NIHON KOHDEN
CORPORATION

OPERATOR'S MANUAL

PORTABLE DEFIBRILLATOR
CARDIOLIFE
Model TEC-7100
TEC-7200

Model
TEC7100/7200A
TEC7100/7200B
TEC7100/7200C
TEC7100/7200F
TEC7100/7200G
TEC7100/7200R
TEC7100/7200J
TEC7100/7200K
TEC7100/7200E
TEC7100/7200U
TEC7100/7200H
TEC7100/7200W

OM.TEC7100/7200.04

GENERAL HANDLING PRECAUTIONS

This device is intended for use only by qualified medical personnel.

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, extreme atmospheric pressure, excessive humidity and temperatures, poorly ventilated areas, and dusty, saline or sulphuric air.

   (2) The instrument should be placed on an even, level floor. Vibration and mechanical shock should be avoided even during moving.

   (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 should correspond in frequency and voltage to specifications, and have allowable 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 mis-diagnosis or other problems.

   (5) All circuitry used for direct patient connection must be doubly checked.

   (6) Check that battery voltage and battery condition are perfect when using battery-operated models.

4. **During operation:**

   (1) Both the instrument and the patient must receive constant and 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 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 to keep them ready 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.**

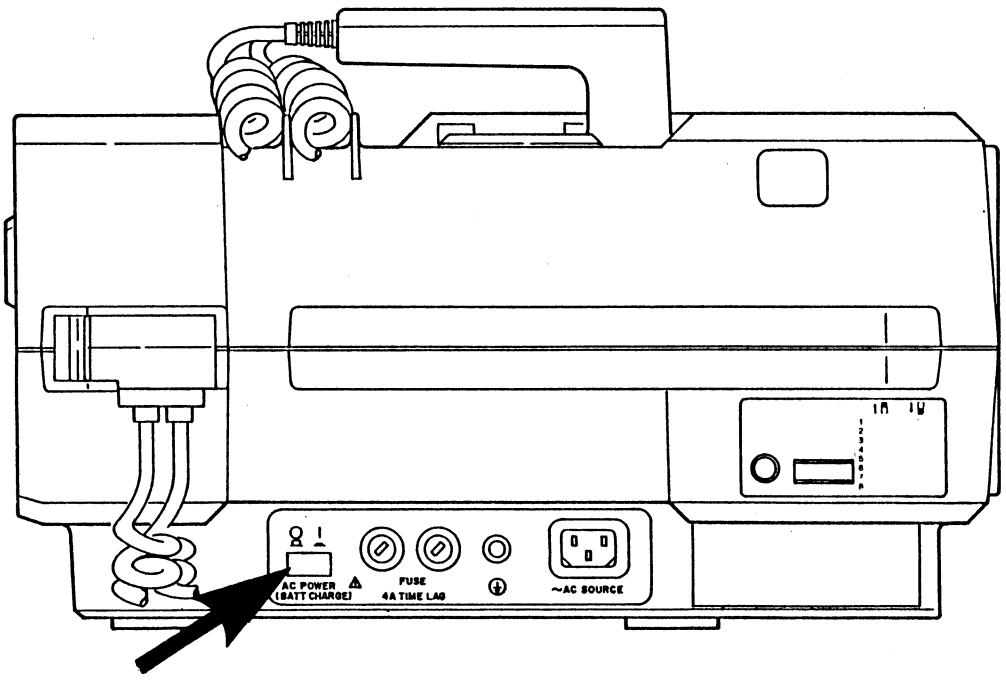
8. **Maintenance and inspection:**
   (1) The instrument and parts should undergo regular maintenance inspections.
   (2) If stored for extended periods without being used, make sure prior to operation that the instrument is in perfect operating condition.

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

10. **When the instrument is used with a defibrillator, make sure that the instrument is protected against defibrillator discharge. If not, remove patient cables and/or transducers from the instrument to avoid possible damage.**

CAUTION

To operate on AC (line) power or to charge the battery, the power switch on the right side of the defibrillator must be in the "ON" position at all times.



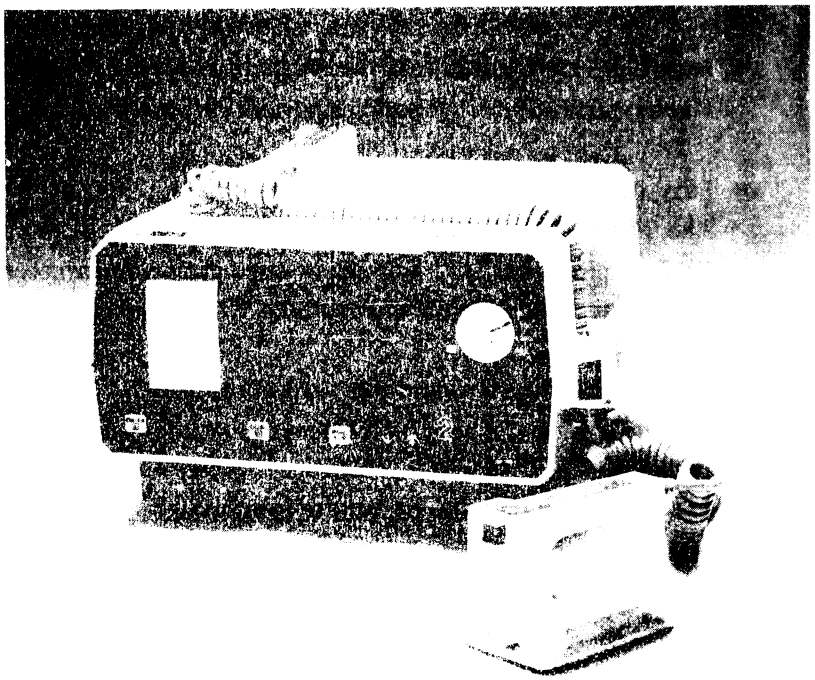
CONTENTS

Section 1 General

1-1 Introduction

The CARDIOLIFE TEC-7100 / 7200 [illegible] defibrillator is designed to provide the medical profession with the vital functions of defibrillation, cardioversion and ECG monitoring within a single housing.
The unit has been designed for simplicity of [illegible] monitoring recording, and compactness, with only two steps required before energy discharge [illegible] energy level adjustment. This enables it to meet the various needs of the hospital, clinic, [illegible] and ambulance. The sternum paddle is equipped with a three-color coded contact [illegible] the operator to know the quality of paddle contacts before discharge.
One of the unique features of the TEC-7100 / 7200 is its 5.5 in. CRT display. It provides non-fade two-trace monitoring with large digital indications of [illegible] energy and heart rate with preset alarm limits. The cascade capability features and [illegible] ECG display and manual freezing of abnormal beats of interest. During synchronized cardioversion, the [illegible] synchronization is clearly shown as a bright spot on the R-wave.
The thermal array recorder prints [illegible] with adjustable margins. In the SYNC mode, a synchronization mark is recorder across the corresponding position.
The unit with only 12.9 kg including the [illegible] battery with charger, and AC power supply. They are all contained in a compact housing which measures 344 W × 136 H × 370 D mm (excluding paddles).

This manual covers model TEC-7100 / 7200. Operations and performances of all these models are common unless otherwise specified. Please read this manual thoroughly prior to operation to assure safety and optimum performance.



1-2 Features

- **AC (built-in AC power supply) and DC (built-in rechargeable battery) operation**
  The Model TEC-7100 / 7200 incorporates an AC power supply and is designed to be small and light.
  The battery can be charged repeatedly with the built-in charger.

- **Paddle contact indicator (TEC-7200 only)**
  The equipment measures the trans-thoracic resistance of a patient during paddle application and indicates this through the paddle indicator. This results in a maximum defibrillation of the patient, while minimizing the difference between the set energy and the actual energy delivered.
  The actual measured values of the amount of energy delivered to the patient and trans-thoracic resistance will be printed as data after the discharging operation.

- **Ease of operation**
  The easy and quick operation is as follows : 1) Power on / Energy set, 2) Energy charge, and 3) Discharge.

- **Slide-off paddle electrodes (for pediatric use)**
  If it is necessary to defibrillate a pediatric patient, the adult paddle electrodes can easily be slid off to reveal pediatric paddle electrodes.

- **Autoclave sterilization of internal paddles (TEC-7200 only)**
  Heat-resistant internal paddles permit autoclave sterilization.

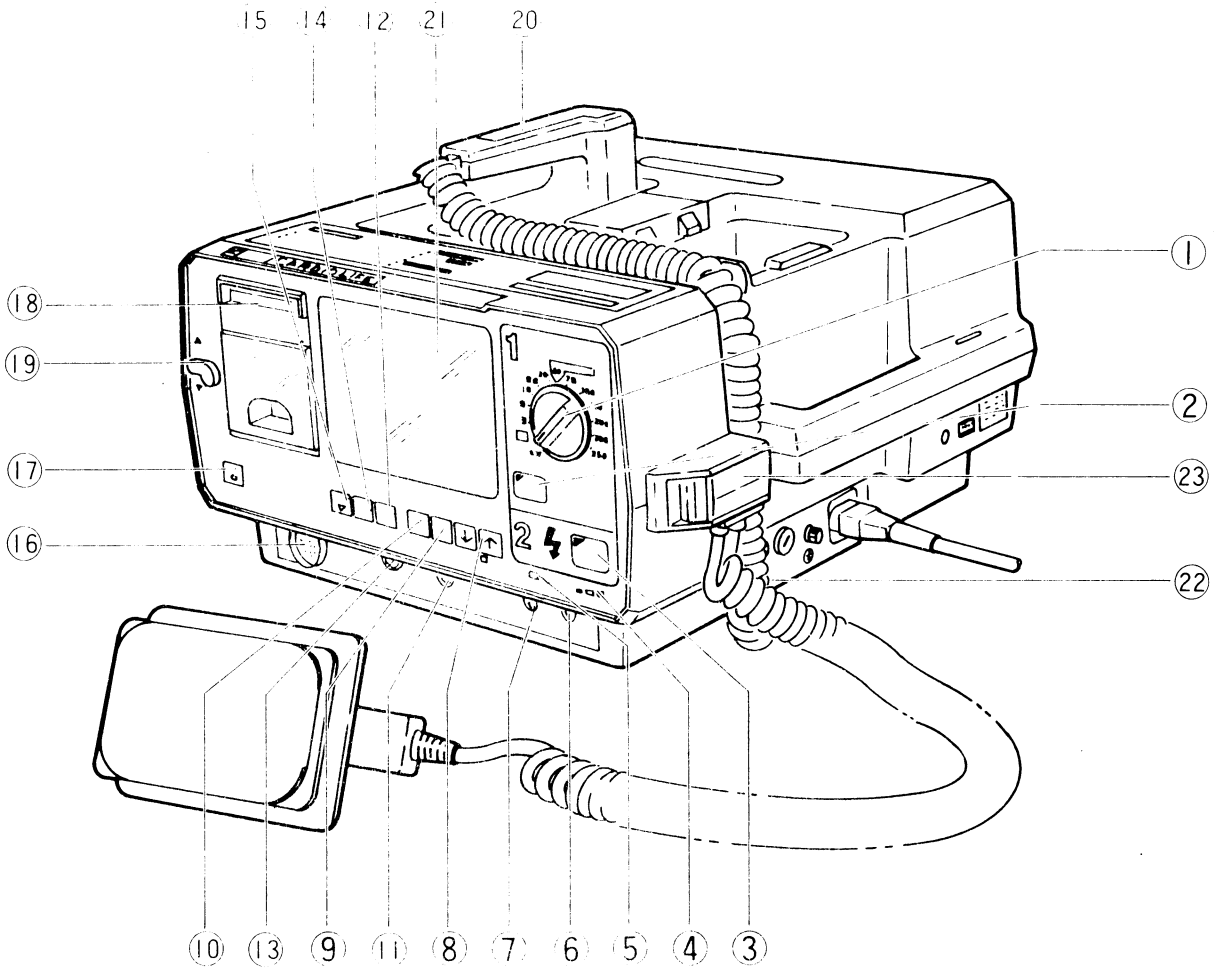
- **Easy-to-view 5.5-inch monitor**
  The TEC-7100 / 7200 also has the features of an ECG monitor. The 5.5 inch CRT displays an ECG waveform cascading onto a second trace, heart rate, heart rate alarm limits, energy level, lead selection, sensitivity, and various user messages.

- **ECG monitoring via telemeter system (optional)**
  The utilization of an optional telemeter system permits ECG monitoring.

- **12-lead ECG measuring capability (optional)**
  The use of an optional patient cable permits recording of leads, I, II, III, aV_R, aV_L, aV_F, and V.

- **Thermal array recorder**
  The built-in recorder uses a thermal head to provide higher frequency characteristics and good linearity for recording of precise waveforms.

1-3 Name of Panels, Controls, etc.



1 Output energy select dial
2 Synchronization mode select key
3 Energy charge key
4 Battery level indicator
5 Battery charge indicator
6 ECG output terminal
7 External ECG input terminal
8 High / low select key / calibration key
9 High / low limit set
10 Alarm ON / OFF key
11 QRS sound volume control knob
12 Sensitivity select key
13 Intensity control knob
14 Lead select key
15 Freeze key
16 ECG input connector
17 Record / stop key
18 Recorder
19 Head release / paper feed lever
20 Paddle
21 Monitor
22 AC power switch
23 Paddle connector (TEC -7200 only)

1-4 Composition

Defibrillator TEC-7000 series are composed of the following parts.

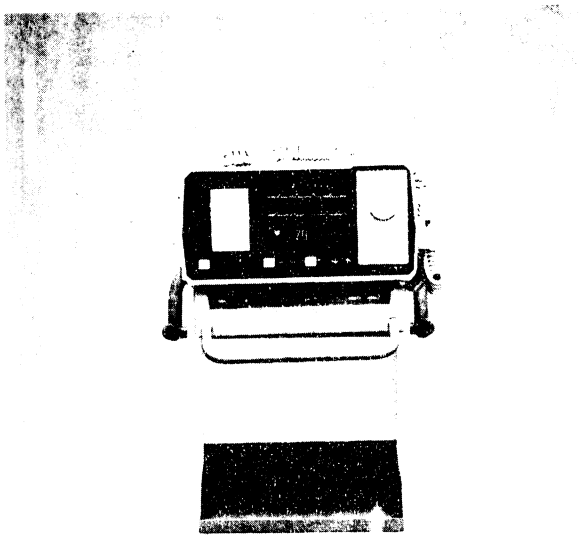
- **TEC-7100 type**
  Defibrillator Main Unit
  External Paddle

- **TEC-7200 type**
  Defibrillator Main Unit
  External Paddle* (ND-702V#)

- **Optional Accessories**

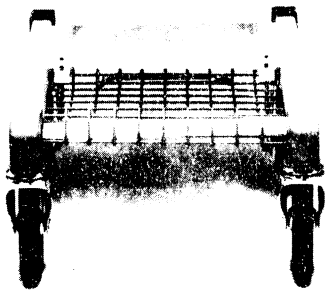
†For TEC-7100 / 7200

Cart	KD-701V
Electrode Leads*	BR-008P
(5-electrode)	BR-004P
	BR-009P
Roll Paper Adapter	RH-701V
Roll Paper	RQS-50-3
(50 mm × 30m)	
Tilt Stand	KH-701V
Transmitter*	ZB-312PA
	ZB-512V
Receiver*	ZR-702V
	ZR-701VK
Battery Charger*	SB-642P#



†For TEC-7200 only

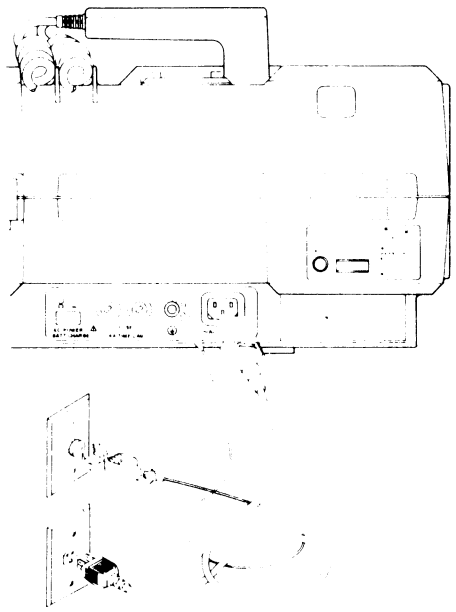
Internal Paddle	ND-723V
	ND-725V
	ND-727V
Ant-Post Paddle*	ND-704V#



Refer to **TEC-7100 / 7200 System Component Table** (**Pg. 69**) as for the parts marked with an asterisk.

Section 2 System Operation Preparation

2-1 Ground Lead and Power Cord Connection



1. Turn off the power. Connect the GND terminal of the main unit to a good ground facility with the provided ground lead.

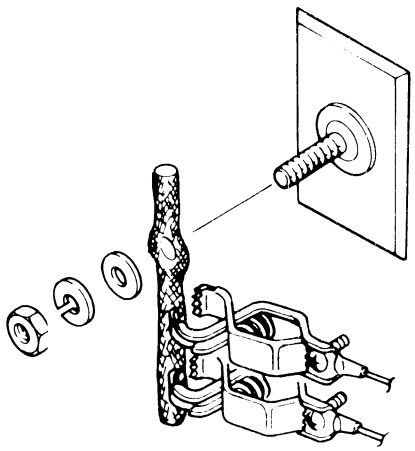
- When two or more units of medical equipment are used, one-point grounding is recommended.

> ***WARNING***
>
> ***Never use a water pipe or gas pipe as a ground.***

When a 3-prong power cord is used, the instrument is automatically grounded. However, connecting the ground lead is recommended against the disconnection of the ground lead in the 3-prong power cord.

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

> **CAUTION**
>
> **Fully charge the battery to provide for emergencies.**



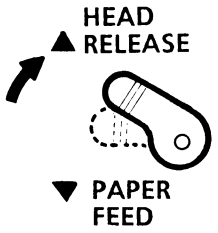
One-Point Grounding

To protect patients from electric shock from the simultaneous operation of two or more units of medical equipment, it is necessary to prevent the creation of shorts between the combined equipment. When shorts exist in the equipment, current flows into patients connected to them, giving electric shocks or AC interference.

One-point grounding should be strictly observed to protect not only the patient, but also prevent causing failure or damage to the equipment when two or more units are simultaneously operated. One-point grounding can be made, for example, in the following way. Prepare a 15 cm long and 2~3 cm thick shield wire. Solder both ends so the wire will not untwine, and make a hole on each soldered end with the tip of a screwdriver. Then connect the wire firmly to the grounding terminal and secure the wire with a large alligator clip. A number of these clips permit grounding a number of units of medical equipment with a single grounding terminal.

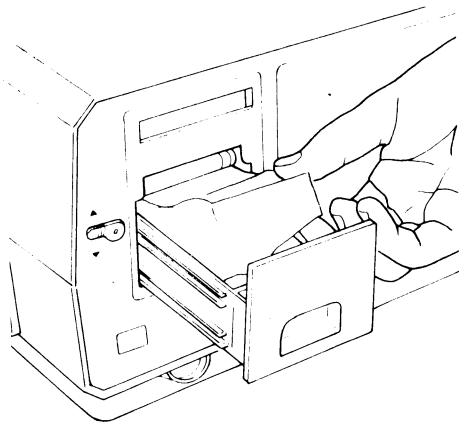
2-2 Recording Paper Loading

◆ Z-fold paper

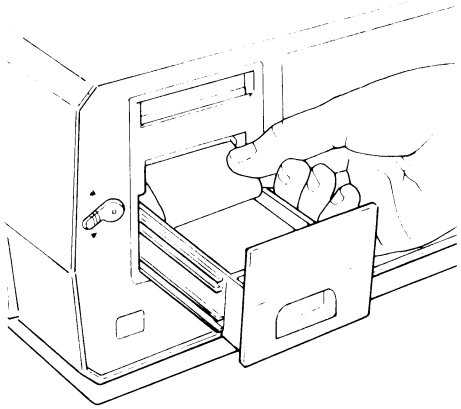


Z-fold Paper Loading

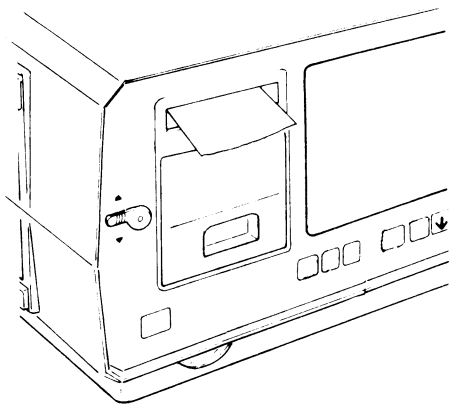
1. Lift the HEAD RELEASE / PAPER FEED lever to the HEAD RELEASE (▲) position.



2. Pull the recording paper tray out. With the fold in the recording paper pointing toward you, place the paper in the tray.



3. Insert the end of the recording paper through the slot immediate above the guide roller.
   Feed the paper out of the top opening by hand.



4. Set the HEAD RELEASE / PAPER FEED lever back to the neutral position and push the recording paper tray back.
   Paper loading is now complete.
   Keep pressing the HEAD RELEASE / PAPER FEED lever downward, and feed the paper for approximately 5 cm.

CAUTION

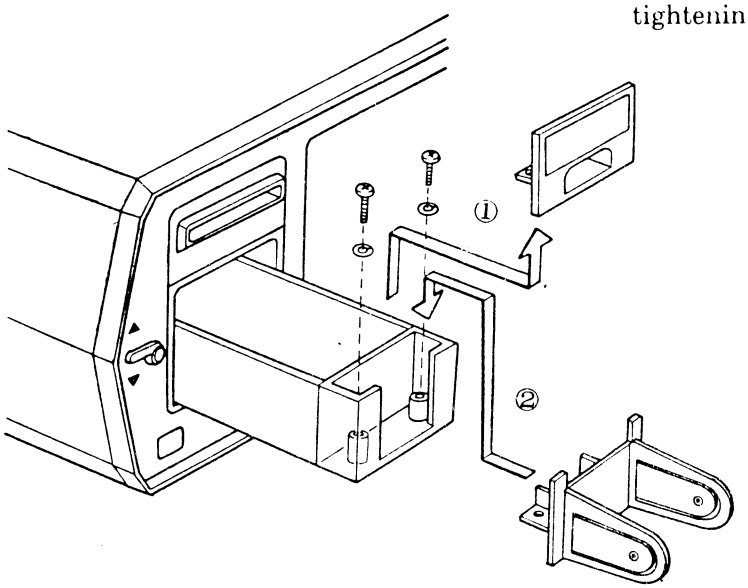
- **Use the specified recording paper (high sensitivity) exclusively made for a thermal array recorder to obtain clear recordings.**

◆ Roll Paper (Option)

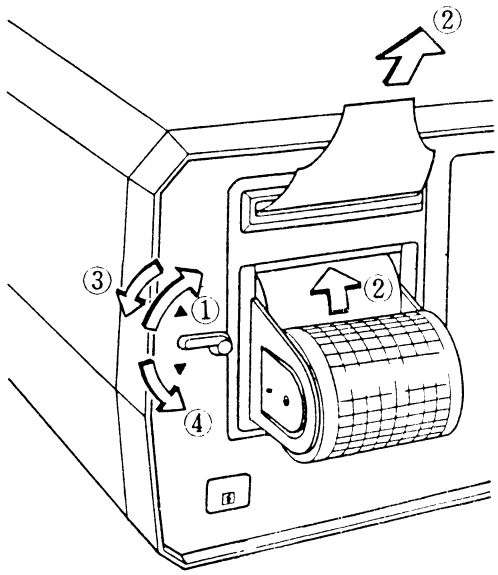
Attachment of Roll Paper Adapter (Option)

1. Loosen the two screws which secure the paper tray front panel to remove it from the tray.

2. Set the roll paper adaptor on the tray and secure it by tightening the two screws.



Roll Paper Loading



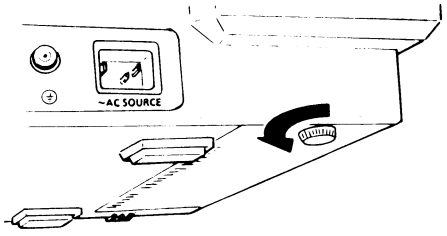
1. Lift the HEAD RELEASE / PAPER FEED lever to the HEAD RELEASE (▲) position.

2. Place the recording paper in the adapter.
   Insert the end of the recording paper through the slot immediately above the guide roller.
   Feed the paper out of the top opening by hand.

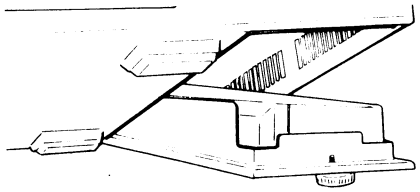
3. Set the HEAD RELEASE / PAPER FEED lever back to the neutral position and push the recording paper tray back.
   Paper loading is now complete.

4. Push the HEAD RELEASE / PAPER FEED lever down, and feed the paper for approximately 5 cm.

2-3 Battery Installation



1. To open the battery housing, loosen the screw, on the bottom of the equipment.



2. Insert the battery into the housing with its label up. Close the housing and tighten the screw.

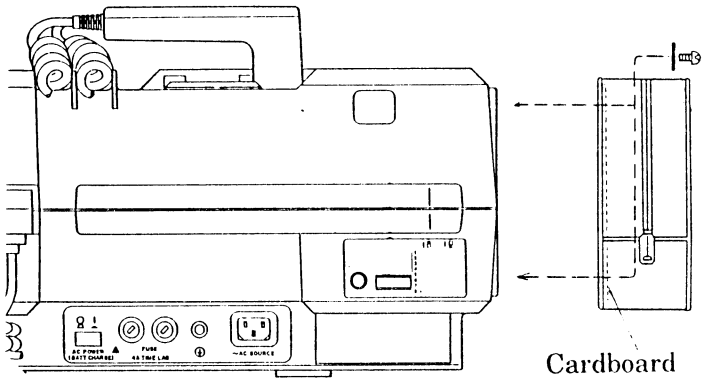
CAUTION

Charge the battery prior to initial use.
(For charging, refer to Section 6-3.)

2-4 How to Mount Accessory Pouch to TEC-7100 / 7200

◆ Procedure

1. Open the zipper of the pouch.
2. Take out the piece of cardboard which is inside.
3. Secure the pouch to the rear of the main unit using four screws and washers
4. Replace the cardboard and close the zipper.



Mounting accessories

Description	Q'ty
Screw, M4 × 8	4
Washer (M4)	4

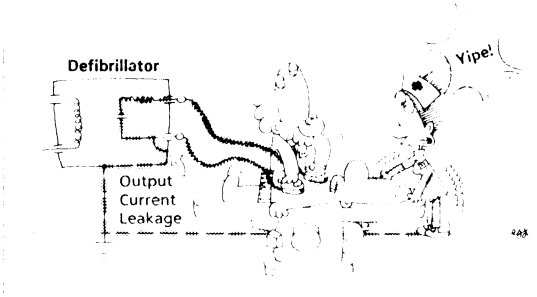
Section 3 Defibrillation

3-1 Cautions when Using the Defibrillator

1. The defibrillator must be operated only by personnel who have been properly trained, as it generates a very high voltage.

2. Do not use the defibrillator in a place where any inflammable anesthetic gas is used.

3. The operator or assistant should be kept away from the bed during defibrillation and should never touch the equipment connected to the patient. This may cause the discharge current to pass through them and return via the floor to the output circuit resulting in the formation of a closed circuit, which may be dangerous.



4. Any equipment which is not provided with a defibrillation protection circuit should be removed from the patient during defibrillations.

5. Never allow the equipment to discharge if any person other than the patient is touching the electrode face of the paddle.

6. Do not expose the external paddles to temperatures above 60°C, and always keep them dry. Autoclave sterilization is impossible for external paddles.

7. Apply contact gel only on the electrode faces of the paddles. Never allow the equipment to discharge when contact gel makes a potential circuit between them.

8. After use, thoroughly remove any remaining contact gel before rehousing the paddles.

9. Periodically perform operational tests to confirm that the defibrillator is operating correctly. Be sure to inspect the accessories at the same time.
(For test procedures, refer to Section 7-4.)

10. When the battery level indicators show that the level is low, charge the battery at once.
(For charging the battery, refer to Section 6-3.)

11. if a message ERROR 1 to 4 is displayed on the screen, do not operate the instrument and contact our service personnel because the defibrillator is out of order.

3-2 Procedures for Cardiopulmonary Resuscitation

Ventricular fibrillation is not only observed in patients struck by acute myocardial infarction but also occurs as a result of many different diseases. A patient with cardiac arrest will lose consciousness within ten seconds of its onset due to loss of cardiac output. If this condition continues for between three to five minutes, irreversible changes will occur in his central nervous system.

In general, in the case of a patient whose respiratory and circulatory functions have stopped, initial treatment is recommended according to the sequence shown in the chart on the next page.

This treatment is called cardiopulmonary resuscitation (CPR). As shown in the chart on the next page, proceeding with this treatment in the sequence shown below ensures correct treatment.

When a patient who requires urgent resuscitation is found, first secure his air way. If he stops breathing, perform artificial respiration. If his heart has stopped, give cardiac resuscitation (massage), then administer appropriate drugs and observe his electrocardiogram. This can determine if the cardiac arrest is caused by ventricular fibrillation or cardiac standstill, or determine if there is another hazardous arrhythmia.

If ventricular fibrillation is observed, try to defibrillate it (anterior beat electrical defibrillation).

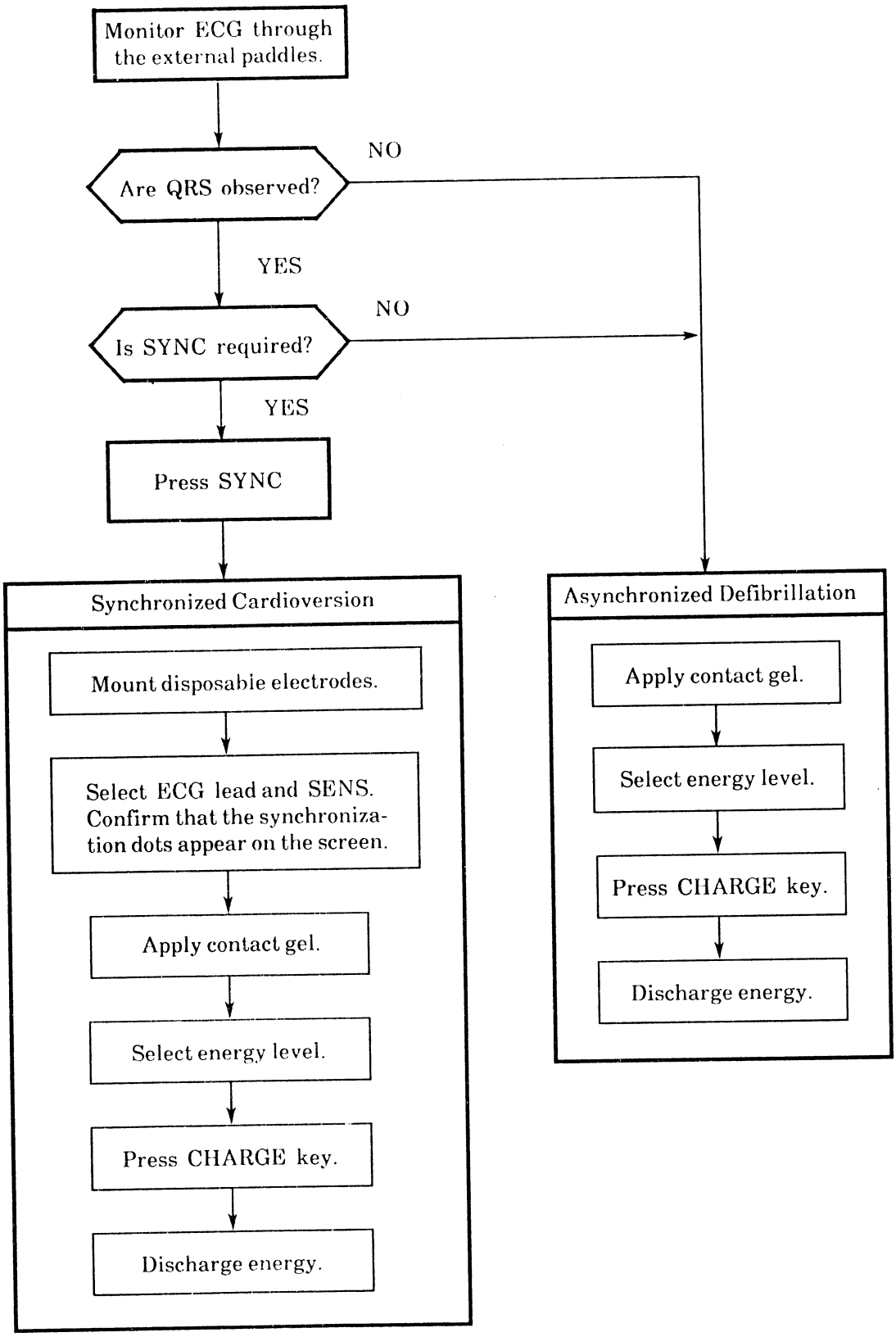
However, before starting defibrillation, it is mandatory that the hypoxic condition of the patient be improved. This increases the percentage of successful cases of defibrillation.

Although, from the viewpoint of treating ventricular fibrillation, electrical defibrillation is indispensable, it must be recognized that the treatment is only auxiliary.

Sequence of Cardiopulmonary Resuscitation

A. (Air way)	Securing the air way
B. (Breathing)	Artificial respiration
C. (Circulation)	Cardiac resuscitation (massage)
D. (Drugs)	Administration of drugs such as adrenaline, sodium bicarbonate and calcium.
E. (ECG)	Determination whether the arrest is caused by ventricular fibrillation or cardiac standstill through ECG waveform.
F. (Fibrillation treatment)	Defibrillation
G. (Gauge)	Measurement of blood pressure, volume of urine, blood gases and electrolytes.

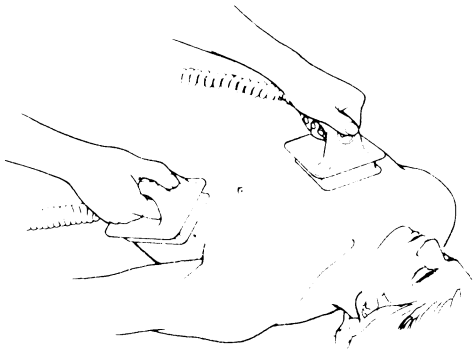
◆ Emergency Procedures for Monitoring and Defibrillation



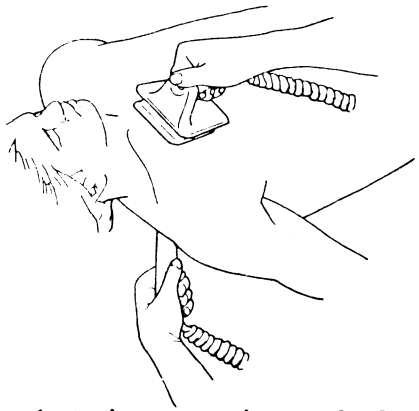
3-3 Paddle Positions

◆ Paddle positioning methods

Two kinds of paddle positioning are available as shown below. Optional Ant-Post paddles ND-704V / 704VG are required for the anterior-posterior method.

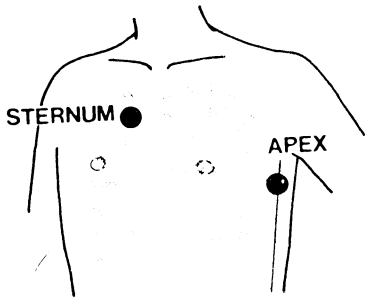


Anterior-anterior method



Anterior-posterior method

◆ Anterior-anterior method

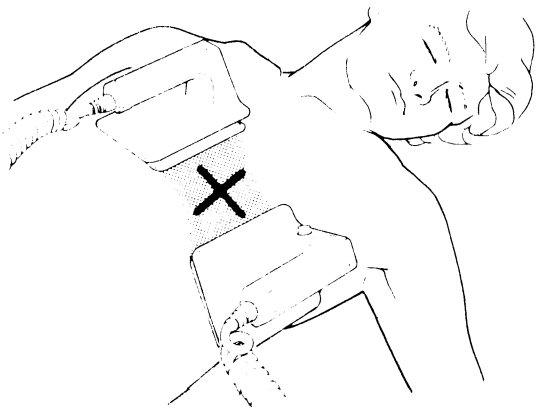


Press the STERNUM paddle on the right edge of 2nd and 3rd intercostal sternum and press the APEX paddle on the 5th middle axillary line.

WARNING

Take care that both paddles are not connected by contact gel.

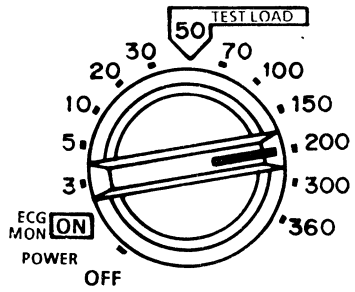
The figure below shows a bad example where the paddle electrodes have been shorted by contact gel.



3-4 Asynchronized Defibrillation by Paddle Leads

WARNING

- ***Make sure that the operator and all other personnel do not come in contact with the patient's body or any metal touching the patient during defibrillation.***
- ***Do not touch the paddle electrode faces after energy charging.***

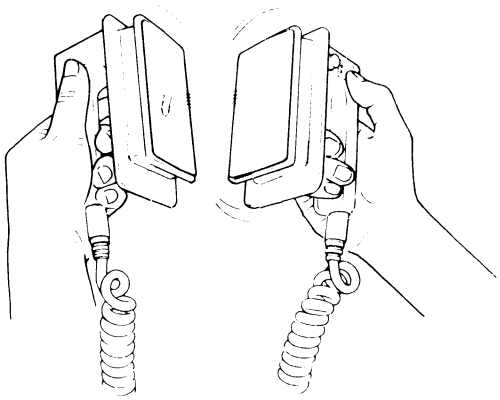


1. When using AC power, press the AC POWER button on the right side of the main unit.
   Then select the desired output energy level required for defibrillation of the patient by using the ENERGY SELECT dial.

2. Verify that the lead indication on the screen displays "PADL" (paddle lead).
   When power is turned on, "PADL" is automatically selected.

   ▸ If another lead is selected, press the LEAD key on the front panel to select the paddle lead.

   Confirm that the SYNC mode indicator lamp is off.



3. Remove the external paddles from the paddle housing.
   Then, uniformly apply the contact gel to both of the electrode faces

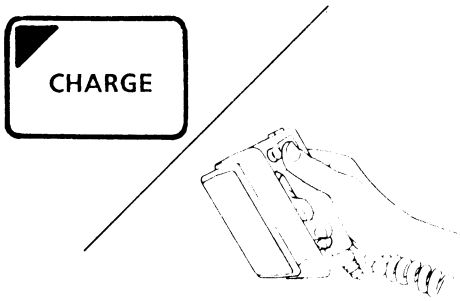
NOTE

In order to easily remove the paddles from the main unit, slightly tilt the handles towards each other while lifting.
(See diagram on the main unit.)

4. Press the paddles against patient's chest and check his ECG through the monitor.

NOTE

When it is determined from observed waveforms that the synchronized cardioversion is required, follow the procedure for synchronized cardioversion as shown in Section 3-5 or 3-6.

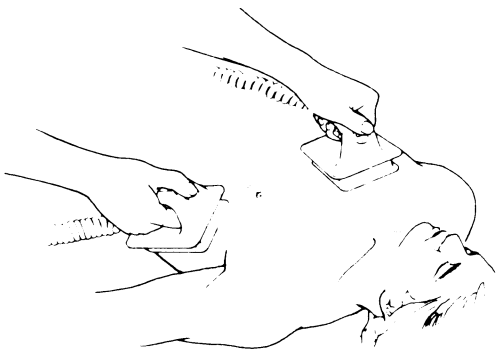


5. When it is verified that the patient's fibrillation is ventricular, press the CHARGE key or CHARGE button on the APEX paddle to charge the required energy.

   - The CHARGE indicator lamps on both the monitor and the paddle flash during charging then are lit continuously when charging is complete. A continuous tone is also emitted when charging is complete.

   - To change from one set energy level to another after completion of charging, select the required level with ENERGY SELECT dial. Approximately 1 second later, the previously charged energy will start changing to the newly selected one.

6. For the TEC-7200, once the energy level is selected, the paddle contact indicator lamps will display the contact resistance between the paddles and patient. When the green "GOOD" illuminates, press the DIS-CHARGE button. If the green "GOOD" does not illuminate, check the amount of applied contact gel and press the paddles against the patient with force until the "GOOD" illuminates. (The indicator may not illuminate for some patients.)



7. Make sure that the CHARGE indicator lamp is illuminated. Then, press both DISCHARGE buttons on the external paddles at the same time to discharge the preset output energy into the patient.

NOTE

If a single defibrillation is not effective, the above procedures may be repeated for another defibrillation after other treatments such as medication, cardiac massage, etc.

A second defibrillation is usually performed at the same energy level as the first. This is because the first defibrillation reduces electrode-to-skin impedance so that effective current will increase.

If no effect is obtained yet, increase the energy.

CAUTION

- If it is desired to clear the energy setting after charging has been completed, set the **ENERGY SELECT** dial to the **ECG MON** position. If defibrillation is not performed within 40 sec. after charge completion, stored energy will be automatically discharged internally for safety.
- When the energy has been discharged, it cannot be recharged again until the monitor displays "0J" energy.

3-5 Synchronized Cardioversion by Paddle Leads

WARNING

Because of the potential danger of noise interference, Nihon Kohden recommends that synchronization be carried out by using the ECG cable and electrodes. However, if the operator feels that it is absolutely necessary, paddle synchronization is possible by setting the DIP switch on the right side of the equipment to the "PDL SYNC" position.

CAUTION

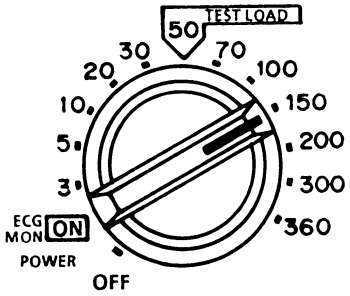
- Before performing synchronized cardioversion by paddle lead, set the DIP switch on the right side of the equipment to the "PDL SYNC" position.
  (For the setting procedure, refer to Section 7-2.)
- "USE ECG CABLE" message is displayed on the screen even if synchronized cardioversion is selected by the DIP switch.

NOTE

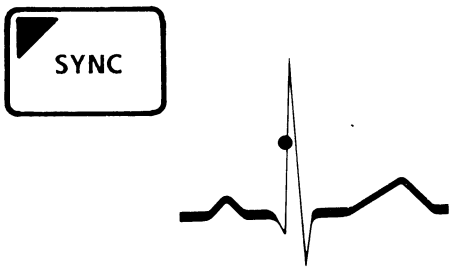
When performing a synchronized cardioversion which is not urgent, perform defibrillation according to the synchronized cardioversion shown in Section 3-6.

WARNING

- *Make sure that the operator and all other personnel do not come in contact with the patient's body or any metal touching the patient during defibrillation.*
- *Do not touch the paddle electrode faces after energy charging.*

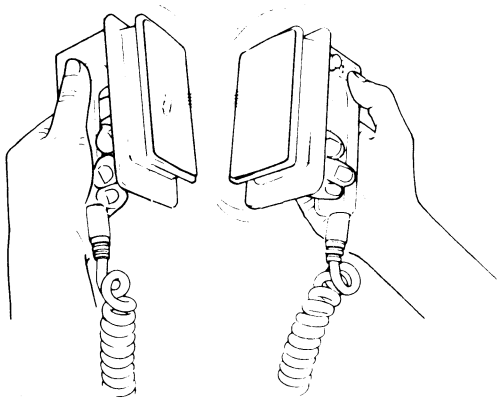


1. When using AC power, press the AC POWER button on the right side of the main unit.
   Then select the desired output energy level required for defibrillation of the patient by using the ENERGY SELECT dial.



2. Press the SYNC mode select key, and the SYNC mode indicator lamp lights.
   A spot which indicates the synchronization position will appear on the screen at the rising portion (Q-R) of an ECG waveform and a sound synchronized with the QRS will be emitted. Control the brightness by the intensity control knob to observe this bright point clearly.

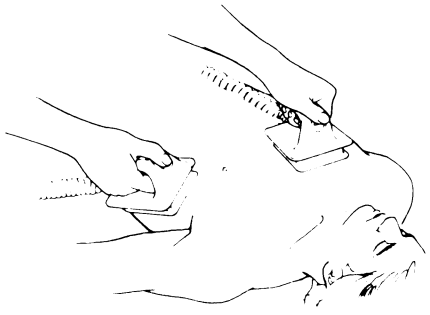
3. If the spot which indicates the synchronization position is not displayed on the QRS complex, correct synchronization will not be made. To make that spot appear on the QRS complex, proceed as follows:
   - Change the amplitude of the ECG using the SENS key.
   - Change the lead using the LEAD select key.
   - Change the setting positions of the electrodes.



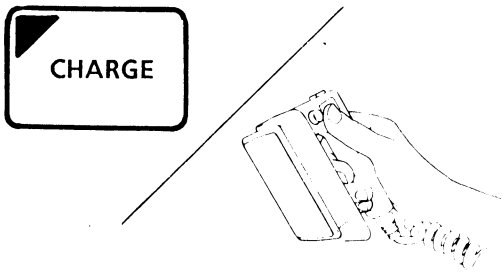
4. Remove the external paddles from the paddle housing.
   Then, uniformly apply the contact gel to both of the electrode faces.

NOTE

In order to easily remove the paddles from the main unit, slightly tilt the handles towards each other while lifting.
(See diagram on the main unit.)



5. Press the paddles against patient's chest and check his ECG through the monitor.

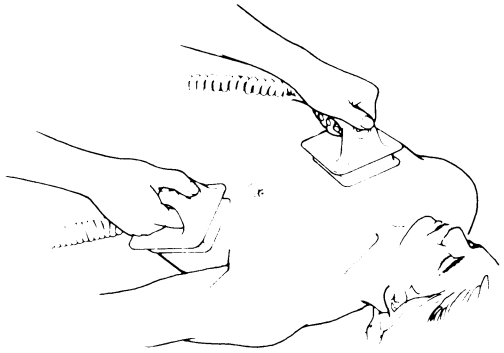


6. Press the CHARGE key or CHARGE button on the APEX paddle to charge the required energy.

   - The CHARGE indicator lamps on both the monitor and the paddle flash during charging then are lit continuously when charging is complete. A continuous tone is also emitted when charging is complete.

   - To change from one set energy level to another after completion of charging, select the required level with ENERGY SELECT dial. Approximately 1 second later, the previously charged energy will start changing to the newly selected one.

7. For the TEC-7200, once the energy level is selected, the paddle contact indicator lamps will display the contact resistance between the paddles and patient. When the green "GOOD" illuminates, press the DISCHARGE button. If the green "GOOD" does not illuminate, check the amount of applied contact gel and press the paddles against the patient with force until the "GOOD" illuminates. (The indicator may not illuminate for some patients.)



8. Make sure that the CHARGE indicator lamp is illuminated. Then, keep pressing both DISCHARGE buttons on the external paddles at the same time until the preset output energy is discharged into the patient.

NOTE

If a single defibrillation is not effective, the above procedures may be repeated for another defibrillation of increased energy level.

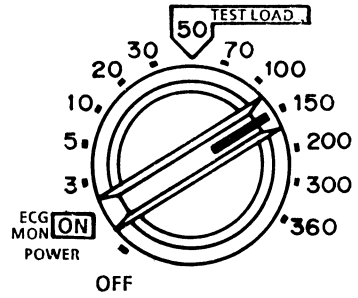
CAUTION

- If it is desired to clear the energy setting after charging has been completed, set the ENERGY SELECT dial to the ECG MON position. If defibrillation is not performed within 40 sec. after charge completion, stored energy will be automatically discharged internally for safety.
- When the energy has been discharged, it cannot be recharged again until the monitor displays "0J" energy.
- SYNC mode is automatically turned off (ASYNC mode) when the energy is discharged. (TEC-7100/7200A only)

3-6 Synchronized Cardioversion by Electrode Leads

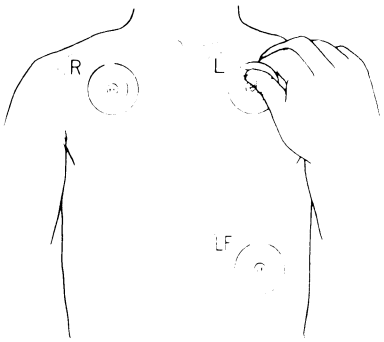
WARNING

- ***Make sure that the operator and all other personnel do not come in contact with the patient's body or any metal touching the patient during defibrillation.***
- ***Do not touch the paddle electrode faces after energy charging.***



1. When using AC power, press the AC POWER button on the right side of the main unit.
   Then select the desired output energy level required for defibrillation of the patient by using the ENERGY SELECT dial.

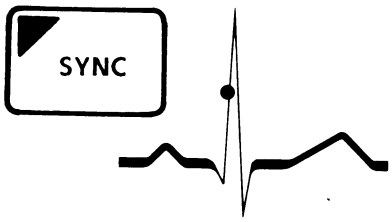
2. Plug the ECG connection cord into the ECG input connector.



3. Place the electrodes on the corresponding sites of the patient.
   Clip the end of each attached electrode lead on to its electrode.
   RA (R) ..... White (Red) lead
   LA (L) ..... Black (Yellow) lead
   LL (LF) ..... Red (Green) lead
   For the setting procedure, refer to Section 4-3.

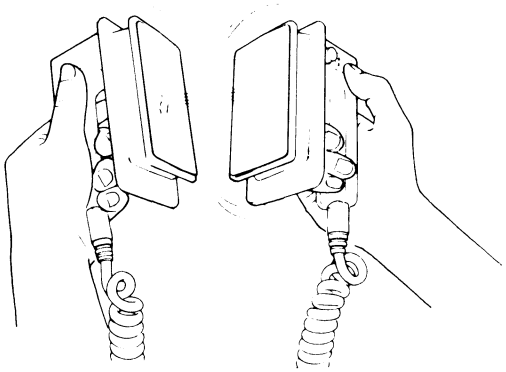
4. Plug the electrode lead into the corresponding socket of the ECG connection cord.

5. Press the LEAD select key to select the desired lead.
   - Lead II is the usual selection as it provides the largest waveform.



6. Press the SYNC mode select key, and the SYNC mode indicator lamp lights.
   A spot which indicates the synchronization position will appear on the screen at the rising portion (Q-R) of an ECG waveform and a sound synchronized with the QRS will be emitted. Control the brightness by the intensity control knob to observe this bright point clearly.

7. If the spot which indicates the synchronization position is not displayed on the QRS complex, correct synchronization will not be made. To make that spot appear on the QRS complex, proceed as follows:
   - Change the amplitude of the ECG using the SENS key.
   - Change the lead using the LEAD select key.
   - Change the setting positions of the electrodes.



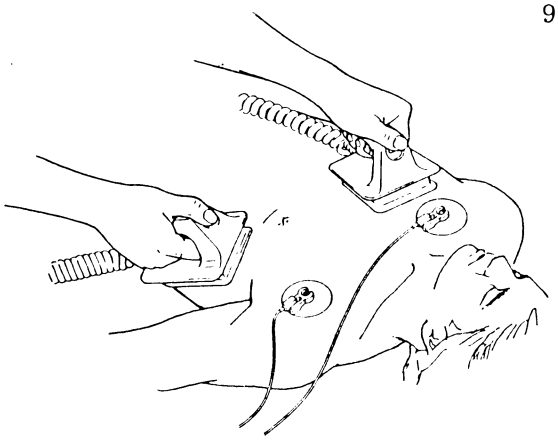
8. Remove the external paddles from the paddle housing.
   Then, uniformly apply the contact gel to both of the electrode faces.

NOTE

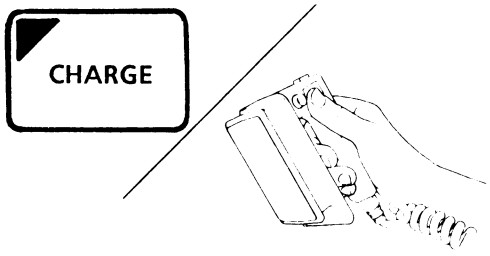
In order to easily remove the paddles from the main unit, slightly tilt the handles towards each other while lifting.
(See diagram on the main unit.)

---

9. Press the paddles against patient's chest.



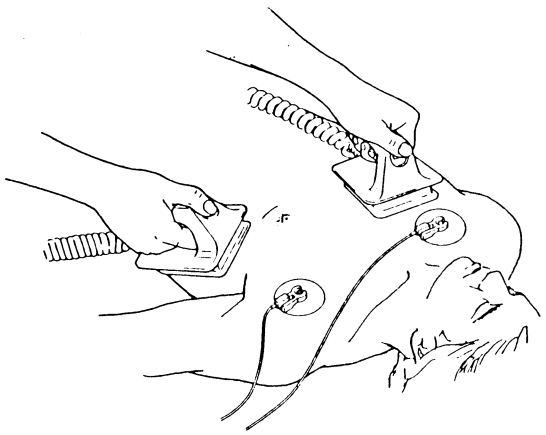
10. Press the CHARGE key or CHARGE button on the APEX paddle to charge the required energy.



- The CHARGE indicator lamps on both the monitor and the paddle flash during charging then are lit continuously when charging is complete. A continuous tone is also emitted when charging is complete.

- To change from one set energy level to another after completion of charging, select the required level with ENERGY SELECT dial. Approximately 1 second later, the previously charged energy will start changing to the newly selected one.

11. For the TEC-7200, once the energy level is selected, the paddle contact indicator lamps will display the contact resistance between the paddles and patient. When the green "GOOD" illuminates, press the DIS-CHARGE button. If the green "GOOD" does not illuminate, check the amount of applied contact gel and press the paddles against the patient with force until the "GOOD" illuminates. (The indicator may not illuminate for some patients.)



12. Make sure that the CHARGE indicator lamp is illuminated. Then, keep pressing both DISCHARGE buttons on the external paddles at the same time until the preset output energy is discharged into the patient.

NOTE

If a single defibrillation is not effective, the above procedures may be repeated for another defibrillation of increased energy level.

CAUTION

- If it is desired to clear the energy setting after charging has been completed, set the ENERGY SELECT dial to the ECG MON position. If defibrillation is not performed within 40 sec. after charge completion, stored energy will be automatically discharged internally for safety.
- When the energy has been discharged, it cannot be recharged again until the monitor displays "0J" energy.
- Synchronized cardioversion is impossble while "LEADS OFF" message is displayed on the monitor or when using the optional telemeter.
- SYNC mode is automatically turned off (ASYNC mode) when the energy is discharged. (TEC-7100/7200A only)

3-7 Defibrillation by Internal Paddles (Optional for TEC-7200 only)

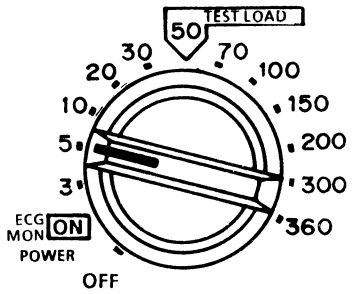
WARNING

- *Make sure that the operator and all other personnel do not come in contact with the patient's body or any metal touching the patient during defibrillation.*
- *Do not touch the paddle electrode faces after energy charging.*

WARNING

The internal paddles should always be sterilized before use.

1. Insert the connector of the internal paddles into the paddle connector of the main unit.



2. Press the AC power switch to turn on the power.
   Then select the output energy level required for defibrillation of the patient by using the ENERGY SELECT dial.

3. Press the CHARGE key to charge the required energy.

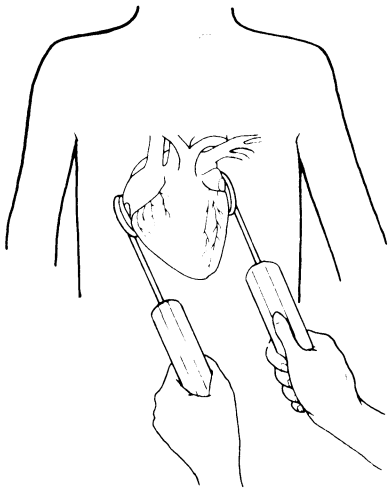
   - The energy display on the monitor flashes during charging and a continuous tone will be emitted once charging is completed.
   - To change one selected energy level to another after completion of charging, select the required level with ENERGY SELECT dial. 1 second later, the previously charged energy level starts to change to the newly selected one.

WARNING

Synchronized cardioversion mode can be selected when using internal paddles. However, because of the potential danger of noise interference, it is recommended that synchronization be carried out by using the ECG cable and electrodes.

NOTE

For safety, when using the internal paddles, the maxmum energy charge is limited to 50J automatically regardless of the energy setting.



4. Hold the paddles to the auricles of the heart.

- In order to provide better contact between the internal paddles and heart, place sterilized gauze soaked with physiological saline solution into between each internal paddle and the heart muscle.
- The polarity of the internal paddle electrodes is unimportant.

NOTE

The above paddle positioning is recommended for ease of placement. However, in the case of defibrillation using internal paddles, there are usually no practical differences due to paddle placement.

5. Make sure that the CHARGE indicator lamp is illuminated. Then press the DISCHARGE buttons on the internal paddles to discharge the preset output energy into the patient.

3-8 Auto Recording Activated by Energy Charging

When the CHARGE button is depressed with the built-in recorder set to the AUTO REC mode, the recorder will start automatically and stop approx. 15 sec (depending on the amount of annotation) after discharged.
When a discharging takes place during recording, the following characters are printed together : selected energy level, *delivered energy level, *trans-thoracic resistance, *time, *date, recording mode, and an arrow which shows the moment of discharging. (*TEC-7200 only)

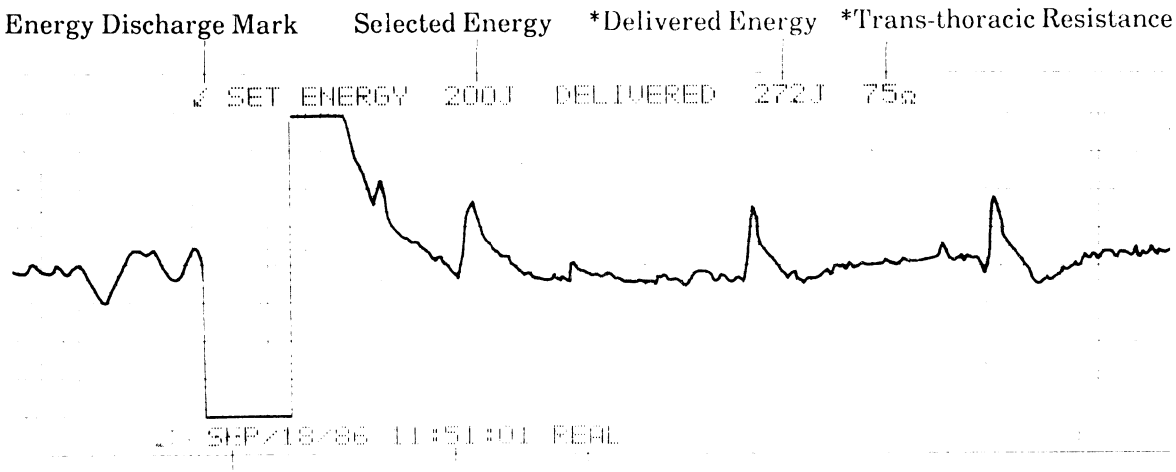
CAUTION

When using this mode, the DIP switch on the right side of the main unit should be set to the AUTO REC mode. (For the setting procedure refer to Section 7-2.)

NOTE

- If any discharge is not made even in 40 seconds after start of charging, the recording will stop automatically.
- If a width of recorded baseline is over 5 mm because of AC interference, character printing and waveform recording will be faint.
- If a discharging takes place during recording in delay mode, characters cannot be printed for 4 seconds.

[Example of Auto Recording]



3-9 Paddle Contact Resistance

Before defibrillation, it is important to reduce the contact resistance between the paddle and patient as much as possible.

For adult patients, it is recommended that each paddle be pressed with approximately 10 Kg of force. Enough care must be taken not to lean on the chest of the patient when pressing the paddles. This will cause slippage of the paddle which may create a hazard.

The Model TEC-7200 can display the contact resistance of the electrodes through the paddle contact indicator by measuring contact resistance between the patient and the paddles during paddle application.

The indicator lamp will be illuminated according to the contact resistance as follows:

Green for 0 to 100 ohms ---- Good

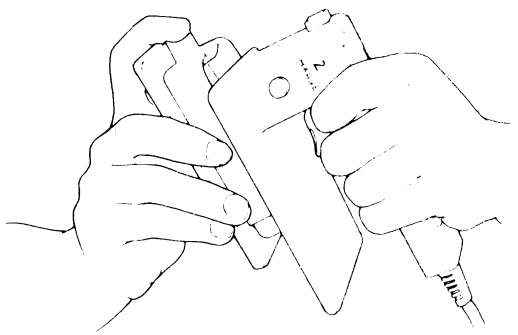
Yellow for 100 to 200 ohms

Red for over 200 ohms ------ Poor

If the green "GOOD" does not illuminate, check the amount of applied contact gel and press the paddles against the patient with force until the "GOOD" illuminates. (The indicator may not illuminate for some patients.)

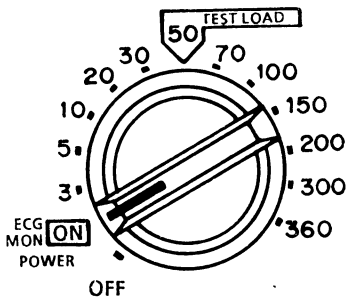
3-10 Slide-off Paddles (for pediatric case)

If it is necessary to defibrillate a pediatric patient, the adult paddle electrodes can easily be slid off to reveal pediatric paddle electrodes.



Section 4 ECG Monitoring

4-1 Set Up

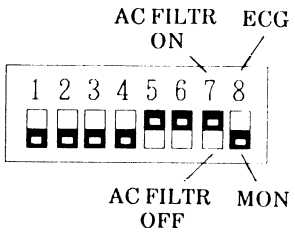


1. **Power on**

- When using AC power, press the AC POWER button on the right side of the main unit.
  Then using the ENERGY SELECT dial, select the "ECG MON ON" mode.

- When using battery, set the AC POWER button to "OFF" and use the ENERGY SELECT dial to select the "ECG MON ON" mode.
  Check the battery level with the BATTERY indicator lamps before operating.

- The self-check function starts when the power is turned on. The message "READY" appears if conditions are good.
  Make sure that "READY" is displayed on the screen before operating. If a message other than "READY" is displayed, take necessary measures by referring to Section 7-3, Troubleshooting and Messages.



2. **Mode selection**

- Set the DIP switches on the right side of the main unit to the "MON" and "AC FILTR" position.

- ▸ The time constant of the waveforms displayed on the CRT screen is set to 0.32 seconds in the "MON" mode.

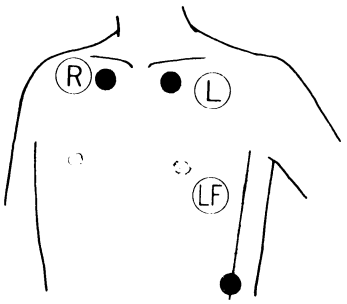
- ▸ When using a telemeter, the time constant is fixed to 0.32 second regardless of the DIP switch setting.

NOTE

If a clear and precise waveform cannot be gained because of too much AC interferences, first check the grounding. When no problem is found, turn this filter ON. In this case, a slight distortion caused by the filter is inevitable.

4-2 Electrode Setting Positions

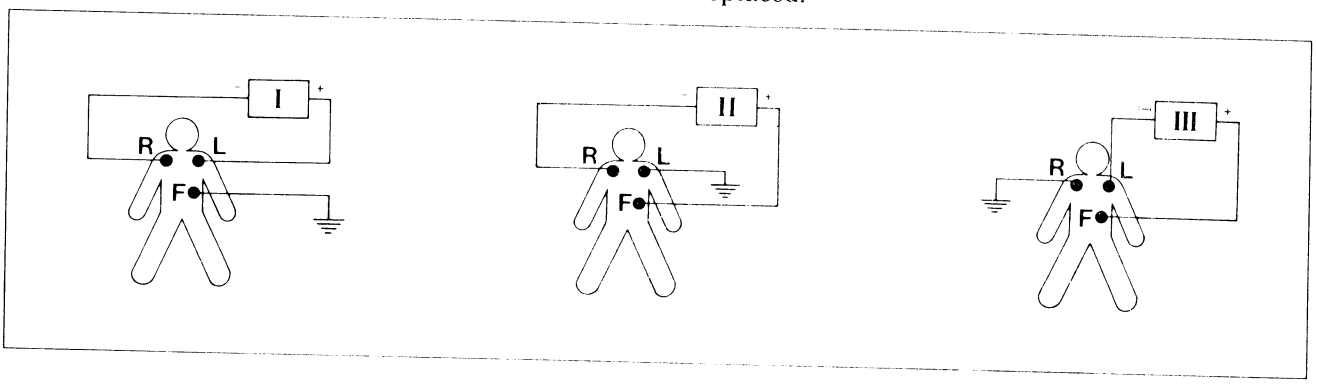
◆ Three-Electrode Lead Method



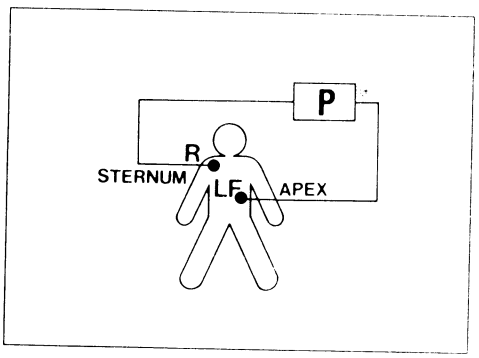
Symbol		Lead Color		Setting Position
AHA	IEC	AHA	IEC	
LL	LF	Red	Green	The lowest rib on the left anterior axillary line
LA	L	Black	Yellow	Below the right clavicle
RA	R	White	Red	Below the left clavicle

Refer to **TEC-7100 / 7200 System Component Table (Pg. 69)** as for the lead symbols and the leads color.

- If it is impossible to set electrodes on the positions shown below (for example because the patient has been subjected to a chest surgical operation), a relatively stable ECG can be obtained by setting the electrodes below on shoulder joints.
- The electrodes, when attached correctly, can be used continuously for three days. When the contact of the electrodes become poor due to sweat or body movement, the electrodes should be replaced.

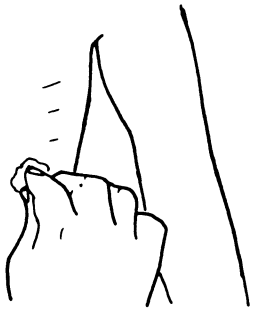


◆ Paddle Lead Method

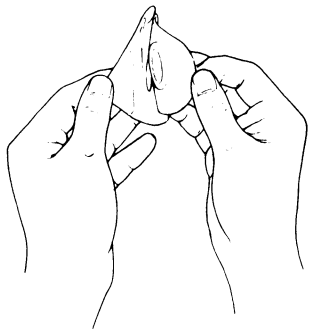


This lead is used for checking an ECG when using the paddle lead method. It is not used for usual ECG recording and monitoring.

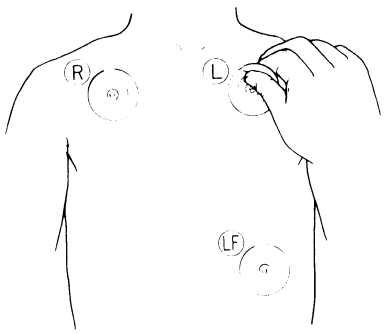
4-3 Electrode Placement



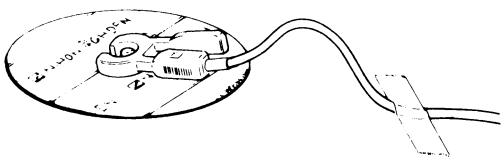
1. Clean the electrode monitoring site with absorbent cotton soaked with alcohol. Then wipe with clean dry absorbent cotton to allow the alcohol to evaporate completely.
   If the sites are pretreated by rubbing with Nihon Kohden's SKINPURE ®, a more stable waveform can be obtained.



2. While taking much care not to touch the adhesive surface of the electrodes, peel off the protective covers.



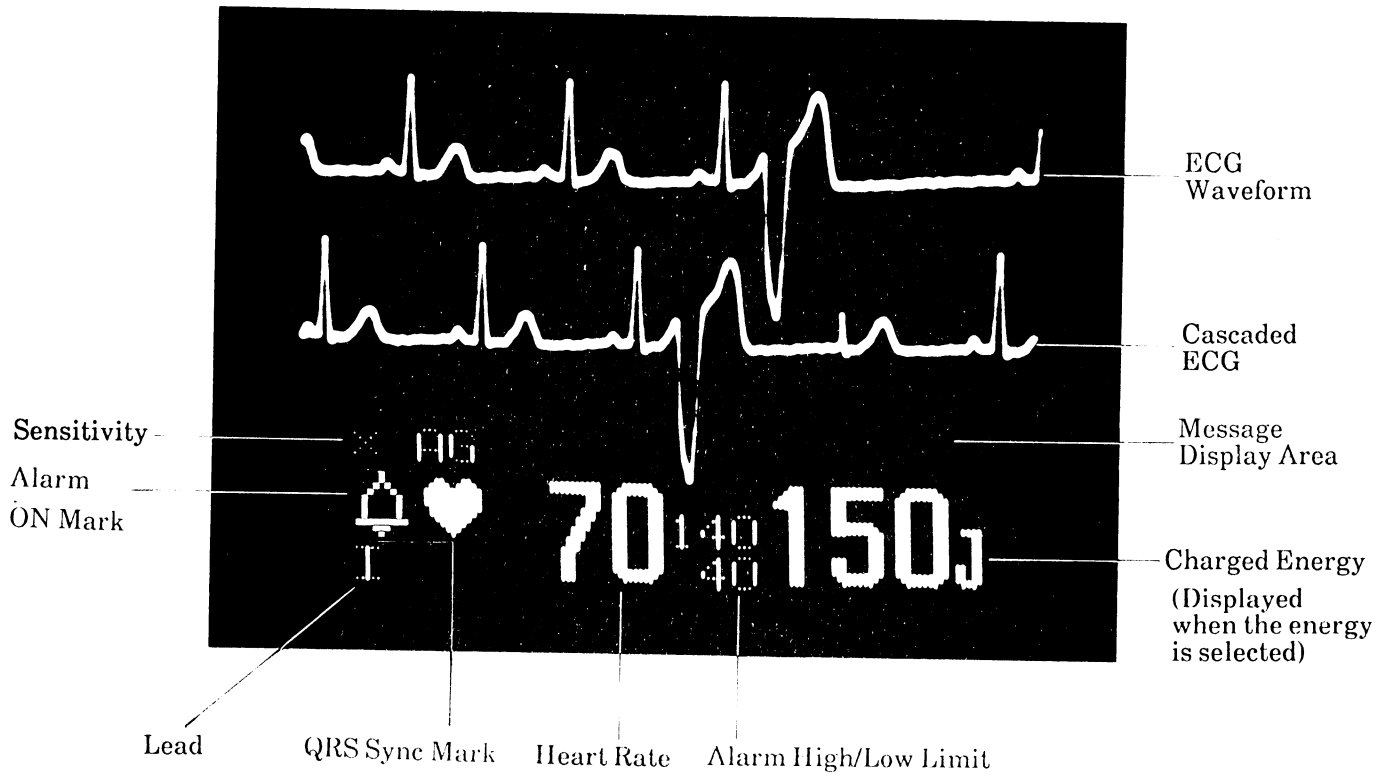
3. Place the electrodes on the corresponding sites of the patient. Do not apply them on wrinkly or uneven places.
   RA (R) ..... White (Red) lead
   LA (L) ..... Black (Yellow) lead
   LL (LF) ..... Red (Green) lead
   Refer to **TEC-7100 / 7200 System Component Table (Pg. 69)** as for the symbols and the leads color.



4. Clip the electrode lead to the raised portion at the center of the electrode.
   Check to make sure that the electrodes are not being pulled by the electrode leads.

5. Connect the electrode lead to the ECG connection cord socket. Then plug the cord into the ECG input connector.

4-4 Description of the Screen



The CRT screen displays ECG waveform, cascaded ECG waveform, sensitivity, heart rate, alarm mark (ON/OFF), alarm set values (higher and lower), charged energy, QRS synchronization mark and various user messages.
When the alarm function is set to "OFF", the alarm set values (higher and lower) will not be displayed.

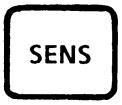
◆ Lead Selection

The lead name is displayed on the lower left corner of the screen.
Whenever the LEAD select key is pressed, the lead name display will be switched in the sequence of PADL (paddle lead) → I → II → III → TEST → PADL.

CAUTION

When monitoring an ECG through the telemeter, set the DIP switch on the right side of the main unit to the "LEAD" position (12-lead). For the sestting procedure, refer to Section 7-2.

◆ Sensitivity Selection



Whenever the SENS select key is pressed, sensitivity will change in the sequence of × AG (AUTO GAIN) × 1/2 → × 1 → × 2 → × 4 → × AG (AUTO GAIN). The selected sensitivity will be displayed to the lower left of the ECG cascade waveform.

CAUTION

Although the AUTO GAIN provides optimum sensitivity for QRS detection, if sensitivity is not stabilized due to arrhythmia, another sensitivity should be selected.

◆ On / Off Operation of the Alarm Function

When the alarm function is turned on by pressing the ALARM ON / OFF key, the alarm off mark changes to the alarm on mark and alarm set values (higher and lower) will be displayed on the CRT screen. With this mode selected, when the patient's heart rate exceeds the higher or lower limit, an alarm beep will sound and the heart rate display flashes.

When the alarm mode is turned off by pressing the ALARM ON / OFF key again, the alarm on mark changes to the alarm off mark and the alarm set values disappear from the screen and only the heart rate is displayed continuously.

When selected, the alarm mode permits automatic alarm recording. Once the DIP switch on the right side of the equipment is set to ALARM REC, this mode permits automatic recording of an ECG for approximately 15 seconds, depending on the amount of annotation.

NOTE

- Automatic alarm recording is not functional during the annotation which is performed immediately after discharge.
- Automatic alarm recording is functional, even while the high and low limits are being set.

4-5 Alarm Function Setting and Recording

With the heart rate alarm set values (higher and lower) established, an alarm beep will sound when the patients heart rate goes outside the limits.
With the DIP switch on the right side of the main unit set to the ALM REC position, when the alarm is activated, an automatic recording of the ECG for approximately 15 seconds will be made, depending on the amount of annotation.
In the alarm record mode, "ALARM" will be printed out on recording paper.

NOTE

Automatic alarm recording is performed even when the waveform has been frozen.

1. Press the ALARM ON / OFF key to turn the alarm on.
   This will cause the alarm OFF mark to be changed the alarm on mark, and the alarm higher and lower limits to be displayed on the right of the heart rate display. (When the power is turned on, the initial higher and lower limits are continuously set respectively to 140 and 40.)

2. Press the HI / LO LIMITS alarm set key. This will cause the lower alarm limit to flash.
   Set the desired lower limit by pressing the ↑ and ↓ key, then pressing the HI/LO LIMITS alarm set key. (the lower limit changes in increments of 5 up to 100 and in increments of 10 over 100.)

Increase

Decrease

NOTE

The alarm HI / LO LIMITS are set to the selected value at the moment the HI / LO LIMITS key is pressed.

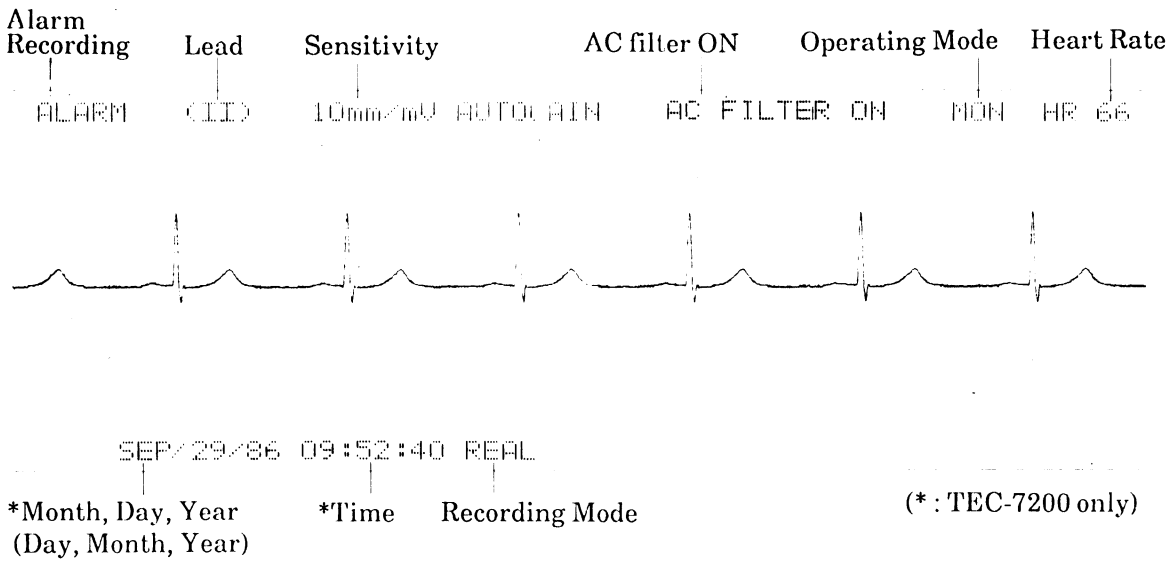
HI/LO LIMITS

3. Once the lower limit is established, the higher limit will flash. Set the desired higher limit in the same manner as for the lower limit. When the alarm high limit setting is finished, the value displayed on the screen stops flashing.

NOTE

CAL function is not available when setting alarm high / low limit.

[Example of Alarm Recording]



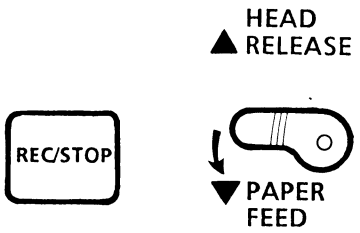
4-6 Manual Recording

◆ Manual Recording

To select manual recording, proceed as follows:

1. Press the REC / STOP key to start recording.

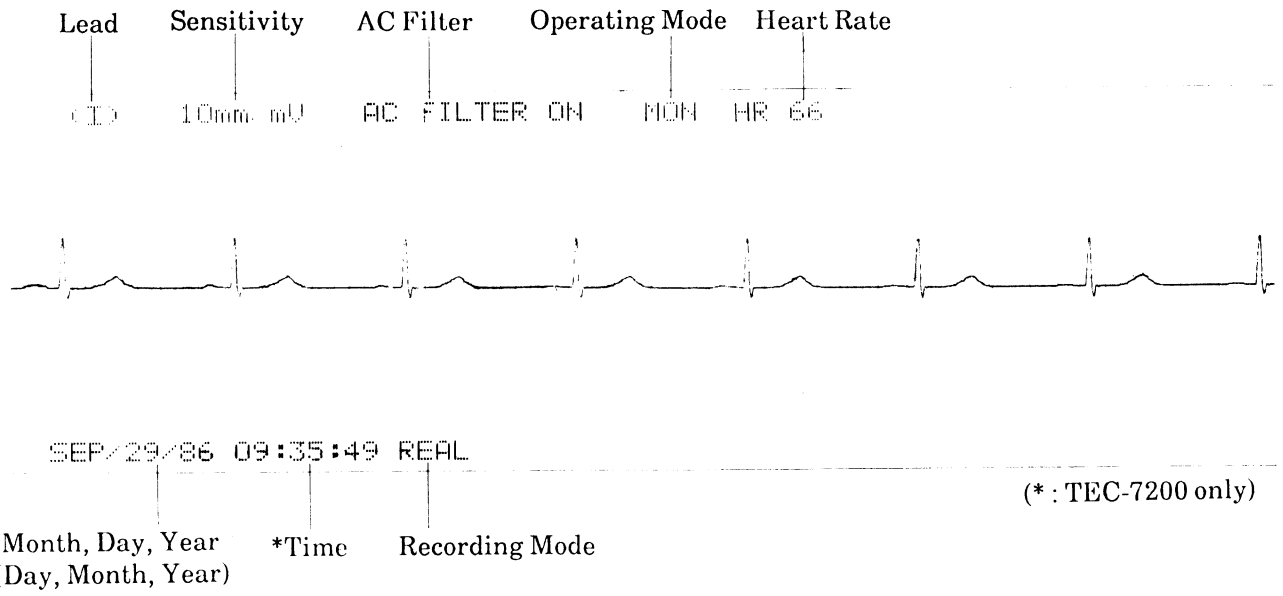
2. Pressing the REC / STOP key again will cause the recording to stop. Push the HEAD RELEASE / PAPER FEED lever down to the PAPER FEED (▼) position until the end of the recording can be seen.



NOTE

- Two recording modes are selectable by the DIP switch on the right side of the main unit. Select REC REAL for real time ECG recording and DELAY for delayed ECG recording. Refer to Section 7-2 for DIP switch setting instructions.
- "REAL" or "DELAY" are printed on the bottom margin of the recording paper during the corresponding mode.

[Example of Manual Recording]



◆ Freeze Recording

The freeze recording function allows a static waveform on the screen to be recorded.

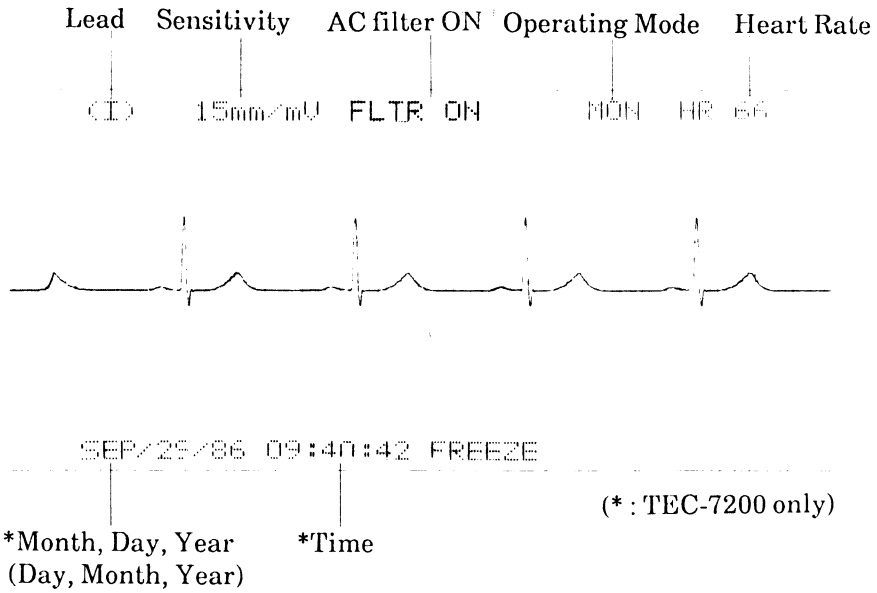
1. Press the FREEZE key to freeze the cascade waveform on the screen.

2. Press the REC / STOP key to start recording. The recording will continue for approximately 4 seconds, then the paper will automatically feed and stop.

NOTE

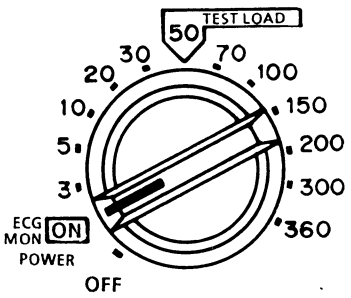
- In the freeze recording mode, "FREEZE" will be printed out on the recording paper.
- Repeated freeze recordings are possible.
- When the REC / STOP key is pressed again, the freeze recording stops even if it is incomplete.

[Example of Freeze Recording]



Section 5 Diagnostic ECG Measurement

5-1 Set Up

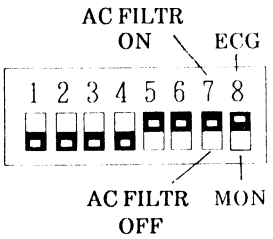


1. **Power on**

- When using AC power, press the AC POWER button on the right side of the main unit.
  Then using the ENERGY SELECT dial, select the "ECG MON ON" mode.

- When using battery, set the AC POWER button to "OFF" and use the ENERGY SELECT dial to select the "ECG MON ON" mode.
  Check the battery level with the BATTERY level indicator lamps before operating.

- The self-check function starts when the power is turned on. The message "READY" appears if conditions are good.
  Make sure that "READY" is displayed on the screen before operating. If a message other than "READY" is displayed, take necessary measures by referring to Section 7-3, Troubleshooting and Messages.



2. **Mode Selection**

- Set the DIP switch on right side of the main unit to the ECG position.

  ▸ The time constant of waveform displayed on the CRT screen is set to 3.2 seconds in "ECG" mode.

  ▸ When using a telemeter, the time constant is fixed to 0.32 seconds regardless of the DIP switch setting.

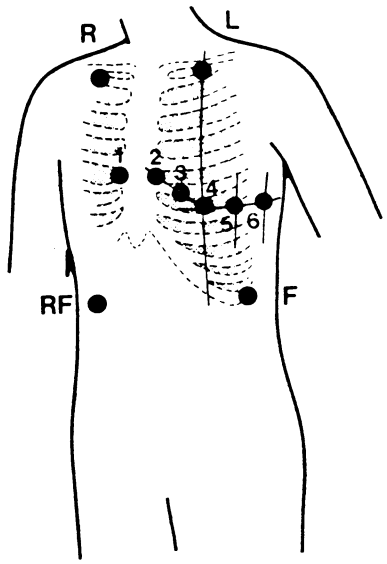
NOTE

If a clear and precise waveform cannot be gained because of too much AC interferences, first check the grounding. When no problem is found, turn the AC filter ON. In this case, a slight distortion caused by the filter is inevitable.

5-2 Electrode Setting Positions

The defibrillator can be used for recording an ECG with the 5-electrode (12-lead) system by using optional patient cables (see Section 11).
Change the chest electrode from V_1 to V_6 to record each chest lead.
Before using this function, set the DIP switch on the right side of the main unit to the "LEAD" (12-lead) position.

◆ Electrode Positions



For the electrode setting procedure, refer to Section 4-3.

Symbol		Lead Color		Setting Position
AHA	IEC	AHA	IEC	
RA	R	White	Red	Below the right clavicle
LA	L	Black	Yellow	Below the left clavicle
LL	F	Red	Green	Around 12 to 15 mm above the iliac bone on the left clavicle center line, or around 12 to 15 mm above the iliac bone on the left edge of the spine.
RL	N	Green	Black	On the right clavicle center line at the same level with for F (LL)
C	C	Brown	White	Any one of chest electrode positions (V_1 to V_6)

Refer to **TEC-7100 / 7200 System Component Table (Pg. 69)** as for the lead symbols and the leads color.

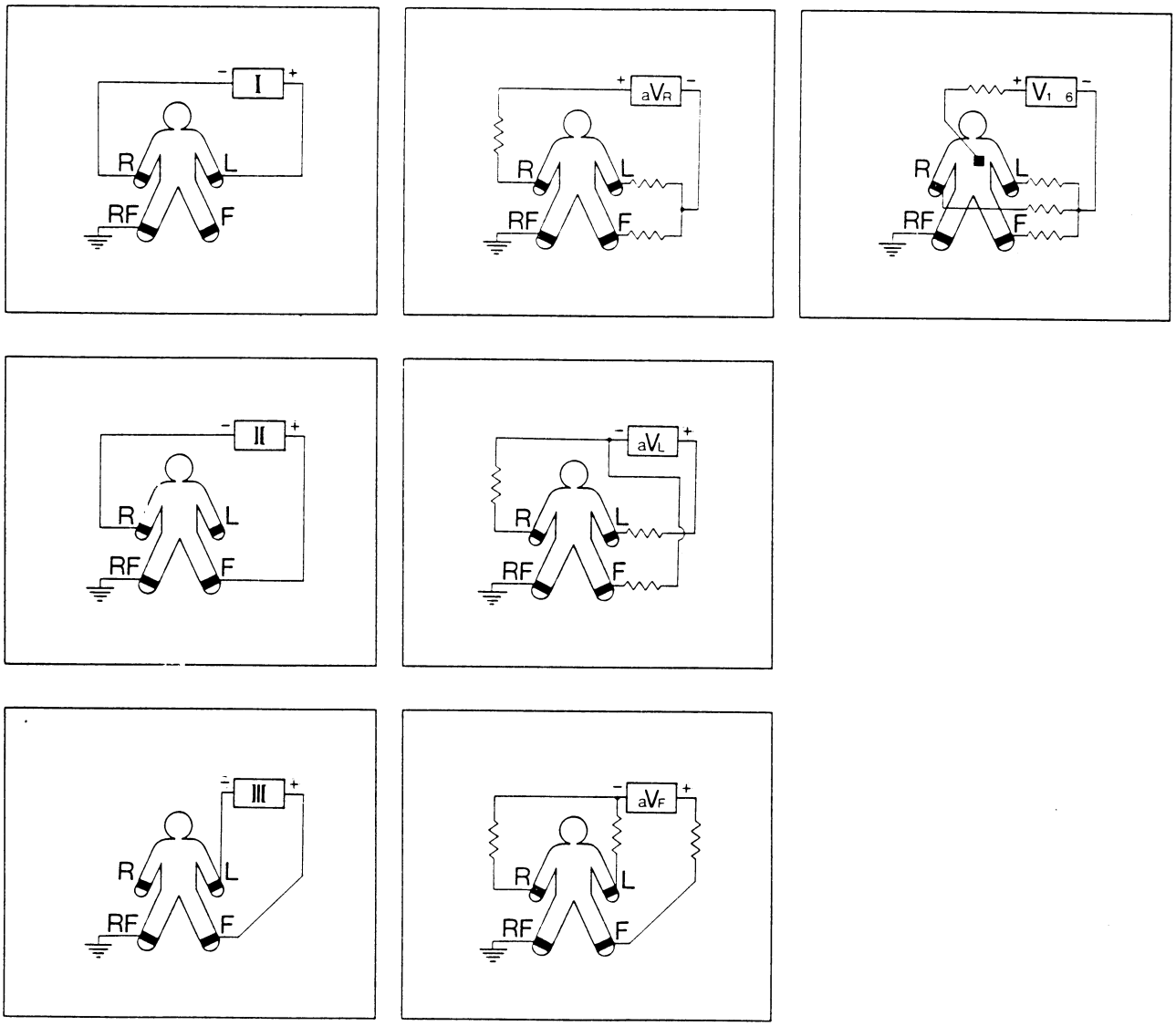
Electrode Positions on the Chest

V_1 : Fourth intercostal space at the right border of sternum
V_2 : Fourth intercostal space at the left border of sternum
V_3 : Halfway between V_2 and V_4
V_4 : Fifth intercostal space on left midclavicular line
V_5 : Left anterior axillary line at the horizontal level of V_4
V_6 : Left mid-axillary line at the horizontal level of V_4

◆ Connection of Leads

The relationship between the electrode positions and leads is shown below.

Bipolar Limb leads	Unipolar Augmented Limb Leads	Unipolar Chest Leads



5-3 ECG Recording

◆ Lead Selection

Whenever the LEAD select key on the front of the equipment is pressed, the lead will be switched in the sequence of PADL → I → II → III → aV_R → aV_L → aV_F → V → AUX → TELE → TEST → PADL, etc.
The defibrillator permits standard 12-lead recording to be performed.
Since TELE is used for ECG monitoring through the telemeter and AUX for external ECG monitoring, these leads are not used for ECG diagnosis.

- The "TELE" message is not displayed on the screen when the optional receiver is not connected.

◆ Check before Recording

1. Using the LEAD select key, switch the lead from I to V and check to ensure that the message "LEADS OFF" is not displayed on the monitor screen.
   If "LEADS OFF" is displayed, check the application of the electrodes and take corrective action.

2. Press the REC / STOP key to start recording.
   Using the LEAD select key, select the TEST lead and then press the CAL key to record a 1mV calibration waveform.
- Check that the amplitude is 10 mm at a sensitivity of 1.

◆ Recording

1. Press the LEAD select key and select the lead I.

2. Press the REC / STOP key and make a recording of the desired length.

3. Press the CAL key to record a 1mV waveform at the end of the lead.

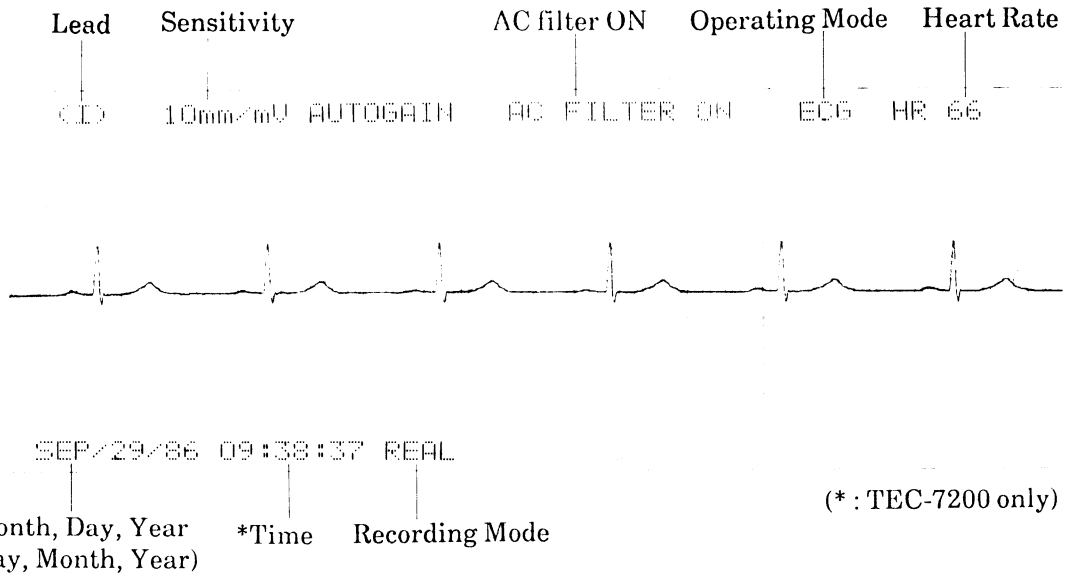
REC/STOP

4. Press the REC / STOP key to stop the recording, then press the LEAD select key and select lead II. Repeat the steps 1 through 3 to record waveforms for all the leads.

NOTE

- Two recording modes are selectable by the DIP switch on the right side of the main unit. Select REC REAL for real time ECG recording and DELAY for delayed ECG record-ing. Refer to Section 7-2 for DIP switch setting instructions.
- "REAL" or "DELAY" are printed on the bottom margin of the recording paper during the corresponding mode.

[Example of Recording]



Section 6 Power Supply

6-1 Switching between Battery and AC Operation

When the AC POWER button is in the "OFF" (⏏) position or the power cord is not plugged into an AC outlet, setting the ENERGY SELECT dial to the "ECG MON ON" position or the desired output energy level will allow the equipment to automatically operate with the built-in battery.

The battery level indicator on the front of the equipment shows the remaining battery level.

Plugging the attached power cord into an AC outlet and setting the AC POWER button to "ON" (⎓) will set the equipment to AC power operation. The AC POWER button should be set to ON at all times.

NOTE

If the operation switches from AC power to battery power due to disconnection of the power cord from the AC outlet during energy charging, all the charged energy before will be cleared. In this case, press the CHARGE key again to recharge the energy.

6-2 Battery Level Indication

The provided battery supplies more than 30 discharges with a discharge energy of 360 J, or more than 1 hour of continuous monitoring.
The battery level indicator on the front of the equipment shows the remaining battery level.

Battery Level Indicator	Monitoring time available	Discharge.times (at 360J) available
All lamps illuminated.	30 min ~ 1 hour	15 ~ 30 times
Two lamps illuminated.	5 ~ 30 min	3 ~ 15 times
Orange lamp only illuminated. (Be sure to charge the battery immediately.)	<5 min	<3 times
Orange lamp flashing. (Be sure to switch to AC operation.)	No operation	No operation

NOTE

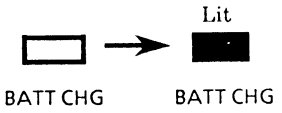
The above data refers to the battery condition assuming that the battery started out fully charged, and the cautions written in Section 6-5 have been followed.

CAUTION

When the battery level drops below a certain level, a "LOW BATTERY" message appears. As the level gets extremely low, only the orange lamp will flash, and an alarm beep sounds. At this time, the power of the instrument will automatically turn off. Charge the battery immediately according to the procedure in Section 6-3.

6-3 Charging

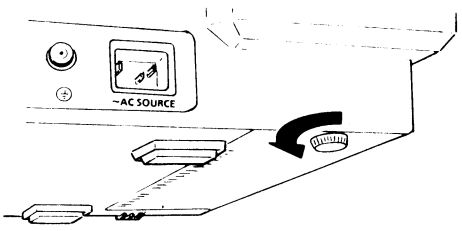
The battery should be charged after each use.



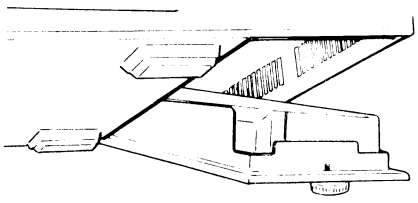
- **How to Charge the Battery**
  Plug the power cord into an AC outlet and press the AC POWER button (⎓). The CHARGE indicator lamp will light and the battery will be charged.

- **Display During Battery Charging**
  The battery charge lamp (BATT CHG) is lit to indicate that the battery is "being charged." The battery will be charged to the 80% level in 2 hours (fully charged in 15 hours).
  If the battery is charged fully and then gives an inadequate operating time, it is assumed that the battery service life is over. Replace it with a new one. When purchasing the battery, consult our distributor.

6-4 How to Replace the Battery



1. Loosen the screws on the battery housing on the bottom of the equipment, and open the battery compartment.



2. Replace the battery with a new one, close the battery compartment and tighten screws.

6-5 Battery (LCT-1912NK) Information

◆ Cautions for discharge

(1) Discharge should be carried out at ambient temperature of 0 to + 40°C.

(2) The minimum discharge voltage is determined by the level of discharge current.

Discharge Current	Minimum Discharge Voltage
0.95 ~ 1.90 A (During monitoring)	9.30 V

(3) Charge the battery immediately after use.

◆ Inspection

(1) Periodically inspect the battery to keep it in faultless condition.

(2) Visually inspect the appearance of the battery and see if there is any damage such as cracks, deformations or any electrolyte leakage on the terminals. If necessary, replace the battery at once. If the battery is dirty it should be cleaned.

◆ Maintenance

(1) Store the spare battery in a dry cool place.

(2) It is recommended that the spare battery in storage be charged at least once a month.

(3) Avoid storing a discharged battery because it will shorten the battery life.

◆ Others

(1) Clean the battery with a clean cloth.
Avoid organic solvents such as gasoline and thinner or oils and do not wipe the battery with cloth containing these materials.

(2) The battery may produce inflammable gases. Therefore, keep it away from fire and never short it.

(3) Do not open the battery. If sulphuric acid comes in contact with skin or clothes due to damage to the battery, immediately wash well with water. Should it come into the eyes, immediately bathe the eyes with clean water and then have them treated by a doctor.

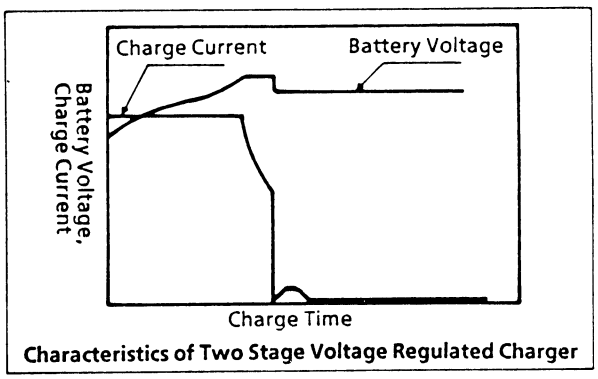
(4) Never discard the battery into a fire. This can cause it to explode, and may result in serious injury.

<Reference>

◆Charging System

The equipment employs a two-stage voltage control charging system.

In this charging system, the regulated voltage of the charger is controlled in two stages. In the initial stage, a maximum charging current is supplied to the battery. When the battery voltage reaches a certain level, the voltage is regulated and the charging current is reduced. In the second stage, the regulated voltage is decreased and a small current is supplied to protect the battery voltage from self-discharge without shortening the battery life.



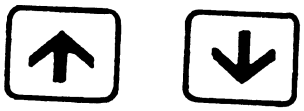
Characteristics of Two Stage Voltage Regulated Charger

Section 7 Miscellaneous Settings and Maintenance

7-1 Setting of Date and Time (TEC-7200 only)

Month Day Year Hour Minute
SEP / 16 / 86 12 : 00

1. Simultaneously press both the HI / LO LIMITS key and the CAL key to display the date on the CRT screen.
   Then the month* (day)* comes flashing.
   * Refer to **TEC-7100 / 7200 System Component Table (Pg. 69)** as for the date display.



Month Day Year Hour Minute
NOV / 1 6 / 86 12 : 00

2. Press the ↑ or ↓ key to select a new month* (day)*, then press the ALARM ON / OFF key.
   The month* (day)* is set with the day* (month)* flashing.
   * Refer to **TEC-7100 / 7200 System Component Table (Pg. 69)** as for the date display.

3. Set date and time one by one in the same manner. When the minute setting is completed, the clock display will disappear. Now the date and time are set.
   At this time, the second is set to 00.

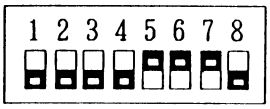
   ▸ If you make a mistake in the time setting, repeat the above procedure from step 1.

CAUTION

- The alarm HI / LO LIMITS cannot be set while the time is being set.
- The CAL function is not possible during time setting.

7-2 Setting of the DIP Switch

The DIP switch allows the operator to set the equipment to any of the modes shown below. Remove the cover marked with ⚠ to set the switches.



Factory Setting

- **Panel Display**

No.	↑	↓
1	PDL SYNC	OFF
2	REC REAL	DELAY
3	LEAD	P I II III
4	PPR SENS	HIGH
5	AUTO REC	OFF
6	ALM REC	OFF
7	AC FLTR	OFF
8	ECG	MON

1. **PDL SYNC (Paddle synchronization)**
   PDL SYNC : Synchronized cardioversion using the paddle leads.
   OFF : Synchronized cardioversion is impossible using the paddle leads.

2. **REC REAL / DELAY (Real-time / Delay Recording)**
   REC REAL : Real-time ECG recording
   DELAY : Delayed ECG recording (4secs)
   - In these modes, REAL or DELAY will be printed out during recording.

3. **LEAD / P I II III**
   LEAD : 5-electrode (12-lead) method
   P I II III : 3-electrode method
   - When monitoring an ECG waveform through the telemeter or an external ECG waveform, select the "LEAD" position.

4. **PPR SENS (Paper Sensitivity)**
   PPR SENS : When using the paper other than the recommended (standard sensitivity) paper
   HIGH : When using the recommended (high sensitivity) paper.

CAUTION

- Use the specified recording paper (high sensitivity) exclusively made for a thermal array recorder to obtain clear recording.

5. AUTO REC (Auto Recording)

AUTO REC : Auto recording after discharge.

- This mode provides a record from the start of charging to approx. 15 seconds after end of discharge, depending on the amount of annotation. If discharge is not performed in approximately 40 seconds from the start of charging, the recording will automatically stop.

OFF : Auto recording can not be executed.

6. ALM REC (Alarm Recording)

ALM REC : Auto recording when a heart rate alarm occurs.

- This mode provides a record for approx. 15 seconds until annotation printing is completed.

OFF : Auto recording by heart rate alarm can no t be executed.

7. AC FLTR (AC Filter)

AC FLTR : AC interference noise is eliminated. Note that in this mode, the ECG waveform will be distorted.

OFF : Used in ECG diagnosis.

8. ECG / MON (ECG / Monitor)

ECG : A time constant of 3.2 sec for diagnosis

MON : A time constant of 0.32 sec for monitoring

- When the equipment is used as a defibrillator (when an energy level is selected) or when the PADL or TELE lead is selected, the time constant will be automatically set to 0.32 sec independent of the switch setting. The selected mode will be printed out on the recording paper.
  In the AUX lead mode, the mode will not be printed out.

7-3 Troubleshooting and Messages

Message	Cause and Corrective Action
LEADS OFF	(Cause) Electrode(s) detached. (Action) Check the electrode placement. • While this message is displayed, the input waveform cannot be displayed on the screen, and CAL function is not possible.
LOW BATTERY	(Cause) Battery low. (Action) Charge battery at once according to the procedure in Section 6-3.
CONNECT PADDLES (TEC-7200 only)	(Cause) Paddles are not connected. (Action) Insure paddles are correctly attached to the connector.
PAPER EMPTY	(Cause) Recording paper is all consumed or the thermal head is set to HEAD RELEASE, even though recording paper remains. (Action) Replace recording paper according to procedure of Section 2-2 or set HEAD RELEASE / PAPER FEED lever back to the neutral position. • This message can also be displayed when the recording paper is running off center. • This message is not displayed when the recording paper is used up during paper feeding.
READY	The equipment functions are normal.
SYNC ON	SYNC mode is selected.
NG (TEST AT 50 J)	(Cause) Discharge test was made with energy other than 50 J. (Action) Discharge test should be made with energy of 50 J. If this message is displayed when the discharge test is performed at 50 J, contact our service personnel.
TEST OK	The 50 J discharge test is normal.
USE ECG CABLE	(Cause) With either PADL or TELE lead selected, the SYNC mode was chosen. (Action) Select other leads or select the PDL SYNC mode using the DIP switch on the right side of the main unit. This message will be displayed for approx. 7 sec. even when PDL SYNC is selected. Synchronized cardioversion by paddle leads is possible even though this message appears.

Message	Cause and Corrective Action
ERROR 1 ~ 4	(Cause) The equipment is faulty. (Action) Contact our service personnel. ● "ERROR 4" message is displayed when turning the power on immediately after turning the power off during energy charging. In this case, turn the power on again.
LEADS OFF (XMTR)*	(Cause) Transmitter electrode(s) detached. (Action) Check the electrode placement.
LOW XMTR BATT*	(Cause) Transmitter battery exhausted. (Action) Replace the battery with a new one. For the replacement procedure, see the transmitter manual.
NURSE CALL*	(Cause) The patient is calling. (Action) Go to the patient immediately.
SIGNAL LOSS*	(Cause) Normal signal reception not obtained. This message is displayed when the transmitter battery is exhausted, the antenna is attached in a wrong way or the radio signal is too weak because the transmitter is too far from the receiver. (Action) Check to make sure that the battery is not used up, the transmitter lead antenna is connected, and the transmitter is not far from the receiver. There should be no visible obstacles between the transmitter and receiver.

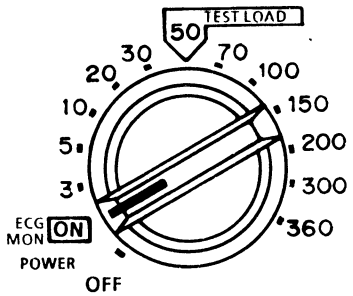
* marked message will be displayed only when optional receiver is connected to the equipment.

7-4 Equipment Inspection

WARNING

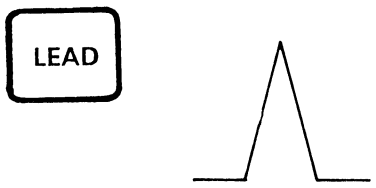
Do not use contact gel when performing the discharge test.

Perform a discharge test at monthly intervals to ensure the normal operation of the equipment.

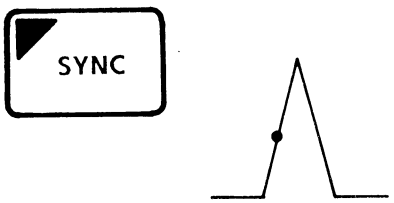


1. Set the ENERGY SELECT dial to "ECG MON ON" position, and the self-diagnostic function will be activated. Make sure that the "READY" message appears on the CRT screen. If any message other than "READY" appears, see Section 7-3.

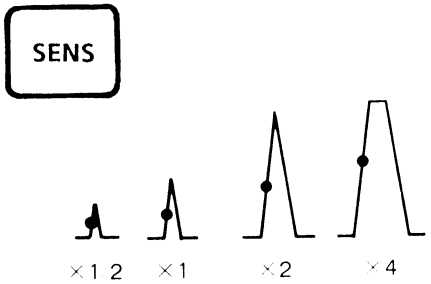
2. Using the LEAD select key, select the TEST mode.

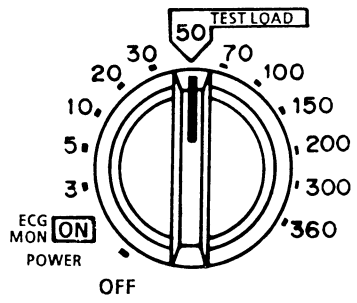


3 Press the SYNC MODE select key, the SYNC mode indicator lamp will be illuminated. Observe that spots, which indicate the synchronization positions, appear at the rising portions of the ECG simulated waveforms (equivalent to Q-R of an ECG), and verify that a sound synchronized with the waveform is emitted.



4. Press the SENS select key and confirm that amplitude of the waveform changes in the sequence x1 / 2 → x1 → x2 → x4 → xAG → x1 / 2.

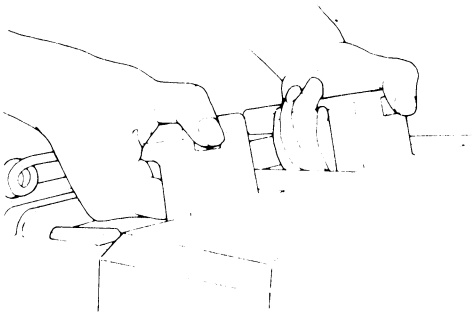




5. Using the ENERGY SELECT dial, set to 50J (for the discharge test). The defibrillator will be charged to 50J.

   - The CHARGE indicator lamps on both the monitor and the paddle flash during charging then are lit continuously when charging is complete. A continuous tone is also emitted when charging is complete.

   - Note that when the charge energy is set to a value other than 50J, the "NG (TEST AT 50J)" message will appear on the screen when the energy discharge is executed.



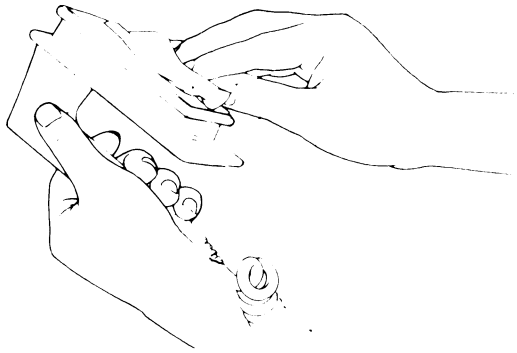
6. While the external paddles are placed into the paddle housing, slightly press the paddles on the discharge test electrodes, then simultaneously press both the right and left discharge buttons on the paddles to discharge the energy.

7. Check that the defibrillator discharge energy is synchronized with the QRS waveform and the "TEST OK" message displayed on the CRT screen.

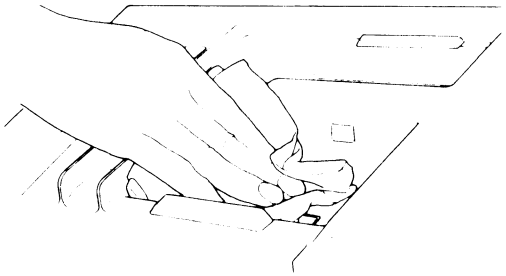
8. If the AUTO REC mode has been selected, check that the waveform is automatically recorded from the start of charging to approximately 15 seconds after discharging until annotation printing is completed.

7-5 Handling the Paddles

◆ Cleaning of the Paddles

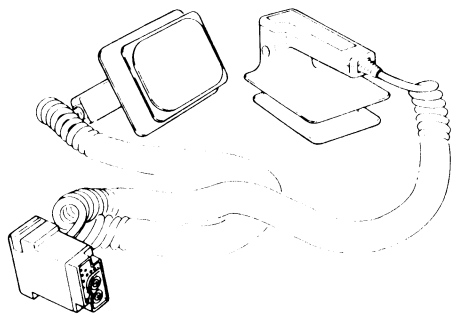


1. Remove contact gel completely from the paddle electrode faces.



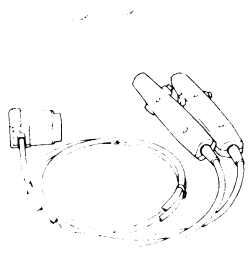
2. Remove dirt completely from inside the paddle housing with a clean cloth.

◆ Disinfection and Sterilization of the Paddles



1. The external paddles should not be exposed to heat over 60 °C nor be dipped into water or other liquids. Sterilization methods (such as autoclave) in which the external paddles are exposed to high temperatures or those using antiseptic solutions cannot be used. Ethylene oxide gas is most suitable for sterilization of the external paddles.

No Autoclave
Ethlene Oxide Gas



2. The internal paddles are heat-resistant and can be autoclaved. Note that since the internal paddle cords use a silicon material, trichloroethylene, carbon tetrachloride, gasoline, benzine, kerosene and toluene should not be used for cleaning.

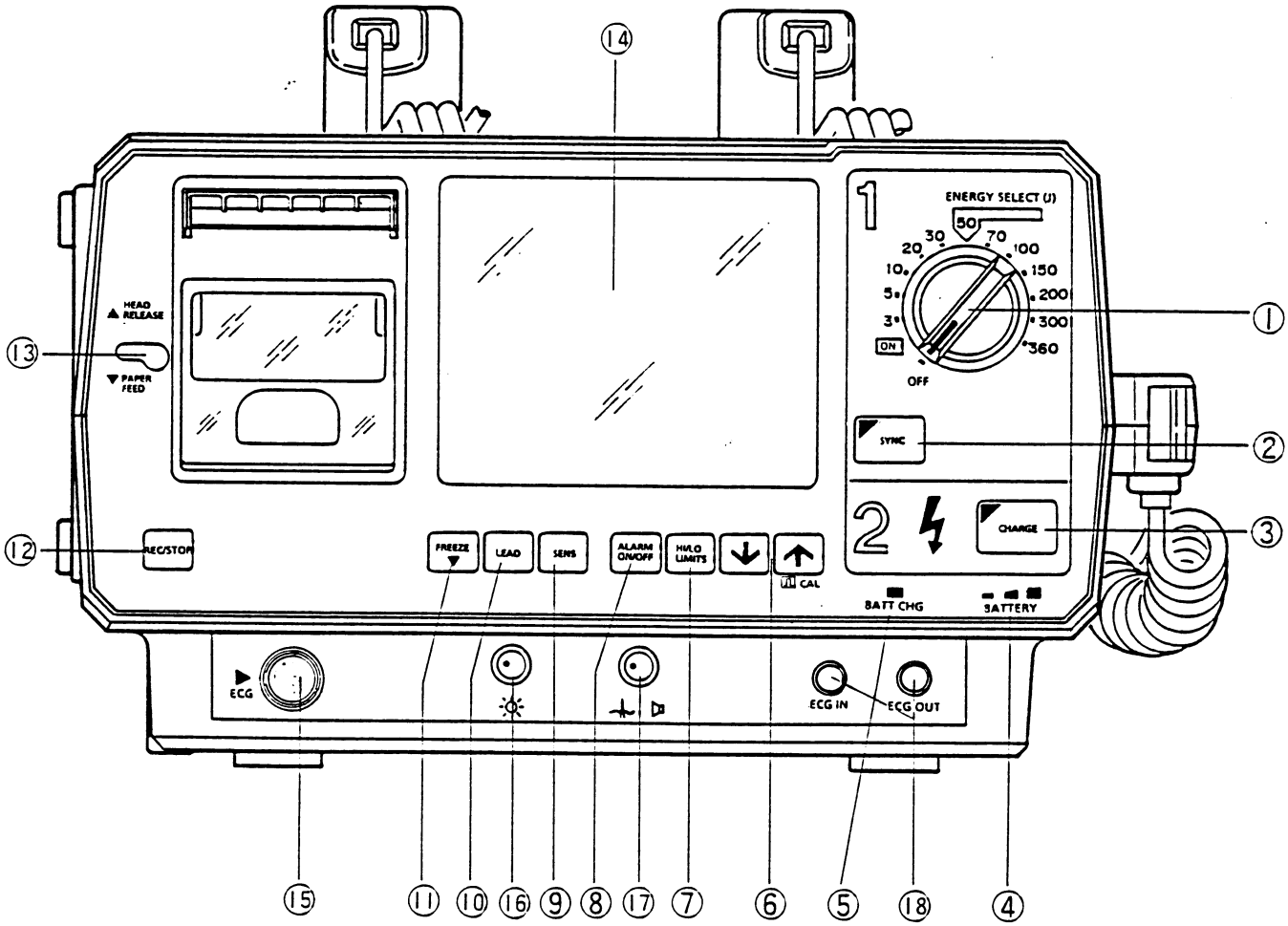
Autoclave
Ethlene Oxide Gas

Section 8 General Name and Function Explanation

8-1 Front Panel

Name	Functional Description
1. ENERGY SELECT (J) Output energy selection dial	Used to turn the instrument's power on and set the energy level. Set to the "ECG MON ON" position when using the equipment as a monitor. Set to a suitable energy level of energy between 3 and 360J when using the equipment as a defibrillator. Set to 50J when testing the discharge energy level of the defibrillator.
2. SYNC Synchronization mode select key	When the power is turned on, the defibrillating system will be automatically set to the asynchronization mode with the mode lamp not lit. When pressed, the system is set to synchronization mode, with the lamp lit.
3. CHARGE Energy charge key	Used for charging to the required level. Both energy display on monitor and charge lamp flash during charging, once the charging is completed a continuous beep will sound, with the lamp illuminated.
4. BATTERY Battery level indicator lamps	Indicates the battery level. When only the orange lamp is lit, the battery must be charged. ■ ■ ■ : All lamps are illuminated when the battery level is adequate. ■ ■ □ : Lamp on the right end is extinguished when the level is reduced. ■ □ □ : Orange lamp only illuminated. Charge the battery immediately. ■ □ □ : Orange lamp is flashing. Switch AC power operation.
5. BATT CHG Battery charge indicator lamp	Battery charge indicator lamp. When lit, indicates that the battery is "being charged."
6. ↑, ↓ /CAL High/low alarm limits set/calibration key	Used to set the high and low limits of the heart rate and to set the clock. The ↑ key causes a 1mV calibration waveform to appear on the monitor and to be recorded on recording paper.
7. HI / LO LIMITS High / low select key	Used to change the alarm setting. The initial alarm setting range of heart rate is automatically set to 140/40 when the power is turned on. When pressed, causes the alarm setting value to flash. Using the ↑, ↓ /CAL key, set the desired alarm limits (higher and lower).

FRONT PANEL


ENERGY SELECT (J)
50
30
70
20
100
10
150
5
200
3
300
360
ON
OFF
SYNC
CHARGE
HEAD RELEASE
PAPER FEED
REC/STOP
FREEZE
LEAD
SENS
ALARM ON/OFF
HI/LO LIMITS
CAL
BATT CHG
BATTERY
ECG
ECG IN
ECG OUT
1
2
14
13
12
15
11
10
16
9
8
17
7
6
5
18
4

8-2 Right Side Panel

Name	Functional Description
19. AC POWER (BATT CHARGE) AC power (battery charge) button	When pressed, supplies AC power to the equipment. Also, charges the battery during operation with AC power.
20. FUSE Fuse holder	Fuse holder in which 4A (100 ~127 V) or 2A (220 ~ 240 V) time lag fuse is placed. The fuse should be replaced only by an electrical engineer. To replace it, unscrew the holder, remove the fuse and replace it with a new one.
21. GND Ground terminal	Use the attached ground lead to ensure grounding.
22. AC SOURCE AC source inlet	AC source inlet for power cord.
23. TELEMETER ECG OUT	Connected to the optional transmitter to transmit an ECG signal to external equipment (This output is not provided for TEC-7100/7200B, F).
24. DIP switch	Switches allow modes to be selected. Remove the cover marked with ⚠ to set the switches. (For detailed information, refer to Section 7-2.)

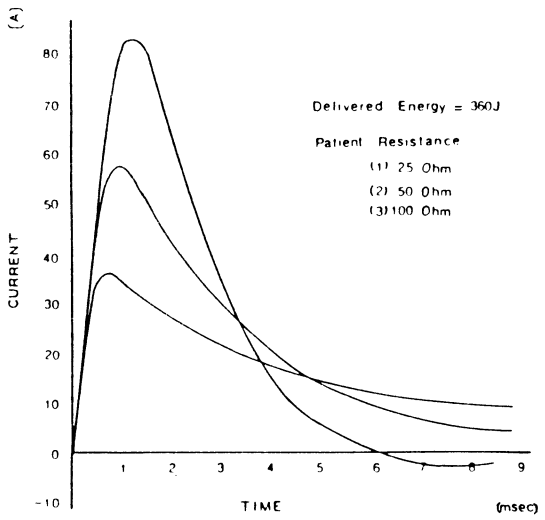
8-3 Top Panel

Name	Functional Description
25. External Paddles	External paddles can be changed to pediatric paddles by sliding off and removing the paddle electrodes.
26. CHARGE Energy charge button	The required amount of energy can be charged by pressing this button in place of pressing the CHARGE key on the main unit.
27. Paddle contact indicator (TEC-7200 only)	Indicates contact resistance when the paddles are applied to a patient. "GOOD"  (green) for 0 to 100 Ω  (yellow) for 100 to 200 Ω "POOR"  (red) for over 200 Ω For best results, discharge the energy while the green lamp is lit.
28. DISCHARGE Discharge buttons	When both buttons are pressed, the preset energy is delivered to a patient.
29. Paddle Connector (TEC-7200 only)	Connects and disconnects the interchangeable paddles to and from the main unit. If the paddles are disconnected from the main unit, energy charging is not possible.
30. Paddle Housing	Housing for the external paddles. Ensure that the paddles are put into this housing when not in use, and during the test mode.

Section 9 Specifications

Defibrillator section

Output energy	3, 5, 10, 20, 30, 50, 70, 100, 150, 200, 300, 360J
Energy limit	50J max for the internal paddles
Charging time	≤ 10sec (AC power supply) ≤ 12sec (Fully charged new battery)
Synchronization trigger	I, II, III, aVR, aVL, aVF, V, TEST, external ECG PADL (Paddle) is available according to the DIP switch setting.
Discharge test	"TEST OK" is displayed on the CRT when energy of 50J is normally discharged to test load. If energy of other than 50J is discharged to test load, "NG (TEST AT 50J)" is displayed.
Charge status indication	Indicator on the main unit and paddle During charging : Blinks After charging is completed : Lit Energy display on the CRT During charging : Blinks After charging is completed : Lit Charge complete sound is emitted after charged.
Discharge timing	≤ 30msec after discharge buttons are pressed (async mode) or after a synchronized point (sync mode).
Automatic internal discharge	Stored energy is internally discharged in the following cases : 40sec (±5sec) after charging starts. Power is turned off. Energy selector is set to MON. 300msec after energy discharge. When the power source is changed from AC to battery during energy charging. Paddles are disconnected from the main unit (TEC-7200).
Automatic synchroniozation reset	Sync mode is automatically turned off (async mode) when the energy is discharged. (TEC-7100/7200A only)
Paddle contact (TEC-7200 only)	Paddle contact impedance is indicated by three colored LEDs. Green : 0~100Ω Yellow : 100~200Ω Red : ≧200Ω
Trans-thoracic resistance (TEC-7200 only)	Patient's trans-thoracic resistance is printed when energy is discharged.



ECG amplifier section

Gain	×1/2, ×1, ×2, × 4, AG (Auto Gain)
Frequency response	0.5 ~100Hz (through ECG electrodes, MON mode)
	0.05 ~100Hz (through ECG electrodes, ECG mode)
	0.5 ~30Hz (through paddles)
CMRR	≥ 100dB
Input impedance	≥ 5MΩ (10Hz, through ECG electrodes)
	≥ 100KΩ (10Hz, through paddles)
Patient leakage current	≤ 10μA
Internal noise	≤ 35μVp-p (referred to input)
Leads off	Detected by electrode detachment
AC filter	Provided
External input	1 DIV/V on CRT at gain of ×1
External output	1V/mV
QRS sync sound	Provided with a sound level adjustment
Calibration waveform	Square waveform of 1mV
TEST waveform	QRS simulated waveform of approx. 1mV and 100msec
Heart rate count range	12~300 bpm

Monitor section

CRT	Non-fade, 5.5 inches, electromagnetic deflection type
Effective display area	110H ×85V (mm)
Waveform display	
Display mode	Cascade mode, freeze mode (Only trace No. 2 is frozen during freeze mode)
Sweep speed	25mm/sec
Sweep length	100mm
Frequency response	DC~30Hz (−3dB)
Max deflection	40mm / trace
Baseline position	Fixed
Sync mark	Spot display on a waveform in SYNC mode
Character display	
Lead	PADL, I, II, III, aVR, aVL, aVF, V, AUX, TEST, TELE (5 electrode mode)
	PADL, I, II, III, TEST (3 electrode mode)
Heart rate	3 digits
Heart rate alarm limits	3 digits
Gain	×1/2, ×1, ×2, ×4, ×AG (auto gain)
Charging energy	Energy charged in the capacitor
Message	TEST OK, LOW BATTERY, PAPER EMPTY, LEADS OFF, etc
QRS sync mark	The heart mark flashes in synchronization with the QRS.

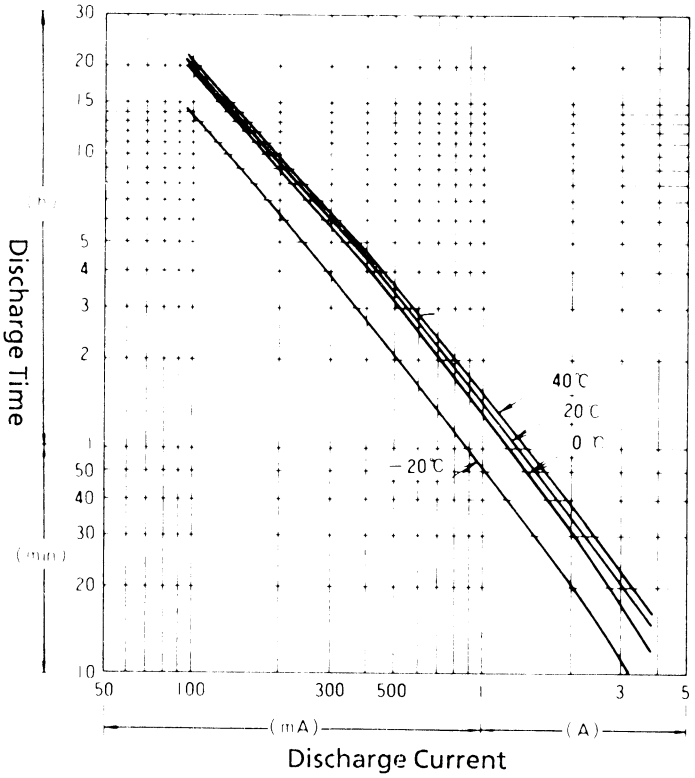
Recorder section

Recording paper	FQS50-3-100, Z-fold paper, 50W (mm)×30 (m) RQS50-3, roll paper, 50W (mm)×30 (m) (requires optional roll paper adaptor RH-701V)
Paper speed	25mm/sec
Effective recording width	40mm (waveform) + 3mm (characters including space)
Frequency response	DC~80Hz (−3dB) Sampling frequency 500Hz
Paper sensor	When the paper is used up, recording stops, an intermittent sound is emitted and "PAPER EMPTY" is displayed on the CRT.
Auto recording	
Energy charge activated	Recording starts by starting charge and stops 15sec after discharged or when annotation printing is complete. If not discharged, recording stops 40sec later.
Alarm activated	Recording starts when detecting heart rate alarm and stops 15sec later or when annotation printing is complete.
Freeze readout recording	Frozen waveform of 4sec is recorded when the REC is pressed in the freeze mode. "FREEZE" is printed at the lower margin of the paper.
Annotation printing	Discharge mark, selected energy, lead, sensitivity, heart rate, MON/ECG mode, AC filter ON/OFF, REAL/DELAY mode, SYNC mode and Sync mark are printed (TEC-7100/7200). In addition to the above, the date, time, trans-thoracic resistance and delivered energy are printed (TEC-7200).

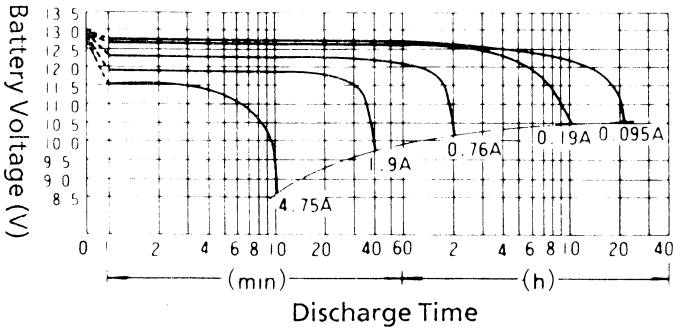
Battery

Battery	LCT-1912NK
Battery charging time	Approximately 2 hours for 80% charging, and 15 hours for full charge Automatically changed from rapid charging mode to trickle charging mode when fully charged
Capacity	1.9AH (20HR) ≧30 times discharge of 360J by fully charged new battery ≦1 hour continuous monitoring
Battery charge indicator	Lit (during charging)
Battery level indicator	Battery level is indicated by three LEDs. "LOW BATTERY" is displayed on the CRT when the level is low.
Over-discharge protector	Turns off the power when the battery level becomes low to prevent the battery from over-discharge.
Self-discharge	Battery capacity naturally decreases at temperature of 20°C without using as follows. 3 months : 90 % 6 months : 80 % 12 months : 60 %

Relationship between discharge current and time at various temperature.

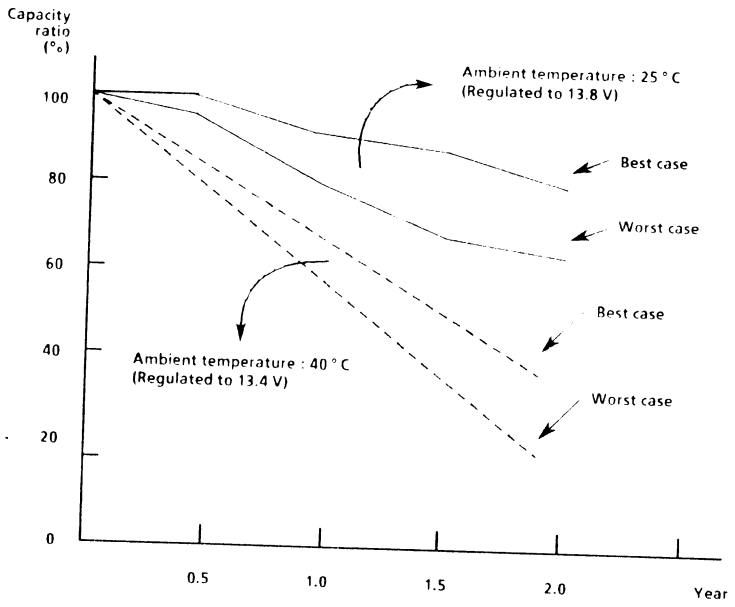


Discharge Characteristic (at 20°C)



Monitoring : Approx. 1A
Recording : Approx. 0.5A
Energy charging : Approx. 8A

Lifetime of LCT-1912 in Trickle Charging



General

Operating temperature	0~35°C
Power requirement	Refer to **TEC-7100 / 7200 System Component Table (Pg. 69)**.
Power consumption	Approx. 200VA
Dimensions	344W × 195H × 370D mm (excluding paddles)
Net weight	12.3 kg (including paddles)

Section 10 Standard Accessories

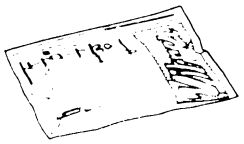
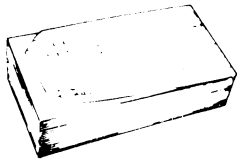
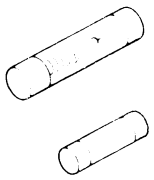
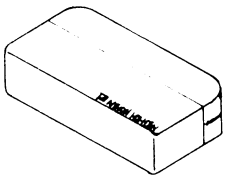
Refer to **TEC-7100 / 7200 System Component Table (Pg. 69)** as for the accessories marked with an asterisk.

TEC-7100 / 7200A

Fig. No.	Name	Code No.	Q'ty
1	Connection cable (3/5-electrodes)	JC-003P	1
2	Electrode lead (3-electrodes)	BR-007P	1
5	Recording paper, Z-fold, 50 mm × 30 m	FQS50-3-100	1
6	Fuse (15A)	5620659	1
	Fuse (AC power fuse), 4A	5620062	2
7	Cover	1112-010705	1
8	Accessory pouch	1132-001214	1
9	External paddles	ND-702V	1
10	Power cord, type UL	5500307	1
12	Battery Pack	LCT-1912NK	1

Other than TEC-7100 / 7200A

Fig. No.	Name	Code No.	Q'ty
1	Connection cable (3/5-electrodes)	JC-002P* JC-004P (TEC7100/7200G)	1
2	Electrode lead (3-electrodes)	BR-002P*	1
3	Disposable electrode (30pcs/set)	5032402	1
4	Contact gel GELAID	6910763	1
5	Recording paper, Z-fold, 50 mm × 30 m	FQS50-3-100	1
6	Fuse (15A)	5620659	1
	Fuse (AC power fuse) 2A : 220V ~ 240V AC 4A : 100V ~ 127V AC	5621079 --------	2
7	Cover	1112-010705	1
8	Accessory pouch	1132-001214	1
9	External paddles	ND-702V#*	1
10	Power cord, type N	5500245	1
11	Grounding lead	--------	1
12	Battery Pack	LCT-1912NK	1

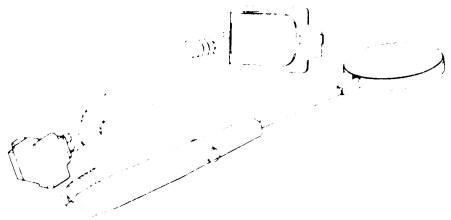
1. 	2. 	3. 	4. 
5. 	6. 	7. 	8. 
9. 	10. 	11. 	12. 

Section 11 Optional Accessories

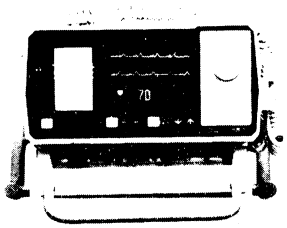
Refer to **TEC-7100 / 7200 System Component Table (Pg. 69)** as for the optional accessories marked with an asterisk.

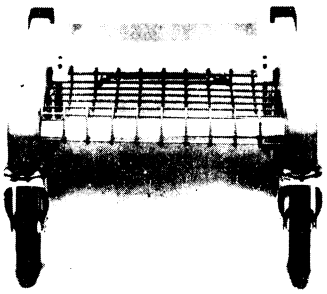
Internal paddle (TEC-7200)
ND-723V (35 mm†)
ND-725V (55 mm†)
ND727V (75 mm†)
† in diameter

Ant-Post paddle*
ND-704V#

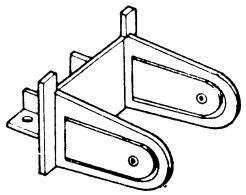


Cart
KD-701V





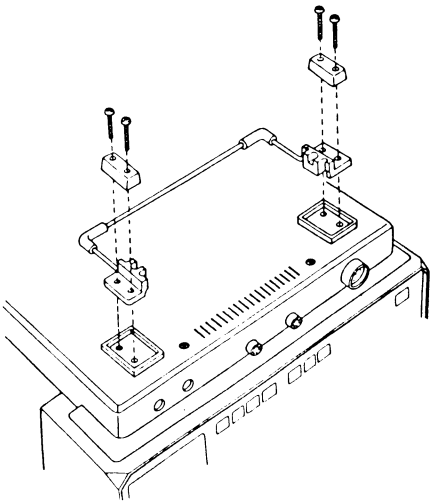
Roll paper adaptor
RH-701V



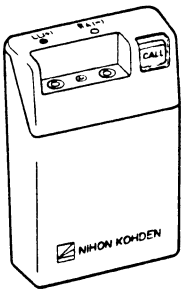
Roll paper (50mm x 30m)
RQS50-3

Electrode lead* (5-electrode)
BR-008P
BR-004P
BR-009P

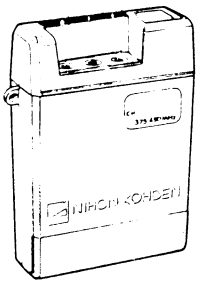
Tilt stand
KH-701V



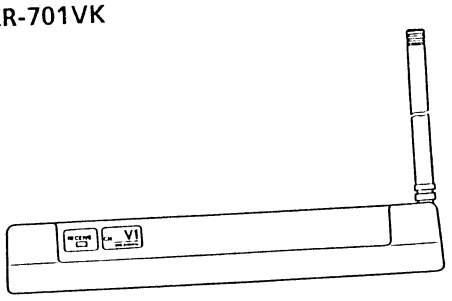
Transmitter*
ZB-312PA



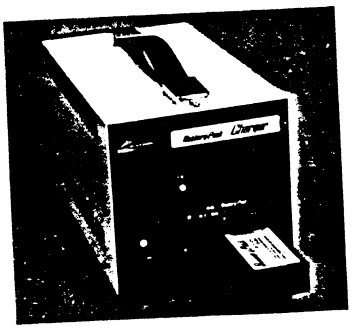
ZB-512V



Receiver*
ZR-702V
ZR-701VK



Battery charger* (for spare battery)
SB-642P#



TEC-7100, 7200 System Component Table

	7100/7200 A	7100/7200 B	7100/7200 C	7100/7200 E	7100/7200 F	7100/7200 G	7100/7200 H	7100/7200 J	7100/7200 K	7100/7200 R	7100/7200 U	7100/7200 W
Date Display	Month / Day / Year	Day / Month / Year	Day / Month / Year	Day / Month / Year	Day / Month / Year	Day / Month / Year	Day / Month / Year	Day / Month / Year	Day / Month / Year	Day / Month / Year	Day / Month / Year	Day / Month Year
AC Line Voltage	117V	240V	220V	220V	220V	220V	220V	100 / 110 / 117V	220 / 240V	220V	220V	220V
AC Line Frequency	60Hz	50Hz	50Hz	50Hz	50Hz	50Hz	50Hz	50 / 60Hz	50 / 60Hz	50Hz	50Hz	50Hz
Lead Symbol & Lead Color	AHA	IEC	IEC	IEC	IEC	IEC	IEC	IEC	IEC†	IEC	IEC	IEC
Connection Cable	JC-003P	JC-002P	JC-002P	JC-002P	JC-002P	JC-004P	JC-002P	JC-002P	JC-002P††	JC-002P	JC-002P	JC-002P
Electrode Leads (3-electrodes)	BR-007P	BR-002P	BR-002P	BR-002P	BR-002P	BR-002P	BR-002P	BR-002P	BR-002P†††	BR-002P	BR-002P	BR-002P
Electrode Leads (5-electrodes)	BR-008P	BR-004P	BR-004P	BR-004P	BR-004P	BR-009P	BR-004P	BR-004P	BR-004P††††	BR-004P	BR-004P	BR-004P
Transmitter*	ZB-312PA	-----	ZB-512V	-----	-----	-----	-----	ZB-512V	ZB-512V	-----	-----	-----
Receiver*	ZR-702V	-----	ZR-701VK	-----	-----	-----	-----	ZR-701VK	ZR-701VK	-----	-----	-----
Battery Charger	SB-642PA	SB-642PK	SB-642PK	-----	-----	-----	-----	SB-642PK	SB-642PK	-----	-----	-----
Ant-Post paddle (TEC-7200 only)	ND-704V	ND-704V	ND-704V	ND-704VE	ND-704VF	ND-704VG	ND-704VH	ND-704V	ND-704V	ND-704VR	ND-704V	ND-704VW
External Paddle (TEC-7200 only)	ND-702V	ND-702V	ND-702V	ND-702VE	ND-702VF	ND-702VG	ND-702VH	ND-702V	ND-702V	ND-702VR	ND-704V	ND-702VW

For Australia and New Zealand † : AHA
†† : JC-001P
††† : BR-001P
†††† : BR-003P

* : Transmission frequency for ZB-512V / ZR-701VK is 395.240~396.580 MHz (UHF)

NIHON KOHDEN
CORPORATION

Head Office
31-4, Nishiochiai 1-chome, Shinjuku-ku,
Tokyo 161, Japan
Telephone: TOKYO (03) 953-1181
Telex: J24804 MEKOHDEN
Facsimile: (03) 954-3355
Cable: NIHONKOHDEN TOKYO

International Marketing Department
Tokyo (Head Office)
Telephone: (03) 954-2674 (direct)

European Representative Office
Büropark Bad Homburg,
Dietrich-Bonhoeffer-Str. 4
D-6380 Bad Homburg v.d.H.,
West Germany
Telefone: 06172-33021
Teletex: 6172968 NK D
Telefax: 06172-303611

Nihon Kohden Corporation
Benelux Training Centre
c/o Hoekloos
Kabelweg 44
1014 BB Amsterdam
The Netherlands
Telephone: 020-5811211
Facsimile: 020-868373

Nihon Kohden (America), Inc.
17112 Armstrong Avenue, Irvine, CA 92714
U.S.A.
Telephone: (714) 250-3959
Telex: 324 545 (WUW) NIHON KOH AME
Facsimile: (714) 250-3210

Nihon Kohden (Deutschland) GmbH
Büropark Bad Homburg,
Dietrich-Bonhoeffer-Str. 4
D-6380 Bad Homburg v.d.H.,
West Germany
Telefone: 06172-32044. . .46
Teletex: 6172968 NK D
Telefax: 06172-303611

北京医疗仪器维修中心

日本光电维修站

北京市丰台西路十七号
电　　话: 37-2146
电报挂号: 0534

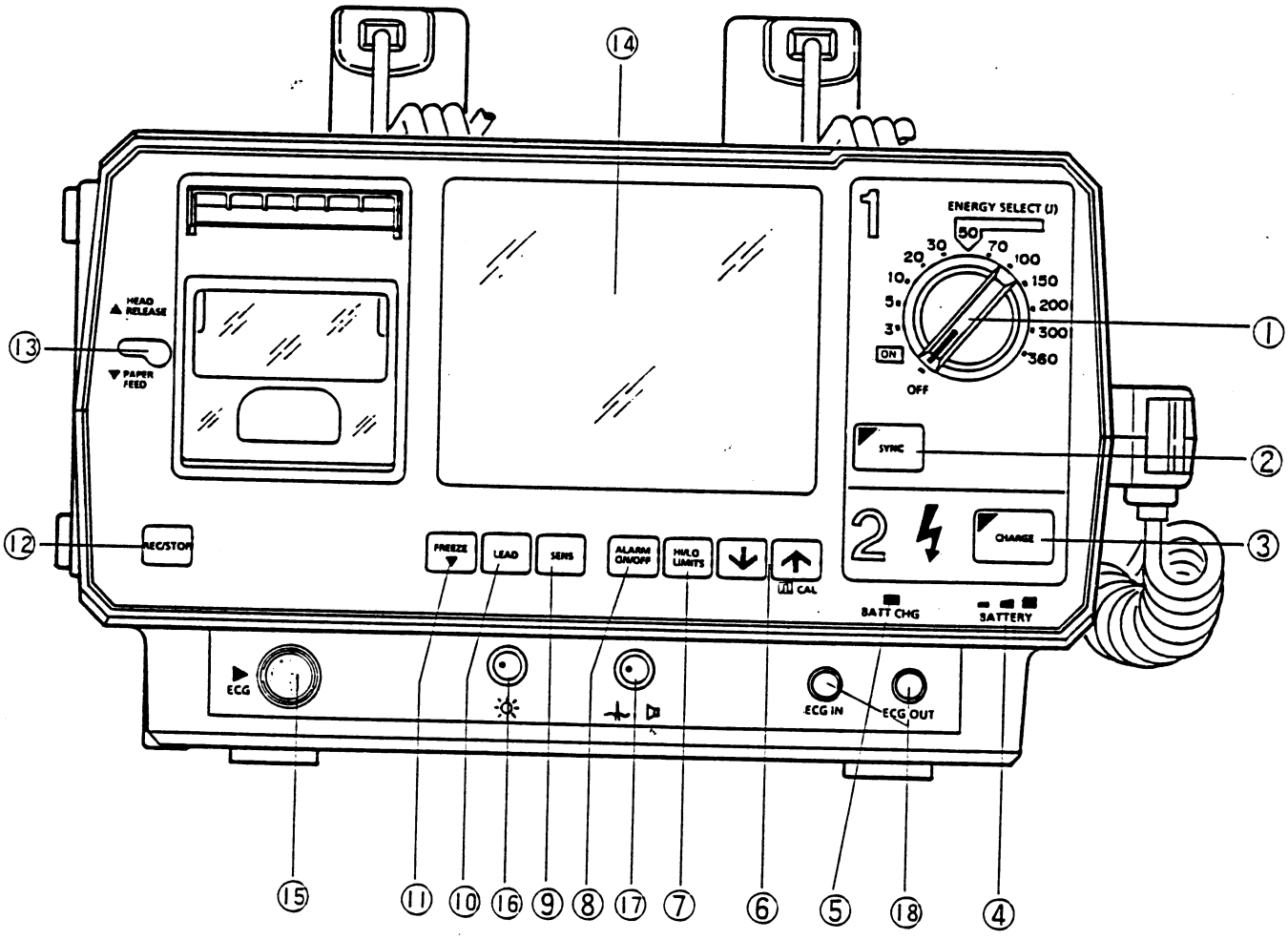
The model and serial number of your instrument are identified on the rear or bottom of the unit. Write the model and serial number in the spaces provided below. Whenever you call your distributor concerning this instrument, these two pieces of information should be mentioned for quick and accurate service.

Model_____ Serial Number _____

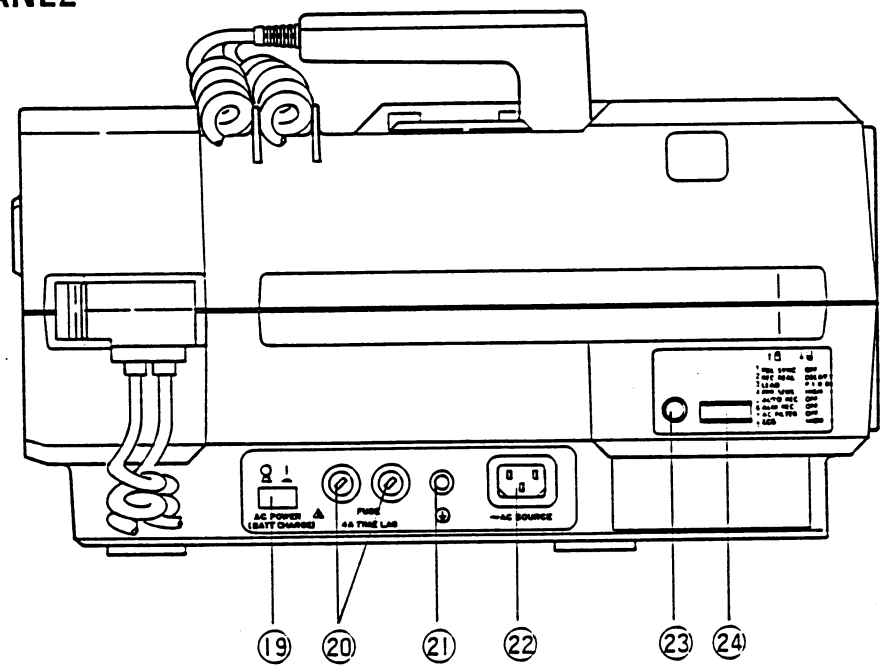
YOUR DISTRIBUTOR

PRINTED IN JAPAN

FRONT PANEL


14
1
ENERGY SELECT (J)
50
30
20
70
100
10
150
5
200
3
300
360
ON
OFF
HEAD RELEASE
PAPER FEED
13
SYNC
2
12
REC/STOP
FREEZE
LEAD
SENS
ALARM ON/OFF
HI/LO LIMITS
CAL
2
CHARGE
3
BATT CHG
BATTERY
ECG
ECG IN
ECG OUT
15
11
10
16
9
8
17
7
6
5
18
4

RIGHT SIDE PANEL



TOP PANEL