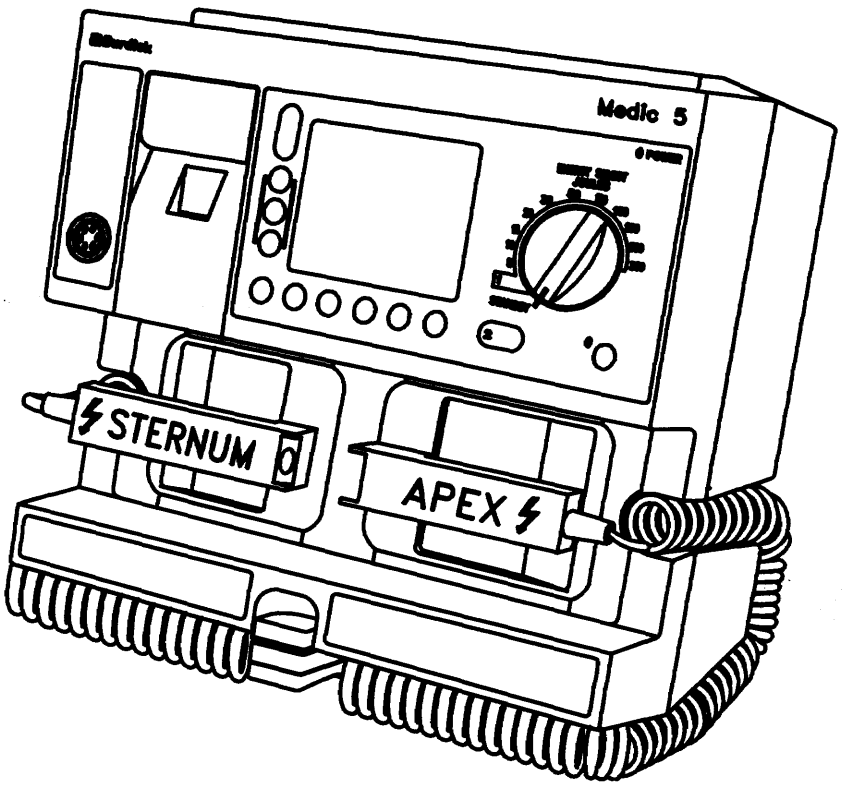
Operating Instructions



Medic 5 Defibrillator/Monitor

Operating Instructions Part No. 086194
Revised 1198

Table of Contents

Section

1 General

Preface - Quick Reference Procedures:

Emergency Defibrillation

1. Apply gel to paddles. Turn ENERGY SELECT switch to desired JOULES setting.
2. Press CHARGE button. Within 10 seconds, a continuous tone indicates that unit is fully charged.

⚠ ***WARNING: STAND CLEAR!***
Make sure all personnel are clear of patient and any equipment connected to the patient or the defibrillator.

3. Press paddles to chest. Simultaneously press and hold both DISCHARGE buttons.

Synchronized Cardioversion

1. Connect patient cable to patient cable connector. Select SENSORS soft key on the display, then the lead desired for monitoring. Synchronized operation will be inhibited if monitoring through the external paddles.
2. Apply conductive gel to paddles and turn ENERGY SELECT to desired Joules. This automatically turns the unit on.
3. Press SYNC for synchronized cardioversion. SYNC indicator will light and "SYNC" message will be displayed on the monitor. Increase gain selection or switch to a different lead if sync marker does not appear on monitor.
4. Press CHARGE button.

⚠ ***WARNING: STAND CLEAR!***
Make sure all personnel are clear of patient and any equipment connected to the patient or the defibrillator.

5. Press paddles firmly on chest and simultaneously press and hold both DISCHARGE buttons located on end of paddles. Discharge will occur within 60 msec. of the next R-wave indication.
6. SYNC button must be reactivated for each synchronized cardioversion attempt.

Definition of Symbols Used on this Equipment

 Consult accompanying documents

 Defibrillation proof Type CF equipment

 Equipotential point

 Dangerous voltage

 Alternating current

 Signal output

Graphic symbols used to identify keys on the keypads or which may appear as display panel graphics are explained in Section 2 of this manual.

List of Cautions & Warnings

NOTICE: Federal law restricts the sale of this device to use by or on the order of a physician or any other practitioner licensed by the law of the state in which he/she practices.

DANGER: There is a possible explosion hazard if the defibrillator is used in the presence of flammable anesthetics.

WARNING: Large amounts of energy are present on the paddles when the defibrillator is discharged. The operator should be careful not to come in contact with the metal surface of the paddles when the defibrillator is energized. Paddles should be held only by the insulated handles.

WARNING: Do not open-air discharge the defibrillator or with the paddles shorted together. This is a hazard to the operator and will shorten the lifetime of the defibrillator.

WARNING: Large amounts of energy are released during defibrillator discharge, observe the following precautions:

1. No one should touch the patient, the defibrillator or anything in contact with the patient during discharge.

2. Only persons familiar with defibrillating procedures should operate the unit.
3. When defibrillating infants, children and smaller animals, set the output at a lower level than normally used on an adult.
4. Never apply the defibrillator paddles very close to or over sensors on the patient.

CAUTION: LIMITED ENERGY OUTPUT - When Internal Paddles are used, the delivered energy is automatically limited to 50 Joules maximum. The lowest appropriate energy should be selected for internal defibrillation to reduce the risk of myocardial damage.

CAUTION: PACEMAKER PATIENTS - Given the wide variation of pacemaker pulse amplitude and duration possibilities, rate meters may continue to count the pacemaker rate during occurrence of cardiac arrest or some arrhythmias. Do not rely entirely upon rate meter alarms. Keep pacemaker patients under close surveillance. See Appendix B for disclosure of the pacemaker pulse rejection capability of this instrument.

CAUTION: The Medic 5 is a battery and AC-line operated instrument. Anyone operating this unit should always bear in mind that the battery can activate the unit without line connections.

CAUTION: Repeated discharges in the vicinity of the sensors will degrade performance of the unit.

CAUTION: Synchronized discharge may be inhibited if any cable other than the recommended Burdick patient cable is used.

CAUTION: The use of non-approved paper may damage the thermal array printhead and invalidate your warranty.

CAUTION: If battery replacement is indicated but cannot be performed immediately, remove the unit from service or label the unit for use on AC power only.

CAUTION: A significant amount of Electromagnetic Radiation is emitted during charge and discharge of the Medic 5's storage capacitor (i.e. delivery of energy to the patient). This may cause other electronic equipment in the immediate vicinity to malfunction.

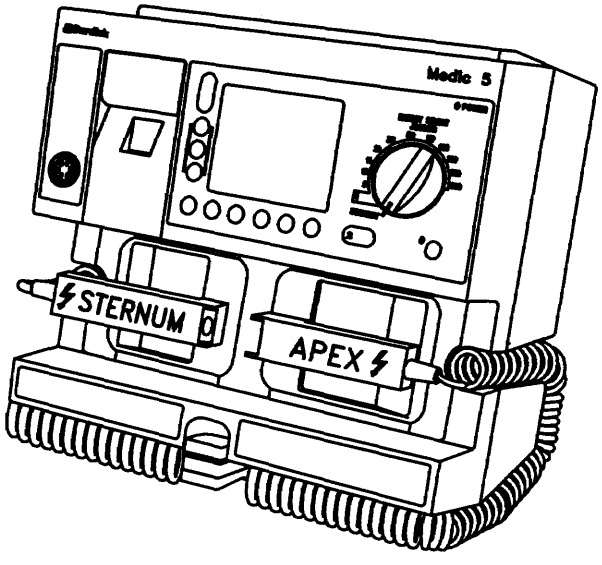
CAUTION: Line isolation monitor transients may resemble actual cardiac waveforms and inhibit heart rate alarms. To minimize this problem, follow the instructions in Section 3 for Sensor Application and Placement.

CAUTION: Connections being made to the ECG OUT connector must maintain proper risk current levels as required by earth ground connected medical class III equipment.

CAUTION: Only 15 minutes of monitoring or 5 discharges at 360 Joules remain when the battery "LOW" message is displayed.

Introduction and General Description

The Burdick Medic 5 is a portable emergency system that has been designed to serve the hospital, clinic or physician's office.



The unit may be powered by an internal battery or AC line voltage. A fully charged battery will produce at least 50 consecutive discharges at 360 Joules or at least 2-1/2 hours of continuous monitor operation. Two or fewer segments displayed next to the battery graphic indicate that the battery needs recharging.

The monitor features a non-fade display with freeze capabilities and heart rate alarm limits. Fixed gain selection (2.5, 5.0, 10.0, 20.0 mm/mV) is available as well as lead selection (I, II, III, aVR, aVL, aVF, Paddle). Should there be a faulty lead connection, a "LOOSE LEAD" message will be displayed. However, if a CHEST lead has a fault condition, NO "Loose Lead" message will be displayed. In addition, the selected energy and heart rate will be displayed.

A permanent record of the monitor trace may be recorded using the built-in recorder. Recordings will be annotated with date, time, lead, gain, filter selection, mode (real-time/delay), heart rate, sync marker, Joules selected, Joules delivered, auto disarm, alarm status and event markers.

During a defibrillation procedure, the printer will run real-time data from the initiation of the defibrillator charging until auto-disarmed or the recording is stopped manually. The recording run during a defibrillation procedure will be annotated with: energy selected, type of discharge, energy delivered, time and date.

Safety Features

To ensure maximum safety, the following features are incorporated.

- Unused defibrillator charges are automatically dumped after 30 seconds into an internal load. In addition, the charge will be dumped if the Energy Select switch is returned to the ECG or STANDBY setting.
- If the energy select switch is rotated to a different energy level, the ready message and the tone will be turned off, and paddle discharge will be disabled. The display will update to indicate the newly selected energy. When the charge button is pressed, the defibrillator will "bleed down" or "top up" the capacitor charge to the new level.
- The defibrillator will not charge if paddles are not connected.
- Defibrillator charge is limited to a maximum of 50 Joules when internal paddles are used.
- Patient cable inputs are isolated from chassis ground and defibrillator protected.
- An intermittent audio tone sounds when the defibrillator is charging. The tone becomes continuous when full charge is reached.

The Medic 5 is a versatile unit designed and built with the emphasis on patient and operator safety.

Inspection Upon Delivery

Your Burdick Medic 5 defibrillator has been thoroughly tested and inspected prior to shipment. Please examine the unit immediately upon receipt for any damage which may have occurred during transit. If any damage is visible, contact the shipping agent and make arrangements for issuance of a concealed damage report.

Check the accessories with the list of standard accessories on the next page. Report any shortage of parts to your local representative or call Burdick, Inc. Technical Service Department at (800)333-7770 or (608)764-1919.

The Medic 5 defibrillator has been shipped with the battery removed to extend its shelf life. See Section 3 - "Installing the Battery" prior to placing the unit into service.

Before use, check your new Medic 5 for proper operation by following the procedure outlined in "Defibrillator Test" on page 37.

Standard Accessories

5-Lead Patient Cable

External Paddle Set

Line Cord (AC Power Cord)

Operating Instructions

Roll Recording Paper

5 oz. Tube Electrolyte

Sample Pack of ECG Sensors

Catalog of ECG Supplies and Accessories

Medic 5 Defibrillator Checklist

Optional Accessories

Adult Internal Paddles with handles (pair)

Pediatric Internal Paddles with handles (pair)

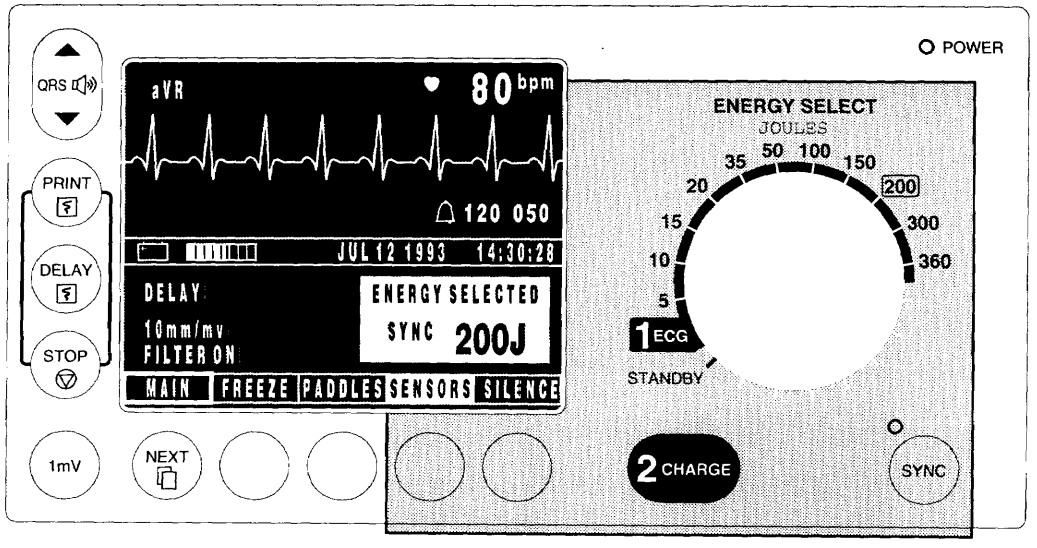
3-Lead Patient Cable

A Service Manual may be obtained upon request from your local representative or call Burdick, Inc. Customer Service Department at (800) 284-4362 or (608)764-1919.

Section

2 *Controls & Displays*

Defibrillator Controls and Displays



Energy Select Switch:

This switch controls Power On and energy selection in a single action. The functions at each position are as follows:

STANDBY:

The defibrillator, monitor and recorder circuits are disabled. Battery circuits are still enabled. Battery charging is disabled only by unplugging mains (line) power.

ECG:

The monitor and recorder circuits are enabled. The monitor will power up with the paddle input as the default setting. Other functions will default to settings as when it was last used.

5 to 360:

The eleven positions indicate the energy level selected. When internal paddles are connected, "INTERNAL PADDLES" is displayed in the defibrillator message box; the energy selected is limited to 50 Joules. The energy selected is echoed on the display in the defibrillator message box.

WARNING: STAND CLEAR!
Make sure all personnel are clear of patient and any equipment connected to the patient or the defibrillator.

CHARGE Button

After you have selected an energy level, depress the CHARGE button to initiate charging to this energy. Doing this also initiates a real-time recording and an intermittent tone indicates the unit is charging. This will change to a continuous tone when charging is completed. If, during charging or when charging is complete, you select a new energy, the instrument will either charge up to the new level, or dump down to the new level, whichever is appropriate. You must press the CHARGE button again to initiate charging to the new level; this new energy level will appear both on the printout and on the monitor. A remote CHARGE button is located on the APEX paddle and operates in the same manner. When charging is complete, the tone becomes steady and you will see the message "READY" in the defibrillator message box on the display.

DISCHARGE Buttons

You must press and hold both discharge buttons (3) on the paddles simultaneously to discharge the defibrillator. These switches are disabled if there is a loose lead while in sync mode, during charging or during internal dumping (automatic or manual). Immediately following discharge, energy delivered will replace the energy selected in the defibrillator message box.

SYNC

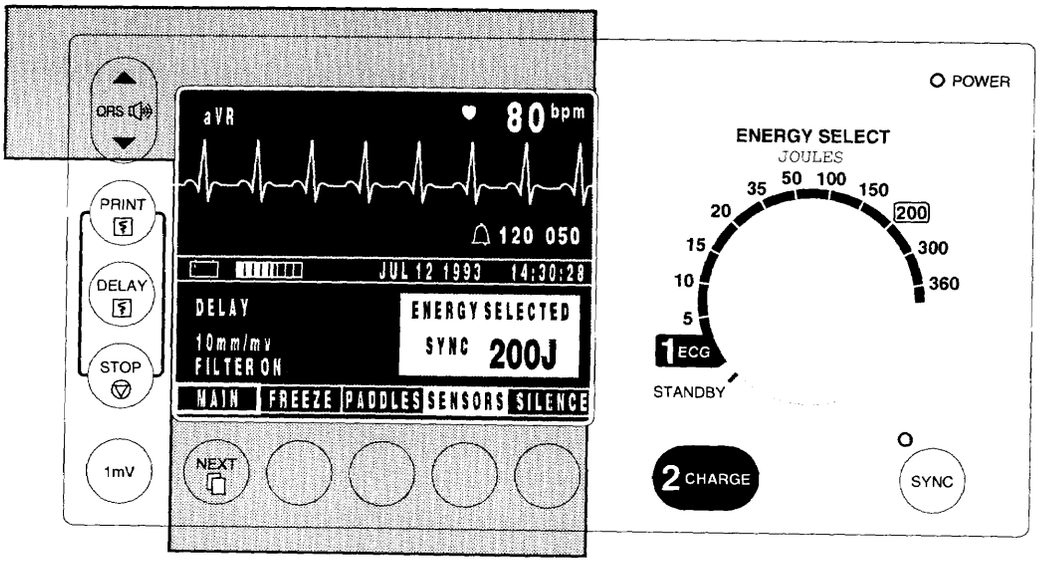
Use this key to toggle between the synchronized and non-synchronized modes of operation. The unit always powers up in non-synchronized mode. Successive presses of the sync key will alternately select/deselect synchronized mode of operation. The unit will automatically revert to non-synchronized mode after a synchronized discharge. The message "SYNC" will be displayed in the defibrillator message box and the LED adjacent to the sync key will light whenever the Sync mode is enabled.

Note: If a loose lead is detected in synchronized mode, discharge is inhibited. However, the chest lead will not trigger a loose lead condition. For this reason a chest lead should never be used with synchronized cardioversion.

Note: The "R" printed on the ECG trace is an indication that the Medic 5 has detected a QRS complex, but does not indicate the exact time of detection. At the start of DELAY mode, an extra "R" may be printed.

CAUTION: ***Synchronized discharge may be inhibited if any other than the recommended Burdick patient cable is used.***

Monitor Controls & Displays



The Monitor operates whenever the Energy Select switch is in any position other than STANDBY. The ECG position allows the Monitor and Chart Recorder to operate without enabling the Defibrillator functions.

The Monitor and Alarm functions are controlled by 5 soft keys, QRS volume keys, and a 1mV calibration key. The ECG signal and the status of the monitor functions are shown at various locations on the display. These are described below.

NEXT

Press this key to advance to the next menu (see Menu Summary, page 30).

SOFT KEYS

Five (5) software-defined keys are located immediately below the display. The function of these keys is determined by labels appearing along the bottom of the display, immediately above the corresponding soft key. The first soft key, labeled "NEXT," is used to select any 1 of 7 menus. Each menu consists of up to 4 sub parts, corresponding to the remaining 4 soft keys.

The menus include MAIN, LEAD 1, LEAD 2, GAIN, FILTER, ALARMS, and CLOCK (see Menu Summary, page 30). The menu options and their operation are described in Section 3.

QRS Volume

The QRS volume keys are used to increase or decrease the volume of the QRS beeper. You do this by alternately pressing the up or down arrow.

Date &Time

The date and time of day are shown within the double bar that separates the upper and lower halves of the display. For instructions on setting the clock/calendar see Section 3, (12/24 hour clock display).

ECG Monitor

A single lead of the ECG signal appears in the top half of the display; this also shows lead selected or paddles. Four (4) seconds of data are displayed continuously.

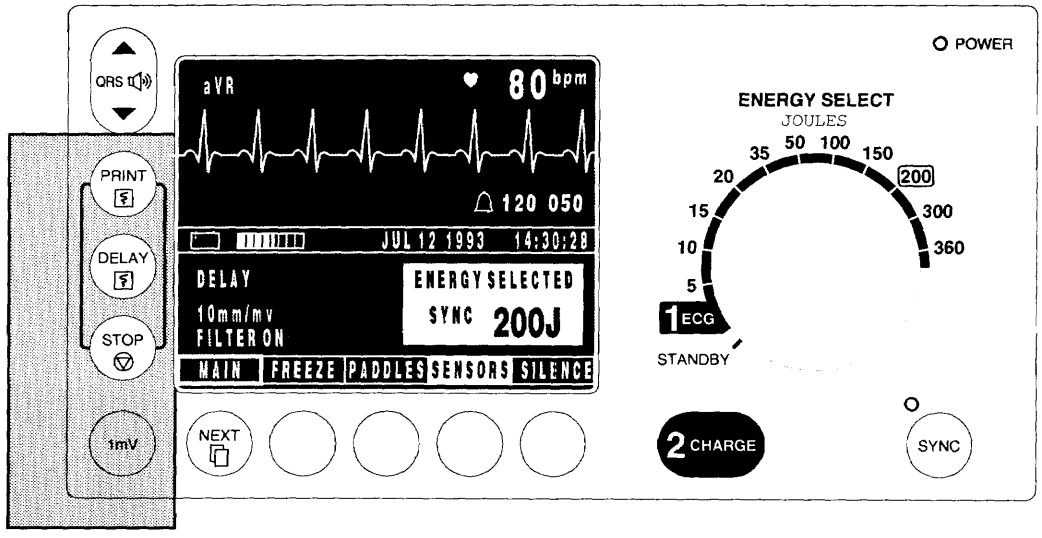
Monitor/Recorder Status

Messages describing the ECG signal source, gain, recorder mode and filter selections are shown at the left side of the display. These messages describe the ECG signal as it is displayed on both the monitor and the recorder. The selections are made using the soft keys (See Section 3).

Heart Rate (HR) Meter Alarm

The Heart Rate meter appears within the ECG Monitor display area. A blinking heart symbol ♥ and an audible beep indicate whenever an R-wave has been detected. Below the HR, the upper/lower alarm limits are displayed, if enabled. Adjacent to the alarm limits is an open bell symbol that indicates whether the alarms are enabled or not (🔔 = ON; 🔕 = OFF). The operation of the HR Meter and alarms is described in Section 3.

Recorder Controls



The four keys, located to the left of the display, relate to the operation of the chart recorder:

PRINT

This key is used to manually start the chart recorder in real-time mode. In real-time mode, ECG data is printed as it is acquired. Subsequent presses of this key create an "Event Marker" ▲ in the printout.

DELAY

This key is used to manually start the chart recorder in delay mode. In delay mode, the ECG is printed 8 seconds after it is acquired. Subsequent presses of this same key create an "Event Marker" ▲ in the printout.

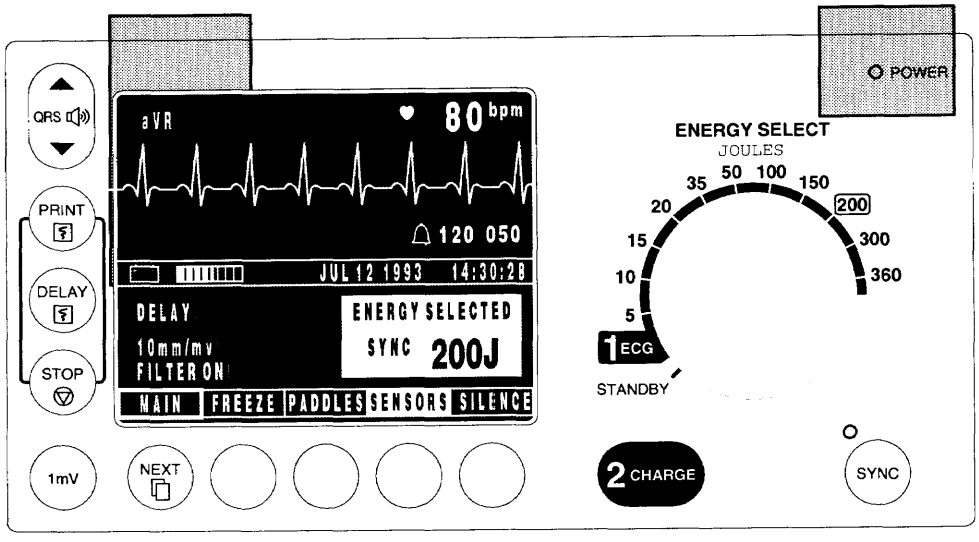
STOP

This key is used to manually stop the chart recorder. The paper will advance far enough to tear off all data printed prior to pressing STOP.

1mV

The 1mV key will add a 1mV, 200 ms duration, calibration pulse to both the monitor display and the chart recorder printout. The data printed by the chart recorder is the same as that displayed on the monitor. See Section 3 for details of how to operate the chart recorder.

Power/Battery Indicators



Refer to the illustration above to locate the following displays which indicate the status of AC power and the battery management system.

POWER Indicator (AC supply)

This lamp, located at the top right-hand corner of the panel, indicates that the unit is plugged in to an external AC power source. Whenever this lamp is lit, and a battery installed and properly connected, the battery will be charging if it is not already fully charged.

Battery Status Indicator

The battery status is indicated whenever the unit is operating from battery power.

The Battery Status Indicator consists of two parts:

1. A battery symbol identifying that the unit is operating from battery power, and
2. An 8-segment bar graphic indicating the approximate remaining battery capacity by the number of filled segments; all eight segments filled indicates a fully charged battery.

See Section 3 (page 17) for information on installing the battery.

Operator Alerts

The following messages may appear in place of the battery indicator during the course of normal operations. See also Section 6, Appendix A.

"LOW" - The battery capacity is approaching the level at which the unit will lose power. When this message first appears, 15 minutes of monitoring or 5 discharges remain. Connect the unit to an AC source if immediate use is required. Leave the unit connected to the AC source for at least 8 hours to restore battery capacity (recharge the battery).

Note: The Medic 5 should be connected to mains power between uses to ensure that the battery is fully charged. If the Medic 5 is operated until the battery "LOW" message appears, 16 hours may be required to fully charge the battery.

Note: When the battery gauge indicates 2 segments, 1 segment or "LOW", Medic 5 performance may be affected in that, during CHARGE sequences, the unit may cease operation and shut off. If this happens, cycle the unit off and on again. Then, retry or immediately connect the unit to mains power.

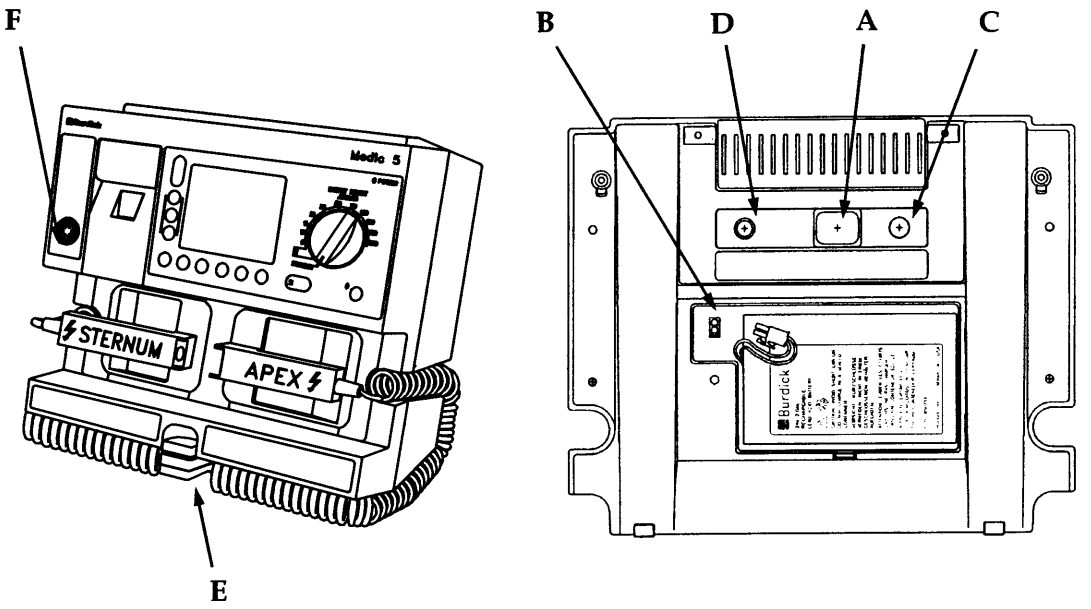
Battery capacity indications will change during operation of the unit. This will happen most dramatically at initial turn-on while in battery and during CHARGE-DISCHARGE cycles. This is normal and does not indicate a fault.

It is recommended that the battery be charged as soon as possible when the battery gauge indicates only a few segments. This practice will enhance the life expectancy of the battery and avoid unanticipated problems during cardiac resuscitation events.

"DEFECTIVE BATTERY" - Two possible conditions can cause this message to appear; it appears only during AC operation.

1. *No battery connected.* Check the battery compartment and the battery connections.
2. *The battery is internally shorted.* Remove the battery immediately and replace. Instructions for this are in Section 4 under "Replacing the Battery". Burdick does not recommend using the Medic 5 without an internal battery installed.

Connections



Refer to the illustration above to locate the following:

AC Power Cord Connector (A)

Use only the Burdick hospital-grade power cord as supplied with the unit.

Battery Connector (B)

The battery connector is located within the battery storage well (shown with cover removed).

Ground Post (C)

This post is connected to the chassis. It may be used to provide a common ground reference (equipotential point) with other equipment.

ECG OUT (D)

Located on the back panel is an analog ECG output. This output is real-time and provides the same ECG lead and gain as is currently being monitored.

The auxiliary output provides ECG data at 1V/mV with the gain set at 10 mm/mV for resistive loads of 10 K or larger. The output can sustain continuous short circuits without damage or degradation of other performance parameters.

A standard RCA type connector with a 75Ω coaxial, or equivalent 2-wire cable, with one wire connected to the center pin of the RCA jack (signal conductor), and the other wire connected to the outside of the RCA jack (earth ground), will ensure proper operation of the output.

CAUTION: ***This is <u>not</u> an isolated equipment connection and proper risk current levels must be maintained with equipment connected to this output.***

Paddle Connector (E)

The paddle set in use is connected here. The standard external paddle set may be disconnected by grasping the connector, with one hand, on the top and bottom and squeezing to release. In addition to removal for cleaning, the standard external paddles may be replaced by an internal paddle set, or by an adapter for use with disposable defibrillator electrodes.

Patient Cable Connector (F)

This connector is used to attach either a 3-lead or 5-lead Burdick patient monitoring cable. This is a fully shielded cable. Only Burdick cables should be used to ensure proper operation.

Section

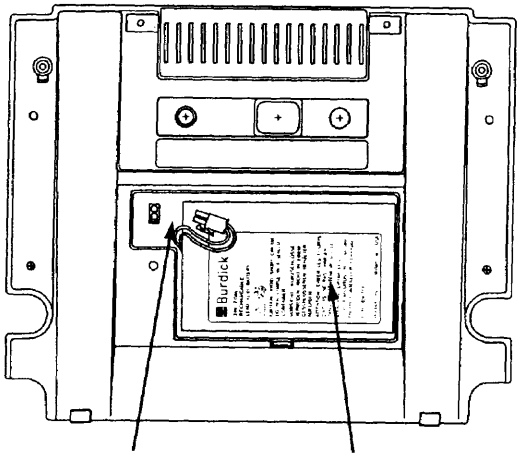
3 Operation

Installing the Battery

Your Medic 5 Defibrillator comes without the battery installed in order to preserve battery shelf life. Before operation you must install the battery in the battery storage compartment in the back of the unit. To do this:

1. Rotate ENERGY SELECT switch to STANDBY position. Disconnect the unit from AC supply line and place unit face down.
2. Remove cover on back of unit by loosening screw using a small coin or screwdriver.
3. Insert battery into compartment, label facing out as shown.
4. Insert latching connector into the mating receptacle and carefully route lead wires into the space provided. Make sure the connector is securely latched.
5. Replace compartment cover and tighten screw securely.

After installing the battery, and before connecting the unit to AC line, turn the ENERGY SELECT switch to the ECG position and verify that the Battery symbol appears on the screen.



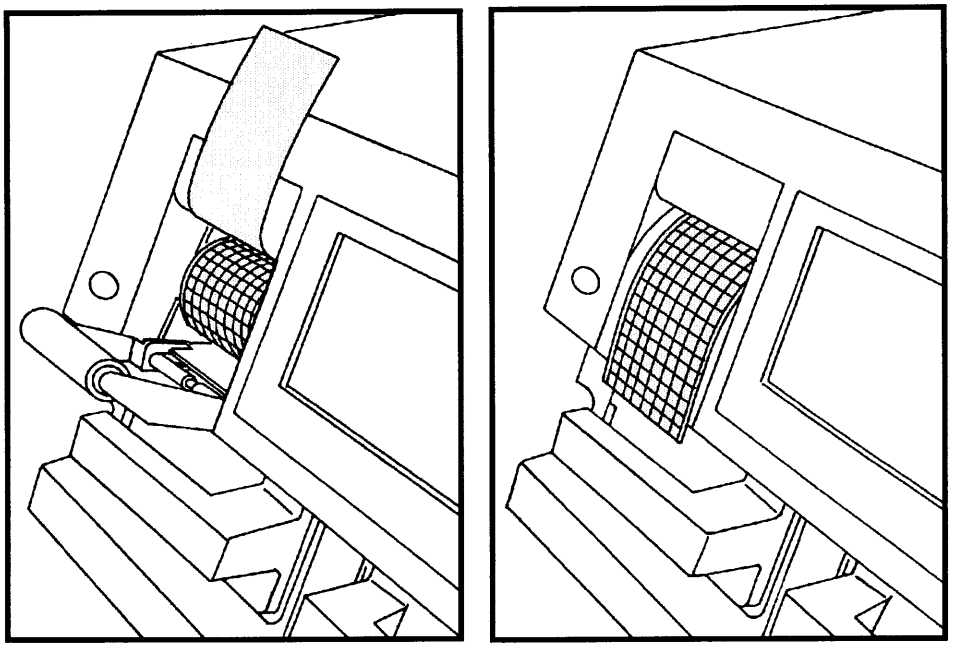
Connector Battery

Battery Compartment with Cover Removed

If the charge level indicator shows that the battery is not at full capacity, again connect the unit to AC line and allow the battery to charge (refer to Section 4 - Testing the Battery).

Loading Paper

Note: The chemistry and thermal characteristics of the approved Burdick ECG paper match the specification tolerances of the unit's Thermal Array Print Head.These characteristics ensure the optimum trace quality.



Loading the paper is a simple three-step operation:

1. Slide open the cover of the paper compartment by placing finger in the slot provided and gently pulling downward; if necessary, remove the empty spool.
2. Place the new paper roll on the spool. Grasp the free end of the paper and pull it out the top of the paper compartment as shown.
3. While holding the end of the paper, slide the cover back up and snap into position.

Refer to your Catalog of ECG Supplies and Accessories that came with your unit for the Burdick Part Number of the paper when reordering.

CAUTION: ***The use of non-approved paper may damage the thermal array printhead and invalidate your warranty.***

Setting the Calendar/Clock

The Medic 5's calendar/clock has been set at the factory to CST (Central Standard Time). The clock will need to be reset if the unit is being used outside the Central Time Zone and when changing to or from Daylight Savings Time.

The calendar automatically adjusts for leap years and should not require resetting.

Note: The Medic 5 will not automatically convert to the year 2000. Manually change the year setting using the instructions below on or after January 1, 2000. Once the year has been changed, the unit will respond correctly and should not require further resetting.

Setting the Date and Time

To set the clock, press the "NEXT" key six times (see page 9) to advance to the "CLOCK" menu. Set date and time by using the "UP" and "ENTER" keys, and by observing the corresponding date and time displayed on the monitor.

CLOCK	JAN	UP	FORMAT	ENTER

1. Press the "UP" key until the current *Month* appears above the 1st soft key. The display will wrap around from DEC to JAN.
2. Press "ENTER". This will update the date/time bar on the monitor and display the current *day* above the first soft key.
3. Repeat steps (1) and (2) for day, year, hour and minute.

When the selection of each date/time element is correct as shown on the display, press "ENTER" to retain this value and advance to the next element.

Note: When setting the HOUR, the values 0-23 are used, corresponding to midnight to 11pm.

Selecting the Display Format

You can display the date in either a month-day-year **(M-D-Y)** format or a day-month-year **(D-M-Y)** format. You can display time using either a 24-hour format or a 12-hour am/pm format. The **M-D-Y** and 24-hour formats are system defaults.

To alter the default display format press "FORMAT", while in the CLOCK menu, to access the following sub-menu:

FORMAT	M-D-Y	D-M-Y	AM/PM	24Hr.

The current format selections will appear in reverse video. To change format press the soft key below the desired format. The menu bar will return immediately to the "CLOCK" menu.

Defibrillation

A 13-position ENERGY SELECT switch lets you select the required energy. The energy level selected is displayed on the monitor. Press the CHARGE button on the front panel (or the CHARGE button on the APEX paddle) to initiate the charge sequence. The recorder automatically starts a real-time printout when the CHARGE button is pressed. While the defibrillator charges, an intermittent tone sounds, warning you that the charging sequence is in progress. When the selected energy level is reached the audio tone becomes continuous and the READY message is displayed on the monitor. The Ready tone remains constant for 27 seconds, then changes to an intermittent tone for 3 seconds. If the charge remains unused, it is automatically dumped into an internal load, the tone stops and "AUTO DISARM" is annotated on the printout and the monitor display.

Remember, the defibrillator energy level is limited to 50 Joules if you are using internal paddles.

You can't discharge the defibrillator during the charge sequence, but you can discharge it at any time during the 30-second ready period. You can dump any unwanted charge internally by returning the Energy Select switch to the ECG or STANDBY positions.

For safety purposes the defibrillator charge is automatically dumped internally under the following circumstances:

- If you don't use the charge within 30 seconds.
- If you unplug the paddles.
- When you turn the Energy Select switch to ECG or STANDBY.

Interpretation of Delivered Energy

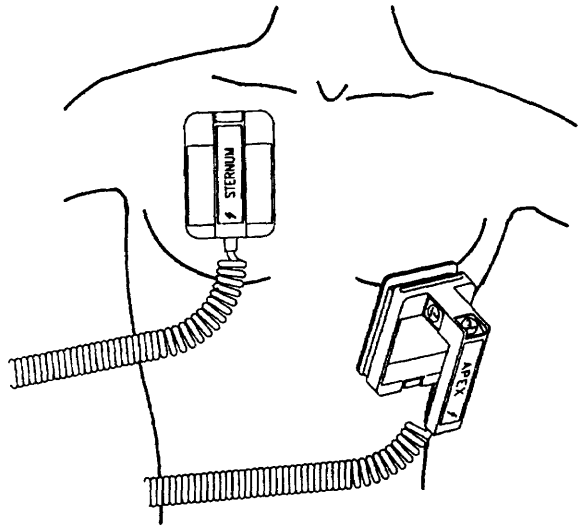
After a discharge, the defibrillator will briefly display the approximate energy which has been delivered. All defibrillators are designed to deliver the correct energy to a "nominal patient" according to AAMI guidelines.

When the delivered energy is greater than the selected energy, the resistance in the patient circuit is higher than AAMI's nominal patient. The increased resistance may be due to poor patient preparation or may be characteristic of the patient. If the preparation is careful, then the patient has an intrinsically high resistance and extra consideration should be given to selecting a higher energy setting before a second shock, if necessary, is applied. If the preparation is flawed, the technique should of course be corrected.

If the delivered energy is low, the preparation was almost certainly done correctly. However, the exact placement of the apex paddle may be reconsidered. Perhaps the current flow missed the bulk of ventricular muscle.

In extreme situations, where the impedance is in excess of the normal AAMI standards, or the energy delivered is beyond the tolerance limits specified the display will show "- - - J" in the message box.

Positioning the Paddles



Paddle positioning is important to succesful defibrillation. Hold the STERNUM paddle in your left hand and place it near the upper sternum, slightly to the patient's right shoulder, below the clavicle.

Hold the APEX paddle in the right hand and position it at the patient's lower left chest near the cardiac apex.

Keep ECG patient cable sensors well clear of the paddle sites.

CAUTION: Repeated discharges in the vicinity of the sensors will degrade performance of the unit.

External Paddle Defibrillation

1. Connect the external paddles.

⚠ ***WARNING: The adult paddles will not fire properly if they are not attached correctly. Confirm correct connection of adult paddles before beginning defibrillation (refer to figure on page 25 for instructions).***

2. Apply a generous amount of conductive gel (i.e. Burdick Cor-gel) over the entire contact surface of both paddles or use disposable electrolyte pads.
3. Set the ENERGY SELECT switch to the required energy.
4. Place the paddles on the proper paddle sites and quickly work the gel into the skin using the paddles.
5. Hold the paddles firmly on the paddle sites and press the APEX paddle CHARGE button. An intermittent audio tone will sound. You may also use the front panel CHARGE button to initiate charging.

⚠ ***WARNING: STAND CLEAR!***
Make sure all personnel are clear of patient and any equipment connected to the patient or the defibrillator.

6. When the audio tone becomes continuous and the READY message appears, clear all personnel from the patient and any connected equipment. Prior to pressing DISCHARGE the monitor will display Joules selected. Press and hold the DISCHARGE button on both paddles simultaneously to discharge the defibrillator.

   After the DISCHARGE buttons are pressed, it will indicate the energy delivered to the patient. If you do not discharge the defibrillator within 27 seconds after the READY message appears, the audio tone will become intermittent again to warn you that the defibrillator will automatically dump its charge internally, not into the patient, in 3 seconds.
7. If further defibrillation is required, repeat steps 3 through 6.
8. On completion, carefully clean the paddles with a soft cloth lightly moistened in warm, soapy water. Dry off the clean paddles thoroughly before storing.

Internal Paddle Defibrillation

1. Disconnect the External Paddles by squeezing the paddle connector (see also page 14) at the front of the defibrillator and pulling. Connect internal paddles.
2. Set the ENERGY SELECT switch to the required energy position. Defibrillator energy level is limited to 50 Joules when internal paddles are connected. If you select a value higher than 50, the Energy Selected display will show 50 Joules and "INTERNAL PADDLES".
3. Press the front panel CHARGE button. An intermittent audio tone will sound.

WARNING: STAND CLEAR!
Make sure all personnel are clear of patient and any equipment connected to the patient or the defibrillator.

4. Place the paddles around the ventricular muscle. A saline-soaked pad may be used between the electrode and myocardium.
5. When the audio tone becomes continuous and the READY message appears on the monitor, clear all personnel and press the DISCHARGE button on the paddle handle. If you do not discharge the defibrillator within 27 seconds after the READY message appears, the audio tone will become intermittent again to warn you that the defibrillator will automatically dump its charge internally, not into the patient, in 3 seconds.
6. If further defibrillation is required repeat steps 2 through 5.
7. On completion, carefully clean the paddles. Remove the internal electrodes from handles. The electrodes may be autoclaved.

Synchronized External Cardioversion

Note: Never use a "V" chest lead for synchronized operation.

1. Connect the external paddles.
2. Ensure a Burdick patient cable is connected to the patient and to the Medic 5 and that "Sensors" input is selected from the Main Menu. Synchronized operation will be inhibited if monitoring through the paddles.
3. Select the desired Lead (not a "V" lead) and ensure that a prominent "R" wave is displayed. Reposition patient sensors if necessary to achieve this.
4. Set the ENERGY SELECT switch to the required energy position.

5. Press the SYNC key on the front panel and increase GAIN if necessary to obtain a sync marker "▲" immediately below each R-wave on the monitor. If the recorder is turned on, each R-wave on the printout will be marked by an "R" above and to the right. When SYNC is activated, the green LED on the SYNC switch will light.
6. Spread a generous amount of conductive gel (i.e. Burdick Cor-gel) over the entire contact surface of both paddles or use disposable electrolyte pads.
7. Place the paddles on the paddle sites and work the gel into the patient's skin using the paddles.
8. Hold the paddles firmly on the paddle sites and press the APEX paddle CHARGE switch. An intermittent audio tone will sound. You may also use the front panel CHARGE switch to initiate charging.

⚠ ***WARNING: STAND CLEAR!***
Make sure all personnel are clear of patient and any equipment connected to the patient or the defibrillator.

9. When the audio tone becomes continuous and the READY message appears, clear all staff from the patient and any attached equipment. Press and hold the DISCHARGE buttons on both paddles until the defibrillator discharges, then release. When in the SYNC mode, discharge of the defibrillator will occur within 60 msec. of the next R-wave indication.

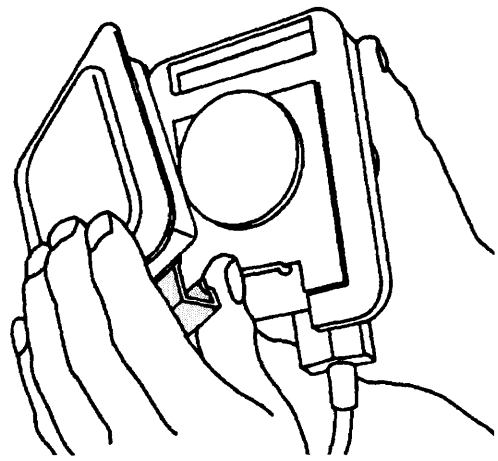
   If the defibrillator is not fired within 27 seconds after the READY message appears, the audio tone becomes intermittent to indicate that the defibrillator will automatically dump its charge internally, not into the patient, in 3 seconds.
10. Observe the display. If further synchronized operation is required, repeat steps 4 through 9.

Important: Press the SYNC key prior to each synchronized discharge.

11. On completion, carefully clean the paddles and return to the storage wells.

Pediatric Defibrillation

Pediatric defibrillation, whether external, internal or synchronized, is carried out using the appropriate paddles in exactly the same manner as detailed on the preceding pages.

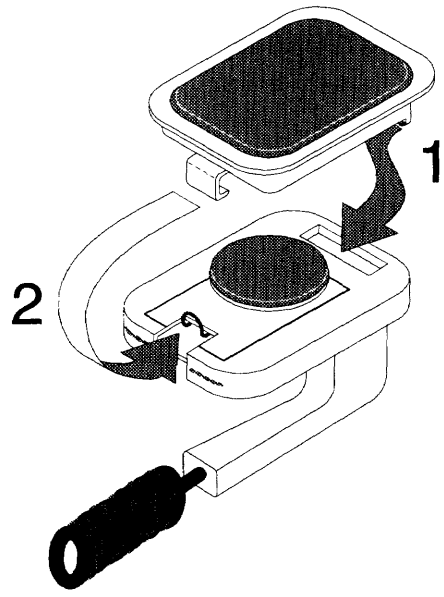


Pediatric Paddles - located underneath the Regular Paddles

Pay particular attention to the energy level selected.

The external pediatric paddles are located underneath the regular adult paddles. To remove the adult paddle, pull out on the tab at the rear of the paddle and lift off. Internal pediatric size paddles are available as an optional accessory.

To reattach the adult paddles, first insert the end opposite the tab into the rectangular slot (step 1 below) and then push the tab end into place (step 2 below).



Reattach Adult Paddles

ECG Monitoring and Recording

You can select the ECG signal source from either the patient cable (SENSORS) for normal long-term monitoring, or from the defibrillator paddles (PADDLES) for a quick assessment of the patient's condition.

The ECG signals are processed by isolated and defibrillator protected circuitry for display on the monitor and recorder. The ECG trace is displayed on both the monitor and recorder at a speed of 25mm/sec.

Electronic filters are provided to remove 50/60 Hz line frequency noise and to reduce muscle tremor artifacts.

Pacer pulses are removed from the ECG signal to prevent inclusion in the Heart Rate calculation (see Appendix B). A vertical marker is superimposed on the ECG trace and recording to indicate the location of a pacemaker pulse.

During synchronized cardioversion a sync marker is superimposed on both the monitor display "▲", and on the ECG recording "R", so that you can verify the synchronization timing.

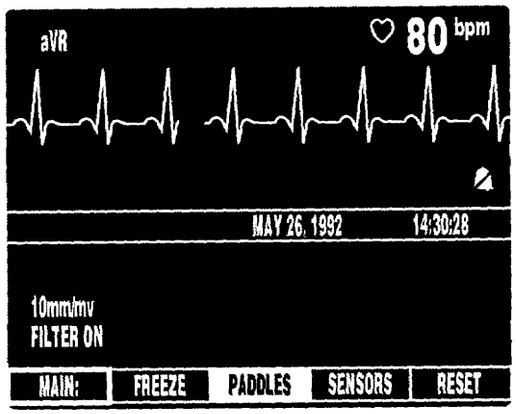
You can increase or decrease the amplitude of the ECG signal by selecting a Gain of 2.5 mm/mV (x 1/4); 5.0 mm/mV (x 1/2); 10 mm/mV (x 1); or 20 mm/mV (x 2).

Operator Alerts

The following messages may appear on the monitor display during the course of normal operations. See also Section 6, Appendix A, for a full list.

1. **LOOSE LEAD** - One or more patient cable sensors not securely attached to the patient. A loose chest lead will not cause this message to appear. The waveform that appears on the display and the recorder will be an artifact and will not be a reliable representation of the ECG signal. The heart rate will not be accurate. Any attempt at SYNC mode defibrillation will be inhibited. This message is displayed, immediately below ECG waveform, only when SENSORS is selected.
2. **WARNING: NO PADDLES CONNECTED** - Check paddles to ensure proper connection. Appears below date/time bar.
3. **INTERNAL PADDLES** - The Medic 5 senses an internal paddle set attached to the paddle connector. Discharge energy will be limited to 50 Joules. Appears inside the highlighted defib. box.

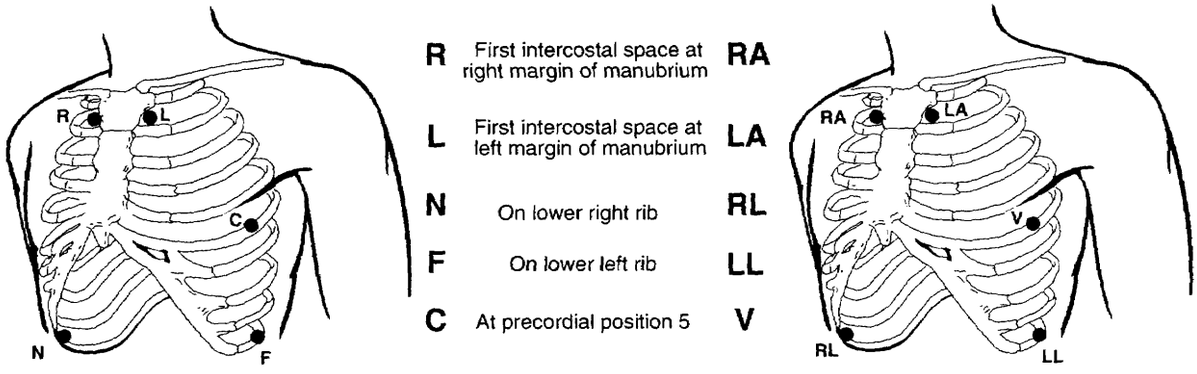
Heart Rate Display



Heart Rate is displayed on the ECG monitor. A beep sounds with each QRS detected. The QRS volume control keys are located to the upper left of the display.

You may pre-set both upper and lower limits to trigger a Heart Rate Alarm (see page 33).

Sensor Application and Placement



One fully shielded 5-lead patient cable is supplied with your Medic 5. An optional 3-lead patient cable is available.

Burdick approved sensors are supplied with your Medic 5. These are high quality, silver/silver chloride, long-term monitoring sensors. Even after repeated defibrillation efforts, the ECG signals return to normal in less than 3 seconds for continued patient monitoring.

Note: The monitor preamp will operate with sensor offsets up to ±300 mV. Recovery time after defibrillation discharge is less than 3 seconds. The limiting factor in recovery is usually the ECG sensor. We strongly recommend using Burdick-approved sensors. The use of any other type sensors, in particular those employing dissimilar metals, may result in excessive polarization potentials which will adversely affect monitor performance.

Prior to applying the sensors, proper preparation of the patient is important. Proper skin preparation will assure baseline stability and a clean trace. Patient skin resistance will vary. To achieve the best possible contact for the sensor, it is necessary to raise the body fluids to the surface of the skin at the sensor contact point. Do this by (1) cleansing the skin with alcohol or acetone and (2) slightly abrading the skin surface using a dry heavy gauze or similar alternative. Use fresh sensors which have not "dried out" and secure the patient cable firmly to minimize movement and reduce "pull" on the sensors.

With the **5-lead patient cable**, five sensors are used. For short-term monitoring, locate arm sensors near the shoulders, and leg sensors near the lower rib cage. Use a fifth sensor as a precordial or chest sensor, placed at any of the recommended ECG precordial positions. Although other sensor configurations may be used, placement of sensors as described will minimize artifacts and false alarms (see page 27).

With the **3-lead patient cable**, the sensors are generally located to produce a modified Lead II. Select Lead II for the display. Locate the sensors directly over the ribs to minimize artifacts produced by sensor movements.

The patient cable leads should be arranged as close together as possible and follow the body contour. Avoid looping excess lead wires. Rather, twist them together to take up any excess length.

Note: This technique also minimizes line isolation monitor transients which may be present in some environments.

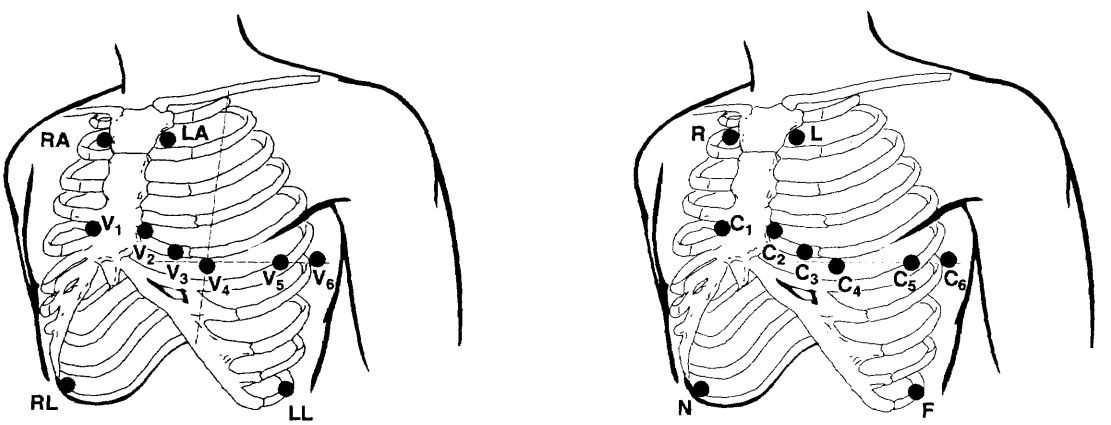
How to Record a Standard 12-Lead ECG

1. Use 5-lead patient cable.
2. Prepare patient's skin and attach 10 sensors to patient at the locations shown on the next page.
3. Select Lead I and press PRINT to record Lead I. After desired length is recorded (at least 6 inches), select Lead II. Follow this procedure for Leads III,aVR, aVL and aVF.
4. Press "STOP" to stop recorder.

5. To record the remaining V(C) Leads:
   a) Attach V(C) Lead-wire to V1(C1) chest sensor
   b) Select "V"("C") on Lead select switches and press PRINT on recorder.
   c) After desired lead length is recorded, press "STOP" and make a note of the appropriate lead designation
   d) Move V lead wire to next chest sensor.
   e) Follow steps b, c, d, for remaining chest sensors.

Annotation will be made of each lead change on the ECG paper. All V(C) leads will be annotated by "CHEST".

Sensor Positions for 12-Lead ECG



V1-	Fourth intercostal space at right margin of sternum.	**-C1**
V2-	Fourth intercostal space at left margin of sternum.	**-C2**
V3-	Midway between 2 and 4.	**-C3**
V4-	Fifth intercostal space at left midclavicular line.	**-C4**
V5-	At horizontal level of position 4, at left anterior axillary line.	**-C5**
V6-	At horizontal level of position 4, at left midaxillary line.	**-C6**
RA-	First intercostal space at right margin of manubrium.	**-R**
LA-	First intercostal space at left margin of manubrium.	**-L**
RL-	On lower right rib.	**-N**
LL-	On lower left rib.	**-F**

Operating the Monitor

The monitor is operable whenever the Energy Select switch is in any position other than STANDBY. The ECG position allows the monitor and chart recorder to operate without enabling the defibrillator functions.

The monitor and alarm functions are controlled via the 5 soft keys located immediately below the monitor display. The labels for these keys appear along the bottom edge of the display.

Menu Summary

MAIN	**FREEZE**	**PADDLES**	**SENSORS**	**SILENCE**
NEXT				
LEAD	**I**	**II**	**III**	**TEST**
NEXT				
LEAD	**aVR**	**aVL**	**aVF**	**CHEST**
NEXT				
GAIN	**2.5**	**5**	**10**	**20**
NEXT				
FILTER	**100Hz**	**25Hz**	**-**	**AC LINE**
NEXT				
ALARMS	**HIGH**	**LOW**	**DEFAULT**	**ON/OFF**
NEXT				
CLOCK	**JAN**	**UP**	**FORMAT**	**ENTER**

Press **NEXT** to return to MAIN menu.

MAIN

The following 4 keys are part of the "MAIN" menu displayed on power up and to which the display returns after 30 seconds if there is no further activity. This menu provides ready access to these functions.

FREEZE Causes the monitor display to hold the data currently displayed. It also starts the recorder in delay mode if it is not already running. Toggles ON/OFF.

PADDLES ECG signal displayed originates from the defibrillator paddle electrodes. This is the power-up default selection.

SENSORS ECG signal displayed originates from the patient cable leads. Use the "LEAD" menu to select the desired lead for monitoring.

SILENCE Silences the Heart Rate alarm for 30 seconds. The alarm will trigger again if the alarm condition persists. This assumes the alarms are enabled.

Selecting the Input Lead for Display

If you select SENSORS from the MAIN menu, the source of the displayed signal may be determined by using the LEAD menus.

LEAD

Used to select a **limb lead** for display.

I Display lead I.

II Display lead II (factory default)

III Display lead III.

Test Displays a flat line centered on the trace.

LEAD

Used to select an **augmented or chest lead** for display.

aVR Display lead aVR.

aVL Display lead aVL.

aVF Display lead aVF.

CHEST Display "V" lead represented by chest electrode position.

The lead selection is annotated on the recording and the monitor display.

Selecting the Amplifier Gain

GAIN Use to set amplifier gain.

2.5	Set gain at 2.5 mm/mV. (x1/4)
5	Set gain at 5 mm/mV. (x1/2)
10	Set gain at 10 mm/mV. (x1) - (factory default)
20	Set gain at 20 mm/mV. (x2)

The gain selection is annotated on the recording and the monitor display.

Gain can affect Heart Rate Indication

If the gain is set too high, as evidenced by a clipping or truncating of the QRS waveform, it is possible that the R and S point could be counted by the detection circuit causing the indicated heart rate to be doubled (twice the actual heart rate of the patient). If the QRS segment appears flattened at the apexes, reduce the gain until the waveform assumes the normal triangular form. This will ensure a correct heart rate indication.

Selecting the Filter

The default frequency response when using a 3- or 5-lead patient cable (SENSORS) is 0.05 - 100Hz. When using the defibrillator paddles (PADDLES) as input, the frequency response is limited to 0.5 - 35Hz. You may engage an artifact/drift filter that limits the frequency to 0.5 - 25Hz.

FILTER Enables selected **ECG filter options** for both displayed and recorder printout waveforms.

100Hz	Turns Artifact/Drift filter OFF (factory default setting)
25Hz	Turns Artifact/Drift filter ON

AC LINE Selects frequency for AC LINE notch filter (sub-menu)

The status of the Artifact/Drift filter is annotated on the recording as FILTER OFF or FILTER (.5 - 25 Hz), and on the monitor as FILTER OFF/FILTER ON.

Note: Use of the 0.5 - 25Hz. filter may result in distortion of the ECG waveform. The filtered ECG should only be used to determine HR and Rhythm.

AC LINE Used to select the desired **line frequency notch filter** menu.

50Hz Use 50 Hz Notch filter.

60Hz Use 60 Hz Notch Filter.

RETURN Return to FILTER menu.

Setting Heart Rate (HR) Alarms

Proper operation of the HR Alarms requires correct Heart Rate detection.

The Heart Rate meter is engaged whenever an ECG signal of sufficient amplitude to trigger the R-wave detector is present. If no R-wave detection is indicated, you should either select another lead, or increase the gain setting. Heart rates of 30 - 300 BPM are indicated. The performance parameters of the Heart Rate meter are disclosed in Appendix B at the back of this publication.

The HR alarms are controlled by the ALARMS menu and the SILENCE key on the MAIN menu.

Four Alarm States

The Alarm Status may be 1 of 4 states. On power up the Alarm Status will default to disabled (OFF).

1. **Alarms Disabled (OFF):**
   You may disable Alarms by using the ALARMS menu. The Alarms OFF condition is indicated by a BELL symbol with a diagonal slash and the absence of the alarm limits display.
2. **Alarms Enabled (ON):**
   You can enable, or arm, Alarms by using the ALARMS menu. Use the same menu to set the upper and lower alarm limits. The Alarms Enabled condition is indicated by a BELL symbol without the slash, followed by the upper/lower alarm limits.

3. **Alarms Triggered:**
The alarms are triggered whenever the alarms are enabled and the measured heart rate is outside the upper or lower limit. The Alarms Triggered condition is indicated visually by a flashing BELL symbol and the corresponding limit. Audibly, it is indicated by a continuous alarm tone. Both visible and audible alarms are latching and continue even if the heart rate returns to within limit values.

   A delayed recording is initiated when an alarm limit is exceeded. The recording will continue until the heart rate is back within the limits, or for 30 seconds, whichever is longer. You may stop it manually at any time. Any recording you make while the alarms are triggered will be annotated with a note indicating "HIGH ALARM" or "LOW ALARM".

4. **Alarm Silence:**

You may "silence" the audible alarm by pressing the SILENCE key on the MAIN menu. The visible alarm will continue flashing. After 30 seconds the alarms will return to the triggered condition if the measured heart rate remains outside the preset limits.

ALARMS Use this menu to control Heart Rate Alarm function.

HIGH	Use to set upper heart rate limit. See HIGH sub menu on next page.
LOW	Use to set lower heart rate limit. See LOW sub menu on next page.
DEFAULT	Use to restore the HIGH and LOW alarm limits to their default values (120 and 50).
ON/OFF	Use to alternately enable/disable heart rate alarms.

HIGH Use to set the upper heart rate limit. The HIGH limit is 300 bpm. The default HIGH limit is 120 bpm.

UP	Increases the heart rate limit by 5 bpm. (between 30 and 100.) and by 10 bpm. (between 100 and 300).
DOWN	Reduces the heart rate limit by 5 bpm. (between 30 and 100.) and by 10 bpm. (between 100 and 300).
RETURN	Return to ALARMS menu.

LOW	Use to set the lower heart rate limit. The LOW limit is 30 bpm. The default LOW limit is 50 bpm.
UP	Increases the heart rate limit by 5 bpm. (between 30 and 100.) and by 10 bpm. (between 100 and 300).
DOWN	Reduces the heart rate limit by 5 bpm. (between 30 and 100.) and by 10 bpm. (between 100 and 300).
RETURN	Press to Return to ALARMS menu.

Note: It is possible for the user to set the HIGH heart rate alarm at the same or lower level than the LOW heart rate alarm. However, it you do this, the heart rate alarm will always sound whenever the alarms are enabled. Both the bell and the high alarm value on the display will flash continuously until either disabled or reset and the printout will show the message "LOW ALARM"

Recording the ECG

Refer to page 11 for identification of recorder controls.

Check that the recording paper is properly loaded.

Establish the source and amplitude of the recorded signal by using the monitor LEAD and GAIN selection menus.

You can record an ECG during paddle monitoring, as well as during patient cable (SENSORS) monitoring.

Select either Real-Time or Delay Mode by pressing PRINT or DELAY keys respectively. An event marker can be inserted into the ECG recording by pressing either the PRINT or DELAY key a **second** time.

Select PRINT mode whenever you want a Real-Time hard copy record of the ECG signals being monitored. A Real-Time recording is started automatically whenever the defibrillator charge cycle is initiated.

Select the DELAY mode to capture any abnormalities of interest which appeared on the monitor within the previous 8 seconds. A delay recording is initiated whenever the "FREEZE" key is pressed or a Heart Rate (HR) alarm is triggered.

Section

4 *Preventive Maintenance*

Routine Maintenance

The Medic 5 has been designed to provide long periods of operation with a minimum of routine maintenance. This section details the routine maintenance which must be carried out by the operator or a qualified hospital technician to ensure a continued high level of performance and safety of operation.

Daily Inspection

In order to ensure the Medic 5 Defibrillator is always ready for use in an emergency, we strongly recommend you adopt a protocol that provides for a routine daily inspection. Such a protocol also enhances operator familiarity with use of the device. Burdick has provided a checklist for your guidance in establishing such a protocol (see information package included with this publication). You may photocopy this checklist or modify it for your institution.

The FDA strongly urges all defibrillator users to incorporate a checklist as a routine part of their daily operations.

Defibrillator Test

The defibrillator should be tested at least once a week. The following test, which may be conducted using either AC line or battery power, proves the operation of the defibrillator, paddles and paddle cables:

1. Ensure a pair of adult external paddles are connected and stored securely in paddle storage area.
2. Set the ENERGY SELECT switch to the 360 Joules position.
3. Press CHARGE on the front panel or APEX paddle.
4. An intermittent tone will sound as the unit charges. When the tone becomes continuous the unit is fully charged. This should occur within 10 seconds.
5. Within 30 seconds (before the energy is automatically dumped), press both DISCHARGE buttons simultaneously. These are located on the end of each paddle.

6. After discharge the display will indicate the Energy Delivered to the internal 50 Ohm test load.
7. The following information will be documented on the recorder strip:
   * Energy selected
   * Energy delivered
   * Time and date

   This recording may be saved for QC records.

If the unit takes more than 10 seconds to charge or indicates a delivered energy of < 324J or > 396J, arrange for the unit to be serviced.

Testing the Battery

Note: Burdick recommends the battery be replaced every 2 years regardless of test results.

The following battery test should be performed once every 3 months:

1. Ensure that the unit has been connected to an AC outlet for a period of at least 16 hours.
2. Unplug the unit from the AC outlet and turn the Energy Select switch to the ECG (monitor) position.
3. Measure the length of time before the unit turns itself OFF.

Note: Low battery indications will occur.

4. If the monitoring time is less than 2-1/2 hours, replace the battery.
5. Connect the unit to an AC outlet and allow it to charge for at least 8 hours before returning it to service.

CAUTION: ***If battery replacement is indicated but cannot be performed immediately, remove the unit from service or label the unit for use on AC power only.***

Replacing the Battery:

To Remove Old Battery: (see illustration page 17)

1. Disconnect the unit from AC line and set ENERGY SELECT switch to STANDBY. Place unit face down.
2. Remove battery storage cover by loosening the thumb screw latch; use a small coin or screw driver if necessary.
3. Disconnect latching connector and remove old battery pack.

Note:

DO NOT PLACE USED BATTERIES IN YOUR REGULAR TRASH!

This sealed lead-acid battery must be collected, recycled or disposed of in an environmentally sound manner.

The incineration, landfilling or mixing of sealed lead-acid batteries with the municipal solid waste stream is PROHIBITED BY LAW in most areas. Return this battery to a federal or state-approved battery recycler. Contact your local waste management officials for other information regarding the environmentally sound collection, recycling and disposal of this battery.

Installing New Battery:

1. Place new battery in the compartment with the battery lead wires to the left.
2. Insert lead wire connector into the mating receptacle in the well to the left of the battery. Make sure the connector snaps into position and is securely latched. Route the lead wires into the space provided.
3. Replace cover and tighten thumbscrew securely.

Charging the Battery

After installing the battery, and before connecting the unit to AC line power, turn the energy select switch to the ECG position. The battery symbol should appear on the display together with the battery charge condition indicator which should show a partial charge (the battery is shipped partially charged). Charge the new battery by connecting the unit to AC line power. The battery is fully charged when the "BATTERY CHARGED" message is displayed. During charging, the "BATTERY CHARGING" message is displayed.

Cleaning the Unit

The Medic 5 case and front panel should be cleaned whenever necessary using the following procedure:

1. Switch the Medic 5 to STANDBY condition and disconnect it from the AC power line.
2. Clean the case and front panel with a soft cloth lightly moistened in warm, soapy water. Pay particular attention to the paddle storage wells and the paddle retaining clips.

DO NOT USE CHEMICALS OR ABRASIVE CLEANERS

Cleaning the Paddles

*CAUTION: **Do not autoclave internal paddle handles! Internal paddle electrodes may be autoclaved after they have been separated from the handles.***

Pay particular attention to the routine care and maintenance of the defibrillator paddles and cables.

Always clean the defibrillator paddles immediately after use with a soft cloth lightly moistened in warm, soapy water. Doing this will prevent a build up of conductive gel on the paddle surfaces which could result in a hazardous conductive path to the user.

Burdick strongly recommends that paddles be cleaned at regular intervals, even if they have not been used.

Cleaning and Disinfecting Patient Cable and Electrodes

To disinfect, wipe the patient cable and the electrodes thoroughly with a swab or soft cloth moistened with a formaldehyde solution such as CIDEX, SONACIDE, LYSOFORM 5% or INCIDIN GG 1.5%. Under no circumstances should you immerse the electrode cables in any type of cleaning fluid, nor should you subject them to hot sterilization with water, steam or air, or to ether sterilization.

Inspection

Check the defibrillator paddles and cables at regular intervals for any sign of damage; cracks, nicks, burn marks, pitting of electrode plates, etc. Replace if necessary.

Section

5 *Technical Description*

Introduction - Purpose

The information contained in this section is provided expressly for the benefit of those users, such as certain hospitals, clinics and other institutions, that have their own in-house biomedical technician support groups.

The preceding Section 4, Preventive Maintenance, describes routine preventive maintenance, testing and cleaning procedures. It also includes instructions for replacing, testing and charging the battery.

This present section contains information restricted to certain first-line basic service procedures that could reasonably be performed by qualified personnel.

If you wish to go beyond this level of maintenance, a comprehensive Service Manual, covering all recommended in-depth service procedures is available upon request from Burdick. However, please read the Notice to Responsible Service Personnel below and pay careful attention to all cautions and warnings in the Service Manual.

Available Documentation

The following documentation is available for this product:

Operating Instructions (supplied with product)

List of Accessories and Supplies (supplied with product)

Service Manual (available upon request)

Notice to Responsible Service Personnel

The contents of this document are not binding. If any significant differences regarding service work between the product and this document are encountered, contact Burdick for confirmation.

We reserve the right to modify products without amending this document or advising the user.

We recommend using authorized Burdick personnel for all service and repairs. We also recommend using only Burdick exchange parts or genuine

spare parts. Burdick will not otherwise assume responsibility for the quality or work performed or for any possible consequences thereof.

This product has been carefully designed and manufactured to a high degree of safety and dependability. However, we can not guarantee against the failure or deterioration of components due to aging and normal wear and tear.

General Description

The Burdick Medic 5 is a portable emergency system that integrates the functions of a defibrillator, monitor and recorder with built-in printout capability. It may be powered from its own rechargeable battery or from an external AC power line.

The controls, displays and operating modes are described in detail in Sections 2 and 3 of this publication.

Safety Considerations

- Unused defibrillator charges are automatically dumped after 30 seconds into an internal load. In addition, the charge will be dumped if the power is switched off or if the unit is returned to ECG or STANDBY setting.
- The defibrillator will not charge if paddles are not connected.
- Defibrillator charge is limited to a maximum of 50 Joules when internal paddles are used.
- Patient inputs are isolated and defibrillator protected.
- An intermittent audio tone sounds when the defibrillator is charging. The tone becomes continuous when full charge is reached.

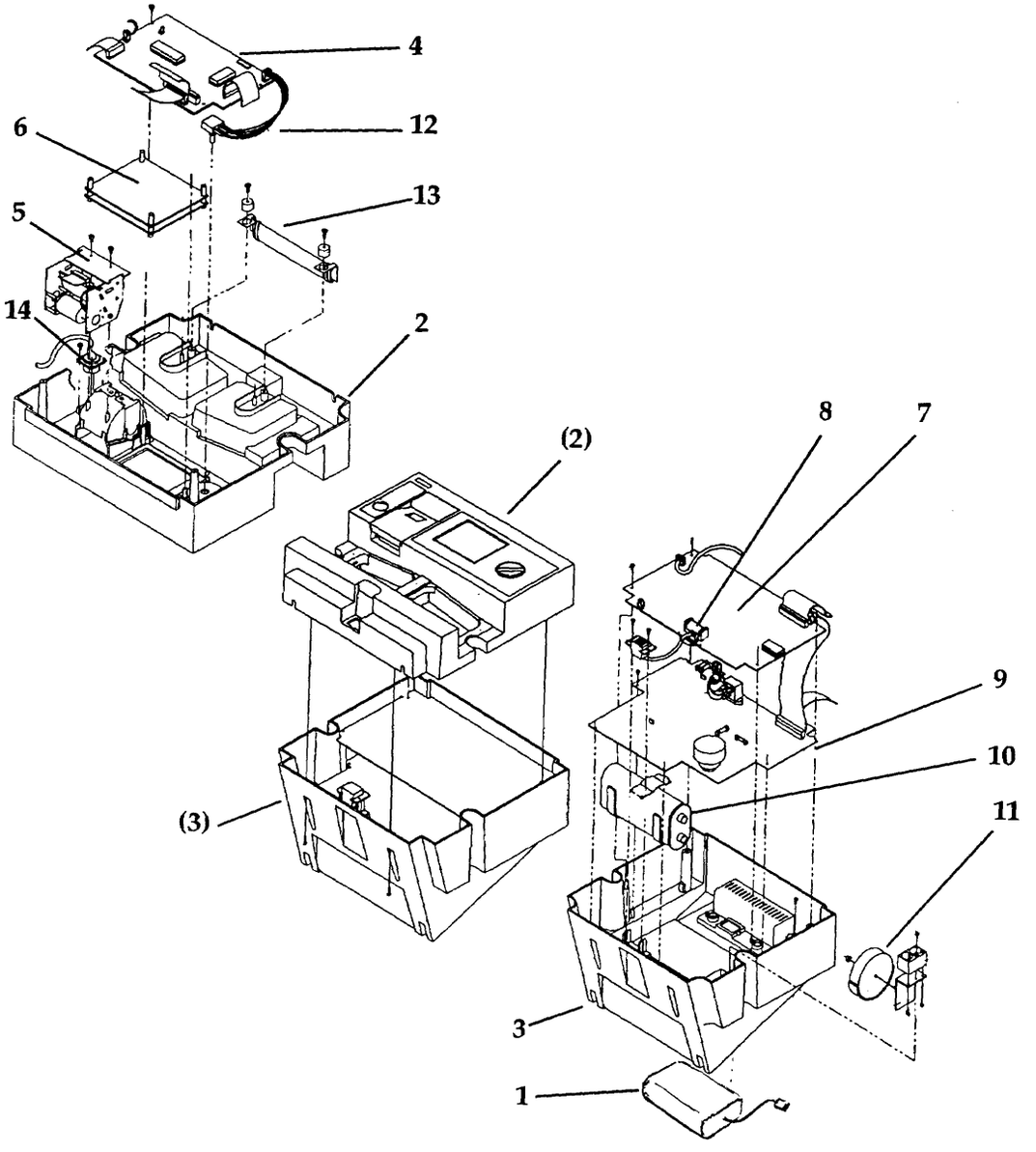
Note: Please read the "Definition of Symbols Used on this Equipment" and the "List of Warnings and Cautions" presented in Section 1, pages 2 and 3 of this publication.

Classification

The Medic 5 is classified as defibrillation-proof Type CF equipment indicated by the symbol:

Basic Design

The Major Sub-Assemblies comprising the Burdick Medic 5 defibrillator are shown and defined in the illustration below.



Medic 5 - Major Sub-Assemblies

1	Battery pack	8	Lithium battery
2	Front enclosure	9	Power supply board
3	Rear enclosure	10	HV storage capacitor
4	Control board	11	Inductor assembly
5	Printer assembly	12	Rotary switch & cable assy
6	Display assembly	13	Resistor - 50 Ohm
7	CPU and R-Wave board	14	Patient cable connector

System Description

The Burdick Medic 5 is a portable emergency system which comprises an integrated defibrillator, monitor and recorder contained within a single housing. It may be powered from either its own internal, rechargeable battery or from an AC power line.

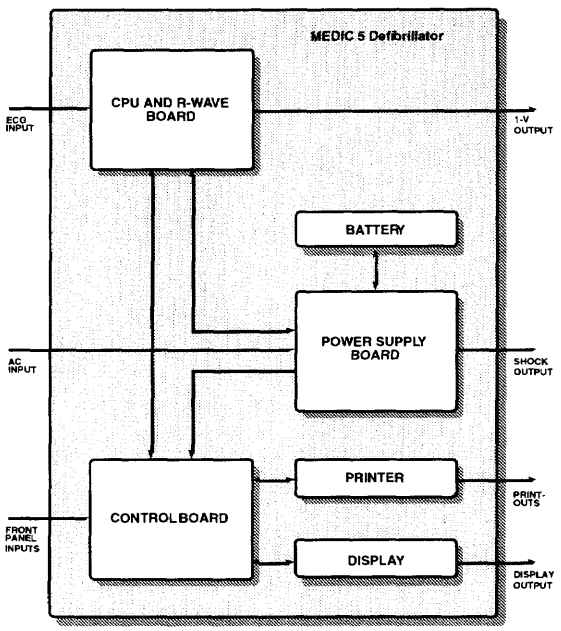
The main circuitry is on three circuit boards: the Power Supply board, the CPU and R-Wave board, and the Control board.

The Power Supply board generates all of the system's power supplies and controls the battery charging function. It also generates and controls the high voltages required for defibrillation.

The CPU and R-Wave board contains the main logic for the system. It acquires and amplifies the ECG signal, detects R-Waves and communicates with the peripheral components to operate the defibrillator.

The control board circuitry controls the thermal array printhead and the liquid crystal display (LCD) associated with the monitor

.



Medic 5 - Basic System Block Diagram

Voltages, Fuses and Leakage Tests

Mains Voltage

The Medic 5 comes configured for operation either on 115V or 230V mains supply.

Fuses

Fuses are mounted internally on the Power Supply board and are not accessible without disassembly. This procedure is covered in the Service Manual and should only be attempted by a qualified technician.

Lithium Back-up Battery

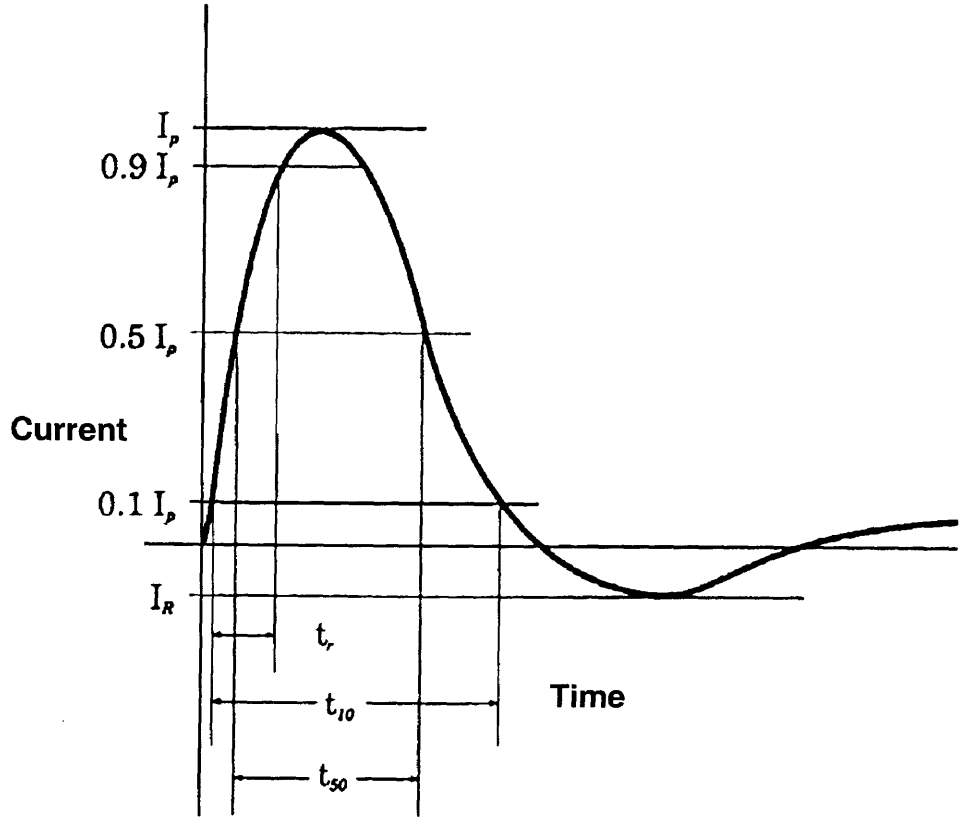
The Medic 5 employs a Lithium Back-up Battery which has a normal service life expectancy of several years. Removal and replacement must be carried out in accordance with your local regulations to avoid the risk of an environmental hazard. This procedure is covered in the Service Manual and should only be attempted by a qualified technician.

Leakage Tests

Recommended procedures for checking chassis and paddle current leakage, and for checking the ground impedance are described in the Service Manual and should only be attempted by a qualified technician.

Discharge Curve

The curve shown below is typical for a 360 Joule discharge. The table gives corresponding waveform parameters for loads of 25, 50 and 100 Ohm.



Sinusoidal Waveform Parameters

Waveform Parameter	Load Resistance		
	25Ω	50Ω	100Ω
I_pA (amps)	78.32	58.5	35.52
I_rA (amps)	5.39	0	0
$t_r$ms (amps)	0.85	0.71	0.50
t_{50}ms	2.99	3.20	4.41
(amps)	4.29	6.27	11.58
t_{10}ms (amps			

Section

6 Appendix

Appendix A - Troubleshooting Guide

Troubleshooting

This section details some of the more common operating problems which may be encountered and the probable causes which should be checked in order to clear the particular problem. If you cannot locate the problem after referring to the tables in this section, refer to the available Service Manual or consult a qualified technician.

General Troubleshooting

PROBLEM	PROBABLE CAUSE
The Medic 5 does not power up	1. Power cable (line cord) not connected, battery discharged 2. Defective power cable (line cord) 3. Internal batteries discharged or not installed properly
Battery charging not indicated when connected to AC outlet	1. Power cable not connected or AC power not available, check LED 2. Battery not properly connected
LOW message displayed after only a short period of operation following a battery charging cycle	1. Internal battery may have reached the end of its useful working life
LOW indicator lights even after a battery charging cycle	1. Internal battery may have reached the end of its useful working life
Display turns on momentarily	1. AC power not plugged in 2. Battery is at end of useful life or totally discharged
AC plugged in, LED fails to light	1. AC cord not connected to unit 2. Blown fuse or defective power supply board

Defibrillator Troubleshooting

PROBLEM	PROBABLE CAUSE
Defibrillator function not working	1. ENERGY SELECT switch set to ECG. Re-set to # of Joules 2. Error message; no paddles
Defibrillator does not charge	1. Paddles are not connected, or are incorrectly connected 2. ENERGY SELECT switch must be set to Joules position
Defibrillator only charges up to 50 Joules at settings >50	1. Internal paddles connected
Defibrillator takes longer than 10 seconds to charge up to 360 Joules	1. Battery level low
Defibrillator does not discharge	1. Defibrillator is still charging 2. Charge has been auto-disarmed 3. Defibrillator in the SYNC mode with ECG GAIN control not correctly set 4. Both paddle buttons not pressed and held at same time 5. In SYNC mode with loose lead
Incorrect Joules Delivered reported during test procedure	1. Paddles not seated correctly in storage 2. Test electrodes dirty 3. Defective paddles or cables
- - - J displayed on monitor after discharge	1. Impedance of patient leads >100 Ohms or <25 Ohms 2. Defective paddles or cables

Recorder Troubleshooting

PROBLEM	PROBABLE CAUSE
No trace	1. Printer is not activated 2. The printer door is not seated properly or idler roller not contacting the paper 3. Dirty printhead
Flatline on the trace	1. ECG GAIN control incorrectly set 2. ECG Lead Select incorrectly set to TEST 3. Defective patient cable 4. Recorder started in Delay Mode within 8 seconds of power-up 5. Using SENSORS but set to PADDLES, or vice-versa

Monitor Troubleshooting

PROBLEM	PROBABLE CAUSE
Flatline on the display trace	1. ECG GAIN control incorrectly set 2. ECG Lead select incorrectly set, or set to TEST 3. Defective patient cable 4. Using SENSORS but set to PADDLES, or vice-versa
Excessively noisy signal	1. Sensor sites not properly prepared 2. Poor sensor/paddle contact 3. Defective patient cable
No Heart Rate Display	1. ECG GAIN control incorrectly set 2. Patient sensors incorrectly placed (change position for a suitable display)
No QRS beep tone	1. QRS VOLUME control set too low 2. ECG GAIN control incorrectly set

Operator Alerts

The following messages may appear on the monitor display during the course of normal operations. An explanation is given for each.

1. **LOOSE LEAD** - One or more patient cable sensors is not securely attached to the patient. A loose chest lead will not cause this message to appear. The waveform that appears on the display and the recorder will be an artifact and will not be a reliable representation of the ECG signal. The heart rate will not be accurate. Any attempt at SYNC mode defibrillation will be inhibited. This message is displayed only when SENSORS is selected.
2. **WARNING: NO PADDLES CONNECTED** - Check paddles to ensure proper connection.
3. **INTERNAL PADDLES** - The Medic 5 senses an internal paddle set attached to the paddle connector. Discharge energy will be limited to 50 Joules.
4. **LOW** - The battery capacity is approaching the level at which the unit will lose power. When this message first appears, 15 minutes of monitoring or up to 5 discharges at 360 Joules remain. Connect the unit to an AC source if immediate use is required. Leave the unit connected to the AC source for at least 8 hours to recharge the battery.

5. **DEFECTIVE BATTERY** - Two possible conditions can cause this message to appear; it appears only during AC operation.
   - *No battery or battery not connected.* Check the battery compartment and the battery connections.
   - *The battery is internally shorted.* Remove the battery immediately and replace. Instructions for this are in Section 4 under "Replacing the Battery". We do not recommend using the Medic 5 without an internal battery.
6. **CHARGING ERROR** - Joule energy stored for a discharge may deviate by more than 20% from the selected value. Discharge is still possible at the user's discretion.

System Errors:

When a SYSTEM ERROR message appears, the defibrillator functions are disabled. Service is required.

7. **SYSTEM ERROR 1** - An apparent short in either the charge or discharge keys has been detected. Holding down the charge or discharge keys when the unit is turned on or holding down the discharge keys while pressing CHARGE can cause this system error. May also be due to a fault in the charging circuit hardware.
8. **SYSTEM ERROR 2** - A fault has occurred in the charging circuits causing excessive charge time.
9. **SYSTEM ERROR 3** - A memory error was detected during operation.
10. If a constant tone is heard when the ENERGY SELECT switch is set to ECG or to a selected energy level and nothing appears on the display, the unit cannot function and requires service.

Appendix B - Heart Rate Meter Performance Disclosure

The following performance parameters are disclosed in accordance with the ANSI/AAMI EC13-1983, American National Standard for Cardiac Monitors, Heart Rate Meters and Alarms.

Tall T-Wave Rejection Capability

The maximum amplitude T-Wave (as defined by AAMI) which will not impact heart rate meter accuracy is 1.4 mV at 10 mm/mV sensitivity.

Heart Rate Averaging

Heart rate averaging is accomplished using the R-R intervals of the previous four QRS complexes, and the display is updated once per second.

Heart Rate Meter Accuracy and Response to Irregular Rhythms

The Heart Rate Meter's response to the four specific irregular rhythm test waveforms stipulated in the AAMI Standard are:

1. Ventricular Bigeminy - indicates 39-40 BPM
2. Slow Alternating Bigeminy - indicates 29-30 BPM variable
3. Rapid Alternating Bigeminy - indicates 60-120 BPM
4. Bi-directional Systoles - indicates 59-60 variable

Response Time of Heart Rate Meter to Change in Heart Rate

For a step increase in heart rate from 80 to 120 BPM, the response time to display a heart rate of at least 105 BPM is less than 4 seconds. For a step decrease from 80 to 40 BPM, the response time to display a heart rate of 55 or less is less than 5 seconds.

Time to Alarm for Tachycardia

For the tachycardia waveforms specified in the AAMI Standard, and with lower and upper alarms set to 60 and 100 respectively, the alarm will sound in the following times:

1/2 Amplitude	less than 5 seconds
Full Amplitude	less than 5 seconds
Double Amplitude	less than 5 seconds

Pacemaker Pulse Rejection Capability

With the waveforms specified by AAMI standards, the Medic 5 heart rate meter will not count pacemaker pulses as R-waves. The performance of the heart rate meter for AAMI-specified waveforms in the presence of AAMI-specified pacemaker pulses is stated below in BPM.

Ventricular Pacemaker Pulse only:

	W/O Overshoot	With Overshoot	Nominal
pacemaker alone	0	0	0
normal paced rhythm	59-60	59-60	60
ineffective pacing	29-30	29-30	30

Section 6 *Appendix*

Section

7 Technical Data

Medic 5 Defibrillator/Monitor Specifications

Defibrillator

Waveform:	damped sinusoidal
Energy Select:	
external:	5, 10, 15, 20, 35, 50, 100, 150, 200, 300, 360 Joules
internal:	5, 10, 15, 20, 35, 50 Joules
Charge Time:	<10 seconds (to 360 Joules)
Ready Signal:	Continuous audio tone; visible indicator
Disarm:	Occurs on selecting ECG, STANDBY or 30 seconds after reaching full charge
Paddles:	Interchangeable between external adult and pediatric, internal and disposable; automatic range limit for internal

ECG Amplifier

Input:	Separate paddle and lead amplifiers Lead amplifier accepts 3- or 5-lead patient cable
Lead Selection:	I, II, III, aVR, aVL, aVF, CHEST
Leakage Current:	less than 20 microamperes - Patient less than 100 microamperes - Chassis
Common mode rejection:>	>85 dB at 60 Hz (lead amp) > 85 dB at 60 Hz (paddle amp)
Freq. response:	0.05-100 Hz (lead amp); 0.5-35 Hz (paddle amp)
Filters:	0.5 - 25 Hz; 50/60 Hz Notch
Gain:	2.5, 5, 10 or 20 mm/mV

Monitor

Size:	5" flat screen; approx. 4 secs of data + alphanumerics
Sweep Speed:	25 mm/sec; trace held by FREEZE key
Annotation:	lead; gain; filter;

Heart Rate Metering

Heart Rate:	30-300 bpm Pacer Pulse enhancement QRS beeper with volume control
Alarms:	High and Low Limits, adjustable over entire range 30-300

Recorder

Type:	Thermal array
Paper Size:	50mm wide, 40mm grid
Paper Speed:	25mm/sec
Annotation:	Date, time, lead, gain, heart rate, filter, auto disarm, energy selected/delivered, low and high alarm

Electrical

AC Input:	115 VAC (99-132 VAC) 230 VAC (207-253 VAC) 50 or 60 Hz
Battery Type:	Sealed lead-acid
Battery Capacity:	2.5 hours monitoring 50 defibrillator discharges maximum
Power Consumption:	Peak current draw: 2.5A (115V); 1.4A (230V);
monitor only:	12 Watts typical
recorder on:	25 Watts typical

Physical

Dimensions:	36 cm (14") wide 34 cm (13.5") high 25 cm (10") deep
Weight:	10.8 kg (23.8 lbs) - includes battery and paper roll

Environmental

Temperature:	0 to 45 C operating -40 to 70 C storage
Humidity:	90% non-condensing
Atmospheric Pressure:	700-1060 hPa Operating 500-1060 hPa Storage
Shock:	Tests performed in accordance with IEC 601 Section 21.6
Vibration:	X-Y orientations performed at 5 to 25 cps with G-force ranging from 0.15 to 4.0

Conforms to Spec:

CSA C22.2, No.125

American National Standard for Cardiac Defibrillator Devices 1989
ANSI / AAMI DF2-1989

American National Standard for Cardiac Monitors, Heart Rate Meters and Alarms
1983 ANSI / AAMI EC13-1983

Burdick, Inc., 500 Burdick Parkway, Deerfield, WI 53531 U.S.A. (608) 764-1919