M2636B TeleMon B Monitor

Service Manual

PHILIPS

Notice

Warranty

Printing History

New editions of this document incorporate all material updated since the previous edition. Update packages may be issued between editions and contain replacement and additional pages to be merged by a revision date at the bottom of the page. Pages that are rearranged due to changes on a previous page are not considered revised.

The documentation printing date and part number indicate its current edition. The printing date changes when a new edition is printed. (Minor corrections and updates which are incorporated at reprint do not cause the date to change.) The document part number changes when extensive technical changes are incorporated.

All Editions and Updates of this manual and their publication dates are listed below.

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About this Book

This User's Guide covers the use of TeleMon B, model M2636B, a monitoring device for use with the Telemetry System Series C.

The User's Guide contains information on performing day-to-day tasks and troubleshooting common problems as well as detailed information about all clinical applications. It includes lists of information messages and configuration choices. **Your purchased system may not include all the functionality described in this document.**

User information for the TeleMon Monitor is also contained in the TeleMon Monitor On-line Info. Info focuses on how to complete basic tasks and troubleshoot problems.

For operating information about the transmitter, ECG and SpO$_2$ measurements, and the Telemetry System in general, please refer to the *Telemetry System Series*

C User's Guide. See also the *Information Center User's Guide* for operating information on the Information Center.

Document Conventions

Warnings

Warning

Warnings are information you should know to avoid injuring patients and personnel.

Cautions

Caution

Cautions are information you should know to avoid damaging your equipment and software.

Notes

Note—Notes contain additional information on the Telemetry System usage.

Procedures

Procedures are indicated in the text by the heading "Task Summary" followed by the following table:

Step	Action
1	
2	
3	

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1
Introduction

Overview and Functional Description

The M2636B TeleMon Monitor is a telemetry extension device providing non-invasive blood pressure (NBP) capability, a bedside/patient-side display, and isolated line power or battery power to extend the M2601A Telemetry Transmitter battery life.

As part of the Telemetry System, TeleMon with a docked transmitter provides local display of ECG waveforms, a pleth wave, a delayed/annotated ECG wave, heart rate, %SpO2, and NBP while simultaneously transmitting ECG, %SpO2 and NBP via a unidirectional RF telemetry link to the Information Center. This is provided by TeleMon within the antenna system coverage area. At the central station, a "docked transmitter" indication will be displayed to distinguish data being sourced from a transmitter docked with TeleMon.

System Compatibility

The M2636B TeleMon Monitor is designed for use with the Telemetry System Series C, and either a conventional Series C or EASI^{TM} transmitter.

The communication from the transmitter to the TeleMon is via an infrared port on the transmitter.

Information Messages and Alarms

Patient alarms are generated and annunciated at the Information Center and at TeleMon B when local alarms are enabled. TeleMon displays information messages; these messages are also displayed in the patient sector at the Information Center, along with the ECG waveforms and SpO_2 and NBP readings.

Ambulatory Use

The transition to ambulatory monitoring is seamless, given that the same transmitter continues to source patient data and no user interaction is required to continue monitoring. The clinician needs only to remove the transmitter from TeleMon.

A Quick Description of the Monitor

Front of TeleMon

- Handle
- NBP Connector
- Transmitter Docking Recess
- Battery Compartment

Back of TeleMon

- NBP Cuff Holder
- Product Label
- Upgrade Port (underneath)
- Power ON/OFF
- AC Power Connector* (18V, 1.83A)
- Speaker
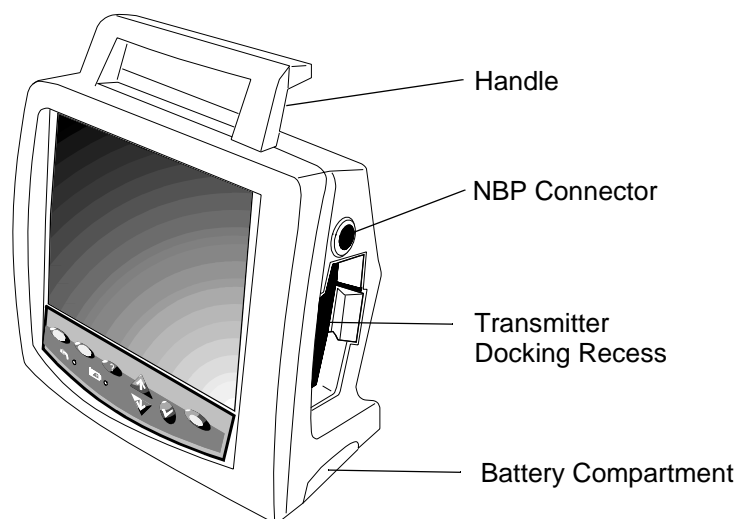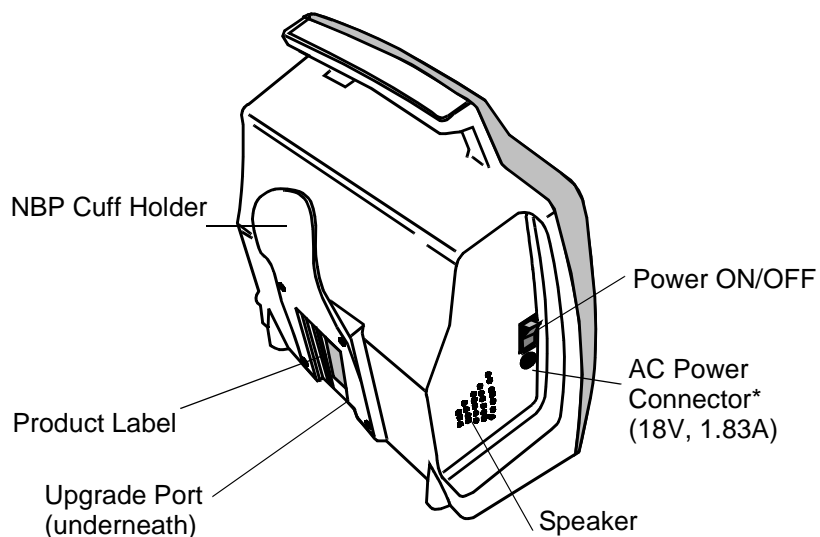
*Use only a TeleMon-specific power supply.

Front Panel   All operational interactions except power on/off and the docking/undocking of the transmitter are performed using the keys on the front panel. In monitoring mode, there are three kinds of keys:

- Direct Action keys (RECORD, SUSPEND, and NBP) — enable immediate actions.
- Input keys (⬆, ⬇, and ⊘) — enable you to navigate through a menu of choices.

• Help key - provides access to operational information during product use.

Below the keys, two indicators provide information on the power status of the monitor.

AC Power Status   *Battery Charge Status*
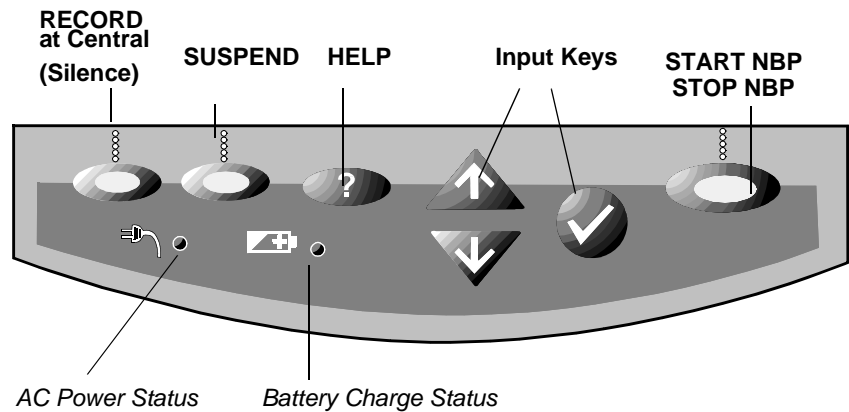
Direct Action Keys   The function of each of the three Direct Action keys is displayed on the screen directly above the key.

RECORD at Central	Initiates central recording. A flashing strip above the label indicates a recording is in progress.
Silence	Silences current alarm at TeleMon
SUSPEND at Central **- or -** **xx:xx min to** **UNSUSPEND**	Temporarily suspends telemetry alarms at central for 3 minutes. Indicates the number of minutes remaining. Press again to UNSUSPEND.
START **STOP**	Starts and stops individual NBP measurement. Scheduled measurements continue uninterrupted.

Input Keys   The three Input keys enable you to select a function by moving the highlight box (cursor) and making task choices about that function.

⬆ ⬇	For general operation: Use arrows to select a function or make a choice on a task list.
⊘	For general operation: Press check mark to open or close the task list for a selected function.

Help

?	Displays, scrolls, and dismisses context sensitive help on the selected function.

Indicators

AC Power	On/Green—AC power is connected
	Off—No AC power is connected.
Battery Charge Status	On/Yellow—Charging the battery
	On/Blinking Yellow—Initiating communication with the battery, or error condition
	Off—No charging because either no battery or battery charged

Main Screen   The Main Screen presents the data in graphical and alphanumeric formats. Up to two waves can be displayed on the screen: two ECG waves, or one ECG and the pleth wave. If an EASI transmitter is docked, the text EASI will be displayed above the primary wave sector. Numerics are presented on the right: HR, %SpO$_2$, and systolic/diastolic and mean NBP. Softkey labels appear across the bottom of the screen. These define the multi-purpose keys directly below.
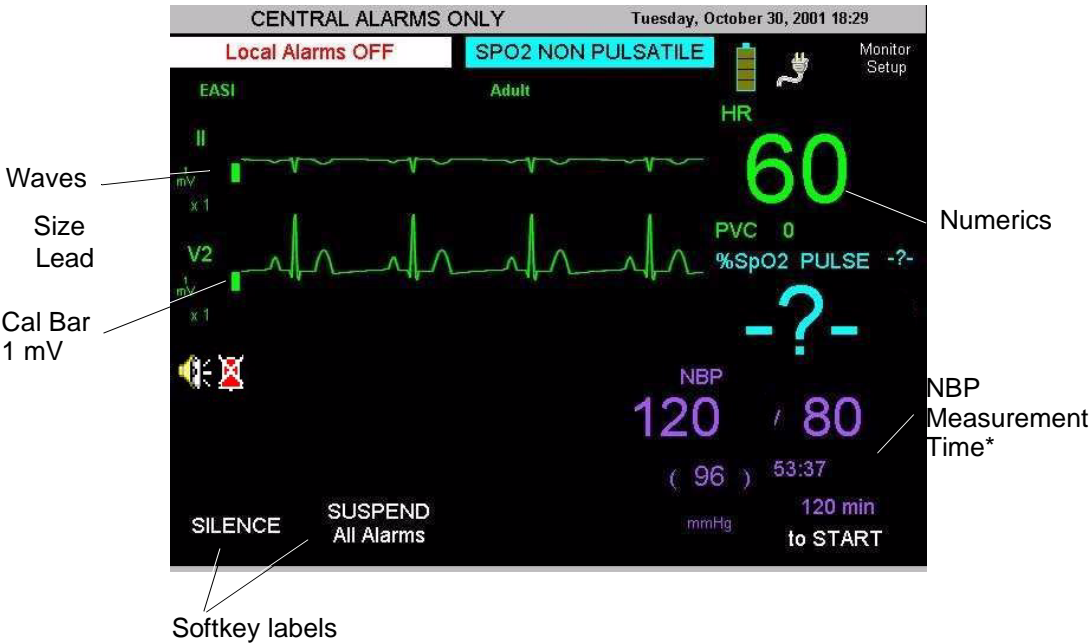
* Time remaining until next automatic measurement, or time of most recent manual measurement.

Other information on the Main Screen includes alarm and information message status, battery and AC power status, and access to monitor setup and service functions.
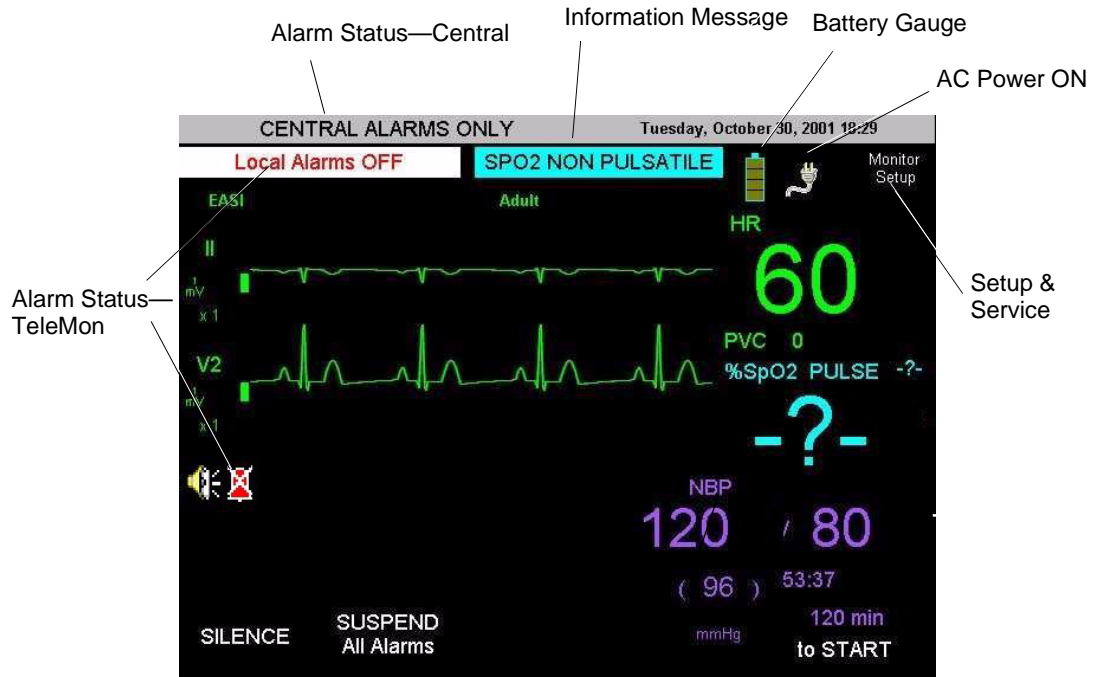
Major Assemblies

TeleMon is made up of three major assemblies:

- Front Panel Assembly
- Monitor Assembly
- Chassis Assembly

The monitor assembly has three boards, the main board, the NBP board and the Inverter board. The distinctive functionality of each board makes this unit particularly easy to service and troubleshoot. Additionally, the unit is designed to require little or no maintenance, making it ideal for today's clinical environment.

Software

TeleMon software is part of the Information Center system, which contains these basic components:

- TeleMon
- Transmitter
- TeleFrame
- SDN
- Information Center/Surveillance Center

TeleMon interfaces to the Information Center using an RF link provided by the transmitter and an SDN interface provided by TeleFrame.

2
Hardware and Software Description

Hardware

The following is a summary of the major TeleMon subassemblies.

Front Panel Assembly

The Front Panel Assembly (Figure 5-3 on page 5-31) contains:

- Molded plastic front housing

- Anti-glare panel bonded to the inside of the window in the front housing.

- Touch-key keyboard unit, including power status LEDs, bonded into a recess below the window of the front housing.

- Keyboard-to-main cable.

Monitor Assembly

The Monitor Assembly contains

- the Chassis Assembly, on which all the PC boards are located.

- the Rear Housing assembly, in which the transmitter dock, the battery compartment, the cooling fan and the speaker are mounted.

Chassis Assembly

The Chassis is a metal plate. To one side of it three PC boards are fastened, containing the major electronics of the TeleMon. The LCD is fastened to the other side.

Main Board Assembly

The Main Board (Figure 5-14 on page 5-42) contains:

- ICs required to store the software and perform the logic of measurement, analysis, calculation and display.

- Coin battery for the Real Time (RT) clock. This clock provides time stamps for data and times the transfer of data to and from TeleMon.

- Keyed connectors for the cables that supply power and control data to units performing specialized functions, such as display or NBP measurement. Each connector is uniquely keyed to prevent any misconnection. All power comes from Main Board circuits.

- The OFF/ON Power Switch, which extends through an opening in the left side of the rear housing when the unit is fully assembled. The switch performs the following functions:

  – When ON, applies line power to the Main Board if the External Power Supply is connected.

  – When ON, applies battery power to the Main Board if the External Power Supply is not connected.

> – When OFF, applies line power to the battery for charging if the External Power Supply is connected. Only the various power and battery indicators are functional.
>
> – When OFF, shuts off all power if the External Power Supply is not connected. The coin battery on the Main Board continues to drive the Real Time (RT) clock and some memory circuits.

- The External Power Connector, which extends through an opening in the rear housing. Use of this connector feeds power from the External Power Supply to the Main Board, which may also distribute it to other modules.

- Serial Port. The Serial Port Connector on the Main Board is accessed through an opening at the bottom of the Rear Housing. The port is used for software updates. The opening is covered by a snap-lock door.

- Optical devices. The transmitter communicates with the TeleMon, when docked, through an infrared (IR) path. IR data is reflected onto an optical device on the Main Board through a perforation in the IR Shield. Another device provides a control and data path to the transmitter through a second perforation.

The NBP Board

The Non-invasive Blood Pressure (NBP) Board (Figure 5-9 on page 5-38) performs operations relating to taking a blood pressure with the cuff. The NBP Board contains:

- IC's for regulating the operation of the Air Pump.

- A connector for the NBP-to-Main Cable.

- The Air Pump with mounting device. The pump is specified for at least 30,000 cycles before it needs to be replaced; 10,000 cycles before it needs to be calibrated.

- Conduit tubing for the air.

The Inverter Board

The Inverter Board (Figure 5-10 on page 5-39) applies 380 VAC at 5 mA to the LCD's backlight, which is fluorescent. An oscillator in the inverter circuit changes DC input current from either the 10.8 battery or the external power supply to AC.

The Inverter Board Assembly consists of:

- A metal shield to limit radiation from the inverter circuits.

- The Inverter Board.

- Integral connectors for the Inverter-to-Main and Inverter-to-Display Cables.

The Display

The Display (Figure 5-13 on page 5-41) contains:

- LCD. The LCD has a half-life of approximately two years. It should be replaced when it loses its brightness.

- Back Light.

- Non-detachable Inverter-to-Display power cable.

- Connector for the Display-to-Main Cable, a ribbon cable conducting LCD control signals from the Main Board.

The Rear Housing Assembly

The Rear Housing Assembly consists of:

- Molded plastic rear housing.

- Speaker Mount (Figure 5-16 on page 5-44), a formed stainless metal piece bent into extensions for the Speaker mount and the data path reflector. Coded optical beams from a docked transmitter are reflected onto the optical receptor of the Main Board and beams from the emitter on the Main Board are reflected into the transmitter. Broken beams are interpreted by software in the processing unit of the Main Board as an undocked transmitter. On the outside of the Rear Housing, the NBP Cuff Holder is screwed to the Speaker Mount through the housing.

- Cooling Manifold Assembly, a formed metal piece fastened to the Rear Housing above the Transmitter Dock. A small cooling fan with integral drive motor is fastened to it. From the fan housing extends the Fan-to-Main Cable. Cooling and venting are facilitated by slots in the bottom and top rear surfaces of the Rear Housing, perforations on the side of the Rear Housing, and large perforations in the Battery Housing. The fan is powered by the OFF/ON switch at the side of the monitor.

- Transmitter Dock (Figure 5-19). Three interlocking plastic pieces forming a dock that fits into the docking port on the side of the Rear Housing. The Dock screws to mounts on the Rear Housing. The screws also hold the dock together. The Transmitter-to-Main power cable interlocks to the back of the Dock and terminates in a connector for Main Board attachment. An integral latch furnishes some resistance to docking and undocking the transmitter, and holds the transmitter in place. An opening in the top of the Dock passes optical data streams between the transmitter and the Main Board via a reflector surface on the Speaker Mount. All ECG and SpO_2 data comes from the transmitter. All RF transmission between the monitor and the Information Center requires docking and ECG cables and leads.

- Speaker held to the Speaker Mount with a metal clip. The Speaker-to-Main Cable is integrally attached to the speaker but features a connector on the Main Board side. The speaker faces perforations in the Rear Housing.

- Formed metal Battery Compartment (Figure 5-17) with detachable connector for the replaceable Battery-to-Main Cable. A flange on this compartment anchors the Chassis. Perforations in the compartment support air cooling. The battery may get warm during charging, especially as it approaches full charge.

- Sliding battery compartment door of molded plastic, key-locked to the Rear Housing.

- NBP tubing with collar connector on one end and external connector on the other, fastened to the Rear Housing with a large hex nut. The tubing carries air from the Air Pump located on the NBP Board.

- Four slip-resistant feet mounted to the bottom of the Rear Housing. They also hold the Battery Compartment in place.

Software

TeleMon interfaces to the Information Center using an RF link provided by the transmitter and an SDN interface provided by the Receiver Mainframe. However, this link is for clinical purposes only. There is a serial port on the bottom of the rear housing of TeleMon, for use in upgrading software.

Within TeleMon's memory, the monitoring software and its configuration files are stored separately from the operating system binary image, allowing the product monitoring software to be upgraded without having to reprogram the entire operating system.

All software components necessary for upgrading a TeleMon are included on a TeleMon Installation CD. These components include:

- TeleMon Application Software

- A compatible TeleMon OS image

- A programming tool for programming the operating system in TeleMon directory

- Microsoft® ActiveSync® Connectivity Software

Service people upgrading/programming TeleMon Monitoring Software will also need the following components:

- TeleMon

- A host computing platform (laptop or desktop) with free serial port

- A synch cable that fits into TeleMon's Upgrade Connector (for example an HP F1223-60901 cable)

- The TeleMon Installation CD

3

Site Planning—Specific Requirements

This chapter provides an overview of site planning for your telemetry system. It includes the following sections:

Environmental Considerations

The monitor should be used in an area reasonably free from vibration, dust, corrosive or explosive gases, and extremes of temperature and humidity. The following paragraphs give information concerning environmental considerations.

Temperature

The monitor operates within specifications at ambient temperatures between 0 and 35º Celsius. Temperatures exceeding these limits could affect instrument accuracy and cause damage.

Operating Altitude

Operate and store TeleMon at altitudes up to 3,048 meters (10,000 feet).

Radio Frequency Interference

Management of the RF environment in your facility is important to the overall performance of your telemetry system, including the monitor. The considerations are the same. In most cases, use of the monitor implies that the Telemetry System is already in place and the RF environment has already been taken into consideration. For full coverage of this topic, refer to the Telemetry System documentation, especially Chapter 2 of the Service Guide.

Warning
TeleMon units containing transmitters that are 25 kHz apart in transmitter frequency interfere with one another at distances of 1-3 feet. This situation is aggravated by ECG cable proximity. Symptoms include dropout (at the information center), waveform artifact of the ECG (at central and TeleMon), and screen freeze (at TeleMon). To avoid this situation, maintain a distance of >3 feet between TeleMon units.

Power Requirements

The monitor is a mobile extension of the Telemetry System and can display and broadcast information through the antenna on battery power alone for up to a five hours. However, for bedside use it should be connected to a grounded wall outlet through its own external power supply. The bedside wall outlet should provide input of 100 - 250 VAC at 50 - 60 Hz. The monitor and therefore the bed need to be within 6 feet of where the external power supply is to be mounted. The line cord between the wall outlet and the external power supply must be grounded and routed and/or mounted to avoid accidental tripping or pulling.

The External Power Supply must be grounded during operation. If a 3-wire receptacle is not available, then a hospital electrician must be consulted to ensure that proper grounding is available on installation. Never attempt to use a three-wire to a two-wire adaptor with the External Power Supply. For details, see the "Electrical Specifications" on page 9-10.

Note—The TeleMon battery may not arrive at your site fully charged due to time in transit or storage. Make sure that the battery is fully charged before using TeleMon.

Antenna System Site Information

Antenna Coverage Area

All transmitter information is available at the TeleMon, whether or not the transmitter is in the antenna coverage area. However, if the TeleMon is outside the antenna coverage area, there is no communication to the Information Center and no indication at the TeleMon that the RF signal is not being received at the Information Center. Outside the coverage area, no alarms can be generated at the Information Center.

4
Installation

This chapter describes the alternatives available for the installation of a TeleMon monitor and its External Power Supply.

Placement on a Flat Surface

The easiest and most mobile way to mount the TeleMon is simply to stand it on a flat surface. The monitor needs to be visible and in a safe place, as free as possible from the danger of accidental pulling, knocking over, or spilling of fluids.

The simplest placement of the External Power Supply is on the floor near the TeleMon. The power output cable allows a distance from TeleMon of six feet. Do not place the monitor where it can be pulled down onto the patient. The power input cord should run directly to the wall wherever possible. It should not be strung across a passage.

Warning

To avoid the risk of accidental entanglement and strangling, place or mount the AC power cabling away from the patient. Use similar caution in temporarily storing ECG, NBP or SpO$_2$ cables.

Warning

TeleMon units containing transmitters that are 25 kHz apart in transmitter frequency interfere with one another at distances of 1-3 feet. This situation is aggravated by ECG cable proximity. Symptoms include dropout (at the information center), waveform artifact of the ECG (at central and TeleMon), and screen freeze (at TeleMon). To avoid this situation, maintain a distance of >3 feet between TeleMon units.

Mounting on a Pole

Mounting on an IV pole combines mobility with stability. The External Power Supply can be mounted apart or near the TeleMon on the same pole. For example, mount the power supply at the bottom of the IV pole.

Note—The power input cord must run from the TOP of the power supply to the monitor, to avoid seepage of spills into the plug on the other side (Figure 4-2).

For pole mounting, use the Pole Clamp, Part Number 5061-8363, which can support a maximum load of 14 pounds (6.5 kg).
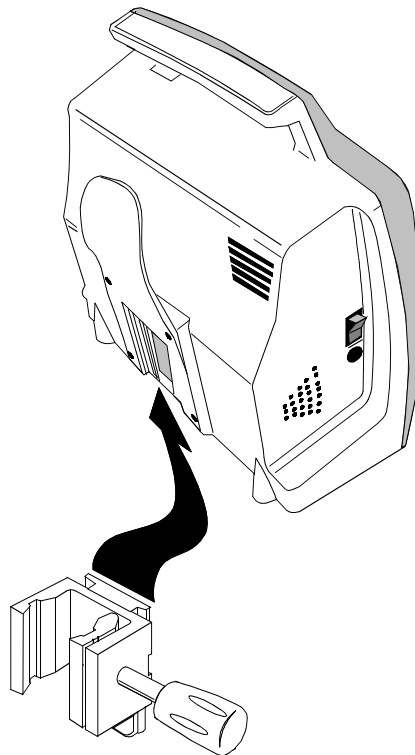
Figure 4-1 Mounting TeleMon with Pole Clamp

Use of Pole Clamp with Monitor

Step 1. Screw the Dovetail to the rear surface of the Pole Clamp, using the screws provided with the Dovetail. Two alignments are available, horizontal and vertical.

Step 2. Fasten the Pole Clamp to the supporting rail or pole. Use your judgement to determine the most stable and solid method of mounting.

Step 3. Slide the NBP Cuff Holder on the back of the TeleMon down over the Dovetail until the latch snaps.

Note—To remove the monitor, slide your finger under the TeleMon and push the latch at the back, which is on the Dovetail.

Warning

Do not mount the TeleMon below fluids, which may drip or leak onto it.

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**Use of Pole
Clamp with
External
Power Supply**
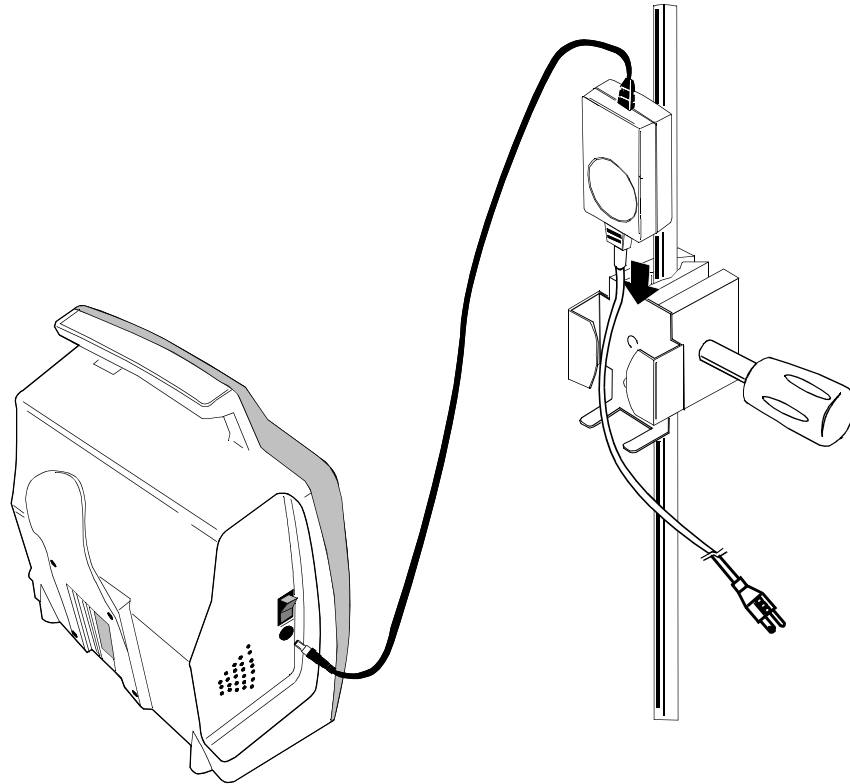
Figure 4-2 Mounting Power Supply with Pole Clamp

Step 1. Screw the External Power Supply Bracket to a Pole Clamp with the screws
provided.

Step 2. Fasten the Pole Clamp to the supporting rail or pole.

Step 3. Slide the External Power Supply into its bracket.

Mounting on the Wall (General)

Wall mounting requires the most preparation and is the most stable, but least mobile, configuration.

Caution

These mounting instructions are neither applicable in California nor sanctioned by the California OSHPD for installation in the State of California, U.S.A., in conformance to that state's requirements for seismic protection.

The following instructions describe surface wall mount base installation to a wall.

Before instruments have been installed, the hospital or other facility, its consultants, or its contractors shall be responsible for meeting the following conditions:

- That the wall is adequate to safely mount monitoring instruments, including the selection of fasteners and their proper installation.

- That the installation has been completed in accordance with accepted standards of good workmanship.

- Anchorage or support in a metal stud or wood stud wall must be verified by a registered professional engineer before installing the mounting system.

Warning

Existing wall construction and reinforcement:

The wall mounts must be capable of supporting four times the specified weight capacity after they have been properly installed. To provide this support in plaster, plasterboard, or gypsum board walls, the wall covering must be removed in the area of work and a reinforcement must be provided within the wall structure.

Do not install a wall mount onto solid brick or brick veneer walls, or onto crumbly wall material such as cinder blocks or deteriorated concrete or concrete block.

Ensure that no electrical wiring, piping, or other utilities within the wall interfere with or can be damaged by the installation process.

Fastenings:

Lead expansion bolts or plastic expansion anchors specifically are not adequate or safe. Use the anchors specified for solid concrete construction.

Never mount heavy instrumentation to plain gypsum board using expansion anchors. The wall covering (plasterboard or plaster) must be removed and the wall must be reinforced internally, in new or existing construction.

In Installation:

No portion of the mount or mainframe may extend over a patient's bed.

Never exceed the maximum rated load specified on the label(s) attached to the wall mount in use.

Never exceed any maximum instrument stacking height specified on the label(s) attached to the wall mount in use.

Do not attempt to remove any wall mount while instruments are attached.

The wall mount is mounted directly to the wall. All mountings and anchorages must conform to local building codes and regulations. A variety of mounts are available and can be purchased, or the user can devise his own, provided it conforms to the warnings and regulations stated in this manual.

Installation consists of building a mount to which the Dovetail or External Power Supply Bracket are fastened. The monitor then slides and snaps onto the Dovetail and the External Power Supply slips into its bracket. The bracket can also be mounted directly on the wall.

In general, wall mounts must be installed securely to the wall's internal structure with number 10 sheet metal screws, 1/4-20 or 10-32 pan head machine screws, or bolts with nuts or toggle wings. The type of fastening and method depends on the wall construction.

Note—Machine screws have built-in lock washers or other means of securing threads. All sheet-metal screws have type-A threads.

You can install the mount base in three ways:

1. On Hollow Block or Hollow Tile Walls.
2. On Solid Concrete or Solid Block Walls.
3. On Drywall.

Warning

Do not install wall mount onto solid brick walls or tile veneer walls, or onto weak or crumbly wall material such as cinder blocks, brick, brick veneer, clay or rubble construction.

5
Troubleshooting, Service and Repair

This chapter describes maintenance, troubleshooting and service. It includes the following sections:

Troubleshooting

Purpose   This section provides troubleshooting instructions for TeleMon. To properly troubleshoot TeleMon, a clear understanding of the Telemetry system is required.

When troubleshooting TeleMon consider that problems can occur because of:

- Equipment malfunctions: hardware failures, etc.
- Application faults: usually leads off, battery problems, ECG equipment malfunction, transmitter malfunction, $\%SpO_2$ malfunction.
- RF problems: as a result of RF environmental conditions, or problems like not receiving a signal, receiving a weak signal, etc. (Solutions to this type of problem are described in the Telemetry System Service and Reference Guide.)

This section presents symptoms that show up when failures occur, and provides a corrective action to fix those failures. In this section you will find:

- Alarms and Information Messages
- Self-test and Event Log Messages
- NBP Event Log Error Codes
- Additional Troubleshooting Tips

Alarms and Information Messages   Two types of signals can be generated during monitoring:

- Patient alarms indicate a life-threatening situation or less urgent situation, such as heart rate alarm.
- Information messages indicate that the monitor cannot measure or detect alarm conditions reliably.

Patient Alarms   When a transmitter is docked in TeleMon, all patient alarms are generated, displayed, recorded, and silenced either at TeleMon locally, or at the Information Center and Surveillance Center.

Warning

No patient alarms are annunciated at the TeleMon when local alarms are off. When local alarms are off, telemetry alarms are presented at the central monitor only, and all alarm adjustments must be made at central.

All central alarms can be temporarily suspended for 3 minutes from TeleMon. When alarms are suspended at TeleMon, any active alarm will be silenced. When alarms are unsuspended, the arrhythmia time outs will be reset.

NBP alarm settings (limits and on/off) are adjusted at central.

Visual Indicators on TeleMon for Patient Alarms:

- Message **CENTRAL ALARMS ONLY** displayed in black on top banner
- Message **Local Alarms OFF** displayed in alarm message area.

Suspending Patient Alarms

You can suspend central telemetry alarms from TeleMon for 3 minutes to prevent false alarms from occurring during a change of electrodes or other activity that could cause motion artifact alarms.

Visual Indicators on TeleMon for Suspended Alarms:

- Message **CENTRAL ALARMS SUSPENDED** displayed in red on top banner opposite the date.
- Number of minutes remaining in the suspension period displayed above the Suspend Alarms key.
- The **SUSPEND at Central** key label changed to **xx:xx min to UN SUSPEND**.

Note—When the transmitter is undocked, the suspend capability reverts to standard telemetry operation; that is, suspend is enabled at central.

Task Summary

To suspend alarms at central from TeleMon, use the following procedure.

Step 1. Press the key below **SUSPEND at Central** to suspend all telemetry alarms at central for 3 minutes.

Step 2. To restart suspended alarms, press **xx:xx min to UNSUSPEND**.

Information Messages

The following table lists all the information messages that TeleMon can display. These messages are text only; no sound is generated at TeleMon when any of these conditions is active.

Warning
When local alarms are off, information messages at TeleMon are silent.

If multiple information messages are active, an up arrow (↑) will be displayed to the right of the information message area. Messages will cycle through the sector at a rate of one every two seconds. There is no audible indicator for any information signal.

All information messages are non-latching, that is, the information message resets automatically when the condition is corrected, and the information message is erased from the display. NBP information messages will remain on the display until the situation is corrected.

Visual Indicators on TeleMon for Information Message Conditions:

- Message displayed in information message area

The following table lists all of the information signals (in alphabetic order) that could appear in the information message area at the top center of the TeleMon display.

Table 5-1. TeleMon Information Messages

Information Message	Problem	Corrective Action
CHARGE MON BAT *Note*—Will not be displayed at central if Xmtr BATTERY WEAK message is also in effect, but both information messages will be displayed at TeleMon.	TeleMon battery is <= 25%. If TeleMon battery level is <= 15%, TeleMon will start a 5-minute shutdown counter, and if no action is taken to clear the condition, TeleMon will shutdown the device and latch the power supply until it is connected to AC power.	Connect to AC power and charge battery, or insert battery with >25% charge.
CUFF NOT DEFLATED	Cuff pressure is greater than a specified safety limit for a period of time.	Remove cuff from patient and disconnect from tubing. Gently expel any air. [If water in cuff, replace cuff.] Reconnect and reapply cuff to patient. *Note*—If the alarms are suspended at the Information Center, this information message unsuspends them. To clear the information message, initiate a new NBP measurement.
ECG EQUIP MALF	ECG PC board in the transmitter is malfunctioning	Replace transmitter. For details, see the Telemetry System Service Training and Reference Guide.
INVALID LEADSET	EASI transmitter has a 3-wire leadset, or no leadset attached to it.	Undock transmitter and attach a 5-wire leadset.
LEADS OFF	Lead(s) not connected, or 3-wire leadset is connected to a 5-lead transmitter trunk cable.	Reconnect lead(s). Attach 3-lead trunk cable.
CHECK LEADS	Selectable lead unavailable due to leads off condition.	Reconnect lead(s).

Table 5-1. TeleMon Information Messages

Information Message	Problem	Corrective Action
NBP CUFF OVERPRESS	Cuff pressure increased above overpressure safety limits	Remove cuff from patient and disconnect from tubing. Gently expel any air. [If water in cuff, use new cuff.] Reconnect and reapply cuff to patient. *Note*—If the alarms are suspended at the Information Center, this information message unsuspends them. To clear the information message, initiate a new NBP measurement.
NBP EQUIP MALF	The tube in the cuff may be kinked or disconnected, or there is a malfunction in the NBP hardware.	Unkink and/or connect tubing. Reconnect the transmitter by redocking. Take another measurement. If problem persists, contact your service provider. Replace the cuff. Conduct an NPB calibration, (see "NBP Diagnostics, Calibration" on page 5-17). If necessary, replace the NBP Board (see "The NBP Board" on page 5-38).
NBP INTERRUPTED	The preset maximum time for total measurement has been exceeded because of motion artifact or arrhythmia activity or, the user pressed STOP during the measurement.	Reapply cuff. Ask patient to refrain from moving during measurement.
NBP MEASURE FAILED	No measurement values can be derived because no pulse or inconstant pulse is sensed.	Reapply cuff, or choose a new location. Reconnect the transmitter by redocking. Obtain a manual measurement. If problem persists, use a different transmitter.

Table 5-1. TeleMon Information Messages

Information Message	Problem	Corrective Action
XMTR FAIL	Error writing TeleMon data to transmitter eeprom.	Replace transmitter and contact service.
SPO2 EQUIP MALF	Malfunction in the $\%SpO_2$ hardware, or transducer/adapter cable damaged	Change transducer or adapter cable. If message persists, replace transmitter.
SPO2 ERRATIC	Erratic $\%SpO_2$ measurements, often due to a faulty transducer or incorrect positioning of the transducer May also be caused by optical shunting if sensor too big or too small.	Line up light source and photodetector - they must be opposite each other and light must pass through the arteriolar bed. Reposition transducer to site with higher perfusion. Replace transducer or adapter cable. Use different sensor with correct fit.
SPO2 INTERFERENCE	Level of ambient light is so high that the $\%SpO_2$ transducer cannot measure $\%SpO_2$ or pulse rate. Transducer or adapter cable is damaged. May also be due to electrical interference. May also be generated by a defective transmitter.	Cover sensor with non-white opaque material (for example, pulse oximeter probe wraps - Posey wrap or equivalent) to reduce ambient light. If message persists, inspect and replace transducer or adapter cable as needed. Reduce sources of electrical interference. If the above corrective actions are ineffective, use a different transmitter, and replace the defective one.

Table 5-1. TeleMon Information Messages

Information Message	Problem	Corrective Action
SPO2 NOISY SIGNAL	Excessive patient movement or electrical or optical interference is causing irregular pulse patterns	Locate sensor at site with less movement. Reduce sources of electrical or optical interference. If the above corrective actions are ineffective, consult the Telemetry System Service Training and Reference Guide.
SPO2 NON PULSATILE	Pulse too weak or not detectable May also be generated by a defective transmitter. NPB measurement being made on the same extremity as %SpO$_2$	Relocate sensor to site with improved circulation. Warm area to improve circulation. Try another sensor type. If the above corrective actions are ineffective, use a different transmitter.
SPO2 TRANS MALF	The %SpO$_2$ transducer is malfunctioning. %SpO$_2$ connector on the transducer or transmitter is dirty or corroded.	Replace the transducer or adapter cable. Change the transmitter.
Xmtr BATTERY DEAD	If it communicates, transmitter was docked with a dead 9-volt battery. Transmitter EPROM may be damaged; ECG monitoring may stop.	Undock transmitter and replace transmitter battery.
Xmtr BATTERY WEAK *Note*—Overrides CHARGE MON BAT message at central, but both messages will be displayed at TeleMon.	Transmitter was docked with a weak 9-volt battery.	Undock transmitter and replace transmitter battery.
XMTR MALF	Transmitter malfunctioning	Replace transmitter.

**Self-Test
Error and
Event Log
Messages**

The following table describes TeleMon Self-Test Error Messages, and Event Log Messages (available in Service Mode). Additionally, this table provides corrective action to remedy these failures.

There are differences in the severity of event log messages and error messages:

- Error messages can prevent TeleMon from getting into monitoring mode, and require immediate attention.
- Screen messages and event log messages, on the other hand require attention, but don't prevent TeleMon from getting into monitoring mode.

For details on displaying the Event Log, see "Viewing the Event Log" on page 5-16.

Table 5-2. TeleMon Information Messages

Message	Problem	Message Type	Log Entry	Corrective Action
Battery dead. System will shut down. Restart with AC cable attached.	Battery	Error	No	Recharge battery.
Battery needs reconditioning	Battery	Message	No	Recondition battery. If problem persists, replace battery.
Button "xxx" is not functioning	Keyboard	Error	No	Reboot. If problem persists, replace keyboard.
Calibration EXPIRED	NBP	Message	No	Conduct NBP calibration.
Calibration INVALID	NBP	Error	No	NBP Calibration process has failed. Recalibrate NBP module.
NBP communication failure	NBP	Error	Yes "NBP test err XXXXX"	Reboot TeleMon. If problem persists, replace NBP board.
Calibration date UNKNOWN	NBP	Message	No	Caused by TeleMon software upgrades where the NBP module has been used more than 100 measurements. Conduct NBP calibration.

Table 5-2. TeleMon Information Messages

Message	Problem	Message Type	Log Entry	Corrective Action
No/FFX1/Startup.ini OS Err 2	OS	Error	No	TeleMon automatically tries to connect to host PC for service. Reload the TeleMon application software.
Cannot find 'self-test,' (or one of its components). Make sure the path and filename are correct and that all required libraries are available.	OS	Error	No	Irreversible damage to the main processor board caused by disconnecting adapter cable during application software upgrade. Replace main processor board.
None	Time	Error	No	Set clock correctly. If problem persists, replace coin cell battery.
None	Time *(Reboot with no corresponding error log)*	Error	No	Replace coin cell battery.
None	Time *(Time stamp on NBP measurement is incorrect)*	Error	No	Replace coin cell battery.

NBP Event Log Error Codes

Every NBP measurement is captured in the event log in the following format:

INFO <time> <date> Nbp.cpp(349) NBP SunTech Err=XX data=SYS/DIA/MEAN

where,

- XX = the error code (see table below)
- SYS = returned systolic value
- DIA = returned diastolic value
- MEAN = returned mean value

The following table lists NBP error codes and their appropriate TeleMon message. For details on troubleshooting NBP messages, see "TeleMon Information Messages" on page 5-4.

Table 5-3. NBP Event Log Error Codes

NBP Error Code	TeleMon Message	Probable Cause	Additional Information
0	N/A	No error	Valid NBP measurement
1	NBP MEASURE FAILED	Weak or no oscillometric signal	
2	N/A	Artifact/erratic oscillometric signal	Questionable NBP measurement
3	NBP MEASURE FAILED	Exceeded retry count	
4	NBP INTERRUPTED	Exceeded measurement time limit	
85	NBP MEASURE FAILED	Blocked valves of pneumatics	
86	NBP INTERRUPTED	User aborted measurement	
87	NBP INTERRUPTED	Inflation time-out, or air leak	
88	NBP INTERRUPTED	Safety time-out	
89	NBP CUFF OVERPRESS	Cuff overpressure	
90	NBP EQUIP MALF	Power supply out of range, or other hardware problem	
91	NBP EQUIP MALF	Safety override fitted or autozero out of range	
97	NBP EQUIP MALF	Transducer out of range	
98	NBP EQUIP MALF	A/D out of range	
99	NBP EQUIP MALF	EEPROM calibration data CRC failure	
	NBP MEASURE FAILED	Any communication failures	
	CUFF NOT DEFLATED	Cuff has pressure > 15 mmHg after 3 minutes of measurement	

Table 5-4. Additional Troubleshooting Tips

Issue	Probable Cause
Parameters transmitted to Information Center	TeleMon displays ECG waveforms, a pleth wave, a delayed/annotated ECG wave, heart rate, %SpO2, and NBP, and transmits to the IC ECG, %SpO2 and NBP. ECG, %SpO2 and NBP are calculated by TeleMon, the remainder parameters are calculated by the transmitter.
Antenna coverage area	It is important to keep the patient within the antenna covering area because TeleMon does not indicate when and if the transmitter is outside the covering area.

Table 5-4. Additional Troubleshooting Tips

Issue	Probable Cause
Display looks dark	If the display looks dark even after adjusting the brightness, it's possible the display needs to be replaced. The display's estimated half-life is approximately two years. (For details, see "The Display" on page 5-41.)
NBP measurement difficulties	If you experience difficulties conducting NPB measurements, (for example a new patient has higher HR than the previous one), reboot TeleMon to reset internal settings.
Diminishing battery life	If the battery life seems to be diminishing after a number of charge/discharge cycles, the battery may need reconditioning. For details on how to recondition the battery, see "Using the Battery Reconditioner" on page 5-26.

Power On Self-Test

The self-test function checks the following components:

- Circuit boards operation (including processor board)
- Reporting of application and operating system revision numbers
- Reporting of internal NBP module software revision number
- TeleMon hardware revision
- Clock
- Keypad
- Battery charge
- Battery reconditioning
- NBP calibration and use count
- NBP measurement failure messages

If during the self-test the battery charge is detected to be below 15%, the monitor will not come up in Monitoring Mode. Instead, the monitor will power off and log a shutdown event in the Event Log. To start the monitor again, insert the AC/DC power cable, or insert a fully-charged battery.

If during self-test the NBP calibration is determined to be invalid, you are forced to enter Service Mode. You cannot enter Monitoring Mode until you complete a valid NBP calibration.

Note—If a message displays on the screen indicating that the battery needs reconditioning, TeleMon still comes up to monitoring mode. You may continue using the battery if it has enough charge for your monitoring needs. However, the battery should be reconditioned as soon as possible.

If power is interrupted to the TeleMon and it does not have a battery installed, TeleMon's settings revert to the unit settings.

Service Mode

This section covers TeleMon's Service Mode.

Service mode presents all the device setup functions in the Device Setup Menu. All settings selected in the Device Setup Menu are saved once you exit the Setup Menu and are retained even after a power cycle. The following settings are available in Service Mode:

- Restore standard settings
- Enter Demo mode
- Adjust the display contrast, and date & time.
- View transmitter information.
- Perform service functions on TeleMon and the transmitter
    - View TeleMon event log
    - Calibrate and diagnose NBP
    - Upgrade software/clone settings
    - Configure alarms
    - Configure the transmitter

The first four items are available to users as well as service personnel. All other service functions are password protected and should be performed by qualified service personnel only.

Note that you do not need the transmitter while in Service Mode.

Activating Service Mode

Service Mode can be activated during the power-up sequence in either one of two ways:

- turn TeleMon ON. During self-test, the message Push button for Service appears above the pink (NBP) button; press the pink (NBP) button below the display.
- once you have a PC setup to service TeleMon, attach an appropriate service cable, (for example an HP F1223-60901 cable) from the PC to the upgrade port on TeleMon, and turn TeleMon ON.

To exit Service Mode, you can either:

- turn the monitor off, or
- click Done at the General Configuration Menu and press Accept.

For more information on display settings, see "Monitor Setup" on page 2-13. When you restore standard settings, all setting revert to the factory default, except for alarm sound type, NPB calibration date and use count, and the ability to turn off local alarms.

Restoring Standard Settings

When you restore standard settings, all setting revert to the factory default, except for alarm sound type, NPB calibration date and use count, and the ability to turn off local alarms.

To restore standard settings, use the following instructions.

Step 1. From the Device Setup Menu, select Restore Standard Settings.

Caution

Current settings will be lost when standard unit settings are restored.

Step 2. Press Go.

Step 3. Press Accept or Cancel at the confirmation dialog box.

If you press Accept, a message appears when the restore completes.

Step 4. Press Done to return to the Device Setup menu.

Entering Demo Mode

Demo mode facilitates learning how to use TeleMon. It shows sample wave forms for a 5-lead transmitter and helps you familiarize yourself with the controls.

Note that no EASI measurements are available in Demo Mode, and that the ECG wave form has a drop-out every 60 seconds. No transmitter is required to run the demo.

Warning

If the transmitter is docked to TeleMon while in Demo Mode, the transmitter continues to transmit information to the Information Center, but that information doesn't display on TeleMon, nor does the demo data go to the Information Center. While in Demo Mode TeleMon displays only the pre-programmed demonstration.

Step 1. To activate Demo Mode, select **Enter Demo Mode** from the Device Setup Menu.

Step 2. To exit Demo Mode, turn the monitor OFF.

Change Date & Time, Display Contrast

This selection allows you to change the contrast of the display to better suit your viewing conditions. It also allows you to verify or change the date and time.

To adjust the display contrast or work with the date and time, follow these instructions.

Step 1. From the General Configuration Menu, select Date & Time, Display Contrast.

Step 2. Press Go.

Step 3. Select either Adjust Display Contrast or Set or Verify Time and Date.

Step 4. To adjust the display contrast: Use the arrow keys to adjust the contrast. The screen sample displays the result of the selection. Press Done.

To set the date and time: Use the arrow keys to adjust each number and use the Next Setting key to move among fields. Press Done after you complete the changes.

Viewing Transmitter Information

This selection allows you to view the current settings of the docked transmitter.

To view the transmitter information, follow these steps.

Step 1. From the General Configuration Menu, select View Transmitter Information.

Step 2. Press Go.

Step 3. Press View SpO2 Hardware to view the SpO2 hardware information.

Step 4. If you remove the transmitter and insert a different one, press Update to update the display with information from the new transmitter.

Step 5. Press Done to exit.

Performing Service Functions

This section describes the service functions that are password-protected. When you select TeleMon and Transmitter Service from the Device Setup Menu, you are prompted to enter the password. The password to access these functions is 14432.

To access the TeleMon and Transmitter Service menu:

Step 1. Select it and press Go.

Step 2. Enter the password 14432.

To enter the password:

a. Use the Navigate through digits button to move the flashing cursor to the next field. Use the Select digit arrows to change the number.

b. After you have entered the password of 14432, press Enter password.
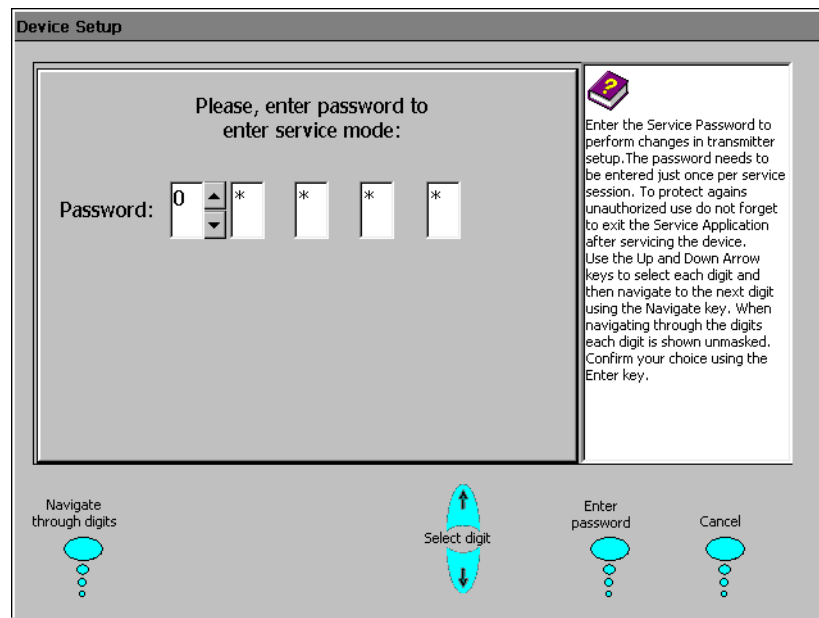
If you entered the password correctly, the TeleMon and Transmitter Service menu appears.

Device Setup

Telemon and Transmitter
Service Menu

Select procedure from the list:

```
View Telemon Event Log
Calibrate & Diagnose NBP
Upgrade Software/Clone Settings
Configure Alarms
Configure Transmitter
```

Device Service Menu:
Use the Up and Down Arrow
keys to select device service
screen of interest.
Press the Go! key to activate
corresponding screen.

Press Done key to return to
general configuration menu.

Scroll

Go

Done

Viewing the Event Log

Displaying the event log is useful during troubleshooting. Events that are logged include:

- Monitor mode start
- Watchdog timer arming
- Watchdog timer resets
- System exception resets
- Battery critically low shutdown events
- Alarm suspend/unsuspend events
- NBP out of calibration
- Battery out of calibration

To view the event log, use the following steps.

Step 1. Select **View the Event Log** from the Device Setup Menu.

Step 2. Use the up/down arrows on the front panel to scroll through the log.

Step 3. Use the up/down buttons to view the upper or lower portion of the screen. For logs with more than one section, press the View older log. This key is available only if two sections exist.

Step 4. Press **Done** to exit the Event Log.

Step 5. To exit Setup, press **Done** twice and then **Accept**.

Note—When the Event Log reaches a maximum size, TeleMon copies the Event Log to a different file (RunTimeOld.txt) and makes space for a new file. For details on downloading event log files, see page 5-16.

Downloading the Event Log

Downloading the event log may be necessary when troubleshooting TeleMon. To download the event log, a connection between the PC and TeleMon needs to be established. This connection gives you access to the event log file(s). For information on connecting the TeleMon to a PC, see "Upgrading the Software" on page 5-19. Use the following steps to download the TeleMon Event Log onto a PC.

Step 1. Enable ActiveSync serial connections. For details, see "Enabling/Disabling ActiveSync Serial Connections" on page 5-23.

Step 2. Connect the synch cable to the host PC.

Step 3. With TeleMon OFF, remove the door that protects the TeleMon upgrade port, underneath the monitor. (You may use a slot-head screwdriver to carefully push and release the latch.)

Step 4. Connect the free end of the synch cable to TeleMon.

Step 5. Turn TeleMon ON to establish the connection.

Step 6. When the host PC asks if you want to set up a partnership, select **No**. (TeleMon does not support full partnerships over ActiveSync.)

Step 7. Click the **Next** button on the PC.

Step 8. Open **Windows Explorer** on the PC.

Step 9. Select the **Mobile Device** directory, and double-click on **My Computer**.

Step 10. Double click on the **Ffx1** subdirectory.

Step 11. Copy the **RunTimeLog.txt** file to a floppy, or to the hard drive. If a file **RunTimeOld.txt** is available, copy that file as well.

Step 12. Before disconnecting, make sure that the RunTimeLog.txt file displays in the destination folder. (The file is standard text accessible through Notepad, or a similar application.)

Step 13. Rename the log files on the PC using the following format:

– TeleMonSerial#_date.txt

Step 14. When done, close **Windows Explorer**.

Step 15. Disconnect the cable and restart TeleMon.

NBP Diagnostics, Calibration

### Determining When to Perform Calibrations

The NBP calibration should be performed once a year or every **10,000** measurements, whichever comes first. (A measurement count appears on the screen during the self-test after the monitor is first turned on.). If "NBP USE COUNT HIGH" appears, the relative NBP use count is higher than the count limit detected in self-test mode. You must calibrate NBP to remove either of these messages. The calibration procedure is done in Service Mode.

Quick-Check Capability

TeleMon gives you the ability to check the pressure reading before you perform the calibration. To check the pressure reading, you need an adult cuff or a manometer pressure generator (BP bulb), and a T adaptor. You do not need a PC or a transmitter for this procedure.

Use these steps to check the pressure reading.

Step 1. Connect the adult cuff, or manometer to the monitor.
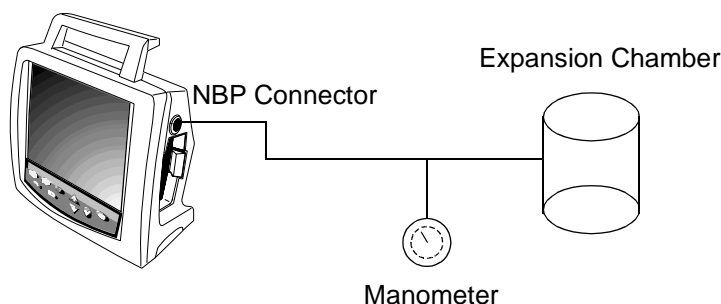
Step 2. Select TeleMon and Transmitter Service from the General Configuration menu and press Go!

Step 3. Enter the password 14432 and press Enter Password.

Step 4. Select **Calibrate and Diagnose NBP** from the TeleMon and Transmitter Service Menu and press Go!.

Step 5. Apply pressure and press the **Read Pressure** button.

Step 6. Check the pressure reading on the TeleMon screen to see if it's different from the pressure you applied. This reading will be a good indicator of the need to conduct a calibration.

Note, regardless of the accuracy of this quick-check, the NBP calibration should be performed at least once a year or every **10,000** measurements, whichever comes first.

**Step 7.** To exit Setup, press **Done** twice and then press **Accept**.

Conducting NBP Calibration

To conduct the calibration, you will need a manometer pressure generator (BP bulb), and a T adaptor. It's also recommended that you use an expansion chamber, or an adult cuff applied around a bottle or other object of appropriate size; using an expansion chamber or a cuff makes it easier to stabilize at a given pressure. You will not need a PC or a transmitter to conduct this calibration.

Before you start this calibration, note that you must complete the calibration within three minutes, and that valves release if pressure is over 300 mmHg.

Note—If the calibration fails and you power off TeleMon, you are forced to enter service mode when you start TeleMon again. You cannot use any monitoring functions until you successfully complete NBP calibration.

Step 1. Connect a manometer with a pressure generator to the monitor using the tubing and the T adapter.
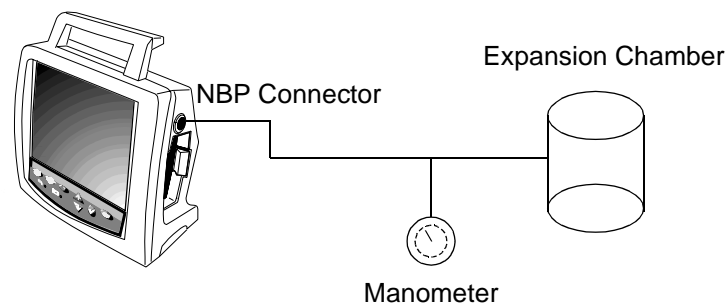
Step 2. Select TeleMon and Transmitter Service from the General Configuration menu and press Go!

Step 3. Enter the password 14432 and press Enter Password.

Step 4. Select **Calibrate and Diagnose NBP** from the TeleMon and Transmitter Service Menu and press Go!.

Step 5. Apply 0 mmHg, and press Read Pressure.

Step 6. Apply 250 mmHg and press Read Pressure.

  – If calibration is successful, the function reports that the Calibration is successful.

Step 7. Press the check-mark button to return to the Setup menu.

  – If calibration fails, you must restart the NBP Calibration.

Step 8. To exit Setup, press **Done** twice and then press **Accept**.

Note—The air pump is rated for approximately 30,000 cycles. After that, the assembly must be replaced. For details, see "The NBP Board" on page 5-38.

Upgrading the Software

TeleMon ships with the appropriate software from the factory. However, it may be necessary to upgrade the monitor's software while servicing the unit. This section describes how to upgrade the software, for both application and operating system.

TeleMon's monitoring software and its configuration files are stored separately from the operating system. This setup allows you to upgrade the monitoring software without reprogramming the operating system.

Note—You use the TeleMon Support Tool to upgrade the application software. Therefore, the TeleMon Support Tool must first be installed on your host computer. Refer to "Installing the TeleMon Support Tool" on page 5-22 for more information.

The required software components for upgrading TeleMon are contained on the TeleMon Installation CD. Those components are:

- TeleMon Application Software (in directory \Telemon Support)
- TeleMon Operating System (in directory \Tm_os)
- Programming tool for programming the Operating System in TeleMon (in directory \OS_Tool)
- Microsoft ActiveSync Connectivity Software (in directory \msasync)

Additionally you will need the following items to upgrade TeleMon:

- A host computer, laptop or desktop, with a free serial port.
  Note—If you are using a laptop, it must be plugged into an AC power source to insure that the processes are not interrupted.

- A synch cable that fits into TeleMon's upgrade connector, for example an HP F1258A or HP F1223-60901 cable.
- A TeleMon Installation CD.

Getting Started

The first step to upgrade TeleMon's software is setting up the host computer; this includes installing the TeleMon Support Tool. Once the host computer is setup, and you've determined what portion of the software needs to be upgraded, you can proceed with the installation.

Note—TeleMon must be connected to AC power when you are upgrading the software or operating system.

The following table describes the different software installation procedures described in this section.

Table 5-5. Software Installation

If	Then
you need to install the operating system,	see "Upgrading TeleMon's Operating System" on page 5-22.
you need to install TeleMon's application software,	see "Installing TeleMon's Application Software" on page 5-23.

Table 5-5. Software Installation

If	Then
you need to enable or disable ActiveSync connections,	see "Enabling/Disabling ActiveSync Serial Connections" on page 5-23.
you need to download the event log,	see "Downloading the Event Log" on page 5-16.

Setting Up the Host Computer

To upgrade the TeleMon software, you need a PC with the TeleMon Support Tool and Microsoft ActiveSync installed. The Microsoft ActiveSync connectivity software is included on the TeleMon Installation CD under CD:\msasync. You only need to install this software on your PC once, when you first set it up for servicing TeleMon.

If you already have Microsoft ActiveSync installed, you will need to uninstall it and make modifications to your synchronization files. Follow this procedure to ensure the register files are setup correctly, otherwise you may experience difficulties upgrading TeleMon software.

Note—Setting up your PC to service TeleMon requires changes to existing partnership and synchronization files on your PC; furthermore, previously established partnerships and synchronization files could be lost. For this reason, it is recommended that you back up existing Microsoft ActiveSync settings before using this procedure.

Use the following steps to setup your computer.

Step 1. If you already have Microsoft ActiveSync installed, back up existing Microsoft ActiveSync settings on your PC.

If you do not have ActiveSync installed, skip to step 3.

Step 2. Uninstall Microsoft ActiveSync from your PC.

Step 3. Insert the installation CD into the CD-ROM drive.

Step 4. Activate **Windows Explorer** and double-click on the **CD:\msasync\Current_User_CE_Service.reg** file to install this register.

Step 5. Double-click on the **CD:\msasync\Local_Machine_CE_Service.reg** to install this register.

Step 6. Install ActiveSync on your PC (CD:\msasync\Msasync.exe), and follow the instructions on the screen.

Step 7. When the installation screen displays, click **Next**.

Step 8. When the reinstall screen displays, click **Next**.
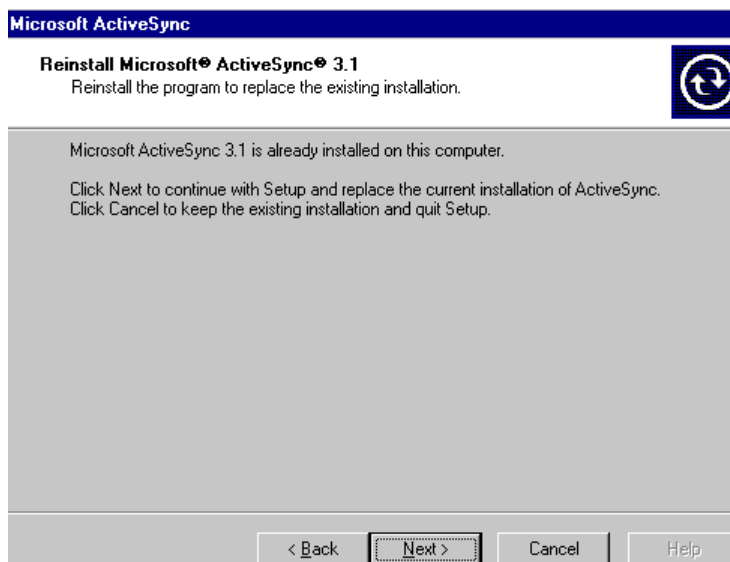
Step 9. When the Registry Settings Failed message displays, click **OK**.
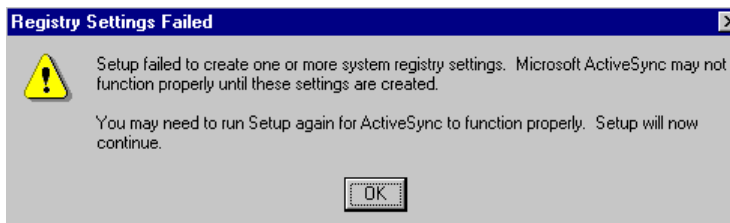
Step 10. Set the baud rate of COM1 to 115K (if you are using a port other than COM1 to connect to TeleMon, set that port's baud rate to 115K).

Installing the TeleMon Support Tool

The TeleMon Support Tool simplifies the process of upgrading TeleMon's software, cloning settings from one TeleMon to another, and changing the displayed language used by TeleMon.

To install the TeleMon Support Tool:

Step 1. Insert the TeleMon Support Tool installation CD into your host computer's CD-ROM drive.

Step 2. Navigate to the TM_Support directory of the CD, run TeleMon Support.msi, and follow the on-screen instructions.

Note—If the installation program does not run, refer to the ReadMe.txt file in the TM-Support directory for instructions.

At this point, the PC is ready for servicing TeleMon.

Upgrading TeleMon's Operating System

Upgrading the operating system is necessary only when the operating system is corrupt, or when required by an upgrade/service procedure.

Upgrading the software can take over ten minutes. To upgrade TeleMon's operating system, use the following steps.

Step 1. With TeleMon OFF, remove the door that protects the TeleMon upgrade port, underneath the monitor (you can use a slot-head screwdriver to carefully push and release the latch).

Step 2. Connect the synch cable to TeleMon. Do not connect it to the PC yet.

Note—When connecting and disconnecting the adapter cable, do so very gently to ensure that no damage is done to the circuit board. The circuit board can be damaged if not handled properly.

Step 3. Disable the Microsoft ActiveSync serial port connection on the PC. (See "Enabling/ Disabling ActiveSync Serial Connections" on page 5-23.)

Step 4. Be sure that the baud rate is set to 115K for the port that you are using to connect to TeleMon.

Step 5. Insert the installation CD into the CD-ROM drive.

Step 6. Run the Clearcom program, CD:**OS_Tool\Clearcom.exe**, on the host PC. *(The program will run in the background. You won't see a message on the screen.)*

Step 7. Run the OS download tool, CD:**OS_Tool\TabletDL.exe**, on the host PC. (A dialog box displays on the screen.)

Step 8. Click on the **Browse** button, select the OS image you want to download; CD:\Tm_os\xxxxxxxx.bin, where xxxxxxxx is the revision number, and then click Open.

Step 9. Connect the serial cable to the PC's serial port COM1.

Step 10. Click the **Download** button.

Step 11. To initiate the download process, press and hold the NBP button, (last button on the right), and turn TeleMon ON. Hold the NBP button down until the download process starts.

    – If the download doesn't start, and a time-out error displays on the computer screen, restart the process beginning with step 1.

Step 12. When the PC recognizes TeleMon and the download begins, release the NBP button. You'll see a progress bar on the screen. (If the download is unsuccessful, close the download window and restart the process starting with step 1.)

    Once the download completes, the progress bar disappears from the screen.

Step 13. When done, click **Exit** on the computer.

Step 14. Remove the cable, replace the upgrade port door, and reboot TeleMon.

Step 15. As TeleMon boots up, check the self-test to ensure no errors are detected.

Enabling/Disabling ActiveSync Serial Connections

Use the following steps to enable or disable Microsoft ActiveSync on the host PC.

Step 1. Double-click on the ActiveSync icon on the desktop.

Step 2. Click on **File** and select **Connection Settings**.

Step 3. To enable or disable ActiveSync, click the **Allow serial cable or infrared connection to this COM port** box, and select the appropriate **COM** setting from the pull-down menu.

Step 4. Click **OK** when done.

Step 5. Close the Microsoft ActiveSync window to exit this menu.

Installing TeleMon's Application Software

Once the host PC has ActiveSync and the TeleMon Support Tool installed, install the TeleMon Application Software by using the following steps.

Note—Except for NBP calibration and use count, all TeleMon settings revert to the default settings when the upgrade is complete. If you need to preserve the current settings of your TeleMon, use Clone Settings to retrieve the configuration from the TeleMon and save the settings. Refer "Cloning Settings" on page 5-25 for more information. Make sure that the OS programming tool is not running on the host PC. If it is, exit that program.

Step 1. Enable the ActiveSync serial connections on the host PC. ("Enabling/Disabling ActiveSync Serial Connections" on page 5-23.)

Step 2. Connect the synch cable to the host PC.

Step 3. Be sure that the baud rate is set to 115K for the port that you are using to connect to TeleMon.

Step 4. With TeleMon OFF, remove the door that protects the TeleMon upgrade port, underneath the monitor.

Step 5. Turn TeleMon ON.

Step 6. When the self-test screen appears, connect the cable to the TeleMon upgrade port.

Caution

Make sure that synch cable is not accidentally disconnected while the application software is being installed. Should this happen, irreversible damage to the main processor board will occur, and you will need to replace it. If the cable is accidentally disconnected, the following error message displays on the TeleMon screen: "Cannot find 'self-test,' (or one of its components). Make sure the path and filename are correct and that the required libraries are available."

Note—When connecting and disconnecting the adapter cable, do so very gently to ensure that no damage is done to the circuit board. This board is fragile and can be damaged if not handled properly.

– TeleMon should recognize the connection to the host PC and boot to Service Mode. At this point, you'll see the Connecting to Serial @ 115K message on the TeleMon screen.

– TeleMon automatically connects to the host PC. If it doesn't, repeat this process. (It is possible the Clearcom program wasn't launched properly. See step 1.)

Step 7. When the PC asks if you want to set up a partnership, select **No**, and click the **Next** button. (The ActiveSync task bar icon will turn green when connected.)

Step 8. Start the TeleMon Support Tool.

Step 9. Click Upgrade TeleMon Software.

Step 10. Select the language for the upgrade.

– If necessary, select either AAMI or IEC. Be sure to select the appropriate standard for your location.

Step 11. Click Upgrade Software

        –   A progress bar indicates the status of the upgrade.

Step 12. When the upgrade is complete, you can turn TeleMon OFF and remove the cable.

Step 13. Replace the upgrade port door and turn TeleMon ON. The application installation process is now complete.

Step 14. Verify that the TeleMon software version in the boot screen matches the version of the software on the CD-ROM.

Step 15. Verify that the time and date are properly set.

Cloning Settings

The Clone TeleMon Settings function of the Support Tool allows you to configure other TeleMon monitors with identical settings. Using the Support Tool, you can retrieve configuration settings from a monitor, create a new configuration file, or open a configuration file. You can also print a configuration file for later reference.

Before you can use the cloning software, you must prepare your computer as described in the section "Setting Up the Host Computer" on page 5-20.

To use the support software to clone settings, follow these steps:

Step 1. Connect one end of the serial cable to your computer.

Step 2. Power on TeleMon and connect the serial cable to TeleMon when the self-test screen displays.

Step 3. Start Active Sync if it is not already running.
You are prompted to start Active Sync if it is not running when you try to retrieve or send settings.

Step 4. Start the TeleMon Support Tool.

Step 5. Click Clone TeleMon Settings.
The Clone TeleMon Settings window displays.

Note—The Clone Settings selection on the TeleMon monitor displays an information screen only. You cannot change any settings on this screen.

Creating and Using a New Configuration
If you are creating a new configuration, adjust the settings and either save them or send them to the TeleMon. If there are any settings in the fields, click New Configuration to clear all fields.

To send the settings to the TeleMon, click the Send Configuration button.

To save the settings, click Save Configuration.

Retrieving a Saved Configuration
If you want to use a previously saved configuration, click Open Configuration and open the configuration file you want to use.

You can edit a saved configuration file and save it with a different name if you want to keep the older configuration file.

Retrieving a Configuration from TeleMon
If you want to retrieve a configuration from a TeleMon, click Get Configuration. You can then make changes, save the configuration, or send the configuration to other TeleMon monitors.

Changing TeleMon's Language Display

The Change Language function of the Support Tool allows you to change the language that TeleMon displays. This might be necessary if your location needs to use more than one language.

Before you can change TeleMon's language, you must prepare your computer as described in the section "Setting Up the Host Computer" on page 5-20.

To use the support software to change the language, follow these steps:

Step 1. Connect one end of the serial cable to your computer.

Step 2. Power on TeleMon and connect the serial cable to TeleMon when the self-test screen displays.

Step 3. Start Active Sync if it is not already running.
You are prompted to start Active Sync if it is not running when you try to change the language.

Step 4. Start the TeleMon Support Tool.

Step 5. Click Change Language.
The Change TeleMon Language window displays.

Step 6. Select the language you want to use.

– If necessary, select either AAMI or IEC. Be sure to select the appropriate standard for your location.

Step 7. Click Change Language.

– A progress bar indicates the status.

Step 8. When the process is complete, you can turn TeleMon OFF and remove the cable.

Step 9. Replace the upgrade port door and turn TeleMon ON.

Step 10. Verify that the language displayed is the one you selected.

Step 11. Verify that the time and date are properly set.

Using the Battery Reconditioner

The Battery Reconditioner can be used for charging or reconditioning the TeleMon battery. The reconditioner is an optional accessory.

During normal operating conditions, the battery is recharged while TeleMon is connected to an AC power source. However, over time the battery loses its ability to fully charge. When the battery's capacity changes by 10% from the last time it was reconditioned, a microchip inside the battery indicates that it needs reconditioning to optimize its performance.

To keep the battery within its optimum capacity range, it's necessary to recondition it when it loses 10% of its capacity, or approximately after 30 cycles. TeleMon indicates when the battery needs reconditioning during the self-test.

This section describes how to use the reconditioner.

Warning

Do not use the battery reconditioner in the patient vicinity.
Be sure there is no contact between the patient and the charger, including no contact
from the charger to a medical care giver to the patient.

The Battery Reconditioner can be used for charging or reconditioning the TeleMon battery. During normal operating conditions, the battery is recharged while TeleMon is connected to an AC power source. However, over time the battery loses its ability to fully charge. When the battery's capacity changes by 10% from the last time it was reconditioned, a microchip inside the battery indicates that it needs reconditioning to optimize performance.

During the reconditioning process, the battery is discharged, charged, discharged again, and then charged again.

The following table lists the definition for each LED state on the reconditioner.

LED State	Icon	Definition
Off	🔋	No battery detected in bay
Green Flash	🔋	Charging
Green Solid	🔋	Fully charged
Yellow Flash	▶◀	Reconditioning
Yellow/Green Flash	▶◀	Reconditioned and fully charged
Yellow Solid	↻	Standby: battery in bay waiting to be charged
Red Flash	⊗	Error: • Check the battery reconditioner bays to ensure that they are clean of foreign objects. • Ensure that the correct type of battery has been inserted. • Check to see if a battery is defective. The reconditioner indicates an error if a battery reaches a temperature higher than 65°C (149°F).

Determining when to recondition or charge the battery
The TeleMon monitor checks the battery during self-test, and the display indicates when the battery needs reconditioning or charging.

Before you start this process, note that reconditioning the battery can take over 12 hours. During the reconditioning process, the battery is discharged, charged, and again discharged a second time to reset its internal settings; finally to get it ready for use, it's recharged.

Recondition a Battery

To recondition a battery, use the following procedure.

Step 1. Connect the reconditioner to power.

Step 2. Insert the battery to be reconditioned into the LEFT bay.

Note—Only the LEFT bay can be used for reconditioning.

Step 3. Press the recondition button. The recondition button is the blue button with the Ⓦᵏ symbol.

During reconditioning, the LED flashes yellow. When reconditioning is complete, the LED flashes between yellow and green.

Charging a Battery

To charge a battery using the Reconditioner, use the following procedure.

Step 1. Connect the reconditioner to power.

Step 2. Insert the battery to be charged into *either* bay.

During charging, the LED flashes green. When charging is complete, the LED stays green.

Note—When a message displays on the screen indicating that the battery needs reconditioning, TeleMon still comes up to monitoring mode. You may continue using the battery if it has enough charge for your monitoring needs. However, the battery should be reconditioned as soon as possible.

Repair

This section covers how to repair TeleMon.

Repair is the replacement of currently defective replaceable modules. Once you have determined the module in which the defect is located, disassemble the monitor to the appropriate level, replace the module, and reassemble. Refer to the overview below to locate the appropriate level.

Note—Replaceable modules are listed in Chapter 7.

Note—If you replace the NBP Board or Main Board, you must recalibrate the NBP.

Tools

Table 5-6 lists the tools required to disassemble and reassemble the Monitor Unit of the M2636B TeleMon.

Table 5-6. Tools for Monitor Disassembly/Reassembly

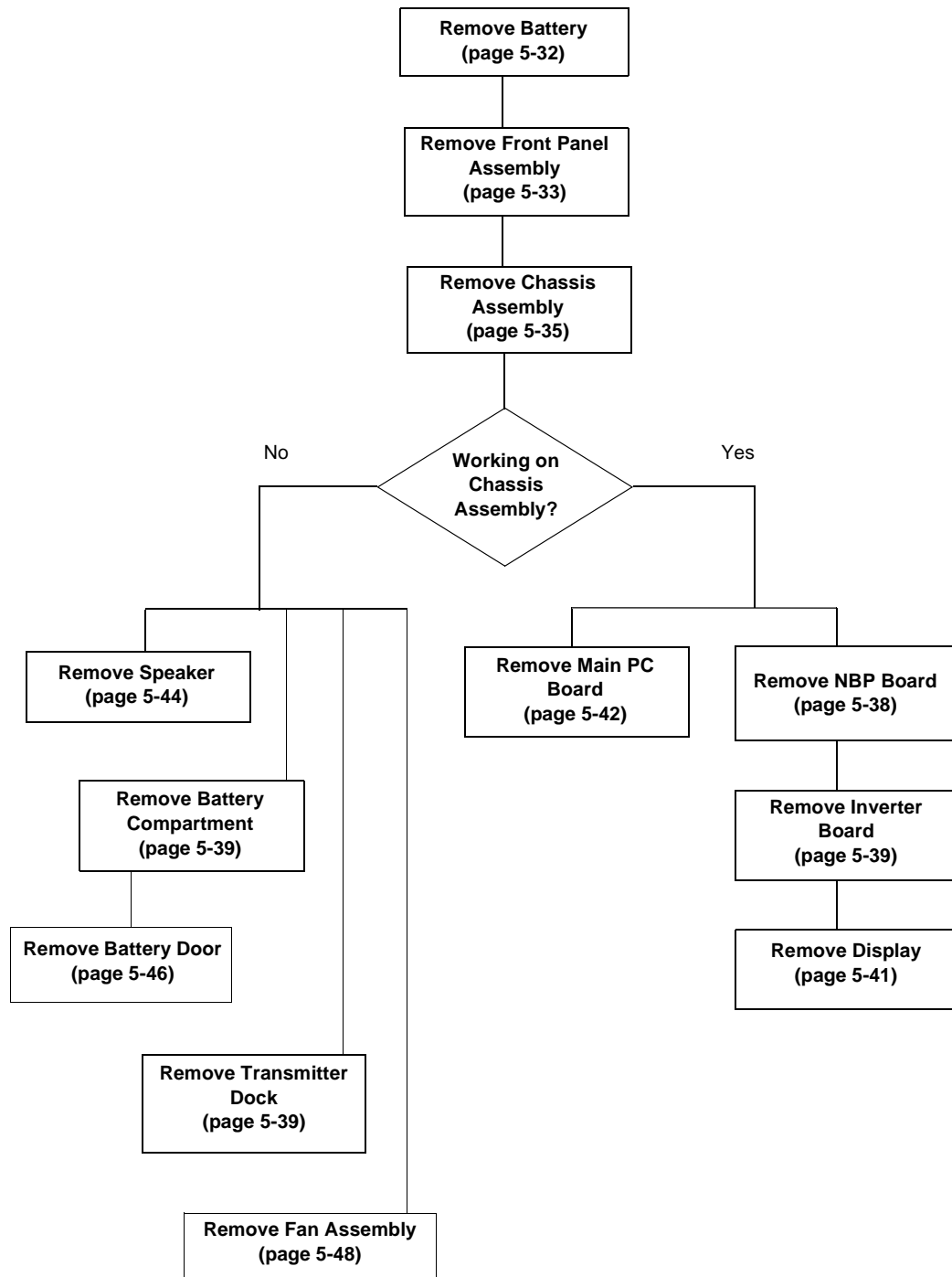| Tools |
|---|
| Number 6 Torx screwdriver |
| Number 10 Torx screwdriver |
| 3/16 Nut Driver |

Overview

```
                          ┌─────────────────────┐
                          │   Remove Battery    │
                          │   (page 5-32)       │
                          └─────────┬───────────┘
                                    │
                          ┌─────────┴───────────┐
                          │ Remove Front Panel  │
                          │     Assembly        │
                          │   (page 5-33)       │
                          └─────────┬───────────┘
                                    │
                          ┌─────────┴───────────┐
                          │   Remove Chassis    │
                          │     Assembly        │
                          │   (page 5-35)       │
                          └─────────┬───────────┘
                                    │
                                  ◇ Working on
                         No      Chassis      Yes
                              Assembly?
```

Figure 5-1 Monitor Disassembly Overview

Remove Speaker (page 5-44)

Remove Main PC Board (page 5-42)

Remove NBP Board (page 5-38)

Remove Battery Compartment (page 5-39)

Remove Inverter Board (page 5-39)

Remove Battery Door (page 5-46)

Remove Display (page 5-41)

Remove Transmitter Dock (page 5-39)

Remove Fan Assembly (page 5-48)

START HERE

A

B

Fan Installed? — N → **Install Fan Assembly (page 5-48)**

Display Installed? — N → **Install Display (page 5-41)**

Battery Door In Place? — N → **Replace Battery Door (page 5-46)**

Inverter Board Installed? — N → **Install Inverter Board (page 5-40)**

Xmitter Dock Installed? — N → **Install Xmitter Dock (page 5-47)**

NBP Board Installed? — N → **Install NBP Board (page 5-38)**

Battery Compartment Installed? — N → **Install Battery Compartment (page 5-46)**

Main Board Installed? — N → **Install Main PC Board (page 5-43)**

Speaker Installed? — N → **Install Speaker (page 5-44)**

Chassis Assembled? — Y → **Install Chassis (page 5-36)** ← Y — Rear Housing Assembled? — N → A

Install Front Panel Assembly (page 5-34)

N → B

Replace battery (page 5-32)

END HERE

Note—The order of reassembly depends on what modules you accessed.

Figure 5-2 Monitor Reassembly Overview
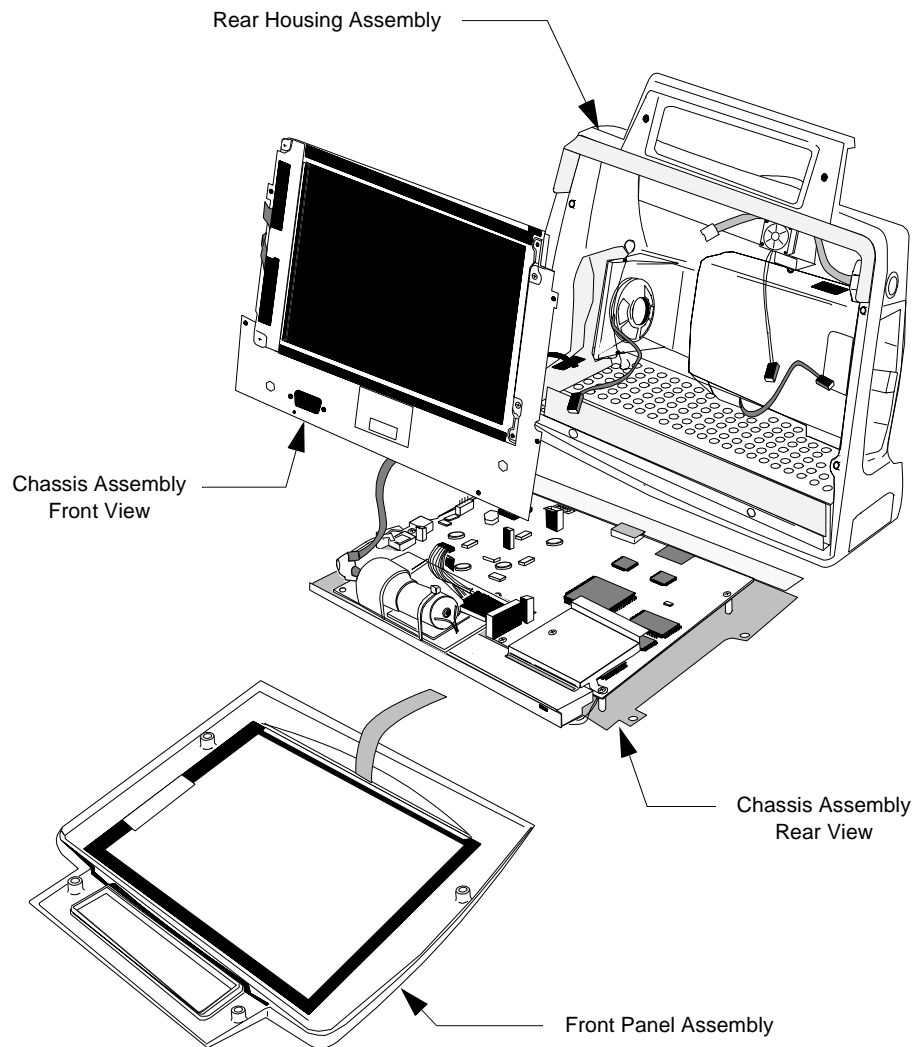
Figure 5-3 Exploded View of the TeleMon Monitor

Before You Begin

Before you begin, please keep in mind that the M2636B TeleMon is a carefully engineered, complex measuring instrument, even though compact and easy to use. It should be treated with care. Use a flexible work surface. Do not drop or shove the assemblies aside. Refrain from placing fluids where they can be accidentally spilled onto TeleMon's electronic components.

Pay special attention to inserting and removing assemblies and to deploying the fasteners. Never force an assembly. During reassembly, tighten the screws only until they are snug. If you are tightening a set of screws, proceed in sequence to opposite sides; for example, if 1, 2, 3 and 4 are at the four corners of a square, tighten in the sequence, 1, 3, 2, 4. This practice helps to prevent misalignment and breakage.

Caution

Your monitor contains components that will be damaged if ESD precautions are not observed.

The Battery
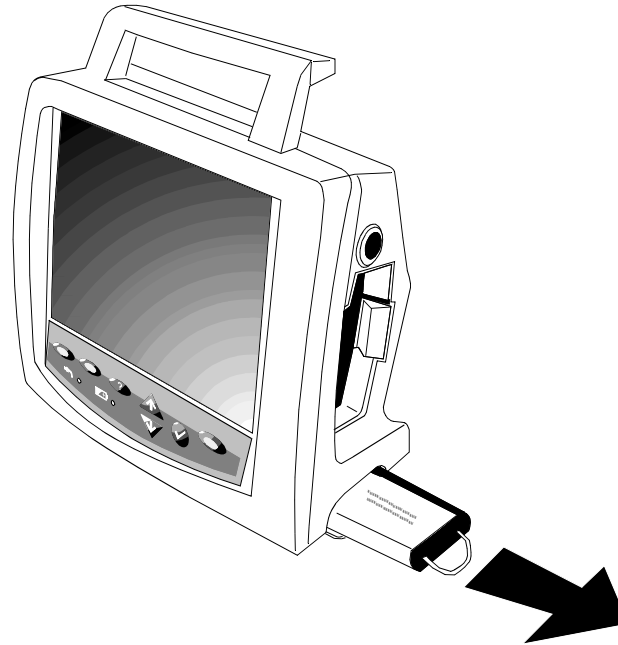
Figure 5-4 Removing the Battery

Removal of Battery

Step 1. Open the battery door on the lower right side of the monitor.

Step 2. Pull the battery straight out by the battery strap.

Replacement of Battery

Note—Installing the battery in the monitor is the last step of any reassembly. Do not install the battery in a partially disassembled monitor.

Step 1. Stand the fully assembled monitor upright.

Step 2. Insert the battery with the battery name down. Make sure that it is all the way in.

Step 3. Close the battery door.

Step 4. Turn the power switch to the "ON" position. The self-test display should appear, followed by the standard display.

Step 5. Check the battery gauge to verify the charge state of the battery.

Step 6. Perform operational and safety tests as applicable.

**The Front
Panel
Assembly**

6mm T-10

6mm T-10

Rear View
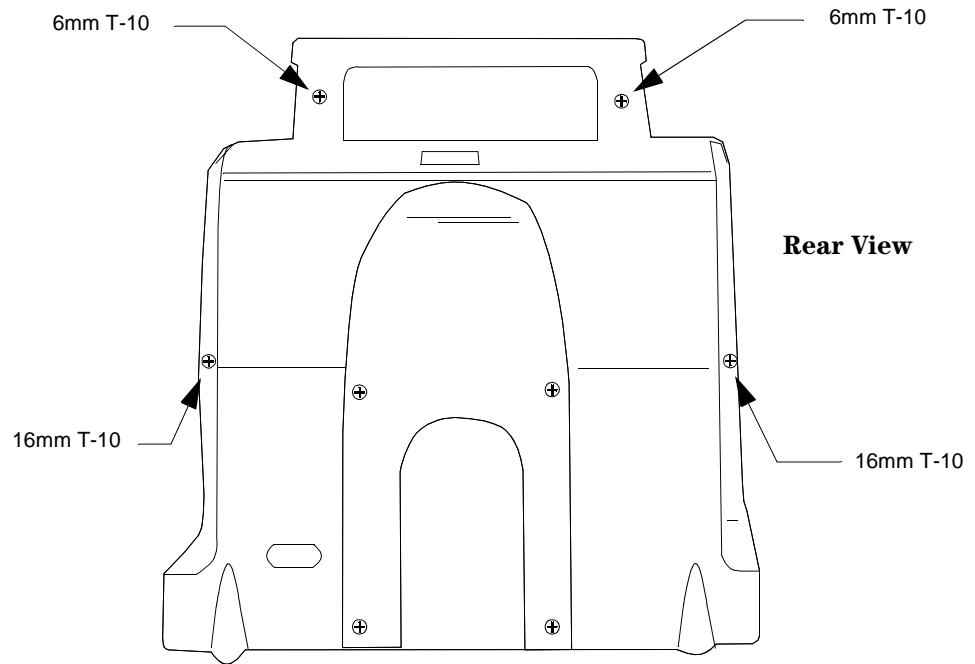
16mm T-10

16mm T-10

Figure 5-5 Unfastening the Front Panel Assembly

**Removal of
Front Panel**

Step 1.   Place the monitor face-down on a clean, soft surface.

Step 2.   Remove the two 6mm T-10 screws in the handle and the two 16mm T-10 screws near the base. You may have to invert the monitor to drop out the screws.

Step 3.   Placing the monitor on its back, open the front panel from the top and slide it toward the top of the unit, uncovering the Keyboard-to-Main Cable.
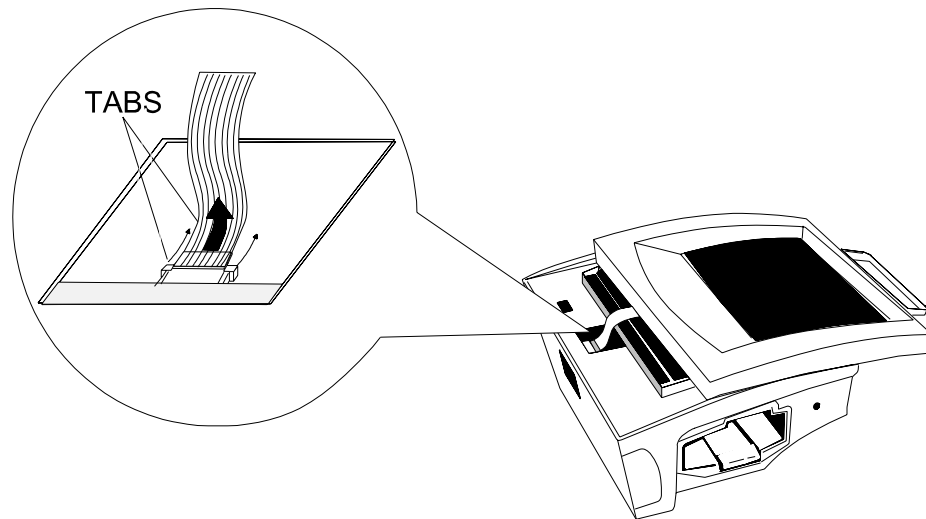
TABS

Figure 5-6 Disconnecting the Keyboard-to-Main Cable

Step 4. Lift the tabs on the monitor connector to the Keyboard-to-Main Cable to unlock the cable. Pulling the cable out, lift off the Front Panel Assembly.

Installation of Front Panel

Note—The monitor must be completely assembled except for the Front Panel Assembly. Only the Monitor Assembly, the Front Panel Assembly and the fasteners should remain loose on hand.

Step 1. Place the Monitor on its back on the work surface.

Step 2. On the Front Panel, to remove dust that can be trapped in the display area, wipe the LCD screen and anti-glare panel with a lint-free cloth moistened with isopropyl alcohol.

Step 3. Position the Front Panel Assembly over the Monitor, with the Keyboard-to-Main Cable closest to the bottom of the monitor.

Step 4. The cable connector is visible through an opening in the bottom front of the Chassis Assembly. Make sure the side tabs are fully up.

Step 5. Insert the loose end of the cable into the top of the connector and lock by sliding the tabs down.

Step 6. Slide the Front Panel Assembly toward the bottom of the unit and snap it in place. The Keyboard-to-Main cable assumes an S shape.

Note—The Front Panel must contain the plastic film for ESD and water protection. It is suggested you begin closure at the handle and push the film under the front panel at the bottom.

Step 7. Holding the Front Panel tightly to the Rear Assembly, turn the monitor over and secure the Front Panel Assembly with two 6mm T-10 screws in the handle and two

16mm T-10 screws in the housing. Be sure to tighten in a sequence of opposite corners.
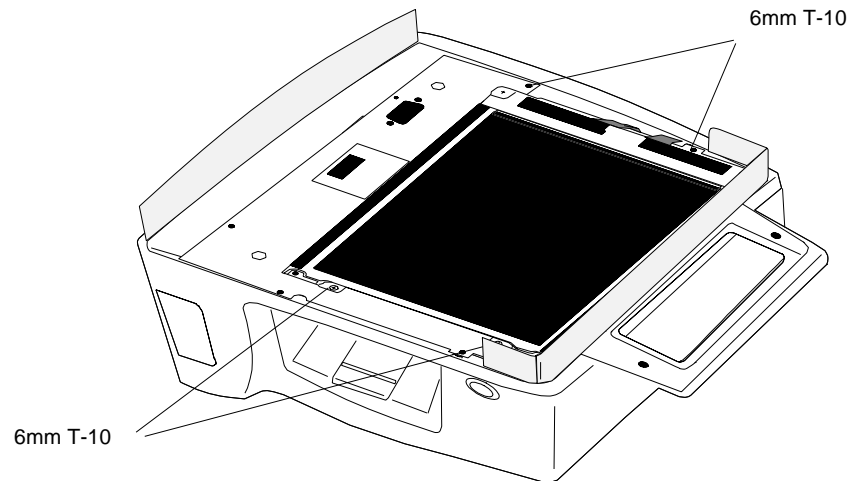
The Chassis Assembly

Figure 5-7 Detaching the Chassis Assembly

Removal of Chassis Assembly

Step 1. Place the monitor on its back.

Step 2. Remove the four 6mm T-10 screws holding the Chassis to the monitor.

Step 3. Stand the monitor up. Carefully lift out the Chassis Assembly, right side first, so that you can pass the power switch through its opening on the left side of the Rear Housing.

Note—The assembly remains tethered to the monitor by four cable connections and a tubing connection.

NBP Collar Connector
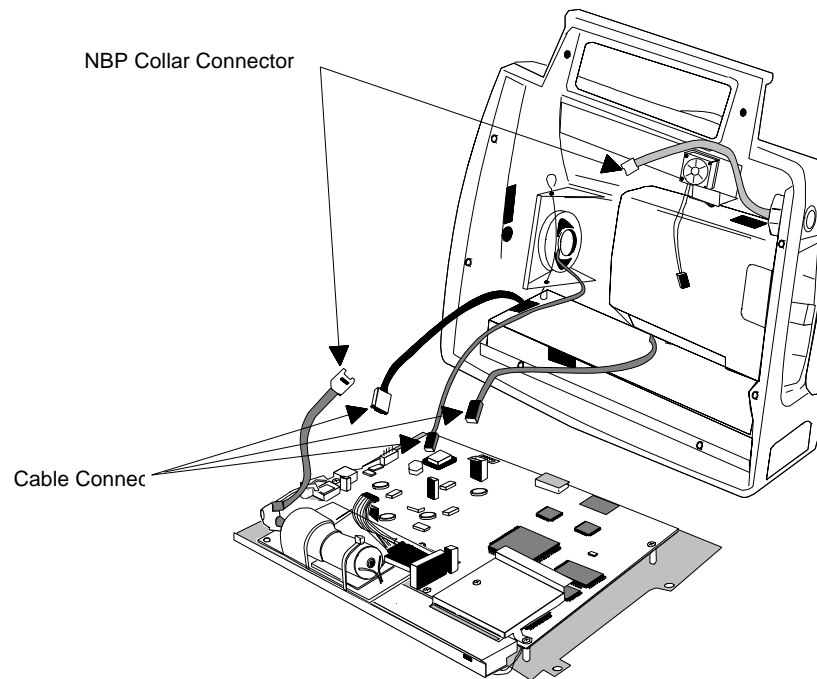
Cable Connec

Figure 5-8 Chassis Assembly Cables

Step 4. Unhook the NBP tubing from behind the Speaker Clip. Twist the NBP Tubing Collar Connector to separate the tubing.

Note—Half the tubing remains attached to the Rear Housing Assembly and half to the NBP Board.

Step 5. Gently pull on the Fan-to-Main Cable connector at the Main Board to release the cable. It remains attached to the fan.

Step 6. Squeeze the spring tab on the Speaker-to-Main Cable Connector at the Main Board to release the cable. It remains attached to the Speaker.

Step 7. Squeeze the spring tab on the Transmitter Power Cable at the Main Board to release the cable. It remains attached to the Transmitter Bay Assembly.

Step 8. Gently pull on the Battery-to-Main Cable connector from the Main Board. The cable remains connected to the Battery Compartment.

Note—The order of disassembly at this point depends of which units attached to the Chassis Assembly, or to the Rear Housing Assembly, you wish to replace.

Installation of Chassis Assembly   *Note*—The Chassis Assembly and the Rear Housing Assembly must be completely assembled. Make sure the films are in position on the top of the Rear Housing and on the bottom of the Chassis.

Note—All the connectors on the Main Board are keyed to the appropriate cable connector. Do not force a connector. If it does not easily fit, it is the wrong connector.

Step 1. Stand the Rear Housing Assembly up on the work surface, facing you.

Step 2. Align the Chassis Assembly flat on the work surface before the Rear Housing Assembly, with the Main Board up and the NBP Board closest to you.

Step 3. Fit the flange on the bottom front of the Battery Compartment between the Chassis and the Main Board.

Step 4. Press the connector of the Transmitter Power Cable into the keyed connector on the Main Board.

Step 5. Press the connector of the Speaker-to-Main Cable into the keyed connector on the Main Board. You may have to tilt the Chassis Assembly up a little.

Step 6. Tilting the Chassis Assembly up, press the Battery-to-Main Cable connector into the keyed connector at the left side of the Main Board.

Caution

Make sure that when the Chassis Assembly is tilted into place, the cable folds into the pocket formed by the fold in the battery connector film (attached to the Speaker Housing).

Step 7. Twist the two halves of the NBP Tubing Collar Connector together until they snap-lock into place. Hook the tubing behind the top of the Speaker Clip.

Step 8. Running the Fan-to-Main Cable over the **top** of the NBP Tubing, press the connector into the keyed connector on the Main Board.

Step 9. Holding the Chassis Assembly, lay the Rear Housing Assembly on its back on the work surface.

Step 10. Starting from the left side, so that you can insert the power switch on the Main Board into the appropriate opening in the Rear Housing Assembly, insert the Chassis Assembly into the Rear Housing Assembly.

Note—With your finger, insure that the Fan-to-Main Cable bows to the left, out of the way of the transmitter optical path.

Step 11. Aligning the screw holes in the Chassis with the screw mounts on the Rear Housing Assembly, fasten the Chassis Assembly to the Rear Housing Assembly with four 6mm T-10 screws.

Hint—Place the most accessible screws first.

Step 12. Be sure no ribbon cable protrudes beyond the Display on the left side of the Monitor Assembly, adjusting the position of the cable and/or Chassis Assembly, if necessary.

The NBP Board

Remove the NBP Board either to replace it or to access the Inverter Board or the Display. The Main Board can have been removed or it can be in place.
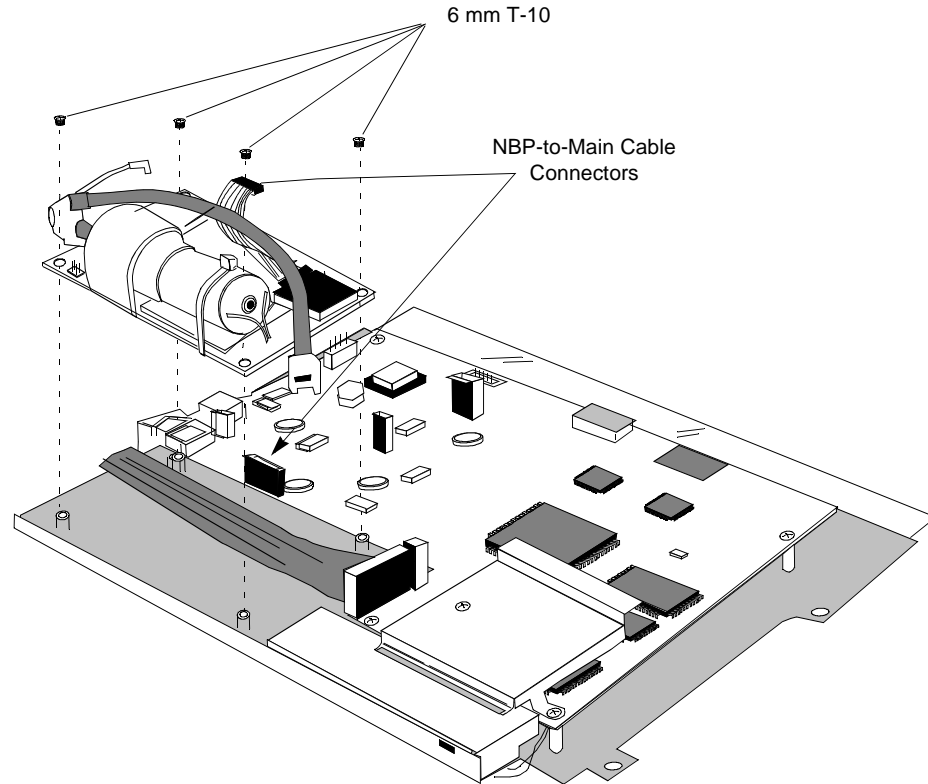

Figure 5-9 Removal of the NBP Board

Removal of NBP Board

Step 1. If necessary, press the spring tab on the NBP-to-Main Connector and disconnect the NBP-to-Main Cable from the Main Board.

   Note—If the Main Board has been removed from the Chassis, this cable may already have been disconnected.

Step 2. Remove the four 6mm T-10 screws holding the NPB Board to the Chassis and lift the board from the Chassis.

Installation of NBP Board

The Display and Inverter Board with shield must be in place and must be connected. The Inverter-to-Main and Display-to-Main Cables will run under the NBP Board and must be in place now.

Step 1. Place the NBP Board on the Chassis with the pump facing up and on the outside edge. The holes in the board should match the mounts on the chassis. Be sure the two cables are under the board, and that one screw mount divides the ribbon cable.

Step 2. Secure the board to the Chassis with four 6mm T-10 screws.

Step 3. Make sure the NBP-to-Main Cable is attached to the connector on the NBP Board.

Step 4. If the Main Board is in place, press the connector of the NBP-to-Main Cable into the keyed connector on the Main Board. If the Main Board is not in place, perform this step when you mount the Main Board.

The Inverter Board

Remove the Inverter Board to replace it or to access the Display. Before removing the Inverter Board, remove the NBP Board. The Main Board can have been removed or can be in place.
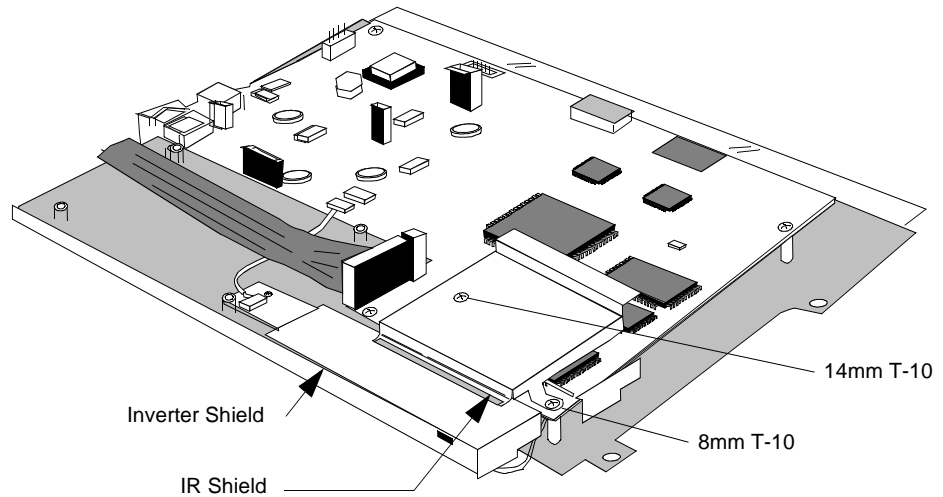

Figure 5-10 The Inverter and IR Shields

Removal of Inverter Board

Step 1. If necessary, remove the 14mm and 8 mm T-10 screws holding the IR Shield to the Main Board and take off the shield.

Note—If the Main Board has been removed, the IR Shield has been removed already.
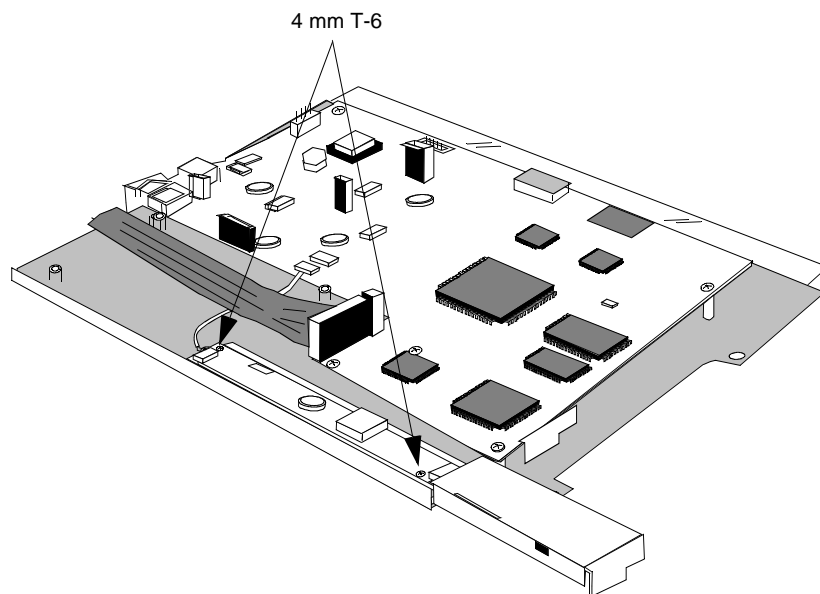
Figure 5-11 Removing the Inverter Shield

Step 2. Using the T-10 screwdriver, remove the two 4mm T-10 screws holding the Inverter Shield to the Chassis.

Step 3. Lift and slide out the Inverter Shield.

Inverter-to-Main Cable

Inverter-to-Display
Cable Connector
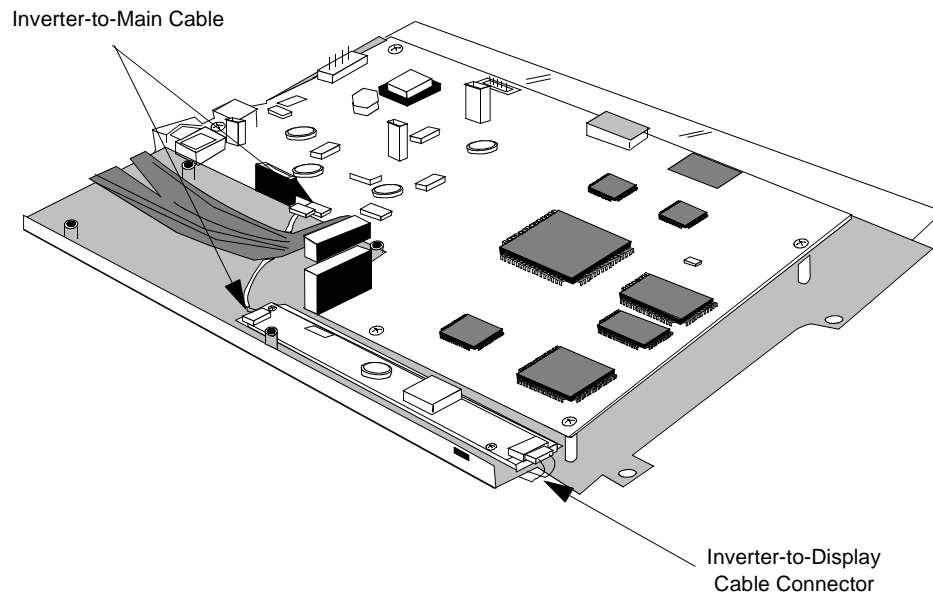
Figure 5-12 Inverter Board Connections

Step 4. If necessary, detach the Inverter-to-Main Cable connector from the Inverter Board by using fingernails on the two edges of the connector to work it loose. Do not pull on the wires or use a screwdriver.

Caution—Take extra care, as excessive force can damage the connector.

Step 5. Detach the Inverter-to-Display connector from the Inverter Board.

Step 6. Remove the two 4mm T-6 screws holding the Inverter Board to the Chassis. Lift off the board.

Installation of Inverter Board

The Display must be in place and must be connected. The NBP Board must have been removed. If the Main Board is in place, the IR Shield must have been removed.

Step 1. Place the Inverter Board on the Chassis with the large connector on the right. The screw holes in the board should match the screw mounts on the Chassis. If the large square aperture is farthest from you and the ribbon cable is on the left, the Inverter Board will be on the side closest you and to the right.

Step 2. Fasten the Inverter Board to the Chassis with the two 4mm T-6 screws.

Step 3. On the right side, gently press the connector of the Inverter-to-Display Cable into the large connector of the Inverter Board.

Step 4. On the left side of the Inverter Board, press the Inverter-to-Main Cable into the keyed connector.

Note—This cable will run under the NBP Board and must be in place, regardless of whether the Main Board is present. Take it off the Main Board, if necessary.

Step 5. If the Main Board is present, connect the Inverter-to-Main Cable to the small keyed female connector on the side of the Main Board closest to the future position of the NBP Board.

Step 6. Slide the Inverter Shield over the Inverter Board from the right. Make sure that the positioning tab on the shield is lined up with the corresponding slot of the projection on the Chassis, and that the screw holes are aligned with the mounts.

Note—The tab does not have to be in the slot.

Note—No wires should be showing under the right side of the shield.

Step 7. Fasten the shield to the Chassis with the two 4mm T-10 screws.

Step 8. If the Main Board is present, fasten the IR Shield to the Main Board. The 14mm T-10 screw goes on the inside. The other is an 8mm T-10.

The Display The LCD has a half-life of approximately two years. It should be replaced when it loses its brightness.

Removal of the Display requires prior removal of the Inverter Shield and Board, which in turn require prior removal of the NBP Board. The Main Board may be in place.
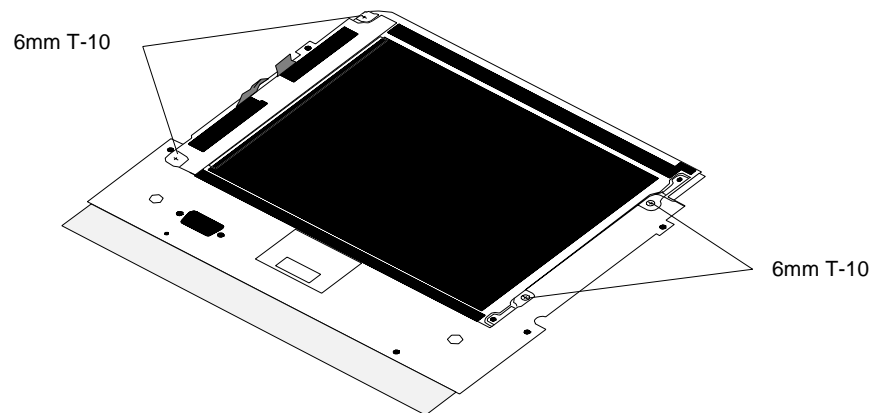
6mm T-10

6mm T-10

Figure 5-13 The Display

Removal of Display

Step 1. Detach the Display-to-Main Cable connector from the Main Board Connector by pulling.

Step 2. Holding the Chassis upright, remove the four 6mm T-10 screws from the Display.

Step 3. Lift off the Display.

Installation of Display

Step 1. Hold the Chassis on its edge with the board side facing away from you. If no board is present, the board side is the one with the tall screw mounts. The large square aperture should be at the bottom. The ESD film should be over the yellow strip on the bottom of the board side.

Step 2. Start two 6mm T-10 screws in the screw mounts on the right of the chassis.

Step 3. Position the Display in front of the Chassis with the ribbon cable to the left (Display-to-main) and the dark side toward you. Insert the slots on the right side of the display under the two screws that were started.

Step 4. Start the screws on the left side of the Display and tighten all four 6mm T-10 screws.

Step 5. Place the Chassis flat on the work surface with the Display down.

Step 6. Bend the Display-to-Main Cable over the edge of the Chassis so that one half of the cable falls on each side of the screw mounting post.

Step 7. If the Main Board is present, connect the cable to the female connector on the Main Board by pushing down.

The Main PC Board

Remove the Main Board only to replace it. The NBP Board, Inverter Board and Display can remain in place.
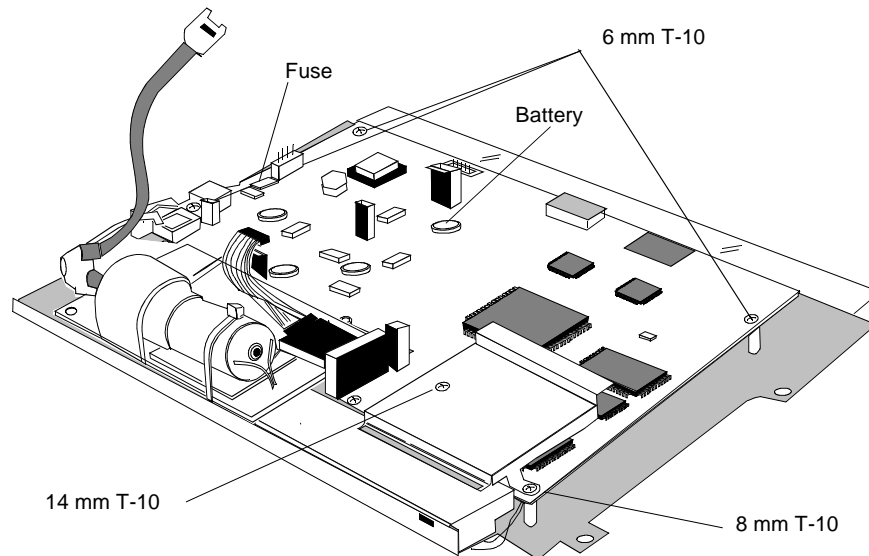
Figure 5-14 Main PC Board

Removal of Main Board

Step 1. If necessary, disconnect the Display-to-Main cable from the Main Board.

Note—If the Display has been removed, the cable may not be connected to the Main Board. If present, it is the ribbon cable that runs under the NBP Board.

Step 2. If necessary, disconnect the Inverter-to-Main Cable from the Main Board.

Note—If the Inverter Board Assembly has been removed, the cable may not be present. If present, it is the other cable that runs under the NPB Board.

Step 3. If necessary, disconnect the NBP-to-Main Cable from the Main Board.

Note—If the NBP Board has been removed, the cable may not be present. It is the large and obvious cable connected to the top of the Main Board.

Step 4. Remove the three 6mm T-10 screws holding the Main Board to the Chassis.

Step 5. Lift the Main Board off the Chassis.

Installation of Main Board

Step 1. Place the Chassis face down on the work surface. The face is the side that features the short screw mounts, to which the Display is attached.

Step 2. Align the Main Board on the mounting posts, face up.

Step 3. If necessary, connect the Inverter-to-Main Cable to the Main Board. The connector on the board is the small one nearest to the location of the NBP Board.

Note—If the NBP Board is in place, connecting the cable before fastening the board permits you to maneuver the board. However, if the Inverter Board is not in place, the cable may not yet be available.

Step 4. Fasten the Main Board to the mounting posts with three 6mm T-10 screws. Leave the holes for the IR Shield empty.

Step 5. If necessary, connect the Display-to-Main Cable to the board.

Note—If the NBP Board is in place, this ribbon cable runs under it. If the Display is not in place, the cable may not yet be available.

Step 6. If necessary, connect the NBP-to-Main Cable to the Main Board.

Note—If the NBP Board is not in place, the cable may not be available.

Step 7. Fasten the IR Shield to the Main Board with a 14mm T-10 screw nearest the Display-to-Main connector and an 8mm T-10 screw on the other side.

Replacing the Main Board Fuse or Battery

The main board contains fuses and a battery. Refer to the following diagram for the locations and specifications of these components. Both components are field replaceable.
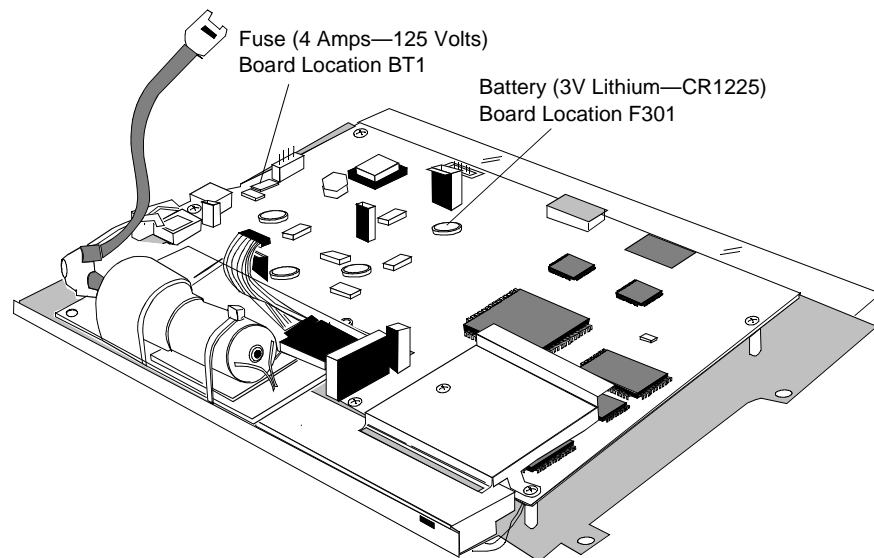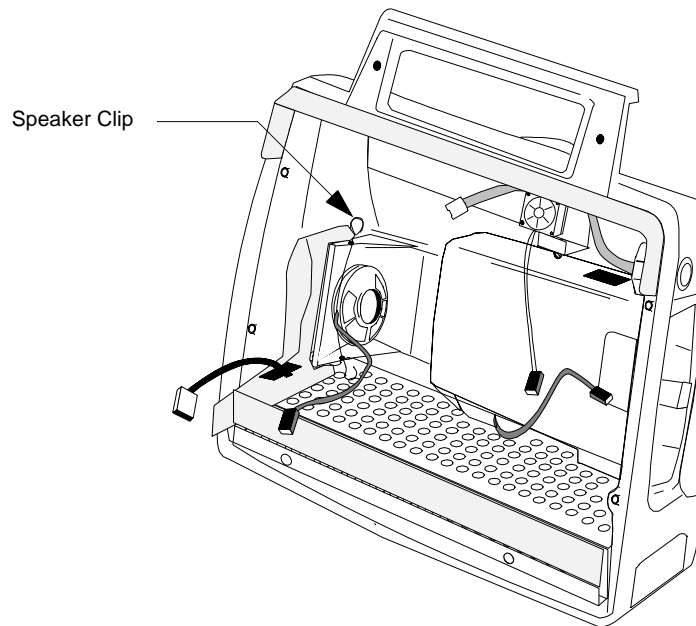

Figure 5-15 Main PC Board

The Speaker

Speaker Clip

Figure 5-16 The Speaker

Removal of Speaker	**Step 1.** Inside the Rear Housing, remove the Speaker Clip holding the Speaker to the mount.
	Step 2. Twist and pull out the Speaker.

Installation of Speaker	**Step 1.** Position the Speaker against the mount, making sure the Speaker-to-Main Cable is on the outside. Slide the rim of the Speaker under the prongs provided.
	Step 2. Insert one end of the Speaker Clip into the slot on the bottom of the mount, bend it over the outside rim of the speaker, and insert the other side into the slot on the top of the mount.

Caution—The clip must follow the notch in the outside rim of the speaker. Placing it across the center will create a path for ESD between the clip and the cable connector.

**The Battery
Compartment**

Bottom of TeleMon
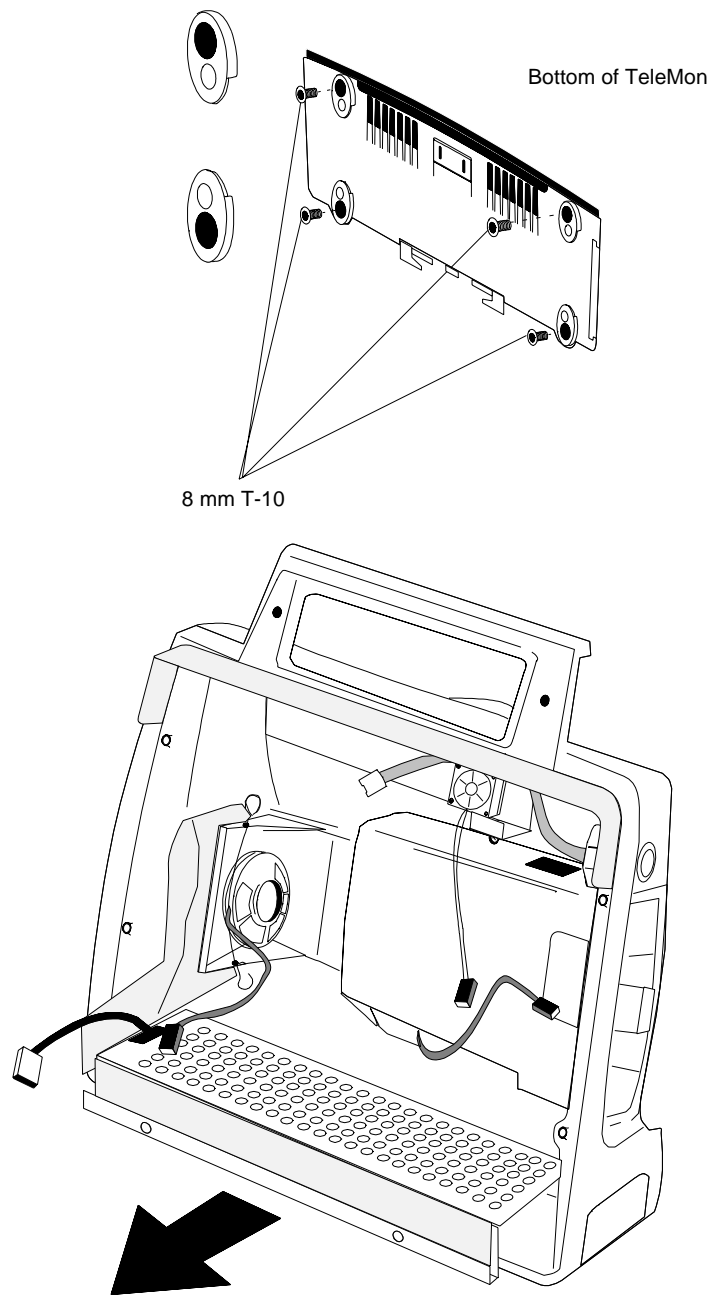
8 mm T-10

Figure 5-17 Removal of the Battery Compartment

**Removal of
Battery
Compartment**

Step 1. Remove the four 8mm T-10 screws holding the four feet to the bottom of the Rear Housing and pull the feet off.

Step 2. Slide the Battery Compartment out of the open front of the Rear Housing.

Hint—The Battery Door must be open, and the serial port door must have been removed.

Step 3. Remove the pin holding the Battery Connector to the compartment.

Installation of Battery Compartment

Step 1. Stand the Rear Housing up with the open side facing you.

Step 2. Open the battery door on the housing, if necessary.

Step 3. Attach the Battery Connector to the Battery Compartment with the pin. Make sure that the wires face up.

Step 4. Place the Battery Compartment in the bottom of the Rear Housing through the front, making sure the cable is on the left. The left side of the film pocket must go over the left side of the Battery Compartment.

Step 5. Place the Rear Housing on its back.

Step 6. Fasten the four feet to the bottom of the case with four 8mm T-10 screws. The cut-outs in the feet must face the inside.

Caution—Tighten the screws only until snug. Do not overtighten.

The Battery Door
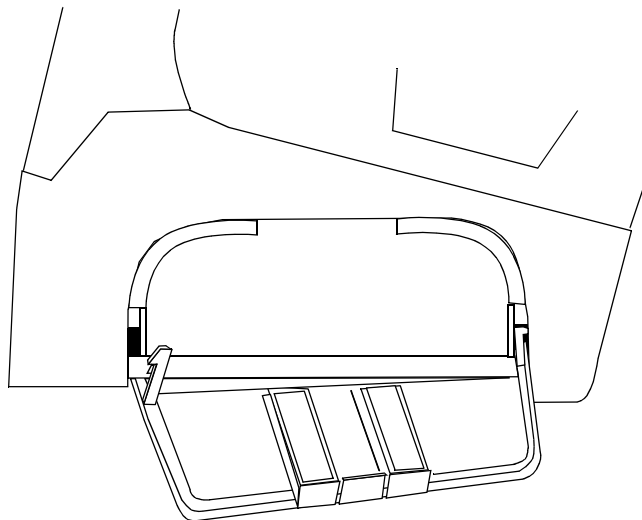
Figure 5-18 The Battery Door

Removal of Battery Door

Step 1. Make sure the Battery Door is open and is in a horizontal position.

Step 2. Push the Battery Door post closest to the open side of the Rear Housing. The door falls out.

Installation of Battery Door

Step 1. Placing the Battery Door in a horizontal position under the battery port, hook the door post closest to the back of the TeleMon into the slot provided.

Step 2. Snap the other door post into its slot, pushing up from the bottom.
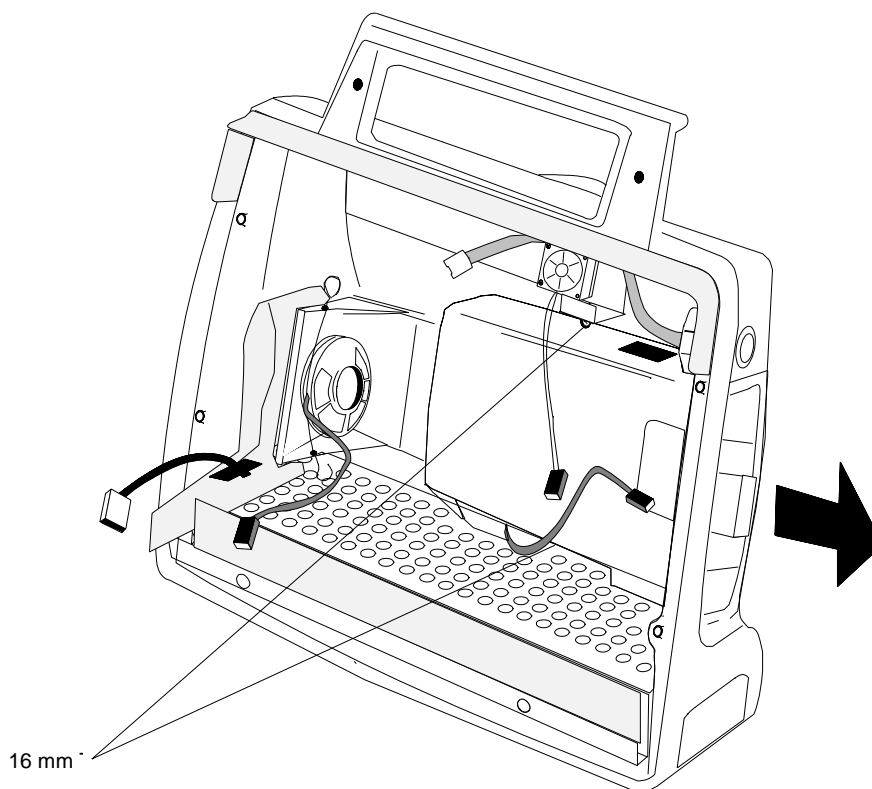
**The
Transmitter
Dock**

16 mm

Figure 5-19 The Transmitter Dock

**Removal of
Transmitter
Dock**

Step 1. Remove the two 16 mm T-10 screws holding the dock to the case.

Step 2. Lift and slide the dock part way through the docking opening.

Step 3. Thread the connector of the Transmitter Power Cable (attached to the bay) through the bottom of the docking port and finish removing the Transmitter Bay Assembly. Rocking the assembly facilitates removal. The three component pieces come apart in your hand.

**Installation of
Transmitter
Dock**

Step 1. Holding the three component pieces of the dock together, insert the top rear into the docking port. The cable should be at the bottom.

Step 2. Thread the connector of the Transmitter Power Cable through the bottom of the port.

Step 3. Push the dock fully in.

Step 4. Fasten the dock to the case with the two 16mm T-10 screws.

Note—Before you insert the fasteners, make sure the Fan-to-Main Cable and the NBP Tubing run outward over the top of the dock.

The Fan Assembly

Removal of Fan Assembly

Step 1. If the NBP Tubing is in place, remove it from the supporting channel of the Speaker Mount.

Step 2. Remove the two 14 mm T-10 screws from the top of the fan housing and the one 6 mm T-10 screw from the exhaust conduit.

Step 3. Lift and slide the Fan Assembly out over the reflective surface of the Speaker Mount.

Note—Do not attempt to pry the fan housing from the exhaust conduit, to which it has been bonded.

Installation of Fan Assembly

Step 1. With an alcohol swab, wipe away any dust or lint that have accumulated on the Rear Housing or vent.

Step 2. Insert the Fan Assembly over the top of the reflective surface of the Speaker Mount and hold it so that the holes are aligned with the screw mounts.

Step 3. Fasten Fan Assembly to the screw mounts with two 14 mm T-10 screws through the top of the fan housing and one 6 mm T-10 screw through the exhaust conduit.

Hint—Replace the 6mm screw first.

Step 4. Replace the NBP Tubing in the supporting channel of the Speaker Mount.

Step 5. Insure that the Fan-to-Main Cable runs over the **top** of the NBP Tubing.

The Splash Guard

The splash guard helps protect the internal components of the TeleMon.

Removing the Old Splash Guard

If necessary, remove the old splash guard by carefully pulling the guard away from the TeleMon housing. You should do this with no other components attached to the rear housing.

Installing the New Splash Guard

Step 1. Remove the adhesive protector from the middle portion ONLY of the guard.

Step 2. Align edge of adhesive with top edge of rear housing and press into place. Note that the plastic extends beyond the housing. No adhesive, however, should be exposed beyond the housing.

Caution

The adhesive on the splash guard is very strong. Therefore, be very careful when installing it. Do not reposition the splash guard. If you make a mistake when installing the splash guard, remove it and install a new one.

Step 3. Remove the other adhesive protectors and press the guard into the corners.

There should be no gaps between the rear housing and the splash guard.

Remove adhesive protector from center portion first.

Remove adhesive protector from sides and press into corners.
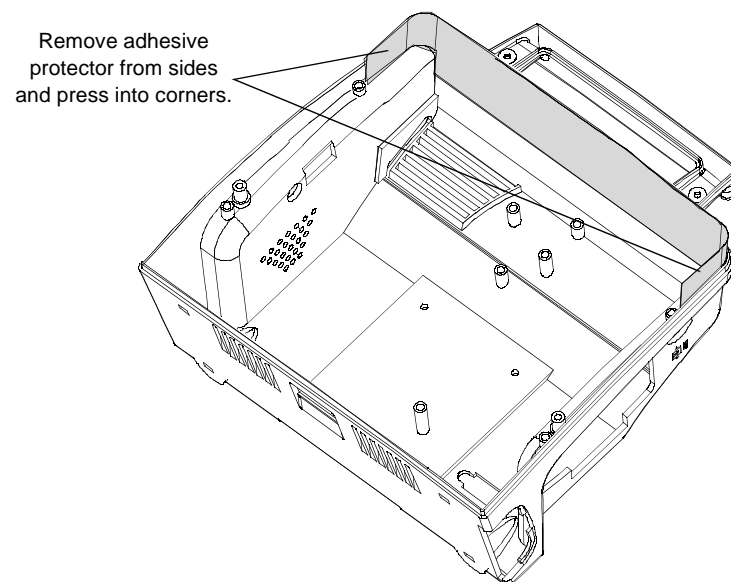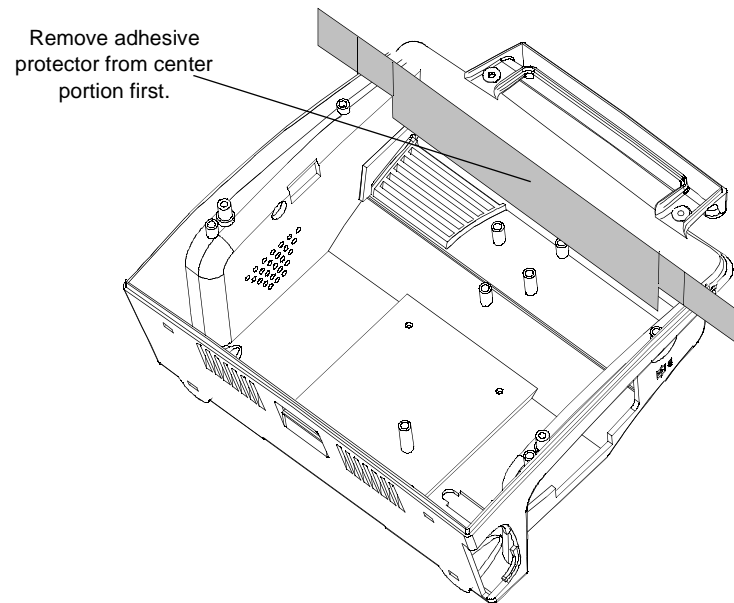
Repair

6
Test and Inspection Matrix

This chapter includes the Test and Inspection Matrix for the M2636B TeleMon Monitor.

Tests that require power should be performed with the TeleMon on AC power, but with the battery installed.

M2600A Telemetry System - Test and Inspection Matrix

Test Block Name	Test or "Inspection" to Perform	Expected Test Results	What to Record on Service Record
Visual Test:	Inspect the system (and packing material if applicable) for obvious signs of damage. Also check external leads and accessories.	The system does not have any obvious signs of damage = Pass.	**V:P** or **V:F** where P=Pass and F=Fail
Power On:	<table><tr><td>**Step**</td><td>**Action**</td></tr><tr><td>1</td><td>Switch on the M2636B.</td></tr><tr><td>2</td><td>Observe that the monitor boots up successfully without displaying any error codes and that output appears on the display (example waveform and parameter labels). An indication that the "battery needs reconditioning" is acceptable.</td></tr><tr><td>3</td><td>Insert a functioning Telemetry transmitter that is compatible with the M2636B. Observe that the "Transmitter Disconnected" prompt disappears when the transmitter is docked.</td></tr></table>	Monitor boots up displaying no error codes, responds correctly to telemetry transmitter = Pass	**PO:P** or **PO:F** where P = Pass and F = Fail

Test Block Name	Test or "Inspection" to Perform	Expected Test Results	What to Record on Service Record
Performance Test NBP:	**Accuracy Test** 	Value displayed on Monitor = x1 If difference <=3mm proceed to next test	

Accuracy Test

Step	Action
1	Connect the manometer and the pump to the NBP connector.
2	Go to Service Mode.
3	Go to the Calibration application.
4	Raise the pressure to 280 mmHg with the manometer and pump.
5	Wait 10 seconds for the measurement to stabilize.
6	Compare the manometer values with the displayed values. Document the value displayed by the Monitor. If the difference is greater than 3mmHg then calibrate the module.

Leakage Test

Leakage test value = x2
If <= 6mmHg proceed to next test

Step	Action
1	Watch the pressure value for 60 seconds. After 60 seconds the value should have decreased by less than 6 mmHg.
2	Calculate and document: Leakage test = Accuracy - displayed value.

Test Block Name	Test or "Inspection" to Perform	Expected Test Results	What to Record on Service Record
	Linearity Test 	Step	Action
---	---
1	Reduce the manometer pressure to 150 mmHg.
2	Wait 10 seconds for the measurement to stabilize, then compare the manometer values with the the displayed values.
3	Document the value displayed. If the difference is greater than 3mmHg then calibrate the module.		Value displayed by Monitor = x3	**PN:P/x1/x2/x3** or **PN:F/x1/x2/x3** Where P = Pass And F = Fail
<u>Safety</u> (<u>1</u>):		Step	Action
---	---
1	System Safety Test Enclosure Leakage Current/Normal Condition: See the next section, "Safety Tests," for details.
2	System Safety Test Enclosure Leakage Current/Single Fault Condition: See the next section, "Safety Tests", for details.		Normal Condition maximum leakage current = x1 ($\leq$300 µA) Single fault maximum leakage current = x2 ($\leq$300 µA)	**S1:P/x1/x2** or **S1:F/x1/x2**
<u>Safety</u> (<u>2</u>):	Protective Earth. See the next section, "Safety Tests," for details.	Protective earth with mains cable: Maximum impedance = x1 ($\leq$200 µOhm)	**S2: P/x/** or **S2:F/x**
<u>Safety</u> (<u>3</u>):	Patient Leakage Current/ Single Fault Condition: See the next section, "Safety Tests," for details.	Maximum leakage current = x1($\leq$300 µA)	**S3:P/x** or **S3:F/x**

Safety Tests

The test procedures outlined in this section are to be used **only** for verifying safe installation or service of the product in question.

The setups used for these tests and the acceptable ranges of values are derived from local and international standards but may not be equivalent.
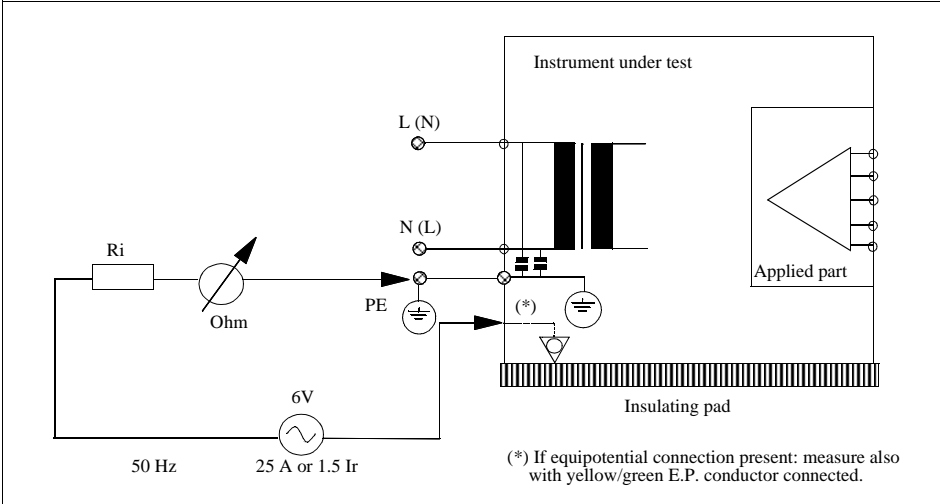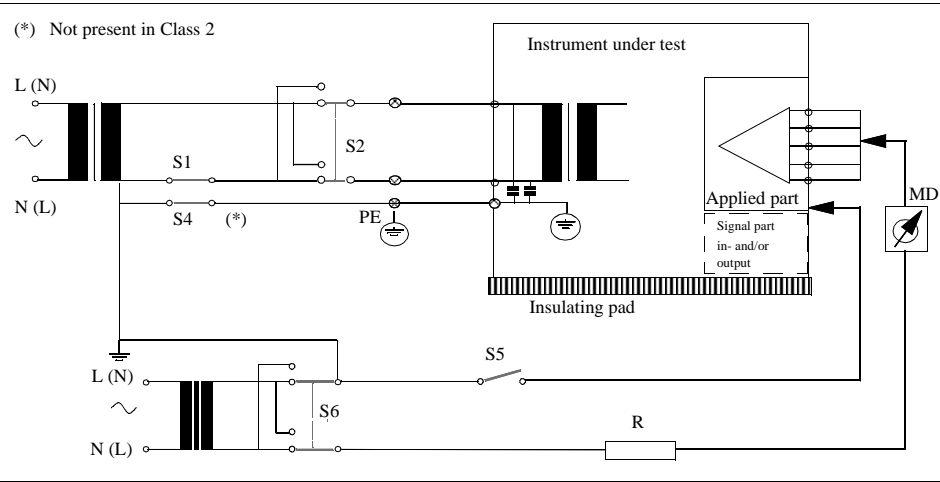
These tests are **not a substitute for local safety testing** where it is required for an installation or a service event.

If using the Metron Safety tester use your local regulation to perform the test, *for example* in Europe IEC601-1/IEC601-1-1 and in the US UL2601-1. The Metron Report should print results with the names listed below, along with other data.

Safety checks at installation refer to safety aspects directly related to the installation and setup activities and not to intrinsic safety features that have already been checked during final acceptance testing at the factory.

Test Block Name	Test or Inspection to perform
S(1) System Enclosure Leakage Current - NC (normal condition)	 Measures leakage current of exposed metal parts of Instrument under Test (IUT) and between parts of the system within the **patient environment**; normal and reversed polarity using S2. *Safety test according IEC 601-1-1 (Clause 19.201.1)* Report largest value
S(1) System Enclosure Leakage current - OE (open earth)	 Measures leakage current of exposed metal parts of Instrument under Test (IUT) with Protective Earth (PE) open circuit (S4= open) and between parts of the system within the **patient environment**; normal and reversed polarity using S2. *Safety test according IEC 601-1-1 (clause based on 19.201.1}* Report largest value.

Test Block Name	Test or Inspection to perform
S(2) Protective Earth	 Measures impedance of Protective Earth (PE) terminal to all exposed metal parts of Instrument under Test (IUT), which are for safety reasons connected to the Protective Earth (PE). Includes normally the wiring in the mains cable (max. 200 mOhm). Test current 25 Amps applied for 5 seconds to 10 seconds. The recommendation is to flex the main cable during the test in order to identify potential **bad** contact or damage of the earth wire. *Safety test according IEC 601-1 (Clause 18)* Report largest value.
S(3) Patient Leakage current - AC	 Measures patient leakage current from applied Part to earth caused by external main voltage on applied Part with switch S5 open and closed. Each polarity combination possible is tested using S2 and S6. This test is applicable for every listed module. (ECG, ECG / RESP, Invasive Pressure, Cardiac Output, CO_2, SpO_2, SvO_2, FiO_2 Temperature) *Safety test according IEC 601-1 (Clause 19.4.h}* Report largest value.

M2600A Telemetry System - When to Perform Test Blocks

Service Event When performing.....	Test Block(s) Required Complete these tests
Installation of M2636B.	Perform Visual, Power On test block.
Repairs affecting the power supply assembly (excluding battery).	Perform Power On and Safety (2) test blocks.
Repairs where the monitor has been dropped.	Perform Power On and Safety (2) and (3) test blocks.
Repairs where NBP or main processor board have been replaced.	Calibrate NBP and perform Power On test block.
All other repairs, hardware or software upgrades.	Perform Power On test block.
Upgrade to hardware.	Perform Power On test block.
Upgrade to software.	Perform Power On test block and check revision code for correct load.
Preventive Maintenance.	Perform all Performance test blocks.

7
Parts List

This chapter includes an orderable parts list for the M2636B TeleMon Monitor.

Number	Description	Part
0950-3769	Transformer between the wall outlet and the TeleMon monitor.	External Power Supply
0950-3919	A PC board mounting the electronics for the inverter.	Inverter Board
1420-0864	3 V Lithium battery pressed into a holder mounted on the main board. It powers the internal RT clock.	Coin Cell Battery
2090-0392	A 19.6 cm. color DSTN Liquid Crystal Display (LCD) with integral backlight, used as the front display screen.	Display
8121-0109	Runs between the Battery Compartment and the Main Board. Integral connectors on each end.	Battery-to-Main Cable
M1204-61025	Circular speaker with integral input cable.	Speaker and Cable
M1275-01026	Wire clip holding speaker to mount.	Speaker Clip
M2626-40001	Pre-formed plastic case for mounting the other parts of the Rear Housing Assembly.	Rear Housing
M2636-01007	Formed metal exhaust conduit to which the cooling fan with integral cable have been bonded.	Cooling Manifold Assembly
M2636-01008	The bracket holding the External Power Supply to its mount.	External Power Supply Bracket
M2636-11302	Contains the operating system, application software and PC Connectivity Tool.	Software CD ROM Kit
M2636-20010	Fastens battery cable connector to the Battery Compartment.	Alignment Pin for battery connector
M2636-40002	Pre-formed plastic part.	Battery Door
M2636-40003	Pre-formed plastic part, one-half of the Transmitter Dock.	Transmitter Bay
M2636-40004	The other half of the Transmitter Dock.	Transmitter Latch
M2636-40005	Pre-formed plastic part, fastened to rear of Rear Housing. It hold the external cables and cuff attaching to the monitor.	NBP Cuff Holder
M2636-40006	Plastic foot attached to bottom of monitor.	Monitor Foot (4)
M2636-40007	Pre-formed plastic part, which screws to a wall or pole mount. It then slides into the NBP Cuff Holder and is held by a snap latch.	Dovetail

Number	Description	Part
M2636-40008	Pre-formed plastic part. The door covering the serial upgrade port, visible through an opening in the bottom of the Rear Housing.	Serial Upgrade Door
M2636-60100	Assembly consisting of pre-formed plastic case, display, antiglare panel, keyboard and keyboard overlay.	Front Panel Assembly
M2636-60101	Splash guard kit consisting of plastic film with adhesive.	Splash Guard Kit
M2636-60102	Kit of extra screws required for reassembly. Consists of:	Screw Kit
	Screw used for monitor assembly.	M3.0x8mm Torx T-10
	Screw used for monitor assembly.	M2.0x4mm Torx T6
	Screw used for monitor assembly.	M3.0x14mm Torx T-10
	Screw used for monitor assembly.	M3.0x6mm Torx T-10
	Screw used for monitor assembly.	M3.0x4mm Torx T-10
	Screw used for monitor assembly.	M3.0x16mm Torx T-10
M2636-60110	Ribbon cable between the LCD and the Main Board. Splits at one end. Three integral connectors.	LCD Data Cable
M2636-60120	Runs between the Inverter Board and the LCD. Integral connectors on each end.	Inverter-to-LCD Cable
M2636-60130	Runs between the NBP Board and the Main Board. Integral connectors on each end.	NBP-to-Main Cable
M2636-60140	Power cable running between the transmitter and the Main Board. Integral connector on each end.	Transmitter-to-Main Cable
M2636-60302	A PC board mounting the electronics and the cuff pump for non-invasive blood pressure (NBP) measurements. *Note*—The new NBP module is compatible with older versions of the TeleMon software and hardware.	NBP Board Assembly
M2636-60301	The air conduit tubing, mount, and collar connector.	NBP Connector Assembly
M2636-60412	Device for reconditioning the battery.	Battery Conditioner
M2636-60500	10.8-volt, rechargeable NiMH.	Internal Battery
M2636-68200	A PC board mounting ICs and other electrical components, containing the TeleMon's major electronics (exchange assembly).	Main Board
M2636-90035	TeleMon Release B User and Service Documentation (CD-ROM).	User and Service Documentation CD

8
Maintenance and Cleaning

Maintenance

Care and maintenance of TeleMon is limited to making sure the unit is clean and inspected to see if the unit damaged should it be dropped or exposed to any other such trauma. In order to keep your Telemon in the best working condition, perform all maintenance activities as described in this manual.

Date & Time

The date and time displayed at the upper right of the display can be adjusted in Service Mode. See "Change Date & Time, Display Contrast" on page 5-13 for details.

TeleMon Disinfection

Under normal operation, the transmitter recess and TeleMon exterior should be disinfected between patients.

Warning
To prevent fire, provide adequate ventilation and do not permit smoking when cleaning or disinfecting the equipment.

Warning
Disconnect line power and remove battery from TeleMon to prevent electrical shock and accidental turn-on during cleaning.

Warning
Exposure of electrical contacts or connections to saline or other liquids is dangerous. Electrical contacts and connections such as cable connectors, power supplies, and plug-in connections must be kept clean and dry. Do not immerse this device in water.

Warning
Do not use any abrasive cleaning materials on any part or component of the TeleMon. Do not clean any part or component of the TeleMon in any overly vigorous or abrasive fashion. Using abrasive cleansers and abrasive cleaning actions will damage the components.

Caution

Use only a 10% solution of sodium hypochlorite (bleach) in water as a cleaning fluid. Do not use any other cleansers, such as betadine.

Caution

Remove the battery and any cables or accessories before you clean TeleMon.

Disinfection Instructions

To disinfect the TeleMon exterior, battery compartment, and transmitter recess, use the following directions:

Step 1. Turn TeleMon OFF.

Step 2. Disconnect the power cord, and remove the battery.

Step 3. Undock the transmitter as well, and the NBP cable.

Step 4. Wipe the outside surface, the battery compartment, and the transmitter recess with a pad dampened with a solution of 10% sodium hypochlorite (bleach) in water. Do not use any other cleaning agents.

Step 5. Wipe all cleaned surfaces dry with a clean, dry pad.

Step 6. If further cleaning is necessary,

    a. lightly spray surfaces with cleaning solution.
    b. scrub down surfaces with a cotton swab, sponge applicator, or stiff brush. The area under the power contacts should be carefully cleaned such that all visible contamination is removed.
    c. tip TeleMon to allow excess fluid to run out of recess and battery compartment.
    d. wipe cleaned surfaces dry with a clean, dry pad.

Note—Do not immerse the monitor in cleaning solution.

Step 7. Allow TeleMon to air-dry for 1/2 hour before reuse.

NBP Cuff Cleaning

The cuff can be disinfected by immersion in a decontamination solution of 70-85% isopropyl alcohol, but remember to remove the rubber bag if you use this method. The cuff should not be dry cleaned.

The cuff can also be machine-washed or hand-washed as recommended by the manufacturer; the latter method will prolong the service life of the cuff. Before washing, remove the latex rubber bag and, for machine-washing, close the Velcro fastening. Allow the cuff to dry thoroughly after washing, then reinsert the rubber bag.
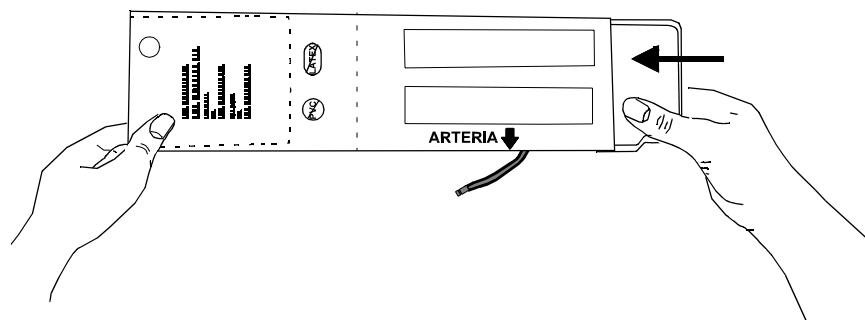
NBP Calibration

NBP calibration should be performed once a year or every 10,000 measurements, whichever comes first. The calibration procedure is done in the Service Mode of TeleMon. See "NBP Diagnostics, Calibration" on page 5-17 for instructions.

Accessories

The performance specifications and tolerance of TeleMon are established using our supplied accessories and supplies. Non-supplied accessories and supplies may corrupt the performance of the equipment. We assume no liability for poor performance or injury caused by non-supplied accessories and supplies.

Warning

Non-supplied accessories and supplies may corrupt the performance of the equipment. Use only EC-12 compliant electrodes with this device. Use of electrodes that are non-compliant may provide erroneous results.

The following accessories are available for use with the TeleMon Monitor.

Description	Order Number
Power Supply	M4792A
Rechargeable NiMH Battery Pack	M4790A
Battery Reconditioner, Universal *Note*—This part does not include a power cord; be sure to order the appropriate localized power cord.	M4791A
ECG Transmitter Trunk Cable • 5-lead AAMI • 5-lead IEC • 3-lead AAMI • 3-lead IEC	 M4793A M4794A M4795A M4796A
ECG/%SpO$_2$ Cable Clip	M1509A

Description	Order Number
3-wire ECG Lead Set • Snap, AAMI for M2601A, 0.7 m (30 inch) • Grabber, AAMI for M2601A, 0.7 m (30 inch) • Snap, IEC for M2601A, 0.7 m (30 inch) • Grabber, IEC for M2601A, 0.7 m (30 inch)	M2590A M2591A M2594A M2595A
5-wire ECG Lead Set • Snap, AAMI for M2601A, 0.7 m (30 inch) • Grabber, AAMI for M2601A, 0.7 m (30 inch) • Snap, IEC for M2601A, 0.7 m (30 inch) • Grabber, IEC for M2601A, 0.7 m (30 inch)	M2592A M2593A M2596A M2597A
Combiner Shield • 3-wire • 5-wire	M2598A M2599A
ECG Electrodes • High Performance Foam,1/pack, 200/case • High Performance Foam,3/pack, 300/case	14445A 14445C
ECG Electrode Kit	M2202A
ECG Electrode Kit • 30 electrodes • Foam, 5/pack, 300/case • Foam, 30/pack, 300/case	40489E 40493D 40493E
%SpO_2 Transducer • HP Reusable Adult Finger • HP Reusable Pediatric/Small Adult Finger • HP Reusable Adult/Pediatric Ear Clip	M1191A M1192A M1194A
%SpO_2 Extender Cable	M1941A
Wristband	M1627A
Nellcor Oxisensor™ • D-20 • D-25	M1903A/B M1904A/B
Adapter Cable for use with Nellcor Oxisensor™ disposable transducers	M1943A

Description	Order Number
NBP Cuff • Traditional Multi-Patient - Pediatric • Traditional Multi-Patient - Adult • Traditional Multi-Patient - Large Adult • Long-Life Multi-Patient - Pediatric • Long-Life Multi-Patient - Small Adult • Long-Life Multi-Patient - Adult • Long-Life Multi-Patient - Large Adult	40401B 40401C 40401D M1572A M1573A M1574A M1575A
NBP Cuff Connect Tubing • Standard, 1.5m (5 ft) • Long, 3.0m (10 ft)	M1598B M1599B

OXISENSOR II™ is a trademark of NELLCOR® Incorporated.

Note—Disposable transducers are not available from us as parts in the USA or Canada. In those countries, contact NELLCOR® Incorporated directly.

9
Safety and System Specifications

Safety Information

Warning

The equipment is not suitable for use in the presence of a flammable anesthetic mixture with air or with oxygen or nitrous oxide.

Warning

Possible explosive hazard if used in the presence of flammable anesthetics.

Warning

No patient alarms are annunciated at the TeleMon. Telemetry alarms are presented at the central monitor only, and all alarm adjustments must be made at central.

Warning

Information messages at TeleMon are silent. There is no audible sound at TeleMon associated with any information message.

Warning

Do not touch the patient, bed, transmitter, or TeleMon during defibrillation.

Warning

Do not mutilate or puncture battery; do not dispose of in fire. The battery can burst or explode, releasing hazardous chemicals. Replace battery with only the type recommended in this manual. Recycle or dispose of properly per local regulations.

Warning

If battery leakage should occur, use caution in removing the battery. Avoid contact with skin. Clean the battery compartment according to instructions in this manual. See "TeleMon Disinfection" on page 8-1.

Warning

Certain failure conditions, such as extended short circuiting, can cause a battery to overheat during normal use. High temperatures can cause burns to the patient and/or user, or cause the battery to flame. If TeleMon becomes hot to the touch, unplug the AC power, turn the device off, and place it aside until it cools. Then remove and discard the battery. It's a good idea to place a piece of tape across the contacts of the battery to prevent inadvertent shorting. Have TeleMon operation checked by service to identify the cause of overheating.

Warning

Failure on the part of the responsible individual hospital or institution employing the use of this equipment to implement a satisfactory maintenance schedule may cause undue equipment failure and possible health hazards.

Warning

If TeleMon is out of antenna range, there is no local indication at TeleMon of this state. No signal will be received at central, and the message NO SIGNAL will be displayed at the central.

Warning

Cycling power repeatedly when the battery is critically low may harm TeleMon or the transmitter. If the battery is critically low, do not attempt to cycle power (reboot) the monitor until the either the battery has been replaced or AC power has been applied.

Warning

Non-supplied accessories and supplies may corrupt the performance of the equipment. Use only EC-12 compliant electrodes with this device. Use of electrodes that are non-compliant may provide erroneous results.

Warning

Some pace pulses can be difficult to reject. When this happens, the pulses are counted as a QRS complex, and could result in an incorrect HR and misdetection of cardiac arrest or some arrhythmias. Keep pacemaker patients under close observation.

Warning

During complete heart block or pacemaker failure (to pace or capture), tall P-waves (greater than 1/5 of the average R-wave height) may be erroneously counted by the arrhythmia algorithm, resulting in missed detection of cardiac arrest.

Warning

When arrhythmia monitoring paced patients who exhibit only intrinsic rhythm, the monitor may erroneously count pace pulses as QRS complexes when the algorithm first encounters them, resulting in missed detection of cardiac arrest.

Warning

For patients who exhibit intrinsic rhythm only, the risk of missing cardiac arrest may be reduced by monitoring these patients with the the low heart rate limit at or slightly above the basic/demand pacemaker rate. A low heart rate alarm alerts you when the patient begins pacing. Proper detection and classification of the paced rhythm can then be determined.

Warning

When an external pacemaker is being used on a patient, arrhythmia monitoring is severely compromised due to the high energy level in the pacer pulse. This may result in the arrhythmia algorithm's failure to detect pacemaker noncapture or asystole.

 Warning

Do not mix transmitter leadsets and transmitter ECG trunk cables. Only use a 5-wire leadset with a 5-lead trunk cable or a 3-wire leadset with a 3-lead trunk cable.

If a 5-wire leadset is plugged into a 3-lead trunk cable, only one lead will be monitored by both the Information Center and TeleMon, and there will be no informational notification displayed.

If a 3-wire leadset is plugged into a 5-lead trunk cable, a LEADS OFF information message will be displayed, and no monitoring will occur at TeleMon or the Information Center.

Use only one trunk cable per transmitter; do not use additional cables to extend the cable length.

Use the trunk cable only with the TeleMon device. Do not use with other telemetry monitoring systems or other bedside monitors.

 Warning

Do not perform noninvasive blood pressure measurements on patients with sickle-cell disease or any condition where skin damage has occurred or is expected.

 Warning

Use clinical judgement to decide whether or not to perform automatic blood pressure measurements on patients with severe blood clotting disorders, because of the risk of hematoma in the limb wearing the cuff.

 Warning

Before beginning to monitor a patient, verify that you have selected the patient type (Adult or Pediatric) under Monitor Setup that is appropriate for your patient.

 Warning

Do not apply the cuff to a limb that has an intravenous infusion or catheter in place. This could cause tissue damage around the catheter when the infusion is slowed or blocked during cuff inflation.

Warning

Use only approved cuffs and tubing in order to prevent inaccurate data, injury, or damage. All specified cuffs and the TeleMon are protected against the effects of the discharge of a defibrillator.

Warning

Prolonged series of non-invasive blood pressure measurements in automatic mode may be associated with purpura, ischemia, and neuropathy in the limb wearing the cuff. When monitoring a patient, examine the extremities of the limb frequently for normal color, warmth, and sensitivity. If any abnormality is observed, stop the blood pressure measurements immediately.

Warning

Blood pressure readings may be affected by the position of the subject, his/her physiologic condition, and other factors.

Warning

To obtain accurate blood pressure readings, the cuff must be the correct size and also be correctly fitted to the patient. Incorrect size or incorrect fitting may result in incorrect readings.

Warning

To prevent fire, provide adequate ventilation and do not permit smoking when cleaning or disinfecting the equipment.

Warning

Disconnect line power and remove battery from TeleMon to prevent electrical shock and accidental turn-on during cleaning.

Warning

Exposure of electrical contacts or connections to saline or other liquids is dangerous. Electrical contacts and connections such as cable connectors, power supplies, and plug-in connections must be kept clean and dry. Do not immerse this device in water.

Warning

Although this equipment is shielded against Electromagnetic Interference (EMI), we recommend you avoid the use of other electrically radiating devices in close proximity to this equipment.

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Warning

TeleMons with transmitters that are broadcasting 25 kHz apart interfere with one another at distances of 1-3 feet. This situation is aggravated by ECG cable proximity. Symptoms include dropout (at the information center), waveform artifact of the ECG (at central and TeleMon), and screen freeze (at TeleMon). To avoid this situation, maintain a frequency spacing of >25 kHz between channels or a physical distance of >1 m (3 ft.) between devices.

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Warning

Use only a TeleMon-specific power supply of the appropriate voltage and amperage for this device.   See "Accessories" on page 8-3 for accessory information.

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Warning

U.S. Law restricts this device to sale by or on the order of a physician. This product is intended for use in health care facilities by trained healthcare professionals. It is not intended for home use.

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Cautions

Caution

This device is not to be used during electrosurgery.

Caution

During defibrillation, monitoring may be temporarily interrupted or distorted. After defibrillation, TeleMon will continue to monitor as before; the monitor settings will not be affected.

Caution

Do not compress or restrict pressure tubes during an NBP measurement.

Caution

The TeleMon NBP may not operate correctly if used or stored outside the relevant temperature or humidity ranges.

Caution

Do not use any abrasive cleaning materials on any part or component of the TeleMon. Do not clean any part or component of the TeleMon in any overly vigorous or abrasive fashion. Using abrasive cleansers and abrasive cleaning actions will damage the components.

Caution

Remove the battery and any cables or accessories before you clean TeleMon.

Caution

Conductive parts of electrodes should not contact earth or other conductive parts.

Electro-magnetic Compatibility

The electromagnetic compatibility (EMC) validation of the M2636B TeleMon Monitor included tests performed according to the international standard for EMC with medical devices. See the Manufacturer's Declaration for details.

During the test program, the M2636B was subjected to many EMC tests, both international standard and our proprietary tests. During most of the testing, no anomalies were observed, except for some immunity tests which required reduced levels of the external influence for compliance.

EN 61000-4-3

EN 61000-4-3 specifies that the product be subjected to an electromagnetic field of 3 V/m over a frequency range of 26 to 1000 MHz with no degradation of performance. At most of the test frequencies in this specified range, no anomalies were observed. However, at the product transmit/receive frequency, and a few others, the radiated field imposed caused interference with a resultant drop-out of ECG and pleth signal. For frequencies in the range of 108.89 MHz to 223 MHz a reduced level of 1.0 V/m was met, and in the range of 311 MHz to 601 MHz a reduced level of 1.6 V/m was met, with no anomalies.

IEC 801-2

The IEC 801-2 Electrostatic Discharge Test calls for the product to withstand air discharges at up to 8 kV, and contact discharges to exposed metal on the M2636B or to a nearby metal plate at voltage settings up to 4 kV with no change of operating state. The M2636B passes the air discharge test and contact discharge tests at a

reduced level. Air discharges of more than 6 kV to the screws on the rear of the M2636B housing, or to the bottom of the housing, may cause an instrument reset, whereby the product goes through Power-on Self-Test (as if the M2636B were just powered on). Some settings revert to default selections. Lower levels of air discharge, or the contact discharge test, may cause a momentary ECG information message to occur, but with no change of state.

Avoiding Electro-magnetic Interference

If electromagnetic interference (EMI) is encountered, there are a number of actions that can be taken to mitigate the problem.

- Eliminate the source. Possible sources of EMI can be turned off or moved away to reduce their strength.
- Attenuate the coupling. If the coupling path is through the patient leads, the interference may be reduced by moving and/or rearranging the leads. If the coupling is through the power cord, plugging the M2636B into a different circuit or moving the power supply away from the monitor may help.
- Add external attenuators. If EMI becomes an unusually difficult problem, external devices such as an isolation transformer or a transient suppressor may be of help. A service representative or designee can be of help in determining the need for external devices.
- Cellular telephones are a possible source of signal interference with patient monitors and telemetry transmitters. Our recommendation is to keep an operating cell phone at least 30 cm (1 ft) away from the M2636B.

System Specifications

Intended Use   TeleMon is indicated for use in the monitoring, recording, and alarming of multiple physiologic parameters in adult and pediatric patients to gain information for treatment, to monitor adequacy of treatment, or to exclude causes of symptoms.

TeleMon is a prescription device for use in healthcare facilities by trained healthcare professionals. TeleMon is not intended for home use.

Safety Standards   The M2636B TeleMon Monitor complies with the Council Directive 93/42/EEC of 14 June, 1993 concerning medical devices, and carries CE marking accordingly.

CE 0123

The following accessories and system components are independently CE-marked:
- Power Supply accessory
- Battery Reconditioner accessory
- Telemetry System

Note—The Battery Reconditioner is not for use in the patient vicinity.

The M2636B TeleMon also complies with the following international safety requirements for medical electrical equipment:
- IEC 60601-1/ EN 60601-1
- IEC 60601-1-1/ EN 60601-1-1
- IEC 60601-1-2/ EN 60601-1-2
- IEC 60601-2-27/ EN 60601-2-27
- IEC 60601-2-30/ EN 60601-2-30
- CAN/ CSA C22.2 No. 601.1-M90
- UL 2601-1

The monitor is a Class I device and has an IPX 1 rating (excluding the power supply). The device has BF and CF applied parts.

The system provides continuous operation when in use.

NBP Standards   Non-invasive blood pressure measurements determined with this device are equivalent to those obtained by a trained observer using the cuff/stethoscope auscultation method, within the limits prescribed by the American National Standard, *Electronic or automated sphygmomanometers*.

The NPB portion of the device also meets all relevant parts of the following safety standard:
- ANSI/AAMI SP10

NBP internal operating software ensures that:
- Maximum cuff inflation time is limited to 60 seconds.
- Duration of blood pressure reading is limited to 170 seconds.

Authorized Europe/ Middle East/Africa Representative	Philips Medizinsysteme Böblingen GmbH Hewlett Packard Str. 2 71034 Böbingen Germany FAX: (+49) 7031 464 1552

Electrical Specifications

Line Power

Power Input	An external power supply is used.
Input	100-250 VAC +6%/-10%; 50-60 Hz +/-6%
Input Power	Average (36 Watts, 64 VA), Max (39 Watts, 81 VA)
Output	18 VDC

Battery

Type	10.8V Nickel Metal Hydride (NiMH) Smart Battery (part number M2636-60500), package style DR35
Operating Time	Typical 5 hours at 25º C (77º F)
	With $\%SpO_2$ and NBP measurements 4 times/hour: up to 3.5 hours
Charge Time	From 15% of capacity to fully charged: 2-3 hours typical at 25º C (77º F), TeleMon on or off
Electrodes	Compatible with EC-12 electrodes only

Environmental Specifications

Operating

Temperature Range	Monitor without NBP Cuff: 0º C to 35º C (32º F to 95º F)
	Monitor with NBP Cuff: 10º C to 35º C (50º F to 95º F)
Altitude Range	Up to 3048 m (10,000 ft.)
Humidity Range	$\leq 90\%$ relative humidity at 35º C (95º F), non-condensing

Shipping & Storage

Temperature Range	0º C to 60º C (32º F to 140º F) / without battery
	0 to 50º C (32 to 122º F) / with battery
Altitude Range	Up to 3048 m (10,000 ft.)
Humidity Range	≤ 90% relative humidity, non-condensing

NBP Measurement Specifications for TeleMon B

Note—For ECG, ST, and %SpO$_2$ specifications, please refer to the *Telemetry System, Series C, User's Guide*.

Measurement Range	Systolic: 40 to 260 mmHg Diastolic: 25 to 200 mmHg
Initial Inflation Pressure	Adult: 160 mmHg Pediatric: 120 mmHg
Maximum Pressure	280 mmHg
Overpressure Safety Limit	300 mmHg (max)
Accuracy	+/- 3 mmHg or 5% of reading (whichever is greater)
Heart Rate Range	40 to 200 b/min
Cuff Deflation Rate	6 mmHg/step
NBP Alarm range at Central	10 to 260 mmHg
Rated Life	30,000 measurement cycles (36/day for 2.3 years)
Cuff Inflation Time	60 sec man (adult or pediatric)
Limitations on Use	Not for use on neonates. When used on patients suffering from cardiac arrhythmias, information presented will have undefined accuracy.
Auto Mode Repetition Time	5,10, 15, 30, 60 or 120 minutes
Typical Measurement Time @ HR > 60 b/min in Auto or Manual Mode	Average: 30 seconds Maximum: 170 seconds

Explanation of Symbols

The following icons can be found on the TeleMon exterior.

Symbol	Explanation
⚠	Consult accompanying documents (including this User's Guide) and particularly any warning messages.
$C\epsilon$ **0123**	This device complies with the Council Directive 93/42/EEC of 14 June 1993 concerning medical devices.
(SA)	This device complies with Canadian Standards Association and nationally recognized testing lab requirements.
R_x	Prescription Device
┤♥├	Applies to the transmitter, indicates that the instrument is Type CF Defibrillation Proof and is designed to have special protection against electric shocks for intra-cardiac application (particularly regarding allowable leakage current by having an F-type isolated or floating applied part), and is defibrillator proof.
┤🕴├	Applies to the NBP Module; indicates that the module is Type BF Defibrillation Proof and is designed to have special protection against electric shocks for intra-cardiac application, particularly regarding allowable leakage currents by having an F-type isolated or floating applied part.
⊕	Electrical Power Input
⊙	Power ON
○	Power OFF
(▮▯▯▯▯▯ Ni1030 HP, 10.8V)	Battery Insertion

Symbol	Explanation
	Date of Manufacture
	Direct Current

System Specifications