ZOLL®

R Series® ALS Operator's Guide

9650-0912-06 Rev. G

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Chapter 1
General Information

Product Description

The ZOLL® R Series® products combine a defibrillator, ECG display, advanced monitoring capabilities, and Noninvasive Transcutaneous Pacing (NTP) with communication, data printing and recording capabilities in a single lightweight portable instrument. The unit has been designed for all resuscitation situations and its small, compact, lightweight design makes it ideal for accompanying patients during transport. The product is powered by AC mains and an easily replaced battery pack that is quickly recharged in the device when it is connected to AC mains. In addition, the unit's battery may be recharged and tested using a ZOLL SurePower™ Battery Charger.

The product is designed for use in the hospital. All of its ruggedized features add to its durability in hospital applications.

There are multiple models of the R Series defibrillator that can contain a variety of functions. Your model may not contain all of the functions that are documented in this manual. Those features that are not contained in all models are specified as optional.

The R Series is a versatile manual/advisory external defibrillator. When operating in the manual configuration, the device operates as a conventional defibrillator where the device's charging and discharging are fully controlled by the operator. In advisory mode, some of the features of the device are automated and a sophisticated algorithm is used to identify shockable ECG rhythms (VF and wide complex VT >150 bpm) that should be treated by defibrillator shock delivery. Depending on local protocols, the unit may be configured to automatically analyze the ECG, charge the defibrillator (if appropriate), and prompt the operator to *PRESS SHOCK* between periods of CPR.

The R Series unit assists caregivers during cardiopulmonary resuscitation (CPR) by evaluating the rate and depth of chest compressions and providing feedback to the rescuer.

Real CPR Help® requires the use of OneStep™ CPR electrodes or OneStep Complete electrodes. When using these pads, the displayed ECG waveforms can be adaptively filtered, using the See-Thru CPR® feature, to reduce the artifact caused by chest compressions.

The R Series is a Code-Ready® defibrillator. It extends testing beyond shock delivery and checks more than 40 measures of readiness, including the presence of the correct cables and electrodes, the type of electrode, and other important electronic functions. The R Series also verifies the condition and expiration date of OneStep electrodes. This code readiness testing can occur automatically, without disconnecting electrodes or paddles, or requiring additional equipment to test shock delivery. The system also provides a printed, or electronic log to alert hospital personnel of any defibrillator functions or accessories that are compromised in advance of a code.

Some R Series models include an optional transcutaneous pacemaker consisting of a pulse generator and ECG sensing circuitry. The pacing option supports both demand and asynchronous noninvasive pacing for adult, pediatric, or neonatal patients. OneStep Pacing electrodes and OneStep Complete electrodes allow demand pacing and ECG monitoring without separate ECG electrodes when the R Series is used with the OneStep Pacing cable.

Information regarding the unit's operation, ECG, and other physiological waveforms are displayed on a large 6.5 inch (16.5 cm) diagonal display which provides high contrast and visibility under virtually all lighting conditions. Operating and warning messages are displayed on the monitor, and the unit can also be configured with voice prompts to alert the user to unit status. The R Series performs code readiness testing when the unit is OFF but connected to AC power, when the defibrillator is initially turned on, and periodically during operation.

An annotating strip chart recorder is included to provide immediate documentation as well as summary report functions about patient care and treatment.

A sophisticated data collection system, including summary report, printer, and multiple communication ports is available for this unit. The stored data can be reviewed and archived on a properly equipped personal computer using ZOLL CodeNet® Central software or ZOLL RescueNet® Code Review software. R Series data files may be transferred to a PC using USB or Compact Flash cards or Wi-Fi.

R Series products are intended for use in Manual mode by personnel certified by appropriate federal, state, or local government authority to provide advanced life support care.

How to Use This Manual

The R Series Operator's Guide provides information operators need for the safe and effective use and care of the R Series products. It is important that all persons using this device read and understand all the information contained within.

Please read thoroughly the safety considerations and warnings section.

Procedures for daily checkout and unit care are located in "Maintenance" on page 12-1.

This manual is supplemented by manual inserts for options available on the R Series. These inserts contain additional warnings, precautions, and safety-related information.

Operator's Guide Updates

An issue or revision date for this manual is shown on the front cover. If more than three years have elapsed since this date, contact ZOLL Medical Corporation to determine if additional product information updates are available.

All users should carefully review each manual update to understand its significance and then file it in its appropriate section within this manual for subsequent reference.

Product documentation is available through the ZOLL website at www.zoll.com. From the Products menu, choose Product Manuals.

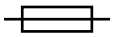
Unpacking

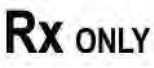
Carefully inspect each container for damage. If the shipping container or cushion material is damaged, keep it until the contents have been checked for completeness and the instrument has been checked for mechanical and electrical integrity. If the contents are incomplete, if there is mechanical damage, or if the defibrillator does not pass its electrical self-test, U.S.A. customers should call ZOLL Medical Corporation (1-800-348-9011). Customers outside of the U.S.A. should contact the nearest ZOLL authorized representative. If the shipping container is damaged, also notify the carrier.

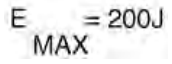
Symbols Used on the Equipment

Any or all of the following symbols may be used in this manual or on this equipment:

Symbol	Description
	Dangerous voltage.
	Attention, consult accompanying documents.
	Fragile, handle with care.
	Keep dry.
	This end up.
	Temperature limitation.
	Conformité Européenne Complies with medical device directive 93/42/EEC.

Symbol	Description
	Type B patient connection.
	Type BF patient connection.
	Type CF patient connection.
	Defibrillator-proof type BF patient connection.
	Defibrillator-proof type CF patient connection.
	Fusible link.
	Equipotentiality.
	Alternating current (AC).
	Direct current (DC).
	Contains lithium. Recycle or dispose of properly.
	Keep away from open flame and high heat.
	Do not open, disassemble, or intentionally damage.
	Do not crush.
	Do not discard in trash. Recycle or dispose of properly.

Symbol	Description
	Return to a collection site intended for waste electrical and electronic equipment (WEEE). Do not dispose of in unsorted trash.
	Date of manufacture.
	Use by.
	Latex-free.
	Do not reuse.
	Do not fold.
	Not sterile.
	Nonionizing electromagnetic radiation from Wi-Fi during data transfer.
	Manufacturer.
	Authorized representative in the European Community.
	Serial Number.
	Catalogue number.
	Consult instructions for use.
	Prescription only.

Symbol	Description
	Maximum energy.
	Test port.

Conventions

This guide uses the following conventions:

Within text, the names and labels for physical buttons and softkeys appear in **boldface** type (for example, “Press the **SHOCK** button or the **Code Marker** softkey”).

This guide uses uppercase italics for audible prompts and for text messages displayed on the screen (for example, *CHECK PATIENT*).

WARNING! **Warning statements alert you to conditions or actions that can result in personal injury or death.**

Caution Caution statements alert you to conditions or actions that can result in damage to the unit.

Defibrillator Function

The R Series product contains a direct current (DC) defibrillator capable of delivering up to 200 joules. It may be used in synchronized mode to perform synchronized cardioversion using the patient’s R-wave as a timing reference. The unit uses paddles or disposable, pregelled electrodes for defibrillation.

Intended Use — Manual Operation

Use of the R Series products in the manual mode for defibrillation is indicated on victims of cardiac arrest where there is apparent lack of circulation as indicated by:

- Unconsciousness.
- Absence of breathing.
- Absence of pulse.

This product should be used only by qualified medical personnel for converting ventricular fibrillation and rapid ventricular tachycardia to sinus rhythm or other cardiac rhythms capable of producing hemodynamically significant heart beats.

In manual mode, the unit can also be used for synchronized cardioversion of certain atrial or ventricular arrhythmias. A qualified physician must decide when synchronized cardioversion is appropriate.

The advisory function should be used to confirm ventricular fibrillation or wide complex ventricular tachycardia (greater than 150 beats per minute) in patients meeting the three conditions indicating lack of circulation (listed above).

Intended Use — ECG Monitoring

The unit is intended for use when ECG monitoring is indicated to evaluate the patient's heart rate or ECG morphology. In ECG monitoring mode, the unit is intended to be used by personnel who are qualified by training in the use of the R Series defibrillator, basic life and/or advanced life support, or other physician-authorized emergency medical training.

Intended Use — Real CPR Help

The Real CPR Help function provides visual and audio feedback designed to encourage rescuers to perform chest compressions at the AHA/ERC recommended rate of 100 compressions per minute. Voice and visual prompts encourage a compression depth in accordance with AHA and/or ERC recommendations of 2 inches (5 cm) minimum for adult patients.

Defibrillator Complications

Inappropriate defibrillation or cardioversion of a patient (for example, with no malignant arrhythmia) may precipitate ventricular fibrillation, asystole, or other dangerous arrhythmias.

Defibrillation without proper application of electrodes or paddle electrolyte gel might be ineffective and cause burns, particularly when repeated shocks are necessary. Erythema or hyperemia of the skin under the paddles, or electrodes often occurs; this effect is usually enhanced along the perimeter of the paddles or electrodes. This reddening should diminish substantially within 72 hours.

Defibrillator Output Energy

R Series defibrillators can deliver as much as 200 joules into a 50 ohm impedance. The energy delivered through the chest wall, however, is determined by the patient's transthoracic impedance. An adequate amount of electrolyte gel must be applied to the paddles and a force of 10 to 12 kilograms (22 to 26.4 pounds) must be applied to each paddle in order to minimize this impedance. If hands-free therapy electrodes are used, make sure that they are properly applied. (Refer to the instructions on the electrode package).

External Pacemaker (Optional)

Some R Series products include an optional transcutaneous pacemaker consisting of a pulse generator and ECG-sensing circuitry. Noninvasive transcutaneous pacing (NTP) is an established and proven technique. This therapy is easily and rapidly applied in both emergency and nonemergency situations when temporary cardiac stimulation is indicated.

The output current of the pacemaker is continuously variable from 0 to 140 mA. The rate is continuously variable from 30 to 180 pulses per minute (ppm), by increments of 2.

The pacing output pulse is delivered to the heart via ZOLL hands-free defibrillation/pacing electrodes placed on the patient's back and the precordium.

The characteristics of the output pulse, together with the design and placement of the electrodes, minimize cutaneous nerve stimulation, cardiac stimulation threshold currents, and reduce discomfort due to skeletal muscle contraction.

The unique design of the R Series products allow clear viewing and interpretation of the electrocardiogram on the display without offset or distortion during external pacing.

Proper operation of the device, together with correct electrode placement, is critical to obtaining optimal results. Every operator must be thoroughly familiar with these operating instructions.

Intended Use — Pacemaker

This product can be used for temporary external cardiac pacing in conscious or unconscious patients as an alternative to endocardial stimulation.

The purposes of pacing include:

- Resuscitation from standstill or bradycardia of any etiology.

  Noninvasive pacing has been used for resuscitation from cardiac standstill, reflex vagal standstill, drug-induced standstill (due to procainamide, quinidine, digitalis, b-blockers, verapamil, etc.) and unexpected circulatory arrest (due to anesthesia, surgery, angiography, and other therapeutic or diagnostic procedures). It has also been used for temporary acceleration of bradycardia in Stokes-Adams disease and sick-sinus syndrome. It is safer, more reliable, and more rapidly applied in an emergency than endocardial or other temporary electrodes.

- As a standby when standstill or bradycardia might be expected.

  Noninvasive pacing can be useful as a standby when cardiac arrest or symptomatic bradycardia might be expected due to acute myocardial infarction, drug toxicity, anesthesia, or surgery. It is also useful as a temporary treatment in patients awaiting pacemaker implants or the introduction of transvenous therapy. In standby pacing applications, noninvasive pacing might provide an alternative to transvenous therapy that avoids the risks of displacement, infection, hemorrhage, embolization, perforation, phlebitis, and mechanical or electrical stimulation of ventricular tachycardia or fibrillation associated with endocardial pacing.

- Suppression of tachycardia.

  Increased heart rates in response to external pacing often suppress ventricular ectopic activity and might prevent tachycardia.

WARNING! This device must not be connected to internal pacemaker electrodes.

Pacemaker Complications

Ventricular fibrillation does not respond to pacing and requires immediate defibrillation. Therefore, the patient's dysrhythmia must be determined immediately, so that you can employ appropriate therapy. If the patient is in ventricular fibrillation and defibrillation is successful but cardiac standstill (asystole) ensues, you should use the pacemaker.

Ventricular or supraventricular tachycardias can be interrupted with pacing, but in an emergency or during circulatory collapse, synchronized cardioversion is faster and more certain.

Pulseless electrical activity (PEA) can occur following prolonged cardiac arrest or in other disease states with myocardial depression. Pacing might then produce ECG responses without effective mechanical contractions, making other effective treatment necessary.

Pacing can evoke undesirable repetitive responses, tachycardia, or fibrillation in the presence of generalized hypoxia, myocardial ischemia, cardiac drug toxicity, electrolyte imbalance, or other cardiac diseases.

Pacing by any method tends to inhibit intrinsic rhythmicity. Abrupt cessation of pacing, particularly at rapid rates, can cause ventricular standstill and should be avoided.

Noninvasive temporary pacing can cause discomfort of varying intensity, which occasionally can be severe and preclude its continued use in conscious patients.

Similarly, unavoidable skeletal muscle contraction might be troublesome in very sick patients and might limit continuous use to a few hours. Erythema or hyperemia of the skin under the hands-free therapy electrodes often occurs; this effect is usually enhanced along the perimeter of the electrode. This reddening should lessen substantially within 72 hours.

There have been reports of burns under the anterior electrode when pacing adult patients with severely restricted blood flow to the skin. Prolonged pacing should be avoided in these cases and periodic inspection of the underlying skin is advised.

There are reports of transient inhibition of spontaneous respiration in unconscious patients with previously available units when the anterior electrode was placed too low on the abdomen.

WARNING! This device must not be connected to internal pacemaker electrodes.

Pediatric Pacing

Pacing can be performed on pediatric patients weighing 33 lb. (15 kg) or less using ZOLL pediatric hands-free therapy electrodes. Prolonged pacing (in excess of 30 minutes), particularly in neonates, can cause burns. Periodic inspection of the underlying skin is recommended.

Intended Use — SpO_2 Monitoring

The R Series pulse oximeter, with the Masimo® SET® technology and the LNCS® series of oximeter sensors, is indicated for the continuous, noninvasive monitoring of arterial oxygen saturation (SpO_2) and pulse rate during both no motion and patient motion conditions for adult patients, and no motion conditions for pediatric and neonatal patients in a hospital or prehospital environment.

Intended Use — $EtCO_2$ Monitoring

The ZOLL R Series $EtCO_2$ option with Respironics Novametrix technology is indicated for the continuous noninvasive monitoring of end tidal carbon dioxide ($EtCO_2$) and respiration rate in patients requiring ventilator support, in-hospital transport, or anesthesia.

This option uses the CAPNOSTAT 5 Mainstream CO_2 sensor attached to an airway adapter that connects to an endotracheal tube, mask or disposable mouthpiece.

The R Series $EtCO_2$ option is designed to monitor adult, pediatric, and neonatal patients.

The following substances can influence CO_2 measurements made with the CAPNOSTAT 5 CO_2 sensor:

- elevated oxygen levels
- nitrous oxide
- halogenated agents

The R Series $EtCO_2$ option provides settings for high oxygen and/or nitrous oxide compensation. Halogenated anesthetic agents alter CO_2 readings, but the R Series unit will monitor CO_2 within specifications when these agents are present at normal clinical levels. The presence of Desflurane in the exhaled breath beyond normal values (5%) may positively bias measured carbon dioxide values by up to an additional 3 mmHg.

The R Series $EtCO_2$ option is intended for use only with the ZOLL/Respironics Novametrix CAPNOSTAT 5 Mainstream CO_2 Sensor and mainstream airway adapters.

The R Series $EtCO_2$ option can be used on adult patients (21 years of age and older) and on pediatric patients, as described in the following table:

Pediatric Subpopulation	Approximate Age Range
Newborn (neonate)	Birth to 1 month of age
Infant	1 month to 2 years of age
Child	2 to 12 years of age
Adolescent	12-21 years of age

Intended Use — NIBP

The ZOLL R Series NIBP option is indicated for the non-invasive measurement of arterial blood pressure for resting patients in critical care and in-hospital transport.

The R Series NIBP option is designed to measure blood pressure for adult patients (21 years of age and older) and for pediatric patients, as described in the following table:

Pediatric Subpopulation	Approximate Age Range
Newborn (neonate)	Birth to 1 month of age
Infant	1 month to 2 years of age
Child	2 to 12 years of age
Adolescent	12-21 years of age

ECG Monitoring

The patient's ECG is monitored by connecting the patient to the unit via a 3- or 5-lead patient cable, hands-free therapy electrodes, or through paddles. Five seconds of ECG is presented on the display along with the following information:

- averaged heart rate, derived by measuring R to R intervals
- lead selection - I, II, III, aVR, aVL, aVF, V (with ECG cable), PADDLES or PADS, P1, P2, P3 (when using OneStep Pacing cable with OneStep Complete electrodes).

  P1, P2, and P3 are non-standard ECG leads derived from electrodes within particular OneStep electrodes. While ECG signals acquired from these leads are appropriate for rhythm assessment and determining electrical capture during pacing, they should not be used for ECG morphological evaluation. Attach conventional ECG electrodes for diagnostic purposes.
- ECG size - 0.5, 1, 1.5, 2, 3 cm/mV
- other operational prompts, messages, and diagnostic codes

Monitoring or diagnostic ECG bandwidth is selectable.

Recorder Function

The strip recorder is provided to document events. The strip recorder normally operates in the delay mode (6 seconds) to ensure the capture of ECG information immediately preceding critical events. The recorder may be activated manually by pressing the **RECORDER** button. It is activated automatically whenever a defibrillation **SHOCK** is delivered, a heart rate alarm occurs, or the rhythm analysis function is activated. The strip recorder may also be configured not to print during these events.

Paddles and Electrodes

The R Series will defibrillate, cardiovert, and monitor ECG using either defibrillation paddles or hands-free therapy electrodes.

The pacer version of the R Series will pace using ZOLL hands-free therapy electrodes.

ENERGY SELECT, **CHARGE** and **SHOCK** controls are located on the paddles and front panel. When using hands-free therapy electrodes, you must use the controls on the front panel of the unit. To switch between paddles and hands-free therapy electrodes, remove the OneStep cable from the apex paddle and connect the hands-free therapy electrodes to the cable.

The Advisory function cannot be activated unless hands-free therapy electrodes are attached to the OneStep cable and used as the ECG monitoring lead.

The R Series can monitor the patient's ECG while pacing without the need for a separate ECG cable and ECG electrodes. This also allows demand pacing when separate ECG electrodes are either not connected, or unavailable. OneStep pacing capability requires the OneStep Pacing cable along with OneStep Pacing electrodes, or OneStep Complete electrodes.

Note: The ZOLL OneStep Pacing electrodes, or OneStep Complete electrodes**,** MFE Pads, Pediatric MFE Pads, stat-padz®**,** and ECG electrodes are disposable, single-use items.

You should always check the expiration date on the electrode packaging. Do not use expired electrodes, which might result in false patient impedance readings and affect the level of delivered energy, or cause burns.

This symbol on the electrode package is accompanied by the expiration date.

For stat-padz II, this symbol does not appear; the expiration date appears on the lower right corner of the label, below the lot number.

The R Series defibrillator reads and reports the expiration date for OneStep Pacing electrodes, OneStep CPR electrodes, and OneStep Complete electrodes. When these electrodes exceed their expiration date, the Code Readiness indicator will change to a red "X."

Note: ZOLL electrodes contain no hazardous materials and may be disposed of in general trash unless contaminated with pathogens. Use appropriate precautions when disposing of contaminated electrodes.

When the patient is less than 8 years old or weighs less than 55 lb. (25 kg), use ZOLL pedi-padz® ***II*** pediatric defibrillation electrodes. Do not delay therapy to determine the patient's exact age or weight.

Batteries

R Series products use an easily replaced rechargeable lithium-ion battery pack (the ZOLL *SurePower* battery pack). A new, fully charged battery pack typically delivers more than 5 hours of ECG monitoring. Use of other functions (such as the defibrillator, printer, or pacemaker) reduces this time.

When a *LOW BATTERY* message appears on the display and the unit emits two beeps in conjunction with the displayed message, the battery must be replaced and recharged.

You can charge the battery by either of the following methods:

- **Internal charging** — plug the R Series into an AC power supply to automatically begin charging the installed battery pack. The front panel battery indicator operates as follows:

When the indicator is:	It means:
Steady yellow	Battery is charging
Steady green	Battery is charged
Alternating yellow and green	No battery is installed or a battery charging fault has been detected.
Not lit	The defibrillator is not connected to AC mains.

Note: Upon power up, it takes approximately 45 seconds for the LEDs on the battery to accurately display run time.

- **External charging** — use the ZOLL SurePower Battery Charger to charge the battery pack and test the battery's capacity. For details, refer to the *ZOLL SurePower defibrillator battery Operator's Manual*.

Code-Ready System

The R Series defibrillator's Code-Ready system tests the defibrillator whenever the unit is turned on, periodically during operation, whenever manual testing is initiated by the operator, and automatically, at pre-configured intervals.

The code readiness indicator on the front panel shows the result of the most recent readiness check. Also, OneStep Pacing, CPR or Complete electrodes provide an interface that communicates the electrode's expiration date and condition to the defibrillator.

The Defib Test Log stores the results for as many as 1000 defibrillator tests in internal memory. Each log entry shows the time and date of the defibrillator test. The Defib Test Log can be printed on the stripchart or transferred to a personal computer for printing and archiving.

Safety Considerations

All operators should review these safety considerations before using the R Series.

R Series products are high-energy defibrillators capable of delivering 200 joules. To completely deactivate the unit, turn the Mode Selector to OFF.

To manually disarm a charged (or charging) defibrillator, do one of the following:

- Turn the Mode Selector to **OFF**, **MONITOR**, or **PACER**.
- Change the selected defibrillator energy.

For safety, the R Series unit automatically disarms if left charged for more than either 60 or 120 seconds (user configurable) if the **SHOCK** button is not pressed.

Warnings

General

Federal (U.S.A.) law restricts this defibrillator to use by or on the order of a physician.

Only appropriately trained, skilled personnel who are familiar with equipment operation should perform emergency defibrillation. The prescribing physician should determine what training, such as Advanced Cardiac Life Support (ACLS) or Basic Life Support (BLS) certification, is appropriate.

Only skilled personnel trained in Advanced Cardiac Life Support (ACLS) and who are familiar with equipment operation should perform synchronized cardioversion. The precise cardiac arrhythmia must be determined before attempting defibrillation.

These operating instructions describe the functions and proper operation of the R Series products. They are not a substitute for a formal patient care training course. Operators should obtain formal training from an appropriate authority before using this defibrillator for patient care.

Proper operation of the unit and correct electrode placement is critical to obtaining optimal results. Operators must be thoroughly familiar with proper device operation.

The use of external pacing/defibrillation electrodes or adapter devices from sources other than ZOLL is not recommended. ZOLL makes no representations or warranties regarding the performance or effectiveness of its products when used with pacing/defibrillation electrodes or adapter devices from other sources. Defibrillator failures attributable to the use of pacing/defibrillation electrodes or adapters not manufactured by ZOLL might void ZOLL's warranty.

Do not disassemble the unit. A shock hazard exists. Refer all problems to authorized service personnel.

Follow all recommended maintenance instructions. If a problem occurs, obtain service immediately. Do not use the defibrillator until it has been inspected by appropriate personnel.

The R Series unit might not perform to specifications when stored at the upper or lower extreme limits of storage temperature and then immediately put into use.

Avoid using the R Series adjacent to, or stacked on, other equipment. If unavoidable, verify that the R Series operates normally in this configuration before clinical use.

The R Series should be installed and put into service according to the EMC information in Appendix A of this manual.

Assess the Wi-Fi performance for the possibility of RFI in your environment of use.

If multiple devices are transmitting simultaneously to the same access point, Wi-Fi data transfer will be slowed down. If the access point is too overloaded, data transmission failures can occur.

The use of accessories, transducers, and cables other than those specified in this manual and related R Series option manual inserts may result in increased emissions or decreased immunity of the R Series.

Do not use or place the unit in service if the Code Readiness indicator (at the upper right of the front panel) displays a red "X".

Carefully route patient cables to avoid tripping over them, or inadvertently pulling the unit onto the patient.

Always inspect the unit for damage if it has been dropped.

ECG Analysis, Defibrillating, Pacing and CPR

Prior to attempting synchronized cardioversion, ensure the ECG signal quality is good and that sync markers are displayed above each QRS complex.

Do not use the unit in advisory mode during patient movement. A patient must be motionless during ECG rhythm analysis. Do not touch the patient during analysis. If transporting the patient, cease all movement before beginning ECG analysis.

ECG rhythm analysis does not warn of patient asystole, which is not a shockable rhythm.

The ECG rhythm analysis function might not reliably identify ventricular fibrillation in the presence of an implanted pacemaker. Inspection of the electrocardiogram and clinical evidence of cardiopulmonary arrest should be the basis for any treatment of patients with an implanted pacemaker.

Implanted pacemakers might cause the heart rate meter to count the pacemaker rate during incidents of cardiac arrest or other arrhythmias. Dedicated pacemaker detection circuitry may not detect all implanted pacemaker spikes. Check the patient's pulse; do not rely solely on heart rate meters. Patient history and physical examination are important factors in determining the presence of an implanted pacemaker. Pacemaker patients should be carefully observed.

Do not place electrodes directly over an implanted pacemaker.

The R Series unit detects ECG electrical signals only. It does not detect a pulse (effective circulatory perfusion). Always verify pulse and heart rate by physical assessment of the patient. Never assume that the display of a nonzero heart rate means that the patient has a pulse.

To avoid possible damage to the R Series unit, turn off pacing before defibrillating the patient with a second defibrillator.

Do not use the unit’s ECG-out signal as a synchronization pulse for another defibrillator or cardioverter.

Place the patient on a firm surface before performing CPR.

Battery

Do not operate the unit without a battery. Keep a fully charged spare battery pack with the defibrillator at all times.

Test battery packs regularly. A battery that does not pass the ZOLL charger’s capacity test might cause the R Series unit to shut down unexpectedly.

When the warning *LOW BATTERY* appears, plug the R Series unit into a power source or install a fully charged battery pack. When the warning *REPLACE BATTERY* appears, immediately replace the battery pack with a fully charged pack or plug the R Series unit into a power source, as unit shut down due to a low battery condition is imminent.

If mistreated, a battery pack might explode. Do not disassemble a battery pack or dispose of it in fire.

Operator Safety

Do not use R series products in the presence of oxygen-rich atmospheres, flammable anesthetics, or other flammable agents (such as gasoline). Using the unit in such environments might cause an explosion.

Do not use the unit near or within standing water. Electrical safety might be compromised when the defibrillator is wet.

Never discharge the unit with the defibrillation electrodes or paddles shorted together or in open air.

Do not discharge the defibrillator except as indicated in the instructions. Discharge the defibrillator only when defibrillation electrodes or paddles are properly applied to the patient.

To avoid risk of electrical shock, do not touch the gelled area of the hands-free therapy electrodes during pacing or defibrillation.

To avoid risk of electrical shock, do not allow electrolyte gel to accumulate on hands or paddle handles.

To avoid risk of electrical shock, do not allow patient connectors to contact other conductive parts, including earth.

For defibrillation using paddles, use only high-conductivity electrolyte gel specified for such use by the manufacturer.

When using paddles for defibrillation, use your thumbs to operate the **SHOCK** buttons. Doing so avoids inadvertent shock to the operator and unintentional depression of an **ENERGY SELECT** button, which causes the defibrillator to disarm. Keep your hands and fingers away from the paddle plates.

The use of accessory equipment that does not comply with the equivalent safety requirements of the R Series defibrillator could reduce the level of safety of the combined system. When choosing accessory equipment, consider the following:

- Use of the accessory in the patient vicinity.
- Evidence that the safety certification of the accessory has been performed in accordance with the appropriate IEC (EN) 60601-1 and/or IEC (EN) 60601-1-1 harmonized national standards.

Always check that the equipment functions properly and is in proper condition before use.

Disconnect all electro-medical equipment that is not defibrillation-protected from the patient prior to defibrillation.

Before discharging the defibrillator, warn everyone to STAND CLEAR of the patient.

Do not touch the bed, patient, or any equipment connected to the patient during defibrillation. A severe shock can result. To avoid hazardous pathways for the defibrillation current, do not allow exposed portions of the patient's body to touch any metal objects, such as a bed frame.

When the R Series is performing a Code Readiness test, as indicated on the display, do not touch the connected paddles, electrodes, or OneStep cable connector.

Patient Safety

This equipment should be connected to only one patient at a time.

Use only OneStep Pediatric electrodes to defibrillate patients under 8 years of age in Advisory modes. Use of adult electrodes, or pediatric electrodes other than OneStep Pediatric electrodes, can result in the delivery of excessive energy doses.

Neonatal and pediatric defibrillation energy level settings should be based on site-specific clinical protocols.

To ensure patient safety, connect the R Series only to equipment with galvanically isolated circuits.

Use only high-quality ECG electrodes. ECG electrodes are for rhythm acquisition only; you cannot use ECG electrodes for defibrillation or pacing.

Do not use therapy or ECG electrodes if the gel is dried, separated, torn or split from the foil; patient burns may result from using such electrodes. Poor adherence and/or air pockets under therapy electrodes can cause arcing and skin burns.

Check the expiration date on the electrode packaging. Do not use electrodes after their expiration date.

Excessive body hair or wet, diaphoretic skin can inhibit electrode coupling to the skin. Clip excess hair and dry any moisture from the area where an electrode is to be attached.

Therapy electrodes should be replaced periodically during continuous pacing. Consult electrode directions for proper replacement instructions.

Prolonged pacing (more than 30 minutes), particularly in neonates or adults with severely restricted blood flow, may cause burns. Periodically inspect the skin under the electrodes.

Carefully route the patient cables to reduce the possibility of patient entanglement or strangulation.

To avoid electrosurgery burns at monitoring sites, ensure proper connection of the electrosurgery return circuit so that a return path cannot be made through monitoring electrodes or probes.

During electrosurgery, observe the following guidelines to minimize electrosurgery unit (ESU) interference and provide maximum operator and patient safety:

- Keep all patient monitoring cables away from earth ground, ESU knives, and ESU return wires.
- Use electrosurgical grounding pads with the largest practical contact area.

Always ensure proper application of the electrosurgical return electrode to the patient.

Check electrical leakage levels before use. Leakage current may be excessive if more than one monitor or other piece of equipment is connected to the patient.

Do not use the ZOLL OneStep Pacing cable (**REF** 1009-0913-02) or the ZOLL Multi-Function Cable (**REF** 1009-0913-03) in a 220/240 VAC 60Hz power environment. Patient leakage current may be excessive.

Cautions

If the unit is to be stored longer than 90 days, remove the battery pack.

Do not sterilize the defibrillator, or its accessories unless the accessories are labelled as sterilizable.

Do not immerse any part of the defibrillator in water.

Do not use ketones (such as acetone or MEK) on the defibrillator.

Avoid using abrasives (including paper towels) on the display window.

Grounding reliability can be achieved only when the equipment is connected to a receptacle marked “HOSPITAL ONLY,” “HOSPITAL GRADE,” or equivalent. If the grounding integrity of the line cord or AC receptacle is questionable, operate the defibrillator using battery power only.

To protect the unit from damage during defibrillation, for accurate ECG information, and to protect against noise and other interference, use only internal current-limiting ECG cables specified or supplied by ZOLL.

For continued safety and EMI performance, use only the line cord supplied by ZOLL.

Dispose of battery packs in accordance with national, regional and local regulations. Battery packs should be shipped to a reclamation facility for recovery of metal and plastic compounds as the proper method of waste management.

Restarting the Defibrillator

Certain events require the R Series products to be restarted after they shut off or become inoperative (for example, when the battery runs down and the unit shuts off).

In such a case, always try to restore defibrillator operation as follows:

1. Turn the Mode Selector to **OFF**.
2. If necessary, replace a depleted battery with a fully charged pack, or connect the defibrillator to AC mains.
3. Turn the Mode Selector to the desired operating mode to restart the unit.

This sequence is necessary to restart the defibrillator and can also be used to clear some fault messages when immediate use of the defibrillator is required.

If restarted after a shutdown period of 10 seconds or more, the unit restores all settings (such as ECG lead, ECG size, and alarm state and limits) to their power-up default values. After restoring device operation, you might need to reinstate previously selected, non-default settings.

FDA Tracking Requirements

U.S. Federal Law (21 CFR 821) requires the tracking of defibrillators. Under this law, owners of this defibrillator must notify ZOLL Medical Corporation if this product is

- received
- lost, stolen, or destroyed
- donated, resold, or otherwise distributed to a different organization

If any such event occurs, contact ZOLL Medical Corporation in writing with the following information:

1. Originator's organization – Company name, address, contact name, and contact phone number
2. Model number, and serial number of the defibrillator
3. Disposition of the defibrillator (for example, received, lost, stolen, destroyed, distributed to another organization), new location and/or organization (if known and different from originator's organization) – company name, address, contact name, and contact phone number
4. Date when the change took effect

Please address the information to:

ZOLL Medical Corporation
Attn: Tracking Coordinator
269 Mill Road
Chelmsford, MA 01824-4105

Fax: (978) 421-0025
Telephone: (978) 421-9655

Notification of Adverse Events

As a health care provider, you may have responsibilities under the Safe Medical Devices Act (SMDA), for reporting to ZOLL Medical Corporation, and possibly to the FDA, the occurrence of certain events.

These events, described in 21 CFR Part 803, include device-related death and serious injury or illness. In addition, as part of our Quality Assurance Program, ZOLL Medical Corporation requests to be notified of device failures or malfunctions. This information is required to ensure that ZOLL Medical Corporation provides only the highest quality products.

Software License

Note: Read this Operator's Guide and License agreement carefully before operating any of the R Series products.

Software incorporated into the system is protected by copyright laws and international copyright treaties as well as other intellectual property laws and treaties. This software is licensed, not sold. By taking delivery of and using this system, the Purchaser signifies agreement to and acceptance of the following terms and conditions:

1. **Grant of License:** In consideration of payment of the software license fee which is part of the price paid for this product ZOLL Medical Corporation grants the Purchaser a non-exclusive license, without right to sublicense, to use the system software in object-code form only.
2. **Ownership of Software/Firmware:** Title to, ownership of and all rights and interests in the system software and all copies thereof remain at all times vested in the manufacturer, and Licensors to ZOLL Medical Corporation and they do not pass to purchaser.
3. **Assignment:** Purchaser agrees not to assign, sublicense or otherwise transfer or share its rights under the license without the express written permission of ZOLL Medical Corporation.
4. **Use Restrictions:** As the Purchaser, you may physically transfer the products from one location to another provided that the software/firmware is not copied. You may not disclose, publish, translate, release or distribute copies of the software/firmware to others. You may not modify, adapt, translate, reverse engineer, decompile, crosscompile, disassemble or create derivative works based on the software/firmware.

NO IMPLIED LICENSE

Possession or purchase of this device does not convey any express or implied license to use the device with replacement parts which would, alone, or in combination with this device, fall within the scope of one or more of the patents relating to this device.

Service

The R Series does not require periodic recalibration or adjustment. Appropriately trained and qualified personnel should, however, perform periodic tests of the defibrillator to verify proper operation.

If a unit requires service, contact the ZOLL Technical Service Department.

For customers In the U.S.A.		For customers outside the U.S.A.
Telephone:	1-800-348-9011 1-978-421-9655	Call the nearest authorized ZOLL Medical Corporation representative.
Fax:	1-978-421-0010	To locate an authorized service center, contact the International Sales Department at ZOLL Medical Corporation 269 Mill Road Chelmsford, MA 01824-4105 Telephone: 1-978-421-9655

When requesting service, please provide the following information to the service representative:

- Unit serial number
- Description of the problem
- Department using the equipment and name of the person to contact
- Purchase order to allow tracking of loan equipment
- Purchase order for a unit with an expired warranty
- Sample ECG or other stripcharts demonstrating the problem (if available and applicable), less any confidential patient information.

Returning a unit for service

Before sending a unit to the ZOLL Technical Service Department for repair, obtain a service request (SR) number from the service representative.

Remove the battery pack from the unit. Pack the unit with its cables and battery in the original containers (if available) or equivalent packaging. Be sure the assigned service request number appears on each package.

For customers	Return the unit to
In the U.S.A.	ZOLL Medical Corporation 269 Mill Road Chelmsford, MA 01824-4105 Attention: Technical Service Department (*SR number*) Telephone: 1-800-348-9011
In Canada	ZOLL Medical Canada Inc. 1750 Sismet Road, Unit #1 Mississauga, ON L4W 1R6 Attention: Technical Service Department (*SR number*) Telephone: 1-866-442-1011
In other locations	The nearest authorized ZOLL Medical Corporation representative. To locate an authorized service center, contact the International Sales Department at ZOLL Medical Corporation 269 Mill Road Chelmsford, MA 01824-4105 Telephone: 1-978-421-9655

The ZOLL Serial Number

Each ZOLL product displays a serial number that contains information about that product. From left to right, ZOLL serial numbers are structured as follows:

- A two-character product code
- A three-character date-of-manufacture code
- A product serial number of six or more alphanumeric characters

The product code for the R Series defibrillator is AF.

The first two characters of the date-of-manufacture code give the last two digits of the year (for example, “06” appears for products manufactured in 2006). The last character of the date-of-manufacture code gives the month in which the product was manufactured. The month appears in the form of a single alphanumeric character: “A” for January, “B” for February, “C” for March, and so on through “L” for December.

The product serial number is a unique set of alphanumeric characters that ZOLL assigns to each individual unit.

Chapter 2
Product Overview

Defibrillator Controls and Indicators

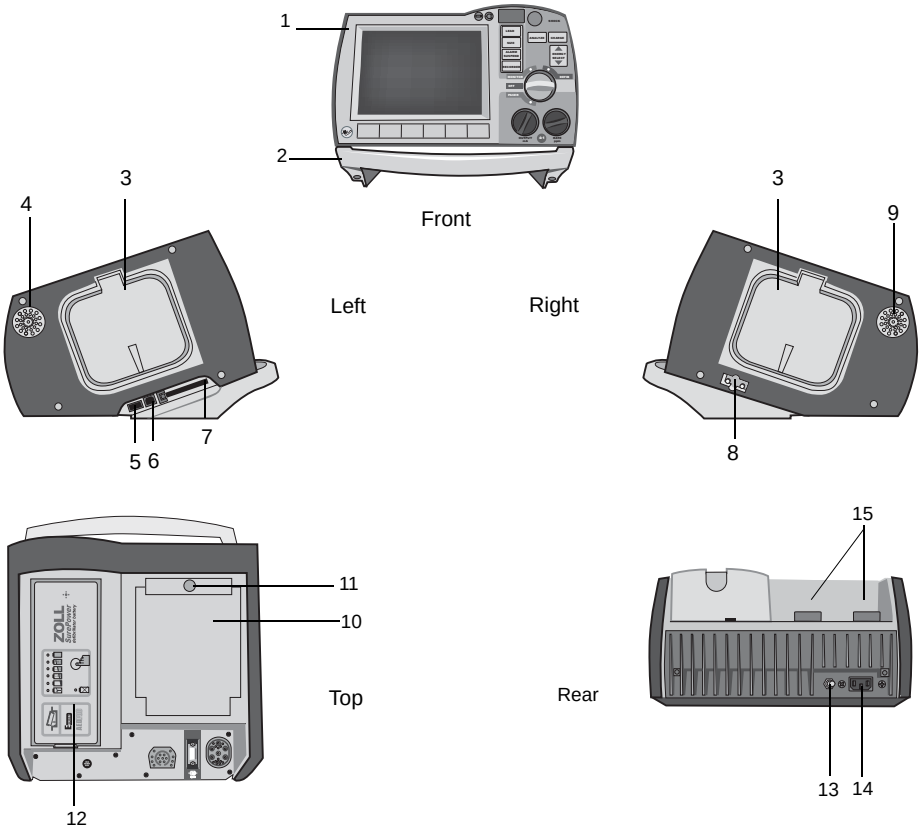


Table 2-1. R Series Unit Features

	Item	Description
1	Front panel	Includes the display screen and primary controls.
2	Handle	Integrated carrying handle.
3	External paddle well	Holds paddles when not in use. Allows defib self-test when paddles are stowed in their respective wells.
4	Beeper	Emits R-wave detection beeps, defib charge Ready tones, and alarm tones.
5	USB host connector (Optional)	(Reserved for future use — do not connect to any equipment.)
6	USB device connector	For connecting the R Series defibrillator to a USB device. For details, refer to “Event Records and Reports” on page 10-1.
7	Data card slot	Holds a compact flash card for copying data stored in the device’s internal memory. Accepts a CF memory card or a WiFi card.
8	Defibrillator test port	When not using OneStep electrodes or paddles, connect the patient end of a OneStep cable to this port to allow device checks.
9	Speaker	Issues voice prompts.
10	Paper Compartment	Holds the paper for the stripchart printer.
11	RELEASE button	Allows access to the paper compartment.
12	Battery compartment	Holds a rechargeable lithium ion battery pack.
13	Grounding post	Electrical ground for biomedical test equipment.
14	AC mains connector	For connecting the device to an AC power source.
15	Patient connectors	For details, refer to “Patient Cables and Connectors” on page 2-7.

The Front Panel

The front panel of the R Series device includes the display screen, softkeys, battery indicator, AC power indicator, Code Readiness indicator, **SHOCK** button, and control panel. The control panel configuration varies slightly depending on the model. See Figure 2-1.

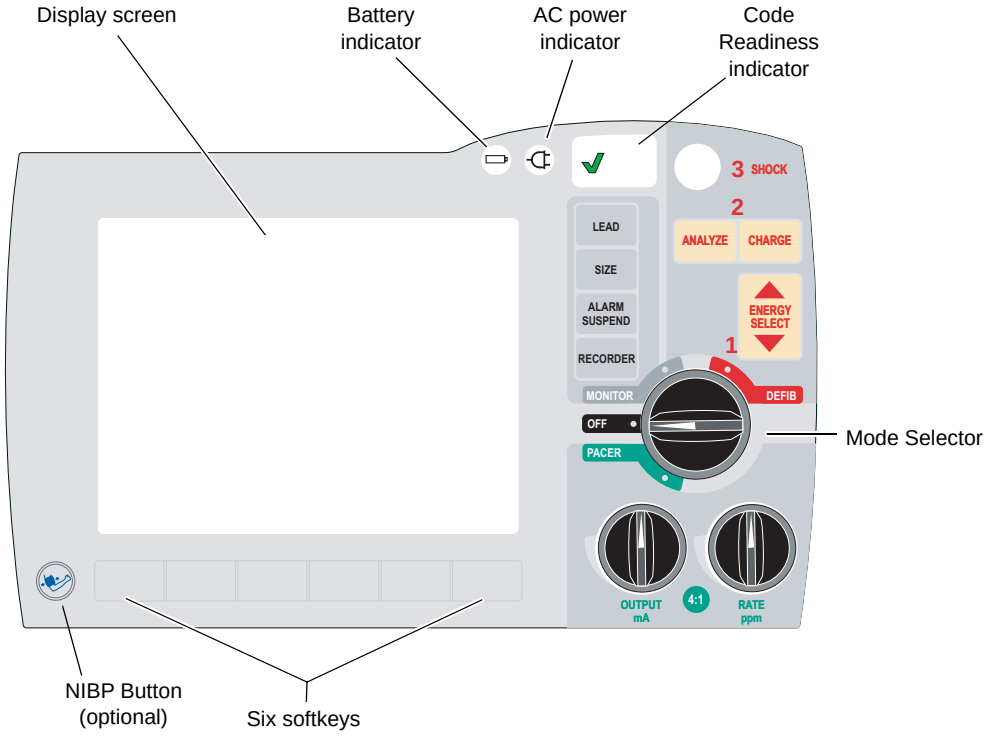


Figure 2-1. R Series Front Panel

Table 2-2 describes the controls and indicators that appear on the front panel.

Table 2-2. R Series Controls and Indicators

Control or Indicator	Description
Display screen	Shows therapeutic settings, physiological waveforms, and other information for each monitored parameter, messages, time, and softkey labels.
Battery indicator	Indicates battery status: Steady yellow: Battery is charging. Steady green: Battery is charged. Alternating yellow and green: No battery is installed, or there is a battery charging fault.
Indicator for AC power	Illuminated when the unit is plugged into an alternating current (AC) power source.
Code Readiness indicator	Shows the status of the unit, based on its most recent Readiness check: • A green "✓" indicates the unit is ready for therapeutic use. • A red "X" indicates the unit's Readiness is compromised an that it may not be ready for therapeutic use.

Table 2-2. R Series Controls and Indicators (continued)

Control or Indicator	Description
Mode Selector	Selects the mode of operation (available options depend on model): • OFF — Unit is powered off. • MONITOR — Physiological monitoring (ECG and other options) • DEFIB — Manual or advisory defibrillation • PACER — Noninvasive external pacing
ENERGY SELECT Buttons	Two sets of up-down arrow buttons control the selection of defibrillator energy, one set located on the front panel and the other located on the sternum paddle.
CHARGE Button	Charges the defibrillator to the selected energy. In addition to the **CHARGE** button on the front panel, there is one located on the apex paddle handle.
SHOCK Button	The front panel **SHOCK** button is only active when using OneStep electrodes, hands-free therapy electrodes (see “R Series Accessories” on page B-1 for a list), external autoclavable paddles, or internal defibrillation paddles without a discharge button. The **SHOCK** button illuminates when the device is charged and ready. To discharge the defibrillator when using paddles (internal or external) with discharge buttons, press and hold the **SHOCK** buttons on the paddles.
ANALYZE Button	Initiates ECG analysis to determine whether or not a shockable rhythm is present.
LEAD Button	Selects the ECG source for display and printing. Pressing this button sequentially selects ECG signals derived from each of the following lead configurations: I, II, III, aVR, aVL, aVF, PADDLES, or PADS, P1, P2, and P3 (when using OneStep Pacing electrodes, or OneStep Complete electrodes with OneStep Pacing cable) for display. The PADS or PADDLES lead setting is automatically selected when the defibrillator powers up in DEFIB or MONITOR mode with either hands-free therapy electrodes or paddles attached to the OneStep cable. Lead II or P3 (OneStep Pacing) is automatically selected when the R Series is powered up in PACER mode. Pads or Paddles monitoring is not available in PACER mode.
SIZE Button	Selects the amplitude scale for the displayed ECG waveform. Available sizes are 0.5, 1, 1.5, 2, and 3 centimeters per millivolt (cm/mV).
ALARM SUSPEND Button	Activates, deactivates or audibly suspends all alarm functions. A bell symbol ( ) appears on the display when alarms are enabled. When alarms are either audibly or permanently disabled, an “X” appears across the bell ( ) symbol.
RECORDER Button	Starts or stops the stripchart recorder. You can switch the unit to diagnostic ECG bandwidth (0.05 - 150Hz) by pressing and holding the **RECORDER** button. Diagnostic bandwidth is maintained as long as the **RECORDER** button is held down. When the **RECORDER** button is released, the unit reverts to standard monitoring bandwidth.
PACER OUTPUT mA (optional)	When pacing is selected, this control sets the amount of current delivered. The selected current setting is indicated on the display.
PACER RATE ppm (optional)	When pacing is selected, this control sets the rate (pulses per minute) at which the pacemaker will operate. The selected pace rate setting is indicated on the display.

Table 2-2. R Series Controls and Indicators (continued)

Control or Indicator	Description
4:1 Button (optional)	This button is used to determine a patient's underlying ECG rhythm. While depressed, this button causes pacing stimuli to be delivered at ¼ of the indicated ppm setting. When the button is released, normal pacing resumes.
NIBP Button (optional)	Allows you to start single, auto, or STAT non-invasive blood pressure measurements as described in the option insert *Non-Invasive Blood Pressure* (part number 9650-0914-01). Your unit has this button only if you ordered this configuration.
Softkeys	Six unlabeled buttons located directly below the display control different functions depending on the operating mode of the unit. Labels for the softkeys appear at the bottom of the display directly above each softkey to indicate its function.
Charge Indicator Light (not shown)	Located on the apex paddle, this light turns on when the defibrillator is charged and ready.

Display Screen

The front panel includes a color display which shows:

- The elapsed time (since the unit was turned on).
- The ECG trace, selected lead, size, heartbeat indicator, and alarm status.
- The selected energy, charging status, and delivered energy for defibrillation and synchronized cardioversion.
- The output current and stimulus rate for pacing.
- The measured SpO_2 percent saturation, signal strength, plethsymographic trace (if applicable), and alarm status indicators for optional SpO_2 monitoring.
- Non-invasive blood pressure (NIBP) readings: diastolic, systolic, and mean, plus alarm status indicators (optional; refer to the insert *Non-Invasive Blood Pressure (NIBP)*, part number 9650-0914-01).
- The patient's carbon dioxide level, respiration rate and capnogram (if applicable), and alarm status indicators for CO_2 monitoring (optional; refer to the insert *End Tidal Carbon Dioxide ($EtCO_2$)*, part number 9650-0915-01).
- Messages and prompts.
- Labels above the softkeys (appropriate to the context).
- CPR Index™ and Release Bar.
- CPR Rate and Depth.

Figure 2-2 shows the layout of parameter values, waveforms, system data, and softkey labels.

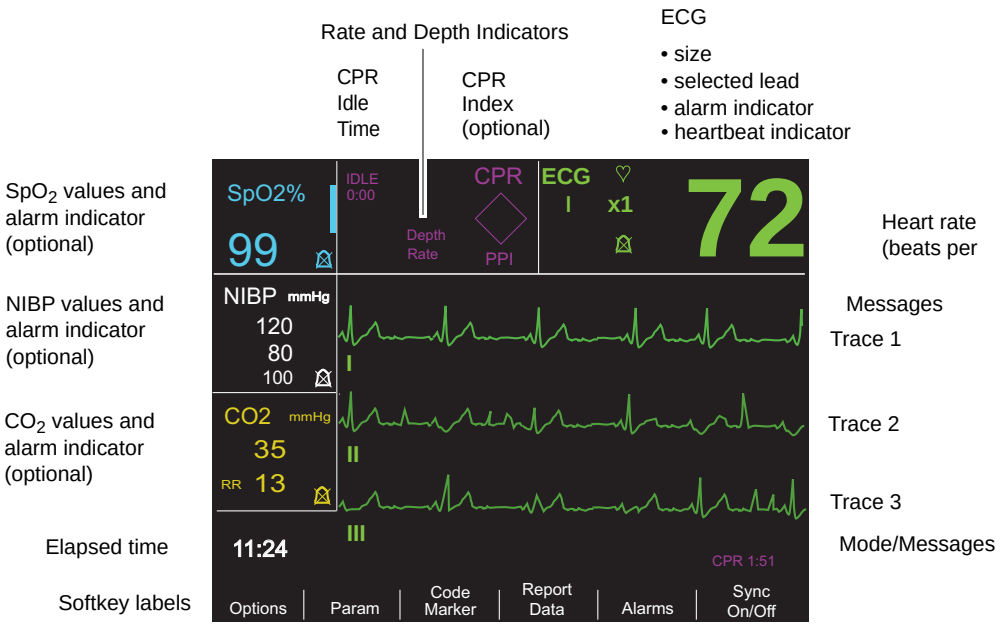


Figure 2-2. R Series Display Screen (shown with optional SpO_2, NIBP and CO_2 monitoring)

Color coding

To differentiate information for various parameters, the unit displays each type of information in a specific user-configurable color.

Messages

During operation, a fault or error message is displayed when a fault is detected. If this occurs, turn the unit off and then on and recheck operation. If the fault persists, contact your authorized ZOLL agent as described on page 1-21.

Patient Cables and Connectors

The back of the unit includes a set of connectors for patient cables.

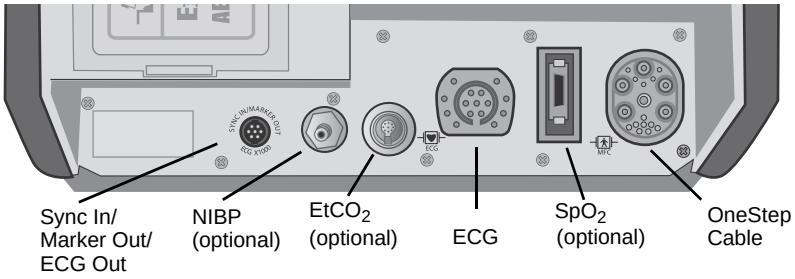


Figure 2-3. Patient Cable Connectors

Connector	Description
OneStep Cable	For connecting paddles or ZOLL hands-free therapy and pacing electrodes using either OneStep or OneStep Pacing cables.
ECG	For connecting 3- or 5-lead ECG cable or OneStep Pacing cable's ECG cable.
Sync In / Marker Out / ECG x1000	Connector for • An incoming defibrillator synchronization signal from an external patient monitor. • Output of R wave marker to an external patient monitor. • ECG signal output for use with other equipment such as patient monitors and radio telemetry equipment (1 V/cm of displayed ECG signal).
NIBP	(Optional) For connecting blood pressure cuff cable.
$EtCO_2$	(Optional) For connecting CO_2 monitor cable.
SpO_2	(Optional) For connecting pulse oximeter cable.

OneStep Cables

The R Series ships with either a OneStep, or OneStep Pacing cable.

The OneStep Pacing cable has an additional connector that plugs into the rear panel ECG connector. This cable is used with OneStep Pacing electrodes or OneStep Complete electrodes for external pacing and ECG monitoring. Alternatively, you can disconnect the OneStep Pacing cable from the ECG connector and use a 3- or 5-lead ECG cable.

Figure 2-4. OneStep Cables

OneStep Cable Manager (Optional)

As an option, the OneStep Cable Manager is available to store and organize cables.

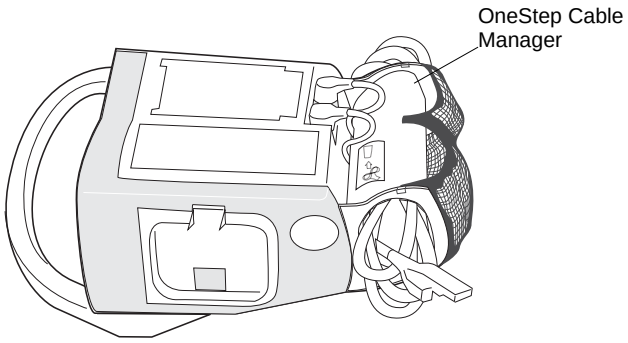
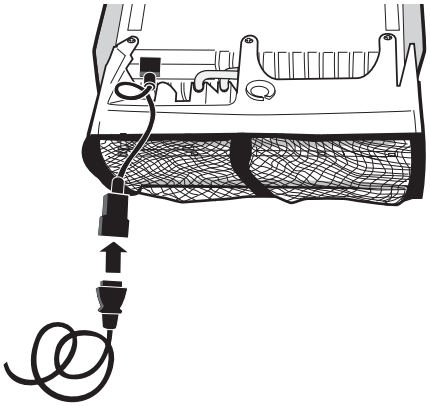


Figure 2-5. The R Series with the Optional OneStep Cable Manager (Side View)

Power Cord

The AC power cord is used to operate the R Series unit when battery power is not being used. An additional extension cord is available for use when the cable organizer accessory is attached to the unit. The extension cord plugs into the main AC power cord as shown below.



External Paddles

Paddles are defibrillation-proof Type BF equipment.

The external paddles on the R Series device are used for defibrillation and synchronized cardioversion.

Caution You cannot use paddles for ECG analysis or pacing.

Defibrillation paddles can be used for ECG monitoring when it is not practical to apply ECG electrodes. Press the **LEAD** button to select PADDLES as the ECG source.

The paddles are stowed in wells on either side of the unit. To release the paddles, grasp the handles and then press down on the latch button above each paddle.

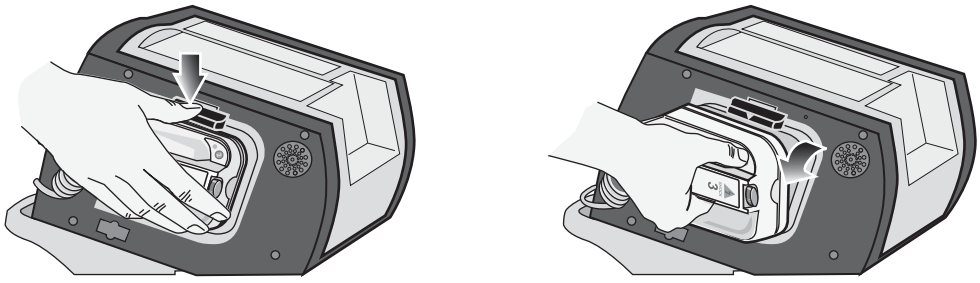


Figure 2-6. Releasing the Paddles

Attach the OneStep cable from the R Series unit to the connector at the base of the apex paddle.

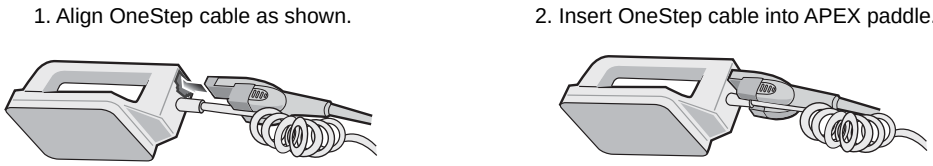


Figure 2-7. Attaching the OneStep Cable to the APEX Paddle

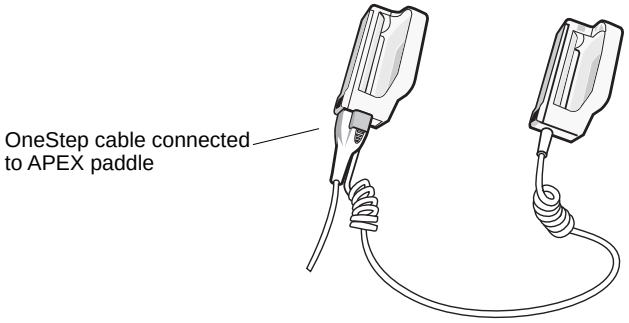


Figure 2-8. OneStep Cable Connected to APEX Paddle

If you need to detach the OneStep cable from the APEX paddles, push the **RELEASE** button (see Figure 2-9) in the direction of the arrow and unplug the OneStep cable.

Refer to Chapter 3, "Manual Defibrillation" before using paddles for defibrillation. The paddles include controls for selecting defibrillation energy, charging, delivering a shock, and turning the stripchart recorder on and off.

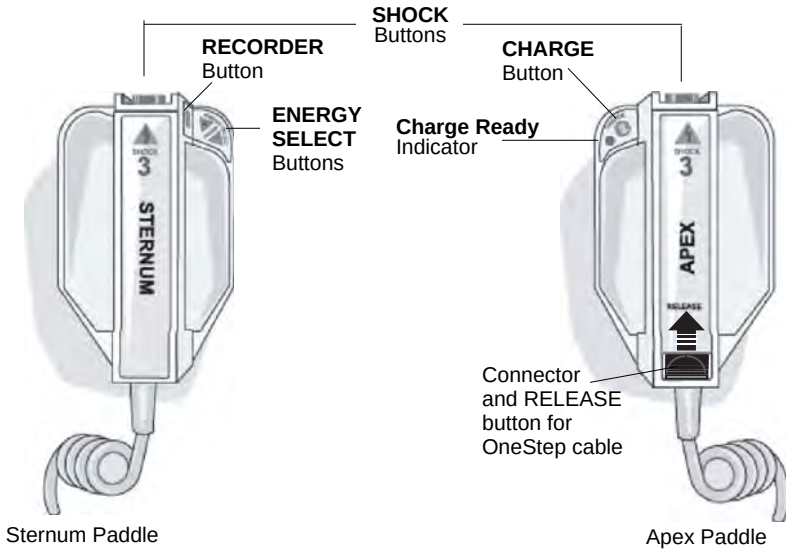
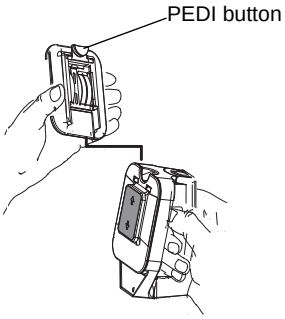


Figure 2-9. External Paddles

Pediatric-size electrodes are built into the paddle assembly beneath the standard electrode plates. The user must manually adjust energy settings to pediatric levels consistent with their institution's protocols.



To expose the pediatric plate, press the PEDI button at the top of the paddle, then slide the Adult plate upward.

Before replacing the Adult plate, be sure to clean the pediatric plate and surrounding area

Figure 2-10. Pediatric Plate

Note: The R Series defibrillator also supports ZOLL autoclavable internal handles for use during open chest defibrillation procedures.

Working with Menus

For some functions, the screen shows a menu of options with related softkeys for navigating through the menus and making selections and entries.

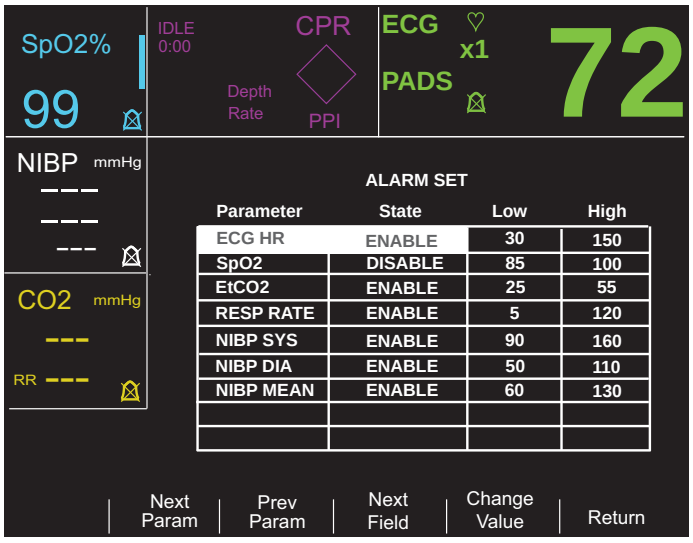


Figure 2-11. Example Display Screen

On the display, highlighting indicates the currently selected item, that is, the item or value you are working with.

The following table summarizes some of the more common softkeys.

Softkey	Action
Next Item **Next Field**	Moves the highlighting down to the next item in a vertical list.
Prev Item	Moves the highlighting up to the previous item in a vertical list.
Next Digit	Moves the highlighting to the right in a series of letters or digits.
Prev Digit	Moves the highlighting to the left in a series of letters or digits.
Inc **Inc Digit**	Increases the highlighted value or digit. (For example, changes 2 to 3 or B to C).
Dec **Dec Digit**	Decreases the highlighted value or digit. (For example, changes 2 to 1 or B to A).
Newer	Moves the highlighting to the adjacent item with the more recent date or time.
Older	Moves the highlighting to the adjacent item with the older date or time.
Enter	Accepts the settings with the values currently shown.
Return	Displays the previous menu.
Next Param	Moves the highlighting to the next parameter.
Prev Param	Moves the highlighting to the previous parameter.
Change Value	Changes the value of the selected parameter.

Defib Mentor Mode (Optional)

Defib Mentor™ mode is a nonclinical tutorial mode available when the Mode Selector is turned to MONITOR. When in this mode, the device displays a brief description of each front panel control's function when that control is activated.

Note: Do not run the Defib Mentor mode with a patient connected to the R Series unit.

To access Defib Mentor mode:

1. Turn the Mode Selector to **MONITOR**.
2. Press the **Options** softkey.
3. Press **MORE.**

   Additional options appear.
4. Press **Mentor**.
5. Press **Confirm Mentor Mode**.

   The unit is now in Defib Mentor Mode, a non-clinical operating mode.
6. Activate a front panel control (except the Mode Selector or the **Exit Mentor** softkey).

   A brief description of that control's function appears on the screen.

To exit Mentor mode, press the **Exit Mentor** softkey or turn the Mode Selector to **OFF**, **DEFIB**, or **PACER**.

Note: After 60 seconds of non use in the Mentor mode, the R Series returns to MONITOR mode.

Common Tasks

Follow the instructions in the subsequent sections for:

- “Replacing a Battery Pack” on page 2-13.
- “Adjusting Display Brightness” on page 2-13.
- “Using Code Markers” on page 2-14.

Replacing a Battery Pack

To remove a battery pack, press the tab on the end of the battery pack inward, and lift the battery pack out of the compartment.

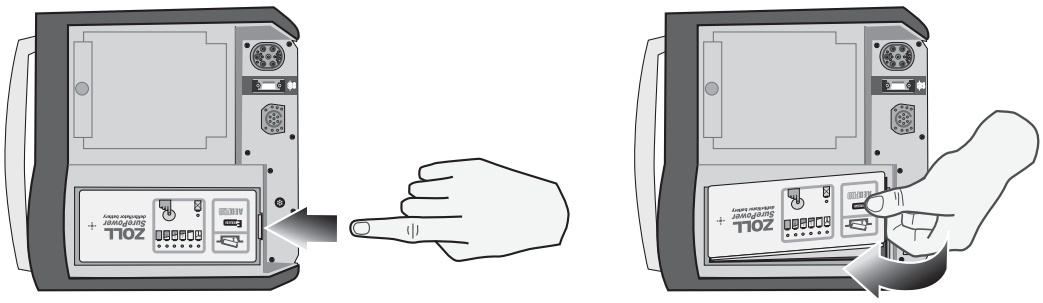


Figure 2-12. Removing a Battery Pack

To install a battery pack:

1. Place the end of the battery pack opposite the tab into the end of the compartment closest to the front of the unit.
2. Lower the tabbed end of the battery pack into the compartment and press down on the tabbed end until it locks into place.

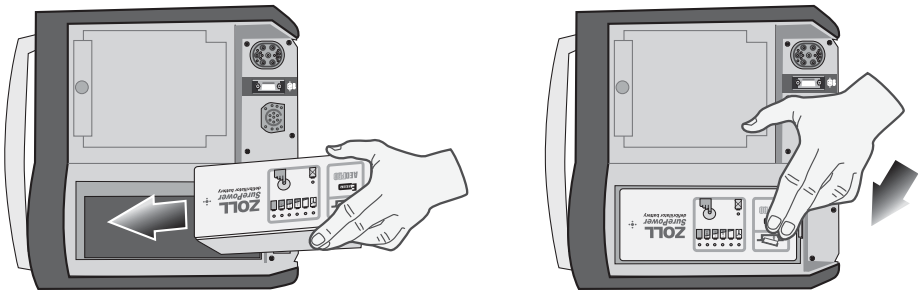


Figure 2-13. Installing a Battery Pack

Adjusting Display Brightness

To adjust brightness:

1. Press the **Options** softkey.

2. Press the **High Bright** or **Low Bright** softkey to select high and low brightness.

Note: Brightness level affects battery run time. Selecting high bright will cause the battery charge to be depleted at a faster rate than when selecting low bright.

Using Code Markers

Pressing the **CODE MARKER** softkey causes the unit to display a preconfigured list of clinical actions. Pressing the softkey associated with a particular action causes that action, and 6 seconds of ECG, to be recorded along with a date and time stamp in the Summary Report memory. You can supplement an event summary by manually adding code markers which itemize drugs or treatments administered to the patient.

Up to six Code Markers can be displayed on the screen at one time.

Figure 2-14. Code Markers

The right-most softkey is labeled MORE when there are more than six items on the code marker list. Press the MORE softkey to see the next set of Code Markers displayed above the softkeys.

Separate code marker lists are maintained for DEFIB, MONITOR, and PACER modes, thereby enabling the display of appropriate code markers for each particular protocol. (For information on configuring these code marker lists, refer to the *R Series Configuration Guide*.)

The code markers are removed from the display after 10 seconds. If no Code Marker softkey has been pressed during that time, a “default” event mark is stored in Summary Report memory.

Chapter 3
Manual Defibrillation

Paddles are a defibrillation-protected Type BF patient connection.

ECG leads are a defibrillation-protected Type CF patient connection.

Emergency Defibrillation Procedure with Paddles

WARNING! **To avoid risk of electrical shock, do not allow electrolyte gel to accumulate on hands or paddle handles.**

When defibrillating with paddles, use your thumbs to operate the SHOCK buttons in order to avoid inadvertent operator shock. No portion of the hands should be near the paddle plates.

Determine the Patient's Condition Following Local Medical Protocols

Verify:

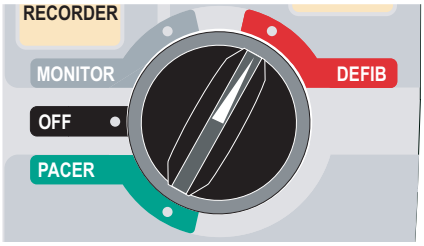
- Unconsciousness.
- Absence of breathing.
- Absence of pulse.

Begin CPR Following Local Medical Protocols.

Request additional assistance.

1 Select DEFIB

Turn the Mode Selector to **DEFIB**. The unit automatically defaults to 120 joules or the preconfigured first shock energy selection.



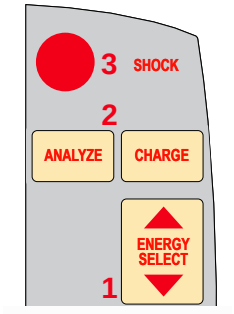
Note: Defibrillator PADDLES are selected as the ECG source when the instrument is turned to **MONITOR** or **DEFIB** with paddles connected to the OneStep cable.

Energy Select

Look at the Display and verify the energy is appropriate. Unless internal handles are connected to the OneStep cable, the default energy selections for adult patients are:

- Shock 1 - 120 joules
- Shock 2 - 150 joules
- Shock 3 - 200 joules

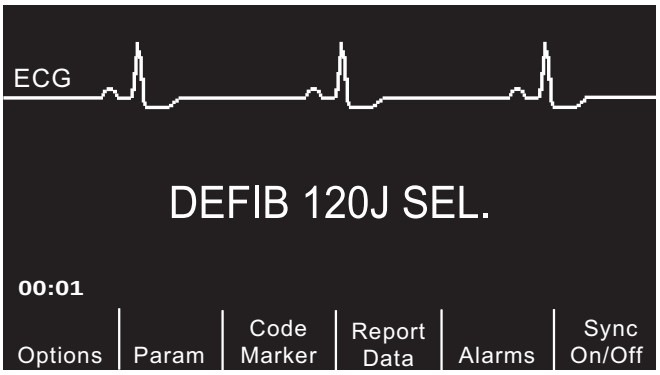
If medical protocol allows, you may select a different energy level using the up and down arrow buttons. One pair is located on the front panel of the unit; the other pair is located on the sternum paddle.



or

Note: Neonatal and pediatric defibrillator energy levels should be selected based on site-specific protocols.

The selected energy level is shown as *DEFIB XXXJ SEL.* on the display.



If you have configured Shocks 1, 2, and 3 to escalating energy levels (see the *R Series Configuration Guide* for instructions), the R Series automatically sets the energy to the preconfigured Energy Level: Shock 1, 2, 3 setting at power-up and after each of the first two shocks. The *ENERGY INCREMENTED* message will be displayed after Shocks 1 and 2 are delivered. Manually changing the energy level outside the preprogrammed sequence and delivering a shock disables the automatic escalation function.

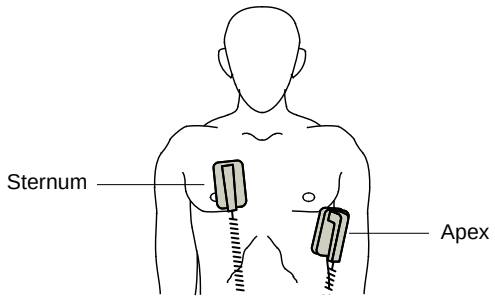
Prepare Paddles

Release the paddles, apply a liberal amount of electrolyte gel to the electrode surface of each paddle, and rub the electrode surfaces together to evenly distribute the applied gel. (You can substitute electrode gel patches for the gel.)

Apply Paddles to Chest

Apply the paddles firmly to the anterior wall of the chest. Place the sternum paddle to the right of the patient's sternum (patient's right), just below the clavicle.

Place the apex paddle on the chest wall, just below and to the left of the patient's left nipple, along the anterior-axillary line.



Rub the paddles against the skin to maximize the paddle-to-patient contact.

WARNING! **Do not permit gel to accumulate between the paddle electrodes on the chest wall (gel bridge). This could cause burns and reduce the amount of energy delivered to the heart.**

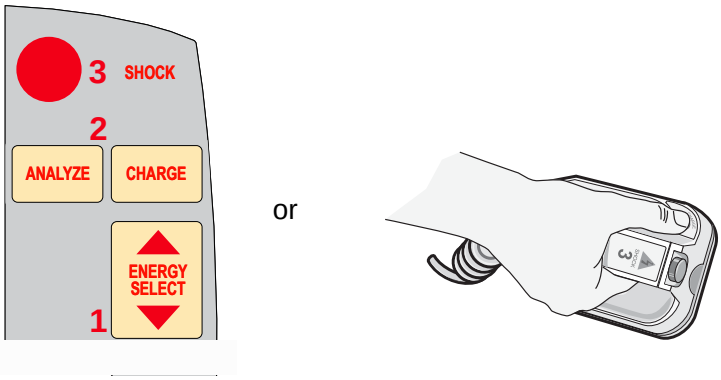
If using defibrillator gel pads, make sure that the size of the pad is large enough to cover the entire paddle electrode area.

The paddles may be used for ECG monitoring in emergency situations when time does not allow connection of standard ECG monitoring electrodes.

If an ECG cable and ECG electrodes are in use, press the **LEAD** button to select the desired ECG lead.

2 Charge Defibrillator

Press the **CHARGE** button on the apex handle or on the front panel.



If both **SHOCK** buttons on the paddles are depressed when the **CHARGE** button is activated, the unit does not charge and a *RELEASE SHOCK BUTTON* message appears on the display.

To increase or decrease the selected energy after you have pressed the **CHARGE** button, use the defibrillator **ENERGY SELECT** buttons on either the sternum paddle or the defibrillator front panel.

Caution Changing the selected energy while the unit is charging or charged causes the defibrillator to disarm itself. Press the **CHARGE** button again to charge the unit to the newly selected energy level.

After charging to the selected energy, the charge indicator on the apex paddle lights. A distinctive charge ready tone sounds, and the message *DEFIB XXXJ READY* is displayed. The defibrillator is now ready to discharge.

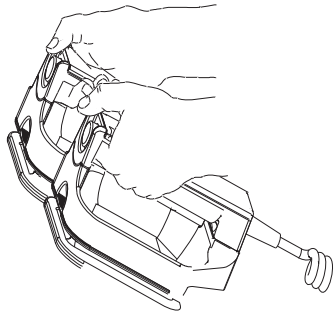
3 Deliver Shock

WARNING! **Warn all persons in attendance of the patient to STAND CLEAR prior to defibrillator discharge.**

Do not touch the bed, patient, or any equipment connected to the patient during defibrillation. A severe shock can result. Do not allow exposed portions of the patient's body to come into contact with metal objects, such as a bed frame, as unwanted pathways for defibrillation current may result.

Apply a force of 10 - 12 kilograms (22 - 26.4 pounds) to each paddle in order to minimize patient impedance and achieve optimal results.

Using your thumbs, simultaneously press and hold both **SHOCK** buttons (one on each paddle) until energy is delivered to the patient.



Caution Use only thumbs to depress the **SHOCK** buttons. Failure to do so could result in the inadvertent depression of the **ENERGY SELECT** buttons, causing the defibrillator to disarm itself.

Once the energy is delivered, the display simultaneously shows *XXXJ DELIVERED* and *DEFIB XXXJ SEL*. After approximately 5 seconds, the *XXXJ DELIVERED* message disappears, and the *DEFIB XXXJ SEL*. message remains to indicate the selected energy level.

Note: If the defibrillator is not discharged within 60 seconds after reaching the selected energy level, the unit automatically disarms itself.

During the 10 seconds prior to disarming, the charge ready tone beeps intermittently. The charge ready tone then stops, the charge indicator light goes off, and the monitor message changes to *DEFIB XXXJ SEL*. Press the **CHARGE** button to recharge the unit.

Autoclavable External Paddles

ZOLL Autoclavable External Paddles are available for use with manually operated ZOLL defibrillators when sterile conditions must be maintained during defibrillation.

Emergency Defibrillation Procedure with Hands-Free Therapy Electrodes

ZOLL hands-free therapy electrodes are a defibrillation-protected Type BF patient connection.

ECG leads are a defibrillation-protected Type CF patient connection.

Determine the Patient's Condition Following Local Medical Protocols

Verify:

- Unconsciousness.
- Absence of breathing.
- Absence of pulse.

Begin CPR Following Medical Protocols

Request additional assistance.

Prepare Patient

Remove all clothing covering the patient's chest. Dry chest if necessary. If the patient has excessive chest hair, clip or shave it to ensure proper adhesion of the electrodes.

Attach hands-free therapy electrodes according to instructions on the electrode packaging.

Ensure that the therapy electrodes are making good contact with the patient's skin and are not covering any part of the ECG electrodes.

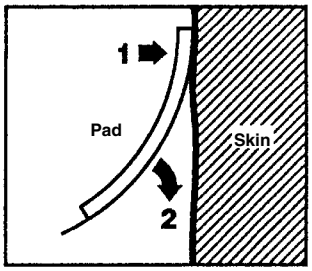
Connect the hands-free therapy electrodes to the OneStep cable if not preconnected.

If defibrillation electrodes are not making good contact with the patient's skin, the unit issues the messages *CHECK PADS* and *POOR PAD CONTACT* and does not allow delivery of energy. If a short circuit exists between the electrodes, the unit issues the message *DEFIB PAD SHORT*.

Therapy Electrode Application

WARNING! Poor adherence and/or air under the therapy electrodes can lead to the possibility of arcing and skin burns.

1. Apply one edge of the pad securely to the patient.
2. Roll the pad smoothly from the applied edge to the other, being careful not to trap any air pockets between the gel and skin.

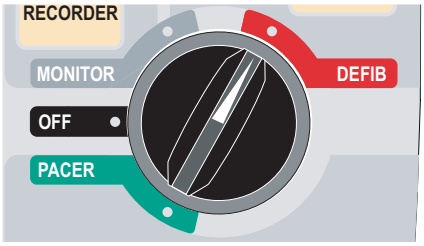


Note: If it is not possible to place the "BACK" electrode on the patient's back, place the electrodes in the standard apex-sternum positions. Effective defibrillation results, but pacing will usually be less effective.

WARNING! Application of adult electrodes to a pediatric patient will result in the automatic selection of adult energy levels. If needed, manually adjust the energy settings based on site-specific protocols.

1 Select DEFIB

Turn the Mode Selector to DEFIB. The unit automatically defaults to 120 joules or the preconfigured first shock energy selection.



PADS is selected as the ECG source when the instrument is turned to MONITOR or DEFIB and paddles are not connected to the OneStep cable. You may select any of the other ECG leads by pressing the front panel **LEAD** button.

Energy Select

Look at the display, and verify the selected energy is appropriate. The default energy selections for adult patients are:

- Shock 1 - 120 joules
- Shock 2 - 150 joules
- Shock 3 - 200 joules

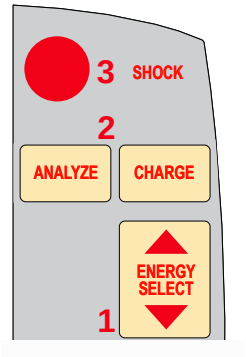
When used with OneStep Pediatric electrodes, the default energy selections are:

- Shock 1 - 50 joules
- Shock 2 - 70 joules
- Shock 3 - 85 joules

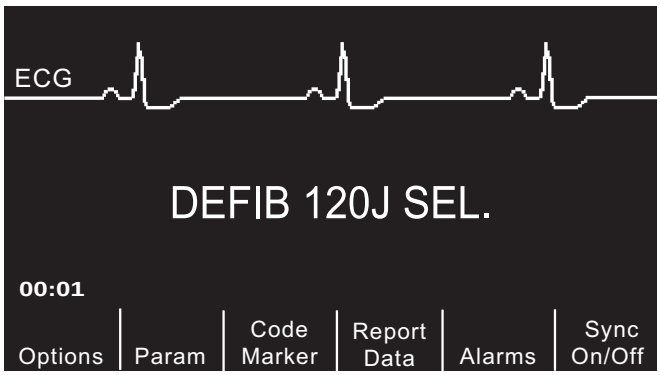
WARNING! When used with pedi-padz, defibrillator energies must be set manually based on site-specific institutional protocols for pediatric defibrillation.

After the third shock, all subsequent shocks are delivered at the same energy as the third shock in both Adult and Pediatric modes.

If medical protocol allows, you may select a different energy level using the **ENERGY SELECT** buttons on the front panel.



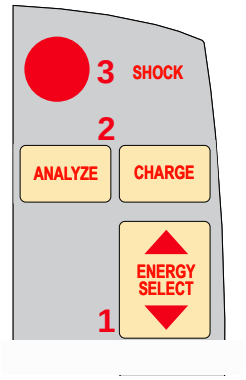
The selected energy level is shown as *DEFIB XXXJ SEL.* on the display.



If you have configured Shocks 1, 2, and 3 to escalating energy levels (see the *R Series Configuration Guide* for instructions), the R Series automatically sets the energy to the preconfigured Energy Level: Shock 1, 2, 3 setting at power-up and after each of the first two shocks. The *ENERGY INCREMENTED* message will be displayed after Shocks 1 and 2 are delivered. Manually changing the energy level outside the preprogrammed sequence and delivering a shock disables this function.

2 Charge Defibrillator

Press the **CHARGE** button on the front panel.



To increase or decrease the selected energy after you have pressed the **CHARGE** button, use the defibrillator **ENERGY SELECT** buttons.

Caution Changing the selected energy while the unit is charging or charged causes the defibrillator to disarm itself. Press the **CHARGE** button again to charge the unit.

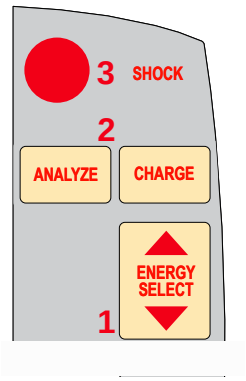
After charging to the selected energy, the **SHOCK** button on the front panel lights. A distinctive charge ready tone sounds and the *DEFIB XXXJ READY* is displayed. The defibrillator is now ready to discharge.

3 Deliver Shock

WARNING! **Warn all persons in attendance of the patient to STAND CLEAR prior to defibrillator discharge.**

Do not touch the bed, patient, or any equipment connected to the patient during defibrillation. A severe shock can result. Do not allow exposed portions of the patient's body to come into contact with metal objects, such as a bed frame, as unwanted pathways for defibrillation current may result.

Press and hold the **SHOCK** button until energy is delivered to the patient.



Note: If the defibrillator is not discharged within 60 seconds after reaching the selected energy level, the unit automatically disarms itself.

During the 10 seconds prior to disarming, the charge ready tone beeps intermittently. The charge ready tone then stops, the **SHOCK** button light goes off, and the monitor message changes to *DEFIB XXXJ SEL*. Press the **CHARGE** button to recharge the unit.

Once the energy is delivered, the display simultaneously shows *XXXJ DELIVERED* and *DEFIB XXXJ SEL*. After approximately 5 seconds, the *XXXJ DELIVERED* message disappears and the *DEFIB XXXJ SEL*. message remains to indicate the selected energy level.

Autoclavable Electrodes

ZOLL Autoclavable Internal Handles are designed for use with a manually operated ZOLL defibrillator to defibrillate the heart during open chest procedures. Two types of Autoclavable Internal Handles are available:

- Molded Autoclavable Internal handles with integrated electrode spoons
- Autoclavable Internal Handles with removable internal defibrillation electrodes

When these internal handles are used, the R Series defibrillator can operate only in Manual mode even if the unit supports Advisory mode. When an internal handle set is connected to the R Series, it automatically limits energy output to a maximum of 50 joules.

For step-by-step procedures for open chest defibrillation as well as important cleaning and sterilization information, refer to the *Autoclavable Internal Handle and Electrode Operator's Guide*.

Chapter 4
Advisory Defibrillation

ZOLL hands-free therapy electrodes are a defibrillation-protected Type BF patient connection.

When the Mode Selector is turned to DEFIB and hands-free therapy electrodes are used, the R Series can identify shockable rhythms using its built in ECG analysis capability. You must read the advisory messages, charge the defibrillator to the preconfigured or user-selected energy level (if automatic charge is disabled), and deliver treatment to the patient when required by protocol and patient condition.

The advisory function can be activated only when:

- Hands-free therapy electrodes are connected and selected as the ECG source.
- Hands-free therapy electrodes are properly connected to the patient.
- The Mode Selector is turned to **DEFIB**.

WARNING! **Use only pediatric electrodes to defibrillate patients under 8 years of age in Advisory mode. Use of adult electrodes with pediatric patients can result in the delivery of excessive energy doses.**

Advisory Defibrillation Procedure

Determine the Patient's Condition Following Local Medical Protocols

Verify:

- Unconsciousness.
- Absence of breathing.
- Absence of pulse.

Begin CPR Following Local Medical Protocols

Request additional assistance.

Prepare Patient

Remove all clothing covering the patient's chest. Dry chest if necessary. If the patient has excessive chest hair, clip or shave it to ensure proper adhesion of the electrodes.

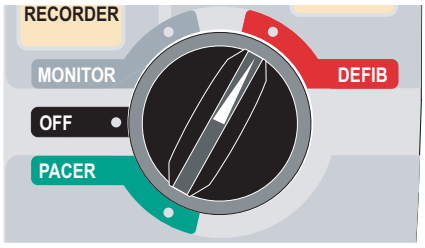
Attach hands-free therapy electrodes according to instructions on the electrode packaging and as described in "Therapy Electrode Application" on page 3-6.

Ensure that the electrodes are making good contact with the patient's skin and are not covering any part of the ECG electrodes.

If therapy electrodes are not making good contact with the patient's skin, the unit issues the messages *CHECK PADS* and *POOR PAD CONTACT* and does not allow delivery of energy. If a short circuit exists between the electrodes, the unit issues the message *DEFIB PAD SHORT*.

1 Select DEFIB

Turn the Mode Selector to **DEFIB**. The unit displays *DEFIB 120J SEL* on the monitor.



Energy Select

The default energy selections for adult patients are:

- Shock 1 - 120 joules
- Shock 2 - 150 joules
- Shock 3 - 200 joules

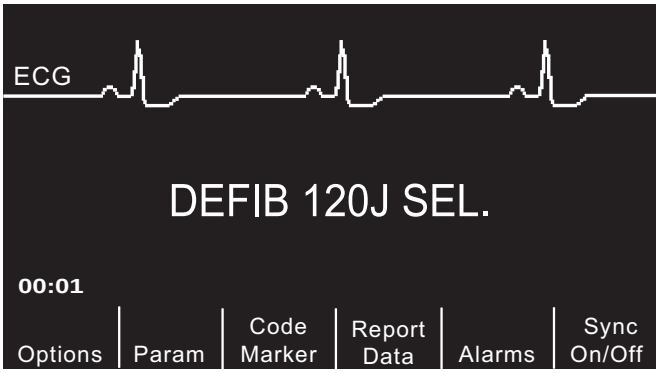
When used with OneStep Pediatric electrodes, the default energy selections for pediatric patients are:

- Shock 1 - 50 joules
- Shock 2 - 70 joules
- Shock 3 - 85 joules

WARNING! Use only OneStep Pediatric electrodes to defibrillate patients under 8 years of age in Advisory mode. Use of adult electrodes, or pediatric electrodes other than OneStep Pediatric electrodes, can result in the delivery of excessive energy doses.

After the third shock, all subsequent shocks are delivered at the same energy as the third shock in both Adult and Pediatric modes.

If medical protocols allow, you may select a different energy level using the energy select up and down arrow buttons on the front panel. The new energy setting displays on the monitor.

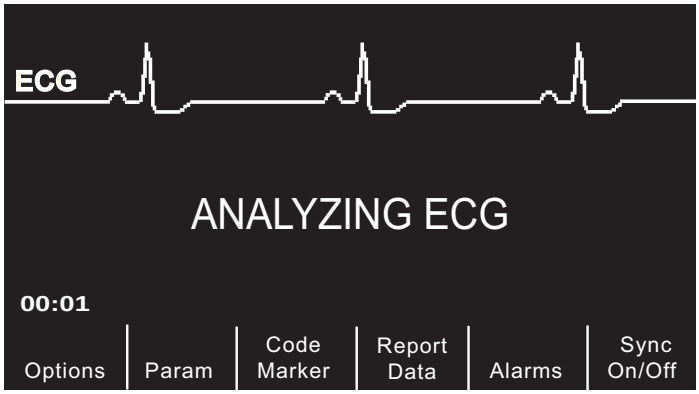


If you have configured SHOCK 1, 2, and 3 to escalating energy levels, and then you manually change the energy level outside preconfigured SHOCK 1, 2, 3 sequence and deliver a shock, it disables the automatic energy escalation. See the Energy Level: Shock 1, 2, 3 section of the *R Series Configuration Guide* for more details.

2 Press ANALYZE Button

WARNING! Keep patient motionless during ECG analysis. Do not touch the patient during analysis. Cease all movement via stretcher or vehicle before analyzing the ECG.

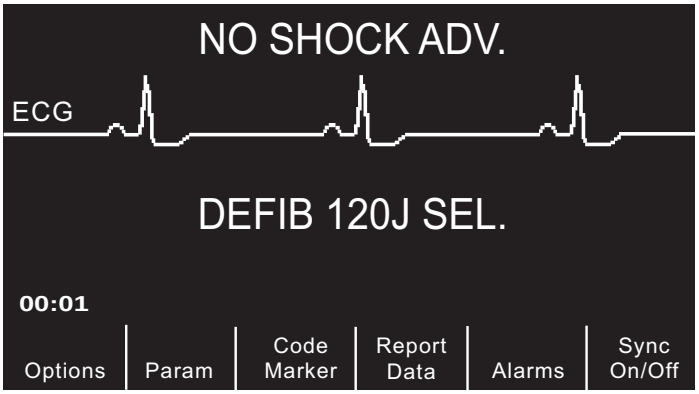
Press the **ANALYZE** button to begin the analysis of the patient's ECG rhythm and to determine if a shockable rhythm is present.



An *ANALYZING ECG* message is displayed for 6 to 12 seconds while the patient's ECG is analyzed. Once the analysis is completed, the unit indicates whether or not a shock is advised.

The analysis normally consists of three consecutive 3-second ECG rhythm analyses. If at least two of the three analyses determine that the patient has a shockable rhythm, the unit automatically charges to the preconfigured energy level and prompts the operator to shock the patient. If two or more of the three 3-second ECG analyses do not detect a shockable rhythm, the unit alerts the operator that no shock is advised.

WARNING! ECG rhythm analysis does not warn of patient asystole, which is not a shockable rhythm.



When a nonshockable rhythm is detected, the unit displays a *NO SHOCK ADV.* message. Follow the local protocols to continue CPR or other life support, and re-analyze the ECG at appropriate intervals.

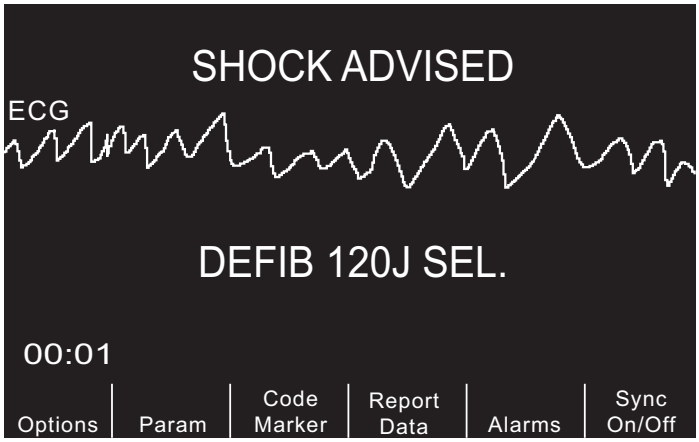
Note: When a nonshockable rhythm is detected, the R Series does not prevent the user from manually defibrillating the patient.

When a shockable rhythm is detected (ventricular fibrillation or wide-complex tachycardia with heart rate > 150), one of the following occur:

- Units with the automatic charge option enabled automatically charge to the preconfigured or user selected energy setting.

- Units with the automatic charge option disabled will alternately display the messages *SHOCK ADVISED* and *PRESS CHARGE*. Press the **CHARGE** button.

Regardless of the analysis result, the user can control the defibrillator manually. For example, the user can defibrillate the patient even if the advisory function issues a NO SHOCK ADV. message.



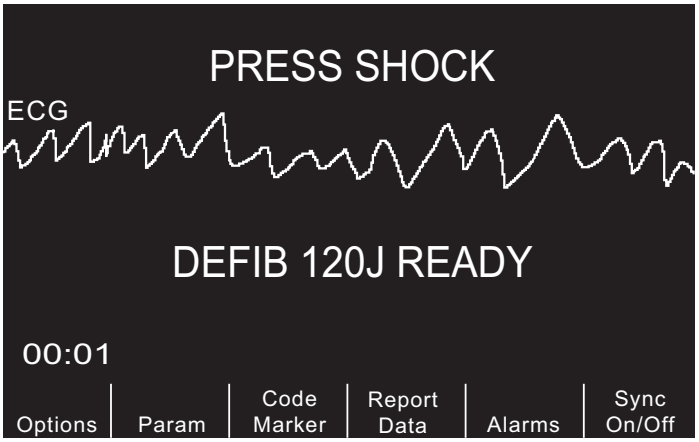
3 Press SHOCK

WARNING! Warn all persons in attendance of the patient to STAND CLEAR prior to defibrillator discharge.

Do not touch the bed, patient, or any equipment connected to the patient during defibrillation. A severe shock can result. Do not allow exposed portions of the patient's body to come in contact with metal objects, such as a bed frame, as unwanted pathways for defibrillation current may result.

Once the unit is charged to the selected energy, the **SHOCK** button illuminates and the *PRESS SHOCK* message is displayed. Simultaneously, the monitor displays the energy level to which the defibrillator is charged, *DEFIB XXXJ READY*.

Note: Rhythm analysis does not continue after the defibrillator is charged and ready once a decision to shock has been made. The R Series unit will not automatically disarm the defibrillator if the patient's rhythm reverts to a non-shockable rhythm before the shock has been delivered.



A continuous tone sounds for 50 seconds, followed by an intermittent beeping for 10 seconds.You must deliver the shock within this 60 second interval, or the defibrillator will disarm itself.

Press and hold the illuminated **SHOCK** button on the front panel until energy is delivered to the patient. An *XXXJ DELIVERED* message appears on the display for approximately 5 seconds.

Watch the patient or ECG response to verify that the shock has been delivered.

After the energy has been delivered to the patient, the display returns to *DEFIB XXX J SEL*.

Perform CPR

Begin chest compressions and rescue breathing per local protocol.

Repeat Analysis

Press the **ANALYZE** button to restart an ECG analysis and determine if additional shocks are required.

Note: Reanalysis of the ECG rhythm is inhibited for 3 seconds after each shock.

Continue Patient Care

Continue patient care according to medical protocols.

Advisory Function Messages

SELECT DEFIB MODE

Displayed if the **ANALYZE** button is pressed, but the unit is not in the **DEFIB** mode. Turn the Mode Selector to **DEFIB** to enable the defibrillator and advisory capability.

SELECT PADS

Displayed if the **ANALYZE** button is pressed while the device is operating in any ECG lead other than "PADS." Press the **LEAD** button until "PADS" is selected.

REMOVE SYNC

Displayed if the **ANALYZE** button is pressed while the device is in Sync mode. Turn off Sync mode by pressing the **Sync On/Off** softkey. Press the **ANALYZE** button again to initiate ECG rhythm analysis.

Warning Messages

Warning messages prompt the operator to check the patient, the unit, the electrodes and/or connections.

NOISY ECG / RETRY ANALYSIS

A *NOISY ECG* message alternating with a *RETRY ANALYSIS* message is displayed for 5 seconds when the unit detects a noisy ECG signal during ECG analysis. Check and adjust electrode placement and cable connections to help eliminate the noise source. Keep patient motionless during ECG analysis. Press the **ANALYZE** button again to begin ECG analysis.

CHECK PATIENT

The unit has detected a shockable rhythm during continuous background ECG analysis (i.e., Smart Alarms™). The prompt is given only when the heart rate alarms are enabled and the unit detects a shockable rhythm. The screen message persists as long as a shockable rhythm is being detected. Press the **ANALYZE** button to begin ECG analysis.

Note: This CHECK PATIENT analysis function operates continuously when heart rate alarms are enabled and does not require pressing the **ANALYZE** button for operation.

CHECK PADS / POOR PAD CONTACT

The therapy electrodes are not properly attached to the patient, or the cable connections have become loose.

Check that the therapy electrodes are making good contact with the patient's skin and that all cables are securely connected. This voice prompt will not sound if the therapy electrodes were not previously connected to the patient.

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Chapter 5
Synchronized Cardioversion

Paddles are a defibrillation-protected Type BF patient connection.

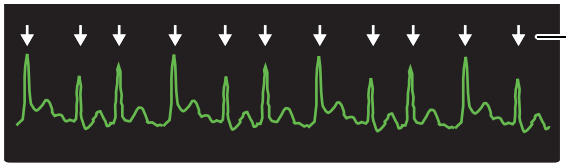
ECG leads are a defibrillation-protected Type CF patient connection.

WARNING! **Only skilled personnel trained in Advanced Cardiac Life Support and familiar with equipment operation should perform synchronized cardioversion. The precise cardiac arrhythmia must be determined before attempting defibrillation or cardioversion.**

Before attempting synchronized cardioversion, ensure that ECG signal quality is sufficient to minimize the risk of synchronizing on artifact.

Certain arrhythmias, such as ventricular tachycardia, atrial fibrillation, and atrial flutter, require synchronizing the defibrillator discharge with the ECG R-wave to avoid the induction of ventricular fibrillation. In this case, a synchronizing (Sync) circuit within the defibrillator detects the patient's R-waves. When the **SHOCK** button (or buttons, if using paddles) is pressed and held, the unit discharges with the next detected R-wave, thus avoiding the vulnerable T-wave segment of the cardiac cycle.

When in the Sync mode, the unit displays markers (↓) above the ECG trace to indicate the points in the cardiac cycle (R waves) where discharge can occur.



Verify that markers are clearly visible on the monitor and their location is appropriate and consistent from beat to beat. If necessary, use the **LEAD** and **SIZE** buttons to establish settings that yield the most consistent Sync marker pattern.

The synchronized cardioversion procedure for ZOLL hands-free therapy electrodes is identical to that for paddles with the exception of the **SHOCK** button location.

The R Series defibrillator supports two types of synchronized cardioversion:

- **Synchronized Cardioversion** — The R Series monitors the patient's ECG and synchronizes shock delivery with this ECG source. For instructions, refer to "Synchronized Cardioversion Procedure" below.
- **Remote Synchronized Cardioversion** — An external device (such as a patient monitor) monitors the patient's ECG and provides a synchronization pulse to the R Series' Sync In/Marker Out connector. The R Series synchronizes shock delivery with these external pulses.

Note: When using the Remote Sync function, the procedure and displayed information are different. Make sure to follow the instructions for Remote Synchronized Cardioversion on page 5-5.

Synchronized Cardioversion Procedure

Determine the Patient's Condition and Provide Care Following Local Medical Protocols

Prepare Patient

Remove all clothing covering the patient's chest. Dry chest if necessary. If the patient has excessive chest hair, clip or shave it to ensure proper adhesion of the electrodes.

Attach ECG electrodes as described in"Monitoring Electrodes Attachment" on page 9-3.

A standard ECG cable and ECG electrodes are recommended for use during cardioversion. Hands-free therapy electrodes may be used as an ECG source. Signal quality will be equal to that of standard leads except immediately following a discharge when there may be more noise due to muscle tremors, especially if an electrode is not in complete contact with the skin.

Attach hands-free therapy electrodes according to instructions on the electrode packaging and as described in "Therapy Electrode Application" on page 3-6.

Ensure that the therapy electrodes are making good contact with the patient's skin and are not covering any part of any other electrodes.

Connect the hands-free therapy electrodes to the OneStep cable if not preconnected.

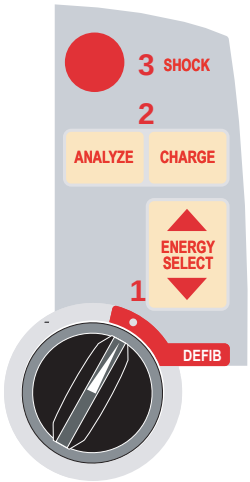
If therapy electrodes are not making good contact with the patient's skin, the unit issues the messages *CHECK PADS* and *POOR PAD CONTACT* and does not allow delivery of energy. If a short circuit exists between the electrodes, the unit issues the message *DEFIB PAD SHORT*.

An *ECG LEAD OFF* condition prevents synchronized discharge if leads are selected as the ECG source. This condition does not prevent the use of the defibrillator; it simply prevents use in a synchronized manner.

If paddles are being used for synchronized cardioversion, refer to "Emergency Defibrillation Procedure with Paddles" on page 3-1 for preparing paddles, applying paddles, charging the defibrillator, and delivering a shock. Note, however, that synchronized discharge with paddles as an ECG source is discouraged since the artifact induced by moving the paddles may resemble an R-wave and trigger defibrillator discharge at the wrong time.

1 Select DEFIB

Turn the Mode Selector to **DEFIB**. Select the desired energy using the up and down arrow keys on the front panel (or sternum paddle if using paddles).



Press the Sync On/Off softkey

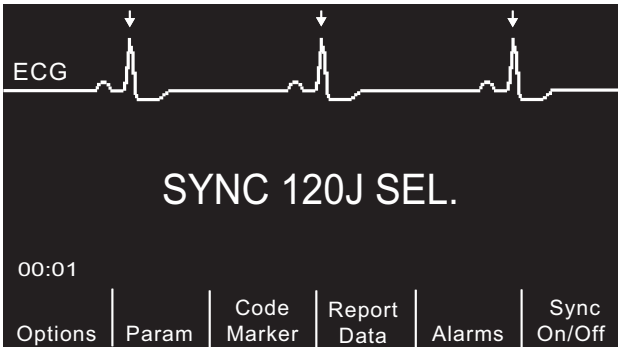
Your system will be in Sync mode once you press the **Sync On/Off** softkey if your R Series is not configured to support Remote Sync. However, if your R Series is configured to support Remote Sync, pressing the **Sync On/Off** softkey will cause two other softkeys to be displayed: **Remote Sync** and **Sync**. Press the **Sync** softkey to enter Sync mode.

The selected energy level is displayed on the monitor.

A Sync marker (↓) appears on the monitor above each detected R-wave to indicate where discharge will occur.

Verify that the markers are clearly visible on the monitor and their location is appropriate and consistent from beat to beat. If necessary, use the **LEAD** and **SIZE** buttons to establish settings that yield the best display.

A *SYNC XXXJ SEL.* message appears on the display. If *DEFIB XXXJ SEL.* appears, press the **Sync On/Off** softkey. (If your unit supports Remote Sync, you must also press the **Sync** softkey.) Two quick beeps sound.



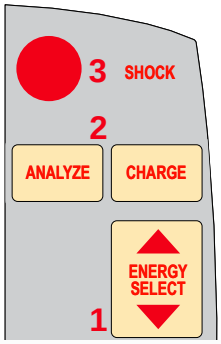
Unless otherwise configured, the unit automatically exits Sync mode after each shock and when the Mode Selector is moved to **MONITOR**, **PACER** or **OFF**.

To reactivate Sync mode, press the **Sync On/Off** softkey again. (If your unit supports Remote Sync, press the **Sync** softkey again.) Changing the selected energy levels does not cause the unit to leave Sync mode.

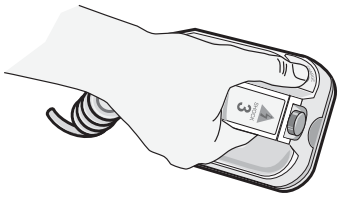
Note that the unit can be configured to stay in Sync mode after defibrillation, if desired. Refer to the *R Series Configuration Guide* for instructions.

2 Charge Defibrillator

Press the **CHARGE** button on the front panel or on the apex paddle handle.



or



To abort charging and increase or decrease the selected energy after the **CHARGE** button has been pressed, use the **ENERGY SELECT** buttons on either the defibrillator front panel or the sternum paddle. Press the **CHARGE** button again to charge the unit to the newly selected energy level.

After charging the unit to the selected energy, either the front panel **SHOCK** button or the APEX paddle charge indicator illuminates. A distinctive audible tone sounds and the *SYNC XXXJ READY* message is displayed.

The defibrillator is now ready to deliver therapy.

3 Deliver SHOCK

WARNING! Warn all persons in attendance of the patient to STAND CLEAR prior to defibrillator discharge.

Verify that no one is in contact with the patient, monitoring cable or leads, bed rails, or any other potential current pathways.

Verify that the ECG waveform is stable and that Sync markers appear over each R-wave.

Press and hold the illuminated **SHOCK** button on the front panel, (or simultaneously press and hold both paddle **SHOCK** buttons) until energy is delivered to the patient. The defibrillator will discharge with the next detected R wave.

Note: If the defibrillator is not discharged within 60 seconds after reaching the selected energy level, the unit automatically disarms itself. During the ten seconds prior to this internal disarm, the charge ready tone beeps intermittently. The charge ready tone then stops, and the defibrillator remains in Sync mode.

Once the energy is delivered, the display simultaneously shows *XXXJ DELIVERED* and *DEFIB XXXJ SEL*. After approximately 5 seconds, the *XXXJ DELIVERED* message disappears and the *DEFIB XXXJ SEL*. message remains to indicate the selected energy level.

If additional countershocks are necessary, readjust the energy level as necessary, press the **Sync On/Off** softkey, followed by the **Sync** softkey (if your unit supports Remote Sync), and repeat. Note that *SYNC XXXJ SEL* must be displayed prior to pressing the **CHARGE** button.

If the **ANALYZE** button is pressed while the unit is in Sync mode, the unit displays the *REMOVE SYNC* message and does not allow ECG rhythm analysis until the unit is taken out of Sync mode.

Remote Synchronized Cardioversion Procedure

The R Series may be configured to receive defibrillation synchronization pulses from a remote ECG monitoring device. See the *R Series Configuration Manual*. Be sure that the remote device is connected to the Sync In/Marker Out connector on the R Series unit. The remote device must have a Sync out connector and a cable must be provided to connect the two devices. Ensure the remote device conforms with the Sync In/Marker Out specifications (described in Appendix A, “Defibrillator Specifications”).

WARNING! A lethal arrhythmia may be induced through improper synchronization. Qualified personnel within the hospital should verify synchronization delay for the entire remote monitor and defibrillator system prior to clinical use. Synchronization delay for the system as a whole must not exceed 60 msec.

Determine the Patient's Condition and Provide Care Following Local Medical Protocols

Prepare Patient

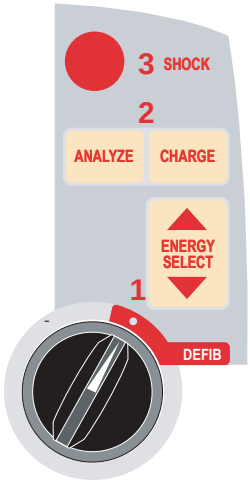
Prepare the patient as described in "Prepare Patient" on page 5-2.

Follow the instructions provided with the external monitoring device to prepare the patient for ECG monitoring and synchronization with a separate defibrillator.

1 Select DEFIB

Turn the Mode Selector to **DEFIB**.

Select the desired energy using the up and down arrow keys on the front panel (or sternum paddle if using paddles).



Press Sync On/Off softkey, then press the Remote Sync Softkey

The selected energy level is displayed on the monitor.

The words "REMOTE SYNC" are displayed in place of the ECG trace, and a *REMOTE SYNC XXXJ SEL.* message appears on the display.

The ECG heartbeat indicator will flash with each synchronization pulse received from the remote monitoring device.

Unless otherwise configured, the unit automatically exits Sync mode after each shock, and if the Mode Selector is moved to **MONITOR**, **PACER** or **OFF**.

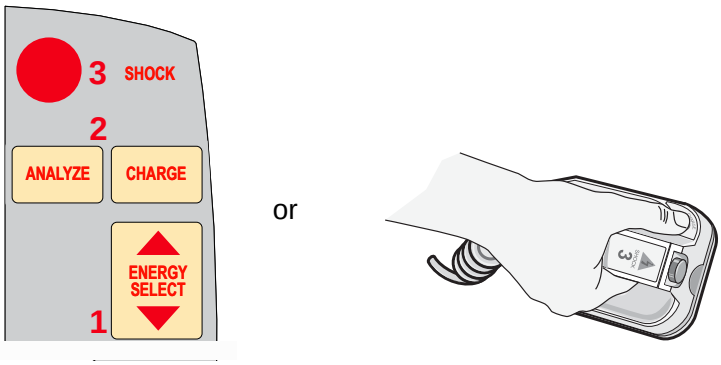
Press the **Sync On/Off**, **Remote Sync** softkey sequence again to reactivate Remote Sync mode. Changing the selected energy levels does not cause the unit to leave Remote Sync mode.

View the ECG trace on the remote device's display. Verify that Sync markers appear with each R-wave. The Sync markers will appear as described in the remote device's user manual.

WARNING! **Verify the ECG waveform is stable and that a Sync marker appears only with R-waves. If Sync markers are not present on the remote device display, or do not appear to be nearly simultaneous with each R-wave, do not proceed with synchronized cardioversion.**

2 Charge Defibrillator

Press the **CHARGE** button on the front panel or, if using paddles, on the apex paddle handle.



To abort charging and increase or decrease the selected energy after the **CHARGE** button has been pressed, use the **ENERGY SELECT** buttons on either the defibrillator front panel or the sternum paddle. Press the **CHARGE** button again to charge the unit.

After charging the unit to the selected energy, either the front panel **SHOCK** button or, the apex paddle charge indicator illuminates. A distinctive audible tone sounds and the energy ready *REMOTE SYNC XXXJ READY* message is displayed.

The defibrillator is now ready to deliver therapy.

3 Deliver SHOCK

WARNING! **Warn all persons in attendance of the patient to STAND CLEAR prior to defibrillator discharge.**

Verify that no one is in contact with the patient, monitoring cable or leads, bed rails, or any other potential current pathways.

Press and hold the illuminated **SHOCK** button on the front panel, or simultaneously press and hold both paddle **SHOCK** buttons until energy is delivered. The defibrillator will discharge with the next remote synchronization pulse.

Note: If the defibrillator is not discharged within 60 seconds after reaching the selected energy level, the unit automatically disarms itself. During the ten seconds prior to this internal disarm, the charge ready tone beeps intermittently. The charge ready tone then stops and the defibrillator remains in Remote Sync mode.

Once the energy is delivered, the display simultaneously shows *XXXJ DELIVERED* and *DEFIB XXXJ SEL*. After approximately 5 seconds, the *XXXJ DELIVERED* message disappears and the *DEFIB XXXJ SEL*. message remains to indicate the selected energy level.

If additional countershocks are necessary, readjust the energy level as necessary, press the **Sync On/Off**, and then the **Remote Sync** softkeys and repeat. Note that *REMOTE SYNC XXXJ SEL* must be displayed prior to pressing the **CHARGE** button.

If the **ANALYZE** button is pressed while the unit is in Remote Sync mode, the unit displays the *REMOVE SYNC* message and disallows ECG rhythm analysis until the unit is taken out of Sync mode.

Chapter 6
Real CPR Help

Real CPR Help is defibrillation-proof Type BF equipment.

WARNING! The Real CPR Help function is fully functional *only* when using adult CPR electrodes. Do *not* use Adult CPR electrodes with patients under 8 years of age.

WARNING! Use *only* Pediatric CPR electrodes with patients under 8 years of age. The use of Pediatric CPR electrodes enables the R Series unit to display Idle Time and Compression Rate and Depth measurements. Pediatric CPR electrodes do *not* enable Real CPR voice prompts or any visual indication of ineffective CPR.

When used with OneStep CPR electrodes or OneStep Complete electrodes, the R Series unit can provide rescuers with feedback about the quality of CPR they are delivering to their patients. The way in which feedback is provided varies with respect to the operational mode and user configuration, but is derived from compression rate and depth measurements.

When applied according to package instructions, ZOLL OneStep CPR and OneStep Complete electrodes provide a chest compression sensor that is located between the rescuer's hands and the patient's lower sternum. This sensor monitors the rate and depth of chest compressions and sends this information to the R Series unit for processing and display.

The R Series defibrillator uses this information to provide feedback to the rescuer in one or more of the following forms:

- CPR Index

- CPR Idle Time Display
- CPR Rate Metronome
- Voice prompts
- Chest Compressions Waveform display
- *FULLY RELEASE* display prompt (if configured)

Real CPR Help Field

Whenever OneStep CPR, or OneStep Complete electrodes are connected to the R Series defibrillator, the unit illuminates the Real CPR Help field in the upper center portion of the display. This field includes the indicators described in the next sections.

CPR Index (Optional/Adult Only)

This diamond-shaped figure provides a quick, overall indicator of how well the rescuer's combined rate and depth of chest compressions match the AHA/ERC recommendations for adult CPR.

Before chest compressions begin (and after each shock), the CPR Index is displayed as a hollow outline. This index starts to fill from the center out as compressions begin, and becomes fully filled when consistent chest compression depth exceeding 1.5 or 2 inches, depending on the configuration, and rate exceeding 90 compressions per minute (cpm) are simultaneously achieved. Should the chest compression rate or depth begin to fall below the AHA/ERC recommended levels, the Index will only partially fill to indicate the need for more vigorous efforts. Following the cessation of compressions, the Index’s fill level gradually decreases until a hollow outline is displayed after a short period of time.

When complete filling of the CPR Index has not been achieved due to diminished compression rate or depth, and the CPR Dashboard is configured Off, the R Series will display the words RATE and/or DEPTH to assist the rescuer in determining whether chest compression rate or depth should be increased. When an appropriate rate or depth has been achieved, 80 cpm and 1.5 or 2 inches, respectively, one or both of these words will disappear from the display.

This feature is unavailable while using Pediatric CPR electrodes.

CPR Idle Time Display

This display indicates the elapsed time in minutes and seconds since the last detected chest compression. When compressions are being delivered, this time display will be blanked. Three seconds following the cessation of compressions, the display will illuminate and show the elapsed time since the last detected compression. If no compressions have been delivered for more than 20 minutes, dashes (---) will be displayed in this time field.

CPR Rate and Depth Display

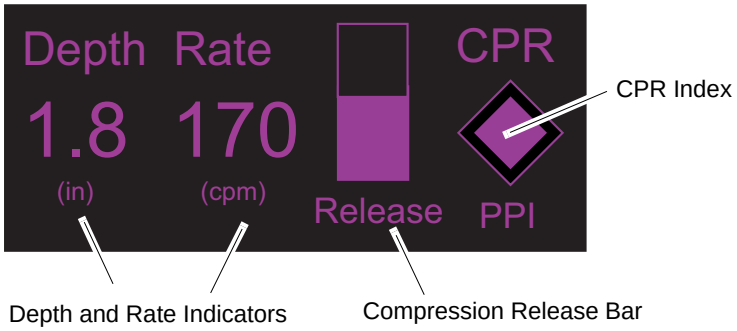
If the CPR Dashboard is configured On and the CPR Idle Time is not displayed, the Rate and Depth values will be displayed in the Real CPR Help field. The values will be highlighted and displayed in red if they are below the appropriate values (adult CPR electrodes only).

Compression Release Bar (Adult only)

If the CPR Dashboard is configured On, the Compression Release Bar shows the release of the chest compression by the rescuer. When the release of the chest is properly administered (fully released), the bar will fill all the way to the top.

This feature is unavailable while using Pediatric CPR electrodes.

CPR Dashboard



CPR Metronome

The R Series unit includes a CPR metronome feature that can be used to encourage rescuers to perform chest compressions at the AHA/ERC recommended rate of 100 compressions per minute. This feature can be configured.

When activated, the metronome beeps at the AHA/ERC recommended rate to provide a compression rhythm for rescuers to follow. The metronome is silent when no chest compressions are being detected by CPR-equipped hands-free therapy electrodes.

When Manual and Advisory modes are configured to “Yes,” the metronome only beeps when chest compressions are detected and their rate falls below the AHA/ERC recommended levels. When compressions are being performed at 80 compressions per minute or higher, the metronome is silent. Should the detected compression rate fall below this level, the metronome will begin beeping until recommended compression rates are consistently achieved over several compression cycles. The metronome stops beeping approximately 2 seconds after the last chest compression is detected.

When Manual and Advisory modes are configured to “Continuous,” the metronome beeps as long as compressions are detected, even when they are being performed at 80 compressions per minute or higher. The metronome stops beeping approximately 2 seconds after the last chest compression is detected.

Fully Release prompt

The R Series unit can be configured to display the text prompt, FULLY RELEASE, which reminds rescuers to lift (fully release) their hands from the patient’s chest during compressions to allow full recoil.

By default, the FULLY RELEASE text prompt is not enabled.

This feature is unavailable while using Pediatric CPR electrodes.

CPR Voice Prompts (Adult only)

The R Series unit can be configured to issue voice prompts related to the depth of chest compressions as feedback to rescuers performing CPR. Two voice prompts are available for this purpose:

- Push Harder
- Good Compressions

When chest compressions are detected but their depth is consistently less than 1.5 or 2 inches (3.8 or 5 cm), depending on the configuration, the defibrillator will issue the prompt “Push Harder” every 15 seconds. If the rescuer responds by increasing compression depth to more than 1.5 or 2 inches (3.8 or 5 cm), depending on the configuration, on a consistent basis, the unit will issue a “Good Compressions” prompt.

See the *R Series Configuration Guide* for information on enabling/disabling CPR voice prompts.

CPR Voice prompts are unavailable while using Pediatric CPR electrodes.

Chest Compressions Bar Graph

The R Series unit can display a CPR compression bar graph computed from the CPR sensor signals. This bar graph, representing depth of compression, is presented on a displacement scale with a reference marker at 1.5 or 2.0 inches, depending on the configuration. When the full width of the trace is visible, the unit displays a minimum of 12 seconds of compression data.

Displaying the CPR Bar Graph

To display the CPR displacement bar graph in the Trace 2 or 3 position:

1. Press the **Options** softkey, then press **Traces**.
2. Press either the **Trace 2** or **Trace 3** softkey.
3. Press **CPR**.

Note: Note: The **CPR** softkey appears only when OneStep CPR or OneStep Complete electrodes are in use.

Chapter 7
See-Thru CPR (Optional)

WARNING! The See-Thru CPR filter works only when the R Series defibrillator is monitoring CPR.

The See-Thru CPR filter stops if:
— The unit is in pace mode.
— Patient impedance is invalid.
— OneStep CPR electrodes or OneStep Complete electrodes are no longer detected.

The See-Thru CPR filter will not remove all CPR artifact. Always stop CPR to verify the patient's ECG rhythm before making treatment decisions.

The See-Thru CPR filter does not operate during ECG rhythm analysis. Always stop chest compressions during ECG rhythm analysis to avoid incorrect results caused by the presence of CPR artifact.

Diagnostic bandwidth is never applied to the See-Thru CPR waveform.

See-Thru CPR enables the rescuer to see a close approximation of the patient's underlying ECG rhythm while performing CPR. See-Thru CPR is available if the R Series is monitoring CPR.

Chest compressions introduce *CPR artifact* into the ECG signal. See-Thru CPR uses a filter that relies on the correlation between CPR compressions, as detected by the ZOLL Onestep CPR or OneStep Complete electrodes, and the CPR artifact to remove much, but not all, of the artifact from the ECG signal. Under some conditions, residual noise after filtering can obscure the ECG rhythm, requiring the rescuer to stop CPR to assess the ECG. For example, in the case of asystole or low amplitude PEA, the residual artifact seen after filtering may look like fine ventricular fibrillation.

Because the filtered ECG signal may contain residual chest compression and/or filtering artifacts, *a rescuer should always follow the standard procedure of stopping CPR to assess the patient's ECG rhythm before determining treatment.*

Using See-Thru CPR

To use See-Thru CPR

- The R Series unit must be monitoring CPR.
- OneStep CPR or OneStep Complete electrodes must be attached to the unit.

When chest compressions begin, the R Series unit *automatically* starts filtering the CPR artifact after detecting the first 3 to 6 compressions.

The filtered ECG, with the label "FIL," may be displayed on the second or third trace (by selecting **FILT ECG** in the Trace2 or Trace3 menu). See-Thru CPR filtering continues as long as the OneStep CPR or OneStep Complete electrodes detect compressions and patient impedance is valid. When no compressions are detected or one of the conditions noted above occurs, See-Thru CPR filtering stops, and unfiltered ECG signals are displayed. When compressions resume, filtering automatically restarts after 3 to 6 chest compressions.

Note: There is a delay of approximately 1/16 second between the See-Thru CPR waveform and the Trace 1 ECG waveform.

If configured to display the CPR Dashboard, the R Series unit can also be configured to display the filtered ECG in Trace1. When the unit is configured to display the filtered ECG in Trace1, the softkey **Disable Filt ECG** appears, which you can press to disable display of the filtered ECG in Trace1 and replace it with the unfiltered ECG. When the unit displays the unfiltered ECG in Trace1, the softkey **Enable Filt ECG** appears, which can redisplay the filtered ECG in Trace1.

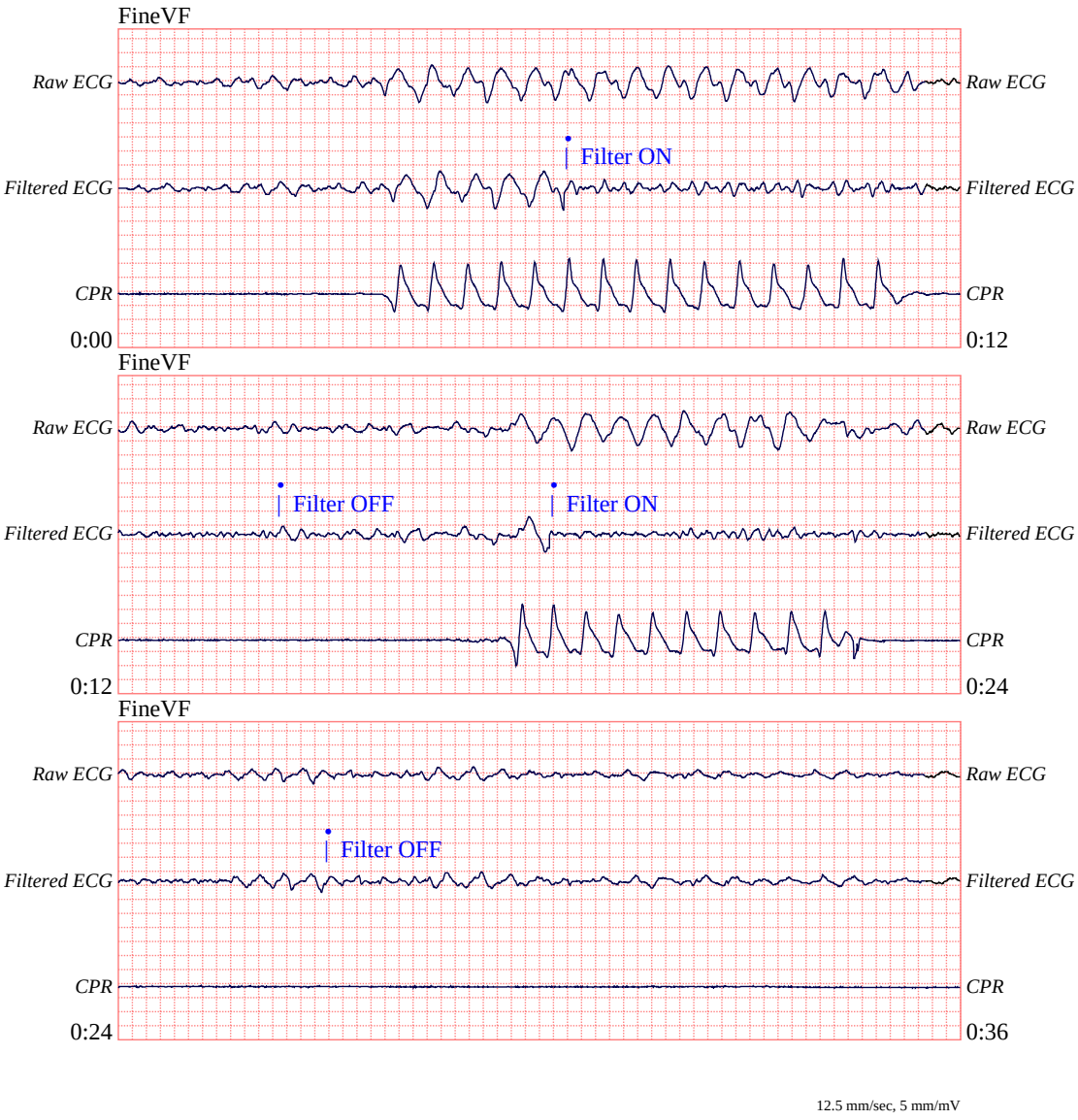
Examples

The following examples show the effects of See-Thru CPR filtering on ECG signals contaminated with CPR artifacts.

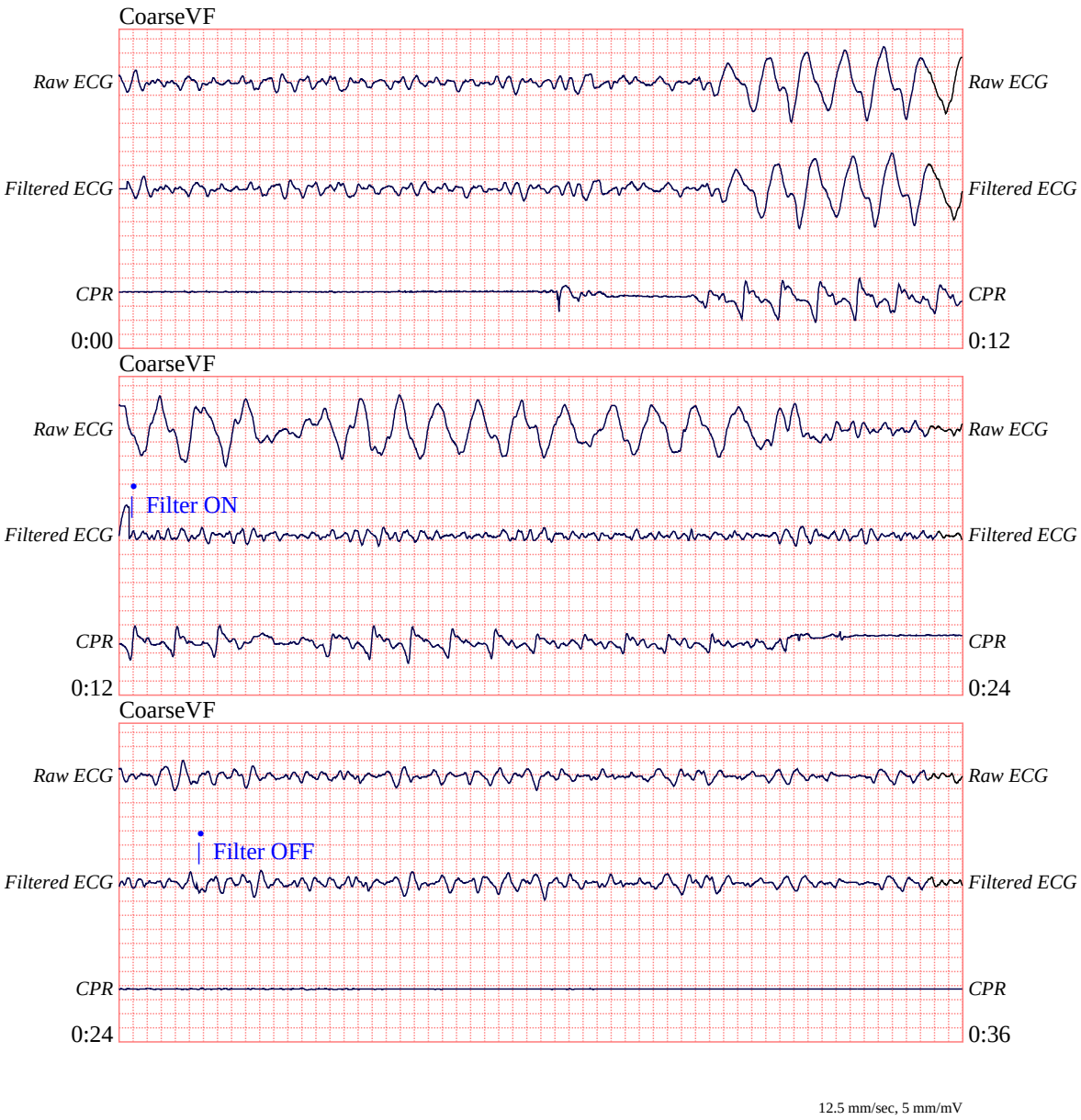
Each example includes:

- ECG signal with CPR artifact.
- ECG signal after the See-Thru CPR filter has removed CPR artifact.
- Indication of the period during which See-Thru CPR is active.
- CPR signal to show when CPR activity occurred.

The following figure shows a patient in Fine VF. It is difficult for a rescuer to discern this rhythm during CPR compressions. When the CPR filter turns on, the Fine VF rhythm becomes more obvious.



The following figure shows a patient in VF, which, during compressions, is slightly more difficult to discern. When viewing this ECG, it is possible to view the underlying rhythm as the filter is able to reject all of the CPR artifact.



The following figure shows a patient in PEA, which could easily be mistaken for Fine VF because enough of the compression artifact leaks through to distort this signal. When the CPR filter turns on, the PEA is still not obvious because of the left over ripples from the CPR signal. About 14 seconds into this chart, the rhythm changes to asystole, which could easily be mistaken for coarse VF. When the CPR filter turns on, the CPR compression ripples are still obvious, making the rhythm look like Fine VF.

The following figure shows a patient with an organized rhythm where See-Thru CPR effectively filters out artifact created by CPR.

Chapter 8
Noninvasive Temporary Pacing (Optional)

When ZOLL hands-free therapy electrodes are used, the patient connection is considered to be defibrillation-protected Type BF.

ECG leads are a defibrillation-protected Type CF patient connection.

WARNING! **To avoid risk of electrical shock, do not touch the gelled area of the hands-free therapy electrodes while pacing.**

Therapy electrodes should be replaced periodically. Consult electrode directions for specific recommendations.

Prolonged pacing (in excess of 30 minutes), particularly in neonates or adults with severely restricted blood flow, may cause burns. Periodic inspection of the underlying skin is recommended.

If the unit was NOT turned off and less than 10 minutes have elapsed since the pacing mode was last used, reactivating the pacer mode causes pacing to resume immediately at the previously selected mA and ppm settings.

Noninvasive Temporary Pacing

R Series defibrillators with the pacer option contain a VVI demand pacemaker – a safe and effective design for Noninvasive Temporary Pacemakers.

Proper demand pacing requires a reliable, high quality surface ECG signal. For best results:

- Apply both standard ECG monitoring electrodes and hands-free pacing therapy electrodes (such as, OneStep electrodes or stat-padz***)*** to the patient,

  or
- Use OneStep Pacing electrodes, or OneStep Complete electrodes. These hands-free therapy pads include both ECG monitoring and pacing/defibrillation electrodes in a single pad assembly. They provide reliable ECG monitoring without the need to use separate ECG leads. With these electrodes you must also use the OneStep Pacing cable.

Determine Patient Condition and Provide Care Following Local Medical Protocols.

Prepare the Patient

Remove all clothing covering the patient's chest. Dry chest if necessary. If the patient has excessive chest hair, clip it to ensure proper adhesion of the electrodes.

1 Apply ECG Electrodes/Hands-Free Therapy Electrodes

The R Series supports two electrode configurations for pacing:

- **OneStep Pacing Configuration**

  Simultaneous ECG monitoring and pacing can be performed with a single set of therapy electrodes when using OneStep Pacing electrodes or OneStep Complete electrodes along with a OneStep Pacing cable. The OneStep Pacing cable must be connected to both the MFC and ECG connectors of the R Series unit. Attach OneStep electrodes according to instructions on the electrode packaging. Then connect the electrodes to the OneStep Pacing cable.

- **Separate ECG Electrodes and Hands-free Therapy Electrodes Configuration**

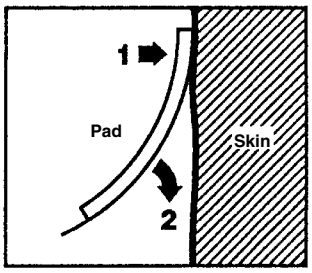
  Apply ECG electrodes, attach lead wires, and connect the ECG cable to the R Series rear panel (see page 9-3 for instructions on attaching ECG electrodes to the patient). Attach hands-free therapy electrodes according to instructions on the electrode packaging. Connect these therapy electrodes to the OneStep cable.

Therapy Electrode Application

WARNING! Poor adherence and/or air under the therapy electrodes can lead to the possibility of arcing and skin burns.

1. Apply one edge of the pad securely to the patient.

2. Roll the pad smoothly from the applied edge to the other, being careful not to trap any air pockets between the gel and skin.

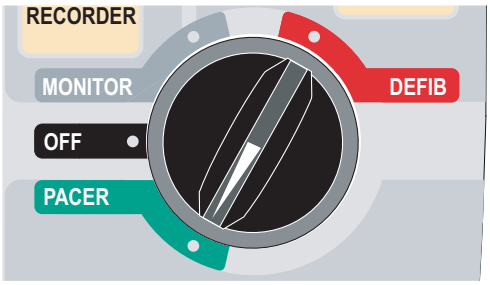


3. Ensure that hands-free therapy electrodes are making good contact with the patient's skin and are not covering any part of any other ECG electrodes.
4. If using OneStep Pacing electrodes or OneStep Complete electrodes, select ECG lead P1, P2, or P3; otherwise, select an appropriate ECG lead. Adjust ECG size for a clean, well-defined ECG signal.
5. Verify proper R-wave detection. The heart-shaped symbol flashes with each R-wave when proper detection is taking place. Adjust ECG size for a clean, well-defined ECG signal.

Note: When the OneStep Pacing electrode configuration is used and the unit is switched to **PACER** mode, P3 is automatically selected as the ECG source. When separate ECG electrodes and hands-free therapy electrodes are used, Lead II is automatically selected as the ECG source.

While ECG signals acquired from P1, P2 or P3 are appropriate for ECG rhythm assessment and determining electrical capture during pacing, they should not be used for diagnostic purposes. Conventional ECG electrodes and cable should be used for this purpose.

2 Turn Selector Switch to PACER



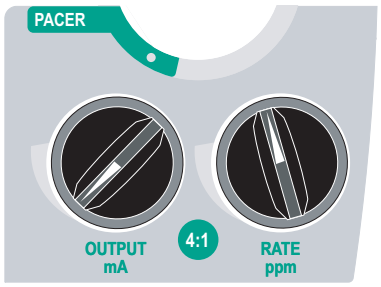
Set the Pacer Output to 0 mA

If the unit has just been turned on, the **PACER OUTPUT** is automatically set to 0 mA.

3 Set Pacer Rate

Set the **PACER RATE** to a value 10-20 ppm higher than the patient's intrinsic heart rate. If no intrinsic rate exists, use 100 ppm.

The pacer rate increments or decrements by a value of 2 ppm on the display when the knob is turned.

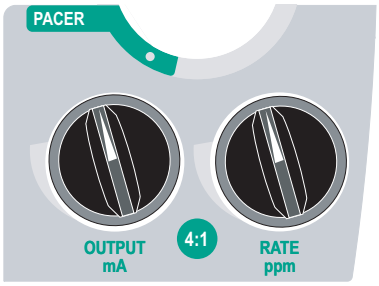


Observe the pacing stimulus marker on the display or stripchart (⎍) and verify that it is well-positioned in diastole.

Pacing Stimuli

4 Set Pacer Output

Increase **PACER OUTOUT** until stimulation is effective (capture); the output mA value is displayed. The pacer output increments and decrements by a value of 2 mA on the display when the knob is turned.



Note: When the unit is switched out of PACER mode into DEFIB or MONITOR mode and then switched back to PACER mode, within 10 minutes the pacer settings remain unchanged.

If the unit is turned off for more than 10 seconds, the pacer's power up default settings are restored.

5 Determine Capture

It is important to recognize when pacing stimulation has produced a ventricular response (capture). Determination of capture must be assessed both electrically and mechanically in order to ensure appropriate circulatory support of the patient.

Electrical capture is determined by the presence of a widened QRS complex, the loss of any underlying intrinsic rhythm, and the appearance of an extended, and sometimes enlarged, T-wave.

Ventricular response is normally characterized by suppression of the intrinsic QRS complex.

WARNING! Determination of electrical capture should only be performed by viewing the ECG trace on the R Series display with its ECG connection directly attached to the patient. Use of other ECG monitoring devices might provide misleading information due to the presence of pacer artifacts.

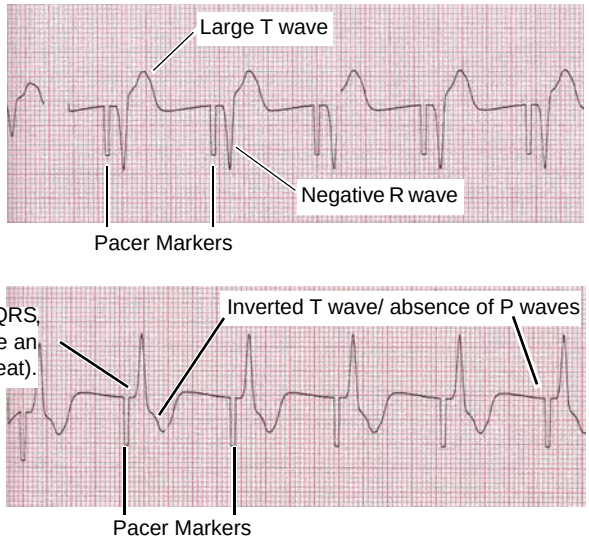
Mechanical capture is assessed by palpation of the peripheral pulse.

To avoid mistaking muscular response to pacing stimuli for arterial pulsations, use ONLY the following locations for palpating pulse during pacing:

- femoral artery
- right brachial or radial artery

Effective pacing

The following ECG traces illustrate typical examples of effective pacing.



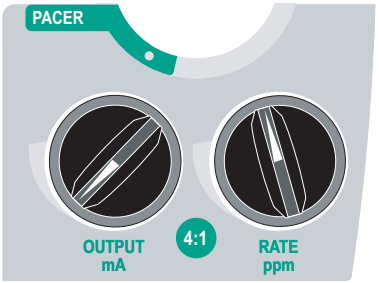
Changing ECG leads and size can sometimes be helpful in determining capture.

Note: The shape and size of the paced ECG waveforms can vary depending on the ECG lead configuration chosen; variation from patient to patient can be expected.

6 Determine Optimum Threshold

The ideal pacer current is the lowest value that maintains capture — usually about 10% above threshold. Typical threshold currents range from 40 to 80 mA. Location of the hands-free therapy or OneStep therapy electrodes affects the current required to obtain ventricular capture. Typically the lowest threshold is obtained when the position of the electrodes provides the most direct current pathway through the heart while avoiding large chest muscles. Lower stimulation currents produce less skeletal muscle contraction and are better tolerated.

4:1 Mode



Pressing and holding the 4:1 button temporarily withholds pacing stimuli, thereby allowing you to observe the patient's underlying ECG rhythm and morphology.

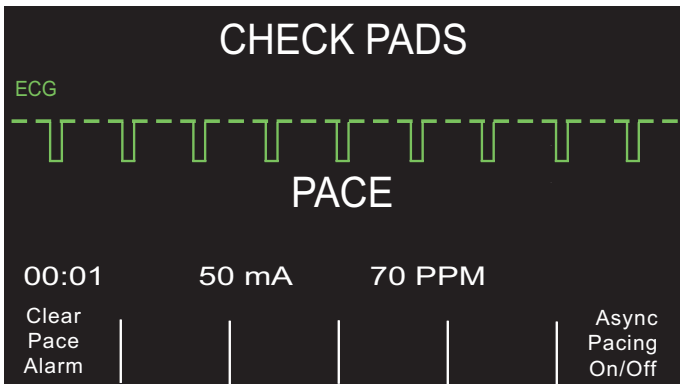
When depressed, this button causes pacing stimuli to be delivered at ¼ of the indicated ppm setting.

Pace Fault

If the unit is attempting to deliver pacing therapy and one of the following conditions occur, the messages *CHECK PADS* and *POOR PAD CONTACT* are alternately displayed on the screen and an audible alarm sounds:

- The OneStep cable is not connected to the device.
- The cable is defective.
- Therapy pads are not connected to the OneStep cable.
- The therapy pads are not making good skin contact.

The alarm will continue to sound until proper connections between the patient and pacer are achieved and the leftmost softkey (**Clear Pace Alarm**) is pressed.



Special Pacing Applications

Noninvasive Temporary Pacing can be performed in the Cardiac Catheterization Lab either for emergency pacing or standby pacing. For pacing in X-ray and fluoroscopic applications, ZOLL pro-padz® radiolucent hands-free therapy electrodes may be used.

Noninvasive Temporary Pacing can be performed in the Operating Room using ZOLL pro-padz sterile hands-free therapy electrodes.

Caution Under certain conditions, it might not be possible to properly monitor or pace while electrosurgical apparatus is operating. Observe the device carefully for evidence of proper operation.

Standby Pacing

For certain patients at risk of developing symptomatic bradycardia, it may be advisable to use the unit in standby mode. When used in standby mode, the unit automatically provides pacing stimuli whenever the patient's heart rate drops below the pacer rate setting. Patient's ECG must be monitored using one of the two electrode configurations described on page 8-2. To use the device in standby mode:

1. Establish effective pacing (see instructions on previous pages). Note the mA output at capture and run an ECG stripchart to document ECG morphology during capture.
2. Set the mA output 10% higher than the minimum mA output necessary to effect consistent ventricular capture.
3. Turn the pacing rate (ppm) below the patient's heart rate. This suppresses pacing unless the patient's own rate drops below the pacer rate setting. The pacing rate should be set at a level sufficient to ensure adequate cardiac output.
4. Check the threshold periodically.

Asynchronous Pacing

If ECG electrodes are not available or there is some circumstance that prevents or interferes with the surface ECG, the R Series delivers pacemaker pulses asynchronously.

Asynchronous pacing should be performed only in an emergency when no alternative is available. To pace asynchronously:

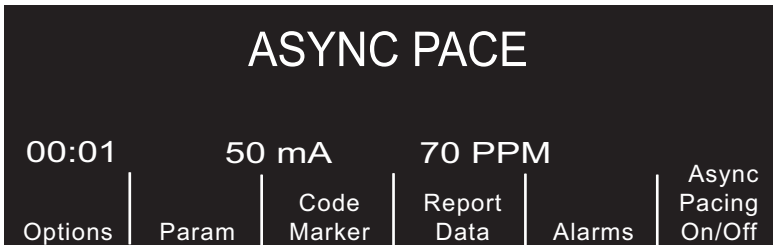
Turn the Mode Selector to PACER.

Press the Async Pacing On/Off softkey.

Note: If the pacer output is set to 8 mA or higher, pacing stimuli begin immediately at the set rate.

The display shows "ASYNC PACE" to indicate that asynchronous pacing has been activated. The annotation "ASYNC PACE" is also printed on the stripchart when activated by the

RECORDER button, and printed on the corresponding summary report. To return to demand pacing, press the **Async Pacing On/Off** softkey again. The display returns to "PACE."



Pace stimuli are also delivered asynchronously whenever there is an *ECG LEAD OFF* condition. Due to the lead off condition, no ECG waveforms will be displayed when pacing by this method. Use other means to determine capture such as checking the patient's pulse.

When asynchronously pacing with an ECG LEAD OFF condition, the rate and mA should be set at the known capture level or high enough (100mA) to presume capture.

Pediatric Pacing

Noninvasive pacing of pediatric patients is performed in an identical manner to adult pacing. Smaller size pediatric therapy electrodes (OneStep pediatric electrodes) are available for patients weighing less than 33 lbs/15 kg. Continuous pacing of neonates can cause skin burns. If it is necessary to pace for more than 30 minutes, periodic inspection of the underlying skin is strongly advised. Carefully follow all instructions on electrode packaging.