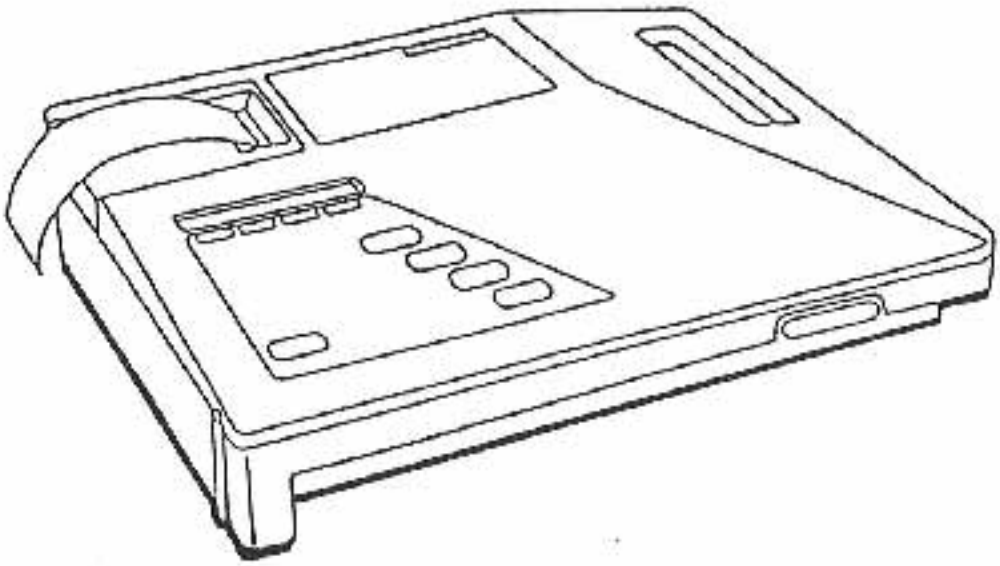
# Operating Instructions



## EK10 Electrocardiograph

Operating Instructions Part No. **086063**
Revised 6-88; Reprinted 7-93

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**EK-10 OPERATOR MANUAL** **CONTENTS**




**P/N 086063**

# SECTION 1

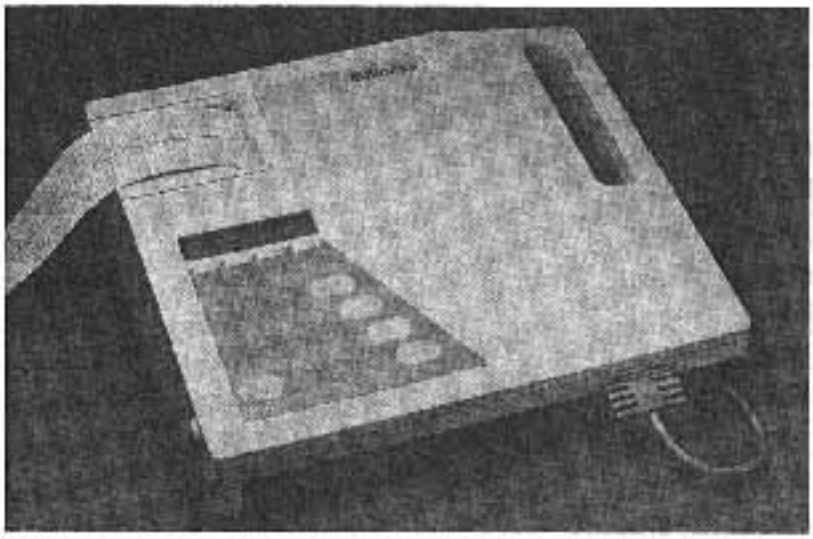


Fig. 1-1 The EK10 Electrocardiograph

## FOREWORD

Your Burdick EK10 Electrocardiograph is designed and manufactured to provide consistently accurate diagnostic records with maximum definition and fidelity. It is intended for use with quality ECG supplies, such as those offered by Burdick. The use of inferior quality supplies may adversely affect the reliability of your electrocardiograph and the electrocardiograms produced by it. The use of quality supplies not to Burdick specifications may also give poor results.

## INSPECTION

Your new Burdick EK10 Electrocardiograph has been thoroughly tested and inspected prior to shipment from the factory. Please inspect your EK10 upon delivery for any damage that may have occured in transit. If any damage is evident,contact the shipping agent and make a concealed damage report promptly. Return warranty card immediately to protect your service warranty. Refer to Section 6 of this manual for terms of the Burdick limited warranty.

Be sure to check the accessories furnished against the list of standard accessories for your unit. Any shortage of parts should be reported to your Burdick dealer, or directly to the Burdick Corporation.

## INTRODUCTION - GENERAL DESCRIPTION

The EK10 is a single channel electrocardiograph with two modes of operation; automatic or manual mode. A battery powered feature is optional.

To ensure maximum patient safety, all ECG leads to the patient are electrically isolated from both the chassis and the power input. The instrument meets or exceeds the frequency response recommendations of the Association for the Advancement of Medical Instrumentation (AAMI) for diagnostic electrocardiographs. It also complies with accepted specifications for patient and operator safety.

When sensors are properly attached to the patient's arms, legs and chest, the EK10 will automatically connect them to the instrument's amplifier in the correct combination and polarity to provide recordings of the standard 12 leads. As each lead segment is printed, it is identified appropriately on the paper trace. Provision is also made to record the ECG manually by activating the appropriate lead select button.

In the automatic mode the EK10 will automatically sequence through the 12 leads in the pre-set format - 1 channel or 3 channel - and stop when complete. For manual operation the operator selects the desired lead group and observes this lead continuously on the writer until a new lead is selected or the acquisition is halted by pressing STOP.

## ACCESSORIES

### Standard Accessories

| Qty. | Part Number | Description |
|---|---|---|
| 1 | 086063 | Operator's Manual |
| 1 | 007035 | ECG Patient Cable (10 lead) |
| 1 | 047864 | Disposable Sensor Starter Kit (100 sensors and 10 clips) |
| 1 | 007958 | Roll Recording Paper - 150ft. (black grid - black trace) |
| 1 | 047262 | AC Power Cord |
| 1 | 007036 | Sample Pack of Pressure Sensitive ECG Mounts (100 of P/N 007037) |

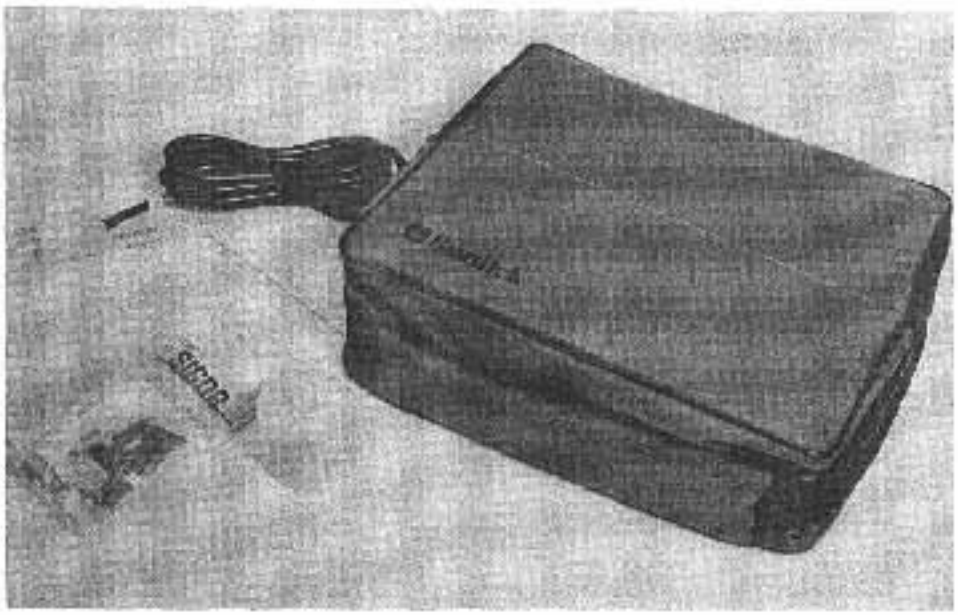


Fig.1-2, Burdick offers many useful accessories for the EK10

**Optional Accessories - Supplies**

| Part Number | Description |
|---|---|
| *007174 | Input Cable, 1V to 1mV |
| *007175 | Output Cable, 1V |
| 007037 | Single Sheet Pressure Sensitive ECG Mounts (100 per box) |
| 007039 | Soft Shell Carrying Case |
| 007176 | Shoulder Strap for Case |
| 007957 | Chemical-Thermal ECG Recording Paper 150 ft. roll (orange grid - black trace) |
| 862278 | Battery Pack |
| 007364 | Welsh Bulbs (6) |
| 007157 | Limb Plates (4) |
| 007158 | Limb Straps |
| 007853 | Lectro-pads (50) |
| 007886 | Liqui-cor (6-oz) |
| 007038 | 5-Lead Patient Cable |

* See page 23 for application.

Contact your Burdick dealer for information on these and other useful accessories.

## SECTION.2

### POWER CONNECTION

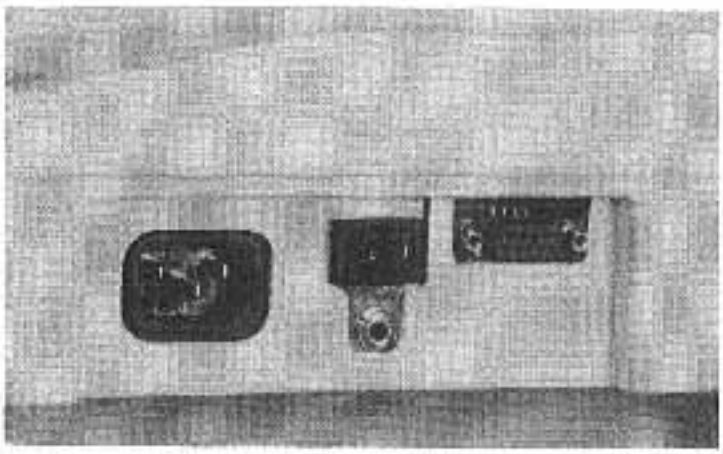


Fig. 2-1, Back Panel of EK10 showing cord receptacle and ON-OFF switch (Note: 1 = ON, O = OFF).

Your EK10 is supplied with a 3-conductor power cable. Connect the cable to the power jack on the back panel of the EK10 and to a properly maintained and grounded electrical wall outlet to automatically ground the unit.

**CAUTION:** The unit must only be operated at the voltage and frequency specified.

### USE OF MULTIPLE ELECTRICAL APPARATUS

If the EK10 is to be connected to a patient who also has other electrically operated devices attached to or close to the body, care must be taken to ensure a safe patient environment. This is particularly important when using cardiac catheters.

The ECG leads are electrically isolated from ground to ensure patient safety. However it is important to ensure that any other equipment in the immediate vicinity is properly grounded - unless it is double insulated - and operated strictly according to manufacturer's instructions. All equipment and wiring should be visually inspected for safety on a regular basis.

### GROUNDING

Maximum patient and operator safety is ensured when the EK10 is properly grounded. This is normally achieved automatically when the 3-conductor power cable is connected as described above under "Power Connection". An auxiliary ground lead is also provided. This may be used to connect a bedframe or a metal table to the grounding jack. This is an effective procedure whenever objectional AC interference is traced to this source. It

can also be used to ground the EK10 in the event of inadequate grounding through the normal electrical supply outlet. In this case make sure the spring clip is connected to make a positive connection to a well-grounded object, such as a cold water pipe. The ground wire plug is designed to accept an additional ground wire should multiple grounding be required.

## ECG PAPER

The chemistry and thermal characteristics of Burdick's ECG paper matches the specification tolerances of the EK10's Thermal Array Print Head. These characteristics ensure the optimum trace quality; not only during AC operation, but more importantly, under the lower power levels of DC operation. The use of non-approved supplies may invalidate your warranty.

**Recommended ECG Papers:**

| Burdick Part Number | Grid - Trace Color |
|---|---|
| 007957 | Chemical-Thermal, Orange-Black |
| 007958 | Chemical-Thermal, Black-Black |

**NOTE:** The Thermal Array Print Head employed in the EK10 is pre-adjusted at the factory for optimum trace performance. There is no provision for operator adjustment.

## CONTROLS - LOCATION & FUNCTION

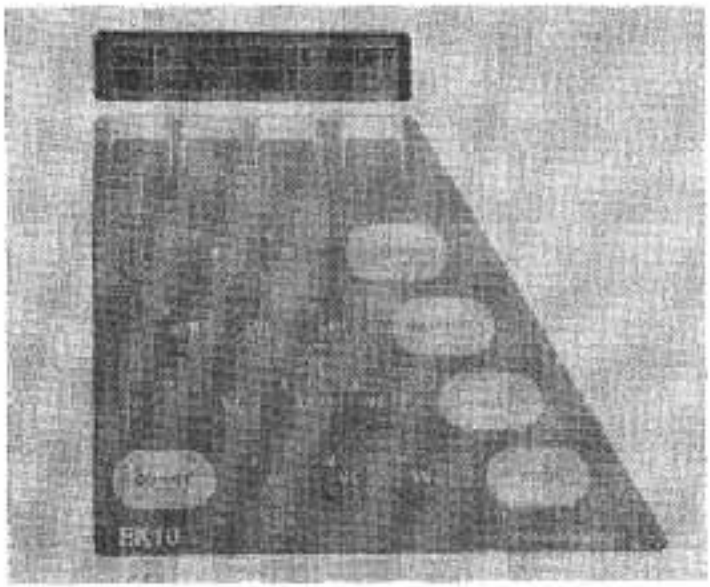



Fig. 2-2. Control Panel with LCD Display (Main Menu)

All the normally used operating controls are integrated into a single "soft-touch" control panel. This feature is combined with advanced solid state circuitry to provide outstanding dependability. The one piece construction effectively keeps the control contacts dust free.

An LCD (Liquid Crystal Display) located directly above the control panel provides a continuous visual indication of the operating parameters selected for any specific ECG recording.

**NOTE:** Use a firm and consistent touch when pressing the control keys. NEVER use a pen or pencil to activate the key pads, otherwise the panel overlay may be irreparably damaged. A short "beep" indicates your input is accepted and the display will change accordingly. A long "beep", however, means the input is NOT accepted; usually because a wrong key is presed.

**INDIVIDUAL CONTROL FUNCTIONS:**

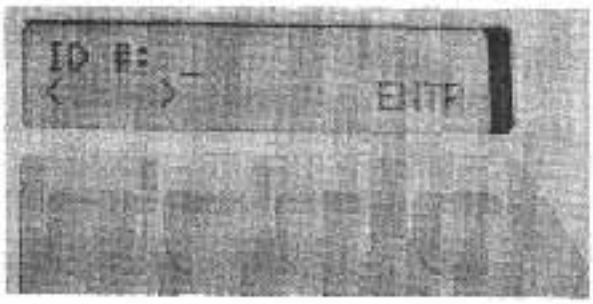
This section describes briefly the purpose and function of each key on the control panel.

| | |
|---|---|
| * ON-OFF or **ON/standby** | Pressing this button will apply power to the instrument. Pressing it again will turn it off. The use of solid state circuitry throughout virtually eliminates warm-up time. |
| AUTO | Selects Automatic ECG Mode of operation. |
| MANUAL | Selects Manual Mode of operation. |
| 1mV | Calibration test signal. Standard 1mV input pulse. |
| STOP | Permits operator to halt acquisition of ECG at any point in manual or automatic mode. |
| ECG LEAD MANUAL SELECTORS | On the EK10 these twelve buttons serve the same function as the rotary lead selector switch employed on earlier models such as the EK8. They are marked in the same fashion: I, II, III, aVR, aVL, aVF, V1, V2, V3, V4, V5, V6, and are primarily used to select individual ECG leads while operating in Manual Mode. |

| | |
|---|---|
| NUMERIC VALUE INPUTS | The same array of buttons used for lead selection also has a second numeric value indication at the top left-hand corner of each button. These are in sequence 1 thru 9 and 0; used for entering the patient ID number on the LCD display. This information is then annotated on any subsequent ECG recordings. |
| M,P, | Used to select main menu "M" or previously selected menu "P" for review on the LCD (Liquid Crystal Display). |
| LCD SOFT KEYS | Four unmarked buttons are located directly below the LCD. These relate to the adjacent function of whatever menu is being presented in the LCD display (see Fig. 2-3) and may be used to select or modify the appropriate function. |

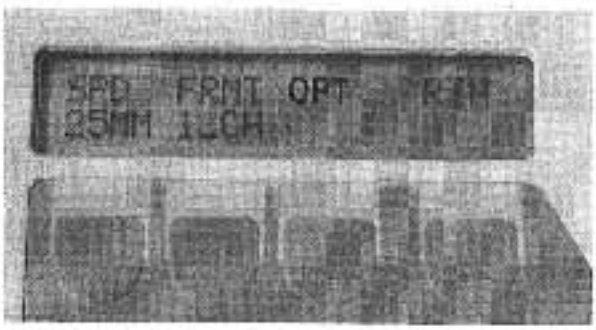
***NOTE: On later models the ON-OFF key is designated as ON/standby**


a) Main Menu




b) ID Menu

c) AMP Menu




d) WRT Menu

Fig. 2-3, Primary LCD Displays

## SECTION 3

### OPERATING MODES

The EK10 provides for two modes of operation; Automatic and Manual. Instructions for preparation and operation in both modes are given.

### SUGGESTIONS FOR FIRST TIME OPERATION

**NOTE:** If your instrument is equipped with the optional battery pack, you must first fully charge the batteries before attempting to use the EK10 on battery power alone (DC operation). You can, however, operate it at any time in the AC power mode, even with batteries discharged. Instructions for initial set up and charging batteries are on pages 17 and 18 of this publication.

Before using your new EK10 on a patient, it is advisable to first operate the unit and familiarize yourself with the controls and sequence of operation. This will also afford an opportunity to check the EK10 for proper operation. During this dry run, the patient cable will not be connected, so you will not get any valid ECG recording, only a random trace. The lead code markings and any ID code selected by the operator will be recorded on the paper. The presence and proper appearance of these markings generally indicates correct functioning of the instrument and valid ECG traces will be recorded when the patient cable and appropriate sensors are subsequently connected to a patient.

Pay particular attention to the pre-set parameters and how to set them properly (see Pre-set Parameters-Description and Input Instructions). The sequences indicated can be practiced in either the AC or DC (battery power) mode of operation. Then you are ready to try a dry run. Go through the procedure in both AUTO and MANUAL modes.

### PAPER LOADING

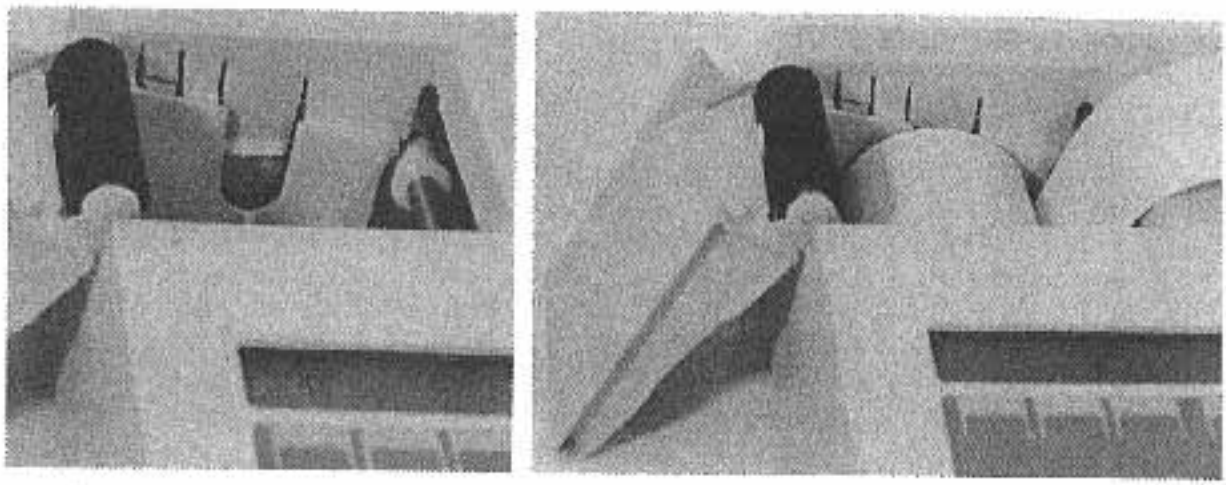
Loading your EK10 is a simple three-step operation.

**NOTE:** Check that the ECG paper is the correct type for use in your EK10 to ensure optimum trace quality.

1. Remove the top cover from the paper compartment by placing a finger in the slot provided and lifting gently; if necessary, remove the empty spool.

2. Grasp the free end of the paper and insert the roll into the paper holder as shown in Fig. 3-1.

3. While holding the end of the paper, replace the cover and snap into position.



a) Cover and Feed Roll Removed b) Inserting New Roll

Fig. 3-1, Loading ECG Paper

## ROUTINE OPERATING PROCEDURE

### THE PATIENT ENVIRONMENT

With the EK10's extreme sensitivity, the minute voltages of the heart can be recorded precisely, providing accurate information on which to base the diagnosis.

**NOTE:** Since the electrocardiograph picks up the minute voltages readily, the same unit will also tend to register any artifacts that may be present, such as muscle tremors and AC. These artifacts, if present, can usually be eliminated or minimized by carefully reading and following the instructions given in this manual.

### LOCATION

Locate the Electrocardiograph and the patient as far removed as possible from extraneous equipment cords, building electrical wiring, and any other likely source of electrical interference.

# LEAD ARRANGEMENT AND CODING

## STANDARD LIMB LEADS

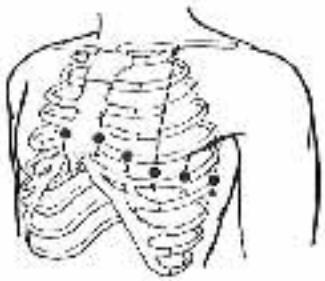
| LEAD | SENSORS CONNECTED | CODE COLOR | |
|---|---|---|---|
| | | | BODY |
| LEAD 1 | LA and RA | RL | GREEN |
| LEAD 2 | LL and RA | LL | RED |
| LEAD 3 | LL and LA | RA | WHITE |
| | | LA | BLACK |

## AUGMENTED LIMB LEADS

| LEAD | SENSORS CONNECTED | CODE COLOR | |
|---|---|---|---|
| | | | BODY |
| aVR | RA and (LA-LL) | RL | GREEN |
| aVL | LA and (RA-LL) | LL | RED |
| aVF | LL and (RA-LA) | RA | WHITE |
| | | LA | BLACK |

## CHEST LEADS

| LEAD | SENSORS CONNECTED | CODE COLOR | | |
|---|---|---|---|---|
| | | | BODY | INSERT |
| $V_1$ | $V_1$ and (LA-RA-LL) | $V_1$ | BROWN | RED |
| $V_2$ | $V_2$ and (LA-RA-LL) | $V_2$ | BROWN | YELLOW |
| $V_3$ | $V_3$ and (LA-RA-LL) | $V_3$ | BROWN | GREEN |
| $V_4$ | $V_4$ and (LA-RA-LL) | $V_4$ | BROWN | BLUE |
| $V_5$ | $V_5$ and (LA-RA-LL) | $V_5$ | BROWN | ORANGE |
| $V_6$ | $V_6$ and (LA-RA-LL) | $V_6$ | BROWN | VIOLET |



$V_1$ Fourth intercostal space at right margin of sternum
$V_2$ Fourth intercostal space at left margin of sternum
$V_3$ Midway between position 2 and position 4
$V_4$ Fifth intercostal space at junction of left midclavicular line
$V_5$ At horizontal level of position 4 at left anterior axillary line
$V_6$ At horizontal level of position 4 at left midaxillary line

Fig. 3-2

## PATIENT PREPARATION

A high quality ECG is more readily obtained from a patient who is relaxed both mentally and physically. Assure your patient that there is no danger or pain involved in the procedure. Explain that his/her full cooperation will assist in the production of a valuable diagnostic record.

Make your patient comfortable on a cot, small bed, or a well-padded table large enough to support both arms and legs and allow for complete relaxation. Support the patient's head with a pillow. Avoid discomfort by protecting the patient from cold, drafts and any other disturbing factors.

## SENSORS

The disposable sensors included in the accessory package that came with your EK10 Electrocardiograph are designed to be used with this instrument. Never mix sensors with those of another manufacturer or mix reuseable and disposable sensors. This can result in considerable baseline drifting or blocking.

**Reuseable Sensors (Welsh Bulbs - Limb Plates)**

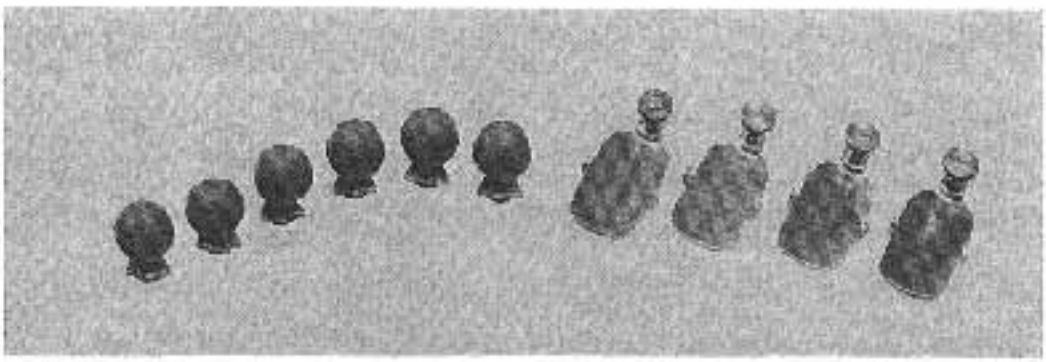


Fig. 3-3, Reusable Type Sensors

For dependable performance, sensors must be kept clean. They should be washed after each use and scoured frequently with a non-abrasive kitchen cleanser. Never use a metallic pad to clean the electrodes. Excessive corrosion or accumulation of sensor paste causes drifting or blocking and impairs the quality of the ECG. Replace corroded sensors.

**Electrolyte (for reusable sensors only - see also Fig. 3-5)**

Burdick strongly recommends the use of *Liqui-Cor* and *Lectro-Pads* as electrolytes. Both provide excellent conductivity between skin and sensor; both are hypoallergenic, non- abrasive and water soluble for quick and easy clean up.

Liqui-Cor applies easily from a convenient flip-spout squeeze bottle. Its wetting action effectively penetrates skin oils.

Lectro-Pads are thin pads, slightly larger than the limb sensors. Thoroughly impregnated with a non-irritating electrolyte, Lectro-Pads stay moist for a long time, do not soil clothing, and save preparation and clean up time. Lectro-Pads come in convenient 5-pad packages. When using four limb plates and Welsh bulb sensors, the fifth pad can be used to "prep" the V lead area of the patient.

Wipe the sensors clean after each use. Preferably they should be washed after each use and scoured frequently with a good kitchen cleanser. Observance of this practice avoids the risk of baseline drifting caused by corrosion or excessive accumulation of electrolyte.

**Disposable Sensors**

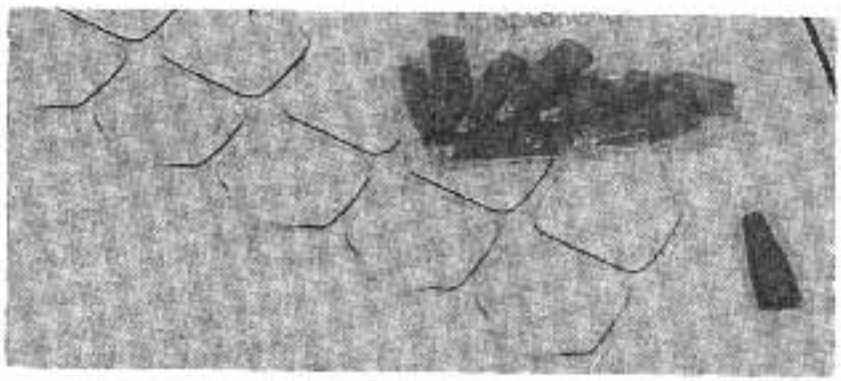


Fig. 3-4, Disposable Sensors

Burdick's disposable Sensors are time-saving problem solvers. They are an affordable, efficient alternative to bulbs, plates, straps, creams and gels. These disposable sensors utilize a highly conductive natural adhesive and offer a cost-effective medium for quick, stable and reliable ECG signals.

## SENSOR APPLICATION

### LIMB SENSORS

**Reusable Limb Plates**

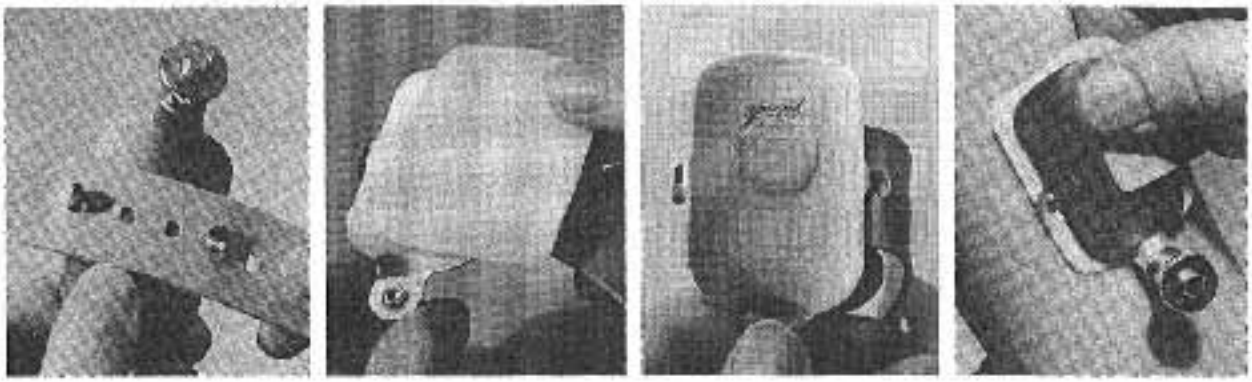


Fig. 3-5, Applying Reusable Limb Plates

1. Expose the arms, legs and chest.
2. Connect sensor straps to the ears of the electrodes.
3. Place a Burdick Lectro-Pad on each sensor.
4. The pad extends slightly beyond the edge of the sensor. Firmly stroke the area to which you apply the sensor with this overlapping edge. This action squeezes a little electrolyte from pad to help clean and "prep" the skin.
5. If using paste, apply a small amount as shown in Fig. 3-5, and spread it evenly over the sensor surface. Apply the same amount to each sensor
6. Locate the sensors on a smooth fleshy part of the upper arm. Position each sensor so that it will not press against the body, table or bed when the patient is relaxed. Placing the sensor on the upper arm will minimize muscle tremor artifacts. Clean the area with an alcohol swab if the skin is oily.
7. Using the method illustrated above, attach the leg sensors in a similar fashion on a fleshy part of the lower leg; but not over the tibia.or near the ankle.
8. Connect the appropriate patient cable limb leads to the sensors.

## CHEST SENSOR APPLICATION

### Welsh Bulb Sensors

1. Connect the six self-retaining sensors to the appropriate V- 1 through V- 6 leads on the patient cable.

2. Locate the position of the six leads on the patient's chest; refer to Fig.3-2, Lead Arrangement & Coding. Apply a small amount of Liqui-Cor electrolyte, using the same quantity at each sensor. A tongue depressor is ideal to spread the electrolyte evenly on the skin at each site.

3. Apply the sensors. The rubber bulb is squeezed and the sensor applied firmly. Only a small dimple should remain in the bulb when released.

4. Check that the leads conform to body contours and that there is no strain imposed on any of the sensors. Excess lead wire should lie flat on the patient, not coiled.

**NOTE:** For very hairy patients, any one of the following three successful techniques may be employed to ensure good contact and adhesion of the electrodes.

a) Spread the hair between thumb and forefinger; apply the sensor to the exposed skin.

b) Use a water dampened towelette to moisten the skin area to enhance the adhesive tack prior to applying the sensor.

c) If methods a) and b) do not work, shaving may be necessary. In any case the sensor may be reapplied to the shaved area without significant loss of tack.

## DISPOSABLE SENSORS - APPLICATION

1. Remove individual sensors from the package liner card and position on the patient.

2. First apply the limb position sensors, preferably locating them on the inside and generally hairless areas of the arms and legs.

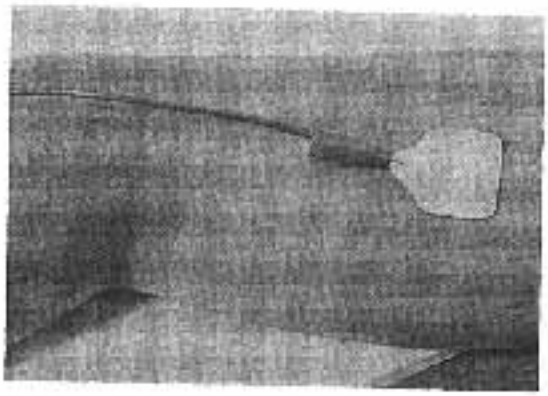


Fig. 3-6. Disposable Sensor Applied to Limb

**NOTE:** For very hairy patients, any one of the following techniques may be employed to ensure good contact and adhesion of the electrodes.

a) Spread the hair between thumb and forefinger; apply the sensor to the exposed skin.

b) Use a water dampened towelette to moisten the skin area to enhance the adhesive tack prior to applying the sensor.

c) If methods a) and b) do not work, shaving may be necessary. In any case the sensor may be reapplied to the shaved area without significant loss of tack.

3. Next apply the sensors to the chest area (V-1 through V-6 positions) - refer to Fig. 3-2.

4. Attach alligator adapter clips to the apex of each sensor.

5. At this time perform any other preparatory tasks to allow the patient a short time to relax and also to give the recorder-sensor system time to stabilize

6. When the ECG record is completed, simply remove and discard the sensors. There is no clean up.

**SETTING-UP EQUIPMENT**

Your Burdick EK10 will perform the stated operations in this manual in either AC or DC mode (battery operation).

**AC Operation**

The following sequence of steps is required for AC operation:

a) Connect AC cord to EK10.

b) Plug AC cord into suitable grounded outlet.

**CAUTION:** The unit must only be operated on the voltage and frequency specified.

c) Set main power switch on rear of EK10 to ON position.

**IMPORTANT:** Ensure main switch on the back of the unit is ON for AC operation (I position depressed). If it is set inadvertently in the OFF position you will be operating on battery power only; prolonged usage in this mode will drain the batteries.

d) Press ON-OFF (standby) keypad on main control panel to ON.

e) EK10 will now display MAIN menu and is ready for operation.

**DC (battery) Operation** - with optional battery pack

**NOTE:** Since the battery is shipped in an uncharged state, for first time operation the battery must be charged (see "Charging Batteries" on the following page) before attempting to operate the Elite on battery power.

The following sequence of steps is required for DC operation:

a) Set main power switch on rear of EK10 to OFF (O) position.

b) The instrument will now power up on DC (battery power) when ON-OFF(standby) keypad is pressed to ON.

c) If battery power is sufficient for sustained operation, the EK10 will display MAIN menu and is ready to be used.

d) The EK10 will display "LB" (Low Battery) on the MAIN menu if battery charge level is insufficient to allow at least 15 minutes of continuous operation.

**NOTE:** Should the ON-OFF (standby) keypad remain ON with no further input from the operator, built-in circuitry will automatically switch the EK10 to the OFF (standby) condition after a period of 15 minutes. This feature prevents excessive battery drain in the event of a delay in acquiring ECGs.

**Charging Batteries**

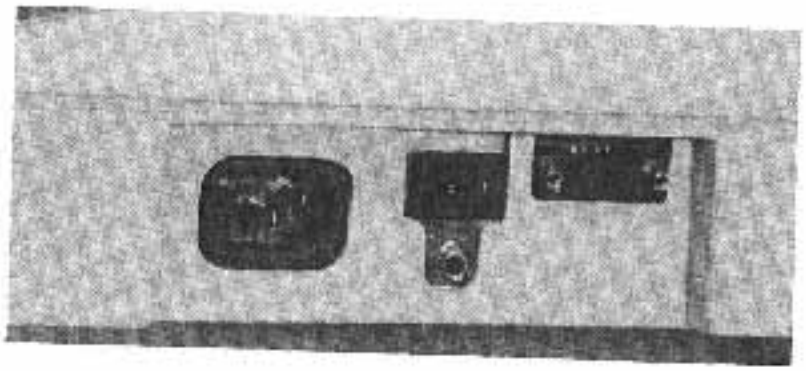


Fig. 3-7. Main Switch must be ON (I depressed) to recharge battery.

The EK10 is in a permanent charge mode whenever it is plugged in to a suitable wall outlet with the main switch in the ON position (normal AC operating condition). The instrument is equipped with a nickel-cadmium rechargeable battery and control circuitry which prevents "over charge" situations.

When fully charged the batteries have sufficient power to permit up to one (1) hour of continuous full-power operation including printing, or approximately 50 ECG recordings in AUTO mode under normal conditions. Typically, the EK10 will require about 15 hours to fully recharge. However, it can still be used in AC mode, without affecting the recharge time.

To ensure maximum battery life, the batteries should be allowed to cycle (discharge) occasionally, until the **LB** (Low Battery) warning is displayed. If not subject to heavy battery use, once every six months is sufficient. Do not attempt to discharge the battery completely; this could result in irreversible damage and may invalidate the warranty. Never remove the battery and attempt to recharge it by means of a conventional battery charger.

**ESTABLISHING OPERATING PARAMETERS**

The following operating parameters typically do not change on a patient-to-patient or day-to-day basis. Consequently, they may conveniently be pre-set into your EK-10 by using the four soft keys adjacent to the LCD display. They will then be applied to every ECG taken subsequently until the parameters are modified by the operator.

**PRE-SET PARAMETERS** (Description and Input Instructions)

*Limb Lead Gain:* Controls the amplitude of the ECG recording from the Limb Leads only.

**Limb Setting Options:**

**L = xH** A 1mV patient input will be displayed as 0.5 cm. deflection on the recording, a gain of 1/2.

**L = x1** A 1mV patient input will be displayed as a 1.0 cm. deflection on the recording, a gain of 1.

**L = x2** A 1mV patient input will be displayed as a 2.0 cm. deflection on the recording, a gain of 2.

*Chest Lead Gain:* Controls the amplitude of the ECG recording from the chest leads only.

**Chest Lead Options:**

**C = xH** A 1mV patient input will be displayed as 0.5 cm. deflection on the recording, a gain of 1/2.

**C = x1** A 1mV patient input will be displayed as a 1.0 cm. deflection on the recording, a gain of 1.

**Filter:**

The EK10 offers the option of generating ECG recordings through either a filtered or unfiltered frequency response. Filtered mode has 30Hz, 3dB response; unfiltered mode meets or exceeds AAMI Standard for Diagnostic Electrocardiographic Devices (unfiltered).

**Writer Speed:**

This controls the rate at which the paper passes across the print head. Available speeds are 25 or 50 mm. per second.

**Writer Format:**

The EK10 can record the ECG in either a 1-channel or a simulated 3-channel format. In either case all leads are clearly identified above each individual lead trace. Special pressure-sensitive mounts, Burdick part number 007037, are available for use with the 3-channel format

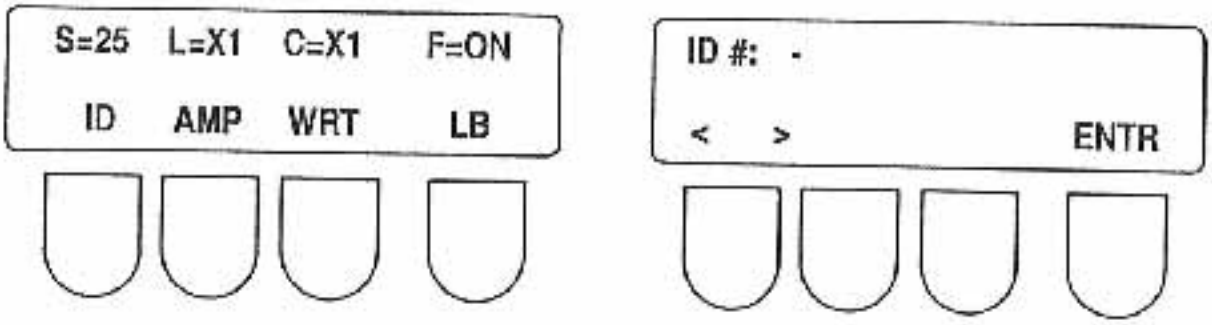
**Lead Sequencing per Format:**

1- Channel: I, II, III, aVR, aVL, aVF, V1, V2, V3, V4, V5, V6.

3- Channel: I, aVR, V1, V4, ... II, aVL, V2, V5, ...III, aVF, V3, V6.

**Note:** Each individual lead recording normally represents 2.5 seconds of cardiac activity in the automatic mode.

**INPUT INSTRUCTIONS:**




a) MAIN menu b) ID menu

Fig. 3-8. LCD Displays

The following sequence leads the operator through the function of each control key. The effect of pressing each key on the LCD display above the control panel and/or the EK10's memory is stated in the second column.

| Control Key Sequence | Display and Effect |
|---|---|
| ON | Main power is on. Main menu displayed (ID. AMP. WRT. - ) |
| ID | Press soft key under ID on display. ID menu will now be displayed. Enter the patient ID #, up to 12 characters, by pressing appropriate number keys and cursor keys (below arrows) to insert spaces or move numerals. Press key under ENTR to enter ID # into memory. Display will return to MAIN menu. (ID. AMP. WRT.) |
| AMP | Press AMP; Amplifier menu now shown. |

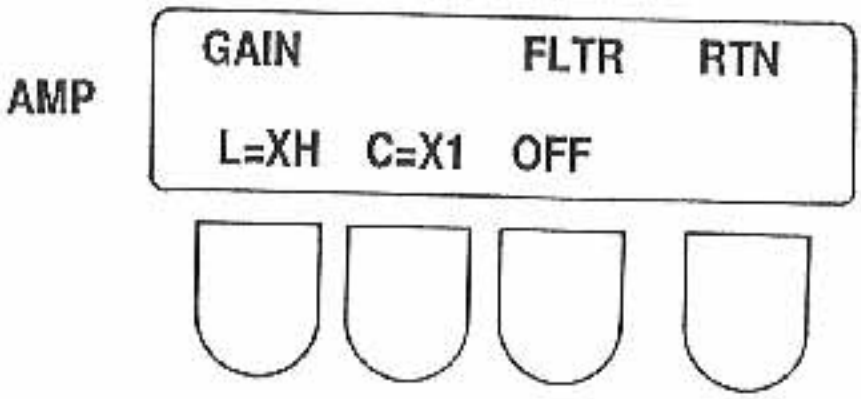



Fig. 3-9, Amplifier (AMP) Menu Display

| | |
|---|---|
| L Key | Change Limb Lead Gain to H (1/2), 1, or 2 by pressing key below L. |
| C Key | Change Chest Lead Gain to H (1/2), or 1 by pressing key below C. |
| ON-OFF Key | Change Filter setting to ON or OFF by pressing key below ON. |
| RTN Key | Press key under RTN to return display to MAIN menu ( ID, AMP, WRT ). |
| WRT Key | Writer menu is displayed on LCD panel. |

**WARNING: If any of the messages shown below should appear on the LCD display, contact your dealer or authorized Burdick service representative for service.**

**ROM CHECKSUM ERROR**
**SERVICE NEEDED**

**RAM CHECK ERROR**
**SERVICE NEEDED**

**LO PRINTHEAD RESIST**
**SERVICE NEEDED**

**HI PRINTHEAD RESIST**
**SERVICE NEEDED**

**P. H. STROBE ERROR**
**SERVICE NEEDED**

**NOTE: Features printed in Bold Type on this page are available only or units commencing with Serial No.32001.**

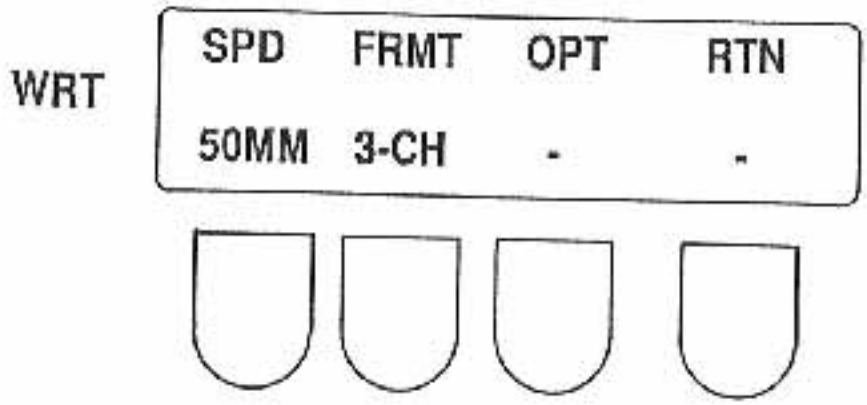



Fig. 3-10. Writer (WRT) Menu Display

SPD Key — Select 25mm/sec., or 50mm/sec.

FRMT Key — Select 1-channel or 3-channel.

**OPT Key** — **Press OPT key to proceed to Option (OPT) menu.**

RTN Key — Press RTN key to return display to MAIN menu.

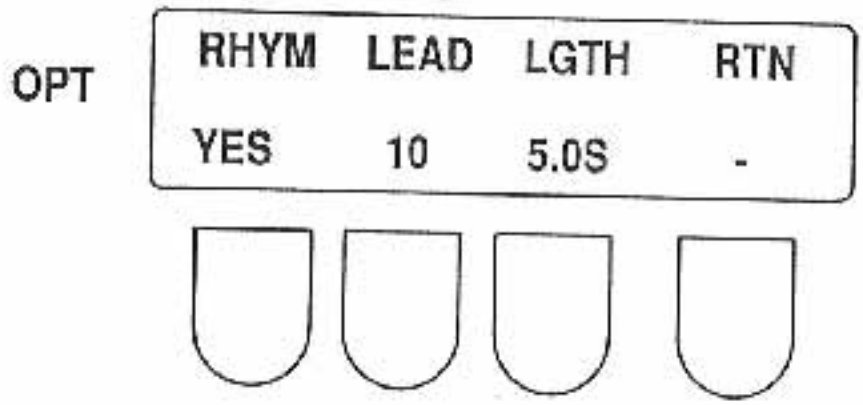



**Fig. 3-10A. Option (OPT) Menu Display**

NOTE: Features on this page are available only on units commencing with Serial No. 32001.

| | |
|---|---|
| **RHYM Key** | **Select YES or NO for Rhythm Strip recording.** |
| **LEAD Key** | **Select 10 or 5 lead for appropriate patient cable.** |
| **LGTH Key** | **Select 5.0 sec. or 2.5 sec. for preferred length of Rhythm Strip recording.** |
| **RTN Key** | **Press RTN key to return to Writer menu.** |

CAUTION: Actual Patient Cable used must correspond with that selected by the LEAD KEY to ensure the proper V-lead designation on the ECG recording.

## 1-VOLT PER CENTIMETER OUTPUT:

**A 1 Volt output is available at the 9-pin D-Type connector located on the back of the unit. The output is approximately 1 Volt per millivolt input to the patient connector. The ECG signal available at the 1 Volt output jack will be whatever lead has been selected at the keyboard. This output will be active in either auto or manual mode and will always be filtered to appproximately 30Hz regardless of the filter position selected.**

**The 1 Volt output utilizes the 9-pin connector J1, with Pin 1 signal, Pin 7 ground. This output may be used for camera gating purposes or connected to a monitor directly. A connecting cable, Burdick Part Number 007175, with a matching 9-pin connector on one end is available as an optional accessory. No connector is furnished on the other end; the user may attach any style of connector compatible with whatever accessory equipment is being used.**

**A 1V to 1mV input cable, Part Number 007174, with a 15-pin connector on one end which mates with the patient cable connector of the EK10, is also available as an option.**

**Specification:**

| | |
|---|---|
| **Gain** | **± 10%** |
| **Frequency Response** | **No less than 30Hz** |

**Accessory Cables:**

| | |
|---|---|
| **007174** | **Input cable, 1V to 1mv.** |
| **007175** | **Output cable, 1V.** |

## RECORDING A 12-LEAD ECG (Automatic Mode)

This sequence is used to record a 12-lead ECG, operating the EK10 in the **AUTO** (Automatic) Mode.

| Control Key Sequence | Display and Effect |
|---|---|
| ON Key | Power is on. MAIN menu is displayed (ID, AMP, WRT) |
| ID Key | Patient Identification (ID) menu is displayed. Enter up to 12 characters. |

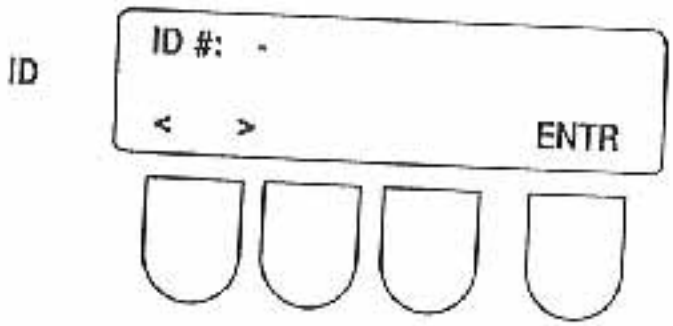



Fig. 3-11, Patient Identification (ID) Menu

| | |
|---|---|
| < | The soft key below this symbol moves the display cursor one space to left. |
| > | The soft key below this symbol moves the display cursor one space to right. |

Using the above two keys and the appropriate numerical keys on the main keyboard (numbers in top left hand corner of each key), enter the full patient ID number. You may use up to twelve (12) characters. Review for accuracy.

| | |
|---|---|
| ENTR Key | Patient ID number as shown on display is now entered into memory and will be imprinted on the ECG. Display returns to MAIN menu. (ID, AMP, WRT) |

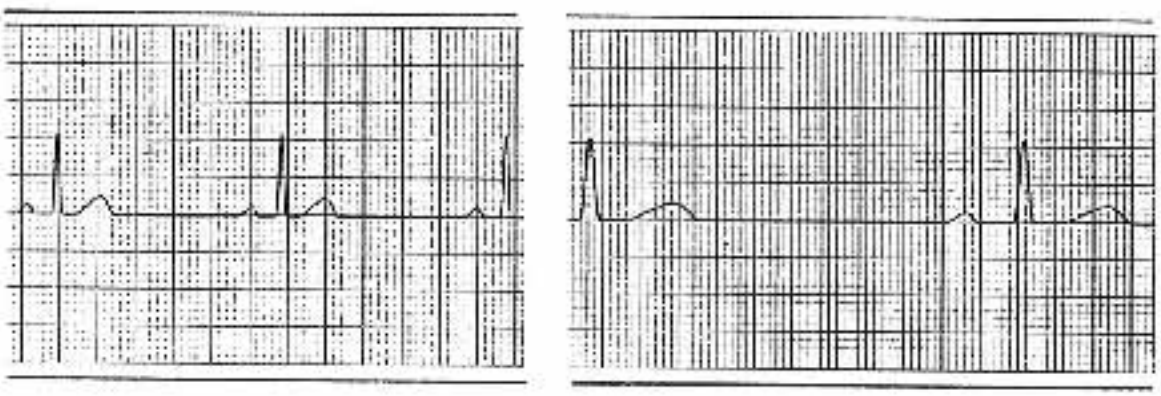
| | |
|---|---|
| AUTO Key | Press AUTO key to initiate ECG recording. The EK10 will automatically go into the lead sequence as selected in Format (1-Channel or 3-Channel). The instrument will stop when the requested format has been printed. The STOP key may also be used to halt the acquisition at any time. |

**RECORDING AN ECG IN MANUAL MODE**

When a manual ECG is required, the operator must review the pre-set parameters; gain, filter, writer speed and format, just as in the AUTO mode.

The EK10 is then ready to print an ECG from any lead as selected by the operator. Initiate the desired sequence by pressing the MANUAL key then the appropriate key for each lead as required. The leads and the pre-set gains will be indicated on the printout automatically. The duration of each individual lead trace will depend on the elapsed time between pressing each lead key. A calibration pulse may be recorded on any trace by pressing the 1mV key.

To terminate the ECG record from any lead, or when the sequence is completed to the operator's satisfaction, simply press the STOP key.



a) ECG at 25mm./sec. b) ECG at 50mm./sec.

Fig. 3-12, Comparative ECG Traces

**NOTE:** The majority of ECGs are recorded at a standard paper speed of 25 mm. per sec., which produces a satisfactory and readable trace in most cases. However it is sometimes difficult to measure the duration of certain types of waveforms, complexes and intervals. The novice technician will soon learn to recognize the individual leads that require the higher paper speed to expand the trace in order to ensure better readability.

Your Burdick EK10 offers a higher 50 mm. per sec. paper speed for just such cases so that the operator may adjust the parameters accordingly.

## ARTIFACTS - CAUSE AND RECOGNITION

Improper technique is a common cause of poor ECG records, resulting in artifacts and defects that interfere with the interpretation. The more common artifacts are caused by patient movement, muscle tremor, improperly affixed sensors, or electrical interference (AC).

### Patient Movement

Patient movement can cause abnormal trace deflections ranging from irregular vibration in frequency and amplitude due to muscular contraction or tremor, to major shifts in the baseline caused by body or sensor movement. The figure below is typical of this type of artifact.

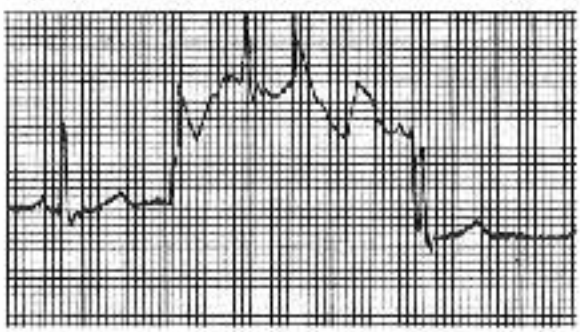


Fig. 3-13, Artifact - Somatic Tremor and Patient Movement

To minimize this type of artifact it is necessary to gain the patient's full cooperation. This may require no more than a simple explanation of why it is necessary to relax; or it may require a larger or more

comfortable bed. In some cases somatic tremor may be unavoidable, but its effects may be minimized by having the patient place his/her hands under the buttocks.

**Improperly Installed Sensors**

An example of baseline shift caused by loose sensors is shown below. If the baseline does not come to rest near the center of the paper within half a minute of first attempting to record that particular lead, check the sensor to ensure that it is properly applied. A baseline jump occuring when the lead is switched during an R or T wave is unavoidable. The trace will return to normal in a few seconds. If baseline drift occurs -shifting up and down -it is due to either patient respiration or corroded sensors.

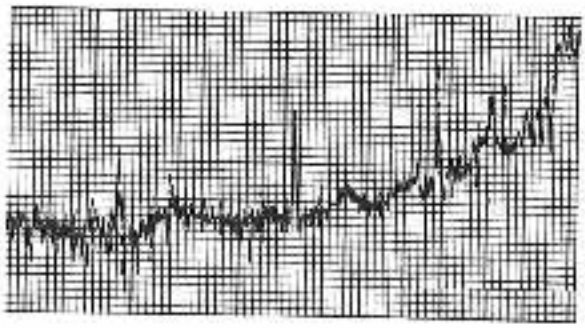


Fig.3-14. Artifact - Loose Sensors

**Corroded Reuseable Sensors**

Corroded sensors can cause a variety of artifacts, such as, large sawtooth waves, drifting and blocking. This will not be a problem if the sensors are always cleaned after each use and replaced when necessary. Substitute electrolytes and/or paste can introduce problems due to poor conductivity or film build-up on the sensor. If a paste or cream is used, wash the sensors after each use and scour frequently.

**Electrical Interference (AC)**

Electrical interference can obliterate much of an ECG recording by producing a wide baseline. Its amplitude depends on the strength of the AC source and the lead being recorded. In any one lead the amplitude is usually steady. The frequency of the interference signal corresponds to the supply line frequency (usually 60Hz). The result of typical AC interference on the ECG is shown below.

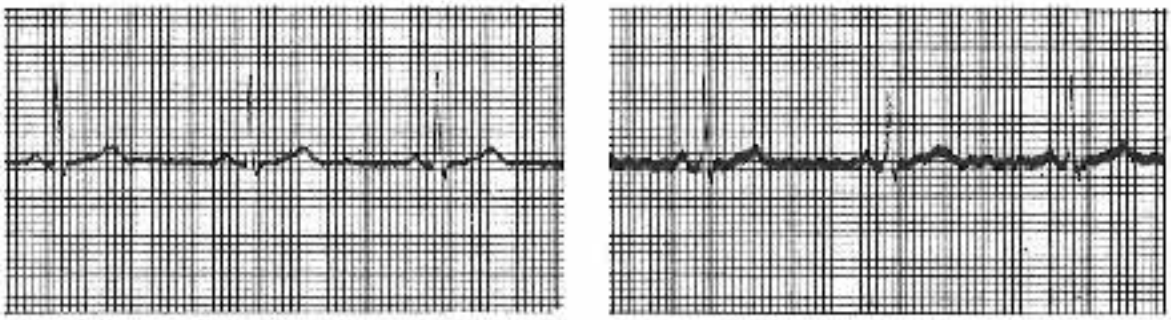


Fig.3-15. Artifact - Alternating Current

**To eliminate or minimize AC effects:**

1. Locate the EK10 so that the line cord is well away from the patient and the patient cable. Do not pass the line cord under or near the patient or table.

2. Be sure the EK10 is properly grounded by means of the wall outlet to which it is connected. It is advisable to ground a metal patient table or metal bed frame by connecting them to the EK10 via an auxiliary ground lead.

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

4. Diathermy or X-ray equipment in adjacent offices should NOT be in operation. Other electrical equipment, including electrically actuated beds, or lighting fixtures may also generate interference even though not in use. If this proves to be a problem, disconnect such equipment.

5. Electrical wiring in walls and ceilings is also a possible source of AC interference. Frequently, simply moving the patient table to a different location in the room will alleviate the problem. Occasionally, in severe cases, it may be necessary to use a grounded screen located between the AC source and the patient.

6. Check the pre-set parameters on the LCD display of your EK10. The ON filter setting may effectively limit the AC interference. In extreme cases where the problem cannot readily be solved by the user, contact your Burdick Field Representative. He has equipment

which will aid in pin- pointing the source of interference and can offer guidance to eliminate or reduce the problem.

**Loose or Broken Leads**

A broken wire in the patient lead may cause rapid and erratic trace deflections. Similar large amplitude excursions can be caused by a poor connection at the sensors.

**Operation with AC Filter**

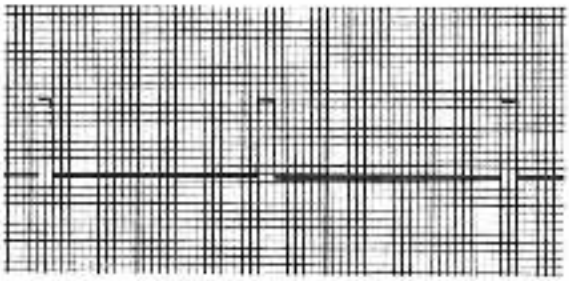
Selection of an unfiltered or a filtered frequency response is determined by the pre-set parameters employed. These can be verified anytime by calling up the LCD display (refer to Section 3, Input Instructions).

In normal operation with no filter, the EK10 exceeds AAMI recommended standards for diagnostic accuracy and definition. There can be a small nominal loss of amplitude in the QRS complex when the filter is employed.

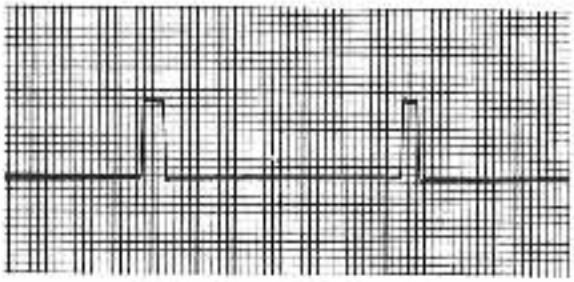
A reference calibration mark should be included in every ECG recording, filtered or unfiltered. In the AUTO mode, the EK10 automatically records a calibration mark at the start of each lead trace. Unfiltered, the calibration pulse has a relatively squared corner and an almost instantaneous rise and fall to the trace excursion. With a filtered response, the corners are not square and there is more slope to the excursion rise and fall. The simulated traces below show typical examples of recordings made both with and without the filter.

**Pacemaker Spikes**

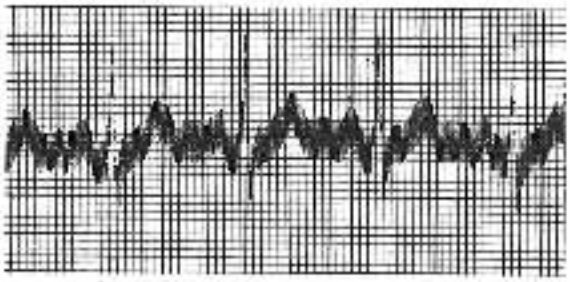
With the filter ON, the high frequency spikes produced by a cardiac pacemaker cannot be recorded. In most cases, pacemaker spikes may be recorded with the filter OFF.



Calibration without Filter

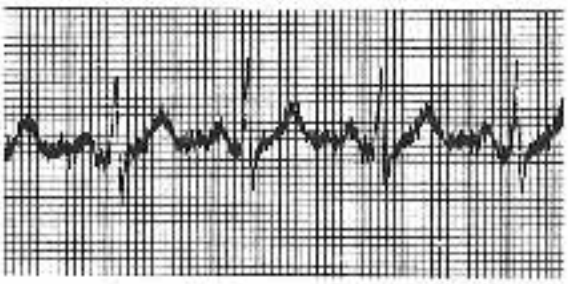


Calibration with Filter On,
Note the small overshoots
in the leading edge

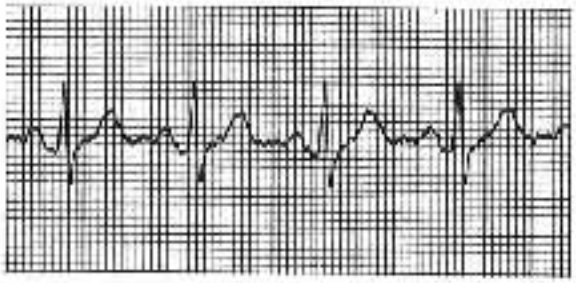


Moderate AC without Filter

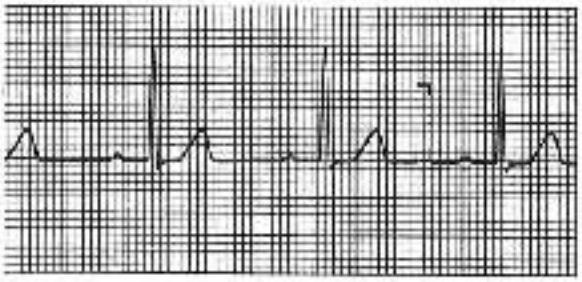
Same Tracing with Filter On



Somatic Tremor without Filter



Same Tracing with Filter On



QRS Complexes (No Filtering)

Same ECG with Filter On,
Note the minimal loss of R wave
Amplitude

Fig.3-16. Typical Traces without and with Filtering

## SECTION 4

### MAINTENANCE

There are no required operator maintenance or adjustment procedures for the EK10. In the event of a malfunction, or the need for an adjustment becoming evident, contact your Burdick dealer or service representative.

After extended usage, two years or more, the battery pack - if your unit has this optional feature - may need to be replaced if it will no longer hold a full charge. Access to the battery is gained by removing the large square snap-in cover panel on the back of the unit.

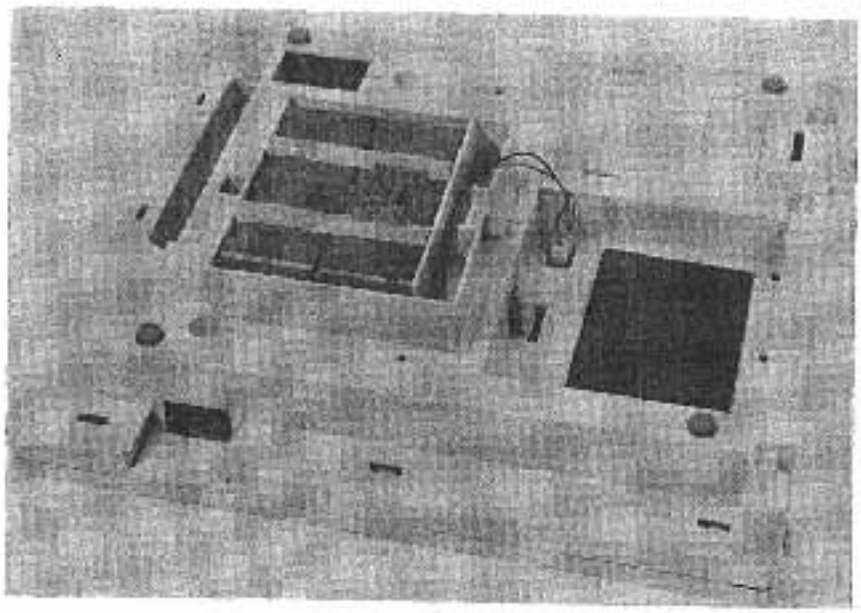


Fig.4-1,Battery Compartment with Cover Removed

Carefully disconnect the battery terminal connector using a plier to grip the connector - don't pull on the wires - and lift out the battery pack. The replacement battery comes complete with leads and connector. The connector has grooves on one side only to ensure that it is correctly polarized when connected. Make sure the leads are tucked neatly around the battery and that the cover does not trap the leads before it is snapped shut.

## SECTION 5

## SPECIFICATIONS:

| | |
|---|---|
| **Dimensions:** | 11" x 13" x 3-3/16" |
| **Weight:** | 9 lb. including optional battery. |
| **Power Requirements:** | 120/240VAC, 50/60Hz standard. |
| | 12.5Vdc nickel-cadmium battery (*optional*) |
| **Environmental Parameters:** | |
| Operating temperature | 10deg.C to 40deg.C |
| Storage temperature | -34deg.C to 70deg.C |
| Relative humidity | 15% to 90% non-condensing |
| **Acquisition parameters:** | |
| Lead selection | I, II, III, aVR, aVL, aVF, V1, V2, V3, V4, V5, V6. |
| Frequency response | Meets or exceed AAMI standard for Diagnostic Electrocardiographic devices (unfiltered) 04 - 30Hz, -3dB (filtered) |
| Input impedance | greater than 50Mohm |
| Electrode offset tolerance | ± 300mV |
| A/D conversion | 8 bits |
| **Printout:** | |
| Paper type | thermal |
| Chart speeds | 25 or 50mm/sec. ± 2% |
| Printout format | 1 - channel auto or manual |
| Printout device | 48mm. thermal dot array |
| Paper dimension | 50mm. wide, 45mm. grid, x 150 ft. roll |
| Lead marking | leads are imprinted on each lead trace above waveform |
| **Safety:** | |
| Leakage current | Patient, less than 10 microamps<br>Chassis, less than 100 microamps |
| Defibrillator protection | to 5,000V, 400 Joules |

Rev: 11-89

## WARRANTY AND SERVICE INFORMATION

**BURDICK MAKES NO WARRANTY OTHER THAN THE ONE SET FORTH HEREIN. SUCH LIMITED WARRANTY IS IN LIEU OF ALL OTHER WARRANTIES EXPRESS OR IMPLIED INCLUDING BUT NOT LIMITED TO ANY EXPRESS OR IMPLIED WARRANTY OF MERCHANTABILITY OR FITNESS FOR PARTICULAR PURPOSES AND SUCH CONSTITUTES THE ONLY WARRANTY MADE WITH RESPECT TO THE PRODUCTS.**

### Your Burdick Limited Warranty:

Any equipment* component which fails to operate in normal use during the period of **one year** from the purchase date will be exchanged without charge. However, the customer assumes all responsibility for shipping charges.

All accessories supplied with new equipment are warranted for **ninety (90) days**, and will be repaired or replaced at Burdick's option. Accessories sold separately are warranted for a period of ninety (90) days from the date of original purchase.

This warranty gives you specific legal rights. You may have other rights which vary from state to state. This warranty does not apply to equipment damaged by shipping, accident, misuse, theft, neglect, fire or Acts of God, deterioration caused by use of chemicals not encountered during normal operation, equipment failures due to use of paper or other supplies not conforming to Burdick approved specifications and standards, or unauthorized modifications.

Authorized Burdick dealers are responsible for maintaining the Burdick equipment they sell. They are equipped to provide on site field service whenever it is practical. If trouble occurs, contact the Burdick dealer from whom the equipment was originally purchased to arrange for service. The engineering and service specialists of the Burdick Corporation are always ready to assist customers and dealers; repair information can be supplied by telephone or mail.

The manufacturer's warranty card should be returned by the dealer/installer. In the event a warranty card was not returned, the following information must be supplied to Burdick before warranty support can be provided:

1) Customer name and address.
2) Equipment model, serial number and date of installation.
3) Installation date of new part, new accessory or new unit.
4) Name of dealer from whom equipment was purchased.
5) Complete description of unit's condition; state if symptoms are constant or intermittent.
6) Complete list of all steps taken in attempt to remedy problem.

### Service:

Burdick products are sold and serviced through a nationwide network of medical equipment distributors who have been carefully selected for their proven ability to serve the medical profession. All of these Authorized Service Agents participate in an ongoing certification program and must demonstrate a high caliber of technical expertise. Service, parts and accessories for Burdick equipment are available from your authorized Burdick dealer. For more information or special assistance, contact the Burdick Corporation at **(800)-333-7770** or **(608)-868-4678**.

### Returning Equipment for Service:

If equipment is being returned to a service center for repair, prior authorization must first be obtained by phone or mail. Always include a detailed list of symptoms, and if applicable, a sample trace recording. Please include your name and phone number. This will assure you are provided with the fastest and most efficient service possible. If circuit boards are shipped to a service center, always ensure they are adequately protected and enclosed in an anti-static bag.

If a unit must be returned to the Burdick factory or to a Regional Service Center for repair, the unit and accessories should be carefully packed in a strong carton, preferably the one specifically designed for that unit. Shipping containers are available from your Burdick dealer, however, the customer is responsible for and assumes all risks associated with shipment of the unit. Ensure that the package is clearly marked for protection against rough handling. Example: "DELICATE ELECTRONIC EQUIPMENT - HANDLE WITH CARE".

*Equipment is considered to be the main electronic assembly, and by definition does not include any accessories.

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**APPENDIX:** **List of Illustrations**

SIEMENS

BURDICK UPTIME

# SIMPLIFYING YOUR SERVICE NEEDS: Service Contract Options

**SIEMENS BURDICK, INC.**
15 Plumb Street, Milton, WI 53563

Publication No. 086055

Revised: July 1992

BURDICK UPTIME™

# offers FIVE different service option to meet your specific needs

BURDICK UPTIME is your best protection against downtime

- You have access to the facilities, the knowledge and the people you require.
- Swift, efficient service and/or parts replacement helps keep your Siemens Burdick instrument in first-class operating condition.
- Factory-approved assistance and planned maintenance is done only by Siemens Burdick-trained technicians.

BURDICK UPTIME is your best protection against high-priced repairs

- Guarantees your instrument will receive the most skilled attention at the lowest possible cost.
- One small annual fee protects your Siemens Burdick equipment against service and/or parts cost for a full year.
- Consider the high cost of a one-time repair. If your UPTIME covered instrument requires attention just once during the year, you're already dollars ahead.

BURDICK UPTIME is your best protection against equipment frustration

- Siemens Burdick has made a major commitment to provide the resources you need to keep your equipment functional.
- No time lost searching for appropriate repair facilities or parts availabilities.
- A factory trained service technician will be working on your instrument.
- Optional loaners are available in most instances to keep your facility functioning.

BURDICK

# UPTIME™

## Siemens Burdick offers these service options to better meet your specific needs

### 1 AND 2 PERSONAL ON-SITE SERVICE*

**WHAT YOU DO**
- Call **800-333-7770** 608-868-4678
- Ask for "Technical Service Support"

**WHAT YOU RECEIVE**
- On-site, next-day service by local technicians
- Instrument inspected and repaired***
- Performance inspections and documentation

**TYPE 1:** Service 8 A.M. to 5 P.M. Monday thru Friday**
**TYPE 2:** Service 24 hours a day, 7 days a week**

**WHAT YOU GAIN**
- Extended product life
- Minimal downtime
- Increased reliability
- Easy budgeting
- One-time invoicing
- Reduced service cost

### 3 AND 4 DIRECT-TO-SIEMENS BURDICK SERVICE

- Call **800-333-7770** 608-868-4678
- Ask for "Technical Service Support" and inquire about shipping instructions

- Instrument inspected and repaired by factory-trained service technicians
- Complete performance inspection that the instrument meets factory performance criteria
- 3-day return shipping
- Free return shipping

**TYPE 3:** Mail-in direct to Siemens Burdick
**TYPE 4:** Mail-in direct to Siemens Burdick and receive free use of loaner equipment while your unit is in for repair

- Most economical way of repairing an instrument
- Minimal downtime
- Guaranteed product return time
- Easy budgeting
- Reduced service cost

### 5 PARTS EXCHANGE SERVICE

- Call **800-333-7770** 608-868-4678
- Ask for "Technical Service Support"

- Next-day parts shipment***
- Shipped via air express, UPS, or mail, according to the urgency of your need

- Protects against high cost of replacement parts
- Technical customer support hotline
- Offers best economy for your biomedical support groups

* For locations within 100 miles of a field service engineer.
** Holidays not included.
*** Consumables and ancillary products not included (e.g. cables, accessories, disposables, styli, lamps and batteries).

**NOTE:** To qualify for next-day service, orders must be received at Siemens Burdick by 1:00 P.M. Central Standard Time.

Guard against the risk of your Siemens Burdick ECG unit being down for a prolonged period. Protect against improper service. Sign up now for UPTIME.

TEAR HERE

**Yes,** I am interested in the Siemens Burdick UPTIME service program

☐ Please have a service representative contact me and provide costs for the UPTIME contract most applicable to our needs.

☐ Please rush me a completed contract form, showing costs, for our instrument:

**NOTE: Model, Serial Number and date purchased must be provided to obtain a completed contract form.**

Product name _____

Model No. _____ Serial No. _____

Date purchased _____ Purchased from _____

Name _____ Title _____

Name of facility, practice or institution

_____

Address _____

City _____ State _____ Zip _____

Telephone No. (_____) _____

# Siemens Burdick Technical Service Seminars train your Personnel

For facilities with their own Biomedical Service Staffs, Siemens Burdick offers highly informati training classes that qualify your people to beco experts at inspecting and effectivoly maintainin Siemens Burdick instruments. These classes ar scheduled at convenient times throughout the y and are conducted at Siemens Burdick headquarters in Milton, Wisconsin.

Since highly personalized teaching methods are used, the size of these classes is limited. Those interested in attending should make arrangements well in advance.

A schedule of classes for the coming year and additional information on these Technical Service Seminars may be obtained by contacting: Technical Service Training, Siemens Burdick, Inc 15 Plumb Street, Milton, WI 53563; or call (800) 333-7770 or (608) 868-4678.

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# OPERATING INSTRUCTIONS
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If you would like to receive any updates which may become available for this manual, please complete the registration form below and return it to Burdick.

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We appreciate your comments and suggestions as well as any additions or deletions which could make this publication a more useful tool. Any errors should be identified along with the page number on which they occur. All comments and suggestions become the property of Burdick, Inc. Thank you for helping us to serve you better.

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