



***GE Medical Systems***

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# **Technical Publications**

**Direction 2176911–100**

**Revision 3**

## **IDF Calibration Procedure**

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**Operating Documentation**



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- CE MANUEL DE MAINTENANCE N'EST DISPONIBLE QU'EN ANGLAIS.
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- VERSUCHEN SIE NICHT, DAS GERÄT ZU REPARIEREN, BEVOR DIESES KUNDENDIENST-HANDBUCH NICHT ZU RATE GEZOGEN UND VERSTANDEN WURDE.
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- O NÃO CUMPRIMENTO DESTA AVISO PODE POR EM PERIGO A SEGURANÇA DO TÉCNICO, OPERADOR OU PACIENTE DEVIDO A CHOQUES ELÉTRICOS, MECÂNICOS OU OUTROS.

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- 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.
- SI PROCEDA ALLA MANUTENZIONE DELL'APPARECCHIATURA SOLO DOPO AVER CONSULTATO IL PRESENTE MANUALE ED AVERNE COMPRESO IL CONTENUTO.
- NON TENERE CONTO DELLA PRESENTE AVVERTENZA POTREBBE FAR COMPIERE OPERAZIONI DA CUI DERIVANO LESIONI ALL'ADDETTO ALLA MANUTENZIONE, ALL'UTILIZZATORE ED AL PAZIENTE PER FOLGORAZIONE ELETTRICA, PER URTI MECCANICI OD ALTRI RISCHI.

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## Direction 2176911–100

### Revision 3

# IDF Calibration Procedure

## 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**  
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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.

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**REVISION HISTORY**

| <b>REV</b> | <b>DATE</b>    | <b>REASON FOR CHANGE</b>   |
|------------|----------------|--|
| A          | Dec. 7, 1996   | Preliminary release. (Created from Service Note 3682.)   |
| 0          | Dec. 12, 1996  | Initial release.   |
| 1          | Dec. 17, 1996  | Added procedures to remove VIC1 A8 board in Section 4 and to replace VIC1 A8 board in Section 9. |
| 2          | Jan. 9, 1998   | Remove Section 9–2, Gamma Correction, as per SPR BUCge26318.                                     |
| 3          | April 29, 1999 | Modified Table 3, as per SPR BUCge38199  |

**LIST OF EFFECTIVE PAGES**

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## SECTION 1 APPLIES TO

Rev. 5 and above IDF systems, part number 2121080 (as identified on the CMT sticker).

## SECTION 2 PURPOSE

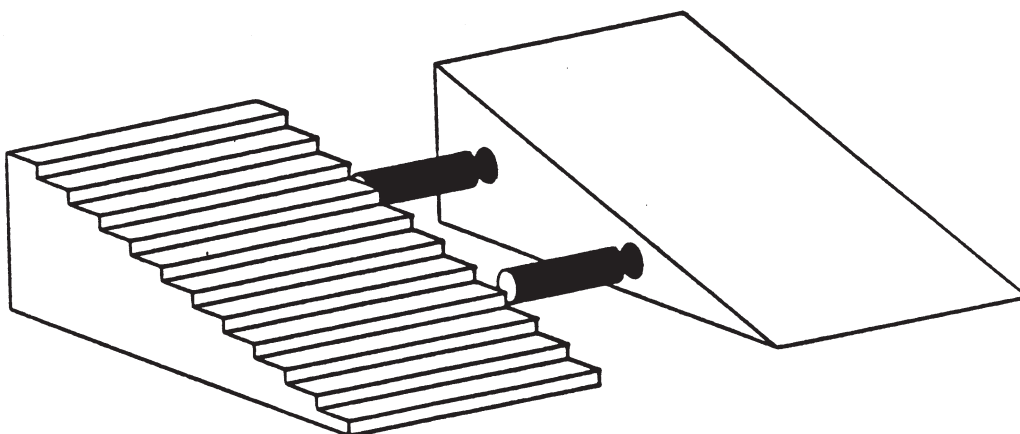
### Note:

The IDF is factory calibrated to provide a unity gain with a 0.7V video input signal (white 700mV, black 50mV – measured relative to blank). It may be necessary to perform calibration after replacement of EAPU, EDTU or AEEU boards.

## SECTION 3 REQUIRED EQUIPMENT

- Digital storage oscilloscope
- IDF step and linear ramp phantom (see Illustration 1)
- 1/32 inch (0.7938 mm) copper plate from the CV phantom
- 5–7 mm French catheter, normally available in Cardio/Angio sites

ILLUSTRATION 1  
IDF STEP AND LINEAR RAMP PHANTOM



## SECTION 4 SYSTEM CONFIGURATION

1. Select Service Mode Unit C024 (Image Module Configuration) and turn off In-Room Display (IRD)(IN ROOM DISPLAY = NONE).

2. Remove the VIC1 A8 board from VIC module:
  - Turn off console
  - Turn off VIC module
  - Pull the VIC1 A8 board from the VIC module
  - Turn on the VIC module and wait for module to boot up
  - Turn on the console
3. Return to Applications software.
4. Select a DLX Application (VASCULAR or DYNAMIC ANGIO).
5. From the fluoro adjust screen select:
  - IDF Fluoro
  - 9 inch (228.6 mm) FOV for 9 inch Image Intensifiers; 12 inch (305 mm) FOV for 12 and 16 inch IIs
  - 70 kVp Fluoro

## SECTION 5

### LOGGING PARAMETERS

The IDF system is shipped with the Final Test Report, where information regarding factory calibrations for nine parameters is found. Log the nine parameters from this report in Appendix B, page B-1 of the Final Test Report. These parameters are to be used if it becomes necessary to reload the parameters information. A description of all parameters is located in Appendix A of the Final Test Report. To verify values:

1. Put the Lexan service key on top of the IDF console to access the alphanumeric keyboard.
2. Turn system(s) on. A self-test runs for about 20 seconds before the system(s) go to the bypass mode. If any errors are detected, the system returns to bypass mode and locks itself.
3. Access the Utilities Menu:
  - Monoplane or frontal plane, press [CMND] [U] [2] [5] [5] [ENTER] on the RCU.
  - Lateral plane, press [CMND] [U] [2] [5] [4] [ENTER].
4. The Utilities Main Menu is displayed:
  - [1] NOVRAM Parameters Handling
  - [2] Disk Directory Handling
  - [3] Installation
  - [4] Diagnostics
  - [5] Communications
  - [6] Self Test
5. Check that all calibration parameters for each screen match those of the Final Test Report.

#### 5-1 Default Parameter Changes

1. From the Utility Menu select [1] NOVRAM Parameters Handling.

2. Press [5] Angio–Room Parameters.
3. Make changes to the Default parameters listed in Table 1.

**Note:** To make changes, use the arrow keys to select the appropriate parameter and enter the recommended value.

TABLE 1  
ANGIO PARAMETERS

| PARAMETERS | VALUE | DESCRIPTION   |
|------------|-------|---|
| ACQ–A      | :2    | AMOUNT OF NOISE REDUCTION WITH THE FNR FILTER. INCREASING THE VALUE TO 3 WILL RESULT IN LESS NOISE IN FLUORO AT THE EXPENSE OF LAG. |
| SUB–A      | :2    | AMOUNT OF NOISE REDUCTION IN SECOND PASS OF ROADMAP PROTOCOL (DURING SUBTRACTION AFTER INJECTION). SET TO SAME VALUE AS ACQ–A.      |
| PRE–A      | :5    | AMOUNT OF NOISE REDUCTION IN FIRST PASS OF ROADMAP PROTOCOL. THIS IS SET TO MAXIMUM NOISE REDUCTION.                                |
| ACQ–M      | :2    | MOTION DETECTION THRESHOLD. MAINTAIN AT 2.  |
| SUB–M      | :2    | MOTION DETECTION THRESHOLD IN SECOND PASS OF ROADMAP PROTOCOL. SET TO SAME VALUE AS ACQ–M.  |
| PRE–M      | :3    | MOTION DETECTION THRESHOLD IN FIRST PASS OF ROADMAP PROTOCOL. THIS IS SET TO HIGHEST VALUE.   |

4. Press [ENTER] to return to the previous menu.
5. Press [7] Common Parameters.
6. Make changes to the Default parameters listed in Table 2.

TABLE 2  
COMMON PARAMETERS

| PARAMETER | VALUE | DESCRIPTION  |
|-----------|-------|--|
| A–NORM–EN | :6    | ENERGY OF SPATIAL EDGE ENHANCEMENT FILTER IN NOSUB MODE. |
| A–SUB–EN  | :6    | ENERGY OF SPATIAL EDGE ENHANCEMENT FILTER IN SUB MODE.   |
| B–NORM–EN | :6    |  |
| A–NORM–WD | :8    | WIDTH OF SPATIAL EDGE ENHANCEMENT FILTER IN NOSUB MODE.  |
| A–SUB–WD  | :8    | WIDTH OF SPATIAL EDGE ENHANCEMENT FILTER IN SUB MODE.    |
| B–NORM–WD | :8    |  |

**For Neuro applications, the filter values have been optimized. Refer to Table 3, below.**

TABLE 3  
NEURO APPLICATION PARAMETERS

| PARAMETER | FILTER |        |      |
|-----------|--------|--------|------|
|           | LOW    | MEDIUM | HIGH |
| A-NORM-EN | 8      | 11     | 15   |
| A-SUB-EN  | 8      | 11     | 15   |
| B-NORM-EN | 8      | 11     | 15   |
| A-NORM-WD | 2      | 2      | 2    |
| A-SUB-WD  | 2      | 2      | 2    |
| B-NORM-WD | 2      | 2      | 2    |

According to Customer needs and/or feedback, select the appropriate Filter.

## SECTION 6 IDF CONFIGURATION

1. Move the cursor to DO-CALIB parameter using the arrow keys. Hit [SPACE] to change from 0 to 1.
2. Hit [ENTER]. The display returns to the NOVRAM Parameters Handling sub-menu
3. Enter selection [3]. TV Chain Parameters screen is displayed.
4. Move cursor to LEFT-GAP parameter using the arrow keys. Change the value to 2.
5. Press [ENTER] 2 times to return to the Utilities Main menu.

## SECTION 7 X-RAY ROOM SET-UP

### 7-1 Gray Scale Setup

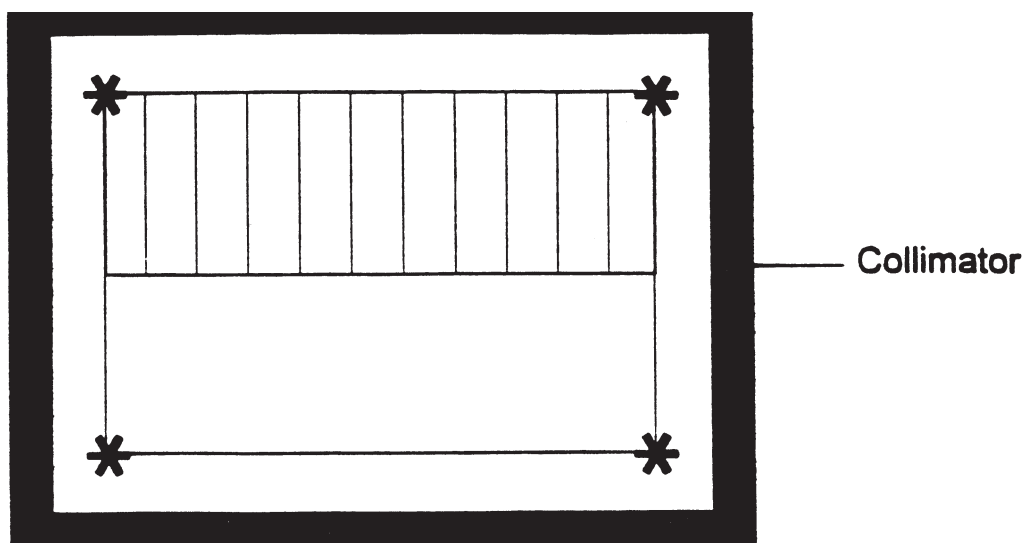
1. Make selection [3] then select [1] for EAPU calibration.
2. Select Option [2] DAC A and B setting in the EAPU calibration menu.
3. Connect oscilloscope to monitor A video and set:
  - Vertical – 200 mV/div.
  - Horizontal – 5  $\mu$ seconds/div.
4. Verify that the blanking-white level measures 700mV. If necessary, adjust by pressing [A] (for monitor A), key in new value, and press [Enter]. The system will update the waveform automatically.
5. Repeat Steps 1 through 4 for monitor B.

**Note:** For additional information regarding utilities software, see Appendix A in the IDF Service Manual.

**7-2 Phantom Position**

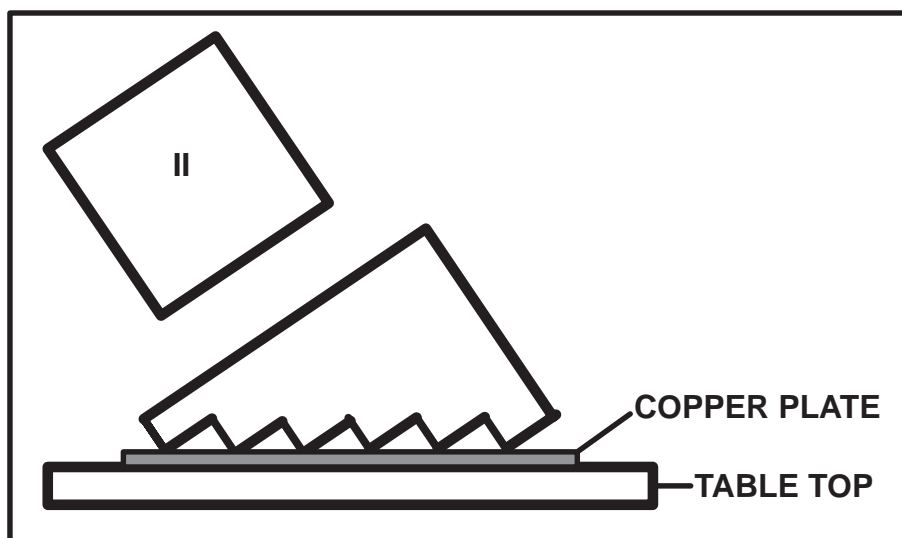
1. Press [ENTER] four times (until monitor display goes blank) to exit utilities.
2. Set the SID to 100 cm.
3. Place a 1/32 inch copper plate under the step phantom.
4. Position the phantom upside down with the thick end on the right side of the image and the steps above the ramp as shown in Illustration 2 (as viewed on the monitor).

ILLUSTRATION 2  
PHANTOM IN X-RAY SETTINGS



5. Prop up the thin side of the phantom to make it level with the table, or position the gantry pivot to  $-22^\circ$  (see Illustration 3).

ILLUSTRATION 3  
PHANTOM WITH GANTRY PIVOT SET TO  $-22^\circ$ .



6. Fluoro to center phantom, adjusting table height and position until left and right edges of phantom are tangent to the asterisks.

**Note:** Since DO-CAL parameter was set to 1, four location asterisks will be displayed throughout the procedure.

## SECTION 8

### FLUORO MODE CALIBRATION

**Note:** During the calibration procedure, the filter MUST be off. Make sure that the filter LED on the RCU is in the off position. Select LIH to view the IDF image.

#### 8-1 Set IDF Parameters

1. Go to the Utilities Menu [CMND] [U] [2] [5] [5] [ENTER] for monoplane or frontal plane, or [CMND] [U] [2] [5] [4] [ENTER] for lateral plane.
2. Select [1] NOVRAM Parameters Handling from the Utilities Main Menu.
3. Select [7] Common Parameters. The Common Parameters should be:
  - NOIS\_TRSH = 1
  - LUT\_TYPE = 0
4. Press [ENTER].
5. Press [5] to select Angio-Room parameters.
6. Set ACQ-A = 5.
7. Press [ENTER] twice.

#### 8-2 Fluoro Gain Bias Protocol

1. Position EDR switch/jumper on the VIC1 A14 board to OFF/B to disable Advantx EDR.
2. Make selection [3] then select [1] for EAPU calibration. The EAPU CALIBRATION-FLUORO menu is displayed:
  - [1] Bypass
  - [2] DAC A & B Setting
  - [3] Gain/Bias (of selected FS)
  - [4] Anti-blooming LUT (of selected FS)
  - [5] Logarithmic table (of selected FS)
  - [6] Select FTSW type

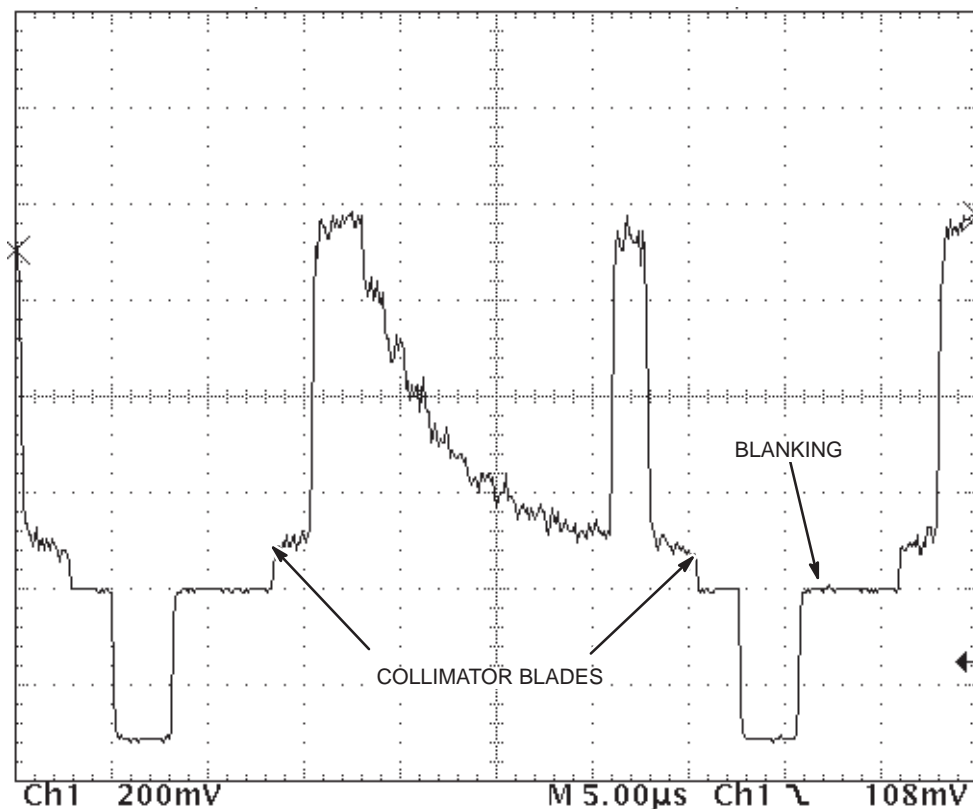


3. Select Option [4] Anti-blooming LUT.
4. Select [C] for Calibrate.
5. Press [S] to set default Look Up Table.
6. Press [Enter].
7. Press [Y] (for yes) to confirm.
8. Press [Enter] 4 times to exit Utilities.

### 8-3 Evaluation Of No Sub Calibration Results

1. Select Conv. Fluoro on the Advantx console.
2. Take a fluoro exposure with the oscilloscope connected to the monitor, capturing the gray scale horizontal line.
3. Save waveform for comparison using "Save Reference Function" if available. See Illustration 4.

ILLUSTRATION 4  
CONV FLUORO SAMPLE WAVEFORM



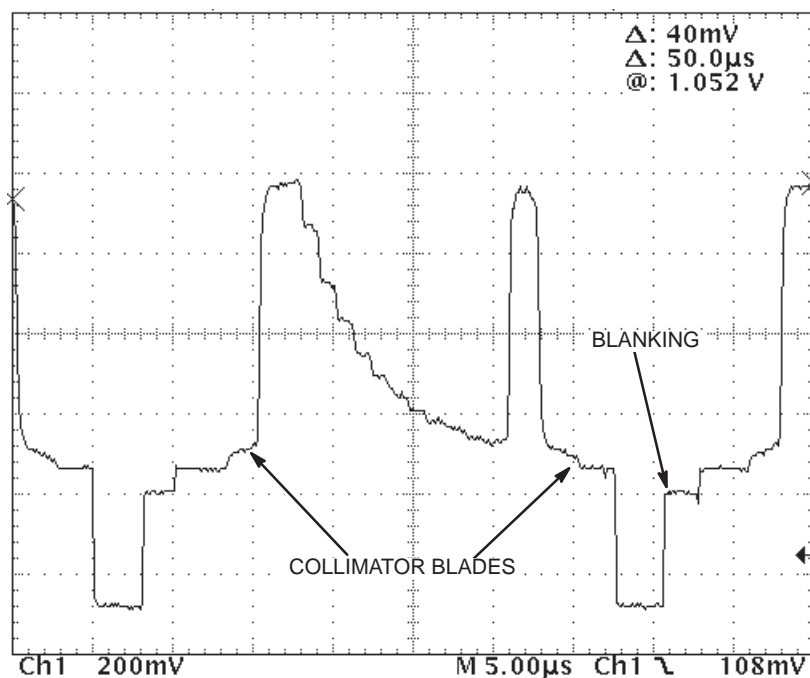
4. Select IDF Fluoro on the Advantx console, LIH, and turn off filters on the IDF RCU.
5. Select NO SUB mode on the IDF RCU.

**Note:**

Every time you exit the Utility Mode the filter and LIH function returns to their default state. Do not forget to switch the filter off, LIH on, and select the NO SUB mode.

6. Acquire a fluoro image for about 10 seconds, capturing the gray scale horizontal line with the scope connected to the monitor. See Illustration 5.

ILLUSTRATION 5  
IDF FLUORO SAMPLE WAVEFORM



7. Compare waveforms on scope. If the waveforms match go to Step 9 If the waveforms do not match go to Step 8
8. Change the FLR-GAIN and FLR-BIAS in the TVCHAIN parameters to adjust the IDF waveform.
  - Go to the Utilities Menu [CMND] [U] [2] [5] [5] [ENTER] for monoplane or frontal plane, or [CMND] [U] [2] [5] [4] [ENTER] for lateral plane.
  - Select [1] NOVRAM Parameters Handling, [3] TVCHAIN Parameters.
  - Increase the FLR-GAIN to decrease the amplitude;
  - Increase FLR-BIAS to increase the offset.

**Note:**

CONV. FLUORO peak white may not match IDF peak white. Ignore the highest peaks and match only the step portion of the waveform.

9. Press [ENTER] three times to exit the Utilities Menu and repeat Steps 1 through 8 until both waveforms match.
10. Go to the Utilities Menu [CMND] [U] [2] [5] [5] [ENTER] for monoplane or frontal plane, or [CMND] [U] [2] [5] [4] [ENTER] for lateral plane.
11. Select [1] NOVRAM Parameters Handling, [3] TVCHAIN Parameters.
12. Set FLR–SGAIN to match FLR–GAIN and FLR–SBIAS to match FLR–BIAS.
13. Press [ENTER] three times to exit the Utilities Menu.

## SECTION 9

### FLUORO SUBTRACTED PROTOCOLS: SUB, ROADMAP

Subtracted image quality is directly dependent on the LOG correction performed on acquired images. The following procedures are implemented to optimize LOG correction.

#### 9-1 LOG Table Calibration

The goal of this procedure is to calibrate the LOG parameters so that after logarithmic correction, a straight line over the entire dynamic range is achieved on the IDF phantom image.

1. Set the phantom as shown in Illustration 3.
2. Go to the Utilities Menu [CMND] [U] [2] [5] [5] [ENTER] for monoplane or frontal plane, or [CMND] [U] [2] [5] [4] [ENTER] for lateral plane.
3. Select [1] NOVRAM Parameters Handling.
4. Select [3] TV Chain Parameters. Set FLR\_WIDTH to 0.
5. Select [5] Angio Parameters and make a note of the original value for ACQ–A.
6. Set ACQ–A = 5 in [5] Angio Parameters.
7. Press [ENTER] three times to exit the Utilities Menu.
8. Select NO SUB mode and filter off on the RCU.
9. Acquire a fluoro image for about 10 seconds.
10. Go to the Utilities Menu [CMND] [U] [2] [5] [5] [ENTER] for monoplane or frontal plane, or [CMND] [U] [2] [5] [4] [ENTER] for lateral plane. Select [3] Installation.
11. Select [1 ] EAPU calibration sub–menu.
12. Select Option [5] LOG Table. The image acquired in Step 9 is displayed on the monitor.
13. Press [P] to display the profile of the original data. Make sure that the profile is taken over the phantom's ramp. The analysis line can be moved using the arrows. Hold and maintain the arrow to move faster up or down.
14. Press [ENTER] to exit profile (The profile is still displayed).

15. Press [C] (calibrate) and then [S] (default). This will set fluoro LOG parameters to (viewed at the top left corner of the screen):
  - $x = 2$
  - $G = 55$
16. Press [ENTER] and the Confirm exit [ Y/N] message appears on the screen. Press [Y].
17. Press [ENTER] three times to exit the Utilities Menu.
18. Acquire a new fluoro image for about 10 seconds.
19. Go to the Utilities Menu [CMND] [U] [2] [5] [5] [ENTER] for monoplane or frontal plane, or [CMND] [U] [2] [5] [4] [ENTER] for lateral plane.
20. Select [3] [1] [5] to get to the logarithmic table in EAPU calibration panel.
21. Press [L] (LOG XFER) to activate the LOG correction on the displayed image. The phantom image will be significantly brighter. This indicates a logarithmic conversion of the displayed image. Be sure to press [L] only one time.
22. Exit Utilities.

**Note:**

Segment Correction (Section 9-2) should not be executed unless an optimum linearity correction is required.

23. Test the results by operating SUB and check the subtraction quality by moving the 5F catheter over all 11 steps of the phantom. The apparent width and contrast of the catheter should remain constant over the entire range.
24. Select [1] [5] Angio parameters sub-menu.
25. Restore ACQ-A to the value listed in Table 1.
26. Select [7] to enter the Utilities panel.
27. Change DO-CALIB parameter in COMMON PARAMETERS screen to 0.
28. Exit Utilities.
29. Enable ADVANTX EDR by positioning the EDR switch/jumper on the VIC A14 board to ON/A.
30. Select Service Mode Unit C024 (Image Module Configuration) and turn on IRD display (IN ROOM DISPLAY = ON)..
31. Replace the VIC1 A8 board in the VIC module:
  - Turn off console.
  - Turn off VIC module.
  - Install the VIC1 A8 board into the VIC module.
  - Turn on the VIC module and wait for module to boot up.
  - Turn on the console.

## 9-2 Segment Correction

**Note:** Perform one or two segment corrections (Steps 1 through 5) if some curvature still exists on the LOG corrected profile.

1. Acquire a fluoro image and evaluate the segment of the LOG profile where additional correction is required.
2. Move the cursor to read the index values at the beginning and end of the profile segment that requires correction.
3. Enter the beginning value at P1 and the end value at P2. P1 is the lower and P2 is the higher index value.
4. Enter the curve correction value at E12.

**Note:** A 128 value will give a linear response (no correction), while values over and under 128 produce negative (below linear) or positive (above linear) arcs, respectively.

5. Use a second set of parameters (P3, P4 and E34; same as P1, P2 and E12, respectively) if curve correction is required at two different (or superimposed) segments. A new iteration of Segment and X correction may be necessary to achieve the best results.

## 9-3 X: Setting Curve Starting Point

When optimum slope angle and maximum linearity are obtained:

1. Modify the X parameter on the (C) calibration menu to set the curve start point.
2. Use X values from 0 to 20 to reduce the noise (when data on the thick side of the phantom is noisy) by changing the entry level into the LOG conversion table. Cut off collimator data and noise, but keep all data of the phantom visible.

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