GE Healthcare

Dash™ 2500 Patient Monitor
Service Manual

Dash 2500 Patient Monitor
English
2042481-001 D (paper)
2042482-001 D (CD)

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NOTE: In addition to software version RAO, the information in this manual also applies to the old Dash 2500 Patient Monitor software version. There are no user-apparent differences among these software versions. Due to continuing product innovation, specifications in this manual are subject to change without notice.

NOTE: For technical documentation purposes, the abbreviation GE is used for the legal entity name, GE Medical Systems *Information Technologies*.

Contents

1 Introduction

For your notes

Manual Information

Revision History

Each page of this manual has the document part number and revision letter at the bottom of the page. The revision letter identifies the document's update level. The revision history of this document is summarized below.

Revision	Comment
A	Initial release of the manual
B	ECO release
C	ECO release
D	ECO release

Manual Purpose

This manual supplies technical information for service representatives and technical personnel so they can maintain the equipment to the assembly level. Use it as a guide for maintenance and electrical repairs considered field repairable. Where necessary the manual identifies additional sources of relevant information and technical assistance.

See the operator's manual for the instructions necessary to operate the equipment safely in accordance with its function and intended use.

Intended Audience

This manual is intended for service representatives and technical personnel who maintain, troubleshoot, or repair this equipment.

Ordering Manuals

To order additional copies of this manual, call Accessories and Supplies and request part number 2042481-001 for a paper copy, and 2042482-001 for a CD copy. Refer to the How To Reach Us page for Accessories and Supplies contact information.

WARNING
This Service Manual is available in English only except as otherwise expressly required by local law or agreed to at a local level.

- If a customer's service provider requires a language other than English, it is the customer's responsibility to provide translation services.
- Do not attempt to service the equipment unless this Service Manual has been consulted and is understood.
- Failure to heed this Warning may result in injury to the service provider, operator or patient from electric shock, mechanical or other hazards

Illustrations

All illustrations in this manual are only examples, and may not necessarily reflect your system settings or data displayed in your system. If a particular selection is not available in your system, the selection is shown grayed in the menu.

Safety Information

Responsibility of the Manufacturer

GE is responsible for the effects of safety, reliability, and performance only if:

- Assembly operations, extensions, readjustments, modifications, or repairs are carried out by persons authorized by GE.
- The electrical installation of the relevant room complies with the requirements of the appropriate regulations.
- The equipment is used in accordance with the instructions for use.

General

This device is intended for use under the direct supervision of a licensed health care practitioner.

This device is not intended for home use.

Federal law restricts this device to be sold by or on the order of a physician.

Contact GE for information before connecting any devices to the equipment that are not recommended in this manual.

Parts and accessories used must meet the requirements of the applicable IEC 601 series safety standards, and/or the system configuration must meet the requirements of the IEC 60601-1-1 medical electrical systems standard.

Periodically, and whenever the integrity of the device is in doubt, test all functions.

The use of ACCESSORY equipment not complying with the equivalent safety requirements of this equipment may lead to a reduced level of safety of the resulting system. Consideration relating to the choice shall include:

- use of the accessory in the PATIENT VICINITY; and
- evidence that the safety certification of the ACCESSORY has been performed in accordance to the appropriate IEC 60601-1 and/or IEC 60601-1-1 harmonized national standard.

If the installation of the equipment, in the USA, will use 240V rather than 120V, the source must be a center-tapped, 240V, single-phase circuit.

Warnings, Cautions, and Notes

The terms danger, warning, and caution are used throughout this manual to point out hazards and to designate a degree or level or seriousness. Familiarize yourself with their definitions and significance.

Hazard is defined as a source of potential injury to a person.

DANGER indicates an imminently hazardous situation, which, if not avoided, will result in death or serious injury. Methods to avoid the hazard should be included.

This signal word is to be limited to the most extreme situation. This signal word shall not be used to indicate incidents resulting in property damage only.

WARNING indicates a potentially hazardous situation, which, if not avoided, could result in death or serious injury. This includes serious adverse reactions, or limitations in use. Steps that should be taken to avoid or minimize the hazard should be included.

This signal word is not to be used to indicate incidents resulting in property damage only.

CAUTION indicates a potentially hazardous situation, which, if not avoided, may result in minor or moderate injury.

It may also be used to alert against unsafe practices or to describe recommended. This signal word may be used to indicate incidents resulting in potential property damage only. Practices for the safe and effective use of the device.

NOTE shall be used for informational messages that do not pertain to a hazard.

Equipment Symbols

NOTE: Some symbols may not appear on all equipment.

ATTENTION: Consult accompanying documents before using the equipment.

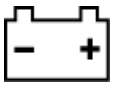
Defibrillator-proof type CF equipment; type CF equipment is specifically designed for applications where a conductive connection directly to the heart is established. The paddles indicate the equipment is defibrillator proof.

Defibrillator-proof type BF equipment; type BF equipment is suitable for intentional external and internal application to the patient, excluding direct cardiac application. Type BF equipment is type B equipment with an F-type isolated (floating) part. The paddles indicate the equipment is defibrillator proof.

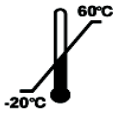
Temperature

Potential Equalization Terminal: Terminal for providing a connection between the equipment and the potential equalization busbar of the electrical installation.

Alternating current (AC)



Battery in use



Storage temperature

Packaging label depicting the transportation and storage atmospheric pressure range of 500 to 1060 hPa.

This side up

Keep dry

Fragile, handle with care

WASTE OF ELECTRICAL AND ELECTRONIC EQUIPMENT (WEEE): This symbol indicates that the waste of electrical and electronic equipment must not be disposed as unsorted municipal waste and must be collected separately. Please contact an authorized representative of the manufacturer for information concerning the decommissioning of your equipment.

The separate collection symbol is affixed to a battery, or its packaging, to advise you that the battery must be recycled or disposed of in accordance with local or country laws. To minimize potential effects on the environment and human health, it is important that all marked batteries that you remove from the product are properly recycled or disposed. For information on how the battery may be safely removed from the device, please consult the service manual or equipment instructions. Information on the potential effects on the environment and human health of the substances used in batteries is available at this url: http://www.gehealthcare.com/euen/weee-recycling/index.html

Manufacturer: This symbol is accompanied by the name and the address of the manufacturer.

Manufacturing Date: This symbol is accompanied by the date of the manufacturing.

European authorized representative.

This product consists of devices that may contain mercury, which must be recycled or disposed of in accordance with local, state, or country laws. (Within this system, the backlight lamps in the monitor display contain mercury.)

This product get an Nationally Recognized Testing Laboratory (NRTL) approve based on United States standard UL 60601-1:2003 and Canada standard CAN/CSA-C22.2 No. 601.1-M90.

Service Information

Service Requirements

Follow the service requirements listed below.

- Refer equipment servicing to GE-authorized service personnel only.
- Any unauthorized attempt to repair equipment under warranty voids that warranty.
- It is the user's responsibility to report the need for service to GE or to one of their authorized agents.
- Failure on the part of the responsible individual, hospital, or institution using this equipment to implement a satisfactory maintenance schedule may cause undue equipment failure and possible health hazards.
- Regular maintenance, irrespective of usage, is essential to ensure that the equipment will always be functional when required.

Equipment Identification

Every GE device has a unique serial number for identification. The device plate is located on the rear of the patient monitor.

2 Equipment Overview

For your notes

Components

Equipment Description

The Dash 2500 patient monitor is intended to monitor and measure oscillometric noninvasive blood pressure (systolic, diastolic, and mean blood pressure), heart rate/pulse, respiration rate, ECG with lethal arrhythmia (VTACH, VFIB/VTACH, and asystole), oxygen saturation (SpO_2) by noninvasive pulse oximetry, and predictive temperature with an electronic thermometer for adult, pediatric and neonatal patients. The Dash 2500 Monitor also detects alarm limit conditions and is capable of recording up to two waveforms. Using this Monitor, a clinician can view, record, and recall clinical data derived from each parameter.

The Dash 2500 can be configured with or without a printer and/or temperature module. Also, the units are ordered with either Masimo or Nellcor SpO_2.

The network function is optional for Dash 2500.

Configurations

Each monitor is supplied with an accessory pack. The contents of the pack vary according to model. Unpack the items carefully, and check them against the checklists enclosed within the accessory boxes. If an accessory is missing or if an item is in a nonworking condition, contact GE Medical Systems *Information Technologies* immediately.

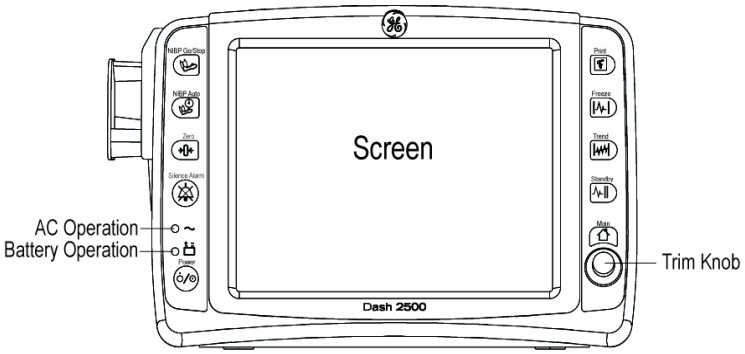
NOTE: Perform regular functional testing of each of the parameters, using the accessories supplied with the Dash 2500 Monitor.

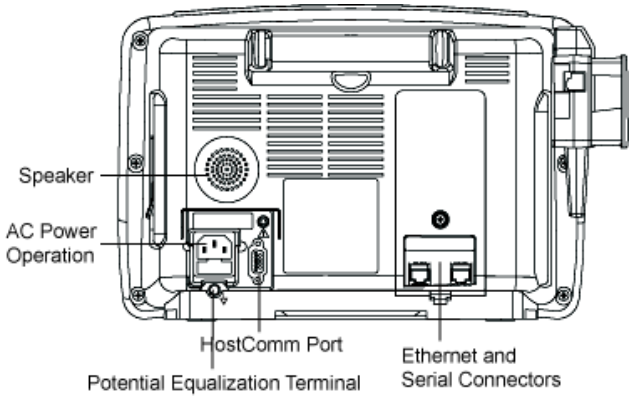
It is recommended that all the packaging be retained, in case the Monitor must be returned for service in the future.

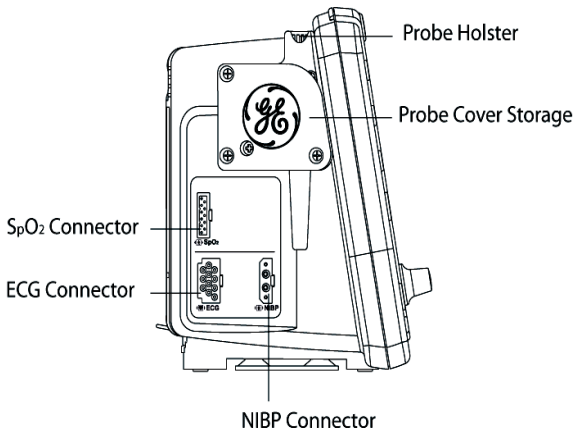
Controls and Indicators

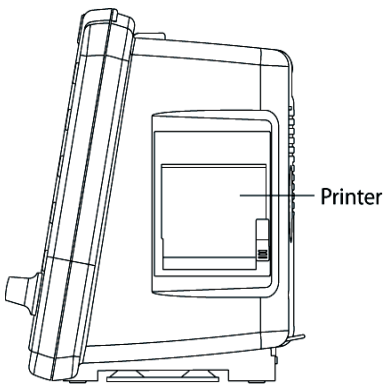
Descriptions of the items shown are listed on the pages that follow. Refer to Chapter 1 Introduction for symbol definitions.

Monitor









AC Power Indicator

The indicator lights green when AC mains power is applied to the Monitor. The indicator does not illuminate when the Monitor has no AC mains power.

Battery Power Indicator

The indicator lights yellow when the Monitor is operating on battery power. The indicator does not illuminate when the Monitor has no battery power. The battery indicator is in the front panel of the Monitor.

Front Panel Controls

NIBP Go/Stop - starts and stops any determination of noninvasive blood pressure.

NIBP Auto - is a dual-function hardkey. Starts auto BP determinations by a single-press and gives you access to change the NIBP cycle time.Starts stat determinations pressing and holding the key down (5 minutes of continuous NIBP cycles).

Zero - zeros the IBP determination.This hardkey is available only for use when IBP is configured.IBP is not configured in Dash 2500.

Silence Alarm - temporarily silences alarms; acknowledges alarming crisis conditions.

Power - turns Monitor off and on.

Print - prints a snapshot (timed recording) with a single-press. Pressing and holding the key down allows for a continuous recording of the chosen waveforms.

Freeze - captures up to 16.8 seconds of waveforms on the screen. The number of seconds varies depending on the selected sweep speed.

Trend - enters and exits trends (view patient trends data). This hardkey can be configured through the configuration mode to display two different views: mini trends or full trends.

Standby - enters and exits standby mode.

Main - closes the menu system and takes you back to the main screen.

Theory Of Operation

The Monitor is a portable unit that receives input power from an external AC source, or internal rechargeable battery.

When the Power button is pressed, the Main Board is brought out of a sleep mode and turns on the power regulators. The power regulators provide conditioned power from one of the two input power sources:

- AC Mains
- Internal battery

Once the Monitor is energized, a self-test is performed. The self-test automatically tests the main functions of the Monitor. Failure of the self-test sets the Monitor into a fail-safe mode with an audio alarm. Under normal operating condition, the Monitor is ready to monitor the patient's vital signs using four external attachments:

- Temperature probe for either rectal or oral use
- SpO_2 sensor
- ECG leads
- Cuff

Interface with a central station or other device is accomplished through the 9-pin host communication port or the 15-pin wireless communication port on the back of the Monitor.

NELLCOR® SpO_2 and MASIMO SET® SpO_2

When the SpO_2 sensor is attached to the SpO_2 connector and to the patient, it senses both the pulse rate and oxygen saturation. These analog signals are routed to and analyzed by the SpO_2 PWA. The results are digitized and sent to the DAS Board, and DAS repacks and sends them to Main Board through the opto couplers. The couplers provide for patient isolation as well as serial data interface. The Main Board routes the data to the appropriate screen displays and/or printer.

A reset signal to the SpO_2 PWA is also provided for power up sequencing.

DINAMAP® Blood Pressure and Pulse

When the cuff and hose are attached to the Monitor and Non-Invasive Blood Pressure (NIBP) determination is initiated, the pump inflates the cuff. The pressure transducers (PT1 and PT2) monitor pressure information. The pneumatic manifold has two valves, which are used to deflate the cuff. Valve control is through the Main Board. Determinations are made for the systolic BP, diastolic BP, pulse rate, and Mean Arterial Pressure (MAP). The results are displayed on the Monitor's front panel Liquid Crystal Display (LCD) screen.

If an over-inflation condition occurs, it is detected by PT2, resulting in assertion of OVERPRESSURE. The OVERPRESSURE signal is routed to the PVM to release the air pressure. The Main Board generates an alarm condition with the speaker sounding and a message in the LCD.

Alaris® Oral and Rectal TURBO TEMP Thermometry

The Monitor has one temperature channel for oral or rectal determinations. When a temperature probe is attached to the temperature connector and to the patient, TEMP input is routed to the DAS Board. This input represents the temperature to be measured. The DAS Board converts the TEMP signal to a digital signal and sends to Main Board. During the conversion, the Main Board determines the patient temperature using either a predictive or monitor mode algorithm depending on the user's setup. The patient temperature is distributed as a digital signal to the LCD display or to the printer.

The Monitor has a probe check feature to determine if a probe is connected to the Monitor and whether it is an oral or rectal probe.

ECG with Heart Rate and Respiration

The ECG parameter provides an electro-cardiographic waveform in 3-electrode or 5-electrode configuration. The 3-electrode configuration derives a waveform from Lead I, II, III and displays this waveform as the primary lead. The 5-electrode configuration derives waveforms from Lead I, II, III, aVR, aVL, aVF, VA, and displays this waveform as the primary lead. In 5-electrode configuration, another waveform can be displayed as the secondary lead.

Breath rate is calculated by measuring the thoracic impedance between two electrodes. As the patient breathes, the movement of the chest changes the measured impedance to produce the respiration rate.

In the ECG menu for the monitor, the pacer detection option enables/disables the pacemaker detection algorithm. It must be used whenever the monitored patient has a pacemaker. Pace detection choices are PACE 1, PACE 2, and OFF.

Host Communication Port

An isolated host communication port provided on the back panel of the monitor. The DB9 connector provides a channel of RS232 compatible communication.

NOTE: The DB9 connector should be used with approved interface devices ONLY.

Communication Adaptor Connector

The nonisolated DB15 connector provides +5 V (500 mA Max), +12 V (250 mA Max), Remote Alarm Signal, and two TTL communication channels. The communication adaptor connector is used to interface the Monitor with other electronic devices. (a central nurse's station or remote alarm device). Signals can be sent to the monitor to initiate blood pressure determinations and other functions. Patient data can also be retrieved through this port.

NOTES:

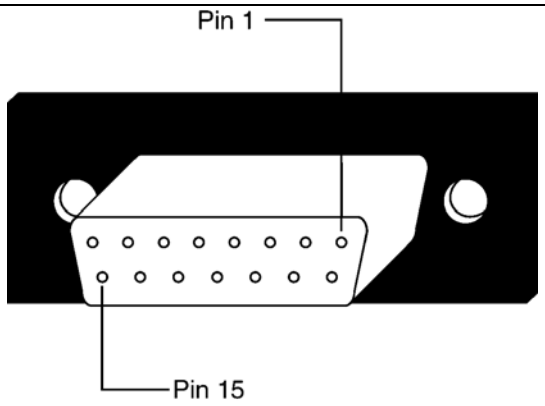
When the network module is connected, remote alarm is not available. The alarms will response on CIC directly.

When using the remote alarm, the monitor alarm should be considered the primary alarm source. The remote alarm is used for secondary consideration only.

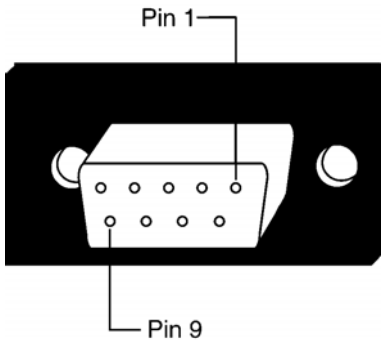
WARNING
Auxiliary equipment connected to the Dash 2500 Patient Monitor will result in the formation of an electromedical system, and thus must comply with the requirements of EN 60601-1-1/ IEC 60101-1. All Communication Adaptor Connectors are NON-ISOLATED and should be connected to equipment conforming to respective IEC or ISO standards (e.g. IEC60950 for data processing equipment), configured to comply with IEC 60101-1-1 ONLY.

DB15 / DB9 Connector Pin Assignments

Pins are numbered from right to left, top to bottom.



DB15 Connector Pins



DB9 Connector Pins

Pin	Function	Pin	Function
1	Ground	1	DCD
2	TX2_Inverted TTL Transmit Data	2	TX2_RS232
3	RX2_Inverted TTL Receive Data	3	RX2_RS232
4	Fused +5 volts	4	DTR
5	Fused +12 volts	5	GND
6	No connection	6	DSR
7	Ground	7	RTS
8	Remote Alarm (open collector, 75mA Max Sink)	8	CTS
9	No Connection	9	No Connection
10	No Connection		
11	TX1 Inverted TTL Transmit Data		
12	Port Enable Control <low=port 2> (When in use, DB9 4 & 5 disabled)		
13	RX1 Inverted TTL Receive Data		
14	No connection		
15	No connection		

Functional Description

The following section provides the functional interface relationship. The Monitor contains a number of electrical and electro-mechanical assemblies. These assemblies are:

- PSU Module
- DC2DC PWA
- Main Board
- UI PWAs
- DAS PWA
- SpO_2 PWA
- Interface PWA
- CCFL inverter PWA
- Pneumatic control device
- Liquid Crystal Display (LCD) Assembly
- Printer (optional)
- TURBO TEMPerature (optional)
- NiMH Battery

PSU Module

The PSU module is an AC Mains to DC converter. The module receives AC power from the mains input connector. When AC INPUT is applied to the module, the module AC/DC Converter changes the AC INPUT supply via rectifier circuit to a high voltage DC. The DC power is then routed through a high frequency switching converter and regulated to 12 VDC. This supply is connected to the DC2DC PWA for further regulation.

DC2DC PWA

The PSU supplies regulated DC power to Monitor. The DC2DC PWA is designed to operate from the output of the AC MAINS PSU module
(+12 VDC), or from an internal NiMH rechargeable battery (+8.4 VDC). The PSU automatically selects the power source based on the following priority:

- Valid AC MAINS input
- Valid NiMH battery

The DC2DC PWA converts the selected power source into the following main voltages:

- VRAW1 (7 V-12 V DC)
- +5V
- +12V
- +3.3V

The +12 V printer supply voltage and AUX +12 V are up converted from VRAW1 and maintained by a boost regulator to +12 V.

VBAT is the battery voltage protected by a 100 mA auto-reset fuse. It is also used to power the fail-safe alarm circuits on the Main Board.

The DC2DC PWA contains firmware that reports the charge status of the battery to the secondary processor on the Main Board. The secondary processor charges the battery at the fastest rate allowable while keeping the Monitor power consumption under 60 W.

The host communication port control circuitry selects whether Channel 2 is routed to the Comms connector (DB-9) or the wireless connector (DB-15). If Channel 2 is routed to the Comms connector, it is configured for RS-232 signals. Channel 1 and Channel 2 on the wireless connector are only available as inverted TTL.

Main Board

The Main Board is configured with Flash ROM, EEPROM, RAM, Primary Processor, Secondary Processor, and NIBP. The Primary Processor operates from a 4.9152 MHz crystal stepped up to 49.152 MHz. The Primary Processor services and controls the RAM, Flash ROM, EEPROM, the physiological interface modular devices and display backlighting. The Secondary Processor monitors the power supply circuit and signals within the NIBP circuits, controls the power-on/off sequences, and performs watchdog tasks on it and the Primary Processor monitors. The Secondary Processor monitors the power supply circuit and controls the battery back up enable when no external sources are present and shuts down the unit when the battery is exhausted. It enables the battery charging circuit based on the battery charge status, unit power consumption, and the availability of an external power source.

The Random Access Memory (RAM) is composed of a SRAM chip and two SDRAM chips. The 512 Kbytes of battery-backed SRAM is provided to store trend data and to provide space for working algorithms and is accessed on bits D[0:15] of the data bus. The two 64-Mbit SDRAM chips are set up to form a 32-bit data bus on bits D[31:0] that is used for running the program and working memory. This gives 16 Mbytes of memory with an access time of less that 20 ns. The program is loaded (including the boot code) from the 16-bit FLASH Read Only Memory (ROM). The Electronically Erasable Programmable Read Only Memory (EEPROM) is an 8-bit chip that is used to store the calibration and other “setting” variables that have to be maintained in the event of a complete power failure.

If a hardware or software error causes a malfunction, its watchdog will provide an internal and external RESET (L) signal. The FAILSAFE controller causes the FAILSAFE (L) signal to go low. This signal passes to the Secondary Processor, which disables the Primary Processor's power supplies, thus turning it off. FAILSAFE (L) also passes to the control logic, which dumps the cuff pressure. The system is left in a safe state but remains ON to enable the Secondary Alarm to stay active. The Primary Processor monitors the activity of the secondary via its handshaking communications. If the Secondary fails, the Primary can assert the FAILSAFE line by overriding the FAILSAFE controller. The Secondary Alarm is a hardwired alarm that will sound in the event of a FAILSAFE condition. Pressing

the OFF-key can immediately reset this alarm although it times-out after about 10 minutes.

SpO_2 PWA

The Monitor can be configured with either NELLCOR® or MASIMO SET® SpO_2 hardware in config manager menu. When the Monitor is configured with NELLCOR® hardware, only NELLCOR® config manager menu is available; when the Monitor is configured with MASIMO SET® hardware, MASIMO SET® config manager menu is available.

The SpO_2 processor monitors the pulse oximetry signal. The processor takes the signals and derives the oxygen saturation and heart rate data and converts them into serial data. The serial data from the SpO_2 processor is repacked by DAS board and sent across an isolation barrier (opto couplers) and passed to the Primary Processor via a dual-channel UART.

UI PWAs

The UI PWAs provide access to the basic functions of the Monitor. The buttons that control each function are integrated to form a touch pad front panel. The AC LED is continuously green when an external power source is present or flashing green when the unit does not recognize the battery. The battery LED is continuously yellow when the unit is running on battery and flashes yellow when the battery is low.

DAS PWA

The DAS PWA is composed of ECG and MPDAS. Both ECG and MPDAS are isolated to earth, and isolated from each other.

ECG accepts signals from a 3-electrode cable or a 5-electrode cable for processing. The 3-electrode cable provides a single lead configuration with Lead I, Lead II, or Lead III available. The 5-electrode cable provides a configuration with Lead I, II, III, aVR, aVL, aVF, VA and displays this waveform as the primary lead. In 5-electrode configuration, another waveform can be displayed as the secondary lead.

A hybrid on the PWA provides lead-to-lead defibrillator protection. In addition, a passive R/C network located on this PWA provides the first stage of high frequency filtering for EMC and ESU interference rejection. Two electrodes are selected for ECG measurement by a multiplexer (LS0, LS1 signal controlled) and passed to a differential amplifier. A second multiplexor selects the third electrode (the one not sent to the differential amplifier) and drives the signal with an amplified and inverted version of the common mode voltage of the two measuring electrodes. This feedback action cancels most of the common mode signal applied to the differential amplifier. The output signal from the differential amplifier is then routed to the bandpass filter and pacemaker detection circuit.

The ECG PWA uses the pacemaker detection circuit to prevent pacemaker signals from interfering with heart rate measurements. The ECG signals are sent

through a bandpass filter designed to pass pacemaker pulses in preference to ECG signals. The filter output is applied to a comparator that asserts an output signal when the input signal exceeds its positive or negative threshold. This output signal is used by the controller to blank the ECG signal channel and alert the host to the presence of a pacemaker pulse. The filtered ECG signal is routed to the A/D converter for transfer to the Main Board.

The respiration circuit uses the ECG electrodes to measure respiration rate. This is achieved by applying an excitation current (65.536kHz, well outside the bandwidth of normal ECG signals) generated by a square wave switch onto two selected electrodes. The measured voltage drop is filtered, the baseline component removed, and amplified. The analog voltage representing the impedance is routed to A/D converter for transfer to the Main Board.

The ECG provides isolated power to its circuitry using an isolation transformer. A transformer driver drives the transformer primary at a frequency of about 350 KHz. The voltage of the transformer secondary is full-wave rectified using two Schottky barrier diodes. The isolated voltage is filtered by capacitors and regulated by a +5 V regulator. Isolated ground is obtained from the center tap of the transformer. The data transferred from the A/D converter to the host is isolated using opto couplers.

In the temperature parameter, the Alaris® probe and the calibration resistor chain are connected to an AD7738 24-bit serial DAC, which is read by the micro controller. The micro controller computes the resistance for the probe (and associated leads) and transmits the resistance value to the Primary Processor in a serial data stream.

Pneumatic Control

The pneumatic functional block includes the control signal decode logic, the valve driver circuitry, the pump driver circuitry, and a safety interlock circuit.

There are two transducers on board, PT1 and PT2. PT1 is used for main readings while PT2 confirms readings and is used to derive overpressure signals. The following signals are multiplexed into a 16-bit SAR A/D converter via a multiplexor:

- PT1A - the output of the measurement pressure sensor after amplification and filtering by means of a passive 1 KHz low pass anti-alias filter
- PT1B - the output of the measurement pressure sensor after amplification and filtering by means of a passive 20 Hz low pass anti-alias filter
- PT2 - the output of the confirmation/over-pressure sensor after amplification
- TH REF - the voltage that the amplified PT2 has to attain before the safety circuit cuts in.
- VBAT- 1/4 ratio of VBAT voltage
- Valve Sense

The 16-bit value out of the ADC is available on the data bus at D[15:0].

Control signals for the board are derived via four different sources: direct control from outputs of the processor, controls signal derived from processor address write commands (which are stored in an addressable latch), signals derived from the watchdog timer, and signals generated by the overpressure functional block. The four valve control signals and the pump control signal are derived from the write address and stored in an addressable latch. Latch values are cleared by application of system RESET. Each latch signal is individually gated in a programmable logic device (XC9572) with the fail safe input signal (watchdog timer) and the overpressure latch output to ensure pressure is removed from the patient cuff should either overpressure or processor failure condition occur. A cross-coupled latch for overpressure is formed with discrete logic included in the programmable logic device. It is set by the occurrence of an overpressure condition existing for a period greater than 500 milliseconds. When this condition occurs, Filter_OVP-0 transitions low setting the latch. The latch output state is indicated by the Latched-OVP signal. The latch can only be cleared by the PNEURESET input.

LCD Assembly

The Monitor series uses a TFT active-matrix-color liquid display. The 10.4 inch diagonal color display area contains 640 x 480 pixels and is backlit by cold-cathode fluorescent lamps.

The LCD has the following specific characteristics. These are neither defects nor malfunctions:

- The ambient temperature may affect the display condition of the LCD.
- Uneven brightness and/or small spots may be noticed depending on different display patterns.

The LCD is driven from the Primary Processor via buffers (HCT244) on a dedicated LCD driver port:

Signal	Name
Clk	Clock
Vsync	Vertical Sync
Hsync	Horizontal Sync
R[0:3]	Red bits (0:3)
G[0:3]	Green bits (0:3)
B[0:3]	Blue bits (0:3)

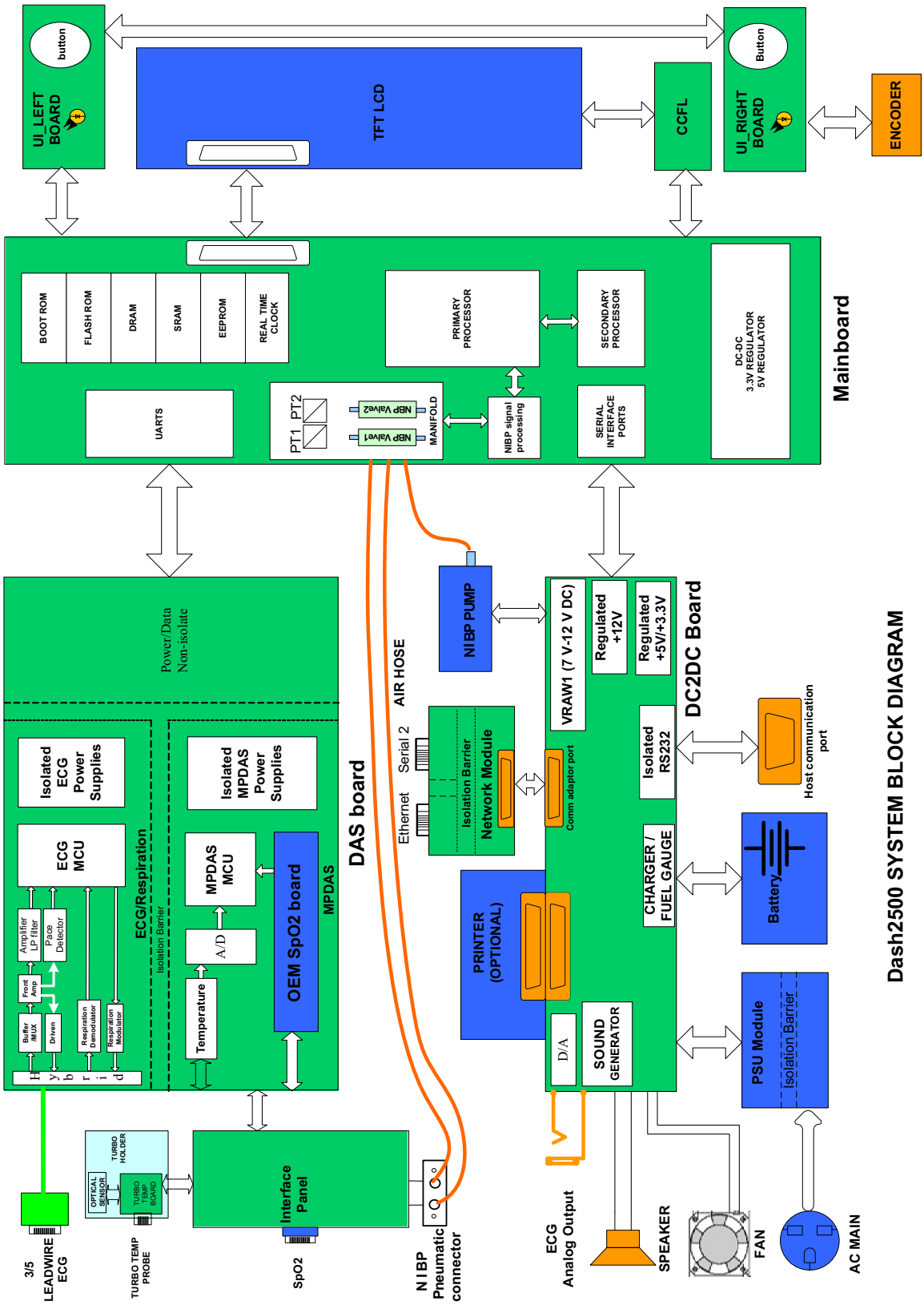
The display module has a 31-way control signal connector and a 3-way backlight driving connector.

Printer (Optional)

The Monitor uses a thermal graphics printer. The printer requires a 5 V supply for its logic circuitry and 12 V (nominal) for the motor. The power and data lines are connected to the DC2DC Board by a 40 pin connector. The data lines are connected to the SCC3 port on the Primary Processor.

The printer has a built-in sensor to monitor the printer paper level. When the printer is out of paper, it sends a PAPER OUT signal to the Secondary Processor.

System Block Diagram



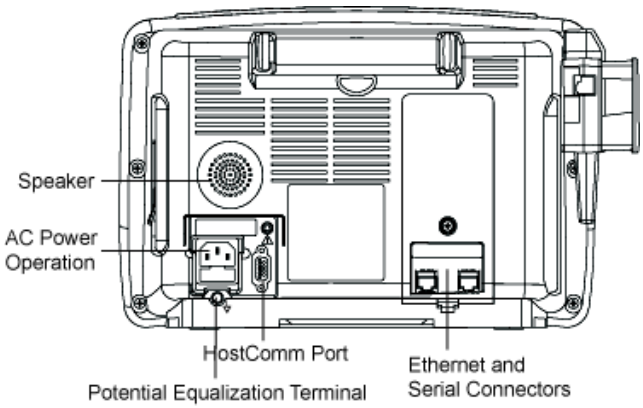
3 Installation

For your notes

Connections

Rear Panel Connections

The back of the Monitor has all ports for equipment.



NOTE: When using the remote alarm, the Monitor should be considered the primary alarm source. The remote alarm is used for secondary consideration only.

Power Up

After making all connections, plug the power cord into an AC wall outlet.

You can turn on the Dash 2500 Monitor by pressing either the **Power** button or the Trim Knob. If the Monitor is using battery power, it can be turned on only by the **Power** button on the front of the unit.

On power-up, the Monitor performs the following steps in the order listed:

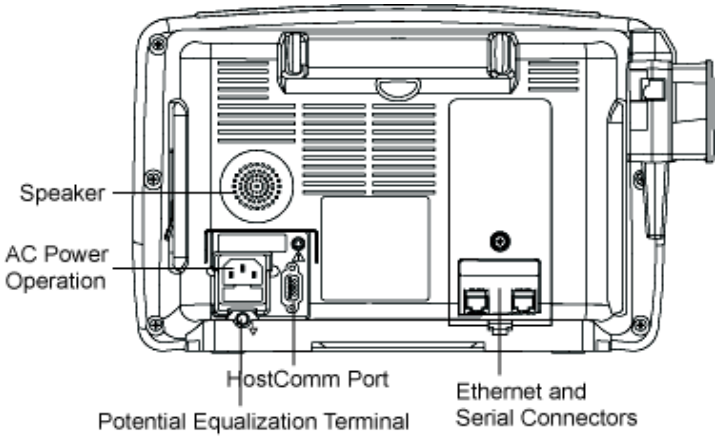
- At initial power up, the fail safe alarm sounds briefly.
- All indicator lights switch on.
- The screen momentarily displays the GE Medical Systems *Information Technologies* logo.
- The Monitor performs a self-test - the screen displays the model and revision number of the Monitor - and a start-up tone sounds.
- The main waveform screen appears.

Set Up/Configure

Setting up the Dash 2500 Monitor for the First Time

Unpacking and Preparation for Installation

Unpack and identify the contents of all shipping materials:



Rear View of Monitor

1. Remove the Monitor.
2. If an additional grounding point is provided, unpack the grounding cord and connect the grounding cord to the Earth Connector in the backside of the Monitor. Connect the other side of the grounding cord to the hospital grounding point.
3. Unpack the AC cord. Plug the AC cord into the AC Mains input at the back of the Monitor.
4. Plug the AC cord into a Hospital Grounded AC receptacle. A green LED illuminates on the front of the Monitor indicating that an AC source is available.
5. Prior to usage, it is necessary to charge the Monitor for 12 hours. This calibrates the battery circuitry with the charge status of the battery.

Integrity of Hoses and Cuffs

When the pneumatic integrity of any NIBP cuff or hose is in doubt, replace the cuff and hose, and discard the questionable accessories.

Set the Date and the Clock

The Monitor uses a Trim Knob to navigate through the menu systems. Turing the Trim Knob moves the arrow cursor, and pressing the Trim Knob makes the selection.

1. Power on the Monitor using the **Power** button.
2. Use the Trim Knob to select the **no** option when the Monitor prompts to admit a new patient.
3. Press or turn the Trim Knob to access the **Main Menu**.
4. Turn the Trim Knob to scroll down the menu. The arrow at the bottom of the list indicates that the list continues on a second screen. Highlight the **other system settings** option and press the Trim Knob.
5. Turn the Trim Knob to scroll down the menu to highlight the **Adjust date & time** option. Press the Trim Knob to continue.
6. Turn the Trim Knob to scroll down and highlight the appropriate date and time components to be changed if necessary (Month, Day, Year, Hour, Minute, Second). Press the Trim Knob. The field is displayed in a box. Turn the Trim Knob to the desired number and press the Trim Knob.
7. After all of the settings are changed, use the Trim Knob to scroll down and highlight the **set new time and date** option. Press the Trim Knob to save the settings and continue.
8. The message, **CAUTION! This will delete all trends, and stored waveforms. Are you sure you want to do this?** displays. Highlight the **yes** option and press the Trim Knob. A pop-up window displays the message, **Clearing all trends, and stored waveforms.** to confirm that the function is processing.

Configure

Refer to Appendix C to configure and set up the Dash 2500 Monitor for patient use.

Mounting Options

Please contact your local dealer and GE Medical systems *Information Technologies* for help.

Network set up

Refer to Chapter 6 FRU for network module assembly and Chapter F Connection for network installation configuration procedure.

Batteries

The Monitor uses one nickel-metal-hydride (NiMH) storage battery. The battery can be charged at any time without reducing the charging capacity. Take out the battery pack if storing for long term; over discharge might impair the battery.

Procedures For First Use

Follow these procedures to condition a new NiMH battery and optimize its performance:

The internal battery automatically charges when the AC power supply is in use.

NOTE:

When the battery is charged for the first time, the charger may indicate prematurely that charging is complete. This is normal and can happen with all rechargeable batteries when first charged.

Battery Charging

The Monitor charges the NiMH battery whenever the AC power supply is in use. The Monitor automatically senses if the battery needs recharging. Battery charging continues whenever it's needed while the Monitor is connected to the AC power supply, even when the Monitor is turned off.

- Batteries should be charged before first use or after prolonged periods of storage for at least 12 hours.
- The battery should be charged at room temperature (59°F - 86°F; 16°C - 30°C).
- It is normal for the battery to become warm during charging or after use.
- Batteries can be charged or topped-off at any time. It is not necessary to wait until they are fully discharged.
- If the Monitor is idle for extended periods, it should be at least fully charged and discharged once a month to ensure optimum performance.

Battery Maintenance

Battery should be maintained to prolong its life. Do not monitor patients during maintenance. Maintenance procedures are as follows:

- Connect the power cord to the Monitor and the AC wall outlet.
- Power the Monitor on and verify the battery is charging.
- Power the Monitor off and leave attached to AC power for a minimum of 4 hours (8 hours recommended).
- Power the Monitor on and verify the battery charge status. If further charging is required, power the Monitor off and recheck every 30 minutes (or longer) until the battery is fully charged.
- If the required charge time exceeds 12 hours, replace the battery.

Battery Troubleshooting

Trouble	Problem Cause	Remedy
Battery inoperative or does not last very long.	Battery not fully charged. Battery in long-term storage or non-use.	Charge and discharge battery up to three times for optimum performance.
Battery will not charge.	Charging battery in unusually cold or hot temperatures.	Charge at basic room temperature of 59°F (16°C) to 86°F (30°C). Slowly bring battery to basic room temperature before recharging. Batteries cannot be fully charged unless internal temperatures between 57°F (15°C) and 109°F (40°C).

Long-Term Storage

If it becomes necessary to store the Monitor for an extended period of time, remove all attached accessories. Attach the original packing inserts, and place the Monitor into the original shipping container.

Generally, long-term storage of a nickel-metal hydride battery in either a charged or discharged condition has no permanent effect on capacity. Capacity loss due to self-discharge is reversible, and nickel-metal hydride batteries can recover to full capacity by proper recharging. For example, cycling through repeated charge/discharge cycles can restore a full capacity of a nickel-metal hydride battery that was stored at room temperature for up to one year.

Long-term storage at high temperatures can lead to deterioration of seals and separators and should be avoided.

Installation check out

GE recommends that qualified personnel shall perform the following tests after installation, and record the results on the Appendix B, Test Record .

The Dash 2500 monitor has been thoroughly tested before leaving manufacturing. There is no need to re-test the parameters or operation of the unit upon installation except for the following:

1. Electrical safety tests. Refer to Chapter 4, Electrical Safety Tests .
2. Battery check. Ensure the battery indicator displays on the patient monitor without an error. Refer to Chapter 4, Battery Testing Test Procedure on page 4-27
3. Network testing if the Dash 2500 monitor is networked. Refer to Chapter 4, Network Testing .

4 Maintenance

For your notes

Required Service Equipment

- Multi Parameter Test Kit: MARQIII-KIT
- Masimo Test Kit: 2021087-001
- Oxymax Simulator: 2007650-002
- ECG simulator (DNI model 214B or equivalent)
- ECG cable (PN 412931-001, 411203-001, 411202-001)
- SPO_2 simulator (BIO-TEK SPO_2 simulators)
- SPO_2 adapter cable and sensor (Masimo: 2016041-002, Nellcor: DOC-10)
- NIBP analyzer (DNI Nevada "CuffLink" or Meriam Instrument Smart Manometer Model 350 DM2000 or equivalent)
- Adult Cuff (Critikon REF 2203)
- Adult Hose (DASH type: 414873-001)
- Adult mandrel, end block and spacer blocks (DNI PN 5215-0268, 5215-0269) (Lead test)
- Inflation bulb and associated tubing
- Manometer Digital 0-600 mmHg range or equivalent
- Temperature probe simulator (Alaris® PN TE1811)
- Temperature probe, oral (Alaris® PN 3887)
- Oscilloscope (capable of measuring ECG signal @ 0.75 Hz, 1 V amplitude)
- 1/8" stereo plug (Radio Shack PN 274-284C)
- Safety Tester (DNI Nevada 235A or equivalent)
- DMM (Fluke 8842 or equivalent)
- Serial communication cable
- Test plug assembly with 470 W resistor
- Dash 2500 software download tool
- Screw driver for Phillips cross head 1 and 2 screws

Maintenance Schedule

Manufacturer Recommendations

To ensure the Monitor is always functional when required, qualified service personnel should perform the following regular maintenance.

- **Visual Inspection:** Perform a visual inspection upon receipt of the equipment, every 24 months thereafter, and prior to servicing the unit.
- **Cleaning:** Clean the unit every 24 months thereafter, and each time the unit is serviced.
- **Conditioning the Batteries:** Condition the batteries once every month or as needed.
- **Calibrating the NIBP Software:** Calibrate the software upon receipt of the equipment, every 24 months thereafter, and each time the unit is opened for service.
- **Electrical Safety Tests:** Perform safety tests upon receipt of the equipment, every 24 month thereafter, and each time the unit is serviced.
- **Checkout Procedure:** Perform the checkout every 24 months thereafter, and each time the unit is serviced.

Manufacturer Responsibility

CAUTION
Failure on the part of all responsible individuals, hospitals or institutions, employing the use of this device, to implement the recommended maintenance schedule may cause equipment failure. The manufacturer does not, in any manner, assume the responsibility for performing the recommended maintenance schedule, unless an Equipment Maintenance Agreement exists. The sole responsibility rests with the individuals, hospitals, or institutions utilizing the device.

Visual Inspection

The Monitor and its components should be carefully inspected prior to installation, once every 24 months thereafter and each time the equipment is serviced.

- Carefully inspect the equipment for physical damage to the case, the display screen, and the keypad. Do not use the Monitor if damage is determined. Refer damaged equipment to qualified service personnel.
- Inspect all external connections for loose connectors or frayed cables. Have any damaged connectors or cables replaced by qualified service personnel.
- Inspect the display face for marks, scratches, or other damage.
- Safety labels and inscription on the device are clearly legible.

Cleaning

Cleaning the Monitor

Monitor Exterior

The exterior surfaces of the Dash 2500 Monitors may be cleaned with a dampened, lint-free cloth. Use one of the following approved solutions:

- Mild soap (diluted)
- Commercial diluted bleach solution or bleach wipe, such as Dispatch® Brand Hospital Disinfectant with Bleach Single-Piece Towels
- Commercial diluted ammonia solution
- Wipe off cleaning solutions with a clean, dry cloth

Never use the following cleaning agents:

- Abrasive cleaners or solvents of any kind
- Acetone
- Ketone
- Alcohol-based cleaning agents
- Betadine
- Quaternary ammonium disinfectants such as Virex®, Sani-Wipes®, Ascepti-Wipes®, or products containing similar active ingredients to these should be avoided.
- Cleaning solutions containing wax
- Never pour or spray water or any cleaning solution on the equipment or permit fluids to run behind switches, into connectors, into the recorder, or into any ventilation openings in the equipment.

Display

To clean the display screen, use a soft, clean cloth dampened with a glass cleaner. Never spray the glass cleaner directly onto the display, and never use alcohol or hospital disinfectants like Cidex or Betadine.

Failure to follow these cleaning recommendations may melt, distort, or dull the finish of displays and cases; blur lettering on labels; embrittle cases and lead to cracks and breakage; or cause equipment failures. Use of non-approved cleaning agents is considered abuse and is not covered under warranty.

Cuff Cleaning and Disinfection

General

The cuff must be thoroughly cleaned with the specified detergent before reuse. The additional use of household bleach as described below provides at least intermediate-level disinfection.

- Apply cuff hose plugs before cleaning.
- The following cleansing procedure was repeated 20 times on DURA-CUF® Blood Pressure Cuffs and once on SOFT-CUF® Blood Pressure Cuffs without affecting the performance of the cuff.

- While this procedure is adequate for cleaning/disinfection, it may not remove all stains.
- Do **not** immerse hoses.
- Do **not** immerse cuffs without prior application of cuff hose caps.

Materials

- Enzymatic detergent such as ENZOL® enzymatic detergent (US) or Cidezyme® enzymatic detergent (UK)
- Distilled water
- 10% solution of household bleach (5.25% sodium hypochlorite) in distilled water
- Soft cloths and soft-bristled brushes
- Spray bottles

Procedure

1. Prepare the enzymatic detergent according to the manufacturer's instructions and the 10% bleach solution, in separate spray bottles.
2. Spray the detergent liberally on device. If the material is dried on, allow the cuff to sit for 1 minute. For soil on the soft part of the closure or the cuff itself, wipe the material off with a soft cloth. For persistent contamination on the soft part of the closure, use a soft-bristled brush to loosen particles. Rinse with copious amounts of distilled water. Repeat until no visible contamination remains. For soil on the hook part of the closure, use a soft-bristled brush to remove the material, and rinse with copious amounts of distilled water. Repeat until no visible contamination remains.
3. Spray the 10% bleach solution on the affected area until the area is saturated. Allow the cuff to sit for 5 minutes.
4. Wipe away any excess solution and rinse the cuff again with distilled water. Allow 2 hours for drying.

The user has the responsibility to validate any deviations from the recommended method of cleaning and disinfection.

For additional information on infection control procedures, contact GE Medical Systems *Information Technologies* Technical Support.

Temperature Devices

Do not immerse predictive temperature probes. The probe can be cleaned with a solution of 10% bleach in water. Use a cloth or sponge-just damp, not wet-and avoid getting any liquid into the interior of the probe.

SpO_2 Sensors

Adhesive sensors are sterile and for single use only. Reusable sensors should be cleaned before reuse with a 70% alcohol solution. If low-level disinfection is required, use a 1:10 bleach solution. Do not use undiluted bleach (5% - 5.25% sodium chlorite) or any cleaning solution other than those recommended here because permanent damage to the sensor could occur. Do not sterilize the

sensor by irradiation, steam, or ethylene oxide. If disposable sensors or their packaging are damaged, they must be disposed of as advised in this section.

To clean or disinfect the sensor:

1. Saturate a clean, dry gauze pad with the cleaning solution. Wipe all surfaces of the sensor and cable with this gauze pad.
2. Saturate another clean, dry gauze pad with sterile or distilled water. Wipe all surfaces of the sensor and cable with this gauze pad.
3. Dry the sensor and cable by wiping all surfaces with a clean, dry gauze pad.

Electrical Safety Tests

General

Electrical safety tests provide a method of determining if potential electrical health hazards to the patient or operator of the device exist.

These instructions are intended for every component in the system.

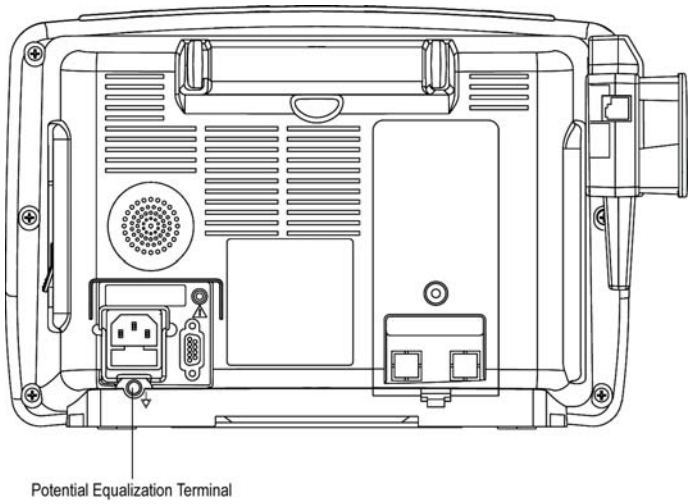
Test Equipment

The recommended test equipment required to perform electrical safety tests is listed below.

Item	Specification
Leakage Current Tester	Equivalent to the circuits shown
Digital Multimeter (DMM) (optional based on leakage tester used and locality)	AC volts, ohms
Ground Bond Tester	0-1 ohm
ECG Test Body	All leads together
Masimo SET SPO2 Test Body	2006036-001
GE and Nellcor SPO2 Test Body	2006646-001

Safety Resistance Testing

Using a safety analyzer (Dynatech Nevada Model 235A or equivalent), check the ground resistance of the Monitor. Refer to the **Rear View of Monitor with Safety Connection Exposed** graphic for locations of test points.



Rear View of Monitor with Safety Connection Exposed

Earth-To-Secondary Continuity ? Verify that the resistance between the AC mains ground pin and the potential equalization terminal is less than 0.1 Ω.

AC Mains Leakage - Normal Polarity ? 260 VAC is applied at the Monitor's AC Mains input in normal polarity.

No Fault ? Verify that the leakage from line to ground pin is less than 500 μA.

Open Ground ? Disconnect the Monitor's ground lead from earth ground (for the duration of this test only) and verify that the leakage from line to ground pin is less than 500 μA.

Open Neutral ? Open the Monitor's neutral lead (for this test only) and verify that the leakage from line to ground is less 500 μA.

AC Mains Leakage - Reverse Polarity ? 260 VAC is applied at the Monitor's AC Mains input in reverse polarity (inputs to line pin and Neutral pin reversed).

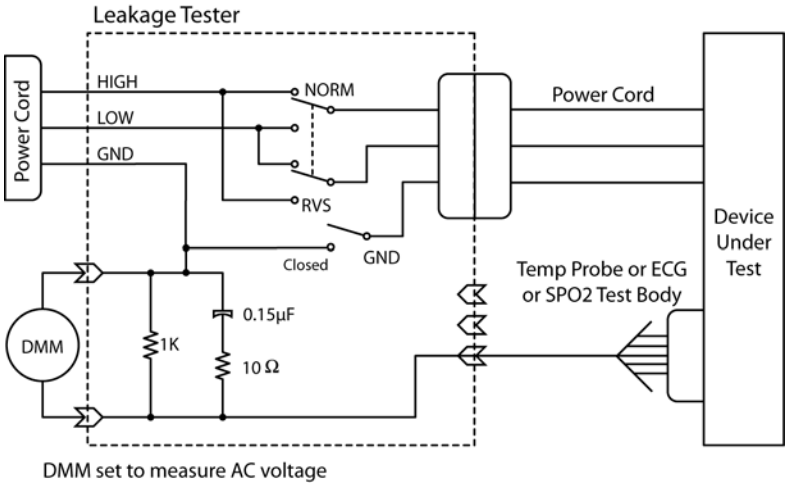
No Fault ? Verify that the leakage from line to ground pole is less than 500 μA.

Open Ground ? Disconnect the Monitor's ground lead from earth ground (for the duration of this test only) and verify that the leakage from line to ground is less than 500 μA.

Open Neutral ? Open the Monitor's Neutral lead (for the duration of this test only) and verify that the leakage from line to the ground is less than 500 μA.

Patient (Source) Leakage Current Test

This procedure measures the leakage current from the ECG/RESP connector or the SPO2 connector or the TurboTemp of the device to ground.



Patient (Source) Leakage – From ECG/Resp connector to Ground

Normal Polarity - Configure the leakage tester like the circuit shown above with GND switch CLOSE and polarity switch NORM.

No Fault - Verify that the leakage current from ECG test body to ground pin is less than 10 µA (0.01 volts on the DMM).

Open Ground - Change the GND switch to the Open position. Verify that the leakage current from ECG test body to ground pin is less than 50 µA (0.05 volts on the DMM).

Reverse Polarity - Change the leakage current switch to the RVS position with GND switch CLOSE.

No Fault - Verify that the leakage current from ECG test body to ground pin is less than 10 µA (0.01 volts on the DMM).

Open Ground - Change the GND switch to the Open position. Verify that the leakage current from ECG test body to ground pin is less than 50 µA (0.05 volts on the DMM).

Patient (Source) Leakage – From SpO2 connector to Ground

Normal Polarity - Configure the leakage tester like the circuit shown above with GND switch CLOSE and polarity switch NORM. Connect the SpO2 Test Body to the blue SpO2 connector of the device under test, using the appropriate SpO2 Test Body.

No Fault - Verify that the leakage current from SpO2 test body to ground pin is less than 100 µA (0.1 volts on the DMM).

Open Ground - Change the GND switch to the Open position. Verify that the leakage current from SpO2 test body to ground pin is less than 500 μA (0.5 volts on the DMM).

Reverse Polarity - Change the leakage current switch to the RVS position with GND switch CLOSE.

No Fault - Verify that the leakage current from SpO2 test body to ground pin is less than 100 μA (0.1 volts on the DMM).

Open Ground - Change the GND switch to the Open position. Verify that the leakage current from SpO2 test body to ground pin is less than 500 μA (0.5 volts on the DMM).

Patient (Source) Leakage – From TurboTemp connector to Ground

Normal Polarity - Configure the leakage tester like the circuit shown above with GND switch CLOSE and polarity switch NORM. Connect the Probe to the TurboTemp connector of the device under test.

No Fault - Verify that the leakage current from TurboTemp Probe to ground pin is less than 100 μA (0.1 volts on the DMM).

Open Ground - Change the GND switch to the Open position. Verify that the leakage current from TurboTemp Probe to ground pin is less than 500 μA (0.5 volts on the DMM).

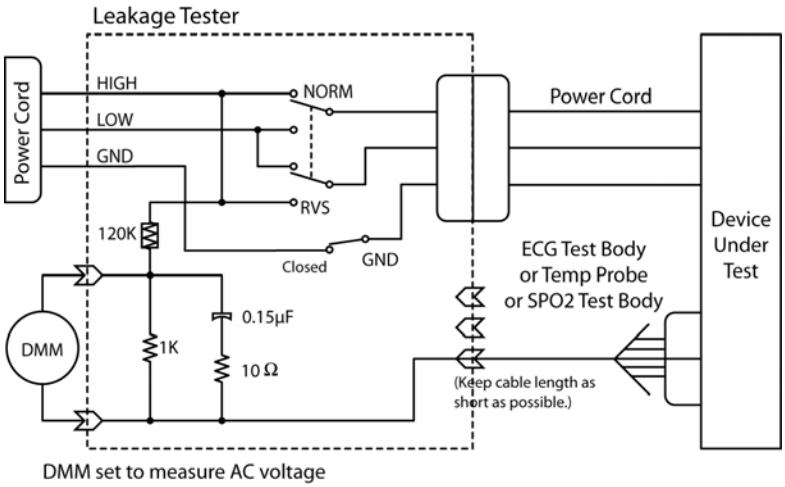
Reverse Polarity - Change the leakage current switch to the RVS position with GND switch CLOSE.

No Fault - Verify that the leakage current from TurboTemp Probe to ground pin is less than 100 μA (0.1 volts on the DMM).

Open Ground - Change the GND switch to the Open position. Verify that the leakage current from TurboTemp Probe to ground pin is less than 500 μA (0.5 volts on the DMM).

Patient (Sink) Leakage Current Testing (Mains Voltage on the Applied Part)

This procedure measures the leakage current from a mains voltage source into the ECG/RESP connector or the SpO2 connector or the TurboTemp connector of the device. .



Patient (Sink) Leakage – From AC mains to ECG/Resp connector

Normal Polarity - Configure the leakage tester like the circuit shown above with GND switch CLOSE and polarity switch NORM. Verify that the leakage current from ECG test body to ground pin is less than 50 µA (0.05 volts on the DMM).

Reverse Polarity - Change the leakage current switch to the RVS position with GND switch CLOSE.Verify that the leakage current from ECG test body to ground pin is less than 50 µA (0.05 volts on the DMM).

Patient (Sink) Leakage – From AC mains to SpO2 connector

Normal Polarity - Configure the leakage tester like the circuit shown above with GND switch CLOSE and polarity switch NORM. Connect the SpO2 Test Body to the blue SPO2 connector of the device under test, using the appropriate SpO2 Test Body.

Verify that the leakage current from SpO2 test body to ground pin is less than 5mA (5 volts on the DMM).

Reverse Polarity - Change the leakage current switch to the RVS position with GND switch CLOSE.

Verify that the leakage current from SpO2 test body to ground pin is less than 5mA (5 volts on the DMM).

Patient (Sink) Leakage – From AC mains to TurboTemp connector

Normal Polarity - Configure the leakage tester like the circuit shown above with GND switch CLOSE and polarity switch NORM. Connect the Probe to the TurboTemp connector of the device under test.

Verify that the leakage current from TurboTemp Probe to ground pin is less than 5mA (5 volts on the DMM).

Reverse Polarity - Change the leakage current switch to the RVS position with GND switch CLOSE.

Verify that the leakage current from TurboTemp Probe to ground pin is less than 5mA (5 volts on the DMM).

Checkout Procedures

These checkout procedures provide service personnel with a method to verify operational and functional performance of the Monitor. Failure to attain any of the listed results indicates a potential malfunction of the Monitor.

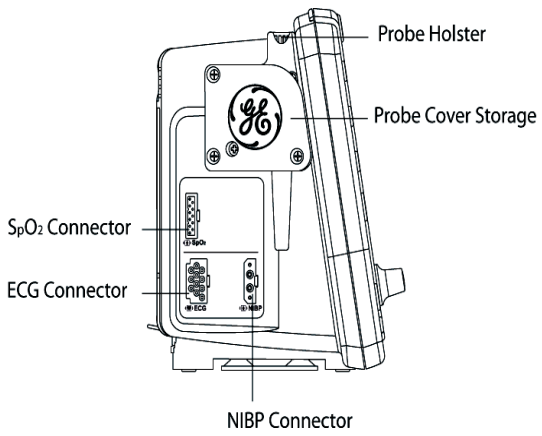
Perform the checkout procedures every 24 months thereafter, and each time you service the unit.

The checkout procedures are based on the assumption that the tested monitor has known good cables and test equipment. It also requires that the user be familiar with the operation of all test equipment required for the checkout procedures. For more information concerning the operation of these components, refer to the operation manual.

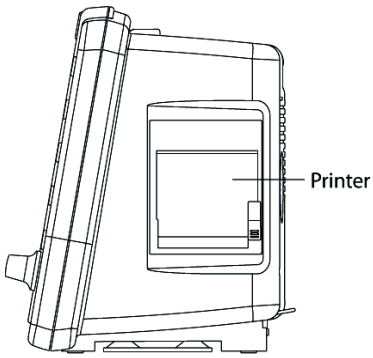
NOTE: All devices are tested and calibrated during manufacturing and are certified for operation at installation.

Parameter Level Functional Testing

After the initial configuration is complete, perform functional testing of each of the parameters. Using the accessories supplied with the Monitor, initialize the parameters.



Left Side View of Monitor



Right Side View of Monitor

Functional tests to be performed:

- **SpO_2:** The SpO_2 sensor used depends on the Monitor configuration.

  NELLCOR® —SpO_2 configured monitors use an assembly consisting of two parts: the DS-100A, and the extender cable NELL1 GE cable.

  MASIMO SET® —SpO_2 configured monitors use an assembly consisting of an interface cable and a sensor.

  Connect the cables prior to attaching to the Monitor. An SpO_2 reading displays within moments of attaching the sensor to either an SpO_2 simulator or to your finger.

- **Blood Pressure:** A blood pressure test is carried out by connecting the supplied hose and cuff together, then attaching them to the NIBP Connector on the left side of the Monitor. Press the **NIBP Go/Stop** hardkey on the front to begin the NIBP cycle.

- **ECG:** ECG monitoring uses 3-electrode or 5-electrode configuration.

  3-Lead ECG connection —Connect the ECG lead connector to the ECG trunk cable prior to connecting to the Monitor. The simplest way to function test the ECG circuits is through the usage of an ECG simulator.

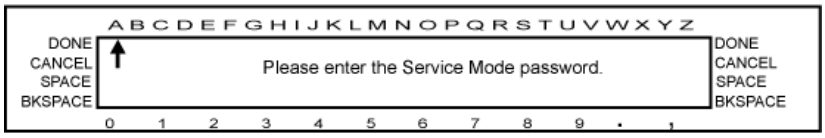
  5-Lead ECG connection —Connect the ECG lead connector to the ECG trunk cable prior to connecting to the Monitor. The simplest way to function test the ECG circuits is through the usage of an ECG simulator.

- **Temperature:** Connect the supplied temperature probe to the corresponding connection. A predictive temperature begins once the probe is removed from the holster. Replace the probe after completion of the TEMP cycle.

Service Mode Operation

The Monitor Service Mode exercises the built-in diagnostic features of the Monitor and the installed parameters. Access the Service Mode from a cold start by proceeding as follows:

1. Power on the Monitor using the **Power** hardkey.
2. Use the Trim Knob to select the **no** option when the Monitor prompts to admit a new patient.
3. Press or turn the Trim Knob to access the **Main Menu**.
4. Turn the Trim Knob to scroll down the menu. The arrow at the bottom of the list indicates that the list continues on a second screen. Highlight the **other system settings** option and press the Trim Knob.
5. Highlight the **go to service mode** option and press the Trim Knob. Turn the Trim Knob and press the Trim Knob again to answer **yes** at the prompt to display the dialog box.

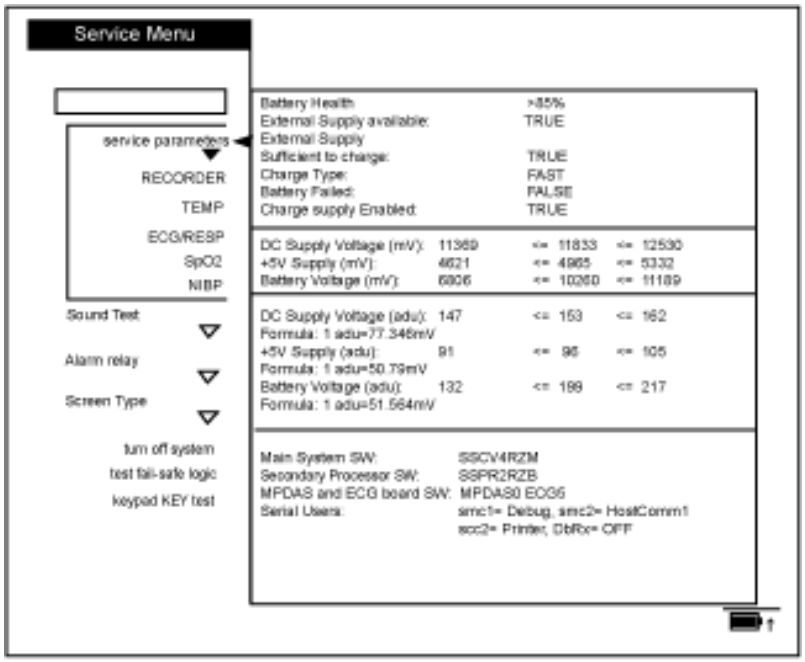


6. A row of numbers is displayed at the bottom of the screen. Turn the Trim Knob and move the arrow to the desired number, then press the Trim Knob to select the number. Enter the Service Mode password, **2213**.
7. After the password is selected, turn the Trim Knob to the **DONE** option and press the Trim Knob.
8. In the process of entering the Service Mode, the Monitor resets itself. Successful entry into the Service Mode is indicated by the **Service Menu** title displayed on the upper left side of the display.

   NOTE:

   The Service Mode can also be entered directly from a cold start by pressing and holding the following two keys until full power-up: **Power** and **NIBP Auto**. To make any changes to the **Service Menu**, the password has to be entered, follow Step 6.

9. At this point the Service Mode main screen should be present in the main display, as shown in the following graphic. The **Service Menu** service parameters area displays a list that corresponds to the number and type of parameters that have been detected by the Monitor. If the Service Mode was entered directly (as described in the **NOTE** above), enter service password appears above the service parameters on the **Service Menu**. The password MUST be entered (as described in Steps 5 and 6) before any changes to calibration can be made.



Main Service Menu

For each parameter, there are one or more service screens that display operating values and tests that are applicable to the parameter type. Refer to the following paragraphs for information about each parameter. At the conclusion of the tests, select **go to service menu** at the top of the screen to return to the **Service Menu** main screen.

NOTE:

Additional resources depend on the configuration of the Monitor.

SpO_2 Testing

For Monitors With NELLCOR® SpO_2 ? NELLCOR® recommends use of the SRC-MAX Portable Tester for use with the Dash 2500 Monitor equipped with the NELLCOR® SpO_2 system.

On occasion when testing the integrity of the NELLCOR® oximetry system, abnormal results may occur when introducing large changes in the pulse rate and/or pulse amplitude. Extreme changes in the rate sent to the NELLCOR® sensor by the SpO_2 simulator may cause the SpO_2 algorithm to completely miss finding the pulse rate. This is an expected result. To work around this, incrementally step up or down the settings on your SpO_2 simulator and allow the Monitor to detect and display the new pulse rate or saturation.

For Monitors With MASIMO SET® SpO_2MASIMO SET® ? recommends BIO-TEK SpO_2 simulators.

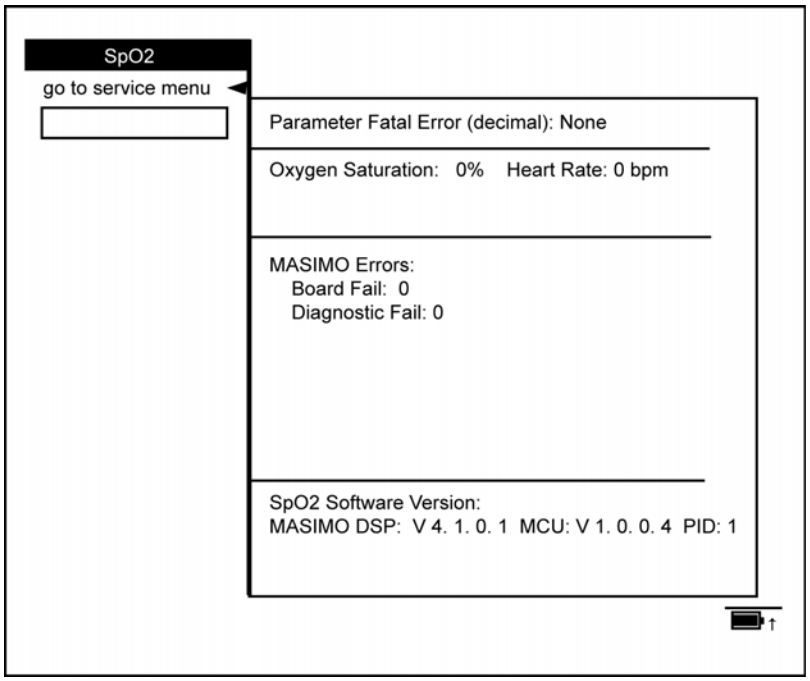
Test Procedure

The following table shows the allowable tolerance of the indicated simulator values.

Range	Accuracy
70% - 100% (Adult/ Ped)	± 2 digits
70% - 100% (Neonate)	± 3 digits
1% - 69%	No accuracy required

The following procedure applies to both Nellcor and Masimo equipped units.

1. Disconnect all sensor cables from the SpO_2 Parameter, and ensure that the SpO_2 parameter is listed within the main **Service Menu**.
2. From the **Service Menu**, turn and press the Trim Knob to select the **SpO_2** service parameter. The **SpO_2** service menu appears. The text under Error and Version sections reflects the installed type of SpO_2. The illustration shows both text examples.

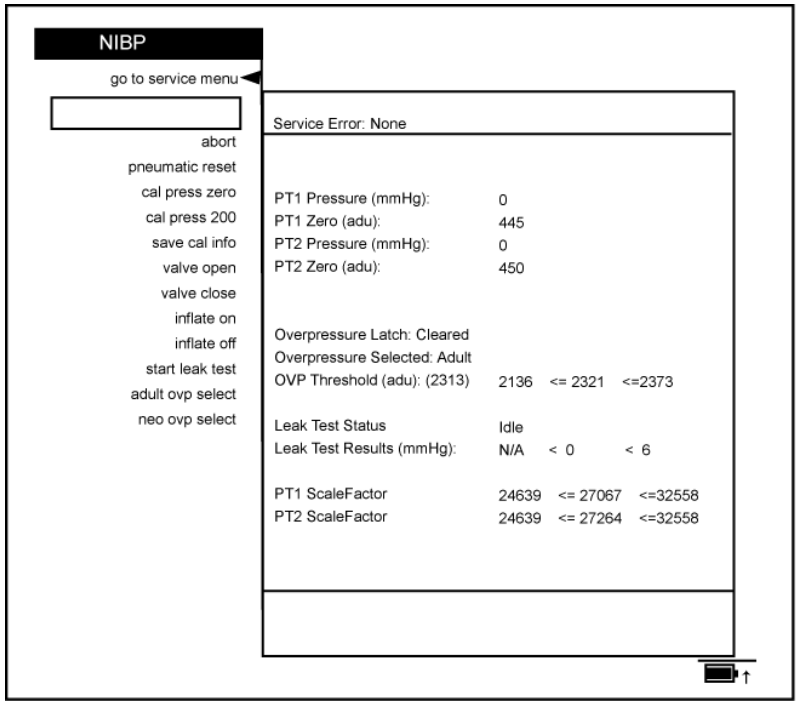


SpO_2 Service Menu

3. All SpO_2 mode operations take place with MASIMO SET® and NELLCOR® power-up defaults. No menu settings are reflected.
4. Connect the appropriate SpO_2 simulator and cable to the SpO_2 parameter. Be sure it is fully seated in the socket.

5. Vary the values on the simulator. Verify that the Monitor responds accordingly by displaying the proper heart rate value and saturation value.

NIBP Testing



NIBP Service Menu

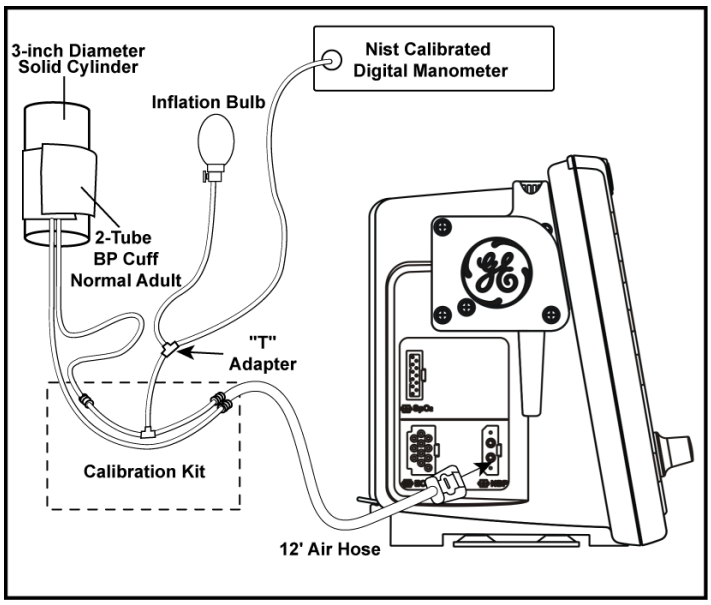
Perform the following tests to determine that the NIBP parameter is functioning normally.

Always enter Service Mode with the password before attempting to recalibrate equipment.

CAUTION
Calibration equipment should always be kept dry and free of particulate matter. Moisture or foreign substances introduced to the pneumatic system will likely cause damage to the Monitor and/or accessories.

NIBP Leak Test

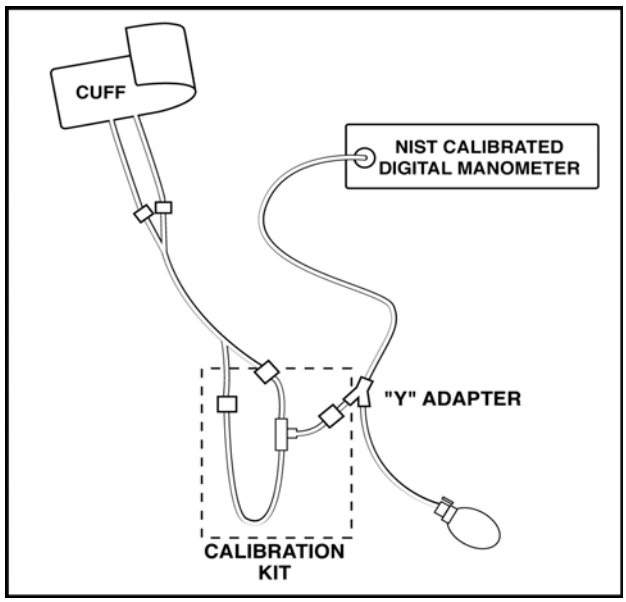
1. Using the calibration kit, an adult cuff and air hose, and a manometer, set up the equipment as shown in the **NIBP Test Setup** graphic. Connect the hose to the NIBP Parameter. Make sure that all of the fittings are tight and that the valve on the manual inflation bulb is fully closed.



NIBP Test Setup

2. From the **Service Menu**, turn and press the Trim Knob to select the **NIBP** service parameter.
3. Turn and press the Trim Knob to select **start leak test**. Observe that the **Leak Test Status** message on the menu indicates **Busy**.
4. Observe that the pump begins inflating the system to 200 - 210 mmHg, at which point the pump operation will cease. The Monitor will begin to calculate system pressure loss rate.
5. After about 60 seconds the pressure is released, and the menu should display **Leak Test Status Passed**, and the **Leak Test Results** indication should be a value less than 6. **Service Error: None** should continue to display.
6. If the menu displays **Leak Test Failed**, continue with Steps 7 through 9.

7. Using the calibration kit, an adult cuff and air hose, and a manometer, set up the equipment as shown in the **Leak Test Setup** graphic.



Leak Test Setup

8. Close the pressure release valve on the manometer inflation bulb and slowly increase the pressure to 200 mmHg ± 1 mmHg.
9. Verify the pressure indicated on the manometer remains within 5 mmHg of 200 mmHg for 60 seconds. If not, either the cuff or hose or both may be defective. If the cuff and hose pass this test, repeat Steps 1 through 7 to try to isolate the leak. Repeat the leak test for all cuff and hose combinations to be used with the Monitor.

NIBP Calibration Check

1. Using the calibration kit, an adult cuff and air hose, and a manometer, set up the equipment as shown in the **NIBP Test Setup** graphic. Connect the hose to the NIBP Parameter. Make sure all fittings are tight and that the inflation bulb valve is closed tightly.
2. From the **Service Menu**, turn and press the Trim Knob to select the **NIBP** service parameter.
3. Turn and press the Trim Knob to select **pneumatic reset**.
4. Turn and press the Trim Knob to select **valve close**.
5. Observe that both **PT1 Pressure** and **PT2 Pressure** equal initial values of 0 mmHg.
6. Connect the pneumatic hose to the Monitor's NIBP port.
7. Fold the adult cuff so the index line is aligned with the inner range mark on the inside of the cuff. Make sure all fittings are tight and that the valve on the inflation bulb is closed tightly. If there is doubt about the integrity of the system, perform the leak test before continuing.
8. Close the pressure release valve on the manometer inflation bulb and manually pump up the pressure until the manometer indicates approximately 220 mmHg.

9. Allow the pressure to stabilize for at least 1 minute. Then open the pressure release valve on the manometer inflation bulb and carefully bleed off pressure until the manometer indicates 200 mmHg.
10. Observe that the values of **PT1 Pressure** and **PT2 Pressure** on the menu indicate within 1 mmHg of the pressure shown on the manometer. If not, please check and repair the device.
11. Verify the system linearity by repeating Steps 8 and 9 using manometer readings of 250 mmHg, 150 mmHg, and 50 mmHg. Observe that the PT1 and PT2 Pressures are within 3 mmHg of manometer readings for each of these pressure indications. If not, proceed to the "Pressure Recalibration" section.

Pressure Recalibration

1. Using the calibration kit, an adult cuff and air hose, and a manometer, set up the equipment as shown in the **NIBP Test Setup** graphic. Do not connect the pneumatic hose to the NIBP port yet**.**
2. From the **Service Menu**, Turn and press the Trim Knob to select the **NIBP** service parameter.
3. Turn and press the Trim Knob to select **pneumatic reset**.
4. Turn and press the Trim Knob to select **valve close**.
5. Observe that both **PT1 Pressure** and **PT2 Pressure** display initial values of **0** on the menu.
6. Turn and press the Trim Knob to select **cal press zero**. Observe that the message **Inflate System to 200 mmHg Then Hit Cal Press 200** is displayed on menu.
7. Connect hose to NIBP Parameter.
8. Fold the adult cuff so the index line is aligned with the inner range mark on the inside of the cuff. Make sure all fittings are tight and that the valve on the inflation bulb is closed tightly. If there is doubt about the integrity of the system, perform the leak test before continuing.
9. Close the pressure release valve on the manometer inflation bulb and manually pump up the pressure until the manometer indicates approximately 220 mmHg.
10. Allow the pressure to stabilize for at least 1 minute. Then open the pressure release valve on the manometer inflation bulb and carefully bleed off pressure until the manometer indicates a little more than 200 mmHg.
11. Turn and press the Trim Knob to select **cal press 200**, but do not press the Trim Knob.
12. When the manometer indicates exactly 200 mmHg, press the Trim Knob. Observe that system pressure is released, and the message,**!!!!! CAL INFO NOT SAVED!!!!! Service Error: None** is displayed on menu.
13. Turn and press the Trim Knob to select **save cal info**. The message,**!!!!!CAL INFO NOT SAVED!!!!** disappears. This indicates your new calibration values have been saved.
14. Repeat the calibration check procedure to confirm the calibration setting.

Overpressure Tests

1. Using the calibration kit, an adult cuff and air hose, and a manometer, set up the equipment as shown in the **NIBP Test Setup** graphic. Connect the hose to the NIBP Parameter. Make sure all fittings are tight and that valve on inflation bulb is closed tightly.
2. From the **Service Menu**, Turn and press the Trim Knob to select the **NIBP** service parameter.
3. Turn and press the Trim Knob to select **pneumatic reset**.
4. Turn and press the Trim Knob to select **valve close**.
5. Verify the menu displays **Overpressure Latch: Cleared and Overpressure Selected: Adult**. If not, turn and press the Trim Knob to select **adult ovp select**.
6. Turn and press the Trim Knob to select **inflate on**. The pump should begin to inflate the system.
7. Watch the pressure indication increase on the manometer, and observe that the pump is shut down and the pressure is released when the manometer indicates in the range of 300 to 330 mmHg. Observe that the menu displays **Service Error: Over Pressure Condition Detected**.
8. Turn and press the Trim Knob to select **pneumatic reset**.
9. Turn and press the Trim Knob to select **valve close**.
10. Turn and press the Trim Knob to select **neo ovp select**. Verify the menu displays **Overpressure Latch: Cleared and Overpressure Selected: Neo**.
11. Turn and press the Trim Knob to select **inflate on**. The pump should begin to inflate the system.
12. Watch the pressure indication increase on the manometer, and observe that the pump is shut down and the pressure is released when the manometer indicates in the range of 150 to 165 mmHg. Observe that the menu displays **Service Error: Over Pressure Condition Detected.**
13. If the overpressure test results in an out of tolerance condition, contact GE Medical Systems *Information Technologies* Technical Support at 1-800-558-7044 (USA), 86-800-810-8188 (China) or contact your local representative. If you are a cell phone or Xiaolingtong user, or your area does not support 800 free-call service, please dial: 86-010-67882652 (China). If you are a EMEA user, please contact your local GE service provider.

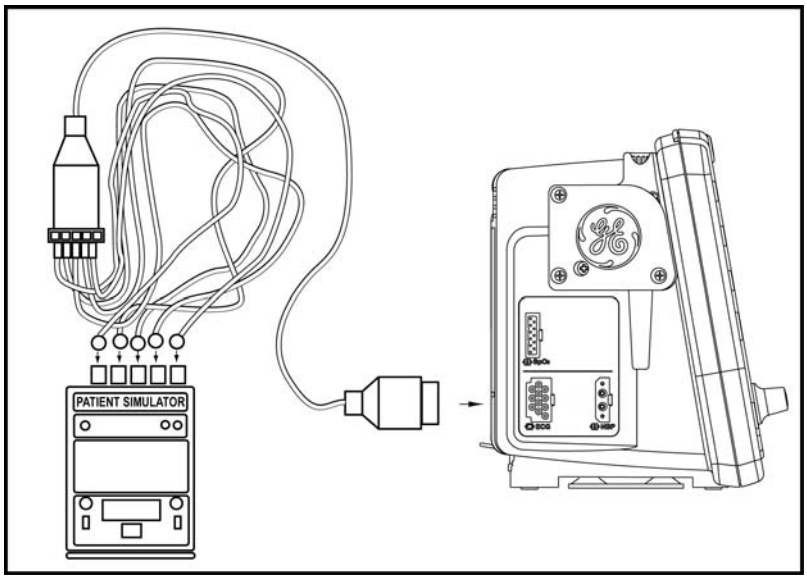
Overpressure Calibration

NOTE:

Overpressure calibration is adjusted by software based on “Pressure Calibration” section.

ECG Testing

Connect the ECG leads to the ECG trunk cable prior to connection to the Monitor. The simplest way to function test the ECG circuitry is through the usage of an ECG simulator with the Monitor in normal monitoring mode.



1. Set the ECG simulator to output a Paced ECG Waveform.
2. Press **Power** hardkey to power up UUT.
3. Select **no** at new patient prompt. Set the ECG high alarm to **150** and the low alarm to **50**.
4. Verify that the ECG waveform is displayed on LCD display.
5. From ECG menu, select **Pace 1** and verify paced marker on display waveform.
6. From ECG menu, select **Pace 2** and verify paced marker on display waveform.
7. From ECG menu, select **PACE OFF**. Turn paced off on simulator.
8. After unit has learned the patient waveform change the bpm to **30**.
9. Verify **HR LOW** alarm and HR is 30 $\pm$ 4 bpm on unit.
10. Set ECG simulator to 160 bpm.
11. Verify that the ECG waveform is displayed on the LCD display.
12. Verify **HR HIGH** alarm and HR is 160 ± 4 bpm on unit.
13. Set ECG simulator to 80 bpm.
14. Set ECG high alarm to **200** and low alarm to **30**.
15. Set ECG simulator to VTACH.
    - Set simulator MPS450 to 160 bpm
    - Set simulator MPS214B to 180 bpm
16. Verify **ECG VTACH** alarm and HR is 180 ± 4 bpm.
17. Set ECG simulator to 80 bpm.

18. Press **Silence Alarm** hardkey to acknowledge the alarm and verify HR is 80 ±4.
19. Connect scope to analog output using 1/8" stereo plug (+ to ring, - to shield).
20. Verify that the ECG waveform is displayed on the scope (amplitude approximately 1V/mV).
21. Disconnect scope from analog output.
22. Remove and reattach Leads I, II, III, sequentially and verify **ECG LEAD FAIL** alarm on display.
23. From **ECG** menu, select **turn parameter off**.

RESP Testing

1. Set simulator Respiration to 20 BrPM.
2. Set simulator delta ohms to 1.0.
3. Set simulator Baseline to 1K, and Lead to II.
4. Verify that the RESP waveform is displayed on the LCD display.
5. Record and verify the UUT RESP reading 20 ± 3bpm.
6. Set simulator Respiration to 60 BrPM.
7. Record and verify the UUT RESP reading 60 ± 3bpm.
8. From **RESP** menu, select **turn parameter off**.

Temperature (Perform if equipped with Temp module)

The Temperature Simulator for the Alaris System is available from Alaris Medical Systems, Inc. (619) 458-7000.

The Alaris® Turbo Temp® probes cannot be calibrated. These probes must be discarded after 2 years from the date of manufacture stamped into the RJ45 connector (first two digits = year, second two digits = week). Refer to the illustration example (0520 = fw20 in 2005).

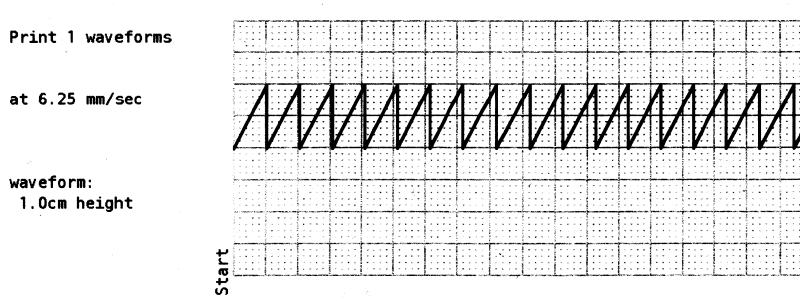
It is the responsibility of the user to maintain proper records.

Alaris® Turbo Temp® Probe Date Code

1. Turn Monitor off. Make sure the temp probe is properly stored in the probe well.
2. Disconnect the temp probe cable from the monitor.
3. Connect Temp simulator; set to 80.2°F.
4. Turn the Monitor on.
5. Put the Monitor into temp monitor mode:
   a. partially remove the probe from the well (stop when you hear the Monitor beep).
   b. Quickly re-insert the probe and remove again (you should hear two beeps of a different tone).
   c. A temperature value should appear quickly, if not, repeat Step 5b.
6. Record and verify the reading in the temp display is 80.2 ± 0.2°F.
7. Set the simulator to 98.6°F.
8. Record and verify the reading in the temp display is 98.6 ± 0.2°F.
9. Set the simulator to 107.8°F.
10. Record and verify the reading in the temp display is 107.8 ± 0.2°F.
11. Calibration is complete. If the monitor does no pass the calibration verification then contact Technical Support.

Recorder Testing (if installed)

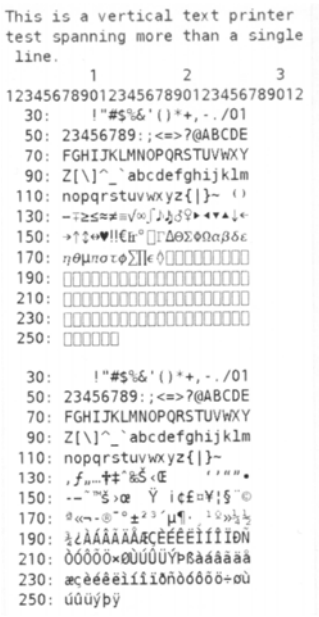
1. Ensure that paper has been loaded into the Recorder and you are presently in the Service Mode.
2. From the **Service Menu**, turn and press the Trim Knob to select the **Recorder** test option. Turn and press the Trim Knob to select the **Print 1 Waveforms** option. Turn and press the Trim Knob to select the **Wave Test 6.25 mm/s** option. Verify that all printouts are of even tone and all pixels are present.



Sample 6.25 mm/s - 1 waveform chosen

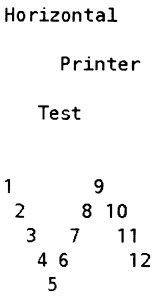
3. Allow for the paper to spool out a 12-inch printed section then press **Stop Test**.

4. Select **Vertical Text** test. Verify that the printed text is legible and evenly spaced.



Vertical Text Test Printout

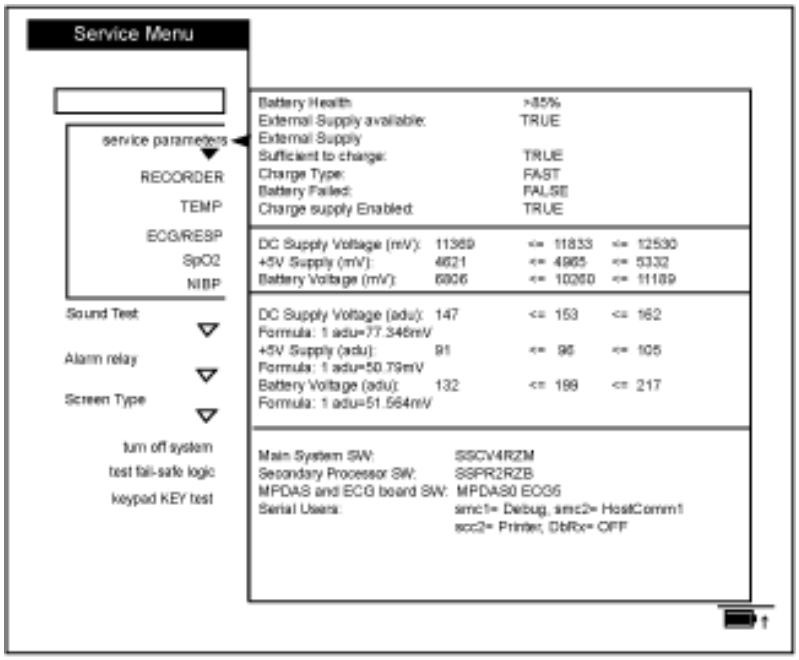
5. Select **Horizontal Text** test. Verify that the printed text is legible and evenly spaced.



Horizontal Text Test Printout

Battery Testing

From within the **Service Menu**, battery status information is displayed on the upper right-hand section of the display.



Battery/ Power Supply Menu

Battery Health

The Monitor's software approximates the true status of the battery's health. The value indicated is displayed as both a number (in percentage) on the top of the display and as an icon on the lower right area of the display.

External Supply available

TRUE indicates a source other than the internal battery is providing power for the Monitor and a source to charge the internal battery.

External Supply Sufficient to Charge

If the voltage from the external supply is greater than that of the internal battery, the Monitor will display the results as **TRUE**. **FALSE** will result if either the voltage is equal to or lower than the power available from the internal battery.

Charge Type

FAST indicates battery is charged fast when it is not full. **TRICLE** indicates battery is charged slowly when it is already full.

Battery Failed

Any result other than **FALSE** indicates that the internal battery has suffered a failure and should be investigated.

Charger Supply Enabled

This status indicator should always be **TRUE** as the Monitor consistently attempts to keep the battery at its fullest capacity. A **FALSE** indicates the battery may be faulty, not installed, or the charge circuit may have failed. Also, if no external source of power is available, the Monitor registers a **FALSE** result.

Test Procedure

1. Verify AC Mains indicator on front panel of unit near **Power** hardkey is lit with AC Mains plugged in.
2. Turn on Monitor.
3. Remove AC Mains and verify uninterrupted battery operation.

   NOTE:
   If this fails, check fuse in communications well.

4. Verify battery indicator near **Power** hardkey.

   NOTE:
   Battery life is dependent upon battery usage. A fully charged battery should last greater than 180 minutes using the following setup: (NIBP: 5-min auto cycle with adult cuff. ECG, RESP, SpO_2: Active. TEMP: predictive mode. Printer: printing 2 waveforms for 1 min every 20 min at 25 mm/s.).

Fail-Safe Logic Testing

From the **Service Menu**, turn the Trim Knob to select **test fail-safe logic**. A dialogue box displays: **CAUTION! This causes the system to freeze for approx. 2 seconds then enter the fail-safe mode. Continue?**

1. Turn the Trim Knob to the **yes** option and press the Trim Knob.
2. After 2 seconds, the system freezes, an alarm sounds, and the screen goes blank. Recycle the system power using the **Power** hardkey. To return to the Service Mode, repeat the procedures as described in “Service Mode” section.

Keypad Key Testing

1. From the **Service Menu**, turn and press the Trim Knob to select **keypad KEY test**. With the exception of the **Power** hardkey, verify that each key press produces a tone. You may hear different tones in some occasions. This does not affect the testing results.
2. After all keys have been tested, press the Trim Knob again to stop the test.

Sound Testing

1. From the **Service Menu**, turn and press the Trim Knob to select **Sound Test**.
2. Select **ON** to start the test. The monitor generates a serial of tones the Monitor has one by one every 2 seconds.
3. Select **OFF** to stop the test.

Communications Testing

Set up Terminal

1. Connect serial communication cable from PC to rear of UUT (DB9).
2. Invoke terminal program with settings:

   9600 baud,
   No parity,
   8 bits,
   1 stop bit,
   flow = None,
   no cr/lf character enabled

   NOTE:
   Terminal must be set to an available communication port (comm1 is default) or redirect the terminal program to an appropriate port.

Configure UUT for Communication

1. Turn the Trim Knob to get to the **Main Menu** and select **other system settings**.
2. Select **go to config mode**, select **yes** at the verification prompt.
3. Enter password **2508**, and select **done**.
4. After the unit reboots, turn the Trim Knob to display the **Configuration Menu**.
5. Select **other system settings**, then **Config HostComm**.
6. Configure the COMMS port for **Remote access** Serial 2.
7. Select **Serial 2 setup** and configure Serial 2 for ASCII cmd, 9600 baud.
8. Select **go to previous menu**, then **save default changes**.
9. Select **exit config mode**, select **yes** at the verification prompt.
10. After the unit reboots, select **no** at "new patient" prompt.

Communication Test

Execute the following commands (by sending text files from the terminal program) and verify the appropriate response.

NOTE:

Each string is preceded by a space. "^" represents the space character.

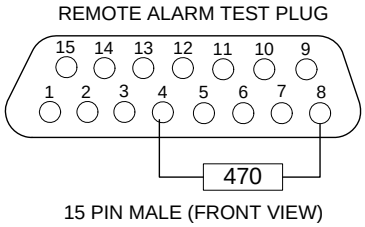
"^NC0!E" Verify that UUT pump starts.

"^ND!5" Verify that UUT pump stops.

"^TB!9" Verify return temperature status in the form "...TB-99999...".

Remote Alarm Testing

1. Install the test plug into 15 pin communications port on rear of unit, as shown in **Test Plug Assembly** graphic.
2. Use the DMM to measure voltage between pins 4 and 8 of DB15 connector and record the result.



Test Plug Assembly

3. From the **Service Menu**, turn and press the Trim Knob to select **Alarm relay**.
4. Select **Alarm relay / ON**. Measure and record voltage between pins 4 and 8 of DB15 connector. Verify the voltage is 0 V.
5. Select **Alarm relay / OFF**. Measure and record voltage between pins 4 and 8 of DB15 connector. Verify the voltage is 5 V.
6. Remove test plug assembly from DMM.

Network Testing

Install and set up the network module for Dash 2500. Check that the connector and the plugs are clean and intact, then connect the monitor into the network.

Select **View patient tab** on the CIC, set up the unit number and bed number of the connected monitor to establish communication. If the unit name is the same as CIC unit setting on the monitor, the CIC will establish communication automatically. If it does not display automatically, right click an multi-patient view window and select the correct unit/bed of the monitor.

NOTE: In general, it needs less than 30 seconds to let monitor to be detected and establish communication by CIC after you finished all above steps.

If the monitor information (e.g. bed number, unit number, and patient name) is displayed on the CIC patient tab, the communication is established successfully.

Country of Use

This option have two setting values: **CHINA** and **Other.** The **CHINA** setting will cause the monitor to have the same factory default, ECG parameter, QRS width setting between adult, pediatric, and neonate patient types. The user can still choose to change the setting for a particular patient through the ECG parameter advanced settings menu.

Turn off system

Selection of this menu item brings up a dialogue window requesting you to confirm your decision: **CAUTION! This turns the system off. Are you sure you want to do this?**

Selecting **yes** powers off the Monitor. Selecting **no** returns the Monitor to the **Service Menu**.

Service Mode Exit

To exit the Service Mode and power off the Monitor, locate and press the **Power** hardkey at the front of the Monitor.

5 Troubleshooting

For your notes

General Troubleshooting

Problem	Cause	Solutions
Unit will not power on	■ No AC power ■ Faulty AC2DC power supply ■ Faulty DC2DC PWA ■ Faulty Main Board ■ Faulty cables ■ Faulty power off/on front panel switch	■ Check AC power ■ Replace PSU module; FRU 2023852-011 ■ Replace DC2DC PWA; FRU 2023852-012 ■ Replace Main Board; FRU 2023852-007 ■ Replace defective cable; FRU 2023852-015 ■ Replace defective PWA keyboard; FRU 2023852-006
Unit will not operate on battery	■ Faulty battery pack ■ Faulty DC2DC PWA	■ Replace battery pack; FRU 2023852-029 ■ Replace DC2DC PWA; FRU 2023852-012
Unit powers on but no display	■ Faulty display ■ Faulty backlight driver ■ Faulty Main Board ■ Faulty DC2DC PWA	■ Replace LCD PANEL ASSY; FRU 2023852-032 ■ Replace INVERTER PWA; FRU 2023852-031 ■ Replace Main Board; FRU 2023852-007 ■ Replace DC2DC PWA; FRU 2023852-012
Unit will not generate sound	■ Faulty speaker assembly ■ Faulty Main Board	■ Replace speaker assembly; FRU 2023852-014 ■ Replace Main Board; FRU 2023852-007
Unit will not respond to Trim Knob	■ Faulty encoder ■ Faulty Main Board	■ Replace encoder; FRU 2023852-016 ■ Replace Main Board; FRU 2023852-007
Unit Host Comms not functional	■ Faulty Main Board ■ Faulty DC2DC PWA	■ Replace Main Board; FRU 2023852-007 ■ Replace DC2DC PWA; FRU 2023852-012

Parameter Troubleshooting

Problem	Cause	Solutions
Unit will not perform NIBP function	■ Faulty Main Board ■ Faulty pneumatics assembly ■ Faulty pneumatics cable ■ Faulty front panel button	■ Replace Main Board; FRU 2023852-007 ■ Replace pneumatics assembly; FRU 2023852-010 ■ Replace pneumatics assembly; FRU 2023852-010 ■ Replace defective keyboard PWA; FRU 2023852-006
Unit will not perform ECG function	■ Faulty DAS PWA assembly ■ Faulty ECG cable assembly ■ Faulty Main Board	■ Replace DAS box; FRU 2023852-049 (Nellcor SpO2) ■ Replace ECG cable ■ Replace Main Board; FRU 2023852-007
Unit will not produce an analog ECG waveform output	■ Faulty Defib cable assembly ■ Faulty DC2DC PWA ■ Faulty Main Board	■ Replace Defib cable assembly ■ Replace DC2DC PWA; FRU 2023852-012 ■ Replace Main Board; FRU 2023852-007
Unit will not perform SpO2 function	■ Faulty DAS PWA assembly ■ Faulty Main Board	■ Replace DAS box; FRU 2023852-049 (Nellcor SpO2) ■ Replace Main Board; FRU 2023852-007
Unit will not perform TEMP function	■ Faulty temperature probe ■ Faulty DAS PWA assembly ■ Faulty Main Board	■ Replace temperature probe ■ Replace DAS box; FRU 2023852-049 (Nellcor Spo2) or 2023852-050 (Masimo Spo2) ■ Replace Main Board; FRU 2023852-007
Unit will not print	■ Unit out of paper or paper incorrectly installed ■ Faulty printer ■ Faulty Main Board ■ Faulty PSU module	■ Check paper installation ■ Replace printer; FRU 2023852-008 ■ Replace Main Board; FRU 2023852-007 ■ Replace PSU module; FRU 2023852-011

Error Codes

Alarm Code Interpretation

If any other alarms appear that are not listed in the paragraphs that follow, record the error message and report the failure to Customer Support. Refer to the operation manual for information about patient alarms and general procedural alarms.

For network module's troubleshooting, the information appear as the LED light in the network module board, refer to Appendix F, LEDs .

System Failures

When a system failure is encountered, the error code is displayed on the screen for 5 seconds and the system enters fail-safe mode. The error code is recorded in the history log.

General system error codes are listed below. If any other **SY** or similar code displays, report it to Customer Support.

System Error Messages

Error	Explanation	Possible Error Source
SY-16	Power fail signal true time is too long	Main CPU Board
SY-19	Software detected power supply out of limits failure	Main CPU Board
SY-20	Checksum of code in flash memory is not valid	Main CPU Board
SY-40	Unexpected interrupt	Main CPU Board
SY-43	Real time clock running stopped	Main CPU Board
SY-44	Real time clock running abnormal	Main CPU Board

Hardware Error Messages

Error	Explanation	Possible Error Source
8193	HW, time base failure	Main CPU Board
8202	HW, power supply, system failure	Power Supply, Main CPU Board
8222	HW, RAM test failure	Main CPU Board
8232	HW, ROM checksum failure	Main CPU Board
8252	HW, secondary processor not compatible	Main CPU Board
8253	HW, secondary communications failure	Main CPU Board
26631	Operating system 300 Hz timer re-entry error	Main CPU Board
27268	Unexpected error condition	Main CPU Board

NIBP Parameter Error Messages

Error	Explanation	Possible Error Source
110	Overpressure circuit failure	Main CPU Board
130	EEProm read failure	Main CPU Board
131	EEProm write failure	Main CPU Board
140	Transducer initialization failure	Main CPU Board, Pneumatic Assembly
141	Calibration of a transducer channel's zero failed	Main CPU Board, Pneumatic Assembly
142	Calibration of a transducer channel's span failed	Main CPU Board, Pneumatic Assembly
150	Auto zero failure	Main CPU Board, Pneumatic Assembly
180	Excessive leakage	Pneumatic Assembly, Interface Panel
190	Commands out of sequence	Main CPU Board
220	Valve in illegal state	Main CPU Board, Pneumatic Assembly
221	Pressure too high for too long	Main CPU Board, Pneumatic Assembly
227	Error calibration digital pot. Time out or setting not within correct range	Main CPU Board, Pneumatic Assembly

ECG Parameter Error Messages

Error	Explanation	Possible Error Source
101	MPDAS Board data rate error	MPDAS Board
102	MPDAS Board revision not compatible	MPDAS Board
103	MPDAS Board hardware error	MPDAS Board
109	Processing of ECG waveform too far behind	MPDAS Board, Main CPU Board
113	Data requested from ECG data manager is not available	MPDAS Board
114	Data requested from ECG data manager is not available	MPDAS Board
128	Errors returned while generating analog O/P	MPDAS Board
128-132	Errors returned while generating analog O/P	MPDAS Board
201	MPDAS Board command queue overrun	MPDAS Board

Temperature Parameter Error Messages

Error	Explanation	Possible Error Source
101	MPDAS Board data rate error	MPDAS Board
102	MPDAS Board revision not compatible	MPDAS Board
103	MPDAS Board hardware error	MPDAS Board
111	Software error-state machine bad probe number	MPDAS Board
120	TEMP type undefined	MPDAS Board

SpO_2 Parameter Error Messages

Error	Explanation	Suggested Replacement
101	MPDAS Board data rate error	MPDAS Board
102	MPDAS Board revision not compatible	MPDAS Board
103	MPDAS Board hardware error	MPDAS Board
125	Too many reset requests	MPDAS Board, Main CPU Board
126	Nellcor has posted a "serious" FE error	MPDAS Board
129	FE data OK- processing stalled	MPDAS Board
130	Masimo has posted either a board or diagnostic failure-type available in Service Mode	MPDAS Board
131	Msg looks out of sequence	MPDAS Board
132	Missing characters inside a packet	MPDAS Board
133	Not able to correctly set parameter	MPDAS Board
134	NELL_SendCommand () called before previous call completed	MPDAS Board
135	Not enough room left in transmit FIFO to send data	MPDAS Board
136	Receive FIFO full, probably lost data	MPDAS Board
137	Queue out to OEM board is full	MPDAS Board
138	Nellcor has posted too many auto resets	MPDAS Board
139	Nellcor software error	MPDAS Board
140	Nellcor has posted too many communication errors	MPDAS Board
141	No communication with MPDAS board. Unit may be configured incorrectly	MPDAS Board
150	Queue out to OEM board is full	MPDAS Board
151	Nellcor C-LOCK logic re-entered	MPDAS Board

Respiration Parameter Error Messages

Error	Explanation	Possible Error Source
101	This means something was wrong with memory at wake up. Couldn't get data space.	MPDAS Board
102	These last three mean that the algorithm; execution couldn't keep up with the data acquisition	MPDAS Board
103		
104		

Recorder Parameter Error Messages

Error	Explanation	Suggested Replacement
101	Output (to printer) queue overflow	Printer
102	Output (to printer) queue overflow	Printer
103	Output (to printer) queue overflow	Printer
104	Input queue (from system) overflow	Printer
105	Queue freeze error	Printer
110	Invalid speed setting	Printer
111	Invalid number of waves setting	Printer
112	Invalid density setting	Printer
114	Bad command	Printer
115	Bad command	Printer
120	Queue not initialized	Printer
121	Annotation queue overflow	Printer
122	Invalid location	Printer
123	Not enough room	Printer
140	Bad command for this mode	Printer
141	Bad command for this mode	Printer

6 Field Replaceable Units

For your notes

Ordering Parts

The parts lists and drawings in this chapter supply enough detail for you to order parts for the assemblies considered field replaceable.

If you require additional information or troubleshooting assistance, contact GE Technical Support.

To order parts, contact Service Parts at the address or telephone number listed on the “How to Reach Us...” page found in service manual CD.

For the latest parts information, including substitutions, obsolescence, and compatibility, please contact you local GE service provider.

Parts

The table below lists field replaceable units that can be ordered.

NOTE:

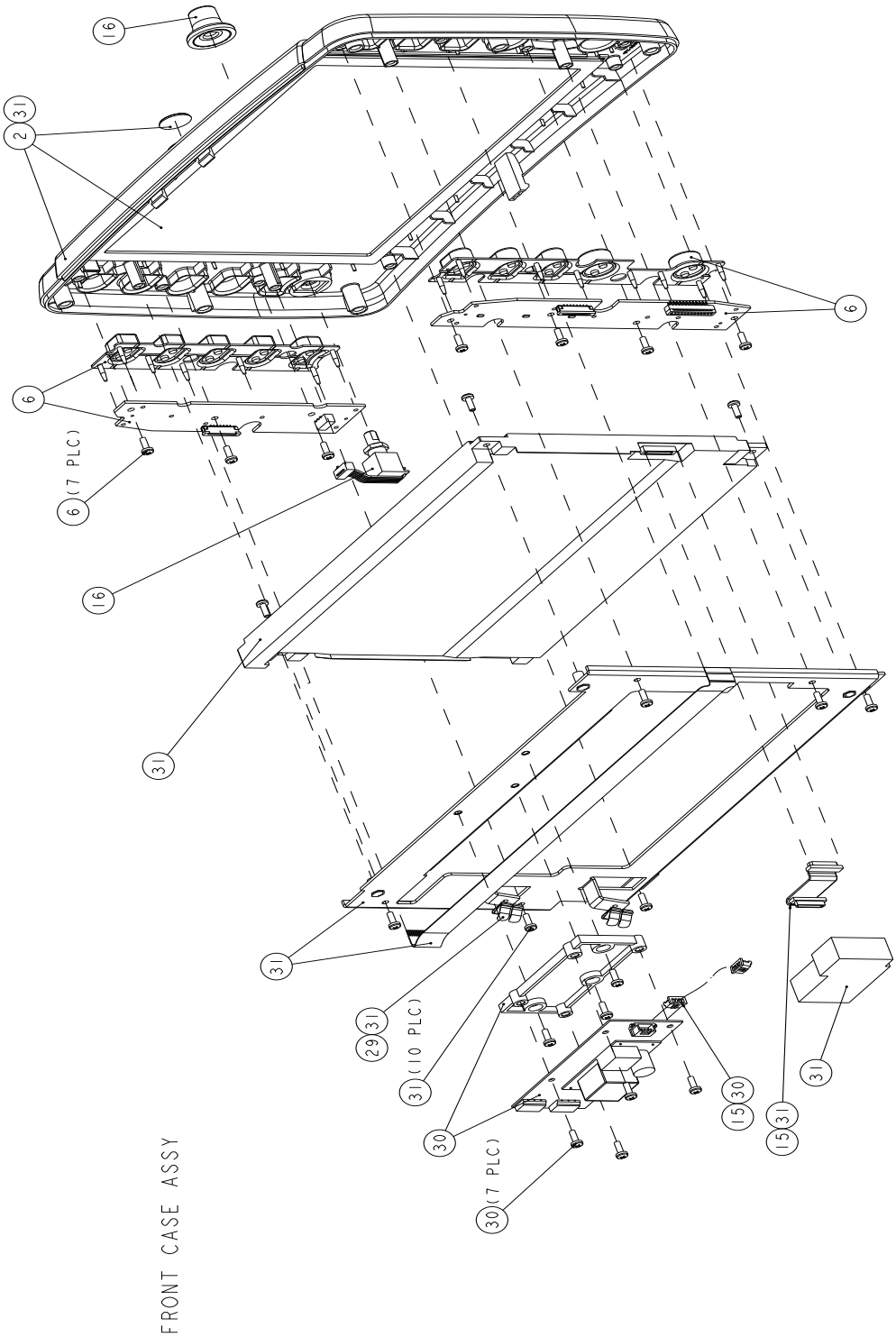
Due to recent branding changes, the part ordered may vary slightly from the previous part. Contact you local GE service provider for a full list of available parts

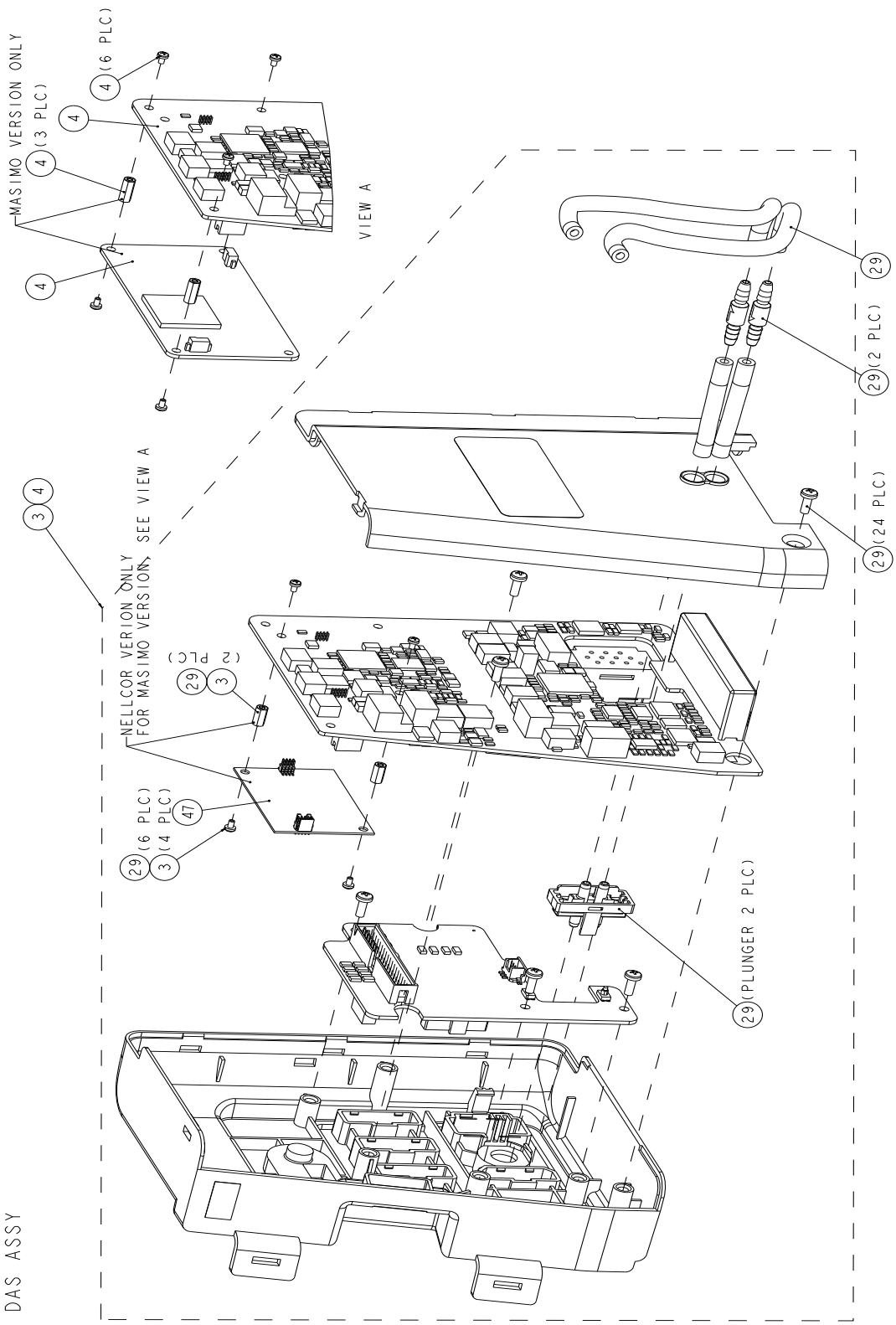
Find Number	Item Number	Item Description
-	633176	BATTERY, 3.6V, PWB
2	2023852-002	FRU, DASH 2500, PLASTIC FRONT CASE
3	2023852-003	FRU, DASH 2500, DAS NELLCOR
4	2023852-059	FRU, DASH 2500, DAS MASIMO
5	2023852-005	FRU, DASH 2500, TURBO TEMP
6	2023852-006	FRU, DASH 2500, PWA KEYBOARD
7	2023852-007	FRU, DASH 2500, PWA MAIN BOARD
8	2023852-008	FRU, DASH 2500, PRINTER
9	2023852-009	FRU, DASH 2500, RECORDER ROLLER
10	2023852-010	FRU, DASH 2500, PNEUMATIC ASSY KIT
11	2023852-011	FRU, DASH 2500, PSU MODULE ASSY
12	2023852-012	FRU, DASH 2500, DC2DC PWA
13	2023852-013	FRU, DASH 2500, FAN ASSY
14	2023852-014	FRU, DASH 2500, SPEAKER ASSY
15	2023852-015	FRU, DASH 2500, CABLES
16	2023852-016	FRU, DASH 2500, TRIM KNOB
17	2023852-051	FRU, DASH 2500, SCREW-LOCK SCREW
18	2023852-018	FRU, DASH 2500, LABEL SET ENGLISH
19	2023852-019	FRU, DASH 2500, LABEL SET CHINESE
20	2023852-020	FRU, DASH 2500, LABEL SET FRENCH
21	2023852-021	FRU, DASH 2500, LABEL SET GERMAN
22	2023852-022	FRU, DASH 2500, LABEL SET ITALIAN
23	2023852-023	FRU, DASH 2500, LABEL SET SPANISH

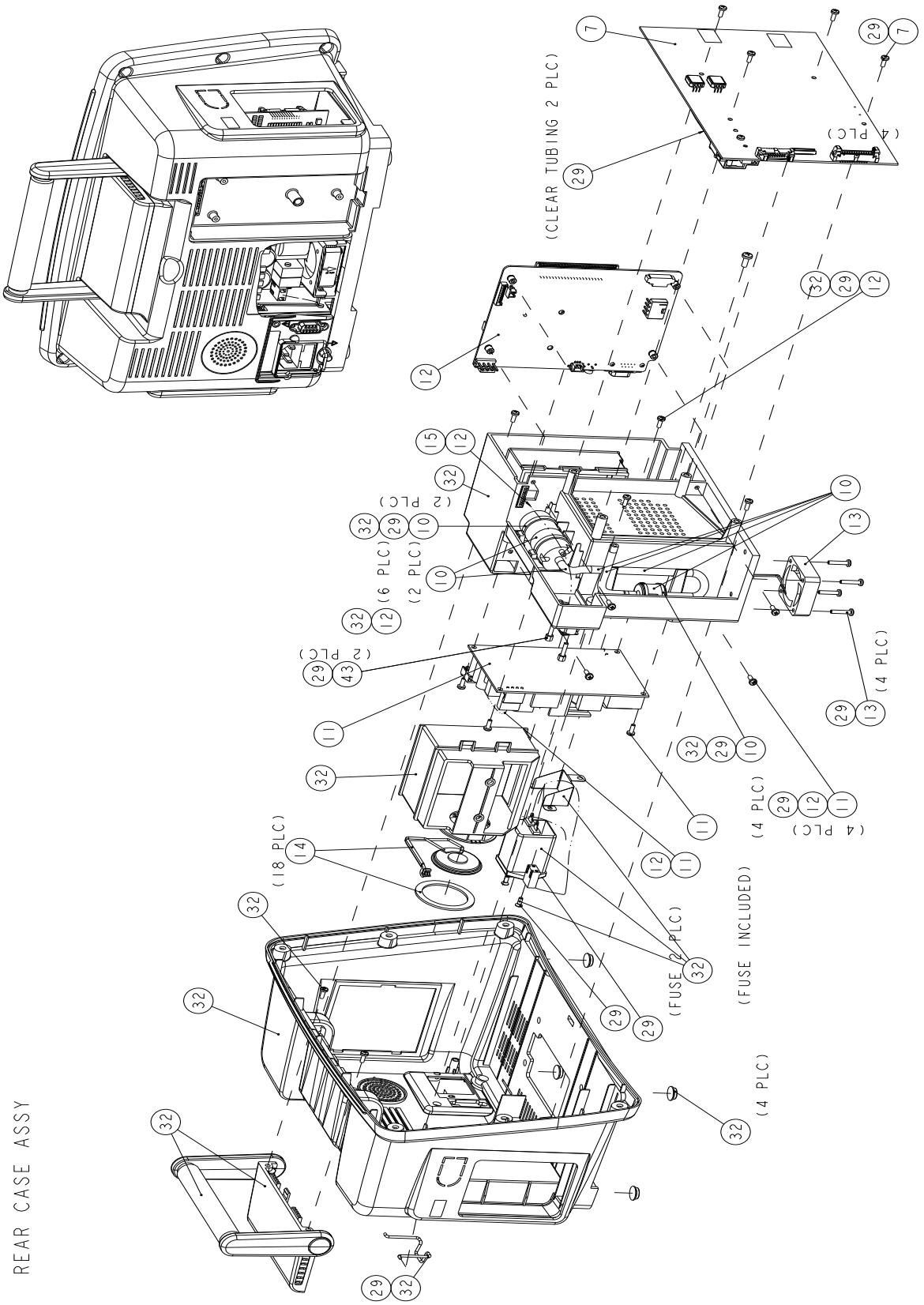
Find Number	Item Number	Item Description
24	2023852-025	FRU, DASH 2500, LABEL SET PORTUGUESE
25	2023852-026	FRU, DASH 2500, LABEL SET HUNGARIAN
26	2023852-027	FRU, DASH 2500, LABEL SET RUSSIAN
27	2023852-028	FRU, DASH 2500, LABEL SET POLISH
28	2023852-029	FRU, DASH 2500, BATTERY
29	2023852-030	FRU, DASH 2500, HARDWARE KIT
30	2023852-031	FRU, DASH 2500, INVERTER PWA
31	2023852-032	FRU, DASH 2500, LCD PANEL ASSY
32	2023852-037	FRU, DASH 2500, PLASTIC REAR CASE
33	2023852-039	FRU, DASH 2500, LABEL SET CZECH
34	2023852-040	FRU, DASH 2500, LABEL SET DANISH
35	2023852-041	FRU, DASH 2500, LABEL SET GREEK
36	2023852-042	FRU, DASH 2500, LABEL SET SWEDISH
37	2023852-043	FRU, DASH 2500, LABEL SET FINNISH
38	2023852-044	FRU, DASH 2500, LABEL SET DUTCH
39	2023852-045	FRU, DASH 2500, LABEL SET ROMANIAN
40	2023852-046	FRU, DASH 2500, LABEL SET TURKISH
41	2023852-047	FRU, DASH 2500, LABEL SET NORWEGIAN
42	2023852-048	FRU, DASH 2500, LABEL SET KOREAN
43	2023852-052	FRU, DASH 2500, SOFTWARE CD W/O NET
44	2023852-054	FRU, DASH 2500, NETWORK MODULE
45	2023852-056	FRU, DASH 2500, OP MNL/LABEL CN
46	2023852-057	FRU, DASH 2500, SOFTWARE CD W/I NET
47	2023852-060	FRU, DASH 2500, NELLCOR SPO2 BOARD

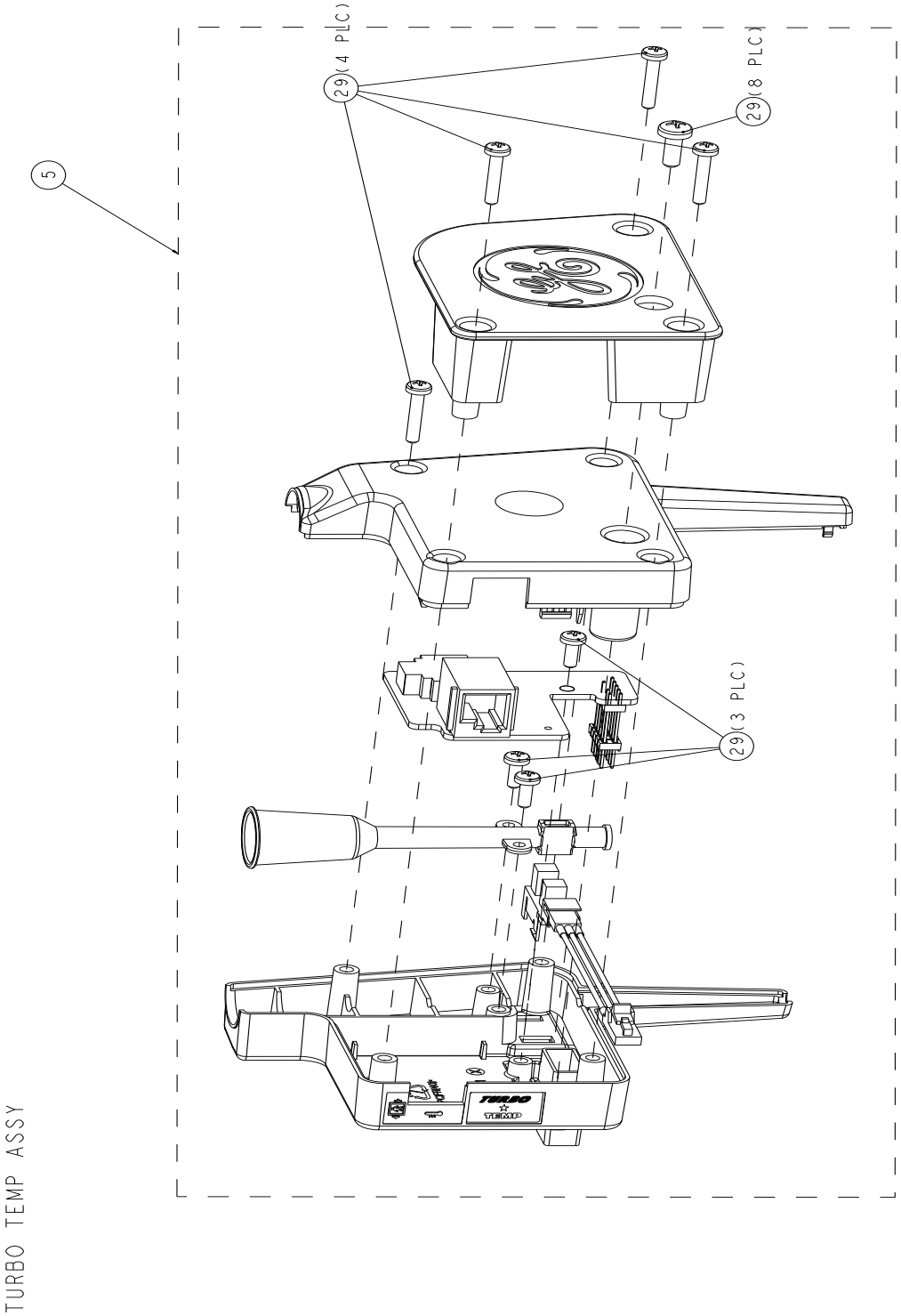
Assembly Drawings

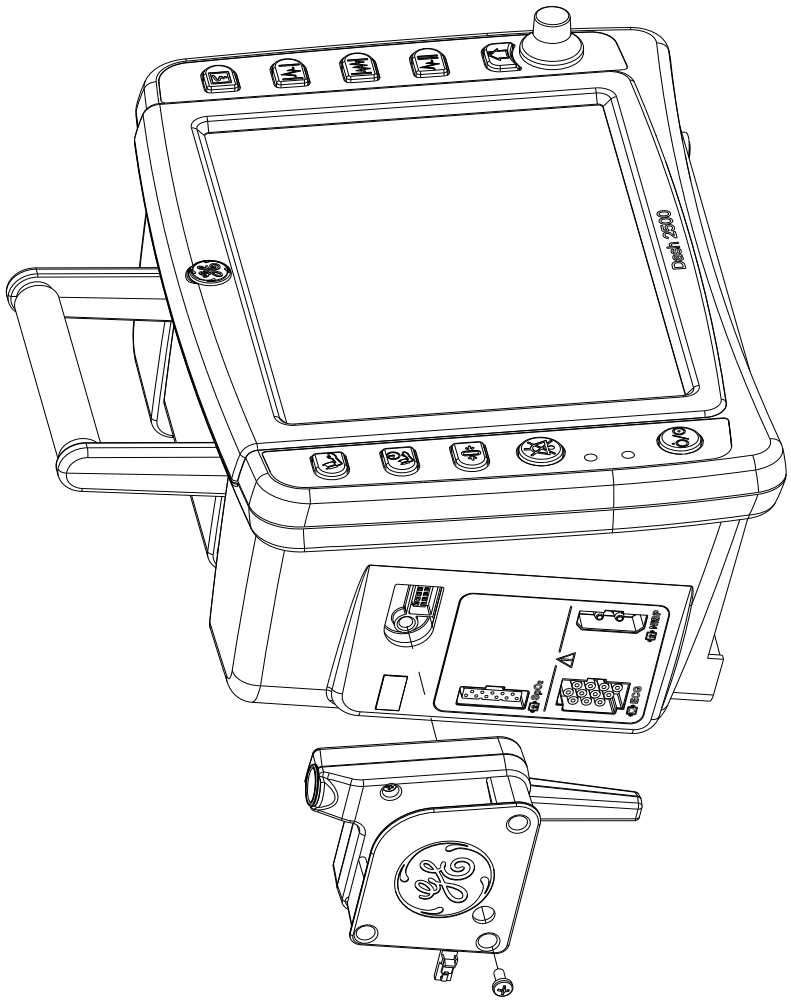
The assembly drawings below indicate the field replaceable parts.



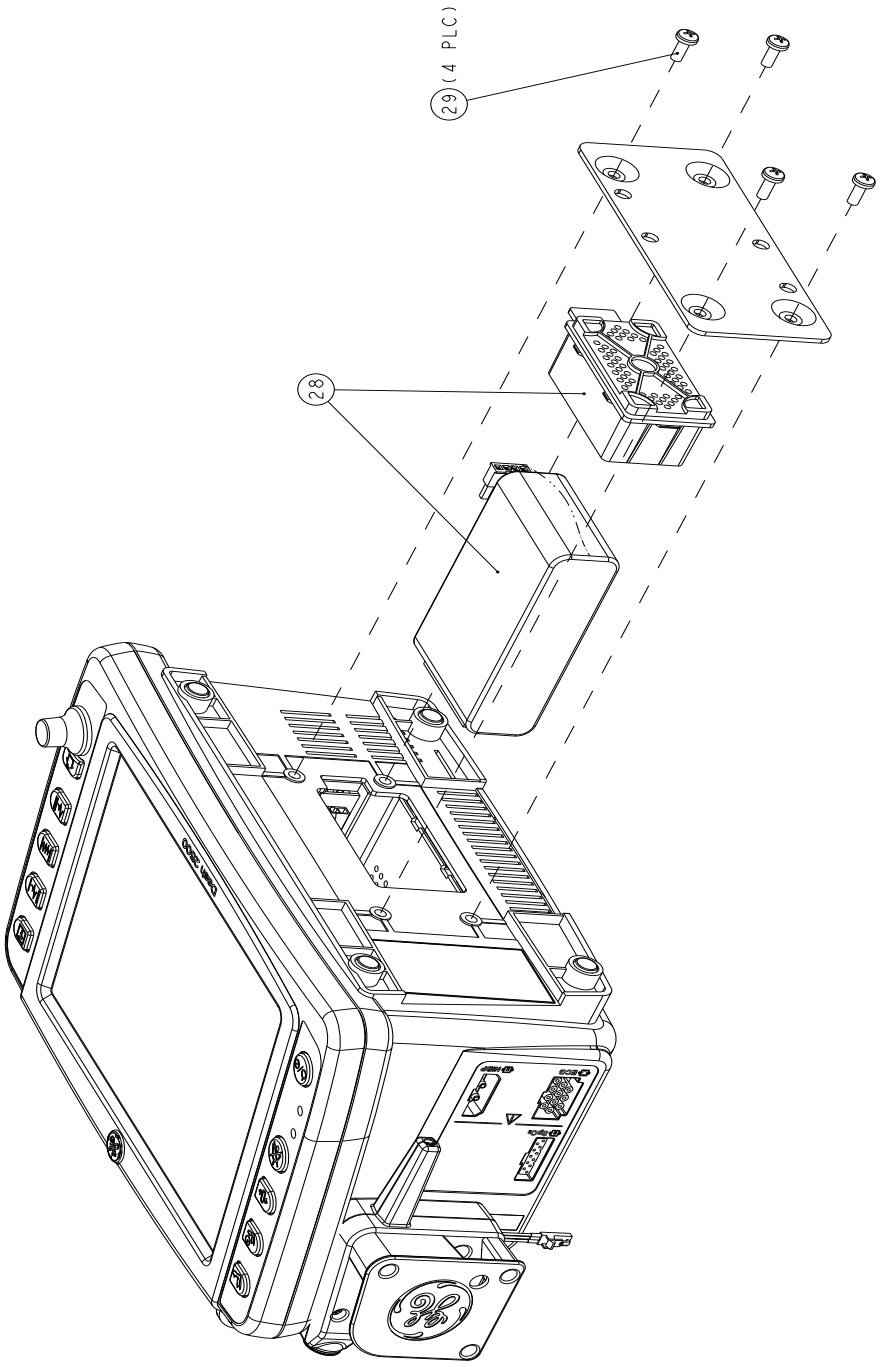

MASIMO VERSION ONLY
4 (3 PLC)
4 (6 PLC)
4
4
VIEW A
29
29 (2 PLC)
29 (24 PLC)
3 4
NELLCOR VERION ONLY
FOR MASIMO VERSION, SEE VIEW A
29 (2 PLC)
3
47
29 (6 PLC)
3 (4 PLC)
29 (PLUNGER 2 PLC)
DAS ASSY


REAR CASE ASSY
(CLEAR TUBING 2 PLC)
(4 PLC)
(2 PLC)
(6 PLC)
(2 PLC)
(2 PLC)
(4 PLC)
(4 PLC)
(4 PLC)
(18 PLC)
(FUSE 2 PLC)
(FUSE INCLUDED)
(4 PLC)

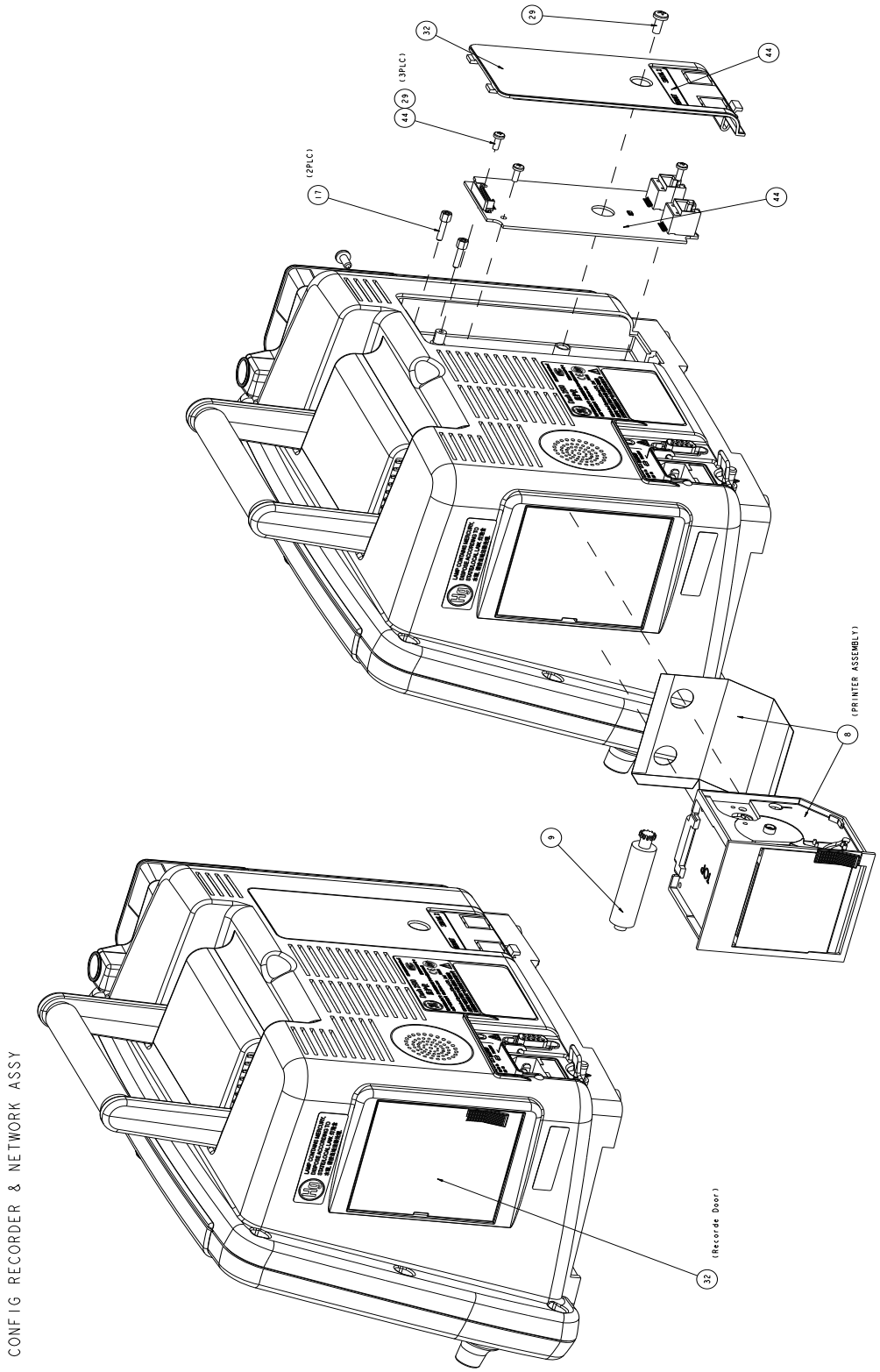

5
29 (4 PLC)
29 (8 PLC)
29 (3 PLC)
TURBO TEMP ASSY

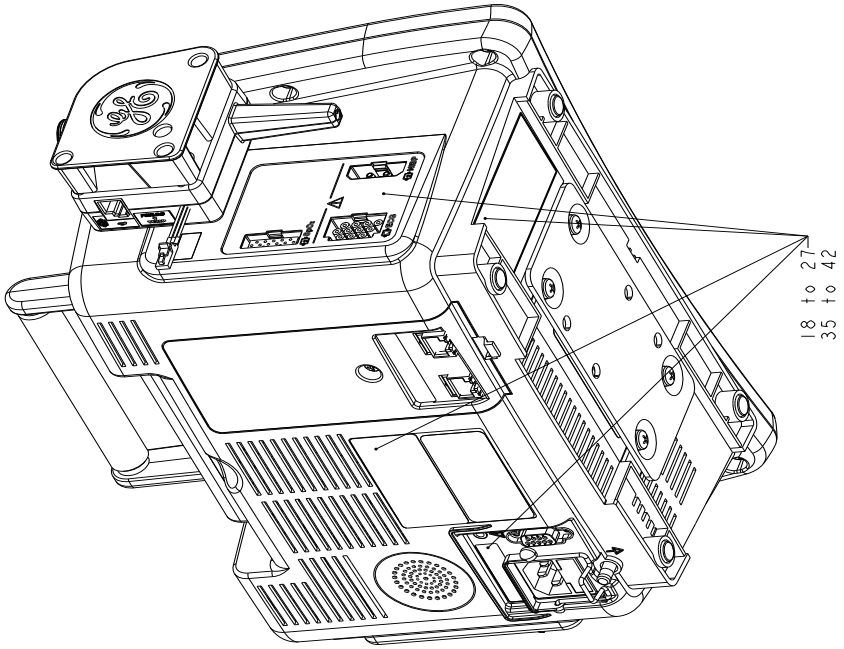


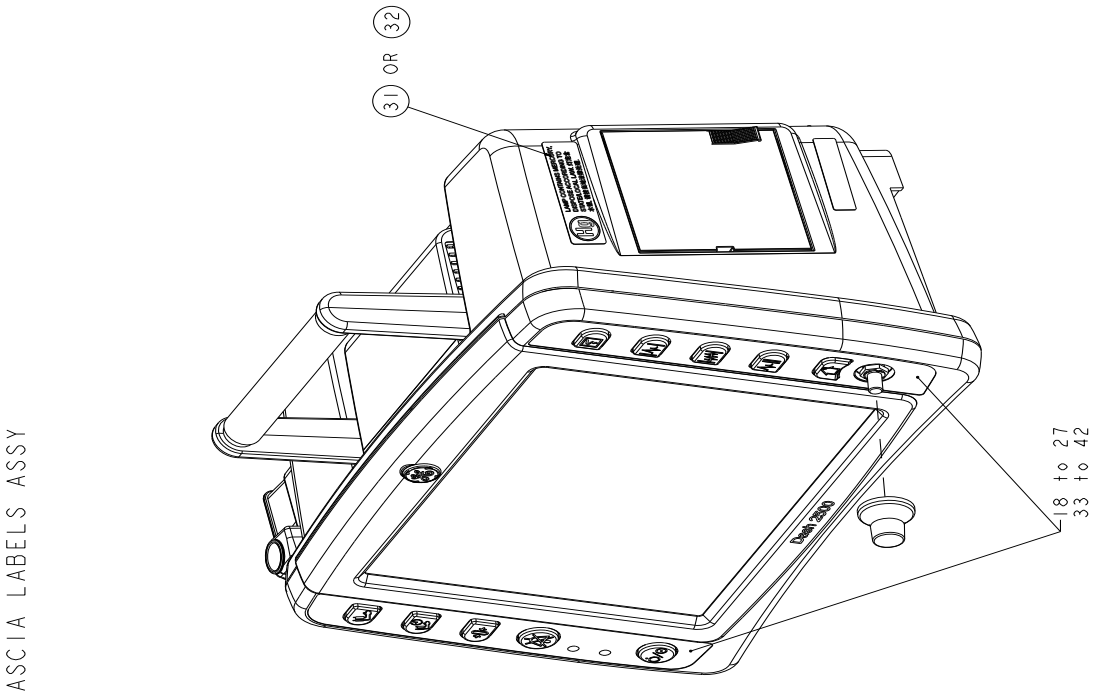
CONFIG TURBO TEMP ASSY



CONFIG BATTERY ASSY


CONFIG RECORDER & NETWORK ASSY
29
32
44
(3PLC)
29
44
(2PLC)
17
44
(PRINTER ASSEMBLY)
8
9
32
(Recorde Door)


18 to 27
35 to 42


31 OR 32
18 to 27
33 to 42
FASCIA LABELS ASSY

Disassembly Guidelines

REPAIR TO THE FRU LEVEL — Field repairs are recommended to the field replaceable unit (FRU) only. Attempting a field repair on a PCB or a factory sealed component or assembly could jeopardize the safe and effective operation of the Monitor.

DAS ASSEMBLY — Do NOT open the DAS assembly as this breaks the isolation barrier which may result in patient death or serious injury. The DAS assembly is a field replaceable unit only. There are NO field repairs or adjustments for the DAS assembly.

DC2DC ASSEMBLY— When removing the GCX plate from the bottom of the Monitor, clearly identify the screws to ensure the same screws are used to replace the GCX plate. Screws that are too long will penetrate into the DC2DC assembly and cause the battery to split or break.

NOTE:

GE recommends that you assemble the Monitor using the NEW fasteners (screws, washers, etc.) provided in the FRU Kits. Some fasteners, like the screws with a thread locking coating, are NOT intended to be re-used more than three times.

Tools Required

A standard set of hand tools is required for disassembly and assembly.

Before Disassembly

Before you disassemble the Monitor, you should ALWAYS do the following tasks.

1. Unplug the monitor.
2. Remove the battery.
3. Provide appropriate electrostatic discharge protection to prevent damaging the Monitor.
4. Be aware that the nonspecific disassembly instructions apply to all monitors supported by this service manual. Disassembly for specific models of the Monitor are identified when required.

Hardware Precautions

When disassembling the Monitor, observe the following guidelines:

- Remove the handle assembly, then remove the display assembly to access the field replaceable units of the display assembly and the main unit.
- Note the positions of wires, cables, and different sized screws; marking them if necessary to ensure they are replaced correctly.
- DO NOT kink, pinch, stretch, twist, or tightly fold a flex cable.
- Unless otherwise stated, reassemble the Monitor in reverse order of disassembly.

Electrostatic Discharge (ESD) Precautions

All external connector inputs and outputs of the Monitor are designed with protection from ESD damage. However, if the Monitor requires service, exposed components and assemblies contained within are susceptible to ESD damage. This includes human hands, non-ESD protected work stations and/or improperly grounded test equipment.

The following guidelines help make a service workstation more resistant to ESD damage:

- Discharge any static charge you may have built up before handling semiconductors or assemblies containing semiconductors.
- A grounded, antistatic wristband (3M PN 2046 or equivalent) or heel strap should be worn *at all times* while handling or repairing assemblies containing semiconductors.
- Use properly grounded soldering and test equipment.
- Use a static-free work surface (3M PN 8210 or equivalent) while handling or working on assemblies containing semiconductors.
- DO NOT remove semiconductors or assemblies containing semiconductors from antistatic containers (Velo-stat bags) until absolutely necessary.
- Make sure power to an assembly is turned off before removing or inserting a semiconductor.
- DO NOT slide semiconductors or electrical/electronic assemblies across any surface.
- DO NOT touch semiconductor leads unless absolutely necessary.
- Semiconductors and electrical/electronic assemblies should be stored only in antistatic bags or boxes.
- Handle all PCB assemblies by their edges.
- DO NOT flex or twist the circuit board.

These guidelines may not guarantee a 100% static-free workstation, but can greatly reduce the potential for failure of any electrical/electronic assemblies being serviced.

Remove/Replace Battery

1. Remove the four M5 screws with the driver, then take off the aluminium plate.

Four Screws

2. Take off the plastic cover.

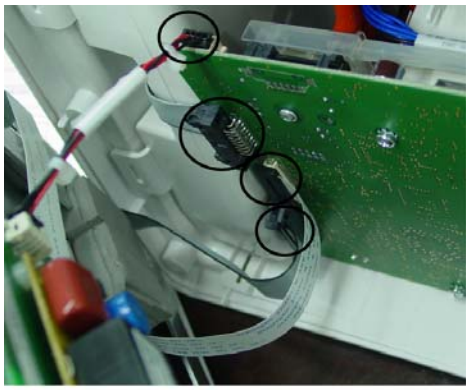
3. Release the lock and then take out the battery and wires.

4. Replace the battery.

Replace Plastic Front Case

1. Remove the temperature module first.
2. Remove all the six screws from rear case. The unit is separated into front case and rear case.

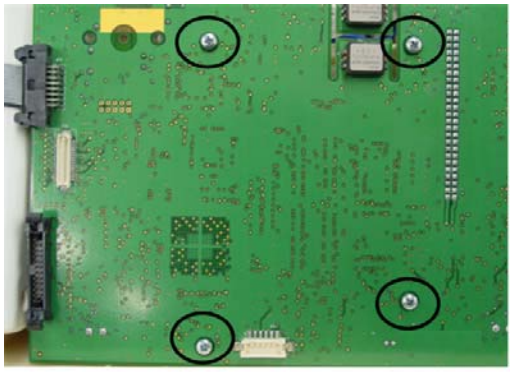
3. Take off the four different wires and replace the front case.



Four Wires

Replace Main Board Assembly

1. Separate the front case and the rear case, then remove the four screws and take the Main Board out of rear case.

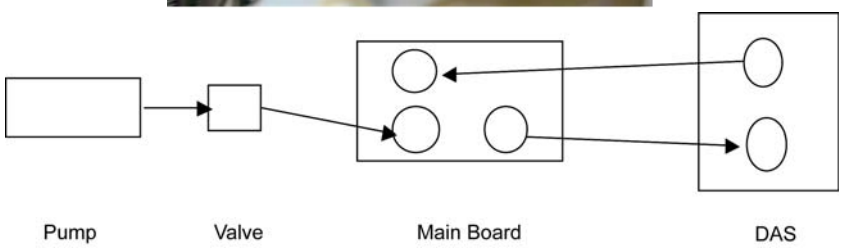


Four Screws

2. Pull out all tubes that are connected to the Main Board and replace the Main Board. Connect the jumper to the Main Board as indicated in the following graphic.

Jumper

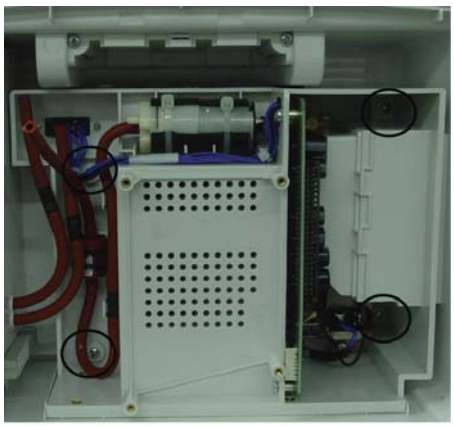
3. Connect all the tubes to the Main Board as indicated in the following graphics.



Tube Connection

Replace DAS Board Assembly

1. Remove the recorder assembly first.
2. Remove the four screws from the rear case assembly and take out the chassis assembly.

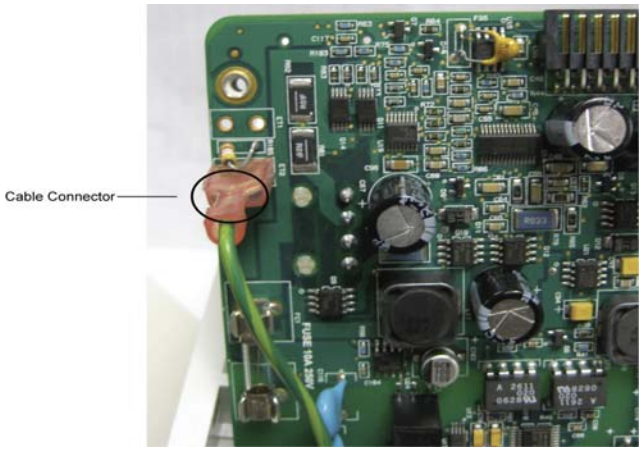


Four Screws

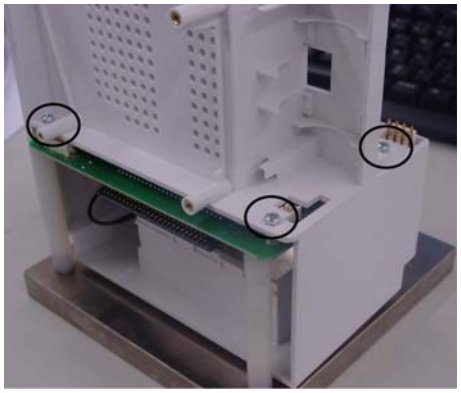
3. Pull out the DAS assembly and replace with the new DAS assembly. There are two DAS assemblies to select: DAS assembly with NELLCOR® SpO_2 or DAS assembly with MASIMO® SpO_2.

Replace DC2DC Board Assembly

1. Remove AC2DC board first.
2. Pull out the grounding cable from the DC2DC PWA.



3. Remove the four screws and replace the DC2DC PWA.



Replace AC2DC Board Assembly

1. Disconnect the three cables.

Four Screws

2. Remove the four screws.

Four Screws

3. Replace the AC2DC assembly.

Replace Keyboard and Trim Knob

1. Remove the inverter board and disconnect the cables.
2. Remove all the six screws and take out the LCD assembly.

Six Screws

3. Replace either the left or the right keypad PWA.

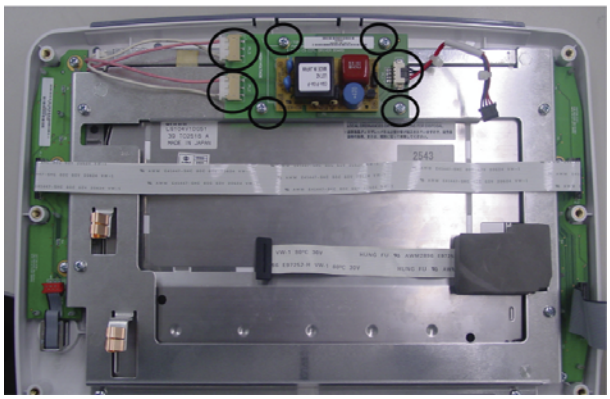
Seven Screws

4. Take out the gasket, then use a sleeve to get the corder out. Replace it with the new corder and replace the knob.

Replace the Invert Board

1. Pull out the cables and remove all the four screws.

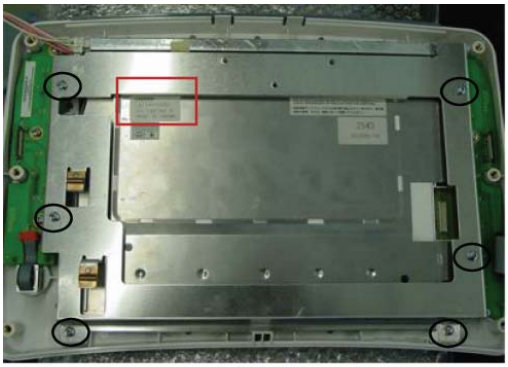
Three Cables Four Screws



2. Replace the invert board.

Replace the LCD panel

1. Remove the inverter board and disconnect the cables.
2. Remove all the six screws and take out the LCD assembly.

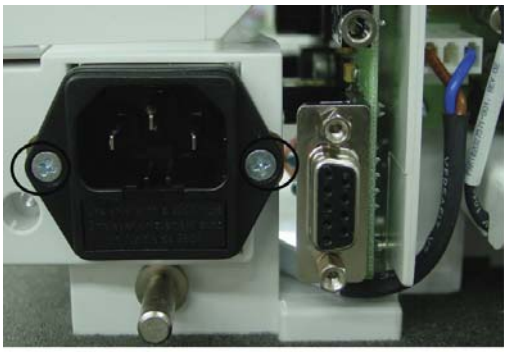


Six Screws

3. Check and record the display's manufacture part number. (see above graphic, red rectangle label)
4. After assembling the whole unit, please enter into Service Mode, See Service Mode Operation on page 4-13. Set up the Screen Type
   - If the LCD is Sharp (LQ104V1DG5B) or AUO (G104VN01), set up the **Screen Type** to **NEC**.
   - If the LCD is Sharp (LQ104V1DG59), set up the **Screen Type** to **SHARP**.
5. Choose **turn off system** to restart the monitor, and check whether the LCD display nomally.

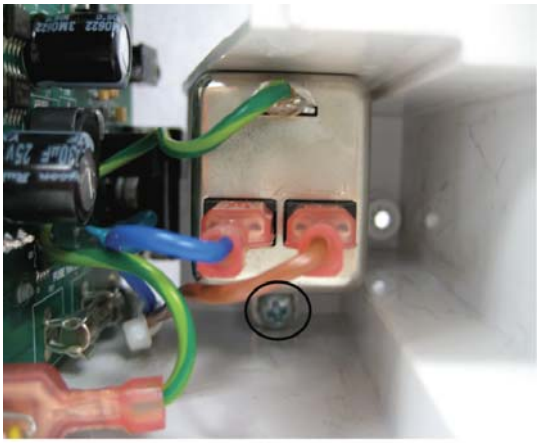
Replace the AC Inlet

1. Remove the two screws and take out the AC Inlet.



Two Screws

2. Remove the grounding screw.

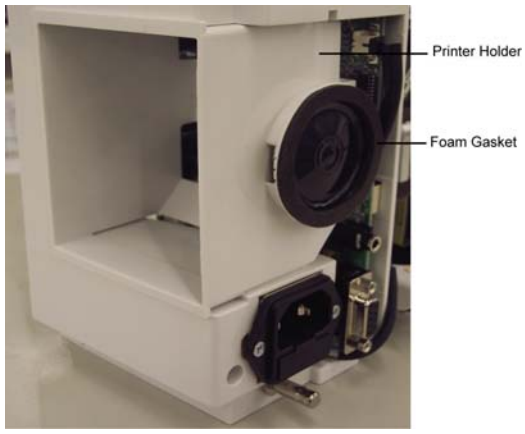


Grounding Screw

3. Replace the AC Inlet.

Replace the Speaker

1. Pull out the printer holder and slip out the foam gasket.



2. Replace speaker.
3. Stick the new foam gasket to the speaker.

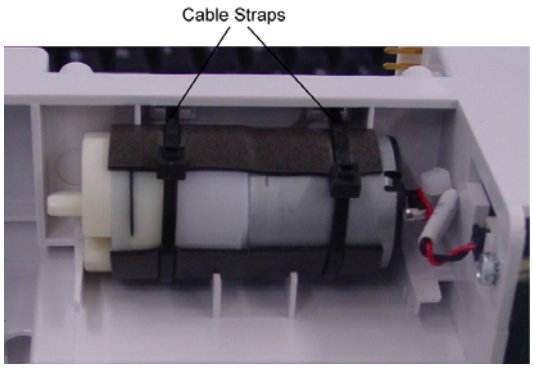
Replace the printer

1. Remove the two screws.

2. Replace the printer

Replace the Pneumatic Pump

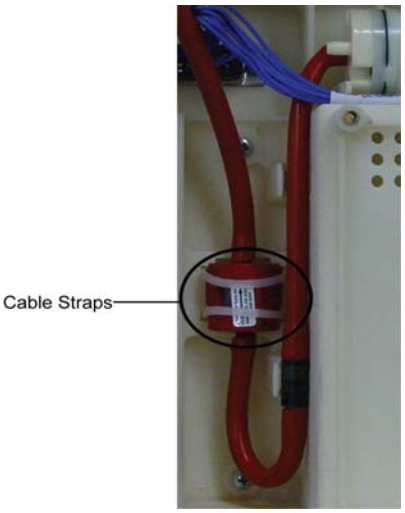
1. Cut off the cable straps.



2. Replace the pneumatic pump.
3. Tie the replaced pump with new cable straps.

Replace the Check Valve

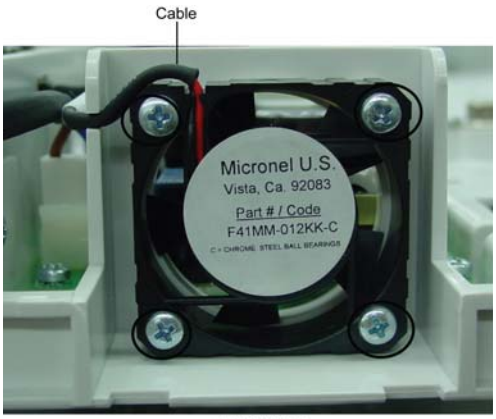
1. Cut off the cable straps.



2. Replace the check valve.
3. Tie the check valve with new cable straps.

Replace the Fan

1. Remove all the screws and pull out the cable.



2. Replace the fan.

Assemble Network Module

The Dash 2500 network module is installed inside the interface cover.

1. Turn off the power of Dash 2500 Monitor
2. Remove the screw and open the interface cover.

3. If the monitor is the old version, replace the port's two screws into new screw-locks (PN 2038990-001), with the 5mm hexagonal socket wrench.

4. Connect the network module board into the port

5. Install the three screws

6. Close the interface cover.

NOTE: Installing network module no need to open the unit, no special calibration needed after assembly.

After Assembly

Perform the Electrical Safety Tests and Checkout Procedures after assembly to ensure the Monitor with new FRUs work functionally. Refer to Chapter 4 and Appendix B for details.

For your notes

A Technical Specifications

For your notes

Technical Specifications

Due to continual product innovation, specifications are subject to change without notice. The following specifications are accurate as of the date of this publication, and pertain to the Monitor

General Specifications

Specifications	
Mechanical	
Monitor	8.7 in (H) x 6.7 in (D) x 14.1 in (W) 22.0 cm (H) x 17.0 cm (D) x 35.8cm (W)
Weight	
Dash 2500 Patient Monitor	12 lb (5.5 kg)
Environmental*	
Operating Temperature	41°F to 104°F (5°C to 40°C)
Storage and Transportation Temperature	-4°F to 140°F (-20°C to 60°C)
Operating Humidity	5% to 95% noncondensing
Storage and Transportation Humidity	5% to 95% noncondensing
Operating Atmospheric Pressure	700 hPa to 1060 hPa
Storage and Transportation Atmospheric Pressure	500 hPa to 1060 hPa
Electrical	
AC Input Voltage	100-240 V
AC Input Frequency	50/60 Hz
AC Input Power	120 VA
Internal Battery	8.4 V nickel-metal-hydride (NiMH)
Power Supply	The Dash 2500 Patient Monitor can be powered from the internal battery or AC power.
Battery	An internal, rechargeable battery pack powers the Monitor for greater than 180 minutes at a specified load. The battery typically charges to full capacity within 4 hours when power off.
* The Monitor may not meet Performance Specifications (ANSI/AAMI SP10) if it is stored or used outside of the specified ranges of environmental parameters.	

Specifications	
Power Cable	The power cable is detachable.
Fuses	
Internal	
FS1	0.5 amp, 60V, auto-reset
FS2	1.85 amp, 60V, auto-reset
FS3	10 amp, 250V, fast acting, not resettable
FS4	0.5 amp, 60V, auto-reset
FS5	0.1 amp, 60V, auto-reset
External	
FS	1amp, 250V, not resettable
FS	1amp, 250V, not resettable

NIBP Specifications

Specifications	
Method	Oscillometric with step deflation
Modes	Manual, automatic, stat
BP Measurement Ranges	
Systolic	30 to 290 mmHg (adult/pediatric) 4.0 to 38.7 kPa (adult/pediatric) 30 to 140 mmHg (neonate) 4.0 to 18.7 kPa (neonate)
MAP	20 to 260 mmHg (adult/pediatric) 2.7 to 34.7 kPa (adult/pediatric) 20 to 125 mmHg (neonate) 2.7 to 16.7 kPa (neonate)
Diastolic	10 to 220 mmHg (adult/pediatric) 1.3 to 29.3 kPa (adult/pediatric) 10 to 110 mmHg (neonate) 1.3 to 14.7 kPa (neonate)
Resolution	1 mmHg
Accuracy	Meets AAMI/ANSI standard SP10:2002
Initial Cuff Inflation Pressure	135 ± 15 mmHg default; user selectable (adult/pediatric) 100 ± 15 mmHg default; user selectable (neonate)
Maximum Determination Time	120 s (adult/pediatric) 85 s (neonate)
Over Pressure Monitor	300 to 330 mmHg (adult/pediatric) 150 to 165 mmHg (neonate)
Pulse Rate	When NIBP is the source, HR values are derived from the pulse rate that is determined by the oscillometric technique of measuring blood pressure. The rate source field is labeled NIBP. Adult/Pediatric Range: 30 to 200 bpm (± 3.5% or 3 bpm) Neonate Range: 30 to 220 bpm (± 3.5% or 3 bpm)

GE Healthcare Patents

4,638,810; 5,052,397; 4,754,761; 5,170,795; 6,188,407; 5,357,970; 5,704,362; 5,680,870; 5,518,000; 6,893,403; 6,423,010; 6,358,213; 5,704,362; 5,579,776 and international equivalents. US patents pending.

NELLCOR® OXIMAX® SpO_2 Specifications

Specifications	
Measurement Range	
SpO_2	1 to 100%
Pulse Rate	20 to 250 bpm
Perfusion Range	0.03 to 20%
Accuracy	
Saturation	
Adult*	70 to 100% ± 2 digits
Neonate*	70 to 100% ± 3 digits
Low Perfusion**	70 to 100% ± 2 digits
Pulse Rate	
Adult and Neonate	20 to 250 bpm ± 3 digits
Low Perfusion**	20 to 250 bpm ± 3 digits
*Adult specifications are shown for OxiMax®MAX-A and MAX-N sensors with the N-600. Saturation accuracy will vary by sensor type. **Applicability: OxiMax® MAX-A, MAX-AL, MAX-P, MAX-I, and MAX-N sensors.	

Specifications: NELLCOR® OXIMAX® Sensor Accuracy	
NOTE: All NELLCOR® OXIMAX® sensors must be used with the NELL1 GE cable; the SCP-10 cable. RS-10 and Oxisensor® II sensors are not compatible with the Dash 2500 Patient Monitor.	
Sensor Model	**SpO_2 Range 70% - 100%**
OXIMAX®	
MAX-A, MAX-AL	± 2 digits
MAX-N (Adult)	± 2 digits
MAX-N† (Neonate)	± 3 digits
MAX-P	± 2 digits
MAX-I	± 2 digits
MAX-FAST	± 2 digits
SC-A (Adult)	± 2 digits
SC-PR (Neonate)	± 3 digits

Specifications: NELLCOR® OxiMAX® Sensor Accuracy	
MAX-R‡	± 3.5 digits
OxiCliq®	
OxiCliq A	± 2.5 digits
OxiCliq P	± 2.5 digits
OxiCliq N (Adult)	± 2.5 digits
OxiCliq N† (Neonate)	± 3.5 digits
OxiCliq I	± 2.5 digits
Reusable Sensor Models	
D-YS (Infant to Adult)	± 3 digits
D-YS (Neonate)	± 4 digits
D-YS & D-YSE	± 3.5 digits
D-YS & D-YSPD	± 3.5 digits
DS-100A	± 3 digits
OXI-A/N (Adult)	± 3 digits
OXI-A/N (Neonate)	± 4 digits
OXI-P/I	± 3 digits
Neonatal Sensor Accuracy	When sensors are used on neonatal subjects as recommended, the specified accuracy range is increased by ± 1 digit, as compared to adult usage, to account for the theoretical effect on oximeter measurements of fetal hemoglobin in neonatal blood. For example, MAX-N accuracy on neonates is ± 3 digits, rather than ± 2 digits.
Sensor Light Source	
Wavelength	Infrared: 890 nm (nominal) Red: 660 nm (nominal)
Power Dissipation	Infrared: 22.5 mW (max) Red: 30 mW (max)

† The MAX-N, D-YS, OXI-A/N, and OxiCliq N were tested on patients >40 kg.

‡ The accuracy specification has been determined between saturations of 80%-100%.

NELLCOR® Puritan Bennett, Inc. Patents

4,621,643; 4,653,498; Re.35,122; 4,700,708; 4,770,179; 4,802,486; 4,869,254; 4,928,692; 4,934,372; 5,078,136; 5,351,685; 5,421,329; 5,485,847; 5,533,507; 5,577,500; 5,803,910; 5,853,364; 5,865,736; 6,083,172 and international equivalents.

MASIMO SET® SpO_2 Specifications

Specifications	
Measurement Range	
SpO_2	1 to 100%
Pulse Rate	25 to 240 bpm
Perfusion Range	0.02 to 20%
Accuracy and Motion Tolerance	
Saturation	
Without Motion - Adult/Pediatric*	70 to 100% ± 2 digits
Without Motion - Neonate*	70 to 100% ± 3 digits
With Motion - Adult/Pediatric/Neo**†	70 to 100% ± 3 digits
Low Perfusion‡	70 to 100% ± 2 digits 0 to 69% unspecified
Pulse Rate	
Without Motion	25 to 240 bpm ± 3 digits
With Motion	normal physiologic range 25 to 240 bpm ± 5 digits

* The MASIMO SET® SpO_2 parameter with LNOP-Adt sensors has been validated for no motion accuracy in human blood studies on healthy adult volunteers in induced hypoxia studies in the range of 70-100% SpO_2 against a laboratory co-oximeter and ECG monitor. This variation equals plus or minus one standard deviation. Plus or minus one standard deviation encompasses 68% of the population.

**The MASIMO SET® SpO_2 parameter with LNOP-Adt sensors has been validated for motion accuracy in human blood studies on healthy adult volunteers in induced hypoxia studies while performing rubbing and tapping motions at 2 to 4 Hz at an amplitude of 1 to 2 cm and a nonrepetitive motion between 1 to 5 Hz at an amplitude of 2 to 3 cm in induced hypoxia studies in the range of 70-100% SpO_2 against a laboratory co-oximeter and ECG monitor. This variation equals plus or minus one standard deviation. Plus or minus one standard deviation encompasses 68% of the population.

†The MASIMO SET® SpO_2 parameter with LNOP-Neo Pt sensors has been validated for neonatal motion accuracy in human blood studies on neonates while moving the neonate's foot at 2 to 4 cm against a laboratory co-oximeter and ECG monitor. This variation equals plus or minus, one standard deviation. Plus or minus one standard deviation encompasses 68% of the population.

‡The MASIMO SET® SpO_2 parameter has been validated for low perfusion accuracy in bench top testing against a Biotek Index 2 simulator and MASIMO's simulator with signal strengths of greater than 0.02% and a% transmission of greater than 5% for saturations ranging from 70 to 100%. This variation equals plus or minus, one standard deviation. Plus or minus one standard deviation encompasses 68% of the population.

NOTE: Note: LNCS sensors using LNCS cable technology offer nearly the same performance as the LNOP flex-circuit design. The LNOP single patient sensor line is still the industry "gold standard", while LNCS is the best cabled sensor alternative.

Specifications: MASIMO® Sensor Accuracy	
Sensor Model	**SpO_2 Range 70% - 100%**
LNOP	
LNOP-ADT	± 2 digits
LNOP-ADT Long	± 2 digits
LNOP-PDT	± 2 digits
LNOP-NEO	± 3 digits
LNOP-NEO PT	± 3 digits
LNOP-DCI (reusable)	± 2 digits
LNOP-DCSC (reusable)	± 2 digits
LNOP-DCIP (reusable)	± 2 digits
NRI25 (reusable)	± 2 digits
Resolution	
Saturation (% SpO_2)	1%
Pulse Rate (bpm)	1
Low Perfusion Performance	
0.02% Pulse Amplitude	Saturation (% SpO_2) ± 2 digits
and% Transmission >5%	Pulse Rate ± 3 digits
Interfering Substances	Carboxyhemoglobin may erroneously increase readings. The level of increase is approximately equal to the amount of carboxyhemoglobin present. Dyes, or any substance containing dyes, that change usual arterial pigmentation may cause erroneous readings.
Sensor Light Source	
Wavelength	Infrared: 905 nm (nominal) Red: 660 nm (nominal)
Power Dissipation	Infrared: 22.5 mW (max) Red: 27.5 mW (max)

MASIMO® Patents

5,482,036; 5,490,505; 5,632,272; 5,685,299; 5,758,644; 5,769,785; 6,002,952; 6,036,642; 6,067,462; 6,157,850; 6,206,830; 6,263,222 and international equivalents.

ECG Specifications

Specifications	
Leads available	3-electrode configuration: I, II, III 5-electrode configuration: I, II, III, aVR, aVL, aVF, and VA
QRS amplitude range	0.5 to 5.0 mV
Heart rate accuracy	30 to 300 bpm ± 3 bpm or 3% of reading, whichever is greater
Heart rate resolution	1 bpm
Bandwidth	0.5 to 40 Hz +1/-6 dB 0.05 to 40 Hz +1/-6 dB 0.05 to 100 Hz +1/-6 dB
Standardizing voltage	1 mV marker
Defibrillation protection	5000 V, 360 J
Reovery time	< 5 s
Common mode rejection	1 mV RTI or 10 mm p-p max displayed noise allowed with 20 Vrms, 50-60 Hz input
Input Impedance Common mode Differential	 > 2.5 MΩ at 10 Hz > 2.5 MΩ from DC to 60 Hz
60 Hz tolerance	up to 10 mV
Pacemaker detection/rejection Input voltage range	 ± 2 mV to ± 700 mV
Tall T wave rejection	100% @ 0.05 to 40Hz or 0.05 to 100Hz 80% @ 0.5 to 40Hz
Lead off sensing current	< 0.1 μA DC signal leads < 1 μA DC driven lead
Time to alarm	high heart rate < 10 s per AAMI EC13 - 2002 low heart rate < 10 s per AAMI EC13 - 2002 cardiac standstill < 10 s per AAMI EC13 - 2002 tachycardia waveforms < 10 s per AAMI EC13 - 2002
ANSI/AAMI EC13-2002 Section 4.1.2.1 d). The Heart Rate Averaging computation is as follows, the average of the last 8 R-to-R intervals, the update rate of the Heart Rate on the display is once per second.	
When tested in accordance with ANSI/AAMI EC13-2002 Section 4.1.2.1f), the response time of the heart rate meter to changes in heart rate is:	
Step increase from 80 to 120 BPM Step decrease from 80 to 40 BPM	average 6.75 sec, range 6.5 to 7.3 sec average 10.04 sec, range 8 to 11 sec
When tested in accordance with ANSI/AAMI EC13-2002 Section 4.1.2.1g), the time to alarm for ventricular tachycardia is:	

Specifications	
For Figure 4a	averages range from 5 to 9 seconds with individual values ranging from 4 to 11 seconds.
For Figure 4b	averages range from 5 to 8 seconds with individual values ranging from 4 to 11 seconds
When tested in accordance with ANSI/AAMI EC13-2002 Section 4.1.4.3), the minimum input slew rate that will cause approximately 50% of the pulses to trigger the pacer pulse detector is:	
For Figure 5d	3.33 v/s RTI, +/- 10%
When tested in accordance with ANSI/AAMI EC13-2002 Section 4.1.2.1e), the heart rate after a 20 second stabilization period is:	
For Figure 3a	1X size setting: not detect 2X size setting: 80 ± 3 bpm
For Figure 3b	1X size setting: 30 ± 3 bpm 2X size setting: 60 ± 3 bpm
For Figure 3c	1X size setting: 120 ± 3 bpm 2X size setting: 120 ± 3 bpm
For Figure 3d	1X size setting: not detect 2X size setting: 90 ± 9bpm

RESP Specifications

Specifications	
ECG-Derived Respiration Rate	
Leads available	I or II
Range	6 to 120 breaths/min (adult/pediatric) 6 to 180 breaths/min (neonate)
Accuracy	± 2 breaths/min or ± 3% of reading; whichever is greater
Resolution	1 breath/min
Base Impedance	100 to 2000 Ω
Detection Sensitivity	0.2 Ω @ 30 breath/min with 500 Ω baseline impedance
Excitation Frequency	65.5 kHz
Amplitude	< 300 μA rms

HR/Pulse Specifications

Specifications	
ECG	
Heart rate accuracy	30 to 300 bpm ± 3 bpm or 3% of reading, whichever is greater
Time to alarm	high heart rate < 10 s per AAMI EC13 - 2002 low heart rate < 10 s per AAMI EC13 - 2002 cardiac standstill < 10 s per AAMI EC13 - 2002 tachycardia waveforms < 10 s per AAMI EC13 - 2002
NELLCOR SpO_2	
Range	20 - 250 bpm
Accuracy and Tolerance	20 to 250 bpm ± 3 digits
Low Perfusion	20 to 250 bpm ± 3 digits
MASIMO SpO_2	
Range	25 - 240 bpm
Accuracy and Motion Tolerance	
Without Motion	25 to 240 bpm ± 3 digits
With Motion	normal physiologic range 25 to 240 bpm ± 5 digits
Noninvasive Blood Pressure	
Range	
Adult/ped	30 - 200 bpm
Neonate	30 - 220 bpm
Accuracy	± 3.5%
Alarm Limits	
Range	30 - 250 bpm

TURBO TEMP Specifications

Specifications	
Scale	° Fahrenheit (F) ° Celsius (C)
Predictive Mode	
Range	96.0°F (35.6°C) to 106.0°F (41.1°C)
Resolution	0.1°F (0.1°C)
Monitor Mode	
Range	80.0°F (26.7°C) to 108.0° F (42.2°C)
Accuracy	± 0.2°F (± 0.1°C) (when tested in a calibrated liquid bath; meets ASTM E1112, Table 1, in range specified)
Resolution	0.1°F (0.1°C)
Probes	**CAUTION:** Use only Alaris® probes and probe covers. The size, shape, and thermal characteristics of the probe covers can affect the performance of the instrument. Inaccurate readings or retention problems may occur unless Alaris® probes and probe covers are used.
Determination Time	Approx. 10 seconds, typical

Alaris® Patents

D,300,728; D,300,909 and other pending patent.

B Test Record

For your notes

TEST RECORD

Model _____

Serial _____

Description	Min	Max	Actual	Pass	Fail	N/A
Safety Testing*						
AC mains ground pin to earth ground resistance (Ω)*	0	0.1				
Normal no-fault leakage (µA)*	0	500				
Normal open-ground leakage (µA)*	0	500				
Normal open-neutral leakage (µA)*	0	500				
Reverse no-fault leakage (µA)*	0	500				
Reverse open-ground leakage (µA)*	0	500				
Reverse open-neutral leakage (µA)*	0	500				
Patient (Source) Leakage Current- ECG-Normal no-fault leakage (µA)*	0	10				
ECG-Normal open-ground leakage (µA)*	0	50				
ECG-Reverse no-fault leakage (µA)*	0	10				
ECG-Reverse open-ground leakage (µA)*	0	50				
Spo2-Normal no-fault leakage (µA)*	0	100				
Spo2-Normal open-ground leakage (µA)*	0	500				
Spo2-Reverse no-fault leakage (µA)*	0	100				
Spo2-Reverse open-ground leakage (µA)*	0	500				
Temp-Normal no-fault leakage (µA)*	0	100				
Temp-Normal open-ground leakage (µA)*	0	500				
Temp-Reverse no-fault leakage (µA)*	0	100				
Temp-Reverse open-ground leakage (µA)*	0	500				
Patient (Sink) Leakage Current- ECG-Normal Single-fault leakage (µA)*	0	50				
ECG-Reverse Single-fault leakage (µA)*	0	50				
Spo2-Normal Single-fault leakage (µA)*	0	5				
Spo2-Reverse Single-fault leakage (µA)*	0	5				
Temp-Normal Single-fault leakage (µA)*	0	5				
Temp-Reverse Single-fault leakage (µA)*	0	5				
SpO_2 Testing						
SpO2 reading at 98% Saturation	96	100				
BPM reading at 80 BPM	76	84				

Description	Min	Max	Actual	Pass	Fail	N/A
NIBP Testing (Perform in Service Mode)						
Leakage Test						
UUT Pressure - 50 mmHg	47	53				
UUT Pressure - 150 mmHg	147	153				
UUT Pressure - 250 mmHg	247	253				
Verify adult overpressure occurs between 300~330 mmHg	300	330				
Verify neo overpressure occurs between 150~165 mmHg	150	165				
Initial cuff inflation (Adult cuff)	161	195				
Systolic Reading (120/80 Adult)	107	133				
Diastolic Reading (120/80 Adult)	67	93				
Heart Rate reading @ 80 BPM (NIBP)	76	84				
Inflate/ Deflate cycle time <120 seconds						
Initial cuff inflation (Neonatal cuff)	94	151				
Systolic Reading (100/65 Neonatal)	87	123				
Diastolic Reading (100/65 Neonatal)	52	78				
ECG Testing (Perform in Monitor Mode)						
Verify Waveform						
Verify paced 1 marker on ECG signal						
Verify paced 2 marker on ECG signal						
Verify HR LOW alarm and BPM at 30	26	34				
Verify HR HIGH alarm and BPM at 160	156	164				
Verify ECG VTACH alarm and BPM at 180	176	184				
Verify ECG LEAD FAIL alarm						
RESP Testing (Perform in Monitor Mode)						
Verify Waveform						
Verify RESP (@ 20 BPM)	17	23				
Verify RESP (@ 60 BPM)	57	63				

Description	Min	Max	Actual	Pass	Fail	N/A
Temperature Testing (Perform in Service or Monitor Mode - requires Alaris Temp Simulator)						
Measured Temp in ½F (98.6½ nominal)	98.4	98.8				
Measured Temp in ½F (80.2½ nominal)	79.9	80.5				
Measured Temp in ½F (107.8½ nominal)	107.5	108.1				
Probe Disconnected						
Probe Type						
Probe In/Out Detect						
Recorder Testing						
Recorder Test						
Battery System Testing (Perform in Monitor Mode)*						
Verify AC Mains Indicator*						
Remove AC, Verify uninterrupted battery operation*						
Verify Battery LED is lit*						
Fail-safe Logic Testing						
Fail-safe Logic						
Keypad Key Testing (Perform in Service Mode)						
Verify appropriate responses to key presses						
Sound Testing						
Speaker Test						
Communications Testing						
Verify pump starts, stops and temp status returns						
Remote Alarm Testing						
Voltage between pins 4 and 8, alarm inactive	4.7	5.3				
Voltage between pins 4 and 8, alarm active	0.0	0.1				
Network Testing*						
Verify network communication*						
* Installation check out items						

Tested By: **Date:**

Signature: **Facility:**

C Configuration

For your notes

Monitor Configuration Mode

Enter Configuration Mode

1. Select **other system settings** from the **Main Menu**.
2. Select **go to config mode**. The message, **This will initiate the sequence for entering Configuration Mode. Do you want to do this?** appears.
3. Select **Yes** to enter configuration mode.
4. The message, **Please enter the Config Mode password.** appears. Enter the password. FACTORY SET CONFIG PASSWORD: **2508**.
5. Select **Done**.
6. The system will restart in configuration mode. Press the Trim Knob to access the **Configuration Menu**.

Configure Default Changes

1. Select **admit patient** from the **Configuration Menu**.
2. Select **Choose patient settings**. Selections are **ADULT**, **PEDIATRIC** and **NEONATE**. Select the patient type.
3. A popup window appears: **All unsaved changes to the current default will be lost! Are you sure you want to do this?** Select **Yes**.
4. Change all other available settings as desired.
5. To save your changes for the selected table, go to **other system settings**, select **save default changes**. The default changes are saved.

Exit Configuration Mode

1. Select **other system settings** from the **Configuration Menu**.
2. Select **exit config mode**.
3. A popup window appears: **This will exit configuration mode. All unsaved changes will be lost. Are you sure you want to do this?** Select **Yes**.
4. The system will automatically restart in patient monitoring mode.

WARNING
All monitoring will cease when entering configuration mode. Do not enter this mode if actively monitoring a patient.

Default Table Name	Understanding the Options	Factory Default	Adult	Pediatric	Neonate
Adjust Alarms					
Adjust alarm volume	It allows the user to adjust the alarm volume. Alarm volume applies to all alarms (excluding system failures).	4			
Choose autoset%	It allows the user to change the percentage at which limits are automatically adjusted around the patient's current condition when the autoset all is confirmed.	20%			
autoset all	It allows the user to autoset all currently operating parameter alarm limits around the patient's current condition using the percentage confirmed in Choose autoset%	N/A			
Config settings	It opens the Config Adjust Alarms menu.	N/A			
Alarm volume low range	It allows the user to specify the lowest range for which the alarm volume can be adjusted.	1			
Alarm silence time (in min)	It allows the user to adjust the length of time alarms are temporarily silenced when the alarm silence feature is activated.	2			
Admit Patient					
discharge	Allows the user to discharge a patient.	N/A			
Choose Patient settings	It allows the user to choose a user default table.	ADULT			
enter bed number	This opens a data entry dialog box with the text Enter Bed Number.	blank			
enter unit number	This opens a data entry dialog with the text Enter Unit Number.	blank			
View Patient Trends					
Choose graphs to print	Confirmed selections are printed on the bedside recorder when print chosen graphs is chosen. If there are no confirmed selections for this choice when print chosen graphs is confirmed, up to two selections are automatically confirmed. The selections automatically confirmed are the highest priority parameters included in the confirmed patient's parameter list, up to a maximum of two.	0 chosen			
Display as	User can choose whether to view trended derived vital signs data in the Full trends window either numerically or graphically. When the Full trends window is opened, the configured default becomes the confirmed selection of this choice.	numbers			

Default Table Name	Understanding the Options	Factory Default	Adult	Pediatric	Neonate
View vitals every/View vitals for	View vitals every is displayed when Display as in View patient trends is numbers. It allows the user to choose the set of viewable times for which to display data. View vitals for is displayed when Display as in View patient trends is graphs. It allows the user to choose the span of time to be viewed.	1 min/40 min			
Mini trends...	It opens the Mini trends menu which has go to main menu as its first menu choice.	N/A			
View trends on main screen?	It allows the user to turn on or off the viewing of the Mini trends window in the waveform region of the main monitoring screen.	yes			
Display as	User can choose whether to view trended derived vital signs data in the Mini trends window either numerically or graphically.	numbers			
View vitals every/View vitals for	View vitals every is displayed when Display as in Mini trends is numbers. It allows the user to choose the set of viewable times for the Mini trends window. View vitals for is displayed when Display as in Mini trends is graphs. It allows the user to choose the span of time to be viewed in the Mini trends window.	1 min/50 min			
Config Settings	It opens the Config View Patient Trends menu.	N/A			
Save previous patient data?	User specifies whether Select Patient is available or unavailable in clinical mode.	yes			
Trend key default	User specifies which window (either Full trends or Mini trends) that the hardkey activates/deactivates.	mini trends			
Setup HR/Pulse					
Select source	User specifies the source from which HR/Pulse rate is to be derived.	auto			
Adjust QRS volume	User specifies the volume for the QRS beep relative to the other volume settings for alarms and key clicks.	0			
Adjust limits	Patient alarm limits may be adjusted by the auto-set feature or manually.	auto-set			
hi	Allows the user to set the "hi" alarm limit.	A=150, P=160			
lo	Allows the user to set the "lo" alarm limit.	A=50, P=60			
Advanced settings...	It opens the Advanced Setup HR/Pulse menu.	N/A			
Limit alarms priority	User specifies audio alarm associated with limit alarms.	warning			
Change color based on source?	User specifies if HR/Pulse vital sign area color is based on current heart rate source or configured color choice in HR/Pulse parameter.	yes			
Select HR/Pulse's color	User specifies the color for information related to HR/Pulse that is displayed in the Limit and Full and Mini trends windows.	green			

Default Table Name	Understanding the Options	Factory Default	Adult	Pediatric	Neonate
Setup ECG					
Lead selection	User can choose the lead to be displayed as the ECG waveform.	Lead II			
Waveform size	User specifies the multiplying factor used to change the appearance of the ECG waveforms displayed.	1X			
Pacer detection?	It allows the user to instruct the Monitor to analyze ECG data for pacemaker pulse	PACE OFF			
Arrhythmia detection	User specifies whether the monitor will detect and display arrhythmia conditions	yes			
Re-learn	It allows the user to instruct the Monitor to "learn" a new ECG pattern so that it can more accurately calculate the patient's heart rate	N/A			
Advanced settings...	It opens the Advanced ECG menu.	N/A			
Cardiac sweep speed	User specifies the default sweep speed for all cardiac-based waveforms (except the ECG waveform if Fixed ECG sweep speed? is yes). This choice appears in all menus associated with cardiac-based waveforms. A change in one menu affects all cardiac-based waveforms.	25.0 mm/s			
calibration pulse	The user chooses this to interject one cycle of a 1 mV square-wave into the display of the ECG waveform	N/A			
Display filter	User specifies the type of display filtering done on raw ECG waveform data before it is displayed or recorded.	0.5 to 40 Hz			
QRS width	User specifies the size of QRS width detection by the EKPro algorithm.	Normal			
other alarm priorities	User specifies audio alarm associated with these alarms.	N/A			
VTACH	User specifies the audio alarm associated with ECG VTACH in Adult and Pediatric modes. Menu item is not viewable in Neonate mode.	crisis			
Lead fail	User specifies the audio alarm associated with ECG LEAD FAIL.	procedural			
Replace electrodes	User specifies the audio alarm associated with ECG REPLACE ELECTRODES.	procedural			
Artifact	User specifies the audio alarm associated with ECG ARTIFACT.	message			
Select ECG's color	User specifies the color for information displayed in ECG's waveform area.	green			
Config settings...	It opens the Config ECG menu.	N/A			

Default Table Name	Understanding the Options	Factory Default	Adult	Pediatric	Neonate
Fixed ECG sweep speed?	When yes, the speed of the ECG waveform is fixed at 25.0 mm/s. When no, the speed of the ECG waveform changes according to the Cardiac sweep speed menu choice.	no			
Setup NIBP					
setup custom series	An extended menu where the user may configure a custom auto mode protocol.	N/A			
1st BP Series	User specifies the auto mode interval for step 1 of the protocol.	q5min			
repeat	User specifies the number of determinations to be done at 1st BP series interval.	x4			
2nd BP Series	User specifies the auto mode interval for step 2 of the protocol.	q15min			
repeat	User specifies the number of determinations to be done at 2nd BP series interval.	x4			
3nd BP Series	User specifies the auto mode interval for step 3 of the protocol.	q30min			
repeat	User specifies the number of determinations to be done at 3rd BP series interval.	x2			
4nd BP Series	User specifies the auto mode interval for step 4 of the protocol.	q60min			
repeat	User specifies the number of determinations to be done at 4th BP series interval.	x1			
Auto BP	User specifies the interval of time between auto mode determinations.	manual			
Adjust limits	Patient alarm limits may be adjusted by the auto-set feature or manually.	auto-set			
systolic hi	Allows the user to set the "hi" alarm limit.	A=200, P=150			
lo	Allows the user to set the "lo" alarm limit.	A=80, P=70			
diastolic hi	Allows the user to set the "hi" alarm limit.	A=120, P=90			
lo	Allows the user to set the "lo" alarm limit.	A=30, P=30			
mean hi	Allows the user to set the "hi" alarm limit.	A=140, P=100			
lo	Allows the user to set the "lo" alarm limit.	A=40, P=40			
Advanced settings...	It opens the Advanced NIBP menu.	N/A			

Default Table Name	Understanding the Options	Factory Default	Adult	Pediatric	Neonate
Initial target pressure	User specifies the pressure the Monitor initially pumps to for the next determination.	auto			
Limit alarms priority	User specifies whether the limit alarms associated with NIBP are issued as either warning or crisis alarms.	warning			
other alarm priorities	User specifies audio alarm associated with these alarms.	N/A			
No determination	User specifies the audio alarm associated with NIBP NO DETERMINATION.	procedural			
Overpressure	User specifies the audio alarm associated with NIBP OVERPRESSURE.	procedural			
Pump timeout	User specifies the audio alarm associated with NIBP PUMP TIMEOUT.	procedural			
Total timeout	User specifies the audio alarm associated with NIBP TOTAL TIMEOUT.	procedural			
Level timeout	User specifies the audio alarm associated with NIBP LEVEL TIMEOUT.	procedural			
Select NIBP's color	User specifies the color for information displayed in NIBP's vital sign area as well as information related to NIBP that is displayed in the Limit and Full and Mini trends windows.	purple			
Setup SpO2					
View waveform?	It allows the user the option of viewing the SpO2 waveform area.	yes			
Adjust limits	Patient alarm limits may be adjusted by the auto-set feature or manually.	hi 100 A = lo 90, P = lo 92			
Advanced settings...	It opens the Advanced SpO2 menu.	N/A			
View signal strength bar?	It allows the user the option of viewing the graphic signal strength bar.	no			
View SpO2 PR?	Controls how the Monitor behaves concerning the handling of SpO2 derived pulse rate.	yes			
Enable Spot check?	Allows use to specify monitor behavior when the SpO2 LOST PULSE or SpO2 SENSOR OFF alarm is issued.	yes			
Turn c-Lock on?(NELLCOR ONLY)	User specifies whether C-LOCK is enabled.	no			
Cardiac sweep speed	User specifies the sweep speed for all cardiac waveforms. This choice appears in all menus associated with cardiac waveforms. A change in one menu affects all cardiac waveforms.	25.0 mm/s			
Limit alarms priority	User specifies audio alarm associated with limit alarms, including SpO2 PR limit alarms if View SpO2 PR? is set to yes.	warning			

Default Table Name	Understanding the Options	Factory Default	Adult	Pediatric	Neonate
other alarm priorities	User specifies audio alarm associated with these alarms.	N/A			
Lost pulse	User specifies the audio alarm associated with SpO2 LOST PULSE.	procedural			
Sensor disconnected	User specifies the audio alarm associated with SpO2 SENSOR DISCONNECTED.	procedural			
Sensor faulty	User specifies the audio alarm associated with SpO2 SENSOR FAULTY.	procedural			
Sensor off	User specifies the audio alarm associated with SpO2 SENSOR OFF.	procedural			
Signal quality (MASIMO ONLY)	User specifies the audio alarm associated with SpO2 SIGNAL QUALITY	message			
Select SpO2's color	User specifies the color for the information displayed in SpO2's vital sign and waveform areas as well as information related to SpO2 that is displayed in the Limit and Full and Mini trends windows.	blue			
Config settings...	It opens the Config SpO2 menu.	N/A			
Averaging (MASIMO ONLY)	User specifies the averaging time used by the Masimo SpO2 algorithm to calculate SpO2 values	12			
Sensitivity (MASIMO ONLY)	User specifies the sensitivity thresholds used by the Masimo SpO2 algorithm for calculating SpO2 values under low profusion conditions	Normal			
FAST SAT (MASIMO ONLY)	User specifies the whether or not the Masimo SpO2 algorithm calculates the SpO2 values quicker	OFF			
Response mode (NELLCOR ONLY)	User specifies the setting for the Nellcor SpO2 algorithm for rejecting noise and calculating SpO2 values.	Normal			
SAT SECONDS (NELLCOR ONLY)	User specifies the time setting for the Nellcor SpO2 algorithm to hold off limit alarms or OFF to disable any hold off.	OFF			
Setup RESP					
Lead to analyze	User can choose the lead from which the respiration waveform is characterized and the impedance respiration rate is derived.	Lead II			
View waveform?	It allows the user the option of viewing the RESP waveform area.	yes			
Waveform size	User specifies the multiplying factor used to change the appearance of the RESP waveform.	1X			
Adjust limits	Patient alarm limits may be adjusted by the auto-set feature or manually.	N/A			
hi	Allows the user to set the "hi" alarm limit.	A=30, P=60			
lo	Allows the user to set the "lo" alarm limit.	A=6, P=10			

Default Table Name	Understanding the Options	Factory Default	Adult	Pediatric	Neonate
Advanced settings...	It opens the Advanced RESP menu.	N/A			
Resp sweep speed	User specifies the sweep speed for all respiratory waveforms. This choice appears in all menus associated with respiratory waveforms. A change in one menu affects all respiratory waveforms.	A/P=12.5mm/s			
Cardiogenic filter	It allows the user to select the type of filtering performed.	auto			
Limit alarms priority	User specifies audio alarm associated with limit alarms.	warning			
other alarm priorities	User specifies audio alarm associated with these alarms.	N/A			
Resp approaching	The user specifies the alarm type associated with RESP RATE APPROACHING HR.	warning			
Lead fail	User specifies the audio alarm associated with RESP LEAD FAIL.	procedural			
Saturation	User specifies the audio alarm associated with RESP BASELINE SATURATION.	procedural			
Artifact	User specifies the audio alarm associated with RESP ARTIFACT.	procedural			
Select RESP's color	User specifies the color for information displayed in RESP's waveform and vital sign areas as well as information related to RESP that appears in the Limit and Full and Mini trends windows.	blue			
Config settings...	It opens the Config RESP menu.	N/A			
Turn on RESP with ECG?	User specifies whether auto-switching Resp parameter is or is not active.	A=no; P=yes			
Setup TEMP					
Unit of measure	User specifies the unit of measure used to display temperature readings	°F			
Choose mode	User specifies temperature's mode of operation	predictive			
Advanced settings...	It opens the Advanced TEMP menu	N/A			
other alarm priorities	User specifies audio alarm associated with these alarms	N/A			
Bad Probe	User specifies the audio alarm associated with TEMP BAD PROBE	procedural			
Too Hot	User specifies the audio alarm associated with TEMP TOO HOT	procedural			
Disconnected	User specifies the audio alarm associated with TEMP DISCONNECTED	procedural			

Default Table Name	Understanding the Options	Factory Default	Adult	Pediatric	Neonate
Select TEMP's color	User specifies the color for information displayed in TEMP's vital sign area as well as information related to TEMP that is displayed in the Limit and Full and Mini trends windows	yellow			
Config settings...	It opens the Config TEMP menu	N/A			
Allow °C units only?	User specifies whether the units used to display the temperature must always fixed on °C	no			
Setup RECORDER					
Print on alarm?	User specifies whether the detection of patient-type warning or crisis alarm generates an Alarm print.	no			
Vitals summary with printout?	User specifies whether or not a Vitals Summary block of info is printed at the beginning of real time printouts.	no			
Auto printout of vitals summary?	User specifies whether an auto printout of Vitals Summary is initiated at the end of an NIBP/TEMP determination.	OFF			
setup continuous	Allows the user to access continuous options.	N/A			
setup timed	Allows the user to access timed options.	N/A			
Chart speed	It allows the user to choose the tracing speed of a Timed recording.	25.0 mm/s			
Length of strip (in seconds)	Length of Timed recording.	8			
Record key printout	It allows the user to specify the location of printouts that result from pressing the record.	at bedside			
Config settings...	It opens the Config RECORDER menu.	N/A			
setup continuous	Allows the user to access continuous options.	N/A			
Delayed memory (in seconds)	Delayed memory in seconds.	8			
Length of strip (in seconds)	Length of Alarm trace.	20			
setup timed	Allows the user to access timed options.	N/A			
Delayed memory (in seconds)	Delayed memory in seconds.	4			
Other System Settings					
save default changes	It allows the user to copy the contents of the active table onto the confirmed user default table.	N/A			

Default Table Name	Understanding the Options	Factory Default	Adult	Pediatric	Neonate
exit config mode	When selected, the user is prompted with a yes/no dialog box with the text "CAUTION! This will exit configuration mode. All unsaved changes will be lost. Are you sure you want to do this?	no			
Always display battery icon?	User controls when battery icon is viewable when monitor in not on battery power.	no			
adjust date & time	An extended menu where the user specifies a new date and time by manually adjusting the month, day, year, hour, minute and second	N/A			
Advanced Settings...	It opens the Advanced Other System Settings menu.	N/A			
Select color format	User specifies Monitor color configuration.	full color			
Adjust keyclick volume	User specifies the volume of the sounds as listed in USER INTERFACE OVERVIEW.	2			
Adjust system volume	User specifies the volume of the overall system.	8			
Config settings...	It opens the Config Other System Settings menu.	N/A			
Select date format	User specifies the format the date appears on the screen and on all recordings.	mm/dd/yy			
Select time format	User specifies how time is to be formatted when it appears on the display and all recordings. For all languages, when am/pm is confirmed, the time is displayed as HH:MM am or HH:MM pm.	military			
Language	The user specifies the language to be used for text that appears throughout the Monitor's user interface. The language choice is active for all patient settings tables. The new language becomes effective upon selection but is not copied onto the active table until save default changes has been confirmed. The language confirmed has no influence on service mode which is always in English.	English			
Display units?	The user specifies whether the unit of measure for all parameters is displayed in each parameter's respective vital sign area.	yes			
Display limits?	The user specifies whether alarms limits for all parameters are displayed in each parameter's respective vital sign area.	yes			
Display kPa values?	The user specifies whether pressure values are displayed in kPa is in addition to being displayed in mmHg.	no			
reset ALL to factory	When selected, the user is prompted with a yes/no dialog box with the text "CAUTION! This will reset ALL defaults! Are you sure you want to do this?"	no			
send ALL defaults	It allows the user to transmit the contents of all six tables either to another Monitor or PC.	OK			

Default Table Name	Understanding the Options	Factory Default	Adult	Pediatric	Neonate
Config HostComm...					
Unit address	It allows the user to specify the host communications address for this particular monitor.	" "			
IP address	User specifies address for network module communication.	0.0.0.0			
Waveforms to send	It allows the user to specify the waveforms to be sent when a serial port is communicating via the MPS binary protocol.	2 chosen			
Remote access	User specifies which port, if any, is enabled for remote access.	None			
Serial 1 setup	Allows user to configure serial 1 port settings.	NA			
Startup mode	User specifies the protocol of this port on monitor power-up.	ASCII cmd			
Baud rate	User specifies serial data transfer for this port.	(Viewable only in operation mode)38400			
Serial 2 setup	Allows user to configure serial 2 port settings.	N/A			
Startup mode	User specifies the protocol of this port on monitor power-up.	ASCII cmd			
Baud rate	User specifies serial data transfer for this port.	9600			

D Auxiliary Output

For your notes

Auxiliary Output

The auxiliary output is a nonisolated signal input/output meant only for connection to another medical device that is compliant with IEC 601-1. Connection to a noncompliant device could result in a safety risk by exceeding current limits.

The auxiliary output connector provides an analog ECG waveform output. The analog ECG waveform signal is a high level (1 V/mV) representation of the primary lead. The connector is a two-conductor 3.5 mm stereo jack that mates with a 3.5 mm stereo plug (Shogyo SPY 1011, Shogyo SPY 1012, or equivalent). Cable construction should be shielded, three conductor with PVC insulation or equivalent insulating material.

Pin Out:		
	Tip	No Connection
	Ring	ECG Analog Output
	Sleeve	Signal Return
	Dynamic range	> ± 4.75 V minimum
	Scale Factor*	1 V/mV ± 5%
	Output Impedance/Short Circuit Protection	<100 Ω
	Frequency Response	0.05 Hz - 100 Hz +1/-6 dB
	Delay**	22 ± 5ms

* Maximum load of 50 k Ω necessary to maintain scale factor.
** Internal pacemaker pulses are not represented in the auxiliary output.

E EMC Compliance

For your notes

Electromagnetic Compatibility (EMC)

Changes or modifications to this system not expressly approved by GE Medical Systems can cause EMC issues with this or other equipment. This system is designed and tested to comply with applicable regulation regarding EMC and must be installed and put into service according to the EMC information stated in this appendix.

WARNING
Use of portable phones or other radio frequency (RF) emitting equipment near the system may cause unexpected or adverse operation.

WARNING
The equipment or system should not be used adjacent to, or stacked with, other equipment. If adjacent or stacked use is necessary, the equipment or system should be tested to verify normal operation in the configuration in which it is being used.

Guidance and Manufacturer's Declaration – Electromagnetic Emissions

The Dash 2500 Patient Monitor Service Manual is intended for use in the electromagnetic environment specified below. It is the responsibility of the customer or user to assure that the Dash 2500 Patient Monitor Service Manual is used in such an environment.

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

Guidance and Manufacturer's Declaration – Electromagnetic Immunity

The Dash 2500 Patient Monitor Service Manual is intended for use in the electromagnetic environment specified below. It is the responsibility of the customer or user to assure that the Dash 2500 Patient Monitor Service Manual is used in such an environment.

Immunity Test	EN 60601 Test Level	Compliance Level	Electromagnetic Environment – Guidance
Electrostatic Discharge (ESD) EN 61000-4-2	± 6 kV contact ± 8 kV air	± 6 kV contact ± 8 kV air	Floors should be wood, concrete or ceramic tile. If floors are covered with synthetic material, the relative humidity should be at least 30%.
Electrical Fast Transient/Burst EN 61000-4-4	± 2 kV for power supply lines 1 kV for signal lines	± 2 kV for power supply lines 1 kV for signal lines	Mains power should be that of a typical commercial or hospital environment.
Surge EN 61000-4-5	± 1 kV differential mode ± 2 kV common mode	± 1 kV differential mode ± 2 kV common mode	Mains power should be that of a typical commercial or hospital environment.
Voltage dips, short interruptions and voltage variations on power supply input lines EN 61000-4-11	< 5% U_t (> 95% dip in U_t) for 0.5 cycles < 40% U_t (> 60% dip in U_t) for 5 cycles < 70% U_t (> 30% dip in U_t) for 25 cycles < 5% U_t (> 95% dip in U_t) for 5 s	< 5% U_t (> 95% dip in U_t) for 0.5 cycles < 40% U_t (> 60% dip in U_t) for 5 cycles < 70% U_t (> 30% dip in U_t) for 25 cycles < 5% U_t (> 95% dip in U_t) for 5 s	Mains power should be that of a typical commercial or hospital environment. If the user of the equipment requires continued operation during power mains interruptions, it is recommended that the equipment be powered from an uninterrupted power supply or a battery.
Power Frequency (50/ 60 Hz) Magnetic Field EN 61000-4-8	3 A/m	3 A/m	Power frequency magnetic fields should be at levels characteristic of a typical location in a typical commercial or hospital environment.

NOTE:

U_t is the AC mains voltage prior to application of the test level.

Guidance and Manufacturer's Declaration – Electromagnetic Immunity

The Dash 2500 Patient Monitor Service Manual is intended for use in the electromagnetic environment specified below. It is the responsibility of the customer or user to assure that the Dash 2500 Patient Monitor Service Manual is used in such an environment.

Immunity Test	EN 60601 Test Level	Compliance Level	Electromagnetic Environment – Guidance
Conducted RF EN 61000-4-6	3 Vrms 150 KHz to 80 MHz	3 V rms	Portable and mobile RF communications equipment should not be used closer to any part of the equipment, including cables, than the recommended separation distance calculated from the equation applicable to the frequency of the transmitter. **Recommended separation distance** $d = \left[\frac{3.5}{V1}\right]\sqrt{P}$
Radiated RF EN 61000-4-3	3 V/m 80 MHz to 2.5 GHz	3 V/m	$d = \left[\frac{3.5}{E1}\right]\sqrt{P}$ 80 MHz to 800 MHz $d = \left[\frac{7}{E1}\right]\sqrt{P}$ 800 MHz to 2.5 GHz Where P is the maximum output power rating of the transmitter in watts (W) according to the transmitter manufacturer, and d is the recommended separation distance in meters (m). Field strengths from fixed RF transmitters, as determined by an electromagnetic site survey[a], should be less than the compliance level in each frequency range[b]. Interference may occur in the vicinity of equipment marked with the following symbol: 

Note 1: At 80 MHz and 800 MHz, the higher frequency range applies.
Note 2: These guidelines may not apply in all situations. Electromagnetic propagation is affected by reflection from structures, objects, and people.

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

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

Recommended Separation Distances

The table below provides the recommended separation distances (in meters) between portable and mobile RF communications equipment and the Dash 2500 Patient Monitor Service Manual.

The Dash 2500 Patient Monitor Service Manual is intended for use in the electromagnetic environment on which radiated RF disturbances are controlled. The customer or the user of the Dash 2500 Patient Monitor Service Manual can help prevent electromagnetic interference by maintaining a minimum distance between portable and mobile RF communications equipment (transmitters) and the Dash 2500 Patient Monitor Service Manual as recommended below, according to the maximum output power of the communications equipment.

	Separation Distance in Meters (m) According to Frequency of Transmitter		
Rated Maximum Output Power of Transmitter in Watts	**150 kHz to 80 MHz** $d = \left[\frac{3.5}{V1}\right]\sqrt{P}$	**80 MHz to 800 MHz** $d = \left[\frac{3.5}{E1}\right]\sqrt{P}$	**800 MHz to 2.5 GHz** $d = \left[\frac{7}{E1}\right]\sqrt{P}$
0.01	0.12	0.12	0.23
0.1	0.37	0.37	0.74
1	1.17	1.17	2.33
10	3.69	3.69	7.38
100	11.67	11.67	23.33
For transmitters rated at a maximum output power not listed above, the recommended separation distance *d* in meters (m) can be estimated using the equitation applicable to the frequency of the transmitter, where *P* is the maximum output power rating of the transmitter in watts (W) according to the transmitter manufacturer.			
Note 1: At 80 MHz and 800 MHz, the separation distance for the higher frequency range applies. **Note 2**: These guidelines may not apply in all instances. Electromagnetic propagation is affected by absorption and reflection from structures, objects and people.			

Compliant Cables and Accessories

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

The table below lists cables, transducers, and other applicable accessories with which GE Medical Systems claims EMC compliance.

NOTE Any supplied accessories that do not affect EMC compliance are not included.

Part No	Description	Maximum Lengths
2021141-001	CABLE ASSY ECG 3 LEAD W/GRAB, AHA	
2022948-001	CABLE ASSY 3/5 LEAD ESU MULTLNK ECG, AHA	
2017003-001	CABLE ASSY ECG MLT-LNK 3/5 LEAD, AHA	3.6M
2017004-001	CABLE ASSY ECG 3 LEAD NEO, AHA	3.6M
900716-001	900716-001 Leadwire Set, ECG, Multi-Link, Mini-Clip/ DIN, Neo, AHA, 3/set	24 in.
002200	002200 Cuff, NIBP, Dura-Cuf, Inf, 2 TB, Org, Submin, 5/bx	
002201	002201 Cuff, NIBP, Dura-Cuf, Chd, 2 TB, Grn, Submin, 5/ bx	
002202	002202 Cuff, NIBP, Dura-Cuf, Sm Ad, 2 TB, Royal Blu, Submin, 5/bx	
002203	002203 Cuff, NIBP, Dura-Cuf, Ad, 2 TB, Navy, Submin, 5/ bx	
2017002-003	CABLE ASSY SPO2 MASIMO	2.4M
2002800-001	2002800-001 Sensor, SPO2, Masimo, Finger, Ad, Reusable	
2021406-001	2021406-001 CABLE ASSY SPO2 NELLCOR OXIMAX	3M
70124021	SPO2- SENSOR DS 100A	
2008774-001	SENSOR TURBO TEMP LONG, WHITE CORD	
2008775-001	SENSOR TURBO TEMP LONG RECTAL,WHITE CORD	
615118	Probe Covers 20/box	

For your notes

F Connection

For your notes

Product Compatibility

The Dash 2500 monitor has been verified to be able to work in CARESCAPE™ Network environments and only talk to CARESCAPE™ CIC Pro. Other network infrastructures are not supported.

The Dash 2500 monitor could talk to multiple CARESCAPE™ CIC Pro, allow to receive up to 20 requests from CARESCAPE™ CIC Pro at one time.

The Dash 2500 monitor is only able to interact with CIC version 4.0.8, 4.1.1, 5.0.8, 5.1.0 and all of other versions which are compatible with these four. Can not talk to other CARESCAPE Servers including Aware Gateway, Mobile Care Server, Patient Data Server.

The Dash 2500 monitor can not act as Time Master in CARESCAPE Network.

The Dash 2500 monitor does not support bed to bed communication to other Dash 2500's or unity MC monitors (e.g. Dash 3000/4000/5000, Solar 8000).

The Dash 2500 monitor's accessories also apply to legacy Dash 2500 products.

The Dash 2500 monitor's information transfer to CIC Pro as following:

- All Dash 2500 Available parameters: 3/5 lead ECG, NIBP, SpO2, Resp, Temp
- Real-time multi-parameter waveforms
- Graphic/tabular trends
- Real-time Alarm, including Arrhythmia alarms: ASYSTOLE, VFIB/VTAC, VTACH
- Patient admit/discharge & patient name update
- Multiple parameters alarm setting
- "Battery Low" alarm
- Trigger printing alarm strips for DASH 2500 V4 from CIC Pro, manually

CAUTIONS

◆Contact your sales representative before connecting the network module to your network to verify compatibility.

◆Do not insert metallic objects, inflammables, water or other fluids into the unit.

◆There are no user-serviceable parts within this device.

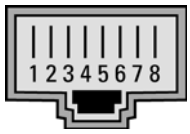
- The ECG display filter can be set in three levels on the Monitor. But when printing ECG from a Unity device, the filter setting will always be 0.5-40 Hz, which is the default setting.

External Connectors

The following tables provide pin-by-pin descriptions and signal names for the external connectors.

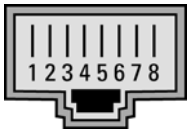
Ethernet Port

This RJ-45 connector connects the network module to the monitoring network.

8-Pin Ethernet Connector			
			
Pin	**Name**	**Input/Output**	**Description**
1	LAN_TRANSMIT+	O	Network transmit non-inverted differential output.
2	LAN_TRANSMIT–	O	Network transmit inverted differential output.
3	LAN_RECEIVE+	I	Network receive non-inverted differential input.
4	NC		
5	NC		
6	LAN_RECEIVE–	I	Network receive inverted differential input.
7	NC		
8	NC		

Service Port

The RS-232 connector is provided as one asynchronous port for software downloading.

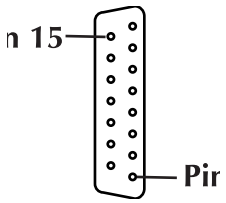
8-Pin RJ-45 Connector			
			
Pin	**Name**	**Input/Output**	**Description**
1	HC_232_TX	O	
2	HC_232_RX	I	
3	NC		
4	COMMON		Signal Common
5	SP_232_TX	O	
6	NC		
7	SP_232_RX	I	
8	NC		

LEDs

System Status LED Chart		
LED State	**Function**	**Description**
Green ON Solid	Working	Communications with network is functioning properly.
Yellow ON solid	Pending	Communications with network is pending.
Yellow blinking 3 times fast in 1 second increments, off for 1 second	Duplicate address	Another device on the monitoring network is broadcasting “RWHAT” packets using the same location as this unit.
Green, slowly blinking (once every 2 seconds)	Boot Code	Boot code is running.
Alternating blinking: Green/Yellow fast. Alternating bi-color LED predominantly Yellow - initial download. Green - completion (once every 2 seconds)	Downloading	The unit is being downloaded, either automatically or manually.
Yellow slowly blinking (once every 2 seconds)	Communications error	Connected to network, but cannot communicate with the Dash 2500 Monitor.
Yellow blinking fast (twice every second)	Other errors	Network module is malfunctioning. Network module is not compatible with software in the Dash 2500 Monitor.

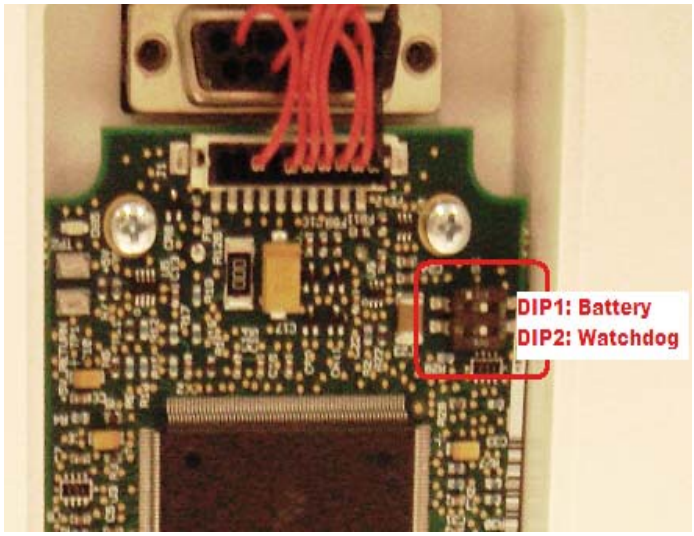
Communication Adaptor Connector

This connector is reserved for connection to GE Medical Systems *Information Technologies* network module ONLY.



Pin Number	Function
1	Ground
2	TX2 Inverted TTL Transmit Data
3	RX2 Inverted TTL Receive Data
4	Fused +5 volts
5	Fused +12 volts
6	No Connection
7	Ground
8	Remote Alarm
9	No Connection
10	No Connection
11	TX1 Inverted TTL Transmit Data
12	Port Enable Control
13	RX1 Inverted TTL Receive Data
14	No Connection
15	No Connection

DIP switch description



- 3V Lithium Coin Battery Switch

  Switch 1 of the dual mini-dip switch serves to disconnect the 3V lithium battery from the Maxim MAX6366 microprocessor supervisory circuit during HP in-circuit testing.

  When the coin battery is connected to the supervisory circuit via switch 2, the voltage measured across the 200 ohm resistor (R8) is to be less than 2 mV indicating a current of less than 10 mA. Switch 2 is to remain in the normally closed state upon completion of production testing.

- Watchdog Enable Switch

  Switch 1 of the dual mini-dip switch serves to disable the MC68EN360 internal watchdog during software development. Switch 1 is to be toggled during production testing to verify operation and positioned to the normally closed state upon completion of production testing.

Installation Configuration Procedure

This procedure describes how to initially configure the network module to your Dash 2500 Monitor and Unity Network®. These procedures are intended to be performed by service personnel or biomedical engineers.

NOTE: Do not install the Dash 2500 monitor into the GE Unity network with more than 1000 Unity devices.

NOTE: The Dash 2500 monitor doesn't support time synchronization with CIC automatically. The trends's data may have difference between Dash 2500 and CIC. This can be minimized by manually checking and adjusting time for synchronization and increasing the trends' interval.

Special Equipment

This procedure requires the installer to have the following:

- Two CAT-5 straight through network cables, P/N:
  418335-001 (5 ft)
  418335-002 (10 ft)
  418335-003 (15 ft)
  418335-004 (20 ft)
  418335-005 (25 ft)
  418335-006 (2 ft)
  418335-007 (50 ft)
  418335-008 (100 ft)
- CARESCAPE Network
- CIC version 4.0.8, 4.1.1, 5.0.8, 5.1.0 and all of other versions which are compatible with these four.
- Windows 2000 or XP PC

Installation of the network module

1. Turn off the power at the Dash 2500 Monitor.
2. Remove the Interface cover on the rear of the Dash 2500 Monitor.
3. Connect the module to the 15-pin connector and insert the supplied screw through the module. Fasten securely.
4. Replace the Interface cover.

NOTE: Refer to Chapter 6, Assemble Network Module for more details.

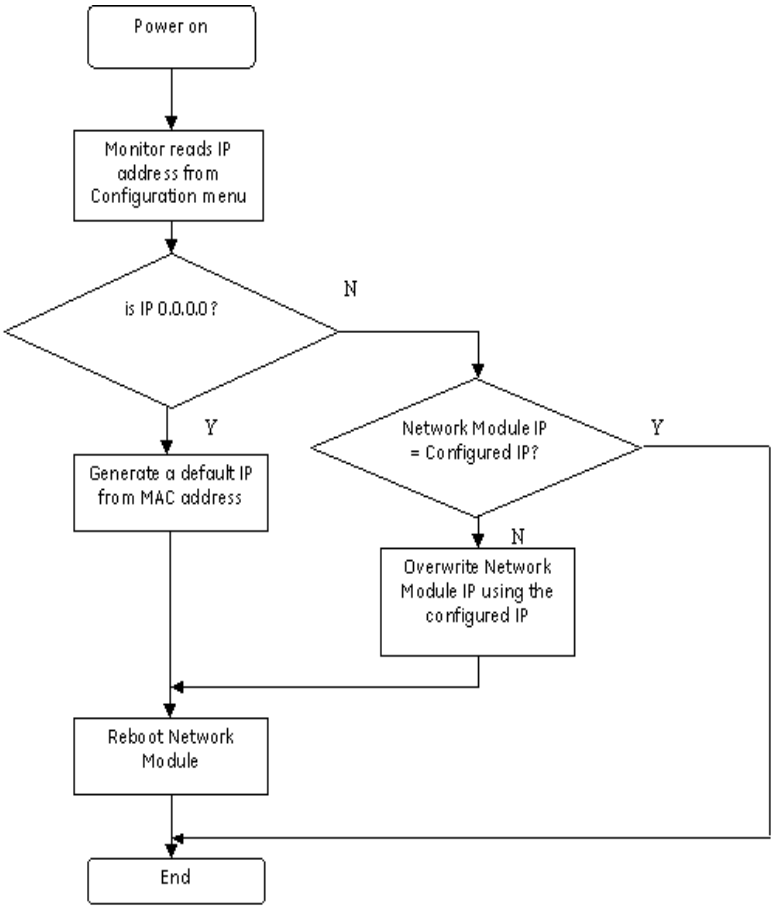
Network module Setup

Connect monitor to network:

1. Turn off the power at the Dash 2500 Monitor.
2. Connect network cable to the port labeled as “Ethernet” on the rear of the Dash 2500 Monitor. Connect the other end of the cable to the clinical network.
3. Turn on the power to the Dash 2500 Monitor.

Set up IP address:

The Dash 2500 Monitor is an Ethernet device bounded with an IP address. It communicates with CIC devices via the clinical network. There are two ways to set up the IP address: 1) an automatically configured IP Address, or 2) a user specified IP address



IP address algorithm

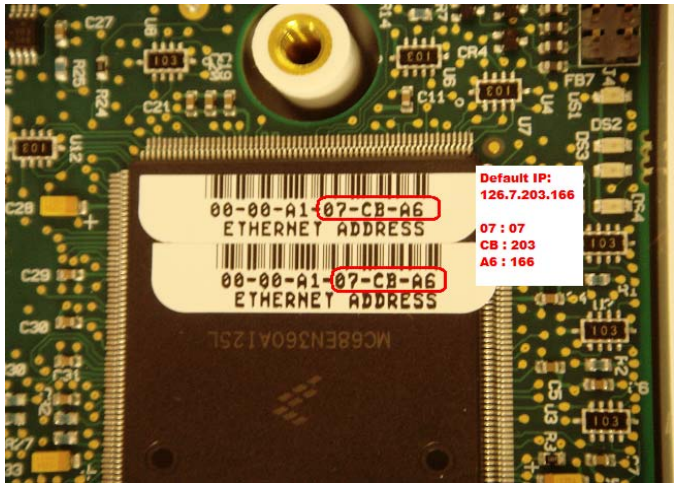
Default IP address. (If your CIC IP is 126.XXX.YYY.ZZZ, please use this method)

In this method, the Dash 2500 Monitor IP address will be set automatically. No configuration is needed.

By factory default, the IP address in Dash 2500 Monitor configuration menu is set as "0.0.0.0". The monitor will automatically generate a default IP address calculated from its MAC address. This IP address is unique in all GE Unity devices and follows below formula:

126. XXX. YYY. ZZZ

where the XXX, YYY and ZZZ are the last three numbers of the monitor MAC address.



NOTE: When using default IP address, the displayed IP "0.0.0.0" showing in Dash 2500 configuration menu is not the real IP. Customer shall ignore it.

Specified IP address (If your CIC IP is not 126.XXX.YYY.ZZZ, please use this method)

In this method, customer shall set the Dash 2500 Monitor IP address manually.

NOTES

- The IP address of the Dash 2500 Monitor must be unique and valid in the entire clinical network.
- The IP address of the Dash 2500 Monitor must be in the same network address of the intended CIC devices. For example, if the CIC IP address is 172.16.***.*** in a class-B sub-network, the valid IP address range for monitor is 172.16.0.1~172.16.255.254.
- The Dash 2500 Monitor network mask is determined by IP settings following the default subnet mask definitions in RFC 791.

Class	Leading bits	Start	End	CIDR prefix	Default subnet mask
Class A	0	0.0.0.0	127.255.255.255	/8	255.0.0.0
Class B	10	128.0.0.0	191.255.255.255	/16	255.255.0.0
Class C	110	192.0.0.0	223.255.255.255	/24	255.255.255.0

How to set up the specified IP address?

1. Enter the configuration menu (consult Dash 2500 Monitor service manual Appendix C).
2. Turn and press the Trim Knob to select **other system settings**.
3. Turn and press the Trim Knob to select **Config HostComm...**
4. Select **IP address** sub-menu, select each of the four numeric fields and set the field values by rotating the Trim Knob. Press the Trim Knob after adjusting each field value to confirm the setting.

   NOTE: Dash 2500 monitor can't inspect the duplicate IP address in the Unity network. If there are other devices with same IP address in network, the monitor will still send device identification information to the CIC. This causes the CIC can't read the IP address normally. So please make sure Dash 2500 monitor uses the unique IP address in the network when installation.
5. In the Admit Patient menu, select **ADULT (PEDIATRIC or NEONATE)**and enter the bed and unit number for this Monitor.
6. Save default changes.
7. Exit config mode.

NOTE: To set back "Default IP Address" method for the network function, enter into boot service menus to clear config memory. For detail steps, refer to Using the Boot Service Menu.

Boot Service Menus and Service Menus

The Boot Service Menus and Service Menus described in this section are presented for advanced users and service personnel only. In most cases, access to these menus will not be necessary and only experienced technicians should attempt to use them.

Preparation

Special Equipment

This procedure requires the installer to have the following:

- Computer to act as a terminal with the following minimum requirements:
  - Windows XP compatible
  - CD drive
  - RS232C serial port (PN 2003629-001 or equivalent)
- PC DIDCA P/N 2006550-001
- CAT-5 straight through network cable
- Windows "Hyper Terminal" tool

Interconnection

To connect a personal computer (PC) to the Network Module, complete the following steps in the order given.

1. Connect the CAT-5 cable to the RJ-45 socket labeled Serial 2 on the monitor.
2. Connect the other end of the CAT-5 cable to PC DIDCA, which is connected to the 9-pin D-sub serial connector.

PC Setup

Follow the steps in the order listed.

1. Apply power to the PC.
2. Run “Hyper Terminal” tool

   Open **start** menu in Windows PC, choose **run** option;

   Type “**hypertrm**” command, and click **OK** button.
3. Set up “Hyper Terminal” tools

   If you are first user for “Hyper Terminal” tool, follow the new connection creating Wizard. Or else choose **new connection** option in **File** menu.

   - Enter a name and choose an icon, click **OK**
   - Select **COM 1** in **Connect using** item, click **OK**
   - Set up the port as following:

     Bits per second: 9600

     Data bits: 8

     Parity: None

     Stop bits:

     Flow control: None.

Communication Tips

Use the following tips if you have problems communicating between the unit and the PC.

- If you enter the wrong configuration data, just exit the menu, re-enter the menu, and type over the old data.
- If communication is interrupted, power cycle the monitor and type: service <enter>
- The network module software is programmed to disconnect communication with the PC after 5 minutes if no interaction is detected. The service menu will be closed. Because the network module can be programmed from a local PC connection or from the network, only one user is allowed to configure the unit at a time.

  NOTE: The interaction for monitor’s configuration only can be performed

via PC, but not network.

Using the Boot Service Menu

While holding down the lowercase "b" key *continuously* at the PC, power ON the Dash 2500 Monitor, The following **BOOT SERVICE MENU** should appear in "Hyper Terminal" window. The file **server selection menu** appears first, select **service menu**.

NOTE: If the monitor does not connect to the CARESCAPE Network, it will jump into the **service menu** automatically in 30 seconds.

```
BOOT SERVICE MENU

1 Change Ethernet Address

2 Change Internet Address

3 Change IPC 1928 ID (9999)

4 Clear Config Memory

5 Country Selection: FRANCE

6 Exit


Your selection -->
```

- Select **1**: **Change Ethernet Address**. This selection allows you to change the Ethernet address of the network module.
- Select **2**: **Change Internet Address**. This selection allows you to change the Internet address of the network module.

  NOTE: This selection is only for R&D purpose. The special generated IP address will be overwritten when the monitor Power ON next time.
- Select **3**: **Change the Network Module ID Number**. This selection allows you to input the unique ID number from the ID number label on the unit. This number is coded into the software at the factory when the ID number label is applied. Ensure that the ID number from the label is the same as the number you input.

  ```
  New IPC-1928 ID: ___ (range 0 to 9999)(Press ENTER key.)

  The IPC-1928 ID has been set to ___.
  ```

  NOTE: The selection is only for R&D purpose. This Network ID is only an internal identification number of the Network Module.
- Select **4**: **Clear Config Memory**. This selection allows you to clear the configurable memory and ID number. The Ethernet and Internet addresses are not affected when you clear the configuration.
- Select **5**: **Country Selection (xxx, xxx is the current country)**. This selection selects what country and software the unit is using. The default is English.
- Select **6**: **Exit**. To quit boot service menu.

Using the Service Menu

Power ON the Dash 2500 Monitor, after 5 seconds type “service <enter>” at the PC, the following **SERVICE MENU** should appear in “Hyper Terminal” window.

```
SERVICE MENU (IPC-1928)

1 Revisions

2 Error Log

3 Event Log

4 Location Menu (X-XXXX) (STANDARD)

5 Unit Type (ADULT)

6 Barometric Pressure 760 mmHg

7 Rwhat Database

8 Set the Time and Date

9. Set Language (current = “English”)

10. View Parameters

11. Exit


Your selection -->
```

- Select **1**: **Revisions**. This selection lists the revision of the Network Module Main Code.
- Select **2**: **Error Log**. This selection lists all errors recorded by the Network Module Main Code. This selection is only for R&D purpose.
- Select **3**: **Event Log**. This selection lists all events recorded by the Network Module Main Code. This selection is only for R&D purpose.
- Select **4**: **Location Menu** (X-XXX) (STANDARD). This selection is inaccessible.
- Select **5**: **Unit Type** (ADULT). This selection is inaccessible.
- Select **6**: **Barometric Pressure 760 mmHg**. This selection is inaccessible.
- Select **7**: **Rwhat Database**. This selection allows the user to see all the Rwhat packets on the network in different formats.

  ```
  RWHAT SERVICE MENU

  1 Display All

  2 Display All (Abbreviated)

  3 Display for Resource

  4 Display for Resource (Abbreviated)

  5 Search for String

  6 Search for String (Abbreviated)

  7 Exit
  ```

- Select **8**: **Set the Time and Date**. In Dash 2500 the Time/Data setting function of Network Module is disabled.

  ```
  TIME AND DATE SERVICE MENU
  ```

```
13:08:09 27-JAN-2006

Setting of Time/Date has been disabled in this software
version
```

- Select **9**: **Set Language ("English")**. Ensure that the language selection is correct for your location. The language selection affects alarm broadcast messages and printed text.
- Select **10**. **View Parameters**. This selection allows the user to view the parameter values in a demonstration mode.
- Select **11**: **Exit**. To quit boot service menu.

G Software download

For your notes

Tools

- A computer with Windows 2000 or XP, native RS-232 port and with CD-ROM
- One equivalent straight through RS-232 serial communication cable (PN 2003629-001) with one male 9-pin connector and one female 9-pin connector.

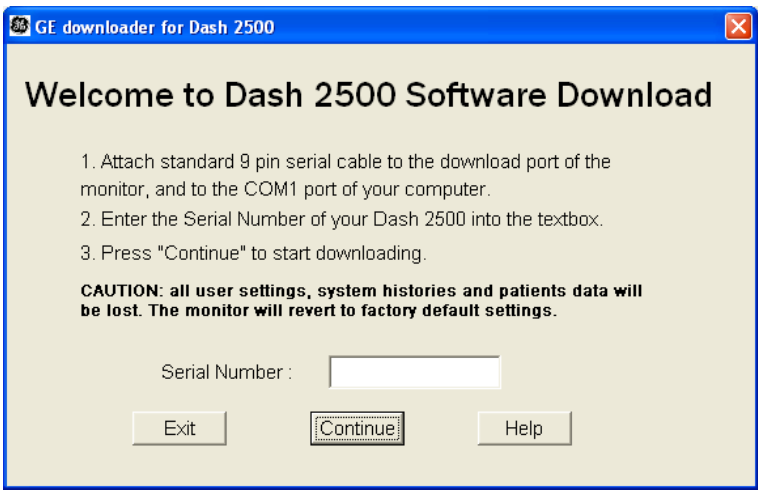
Procedure

1. If the monitor is powered on, turn it off.

   NOTE: It is preferred to download software while running on AC power. Do not monitor patient during software upgrade, remove patient connection.
2. Attach the download cable (standard 9 pin serial cable) to the download port of the monitor, and to the COMM1 port of your computer.

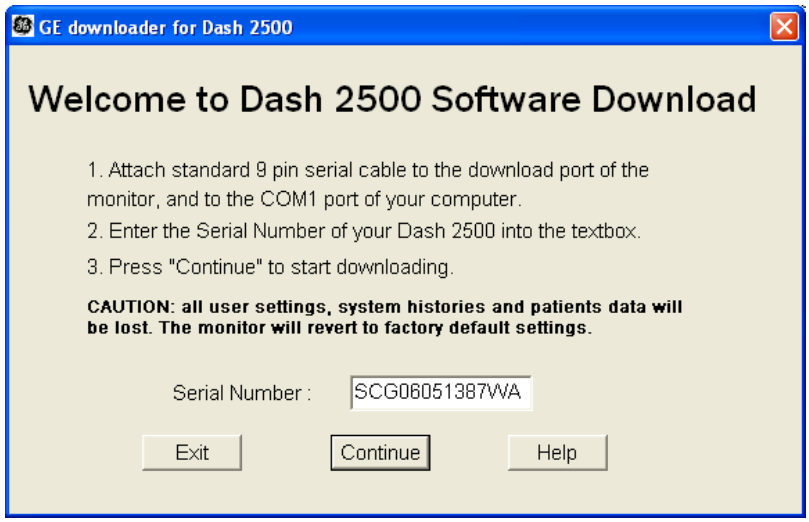
3. Insert software CD into CD driver. The CD will auto run. Below running screen will appear.

   NOTE: If auto-run does not work, click CD-Driver in My Computer twice to enable it.



4. Find the unit Serial Number from product label and put into **Serial Number** text box with uppercase.

5. Click “Continue” on downloader and then Click “OK” on information

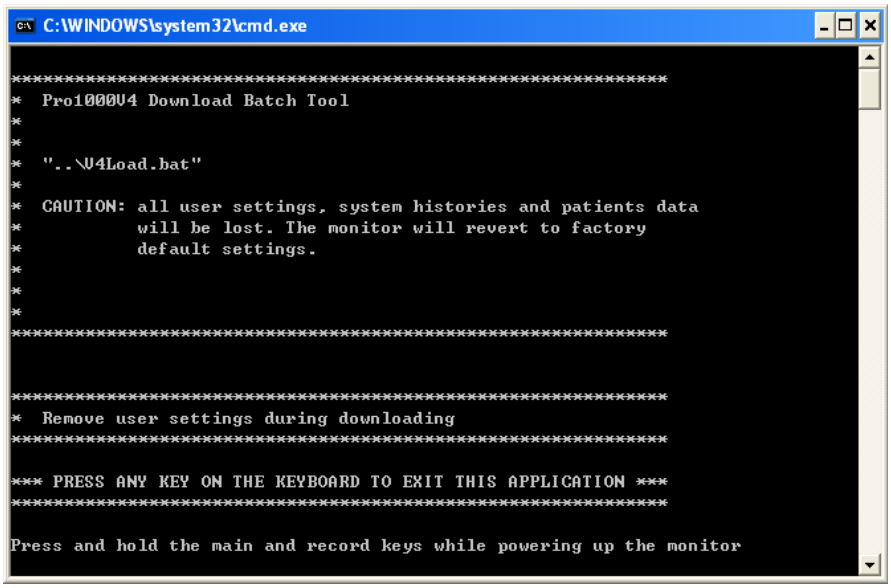


CAUTION

The monitor indicates a “MEMORY LOSS“when upgrade the software. It causes the monitor to revert to factory default settings. All the user settings, system histories and patients data will be lost.

6. Press and hold the "Main" and "Print" hardkeys on the monitor while the unit power on.

Continue to hold the "Main" and "Print" hardkeys until the monitor displays the logo on the screen. At this point the download process will automatically resume.



NOTE: If running on battery power with a low battery, the monitor may not be able to complete the download process before loosing battery power.

NOTE: Each horizontal bar presents a file being downloaded. A bar will change its color till the corresponding file is downloaded completely.

7. The download process takes 5 to 10 minutes while it loads multiple segments of code into the monitor: the application, model number, character fonts, the strings for each language. While the files are downloading, the monitor display will show a series of colored bars, this is an indication that the download is progressing normally. When the download process is completed the computer will beep (if sound is audible).

8. The monitor is now programmed. Turn the power off then back on, and confirm that the correct software revision has been downloaded into the monitor. This can be verified with the power on screen.

NOTE: The monitor indicates a "MEMORY LOSS" condition and causes the monitor to revert to factory default settings. Acknowledge the condition with the Trim knob.

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