GUIDANT

Operator's Manual

$\mathbf{ZOOM}^{\mathsf{TM}}$

Programming System

Model 2920 PRM

CARDIAC

RHYTH

MANAGEMENT

RESTRICTED DEVICE: Federal law (USA) restricts the sale, distribution, or use of this device to, by, or on the lawful order of a physician.

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DESCRIPTION AND USE

The ZOOM™ Programming System, which includes the Model 2920 Programmer/Recorder/Monitor (PRM), is a portable cardiac rhythm management system designed to be used with certain models of Guidant implantable pulse generators.

Refer to the Guidant physician's system manual for the pulse generator being interrogated for instructions on programming the pulse generator.

Intended Use

The Model 2920 PRM is intended to be used as a complete system to communicate with Guidant implantable pulse generators.

The software in use controls all communication functions for the pulse generator. Refer to the physician's system manual for the pulse generator being interrogated for detailed software application instructions.

Contraindications

See the physician's system manual for the Guidant pulse generator for contraindications for use.

The Model 2920 PRM is contraindicated for use with any pulse generator other than a Guidant device.

Precautions

General

- Use only the appropriate Guidant programmers equipped with the appropriate software to program Guidant pulse generators.
- The Model 2920 PRM is designed to be used only with the Model 6577 Sterilizable Telemetry Wand. Do not use the Model 6575 Telemetry Wand with the Model 2920 PRM.
- Use only the supplied stylus with the Model 2920 PRM; the use of any other object could damage the touchscreen.

NOTE: Use of the stylus is recommended for accuracy; however, touching the screen with your finger will also activate a selection.

Preparation for Use

- Remove the telemetry wand from all packaging material before sterilization with steam.
- Avoid establishing telemetry communication between the PRM and the pulse generator when the PRM is in close proximity to monitors, high-frequency electrosurgical equipment, and strong magnetic fields, such as MRI devices. The telemetry link may be impaired and, in the case of MRI, may interfere with the PRM.

Maintenance and Handling

 Do not use an abrasive cloth or volatile solvents to clean any portion of the PRM.

- Keep disks away from magnets and magnetized objects, including telephones, power supply adapters, and monitors.
- Do not use a head cleaning kit intended for standard disk drives on this disk drive.
- The PRM is not waterproof or explosion proof. It should not be used in the presence of flammable gas mixtures including anesthetic mixture with air, oxygen, or nitrous oxide.

Adverse Effects

None known.

SYSTEM FEATURES

The PRM communicates with Guidant pulse generators via radio-frequency (RF) telemetry using the Guidant Model 6577 Sterilizable Telemetry Wand to perform the following functions:

- · Interrogates the programmable pulse generator
- Programs detection and therapy parameters for an implantable Guidant pulse generator
- Displays, records, and stores patient data and allows the physician to evaluate alternative prescription modes
- Stores patient data that can be recalled later in the patient session for analysis
- Patient data can be stored on a disk that can be accessed at future sessions
- Generates printed reports that detail pulse generator functions, stored patient data, and test results
- Allows the physician to perform tests in an electrophysiology (EP) laboratory, operating room, emergency room, or at a patient's bedside

In addition, the PRM has the following capabilities:

- Provides a direct interface between an external stimulator and an implanted Guidant pulse generator for programmed electrical stimulation (PES) during EP studies
- Provides use without device telemetry as an ECG display and recorder for patient diagnosis
- Simultaneously prints real-time surface ECG and telemetered signals (intracardiac electrograms and event markers) via the internal printer/ recorder

The PRM is equipped with the following features:

- PRM function keys including PROGRAM, STAT PACE, STAT SHOCK, and DIVERT THERAPY
- Printer/recorder function keys including paper speed keys, calibrate, zero to baseline, and paper feed
- · Touchscreen with tethered stylus

- Color display screen
- · One LS 120 disk drive
- Internal hard drive
- High-speed 4-inch (110 cm) thermal printer/recorder
- · Connections for slaved stimulation via an external signal source
- Connection to record data on an external FM tape recorder or strip chart recorder or both
- · Connection for an optional external printer.

System Accessories

The ZOOM programming system consists of the Model 2920 PRM and the following accessories:

- Model 2902 AC Power Cord
- Model 6577 Sterilizable Telemetry Wand
- Model 6627 Patient Data Disks (10)
- Model 6750 Surface ECG Patient Cable
- Model 6979 Printer Paper (4)

Other accessories for use with the PRM that can be ordered from Guidant include the following:

- Model 6809 Accessory Kit
- Model 6892 Controller-Stimulator Cable
- Model 6750 Surface ECG Patient Cable
- Model 6924 External Recorder Cable
- Model 6629 ECG-BNC Slave Cable
- Model 6930 Stimulation Input Cable Adapters
- Model 6934 Phono-BNC Adapters
- Model 6977 VGA Extension Cable

NOTE: Accessories should comply with the equivalent safety requirements of the PRM. The PRM complies with those standards listed in "Operating and Storage Conditions."

Optional External Printer

The use of an external printer is optional. Only compatible external printers that have been tested and qualified for use should be used with the Model 2920 PRM. Contact your Guidant sales representative to determine which printer(s) can be used.

Although the external printer meets leakage-current requirements for commercial products, it may not meet the leakage requirements for medical products. Consequently, the external printer must be kept outside the patient environment (at least 1.5 meters away from the patient).

Optional External Monitor

The use of an external monitor is optional. Contact your Guidant sales representative to determine which monitor(s) can be used.

Although the external monitor meets leakage-current requirements for commercial products, it may not meet the leakage requirements for medical products.

PREPARATION FOR USE

1. Set Up the System

Place the PRM on a steady surface. Slide the screen latches to the front and raise the screen. Tilt it to a comfortable viewing angle.

2. Turn the Power On

- a. Connect the power cord into the AC connector on the back panel (Figure 3).
- b. Plug the power cord into the appropriate AC outlet.
- c. Move the power switch to the ON (I) position (Figure 1).
- d. Monitor the PRM screen during power-up for status messages.

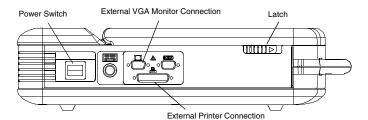


Figure 1. Left side panel of the PRM.

3. Prepare the Telemetry Wand

If the telemetry wand is to be used in a sterile field when using the PRM, it **first must be sterilized** with ethylene oxide or steam. To sterilize, follow the instructions in the product literature for the wand.

CAUTION: Remove the telemetry wand from all packaging material before sterilization.

Plug the telemetry wand into the connector on the right side of the PRM (Figure 2).

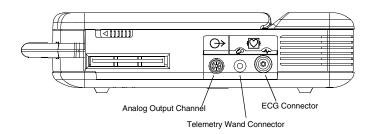


Figure 2. Right side panel of the PRM.

CAUTION: Avoid establishing telemetry communication between the PRM and the pulse generator when the PRM is in close proximity to monitors, high-frequency electrosurgical equipment, and strong magnetic fields, such as MRI devices. The telemetry link may be impaired and, in the case of MRI, may interfere with the PRM.

4. Make External Cable Connections

a. Connect the Model 6750 Surface ECG Patient Cable to the "ECG" connector on the right side of the PRM (Figure 2). This patient connection is electrically isolated. Attach the surface electrodes to the patient in a standard 3-wire or 5-wire configuration.

NOTE: If the PRM is in close proximity to high-frequency electrosurgical equipment, the surface ECG traces may exhibit noise interference. Refer to the troubleshooting section for corrective action.

- b. Connect the Model 6924 External Recorder Cable to the analog output channel on the right side of the PRM (Figure 2). Connect the other end to the multichannel recorder or external strip chart recorder. The Model 2920 PRM has high-level analog outputs.
- c. Connect the Model 6892 Controller-Stimulator Cable to the pacing stimulation source connector marked Stimulator Input (Figure 3) on the rear panel, and then into the corresponding terminal on the electrical stimulation source.

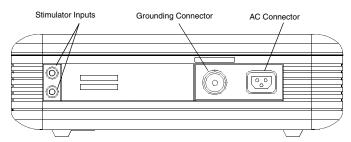


Figure 3. Rear panel of the PRM.

- d. (Optional) Connect the external printer to the PRM using the parallel cable provided with the printer (Figure 1). The external printer must be connected and activated to allow external reports to be printed.
- e. (Optional) Connect the external monitor to the PRM using a standard VGA cable (Figure 1). The Model 6977 VGA Extension Cable is available from Guidant as an accessory.

USING THE PRM

The PRM can be used as an ECG display and/or recorder without running a specific application. Connect the patient leads and start the recorder by selecting the ECG button on the upper right corner of the startup screen (Figure 4). The heart-rate indicator will display the intrinsic ventricular rate as the trace runs.

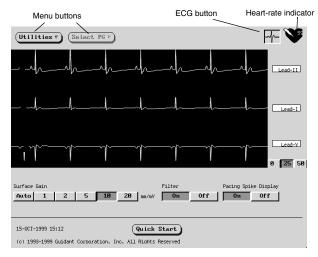


Figure 4. The ECG screen as accessed from the Startup screen.

Key Functions

Refer to the applicable physician's system manual for specific instructions on operating the PRM key functions, use of the STAT SHOCK, STAT PACE, DIVERT THERAPY, INTERROGATE, and PROGRAM keys, and how to use the telemetry wand.

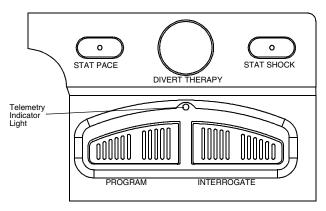
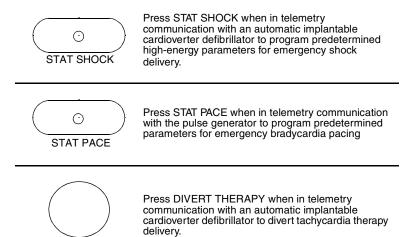


Figure 5. Model 2920 PRM keypad.

DIVERT THERAPY

Figure 5 shows the location of the PRM keys. General key functions are summarized below.





Press INTERROGATE when in telemetry communication with the pulse generator to obtain information stored in the pulse generator's memory.



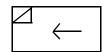
Press PROGRAM when in telemetry communication with the pulse generator to transmit new parameter values to the pulse generator.



Press this key to cause the internal printer/recorder to print a 1-mV calibration pulse.



Press this key to force the trace back to baseline after a defibrillation shock.



Press the paper feed key to scroll the printer paper on the internal printer/recorder.

Paper Speed Keys

Use the speed keys to specify the paper speed for the internal printer/recorder. Values are 0 (stop), 10, 25, 50, and 100 mm/sec.

The printout will show the date and time, lead(s) being printed, gain setting, chart speed, and filter setting.

Monitoring/Recording Functions

Surface ECG

Pressing any speed key will run a surface ECG if the surface ECG patient cable is connected to the PRM and electrodes are attached to the patient (unless a report is being printed). Refer to Step 4 "Make External Cable Connections" for detailed instructions.

Telemetered Channels

Intracardiac electrograms may be printed or displayed and event markers may be printed by the PRM. Refer to the physician's system manual for detailed instructions.

Touchscreen

Use the stylus to activate the desired selection by touching and releasing the screen target. Touch the screen navigation buttons at the bottom of the screen to move from one screen to another.

CAUTION: Use only the supplied stylus with the Model 2920 PRM; the use of any other object could damage the touchscreen.

NOTE: Use of the stylus is recommended for accuracy; however, finger touches will also work on the screen.

Indicators

Telemetry Indicator Light

The Telemetry Indicator Light on the keypad illuminates when telemetry has been established and interrogation or programming is occurring (Figure 5).

Power On Indicator Light

The Power On Indicator Light, located below the screen, is lit when the PRM is turned on.

MAINTENANCE AND HANDLING

Loading the Paper

The internal printer/recorder uses 4-inch wide (110 mm) thermosensitive printing paper. Model 6979 Printer Paper refills can be ordered from Guidant.

Use the following procedure to load paper into the internal printer/recorder:

- 1. Open the printer door.
- If any sheets from the previous pack remain, but did not feed, remove these and rotate the roller with clean fingertips to remove any small pieces of paper still under the printhead.
- 3. Unfold one sheet of paper and orient the pack such that the sensitive side is up and the pagination mark is at the bottom of the paper. Slip the pack into the printer/recorder.

NOTE: You must use paper with pagination markings. Paper will not paginate properly if paper does not have markings.

- 4. Allow the unfolded sheet to lay straight between the guides on the right of the printer/recorder.
- Close the printer door completely. The printer/recorder will automatically begin the paper-loading sequence and will stop at the first pagination mark after paper is detected. If the paper's edges are wrin-

kled, let 4 or 5 pages feed through-the printer will self-align the paper to its proper position.

The printer/recorder is now ready to resume printing.

For information regarding loading paper into the optional external printer, refer to the user manual for the printer.

Thermal Paper Storage

Store the heat-sensitive paper for the internal printer/recorder in a cool, dark environment. Do not attempt to erase the printer/recorder paper. Printed paper will last approximately 30 days under direct fluorescent light. To ensure the permanence of the patient's record, **store the printed paper away from direct sunlight, heat, or fumes from organic compounds.** Storage temperatures above 65°C, sustained exposure to direct sunlight, or exposure to high humidity, acetone, ammonia, alcohols, or other organic compounds may cause the paper to discolor.

NOTES

- If printed reports are to be kept for prolonged periods, you must make a photocopy of the thermosensitive paper as this paper is not intended for long-term retention, and will lose legibility over time.
- Some brands of adhesive tape applied to a printed report will fade the printing after 30 days.

Cleaning the PRM

Clean the housing and touchscreen of the PRM with a soft cloth lightly dampened with water.

Clean the printer/recorder with a dry, soft brush to eliminate dust and particles that may accumulate during printing and storage.

CAUTION: Do not use an abrasive cloth or volatile solvents to clean any portion of the PRM.

The cables used with the PRM are **not** packaged sterile. When necessary, clean the cables with a soft cloth dampened with a mild cleaning solution (eg, Liqui-nox for the sterilizable telemetry wand; Borax or a 1:10 bleach solution for other cables). Using the same method, wipe them completely with sterile water and towel or air dry. **DO NOT use an ultrasonic cleaner nor immerse the cables. Clean the sterilizable telemetry wand in the same manner, allowing no fluids to enter the wand cavity. See the "Preparation for Use" section for sterilization instructions.**

Patient Data Disk

The Model 6627 Patient Data Disk must be inserted with the arrow on the top left side and pointing into the disk drive (Figure 6). Be certain that the write-protect tab is closed on the disk (Figure 7). Insert a patient data disk firmly into the disk drive on the right side of the PRM until the disk ejection button protrudes.

NOTE: Refer to the physician's system manual for complete instructions on using the patient data disk.

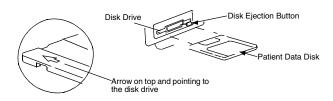


Figure 6. Disk drive on the right side of the PRM.

Caring for Disks

Floppy disks can be damaged easily, making them unusable. To prevent damage to the disks, observe the following:

- · Write on labels before applying them to disks.
- Use only a felt-tipped pen to write on a label that is already applied to a disk.
- Keep food and beverages away from disks and away from the PRM.
- Keep disks away from heat or direct sunlight. Disks should be stored at temperatures between 5° and 60°C (41°-140°F).
- Keep disks dry and stored in a dry area (relative humidity between 8% and 80%).
- · Do not bend disks.
- Do not attach paper clips, staples, or rubber bands to disks.
- Do not try to open the sliding shutter that covers the disks (Figure 7).
- Never touch the exposed disk area beneath the sliding shutter.

NOTE: The write-protect tab must be closed in order to record data to the disk and to print reports. If data cannot be recorded to the disk, check to see that the tab is positioned to cover the hole (Figure 7).

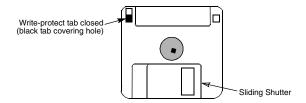


Figure 7. Floppy disk (3.5-inch) with write-protect tab closed.

CAUTION: Keep disks away from magnets and magnetized objects, including telephones, power supply adapters, and monitors.

NOTE: To remove a disk from the disk drive when the PRM is turned off or if the disk ejection button doesn't function, insert a straight metal wire such as a straightened paper clip into the small hole next to the opening for the disk.

Caring for the LS-120 Disk Drive

The Model 2920 PRM contains an LS-120 disk drive that can receive standard DD or HD disks, or an LS-120 disk. The disk drive manufacturer recommends the drive be cleaned after approximately every 80 hours of disk operation using only an LS-120 head cleaning kit.

CAUTION: Do not use a head cleaning kit intended for standard disk drives on this disk drive.

Operating and Storage Conditions

The Model 2920 PRM requires careful handling. The hard disk drive and the LS-120 disk drive must be protected from abusive handling. To protect the PRM from damage, observe the following:

- Do not turn off the PRM while the drive is accessing data.
- Do not subject the PRM to abusive shocks or vibrations.
- When transporting the PRM from a cold environment to a warm environment, allow the PRM to warm to ambient temperature before use.
- Do not place heavy objects on the PRM surface when closed or when in operation.
- · Do not place a magnet on the PRM.
- Do not pour or splash liquid into or onto the PRM.
- Do not scratch, nick or push the touchscreen surface.
- · Do not disassemble the PRM.
- · Remove any disks from the drive prior to transporting the PRM.
- Turn off the PRM and close all covers and doors prior to transporting.
- Unplug all external cables and cords prior to transporting the PRM.

Operate the PRM within a temperature range of 10° to 40° C. Store the PRM at temperatures between - 40° and 70° C, humidity of 10-100%, and 500-1060 hPa pressure. If the PRM has been stored in cold conditions (less than 10° C), turn it on and let the fan run for at least one hour before use.

The PRM is a Class III device that complies with the following standards:

- UL2601-1
- EN60601-1
- CSA-C22 No. 601-1-1
- CSA-C22 No. 601-1-2
- EN50097
- UL94

The PRM is capable of continuous operation, and will not shut off automatically if not used for an extended time, or if paper runs out. Keep the air intake and outlet free from obstruction.

CAUTION: The PRM is not waterproof or explosion proof. It should not be used in the presence of flammable gas mixtures including anesthetic mixture with air, oxygen, or nitrous oxide.

PRM Storage

- If using a patient data disk, remove disk from the disk drive by pressing the disk ejection button (Figure 6), and store the disk in a safe place.
- 2. Turn the PRM switch to the OFF (O) position (Figure 1).
- 3. Unplug the cables from the back and side panels and other equipment
- 4. Lower the screen until the left and right latches lock in place.

TROUBLESHOOTING

If the PRM does not operate properly, be certain that electrical cords and cables are securely connected, and that cords and cables are in good working order (ie, free of visible defects). Table 1 indicates possible causes and corrective action for PRM problems. For external printer problems, refer to the manual for the external printer.

Table 1. Possible Causes and Corrective Actions for PRM Problems

Symptom	Possible Cause	Corrective Action	
	No AC line voltage	Be certain power cord is plugged securely into the rear connector panel of the PRM.	
Internal printer/ recorder does not function	, and the second	Change to a different electrical outlet.	
	Paper jam	Clear paper path of any obstruction.	
Internal printer/	Paper misaligned	Reload paper.	
recorder-paper feed problems	Paper feed obstruction	Clear obstruction from around the paper supply.	
Internal printer/ recorder-no print visible	Paper loaded upside down	Reload paper. (See the "Loading the Paper" section.)	
No analog output	Using incorrect output port and/or connections	Recheck connection of the Model 6924 External Recorder Cable.	
Patient data disk error	Using disk created for a previous model of PRM or unformatted floppy disk	Use only Guidant Model 6627 Patient Data Disks.	
	Write-protect tab open	Close write-protect tab.	
	Improper patient connections	Recheck patient leads for adequate skin contact and correct limb lead placement.	
Noise problems- ECG	"Noisy" equipment	Check surrounding area for equipment with excessive radio frequency emissions. Move unneeded equipment away from patient and/or PRM, or power off unneeded equipment.	

Table 1. Possible Causes and Corrective Actions for PRM Problems

Symptom	Possible Cause	Corrective Action	
Telemetry-No communication	Incorrect application software or incorrect PRM for pulse generator	Install proper application software for pulse generator in use.	
	Incomplete telemetry communication	Reposition wand over the device; repeat interrogation.	
	Incorrect telemetry wand	Use only the Guidant Model 6577 Sterilizable Telemetry Wand.	
Telemetry- Intermittent communication	"Noisy" equipment	Check surrounding area for equipment with excessive radio frequency emissions. Move unneeded equipment away from patient and/or PRM, or power off unneeded equipment.	
	Incomplete telemetry communication	Reposition wand over the device, repeat interrogation.	

LABEL SYMBOLS

Table 2 illustrates the symbols used on the Model 2920 PRM and includes an explanation of each symbol.

Table 2. Label Symbols and Their Meanings

Symbol	Meaning	
	External keyboard connection (For Guidant use only)	
	VGA output for external monitor	
	See instruction manual	
	Serial connector (For Guidant use only.)	
	Parallel connector	
\Rightarrow	Analog output	
	Telemetry wand input	
	Indicates defibrillator-proof CF-type patient	
	ECG cable connector	
△ ←	Paper form feed	
几	Calibration pulse	
	Bring trace to baseline	
	Indicates the potential equalization conductor. This connection allows a common ground with other equipment in a clinical setting.	
\sim	Alternating current	
I	Indicates the risk of electric shock; do not remove the cover (or back). Refer servicing to Guidant.	

WARRANTY INFORMATION

A limited one-year warranty and a warranty registration card for the Guidant PRM is packaged with the PRM. Unless otherwise agreed, the PRM remains the property of Guidant and Guidant must perform all necessary servicing and repair work.

ORDERING ACCESSORIES

To order accessories, contact the nearest Guidant sales representative or contact Guidant Corporation at the address or phone number on the back cover of this manual.

SERVICE

For problems or questions that arise regarding operation or repair of the PRM, call the nearest Guidant representative or the Guidant 24-hour consultation number at 1-800-CARDIAC (1-800-227-3422). The PRM must be serviced by Guidant personnel only.

If the Guidant PRM malfunctions and requires repair, help to ensure efficient service by following these guidelines:

- Leave the configuration of the instrument exactly as it was at the time of malfunction. Contact the nearest Guidant representative or the 24-hour consultation number at 1-800-CARDIAC (1-800-227-3422).
- 2. Write a detailed description of the malfunction(s).
- 3. Save printouts or other materials that illustrate the problem.
- If the PRM must be returned to Guidant for service, pack it in the shipping container in which it was received or in a shipping container provided by Guidant.
- 5. Send the PRM to Guidant at the address on the back of this manual.

For problems or questions that arise regarding operation or repair of the optional external printer, contact the printer manufacturer or agent.

SPECIFICATIONS (Nominal)

Dimensions	Г	
Power rating $100\text{-}240\text{ VAC}$, 2.6 A and $50\text{-}60\text{ Hz}$ Power cord8 ft. 120 VAC Operating temperature 50°F to 105°F (10°C to 40°C)Storage temperature -40°F to 160°F (-40°C to 70°C)Relative humidity \bullet Storage• Operating $20\text{-}95\%$ Atmospheric pressure $500\text{-}1060\text{ hPa}$ External printer supportDB 25 parallel port connectorExternal monitor supportDB 15 VGA port connectorAnalog output $\pm 1\text{ V}$ output via 7-pin DIN connectorECG performance \bullet lead selectionI, II, III, aVR, aVL, aVF, V• intrinsic vent. rate display $30\text{-}240\text{ bpm} \pm 6\text{ bpm}$ • input impedance $> 2.5\text{ M}\Omega$ • electrode offset tolerance 300 mV • storage resolution 800 samples/sec , 4.56 μV • filter settings $0\text{N: }0.5\text{-}40\text{ Hz}$, $\pm 0.2\text{ dB}$; $0\text{FF: }0.05\text{-}100\text{ Hz} \pm 0.2\text{ dB}$ • gain settings $1, 2, 5, 10, 20\text{ mm/mV} \pm 10\%$ Internal printer \bullet paper typethermo-sensitive• paper width \bullet in (110 mm)• chart speed $10, 25, 50, 100\text{ mm/sec}$ Safety features \bullet leakage current $< 10\text{ µA}$ (patient); $< 100\text{ µA}$ (chassis)	Dimensions	
Power cord Operating temperature 50°F to 105°F (10°C to 40°C) Storage temperature -40°F to 160°F (-40°C to 70°C) Relative humidity • Storage • Operating 20-95% Atmospheric pressure External printer support DB 25 parallel port connector External monitor support DB 15 VGA port connector External monitor support Analog output ± 1 V output via 7-pin DIN connector ECG performance • lead selection • intrinsic vent. rate display • input impedance • electrode offset tolerance • storage resolution • filter settings • gain settings 1, 2, 5, 10, 20 mm/mV ± 10% Internal printer • paper width • chart speed • leakage current 8 to 105°F (10°C to 40°C) 50°C to 40°C) 50°C to 70°C) 8 100°F (-40°C to 70°C) 800 hPa 20-95% 4 in V output via 7-pin DIN connector EXTENDANCY 500-100 N connector 800 samples/sec, 4.56 μV ON: 0.5-40 Hz, ± 0.2 dB; OFF: 0.05-100 Hz ± 0.2 dB 1, 2, 5, 10, 20 mm/mV ± 10% Internal printer • paper width • thermo-sensitive 4 in (110 mm) • chart speed 50°-100 μA (chassis)	Weight (approximate)	15.7 lb (7.1 kg)
Operating temperature 50°F to 105°F (10°C to 40°C) Storage temperature -40°F to 160°F (-40°C to 70°C) Relative humidity • Storage 5-100% • Operating 20-95% Atmospheric pressure 500-1060 hPa External printer support DB 25 parallel port connector External monitor support DB 15 VGA port connector Analog output ± 1 V output via 7-pin DIN connector ECG performance • lead selection • intrinsic vent. rate display • input impedance • electrode offset tolerance • storage resolution • filter settings • gain settings 1, 2, 5, 10, 20 mm/mV ± 10% Internal printer • paper type • paper width • chart speed • leakage current 50°F to 105°F (10°C to 40°C) 70°C) 80°F to 160°F (-40°C to 70°C) 800-40°C to 70°C) 809-40 hPa 500-1060 hPa 1, II, III, ava 6 bpm 700-1010 hPa 100-1010 hPa 1	Power rating	100-240 VAC, 2.6 A and 50-60 Hz
Storage temperature -40°F to 160°F (-40°C to 70°C) Relative humidity • Storage • Operating Atmospheric pressure External printer support External monitor support DB 25 parallel port connector External monitor support DB 15 VGA port connector Analog output ± 1 V output via 7-pin DIN connector ECG performance • lead selection • intrinsic vent. rate display • input impedance • electrode offset tolerance • storage resolution • filter settings • gain settings (ON: 0.5-40 Hz, ± 0.2 dB; OFF: 0.05-100 Hz ± 0.2 dB (OFF: 0.05-100 Hz ± 0.2 dB	Power cord	8 ft. 120 VAC
Relative humidity • Storage • Operating Atmospheric pressure External printer support External monitor support DB 25 parallel port connector External monitor support DB 15 VGA port connector Analog output ± 1 V output via 7-pin DIN connector ECG performance • lead selection • intrinsic vent. rate display • input impedance • electrode offset tolerance • storage resolution • filter settings • gain settings Internal printer • paper type • paper width • chart speed • leakage current • 10 μA (patient); < 100 μA (chassis)	Operating temperature	50°F to 105°F (10°C to 40°C)
 Storage Operating 20-95% Atmospheric pressure External printer support External monitor support DB 25 parallel port connector External monitor support DB 15 VGA port connector Analog output ± 1 V output via 7-pin DIN connector ECG performance lead selection l, II, III, aVR, aVL, aVF, V intrinsic vent. rate display input impedance electrode offset tolerance storage resolution filter settings gain settings gain settings 1, 2, 5, 10, 20 mm/mV ± 10% Internal printer paper type paper width thermo-sensitive paper width chart speed 10, 25, 50, 100 mm/sec Safety features leakage current 100 μA (chassis) 	Storage temperature	-40°F to 160°F (-40°C to 70°C)
 Operating Atmospheric pressure External printer support DB 25 parallel port connector External monitor support DB 15 VGA port connector Analog output ± 1 V output via 7-pin DIN connector ECG performance lead selection lead selection intrinsic vent. rate display input impedance electrode offset tolerance storage resolution filter settings gain settings 1, 2, 5, 10, 20 mm/mV ± 10% Internal printer paper type paper width chart speed Lakage current 10 μA (patient); < 100 μA (chassis) 	Relative humidity	
Atmospheric pressure 500-1060 hPa External printer support DB 25 parallel port connector External monitor support DB 15 VGA port connector Analog output \pm 1 V output via 7-pin DIN connector ECG performance • lead selection I, II, III, aVR, aVL, aVF, V • intrinsic vent. rate display intrinsic vent. rate display • input impedance $+$ 2.5 M \oplus 30 samples/sec, 4.56 \oplus V • storage resolution Support Sup	• Storage	5-100%
External printer support DB 25 parallel port connector External monitor support DB 15 VGA port connector $ \begin{array}{lll} & & & \\ & & \\ & & \\ & & \\ & \\ & \\ & \\ $	Operating	20-95%
External monitor support DB 15 VGA port connector Analog output \pm 1 V output via 7-pin DIN connector ECG performance • lead selection I, II, III, aVR, aVL, aVF, V • intrinsic vent. rate display • input impedance > 2.5 M Ω • electrode offset tolerance • storage resolution 800 samples/sec, 4.56 μ V ON: 0.5-40 Hz, \pm 0.2 dB; OFF: 0.05-100 Hz \pm 0.2 dB • gain settings 1, 2, 5, 10, 20 mm/mV \pm 10% Internal printer • paper type thermo-sensitive • paper width 4 in (110 mm) • chart speed 10, 25, 50, 100 mm/sec Safety features • leakage current < 10 μ A (patient); < 100 μ A (chassis)	Atmospheric pressure	500-1060 hPa
Analog output \pm 1 V output via 7-pin DIN connector ECG performance • lead selection • intrinsic vent. rate display • input impedance • electrode offset tolerance • storage resolution • filter settings • gain settings • gain settings Internal printer • paper type • paper width • chart speed Analog output \pm 1 V output via 7-pin DIN connector I, II, III, aVR, aVL, aVF, V 30-240 bpm \pm 6 bpm > 2.5 M Ω 300 mV ON: 0.5-40 Hz, \pm 0.2 dB; OFF: 0.05-100 Hz \pm 0.2 dB Internal printer • paper type • thermo-sensitive 4 in (110 mm) • chart speed Safety features • leakage current \pm 10 μ A (patient); < 100 μ A (chassis)	External printer support	DB 25 parallel port connector
ECG performance • lead selection • intrinsic vent. rate display • input impedance • storage resolution • filter settings • gain settings Internal printer • paper type • paper width • chart speed Safety features • leakage current I, II, III, aVR, aVL, aVF, V 30-240 bpm ± 6 bpm > 2.5 M Ω 300 mV 800 samples/sec, 4.56 μV ON: 0.5-40 Hz, ± 0.2 dB; OFF: 0.05-100 Hz ± 0.2 dB 1, 2, 5, 10, 20 mm/mV ± 10% Internal printer • paper sidth • thermo-sensitive 4 in (110 mm) • chart speed Safety features • leakage current $< 10 \mu A$ (patient); $< 100 \mu A$ (chassis)	External monitor support	DB 15 VGA port connector
• lead selection • intrinsic vent. rate display • input impedance • electrode offset tolerance • storage resolution • filter settings • gain settings • paper type • paper width • chart speed • leakage current I, II, III, aVR, aVL, aVF, V 30-240 bpm \pm 6 bpm > 2.5 M Ω 300 mV 800 samples/sec, 4.56 μ V ON: 0.5-40 Hz, \pm 0.2 dB; OFF: 0.05-100 Hz \pm 0.2 dB 1, 2, 5, 10, 20 mm/mV \pm 10% Internal printer • paper type • thermo-sensitive 4 in (110 mm) • chart speed Safety features • leakage current $= 10 \mu \text{A} \text{ (patient)}; < 100 \mu \text{A (chassis)}$	Analog output	± 1 V output via 7-pin DIN connector
• intrinsic vent. rate display • input impedance • electrode offset tolerance • storage resolution • filter settings • gain settings • gain settings Internal printer • paper type • paper width • chart speed Safety features • leakage current 300 mV 800 samples/sec, $4.56 \mu V$ ON: $0.5-40 Hz, \pm 0.2 dB$; OFF: $0.05-100 Hz \pm 0.2 dB$ 1, 2, 5, 10, 20 mm/mV \pm 10% thermo-sensitive 4 in (110 mm) • chart speed 10, 25, 50, 100 mm/sec	ECG performance	
$ \begin{array}{lll} \bullet & \text{input impedance} \\ \bullet & \text{electrode offset tolerance} \\ \bullet & \text{storage resolution} \\ \bullet & \text{storage resolution} \\ \bullet & \text{filter settings} \\ \bullet & \text{gain settings} \\ \bullet & \text{gain settings} \\ \hline \bullet & \text{paper type} \\ \bullet & \text{paper width} \\ \bullet & \text{chart speed} \\ \hline \end{array} \begin{array}{ll} > 2.5 \text{ M } \Omega \\ 300 \text{ mV} \\ \hline & \text{800 samples/sec, 4.56 } \mu\text{V} \\ \hline & \text{ON: 0.5-40 Hz, } \pm 0.2 \text{ dB; } \\ \text{OFF: 0.05-100 Hz} \pm 0.2 \text{ dB} \\ \hline & \text{1, 2, 5, 10, 20 mm/mV} \pm 10\% \\ \hline & \text{Internal printer} \\ \hline & \text{paper type} \\ \bullet & \text{paper width} \\ \bullet & \text{chart speed} \\ \hline & \text{10, 25, 50, 100 mm/sec} \\ \hline \\ & \text{Safety features} \\ \hline & \text{eleakage current} \\ \hline \end{array} \begin{array}{ll} > 2.5 \text{ M } \Omega \\ \hline \text{300 mV} \\ \hline \text{ON: 0.5-40 Hz, } \pm 0.2 \text{ dB; } \\ \hline \text{OFF: 0.05-100 Hz} \pm 0.2 \text{ dB; } \\ \hline OFF: 0.05-10$	 lead selection 	I, II, III, aVR, aVL, aVF, V
• electrode offset tolerance • storage resolution • filter settings • gain settings • gain settings 1, 2, 5, 10, 20 mm/mV \pm 10% Internal printer • paper type • paper width • chart speed Safety features • leakage current 300 mV 800 samples/sec, 4.56 μ V ON: 0.5-40 Hz, \pm 0.2 dB; OFF: 0.05-100 Hz \pm 0.2 dB 1, 2, 5, 10, 20 mm/mV \pm 10% thermo-sensitive 4 in (110 mm) • chart speed > 10, 25, 50, 100 mm/sec	• intrinsic vent. rate display	30-240 bpm <u>+</u> 6 bpm
	• input impedance	$>$ 2.5 M Ω
$ \begin{array}{lll} \bullet \ \text{filter settings} & ON: \ 0.5\text{-}40 \ \text{Hz}, \pm 0.2 \ \text{dB}; \\ OFF: \ 0.05\text{-}100 \ \text{Hz} \pm 0.2 \ \text{dB} \\ \bullet \ \text{gain settings} & 1, \ 2, \ 5, \ 10, \ 20 \ \text{mm/mV} \pm 10\% \\ \hline \\ \text{Internal printer} & \bullet \ \text{paper type} & \text{thermo-sensitive} \\ \bullet \ \text{paper width} & 4 \ \text{in} \ (110 \ \text{mm}) \\ \bullet \ \text{chart speed} & 10, \ 25, \ 50, \ 100 \ \text{mm/sec} \\ \hline \\ \text{Safety features} & \bullet \ \text{leakage current} & < 10 \ \mu\text{A (patient);} \ < 100 \ \mu\text{A (chassis)} \\ \hline \end{array} $	electrode offset tolerance	300 mV
 Inter settings gain settings 1, 2, 5, 10, 20 mm/mV ± 10% Internal printer paper type paper width chart speed Safety features leakage current OFF: 0.05-100 Hz ± 0.2 dB 10% 1	storage resolution	800 samples/sec, 4.56 μV
Internal printer • paper type thermo-sensitive • paper width 4 in (110 mm) • chart speed 10, 25, 50, 100 mm/sec Safety features • leakage current < 10 µA (patient); < 100 µA (chassis)	• filter settings	ON: 0.5-40 Hz, \pm 0.2 dB; OFF: 0.05-100 Hz \pm 0.2 dB
 paper type paper width thermo-sensitive 4 in (110 mm) chart speed 10, 25, 50, 100 mm/sec Safety features leakage current < 10 μA (patient); < 100 μA (chassis) 	• gain settings	1, 2, 5, 10, 20 mm/mV \pm 10%
 paper width 4 in (110 mm) chart speed 10, 25, 50, 100 mm/sec Safety features leakage current < 10 μA (patient); < 100 μA (chassis) 	Internal printer	
 chart speed Safety features leakage current 10, 25, 50, 100 mm/sec < 10 μA (patient); < 100 μA (chassis) 	• paper type	thermo-sensitive
Safety features • leakage current < 10 μA (patient); < 100 μA (chassis)	• paper width	4 in (110 mm)
• leakage current < 10 μA (patient); < 100 μA (chassis)	• chart speed	10, 25, 50, 100 mm/sec
, , , , , , , , ,	Safety features	
defibrillator protection to 5000 V, 400 J	leakage current	< 10 μ A (patient); < 100 μ A (chassis)
	defibrillator protection	to 5000 V, 400 J

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