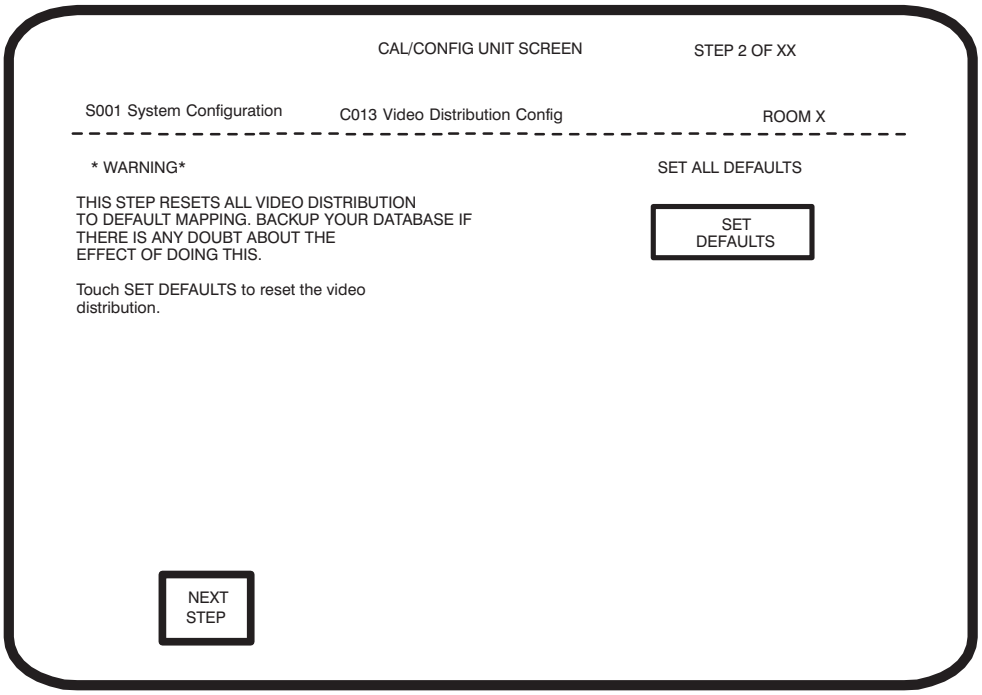
3-2 Step 2. Default Mapping

Step 2 sets defaults and is performed only when default mapping of the Distribution Mode selected in Step 1 is desired. Two variations in screen presentations are available for display as the Step 2 screen, depending on the Distribution Mode selected in Step 1. If SET ALL DEFAULTS was selected in Step 1, a Step 2A screen is displayed for Step 2. If any one of the video Distribution Modes listed in the DISTRIBUTION MODE MENU in Step 1 was selected, a Step 2B screen is displayed.

3-3 Step 2A. Set all Distribution Modes to Default Mapping

- Touch SET DEFAULTS softkey. The unit will automatically set all of the Distribution Modes listed in the DISTRIBUTION MODE MENU in Step 1 to default video mapping based on the device configuration of the system; i.e. Pulscan, Digital, Dual Monitor etc.
- Touching the NEXT STEP softkey returns to Step 1. If viewing of the actual default mapping of any of the Distribution Modes is desired, select a Distribution Mode in Step 1 and then continue to touch the NEXT STEP softkey on succeeding screens to view the video Distribution State mappings associated with the selected Distribution Mode. Touching NEXT STEP on the last step of the unit returns the unit to Step 1. If desired, select another Distribution Mode for viewing or exit the unit by touching NEXT UNIT or UNIT MENU softkey on the Step 1 screen.

C013 STEP 2A SCREEN DISPLAY



Note: Step 2B is only performed when default mapping of a particular Distribution Mode (selected in Step 1) is desired. If customized mapping of a Distribution Mode is to be performed, proceed directly to Step 3 by touching the NEXT STEP softkey.

3-4 Step 2B. Set a Single Mode to Default Mapping

- Touch the SET DEFAULTS softkey. The unit will automatically set the Distribution Mode selected in Step 1 to the appropriate video default mapping based on the existing system configuration; i.e. Pulscan, Digital, Dual Monitor etc.
- Touch the NEXT STEP softkey to step through and view the applicable default Distribution State mappings associated with the Distribution Mode selected in Step 1. Touching the NEXT STEP softkey on the last step returns the unit to Step 1.

Error Condition

When setting default mapping in Step 2 (Steps 2A or 2B), an invalid system configuration may result in the following error code:

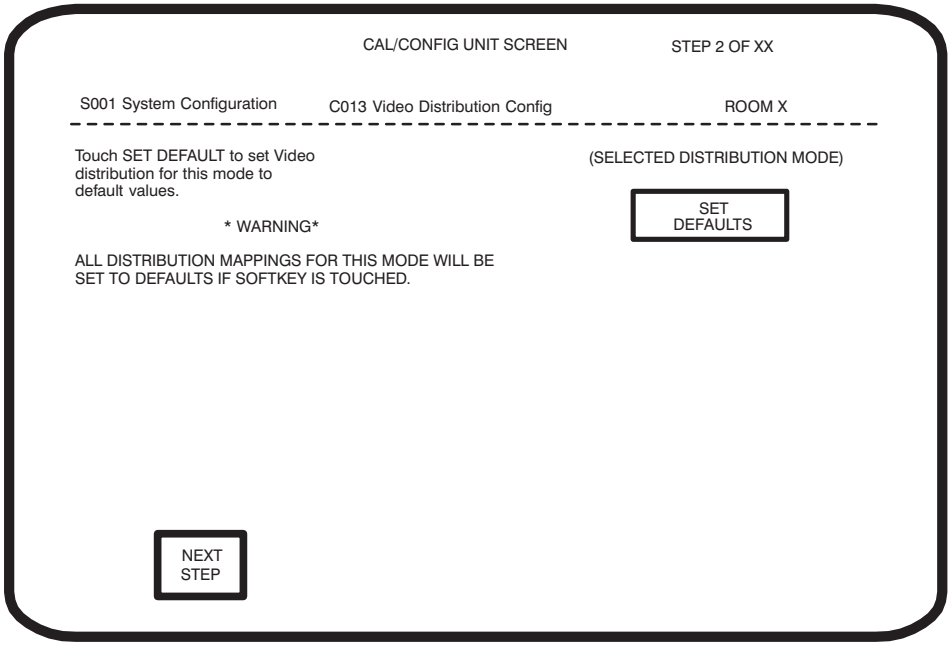
A80B – INVALID CONFIGURATION INPUTS NO DEFAULTS SET FOR THIS APPLICATION

Check that the following options are properly configured for the system before continuing the video distribution configuration.

Pulscan or Camtronics Video Plus – Ref Config. Unit C001
VTR Type – Ref Config. Unit C010
In Room Display – Ref Config. Unit C024
Dual Monitor – Ref Config. Unit C024
Time Base Correction – Ref Config. Unit C011

If all of the option configurations are correct, it may be necessary to check the actual mapping of each distribution state of each distribution mode by viewing the mappings in Steps 3 and up. If no default mapping exists, mapping must be set.

C013 STEP 2B SCREEN DISPLAY



3-5 Steps 3 and Up. Customized Video Mapping

Step 3 and succeeding steps (up to 13 steps) are used to customize the video mapping for each Distribution State associated with a Distribution Mode. Upon entering Step 3, the video distribution for the first DISTRIBUTION STATE of the DISTRIBUTION MODE selected in Step 1 is displayed.

Note: A “More Info” screen provides additional information relating to video distribution configuration.

Before customizing a video mapping, study the default mappings for all Distribution Modes applicable to your system to become familiar with how devices are interconnected. If you customize a Distribution Mode, you must define mappings for all Distribution States pertaining to that mode. It is also recommended that you make copies of Illustration 181 and shade in or mark up the mappings for each state.

Use the following rules as a guide:

- Always send video to a monitor
- Never send progressive video to destinations that can not perform conversion
- Never send low line rate video to a VTR that is setup for high line rate.
- Do not send video to Pulscan inputs unless Pulscan is compatible – interlaced modes do not use the scan convert input, therefore, do not send video to that destination.
- When IDF is configured, send video processor video to J8 (IDF TV camera IN) if and ONLY if the distribution mode is Fluoro Acq and IDF fluoro is performed.
- When in doubt put PULSCAN OUTPUT 2 at the VTR input. PULSCAN OUTPUT 2 is always the right line rate for record acquisitions on a dual line rate system. When doing an acquisition, send the live image to the VTR input.

Valid video port assignments (Source to Destination) for each distribution state are indicated in Table 100. Video sources are screen selectable; video destinations are fixed. To customize or re–define the video distribution for a distribution state, perform the following procedure (See Illustration 183 and Illustration 184 for examples of typical mappings):

Table 100 – Video Port Assignments

J PORT	VIDEO SOURCE OPTIONS	J PORT	VIDEO SOURCE OPTIONS
VIC1 A14 **J2**	VIDEO PROCESSOR	VIC1 A21 **J5**	IN ROOM MONITOR 1
VIC1 A21 **J1**	DF/DX/DLX VIDEO	VIC1 A21 **J6**	IN ROOM MONITOR 2 (Ctrl Room)
VIC1 A21 **J2**	VTR OUT	VIC1 A21 **J7**	AUXILIARY MONITOR
VIC1 A21 **J3**	AUX 1 OUT (Pulscan CH1, DR, DRS, Frame Grabber, or Camtronics Video Plus (RTDM) MON 1 OUT or IDF MON A)	VIC1 A21 **J8**	AUX 1 IN (Pulscan CH1, DR, DRS, Frame Grabber, or Camtronics Video Plus (RTDM) VID IN or IDF TV camera IN)
VIC1 A21 **J4**	AUX 2 OUT (Pulscan CH2, DRS, DX (DLX) Roadmap, or Camtronics Video Plus (RTDM) MON 2 OUT)	VIC1 A21 **J9**	AUX 2 IN (Pulscan CH2 or IDF Video Detection IN)
Selectable	IN ROOM DISPLAY (IRD)	VIC1 A21 **10**	VTR IN

3-5-1 Camtronics Video Plus (RTDM) Setup

Setup Video Distribution for Camtronics Video Plus as follows:

- Accept normal Pulscan defaults for Camtronics Video Plus.
- Use the console dial to position the cursor opposite the SOURCE–DESTINATION to be configured.
- Touch SELECT softkey. The console dial is now enabled to scroll through the options available for the selected SOURCE.
- Enter the desired SOURCE option.

Note: The IRD softkey is only displayed if the IN ROOM DISPLAY parameter was selected in Configuration Unit C011.

- To place the IN ROOM DISPLAY (IRD) in the path of the video signal between a selected source and destination, touch the ENABLE IN ROOM DISPLAY softkey.

CAUTION

Do not enable IRD for the video source:
– NONE
– VIDEO PROCESSOR (when in a progressive application such as Pulscan, Camtronics Video Plus (RTDM), DX, DLX, or DF).
Attempting to do this, will result in a character display on the monitor that appears as if the characters are tearing or as if a loss of horizontal sync is occurring.

- Touch SELECT softkey. Cursor control is now returned to the console dial.
- Select the next SOURCE to be defined and repeat the procedure.
- When all SOURCE TO DESTINATION parameters for a distribution state have been defined, touch the NEXT STEP softkey to proceed to the next Distribution State for the current Distribution Mode. When all Distribution States have been defined, touch the NEXT STEP softkey on the last step to return to Step 1.
- Select the next DISTRIBUTION MODE to be configured and repeat the entire procedure.
- After all DISTRIBUTION MODE/DISTRIBUTION STATES have been configured, exit the unit from Step 1 by touching the NEXT UNIT or UNIT MENU softkey. Exiting the unit loads the data into NV RAM. An “Updating NV database” message is displayed while the configuration data is loaded into the system.

Illustration 183 – Example 1, Fluoro ACQ Mode, Acquisition, Roadmap 2

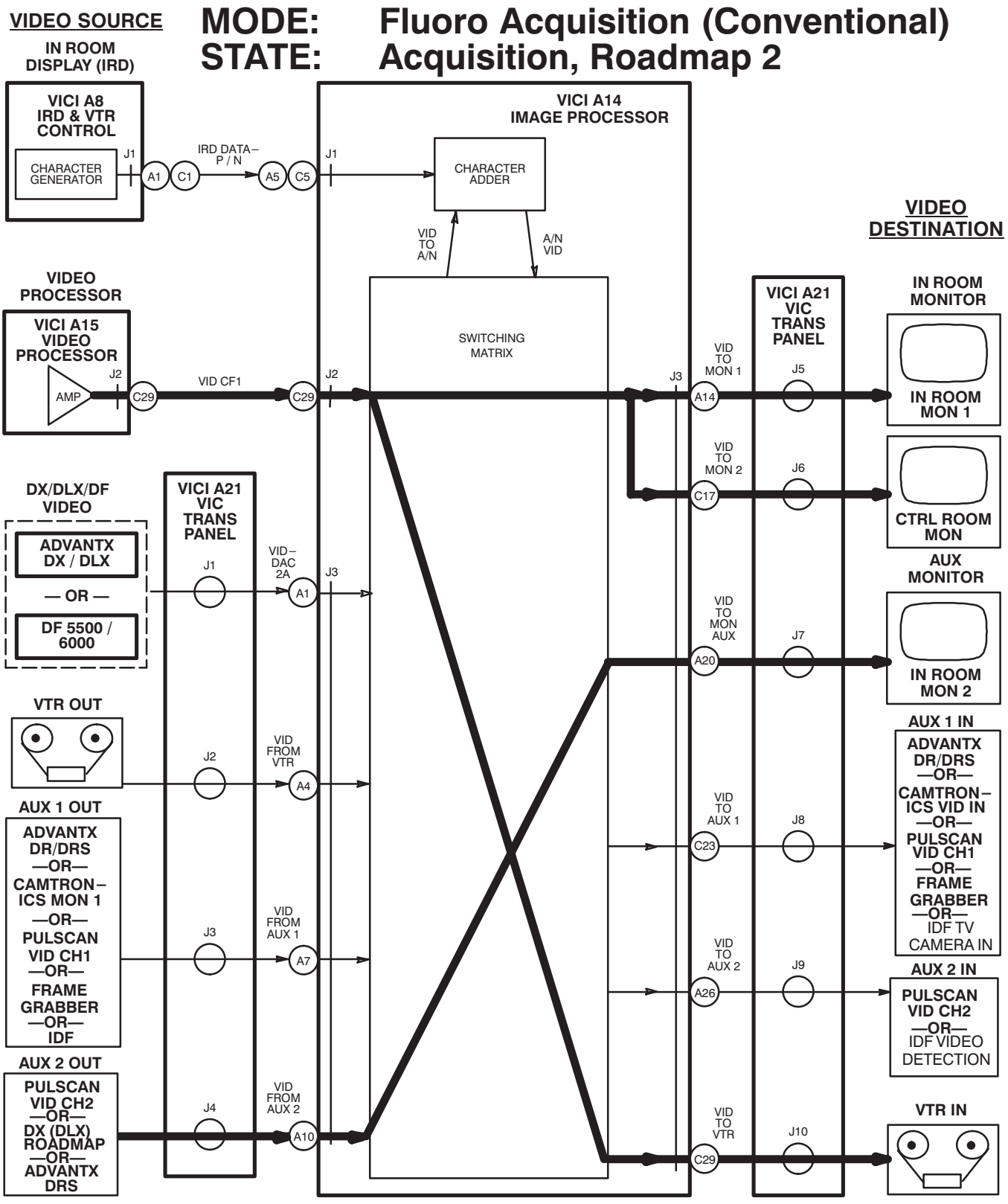
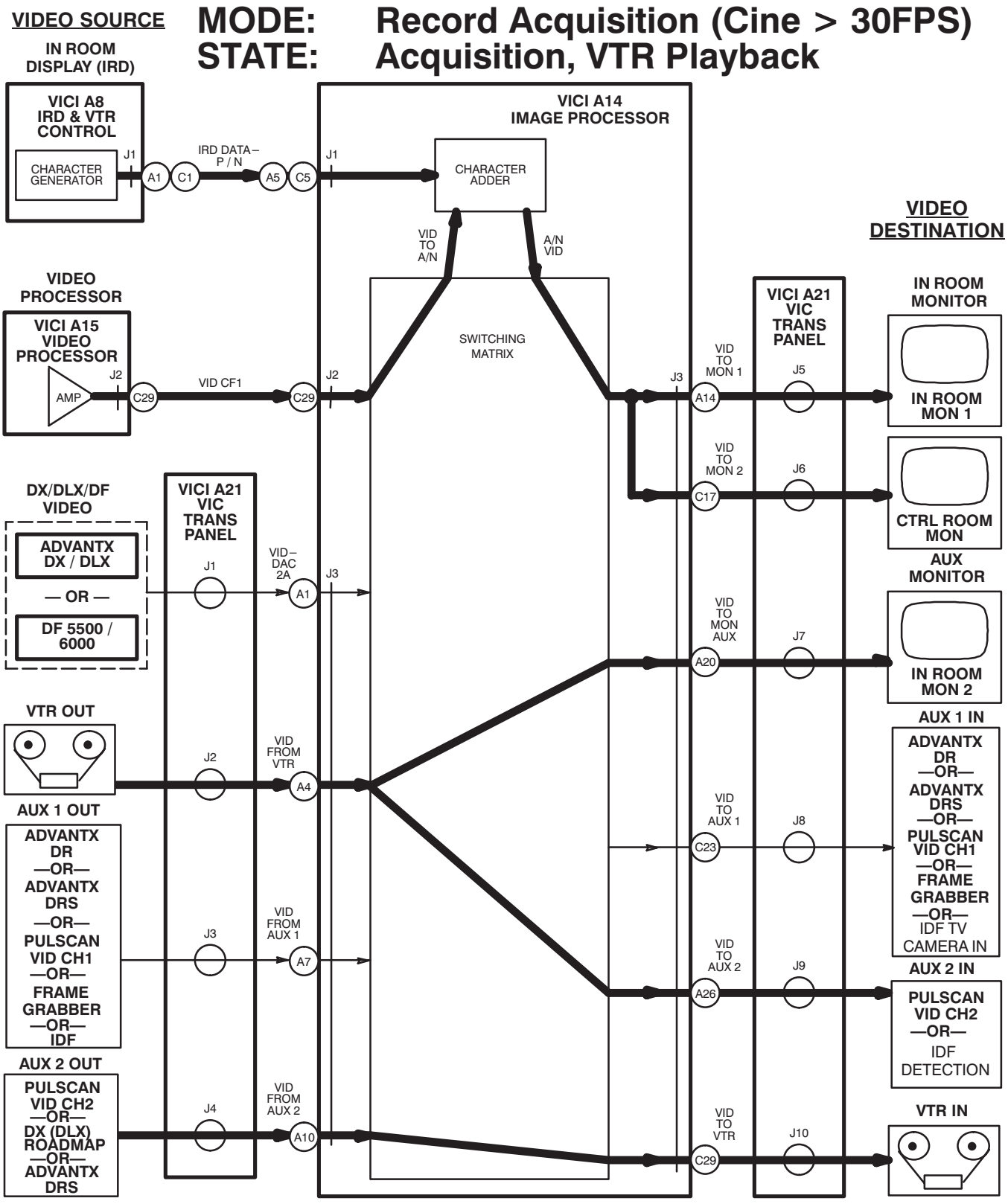
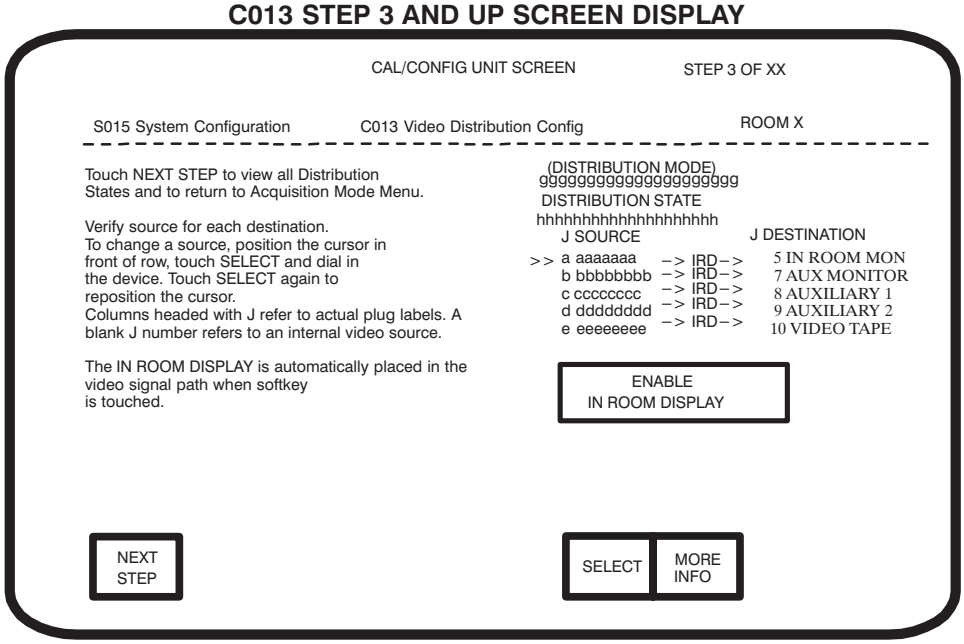


Illustration 184 – Example 2, Record ACQ Mode (Cine > 30FPS), Acquisition, VTR Playback



C013 STEP 3 AND UP SCREEN DISPLAY



C013 MORE INFO SCREEN DISPLAY

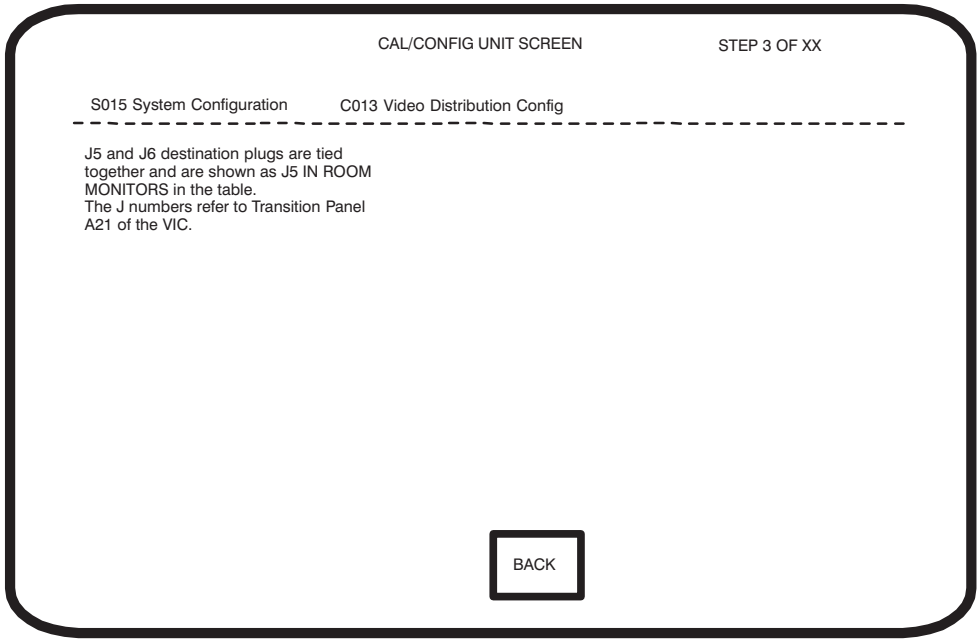


Illustration 185 – Modifying Video Distribution for Camtronics Video Plus (RTDM) (Record Modes > 30 fps)

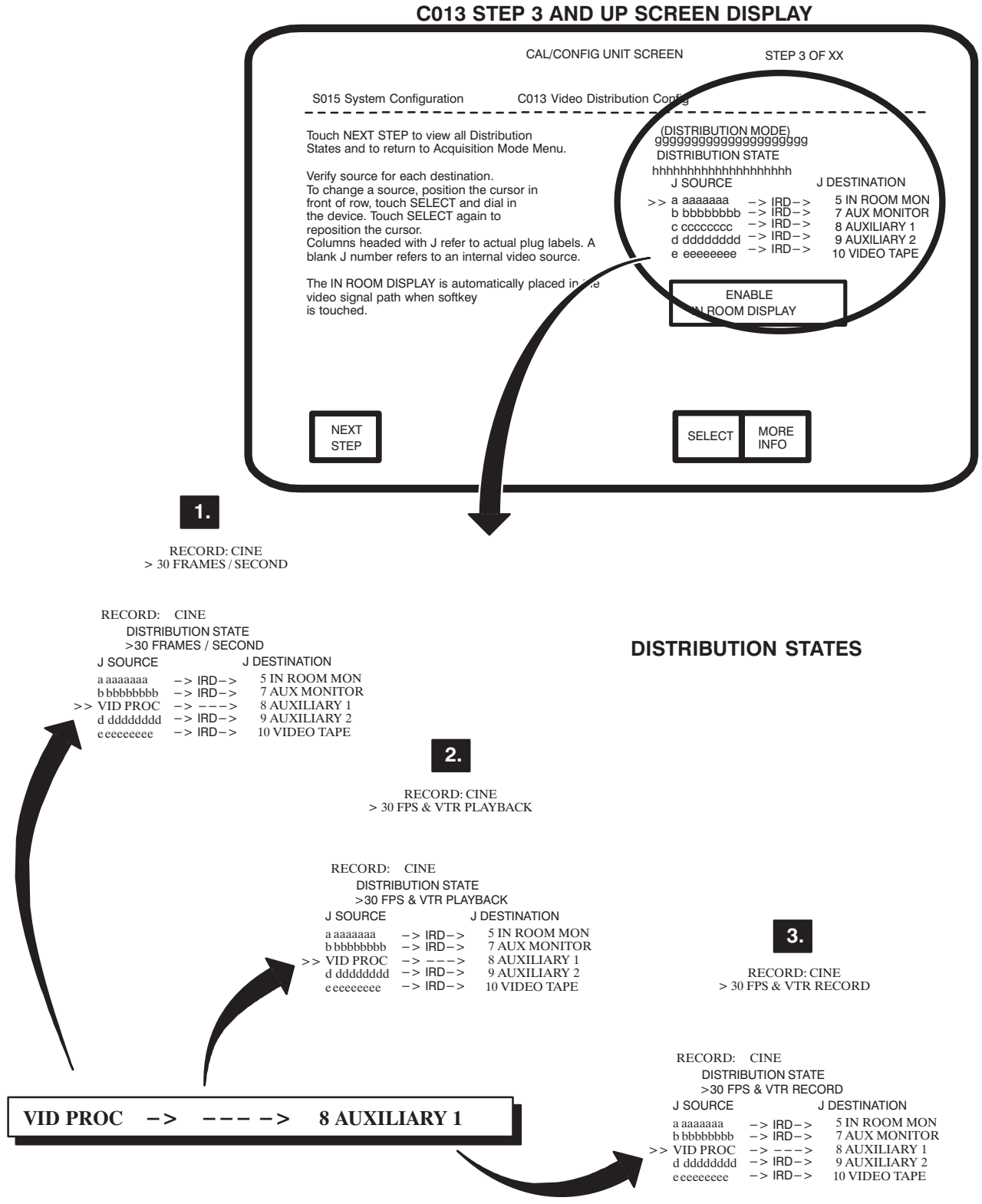
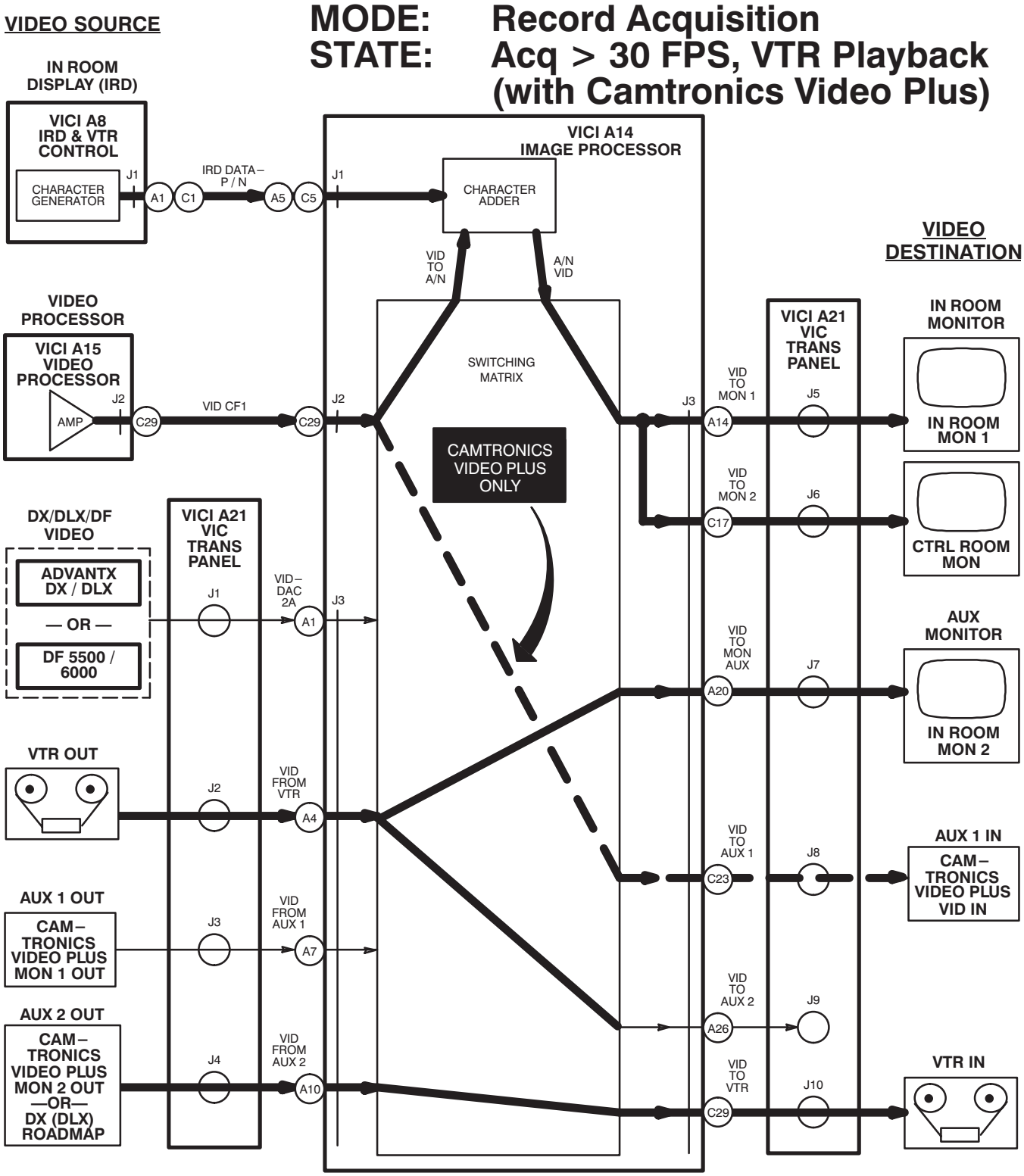


Illustration 186 – Example 2, Record ACQ Mode, ACQ >30 fps, VTR Playback (with Camtronics Video Plus [RTDM])



UNIT C014 – HUR Alarm

Time: x h xx min – Personnel: 1 field engineer

1 DESCRIPTION

Configuration Unit C014 is used to disable or select a heat units remaining (HUR) alarm that provide an audible signal at the console whenever the heat units remaining parameter of an x-ray tube drops to a specified level. When the alarm function is selected, the unit can also be used to set the heat unit remaining level at which the alarm is activated. Only one step is required to accomplish the configuration.

2 EQUIPMENT REQUIRED

None.

Note: Upon entering the unit for the first time, the default setting for alarm is OFF and a value of 20 is indicated for the HUR level. With alarm OFF the default HUR level can be disregarded.

3 CONFIG PROCEDURE

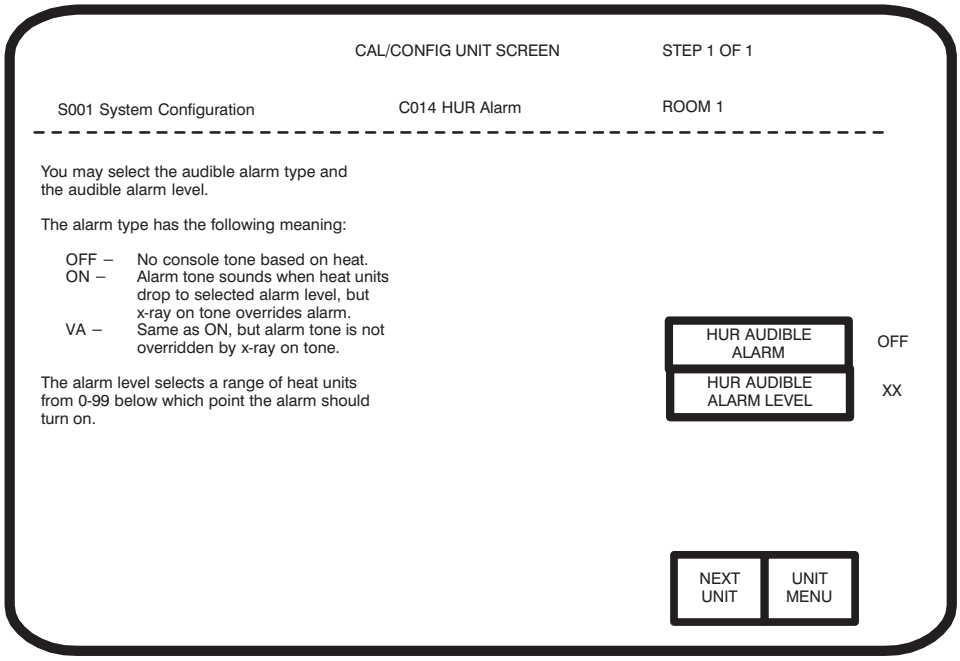
HUR alarm requirements are configured as follows:

- Touch the HUR AUDIBLE ALARM softkey. The softkey is highlighted and the console dial is enabled to provide the following selections:
  - OFF Disables HUR alarm. No console alarm tone will be activated based on heat units remaining.
  - ON Enables the HUR alarm. Alarm tone will be activated at the console whenever the heat units remaining parameter drops to a specified level. However, x-ray ON tone will override HUR alarm tone.
  - VA Same as ON selection, except x-ray ON tone will not override HUR alarm tone.

Note: If either ON or VA alarm is selected, you must establish the desired heat unit remaining level at which the alarm is activated or the default value of 20 will be entered.

- Touch the HUR AUDIBLE ALARM LEVEL softkey. Use the console dial to enter the heat unit remaining level (0-99) at which alarm activation is desired.
- Touch NEXT UNIT or UNIT MENU softkey to exit and proceed to the next configuration unit.

C014 SCREEN DISPLAY



UNIT C020 – Fluoro Configuration

Time: x h xx min – Personnel: 1 field engineer

1 DESCRIPTION

Configuration Unit C020 is used to set up the fluoroscopy configuration of an Advantx system. The unit permits selection of specific fluoro parameters when it is necessary to set up the system to meet special requirements such as state regulations covering normal fluoro and HLC (State of California for example).

The unit is subdivided into two procedures each of which has a special console screen presentation. The appropriate unit screen presentation is automatically displayed on the console screen according to the Imaging Module identified in prerequisite Config Unit C024.

- Procedure 1 applies to systems configured with the VIC Imaging Module.
- Procedure 2 applies to systems configured with an Imageur Imaging Module.

2 EQUIPMENT REQUIRED

None.

3 SPECIAL INSTRUCTIONS

Upon entry into the unit, the unit verifies that all database values for the fluoro configuration are within legal limits. If any database value is determined to be outside the legal limit, the error message “VALUE OUTSIDE NORMAL LIMITS WILL BE CHANGED ON EXIT” is displayed. Upon exit, the corrupt parameter(s) are reset to the default value(s) indicated in Table 102 and AUCUN LIEN .

Table 102 is for Legacy Phase 3 R&F systems, for biplane systems, and for newer software (i.e., ASC SW beginning with G4.XX) single plane LCA/LCV+/LC+ systems.

AUCUN LIEN is for Tilt–C systems, for pre–Legacy Phase 3 R&F systems, and for older software (i.e., ASC SW prior to G4.XX) single plane LCA/LCV+/LC+ systems.

Note: Special setup for New Zealand taper is available for Legacy Phase 3 R&F systems, for biplane systems, and for newer software single plane LCA/LCV+/LC+ systems per notes in Table 102.

However, at this time, the New Zealand taper is not available for Tilt–C systems, for pre–Legacy Phase 3 R&F systems, and for older software single plane LCA/LCV+/LC+ systems.

CAUTION **For Bi–plane Fluoro, the following parameters must be set the same on both planes: Detail, Rotation, Fluoro Type, Edge Enhance, Noise Filter, DX Variant, HLC, Auto Deselect, Auto Deselect delay, Audible Warning and Beep rate.**

Table 101 – Fluoro Config Default Parameters for all Vascular Systems Starting with ZID2 (G8.00 Software and Later Release)

PARAMETER	VALID SELECTIONS	DEFAULT VALUE
Dose Limit (High, Normal, Low)	See notes 5 & 6	100 % (See notes 5 & 6)
Tone (High, Medium, Low)	Off, On	Off (See note 7.)
Taper	(Displayed, but not selectable)	Maximal
Fluoro Spot	(Displayed, but not selectable)	Small
Min Fluoro kV	(Displayed, but not selectable)	60 kV
Max Fluoro kV	(Displayed, but not selectable)	120 kV
Default kV	60 to 120 kV	80 kV
Default Detail (See Note 9.)	Low, Normal, High	Normal (See notes 5 & 6)
Max Pulse Width	(Displayed, but not selectable)	7.5 msec
Field of View (FOV)	Normal, Mag1, Mag2, Mag3	Normal (See Note 2.)
VTR	Off, On	Off (See Note 3)
Rotation (See Note 8.)	Off, On	On (See Note 4.)
Fluoro Type (See Note 8.)	Conv, Pulscan, DX, DR, IDF	DX (See Note 1)
Noise Filter (See Note 8)	None, Low, Medium, High	None
DX Variant (See Note 8)	nosb/sb	nosb
Edge Enhance (See Note 8)	None, Low, Medium, High	None
HLC (See Note 8)	Enabled, Disabled	Disabled (Note 9)
Auto Deselect (See Note 8)	Enabled, Disabled	Enabled (Note 10)
Auto Deselect Delay (See Note 8)	0 to 300 seconds	0 (Note 11)
Audible Warning (See Note 8)	Enabled, Disabled	Enabled (Note 12)
Beep Rate (See Note 8)	Continuous or 0.5, 1, 1.5, 2 beep/second	0.5

Table 101 – Fluoro Config Default Parameters for all Vascular Systems Starting with ZID2 (G8.00 Software and Later Release) (Continued)

Note 1: If a component (e.g. Pulscan, IDF, etc.) is not configured, then it will not be displayed as a selection for Fluoro Type.

Note 2: When the image intensifier does not have a Mag3 mode, the Field of View (FOV) will not allow selection of Mag3.

Note 3: When VTR is not configured, the VTR entry will not be displayed or active.

Note 4: When there is no TV camera rotator, the Rotation entry will not be displayed or active.

Note 5: For all countries **EXCEPT** New Zealand: Set Dose Limit Normal for 100% and Low Dose Limit for 50%. (Dose Limit [High] is 100%, not selectable.) Set Default Detail for Normal.

Note 6: For New Zealand: Set Dose Limit (Normal, Low) for 50% or less. (Dose Limit [High] is 100%, not selectable.) Set Default Detail for Normal or Low.

Note 7: Set Tone (High, Medium, Low) for Off.

Note 8: On biplane systems, this parameter must be configured the same on both the frontal and lateral planes.

Note 9: The HLC Parameters should be set to ”Enabled” for all countries, except JAPAN, TAIWAN, AUSTRALIA, NEW ZEALAND, UK, SWITZERLAND, CZESK REPUBLIC where it shall be set to ”Disabled”.
In Spain and Italy, it is also recommended to set HLC to disabled. A possible alternative is to lower Fluoro II entrance doses and set them according to “German” specific settings (Euratom offers two alternatives: a limitation on the Skin Entrance Dose (Taper) or a limitation on the Fluoro II entrance Dose)

Note 10: The ”Auto Deselect ” parameter shall be set to ”Enabled” in the USA. It may be set to ”Disabled” in other countries, in case of serious customer issue.

Note 11: The ”Auto Deselect Delay ” parameter shall be set to ”0 seconds” in the USA. It is recommended to have it set to 60 seconds in all other countries.

Note 12: The ”Audible Warning” parameter shall be set to ”Enabled” in the USA. It may be set to ”Disabled” in other countries, in case of serious customer issue.

WARNING

COMPLIANCE TO IEC 601–2–43 STANDARDS REQUIRES TO HAVE SPECIFIC DEFAULT FLUORO PARAMETERS WHEN POWERING UP THE SYSTEM, RESETTING THE SYSTEM OR AFTER A CONSOLE OFF/ON. THEREFORE, DO NOT MODIFY DEFAULT VALUES IN C020 STEP 1 SCREEN FOR THE FOLLOWING PARAMETERS: KV, FOV, DETAIL, FLUORO TYPE, DX VARIANT, UNLESS OTHERWISE SPECIFIED BY APPLICABLE NOTES.

Table 102 – Fluoro Config Default Parameters for all NF2 and ZID1 Vascular Systems (G6 and G7 Software Releases)

PARAMETER	VALID SELECTIONS	DEFAULT VALUE
Dose Limit (High, Normal, Low)	See notes 5 & 6	100 % (See notes 5 & 6.)
Tone (High, Medium, Low)	Off, On	Off (See note 7.)
Taper	(Displayed, but not selectable)	Maximal
Fluoro Spot	(Displayed, but not selectable)	Small
Min Fluoro kV	(Displayed, but not selectable)	60 kV
Max Fluoro kV	(Displayed, but not selectable)	120 kV
Default kV	60 to 120 kV	75 kV
Default Detail (See Note 8.)	Low, Normal, High	Normal (See notes 5& 6)
Max Pulse Width	(Displayed, but not selectable)	7.5 msec
Field of View (FOV)	Normal, Mag1, Mag2, Mag3	Normal (See Note 2.)
VTR	Off, On	Off (See Note 3.)
Rotation (See Note 8)	Off, On	On (See Note 4.)
Fluoro Type (See Note 8)	Conv, Pulscan, DX, DR, IDF	DX (See Note 1.)
Noise Filter (See Note 8)	None, Low, Medium, High	None
DX Variant (See Note 8)	nosb/sub	nosb
Edge Enhance (See Note 8)	None, Low, Medium, High	None
HLC	Enabled, Disabled	Disabled (Note 9)
Auto Deselect	Enabled, Disabled	Enabled (Note 10)
Auto Deselect Delay	0 to 300 seconds	0 (Note 11)
Audible Warning	Enabled, Disabled	Enabled (Note 12)
Beep Rate	Continuous or 0.5, 1, 1.5, 2 beep/second	0.5

Table 102 – Fluoro Config Default Parameters for all NF2 and ZID1 Vascular Systems (G6 and G7 Software Releases) (Continued)

Note 1: If a component (e.g. Pulscan, IDF, etc.) is not configured, then it will not be displayed as a selection for Fluoro Type.

Note 2: When the image intensifier does not have a Mag3 mode, the Field of View (FOV) will not allow selection of Mag3.

Note 3: When VTR is not configured, the VTR entry will not be displayed or active.

Note 4: When there is no TV camera rotator, the Rotation entry will not be displayed or active.

Note 5: For all countries **EXCEPT** New Zealand: Set Dose Limit Normal for 100% and Low Dose Limit for 50%. (Dose Limit [High] is 100%, not selectable.) Set Default Detail for Normal.

Note 6: For New Zealand: Set Dose Limit (Normal, Low) for 50% or less. (Dose Limit [High] is 100%, not selectable.) Set Default Detail for Normal or Low.

Note 7: Set Tone (High, Medium, Low) for Off.

Note 8: On biplane systems, this parameter must be configured the same on both the frontal and lateral planes.

Note 9: The HLC Parameters should be set to ”Enabled” for all countries, except JAPAN, TAIWAN, AUSTRALIA, NEW ZEALAND, UK, SWITZERLAND, CZESK REPUBLIC where it shall be set to ”Disabled”.

Note 10: The ”Auto Deselect ” parameter shall be set to ”Enabled” in the USA. It may be set to ”Disabled” in other countries, in case of serious customer issue.

Note 11: The ”Auto Deselect Delay ” parameter shall be set to ”0 seconds” in the USA. It is recommended to have it set to 60 seconds in all other countries.

Note 12: The ”Audible Warning” parameter shall be set to ”Enabled” in the USA. It may be set to ”Disabled” in other countries, in case of serious customer issue.

Table 103 – Fluoro Config Default Parameters for Legacy Phase 3 R&F Systems, & for Newer Software SP LCA/LCV+/LC+ Systems, up to NF1: Titan Release G3 to G5

PARAMETER	VALID SELECTIONS	DEFAULT VALUE
Dose Limit (High, Normal, Low)	See notes 6 & 7.	100 % (See notes 6 & 7.)
Tone (High, Medium, Low)	Off, On	Off (See note 8.)
Taper	(Displayed, but not selectable)	Maximal
Fluoro Spot	(Displayed, but not selectable)	Small
Min Fluoro kV	(Displayed, but not selectable)	60 kV
Max Fluoro kV	(Displayed, but not selectable)	120 kV
Default kV	60 to 120 kV	75 kV
Default Detail (See Note 9.)	Low, Normal, High	Normal (See notes 6 & 7.)
Max Pulse Width	(Displayed, but not selectable)	7.5 msec
Field of View (FOV)	Normal, Mag1, Mag2, Mag3	Normal (See Note 3.)
VTR	Off, On	Off (See Note 4.)
Rotation (See Note 9.)	Off, On	On (See Note 5.)
Fluoro Type (See Note 9.)	Conv, Pulscan, DX, DR, IDF	DX (See Notes 1 & 2.)
Noise Filter (See Note 9.)	None, Low, Medium, High	None (See Note 1.)
DX Variant (See Note 9.)	None, LIH, RDMP	None (See Note 1.)
Edge Enhance (See Note 9.)	None, Low, Medium, High	None (See Note 1.)

Note 1: When DX is not configured, the Noise Filter, Edge Enhance, and DX Variant entries will not be displayed or active. The Fluoro Type entry will not allow selection of DX. When Edge Enhance is not configured, the Edge Enhance line is not displayed or active. When Roadmap is not configured, the RDMP entry is not selectable in DX Variant.

Note 2: If a component (e.g. Pulscan, IDF, etc.) is not configured, then it will not be displayed as a selection for Fluoro Type.

Note 3: When the image intensifier does not have a Mag3 mode, the Field of View (FOV) will not allow selection of Mag3.

Note 4: When VTR is not configured, the VTR entry will not be displayed or active.

Note 5: When there is no TV camera rotator, the Rotation entry will not be displayed or active.

Note 6: For all countries **EXCEPT** New Zealand: Set Dose Limit (Normal, Low) for 100%. (Dose Limit [High] is 100%, not selectable.) Set Default Detail for Normal.

Note 7: For New Zealand: Set Dose Limit (Normal, Low) for 50% or less. (Dose Limit [High] is 100%, not selectable.) Set Default Detail for Normal or Low.

Note 8: Set Tone (High, Medium, Low) for Off.

Note 9: On biplane systems, this parameter must be configured the same on both the frontal and lateral planes.

Table 104 – Fluoro Config Default Parameters for Tilt–C Systems, for Pre–Legacy Phase 3 R&F Systems, & for Older Software SP LCA/LCV+/LC+ Systems

PARAMETER	VALID SELECTIONS	DEFAULT VALUE
Dose Limit (High, Normal, Low)	(Displayed, but not selectable)	100 %
Tone (High, Medium, Low)	(Displayed, but not selectable)	Off
Taper	(Displayed, but not selectable)	Maximal
Fluoro Spot	(Displayed, but not selectable)	Small
Min Fluoro kV	(Displayed, but not selectable)	60 kV
Max Fluoro kV	(Displayed, but not selectable)	120 kV
Default kV	60 to 120 kV	75 kV
Default Detail	Low, Normal, High	Normal
Max Pulse Width	(Displayed, but not selectable)	7.5 msec
Field of View (FOV)	Normal, Mag1, Mag2, Mag3	Normal (See Note 3.)
VTR	Off, On	Off (See Note 4.)
Rotation	Off, On	On (See Note 5.)
Fluoro Type	Conv, Pulscan, DX, DR, IDF	DX (See Notes 1 & 2.)
Noise Filter	None, Low, Medium, High	None (See Note 1.)
DX Variant	None, LIH, RDMP	None (See Note 1.)
Edge Enhance	None, Low, Medium, High	None (See Note 1.)

Note 1: When DX is not configured, the Noise Filter, Edge Enhance, and DX Variant entries will not be displayed or active. The Fluoro Type entry will not allow selection of DX. When Edge Enhance is not configured, the Edge Enhance line is not displayed or active. When Roadmap is not configured, the RDMP entry is not selectable in DX Variant.

Note 2: If a component (e.g. Pulscan, IDF, etc.) is not configured, then it will not be displayed as a selection for Fluoro Type.

Note 3: When the image intensifier does not have a Mag3 mode, the Field of View (FOV) will not allow selection of Mag3.

Note 4: When VTR is not configured, the VTR entry will not be displayed or active.

Note 5: When there is no TV camera rotator, the Rotation entry will not be displayed or active.

4 CONFIG PROCEDURE 1 SYSTEMS WITH VIC IMAGING MODULE

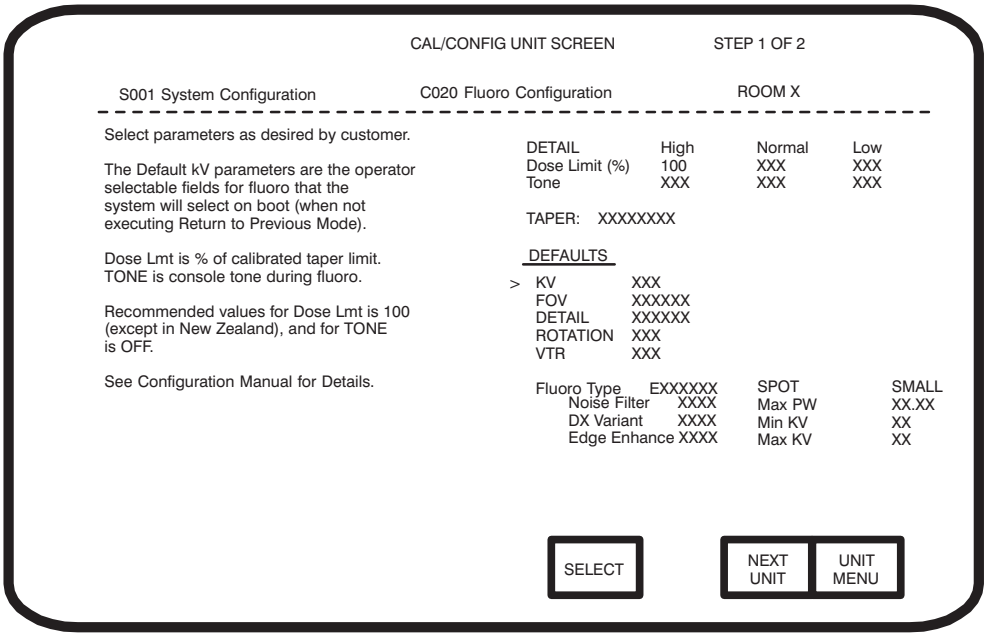
- If a change to a parameter is desired, use the console dial to position the cursor opposite the parameter to be changed.
- Touch the SELECT softkey and use the console dial to scroll through the selections pertaining to the parameter until the desired selection is indicated.
- Touch the SELECT softkey again to enter the selection.
- Repeat the above procedure as applicable to the other parameters you want to change.
- Touch the NEXT UNIT or UNIT MENU softkey to exit. The message “Updating NVRAM” is displayed while the unit values are being stored in the database.

5 CONFIG PROCEDURE 1 FOR VASCULAR SYSTEMS WITH VIC IMAGING MODULE, STARTING WITH NF2

The last bullet must read:

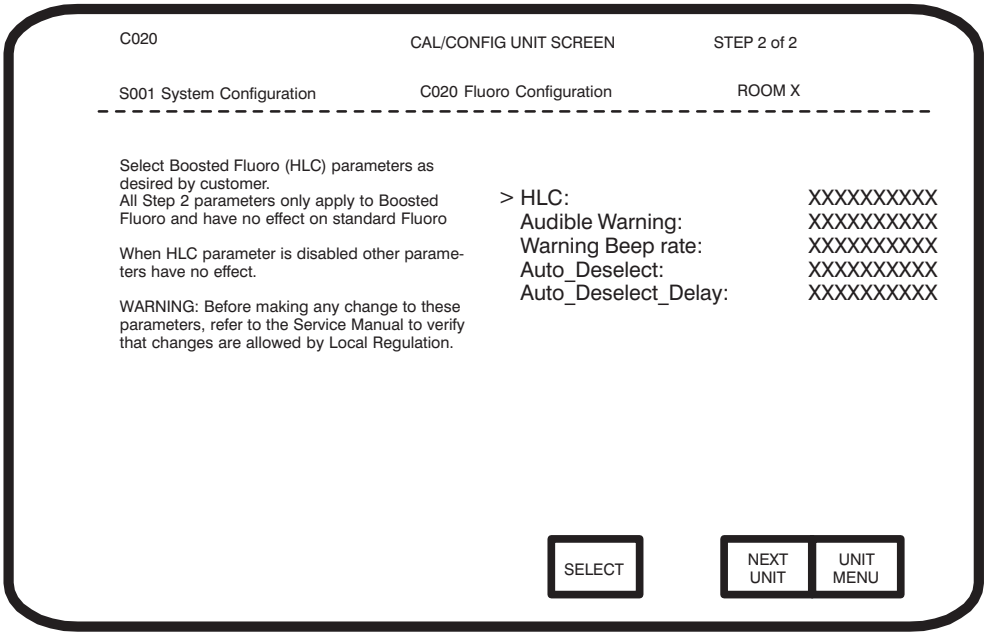
- Touch the NEXT STEP softkey to proceed to next step.

C020 STEP 1 SCREEN DISPLAY
(LEGACY PHASE 3, BIPLANE &
NEWER SW SP LCA/LCV+/LC+ SYSTEMS)



Note: The defaults that appear depend upon system configuration.

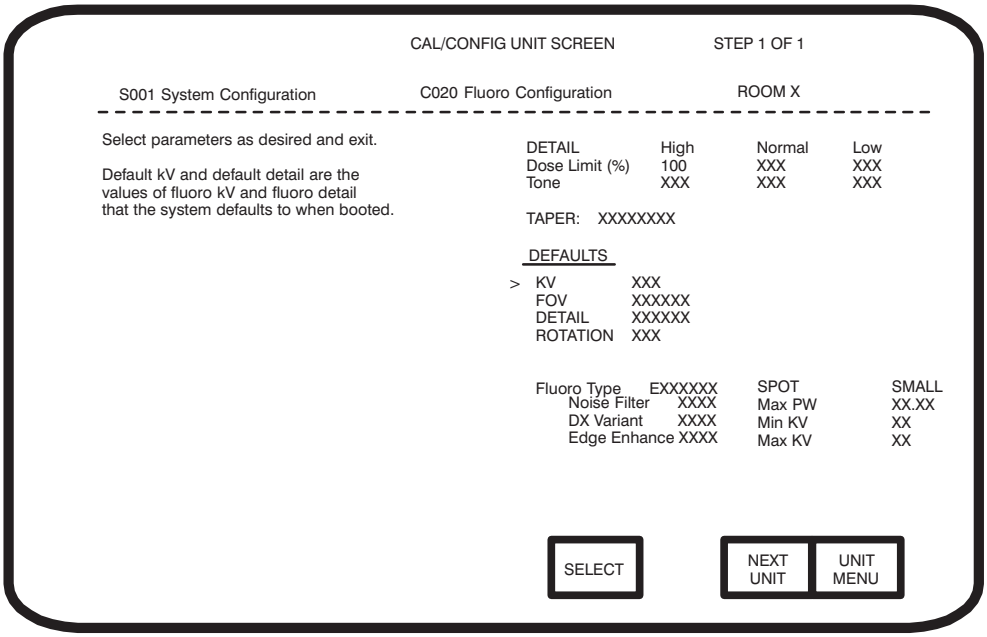
C020 STEP 1 SCREEN DISPLAY
(LEGACY PHASE 3, BIPLANE &
NEWER SW SP LCA/LCV+/LC+ SYSTEMS)



Note: HLC parameters are not applicable to Tilt–C systems. Therefore, select Disabled for HLC on Tilt–C systems.

Note: HLC parameters can take two values: Enabled and disabled
Audible Warning can take two values: Enabled and disabled
Warning Beep rate can take five values: Continuous, 0.5 beeps/second, 1 beep/second, 1.5 beeps/second, 2 beeps/second,
Auto_Deselect can take two values: Enabled and Disabled
Auto_Deselect_Delay can take any value from 0 to 300 seconds, by steps of 1 second.

C020 STEP 1 SCREEN DISPLAY
(TILT–C, PRE–LEGACY PHASE 3 &
OLDER SW SP LCA/LCV+/LC+)

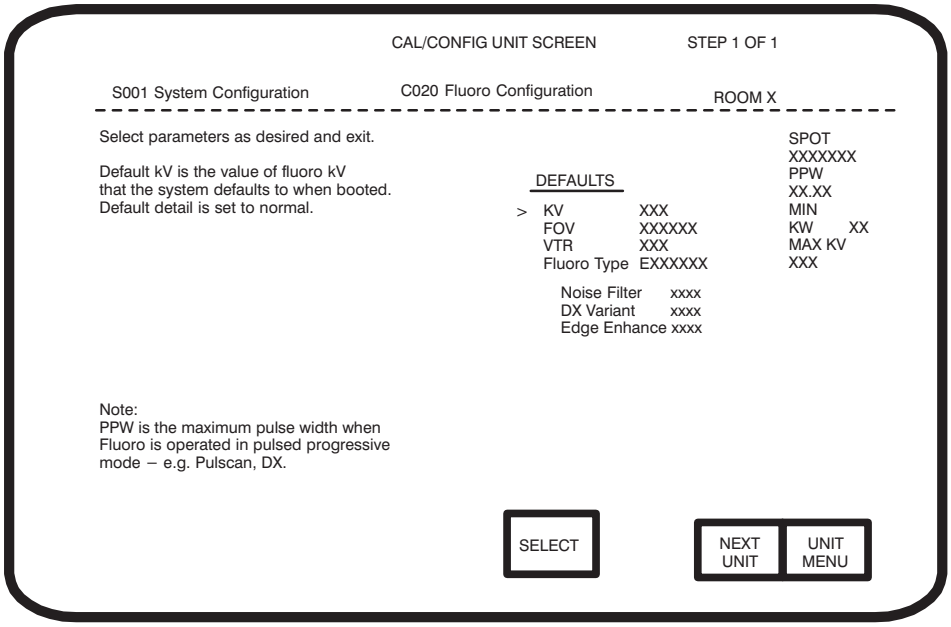


Note: The defaults that appear depend upon system configuration.

6 CONFIG PROCEDURE 2 – SYSTEMS WITH IMAGEUR IMAGING MODULE

- If a change to a parameter is desired, use the console dial to position the cursor opposite the parameter to be changed.
- Touch the SELECT softkey and use the console dial to scroll through the selections pertaining to the parameter until the desired selection is indicated.
- Touch the SELECT softkey again to enter the selection.
- Repeat the above procedure as applicable to the other parameters you want to change.
- Touch the NEXT UNIT or UNIT MENU softkey to exit. The message “Updating NVRAM” is displayed while the unit values are being stored in the database.

C020 STEP 1 SCREEN DISPLAY (SYSTEMS WITH IMAGEUR)



Blank page.

UNIT C025 – AEC Configuration

Time: x h xx min – Personnel: 1 field engineer

1 DESCRIPTION

Configuration Unit C025 is used to program a film screen/film speed combination for each of the following AEC Function Labels; DETAIL, SLOW, MEDIUM, and FAST. The actual screen/speed combinations assigned are based on customer preference at the site.

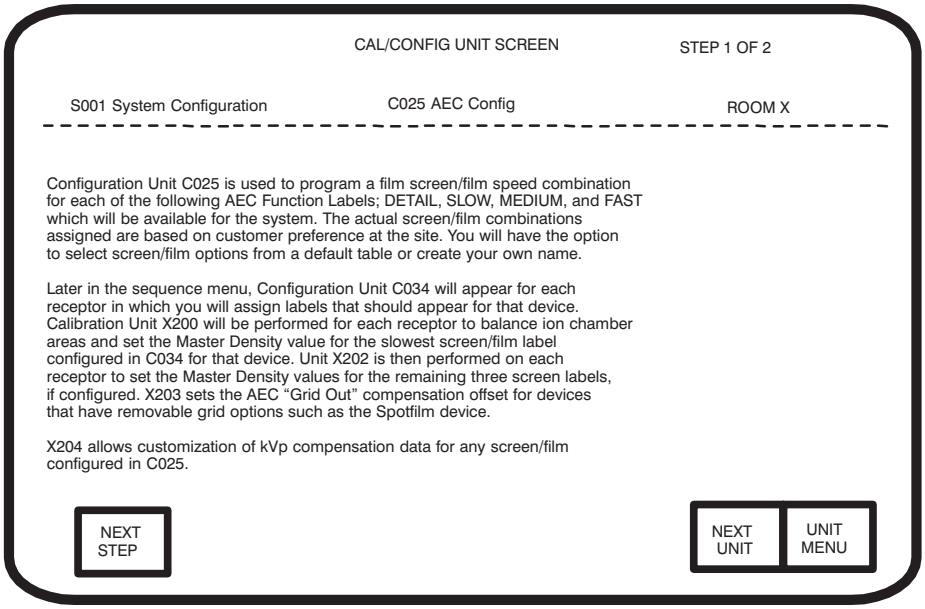
2 EQUIPMENT REQUIRED

None.

3 CONFIG PROCEDURE

3-1 Step 1 of 2. Information Screen

C025 STEP 1 SCREEN DISPLAY



3-2 Step 2 of 2. Assigning Labels

- Touch the SCREEN TYPE softkey for the desired label.
- Use the console dial to scroll through the intensifier screen types until the desired screen type is displayed for each function label . Default intensifier screen selections are as follows:

Lanex Regular	Cronex Hi Plus	Other
Lanex Medium	Quanta III	None
Lanex Fast	Xomatic Reg	

Note: The source of the screen/film and system speed information is displayed directly below each label. When “Deflt” is displayed, the screen/film and system speed information that is displayed for that label is from the default selections outlined above. When “NV Ram” is displayed, the screen/film and system speed information that is displayed for that label is from the NV Ram, where the configuration and calibration information is stored in an Advantx system. The position of this is shown as “cccccc” in the step 2 display.

Note: The user may develop a custom screen by selecting “OTHER” for the screen type. A typewriter screen will allow the user to enter a name for the new screen after deselecting the screen type softkey. A flat response kVp compensation data curve (Lanex Regular) is used as default for the new screen. The response of this curve is able to be changed in X204 (kVp compensation cal unit).

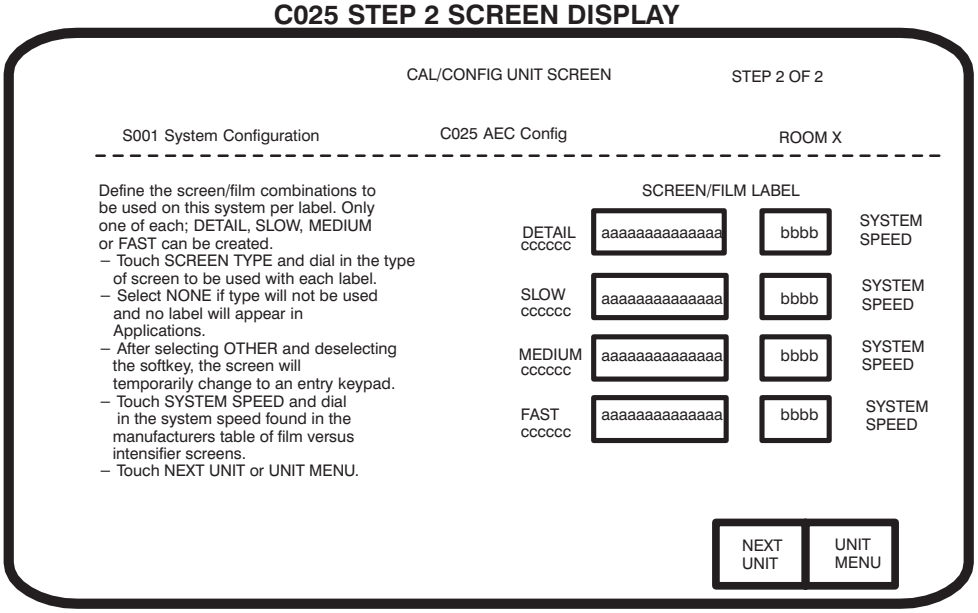
- If the DETAIL, SLOW, MEDIUM, or FAST label will not be used on the system, select NONE. Selecting NONE will eliminate the label from applications.
- Refer to Table 105, Screen/Film Speed Tables given in this unit or to the actual manufacturers table of film versus intensifier screens to determine the appropriate film speed.
- Touch SYSTEM SPEED softkey for the desired label.
- Use the console dial to scroll through the screen/film speeds available (0–to–1200, in increments of 5) until the proper selection is displayed.
- Touch NEXT UNIT or UNIT MENU softkey to exit.

Note: For a single receptor, The dynamic range of the ion chamber is such that the ratio between the fastest screen/film speed to the slowest screen/film speed cannot exceed 8:1. (i.e. if the slowest screen/film combination used is 50, then the fastest combination that you can use on this same ion chamber system is 400).

If this ratio is greater than 8:1, an error message is displayed and exit from the unit is prohibited.

Note: A maximum number of 14 characters/spaces are allowed for SCREEN TYPE and 4 for SYSTEM SPEED.

C025 STEP 2 SCREEN DISPLAY



C025 TYPEWRITER SCREEN DISPLAY

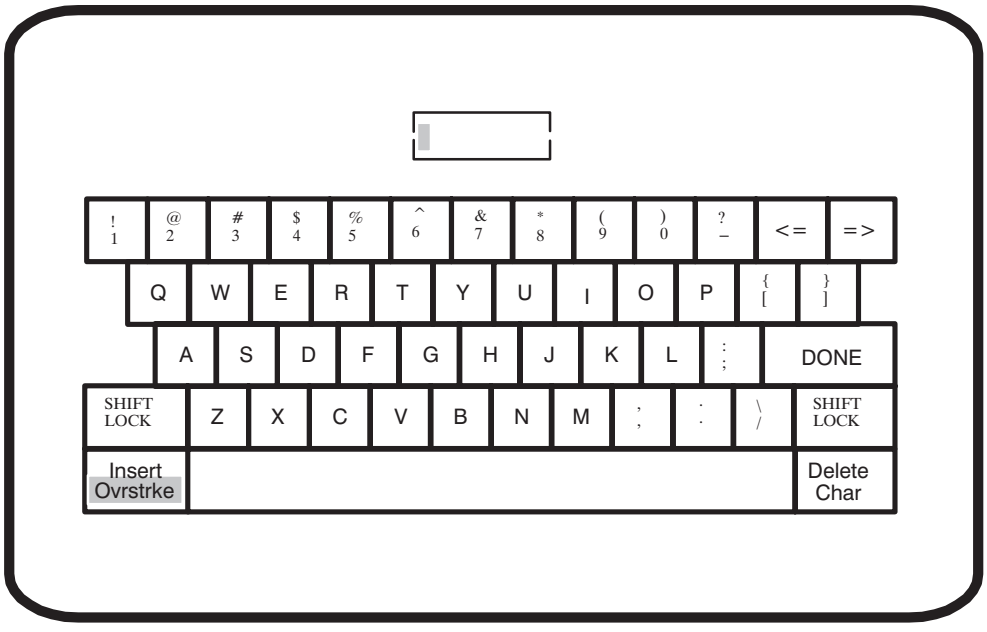


Table 105 – Screen/Film Speed Tables

DUPONT	Cronex SP	QUANTA III	QUANTA II	HI-PLUS	PAR	U–V Rapid	U–V Fast Detail	U–V Detail
CRONEX 4	200	800	400	250	100	–	–	–
CRONEX 7,7L	–	400	200	100	–	–	–	–
CRONEX 10T	–	–	–	–	–	–	–	–
Ultra–Vision G/L	–	–	–	–	–	400	200	100

DUPONT	QUANTA RAPID	QUANTA SUPER RAPID	Lightning Plus	QUANTA DETAIL	QUANTA FAST DETAIL	QUANTA V		
CRONEX 4	800	1200	320	100	–	–		
CRONEX 4L	–	–	–	–	400	–		
CRONEX 6 +	–	–	–	100	–	–		
CRONEX 7,7L	–	–	–	64	250	–		
CRONEX 8,8L	–	–	–	–	–	400		
CRONEX 10T	400	600	–	–	–	–		
CRONEX 10, 10L	–	–	–	–	250	–		

KODAK	X-OMATIC FINE SCREEN	X-OMATIC REGULAR SCREEN	MEDIUM SPEED CAWO4	HIGH SPEED CAWO4		
X-OMAT K	30	200	100	250		
X-OMAT RP	30	200	100	250		
X-OMAT L	30	200	100	250		
X-OMAT G	20	100	–	–		

Table 105 – Screen/Film Speed Tables (Continued)

KODAK FILM	KODAK LANEX FINE SCREEN 60 KV	KODAK LA-NEX FINE SCREEN 80–120 KV	KODAK LA-NEX MEDIUM SCREEN	KODAK LA-NEX REGULAR SCREEN (GREEN SENSITIVE)	KODAK LA-NEX FAST SCREEN	KRUPPA SCREEN (BLUE SENSITIVE)
T-MAT G	80	100	300	450	600	200
T-MAT L	80	100	300	400	600	200
T-MAT H	–	–	600	800	1200	400
T-MAT C	–	–	300	400	600	–
ORTHO G	80	100	250	400	600	200
ORTHO H	–	–	500	800	1200	–
ORTHO L	80	100	250	400	600	200
ORTHO C	–	–	250	400	–	200
ORTHO M	SINGLE SCREEN 40	–	–	–	–	–
MIN-R	20	–	–	–	–	–
NMB	25	–	–	–	–	–

AGFA	MR100	MR200	MR400	MR800	FIN	Universal	Special	
Curix RP1, RP1 L	100	200	400	800	50	100	200	
Curix MR4	70	100	200	400	–	–	–	

AGFA	Curix Ortho Fine	Curix Ortho Medium	Curix Ortho Regular	Curix Ortho Fast				
Curix Ortho G	80	300	400	600				
Curix Ortho l	80	300	400	600				
Curix Ortho ST–G	80	300	400	600				
Curix Ortho ST–L	80	300	400	600				

Table 105 – Screen/Film Speed Tables (Continued)

Fuji	GF–1	GM–1	GH–1	GX–1	BF–III	BM–III	BH–III	BX–III	Special
HR–G	100	200	400	600	–	–	–	–	–
HR–L	100	200	400	600	–	–	–	–	–
HR–C	100	200	400	600	–	–	–	–	–
HR–H	200	400	800	1200	–	–	–	–	–
RXO–G	100	200	400	600	–	–	–	–	–
RX	–	–	–	–	70	100	200	250	400
RX–L	–	–	–	–	70	100	200	250	400
RX–G	–	–	–	–	35	50	100	125	400
RX–U					35	50	100	125	200

UNIT C034 – AEC Labels

Time: x h xx min – Personnel: 1 field engineer

1 DESCRIPTION

Configuration Unit C034 is used to assign AEC Labels for film/speed combinations to each receptor in a system having an ion chamber. There are four AEC Labels that can be enabled for each receptor in the system (DETAIL, SLOW, MEDIUM, FAST). Any combination may be assigned to a receptor.

Note: S001, System Configuration sequence menu, presents the unit once for each receptor (w/ion chamber) used in the system. Only the AEC Labels covering the screen/film speed combinations defined in Configuration Unit C025 are displayed on the unit screen.

2 EQUIPMENT REQUIRED

None.

3 CONFIG PROCEDURE

Upon entering the configuration unit, any previously defined AEC Labels and their corresponding film speed and intensifier screen type are displayed on the screen in reverse video. If necessary to change an assignment, perform the following procedure:

- Touch the desired AEC label softkeys (DETAIL, SLOW, MEDIUM FAST) that you want to be applicable to the receptor. Touching a highlighted softkey will disable a selection. Touching an unhighlighted softkey will enable a selection.
- After each selection, the system will automatically calculate a new relative film screen gain for the AEC label selected. The dynamic range of the ion chamber is such that the ratio between the fastest screen/film speed to the slowest screen/film speed cannot exceed 8:1. (i.e. if the slowest screen/film combination used is 50, then the fastest combination that you can use on this same ion chamber system is 400).

  If this ratio is greater than 8:1, an error message is displayed and exit from the unit is prohibited.

DYNAMIC RANGE OF THE SYSTEM SPEEDS EXCEEDED, SEE MORE INFO

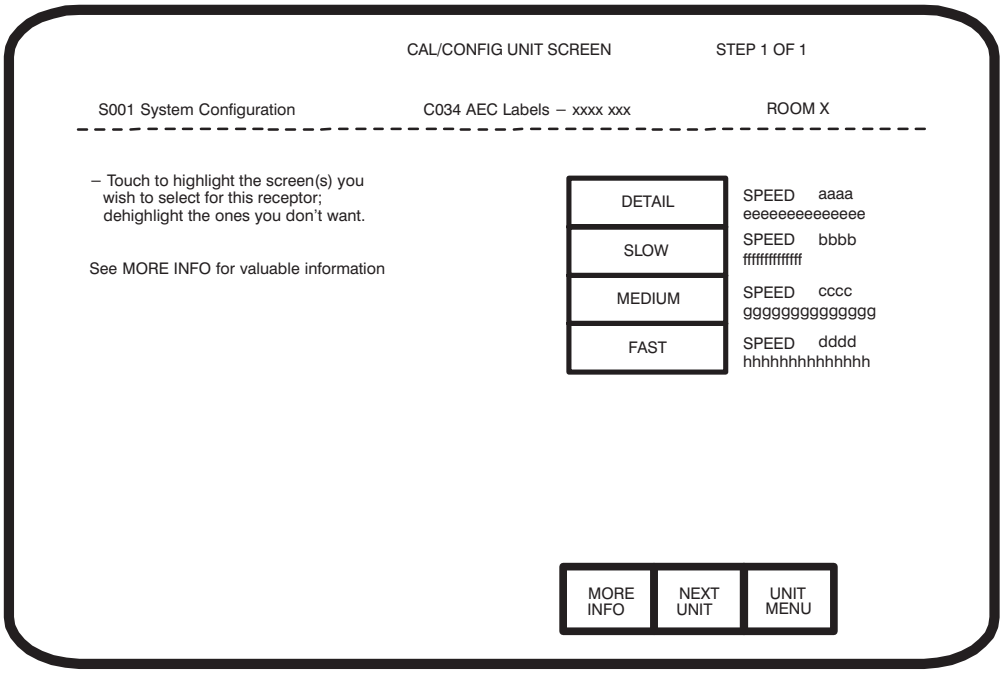
- Touch MORE INFO softkey to access the MORE INFO screen for instructions covering corrective action. Make the necessary adjustments or re-definitions for proper AEC operation.
- After making selections and/or re-definitions only those AEC labels selected for the receptor being configured should be highlighted.



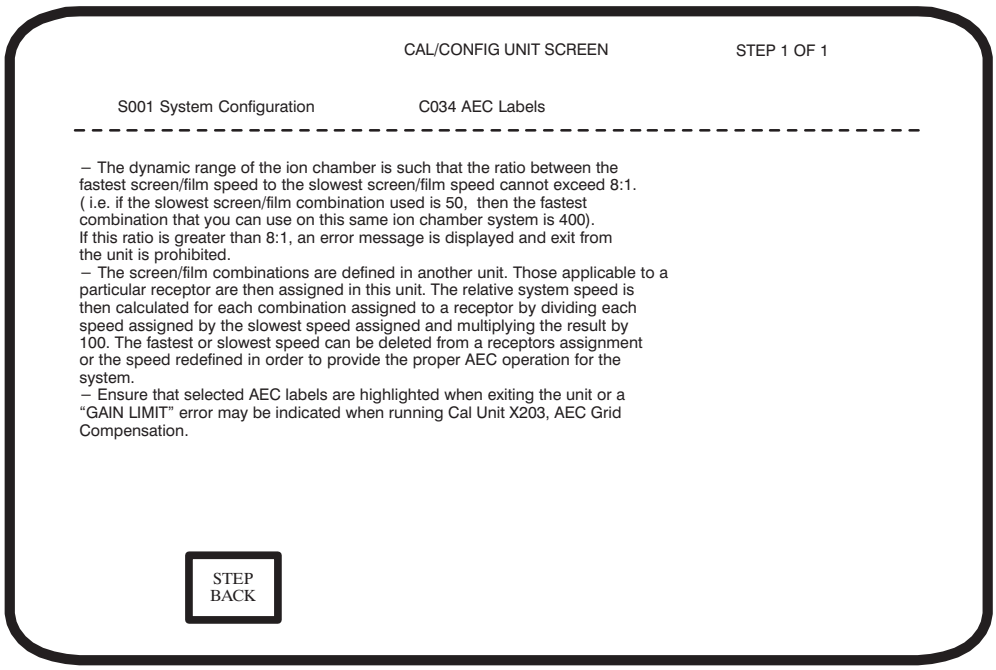
Ensure that selected AEC labels are highlighted when exiting the unit or a "GAIN LIMIT" error may be indicated when running Cal Unit X203, AEC Grid Compensation.

- Touch NEXT UNIT or UNIT MENU softkey to exit. An "Updating NV Database" message is displayed while the configuration data is being loaded into the system.

C034 SCREEN DISPLAY



C034 MORE INFO SCREEN DISPLAY



Configuration Units

Notepad

Units C004 – C034

Unit	Note

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REVISION HISTORY

REV	DATE	REASON FOR CHANGE	PAGES
0	Aug. 25, 1995	Initial product release.	
1	Dec 15, 1995	Includes SPR fixes from pilot lot SCAT.	
2	Jan. 19, 1996	Added kV waveforms to R020.	
3	Apr. 12, 1996	Updated cal units R003, R020, V056, V069, X006, X102, X110, and X220.	
4	Oct. 17, 1996	Carmen M4 release.	
5	Feb. 6, 1997	Updated X011 and C004 for MX150 TH.13 (V3) x–ray tube.	
6	Feb. 21, 1997	Revised to include combined software for LCA, LCV+, LC+, Tilt–C, Tilt–C Vascular, and Legacy R&F systems. This revision combines the units from calibration users guides 2138868–100 (Legacy) and 2120227–100 (Tilt–C).	
7	May 5, 1997	Updated C006, C007, C009, C010, C013, D005, P119, P404, P551, R013, R022, T006, T009, V050, V053, V062, V063, V072, X100, X104, X107, X120, X123, X130, X133 and X140 for LC+.	
8	July 21, 1997	Updated C004, C006, C009 (Corrected CF Input Signal for Saticon A), C013, P019, R017, V056, X105, X107, X120, X121, X122, X123, X130, X131, X140, X141, and X233.	
9	Nov. 26, 1997	Release for Carmen M5. Updated C013, C020, R003, R013, X011, X101, X107, X121, X123, X131, X133, X141, X143, X233, P107, P313, and V072. Added new unit V001. Resolved SPR's BUCge24574, BUCge26450, BUCge28581, BUCge29001, BUCge29330, BUCge32007, and XRYge24655.	
10	Feb. 27, 1998	Release for LCN+/LCLP+ M3 and Legacy Phase 3 M3. Updated T009, T014, R005, R013, R018, R021, R024, P102, P103, P313, P508, X001, X004, X006, X011, X100, X101, X102, X104, X105, X107, X110, X120, X121, X122, X123, X130, X131, X132, X133, X140, X141, X143, X200, X209, X212, X217, X220, X222, X225, X233, S007, V001, V004, V012, V020, V021, V051, V053, V059, V062, V064, V065, V066, V068, V070, V072, C006, C020. Added new units P126 and T015. Resolved sprs BUCge21604, BUCge30393, XRYge23162, XRYge25470, XRYge25756.	

REV	DATE	REASON FOR CHANGE	PAGES
11	June 12, 1998	Release for LCN+/LCLP+ M4 and Legacy Phase 3 M4. Updated requirements for PC tool (Section 1–3), resolving CQA981871. Updated Section 2–4 Power Up Sequence. Resolved SPR XRYge25829. Updated T015, R005, R013, R017, R018, R021, R024, R025, P102, P103, P508, X001, X004, X006, X100, X101, X104, X105, X107, X110, X120, X121, X122, X130, X131, X132, X200, X209, X212, X217, X220, X222, X225, X233, V001, V003, V004, V012, V020, V021, V051, V053, V059, V062, V064, V065, V066, V068, V070, V072, C020.	
12	July 29, 1998	Added XQ1585 PUT to V050, V053, V062, V065, V072 and C009.	
13	Nov. 12, 1998	Updated for ASC software G4.XX. Updated Section 1–7. Updated R003, V004, V021, V065, V072, P508, X101, X107, X121, X123, X131, X133, X143, X233, C006, C020.	
14	April 15, 1999	Updated for positioning tool (Section 4–8), Secton 9 (Taper and SID: X1xx), Section 12–5 and 12–8.	
15	July 7, 1999	Updated per SPR BUCge 41758 for Fluoro values in Secton 9 (X100, X101, X120, X121), per SPR BUCge 40231 for changed tolerance (DX130, DX131) and Table 12–12 in Section 12. Added text on X152 screen display.	
16	November 15, 1999	Updated V056, R013, C020, X131, V001.	
17	January 17, 2000	Updated as per SPRs XRYge29444 and XRYge29439.	
18	April 26, 2000	New scope ZID1M4. T015, X107, X123, X133, X213, X214, X233. Also BUCge48910: T015 added FRU list.	
19	May 10, 2000	Updated X107, X233, X209, T015 per BUCge53732.	
20	May 24, 2000	Updated X107, X123, X133, X233 per BUCge54246 (Dose levels for Germany).	
21	June 5, 2000	Corrected P038, Step 2, in Sec. 7 per CQA 1003532.	
22	June 13, 2000	Updated T015, X107, X123, X133, X209, X211, X214 and X233 as per SPR BUCge54771	
23	Sept. 20, 2000	Updated P040, Lateral and Longitudinal Cassette Damping Adjustment.	
24	January 2001	Updated for ZID2 Program with Integration of IQSO changes. Updated X225 as per SPR BUCge46243	
25	February 2001	– C020: default fluoro values updated with SPR B60564 – Texts updated with SPR BUCge61923/61120 for new japanese regulation	

REV	DATE	REASON FOR CHANGE	TOTAL PAGES
26	June 2001	New presentation: Creation of a Jobcard for each Cal Unit.	Volume 1 (594) and Volume 2 **1200**
27	January 2002	C020: default fluoro values updated to be compliant to IEC.	Volume 1 (594) and Volume 2 **1200**
28	March 2, 2004	Values in tables and text modified	Volume 1 (594) and Volume 2 **1200**
29	April, 2004	Values updated in X101, X130, X150 screen display. Screenprint errors corrected.	Volume 1 (594) and Volume 2 **1200**
30	December, 2004	Notice added in X107, X123, X133 and X233	Volume 1 (594) and Volume 2 **1200**
31	March 2006	Note added in X225 (SPR EURge 40357)	Volume 1 (594) and Volume 2 **1200**

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