Meaningful innovations

Philips HeartStart MRx Monitor/Defibrillator
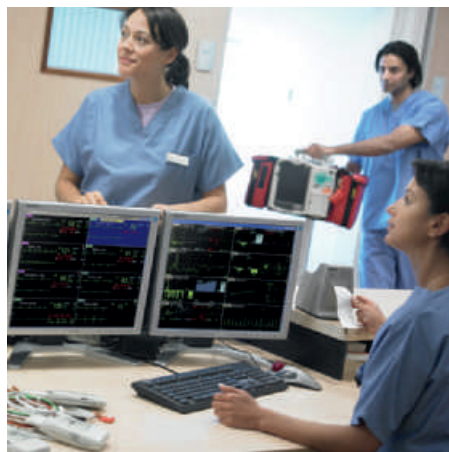
PHILIPS

sense and simplicity

Easy to use, clinical

Innovation is changing the way emergency cardiac patients are treated throughout the hospital. Advances in resuscitation technology are improving CPR quality and making cooling more widely available. Robust data management solutions are supporting quality initiatives to improve resuscitation outcomes. These advancements are giving you tools designed to help you return more patients to active living.

Philips is leading the way with meaningful innovations in emergency cardiac care that can help you effectively respond to patients in a range of clinical situations throughout the hospital. We draw on the experience of our vast worldwide customer base to design solutions that matter to you.

The Philips HeartStart MRx Monitor/Defibrillator, seamlessly provides industry-leading patient monitoring, superb diagnostic measurements, and evidenced-based, proven resuscitation therapies in an intuitive and easy-to-use design. Philips open systems approach to data management, we call "Connected Care," helps streamline information flow and patient care throughout the hospital.

- **Ease of use** is the hallmark of all Philips defibrillators and the HeartStart MRx is no exception. In the moment of need, the MRx's intuitive and easy-to-use design can help your team save a life.
- **Clinical networking capability** on the IntelliVue Clinical Network for monitoring and review at the central station. MRx is the only monitor/defibrillator that has the ability to connect to a clinical monitoring network.
- **Scalable platform** for use as a crash cart or as a high-end critical care transport monitor, the MRx can be easily upgraded in-house so that you can receive the benefits of Philips advancements now and into the future.
- **Standardized alarms, cables, and interchangeable accessories** among Philips defibrillators and IntelliVue patient monitors mean enhanced ease of use and "plug and play" patient hand-off, as well as simplified inventory management and reduced costs.

With clinical networking capability on the Philips IntelliVue Clinical Network, the MRx is the only monitor/defibrillator that can connect to a clinical monitoring network.

Real-time measurement and feedback with Q-CPR, along with retrospective data review, have been shown to improve ROSC.[1]

networking on the go

Intuitive design with therapy controls and connections on the right side and monitoring on the left.

Defibrillation as easy as 1-2-3
1. Select energy.
2. Charge button charges the defibrillator in < 5 seconds.
3. Press shock button to deliver therapy.

Automated self-tests run hourly, daily, and weekly. Simplify your defibrillator shift checks and free up clinician time. Self-tests from the past year can be viewed easily on the display.

Active ready-for-use visual indicator flashes with a black hourglass indicating that the unit has passed a self-test within the last 60 minutes and is ready for use. If not ready for use, MRx calls for attention with a flashing red "X" and an audible chirp. This technology helps ensure that the device is always ready to use.

Color-coded monitoring ports enable easy identification. If your hospital uses Philips patient monitors, the monitoring ports are the same for simple patient hand-off.

Large color display shows 4 waveforms and numerics, or lets you view all 12 leads at once with the 12-lead cardiograph option. Task-specific views, such as CodeView, MonitorView, PacerView, and 12-LeadView, emphasize important information for easy viewing at a glance.

Automated External Defibrillator (AED) mode analyzes and charges for a potentially lifesaving shock within 10 seconds, guiding the user with clear, concise voice and on-screen prompts.

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

Configure MRx to power on with specific settings to meet the particular needs of your clinical area.

Soft keys are automatically customized to match the clinical view at the time, making the most important controls for monitoring, resuscitation, or pacing visible and available at the clinician's fingertips.

Q-CPR measurement and feedback tool helps improve CPR quality by providing CPR feedback where you want it – on the patient's chest.

Advanced monitoring capabilities

The HeartStart MRx pairs proven defibrillation therapy with industry-leading monitoring capabilities consistent with all Philips patient monitors so one device provides these key functions during critical care transport.

The optional networking capability of the HeartStart MRx connects it to the Philips IntelliVue Clinical Network wirelessly or over a wire. This means that waveforms, vitals, and alarms stream in real-time to the IntelliVue Information Center wherever the MRx travels with a patient throughout the hospital or is used in an overflow situation.

MRx connectors, cables, and supplies are interchangeable with Philips patient monitors to allow "plug and play" patient hand-off to other Philips monitors and the HeartStart MRx for easy transports. Common supplies simplify purchasing, stocking, and managing inventory.

for critical care transport

ST/AR Basic Arrhythmia Detection

Detects and labels 10 rhythm disturbances and irregularities, including five life-threatening arrhythmias. Generates visible and audible alarms as needed.

Pulse Oximetry with FAST SpO$_2$

Patented Fourier Artifact Suppression Technology (FAST) SpO$_2$ with its low-noise hardware and quality indicators enables 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, as well as calculates mean arterial pressure.

Invasive Blood Pressure (IBP) – 2 lines

Produces real-time waveforms and numeric values for systolic, diastolic, and mean arterial pressure and works with a range of catheters and blood pressure transducers. Filters out typical artifacts, such as respiratory variation and pressure changes caused by flushing the line or drawing blood samples.

Microstream® Capnography (EtCO$_2$)

For use with intubated and non-intubated patients, it is convenient and flexible, requiring no zeroing, no warm-up time, and no external sensor to interfere with the patient's airway.

Continuous Temperature

Provides continuous core or skin body temperature readings at a variety of sites for post-resuscitation cooling protocols.

Vital Signs Trending

View and print numeric vital signs trending for the current patient or previous patient events. Trend data is visible at selected intervals for up to the 12 most recent hours of monitoring.

12-Lead ECG Option

Philips DXL algorithm provides key tools, such as STEMI-Culprit Artery; critical values that detect four distinct life-threatening conditions; and enhanced gender-specific diagnostic criteria that enable confident STEMI decision-making in the field to help speed triage in the ED.

Waveforms, vitals, and alarms stream in real-time to the IntelliVue Information Center wherever the MRx travels with a patient throughout the hospital or when it is used in an overflow situation.

Code blue: proven resuscitation

Philips evidence-based, proven resuscitation therapies are designed to work together with the Code Team to help give patients the best chance of survival and return them to active living.

- **SMART Biphasic** uses real-time impedance compensation technology to adjust and deliver personalized electric medicine for each patient on each shock. Philips biphasic therapy has been rigorously studied and is supported by substantial peer-reviewed, published data. It has been clinically proven to deliver high first shock efficacy for long-downtime SCA patients, as well as to effectively defibrillate across the full spectrum of patients, including those considered "difficult-to-treat."[2-6]
- **Q-CPR** measurement and feedback tool is supported by more published clinical data than any other CPR quality improvement tool. Q-CPR helps to minimize interruptions to chest compressions and the resulting drop in coronary perfusion pressure.

> "The shock remains important, but we also need integrated quality CPR, cooling, and good post-arrest care. Resuscitation is about saving a patient's life on the front end and returning the person to an active life on the back end."

Dr. Lance Becker
Professor of Emergency Medicine
Director, Center for Resuscitation Science
University of Pennsylvania

- **Quick Shock** in AED mode enables time-to-shock in less than 10 seconds, and a fast charge time (<5 seconds) in manual mode, helping to minimize CPR interruptions. Delivering a shock quickly after chest compressions is critical as the benefits of CPR – oxygenated blood delivered to vital organs – dissipate in seconds.[7,8]
- **Therapeutic Hypothermia** has been shown to improve outcomes when delivered early after an ischemic event.[9-13] The MRx has core temperature monitoring and trending reports to support cooling protocols. And, Philips offers innovative surface and endovascular temperature modulation therapy with its InnerCool product family.

In addition to defibrillation, the HeartStart MRx delivers effective synchronized cardioversion and noninvasive pacing.

- **Synchronized cardioversion** – Peer-reviewed evidence supports the effectiveness of Philips SMART Biphasic synchronized cardioversion capabilities, which are activated with the push of a button.[2,17,18]
- **Noninvasive pacing** – Users can perform transcutaneuous pacing, which offers a constant 40-msec pulse width, and an adjustable rate and output (mA). MRx offers both demand mode and fixed mode.
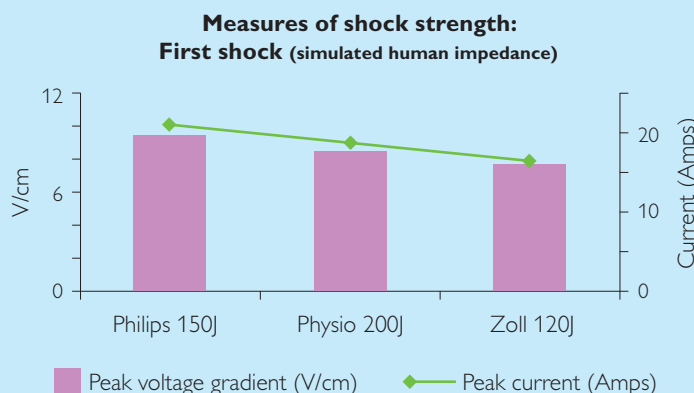

Measures of shock strength:
First shock (simulated human impedance)

Legend: Peak voltage gradient (V/cm) — Peak current (Amps)

Figure 1.

First shock, best shock

For meaningful shock strength comparisons, it's widely recognized that it is necessary to look beyond energy and compare current levels delivered to the patient. The American Heart Association and the European Resuscitation Council are advocating a shift to "current-based defibrillation."[14,15] Using standard protocols, Philips distinct biphasic low energy/high current design delivers higher shock strength (peak voltage gradient) starting with the first shock than other common biphasic waveforms that typically escalate their energy levels in order to reach similar shock strength.[16] *(Figure 1)*. Escalation potentially wastes time and shocks during an arrest.

therapies

## Q-CPR: CPR quality improvement tool

The Philips Q-CPR measurement and feedback tool is supported by more published research than any other CPR quality improvement tool and is available as a fully integrated option with the HeartStart MRx.

Philips Q-CPR has been enhanced based on new research and input from current customers. It is available with the award-winning* digital CPR meter, which enables you to rapidly adjust performance by displaying dynamic, real-time feedback for each compression, directly on the patient's chest. Voice prompts are also available and can be configured based on user preference. When Q-CPR is in use, the Code Team leader can glance at the MRx's large color screen to view all critical parameters while the clinician performing CPR receives real-time feedback on the patient's chest.

Study demonstrates Q-CPR reinforces effective CPR

A study used the HeartStart MRx with Q-CPR during actual cardiac arrest events to provide real-time feedback and simultaneously capture performance data. When medical professionals participated in weekly debriefing sessions, improvements were shown in CPR performance, which correlated with an increase in return of spontaneous circulation (ROSC).[1]

As this study demonstrated, continuous CPR training and improvement is the cornerstone to a successful CPR quality improvement program. Philips robust data management program, HeartStart Event Review Pro, captures and stores an entire code, including Q-CPR data, for post-event review to help the Code Team reach its full potential for quality improvement and ultimately saving more lives. This breakthrough application provides a comprehensive, insightful view of a resuscitation event, along with built-in, easy-to-use navigation to pinpoint key areas in a specific patient's code event for learning and improvement.
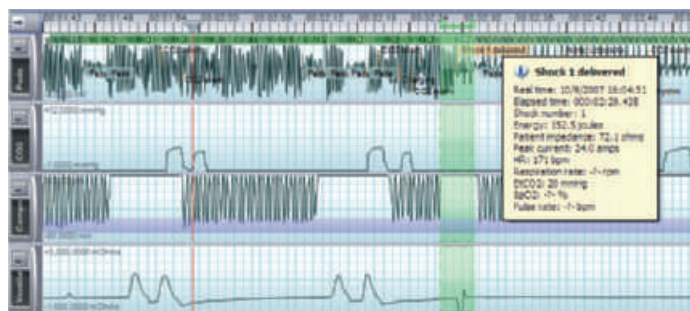
* Philips digital CPR meter was awarded the 2009 red dot product design award. The red dot is an internationally recognized quality label for excellent design.
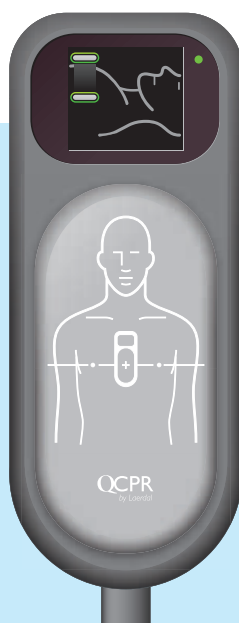
Hitting the mark.
Good compressions.

Compress faster.

Compress deeper.

The CPR meter helps ensure that every compression meets depth, rate, and complete release targets to help improve the patient's chance of survival and increase the opportunity for a complete neurological recovery.

Supporting patients from

Philips is uniquely equipped to support emergency patients from the point of discovery to and through treatment at the hospital. Your team can collaborate with pre-hospital teams equipped with the MRx on incoming critical care patients, including stroke, trauma, respiratory, pediatric, cardiac to help care teams better prepare for patient arrival using Periodic Clinical Data Transmission via the Philips Telemedicine System.

In your ED, you can receive 12-lead ECGs, vitals, and waveforms for all types of in-coming emergency patients. This pre-hospital data can also be sent to your chest pain observation center, Cath Lab, or cardiologist's smart phone via fast, flexible, and reliable transmission capabilities.

When working with your EMS systems as a central receiving hospital in a regional STEMI network, Philips supports your STEMI team: from EMS to the ED and through to the Cath Lab, to help you reduce time to treatment for STEMI care and return more patients to active living. From decision support tools that support time-saving triage in the ambulance or the ED, to robust and flexible transmission capabilities to get information to one or multiple destinations, Philips has the right set of tools to help you shave life-saving minutes off time to treatment.

The HeartStart MRx is a key element of Philips total STEMI solution and works with Philips cardiographs, patient monitors, ECG information management systems, and Cath Lab imaging and information solutions to streamline workflow, improve productivity, and raise the quality of your hospital's STEMI care.

Saving HeartStart MRx information for review and documentation

For regulatory reporting, such as the Joint Commission's mandate for sentinel events, the MRx automatically stores up to 12 hours of continuous ECG waveform and event data (including drug and therapy markers) and up to 55 Event Summaries. Data can be exported from the MRx using an affordable CompactFlash® data card or through LAN cable connectivity to the hospital network, as well as wirelessly via Bluetooth® for transfer to a laptop or personal computer and into a database.

Review results on screen or print them 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.

Discovery-to-treatment
Saving minutes. Saving muscle.

Emergency Responder | Monitor/Defibrillator | Wireless 12-Lead ECG | Cardiograph | Cath Lab | Post-Intervention Monitoring

< 90 minutes

Diagnosis — Treatment — Management
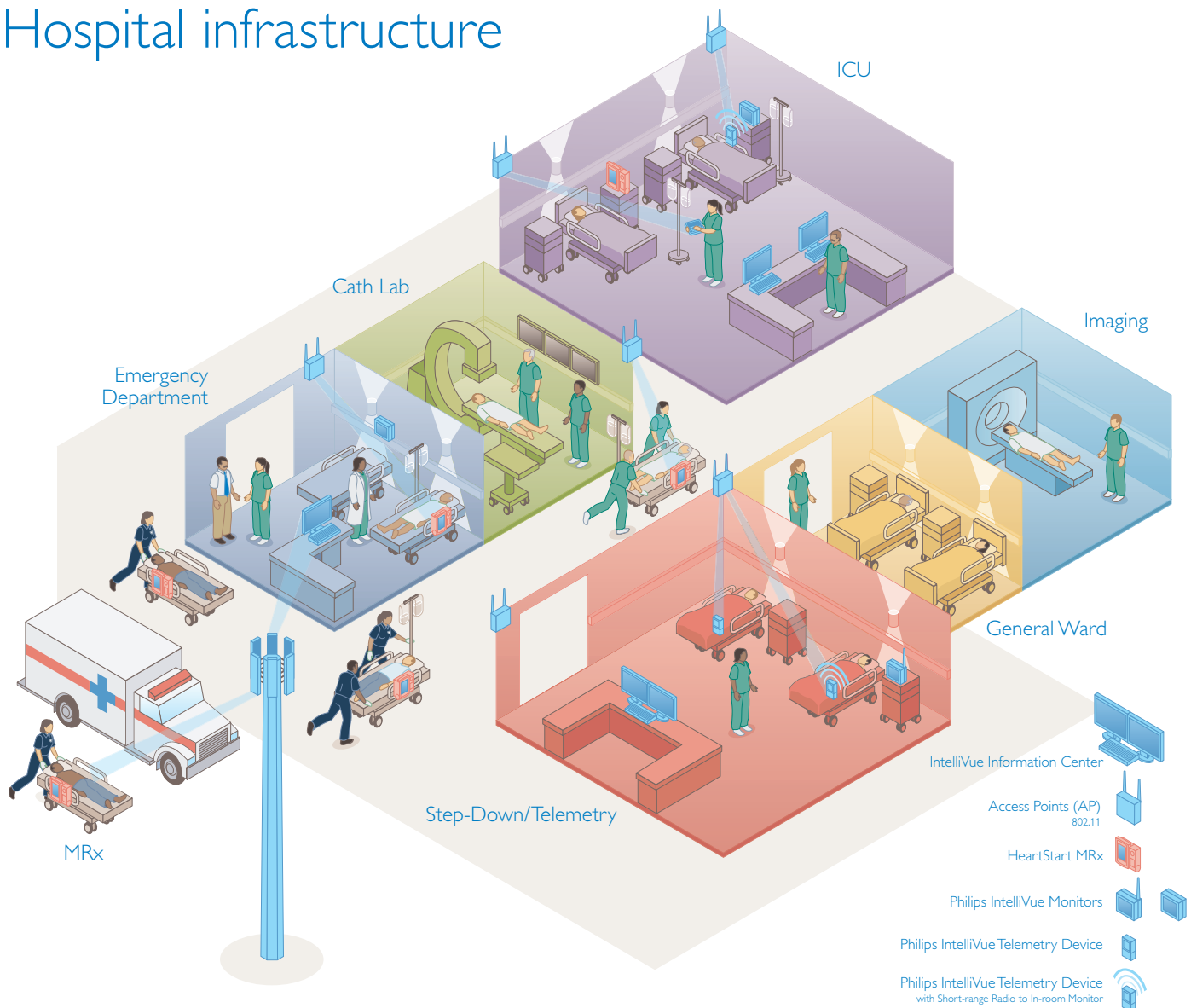
discovery-to-treatment

Connected care for workflow efficiency

Wired and wireless networking capability connects the HeartStart MRx to the IntelliVue Clinical Network. This means that waveforms, vitals, and alarms from the MRx stream in real-time to the IntelliVue Information Center and can be reviewed using a range of Clinical Review Applications. Bi-directional information flow means that from the bedside, you can use the HeartStart MRx to admit, discharge, and transfer patients so that data moves with the patient.

Overcrowded, but not overlooked

Patients monitored by a HeartStart MRx can be in a crowded ED, in a chest pain room, in the Cath Lab, or in almost any monitoring area of the hospital, but they have the added safety and surveillance at the central station.

Hospital infrastructure

ICU

Cath Lab

Imaging

Emergency Department

General Ward

IntelliVue Information Center

Access Points (AP)
802.11

HeartStart MRx

Philips IntelliVue Monitors

Philips IntelliVue Telemetry Device

Philips IntelliVue Telemetry Device
with Short-range Radio to In-room Monitor

Step-Down/Telemetry

MRx

Support and standardization

Education and training solutions

Philips has created a variety of education and training solutions using sound instructional design principles to further enhance the HeartStart MRx experience.

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 at no charge. Philips also offers DVD-based training.

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. Customized on-site, instructor-based training delivered by Philips clinical educators in a realistic critical care context is also available.

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

HeartStart defibrillation pads and paddles
HeartStart multifunction defibrillator pads come in adult, pediatric, and specialty choices to fit the needs of a variety of departments, caregivers, patients, and treatments. If paddles are preferred, the MRx is optionally equipped with a set of external paddles with unique Paddle Contact Indicators. For open-heart and other intrathoracic procedures, the MRx can be used with Philips internal defibrillation paddles, which come in a range of sizes with and without switches on the paddle handle.

MRx basic functions and optional features

Physical

Dimensions	Without external paddles: 12.4″ (W) x 8.3″ (D) x 11.7″ (H) (313 mm x 210 mm x 295 mm). With external paddles: 13.4″ (W) x 8.3″ (D) x 13.6″ (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

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

Model	HeartStart MRx (M3535A)
Waveform	Biphasic Truncated Exponential. 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″ (50 mm) W by 100 ft. (30 m) L 2.95″ (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%
Battery capacity	A new, fully-charged M3538A battery, operating at room temperature 25°C (77°F), provides at least 5 hours of monitoring, with ECG, SpO_2, CO_2, temperature, two invasive pressures monitored continuously, NBP measured every 15 minutes, and 20 200J discharges. A fully charged new battery provides approximately 3.5 hours of monitoring, with ECG, SpO_2, CO_2, temperature, 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

Available options

Noninvasive pacing	SpO_2 pulse oximetry
Noninvasive blood pressure	CO_2 monitoring
Invasive blood pressure (2 lines)	Continuous temperature monitoring
12-lead acquisition	12-lead transmission
Q-CPR measurement and feedback	Audio recording
ACI-TIPI & TPI predictive instruments	Periodic clinical data transmission
Batch/LAN data transfer*	IntelliVue networking*

*Available with either Batch/LAN data transfer or IntelliVue networking.
For detailed specifications see the HeartStart MRx product description document. Application notes are also available to describe the advanced features of the HeartStart MRx.

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Royal Philips Electronics**

How to reach us
www.philips.com/healthcare
healthcare@philips.com

Asia
+49 7031 463 2254

Europe, Middle East, Africa
+49 7031 463 2254

Latin America
+55 11 2125 0744

North America
+1 425 487 7000
800 285 5585 (toll free, US only)

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