DINAMAP®

PRO 1000V3 Monitor
Service Manual

GE Medical Systems
Information Technologies

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CAUTION**:** Federal (U.S.A.) law restricts this device to sale by or on the order of a health care practitioner.

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INTRODUCTION

SECTION 1. INTRODUCTION

1.1 SCOPE OF MANUAL

This Service Manual provides service and parts repair information about the DINAMAP® PRO 1000V3 Monitor. This manual is intended for use by trained service technicians who are familiar with electromechanical devices and digital and analog circuit techniques.

WARNINGS

To reduce the risk of electric shock, do not remove covers. Refer servicing to qualified service personnel.

Only qualified service-technicians should perform repairs to this equipment.

Voltages dangerous to life exist in this unit. Take care when servicing power supply and display assembly.

For information about operating the Monitor in a clinical environment, refer to the separate Operation Manual.

This Service Manual consists of the following five sections:

Section 1 Describes how to use this manual. Information is also provided about the physical and functional characteristics of the Monitor, and how to get assistance in the event the unit fails to function properly.

Section 2 Provides a general overview of the Monitor including user controls, external connections, and product/parameter specifications.

Section 3 Presents principles of operation for the Monitor, including an overall system description and principles of operation at the component level.

Section 4 Provides information about periodic and corrective maintenance of the Monitor. Procedures include module performance tests and calibration procedures.

Information is provided to facilitate isolating faults to the subassembly level.

1.2 MANUAL CHANGES

If, in the normal use of this manual, you notice errors, omissions, incorrect data, or if you can suggest comments that may help improve this manual, please notify:

GE Medical Systems *Information Technologies*
Technical Publications
4502 Woodland Corporate Boulevard
Tampa, Florida 33614

Changes to the Service Manual, either in response to user input or to reflect continuing product improvements, are accomplished through the reissuing of an updated manual.

Changes occurring between reissues are addressed through Change Information Sheets and replacement pages. If a Change Information Sheet does not accompany your manual, the manual is correct as printed.

1.3 SERVICE POLICY

The warranty for this product is enclosed with the product in the shipping carton. All repairs on products under warranty must be performed or approved by Product Service personnel. Only qualified electronics service personnel should repair products not covered by warranty.

Unauthorized repairs will void the warranty.

1.3.1 Extended Warranties

Extended warranties may be purchased on most products. Contact your Sales Representative for details and pricing.

1.3.2 Assistance

If the product fails to function properly, or if assistance, service or spare parts are required, contact Customer Support. Before contacting Customer Support, it is helpful to attempt to duplicate the problem and to check all accessories to ensure that they are not the cause of the problem. If you are unable to resolve the problem after checking these items, contact GE Medical Systems

Information Technologies. Prior to calling, please be prepared to provide:

- the product name and model number
- a complete description of the problem
- the software revision

If repair parts or service are necessary, provide the following information:

- the product serial number
- the facility's complete name and address
- a purchase order number if the product is in need of repair or when you order spare parts
- the facility's account number, if possible
- the part number for spare or replacement parts

1.3.3 Service

If your product requires warranty, extended warranty or non-warranty repair service, call Customer Support and a representative will assist you. Estimates for non-warranty repairs are provided at no charge; however, the product must be sent to the GE Medical Systems *Information Technologies* Service Center in order to provide you with an estimate.

To facilitate prompt service in cases where the product has external chassis or case damage, please advise the Customer Support representative when you call.

The Customer Support representative records all necessary information and provides you with a Return Merchandise Authorization number (RMA). Prior to returning any product for repair, you must have an RMA number. Contact technical support at **1-877-274-8456**, Option 4, Monday through Friday, 8:00 a.m. to 6:00 p.m. EST, excluding holidays.

Packing Instructions If the original shipping carton **is** available, follow these recommended packing instructions:	1) Remove all hoses, cables, sensors, and power cords from the Monitor before packing. 2) Pack only the accessories you are requested to return; place them in a separate bag and insert the bag and the product inside the shipping carton. 3) Use the original shipping carton and packing materials, if available.
If the original shipping carton is **not** available, follow these recommended packing instructions:	1) Place the product in a plastic bag and tie or tape the bag to prevent loose particles or materials from entering openings such as hose ports 2) Use a sturdy corrugated container to ship the product; tape securely to seal the container for shipping 3) Pack with 4 to 6 inches of padding on all sides of the product.

Insurance

Insurance is at the customer's discretion. The shipper must initiate claims for damage to the product.

1.3.4 Service Loaners and Rentals

A loaner unit is provided at no charge during the warranty period of the product when we perform the repair service. Within 48 hours of your request, a loaner will be shipped to your facility.

- GE Medical Systems *Information Technologies* pays the shipping charges for a loaner sent to the customer for product repairs under the warranty.
- Rental units are available in non-warranty situations.
- The customer pays the shipping charges to return a loaner.

All loaners provided to customers must be returned within the specified time stated on the loaner agreement or a rental fee will be incurred.

1.3.5 Repair

Repair parts can be ordered from GE Medical Systems *Information Technologies*:

Via phone 1-800-558-7044
Via FAX 1-800-421-6841

Exchange replacement assemblies such as Circuit Board Assemblies also are available; ask the Customer Support representative for details.

Please allow one working day for confirmation of your order. All orders must include the following information.

- Facility's complete name, address, and phone number
- FAX number
- Your purchase order number
- Your account number

1.3.6 Replacement Accessories

Replacements, such as hoses and sensors, must be purchased from GE Medical Systems *Information Technologies* at 1-877-274-8456. Have the Reorder/Product Code of the item you wish to order, your purchase order and account number available.

1.4 PRODUCT DESCRIPTION

The Monitor and storage batteries are described below. Refer to Section 2 for specifications.

1.4.1 General Description

The Monitor is designed for patient monitoring in acute care settings such as critical care, emergency room, radiology, labor and delivery, and operating room. It allows the clinician to view, record, and recall clinical data derived from each parameter. These data include heart rate, respiration rate, oxygen saturation, noninvasive blood pressure, and temperature. Alarm limit conditions are also detected.

The recorder provides numeric and waveform printouts of monitored data. Up to two waveforms can be traced simultaneously. Each Monitor can monitor one patient at

the bedside. Patient sensor connections are made at the side of the unit, and network and device connectors are at the rear. Indicators for external AC/DC operation, battery operation, and battery charging are at the front of the unit.

At the time of publication, the available functioning parameters included the following:

- DINAMAP® NIBP*
- NELLCOR®** OXIMAX® or MASIMO SET®*** pulse oximetry (SpO_2)
- EK-Pro® 3-lead ECG*, with respiration
- 2-channel thermal recorder
- IVAC TURBO TEMP™†, oral or rectal thermometry

The Monitor series uses a TFT active-matrix-color liquid display. The 10.4” diagonal color display area contains 640 x 480 pixels. The LCD has the following specific characteristics. These are neither defects nor malfunctions:

- The ambient temperature may affect the display condition of the LCD.
- The LCD uses replaceable cold cathode tubes for backlighting. Optical characteristics, such as luminance or uniformity change over the course of time or viewing angle.
- Uneven brightness and/or small spots may be noticed depending on different display patterns.

*DINAMAP® and EK-Pro® is a trademark of GE Medical Systems *Information Technologies*.

**NELLCOR®, OXIMAX®, OXIMAX XL™, OxiCliq®, C-LOCK®, and SatSeconds™ are trademark of Nellcor Puritan Bennett Inc.

***MASIMO SET® is a trademark of Masimo Corporation. Possession or purchase of this device does not convey any express or implied license to use the device with replacement parts which would, alone, or in combination with this device, fall within the scope of one or more of the patents relating to the device.

† IVAC TURBO TEMP™ is a trademark of ALARIS Medical Systems.

Other Monitor features include:

- The ability to use industry standard accessories.
- Remote alarm capability.
- An intuitive graphical user interface, with a simple Select*Knob* that moves the user through menus in a logical and easy to understand format.
- Eight hard keys for quick access to alarm silence, standby, record, freeze, NIBP Go/Stop, AUTO-BP or STAT NIBP, trend and the main menu.

1.4.2 Storage Batteries

The Monitor operates from AC mains power, an external DC power supply, or from the internal Nickel Metal Hydride storage battery. When external DC power becomes available, the system rapidly switches from battery power to external power.

1.5 DISPOSAL OF PRODUCT WASTE

As you use the PRO Monitor, you will accumulate solid wastes that require proper disposal or recycling. These include batteries, patient applied parts, and packaging material.

1.5.1.Batteries

Caution: Do not incinerate batteries.
The sealed, rechargeable backup battery contains lead and can be recycled. The rechargeable memory battery is of the Nickel Metal Hydride form. Discharge this battery prior to disposal. Place the battery in packaging which electrically isolates its contents. Do not puncture or place the battery in a trash compactor. Do not incinerate the battery or expose it to fire or high temperatures. Dispose in accordance with regional body controlled guideline.

1.5.2 Patient Applied Parts

Certain patient applied parts, such as those with adhesive (disposable SpO_2 sensors), are intended for single use and should be disposed of properly as medical waste in accordance with regional body controlled guideline.

Other patient applied parts, such as blood pressure cuffs, should be cleaned according to instructions. Inspect reusable applied parts for wear, replace as necessary, and dispose of used product as medical waste in accordance with regional body controlled guideline.

1.5.3 Packaging Material

Retain original packaging materials for future use in storing or shipping the Monitor and accessories. This recommendation includes corrugated shippers and inserts.

Whenever possible recycle the packaging of accessories and patient applied parts.

1.5.4 Monitor

At the end of its service life, the product described in this manual, as well as its accessories, must be disposed of in compliance with the guidelines regulating the disposal of such products. If you have questions concerning disposal of the product, please contact GE Medical Systems *Information Technologies* or its representatives.

SECTION 2.
PRODUCT DESCRIPTION

SECTION 2. PRODUCT DESCRIPTION

2.1 INTRODUCTION

DINAMAP® PRO 1000V3 Monitors provide non-invasive determination of systolic blood pressure, diastolic blood pressure, mean arterial pressure, pulse rate, 3-lead ECG, temperature, and oxygen saturation. These portable AC and DC operated Monitors are primarily intended for use in hospital acute care settings such as outpatient surgery, accident and emergency, labor and delivery, GI/endoscopy, and medical/surgical units.

2.2 PRODUCT CONFIGURATIONS

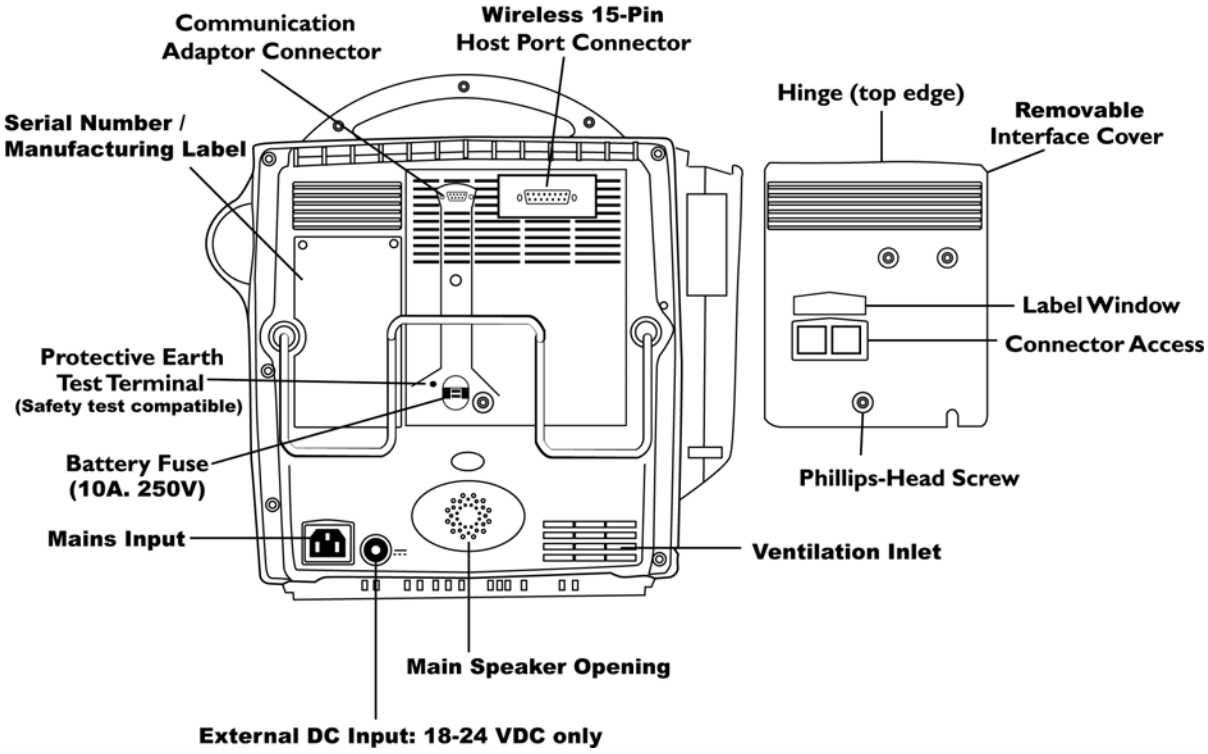
Each Monitor is supplied with an accessory pack. The contents of the pack vary according to model. Unpack the items carefully, and check them against the checklists enclosed within the accessory boxes. If an accessory is missing or if an item is in a nonworking condition, contact GE Medical Systems immediately.

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

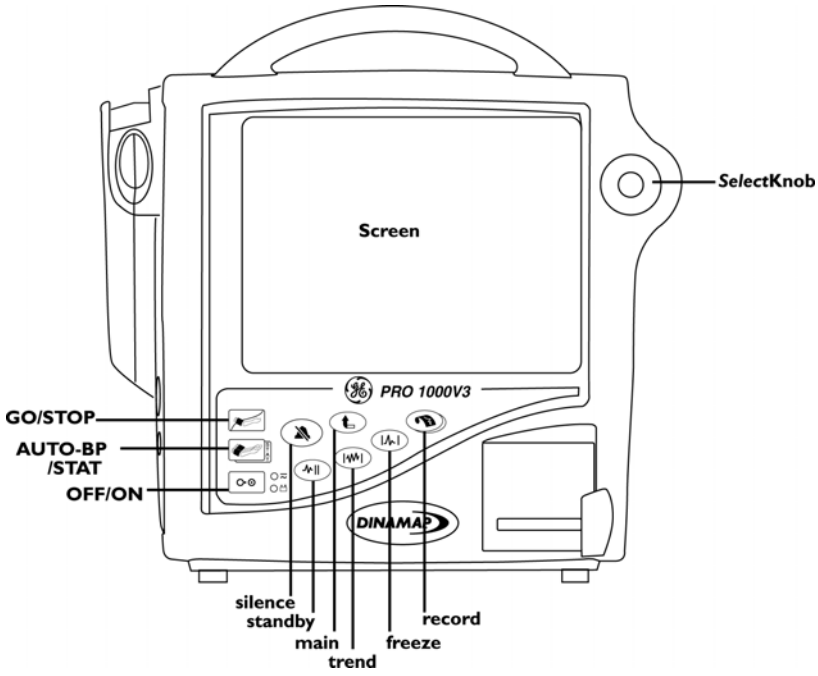
2.3 CONTROLS, INDICATORS, AND CONNECTORS

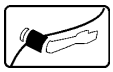
Descriptions of the items shown are listed on the pages that follow. For symbol definitions, refer to 2.3.2 Front Panel Controls and Indicators.

2.3.1 Rear Panel Connections



2.3.2 Front Panel Controls and Indicators





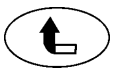
NIBP GO/STOP starts and stops any determination of noninvasive blood pressure.

AUTO-BP/STAT is a dual-function hard key. 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).

OFF/ON turns Monitor off and on.

silence temporarily silences alarms; acknowledges alarming crisis conditions.

standby enters and exits standby mode.



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

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

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

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

2.3.3 Symbols Associated With the PRO 1000 Monitor

NOTE: Interconnected equipment must be installed by a qualified service person.

Symbol	Definition
	CE Mark
	External Communications Port Connector
	Attention, consult accompanying documents
	Type CF applied part

Symbol	Definition
	Battery in use
	Canadian Standards Association
	Storage temperature
	External AC or DC power indicator
	External DC power input
	External AC power input
	Keep away from heat
	This way up
	Keep dry
	Fragile, handle with care
SN	Serial number
REF	Catalog number
	Predictive temperature
	Functional earth terminal (ground lug)
	Defibrillator-proof type BF equipment
	Defibrillator-proof type CF equipment

2.4 HOST PORT CONNECTORS (BENEATH REAR PANEL)

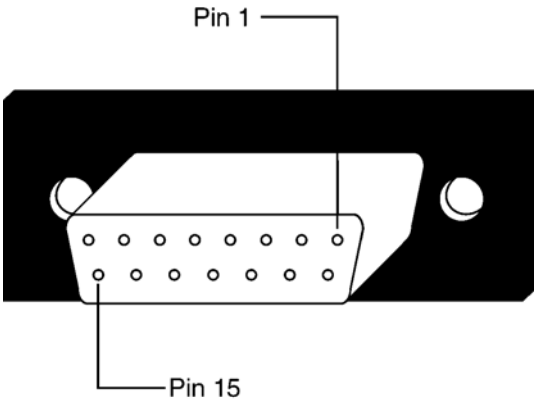
All host port signals should be only connected to equipment conforming to IEC 60601-1. Where isolation level converter should be used. If an external alarm control is required, GE Medical Systems *Information Technologies* part number 487208 (Isolated Remote Alarm Cable Assembly) should ALWAYS be used.

Please refer to the Information Sheet included with the isolated remote alarm cable for operational details.

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

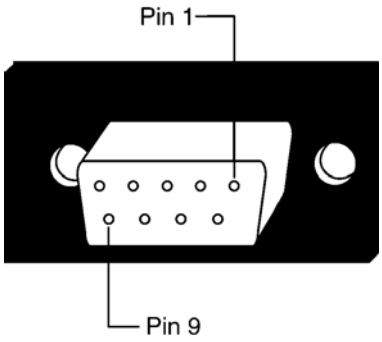
2.4.1 DB15 / DB9 Connector Pin Assignments

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



DB15 Connector Pins

Pin	Function
1	Ground
2	TX2_Inverted TTL Data
3	RX2_Inverted TTL Data
4	AUX5V (600mA max.)
5	AUX12V (250mA max.)
6	Serial Level Control (High=TTL Low=-RS-232)
7	Ground
8	Remote Alarm (open collector, 75mA Max Sink)
9	No Connection
10	No Connection
11	TX2_RS232
12	Port Enable Control <low=port 2> (When in use, DB9 4 & 5 disabled)
13	RX2_RS232
14	No connection
15	No connection



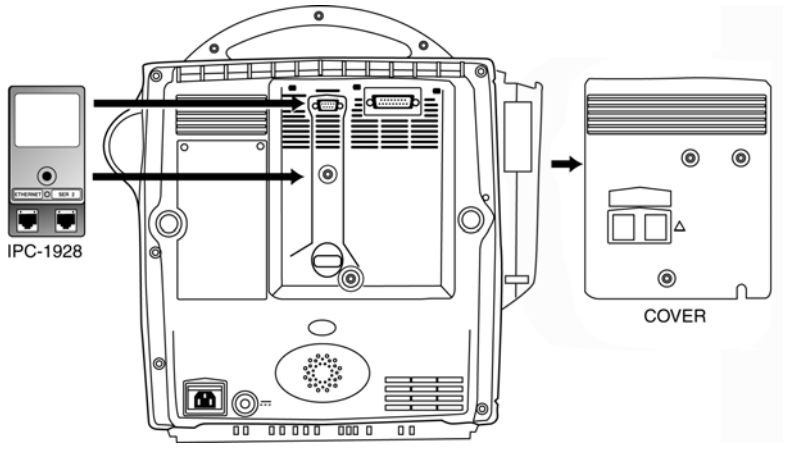
DB9 Connector Pins

Pin	Function
1	Ground
2	TX1 Inverted TTL Data
3	RX1
4	TX2
5	RX2
6	+5V (600mA Max)
7	+12V (400mA Max)
8	No Connection
9	No Connection

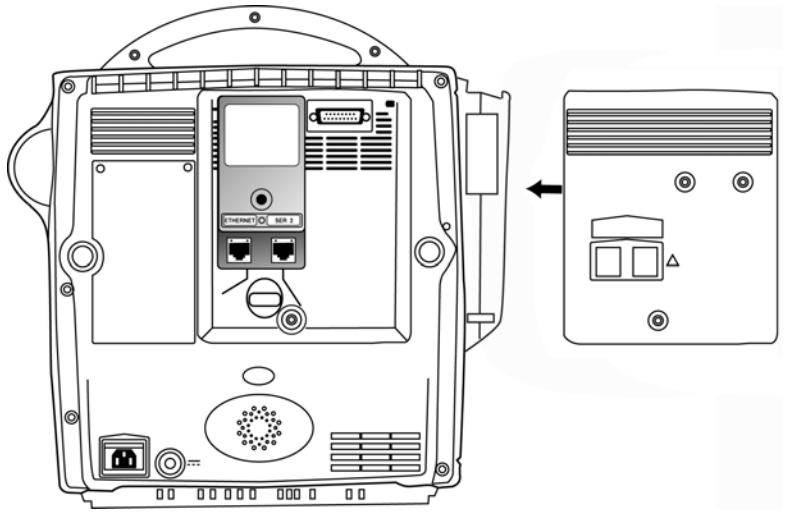
2.4.2 IPC-1928 INSTALLATION

The IPC-1928 allows the Monitor to communicate with a central monitoring station.

CAUTION! Before the installation procedure starts, be sure that the Monitor's power source is turned off.

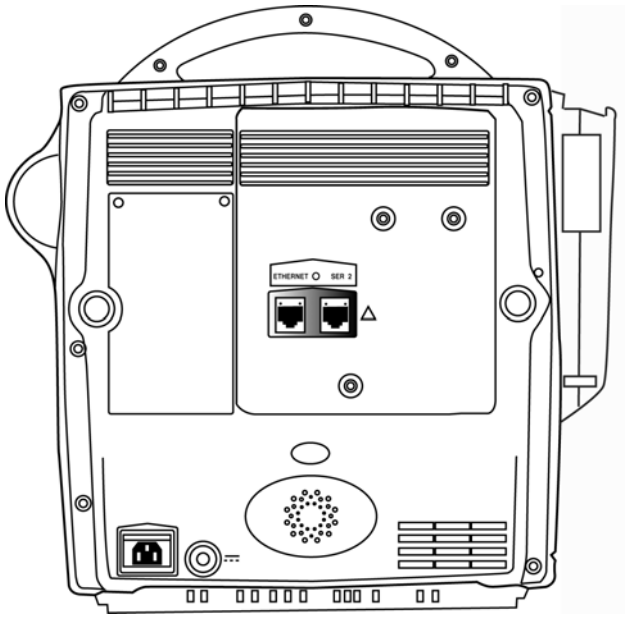


1. Use a Phillips-head screwdriver to remove the screw securing the Host Communications cover at the rear of the Monitor. Remove the cover.



2. Insert the nine-pin connector of the IPC-1928 with the receptor found under the Host Communication

cover. Use the Phillips-head screwdriver to tighten the securing screw. Hand-tighten only.



3. Replace the Host Communications cover and use the Phillips-head screwdriver to tighten the screw to secure the cover.

When the Monitor is reconnected to the power source and turned on, an amber light should be seen indicating that the IPC-1928 is ready to send and receive communications. A green light indicates that communication is taking place.

2.5 COMPATIBLE PARTS

The following parts are available from Customer Service.

Description of Compatible Part	Code
SOFT-CUF®, Cuff, Infant	2500
SOFT-CUF®, Cuff, Child	2501
SOFT-CUF®, Cuff, Small Adult	2502
SOFT-CUF®, Cuff, Adult	2503
SOFT-CUF®, Cuff, Large Adult	2504
SOFT-CUF®, Cuff, Thigh	2505
SOFT-CUF®, Cuff, Neonatal type 1	2521
SOFT-CUF®, Cuff, Neonatal type 2	2422
SOFT-CUF®, Cuff, Neonatal type 3	2523
SOFT-CUF®, Cuff, Neonatal type 4	2524
SOFT-CUF®, Cuff, Neonatal type 5	2525
DURA-CUF® Cuff, Infant	2783
DURA-CUF® Cuff, Child	2781
DURA-CUF® Cuff, Small Adult	2779
DURA-CUF® Cuff, Adult	2774
DURA-CUF® Cuff, Large Adult	2791
DURA-CUF® Cuff, Thigh	2796
DURA-CUF® Cuff, Assortment cuff pack	2699
DURA-CUF® Cuff, Child pack	2697
CLASSIC-CUF®, Cuff, Infant	2618
CLASSIC-CUF®, Cuff, Child	2613
CLASSIC-CUF®, Cuff, Small Adult	2608
CLASSIC-CUF®, Cuff, Adult	2603
CLASSIC-CUF®, Cuff, Large Adult	2643
CLASSIC-CUF®, Cuff, Thigh	2648
CLASSIC-CUF®, Cuff, Neonatal type 1	2638
CLASSIC-CUF®, Cuff, Neonatal type 2	2633
CLASSIC-CUF®, Cuff, Neonatal type 3	2628
CLASSIC-CUF®, Cuff, Neonatal type 4	2623
CLASSIC-CUF®, Cuff, Neonatal type 5	2619

Description of Compatible Part	Code
SENSA-CUF®, Cuff, Infant	2458
SENSA-CUF ®, Cuff, Child	2460
SENSA-CUF ®, Cuff, Small Adult	2462
SENSA-CUF ®, Cuff, Adult	2464
SENSA-CUF ®, Cuff, Large Adult	2466
SENSA-CUF ®, Cuff, Thigh	2468
12 Foot (approx. 3.7 meters) Long Adult / Pediatric Hose	107365
24 Foot (approx. 7.3 meters) Long Adult / Pediatric Hose	107366
12 Foot (approx. 3.7 meters) Long Neonatal Hose	107368
IVAC* TURBO★TEMP Oral Temperature Probe	2008774-001
IVAC* TURBO★TEMP Rectal Temperature Probe	2008775-001
IVAC* Temperature Probe Covers	088015
DINAMAP® PRO Monitor Operation Manual	2012093-001
DINAMAP® PRO Monitor Service Manual	2012819-001
Accessory Pole/Basket/Base	107476
Printer Paper (Box of 10)	008736
Power Cable	316579
NELLCOR OXIMAX** SpO_2 Extension Cable (DOC-10)	2008773-001
NELLCOR OXIMAX** Finger Sensor	407705-006
MASIMO SET*** SpO_2 Cable	2009743-001
MASIMO SET*** SpO_2 Sensor	2009745-001
NIBP Calibration Kit	320246

***** IVAC TURBO★TEMP™ is a trademark of ALARIS Medical Systems.

** NELLCOR®, OxiMax ®, OxiMax® XL™, OxiCliq®, C-LOCK®, and SatSeconds™ are trademark of Nellcor Puritan Bennett Inc.

***MASIMO SET® is a trademark of Masimo Corporation. Possession or purchase of this device does not convey any express or implied license to use the device with replacement parts which would, alone, or in combination with this device, fall within the scope of one or more of the patents relating to the device.

2.6 PRODUCT COMPLIANCE

The DINAMAP® PRO 1000V3 Monitor is classified in the following categories for compliance with IEC 601-1:

- Class I, internally powered
- Transportable (intra-hospital)
- For continuous operation
- Not suitable for use in the presence of flammable anesthetics
- Not for use in the presence of an oxygen-enriched atmosphere (oxygen tent)
- Type BF and type CF applied parts
- Defibrillation protected. When used with the GE Medical Systems *Information Technologies*-recommended accessories, the Monitor is protected against the effects of defibrillator discharge. If monitoring is disrupted by the defibrillation, the Monitor will recover.

IPX1 The DINAMAP® PRO 1000V3 Monitor is protected against vertically falling drops of water and conforms with the IEC 529 standard at level of IPX1. Vertically falling drops of water shall have no harmful effects to the Monitor.

CE
0086

This product conforms with the essential requirements of the Medical Device Directive 93/42. Accessories without the CE mark are not guaranteed to meet the Essential Requirements of the Medical Device Directive.

DINAMAP® PRO 1000V3 Monitor is classified with respect to electric shock, fire and mechanical and other specified hazards only in accordance with CAN/CSA C22.2 No. 601.1. Also evaluated to IEC-601-2-30.

- This equipment is suitable for connection to public mains as defined in CISPR 11.
- The signal systems of the Monitor conform to EN 475:1995.
- This Monitor conforms to safety standard for medical devices to IEC 601-1, EN 60601, BS 5724-1, AS/NZS3200.1.0.
- This Monitor conforms to EMC safety standard to IEC 60601-1-2.
- Software is developed in accordance with IEC 601-1-4.
- The ECG parameter conforms to IEC 60601-2-27.
- The SpO_2 parameter conforms to EN 865:1997 with the exception of Clauses 36, 48, sub-clause 51.104.1.
- The NIBP parameter conforms to IEC 601-2-30 with the exception of Clause 36, sub-clause 51.105, EN 1060 Part 1 & 3, ANSI/AMMI SP10 & SP10a.
- The TEMP parameter conforms to ASTM E 1112.

2.7 SPECIFICATIONS

2.7.1 Mechanical

Monitor	14.75 in (H) x 9.5 in (D) x 14.5 in (W) 37.47 cm (H) x 24.13 cm (D) x 36.83 cm (W)

2.7.2 Weight

PRO 1000V3 Monitor	13 lb (5.9 kg)

2.7.3 Environmental*

Operating Temperature	+41° F to +104° F (+5° C to +40° C)
Storage Temperature	-4.0° F to +122° F (-20° C to +50° C)
Operating Humidity	5% to 95% noncondensing
Storage Humidity	5% to 95% noncondensing
Operating Atmospheric Pressure	700 hPa to 1060 hPa
Storage Atmospheric Pressure	500 hPa to 1060 hPa

2.7.4 Electrical

AC Input Voltage	120 - 240 V
AC Input Frequency	50 - 60 Hz
AC Input Power	60 - 120 VA
DC Input Voltage	18 - 24 V (supplied from a source conforming to IEC 601-1)
DC Input Power	60 VA (supplied from a source conforming to IEC 601-1)
Internal Battery	12 V nickel-metal-hydride (NiMH)

2.7.5 Power Supply

The PRO 1000V3 Monitor can be powered from the internal battery, AC power, or an external DC power source.

Battery

An internal, rechargeable battery pack powers the Monitor for 120 minutes (+/- 10 minutes) at a specified load. The battery typically charges to 90% capacity within 3 hours.

The Monitor may not meet Performance Specifications (ANSI/AAMI SP10) if it is stored or used out of environmental specification ranges.

Capacity	7.0 amp-hr (manufacturer's rating)
Battery Life	120 minutes (+/- 10 min) using fully charged internal battery (NIBP: 5-min auto cycle with adult cuff. ECG, RESP, SpO2: Active. TEMP: predictive mode. Printer: printing 2 waveforms for 1 min every 20 min at 25 mm/sec.)
Charge time	3 hours maximum with the Monitor switched off 4 hours maximum with the Monitor switched on

Power Cable

The 16-gauge power cable is detachable and measures 10 ft (3 meters) in length. **Note:** When operating on AC power, use only the GE Medical Systems *Information Technologies*-supplied mains power cord to ensure water ingress protection. Labeling of the power cord and/or the Monitor is recommended to avoid accidental use of an alternate power cord that may compromise the IPX1 rating.

Fuses

Internal

FS1 0.5 amp	60V, auto-reset
FS2 5 amp	125V, fast acting, not resettable
FS3 5 amp	125V, fast acting, not resettable
FS4	0.1amp, 60V, auto-reset
FS5	0.5 amp, 60V, auto-reset
FS7	0.5 amp, 60V, auto-reset
FS8	0.5 amp, 60V, auto-reset

External

FS6	10 amp, 250V, Battery Disconnect, fast acting, not resettable

2.7.6 NIBP

Method	Oscillometric with step deflation
Modes	Manual, automatic, stat

BP Measurement Ranges

Systolic	30 to 290 mmHg (adult/ped) 30 to 140 mmHg (neonate)
MAP	20 to 260 mmHg (adult/ped) 20 to 125 mmHg (neonate)

Diastolic	10 to 220 mmHg (adult/ped) 10 to 110 mmHg (neonate)
Resolution	1 mmHg
Accuracy	Meets or exceeds AAMI/ANSI standard SP10
Initial Cuff Inflation Pressure	150 mmHg default; user selectable (adult/ped) 110 mmHg default; user selectable (neonate)
Maximum Determination Time	120 s (adult/ped) 85 s (neonate)
Over Pressure Monitor	300 to 330 mmHg (adult/ped) 150 to 165 mmHg (neonate)
Hose/Cuff Interface	Clippard screw connectors at cuff end
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/ped Range:	30 to 200 bpm (± 3.5%)
Neonate Range:	30 to 220 bpm (± 3.5%)

Critikon US Patent
4,638,810; 5,052,397; 4,627,440; 4,754,761; 5,170,795; 6,188,407; 5,357,970; 5,704,362; 5,680,870; 5,518,000 and international equivalents. US patents pending.

2.7.7 TURBO★TEMP

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 110.0° F (43.3° 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	Use only IVAC* 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 IVAC* probes and probe covers are used.
Determination Time	approx. 10 seconds, typical

IVAC® Patents
U.S. D300,728, D300,909

2.7.8 NELLCOR® OXIMAX® SpO_2

Measurement Range

SpO_2	1 to 100%
Pulse Rate	20 to 250 beats/min

Accuracy and Motion Tolerance

Saturation	
Without Motion - Adults*	70 to 100% ±2 digits
Without Motion - Neonate*	70 to 100% ±3 digits
With Motion - Adults/Neo**	70 to 100% ±3 digits
Low Perfusion	70 to 100% ±2 digits 0 to 69% unspecified
Pulse Rate	
Without Motion	20 to 250 beats/min ±3 digits
With Motion	normal physiologic range 55 to 125 beats/min ±5 digits
Low Perfusion	20 to 250 beats/min ±3 digits

*Adult specifications are shown for OXIMAX MAX-A and MAX-N sensors. Neonate specifications are shown for OXIMAX MAX-N. Saturation accuracy will vary by sensor type.
**Applicability: OXIMAX MAX-A, MAX-AL, MAX-P, MAX-I, and MAX-N sensors.

NELLCOR® Sensor Accuracy

Note: All NELLCOR® sensors must be used with the NELLCOR® DOC-10 cable; the SCP-10 cable is not compatible with the PRO 1000V3 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-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 with D-YSE	±3.5 digits
D-YS with 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, 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.

* The accuracy specification under motion conditions is ±3. For a definition of motion, contact NELLCOR® Technical Services or your local representative.

† The MAX-N and the OxiCliq N were tested on patients >40 kg.

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

Sensor Light Source

Wavelength	Infrared: 890 nm (nominal) Red: 660 nm (nominal)
Power Dissipation	Infrared: 22.5 mW (max) Red: 30 mW (max)

NELLCOR® Patents

US Patent No. 4,621,643; 4,653,498; 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; Re. 35,122 and foreign equivalents.

2.7.9 MASIMO SET® SpO_2

Measurement Range	
SpO_2	1 to 100%
Pulse Rate	25 to 240 beats/min
Perfusion Range	0.02 to 20%
Accuracy and Motion Tolerance	
Saturation	
Without Motion - Adult/Ped*	70 to 100% ±2 digits
Without Motion - Neonate*	70 to 100% ±3 digits
With Motion - Adult/Ped/Neo**†	70 to 100% ±3 digits
Low Perfusion‡	70 to 100% ±2 digits 0 to 69% unspecified
Pulse Rate	
Without Motion	25 to 240 beats/min ±3 digits
With Motion	normal physiologic range 25 to 240 beats/min ±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% SpO2 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 stimulator 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.

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 and % Transmission >5%	Saturation (% SpO_2) ±2 digits 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; 6,206,830; 6,157,850, and international equivalents.

2.7.10 ECG

Leads available	3-lead configuration: I, II, III, MCL1
QRS amplitude range	0.5 to 5.0 mV
QRS duration range	40 to 120 ms (does not reject 10 ms, 1 mV QRS)
Heart rate accuracy	30 to 300 beats/min ± 3 BPM or 3% of reading, whichever is greater
Heart rate resolution	1 beat/min
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
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	> 2.5 MW at 10 Hz
Differential	>2.5 MW from dc to 60Hz
60 Hz tolerance	up to 10 mV
Pacemaker detection/rejection	
Input voltage range	± 2 mV to ± 700 mV
Input pulse width	0.1 ms to 2 ms
Over/under shoot:	2 mV (max)
Baseline drift	<0.5 mV/hour with a ±700-mV, 2-ms pacemaker pulse applied
with under or overshoot of	± 2 mV
Pacer amplitude	± 2 mV to ± 700 mV
Pacer width	0.1 ms to 2 ms
Tall T wave rejection	100% @ 0.05 to 40Hz or 0.05 to 100Hz
Lead off sensing current	< 0.1 mA DC signal leads < 1 mA DC driven lead

Time to alarm	high heart rate < 10 s per AAMI EC13 - 1992 low heart rate < 10 s per AAMI EC13 - 1992 cardiac standstill < 10 s per AAMI EC13 - 1992 tachycardia waveforms < 10 s per AAMI EC13 – 1992

2.7.11 RESP
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 W
Detection Sensitivity baseline impedance	0.2 W @ 30 breath/min with 500 W
Bandwidth	0.1 to 5.0 Hz
Excitation Frequency Amplitude	61.5 kHz < 300 µA rms

2.7.12 HR/Pulse
ECG

Time to alarm	high heart rate < 10 s per AAMI EC13 - 1992 low heart rate < 10 s per AAMI EC13 - 1992 cardiac standstill < 10 s per AAMI EC13 - 1992 tachycardia waveforms < 10 s per AAMI EC13 – 1992 - 1992 tachycardia waveforms < 10 s per AAMI EC13 – 1992

SpO_2
NELLCOR:
Measurement Range

SpO_2	1 to 100%
Pulse Rate	20 to 250 beats/min

Accuracy and Motion Tolerance
Saturation

Without Motion - Adults*	70 to 100% ±2 digits
Without Motion - Neonate*	70 to 100% ±3 digits
With Motion - Adults/Neo**	70 to 100% ±3 digits
Low Perfusion	70 to 100% ±2 digits 0 to 69% unspecified

MASIMO:
Measurement Range

SpO_2	1 to 100%

Accuracy and Motion Tolerance
Saturation

Without Motion - Adult/Ped*	70 to 100% ±2 digits
Without Motion - Neonate*	70 to 100% ±3 digits
With Motion - Adult/Ped/Neo**†	70 to 100% ±3 digits
Low Perfusion‡	70 to 100% ±2 digits 0 to 69% unspecified

Noninvasive Blood Pressure
Range

Adult/ped	30 - 200 beats/min
Neonate	30 - 220 beats/min
Accuracy	± 3.5%

Alarm Limits
10 - 250 beats/min

SECTION 3.
PRINCIPLES OF OPERATION

SECTION 3. PRINCIPLES OF OPERATION

3.1 INTRODUCTION

This section provides an overall theory of operation and functional description of the DINAMAP PRO 1000V3 Monitor. The Monitor has Blood Pressure (BP), Pulse, Temperature, SpO_2, and ECG monitoring capability. The printer module is optional.

3.2 OVERALL PRINCIPLES OF OPERATION

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

When the OFF/ON 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 three input power sources:

- AC Mains
- External DC
- Internal battery

The regulated power is routed to the Printed Wiring Assemblies (PWA) through the cable harnesses. 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.

3.2.1 Nellcor SpO_2 and Masimo SpO_2

When the SpO_2 sensor is attached to the SpO_2 connector and to the patient, it senses both the heart 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

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.

3.2.2 Cuff Blood Pressure (BP) 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.

3.2.3 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 Main Board. This input represents the temperature to be measured. The Main Board converts the TEMP signal to a digital signal. 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.

3.2.4 ECG with Heart Rate and Respiration

The ECG parameter provides an electrocardiographic waveform in a 3-electrode configuration. The 3-electrode configuration derives waveforms for leads I, II, or III. The use of MCL1 as an ECG lead requires the user to reposition the electrodes. The MCL1 lead setting results in the ECG hardware being configured as lead I. It includes a waveform cascade feature and can display one waveform as the primary 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.

3.2.5 Host Communication Ports

There are two Host Comm Ports provided on the back panel of the Monitor. The DB9 connector provides +5V(600mA Max), +12V(400mA Max), and two channels of TTL compatible communications. The DB15 connector provides +5V(600mA Max), +12V(250mA Max), Remote Alarm Signal, and a TLL/RS-232 selectable communication channel.

NOTE: When the DB15 port is enabled, channel 2 of the DB9 port is disabled.

The Host Comm Ports are 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.

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

The host port signals on the DB15 connector should be connected only to equipment conforming to IEC 60601-1.

Where isolation of data communication is required, the ILC 1927 isolated level converter should be used.

If external alarm control is required, GE Medical Systems *Information Technologies* part number 487208 (Isolated Remote Alarm Cable Assembly) should always be used. *Refer to the Information Sheet included with the isolated remote alarm cable for operational details.*

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

3.3 FUNCTIONAL DESCRIPTION

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

- Power Supply Unit (PSU) PWA
- PSU Module
- Main Board
- Keyboard PWA
- ECG PWA
- SpO_2 PWA
- Pneumatic control device
- Liquid Crystal Display (LCD) Assembly
- Printer PWA w/printer (optional)

3.3.1 PSU PWA

The PSU supplies regulated DC power to Monitor. The PSU PWA is designed to operate from the output of the AC MAINS PSU module (+24VDC), EXTERNAL DC (+18VDC to +28VDC) source, or from an internal NiMH rechargeable battery (+12VDC). The PSU automatically selects the power source based on the following priority:

- Valid EXTERNAL DC input = +16VDC (If greater than or equal to output of Mains Converter)
- Valid AC MAINS input
- Valid NiMH battery

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

- VRAW1 (14.4VDC)

- VRAW2 (14.4VDC)
- VBAT

The +12V printer supply voltage is down converted from VRAW1 and maintained by a boost regulator to +12V when VRAW1 falls under 12V. ANA+ is regulated to +14.4VDC from VRAW2 by a MAX668 step up controller. AUX +12V is down converted from ANA+ using an LM340 regulator. ANA- is down converted from VRAW2 to –14.4VDC using a LM2594 step down regulator.

VBAT is the battery voltage protected by a 500mA auto-reset fuse. It is also used to power the failsafe alarm circuits on the Main Board.

The PSU 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 60W.

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 wireless connector, it can be configured for RS-232 or inverted TTL signals. Channel 1 is only available on the Comms connector as inverted TTL.

3.3.2 Mains Converter Module

The Mains converter 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 24 VDC. This supply is connected to the PSU PWA for further regulation. The PSU only selects this source when DC Output is greater than +16VDC and greater than the EXTERNAL DC input voltage.

3.3.3 Main Board

The Main Board is configured with Flash ROM, EEPROM, RAM, 16-bit ADC, Primary Processor, Secondary Processor, NIBP, and Temperature. 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 itself 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.

In the temperature parameter, the IVAC probe and the calibration resistor chain are connected to a ADS1240 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.

The Random Access Memory (RAM) is comprised 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 20ns. 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.

3.3.4 SpO_2 PWA

The Monitor is pre-configured with either Nellcor or Masimo SpO_2 hardware.

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 sent across an isolation barrier (opto couplers) and passed to the Primary Processor via a dual-channel UART.

3.3.5 Keyboard PWA

The Keyboard PWA provides access to the basic functions of the PRO Monitor. The buttons that control each function are integrated with its status LED to form a touch pad front panel. LEDs indicate the status of those functions by illuminating green when active and yellow when inactive. The exception is the “SILENCE” button, which is red when active. The function LEDs are driven by latches on the Main Board. The battery LED is continuously yellow when the unit is running on battery and flashes yellow when the battery is charging. The AC LED is green when an external power source is present. The keyboard is connected to the Main Board via a 36 way board-to-board connector.

3.3.6 ECG PWA

The ECG PWA accepts signals from a 3-electrode cable for processing. The 3-electrode cable provides a single lead configuration with Lead I, Lead II, or Lead III available. The cables specified by Critikon are shielded and provide 1k-Ohm series (safety) resistors internal to the cable that are part of the current limiting defibrillator protection circuitry. Gas surge arrestors on the PWA provide 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 (61.5 kHz, 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 PWA 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 +5V 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.

3.3.7 Pneumatic Control

The pneumatic functional block includes the control signal decode logic, the valve driver circuitry, the pump driver circuitry; pump current measurement circuit, 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 1KHz low pass anti-alias filter
- PT1B - the output of the measurement pressure sensor after amplification and filtering by means of a passive 20Hz 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
- PUMPC - the pump current
- VBAT- 1/11 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.

3.3.8 LCD Assembly

The Monitor uses TFT (thin film transistor) active matrix color liquid display. The 10.4" diagonal display contains 640 x 480 pixels and is backlit by cold-cathode fluorescent lamps.

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

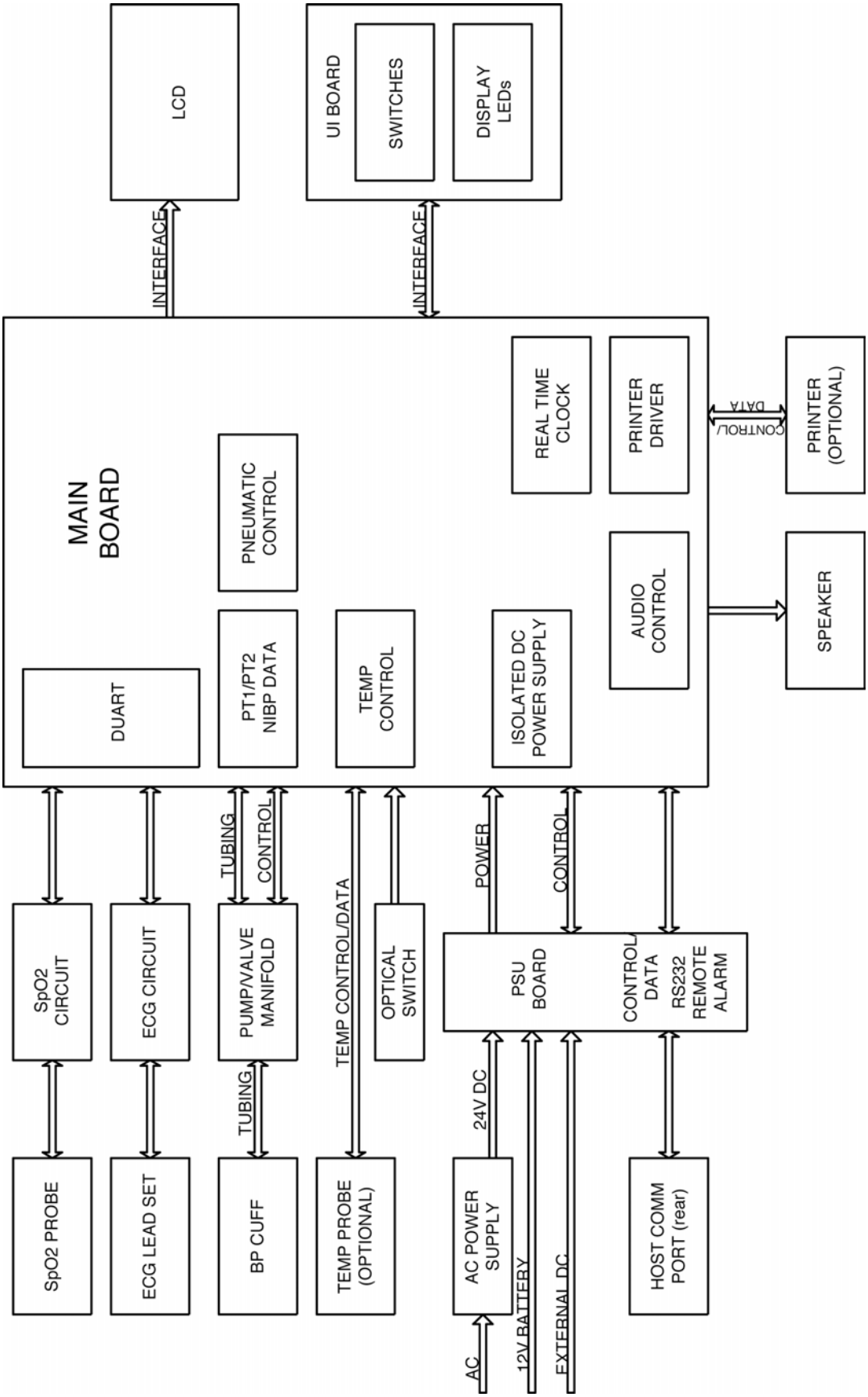
Signal	Name
Clk	Clock
Vsync	Vertical Sync
Hsync	Horizontal Sync
R[0:3]	Red bits (0:3)
G[0:3]	Green bits (0:3)
B[0:3]	Blue bits (0:3)

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

3.3.9 Printer (Optional)

The Monitor uses a thermal graphics printer. The printer requires a 5V supply for its logic circuitry and 12V (nominal) for the motor. The power and data lines are connected to the Main Board by a 40-way cable. 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.


LCD
UI BOARD
SWITCHES
DISPLAY LEDs
INTERFACE
INTERFACE
MAIN BOARD
DUART
PT1/PT2 NIBP DATA
PNEUMATIC CONTROL
TEMP CONTROL
ISOLATED DC POWER SUPPLY
REAL TIME CLOCK
PRINTER DRIVER
AUDIO CONTROL
CONTROL
DATA
PRINTER (OPTIONAL)
SPEAKER
TUBING
CONTROL
TEMP CONTROL/DATA
POWER
CONTROL
SpO2 CIRCUIT
ECG CIRCUIT
PUMP/VALVE MANIFOLD
OPTICAL SWITCH
PSU BOARD
CONTROL DATA
RS232
REMOTE ALARM
TUBING
24V DC
SpO2 PROBE
ECG LEAD SET
BP CUFF
TEMP PROBE (OPTIONAL)
AC POWER SUPPLY
HOST COMM PORT (rear)
AC
12V BATTERY
EXTERNAL DC

SECTION 4.
GENERAL MAINTENANCE

SECTION 4. GENERAL MAINTENANCE

4.1 INTRODUCTION

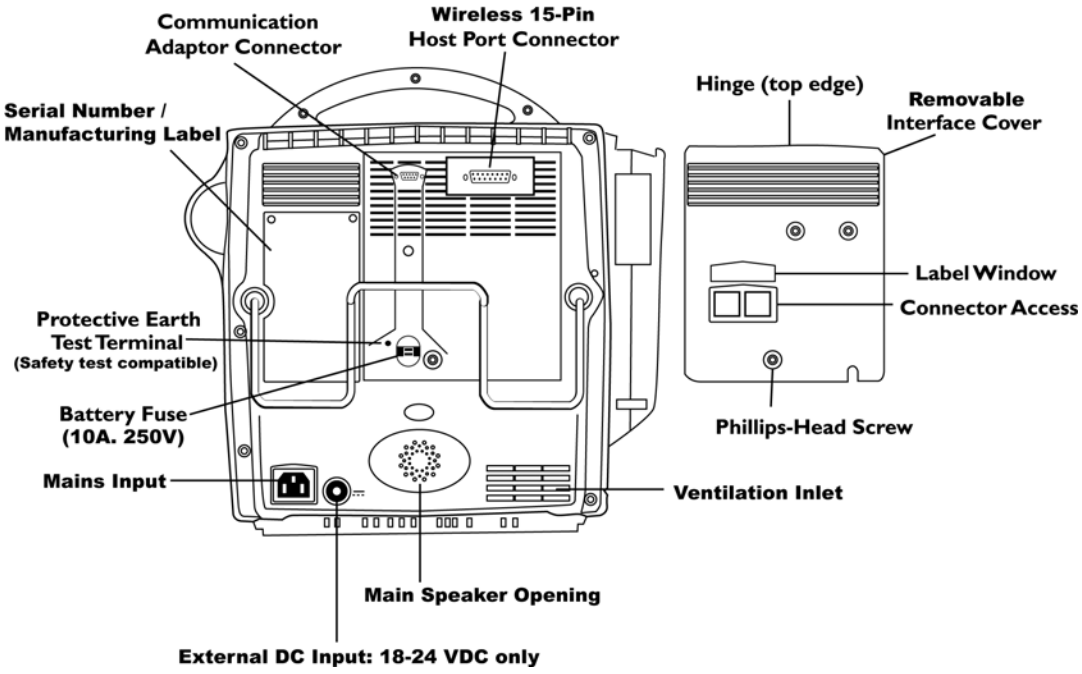
This section contains general DINAMAP PRO 1000V3 Monitor service procedures, including alarm code interpretation, service mode operation, periodic maintenance, and battery care.

4.2 SETTING UP THE DINAMAP PRO 1000V3 MONITOR FOR THE FIRST TIME

4.2.1 Unpacking and Preparation for Installation

Unpack and identify the contents of all shipping materials:

1. Remove the Monitor.
2. Unpack the AC cord but ***do not*** plug the Monitor in at this time.
3. Turn the Monitor to the backside for access to the Host Comms Cover.

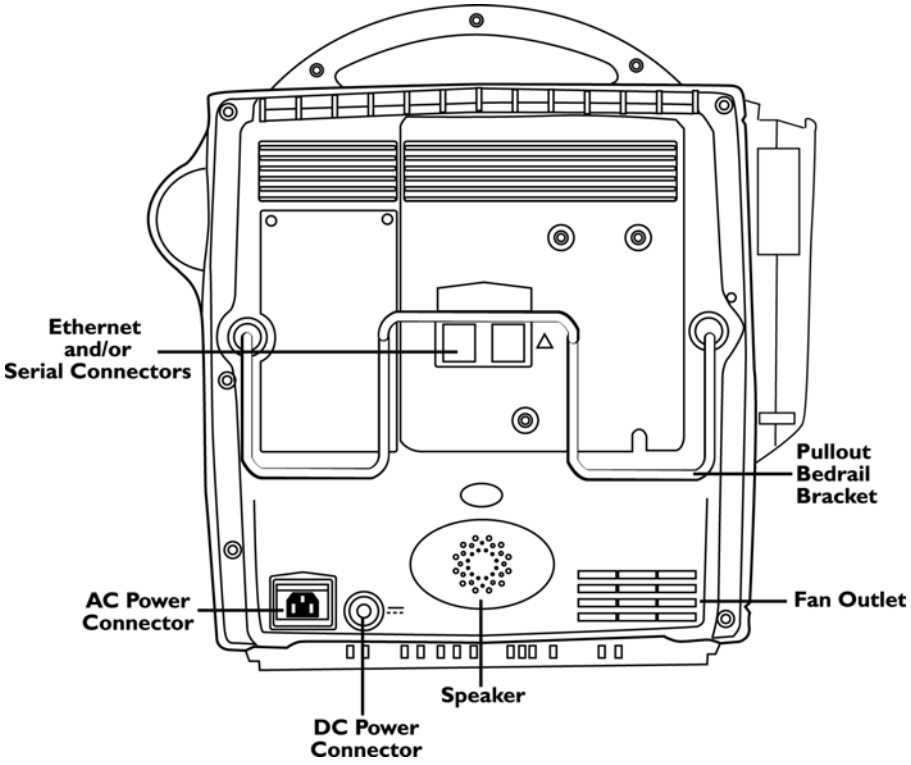


Rear View of Monitor

4. Use a Phillips-head screwdriver to remove the single screw that secures the Host Comms cover.
5. The Battery fuse and the Fuse Holder are not connected at time of shipment. Locate and remove the fuse and fuse.
6. Identify the Battery Fuse holder located within the Host Comms

well, behind the Host Comms cover, near the lower left side.
Note: The battery is not located behind the Host Comms cover.

7. Insert the Battery Fuse into the Battery Fuse holder.
8. Press the Battery Fuse Holder into the Battery Fuse mount using thumb pressure until it is securely snapped in place.
9. Replace the Host Comms cover; refasten the Phillips screw. Tighten using hand-tools only.
10. Plug the AC cord into the AC Mains input at the back of the Monitor.



Rear View of Monitor

11. 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.

    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.

4.2.2 Set the Date and the Clock

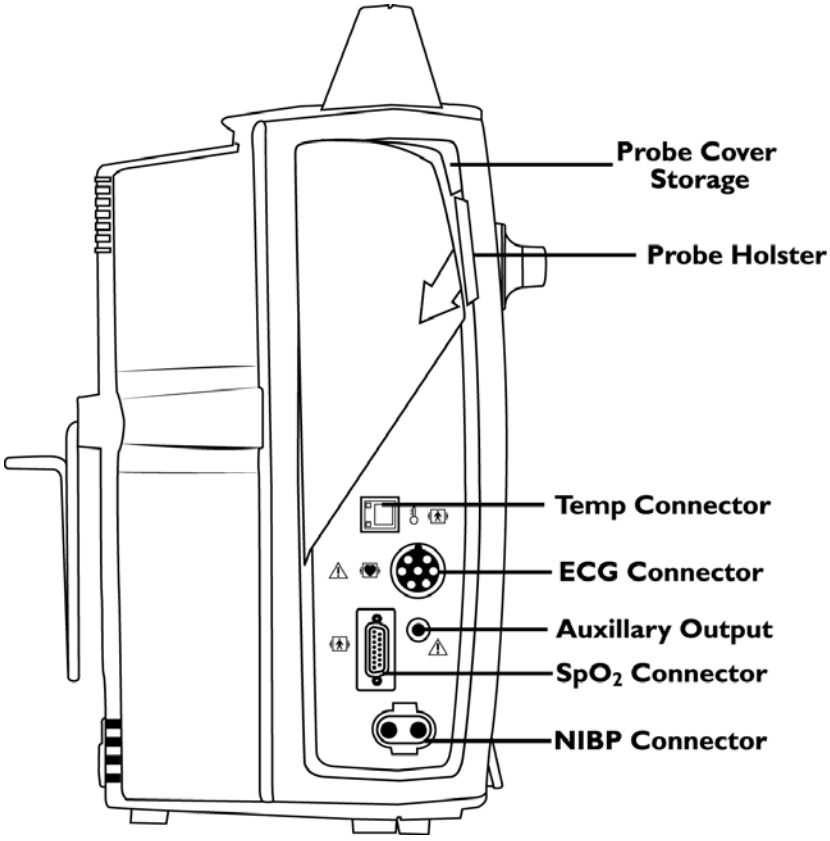
The Monitor uses a *Select*Knob to navigate through the menu systems. Rotating the *Select*Knob moves the arrow cursor, and pressing the *Select*Knob makes the selection.

1. Power on the Monitor using the **OFF/ON** button.
2. Use the *Select*Knob to select the ***no*** option when the Monitor prompts to admit a new patient.
3. Press or turn the *Select*Knob to access the main menu.
4. Turn the *Select*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 *Select*Knob.
5. Turn the *Select*Knob to scroll down the menu to highlight the **Adjust date & time** option. Press the *Select*Knob to continue.
6. Turn the *Select*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 *Select*Knob. The field is displayed in a box. Turn the *Select*Knob to the desired number and press the *Select*Knob.
7. After all of the settings are changed, use the *Select*Knob to scroll down and highlight the **set new time and date** option. Press the *Select*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 *Select*Knob.

   A pop-up window displays the message, *Clearing all trends, and waveforms*, to confirm that the function is processing.

4.2.3 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 Monitor in such a way that only one parameter is functioning at a time.



Left Side View of Monitor

Functional tests to be performed:

- 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 GO/STOP hardkey on the front to begin the NIBP cycle.
- Connect the supplied temperature probe to the corresponding connection (see illustration above). A predictive temperature begins once the probe is removed from the holster on the left side. Replace the probe after completion of the Temp cycle.

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 DOC-10.

Masimo 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.
- 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.
    1. Set the simulator to normal heart rate.
    2. Set ECG amplitude to 1.5mV, BPM to 80.
    3. Set respirations to 20 RPM and the delta ohms to 1.0.
    4. Verify that the ECG waveform is displayed.
    5. Sequentially remove and reattach leads I, II, and III, and verify each time that **LEAD OFF** displays.
    6. From the ECG menu, select **turn parameter off** option.

4.3 PERIODIC MAINTENANCE

4.3.1 Required

Perform the following maintenance procedures as required.

4.3.1.1 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.

4.3.1.2 Cleaning of the Monitor

CAUTION!

Do not clean Monitor with isopropyl alcohol or other solvents.

Do not immerse unit.

Wipe the exterior of the Monitor with a cloth slightly dampened with a mild detergent or normal hospital bactericides. Use dishwashing detergents such as:

IVORY® and JOY®	(registered trademarks of Procter & Gamble Corp.)
PALMOLIVE®	(registered trademark of Colgate-Palmolive Corp.).

4.3.1.3 Cleaning of Accessories

Clean the adult cuffs supplied for use with the Monitor by hand washing in warm, soapy water. However, take care to avoid entry of water into the cuff and hoses at any time. If water enters the cuff, dry the cuff by passing air through it.

The neonatal cuffs are for single patient use - discard if they become soiled.

Clean cuffs and hoses with a cloth slightly dampened with mild detergent.

Do not immerse hoses.

Do not immerse cuffs without prior application of cuff hose caps.

Clean SpO_2 sensor surface before and after each patient use. Reusable sensors can be wiped with a 70% alcohol solution. If low level subsection is required, wipe with a 1:10 bleach solution. Do not use undiluted bleach (5-5.25% sodium hypochlorite) or any other cleaning solution other than those recommended here or in the directions for use for the sensor being used. Permanent damage to the sensor could occur. Do not immerse the sensor in water or these cleaning solutions because the sensor and its connector are not liquid proof. Do not sterilize the sensor by irradiation, steam autoclave, or with ethylene oxide. Refer to directions or use for the appropriate NELLCOR® sensor.

Follow manufacturer's instructions for cleaning ECG lead wires and cable. Compatible cleaning and disinfecting solutions are dishwashing detergents such as:

- IVORY® and JOY® (registered trademarks of Procter & Gamble Corp.)
- PALMOLIVE® (registered trademark of Colgate-Palmolive Corp.).
- Chlorine bleach disinfectant, 5.25%, three-quarter cup per gallon of water.

CAUTION! **Do not apply isopropyl alcohol to the Monitor - some parts can become marred and cracked.**

- Isopropyl alcohol (for accessories only).

- Cidex Formula 7 (registered trademark of Johnson & Johnson Medical Products, Inc.) or pHisoHex (registered trademark of Winthrop-Breon Laboratories).

Quaternary-based germicidal detergents such as:

- VESTAL INSURANCE® (registered trademark of the Vestal Corp.).
- HI-TOR PLUS® (registered trademark of the Huntington Corp.).
- VIREX® (registered trademark of S.C. Johnson & Son Corp.).

For the above, follow manufacturers' recommendations for dilution rate and use. These recommendations are not an endorsement of the manufacturers or of the effectiveness of these materials for cleaning or disinfecting.

4.3.1.4 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.

4.3.2 Annual Procedures

Perform the test procedures described in paragraph 4.8 every twelve months, or whenever the accuracy of any reading is in doubt.

NOTE: An internal, 3.6V NiMh battery acts as an alarm backup and maintains the nonvolatile RAM memory when the Monitor is off or away from AC mains. A system alarm message is generated if backup battery replacement is required.

4.4 CARE OF STORAGE BATTERIES

The Monitor uses one nickel-metal-hydride (NiMH) storage battery. The battery can be charged at any time without reducing the charging capacity.

4.4.1 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. 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.

4.4.2 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.

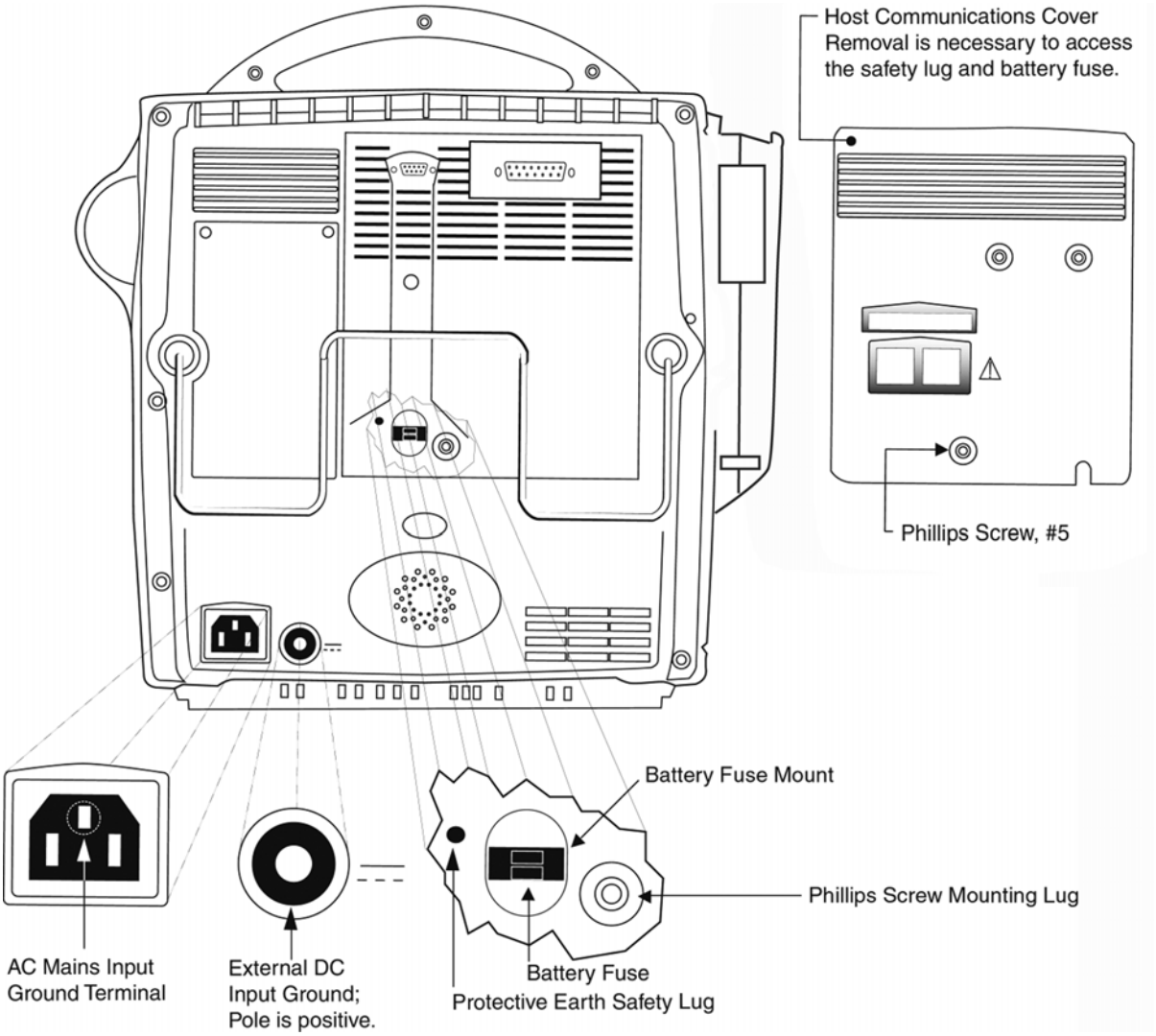
- Batteries should be charged before first use or after prolonged periods of storage.
- The battery should be charged before use, as a charged battery loses some charge when left in storage.
- The battery should be charged at room temperature (59° F - 86° F; 16° C - 30° C).
- It is normal for the battery 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 fully charged once a month to ensure optimum performance.

4.4.3 Battery Troubleshooting

Trouble	Probable Cause	Remedy
Battery inoperative or does not last very long.	Battery not fully charged. Battery in long-term storage or nonuse.	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).

4.5 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 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 External DC connector ground is less than 1Ω.

AC Mains Leakage – Normal Polarity For the following tests, 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	For the following tests, 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.
ECG Leakage	Using ECG probe adapter, verify that the leakage from the ECG circuit to earth ground is less than 50 μA.
Temperature Leakage	Using Temperature probe adapter, verify that the leakage from the Temperature circuit to earth ground is less than 150 μA.
SPO2 Leakage	Using SPO2 probe adapter, verify that the leakage from the SPO2 circuit to earth ground is less than 150 μA.

4.6 HI-POT TESTS

Hi-Pot testing is done on every unit at the factory and should not be repeated unnecessarily nor performed more often than required. (If unit is opened for repair, Hi-Pot testing is required otherwise hi-pot test may be exempted.)

Note: If the necessary Hi-Pot equipment is not available, an alternate test using a Safety Analyzer can be used. Refer to Section 4.7.

CAUTION! High voltage will be applied to the monitor under test when the hi-pot START switch is activated.

4.6.1 AC Mains Hi-Pot

1. Set the hi-pot timer for 1 minute.
2. If not already set, set the hi-pot TEST VOLTAGE to 1.5 kilovolts AC. To set the hi-pot TEST VOLTAGE for the first time:
    a. Turn the hi-pot power switch off.
    b. Disconnect the cables from the front of the hi-pot.
    c. Shut off the timer.
    d. Push on the START switch.
    e. Adjust the TEST VOLTAGE knob until the meter reads 1.5 kilovolts AC.
    f. Push **STOP** and turn timer back on.
    g. Connect the hi-pot cables to the front of the hi-pot.
3. **Turn the hi-pot power switch off.**
4. Plug a power cord into the monitor.
5. Connect the HOT lead from the hi-pot tester to the power cord line and neutral leads.
6. Connect the GND lead from the hi-pot tester to the power cord earth ground lead.
7. **Turn the hi-pot power switch on**.
8. Momentarily raise the hi-pot START switch to start the test.
9. If the hi-pot does not alarm before the timer expires, the monitor passed the test.
10. **Turn the hi-pot power switch off**.

4.6.2 ECG / SPO2 / Temp Hi-Pot

1. **Turn the hi-pot switch off**.
2. Set-up the hi-pot tester to test at 1.5 kilovolts AC for 1 minute (as in the previous test).
3. Insert the ECG, SPO2 and Temperature test adapters into the monitor under test.
4. Connect the GND hi-pot test cable to the AC MAINS cable earth ground.
5. Connect the HOT hi-pot test cable to the ECG test adapter.
6. **Turn the hi-pot power switch on**.
7. Momentarily raise the hi-pot START switch to start the test.
8. If the hi-pot does not alarm before the timer expires, the monitor passed the test.
9. Repeat steps 5 through 8 individually for the SPO2 and Temperature adaptors.

10. Turn the hi-pot power switch off and remove hi-pot cables.
11. Disconnect the probe adapters from the monitor under test.

4.7 ALTERNATE HI-POT TEST

Required Equipment:

-AC Inlet test adapter (Line and Neutral shorted, earth ground separated)
-ECG test adapter (ECG connector with all leads shorted)
-SPO2 test adapter (SPO2 connector with all leads shorted)
-Temperature test adapter (Temperature connector with all leads shorted)
-DC Jack test adapter (DC jack with both leads shorted)
-Dynatech Nevada 235a (DNI Safety Analyzer) or equivalent
-Alligator clip lead
-Pro1000 monitor (UUT)

Test Procedure:

Note: Test may be performed using either 250VAC or 125VAC; depending on country of origin. Record test for 250VAC in Appendix A (of this section) and test for 125VAC in Appendix B (of this section).

4.7.1 Earth to Protective Ground Continuity

1. Insert the AC inlet test adapter and the DC Jack test adapter.
2. Measure the resistance between the AC Mains ground pin and the DC Jack test adapter.
3. Record the resistance in step 5.1.3 of appendix A or B.

Note: Sections 4.7.2 and 4.7.3 apply AC Mains voltage to the UUT's AC mains connector. Leakage current across AC Mains isolation is measured.

4.7.2 AC Mains Leakage (Normal Polarity)

1. Plug Pro1000 into the (DNI) Safety Analyzer.
2. Select ground leakage conductor on the DNI Safety analyzer.
3. Apply 250/125VAC at the UUT's AC Mains input, in normal polarity.
4. Record the leakage in step 5.2.4 of appendix A or B.
5. Push the open ground switch.
6. Record the leakage in step 5.2.6 of appendix A or B.
7. Push the open ground switch and the open neutral switch.
8. Record the leakage in step 5.2.8 of appendix A or B.

4.7.3 AC Mains Leakage (Reverse Polarity)

1. Apply 250/125VAC at the UUT's AC Mains input, in reverse polarity.
2. Record the leakage in step 5.3.2 of appendix A or B.
3. Push the open ground switch.
4. Record the leakage in step 5.3.4 of appendix A or B.
5. Push the open ground switch and the open neutral switch.
6. Record the leakage in step 5.3.6 of appendix A or B.
7. Remove AC Mains voltage from the UUT.
8. Remove the test adapters from the unit.

Note: Sections 5.4 through 5.6 apply AC Mains voltage to patient cable connectors. Leakage current across patient isolation is measured.

4.7.4 Temperature Leakage (Perform on both connectors for V1/V2)

1. Install the temperature test adapter and plug UUT into DNI Safety Analyzer.
2. Connect the temperature test adapter, using the alligator clip lead, to the RA ECG lead output on the DNI Safety analyzer. This wire is used to connect AC line voltage to the temperature input connector in the following steps.
3. Select the Isolation test on the DNI Safety analyzer.

WARNING! **The next step puts the AC line voltage to the ECG lead outputs, alligator clip lead, and temperature test adapter.**

4. Press the isolation switch and hold to take a measurement.
5. Record the leakage in step 5.4.5 of appendix A or B.
6. Remove the test adapter from the unit.

4.7.5 SPO2 Leakage

1. Install the SPO2 test adapter and plug UUT into DNI Safety Analyzer.
2. Connect the SPO2 test adapter, using the alligator clip lead, to the RA ECG lead output on the DNI Safety analyzer. This wire is used to connect AC line voltage to the SPO2 input connector in the following steps.
3. Select the Isolation test on the DNI Safety analyzer.

WARNING! **The next step puts the AC line voltage to the ECG lead outputs, alligator clip lead, and SPO2 test adapter.**

4. Press the isolation switch and hold to take measurement.
5. Record the leakage in step 5.5.5 of appendix A or B.
6. Remove the test adapter from the unit.

4.7.6 ECG Leakage

1. Install the ECG test adapter and plug UUT into DNI Safety Analyzer.
2. Connect the ECG test adapter, using the alligator clip lead, to the RA ECG lead output on the DNI Safety analyzer. This wire is used to connect AC line voltage to the ECG input connector in the following steps.
3. Select the Isolation test on the DNI Safety analyzer.

WARNING! **The next step puts the AC line voltage to the ECG lead outputs, alligator clip lead, and ECG test adapter.**

4. Press the isolation switch and hold to take a measurement.
5. Record the leakage in step 5.6.5 of appendix A or B.
6. Remove the test adapter from the unit.

TEST RECORD (Appendix A)
250VAC

Model # Serial #

Step	Description	Min	Max	Actual	Pass	Fail	N/A
	Safety Tests at 250VAC						
1	System to Protective Ground Continuity (Ω)	0	<1				
2	Normal no-fault leakage (uA)	0.0	5.0				
3	Normal open-ground leakage (uA)	50	200				
4	Normal open-ground and open-neutral leakage (uA)	100	250				
5	Reverse no-fault leakage (uA)	0.0	5.0				
6	Reverse open-ground leakage (uA)	50	200				
7	Reverse open-ground and open-neutral leakage (uA)	100	250				
8	Upper Temp leakage (uA) (V1/V2 only)	4	20				
9	Lower Temp leakage (uA) (V1/V2 only)	4	20				
10	Temp leakage (uA) (V3 only)	25	100				
11	SPO2 leakage (uA)	25	100				
12	ECG leakage (uA)	4	20				

TEST RECORD (Appendix B)
125VAC

Model # Serial #

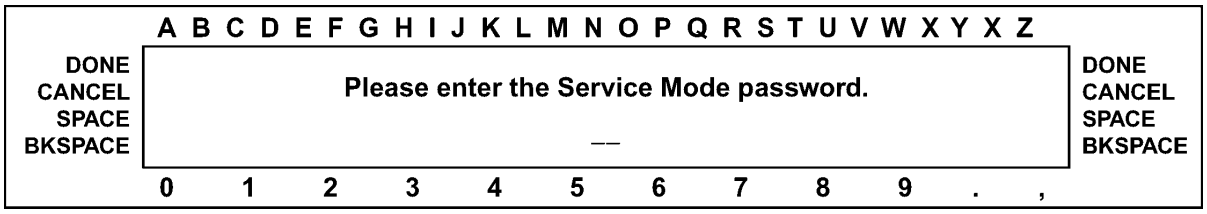
Step	Description	Min	Max	Actual	Pass	Fail	N/A
	Safety Tests at 125VAC						
1	Earth to Protective Ground Continuity (Ω)	0	<1				
2	Normal no-fault leakage (uA)	0.0	5.0				
3	Normal open-ground leakage (uA)	20	75				
4	Normal open-ground and open-neutral leakage (uA)	30	100				
5	Reverse no-fault leakage (uA)	0.0	5.0				
6	Reverse open-ground leakage (uA)	20	75				
7	Reverse open-ground and open-neutral leakage (uA)	30	100				
8	Upper Temp leakage (uA) (V1/V2 only)	2	10				
9	Lower Temp leakage (uA) (V1/V2 only)	2	10				
10	Temp leakage (uA) (V3 only)	20	60				
11	SPO2 leakage (uA)	20	60				
12	ECG leakage (uA)	2	10				

4.8 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:

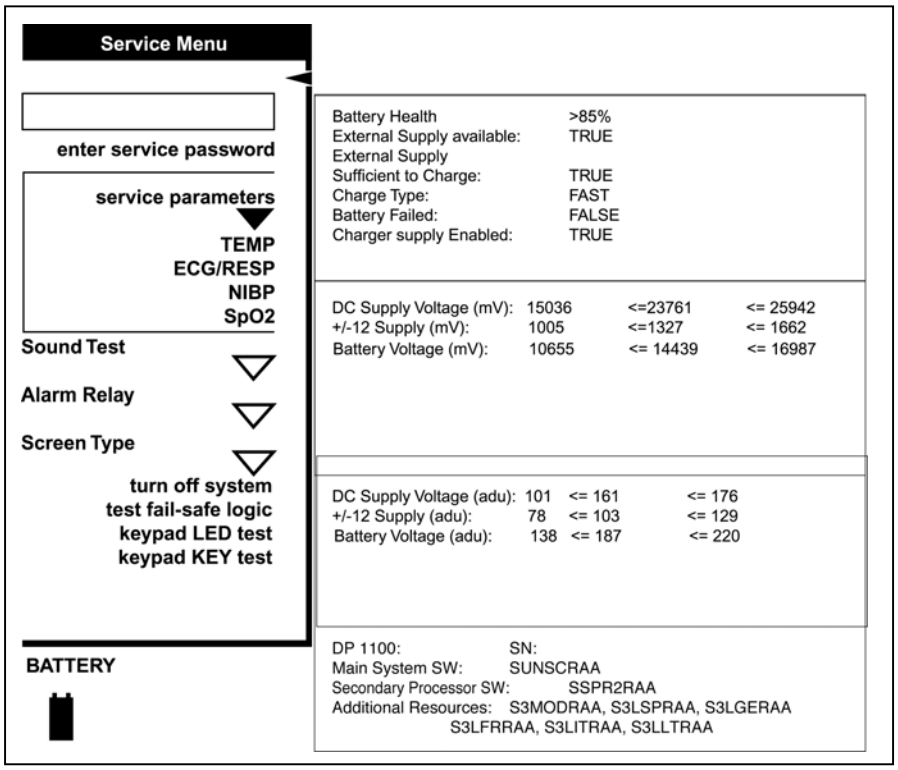
1. Power on the Monitor using the **OFF/ON** button.
2. Use the *Select*Knob to select the ***no*** option when the Monitor prompts to admit a new patient.
3. Press or turn the *Select*Knob to access the main menu.
4. Turn the *Select*Knob to scroll down the menu. The arrow at the bottom of the list indicates that the list continues on a second screen. Highlight the **other system settings** option and press the *Select*Knob.
5. Highlight the **go to service mode** option and press the *Select*Knob. Turn the *Select*Knob and press the 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 *Select*Knob and move the arrow to the desired number, then press the knob to select the number. Enter the service mode password, **2-2-1-3**.
7. After the password is selected, turn the *Select*Knob to the **DONE** option and press the 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: OFF/ON and AUTO-BP. To make any changes to the Service Menu, the password has to be entered: press the *Select*Knob to enter service password.

9. At this point the Service Mode main screen should be present in the main display, as shown below. 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.

4.8.1.SpO_2 Tests

4.8.1.1 For Monitors With Nellcor SpO_2:

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 rate sent to the Nellcor sensor by the SpO_2 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.

Nellcor recommends use of the SRC-MAX Portable Tester for use with PRO Monitors equipped with the Nellcor SpO_2 system.

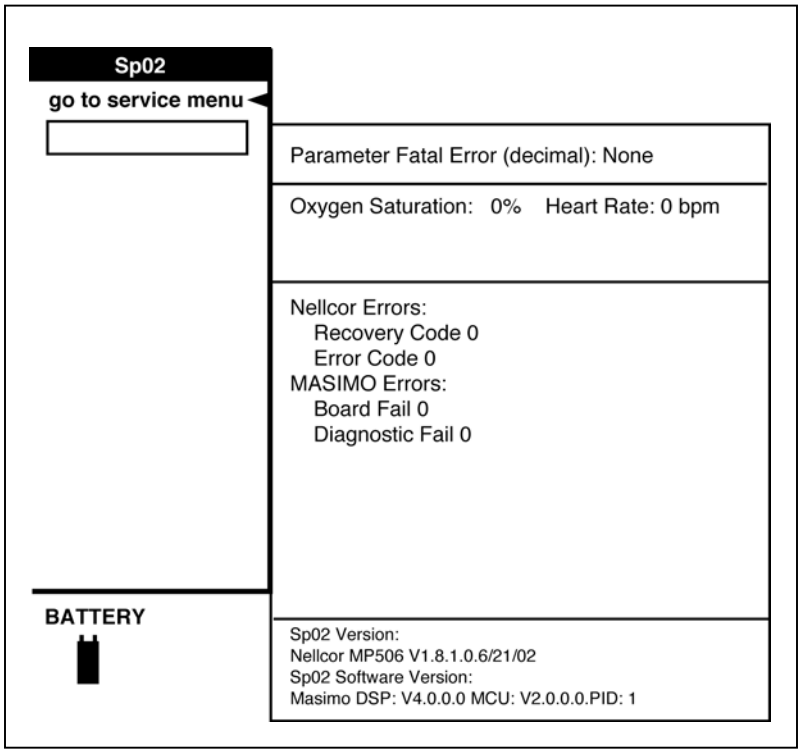
4.8.1.1 For Monitors With Masimo SpO_2:

Masimo recommends BIO-TEK SpO_2 simulators.

Test Procedure:

1. Disconnect all sensor cables from the SpO_2 Parameter, and ensure that the SpO_2 parameter is listed within the main Service Menu.

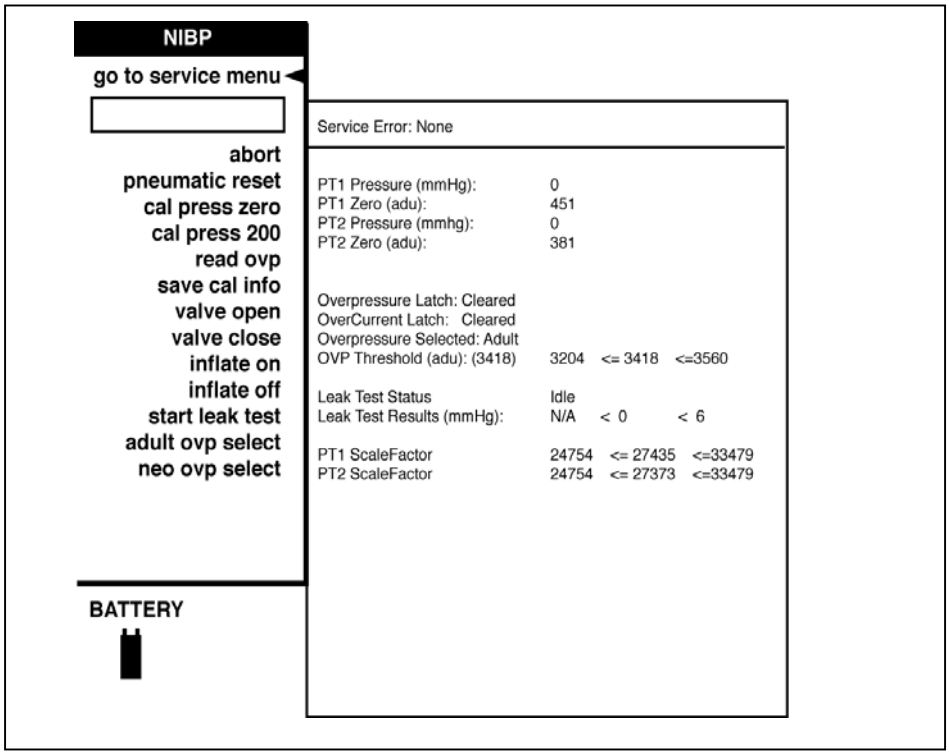
2. From the Service Menu, turn and press the *Select*Knob to select the SpO_2 service parameter. The SpO_2 service menu displays. The text under Error and Version sections reflects the installed type of SpO_2. The illustration shows both text examples.



SpO_2 Service Menu

3. All SpO_2 mode operations take place with Masimo and Nellcor power-up defaults. No menu settings are reflected.
4. Connect the appropriate SpO_2 simulator and cable to the side interface panel SpO_2 connector. Be sure it is fully seated in the socket.
5. Set simulator for 98% saturation and 80BPM. Verify that the Monitor responds accordingly by displaying the proper heart rate value and saturation value.

4.8.2 NIBP Tests



NIBP Service Menu

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

4.8.2.1 Leak Test

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.

Inspection of pneumatic hose O-rings is recommended once a year.

1. Using the calibration kit (part number 320246), an adult cuff and air hose, and a manometer, set up the equipment as shown in Figure 4-1. 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.

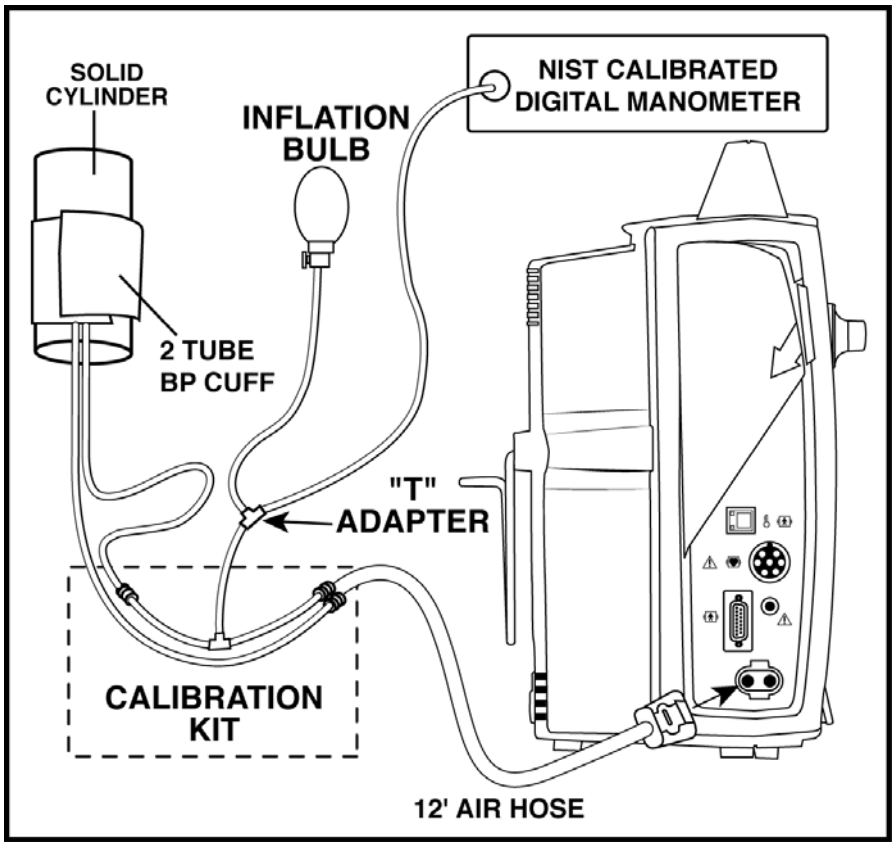


Figure 4-1. NIBP Test Setup

2. From the Service Menu, turn and press the *Select*Knob to select the **NIBP** service parameter.
3. Turn and press the *Select*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 to Step 9.
7. Using the calibration kit (part number 320246), an adult cuff and air hose, and a manometer, set up the equipment as shown in Figure 4-2.

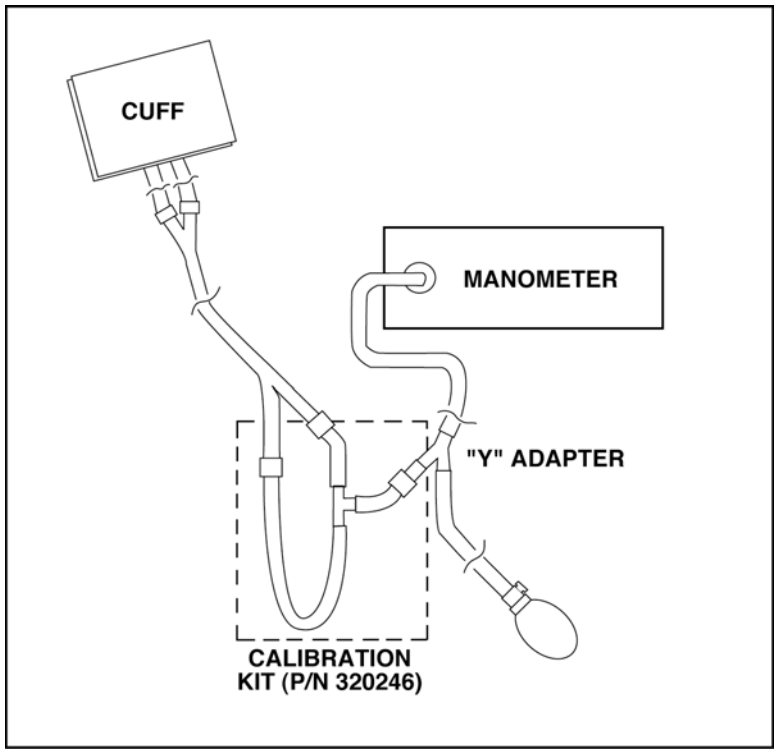


Figure 4-2 Leak Test Setup

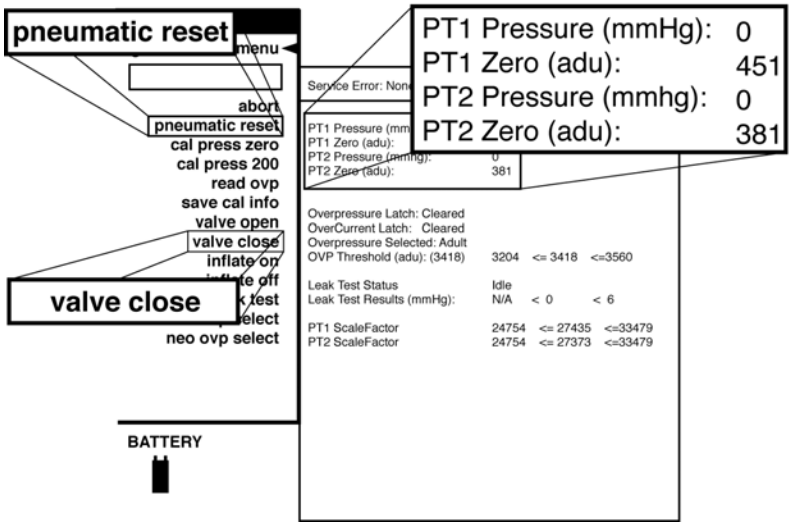
8. Close the pressure release valve on the manometer inflation bulb and slowly increase the pressure to 200-mmHg ±1 mmHg.
9. Verify the pressure indicated on the manometer remains within 5 mmHg of 200 mmHg for 60 seconds. If not, either the cuff or hose or both may be defective. If the cuff and hose 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.

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.

4.8.2.2 NIBP Calibration Check

1. Using the calibration kit (part number 320246), an adult cuff and air hose, and a manometer, set up the equipment as shown in Figure 4-1. Connect the hose to the NIBP Parameter. Make sure all fittings are tight, and that the inflation bulb valve is closed tightly.



NIBP Service Menu

2. From the Service Menu, turn and press the *Select*Knob to select the **NIBP** service parameter.

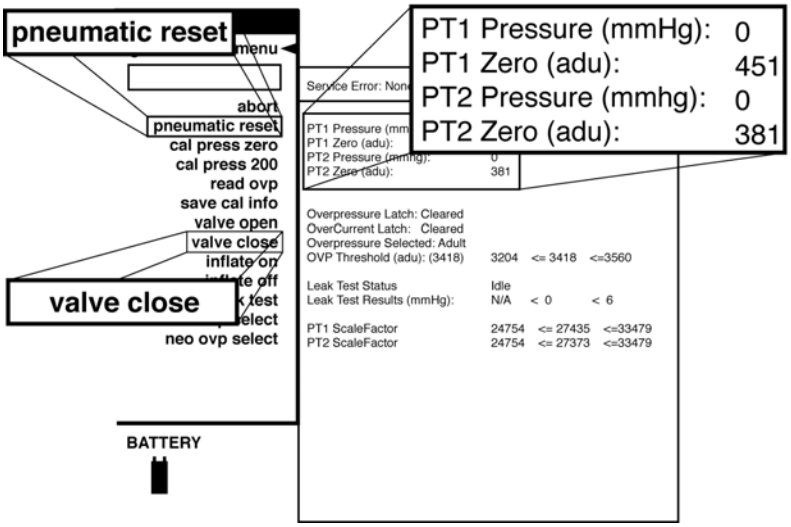
3. Turn and press the *Select*Knob to select **pneumatic reset**.
4. Turn and press the *Select*Knob to select **valve close**.
5. Observe that both **PT1 Pressure** and **PT2 Pressure** equal initial values of zero mmHg **(0 mmHg)**.
6. Connect the pneumatic hose to the Monitor's NIBP port.
7. Fold 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 (paragraph 4.8.2.1) 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 one 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.
11. Verify the system linearity by repeating steps 8 & 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 paragraph 4.8.2.3.

4.8.2.3 Pressure Recalibration

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.

1. Always enter Service Mode with the password, as described in paragraph 4.8, before attempting to recalibrate equipment.

2. Using the calibration kit (part number 320246), an adult cuff and air hose, and a manometer, set up the equipment as shown in Figure 4-1. Do not connect the pneumatic hose to the NIBP port yet.
3. From the Service Menu, Turn and press the *Select*Knob to select the **NIBP** service parameter.



NIBP Service Menu

4. Turn and press the *Select*Knob to select **pneumatic reset**.
5. Turn and press the *Select*Knob to select **valve close**.
6. Observe that both **PT1 Pressure** and **PT2 Pressure** display initial values of **0** on the menu.
7. Turn and press the *Select*Knob to select **cal press zero**. Observe that the message **Inflate System to 200 mmHg Then Hit 'Cal Press 200'** is displayed on menu.
8. Connect hose to NIBP Parameter.
9. 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 valve on inflation bulb is closed tightly. If there is doubt about the integrity of the system, perform the leak test (paragraph 4.8.2.1) before continuing.
10. Close the pressure release valve on the manometer inflation bulb and manually pump up

the pressure until the manometer indicates approximately 220 mmHg.

11. Allow the pressure to stabilize for at least a 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.
12. Turn and press the *Select*Knob to select **cal press 200**, but do not press the knob.
13. When the manometer indicates exactly 200 mmHg, press the Rotor. Observe that system pressure is released, and the message: **!!!!! CAL INFO NOT SAVED!!!!!** is displayed on menu.
14. Turn and press the *Select*Knob to select **save cal info**. If the system is operating normally, the menu displays **Service Error: None**, and the calibration setting is saved.
15. Repeat the calibration check procedure (paragraph 4.8.2.2) to confirm the calibration setting.

4.8.2.4 Overpressure Tests

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.

1. Using the calibration kit (part number 320-246), an adult cuff and air hose, and a manometer, set up the equipment as shown in Figure 4-1. 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 *Select*Knob to select the **NIBP** service parameter.
3. Turn and press the *Select*Knob to select **pneumatic reset**.
4. Turn and press the *Select*Knob to select **valve close**.
5. Observe that the menu displays **Overpressure Selected Adult**. If not, turn and press the *Select*Knob to select **adult ovp select**.
6. Turn and press the *Select*Knob to select **inflate on**. The pump should begin to inflate the system.

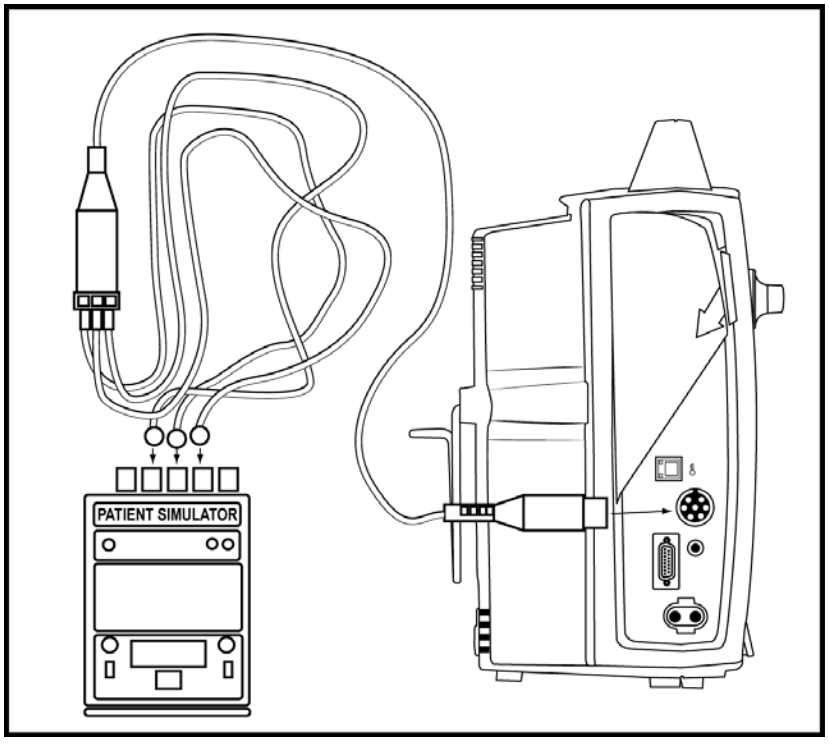
7. Watch the pressure indication increase on the manometer, and observe that the pump is shut down and the pressure is released when the manometer indicates in the range of 300 to 330 mmHg. Observe that the menu displays **Service Error: None**.
8. Turn and press the *Select*Knob to select **pneumatic reset**.
9. Turn and press the *Select*Knob to select **valve close**.
10. Turn and press the *Select*Knob to select **neo ovp select**. Observe that the menu displays **Overpressure Selected Neo**.
11. Turn and press the *Select*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: None**.
13. If the overpressure test results in an "out of tolerance" condition, contact GE Medical Systems *Information Technologies* at 877-274-8456 for assistance.

4.8.3 ECG Tests

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 ECG simulator to 80BPM Paced.
2. Set ECG simulator amplitude to 1.0mV
3. Press **ON/OFF** button to power up UUT.
4. Select **no** at new patient prompt. Set the ECG high alarm to **150** and the low alarm to **50**.
5. Verify that the ECG waveform is displayed on LCD display.
6. From ECG menu, select **Pace 1** and verify paced marker on display waveform.
7. From ECG menu, select **Pace 2** and verify paced marker on display waveform.
8. From ECG menu, select **pace detection off**. Turn paced off on simulator.

9. After unit has learned the patient waveform change the BPM to 30.
10. Verify “HR LOW” alarm with HR 30 ±4 on unit.
11. Set ECG simulator to 160BPM
12. Verify that the ECG waveform is displayed on the LCD display.
13. Verify “HR HIGH” alarm with HR 160 ± 4 on unit.
14. Set ECG simulator to 80 BPM.
15. Set ECG high alarm to **200** and low alarm to **10**.
16. Set ECG simulator to VTACH.
17. Verify “ECG VTACH” alarm and HR is 180 ± 4.
18. Set ECG simulator to 80 BPM
19. Press **silence** hardkey to acknowledge the alarm and verify HR is 80 ± 4.
20. Connect scope to analog output using 1/8” stereo plug (+ to ring, - to shield).
21. Verify that the ECG waveform is displayed on the scope (amplitude approximately 1V).
22. Disconnect scope from analog output.
23. Remove and reattach leads I, II, III, sequentially and verify “ECG LEAD FAIL” alarm on display.
24. From ECG menu, select **turn parameter off**.



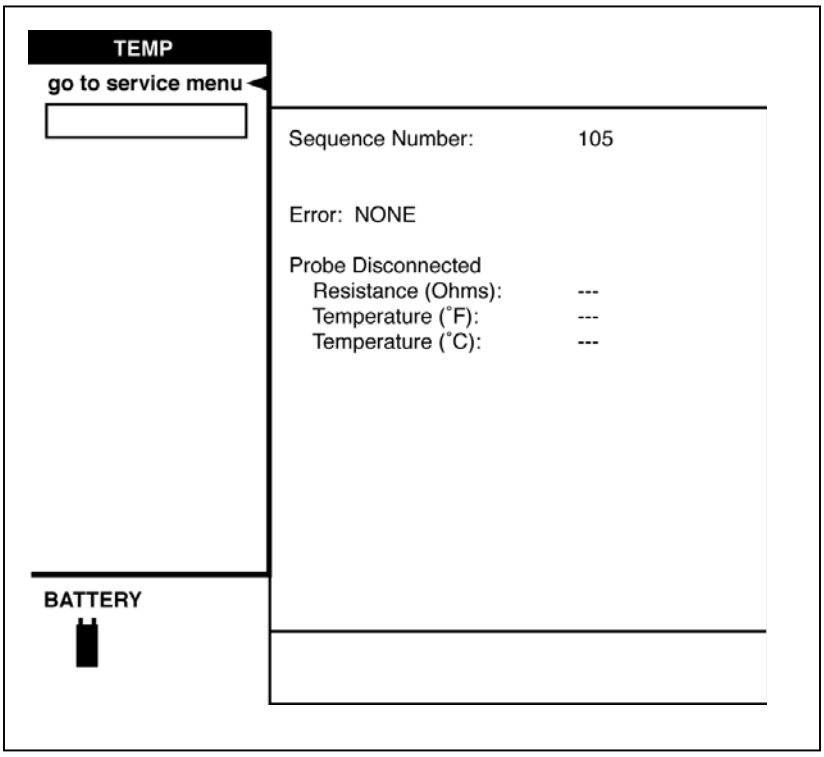
4.8.4 RESP Test

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.
6. Set simulator Respiration to 60 BrPM.
7. Record and verify the UUT RESP reading.
8. From RESP menu, select turn **parameter off**.

4.8.5 TEMP Tests (if fitted)

The PRO 1000 temperature system uses ALARIS Model 2885 and 2886 temperature probes. This system is self-calibrating. The only maintenance required is to verify that the temperature functions work properly. These checks require an IVAC probe simulator (P/N TE 1811), available from ALARIS Medical Systems, Inc., San Diego, CA. (619) 458-7000. GE Medical Systems *Information Technologies* does not stock this tester.

1. Disconnect any temperature probe from the IVAC temperature connector.
2. From the Service Menu, turn and press the *Select*Knob to select the **TEMP** service parameter. The TEMP service menu displays as shown below.
3. To check the temperature system, connect the IVAC probe simulator to the temperature probe connector on the side interface panel and insert a temperature probe into the holster.
4. Set the probe simulator to 98.6, verify and record the displayed temperature is 98.6^{o}F +/-0.2^{o}F. Set the probe simulator for the other values (80.2 and 107.8) and verify and record the displayed temperatures.



Temperature Service Menu

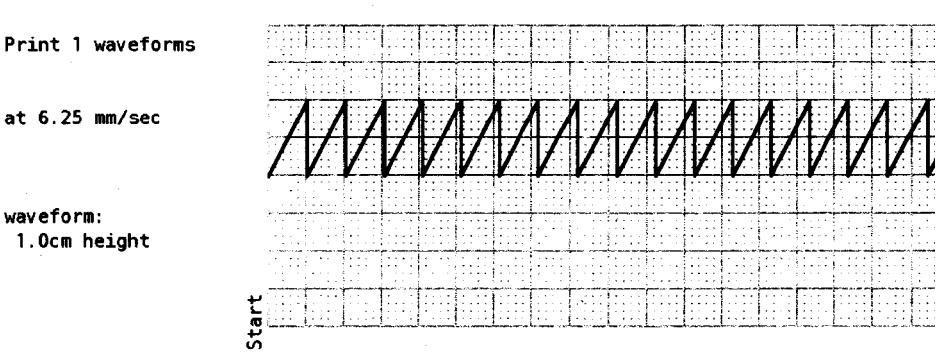
5. Set the probe simulator to B.P. Verify the temperature displayed is 106.0+/-0.2^{o}F and Probe indication is IN. Press the broken probe button and verify the monitor displays “Probe Disconnected”.
6. Set simulator for both Oral and Rectal and verify the correct probe type is indicated.
7. Remove and insert probe from holster and verify probe IN/OUT detection.

Calibration verification is complete. Disconnect the probe simulator and install the temperature probe. If the Monitor does not pass the calibration verification then contact customer service.

4.8.6 RECORDER TESTS

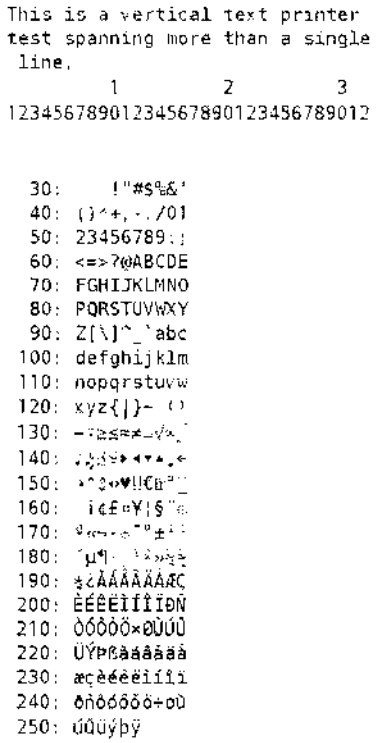
1. Ensure that paper has been loaded into the Recorder Parameter, and you are presently in the Service Mode.
2. From the Service Menu, turn and press the *Select*Knob to select the **RECORDER** test option. Turn and press the *Select*Knob to choose the

Print 1 Waveforms option. Turn and press the *Select*Knob to choose the **Wave Test 6.25mm/S** option. Verify that all printouts are of even tone and all pixels are present.



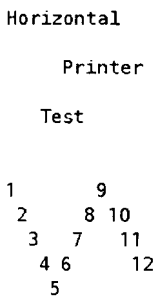
Sample 6.25 mm/sec – 1 waveform chosen

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 printout

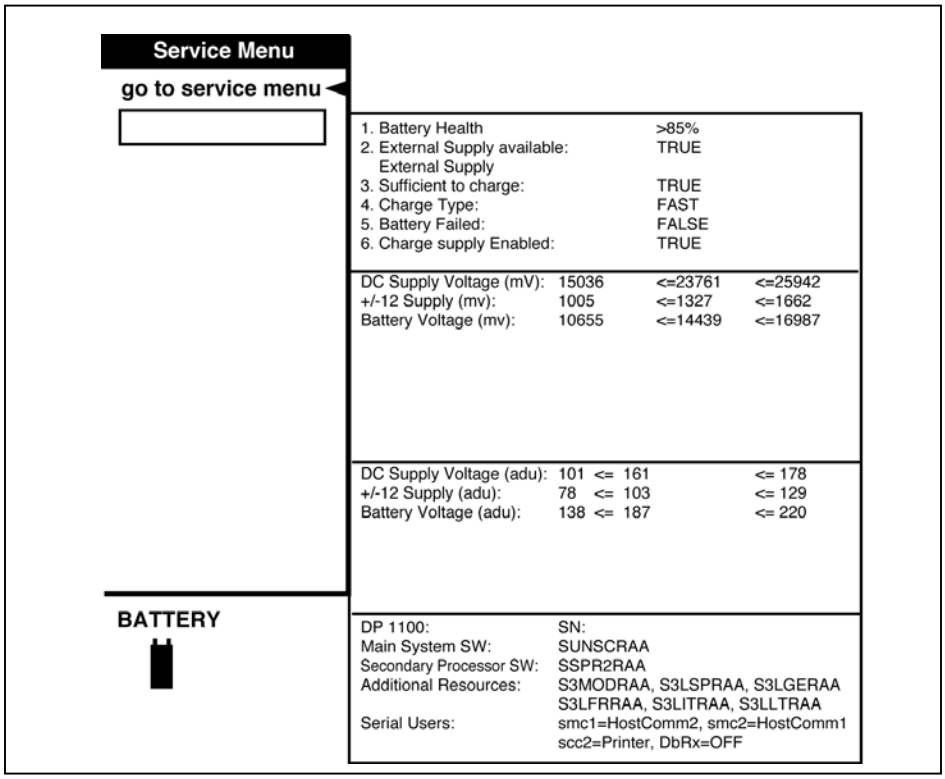
5. Select Horizontal Text test. Verify that the printed text is legible and evenly spaced.



Horizontal Text Test Printout

4.8.7 Battery Tests

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) and as an icon on the bottom-left 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 or Slow.

Battery Failed: Any result other than FALSE, indicates that the internal battery has suffered a failure and should be investigated.

Charger Supply Enabled: 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 or not installed, or the charge circuit may have failed. Also, if no external source of power is available, the Monitor registers a FALSE result.

4.8.7.1 Test Procedure:

1. Verify AC Mains indicator on front panel of unit near **OFF/ON** button 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 is lit near **OFF/ON** button.

Note: Battery life is dependent upon battery usage. A fully charged battery should last 120 minutes (+/- 10 min) using the following setup:
(NIBP: 5-min auto cycle with adult cuff. ECG, RESP, SpO2: Active. TEMP: predictive mode. Printer: printing 2 waveforms for 1 min every 20 min at 25 mm/sec.). If the battery cannot hold a charge for at least 120 minutes (+/- 10 min), we recommend replacing the battery.

4.8.8 Failsafe Logic Test

1. From the Service Menu, turn the *Select*Knob to select **test fail-safe logic**. A dialogue box displays:

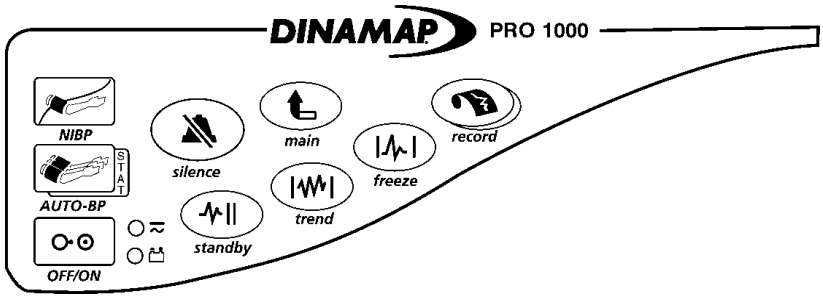
CAUTION!	This causes the system to freeze for approximately 2 seconds then enter the fail-safe mode. Continue?

2. Turn the *Select*Knob to the **yes** option and press the knob.

3. After two seconds, the system freezes, an alarm sounds, and the screen goes blank. Recycle the system power using the OFF/ON button. To return to the Service Mode, repeat the procedures as described in Section 4.8.

4.8.9 Keypad LED Test

1. From the Service Menu, rotate and press the *Select*Knob to select **keypad LED test**. Observe that each of the keys on the Monitor face, illuminate one key at a time. With the exception of the **OFF/ON** key, observe whether or not any of the keys fail to illuminate.



2. After all keys have been tested, press the *Select*Knob again to stop the test.

4.8.10 Keypad Key Test

1. From the Service Menu, rotate and press the *Select*Knob to select **keypad KEY test**. With the exception of the **OFF/ON** key, observe that each key press toggles the key LED color and produces a beep tone.
2. After all keys have been tested, press the *Select*Knob again to stop the test.

4.8.11 Sound Test

Verify that the Monitor produces tones of various pitches when this option is selected.

4.8.12 Communications Tests

4.8.12.1 Set up Terminal

1. Connect serial communication cable from PC to rear of UUT (DB15).
2. Invoke terminal program with settings:

9600 baud,
No parity,
8 bits,
1 stop bit,
flow = xon/xoff ,
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.

4.8.12.2 Configure UUT for Communication

1. Rotate the rotor 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, rotate the rotor 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.

4.8.12.3 Communication Test

1. 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…".

4.8.13 Remote Alarm Test

1. Install test plug assembly to DMM which inserts a 470Ω resistor across DMM terminals.

2. Use the DMM to measure voltage between pins 4 and 8 of DB15 connector (see Figure 5) and record the result.
3. Select *Alarm relay / ON*.
4. Measure and record voltage between pins 4 and 8 of DB15 connector.
5. Select *Alarm relay / OFF*.
6. Remove test plug assembly from DMM.

4.8.14 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.

4.9 SERVICE MODE EXIT

To exit the service mode and power off the Monitor, locate and press the key marked OFF/ON at the front of the Monitor.

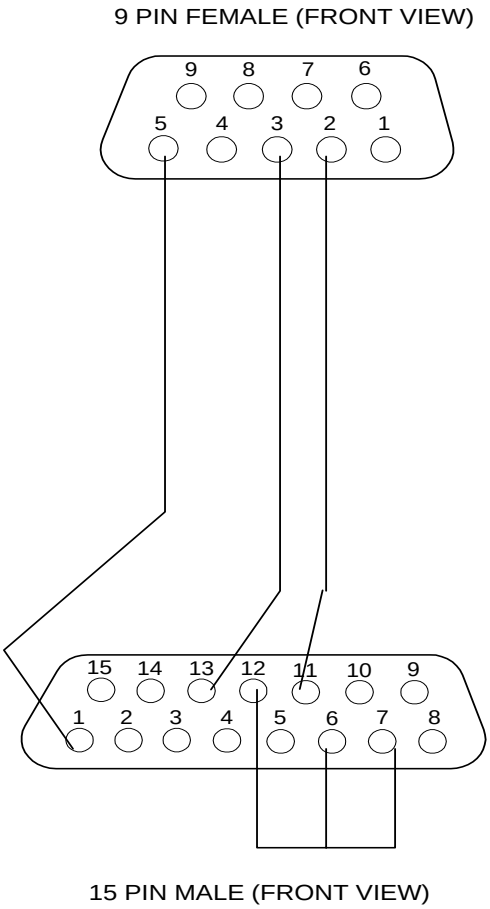


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Figure 4-3. SERIAL COMMUNICATION CABLE

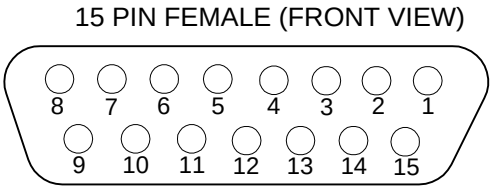


Figure 4-4. DB15 REAR PANEL CONNECTOR

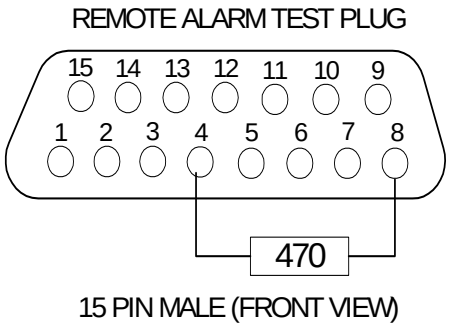


Figure 4-5. TEST PLUG ASSEMBLY

APPENDIX A:
Test Record

Model# _____

TEST RECORD

Serial#_____.

Step	Description	Min	Max	Actual	Pass	Fail	N/A
Safety Testing							
4.5	External DC to GND Resistance (m)	0	1000				
4.5	Normal no-fault leakage (µA)	0	500				
4.5	Normal open-ground leakage (µA)	0	500				
4.5	Normal open-neutral leakage (µA)	0	500				
4.5	Reverse no-fault leakage (µA)	0	500				
4.5	Reverse open-ground leakage (µA)	0	500				
4.5	Reverse open-neutral leakage (µA)	0	500				
4.5	ECG leakage (µA)	0	50				
4.5	Temp Leakage (µA)	0	150				
4.5	SPO2 Leakage (µA)	0	150				
Hi-Pot Testing							
4.6.1	AC Main Hipot (mA)	0	2.5				
4.6.2	ECG (mA)	0	1				
4.6.2	SPO2 (mA)	0	1.5				
4.6.2	Temp (mA)	0	1.5				
SpO_2 Testing							
4.7.1	SpO_2 reading at 98% Saturation	96	100				
4.7.1	BPM reading at 80BPM	76	84				
NIBP Testing (Perform in Service Mode)							
4.7.2.1	Leakage Test						
4.7.2.2	UUT Pressure - 50 mmHg	47	53				
4.7.2.2	UUT Pressure - 150 mmHg	147	153				
4.7.2.2	UUT Pressure - 250 mmHg	247	253				
4.7.2.4	Verify adult overpressure occurs between 300~330 mmHg						
4.7.2.4	Verify neo overpressure occurs between 150~165 mmHg						
4.7.2	Initial cuff inflation (Adult cuff)	161	195				
4.7.2	Systolic Reading (120/80 Adult)	107	133				
4.7.2	Diastolic Reading (120/80 Adult)	67	93				
4.7.2	Heart Rate reading @ 80 BPM (NIBP)	76	84				
4.7.2	Inflate/ Deflate cycle time <120 seconds						
4.7.2	Initial cuff inflation (Neonatal cuff)	94	151				
4.7.2	Systolic Reading (100/65 Neonatal)	87	123				
4.7.2	Diastolic Reading (100/65 Neonatal)	52	78				
ECG Testing (Perform in Monitor Mode)							
4.7.3	Verify Waveform						
4.7.3	Verify paced 1 marker on ECG signal						
4.7.3	Verify paced 2 marker on ECG signal						

4.7.3	Verify HR LOW alarm and BPM at 30	26	34				
4.7.3	Verify HR HIGH alarm and BPM at 160	156	164				
4.7.3	Verify ECG VTACH alarm and BPM at 180	176	184				
4.7.3	Verify ECG LEAD FAIL alarm						
RESP Testing (Perform in Monitor Mode)							
4.7.4	Verify Waveform						
4.7.4	Verify RESP (@ 20 BPM)	17	23				
4.7.4	Verify RESP (@ 60 RPM)	57	63				
4.7.4	Verify Waveform						
4.7.4	Verify RESP (@ 20 BPM)	17	23				
4.7.4	Verify RESP (@ 60 RPM)	57	63				
Temperature Testing (Perform in Service or Monitor Mode - requires Alaris Temp Simulator)							
4.7.5	Measured Temp in ºF (98.6º nominal)	98.4	98.8				
4.7.5	Measured Temp in ºF (80.2º nominal)	79.9	80.5				
4.7.5	Measured Temp in ºF (107.8º nominal)	107.5	108.1				
4.7.5	Probe Disconnected						
4.7.5	Probe Type						
4.7.5	Probe In/Out Detect						
Recorder Testing							
4.7.6	Recorder Test						
Battery System Testing (Perform in Monitor Mode)							
4.7.7	Verify AC Mains Indicator						
4.7.7	Remove AC, Verify uninterrupted battery operation						
4.7.7	Verify Battery LED is lit						
Failsafe Logic Testing							
4.7.8	Failsafe Logic						
Front Panel LED Testing							
4.7.9	Keypad LED Test						
Front Panel Key Testing (Perform in Service Mode)							
4.7.10	Verify appropriate responses to key presses						
Sound Test							
4.7.11	Speaker Test						
Communications Testing							
4.7.12	Verify pump starts, stops and temp status returns						
Remote Alarm Test							
4.7.13	Voltage between pins 4 and 8, alarm inactive	4.7	5.3				
4.7.13	Voltage between pins 4 and 8, alarm active	0.0	0.1				

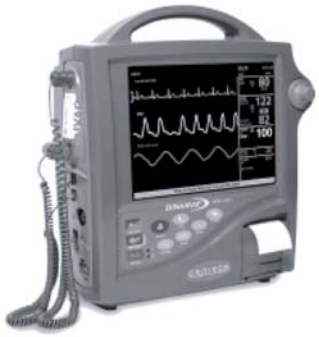
Tested by: _____

Date: _____

Signature: _____

Facility: _____

APPENDIX B:
Monitor Configuration Log



MONITOR CONFIGURATION LOG - Appendix B

DINAMAP PRO 1000 Monitor

Note: Please refer to the PRO 1000 Pre-Service and Calibration Procedures for instructions.

Date: _____ City: _____

Hospital: _____

Serial Numbers:

_____ _____ _____ _____

_____ _____ _____ _____

_____ _____ _____ _____

How to Enter Configuration Mode

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

How to Configure Default Tables

1. Choose **admit patient** from the **Configuration** Menu.
2. Choose **Choose patient settings**. Select the table you wish to configure (**default 1** through **default 6**).
3. A popup window appears: **All unsaved changes to the current default will be lost! Are you sure you want to do this?** Choose **Yes**.
4. Choose **Patient type** and select either **Adult, pediatric,** or **neonate.**
5. Change all other available settings as desired.
6. To save your changes for the selected table go to **other system settings**, choose **save default changes**.
7. A popup window appears: **Enter the name for this default**. Rename or accept the default table and choose **DONE**. Your data will be saved.
8. Repeat steps 1 through 7 for configuring the remaining five default tables.

How to Exit Configuration Mode

1. Choose **other system settings** from the **Configuration** Menu.
2. Choose **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?** Choose **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 (0 to 5)	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%			
Config settings	It opens the Config Adjust Alarms menu.				
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					
Choose Patient settings	It allows the user to choose a user default table.	ADULT			
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			
View vitals every	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.	NIBP			
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			

A=adult, P=pediatric, N=neonate. If not specified, the factory default setting is the same for adult, pediatric, and neonate.

Default Table Name	Understanding the Options	Factory Default	Adult	Pediatric	Neonate
View vitals every	"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.	NIBP			
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.	150			
lo	Allows the user to set the "lo" alarm limit.	50			
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.	light green			
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 (i.e. Asystole, Vtach, VFib). If an arrhythmia condition is active and alarming, and the user selects no, the arrhythmia condition will be removed. If the condition was of a crisis priority, it will still require user acknowledgement.	yes			
Advanced settings…	It opens the Advanced ECG menu.	N/A			

A=adult, P=pediatric, N=neonate. If not specified, the factory default setting is the same for adult, pediatric, and neonate.

Default Table Name	Understanding the Options	Factory Default	Adult	Pediatric	Neonate
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			
Cascade ECG?	The user can choose to expand the ECG waveform area into a second waveform area.	no			
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.	light green			
Config settings…	It opens the Config ECG menu.	N/A			
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			
3rd 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			

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Default Table Name	Understanding the Options	Factory Default	Adult	Pediatric	Neonate
4th 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, N=100			
lo	Allows the user to set the "lo" alarm limit.	A=80, P=70, N=40			
diastolic hi	Allows the user to set the "hi" alarm limit.	A=120, P=90, N=60			
lo	Allows the user to set the "lo" alarm limit.	A=30, P=30, N=20			
mean hi	Allows the user to set the "hi" alarm limit.	A=140, P=100, N=70			
lo	Allows the user to set the "lo" alarm limit.	A=40, P=40, N=30			
Advanced settings…	It opens the Advanced NIBP menu.	N/A			
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			
Config settings…	It opens the Config NIBP menu.	N/A			
Auto BP default	User specifies the selection that will be confirmed when Auto BP is manual and the AUTO-BP/STAT hardkey is pressed.	10 min			
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 lo 90			
Advanced settings…	It opens the Advanced SpO2 menu.	N/A			

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Default Table Name	Understanding the Options	Factory Default	Adult	Pediatric	Neonate
View signal strength bar?	It allows the user the option of viewing the graphic signal strength bar.	yes			
View SpO2 PR?	Controls how the Monitor behaves concerning the handling of SpO2 derived pulse rate.	no			
Spot check enable	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			
Masimo SpO2:					
Lost pulse	User specifies the audio alarm associated with SpO2 LOST PULSE.	procedural			
other alarm priorities	User specifies audio alarm associated with these alarms.	N/A			
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 associted with SpO2 SENSOR OFF.	procedural			
Signal quality (MASIMO ONLY)	User specifies the audio alarm associated with SpO2 SIGNAL QUALITY.	message			
Nellcor SpO2:					
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 associted with SpO2 SENSOR OFF.	procedural			
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.	white			
Config settings…	It opens the Config SpO2 menu.	N/A			
Masimo SpO2:					

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Default Table Name	Understanding the Options	Factory Default	Adult	Pediatric	Neonate
Averaging	User specifies the averaging time used by the Masimo SpO2 algorithm to calculate SpO2 values.	12			
Sensitivity	User specifies the sensitivity thresholds used by the Masimo SpO2 algorithm for calculating SpO2 values under low perfusion conditions.	Normal			
FAST SAT	User specifies the whether or not the Masimo SpO2 algorithm calculates the SpO2 values quicker.	OFF			
Nellcor SpO2:					
Response mode	User specifies the setting for the Nellcor SpO2 algorithm for rejecting noise and calculating SpO2 values.	Fast			
SAT SECONDS (NELLCOR ONLY)	User specifies the time setting for the Nellcor SpO2 algorithm to holf 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	A=LII, P=LII, N=L1			
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.	A=30, P=60, N=100			
hi	Allows the user to set the "hi" alarm limit.	A=30, P=60, N=100			
lo	Allows the user to set the "lo" alarm limit.	A=6, P=10, N=15			
Advanced settings...	It opens the Advanced RESP menu.	N/A			
Resp sweep speed (mm/s)	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=12.5, N=6.25			
Cardiogenic filter	It allows the user to select the type of filtering performed.	auto			
Detection threshold	User adjusts the cursor on the impedance waveform to specify the breath detection threshold.	"--"			
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			

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Default Table Name	Understanding the Options	Factory Default	Adult	Pediatric	Neonate
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.	light 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.	no			
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			
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. For some European countries, temperature must always be displayed in °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			
Waveforms to record	User specifies the waveforms that are traced for a Continuous recording.	1 chosen			
setup timed	Allows the user to access timed options.	N/A			
Waveforms to record	User specifies the waveforms that are traced for a Timed recording.	0 chosen			
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			

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Default Table Name	Understanding the Options	Factory Default	Adult	Pediatric	Neonate
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					
Always display battery icon?	User controls when battery icon is viewable when monitor in not on battery power.	no			
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 parameter's 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			
Config HostComm					
Unit address	It allows the user to specify the host communications address for this particular monitor.	" "			
IP address	User specifies address for 1928 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			

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Default Table Name	Understanding the Options	Factory Default	Adult	Pediatric	Neonate
Remote access	User specifies which port, if any, is enabled for remote access.	OFF			
Serial 1 setup	Allows user to configure serial 1 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			
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			

A=adult, P=pediatric, N=neonate. If not specified, the factory default setting is the same for adult, pediatric, and neonate.

APPENDIX C:
Error Codes

C.1 ALARM CODE INTERPRETATION

Refer to Section, 4.4.3 Battery Troubleshooting, for information about procedural alarms that involve battery operation. If any other alarms display that are not listed in the paragraphs that follow, record the error message and report the failure to Customer Support. Refer to the Operations Manual for information about patient alarms and general procedural alarms.

C.1.1 System Failures

When a system failure is encountered, the error code is displayed on the screen for five seconds and the system enters failsafe 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 Code	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 (DS1284) running too slow	Main CPU Board
SY-44	Real time clock (DS1284) running too fast	Main CPU Board

Hardware Error Messages

Error Code	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 Hertz timer re-entry error	Main CPU Board
27268	Unexpected error condition	Main CPU Board

NIBP Parameter Error Messages

Decimal Error #	Explanation	Possible Error Source
110	Overpressure circuit failure.	Main CPU Board
112	Overpressure watchdog error	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
151	Auto zero. Verify failed.	Main CPU Board, Pneumatic Assembly
170	Pump current failure	Pneumatic Assembly, Main CPU Board
171	Pump current value out of NI_RANGE.	Pneumatic Assembly, Main CPU Board
180	Excessive leakage.	Pneumatic Assembly, Interface Panel
190	Commands out of sequence	Main CPU Board
200	Ovp setpoint not found	Main CPU Board
210	Pump stuck on during idle	Pneumatic Assembly, Main CPU Board
220	Valve in illegal state	Pneumatic Assembly, Main CPU Board
221	Pressure too high for too long	Main CPU Board, Pneumatic Assembly

Temperature Parameter Error Messages

Decimal Error #	Explanation	Suggested Replacement
111	software error -state machine bad probe number	Main CPU Board
112	Temp sample rate error	Main CPU Board
113	Temp lost synchronization with PIC	Main CPU Board
114	Unable to synchronize with the Temp PIC	Main CPU Board

ECG Parameter Error Messages

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

SPO2 Parameter Error Messages

Decimal Error #	Explanation	Suggested Replacement
125	too many reset requests	SPO2 Board, Main CPU Board
126	Nellcor has posted a "serious" FE error	SPO2 Board
129	FE data OK- processing stallled	SPO2 Board
130	MASIMO has posted either a board or diagnostic failure -- type available in service mode	SPO2 Board
131	msg looks out of sequence	SPO2 Board
132	missing characters inside a packet	SPO2 Board
133	not able to correctly set parameter	SPO2 Board
134	NELL_SendCommand() called before previous call completed	SPO2 Board
135	Not enough room left in transmit FIFO to send data	SPO2 Board
136	Receive FIFO full, probably lost data	SPO2 Board
137	queue out to OEM board is full	SPO2 Board
138	Nellcor has posted too many auto resets	SPO2 Board
139	Nellcor software error	SPO2 Board
140	Nellcor has posted too many communication errors	SPO2 Board
141	No communication with SPO2 board. Unit may be configured incorrectly	SPO2 Board

Recorder Parameter Error Messages

Decimal 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

Respiration Parameter Error Messages

Decimal Error #	Explanation	Suggested Replacement
101	This means something was wrong with memory at wake up. Couldn't get data space.	ECG Board
102	These last three mean that the algorithm execution couldn't keep up with the data acquistion	ECG Board
103		
104		

APPENDIX D:
Required Service Equipment

D.1 REQUIRED SERVICE EQUIPMENT

- ECG simulator (DNI model 214B or equivalent)
- ECG cable (pn 107326 & 107328)
- SPO2 simulator (Nellcor recommends use of the SRC-MAX Portable Tester; Masimo recommends BIO-TEK SpO2 simulators)
- SPO2 adapter cable
- NIBP analyzer (DNI Nevada “CuffLink” or equivalent)
- Adult Cuff (pn 2774)
- Adult Hose (pn 107365)
- Adult mandrel, end block and spacer blocks (DNI pn 5215-0268,5215-0269)
- Calibration Kit, pn 320246 available through GE Medical Systems
- Inflation bulb and associated tubing
- Manometer Digital 0-600mmHg range or equivalent
- Temperature probe simulator (Alaris pn TE1811)
- Temperature probe, oral
- Oscilloscope (capable of measuring ECG signal @ 0.75Hz, 1V amplitude)
- 1/8” stereo plug (Radio Shack # 274-284C)
- Hipot Tester (1500VAC)
- Safety Tester (DNI Nevada 235A or equivalent)
- DMM (Fluke 8842 or equivalent)
- Temp probe Hi Pot adapter (Temp probe assembly with probe removed and probe cable leads shorted and attached to connector compatible with Hi Pot tester.)
- SpO_2 probe Hi Pot adapter (SpO_2 adapter cable with leads shorted and attached to connector compatible with Hi Pot tester.)
- ECG Hi Pot adapter (ECG cable with leads shorted and attached to connector compatible with Hi Pot tester.)
- Serial communication cable (see Figure 3)
- Test plug assembly with 470Ω resistor

NOTE: Hi-Pot testing is done on every unit at the factory and should not be repeated unnecessarily nor performed more often than required. (If unit is opened for repair, Hi-Pot testing is required.)

APPENDIX E:
Troubleshooting

E.1 TROUBLESHOOTING

Problem: Unit will not power on

Cause:

- No AC Power
- Faulty power supply
- Faulty PSU PWA
- Faulty Main Board
- Faulty cables
- Faulty power Off/On front panel switch

Solution:

- Check AC Power
- Replace power supply; FRU # 2014832-001
- Replace PSU PWA; FRU # 2014829-001
- Replace Main Board; FRU # 2013782-001
- Replace defective cable; FRU # 2014843-001 or 2014828-001
- Replace defective keyboard PWA; FRU # 2013781-001

Problem: Unit will not operate on battery

Cause:

- Rear case battery disconnect fuse open or not plugged in
- Faulty battery pack
- Faulty PSU PWA

Solution:

- Plug in or replace battery disconnect fuse; Part # 628192
- Replace battery pack; FRU # 2014833-001
- Replace PSU PWA; FRU # 2014829-001

Problem: Unit will not operate on external DC power

Cause:

- Faulty DC input jack/DC cable
- Faulty PSU PWA

Solution:

- Replace DC input jack/cable; FRU # 2014835-001
- Replace PSU PWA; FRU # 2014829-001

Problem: Unit powers on but no display

Cause:

- Faulty display
- Faulty backlight driver
- Faulty Main Board
- Faulty PSU PWA

Solution:

- Replace display; FRU # 2013792-001

- Replace Main Board; FRU # 2013782-001
- Replace Main Board; FRU # 2013782-001
- Replace PSU PWA; FRU # 2014829-001

Problem: Unit will not perform NIBP function

Cause:

- Faulty Main Board
- Faulty pneumatics assembly
- Faulty pneumatics cable
- Faulty front panel switch

Solution:

- Replace Main Board; FRU # 2013782-001
- Replace pneumatics assembly; FRU # 2013788-001 or 2014830-001
- Replace defective keyboard PWA; FRU # 2013781-001

Problem: Unit will not perform ECG function

Cause:

- Faulty ECG PWA assembly
- Faulty ECG cable assembly
- Faulty Main Board

Solution:

- Replace ECG PWA; FRU # 2013778-001
- Replace ECG cable; FRU # 2014620-001
- Replace Main Board; FRU # 2013782-001

Problem: Unit will not produce an analog ECG waveform output

Cause:

- Faulty Defib cable assembly
- Faulty Main Board

Solution:

- Replace Defib cable assembly; FRU # 2014619-001
- Replace Main Board; FRU # 2013782-001

Problem: Unit will not perform SPO2 function

Cause:

- Faulty SPO2 PWA assembly
- Faulty Main Board

Solution:

- Replace SPO2 PWA; FRU # 2013783-001 Nellcor or 2013786-001 Masimo
- Replace Main Board; FRU # 2013782-001

Problem: Unit will not perform Temperature function

Cause:

- Faulty temperature probe

- Faulty temperature probe sensor
- Faulty Main Board

Solution:

- Replace temperature probe
- Replace probe sensor; FRU # 2013777-001
- Replace Main Board; FRU # 2013782-001

Problem: Unit will not print

Cause:

- Unit out of paper or paper incorrectly installed
- Faulty printer
- Faulty Main Board
- Faulty PSU PWA

Solution:

- Check paper installation
- Replace printer; FRU # 2013787-001
- Replace Main Board; FRU # 2013782-001
- Replace PSU PWA; FRU # 2014829-001

Problem: Unit will not generate sound

Cause:

- Faulty speaker assembly
- Faulty Main Board

Solution:

- Replace speaker assembly; FRU # 2014831-001
- Replace Main Board; FRU # 2013782-001

Problem: Unit will not respond to rotary knob

Cause:

- Faulty encoder
- Faulty Main Board

Solution:

- Replace encoder; FRU # 2014712-001
- Replace Main Board; FRU # 2013782-001

Problem: Unit Host Comms not functional

Cause:

- Faulty Main Board
- Faulty PSU PWA

Solution:

- Replace Main Board; FRU # 2013782-001
- Replace PSU PWA; FRU # 2014829-001

APPENDIX F:
Electromagnetic Compatibility

Electromagnetic Compatibility (EMC): PRO 1000V3 Monitor

Changes or modification to this system not expressly approved by GE Medical System could cause EMC issues with this or other equipment. This system is designed and tested to comply with applicable regulation regarding EMC and needs to be installed and put into service according to the EMC information stated as follows.

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 DINAMAP® PRO 1000V3 Monitor is intended for use in the electromagnetic environment specified below. It is the responsibility of the customer or user to ensure that the DINAMAP PRO 1000V3 Monitor is used in such an environment.

Emissions Test	Compliance	Electromagnetic Environment – Guidance
RF emissions EN 55011	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 EN 55011	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 DINAMAP PRO 1000V3 Monitor is intended for use in the electromagnetic environment specified below. It is the responsibility of the customer or user to ensure that the DINAMAP PRO 1000V3 Monitor 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 input/output lines	± 2 kV for power supply lines ±1 kV for input/output 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 DINAMAP PRO 1000V3 Monitor requires continued operation during power mains interruptions, it is recommended that the DINAMAP PRO 1000V3 Monitor be powered from an uninterruptible 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 characteristics 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 DINAMAP PRO 1000V3 Monitor is intended for use in the electromagnetic environment specified below. It is the responsibility of the customer or use to assure that the DINAMAP PRO 1000V3 Monitor 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 be used on closer to any part of the equipment, including cables, than the recommended separation distance calculated fro the equation applicable to the frequency of the transmitter. **Recommended separation distance** $d = 1.2\sqrt{P}$
Radiated RF EN 61000-4-3	3 V/m 80 MHz to 2.5 GHz	3 V/m	$d = 1.2\sqrt{P}$ 80 MHz to 800 MHz $d = 2.3\sqrt{P}$ 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, and 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 communication equipment and the DINAMAP PRO 1000V3 Monitor.

The DINAMAP PRO 1000V3 Monitor is intended for use in the electromagnetic environment on which radiated RF disturbances are controlled. The customer or the user of the DINAMAP PRO 1000V3 Monitor can help prevent electromagnetic interference by maintaining a minimum distance between portable and mobile RF communications equipment (transmitters) and the DINAMAP PRO 1000V3 Monitor 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** [a] $d = 1.2\sqrt{P}$	**80 MHz to 800 MHz** [a] $d = 1.2\sqrt{P}$	**800 MHz to 2.5 GHz** [a] $d = 2.3\sqrt{P}$
0.01	0.12	0.12	0.23
0.1	0.38	0.38	0.73
1	1.2	1.2	2.3
10	3.8	3.8	7.3
100	12	12	23

[a] At 80 MHz and 800 MHz, the separation distance for the higher frequency range applies.

For transmitters rated at a maximum output power not listed above, the recommended separation distance [*d*] in meters (m) can 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:

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
ECG Cables		
107326	Cable, ECG, 3 lead, AHA	3.6 m /12 ft
107331	Cable, ECG, 3 ld, with ESU filter for OR, AHA	3.6 m /12 ft
107384	Cable, ECG, 3 ld, Safety, AHA	3.6 m /12 ft
008732	Cable, ECG with 3 LD Leadwire set, Snap, AHA, D-Series, Includes cable and 3-lead Leadwire Set.	4.3m /14.35 ft
ECG Multi-Link Lead wires		
107230	Ldwr Set, Gray, AHA, 3-Ld ECG Cable w/Grabber	100cm /2.35 ft
107231	Ldwr Set, Gray, AHA, 3-Ld ECG Cable w/Snap	100cm /2.35 ft
107314	Ldwr Set, Gray, AHA, 3-Ld ECG Cable w/Grabber, Pediatric	100cm /2.35 ft
107328	Ldwr Set, AHA, 3-Ld ECG Cable w/Snap	100cm /2.35 ft
Temperature Cables and Probes		
2008774-001	TurboTemp Oral Probe, Blue	3.0m / 10 ft
2008775-001	TurboTemp Rectal Probe, Red	3.6 m / 12 ft
2016998-001	Dual Temp Cable	20 cm / 8 in
Pulse Oximetry Cables and Sensors		
407705-006	Nellcor DuraSensor Reusable Finger Probe (DS100A)	0.9 m / 3 ft
2008773-001	Nellcor Interface Cable, OxiSmart, DOC10 Cable	3.3 m / 11 ft
2009743-001	Masimo PC08 Cable	2.5 m / 8.2 ft
2009745-001	Masimo Finger Sensor, Adult, Reusable	N/A

Accessories		
N/A	RJ45 series Category 5 cable	N/A
316579-001	AC cable, Hospital Grade, AHA,	3.6 m / 12 ft
ILC1927	Isolated Level Converter	N/A
IPC1928	Isolated Protocol Converter	N/A

Electromagnetic Compatibility (EMC): ILC-1927

Changes or modification to this system not expressly approved by GE Medical System could cause EMC issues with this or other equipment. This system is designed and tested to comply with applicable regulation regarding EMC and needs to be installed and put into service according to the EMC information stated as follows.

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 DINAMAP® IPC-1927 is intended for use in the electromagnetic environment specified below. It is the responsibility of the customer or user to ensure that the DINAMAP IPC-1927 is used in such an environment.

Emissions Test	Compliance	Electromagnetic Environment – Guidance
RF emissions EN 55011	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 EN 55011	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	Not Applicable	
Voltage fluctuations/ Flicker emissions EN 61000-3-3	Not Applicable	

Guidance and Manufacturer's Declaration – Electromagnetic Immunity

The DINAMAP ILC-1927 is intended for use in the electromagnetic environment specified below. It is the responsibility of the customer or user to ensure that the DINAMAP ILC-1927 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 input/output lines	N/A	No AC Input
Surge EN 61000-4-5	± 1 kV differential mode ± 2 kV common mode	N/A	No AC Input
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 DINAMAP ILC-1927 requires continued operation during power mains interruptions, it is recommended that the Host monitor be powered from an uninterruptible 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 characteristics 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 DINAMAP ILC-1927 is intended for use in the electromagnetic environment specified below. It is the responsibility of the customer or use to assure that the DINAMAP ILC-1927 is used in such an environment.

Immunity Test	EN 60601 Test level	Compliance level	Electromagnetic Environment – Guidance
Conducted RF EN 61000-4-6 Radiated RF EN 61000-4-3	3 Vrms 150 KHz to 80 MHz 3 V/m 80 MHz to 2.5 GHz	3 V rms 3 V/m	Portable and mobile RF communications equipment should be used on closer to any part of the equipment, including cables, than the recommended separation distance calculated fro the equation applicable to the frequency of the transmitter. **Recommended separation distance** $d = 1.2\sqrt{P}$ $d = 1.2\sqrt{P}$ 80 MHz to 800 MHz $d = 2.3\sqrt{P}$ 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, and 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 communication equipment and the DINAMAP ILC-1927.

The DINAMAP ILC-1927 is intended for use in the electromagnetic environment on which radiated RF disturbances are controlled. The customer or the user of the DINAMAP ILC-1927 can help prevent electromagnetic interference by maintaining a minimum distance between portable and mobile RF communications equipment (transmitters) and the DINAMAP ILC-1927 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** [a] $d = 1.2\sqrt{P}$	**80 MHz to 800 MHz** [a] $d = 1.2\sqrt{P}$	**800 MHz to 2.5 GHz** [a] $d = 2.3\sqrt{P}$
0.01	0.12	0.12	0.23
0.1	0.38	0.38	0.73
1	1.2	1.2	2.3
10	3.8	3.8	7.3
100	12	12	23

[a] At 80 MHz and 800 MHz, the separation distance for the higher frequency range applies.

For transmitters rated at a maximum output power not listed above, the recommended separation distance [*d*] in meters (m) can 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:

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
Accessories		
N/A	RJ45 series Category 5 cable	N/A
683235	Adapter Cable, RJ45 to DB15.	600 mm / 2 ft
683236	Adapter Cable, RJ45 to DB25.	460 mm / 18 in
683242	Adapter Cable, RJ45 to DB9.	3.0 m / 10 ft

Electromagnetic Compatibility (EMC): ILC-1928

Changes or modification to this system not expressly approved by GE Medical System could cause EMC issues with this or other equipment. This system is designed and tested to comply with applicable regulation regarding EMC and needs to be installed and put into service according to the EMC information stated as follows.

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 DINAMAP® IPC-1928 is intended for use in the electromagnetic environment specified below. It is the responsibility of the customer or user to ensure that the DINAMAP IPC-1928 is used in such an environment.

Emissions Test	Compliance	Electromagnetic Environment – Guidance
RF emissions EN 55011	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 EN 55011	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	Not Applicable	
Voltage fluctuations/ Flicker emissions EN 61000-3-3	Not Applicable	

Guidance and Manufacturer's Declaration – Electromagnetic Immunity

The DINAMAP IPC-1928 is intended for use in the electromagnetic environment specified below. It is the responsibility of the customer or user to ensure that the DINAMAP IPC-1928 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 input/output lines	N/A	No AC Input
Surge EN 61000-4-5	± 1 kV differential mode ± 2 kV common mode	N/A	No AC Input
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 DINAMAP IPC-1928 requires continued operation during power mains interruptions, it is recommended that the Host monitor be powered from an uninterruptible 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 characteristics 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 DINAMAP IPC-1928 is intended for use in the electromagnetic environment specified below. It is the responsibility of the customer or use to assure that the DINAMAP IPC-1928 is used in such an environment.

Immunity Test	EN 60601 Test level	Compliance level	Electromagnetic Environment – Guidance
			Portable and mobile RF communications equipment should be used on closer to any part of the equipment, including cables, than the recommended separation distance calculated fro the equation applicable to the frequency of the transmitter. **Recommended separation distance**
Conducted RF EN 61000-4-6	3 Vrms 150 KHz to 80 MHz	3 V rms	$d = 1.2\sqrt{P}$
Radiated RF EN 61000-4-3	3 V/m 80 MHz to 2.5 GHz	3 V/m	$d = 1.2\sqrt{P}$ 80 MHz to 800 MHz $d = 2.3\sqrt{P}$ 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, and 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 communication equipment and the DINAMAP IPC-1928.

The DINAMAP IPC-1928 is intended for use in the electromagnetic environment on which radiated RF disturbances are controlled. The customer or the user of the DINAMAP IPC-1928 can help prevent electromagnetic interference by maintaining a minimum distance between portable and mobile RF communications equipment (transmitters) and the DINAMAP IPC-1928 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** [a] $d = 1.2\sqrt{P}$	**80 MHz to 800 MHz** [a] $d = 1.2\sqrt{P}$	**800 MHz to 2.5 GHz** [a] $d = 2.3\sqrt{P}$
0.01	0.12	0.12	0.23
0.1	0.38	0.38	0.73
1	1.2	1.2	2.3
10	3.8	3.8	7.3
100	12	12	23

[a] At 80 MHz and 800 MHz, the separation distance for the higher frequency range applies.

For transmitters rated at a maximum output power not listed above, the recommended separation distance [*d*] in meters (m) can 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:

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
Accessories		
N/A	RJ45 series Category 5 cable	N/A
683235	Adapter Cable, RJ45 to DB15.	600 mm / 2 ft
683236	Adapter Cable, RJ45 to DB25.	460 mm / 18 in
683242	Adapter Cable, RJ45 to DB9.	3.0 m / 10 ft

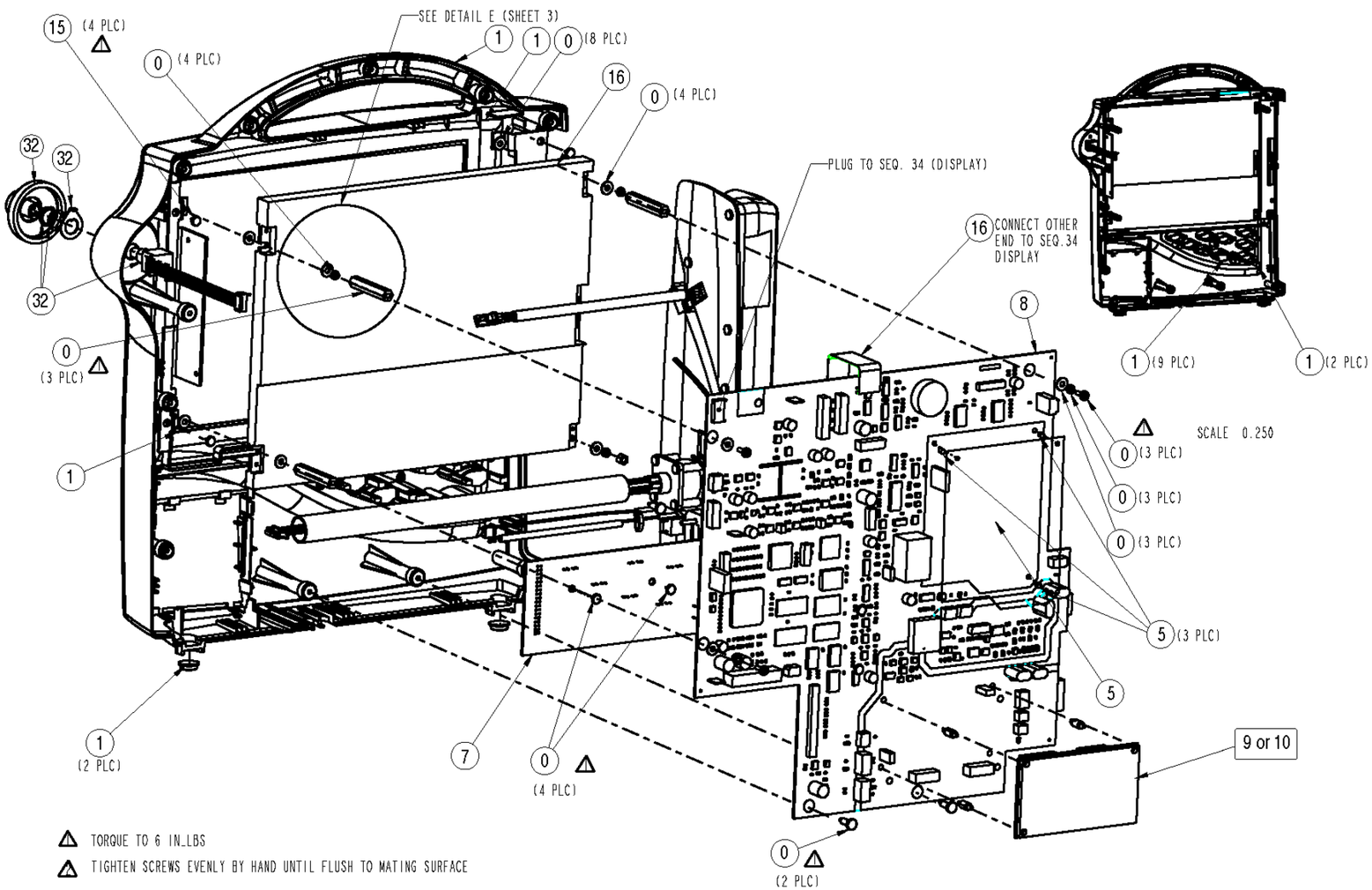
APPENDIX G:
Field Replacement Units (FRUs)

F.1 FRU IDENTIFICATION TABLE

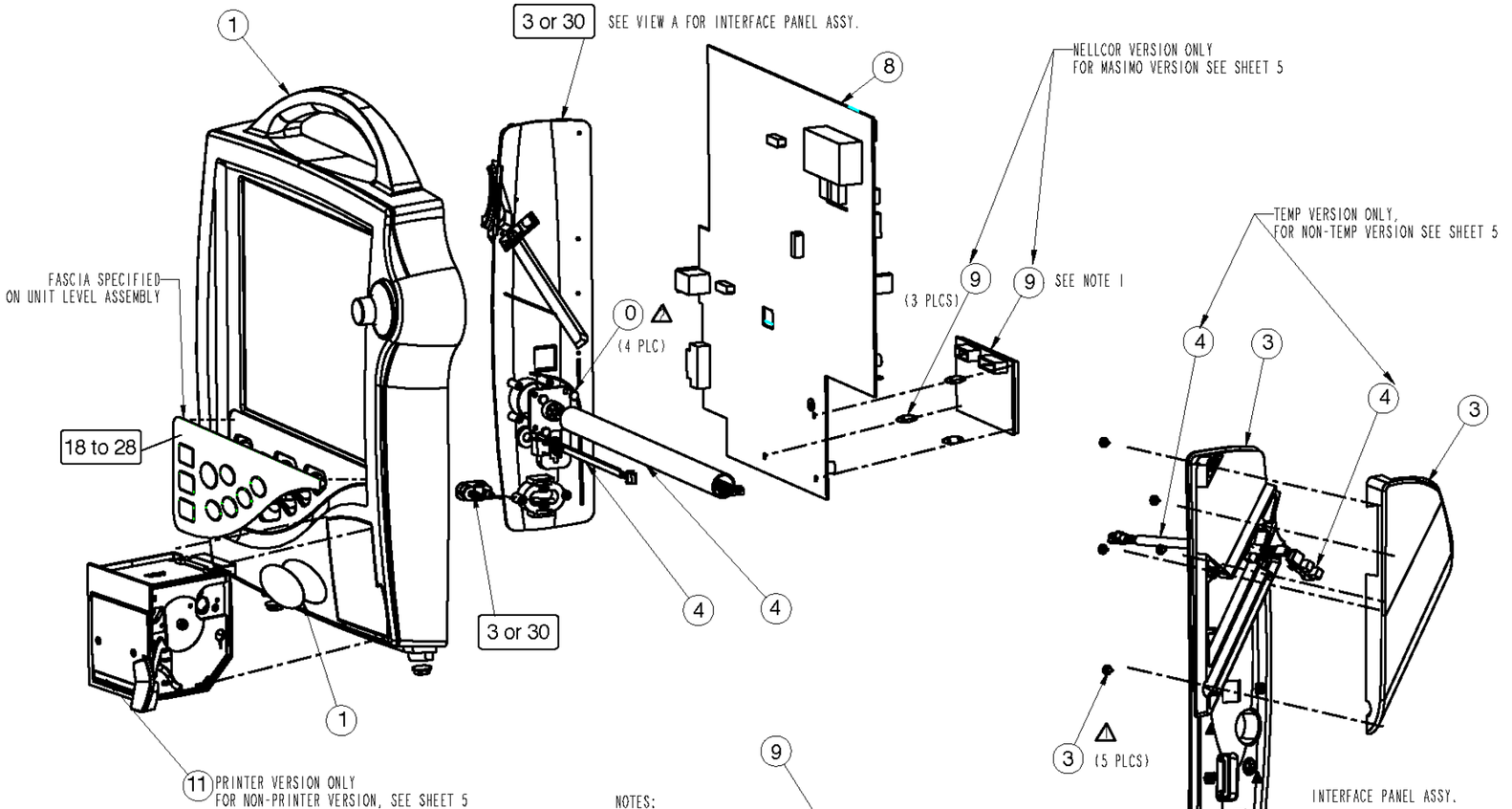
The following table offers details of each of the corresponding bubble numbers that appear on the FRU assembly drawings.

FRU IDENTIFICATION TABLE

Bubble Number	Item Number	Item Description	Notes
0	2014595-001	KIT, HRDWR, SCREWS & WASHERS DP1100 FRU	All internal hardware, screws, washers, spacers, etc.
1	2013774-001	PLASTIC FRONT AND REAR CASE PRO1000V3 FRU	Must order correct fascia for country.
3	2013776-001	ASSY, INTERFACE PANEL & COVER PRO1000V3 FRU	If Temperature version, order FRU #2013777-001
4	2013777-001	ASSY, TEMP PROBE SENSOR, PRO1000V3 FRU	
5	2013778-001	ASSY, PWA ECG BOARD PRO1000V3 FRU	If ECG cable is needed, order FRU #2016503-001.
7	2013781-001	ASSY, PWA KEYBOARD PRO1000V3 FRU	
8	2013782-001	ASSY, PWA MAIN BOARD PRO1000V3 FRU	
9	2013783-001	ASSY, NELLCOR SPO2 BOARD & HARDWARE FRU	This kit includes the Nellcor PWA, hardware and spacers for PRO Series, ProCare and PRO 1000V3 Monitors using Nellcor SPO2.
10	2013786-001	ASSY, MASIMO SPO2 BOARD & HARDWARE FRU	This kit includes the Masimo PWA, hardware and spacers for PRO Series, ProCare and PRO1000V3 Monitors using Masimo SPO2.
11	2013787-001	KIT, PRINTER PRO1000V3 FRU	Includes all printer assembly items, printer door, printer button, cable assembly, and label.
12	2013788-001	KIT, PNEUMATIC 12V ASSY PRO1000V3 FRU	Pump Assembly.
13	2016503-001	KIT, CABLE ASSEMBLIES, PRO1000V3 FRU	
16	2013792-001	KIT, DISPLAY, PRO1000V3 FRU	Display Cable is included.
18	2013794-001	KIT, FASCIA PRO1000 ENGLISH FRU	
19	2013795-001	KIT, FASCIA PRO1000 SPANISH FRU	
20	2013796-001	KIT, FASCIA PRO1000 FRENCH FRU	
21	2013797-001	KIT, FASCIA PRO1000 GERMAN FRU	
22	2013798-001	KIT, FASCIA PRO1000 RUSSIAN FRU	
23	2013799-001	KIT, FASCIA PRO1000 HUNGARIAN FRU	
24	2013800-001	KIT, FASCIA PRO1000 POLISH FRU	
25	2013801-001	KIT, FASCIA PRO1000 CHINESE FRU	
26	2013802-001	KIT, FASCIA PRO1000 JAPANESE FRU	
27	2017285-001	KIT , FASCIA PRO1000 PORTUGESE FRU	
28	2017286-001	KIT , FASCIA PRO1000 ITALIAN FRU	
30	2014694-001	ASSY, NON-TEMP INTERFACE PANEL DP1100 FRU	
31	2014711-001	ASSY, PRINTER BLANKING PLATE, DP1100 FRU	Used only on non-printer versions.
32	2014712-001	ASSY, ROTOR KNOB & ENCODER, DP1100 FRU	Includes, knob, rotor, and washer.
36	2014829-001	ASSY, PWA PSU BOARD PRO1000V3 FRU	
37	2014831-001	ASSY, SPEAKER PRO1000V3 FRU	
38	2014832-001	ASSY, PSU MODULE 60W PRO1000V3 FRU	
39	2014833-001	ASSY, BATTERY PACK & BRACKET PRO1000V3 FRU	

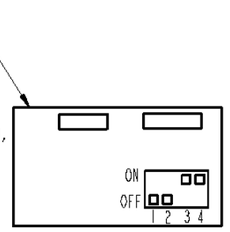


2014591 PRO 1000 V3
FRU'S ASSEMBLY SHEET 1

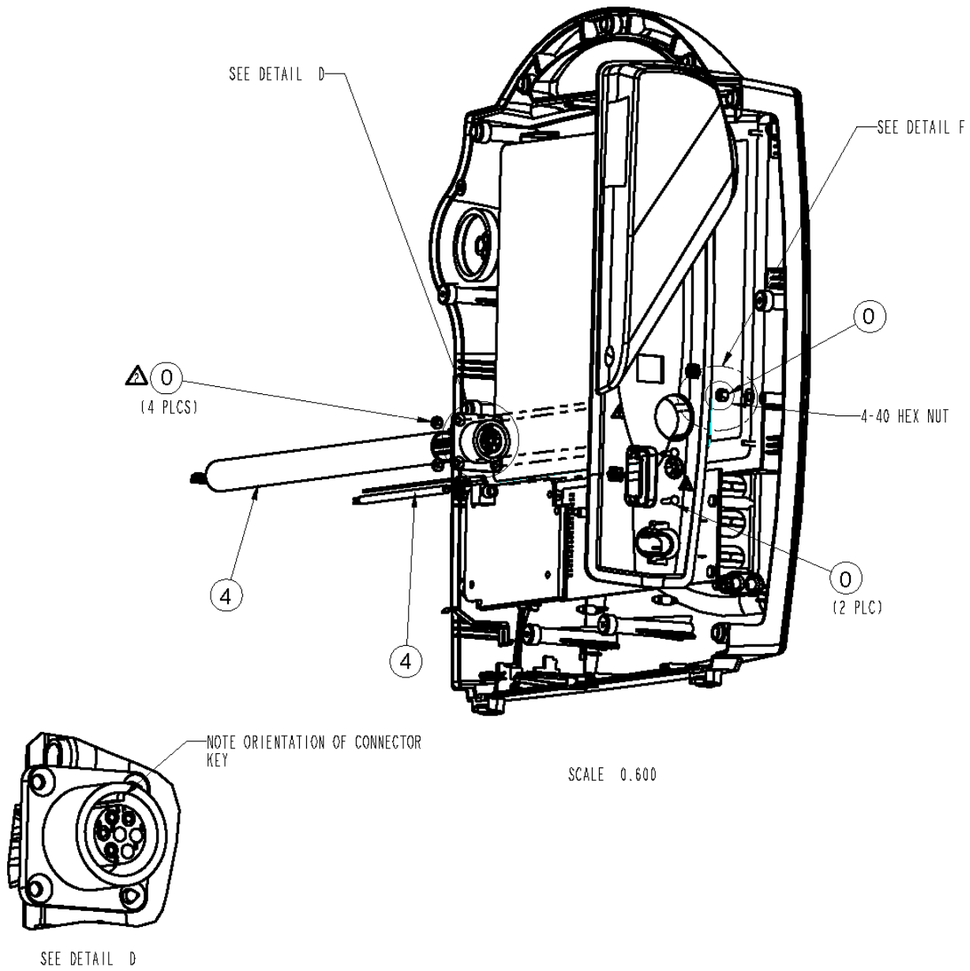


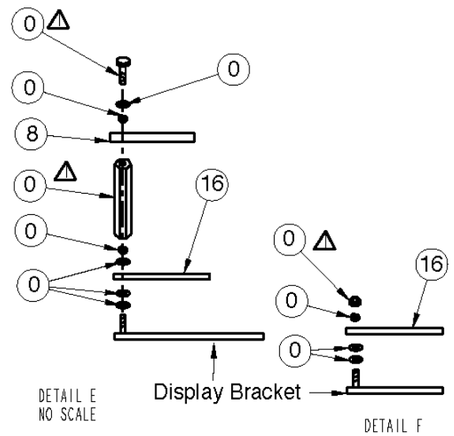
NOTES:

1. BEFORE INSTALLING THE NELLCOR SPO2 PCB (SEQ. 71), REMOVE KEY FROM CONNECTOR J2, SET BAUD RATE BY SETTING SW1 AS FOLLOWS:
OFF: SWITCHES 1, 2
ON: SWITCHES 3, 4

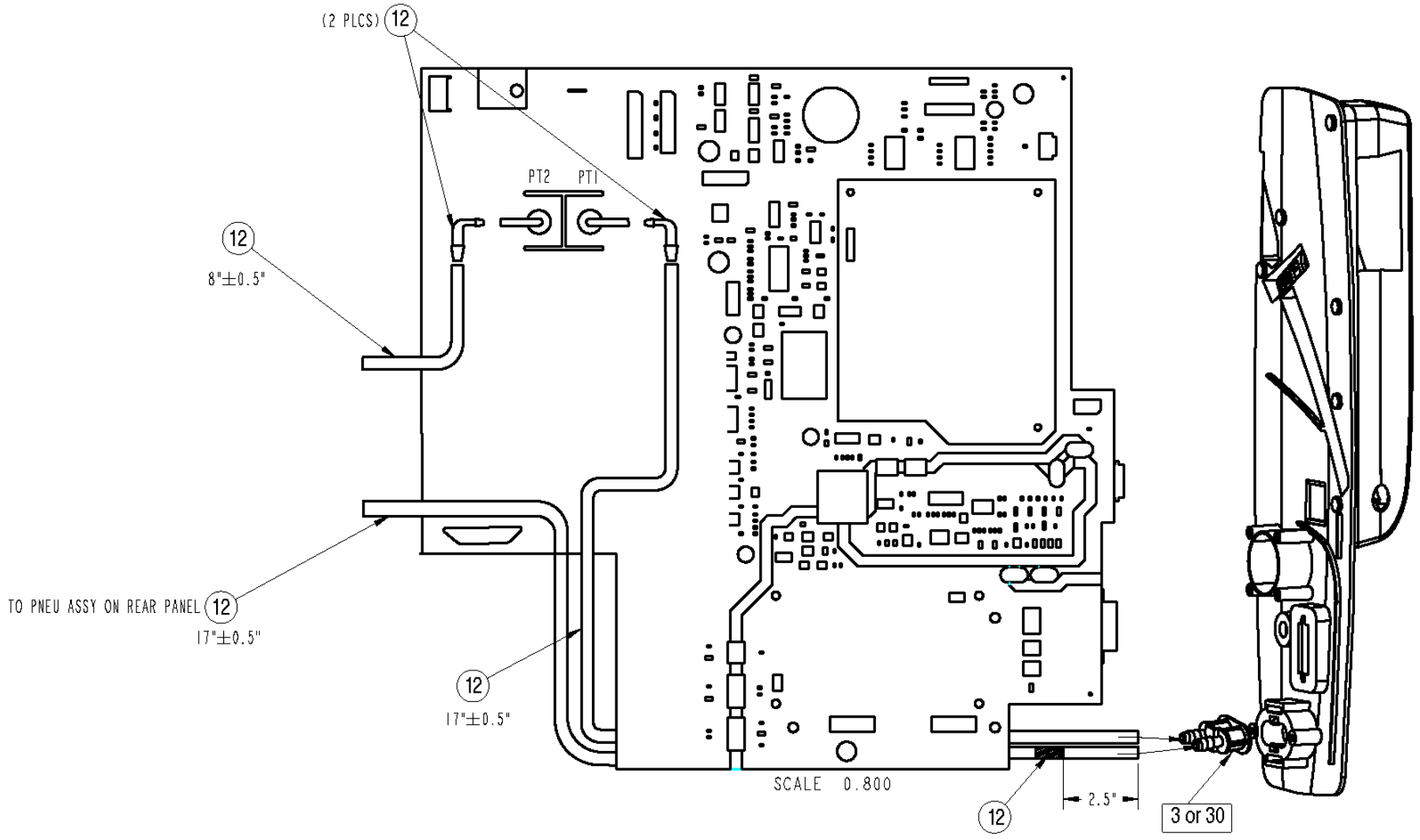


2014591 PRO 1000 V3
FRU'S ASSEMBLY SHEET 2



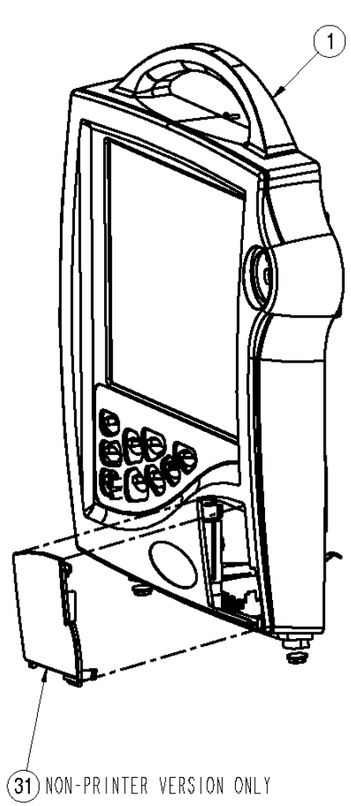


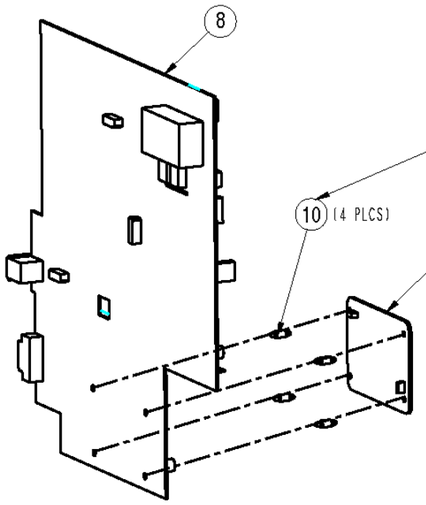
2014591 PRO 1000 V3
FRU'S ASSEMBLY SHEET 3

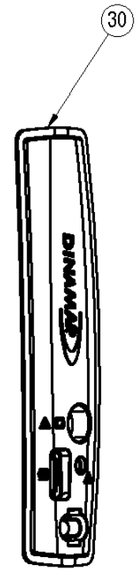


TUBING CONNECTION DIAGRAM

2014591 PRO 1000 V3
FRU'S ASSEMBLY SHEET 4







INTERFACE PANEL
NON-TEMP VERSION ONLY

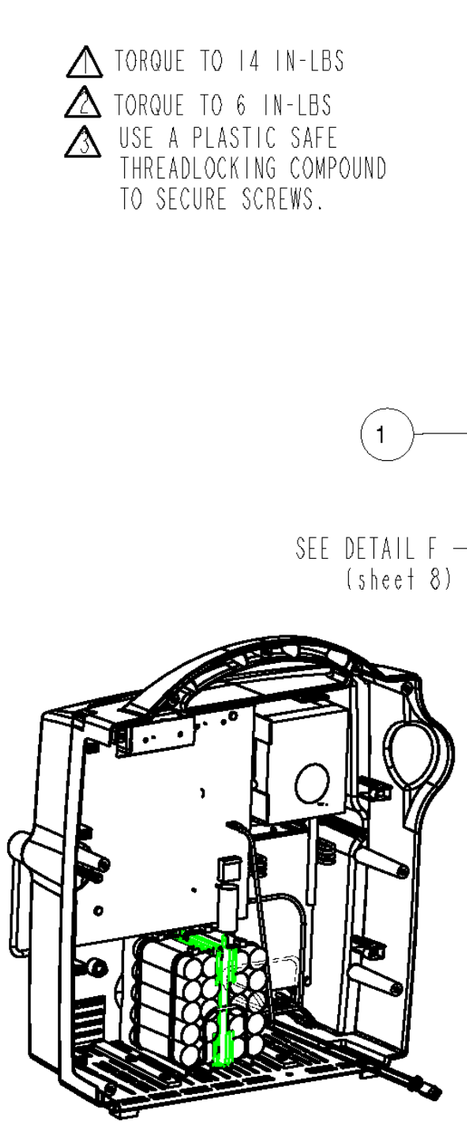
SCALE 0.500

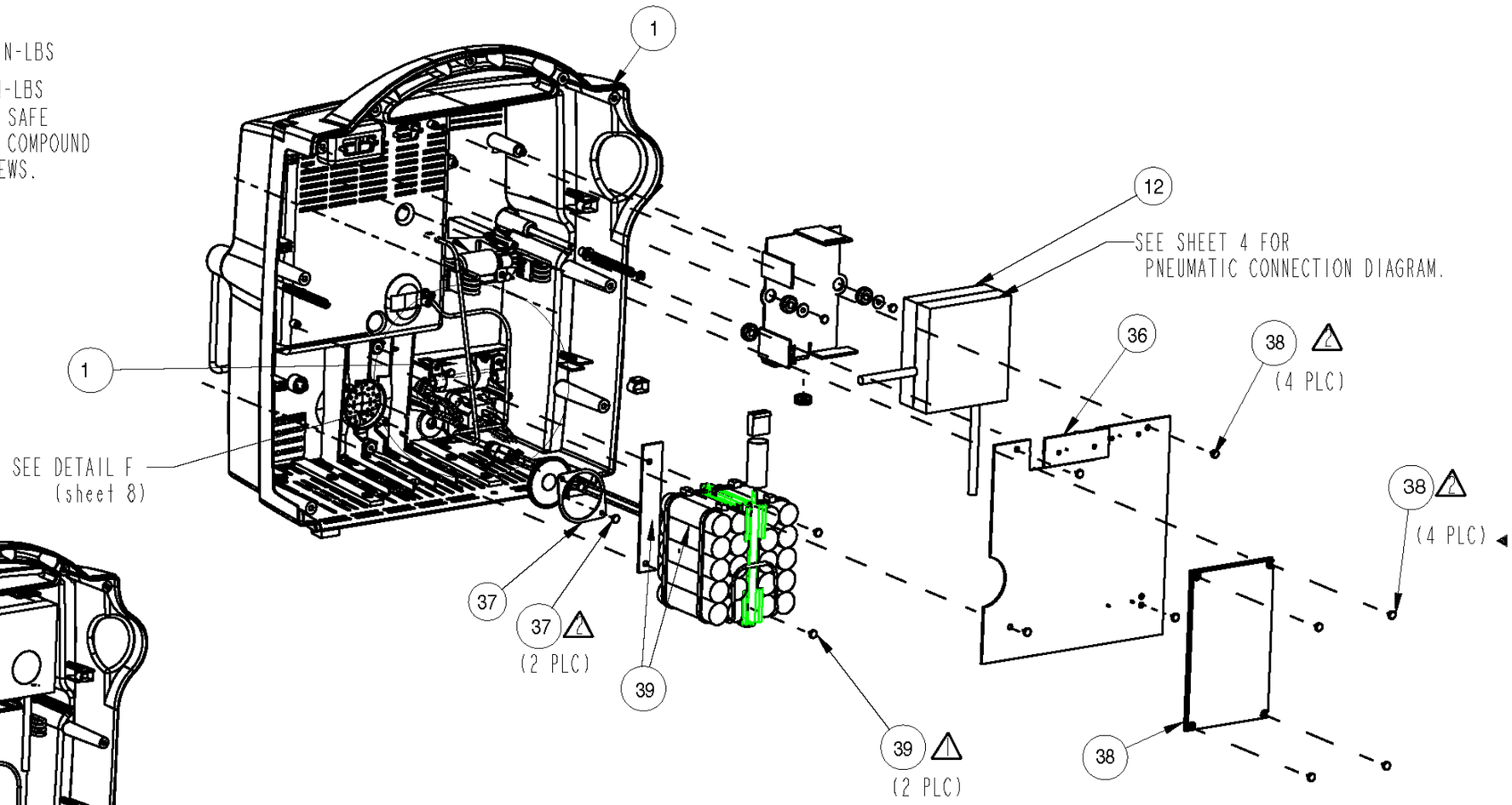
2014591 PRO 1000 V3
FRU'S ASSEMBLY SHEET 5

⚠ TORQUE TO 14 IN-LBS

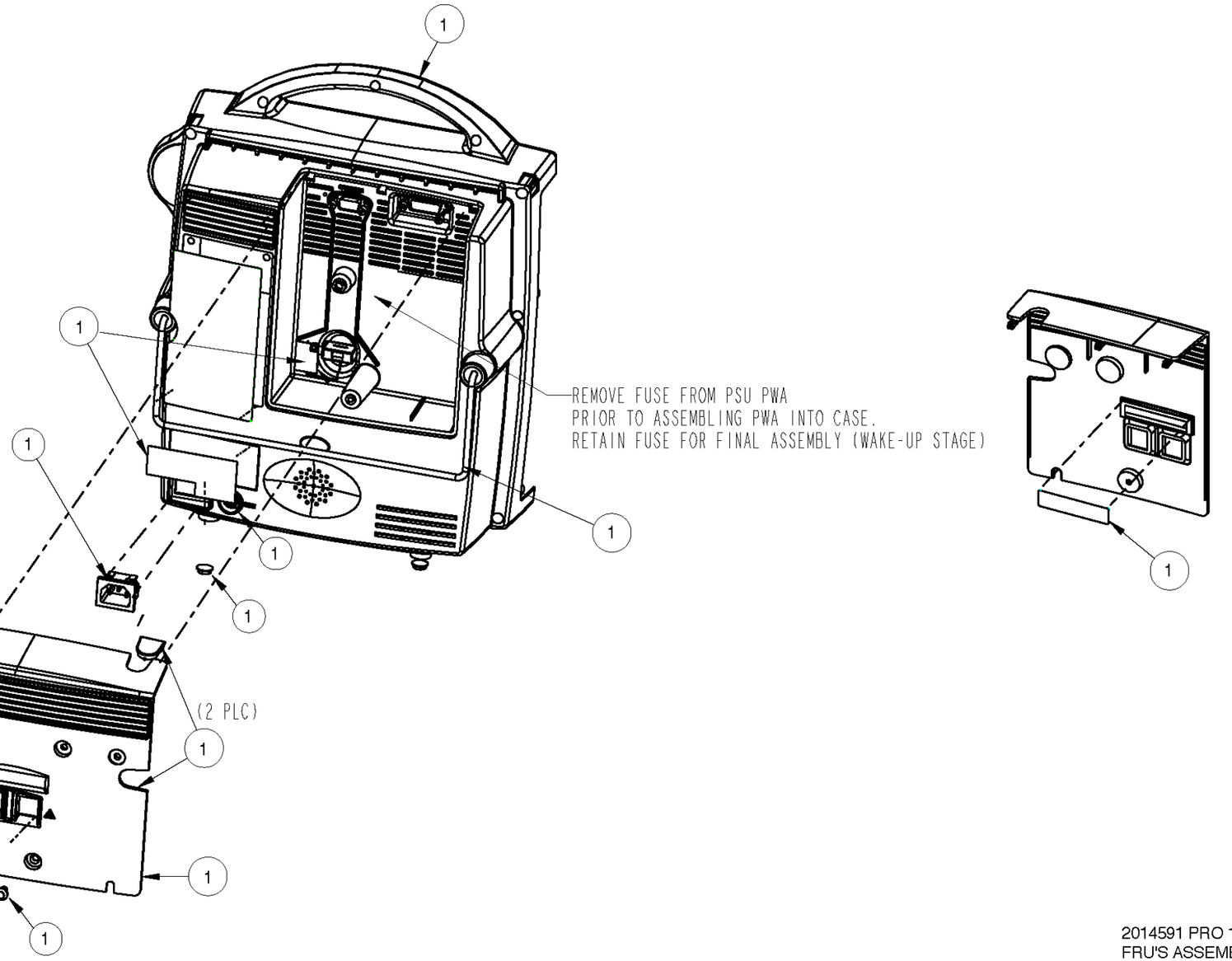
⚠ TORQUE TO 6 IN-LBS

⚠ USE A PLASTIC SAFE THREADLOCKING COMPOUND TO SECURE SCREWS.

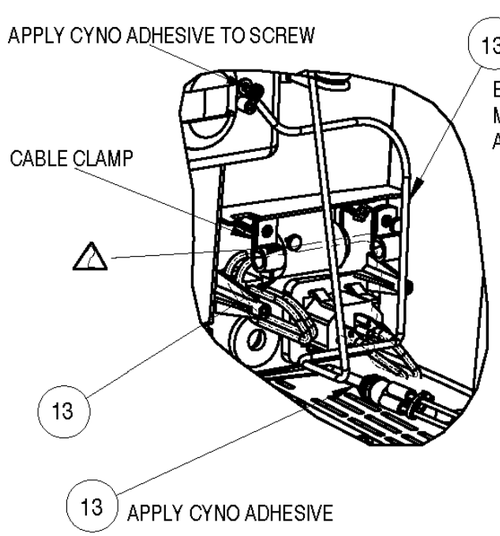




2014591 PRO 1000 V3
FRU'S ASSEMBLY SHEET 6

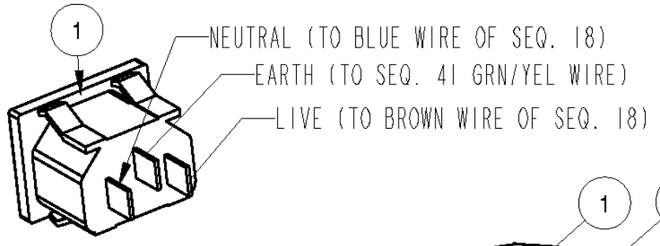


2014591 PRO 1000 V3
FRU'S ASSEMBLY SHEET 7



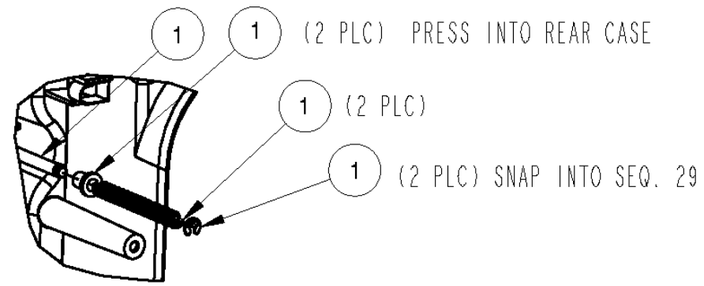
REMOVE WASHER AND DRESS NUT FROM SEQ 17
BEFORE INSTALLATION. REPLACE H/W ON OUTSIDE OF UNIT
TO ASSEMBLE.

DETAIL F

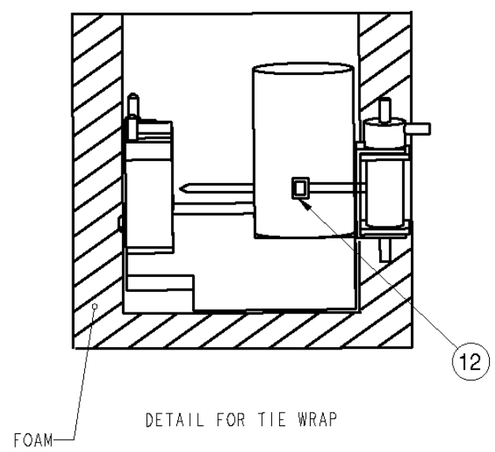


VIEW OF POWER INPUT MODULE

SCALE 1.000

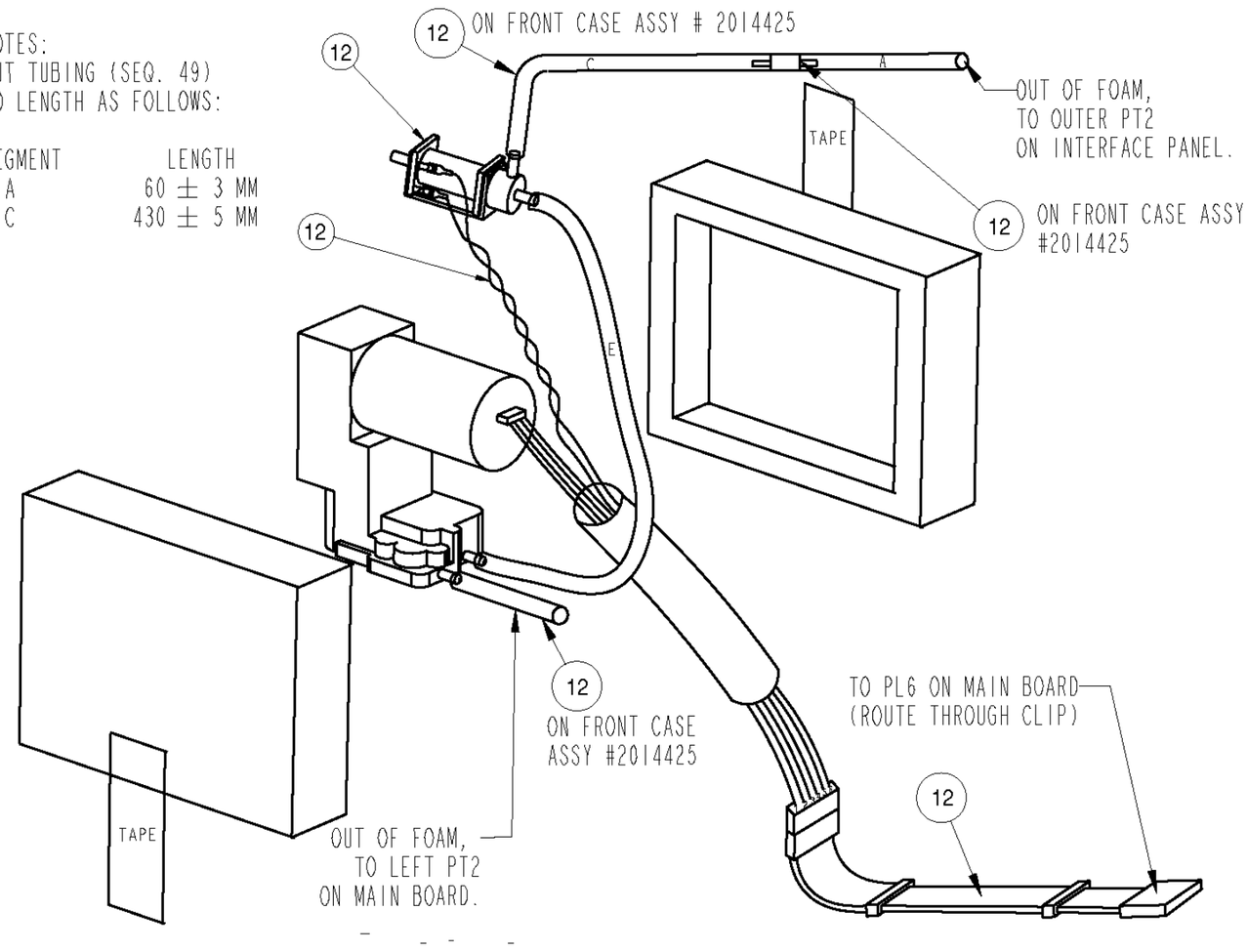


DETAIL E



NOTES:
CUT TUBING (SEQ. 49)
TO LENGTH AS FOLLOWS:

SEGMENT	LENGTH
A	60 ± 3 MM
C	430 ± 5 MM



PNEUMATIC CONNECTION DIAGRAM

2014591 PRO 1000 V3
FRU'S ASSEMBLY SHEET 9

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