Mortara INSTRUMENT

REF 9515-163-50-ENG Rev F1

ELI 250

12-LEAD RESTING ELECTROCARDIOGRAPH

USER MANUAL

Manufactured by Mortara Instrument, Inc. Milwaukee, Wisconsin U.S.A.

CE 0459

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

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NOTICES

Manufacturer's Responsibility

Mortara Instrument, 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 Mortara Instrument, Inc.
- The device (ELI 250) 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

Mortara Instrument, 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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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 not 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 250 include series resistance (10 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 Mortara Instrument, 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.
- To ensure the safety of both the patient and the device, 1.5 meters (5 feet) of open area should surround 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 250 shall be operated from its internal electrical power source.
- 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 250 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.
- To maintain immunity to potential interfering electromagnetic signals, shielded cabling must be used when connecting the ELI 250 to a network.
- To maintain operator and patient safety, equipment connected to the same network as the ELI 250 must meet the requirements of IEC 60950 or IEC 60601-1.
- To prevent electric shock due to unequal ground potentials that may exist between points of a distributed network system, or fault conditions in external network connected equipment, network cable shielding must be connected to protective earth ground appropriate to the area where the ELI 250 is used.
- The ELI 250 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.

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 as this may damage equipment or reduce its usable life. Wipe the exterior surfaces with a warm water and mild detergent solution and then dry with a clean cloth.
- No user serviceable parts inside. Dangerous voltages present when Mains is applied. 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 Mortara Instrument 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.
- Do not connect telephone cable to LAN connector.

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 250; 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 250 will automatically turn off (blank screen) if the batteries have been severely discharged and the AC mains is disconnected from the unit.
- After operating the ELI 250 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 250. A light will illuminate, next to the on/off switch, indicating that the unit is charging. This light will turn off when the battery is fully charged.
- The ELI 250 is a UL Classified Device:

WITH RESPECT TO ELECTRIC SHOCK,
FIRE AND MECHANICAL HAZARDS ONLY IN ACCORDANCE
WITH UL2601-1, IEC60601-1, CAN/CSA CC22.2 No. 601.1,
AND IEC60601-2-25

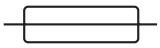
EQUIPMENT SYMBOLS AND MARKINGS

Symbol Delineation

Attention, consult accompanying documents

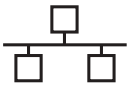
Alternating current

Protective earth (ground)



Fuse

Telephone line (modem)



Network (LAN)

Defibrillator-proof type CF applied part

Output/Transmit

Input

ON/OFF (power)

Stop (of action)

	Shift key (to enter upper case text)
	Space key
	Enter key (accept data/return)
	Initiate printing of 12-Lead ECG
	Initiate printing of continuous rhythm strip
	Do not dispose as unsorted municipal waste. Per EC Directive 2002/96, requires separate handling for waste disposal according to national requirements
	Indicates compliance to applicable EEC directives

ELECTROMAGNETIC COMPATIBILITY (EMC)

Electromagnetic compatibility with surrounding devices should be assessed when using the system.

An electronic device can either generate or receive electromagnetic interference. Testing for electromagnetic compatibility (EMC) has been performed on the ELI 250 cardiograph according to the international standard for EMC for medical devices (IEC 60601-1-2). This IEC standard has been adopted in Europe as the European Norm (EN 60601-1-2).

The system should not be used adjacent to, or stacked on top of other equipment. If the system must be used adjacent to or stacked on top of other equipment, verify that the system operates in an acceptable manner in the configuration in which it will be used.

Fixed, portable, and mobile radio frequency communications equipment can affect the performance of medical equipment. See Table X-4 for recommended separation distances between the radio equipment and the system.

The use of accessories and cables other than those specified below, may result in increased emissions or decreased immunity of the system.

9293-032-50	ELI 250 Patient cable, 12 channel, 10 leadwires banana plug - **AHA**
9293-032-51	ELI 250 Patient cable, 12 channel, 10 leadwires banana plug - **IEC**
9293-033-50	ELI 250 Patient cable, 12 channel, 10 leadwires snap - **AHA**
9293-033-51	ELI 250 Patient cable, 12 channel, 10 leadwires snap - **IEC COLORS**
9281-002-50	Banana plug to snap leadwire, 4mm, set of 10
3181-008	Power cord, hospital grade, 8' **US**
3181-002	Power cord, hospital grade, 8' **INTERNATIONAL**

Table X-1 Guidance and Manufacturer's Declaration: Electromagnetic Emissions

The system is intended for use in the electromagnetic environment specified in the table below. The customer or the user of the system should assure that it is used in such an environment.

Emissions Test	Compliance	Electromagnetic Environment: Guidance
RF Emissions CISPR 11	Group 1	The system uses RF energy only for its internal function. Therefore, its RF emissions are very low and not likely to cause any interference in nearby electronic equipment.
RF Emissions CISPR 11	Class A	The system is suitable for use in all establishments other than domestic and those directly connected to the public low-voltage power supply network that supplies buildings used for domestic purposes.
Harmonic Emissions IEC 61000-3-2	Complies	
Voltage fluctuations/flicker emissions IEC 61000-3-3	Complies	

Table X-2 Guidance and Manufacturer's Declaration: Electromagnetic Immunity

The system is intended for use in the electromagnetic environment specified below. The customer or the user of the system should assure that it is used in such an environment.

Emissions Test	Compliance	Compliance Level	Electromagnetic Environment: Guidance
Electrostatic Discharge (ESD) IEC 61000-4-2	+/- 6 kV contact +/- 8 kV air	+/- 6 kV contact +/- 8 kV air	Floors should be wood, concrete, or ceramic tile. If floors are covered with synthetic material, the relative humidity should be at least 30%.
Electrical Fast transient/burst IEC 61000-4-4	+/- 2 kV for power supply line +/- 1 kV for input/output lines	+/- 2 kV for power supply line +/- 1 kV for input/output lines	Mains power quality should be that of a typical commercial or hospital environment.
Surge IEC 61000-4-5	+/- 1 kV differential mode +/- 2 kV common mode	+/- 1 kV differential mode +/- 2 kV common mode	Mains power quality should be that of a typical commercial or hospital environment.
Voltage dips, short interruptions and voltage variations on power supply input lines IEC 61000-4-11	<5% UT (>95% dip in UT) for 0.5 cycle 40% UT (60% dip in UT) for 5 cycles	<5% UT (>95% dip in UT) for 0.5 cycle 40% UT (60% dip in UT) for 5 cycles	Mains power quality should be that of a typical commercial or hospital environment. If the user of the system requires continued operation during power mains interruptions, it is recommended that the system be powered from an uninterruptible power supply or a battery.
Power frequency (50./60 Hz) magnetic field	3 A/m	3 A/m	Power frequency magnetic fields should be at levels characteristic of a typical location in a typical commercial or hospital environment.

NOTE: *UT is the a.c. mains voltage prior to application of the test level.*

Table X-3 Guidance and Manufacturer's Declaration: Electromagnetic Immunity

The system is intended for use in the electromagnetic environment specified below. The customer or the user of the system should assure that they are used in such an environment.

Emissions Test	IEC 60601 Test Level	Compliance Level	Electromagnetic Environment: Guidance
Conducted RF IEC 61000-4-6	3 Vrms 150 kHz to 80 MHz	3 Vrms 150 kHz to 80 MHz	Portable and mobile RF communications equipment should be used no closer to any part of the system, including cables, than the recommended separation distance calculated from the equation applicable to the frequency of the transmitter. **Recommended separation distance** $d = \left[\frac{3.5}{3Vrms}\right]\sqrt{P}$
Radiated RF IEC 61000-4-3	3 Vrms 80 MHz to 2.5 GHz	3 Vrms 80 MHz to 2.5 GHz	$d = \left[\frac{3.5}{3V/m}\right]\sqrt{P}$ 80 MHz to 800 MHz $d = \left[\frac{7}{3V/m}\right]\sqrt{P}$ 80 MHz to 800 MHz Where *P* is the maximum output power rating of the transmitter in watts (W) according to the transmitter manufacturer and *d* is the recommended separation distance in meters (m). Field strengths from fixed RF transmitters, as determined by an electromagnetic site survey[a], should be less than the compliance level in each frequency range[b]. Interference may occur in the vicinity of equipment marked with the following symbol: 

a. Field strengths from fixed transmitters, such as base stations for radio (cellular/cordless) telephones and land mobile radios, amateur radios, AM and FM radio broadcast and TV broadcast cannot be predicted theoretically with accuracy. To assess the electromagnetic environment due to fixed RF transmitters, an electromagnetic site survey should be considered. If the measured field strength in the location in which the system is used exceeds the applicable RF compliance level above, the system should be observed to verify normal operation. If abnormal performance is observed, additional measures may be necessary, such as reorienting or relocating the system.

b. Over the frequency range 150 kHz to 80 MHz, field strengths should be less than [3] V/m.

Table X-4 Recommended Separation Distances Between Portable and Mobile RF Communications Equipment and the ELI 250 cardiograph.

The system is intended for use in the electromagnetic environment in which radiated RF disturbances are controlled. The customer or the user of the system can help to prevent electromagnetic interference by maintaining a minimum distance between portable and mobile RF communications equipment (transmitters) and the system as recommended below, according to the maximum output power of the communications equipment.

Rated Maximum Output Power of Transmitter W	Separation Distance According to Frequency of Transmitter (m)	
	150 KHz to 800 MHz	800 MHz to 2.5 GHz
	$d = 1.2\sqrt{P}$	$d = 2.3\sqrt{P}$
0.01	0.1 m	0.2 m
0.1	0.4 m	0.7 m
1	1.2 m	2.3 m
10	4.0 m	7.0 m
100	12.0 m	23.0 m

For transmitters rated at a maximum output power not listed above, the recommended separation distance *d* in meters (m) can be estimated using the equation applicable to the frequency of the transmitter, where *P* is the maximum output power rating of the transmitter in watts (W) according to the transmitter manufacturer.

NOTE 1: *At 800 MHz, the separation distance for the higher frequency range applies.*

NOTE 2: *These guidelines may not apply in all situations. Electromagnetic propagation is affected by the absorption and reflection from structures, objects, and people.*

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GLOSSARY

INTRODUCTION

Manual Purpose

This Operator's Manual explains how to operate the ELI 250 electrocardiograph. This manual describes how to perform the following tasks:

- Preparing the cardiograph for use
- Using and understanding the keyboard, the viewing screen, and the menu sequences
- View, Acquire, Print and Store ECGs
- Transmitting ECGs (Appendix A)
- Troubleshooting and maintaining the cardiograph (Appendix B)

Audience

This manual is written for clinical professionals. They are expected to have working knowledge of medical procedures and terminology as required for monitoring cardiac patients.

Indications for Use

The ELI 250 is indicated for use in a clinical setting, by qualified medical professionals only for recording ECG data of patients.

- The device is indicated for use to acquire, analyze, display and print ECG data for consideration by physicians.
- The device in indicated for use in a clinical setting, by a physician or by trained personnel who are acting on the orders of a licensed physician. It is not intended as a sole means of diagnosis.
- The interpretations of ECG data by the device are only significant when used in conjunction with physician over-read as well as consideration of all other relevant patient data.
- The device is indicated for use on adult populations, typically symptomatic.
- The device is not intended to be used as a vital signs physiological monitor.

Conventions Used in the User's Manual

The ELI 250 user interface incorporates various function keys with variable labels as displayed on the LCD screen of the unit. These temporary key labels or "softkey" labels will be referred to in this manual in bold Arial font (e.g., Leads). In addition, dedicated keys such as the unit's automatic feature keys will also appear in bold Arial font (e.g., **AUTO 12, RHY, XMT, STOP**). Other conventions, such as notes or tips will appear indented and italicized text.

NOTE: *Notes contain additional information on usage.*

TIP: *Tips contain shortcuts or helpful hints.*

Chapter Purpose

This chapter is intended to provide the user with:

- System description
- Layout overview with graphical presentations
- System specifications

System Description

The ELI 250 is a 12-lead diagnostic electrocardiograph capable of viewing, acquiring, printing, and storing ECG data. The ELI 250 is optionally equipped with Mortara's VERITAS 12-lead resting interpretation algorithm. If this option is enabled, the VERITAS ECG algorithm can provide an over reading physician with a silent second opinion through diagnostic statements output on the ECG report. For additional information on the Mortara VERITAS resting interpretation algorithm, please refer to the Physician's Guide to ECG Interpretation.

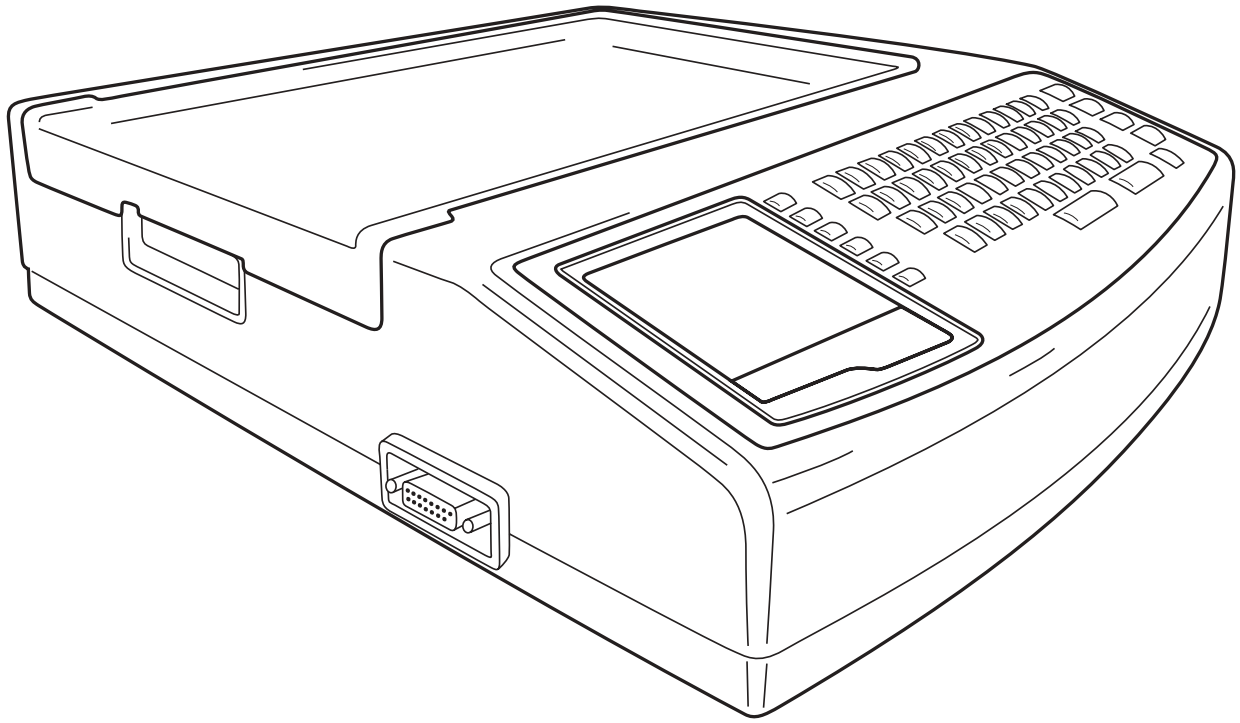
Multiple print formats are supported including: 3+1, six, 3+3, twelve, and 6+6 channels in automatic mode and six or twelve channels during rhythm recording. The ELI 250 can operate on battery or line power.

The ELI 250 electrocardiograph includes:

- Patient Cable
- Hospital Grade Power Cord
- 1 pack paper (standard or A4)
- User's Manual
- Optional Accessory Starter Kit

ELI 250, System Illustration

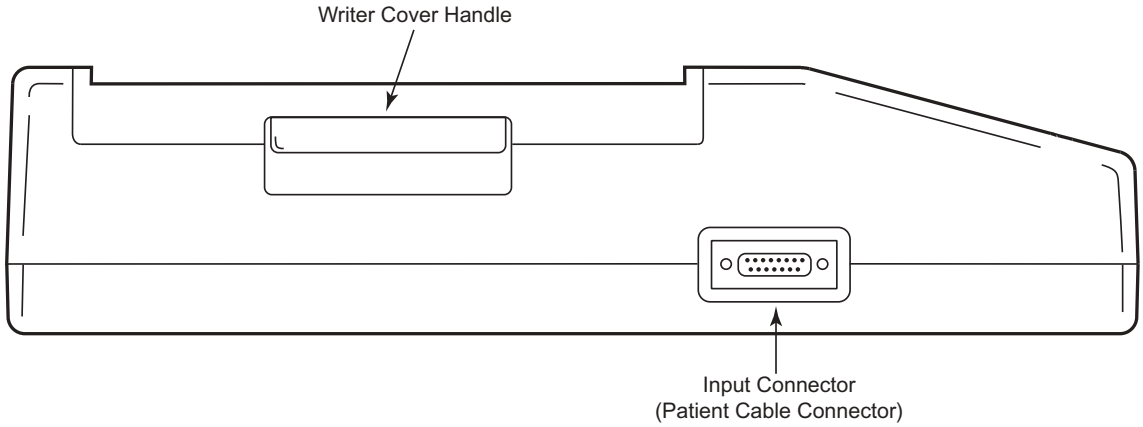
Figure 1-1



System Layout

ELI 250, Left Side

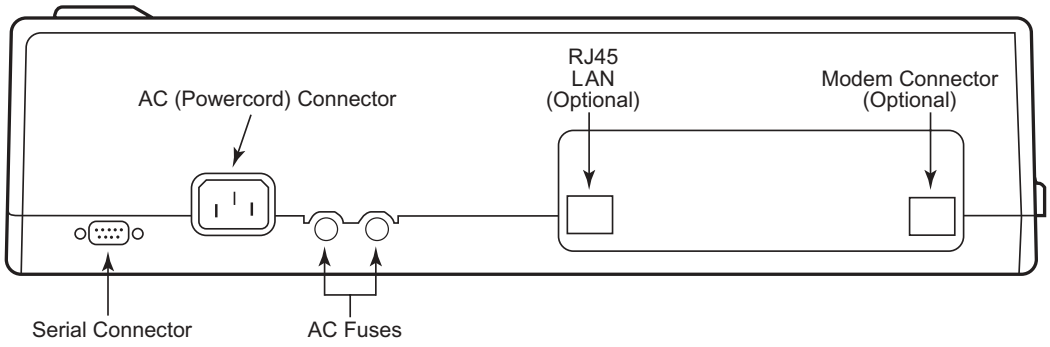
Figure 1-2



Left Side View

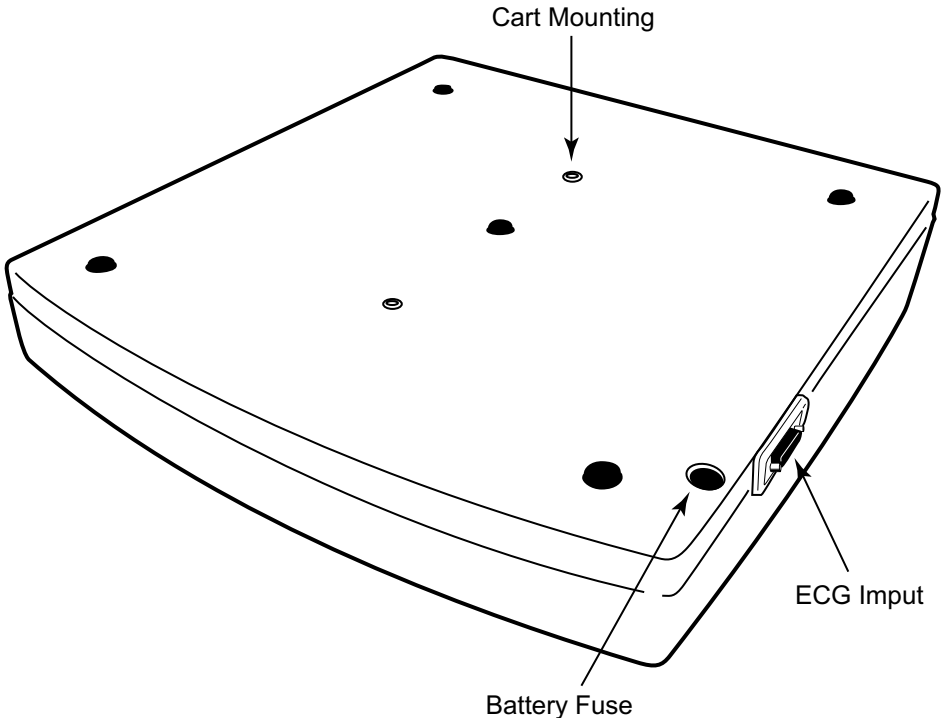
ELI 250, Rear

Figure 1-3



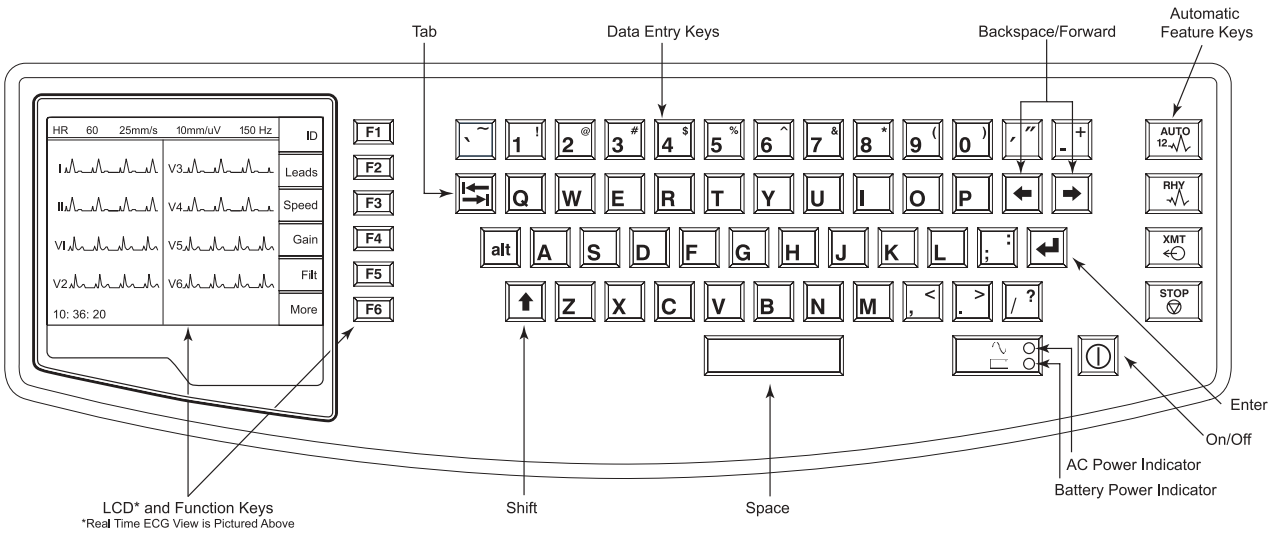
ELI 250, Base

Figure 1-4



ELI 250, Display and Keyboard

Figure 1-5

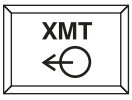


Function Keys activate the liquid crystal display (LCD) label adjacent to each function key. LCD labels/functions change depending upon the screen displayed. If the label is blank, the adjacent function key is deactivated.

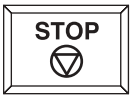
Automatic Feature Keys are used as a one-touch operation for:

ECG Acquisition

Rhythm Printing



Transmitting



Stop

ELI 250 Specifications

Feature	Specifications
Instrument Type	12-lead Electrocardiograph
Input Channels	Simultaneous acquisition of 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 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	Full size (8.5" x 11" or A4), Z-fold thermal paper; 250 sheets stored in paper tray
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+1, 3+3 channel, 6-channel, 12-channel
Rhythm Print Formats	6-channel with configurable lead groups, or 12-channel
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 interference filter 50/60 Hz; low pass filters 40 Hz or 150 Hz
A/D Conversion	20 bit (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	11.25 lb. (5.1kg) including battery
Dimensions	15.5" x 17" x 4" (39.4 cm x 43.2 cm x 10.2 cm)
Power Requirements	Universal AC power supply (100-240 VAC at 50/60 Hz) 50 VA. Internally rechargeable battery

GETTING STARTED

Chapter Purpose

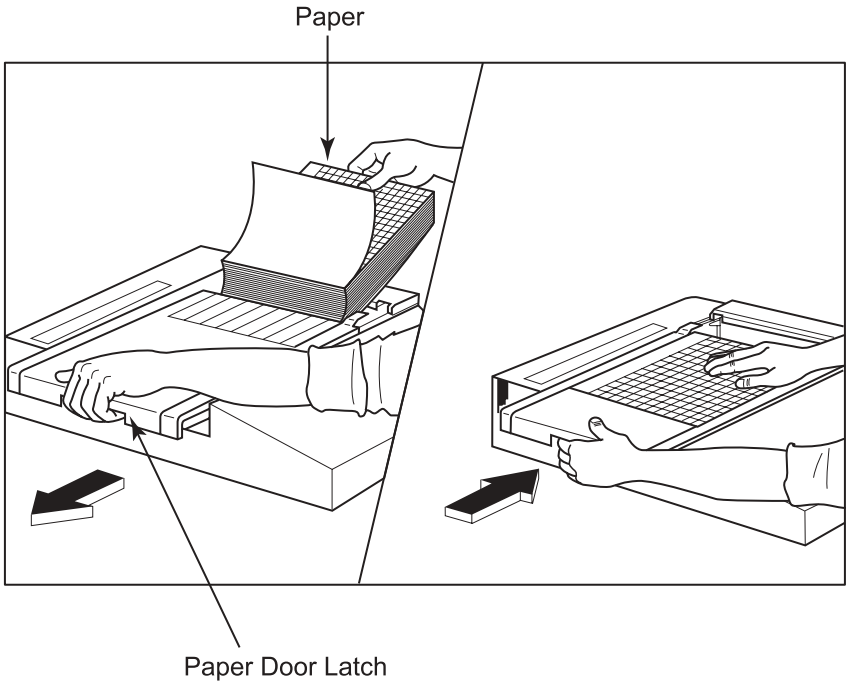
This chapter is intended to provide the user with:

- Equipment set-up procedures:
  - Load paper
  - Apply power
  - Set date and time
- Patient preparation and hook-up
- Real-Time ECG View

Equipment Set-Up

Two AC line fuses and one battery fuse are installed on your ELI 250.

To load paper:



❶ Remove the outer packaging from the paper stack.

❷ Facing the front of the unit, use the release latch on the left side and slide the paper tray cover to the left.

❸ Place the stack of thermal paper into the paper tray such that the grid side of the paper is up when it is pulled over the paper tray cover. The paper cue mark (a small black rectangle) should be in the lower left corner.

❹ Manually advance one page of paper beyond the closure point of the writer. Make sure the paper lays on the black roller evenly within the channel of the paper door. If paper is not manually advanced evenly, risk of jamming or queue faults increases.

❺ Slide writer cover to the right until the cover latches in a locked position. You will hear a sharp click when the door is properly latched.

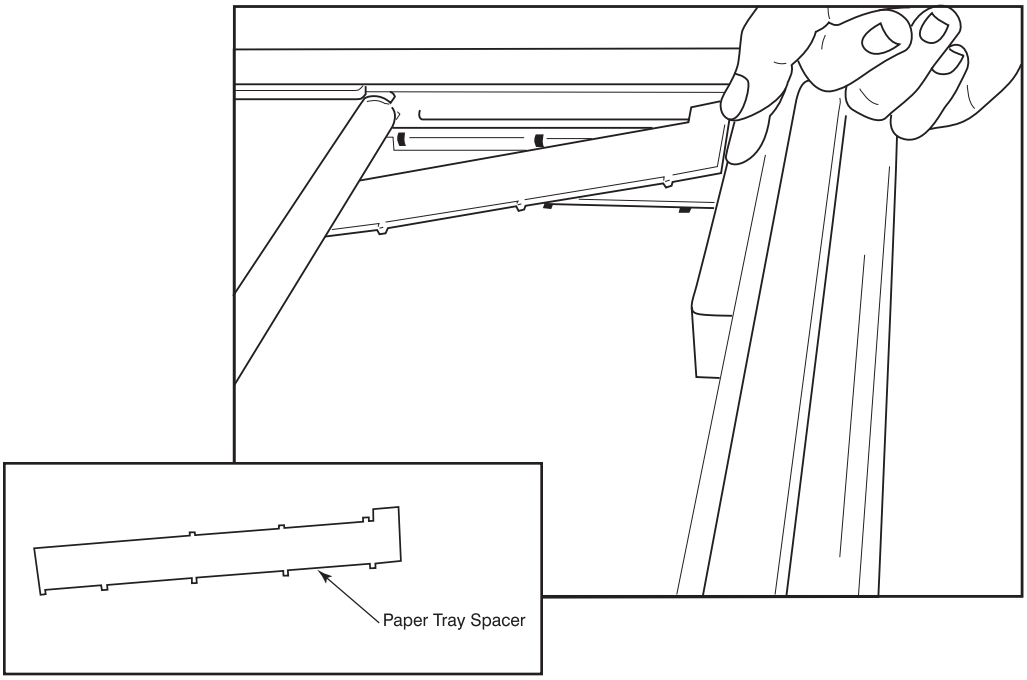
NOTE: *The paper tray spacer should not be inserted if using standard size paper.*

WARNING: *Risk of injury to fingers in writer paper door or platen drive mechnisms.*

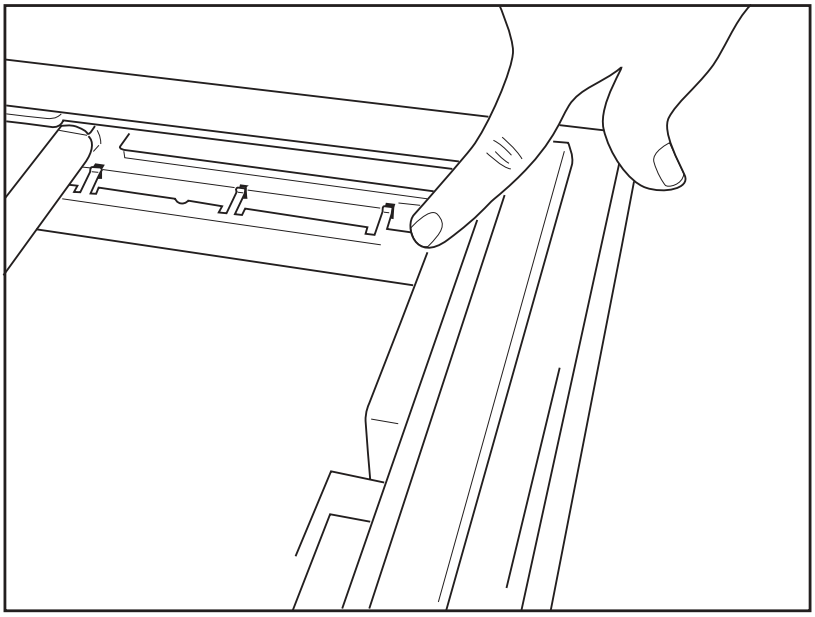
A4 paper users:

If your ELI 250 was ordered with A4 paper, the paper tray spacer will be inserted in the paper tray and the configuration option to use A4 paper will be set to YES. If units are purchased with standard paper, the paper tray spacer will not be provided.

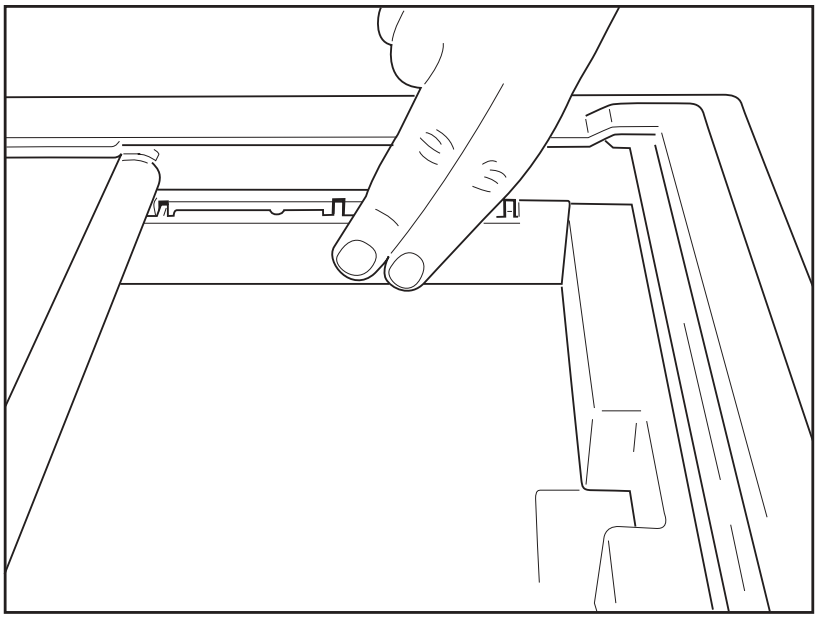
To insert the Paper Tray Spacer:



❶ Slide paper tray spacer towards rear wall of writer tray. Align the bottom four plastic arms with the four openings in the base of the writer tray. Similarly, align the top 3 plastic arms with the three openings on the rear wall of the writer tray.



❷ The paper tray spacer should be parallel with the rear wall of the writer tray, as pictured above.



❸ Gently press paper tray spacer in place.

❹ Set configuration option to use A4 paper. See section 3 for instructions.

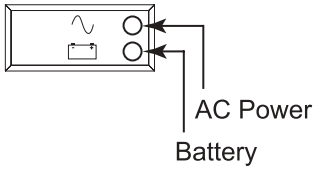
❺ Gently press on the top three plastic arms to remove the paper tray spacer.

To Apply Power to the Electrocardiograph:

❶ Plug the power cord into an AC wall outlet and into the back of the ELI 250. (Reference Figure 1-3). Unit powers on automatically and can not be turned off when AC is connected (unit is in Stand by Mode).

❷ If using battery power, press the power on/off button ⏻ located on the lower right side of the keyboard. (Reference Figure 1-5).

Indicators on the Keyboard will Illuminate as Follows:



The AC power indicator illuminates when unit is connected to mains (AC power).

The battery power indicator illuminates when charging and flashes when battery is low (below 11.0 V). The battery power indicator will turn off when the battery is fully charged.

The electrocardiograph should be connected to AC power for recharging whenever the unit is not in use.

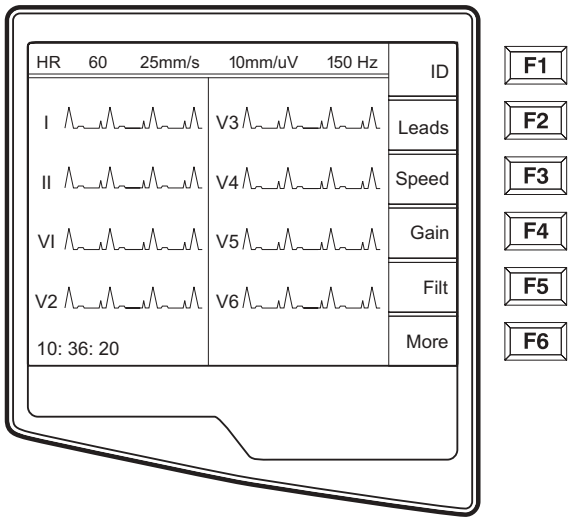
TIP: *Battery voltage is displayed at the bottom of Time/Date screen – see below.*

NOTE: *For typical usage, battery charging time should be approximately 8 hours or less.*

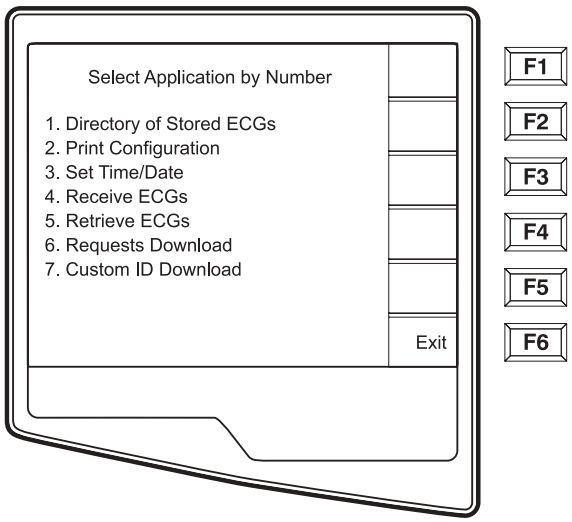
CAUTION: *When the battery charge is depleted to its lowest level (9.5V), the unit will automatically power down. To recharge a battery from its lowest level, 30 hours of recharging without operation will be necessary. Routinely discharging a battery to this level will severely shorten the life of the battery.*

To Set the Time/Date and LCD Contrast:

❶ Select **More** (**F6**) from the Real-Time ECG View.

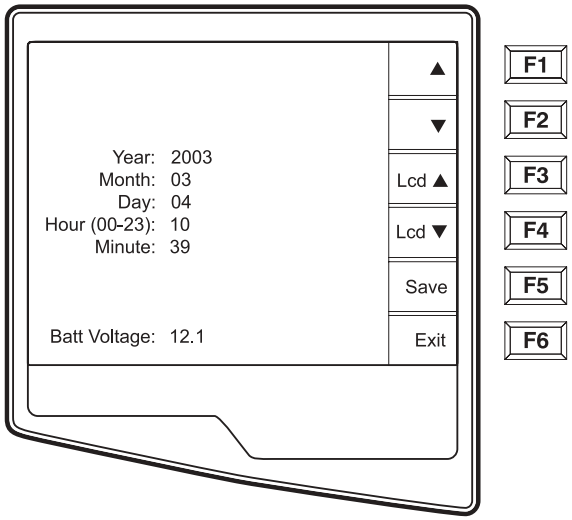


❷ Select number **3** (**Set Time/Date**) from the Application menu.



❸ The preprogrammed date and time is displayed for the ELI 250. To make changes, type in the desired date and time values (using a 24-hour clock) in the same format as displayed. Use (**F1**) and (**F2**) to move back and forth through each row.

TIP: *Use the* ***BACKSPACE*** ← *key to erase entry errors.*



❹ Select **Save** (**F5**) to save changes before exiting.

❺ Select **Exit** (**F6**) to return to Real-Time ECG View. If you did not save before selecting Exit, any changes made to the Time/Date will be lost.

NOTE: *LCD contrast can be adjusted by selecting* **Lcd** *(***F3***) or* **Lcd** *(***F4***).*

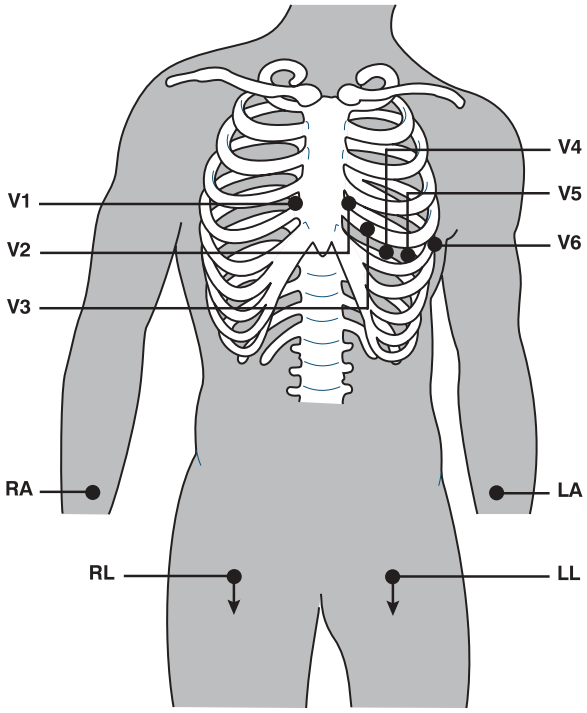
TIP: *The battery voltage value is displayed at the bottom of this screen.*

Patient Preparation

Correct electrode placement is important for acquiring a successful ECG (see Patient Hookup below). Consider performing some patient preparation procedures to remove oils, lotions, and hair from the skin. Optimal skin preparation includes exposing skin on hairy areas, scratching with abrading pad, wiping with alcohol and a dry gauze pad.

> ***TIP:*** *Electrodes should be stored in an air-tight container. Electrodes will dry out if not stored properly which will cause loss of adhesion and conductivity.*

Patient Hookup

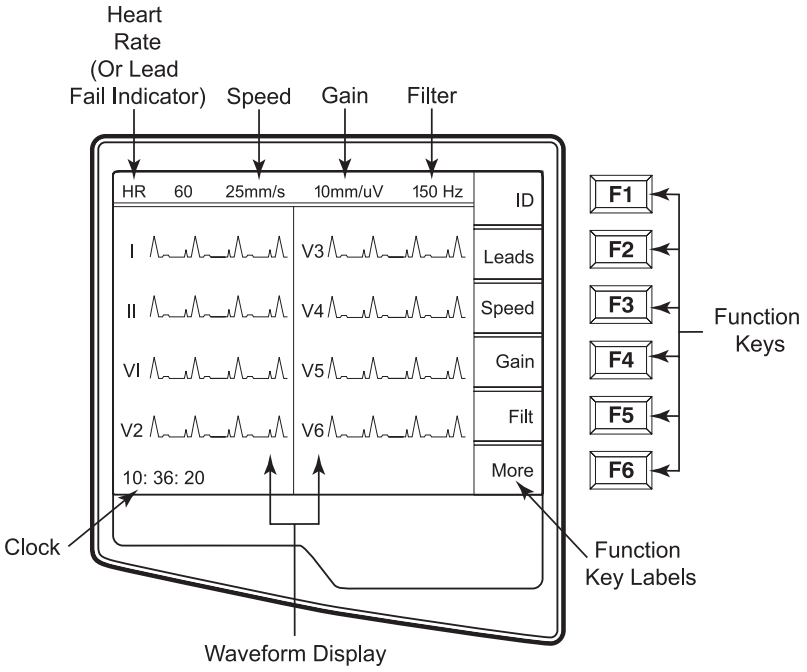


V1	Fourth Intercostal space at the right sternal border
V2	Fourth Intercostal space at the left sternal border
V3	Midway between V2 and V4
V4	Fifth intercostal space at the left of the midclavicular line
V5	Anterior axillary line at same horizontal level as V4
V6	Mid-axillary line on same horizontal level as V4 and V5
RA	Right deltoid or wrist
LA	Left deltoid or wrist
RL	Right thigh or ankle
LL	Left thigh or ankle

Real-Time ECG View

The ELI 250 LCD display offers the user valuable information including waveform display, function keys and parameters (leadfail messages, clock, filter, etc.). Detailed descriptions of the Real-Time ECG View are offered in section 4.

> ***NOTE:*** *Regardless of the display, function keys always correspond to the LCD label adjacent to each function key.*



SYSTEM SETTINGS

Chapter Purpose

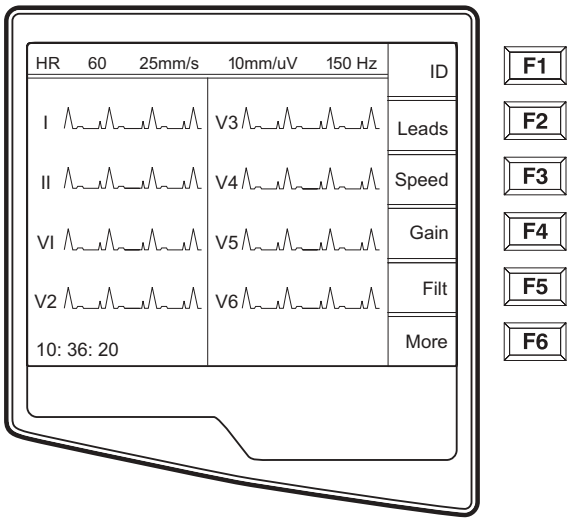
This chapter is intended to provide the user with:

- Instructions to access configuration menus
- Summary of configuration options
- Detailed descriptions of configuration settings

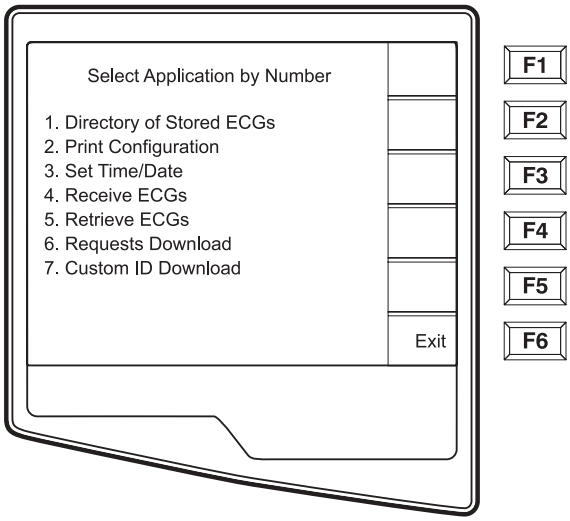
Access Configuration Menus

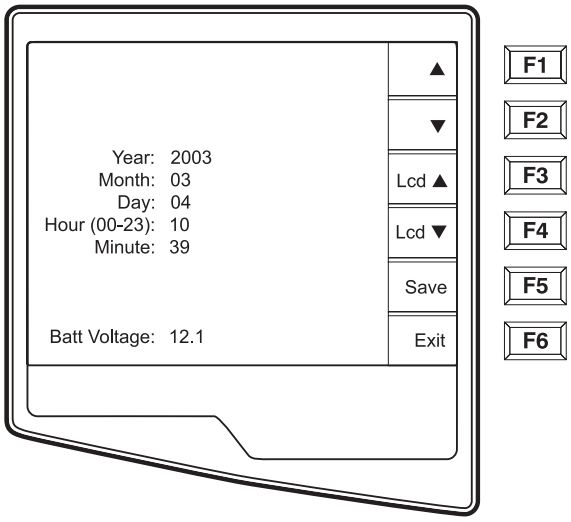
The configuration pages define all ELI 250 operational conditions that do not change on a daily or patient-to-patient basis. Once you set these default conditions, you will rarely need to use the configuration screens again. When you apply power to the ELI 250, it will operate according to the settings you have selected. To access the configuration menus:

❶ Select **More** (**F6**) from the Real-Time ECG View.

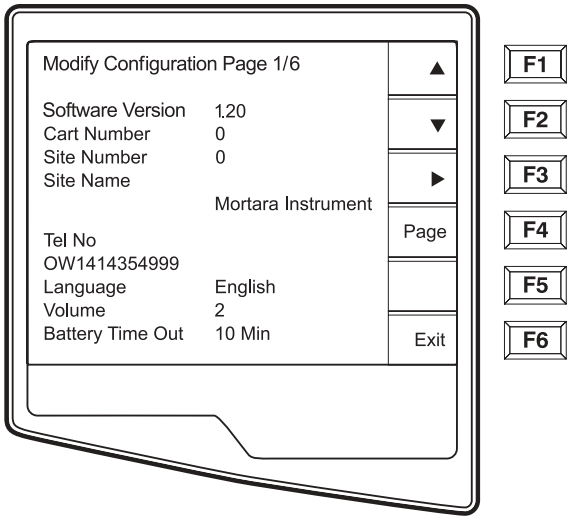


❷ Select **Set Time/Date** (number **3**) from the application menu





❸ 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.



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.

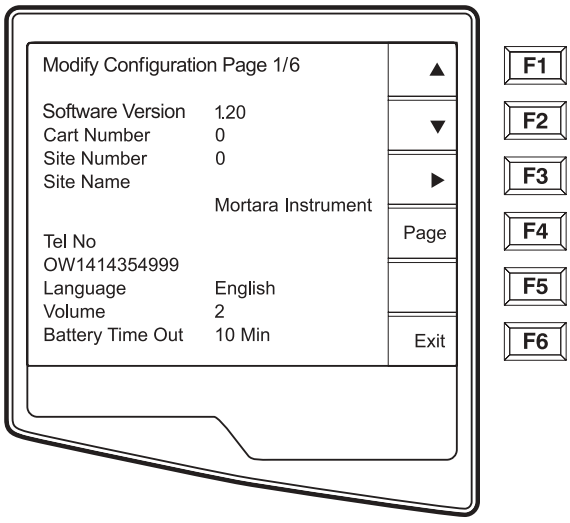
Summary of Configuration Menus

Configuration Parameter	Definition	Configuration Screen
Software Version	The firmware version of the unit	Screen One
Cart Number	User-defined (6 digits)	Screen One
Site Number	User-defined (4 digits)	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	10min, 30min, 60min	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	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
Plot Format	Channels printed: 3+1, 6, 3+3, 12, 6+6; Cabrera or Standard	Screen Two
Interpretation	Yes or No	Screen Two
Reasons	Yes or No	Screen Two
Append	Unconfirmed report	Screen Three
#of copies	0 - 9	Screen Three
#ECGs retrieved	0 - 9	Screen Three
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
Use A4 paper	Yes or No	Screen Three
Caps Lock	Yes or No	Screen Three
Rhythm Format	3 channel, 6 channel or 12 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

Summary of Configuration Menus (Continued)

Configuration Parameter	Definition	Configuration Screen
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
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 Four
Default XMT Media	RS232, Modem, WLAN, LAN, external modem	Screen Six
Barcode Reader	Yes or No	Screen Six
DHCP	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
SSID	Yes or No	Screen Six
Channel Number	0, 1, 2, 3	Screen Six
Security WEP	Yes or No	Screen Seven
WEP Key	0, 1, 2, 3	Screen Seven
WEP Key ID	26 digits in 13 sets of two digits	Screen Seven

Configuration Page 1



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 250. Site numbers designate the hospital, clinic, or institution for ECG records stored in a Mortara Instrument E-Scribe data management system and must 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.)

> ***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 telephone 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

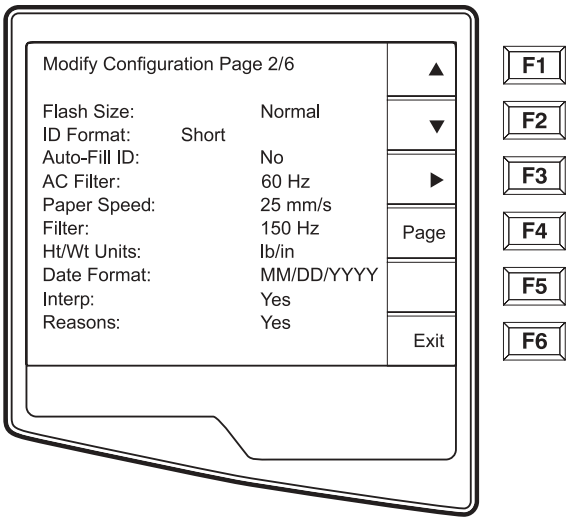
This option defines the keyboard click loudness. Available settings rage from 0 (off) to 8 (loud).

> ***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



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 Mortara E-Scribe Data Management System, can be downloaded to the ELI 250. 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 and if the records belong to the same site.*

AC Filter

The ELI 250 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 Section 4 to change speeds for display or rhythm printing.

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.

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 250 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.

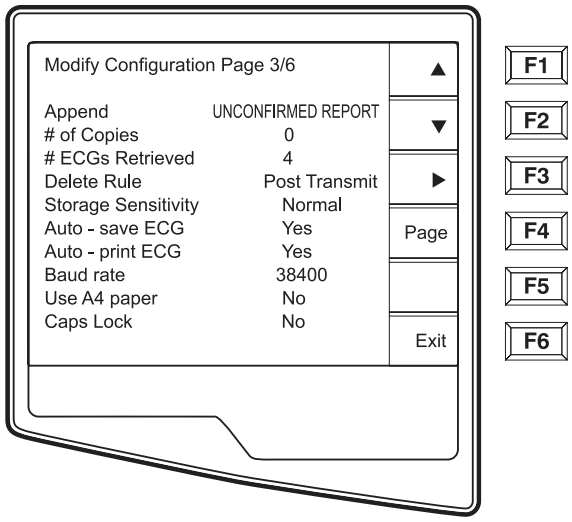
> ***NOTE:*** *A qualified physician should review the computer generated ECG interpretation before the treatment of any patient.*

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



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 nine (9) 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 250 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 250 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 250 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 250 and another Mortara cardiograph, and 38400 bps for a direct connection to the E-SCRIBE data management system.

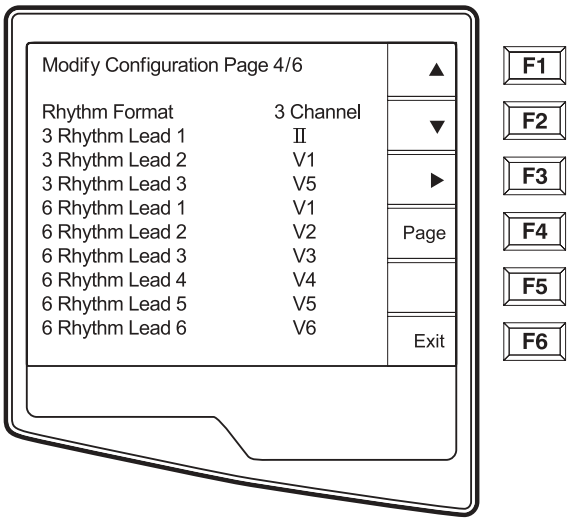
Use A4 Paper

The ELI 250 accommodates use of Z-fold thermal paper in either the letter size (8.5 x 11 inches; 216 x 279 mm) or the "A4" size (8.27 x 11.69 inches; 210 x 297 mm). The provided paper tray spacer is required for use with A4 size paper. Enable this configuration option for A4 printing. The paper tray spacer should not be inserted if the letter size paper is used.

Caps Lock

All character entry is translated to upper case.

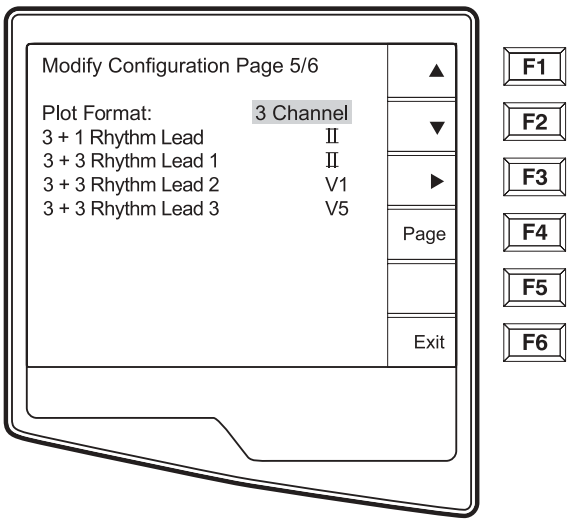
Configuration Page 4



Rhythm Formats

Configuration page four defines the default values for rhythm printing. It is possible to set a 3-channel, 6-channel or 12-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 five 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).
6	5 seconds of 12-leads in a six-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.
12	10 seconds of 12 leads in a 12 channel format
6+6	10 seconds of 12 leads in a 2 page printout (six channels per page)

Rhythm Leads

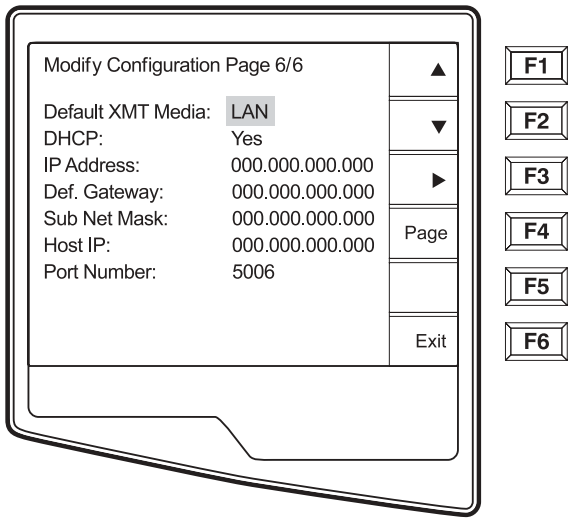
Configuration page four five also identifies the user-selectable 10-second rhythm lead printed in a 3 + 1 channel ECG printout and the three 10-second rhythm leads for the 3+3 channel ECG printout. Use (F3) to make your selection of any of the 12 leads.

NOTE: *Rhythm acquisition is not stored in memory, only printed.*

NOTE: *See section 4 to acquire a rhythm printout.*

Configuration Page 6 (optional LAN connectivity)

The ELI 250 connectivity options are RS232 (or direct), modem, LAN or WLAN. Configuration parameters associated with each type of transmission media will be presented in configuration pages six and seven only if those media are installed in the cardiograph.



Default XMT Media

Configuration page 6 identifies the default transmission media. Those connectivity options which have been optionally purchased and installed (RS232, modem, LAN or WLAN) in your ELI 250 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 250 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

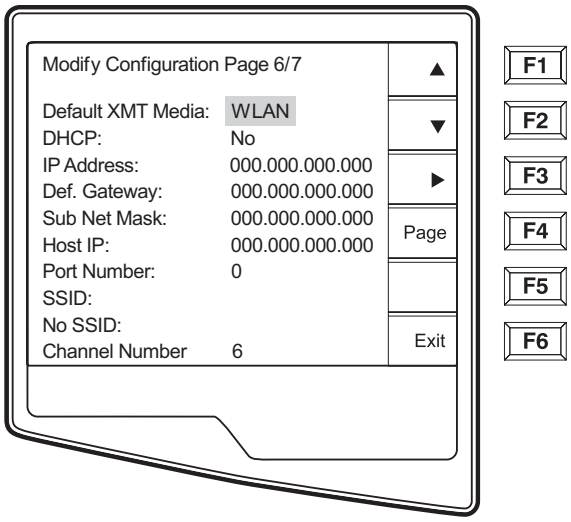
Enter the IP address of the host server.

> ***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 250 as 192.168.000.007.*

Port Number

Enter the port number used by the host server.

Configuration Page 6 (optional WLAN connectivity), (Continued)



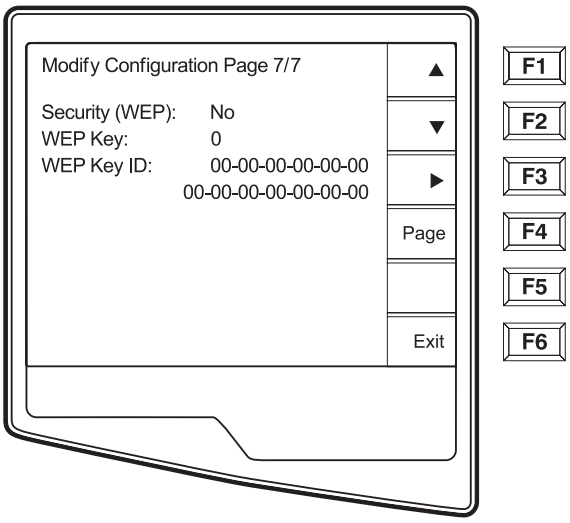
SSID

Service Set Identifier (SSID) is the name of the wireless network. All ELI 250 electrocardiographs that will transmit to the same network must have the same SSID name. This field is case sensitive.

Channel Number

This defines the channel used by the radio to search for the network. The exact channel number varies according to which type of wireless network is used and the country in which you install the WLAN. When moving from one area to another, the ELI 250 WLAN card will automatically scan for the channel of the closest access point.

Configuration Page 7 (optional WLAN connectivity), (Continued)



Security (WEP)

Wired Equivalent Privacy (WEP) is an encrypted security protocol, part of the 802.11 standard, and is used to protect the network from unauthorized users. The IT Manager will provide the 26 HEX digits that are the same to be used by all access points on the network. Therefore, only devices with the proper WEP will be able to login. The ELI 250 adopts a 128-bit encryption. Access points can have multiple WEP Keys stored. Each one of them is identified by a number (e.g., 0, 1, 2, 3).

WEP Key

Enter the WEP Key number (e.g., 0, 1, 2, 3).

WEP Key ID

Enter the 128-bit WEP Key ID value (26 digits in 13 sets of two digits).

RECORD AN ECG

Chapter Purpose

This chapter is intended to provide the user with:

- Display overview
- Overview of patient demographic entry
- Instructions to acquire an ECG
- Instructions to print an ECG
- Instructions to store an ECG
- Rhythm printouts

Display Overview

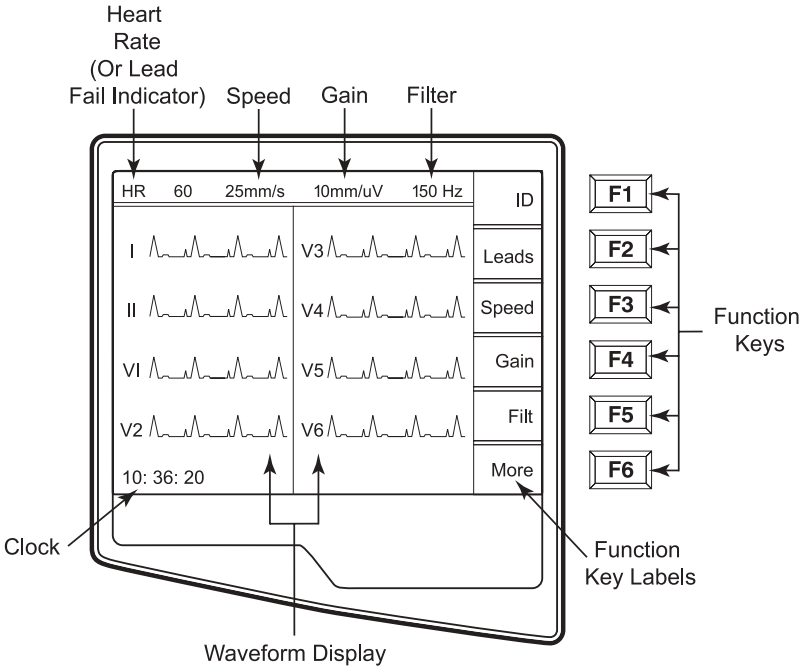
The ELI 250 features a 320 x 240 pixel LCD display for valuable preview of ECG waveform, function key labels and other parameters as explained below:

- Heart Rate: When a patient is connected to the cardiograph, his/her heart rate is displayed in real-time. The heart rate is the average ventricular rate measured over an average of the patient's last five beats.

  NOTE: *If a lead fail occurs, an indicator flashes in this location.*

- Speed: Use **Speed** (**F3**) to select one of the various options for display speed or rhythm printout speed: 5mm/s, 10mm/s, 25mm/s, 50mm/s.

  NOTE: *ECG paper speed is configured in page two of the configuration menus. (See section 3). Paper speed is printed at the bottom-right corner of the ECG printout*



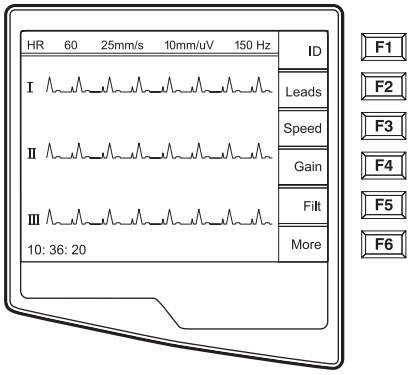
- Gain: Use **Gain** (**F4**) to select waveform amplitude for display and printout: 5mm/mV, 10 mm/mV, 20 mm/mV. Gain is printed at the bottom-right corner of the ECG printout.

- Filter: Use **Filt** (**F5**) to select the low-pass filter options: 40Hz, 150Hz, 300Hz for ECG printouts.

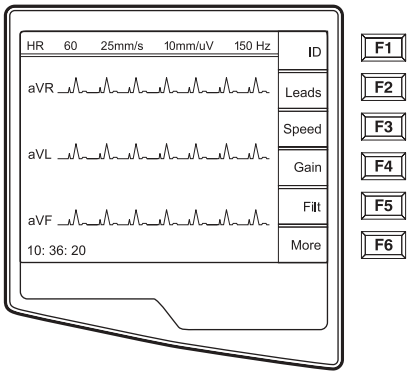
- Clock: Time display with hour, minutes and seconds resolution. (See section 2 for setting a new date and time). When the ECG is acquired, the time displayed is the printed ECG acquisition time.

Function keys always activate the corresponding LCD label adjacent to each key. LCD function key labels change according to the ECG view - the Real-Time ECG View is pictured below and the Acquired ECG View is described later in this section.

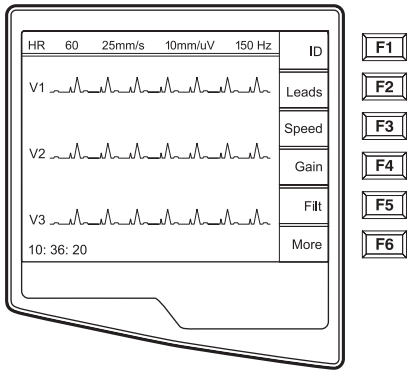
Toggle through the available waveform display formats by selecting **Leads** (**F2**). Waveforms are displayed in the following formats:



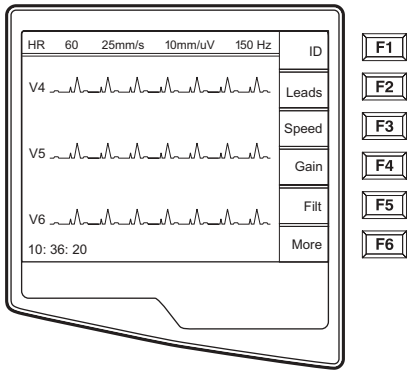
5 seconds of leads I, II, III



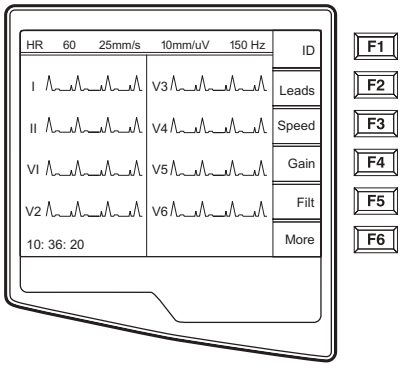
5 seconds of leads aVR, aVL, aVF



5 seconds of leads V1, V2, V3



5 seconds of leads V4, V5, V6

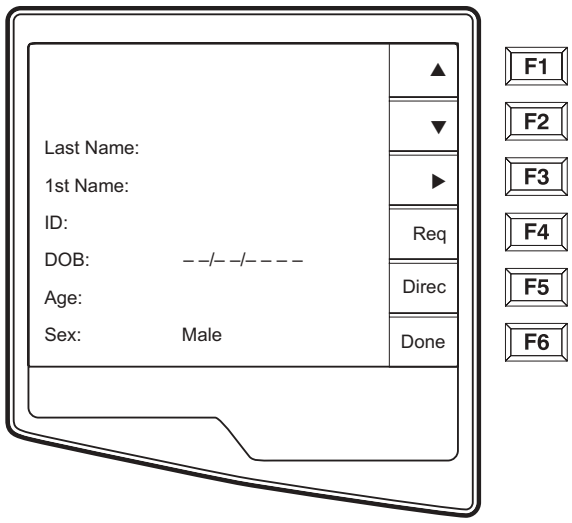


2.5 seconds of leads I, II and V1-V6
(default display – only available in Real-Time ECG View)

Patient Demographics

You may enter patient demographic information before acquisition. The entered patient ID fields will remain populated until you acquire the ECG. However, when you disconnect the leads from the patient, turn off the cardiograph, or change a configuration setting before acquisition, the entered patient demographic information will be cleared for you to enter the demographics of your next patient.

To access the patient demographic data entry menu, press **ID** (**F1**) from the Real-Time ECG View. The patient demographic labels available are determined by the ID format selected in the configuration settings. The short ID format is pictured below:



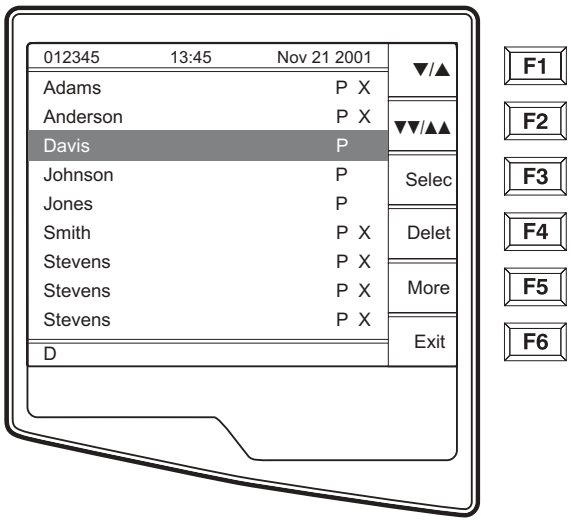
NOTE: *If a Custom ID has been downloaded to the ELI 250, Custom demographic labels will appear as it was designed in your E-Scribe data management system. See Appendix A for more details.*

Patient demographic entry can be completed manually for a new patient or automatically from an existing patient record in the directory. Manually enter the patient demographics and use **Enter**, **Tab** or **F1** (▲) and **F2** (▼)to move to each data entry field. Skipped fields will appear as a blank field on the header of the ECG printout.

TIP: *Type the letter* **F** *to change the gender to female or type the letter* **M** *to change the gender to male.*

To automatically populate the demographics of an existing patient, select the desired patient from the directory by selecting **Direc** (**F5**) from the ID screen.

The patient directory (sorted by name) is pictured below.



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 select a patient name, use the keyboard to enter the first letter of the last name. Once the desired name is highlighted, press **Selec** (**F3**) and the patient ID screen will return with all demographic fields populated. Return to Real-Time ECG View by selecting **Done** (**F6**).

> ***TIP:*** *Automatically populating demographic fields via the directory is only possible when the ID formats match.*

If the Auto-Fill ID is enabled in the configuration, 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 possible when the ID formats are the same between records.*

When time is of the essence or if patient demographics are not available, ID information can be added to the ECG after it has been acquired via the patient directory. Acquiring an emergency or unidentified ECG is explained below.

In addition to the Short, Standard or Long patient ID format, the ELI 250 also supports a Custom ID format. The custom format, which is designed in the E-Scribe data management system, can be downloaded to the ELI 250. Additional information about the Custom ID is described in Appendix A.

ECG Acquisition, Printing, Storage

Acquisition

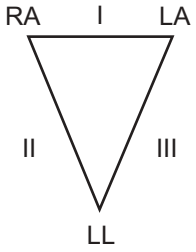
When a patient is connected to the electrocardiograph, the ELI 250 is continuously collecting and processing the ECG data; therefore, you should first instruct the patient to relax in a recumbent position to ensure that the ECG is free from noise and artifact due to patient activity before you press the **Auto ECG** or **Auto RHY** key.

To acquire an emergency ECG or unidentified ECG for a new patient press the **Auto ECG** key 

. The Real-Time ECG View is replaced with the patient ID menu. Select **Enter** or **Done** (**F6**) and the ECG is acquired. "Collecting 10 seconds of data" is displayed on the top of the LCD and "captured, analyzed, formatted" is displayed on the bottom of the LCD. The Real-Time ECG View is then replaced with the Acquired ECG View. To add patient demographics, select the record from the directory and select **ID** (**F1**).

When workflow permits patient demographic entry prior to acquisition, connect the patient to the ELI 250 and enter the patient identification information as explained above. After you complete the last data entry field select **Done** (**F6**) to return to the Real-Time ECG View.

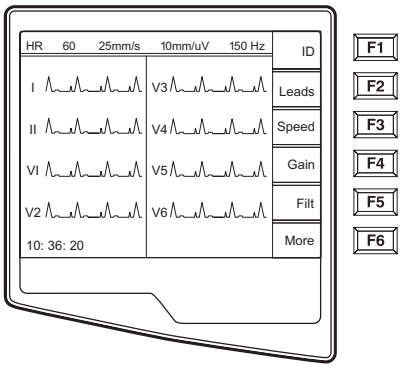
Examine the display for artifact (noise), or baseline drift. Re-prep and replace electrodes if necessary to obtain satisfactory waveforms. (See Patient Preparation, in Section 2). If a lead fail condition exists square waves appear on the display for that lead and the lead in fault displays in the upper-left corner of the screen (one at a time). This is to alert the operator of a lead fail condition. When the problem is corrected, the ELI 250 waits for 10 seconds of good data before analyzing the ECG. Please refer to the following troubleshooting guide based on Einthoven's Triangle:



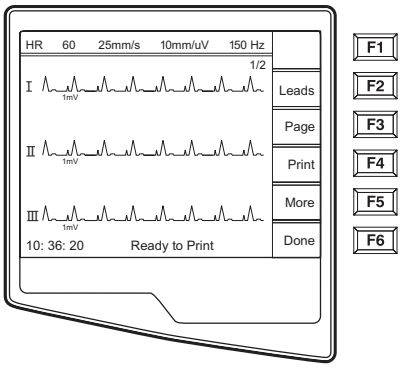
Artifact	Check Electrode
Lead II and III artifact	Poor LL electrode
Lead I and II artifact	Poor RA electrode
Lead I and III artifact	Poor LA electrode
V Leads	Re-prep site & replace electrode

Finally, select the **Auto ECG** key 

. The Real-Time ECG View is then replaced with the Acquired ECG View. The default Real-Time ECG View (as pictured below) is not available in the Acquired ECG View for navigation purposes.



Real-Time ECG View



Acquired ECG View

NOTE: *New softkey labels are available in the Acquired ECG View.*

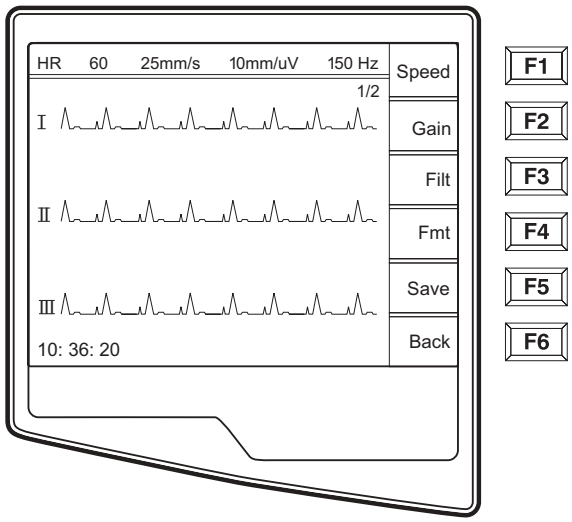
NOTE: *Functions are not available during acquisition.*

Printing

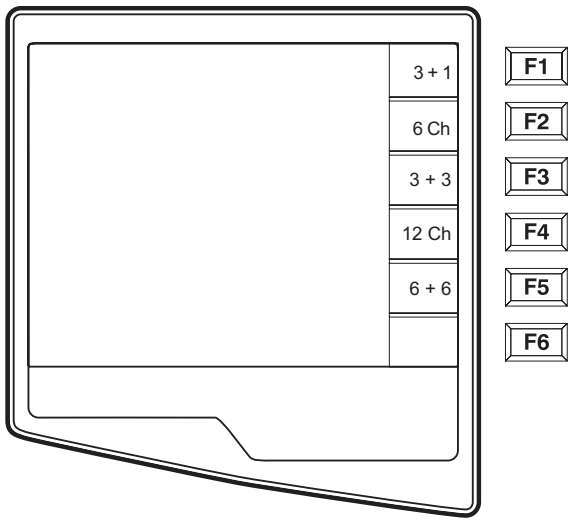
If the auto-print configuration option is enabled, an ECG is printed following acquisition. Regardless of the auto-print configuration setting, a manual printout is possible from the Acquired ECG View by selecting **Print** (**F4**).

Toggle through the available Acquired ECG View waveform formats by selecting **Leads** (**F2**). A preview of the full 10-seconds of ECG waveform is available. The first 5 seconds of waveforms are displayed (page 1 / 2 is displayed in the upper right corner) and by selecting **Page** (**F3**), the last 5 seconds of waveform are displayed (page 2 / 2 is displayed in the upper right corner). If the auto-print configuration option is disabled, the 10-second preview assists in ensuring a quality ECG acquisition prior to printing. When you acquire an ECG, the cardiograph captures the previous 10 seconds. The relationship between the display and the printout is the same – what is displayed in the ECG Acquisition View is what will be printed.

In order to change the speed, gain, filter, or printout format in the Acquired ECG View, select **More** (**F5**). The function key labels change as follows:



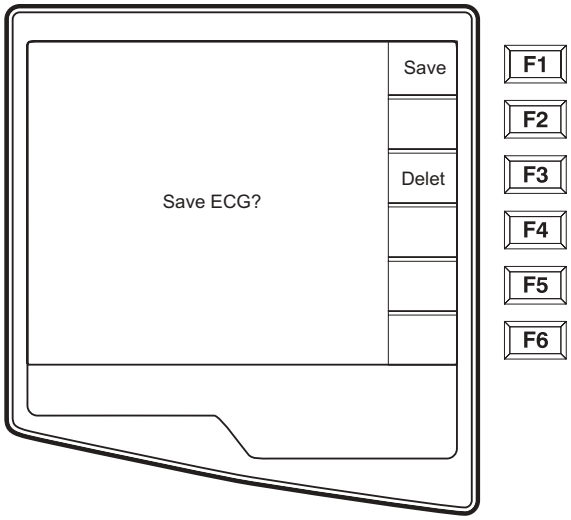
To manipulate the print format of the acquired ECG, regardless of the plot format configuration setting, select **Fmt** (**F4**). The following function keys become available:



Select the function key corresponding to the desired print format. The Acquired ECG View is then displayed and to make an ECG printout copy in the new plot format; select **Print** (**F4**). Select **Done** (**F6**) to return to the Real-Time ECG View.

Storage

The ELI 250 manages storage in one of two ways – automatically or manually. When the Auto Save configuration option is enabled, ECGs are automatically saved upon acquisition and printing. However, when the Auto Save configuration option is disabled, upon completion of acquisition, a prompt is presented as follows and saving the ECG record is at the user's discretion.



NOTE: *If Auto Save is enabled, but the ECG is not printed, the user is prompted to save.*

TIP: *Manual Save is possible by selecting* **More** *(***F5***) and* **Save** *(***F5***) in the Acquired ECG View.*

Acquiring Rhythm Strips

Rhythm strips are printed in the format defined in the configuration (3-channel, 6-channel, or 12-channel). See section 3 for instructions to configure rhythm leads.

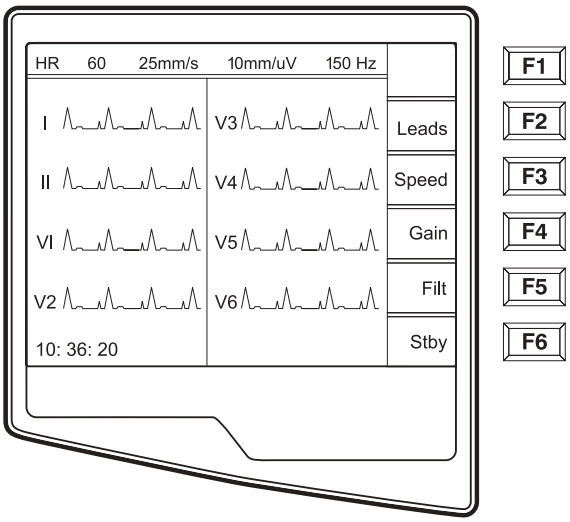
Begin routine rhythm strips by connecting the patient to the ELI 250 and entering the patient identification information as described in this section. After the last data entry field from the ID menu is completed, select **Done** (**F6**) to return to the Real-Time ECG View. Select the **RHY** key 

to begin rhythm printing.

NOTE: *Rhythm printouts are only possible from the Real-Time ECG View.*

NOTE: *Rhythm acquisitions are only printed and not stored in the electrocardiograph.*

The Rhythm Activity Screen appears as soon as the writer begins printing the rhythm strip. Notice, the waveform display format is similar to the Real-Time ECG Screen; however, new functions keys are available during rhythm printing.



In addition to manipulating **SPEED**, **GAIN**, **FILTER** during rhythm printing, the user may also toggle different lead groups. When the default rhythm format is set to either 3-channel or 6-channel, you may change lead groups during printing by selecting **LEADS** (**F2**). The change in lead groups is apparent on the printout whereas the waveform display will remain in the default display of 2.5 seconds of leads I, II and V1-V6.

During 3-channel rhythm printing, the available lead groups are:

1. Default (user-selected in configuration)
2. I-II-III
3. aVR, aVL, aVF
4. V1-V2-V3
5. V4-V5-V6

During 6-channel rhythm printing, the available lead groups are:

1. Default (user-selected in configuration)
2. I-II-III-aVR-aVL-aVF
3. V1-V2-V3-V4-V5-V6

During 12-channel rhythm printing, switching lead groups is not available.

During rhythm printing, you may place the writer in standby mode, **STBY** (**F6**). To continue rhythm printing for the same patient, without advancing to a new page, select **CONT** (**F6**).

To stop the rhythm printing, press **Stop** 

and the writer will automatically form feed in preparation for a new patient's rhythm recording or ECG.

Optional Barcode Scanner

Mortara's optional barcode scanner is purchased separately. By connecting the barcode scanner to the electrocardiograph's RS232 (serial port) all aspects of acquiring an ECG are automated for speed and accuracy of alpha-numeric entry, functions and feature processes.

In order to map the function and feature keys of the electrocardiograph to a desired barcode font, the following values and/or symbols must be available:

Feature Keys	Value	Function Keys	Symbol
AUTO 12 ECG Acquisition	2	F1	[
RHY Rhythm Printing	3	F2	\
XMT Transmitting	4	F3	]
STOP Stop	5	F4	_(underscore)
		F5	{
		F6	}

NOTE: *the ELI software will ignore* **Enter** *(carriage return) as part of a barcode; please use* **F2** *(\) instead.*

Please reference the Barcode Scanner User Manual for instructions for set-up and use.

SPECIAL FUNCTIONS

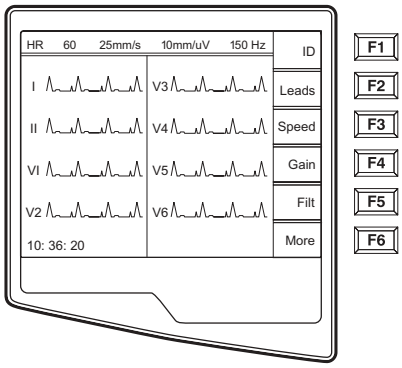
Chapter Purpose

This chapter is intended to provide the user with:

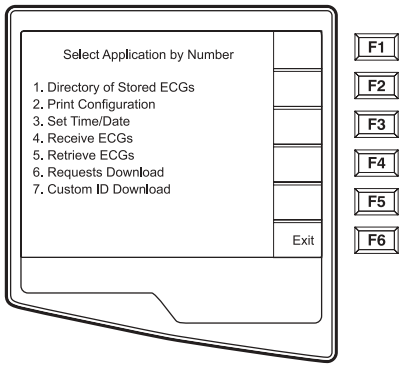
- Summary of the Special Functions
- Patient Directory & Directory Maintenance
- Configuration Printouts
- Set Time & Date

Application Menu

The ELI 250 offers several special functions available through the Application menu. Select **More** (**F6**) from the Real Time ECG View and the Application Menu is displayed.



Real Time ECG View



Application Menu

NOTE: *Function Keys activate the LCD label adjacent to each function key. If the label is blank, the adjacent function key is deactivated.*

TIP: *Select Applications by using the numeric data entry keys.*

The following chart summarizes the application functions available. Descriptions of the Applications are detailed later in this section, following the summary chart.

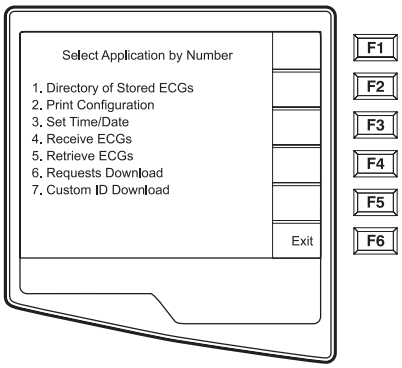
Application	Definition
Directory of Stored ECGs	Patient list of ECGs stored in the internal memory
Print Configuration	Printout of the configuration settings
Set Time/Date	Current date and time; LCD Contrast
Receive ECGs*	Receive ECGs from another electrocardiograph – See Appendix A
Retrieve ECGs*	Retrieve ECGs from the E-Scribe – See Appendix A
Requests Download*	"Patient List" from E-Scribe – See Appendix A
Custom ID Download*	Custom-designed patient demographic format – See Appendix A

*Appendix A details the ELI 250 connectivity options.

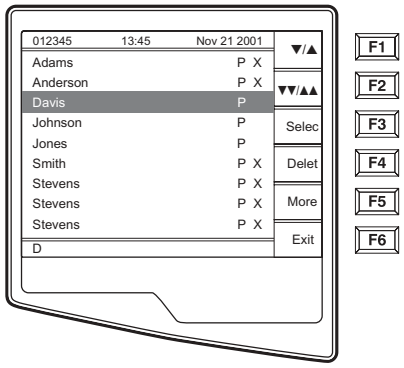
Patient Directory

The standard patient directory saves up to 60 ECGs depending on the storage space required for individual record. The optional expanded memory permits up to 150 ECGs. The heart rate, storage sensitivity, and signal quality determine the ECG file size and ultimately how much memory is needed to store each record.

To access the directory of stored ECGs, select number **1** from the Application menu and the patient directory list is displayed.



Application Menu



Patient Directory (sorted by name)

NOTE: *In the patient directory list, "***P***" represents the record has been printed, "***X***" represents the record has a delete status, and "***T***" represents the record has been transmitted.*

Management of the ECG record is performed within the directory of stored ECGs. The desired record must be highlighted in order to view, print, edit or add demographics, and to change delete status.

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.

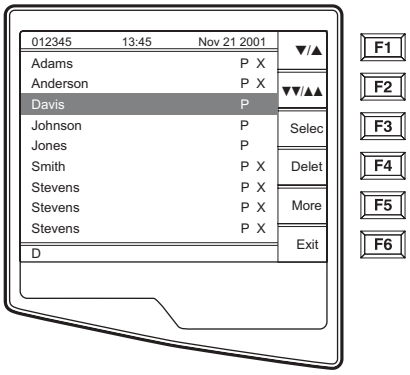
An ECG may be listed in the directory but have a "deleted status" (indicated by "X"). The directory saves those records that have been marked for deletion in the event that you may want to recover the ECG at a later time. All stored ECGs will remain in the directory until it becomes full, at this time, the ELI 250 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 in the configuration. To manually mark an ECG record for deletion, press **Delet** (**F4**) and an "X" will appear. To remove the delete status, select **F4** again.

NOTE: *Only when the directory becomes full, ECGs that are marked for deletion are automatically removed from the directory based on their record size to make room necessary for the new ECG record.*

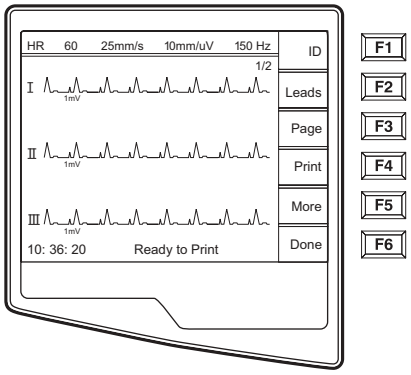
TIP: *Use the delete rule in the configuration settings to automatically define the ECG delete status. (See section 3).*

NOTE: *Record status symbols: X =deleted, P = printed, T=transmitted. When the directory is sorted by ID and Date status symbols are displayed on the top row of the LCD. If sorted by Name, symbols are displayed on the right hand column as pictured below.*

To view a specific ECG record, highlight the desired name from the directory list and press **Selec** (**F3**). The selected patient's ECG is presented in Acquired ECG View with the same functions available as previously described. To access the patient demographics screen, select **ID** (**F1**) to change or add patient information. Toggle through the available Acquired ECG View waveform formats by selecting **Leads** (**F2**) and **Page** (**F3**). To make an additional copy of the ECG, select **Print** (**F4**).



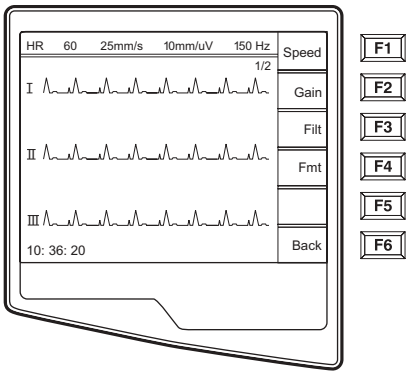
Patient Directory (sorted by name)



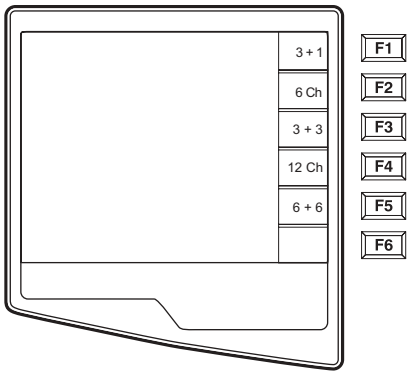
Acquired ECG View

NOTE: *To return to the Patient Directory, select* **Done** (**F6**) *from the Acquired ECG View.*

In order to change the speed, gain, filter, or printout format in the Acquired ECG View, select **More** (**F5**). The function key labels change as depicted below. To manipulate the print format of the acquired ECG, regardless of the plot format configuration setting, select **Fmt** (**F4**). Select **Done** (**F6**) to return to the Acquired ECG View.

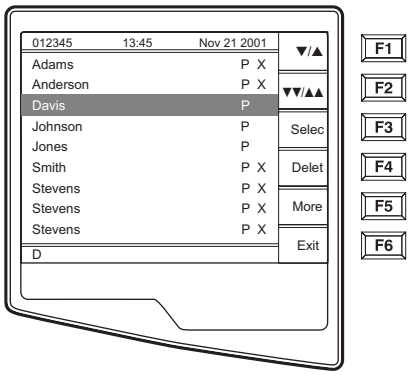


More (F5) from Acquired ECG View

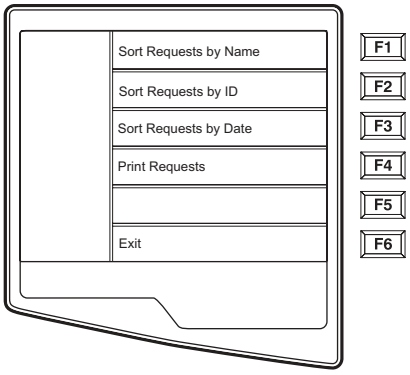


Plot Format (F4)

The directory of stored ECGs is easily sorted either by Name, ID, or Date. To sort the patient records, select **More** (**F5**) from the patient list.



Patient Directory (sorted by name)



Directory Organization

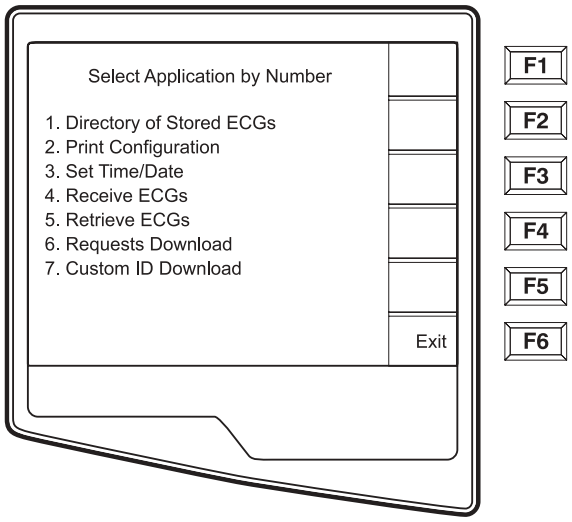
Select **F1** to sort the directory by patient name (ID, time & date are displayed on the top row)

Select **F2** to sort the directory by patient ID (name is displayed on the top row)

Select **F3** to sort the directory by acquisition date (name is displayed on the top row)

To make a printout of the patient directory, select **Print Directory** (**F4**). The directory lists stored ECGs based on how you have the directory sorted. The printout indicates if the ECGs have been printed, marked deleted, or transmitted (with an "X" in the appropriate column). **Exit** (**F6**) to return to the Patient Directory.

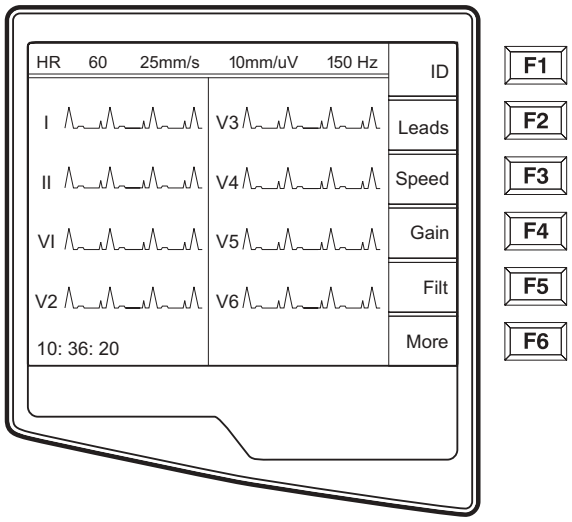
Print Configuration



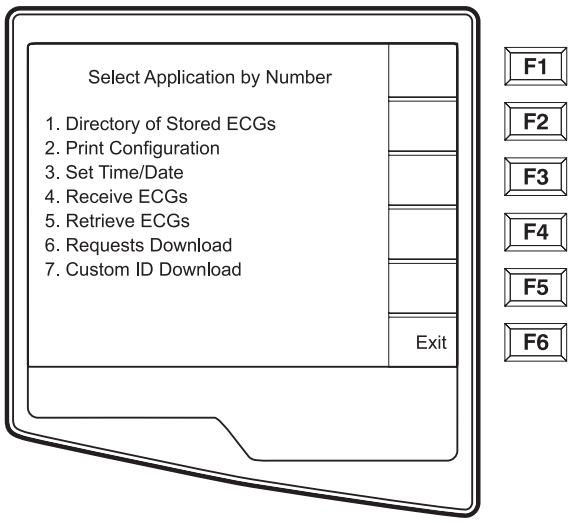
In order to verify the cardiograph's configuration settings, a printout of the unit's configuration is possible from the Application menu by selecting **Print Configuration** (**2**). The configuration printout obtains every configuration setting for the specific cardiograph, the firmware version, the cart number of the unit, and the date and time that the configuration printout occurred.

Set Time/Date and LCD Contrast

❶ Select **More** (**F6**) from the Real Time ECG View.

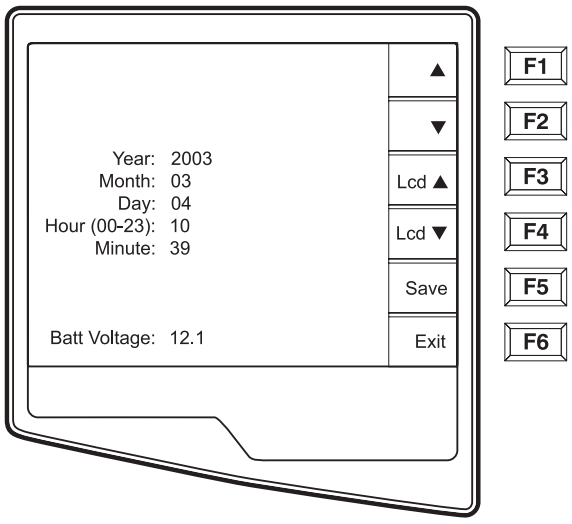


❷ Select **Set Time/Date** (number **3**) from the Application menu.



❸ The preprogrammed date and time is displayed for the ELI 250. To make changes, type in the desired date and time values (using a 24-hour clock) in the same format as displayed. Use (**F1**) and (**F2**) to move back and forth through each row.

TIP: *Use the* ***BACKSPACE*** ← *key to erase entry errors.*



❹ LCD contrast can be adjusted by selecting **Lcd** (**F3**) or **Lcd** (**F4**).

❺ Select **Save** (**F5**) to save changes before exiting.

❻ Select **Exit** (**F6**) to return to Real-Time ECG View. If you do not save before selecting exit, any changes you have made to the time/date will be lost.

TIP: *The battery voltage value is monitored at the bottom of this screen.*

APPENDIX A ELI 250 CONNECTIVITY

Chapter Purpose

This chapter is intended to provide the user with:

- Transmitting Records
  - Direct
  - Modem
  - WLAN
  - LAN
- ECG Receiving instructions
- ECG Retrieving instructions
- Requests Download
- Custom ID

Transmitting Records

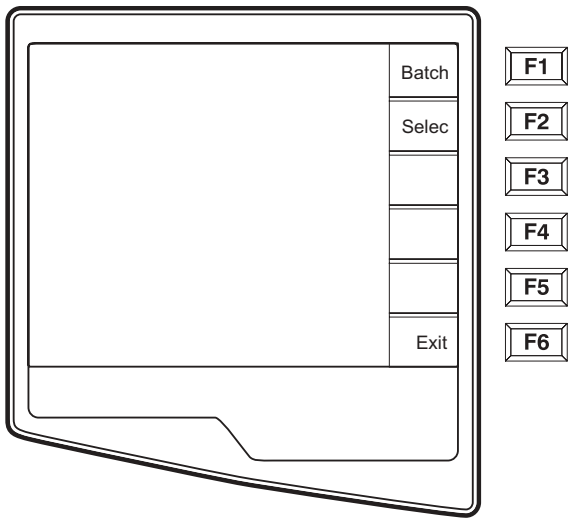
You may transmit ECGs from the ELI 250 to another Mortara Instrument electrocardiograph, to an E-Scribe Data Management System, or to ELI LINK using a direct connection, an optional factory installed internal modem, or network connection.

Before transmitting ECGs certain configuration options must be set depending upon the optional transmission media being used (see Section 3).

NOTE: *Telephone transmission is available with modem option only.*

To transmit records (either to another cardiograph, to ELI LINK or to E-Scribe), select **XMT** 

. The following screen is displayed:

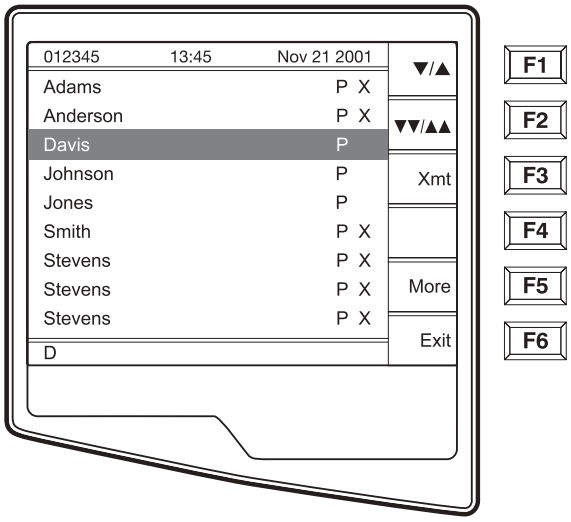


To batch transmit of all records in the directory, select **F1** (**Batch**). If a batch transmission is selected, only those records, which have not been previously transmitted or marked deleted, will be transmitted.

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 will automatically remove a record, based on its size, in order to make room for the new ECG. Only those records

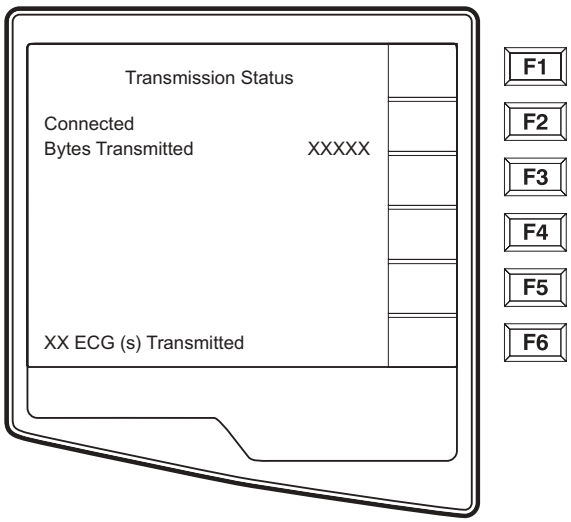
that have been marked for deletion will be removed. Records are automatically marked for deletion based on the Delete Rule configuration. To manually mark an ECG record for deletion, press **Delet** (**F4**) and an "X" will appear in the far right hand column of the directory and to remove the delete status, select **F4** again.

To transmit one ECG, select **F2** (**Selec**) 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** (**XMT**) 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.

Direct Connection

For a direct connection hookup, set the Default XMT media to RS232 from Configuration page 6 (see section 3 of this manual). Connect the ELI 250 to another Mortara Instrument electrocardiograph, to the E-Scribe, or to ELI LINK with a direct connect serial cable.

In the configuration setting, select matching baud rates for both units. Use 38400 bps for a direct connection to E-Scribe.

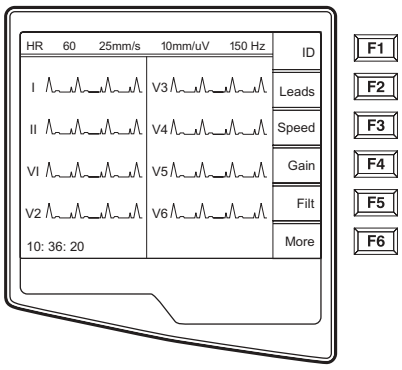
Modem Transmission

For a modem transmission, set the Default XMT media to Modem from Configuration page 6 (see section 3 of this manual). Connect the ELI 250 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 Section 3 of this manual).

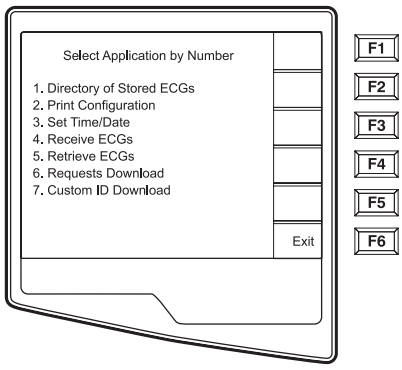
Modem Initialization

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.

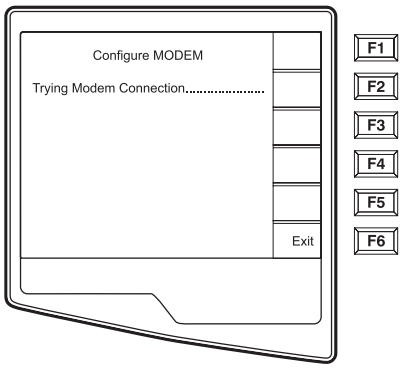


Real Time ECG View

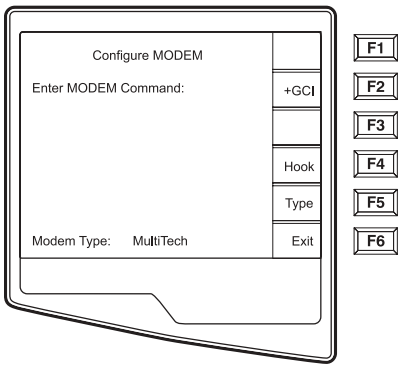


Application Menu

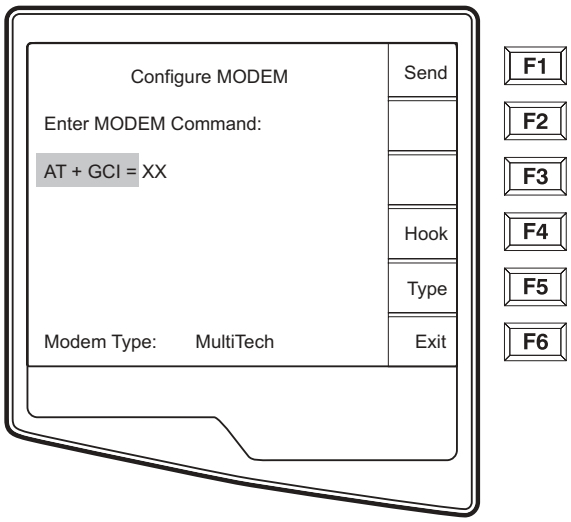
From the Application Menu, simultaneously press **ALT+SHIFT+M** to access the modem initialization string. The following screens appear:



Approximately 30 second delay



From the Configure Modem screen, select **F2** (**+GCI=**) to populate the prefix "**AT+GCI**" of the modem command.



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

The type of modem installed in your cardiograph is displayed at the bottom of the Configure Modem screen. Depending upon the type of modem, use the corresponding list below to enter your country code. Select **F1** (**Send**) to change your country code. "Sending . . ." and "Command stored" will be displayed. Select **F6** (**Exit**) to return to the Application Menu.

XIRCOM MODEM COUNTRY CODE LIST:

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

Blind Dialing for Xircom Modems

Using the ATX3 command may support specific countries where the "wait for dial tone" often causes dialing/telephone issues. Following the steps outlined above, access the Configure Modem Screen. Using the keypad, enter **ATX3**. Select **F1** (**Send**). The following status messages will be displayed:

"Sending…"
"Command Stored"
"Reading Status, please wait….."
The country code string will be displayed.

Press **F6** (**Exit**)

MulitTech MODEM COUNTRY CODE LIST:

Country	Code	Country	Code
Argentina	07	Italy	FD
Australia	09	Japan	00
Austria	FD	Korea	B5
Belgium	FD	Liechtenstein	FD
Canada	B5	Luxembourg	FD
China	B5	Mexico	B5
Cyprus	FD	Netherlands	FD
Czech Republic	FD	New Zealand	7E
Denmark	FD	Norway	FD
Finland	FD	Philippines	B5
France	FD	Portugal	FD
Germany	FD	Slovak Republic	FD
Greece	FD	Spain	FD
Hong Kong	99	Sweden	FD
Hungary	FD	Switzerland	FD
Iceland	FD	Taiwan	FE
Indonesia	99	United Kingdom	FD
Ireland	FD	United States	B5

External Modem

Before using the external modem, modem command(s) must be entered and two configuration settings must be defined. In the configuration, select "external modem" for the XMT Media and set the baud rate to 57600.

From the modem configuration screen, as described above, enter and send the initialization command as AT&FEQX4&K.

If a country specific code is necessary the following list of countries require "%T19,0,XX" to be added to the modem initialization string. Where "XX" is replaced by the country code number in the following table:

EXTERNAL MODEM COUNTRY CODE LIST:

Country	Code	Country	Code
Afghanistan	34	Canary Islands	34
Albania	34	Cape Verde	34
Algeria	34	Cayman Islands	34
American Samoa	34	Central African Republic	34
Andorra	34	Chad	34
Angola	34	Chile	34
Anguilla	34	China	34
Antigua and Barbuda	34	Colombia	34
Argentina	34	Congo	34
Armenia	34	Congo, The Democratic Republic of the	34
Aruba	34	Cook Islands	34
Australia	1	Costa Rica	34
Austria	34	Côte D'Ivoire	34
Azerbaijan	34	Croatia	34
Bahamas	34	Cyprus	34
Bahrain	34	Czech Republic	25
Bangladesh	34	Denmark	34
Barbados	34	Djibouti	34
Belarus	34	Dominica	34
Belgium	34	Dominican Republic	34
Belize	34	East Timor	34
Benin	34	Ecuador	34
Bermuda	34	Egypt	34
Bhutan	34	El Salvador	34
Bolivia	34	Equatorial Guinea	34
Bosnia and Herzegovina	34	Estonia	34
Botswana	34	Ethiopia	34
Brazil	34	Faero Islands	34
Brunei Darussalam	34	Fiji	34
Bulgaria	34	Finland	34
Burkina Faso	34	France	34
Burundi	34	French Guiana	34
Cambodia	34	French Polynesia	34
Cameroon	34	Gabon	34

Country	Code	Country	Code
Canada	34	Gambia	34
Georgia	34	Korea, Republic of (South Korea)	30
Germany	34	Kyrgyzstan	34
Ghana	34	Lao People's Democratic Republic	34
Gibraltar	34	Latvia	34
Greece	34	Lebanon	34
Greenland	34	Liberia	34
Grenada	34	Libya	34
Guadeloupe	34	Liechtenstein	34
Guam	34	Lithuania	34
Guatemala	34	Luxembourg	34
Guernsey, C.I.	34	Macau	34
Guinea	34	Macedonia, The Former Yugoslav Republic of	34
Guinea-Bissau	34	Madagascar	34
Guyana	34	Malawi	34
Haiti	34	Malaysia	30
Holy See (Vatican City State)	34	Maldives	34
Honduras	34	Mali	34
Hong Kong	30	Malta	34
Hungary	30	Martinique	34
Iceland	34	Mauritania	34
India	30	Mauritius	34
Indonesia	30	Mayotte	34
Iran	34	Mexico	34
Iraq	34	Moldova, Republic of	34
Ireland	34	Monaco	34
Isle of Man	34	Mongolia	34
Israel	,30	Montserrat	34
Italy	34	Morocco	34
Jamaica	34	Mozambique	34
Japan	10	Namibia	34
Jersey C.I.	34	Nauru	34
Jordan	34	Nepal	34
Kazakhstan	34	Netherlands	34
Kenya	34	Netherlands Antilles	34
Kiribati	34	New Caledonia	34
Kuwait	34	New Zealand	9
		Nicaragua	34
Niger	34	Swaziland	34
Nigeria	34	Sweden	34
Norway	34	Switzerland	34
Oman	34	Syrian Arab Republic	34
Pakistan	34	Taiwan	34
Palestine Territory, Occupied	34	Tajikistan	34

Country	Code	Country	Code
Panama	34	Tanzania, United Republic of	34
Papua New Guinea	34	Thailand	34
Paraguay	34	Thaiti	34
Peru	34	Togo	34
Philippines	30	Tonga	34
Poland	30	Trinidad and Tobago	34
Portugal	34	Tunisia	34
Puerto Rico	34	Turkey	34
Qatar	34	Turkmenistan	34
Reunion	34	Turks and Caicos Islands	34
Romania	34	Uganda	34
Russian Federation	34	Ukraine	34
Rwanda	34	United Arab Emirates	34
Saint Kitts and Nevis	34	United Kingdom	34
Saint Lucia	34	Uruguay	34
Saint Vincent and the Grenadines	34	USA	34
Samoa	34	Uzbekistan	34
Saudi Arabia	34	Vanuatu	34
Senegal	34	Venezuela	34
Seychelles	34	Viet Nam	30
Sierra Leone	34	Virgin Islands, British	34
Singapore	30	Virgin Islands, U.S.	34
Slovakia	34	Yemen	34
Slovenia	30	Yugoslavia	34
Solomon Islands	34	Zambia	34
South Africa	35	Zimbabwe	34
Spain	34		
Sri Lanka	34		
Sudan	34		
Surinam	34		

WLAN Transmission

For a WLAN transmission, set the Default XMT media to WLAN from Configuration page 6 (see section 3 of this manual). It is necessary that the IT Manager of your facility configure the wireless access point(s) and E-Scribe workstation. Also, it is required that your IT Manager set the ELI 250 WLAN configuration values. Refer to section 3 for more information on WLAN configuration setup. The ELI 250 can be configured for DHCP (Dynamic Host Communication Protocol) and for WEP (Wired Equivalent Privacy) security.

> ***NOTE:*** *Environmental conditions may affect the reliability of WLAN transmissions.*

If DHCP is set to NO, your wireless access point will have a static network setting and the following parameters must be configured in the ELI 250:
IP Address
Def Gateway
Sub Net Mask

If DHCP is set to YES, your wireless access point will have an automatic network setting and IP Address, Def Gateway and Sub Net Mask do not need to be configured.

In either DHCP setting, the following wireless network parameters must be configured in the ELI 250 by your IT Manager:
Host IP
Port Number
SSID
Channel Number

> ***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 250 as 192.168.000.007.*

If WEP Security is disabled on your access point then set Security (WEP) to NO. If WEP Security is enabled on your access point then the following wireless network parameters must be configured in the ELI 250 by the IT Manager:
Security (WEP): YES
WEP Key
WEP Key ID

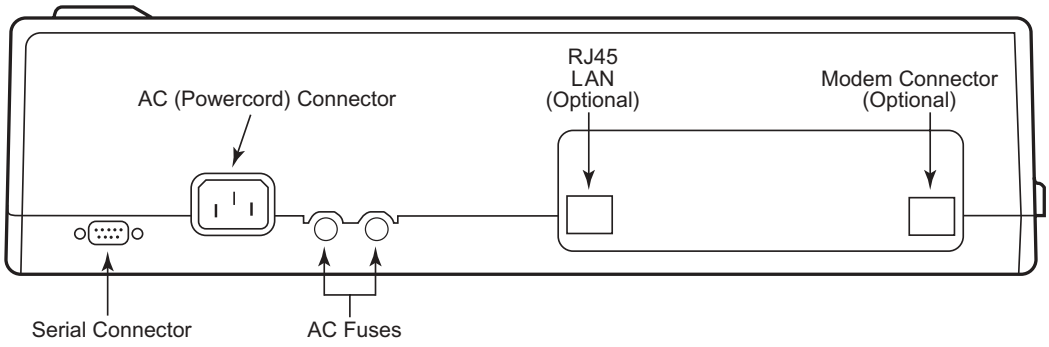
> ***NOTE:*** *The range for the WEP Key on the ELI 250 is 0-3. If the range on your access point is 1-4, then 0 at the ELI 250 maps to 1 on the access point; 1 at the ELI 250 maps to 2 on the access point, etc.*

LAN Transmission

For a LAN transmission, set the Default XMT media to LAN from Configuration page 6 (see section 3 of this manual). It is necessary that the IT Manager of your facility set the ELI 250 LAN configuration values. Refer to section 3 for more information on LAN configuration setup.

> ***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 250 as 192.168.000.007.*

Connect the Ethernet cable to the LAN connection at the rear of the ELI 250, as pictured below.



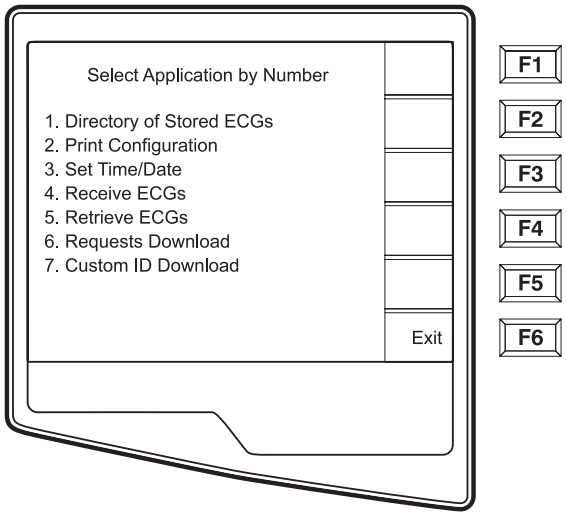
> ***CAUTION:*** *Possible damage to the cardiograph may occur if telephone cable is connected to the LAN connector.*

Ethernet Status LEDs

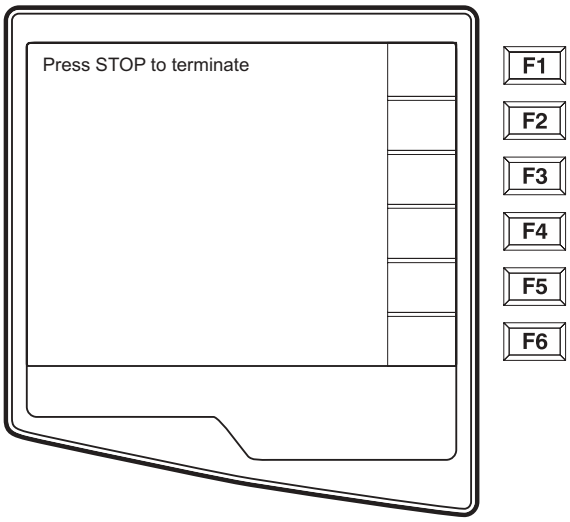
At the external LAN interface connector, the user is presented with two LEDs (Light Emitting Diodes). The two status indicator LEDs provide signals for “link status” and “packet transmit/receive”. As the external connector is viewed from the outside, rear of the ELI 250, the left LED remains illuminated when the network link is detected. The ELI 250 LAN will support signaling rates of 10 and 100 MBPS. The right LED flashes when a transmit or receive packet occurs or any traffic on the network is detected.

Receive ECGs

To receive ECGs from another Mortara Instrument electrocardiograph (using either a telephone or a direct connection), select **Receive ECGs** (**4**) from the Application Menu.



The LCD displays the following message:

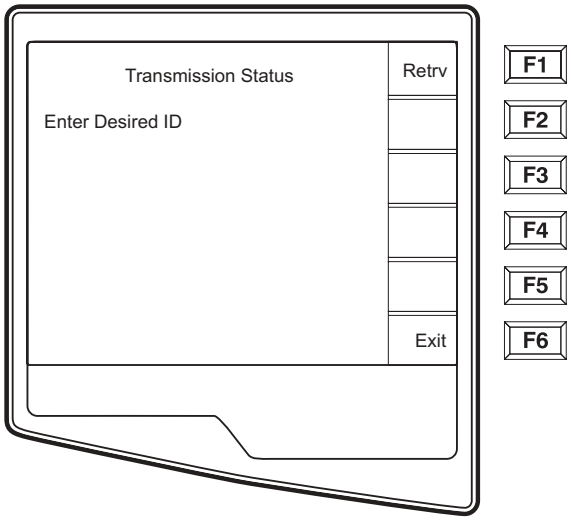


When the LCD displays the above message, the unit is ready to receive the ECGs from the transmitting electrocardiograph. Follow the instructions on transmitting records as described in this section. The receiving unit only acts as a printer. Received ECGs will not be viewed or stored. To terminate the receiving mode, press the **STOP** key.

> ***NOTE:*** *The ELI 250 will receive records from Mortara model cardiographs except for Mortara's Portrait. The Mortara model cardiographs (ELI 100, ELI 200, Landscape, and Portrait) will not receive the ELI 250 records.*

Retrieve ECGs

It is possible to retrieve ECGs from the E-Scribe Data Management System using any of the connectivity options. Before attempting to retrieve ECGs, please configure the Default XMT Media, the telephone number (if using modem transmission) and the site number (see Section 3). Select **Retrieve ECGs** (**5**) from the Application Menu. The following screen appears:



NOTE: *The ID field defaults the last acquired ECG*

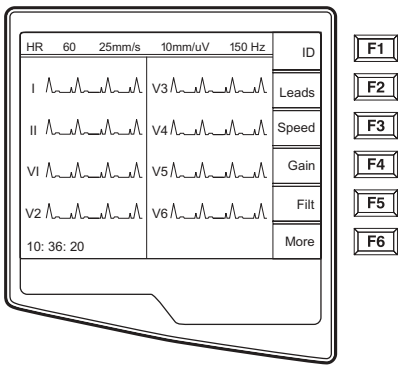
ECGs are retrieved by ID number. Enter the desired ID and select **F1**. E-Scribe transmits the most recent ECG with the specified ID number (or the configured number of ECGs retrieved– refer to Section 3). The ELI 250 prints the retrieved ECG(s) and returns to the Real-Time ECG View. Viewing and storing retrieved ECGs is not possible.

Requests Download

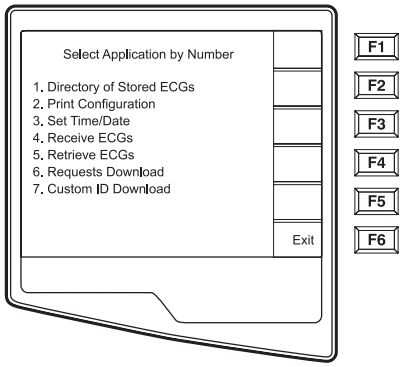
The ELI 250 can download and process a patient request list from the E-Scribe, which identifies the ECGs (or ECG orders) needed for particular patients. Request Codes are designed in your E-Scribe Data Management System, which contain the particular patients who require ECGs. The technician at the cardiograph selects the desired Request Code (e.g. a code specific to a department or floor) and does not have to enter the demographic information for the patients belonging to the Request Code. Once downloaded, the patient list for each Request Code is stored in the cardiograph as the Request List (similar to the patient directory). As with the other forms of ECG data transmission, you can use either the optional modem or a direct connection. Follow the hookup instructions under Transmitting Records in this section.

> ***NOTE:*** *A Custom ID must be downloaded before downloading the Requests (please reference the E-Scribe Operator Manual and Custom ID Format of this Section).*

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

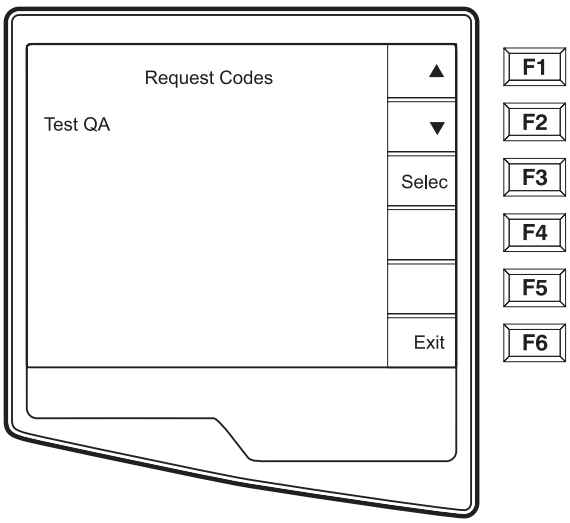


Real Time ECG View

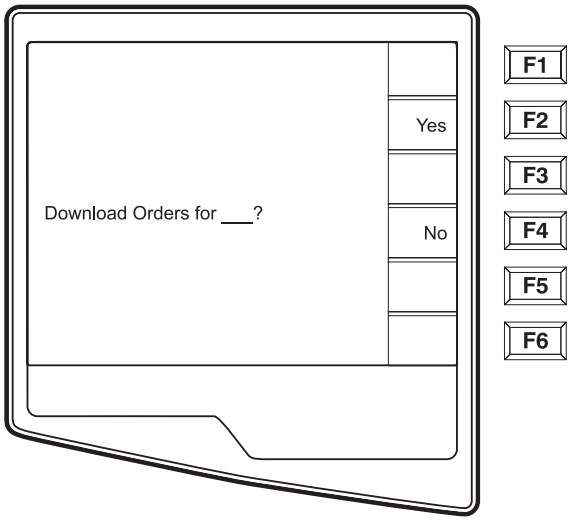


Application Menu

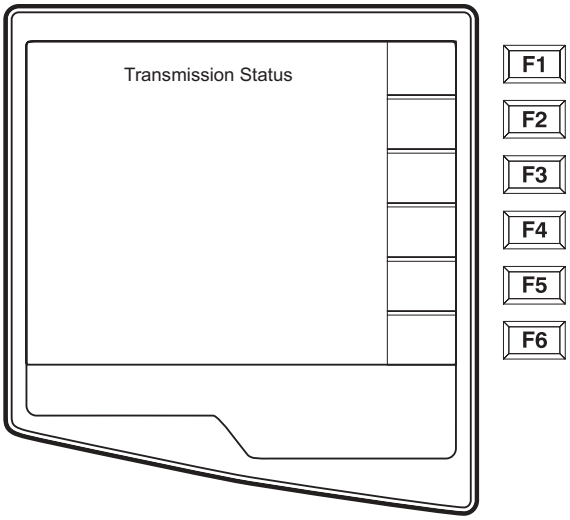
From the Application Menu, select number **6** (**Requests Download**) and the following screen is displayed:



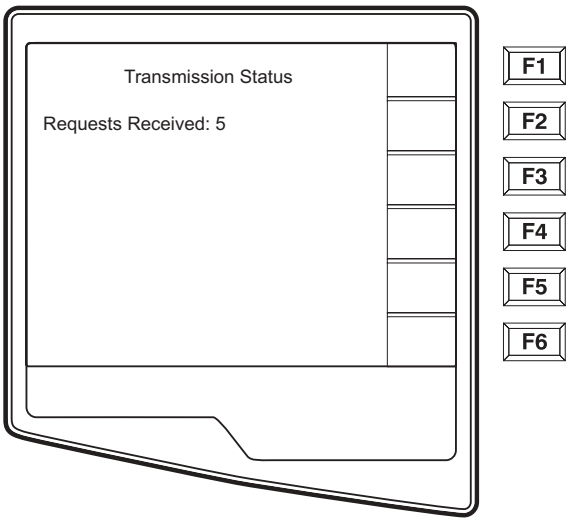
The Request Code(s) is (are) displayed. Use F1 (**F1**) and (**F2**) to scroll through the available Request Codes. Request Codes are only available if a Custom ID has been downloaded. Once you find the desired Request Code, Select **F3** (**Selec**) to select the desired Request Code. Confirm or deny your download by selecting **F2** or **F3** from the following screen:



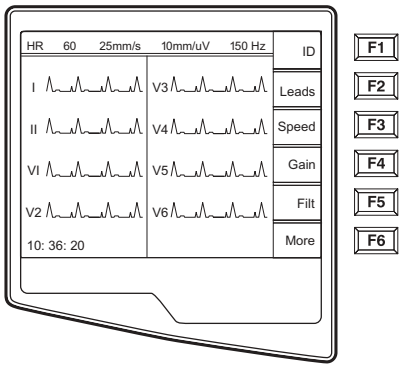
NOTE: *A Custom ID must be downloaded before downloading the Requests.*



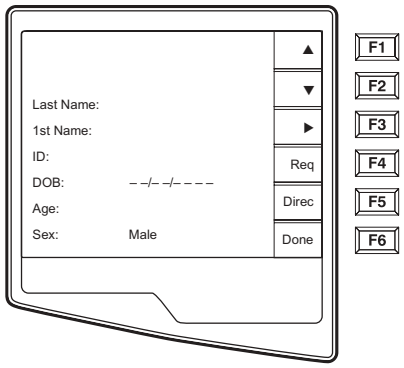
"Transmission Status" will be displayed for approximately 10 seconds followed by "Dialing: telephone number", "Waiting for Response", and "Connected". Once connected, the following screen indicates the number of Requests received (patients) for the Request Code. This only appears briefly and returns to the Real Time ECG View.



When the Request List has been downloaded, you may select the patients who need ECGs. Select **ID** (**F1**) from the Real-Time ECG View.



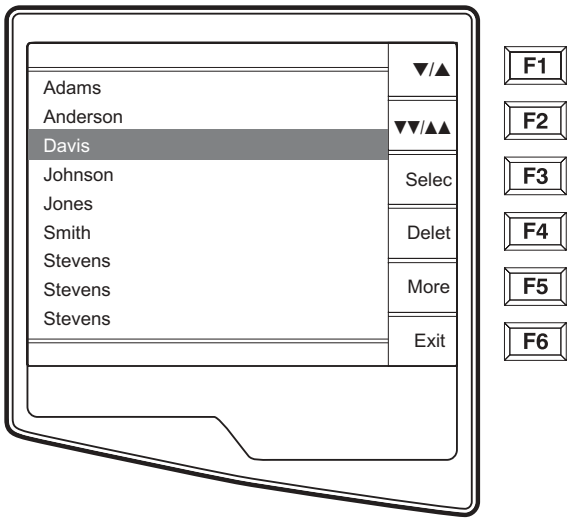
Real Time ECG View



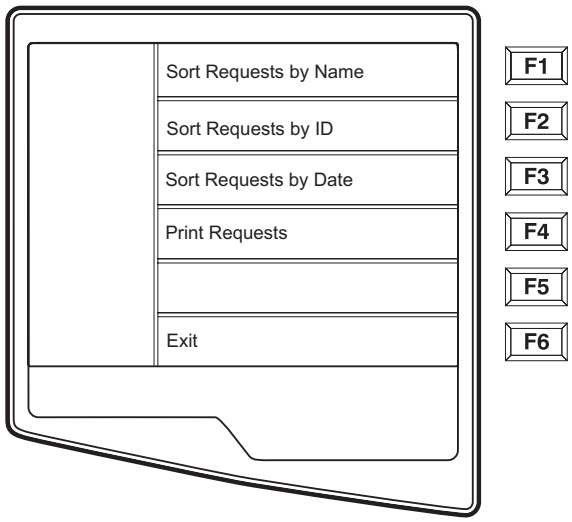
Patient ID

Patient Request List

Select **Req** (**F4**) from the Patient ID screen and the Patient Request List is displayed. The Patient Request List is comparable to the Patient Directory in looks and in practice. The Patient Request List (sorted by name) is pictured below.



Similar to the Directory of stored ECGs, the Patient Request List is easily sorted either by Name, ID, or Date. To sort the Requests, select **More** (**F5**) from the Patient Request List.

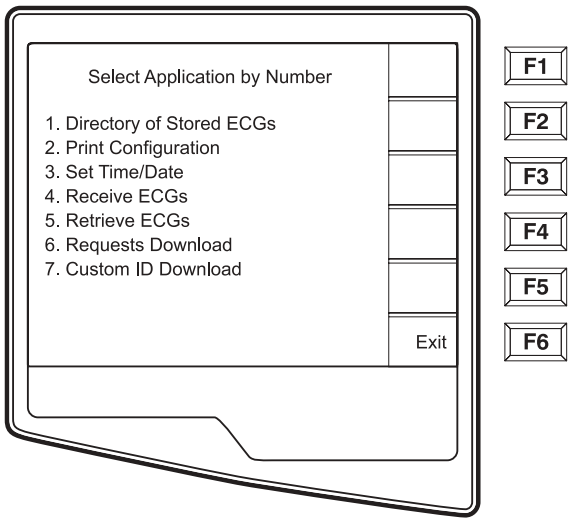


Select **F1** to sort the requests by patient name (ID, time & date are displayed on the top row)
Select **F2** to sort the requests by patient ID (name is displayed on the top row)
Select **F3** to sort the requests by acquisition date (name is displayed on the top row)

To make a printout of the Patient Requests List, select **Print Requests** (**F4**). **Exit** (**F6**) to return to the Patient Requests List.

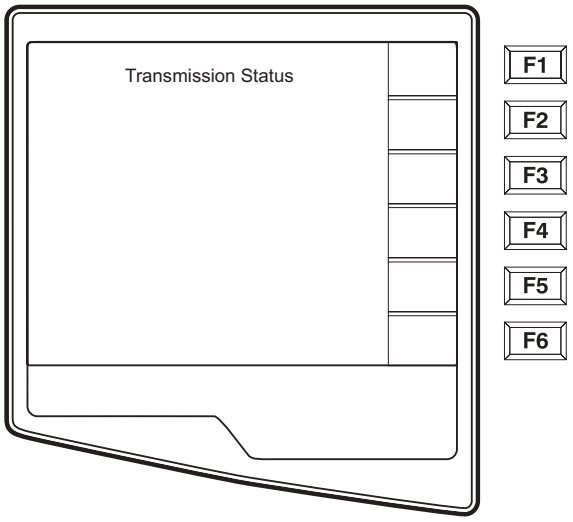
Use ▼/▲ (**F1**) to navigate down the Patient Request List and **Shift** ▼/▲ (**F1**) to move up the list. Similarly, use ▼▼/▲▲ (**F2**) to page down and **Shift** ▼▼/▲▲ (**F2**) to page up through the Request List. To quickly select a patient name, use the keyboard to enter the first letter of the last name. Once the desired name is highlighted, press **Selec** (**F3**) and the patient ID screen will return with all demographic fields populated. Return to Real-Time ECG View by selecting **Done** (**F6**). Once the ECG is acquired, the patient will be automatically removed from the Patient Request List and the ECG will be stored in the Patient Directory.

Custom ID Download

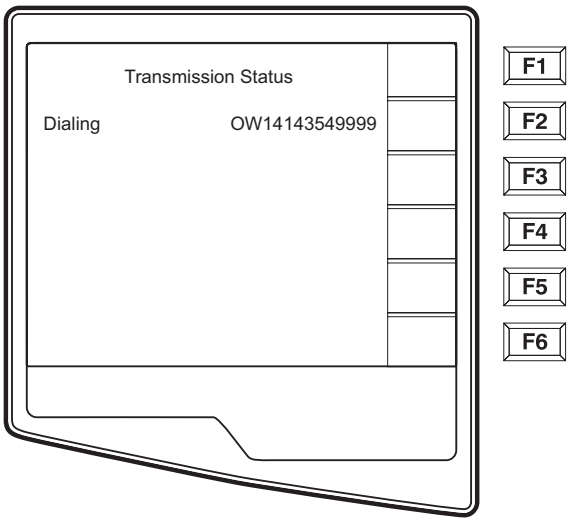


Custom ID formats are uniquely defined by your facility's needs. This customized ECG header information is designed in the Mortara E-Scribe data management system and downloaded to the ELI 250 as the Group Name either by serial connection (direct) or modem transmission.

Select **Custom ID Download** (**7**) from the Application menu and the following screen appears:



"Transmission Status" will remain visible for approximately 10 seconds before the following screen appears:



"Waiting for Response", "Connected", and "Custom ID downloaded" will be displayed before returning to the Real-Time ECG View, which indicates the Custom ID download is complete. The new Custom ID becomes the customized header format for all future ECGs until you select a different ID format in the configuration settings. You may alter the ID format configuration to Short, Standard, Long or Custom based on your patient demographic entry needs. The Custom ID is only deleted upon downloading a new Custom ID or on the rare occasion of downloading software – it will not be lost due to power loss or switching to a different ID format.

TIP: *Upon Custom ID download, the ID format will assume the group name as designed in the E-Scribe.*

NOTE: *A Custom ID must be downloaded before downloading the Request Codes (please reference the E-Scribe Operator Manual).*

NOTE: *The site number must be configured in the cardiograph and recognized as an established, valid site number at the E-Scribe before downloading the custom ID.*

TIP: *Confirm the baud rate in the configuration settings before downloading the custom ID from the E-Scribe.*

APPENDIX B MAINTENANCE AND TROUBLESHOOTING

Troubleshooting Chart

LCD Message	Problem	Correction
BATTERY LOW	Unable to acquire ECG or unable to print.	Charge the battery with AC power.
CONNECTION FAILED	Unable to transmit or receive ECGs.	Check for correct baud rate, phone number, and cable connections or site number.
NO ANSWER	Unable to transmit ECG.	Check for correct phone number. Insure modems and E-SCRIBE are online.
LEADS OFF OR ONE OR MORE OF THE FOLLOWING: RA, LA, LL, V1, V2, V3, V4, V5, V6	Lead fail.	Indication of RL/RA/LA/LL/V1/V2/V3/V4/V5/V6. Check limb leads. Correct faulty lead(s).
TRANSMIT FAILED	Unable to transmit ECG.	Check phone line. Insure site number is valid. Try again.
UNABLE TO SAVE ECG	No available memory. ECG data too noisy to store.	Press stop to continue. Transmit or mark records for deletion in the directory. Correct noise and try aquisition/storage again.
LEAD FAULT, NO ECG CAPTURE	Lead fail or noisy ECG data.	Correct faulty lead or noise.
PAPER QUEUE FAULT	Unable to print.	Add paper; manually advance page evenly passed closure point of writer and close writer cover and press STOP.

Inspection and Cleaning

If the hospital or institution fails to implement a satisfactory cleaning and inspection schedule for this equipment, it may result in equipment failure and health hazards.

NOTE: *Only qualified service personnel should repair or replace ELI 250 parts.*

Inspecting the ELI 250

Inspect the equipment for the following conditions on a regular basis:

- Examine patient cable, power cable and other accessory cables for obvious damage (e.g. torn insulation, broken connectors, etc.). Replace cables as necessary.
- No bent prongs or pins on the plugs and connectors. Check the fit of cables with connectors on the ELI 250 to ensure proper fit.
- All cords and connectors are securely seated in their corresponding connections.
- Examine the equipment for missing screws, cracks or broken areas that might allow unintended access to internal electronics areas.

Cleaning the ELI 250

Disconnect the power source. Clean the exterior surface of the unit with a damp cloth using a solution of mild dishwashing detergent diluted in water. After washing, thoroughly dry off the unit with a clean, soft cloth or paper towel.

Cleaning Print-Head

NOTE: *Do not let soap or water come into contact with the writer, plugs, jacks or vents.*

Test Operation

After cleaning and inspecting the ELI 250 proper operation of the unit may be confirmed by using an ECG simulator to acquire and print a standard 12-lead ECG of known amplitude. Printing should be dark and even across the page. There should be no evidence of print-head dot failure (e.g. breaks in printing forming horizontal streaks). Paper motion should be smooth and consistent during printing. Waveforms should appear normal, with proper amplitude, and without distortion or excessive noise. Paper should stop with perforations near the tear-bar (indicating proper cue sensor operation).

Recommendations to Biomedical Staff

Following any service to the ELI 250 or when non-compliant operation is suspected, Mortara Instrument, Inc. recommends the following procedures:

- Confirm proper operation
- Perform testing to ensure continued electrical safety of the device (use IEC 60601-1 or ANSI/AAMI ES1 methods and limits)
- Patient leakage current
- Chassis leakage current
- Earth leakage current
- Dielectric strength (mains and patient circuits)

Cleaning the Patient Cable

Patient cables should be kept clean using a damp cloth of lukewarm soapy water or a neutral cleaner. To disinfect the patient cable, use a damp cloth of chemical disinfectants containing ethanol (70% - 80%), propanol (70% - 80%) or aldehydes (2% - 4%).

> ***WARNING:*** *Do not attempt to clean/disinfect the ELI 250 or patient cable(s) by submerging into a liquid, autoclaving, or steam cleaning. Never expose cables to strong ultra-violet radiation.*

Battery Maintenance

The ELI 250 houses an internal sealed lead-acid battery. When installed, the battery has a shelf life of approximately six months, without recharging. If the battery has been stored for a long period in a discharged state; it may not be able to regain its capacity even if it is recharged.

For information about replacing the battery, please refer to the ELI 250 service manual.

Mortara Instrument, Inc. recommends that the ELI 250 be plugged into AC power whenever possible to maximize battery life and for the user to develop a habit of recharging the battery before the unit indicates "low battery" condition. (That is, reduce depth of discharge.) Battery life varies by how the battery is maintained and how much it is used. For improved battery life, keep the cardiograph plugged in when not in use.

The sealed lead-acid battery will provide optimum life when the unit is fully charged after each use. The ELI 250 will charge a depleted battery to 90% of its capacity in approximately 8 hours or less. To recharge a battery from its lowest level, 30 hours of recharging without operation will be necessary.

GLOSSARY

TERM	DEFINITION
Augmented lead	(aVL, aVR, aVF) The difference between one site and the average of the potential of two other sites; unipolar extremity leads.
Baseline drift	The QRS complexes are present, but the baseline wanders due to poor skin/electrode contact and/or patient movement.
Bradycardia	A slow heart rate.
Calibration pulse	Standardization pulse. A base to compare the relationship of QRS complexes to one another.
Gain	An increase in amount, magnitude or degree.
J point	The end of the QRS complex; the point where the QRS ends and the ST segment begins (QRS offset).
Limb lead	Bipolar lead that represents the differences of electrical potential between two selected sites (leads I, II, III).
Muscle noise	Grossly uneven baseline caused by patient body tremor or other muscle movement. The artifact may be so large that it overtakes the complex.
Precordial leads	(V1-V6) Unipolar chest leads.
Premature atrial complex (PAC)	An arrhythmia that has its origin in the atrium.
Premature Ventricular Complex (PVC)	An arrhythmia that has its origin in the ventricle.
ST depression	The amount of ST deviation below the baseline.
ST elevation	The amount of ST deviation above the baseline.
ST level	The numerical value of the measured ST segment in microvolts.
ST segment	Ventricular repolarization. The end of the S wave (J point) to the beginning of the T wave.
Tachycardia	A rapid heart rate.