Welch Allyn®
ELI® 150
Service Manual

⚠ **CAUTION:** *Federal law restricts this device to sale by or on the order of a physician*

For patent information, please visit www.welchallyn.com/patents

For information about any Welch Allyn product, visit: https://www.welchallyn.com/en/about-us/locations.html

Customer Service and Technical Support: https://www.welchallyn.com/en/other/contact-us.html 1.888.667.8272,

mor_tech.support@hillrom.com

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*901129 ELECTROCARDIOGRAPH*

EC REP EU IMPORTER

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NOTICES

Manufacturer's Responsibility
Welch Allyn, Inc., is responsible for the effects on safety and performance only if:
- Assembly operations, extensions, readjustments, modifications or repairs are carried out only by persons authorized by Welch Allyn, Inc.
- The device (ELI 150) is used in accordance with the instructions for use.

Responsibility of the Customer

The user of this product is responsible for ensuring the implementation of a satisfactory maintenance schedule. Failure to do so may cause undue failure and possible health hazards.

Equipment Identification

Welch Allyn, Inc. equipment is identified by a serial and reference number on the back of the device. Care should be taken so that these numbers are not defaced.

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Other Important Information

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Notice to EU Users and/or Patients:

Any serious incident that has occurred in relation to the device, should be reported to the manufacturer and the competent authority of the Member State in which the user and/or patient is established.

Disposal:

This product and its accessories must be disposed of according to local laws and regulations. Do not dispose of this product as unsorted municipal waste. For more specific disposal information see www.welchallyn.com/weee.

WARRANTY INFORMATION

Your Welch Allyn Warranty

WELCH ALLYN, INC. (hereinafter referred to as "Welch Allyn") hereby warrants that Welch Allyn products (hereinafter referred to as "Products") shall be free from defects in material and workmanship under normal use, service and maintenance for the warranty period of such Product from Welch Allyn or an authorized distributor or representative of Welch Allyn. Normal use, service and maintenance means operation and maintenance in accordance with appropriate instructions and/or information guides. This Warranty does not apply to damage to the Products caused by any or all of the following circumstances or conditions:

- a) Freight damage;
- b) Parts and/or accessories of the Products not obtained from or approved by Welch Allyn;
- c) Misapplication, misuse, abuse and failure to follow the Product instruction sheets and/or information guides;
- d) Accident, a disaster affecting the Products;
- e) Alterations or modifications to the Products not authorized by Welch Allyn;
- f) Other events outside of Welch Allyn's reasonable control or not arising under normal operating conditions.

THE REMEDY UNDER THIS WARRANTY IS LIMITED TO THE REPAIR OR REPLACEMENT WITHOUT CHARGE FOR LABOR OR MATERIALS, OR ANY PRODUCTS FOUND UPON EXAMINATION BY WELCH ALLYN TO HAVE BEEN DEFECTIVE. This remedy shall be conditioned upon receipt of notice by Welch Allyn of any alleged defects promptly after discovery thereof within the warranty period. Welch Allyn's obligations under the foregoing warranty will further be conditioned upon the assumption by the purchaser of the Products (i) of all carrier charges with respect to any Products returned to Welch Allyn's principal place or any other place as specifically designated by Welch Allyn or an authorized distributor or representative of Welch Allyn, and (ii) all risk of loss in transit. It is expressly agreed that the liability of Welch Allyn is limited and that Welch Allyn does not function as an insurer. A purchaser of a Product, by its acceptance and purchase thereof, acknowledges and agrees that Welch Allyn is not liable for loss, harm or damage due directly or indirectly to an occurrence or consequence therefrom relating to the Products. If Welch Allyn should be found liable to anyone under any theory (except the expressed warranty set forth herein) for loss, harm or damage, the liability of Welch Allyn shall be limited to the lesser of the actual loss, harm or damage, or the original purchase price of the Product when sold.

EXCLUDED FROM THE LIMITED WARRANTY SET FORTH ABOVE ARE CONSUMABLE ITEMS SUCH AS PAPER, BATTERIES, ELECTRODES, PATIENT CABLES, LEAD WIRES AND MAGNETIC STORAGE MEDIUMS.

EXCEPT AS SET FORTH HEREIN WITH RESPECT TO REIMBURSEMENT OF LABOR CHARGES, A PURCHASER'S SOLE EXCLUSIVE REMEDY AGAINST WELCH ALLYN FOR CLAIMS RELATING TO THE PRODUCTS FOR ANY AND ALL LOSSES AND DAMAGES RESULTING FROM ANY CAUSE SHALL BE THE REPAIR OR REPLACEMENT OF DEFECTIVE PRODUCTS TO THE EXTENT THAT THE DEFECT IS NOTICED AND WELCH ALLYN IS NOTIFIED WITHIN THE WARRANTY PERIOD. IN NO EVENT, INCLUDING THE CLAIM FOR NEGLIGENCE, SHALL WELCH ALLYN BE LIABLE FOR INCIDENTAL, SPECIAL OR CONSEQUENTIAL DAMAGES, OR FOR ANY OTHER LOSS, DAMAGE OR EXPENSE OF ANY KIND, INCLUDING LOSS OF PROFITS, WHETHER UNDER TORT, NEGLIGENCE OR STRICT LIABILITY THEORIES OF LAW, OR OTHERWISE. THIS WARRANTY IS EXPRESSLY IN LIEU OF ANY OTHER WARRANTIES, EXPRESS OR IMPLIED, INCLUDING, BUT NOT LIMITED TO THE IMPLIED WARRANTY OF MERCHANT ABILITY AND THE WARRANTY OF FITNESS FOR A PARTICULAR PURPOSE.

USER SAFETY INFORMATION

⚠	**WARNING:**	Means there is the possibility of personal injury to you or others.
⚠	**Caution:**	Means there is the possibility of damage to the equipment.
	Note:	Provides information to further assist in the use of the device.

Federal law restricts this device for sale to or on the order of a physician.

⚠ WARNING(S)

- Device (electrocardiograph, Class I) captures and presents data reflecting a patient's physiological condition that when reviewed by a trained physician or clinician can be useful in determining a diagnosis. However, the data should <u>not</u> be used as a sole means for determining a patient's diagnosis.

- To ensure that electrical safety is maintained during operation from AC (~) power, the device must be plugged into a Hospital Grade outlet.

- To maintain designed operator and patient safety, peripheral equipment and accessories used that can come in direct patient contact, must be in compliance with UL 2601-1, IEC 601-1 and IEC 601-2-25.

- Patient cables intended for use with the ELI 150 include series resistance (9 Kohm minimum) in each lead for defibrillation protection. Patient cables should be checked for cracks or breakage prior to use.

- Conductive parts of the patient cable, electrodes and associated connections of Type CF applied parts, including the neutral conductor of the patient cable and electrode should not come into contact with other conductive parts, including earth ground.

- To maintain designed operator and patient safety, only use parts and accessories supplied with the device and available through Welch Allyn, Inc.

- ECG electrodes could cause skin irritation and should be examined for signs of irritation or inflammation.

- To prevent possible infection, single use components (e.g., electrodes) should be limited to one-time use only.

- To avoid the possibility of serious injury or death during patient defibrillation, do not come into contact with device or patient cables. Additionally, proper placement of defibrillator paddles in relation to the electrodes is required to minimize harm to the patient.

- A possible explosion hazard exists; do not use the device in the presence of flammable anesthetics.

- Before attempting to use the device for clinical applications the operator must read and understand the contents of the manual and any documents accompanying the device.

- Where the integrity of external protective earth conductor arrangement is in doubt, the ELI 150 shall be operated from its internal electrical power source.

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- All signal input and output (I/O) connectors are intended for connection of only devices complying with IEC 60601-1, or other IEC standards (e.g. IEC 60950), as appropriate to the device. Connecting additional devices to the ELI 150 may increase chassis and/or patient leakage currents. To maintain operator and patient safety, consideration should be given to the requirements of IEC 60601-1-1, and leakage currents should be measured to confirm no electric shock hazard exists.

- The ELI 150 has not been designed for use with high-frequency (HF) surgical equipment and does not provide a protective means against hazards to the patient.

- The quality of the signal produced by the electrocardiograph may be adversely affected by the use of other medical equipment, including but not limited to defibrillators and ultrasound machines.

- The ELI 150 uses a lead-acid gel cell battery. Disposal of this battery must be in compliance with governmental regulations.

- This unit can operate using AC power. Caution should be taken when working on this unit to limit the exposure to high voltages. The unit should not be connected to AC power and the battery fuse should be removed when replacing any assembly of this unit.

 Caution(s

- To prevent possible damage to the keypad, do not use sharp or hard objects to depress keys, only use fingertips.

- Do not attempt to clean the device or patient cables by submersing into a liquid, autoclaving, or steam cleaning. Wipe the exterior surfaces with a warm water and mild detergent solution and then dry with a clean cloth.

- No user serviceable parts inside. Screw removal by qualified service personnel only.

- The rechargeable internal battery is a sealed lead acid type and it is totally maintenance free. If the battery appears to become defective, refer to Welch Allyn Service Department.

- Do not pull or stretch patient cables as this could result in mechanical and/or electrical failures. Patient cables should be stored after forming them into a loose loop.

Notes

- Excessive patient movement could interfere with the operation of the device.

- Proper patient preparation is important to proper application of ECG electrodes and operation of the device.

- There is no known safety hazard if other equipment, such as pacemakers or other stimulators, are used simultaneously with the ELI 150; however, disturbance to the signal may occur.

- If the ECG amplifier input is out of normal operating range, the display will indicate a lead fail for the lead(s) where this condition is present and if the signal is being printed, the respective lead(s) will print out as a square wave.

- As defined by IEC 60601-1 and IEC 60601-2-25, the device is classified as follows:
    - Class I equipment or internally powered
    - Type CF applied parts
    - Ordinary equipment
    - Not suitable for use in the presence of flammable anesthetics
    - Continuous operation

    NOTE: From a safety perspective, per IEC 60601-1 and derivative standards / norms, this unit is declared to be "Class I" and uses a three-prong inlet to ensure an earth connection is made along with mains. The ground terminal on the mains inlet is the only protective earth point in the unit. Exposed metal accessible during normal operation is double insulated from mains. Internal connections to earth ground are functional earth.

- The ELI 150 will automatically turn off (blank screen) if the batteries have been severely discharged.

- After operating the ELI 150 using battery power, always reconnect the power cord. This ensures that the batteries will be automatically recharged for the next time you use the ELI 150. A light will illuminate, next to the on/off switch, indicating that the unit is charging.

- The ELI 150 is a UL Classified Device:

WITH RESPECT TO ELECTRIC SHOCK,
FIRE AND MECHANICAL HAZARDS ONLY IN ACCORDANCE WITH
IEC 60601-1, CAN/CSA C22.2 No. 60601-1, AND
IEC 60601-2-25

GENERAL

Service Manual Purpose

The purpose of this manual is to supply information to service personnel so they can maintain the ELI 150 Interpretive and Non-Interpretive Electrocardiograph at the assembly and subassembly level. Although the manual includes parts lists, mechanical assembly parts, and printed circuit board information, it is intended to function primarily as a guide to preventative and corrective maintenance and electrical repairs considered field repairable.

Periodic Safety Inspections

Follow the recommended maintenance schedule. Inspect the power cord and transmission cables periodically for fraying or other damage and replace as needed. Broken or frayed wires may cause interference or loss of signal. Pay particular attention to points where wires enter connectors.

Proper Power Cord

Use only the power cord specified for the equipment. This product requires a three-wire, (18 gauge, SJT- grade) power cord, which is supplied with a three-terminal, polarized plug (hospital grade) for connection to the power source and protective ground. Use only a power outlet with a protective ground outlet. An interruption of the grounding connection could cause an electrical shock hazard.

Proper Fuse

Use only the fuse specified for the equipment (identical in type, voltage and current rating). Substituting a different fuse type could cause a fire hazard. Always make sure fuses have been installed before operating the unit.

Do Not Operate in Explosive Atmospheres

Do not operate the ELI 150 in the presence of flammable gasses or anesthetics; this environment could cause an explosion. Refer to Operator's Manual Safety Information: Warning(s) and Caution(s).

Use Only Safe Methods of Interconnection

To prevent electrical shock from the product when it is connected to other electrical equipment, proper grounding is essential. Refer to Operator's Manual Safety Information: Warning(s) Peripheral equipment.

Do Not Mount Product above Patient

Do not mount or place the product where it could fall on a patient or where it could be accidentally knocked off a shelf or other mounting arrangement.

Recommended Accessories

For the patient's safety and optimum equipment performance, use only the accessories specified by Welch Allyn, Inc.

Sterilizing this Product

Do not sterilize this product or any accessories unless specifically directed by the manufacturer. Sterilization and sterilization environments can seriously damage many components and accessories.

Liquid Spills

Do not set beverages or other liquids on or near the ELI 150, and/or optional equipment.

Product Information

See this section of Operator's Manual

EQUIPMENT SYMBOLS AND MARKINGS

Symbol Delineation

CAUTION The caution statements in this manual identify conditions or practices that could result in damage to the equipment or other property, or loss of data.

WARNING The warning statements in this manual identify conditions or practices that could lead to illness, injury, or death. In addition, when used on a patient applied part, this symbol indicates defibrillation protection is in the cables. Warning symbols will appear with a grey background in a black and white document.

Electrostatic sensitive devices

Do not dispose as unsorted municipal waste. Requires separate handling for waste disposal according to local requirements.

Indicates compliance to applicable European Union directives

Follow instructions/directions for use (DFU) – mandatory action. A copy of the DFU is available on this website. A printed copy of the DFU can be ordered from Welch Allyn for delivery within 7 calendar days.

Medical Device

Model Identifier

Reorder Number

MAINTENANCE AND CLEANING

⚠️ **CAUTION:**

Remove battery fuse before attempting any disassembly.

Removal of the battery fuse will not cause a loss of ECGs or of the configuration. This information is stored in FLASH memory.

Introduction

This section provides servicing and maintenance instructions for the ELI 150 interpretive electrocardiograph. Subsequent parts of this section are disassembly, inspection techniques, cleaning techniques, and installation.

Recommended Cleaning Supplies

- Anti-static mat & wrist band, properly grounded
- Clean, lint-free cloth
- Hospital grade germicidal solution
- DRY, low pressure, compressed air (30 psi)
- Electronic safe non-residue solvent, such as Flux-off
- Masking tape
- Non-metallic, soft-bristle brush
- Naphtha
- Vacuum cleaner, Static Safe

Equipment Required

- Screwdriver Philips #2.
- Allen Wrench 0.05 inch or a 1.25 mm
- Vibra-Tite or similar product to prevent screws from vibrating loose.
- Digital Multi Meter (DMM)

Note: The equipment and solvent mentioned above are standard shop commodities that are available from commercial sources. If in the performance of normal maintenance or repair, the PCB assembly, AC connector assembly, or writer assemblies are removed or replaced, a leakage test should be performed. See section on testing.

Cleaning and Inspecting Techniques

This section contains instructions for periodic cleaning and inspection of the instrument as preventative maintenance measures. It also contains specific cleaning procedures to be conducted after disassembly. Parts having identical cleaning procedures are grouped under common headings. No special tools are required.

Interior Cleaning

> **WARNING**
>
> *Ventilate work area thoroughly when using solvents. Observe manufacturers warnings on solvent containers with regard to personnel safety and emergency first aid. Be sure that first aid equipment is available before using chemicals. Observe all shop safety and fire precautions.*

Printed Circuit Board Cleaning

The printed circuit board assemblies in the ELI 150 system contain static sensitive devices. Use special handling procedures to prevent damage due to ESD.

Clean assembled parts with a vacuum cleaner or low pressure compressed air (30 psi). Take care when cleaning printed circuit boards that wires or component leads are not bent back and forth in such a manner as to weaken them and cause them to eventually break.

Dry with low pressure compressed air.

Metallic and Plastic Parts Cleaning

⚠️
CAUTION

Do not wipe over surfaces of nameplates or labels with abrasive cleaners or materials, as this will eventually wear away the nameplate information. Do not use solvents to clean plastic parts.

Brush all surfaces and parts with a nonmetallic, soft bristle brush.

Wipe metal surfaces with soft, nonabrasive cloth dampened with isopropyl alcohol. Dry

surfaces with clean cloth.

Wipe surfaces of nameplates and labels with dry cloth.

Exterior Cleaning

Use a damp cloth to clean external covers and the line cord. Use a Hospital grade germicidal solution.

Printhead Cleaning

Open the writer cover as explained in the section on final assembly.

Apply isopropyl alcohol to a clean cloth, and wipe the writer printhead until all foreign matter is removed. Dry

the printhead thoroughly before use. Use a dry clean cloth for this.

After cleaning is completed, inspect the unit using the techniques described previously.

After the inspection is complete, install the cover as explained in the section on final assembly.

Inspection of Writer Assembly Harness

Visually inspect the wire harnesses for wear, maintenance damage, corrosion, deterioration, and damage resulting from dropping.

If no defects are found, install the cover and restore the unit to service.

If a defect is found in the cables, replace the damaged cable with a new cable.

Exterior Inspection

Visually inspect the entire instrument for wear, maintenance damage, corrosion, deterioration, and damage resulting from dropping.

Interior Visual Inspection

Check all connectors for loose, bent or corroded contact points

Check wire, harnesses and cables for signs of wear or deterioration.

Inspect components and their leads for security of mounting, deterioration or leakage.

Check terminals and connections for proper installation, failed soldering, loss or wear.

Inspect PCB surfaces for charring, cracking or brittleness.

Note: Some degree of discoloration of the PCB surface may be expected due to continued exposure to the operating temperatures of some of the components.

Check the identification nameplate and other decals for legibility.

Inspect chassis, covers, and brackets for warping, bending, surface damage or missing captive hardware.

Check all screws and nuts for tightness or signs of stripped or crossed threads.

Check for any other form of mechanical damage, which may indicate a failure.

If, during the process of normal maintenance or repair, the PCB assembly, AC connector assembly, or writer assembly are removed and replaced, perform the leakage test as describe in the section on Testing and Troubleshooting.

Preventative Maintenance Schedule:

Maintenance to be Performed	Period	Notes
Clean and inspect unit.	6 mo.	Perform every 3 mo. if unit is in heavy use.
Printhead cleaning	80 hrs	Monthly cleaning recommended
Leakage tests.	-	As required by facility or regulatory requirements.

Table 1

SYSTEM SETTINGS

Access Configuration Menus

The configuration pages define all ELI 150 operational conditions that do not change on a daily or patient-to-patient basis. Once you set these default conditions, you will rarely need to use the configuration screens again. When you apply power to the ELI 150, it will operate according to the settings you have selected. To access the configuration menus:
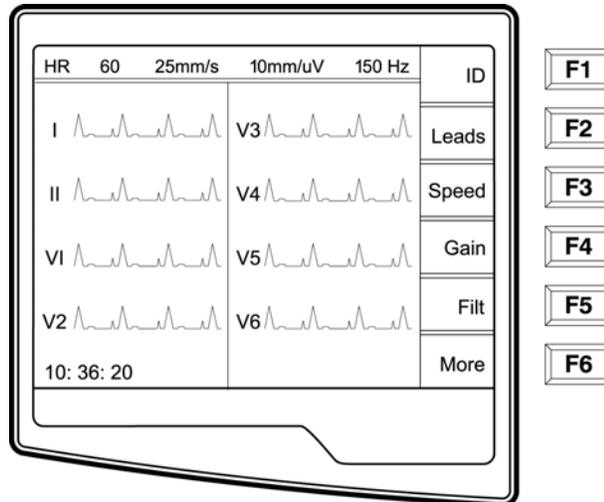
▢   Select **More (F6)** from the Real-Time ECG View.
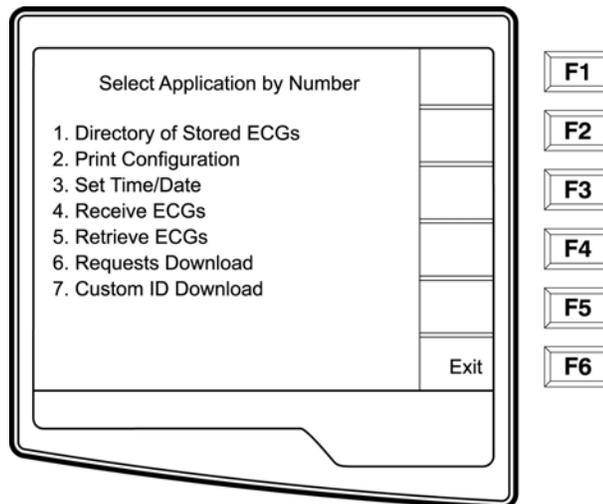
Select **Set Time/Date** (number 3) from the application menu

```
┌─────────────────────────────────┐
│  ┌──────────────────────┬─────┐  │    ┌──────┐
│  │                      │  ▲  │  │    │  F1  │
│  │                      ├─────┤  │    └──────┘
│  │                      │  ▼  │  │    ┌──────┐
│  │  Year:    2005       ├─────┤  │    │  F2  │
│  │  Month:   03         │Lcd ▲│  │    └──────┘
│  │  Day:     04         ├─────┤  │    ┌──────┐
│  │  Hour (00-23): 10    │Lcd ▼│  │    │  F3  │
│  │  Minute:  39         ├─────┤  │    └──────┘
│  │                      │Save │  │    ┌──────┐
│  │                      ├─────┤  │    │  F4  │
│  │  Batt Voltage: 12.1  │Exit │  │    └──────┘
│  └──────────────────────┴─────┘  │    ┌──────┐
│                                   │    │  F5  │
└─────────────────────────────────┘    └──────┘
                                        ┌──────┐
                                        │  F6  │
                                        └──────┘
```
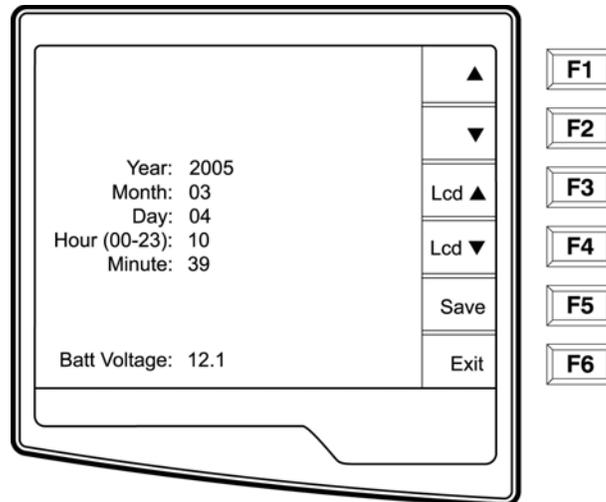
✎ From the Set Time/Date screen, simultaneously press ⌨ (SHIFT) + ALT + C. The first configuration screen will appear. Notice the page indicator in the upper right hand corner on each screen.

```
┌─────────────────────────────────┐
│  ┌──────────────────────┬─────┐  │    ┌──────┐
│  │ Modify Configuration │  ▲  │  │    │  F1  │
│  │ Page 1/6             ├─────┤  │    └──────┘
│  │                      │  ▼  │  │    ┌──────┐
│  │ Software Version: 1.20│     │  │    │  F2  │
│  │ Cart Number:     0   ├─────┤  │    └──────┘
│  │ Site Number:     0   │  ►  │  │    ┌──────┐
│  │ Site Name:           ├─────┤  │    │  F3  │
│  │       Mortara Instrument│  │  │    └──────┘
│  │ Tel No:              │Page │  │    ┌──────┐
│  │ OW1414354999         ├─────┤  │    │  F4  │
│  │ Language:  English   │     │  │    └──────┘
│  │ Volume:    2         ├─────┤  │    ┌──────┐
│  │ Battery Timeout: 10 Min│Exit│ │    │  F5  │
│  └──────────────────────┴─────┘  │    └──────┘
│                                   │    ┌──────┐
└─────────────────────────────────┘    │  F6  │
                                        └──────┘
```
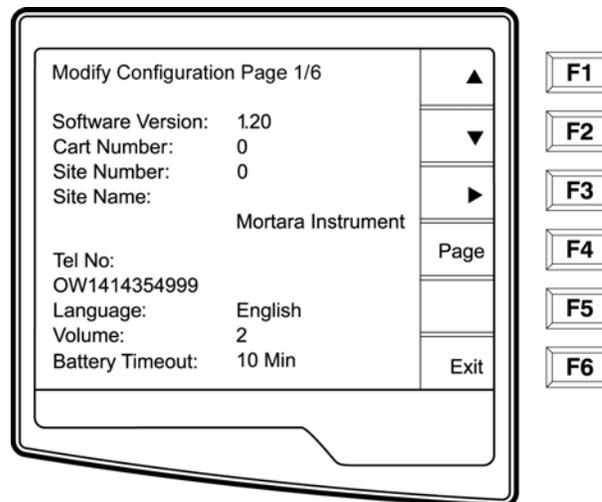
NOTES: Use **Page (F4)** *to toggle through the configuration pages.*
Use ▲ **(F1)** *and* ▼ **(F2)** *to move back and forth through each configuration option.*
Use ► **(F3)** *to toggle through pre-programmed available settings per configuration field.*
Use **Exit (F6)** *to return to the Real-Time ECG View. Any changes you have made will be saved.*
Use the **BACKSPACE**⌫ *key to erase entry errors.*

The following chart summarizes the configuration screens and the available options for each parameter.

Summary of Configuration Menus

Configuration Parameter	Definition	Configuration Screen
Software Version	The firmware version of the unit	Screen One
Cart Number	User-defined (4 digits; 0 to 9999)	Screen One
Site Number	User-defined (4 digits; 0 to 4095)	Screen One
Site Name	User-defined (up to 30 alphanumeric characters)	Screen One
Telephone Number	User-defined (up to 30 alphanumeric characters)	Screen One
Language	Firmware language availability	Screen One
Volume	Range from 0 – 8	Screen One
Battery Timeout	10 min, 30 min, 60 min	Screen One
Flash Size	Normal memory or Expanded memory (optional)	Screen Two
ID Format	Short, Long, Standard, Custom (optional)	Screen Two
Auto-Fill ID	Yes or No	Screen Two
AC Filter	None, 60Hz, 50Hz	Screen Two
Paper Speed	25mm/sec or 50 mm/sec	Screen Two
Filter	Frequency response for printouts: 40Hz, 150Hz, or 300Hz	Screen Two
Height/Weight Units	lb/in or kg/cm	Screen Two
Date Format	US (mm/dd/yyyy) or European (dd.mm.yyyy)	Screen Two
Interpretation	Yes or No	Screen Two
Reasons	Yes or No	Screen Two

Append	Unconfirmed Report, Reviewed by, Blank	Screen Three
#of copies	0 - 9	Screen Three
#ECGs retrieved	0 - 7	Screen Three

Configuration Parameter	Definition	Configuration Screen
Delete Rule	Post plot, post transmit, post plot/xmt	Screen Three
Storage Sensitivity	Normal or High	Screen Three
Auto-save ECG	Yes or No	Screen Three
Auto-print ECG	Yes or No	Screen Three
Baud Rate	Serial Baud Rates: 9600, 19200, 38400, 57600, or 115200	Screen Three
Caps Lock	Yes or No	Screen Three
Rhythm format	3 channel or 6 channel	Screen Four
3 Rhythm Lead 1	V1-V6, I, II, III, aVR, aVL, aVF	Screen Four
3 Rhythm Lead 2	V1-V6, I, II, III, aVR, aVL, aVF	Screen Four
3 Rhythm Lead 3	V1-V6, I, II, III, aVR, aVL, aVF	Screen Four
6 Rhythm Lead 1	V1-V6, I, II, III, aVR, aVL, aVF	Screen Four
6 Rhythm Lead 2	V1-V6, I, II, III, aVR, aVL, aVF	Screen Four
6 Rhythm Lead 3	V1-V6, I, II, III, aVR, aVL, aVF	Screen Four
6 Rhythm Lead 4	V1-V6, I, II, III, aVR, aVL, aVF	Screen Four
6 Rhythm Lead 5	V1-V6, I, II, III, aVR, aVL, aVF	Screen Four
6 Rhythm Lead 6	V1-V6, I, II, III, aVR, aVL, aVF	Screen Four
Plot Format	Channels printed: 3, 3+1, 3+3; Cabrera or Standard	Screen Five
3 + 1 Rhythm Lead	V1-V6, I, II, III, aVR, aVL, aVF	Screen Five
3 + 3 Rhythm Lead 1	V1-V6, I, II, III, aVR, aVL, aVF	Screen Five

3 + 3 Rhythm Lead 2	V1-V6, I, II, III, aVR, aVL, aVF	Screen Five
3 + 3 Rhythm Lead 3	V1-V6, I, II, III, aVR, aVL, aVF	Screen Five
XMT Media	RS232, Modem, GSM, LAN, External Modem	Screen Six
DHCP (LAN only)	Yes or No	Screen Six
IP Address	XXX.XXX.XXX.XXX	Screen Six
Def Gateway	XXX.XXX.XXX.XXX	Screen Six
Sub Net Mask	XXX.XXX.XXX.XXX	Screen Six
Host IP	XXX.XXX.XXX.XXX	Screen Six
Port Number	XXX.XXX.XXX.XXX	Screen Six

Configuration Page 1

```
Modify Configuration Page 1/6          ▲        F1

Software Version:   1.20                ▼        F2
Cart Number:        0
Site Number:        0
Site Name:                              ▶        F3
                    Mortara Instrument
                                      Page       F4
Tel No:
OW1414354999
Language:           English                      F5
Volume:             2
Battery Timeout:    10 Min             Exit       F6
```

Software Version

The displayed number identifies the firmware version of your electrocardiograph.

Cart Number

Cart numbers indicate which electrocardiograph transmitted a particular ECG.

Site Number

This option identifies the site of your ELI 150. Site numbers designate the hospital, clinic, or institution for ECG records stored in a Welch Allyn, E-Scribe data management system and <u>must</u> be defined for transmitting and retrieving ECGs from the data management system. You can use up to four digits for the site number, numbers from 0 –4095 are supported.

Site Name

This option defines your clinic, hospital, or office name. You can enter up to 30 alphanumeric characters. The site name prints at the bottom, left edge of the ECG printout.

Telephone Number

This option specifies the telephone number for modem transmission (to another unit or to an E-Scribe data management system). Enter up to 30 alphanumeric characters, and use the **BACKSPACE**⌫ key to erase entry errors.

To wait for an additional dial tone, use the letter **W**. For example, you may need to dial a **9** to get an outside line.

      EXAMPLE: 9**W**14145554321

To insert a pause use a comma (**,**).
To change tone dialing to pulse dialing, use the letter **P**.

      EXAMPLE: **P**14145554321

(If necessary, you can use both the letter W and the letter P in the same phone number.)
Note: it is not necessary to use alpha characters in the telephone number with GSM connectivity.

TIP: Instead of entering the configuration menus, use a shortcut to quickly delete or modify a phone number. From the application screen, simultaneously press ☐⏏ **(SHIFT) + ALT + P. To edit an existing number, use the tab key.**

Language

There are several languages available on the cardiograph.

> *CAUTION: upon selecting a new language and exiting the configuration screen, function labels are immediately translated.*

If an unknown language is visible, use the following steps to revert to the language of your country:

1. **F6** from Real-Time ECG View
2. Select number **3**
3. Simultaneously press ☐⏏ **(SHIFT) + ALT + C**
4. Press **F2 (▼)** four times
5. Press **F3 (►)** until the desired language appears
6. **F6** to return to Real-Time ECG View

Alphabets of specific languages may require the use special characters in demographic fields. This is accomplished by selecting **ALT** + the letter. For example, ñ is entered by selecting **ALT** +n. Hold the ALT key and scroll the letter to view the available letter selections with diacritics.

Volume

This option defines the keyboard click loudness. Available settings rage from 0 (off) to 8 (loud).
> *TIP: Use the* **BACKSPACE**⏏ *key to erase entry errors*

Battery Timeout

This setting determines when the cardiograph will switch off in order to conserve the battery life of the unit. The battery timeout will only occur if the keypad has not been depressed for the time specified. The battery timeout setting is ignored if an active ECG signal is detected, during transmission, or while rhythm printing.

Configuration Page 2

```
Modify Configuration Page 2/6          ▲      F1

Flash Size:           Normal                  F2
ID Format:      Short
Auto-Fill ID:         No                ▶     F3
AC Filter:            60 Hz
Paper Speed:          25 mm/s                 F4
Filter:               150 Hz          Page
Ht/Wt Units:          lb/in                   F5
Date Format:          MM/DD/YYYY
Interp:               Yes                     F6
Reasons:              Yes             Exit
```
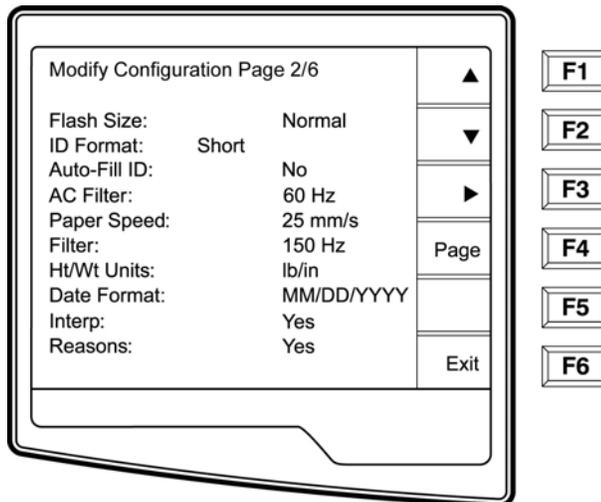
Flash Size

Flash Size indicates the ECG storage capacity of your electrocardiograph. Normal Flash Size is the standard memory capacity. If the optional expanded memory has been installed, Expanded will be displayed.

ID Format

This option defines the format for the patient ID information prompts. There are three standard formats: short, standard, or long. A custom ID format is optional when downloaded from the E-Scribe Data Management System.

The short format includes the patient's last name and first name, patient ID number, date of birth, which will automatically calculate the age, and gender field.

The standard format includes the patient's last name, patient ID number, age, height, weight, gender, race, medication 1, medication 2, and a location field.

The long format is identical to the standard format except that it includes the patient's first name, room and comment fields.

The custom format, which is designed in the Welch Allyn E-Scribe Data Management System, can be downloaded to the ELI 150. The custom ID format is uniquely designed to meet your facility's needs. Please see Appendix A to download a Custom ID.

Auto-Fill ID

When enabled, the system will automatically populate the demographic fields in the ID screen. When the patient ID field is manually populated and followed either by selecting enter or **F2 (▼)** the system automatically scans the patient directory and if records with the exact ID are found, the existing data is used to fill some of the demographic fields. The auto-fill feature is designed to only automatically populate last name, first name, date of birth, age and gender. If no matching records are found, a brief message is displayed and the user must manually enter the patient's demographics.

> NOTE: In order to avoid the use of incorrect data, the Auto-Fill ID feature is only supported if the ID formats are the same between records.

AC Filter

The ELI 150 removes 60Hz or 50Hz interference. The setting you select depends on the line frequency in your country. Always use the 60Hz setting in the United States. If the AC interference is present, check to see that the proper AC filter is selected.

Paper Speed

The writer speed can be configured at 25mm/s or 50mm/s for default ECG printouts. For rhythm printouts and display, speeds of 5mm/s or 10mm/s are also available. See the Assembly/Disassembly section to change speeds for display or rhythm printing. Paper speed is printed at the bottom-right corner of the ECG printout.

Filter

The ECG plot frequency filter (or print filter) can be set to 40Hz, 150Hz, or 300Hz. The plot frequency filter does not filter the acquired digital record. A 40Hz plot filter setting will reduce the noise (40Hz and higher frequencies) on the printed ECG, a 150Hz plot filter setting will reduce the noise (150Hz and higher frequencies) on the printout and a 300Hz plot filter setting will not filter the printed ECG. The filter setting is printed at the bottom right corner of the ECG printout.

Height/Weight Units

This option defines the units of weight and height to either pounds/inches (lb/in) or kilograms/centimeters (kg/cm).

Date Format

This option defines the format for entering and displaying the patient's date of birth in either the U.S. format or the European format.

> **For example:**   **July 16th, 2003 is displayed as follows:**
>
> **US Date Format:**   **MM/DD/YYYY (07/16/2003)**
> **European Date Format:**   **DD.MM.YYYY (16.07.2003)**

NOTE: the date format option does not modify the acquisition date printed on each ECG. Using the example above, the acquisition date would print as 16-Jul-2003.

Interpretation Option

The ELI 150 automatically analyzes ECGs and prints the optional interpretation on the ECG printout. This option allows you to select or suppress the "interpretive" text on the ECG report.

NOTE: A qualified physician should review the computer generated ECG interpretation before the treatment of any patient.
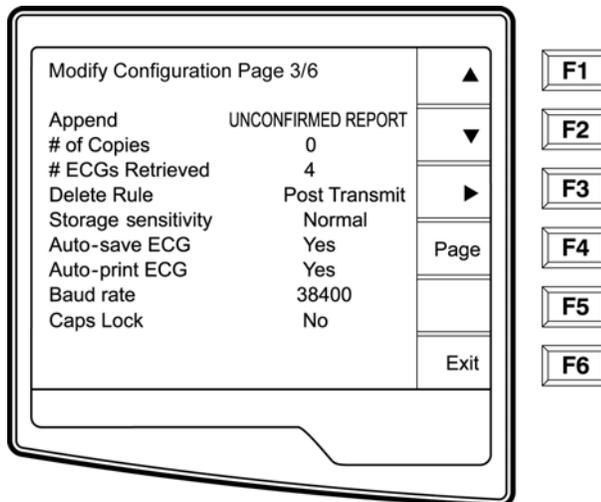
Reasons

The reason statements indicate why a particular interpretive statement was printed. Reason statements print in [square brackets] within the interpretive text (if the interpretation is turned on). Turning the reason statement function on or off does not affect the measurements performed or the interpretive statements selected by the analysis program.

> For Example:
> Anteroseptal Infarct [40+ MS Q WAVE IN V1-V4]
> Where "Anteroseptal Infarct" is the interpretive statement.

And "40+ MS Q WAVE IN V1-V4" is the reason statement or explanation as to why the interpretive statement was printed.

Configuration Page 3

```
┌─────────────────────────────────────────────────┐
│  ┌──────────────────────────────┬──────┐         │
│  │ Modify Configuration Page 3/6 │  ▲   │   [F1]  │
│  │                               ├──────┤         │
│  │ Append        UNCONFIRMED REPORT│ ▼  │   [F2]  │
│  │ # of Copies            0      ├──────┤         │
│  │ # ECGs Retrieved       4      │  ►   │   [F3]  │
│  │ Delete Rule      Post Transmit├──────┤         │
│  │ Storage sensitivity   Normal  │      │   [F4]  │
│  │ Auto-save ECG          Yes    │ Page │         │
│  │ Auto-print ECG         Yes    ├──────┤         │
│  │ Baud rate            38400    │      │   [F5]  │
│  │ Caps Lock              No     ├──────┤         │
│  │                               │ Exit │   [F6]  │
│  └──────────────────────────────┴──────┘         │
│                                                   │
└─────────────────────────────────────────────────┘
```

Append

A status or statement phrase can be appended to the ECG and printed under the interpretive text printout. Either "unconfirmed report" or "reviewed by" can be selected. However, if you wish to have nothing appended to the ECG, "blank" may be selected.

Number of Copies

This option defines the number of printed copies when an ECG is taken. A zero (0) setting prints the original only; one (1) prints the original plus 1 copy; two (2) prints the original plus 2 copies, and so on. Up to 9 copies may be selected.

ECGs Retrieved

This option defines the number of ECGs retrieved from an E-Scribe data management system. The ECGs are retrieved by ID number. A zero (0) setting retrieves the most current ECG for that ID number. Settings from one (1) to seven (7) retrieve the most current ECG plus "X" number of ECGs identified by the entered value. EXAMPLE: If you enter the number 5, you will retrieve the most current ECG plus the five preceding ECGs for that ID number. ECGs retrieved from the E-Scribe are only printed at the ELI250 and not saved.

Delete Rule

This option defines the ECG auto delete status in the patient directory. ECGs that are marked for deletion will be automatically removed or erased based on its date (a first in/first out philosophy) to make room necessary for the new ECG record. ECGs are only erased from the directory when they are marked for deletion and if the directory becomes full. More than one ECG may be removed from the directory in order to make room for the the new incoming record. The delete rule selections are:

Post Plot = ECG is automatically marked deleted after printing.

Post Transmit = ECG is automatically marked deleted after transmission.

Post Plot/Transmit = ECG is automatically marked deleted after transmission and printing.

Storage Sensitivity

The ECG storage sensitivity setting dictates the resolution of the stored record. The sensitivity settings are either Normal or High. If the configuration value is set to High, the stored ECG will have a high resolution. As a result, the records size will be large and will reduce the storage capacity in the ECG directory.

Auto Save ECG

This option defines whether or not the ELI 150 is to automatically save newly acquired ECGs in the directory, once they are acquired and printed. If the auto save configuration option is set to NO, and the record is printed, the ELI 150 will prompt you to "Save ECG?" **SAVE (F1)** will store the ECG in the directory.

> *NOTE: manually save ECGs by selecting More (F5) from the Acquired ECG view and Save (F5).*

Auto Print ECG

This option defines whether or not the ELI 150 will automatically print the ECG after acquisition. If the selected configuration option is set to NO, a manual printout is possible after acquisition.

Baud Rate

The user-selectable baud rate determines the serial port's data transmission rate in bits per second (bps). Set the baud rate to: 9600, 19200, 38400, 57600, or 115200 bps for direct data transmission between the ELI 150 and another Welch Allyn cardiograph, and 38400 bps for a direct connection to the E-SCRIBE data management system.

Caps Lock

All character entry is translated to upper case.

Configuration Page 4
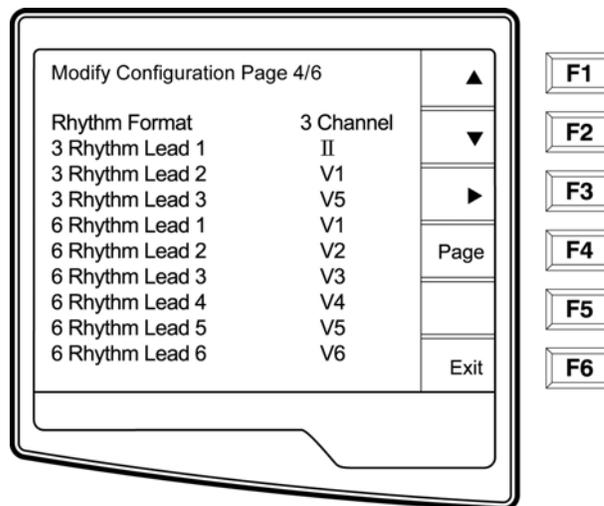
Rhythm Formats

Configuration page four defines the default values for rhythm printing. It is possible to set a 3-channel or 6-channel default rhythm format. Define rhythm leads one through three to customize a three-channel rhythm printout or

define rhythm leads one through six to customize the six-channel rhythm printout. Use (F3) to toggle through each of the 12 leads.

Configuration Page 5
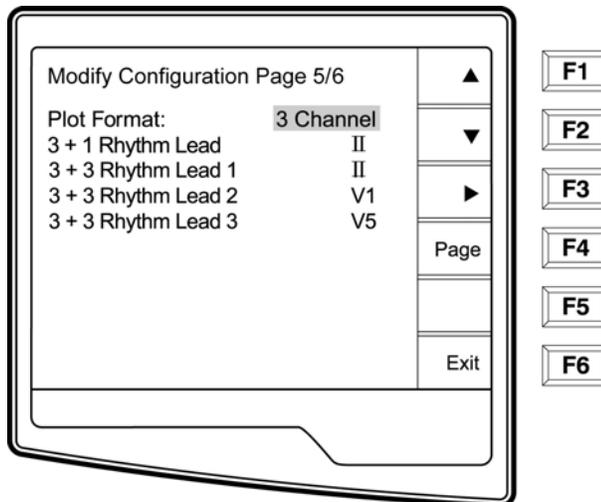
Plot Format

This option defines the default for one of the available plot formats in either Standard or Cabrera presentation. Please note that regardless of the plot format selected, 10 seconds of 12-leads are always stored.

The ECG plot options are:

Format Option	ECG Data
3+1	2.5 seconds of 12 leads in a three-channel format and the fourth channel is a 10 second rhythm strip of lead II *user defined).
3	2.5 seconds of 12 leads in a three-channel format
3+3	2.5 seconds of 12 leads in a three-channel format plus 10 second rhythm strip of leads II, V1 and V5 (user defined) in a three-channel format.

Rhythm Leads

Configuration page five identifies the three user-selectable 10-second rhythm leads for the 3+1 and 3+3 channel ECG printout. Use (F3) to make your selection of any of the 12 leads.

> *NOTE: rhythm acquisition is not stored in memory, only printed. NOTE: see*
>
> *Assembly/Disassembly section to acquire a rhythm printout.*

Configuration Page 6

The ELI 150 connectivity options are RS232 (or direct), internal or external modem, LAN or GSM. Configuration parameters associated with each type of transmission media will be presented in configuration page six only if those media are installed in the cardiograph.

```
Modify Configuration Page 6/6        ▲        F1

XMT Media:     LAN                    ▼        F2
DHCP:          Yes
IP Address:    000.000.000.000        ▶        F3
Def. Gateway:  000.000.000.000
Sub Net Mask:  000.000.000.000               F4
Host IP:       000.000.000.000      Page
Port Number:   5006                          F5

                                    Exit       F6
```
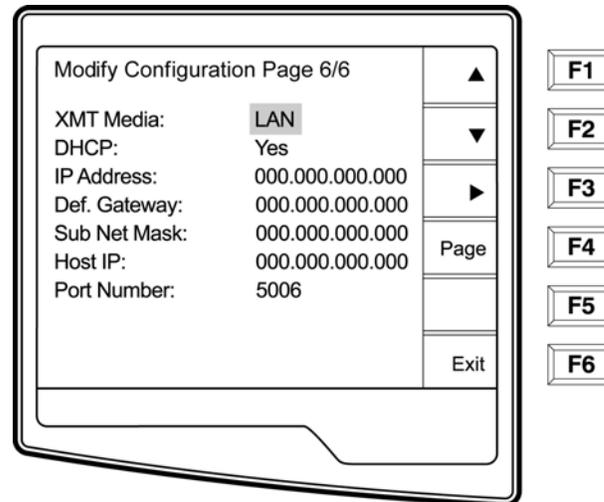
XMT Media

Configuration page 6 identifies the default transmission media. Those connectivity options which have been optionally purchased and installed (RS232, modem, LAN, GSM, or external modem) in your ELI 150 will be available for default selection.

DHCP

This setting defines whether the Dynamic Host Communication Protocol (DHCP) will be used to obtain an IP address. If DHCP is Yes, the network will automatically and dynamically assign an IP address therefore, there is no need to manually enter an IP address. If DHCP is No, you must enter the IP address, Def Gateway and Sub Net Mask.

> *NOTE: all parameters related to network connection must be entered under the direction of the IT Manager of the facility where the unit is installed.*

IP Address

Define the fixed IP address used by the ELI 150 for network transmission (if DHCP is not selected).

Def Gateway

Enter the address of the default gateway (if DHCP is not selected).

Sub Net Mask

Enter the Sub Net address (if DHCP is not selected).

Host IP

Enter the IP address of the host server.

27

Note: addresses are always entered as 4 sets of 3 digits; therefore, an address of 192.168.0.7 must be entered on the ELI 150 as 192.168.000.007.

Port Number

Enter the port number used by the host server.

ASSEMBLY / DISASSEMBLY OF UNIT

> ⚠ **CAUTION:**
>
> *Remove AC power and battery fuse before attempting any disassembly.*
>
> *Removal of the battery fuse will not cause a loss of ECG's or of the configuration. This information is stored in FLASH memory.*
>
> *Dangerous voltages are present on the circuit board of the ELI 150. Caution should be taken when removing or replacing the motherboard.*

> *Static sensitive parts. Appropriate measures should be taken when opening this unit*

For illustration purposes the ELI 150 with a modem will be used to demonstrate the disassembly of the unit. The parts list for the ELI 150 components are located on Parts list section of this manual.

Fuse Removal

Locate the fuse on the bottom of the unit.
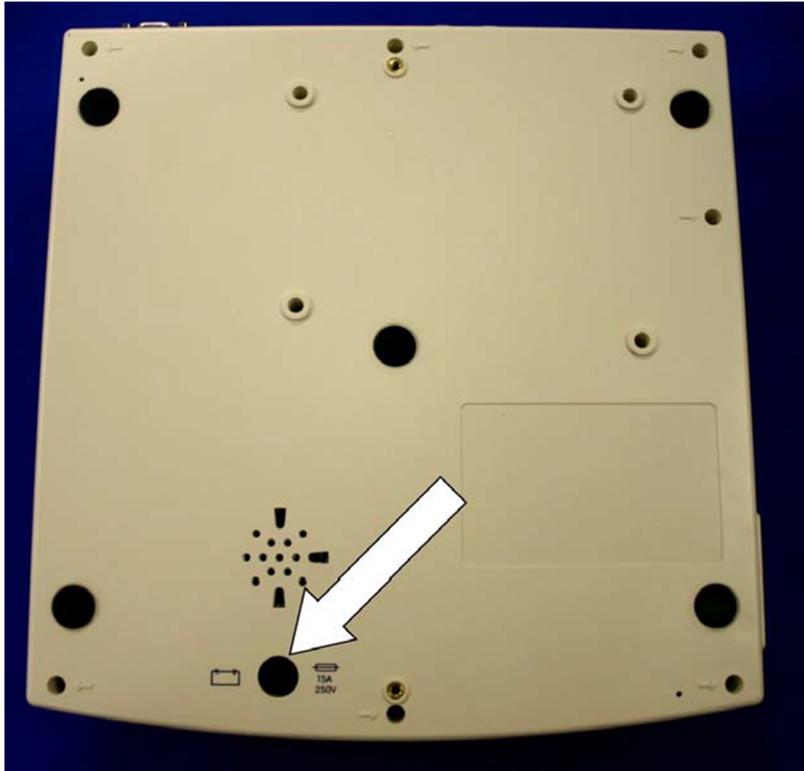
Insert a flat blade screwdriver into the slot of the fuse holder, item # 2, push in slightly and rotate the screwdriver counterclockwise 1/4 turn. The fuse holder, item # 2, is spring loaded and will come out easily. The fuse is a 5 Amp Type T SLO BLO 250V fuse, item number 1, in the parts listing.

Cover Assembly Removal / Installation

From the standard operating position:

Turn unit over so that it is resting on the writer. Locate the mounting screws for the top cover. There are 7 screws around the perimeter of the unit and marked with arrows in the plastic.

Loosen these screws, item # 8, using a Philips head screwdriver.

> *Note: When removing screws, loosen the screw but do not remove, the screw can remain in the screw hole by placing tape over the holes with the screw still in the hole. The tape will hold the screws so that they will not be lost during disassembly.*
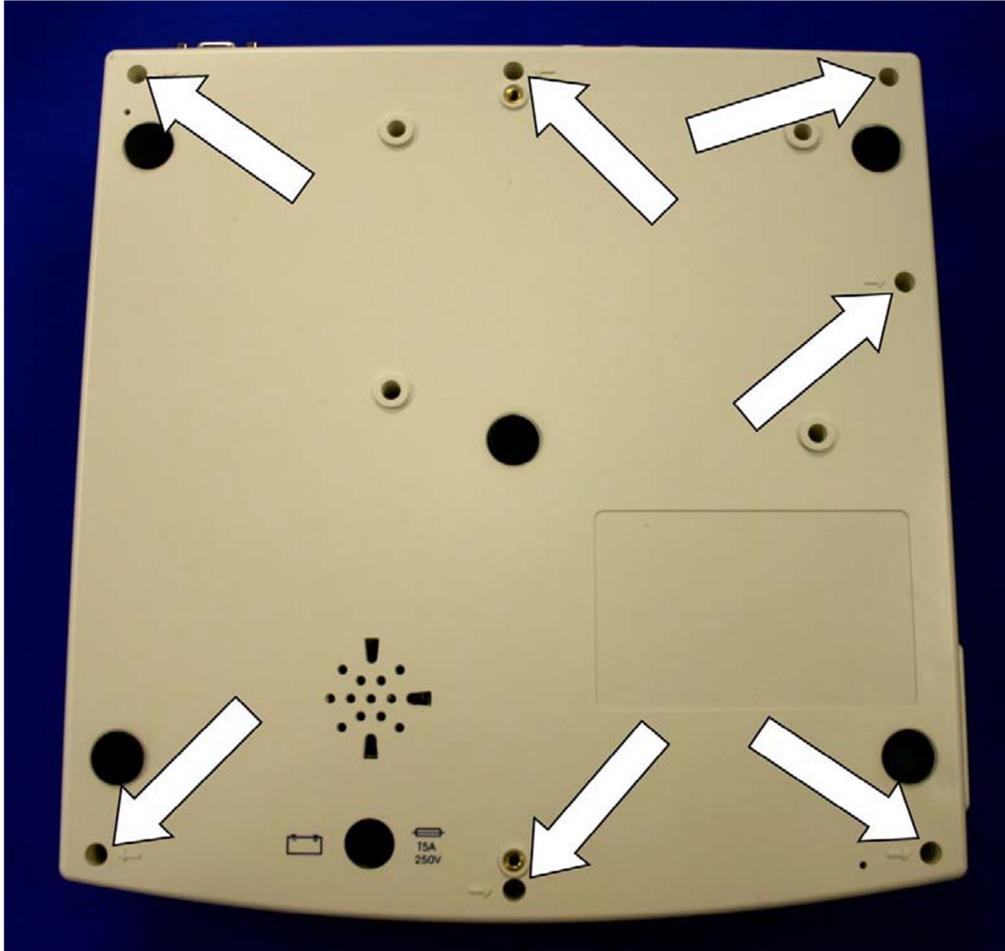
Turn the unit over so that it is resting in its normal position.

CAUTION

The unit will be in two pieces, Top and Bottom. Care must be taken when turning the unit over. Hold the top cover to the bottom of the unit securely when turning unit over.

Open the writer door by lifting up on the writer door latch and sliding the door to the left.
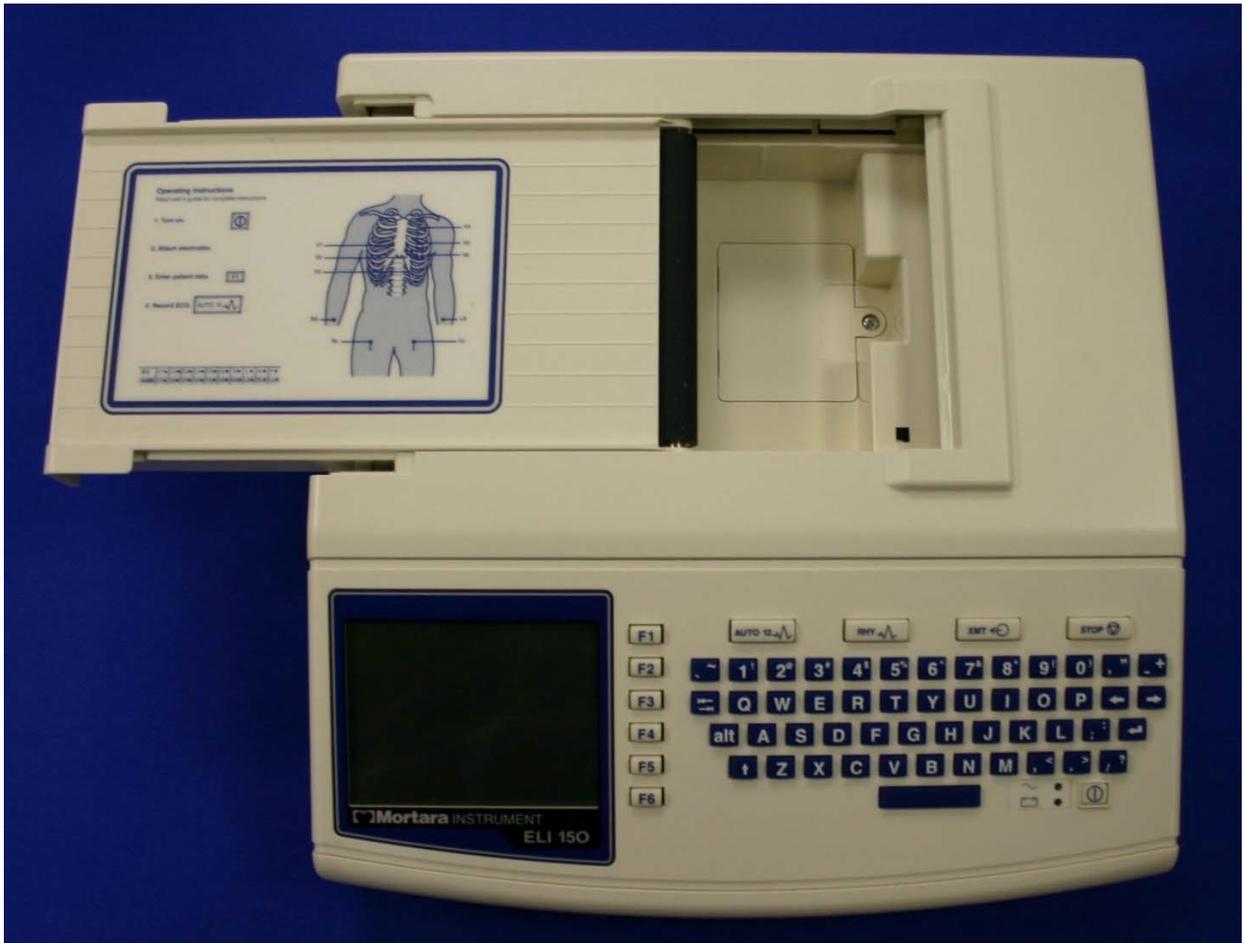
Lift up and rotate the right side of the top cover to left a small distance. Reach in and remove the keyboard/LCD cable, item # 22, from the top cover of the unit.
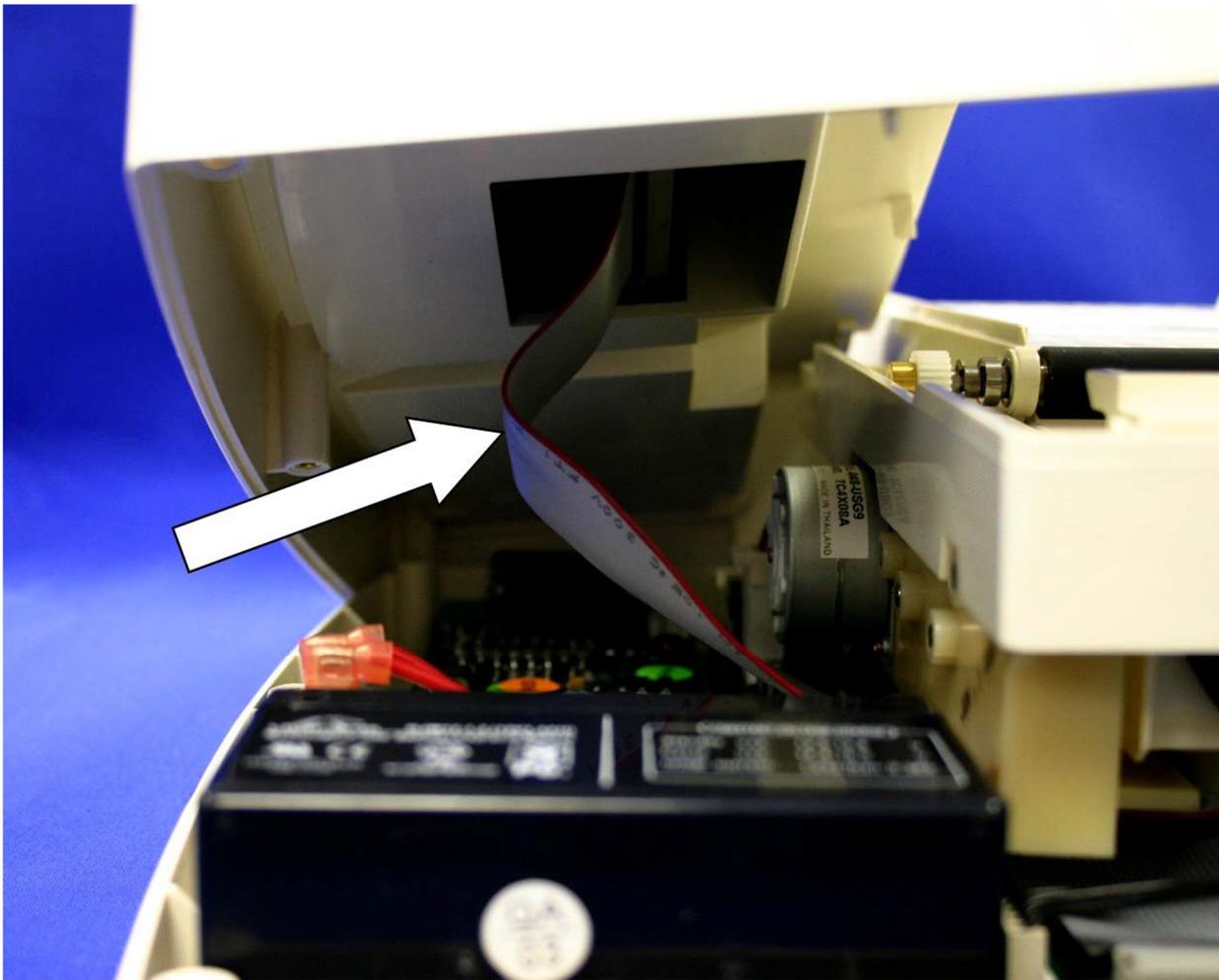
Note: Slide your hand into the unit and disconnect the Keyboard/LCD, item # 22, ribbon cable from the top cover.

Slide top cover off the unit, rotating as needed to clear the writer door.

Set the cover to the side.

> ### CAUTION:
>
> ⚠️ *With the cover off the unit dangerous voltages are present on the circuit board of the ELI 150. Care should be taken any time the cover is removed from the unit.*

Re-assemble in reverse order.

Battery Removal

Once the top cover is removed, the battery can be accessed for replacement if needed. Make sure that the battery fuse holder and fuse, Items 1 and 2, have been removed.

Locate the battery, item number 4, near the front of the unit.

Slide the Fast on cable connections off of the battery.

__Note the polarity of the battery connections. The red wire is connected to the positive terminal of the battery and the black wire is connected to the negative terminal of the battery.__
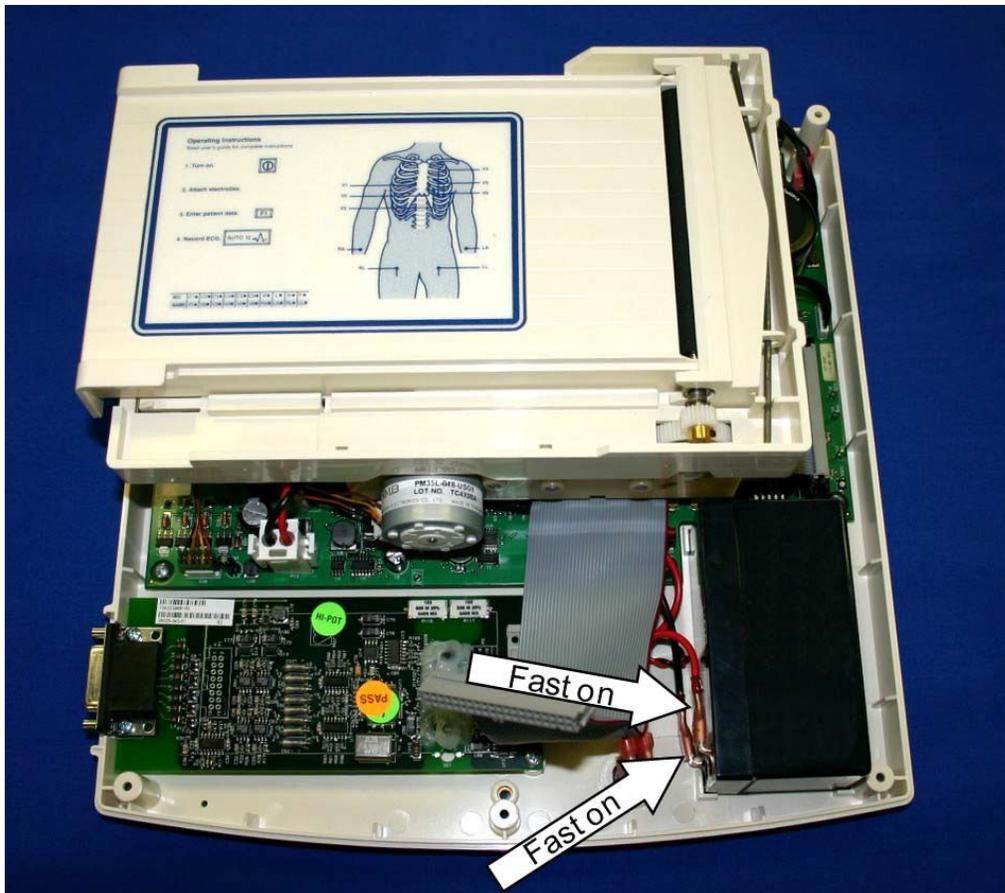
The battery, item # 4, is attached to the base of the unit using double-sided tape, item # 11, using a flat blade screwdriver gently pry the battery loose from the bottom plastic chassis.

Install the new battery in the same location using double sided tape, item # 11, and reconnect the battery cables.

<u>Note the polarity of the battery connections. The red wire is connected to the positive terminal of the battery and the black wire is connected to the negative terminal of the battery.</u>

⚠️

CAUTION:

Reversing the battery cable connections on the battery will damage the ELI 150 motherboard.

Risk of explosion – DO NOT SHORT BATTERY TERMINALS TOGETHER

Disposal of the spent battery must be in accordance with regulation for disposal of lead-acid batteries.

Reassemble unit in reverse order.

Keyboard/LCD Removal

With the top cover removed turn the cover over to access the inside of the top cover and locate the mounting screws for the keyboard and LCD.
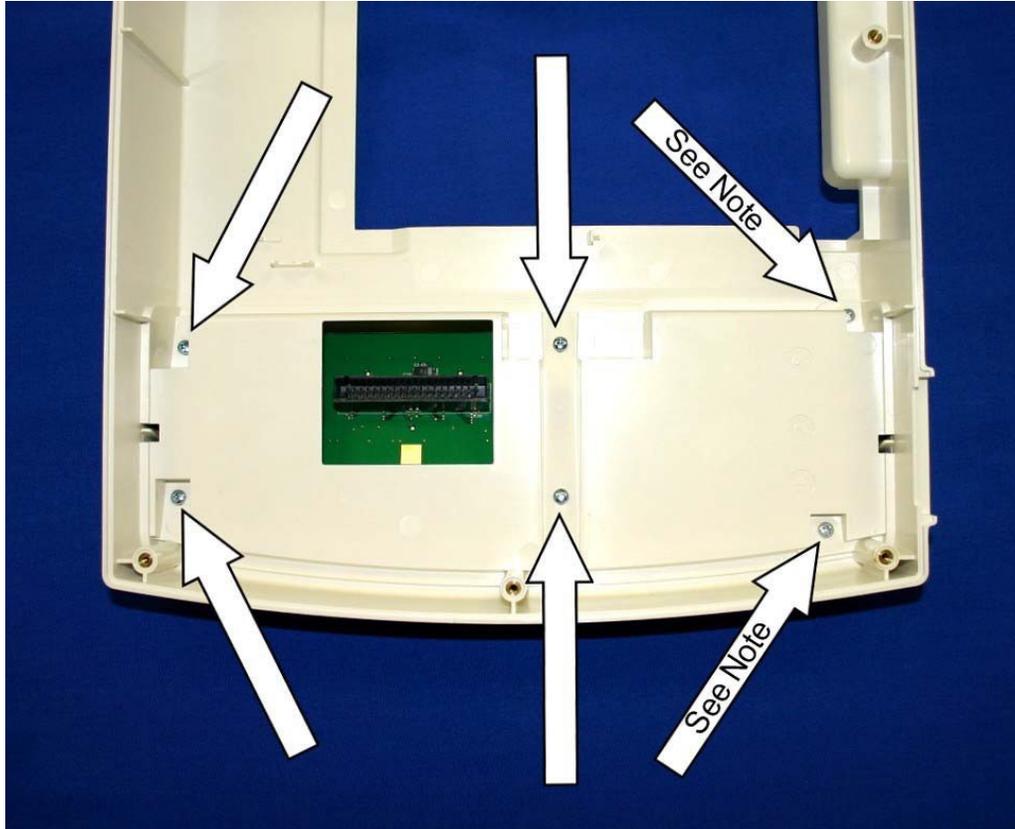
Remove the mounting screws from the underside of the cover.

> *Note: Four of the mounting screws are item # 7. The remaining 2screws, at the noted locations, are item# 6 and are shorter than the other screws. This becomes important when reinstalling the keyboard assembly. Installing the longer screws (item # 7) in the noted locations will cause the screw to push through the plastic cover.*

The keyboard assembly can then be removed from the top cover. The picture below shows the keyboard assembly removed from the top cover. The keyboard assembly consists of the Keyboard PCB (item # 26), LCD (item # 5) the Keypad (item # 3) and the keyboard bezel (item # 17).
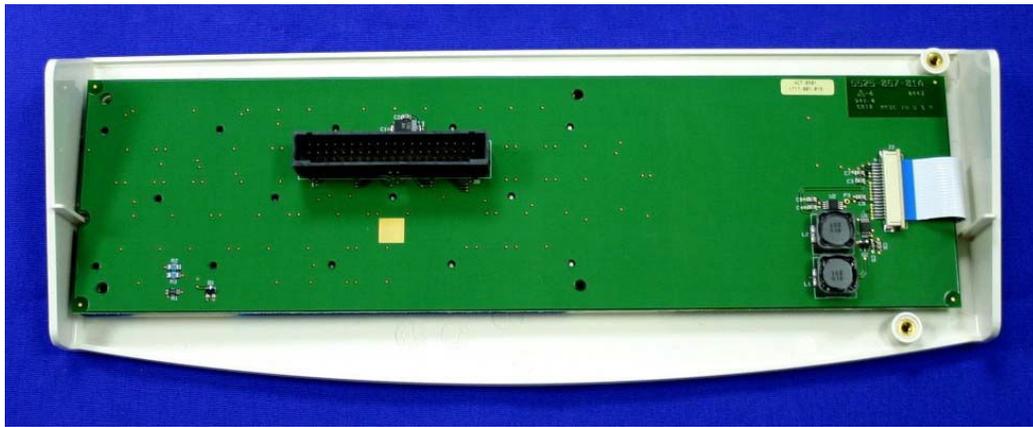
Remove the LCD cable from the keyboard by 1) sliding the connector to the right then 2) lifting up on the connector.
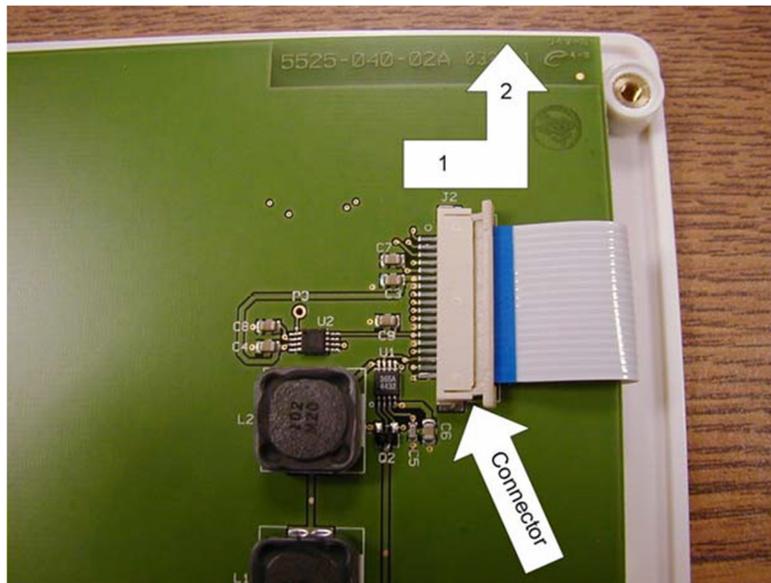
The keyboard circuit board, item # 26, can then be lifted off the assembly.
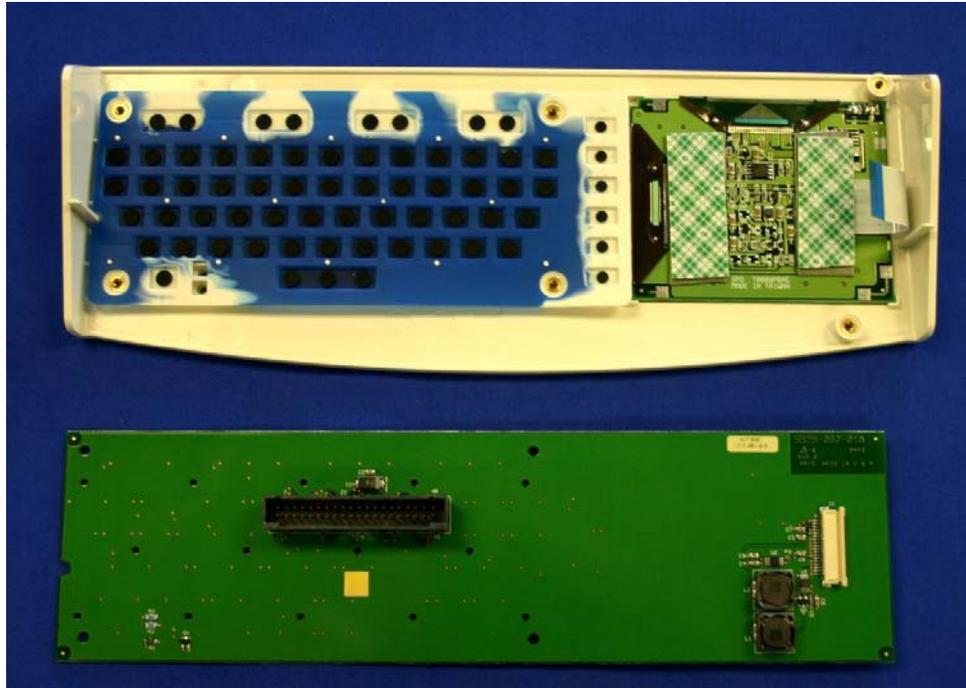
The key pad, item # 3, can now be removed from the keyboard bezel, item # 17.

The LCD is attached to the keyboard bezel by means of double-sided tape, item #10, near the top of the LCD. Care should be taken when removing the LCD from the keyboard cover.

When replacing the LCD, remove the old double sided tape and cut a piece of double-sided tape approximately 2 inches. Place this strip of double-sided tape, item # 10, onto mounting surface on Keyboard Bezel as shown.
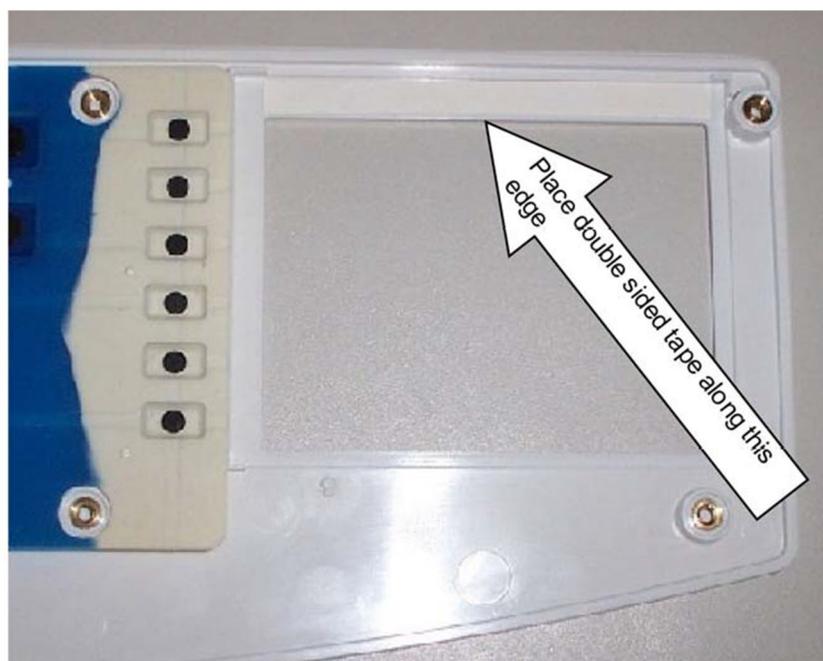
For the installation of a new LCD, item # 5, cut four pieces of foam tape, item #12, to approximately 2 inches (5 cm). Place two strips of foam tape onto LCD as shown. Place the remaining two strips over the first two strips as shown. Leave the paper backing on the second set of foam tape.
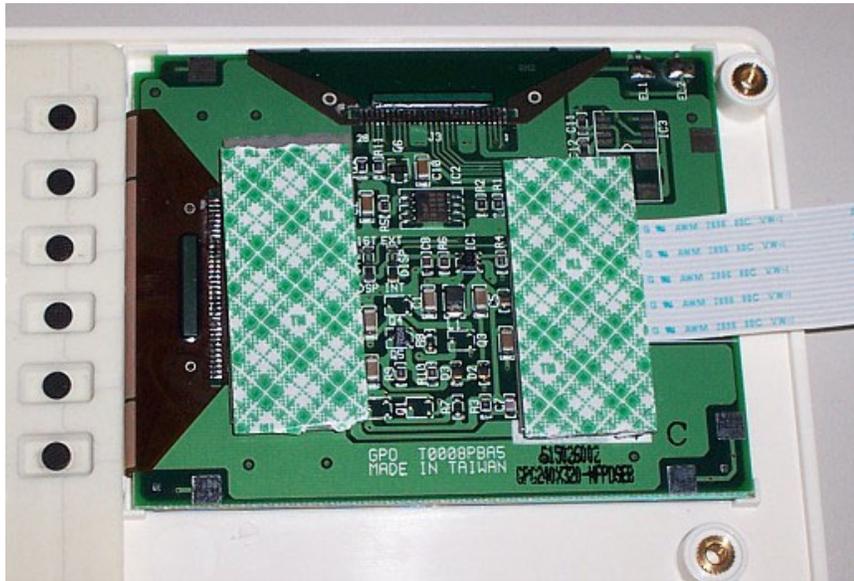
Reinstall Keyboard and LCD assembly in reverse order.

Writer Removal / Installation

Located on the perimeter of the motherboard are the cables for the writer. There are a total of 5 cables that need to be removed, 2 print head cables (item number 35), 1 cue sensor cable (item # 39), 1 print head ground cable (item # 38) and the writer motor cable (item # 40).
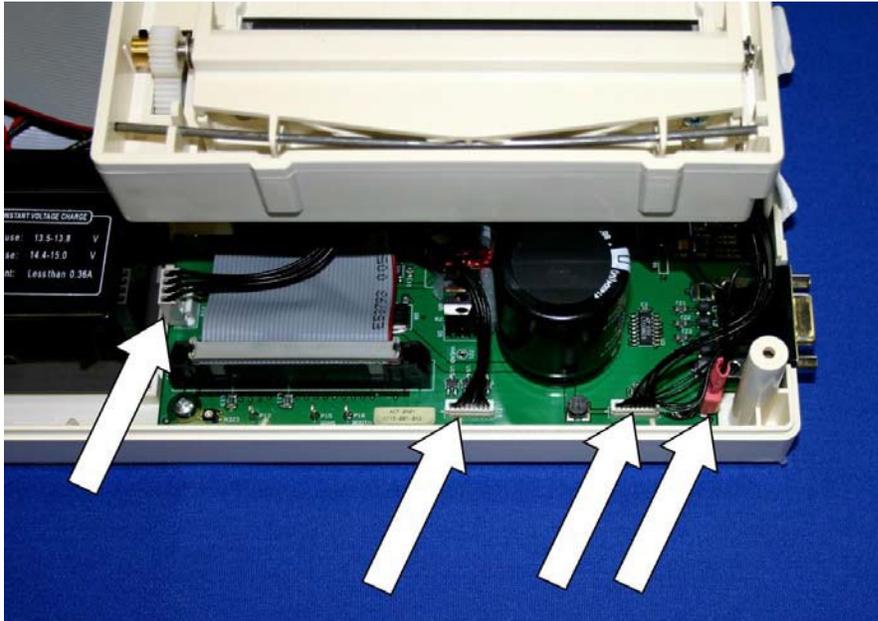
The picture above shows the location of the cables for the cue sensor (item # 39), two print head cables (item # 35) and a ground wire (item # 38) [cables listed left to right].

The following picture shows the location of the writer motor cable (item #40).
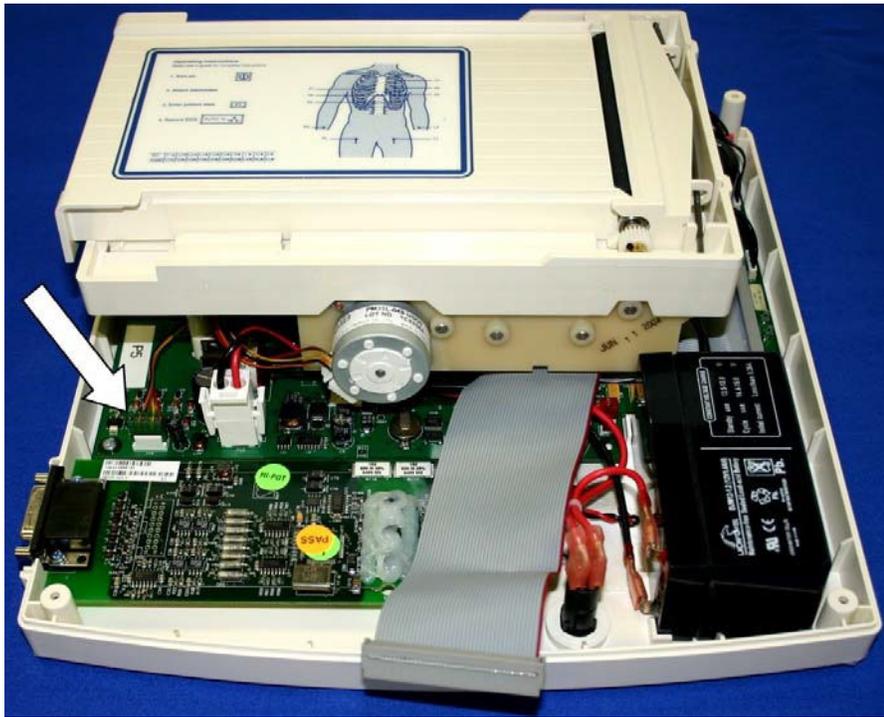
NOTE: The writer motor cable must be run behind the writer standoff and under the writer assembly for patient safety reasons.

Remove the listed cables.

Turn the unit over and remove the 4 screws, item 8, holding the writer to the bottom chassis.
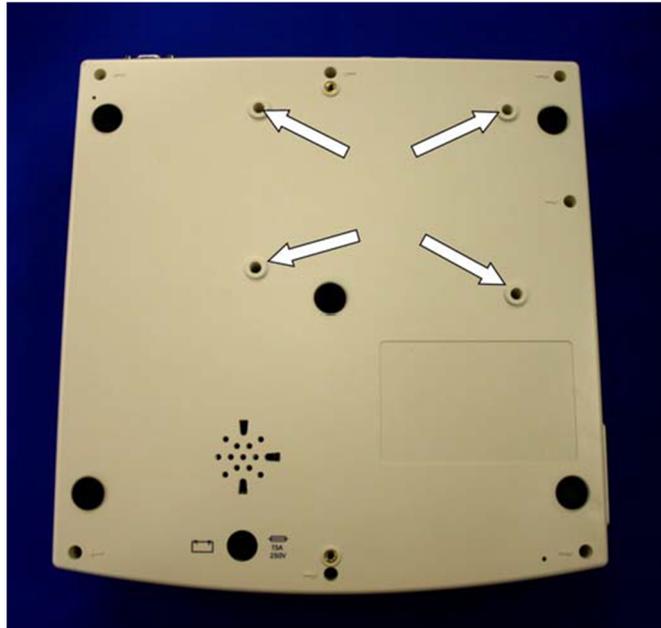
CAUTION

Due to the weight of the battery (item # 4), the bottom chassis of the unit may tilt off the writer while the unit is upside down. Make sure that the bottom chassis is supported while performing this procedure.

Lift the bottom chassis straight off of the writer assembly.

Re-assemble in reverse order.

Printhead Removal / Installation

<table>
<tr>
<td>

⚠

</td>
<td>

CAUTION

The printhead is a static sensitive part. Appropriate measures should be taken when handling this part.

</td>
</tr>
</table>

With the writer removed from the unit, close the writer door. Turn the writer over and locate the O-Ring, item # 27, that holds the print head assembly to the writer base. Remove the O-Ring. Please note that once the O-Ring is removed the print head assembly will be loose in the writer chassis.
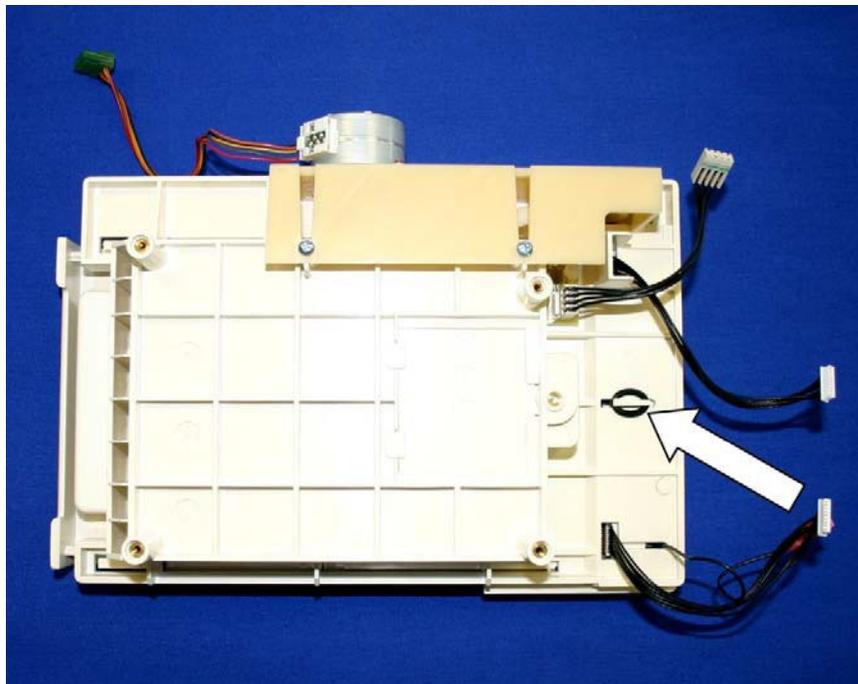
Turn the writer over and open the writer door.
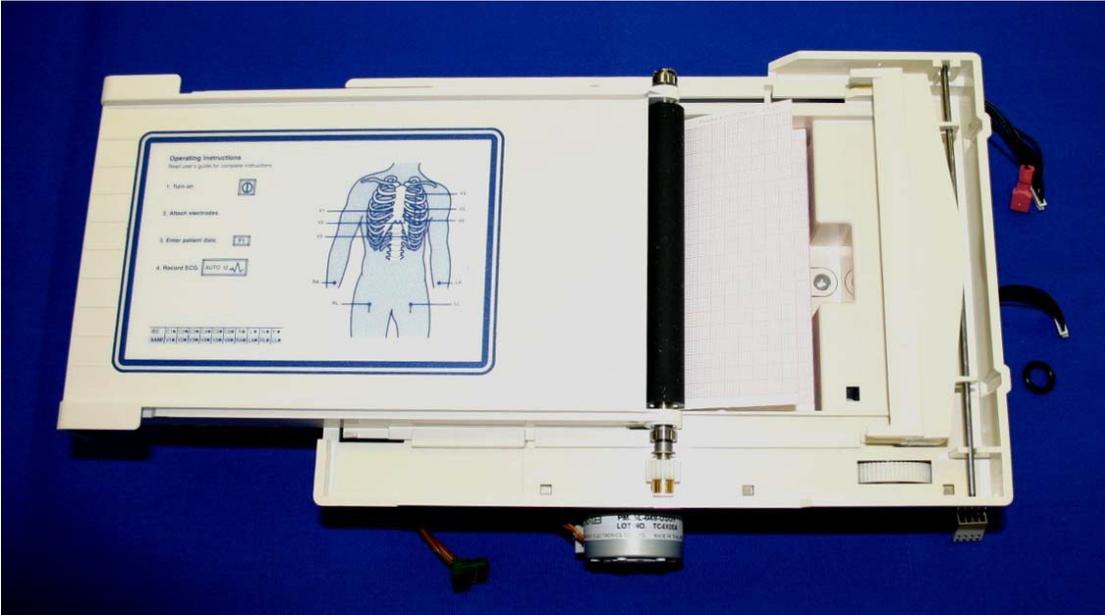
Carefully guide the printhead assembly out of the writer chassis making sure that no damage occurs to the cables attached to the printhead.
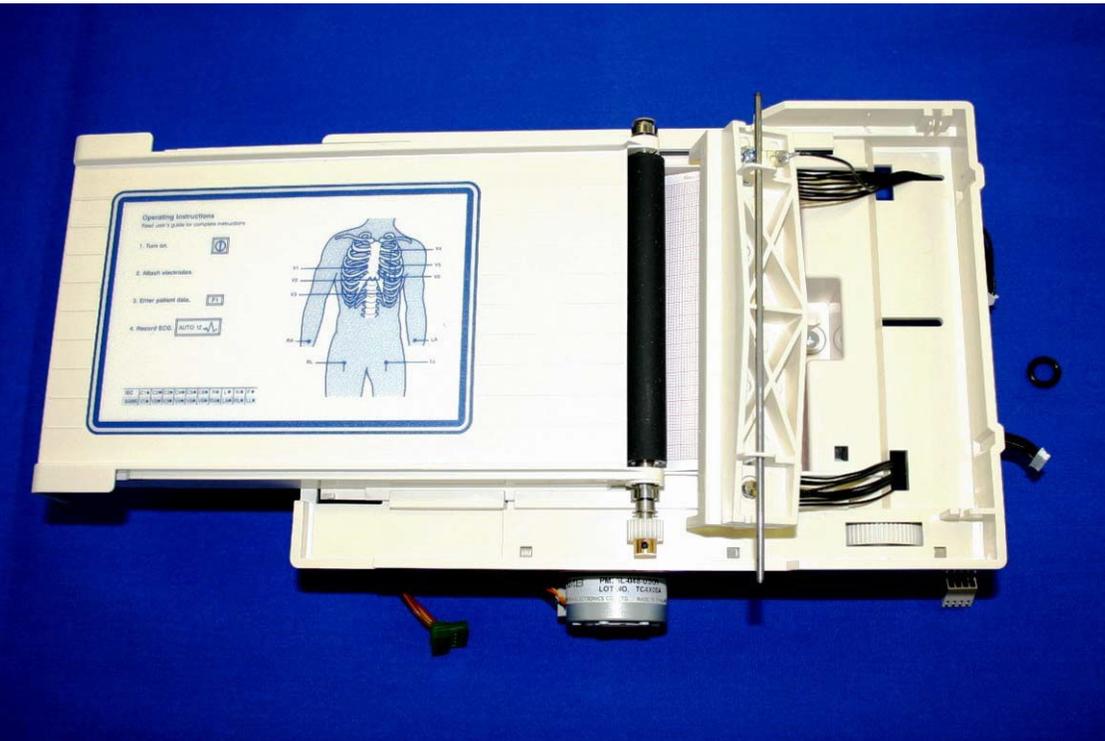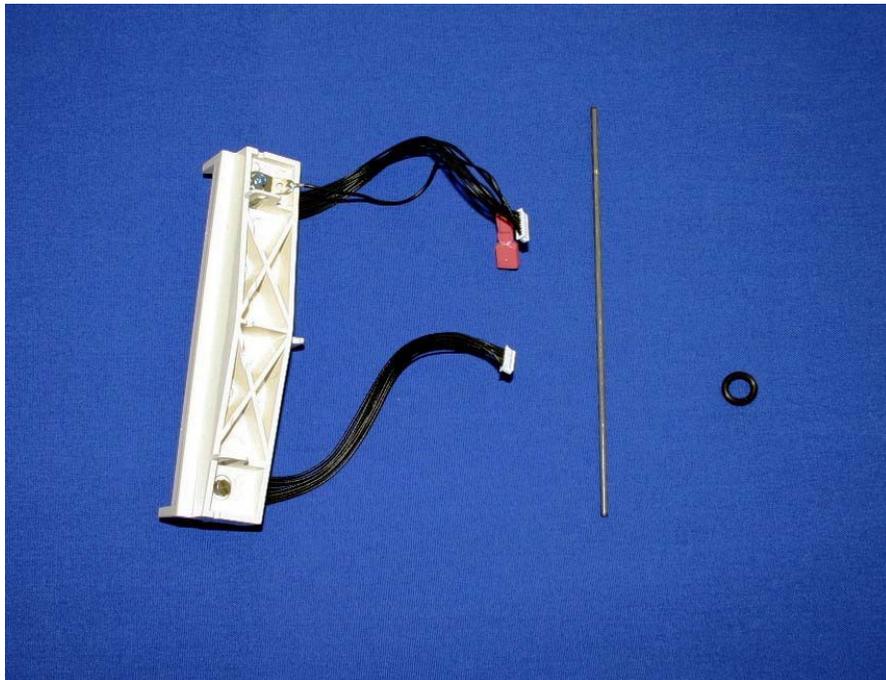
The picture above shows the print head assembly, spring bar and the O-ring removed from the writer chassis.

To remove the print head from the print head assembly remove the Hex shoulder screw, item # 37, from the back of the print head assembly.
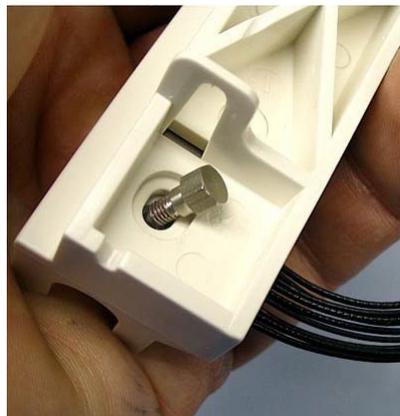
Remove the Philips screw, item # 7, from the print head assembly.
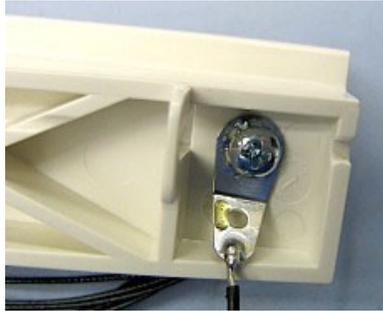
Remove the print head from the print head mount.

Remove the cables, item # 35 (qty 2) from the print head.

Note: An Antistatic brush is attached to the print head, item # 34. This brush must be installed on print head prior to reassembly. Failure to install the anti-static brush can cause premature failure of the print head.

Re-assemble in reverse order.

Writer Motor Removal / Installation

Flip the writer assembly over and locate the writer motor and gear assembly.
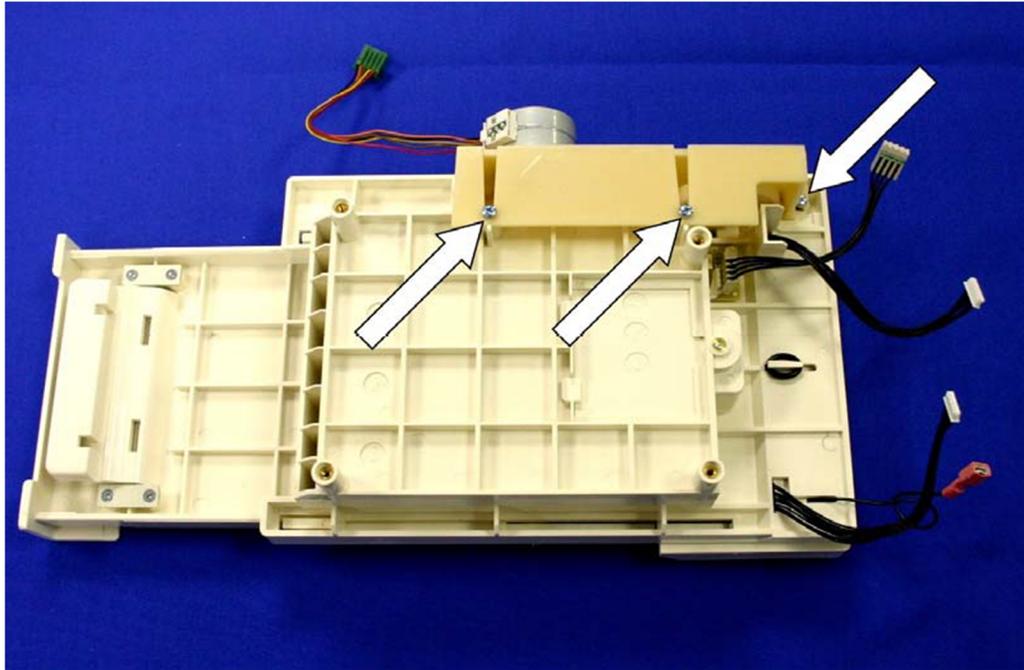
Remove the three screws, item # 7, holding this assembly to the writer assembly.
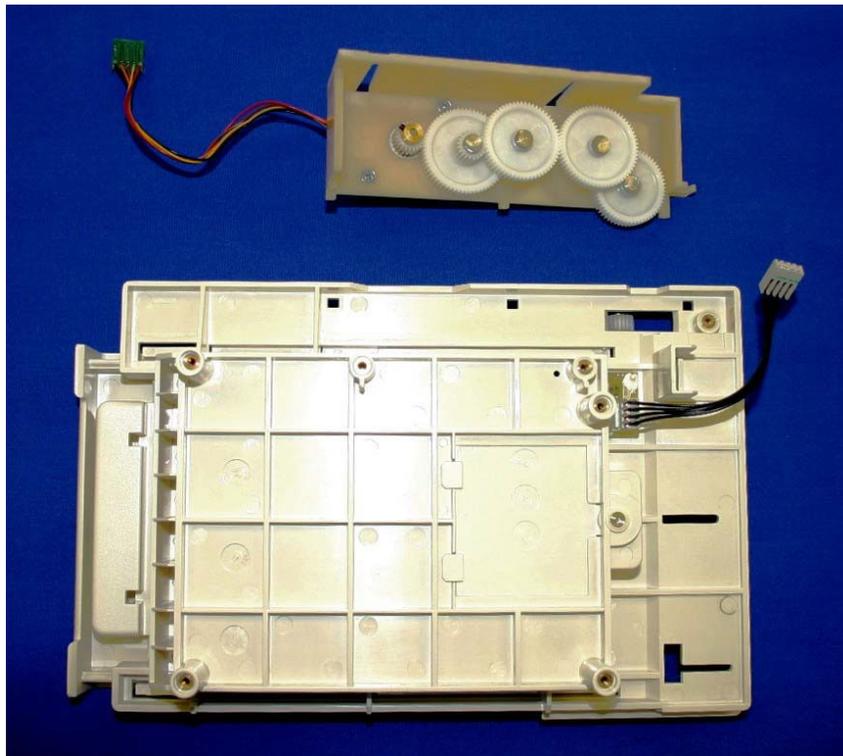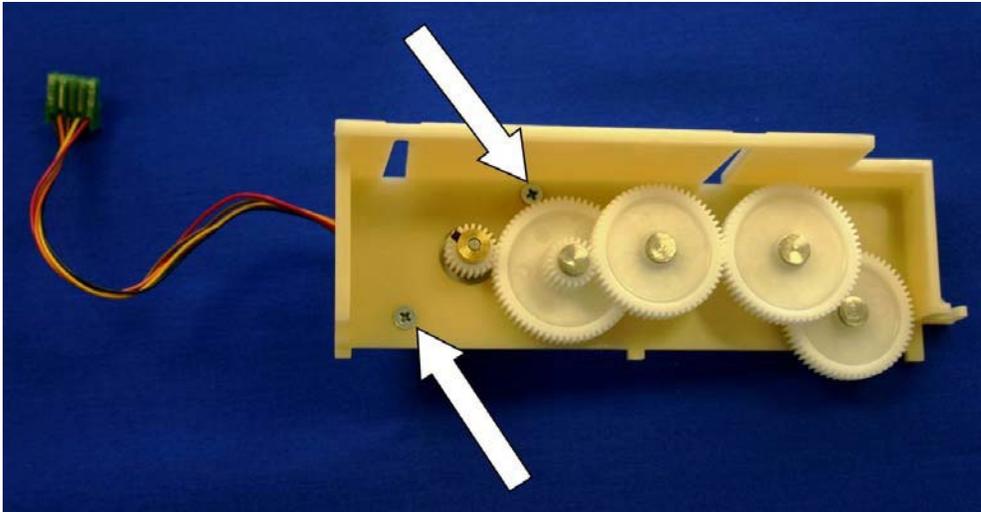
To remove the writer motor remove the two screws, item number 29, holding it to the gear assembly bracket. The writer motor will slide through the assembly.

Use a 0.05 inch or a 1.25 mm size Allen wrench to remove the gear from the writer motor.
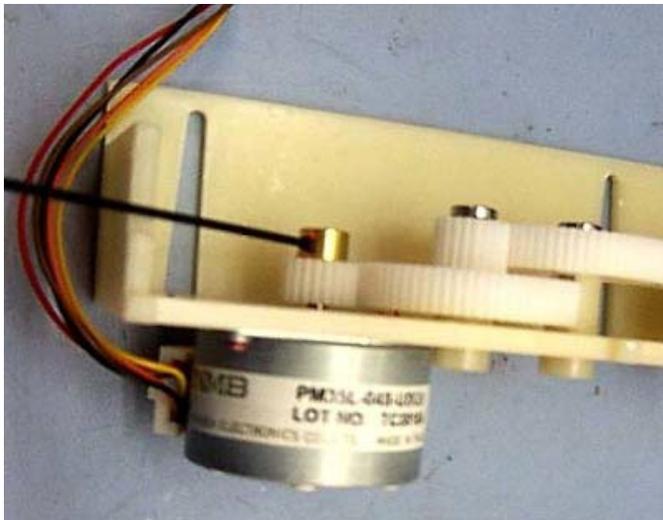
When installing a new writer motor into the gear assembly make sure that the writer motor gear, item # 41, is aligned with its mating gear of the gear assembly. The set screw of the writer gear should be tightened to 4 +/- 1 lbs.-in.

Re-assemble in reverse order.

Note: The screws holding the writer motor to the gear assembly bracket are coated with Vibra-tite to reduce the possibility of the screws vibrating loose. You may need to re-coat the screws to prevent vibration from loosening the screws.
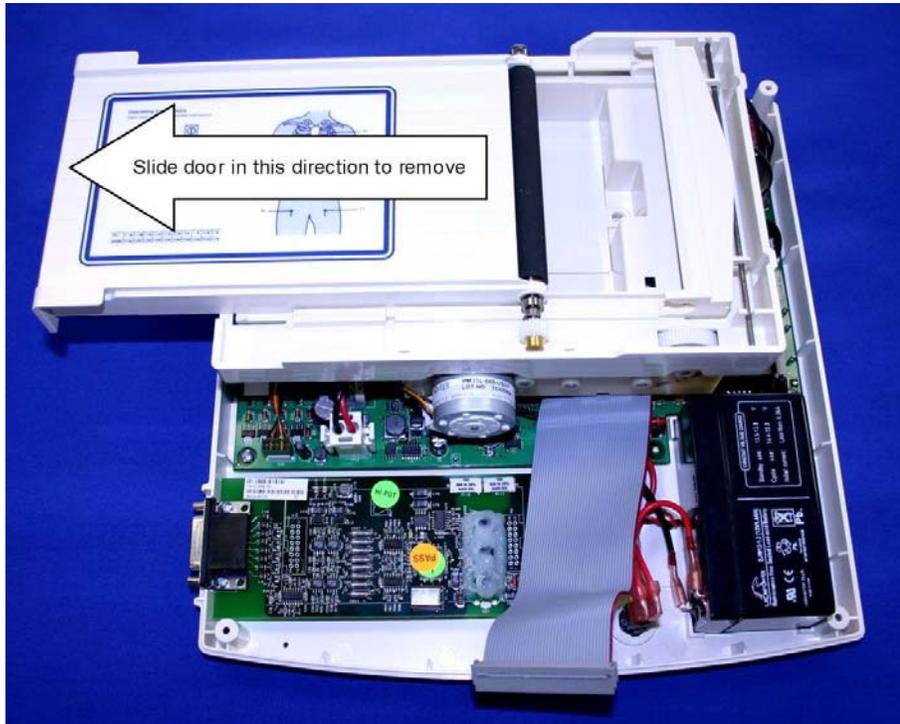
Writer Door Removal/Installation

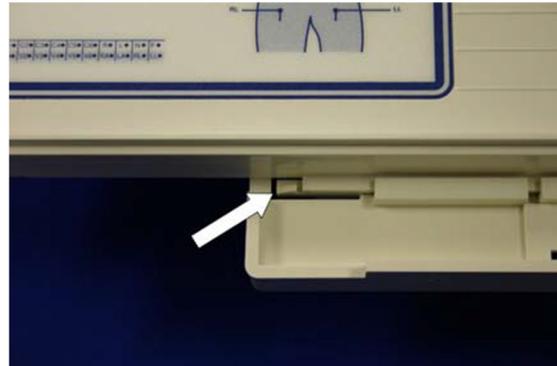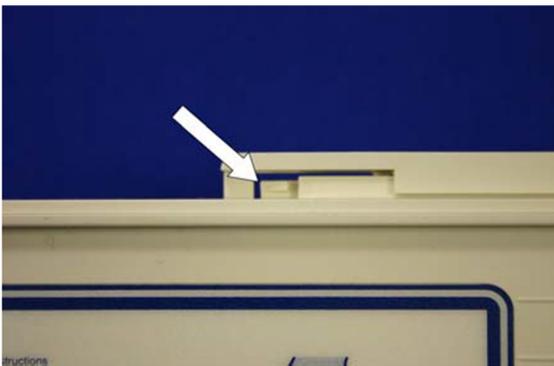To remove the writer door the writer it is not required to remove the writer from the unit.

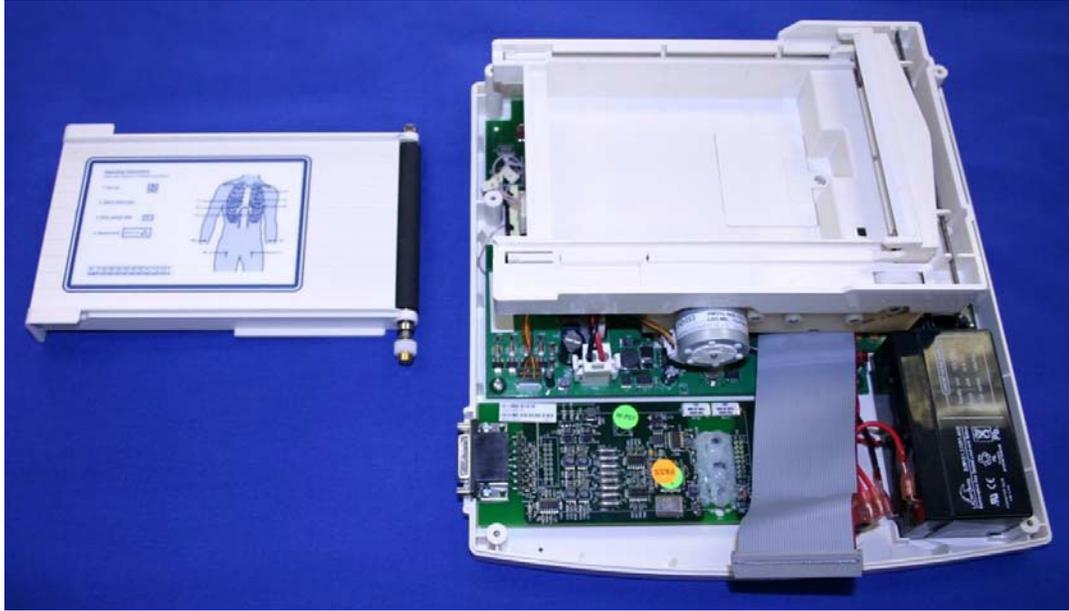With the top cover of the unit removed open the writer door.
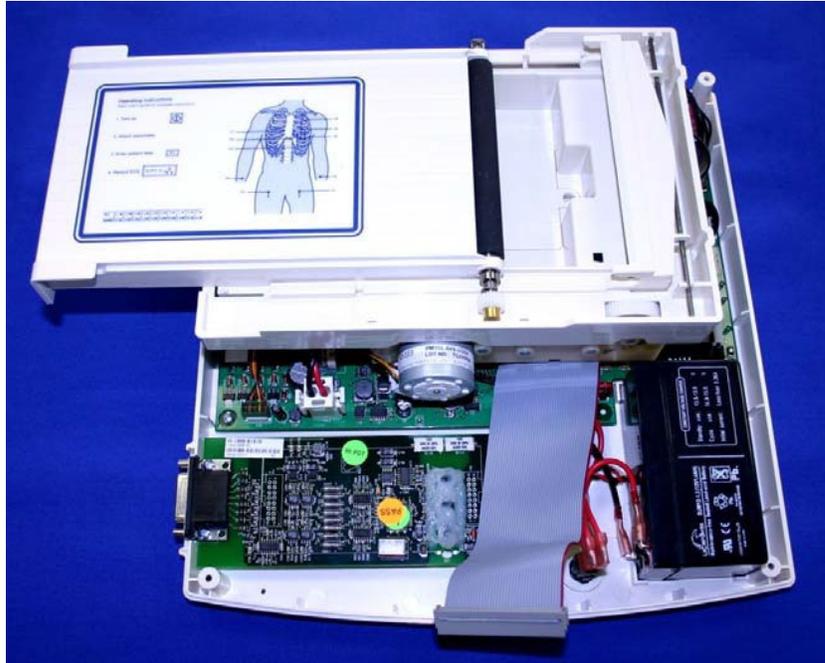
Hold the unit steady and quickly pull the writer door, item # 42, towards the left of the unit.
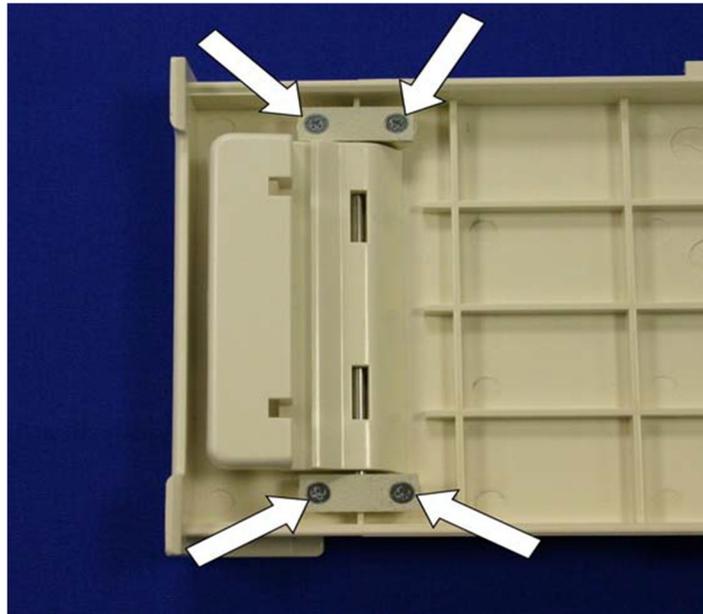

The writer door should come off the writer assembly. The writer door is retained on the writer assembly by two plastic clips.
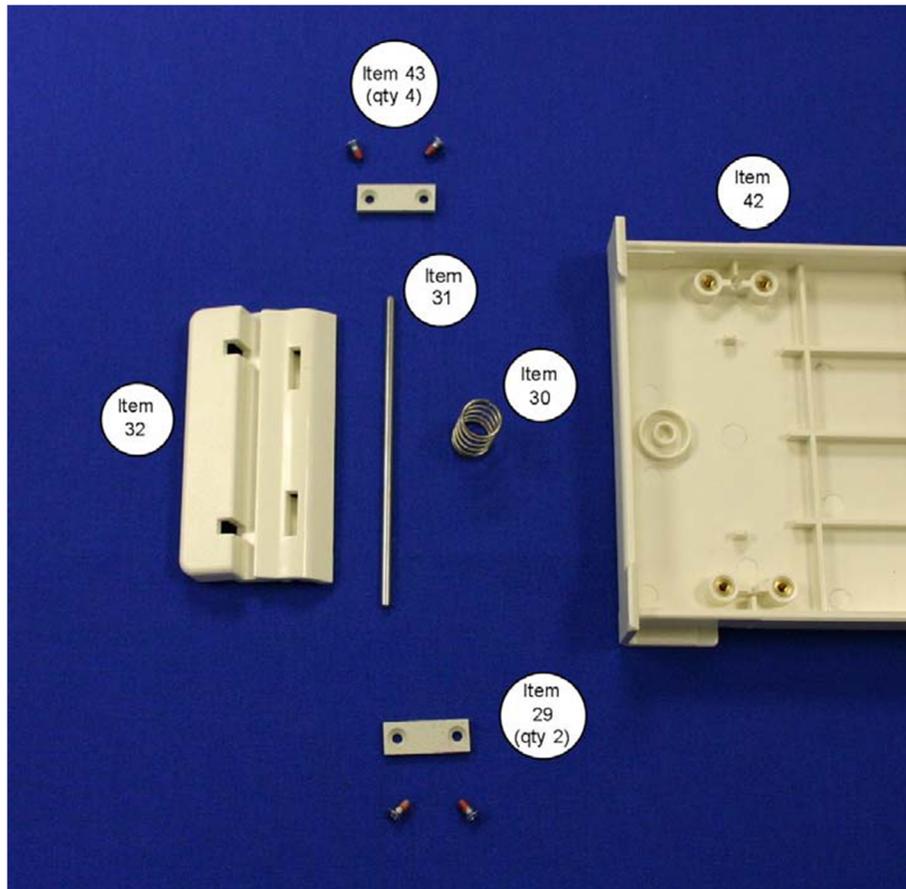

Slide the writer door off the writer assembly.

To replace the writer latch assembly flip the writer door over and locate the 4 screws, item #43, securing the pivot bar retaining plates, item # 29, to the writer door.

Lift the writer latch parts off the writer door.

The writer latch consists of the following item numbers:

Item # 30, Spring
Item # 31, Bar release pivot
Item # 32, Latch release
Item # 29, Pivot Bar restraining plate (QTY 2)
Item # 43, Screws (QTY 4)

Reassemble the latch and the writer in the reverse order.

Printed Circuit Board Assembly Removal / Installation

CAUTION

The Motherboard is a static sensitive part. Appropriate measures should be taken when handling this part.

Areas of the motherboard can have high voltage applied to them. Appropriate measures should be taken when the unit cover is removed.

Remove AC power before opening the unit.

Remove the battery fuse before opening the unit.

Note

There are 5 different motherboards available for the ELI 150 for the different modes of connectivity (No connectivity, RS232, Modem, LAN, CSM F1 Modem and CSM F2 Modem). For the unit to operate as intended and according to the labeling of the unit the motherboard should be replaced with the same version motherboard.

With the top cover and the writer assembly removed from the unit, locate and remove all cables from the motherboard.
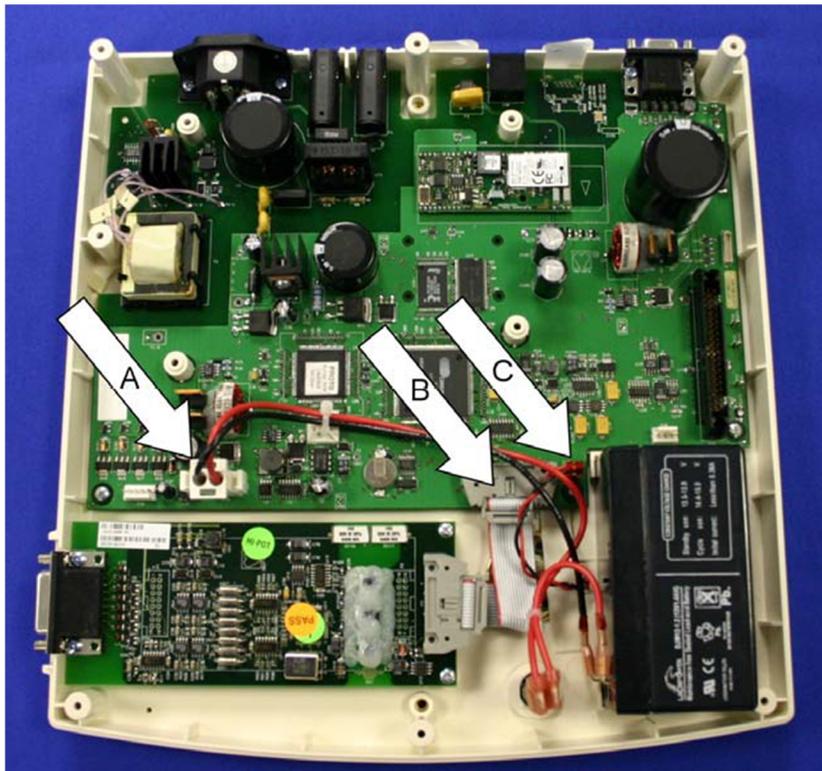
Remove the battery power Cable labeled A (item # 24), remove the Front End cable labeled B (item # 21) and the speaker labeled C (item # 23).

Remove the tie wrap, item # 13, holding the battery cables to the motherboard. When reinstalling the motherboard make sure that this cable is tie wrapped to the motherboard to ensure that the cable does not come in contact with the Front End board for patient safety reasons.
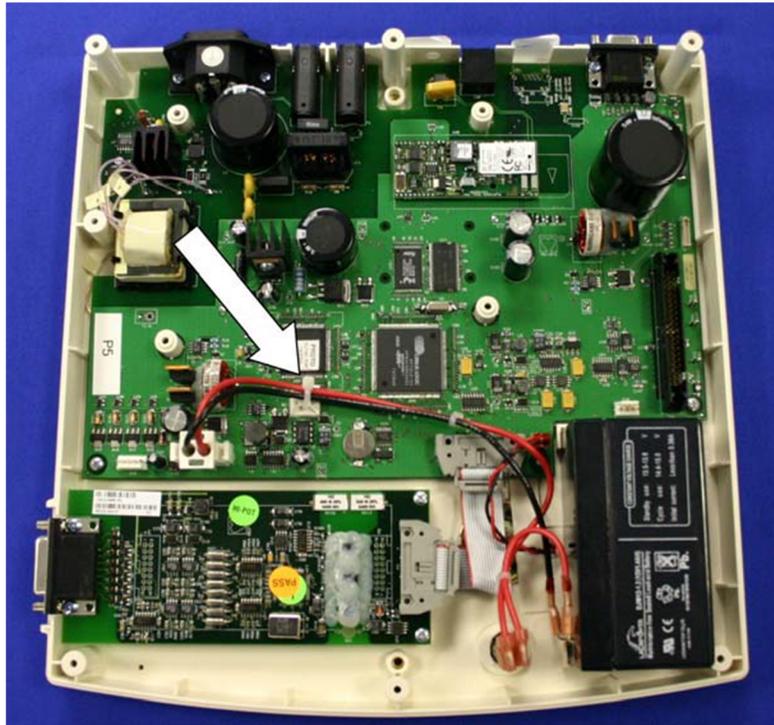
Once the cables are removed remove the 2 screws, item # 6, at the "front" of the board.
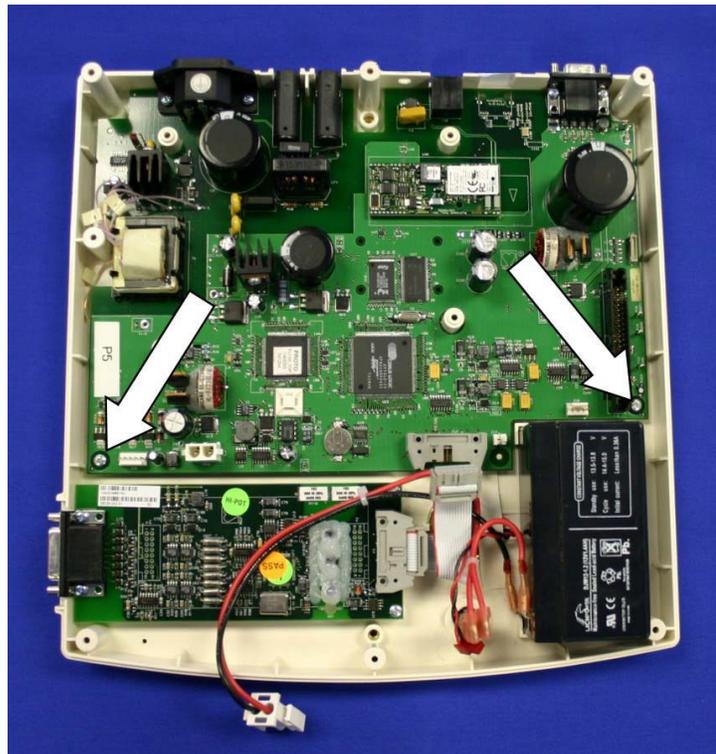
Remove the four screws, item # 7, at the back of the Motherboard.

The Motherboard will now be loose and can be removed from the bottom chassis.

Re-assemble in reverse order.

CAUTION

1.) Static precautions should be taken when replacing the motherboard.
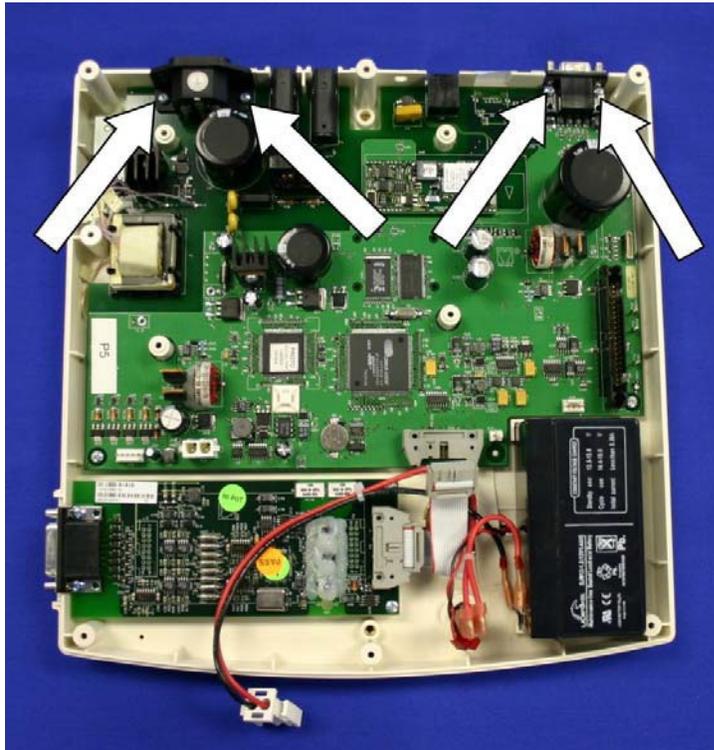*2.) When installing a new board, do not replace the battery fuse until all cables have been connected to the board.*
3.) The screws that hold the front of the motherboard down are shorter than the screws that hold the back of the motherboard down. Make sure that when installing the motherboard that the correct screws are used for the correct locations.
4.) Make sure that the battery cable is tie wrapped to the motherboard to eliminate the possibility if the battery cable to come in contact with the Front End board. The tie wrap item number is 13 in the parts list.

Front End Board Removal and Replacement

Locate the front-end board in the unit.

Remove the cable, item # 21, from the front-end board to the motherboard.

Locate the 2 screws holding the front-end to the chassis to the right of the Front End and remove.

Note: These screws will be shorter, item # 6, than those where the patient cable connects to the front end board, item # 7. This is important when reassembling the unit.
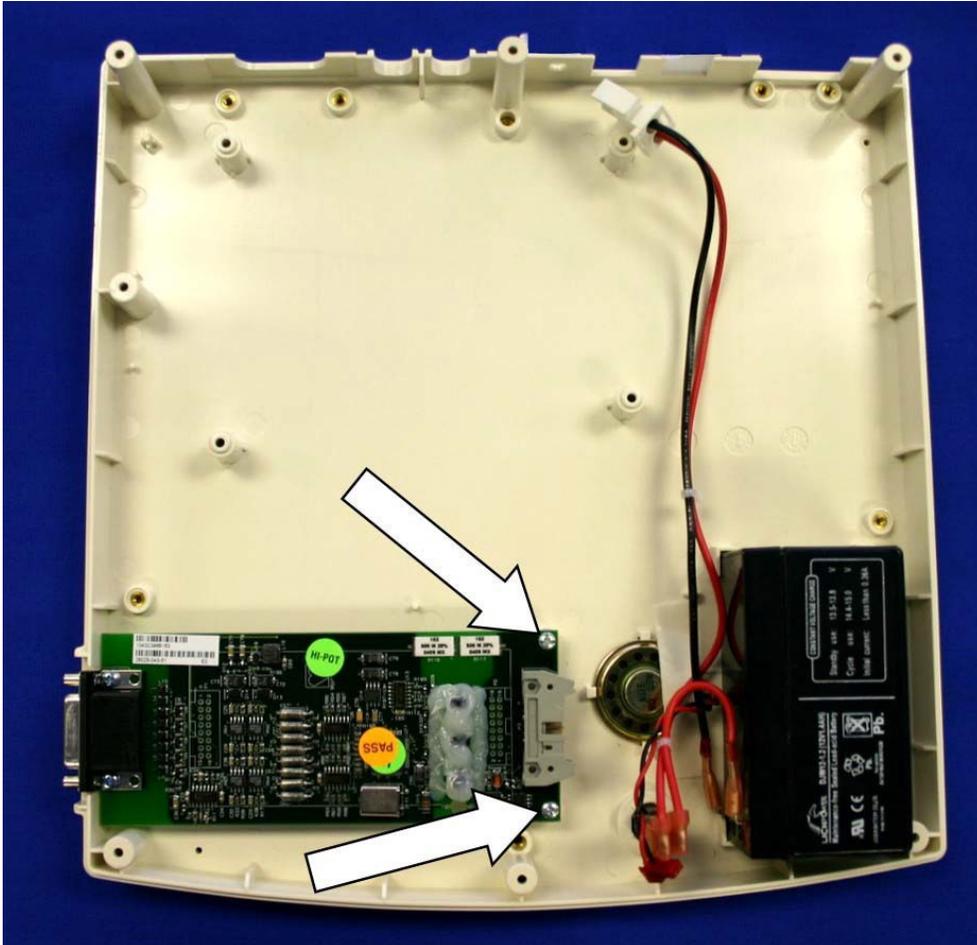
Remove the screws, item # 7, near the patient cable connecter.
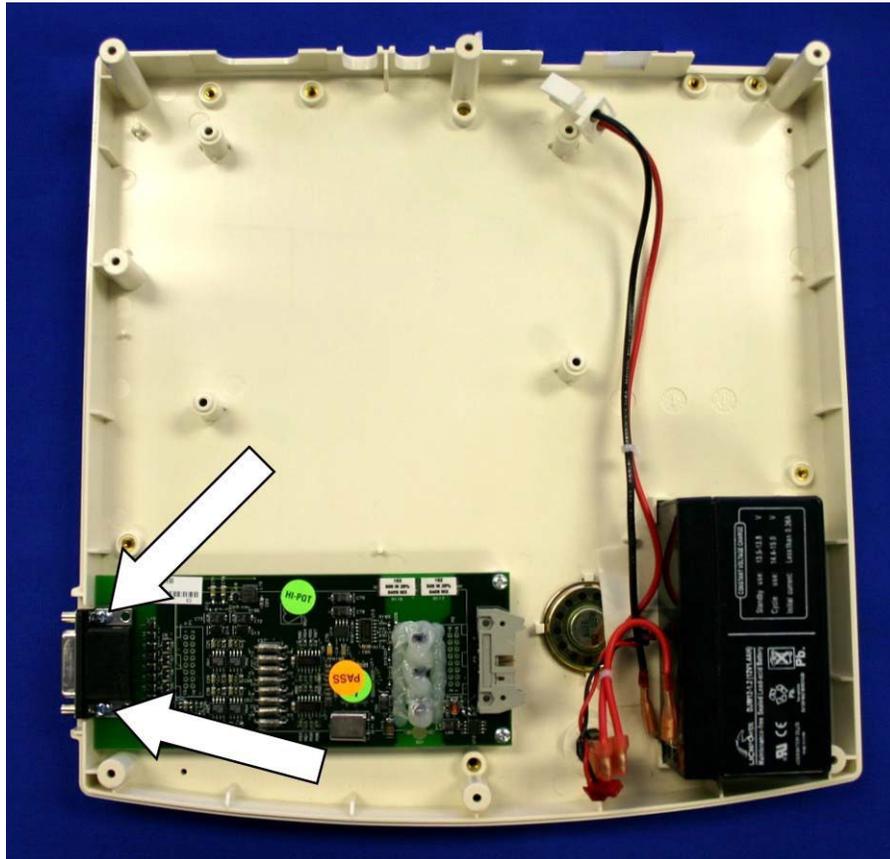
Lift the front-end out of the chassis.

Reassemble in reverse order.

TECHNICAL DESCRIPTION

Introduction

The WELCH ALLYN ELI 150 is an advanced interpretive electrocardiograph system utilizing the latest electronic technology and software. The ELI 150 offers 12-lead patient ECG monitoring, a 320 by 240 LCD display. A full function touchpad keyboard, 4-inch thermal writer for printing waveforms and interpretive data, a real-time electronic clock and calendar, an RS-232 level serial communications port, internal power supply, battery, and battery re-charge circuitry and optional internal MODEM. The system utilizes CMOS digital components to minimize power consumption and enhance performance. The ELI 150 is a modular assembly taking advantage of sub-assemblies designed at Welch Allyn, Inc.

The system consists of the following major sub-assemblies and parts:

- Main System board (Motherboard) Assembly
- Front end board
- Keyboard and LCD Display
- Writer Assembly
- Battery
- Interconnect Cable Assemblies

The following page shows a block diagram of the ELI 150.

ELI 150 Block Diagram

ELI 150 Block Diagram
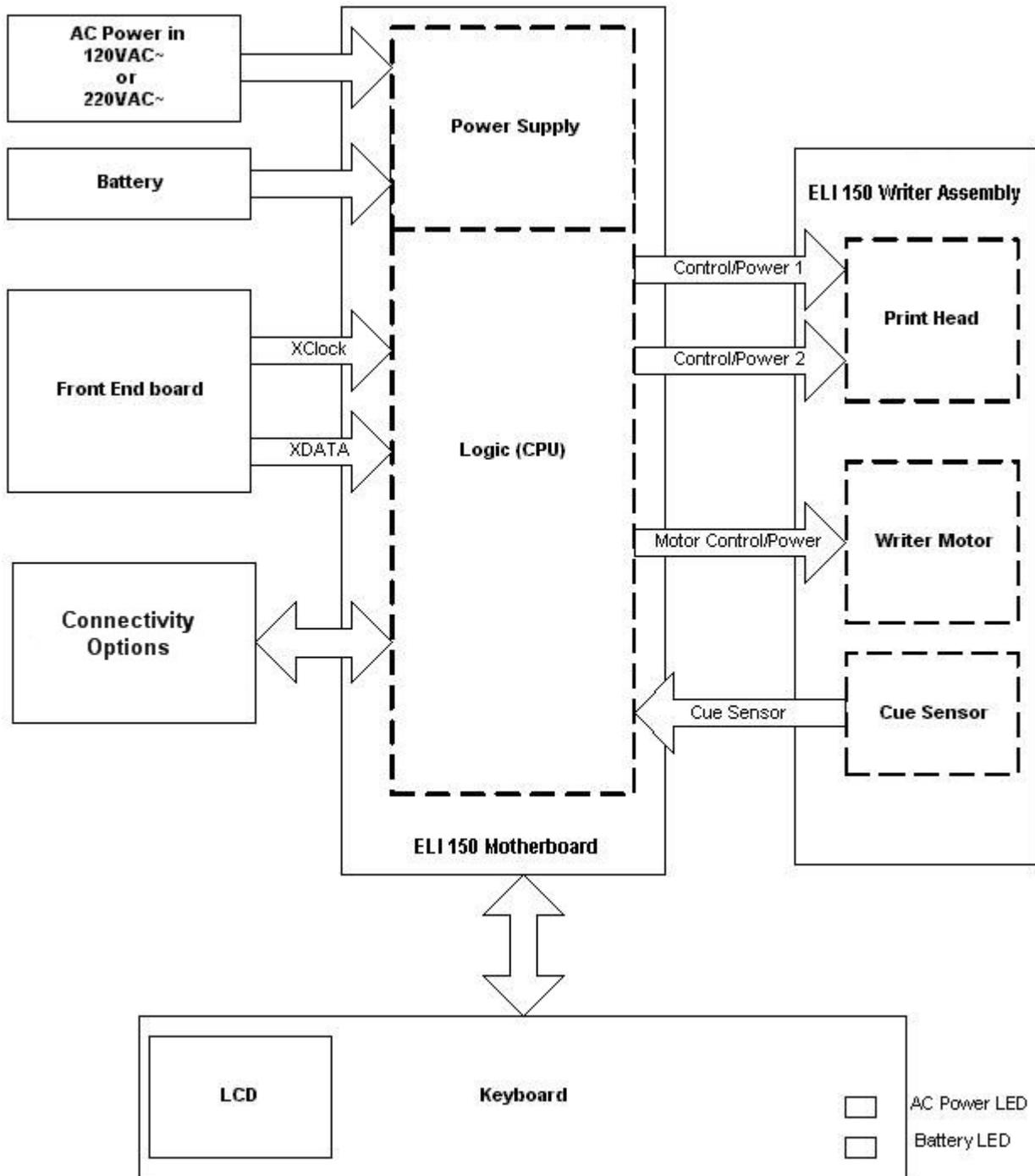
Main System Board

The main system board or motherboard of the ELI 150 contains the digital logic circuitry and the power supply of the ELI 150. The rear section of the motherboard (located at what is the back of the unit when mounted in the chassis) contains the power supply of the unit.

Power Supply
The AC power supply consists of the AC inlet connector, AC inlet fuses and a switching power supply. The switching power supply automatically senses the input voltage coming in on the AC line and switches to supply the proper voltage to the unit.

The AC power supply powers the unit for operation and charges the internal battery. When the unit is not connected to an AC power source the internal battery will supply power to operate the unit.

Logic Circuitry
The logic circuitry or digital section of the mother board contains the microprocessor, FLASH memory, Real time clock, LCD & keyboard control circuitry, interface circuitry for modem and RS232 communications, and the Writer interface circuitry.

Writer Interface
The writer interface on the motherboard consists of 5 connectors. Two of the connectors/cables connect directly to the thermal printhead of the writer. These two cables carry power, data and ground connections to the printhead. The third cable of the writer interface is for motor control and carries power, ground and stepper signals to the writer motor. The fourth cable is for the cue sensor and allows the motherboard to sensor when the paper is at the correct position to start printing. The fifth cable is an additional grounding wire for the printhead.

Connectivity Options
The connectivity options for the ELI 150 are: Internal Modem, GSM Modem, External Modem, LAN and Direct Connection. Each one of these options except Direct Connection and External Modem requires a circuit board to be soldered to the motherboard of the ELI 150. Please see the appendices associated with the Connectivity options.

The ELI 150 has a 9-pin RS232 port. This port serves three functions. The first is it allows software to be downloaded to the unit (the connectivity options are not required for this). The second, and most common, is for transmitting ECG's either to another unit or to a data management system (The connectivity option is required for this form of transmission). The third function is for transmitting ECGs to either a data management system or another electrocardiograph via an external modem (the connectivity option is required for this form of transmission).

Keyboard and LCD interface
The keyboard and LCD interface consists of a large ribbon cable that connects from the motherboard to the keyboard and LCD of the unit. This cable carries the data to the LCD and keyboard inputs to the motherboard.

Front End Board

The analog information from the patient enters the unit via the patient cable then enters the front end board. The information is immediately digitized to create the 12 leads of ECG data. This digitized information is then sent to the motherboard via an interconnect cable. This interconnect cable carries power and ground from the motherboard to the front end and also caries serial clock and data from the front end to the motherboard. If the motherboard does not receive the clock and data signals from the front end, the LCD will not display any ECG waveforms.

Patient Input

Connector:	Pin #:	Name:	Description:
	1	V2	Patient Lead
	2	V3	Patient Lead
	3	V4	Patient Lead
	4	V5	Patient Lead
	5	V6	Patient Lead
	6	SHIELD	Isolated Front-End Ground
	7	Reserved	
	8	Reserved	
	9	RA	Patient Lead
	10	LA	Patient Lead
	11	LL	Patient Lead
	12	V1	Patient Lead
	13	Reserved	
	14	RL	Patient Lead
	15	Reserved	

Specifications

Feature	Specifications
Instrument Type	12-lead Electrocardiograph
Input Channels	Simultaneous acquisition of all 12 leads
Standard Leads Acquired	I, II, III, aVR, aVL, aVF, V1, V2, V3, V4, V5, V6
Waveform Display	Backlit, 1/4 VGA LCD 3-channel lead groups or complete 8-channel presentation
Input Impedance Input Dynamic Range Electrode Offset Tolerance Common Mode Rejection	Meet or exceed the requirements of ANSI/AAMI EC11
Patient Leakage Current Chassis Leakage Current	Meet or exceed the requirements of ANSI/AAMI ES1
Digital Sampling Rate	10,000 s/sec/channel used for pacemaker spike detection; 1000 s/sec/channel used for recording and analysis
Special Functions	Optional Mortara VERITAS resting interpretation algorithm; connectivity options for bi-directional communication; flash memory storage of ECGs
Paper Type	Z-fold thermal paper; 108 mm (4") wide, perforat- ed double Z-fold 200 double Z-fold sheets
Thermal Recorder	Computer-controlled dot array; 8 dots/mm
Thermal Writer Speeds	5, 10, 25, or 50 mm/s
Gain Settings	5, 10, or 20 mm/mV
Report Print Formats	Standard or Cabrera; 3, 3+1 or 3+3 channel
Rhythm Print Formats	3 channel or 6-channel with configurable lead groups
Keyboard Type	Elastomer keypad with complete alphanumeric keys, soft-key menu and dedicated function keys
Frequency Response	0.05 to 300 Hz
Filters	High performance baseline filter; AC interface fil- ter 50/60 Hz; low pass filters 40 Hz or 150 Hz
A/D Conversion	20 bits (1.17 microvolt LSB)
Device Classification	Class I, Type CF defibrillation proof applied parts
ECG Storage	Up to 60 ECGs; optional expanded up to 150 ECGs
Weight	7.2 lbs. (3.3 kg) including battery (without paper)
Dimensions	11.25" x 11.5" x 3.75" (29.2 cm x 30.5 cm x 10.2 cm)
Power Requirements	Universal AC power supply (100-240 VAC at 50/60 Hz) 50 VA. Internally rechargeable battery.

Parts List

Item Number	Part Number	Part Description	QTY Per Unit
1	4021-006	FUSE 5 AMP TYPE T SLO BLO 250V	1
2	4110-006	FUSE HOLDER 5 X 20 PANEL SNAP-IN MT SLTD	1
3	4160-029-50	KEYPAD ELASTOMERIC ELI 150 UNIVERSAL	1
4	4800-008	BATTERY RECHARGEABLE SLA 12V 1.3/1.4Ah	1
5	5400-014-02	LCD PANEL 320 X 240 3.9 MONO	1
6	6020-430	SCREW PHILLIPS PANHEAD M3 x 6	6
7	6020-831	SCREW PHILLIPS PANHD M3X8 ZINC PLTD	11
8	6020-930	SCREW PHILLIPS PANHEAD M3 x 10 ZINC PLTD	11
9	6320-003	FOOT BLACK .64 OD X .115 ADHESIVE	5
10	7401-002	TAPE TWO-SIDED ADHESIVE 0.009THK x 0.25W	3
11	7401-003	TAPE 2SIDED ADHESIVE 0.031 THK x.50 WIDE	6
12	7401-005	TAPE 2SIDED VHB ACRYLIC 3M .045TH x .75W	2
13	7495-001	CABLE TIE LOCKING 3.9 x .10	1
14	7500-006	CLIP CABLE ADHESIVE BACKED .5 x .5	1
15	8347-001-50	HOUSING UPPER ELI 150	1
16	8347-002-50	HOUSING LOWER ELI 150	1
17	8347-003-50	KEYBOARD BEZEL ELI 150	1
18	9042-044-01	LABEL AC ON / BATTERY CHARGED ELI 150	1
19	9042-045-01	LABEL ELI 1XX SERIES NAMEPLATE	1
20	22500-100-60	ELI 150 WRITER ASSEMBLY 4"	1
21	25018-035-50	CABLE ASSEMBLY 14 CONDUCTOR	1
22	25018-038-50	CABLE ASSY KEYBOARD TO MOTHERBD ELI 150	1
23	25020-053-50	SPEAKER LEADS & CONNECTOR ASSY ELI250	1
24	25020-063-50	CABLE ASSY BATTERY TO PCB ELI 150	1
25	26025-043-51	10K+ FRONT END PCB ASSY	1
26	26025-067-50	ELI 150 KEYBOARD PCB ASSEMBLY	1
27	6141-003	O-Ring	1
28	6020-730-02	Screw Philips Flat M3 x 6 ZP Coated	6
29	8342-020-01	Pivot Bar Restraining Plate	2
30	8342-019-01	Spring Compression .5 OD x .85 L	1
31	8342-018-01	Bar Release Pivot 3.950 x .118 Dia.	1
32	8342-008-01	Latch Release ELI200+	1
33	5450-005	Print Head	1
34	7480-090	Brush Anti-Static	1
35	25018-034-50	Cable Assembly Print head to PCB	2
36	8347-006-50	Print Head Mount ELI 150	1
37	6001-002-01	Screw, Shoulder HEX M3 x 6mm Coated	1
38	25020-058-50	Ground Wire For ELI Print Head	1
39	25020-060-50	Cable Assembly Cue Sensor	1
40	6545-006-01	Motor Stepper PM 35mm 1-2PH 48 Step/Rev	1
41	8342-009-01	Gear Spur 22 Teeth With Brass Hub	1
42	8347-005-50	Paper Tray Cover (Writer Door)	1
43	6020-730-02	Screw Philips Flat M3 x 6 ZP Coated	4
44	26025-065-50	ELI 150 MOTHERBOARD PCB ASSY	1
45	26025-065-51	ELI 150 MOTHERBOARD PCB ASSY w/Modem	
46	26025-065-52	ELI 150 MOTHERBOARD PCB ASSY w/CSM Modem –F1	
47	26025-065-53	ELI 150 MOTHERBOARD PCB ASSY w/CSM Modem –F2	
48	26025-065-54	ELI 150 MOTHERBOARD PCB ASSY w/LAN	

The following parts are associated with the GSM version of the ELI 150.

Item Number	Part Number	Part Description	QTY Per Unit
49	25018-034-50	Cable Assembly ELI 200+ Printhead to PCB (For use in connecting the SIM Simulator board to Remote SIM Connector Assembly on GSM modems)	1
50	26025-073-50	SIM Simulator PCB	1
51	26025-074-50	Remote SIM Connector PCB	1
52	3171-009	Cable Assembly Coax 6"	1
53	3600-008	Antenna F1 900/1800 MHz Right Angle	1
54	3600-009	Antenna F2 850/1900 MHz Right Angle	1
55	6160-003	Standoff Nylon 1" X 0.05mm	4

TROUBLESHOOTING AND TESTING

Introduction

Since repair of the ELI 150 is limited to replacement of subassemblies the troubleshooting guide does not extend to the component level

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CAUTION:

Remove AC power and battery fuse before attempting any disassembly.

Removal of the battery fuse will not cause a loss of ECG's or of the configuration. This information is stored in FLASH memory.

Dangerous voltages are present on the circuit board of the ELI 150. Caution should be taken when removing or replacing the motherboard.

Troubleshooting

AC power connected to unit, back-light is on, nothing on display.
1) Check AC fuses.
2) Does unit power up on battery?
      A) If yes, there is an AC power supply problem. Replace the motherboard.
      B) If no, power supply or battery problem. Replace motherboard and check battery for possible replacement.
3) Check the Keyboard/LCD cable going to the keyboard and the motherboard. If disconnected reconnect and test again.
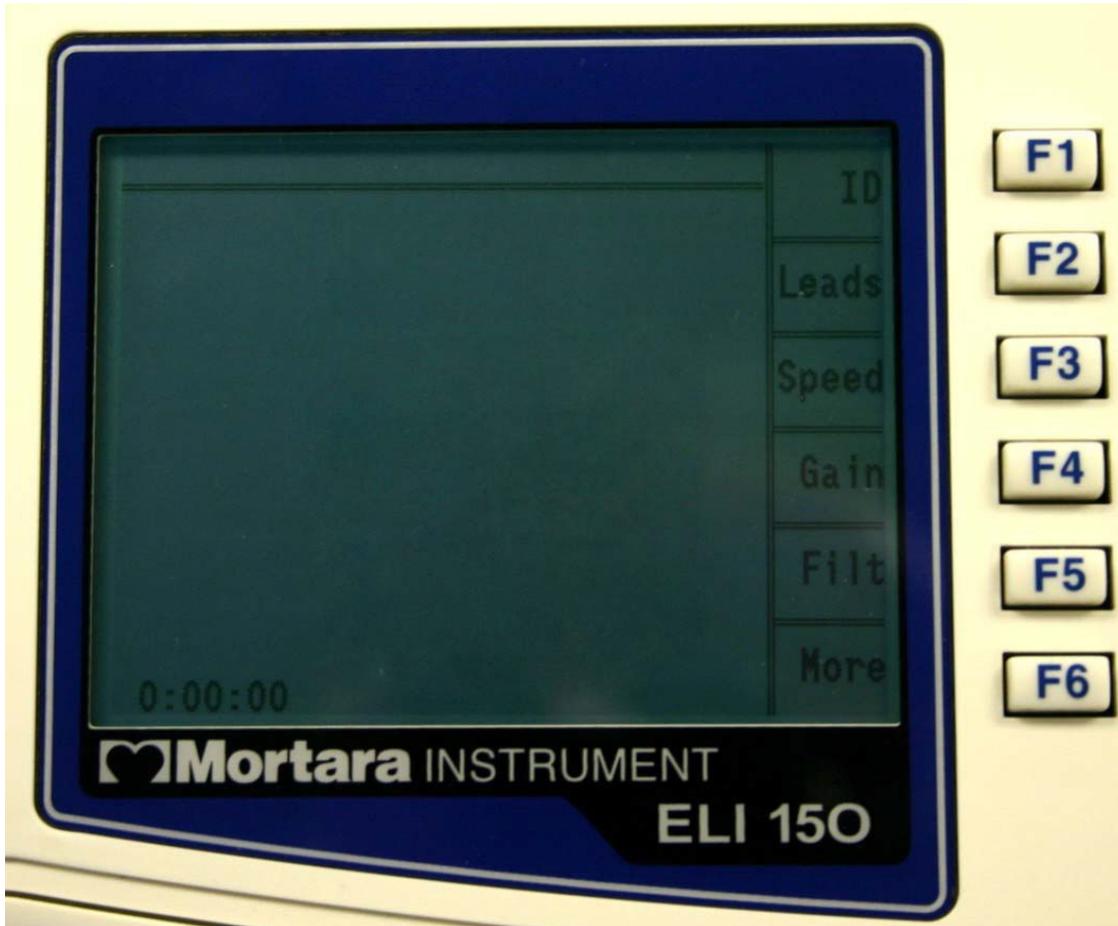4) Replace the Keyboard/LCD cable.

With AC power on nothing displayed on LCD
1.) Press any key on the keyboard. If speaker tone is heard there is a possible LCD problem. Replace LCD.

Unit works on AC power but not on battery
1) Check battery fuse.
2) Open unit and check battery connections.
3) Replace battery.

Unit turns on, no waveform is displayed but function key options are displayed.

Press any key on the keyboard, if no response there is a possible communications problem between front end board and motherboard.
1) Replace cable between front end and motherboard.
2) Replace front end board
3) Replace motherboard

No keyboard functions and LCD is frozen

Note: It is possible that the LCD may be active but not receiving new data
There is a software problem.
1) Remove AC power from the unit.
2) Press and hold the On/Off key for 10 seconds. Unit should turn off.
3) Wait 10 seconds then turn the unit on again. Unit should start to respond correctly.

Or

1) Remove AC power.
2) Remove battery fuse from unit and leave out for 10 seconds.
3) Install battery fuse.

RS-232 Transmit/Receive Problems

Make sure that the baud rate set in the configuration matches that of the system that is being transmitted to or received from. If the baud rate is set correct there is a problem with either the transmission cable or the RS232 portion of the motherboard and the motherboard should be replaced.

Optional Modem Transmit/Receive Problems

If the unit does not transmit via the modem the first item to check is the configuration. Make sure that a telephone number is entered and that the number is correct. The next item to check is the modem initialization string (please see the configuration section of the operator manual for these settings).

Testing

CAUTION:

Dangerous voltages are present on the circuit board of the ELI 150. Caution should be taken when removing or replacing the motherboard.

Power Supply Test

1.) Remove battery fuse and AC power from the unit.
2.) Open unit to access the connections to the battery.
3.) Remove one of the battery cables from its terminals.
4.) Connect DMM set to a current setting to measure the current that the unit is using.
5.) Install the battery fuse and measure the unit "Off Current" (<40uA)
6.) Turn the unit on and measure the current draw from the battery. This should read less than 250 mA.
7.) Verify that the AC LED on the keyboard is not on.
8.) Increase the setting on the DMM to the 2000 mA range.
9.) Apply AC power to the unit and verify that the current reading on the battery does the following A.)
     Reverses polarity
     B.) That the value starts decreasing as time increases. (this indicated that the battery is charging).
     C.) That the AC LED is now "ON"
10.) Disconnect the positive battery terminal and measure the voltage coming
     from the charger, it should be between 13.0 and 14.0 vdc.
11.) Remove AC power and the battery fuse.
12.) Remove the DMM and reconnect the battery cable to the battery.
13.) Close the unit.

Keyboard Test

1.) Turn Unit on.
2.) Press the F1, ID, key.
3.) Start pressing the alpha keys on the keyboard and verify that they are displayed on the screen. When the
     characters reach the end of the line, press the enter key and continue entering characters in the First Name field.
4.) If all characters are present the test has passed. If any of the characters are not displayed there is a possible
     keyboard problem.

LCD Test

1.) Turn the unit on.
2.) Apply an input signal from a simulator.
3.) Verify that there are no gaps, missing segments or large black areas on the screen.
4.) Enter the configuration of the unit.
5.) Locate the Contrast setting for the display.
6.) Change the contrast setting to full and then decrease the setting. Verify that the screen goes fully dark and then
     blank.
7.) Reset the contrast to an acceptable level.

Speaker Test

1.) Turn the unit on.

2.) Press the F6, More, key.

3.) Press the number 3 key to select the "Date & Time" option.

4.) Press the following key strokes to access the configuration options: ALT + Shift + C

5.) Page through the configuration to find the Volume option.

6.) Highlight the Volume option and increase the value by pressing a number key, note that the tone emitted by the speaker.

7.) Test different values from 0, turns the speaker off, to 8, maximum value. With each change the volume of the tone should change accordingly.

8.) If the tone does not change, replace the speaker.

9.) If replacing the speaker does not resolve the problem the motherboard needs to be replaced.

Date / Time Test
1.) Turn the unit on.
2.) Press the F6, More, key.
3.) Press the number 3 key to select the "Date & Time" option.
4.) Enter the current date and time into the unit.
5.) Press the F5 Save option to save the changes.
6.) Press the F6 Exit option to return to the main menu of the ELI 150.
7.) Observe the time in the lower left corner of the display it should be set to the correct time.

If the date and time are not retained there is a motherboard problem and replacement of the motherboard is recommended.

Writer Tests
From the main menu press and hold the following key combination *Alt + Shift +RHY*. The following test strip will be printed.
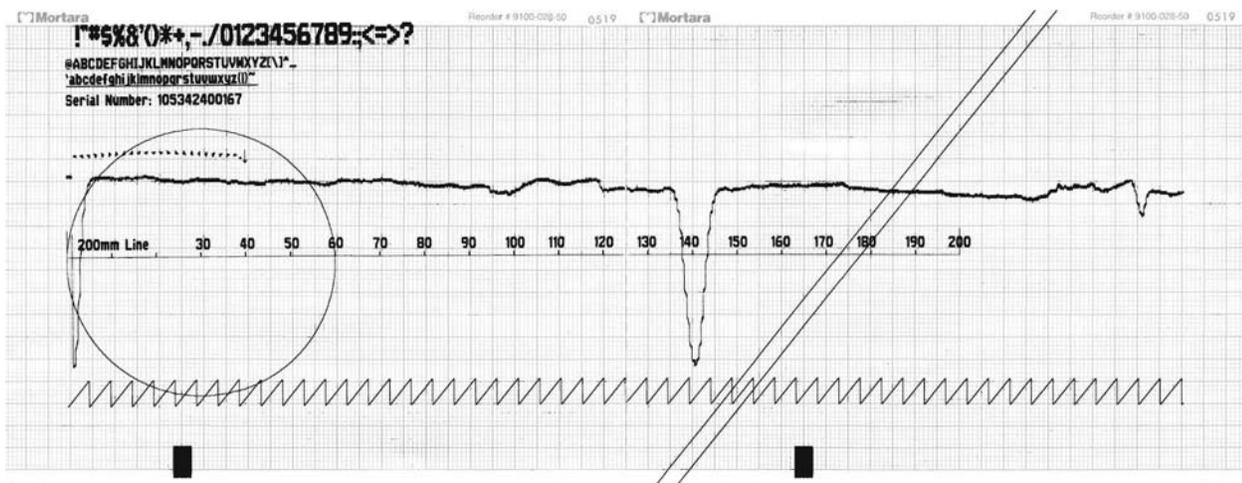
Note: This test should be performed with the AC power connected to the unit.

Description of printout
At the top of the writer test print out will be the printable characters of the writer.

The next section will have a 200-mm line. This line should be measured with a ruler and will indicate if there is a writer motor problem if the line is too short or too long. The tolerance of this line is +/- 2-mm.

The next line that prints is an indication of the cue sensor. At the beginning of the printout there should be a dip towards the bottom off the page and then it should move to a baseline level. When the cue mark is sensed for the second page of the printout a second dip is printed. *Note: there will be fluctuation in this line, this is normal. Look for extreme variations that can indicate possible problems with the cue sensor or cue sensor circuitry.*

The next line that prints is a zigzag line. Check to see that none of the dots are missing.

At the bottom of the page, starting in the lower left and continuing to the top of the page, two diagonal lines will be printed. Check these lines for any missing dots. If dots are missing the print head may need to be cleaned or replaced. Also check the lines for any "steps" which can indicate a motor problem.

Another item that is printed is a circle. Check the circle to make sure that there are no breaks or gaps in the printing. This can indicate a problem with the writer motor and the thermal print head.

Near the end of the first page and continuing onto the second page will be two diagonal lines. Check these lines to see if there are gaps. If there are gaps sections of the print head may be burned out. If this is the case the print head should be replaced.

When printing an ECG at different paper speeds the calibration pulse printed at the beginning of each trace can be used to check the paper speed. Check the calibration pulse by measuring the width and amplitude of the pulse at the beginning of each line of ECG tracing. Use the following table for the correct measurements.
Note: The measurements should be made using a ruler and not the grid on the paper.

Paper Speed	Cal Pulse Width
5mm/sec	1mm
10mm/sec	2mm
25mm/sec	5mm
50mm/sec	10mm

Gain Setting	Cal Pulse Amplitude
5mm/mV	5mm
10mm/mV	10mm
20mm/mV	20mm

Adjusting the Writer Cue Sensor

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CAUTION:

Dangerous voltages are present on the circuit board of the ELI 150. Caution should be taken when connecting test equipment to the circuit board.

</td></tr>
</table>

Note: This procedure should be performed any time the Cue Sensor or the Motherboard is replaced.
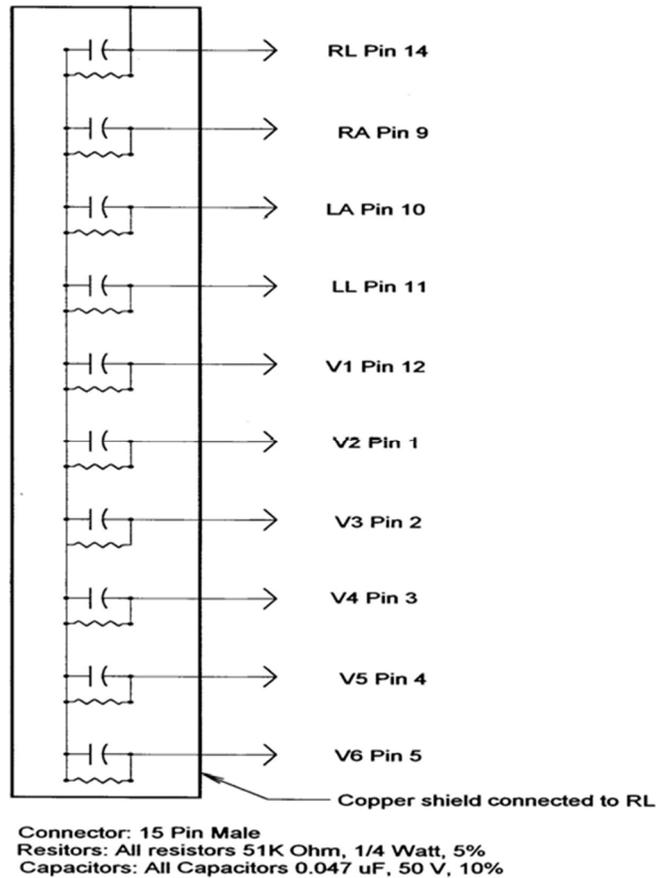*Note: This test should be performed with the AC power turned on.*

1) Install paper into the unit with the cue mark approx. 1 – 2 inches away from the tear bar. Make sure that the cue sensor is seeing white and not any markings on the paper.
2) Use a DMM to measure the DC voltage at test point P15 on the motherboard with respect to ground (P12). Adjust R323 on the motherboard to between 1.90 V-DC and 2.10 V-DC at test point P15. Set this as close to 2.0 V-DC as possible.
3) Perform either the Writer test or print a test ECG. The paper should cue to the next sheet of paper, print and then advance to the beginning of the next sheet of paper.
4) If the Writer test is performed the results should be compared with the test printout in this manual.

ECG Test
1.) Connect a simulator to the patient cable and connect the patient cable to the unit.
2.) Turn the unit on.
3.) Press the F1 key and enter a test patient name.
4.) Press the Auto key. The unit will acquire the ECG and depending on the units' configuration, will print the ECG.
5.) Verify that the printed ECG is correct for the simulated input to the unit.

Noise Test

Perform the noise test using a shorting plug of the following design.

Connector: 15 Pin Male
Resitors: All resistors 51K Ohm, 1/4 Watt, 5%
Capacitors: All Capacitors 0.047 uF, 50 V, 10%

Please note that Welch Allyn does not supply this shorting plug

1.) Turn the unit on with the shorting plug connected to the input connector of the unit.
2.) Increase the gain of the unit to 20mm/mV.
3.) Select the **RHY** button to print a rhythm strip.
4.) After 200 mm of paper have printed, press the **Stop** button to stop the printout.
5.) Visually inspect the baseline of the rhythm strip for any peaks greater than 0.5 mm. If there are no peaks greater than 0.5mm the test is successful.

Lead Fail Test

Perform the lead fail test as follows:

Connect the patient cable to a simulator or a shorting bar. Disconnect one lead at a time from the simulator or shorting bar and verify that the correct lead fail message appears on the LCD while in the Main Menu screen. Only the message for the disconnected lead should appear as shown below.

Lead	Message
Right Arm	LEAD RA OFF
Left Arm	LEAD LA OFF
Left Leg	LEAD LL OFF
V1	LEAD V1 OFF
V2	LEAD V2 OFF
V3	LEAD V3 OFF
V4	LEAD V4OFF
V5	LEAD V5 OFF
V6	LEAD V6 OFF
All Leads off	LEADS OFF

Transmitting Records

You may transmit ECGs from the ELI 250/210 to another Welch Allyn electrocardiograph or to an E-Scribe Data Management System using a direct connection or an optional factory installed internal modem.

Before transmitting ECGs to E-Scribe, the site number must be defined as well as the telephone number in the configuration.

NOTE: Telephone transmission is available with modem option only.

To transmit records (either to another cardiograph or to E-Scribe), select the **XMT Key** ⌷. The following screen is displayed:
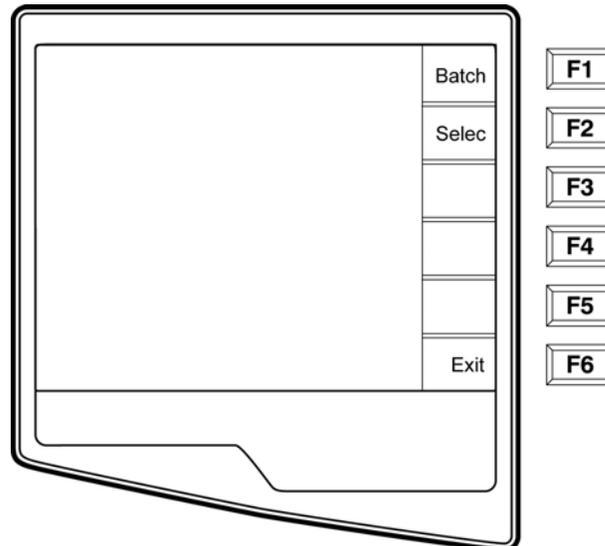

To batch transmit of all records in the directory, select **F1 (Batch)**. If a batch transmission is selected, only those records which have not been previously transmitted or marked deleted will be transmitted.

An ECG may be listed in the directory but have a "deleted status" (indicated by "X"). The directory saves those records that have been marked for deletion in the event that you may want to recover the ECG at a later time. All

stored ECGs will remain in the directory until it becomes full, at this time, the ELI 250/210 will automatically remove a record, based on its size, in order to make room for the new ECG. Only those records that have been marked for deletion will be removed. Records are automatically marked for deletion based on the Delete Rule configuration. To manually mark an ECG record for deletion, press **Delete (F4)** and an "X" will appear in the far right hand column of the directory and to remove the delete status, select **F4** again.

To transmit one ECG, select **F2 (Select)** to choose a record from the patient directory.
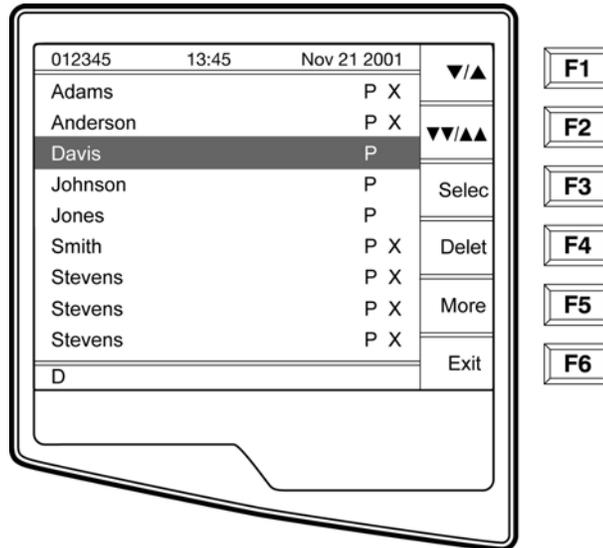
Use **(F1)** to navigate down the directory list and **Shift (F1)** to move up the list. Similarly, use **(F2)** to page down and **Shift (F2)** to page up through the directory. To quickly find and select a patient name, use the keyboard to enter the first letter(s) of the last name. The letters will be displayed on the lower left corner of the LCD and the desired name will automatically be highlighted. When the desired record is highlighted, use **F3 (Select)** to transmit the individual ECG.

The following screen appears during a batch transmission or for a single record transmission:
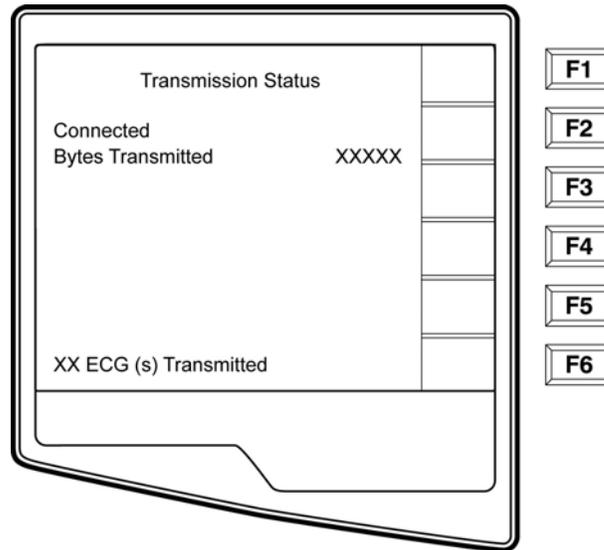
After the transmission of your record(s), the Real-Time ECG View is displayed.

Serial Port Test (Direct connect transmission)
For a direct connection hookup, connect the ELI 250/210 to another ELI 250/210 with a direct connect serial cable (Welch Allyn P/N: 25000-024). Plug each end of the cable into the serial ports (RS232).

In the configuration setting, select a baud rate of 9600 or 38400 bps for both units.

See above section on Transmitting Records to perform the test transmission.

Modem Test

Modem Transmission

For a modem transmission, connect the ELI 250/210 to a standard telephone jack with the provided phone line cable. Plug the cable into the telephone jack located on the back of the cardiograph and the other end into a telephone wall jack. Confirm telephone number in the configuration settings (see System Settings section of Operator's manual).
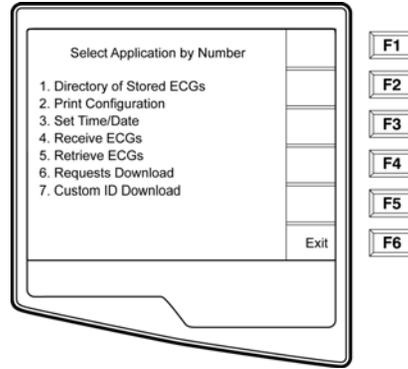
Modem Initialization

The modem initialization string is country specific. At the time of production, the modem initialization string is configured for the country of purchase. However, if the unit is relocated to a different country, the modem initialization string will need to be modified.

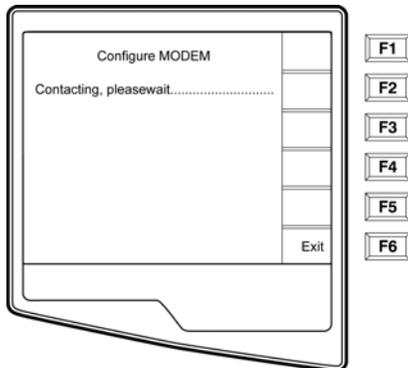From the Real Time ECG View, select **F6 (More)** to display the Application Menu.
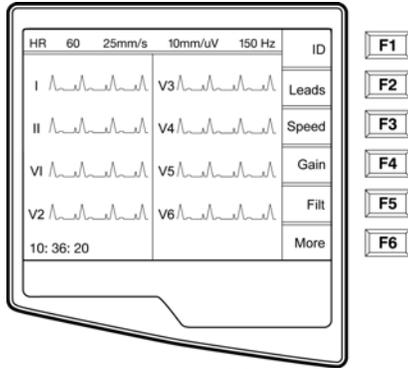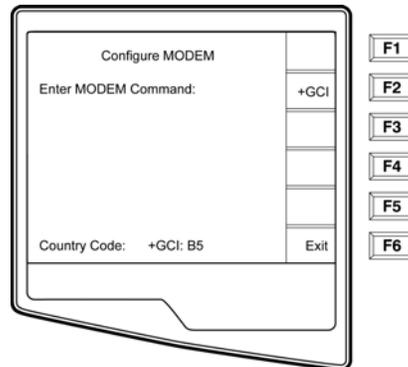
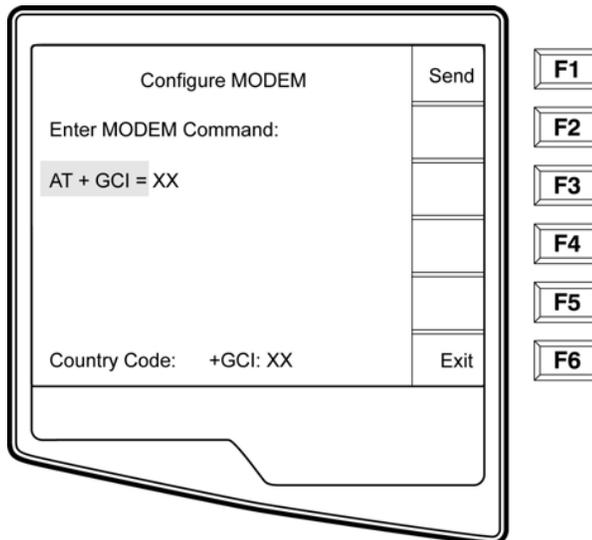**Real Time ECG View**

Application Menu

From the Application Menu, simultaneously press **ALT+SHIFT+M** to access the modem initialization string. The following screens appear:

Approximately 30 second delay

Select **F2 (+GCI=)** to populate the prefix "**AT+GCI**" of the modem command.

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TIP: "AT+GCI" will be highlighted – cursor is not present – use keypad to enter country code.

Enter your country code as listed below. Select **F1 (Send)** to change your country code. "Command stored" will be displayed. Select **F6 (Exit)** to return to the Application Menu.

Country	Code	Country	Code
Argentina	07	Liechtenstein	68
Australia	09	Luxembourg	69
Austria	0A	Japan	00
Barbados	0E	Korea	61
Belgium	0F	Malaysia	6C
Brazil	16	Mexico	73
Canada	20	Netherlands	7B
Czech Republic	2E	New Zealand	7E
China	26	Norway	82
Denmark	31	Poland	8A
Finland	3C	Portugal	8B
France	3D	Russia	B8
Germany	04	South Africa	9F
Greece	46	Singapore	9C
Guam	48	Slovak Republic	FC
Hungary	51	Spain	A0
Hong Kong	50	Sweden	A5
Iceland	52	Switzerland	A6
India	53	Taiwan	FE
Indonesia	54	Thailand	A9
Ireland	57	United Kingdom	B4
Israel	58	United States	B5
Italy	59	Venezuela	BB

Receive ECGs

To receive ECGs from another Welch Allyn electrocardiograph (using either a telephone or a direct connection), select **Receive ECGs (4)** from the Application Menu.
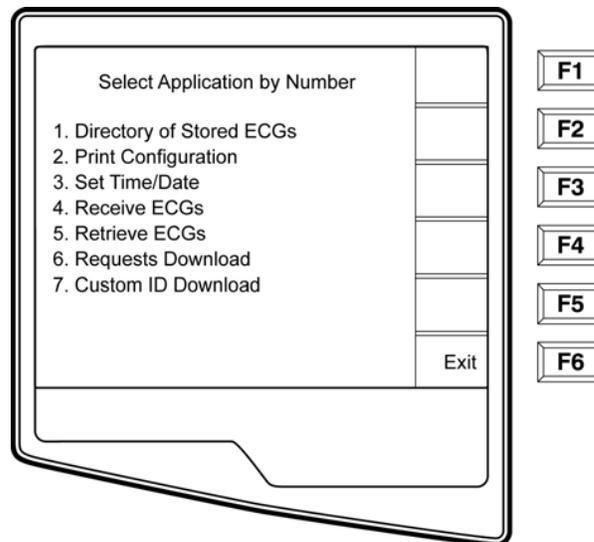
The LCD displays the following message:
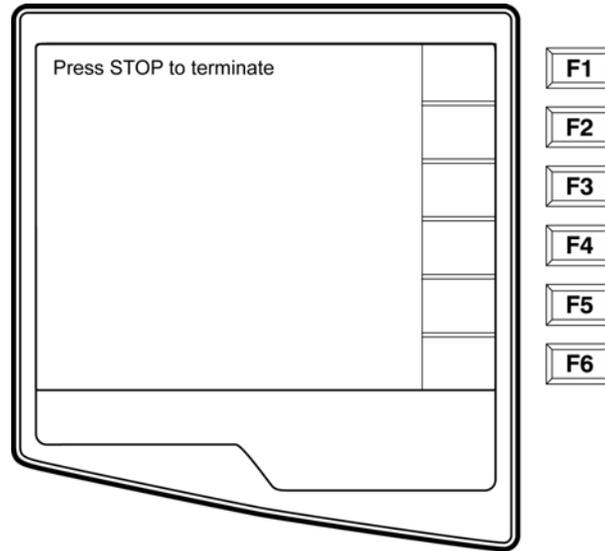
When the LCD displays the above message, the unit is ready to receive the ECGs from the transmitting electrocardiograph. Follow the instructions on transmitting records as described in this section. The receiving unit only acts as a printer. Received ECGs will not be viewed or stored. To terminate the receiving mode, press the **STOP** key.

> *Note: The ELI 150 will receive records from Welch Allyn model cardiographs. The Welch Allyn model cardiographs (ELI 100, ELI 200, Landscape, and Portrait) will not receive the ELI 150 records*.

WLAN Test

The following test requires a properly configured access point and test software to receive ECG data from the UUT. It is recommended to setup the test configuration to use DHCP, WEP key encryption, and channel 6; however this is not a requirement.

Note- The cardiograph uses WEP keys 0-3; these may not correspond directly to your access point WEP keys if it uses keys 1-4. (See example in table)

Linksys	Cardiograph
1	0
2	1
3	2
4	3

From the main menu press the "more" key.

Select "system configuration" and page to the menu screen containing the WLAN settings.

Set the "Default XMT Media" to WLAN and install your network information; the following settings are required in the cardiograph and should be obtained from your local network personnel:

Host IP address   (network specific)
Port #:   5005
SSID: (access point name)

Channel Number: 6
WEP info (if used)

Once this setup is completed ECGs can be transmitted by pressing the "XMT" key from the main menu and selecting the record you wish to send.

Transmission information can be viewed in the test software window.

When completed the UUT display will return to the ECG directory and a "T" flag will be set indicating proper transmission. The transmitted ECG can be seen in the target directory (C:\UNIPRO) listed as a new file.

Safety Tests

If the cardiograph housing was opened for repair or inspection work, the following safety tests should be performed in accordance with the EN/IEC 60601-1 or EN 62353/IEC 62353 methods and limits.

In countries with different national legislation, the country specific standards and guidelines for retesting of electrical medical devices are obligatory.

Objective evidence of testing results versus the defined standards should be provided as part of the servicing record.

The following tests are performed per the above specifications:

AC Hi-Pot Patient to Mains

Earth Leakage
Enclosure Leakage
Patient Source
Patient Sink

ELI150 TEST DATA RECORD

Unit Serial #:_____

- Device Cleaning
- Print device configuration (Attach to this report)
- Power Testing
    1. Note Battery Age (If not possible enter N/A)   ____/____ (week/year)
    2. Off Current   _____ uA (<40uA)
    3. On Current   _____ mA (<250mA)
    4. Charging current flow + AC LED   PASS/FAIL (Circle one)
    5. Battery Charger Output Voltage   _____ VDC (13.0-14.0 VDC)
- Functional Testing
    1. Keyboard Test   PASS/FAIL (Circle one)
    2. LCD pixel check   PASS/FAIL (Circle one)
    3. LCD Contrast   PASS/FAIL (Circle one)
    4. Speaker Test   PASS/FAIL (Circle one)
    5. Time/Date   PASS/FAIL (Circle one)
- Writer Assembly / Cue Sensor Adjustment (see section A.1):
    1. Mechanical Operation   PASS/FAIL (Circle one)
    2. Print Head Alignment   PASS/FAIL (Circle one)
    3. Print Quality   PASS/FAIL (Circle one)
    4. Cue Sensor Calibration_____VDC (1.95-2.05 VDC)   PASS/FAIL (Circle one)
    5. Operational Gear Meshing   PASS/FAIL (Circle one)
    6. Writer Tracking   PASS/FAIL (Circle one)
- Analog Front End Testing:
    1. ECG Throughput Test   PASS/FAIL (Circle one)
    2. ECG Noise Test   PASS/FAIL (Circle one)
    3. Lead Failure Test   PASS/FAIL (Circle one)
- Communication Options (based on options present)
    1. RS232   PASS/FAIL/NA (Circle one)
    2. Modem   PASS/FAIL/NA (Circle one)
    3. LAN   PASS/FAIL/NA (Circle one)
    4. WLAN B, G or G2   PASS/FAIL/NA (Circle one)
- Safety Testing   PASS/FAIL (Circle one)

Performed by: _____   Date:_____/_____/_____

CONNECTIVITY OPTIONS

Introduction

There are four connectivity options on the ELI 150. These options are Serial Connectivity, Modem Connectivity, LAN Connectivity and GSM Modem Connectivity. Each option uses different hardware soldered to the ELI 150 motherboard except for the Serial Connectivity option.

For operation of the different types of connectivity options please refer to the ELI 150 Operator Manual.

RS232/Serial Connectivity Option

The Serial Connectivity option will allow the user to transmit and receive ECG information via the nine pin serial port on the back of the ELI 150. The RS232/Serial Connectivity option is the only option that does not require a modification to the motherboard of the ELI 150 but requires the connectivity option within the ELI 150 software be installed.

To upgrade a unit to the Serial Connectivity option you will need to contact Welch Allyns Technical Support Group to obtain the software and the units serial number file.
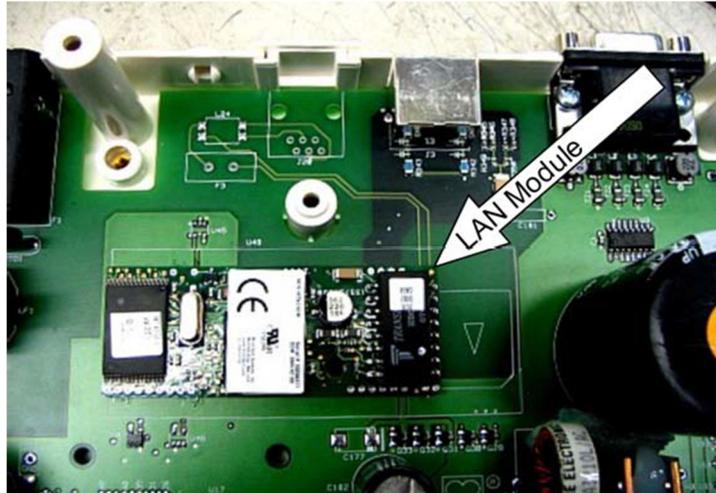
Modem Connectivity Option

The Modem Connectivity option for the ELI 150 is soldered to the motherboard and is not field replaceable. If there is a problem with the modem the motherboard of the unit will require replacement.
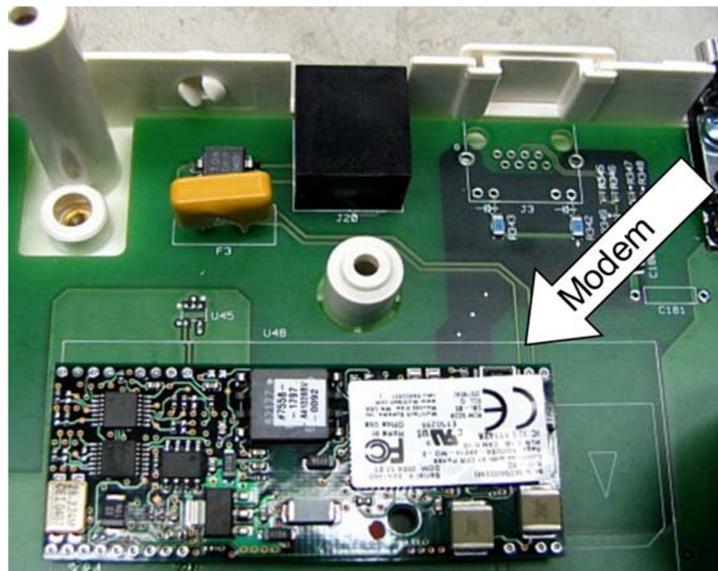
LAN Connectivity Option

The LAN Connectivity option for the ELI 150 is soldered to the motherboard and is not field replaceable. If there is a problem with the LAN option the motherboard will require replacement.

GSM Modem Connectivity Option

The GSM Modem Connectivity option for the ELI 150 is soldered to the motherboard and is not field replaceable. If there is a problem with the GSM Modem option the motherboard will require replacement.

It is important to note that there are two different versions of the GSM modems. The types are F1which is typically for Europe (working in 900/1800 MHz bands) and F2 which is typically for North America (850/1900 MHz bands). By looking at the motherboard or the GSM modem itself you will not be able to tell which GSM modem is installed. If the motherboard of the ELI 150 must be replaced it must be replaced with the correct type of GSM mode. To ensure that the correct options are installed please make sure that when ordering the board you specify the **UNIT serial number**.

In order for the GSM modem to operate correctly a SIM card must be installed and the SIM card must have the Data option activated. Welch Allyn does not provide the SIM modules the can be obtained from the service provider.

A replacement motherboard will require some assembly. The GSM modem will be soldered to the motherboard as shown.
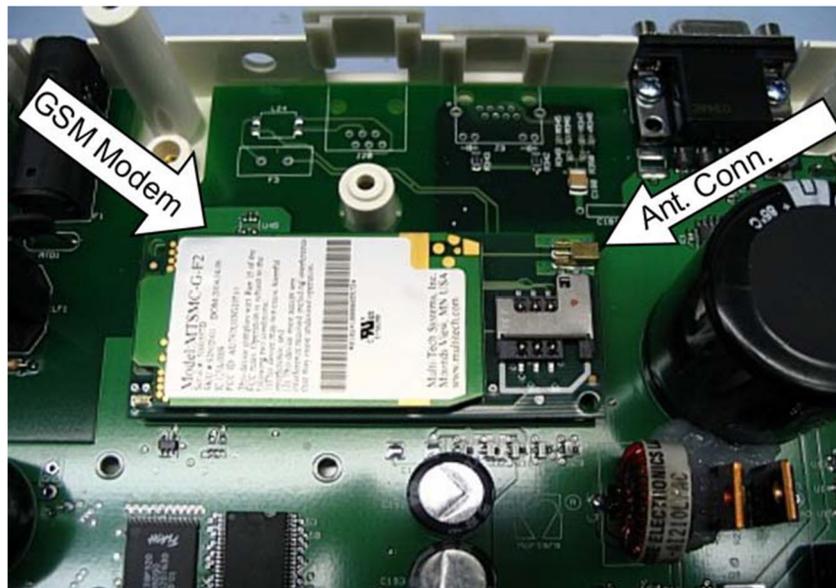
The antenna cable, item 52, will need to be removed from the modem of the old motherboard and connected to the modem of the new motherboard.
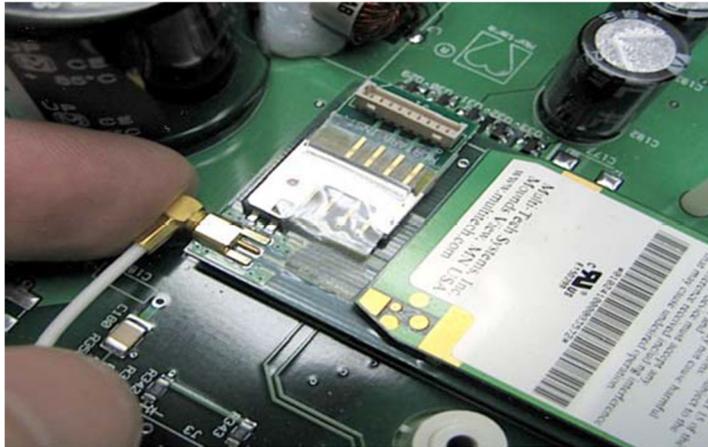
A connection from the GSM modem to the Remote SIM Connector PCM, item 51, board will be required. Take either the existing SIM simulator board, item 50, and the cable, item 49, or the cable assembly supplied with the replacement motherboard and the install it onto the GSM modem as shown.
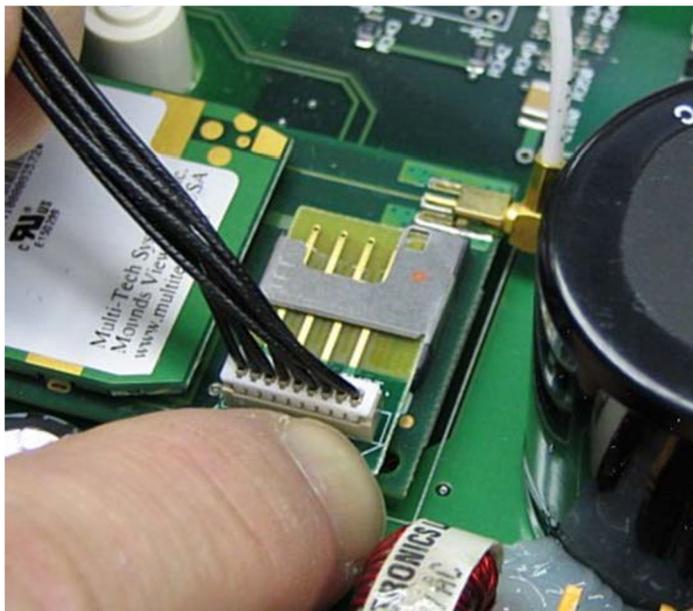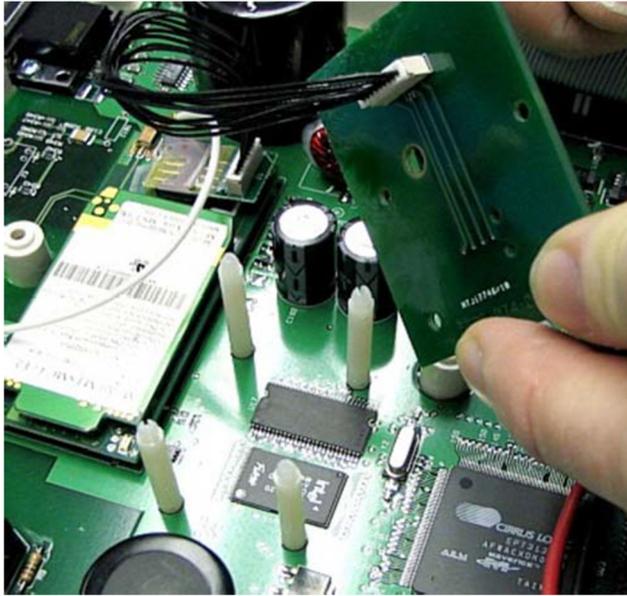
Use tape to secure the SIM simulator PCB, item 50, to the GSM modem.
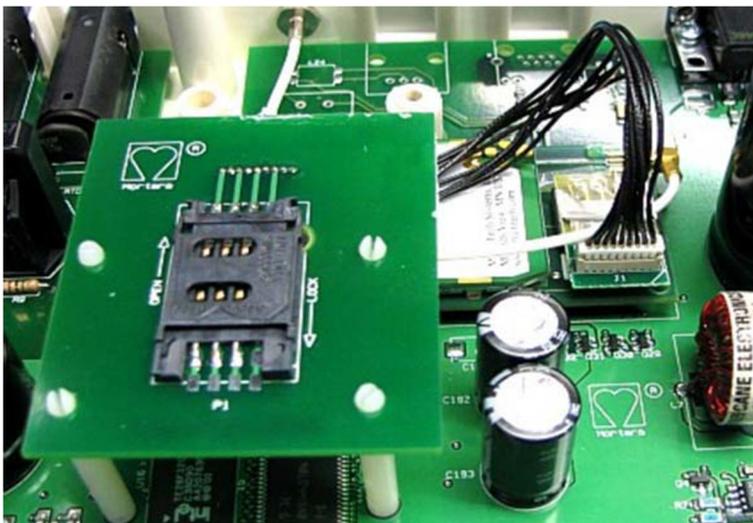

Install the 4 standoffs, item 55, onto the motherboard. The standoffs will secure the Remote SIM Connector PCB to the motherboard.

Install the remaining end of the SIM simulator cable, item 49, by connecting it to the Remote SIM PCB, item 51.

Press the Remote SIM PCB, item 51, onto the standoffs making sure that the orientation of the Remote SIM PCB is correct.

Reassemble the unit in reverse order.