GE Medical Systems

Technical Publications

2114806

Revision 7

ADVANTX IDF sm Service Manual

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1.0 INTRODUCTION

1.1 IDF Overview

IDF is a digital image processing system designed to extend the advantages of digital technology to conventional fluoroscopy.

IDF, activated by ADVANTX and controlled by a touch-sensitive keypad (Remote Control Unit), acquires video signals from the VIC that provides a high resolution signal (1249 lines in Europe. 1023 in U.S.).

IDF's unique software improves the image by enhancing contrast and reducing noise, and displays the real-time, processed image on two video monitors. The user can select the fluoro mode, edge filter, usage of second monitor and last image hold operations that are explained fully in the User's Manual.

IDF's main features include:

- DOSE REDUCTION: IDF's proprietary noise reduction software combines heavily-weighted- averaging with a unique motion detection capability. In this way, fluoroscopic images acquired at very low dosages can be greatly enhanced while avoiding the blurring (due to the natural motion of body organs) that is typical of heavily-averaged images.
- LAST IMAGE FREEZE: Contributing to dose reduction, the currently displayed image is automatically "frozen" in memory and displayed on the video monitor each time the foot switch is released. Intermediate results can be evaluated.
- ROADMAPPING: This feature provides a quick and convenient tool for interventional procedures such as PTA, since it allows clear visualization of both the blood vessel and the catheter, During the first roadmapping phase, IDF generates the maximum opacificated image of a vessel. In the second phase the image from the previous phase is automatically reversed black/white so the vessel shows as a white "roadmap" against a clean subtracted background. The averaged real-time fluoroscopic image is then superimposed *on* the "roadmap" and the inserted catheter clearly shows up as black within the white vessel.
- SUBTRACTION: This feature provides a real time subtracted image which allows clear visualization of the blood vessel. A mask image of the anatomy is captured and then subtracted from the live image containing the contrast material. The result is a clear image of the vessel, without the anatomy.
- a REAL-TIME EDGE ENHANCEMENT: This feature enhances the contours of the arteries or small vessels. The user can turn it on and

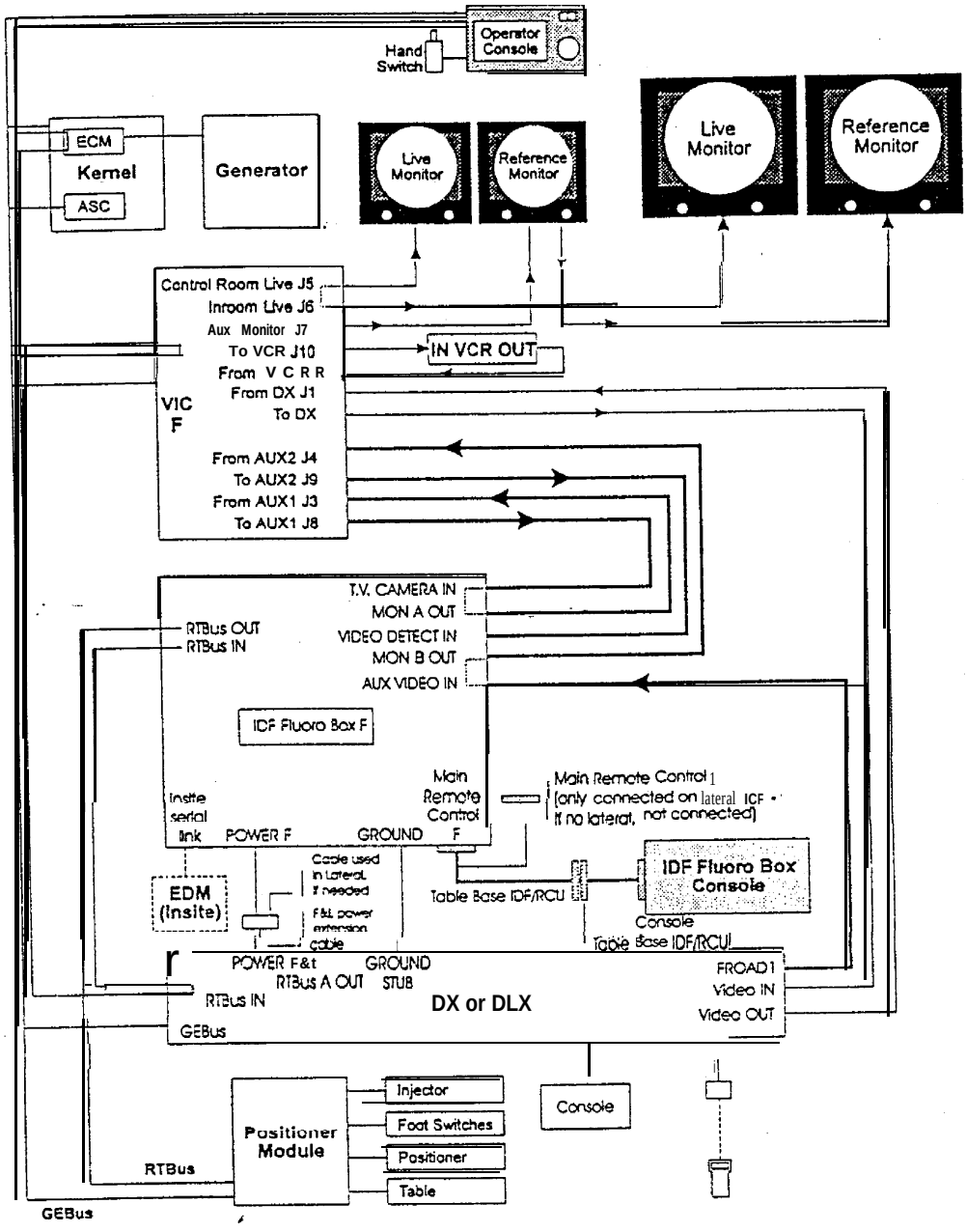


Figure I-I: IDF Image Processing System

1.2 Technical Specifications

Video Input:	RS-343 or RS-343A (1023 or 1249 TV lines)
S/N Ratio:	Better than 54dB (pk -pk) video to RMS noise
A/D Converter:	
Resolution:	10 bits
Sampling Rate:	20 MHz
Video Bandwidth:	-3dB at 8 MHz
Video Input Level:	1 Vp-p composite
Number of inputs:	3 (Camera In, Auxiliary In, Video Detection)
Fluoro Rate:	30 (25) fr/sec
Video Output:	RS-343 or RS-343A (1023 or 1249 TV lines)
Output Ports:	2 for two TV monitors
Video Bypass:	Dual bypass, automatic at power off
Image Format:	1024 lines x 1024 pixels(interpolated)
Real-time Image Processing:	
Averaging:	Real time with motion detection
Real-time Analog Edge Enhancement:	Adjustable strength and width programmable parameters
Logarithmic Subtraction:	Real-time DSA

Operating Conditions:

Line Voltage:	2 1 O-240 VAC
Frequency:	48-63 Hz
Ambient Temperature:	25°F-95°F (5°C-35°C)
Relative Humidity:	20% to 80%, non-condensing
Power Consumption:	5oow
Fuse:	3ASB X 2

Mechanical:

Electronic Unit:

Dimensions (HxWxD):	9.3" x 17.5" x 20.3" (23.5cm X 43cm X5 1.5cm)
Weight:	50.6 lbs (23 Kg)

RCU:

Dimensions (HXWXD):	10" X 8.5" X 1.4" (25.5cm X 2 1.5cm X 3.5cm)
Weight:	2.4 Ibs (1.1 Kg)

GE Medical **Systems** reserves the right to change specifications without prior notice.

1.3 Safety Conventions and Regulations

1.3.1 SAFETY CONVENTIONS

DANGER — WILL RESULT l-N SEVERE INJURY IF THE INSTRUCTIONS ARE NOT FOLLOWED.

WARNING — AN OPERATING OR MAINTENANCE PROCEDURE, PRACTICE, CONDITION, ETC., WHICH, IF NOT STRICTLY OBSERVED, COULD RESULT IN SERIOUS INJURY.

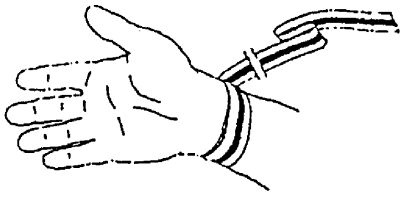
CAUTION — Hazard exists which **will,** or **could,** cause a minor injury.

Notice: A notice indicates possible equipment damage.

Note: An essential operating, installation, or maintenance: procedure, practice, condition, etc., which must be highlighted.

1.3.2 SAFETY REGULATIONS

- In accordance with the European Directive, the patient database manager must have a complete confidentiality agreement before sending a disk containing patient files for repair.
- This document conforms with IEC 950 UL 1950, CSA 22.2 950.
- Take unusual precautions against static electricity when handling an internal disk drive. Wear an antistatic bracelet to avoid equipment damage.

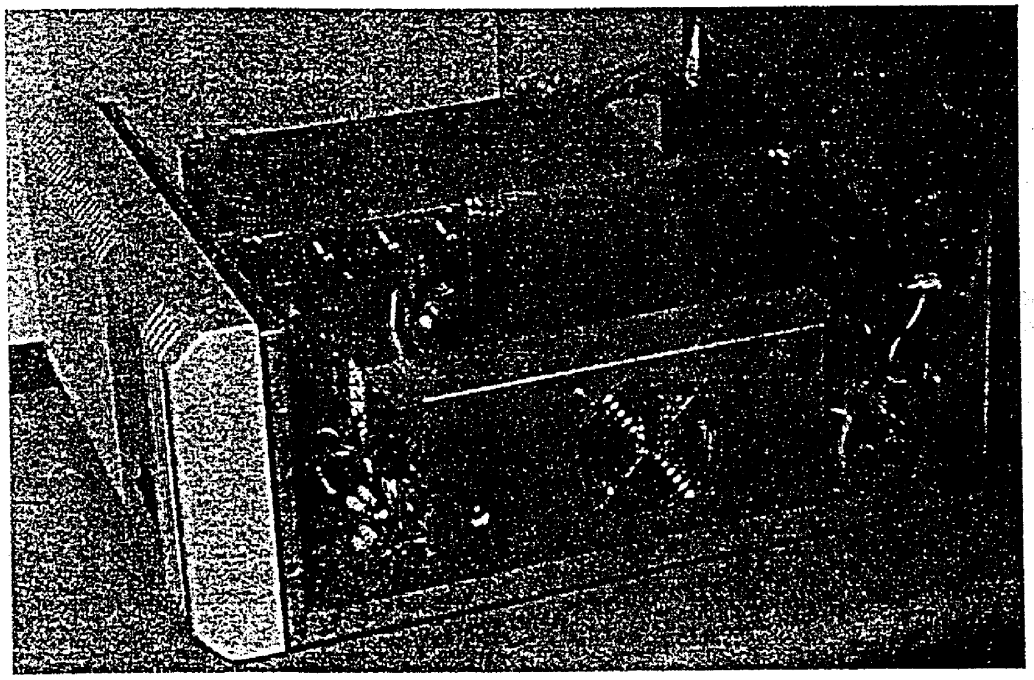


2.0 SYSTEM DESCRIPTION

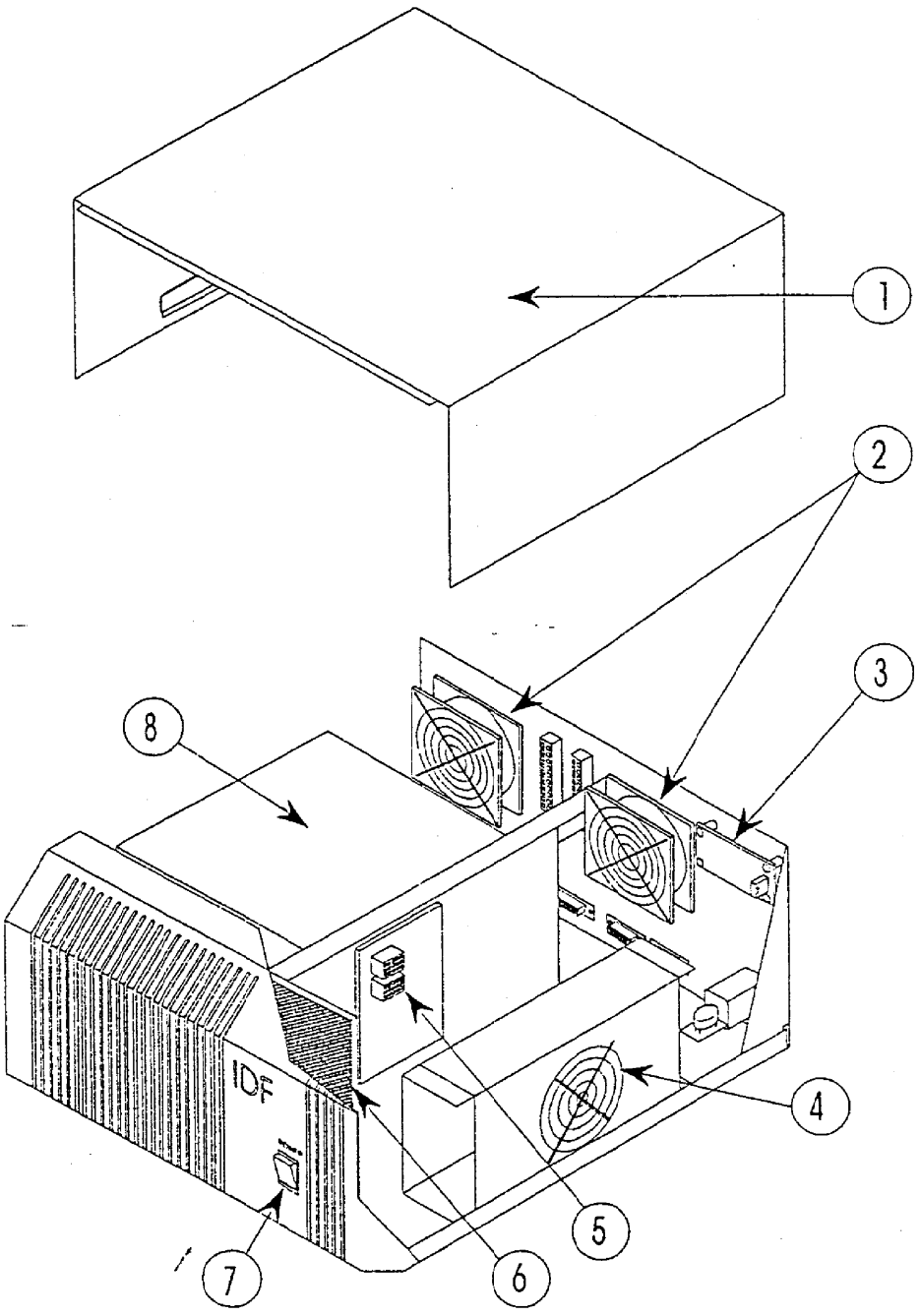
This section is divided into three major subsections:

- Identification of Parts: Two annotated illustrations which identify the IDF parts of interest to the service technician.
- System Configurations: Card cage configurations and bus connections
- Block Diagram Description: System configurations at the block diagram level.

2.1 Overview Description

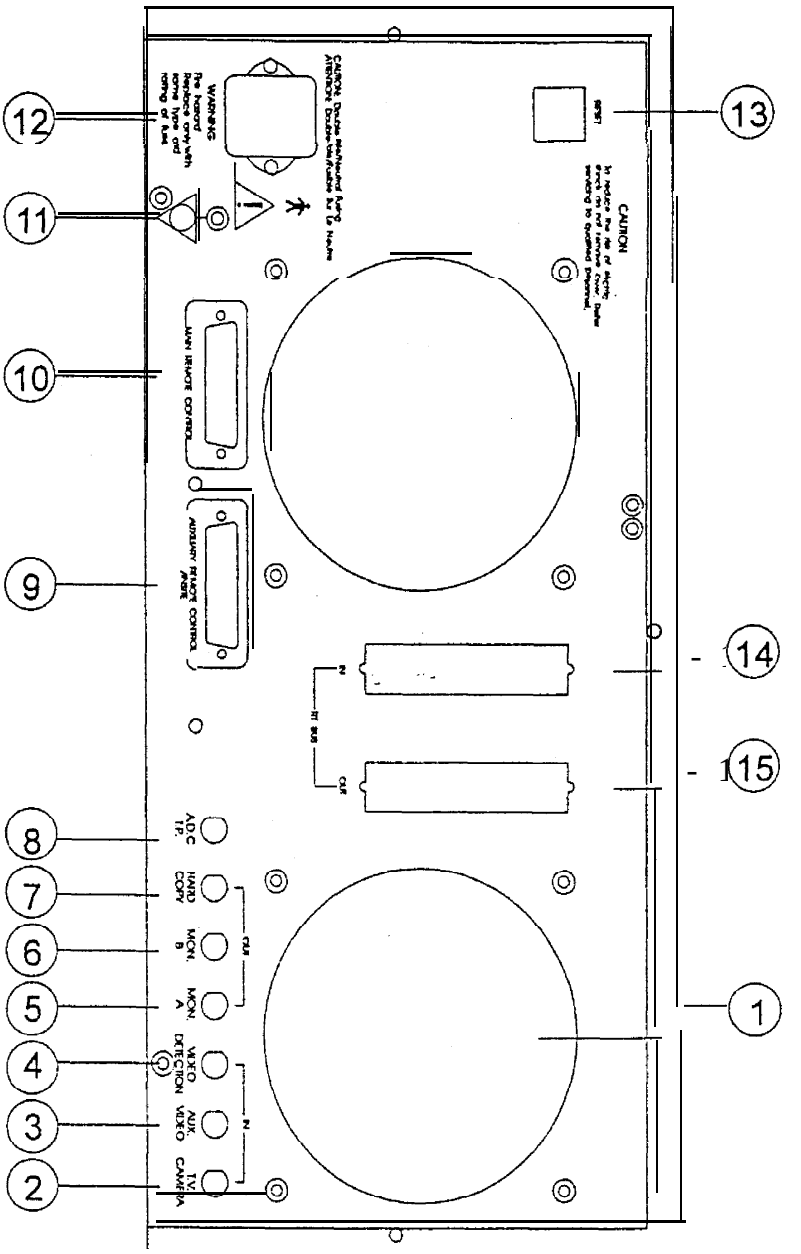


Photograph 2-1: Internal View of IDF



1. Unit Cover
2. Fans
3. Reset Panel
4. Power Supply Unit
5. DCDB
6. Air Filter
7. ON/OFF Switch
8. Card Cage

Figure 2-1: Internal View of IDF



1. Fan
2. TV Camera Connector
3. Auxiliary Video Connector
4. Video Detection Connector
5. Monitor A Connector
6. Monitor B Connector
7. Hard Copy Connector
8. ADC Test Connector
9. Auxiliary RCU Cable Connector
10. RCU Cable Connector
11. Ground Connector
12. Power Cable Socket
13. Reset Button
14. RT BUS IN Connector
15. RT BUS OUT Connector

Figure 2-2: Rear Panel Close-Up

2.2 Sub System Description

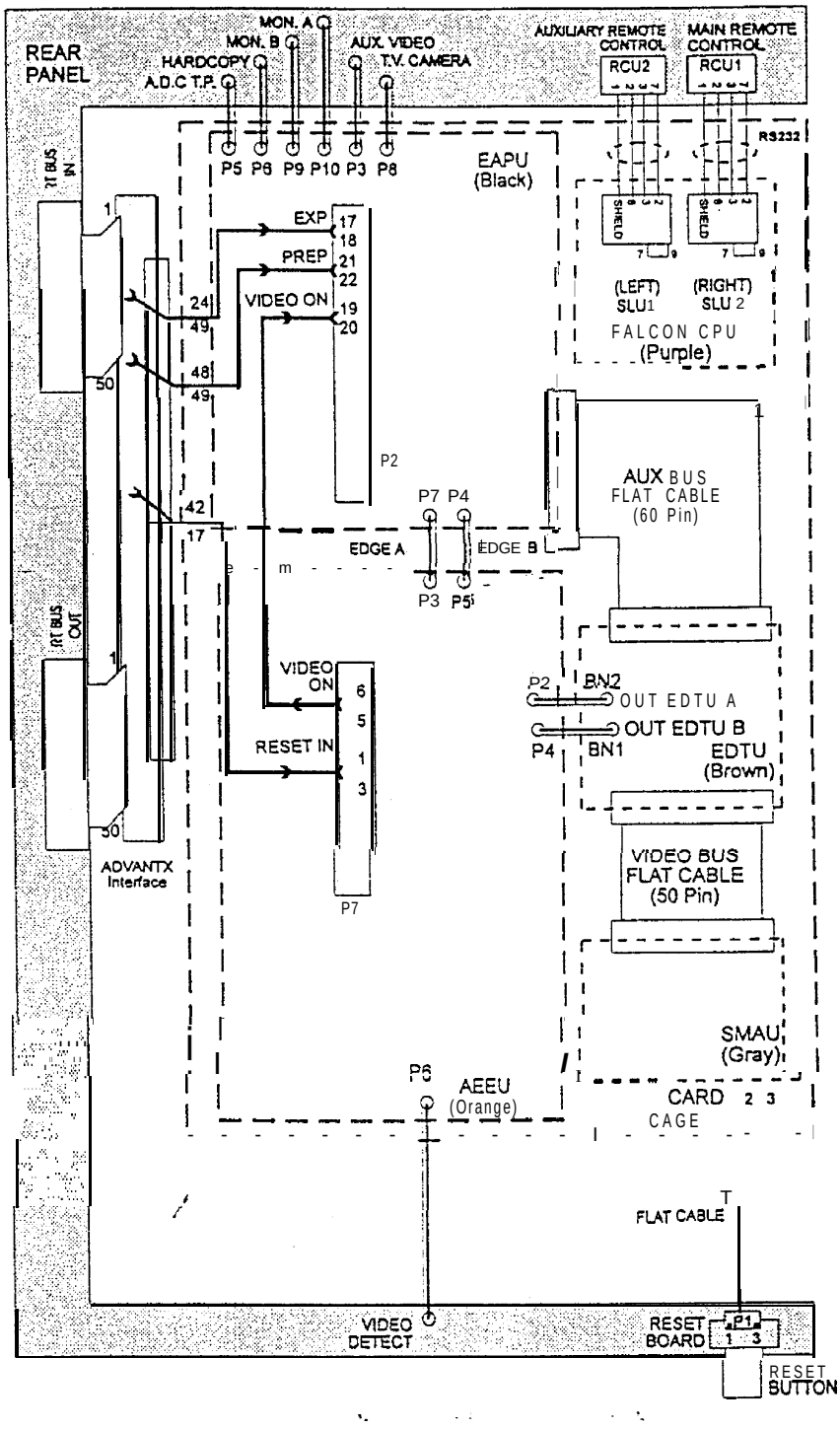


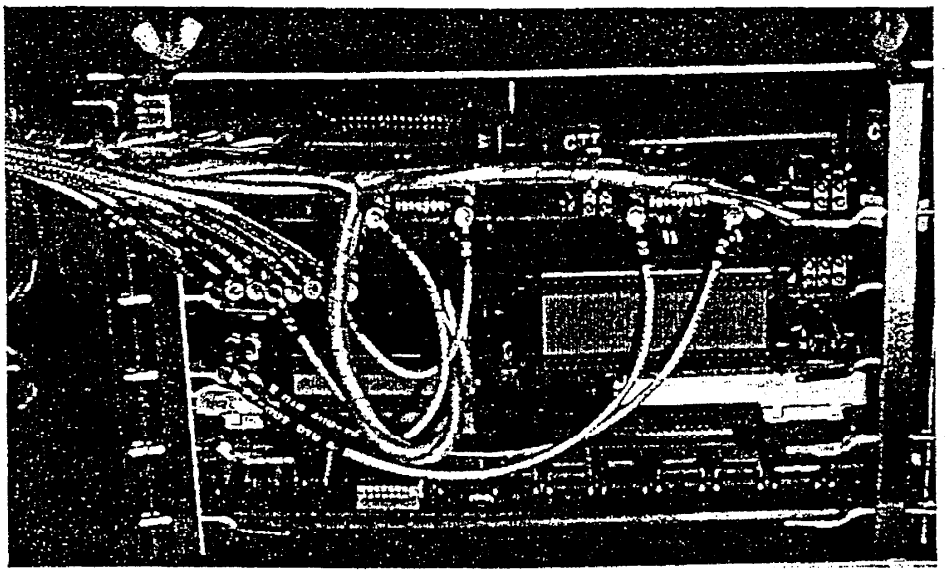
Figure 2-3: Internal Cable **Interconnection Diagram**

NOTE

In a Biplane installation: The same configuration is for each plane. The software on the ETBM board is specific to frontal and lateral (refer to sec. **3.5.1.1** for changing plane of system).

Table 2-l: System Configuration

MODULE	COLOR CODE EXTRACTOR
FALCON	PURPLE
EAPU	BLACK
EDTU	BROWN
SMAU	GRAY
ETBM	BLUE
AEEU	ORANGE
GRANT CARD	
SRCU	
11 SLOT CAGE	
70A POWER SUPPLY	



Photograph 2-2: Card Cage Boards

Table 2-1: System Configuration

MODULE	COLOR CODE EXTRACTOR
FALCON	PURPLE
E A P U	BLACK
EDTU	BROWN
SMAU	GRAY
E-IBM	BLUE
AEEU	ORANGE
GRANT CARD	
SRCU	
I I SLOT CAGE	
70A POWER SUPPLY	

Photograph 2-2: Card Cage Boards

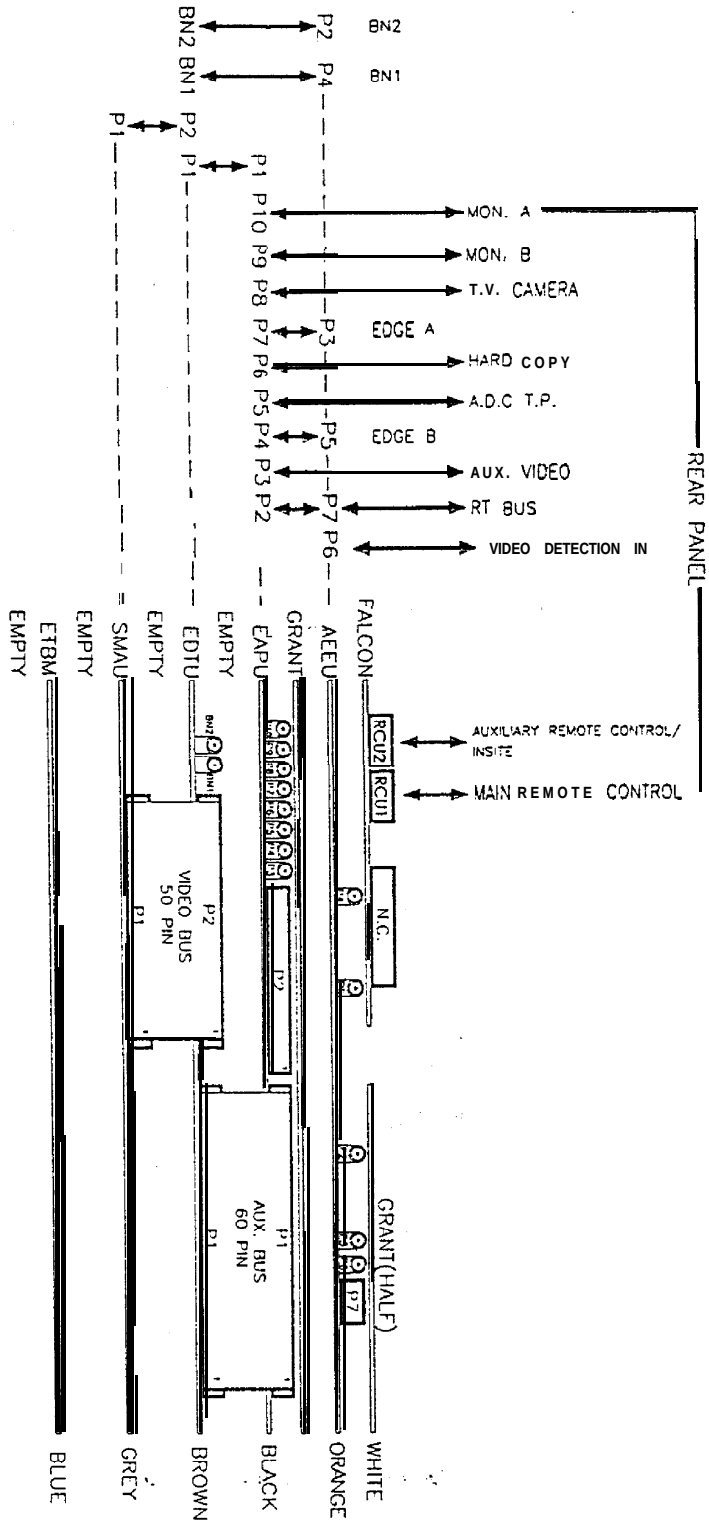


Figure 2-4: Card Cage Boards Interconnection and Sequence

NOTE
The FALCON board resides in slot #1 on the left hand side of the card cage.

2.3 IDF Block Diagram Description

2.3.1 General

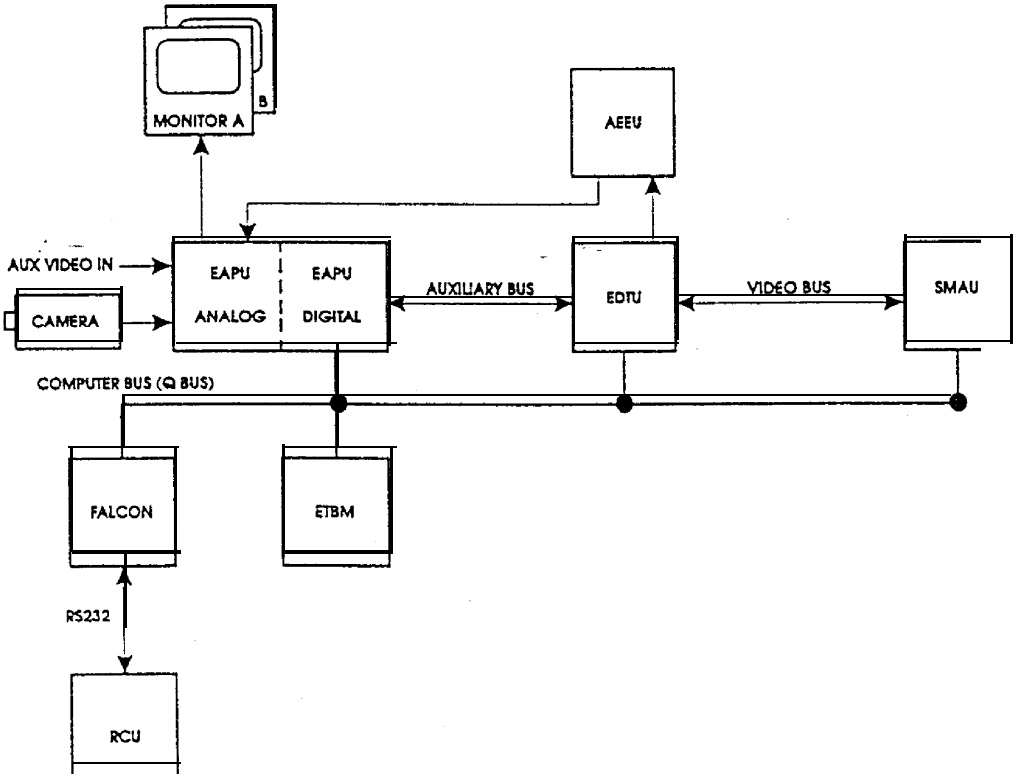


Figure 2-5: Sub System Block Diagram

2.4 IDF Basic Structure

2.4.1 Card Cage

All IDF boards, as required by the configuration setup (see 3.5.1), are plugged into the 11 slot Q-bus.

2.4.2 Power Supply

The main power supply unit is a switching module which is configured to 220V. It provides +5VDC, +12VDC and -12VDC.

2.4.3 Direct Current Distribution Board

The DCDB (refer to layout fig.3-6) receives voltage from the power supply unit (J1) and distributes it to the card cage (J3) and to the RCU (J9).

2.4.4 Host Computer (FALCON)

All IDF configurations are controlled by the SBC11-21 host computer. Using software from the main software memory bank (located on ETBM board), the host computer controls the various IDF functions.

2.4.5 RCU

The RCU is a touch-sensitive keypad that enables the operator interface with the IDF. The RCU communicates with the IDF via an RS-232 D-25 pin cable, using ASCII code data. IDF calibrations are also carried out via the RCU.

The RCU contains two boards: the keypad interface board and the keypad board. The two boards communicate through a direct connector-to-connector connection, The keypad board contains all of the push buttons and LEDs for the RCU functions. The keypad interface board is the RCU logic card. The RCU receives its dedicated 5V supply from the DCDB together with sense lines, to compensate for cable length.

2.4.6 ETBM

The Tables and Bank Memory board holds the IDF operational software, as well as the averaging tables. The software is specific to frontal and lateral (refer to sec. 3.5.1.1 for system plane change). The board also contains the NOVRAM (Non-Volatile RAM) which stores the parameters of the system.

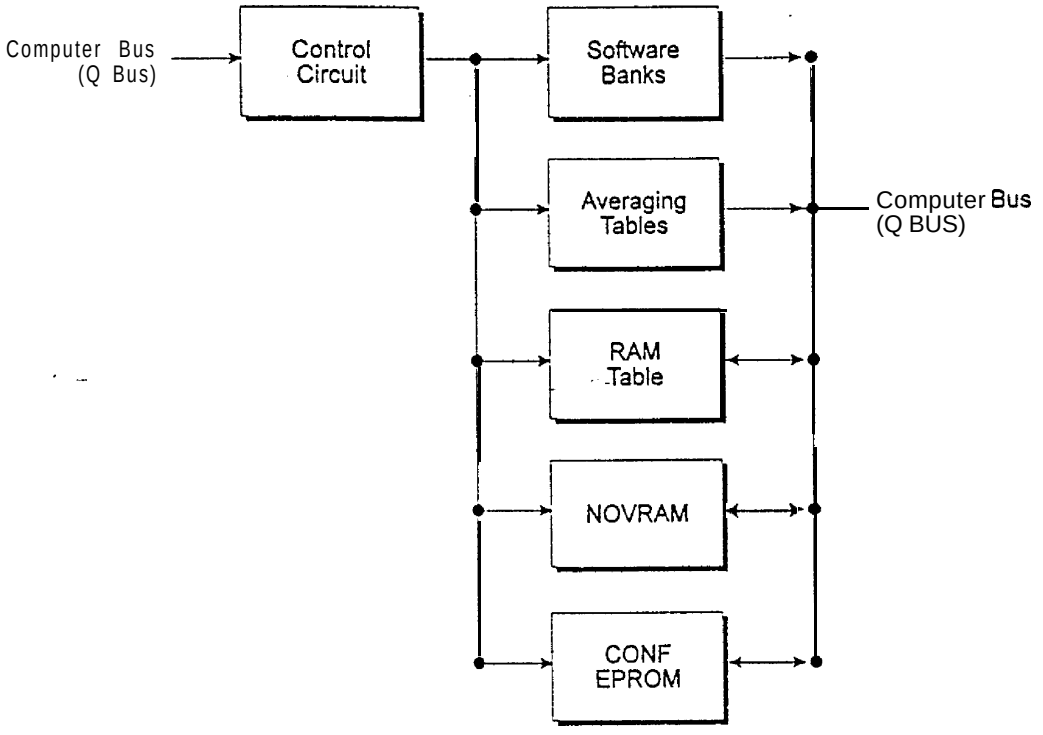


Figure 2-6: ETBM Block Diagram

2.4.8 Reset Board

The Reset board is located on the rear panel. It controls the system reset. The button LED indicates that the 5V supply is present in the system, thus constituting an important troubleshooting indicator.

2.4.9 Cooling F a n s

There are two 12VDC cooling fans located in the rear panel. They are automatically powered on and off with the system.

2.4.10 Filter

A washable air filter is mounted across the front of the unit (Fig. 2-l).

2.4.11 Grant Card

Grant cards are required for computer bus continuity only, since the Q BUS works in a daisy chain configuration. There are two types of grant cards: half and full. This board has no significance in IDF, other than for bus continuity.

2.5 IDF Main Acquisition Blocks

2.5.1 General

The EAPU, EDTU, SMAU and AEEU boards comprise the main acquisition block.

2.5.2 EAPU

This Analog Processing Unit receives the various inputs from the x-ray room and processes them. The major input is the video signal from the TV camera. This signal is digitized and transferred for further processing to the various acquisition boards.

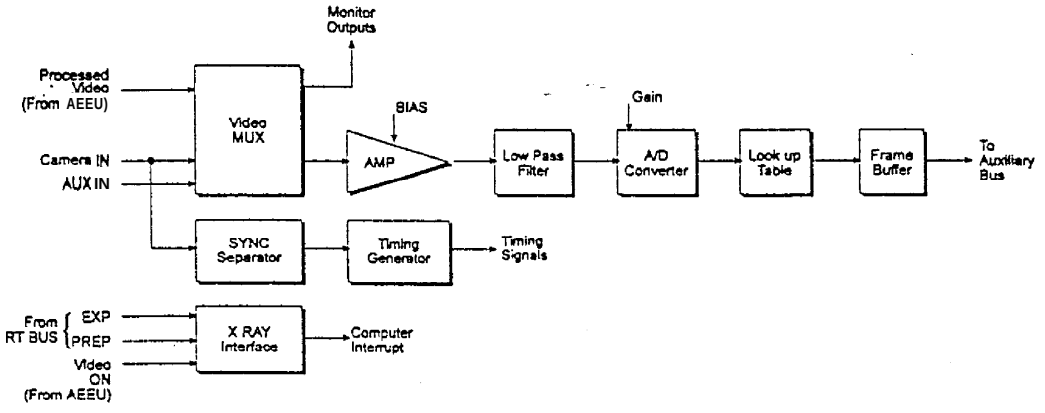


Figure 2-7: EAPU Block Diagram

2.5.3 EDTU

This Display Timing Unit receives the external video timing from the EAPU, and then generates the system clock signal required to synchronize all IDF operations to this external timing.

The EDTU also includes the display OUT generator which converts the digital bus data into two analog channels: MON A and MON B. The display is comprised of a video image with text overlay added by the EDTU.

The EDTU also controls all data transfer on the video buses.

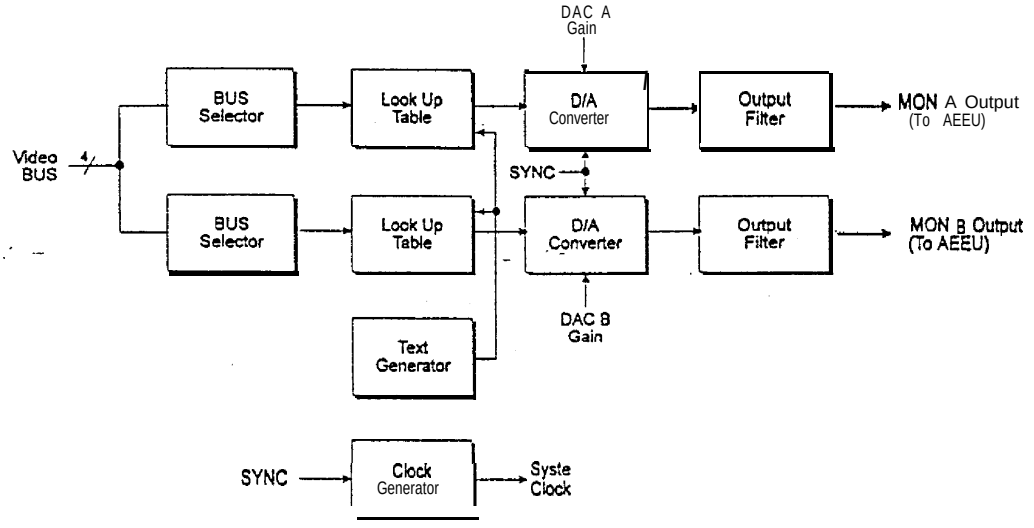
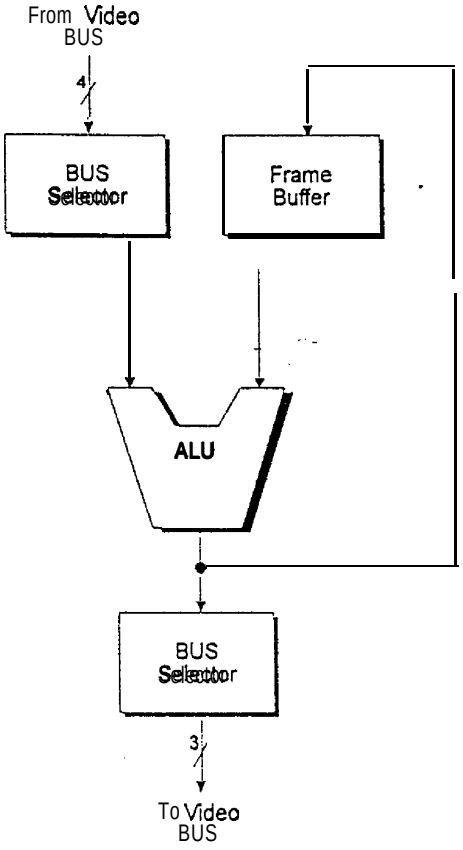


Figure 2-8: EDTU Block Diagram

2.5.4 SMAU

The Memory Arithmetic Unit processes data which is acquired ***by*** the EAPU. The processing primarily involves the averaging of new incoming image data with existing image data already acquired and processed. This process is done in teal time and the resulting data is used for video image display. This board is also responsible for real time subtraction procedures.



(Two Identical Units on One SMAU Board)

Figure 2-9: SMAU Block Diagram

2.5.5 AEEU

The Analog Edge Enhancement Unit is a dual analog filter that provides for sharper contour display. It is also involved in the video detection function that is one of the conditions for image acquisition, and in generation of system reset upon Reset command from RT BUS.

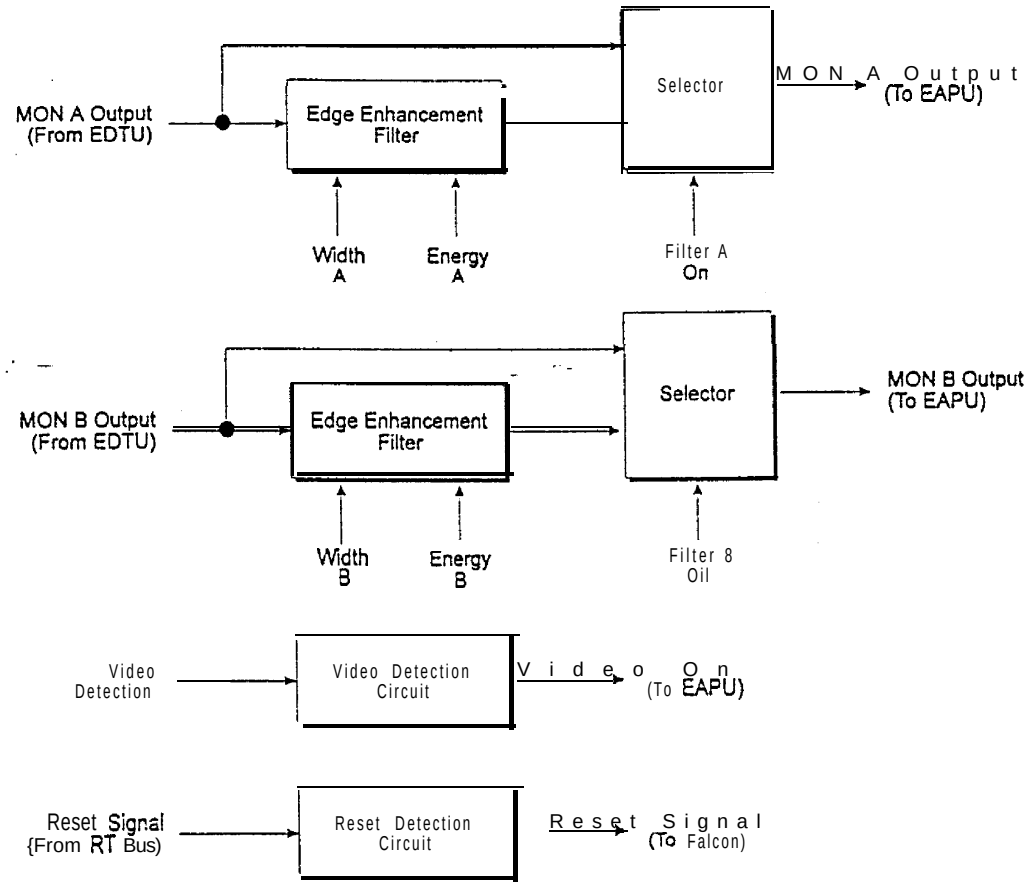


Figure 2-10: AEEU Block Diagram

2.5.6 Host Computer

The SBC 11/21 Plus (FALCON is a single Board Computer manufactured by Digital Equipment Corporation).

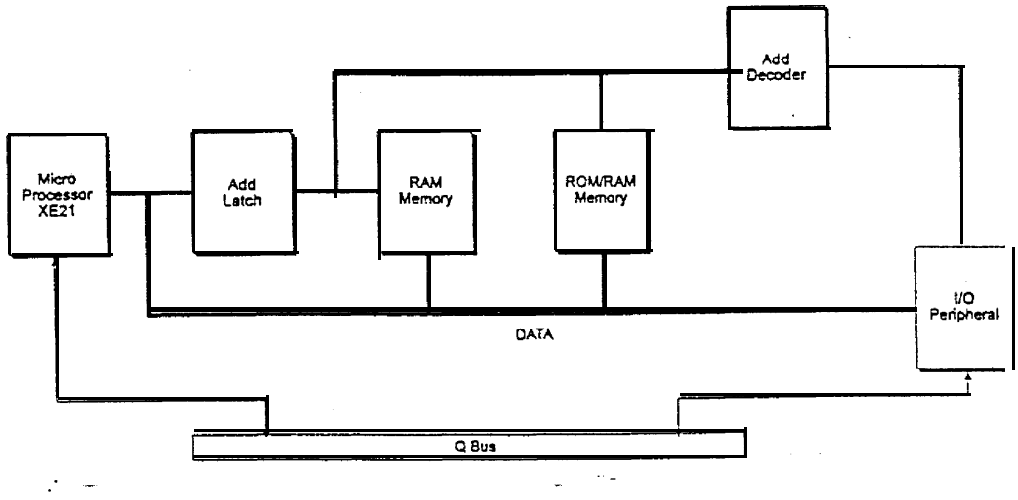


Figure 2-11: CPU Block Diagram

2.5.7 Software Flow Diagrams

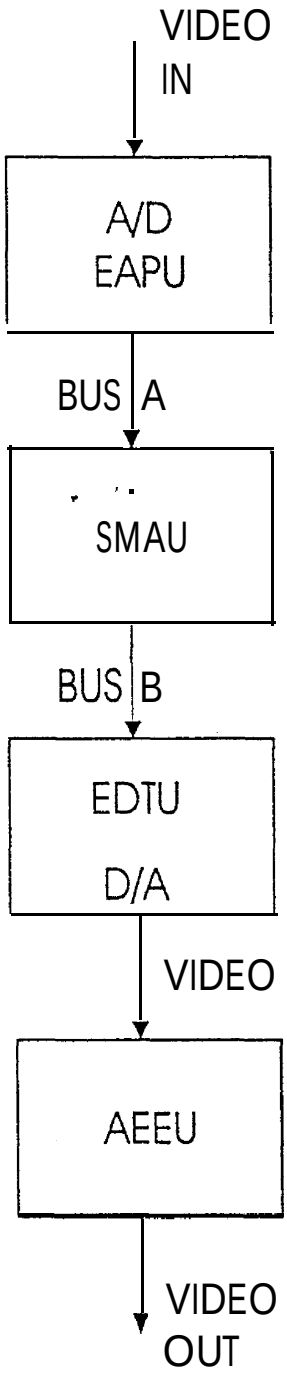


Figure 2-12: Normal Acquisition Software Flowchart

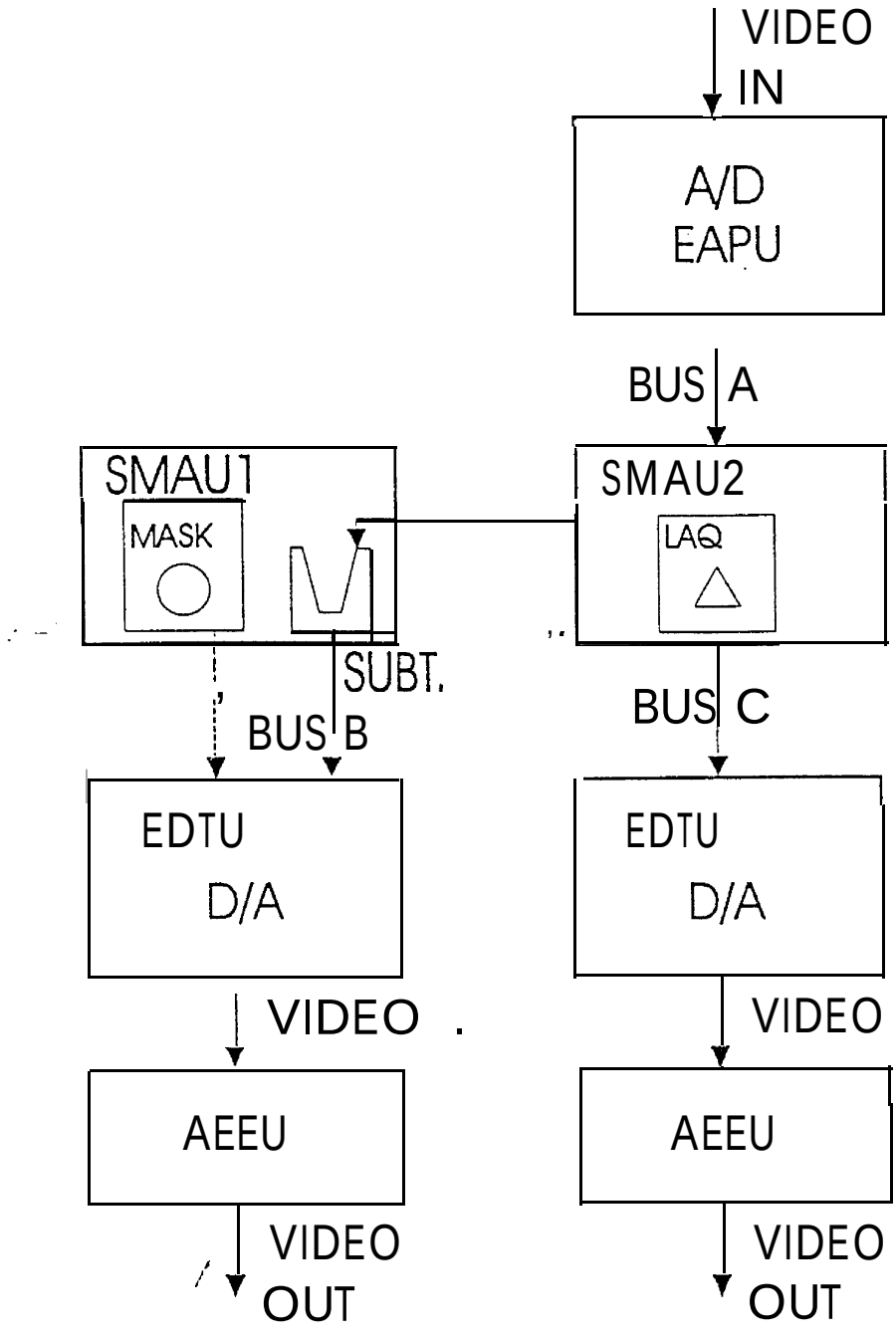


Figure 2-13: Subtracted Acquisition Software Flowchart

2.5.8 Keyboard

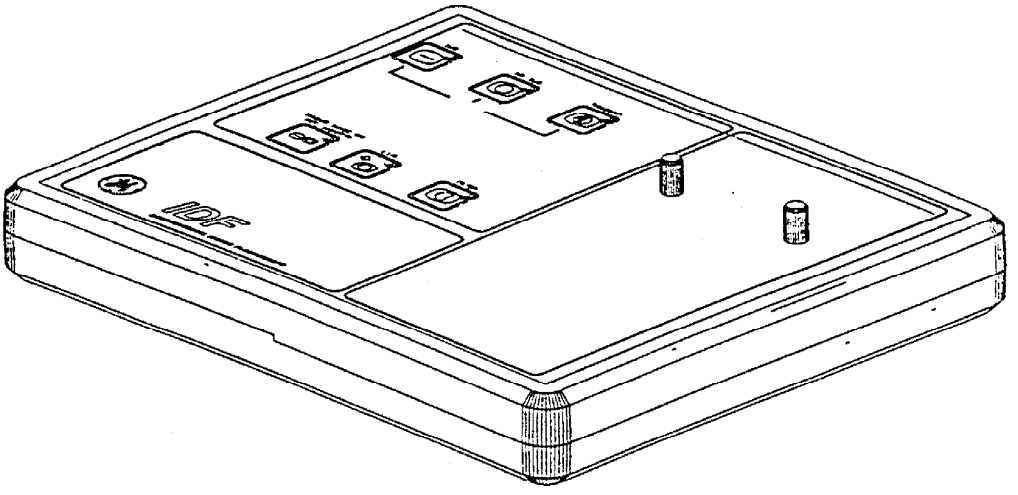
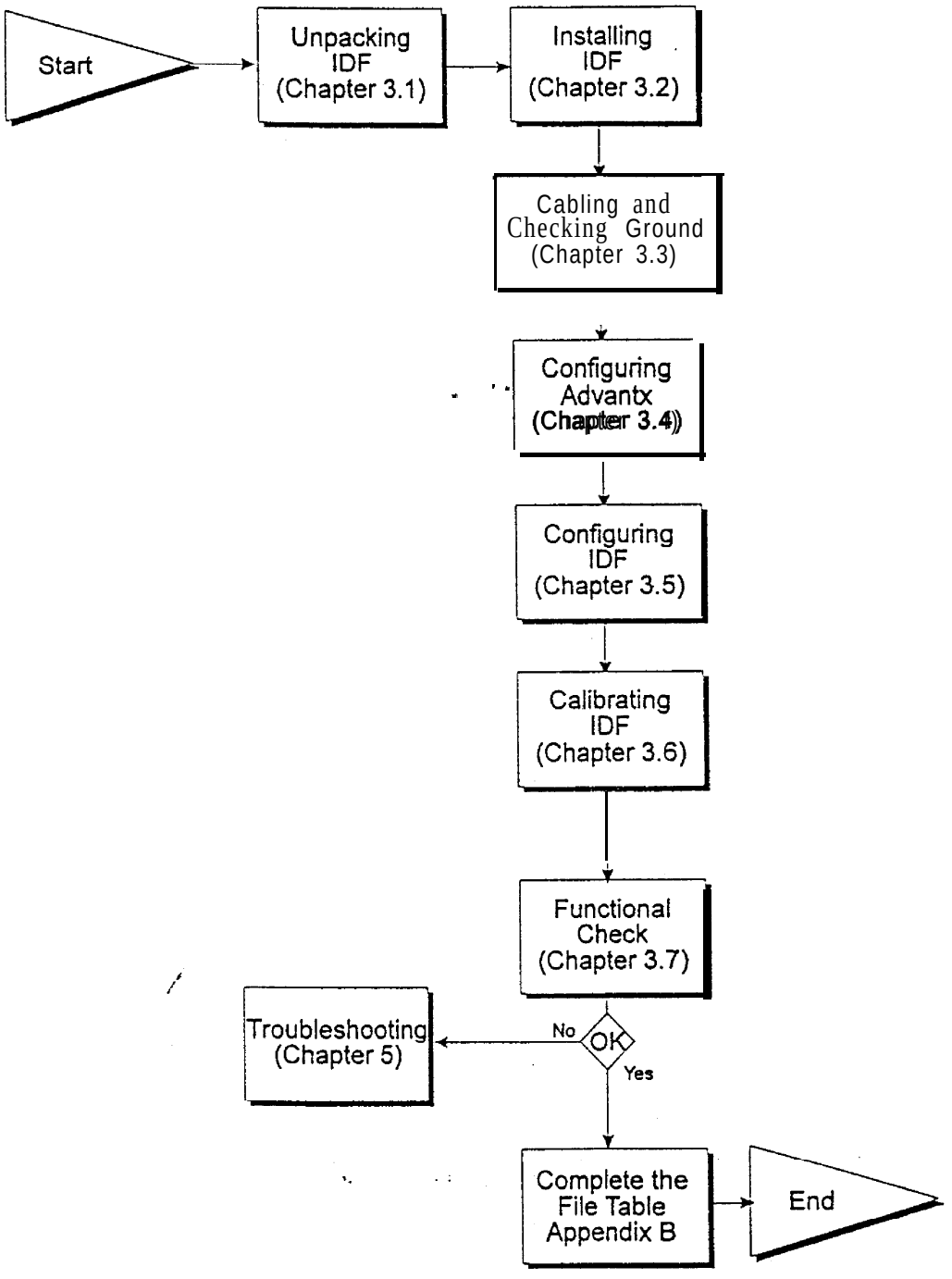


Figure 2-14: IDF Keyboard

3.0 INSTALLATION

3.0.1 Installation Steering Guide



3.1 Unpacking IDF

3.1 .I Packing List

There are two basic configurations: FRONTAL and LATERAL. The packing list differs from one to another, Check the content according to the appropriate configuration.

3.1.1.1 FRONTAL SYSTEM

CATALOG No.	DESCRIPTION	QTY.
FP-923-IDF -F	EDF Frontal system	1
SRCU-GE	IDF operation console	1
61AR200910	Service manual	1
6 1 AR200900	Operation manual	1
61AR200930	Pre-installation Manual (PIM)	1
6 I AR200920	Final test result form	1
ID61005001	Service key Lexan	1
61SM200100	IDF calibration phantom	1
61AP100063	Table base to IDF console cable	1
61AP100062	Table base to IDF box cable	1
61AP100072	FRONTAL video to AUX VIDEO IN cable	1
61AP100073	FRONTAL video to VIDEO DETECTION cable	1
61AP100071	FRONTAL video to TV CAMERA IN cable	1
61AP100074	FRONTAL video to MON A cable	1
61AP100058	IDF Power Cable	1
61AP100059	FRONTAL grounding cable	1
ID61005201	LABEL - [DX RTBUS A OUT - MIS 27056A]	1
ID6 1005202	LABEL - [IDF RTBUS IN F - MIS 27056A]	1
ID6 1005203	LABEL - [IDF RTBUS OUT F - MIS 27057A]	1
ID6 1005204	LABEL - [IDF MON B OUT F - MIS 27058A]	1
ID61005265	LABEL [MIS 27057A]	1
ID61005266	LABEL [MIS 27058A]	1
61 SM400250	Bed panel - small	1
6 1 SM400260	Bed panel - large	1
61SA106301	Anti-Seismic kit	1
61SA106201	Cable harness kit	1

3.1.1.2 LATERAL SYSTEM

CATALOG No.	DESCRIPTION	QTY.
FP-923-IDF -L	IDF Lateral system	1
6 1 AR200920	Final test result form	1
61AP100082	LATERAL video to AUX VIDEO IN cable	1
61AP100083	LATERAL video to VIDEO DETECTION cable	1
61AP100081	LATERAL video to TV CAMERA IN cable	1
61AP100084	LATERAL video to MON A cable	1
61AP100061	LATERAL grounding	1
ID6 1005205	LABEL - [DX RTBUS B OUT - MIS 27047A]	1
ID6 1005206	LABEL - [IDF RTBUS I-N L - MIS 27047A]	1
ID61005207	LABEL - [IDF RTBUS OUT L - MIS 27048A]	1
ID6 1005208	LABEL - [IDF MON-B OUT L - MIS 27049A]	1
ID6 1005262	LABEL - [MIS 27048A]	1
ID6 1005263	LABEL - [MIS 27049A]	1
61SA106301	Anti-Seismic kit	1
61SA106201	Cable harness kit	1

3.1.2 Visual Inspection

On receipt of the IDF, remove the equipment from its packing material and check for visible external damage. **In the event of damage, notify the shipping agent immediately.**

> **CAUTION**
>
> Never open the unit with the power on.

Visually inspect the unit interior by following these steps:

a. Remove the two slotted-head captive screws and the Philips screw above, on the rear panel of the unit. Gently pull the cover slightly toward the back and UP-

b. Check. that all boards in the card cage are locked in place. See Figure 2-4 for the correct order of card insertion per system configuration.

c. Check that all connectors are firmly seated in their sockets.

d. Close the unit top by gently setting it into place and secure the three retaining screws on the unit rear panel.

> **CAUTION**
>
> Check that the system is compatible with your electrical system. (220V)

3.2 Installing IDF

* Refer to the IDF PIM for placing IDF box(es).

* If the table mounting option is available, the table **mounting** arm should be attached on the side of the tabfe opposite the side where the physician usually works.

* If located in seismic area, mount the anti-seismic kit provided in the IDF box and refer to the IDF PIM for mounting.

* Drill nine 0 7 +I mm holes on mounting surface according to the drawing IDF6 10050 10, included in IDF shipment+- Position IDF box on top of monting surface and fix with the nine 0 6 mm screws and washers supplied (6 1SA10630 1). See figure below.

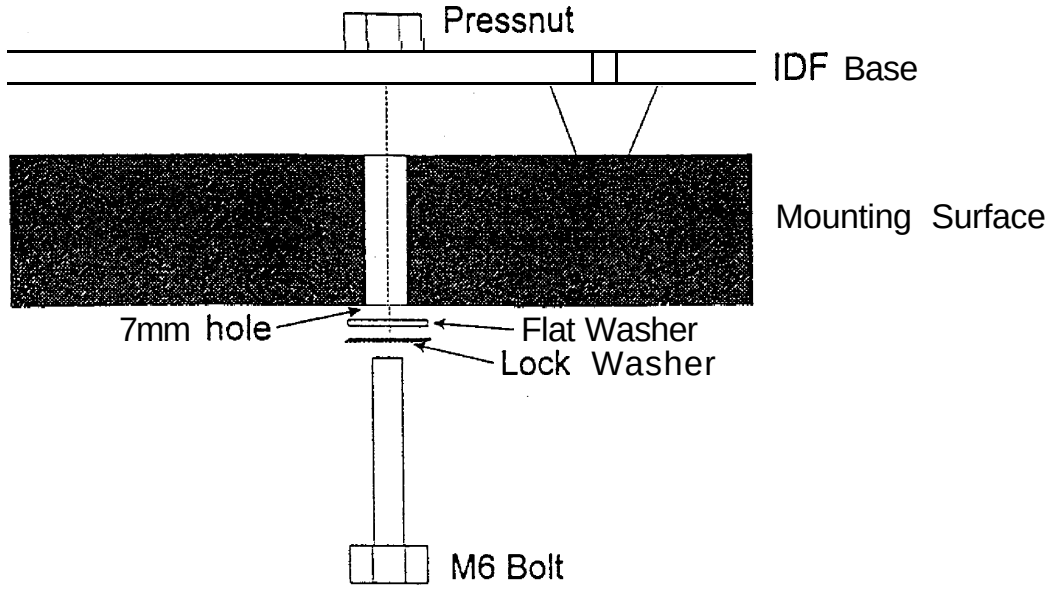


Figure 3-1 IDF Anti-Seismic Clamp

3.3 Cabling IDF

For single plane or frontal biplane IDF, the labels of cables and sockets indicating this plane are "F" on IDF and "F" or "A" on DX.
For the lateral biplane system, the labels of cables and sockets indicating this plane are "L" on IDF and "L" or "B" on DX.
The frontal (or single) plane and lateral plane IDF cabling are the same on each plane, except for the console and Power cables.

Refer to Figure 3-4 for Cabling Diagram and 3-5 for IDF MIS Map

3.3.1 RTBUS Cables

Disconnect the RTBUS cable from the "DX RTBUS A OUT" socket. Put the "IDF RTBUS OUT F" and MIS number stickers on the cable and connect it to this socket. Take the new RTBUS cable, On each limit, put the "DX RTBUS A OUT," "IDF RTBUS IN F" and MIS number stickers and connect it between these sockets.

Same for lateral.

3.3.2 Video F

Disconnect the Video F cable from the "DX FROAD 1" socket. Put "IDF MON B OUT F" and MIS number stickers on the cable and connect it to this socket. Take the new Video F cable labeled with the stickers, "DX FROAD1" and "IDF AUX VIDEO IN F" and connect it on these sockets.

Same for lateral.

3.3.3 Video F

Take the new Video F cable labeled with the stickers "VIC 19 F" and "IDF VIDEO DETECT IN F" and connect it on these sockets.

Same for lateral.

3.3.4 Video F

Take the new Video F cable labeled with thestickers "VIC J3 F" and "IDF MON A OUT F" and connect it on these sockets.

Same for lateral.

3.3.5 Video F

Take the new Video F cable labeled with the stickers "VIC J8 F" and "IDF TV CAMERA IN F" and connect it on these sockets.

Same for lateral.

3.3.6 Power F

Take the EDF Power Cable with stickers "IDF F," "IDF L," and "DLX PIT." Connect the "DLX PIT" end to the power distribution of the DLX cabinet. (Refer to figures 3-2 to locate the DLX PITs in DLX1/DLX2 cabinets, and to figure 3-3 to locate Power Distribution Outlets in DLX3 cabinet).

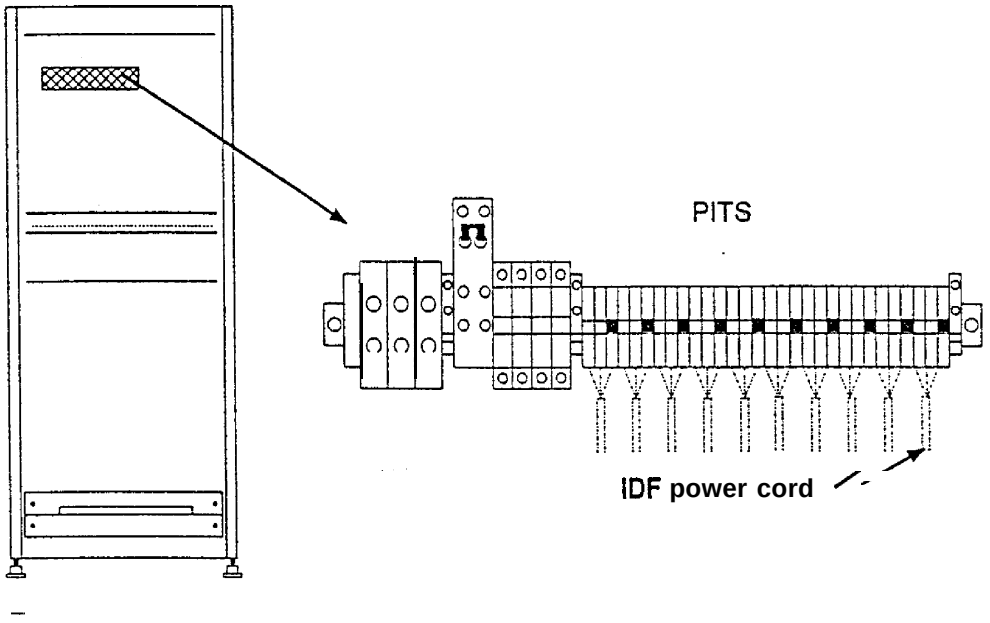


Figure 3-2 DLX1 I DLX2 Cabinet with PITS Detail

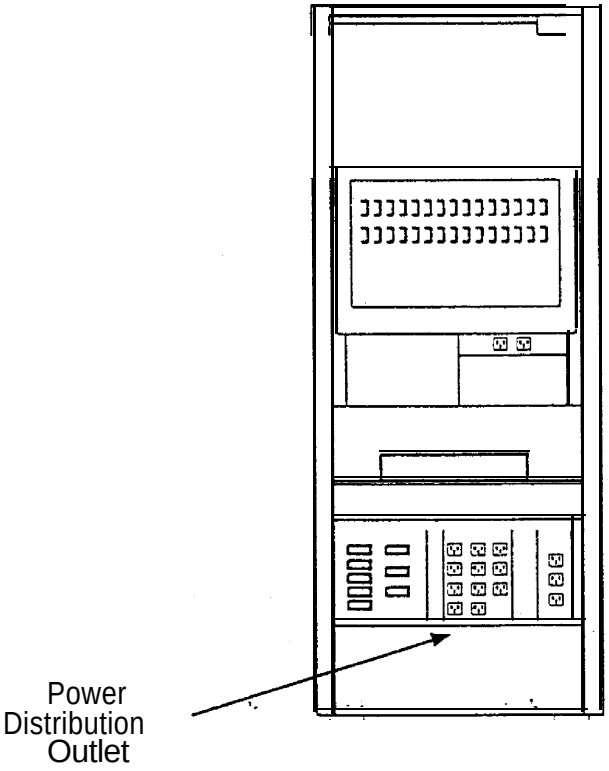


Figure 3-3: DLX3 Cabinet

Connect the "IDF F" and "IDF L" ends into the "Power F" and "Power L" IDF box sockets respectively.

If there is no lateral plane, the "IDF L" cable end is not connected+

Make sure that the derivation box of this cable is placed inside the DLX cabinet and that all cables going out of the DLX cabinet are secured with strain relief, similarly to the other cables.

3.3.7 Ground F

Take the new Ground F cable labeled with the stickers "DX GROUND STUB" and "IDF GROUND F" and connect it on these sockets. The ground stub of the DX is at the bottom of the DX cabinet.

Same for lateral.

3.3.8 IDF Console

Only used when the console cabling passes through the tabte base.

Take the new IDF Console cable labeled with the stickers "TABLE BASE IDF/RCU" and "IDF CONSOLE" and connect it on these sockets.

No cable for lateral.

3.3.9 IDF Y

Take the new IDF Console cable labeled with the stickers "TABLE BASE IDF/RCU," "IDF MAIN REMOTE CONTROL F" and "IDF MAM REMOTE CONTROL L" and connect it on these sockets. If there is no lateral plane, the cable socket labeled "IDF MAIN REMOTE CONTROL L" is not connected.

If the table base is not used, connect "TABLE BASE IDF/RCU" end to the IDF console.

No cable for lateral.

3.3.10 Insite

To be defined.

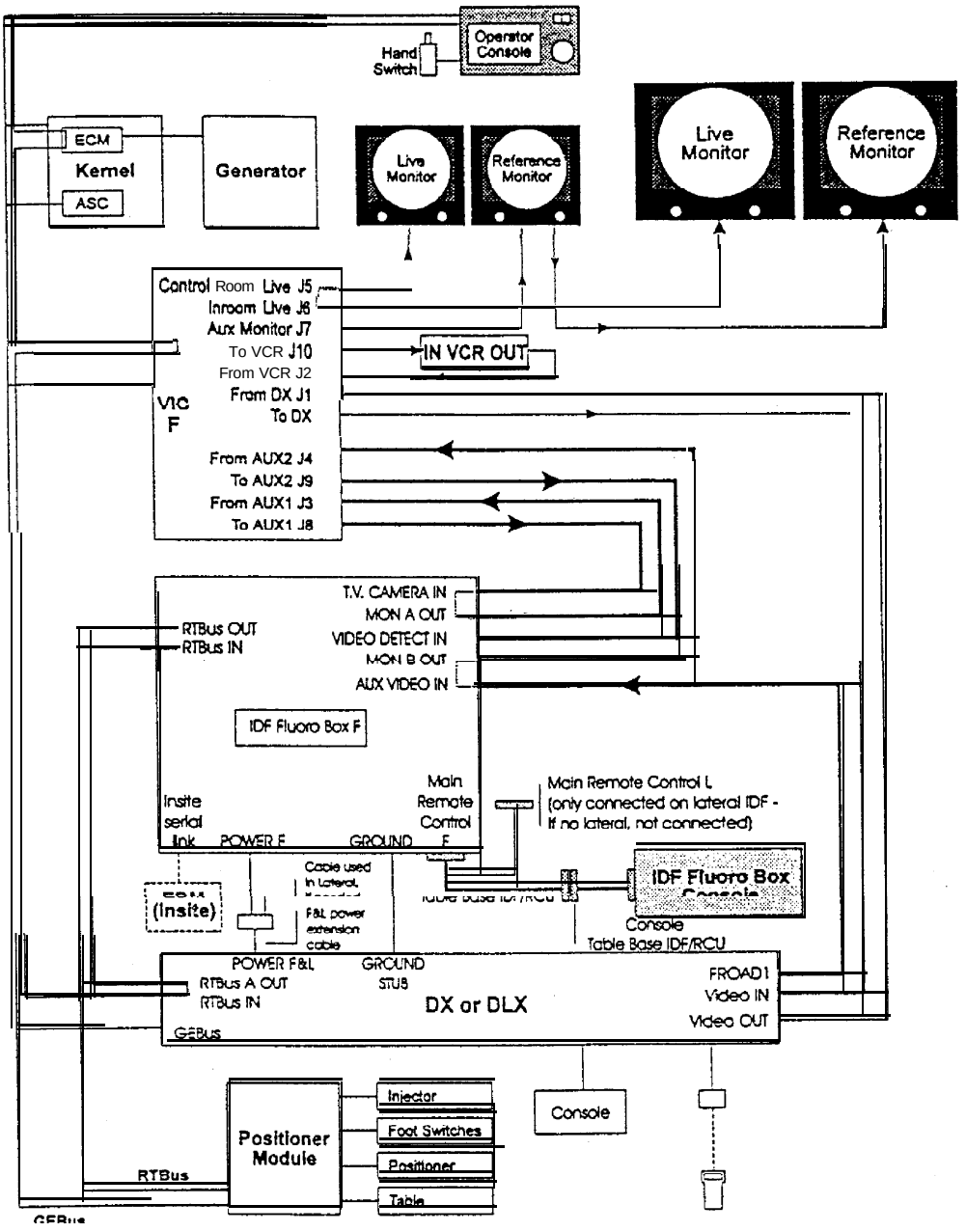


Figure 3-4 IDF Cabling Diagram

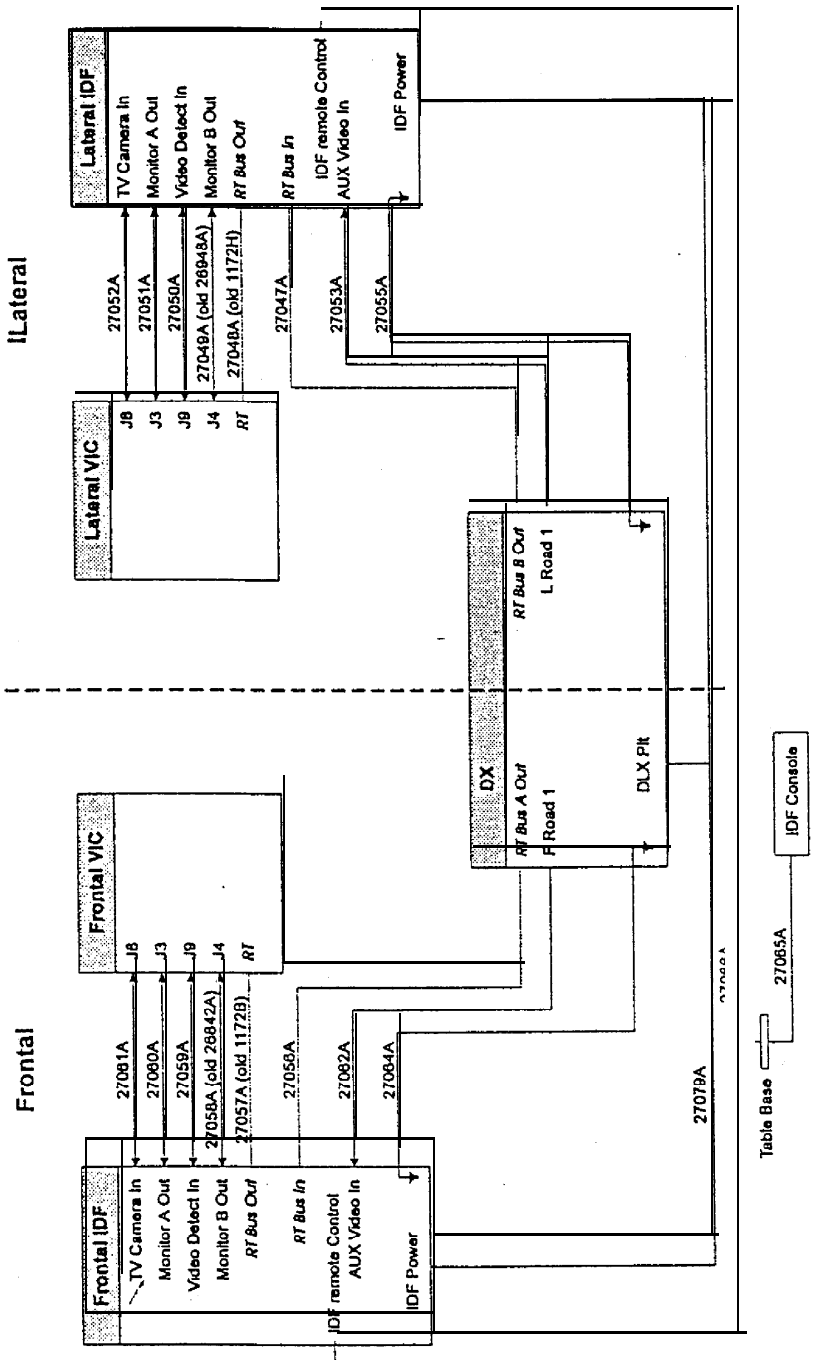


Figure 3-5 MIS Map

3.3.11 Installation Ground Cables Check Procedure

In an installed IDF component, the impedance between the IDF ground connections from the LFX2 and any metal parts must not exceed 0.5 ohm.

Measuring this impedance is done by generating a current on the ground connection to be checked, and checking the drop in voltage.

a. Disconnect the equipment from the mains.
b. Power on the measuring apparatus.

> NOTE
> Measurement apparatus: SEFFLEC model CP255 A 25A (or other similar model).
>
> Apparatus requirements:
> - IOA to 25 A,
> - vacuum voltage of 6.0V maximum.

c. Connect the apparatus to the connections to be tested.
d. Generate a current between the two ground terminals that is greater than 10A and less than 25A.

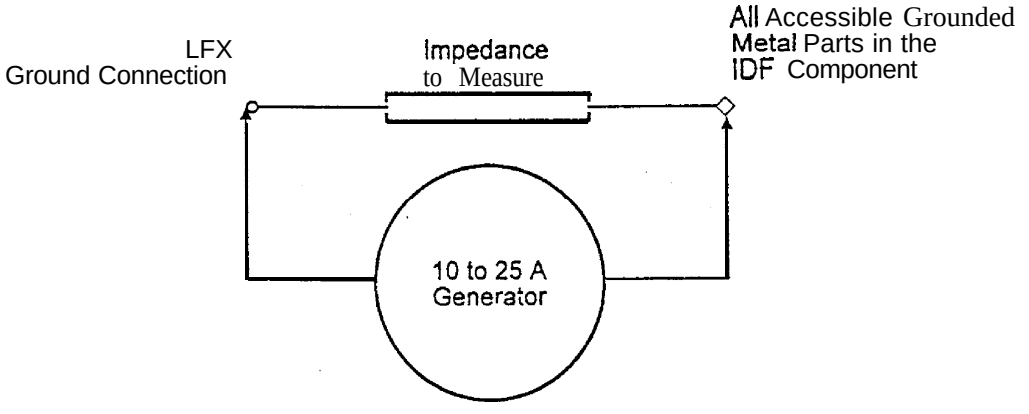


Figure 3-6: Installation Ground Cables Check Procedure

e. If the impedance exceeds 0.55 ohm, check that the connections were correctly made. Refer to figure 3-7 below.

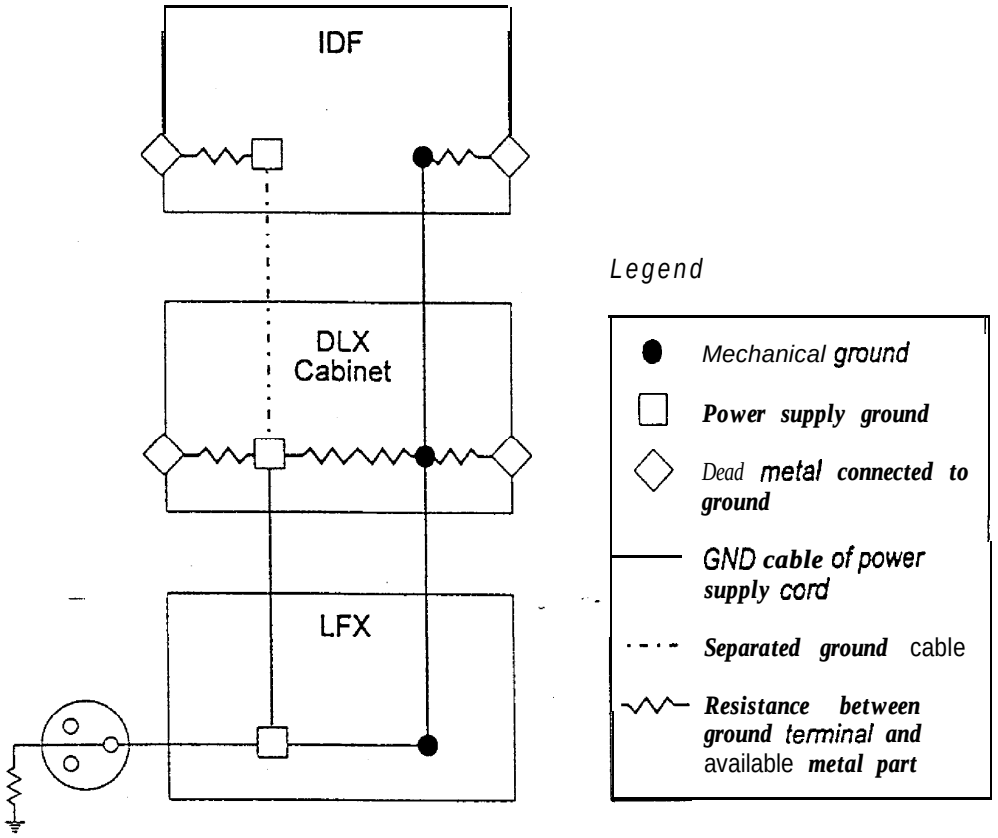


Figure 3-7: Cabling/Grounding Diagram

3.4 Configuring ADVANTX

ADVANTX should be at least MP 12 (software release 18.X).

For configuring IDF option on the ADVANTX system, you need to do C01 1 and CO13 calibrations (on each plane). Depending on the vascular system (SP/BP), the calibrations must be done for single plane IDF, frontal, or/and lateral biplane IDF.

On the ADVANTX console:

a. Select S00 I System Configuration.
b. Select CO1 1 General Configuration. Select "IDF Fluoro" option.
c. Select CO 13 Video Distribution Configuration. Run "Set All Default."

> CAUTION
>
> If there is a specific video distribution, it will have to be re-entered.

3.5 Configuring IDF

3.5.1 Hardware Configuration

3.5.1.1 CHANGING PLANE OF SYSTEM

The system is hardware-configured to be used on the frontal plane or lateral plane (in mono-plane installations, use frontal configuration). However, it may be sometimes necessary to convert a frontal system to a lateral one, or vice versa.

The plane is set by a configuration PROM located on the ETBM board, A second chip that allows for the other plane configuration is always available on the board. To change the system's plane:

a. Eject the ETBM board from the card cage (blue extractors).
b. Swap U21, u22.
c. Insert the ETBM board back into the card cage.

3.5.1.2 EAPU HARDWARE CONFIGURATION

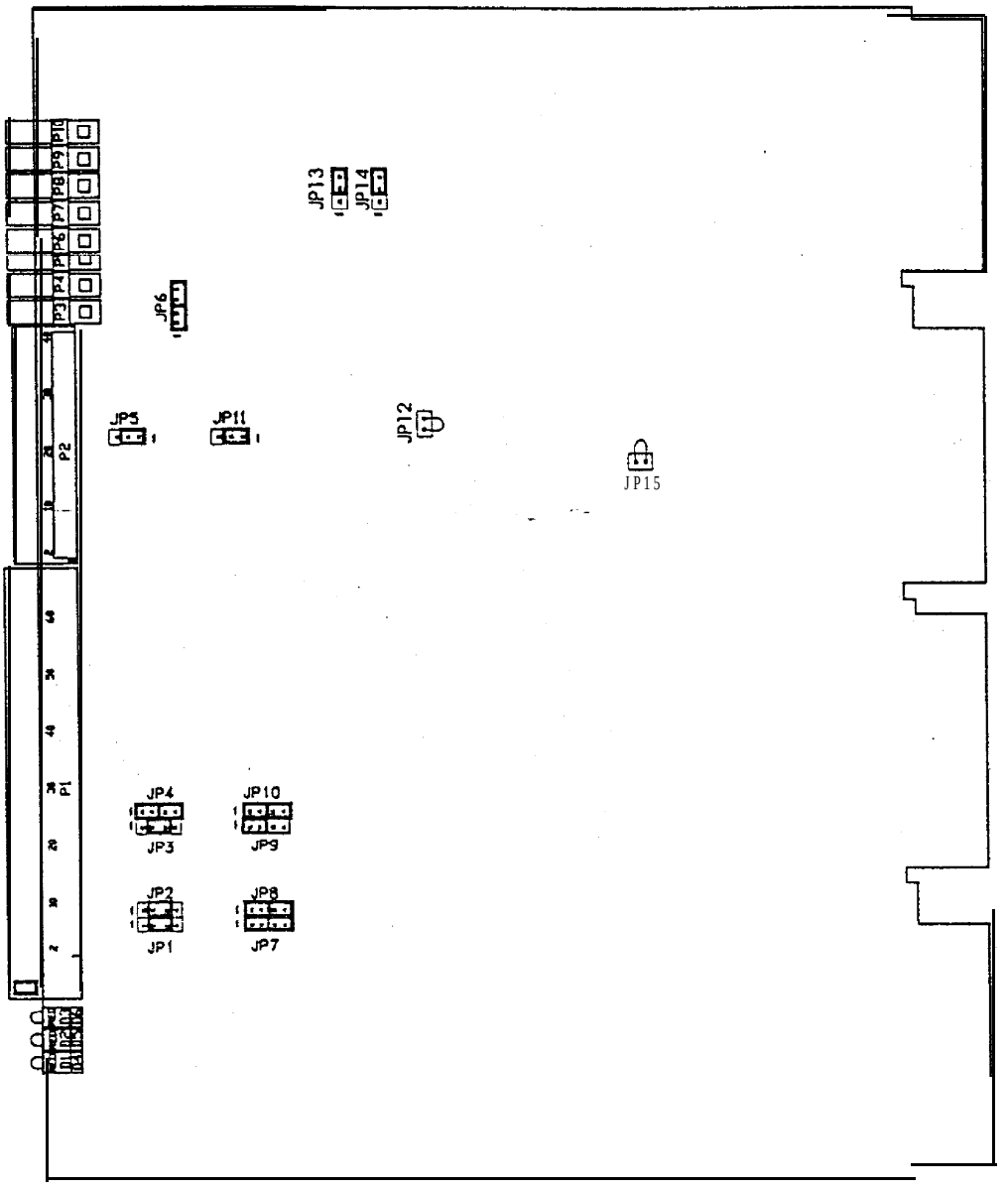


Figure 3-8: EAPU Board Layout Diagram

LEDs 1, 3:	+5V on board	LED 5:	+5V System
LEDs 2, 4:	-5V on board	LED 6:	Reply

Table 3-I: EAPU Jumper Setups

(Factory Setup Position is marked in **bold**).

Function	Jumper No.	Setup Position	Selection	Notes
INPUT 0	JP1	**1-2, 3-4** 2-3	**Dry** contact Voltage Drive	EXP
INPUT 1	JP2	**I-2,34** 2-3	**Dry contact** Voltage Drive	PREP
INPUT 2	JP3	**1-2, 3-4** 2-3	Dry contact **Voltage** Drive	VIDEO DETECTION
INPUT 3	JP4	**l-2,3-4** 2-3	Dry contact Voltage Drive	N/A
INPUT 4	JP9	**f-2,3-4** 2-3	Dry contact **Voltage** Drive	N/A
INPUT 5	JP10	**l-2,3-4** 2-3	Dry contact **Voltage** Drive	N/A
INPUT 6	JP7	**1-2, 3-4** 2-3	Dry contact -Voltage Drive	N/A
INPUT 7	JP8	**1-2, 3-4** 2-3	Dry contact Voltage Drive	N/A
RELAY 0	JP11	**1-2** 2-3	Close Contact	N/A
RELAY 1	JP5	**1-2** 2-3	**Close** Contact	N/A
MON B OUT	JP6	**1-2,3-4** 2-3	Buffered Direct	DISPLAYED CAMERA IN
FILTER	JPf3	**l-2** 2-3	HR OS,IHR	*
	JP14	**l-2** 2-3	HR OS,IHR	*

* HR = High Resolution, OS = Low Resolution Oversampled,
IHR = Interpolated High Resolution

Please note: Pin ***no. I*** ofjc ımper is soldered to the square pad on printed circuit board's solder side.
Jumper nos. 1 2 and 15 are ground connections and are factory hard wired.

3.5.1.3 ETBM HARDWARE CONFIGURATION

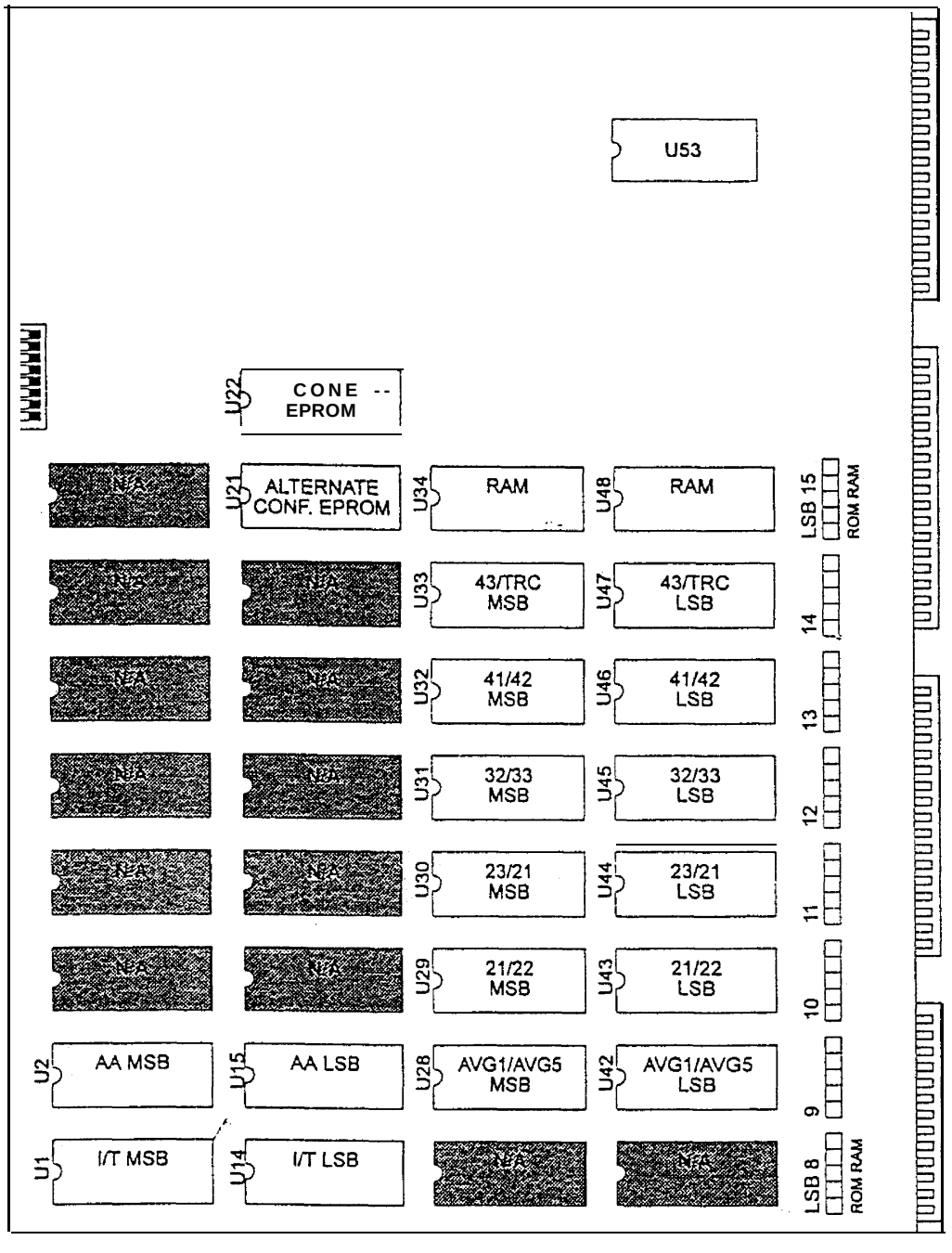


Figure 3-9 ETBM Board Layout-

ETBM DIP Switch setting

Switch 8 determines which screen appears automatically after completion of self test:

UP: Go to nominal software (version A)
DOWN: Go to utilities software (version I)

This switch must be set UP for nominal site operation.

All other switches should be set in the DOWN position.

Note: For switches marked OPEN/CLOSED: OPEN = UP, CLOSED (the word "CLOSED" might not appear) = DOWN.

Table 3-2: ETBM Jumper Setups

(Factory Setup Position is marked in bold).

Function	Jumper NO.	Selection
Bank 8 RAM/ROM	LSB8	N/A
Bank 9 RAM/ROM	LSB9	**RAM** ROM
Bank IO RAM/ROM	LSBIO	**RAM** ROM
Bank 11 RAM/ROM	LSB1I	**RAM** ROM
Bank 12 RAM/ROM	LSB12	**RAM** ROM
Bank 13 RAM/ROM	LSB13	**RAM** ROM
Bank 14 RAM/ROM	LSB14	**RAM** ROM
Bank 15 RAM/ROM	LSB15	**RAM** ROM

3.5.1.4 SMAU HARDWARE **CONFIGURATION**

Table 3-3: SMAU Jumper Setups

(Factory Setup Position is marked in bold).

Function	Jumper No.	Setup Position	Selection	Notes
SMAU Number	SMAU **1,2,3,4**	1 2	**Normal** 2nd Ch. in HR Sys.	3,4 not in use

3.5.1.5 **AEEU HARDWARE** CONFIGURATION

LED Description

LED D5: +5V ANALOG

LED D6: -5v (No. 1)

LED D7: -5v (No. 2)

LED D8: +5V DIGITAL

LED D9: EDGE A ON

LED D10: EDGE B ON

LED D11: VIDEO DETECTION

Tabie 3-4: AEEU Jumper Setups

(Factory Setup Position is marked in bold).

Function	Jumper No.	setup Position	Selection
ANA/DIG GND Connection	JP121	ON OFF	Connected Not connected
WATCHDOG Connection	JP122	ON OFF	Connected Not connected

3.5.1.6 DCDB HARDWARE CONFIGURATION

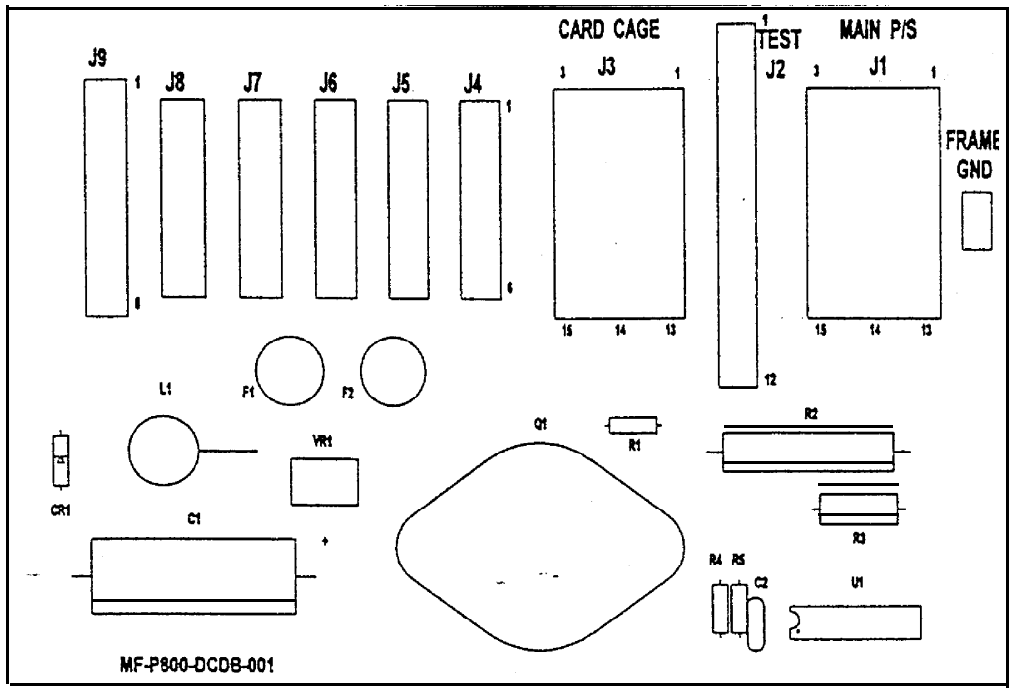


Figure 3-10: DCDB Layout Diagram

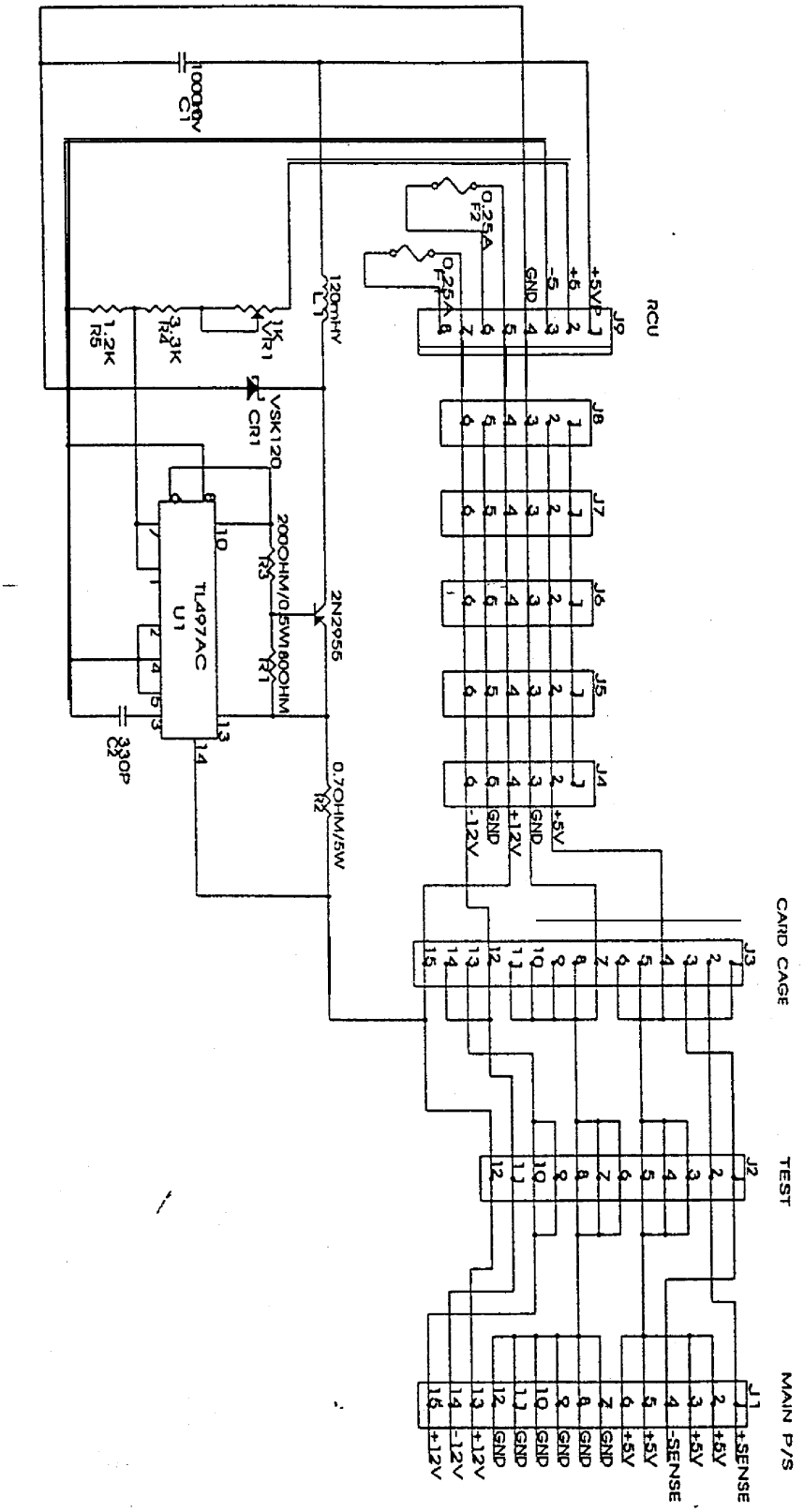


Figure 3-11: DCDB Schematics

3.5.1.7 POWER CONNECTIONS

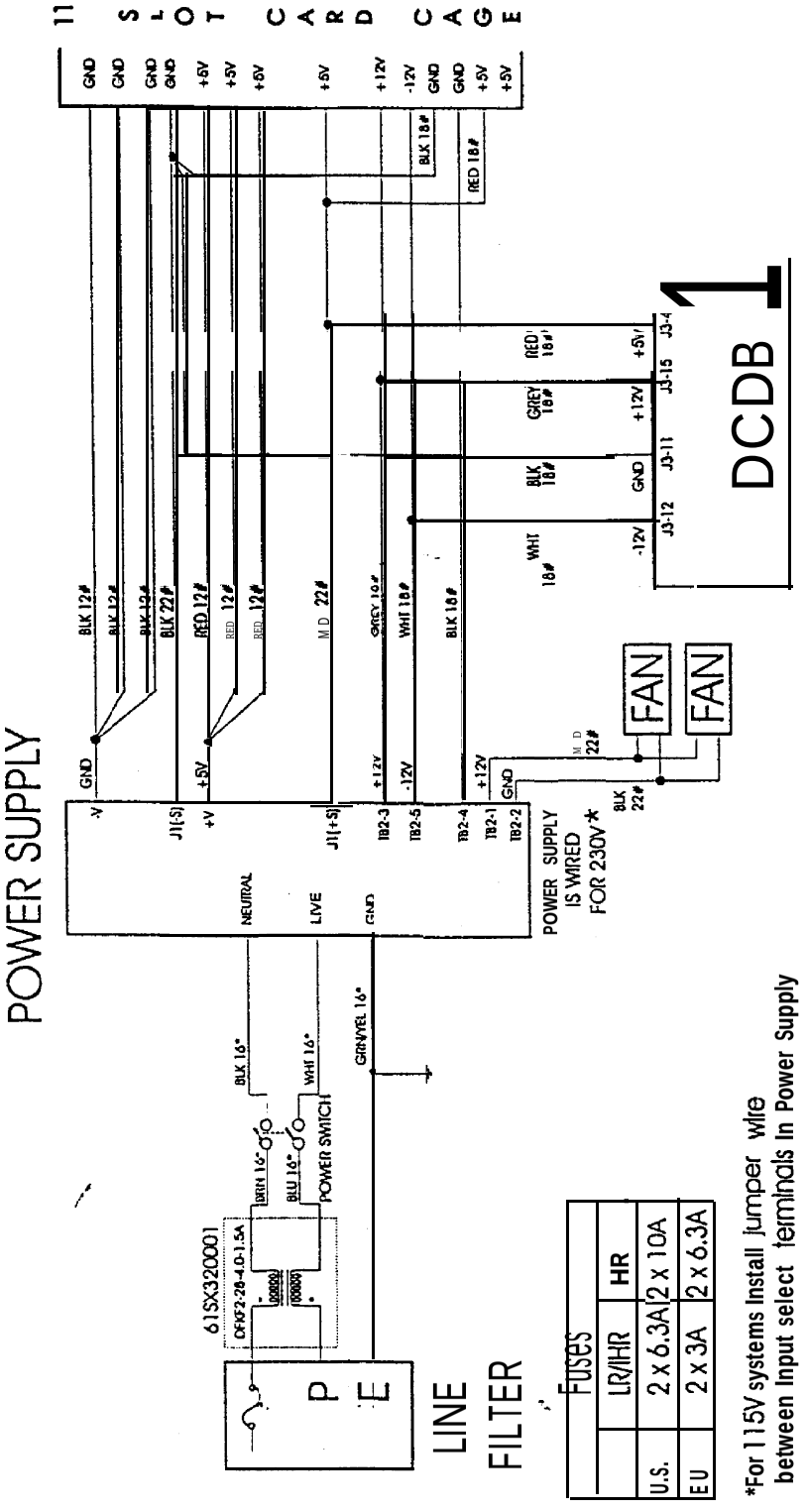


Figure 3-12: Power Connections Schematic

3.5.2 Software Configuration

The system is factory set. However, in case of 50 Hz operation, the following procedure must be executed:

3.5.2.1 50 HZ / 60 HZ PARAMETER CHANGE

IDF is selected in 60 Hz by default. To select 50 Hz follow the following procedure:

a. Put the service key Lexan on top of the IDF's console in order to have access to the alphanumeric keyboard.
b. Turn system(s) on. A self test procedure will take place for about 20 seconds and then the system(s) will go to the bypass mode. In case of any errors detected, the appropriate error codes will be displayed for ten seconds and then the system will return to the bypass mode and lock itself. Please refer to Chapter 4 for further information regarding Self Test.
c. To access the Utilities Menu on a monoplane or a frontal plane, press [CMND] [U] [2] [5] [5] [ENTER] on the RCU.
On a lateral plane press [CMND] [U] [2] [5] [4] [ENTER].
d. After the password has been entered, the Utiiities Main Menu is displayed with the following options:

1. NOVRAM Parameters Handling
2. Disk Directory Handling
3. Installation
4. Diagnostics
5. Communications
6. Self Test

e. Enter selection: [1]
f. The following sub-menu is then displayed:

1. System Configuration
2. Hardware Parameters
3. TV Chain Parameters
4. Input-Output Table
5. Angio Room Parameters
6. Cardio Room Parameters
7. Common Parameters
8. Post Processing Parameters

g. Enter selection: [2]
h. Hardware parameters screen is now displayed. Using the arrows bring the cursor to FREQUENCY parameter. To change frequency from 60 to 50 Hz press [SPACE].
i. Press [ENTER] to exit. The system will perform a self test sequence and return to the normal mode.

3.6 CALIBRATION

For calibration procedure, refer to direction 2176911-100: IDF Calibration Procedure.

3.7 FUNCTIONAL CHECK

Select IDF on Ad'x console. Perform acquisition in SUB and NO-SUB and RDMAP modes as described in IDF Operator Manual. Page 1-4.

Select LAST IMAGE HOLD and FILTER and NO-SUB IMAGE UN REFERENCE MONITOR to verify proper operation of each setting refer to IDF Operator Manual. Page l-3.

4.0 SYSTEM SELF TEST

4.1 General

4.1.1 System Self Test Features

The system self test module is called up by the software under the following five conditions:

a. At system power up .
b. At system reset.
c. After changing hardware parameters: a complete system self test is performed using the new hardware parameters.
d. After selecting Utilities Menu Option 6: a complete system self test is performed without having to turn the system on and off.
e. After 60 ms without software presence (watchdog*).
* NOTE: The watchdog mechanism enables the system to detect a S/W "derailment", which can be casued by strong electromagnetic fields. This situation forces the system into a warm reset.

The main features of the system self test are:

- All boards are checked sequentially and an error list is displayed at the end.
- In most cases, the test will not get "stuck" when it detects a hardware fault, i.e., it will continue on to the next check. If, however, the test does get stuck, the screen disptay informs the user which test caused the system self test failure. See Table 4.1 for test description.
- Visual indication of test progress:
  - * Test Number Counter
  - * Timer

4.2 Errors Display

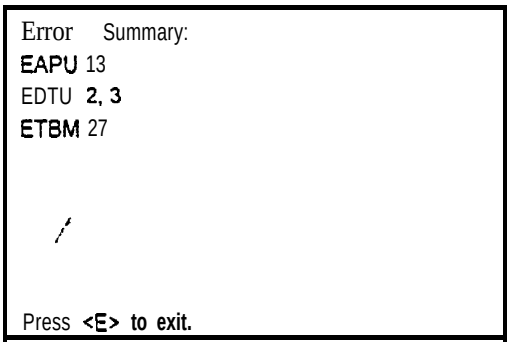


Figure 4-l: Screen Error Sample

4.2.1 General

If any error was detected during the self test, the error message appears when the self test is concluded:

x: Y,Y,Y,Y...
x: Y,Y,Y,Y...

etc., where:

X = board name (Sec. 4.2.2), and
Y = the error number(s) (Sec. 4.2.3)

For instance, a failure in the SMAU board could display an error message as follows:

ERROR SUMMARY

SM1A: 0 1 2
SM1B: 0 1 2

-After 10 seconds the error message screen will- disappear, and the monitor will display bypass images and all RCU LEDs will light up to indicate an error. The system is then locked and can not be operated in the nominal mode.

> NOTE
>
> When the system locks up after self test failure, the only way to communicate with it is by accessing the utilities software as described in Appendix A.

The self test has a predefned time limit of 15,000 vertical pauses, or approximately 5 minutes. If, for any reason, the maximum time elapses before the self test is completed, the remaining tests are aborted and the system will display the following error message:

** xx

Where xx= Test number where Self Test reached the limit.

After 10 seconds the error message screen will disappear, as described above.

4.2.2 Error Categories

The error list is currently divided into 6 categories:

1 EAPU Errors
2 EDTU Errors
3 ETBM Errors (including NOVRAM)
4 SMAU Errors
5 AEEU Errors
6 SRCU Errors

4.2.3 Error List

NOTE

If at the beginning of the Self test, you receive ANY of the following errors:

EAPU: 0
EDTU: 0,1
ETBM: 0,1

the Self test is immediately ABORTED.

Since there is no monitor display with these kinds of errors, error notification will be through the RCU LED prompts (see Sec. 42.5).

4.2.3.1 EAPU ERRORS

0 Non-existent EAPU, or EAPU not responding
1 EAPU CSR not OK
2 EAPU RAY ENABLE register not OK
3 EAPU RAY POLARITY register not OK
4 EAPU RAY DEBOUNCE register not OK
5 EAPU BOS bits register not OK
6 EAPU LUT RAM not OK

Internal Sync Failure - check signal bits:
7 VAC bit not OK
8 ODD/EVEN bit not OK

12 VAC signal going into Q-BUS not OK.
(in this case no counter progression is seen during self test)

13 INPUT LUT failure, using LINEAR LUT and HORIZONTAL RAMP (generated by EAPU), with SMAU1 - Unit A

4.2.3.2 EDTU ERRORS

0 Non-existent EDTU, or EDTU does not respond
1 Text memory interface does not respond

EDTU Registers Failure:
2 DVA CSR not OK
3 DVB CSR not OK
4 ALU CSR not OK
5 HST CSR not OK
6 TXT CSR not OK
7 Text memory not OK

Output LUT Failure
(using analog loopbacks with SMAUI-Side A, input BUS-A, output BUS-D):
10 using DVA - LUTO
11 using DVA - LUT1
12 using DVB - LUTO
13 using DVB - LUT1

4.2.3.3 ETBM ERRORS

0 NOVRAM does not respond
1 Bad password in Config. EPROM

2 CSR not OK
3 RAM Bank (#15) not OK

6 NOVRAM BATTERY not OK
7 NOVRAM MEMORY not OK

NOVRAM Set-Defaults from ROM:
20 Hardware parameters (default from Config. EPROM)
21 TV chain parameters (*)
22 Input-Output tables (from Config. EPROM)
23 Software Angio parameters (*)
25 Software Common parameters (*)
27 Installation parameters (from ROM table)

(*) These pages are not automatically defaulted. Self test indicates only bad checksum.

4.2.3.4 SMAU ERRORS (SM1A, SM1B)

> **NOTE**
>
> In the case of SMAU errors 0, I, or 2, all other SMAU checks are aborted and the SMAU will be defined as non-existent.

0 Non-existent SMAU, or SMAU does not respond
1 ALU register does not respond
2 SMAU Mapping 16 bit does not respond
3 CSR not OK

SMAU Memory Failure (also checking "Shadow Bank"):
4 First memory bank not OK
5 Second memory bank not OK

SMAU Operation Failure:
10 BUSY, GO bits not OK
11 CLEAR operation failed
12 SET operation using ALU failed
13 INTERLACE mode not OK
14 PROGRESSIVE mode not OK

SMAU "Internal" Bus Transfer Failure:
20 Internal transfer OUT-B + INP_B not OK
21 Internal transfer OUT-C + INP_C not OK
22 Internal transfer OUT-D + INP_D not OK
25 Internal transfer OUT-3ST + IN-1 not OK (self copy)

4.2.3.6 AEEU ERRORS

0 Non-existent AEEU, or AEEU does not respond

4.2.3.7 SRCU ERRORS

Serial I/O Devices fail:

2 1 ST RCU (Main SRCU) does not exist or does not respond (Falcon SLU 2)

In lateral system there is no RCU test

4.2.4 Test Number Display During Self Test

Self test is called up under one of four conditions, as described in 4.1.1. During the test, the user sees the progress of the timer and the number of the test currently being performed, as follows:

. Table 4-1: Self-Test Number Display .

TEST #	TEST NAME	TEST DESCRIPTION
1	Start Main System Check	Checks system existence.
2	EAPU/EDTU Registers Check	Checks R/W Registers and EAPU's LUT RAM.
3	Internal Sync Check	Checks internal sync of EAPU.
4	Text Memory Check	Checks text memory of EDTU. Note that information can be displayed on the monitor only after tests 1 - 4.
6	Check VAC Interrupt on Q-BUS	Checks VAC interrupt on Q-Bus from EAPU. This signal is responsible for synchronizing all of the self test checks, and all software. If this signal fails, the self test will continue without display of the timer progression.
7	Check ETBM (including NOVRAM)	1. R/W Register. 2. RAM Bank (Holds Subtract Table for Fluoro mode: Bank # 15). 3. NOVRAM Back up battery and memory.

Table 4-2 Self-Test Number Display (continued)

TEST #	TEST NAME	TEST DESCRIPTION
8	Checksum of NOVRAM pages	Checks each of the following parameters: 1. Hardware 2. TV-Chain 3. IO Tables 4. Angio 5. Common 6. Installation
9	Check SRCU	SRCU connection is checked using the Backspace character test.
10	Start "Parallel" Calculation (while continuing boards check) of Logarithmic Subtract Table	In the EAPU: Table # 1 Linear LUT Table # 2 Fluoro LUT Table # 3 Sub LUT In the ETBM: Logarithmic Subtract Table (Fluoro) All tables are built according to NOVRAM parameters while board checking continues.
12 16	SMAU1 - Side A Check SMAU1 - Side B Check	Checks existence of SMAUs, then check: 1. R/W Registers 2. Memory 3. Operation:
20	AEEU Check	Checks existence of AEEU
3 2	Video Transfer between Sides A <-> B of SMAU	Check internal transfer of SMAU using all buses.
34 36 38	Input LUTs Check Output LUTs Check AGC Check	Wait for completion of EAPU LUTs Checks system features using SMAU 1. Input LUT Set bypass mode to check. 2. Output LUTs (at DVA, DVB) 3. Gain and Bias Set mode back to Normal
70	Wait to Finish Table Calculation	
75	Stop the Timer and Display Errors (if any)	

4.2.5 RCU Display During Self Test

Each time a failure occurs during the self test, a specific LED lights up on the RCU. This provides the user with immediate feedback while the test is running. as opposed to waiting for the error display at the end of the self test.

Table 4-2 summarizes the LEDs (identified by key index number and mnemonic) that light up upon detection of specific error conditions.

Tabfe 4-2: RCU Display during Self Test

KEY MNEMONIC	ERROR DESCRIPTION
SUB	EAPU (all errors) EDTU (errors 0,1) ETBM (error 0)
NO SUB	EDTU (all errors)
ROADMAP	SMAU (all errors)
NO SUB IMAGE ON REF MON	ETBM (all errors)
LIH	SRCU (all errors)
FILTER	AEEU (all errors)

5.0 TROUBLESHOOTING AND REPLACEMENT PROCEDURES

5.1 General

Sections 5.2-5.3 of this section provide troubleshooting information on the following two areas:

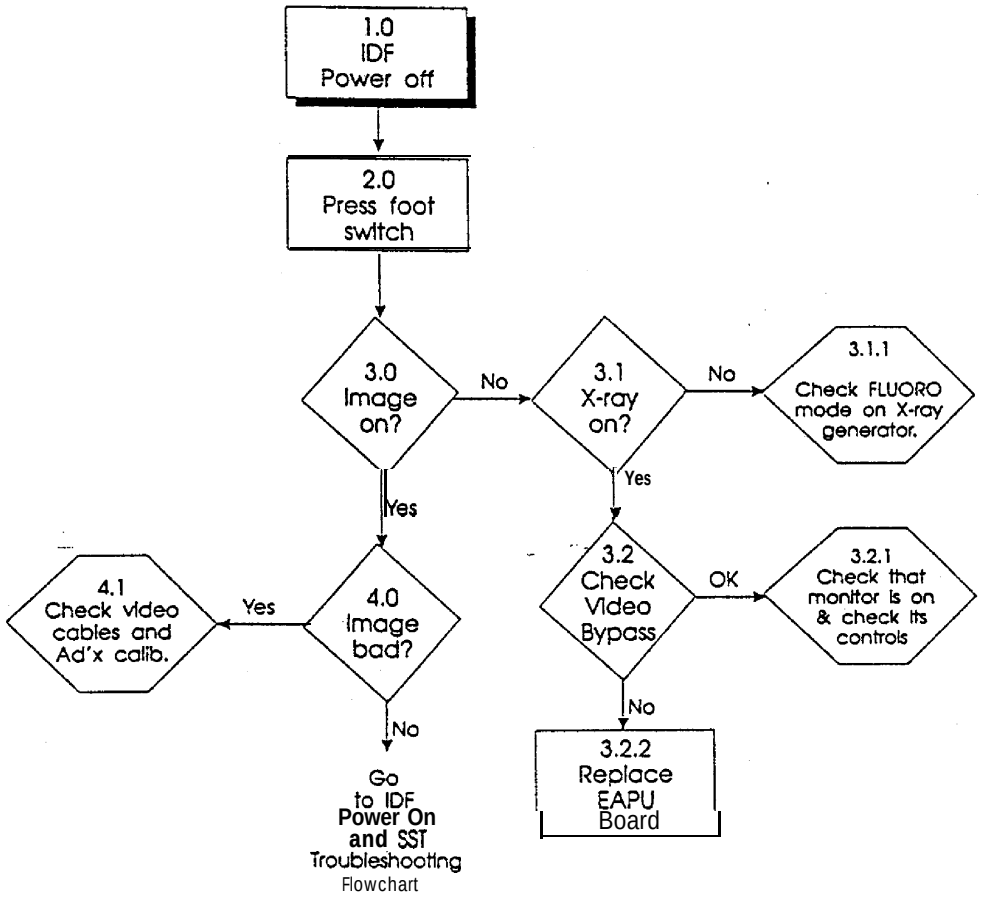
a. IDF to X-ray connections and input video,
b. power on and system self test (SST)

Each subsection is comprised of:

a. a troubleshooting flowchart in which each block is numbered,
b. a concise list of typical faults and corrective actions, and
c. a more detailed troubleshooting description, with references to the flowchart.

Sections 5.5-5.9 provide step-by-step replacement or disassembly procedures for major IDF assemblies.

5.2 IDF to X-Ray Connections and Input Video



NOTES TO FLOWCHART:

1. In power off mode, the IDF is totally bypassed (both Camera In and AUX In inputs). A normal fluoro image should be displayed on the monitor. Select IDF on Ad'x console.
2. When the foot switch is pressed, fluoro X-ray is activated and the TV image passes directly to the image monitor.
3. Verify that a direct fluoro image is displayed on the monitor.
   - 3.1 if there is no image on the display: Check that the X-ray equipment is powered on.
     - 3.1.1 No X-ray radiation: check that Fluoro mode is active and check other possible X-ray inhibit interlocks.
   - 3.2 Verify the video bypass normally closed relay on the EAPU board by checking continuity between Cam In and MonA.
     - 3.2.1 X-rayradiation is on but still no image on monitor: Check that TV monitor is powered on and that the brightness and contrast controls are properly set. Check VIC video routing.

4. Normal fluoro image is displayed, but of poor quality.
   4.1 Check either Fluoro techniques KV and MA or Fluoro automatic exposure control and collimate image properly,

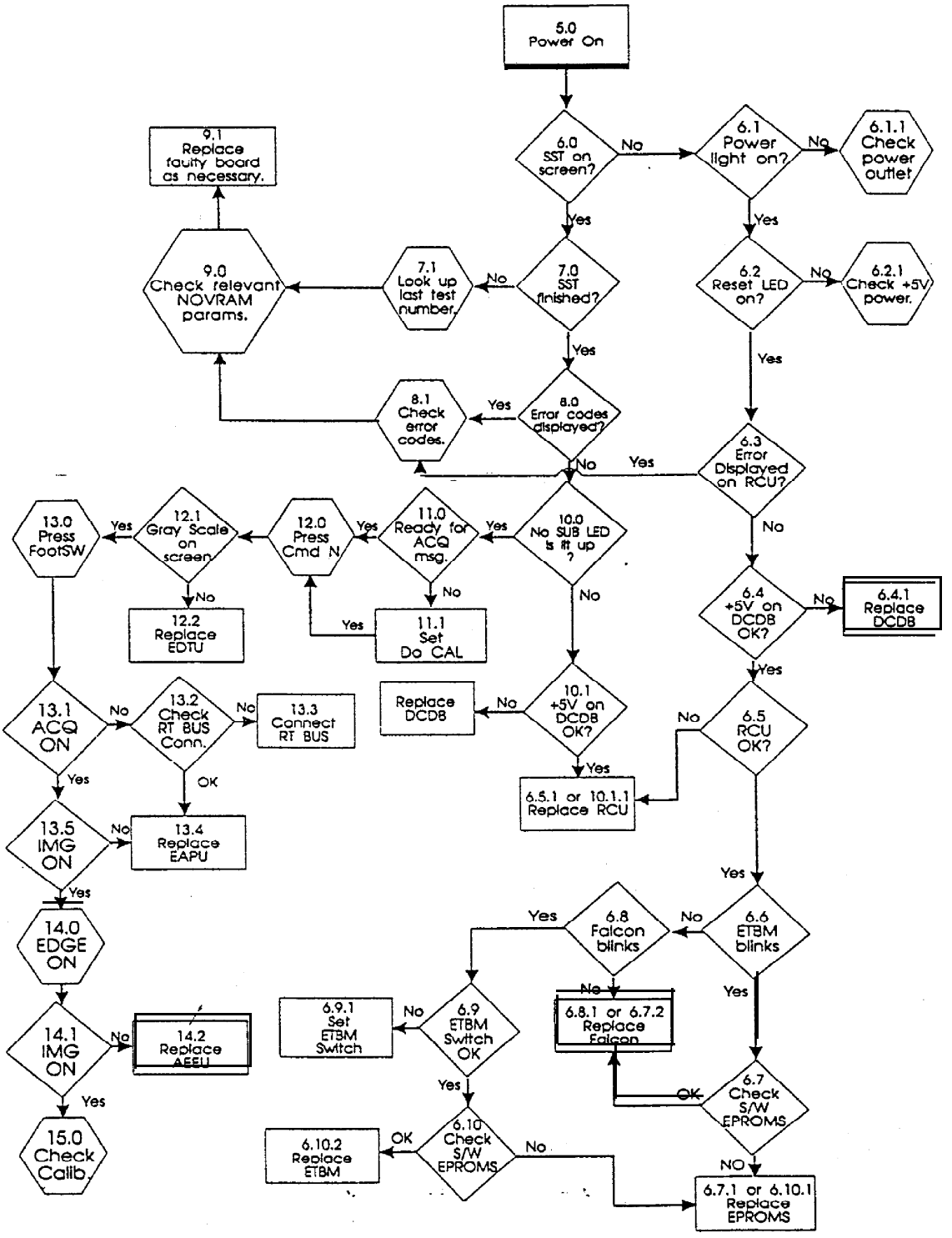
TYPICAL FAULTS	CORRECTIVE ACTIONS
a. No bypass on monitor.	a. Check EAPU video input plug (P 10) and any other video chain plug.
b. Poor X-ray fluoro image.	b. Manually adjust fluoro technique or check automatic exposure control.
c. No image on monitor.	c. Check connections on CAM IN to F+ and MON A OUT to monitor.
d. Image on monitor is very dim in comparison to image before installation.	d. One of video chain items (monitor, VCR) is terminated when it is supposed to be HI impedance.
e. Image on monitor is very bright in comparison to image before installation.	e. Last item on video chain (monitor, VCR) is not terminated at 75Ω.

5.3 Minimum Configuration

The following table describes minimum configuration in which the IDF will still respond and report various error messages. The boards listed under "Operating Boards" are the only boards assumed OK.

OPERATING BOARDS	CHECK
FALCON	Blinking LED on board when trying to boot
FALCON, ETBM, RCU	Self Test Led codes (on RCU)
FALCON, ETBM, EAPU. EDTU	Self Test display on screen
FALCON, ETBM, EAPU, EDTU, SMAU	System operational without Edge Enhancement filter (provided video routine bypass AEEU)

5.4 Power On and System Self Test



NOTES TO FLOWCHART:

5. Power on the IDF using the Front panel switch.
6. Verify that the SST message is displayed on the screen.
   - 6.1 If not, verify that the power switch is illuminated.
     - 6.1.1 If not, check the power outlet cables and the IDF fuses.
   - 6.2 If power switch illuminated, verify that the Reset LED (on the IDF rear panel) is illuminated.
     - 6.2.1 If not, check the IDF +5V DC power supply.
   - 6.3 Check if any RCU LEDs light up during self-test.
   - 6.4 If not, check +5V on DCDB board.
     - 6.4.1 If no +5V, replace DCDB (or DCDB fuses), check if LED on FALCON board is blinking.
   - 6.5 Check RCU, RCU Cable and SLU connections to Falcon CPU.
   - 6.6 ETBM should blink once (at bootup) when CPU loads S/W at power on.
   - 6.7 In case of S/W upgrade, check for correct position and polarity of ETBM EPROMs. Refer to fig. 3-5.
   - 6.8 If the Falcon CPU board LED blinks, this indicates that the CPU is unable to load the S/W.
   - 6.9 Check ETBM Switch position according to Table 3.2.
   - 6.10 Replace suspect EPROMs or ETBM Board.
7. The SST can take up to 1,000 VAC (vertical pulses), approximately 20 seconds, and then terminates with or without error messages.
   - 7.1 If the SST was terminated before completion:
     display and then record the error list, checking the error codes in Secs. 4.2.2 and 4.2.3.
     record the last test number, checking the test number codes in Sec. 4.2.4.
8. If the SST was completed, check if the system has errors to display (refer to chapter 4 for self test detailed procedure).
   - 8.1 If yes, display and then record the error list, checking the error codes in Secs. 4.2.2 and 4.2.3.
9. Check the relevant NOVRAM parameter settings (software, hardware, TV chain), as well as the Configuration EPROM parameters.
   - 9.1 If the parameters are OK, then replace the faulty board(s).
10. When the SST is successfully completed check the RCU operation.
    - 10.1 The RCU should initialize and the NO SUB LED should illuminate. Check that the RCU responds to [LIH] and [FILTER] pressing.
      - 10.1.1 If some RCU LEDs are on but it does not respond to function keys, check the cable connections and replace the RCU unit as necessary.
    - 11.1 Set DO CAL=1 (Common Menu). Select LIH and Edge Off on RCU.
12. Cmd N should display an artificial gray scale on screen. If not, replace EDTU Board.

13.0 Press Fluoro Foot Switch. The message "ACQ ON" should be displayed.
13.2 If no message, check RT bus connection.
13.4 If OK, replace EAPU.
13.5 The radiated image should be displayed.
14.0 Select Edge On.
14.1 Verify edge enhancement image.
15.0 If problem related to image contrast, perform calibration procedure, refer to sec. 3-6.

TYPICAL FAULTS	CORRECTIVE ACTIONS
a. Image is cut vertically.	a. NOVRAM TV chain parameter is set for wrong line frequency (50/60 Hz).
b. Hardware fauit on boards, as indicated by RCU LEDs (see Sec. 4.2.5) and/or error list on the screen (see Secs. 4.2.2 and 4.2.3).	b. Either the hardware is non-existent or you have to correct the relevant NOVRAM hardware parameter, If not replace the concerned board.
c. No RCU response.	c. Missing connection or RCU cable missing;.
d. No System Self Test on the screen.	d. Check if any LED(s) are lit up on the RCU. If not, and if the DC supply is OK, then replace the Falcon board or ETBM board.
e. Operation aborted during Fluoro acquisition.	e. Wrong sequence of boards installed in the card cage.

5.5 Power Supply

5.5.1 Power Supply Adjustment

In case of power supply replacement check ±12V and +5V for proper setting. +5V should be adjusted while monitoring the voltage on the AEEU board. See potentiometer position on the next drawing.

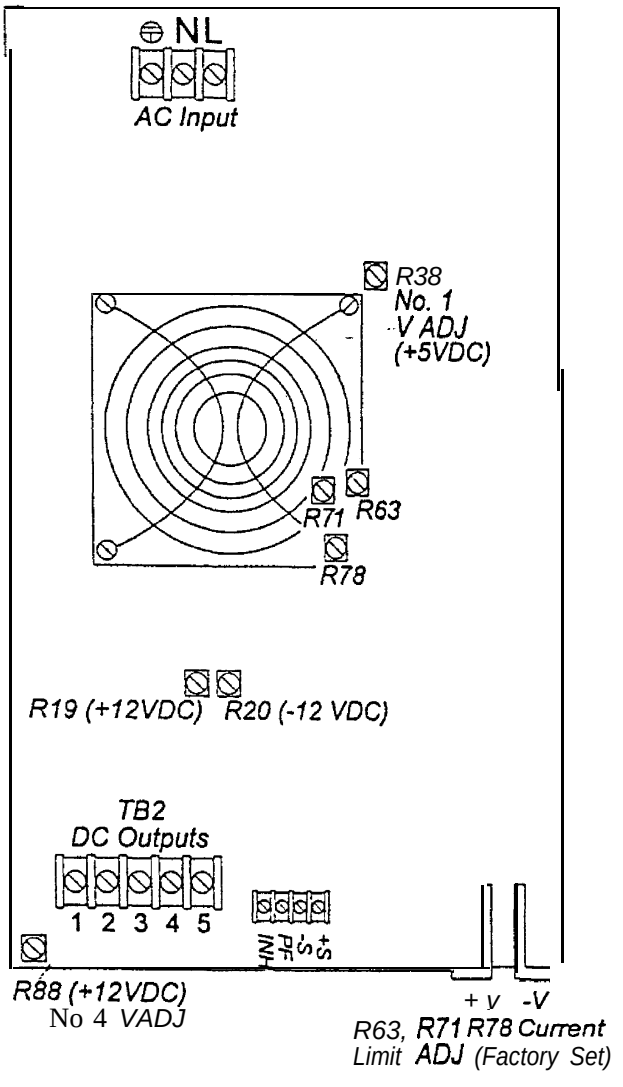


Figure 5-I: Power **Supply Layout**

Adjust the following voltage on the card cage (with all boards):

1. +5VDC from (4.95 to 5.05)
2. +12VDC from (11.4 to 12.6)
3. -12VDC from (I 1.4 to 12.6)

5.5.2 Power Supply Replacement

> Warning: Before replacing the Power Supply Unit, disconnect from the mains supply.

Replace the power supply unit as follows:

a. Use a Philips screwdriver to remove the screws on the rear panel of the unit. Gently pull the cover slightly toward the back and up.
b. Disconnect the power cables from DCDB-J1 and from the Mains input (Fig. 2-I).
c. Unscrew the two screws on the bottom of the power supply unit.
d. Remove the power supply from the IDF.
e. The +5V must be checked for proper setting.
Adjust the potentiometer while monitoring the voltage on the AEEU board using a digital volt meter. See potentiometer position in next figure.
f. To replace the unit, reverse steps a. - d.

5.6 DCDB Replacement

To replace the DCDB, disconnect all the connectors from the board. Unscrew the 5 Philips screws, and remove the board. Install the new board by reversing these steps.

5.7 DCDB Testing

Connector J2 is used for testing purposes. The unit should be tested with the RCU connected. The readings should be:

1	GND
2	5V
3	5V
4	5V
5	5V
6	GND
7	GND
8	GND
9	12V regulated
10	12V regulated
11	-12V
12	12V unregulated

J3 outputs to the card cage.
J4 through J8 provide output voltages to the FPNL board (RESET board on the rear panel) and have the following test points:

1	spare
2	5V
3	GND
4	12V unregulated
5	GND
6	-12V

J9 outputs to the RCU. Tests should be made with the RCU connected and give the following readings:

1	5V
2	5V
3	GND
4	GND
5	12V
6	12v
7	-12v
8	-12v

The 5V output voltage should be adjusted using potentiometer VR1. Refer to Fig. 3-6.

Fuse 1 is +12V and fuse 2 is 12V.

5.8 Filter Cleaning

The filter across the front of the unit (Fig. 2-1) should be cleaned periodically. To clean a filter:

a. Remove the two cover screws. Gently pull the top cover slightly toward the back and up.
b. Pull the filter out.
c. Clean the filter with a hot detergent solution.
d. After drying, recoat with airclean spray.
e. Repeat this process once a month or more, according to environmental conditions.

IMPORTANT
A clogged air filter can fead to erratic circuit failures.

5.9 Opening the RCU

To open the RCU, unplug the communications cable and unscrew the eight Phillips screws on the bottom of the unit. Gently remove the bottom.

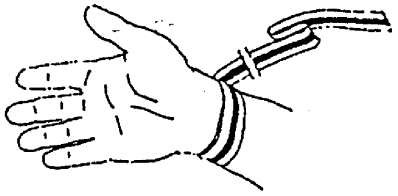
5.10 Replacing Boards in the Card Cage

To replace a board in the card cage remove the two wing nuts that hold the two metal holders on the two sides of the boards. Remove cable connection and eject the board using the metal extractors.

WARNING

AVOID ELECTRIC SHOCK!
DISCONNECT WORKSTATION FROM POWER BEFORE SERVTCMG.

Notice: Take unusual precations against stastic electricity when handling the motherboard. Wear an antistatic bracelet to avoid equipment damage.



Reverse the above steps to insert the board.

If boards are to be replaced the following adjustments should be made

Board Replaced	Action
FALCON	None
SMAU	None
ETBM	Reload Calibration parameters from Appendix B
AEEU	3.6.6 (Filter Calibration)
EDTU	3.6.4.4 (Output gain)
EAPU	FLR+Sub

APPENDIX A: Utilities Software Reference Manual

The main menu of the utilities sofhvare offers six options for parameters selection, directory management, installation, communication, and Self Test.

Most IDF system parameters are factory preset and the user may want to modify some of these parameters.

Most of the parameters are not used for the IDF application. The list is given here for reference only. They should be kept to the default value for a proper IDF operation.

The following sections describe the six Utilities Menu options available to the user.

> NOTE
>
> It is strongly recommended that only qualified technicians access the utilities functions.

a. Put the service key Lexan on top of the IDF's console in order to have access to the alphanumeric keyboard.
b. To access the Utilities Menu on a monoplane or a frontal plane, press [CMND] [U] [2] [5] [5] [ENTER] on the RCU.
   On a lateral plane press [CMND] [U] [2] [5] [4] [ENTER].
c. After the password has been entered, the Utilities Main Menu is displayed (see next page).

A.1 Utilities Main Menu

The Utilities Main Menu contains six options:

IDF - UTILITIES MENU (G10.56) FRONTAL

1. NOVRAM Parameters Handling
2. Disk Directory Handling
3. Installation
4. Diagnostics
5. Communications
6. Self Test

To select the desired option, press the appropriate number on the alphanumeric keyboard. The selected sub-menu is displayed.

In monoplane installations, the Frontal label will be displayed in the message field.

In biplane installation;: the appropriate label - Frontal or Lateral - will be displayed in this message field (according to configuration EPROM).

A.2 Option 1: NOVRAM Parameters Handling (G10.56)

The NOVRAM Parameters Handling option has its own sub-menu, as follows:

1. System Configuration
2. Hardware Parameters
3. TV Chain Parameters
4. Input-Output Table
5. Angio Room Parameters
6. Cardio Room Parameters
7. Common Parameters
8. Post Processing Parameters

<RETURN> - EXIT

ENTER SELECTION: ■

These parameters are stored on the NOVRAM (Nonvolatile Memory) of the ETBM board.

These parameters are factory preset, but may be adjusted to the customer's specific needs. In any group, the parameters can be changed in one of two ways:

a. Individually: using the correct key sequence for each parameter (see para. A.2).

b. All together: using the <S> 'Set Default' option, which reloads the Configuration EPROM defauft parameters.

NOTE
The parameters should be changed by a qualified technician only.

When changing individual parameters, use the arrow keys to move the cursor to the desired parameter. There are two ways to modify a parameter:

a. "rolling": Press the [SPACE] key until the desired value is displayed. The values scroll in a "wrap-around" manner.

b+ "numeric": Enter a new value via the numeric keys on the keyboard. The [←] (BACKSPACE) key may be used to erase mistakes, or the [ENTER] key may be used to set data and start from the beginning.

If a numeric value outside the "possible values" range is entered, the system will beep and enter the closest permitted value.

NOTE
The parameters whose type is marked N/A are not used on IDF.

A.2.1 System Configuration

When selecting Option [1]: System Configuration from the NOVRAM Parameters Handling sub-menu, a table is displayed of the features CONFIGURED (in the Configuration EPROM) versus the actual features AVAILABLE, i.e., the required hardware boards installed which have passed the Self Test.

A.2.2 Hardware Parameters

When Option [2]: Hardware Parameters is selected from the NOVRAM Parameters Handling sub-menu, the hardware parameters and their current settings are displayed.

HARD WARE PARAMETERS (G10.56)

IMG-SIZE	:2	FREQUENCY	:60		
MAU-NO	:2	MIM-SIZE	:0	VDC	:0
RTZ	:0	RTEE	:1	2ND-RCU	:0
DISK	:0	DTSK-STAB	:20		
TEST1	:0	TEST2	:0	TEST3	:0

<SPACE> • CHANGE, <S> • DEFAULT, <RETURN> • EXIT

Screen Sample 1: Hardware Parameters Default Screen

Table A-l provides a short description, possible values, and the ROM default setting for each hardware parameter.

Table A-l: **Summary** of Hardware Parameters

PARAMETER	DESCRIPTION	POSSIBLE VALUES	FACTORY DEFAULT VALUE	TYPE
IMaGe SIZE	Acquisition resolution: 2 IHR: 512 x 1024	2	2	N/A
FREQUENCY	Line frequency of video	50,60 (Hz)	60	Roll
MAU-NO	# of MAW boards installed	1,2	2	Roll
MIM-SIZE [SMIM and/or EMIM]	# of MIM boards installed (increments of 16MB) 0 0 MIM boards I 1 SMIM board @ 16 MB 3 l SMIM board @ 48 MB 4 1 EMIM board @ 64 MB 6 2 SMIM boards @ 96 MB 8 1 EMIM board @ 128 MB 12 l EMTM board @ 192 MB I6 2 EMIM boards @ 256 MB 20 2 EMIM boards @ 320 MB 24 2 EMIM boards @ 384 MB		0	N/A
VDC	Is VDC installed?	0- no 1 - yes	0	N/A
RTZ	Is RTZ installed?	0- no I - yes	0	N/A
RTEE	Is Real-time Edge Enhancement installed?	0- no 1 - yes	I	Roll
2ND-RCU	Is 2ND_RCU or Wireless RCU installed?	0- no 1 - yes	0	N/A
DISK	Is hard disk installed?	0- no 1 -yes	0	N/A
DISK-STAB	Number of seconds before system accesses disk drive after the system is powered on	0..60	20	N/A
TEST I	System Self-Test Setup	0..255	0	N/A
TEST 2	System Self-Test Setup	0...255	0	N/A
TEST 3	System Self-Test Setup	0...255	0	N/A

Note: The parameters are displayed on the screen with their capitalized letters only,

Note: Frequency (50, 60 Hz) should match the video standard: 50 Hz for CCIR and 60 Hz for RS170 or RS343. This parameter does not necessarily match the country line frequency.

A.2.3 TV CHAIN PARAMETERS

When Option 3: TV Chain Parameters is selected from the NOVRAM Parameters Handling sub-menu, the TV chain parameters and their current settings are displayed. TV chain parameters deal mainly with the monitor display.

TV CHAIN PARAMETERS (G 10.56)

MON-NO	:2	LEFT-GAP	:0	RIGHT-GAP	:0
FLR-S-STAB	:20	FLR-L-STAB	:70	FLR-IDLE	:135
FLR-GAM	:69	FLR-SGAM	:69	FLR-MARGIN	:40
FLR-BIAS	:125	FLR-SBIAS	:125	FLR-WIDTH	:0
PFLR-GAIN	:85	PFLR-BIAS	:128	RAD-ERSKP	:1
CNE-GAIN	:85	CNE-SGAIN	:85	CNE-MRGM	:40
CNE-BIAS	:128	CNE-SBIAS	:128	CNE-WIDTH	:160
CNE-15GN	:85	CNE-15BS	:128	CNE-15STB	:60
RAD-GAIN	:85	RAD-SGAM	:85	BUS	:0
RAD-BIAS	:128	RAD-SBIAS	:128		
RAD-DSSKP	:1	RAD-FRDLY	:5	RAD-FRINT	:1
BY P-ROUTE	:17	FLR-ROUTE	:31	CNE-ROUTE	:31

<SPACE> - CHANGE, <S> - DEFAULT, <RETURN> - EXIT

Screen Sample 2: T.V. Chain Parameters Default Screen

For each TV chain parameter, Table **A-2** provides a short description, possibfe values, and the ROM default setting.

Table A-2: Summary of TV Chain Parameters

PARAMETER	DESCRIPTION	POSSIBLE VALUES	FACTORY DEFAULT VALUE	TYPE
MONitor-NO		2	2	N/A
LEFT GAP/ RIGHT GAP	Sets left and right margins of text display	Left Gap + Right Gap ≤ 0...8	0	Num
FLuoRo-STAB	Number of TV frames (25* = 1 sec) to reach image stabilization (ABS), after pressing the Fluoro FTSW. No acquisition to MIM during that period	0...255	20	Num
CiNE-STAB	Number of Frames to reach Cine Camera Stabilization, after pressing the Cine FTSW.	0...255	60	N/A
PFLR STAB	Number of frames to reach image stabilization, after pressing the PFLR FTS W.	0...255	20	N/A

* 30 for American systems.

Note: The parameters are displayed on the screen with their capitalized letters only.

Table A-2: Summary of TV **Chain Parameters (continued)**

PARAMETER	DESCRIPTION	POSSIBLE VALUES	FACTORY DEFAULT VALUE	TYPE
FLuoRo-GAIN	Multiplication factor for full range of fluoroscopic image signal.	0...255	69	Num
FLuoRo-SGAIN	Multiplication factor for full range of fluoroscopic subtracted image signal.	0...255	69	Num
FLuoRo-MaRGIN	Lowest values (in gray ievel) for the subtracted protocols when working with ACE.	0...255	4 0	Num
FLuoRo BIAS	Bias Level for fluoroscopic image signal	0...255	125	Num
FLuoRo SBIAS	Bias Level for fluoroscopic subtracted image signal	0...255	125	Num
FLuoRo WIDTH	Total range (in gray levels) for the Fluoro subtraction protocols. The Fluoro - Margin value plus the Fluoro - Width value is the top (i.e., whitest) value of the subtracted images. If 0, no ACE is performed.	0...255	0	Roll
PFLR GAM	Multiplication factor for full range of Pulsed Fluoro Image signal.	0...255	85	N/A
PFLR BIAS	Bias level for Pulsed Fluoro Image signal	0...255	12s	N/A
RADio ERSKiP	The number of X Ray pulses to skip in ER mode before starting acquisition to the MIM.	0...255	1	N/A
CiNE GAIN	Multiplication factor for full range of Cine image signal	0...255	85	N/A
CiNE SGAIN	The initial Gain value for Cine subtracted protocols	O-255	85	N/A
CiNE MarGIN	Lowest value (in gray levels) for the Cardio - DSA protocol.	0...255	40	N/A
CiNE BIAS	Bias level for cine image signals.	0...255	128	N/A
CiNE SBIAS	Bias level for subtracted cine image signals.	0...255	12s	N/A
CiNE WIDTH	Total range (in gray levels) for the Cardio DSA protocol images. The Cine Margin value plus the Cine Width is the top (i.e. whitest) value . in the subtracted images.	0...255	160	N/A

Table A-2: Summary of TV Chain Parameters (continued)

PARAMETER	DESCRIPTION	POSSIBLE VALUES	FACTORY DEFAULT VALUE	TYPE
CINE 15GN	Gain at 12.5 (15) PPS of X-Ray	O-255	85	N/A
CINE 15BS	Bias at 12.5 (15) PPS of X-Ray	0...255	128	N/A
CINE 15STaB	NSTAB (in frames) between cine FTSW command and acquisition to MIM at 12.5/(15) PPS.	0...255	60	N/A
RAD GAIN	Multiplication factor for full range of Radiographic image signal	0...255	85	N/A
RAD SGAIN	A calculated value for the gain in RAD - DSA subtracted protocol.	0...255	85	N/A
BOS	Beginning of sample	0...3	0	N/A
RAD BIAS	Bias Level for Radiographic image signal	0...255	128	N/A
RAD SBIAS	Bias Level for Radiographic-subtracted image signal	O-255	128	N/A
RAD DSSKiP	The number of pulses to skip in DSA mode before acquiring the mask and starting acquisition to the MIM.	O-255	1	N/A
RAD FRame-DeLaY	Frames delay between Snap Pulse interrupt and onset of acquisition within each pulse.	0...9	0	N/A
RAD FRame-INTegration	Acquisition length (in frames). For progressive mode it is set to 1 since only one frame (without averaging) is acquired.	1..16	1	N/A
BYP ROUTE	Routes the input video to preselected output	0...31	17	Num
FLR ROUTE	Routes the video during fluoro operations to preselected outputs	0...31	31	Num
CNE ROUTE	Routes the video during cine operations to preselected outputs	0...31	31	N/A
N-SAMPLE	Averaged number of frames for /ACE calculation.	0...255	16	Num
N-MASK	Averaged number of frames for MASK acquisition.	O-255	16	Num

A.2.4 Input-Output Table

Option 4: Input Output Table from the NOVRAM Parameters **Handling** sub-menu is used to assign input/output functions. This functions are not **available on** IDF.

a. Inputs

```
                        INPUT- OUTPUT TABLE                (G 10.56)

FLUORO-FS     :4        Cl-NE-FS      :0        PFLR-FS       :0
ECG-SGNL      :o        ER-SGNL       :0        SNAP-SGNL     :0
CONTROL I     :0        CONTROL 2     :0

                        OUTPUT PORT FUNCTIONS

CRD_ACQON     :0        REVIEW        :0        BYPASS        :0
CARDIO        :0        VIEW-ACTV     :0        BUSY          :0
MASK          :0        FDSA-MXOP     :0        DSA           :0

OUT-PLRTY     :0        INP_DBNCE     :0        INP_POLRT     :255

<SPACE, - CHANGE, <S> - DEFAULT, <RETURN> - EXIT
```

Screen Sample 3: input-Output Parameters Default Screen

Table A-3: Input fort Bits

Signal	Debounce	Default	Port	EAPU P2 Pins
Fluoro FS	Y	4	XR1	1,2
Cine FS	Y	0	XR4	7,8
PFLR FS		0		
ECG Signal		0		
ER Signal	Y	0	XR2	3,4
Snap Signal	N	0	XR5	9,10
Control 1	N	0	XR6	11,12
Control 2	Y	0	XR3	5,6

NOTE
Fluoro FS is the only input used on the IDF.

b. Outputs

Output bits are not available for the IDF.

A.2.5 Angio Room Parameters

When Option 5: Angio Room Parameters is selected from the NOVRAM Parameters Handling sub-menu, the Angio Room Parameters and their current settings are displayed.

ANGIO PARAMETERS (G 10.56)

FDSA-LO W	:80	MXOP-LO W	:80	RDM-LOW	:80
FDSA-HIGH	:160	MXOP-HIGH	:160	RDM-HIGH	:200
USA-LOW	:80	ER-TO-MIM	:0	RADIO-A	:4
DSA-HIGH	:160	AQ-TO-MIM	:0	RADIO-M	:3
ACQ-A	:4	STAB-A	:4	PRE-A	:4
ACQ-M	:3	SUB-M	:3	PRE-M	:3
ACQ-LINK	:0	SUBT-LINK	:0	DSA-LINK	:0
FLR-FR/SC	:4	FLD-FRM	:1	IMG-STDY	:1
RAD-IN/PR	:0	VDC-MOD-A	:3	FTSW-OVER	:0

<SPACE> - CHANGE, <S> - DEFAULT, <RETURN> - EXIT

Screen Sample 4: Angio Room Parameters Default Screen

Table A-4 lists each specific Angio Room Parameter, a description, possible values for the parameter, and the factory default setting.

Table A-4: Summary of Angio Room Parameters

PARAMETER	DESCRIPTION	POSSIBLE VALUES.	FACTORY DEFAULT VALUE	TYPE
FDSA-LOW	Sets lower limit (MIN) for FDSA subtracted image window	0..255 < FDSA-HIGH	80	Num
MaXOP-LOW	Sets lower limit (MM) for MAXOP subtracted imaee window	0..255 < MaXOP-HIGH	80	N/A
RoaDMap-LOW	Sets lower limit (MIN) for roadmap subtracted image window	0..255 < RoaDMap-HIGH	80	N/A
FDSA-HIGH	Sets upper limit (MAX) for FDSA subtracted image window	0..255	160	Num
MaXOP-HIGH	Sets upper limit (MAX) for MAXOP subtracted image window	0..255	160	N/A
RoaDMap-HIGH	Sets upper limit (MAX) for roadmap subtracted image window	0..255	200	Num
DSA-LO W	Sets lower limit (MIN) for DSA display	0..255 < DSA-HIGH	80	N/A

Table A-4: Summary of Angio Room Parameters (continued)

PARAMETER	DESCRIPTION	POSSIBLE VALUES	FACTORY DEFAULT VALUE	TYPE
ER-TO-MIM	In Radiographic studies disables the acquisition to Cine Memory for non-subtracted images protocol (ER Testshot) Indicates whether images are kept in MIM	0: no I: yes	1	N/A
RADIO-A	Averaging factor for ER/DSA interlaced acquisition with RADFRINT >1	1..5	4	N/A
DSA-HIGH	Sets upper limit (MAX) for Angio DSA display	0..255	160	N/A
AQ-TO-MI M	Enables acquisition to MIM of non-subtracted fluoro images. FDSA, MAX-OP and Road Map are not affected.	0: no 1: yes	0	N/A
RADIO-M	Motion Detection Threshold for ER/DSA interlaced acquisition with RADFRINT > 1	1..3	3	N/A
ACQ-A	Averaging factor for Fluoro Acquisition A = I: No motion detection. A = 5: Averaging without motion detection.	1..5	4	Num
SUB-A	Averaging factor for Subtracted Fluoro Protocols	1..5	4	Num
PRE-A	Averaging factor for pre-averaging in Road Map protocol	1..5	4	Num
ACQ-M	Motion Detection Threshold for Fluoro Acquisition	1..3 1: Most sensitive	3	Num
SUB-M	Motion Detection Threshold for Subtracted Fluoro Protocols	1..3	3	Num
PRE-M	Motion Detection Threshold for pre-averaging in Road Map protocol	I..3	3	Num

Table A-4 Summary of Angio Room Parameters (continued)

PARAMETER	DESCRIPTION	POSSIBLE VALUES	FACTORY DEFAULT VALUE	TYPE
ACQ-LINK	Automatic transition to Cine mode (if installed) after releasing the Fluoro FTSW during non-subtracted fluoro. 0: No Link 1-254: Link, show selected number of half loops, stop and display the center image of the loop. 255: Link and loop forever	0..255	0	N/A
SUBT-LINK	Automatic transition to Cine mode (if installed) after releasing the Fluoro FTSW during FDSA and MaxOp. 0: No Link 1-254: Link, show selected number of half loops, stop and display the center image of the loop. 255: Link and loop forever	0..255	255	N/A
DSA-LINK	Automatic transition to Cine mode (if installed) after releasing the RAD FTSW. 0: No Link I- 254: -Link, show selected numbeof half loops, stop and display the center image of the loop. 255: -Link and loop forever	0..255	255	N/A
FLR FWSC	Default acquisition rate 0: Locked I: .25 f/s (1 frame every 4 seconds) 2: .5 f/s (1 frame every 2 seconds) 3: 1 f/s (1 frame every second} 4: 2 f/s (2 frames per second) 5: 3 f/s 6: 4 f/s 7: 6 f/s 8: 1 5/12.5 f/s (acquires 12.5 fr/sec in 50 Hz or I5 fr/sec in 60 Hz systems) 9: 30/25 f/s (Real Time: acquires 2.5 fr/sec in 50 Hz or 30 fr/sec in 60 Hz systems) 10: GRAB: acquires only when [FIX] is depressed	0.. 10	4	N/A

Table A-4: Summary of Angio Room Parameters (continued)

PARAMETER	DESCRIPTION	POSSIBLE VALUES	FACTORY DEFAULT VALUE	TYPE
FieLD-FRaMe	Defines the default resolution (i.e. matrix size) of images acquired in the Cine memory.	0: field 1: frame .		N/A
IMaGE-STuDY	Determines the default setting of the STUDY/IMAGE button with power up (and CLR S).	0: image I: study	1	N/A
RAD IN/PR	Interlace/Progressive under RAD FTSW. Indicates which type of video scan is active.	0: interfaced	0	N/A
VDC-MOD-A	Video Data Compression level for Angio mode: 0: Higher compression mode. 3: Complete restoration.	0,3	1	N/A
FTSW-OVER	Determines action to be taken if foot switch is depressed during storage/retrieval of images to/from the disk. 0: Go to Acquisition. 1: Go to Bypass.	0,1	0	Roil

A.2.6 Cardio Room Parameters

When Option 6: Cardio Room Parameters is selected from the NOVRAM Parameters Handling sub-menu, the Catdio Room parameters and their current settings are displayed.

CARDIO PARAMETERS (G 10.56)

CINE-A	:1	FLR-A	:3	PFLR-A	:3
CINE-M	:1	FLR-M	:2	PFLR-M	:2
CNE-FR/SC	:2	FLD-FRM	:0	IMG-STDY	:1
CINE-LINK	:255	CME-CLIP	:0	L.I.HOLD	:0
RTE-LNK-C	:3	RTE-LNK-F	:3	RTE-LNK-P	:3
BTWN-LOOP	:0	RFVW-STAB	:0	SYNC-STAB	:5
PLS-IN-PR	:0	CNE-IN-PR_	:0	CH-FT-PRI	:1
RDMP-ACQ	:1	FTSW-P 1	:4	FTS W-P2	:6
VDC-MUD-C	:0				

<SPACE> - CHANGE, <S> - DEFAULT, <RETURN> - EXIT

Screen Sample 5: Cardio Room Parameters Default Screen

Table A-5 lists each specific Cardio Room Parameter, a description, possible values for the parameter, and the factory default setting.

The cardio room parameters are nut used on the IDF.

Table A-5: Summary of Cardio Room Parameters

PARAMETER	DESCRIPTION	POSSIBLE VALUES	FACTORY DEFAULT VALUE	TYPE
CiNE-A	Averaging factor for Cine Acquisition	1..5	1	N/A
FLuoRo-A	Averaging factor for Fluoro Acquisition	1..5	3	N/A
PFLR-A	Averaging factor for Pulse Fluoro Acquisition	1..5	3	N/A
CiNE-M	Motion Detection Threshold for Cine Acquisition	1..3	1	N/A
FLouRo-M	Motion Detection Threshoid for Fluoro Acquisition	I..3	2	N/A
PFLR-M	Motion Detection Threshold for Fluoro Acquisition	1...3	2	N/A
CiNE FR/SC	Default frames/second acquisition interval: 0: LOCK 1: 15 fr/sec 2: 30 fr/sec 3: P1 (programmed acq. rate) 4 : P2 (programmed acq. rate)	0..4	2	N/A
FieLD-FRaMe	Defines the default resolution (i.e., matrix size) of images acquired in the Cine memory.	0: field I: frame	0	N/A
IMaGe-STuDY	Determines the default setting of the STUDY/IMAGE button with power up. CLR S, and reset.	0,1	1	N/A

Table **A-5: Summary of Cardio** Room Parameters (continued)

PARAMETER	DESCRIPTION	POSSIBLE VALUES	FACTORY DEFAULT VALUE	TYPE
CINE-LINK	Automatic transition to CINE mode after releasing CINE FTSW 0: No Link s-254: Link show selected number of half loops, stop and display the center image of the loop. 255: Link and loop forever	0..255	253	N/A
CINE-CLIP	Deletes # of images from the end of the cine loop, in cases when these images are partially "destroyed"	0..255	0	N/A
L.I. HOLD	Last image hold on fluoro foot switch release	0	0	N/A
RTEe-LiNK-C	Automatic linkage between Cine FTSW and the RTEE preset filters. 0: Disable RTEE filtering 1: Selects optimal RTEE filter 2: Selects the optima1 filter if RTEE is already active. 3: Stay in manually selected RTEE filter.	0..3	3	N/A
RTEe-LiNK-F	Automatic linkage between the FLR FTS W and the RTEE preset filters 0: Disable RTEE filtering 1: Selects optimal RTEE filter 2: Selects the optimal filter if RTEE is already active. 3: Stay in manually selected RTEE filter.	0..3	3	N/A
RTE-LiNK-P	Automatic linkage between Pulsed Fluoro FTSW and the RTEE preset filters 0: Disable RTEE filtering 1: Selects optimal RTEE filter 2: Selects the optimal filter if RTEE is already active. 3: Stay in manually selected RTEE filter,	0..3	3	N/A
BeTWeeN-LOOP	The delay (in frames) between each view. Typical ranges are: 4 - 6 seconds = 100 - 150 frames (@ 25isec).	0..255	0	N/A

Table A-S: Summary of Cardio Room Parameters (continued)

PARAMETER	DESCRIPTION	POSSIBLE VALUES	FACTORY DEFAULT VALUE	TYPE
REVieW-STAB	Allows a short delay between the actual command to the archive and the video transmission.	0..255	0	N/A
SYNC STAB	# of images after which the S/W retests the synchronization behveen the input video and the selected field. If the selected field is not the optimal (i.e., the brightest), then the synchronization flips to another field.	0..255	5	N/A
PLS IN-PR	Indicates which video camera is active under PFLR FTSW mode. 0: = interlace	0	0	N/A
CINE-IN-PR	Indicates which video camera is active under CME FTSW mode. 0: = Interlace	0	0	N/A
CiNeFootswi tch PRIority	Sets priority between the FLR and CINE FTS W commands. 0: Fluoro 1: Cine	0,1	1	N/A
RoaDMaP-ACQ	Determines the response of the system to the CINE FTSW while in ROADMAP. 0: Display without acquiring to Cine memory (MIM LOCKED) I: Abort ROADMAP mode and start acquiring images to store in MIM.	0,1	1	N/A
FTSW-Prog1	Time in seconds for the limited acquisition period. If the selected number is I ≤ n ≤ 100 then the acquisition will be ofn sec at 30 fr/sec. If 101 ≤ n ≤ 255 then the acquisition will be of (n-100) sec at 15 frkec.	1..255	4	N/A
FTSW-Prog2	Total Acquisition time for P2 If the selected number is 1 ≤ n ≤ 100, then the acquisition will be of n sec at 30 fr/sec. If 101 ≤ n ≤ 255, then the acquisition will be of (n-100) sec at 15 fr/sec.	1..255	6	N/A
VDC-MOD-C	Sets specific compression mode for cardio systems with a VDC board. 0: Higher Compression mode 3: Complete restoration of data	0..3	0	N/A

A.2.7 Common Parameters

When Option 7: Common Parameters is selected from the NOVRAM Parameters Handling sub-menu, the Common Parameters and their current settings are displayed. The Common Parameters relate mainly to software features that are common to both the Angio and Cardio applications.

COMMON PARAMETERS (G l 0.56)

ANG-CARD	:1	BIPL-MODE	:0	DEF-EDGE	:1
ARCH-REVW	:0	REVW-CYCL	:1		
SUBT-LOW	:60	ACQ-HOME	:0	STR-BY/AQ	:1
SUBT-HIGH	:180	ACQ-ZM-OF	:0	ZERO-RBW	:0
BLK-LEVEL	:0	WI-IT-LEVEL	:255	NOIS-THRS	:1
DISK-HOLD	:1	DO-CALIB	:0	LUT-TY PE	:0
A-NORM-EN	:8	A-SUB-EN	:8	B-NORM-EN	:8
A-NORM-W-D	:2	A-SUB-WD	:2	B-NORM-WD	:2
CAL-GAIN	:85	DAC-A-SUB	:128	DAC-A-NRM	:128
CAL-BIAS	:128			DAC-B-NRM	:128

<SPACE> - CHANGE, <S> - DEFAULT, <RETURN> - EXIT

Screen Sample 6: Common Parameters Default Screen

Table A-6 lists each specific Common Parameter, a description, possible values for the parameter, and the factory default setting.

Table A-6: Summary of Common Parameters

PARAMETER	DESCRIPTION	POSSIBLE VALUES	FACTORY DEFAULT VALUE	TYPE
ANGio-CARDio	In a multimode room. defines the start-up mode after power-up. 1: Angio	1	1	N/A
BIPL-MODE	In biplane installations, both the frontal and lateral systems parameters are set for the same value. 0: Frontaf is default operating mode 1: Default is biplane mode.	0,1	0	Roll
DEF EDGE	Determines-the default status of the edge enhancementfilter 0: off 1: On	0, 1	1	Roll
ARCHive-REVieW	Used only when the system is installed for image processing as part of the archive review station. Activates CMD-X and CMD-T upon termination of self test if set for 1.	0,1	0	N/A
REVW-CYCL	Determines how many times the whole memory will be displayed after pressing Review key of RCU.	1..255	1	N/A
SUB-LOW	Default window low limit for subtracted images following CMD-M or SUBT keys.	0..255	60	N/A
ACQ-HOME	Sets the home window at the beginning of each acquisition: 1: Keep user-selected window 0: Return to default window	0,1	0	N/A

Note: The parameters are displayed on the screen with their capitalized letters only.

Table A-6: **Summary of Common Parameters (continued)**

PARAMETER	DESCRIPTION	POSSIBLE VALUES	FACTORY DEFAULT VALUE	TYPE
SToRe-BYpass/AcQ	Determines whether the system will revert to BY-PASS or ACQ after the images from the MIM have been copied to disk during CMD-S. 0: System reverts to Bypass 1: System reverts to ACQ.	0,1	1	N/A
SUB-HIGH	Default window high limit for subtracted images following CMD-M or SUBT key	0..255	180	N/A
ACQ--ZooM-OFf	Determines action to be taken with zoom mode when starting acquisition: 0: Stays in RTZ when FTSW is pressed. 1: Returns to normal size when FTSW is pressed. NOTE: When starting subtraction, Zoom is always turned off.	0,1	0	N/A
ZERO-RB W	When performing inverse B/W display, defines which transformation to do on pixel value 0, 0: Black stays black (0→0), i.e., regular operation (to keep the circle blank at black) 255: Black becomes white (0→255). reversed like the other gray levels	0,255	0	N/A
BLacK-LEVEL	Sets minimum black level	BLacK-LEVEL < WHiTe-LEVEL	5	Num
WHiTe-LEVEL	Sets maximum white level	BLacK-LEVEL < WHiTe-LEVEL	250	Num
NOISe-THReSh	Threshold for determining noise	1..255	1	Num
DISK-WOLD	Defines the number of TV frames during which the "Disk Active" message is displayed, enabling faster disk access, as follows: 1..255: 0.2 to 10 seconds 0: After the first disk access, the "Disk Active" message will remain displayed until another function is selected.	0..255	1	N/A

Table A-6: Summary of Common Parameters (continued)

PARAMETER	DESCRIPTION	POSSIBLE VALUES	FACTORY DEFAULT VALUE	TYPE
DO•CALIB	Displays four asterisks on the display that indicate the ROI for automatic gain and bias calculation.	0: No 1: Yes	0	Roll
LUT TYPE	Selects the look up table Least Significant Bit (LSB) for the 10 bit to 8 bit conversion. 0: linear table LSB 1: LSB out = LSB in 2: LSB out = linear LSB + LSB in	0...2	0	Roll
A-NORM-EN	Energy of NO SUB MON A edge enhancement filter	0..15	8	Num
A-SUB-EN	Energy of SUB MON A edge enhancement filter	0..15	8	Num
B-NORM-EN	Energy of MON B edge enhancement filter	0..15	8	Num
A-NORM-W	Width of NO SUB MON A edge enhancement filter	1, 2, 4, 8	2	Num
A-SUB-WD	Width of SUB MON A edge enhancement filter	1, 2, 4, 8	2	Num
B-NORM-R-D	Width of MON B edge enhancement filter	1, 2, 4, 8	2	Num
CAL-GAIN	Default value of calibration pain	0..255	85	Num
DAC-A-SUB	Value of MON A output gain during SUB operation with FILTER on	0..255	128	Num
DAC-A-NRM	Value of MON A output gain during NO SUB operation with FILTER on	0..255	128	Num
CAL-B IAS	Default value of calibration bias	0..255	12s	Num
DAC-B-NRM	Value of MON B output gain with FILTER on	0..255	128	Num

A.2.8. Post Processing Parameters

When Option 8: Post Processing Parameters is selected from the NOVRAM Parameters Handling sub-menu, the Post Processing parameters and their current settings are displayed.

```
                    POST PROCESSING PARAMETERS          (G 10.56)

DEF-SMT      :1     DEF-EDG:    1     EDG-SMT      :0
EDG 1-SHRP   :20    EDG2-SHRP   :30   .
COLLIMX      :5     COLLIMY     :3

DO-SMOOTH    :1     DO-MEDIAN   :0     DO-COMPEN    :40
SMT-LENG     :5     DO-AVRG     :1     DO-LOG       :1
FRENCH       :1

        <SPACE> - CHANGE, <S> - DEFAULT, <RETURN> - EXIT
```

Screen Sample 7: Post Processing Parameters Default Screen

Table A-7, on the following page, lists each specific Post Processing Parameter, a description, possible values for the parameter, and the factory default setting.

The post processing parameters are not used on the IDF.

Table A-7: Summary of Post Processing Parameters

PARAMETER	DESCRIPTION	POSSIBLE VALUES	FACTORY DEFAULT VALUE	TYPE
DEFault-SMooTh	Determines the default selected filter SMT1 or SMT2 in post processing (CMD 2).	1 SM1 2 SM2	1	N/A
DEFault-EDGe	Determines the default selected filter EDG I or EDG2 in post processing (CMD 3).	1 EE1 2 EE2	1	N/A
EDGe-SMooTh	Automatically concatenates the Smooth to the Edge function. 1: Perform smooth directly after edpe.	0,1	0	N/A
EDGe1-SHaRP	The center coefficient of the operating kernel. Controls the sharpness of the post processing Edge Filter 1 Higher values produce more prominent enhancement.	13..23	20	N/A
EDGe2-SHaRP	The center coefficient of the operating kernel. Controls the sharpness of the post processing Edge Fifter 2 Higher values produce more prominent enhancement.	21..35	30	N/A
COLLIMator-X	Defines the right and left default setting of the electronic collimator aperture.	0..22	5	N/A
COLLIMator-Y	Defines the top and bottom default settings of the electronic collimator aperture.	0..8	3	N/A
DO-SMOOTH	Activates or deactivates the running average smoothing filter on the densitometric profile.	1=on 0=off	1	N/A
DO-MEDIAN	Activates or deactivates the low pass filter for smoothing the densitometric profile.	1=on 0=off	0	N/A
DO-COMPENsation	Sets a correction factor for the specific placement of the edge definition markers.	0..100	40	N/A
SMooTh-LENGth	Sets the length of the digital filter.	1,3,5,7,9,11,13,15	5	N/A
DO-AVeRaGe	Activates or deactivates the calculation of 5 parallel densitometric profiles, 2 on each side of the line indicated by the markers. These 5 lines are averaged (sideways) and the result is used for the edee definition selection.	1=on 0=off	1	N/A
DO LOG				
FRENCH	Accepts the scaling factor of the catheter diameter in French vatues.	0: French 1: mm	1	N/A

Note: The parameters are displayed on the screen with their capitalized letters only.

A.3 Option 2: Disk Directory Handling

The disk directory parameters are not available on the IDF.

A.4 Option 3: Installation

> NOTE
>
> Installation and calibration procedures should be performed by a qualified technician only.

The Installation sub-menu contains three options for installation and calibration procedures, as follows:

1. EAPU Calibration
2. Edit Text Header
3. Circular Blank Limits

A.4.1 EAPU Calibration

EAPW is the new, improved analog interface between the camera and the digital processor. It has been modified with options for better image quality and compatibility with progressive cameras. The process requires a phantom and a collimated image. All modes - fluoroscopy, cine, pulsed fluoro, and radio should be calibrated separately.

When Option 1: EAPU Calibration is selected from the Installation sub-menu, the following key prompts appear on the bottom of the screen:

1. Bypass
2. DAC A and B Setting
3. Gain and Bias (of selected foot switch)
4. Anti-blooming LUT (of selected foot switch)
5. Logarithmic Tables (of selected foot switch)
6. Select Foot Switch Type

Press ENTER to exit from the calibration option.

Press the appropriate number to select the requested function.

> NOTE
>
> The calibration must be repeated for each selected foot switch. Select the desired foot switch type by pressing [6]. Roll between all possible foot

switches. The selected type will be displayed on the right side of the top line.

1. BYPASS

Bypass mode displays the original video image on Monitor A (or otherwise, according to Bypass Routing parameter).

2. DAC A and B SETTING

Allow adjustment of the brightness of each monitor, as well as output to the hard copy.

When DAC A and B are selected, the following appears on the screen:

MONITOR A D /A : 128
MONITOR B D / A : 1 2 8

By setting a new value of D/A, you can change the brightness on the monitor.

3. GAIN and BIAS

Gain and bias are set or calculated separately for each mode of operation. The range of both parameters is 0 - 255. The gain default value is 69. Lower values are for the higher gain (stretching the dynamic range). The bias default value is 128. Increasing the value elevates the video voltage generating a "whiter" image.

When Option 3: GAIN and BIAS is selected from the sub-menu, the following menu is displayed:

EAPU Calibration (Selected Foot Switch)

Fluoro Gain 69
Fluoro Bias 125
Cal. Margin 0
Cal. Width 255

The following options are available:

<M>Margin <W>Width <S>Default <A>ACE <CR>Exit

For calibration, press A (ACE) to start Automatic Contrast Enhancement Procedure.

RESULTS:

Min Sample:(0 -255)
Max Sample(0-255)

New Gain (O-255)
New Bias (O-255)

CONFIRM UPDATE PARAMETERS [Y OR N]

Press [Y] to confirm these new values. Press [N] to restore the previous values.

When DO CALIB in the TV Common Parameters is set at 1, four asterisks forming a square are displayed in the center of the screen. The phantom must be aligned with this area (the region for calculating the gray level distribution histogram .)

Selecting ACE displays the calculated values of the selected image. These are only the initial values. The images are tested and the new values for the selected foot switch are displayed. The minimum and maximum values are given as a reference for the range of gray levels in that image (similar to the auto windowing function). The idea is to get the minimum and maximum image gray levels as close as possible to the margin and width values.

4. ANTI-BLOOMING LUT

Anti-blooming is a function which reduces the "white out" section caused by regional over exposure. In the improved image, details which are lost in the bright background are clearly visible. LUT is calculated according to a three segment graph which determines the ratio between the 10 bits digital input and the 8 bits output of the EAPU. White sections are suppressed and the overall content is balanced by setting the slope and the "knees" of the curve. Anti-blooming functions in real time according to which foot switch was selected.

Anti-blooming LUT displays the following default values:

X1:	0
Y1:	0
x2	0
Y2	0
Y3	255
SIZE	40

The following options are available:

<T>	Pattern
<P>	Profile
<C>	Calibrate
<CR>	Exit

<T> Displays a continuous ramp of gray levels (0 • 255) on the monitor. Pattern tests the effects of the selected LUT.

<P> The following parameters appear at the top of the screen upon selecting Profile.

Data
Index
Row
Col

The following menu is displayed at the bottom of the screen:

ROW/COL pos: Up, Down, Left, Right, Home

<FIX> -(graph color) <CR> -(exit)

Use the arrow keys to move the central line and the marker to any position (pixel) on the image.

Its coordinates according to the image matrix are indicated by Row and Col. The current gray level of the indicated pixel is displayed as Data.

Index is the value of the same pixel prior to the logarithmic transformation by the LUT.

The range of gray levels for the profile is delineated by the two horizontal lines. The values under the central line are displayed as profile graph, ranging from 0 • 255.

<C> Displays the calibration menu.

<A>	X1
<B>	YI
<C>	x2
<D>	Y2
<E>	Y3
<F>	SIZE
<S>	DEFAULT
<CR>	EXIT

The Xs and Ys are the coordinates of the three "knees" of the graph. The input is 10 bits and the output is 8 bits. <F> is a parameter which calculates a running average to determine the length of a limited segment around the knee for smoothing the comer, The range for <F> is 0 • 40.

5. LOGARITHMIC TABLES.

When Option 5: LOGARITHMIC TABLES is selected from the Installation sub-menu, the following options are available::

This submenu supports the calibration protocol for the LUT in order to improve the subtracted image.

<L> LOG XFER-is relevant in fluoro only. It activates a logarithmic transformation of the displayed image and replaces the original with the transformed image. The new processed image will include a white hyphen mark on its top left corner.

<T> Displays a continuous ramp of gray levels (0 - 255) on the monitor. Pattern tests the effects of the selected LUT.

<P> The following parameters appear at the top of the screen upon selecting Profile.

Data
Index
Row
Col

To manipulate the profile, refer to the preceding paragraph.

<C> Calibrate- Enables modification of the LOG correction algorithm. The following parameters can be modified:

<S> Default calibration. It is possible to modify the logarithmic transfer function for correcting the irregularities of the X-ray system and imaging chain. Selected segments of the transfer function are recalculated according to the coordinates set by the following parameters.

<X> Selects XO: the curve starting point

<G> Selects GM: Gamma correction value

<1> to <6> Selects P1, P2, E12, P3, P4 and E34 respectively to enable segment alinearity correction in two different segments.

P1, P2, P3, and P4 are the markers on the X axis of the modification segments.

E 12 is the coefficient for recalculating the segments of the graph between P1 and P2.

E34 is the coefficient for the segment delineated by P3 and P4

E= 128 will form a straight line between these two points. Values greater than 128 will form convex curves. Values less than 128 will form concave curves.

NOTE

A second segment may be designated for correction, in the same format as the first correction segment: P3, P4 and E34. Both segments may be located at any position on the original data profile, either separately or overlapping.

6. SELECT FOOT SWITCH TYPE

Not avaiiable for IDF.

A.4.2 Edit Text Header

For IDF this text header is not used by the application.

When Option 2: Edit Text Header is selected from the Installation sub-menu, the user may modify the default header. Type in any M-character line for the text header which will be displayed on the monitors. This header is usually used to display the hospital or institution name.

The following key prompts appear at the bottom of the screen:

<S> Default, <E> Edit, <C> Clear, <Ret> Exit
<S> the default header (i.e., BLANK) is reinstated
<E> enables modification (editing) of the current header
<C> the header message is cleared and the header line will be blank

NOTE

The BACKSPACE key can be used to erase incorrect data.

A.4.3 Circular Blank Limits

This option is not used for IDF.

A.5 Option 4: Diagnostics

This option is not available for the IDF.

A.6 Option 5: Communications

This option is not available for the IDF.

A.7 Option 6: Self-Test

The system performs its complete SST when selecting this option from the Utilities Menu. See Sec. 4: System Self-Test for more information.

APPENDIX B: GE Parameters

Table B-I : **Calibration** Parameters

Screen	Parameters	Default Value	Calibrated Frontal	Calibrated Lateral
T.V. Chain	FLR-GAM	69		
	FLR-SGAIN	69		
	FLR-BIAS	125		
	FLR-SBIAS	125		
Common Parameters	DAC-A-NRM	128		
	DAC-A-SUB	128		
	DAC-B-NORM	I28		
Installation/ EAPU Calibration/ DAC A & B Setting	MONITOR A D-A	128		
	MONITOR B D-A	12s		

Table B-2: Setup Parameters

SCREEN	PARAMETERS	DEFAULT	FRONTAL	LATERAL
Hardware Parameter	FREQUENCY	60		
	RTEE	1 I		
TV Chain	LEFT GAP/	0		
	RIGHT GAP	0		
	FLR-S-STAB	20		
	FLR-L-STAB	70		
	FLR-IDLE	135		
Angio Room	FDSA-LOW	80		
	RDM-LOW	80		
	FDSA-HIGH	160		
	RDM-HIGH	200		
	ACQ-A	4		
	SUB-A	4		
	PEE-A	4		
	ACQ-M	3		
	SUB-M	3		
	PRE-M	3		
Common Parameters	DEF EDGE	1		
	A-NORM-EN	8		
	A-SUB-EN	8		
	B-NORM-EN	8		
	A-NORM-WD	2		
	A-SUB-WD	2		
	B-NORM-WD	2		
Log Parameters	X (Curve start point)	2		
	G (GAMMA)	55		
	Segment-Correction	000000		

After installation, please completely fill in the table with the parameters.

APPENDIX C: QBus

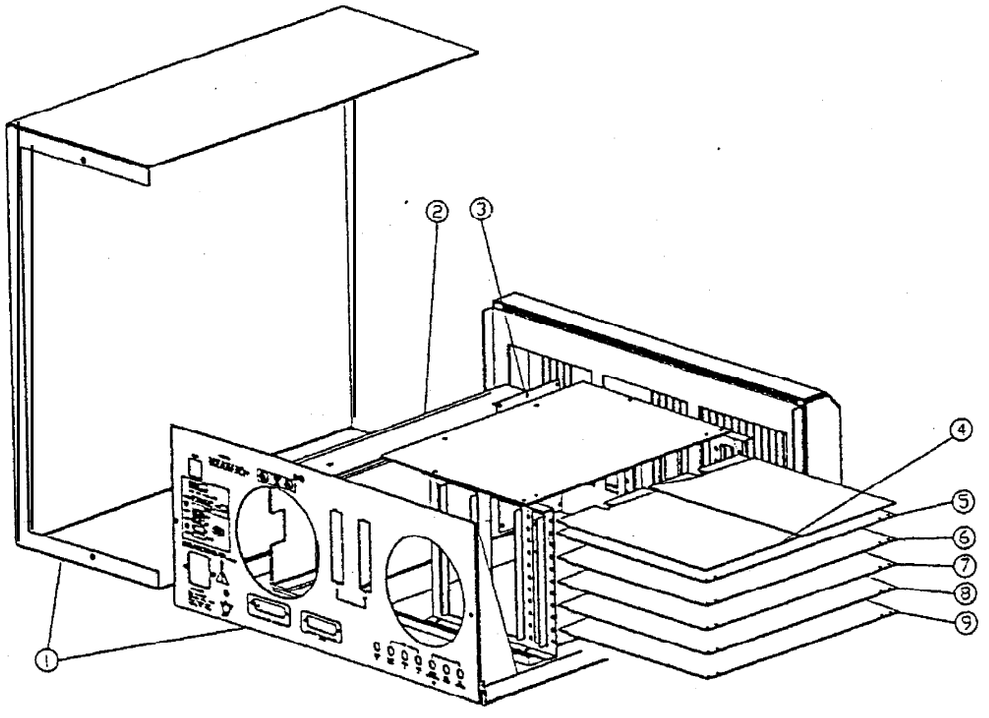
Table **C-1: SBC-11/21 Falcon** Module Backplane **Pin Identification (Component Side)**

BACKPLANE PIN	SBC-11/21 FALCON SIGNAL FUNCTION	QBUS SIGNAL NAME
AA1	**Bus** terminator	BIRQ5 L
AB1	Bus terminator	BIRQ6 L
AC-I	Bus terminator	BDAL16 L
AD1	Bus terminator	BDAL17 L
AE1	STOP L	SSPARE1
AF1	SRUN L	SSPARE2
AH1	Not Connected	SSPARE3
AJ1	GND	GND
AK1	Not Connected	MSPAREA
AL1	GND	MSPAREA
AM1	GND	GND
AN1	BDMR L	BDMR L
AP1	BHALT L	BHALT L
AR1	Bus Terminator	BREF L
AS1	Not Connected	+12B
AT1	GND	GND
AU1	Not connected	PSPARE1
AV1	+5 VB (battery)	+5B
BA1	BDCOK H	BDCOK H
BB1	BPOK H	BPOK H
BC1	Bus Terminator	S S P A R E 4
BD1	Bus Terminator	SSPARE5
BE1	Bus Terminator	SSPARE6
BF1	Bus Terminator	SSPARE7
BH1	START L	SSPARE8
BJ1	GND	
BK1	Not Connected	MSPAREE
BL1	Not Connected	MSPAREB
BM1	GND	
BN1	BSACKL	BSACKL
%PI	Bus Terminator	BIRQ7 L
BR1	BVNT L	BVNT L
BS1	Not Connected	+12B
BT1	GND	GND
BU1	Not Connected	PSPARE2
BV1	+5V	+5V

Table C-2: SBC-11/21 Falcon Module Backplane Pin Identification (Solder Side)

BACKPLANE PIN	SBC-11121 FALCON SIGNAL FUNCTION	QBUS SIGNAL NAME
AA2	+5V	+5V
A02	Not Connected	-12V
AC2	GND	GND
AD2	+12V	+12V
AE2	BDOUT L	BDOUT L
AF2	BRPLY L	BRPLY L
AH2	BDIN L	BDIN L
AJ2	BSYNC L	BSYNC L
AK2	BWTBT L	BWTBT L
AL2	BIRQ4	BIRQ4
AM2	Not Connected	BIAKO L
AN2	BIAKO L	BIAKO L
AP2	BBS7 L	BBS7 L
AR2	Not Connected	BDMGO L
AS2	BDMGO L	BDMGO L
AT2	BINIT L	BINIT L
AU2	BDALO L	BDALO L
AV2	BDAL1 L	BDALI L
BA2	+5V	+5V
BB2	Not Connected	-12V
BC2	GND	GND
BD2	Not Connected	+12V
BE2	BDAL2 L	BDAL2 L
BF2	BDAL3 L	BDAL3 L
BH2	BDAL4 L	BDAL4 L
BJ2	BDALS L	BDALS L
BK2	BDAL6 L	BDAL6 L
B	BDAL7 L L	BDAL7 L 2
BM2	BDAL8 L	BDAL8 L
BN2	BDALS L	BDALS L
BP2	BDAL10 L	BDAL10 L
BR2	BDAL11 L	BDAL11 L
BS2	BDAL12 L	BDAL12 L
BT2	BDAL13 L	BDALI3 L
BU2	BDAL14 L	BDAL14 L
BV2	BDAL15 L	BDAL15 L

APPENDIX D: GE Spare Parts



1. IDF Enclosure
2. Power Supply
3. DCDB
4. CPU
5. AEEU
6. EAPU
7. EDTU
8. SMAU
9. ETBM

Figute D-I: Internal View of IDF

Table D-l: GE Spare Parts

ITEM NO.	PART NO.	F R U	R E P	DESCRIPTION	QTY	A P P
I	2116692	1	No	IDF-Enclosure	1	
2	2114015	1	No	IDF Power Supply 400 W	1	
3	2114013	1	Yes	IDF DC-Distribution Board (DCDB)'	1	
4	2114014	1	NO	IDF CPU Falcon	1	
5	2114010	1	Yes	IDF Analog Real Time Edge Enh. +Fluoro ADV. IF (AEEU)	1	
6	2114006	1	Yes	IDF Enhanced Processing Board (EAPU)	1	
7	2114008	1	Yes	IDF Enhanced Timing Board (EDTU)	1	
8	2114007	1	Yes	IDF Memory Arithmetic Board (SMAU)	1	
9	2114009	1	Yes	IDF Software Bank Memory Board (ETBM)	1	
10	2114005	-	-	IDF Spare parts kit		
11	2114011	1	Yes	IDF Remote Control Unit (RCU)	1	
12	2114016	1	No	IDF FluoroPlus Phantom	1	
13	2114017	1	Yes	IDF Frontal Cable Set	1	
14	2114018	1	Yes	IDF Lateral Cable Set	1	
15	2114806	2	-	IDF Service Manual (SM) including Lexan	1	
16	2114807	2	-	IDF Operation Manual (OM)	1	
17	2114808	2	-	Pre-installation Manual (PIM)	1	

APPENDIX E: Biplane RCU Cable Diagram

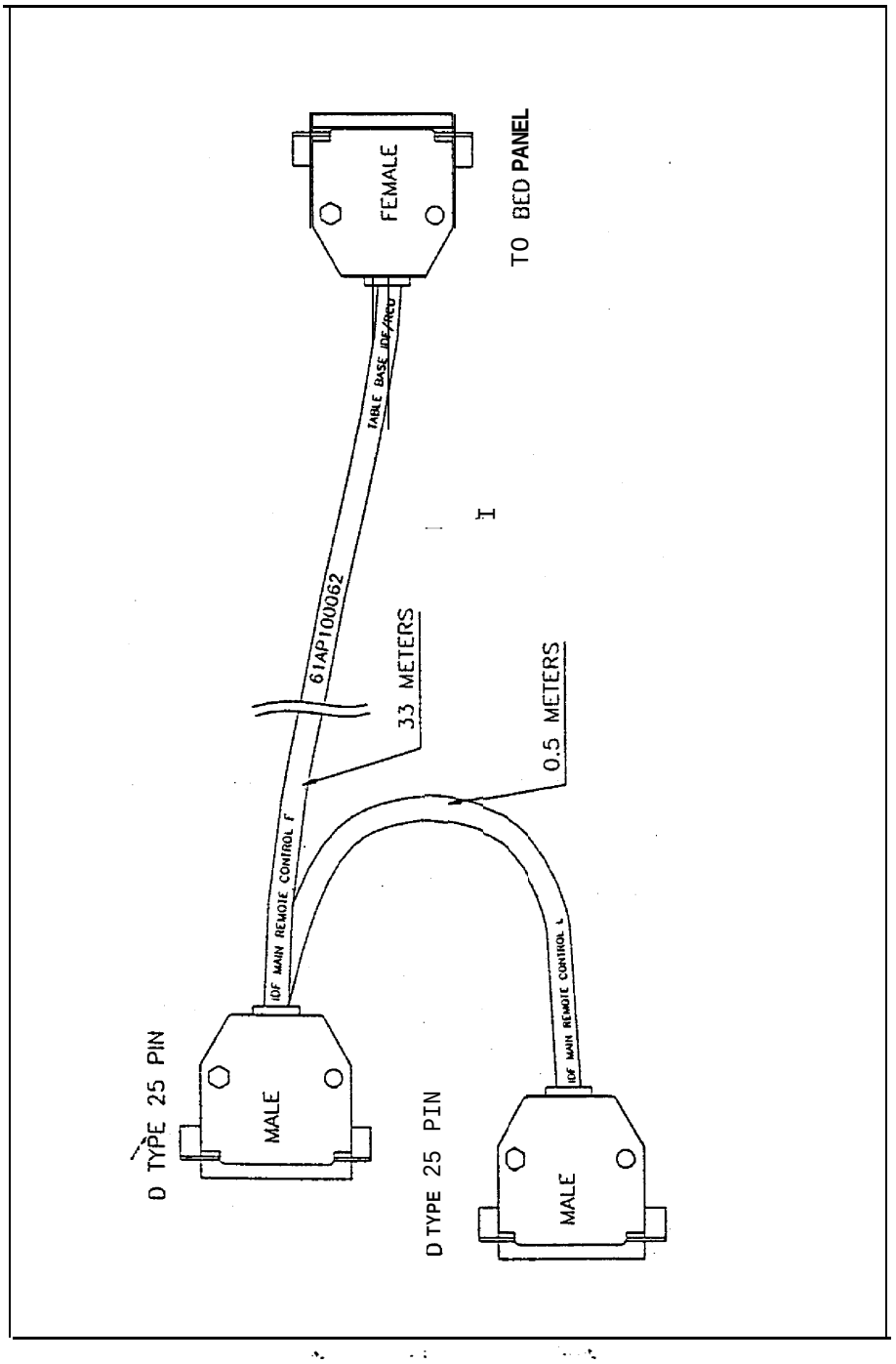


Figure E-1: Biplane RCU Cable

APPENDIX F: Frontal Plane Cable Description

Description	Label	MIS Number
RTBUS F DX RTBUS A OUT→IDF RTBUS IN This cable is provided by GE	Must have 2 stickers to put on the current cable. Sticker 1: DX RTBUS A OUT • MIS 27056A Sticker 2: IDF RTBUS IN F • MIS 27056A	27056A
RTBUS FVIC→DX (RTBUS A OUT) This cable must be disconnected from DX RTBUS A OUT socket and connected to IDF RTBUS OUT F socket This cable is provided by GE	Must have 2 stickers to put on the current cable. Sticker 1: IDF RTBUS OUT F • MIS 27057A Sticker 2: MIS 27057A	27057A
Video F VIC J4→DX (FROAD1) This cable must be disconnected From DX FROAD1 socket and connected to IDF MON B OUT F socket This cable is provided by GE	Must have 2 stickers to put on the current cable. Sticker I: IDF MON B OUT F • MIS 27058A Sticker 2: MIS 27058A	27058A
Video F VIC→IDF BOX	VIC J9 F IDF VIDEO DETECT TN F 61AP100073	27059A 27059A
Video F VIC→IDF BOX	VIC J3 F IDF MON A OUT F 61AP100074	27060A 27060A
Video F VIC→IDF BOX	VIC J8 F IDF TV CAMERA I-N F 61AP100071	27061A 27061A
Video F DX→IDF BOX	DX FROAD1 IDF AUX VIDEO IN F 61AP100072	27062A 27062A
I DF Power Extension CABLE DX→Power link	DX PIT IDF F IDF L 61AP100058	27079A 27079A 27079A
Ground F DX Ground Stud→IDF BOX Ground	DX GROUND STUB IDF GROUND F 61AP100059	27064A 27064A

Description	Label	MIS Number
IDF Console TABLE BASE→IDF Console	TABLE BASE IDF/RCU	27065A
	IDF CONSOLE	27065A
	61AP100063	
IDF Y TABLE BASE→IDF BOX In monoplane, the "IDF MAIN REMOTE CONTROL L" socket is not connected	TABLE BASE IDF/RCU	27066A
	IDF MAIN REMOTE CONTROL F	27066A
	IDFMAIN REMOTE CONTROL L	27066A
	61AP100062	

APPENDIX G: Lateral Plane Cable Description

Description	Label	MIS Number
RTBUS L DX RTBUS B OUT→IDF RTBUS IN This cable is provided by GE	Must have 2 stickers put on the current cable. Sticker 1 : DX RTBUS B OUT • MIS 27047A Sticker 2: IDF RTBUS IN L • MIS 27047A	27047A
RTBUS L VIC→DX (RTBUS B OUT) This cable must be disconnected from DX RTBUS B OUT socket and connected to IDF RTBUS OUT L socket This cable is provided by GE	Must have 2 stickers to put on the current cable. Sticker 1: IDF RTBUS OUT L • MIS 27048A Sticker 2: MIS 27048A	27048A
Video L VIC J4→DX (LROAD I) This cable must be disconnected from DX LROADI socket and connected to IDF MON B OUT L socket This cable is provided by GE	Must have 2 stickers to put on the current cable. Sticker 1: IDF MON B OUT L • MIS 27049A Sticker 2: MIS 27049A	27049A
Video L VIC→IDF BOX	VIC J9 L IDF VIDEO DETECT L 61AP100083	27050A 27050A
Video L VIC→IDF BOX	VIC J3 L IDF MON A OUT L 61AP100084	27051A 2705 1 A
Video L VIC→IDF BOX	VIC J8 L IDF TV CAMERA IN L 61AP100081	27052A 27052A
Video L DX→IDF BOX	DX LROAD1 IDF AUX VIDEO IN L 61AP100082	27053A 27053A
Ground L DX Ground Stud→IDF BOX Ground	DX GROUND STUB IDF GROUND L 61AP100061	27055A 27055A