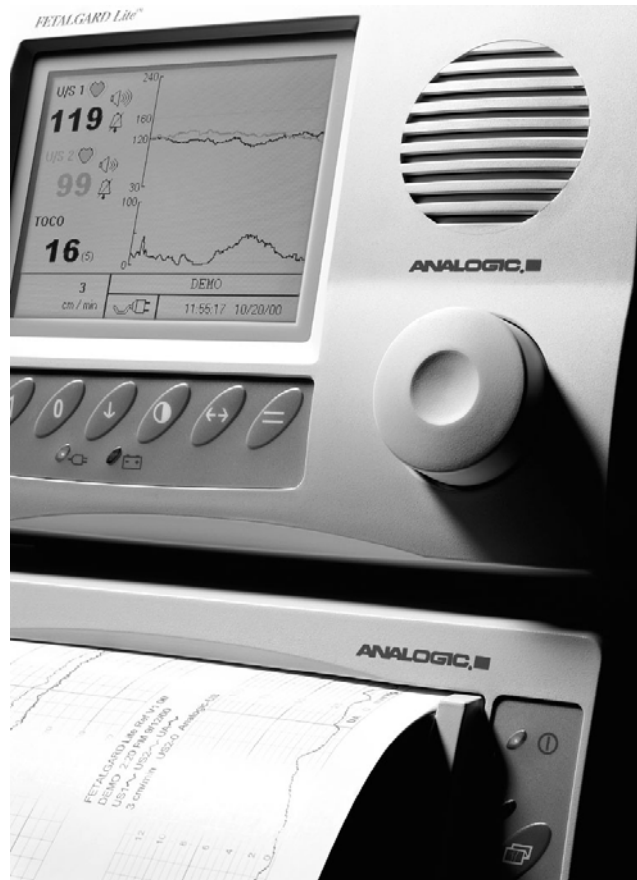


FETALGARD Lite™



Service Manual

ANALOGIC® ■

The World Resource
for Precision Signal Technology

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Figure 1-0. FETALGARD Lite Monitor and Recorder

1. Introduction

1.1 General

The FETALGARD Lite Service Manual supplements the operator maintenance and troubleshooting procedures included in the FETALGARD Lite Operator's Manual. Refer to the Operator's Manual for maintenance and troubleshooting procedures that may be performed during normal operation.

Maintenance and repair of the monitor, beyond the level normally accomplished during operation, are limited to the replacement of the battery, to replacement of the board assembly within the case, to replacement of the speaker and to components of the LCD display installed in the case front-cover assembly. Procedures for isolating the probable cause of apparent malfunction to these assemblies are contained in this manual.

This manual also includes the troubleshooting guide for replacement of accessories and options.

The information in this FetalGard Lite Service Manual applies to FGL System Assembly Serial Number FA000001 thru FA99999 and FGL Recorder Serial Number FB010001 thru FB019999. For FGL Recorder Serial Number FB000001 thru FB009999 refer to FetalGard Lite Service Manual APN 16-400809.

CAUTION: Only qualified technical personnel should attempt to carry out any disassembly, removal, and replacement of internal assemblies.



NOTE: Information included in this manual describes options and accessories that may not be installed in your equipment. Consult your configuration listing for those that apply to your unit.

1.1.1 FETALGARD Lite Monitor Specifications:

Physical Characteristics

Dimensions — 18 cm (7.1 inches) H X 24.2 cm (9.5 in.) W X 13 cm (5.1 in.) D

Weight — approx. 1.9 kg (4.2 lbs.)

Safety

Complies with EN60601-1, EN60601-1-1, En60601-2

Class II Equipment, double insulated

Continuous Operation

Type BF applied parts

Power

Internal: Lead-acid, rechargeable

2-hours operation fully charged at 10°C

14 hours to full recharge during monitoring

8 hours to full recharge when monitor is off.

External: AC-powered Battery Eliminator, two models:

BAT-ELIM-A, 100-120V~, 50-60 Hz, 0.15A

BAT-ELIM-B, 220-240V~, 50-60 Hz, 0.08A

Power Dissipation:

Battery-powered: 6 watts, maximum

AC-powered 10 watts, maximum

Environmental

Operating Temperature: 10°C to 45°C (50°F to 110°F)

Storage Temperature: -20°C to 60°C (-29°F to 175°F)

Relative Humidity: 20% to 90% non-condensing

Altitude: 0—3048m (0—10,000 ft)

Doppler Ultrasound FHR Monitoring

Parameter Value

Intensity: <10 mW/cm² (ISATA)

BPM Range:

USA Paper 50-240 BPM

International Paper 50-210 BPM

Accuracy: ±1% ±1 BPM

Leakage: <10 µA @ 264 VAC applied to transducer

Isolation: >4 kV RMS, Type BF applied part

Tocotonometer Uterine Activity (TOCO) Monitoring

Parameter Value

TOCO Range: 0-100 relative units

Resolution: 1 Count

Accuracy: ±1% ±1 relative unit

Leakage: <10 µA @ 264 VAC applied to transducer

Isolation: >4 kV RMS, Type BF applied part

1.1.2 *FETALGARD Lite Recorder Specifications:*

Physical Characteristics

Dimensions — 12.4 cm (4.88 in.) H x 23.4 cm (9.20 in.) W x 26.7 cm (10.52 in.) D

Weight — approx. 3.1 kg (6.8 lbs.)

Safety

Complies with EN60601-1, EN60601-1-1, EN60601-2

Class I Equipment, requires 3-prong outlet with protective earth

Continuous Operation

Power

100-120V~, 50-60 Hz, 0.4A

220-240V~, 50-60 Hz, 0.2A

Power consumption: 20 watts maximum at nominal supply voltage

Environmental

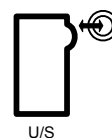
Operating Temperature: 10°C to 45°C (50°F to 110°F)

Storage Temperature: -20°C to 60°C (-29°F to 175°F)

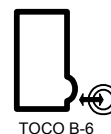
Relative Humidity: 20% to 90% non-condensing

1.1.3 *Definitions and Symbols*

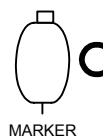
Ultrasound Transducer Input Connector



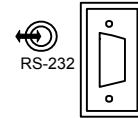
Toco Transducer Input Connector



Remote Marker Input Connector



RS-232 Connector



Battery Eliminator Connector



Drip-proof Equipment Classification



Class II Equipment Symbol (double insulation)
Per IEC 60601-1



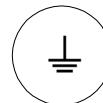
Type BF Applied Part Symbol



Refer to Accompanying Documents



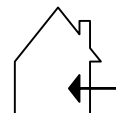
Protective Earth



Functional Earth



Indoor Use Only



1.3 *Mechanical Description.*

As indicated in Figure 1-1, except for the battery, all functioning components of the monitor are installed as subassemblies of the case front-cover assembly. The case rear-cover assembly includes the replaceable battery. The rear cover provides openings through which the five main-board-mounted rear-panel connectors are accessible. Additional mechanical features are included in Chapter 4, *Disassembly*.

1.3.1 *FHR Channel.*

Either the single-fetus U/S1 patient cable (Models AP1S/HCS) or the twins U/S1&2 patient cable (Models AP1T/HCT) is connected to the rear-panel FHR connector. The U/S2 patient cable, when used, is connected, as shown, to the U/S1&2 cable assembly for Models AP1T and HCT.

The transmitter(s) pulsing the ultrasound transducer(s) is (are) gated by control circuitry, and return signals are processed in the CODEC circuitry on the main board. Signals to the flashing LED on the transducer assembly and to the FHR icon in the display are transmitted in synchronism with the beat detection.

1.3.2 *LCD & BACKLIGHT*

The LCD panel is a fluid monochrome LCD display. It is a single-panel display with a resolution of 76,800 pixels. Data to be displayed are stored in the main board. Direct connection to the LCD panel is made through on-board header assembly J7.

The backlight of the LCD is a CCFL (Cold Cathode Fluorescent Lamp) mounted as part of the LCD panel. The ac high-voltage is turned on and off by a digital control bit from the main-board-mounted drive.

1.3.3 *TOCO Channel*

The TOCO circuit uses a Wheatstone bridge, with two strain gauge elements mounted on a load beam. The differential output voltage is proportional to the force applied to the load beam through the plunger. The TOCO circuit is powered from a single regulated 5V-supply excitation.

The amplified and filtered TOCO signal is converted by a 12-bit analog to digital converter, providing an output scale of 2.56LSBs/gram.

1.3.4 *Serial I/O Communications Port*

The RS232 interface is totally isolated from the main board through the use of high-speed optical isolators and isolated 5-volt power supply. The pinouts for the DB9 connector are shown in the table that follows.

Table 1-1. RS232 Serial I/O Connector Pinouts

Pin Number	Short ID	Signal Description
1		Data carrier detect
2	Rx	Receiver data
3	Tx	Transmitter data
4	DTR	Data terminal ready
5		Signal return
6	DSR	Data set ready
7	RTS	Request to send
8	CTS	Clear to send
9		(Unused)

1.3.5 Keypad & Knob

There are 7 front-panel switches, two LED's, and one knob push-button switch. All of these buttons go to the main-board except for the ON/OFF push button, which goes directly to the power supply. The software monitors these signals to determine which buttons were pushed. The two LED's are located on the control panel and inform the user of ac present or battery operation.

The knob consists of a mechanical rotary encoder knob with a momentary push button switch. As the knob is rotated, quadrature-coded outputs are generated. The phase relationship between the two signals, in quadrature, reflect the clockwise or counter clockwise rotation of the knob. This relationship is translated to move the cursor on the LCD display forward or backward, depending on which way the knob is rotated.

1.3.6 Power Supplies

The unit is operated from a 6-volt 4 AH sealed lead acid battery. The battery charger provides enough power to charge the battery even when the unit is operating.

The FETALGARD Lite power is controlled by alternate button closures of the front panel membrane switch. Unit operation starts only via a push of the front panel button, but operation will stop after a delay of approximately 15 seconds when pushing the front-panel membrane switch. This delay permits the main-board processor to shut down in an orderly fashion, after storing the parameters and data, if any.

1.4 Replaceable Spare Parts

1.4.1 FETALGARD Lite Monitor (Single Fetus and Twin Fetuses)

Table 1-2. FETALGARD Lite Monitor Spare Parts

Name	Brief Description	Analogic Ordering Number
Front Case Assembly	Includes Keypad and Speaker Assembly	FGMSP001
Rear Case Assembly	Includes Battery door	FGMSP002
Battery Door	Cover in Rear Case Assembly	FGMSP003
Battery Harness	From Main Board to Battery, Includes terminations	FGMSP004
Battery	6 Volts; Lead-acid, rechargeable	FGMSP005
Main Board Assembly for Single Fetus Monitoring	Complete assembly for AP1S/HCS; no replaceable subassemblies.	FGMSP006
Main Board Assembly for Twin Fetuses Monitoring	Complete assembly for AP1T/HCT; no replaceable subassemblies.	FGMSP007
U/S1	Ultrasound cable assembly for use with Models AP1S and HCS; includes transducer cable assembly and replacement label	FGMSP008
U/S1&2	Ultrasound cable assembly for use with Models AP1T and HCT; includes transducer cable assembly and replacement label	FGMSP009
U/S2'	Ultrasound cable assembly for use with Models AP1T and HCT; includes transducer cable assembly and replacement label	FGMSP010
TOCO-B-6	Pressure Transducer Cable includes transducer cable assembly and replacement label	FGMSP011
U/S Transducer Top Housing	Replacement top housing for U/S transducer; includes label	FGMSP012
U/S Transducer Top Housing w/ LED Board	Replacement of old style top housing w/ new style top housing; includes LED board and label	FGMSP016
TOCO Transducer Top Housing	Replacement top housing for TOCO transducer; includes label	FGMSP013
LCD Display	Complete LCD Assembly and protective shield	FGMSP014
Control Knob	Front-panel knob and sleeve	FGMSP015

1.4.2 FETALGARD Lite Recorder

Table 1-3. FETALGARD Lite Recorder Spare Parts
For FetalGard Lite Recorder Serial Numbers FB010001 thru FB 019999

Name	Brief Description	Analogic Ordering Number
Cover	Chassis cover	FGRSP010
Main PCB	Includes mounted transformer	FGRSP011
AC Harness	AC Wire Harness Set	FGRSP012
AC Receptacle	Receptacle for input power	FGRSP004
Bezel	Bezel with keypad	FGRSP005
Rubber Feet	Rubber Bumper Feet With Screws	FGRSP006
Internal Fuse FZ1, FZ2 100-120 Vac Configuration	5x20 cartridge type time lag fuse, 0.4A, 250V Littlefuse type 239.400 or approved equivalent	FGRSP007
Internal Fuse FZ1, FZ2 220-240 Vac Configuration	5x20 cartridge type time lag fuse, 0.2A, 250V Littlefuse type 239.200 or approved equivalent	FGRSP008
Paper Spacer	Used for HP Paper only	FGRSP013

1.5 Abbreviations, Acronyms, and Phrases

The table that follows defines some of the abbreviated and special terminology that may be found in this manual.

Abbreviation, Etc.	Definition/Description
AP1S	Antepartum monitoring of single fetus
AP1T	Antepartum monitoring of twin fetuses
HCS	Home care monitoring of single fetus
HCT	Home care monitoring of twin fetuses
TOCO	Tocotonometry
U/S1	Ultrasound, single fetus
U/S2	Ultrasound, twin fetuses

2. Safety

2.1 General



NOTE: *This chapter provides a guide to ensure a safe environment in which qualified technical personnel may perform field servicing of the FETALGARD Lite monitors and recorders.*

This manual contains instructions for troubleshooting and performing field service repair of FETALGARD Lite Models AP1S, AP1T, HCS, and HCT, as well as the FETALGARD Lite Recorder. It also contains troubleshooting guides for the replacement of malfunctioning accessories and options.

2.2 Warnings, Cautions, and Notes

The terms *warning*, *caution*, and *note* have specific meanings as used in this manual.

A **WARNING** advises against certain actions or situations that could result in personal injury or death.

A **CAUTION** advises against actions or situations that could damage equipment, produce inaccurate data, or invalidate a procedure.



A **NOTE** provides useful information regarding a function or procedure.

2.3 WARNINGS

WARNING: EXPLOSION HAZARD --- Do not use the FETALGARD Lite in a flammable atmosphere where concentrations of flammable anesthetics or other materials may occur.

WARNING: SHOCK HAZARD --- The power-receptacle must be a three-wire grounded outlet. A hospital grade outlet is required. Never adapt the three-prong plug from the Battery Eliminator or accessory to fit a two-slot outlet. If the outlet has only two slots, make sure that it is replaced with a three-slot grounded outlet before attempting to operate the monitor.

WARNING: SHOCK HAZARD --- Do not attempt to connect or disconnect a power cord with wet hands. Make certain that your hands are clean and dry before touching a power cord.

WARNING: Use only patient cables and transducers supplied with the monitor. Use of any other patient cables may result in out-of-specification performance and possible safety hazards.

2.4 CAUTIONS

CAUTION: Use care when transporting or moving the monitor to assure that the attached patient cables are stored so that they will not be damaged in the move.

CAUTION: Keep the operating environment free of dust, vibrations, corrosive, or flammable materials, and extremes of temperature and humidity. The unit should be kept clean and free of transducer gel and other substances.

CAUTION: Do not operate the unit if it is damp or wet because of condensation or spills. Avoid using the equipment immediately after moving it from a cold environment to a warm, humid location.

CAUTION: Never use sharp or pointed objects to operate the front-panel switches.

CAUTION: General-purpose personal computers and modems are not designed to meet the electrical safety requirements of medical devices. The RS-232 connector on the FETALGARD Lite is electrically isolated to permit safe connections to non-medical devices, which should be connected with a cable of sufficient length to prevent the non-medical equipment from contacting the patient.

2.5 NOTES



NOTE: This chapter provides a guide to ensure a safe environment in which qualified technical personnel may perform field servicing of the FETALGARD Lite monitors and recorders.

3. Troubleshooting Guide

3.1 General

This section provides a guide to the field service engineer/technician in locating the possible cause of an apparent malfunction of the monitor or its accessories/options. Use of built-in diagnostics, flow charts, and step-by-step procedures are provided as aids in the troubleshooting process.

The guide is intended to lead the servicing personnel to a probable field replaceable assembly or component. Items that are serviceable only at the factory are also identified, as well as instructions for their return for repair/replacement.

The initial analysis determines whether the apparent malfunction is caused by a replaceable accessory/option, or by a replaceable assembly/component within the monitor case.

3.2 Required Tools, Materials, and Equipment

Only 1 servicing tool is required to disassemble and remove, and replace any field replaceable assembly. A torque-sensitive tool is required when reassembling the monitor.

Phillips head screwdriver

Torque range to 10 in-lb.; display resolution ± 1 in-lb.



NOTE: When reassembling, be sure to follow torque-limits instructions. Excessive torque may damage the plastic case etc.

3.3 Initial Trouble Diagnosis

The first step in diagnosing a possible malfunction is to duplicate, if possible, the symptoms of the reported malfunction. Thereafter, it is important to categorize the problem as either one of two types, as illustrated in Figure 3-1. They are:

- Totally inoperative condition, or
- Degraded operation.

The totally inoperative condition is indicated by the failure of the monitor to respond to the power ON front-panel action, or by complete loss of monitoring functions during operation.

Degraded operation performance might be indicated by the appearance of artifacts in the display, or by gaps in the pixel display, by intermittent actions, or by obviously inaccurate measures of fetal activity, etc.

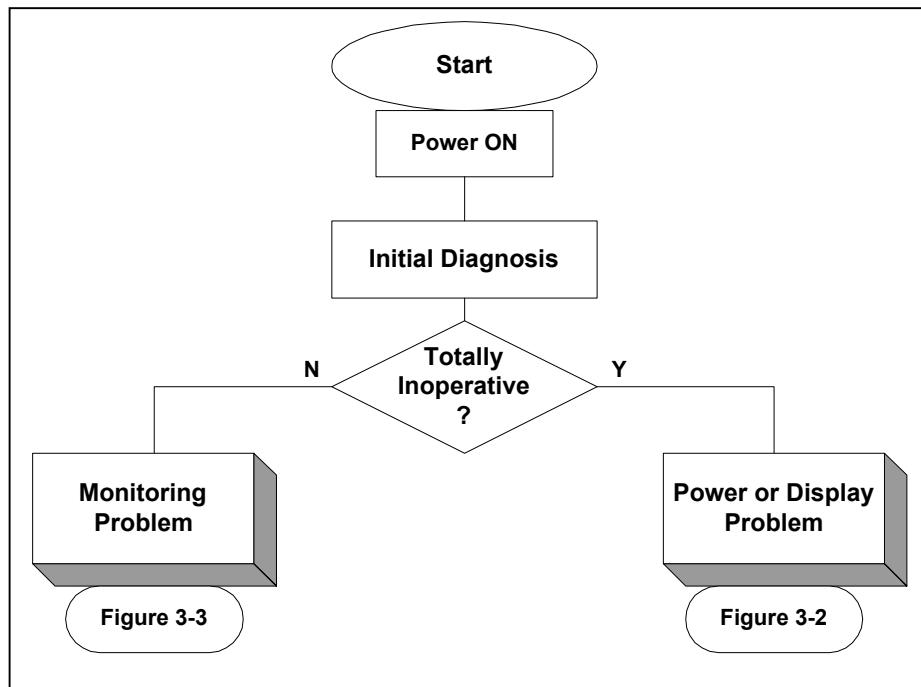
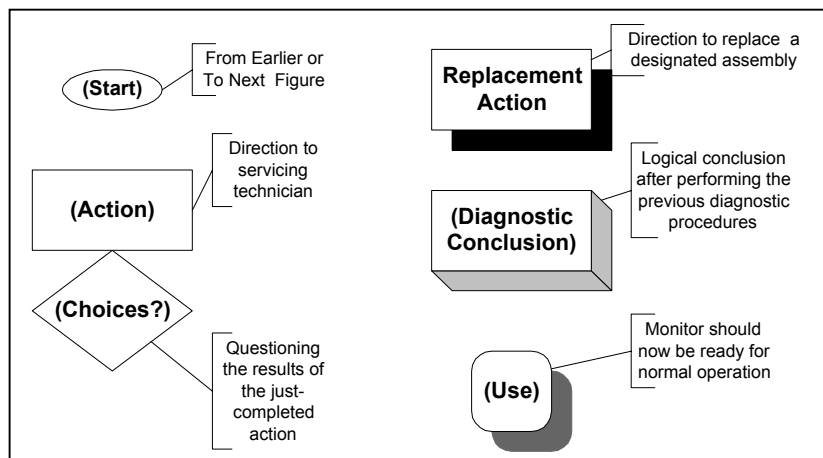


Figure 3-1. Diagnosing Malfunction – Initial Diagnosis

The diagnostic flow charts contain a few standardized graphic symbols.



NOTE: The **Action** procedure in a flow chart will be detailed in a subsequent text.

The **Replacement** action for the designated assembly is detailed in Section 4.

3.4 Power Problem Diagnosis

3.4.1 Diagnostic Flow Chart (Figure 3-2)

The flow chart of Figure 3-2 illustrates a sequence of actions and decisions that might be used after the initial diagnosis of a “total failure” as a power supply or display problem.



NOTE: If the apparent "total failure" is caused by a malfunctioning display backlight, it may be possible to observe a faintly lit display with the appropriate POST message. The troubleshooting under these circumstances is described in this section.

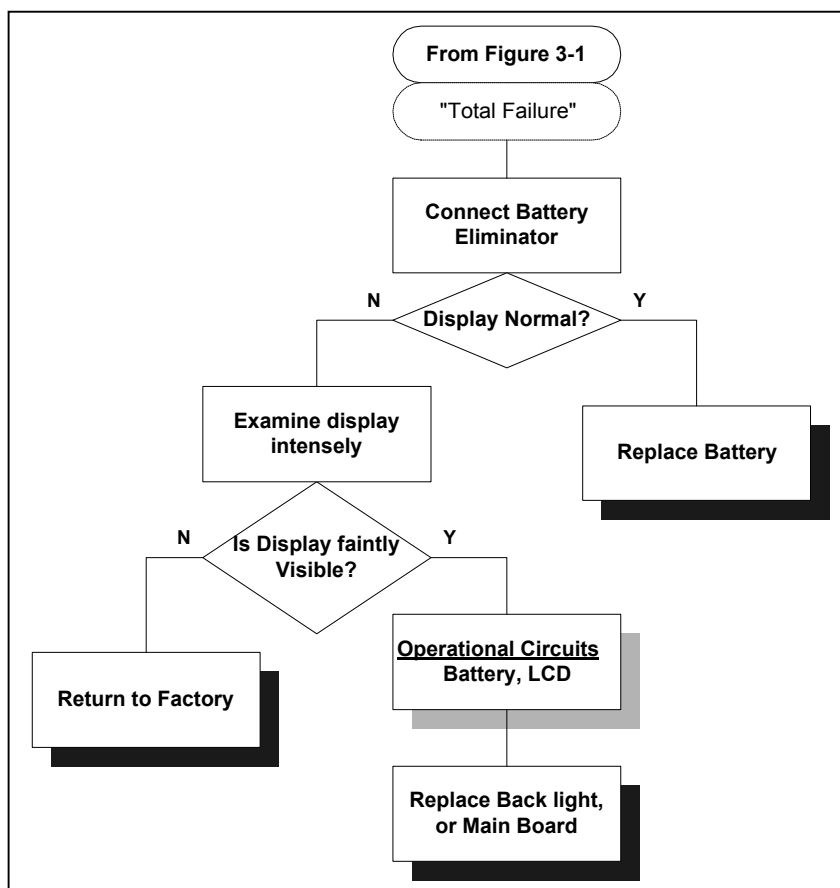


Figure 3-2. Power Diagnosis --- Power Supply or Display

3.4.2 *Diagnostic/Repair Actions (Figure 3-2)*

Examine Display intensely

Reduce background room illumination. If only the back light fluorescent tube or its high voltage driver has failed, the display may be faintly visible.

Refer to Section 4 for removal procedures.

Replace Battery

Refer to Section 4 for step-by-step procedure.

Replace Main Board

Refer to Section 4 for step-by-step procedure.

3.5 *Monitoring Degradation Problems*

3.5.1 *Diagnostic Flow Chart (Figure 3-3)*

Figure 3-3 illustrates a logical sequence of troubleshooting diagnostics when the FETALGARD Lite monitor appears to be operative, but the displayed results are suspect for any number of reasons. The resulting diagnosis will result in replacing either the main board spare parts or the offending cable (with sensor attached).

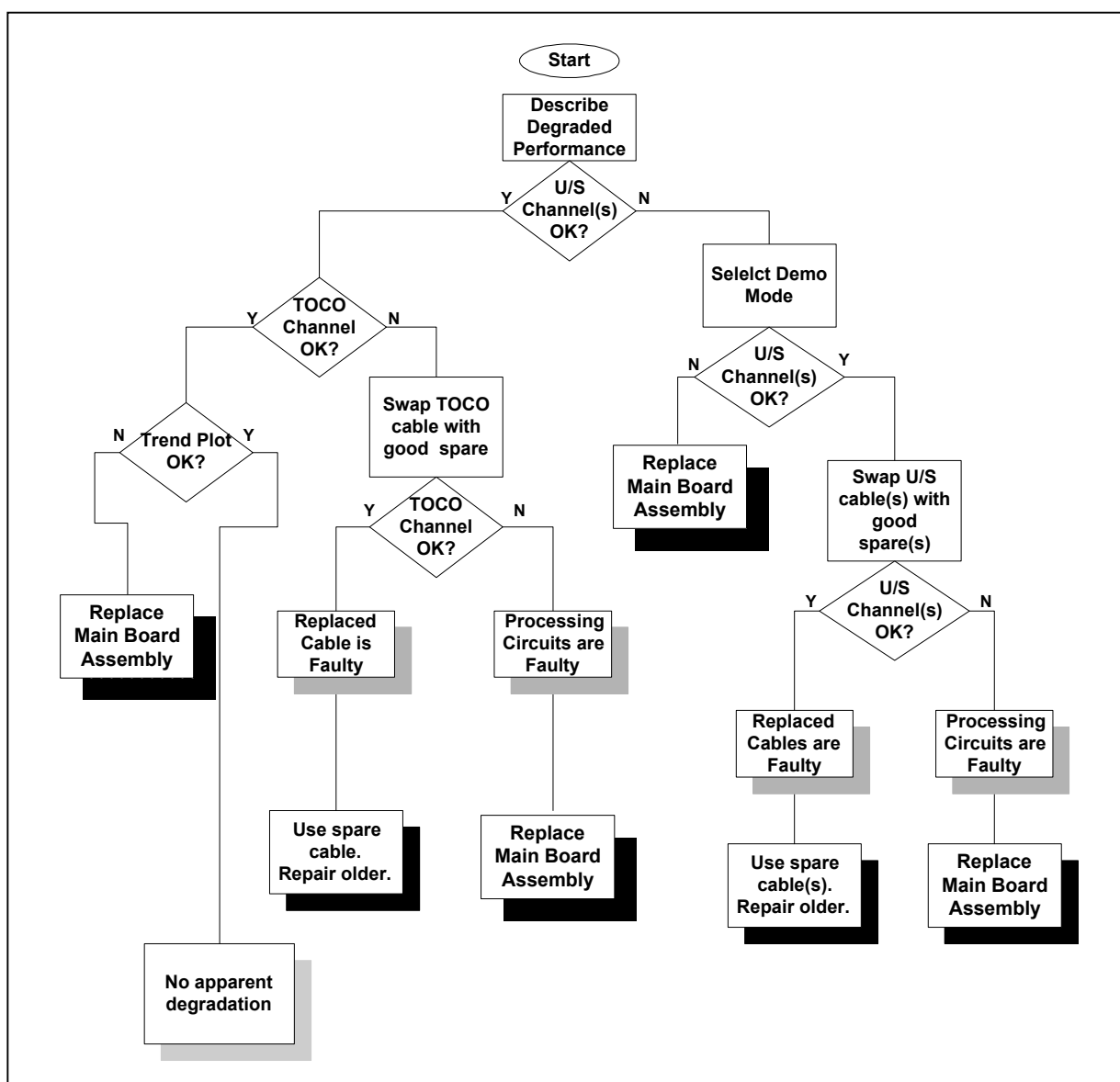


Figure 3-3. Monitoring Degradation, Diagnostic Flow Chart

3.5.2 Diagnostic Repair Actions (Figure 3-3)

Describe Degraded Performance

Examine the display after an apparently successful power up sequence and self-test.

Consider, first, the appearance of artifacts, gaps, or general quality of the display.

Note the values being reported in the numerical frames (FHR(s) and TOCO). Are they clearly unreasonable?

Swap Cables

It is assumed that a set of spares is available, from which the spare cable may be used. Assume that the spare is a factory-qualified, defect-free, spare. At facilities where more than one FETALGARD Lite is installed, it may be more convenient to borrow a cable assembly that was part of a satisfactorily operating FETALGARD Lite monitor.

Replace Main Board Assembly

Refer to Section 4, *Monitor Disassembly/Reassembly*, for step-by-step instructions.

4. Monitor Disassembly/Reassembly

4.1 General

This section contains instructions for the disassembly of the FETALGARD Lite monitor. Step-by-step instructions are supplemented with appropriate illustrations and line drawings. Refer to Section 1 for a listing of the assemblies and components that are included within the list of spare parts. (Disassembly/Reassembly instructions for the FETALGARD Lite Recorder are contained in Section 5.)

In brief, the monitor is comprised of two main assemblies:

- A rear-case assembly, and
- A front-case assembly.

4.2 Rear Case Access (Figure 4-1)

The rear case assembly consists of a molded plastic case, in which the battery is stored. Through-holes in the case cover are provided for the main-board-mounted rear-panel connectors.

4.2.1 Battery Replacement

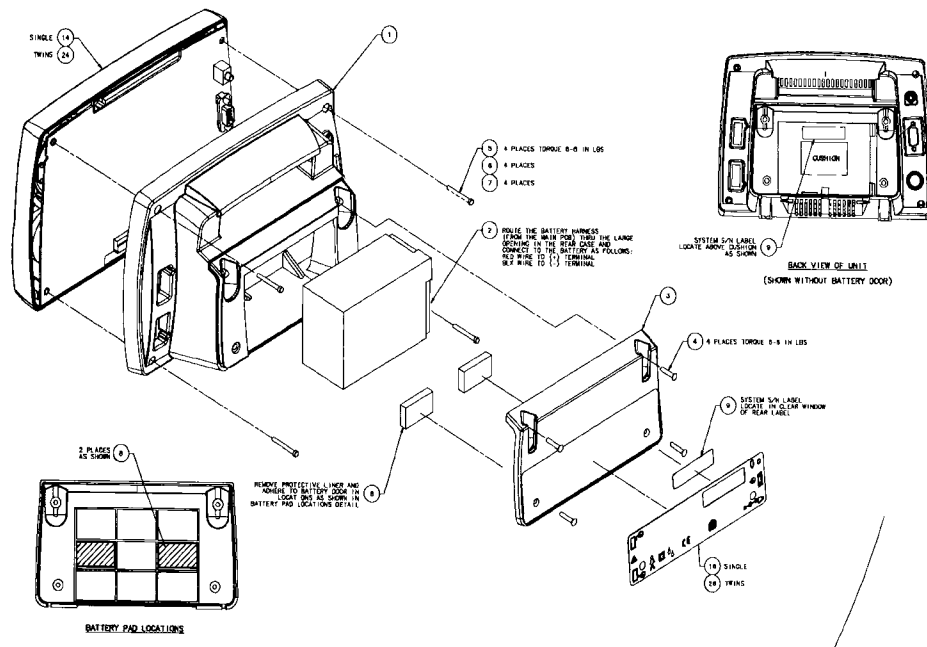


Figure 4-1. Accessing Rear Case Assemblies

Remove the battery cover.

1. Place the FETALGARD Lite on its front-panel, being careful not to place the unit on any surface that will mar the display.
2. Using the Phillips-head screwdriver, unfasten the four screws holding the battery cover in place.
3. Carefully, lift off the back cover.

Remove the Battery

1. Position the monitor assembly on its underside. This will cause the open rear of the case to tilt towards the tabletop, and thus allow gravity force to aid in removing the battery.
2. While monitor is in this tilted position, manually press the battery to move towards the terminal side. The gravity force should cause the battery side opposite the terminals to fall partly out of the case. See Figure 4-2.



Figure 4-2. Monitor Tilted, Battery Removal in Process

3. Carefully remove the battery from the monitor. Use care in removing the battery wires. They are connected to the front-case-side of the main board assembly, and those connections may be damaged if the wiring is mishandled.

4. Remove the wire connections from the battery terminals by sliding the spade connectors off the terminals. Note that the battery case adjacent to the positive terminal is painted red to identify the required connection of the red wire to that terminal.

Reassembly

1. Connect power leads to replacement battery. Note that the red wire is connected to the positive terminal that also is identified by the red-painted case adjacent to the terminal.
2. Carefully, place the new battery in its position in the case.
3. Replace the back cover.
4. Torque each of the four screws to 6-8 in. lb.

CAUTION: Do not over torque.

Battery Disposal

Refer to practices and procedures developed at the local institution when disposing the used battery.



NOTE: Federal, state, and local agencies may require adherence to special procedures for disposal of lead batteries. Be sure that the local practice conforms to these requirements.

4.2.2 Rear Case Replacement**Removal**

1. When replacement of the rear case is required, first remove the battery as described in the previous paragraph.
2. If the replacement is to include the battery door, fasten the battery door in place, using the four screws. If the case is to be replaced without the battery door, place the door aside for later installation.
3. Using a Phillips-head screwdriver, remove the four screws fastening the rear case to the front case assembly.
4. Lift the rear case off the monitor.

Reassembly

1. Place the rear case on the front case, making sure that the battery leads enter the battery compartment in the rear case.
2. Using a Phillips-head screwdriver, fasten the rear case to the front case assembly with the four screws.
3. Torque to a force of 6 to 8 in-lb.
4. Reconnect the battery and install it in the rear case.
5. Fasten the battery door to the rear case. Torque to a force of 6 to 8 in-lb.

CAUTION: Do not over torque.

4.3 Front Case Access (Figure 4-3)

The front case assembly includes the replaceable molded front-case, the main printed-circuit board, the LCD display assembly, and the knob assembly. The speaker assembly and the front-panel keypad are provided as part of the replacement front case.

To access the front case assemblies, remove the rear cover assembly. Follow the procedures of paragraph 4.2. Disconnect the leads to the battery.

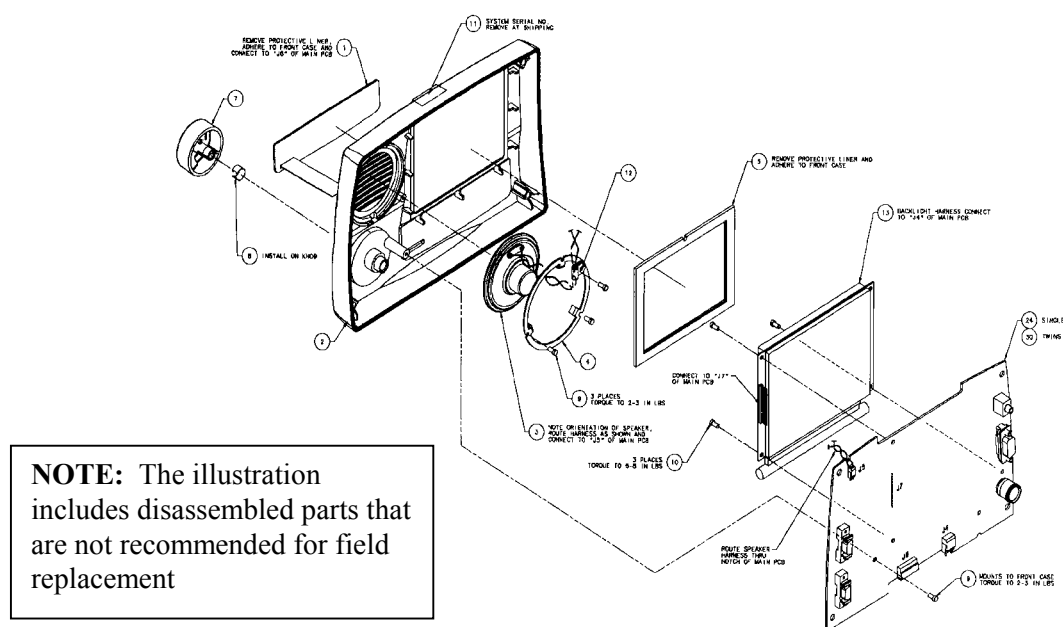


Figure 4-3. Accessing Front Case Assemblies

4.3.2 Main Board Assembly

Removal

The procedure requires disconnecting some of the cables that connect main board circuitry to other assemblies before removing the screw that fastens the board to the front case. It is also necessary to remove the control knob before the main board is freed from the case.

1. Disconnect the connection at J5 (upper left corner of the board) to the speaker assembly.
2. Disconnect the flat ribbon cable that is routed from the front-panel keypad under the main board to the connector. To remove the cable from the connector, first release the "locking" cap to loosen the cable. Slide the cable out, leaving the cap loosely seated in the connector.
3. Connection at J5 to the battery may remain because the other ends have been disconnected from the battery.

4. Connections at J4 of power to the backlight of the display may remain until it is necessary to remove LCD display.
5. At the front panel, remove the control knob by pulling it from the case.
6. Using a Phillips-head screwdriver, remove the screw that fastens the main board assembly to the front case. Remove the main board assembly.

The LCD display remains fastened to the board through connector J7 and the backlight power at J5. It appears as a "daughter Board" for the main board.

Reassemble

Perform the removal steps in reverse order.

Use care when routing the connecting cables. Use the notches along the edges of the main board to keep the cables from interfering with other components or from introducing an interference difficulty when fastening the main board in place.

5. Recorder Disassembly/Reassembly

5.1 General

This section contains instructions for the disassembly of the FETALGARD Lite Recorder. Step-by-step instructions are supplemented with appropriate illustrations and line drawings. Refer to Section 1 for a listing of the assemblies and components that are included within the list of spare parts. (Disassembly/Reassembly instructions for the FETALGARD Lite Monitor are contained in Section 4.)

In brief, the recorder is comprised of two main assemblies:

- A print mechanism assembly, and
- A controller board assembly.

Proper operation of the print mechanism assembly requires precise alignment of mechanical components. The process requires tools not normally available for field replacement. Thus, the spare parts for the FETALGARD Lite Recorder do not include any components of the print mechanism.

WARNING: Disconnect ac power cord from the FETALGARD Lite Recorder. Allow 30 seconds for all capacitors to be discharged.

5.2 Required Tools, Materials, and Equipment

Servicing tools are required to disassemble, remove, and replace any field replaceable assembly. A torque-sensitive tool is required when reassembling the recorder.

Phillips head screwdriver for M3 screws.

M3 Screws to be tightened to 6 - 8 lb-in. unless otherwise specified.

Nut Driver or equivalent wrench for M5 Hex Nut

M5 Nut to be tightened to 20 - 23 lb-in.

Nut Driver or equivalent wrench for M3 Hex Nut

M3 Nut to be tightened to 6 - 8 lb-in.

Nut Driver or equivalent wrench for 3/16 inch Hex # 4-40 Male / Female Standoff

4-40 Standoff to be tightened to 4 - 5 lb-in.



NOTE: *When reassembling, be sure to follow torque-limits instructions.*

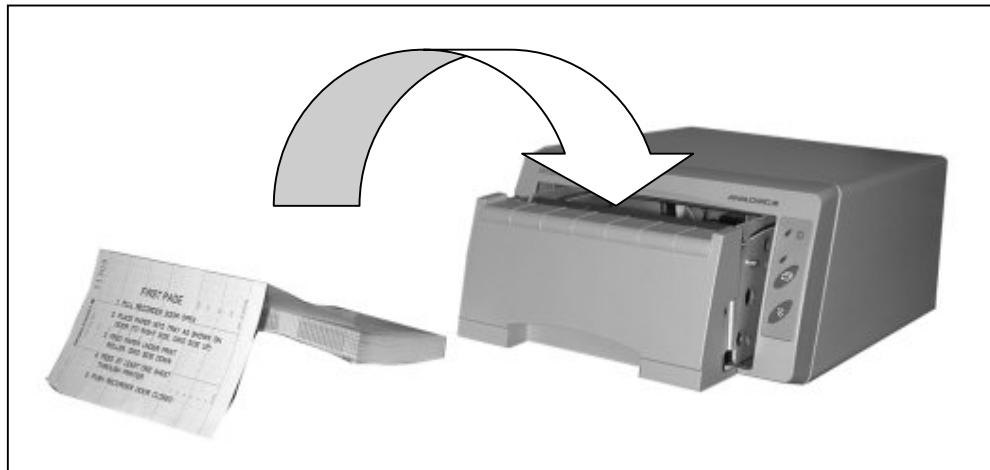


Figure 5-1. FETALGARD Lite Recorder, Strip Chart Loading Configuration

5.3 To Replace the Top Cover

Removal of the top cover is required to obtain access to internal assemblies of the Recorder. Refer to Figure 5-2 and Figure 5-3.

5.3.1 To remove the cover (Figure 5-2 and Figure 5-3)

The wrap around cover is held in place by four screws attaching it to the underside of the chassis, and two screws attaching it to the rear of the chassis.

1. Using an appropriate Phillips screwdriver tool, unfasten the four (4) M3 X 8mm long screws, in the center of each rubber bumper foot, attaching the cover to the underside of the chassis.



NOTE: The rubber bumper feet are held in place by these four screws. Retain the screw-bumper foot assemblies for replacement.

Do not remove the four screws on the underside of the chassis that do not have the rubber bumper foot on them.

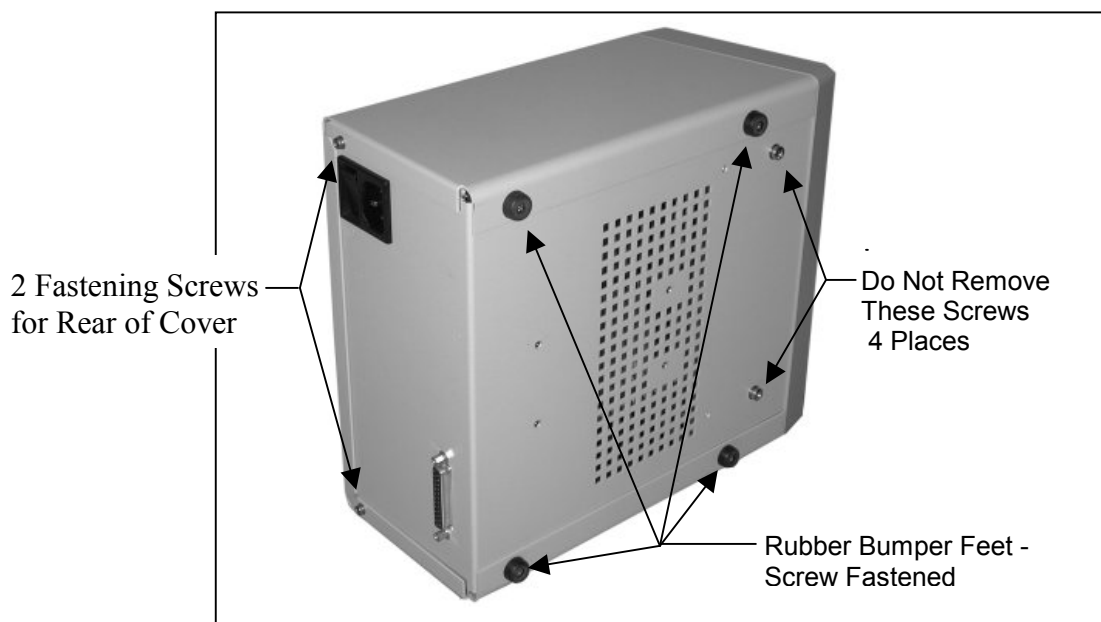


Figure 5-2. Removing Rubber Feet

2. Using an appropriate phillips screwdriver tool, unfasten the two (2) M3 X 8mm Long screws attaching the cover to the rear of the chassis. Retain the lock washer and flat washer assembled with each screw for later replacement.
3. Slide the cover to the rear. Remove.

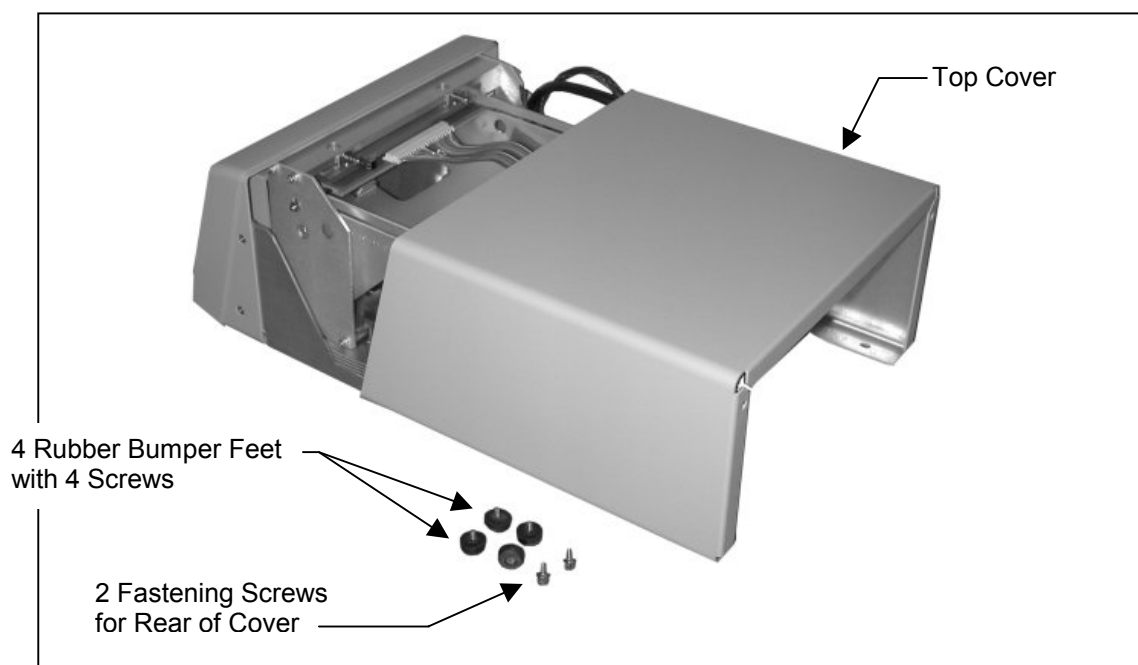


Figure 5-3. Top Cover Removed (Partially)

5.3.2 To reassemble the cover

Perform the 4 steps above in reverse order. Torque M3 Screws in Rubber Bumper Feet to 3 lb – in. Torque M3 Screws on rear of Cover to rear of Chassis 6-8 lb-in.

5.4 To Replace Internal Fuses

There are two field-replaceable fuses on the FGL Recorder Main Board assembly. They are held in clip style fuse holders mounted on the printed circuit board beneath the ac power input switch. Remove Top Cover only as described on paragraph 5.3 to access. See Figure 5-4.

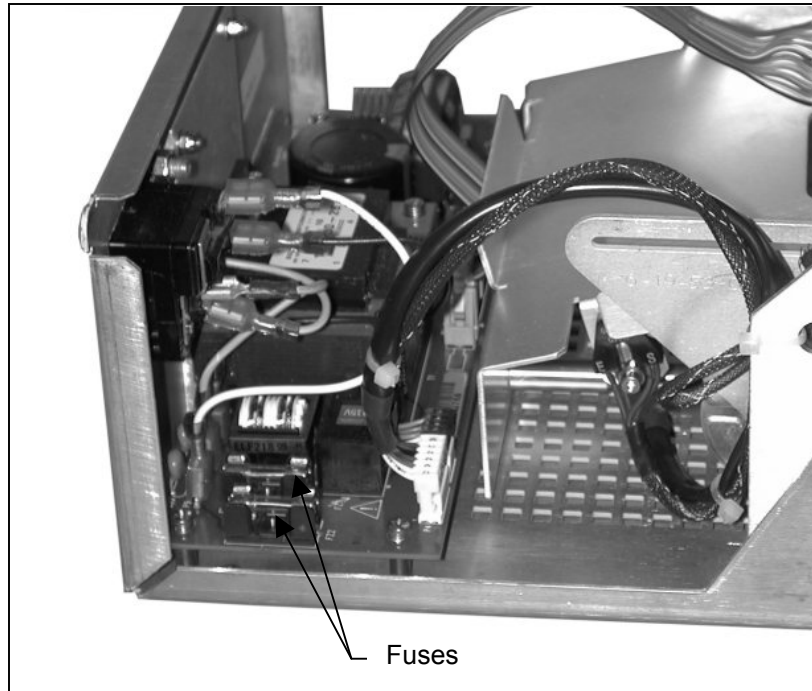


Figure 5-4. Accessing Internal Fuses

5.5 To Replace the AC Power Switch

The AC Power Switch is press-fit with integral plastic snaps in the chassis rear panel.

5.5.1 To Remove the Switch

1. Remove the top cover as described in paragraph 5-3.
2. Locate the power entry module (Figure 5-5).
3. Remove the wire leads connected to the three terminals of the switch,
4. Using an appropriate tool, remove the M5 nut and washer assembly attaching the ground (green and yellow) lead from the ground stud on the chassis. Retain for later reassembly.
5. From the inside of the switch, press the two sides together to release the press-fit snap arm, and push the switch out through the opening in the rear panel.

5.5.2 To Reassemble the AC Switch

Perform the steps of 5.5.1 in reverse order.

Torque the M5 Hex Nut for grounding 20 -23 lb-in.

WARNING: Make sure ground lead (green and yellow wire) is intact and is connected properly to the chassis stud to insure proper safety ground.

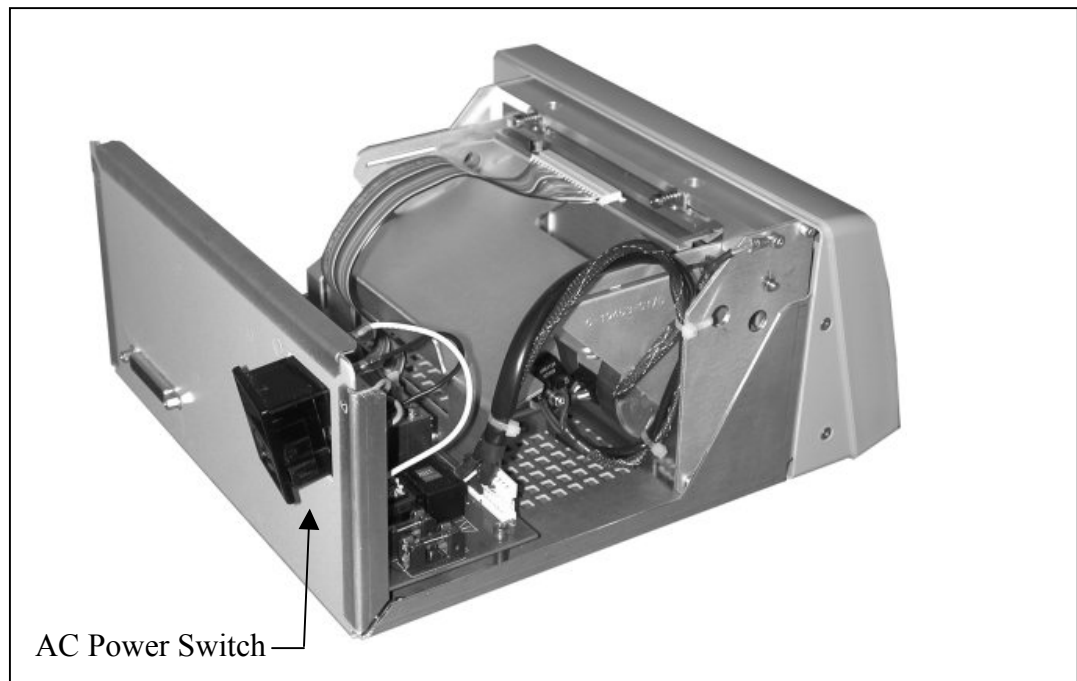


Figure 5-5. Accessing the AC Power Switch (After releasing the snap-fittings)

5.6 To Replace the AC Harness

The AC Harness connects the ac power switch to the controller board and the ground stud on the chassis. Figure 5-6 is a schematic wiring diagram illustrating the relationship of the ac harness leads to other components of the assembly.

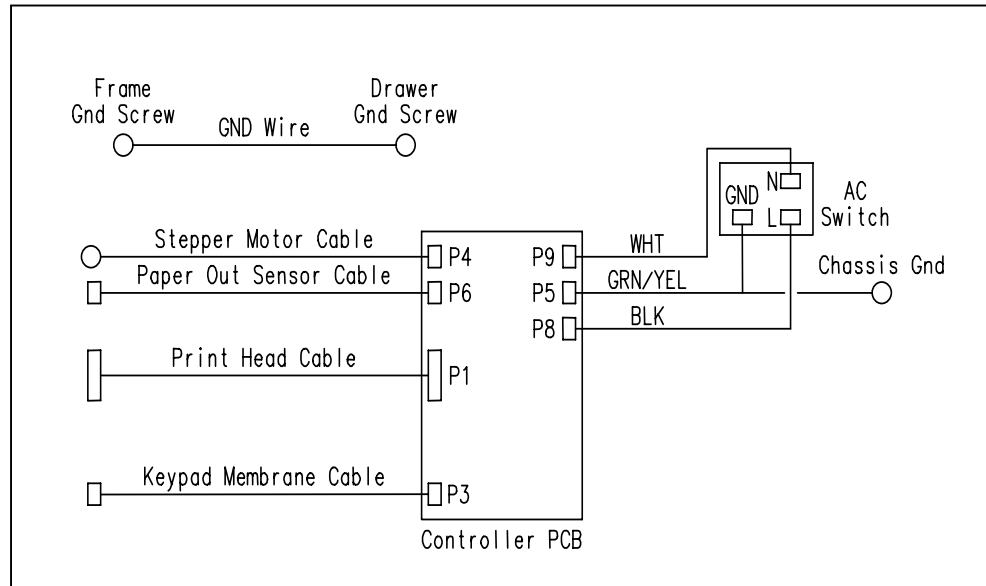


Figure 5-6. AC Harness Wiring Schematic

5.6.2 To Remove the Harness

1. Remove the top cover as described in paragraph 5-3.
2. At the ac switch, remove the wire lead from the spade lugs on the switch.
3. At the main board remove the wire lead from the spade lugs on the printed circuit board.
4. Using an appropriate tool, remove the M5 nut and washer assembly attaching the ground (green and yellow) lead from the ground stud on the chassis rear wall. Retain for later reassembly.
5. Remove the AC Harness set.

5.6.3 To Reassemble the AC Harness

Perform the steps of paragraph 5.6.2 in reverse order.

Torque the M5 Hex Nut for grounding 20 - 23 lb-in.

5.7 To Replace the Main Board Assembly

5.7.1 To Remove the main Board Assembly

1. Remove the top cover as described in paragraph 5.3.
2. Remove the AC Harness assembly as described in paragraph 5.6.

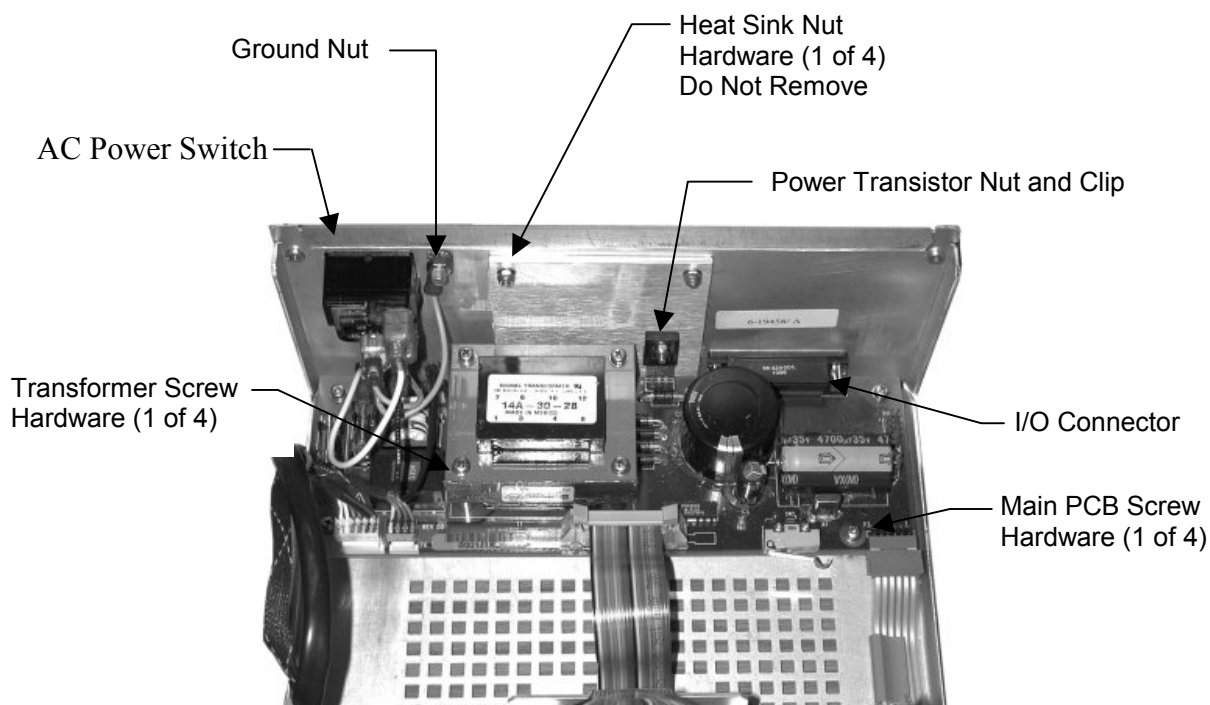


Figure 5-7 Accessing the Main Board Assembly

3. Using an appropriate tool, remove the two 3/16 hex 4-40 female screw lock standoffs that fasten the I/O connector to the chassis rear panel.
4. Using an appropriate tool remove the four (4) M3 X 8mm Phillips head screws and washers that fasten the main board to standoffs in the chassis. (See Figure 5-7.)
5. Using an appropriate tool, remove the four (4) remaining M3 X 40 mm Phillips-head screws and washers that fasten the transformer through the main board to standoffs in the chassis.
6. Using an appropriate tool or M3 nut driver, dislodge and remove the plastic clip that holds the power transistor against the heat-dissipation assembly of the rear chassis. Do not remove the Heat Sink nuts in the corners.

CAUTION: Insulator is used between heat sink and transistor (U2).

7. Disconnect the ribbon cable that connects the main board to the printer assembly.
8. Disconnect the motor cable and sensor cable at the Main Board.
9. Carefully lift the main board up out of the chassis.

5.7.2 *To Reassemble Main Board*

Follow steps of paragraph 5.7.1 in reverse order.

Torque M3 U2 Transistor Clip Hex Nut 6-8 lb-in.

Torque M3 PCB and Transformer Screws 6-8 lb-in.

Torque 3/16 inch Hex / # 4-40 I/O Connector Standoff Screws 4 - 5 lb-in.

Torque M5 AC Power Switch Grounding Hex Nut 20 - 23 lb-in.

Torque M3 Cover Bumper Feet Screws to 3 lb-in.

Torque M3 Rear Cover to Chassis Feet Screws 6-8 lb-in.

6. System Retest

6.1 General

After repair and/or replacement of any part of the FETALGARD Lite monitor, it is essential that the system be retested to assure **both** functionality and safety.

The functionality test requires the operation of the monitor in a Demo mode, and verifying the specified responses in the numeric frames and in the trend graphic waveform.

The safety test requires the use of appropriate test equipment to verify the monitor's specified response to a hi-pot test.

6.2 Functionality Test

Refer to the FETALGARD Lite Operator's Manual.

- Turn the monitor ON. Verify that the monitor screen indicates readiness; no error messages.
- Check to see that there is more than 50% of the battery charge shown in the battery icon. Connect the battery eliminator, if required.
- Connect the U/S and TOCO cables. Check to see that the display reflects the attachments in the appropriate frames.
- Using the Control Knob, update the Date/Time frame. Verify that the display responds correctly.
- Using the Control Knob, select the Demo Mode of operation. Verify that the display responds with the dynamic variation in the numeric frames and the generation of the trend in the graphic frame.
- Using the front-panel keypad buttons, verify the proper response to their activation.
- Leave the Demo Mode and return to normal monitoring action.

6.3 Safety Test

Follow the Health Care institution requirements and procedures to assure the monitor safety by performing the appropriate Hi-Pot tests.

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