



Cardiac Resuscitation



# HeartStart MRx Monitor/Defibrillator

All-in-one monitoring, measurements, and proven therapies

**PHILIPS**

# HeartStart MRx

## Leading-edge monitoring,

The HeartStart MRx Monitor/Defibrillator unites Philips industry-leading monitoring, superior diagnostic measurements, proven therapy capabilities, and CPR measurement and feedback in a lightweight and intuitive package designed to help caregivers save lives every day.

- **Compact, lightweight and intuitive unit** combining a defibrillator, monitor and cardiograph in one unit saves space and reduces weight on hospital beds.
- **Industry-leading physiologic measurements** and Q-CPR real-time measurement and feedback.
- **Proven therapies** including pacing and the SMART Biphasic® waveform for effective defibrillation and synchronized cardioversion with less post-shock trauma.
- **Clinical networking capability\*** on the IntelliVue Clinical Network for monitoring and review at the central station. The HeartStart MRx is the only monitor/defibrillator with clinical networking capability. During transport between clinical units, maintain the level of care provided at the bedside with remote surveillance and automatic updating of vitals.

Recent scientific evidence as well as American Heart Association and European Resuscitation Council guidelines demonstrate that quality CPR and effective defibrillation are inextricably linked.\*\* To assist caregivers in performing quality CPR, the Q-CPR™ measurement and feedback tool offers objective measurement and corrective feedback on compression depth and rate as well as ventilation volume and rate.

**AC or battery power**, with two bays for rechargeable lithium ion batteries. Two fully charged batteries provide a minimum of 10 hours of monitoring – more than any other monitor/defibrillator. Batteries charge to full capacity in just three hours. Battery conditioning is not required.

**Powerful monitoring and measurements**, including:

**Standard**

- 3- and 5-lead ECG
- ST/AR Basic™ arrhythmia algorithm
- Vital signs trending

**Optional**

- FAST SpO<sub>2</sub> (Fourier Artifact Suppression Technology)
- Q-CPR measurement and feedback
- Noninvasive Blood Pressure (NBP)
- Microstream® Capnography (EtCO<sub>2</sub>)
- 12-lead ECG
- 12-lead ECG transmission
- Invasive Blood Pressure, 2 lines
- Temperature

\* Only available in the US.

\*\* Cobb et al. (1999), JAMA, "Influence of Cardiopulmonary Resuscitation Prior to Defibrillation in Patients with Out-of-Hospital Ventricular Fibrillation" Weisfeldt et al. (2002), JAMA, "Resuscitation after Cardiac Arrest - A 3-phase Time-Sensitive Model"

# Monitor/Defibrillator resuscitation, and clinical networking\*



**Color display** shows four waveforms and numerics. It is the largest in its class at 12.8 x 17.7 cm (8.4" diagonal), which allows viewing of all 12 leads at once with the 12-lead acquisition option.

Easily transported by hand or on a hospital bed using the **carrying handle or bedrail hook**. This compact unit weighs only 6 kg (13.2 lbs.) and measures 31.5 x 21.0 x 29.5 cm (12.4" x 8.3" x 11.7").

**Monitoring and therapy controls** sensibly organized.

**Ready for use indicator** flashes with a black hourglass confirming that the unit is ready to go. Otherwise, it asks for attention with a red "X" and an audible chirp when the battery is low, if the unit is not ready to pace or shock, or if the ECG capability is compromised. Operators have assurance that the MRx is ready when needed when the black hourglass is flashing.

**Defibrillation as easy as 1-2-3**

- 1 Select energy** to choose an appropriate dosage.
- 2 Charge button** charges the defibrillator in less than five seconds.
- 3 Shock button** to deliver therapy.

**Quick Shock** delivers a shock typically in less than 10 seconds after the user is prompted to pause chest compressions for defibrillation.

**Automated External Defibrillator (AED) mode** delivers a lifesaving shock within seconds, guided by clear, concise voice and on-screen prompts.

**Integrated strip chart printer** documents ECG rhythm strips, 12-lead reports, clinical events, event summary reports, vital signs trending, operational checks, configuration, status logs, and other device information (50 mm standard or 75 mm optional).

**Monitoring ports** are easily identified and color-coded to avoid confusion in high-stress situations. Ports match Philips patient monitors for easy patient handoffs.

**Soft keys** to customize the display, set and respond to alarms, and select additional monitoring parameters.

**Configure the intuitive user interface** based on preferences.

# Diagnostic-quality measurements and a variety of monitoring modes

There is no reason to compromise on monitoring functionality in a monitor/defibrillator. HeartStart MRx provides easy-to-use, industry-leading measurements common to all Philips patient monitors.

## Arrhythmia using ST/AR

The ST/AR Basic arrhythmia algorithm analyzes the ECG and calculates the heart rate, while continuously monitoring for ventricular arrhythmias and generating visible and audible alarms as needed. ST/AR detects ten rhythm disturbances, including five life-threatening arrhythmias: asystole, ventricular fibrillation, ventricular tachycardia, extreme bradycardia, and extreme tachycardia.

## Pulse Oximetry with FAST SpO<sub>2</sub>

Patented Fourier Artifact Suppression Technology (FAST) SpO<sub>2</sub> with its low-noise hardware and quality indicators enables MRx to provide accurate measurements, even in the presence of low peripheral perfusion.

## Noninvasive Blood Pressure (NBP)

ADVANTAGE® oscillometric NBP provides motion-tolerant systolic and diastolic measurement capabilities. It also calculates mean arterial pressure.

## Invasive Blood Pressure (IBP)

The Invasive Blood Pressure (IBP) measurement produces real-time waveforms and numeric values for systolic, diastolic, and mean arterial blood pressure and works with a range of catheters and blood pressure transducers. Software algorithms filter typical artifacts such as respiratory variation and pressure changes caused by flushing the line or drawing blood samples.

## Microstream® Capnography (EtCO<sub>2</sub>)

Microstream® CO<sub>2</sub> technology for use with both intubated and non-intubated patients is convenient and flexible, requiring no zeroing, heating, and no external sensor to interfere with the patient's airway.

## Philips 12-lead ECG

Common to the Philips PageWriter Touch cardiograph and IntelliVue bedside monitors, the 12-lead algorithm delivers both ECG data and interpretation. It detects ST-segment elevation acute myocardial infarction (STEMI) and differentiates early acute coronary syndromes.

## Continuous Temperature

Temperature measurement provides continuous body temperature readings at a variety of sites including: skin, rectal, nasal, esophageal, arterial, and venous. Temperatures from -1°C to 45°C can be tracked, and the numeric display presented along with other key parameters.

## Vital Signs Trending

In Monitor Mode, the HeartStart MRx provides the ability to view and print numeric vital signs trending for the current patient event. The trend data is visible at selected intervals for up to the most recent 12 hours of monitoring.





# Proven patient therapy



Philips HeartStart defibrillators use sophisticated, clinically-proven technology to provide effective defibrillation, synchronized cardioversion and pacing.

### **Defibrillation and Synchronized Cardioversion with SMART Biphasic Technology**

Designed for maximum efficacy and minimized post-event heart dysfunction, this patented waveform technology measures chest impedance and delivers a shock based on unique patient requirements.

Peer-reviewed evidence supports the effectiveness of SMART Biphasic synchronized cardioversion capabilities, which are activated with the push of a button.\* In Sync Mode, R-wave markers appear on or above each detected R-wave.

### **Noninvasive Pacing**

Users can perform transcutaneous pacing, which offers a constant 40-msec pulse width, and an adjustable rate and output (mA). MRx offers both demand mode and fixed mode.

\* Page et al. (2002), JACC, "Biphasic Versus Monophasic Shock Waveform for Conversion of Atrial Fibrillation"

# Networked\* for workflow convenient



The HeartStart MRx connects to the IntelliVue Clinical Network via a LAN cable or wireless medical transmission service (WMTS) radio.

## HeartStart MRx and the IntelliVue Clinical Network

Wired and wireless networking capability\* connects the HeartStart MRx to the IntelliVue Clinical Network. This means that waveforms, vitals, and alarms from HeartStart MRx stream in real-time to the IntelliVue Information Center and can be reviewed using a range of Clinical Review Applications on the IntelliVue Information Center. Clinicians can monitor and silence alarms from the IntelliVue Information Center. Patients monitored by a HeartStart MRx in a chest pain room, in the emergency department, or at the cardiac cath lab, for example, have the added safety of surveillance at the central station.

The IntelliVue Clinical Network centralizes patient information, streamlining documentation and reporting. For regulatory reporting such as the Joint Commission's

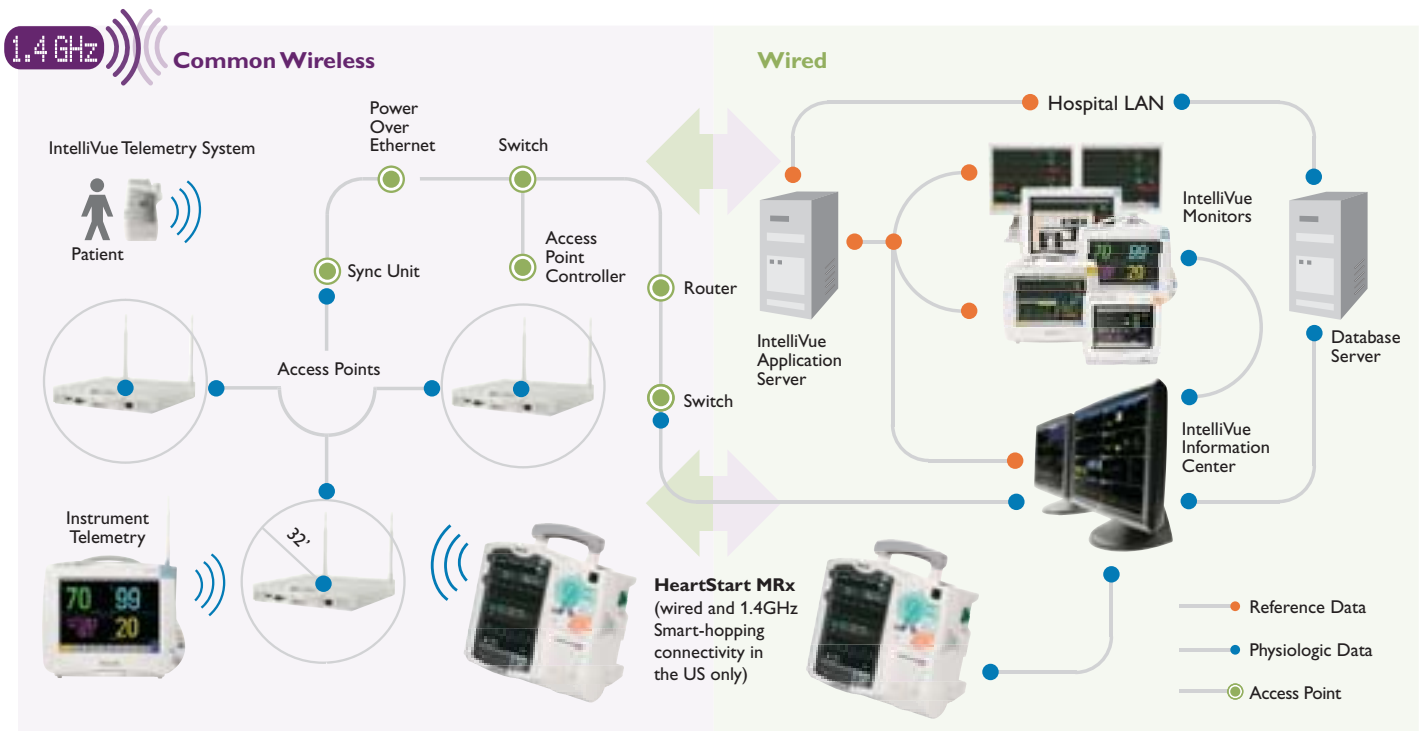
mandate for sentinel events, HeartStart MRx's networking capability ensures continuous streaming of patient data to the IntelliVue Information Center for inclusion in the patient chart.

Bi-directional information flow means that patient data can be entered at either the bedside or central station. The HeartStart MRx can admit, discharge, and transfer patients so that the data moves with the patient. The network is also able to adjust the HeartStart MRx time clock to ensure synchronization with the clinical network.

Because the HeartStart MRx shares the same algorithms, parameters, and medical consumables as other Philips patient monitors, patients do not require re-cabling at handoffs, which means smoother and faster transitions for care givers and less discomfort for patients.

\* Only available in the US.

## Hospital Infrastructure



# efficiency, documentation, and patient safety

## Automated self tests and operational checks

The HeartStart MRx automatically performs hourly, daily, and weekly self tests without user involvement. In addition, users can run operational checks periodically.

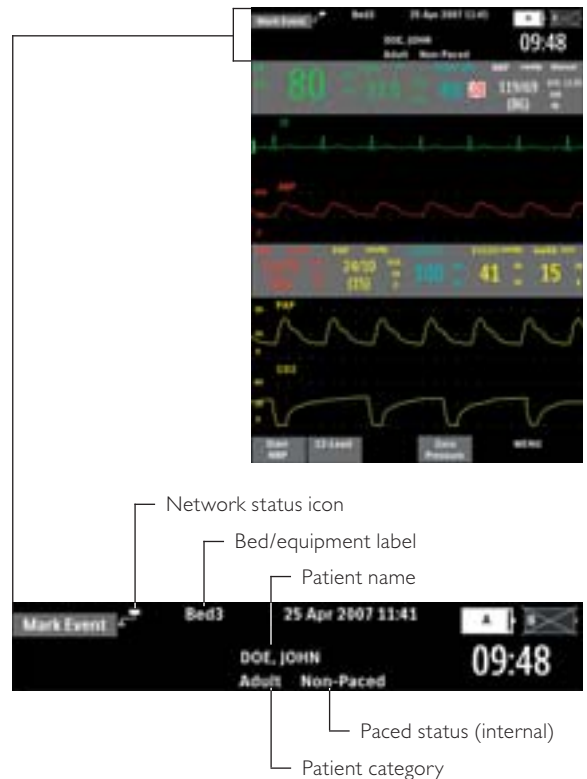
## Saving HeartStart MRx information for review and documentation

To simplify Joint Commission and other reporting requirements, HeartStart MRx's internal memory automatically stores up to twelve hours of continuous ECG waveform and event data (including drug and therapy markers) and up to 55 Event Summaries. The data can also be copied to a removable CompactFlash® data card for transfer to a laptop or personal computer.

Review results on screen or print results using the strip chart printer. Transfer results to a PC running HeartStart Event Review Pro data management software to compile, edit, share, and archive patient care information for quality control and reporting.

## Plug and play with Philips monitor/defibrillators and patient monitors

HeartStart accessories are interchangeable with Philips patient monitors to allow “plug and play” handoff between the bedside and the monitor/defibrillator for easy transports.



An ADT interface allows patients to be admitted, discharged, or transferred at the bedside through HeartStart MRx. Patient data from the IntelliVue Information Center—including patient name, category, pacing status, and location—are displayed on the monitor.

# A range of medical consumables to suit clinician preference



## HeartStart Defibrillator Pads and Paddles

Optimized for Philips defibrillators, HeartStart multifunction defibrillator pads come in adult, pediatric, and specialty choices to fit the needs of a variety of departments, caregivers, patients and treatments – from emergency use to ECG monitoring and radiological procedures. When connected to HeartStart MRx, they can provide ECG monitoring, synchronized cardioversion, and noninvasive pacing, in addition to external defibrillation. If paddles are preferred, the MRx is optionally equipped with a set of external paddles. These anterior/anterior paddles (water resistant available) quickly and easily convert from adult to pediatric by removing the outer surfaces. The paddles also have Philips' patented Patient Contact Indicator (PCI) to assess paddle-to-patient contact and indicate contact quality on the sternum paddle's handle.

For open-heart and other intrathoracic procedures, HeartStart MRx can be used with Philips internal defibrillation paddles, which come in a range of sizes.

## Measurement Supplies

ECG cables, NBP cuffs, SpO<sub>2</sub> sensors, and CO<sub>2</sub> filter lines are interchangeable with HeartStart MRx and other Philips patient monitors. This contributes to efficiency during transfer since there's no need for re-cabling. It also simplifies purchasing, stocking, and managing inventory for cables and other supplies throughout the hospital. All supplies are backed by a one-year warranty.



## Carrying case

A durable, semi-rigid structure covered in easy-to-clean vinyl, the case adds a layer of protection to the HeartStart MRx and enables easy transport of well-organized accessories. Modular pouches can be removed if desired.

## Education Solutions

Philips has created a variety of education and training solutions, all developed using sound instructional design principles, to further enhance your experience with the HeartStart MRx. Some of these solutions include:

### Interactive Multimedia

Use the self-paced, interactive, web-based training program to explore device features, simulate hands-on procedures, and test your understanding. Continuing education credits are available upon course completion. Philips also provides video-based training (optional).

### Instructor-based Training and Toolkit

An Instructor Guide, User Training Workbook, and Skills Checklist combine to help you deliver MRx education in an effective and

efficient manner. On-site instructor-based training delivered by clinical educators is also available, customized to your needs and presented in realistic critical care context.

### Application Notes

Application notes explain the theory behind our therapeutic and monitoring technologies, as well as provide support for their clinical efficacy and intended interpretation.



# Objective feedback on the quality of your CPR with Q-CPR™



## Defibrillation and CPR are inextricably linked

Based on much peer-reviewed research, internationally recognized organizations such as the American Heart Association and the European Resuscitation Council have published guidelines that emphasize not only the importance of both early defibrillation and quality CPR, but also the way in which these therapies work together. Q-CPR™ technology by Laerdal in the MRx is the world's first and only real-time measurement and feedback tool to provide personalized feedback on both components of CPR: ventilation and compressions.

Q-CPR measures and provides feedback on these important aspects of CPR:

- Chest compression rate (too high, too low)
- Chest compression depth (too shallow, too deep)
- Chest compression complete release/recoil
- Chest Compression “hands-off” time
- Ventilation rate (too high, too low)
- Ventilation volume
- Ventilation inactivity



# Product Specifications



Physical	
Dimensions	Without external paddles: 12.4 in. (W) x 8.3 in. (D) x 11.7 in. (H) (313 mm x 210 mm x 295 mm) With external paddles: 13.4 in. (W) x 8.3 in. (D) x 13.6 in. (H) (340 mm x 210 mm x 345 mm)
Weight	13.2 lbs. (6 kg): base unit with 1 battery, pads and pads cable. Carrying case adds 4.1 lbs. (1.86 kg). Paddle tray and external standard paddles add less than 2.5 lbs. (1.1 kg).
Environmental and Physical Requirements	
Water Resistance	Meets IEC 60601-2-4
Solids Resistance	IP2X
Temperature	Operating: 32° - 113° F (0° - 45° C) Storage: -4° - 158° F (-20° - 70° C)
Humidity	Operating: 0% to 95% relative
Safety	Meets EN 60601-1, UL 2601-1, CSA C22.2 No. 601-1-M90 CSA, EN 60601-2-4
Display	
Dimensions	8.4" diagonal (128 mm x 171 mm)
Type	TFT color LCD
Resolution	640 x 480 pixels (VGA)
Wave Viewing Time	5 seconds (ECG)
Defibrillator	
Defibrillator Model	HeartStart MRx (M3535A)
Waveform	Truncated Exponential Biphasic. Waveform parameters adjusted as a function of patient impedance.
Output Energy	Manual (selected): 1-10, 15, 20, 30, 50, 70, 100, 120, 150, 170, 200 Joules maximum energy, limited to 50 Joules for internal defibrillation. AED Mode (single energy output): 150 Joules into a 50 ohm load.
Charge Time	Less than 5 seconds to 200 Joules with a new, fully charged lithium ion battery at 25° C
Shock Delivery	Via multifunction defib electrode pads or paddles
Quick Shock	Less than 10 seconds from cessation of CPR to shock delivery
Patient Impedance Range	Minimum: 15 Ohm (internal defibrillation); 25 Ohm (external defibrillation) Maximum: 180 Ohm
AED Mode	Shock advisory sensitivity and specificity meet AAMI DF-39 guidelines
Strip Chart Printer	
Printer	Standard: 50 mm (paper width) thermal array printer Optional: 75 mm (paper width) thermal array printer
Continuous ECG Strip	Prints primary ECG lead with event annotations and measurements in real-time or with 10-second delay
Auto Printing	Printer can be configured to print marked events, charge, shock and alarms
Reports	Event Summary, 12-lead, Vital Signs Trending, Operational Check, Configuration, Status Log, and Device Information
Paper Size	1.97 in. (50 mm) W by 100 ft. (30 m) L 2.95 in. (75 mm) W by 100 ft. (30 m) L

Battery	
Type	6.0 Ah, 14.8 V, rechargeable lithium ion
Dimensions	6.5" (H) x 3.8" (W) x 1.6" (D) (165 mm x 95 mm x 42 mm)
Weight	1.6 lb. (0.73 kg)
Charge Time	Approximately 3 hours to 100%, 2 hours to 80%
Capacity	At least 5 hours of monitoring with ECG, SpO <sub>2</sub> , CO <sub>2</sub> , temperature and two invasive pressures monitored continuously, NBP measured every 15 minutes, and 20 200J discharges (with a new, fully charged battery, operating at room temperature, 25° C). At least 3.5 hours of monitoring with ECG, SpO <sub>2</sub> , CO <sub>2</sub> , temperature and two invasive pressures monitored continuously, NBP measured every 15 minutes, and pacing at 180ppm at 160mA.
Battery Indicators	Battery gauge on battery, capacity indicator on display; flashing RFU indicator, chirp, and 'Low Battery' message appears on display for low battery condition, when 10 minutes of monitoring time and 6 maximum energy discharges remain (with a new battery at room temperature, 25° C)
Data Storage	
Internal	12 hours of continuous ECG waveforms and events, maximum capacity of 55 Event Summaries
Data Card	60 event summary reports or 240 megabytes of patient data
ECG and Arrhythmia Monitoring	
Input	Up to 4 ECG waves displayed and up to 2 ECG waves print simultaneously Lead I, II, or III obtained through 3-lead ECG cable and separate monitoring electrodes. With 5-lead cable, obtain leads aVR, aVL, aVF, or V. Pads ECG obtained through 2 multifunction defibrillation electrode pads.
Lead Fault	'Lead Off' message and dashed line displayed, if an electrode or lead wire becomes disconnected
Pads Fault	Dashed line displayed if a pad becomes disconnected
Heart Rate Display	Digital readout on display 15 to 300 bpm, accuracy ±10%
Heart Rate/Arrhythmia Alarms	HR, Asystole, VFIB/VTACH, VTACH, extreme tachycardia, extreme bradycardia, PVC rate, Pacer not capture, Pacer not pacing
ECG Size	2.5, 5, 10, 20, 40 mm/mV, autogain
Noninvasive Pacing	
Waveform	Monophasic Truncated Exponential
Current Pulse Amplitude	10 mA to 175 mA (5 mA resolution); accuracy 10% or 5 mA whichever is greater
Pulse Width	40 ms with ± 10% accuracy
Rate	30 ppm to 180 ppm (10 ppm increments); accuracy ± 1.5%
Modes	Demand or Fixed Rate
Refractory Period	340 msec (30 to 80 ppm); 240 msec (90 to 180 ppm)
SpO <sub>2</sub> Pulse Oximetry	
Measurement Range	0 to 100%
Resolution	1%
Alarm Range	Low Limit: 50 to 99% (Adult/Pediatric) High Limit: 51 to 100% (Adult/Pediatric)
Desat Alarm Signal Generation Delay	20 seconds

Noninvasive Blood Pressure	
Pressure Range	Systolic: 40 to 260 mmHg Diastolic: 20 to 200 mmHg
Initial Pressure	Adult: 160 mmHg Pediatric: 120 mmHg
Maximum Pressure	280 mmHg
Alarm Range	Systolic high limit: 30 - 270 (Adult), 35 - 180 (Pediatric) Systolic low limit: 30 - 265 (Adult), 30 - 175 (Pediatric) Diastolic high limit: 15 - 245 (Adult), 15 - 150 (Pediatric) Diastolic low limit: 10 - 240 (Adult), 10 - 145 (Pediatric)
End-Tidal CO <sub>2</sub>	
Measurement Range	0 to 99 mmHg
Resolution	1 mmHg (0.1 kPa)
Sample Size	50 ml per minute
Alarm Range	Low Limit: 10 to 94 mmHg (Adult/Pediatric) High Limit: 20 to 95 mmHg (Adult/Pediatric)
Invasive Blood Pressure	
Channels	2
Transducer Sensitivity	5uV/V mmHg (37.5uV/V/kPa)
Measurement Range	-40 to 361 mmHg (-5.3 to 48.1kPa)
Measurement Resolution	1 mmHg (0.1kPa)
Pulse Rate Range	25 - 350 bpm
Temperature	
Measurement Range	0° - 45° C (32° - 113° F)
Measurement Resolution	0.1° C (0.2° F)
CPR Measurement and Feedback	
Compression Depth Target	-1.50 to -2.00 in. (-38 to -51 mm)
Compression Rate Target	90 to 120 cpm
Ventilation Volume Graphic indicator	Empty, 1/3-full, 2/3-full, full
Ventilation Rate	4 to 16 ventilations per minute or 9-16 vpm after performing rescue breathing following 60 seconds without compressions
12-Lead ECG	
Input	12-lead cable: leads I, II, III, aVR, aVL, aVF, V/C1-V/C6
Display View	All 12-lead ECG waves display simultaneously
Strip Record	All 12-leads print on the strip chart printer in 3x4 format
Transmission	CompactFlash data card; cellular dial-up Internet connection

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