TEC-7511C
TEC-7521C
TEC-7531C

TEC-7511E
TEC-7521E
TEC-7531E

TEC-7511F
TEC-7521F
TEC-7531F

TEC-7511K
TEC-7521K
TEC-7531K

TEC-7511R
TEC-7521R
TEC-7531R

OPERATOR'S MANUAL

PORTABLE DEFIBRILLATOR

TEC-7500

0614-004191C 2001 02 15

NIHON KOHDEN

TEC-7511C
TEC-7521C
TEC-7531C

TEC-7511E
TEC-7521E
TEC-7531E

TEC-7511F
TEC-7521F
TEC-7531F

TEC-7511K
TEC-7521K
TEC-7531K

TEC-7511R
TEC-7521R
TEC-7531R

PORTABLE DEFIBRILLATOR

TEC-7500

0614-004191C

CONTENTS

Section 4 ECG and SpO_2 Monitoring 4.C1

EMC RELATED CAUTION

This equipment and/or system complies with the International Standard IEC60601-1-2 for electromagnetic compatibility for medical electrical equipment and/or system. However, an electromagnetic environment that exceeds the limits or levels stipulated in the IEC60601-1-2, can cause harmful interference to the equipment and/or system or cause the equipment and/or system to fail to perform its intended function or degrade its intended performance. Therefore, during the operation of the equipment and/or system, if there is any undesired deviation from its intended operational performance, you must avoid, identify and resolve the adverse electromagnetic effect before continuing to use the equipment and/or system.

The following describes some common interference sources and remedial actions:

1. Strong electromagnetic interference from a nearby emitter source such as an authorized radio station or cellular phone:
   Install the equipment and/or system at another location if it is interfered with by an emitter source such as an authorized radio station. Keep the emitter source such as cellular phone away from the equipment and/or system.

2. Radio-frequency interference from other equipment through the AC power supply of the equipment and/or system:
   Identify the cause of this interference and if possible remove this interference source. If this is not possible, use a different power supply.

3. Effect of direct or indirect electrostatic discharge:
   Make sure all users and patients in contact with the equipment and/or system are free from direct or indirect electrostatic energy before using it. A humid room can help lessen this problem.

4. Electromagnetic interference with any radio wave receiver such as radio or television:
   If the equipment and/or system interferes with any radio wave receiver, locate the equipment and/or system as far as possible from the radio wave receiver.

If the above suggested remedial actions do not solve the problem, consult your Nihon Kohden Corporation subsidiary or distributor for additional suggestions.

GENERAL HANDLING PRECAUTIONS

This device is intended for use only by qualified medical personnel. Use only Nihon Kohden approved products with this device. Use of non-approved products or in a non-approved manner may affect the performance specifications of the device. This includes, but is not limited to, batteries, recording paper, pens, extension cables, electrode leads, input boxes and AC power.

Please read these precautions thoroughly before attempting to operate the instrument.

1. **To safely and effectively use the instrument, its operation must be fully understood.**

2. **When installing or storing the instrument, take the following precautions**:
   (1) Avoid moisture or contact with water, dust, extreme atmospheric pressure, excessive humidity and temperatures, poorly ventilated areas, and saline or sulphuric air.
   (2) Place the instrument on an even, level floor. Avoid vibration and mechanical shock, even during transport.
   (3) Avoid placing in an area where chemicals are stored or where there is danger of gas leakage.
   (4) The power line source to be applied to the instrument must correspond in frequency and voltage to product specifications, and have sufficient current capacity.
   (5) Choose a room where a proper grounding facility is available.

3. **Before Operation**
   (1) Check that the instrument is in perfect operating order.
   (2) Check that the instrument is grounded properly.
   (3) Check that all cords are connected properly.
   (4) Pay extra attention when the instrument is in combination with other instruments to avoid misdiagnosis or other problems.
   (5) All circuitry used for direct patient connection must be doubly checked.
   (6) Check that battery level is acceptable and battery condition is good when using battery-operated models.

4. **During Operation**
   (1) Both the instrument and the patient must receive continual, careful attention.
   (2) Turn power off or remove electrodes and/or transducers when necessary to assure the patient's safety.
   (3) Avoid direct contact between the instrument housing and the patient.

5. **To Shutdown After Use**
   (1) Turn power off with all controls returned to their original positions.
   (2) Remove the cords gently; do not use force to remove them.
   (3) Clean the instrument together with all accessories for their next use.

6. **The instrument must receive expert, professional attention for maintenance and repairs. When the instrument is not functioning properly, it should be clearly marked to avoid operation while it is out of order.**

7. **The instrument must not be altered or modified in any way.**

8. **Maintenance and Inspection**:

   (1) The instrument and parts must undergo regular maintenance inspection at least every 6 months.

   (2) If stored for extended periods without being used, make sure prior to operation that the instrument is in perfect operating condition.

   (3) Technical information such as parts list, descriptions, calibration instructions or other information is available for qualified user technical personnel upon request from your Nihon Kohden distributor.

9. **When the instrument is used with an electrosurgical instrument, pay careful attention to the application and/or location of electrodes and/or transducers to avoid possible burn to the patient.**

WARRANTY POLICY

Nihon Kohden Corporation (NKC) shall warrant its products against all defects in materials and workmanship for one year from the date of delivery. However, consumable materials such as recording paper, ink, stylus and battery are excluded from the warranty.

NKC or its authorized agents will repair or replace any products which prove to be defective during the warranty period, provided these products are used as prescribed by the operating instructions given in the operator's and service manuals.

No other party is authorized to make any warranty or assume liability for NKC's products. NKC will not recognize any other warranty, either implied or in writing. In addition, service, technical modification or any other product change performed by someone other than NKC or its authorized agents without prior consent of NKC may be cause for voiding this warranty.

Defective products or parts must be returned to NKC or its authorized agents, along with an explanation of the failure. Shipping costs must be pre-paid.

This warranty does not apply to products that have been modified, disassembled, reinstalled or repaired without Nihon Kohden approval or which have been subjected to neglect or accident, damage due to accident, fire, lightning, vandalism, water or other casualty, improper installation or application, or on which the original identification marks have been removed.

In the USA and Canada other warranty policies may apply.

Conventions Used in This Manual and Instrument

◆Dangers, Warnings, Cautions and Notes

Dangers, warnings, cautions and notes are used in this manual to alert or signal the reader to specific information.

DANGER

A danger is used to alert the user to a hazardous situation which will cause death or serious injury.

WARNING

A warning is used to alert the user to possible injury, death or other serious adverse reactions associated with the use or misuse of the instrument.

CAUTION

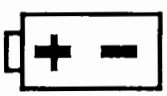
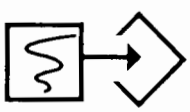
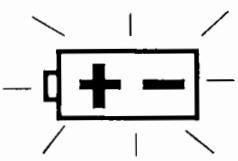
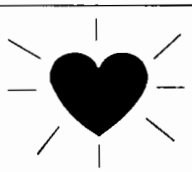
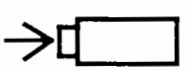
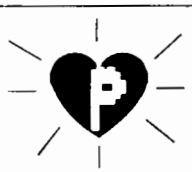
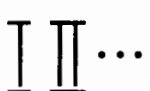
A caution is used to alert the user to possibility of injury or a problem associated with use or misuse of the instrument. This includes potential instrument malfunction or failure, damage to the instrument, or damage to other property.

NOTE

A note is used to provide specific information, in the form of recommendations, requirements, alternative methods or supplemental information.

Explanation of the symbols in this manual/instrument

The following symbols are used in this manual and instrument.

	Battery fully charged		Continuous recording
	Battery less than one third capacity		Report recording
	Battery almost exhausted		Event recording
	No battery power		Telemeter
	QRS sync display (defibrillation/monitor mode)		Battery charging
	QRS sync display (pacing mode)		Battery charge complete
	Alarm off		ECG LEAD
	Alarm suspend		SENS
	Alternating current		Setup

 Defibrillation-proof Type CF applied part	 Attention, consult operator's manual
 Defibrillation-proof Type BF applied part	**SpO_2** SpO_2 data
 Input terminal (ECG)	 Brightness
 Equipotential terminal	 Volume
 High voltage	 The CE mark is a protected conformity mark of the European Community. The products herewith comply with the requirements of the Medical Device Directive 93/42/EEC.
PR Pulse rate data	

SECTION 1

GENERAL

1-1 About This Manual

This operator's manual is for the TEC-7500 Rev. B Series Portable Defibrillator.

The purpose of this operator's manual is to provide a comprehensive guide for the safe use and proper care of the TEC-7500 Series Portable Defibrillator.

Before using the defibrillator, read this manual thoroughly to become familiar with the defibrillator.

NOTE

Use Nihon Kohden parts and accessories to assure maximum performance from your instrument.

1-2 About the TEC-7500 Series Defibrillators

◆Defibrillation

The defibrillator provides both defibrillation and synchronized cardioversion modes.

Defibrillator Charge Time

The defibrillator charges 360 joules within 5 seconds when powered by AC and within 10 seconds when operated from a fully charged new battery.

ECG Recovery Time

After defibrillation, ECG waveforms can be displayed within 3 seconds so you can immediately check and record the change in cardiac rhythm. (When using external paddle, disposable pad or ECG connection cable)

Internal Paddles and Disposable pads (Self-adhesive Defibrillation Pads)

The TEC-7521 and TEC-7531 can use internal paddles and disposable pads. Disposable pads come pre-gelled in a sealed package. Their flat profile and self-adhesives provide secure attachment to the patient's chest. They also maintain a stable and low impedance for an extended period of time. This allows continuous ECG monitoring throughout the defibrillation.

◆Monitoring

Display

The defibrillator monitors both defibrillation and 4 seconds ECG and pulse waveform on a 5.5 inch CRT display. The monitoring presents timely information on the defibrillation procedure and subsequent result. Heart rate, SpO_2 and pulse rate data can be displayed on the display. Heart rate/pulse rate and SpO_2 alarms can be set.

ESU Rejection

An ESU (electrosurgical unit) noise rejection filter assures clear and accurate ECG monitoring.

Receiving and Displaying the Signal from a Transmitter

When an optional ZR-751VK Telemetry receiver is installed, the defibrillator can be used as a bedside monitor to display the ECG waveforms, heart rate and SpO_2 (%).

NOTE

Synchronized cardioversion cannot be performed with a telemetry ECG signal.

◆Pacing (TEC-7531 Only)

The TEC-7531 defibrillator has a non-invasive pacing function which gives electrical stimulation through the patient chest's surface through disposable pads. This allows emergency treatment for bradycardia after defibrillation.

◆AC and Battery Power Operation

For portability and emergency use, the defibrillator can operate on battery as well as AC power. A fully charged, new battery provides 50 discharges at any energy (up to 360 joules), or 2 hours of continuous monitoring.

◆Data Storage

The defibrillator has an internal memory which can store ECG and pulse waveforms and data, even after the power is turned off, for later printing. The memory capacity depends on the type of information stored. See the Recording section for more details.

◆Recording

The following manual and automatic recordings are available.

- **Manual Recording**

Waveform recording
Any length of ECG waveforms, pulse waveforms and annotations at 5, 25 or 50 mm/s recording speed.

Report recording
Saved event data, defibrillation report and up to 5 minutes and 20 seconds ECG waveforms with annotations are recorded when defibrillation is performed, the Event key is pressed, or an alarm occurs

Event recording
Saved ECG waveforms with annotations from 4 seconds before to 12 seconds after the Event key is pressed

Trend recording
Heart rate, SpO_2 and pulse rate trendgraphs and tabular trend data

- **Automatic Recording**

  Defibrillation recording
  ECG and pulse waveforms with annotations from start of charge to 12 seconds after defibrillation

  Alarm recording
  ECG and pulse waveforms with annotations from 4 seconds before to 12 seconds after alarm occurrence

◆Optional Functions

Refer to Section 1-7 "When Using an Optional Unit" for details.

NOTE
Only one of the following optional units can be installed at a time.

- Telemetry function
  With an optional ZR-751VK Telemetry receiver, the defibrillator can display the ECG waveforms and SpO_2 data (%) from a transmitter.

  With an optional QI-751VK Transmitter interface unit and transmitter, the defibrillator can transmit the ECG waveforms to a bedside monitor or central monitor.

NOTE
50 mm/s sweep speed is not available when the ZR-751VK Telemetry receiver or the AL-751VK SpO_2 unit is installed.

- SpO_2 measurement function
  With an optional AL-751VK SpO_2 unit, the defibrillator can measure and display the pulse waveform, SpO_2(%) and pulse rate.

◆Self Check Programs

In addition to an automatic power on self check, a comprehensive program checks the battery, HV capacitor performance, built-in recorder and all critical parts of the defibrillator. Refer to Section 8 "Maintenance".

◆Difference Between Models

		TEC-7511	TEC-7521	TEC-7531
Paddle	External	Yes	Yes	Yes
	Internal	NA	Option	Option
	Disposable pads	NA	Option	Yes
Non invasive pacing		NA	NA	Yes
Telemetry		Option	Option	Option
SpO_2 unit		Option	Option	Option
Sweep speed 50 mm/s		Yes*	Yes*	NA

* 50 mm/s sweep speed is not available when the optional ZR-751VK Telemetry receiver or the AL-751VK SpO_2 unit is installed.

NA: Not available

1-3 Important Safety Information

DANGER

Do not use the defibrillator in a flammable atmosphere (i.e. areas with flammable anesthetics, concentrated oxygen, hyperbaric oxygen) or in an environment in which an electrical arc could ignite an explosion.

WARNINGS

Surrounding Conditions

Fluids such as Ringer's saline solution and blood are excellent electrical conductors; to avoid creating potentially dangerous electrical paths, keep the defibrillator and the immediate area clean and dry at all times.

Radiofrequency or Electromagnetic Field

Do not use any kind of non-essential non-patient care device within a radius of 1 meter around the defibrillator. The use of non-essential non-patient care devices that emit radiofrequency or electromagnetic fields may interfere with the operation of the defibrillator by causing noise on the ECG waveform or error messages. If a non-essential non-patient care device is accidentally placed near the defibrillator, quickly remove it.

When an ESU (Electrical Surgery Unit) is Used

- Do not perform defibrillation while using an ESU.
- Do not attach external paddles, disposable pads or internal paddles to the patient.

Failure to follow these warnings may cause serious electrical burn, shock, or other injury.

Only use the defibrillator in monitor mode when using it with an ESU. Refer to **4-2-6** "Using the Defibrillator with an Electrosurgical Unit".

WARNINGS, continued

Operation

- The defibrillator must only be operated by trained and qualified medical personnel.
- Use only Nihon Kohden LC-S2912NK battery packs supplied by Nihon Kohden or its authorized distributors.
- Do not operate the defibrillator if it gets moist with condensation.
- Do not turn the defibrillator on or off when the defibrillator is in contact with the patient through electrodes, disposable pads, or external or internal paddles. To ensure the safety of the patient and defibrillator operator, follow the procedures recommended in this Operator's Manual to turn the defibrillator on or off.
- Do not perform open discharge. This may cause electrical shock or damage the defibrillator. Do not perform defibrillation when the paddles touch each other. This may damage the defibrillator.
- Before defibrillation, make sure that no one is in contact with either the patient or any equipment which supports or is connected to the patient. Failure to follow this may cause serious electrical shock or injury.
- Do not discharge the energy if the paddles are shorted to each other by contact gel. Failure to follow this may cause serious electrical burn and poor energy discharge to the heart.
- Make sure there is no contact gel anywhere other than the electrode plates of the paddles. If there is gel on the paddle handle, the operator may receive an electrical shock.
- Do not touch the electrode plate or edge of the paddle. Failure to follow this may cause serious electrical burn, shock or other injury.
- If defibrillation is necessary during a battery test, cancel the battery test and perform defibrillation on AC power. Do not defibrillate on battery power because the battery may have been discharged during the battery test.
- Pay careful attention to the energy selection when using internal paddles. Applying high energy to the heart may cause cardiac muscle necrosis.
- Pay careful attention to the energy selection when using the pediatric electrode plates. Applying high energy with the pediatric electrode plates can cause serious electrical burn because the electrode plates are small.

Pacemaker patient

- Keep pacemaker patients under close observation. The pacing rate may continue during cardiac arrest and certain arrhythmias. Do not rely only on heart rate alarms and indicated heart rate.
- False low heart rate indicators may occur with certain pacemakers because of electrical overshoot.

Checks

- Do not open the defibrillator case; there are no operator controls inside and dangerous high voltages may be exposed. Refer servicing to qualified service personnel.
- Check the defibrillator and accessories every month according to Section 8 of this manual.

WARNINGS, continued

Disposable pads

Follow all disposable pads labeling instructions.

- Do not re-use the disposable pads. Pads are disposable.
- If the package is broken, dispose of the pads and do not use them. If the pads are used, this may cause serious electrical burn or poor energy discharge to the heart.
- Do not use the pads if they are past the expiration date. If expired pads are used, this may cause serious electrical burn or poor energy discharge to the heart.
- Use the disposable pads as soon as possible after removing them from the package. If the pads are left for a long period of time after removing them from the package, it may cause serious electrical burn or poor energy discharge to the heart.
- Do not attach a pad on top of a disposable electrode.
- Do not attach pads where there is any ointment on the patient's chest.
- Do not use the disposable pads if:
  - The gel has become dry, or
  - The gel breaks down and releases water.

  This may cause serious electrical burn or poor energy discharge to the heart.
- Do not use the P610 or P612 disposable pads if the color of the gel changes to dark brown and dark brown gel is attached to the protective liner. This may cause serious electrical burn or poor energy discharge to the heart.

Failure to follow these warnings may cause serious skin burn.

SpO_2 measurement

- When the patient has a high fever or insufficient peripheral circulation, the SpO_2 probe may cause a slight burn because the probe increases the skin temperature by 2 or 3 C (4 or 5 F).
- When the patient's oxyhemoglobin or methemoglobin increases abnormally, the SpO_2 data will not be correct.
- When measuring SpO_2 of a patient who is in a state of shock or in cardiopulmonary resuscitation, the acquired SpO_2 data may not be correct due to the patient's body movement.
- If you do not measure SpO_2, disconnect the SpO_2 probe from the SpO_2 unit. If an unused probe is connected to the SpO_2 unit, strong external light will enter the probe and cause a noise waveform and value to appear on the screen. This noise waveform and value can be misjudged to be a valid pulse waveform and SpO_2 (%).
- When measuring SpO_2 with the AL-751VK SpO_2 Unit, make sure of following:
  - When the heart rate alarm is required, set the "SELECT ALARM SOURCE" setting to "HR" on the Setup screen. If the "SELECT ALARM SOURCE" setting is set to "PR", the heart rate alarm does not occur.
  - When "SELECT ALARM SOURCE" setting is set to "PR", if the SpO_2 probe is disconnected, the "SELECT ALARM SOURCE" setting automatically changes to "HR". After connecting the SpO_2 probe, set the "SELECT ALARM SOURCE" setting to "PR".

Alarm

Always keep a patient under close observation when the heart rate/pulse rate alarm function or the SpO_2 alarm function is OFF.

CAUTIONS

Battery

- If the "CHARGE BATTERY" message appears, operate the defibrillator on AC power.
- If the "REPLACE BATTERY" message appears, replace the battery with a new one.
- Do not use a battery which has not been recharged in 6 months. Check the battery after installing or replacing. Refer to Section 8-6 "Checking the Battery".
- Check the battery once a month to ensure optimum performance. Refer to Section 8-6 "Checking the Battery".
- Replace the battery with a new one every year. If a battery is not used for more than one year, discard it.
- When the defibrillator is not in use, connect it to an AC line to maintain the battery charge and ready the defibrillator for use at any time.
- Do not operate the defibrillator on battery power when the following conditions are not met:

  Surrounding temperature: 0 to 45 C

  Relative humidity: 30 to 95 % (0 to 40 C surrounding temperature)
  30 to 80 % (40 to 45 C surrounding temperature)

  Failure to follow this caution may reduce the battery operation time.
- Before disposing of the battery, check with your local solid waste officials about recycling options or proper disposal. The battery is recyclable. At the end of its useful life, special disposal may be required in your area.

Operation

- During defibrillation, remove or disconnect any equipment which has electrical input from the patient and which does not have a defibrillation protection circuit. (The defibrillator protection circuit blocks the high voltage of the defibrillation. Equipment with a defibrillation protection circuit has an identification mark near the input.) Failure to follow this caution may cause serious electrical burn, shock or other injury to the operator and damage to the connected equipment.
- The defibrillator can be damaged by overheating from excessive defibrillation. Observe the following guidelines.
  - Do not defibrillate more than 3 times in one minute.
  - For long term continuous defibrillation, the following limits apply:
    No more than 60 defibrillations at 360 J if you allow 1 minute cool down period after every 1 minute of defibrillation.
    No more than 15 defibrillations at 360 J if there is no 1 minute cool down period after every 1 minute of defibrillation.

CAUTIONS, continued

Connecting an external instrument

When connecting an external instrument to the ECG input connector, ensure that the external instrument complies with the IEC60601-1 safety standard for medical equipment or IEC60601-2-27 particular requirements for the safety of electrocardiographic monitoring equipment. If the instrument does not comply with IEC60601-1 or IEC60601-2-27, use a locally available medical use isolation transformer unit between the instrument and the AC outlet.

SpO_2 measurement

- If the skin gets irritated by the tape, change the attachment site.
- Do not attach the probe to the same limb that is used for NIBP measurement or an IBP catheter.
- To avoid poor circulation, do not wrap the tape too tight.
- For long term monitoring, check the circulation condition by observing the skin color of the measuring site and the displayed pulse waveform. To avoid circulation insufficiency, change the measurement site every 8 hours when using a disposable probe and every 4 hours when using the finger probe, multi-site probe or foot probe. If the skin is irritated from oversensitivity to the tape, discontinue use of the probe.
- When attaching the SpO_2 probe, make sure that the photo emitter and the detector of the probe face each other. Otherwise, SpO_2 cannot be measured properly.
- Do not re-use the disposable probe for another patient.
- When using a disposable probe, replace it with a new one every 96 hours (4 days).
  When using a finger probe, multi-site probe or foot probe, replace it with a new one every 1 year after opening the package.
- If the probe is dirty with blood or bodily fluids, replace it with a new one.
- Keep the patient under close observation or check the alarm settings when the "ALARM OFF" message is displayed. This message is displayed when any alarm setting on the Setup screen is set to "OFF". When the AL-751VK SpO_2 Unit is connected to the defibrillator, the "ALARM OFF" message is always displayed because both the heart rate alarm and pulse rate alarm cannot be set at the same time.

NOTE

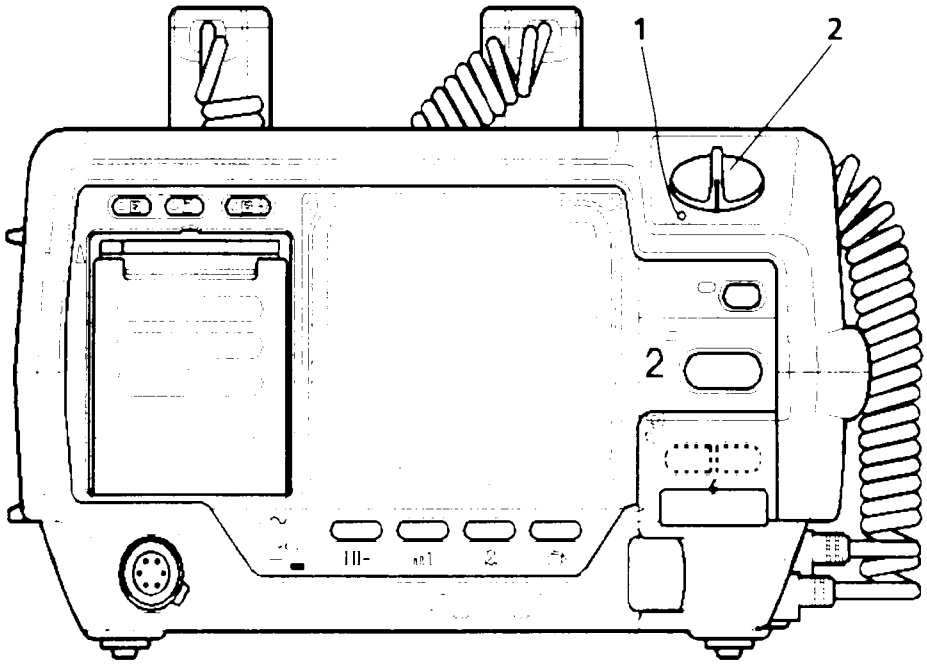
- Use only Nihon Kohden parts and accessories to assure maximum performance from your instrument.
- Even when defibrillation is performed correctly, the patient's skin can get burned.

Make sure there is no excessive interference from a cellular phone.

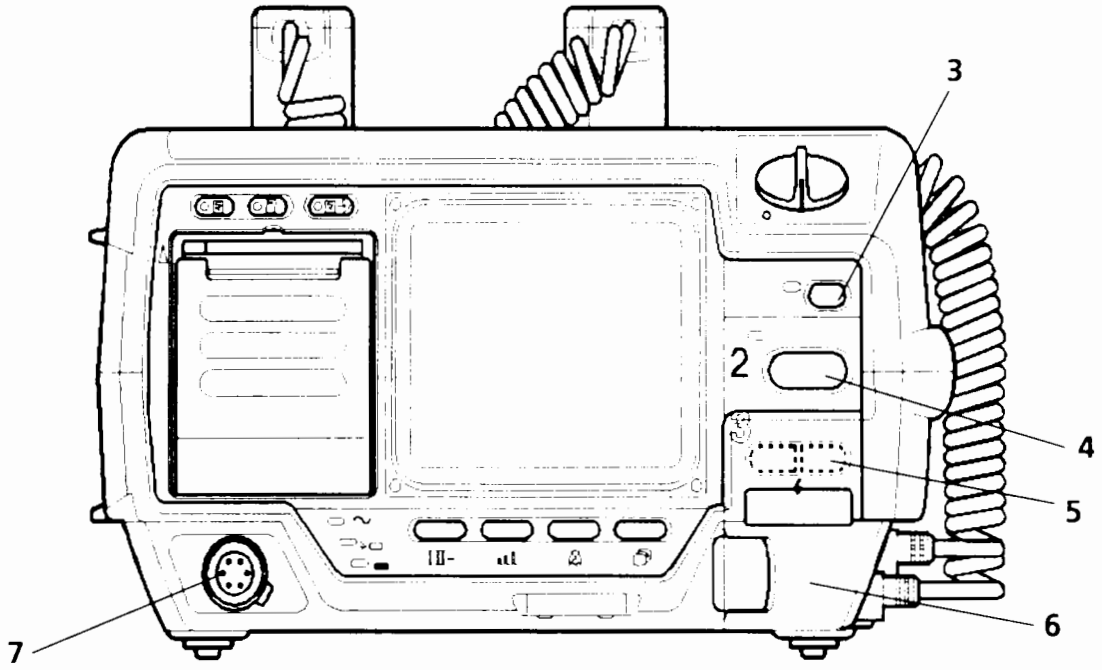
Contact your Nihon Kohden distributor or service engineer if you have any questions concerning safe operation of the defibrillator.

1-4 Panel Descriptions

◆ Front Panel

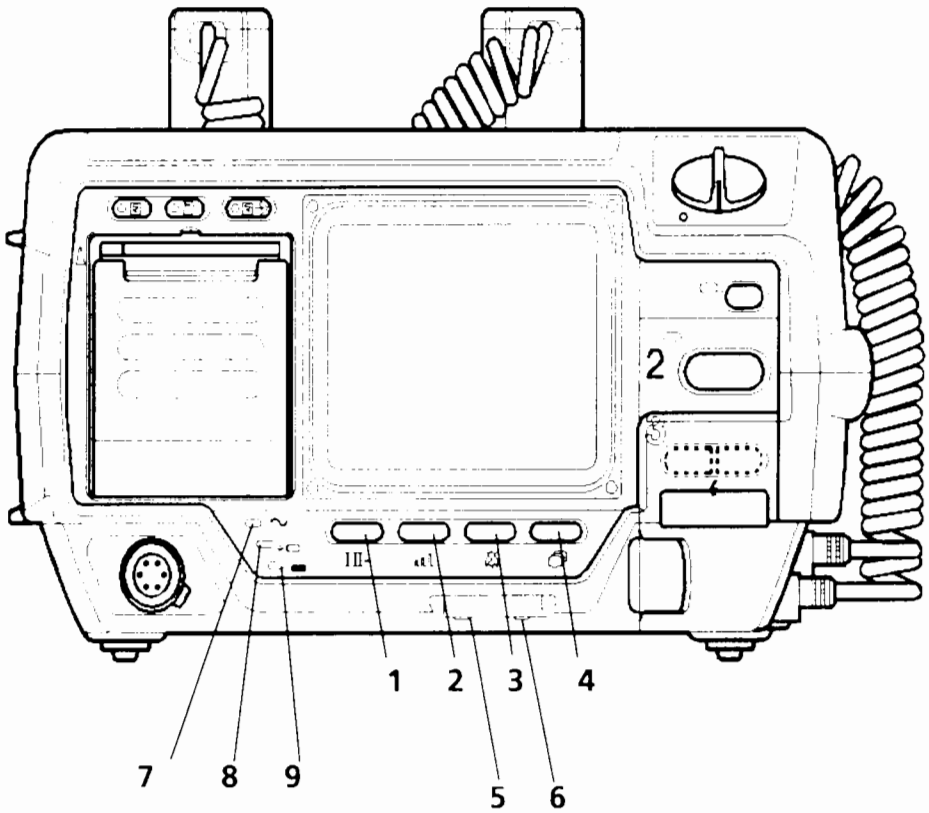


No.	Name	Functions
1	Power lamp	Lights when the power is turned on.
2	ENERGY MODE SELECT control	Turns the unit power on off and selects monitoring mode, pacing mode*, and defibrillation discharge energy. The switch positions are PACING*, OFF, MON, DISARM, 2, 3, 5, 7, 10, 20, 30, 50, 70, 100, 150, 200, 300, and 360 joules. When discharging the charged energy internally, turn the control to the DISARM position. * Pacing is only available for TEC-7531.



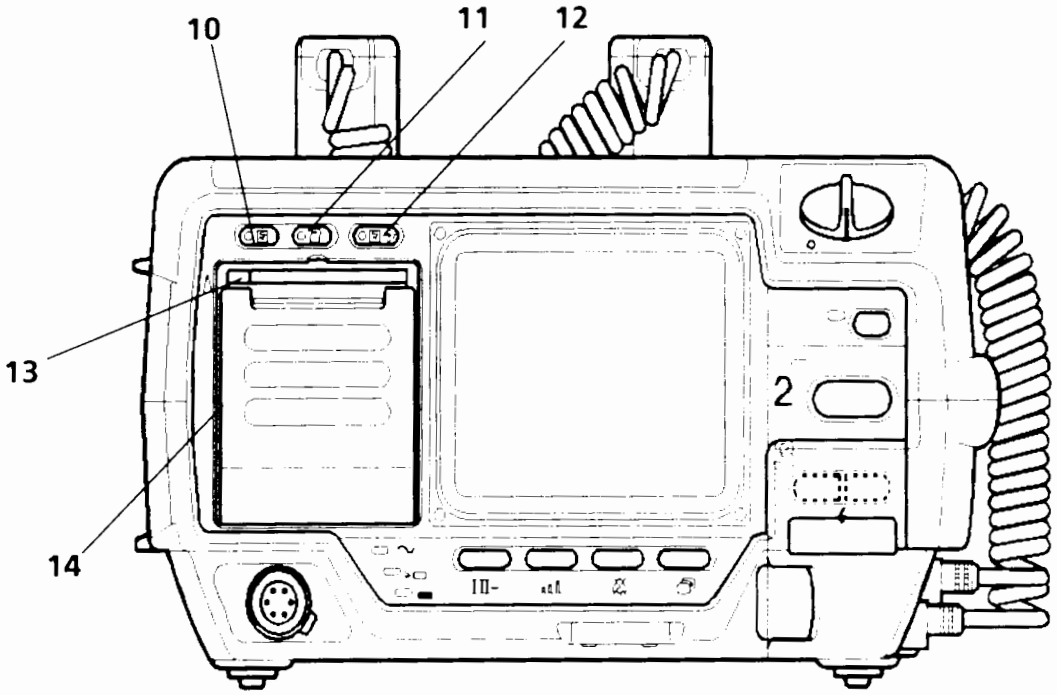
- **Defibrillation block**

No.	Name	Functions
3	SYNC key/lamp Synchronization key/lamp	Press to select synchronized cardioversion mode. The SYNC lamp lights when this mode is selected. The defibrillator discharges the selected energy in synchronization with the next detected QRS wave after both DISCHARGE keys on the front panel or both DISCHARGE buttons on the external paddles are pressed. * TEC-7511 does not have DISCHARGE keys on the front panel.
4	CHARGE key/lamp	Press to charge the selected energy. You can also charge the energy by pressing the CHARGE button on the APEX paddle. This CHARGE lamp and the CHARGE lamp located on the APEX paddle blink when the selected energy is being charged and lights continuously when the energy charge is completed.
5	DISCHARGE keys	TEC-7511: Does not have these keys. Use the DISCHARGE buttons on the external paddles to discharge the energy. TEC-7521/7531: When the external paddles are connected to the defibrillator, these keys are covered by the external paddles connector. Use the DISCHARGE buttons on the external paddles to discharge the energy. When disposable pads or internal paddles are connected, Use these keys to discharge the energy.
6	Paddle connector	Connector for external paddles, internal paddles and pad adaptor for disposable pads (only for TEC-7521 and TEC-7531)
7	ECG input connector	For the ECG connection cable and an external input ECG



- **ECG monitoring block**

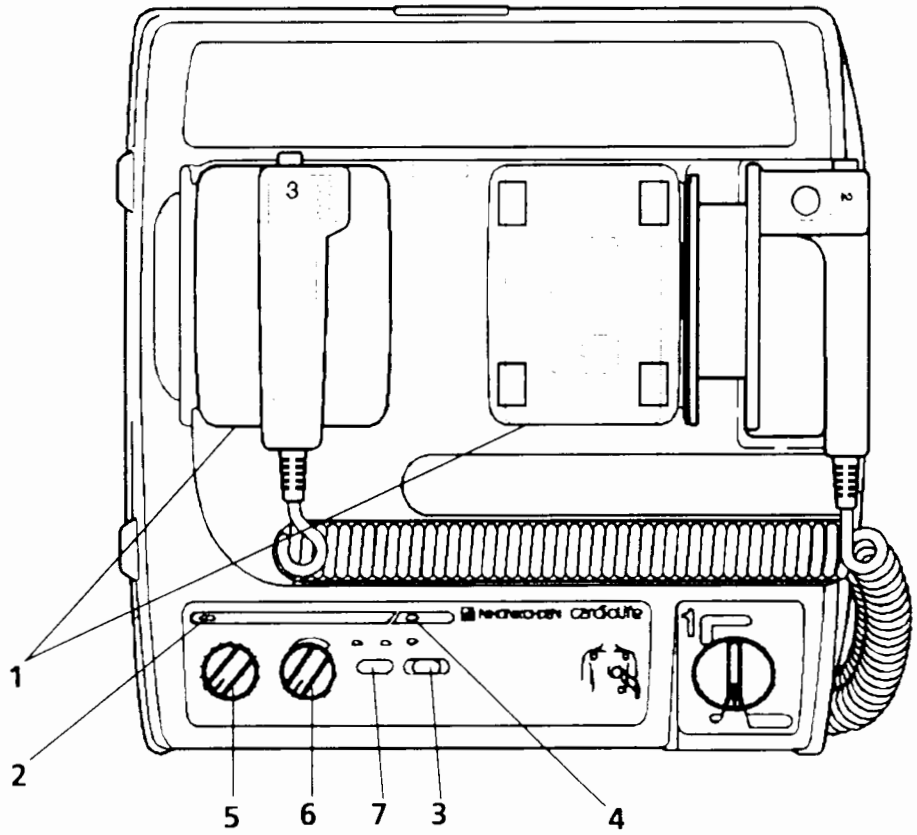
No.	Name	Functions
1	ECG lead key	Press to select the ECG lead. Refer to Section 4-3-1 for the lead selections.
2	ECG sensitivity key	Press to select the ECG display and recording sensitivity. Selection list: · 1·2, 1, 2, 4
3	Alarm suspend key	Press to temporarily stop the alarm sound for three minutes.
4	Setup key	Press to call up the Setup screen. **NOTE** **The Setup screen can only be called up from the monitor screen. If the ENERGY/MODE SELECT control is not turned to the MON position and this key is pressed, the "SELECT MONITOR MODE" message appears.**
5	Brightness control	Turn clockwise to increase the intensity of the trace.
6	Volume control	Turn clockwise to increase the synchronous sound volume.
7	AC power lamp	Lights when AC power is supplied to the defibrillator.
8	Battery charging lamp	Lights when the battery is being charged.
9	Battery charge complete lamp	Lights when the battery is completely charged.



- **Recorder block**

No.	Name	Functions
10	Record key/lamp	Press to start and stop the manual recording. The record lamp lights during the recording.
11	Report key/lamp	Press to start and stop the report or trend recording. The report lamp lights during the recording.
12	Event key/lamp	Press to start and stop the event recording. The event lamp lights during recording. The event lamp blinks when another recording is required. Refer to Section 6-2-4 "Recording and Saving ECG Waveforms (Event Recording)".
13	Magazine release lever	Pull the lever up to open the magazine.
14	Thermal recorder	Recorder section is located here.

◆ Top Panel

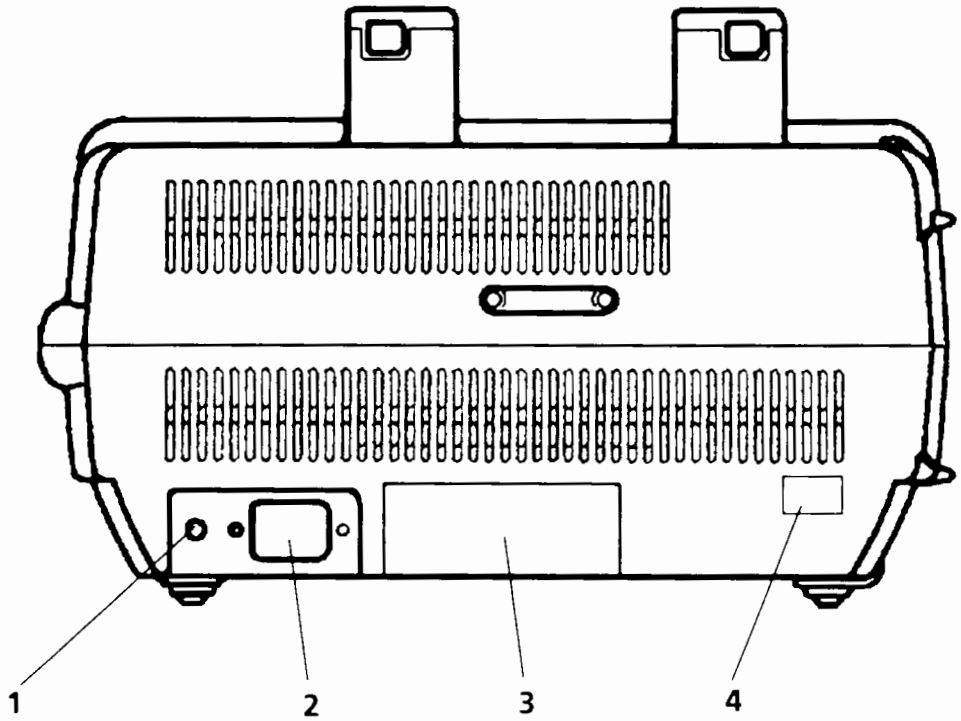


No.	Name	Functions
1	Paddle holders	Holds the external paddles. There are energy discharge test plates at the base of the paddle holders for the charge discharge test. Use the edge around each paddle holder as a temporary holder for the paddles so that contact gel does not get on the defibrillator.

• **Pacing block (TEC-7531 only)**

No.	Name	Functions
2	PACING lamp	Lights when the pacing mode is selected.
3	PACING ON/OFF key lamp	Press to start and stop pacing. During pacing, the PACING ON OFF lamp lights.
4	PULSE lamp	Blinks in synchronization with the pacing pulse.
5	RATE Pacing rate control	Turn to select the pacing frequency (pulse/min). Selection list: 40 to 180 pulse/min in 10 pulse/min steps.
6	OUTPUT Pacing current control	Turn to select the intensity of the pacing current. Selection list: 0 and 8 to 200 mA in 1 mA steps.
7	FIXED/DEMAND mode selection key/lamps	Press to select the fixed or demand pacing mode. The lamp for the selected mode lights. The default setting is fixed mode.

◆ Rear Panel



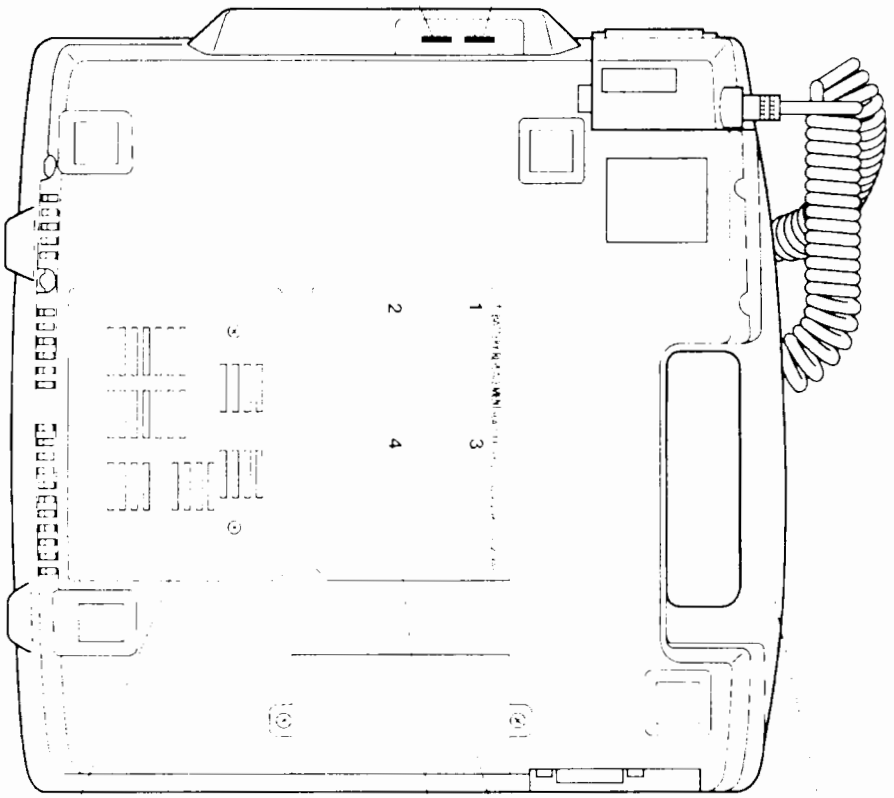
No.	Name	Functions
1	Equipotential ground terminal	Use this terminal for equipotential grounding.
2	AC SOURCE socket	Connector for the AC power cord.
3	Optional unit connector	Optional unit is connected.
4	Label	Shows the model, serial number and Rev. no.

◆ Bottom

Brightness control
Turn clockwise to increase the intensity of the trace.

Volume control
Turn clockwise to increase the synchronous sound volume.

Front



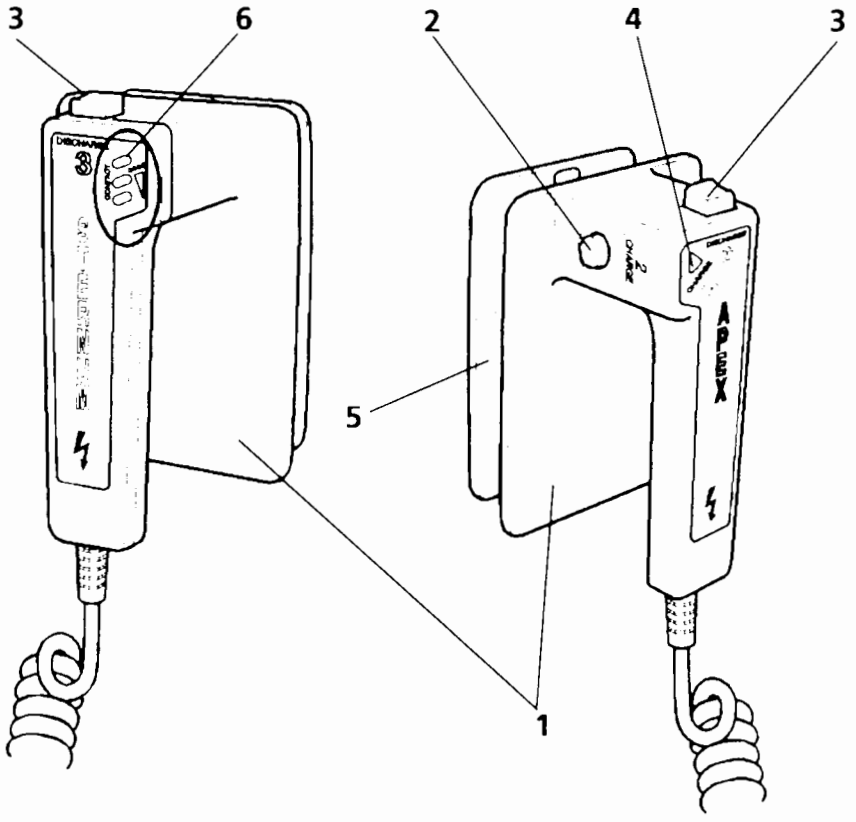
Handle

Battery pack holder

Optional unit connector

Battery handling caution label

◆ **External Paddles**



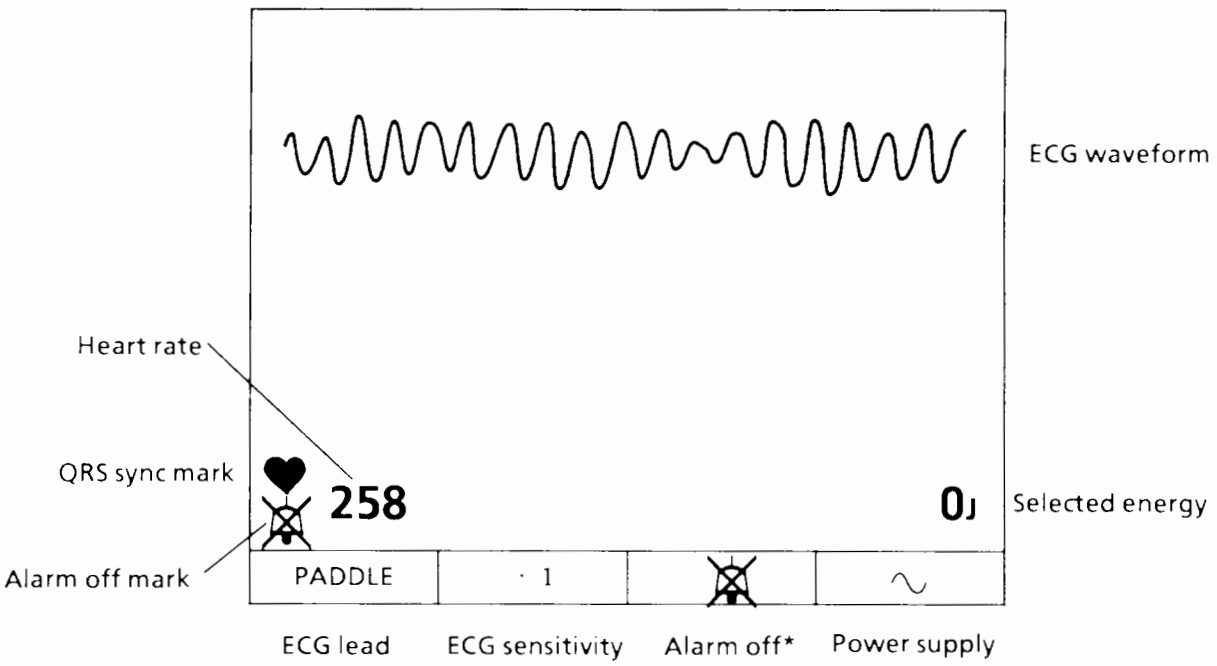
No.	Name	Functions
1	External paddle	Defibrillation charge energy is discharged through the paddles.
2	CHARGE button	Press to charge the selected energy.
3	DISCHARGE buttons	Simultaneously press both buttons to discharge the charged energy.
4	CHARGE lamp	Blinks while the selected energy is being charged. Continuously lights when the energy is completely charged.
5	Adult electrode plate	Use this plate when giving defibrillation to an adult. The pediatric electrode plate is located underneath the adult plate. Use this plate when giving defibrillation to a child.
6	Paddle contact indicator (TEC-7521/7531 only)	Indicates the quality of paddle to patient contact.

1-5 Screen Display and Indications

1-5-1 Screen Display

◆Information on the Defibrillation Screen

The following information can be displayed on the defibrillation screen.

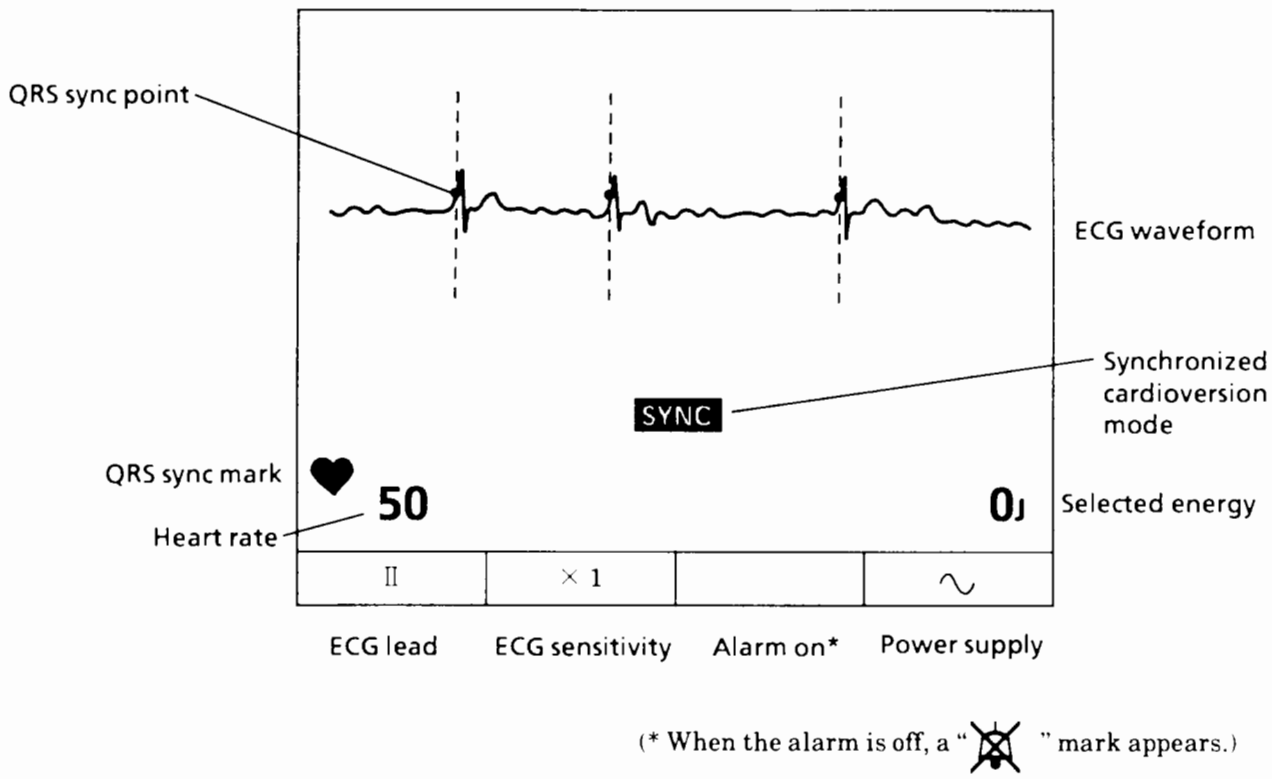


(* When the alarm is off, a " " mark appears.)

This is the defibrillation screen which appears when neither ZR-751VK Telemetry Receiver nor the AL-751VK SpO_2 Unit is installed.

◆Information on the Synchronized Cardioversion Screen

The following information can be displayed on the synchronized cardioversion screen.



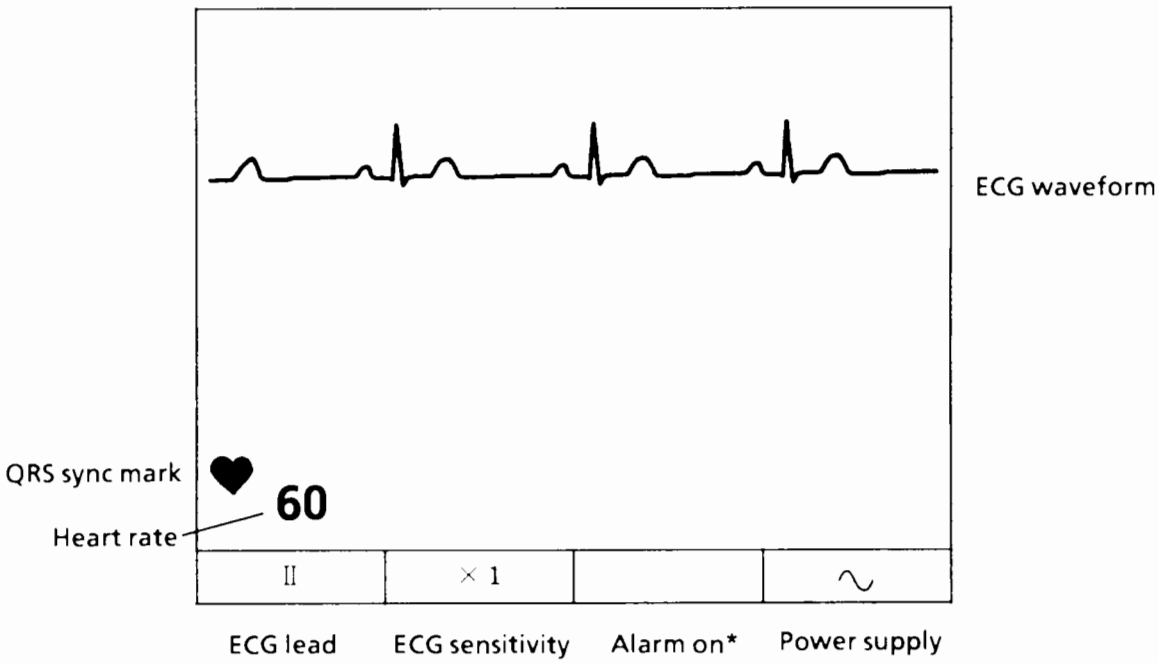
(* When the alarm is off, a " " mark appears.)

This is the synchronized cardioversion screen which appears when neither ZR-751VK Telemetry Receiver nor the AL-751VK SpO_2 Unit is installed.

◆Information on the Monitoring Screen

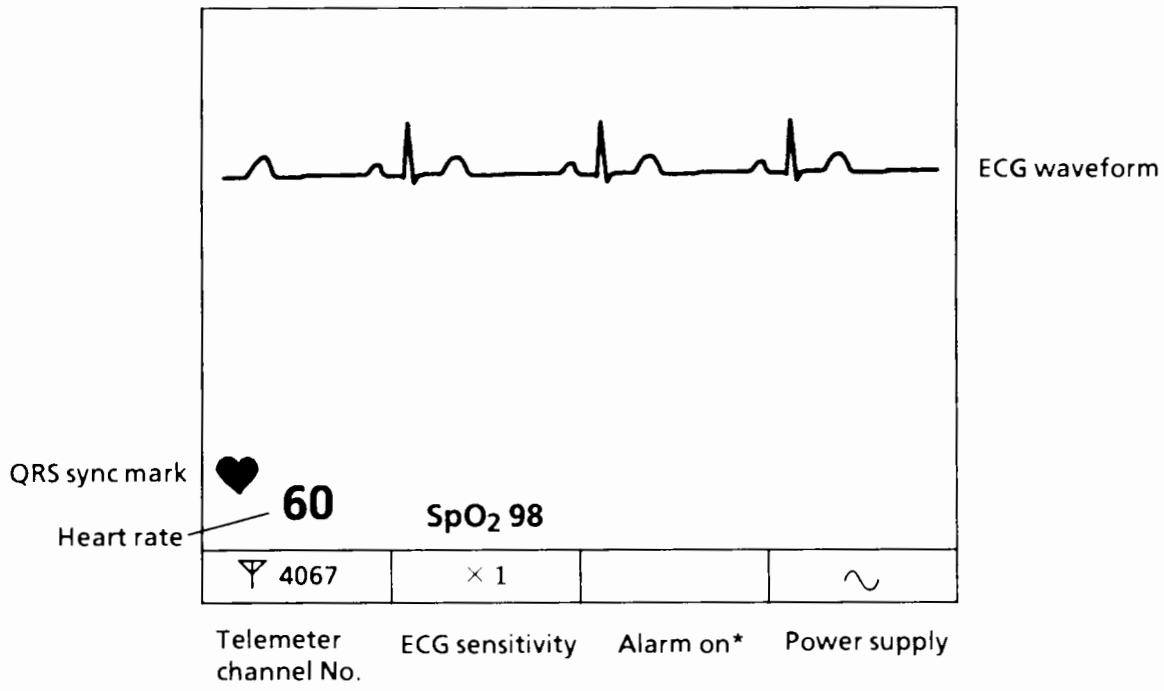
The following information can be displayed on the monitoring screen.

<When neither the ZR-751VK Telemetry Receiver nor the AL-751VK SpO_2 Unit is installed>



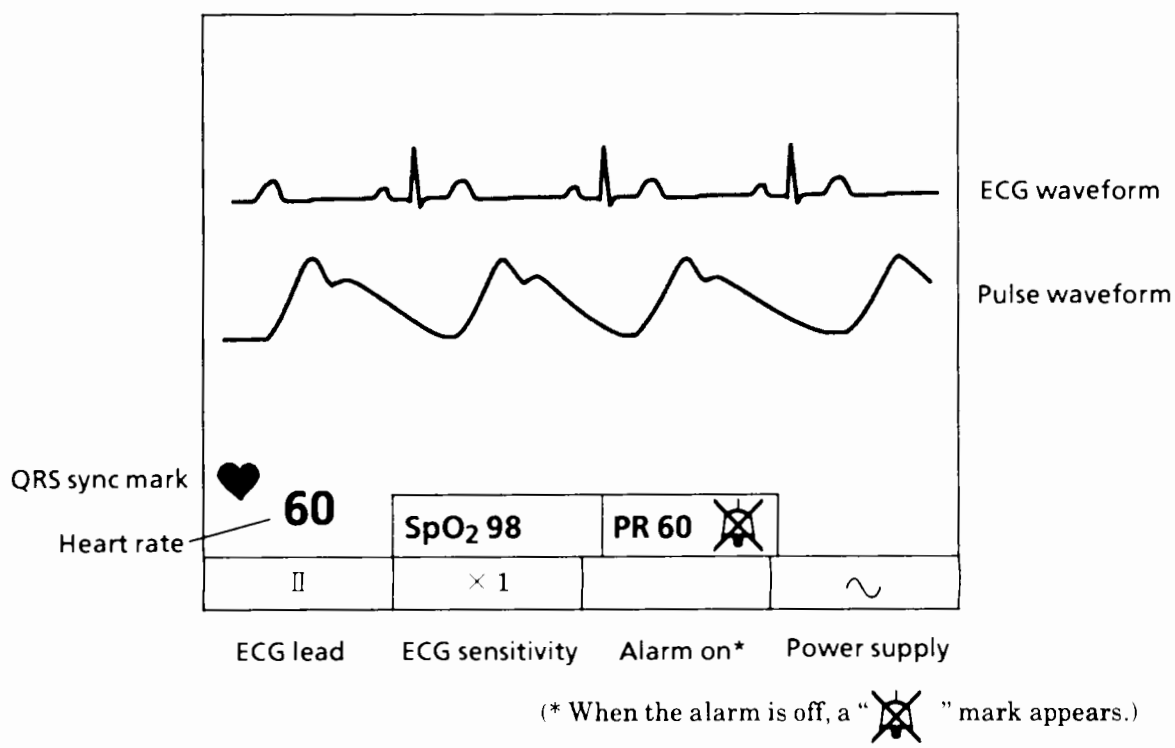
(* When the alarm is off, a " " mark appears.)

<When the ZR-751VK Telemetry Receiver is installed>



(* When the alarm is off, a " " mark appears.)

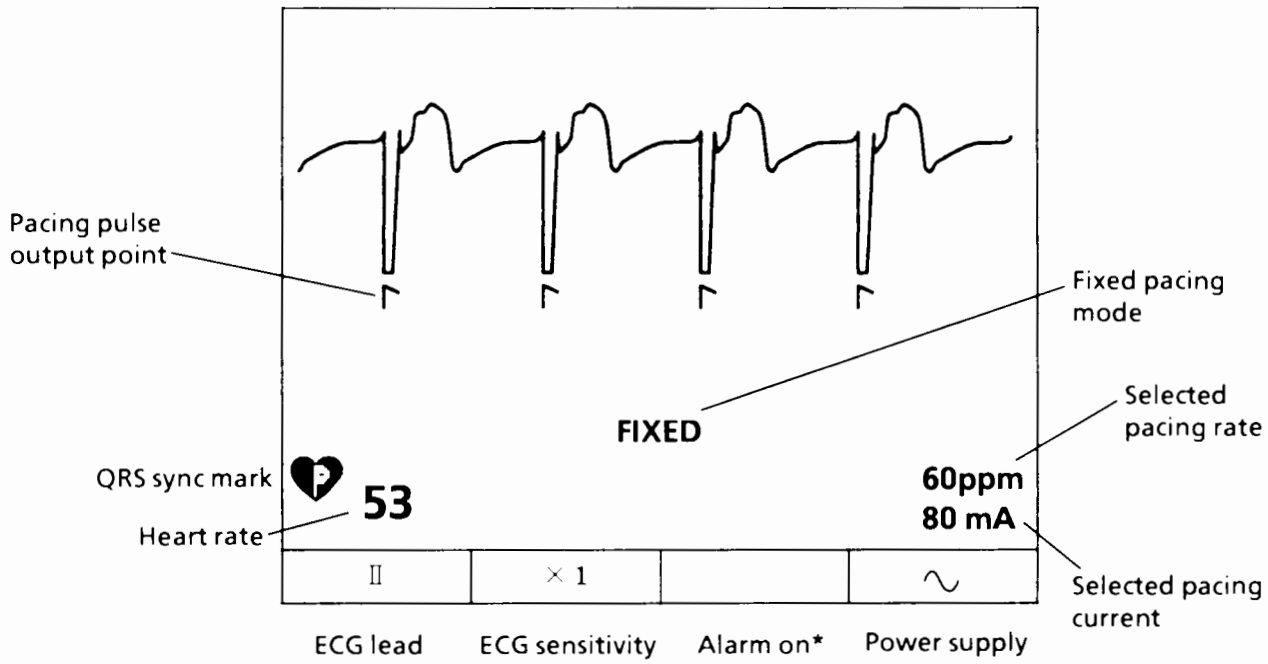
<When the AL-751VK SpO_2 Unit is installed>



(* When the alarm is off, a " " mark appears.)

◆Information on the Pacing Screen in Fixed Mode

The following information can be displayed on the pacing screen in Fixed mode.

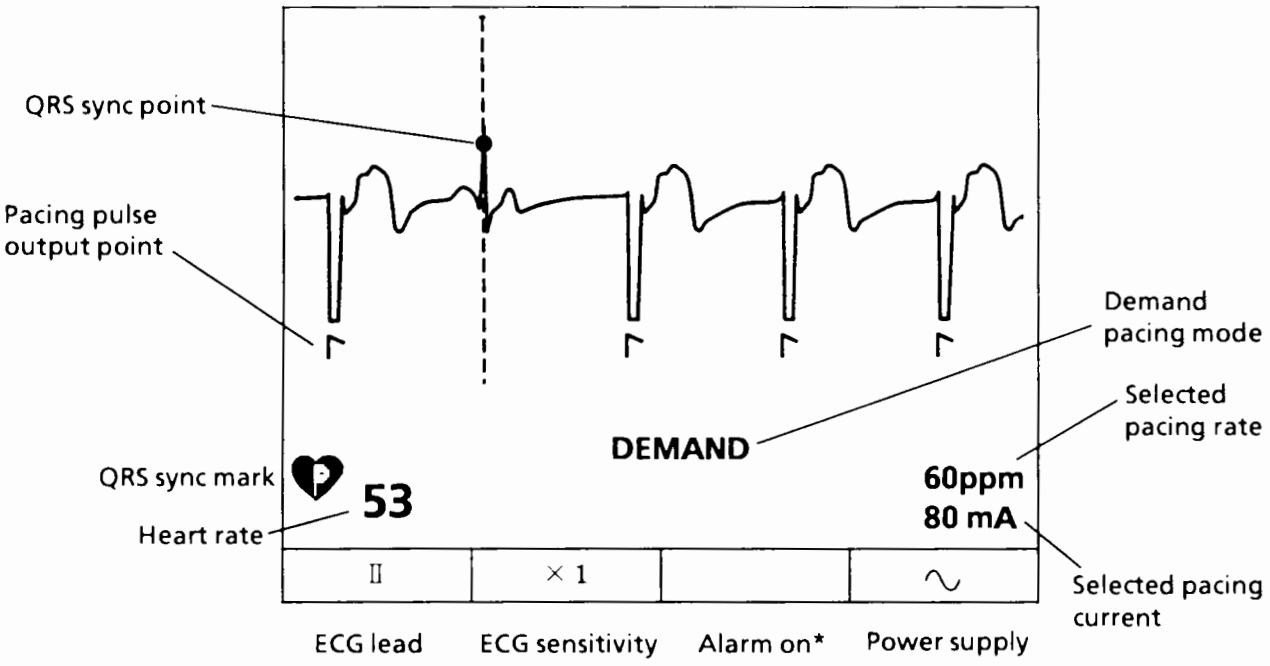


(* When the alarm is off, a "" mark appears.)

This is the pacing screen in Fixed mode which appears when neither ZR-751VK Telemetry Receiver nor the AL-751VK SpO_2 Unit is installed.

◆Information on the Pacing Screen in Demand Mode

The following information can be displayed on the pacing screen in Demand mode.

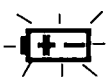


(* When the alarm is off, a " " mark appears.)

This is the pacing screen in Demand mode which appears when neither ZR-751VK Telemetry Receiver nor the AL-751VK SpO_2 Unit is installed.

1-5-2 Battery Charge Indications

A fully charged, new battery can provide 50 full energy (360 joules) discharges or 2 hours of continuous monitoring when the surrounding temperature is 20°C. Battery operation time depends on the operating mode (defibrillation, monitoring or recording), and operating and storage conditions.

Screen Message/mark	Battery level	Available No. of defibrillations at 360 joule
	Fully charged	11 to 50
The blinking "LOW BATTERY" message is displayed about 5 seconds. 	1/3 or less	4 to 10
LOW BATTERY 	Almost discharged	Less than 4
CHARGE BATTERY 	Discharged	Defibrillation is not possible

CAUTION

When the "CHARGE BATTERY" message appears, operate the defibrillator on AC power.

1-6 Battery and AC Operation

The defibrillator operates on either AC or battery power (lead-acid battery). The defibrillator automatically selects the power source according to whether the defibrillator is connected to AC power via the power cord.

- **AC Power Operation**

  When AC power is supplied, the defibrillator automatically operates on AC power and the AC power lamp lights.

  When the defibrillator is connected to the AC power line, the battery is charged and the battery charging lamp lights. After charging, the battery charge complete lamp lights to indicate that the defibrillator can operate on battery power. To ensure that the defibrillator provides constant battery charging, keep the defibrillator connected to AC power during standby periods.

- **Battery Operation**

  When AC power is not supplied, the defibrillator automatically switches to battery power operation. A fully charged, new battery can provide 50 full energy (360 joules) discharges or 2 hours of continuous monitoring when the surrounding temperature is 20°C.

1-7 When Using an Optional Unit

NOTE

- **Only one of the ZR-751VK Telemetry Receiver, QI-751VK Transmitter Interface Unit, AL-751VK SpO_2 Unit, or QI-752VK External Power Interface Unit can be installed at a time.**
- **50 mm/s sweep speed is not available when the ZR-751VK Telemetry receiver or the AL-751VK SpO_2 unit is installed.**

◆ZR-751VK Telemetry Receiver

This lets the defibrillator display the ECG waveforms and the SpO_2 data (%) from a transmitter. For details, refer to the following sections:

2-9 "Setting the Channel Group and Available Channels"
4-4-2 "Selecting ECG Lead"
4-4-7 "Selecting the Transmitter Channel"

For connecting the telemetry receiver to the defibrillator, refer to the ZR-751VK Telemetry Receiver operator's manual.

CAUTION

- **When monitoring ECG waveforms or SpO_2 data (%) from a transmitter, confirm that the channel displayed on the defibrillator screen matches the channel of the transmitter which you want to monitor. For selecting the channel, refer to Section 2-9 "Selecting the Channel Group and Available Channels" and Section 4-4-7 "Selecting the Transmitter Channel".**
- **Synchronized cardioversion cannot be performed with ECG waveforms from the transmitter.**

◆QI-751VK Transmitter Interface Unit with ZB-800P Transmitter

This lets the defibrillator transmit the ECG waveforms to a bedside monitor or central monitor.

For connecting the Transmitter Interface Unit to the defibrillator, refer to the QI-751VK Transmitter Interface Unit and ZB-800P Transmitter operator's manual.

◆AL-751VK SpO_2 Unit

This lets the defibrillator display the pulse waveform, SpO_2(%) and pulse rate.

For connecting the SpO_2 unit to the defibrillator, refer to the AL-751VK SpO_2 Unit installation guide.

For selecting the SpO_2 probe, connecting the SpO_2 probe to the AL-751VK SpO_2 Unit, and attaching the SpO_2 probe to the patient, refer to section 4-3 Preparing for the SpO_2 Monitoring.

When the SpO_2 Unit is installed, an alarm can be generated from SpO_2 data (%) and either ECG waveform or pulse waveform.
For SpO_2 details, refer to the following sections:

2-5-2-2 "Setting Items ◆Alarm"
4-4-8 "Changing the Heart Rate/Pulse Rate Alarm Limits"
4-4-9 "Selecting Alarm Source"
4-4-10 "Changing the SpO_2 Alarm Limits"

To display pulse waveforms in the optimum sensitivity, refer to section 4-4-13 "Changing the SpO_2 Gain".

SECTION 2

PREPARATION AND SETUP

2-1 Grounding and Connecting Cables

◆Connecting the Power Cord

3-prong AC Outlet

Connect the provided power cord to the AC SOURCE socket on the rear panel of the defibrillator and plug the cord into a 3-prong AC outlet.

2-prong AC Outlet

Use the following procedures only when a 3-prong AC outlet is not available and a 2-contact AC outlet is not legally prohibited.

WARNING

Never use a water pipe or gas pipe as a ground because it is not properly grounded and there is a hazard of explosion.

1. Connect the equipotential ground terminal of the defibrillator to a ground post with the ground lead.

2. Connect the power cord to the AC SOURCE socket on the defibrillator and plug the cord into an AC outlet.

◆Equipotential Grounding

CAUTION

Equipotential grounding may be required for patient safety. Consult with a qualified biomedical engineer.

When several medical electronic instruments are used, avoid potential difference between instruments. Potential difference between instruments may cause current to flow to the patient connected to the instruments, resulting in electrical shock (micro shock).
Never use any medical equipment in patient treatment without proper grounding.

Perform equipotential grounding where equipotential grounding is required, such as in the operating room, ICU room, CCU room, cardiac catheterization room and x-ray room.

To equipotentially ground the defibrillator, connect the equipotential ground terminal on the defibrillator to the equipotential ground terminal on the wall with the ground lead.

When grounding is not available, operate the defibrillator on battery power.

◆Stable Power Supply

CAUTION

A sudden loss of power or an extreme power surge can affect data and the instrument. To prevent this, use an uninterruptable power supply (UPS).

2-2 Preparing Battery

2-2-1 Important Safety Information

WARNING

Follow the warnings below to avoid serious personal injury.

- Use only LC-S2912NK battery pack supplied from NIHON KOHDEN or its authorized distributors.
- Do not use the battery in any other equipment.
- Do not discard the battery near open flame.
- Do not contact the plus (+) and minus (−) terminals of the battery.
- Do not open the battery. Failure to follow this warning may damage your skin with internal liquid (material).
- Do not charge the battery with any other product except for Nihon Kohden approved equipment.
- Do not use the battery if there is any physical damage, such as crack, deformation or broken cable.
- Do not use organic solvents such as thinner or acetone on the battery because these damage the battery case. To clean the battery, use a dry cloth.

CAUTION

- Check the battery every month. Refer to Section 8-6 "Checking the Battery".
- Replace the battery with a new one every year. If a battery is not used for more than one year, discard it.
- Store the battery at temperatures between -15 and 40 C and humidity between 25 and 85 %.
- During storage, recharge it every 6 months.
- Before disposing of the battery, check with your local solid waste officials about recycling options or proper disposal. The battery is recyclable. At the end of its useful life, special disposal may be required in your area.

2-2-2 Inserting and Replacing the Battery

WARNING

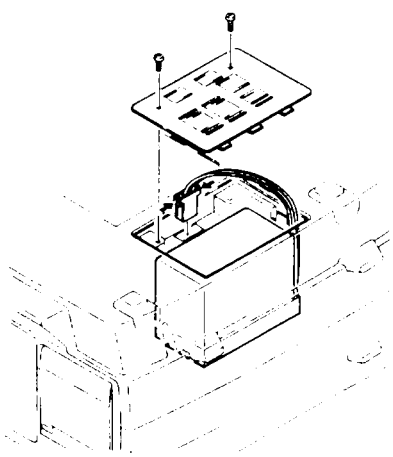
Disconnect the defibrillator from the AC power line before inserting or replacing the battery. Failure to follow this warning may cause serious electrical shock.

1. Disconnect the AC power cord.
2. Turn the ENERGY/MODE SELECT control to the OFF position.
3. Remove the defibrillator from the cart if it is mounted on the cart.
4. Write the date when the new battery is first installed on the two battery check labels and stick them on the battery and defibrillator where they are easy to see.

→

Start date					
Monthly check					
1	2	3	4	5	6
7	8	9	10	11	12

5. Remove the two screws from the battery compartment cover on the bottom of the defibrillator.



6. Insert the battery into the battery compartment.
7. Connect the cable from the battery to the connector inside the battery compartment.
8. Fasten the battery compartment cover with the two screws. Be careful not to pinch the cable under the battery cover.
9. Turn the ENERGY/MODE SELECT control to the MON position and check that the monitoring screen appears.

10. Turn the ENERGY/MODE SELECT control to the OFF position.

11. Connect the AC power cord.

2-2-3 Charging the Battery

CAUTIONS

- **Recharge the battery only at temperatures between 0 and 40°C. At temperatures below 0°C, the battery cannot be recharged to full level. At temperatures over 40°C, the battery will be damaged if recharged and its useful life will be decreased.**
- **Check the battery if it loses its power soon after full charging. Refer to Section 8-6 "Checking Battery".**
- **After every usage, connect the defibrillator to AC power to charge the battery to maintain the battery power. Otherwise, the battery may become damaged and unusable.**
- **Replace the battery with a new one when the "REPLACE BATTERY" message appears.**
- **Operate the defibrillator on AC power when a "CHARGE BATTERY" message appears.**

◆When to Charge the Battery

Always recharge the battery in the following cases:

- After shipment
- After storage
- When the "CHARGE BATTERY" message appears
- Every 6 months, even if not used

NOTE

- **When operating the defibrillator on battery power, if the battery operation time is decreased, check the battery. If the battery does not satisfy the required performance level, replace it with a new one. Refer to Section 8-6 "Checking the Battery".**

- **If the battery charging lamp lights for more than five hours, the battery may be faulty. Check the battery. Refer to Section 8-6 "Checking the battery".**

- **To prevent battery damage, the defibrillator does not charge the battery at temperatures over 40°C.**

- **When the defibrillator is connected to the AC power, if neither the battery charging lamp nor the battery charge complete lamp lights, the surrounding temperature may be over 40°C. Move the defibrillator to a cooler place.**

◆Charging Procedure

1. Turn the ENERGY/MODE SELECT control to the OFF position.

2. Connect the AC power cord to the defibrillator. The AC power lamp lights on the front panel. The defibrillator automatically starts charging the battery and the battery charging lamp on the front panel lights.

It takes about 3 hours for 80 % charge and 3.5 hours for full charge at 20 °C. At low temperatures, it takes longer and at high temperatures, it takes less time to charge the battery. When a new battery is installed, charge it for 3.5 hours or more.

When the battery is fully charged, the battery charging lamp goes off and the battery charge complete lamp on the front panel lights.

◆Maintaining Battery Charge When the Defibrillator Is Not In Use

When the defibrillator is not in use, keep it connected to the AC power. This maintains the battery charge so that the defibrillator can be used at any time on battery power.

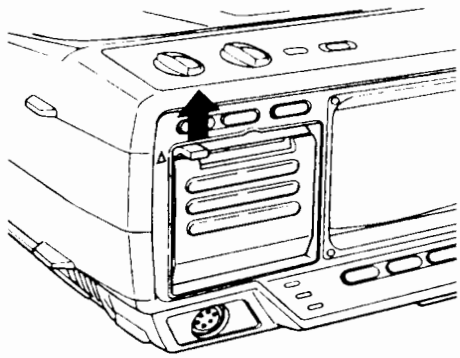
2-3 Loading the Recording Paper

CAUTIONS

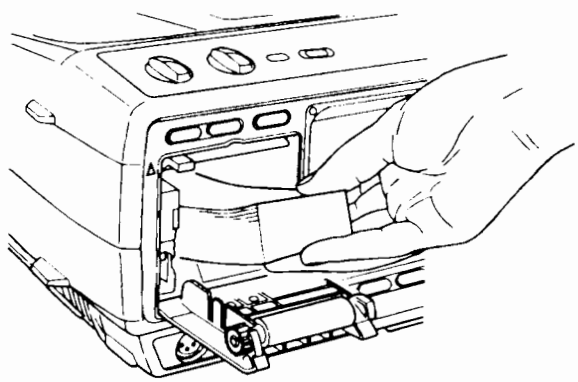
Failure to comply with the following cautions may damage the thermal head.

- **Use only the FQS50-3-100 z-fold or RQS50-3 roll type recording paper.**
- **Do not touch the thermal head by hand. If accidentally touched, immediately clean the thermal head with the thermal head cleaning pen.**
- **Do not allow contact gel, ECG electrolyte cream or saline solution to come in contact with the thermal head. If accidentally contacted, immediately clean the thermal head with the thermal head cleaning pen.**
- **Do not use recording paper which is contaminated with contact gel, ECG electrolyte cream or saline solution to come contact with the thermal head. These may damage the thermal head.**

1. Pull up the magazine release lever of the recorder and pull out the magazine.

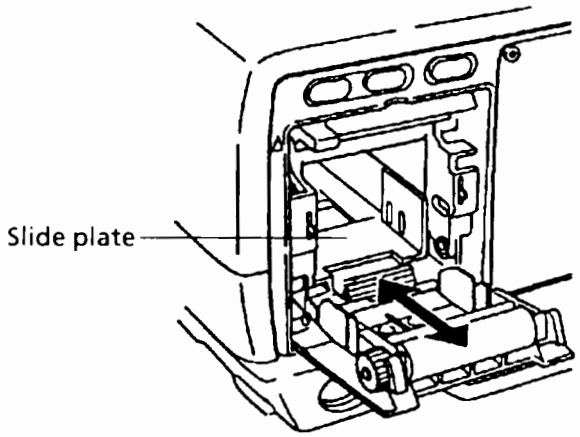


2. Set the recording paper inside the magazine with the printed side up.

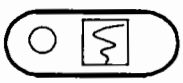


To load z-fold recording paper, first pull the slide plate toward you and load the paper.

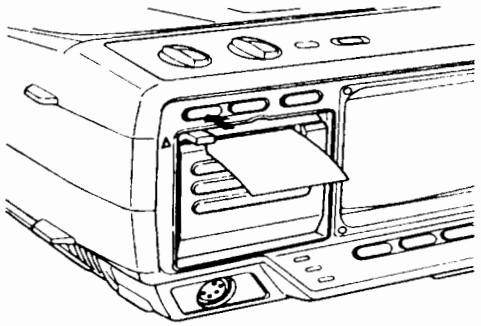
To load roll type recording paper, first push the slide plate back to the inside and load the recording paper in the hollow.



3. Draw out the paper toward you and close the magazine until it clicks.



4. Press the Record key on the front panel to feed the recording paper.



NOTE

When the power is turned on, if the "OUT OF PAPER" message appears, the magazine is not completely closed.

2-4 Power On Procedure

2-4-1 Check Items before Turning the Power On

Before turning on the instrument, check the following items. If there is any damage, contact your Nihon Kohden distributor or representative.

Accessories
- Sufficient number of disposable electrodes
- ECG connection cable prepared
- Pad adaptor, if necessary (TEC-7521/7531)
- Sufficient contact gel (GELAID)
- Sufficient disposable pads, if necessary (TEC-7521/7531)
- Sterilized internal paddle electrode prepared, if necessary (TEC-7521/7531)
- Sufficient recording paper

Connection and Setting
- Power cord and ground lead are properly connected
- Recording paper is loaded

Overview
- Instrument is not dirty, rusted, damaged or in contact with liquid
- Power cord, cables and pins of the paddle connector are not frayed or damaged
- All keys on the operation panel function properly
- Buttons on the external paddles function properly

2-4-2 Turning the Power On

Turn the ENERGY/MODE SELECT control to MON (POWER ON). The self-check program runs, then all lamps on the panels light at the same time.

If no problem is found during self-check, the monitor screen appears.

If a problem is found, an error message appears. Refer to Section 7 "ERROR MESSAGES AND TROUBLESHOOTING".

To turn the power off, turn the ENERGY/MODE SELECT control to the OFF position.

2-4-3 Check Items After Turning the Power On

- There is no fire, smoke or smell.
- There is no electrical shock when touching the instrument.
- Instrument is not too hot.
- Instrument does not affect surrounding equipment.
- There is no error message on the screen when the power is turned on.
- Indicator lights are operative.
- All keys operate properly.
- The screen display is correct.
- The recorded date and time are correct.
- The battery is fully charged.
- The paper is fed correctly.
- There is no error message on the screen or malfunction during operation.
- The alarm settings are correct ("HEART RATE/PULSE RATE ALARM LIMITS" setting, "SELECT ALARM SOURCE" setting when the AL-751VK SpO_2 Unit is connected, etc.).

If any problem is found, do not operate the defibrillator. Contact your Nihon Kohden distributor.

After the power is turned on, you can perform the following checks.

Energy charge check	Refer to 8-4 "Checking Energy Charge and Internal Discharge".
Energy discharge check	Refer to 8-5 "Checking Energy Discharge".
Recorder check	Refer to 8-8 "Checking the Recorder".

2-5 Setup Screen and System Setup Screen

2-5-1 Overview

You can change the hardware and software settings on the Setup screen and System Setup screen. The System Setup screen also provides the hardware check functions.

When a Setup or System Setup screen is opened, the ECG lead key, ECG sensitivity key, Alarm suspend key and Setup key function as the function keys which are displayed at the bottom of the screen.

All changed settings are saved after the power is turned off.

NOTE

Defibrillation and pacing are not available while the Setup or System Setup screen is displayed.

2-5-2 Setup Screen

2-5-2-1 About the Setup Screen

The setup screens are provided to change the telemetry, alarm, recording, monitoring and defibrillation settings. The changed settings are saved after the power is turned off.

Telemetry
- Selects the transmitter channel

Alarm
- Selects either the heart rate alarm or pulse rate alarm.
- Selects the heart rate/pulse rate upper and lower alarm limits
- Selects the SpO_2 (%) upper and lower alarm limits
- Turns all vital alarms on or off
- Turns the heart rate alarm on or off when acquiring the ECG waveforms through the paddles

Recording
- Deletes the saved data
- Selects summary report or trend as the report recording mode
- Selects the total trend time
- Sets the date and the time

Monitor/Defibrillation
- Turns pacing pulse rejection on or off
- Turns the synchronized cardioversion mode on or off when acquiring the ECG waveforms with external paddles, internal paddles, or disposable pads
- Turns the AC interference filter on or off
- Selects the time constant: 0.32 or 3.2 seconds
- Select SpO_2 gain: AUTO, × 1/8, × 1/4, × 1/2, × 1, × 2, × 4, × 8

While you change a setting, real time ECG waveforms are continuously displayed at the top of the screen.

2-5-2-2 Setting Items

◆List of All Settings

Setup Screen	Setting Items	Settings
Telemetry *	TRANSMITTER CHANNEL	
Heart rate/pulse rate alarm limits	HEART RATE/ PULSE RATE ALARM LIMITS***	Upper limit: 20 to 300 in 5 bpm steps and OFF (Default setting **140**) Lower limit: 15 to 295 in 5 bpm steps and OFF (Default setting **40**)
Alarm on/off	ALARM****	**ON** OFF
	SELECT ALARM SOURCE***	**HR** PR
	HEART RATE ALARM WITH PADDLE LEAD	ON **OFF**
SpO_2 alarm limits**	ALARM LIMITS SpO_2	Upper limit: 51 to 99 in 1 % steps and OFF (Default setting: **OFF**) Lower limit: 50 to 99 in 1 % steps and OFF (Default setting: **90**)
	SpO_2 GAIN***	**AUTO** × 1/8 × 1/4 × 1/2 × 1 × 2 × 4 × 8
Recording	CLEAR STORED DATA?	YES **NO**
	REPORT MODE	**SUMMARY** TREND
	TREND TIME	**1**, 2, 3, 4, 8 and 24 hours
	DATE	**JAN 1, 1990**
	TIME	**00:00**
Defibrillation and monitoring	PACING PULSE REJECTION	**ON** OFF
	SYNC BY PADDLE LEAD	ON **OFF**
	AC HUM FILTER	**ON** OFF
	TIME CONSTANT	3.2 sec **0.32 sec**

* Only available when the optional ZR-751VK Telemetry receiver is installed.

** Only available when the optional ZR-751VK Telemetry receiver or AL-751VK SpO_2 unit is installed.

*** Only available when the optional AL-751VK SpO_2 unit is installed.

**** When the power is turned off for 3 seconds or more, "ALARM" is automatically set to "ON".

The default setting is shown in **bold**.

◆Transmitter

TRANSMITTER CHANNEL

NOTE

This appears when the optional ZR-751VK Telemetry receiver is installed.

To receive the signals from a transmitter, select the transmitter channel. You can select one of the channels selected in Section 2-9 "Selecting the Channel Group and Available Channels".

◆Alarm

If DEFAULT is selected in ALARM LIMITS on the System Setup screen, changed alarm limits settings return to default settings.

HEART RATE / PULSE RATE ALARM LIMITS

This item sets the upper/lower alarm limits for the heart rate/pulse rate alarm.

Upper limit: 20 to 300 in 5 bpm steps and OFF (Default setting 140)
Lower limit: 15 to 295 in 5 bpm steps and OFF (Default setting 40)

The "▼" pointer above the heart rate/pulse rate upper/lower alarm limit selection indicator indicates the patient's (current) heart rate or pulse rate.

When both limits are set to "OFF", the heart rate/pulse rate alarm function is turned off.

WARNING

Always keep a patient under close observation when the heart rate/pulse rate alarm function is turned off.

The defibrillator indicates alarms both visually and audibly. When the heart rate/pulse rate exceeds the limit:

- An alarm sounds (Either CONTINUOUS or PERIODIC alarm sound mode can be selected at ALARM BEEPING on the System Setup screen.)
- Numeric data (heart rate or pulse rate) on the screen is highlighted.

ALARM

This turns all vital alarms on or off. The default setting is ON.

NOTE

When the power is turned off for 3 seconds or more, "ALARM" is automatically set to "ON".

WARNING

When OFF is selected, no vital alarms function. Always keep a patient under close observation.

When "OFF" is selected, the "  " mark is displayed.

I	× 1		~

SELECT ALARM SOURCE

NOTE

This appears only when the optional AL-751VK SpO_2 unit is installed.

This selects the source for HEART RATE / PULSE RATE ALARM LIMITS. The Default setting is HR.

Pulse rate alarm is available only when the optional AL-751VK SpO_2 unit is installed. Either heart rate alarm or pulse rate alarm is available at a time.

HR: The alarm generates when the heart rate exceeds the upper/lower limits.
PR: The alarm generates when the pulse rate exceeds the upper/lower limits.

If the SpO_2 probe is disconnected from the AL-751VK SpO_2 unit when measuring pulse waveform, this setting automatically changes from PR to HR.

HEART RATE ALARM WITH PADDLE LEAD

This selects the heart rate alarm function only when the paddle lead is selected. The Default setting is OFF.

WARNING

When OFF is selected, the heart rate alarm does not function. Always keep a patient under close observation.

ALARM LIMITS SpO_2

NOTE

This setting is only available when the optional ZR-751VK Telemetry receiver or AL-751VK SpO_2 unit is installed.

This selects the SpO_2 (%) upper/lower alarm limits.
Upper limit: 51 to 99 in 1 % steps and OFF (Default setting: OFF)
Lower limit: 50 to 99 in 1 % steps and OFF (Default setting: 90)

When both limits are set to OFF, the SpO_2 alarm is turned off.

WARNING

Always keep a patient under close observation when the SpO_2 alarm function is turned off.

◆Report/Recording

CLEAR STORED DATA?

This deletes all saved ECG waveform and data for recording.

REPORT MODE

This selects the report recording mode.
Selection list: SUMMARY (Default setting), TREND

TREND TIME

This selects the time length of the trendgraph.
Selection list: 1, 2, 4, 8, and 24 hours (Default setting: 1)

DATE

This sets the date.

TIME

This sets the time. Seconds start from "00" after the minute is set.

◆Monitor/Defibrillation

PACING PULSE REJECTION

This turns the pacemaker pulse rejection function on or off. This function allows correct heart rate counting when the patient has an implanted pacemaker.

When monitoring a premature baby or infant and the monitor miscounts the narrow width QRS, set this to OFF. The default setting is ON.

SYNC BY PADDLE LEAD

WARNING

Because of the potential danger of noise interference, the ECG signal for synchronized cardioversion should be acquired with the ECG monitoring electrodes (disposable electrodes) and the ECG connection cable. Do not use the ECG signal from external or internal paddles for synchronized cardioversion unless it is absolutely necessary. Paddle synchronization is available when "SYNC BY PADDLE LEAD" is set to ON.

This turns the synchronized cardioversion on or off when acquiring the ECG waveforms with external paddles or internal paddles. The default setting is OFF.

When stable ECG waveforms are obtained with the disposable pads, you can perform synchronized cardioversion with the disposable pads.

AC HUM FILTER

This turns the AC interference filter on or off. The default setting is ON.

The AC hum filter is fixed to ON when pacing mode is selected or when the PADDLE or TELE is selected as the ECG source lead.

TIME CONSTANT

This selects the time constant: 0.32 or 3.2 seconds. When diagnosing the ECG waveforms, set this to 3.2 seconds. The default setting is 0.32 seconds.

The time constant is fixed to 0.32 seconds when defibrillation or pacing mode is selected.

When the optional ZR-751VK Telemetry receiver is installed, the time constant of telemetry ECG waveforms depends on the settings of the transmitter.

SpO_2 GAIN

NOTE

This appears only when the optional AL-751VK SpO_2 unit is installed.

This selects the pulse waveform display sensitivity. The Default setting is AUTO.

AUTO: The sensitivity is automatically set.

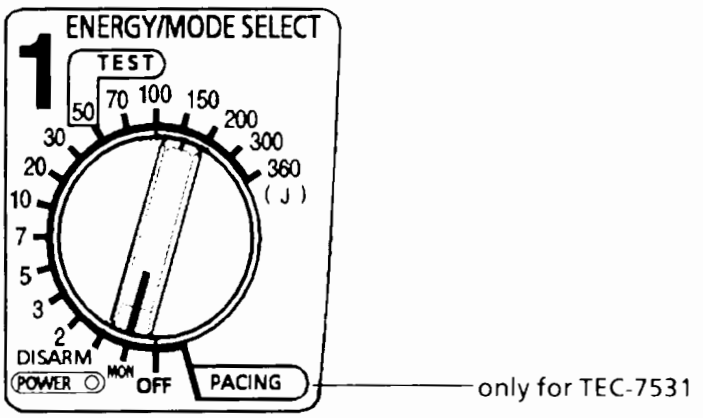
↙1/8···×8: The pulse waveform is displayed in the selected sensitivity.

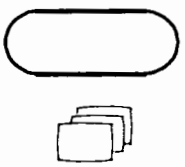
2-5-2-3 Calling Up the Setup Screen

NOTE

- **When there is no key operation for about 60 seconds, the screen returns to the monitoring screen.**
- **During recording, if the Setup key is pressed, the recording stops.**

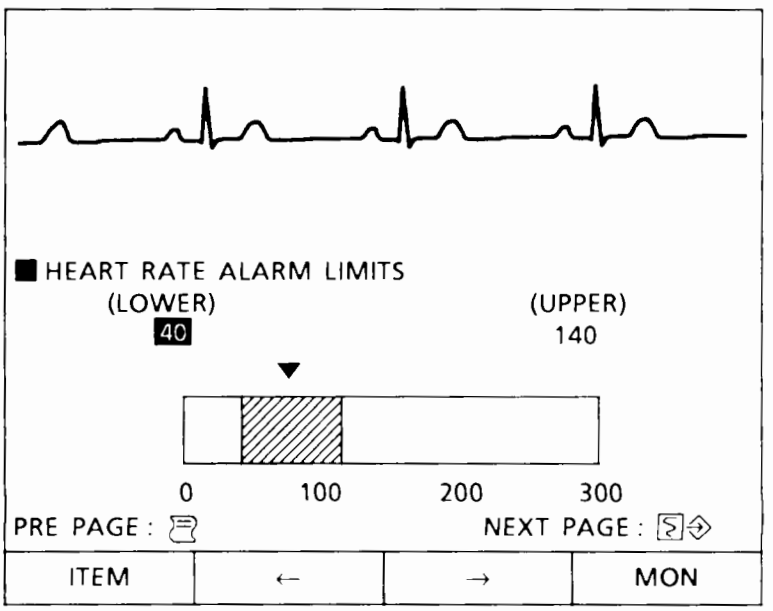
1. Turn the ENERGY/MODE SELECT control to the MON position.





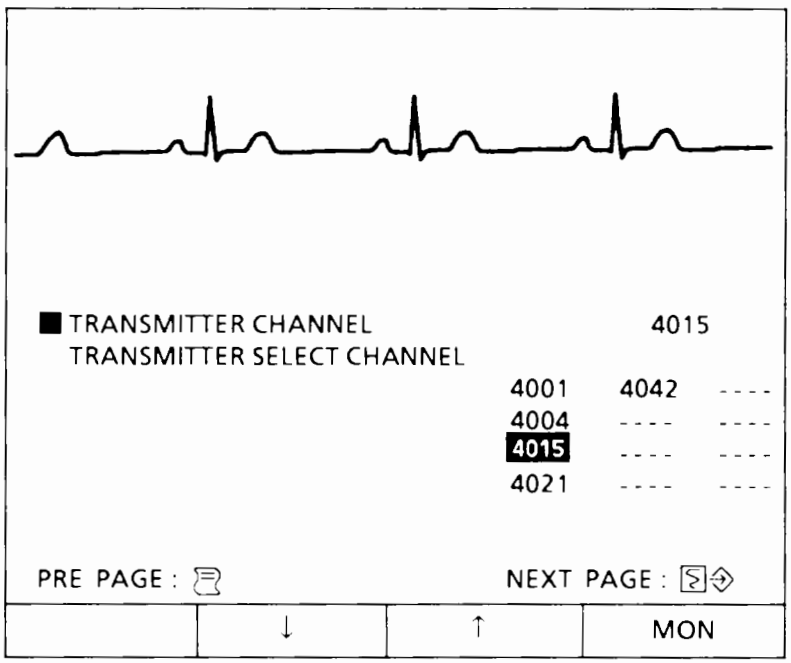
2. Press the Setup key on the front panel.

3. The Setup screen - Heart rate/pulse rate alarm limits appears.



Setup screen - Heart rate/pulse rate alarm limits

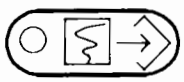
When the optional ZR-751VK Telemetry receiver is installed, the Setup screen - Telemetry appears.



Setup screen - Telemetry

To change the setting for the selected item, press the ON, OFF,↑, ↓, ←, or → function key.
To select the next item, press the ITEM function key.

To go to the previous screen, press the Report key.



To go to the next screen, press the Event key.

You can select defibrillation or pacing mode by turning the ENERGY/MODE SELECT control to DISARM to 360 J or PACING position.

4. Press the MON function key to return to the monitoring screen.

2-5-3 System Setup screen

2-5-3-1 About the System Setup Screen

The System Setup screen has two pages. You can change the hardware settings and check the hardware of the instrument.

System Setup (A) screen

SYSTEM SETUP (A)		
1. UNIT NO.	XXXXX	
2. ALARM LIMITS	LATEST	DEFAULT
3. POWER ON LEAD	PADDLE	II TELE
4. ECG LEADS	3 LEADS	5 LEADS
5. MODE AFTER CV	SYNC	DEFIB
6. TELEMETRY		
7. SWEEP SPEED (mm/s)	25	50
8. USE TEST LEAD		YES
9. ALARM BEEPING	CONTINUOUS	

ITEM	↓	↑	NEXT

System Setup (B) screen

SYSTEM SETUP (B)			
1. BATTERY TEST			
2. HV CAPACITOR TEST			
3. RECORDER TEST			
4. FIELD STRENGTH CHECK			
5. REPORT HISTORY			
6. DELAYED RECORDING	ON		
7. PAPER SPEED (mm/s)	5	25	50
8. RECORD ON ALARM	OFF		
9. RECORD ON CHARGING	ON		
10. RECORD CAL WAVE	OFF		
11. REPORT DATA	ALL	LATEST	
12. DATE FORMAT	DD/MMM/YY		
13. SYSTEM INITIALIZE			

ITEM	EXEC		NEXT

2-5-3-2 Setting and Checking Items

The default settings are underlined.

UNIT NO.

This sets the unit number for the defibrillator. Up to five alphanumeric characters can be entered. The unit no. is printed on all recordings for instrument identification.

ALARM LIMITS

This selects whether or not to change all alarm limits settings to default settings when the power is turned on.

DEFAULT: Changes the settings to the default settings when the power is turned on.
LATEST: No setting changes when the power is turned on. The previously selected settings are used.

POWER ON LEAD

This selects the ECG source lead to acquire the ECG waveforms when the power is turned on.

PADDLE Selects paddle lead. The ECG waveforms are acquired with the external paddles, internal paddles, or disposable pads.
II Selects lead II. The ECG waveforms are acquired with the ECG monitoring electrodes (disposable electrodes) through the ECG connection cable.
TELE Selects the ECG waveforms acquired with the transmitter.

NOTE

- **When TELE is selected, if the transmitter is not turned on, the paddle lead is automatically selected.**
- **When pacing mode is selected, lead II is automatically selected.**

ECG LEADS

This selects the 3 or 5 ECG electrode leads.

3 LEADS When 3 ECG electrode leads is selected, lead I, II or III can be selected by the ECG lead key.
5 LEADS When 5 ECG electrode leads is selected, lead I, II, III, aVR, aVL, aVF or V can be selected by the ECG lead key.

MODE AFTER CV (Cardioversion)

This selects whether synchronized cardioversion mode is turned off or continued after synchronized cardioversion is performed.

DEFIB Automatically changes from synchronized cardioversion mode to defibrillation mode after synchronized cardioversion is performed.
SYNC Continues synchronized cardioversion mode until the Synchronization key on the front panel is pressed.

TELEMETRY

This selects the channel group and available channels when the optional ZR-751VK Telemetry receiver is installed. To select the channel group and available channels, refer to Section 2-9 "Selecting the Channel Group and Available Channels".

SWEEP SPEED (mm/s)

NOTE

This setting is only available on TEC-7511 and TEC-7521 when the ZR-751VK Telemetry receiver or AL-751VK SpO_2 unit is not installed.

This selects 25 mm/s or 50 mm/s sweep speed on the display.
The default setting is 25 mm/s.

USE TEST LEAD

This selects whether or not TEST can be selected with the ECG lead key.
YES: TEST is available.
NO: TEST is not available.

ALARM BEEPING

This selects the type of the vital alarm beeping sound.
CONTINUOUS: beeps continuously
PERIODIC: beeps for 3 seconds once every 30 seconds

BATTERY TEST

This checks the battery performance to confirm safe battery operation. To check the battery, refer to Section 8-6 "Checking the Battery".

HV CAPACITOR TEST

This checks the performance of the HV (high voltage) capacitor to charge the defibrillation energy. To check the capacitor, refer to Section 8-7 "Checking the High Voltage Capacitor".

RECORDER TEST

This checks the built-in recorder with preset waveforms and alphanumeric characters. To check the recorder, refer to 8-8 "Checking the Recorder".

FIELD STRENGTH CHECK

NOTE

Field Strength Check appears only when the optional ZR-751VK Telemetry receiver is installed.

This shows the field strength of the receiving signal of the selected channel. To check the field strength, refer to Section 8-9 "Checking the Field Strength".

REPORT HISTORY

This records the following information for maintenance. The unit no. and date and time are also recorded.

- Up to 30 of the latest error messages
- Number of HV capacitor charges after shipment.
- Up to latest six battery test results
- The latest HV capacitor check results

DELAYED RECORDING

This selects whether real time or delayed waveforms are recorded in manual recording.

ON: Four seconds delayed waveforms are recorded.
OFF: Real time waveforms are recorded.

PAPER SPEED

NOTE

50 mm/s paper speed is only available on TEC-7511 and TEC-7521 when the optional ZR-751VK Telemetry receiver or AL-751VK SpO_2 unit is not installed.

This selects the recording speed in delayed or real time manual recording.
5: 5 mm/s paper speed
25: 25 mm/s paper speed
50: 50 mm/s paper speed

RECORD ON ALARM

This selects whether or not to perform the automatic recording when heart rate, pulse rate or SpO_2 (%) exceeds the selected alarm limit.

ON: Performs the automatic recording.
OFF: Does not perform the automatic recording.

RECORD ON CHARGING

This selects whether or not to perform the automatic recording when the energy charge for defibrillation is started.

ON: Performs the automatic recording.
OFF: Does not perform the automatic recording.

RECORD CAL WAVE

This selects whether or not a calibration waveform is automatically recorded at the beginning of every manual recording.

ON: Calibration waveform is recorded.
OFF: No calibration waveform is recorded.

REPORT DATA

This selects the data for the report recording.

ALL: All Summary report data saved in internal memory is recorded.
LATEST: Only the latest Summary report data (Event data, Defibrillation recording) is recorded.

DATE FORMAT

This selects date format for recording.

Format	Example
YY/MM/DD	96/05/14
MMM/DD/YY	MAY/14/96
DD/MMM/YY	14/MAY/96
YYYY/MM/DD	1996/05/14
MMM/DD/YYYY	MAY/14/1996
DD/MMM/YYYY	14/MAY/1996

SYSTEM INITIALIZE

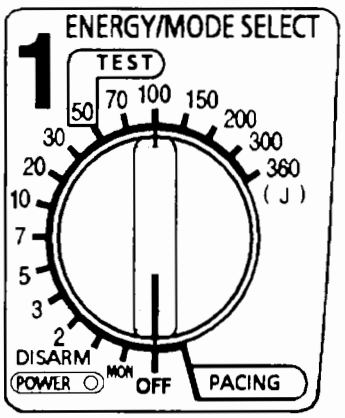
This changes all settings in the Setup screen and System Setup screen to the default settings.

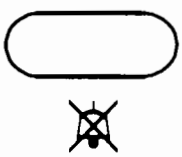
NOTE

The currently selected transmitter channel in the Setup screen, channel group and available channels in the System Setup screen are not changed.

2-5-3-3 Calling Up the System Setup Screen and Setting

1. Turn the ENERGY/MODE SELECT control to the OFF position.





2. Press and hold down the Alarm suspend key and turn the ENERGY/MODE SELECT control to the MON position.

When the System Setup (A) screen appears, release the Alarm suspend key.

SYSTEM SETUP (A)		
1. UNIT NO.	XXXXX	
2. ALARM LIMITS	LATEST	DEFAULT
3. POWER ON LEAD	PADDLE	II TELE
4. ECG LEADS	3 LEADS	5 LEADS
5. MODE AFTER CV	SYNC	DEFIB
6. TELEMETRY		
7. SWEEP SPEED (mm/s)	25	50
8. USE TEST LEAD		YES
9. ALARM BEEPING	CONTINUOUS	

ITEM	↓	↑	NEXT

To change the setting, use the ON, OFF, ↑, ↓, ←, or → function key.

To execute the hardware check, press the EXEC function key.

When the settings can be printed, the PRINT function key appears.
To print the settings, press this key.
To cancel printing, press this key again.

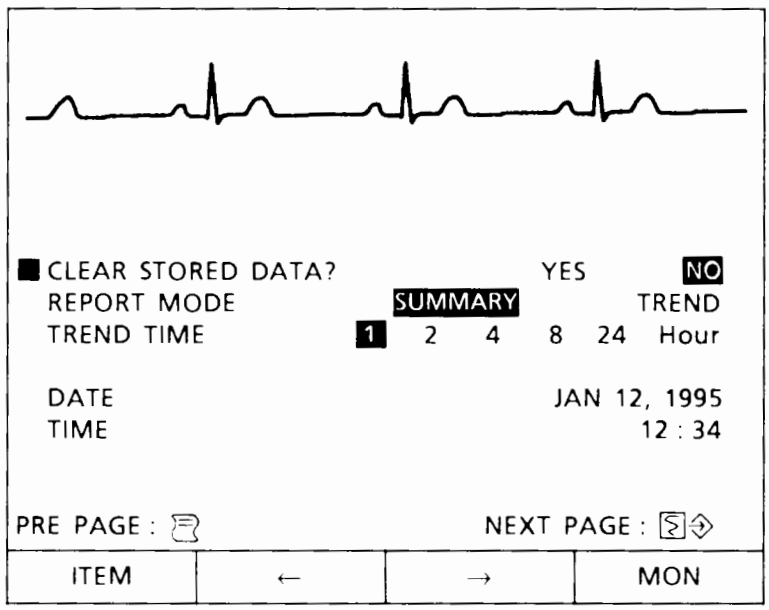
To select an item, press the ITEM function key.

To call up the System Setup (B) or (A) screen, press the NEXT function key.

3. Turn the ENERGY/MODE SELECT control to the OFF position to turn the power off.

2-6 Setting the Date and Time

1. From the Setup screen, press the Report key until the Setup screen - Recording appears.



Setup screen - Recording

2. Press the ITEM function key to select "DATE".
3. Select the month, day or year with the ITEM function key.
4. Change the setting with the ↓ or ↑ function key.
5. Press the ITEM function key to select "TIME".
6. Select the hour or minute with the ITEM function key.
7. Change the setting with the ↓ or ↑ function key. When the minute is set, the clock starts counting from 0 seconds.

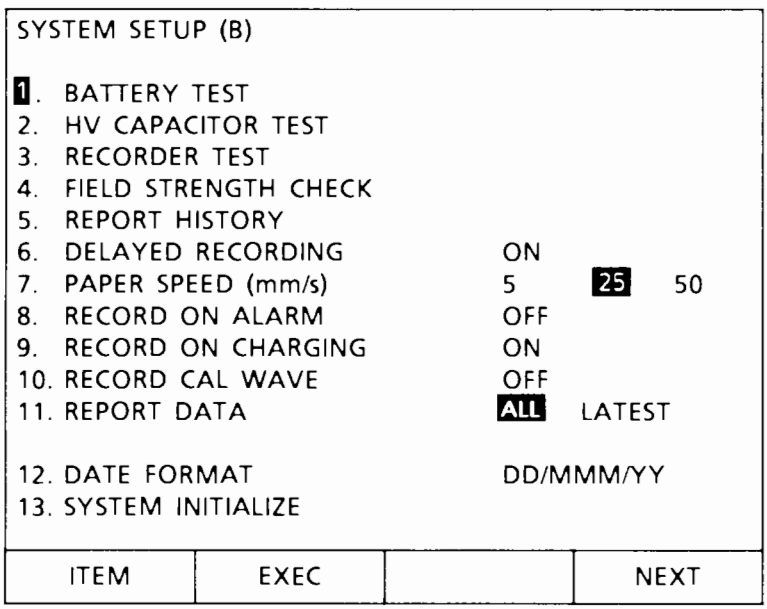
   To return to the monitoring screen, press the MON function key.

2-7 Selecting the Date Format for Recording

You can select the date format for recording from the following formats.

Format	Example
YY/MM/DD	97/05/14
MMM/DD/YY	MAY/14/97
DD/MMM/YY	14/MAY/97
YYYY/MM/DD	1997/05/14
MMM/DD/YYYY	MAY/14/1997
DD/MMM/YYYY	14/MAY/1997

1. From the System Setup (A) screen, press the NEXT function key. The System Setup (B) screen appears.



2. Press the ITEM function key until "DATE FORMAT" is selected.

3. Select the date format with the ← or → function key.

   To return to the System Setup (A) screen, press the NEXT function key.

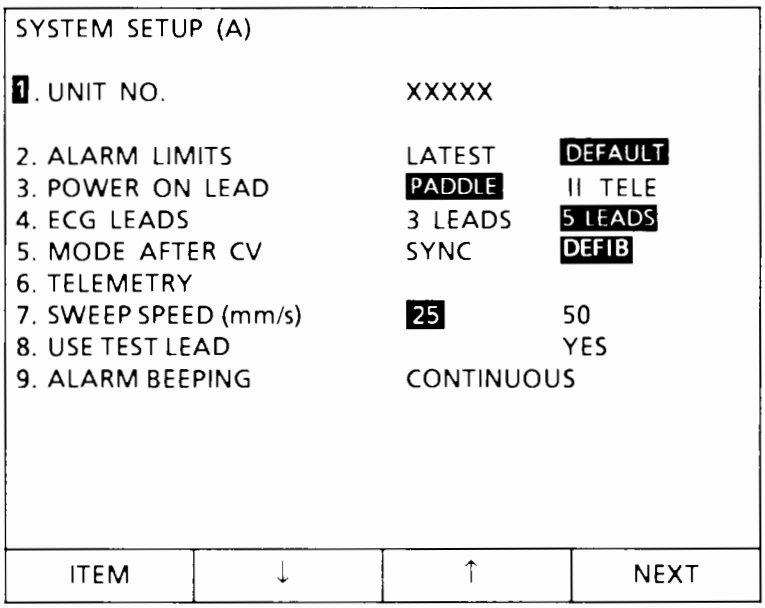
   To turn the power off, turn the ENERGY/MODE SELECT control key to the OFF position.

This setting is saved after the power is turned off.

2-8 Setting the Unit Number

You can assign individual unit numbers to different TEC-7500 series defibrillators.

1. From the System Setup (A) screen, press the ITEM function key to select the digit in "UNIT NO." The selected digit is highlighted.



2. Press the ↑ or ↓ function key. "0" appears on the selected digit. By pressing ↑ or ↓ function key, an alphanumeric character changes from 0 to 9, A to Z and " " (space).

3. When the desired alphanumeric character appears, press the ITEM function key. The next digit is highlighted.

4. Repeat steps 2 to 3 for all digits.

   To turn the power off, turn the ENERGY/MODE SELECT control to the OFF position.

This setting is saved after the power is turned off.

2-9 Selecting the Channel Group and Available Channels

When the optional ZR-751VK Telemetry receiver is installed, select the channel group and available channels according to the channel number of the transmitter.

◆When Using Channel "1001" to "6079"

When using channel "8001" to "8177" or "A000" to "C0FE", refer to page 2.18.

1. From the System Setup (A) screen, press the ITEM function key until "TELEMETRY" is selected.

SYSTEM SETUP (A)

1. UNIT NO.	XXXXX	
2. ALARM LIMITS	LATEST	DEFAULT
3. POWER ON LEAD	PADDLE	II TELE
4. ECG LEADS	3 LEADS	5 LEADS
5. MODE AFTER CV	SYNC	DEFIB
6. TELEMETRY		
7. SWEEP SPEED (mm/s)	25	50
8. USE TEST LEAD		YES
9. ALARM BEEPING	CONTINUOUS	

ITEM	↓	↑	NEXT

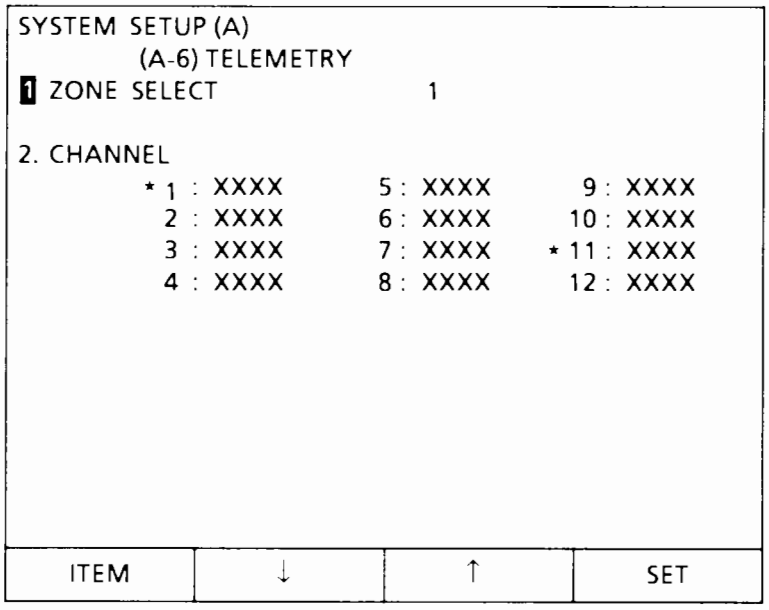
To select another item press the ITEM function key. The cursor appears on the next item number.

2. Press the EXEC function key. The following function keys appear.

EXEC		CANCEL	

To cancel selecting the channel, press the CANCEL function key.

3. Press the EXEC function key. The following screen appears.



To return to the System Setup (A) screen, press the SET function key.

4. Press the ITEM function key to select "ZONE SELECT". The following function keys appear.

5. Select the ZONE from 1 to 6 with ↓ or ↑ function key. The selected ZONE appears beside "ZONE SELECT". The twelve channels are automatically selected.

6. Press the ITEM function key to move the cursor to "CHANNEL".

7. Press the ITEM function key to move the cursor to the desired channel column.

8. Press the ↑ or ↓ function key to change the channel number.

Band	Selectable channels
1	1001 to 1078
2	2001 to 2093
3	3001 to 3039
4	4001 to 4079
5	5001 to 5079
6	6001 to 6079

9. Repeat steps 7 to 8 for the desired column.

NOTE

- **The "—" in the column indicates that no channels is selected .**
- **Channels can only be changed within the same channel group.**
- **When channels which may interfere with each other are set, "*" marks appear beside all channels which may interfere.**
- **To cancel these settings, turn the power off before pressing the SET function key.**

To save these settings, press the SET function key. Then screen returns to the System Setup (A) screen.

To turn the power off, turn the ENERGY/MODE SELECT control to the OFF position.

◆When Using Channel "8001" to "8177" or "A000" to "C0FE"

1. From the System Setup (A) screen, press the ITEM function key until "TELEMETRY" is selected.

SYSTEM SETUP (A)		
1. UNIT NO.	XXXXX	
2. ALARM LIMITS	LATEST	DEFAULT
3. POWER ON LEAD	PADDLE	II TELE
4. ECG LEADS	3 LEADS	5 LEADS
5. MODE AFTER CV	SYNC	DEFIB
6. TELEMETRY		
7. SWEEP SPEED (mm/s)	25	50
8. USE TEST LEAD		YES
9. ALARM BEEPING	CONTINUOUS	

ITEM	↓	↑	NEXT

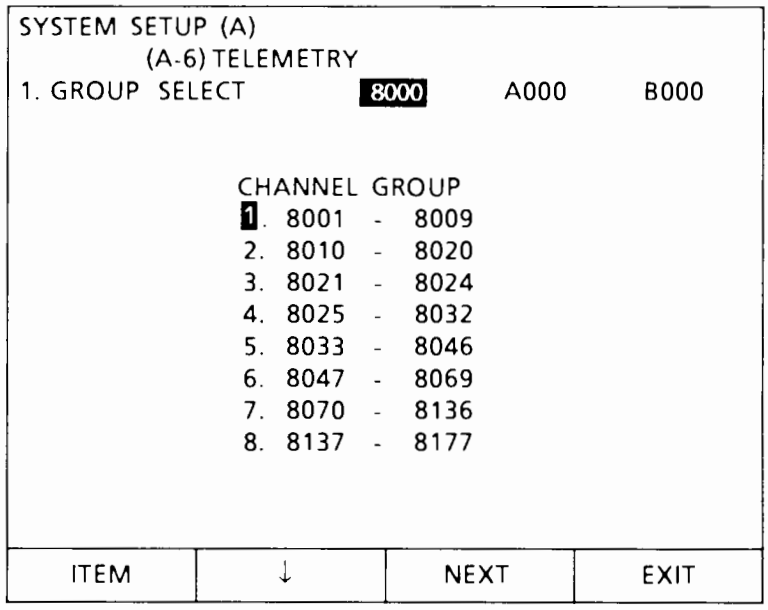
To select another item press the ITEM function key. The cursor appears on the next item number.

2. Press the EXEC function key. The following function keys appear.

EXEC		CANCEL	

To cancel selecting the channel, press the CANCEL function key.

3. Press the EXEC function key. The following screen appears.



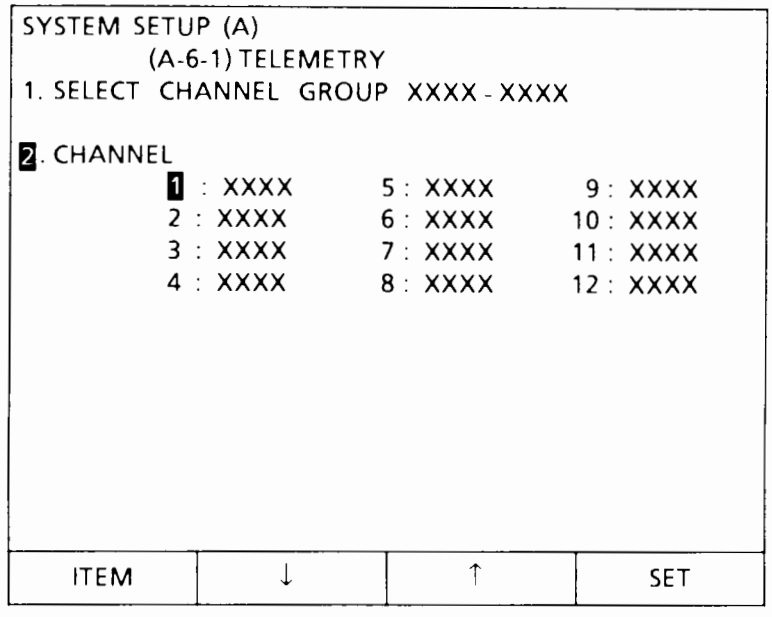
To return to the System Setup (A) screen, press the EXIT function key.

4. Press the ITEM function key to select the GROUP from "8000", "A000", or "B000". The selected GROUP is highlighted and the channel groups of selected GROUP are displayed.

5. Press the ↓ function key to select the channel group.

GROUP	8000	A000	B000
Channel group	8001 - 8009	A000 - A1FE	B000 - B1FE
	8010 - 8020	A100 - A2FE	B100 - B2FE
	8021 - 8024	A200 - A3FE	B200 - B3FE
	8025 - 8032	A300 - A4FE	B300 - B4FE
	8033 - 8046	A400 - A5FE	B400 - B5FE
	8047 - 8069	A500 - A6FE	B500 - B6FE
	8070 - 8136	A600 - A7FE	B600 - B7FE
	8137 - 8177	A700 - A8FE	B700 - B8FE
		A800 - A9FE	B800 - B9FE
		A900 - AAFE	B900 - BAFE
		AA00 - ABFE	BA00 - BBFE
		AB00 - ACFE	BB00 - BCFE
		AC00 - ADFE	BC00 - BDFE
		AD00 - AEFE	BD00 - BEFE
		AE00 - AFFE	BE00 - BFFE
		AF00 - B0FE	BF00 - C0FE

6. Press the NEXT function key. The following screen appears and the selected channel group appears beside "SELECT CHANNEL GROUP".



7. Press the ITEM function key to move the cursor to the desired channel column.

8. Press the ↓ or ↑ function key to select the channel number.

9. Repeat steps 7 to 8 for the desired column.

NOTE

- **The "—" in the column indicates that no channels is selected .**
- **Channels can only be changed within the same channel group.**
- **When channels which may interfere with each other are set, "*" marks appear beside all channels which may interfere.**
- **To cancel these settings, turn the power off before pressing the SET function key.**

To save these settings, press the SET function key. Then screen returns to the System Setup (A) screen.

To turn the power off, turn the ENERGY/MODE SELECT control to the OFF position.

SECTION 3

DEFIBRILLATION AND SYNCHRONIZED CARDIOVERSION

3-1 About Defibrillation and Synchronized Cardioversion

This section explains the procedures to perform defibrillation and synchronized cardioversion with the external paddles, disposable pads and internal paddles.

NOTES

- **Disposable pads and internal paddles are available only for TEC-7521 and TEC-7531 Defibrillator.**
- **Defibrillation is not available when a Setup or System Setup screen is displayed.**

Initial settings on the System Setup screen and Setup screen must be changed before defibrillation and synchronized cardioversion. To change these settings refer to Section 3-3 for defibrillation and Section 4-4 for ECG monitoring.

All other defibrillation and cardioversion settings can be changed at any time without interrupting defibrillation.

When energy charge is started, the defibrillator automatically starts ECG recording and a defibrillation report is automatically created and saved in memory. (Automatic defibrillation report may be turned off, if desired.) After defibrillation this report can be recorded as a summary report as explained in Section 6-2-2 "Recording a Summary Report". For manual recording refer to Section 6-2-1 "Manually Recording ECG and Pulse Waveforms" and for automatic recording refer to Section 6-3-1 "Defibrillation Recording".

3-2 Important Safety Information

WARNING

- Do not perform defibrillation while using an ESU (electrical surgical unit). Remove all electrodes from the patient, turn the defibrillator power off and disconnect the AC power cord from the defibrillator. Failure to follow this warning may cause serious electrical burn, shock, or other injury.
- Before defibrillation, make sure that no one is in contact with either the patient or any equipment which supports or is connected to the patient. Failure to follow this warning may cause serious electrical shock or injury to surrounding staff.
- The defibrillator must be only operated by trained and qualified medical personnel.

CAUTION

Do not put gauze moistened with physiological saline solution on the paddle holder. This may cause rusting of the electrode plate of the external paddle and test electrode.

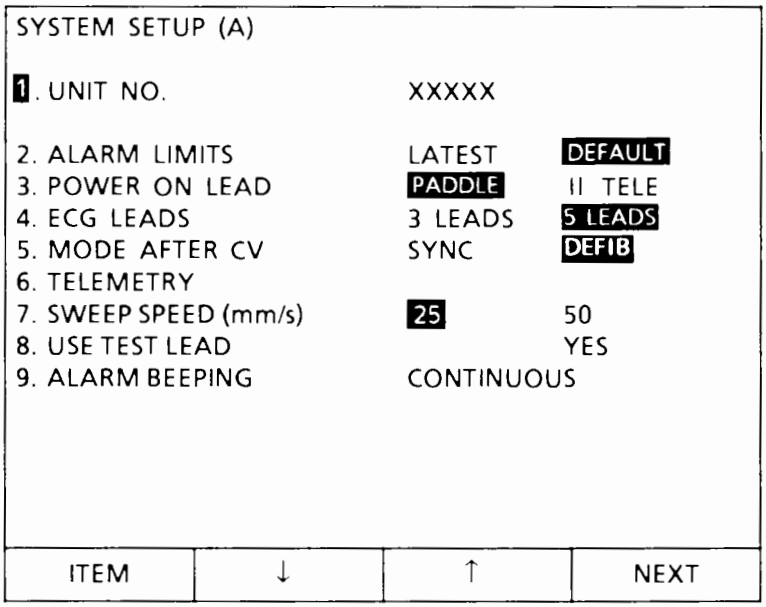
NOTE

Defibrillation and Pacing are not available when the Setup or System Setup screen is displayed.

3-3 Changing Defibrillation Settings

3-3-1 Changing the Default Power On ECG Lead

1. From the System Setup (A) screen, press the ITEM function key until "POWER ON LEAD" is selected.



2. Select "PADDLE", "II" or "TELE" with the ← or → function key. The default setting is PADDLE.

PADDLE:	Selects the paddle lead. The ECG waveforms are acquired with the external paddles, internal paddles, or disposable pads.
II:	Selects lead II. The ECG waveforms are acquired with the ECG monitoring electrodes (disposable electrodes).
TELE:	Selects the ECG waveforms acquired with a transmitter.

NOTE

- **If the optional ZR-751VK Telemetry receiver is not installed, when "TELE" is selected, the paddle lead is automatically selected.**
- **When pacing mode is selected, lead II is automatically selected.**

To turn the power off, turn the ENERGY/MODE SELECT control to the OFF position.

This setting is saved after the power is turned off.

3-3-2 Using the ECG Waveforms from Another Instrument for Synchronized Cardioversion

The TEC-7500 does not have provision for accepting an externally applied synchronizing signal.

When the patient is already connected to another monitor, it may be possible to use the ECG signal from the monitor, however, this is not recommended. If you use the ECG signal from another monitor, the following conditions must be met.

CAUTION

The external instrument must comply with the IEC60601-1 safety standard and CISPR 11 Second Edition 1990-09, Group 1 and Class B standard.

WARNING

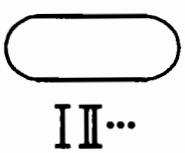
For safe synchronized cardioversion, a defibrillator discharge must occur within 60 ms of the peak of the ECG's R wave. The TEC-7500 detects the peak of the R wave and effects the discharge within 25 ms of the detected peak of R wave. When an external instrument is used to provide the ECG signal, it must amplify the ECG signal from the patient 500-1000 times and output the amplified ECG signal to the TEC-7500 within 35 ms of the peak of the R wave so that the overall delay from the peak of the R wave to discharge does not exceed 60 ms. If these conditions are not met, the cardioversion may be ineffective or may cause ventricular fibrillation.

NOTE

When receiving the ECG signal from a bedside monitor, select lead II or I on the bedside monitor.

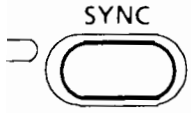
Use the following procedure to check whether synchronized cardioversion can be performed with the ECG waveforms from another instrument or not.

1. Connect the defibrillator to the other instrument with the optional JC-751V External ECG cable.
2. Turn the power of the other instrument on.
3. Turn the ENERGY/MODE SELECT control to the DISARM position.
4. Select "AUX" with the ECG lead key.



5. Connect an ECG simulator to the other instrument and turn the simulator on to generate ECG signals.

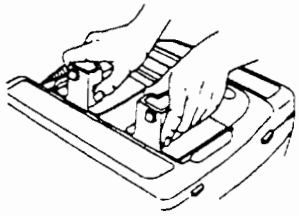
6. Turn the ENERGY/MODE SELECT control to 50 J.



7. Press the SYNC key on the front panel.

8. Check that the " ▼ " mark appears on the rising slope of every QRS waves.

9. Leaving the paddles on their holders, press the CHARGE button on the APEX paddle to start charging.



During charging, a continuous high (pip) tone is generated, a "CHARGING" message appears, and the CHARGE lamps on the APEX paddle and front panel blink.

When charging is completed, a continuous low tone is generated, the "CHARGED" message appears, and the CHARGE lamps light.

10. Simultaneously press and hold both DISCHARGE buttons on the external paddles.

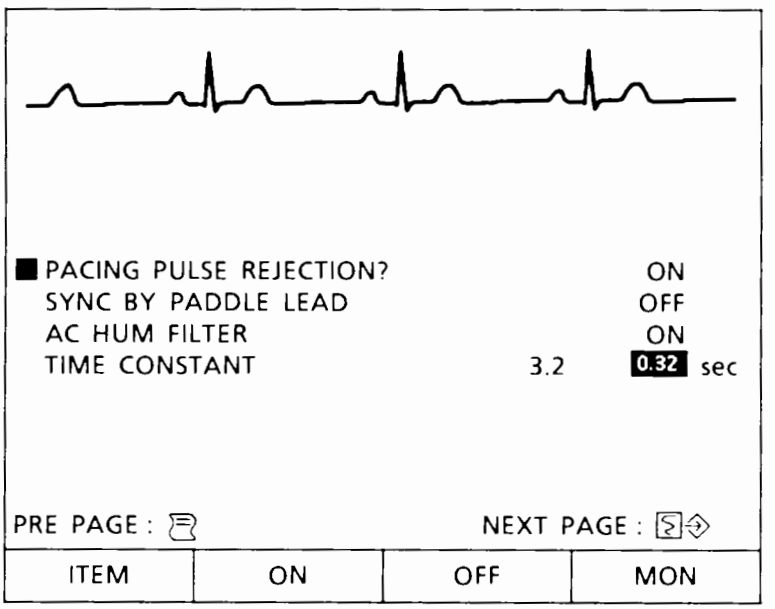
3-3-3 Turning Paddle Synchronization On/Off When Acquiring the ECG Waveforms with the External Paddles or Internal Paddles

WARNING

Because of the potential danger of noise interference, the ECG signal for synchronized cardioversion should be acquired with the ECG monitoring electrodes (disposable electrodes) and the ECG connection cable. Do not use the ECG signal from external or internal paddles for synchronized cardioversion unless it is absolutely necessary.

If stable ECG waveforms are obtained through disposable pads, synchronized cardioversion may be performed with the disposable pads.

1. From the Setup screen, press the Report key until the Setup screen - Defibrillation/monitoring appears.



Setup screen - Defibrillation / monitoring

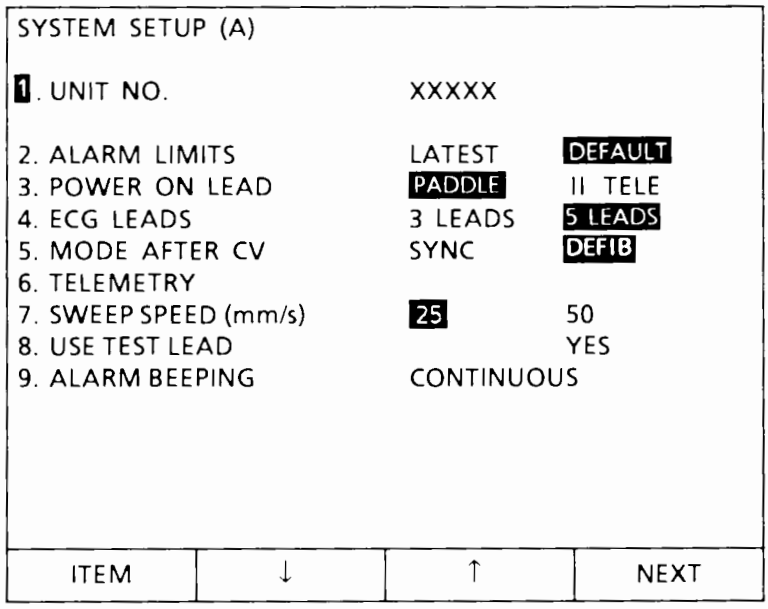
2. Press the ITEM function key until "SYNC BY PADDLE LEAD" is selected.
3. Select the setting with the ON or OFF function key. The default setting is OFF.

   To return to the monitoring screen, press the MON function key.

This setting is saved after the power is turned off.

3-3-4 Selecting the Mode After Synchronized Cardioversion

1. From the System Setup (A) screen, press the ITEM function key until "MODE AFTER CV" is selected.



2. Select the setting with the ← or → function key.

   DEFIB: Automatically changes from synchronized cardioversion mode to defibrillation mode after the synchronized cardioversion is performed.

   SYNC: Continues the synchronized cardioversion mode until the SYNC key is pressed.

   The default setting is "SYNC".

   To turn the power off, turn the ENERGY/MODE SELECT control to the OFF position.

   This setting is saved after the power is turned off.

3-4 Using the Pediatric Electrode Plate

When defibrillating a child, remove the adult electrode plate from the paddle. The pediatric electrode plate is underneath the adult electrode plate.

WARNING

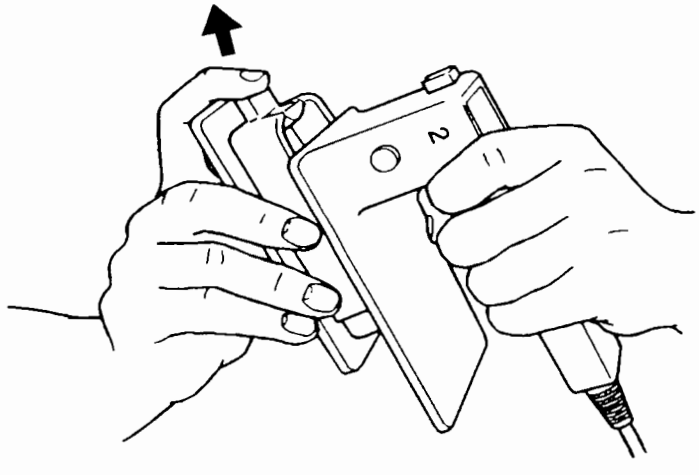
Pay careful attention to the energy selection when using the pediatric electrode plates. Applying high energy with the pediatric electrode plates can cause serious electrical burn because the electrode plates are small.

The current density on the pediatric electrode plates is higher than the current density on the adult electrode plates because the pediatric electrode plates are smaller* than the adult electrode plates. This increases the possibility of electrical burn on the electrode plate placement area. The minimum effective energy should be set.

* The pediatric electrode plates underneath the adult electrode plates are approximately 1/3 the surface area of the adult electrode plates.

To remove the adult electrode plate:

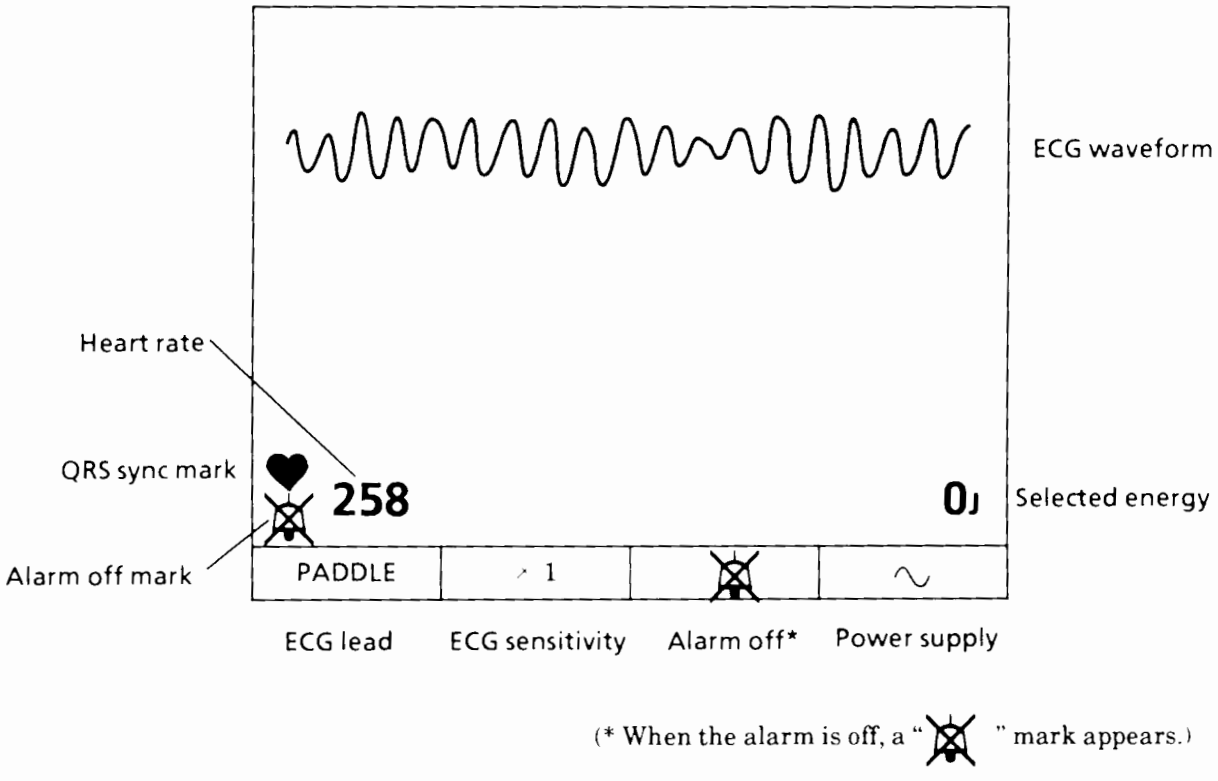
1. Turn the ENERGY/MODE SELECT control to the OFF position.
2. Press the tab of the adult electrode plate to unlock the adult electrode plate.
3. Slide the adult electrode plate forward and off.



3-5 Defibrillation

3-5-1 Information on the Defibrillation Screen

The following information can be displayed on the defibrillation screen.



(* When the alarm is off, a " " mark appears.)

This is the defibrillation screen which appears when neither ZR-751VK Telemetry Receiver nor the AL-751VK SpO_2 Unit is installed.

3-5-2 Defibrillation with the External Paddles

WARNING

Use the ECG monitoring electrodes (disposable electrodes) to monitor the ECG waveforms. If the "PADDLE" (paddle lead) is selected, the acquired ECG waveforms are unstable after discharge. Because polarization voltage is very high.

NOTE

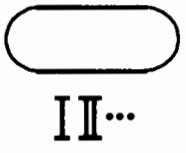
Select the appropriate energy and appropriate size of the external paddles according to the patient. Only use the paddles specified by Nihon Kohden.

1. Check that the external paddles are connected to the defibrillator.
   (The external paddles of TEC-7511 are fixed to the defibrillator.)

2. Turn the power on.

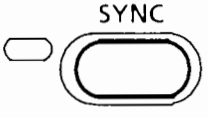
   Turn the ENERGY/MODE SELECT control to the DISARM position to turn the power on.

3. Check the ECG waveforms.



   To get better quality ECG waveforms, use the ECG monitoring electrodes (disposable electrodes) and find the best lead by pressing the ECG lead key. Refer to Section 4-2-3 "Attaching the Electrode to the Patient". The default setting of the ECG lead is "PADDLE" (paddle lead).

   When placing the external paddles on the patient's chest, you can monitor the ECG waveforms.



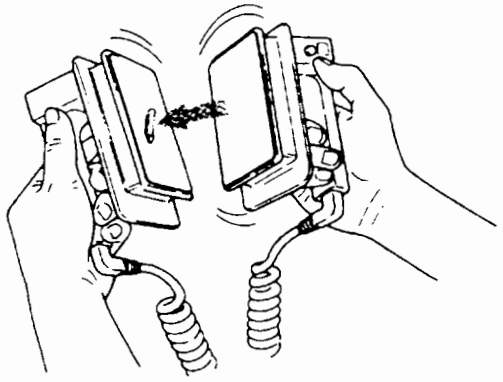
4. Make sure that the defibrillation mode is selected. When the defibrillation mode is selected, the SYNC lamp on the front panel is not lit. If it is lit, press the SYNC key on the front panel to select the defibrillation mode.

5. Prepare the paddles.

WARNINGS

- **Apply contact gel to the surfaces of the external paddles. Failure to follow this instruction causes serious skin burn.**
- **Do not apply contact gel by hand. Failure to follow this warning may cause serious electrical burn, shock, or other injury.**

3) Gently rub the electrode plate surfaces together to evenly spread the gel.



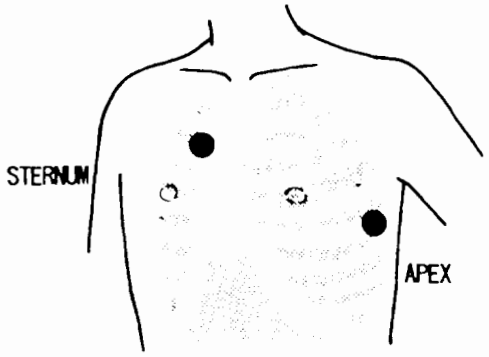
6. Select the energy level.

   Turn the ENERGY/MODE SELECT control to the desired energy position.

7. Place the paddles on the patient.

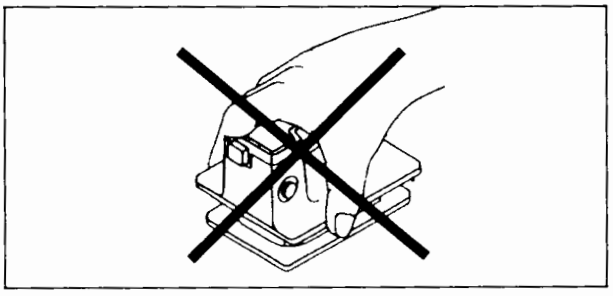
   1) Place the left (STERNUM) paddle on the right edge of second and third intercostal sternum.

   2) Place the right (APEX) paddle on the fifth middle axial line.
   When using the paddle lead, keep the paddles steady.



WARNING

Do not touch the electrode plate or edge of the paddle. Failure to follow this warning may cause serious electrical burn, shock, or other injury.

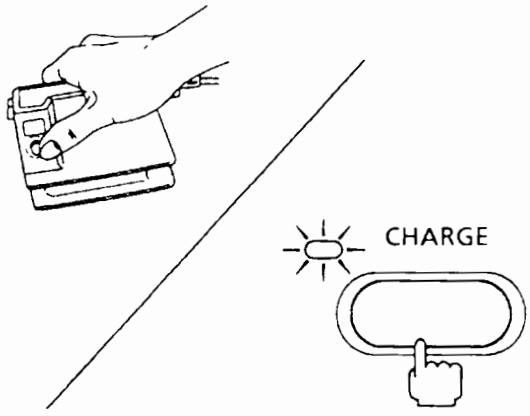


8. Check the ECG waveforms.

   If the patient's ECG requires synchronized cardioversion, follow the procedure described in Section 3-6 "Synchronized Cardioversion"

9. Charge the energy.

   When it is verified that the patient needs defibrillation, press the CHARGE button on the APEX paddle or CHARGE key on the front panel to start charging.



During charging, a continuous high (pip) tone is generated, the "CHARGING" message appears, and the CHARGE lamps on the APEX paddle and front panel blink.

When charging is completed, a continuous low tone is generated, the "CHARGED" message appears, and the CHARGE lamps light.

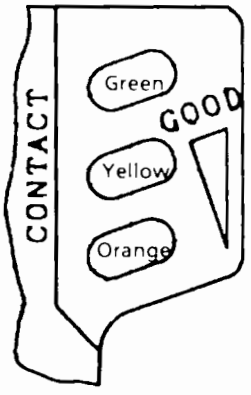
To change the energy level, turn the ENERGY/MODE SELECT control to the desired energy position. The defibrillator starts charging one second after the new energy is selected.

To disarm the charged defibrillator, turn the ENERGY/MODE SELECT control to the DISARM position. The defibrillator immediately discharges itself internally within 20 seconds.

For safety, if the defibrillator is not discharged within 40 seconds after charging, the defibrillator immediately discharges itself internally within 20 seconds.

10. Check the skin-paddle contact impedance.

For TEC-7521 and TEC-7531 defibrillators, the paddle contact indicator on the STERNUM paddle indicates skin-paddle contact impedance. Place the paddles so that the green GOOD lamp lights. Recommended applied pressure is around 10 kg (22 lb.) per paddle.



Lamp	Impedance
Green (GOOD)	0 to 100 Ω
Yellow	100 to 200 Ω
Orange (POOR)	Over 200 Ω

If the GOOD lamp does not light, check the amount of applied contact gel and press the paddles against the patient, gradually increasing the pressure until the GOOD lamp lights.

WARNING

IN CASE OF POOR CONTACT

If the yellow or orange lamp lights, the defibrillator may cause serious electric burn on the patient's skin and poor energy discharge to the patient. In case of an emergency, medical personnel should decide whether to execute defibrillation immediately, regardless of the indicator display, or take action to make good contact before defibrillation.

NOTE

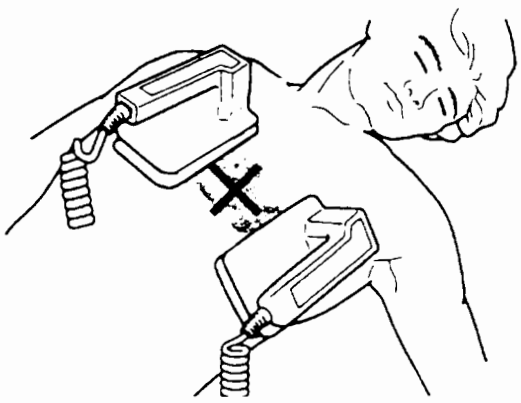
The GOOD lamp may not light for the following patients:

- **Patient with chest hair**
- **Old patient with skin cornification (hardening)**
- **Thin patient**

11. Discharge the energy to the patient.

WARNING

- **Make sure that no one is in contact with either the patient or any equipment which supports or is connected to the patient.**
- **Do not discharge the energy if the paddles are shorted to each other by contact gel. Failure to follow this warning may cause serious electrical burn on the patient skin and poor energy discharge to the patient's heart.**



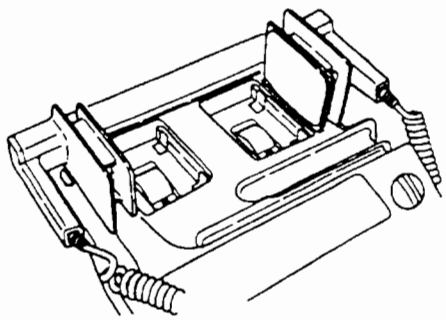
The figure above shows a dangerous situation where the paddle electrodes have been shorted by contact gel.

Simultaneously press both DISCHARGE buttons on the paddles to discharge the energy to the patient.

12. Repeat defibrillation

Repeat steps 6 to 11 if another defibrillation is required, and resume basic life support according to the medical protocols.

Use the edge around each paddle holders to temporarily hold the paddles so that contact gel does not get on the defibrillator. These holders can only be used for the adult electrode plate.



13. After use

1) Turn the ENERGY/MODE SELECT control to the OFF position and disconnect the AC power cord.

2) Wipe the contact gel from the electrode plates and set the paddles in the paddle holder.

CAUTION

Failure to remove contact gel from the electrode plate may cause rusting.

3) Clean the defibrillator and cables as described in Section 8-2-2 "Cleaning the Defibrillator, Cables and Paddles".

4) Return the defibrillator to its storage location and connect it to the AC power to maintain the battery charge.

3-5-3 Defibrillation with Disposable Pads (TEC-7521/TEC-7531 Only)

Disposable pads can only be used with TEC-7521 and TEC-7531.

WARNING

Failure to comply with the following warnings may cause serious skin burn.

- **Do not re-use disposable pads. Pads are disposable.**
- **If the package is broken, dispose of the pads and do not use them. If the pads are used, this may cause serious electrical burn or poor energy discharge to the heart.**
- **Do not use the pads if they are past the expiration date. If expired pads are used, this may cause serious electrical burn or poor energy discharge to the heart.**
- **Use the disposable pads as soon as possible after removing them from the package. If the pads are left for a long period of time after removing them from the package, it may cause serious electrical burn or poor energy discharge to the heart.**
- **Do not attach a pad on a disposable electrode.**
- **Do not attach pads on the patient's chest where there is any ointment.**
- **If pads or their connector get wet, dry them well before use.**
- **Do not use the disposable pads if:**
  - **The gel has become dry, or**
  - **The gel breaks down and releases water.**

  This may cause serious electrical burn or poor energy discharge to the heart.
- **Do not use the P610 or P612 disposable pads if the color of the gel changes to dark brown and dark brown gel is attached to the protective liner. This may cause serious electrical burn or poor energy discharge to the heart.**
- **Do not reuse disposable pads. This may cause serious electrical burn or poor energy discharge to the heart.**

CAUTION

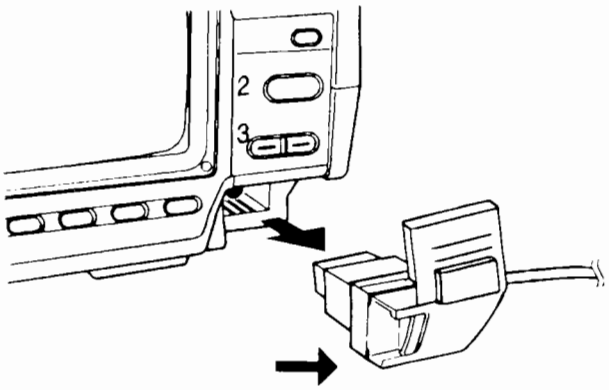
- **Do not use other than the specified disposable pads.**
- **Do not attach disposable pads so that the pads overlap each other. This may cause serious electrical burn.**
- **Do not put anything heavy on the disposable pads or bend the pads. This may damage the pads and cause serious electrical burn.**

NOTE

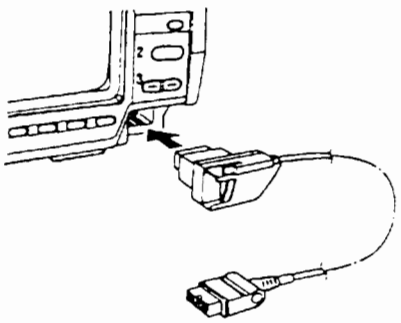
Follow all disposable pad labeling instructions.

1. Connect the pad adaptor to the defibrillator.

   1) Press the paddle release knob of the paddle connector on the right panel and remove the external paddles from the paddle connector.



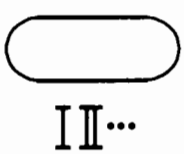
2) Connect the pad adaptor to the paddle connector until it clicks.



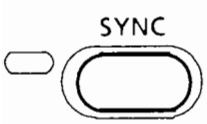
2. Turn the power on.

   Turn the ENERGY/MODE SELECT control to the DISARM position to turn the power on.

3. Check the ECG waveforms.



   The default setting of the ECG lead is "PADDLE" (paddle lead). When the disposable pads are attached to the Apex-Anterior positions, you can monitor the ECG waveforms. When the Apex-Posterior placement is used, use the ECG monitoring electrodes (disposable electrodes) and find the best lead by pressing the ECG lead key. Refer to Section 4-2-3 "Attaching the Electrode to the Patient".

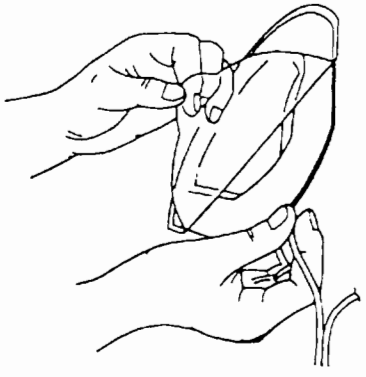


4. Make sure that the defibrillation mode is selected. When the defibrillation mode is selected, the SYNC lamp on the front panel is not lit. If it is lit, the synchronized cardioversion mode is selected. Press the SYNC key to select the defibrillation mode.

5. Prepare the disposable pads.

   1) Clean the patient's chest to remove oil and dirt and allow firm pad contact with the skin. Shave excessive hair, if necessary.

2) Take the disposable pads out of the package and carefully remove the backing from one pad at a time.



WARNING

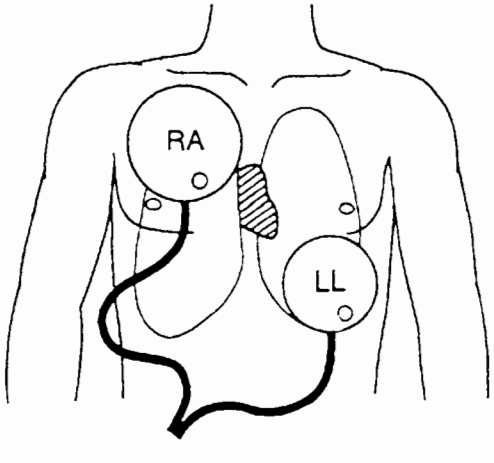
Do not use the P610 or P612 disposable pads if the color of the gel changes to dark brown and dark brown gel is attached to the protective liner. This may cause serious electrical burn or poor energy discharge to the heart.

NOTE

- **Always prepare the second disposable pads before defibrillation. Use the second disposable pads if the gel of the first disposable pads is dry, deteriorated or changes color.**
- **Before attaching the disposable pads to the patient, clean the skin where the pads will be attached. If the skin is moist, use a cotton swab to dry it.**

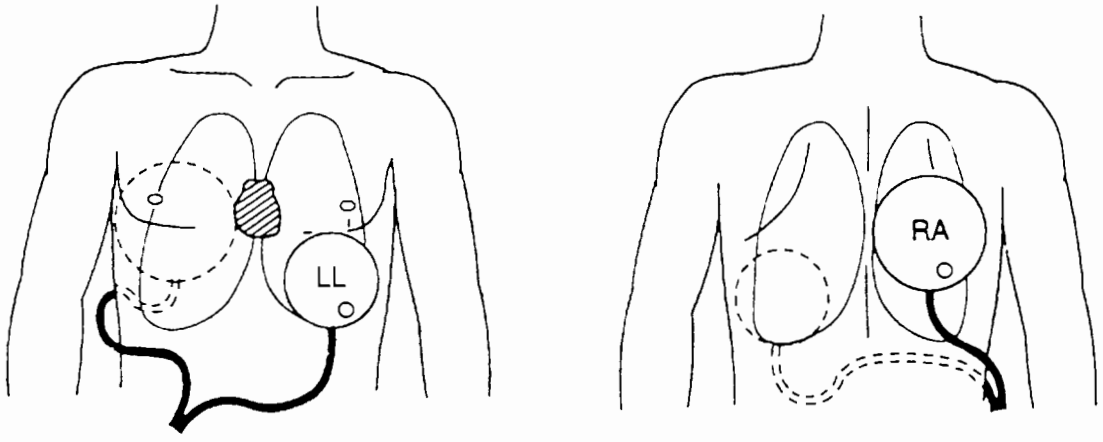
3) Attach the pads to the patient's chest, one at a time.

Apex-Anterior placement



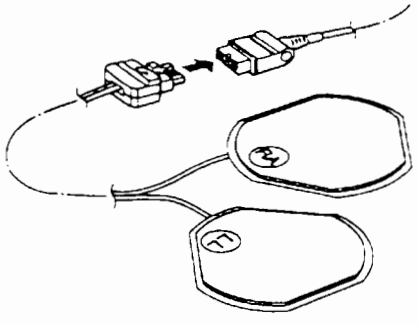
RA: Right edge of the second or third intercostal sternum
LL: Fifth middle axial line

Apex-Posterior placement



RA: Between right scapula and spine
LL: Fifth middle axial line

4) Connect the disposable pads to the pad adaptor.



NOTE

Firmly connect the disposable pads to the pad adapter until the connector of the disposable pads clicks.

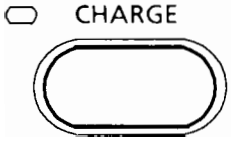
6. Check the ECG waveforms.

   If the patient's ECG requires synchronized cardioversion, follow the procedure described in Section 3-6 "Synchronized Cardioversion".

7. Select the energy level.

   Turn the ENERGY/MODE SELECT control to the desired energy position.

8. Charge the energy.



When it is verified that the patient needs defibrillation, press the CHARGE key on the front panel.

NOTE

If the CHARGE key is pressed when a disposable pad is detached, the "PADDLE LOOSE" message appears and the defibrillator does not start charging. Check that the pads are firmly attached to the patient.

During charging, a continuous high (pip) tone is generated, the "CHARGING" message appears, and the CHARGE lamp on the front panel blinks.

NOTE

If a disposable pad is detached during or after charging, the "PADDLE LOOSE" message appears and the defibrillator immediately discharges itself internally within 20 seconds. Check that the pads are firmly attached to the patient.

When charging is completed, a continuous low tone is generated, the "CHARGED" message appears, and the CHARGE lamp lights.

To change the energy level, turn the ENERGY/MODE SELECT control to the desired energy position. The defibrillator starts charging one second after the new energy is selected.

To disarm the charged defibrillator, turn the ENERGY/MODE SELECT control to the DISARM position. The defibrillator immediately discharges itself internally within 20 seconds.

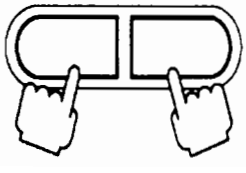
For safety, if the defibrillator is not discharged within 40 seconds after charging, the defibrillator immediately discharges itself internally within 20 seconds.

9. Discharge the energy to the patient

WARNING

- **Make sure that no one is in contact with either the patient or any equipment which supports or is connected to the patient.**
- **Do not discharge the energy if the disposable pads are shorted to each other. Failure to follow this warning may cause serious electrical burn on the patient heart and poor energy discharge to the patient's heart.**
- **Before defibrillation, make sure that the paddles are firmly applied to the patient chest. Failure to follow this warning may cause serious electrical burn or poor energy discharge to the heart.**

DISCHARGE — Simultaneously press the two DISCHARGE keys on the front panel.



10. Repeat defibrillation

    Repeat steps 6 to 9 if another defibrillation is required, and resume basic life support according to the medical protocols.

11. After use

    1) Turn the ENERGY/MODE SELECT control to the OFF position and disconnect the AC power cord.

    2) Clean the defibrillator as described in Section 8-2-2 "Cleaning the Defibrillator, Cables and Paddles".

    3) Press the paddle release knob of the paddle connector on the right panel and remove the pad adaptor from the paddle connector.

    4) Connect the external paddles to the paddle connector until it clicks.

    5) Return the defibrillator to its storage location and connect it to the AC power to maintain the battery charge.

3-5-4 Defibrillation with the Internal Paddles (TEC-7521/TEC-7531 Only)

Internal paddles can only be used with TEC-7521 and TEC-7531.

WARNING

- **Always sterilize the internal paddles before use. Failure to follow this warning may cause serious infection. For sterilization, refer to 8-3-1 "Sterilizing the Paddles".**
- **Use the ECG monitoring electrodes (disposable electrodes) to monitor the ECG waveforms. If the "PADDLE" (paddle lead) is selected, the acquired ECG waveforms are unstable after discharge. Because polarization voltage is very high.**
- **Pay careful attention to the energy selection when using internal paddles. Applying high energy to the heart may cause cardiac muscle necrosis.**

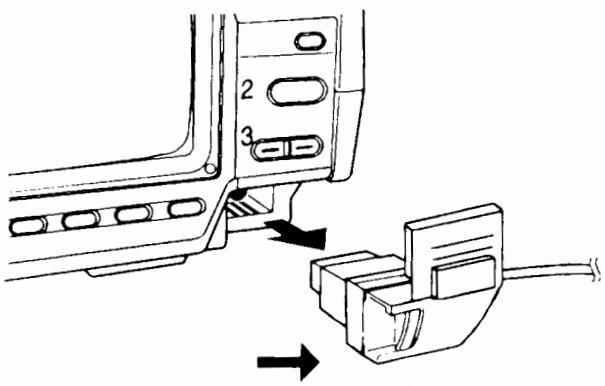
NOTE

Select the appropriate energy and appropriate size of the internal paddles according to the patient. Only use the paddles specified by Nihon Kohden.

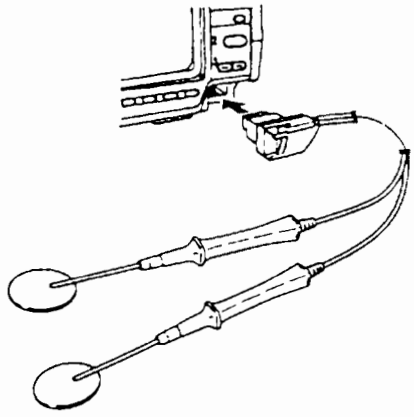
Defibrillation should be performed with the minimum effective energy. It is reported that the cardiac muscle may necrose if high energy is repeatedly applied to the heart with internal paddles. See page 9.12 for references.

1. Connect the internal paddles to the defibrillator.

   1) Press the paddle release knob of the paddle connector on the right panel and remove the external paddles from the paddle connector.



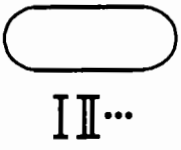
2) Connect the connector of the internal paddles to the paddle connector until it clicks.



2 Turn the power on.

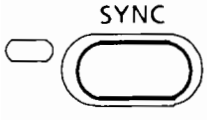
Turn the ENERGY/MODE SELECT control to the DISARM position to turn the power on.

3. Check the ECG waveforms.



When monitoring the ECG waveforms with the defibrillator using the ECG monitoring electrodes, press the ECG lead key to select lead I, II, or III and find the best lead. The default ECG lead setting is "PADDLE" (paddle lead).

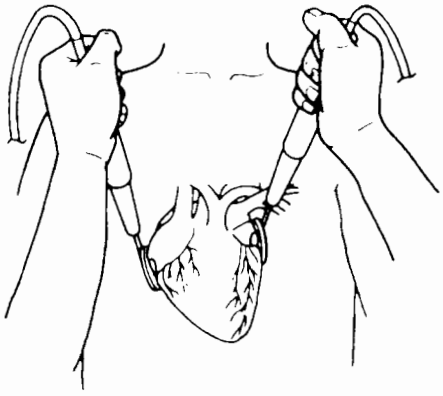
If the patient's ECG requires synchronized cardioversion, follow the procedure in Section 3-6 "Synchronized Cardioversion".



4. Make sure that the defibrillation mode is selected. When the defibrillation mode is selected, the SYNC lamp on the front panel is not lit. If it is lit, press the SYNC key on the front panel to select the defibrillation mode.

5. Position the internal paddles.

Position the sterilized internal paddles against the right and the left atria of the heart.



NOTE

- **It is not necessary to consider the polarities of the internal paddle electrodes.**
- **In order to get better contact between the internal paddles and heart, place sterilized gauze moistened with physiological saline solution between each internal paddle and the heart.**

6. Select the energy level.

   Turn the ENERGY/MODE SELECT control to the desired energy position.

   When the internal paddles are used, 50 J or below can be selected. If above 50 J is selected, the "SET ENERGY BELOW 50 J" message appears and the selected energy cannot be charged.

7. Charge the energy.

CHARGE

Press the CHARGE key on the front panel to start charging.

During charging, a continuous high (pip) tone is generated, the "CHARGING" message appears, and the CHARGE lamp on the front panel blinks.

When charging is completed, a continuous low tone is generated, the "CHARGED" message appears, and the CHARGE lamp lights.

NOTE

During or after charging, if above 50 J is selected, the defibrillator immediately discharges itself internally.

To change the energy level, turn the ENERGY/MODE SELECT control to the desired energy position. The defibrillator starts charging one second after the new energy is selected.

To disarm the charged defibrillator, turn the ENERGY/MODE SELECT control to the DISARM position. The defibrillator immediately discharges itself internally within 20 seconds.

For safety, if the defibrillator is not discharged within 40 seconds after charging, the defibrillator immediately discharges itself internally within 20 seconds.

8. Discharge the energy to the patient

WARNING

- **Make sure that no one is in contact with either the patient or any equipment which supports or is connected to the patient.**
- **Do not discharge the energy if the paddles are shorted to each other. Failure to follow this warning may cause serious electrical burn on the patient's heart and poor energy discharge to the patient's heart.**

Simultaneously press the two DISCHARGE keys on the front panel to discharge the energy to the patient.

9. Repeat defibrillation

Repeat steps 6 to 8 if another defibrillation is required.

10. After use

1) Turn the ENERGY/MODE SELECT control to the OFF position and disconnect the AC power cord.

2) Clean the defibrillator, cables and paddles as described in Section 8-2 "Cleaning".

3) Press the paddle release knob of the paddle connector on the right panel and remove the internal paddles from the paddle connector.

4) Connect the external paddles to the paddle connector until it clicks.

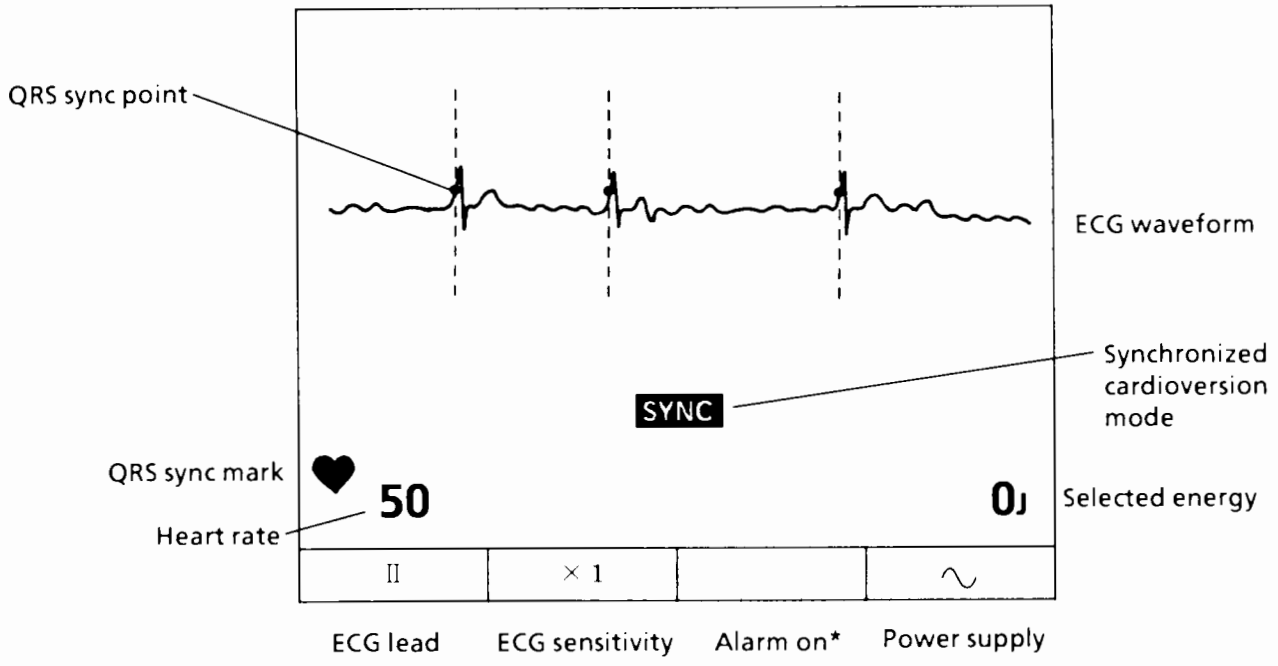
5) Return the defibrillator to its storage location and connect it to the AC power to maintain the battery charge.

6) Sterilize the internal paddles with autoclaving or ethylene oxide gas. Refer to Section 8-3-1 "Sterilizing the Paddles".

3-6 Synchronized Cardioversion

3-6-1 Information on the Synchronized Cardioversion Screen

The following information can be displayed on the synchronized cardioversion screen.



(* When the alarm is off, a " " mark appears.)

This is the synchronized cardioversion screen which appears when neither ZR-751VK Telemetry Receiver nor the AL-751VK SpO_2 Unit is installed.

3-6-2 Synchronized Cardioversion with the External Paddles

WARNING

Use the ECG monitoring electrodes (disposable electrodes) to monitor the ECG waveforms. Do not select "PADDLE" (paddle lead) unless it is absolutely necessary. If "PADDLE" (paddle lead) is selected, accidental discharge occurs which is not synchronized with the patient's QRS wave and the ECG waveforms are unstable after discharge because polarization voltage is very high.

NOTE

Select the appropriate energy and appropriate size of the external paddles according to the patient. Only use the paddles specified by Nihon Kohden.

1. Check that the external paddles are connected to the defibrillator.
(The external paddles of TEC-7511 are fixed to the defibrillator.)

2. Turn the power on.

   Turn the ENERGY/MODE SELECT control to the DISARM position to turn the power on.

3. Prepare the patient to monitor the ECG waveforms with the defibrillator.

   When acquiring the ECG waveforms with the defibrillator, attach the disposable electrodes to the patient. Refer to Section 4-2-3 "Attaching the Electrodes to the Patient".

   When a Nihon Kohden bedside monitor is used, you can use the bedside monitor electrodes and ECG lead.

   1) Disconnect the ECG connection cable from the bedside monitor and disposable electrode lead.

   2) Connect the JC-752V ECG connection cable to the disposable electrode lead and the defibrillator.

   To use the ECG waveforms from another instrument, refer to 3-3-2 "Using the ECG Waveforms from Another Instrument for Synchronized Cardioversion".

4. Select the ECG lead.

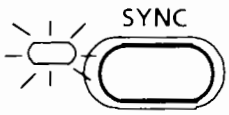
WARNING

- **Do not select "TEST". Failure to follow this warning causes accidental discharge which is not synchronized with the patient's QRS wave.**
- **Do not select "TELE". Synchronized cardioversion cannot be performed with ECG waveforms from the transmitter.**

Press the ECG lead key to select the lead which has the highest QRS wave. The default lead setting is "PADDLE" (paddle lead).

When using the ECG waveforms from another instrument, select "AUX".

5. Select the synchronized cardioversion mode.



1) Press the SYNC key on the front panel to select the synchronized cardioversion mode. The SYNC lamp lights.

2) Check that the "↟" mark appears on the rising slope of every QRS waves. The "↟" mark indicates that the defibrillator detects the QRS wave. If this mark does not appear:
   - Change the amplitude of the ECG waveforms with the ECG sensitivity key.
   - Change the ECG lead with the ECG lead key.
   - Change the electrode position.

6. Prepare the paddles

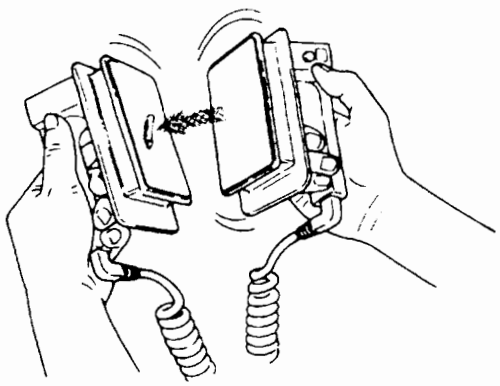
WARNING

- **Apply contact gel to the surfaces of the external paddles. Failure to follow this instruction causes serious skin burn.**
- **Do not apply contact gel by hand. Failure to follow this warning may cause serious electrical burn, shock, or other injury.**

1) Remove the external paddles from their paddle holders by grasping the handles and lifting straight up.

2) Apply contact gel to the electrode plate surface of each paddle.

3) Gently rub the electrode plate surfaces together to evenly spread the gel.



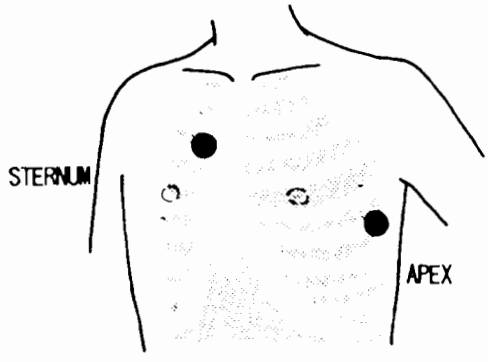
7. Select the energy level.

   Turn the ENERGY/MODE SELECT control to the desired energy position.

8. Place the paddles on the patient.

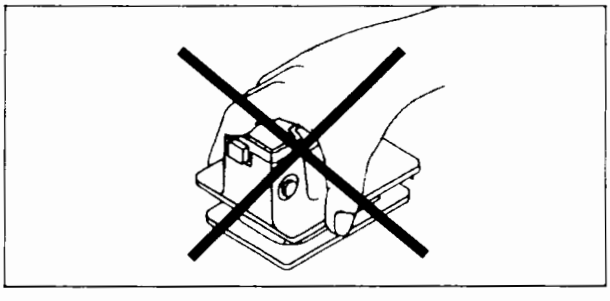
   1) Place the left (STERNUM) paddle on the right edge of the second and third intercostal sternum.

   2) Place the right (APEX) paddle on the fifth middle axial line.
   When using the paddle lead, keep the paddles steady.



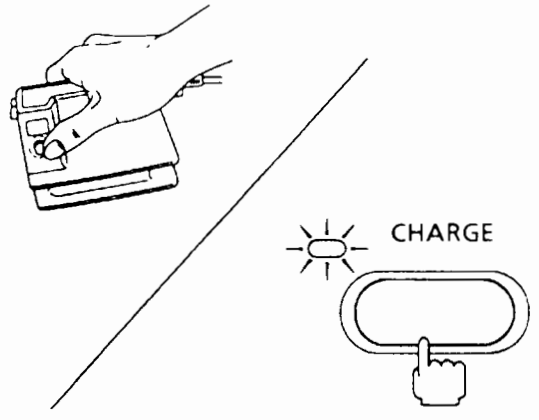
WARNING

Do not touch the edge of the paddle. Failure to follow this warning may cause serious electrical burn, shock, or other injury.



9. Charge the energy

When it is verified that the patient needs cardioversion, press the CHARGE button on the APEX paddle or CHARGE key on the front panel to start charging.



During charging, a continuous high (pip) tone is generated, the "CHARGING" message appears, and the CHARGE lamps on the APEX paddle and front panel blink.

When charging is completed, a continuous low tone is generated, the "CHARGED" message appears, and the CHARGE lamps light.

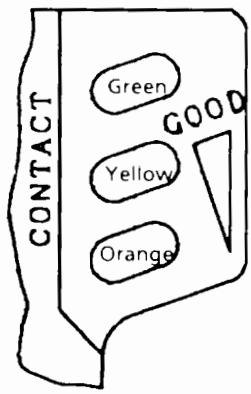
To change the energy level, turn the ENERGY/MODE SELECT control to the desired energy position. The defibrillator starts charging one second after the new energy is selected.

To disarm the charged defibrillator, turn the ENERGY/MODE SELECT control to the DISARM position. The defibrillator immediately discharges itself internally within 20 seconds.

For safety, if the defibrillator is not discharged within 40 seconds after charging, the defibrillator immediately discharges itself internally within 20 seconds.

10. Check skin-paddle contact impedance.

For TEC-7521 or TEC-7531 defibrillators, the paddle contact indicator on the STERNUM paddle indicates skin-paddle contact impedance. Place the paddles so that the green GOOD lamp lights. Recommended applied pressure is around 10 kg (22 lb.) per paddle.



Lamp	Impedance
Green (GOOD)	0 to 100 Ω
Yellow	100 to 200 Ω
Orange (POOR)	Over 200 Ω

If the GOOD lamp does not light, check the amount of applied contact gel and press the paddles against the patient, gradually increasing the pressure until the GOOD lamp lights.

WARNING

IN CASE OF POOR CONTACT

If the yellow or orange lamp lights, defibrillator may cause serious electric burn on the patient's skin and poor energy discharge to the patient. In case of an emergency, medical personnel should decide whether to execute defibrillation immediately, regardless of the indicator display, or take action to make good contact before defibrillation.

NOTE

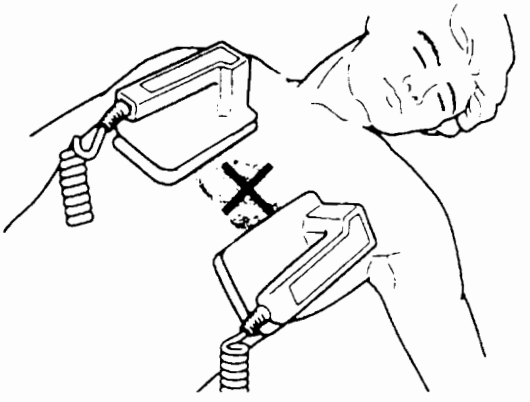
The GOOD lamp may not light for the following patients:

- **Patient with chest hair**
- **Old patient with skin cornification (hardening)**
- **Thin patient**

11. Discharge the energy to the patient

WARNING

- **Make sure that no one is in contact with either the patient or any equipment which supports or is connected to the patient.**
- **Do not discharge the energy if the paddles are shorted to each other by contact gel. Failure to follow this warning may cause serious electrical burn on the patient skin and poor energy discharge to the patient's heart.**



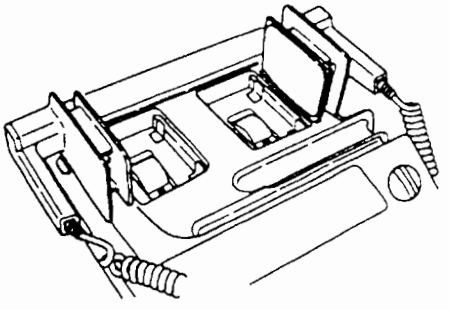
The figure above shows a dangerous situation where the paddle electrodes have been shorted by contact gel.

Simultaneously press both DISCHARGE buttons on the paddles.

12. Repeat cardioversion

Repeat steps 7 to 11 if another cardioversion is required, and resume basic life support according to the medical protocols.

Use the edge around each paddle holders to temporarily hold the paddles so that contact gel does not get on the defibrillator. These holders can only be used for the adult electrode plate.



13. After use

1) Turn the ENERGY/MODE SELECT control to the OFF position and disconnect the AC power cord.

2) Wipe the contact gel from the electrode plates and set the paddles in the paddle holder.

CAUTION

Failure to remove contact gel from the electrode plate may cause rusting.

3) Clean the defibrillator and cables as described in Section 8-2-2 "Cleaning the Defibrillator, Cables and Paddles".

4) Return the defibrillator to its storage location and connect it to the AC power to maintain the battery charge.

3-6-3 Synchronized Cardioversion with Disposable Pads (TEC-7521/TEC-7531 Only)

Disposable pads can only be used with TEC-7521 and TEC-7531.

WARNING

Failure to comply with the following warnings may cause serious skin burn

- Do not re-use disposable pads. Pads are disposable.
- If the package is broken, dispose of the pads and do not use them. If the pads are used, this may cause serious electrical burn or poor energy discharge to the heart.
- Do not use the pads if they are past the expiration date. If expired pads are used, this may cause serious electrical burn or poor energy discharge to the heart.
- Use the disposable pads as soon as possible after removing them from the package. If the pads are left for a long period of time after removing them from the package, it may cause serious electrical burn or poor energy discharge to the heart.
- Do not attach a pad on a disposable electrode.
- Do not attach pads on the patient's chest where there is any ointment.
- If pads or their connector get wet, dry them well before use.
- Do not use the disposable pads if:
  - The gel has become dry, or
  - The gel breaks down and releases water.

  This may cause serious electrical burn or poor energy discharge to the heart.
- Do not use the P610 or P612 disposable pads if the color of the gel changes to dark brown and dark brown gel is attached to the protective liner. This may cause serious electrical burn or poor energy discharge to the heart.
- Do not reuse disposable pads. This may cause serious electrical burn or poor energy discharge to the heart.

CAUTION

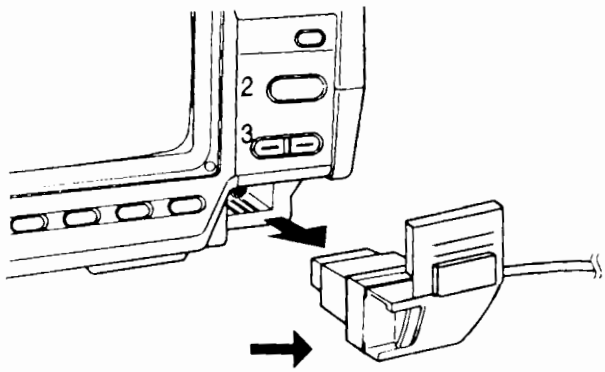
- Do not use other than the specified disposable pads.
- Do not attach disposable pads so that the pads overlap each other. This may cause serious electrical burn.
- Do not put anything heavy on the disposable pads or bend the pads. This may damage the pads and cause serious electrical burn.

NOTE

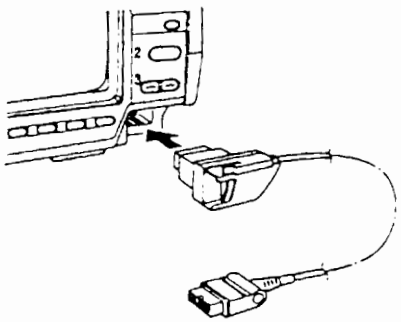
Follow all disposable pads labeling instructions.

1. Connect the pad adaptor to the defibrillator.

   1) Press the paddle release knob of the paddle connector on the right panel and remove the external paddles from the paddle connector.



   2) Connect the pad adaptor to the paddle connector until it clicks.



2. Turn the power on.

   Turn the ENERGY/MODE SELECT control to the DISARM position to turn the power on.

3. Prepare the patient to monitor the ECG waveforms with the defibrillator.

   When acquiring the ECG waveforms with the defibrillator, attach the electrodes to the patient. Refer to Section 4-2-3 "Attaching the Electrodes to the Patient".

   When a Nihon Kohden bedside monitor is used, you can use the bedside monitor electrodes and ECG lead.

   1) Disconnect the ECG connection cable from the bedside monitor and disposable electrode lead.

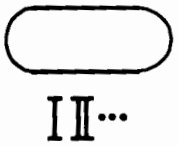
   2) Connect the JC-752V connection cable to the disposable electrode lead and the defibrillator.

   To use the ECG waveforms from another instrument, refer to 3-3-2 "Using the ECG Waveforms from Another Instrument for Synchronized Cardioversion".

4. Select the ECG lead.

WARNING

- **Do not select "TEST". Failure to follow this warning causes accidental discharge which is not synchronized with the patient's QRS wave.**
- **Do not select "TELE". Synchronized cardioversion cannot be performed with ECG waveforms from the transmitter.**

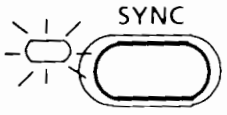


Press the ECG lead key to select the lead which has the highest QRS wave. The default lead setting is "PADDLE" (paddle lead).

When using the ECG waveforms from another instrument, select "AUX".

When acquiring the ECG waveforms with disposable pads, select "PADDLE".

5. Select the synchronized cardioversion mode.



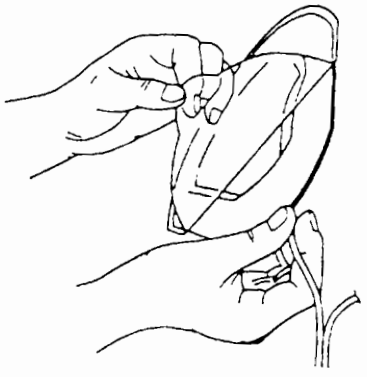
1) Press the SYNC key on the front panel to select the synchronized cardioversion mode. The SYNC lamp lights.

2) Check that the "▼" mark appears on the rising slope of every QRS waves. The "▼" mark indicates that the defibrillator detects the QRS wave. If this mark does not appear:
   - Change the amplitude of the ECG waveforms with the ECG sensitivity key.
   - Change the ECG lead with the ECG lead key.
   - Change the electrode position.

6. Prepare the disposable pads.

1) Clean the patient's chest to remove oil and dirt and allow firm pad contact with the skin. Shave excessive hair, if necessary.

2) Take the disposable pads out of the package and carefully remove the backing from one pad at a time.



WARNING

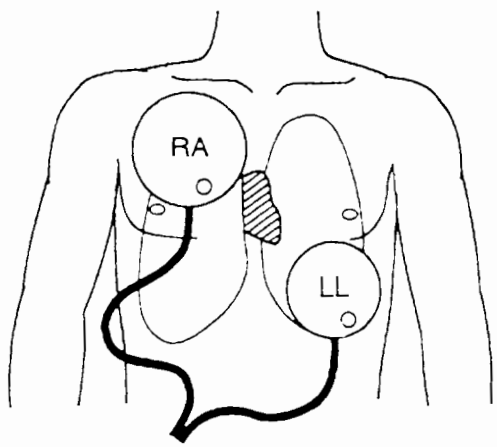
Do not use the P610 or P612 disposable pads if the color of the gel changes to dark brown and dark brown gel is attached to the protective liner. This may cause serious electrical burn or poor energy discharge to the heart.

NOTE

- **Always prepare the second disposable pads before defibrillation. Use the second disposable pads if the gel of the first disposable pads is dry, deteriorated or changes color.**
- **Before attaching the disposable pads to the patient, clean the skin where the pads will be attached. If the skin is moist, use a cotton swab to dry it.**

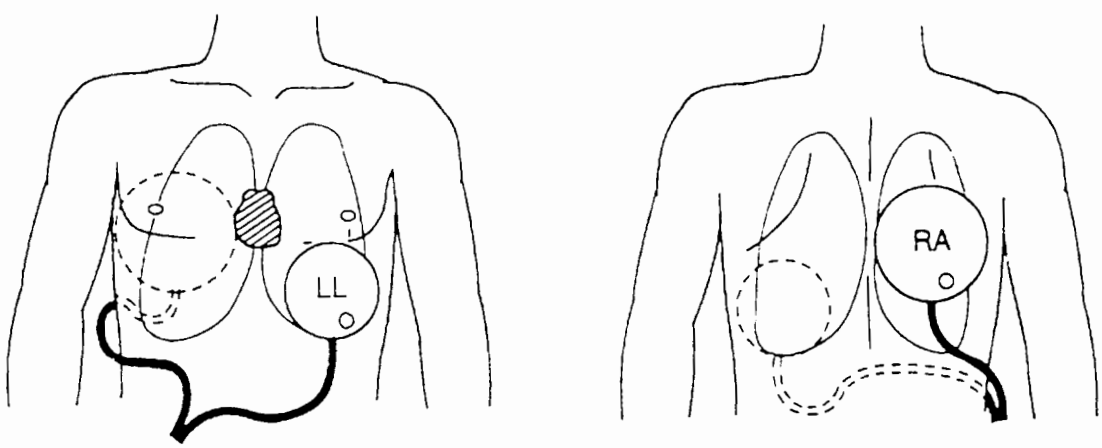
3) Attach the pads to the patient's chest, one at a time.

Apex-Anterior placement



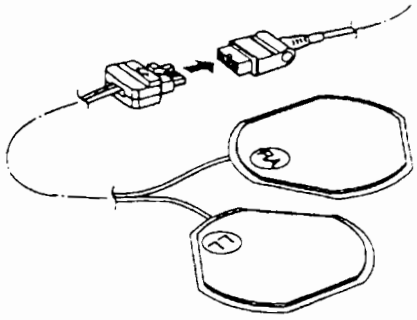
RA: Right edge of the second or third intercostal sternum
LL: Fifth middle axial line

Apex-Posterior placement



RA: Between right scapula and spine
LL: Fifth middle axial line

4) Connect the disposable pads to the pad adaptor.



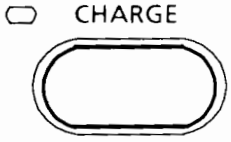
NOTE

Firmly connect the disposable pads to the pad adapter until the connector of the disposable pads clicks.

7. Select the energy level.

   Turn the ENERGY/MODE SELECT control to the desired energy position.

8. Charge the energy



When it is verified that the patient needs cardioversion, press the CHARGE key on the front panel.

NOTE

If the CHARGE key is pressed when a disposable pad is detached, the "PADDLE LOOSE" message appears and the defibrillator does not start charging. Check that the pads are firmly attached to the patient.

During charging, a continuous high (pip) tone is generated, the "CHARGING" message appears, and the CHARGE lamp on the front panel blinks.

NOTE

If a disposable pad is detached during or after charging, the "PADDLE LOOSE" message appears and the defibrillator immediately discharges itself internally within 20 seconds. Check that the pads are firmly attached to the patient.

When charging is completed, a continuous low tone is generated, the "CHARGED" message appears, and the CHARGE lamps light.

To change the energy level, turn the ENERGY/MODE SELECT control to the desired energy position. The defibrillator starts charging one second after the new energy is selected.

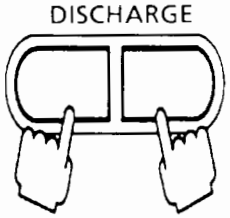
To disarm the charged defibrillator, turn the ENERGY/MODE SELECT control to the DISARM position. The defibrillator immediately discharges itself internally within 20 seconds.

For safety, if the defibrillator is not discharged within 40 seconds after charging, the defibrillator immediately discharges itself internally within 20 seconds.

9. Discharge the energy to the patient

WARNING

- **Make sure that no one is in contact with either the patient or any equipment which supports or is connected to the patient.**
- **Do not discharge the energy if the disposable pads are shorted to each other. Failure to follow this warning may cause serious electrical burn on the patient heart and poor energy discharge to the patient's heart.**
- **Before defibrillation, make sure that the paddles are firmly applied to the patient chest. Failure to follow this warning may cause serious electrical burn or poor energy discharge to the heart.**



Simultaneously press the two DISCHARGE keys on the front panel.

10. Repeat cardioversion

Repeat steps 5 to 9 if another cardioversion is required, and resume basic life support according to the medical protocols.

11. After use

1) Turn the ENERGY/MODE SELECT control to the OFF position and disconnect the AC power cord.

2) Clean the defibrillator as described in Section 8-2-2 "Cleaning the Defibrillator, Cables and Paddles".

3) Press the paddle release knob of the paddle connector on the right panel and remove the pad adaptor from the paddle connector.

4) Connect the external paddles to the paddle connector until it clicks.

5) Return the defibrillator to its storage location and connect it to the AC power to maintain the battery charge.

3-6-4 Synchronized Cardioversion with the Internal Paddles (TEC-7521/TEC-7531 Only)

Internal paddles can only be used with TEC-7521 and TEC-7531.

WARNING

- **Always sterilize the internal paddles before use. Failure to follow this warning may cause serious infection. For sterilization, refer to 8-3-1 "Sterilizing the Paddles".**
- **Use the ECG monitoring electrodes (disposable electrodes) to monitor the ECG waveforms. Do not select "PADDLE" (paddle lead) unless it is absolutely necessary. If "PADDLE" (paddle lead) is selected, accidental discharge occurs which is not synchronized with the patient's QRS wave and the ECG waveforms are unstable after discharge because polarization voltage is very high.**
- **Pay careful attention to the energy selection when using internal paddles. Applying high energy to the heart may cause cardiac muscle necrosis.**

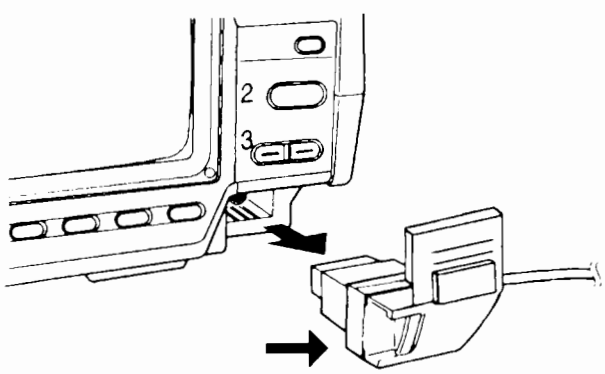
NOTE

Select the appropriate energy and appropriate size of the internal paddles according to the patient. Only use the paddles specified by Nihon Kohden.

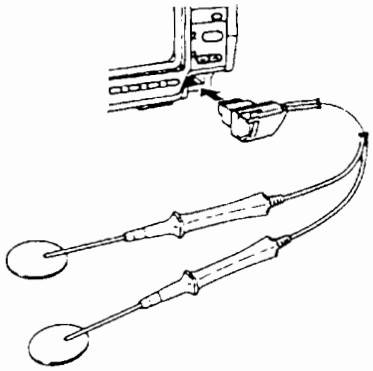
Synchronized cardioversion should be performed with the minimum effective energy. It is reported that the cardiac muscle may necrose if high energy is repeatedly applied to the heart with internal paddles. See page 9.12 for references.

1. Connect the internal paddles to the defibrillator.

   1) Press the paddle release knob of the paddle connector on the right panel and remove the external paddles from the paddle connector.



2) Connect the connector of the internal paddles to the paddle connector until it clicks.



2. Turn the power on.

   Turn the ENERGY/MODE SELECT control to the DISARM position to turn the power on.

3. Prepare the patient to monitor the ECG waveforms with the defibrillator.

   When acquiring the ECG waveforms with the defibrillator, attach the electrodes to the patient. Refer to Section 4-2-3 "Attaching the Electrode to the Patient".

   When a Nihon Kohden bedside monitor is used, you can use the bedside monitor electrodes and ECG lead.

   1) Disconnect the ECG connection cable from the bedside monitor and disposable electrode lead.

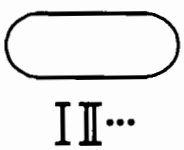
   2) Connect the JC-752V connection cable to the disposable electrode lead and the defibrillator.

   To use the ECG waveforms from another instrument, refer to 3-3-2 "Using the ECG Waveforms from Another Instrument for Synchronized Cardioversion".

4. Select the ECG lead.

WARNING

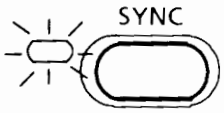
- **Do not select "TEST". Failure to follow this warning causes accidental discharge which is not synchronized with the patient's QRS wave.**
- **Do not select "TELE". Synchronized cardioversion cannot be performed with ECG waveforms from the transmitter.**



Press the ECG lead key to select the lead which has the highest QRS wave. The default lead setting is "PADDLE" (paddle lead).

When using the ECG waveforms from another instrument, select "AUX".

5. Select the synchronized cardioversion mode.

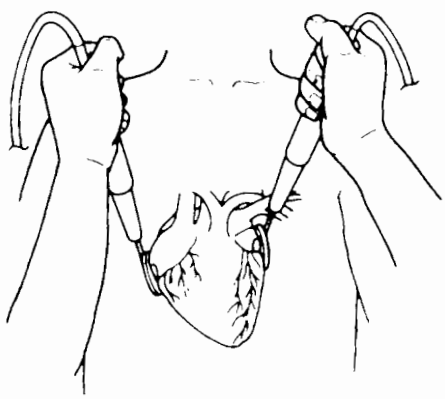


1) Press the SYNC key on the front panel to select the synchronized cardioversion mode. The SYNC lamp lights.

2) Check that the "▼" mark appears on the rising slope of every QRS waves. The "▼" mark indicates that the defibrillator detects the QRS wave. If this mark does not appear:
   - Change the amplitude of the ECG waveforms with the ECG sensitivity key.
   - Change the ECG lead with the ECG lead key.
   - Change the electrode position.

6. Position the internal paddles.

Position the sterilized internal paddles against the right and the left atria of the heart.



NOTE

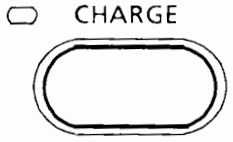
- **It is not necessary to consider the polarities of the internal paddle electrodes.**
- **In order to get better contact between the internal paddles and heart, place sterilized gauze moistened with physiological saline solution between each internal paddle and the heart.**

7. Select the energy level.

Turn the ENERGY/MODE SELECT control to the desired energy position.

When the internal paddles are used, 50 J or below can be selected. If above 50 J is selected, the "SET ENERGY BELOW 50 J" message appears and the selected energy cannot be charged.

8. Charge the energy



Press the CHARGE key on the front panel to start charging.

During charging, a continuous high (pip) tone is generated, the "CHARGING" message appears, and the CHARGE lamp on the front panel blinks.

When charging is completed, a continuous low tone is generated, the "CHARGED" message appears, and the CHARGE lamp lights.

NOTE

During or after charging, if above 50 J is selected, the defibrillator immediately discharges itself internally.

WARNING

Do not touch the electrode of the paddle once the defibrillator has been charged. Failure to follow this warning may cause serious injury from accidental discharge of high voltage.

To change the energy level, turn the ENERGY/MODE SELECT control to the desired energy position. The defibrillator starts charging one second after the new energy is selected.

To disarm the charged defibrillator, turn the ENERGY/MODE SELECT control to the DISARM position. The defibrillator immediately discharges itself internally within 20 seconds.

For safety, if the defibrillator is not discharged within 40 seconds after charging, the defibrillator immediately discharges itself internally within 20 seconds.

9. Discharge the energy to the patient

WARNING

- **Make sure that no one is in contact with either the patient or any equipment which supports or is connected to the patient.**
- **Do not discharge the energy if the paddles are shorted to each other. Failure to follow this warning may cause serious electrical burn on the patient's heart and poor energy discharge to the patient's heart.**

Simultaneously press the two DISCHARGE keys on the front panel to discharge the energy to the patient.

10. Repeat cardioversion

Repeat steps 5 to 9 if another cardioversion is required.

11. After use

1) Turn the ENERGY/MODE SELECT control to the OFF position and disconnect the AC power cord.

2) Clean the defibrillator, cables and paddles as described in Section 8-2-2 "Cleaning the Defibrillator, Cable and Paddles".

3) Press the paddle release knob of the paddle connector on the right panel and remove the internal paddles from the paddle connector.

4) Connect the external paddles to the paddle connector until it clicks.

5) Return the defibrillator to its storage location and connect it to the AC power to maintain the battery charge.

6) Sterilize the internal paddles with autoclaving or EOG. Refer to Section 8-3-1 "Sterilizing the Paddles".

3-7 Screen Messages and What to Do in Case of Trouble

Trouble or screen message	Possible cause	Action
CAUTION-OVERHEATING message and the defibrillator is heating up.	The defibrillation interval is too short.	Turn the ENERGY/MODE SELECT control to the OFF position and disconnect the AC power cord.
ERROR A *** message appears and the defibrillator self-discharges internally during charging	The high-voltage unit is faulty.	Contact Nihon Kohden distributor.
In battery operation, the defibrillator self-discharges the energy during charging.	The battery is almost discharged.	Operate the defibrillator on AC power and recharge the battery. The battery is automatically recharged during AC operation.
CONNECT PADDLES message	No paddle is connected to the defibrillator.	Connect the paddle.
REPLACE ECG ELECTRODES message	The ECG monitoring electrode (disposable electrode) is faulty.	Replace the disposable electrodes.
PADDLE LOOSE message	A disposable pad is detached.	Turn the ENERGY/MODE SELECT control to the DISARM position and reattach the disposable pad firmly.
SET ENERGY BELOW 50 J message	Above 50 J is selected when the internal paddles are connected to the defibrillator.	Select 50 J or below to perform defibrillation with the internal paddles.
USE I, II • • LEAD message	A lead for which synchronized cardioversion cannot be performed is selected when the SYNC key is pressed.	• When acquiring the ECG waveforms with the ECG monitoring electrodes, select lead I or II with the ECG lead key. • When the ECG waveforms are supplied from the external instrument, select "AUX" with the ECG lead key. (defibrillation mode)
When the SYNC key is pressed, the "▼" mark does not appear on the rising slope of every QRS wave	When acquiring the ECG waveforms with the ECG monitoring electrodes, "PADDLE" is selected.	Select lead I, or II with the ECG lead key.
	When acquiring the ECG waveforms with the external paddles, disposable pads, or internal paddles, "SYNC BY PADDLE LEAD" in the Setup screen is set to "OFF".	In the Setup screen, set "SYNC BY PADDLE LEAD" to "ON".

Trouble or screen message	Possible cause	Action
INT - DISCHARGE message	The internal paddles or disposable pads are not connected to the defibrillator firmly. The defibrillator self-discharges the energy internally when any of them are disconnected.	Firmly connect the internal paddles or disposable pads to the defibrillator.
REPLACE DISPOSABLE PADS message	The polarization voltage of disposable pads is high.	Replace disposable pads.
TEST WAVE message	TEST is selected for the ECG lead.	
SELECT MONITOR MODE message	The Setup key was pressed when the instrument was not in the monitoring mode.	When you change the settings, turn the ENERGY/MODE SELECT control to the MON position.

SECTION 4

ECG AND SpO_2 MONITORING

4-1 About ECG and SpO_2 Monitoring

The defibrillator can display ECG waveforms from ECG monitoring electrodes (disposable electrodes), external paddles, disposable pads, internal paddles, or a transmitter. The defibrillator can also display pulse waveforms from the SpO_2 unit. This section contains the information and procedures to monitor ECG waveforms through ECG monitoring electrodes or a transmitter. This section also contains the information and procedures to monitor pulse waveforms through the SpO_2 unit.

Either the optional ZR-751VK Telemetry receiver and transmitter or the optional AL-751VK SpO_2 unit is required to display SpO_2 (%).

Initial settings on the System Setup screen must be changed before ECG monitoring. To change these settings refer to Section 3-3 for defibrillation and Section 4-4 for ECG and SpO_2 monitoring.

All other settings can be changed any time without interrupting ECG monitoring.

To record ECG and pulse waveforms, refer to Section 6-2-1 "Manually Recording ECG and Pulse Waveforms". For automatic alarm recording, refer to Section 6-3-3 "Alarm Recording".

WARNING

- **When the patient has a high fever or insufficient peripheral circulation, the SpO_2 probe may cause a slight burn because the probe increases the skin temperature by 2 or 3 C (4 or 5 F).**
- **When the patient's oxyhemoglobin or methemoglobin increases abnormally, the SpO_2 data will not be correct.**
- **When measuring SpO_2 of a patient who is in a state of shock or in cardiopulmonary resuscitation, the acquired SpO_2 data may not be correct due to the patient's body movement.**
- **If you do not measure SpO_2, disconnect the SpO_2 probe from the SpO_2 unit. If an unused probe is connected to the SpO_2 unit, strong external light will enter the probe and cause a noise waveform and value to appear on the screen. This noise waveform and value can be misjudged to be a valid pulse waveform and SpO_2 (%).**
- **If the heart rate/pulse rate alarm function or the SpO_2 alarm function is off, a  mark is displayed beside each parameter for which the alarm is off. If all alarms are disabled, a  mark is displayed above the Alarm Suspend key and beside all parameters. Always keep a patient under close observation if an alarm is off. For alarms, refer to 2-5-2 "Setup Screen". To change alarm settings, refer to 4-4 "Changing Monitoring Settings".**

4-2 Preparing for ECG Monitoring

4-2-1 Modified Leads and Electrode Positions

◆Overview

For continuous, stable ECG monitoring which is not disturbed by body movement, the electrodes are attached to the patient's chest rather than the limbs. Modified leads are similar to the standard 12 ECG leads except that the electrodes which would normally be placed on the patient's upper and lower limbs are placed on corresponding chest positions instead. Modified leads are often indicated by an "M" in the lead name.

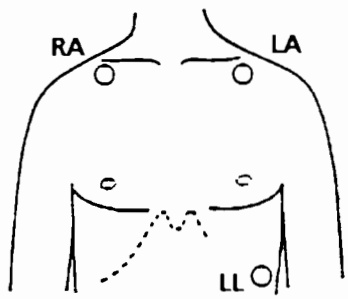
NOTE

- **If the ECG monitoring electrodes (disposable electrodes) cannot be placed on the positions shown below (for example during chest operation), a relatively stable ECG can be obtained by placing the electrodes on the shoulder joints.**
- **For defibrillation or external pacing, place ECG monitoring electrodes on positions other than the paddle positions.**

◆Modified 3-electrode Leads (M I , M II , M III)

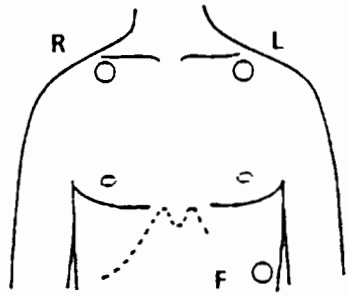
- **Electrode Position**

<AHA>



Electrode position	Symbol	Lead color
Left infraclavicular fossa	LA	Black
Right infraclavicular fossa	RA	White
Left anterior axillary line below the bottom rib	LL	Red

<IEC>

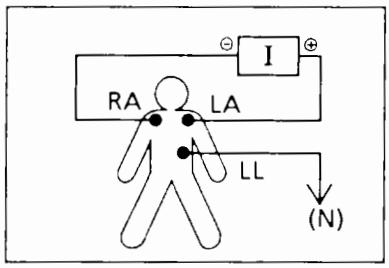


Electrode position	Symbol	Lead color
Left infraclavicular fossa	L	Yellow
Right infraclavicular fossa	R	Red
Left anterior axillary line below the bottom rib	F	Green

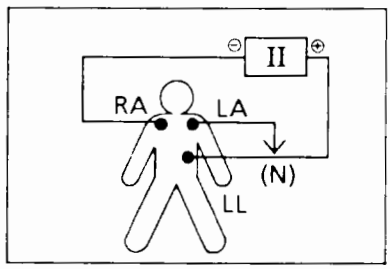
- **Lead Connection**

<AHA>

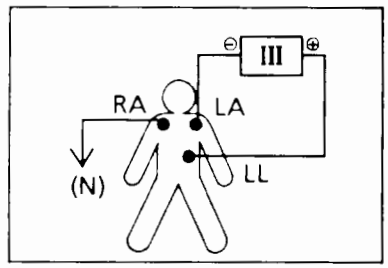
(N): Reference



M I

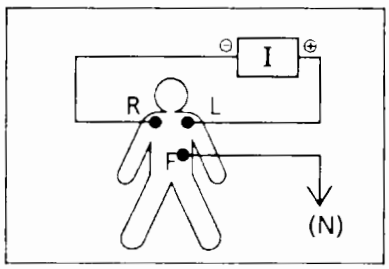


M II

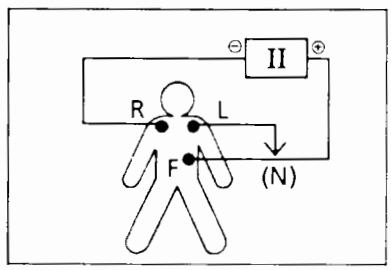


M III

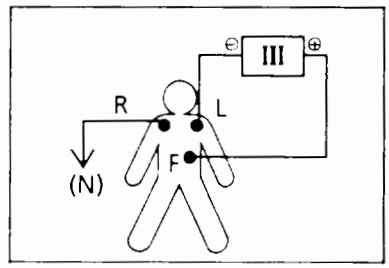
<IEC>



M I



M II



M III

◆Modified 5-electrode Leads (M I , M II , M III , aV_R, aV_L, aV_F, V)

An optional 5-electrode lead is required for 5-electrode ECG measurement.

- **Electrode Position**

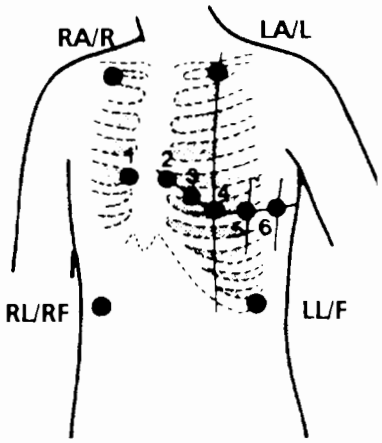
<AHA>

Position	Symbol	Lead color
Right infraclavicular fossa	RA	White
Left infraclavicular fossa	LA	Black
Left midclavicular line about 12–15 mm above the iliac crest or the left edge of the backbone about 12–15 mm above the iliac crest.	LL	Red
Right midclavicular line at the same level as LL	N (RL)	Green
Any one of the chest electrode positions shown in the following	V	Brown

<IEC>

Position	Symbol	Lead color
Right infraclavicular fossa	R	Red
Left infraclavicular fossa	L	Yellow
Left midclavicular line about 12–15 mm above the iliac crest or the left edge of the backbone about 12–15 mm above the iliac crest.	F	Green
Right midclavicular line at the same level as F	N (RF)	Black
Any one of the chest electrode positions shown in the following	C	White

- **Chest Electrode Positions**



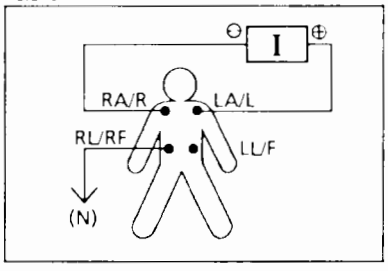
V1: Fourth intercostal space at the right border of the sternum
V2: Fourth intercostal space at the left border of the sternum
V3: Halfway between V2 and V4
V4: Fifth intercostal space on the left midclavicular line
V5: Left anterior axillary line at the same level as V4
V6: Left midaxillary at the same level as V4

- **Lead Connection**

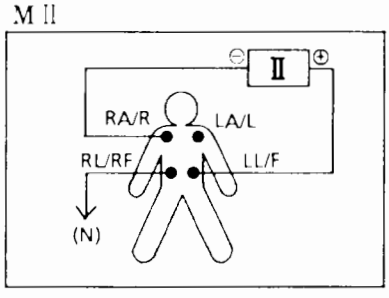
(N): Reference

Modified bipolar limb leads

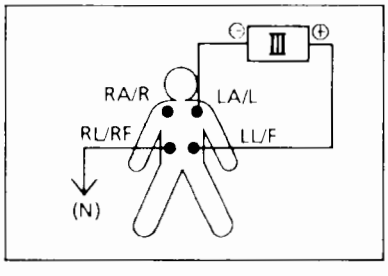
M I



M II

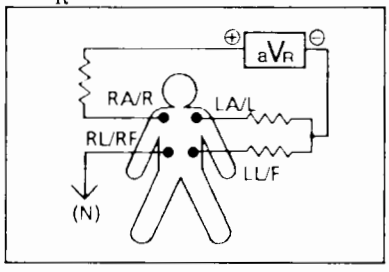


M III

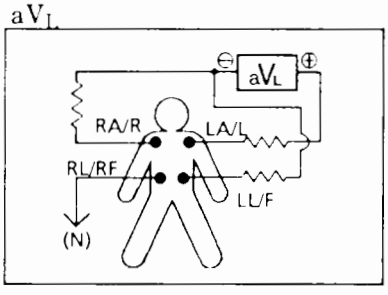


Modified unipolar limb leads

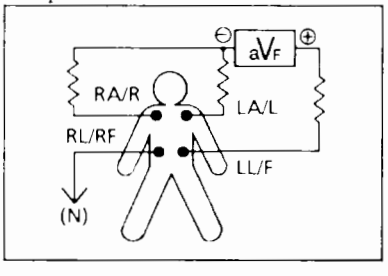
aV_R



aV_L

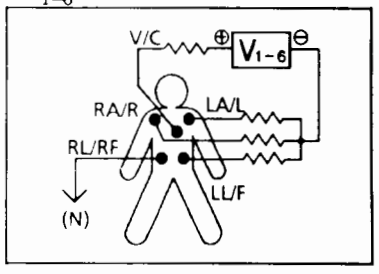


aV_F



Modified unipolar chest leads

V_{1-6}



4-2-2 Selecting and Using Electrodes

◆Electrode Selection

Select the type of disposable electrode according to the purpose.

WARNING

When using a defibrillator together with the monitor, use Ag/AgCl electrodes. Other types of electrodes, stainless steel in particular, will adversely affect the ECG waveform by slowing the baseline recovery on the monitor and result in no monitoring immediately following defibrillation.

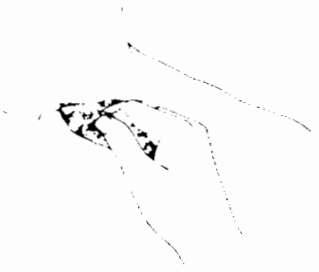
◆Electrode Usage

CAUTION

- **If the electrode has bad contact, replace it with a new one, regardless of the expiration date on the package.**
- **Do not re-use disposable electrodes.**

If the electrode causes skin rash, replace it with a new one and attach it to another position close to the original position.

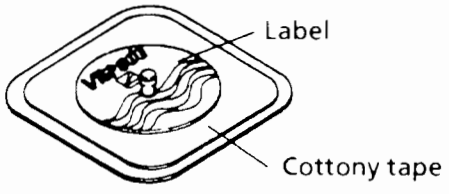
4-2-3 Attaching the Electrodes to the Patient



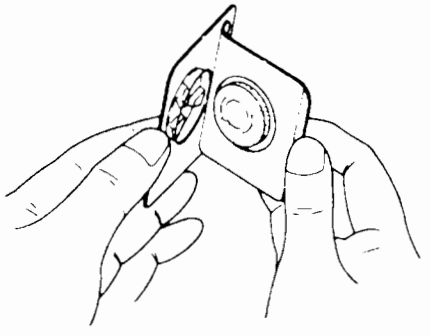
1. Shave excess hair.
   With a piece of cotton pad moistened with alcohol, clean the patient's skin where the electrodes will be attached. Avoid wrinkled or uneven skin areas. Wipe off the alcohol with a dry cotton pad.

NOTE

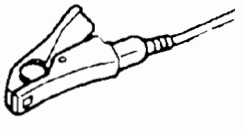
To obtain a stable ECG waveform, rub the skin with tincture of Benzoin.



2. Open the disposable electrode package, and take out the electrode.

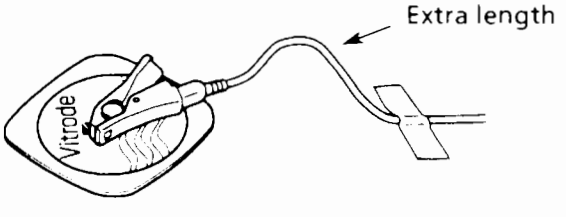


3. Remove the backing paper from the disposable electrode.



4. Place the electrode on the previously cleaned skin.

5. Clip the electrode lead of the ECG connection cable onto the electrode. The identification symbols on the connection part are color-coded.



6. If necessary, fasten the electrode leads with surgical tape (with an extra length of wire between the tape and the electrode) for ECG monitoring. This is effective even when the patient is exercising.

4-2-4 Connecting the Leads to the Defibrillator

Align the ← mark on the front panel with the groove guide of the ECG connection cable. Connect the ECG connection cable to the ECG input connector on the front panel of the defibrillator.

4-2-5 Turning the Power On

Turn the ENERGY/MODE SELECT control to the MON position to turn the power on.

The defibrillator operates on either AC or battery power. The defibrillator automatically selects the power source according to whether the AC power cord is connected to the defibrillator.

4-2-6 Using the Defibrillator with an Electrosurgery Unit

WARNING

When an ESU (Electrical Surgery Unit) is Used

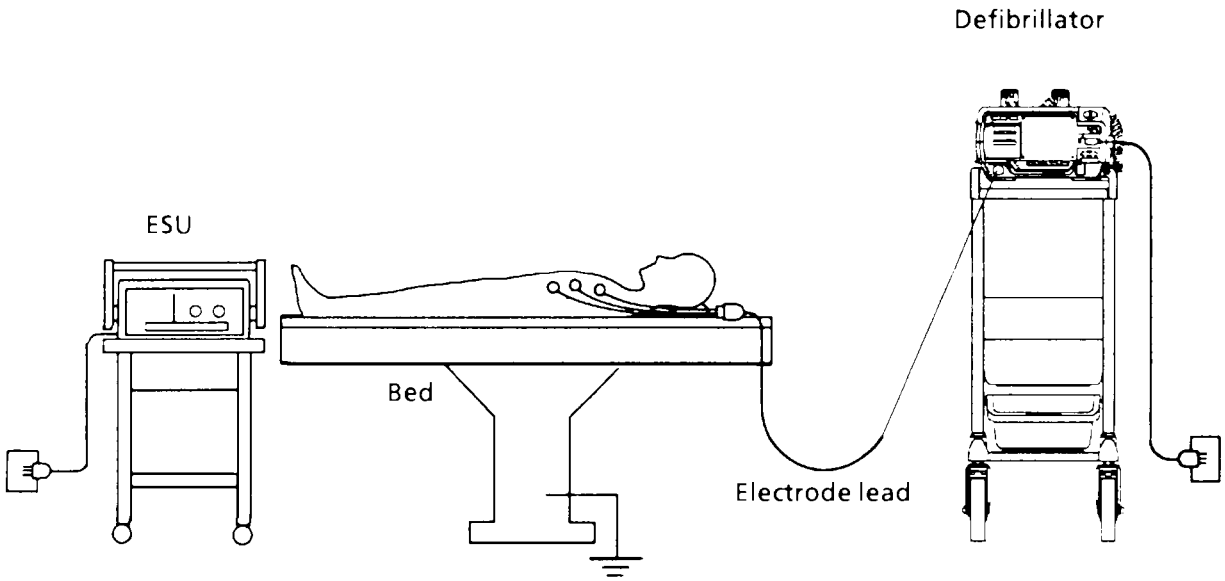
- **Do not perform defibrillation while using an ESU.**
- **Do not attach external paddles, disposable pads or internal paddles to the patient.**

Failure to follow these warnings may cause serious electrical burn, shock, or other injury. Only use the defibrillator in monitor mode when using it with an ESU.

For use with an electrosurgery unit (ESU), the defibrillator has a circuit to protect the patient from skin burn and to reduce ESU interference on the ECG waveform. However, the effectiveness of this circuit depends on electrode position and defibrillator setup. With an electrosurgery unit, pay attention to the following points.

◆Location

To minimize interference with the ECG measurement, the defibrillator should be located as far from the ESU as possible. If possible, set them on opposite sides of the operating table as illustrated below.



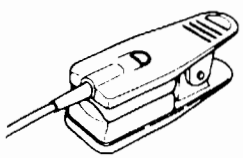
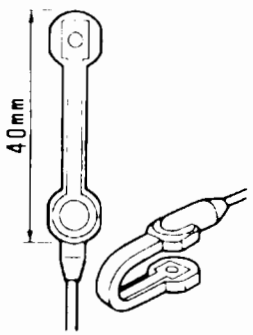
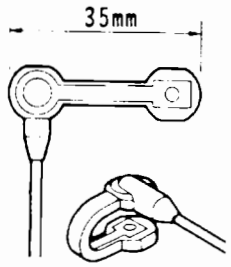
◆Power Supply

Noise from the ESU may interfere with the ECG signal through the AC power line. Therefore, the defibrillator and ESU should be connected to different AC outlets located as far from each other as possible.

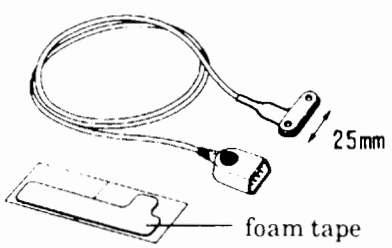
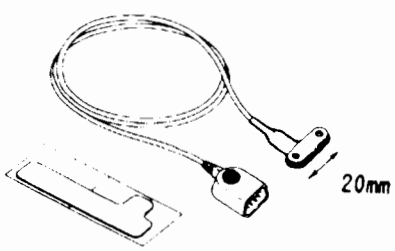
4-3 Preparing for SpO_2 Monitoring

4-3-1 Selecting the Probe

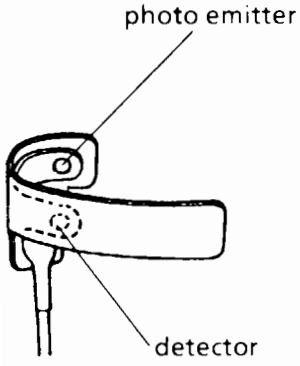
◆Reusable Probes

Model	TL-101T	TL-120T	TL-121T
Description	Finger probe	Multi-site probe	Foot probe
Patient	Adult, child (Weight: more than 20 kg)	Adult, child, infant (Weight: more than 3 kg)	Infant, neonate (Weight: less than 3 kg)
Attachment site	Finger or toe	Finger or big toe	Around foot-top and bottom
Appearance (size)			

◆Disposable Probes

Model	TL-051S	TL-052S	TL-061S	TL-062S
Patient	Adult (Weight: more than 50 kg) Neonate (Weight: less than 3 kg)		Child or adult (Weight: 15 to 50 kg) Infant (Weight: 3 to 15 kg)	
Attachment site	Adult: finger Neonate: foot-top and bottom		Child or adult: finger Infant: toe	
Appearance (Size)				
Cable length	80 cm	160 cm	80 cm	160 cm
Measuring accuracy	80 to 100% ± 2% ; 50 to 80% ± 3%			

4-3-2 Attaching the Probe to the Patient



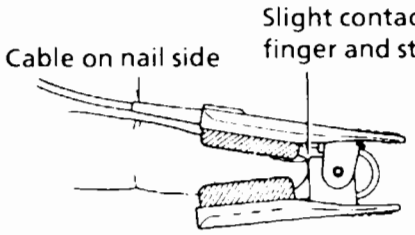
CAUTION

- If the skin gets irritated by the tape, change the attachment site.
- Do not attach the probe to the same limb that is used for NIBP measurement or an IBP catheter.
- To avoid poor circulation, do not wrap the tape too tight.
- For long term monitoring, check the circulation condition by observing the skin color of the measuring site and the displayed pulse waveform. To avoid circulation insufficiency, change the measurement site every 8 hours when using a disposable probe and every 4 hours when using the finger probe, multi-site probe or foot probe. If the skin is irritated from oversensitivity to the tape, discontinue use of the probe.
- When attaching the SpO_2 probe, make sure that the photo emitter and the detector of the probe face each other. Otherwise, SpO_2 cannot be measured properly.
- Do not re-use the disposable probe for another patient.
- When using a disposable probe, replace it with a new one every 96 hours (4 days).
  When using a finger probe, multi-site probe or foot probe, replace it with a new one every 1 year after opening the package.
- If the probe is dirty with blood or bodily fluids, replace it with a new one.

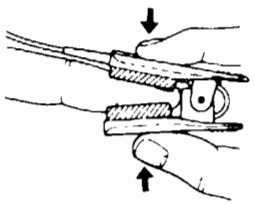
This light-transmission type probe requires the light to penetrate tissue 6 to 14 mm thick (e.g. finger or toe).
The best monitoring condition is tissue approximately 10 mm thick.

- If the patient's nail is too long to attach the finger probe to the optimum position, cut the nail or use the foot probe.
- If the patient's nail polish decreases the amount of transmitted light and SpO_2 data is not correct, remove the polish or use the foot probe.
- To minimize body movement for stable SpO_2 monitoring, fasten the cable with the provided adhesive tape.

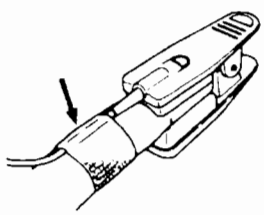
◆Finger Probe TL-101T



1. Clean the attachment site with alcohol.
2. Attach the probe to the finger as shown.



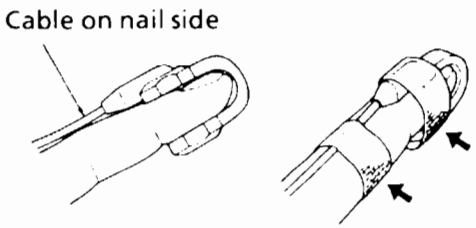
3. Apply light pressure to both sides of the probe to improve contact.



4. Fasten the cable on the skin with the provided stretchable fabric adhesive tape, COTTONY tape, as shown.

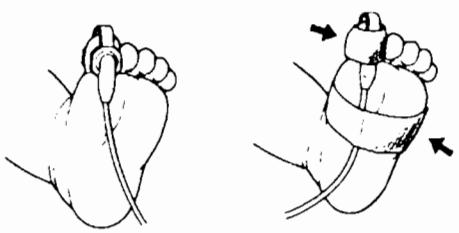
◆Multi-site Probe TL-120T

Finger attachment

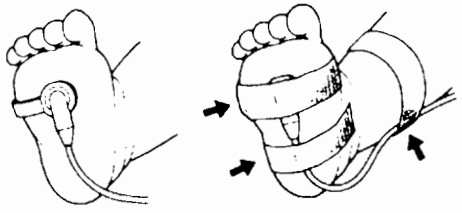


1. Clean the attachment site with alcohol.
2. Attach the probe to the finger or toe as shown left.
3. Fasten the probe and the cable to the finger or toe with the provided stretchable fabric adhesive tape, COTTONY tape.

Toe attachment

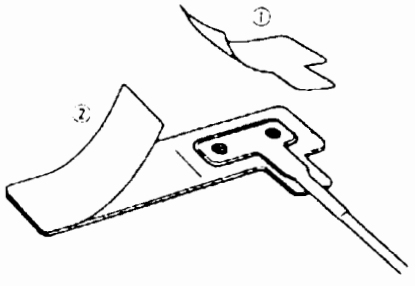


◆Foot Probe TL-121T



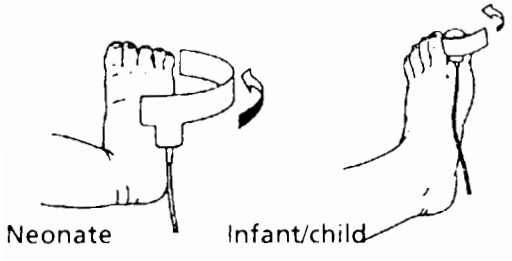
1. Clean the attachment site with alcohol.
2. Attach the probe around the foot top and bottom as shown left.
3. Fasten the probe and the cable to the foot with the provided stretchable fabric adhesive tape, COTTONY tape.

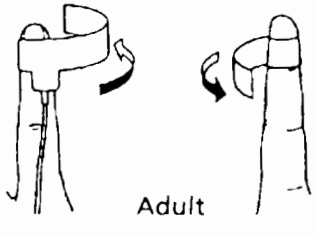
◆Disposable Probes TL-051S, 052S, 061S, 062S



1. Clean the attachment site with alcohol.
2. Remove the backing paper 1 from the foam tape.
3. Attach the probe to the tape with the sensor side up as shown.
4. Remove the rest of the backing paper 2 from the tape.
5. Place the photo emitter of the probe as shown.

   Infant, Neonate: place the photo emitter on the top of the foot.
   Infant, Adult: place the photo emitter just below the finger nail.

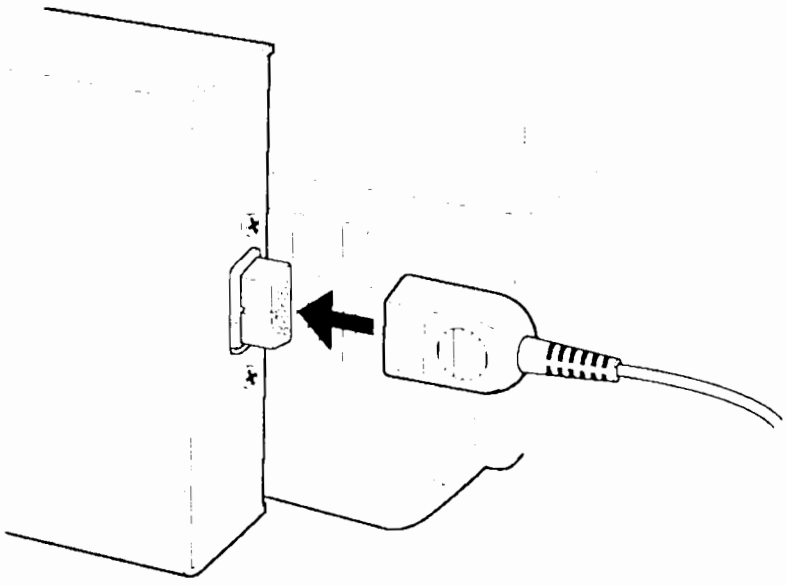




6. Place the photo detector opposite to the photo emitter so that light can pass through the measurement site.
7. Firmly wrap the tape to improve the contact.
8. Secure the probe cable with the fabric (stretch) tape.

4-3-3 Connecting the Probe to the SpO_2 Unit

Connect the SpO_2 probe to the SpO_2 socket on the left side panel of the AL-751VK SpO_2 Unit. For connecting the SpO_2 Unit to the defibrillator, refer to the AL-751VK SpO_2 Unit installation guide.



4-4 Changing Monitoring Settings

4-4-1 Selecting 3 or 5 Electrode ECG Leads

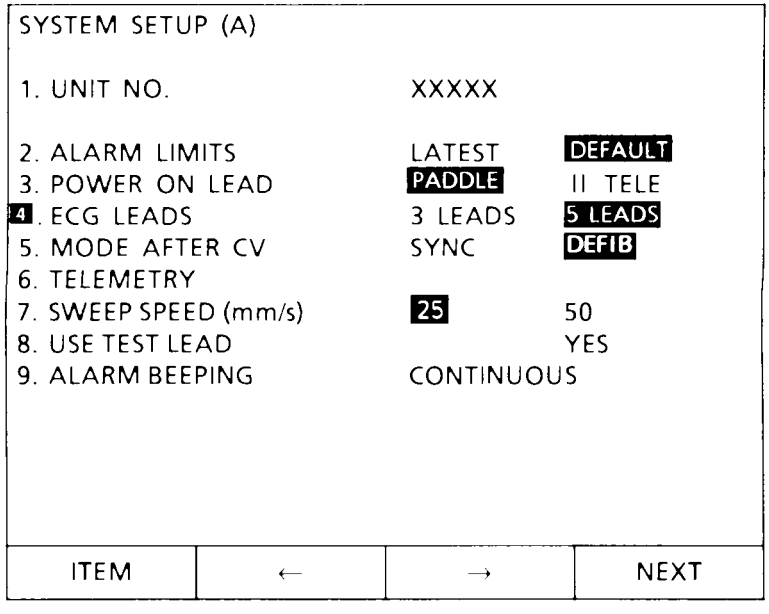
You can select 3 or 5 electrode ECG leads to monitor the ECG waveforms. An optional electrode lead is required for 5-electrode ECG monitoring. Refer to Section 9-4 "Options".

NOTE

Defibrillation and pacing are not available when the Setup screen is displayed.

1. From the System Setup (A) screen, press the ITEM function key until "ECG LEADS" is selected.

   System Setup (A) screen



2. Change the setting with the ← or → function key.

   3 LEADS: When 3 ECG electrode leads is selected, lead I, II and III can be selected by the ECG lead key.

   5 LEADS: When 5 ECG electrode leads is selected, lead I, II, III, aVR, aVL, aVF and V can be selected by the ECG lead key.

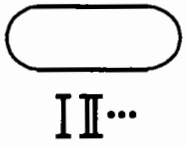
   To turn the power off, turn the ENERGY/MODE SELECT control to the OFF position.

This setting is saved after the power is turned off.

4-4-2 Selecting the ECG Lead

The ECG lead is displayed above the ECG lead key. When the optional Telemetry receiver is installed, the defibrillator displays the ECG waveforms and SpO_2 data (%) from a transmitter.

To select 3-electrode or 5-electrode leads, refer to Section 4-4-1 "Selecting 3 or 5 Electrode ECG Leads". The default setting is 3-electrode lead.



Press the ECG lead key to change the ECG lead.

When the key is pressed, the ECG lead changes as follows.

In defibrillation or monitor mode :

3-electrode:
PADDLE→ Y(telemetry*)→ I →II →III →AUX→TEST→PADDLE ...

5-electrode:
PADDLE→Y(telemetry*) → I →II →III →aVR→aVL→aVF→V→AUX→TEST→ PADDLE ...

* Appears only when the optional ZR-751VK Telemetry receiver is installed.

In pacing mode :

3-electrode:
I →II →III →TEST→ I ...

5-electrode:
I →II →III →aVR→aVL→aVF→V→TEST→ I ...

In pacing mode when the optional Telemetry receiver is installed:

To display the SpO_2 data, select lead I +Y, II +Y, or III +Y.

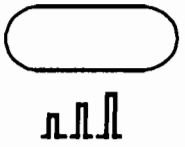
3-electrode:
I →II →III → I +Y→ II + Y→ III + Y→TEST→ I ...

5-electrode:
I →II →III → I +Y→ II + Y→ III + Y→aVR→aVL→aVF→V→TEST → I ...

NOTE

Telemetry ECG cannot be displayed in pacing mode.

4-4-3 Changing the ECG Sensitivity



Press the ECG sensitivity key to change the ECG sensitivity. When the key is pressed, the ECG sensitivity is changed as follows.

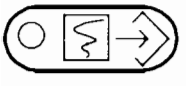
$\times 1/2 \rightarrow \times 1 \rightarrow \times 2 \rightarrow \times 4 \rightarrow 1/2$ ...

4-4-4 Changing the Time Constant Setting

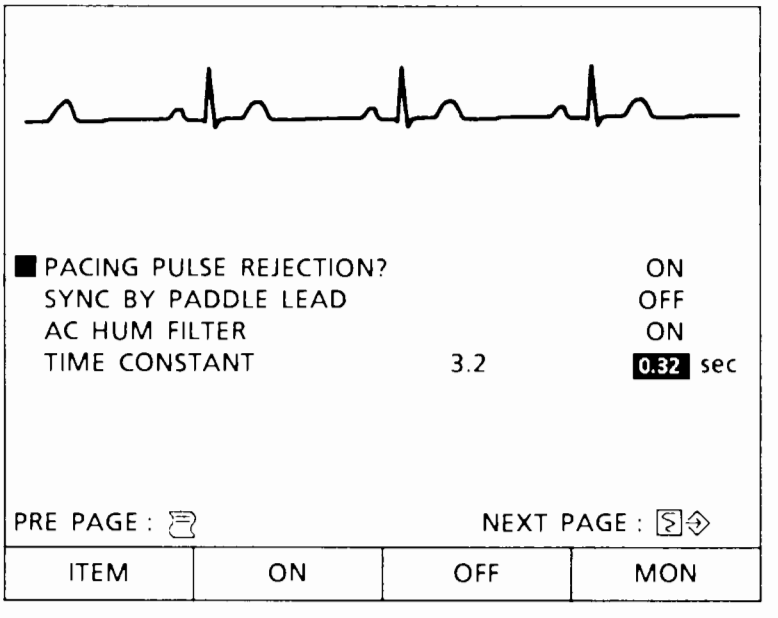
You can set the time constant to 0.32 or 3.2 seconds. When diagnosing the ECG waveforms, select 3.2 seconds. The default setting is 0.32 seconds.

NOTE

- **Defibrillation and pacing are not available when the Setup screen is displayed.**
- **In the defibrillation and pacing mode, the time constant is fixed at 0.32 seconds.**



1. From the Setup screen, press the Event key until the Setup screen - Defibrillation/monitoring appears. The selection cursor appears beside the top of items.



Setup screen - Defibrillation / monitoring

2. Press the ITEM function key until "TIME CONSTANT" is selected.

3. Change the setting with the ← or → function key.

   To return to the monitoring screen, press the MON function key. The monitor screen appears.

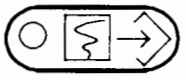
This setting is saved after the power is turned off.

4-4-5 Turning the AC Hum Filter On/Off

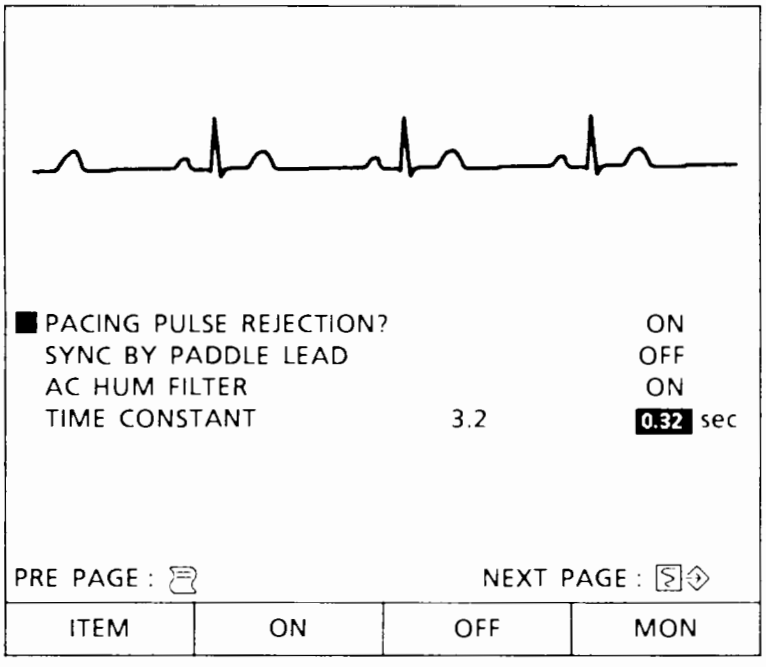
You can turn the AC interference filter on or off. The default setting is ON.

NOTE

- **Defibrillation and pacing are not available when the Setup screen is displayed.**
- **The AC hum filter is fixed to ON when pacing mode is selected or when the PADDLE or TELE is selected as an ECG source lead.**



1. From the Setup screen, press the Event key until the Setup screen - Defibrillation/monitoring appears. The selection cursor appears beside the top of items.



Setup screen - Defibrillation / monitoring

2. Press the ITEM function key until "AC HUM FILTER" is selected.
3. Change the setting with the ON or OFF function key.

   To return to the monitoring screen, press the MON function key.

This setting is saved after the power is turned off.

4-4-6 Turning the Pacing Spike Rejection On/Off

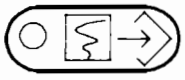
You can turn the pacemaker pulse rejection function on or off. This function allows correct heart rate counting when the patient has an implanted pacemaker. When you monitor a premature baby or infant and the monitor miscounts the narrow width QRS, set this to OFF. The default setting is ON.

WARNINGS

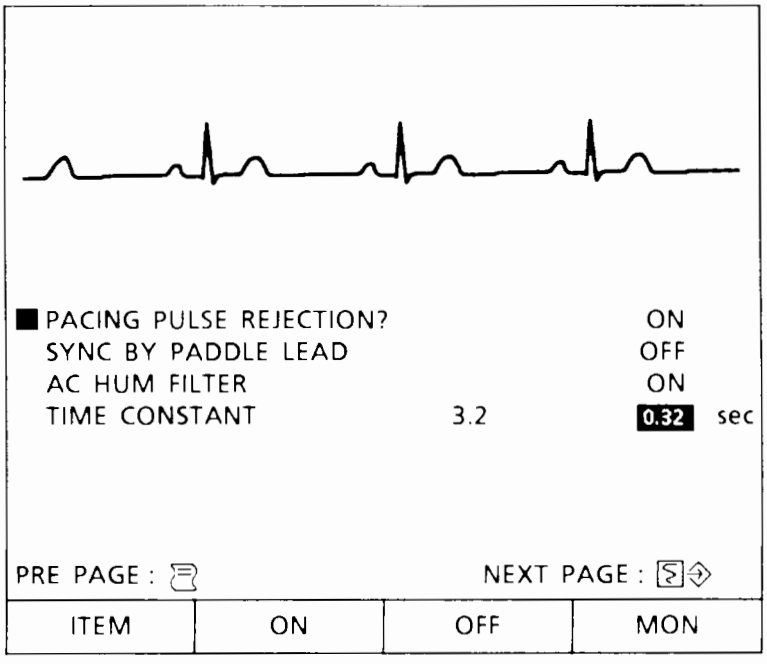
- **Keep pacemaker patients under close observation. The pacemaker rate may continue during cardiac arrest and certain arrhythmias. Do not rely only on heart rate alarms and the indicated heart rate.**
- **False low heart rate indicators may occur with certain pacemakers because of electrical overshoot.**

NOTE

Defibrillation and pacing are not available when the Setup screen is displayed.



1. From the Setup screen, press the Event key until the Setup screen - Defibrillation/monitoring appears.



Setup screen - Defibrillation / monitoring

2. Change the setting with the ON or OFF function key.

   To return to the monitoring screen, press the MON function key.

This setting is saved after the power is turned off.

4-4-7 Selecting the Transmitter Channel

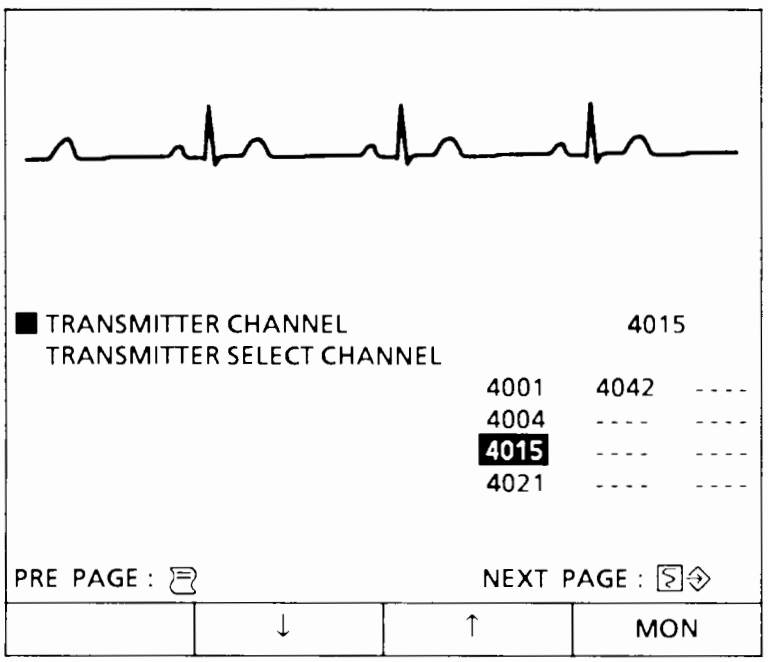
You can select the transmitter channel from the available channels selected in Section 2-8 "Selecting the Channel Group and Available Channels".

NOTE

- **This item appears only when the optional ZR-751VK Telemetry receiver is installed.**
- **Defibrillation and pacing are not available when the Setup screen is displayed.**

1. Turn the ENERGY/MODE SELECT control to the MON position.

2. Press the Setup key on the front panel. The Setup screen - Telemetry appears.



Setup screen - Telemetry

3. Change the channel with the ↓ or ↑ function key. The selected channel is highlighted.

   To return to the monitoring screen, press the MON function key.

This setting is saved after the power is turned off.

4-4-8 Changing the Heart Rate/Pulse Rate Alarm Limits

You can set the upper and lower heart rate/pulse rate alarm limits on the Setup screen.

CAUTION

Keep the patient under close observation or check the alarm settings when the "ALARM OFF" message is displayed. This message is displayed when any alarm setting on the Setup screen is set to "OFF". When the AL-751VK SpO_2 Unit is connected to the defibrillator, the "ALARM OFF" message is always displayed because both the heart rate alarm and pulse rate alarm cannot be set at the same time.

NOTE

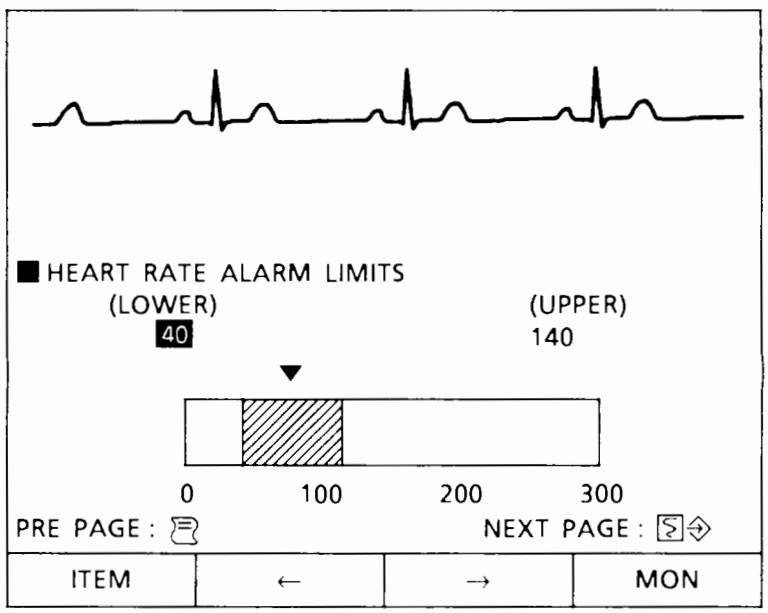
- **Defibrillation and pacing are not available when the Setup screen is displayed.**
- **To set the pulse rate alarm limits, select PR at SELECT ALARM SOURCE. When PR is selected, PULSE RATE ALARM LIMITS is displayed on the screen instead of HEART RATE ALARM LIMITS.**

1. Turn the ENERGY/MODE SELECT control to the MON position.

2. Press the Setup key on the front panel.

   The Setup screen Telemetry appears when the optional ZR-751VK Telemetry receiver is installed. Press the Event key on the front panel to display the Setup screen - heart rate/pulse rate alarm limits.

   The Setup screen - Heart rate/pulse rate alarm limits appears when the optional ZR-751VK Telemetry receiver is not installed.



Setup screen - Heart rate/pulse rate alarm limits

3. Press the ITEM function key to select the lower or upper limit.

   The "▼" pointer above the heart rate/pulse rate upper/lower alarm limit selection indicator indicates the patient's (current) heart rate or pulse rate.

4. Change the setting with the ← or → function key.

   Upper limit: 20 to 300 in 5 bpm steps and OFF (Default setting 140)
   Lower limit: 15 to 295 in 5 bpm steps and OFF (Default setting 40)
   When both limits are set to "OFF", the heart rate/pulse rate alarm function is turned off.

WARNING

Always keep a patient under close observation when the heart rate/pulse rate alarm function is turned off.

5. Repeat steps 3 and 4 for the other alarm limit.

   To return to the monitoring screen, press the MON function key.

These settings are saved after the power is turned off.

If DEFAULT is selected in ALARM LIMITS on the System Setup screen, changed alarm limits settings return to default settings.

4-4-9 Selecting Alarm Source

You can select the alarm source for the heart rate/pulse rate alarm limits. **The default** setting is HR.

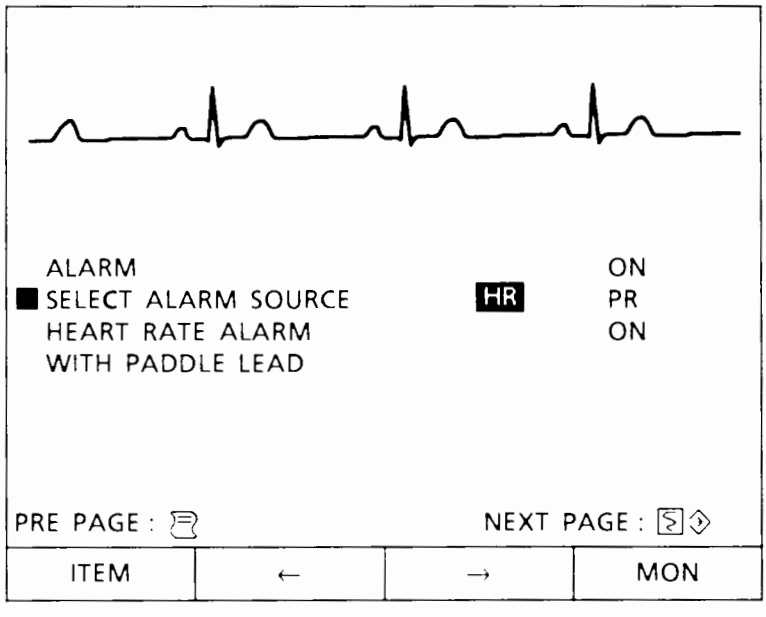
WARNING

When measuring SpO_2 with the AL-751VK SpO_2 Unit, make sure of following:

- **When the heart rate alarm is required, set the "SELECT ALARM SOURCE" setting to "HR" on the Setup screen. If the "SELECT ALARM SOURCE" setting is set to "PR", the heart rate alarm does not occur.**
- **When the "SELECT ALARM SOURCE" setting is set to "PR", if the SpO_2 probe is disconnected, the "SELECT ALARM SOURCE" setting automatically changes to "HR". After connecting the SpO_2 probe, set the "SELECT ALARM SOURCE" setting to "PR".**

NOTE

- **This item appears only when the optional AL-751VK SpO_2 unit is installed.**
- **Defibrillation and pacing are not available when the Setup screen is displayed.**



Setup screen - Alarm ON/OFF

1. From the Setup screen, press the Event key until the Setup screen-Alarm on/off appears.
2. Press the ITEM function key to select "SELECT ALARM SOURCE".
3. Change the setting with the ← or → function key. The default setting is HR.

To return to the monitoring screen, press the MON function key. This setting is saved after the power is turned off.

If the SpO_2 probe is disconnected from the AL-751VK SpO_2 unit while measuring the pulse waveform, this setting automatically changes from PR to HR.

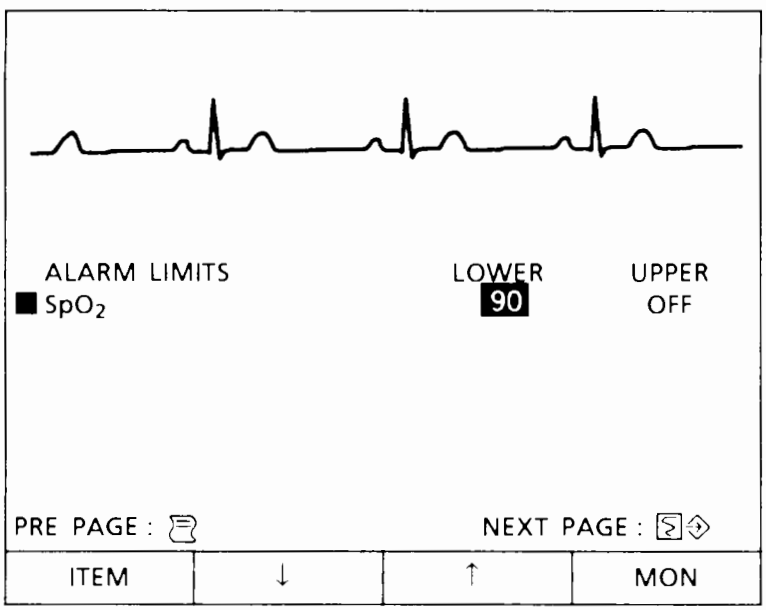
4-4-10 Changing the SpO_2 Alarm Limits

You can select the SpO_2 (%) upper/lower alarm limits. The SpO_2 data can be received from a transmitter or the AL-751VK SpO_2 unit.

NOTE

- **This item appears only when the optional AL-751VK SpO_2 unit or ZR-751VK Telemetry receiver is installed.**
- **Defibrillation and pacing are not available when the Setup screen is displayed.**

1. From the Setup screen, press the Event key until the Setup screen - SpO_2 alarm limits appears.



Setup screen - SpO_2 alarm limits

2. Press the ITEM function key to select the lower or upper limit.

3. Change the setting with the ↓ or ↑ function key.

   Upper limit: 51 to 99 in 1 % steps and OFF. The default setting is OFF.
   Lower limit: 50 to 99 in 1 % steps and OFF. The default setting is 90.

   When the both limits are set to "OFF", the SpO_2 alarm function is turned off.

WARNING

Always keep a patient under close observation when the SpO_2 alarm function is turned off.

4. Repeat steps 2 and 3 for the other alarm limit.

   To return to the monitoring screen, press the MON function key.

These settings are saved after the power is turned off.

If DEFAULT is selected in ALARM LIMITS on the System Setup screen, changed alarm limits settings return to default settings.

4-4-11 Enabling or Disabling All Vital Alarms

You can turn all vital alarms on or off. The default setting is ON.

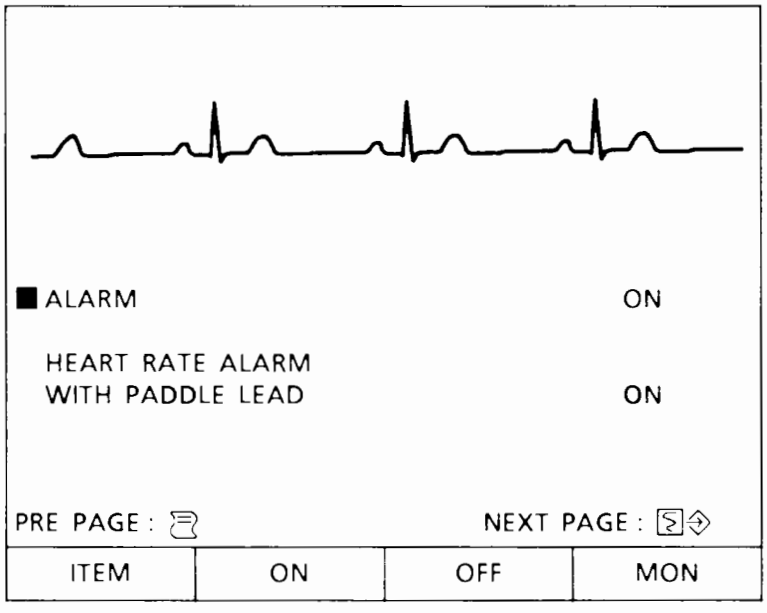
WARNING

When OFF is selected, no vital alarms function. Always keep a patient under close observation.

NOTE

Defibrillation and pacing are not available when the Setup screen is displayed.

1. From the Setup screen, press the Event key until the Setup screen - Alarm on/off appears.



Setup screen - Alarm ON/OFF

2. Change the ALARM setting with the ON or OFF function key.

   To return to the monitoring screen, press the MON function key.

This setting is saved after the power is turned off.

4-4-12 Turning the Heart Rate Alarm On/Off When Paddles Are Used

You can turn the heart rate alarm on or off when using disposable pads, external paddles or internal paddles and the PADDLE lead is selected.

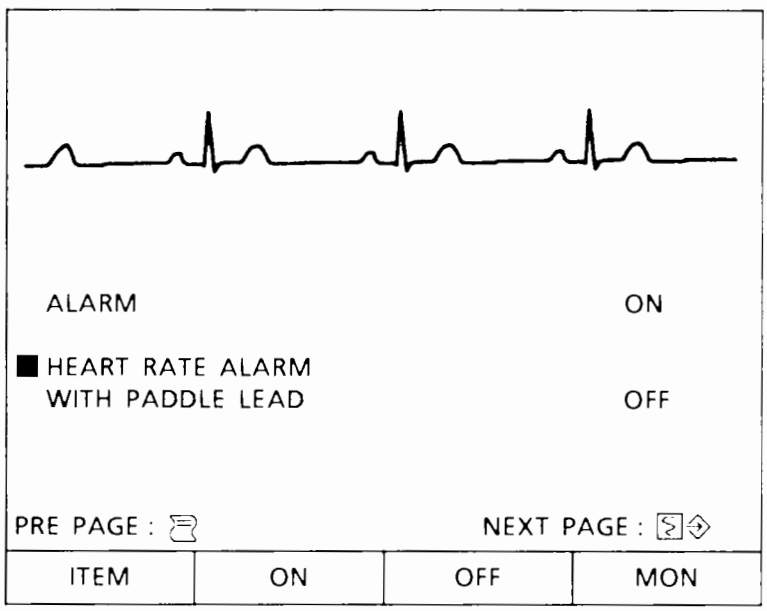
WARNING

When OFF is selected, the heart rate alarm does not function. Always keep a patient under close observation.

NOTE

Defibrillation and pacing are not available when the Setup screen is displayed.

1. From the Setup screen, press the Event key until the Setup screen - Alarm on/off appears.



Setup screen - Alarm ON/OFF

2. Press the ITEM function key to select "HEART RATE ALARM WITH PADDLE LEAD".

3. Change the setting with the ON or OFF function key. The default setting is OFF.

   To return to the monitoring screen, press the MON function key.

This setting is saved after the power is turned off.

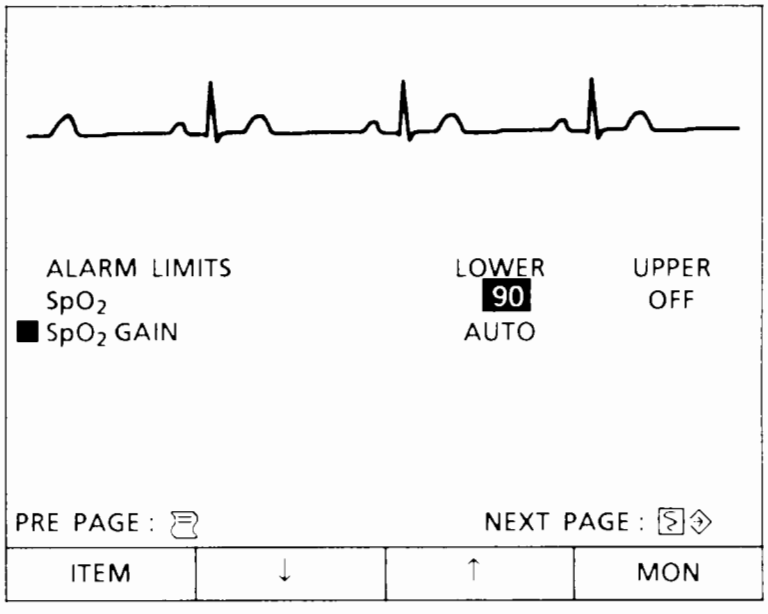
4-4-13 Changing the SpO_2 Gain

This selects the pulse waveform display sensitivity.

NOTE

- **This appears only when the optional AL-751VK SpO_2 unit is installed.**
- **Defibrillation and pacing are not available when the Setup screen is displayed.**

1. From the Setup screen, press the Event key until the Setup screen - SpO_2 alarm limits appears.



Setup screen - SpO_2 alarm limits

2. Press the ITEM function key to select "SpO_2 GAIN".
3. Change the setting with the ↑ or ↓ function key. The default setting is AUTO.

   To return to the monitoring screen, press the MON function key.

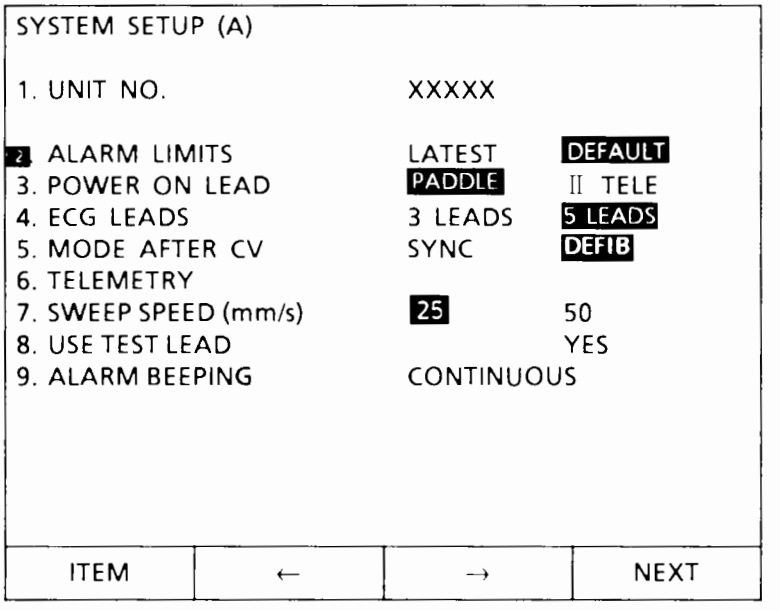
This setting is saved after the power is turned off.

4-4-14 Changing All Alarm Limits to the Default Settings

The default settings are:

	Lower	Upper
Heart rate/Pulse rate	40	140
SpO_2	90	OFF

1. From the System Setup (A) screen, press the ITEM function key until "ALARM LIMITS" is selected.



2. Change the setting with the ← or → function key.

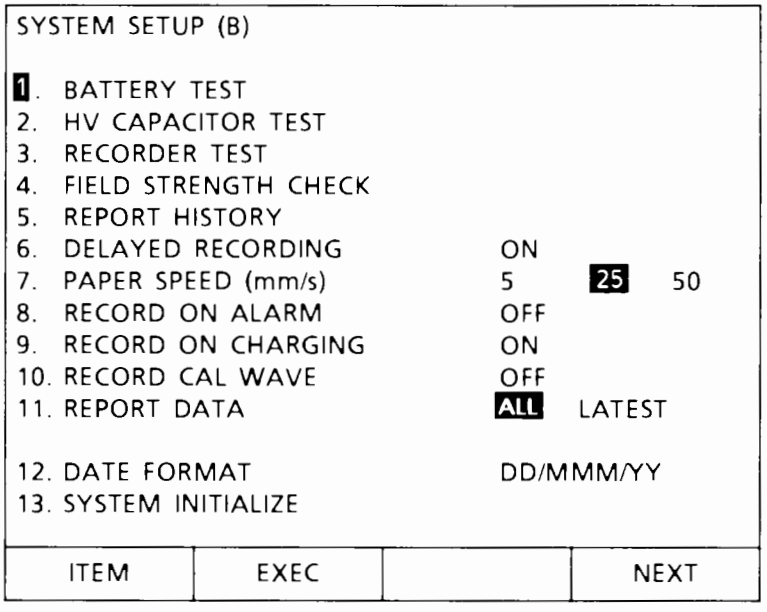
   DEFAULT: The settings are changed to the factory default settings.
   LATEST: The current settings are saved in memory.
   The default setting is LATEST.

3. To turn the power off, turn the ENERGY/MODE SELECT control to the OFF position.

These settings are saved after the power is turned off.

4-4-15 Turning the Alarm Recording On/Off

1. From the System Setup (A) screen, press the NEXT function key. The System Setup (B) screen appears.



2. Press the ITEM function key until "RECORD ON ALARM" is selected.

3. Change the setting with the ON or OFF function key.

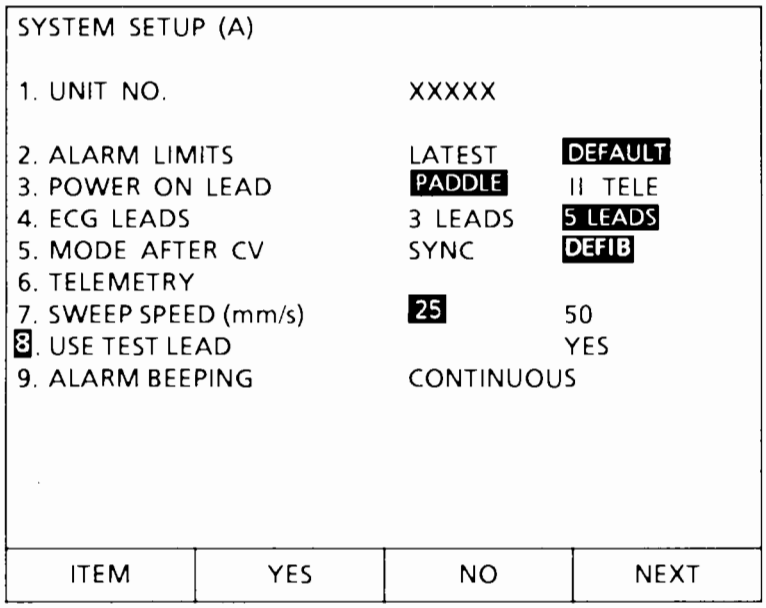
   ON: The alarm recording is turned on.
   OFF: The alarm recording is turned off.
   The default setting is OFF.

   To turn the power off, turn the ENERGY/MODE SELECT control to the OFF position.

This setting is saved after the power is turned off.

4-4-16 Enabling or Disabling the TEST Lead

1. From the System Setup (A) screen, press the ITEM function key until "USE TEST LEAD" is selected.



2. Change the setting with the YES or NO function key.

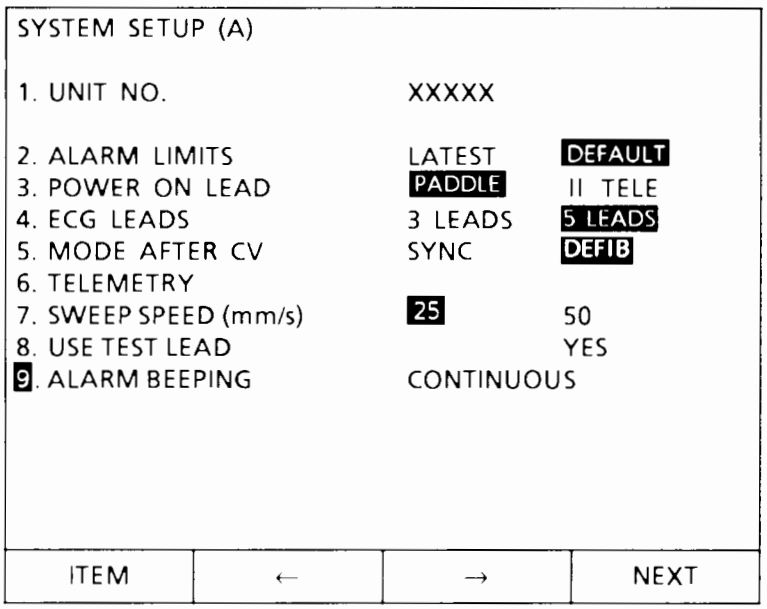
   YES: TEST can be selected with the ECG lead key.
   NO: TEST is not available with the ECG lead key.
   The default setting is YES.

3. To turn the power off, turn the ENERGY/MODE SELECT control to the OFF position.

This setting is saved after the power is turned off.

4-4-17 Setting the Alarm Sound

1. From the System Setup (A) screen, press the ITEM function key until "ALARM BEEPING" is selected.



2. Change the setting with the ← or → function key.

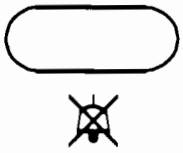
   CONTINUOUS: beeps continuously.
   PERIODIC: beeps for 3 seconds once every 30 seconds.
   The default setting is PERIODIC.

3. To turn the power off, turn the ENERGY/MODE SELECT control to the OFF position.

This setting is saved after the power is turned off.

4-5 Suspending Alarms and Alarm Recording

This function applies only to the heart rate/pulse rate alarm limits and the SpO_2 alarm limits.



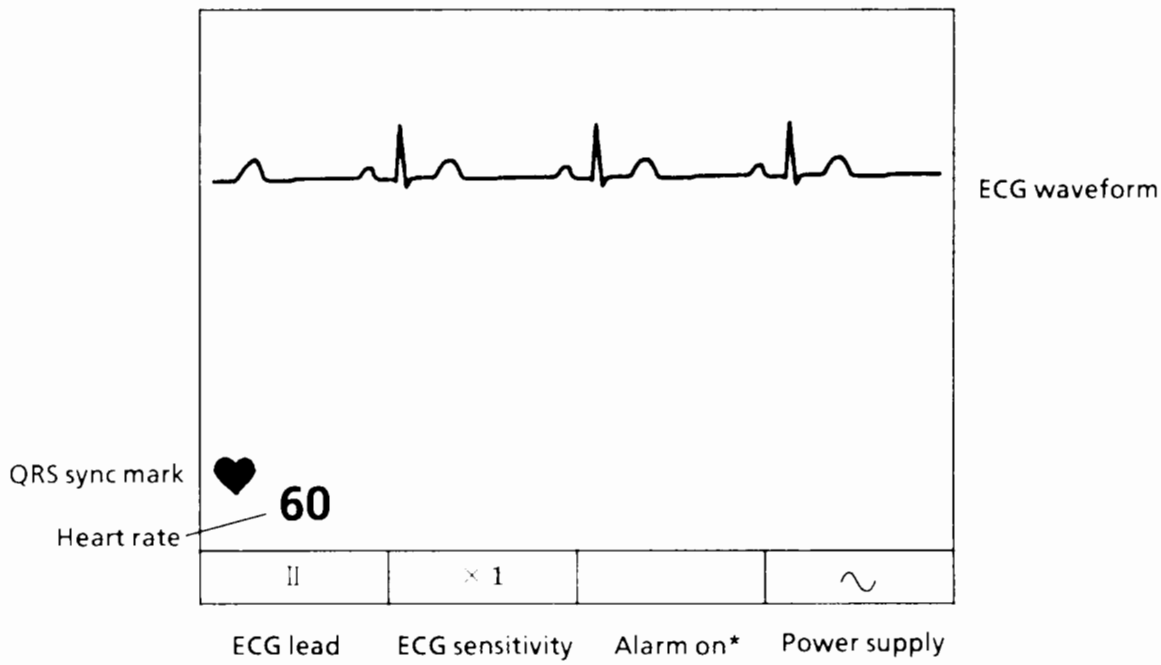
Press the Alarm suspend key on the front panel. All alarm function and alarm recording are suspended for three minutes. To resume alarm function, press this key again.

	× 1	3	~

4-6 Information on the Monitoring Screen

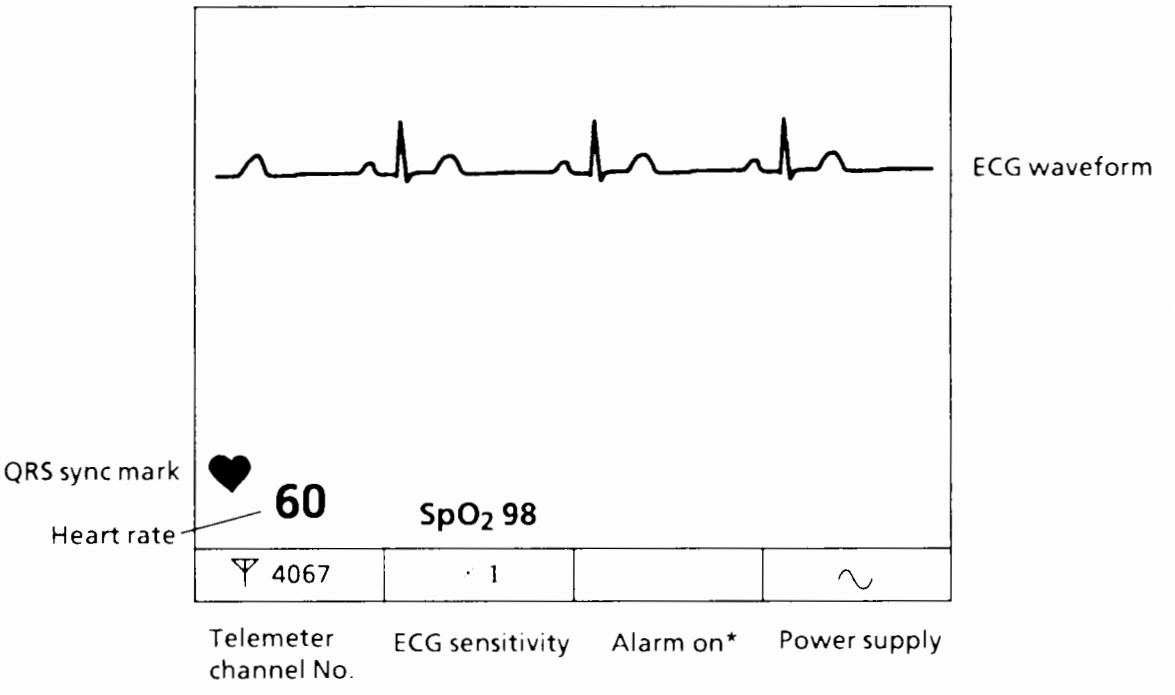
The following information can be displayed on the monitoring screen.

<When neither the ZR-751VK Telemetry Receiver nor the AL-751VK SpO_2 Unit is installed>



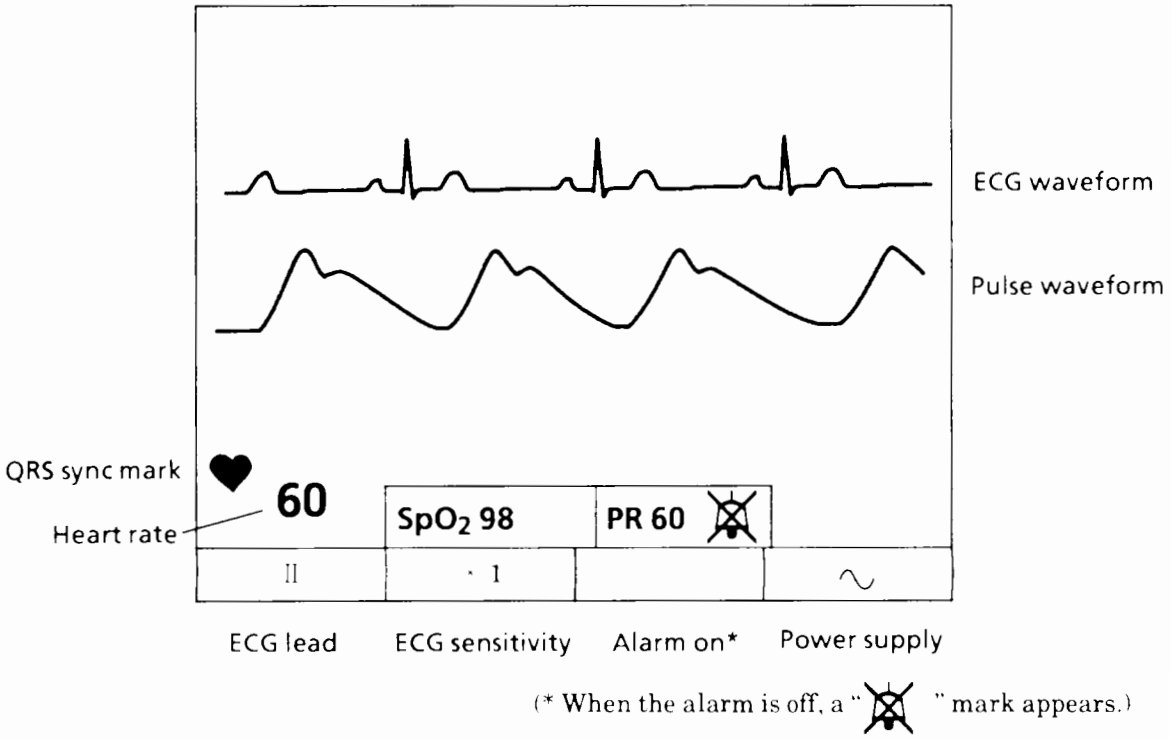
(* When the alarm is off, a " " mark appears.)

<When the ZR-751VK Telemetry Receiver is installed>



(* When the alarm is off, a " " mark appears.)

<When the AL-751VK SpO_2 Unit is installed>



(* When the alarm is off, a " " mark appears.)

4-7 Screen Messages and What to Do in Case of Trouble

Trouble or screen message	Possible cause	Action
ECG LEADS OFF message	An ECG monitoring electrode (disposable electrode) is detached.	Reattach the electrode.
	An electrode lead is disconnected from the electrode.	Snap or clip the electrode lead onto the disposable electrode.
REPLACE ECG ELECTRODES message	A disposable electrode is faulty.	Replace the electrode with a new one.
Dotted lines appear instead of the ECG waveforms.	An ECG monitoring electrode is detached.	Replace the electrode with a new one.
	An electrode lead is disconnected from the electrode.	Snap or clip the electrode lead onto the disposable electrode.
	An electrode lead is faulty.	Replace the ECG connection cable with a new one.
	The ECG connection cable is disconnected from the defibrillator (transmitter).	Firmly connect the ECG connection cable to the defibrillator (transmitter).
	When receiving the transmitter signal, the transmitter battery is almost discharged.	Replace the transmitter battery with a new one.
AC interference (50 or 60 Hz sine wave is superimposed on the ECG waveform.)	The electrode is dry.	Replace the electrode with a new one.
	AC interference filter is set to OFF.	Select "AC HUM FILTER" in the Setup screen to "ON" if the trouble still exists after above action(s).
	An electric blanket is used.	Use another warming method.
Noise which has a high frequency component is superimposed on the ECG waveform	EMG noise is superimposed.	Move the electrode to a position where there is less muscle.
Noise excessively deflects the ECG waveform trace on the screen	The contact between the lead and the electrode is poor due to rust.	Replace the ECG connection cable with a new one.
	The electrode is dirty or cannot be attached firmly to the skin.	Replace the electrode with a new one.
	The electrode is pulled by the lead.	Put some slack into the electrode lead.
Baseline wandering	The baseline is not stable due to respiration or body movement.	Change the electrode position.
	The electrode is dry or past the expiration date.	Replace the electrode with a new one.
	High skin-electrode impedance	Clean the patient's skin with a piece of cotton pad moistened with alcohol.
	New and old electrodes are used together.	Use electrodes which are unpacked at the same time.

Trouble or screen message	Possible cause	Action
No alarm even when heart rate or SpO_2 (%) exceeds the alarm limit.	The Alarm suspend key is pressed.	Press the Alarm suspend key again.
	"ALARM" is set to "OFF".	Select "ALARM" in the Setup screen to "ON".
The heart rate alarm does not occur.	The SpO_2 unit is connected and "SELECT ALARM SOURCE" is set to "PR".	Set "SELECT ALARM SOURCE" to "HR" in the Setup screen.
The pulse rate alarm does not occur.	The SpO_2 unit is connected but SELECT ALARM SOURCE" is set to "HR".	Set "SELECT ALARM SOURCE" to "PR" in the Setup screen.
TELEMETRY ECG LEADS OFF message	An ECG electrode of the transmitter is detached.	Replace the electrode with a new one.
REPLACE TRANSMITTER BATT. message	The battery in the transmitter is almost discharged.	Replace the battery with a new one.
SIGNAL LOSS message	Telemetry signal is weak or not received.	Replace the battery with a new one or check the location of the defibrillator and transmitter. Refer to 8-9 "Checking the Field Strength".
PULSE CHECK message	During SpO_2 measurement, the amount of transmitted light is too small to measure.	Place the probe in a different position where light can pass through more easily.
SpO_2 PROBE OFF message	The SpO_2 probe is not attached to the patient correctly.	Attach the probe to the patient correctly.
	Probe is worn out.	Replace the probe with a new one.
SpO_2 (%) data does not appear.	The ECG lead is not set to a lead which includes "Y".	Select an ECG lead which includes "Y".
CALL	The CALL button on the transmitter is pressed.	Go to the patient.
USE I, II • • OR PADS LEAD message	The ENERGY/MODE SELECT control is turned to the energy position when ZR-751VK is used.	When you do defibrillation or synchronized cardioversion, monitor the ECG waveform with the ECG monitoring electrodes and the ECG connection cable.
REPLACE DISPOSABLE PADS message	The polarization voltage of disposable pads is high.	Replace disposable pads.
TEST WAVE message	TEST is selected for the ECG lead.	
LOW QUALITY SIGNAL	Body movement	Change the measurement site.
	SpO_2 probe is loose.	Attach the probe properly.
	Strong external light (operation lamp, sunlight, fluorescent lamp, etc.)	Cover the measurement site with a blanket.
CHECK PROBE ATTACHMENT	Measurement site is too thick or thin.	Change the measurement site.
	Insufficient circulation for SpO_2 measurement.	Check the patient condition. Reattach the probe properly or change the measurement site.
	The probe is attached too tightly.	Reattach the probe properly.
	Probe is not attached to the patient.	Attach the probe properly.
	Probe lifetime is over.	Replace the probe with new one.

Trouble or screen message	Possible cause	Action
SpO_2 CONNECTOR OFF	SpO_2 probe is disconnected from the SpO_2 unit.	Connect the SpO_2 probe to the SpO_2 unit.
	SpO_2 probe is damaged.	Replace the probe with new one.
	SpO_2 unit is faulty.	Replace the SpO_2 unit with new one.
CHANGE SpO_2 PROBE	Faulty probe	Replace the probe with new one
SpO_2 UNIT MALFUNCTION	Faulty SpO_2 unit.	Replace the SpO_2 unit with new one.
	The SpO_2 unit is disconnected from the defibrillator.	Connect the SpO_2 unit connector to the defibrillator.
SpO_2 probe damage	Did not follow the specified disinfection method.	Replace the SpO_2 probe with a new one.
	Disposable probe is used repeatedly.	Replace the SpO_2 probe with a new one.
SpO_2 value on the defibrillator and the CO oximeter do not match.	Measurement site is not clean.	If necessary, remove the nail polish and clean the measurement site.
	Patient's oxyhemoglobin or methemoglobin is high.	Correct SpO_2 measurement may not be possible.
Unstable SpO_2 value	SpO_2 probe size is inappropriate.	Use the correct size SpO_2 probe.
	SpO_2 probe is attached to the same limb that is used for NIBP measurement.	Attach the SpO_2 probe to the other limb.
Noise overlaps on the pulse waveform.	Strong external light (operation lamp, sunlight, fluorescent lamp, etc.)	Cover the measurement site with a blanket.
	The line frequency selected on the AL-751VK SpO_2 unit is different from the actual line frequency.	Set the correct line frequency on the SpO_2 unit. Refer to the AL-751VK SpO_2 unit installation guide.
ALARM OFF message	Any of the following items is set to OFF in the Setup screen: • ALARM • HEART RATE ALARM WITH PADDLE LEAD (Only when disposable pad is used) • HEART RATE ALARM LIMITS • PULSE RATE ALARM LIMITS (Only when the AL-751VK SpO_2 Unit is installed) • ALARM LIMITS SpO_2 (Only when SpO_2 data is received)	If alarms are required, set these items to ON on the Setup screen.
	The AL-751VK SpO_2 Unit is connected to the defibrillator.	---

NOTE

The "ALARM OFF" message is displayed when any alarm setting on the Setup screen is set to "OFF". When the AL-751VK SpO_2 Unit is connected to the defibrillator, the "ALARM OFF" message is always displayed. Because both the heart rate alarm and pulse rate alarm cannot be set at a time.

SECTION 5

PACING (TEC-7531 Only)

5-1 About Pacing

Non-invasive fixed and demand pacing is only available with TEC-7531 defibrillators. After defibrillation, if bradycardia is observed, immediate electric stimulation may be given through the patient's chest with the disposable pads. The ECG waveforms during pacing can be monitored continuously with the ECG connection cable and disposable electrode.

5-2 Important Safety Information

WARNING

Operation

- Do not perform pacing while using an ESU. Pacing while using an ESU may cause serious electrical burn, shock, or other injury, or the defibrillator may be damaged by the noise emitted by the ESU.
- Always monitor the ECG waveform with the ECG connection cable and disposable electrode.
- The defibrillator must only be operated by trained and qualified medical personnel.

Pacing pads (Disposable pads)

Failure to comply with the following warnings may cause serious skin burn.

- Do not re-use disposable pads. Pads are disposable.
- If the package is broken, dispose of the pads and do not use them. If the pads are used, this may cause serious electrical burn or poor energy discharge to the heart.
- Do not use the pads if they are past the expiration date. If expired pads are used, this may cause serious electrical burn or poor energy discharge to the heart.
- Use the disposable pads as soon as possible after removing them from the package. If the pads are left for a long period of time after removing them from the package, it may cause serious electrical burn or poor energy discharge to the heart.
- If pads or their connector get wet, dry them well before use.
- Do not use the disposable pads if:
  - The gel has become dry, or
  - The gel breaks down and releases water.

  This may cause serious electrical burn or poor energy discharge to the heart.
- Do not use the P610 or P612 disposable pads if the color of the gel changes to dark brown and dark brown gel is attached to the protective liner. This may cause serious electrical burn or poor energy discharge to the heart.

CAUTION

When using the P610 or P612 disposable pads for long term pacing, replace them every 24 hours. Failure to follow this caution may cause poor pacing current and poor energy discharge to the heart.

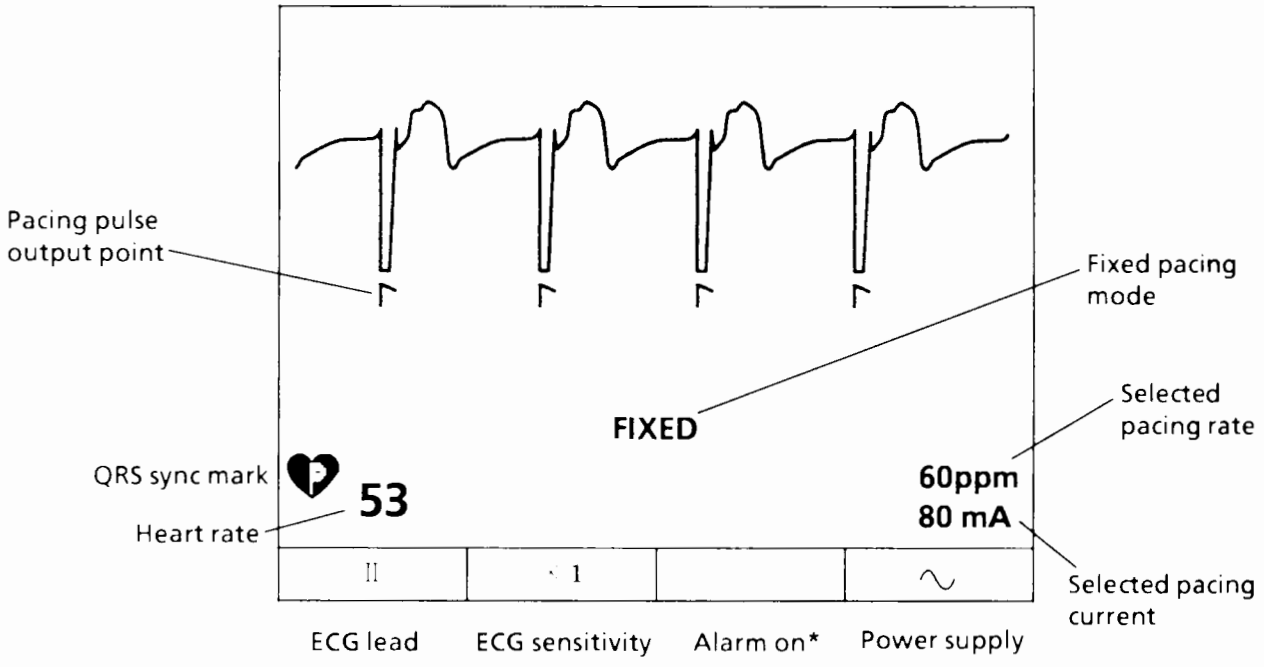
NOTE

Follow all disposable pad labeling instructions.

5-3 Pacing in Fixed Mode

5-3-1 Information on the Pacing Screen in Fixed Mode

The following information can be displayed on the pacing screen in Fixed mode.



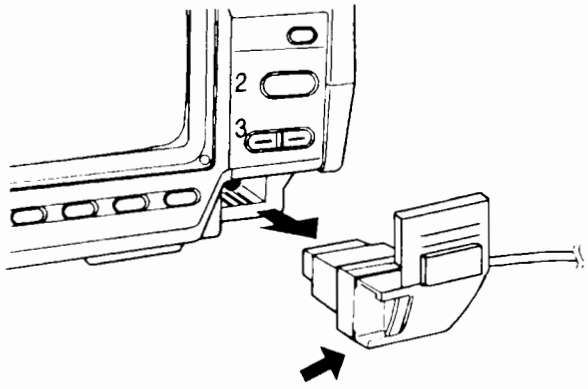
(* When the alarm is off, a " " mark appears.)

This is the pacing screen in Fixed mode which appears when neither ZR-751VK Telemetry Receiver nor the AL-751VK SpO_2 Unit is installed.

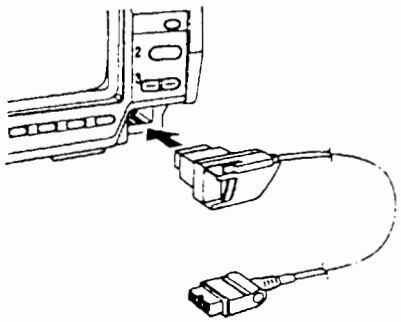
5-3-2 Procedure

1. Connect the pad adaptor to the defibrillator.

   1) Press the paddle release knob of the paddle connector on the right panel and remove the external paddles from the paddle connector.



   2) Connect the pad adaptor to the paddle connector until it clicks.



2. Turn the power on.

   Turn the ENERGY/MODE SELECT control to the PACING position to turn the power on.

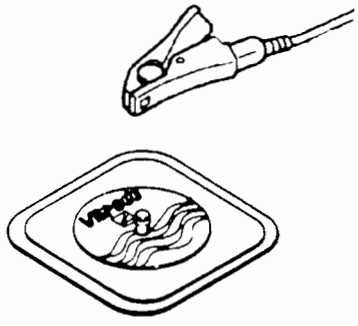
3. Prepare the patient to monitor the ECG waveforms with the defibrillator. Refer to Section 4-2 "Preparing for ECG Monitoring" to attach the electrode to the patient.

   1) Connect the ECG connection cable to the ECG input connector on the front panel.

   2) Shave excess hair.

   3) Clean the patient's skin with a piece of cotton pad moistened with alcohol.

4) Clip the ECG connection cable to the electrode.



5) Attach the disposable electrodes to the patient.

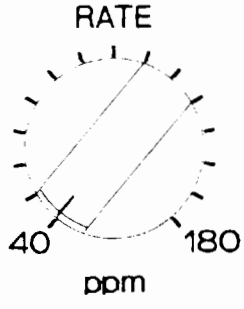
6) Fasten the electrode leads with surgical tape with an extra length of wire between the tape and the electrode.

4. Select the ECG lead.

The ECG lead is set to II when the power is turned on (default setting).

To monitor the ECG waveforms with the ECG monitoring electrodes (disposable electrodes), refer to Section 4-2 "Preparing for ECG Monitoring".

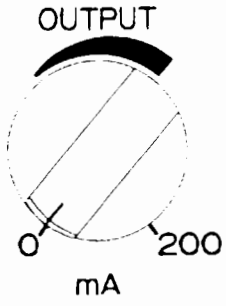
5. Select the pacing rate with the RATE control. The selected rate appears on the lower right corner of the screen.

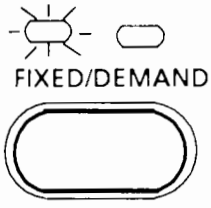


WARNING

The pacing rate must be determined by qualified medical personnel based on the heart rate of the patient in a normal state.

6. Turn the OUTPUT control to 0 mA.





7. Make sure that fixed mode is selected. The FIXED lamp lights when fixed mode is selected. To change the mode, press the FIXED/DEMAND key. The default setting is fixed mode.

8. Prepare the disposable pads.

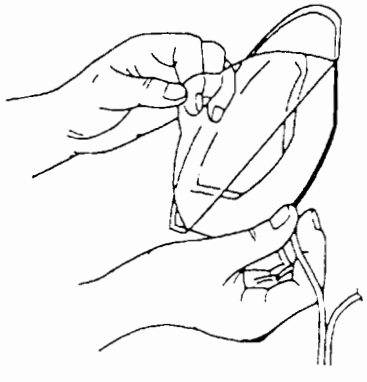
WARNING

Failure to comply with the following warnings may cause serious skin burn.

- **Do not attach the pads over disposable electrode.**
- **Do not attach pads on the papilla or where there is any ointment on the patient's body.**
- **Fit the pad closely to the body surface so that current flows uniformly through the pad. This reduces pain and discomfort to the patient and decreases the pacing current.**
- **Do not use the disposable pads over 24 hours.**
- **Do not use the pads if they are past the expiration date. If expired pads are used, this may cause serious electrical burn or poor energy discharge to the heart.**

1) Clean the patient's chest to remove oil and dirt and allow firm pad contact with the skin. Shave excessive hair, if necessary.

2) Take out the disposable pads out of the package and carefully remove the backing from one pad at a time.



WARNING

Do not use the P610 or P612 disposable pads if the color of the gel changes to dark brown and dark brown gel is attached to the protective liner. This may cause serious electrical burn or poor energy discharge to the heart.

CAUTION

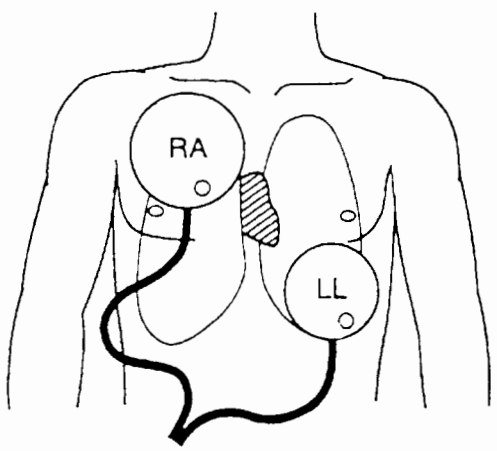
When using the P610 or P612 disposable pads for long term pacing, replace them every 24 hours. Failure to follow this caution may cause poor pacing current and poor energy discharge to the heart.

NOTE

- **Always prepare the second disposable pads before defibrillation. Use the second disposable pads if the gel of the first disposable pads is dry, deteriorated or changes color.**
- **Before attaching the disposable pads to the patient, clean the skin where the pads will be attached. If the skin is moist, use a cotton swab to dry it.**

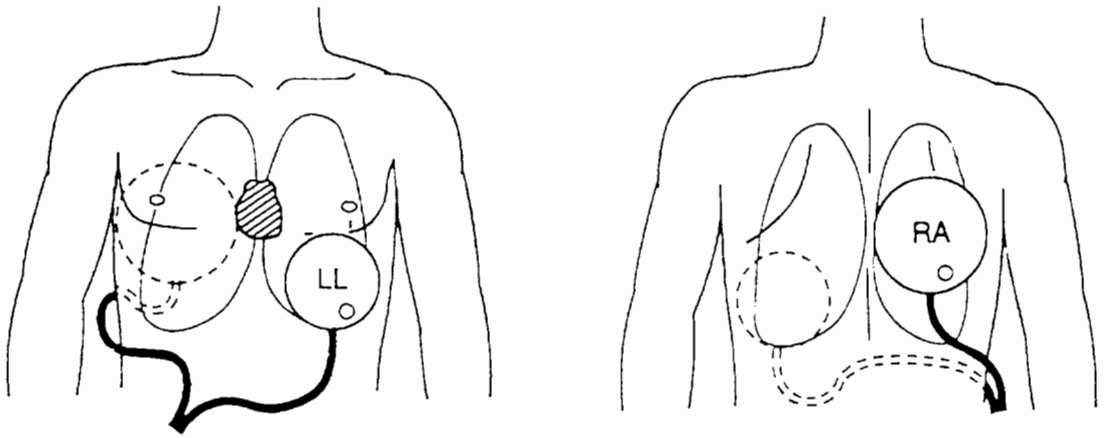
3) Attach the pads to the patient's body, one at a time.

Apex-Anterior placement



RA: Right edge of the second or third intercostal sternum
LL: Fifth middle axial line

Apex-Posterior placement

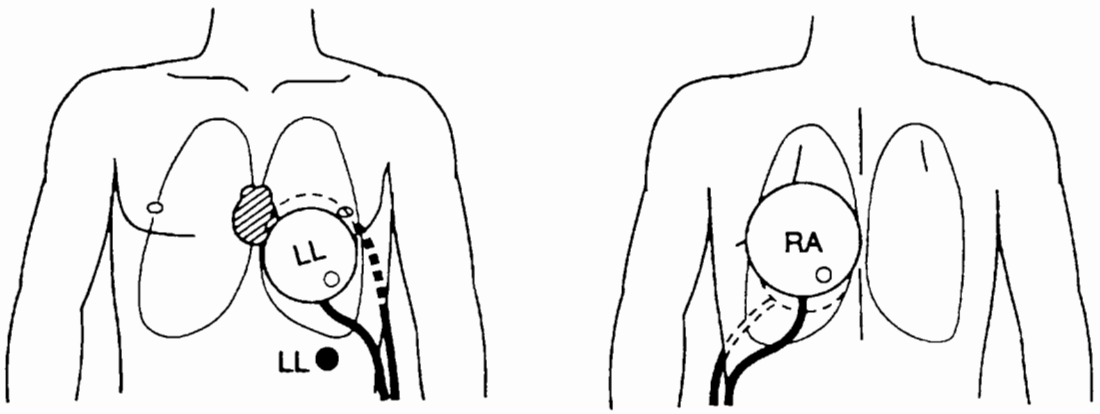


RA: Between right scapula and spine
LL: Fifth middle axial line

Anteroposterior placement

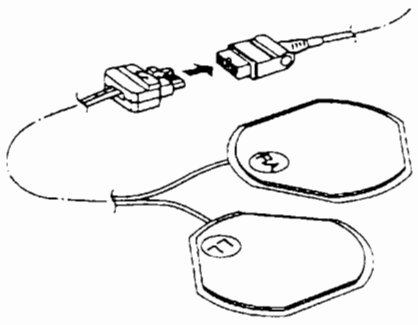
WARNING

This placement is not suitable for defibrillation or monitoring. Use this placement only for pacing.



RA: Between left scapula and spine
LL: Fifth middle axial line

4) Connect the disposable pads to the pad adaptor.



NOTE

Firmly connect the disposable pads to the pad adapter until the connector of the disposable pads clicks.

9. Press the PACING ON/OFF key to start pacing.

10. Increase the pacing current with the OUTPUT control. The pacing current appears on the lower right corner of the screen. When a pacing pulse is output, the pacing pulse lamp lights and a "⎍" mark appears below the ECG waveforms.

WARNING

- **Do not touch the patient during pacing. Failure to follow this warning may cause electrical shock.**
- **The pacing current must only be increased by qualified medical personnel decision.**
- **Keep the intensity of current as low as possible to minimize pain and discomfort to the patient.**

To stop pacing, press the PACING ON/OFF key, then turn the OUTPUT control to 0 mA.

11. After use

1) Turn the ENERGY/MODE SELECT control to the OFF position and disconnect the AC power cord.

2) Clean the defibrillator as described in Section 8-2-2 "Cleaning the Defibrillator, Cables and Paddles".

3) Press the paddle release knob of the paddle connector on the right panel and remove the pad adaptor from the paddle connector.

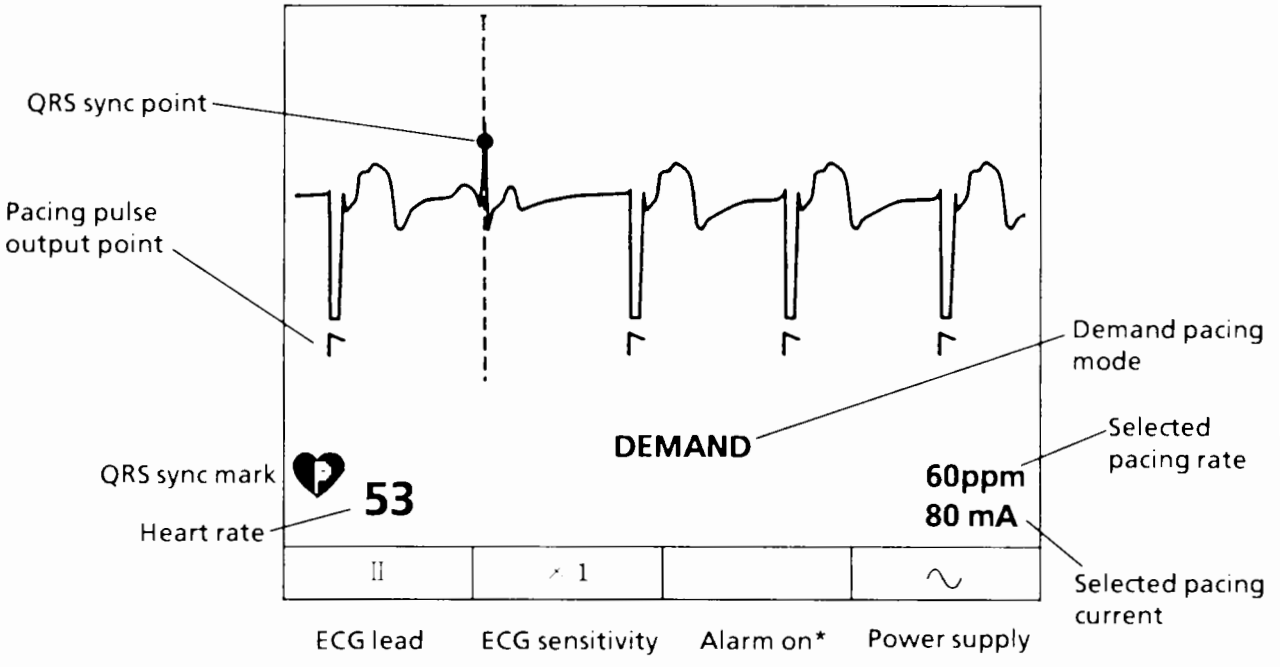
4) Connect the external paddles to the paddle connector until it clicks.

5) Return the defibrillator to its storage location and connect it to the AC power to maintain the battery charge.

5-4 Pacing in Demand Mode

5-4-1 Information on the Pacing Screen in Demand Mode

The following information can be displayed on the pacing screen in Demand mode.



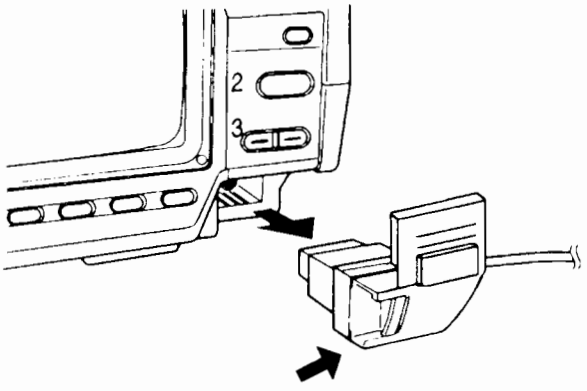
(* When the alarm is off, a "" mark appears.)

This is the pacing screen in Demand mode which appears when neither ZR-751VK Telemetry Receiver nor the AL-751VK SpO_2 Unit is installed.

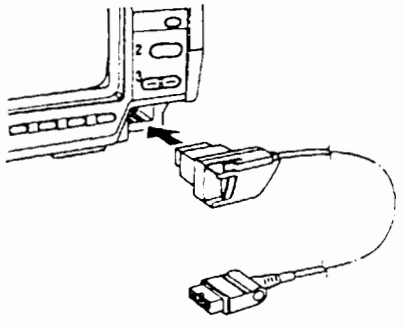
5-4-2 Procedure

1. Connect the pad adaptor to the defibrillator.

   1) Press the paddle release knob of the paddle connector on the right panel and remove the external paddles from the paddle connector.



   2) Connect the pad adaptor to the paddle connector until it clicks.



2. Turn the power on.

   Turn the ENERGY/MODE SELECT control to the PACING position to turn the power on.

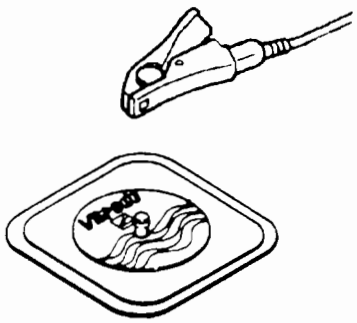
3. Prepare the patient to monitor the ECG waveforms with the defibrillator. Refer to Section 4-2 "Preparing for ECG Monitoring" to attach the electrode to the patient.

   1) Connect the ECG connection cable to the ECG input connector on the front panel.

   2) Shave excess hair.

   3) Clean the patient's skin with a piece of cotton pad moistened with alcohol.

4) Clip the ECG connection cable to the electrode.



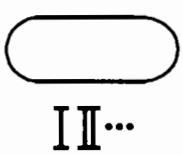
5) Attach the disposable electrodes to the patient.

6) Fasten the electrode leads with surgical tape with an extra length of wire between the tape and the electrode.

4. Select the ECG lead.

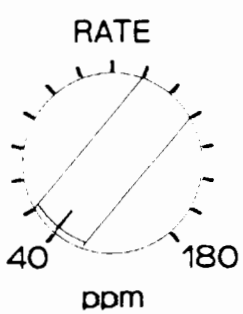
WARNING

Do not select "TEST". Failure to follow this warning causes accidental pacing which is not synchronized with the patient's QRS wave.



Press the ECG lead key to select the lead which has the highest QRS wave. The default setting is II.

5. Select the pacing rate with the RATE control. The selected rate appears in the lower right corner of the screen.



WARNING

The pacing rate must be determined by qualified medical personnel based on the heart rate of the patient in a normal state.

6. Press the FIXED/DEMAND key to select demand pacing mode. The DEMAND pacing lamp lights.

7. Turn the PACING OUTPUT control to 0 mA.

8. Prepare the disposable pads.

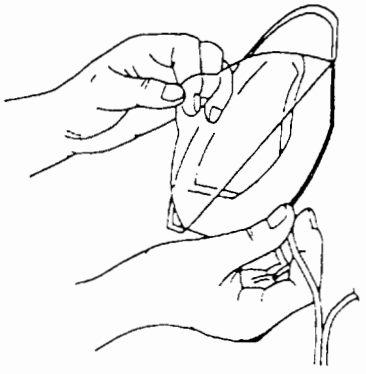
WARNING

Failure to comply with the following warnings may cause serious skin burn.

- **Do not attach the pads over disposable electrode.**
- **Do not attach pads on the papilla or where there is any ointment on the patient's body.**
- **Fit the pad closely to the body surface so that current flows uniformly through the pad. This reduces pain and discomfort to the patient and decreases the pacing current.**
- **Do not use the disposable pads over 24 hours.**

1) Clean the patient's chest to remove oil and dirt and allow firm pad contact with the skin. Shave excessive hair, if necessary.

2) Take out the disposable pads out of the package and carefully remove the backing from one pad at a time.



WARNING

Do not use the P610 or P612 disposable pads if the color of the gel changes to dark brown and dark brown gel is attached to the protective liner. This may cause serious electrical burn or poor energy discharge to the heart.

CAUTION

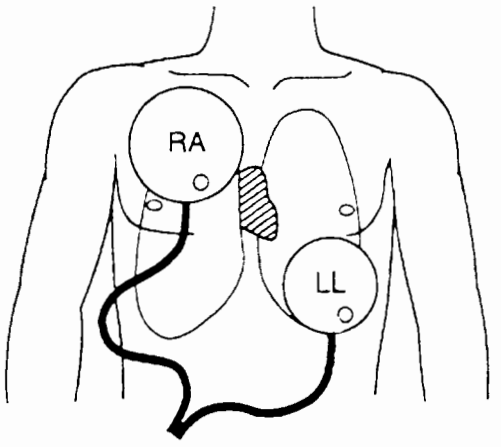
When using the P610 or P612 disposable pads for long term pacing, replace them every 24 hours. Failure to follow this caution may cause poor pacing current and poor energy discharge to the heart.

NOTE

- **Always prepare the second disposable pads before defibrillation. Use the second disposable pads if the gel of the first disposable pads is dry, deteriorated or changes color.**
- **Before attaching the disposable pads to the patient, clean the skin where the pads will be attached. If the skin is moist, use a cotton swab to dry it.**

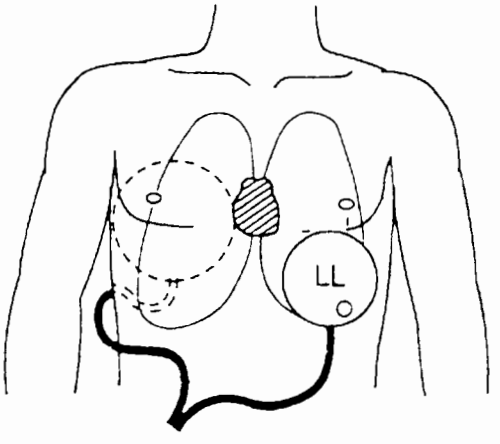
3) Attach the pads to the patient's body, one at a time.

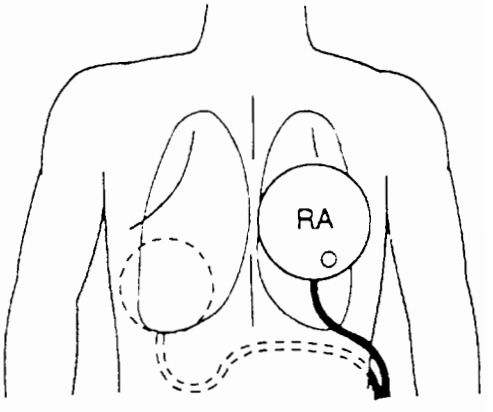
Apex-Anterior placement



RA: Right edge of the second or third intercostal sternum
LL: Fifth middle axial line

Apex-Posterior placement



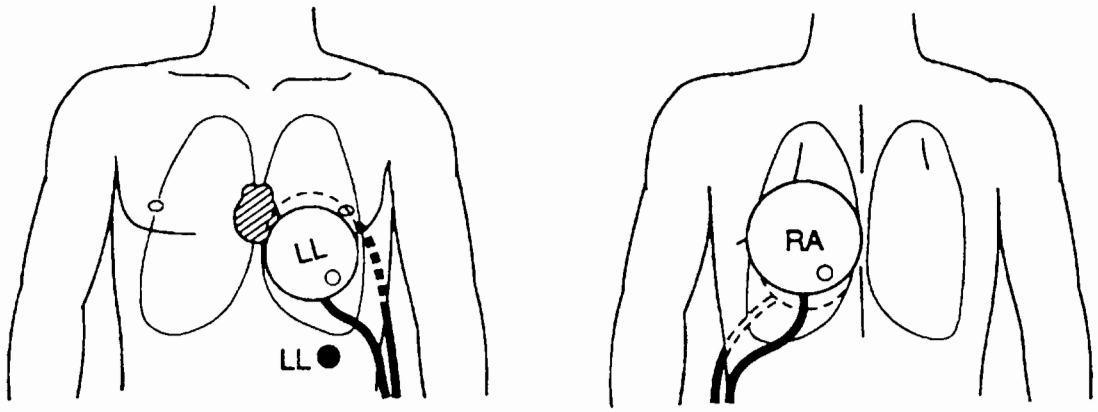


RA: Between right scapula and spine
LL: Fifth middle axial line

Anteroposterior placement

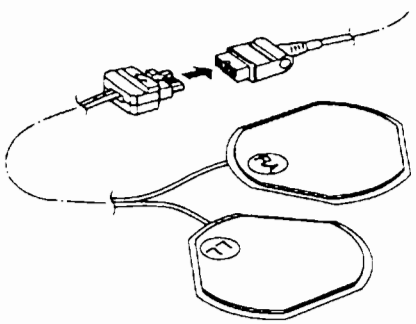
WARNING

This placement is not suitable for defibrillation or monitoring. Use this placement only for pacing.



RA: Between left scapula and spine
LL: Fifth middle axial line

4) Connect the disposable pads to the pad adaptor.



NOTE

Firmly connect the disposable pads to the pad adapter until the connector of the disposable pads clicks.

9. Check that the "↓" mark appears on every QRS waves.

The "↓" mark indicates that the defibrillator detect the QRS wave. If the mark does not appear:

- Change the amplitude of the ECG waveforms with the ECG sensitivity key.
- Change the ECG lead with the ECG lead key.
- Change the electrode position.

PACING ON/OFF

10. Press the PACING ON/OFF key to start pacing.

11. Increase the pacing current with the OUTPUT control. The pacing current appears in the lower right corner of the screen. When a pacing pulse is output, the pacing pulse lamp lights and a "⎍" mark appears below the ECG waveforms.

WARNING

- **Do not touch the patient during pacing. Failure to follow this warning may cause electrical shock.**
- **Do not change the sensitivity or ECG lead setting after pacing is started. If one of these settings is changed, the pacing stops for 3 seconds. Failure to follow this warning may cause serious heart attack.**
- **The pacing current must only be increased by qualified medical personnel decision.**
- **Keep the intensity of current as low as possible to minimize pain and discomfort to the patient.**
- **For 300 ms after the pacing pulse is output, no signal can be detected as a QRS wave.**

NOTE

The paced QRS wave may not be counted correctly.

12. After use

1) Turn the ENERGY/MODE SELECT control to the OFF position and disconnect the AC power cord.

2) Clean the defibrillator as described in Section 8-2 "Cleaning the Defibrillator, Cables and Paddles".

3) Press the paddle release knob of the paddle connector on the right panel and remove the pad adaptor from the paddle connector.

4) Connect the external paddles to the paddle connector until it clicks.

5) Return the defibrillator to its storage location and connect it to the AC power to maintain the battery charge.

5-5 Screen Messages and What to Do in Case of Trouble

Trouble or screen message	Possible cause	Action
PACING PADDLE LOOSE PACER STOP	Pacing is stopped because a disposable pad is detached.	Reattach the disposable pad to the patient.
ECG LEADS OFF PACER STOP	Demand mode pacing is stopped because an ECG monitoring electrode (disposable electrode) is detached.	Reattach the electrode to the patient.
USE Ⅰ, Ⅱ • • LEAD	Pacing is stopped because the lead is changed to TEST.	Select lead Ⅰ, Ⅱ or Ⅲ with the ECG lead key.
PADDLE LOOSE	A disposable pad is not firmly attached to the patient when the pacing mode is selected.	Firmly attach the disposable pads to the patient.
	The pad adaptor is not connected to the defibrillator when the pacing mode is selected.	Connect the pad adaptor to the defibrillator firmly.
REPLACE ECG ELECTRODES	A disposable electrode is faulty.	Replace the electrode with a new one.
ECG LEADS OFF	An ECG monitoring electrode (disposable electrode) is detached.	Reattach the electrode.
	An electrode lead is disconnected from the electrode.	Snap or clip the electrode lead onto the disposable electrode.
TEST WAVE	TEST is selected for the ECG lead.	
SELECT MONITOR MODE	The Setup key was pressed when the instrument was not in the monitoring mode.	When you change the settings, turn the ENERGY/MODE SELECT control to the MON position.

SECTION 6

RECORDING

6-1 About Recording

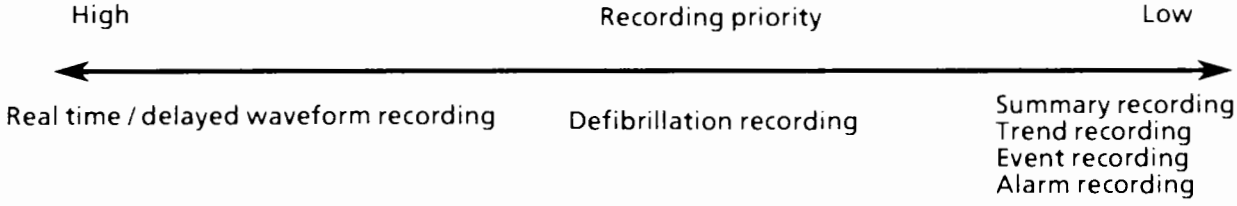
◆ **Recording Modes**

	Recording mode		Recorded data	Length/time of recorded data	Operation/conditions for recording
Manual recording	(Real time or delayed) waveform recording		Waveform on the screen Either real time or 4 seconds delayed waveform recording can be selected. (Delayed is the default setting.)	Continuous	Press the Record key. To perform real time recording, set DELAYED RECORDING in the System Setup screen to OFF.
	Report recording	Summary recording	Saved event data	Up to 100 event data	Press the Report key. REPORT MODE in the Setup screen must be set to SUMMARY. (The default setting is SUMMARY.)
			Saved defibrillation report	Up to 30 reports	
			Saved ECG and pulse from 8 seconds before to 12 seconds after defibrillation	Up to 4 minutes	
			Saved ECG and pulse from 4 seconds before to 12 seconds after the Event key is pressed.	Up to 5 minutes and 20 seconds total	
			Saved ECG and pulse from 4 seconds before to 12 seconds after alarm occurrence		
		Trend recording	Heart rate trendgraph, Pulse rate trendgraph, SpO_2 trendgraph and tabular trend data	1, 2, 4, 8, or 24 hours trendgraphs and trend data	Press the Report key. REPORT MODE in the Setup screen must be set to TREND.
	Event recording		Saved ECG and pulse from 4 seconds before to 12 seconds after the Event key is pressed.	16 seconds	Press the Event key.
Automatic recording	Defibrillation recording		ECG and pulse from the start of charge to 12 seconds after defibrillation	Up to 12 seconds after defibrillation	Press the CHARGE key or CHARGE button.
	Alarm recording		ECG and pulse waveform from 4 seconds before to 12 seconds after alarm occurrence.	16 seconds	Alarm in the Setup screen must be set to ON.

ECG and pulse: ECG and pulse waveforms with annotations
Saved data remain in memory except for trend recording data after the power is turned off.

◆ Recording Priority

If more than one recording mode is activated at the same time, only the highest priority mode is used.



◆ Printed Data

The following data, annotations, and marks can be printed.

	Printed Items	Example
Monitoring	User-defined ID no. of the defibrillator	UNIT NO. 00001
	Date	SEP/01/96
	Time	12:35:46
	ECG lead	PADDLE, TELE, Ⅰ, Ⅱ, Ⅲ, aVR, aVL, aVF, V, AUX IN, TEST
	ECG sensitivity	× 1/2, × 1, × 2, × 4
	AC interference filter setting	AC FLT ON, AC FLT OFF
	Time constant (seconds)	T.C. 0.32, T.C. 3.2
	SpO_2 sensitivity	SpO_2 GAIN × 1/8, × 1/4, × 1/2, × 1, × 2, × 4, × 8
	Real time/delayed waveform recording	REAL, DELAY
	Operation mode	MON, DEFIB, PACING
	Recording speed	25 mm/s, 5 mm/s
	Heart rate (bpm)	HR 60
	SpO_2 (%)*	SpO_2 90, --: The SpO_2 probe is detached or the pulse wave is not detected.
	Pulse rate**	PR 60 --: The SpO_2 probe is detached or the pulse wave is not detected.
	Transmitter channel*	TEL CH. XXXX
	Event mark	E: The Event key is pressed. E▽ ***: The MARK button on the transmitter is pressed
Defibrillation	Discharge mark	"ϟ" mark
	Selected energy	SET 200 J
	Synchronized cardioversion/defibrillation	SYNC, none (for defibrillation)
	Discharge test results	TEST AT 50 J, TEST OK, TEST FAILED
	Transthoracic resistance****	TTR 49 Ω
	Delivered energy****	DELIVERED 200 J
	QRS detection point	dotted line
Pacing*****	Pacing mode	FIXED, DEMAND
	Pacing rate	70 ppm
	Pacing current	80 mA
	Pacing point	"P" mark

* When the optional ZR-751VK Telemetry receiver or AL-751VK SpO_2 unit is installed.

** When the optional AL-751VK SpO_2 unit is installed.

*** When the optional ZR-751VK Telemetry receiver is installed.

**** TEC-7521/7531 only

***** TEC-7531 only

6-2 Manual Recording

6-2-1 Manually Recording ECG and Pulse Waveforms

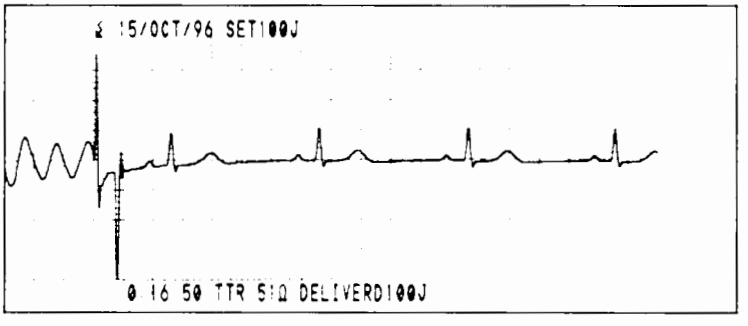
The ECG waveforms can be manually recorded at any time. You can record any length waveform with this mode. ECG waveform recordings are either real time or delayed.

6-2-1-1 Procedure

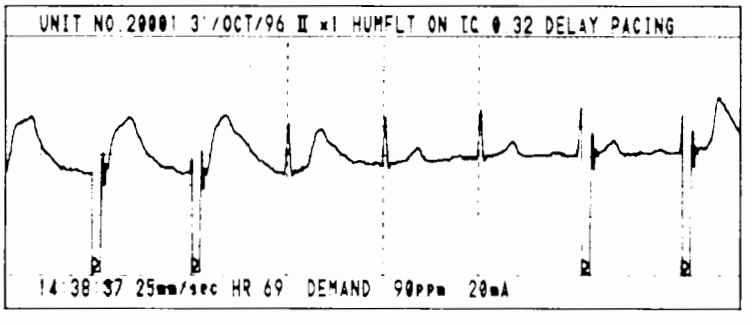
Press the Record key to start or stop recording. This key lights when it is activated. To stop recording, press this key again.

Recording example:

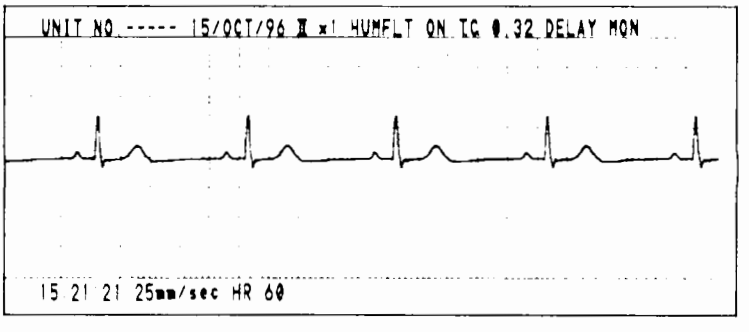
Defibrillation



Pacing

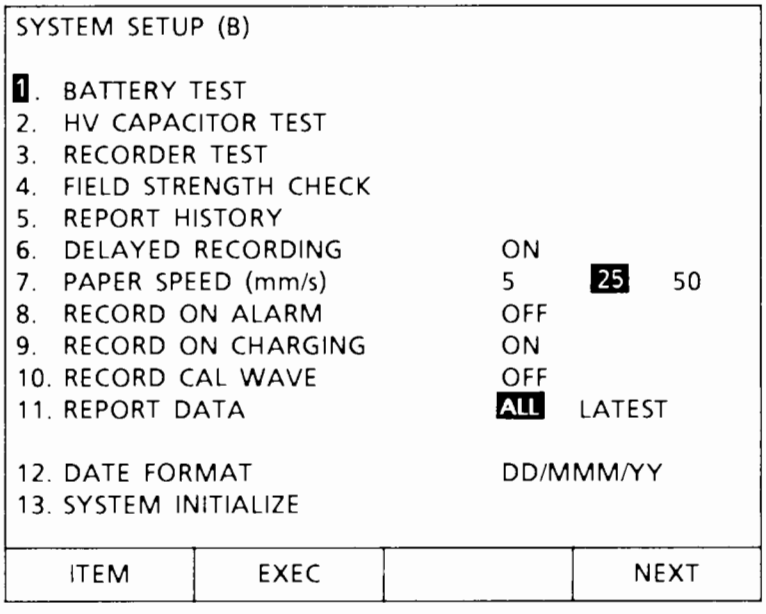


Monitoring



6-2-1-2 Recording a Calibration Waveform at the Beginning of Recording

1. From the System Setup (A) screen, press the NEXT function key. The System Setup (B) screen appears.



2. Press the ITEM function key until "RECORD CAL WAVE" is selected.

3. Change the setting with the ON or OFF function key.

   ON: The calibration waveform is recorded at the beginning of recording.
   OFF: No calibration waveform is recorded.

   The default setting is OFF.

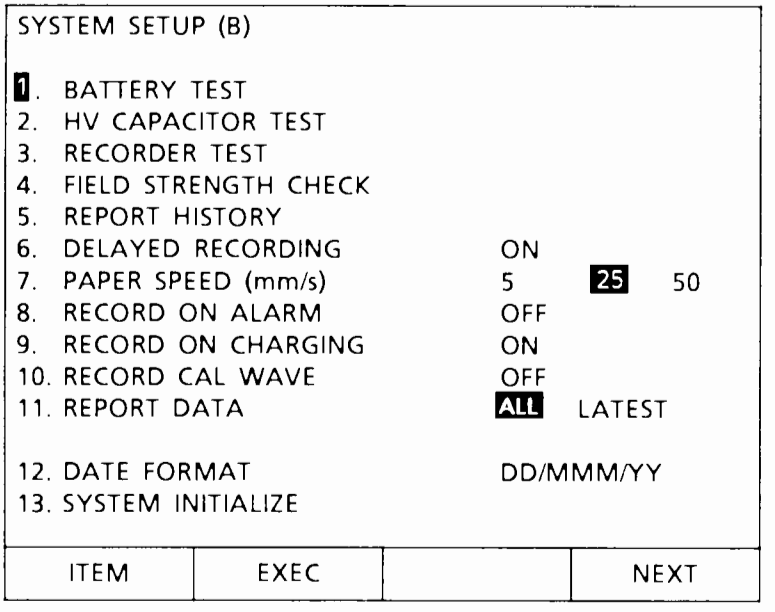
   To turn the power off, turn the ENERGY/MODE SELECT control to the OFF position.

This setting is saved after the power is turned off.

6-2-1-3 Selecting Real Time or Delayed Recording Mode

You can record waveform in real time or after a 4 second delay.

1. From the System Setup (A) screen, press the NEXT function key. The System Setup (B) screen appears.



2. Press the ITEM function key until "DELAYED RECORDING" is selected.

3. Change the setting with the ON or OFF function key.

   ON: Four seconds delayed ECG waveforms are recorded.
   OFF: Real time ECG waveforms are recorded.
   The default setting is ON.

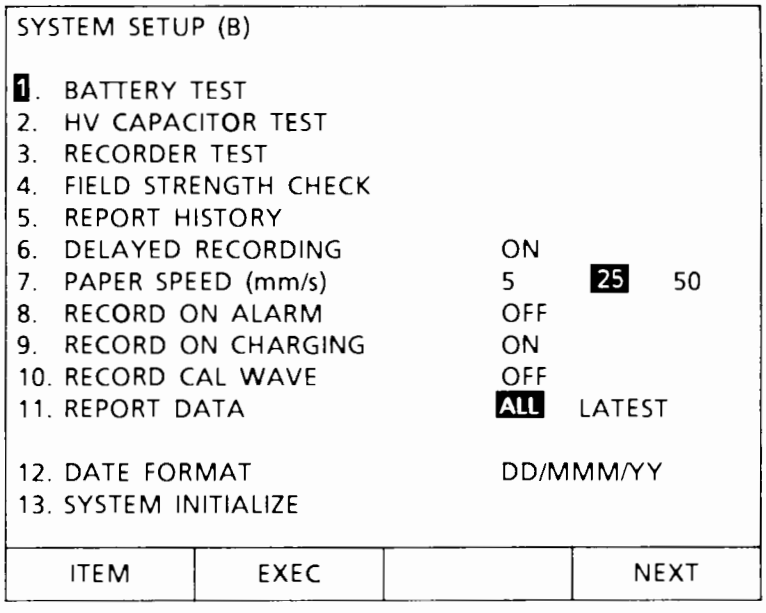
   To turn the power off, turn the ENERGY/MODE SELECT control to the OFF position.

This setting is saved after the power is turned off.

6-2-1-4 Changing the Recording Speed

The recording speed for a delayed or real time recording can be changed. For other recording modes, the recording speed is fixed at 25 mm/s and cannot be changed.

1. From the System Setup (A) screen, press the NEXT function key. The System Setup (B) screen appears.



2. Press the ITEM function key until "PAPER SPEED" is selected.

3. Change the setting with the ← or → function key.

   Selection list: 5, 25 or 50 mm/s. The default setting is 25 mm/s.

   50 mm/s paper speed is only available on TEC-7511 and TEC-7521 when the optional ZR-751VK Telemetry receiver or AL-751VK SpO_2 unit is not installed.

   To turn the power off, turn the ENERGY/MODE SELECT control to the OFF position.

This setting is saved after the power is turned off.

6-2-2 Recording a Summary Report (Report Recording)

6-2-2-1 About Summary Recording

The following saved event data and ECG and pulse waveforms can be recorded as a summary report.

◆ Event Data

Up to 100 event data can be saved in memory. Up to 10 event data which are the same date are recorded on one page. After 100 event data are saved, when the defibrillator detects another event, the oldest data is deleted.

Event	Meaning
POWER ON	The power is turned on.
POWER OFF	The power is turned off.
DEFIB ××× J	The defibrillation is performed at ××× J.
SYNC ××× J	The synchronized cardioversion is performed at ××× J.
DISARMED	The energy is discharged internally within 20 seconds.
EVENT	The Event key is pressed.
DEMAND MODE START	The Demand pacing mode is started.
FIXED MODE START	The Fixed pacing mode is started.
PACING ××× ppm ××× mA	The pacing rate is ××× pulse/min and pacing current is ××× mA.
ALARM SUSPEND	The alarm is suspended.
ALARM HR ×××	Heart rate alarm occurs at ××× bpm.
ALARM SpO_2 ×××	SpO_2 alarm occurs at ××× %.
ALARM PR ×××	Pulse rate alarm occurs at ××× ppm.
ECG LEADS SET	The disposable electrodes and ECG connection cable are attached to the patient.
DISP PADS SET	The disposable pads and pad adaptor are attached to the patient.
PACER STOP	The pacing is stopped.
CHARGING	The charging for defibrillation is started.
ECG LEADS OFF	A disposable electrode is detached.
DISP PADS OFF	A disposable pad is detached.
ALARM OFF	Any of the following setup is set to OFF: ALARM HEART RATE ALARM WITH PADDLE LEAD HEART RATE ALARM LIMITS PULSE RATE ALARM LIMITS (only when the AL-751VK SpO_2 Unit is installed) ALARM LIMITS SpO_2 (only when SpO_2 data is received)
ALARM ON	The settings of the setup are set as follows: ALARM — ON HEART RATE ALARM WITH PADDLE LEAD — ON HEART RATE ALARM LIMITS — not OFF PULSE RATE ALARM LIMITS — not OFF (only when the AL-751VK SpO_2 Unit is installed) ALARM LIMITS SpO_2 — not OFF (only when SpO_2 data is received)

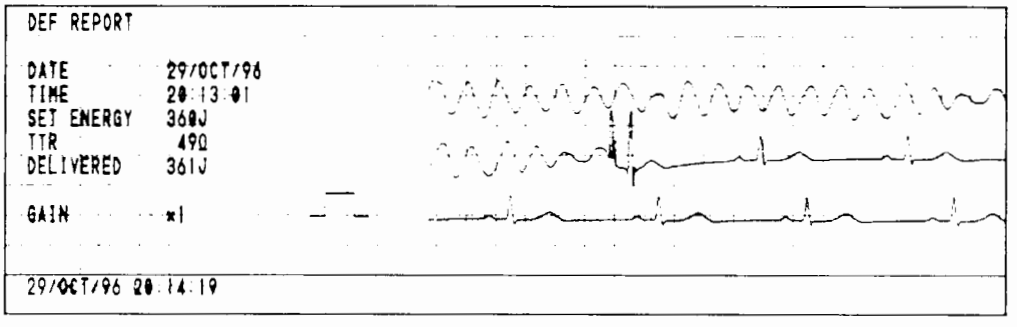
◆ Defibrillation Reports with ECG Waveforms

Up to 12 defibrillation reports with ECG waveforms can be saved in memory.

Defibrillation report:
The defibrillation reports consist of the following data:
Date and time, selected energy, TTR (transthoracic resistance), delivered energy, defibrillation mode (defibrillation or synchronized cardioversion), and sensitivity.

ECG waveforms:
Waveforms from 8 seconds before to 12 seconds after defibrillation with annotations.

Recording example:

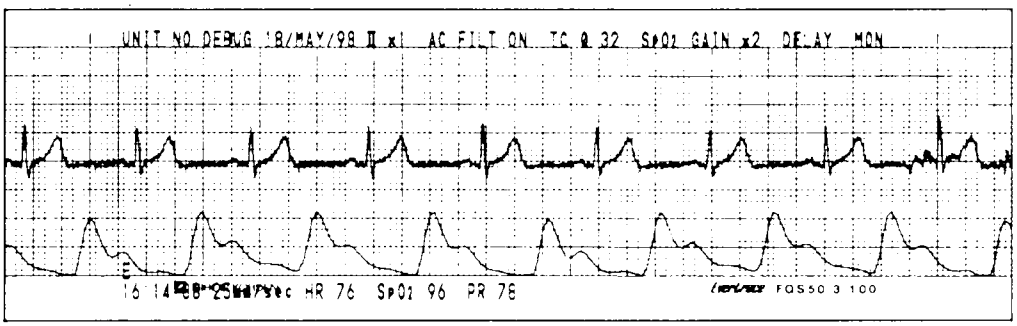


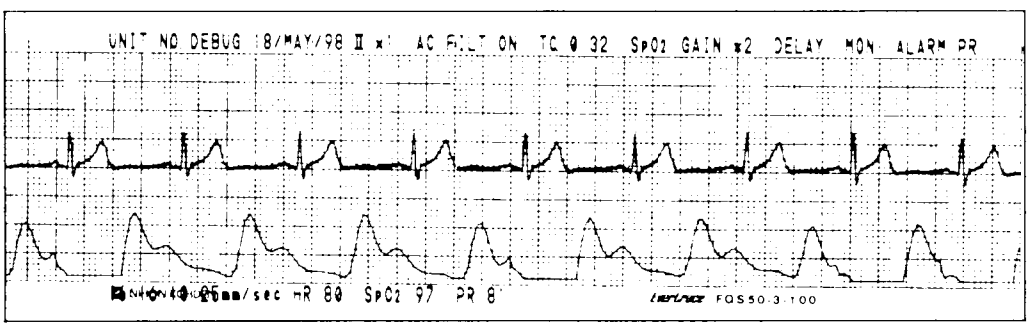
If charging is started during defibrillation recording, the previous defibrillation recording is canceled and a new defibrillation recording is started.

◆ Event and Alarm Reports with ECG and Pulse Waveforms

Waveforms and annotations from 4 seconds before to 12 seconds after the Event key is pressed and from 4 seconds before to 12 seconds after alarm occurrence.

Recording example:





NOTE

"REPORT MODE" in the Setup screen must be set to "SUMMARY" to record the report. Refer to 6-2-3-4 "Selecting the Summary Recording or Trend Recording Mode".

You can only record the latest report data. Refer to Section 6-2-2-3 "Selecting Report Data"

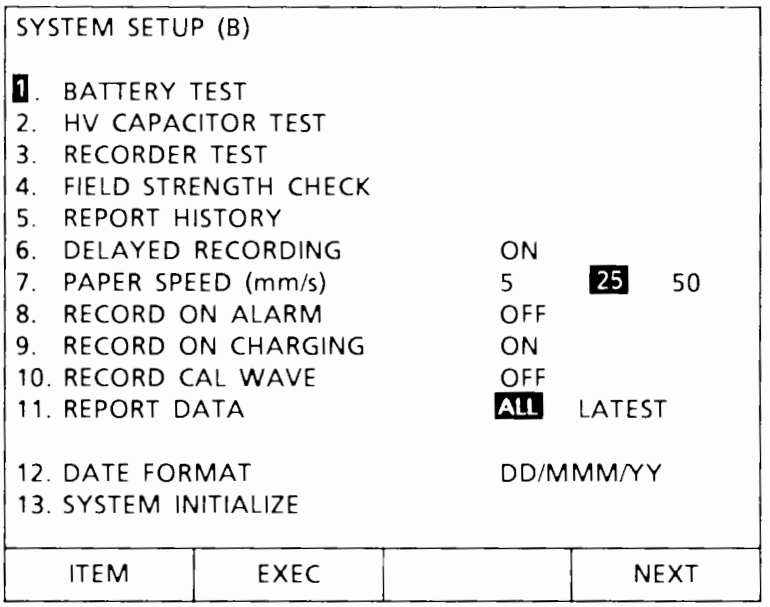
6-2-2-2 Procedure

To start recording, press the Report key on the front panel. To cancel recording press the Report key again.

When there is no report data in memory, the "NO REPORT DATA" message appears.

6-2-2-3 Selecting Report Data

1. From the System Setup (A) screen, press the NEXT function key. The System Setup (B) screen appears.



2. Press the ITEM function key until "REPORT DATA" is selected.

3. Change the setting with the ← or → function key.

   ALL: All Summary report data saved in memory is recorded.
   LATEST: The latest Summary report data (Event data, Defibrillation recording) is recorded.

   The default setting is ALL.

   To turn the power off, turn the ENERGY/MODE SELECT control to the OFF position.

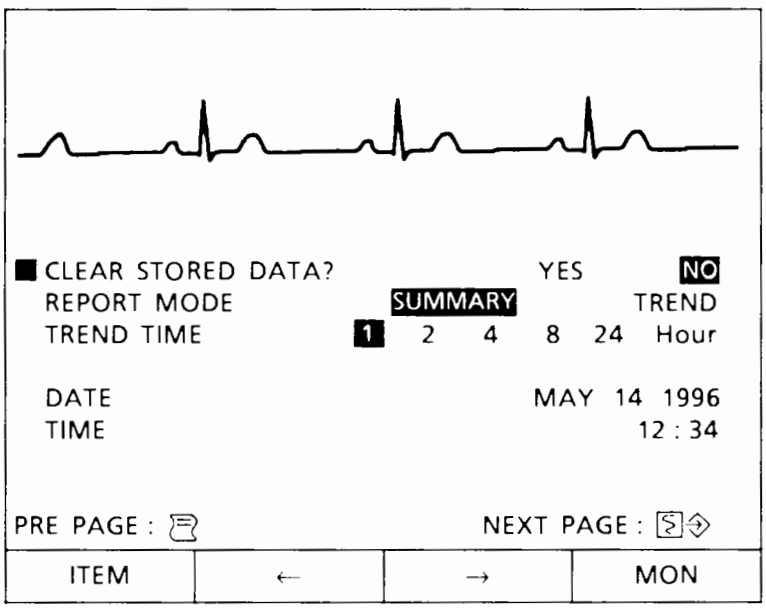
This setting is saved after the power is turned off.

6-2-2-4 Deleting Saved Summary Report Data

To delete the saved Summary report data from memory:

1. From the Setup screen, press the Report key until the Setup screen - Recording appears.

   When this screen appears, "CLEAR STORED DATA?" is selected.



Setup screen - Recording

2. Press the ← function key to select "YES". The following function keys appear.

EXEC		CANCEL	MON

3. Press the EXEC function key to delete the saved data.

   To cancel deleting, press the CANCEL function key.

   To return to the monitoring screen, press the MON function key.

6-2-3 Recording Trendgraphs and Tabular Trend Data (Report Recording)

6-2-3-1 About Trend Recording

Heart rate, pulse rate and SpO_2 trendgraph data are automatically saved in memory. You can record the heart rate, pulse rate and SpO_2 trendgraph and heart rate (max./min./mean), pulse rate (max./min./mean), and SpO_2 (max./min./mean.) tabular trend data of the past 1 to 24 hours.

Trendgraph data is automatically saved in memory. The frequency of data acquisition depends on the selected trend time.

Time length of the trendgraph (hours)	Time interval for the trendgraph data acquisition (minutes)
1	1
2	2
4	4
8	8
24	24

NOTE

- **"REPORT MODE" in the Setup screen must be set to "TREND" to record the trendgraphs and tabular trend data. Refer to 6-2-3-4 "Selecting Summary Recording or Trend Recording Mode".**
- **Trendgraph data is cleared when the power is turned off.**

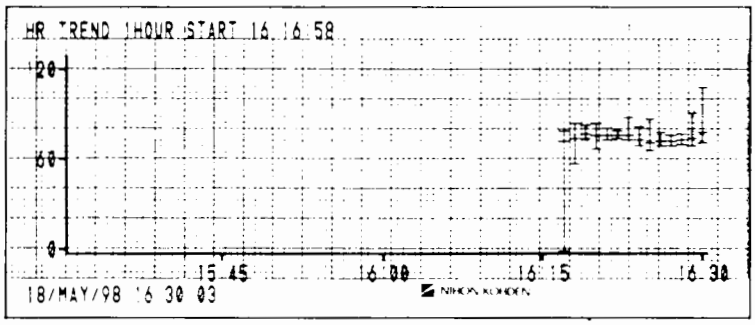
To change the time length of the trendgraph, refer to Section 6-2-3-3 "Changing Time Length of the Trendgraph".

6-2-3-2 Procedure

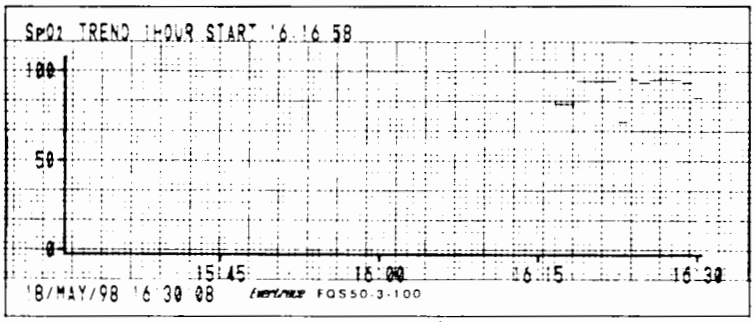
Press the Report key to start recording. The report lamp lights. When saved data are recorded, the recording stops. To cancel recording during recording, press this key again.

Trend recording example :

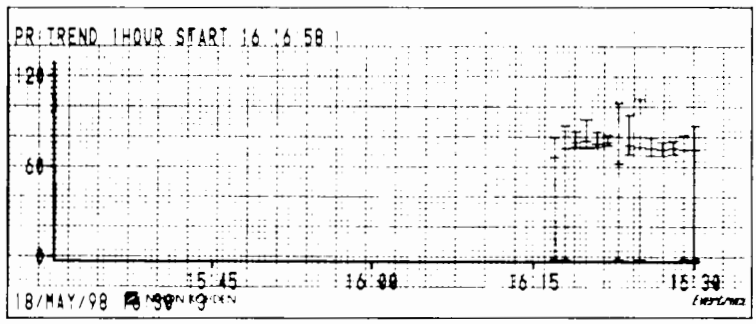
HR trendgraph



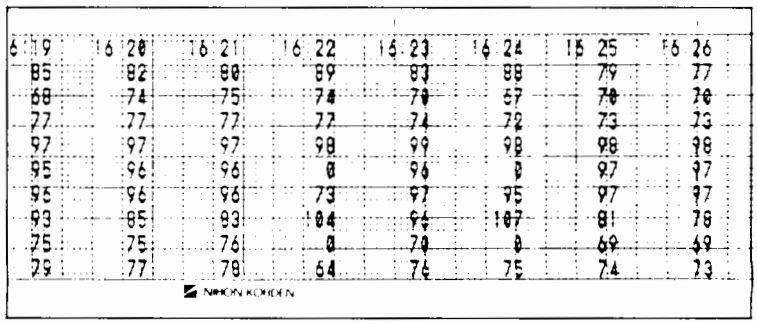
SpO_2 trendgraph



PR trendgraph

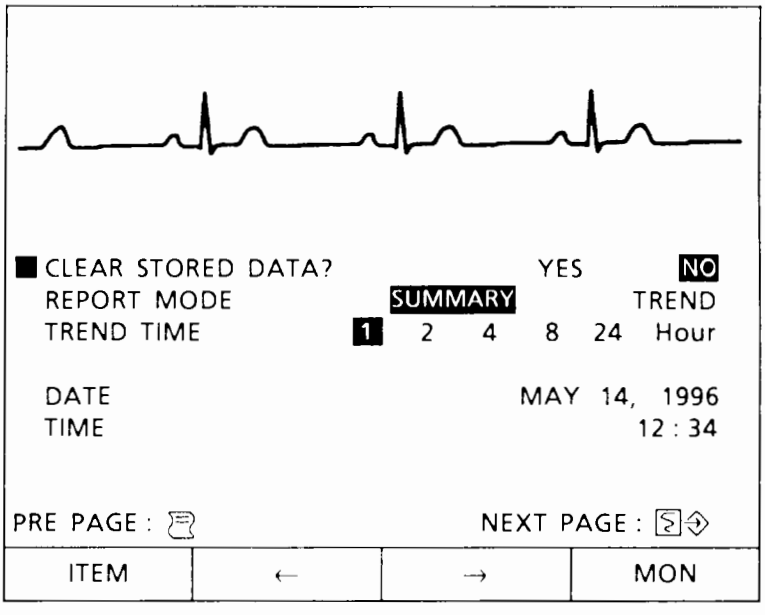


Tabular trend data



6-2-3-3 Changing Time Length of the Trendgraph

1. From the Setup screen, press the Report key until the Setup screen - Recording appears.



Setup screen - Recording

2. Press the ITEM function key until "TREND TIME" is selected.

3. Change the setting with the ← or → function key.

   Selection list: 1, 2, 4, 8, and 24 hours

   The default setting is 1 hour.

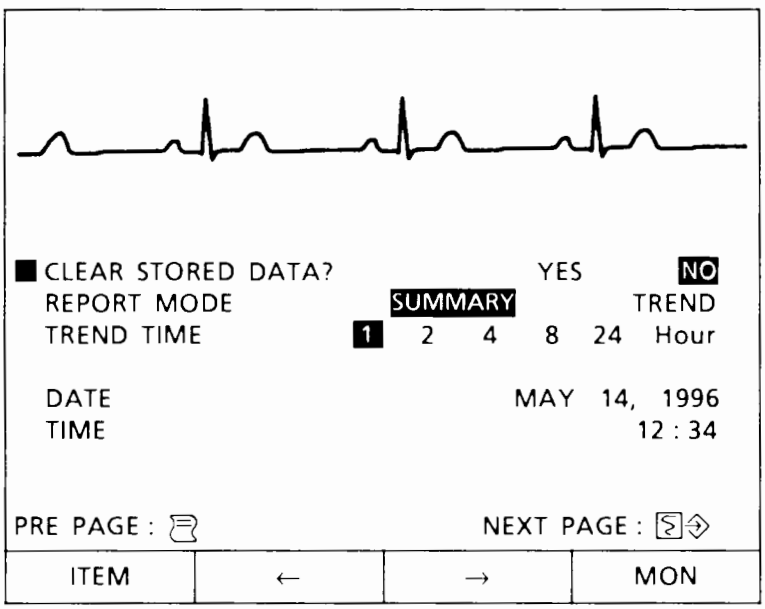
   To return to the monitoring screen, press the MON function key.

This setting is saved after the power is turned off.

6-2-3-4 Selecting Summary Recording or Trend Recording Mode

You can record either the summary report or trendgraphs and trend data by pressing the Report key. The default setting is "SUMMARY" (summary recording).

1. From the Setup screen, press the Report key until the Setup screen - Recording appears.



Setup screen - Recording

2. Press the ITEM function key until "REPORT MODE" is selected.

3. Select the desired recording mode with the ← or → function key.

   SUMMARY: Summary recording mode
   TREND: Trend recording mode

   The default setting is SUMMARY.

   To return to the monitoring screen, press the MON function key.

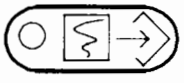
This setting is saved after the power is turned off.

6-2-4 Recording and Saving ECG and Pulse Waveforms (Event Recording)

6-2-4-1 About Event Recording

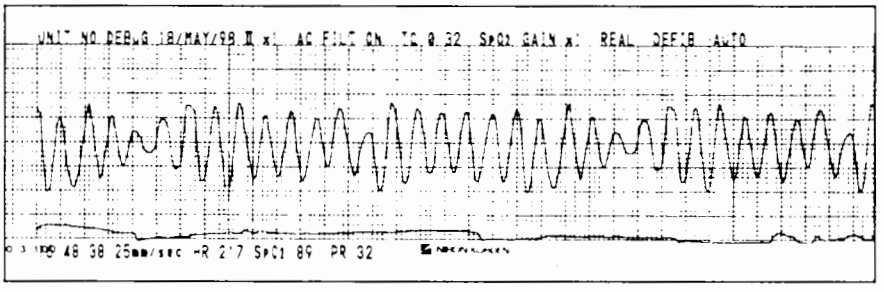
The ECG waveforms with annotations from 4 seconds before to 12 seconds after the Event key is pressed can be recorded and saved in memory. You can record the saved ECG waveforms and annotations, together with the event data and defibrillation reports by pressing the Report key. Refer to 6-2-2 "Recording a Summary Report".

6-2-4-2 Procedure



Press the Event key to start recording. During recording, the event lamp lights.

Recording example:



If the Event key is pressed again during recording, the event lamp blinks and the recording is stopped. When 16 seconds of ECG and pulse waveforms with annotations are saved, the lamp goes off.

If an alarm occurs during recording, the record lamp lights and the recording changes from event recording to alarm recording. The ECG and pulse waveforms with annotations for the event recording are saved in memory.

If the energy is charged during recording, the event lamp blinks, the record lamp lights, and the recording changes from event recording to defibrillation recording. The ECG and pulse waveforms for the event recording are saved in memory.

If the recording paper is used up during recording, the event lamp blinks. When 16 seconds of ECG and pulse waveforms with annotations are saved, the lamp goes off.

6-3 Automatic Recording

6-3-1 Defibrillation Recording

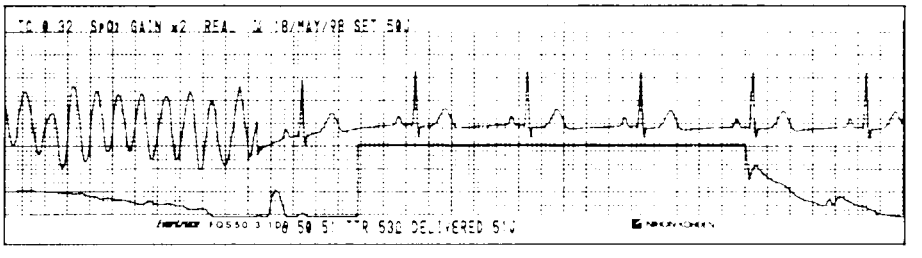
The ECG and pulse waveforms with annotations from start of charge to 12 seconds after defibrillation can be automatically recorded and saved in memory. Defibrillation recording is turned on or off on the System Setup screen.

If the defibrillator is not discharged within 40 seconds after charging, the defibrillator immediately discharges itself internally within 20 seconds and the defibrillation recording is automatically stopped.

During defibrillation recording, if the next charge is started, the previous defibrillation recording is canceled and the next defibrillation recording is started.

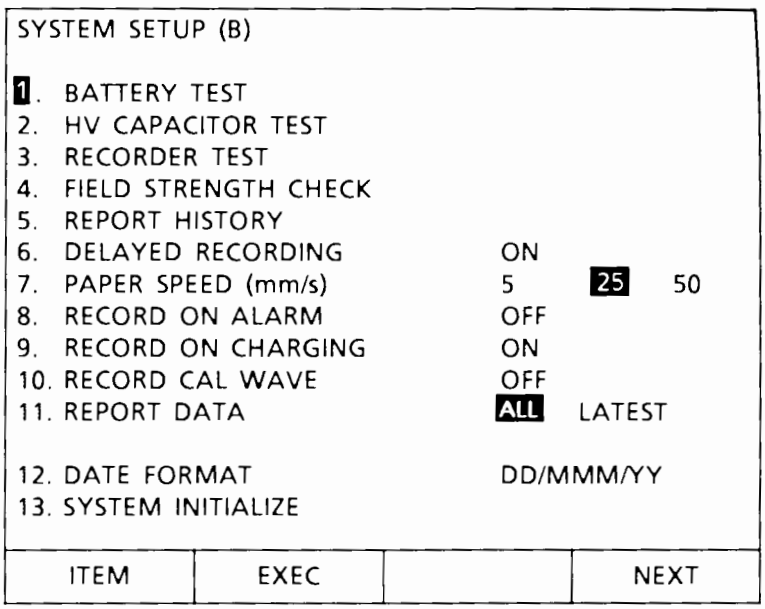
During alarm recording or event recording, if the charge for defibrillation is started, the defibrillation recording is started. The ECG and pulse waveforms with annotations of the alarm recording or event recording are saved in memory,

Recording example:



6-3-2 Turning Defibrillation Recording On/Off

1. From the System Setup (A) screen, **press the NEXT function key. The System Setup** (B) screen appears.



2. Press the ITEM function key until "RECORD ON CHARGING" is selected.

3. Change the setting with the ON or OFF function key.

   ON: The defibrillation recording is turned on.
   OFF: The defibrillation recording is turned off.

   The default setting is ON.

   To turn the power off, turn the ENERGY/MODE SELECT control to the OFF position.

This setting is saved after the power is turned off.

6-3-3 Alarm Recording

The ECG and pulse waveforms with annotations from 4 seconds before to 12 seconds after alarm occurrence can be automatically recorded and saved in memory.

NOTE

To perform alarm recording, "RECORD ON ALARM" in the System Setup screen must be set to "ON". Refer to 6-3-4 "Turning Alarm Recording On/Off".

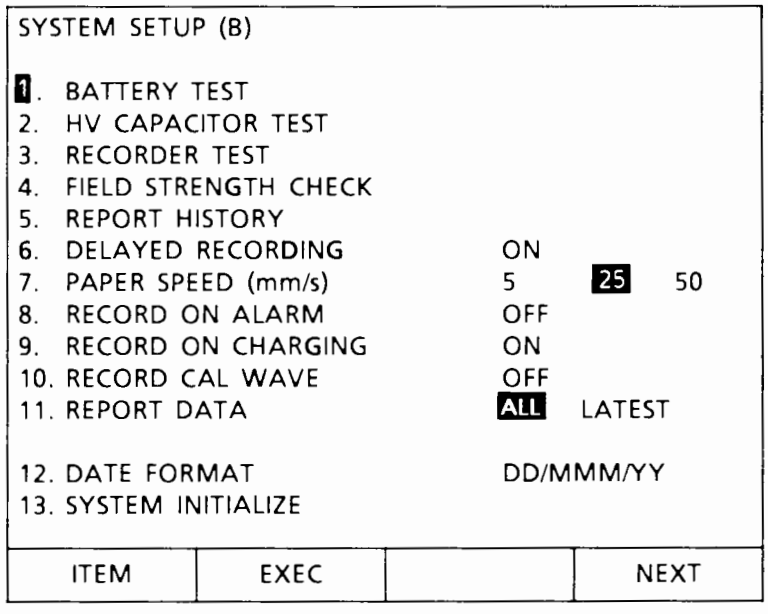
During alarm recording, if a new alarm occurs, the new alarm recording is started. The ECG and pulse waveforms with annotations of both the previous and new alarm are saved in memory.

During alarm recording, if the Event key is pressed, the event lamp blinks and the ECG and pulse waveforms with annotations for the event recording are saved in memory. The alarm recording continues for 16 seconds after the Event key is pressed.

If the charging is started during alarm recording, the ECG and pulse waveforms with annotations are saved in memory and the recording is started.

6-3-4 Turning Alarm Recording On/Off

1. From the System Setup (A) screen, press the NEXT function key. The System Setup (B) screen appears.



2. Press the ITEM function key until "RECORD ON ALARM" is selected.

3. Change the setting with the ON or OFF function key.

   ON: The alarm recording is turned on.
   OFF: The alarm recording is turned off.
   The default setting is OFF.

   To turn the power off, turn the ENERGY/MODE SELECT control to the OFF position.

This setting is saved after the power is turned off.

6-4 Screen Messages and What to Do in Case of Trouble

Trouble or screen message	Possible cause	Action
OUT OF PAPER message	The paper magazine is open.	Close the magazine firmly.
	The recording paper is used up.	Load new paper.
NO REPORT DATA message	No report data is saved.	
	When the printed date is JAN/01/90 and the settings set in Setup screen and System Setup screen are changed to the default settings, the internal lithium battery is discharged.	Contact your Nihon Kohden distributor to replace the battery.
There is no printing (only paper feeding).	The recording paper is upside down.	Reload the recording paper into the paper magazine correctly. Refer to Section 2-3 "Loading the Recording Paper".
Printing is dim.	NK-specified paper is not used.	Use NK FQS50-3-100 or RQS50-3 recording paper.
	The thermal head is dirty.	Clean the thermal head with the provided head cleaning pen.
Dots are missing.	NK-specified paper is not used.	Use NK FQS50-3-100 or RQS50-3 recording paper.
	The thermal head is dirty.	Clean the thermal head with the provided head cleaning pen.
Paper skews to one side.	The recording paper is not loaded correctly.	Reload the recording paper into the paper magazine correctly. Refer to Section 2-3 "Loading the Recording Paper".

SECTION 7

ERROR MESSAGES AND TROUBLESHOOTING

Error messages and troubleshooting related to specific functions, such as defibrillation or recording, are described in other sections. The items on this page apply to all hardware functions in general.

◆Battery

Screen message	Possible cause	Action
INSERT BATTERY	The battery is not installed.	Install the battery.
REPLACE BATTERY	The battery is defective.	Replace the battery with a new one.
	The battery is replaced while the defibrillator is connected to the AC power.	Disconnect the AC power cord and insert the battery again.

◆Hardware

When any of the following error messages or troubles occur, turn the ENERGY/MODE SELECT control to the OFF position, disconnect the AC power cord and contact your Nihon Kohden distributor.

Screen message/trouble	Possible cause
SYSTEM FAILURE message	Any malfunction is detected by self-check program.
ERROR A *** message	The high-voltage unit is faulty.
ERROR D *** message	The CPU board is faulty.
ERROR P *** message	The pacing unit is faulty.
ERROR K *** message	Poor contact of control key/switch.
SUPPLY VOLTAGE TOO HIGH message	The voltage is higher than specified.
The defibrillator heats up and there is no screen message.	There is any malfunction in the defibrillator.
The AC power lamp does not light when the AC power cord is connected.	There is any malfunction in the defibrillator.
No lamp lights when the ENERGY/MODE SELECT control is turned to the MON position.	Faulty lamp.
• The printed date is JAN/01/90. • All settings set in the Setup screen and System Setup screen return to the default settings. • The summary report data is not saved.	The lithium battery is almost discharged.
FET ERROR message	• An error in the FET of the Mother board. • Faulty Mother board.
HV MONITOR ERROR message	• An error in the high voltage monitor circuit. • Faulty HV relay.
RELAY DRIVE ERROR message	• An error in the high voltage relay drive circuit. • Faulty HV relay.

SECTION 8

MAINTENANCE

8-1 Periodic Check

The defibrillator should be checked after each usage and after every 30 days to ensure that it is ready for use in an emergency. Check the following items.

Accessories	• Sufficient number of disposable electrodes • ECG connection cable prepared • Pads adaptor, if necessary • Sufficient contact gel (GELAID) • Disposable pads connection cable prepared (TEC-7521/7531) • Sufficient disposable pads, if necessary (TEC-7521/7531) • Sterilized internal paddles prepared, if necessary (TEC-7521/7531) • Sufficient recording paper
Connection and Setting	• Power cord and ground lead are properly connected • Recording paper is loaded
Overview	• Instrument is not dirty, rusted, damaged or in contact with liquid • Power cord, cables and pins of the paddle connector are not frayed or damaged • All keys on the operation panel function properly • Buttons on the external paddles function properly
Operation	• The power turns on • Operation keys function properly • Energy can be charged and discharged (Refer to Sections 8-4 and 8-5 for checking energy charge and discharge) • The battery is fully charged and ready for use (Refer to Section 8-6 to check the battery)

8-2 Cleaning

8-2-1 Cautions for Cleaning

CAUTION

- **Do not use the following materials to clean the defibrillator, pads adaptor, ECG connection cable. Failure to follow this may damage their surface.**

  -Tricholoroethylene -Benzene -Saline solution
  -Carbon tetrachloride -Kerosene -Gasoline
  -Toluene

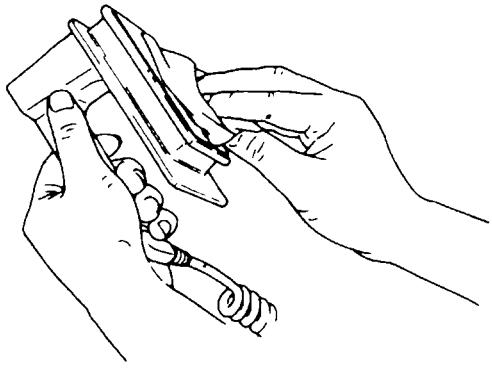
- **Turn the power off and disconnect the power cable before cleaning.**
- **Never sterilize the external paddles by autoclaving or ethylene oxide gas, or heat them above 60 °C.**
- **Do not put gauze moistened with physiological saline solution on the paddle holder. This may cause rusting of the electrode plate of the external paddle and test electrode.**

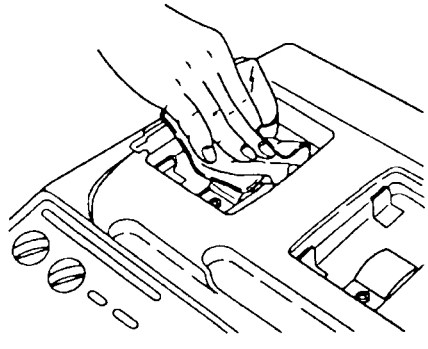
8-2-2 Cleaning the Defibrillator, Cables and Paddles

This defibrillator requires routine cleaning, which includes removing dirt or grime from the exterior surfaces. Wipe the exterior surface of the defibrillator and paddles with a soft cloth moistened with water or alcohol and then wipe them with a clean and dry cloth.

Clean the cables with a dry or alcohol-moistened cloth.

Inspect the condition of the defibrillator, key panels and all the connection cables every time before using them.





8-2-3 Cleaning the SpO_2 Probe

Clean, disinfect or sterilize the probe after use.

CAUTION

Do not soak the probe or cable connector in the cleaning solution. Soaking in the solution may damage them.

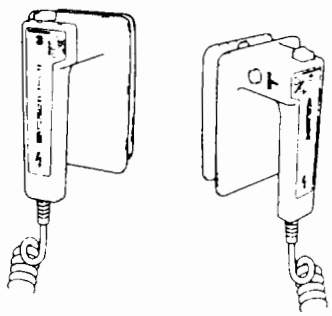
Cleaning

Wipe the probe with a non-abrasive cloth moistened with neutral detergent and approx. 40°C (104°F) warm water.

8-3 Disinfecting and Sterilizing

8-3-1 Sterilizing the Paddles

◆External Paddles



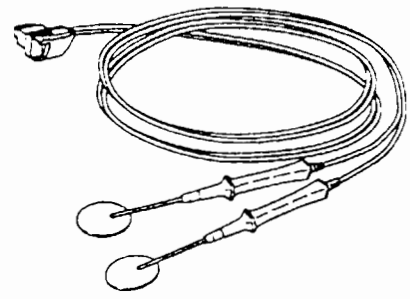
No Autoclave

No EOG

CAUTION

- Do not sterilize the external paddles by autoclaving or ethylene oxide gas, or heat them above 60 °C.
- Do not immerse the external paddles in water or other liquid.
- Do not damage the connector pins of the external paddles.

◆Internal Paddles



The internal paddles can be sterilized by autoclaving and ethylene oxide gas.

CAUTION

- **Do not damage the connector pins of the internal paddles.**
- **Do not sterilize the internal paddles by trichloroethylene, carbon tetrachloride, gasoline, benzene, or toluene, because they damage the cords of the paddles.**
- **Use a new internal paddle after about 100 sterilizations because the internal paddles can withstand up to 100 times sterilization under the following conditions.**
- **Do not bend the electrode. This may damage it.**

◆Sterilization Conditions

- **Ethylene oxide gas**

Composition	Ethylene oxide: 30 %, Carbon dioxide: 70 %
Concentration	940 mg/L
Temperature	50°C
Humidity	50 %
Pressure	1 kg/cm^2 (98 kPa)
Duration	Over 4 hours

After sterilization, to remove the remaining gas from the internal paddles, first decrease the internal pressure of the sterilization equipment to - 760 mm Hg with a vacuum pump, then add carbon dioxide or antiseptic gas in the equipment. Repeat this procedure several times.

- **Autoclaving**

Pressure	2 kg/cm^2 (196 kPa)	1.4 kg/cm^2 (137 kPa)	1.0 kg/cm^2 (98 kPa)
Temperature (°C)	132	126	121
Duration (min)	10	15	20

8-3-2 Disinfecting/Sterilizing the SpO_2 Probe

CAUTION

- **Never autoclave the probe.**
- **The sterilizer temperature must not exceed 65° C (149° F) because the probe and cable may deform or melt above this temperature.**
- **Do not use any disinfectants, such as glutaraldehyde or sodium hypochlorite solution. They may damage the probe.**

To disinfect the cable, wipe them with a non-abrasive cloth moistened with alcohol.

8-4 Checking Energy Charge and Internal Discharge

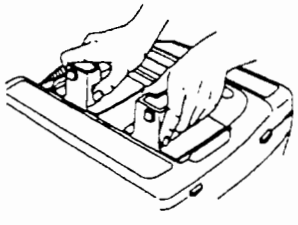
WARNING

- **Never discharge the energy with the paddles in the air or when the paddles are shorted. Failure to follow this warning may cause serious electrical shock and damage to the instrument.**
- **The defibrillator can be damaged by overheating from excessive defibrillation. Observe the following guidelines.**
  - **Do not defibrillate more than 3 times in one minute.**
  - **For long term continuous defibrillation, the following limits apply:**
    No more than 60 defibrillations at 360 J if you allow 1 minute cool down period after every 1 minute of defibrillation.
    No more than 15 defibrillations at 360 J if there is no 1 minute cool down period after every 1 minute of defibrillation.

Check that the defibrillator automatically discharges the charged energy within 20 seconds.

1. Turn the ENERGY/MODE SELECT control to 360 J.

2. Leaving the paddles on their holders, press the CHARGE button on the APEX paddle to start charging.



During charging, a continuous high (pip) tone is generated, the "CHARGING" message appears, and the CHARGE lamps on the APEX paddle and front panel blink.

When charging is completed, a continuous low tone is generated, the "CHARGED" message appears, and the CHARGE lamp lights.

3. Turn the ENERGY/MODE SELECT control to the DISARM position to self-discharge internally.

4. Check that the energy value on the lower right of the screen changes to 0 J within 20 seconds. If not, contact your Nihon Kohden distributor.

NOTE

Do not discharge manually.

8-5 Checking Energy Discharge

WARNING

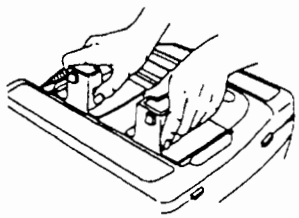
- **Discharge the energy only on the energy discharge test plates. Never discharge the energy with the paddles in the air or when the paddles are shorted. Failure to follow this warning may cause serious electrical shock and damage to the instrument.**
- **The defibrillator can be damaged by overheating from excessive defibrillation. Observe the following guidelines.**
  - **Do not defibrillate more than 3 times in one minute.**
  - **For long term continuous defibrillation, the following limits apply:**
    No more than 60 defibrillations at 360 J if you allow 1 minute cool down period after every 1 minute of defibrillation.
    No more than 15 defibrillations at 360 J if there is no 1 minute cool down period after every 1 minute of defibrillation.

Check that the defibrillator charges energy properly with the energy level at 50 J.

1. Check that the external paddles are not dirty, rusted or damaged.

2. Turn the ENERGY/MODE SELECT control to 50 J.

3. Leaving the paddles on their holders, press the CHARGE button on the APEX paddle to start charging.



During charging, a continuous high (pip) tone is generated, the "CHARGING" message appears, and the CHARGE lamps on the APEX paddle and front panel blink.

When charging is completed, a continuous low tone is generated, the "CHARGED" message appears, and the CHARGE lamps light.

4. Simultaneously press both DISCHARGE buttons on the external paddles to discharge the energy. When properly discharged, the "TEST OK" message appears.

If the "TEST AT 50J" message appears, the discharged energy was not 50 J. Perform the discharge test at 50 J.

If the "TEST FAILED" message appears, the discharge energy is not within ± 10 % of 50 J . Contact your Nihon Kohden distributor.

8-6 Checking the Battery

Check the battery condition once a month. If there are cracks, deformation, damage or electrolyte leakage on the casing, replace the battery with a new one. If the battery is dirty, clean it with a dry cloth.

During the battery test, the battery is charged and discharged. Make sure that the AC power cord is connected. The latest 6 test results are saved in memory.
To check the previous battery test result, refer to 8-10 "Recording the Report History".

It takes up to 5.5 hours to test a new fully charged battery at 20 C.

WARNING

If defibrillation is necessary during battery test, cancel the battery test and perform defibrillation on AC power. Do not use battery power because the energy may have been discharged during the battery test.

NOTE

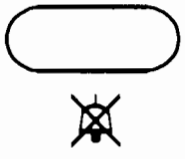
- **If there is a difference in temperature between the battery and the defibrillator, the battery test cannot be done properly. In such a case, install the battery in the defibrillator, leave it for one day, then perform the test.**
- **If the "USE AC POWER SOURCE" message appears, the AC power cord is disconnected or the AC power is not supplied to the instrument. Make sure that the AC power cord is properly connected and that AC power is supplied and repeat the battery test.**

1. Disconnect the AC power cord.

2. Turn the ENERGY/MODE SELECT control to the OFF position.

3. Check the following:
   - The recording paper is loaded.
   - The battery is properly installed.
   - The battery has not been used for over one year. If the battery has been used for more than one year, replace it with a new one.

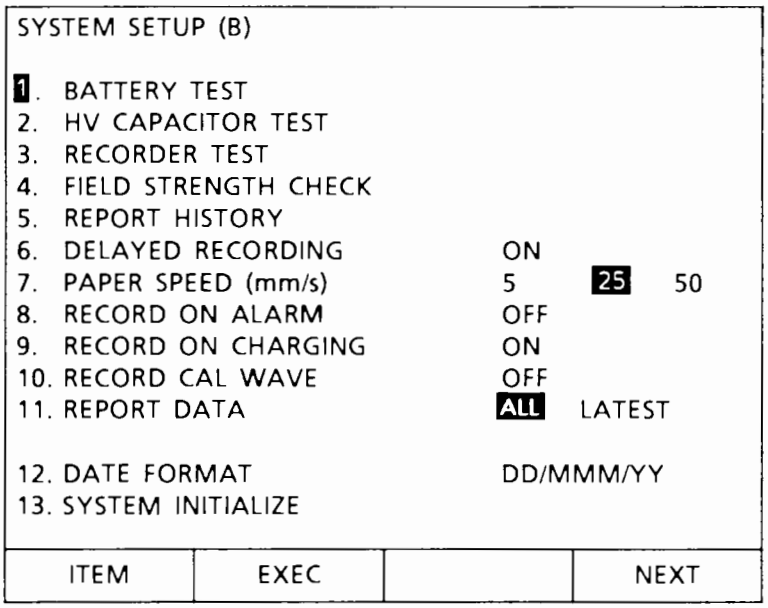
4. Connect the AC power cord.



5. Press and hold down the Alarm suspend key and turn the ENERGY/MODE SELECT control to the MON position.

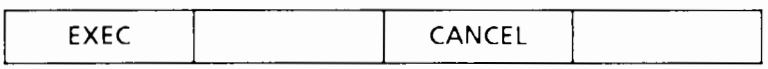
   When the System Setup (A) screen appears, release the Alarm suspend key.

6. Press the NEXT function key or the ITEM function key to select "BATTERY TEST".



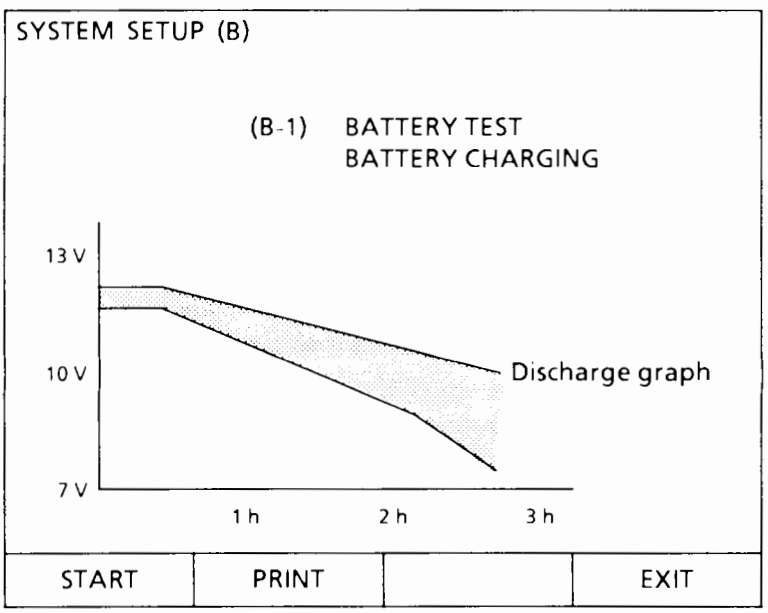
To select another item press the ITEM function key. The cursor appears on the next item number.

7. Press the EXEC function key. The following function keys appear.



To cancel the battery test, press the CANCEL function key.

8. Press the EXEC function key to call up the BATTERY TEST screen.



NOTE

- **If AC power is not supplied to the defibrillator, the "USE AC POWER SOURCE" message appears. Check that the AC power cord is properly connected.**
- **If the battery is not inserted in the defibrillator, the "INSERT BATTERY" message appears. Disconnect the AC power cord and check that the battery is properly inserted in the defibrillator.**

When any of the above messages appear, the START function key does not appear.

9. Press the START function key.

   If the battery is not fully charged, it is charged, then discharged internally.
   If the battery is fully charged, it is discharged internally.

   A message shows the progress of the test.

   BATTERY CHARGING (Test charge)
   ↓
   BATTERY DISCHARGING (Test discharge)
   ↓
   BATTERY CHARGING (Charging for the next use)
   ↓
   BATTERY TEST END

   To print out discharge graph during the battery test, press the PRINT function key. To stop printing, press the key again.

   To cancel the battery test, press the EXIT function key. The System Setup (B) screen appears. Or turn the ENERGY/MODE SELECT control to the OFF position.

   After the battery check is completed, the result appears on the screen and is automatically printed. Then the battery charge is started.

Message		Description
BATTERY GOOD	70, 80, 100 %:	Battery performance is OK. It can be used at any time.
BATTERY WEAK	50, 60%:	Battery can be used if it is fully charged. However, it is recommended that the battery be replaced with a new one because the battery life is nearly over.
BATTERY UNUSABLE	0, 40 %:	Battery life is over and the battery cannot be used. Replace it with a new one immediately.

NOTE

If the battery cannot be charged, the "BATTERY CHARGE ERROR", "BATTERY CHARGE TIME OUT" or "BATTERY DISCHG TIME OUT"message appears. When any of the above messages appear, the battery cannot be used. Replace it with a new one. When a new battery is used and any of the above messages appear again, the defibrillator may be faulty. Contact your Nihon Kohden distributor.

The latest six test results are saved in memory. To check the previous battery test result, refer to 8-10 "Recording the Report History".

10. Press the EXIT key. The System Setup (B) screen appears.

11. Turn the ENERGY/MODE SELECT control key to the OFF position to turn the power off.

12. Disconnect the AC power cord.

13. Mark the month that you tested the battery on the battery check labels and on the defibrillator.

Start date					
Monthly check					
1	2	3	4	5	6
7	8	9	10	11	12

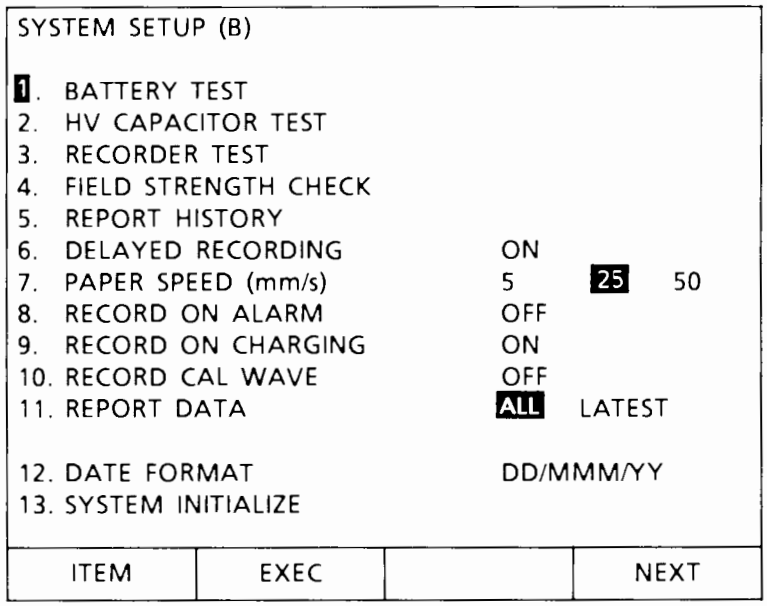
8-7 Checking the High Voltage Capacitor

During this check, the capacitor is charged and discharged. The latest check result is saved in memory. Refer to Section 8-10 "Recording the Report History".

NOTE

Make sure that the AC power cord is connected to ensure the battery charge for emergency operation.

1. From the System Setup (A) screen, press the NEXT function key. The System Setup (B) screen appears.



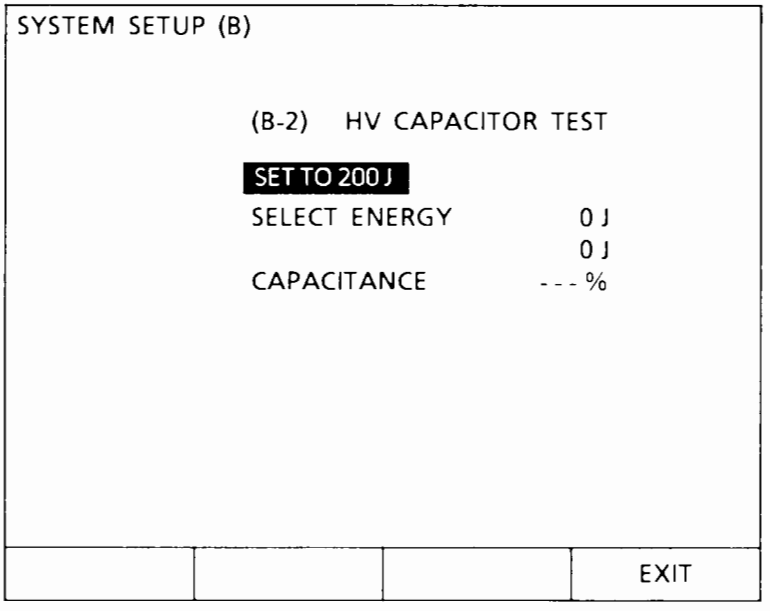
2. Press the ITEM function key until "HV CAPACITOR TEST" is selected.

   To select another item press the ITEM function key. The cursor appears on the next item number.

3. Press the EXEC function key. The following function keys appear.

   To cancel the capacitor test, press the CANCEL function key.

4. Press the EXEC function key to call up the HV CAPACITOR TEST screen.



5. Turn the ENERGY/MODE SELECT control to the 200 J position. The "PUSH CHARGE KEY" message appears. If the ENERGY/MODE SELECT control is turned to another position, the "SET TO 200 J" message appears.

6. Press the Charge key on the front panel. The defibrillator charges the selected energy. After charging is completed, the defibrillator discharges the energy internally and measures the discharged energy. The check result appears.

NOTE

During charging, if the ENERGY/MODE SELECT control is turned to another position, the defibrillator immediately discharges itself internally.

To cancel the HV capacitor test, press the EXIT function key. The System Setup (B) screen appears. Or turn the ENERGY/MODE SELECT control to the OFF position.

Message	Description
CAPACITANCE XXX % TEST OK	100 - 80 %: Capacitor performance is OK. It can be used at any time.
CAPACITANCE XX % TEST FAILED	0 - 79 %: Capacitor life is almost over. Replace it with a new one.

To turn the power off, turn the ENERGY/MODE SELECT control key to the OFF position.

8-8 Checking the Recorder

The built-in recorder can be checked by recording the preset waveforms and alphanumeric characters.

NOTE

Make sure that the AC power cord is connected to ensure the battery charge for emergency operation.

1. From the System Setup (A) screen, press the NEXT function key. The System Setup page (B) appears.

```
SYSTEM SETUP (B)

1. BATTERY TEST
2. HV CAPACITOR TEST
3. RECORDER TEST
4. FIELD STRENGTH CHECK
5. REPORT HISTORY
6. DELAYED RECORDING          ON
7. PAPER SPEED (mm/s)         5    25    50
8. RECORD ON ALARM            OFF
9. RECORD ON CHARGING         ON
10. RECORD CAL WAVE           OFF
11. REPORT DATA               ALL  LATEST

12. DATE FORMAT               DD/MMM/YY
13. SYSTEM INITIALIZE

| ITEM | EXEC |  | NEXT |
```

2. Press the ITEM function key until "RECORDER TEST" is selected.

   To select another item press the ITEM function key. The cursor appears on the next item number.

3. Press the EXEC function key. The following function keys appear.

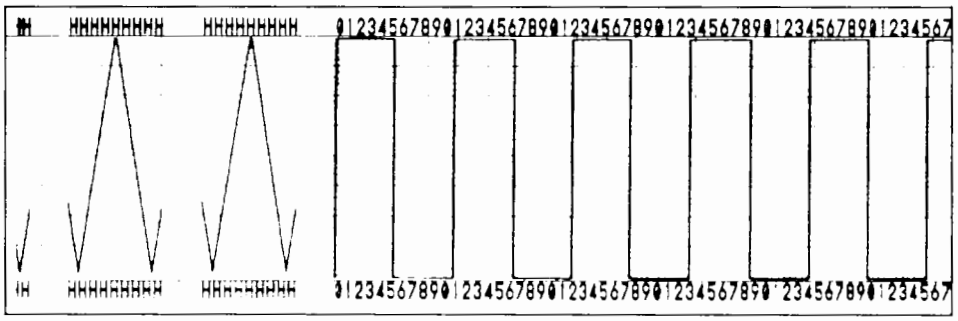
EXEC		CANCEL	

   To cancel checking, press the CANCEL function key.

4. Press the EXEC function key. The recorder starts to record the preset waveforms and characters.

   If there is no more paper, the "PAPER EMP." message appears.
   To cancel the recorder test, press the CANCEL function key.
   When recording is completed, the System Setup (B) screen appears.

   Recording example:



   To turn the power off, turn the ENERGY/MODE SELECT control key to the OFF position.

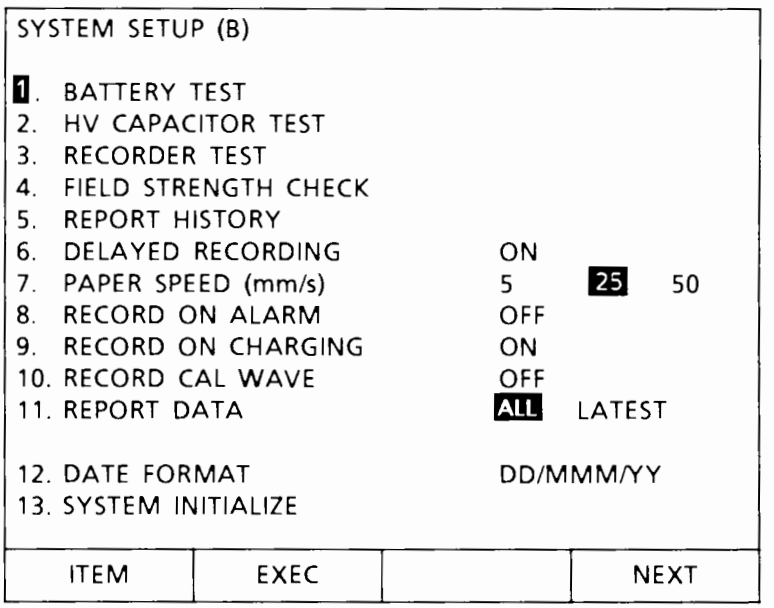
8-9 Checking the Field Strength

The field strength of the receiving signal of the selected channel can be displayed.

NOTE

- **Field Strength Check appears only when the optional ZR-751VK Telemetry receiver is installed.**
- **Make sure that the AC power cord is connected to ensure the battery charge for emergency operation.**

1. From the System Setup (A) screen, press the NEXT function key. The System Setup (B) screen appears.



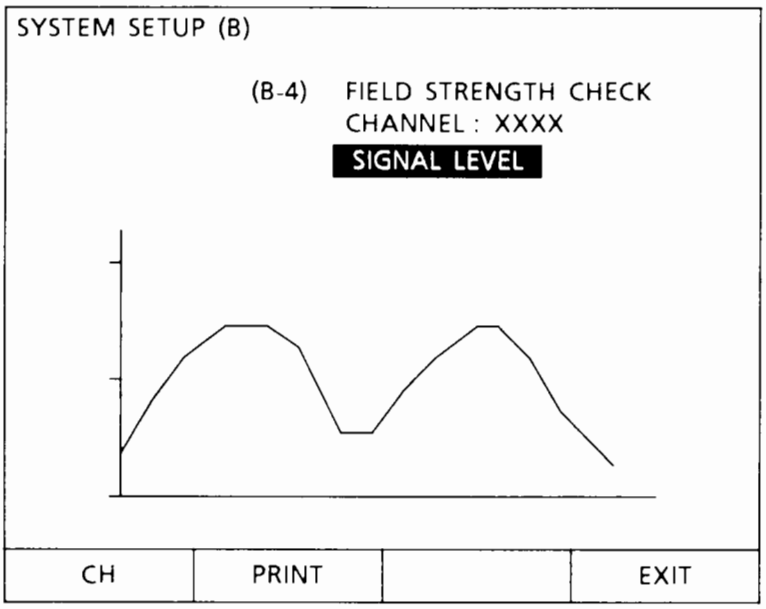
2. Press the ITEM function key until "FIELD STRENGTH CHECK" is selected.

   To select another item press the ITEM function key. The cursor appears on the next item number.

3. Press the EXEC function key. The following function keys appear.

   To cancel checking, press the CANCEL function key.

4. Press the EXEC function key to check field strength. The check result is displayed on the FIELD STRENGTH CHECK screen.



When the field strength of the selected channel is weak, the "SIGNAL LEVEL" message is highlighted. Consider changing the position of the antenna. If the problem is still not solved and all available channels are weak, a poor cable connection is suspected between the related radio signal processing unit, such as antenna, Transmitter interface unit, transmitter, and Main board. Check these cable connections.

To print out the check result, press the PRINT function key. To cancel printing, press this key again.

To check another channel, press the CH function key.

5. Press the EXIT function key. The System Setup (B) screen appears.

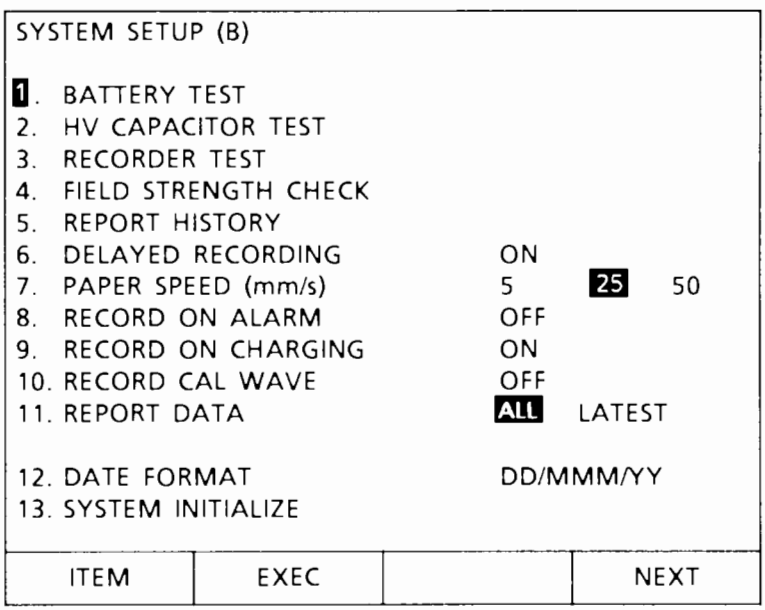
To turn the power off, turn the ENERGY/MODE SELECT control key to the OFF position.

8-10 Recording the Report History

The following information for maintenance can be recorded. The ID number and date and time are also recorded.

- Up to the latest 30 error messages
- Number of HV capacitor charges after leaving the factory
- Results of up to the latest six battery tests
- The latest HV capacitor check results

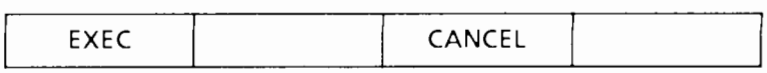
1. From the System Setup (A) screen, press the NEXT function key. The System Setup (B) screen appears.



2. Press the ITEM function key until "REPORT HISTORY" is selected.

   To select another item press the ITEM function key. The cursor appears on the next item number.

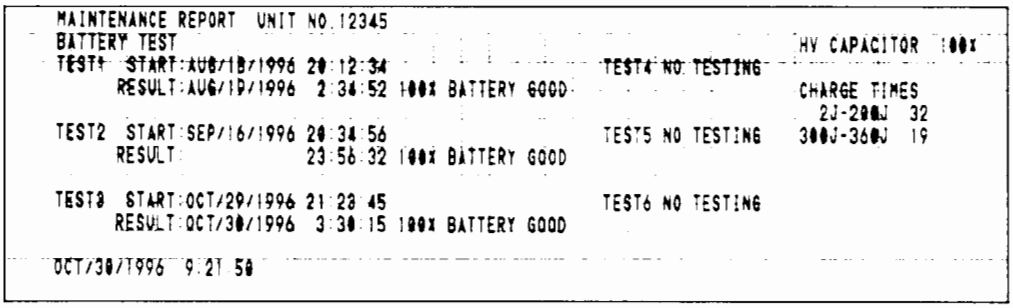
3. Press the EXEC function key. The following function keys appear.



   To cancel the printing, press the CANCEL function key.

4. Press the EXEC function key to print out the report history.

Example:



```
MAINTENANCE REPORT  UNIT NO.12345
BATTERY TEST                                                    HV CAPACITOR  100%
TEST1  START:AUG/18/1996 20:12:34          TEST4 NO TESTING
       RESULT:AUG/19/1996  2:34:52 100% BATTERY GOOD            CHARGE TIMES
                                                                  2J-200J  32
TEST2  START:SEP/16/1996 20:34:56          TEST5 NO TESTING     300J-360J  19
       RESULT:           23:58:32 100% BATTERY GOOD

TEST3  START:OCT/29/1996 21:28:45          TEST6 NO TESTING
       RESULT:OCT/30/1996  3:30:15 100% BATTERY GOOD

OCT/30/1996  9:21:50
```

To turn the power off, turn the ENERGY/MODE SELECT control key to the OFF position.

If there is no more paper, the "PAPER EMP." message appears.

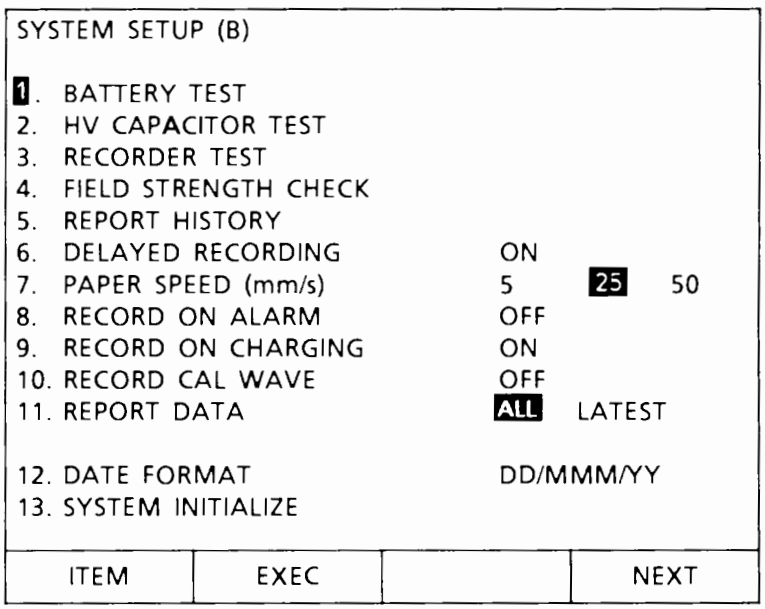
8-11 Changing All Settings to the Default Settings

All settings in the Setup screen and System Setup screen, except for channel group and available channels, can be changed to the default settings.

NOTE

The currently selected transmitter channel in the Setup screen, channel group and available channels in the System Setup screen are not changed by this procedure.

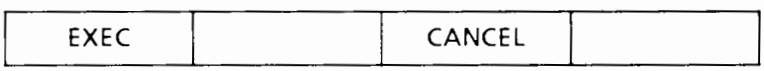
1. From the System Setup (A) screen, press the NEXT function key. The System Setup (B) screen appears.



2. Press the ITEM function key until "SYSTEM INITIALIZE" is selected.

   To select another item press the ITEM function key. The cursor appears on the next item number.

3. Press the EXEC function key. The following function keys appear.



   To cancel changing the settings to the default, press the CANCEL function key.

4. Press the EXEC function key. The settings are changed to the default.

   To turn the power off, turn the ENERGY/MODE SELECT control key to the OFF position.

8-12 Storing the Defibrillator

◆**Short Term Storage (Ready for Use at Any Time)**

CAUTION

To prevent overheating, leave the defibrillator lying flat and do not cover it.

- **When external paddles were used**

1) Turn the ENERGY/MODE SELECT control to the OFF position and disconnect the AC power cord.

2) Wipe the contact gel from the electrode plates and set the paddles in the paddle holder.

CAUTION

Failure to remove contact gel from the electrode plate may cause rusting.

3) Clean the defibrillator and cables as described in Section 8-2-2 "Cleaning the Defibrillator, Cables and Paddles".

4) Return the defibrillator to its storage location and connect it to the AC power to maintain the battery charge and ready the defibrillator for use at any time.

- **When disposable pads were used**

1) Turn the ENERGY/MODE SELECT control to the OFF position and disconnect the AC power cord.

2) Clean the defibrillator as described in Section 8-2-2 "Cleaning the Defibrillator, Cables and Paddles".

3) Press the paddle release knob of the paddle connector on the right panel and remove the pad adaptor from the paddle connector.

4) Connect the external paddles to the paddle connector until it clicks.

5) Return the defibrillator to its storage location and connect it to the AC power to maintain the battery charge and ready the defibrillator for use at any time.

- **When internal paddles were used**

1) Turn the ENERGY/MODE SELECT control to the OFF position and disconnect the AC power cord.

2) Clean the defibrillator, cables and paddles as described in Section 8-2 "Cleaning".

3) Press the paddle release knob of the paddle connector on the right panel and remove the internal paddles from the paddle connector.

4) Connect the external paddles to the paddle connector until it clicks.

5) Return the defibrillator to its storage location and connect it to the AC power to maintain the battery charge and ready the defibrillator for use at any time.

6) Sterilize the internal paddles with autoclaving or ethylene oxide gas. Refer to Section 8-3 "Disinfecting and Sterilizing".

◆Long Term Storage

1. Remove the battery from the defibrillator.

2. Wrap the cable around the paddles.

3. Store the battery and defibrillator in a cool place (0 to 30 C).

NOTE

Check the battery at least every 6 months. Refer to 8-6 "Checking the Battery".

8-13 Lithium Battery

The lithium battery is provided to backup the settings and data when the power is off. The lifetime of the lithium battery is about 7 years. Contact your Nihon Kohden distributor for replacement.

When the lithium battery is almost discharged, the following trouble occurs.

- The printed date is JAN/01/90.
- The settings in the Setup screen and System Setup screen are returned to the default settings.
- The summary report data is not saved.

SECTION 9

REFERENCE

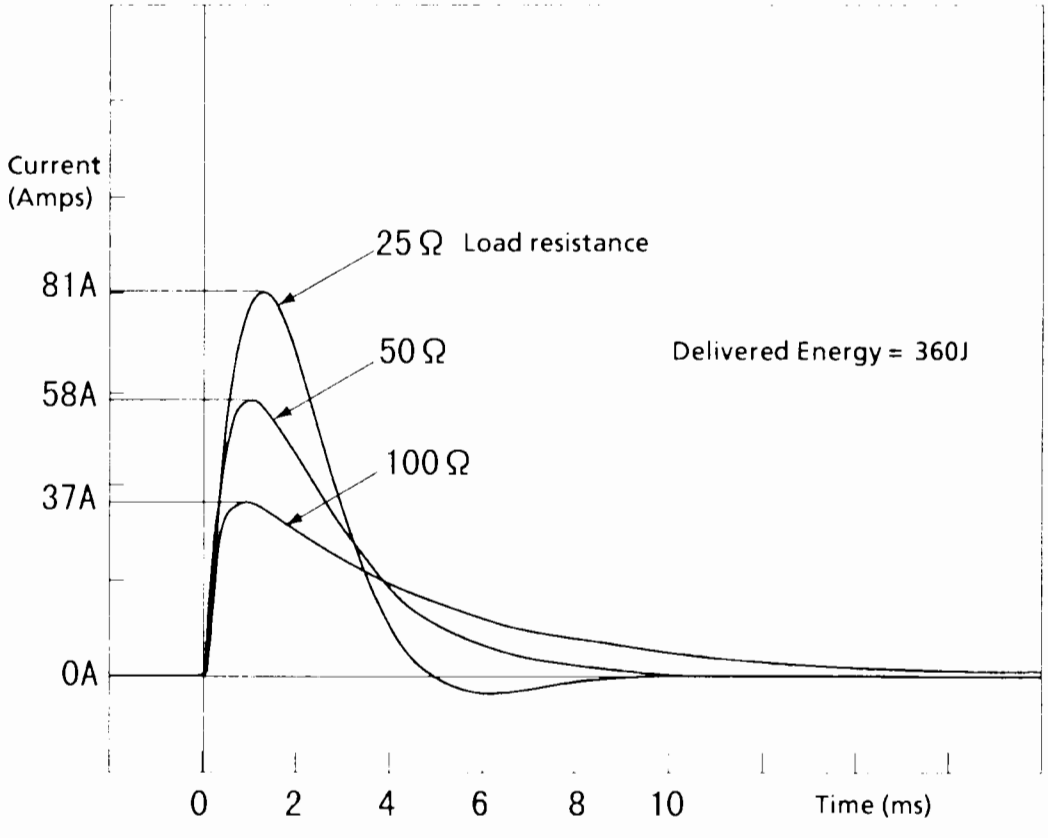
NOTE

Use Nihon Kohden parts and accessories to assure maximum performance from your instrument.

9-1 Specifications

◆ Defibrillator

Output energy (across 50 Ω)	2, 3, 5, 7, 10, 20, 30, 50, 70, 100, 150, 200, 300, 360 J
Output waveform	Edmark, single phase pulse (across 50 Ω)



Charging time for maximum energy (360 J)	Maximum 5 seconds powered by AC or 90 % of the rated mains voltage Maximum 10 seconds powered by battery
Charging time for maximum energy (360 J) after 15 maximum energy discharges by fully charged new battery power at 20°C	Maximum 10 seconds
Number of maximum energy discharges available from a new, fully charged battery at 20°C ambient temperature	50
Maximum charge/discharge frequency	3 cycles per minute
Maximum continuous charge-discharge cycles at 360 J	60 cycles: 3 cycles per minute with 1 minute cool down period after every 1 minute charge/discharge period 15 cycles: 3 cycles per minute with no cool down period

◆ ECG Amplifier

Input signal	3-electrode selectable lead: Paddle, I, II, III, telemetry*, AUX and TEST 5-electrode**selectable lead: Paddle, I, II, III, aVR, aVL, aVF, V, telemetry*, AUX and TEST
Input impedance	Through ECG electrode: ≥ 5 MΩ at 10 Hz Through paddles: ≥ 100 kΩ at 10 Hz AUX: = 100 kΩ at 10 Hz
CMRR	≥ 100 dB (against chassis ground) when AC filter is ON
Internal noise	≤ 30 μVpp when AC filter is ON
Electrode offset tolerance	± 600 mV
Defibrillator discharge protection	Provided
Frequency response	Through ECG electrodes: 0.5 to 80 Hz (– 3 dB) When time constant is 0.32 s. Through paddles: 0.5 to 20 Hz (– 3 dB) Telemetry: 0.4 to 40 Hz (– 3 dB) AUX: 0.5 to 80 Hz (– 3 dB) When time constant is 0.32 s.
Time constant	0.32 or 3.2 s
Sensitivity	10 mm/1 mV (× 1/2, × 1, × 2, × 4 selectable)
AC filter	Available
Pacing pulse rejection	Available
ESU filter	Provided for 3-electrode and 5-electrode input only
QRS sync sound	Provided with a volume control
Test waveform	Simulates QRS waveform of approx. 1 mV, 120 ms and 60 bpm
Heart rate counting range	Defibrillation and monitoring mode: 15 to 300 bpm Pacing mode: 15 to 220 bpm
Electrode detachment detection	Provided

* Only available when the ZR-751VK Telemetry receiver or AL-751VK SpO_2 unit is installed.

** Requires the optional BC-755V ECG connection cable.

◆ Monitor

Effective display area	97 (W) × 74 (H) mm
Number of traces	1 (ECG) + 2 (ECG + pulse)*
Sweep speed	25 mm/s, 50 mm/s**
Sweep length	97 mm
Frequency response	0.05 to 80 Hz (– 3 dB)
Amplitude limit	40 mm
Alphanumeric display	TEC-7511/7521: Heart rate, SpO_2 (%)***, Pulse rate*, ECG sensitivity,ECG lead and charged energy TEC-7531: Heart rate, SpO_2 (%)***, Pulse rate*, ECG sensitivity, ECG lead, charged energy, pacing current and pacing rate

Other display	**Defibrillation mode: SYNC or none** **Charge condition: CHARGING, CHARGED** **Pacing mode (TEC-7531 only):** **FIXED MODE, DEMAND MODE** AC operation marks, **Battery marks** (indicating remaining operation time), **Sync mark,** Alarm suspend **mark,** Messages and error messages

* Only available when the optional AL-751VK SpO_2 unit is installed.

** 50 mm/s is only available on TEC-7511 and TEC-7521 when the ZR-751VK Telemetry receiver or AL-751VK SpO_2 unit is not installed.

*** Available only when the optional ZR-751VK Telemetry receiver or AL-751VK SpO_2 unit is installed.

◆ Alarm

Heart rate/Pulse rate*	Upper limit: 20 to 300 in 5 bpm steps and off Lower limit: 15 to 295 in 5 bpm steps and off An alarm sounds and heart rate is highlighted.
SpO_2**	Upper limit: 51 to 99 in 1 % steps and off Lower limit: 50 to 99 in 1 % steps and off An alarm sounds and SpO_2 % is highlighted.
Lead off alarm	An alarm sounds and a message appears. ECG LEAD OFF, TELEMETRY ECG LEADS OFF**, SpO_2 PROBE OFF**, SpO_2 CONNECTOR OFF*, PULSE CHECK**, PADDLE LOOSE
Alarm on/off	Provided

* Available only when the optional AL-751VK SpO_2 unit is installed.

** Available only when the ZR-751VK Telemetry receiver or AL-751VK SpO_2 unit is installed.

◆ SpO_2

Measuring range	50 to 100%, in 1% steps
Measuring accuracy	± 2 digits, in 1 standard deviation* ($80 \leq SpO_2 \leq 100\%$) ± 3 digits, in 1 standard deviation* ($70 \leq SpO_2 < 80\%$) Unspecified ($0 \leq SpO_2 < 70\%$) (Ambient temperatures between 18 and 40 C assure the above measuring accuracy.)

* 1 standard deviation calculation and SpO_2 measurement whose result is used to calculate 1 standard deviation are performed in accordance with the following document published by the FDA:
GENERAL GUIDANCE DOCUMENT (DRAFT: 9/7/92)
DEVICE: NON-INVASIVE PULSE OXIMETER

◆ Pulse Rate

Measuring range	20 to 250 ppm
Measuring accuracy	± 3 ppm

◆ Recorder

Paper	FQS50-3-100 z-fold paper, RQS50-3 roll type paper
Paper speed	5, 25, 50* mm/s (5 mm/s: Only selected in manual recording for ECG monitoring)
Types of recording	Manual recording: Real time/delayed ECG and pulse** waveform recording, report recording, trend recording, event recording Automatic recording: Defibrillation recording, alarm recording

Real time/delayed ECG waveform recording

Recorded data	Real time/delayed ECG and pulse** waveforms

Summary recording

Paper speed	25 mm /s or 50 mm/s*
Recorded data	Up to 100 event data: POWER ON/OFF, ECG, LEAD SET, DISP PAD SET, LEADS OFF, DISP PADS OFF, CHARGING, DEFIBRILLATION XXX J, SYNCHRONIZED CARDIOVERSION XXX J, DISARMED, EVENT, DEMAND MODE START, FIXED MODE START, PACING XXX bpm XXX mA, PACING STOP, ALARM HR XXX, ALARM SpO_2 XXX*** Up to 12 defibrillation reports: A defibrillation report consists of date and time, selected energy, TTR (Transthoracic resistance), delivered energy, defibrillation mode, ECG sensitivity ECG waveforms: Up to 4 min. ECG waveforms saved when defibrillation is performed and 6 min. ECG waveforms saved when the Event key is pressed and alarm occurs.

Trend recording

Paper speed	25 mm /s or 50 mm/s*
Recorded data	HR trendgraph, SpO_2 trendgraphs*** and tabular trend data
Length of trend time	1, 2, 4, 8, 24 hours

Event recording

Paper speed	25 mm /s or 50 mm/s*
Recorded data	Saved ECG waveforms with annotations from 4 s before to 12 s after the Event key is pressed.

Defibrillation recording

Paper speed	25 mm/s or 50 mm/s*
Recorded data	Saved ECG waveforms with annotations from start of charge to 12 s after defibrillation

Alarm recording

Paper speed	25 mm/s or 50 mm/s*
Recorded data	Saved ECG waveforms with annotations from 4 s before to 12 s after alarm occurrence

Annotation printing

Real time/delayed ECG waveform recording	ID No., date and time, ECG lead, ECG sensitivity, AC filter ON/OFF, time constant, recording mode (REAL/DELAY) operation mode (MON, DEF, PACING), recording speed, heart rate, SpO_2*** (%), pulse rate**, transmitter channel****, event mark
Event recording, defibrillation recording, and alarm recording	

* 50 mm/s is only available on TEC-7511 and TEC-7521 when the ZR-751VK Telemetry receiver or AL-751VK SpO_2 unit is not installed.

** Only available when optional AL-751VK SpO_2 unit is installed.

*** Recorded only when the optional ZR-751VK Telemetry receiver or AL-751VK SpO_2 unit is installed.

**** Recorded only when the optional ZR-751VK Telemetry receiver is installed.

◆ Non-invasive Pacing (TEC-7531 only)

Pacing rate	40 to 180 pulse/min in 10 pulse/min steps
Output current	8 to 200 mA in 1 mA steps
Pacing modes	Demand and Fixed

◆ Battery

Type	Sealed lead-acid rechargeable battery 12 V/2.9 Ah
Capacity	Fully charged new battery at 20℃ Minimum 50 discharges at 360 J, minimum 2 hours continuous monitoring
Charging time	3 hours at 20℃ powered by AC or 90% of the rated mains voltage
Charging indications	The battery charge lamp lights when the battery is being charged. The battery charge complete lamp lights when the battery charge is completed. The "LOW BATTERY" message indicates low battery capacity (maximum 3 discharges at 360 J)

◆ Power Requirement

Line voltage	TEC-7511/7521/7531: 100 to 127 V AC or 200 to 240 V AC
Line frequency	50 or 60 Hz
Power input	450 VA
Power consumption	120 W (Battery operation)

◆ **Electromagnetic Compatibility**

IEC60601-1-2 (1993)
CISPR11 Group 1, Class B

◆ **Safety**

Safety standard	IEC60601-1 (1988), IEC60601-1 Amendment 1 (1991), IEC60601-1 Amendment 2 (1995), IEC60601-2-4 (1983), IEC61000-3-2 (1995)
Types of protection against electrical shock	AC power: Class I equipment Battery power: Internally powered equipment
Degree of protection against electrical shock	Paddle connector DEFIBRILLATION-PROOF TYPE BF APPLIED PART (when external paddles or disposable pads are used) DEFIBRILLATION-PROOF TYPE CF APPLIED PART (when internal paddles are used) ECG connector DEFIBRILLATION-PROOF TYPE CF APPLIED PART SpO_2 socket (on the AL-751VK SpO_2 unit) DEFIBRILLATION-PROOF TYPE BF APPLIED PART
Protection against harmful ingress of water	IPX 1: When the AL-751VK SpO_2 unit is not installed. IPX 0: When the AL-751VK SpO_2 unit is installed.
Degree of safety of application in the presence of a flammable anaesthetic mixture, oxygen or nitrous oxide	Equipment not suitable for use in the presence of a flammable anaesthetic mixture, oxygen or nitrous oxide
Mode of operation	Continuous operation with intermittent loading : Operation at defibrillation mode Continuous operation with short time loading : Battery charging Continuous operation : All operation except above-mentioned

◆ **Operation Conditions**

Temperature	0 to 45 °C
Humidity	0 to 40 °C: 30 to 95 % RH non condensing 40 to 45 °C: 30 to 80 % RH non condensing
Atmospheric pressure	70 to 106 kPa

◆ **Transport and Storage Conditions**

Temperature	-20 to 70 °C
Humidity	15 to 95 % RH, non condensing
Atmospheric pressure	50 to 106 kPa

◆ Dimensions and Weight

344 (W) × 222 (H) × 335 (D) mm
TEC-7511/7521:
Approx. 9.6 kg including battery
TEC-7531:
Approx. 9.9 kg including battery

◆ Other

Protection against vibration	MIL-STD-810D method, Fig 514.3-1~3-3 curve

9-2 Composition and Options

TEC-7531

Defibrillator main unit
External paddles ND-752V*
Standard accessories (including pad adaptor)

TEC-7521

Defibrillator main unit
External paddles ND-752V*
Standard accessories

TEC-7511

Defibrillator main unit (including external paddles)
Standard accessories

Options

Rechargeable battery	LC-S2912NK
ECG connection cable (5 lead)	BC-755V
Disposable electrode	
External ECG cable	JC-751V
Transmitter interface unit	QI-751VK
Telemetry receiver	ZR-751VK
Transmitter	ZB-800PK
Cart	KD-001A
Cart tray assembly (for KD-001A)	DI-001A
Recording paper (Roll)	RQS50-3
SpO_2 unit	AL-751VK
Finger probe	TL-101T
Foot probe	TL-121T
Multi-site probe	TL-120T
SpO_2 Disposable probe	TL-052S
SpO_2 Disposable probe	TL-051S
SpO_2 Disposable probe	TL-061S
SpO_2 Disposable probe	TL-062S
Cottony tape, 20 pcs/set	340703

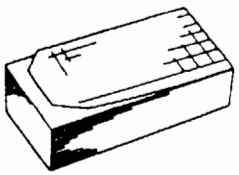
For TEC-7521/7531 Only

Pad adaptor (TEC-7531: Standard accessory)	JC-755V
Disposable pad for adult	610
Disposable pad for child	612
Internal paddle electrode, 25 mm ϕ**	ND-762V
Internal paddle electrode, 35 mm ϕ***	ND-763V
Internal paddle electrode, 45 mm ϕ***	ND-764V
Internal paddle electrode, 55 mm ϕ***	ND-765V
Internal paddle electrode, 65 mm ϕ	ND-766V
Internal paddle electrode, 75 mm ϕ	ND-767V

* Differs according to the destination.
** Does not comply with IEC60601-2-4 56. 101 standard for contact area for adult, child and infant use.
*** Does not comply with IEC60601-2-4 56. 101 standard for contact area for adult use.

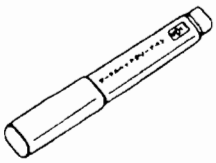
9-3 Standard Accessories

1

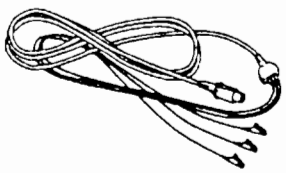


2

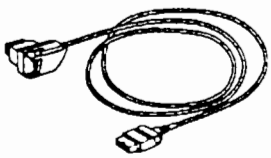
3



4

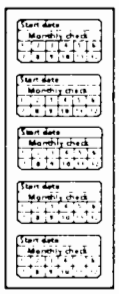


5



6

7



8

No.	Description	Q'ty	Code no.	Supply code no.
1	Recording paper (Z-fold)	1	FQS50-3-100	A222
2	Contact gel GELAID	1	Z-101E	F015
3	Thermal head cleaning pen	1		Y011
4	ECG connection cable (IEC, 3 leads)	1	BC-753V	K350A
5	Pad adaptor (TEC-7531 only)	1	JC-755V	
6	Power cord type N (for TEC-7500F/G/R)	1	094559	
	Power cord type H (for TEC-7500K/E)	1	186656	
	Power cord type GB (for TEC-7500C)	1	483415	
7	Battery check label	2	6124-022441	
8	Ground lead, type D (for TEC-7500C)	1	098029	L912

NOTE

- When you order accessories/consumables which have a supply code no., specify the supply code no., not the model or code no.
- Nihon Kohden purchases the R2 disposable pads from BALLARD Medical Products, USA. To reduce your shipment time and shipping and handling costs from USA, we suggest that you purchase the R2 disposable pads directly from BALLARD Medical Products at the following address or their distributor in your country.

BALLARD Medical Products
1999 Alvin Ricken Drive,
Pocatello, ID 83201, U.S.A.

Customer Service Contact: Ms. Shannon Carr
Ballard Customer Service Phone: (208) 232-9399
Ballard Customer Service Fax: (208) 232-9295

9-4 Options

Description	Code no.	Supply code no.
Rechargeable battery	LC-S2912NK	X041B
Disposable electrode		
Disposable pad for adult*	610	H305
Disposable pad for child*	612	H306
Internal paddle electrode, 25 mm ϕ*	ND-762V	
Internal paddle electrode, 35 mm ϕ*	ND-763V	
Internal paddle electrode, 45 mm ϕ*	ND-764V	
Internal paddle electrode, 55 mm ϕ*	ND-765V	
Internal paddle electrode, 65 mm ϕ*	ND-766V	
Internal paddle electrode, 75 mm ϕ*	ND-767V	
ECG connection cable (IEC, 5 leads)	BC-755V	K351A
External ECG cable	JC-751V	K355
Pad adaptor**	JC-755V	
Transmitter interface unit	QI-751VK	
Transmitter	ZB-800PK	
Telemetry receiver	ZR-751VK	
Cart	KD-001A	
Cart tray assembly for KD-001A cart	DI-001A	
Recording paper (roll)	RQS50-3	A128
Connection cable	JC-752V	K356A
SpO_2 unit	AL-751VK	
Finger probe	TL-101T	P224A
Foot Probe	TL-121T	P225D
Multi-site probe	TL-120T	P225C
SpO_2 Disposable probe	TL-052S	P228B
SpO_2 Disposable probe	TL-051S	P228A
SpO_2 Disposable probe	TL-061S	P229A
SpO_2 Disposable probe	TL-062S	P229B
Cottony tape, 20 pcs/set	340703	

* Options for TEC-7521/7531 only
** Options for TEC-7531 only

CAUTION

Use only the KD-001A cart for the TEC-7500 Portable Defibrillator. If another cart is used, it may tip over or the defibrillator may fall off.

The ND-762V, ND-763V, ND-764V and ND-765V internal paddle does not comply with IEC60601-2-4 56. 101 standard for contact area for adult use. The ND-762V internal paddle does not comply with IEC60601-2-4 56. 101 standard for contact area for infant use.

9-5 References

ANSI/AAMI DF2-1996 Cardiac defibrillator devices
4.3.2 Energy range
A.4.3.2 Energy range

KERBER,RE,CARTER,J.,KLEIN,S,et al.
Open chest defibrillation during cardiac surgery: Energy and current requirements.
American Journal of Cardiology, 46:393-396,1980.

TACKER,WA,GUINN,GA,GEDDES,LA,et al.
The electrical dose for direct ventricular defibrillation in man.
Journal of Thoracic Cardiovascular Surgery, 75:224-226,1978.

RUBIO,PA and FARRELL,EM.
Low-energy direct defibrillation of the human heart.
Annals of Thoracic Surgery, 27:32-33,1979.

Nihon Kohden Corporation
Head Office
31-4, Nishiochiai 1-chome, Shinjuku-ku,
Tokyo 161-8560, Japan

International Division Sales Department
Tokyo (Head Office)
Telephone: +81 (3) 5996-8036
Facsimile: +81 (3) 5996-8100

Nihon Kohden China Service Centers
上海维修站
上海市徐汇区南丹路 169 号 新旺大厦 3008 室
电话：021-6469-9016 传真：021-6486-7218

北京维修站
北京市西城区复兴门内大街 101 号
百盛大厦写字楼 第 7 层第 020B 室
电话：010-6603-7229 传真：010-6603-7216

广州维修站
广州市环市东路 371～375 号 世贸中心南塔 2516 室
电话：020-8777-9108 传真：020-8778-1882

沈阳维修站
沈阳市和平区北二马路 35 号
中国医药集团沈阳有限公司 2 楼 208 室
电话：024-2383-1147 转 315 传真：024-2383-2557

成都维修站
成都市一环路西二段 25 号 华立大厦 420 室
电话：028-773-6236 传真：028-773-6236

Nihon Kohden America, Inc
90 Icon Street, Foothill Ranch, CA 92610, USA
Telephone: +1 (949) 580-1555
Facsimile: +1 (949) 580-1550

Nihon Kohden Europe GmbH
Saalburgstraße 157, Bürohaus 1,
D-61350 Bad Homburg v.d.H., Germany
Telephone: +49 (6172) 309200
Facsimile: +49 (6172) 303611

Nihon Kohden Singapore PTE LTD
70 Shenton Way, #14-05 Marina House
Singapore 079118
Telephone:+65 224-6700
Facsimile: +65 224-6216

The model and serial number of your instrument are identified on the rear or bottom of the unit. Write the model and serial number in the spaces provided below. Whenever you call your distributor concerning this instrument, these two pieces of information should be mentioned for quick and accurate service.

Model _____ Serial number _____

YOUR DISTRIBUTOR

PRINTED IN JAPAN