

Assurity™, Assurity MRI™, Endurity™

Pacemaker

Allure™ RF, Allure Quadra™ RF, Quadra Allure™, Quadra Allure MP™

Cardiac Resynchronization Therapy Pacemaker (CRT-P)

User's Manual



Abbott

CAUTION: Federal (USA) law restricts this device to sale by or on the order of a physician.



WARNING: This product can expose you to chemicals including ethylene oxide, which is known to the State of California to cause cancer and birth defects or other reproductive harm. For more information, go to www.P65Warnings.ca.gov.

TM Indicates a trademark of the Abbott group of companies.

[‡] Indicates a third-party trademark, which is property of its respective owner.

Pat. <http://www.abbott.com/patents>

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Device Description

This manual describes the Abbott Medical pulse generators listed in the table below.

The pulse generator, along with compatible, commercially available leads, constitutes the implantable portion of the pulse generator and CRT-P systems. The lead systems are implanted using either transvenous or transthoracic techniques. These devices can be programmed with Merlin™ Patient Care System (Merlin PCS) equipped with Model 3330 version 24.3.1 (or greater) software. For information on programming, refer to the programmer's on-screen help.

Table 1. Pulse generator descriptions

Name	Model number	Description	Connector type	MRI status
Endurity™ pacemaker	PM1160	Single-chamber pulse generator	IS-1	Untested
Assurity™ pacemaker	PM1240	Single-chamber pulse generator with RF telemetry	IS-1	Untested
Assurity MRI™ pacemaker	PM1272	Single-chamber pulse generator with RF telemetry	IS-1	MR Conditional
Endurity™ pacemaker	PM2160	Dual-chamber pulse generator	IS-1	Untested

Table 1. Pulse generator descriptions

Name	Model number	Description	Connector type	MRI status
Assurity™ pacemaker	PM2240	Dual-chamber pulse generator with RF telemetry	IS-1	Untested
Assurity MRI™ pacemaker	PM2272	Dual-chamber pulse generator with RF telemetry	IS-1	MR Conditional
Allure™ RF CRT-P	PM3222	CRT-P with RF telemetry	IS-1	Untested
Allure Quadra™ RF CRT-P	PM3242	CRT-P with RF telemetry	IS-1/IS4-LLLL	Untested
Quadra Allure™ CRT-P	PM3542	CRT-P with RF telemetry	IS-1/IS4-LLLL	MR Conditional
Quadra Allure MP™ CRT-P	PM3562	CRT-P with RF telemetry	IS-1/IS4-LLLL	MR Conditional

Indications/Intended Use

Implantation of a CRT-P is indicated for:

- Maintaining synchrony of the left and right ventricles in patients who have undergone an AV nodal ablation for chronic atrial fibrillation and have NYHA Class II or III heart failure.
- The reduction of the symptoms of moderate to severe heart failure (NYHA Class III or IV) in those patients who remain symptomatic despite stable, optimal medical therapy, and have a left ventricular ejection fraction $\leq 35\%$ and a prolonged QRS duration.

Implantation of a single-chamber pulse generator, dual-chamber pulse generator, or CRT-P is indicated in one or more of the following permanent conditions, or any combination of these symptoms:

- Syncope
- Presyncope
- Fatigue
- Disorientation

Rate-modulated pacing is indicated for patients with chronotropic incompetence, and for those who would benefit from increased stimulation rates concurrent with physical activity. Chronotropic incompetence has not been rigorously defined. A conservative approach, supported by the literature, defines chronotropic incompetence as the failure to achieve an intrinsic heart rate of 70% of the age-predicted maximum heart rate or 120 bpm during exercise testing, whichever is less, where the age-predicted heart rate is calculated as $197 - (0.56 \times \text{age})$.

Dual-chamber pacing (dual-chamber pulse generators, CRT-Ps) is indicated for those patients exhibiting:

- Sick sinus syndrome
- Chronic, symptomatic second-degree and third-degree AV block

- Recurrent Adams-Stokes syndrome
- Symptomatic bilateral bundle branch block when tachyarrhythmia and other causes have been ruled out

Atrial pacing is indicated for patients with sinus node dysfunction and normal AV and intraventricular conduction systems.

Ventricular pacing is indicated for patients with significant bradycardia and:

- Normal sinus rhythm with only rare episodes of AV block or sinus arrest
- Chronic atrial fibrillation
- Severe physical disability

AF Suppression™ algorithm (dual-chamber pulse generators, CRT-Ps) stimulation is indicated for suppression of paroxysmal or persistent atrial fibrillation episodes in patients with one or more of the above pacing indications.

Only the accessories listed here are approved for the corresponding intended uses with the pulse generators described in this manual.

Table 2. Accessories and their intended uses

Accessory	Intended use
Torque driver	To secure lead connectors and port plugs within the device header
IS-1 port plug	To insulate and protect unused lead receptacles
IS4/DF4 port plug	To insulate and protect unused lead receptacles

MRI Safety Information

MR Conditional pacemakers and CRT-Ps are conditionally safe for use in the MRI environment when used in a complete MR Conditional system and according to the instructions in the Abbott Medical MRI-Ready Systems Manual. Scanning under different conditions may result in severe patient injury or death or device malfunction.

Contraindications

Implanted cardioverter-defibrillator (ICD). Single-chamber pulse generators, dual-chamber pulse generators, and CRT-Ps are contraindicated in patients with an implanted cardioverter-defibrillator.

Rate-adaptive pacing may be inappropriate for patients who experience angina or other symptoms of myocardial dysfunction at higher sensor-driven rates. An appropriate Maximum Sensor Rate should be selected based on assessment of the highest stimulation rate tolerated by the patient.

AF Suppression™ algorithm (dual-chamber pulse generators, CRT-Ps) stimulation is not recommended in patients who cannot tolerate high atrial-rate stimulation.

Dual-chamber pacing (dual-chamber pulse generators, CRT-Ps), though not contraindicated for patients with chronic atrial flutter, chronic atrial fibrillation, or silent atria, may provide no benefit beyond that of single-chamber pacing in such patients.

Single-chamber ventricular demand pacing is relatively contraindicated in patients who have demonstrated pacemaker syndrome, have retrograde VA conduction, or suffer a drop in arterial blood pressure with the onset of ventricular pacing.

Single-chamber atrial pacing is relatively contraindicated in patients who have demonstrated compromise of AV conduction.

For specific contraindications associated with individual modes, refer to the programmer's on-screen help.

Warnings

To prevent permanent damage to the device and tissue damage at the electrode/tissue interface:

- **Electrosurgery.** Do not use electrosurgical devices in the vicinity of an implanted device. If electrocautery is necessary, use a bipolar cauterizer or place the indifferent electrode as far from the implanted device as possible.
- **Lithotripsy.** Do not focus a lithotripsy beam within 6 inches of the device. Program the device to Sensor Off prior to lithotripsy to prevent inappropriate increases in pacing rate. A thorough assessment of device function with special attention to the sensor should be performed following exposure to lithotripsy.
- **Therapeutic radiation.** Do not use ionizing radiation in the vicinity of an implanted device. Radiation therapy may damage the electronic circuitry of the device.
- **Ultrasound treatment.** The device should not be exposed to therapeutic levels of ultrasound energy, as the device can inadvertently concentrate the ultrasound field and cause harm that might not be immediately detectable. Diagnostic ultrasound treatment is not known to affect the function of the device.
- **Ventricular sensing.** In CRT-Ps, Ventricular Sensitivity should be programmed to the highest setting (lowest sensitivity) that will provide ventricular sensing with adequate sensing margin. Left ventricular lead dislodgement, to a position near the atria, can result in atrial oversensing and ventricular inhibition.

Perform a thorough assessment of device function following exposure to any of the above.

Backup VVI operation. In rare instances, the device may revert to Backup VVI operation at the settings listed in the table below. These values are not programmable.

When the device has reverted to Backup VVI operation, the programmer displays a pop-up message indicating that the device is operating at the Backup VVI values. Press the Continue button and follow the on-screen instructions.

Table 3. Backup VVI Settings

Parameter	Setting	
	Single-chamber pulse generators	CRT-Ps
Mode	VVI	VVI
Base rate	67 bpm	67 bpm
Ventricular pacing chamber	NA	LV → RV
Pulse configuration	Unipolar	RV Unipolar Tip LV Unipolar Tip
Sense configuration	Unipolar Tip	RV Unipolar Tip
Pulse amplitude	5.0 V	5.0 V
Pulse width	0.6 ms	0.6 ms
Refractory period	337 ms	337 ms
Sensitivity	2.0 mV	2.0 mV
Interventricular delay	NA	16 ms

Elective Replacement Indicator (ERI). At ERI (page 28), the nominal life of the device is three or six months. When the device exhibits signs of ERI it should be replaced expeditiously.

Patient follow-up visits should be scheduled at an appropriate frequency so that ERI can be detected well before end-of-life (EOL).

Noninvasive Programmed Stimulation (NIPS). Life-threatening ventricular tachycardia or fibrillation may occur during NIPS. During NIPS testing, (1) closely monitor the patient and (2) make defibrillation and resuscitation equipment, and trained personnel, readily available during testing. Only physicians trained in tachycardia induction and reversion protocols should use NIPS. For more information on NIPS, refer to the programmer's on-screen help.

Ventricular support pacing during NIPS testing (dual-chamber pulse generators, CRT-Ps) is delivered in the VOO mode. The specific indications and contraindications for VOO mode can be found on the programmer's on-screen help.

Precautions

For single use only.

Device communication. Communication with the device can be affected by electrical interference and strong magnetic fields. If this is a problem, turn off nearby electrical equipment or move it away from the patient and the programmer. If the problem persists, contact Abbott Medical.

Suboptimal RF communication. For devices with RF telemetry capability, the Merlin™ PCS indicates the quality of the RF communication by the telemetry strength indicator LEDs on both the programmer and the Merlin™ antenna. Below is a list of potential causes of suboptimal radio communication:

Table 4. Possible causes and solutions for suboptimal RF communication

Possible causes	Solutions
The Merlin antenna orientation/ location is suboptimal.	Move or reorient the Merlin antenna slightly. Make sure that the front of the Merlin antenna faces the implantable device.
People or objects interfere with the communication between the Merlin antenna and the device.	Make sure that the space between the Merlin antenna and the device is free from interfering objects/people.
The Merlin antenna is too far away from the device.	Move the Merlin antenna closer to the device.
Someone is holding the Merlin antenna.	Place the Merlin antenna on a flat surface. Do not hold the Merlin antenna.
Other products in the vicinity are causing electromagnetic interference (EMI).	Power off or remove equipment that could cause EMI.
The Merlin antenna cable is wound around the Merlin antenna.	Make sure the Merlin antenna cable is not wound around the Merlin antenna.
CT scans. CT scans, due to their increased power levels and long exposure times, have the remote possibility of interfering with implanted devices. The potential interference is transient and occurs only when the X-ray signal is present. Continuous exposure may cause a temporary sensor rate increase. In addition, there is a	

remote possibility for a device to intermittently oversense while the CT scanning beam is directly over the implanted device.

Sterilization

Sterilization. The package contents have been sterilized with ethylene oxide before shipment. This device is for single use only and is not intended to be resterilized.

If the sterile package has been compromised, contact Abbott Medical.

Storage and Handling

Mechanical Shock. Abbott Medical devices are ruggedly constructed. However, if you suspect the device has been damaged, do not implant it. Return the damaged device to Abbott Medical.

Temperature. Store the pulse generator and accessories between 59°F and 86°F (15°C and 30°C). During transportation and handling, the pulse generator and accessories can be safely exposed to temperatures between -4°F and 140°F (-20° and 60°C). Exposure to temperatures outside this range may result in damage to the device or device malfunction. After cold storage, allow the device to reach room temperature before programming or implanting the device because cold temperature may affect initial device function.

Incineration. Do not incinerate the device. Return explanted devices to Abbott Medical.

Preparation for Implantation

Package Label. Before opening the sterile package, carefully read the label and verify that the package contains the desired device. **Do not implant the pulse generator if:**

- The package is damaged or wet.

- The dot on the ethylene oxide label is purple.
Purple indicates that the package has not been sterilized.
- The Use Before Date on the outer box and the tray has been exceeded.
The Use Before Date reflects the minimum battery voltage required to support the calculated battery longevity shown in the programmer's on-screen help.

Verifying Operation. Before opening the sterile package, verify that the device is operating properly by interrogating it in the package. Remove the magnet and establish communication:

- Inductive communication. Position the Merlin™ PCS telemetry wand over the package and select "Interrogate".
- RF communication. To establish RF communication between the device and the programmer and to troubleshoot communications problems, you must first attach the Merlin™ antenna to the programmer. Please refer to the Merlin™ Patient Care System User's Manual that accompanies the programmer and the Merlin antenna. Use the telemetry strength indicators to evaluate the communication.

If the device is RF-compatible, an icon in the upper left-hand corner of the screen during the programming session indicates the status of the RF communication link. If an RF icon does not appear on the screen during the session, the device is not RF-compatible. Once you have established telemetry, select "Interrogate".

The unit's Measured Data is displayed on the FastPath™ Summary Screen and should indicate normal voltage and battery status. The programmed parameters should be identical to the Shipped Settings displayed on the programmer's on-screen help.

Package Integrity. Ensure that the package has not been opened or in any way compromised. If damage is suspected, return it to the manufacturer.

"Use Before" Date. Do not implant the device after the "use before" date printed on the label.

Opening the Package. If interrogation of the device in its sterile packaging indicates normal functioning, remove it from the package. The package's outer tray can be opened in nonsterile surroundings. However, when opening the inner tray, complete sterile technique must be observed.

Pre-Implant Testing

Compatible Pacing Leads. Devices with IS-1 connectors accept unipolar or bipolar IS-1 short terminal pin leads. Devices with IS4-LLLL connectors accept IS4-LLLL quadripolar leads. Prior to implantation, make sure leads fit easily and snugly into the device header.

Pacing System Analyzer. Before implantation, you may wish to test the device using a compatible pacing system analyzer (PSA) with calibrated sensitivity and output settings. When the probe is attached to the device's connector, the programmed parameters should be identical to the Shipped Settings displayed on the programmer's on-screen help.

Adaptor Probes. Use only IS-1 PSA cable adaptor probes when testing the device. Other probes may damage the connector. Do not use IS-1 adaptor probes in the IS4-LLLL connector.

Capture/Sensing Thresholds. Capture and sensing thresholds should be determined with a PSA before implanting the device. Connect the negative (black) PSA terminal to the portion of the lead terminal pin corresponding to the tip electrode. The positive (red) terminal should be connected to the ring electrode portion of the lead pin for bipolar leads or to an indifferent electrode. For more information on conducting capture and sensing threshold tests, please consult the PSA technical manual.

Establishing Baseline Ventricular Capture/Sensing Thresholds (CRT-Ps). After the leads have been implanted and before they are connected to the device, separately identify and document the baseline morphology for capture and sensing thresholds for each ventricular lead. Once baselines are established, determine if the ECG or IEGM recordings can help discriminate biventricular capture, and negative depolarizations for each lead. In a cardiac resynchronization therapy system, the ECG may display two distinct capture loss morphologies, because the left and right chambers often have different pacing thresholds. To ensure that the device is losing

capture on both sides of the heart, allow the test to run until a marked change in morphology occurs, indicating capture loss on both sides.

Implantation

Data Transmission. Implant the pulse generator no deeper than 5 cm to ensure reliable data transmission. For patient comfort, do not implant the pulse generator within 1.25 cm of bone unless you cannot avoid it.

Case Markings. Examine the markings on the device case and verify proper atrial and ventricular connection.

Setscrew. Exercise caution when turning the setscrew, which may be backed out of the connector if turned counter-clockwise for more than two rotations.

Programming

Programmer. These devices can be interrogated and programmed with the Merlin™ PCS equipped with Model 3330 version 24.3.1 (or greater) software.

For a list of programmable parameters and their programmable values, refer to the programmer's on-screen help.

Setting the Lead Type. When you interrogate the device for the first time, the programmer will prompt you to set the Lead Type. In CRT-Ps, the right- and left-ventricular lead types are independently set. Because some parameters are determined by the Lead Type (for example, Pulse Configuration), you should set this parameter when the device is implanted.

Lead Impedance Values. In CRT-Ps, independent lead impedance values are displayed for the RV and LV leads.

Ventricular Pulse Amplitudes and Pulse Widths. In CRT-Ps, the right and left ventricular pulse amplitudes and pulse widths are independently programmable. The pulse amplitude should be evaluated in each chamber accordingly. Typically, capture thresholds are higher in the left ventricle.

Follow-up Capture Threshold Measurements. In CRT-Ps, the RV and LV capture threshold measurements are evaluated independently. During an RV or LV capture test, you may be able to determine when capture is occurring by noting changes in the ECG morphology. For additional information, refer to the programmer's on-screen help.

AOO(R), VOO(R), and DOO(R) Modes are primarily intended for temporary diagnostic use. Long-term use may result in competitive pacing, inducing potentially dangerous arrhythmias.

Off mode is not recommended for patients who would be adversely affected by even a short cessation of device function.

Pulse Amplitude. If the AutoCapture™ pacing system or Cap Confirm pacing system are not in use, determine the capture threshold before programming the Pulse Amplitude. Program Pulse Amplitude to yield a suitable safety margin for reliable, long-term capture. Reassess capture thresholds periodically.

Noninvasive Program Stimulation (NIPS). Atrial or ventricular tachycardia or fibrillation may occur during NIPS. During NIPS testing, (1) closely monitor the patient and (2) make defibrillation and resuscitation equipment, and trained personnel, readily available during testing.

High-Output Settings. Programming high-output settings or a high Base Rate may shorten the time to ERI.

High Tracking Rates. When programming Maximum Tracking Rates of 190, 200, or 210 bpm, ensure that these rates are appropriate for the patient.

Runaway Protection. Hardware circuitry in the device prevents it from stimulating at rates higher than the runaway protection rate, listed below.

Table 5. Runaway protection for all devices

Device	Runaway protection rate
PM1160, PM1240, PM1272, PM2160, PM2240, PM2272,	220 bpm (± 10 bpm)

Table 5. Runaway protection for all devices

Device	Runaway protection rate
PM3222, PM3242, PM3542, PM3562	

Sensing Configuration. Sensing tests should be performed whenever changes are made to the sensing configuration.

Patient Notifier. Before setting Patient Notifier On, test and ensure patient awareness of the Patient Notifier feature.

Environmental and Medical Therapy Hazards

Abbott Medical devices are equipped with special shielding and filters which significantly reduce the adverse effects of electromagnetic interference (EMI) on the operation of the device.

Patients should be directed to exercise reasonable caution in avoidance of strong electric or magnetic fields. If the device inhibits or reverts to asynchronous operation while in the presence of EMI, the patient should move away from the EMI source or turn the source off.

Advise patients to seek medical guidance before entering environments which could adversely affect the operation of the device, including areas protected by a warning notice preventing entry by pacemaker patients.

Medical Procedures and Environments

In general, pacemaker patients should not be exposed to hospital equipment that produces high electromagnetic field strength signals, such as diathermy machines and electrosurgical units.

- **External Defibrillation.** The electronic circuitry in the device provides protection from defibrillation discharges. Nevertheless, do not place defibrillator paddles directly over the device or pacing lead. Following defibrillation, ensure that the device is operating correctly.
- **Magnetic Resonance Imaging (MRI).** MR Conditional pacemakers and CRT-Ps are conditionally safe for use in the MRI environment when used in a complete MR Conditional system and according to the instructions in the Abbott Medical MRI-Ready Systems Manual.
- **MRI for patients with implantable devices with untested MR status** has been contraindicated by MRI manufacturers. Clinicians should carefully weigh the decisions to use MRI with pacemaker patients. Additional safety concerns include:
 - Magnetic and RF fields produced by MRI may increase pacing rate, inhibit pacing, cause asynchronous pacing or result in pacing at random rates.
 - MRI may result in changes in capture thresholds due to heating of pacing leads.
 - MRI may irreversibly damage the device.
 - Patients should be closely monitored during the MRI.
 - Assess the device function before and after exposure to MRI.
- **Ionizing Radiation.** Therapeutic ionizing radiation (for example, used in linear accelerators and cobalt machines) can permanently damage the device's circuitry. The effect of ionizing radiation is cumulative; the potential for damage to the device is proportional to the patient's total radiation dosage. If the patient must be exposed to ionizing radiation, protect the device during the procedure with local radiation shielding. If tissue near the implant site must be irradiated, it may be necessary to move the device to another area. Before and after exposure to radiation, evaluate the device operation to identify any adverse consequences.

- **Transcutaneous Electrical Nerve Stimulation (TENS).** To reduce the possibility of interference with device function, place the TENS electrodes close to one another and as far from the device as possible. Before allowing unrestricted use of TENS in a home or other setting, screen the patient in a monitored environment for possible interaction.
- **Therapeutic Diathermy.** Avoid diathermy, even if the device is programmed off, as it may damage tissue around the implanted electrodes or may permanently damage the device.
- **Electrosurgical Cautery** can induce ventricular arrhythmias and/or fibrillation or may cause asynchronous or inhibited device operation. If use of electrocautery is necessary, the current path and ground plate should be kept as far away from the device and leads as possible. A bipolar cauterizer may minimize these effects. Following electrocautery, conduct a thorough assessment of the device.
- **RF Ablation.** Radiofrequency (RF) ablation in patients with a device may cause any of the following: asynchronous pacing above or below the programmed rate; reversion to an asynchronous operation; device electrical reset; premature triggering of the elective replacement indicator; or device malfunction or damage.

Minimize RF ablation risks by doing the following:

- Program a non-rate-responsive, asynchronous pacing mode prior to the RF ablation procedure.
- Avoid direct contact between the ablation catheter and the implanted lead or pulse generator.
- Position the groundplate so that the current pathway does not pass near the pulse generator system; in other words, place the groundplate under the patient's buttocks or legs.
- Always have a separate standby external defibrillator immediately available.
- Have a programmer available.

Patient Environment

High-Voltage transmission lines and equipment, arc or resistance welders, induction furnaces, and similar equipment may generate substantial EMI fields that may interfere with device operation.

Communication Equipment, such as microwave transmitters¹, linear power amplifiers, or high-power amateur transmitters may generate sufficient EMI to interfere with the operation of the device. Advise patients to move away from this equipment to resume normal device operation.

Home Appliances that are in good working order and properly grounded do not usually produce enough EMI to interfere with device operation. Electric vibrators, razors, and handtools held directly over the device may disturb its operation.

Twiddler's Syndrome. Caution patients against manipulating the implanted device since it may result in lead damage or lead displacement.

Patient Activities. Any activities that involve repetitive impacts or jarring (such as horseback riding, jackhammer use, etc.) may increase the pacing rate when the device's Sensor is programmed On. Caution patients against such activity and program Sensor parameters with these activities in mind.

Electronic Article Surveillance (EAS). Advise patients that the Electronic Article Surveillance/Anti-theft systems or Electronic Article Surveillance (EAS) systems such as those at the point of sale (tag deactivators) and entrances/exits of stores, libraries, banks, etc., emit signals that may interact with pacemakers and CRT-Ps. It is very unlikely that these systems will interact with their device significantly. However, to minimize the possibility of interaction, advise patients to simply walk through these areas at a normal pace and avoid lingering near or leaning on these systems. If security personnel conduct a search with a handheld wand, the patient should ask that they perform the search quickly, stressing that they should avoid holding the wand over the device for a prolonged period.

¹ Home appliance microwave ovens do not interfere with device operation.

No Pacer Symbol. Caution patients implanted with this device to avoid areas marked with the No Pacer symbol.

Figure 1. No Pacer Symbol



Cellular Phones. An Abbott Medical-designed protective filter in the device prevents cellular phone-generated electromagnetic signals from interfering with the operation of the device.²

The device has also been tested for compatibility with handheld wireless transmitters in accordance with the requirements of AAMI PC69. This testing covered the operating frequencies (450 MHz to 3 GHz) and pulsed modulation techniques of all of the digital cellular phone technologies in worldwide use today. For more information, you or your patient may wish to contact Technical Support (page 30).

Explantation

Do not reuse explanted devices and leads.

Clean explanted equipment with +1% sodium hypochlorite, rinse with water, dry.

Return the explanted device to the manufacturer.

² Carrillo R, Williams DB, Traad EA, Schor JS. Electromagnetic filters impeded adverse interference of pacemakers by digital cellular telephones. JACC 1996; 27(2A):15A Abstract 901-22.

Explant the device before cremation of a deceased patient.

Hex wrenches are available for disconnecting a previously implanted device from the indwelling leads. To obtain the wrenches, contact your local Abbott Medical representative.

Potential Adverse Events

The following are potential complications associated with the use of any pacing system:

- Air embolism
- Body rejection phenomena
- Cardiac tamponade or perforation
- Hematoma, bleeding hematoma, seroma
- Formation of fibrotic tissue, local tissue reaction
- Inability to interrogate or program due to programmer or device malfunction
- Infection
- Erosion
- Interruption of desired pulse generator function due to electrical interference, either electromyogenic or electromagnetic
- Lead malfunction due to conductor fracture or insulation degradation
- Loss of capture or sensing due to lead dislodgement or reaction at the electrode/tissue interface
- Loss of desired pacing and/or sensing due to lead displacement, body reaction at electrode interface, or lead malfunction (fracture or damage to insulation)
- Loss of normal device function due to battery failure or component malfunction

- Pacemaker migration or pocket erosion
- Pectoral muscle or diaphragmatic stimulation
- Phrenic nerve stimulation
- Pneumothorax/hemothorax
- Device migration and pocket erosion
- Endocarditis
- Excessive bleeding
- Induced atrial or ventricular arrhythmias
- Myocardial irritability
- Pericardial effusion
- Pericardial rub
- Pulmonary edema
- Rise in threshold and exit block
- Valve damage
- Cardiac/coronary sinus dissection (CRT-Ps only)
- Cardiac/coronary sinus perforation (CRT-Ps only)
- Coronary sinus or cardiac vein thrombosis (CRT-Ps only)
- Death

Clinician Use Information

When the Sense Configuration is set to Bipolar, the Atrial Sensitivity setting of 0.2 mV or more sensitive settings may be more susceptible to EMI. The devices comply with the electromagnetic compatibility requirements of CENELEC standard EN45502-2-1³, clause 27.5, at Atrial Sensitivity settings of 0.3 mV and less sensitive settings.

When the Sense Configuration is set to Unipolar, the Atrial and Ventricular Sensitivity settings more sensitive than 2.0 mV may be more susceptible to EMI. The devices comply with the electromagnetic compatibility requirements of CENELEC standard EN45502-2-1, clause 27.5 at Atrial and Ventricular Sensitivity settings of 2.0 mV and less sensitive settings. (CENELEC standard EN45502-2-1, clause 27.5.1 requires that the implantable pulse generator be constructed so that commonly encountered electromagnetic signals are unlikely to be confused with sensed beats and change the therapeutic behavior of the implantable pulse generator.)

As required by EN 45502-2-1 Clause 27.4, the device interference mode of operation is characterized as follows:

- The atrial noise mode is “pacing off” for EMI frequencies below approximately 30 Hz and “fixed rate pacing” for frequencies above approximately 30 Hz.
- The ventricular noise mode is “fixed rate pacing” for EMI frequencies of 16.6 Hz - 167 kHz.

Programming Guidelines

General

For a list of all programmable parameters and settings, refer to the programmer's on-screen help.

³ As referenced in this section, the CENELEC standard EN45502-2-1:2003 is equivalent to ANSI/AAMI PC69:2007.

Magnet Use

To interrogate the device, remove the magnet from the programmer telemetry wand. A magnet will interfere with proper telemetry.

Temporary Programming

These devices feature Temporary Programming to aid the clinician in diagnosing and treating the patient. The clinician can temporarily program parameters to assess their effects with the ability to quickly cancel or permanently program the setting. For more information, refer to the programmer's on-screen help.

Preset Programmed Settings

Shipped Settings

The device's parameter settings are preset when the device is manufactured. For additional information, refer to the programmer's on-screen help.

Emergency Settings

The device is equipped with standard, high-output settings that can be quickly programmed using the programmer's Emergency VVI function. Settings for Emergency VVI can be found in the programmer's on-screen help.

NOTE: When Emergency VVI is selected, diagnostic data are cleared from memory without a warning.

Radiopaque Identification

Each device has an X-ray absorptive marker for noninvasive identification⁴.

Table 6. X-ray ID codes for the devices described in this manual

Device model	X-ray ID model code
PM1160, PM1240, PM1272, PM2160, PM2240, PM2272, PM3222, PM3242	SJM HI
PM3542, PM3562	SJM HM

Implantation and Lead Connection

Package Contents

Devices are shipped in a sterile box containing:

- One device
- Connector kit containing:
 - Torque wrench
- Literature

The non-pyrogenic label is applicable to device only and is not applicable to the torque wrench within the device package.

⁴ Models PM1272, and PM2272 may have an HM MRI tag due to global distribution.

Lead Connection

Devices with IS-1 connectors accept unipolar or bipolar IS-1 short terminal pin leads. Devices with IS4-LLLL connectors accept IS4-LLLL quadripolar leads. Prior to implantation, make sure leads fit easily and snugly into the device header.

These devices have a single setscrew for each lead pin. The setscrew makes contact with the pin securing the lead within the connector while an annular spring makes contact with the proximal ring(s).

NOTE: Enter the lead types for each lead on the Patient Information screen. For additional information, refer to the programmer's on-screen help.

CAUTION: After all leads have been implanted and before they are connected to the device, establish and document the baseline morphology for capture and sensing thresholds for each lead using a suitable recording system, such as a 12-lead ECG or Intracardiac Electrogram (IEGM).

To connect the device to the leads:

1. Remove blood and body fluids from the terminal pins of the implanted leads.
2. Check the markings on the device case and verify proper atrial and ventricular connections.

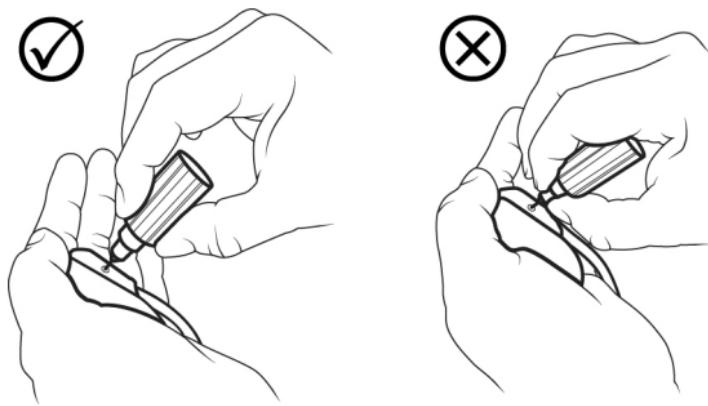
CAUTION: Exercise caution when turning the setscrew, which may be backed out of the connector if turned counterclockwise for more than two rotations.

NOTE: In CRT-Ps: For proper sensing and pacing, it is important to ensure that left and right ventricular signals are correctly detected and that pacing pulses are delivered in the desired chamber.

3. Use the torque wrench packaged with the device to retract the setscrews in the device connector so that the pacing lead terminal pins can be fully inserted.

4. Insert the lead pin firmly into the connector until it is immobile and visible in the viewport at the opposite end of the connector.
5. Grip the torque wrench by the large part of the handle as shown in the figure on the left below. On applicable wrench models, do not grip the torque wrench by the smaller, narrower part of the handle as shown on the right.

Figure 2. Correct vs. incorrect use of torque wrench



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6. Insert the torque wrench through the aperture on the header and into the setscrew on the side of the connector.
 7. Turn the torque wrench clockwise until it clicks. The wrench is torque-limited and when used correctly will not allow excessive tightening.

8. Repeat the steps above for additional lead(s).

9. Tug gently on the leads to ensure they are securely connected to the device.

In order to minimize device migration, secure the device to the subcutaneous pocket via the suture hole in the device header.

After the device has been implanted and the pocket is closed, interrogate the device and set the Lead Type to the correct setting. Lead Type settings are described on the programmer's on-screen help.

NOTE: In CRT-Ps, the right and left ventricular pulse amplitudes and pulse widths are independently programmable. The pulse amplitude and pulse width should be evaluated in each chamber accordingly.

In CRT-Ps, independent lead impedance values are displayed for the RV and LV leads.

Device Registration

An Implantable Device Registration Form is enclosed with each device to serve as a permanent record of information pertaining to the implanted device. The completed original should be returned to the manufacturer in the postage-paid, addressed envelope provided. Copies of the registration form are provided for the hospital and the physician.

Patient Registration Form

Fill out and return the Patient Registration Form to register the patient and facilitate patient tracking.

Patient Identification Card

Fill out the Patient Identification Card as provided in the outer box with the patient's name, implant date, and your name or healthcare facility information along with the contact phone number. Record device information

(model number, serial number, and UDI number) and leads information (model number, serial number, and UDI number) or apply the labels provided with the sterile package in the designated sections of the card. Fill out the implant location of the device in the corresponding location field on the Patient Identification Card. Fill out the model/length and implant location of the leads in the corresponding fields on the Patient Identification Card.

Patient Follow-up

Give the completed card to the patient. This will serve as a temporary card until Abbott Medical mails a permanent card directly to the patient. To obtain a replacement card if a patient loses or damages their card, contact Abbott Medical Technical Support (page 30).

Device Longevity

For estimated longevity calculations, see the programmer's on-screen help.

Elective Replacement Indicator (ERI)

ERI (or Recommended Replacement Time) is the point at which battery voltage has dropped to the lowest capacity that will maintain adequate device operation for a nominal period before end-of-life (EOL). See the table below for the nominal period between ERI and EOL.

When the device reaches ERI, a number of indicators alert the clinician to this condition. For information on these conditions, refer to the programmer's on-screen help.

Table 7. Nominal time from ERI to EOL for all devices

Device	Nominal time period between ERI and EOL
PM1160, PM1240, PM1272, PM2160, PM2240, PM2272, PM3222, PM3242, PM3542, PM3562	6 months

Clearing ERI

When the programmer displays a message that the device has reached ERI, you are able to clear ERI. For additional information on Clearing ERI, refer to the programmer's on-screen help.

**CAUTION: Programming to high output settings with a high Base Rate may shorten the time to ERI.
Programming to lower rates and outputs may restore normal battery status.**

If the programmer displays an ERI warning message, the clinician should fully evaluate the device.

WARNING: At ERI, the nominal life of the device is three months or six months. When the device exhibits signs of ERI (described on the programmer's on-screen help), it should be replaced expeditiously.

End-of-Life

End-of-life (EOL) occurs when the battery voltage has fallen to a level designated in the table below.

For additional information, refer to the programmer's on-screen help.

Table 8. Approximate end-of-life battery voltage for all devices

Device	Approximate EOL battery voltage
PM1160, PM1240, PM1272, PM2160, PM2240, PM2272, PM3222, PM3242, PM3542, PM3562	2.47 V

Technical Support

Abbott Medical maintains 24-hour phone lines for technical questions and support:

- 1 818 362 6822
- 1 800 722 3774 (toll-free within North America)
- + 46 8 474 4147 (Sweden)
- + 61 2 9936 1200 (Australia)
- medical.abbott/manuals

For additional assistance, call your local Abbott Medical representative.

Any serious incident should be reported to Abbott Medical and the FDA.

Additional Information

For additional information on this device, refer to the programmer's on-screen help.

Physical Specifications

Device Measurements

Table 9. Device measurements ⁵

Model	Dimensions ⁶ (h x l x t) (mm)	Weight (g)	Displaced volume ⁷ (cm ³) ⁸
PM1160	41 x 50 x 6	19	9.7
PM1240	47 x 50 x 6	20	10.4
PM1272	47 x 50 x 6	20	10.4
PM2160	46 x 50 x 6	19	10.4
PM2240	47 x 50 x 6	20	10.4
PM2272	47 x 50 x 6	20	10.4
PM3222	55 x 59 x 6	24	14.0

⁵ Device measurements are nominal values.

⁶ Nominal values based on engineering model measurements.

⁷ Nominal values based on engineering model measurements.

⁸ ±0.5 cm³

Table 9. Device measurements

Model	Dimensions (h x l x t) (mm)	Weight (g)	Displaced volume (cm³)
PM3242	56 x 59 x 6	27	15.0
PM3542	56 x 59 x 6	27	15.0
PM3562	56 x 59 x 6	27	15.0

Device Materials

Table 10. Device materials

Model	Can	Case coating	RF antenna ⁹	Connector material
All devices	Titanium	None	Titanium	May contain one or more of the following: Epoxy, Thermoplastic Polyurethane, Polysulfone
IS-1 port plug	N/A	N/A	N/A	Silicone rubber

⁹ For devices with RF telemetry capability.

Table 10. Device materials

Model	Can	Case coating	RF antenna	Connector material
IS4/DF4 port plug	N/A	N/A	N/A	Thermoplastic polymer

Lead Compatibility

Table 11. Lead compatibility

Model	Lead compatibility
All devices	IS-1 ¹⁰
PM3242	IS-1 and IS4-LLLL
PM3542	
PM3562	

¹⁰ Accepts IS-1 short terminal pin leads.

Battery Information

Table 12. Battery information

Model	Power source	Manufacturer; Model	Voltage at BOL	Voltage at ERI
PM3222	1 QMR ¹¹ cell	Greatbatch Medical; Model 2662	3.20 V	2.62 V
PM3242				
PM3542				
PM3562				
All other devices	1 QMR cell	Greatbatch Medical; Model 2662	3.20 V	2.60 V

RF Operating Frequencies

Nearby equipment emitting strong magnetic fields can interfere with RF communication, even if the other equipment complies with CISPR emission requirements. The operating characteristics are as follows:

MICS band: 402-405 MHz. The effective radiated power is below the limits as specified in:

- Europe: EN ETSI 301 839-2
- USA: FCC 47 CFR Part 95; 95.601-95.673 Subpart E, 95.1201-95.1221 Subpart I
- FCC ID: RIASJMRFB

¹¹ QMR is a trademark of Greatbatch Medical.

- Harmonized with the FCC

WARNING: This transmitter is authorized by rule under the Medical Device Radiocommunications Service (in part 95 of the FCC Rules) and must not cause harmful interference to stations operating in the 400.150 - 406.000 MHz band in the Meteorological Aids (that is, transmitters and receivers used to communicate weather data), the Meteorological Satellite, or the Earth Exploration Satellite Services and must accept interference that may be caused by such stations, including interference that may cause undesired operation. This transmitter shall be used only in accordance with the FCC Rules governing the Medical Device Radiocommunications Service. Analog and digital voice communications are prohibited. Although this transmitter has been approved by the Federal Communications Commission, there is no guarantee that it will not receive interference or that any particular transmission from this transmitter will be free from interference.

The following is applicable to Canada only:

This device may not interfere with stations operating in the 400.150-406.000 MHz band in the meteorological aids, meteorological-satellite, and earth exploration-satellite services and must accept any interference received, including interference that may cause undesired operation.

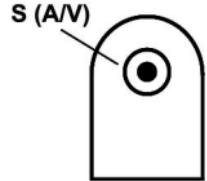
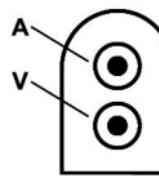
Temperature Effects

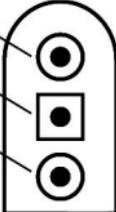
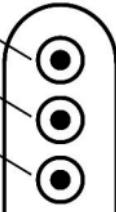
Pacing parameters such as Pulse Rate, Pulse Width, Pulse Amplitude and Sensitivity meet the nominal tolerances defined in the programmer's on-screen help over the temperature range of 25°C to 45°C ($\pm 2^\circ\text{C}$).

Symbols

The symbols below and harmonized symbols may be found on the product or product label. For harmonized symbols, refer to the Universal Symbols Glossary at medical.abbott/manuals.

Symbol	Description
	Single chamber, rate modulated device
	Dual chamber, rate modulated device
	Cardiac Resynchronization Therapy device
	NBG - dual-chamber pacing, dual-chamber sensing, dual-chamber response, rate-modulated
	NBG - dual-chamber pacing, dual-chamber sensing, dual-chamber response, rate-modulated, biventricular sensing and pacing
	NBG - atrial or ventricular pacing, atrial or ventricular sensing, inhibited response, rate-modulated
IS-1	Lead connector accepts unipolar or bipolar IS-1 (International Standard-1) short terminal pin leads.

Symbol	Description
IS4-LLLL	Lead connector accepts quadripolar IS4-LLLL leads. SJ4-LLLL is equivalent to IS4-LLLL. Abbott Medical SJ4 and IS4 connector cavities comply with ISO27186:2010(E).
IS-1	S (A/V)- Single chamber (A or V) IS-1 connector
	A- Atrial IS-1 connector; V- Ventricular IS-1 connector
IS-1	
	

Symbol	Description
IS-1/IS-4-LLLL 	A- Atrial IS-1 connector; LV- Left ventricular IS-4 connector; RV- Right ventricular IS-1 connector
IS-1 	A- Atrial IS-1 connector; LV- Left ventricular IS-1 connector; RV- Right ventricular IS-1 connector
	Accessories
	Product literature
Product of USA	Product of USA

Symbol	Description
Product of Malaysia	Product of Malaysia
UDI	Unique Device Identifier
	Follow instructions for use on this website
medical.abbott/manuals	
	Patient identification card label
	Patient identification
	Date
	Healthcare center or physician
	Physician telephone

Symbol	Description
	Lead model/length
	Location of implant
	Double sterile barrier



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