

SIEMENS

BURDICK EK10
Operating Instructions

EK



CONTENTS

SECTION 1		Page
1.0	Foreword	1
1.1	Inspection	1
1.2	General Description	2
1.3	Accessories	3
SECTION 2		
2.0	Connections	5
2.1	Connection Functions	5
2.2	ECG Paper	6
2.3	Controls - Location & Function	7
2.4	Individual Control Functions	8
2.5	Primary LCD Displays	9
SECTION 3		
3.0	Operating Modes	10
3.1	Suggestions for First Time Operation	10
3.2	Paper Loading	10
3.3	Routine Operating Procedure	11
3.3.1	Patient Environment	11
3.3.2	Equipment Location	11
3.4	Patient Cable and Lead Arrangement	12
3.5	Patient Preparation	13
3.6	Electrodes	13
3.6.1	Disposable Electrodes	13
3.7	Electrode Application	14
3.8	Setting-up Equipment	15
3.9	AC Operation	15
3.9.1	Battery Operation	15
3.10	Charging Batteries	16
3.11	Establishing Operating Parameters	16
3.12	Pre-Set Parameters	17
3.13	Filter	17
3.13.1	Writer Speed	17
3.13.2	Writer Format	17
3.13.3	Lead Sequencing per Format	19
3.14	Input Instructions - Operating Sequence	18
3.15	1 V per Centimeter Output	21
3.16	Recording a 12-Lead ECG (Auto Mode)	22
3.17	Recording an ECG in Manual Mode	23
3.18	Artifacts - Cause and Recognition	24
3.19	Operation with AC Filter	27
SECTION 4	Battery Replacement	29
SECTION 5	Safety	30
SECTION 6	Abbreviations & Acronyms	34
SECTION 7	Technical Data	Back Cover

Section 1

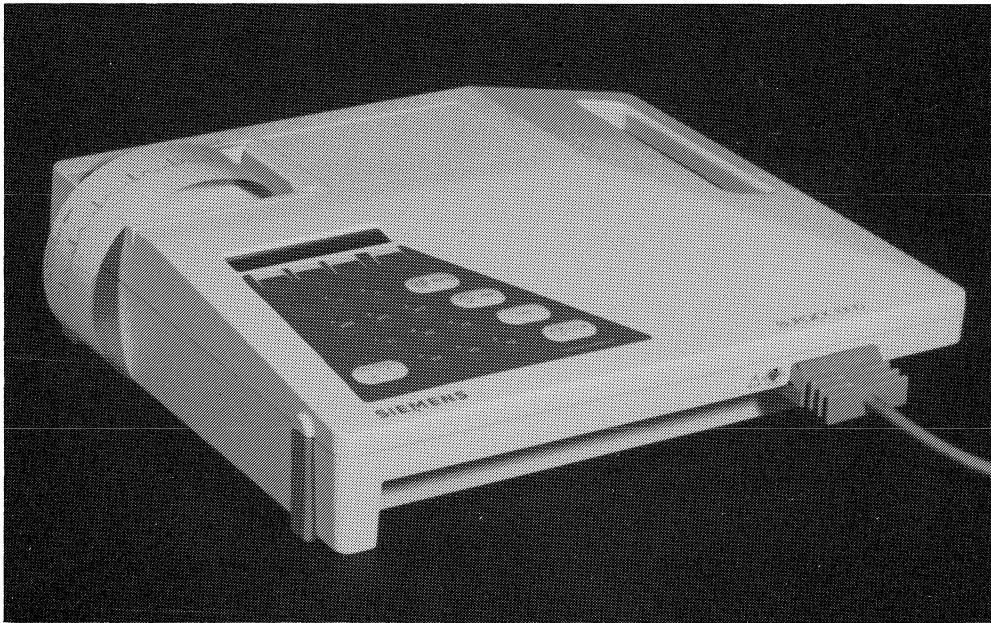


Fig. 1-1 The BURDICK EK10 Electrocardiograph

1.0 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 Siemens for the BURDICK EK10. 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 approved specifications may also give poor results.

1.1 INSPECTION

Your new BURDICK EK10 Electrocardiograph has been thoroughly tested and inspected prior to shipment from the factory. Please inspect the unit upon delivery for any damage that may have occurred in transit. If any damage is evident, contact the shipping agent and make a concealed damage report promptly.

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 Siemens dealer.

1.2 GENERAL DESCRIPTION

The BURDICK EK10 is a single channel ECG Recorder for the acquisition of ECGs, with a write-out on a 50mm strip. It incorporates a thermal array printer with a clear and distinct print-out on thermo-reactive roll paper. The paper roll is easily accessible under a removable cover on the top of the unit.

Programming and ECG acquisition is simple and is carried out with the aid of menus displayed in the 2-line by 20-character LCD window.

In the "Program Mode" you can select:

Standard or Cabrera leads
Manual or Automatic ECG acquisition.

Entry of Patient Data (ID# up to 12 digits) is equally easy thru the display menu.


The BURDICK EK10 can be operated from mains power or from nickel cadmium batteries (optional) that are located in a battery compartment in the underside of the housing. The operating time with fully charged batteries is approximately 50 minutes of continuous acquisition/print cycles. 15 hours are required to completely charge fully depleted batteries. However, the unit can still be operated on mains power while the batteries are being recharged. This will of course prolong the recharging time.

The BURDICK EK10 incorporates circuits for automatic shut-down after approximately 15 minutes of non-use. The message "LB" will be displayed if the battery charge level is insufficient to sustain at least 15 minutes of continuous operation.

The BURDICK EK10 complies with the safety requirements set forth by the International Electrotechnical Commission in Publication No, 601-1, entitled "Safety of Medical Electrical Equipment" and classified as Class 1.

The classification with regard to protection against electrical shock means that when powered from the mains supply, the BURDICK EK10 must only be connected to a properly grounded mains outlet.

When in doubt about the integrity of the AC power supply protective grounding (earthing), use only the battery power for your ECG recordings. Unplug the AC (mains) power cord from the recorder before you begin recording.

The degree of protection for the ECG input is of type CF. This means that the BURDICK EK10 can be used for intracardiac measurements - hence the symbol  above the patient cable socket. This symbol also indicates protection against the effects of defibrillation.

1.3 ACCESSORIES

Standard Accessories

Qty.	Article Number	Description
1	95 84 509 EH49E	Operating Instructions
1	95 84 541 EH49E	Technical Description (German/English only)
1	96 20 626 EH49E	ECG Patient Cable (10 lead)
1	96 20 659 EH49E	Signa II Starter Kit (100 disposable electrodes and 10 clips)
1	96 20 634 EH49E	Roll Recording Paper - 45.7m (150ft) (red grid - black trace)
1	65 00 318 E1948	Mains Power Cable
1	96 20 683 EH49E	Pressure Sensitive Card Mounts for ECGs (100 per box)



Fig.1-2, Useful accessories for the BURDICK EK10

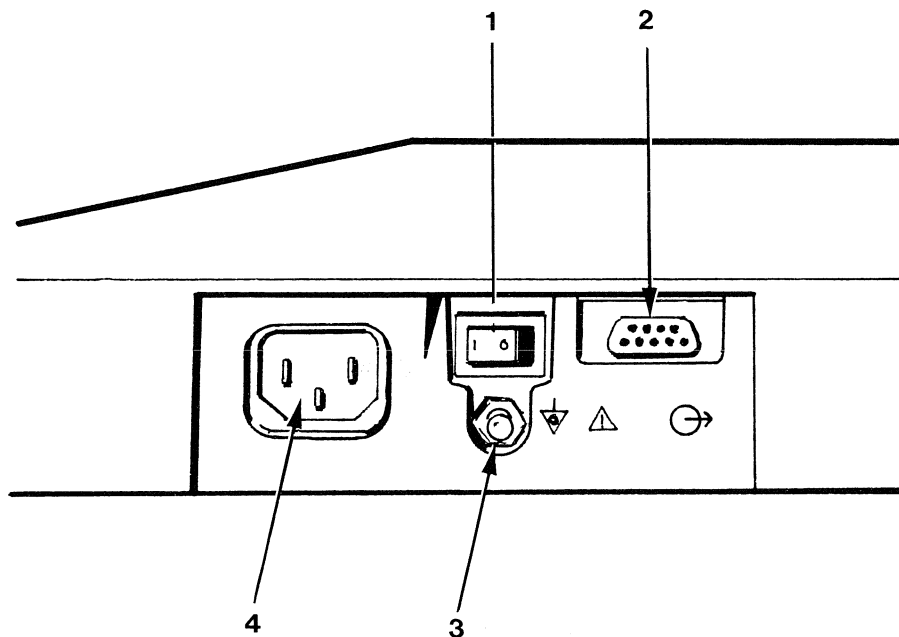
Optional Accessories - Supplies

Article Number	Description
96 20 832 EH49E	Input Cable, 1V to 1mV (see Section 3.15)
96 20 840 EH49E	Output Cable, 1V (see Section 3.15)
96 20 683 EH49E	Single Sheet Pressure Sensitive ECG Card Mounts (100 per box)
96 20 618 EH49E	Soft Shell Carrying Case
96 20 733 EH49E	Chemical-Thermal ECG Recording Paper- 10 rolls, 45.7m (150 ft), black grid - black trace
96 20 741 EH49E	Chemical-Thermal ECG Recording Paper- 10 rolls, 45.7m (150 ft), red grid - black trace
96 20 600 EH49E	Battery Pack
21 71 759 E2018	Potential Equalization Cable
96 20 667 EH49E	Adapter Clips
96 20 675 EH49E	Box of 1000 Signa II Sensors with Adapter Clips

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

Section 2

2.0 CONNECTIONS



Key:	1	Mains power switch	3	Potential equalization connector
	2	1v Output connector	4	Power cable connector

Fig. 2-1, Back Panel of BURDICK EK10

2.1 CONNECTION FUNCTIONS

Power Cable Connector

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

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

Mains Power Switch

Used when operating on mains power to switch the unit on (I), or off (O). Not used for DC (battery) operation.

Patient Cable Connector

The patient cable plugs in to a connector on the front of the unit as shown in Fig. 1.1.

Note: This connector is also used for an optional **1 volt-to-1mV input** cable for special applications where this may be required.

Potential Equalization Connector

Provision is made for a potential equalization cable for those situations where national regulations require its use

1 Volt Output Connector

An optional 1 volt-per-centimeter output cable may be connected to this 9-pin connector Refer to Section 3.15, page 21.

2.2 ECG PAPER

The chemistry and thermal characteristics of Siemens ECG paper matches the specification tolerances of the BURDICK 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 (battery) operation.

Recommended ECG Papers:

Article Number	Grid - Trace Color
96 20 733 EH49E	Chemical-Thermal, Black-Black (Box of 10 rolls)
96 20 741 EH49E	Chemical-Thermal, Red-Black (Box of 10 rolls)

The use of non-approved supplies may invalidate your warranty.

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

2.3 CONTROLS - LOCATION & FUNCTION

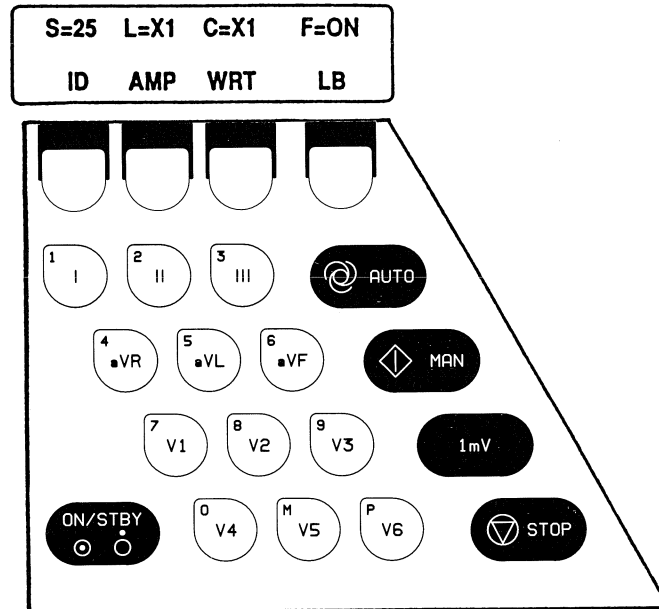


Fig. 2-2, Control Panel with LCD Display (Main Menu)

All operating controls are integrated into a single "soft-touch" control panel. 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 pressed.

2.4 INDIVIDUAL CONTROL FUNCTIONS:

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



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.



Selects Automatic ECG Mode of operation.



Selects Manual Mode of operation.



Calibration test signal. Standard 1mV input pulse. (10mm deflection at x1 gain)



Permits operator to halt acquisition of ECG at any point in manual or automatic mode.

ECG LEAD MANUAL SELECTORS

On the Burdick EK10 these twelve buttons are marked: 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.

***NOTE:** When in Cabrera format this prints out as **-aVR** in both Automatic and Manual modes of operation.

NUMERIC VALUE INPUTS

The same array of buttons used for lead selection also has a second numeric value indication located at the top left-hand corner of each button in sequence 1 thru 9 and 0; used to enter the patient ID number on the LCD display. This information is then annotated on any subsequent ECG recordings.

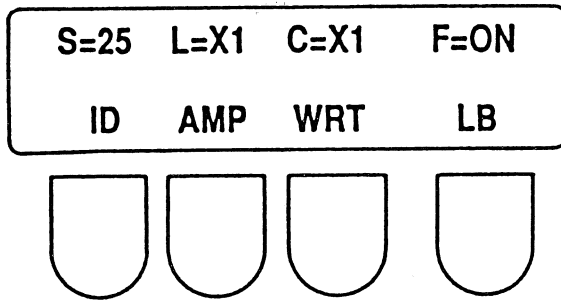
M,P,

Used to select main menu "M" or previously selected menu "P" for review on the LCD (Liquid Crystal Display).

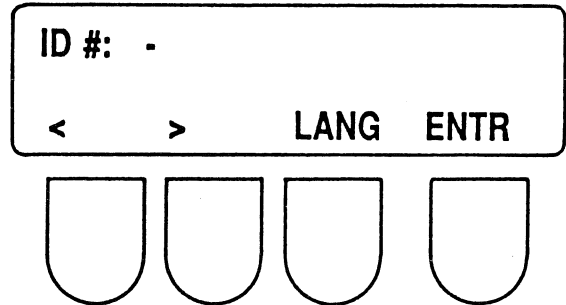
LCD SOFT KEYS

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.

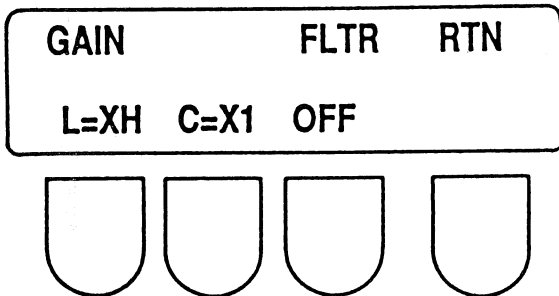
2.5 PRIMARY LCD DISPLAYS



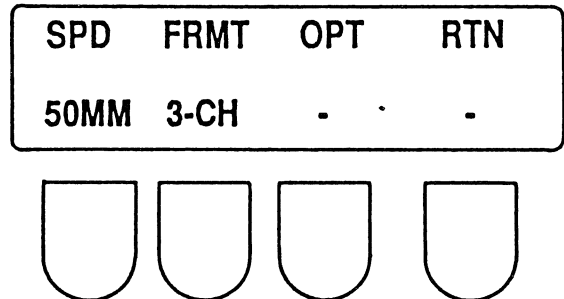
a) Main Menu



b) ID Menu



c) AMP Menu



d) WRT Menu

Fig. 2-3, Primary LCD Displays

Section 3

3.0 OPERATING MODES

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

3.1 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 unit 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 found in Sections 3.9 and 3.10 of this publication.

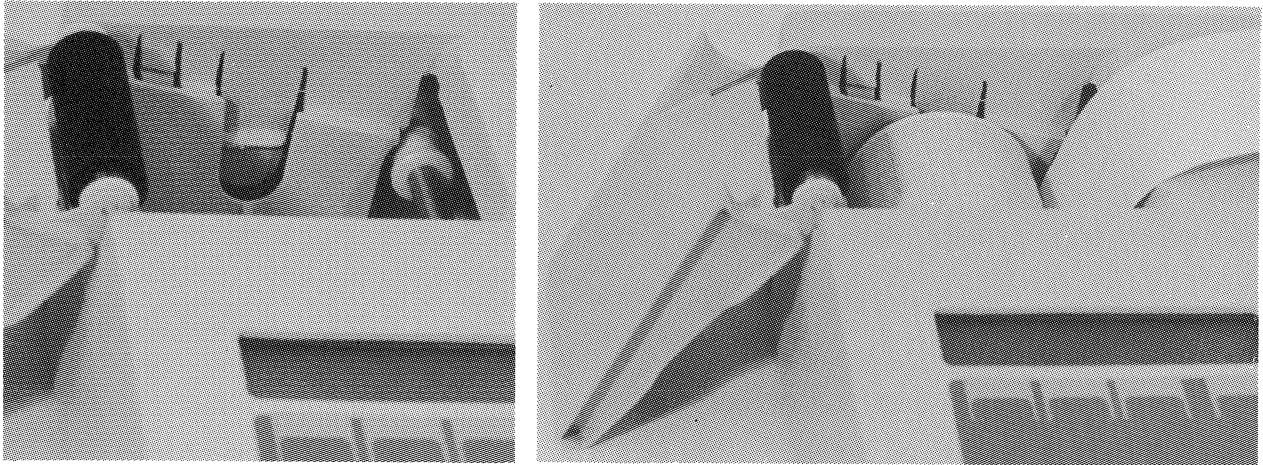
Before using your new BURDICK EK10 on a patient, it is advisable to first operate the unit and familiarize yourself with the controls and sequence of operation. This will also afford an opportunity to check the unit for proper operation. During this dry run, the patient cable will not be connected, so 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 electrodes 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.

3.2 PAPER LOADING

Loading your BURDICK EK10 is a simple three-step operation. Check that the ECG paper is the correct type for use in your unit 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; remove the empty spool with feed roller.
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

3.3 ROUTINE OPERATING PROCEDURE

3.3.1 The Patient Environment

With the BURDICK 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 interference. These artifacts, if present, can usually be eliminated or minimized by carefully reading and following the instructions given in this manual.

3.3.2 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.

3.4 PATIENT CABLE AND LEAD ARRANGEMENT.

3.4.1 Patient Cable (IEC Standard)

Plug	Marking	Location
Red	R	Right Arm
Yellow	L	Left Arm
Green	F	Left Leg
Black	N	Right Leg
Red	C1	Chest
Yellow	C2	Chest
Green	C3	Chest
Brown	C4	Chest
Black	C5	Chest
Violet	C6	Chest

3.4.2 TWELVE STANDARD LEADS

Attach the R,L,F,N limb/extremity leads. Attach the C1 thru C6 chest leads. Reference point is CT

- C1 fourth intercostal space at right sternal border
- C2 fourth intercostal space at left sternal border
- C3 mid-way between C2 and C4
- C4 fifth intercostal space on left mid-clavicular line
- C5 left anterior axillary line at same level as C4
- C6 left mid-axillary line at same level as C4

	Lead	Measurement
Einthoven	I	L-R
	II	F-R
	III	F-L
Goldberger	aVR	R-L,F
	aVL	L-R,F
	aVF	F-R,L
Wilson	V1	C1-CT
	V2	C2-CT
	V3	C3-CT
	V4	C4-CT
	V5	C5-CT
	V6	C6-CT

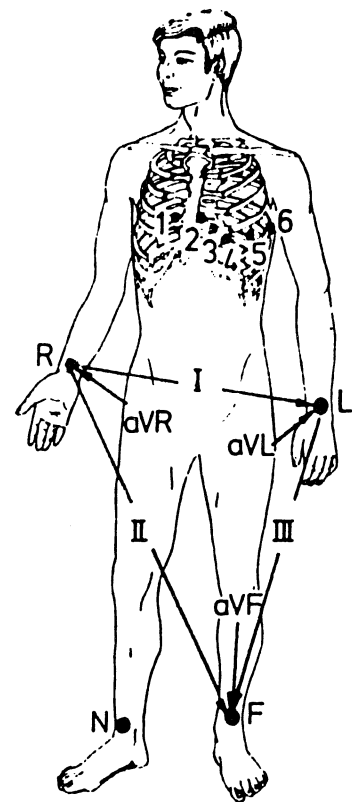


Fig. 3-2

3.5 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.

3.6 ELECTRODES (see also Section 5)

The disposable Signa II electrodes included in the accessory package that came with your BURDICK EK10 Electrocardiograph are designed to be used with this instrument. Never mix electrodes with those of another manufacturer or mix reusable and disposable electrodes. This can result in considerable baseline drifting or blocking and can impair the built-in defibrillator protection.

3.6.1 Disposable Electrodes

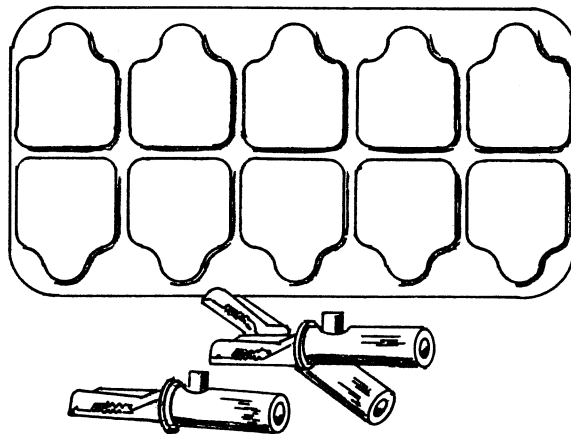


Fig. 3-3, Disposable Signa II Electrodes

Siemens disposable Signa II Electrodes are time-saving problem solvers and are specifically recommended for use with the BURDICK EK10. They are an affordable, efficient alternative to bulbs, plates, straps, creams and gels. These electrodes utilize a highly conductive natural adhesive and offer a cost-effective medium for quick, stable and dependably consistent ECG signals.

3.7. ELECTRODE APPLICATION

1. Remove individual electrodes from the package liner card and position on patient.
2. First apply the limb position electrodes, preferably locating them on the inside and generally hairless areas of the arms and legs.

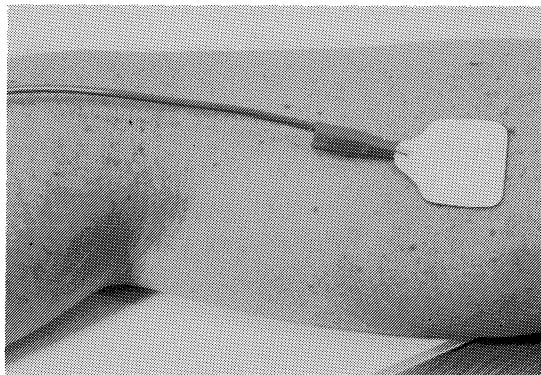


Fig. 3-4. Disposable Electrode Applied to Limb

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 electrode to the exposed skin.
 - b) Use a water dampened towelette to moisten the skin area to enhance the adhesive tack prior to applying the electrode.
 - c) If methods a) and b) do not work, shaving may be necessary. In any case, the electrode may be reapplied to the shaved area without significant loss of tack.
3. Next apply the electrodes to the chest area (positions C1 through C6) - please refer to Fig. 3-2.
 4. Attach alligator adapter clips to the apex of each electrode.
 5. At this time perform any other preparatory tasks to allow the patient a short time to relax and also to give the recorder-electrode system time to stabilize
 6. When the ECG record is completed, simply remove and discard the electrodes. There is no clean up.

3.8 SETTING-UP EQUIPMENT

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

3.9 AC OPERATION

The following sequence of steps is required for AC operation:

- a) Connect AC power cord to the Burdick EK10.
- b) Plug AC cord into suitable grounded mains outlet.

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

- c) Set main power switch on rear of the unit to ON position.

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

- d) Press ON-Standby keypad on main control panel to ON position.
- e) The unit will now display MAIN menu and is ready for operation.

3.9.1 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 unit on battery power.

The following sequence of steps is required for DC operation:

- a) Set main power switch on rear of unit to OFF (O) position.
- b) The unit will now power up on DC (battery power) when ON-Standby keypad is pressed to ON.
- c) If battery power is sufficient for sustained operation, the BURDICK EK10 will display MAIN menu and is ready to be used.
- d) The unit 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-Standby keypad remain ON with no further input from the operator, built-in circuitry will automatically switch the unit 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.

3.10 CHARGING BATTERIES

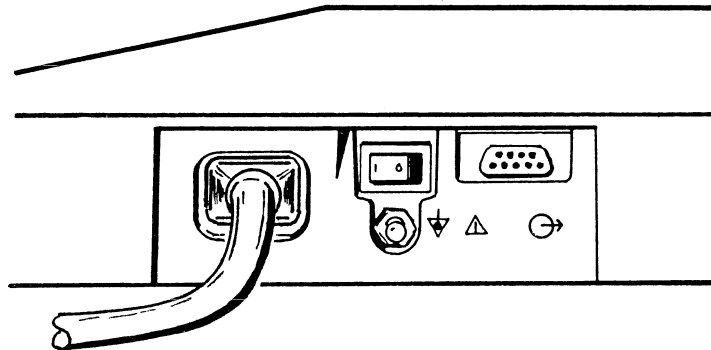


Fig. 3-5, Main Switch must be ON (I depressed) to recharge battery.

The BURDICK 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 up to approximately 50 ECG recordings in AUTO mode under normal conditions. Typically, the unit 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. At this point the battery should be recharged promptly. 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.

3.11 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 BURDICK EK10 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.

3.12 PRE-SET PARAMETERS (Description and Input Instructions)

3.12.1 Limb Setting Options:

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

- 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.

3.12.2 Chest Lead Options:

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

- 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.

3.13 FILTER

The BURDICK EK10 offers the option of generating ECG recordings through either a filtered or unfiltered frequency response. Filtered mode has 30Hz, 3dB response.

3.13.1 Writer Speed:

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

3.13.2 Writer Format:

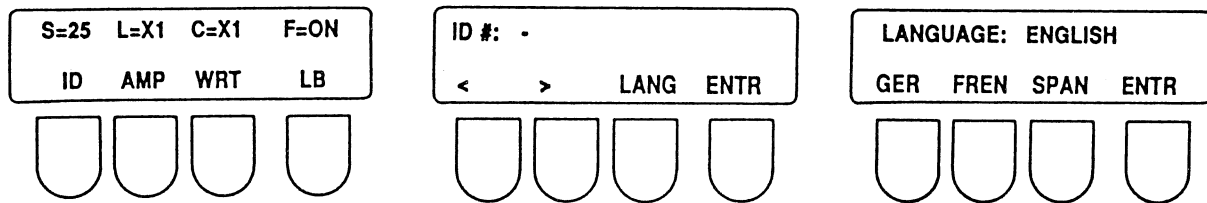
The unit can record the ECG in either a 1-channel or a simulated 3-channel format. A 3-channel Cabrera format is also available. In each case all leads are clearly identified above each individual lead trace on the printout. Special pressure-sensitive mounts are available from your dealer for use with the 3-channel format. These self-adhesive card mounts simplify the task of mounting the continuous ECG printout strip in any desired format. Instructions are printed on the mounts. The reverse side allows for a written record of patient data and findings.

3.13.3 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.
- Cabrera:** aVL, II, V1, V4,.....I, aVF, V2, V5,.....aVR, III, V3, V6.

Note: Each individual lead recording normally represents 2.5 or 5.0 seconds of cardiac activity in the automatic mode, as pre-selected by the operator.

3.14 INPUT INSTRUCTIONS:



a) MAIN menu

b) ID menu

c) LANG menu

Fig. 3-6, 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 unit'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.

SELECT LANGUAGE: For first time operation, press the soft key below LANG on the ID menu, then select the appropriate key for the preferred language. This selection is stored in memory and thereafter becomes the default language to be employed whenever the unit is turned on.

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.

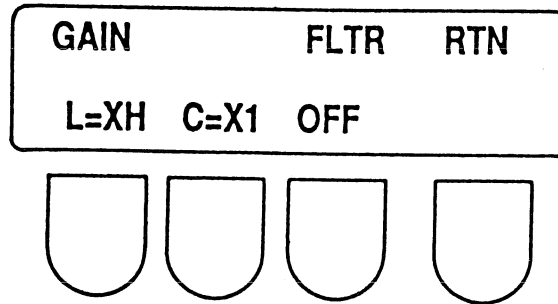


Fig. 3-7. Amplifier (AMP) Menu Display

- 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 Siemens service representative for service.

**ROM CHECKSUM ERROR
SERVICE NEEDED**

**HI PRINthead RESIST
SERVICE NEEDED**

**RAM CHECK ERROR
SERVICE NEEDED**

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

**LO PRINthead RESIST
SERVICE NEEDED**

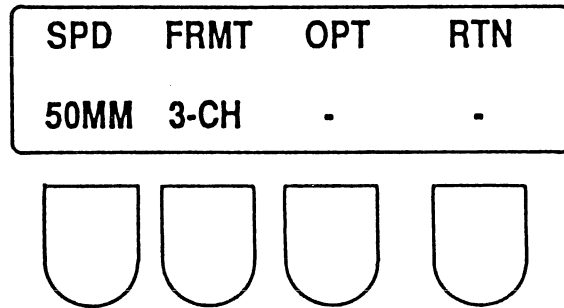


Fig. 3-8, Writer (WRT) Menu Display

- SPD Key** Select 25mm/sec., or 50mm/sec.
- FRMT Key** Select 1-channel, 3-channel. or Cabrera format
- OPT Key** Press OPT key to proceed to Option (OPT) menu.
- RTN Key** Press RTN key to return display to MAIN menu.

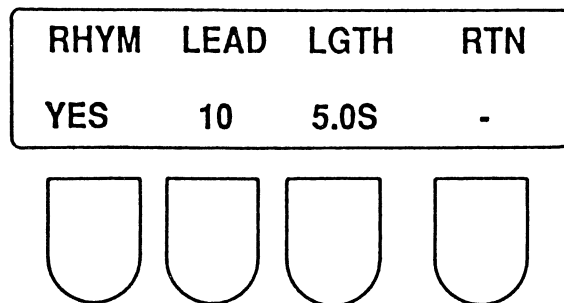


Fig. 3-9. Option (OPT) Menu Display

RHYM Key	Select YES or NO for Rhythm Strip recording. When YES selected generates 10 secs. rhythm strip from Lead II before entering lead hunt sequence.
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 recording.
RTN Key	Press RTN key to return to Writer menu.

3.15 ONE-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 approximately 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 directly to a monitor to display ECG waveforms. A connecting cable 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, with a 15-pin connector on one end which mates with the patient cable connector of the unit, is also available as an option. This feature may be used to generate printouts from a 1 volt per centimeter signal from a monitor output or other source.

Specification:

Gain	$\pm 10\%$
Frequency Response	At least 30Hz

Accessory Cables:

96 20 832 EH49E	Input cable, 1V to 1mv.
96 20 840 EH49E	Output cable, 1V.

CAUTION:

The summation of leakage currents that may arise whenever the BURDICK EK10 is connected to other units creates a potential hazard. Accordingly, only Class I equipment complying with the relevant IEC Publication may be connected to the unit. If in doubt, consult a qualified technician.

3.16 RECORDING A 12-LEAD ECG (Automatic Mode)

This sequence is used to record a 12-lead ECG, operating the BURDICK 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.

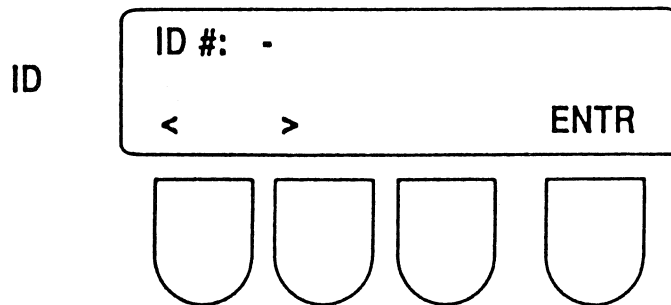


Fig. 3-10. Patient Identification (ID) Menu

- < 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 unit will automatically go into the lead sequence as selected in Format (1-Channel, 3-Channel or Cabrera). The instrument will stop when the requested format has been printed.

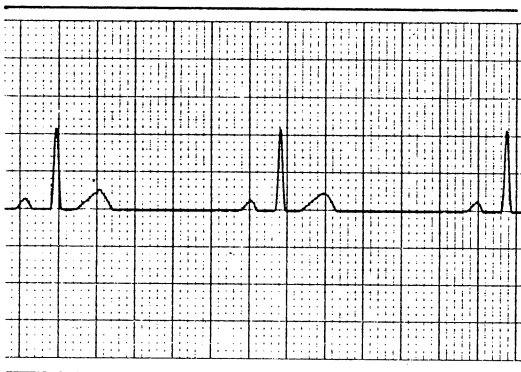
The **STOP** key may also be used to halt the acquisition at any time.

3.17 RECORDING AN ECG IN MANUAL MODE

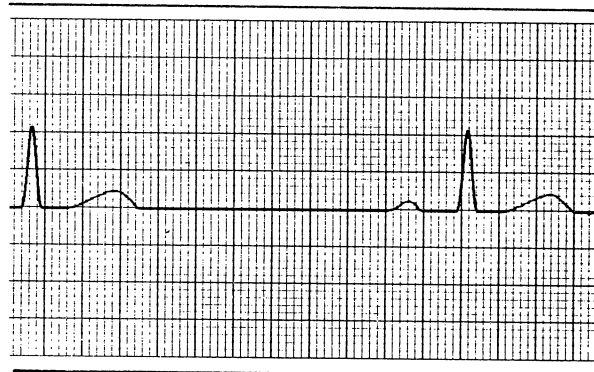
When a manual ECG is required, the operator must review the pre-set parameters; gain, filter, writer speed and format, just as in the AUTO mode.

The BURDICK 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 successive 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 has been completed to the operator's satisfaction, simply press the STOP key.



a) ECG at 25mm/sec.



b) ECG at 50mm/sec.

Fig. 3-11, Comparative ECG Traces

NOTE: The majority of ECGs are recorded at a standard paper speed of 25mm 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 operator 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 50mm per sec. paper speed for just such cases so that the operator may adjust the parameters accordingly.

3.18 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 usually caused by patient movement, muscle tremor, improperly affixed electrodes, or electrical interference (AC).

Overload Indication

The BURDICK EK10 prints the message "OVERLOAD" on the electrocardiogram to alert the operator to an overload condition. This overload condition can be caused by electrode polarization from a defibrillator pulse. When such a condition occurs, the waveform on the electrocardiogram will not provide a true indication of patient cardiac activity. Care must be taken by the user not to misinterpret the patient's condition during such an overload condition.

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. 3-12, 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 Electrodes

An example of baseline shift caused by loose electrodes 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 electrode to ensure that it is properly applied. A baseline jump occurring 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 probably due to patient respiration.

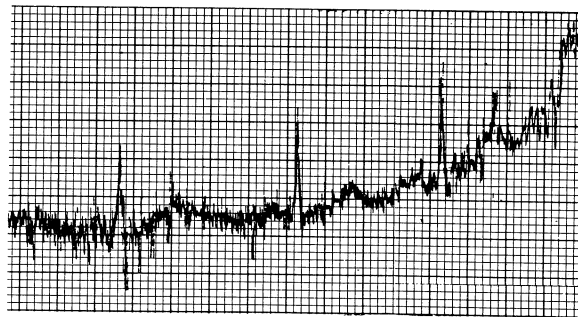


Fig.3-13, Artifact - Loose Electrodes

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 50HZ. The result of typical AC interference on the ECG is shown below.

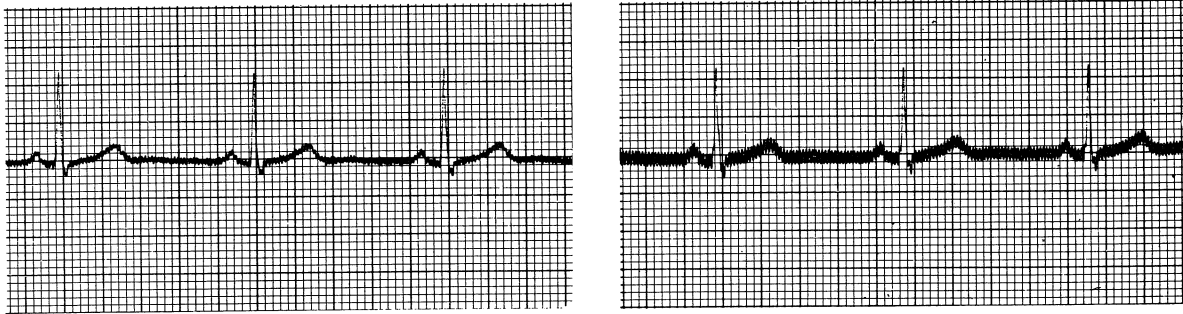


Fig.3-14, Artifact - Alternating Current

To eliminate or minimize AC effects:

1. Locate the BURDICK EK10 so that the mains power cable is well away from the patient and the patient cable. Do not pass the power cable under or near the patient or table.
2. Be sure the unit is properly grounded by means of the wall outlet to which it is connected.
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 unit. 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 Siemens 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 electrodes.

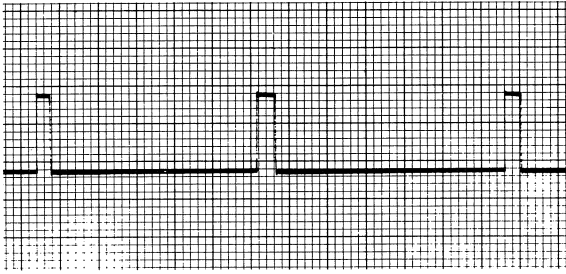
3.19 OPERATION WITH AC FILTER

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 3.14, Input Instructions). There can be a small nominal loss of amplitude in the QRS complex when the filter is employed.

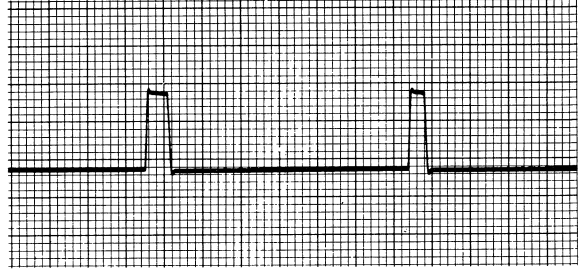
A reference calibration mark should be included in every ECG recording, filtered or unfiltered. In the AUTO mode, the BURDICK EK10 automatically records a calibration mark at the start of each lead trace. Unfiltered, the calibration pulse has a relatively squared corner and an almost instantaneous rise 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 (Fig. 3-15) show typical examples of recordings made both with and without the filter.

Pacemaker Spikes

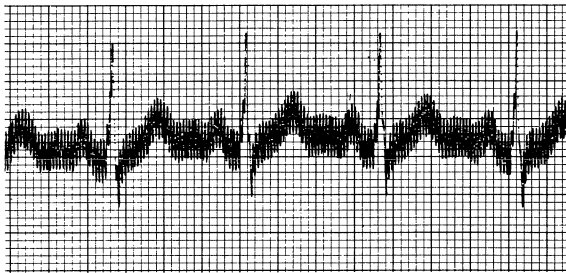
With the filter ON, the high frequency spikes produced by a cardiac pacemaker cannot be recorded. In most cases, pacemaker spikes may be recorded with the filter OFF.



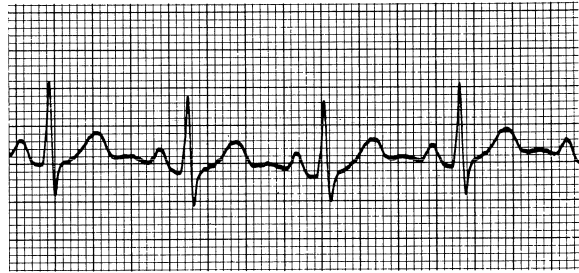
Calibration without Filter



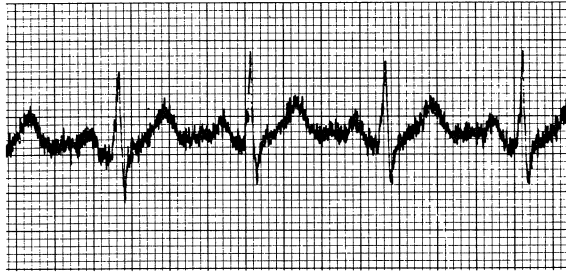
**Calibration with Filter On,
Note the small overshoots
in the leading edge**



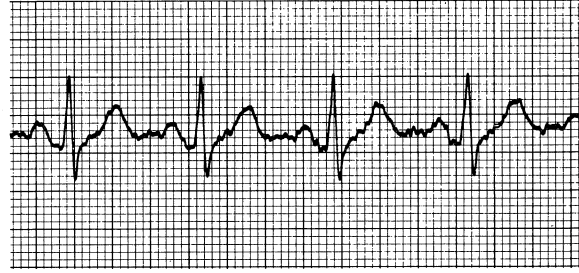
Moderate AC without Filter



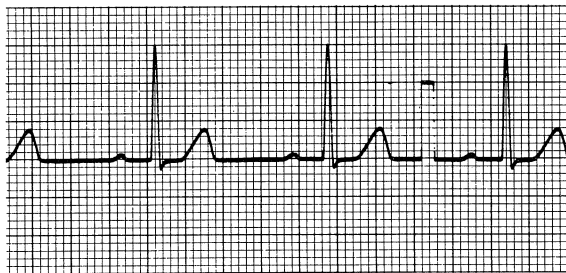
Same Tracing with Filter On



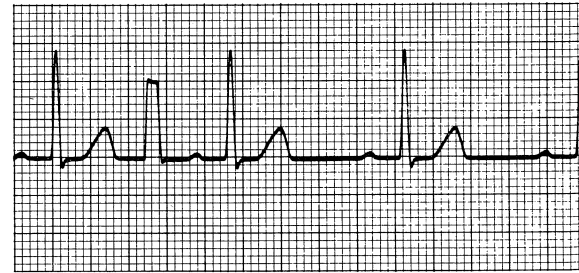
Somatic Tremor without Filter



Same Tracing with Filter On



QRS Complexes (No Filtering)



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

Fig.3-15, Typical Traces without and with Filtering

Section 4

4.0 REPLACING BATTERY

After extended usage, two years or more, the battery pack - if your BURDICK EK10 has this optional feature - may need to be replaced if it will no longer hold a full charge. This should only be done by a qualified technician. Access to the battery is gained by removing the large square snap-in cover panel on the bottom of the unit.

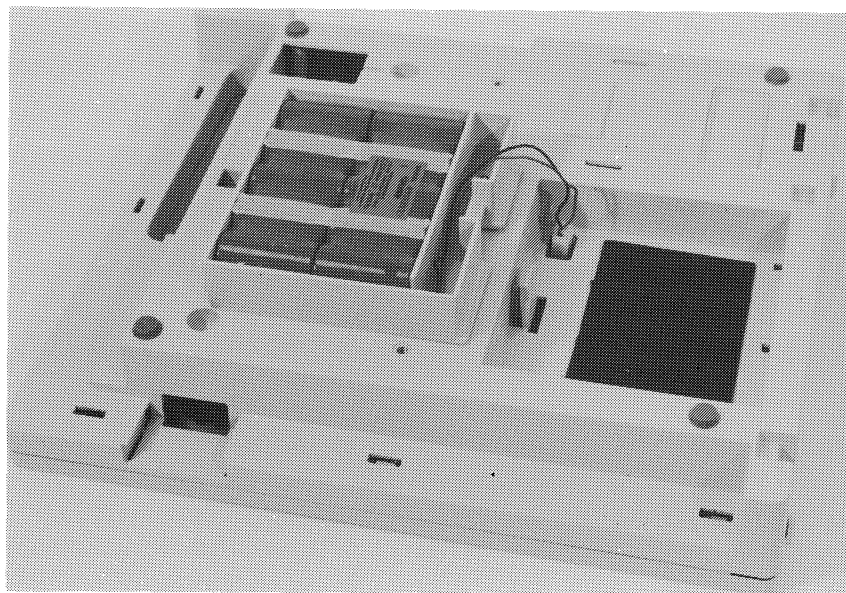


Fig.4-1, Battery Compartment with Cover Removed

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.

If the unit is to be stored for an extended period, fully charge the battery prior to storage. In addition the battery should be charged for 24 hours every second month of storage. **The battery can not be overcharged.**

NOTE: No periodic battery check is necessary.

Section 5

SAFETY


5.0 The symbol  on the unit indicates that some hazard may be present.

Relevant information is supplied in these Operating Instructions

5.1 DESIGN AND CONSTRUCTION

The BURDICK EK10 complies with the safety requirements set forth by the International Electrotechnical Commission in publication No. 601-1 entitled "Safety of Medical Electrical Equipment" and classified as Class 1.


The classification with regard to protection against electrical shock means that the BURDICK EK10, powered from the mains supply, must only be connected to a properly grounded mains outlet.

The degree of protection for the ECG input is of type CF. This means that the unit can be used for intracardiac measurements (hence the symbol  above the patient cable socket). This symbol also indicates protection against the effects of defibrillation.

5.2 GROUNDING

If in doubt about the integrity of the AC power supply's protective grounding (earthing), use only battery power for your ECG recordings. Unplug the AC (mains) power cord before you begin recording.

5.3 POTENTIAL EQUALIZATION

If special regulations prescribe potential equalization, a separate cable may be connected to the equalization terminal on the unit that is indicated by the symbol . **Use only cable Art. No. 21 71 759 E2018.**

5.4 PREVENTIVE MAINTENANCE

The purpose of preventive maintenance is to eliminate future problems and keep the equipment in a condition providing completely safe, satisfactory recordings. Preventive maintenance should be carried out at least once a year as described in the Technical Description.

Before using the BURDICK EK10, always ensure that the line power cord, power plug, power connector and power input socket show no signs of damage.

Immediate maintenance has to be carried out if:

- * The equipment was subject to extreme mechanical stress, e.g. after a heavy fall.
- * The equipment was subject to spillage of liquids.
- * The function of the equipment seems to be disturbed.
- * Parts of the unit enclosure are cracked, removed or lost.
- * Any connector or cord shows signs of deterioration.

5.5 REPAIRS AND MODIFICATIONS

As the manufacturer of electromedical equipment we can only assume responsibility for the safety features of the unit in those cases in which maintenance, repairs or modifications have been carried out by us or by agents expressly authorized by us and in which components affecting the safety of the unit have been replaced by original spare parts in the event of failure.

Furthermore, when such work is carried out we advise you obtain a certificate from the persons carrying out such work, indicating the nature and extent of such work, including details of any change in the rated data or operating range. The certificate should specify the date when the work was done and the name of the firm with an authorized signature.

5.6 NON-EXPLOSION PROOF

The BURDICK EK10 is not designed for operation in areas in which there is a risk of explosion.

5.7 LEAKAGE CURRENTS

All ECG wires (leads), electrodes and connectors, plus their amplifiers, connected to the patient, are galvanically isolated from the rest of the recorder and from ground. This isolation normally limits currents through the patient to only a few microamperes.

This isolation, incorporated to ensure patient safety, is bypassed if the conventional ECG electrodes on the patient cable should contact any metal object or electrically conductive object (such as your bare hands). A potential shock hazard then arises, regardless of whether these objects are grounded or not.

5.8 DEFIBRILLATION PROTECTION

The unit may remain connected to a patient during defibrillation. The patient cable and input circuits are designed to prevent damage to the recorder, even if the defibrillator electrodes should contact the ECG electrodes during defibrillation.

NOTE 1: This defibrillation protection is effective only if the correct patient cable, Art. No. 96 20 626 EH49E, as supplied with the unit, is used.

NOTE 2: The disposable electrodes included in the accessory pack that came with your BURDICK EK10 are designed to be used with this instrument. These electrodes must be used if the built-in defibrillation protection, as required by the IEC standard, is to be maintained. Do not mix electrodes with those of another manufacturer or mix reusable and disposable electrodes. The use of other types of disposable, or reusable electrodes, can lead to considerable baseline drifting or blocking of the recorded signal.

5.9 OVERLOAD CONDITION

The BURDICK EK10 prints the message "OVERLOAD" on the electrocardiogram to alert the operator to an overload condition. This overload condition can be caused by electrode polarization from a defibrillator pulse. When such a condition occurs, the waveform on the electrocardiogram will not provide a true indication of patient cardiac activity. Care must be taken by the operator not to misinterpret the patient's condition during an overload condition.

5.10 HIGH-FREQUENCY SURGERY

The patient cable, Art. No. 96 20 626 EH49E, supplied with the BURDICK EK10, has a built-in 10,000 ohm resistor in each banana plug. These resistors prevent damage to the unit from high-frequency energy. They also reduce the risk of patient burns under the ECG electrodes if the grounding electrode in the high-frequency unit malfunctions.

5.11 LOW BATTERY WARNING (battery option only)

The unit will display LB (Low Battery) on the MAIN menu LCD display if the battery charge level is insufficient to allow at least 15 minutes of continuous operation. The unit should be recharged promptly whenever this occurs.

5.12 CLEANING AND DISINFECTING (Electrode Cables and Electrodes)

For disinfection, the electrode cables and the electrodes should be rubbed with a swab or cloth moistened with a formaldehyde solution such as SONACIDE, CIDEX, LYSOFORM 5% or INCIDIN GG 1.5%.

Under no circumstances may the electrode cables be immersed in any cleaning fluid, nor may they be subjected to hot sterilization with water, steam or air, or to ether sterilization.

5.13 CLEANING AND DISINFECTING THE UNIT

The recorder housing may be cleaned and disinfected in the following manner:

Cleaning: Rub the housing with a cleaning cloth moistened with water to which a mild household detergent can be added if necessary. Never use ether, benzene or similar solvents.

Disinfection: Thoroughly spray the housing with INCIDIN or a similar product.

Section 6

APPENDIX

List of Burdick EK10 Display Acronyms and Abbreviations

ON/STBY	On/Standby
AUTO	Automatic mode
MAN	Manual mode
1mV	1mV calibration pulse
STOP	Stop
MAIN	Main menu
ID	Patient identification menu
AMP	Amplifier menu
WRT	Writer menu
ENTR	Enter into memory
GAIN	Amplifier gain (sensitivity)
FLTR	Filter
RTN	Return to previous menu
SPD	Paper speed
OPT	Options menu
FRMT	Format options
LB	Low battery condition
LANG	Language choice menu
ENG	English
GER	German
FREN	French
SPAN	Spanish
OFF	Off
On	On
Rhym	Rhythm strip
LEAD	Lead selection
LGTH	Length of recording
YES	Yes
NO	No

Technical Data

Model No. 96 20 519 EH49E

Conforms to standards IEC 601-1; IEC SC 62D (C.O) 17

Dimensions 280mm x 330mm x 81mm

Weight 4.1 kg including optional battery.

Power Requirements 220-240VAC, 50/60Hz, 30VA
Mains fuses: 2 x 160mA slow-blow
12.5Vdc nickel-cadmium battery (*optional*)
Battery fuse: 2A slow-blow

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:

Standard Leads: (single channel) I, II, III, aVR, aVL, aVF, V1, V2, V3, V4, V5, V6;

Standard Leads: (three channel) I, aVR, V1, V4;
II, aVL, V2, V5;
III, aVF, V3, V6

Cabrera Leads: aVL, II, V1, V4;
I, aVF, V2, V5;
-aVR, III, V3, V6.

Frequency response Meets or exceeds IEC draft standards (unfiltered)
04 - 30Hz, -3dB (filtered)

Input impedance Greater than 50 M ohms
Electrode offset tolerance $\pm 300\text{mV}$
A/D conversion 8 bits
Signal outputs 1V out per 1mV input, +10% gain
Connector 9-pin D, subminiature

Printout:

Paper type Thermal
Chart speeds 25 or 50mm/sec. $\pm 2\%$
Printout format 1 - channel auto or manual
Printout device 48rim thermal dot array
Paper dimension 50mm wide, 45mm grid, 45.7m roll (150 ft.)
Lead marking Leads are imprinted on each lead trace above waveform

Patient Safety:

Floating input with defibrillator protection according to IEC type CF.

Subject to change without notice

Art. No. 95 84 509 EH49E

Burdick Corporation
Milton, Wisconsin 53563 U.S.A.

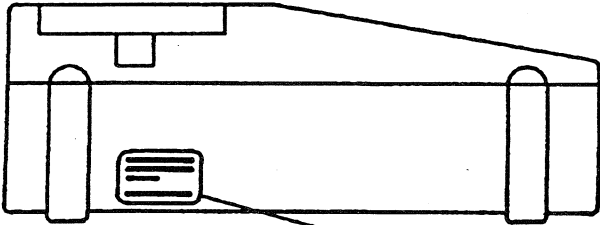
Siemens-Eléma AB
Medicinsk Teknik,
Solna, Sweden
Phone: +468 730 70 00

Ordering No. **A91003-M3111-L500-01-7600**
Printed in U.S.A.
AG 04891.5

Burdick Part No. 086100

Wichtiger Hinweis!

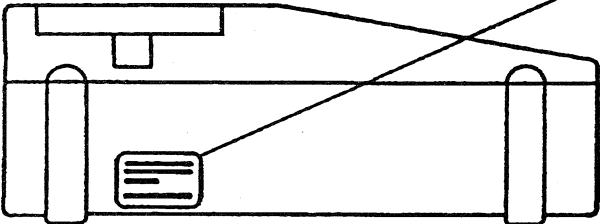
Dieses Etikett ist am vorgegebenen Platz
gemäß Abbildung anzubringen.
(Gilt nur für die BRD.)



BURDICK ELITE

Dieses Gerät ist nicht für
intrakardiale Anwendung
bestimmt!

Gruppe 3 nach Med GV.



BURDICK EK10