CARDIOLINE®
DELTA 1 Plus
USER MANUAL
ENGLISH VERSION

Index

CAUTION: Federal law restricts this device to sale by or on the order of a physician.

This manual is an integral part of the instrument and describes its normal use. It should always be kept close to the equipment. Observance of the manual is a prerequisite for proper instrument performance and correct operation and ensures patient and operator safety depending on these factors.

The symbol (!) denotes : observe the operating instructions ! It serves as an indicator for basically important facts to be noted when operating the instrument.

According to the prescribed International Regulations (see chapter 14. Specifications) the equipment described in this manual is not to be used in presence of an flammable anestetic solution with air or oxygen. The equipment case is not protected against water infiltration. The equipment has been developed, according to the conditions of use, for a continuous operation.

The instrument is not designed for operation in oxygen-enriched atmospheres and/or in zones of risk where explosion hazards may exist.

The prospective measures of class I are effective only if such instruments are connected to power outlet sockets with grounding contact. Cables and plugs which are damaged must be replaces immediately. Extension cords, in particular those with multiple connectors, should not be used.

Instruments into which liquids have penetrated must be immediately cleaned and checked by an authorized service technician.

Patient safety, maintenance of the specified measuring accuracy, and interference-free operation can only be guaranteed when the patient cables, electrodes, transducers, and probes described in this manual are used.

For cleaning and disinfection, line power operated instruments must be separated from the power line.

In the case that the equipment described in this manual could provide suggestions for interpretation or diagnosis, these suggestions must always be checked and validated by a specialist physician. Remco Italia S.p.A. cannot be responsible for the accuracy of the automatic diagnosis or interpretation given by the unit.

Remco Italia considers itself responsible for the effect on safety, reliability, and performance of the equipment only if:

- assembly operations, extensions, readjustments, modifications or repairs are carried out by Remco Italia or by personnell authorized by Remco Italia;
- the electrical installation of the relevant room complies with the applicable international and local requirements;
- the instrument is used in accordance with the instructions for use.

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1. The electrocardiographic examination

This chapter will not deal with clinical or scientific subjects, which are not within our competence, but it will just give some practical and useful suggestions to shorten the execution times and make the most of the technical characteristic of the instruments.

1.1 Preparing the patient

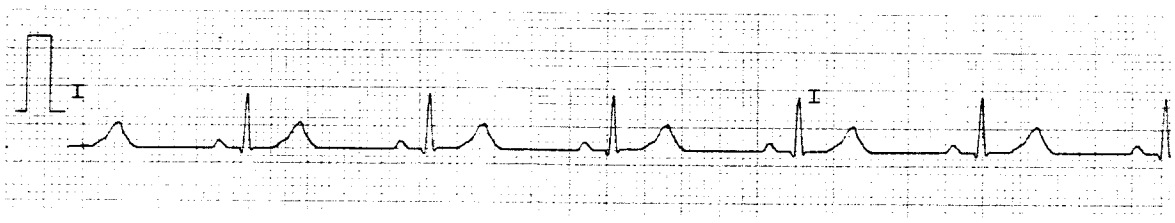
Patient must be lying relaxedly on a comfortable bed that does not force him/her into unnatural position, likely to cause disturbances such as "muscular tremors".
Patient's chest, legs and forearms must be uncovered ad all metal objects such as watches, bracelets and so on, must be removed.
Patient must not be cold, as this too may cause "muscolar tremors".
All possible contacts with any metallic obiect (i.e. bed frame) must be avoided, to prevent A.C. interferences.
Skin at electrode application points must be throughly cleaned with detergent hypo allergic solution.
Reassure the patient as to the harmlessness of the examination.

1.2 Electrode application

Most of the disturbances which may influence the ECG trace (base line stability, A.C. interference, tremors due to poor electrode/skin contacts) depend on the accuracy of this operation.
Patient's skin must be, therefore, prepared as carefully as possible, as mentioned in the previous paragraph : a sufficient quantity of "conductive gel" should be laid on both the inside surface of the electrode and the application points.
Rub patient's skin throughly (particularly if it is thick or dry) so that conductive gel may be fully absorbed in order to ensure a good electrical conduction between subcutaneous tissues and electrode.
Limb electrodes must be secured to patient's legs and arms via the rubber straps, which should be tightened sufficiently but not excessively, to prevent electrodes from moving too easily.
As far as precordial (or chest) electrodes are concerned, we recommend the suction type.
Care must be taken that the patient nor any of the conductive parts connected with the patient (connectors, electrodes) come in contact with other conductive parts.
Wash electrodes with water after every application to ensure good conductivity and long lasting performances.
Avoid the use of alcohol or other liquids as conductors instead of conductive gel as they tend to evaporate and dry off quickly, originating unstable ECG traces and/or artifacts .

1.3 Disturbances and artifacts

Picture no. 1 shows an electrocardiogram recorded under normal conditions.



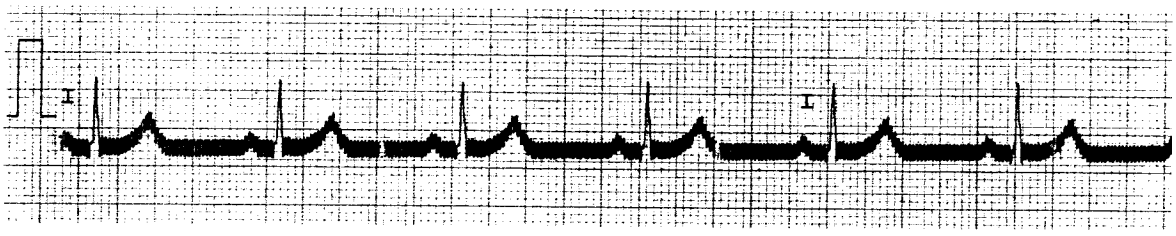
(Picture 1)

The main alterations you may meet with, are the following :

- A.C. interfereces
- muscolar tremor
- base line drift.

1.3.1 A.C. Interference

This disturbance (picture 2) is distinguished by a saw-toothed vibration of constant width and frequency (typically the A.C. 50-60 Hz frequency) superimposed on the recording.



(Picture 2)

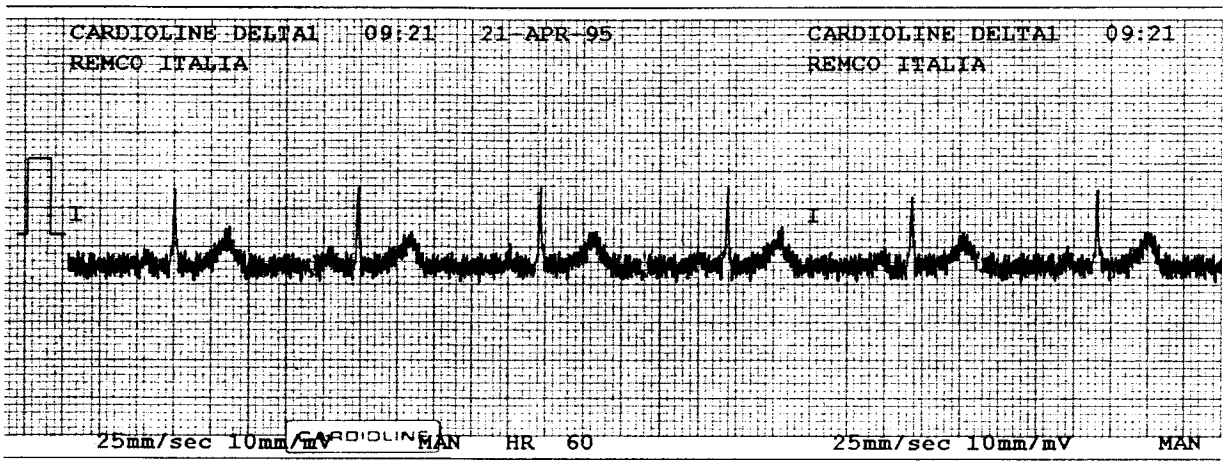
Causes can be schematically identified as follows :

a) presence of strong electro-magnetic fields caused by instruments operating in the vicinity (i.e. : X-rays, radar therapy, and so on)
b) presence of electro-magnetic fields caused by neon lamps, electrical transmission lines, etc.
c) poor earth connection
d) power supply cable and patient cable crossing each other
e) breaking of one of patient cable leads. In this case A.C. interference is of 10 mm or more and it appears exclusively in that part of the trace regarding the broken lead.

The cause of trouble should be identified and removed quickly; if this should not be possible, insert the special filter to eliminate all 50 or 60 Hz

1.3.2 Muscolar tremor

In this case (picture 3) an irregular and unsteady saw-toothed line is superimposed on the electrocardiographic recording.



(Picture 3)

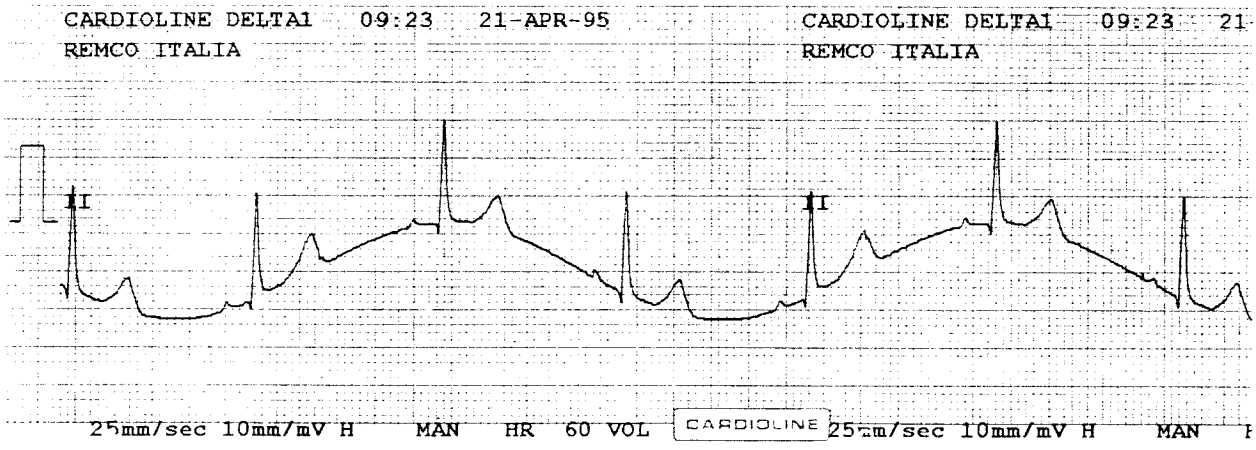
Causes can be schematically identified as follows :

a) restless patient: either cold or uncomfortable, or unwillinglcontracting muscles
b) pathologies (i.e. Parkinson's disease)
c) poor electrode/skin contact, typically caused by a mechanical friction of the electrode on the skin.
   The phenomenon generally appears together with shiftings of the base line.

The cause of troubles should be quickly identified and removed; if this should not be possible, insert the special low-pass filter to attenuate muscular tremors. See, for inserting the filter, "Control keyboard".

1.3.3 Base line drift

This disturbance (picture 4) features notable trace shiftings with respect to paper central line.



(Picture 4)

Causes can be schematically identified as follows :

a) poor electrode/skin contact (conductive gel, or other)
b) loose rubber straps
c) presence of metal particles between electrode and skin
d) false contact between patient cable and electrode : this normally appears as violent trace oscillations from one end of the writing space to the other.

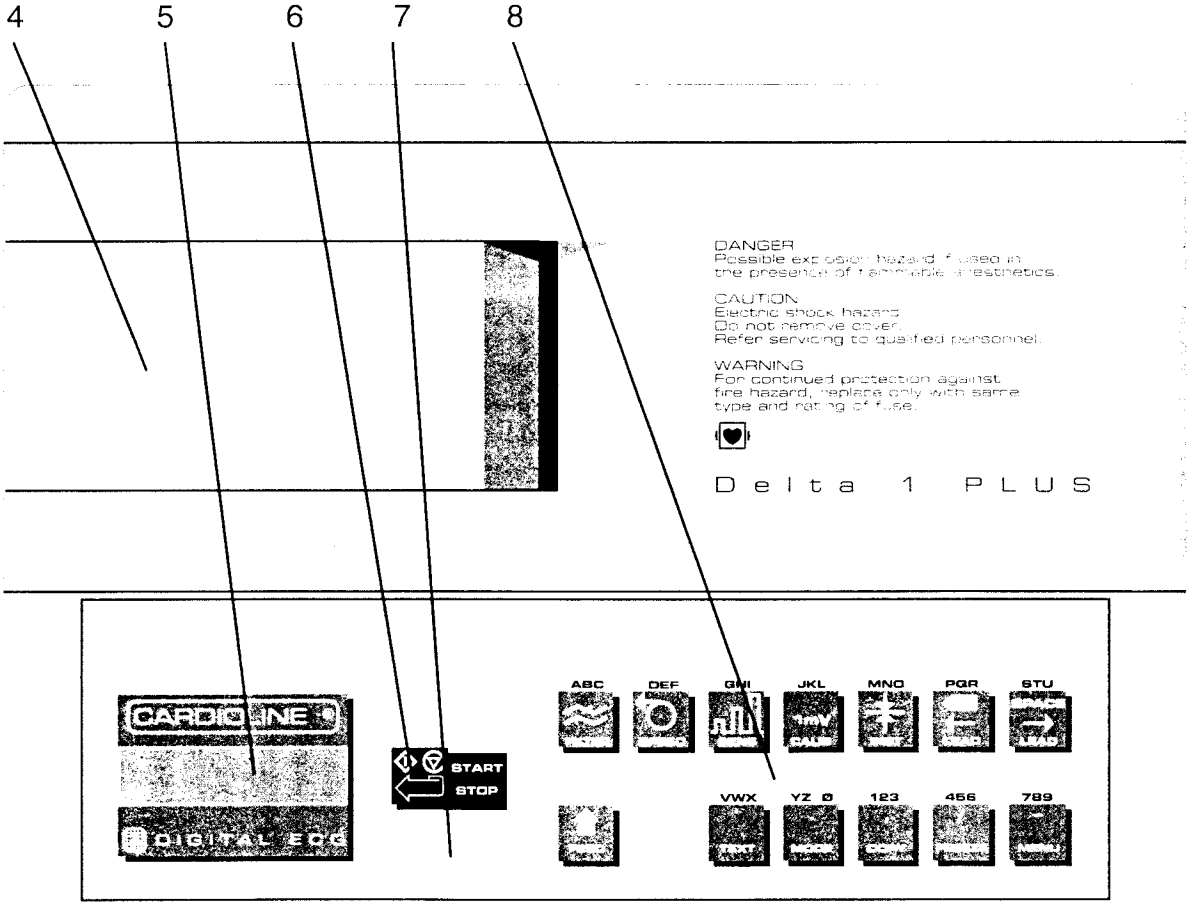
Insert the DRIFT filter to reduce the baseline drift. See for the filter insert "Menu"

To reset base line position, in Manual mode, press shortly the INST key.

Should disturbances persist even after you have checked and/or removed the above listed causes, we recommend that you call our authorized after sale service.
See the chapters about MENU for the filter insertion.

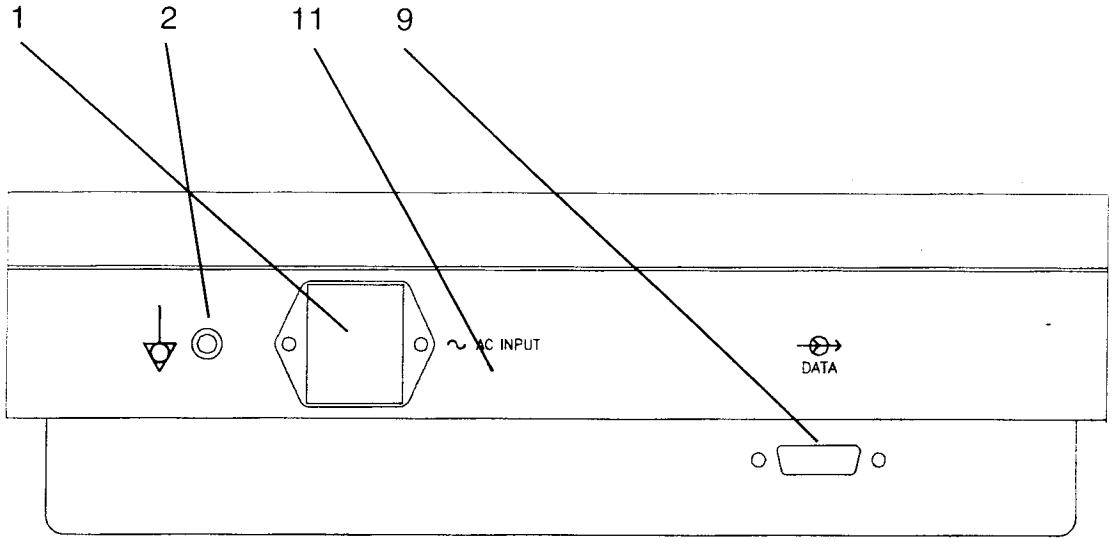
2. Unit parts

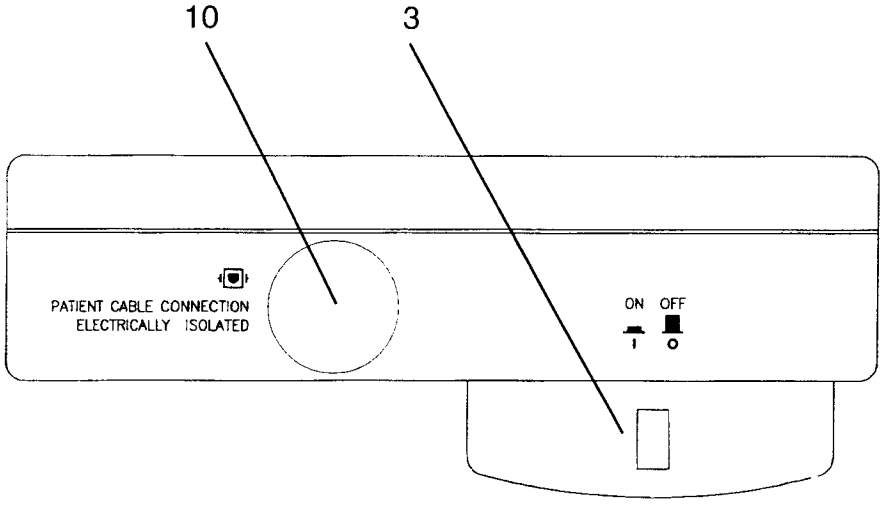
1 A.C. inlet
2 Grounding
3 Mains ON/OFF switch
4 Paper housing
5 Liquid crystal display (LCD)
6 START/STOP key
7 Mains operation led
8 Control keyboard
9 Interface port RS 232 and auxiliary inputs-outputs (optional)
10 Input socket for patient cable
11 Mains and fuses data sticker



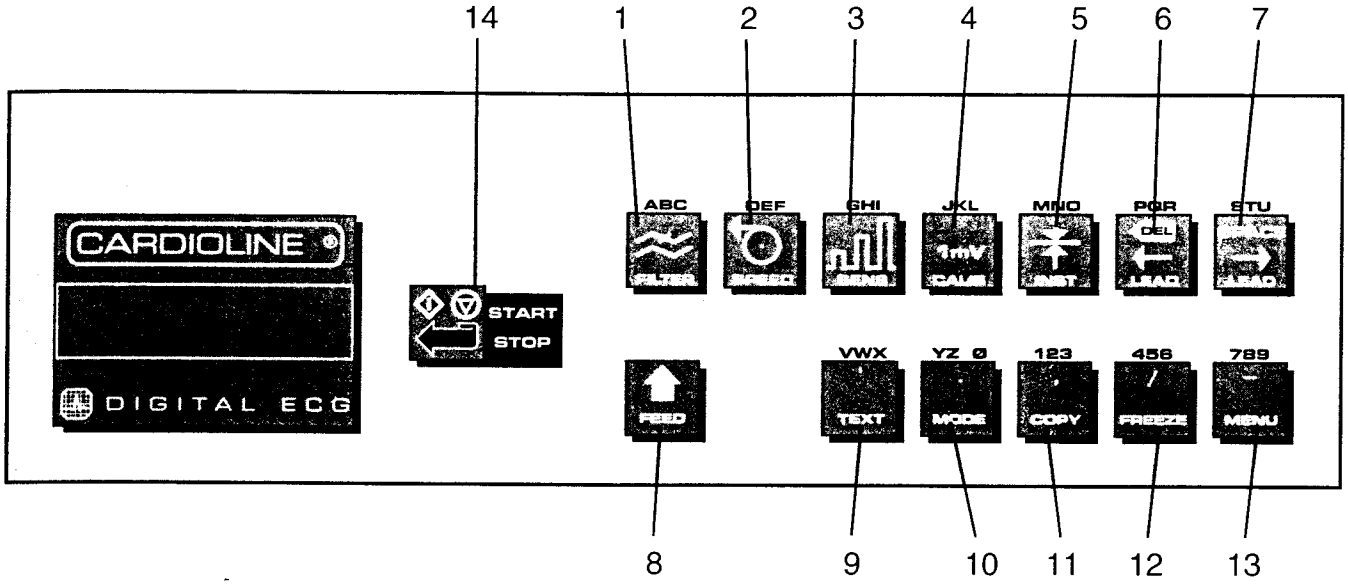
Legenda:

- Communication bidirectional connector (Input/Output)
- ON/OFF switch
- Alternate power supply indicator led
- Equipotentiality
- Isolation according to safety regulations
- Observe the operating instructions !





3. Control keyboard



1 - **FILTER**
Press this key to insert, sequentially, the three muscular filters of increasing strength (MF1, MF2 & MF3); CAUTION: inserting MF2 and MF3 could cause changes in the tracing amplitude and shape. Press again when reached MF3 to set muscular filters off.

2 - **SPEED**
Press this key to change paper speed (6.25, 12.5, 25, 50 mm/sec.). This key is active in the following modes :
a) always while not recording
b) in MANUAL mode even during recording
Please note, in AUTO mode, this key is not active during recording.

3 - **SENS**
Press this key to change amplitude setting (5 - 10 - 20 mm/mV). This key is active in the following modes :
a) always while not recording
b) in MANUAL mode even while recording.
Please note, in AUTO mode, this key is not active during recording.

4 - **CALIB**
Pressing this key will insert a calibration signal in manual mode only (1 mV).

5 - **INST**
Pressing this key in manual mode will speed up centering of the traces if drift has occurred.

6 - **< LEAD**
Press this key to change leads, in MANUAL mode, and passing to the previous lead (or group of leads).

7 - **> LEAD**
Press this key to change leads, in MANUAL mode, and passing to the following lead (or group of leads).

8 - **FEED**
Press this key to skip a page, when using Z-fold paper, or to make the paper run free until the key is released, when using roll paper.

9 - **TEXT**
Disabled key in the base version of Delta 1 Plus. In the I version this key allows the Patient Data entry before recording the ECG.

10 - **MODE**
Press this key to select the operating modes AUTO 1, AUTO 2 or MANUAL and AUTO ARRHYTHMIAS and AUTO CP/I in the I version.

11 - **COPY**
Pressing this key will print a copy of the stored ECG.

12 - **FREEZE**
Disabled key in the base version of Delta 1 Plus. In the I version this key is used to freeze and store the ECG in the memory without recording it on paper, for a late analysis or printout.

13 - **MENU**
With the printer not working, press this key to enter the MENU.

14 - **START/STOP**
Press this key to start recording or to stop it. This same key is active during MENU displaying as ENTER key.

3.1 Text entry: I version

There is a particular use of the keys in the situations of text entry, only in the I version of Delta 1 Plus. The START/STOP key in this case gives an 'Enter' command if used alone, while used with the FEED key (which becomes a Caps Letter key) confirms the present entry and passes to the following one. For the other 12 keys there are indicated three letters' each. This means that pressing once, the key will give the first letter, twice the second and the third time the third one. There are some special characters (such as DEL, SPACE, ', ., ,, /, -), for selecting these ones keep pressed the FEED key and press the desired key.
A little example.
Press TEXT for entering the patient data.
Select, with the >LEAD key to clear the present data.
The unit asks FIRST NAME. For entering EDWARD proceed as follows.
- Press the SPEED key twice, then the START/STOP key;
- Press the SPEED key once, then the START/STOP key;
- Press the TEXT key twice, then the START/STOP key;
- Press the FILTER key once, then the START/STOP key;
- Press the <LEAD key three times, then the START/STOP key;
- Press the SPEED key once, then the START/STOP key;
- Keep pressed the FEED key and press the START/STOP key for confirming the first name.

The unit asks LAST NAME. For entering SMITH proceed as follows.
- Press the >LEAD key once, then the START/STOP key;
- Press the INST key once, then the START/STOP key;
- Press the SENS key three times, then the START/STOP key;
- Press the >LEAD key twice, then the START/STOP key;
- Press the SENS key twice, then the START/STOP key;
- Keep pressed the FEED key and press the START/STOP key for confirming the last name.

The unit asks then ID (Identification Code), BIRTH DATE (to be entered DD/MM/YYYY), AGE, WEIGHT, HEIGHT, SEX (to be selected only with the START/STOP key).

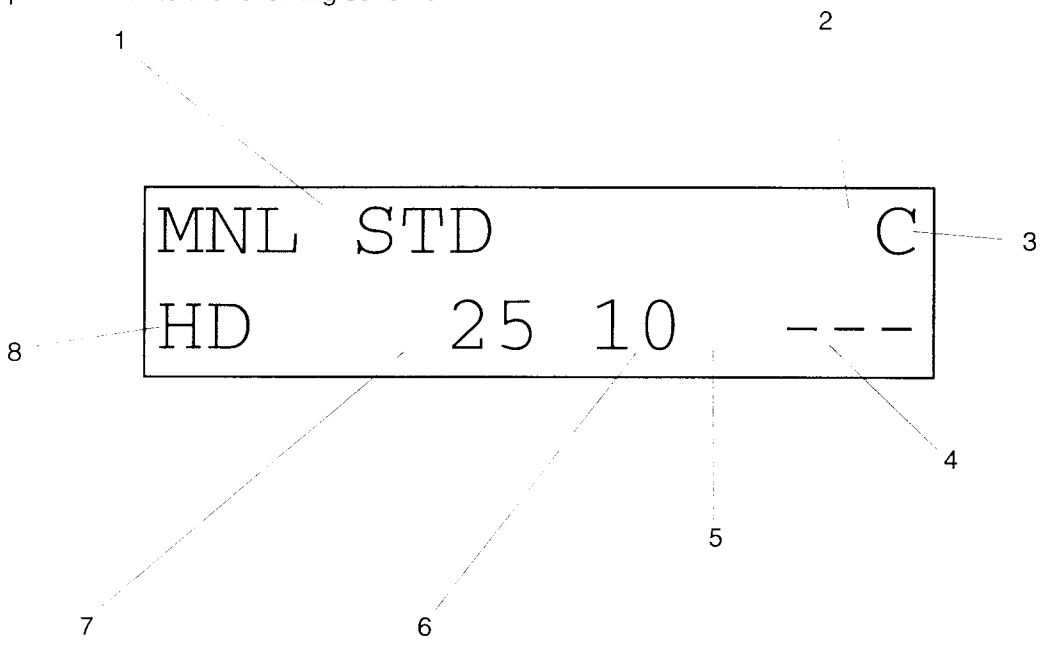
4. Display

4.1 Base version

Besides the usual messages appearing on the liquid crystal display (LCD), i.e., speed, leads, filters, HR, etc.; the LCD will indicate other messages which are explained below.

COVER OPEN	The paper housing cover is not closed properly. The unit will not operate.
PAPER EMPTY	There is no paper in the unit. The unit will not operate.
DELTA 1	The unit is mains operated and it has not been used for approximately three minutes with the STANDBY MODE option enabled (see 9.1 Setup); press START/STOP to restart the unit.
CONNECTING PATIENT	This message appears while the patient is being connected; it will disappear after a few seconds and the patient's heart rate will appear.
OL	Overload signal; this warning will appear if the patient cable is not connected or if peripheral electrodes are disconnected.
VOL	V(chest leads)Overload; this warning will appear if one or more chest electrodes are disconnected. The ECG tracing will then follow automatically.
C	This message indicates that the batteries are recharging while the unit is operating with AC line power.
SUPPLY FAILURE	This message appears when the power supply has been lost during battery recharge (i.e. the AC cable is disconnected).

On the Delta 1 Plus I LCD are displayed contemporarly many informations. For detecting and understanding these informations, please refer to the following scheme.



1. RECORDING PROGRAMS
   In this zone the name of the recording mode is displayed, together with its characteristics. Also in this zone are displayed the Status messages of the printer (i.e. PAPER EMPTY, COVER OPEN, etc).

2. MEMORY STATUS
   This zone is about the buffer memory status. This information may be:
   - blank space : memory is empty;
   - E : an ECG 10 sec. trace is in memory;
   - I : together with the ECG trace, also the Measures and the Interpretation are in memory.

3. BATTERY STATUS
   This zone is about the accumulators status. This information may be:
   - blank space : the unit is working on mains;
   - C : the unit is working on mains and is automatically recharging the accumulators;
   - ▮ : the unit is working on batteries, this symbol shows that the battery is still well charged;
   - ▬ : the unit is working on batteries, this symbol shows that the battery is getting discharged;
   - ▮ : the unit is working on batteries, this symbol shows that the battery is going out of power.

4. ECG TRACE

In this zone the indicated number, with connected patient, indicates the Heart Rate, the presence of the flashing little heart shows the detection of ECG signal; the absence of the input signal is displayed with three lines. The OL message means saturation on peripheral leads input circuits. The VOL message means saturation on chest leads input circuits. The message INS means that the unit is trying to center the trace on paper (selection made by the user with the INST key, or automatically made at the end of an OL situation).

5. AUTORANGE

Here is indicated, with a millivolt symbol, the activation, from Setup, of the autorange on chest leads.

6. SENSITIVITY

Here is indicated the selected recording sensitivity.

7. SPEED

Here is indicated the selected recording speed.

8. FILTERS

In this zone the codes of the filters in use are displayed.

- H Notch Filter
- D Drift Filter
- M1 Muscular Filter 40 Hz
- M2 Muscular Filter 30 Hz
- M3 Muscular Filter 25 Hz

5. Error messages

5.1 Base version

BATTERY CHARGER	This message appears when the battery is being charged.
BATTERY OUT OF ORDER	This message appears when the battery is defective; call your Official Cardioline Service representative.
BATTERY LOW	This message appears when the battery is low. To recharge batteries, see section 9.3.
BATTERY ALREADY FULL	This message appears when the battery has reached full charge; it is therefore useless to leave the unit on to recharge the battery (turn unit off).
BATTERY ALREADY CHARGED	This message appears when the battery has already been recharged and has reached full charge; it is therefore useless to recharge the battery (turn unit off).

The following messages might appear under normal operating conditions and are designed to aid in the servicing and maintenance of your unit; when these messages appear, you should simply press START/STOP and the unit will operate normally.

- CHECKING ROM
- STARTUP ERROR
- PRESS START

If the problem persists, call your Cardioline Service representative.

The following are all malfunction messages:

- INTERNAL ERROR 1
- INTERNAL ERROR 2
- PRINTER ERROR 1
- BAD TEMPERATURE
- BAD SETUP MEMORY
- DS 1287 DON'T STORE SETUP

If pressing START/STOP does not solve the problem, try turning OFF the unit for a few seconds. If the problem persists, call your Cardioline Service representative.

5.1 I version

In particular conditions of not perfect functioning, the unit informs the user with a group of messages, Error or Notice messages. These messages are composed by a description and a code.
Some of these messages are:

E0009: CLOCK BAD CHECK
E0011...0012: BATTERY DAMAGED
E0020: PARAMS BAD CHECK
E0021: BATTERY OUT
E0022: CPU MALFUNCTION
E0023: PRINTER ALARM 1
E0024: PRINTER ALARM 2
E1500...1599: APPL. ERROR

Press START/STOP and the unit will inform the user, with another message, if it is possible to continue working. In case the message CALL ASSISTANCE is displayed, take note of the code and the description of the error and contact the closest Cardioline Authorised Technical Service Center.

6. Preliminary procedure

6.1 AC operation

Before connecting the unit to AC power, please check that the voltage on the back plate conforms with your local voltage. If not, contact your Cardioline dealer immediately and do not attempt to connect the unit to AC power. If the voltage matches, connect the unit using the AC cable provided with the unit; the AC cable is a three pin connector with built-in grounding for stable and correct grounding of the unit; your AC outlet, of course, must have a grounded socket as described in the international safety regulations CEI and/or IEC. Use with a non-grounded AC outlet is not recomended and may cause AC interference.
After connecting the unit to AC outlet, press the power switch to turn on unit (see section 2. Unit parts); the unit will perform a self test. Once completed the test, Delta 1 Plus is ready to use.

6.2 Battery operations

Turn on the power switch; the unit will perform a self test, once completed, it is ready for use. With batteries at full charge, the unit will work for two hours of continuous use without connection with mains.

6.3 Recharging the battery

There are two ways to recharge the battery :

1) Automatic recharge: the battery recharges during normal operation. However, we recomend on a monhly basic, recharging the battery overnight or for eight hours without using it. Simply connect unit to AC power and turn unit on.
2) Forced recharge: this operation is not necessary under normal conditions and should be perfomed only when the battery is completely discharged. For this operation, please refer to section 9.2 or 11.2 (according to the version in your possess).

Note :
Batteries can be charged approximately 500 times without loss in performance.

IMPORTANT:
Batteries are considered consommables therefore they are not covered by warranty.
During battery operation the base version of Delta 1 Plus will switch off automatically after about 3 minutes of non-use; while in the I version it is possible to select to enable the automatic switch off after 5 or 10 minutes of non-use, or to disable it (see chapter 11.1 System Setup).

6.4 Paper loading

To load the paper please follow these simple instructions :

1) open the paper holder cover until vertical;
2) place the pack of paper in the holder as in fig. 1; make sure that the black cue mark (the little black square) on the edge of the paper, is on the bottom side of the paper and that the printed side is not showing.
3) Slide the paper under the printer roller and push it in, as straight as possible, for about an inch (2.5 cm.). The best way to do this is to push on the paper edges with two fingers, (not in the middle). The paper should now be completely around the roller.
4) Close the paper cover; the paper will advance to the first black cue mark.

If the paper does not advance, it has not been pushed far enough around the roller; repeat steps 3 and 4.

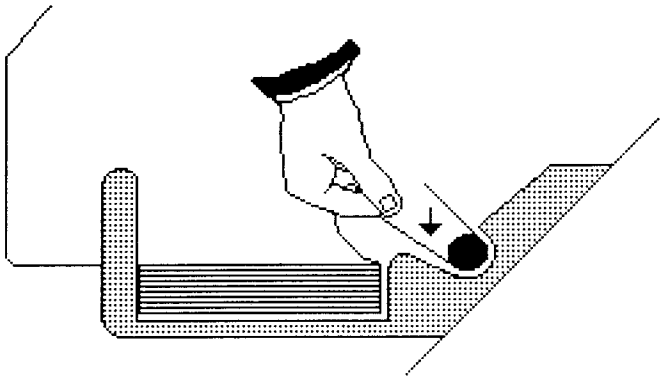


Fig. 1

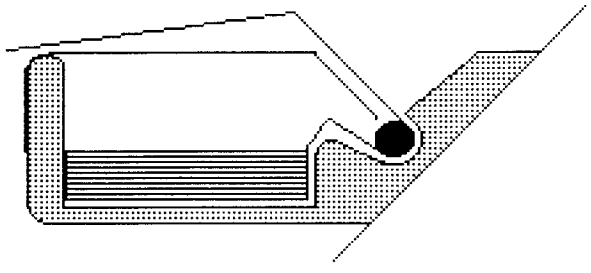


Fig. 2

If the printed side is not showing, the paper has been inserted upside down; repeat steps 1 through 4 making sure the paper has been flipped to the correct side. If the black cue mark is not at the bottom, the unit will not function properly; repeat steps 1 through 4 making sure the black cue mark in the correct position.

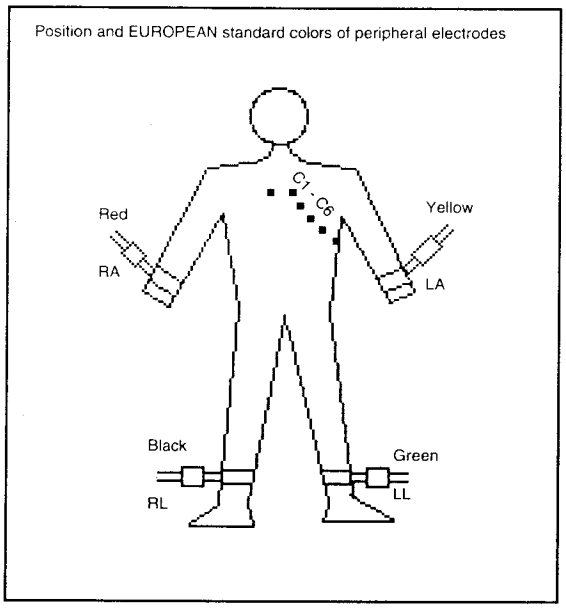
Note :
for safe and problem-free use of the unit, use only Cardioline paper. Use of any other paper will render the warranty void.

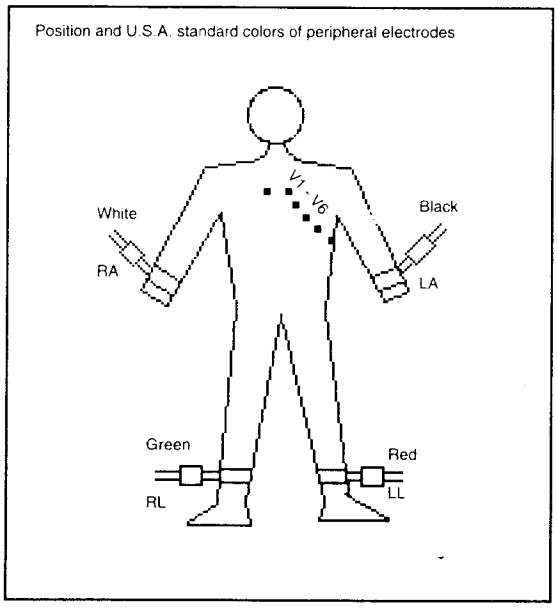
7. Performing an ECG

7.1 Connecting the patient

The Delta 1 Plus can be supplied with different patient cables, depending on geographical distribution. The US color coded patient cable is part number 895.0586. The European standard color coded cable is part number 895.0585.

Connect the cable in its socket on the right of the unit (See section 2. Unit parts).





Hook up the patient following instructions in section 1.2; the unit is a CF type device and is designed to be used for direct cardiac applications.

If you are connecting other instruments to the Delta 1 Plus, make sure that the units comply with medical safety standards; furthermore, all units should share a common grounding (i.e., all units should be connected to AC outlets and have 3 pin plug).

Once the connection has been made, please refer to the operative instructions regarding the version of Delta 1 Plus in your possess.

8. Operative instructions: base version

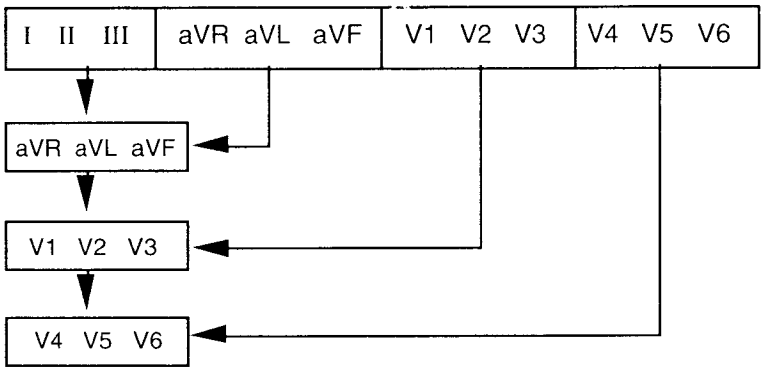
There are three modes to operate with Delta 1 Plus base version.

a) AUTO 1 MODE
It gives the possibility of recording the singles 12 leads, in sequential way, in real time. Proceed as indicated below.

- switch on the unit;
- press the MODE key to select AUTO 1;
- select recording speed with the SPEED key;
- select recording sensitivity with the SENS key;
- insert, if requested, a filter by chossing it pressing the FILTER key;
- start recording with the START/STOP key;
- press the MODE key during recording of one lead to continue the recording time of this lead (LEAD HOLD feature);
- recording stops automatically when all 12 leads have been printed.

b) AUTO 2 MODE
It gives the possibility of recording the 12 leads in a 3-channels format. The leads groups recording is effectued in synchrone way. Proceed as indicated below.

- switch on the unit;
- press the MODE key to select AUTO 2;
- select recording speed with the SPEED key;
- select recording sensitivity with the SENS key;
- insert, if requested, a filter by chossing it pressing the FILTER key;
- start recording with the START/STOP key;
- recording stops automatically when all 4 groups have been printed.



COPY function
When one AUTO 2 recording has been made, it is possible to get one or more copies of this last ECG. Before printing the copy it is possible to modify:

- recording speed (SPEED key);
- recording sensitivity (SENS key);
- inserction of eventually necessary muscular filters (FILTER key).

Press the COPY key to start printing the copy. Printer will stops automatically when recording is completed.

Note :
In AUTO 1 and AUTO 2 modes, during recording with printer active, it is never possible to modify the recording parameters.

Recording time prolongation.
It is possible from SETUP to decide if printing one or two pages for each single lead (or group of leads). For further informations see section 9. Menu: base version.

c) MANUAL MODE
It gives the possibility of recording any of the 12 leads in real time and in continuous. Proceed as indicated below.

- switch on the unit;
- press the MODE key to select MANUAL;
- select recording speed with the SPEED key;
- select recording sensitivity with the SENS key;
- insert, if requested, a filter by chossing it pressing the FILTER key;
- start recording with the START/STOP key;
- change the lead to be recorded with the >LEAD and <LEAD keys;
- stop recording with the START/STOP key.

Note :
During MANUAL recording it is possible, in real time, to:

- modify recording speed (SPEED key);
- insert calibration (1 mV) marker (CALIB key);
- center traces, in case of drift, with INST key;
- modify recording sensitivity (SENS key);
- insert filters (FILTER key)
- change lead.

The following schedule indicates all the possibilities of manual recordings that Delta 1 Plus is able to perform. Please note that it is possible to declare disabled from SETUP the possibility of printing in 3-channels format.

i 12 single leads (I, II, III, aVL, aVR, aVF, V1, V2, V3, V4, V5, V6)
ii 2 single external ch. (only with optional interface board: EXT1 and EXT2)
iii 4 groups of three leads (I-II-III, aVL-aVR-aVF, V1-V2-V3, V4-V5-V6)
iv 1 group with DII and two external channels (only with opt. interf. board)
v 1 stress group of leads (selectable from SETUP)
vi 1 single STD
vii 1 group of three STD

8.1 Auxiliary programs

The digital electrocardiograph Delta 1 Plus has two auxiliary programs:

1 - STRESS
It gives the possibility of recording a group of three leads dedicated to stress test applications.
Selectable groups are: II - aVF - V5 or V2 - V4 - V6 (see Setup procedure for selection: chapter 9.1).
To operate proceed as follows. In MANUAL mode press key >LEAD (or <LEAD) until the above mentioned special group for stress test appears on the LCD. Start recording by pressing the START/STOP key (use this same key for stopping recording).

2 - External Channels Input
This program is active only in presence of the optional Interface board. It gives the possibility of recording traces coming from external equipments (phono, doppler, etc.) together with the II ECG lead.
To operate proceed as follows. In MANUAL mode press key >LEAD (or <LEAD) until the above mentioned special group for external inputs appears on the LCD (II - EXT - EXT). Start recording by pressing the START/STOP key (use this same key for stopping recording).

9. Menu: base version

There are several setup operations that may be selected in order to change some parameters to adapt the unit better to your way of working; these operations are not designed to be performed often, but allow the user a "custom" setup for operation of the unit.

To access these options, press the MENU key. The LCD shows:

DELTA 1 SET UP
START = OK MODE = NO

Press START/STOP if you want to continue or MODE if you want to exit this procedure and go back to ECG recording.
If you press START/STOP the LCD will show the following message .

> & < = CHANGE
START = OK MODE = NO

The arrow keys (>LEAD and<LEAD) will move you to the different options of each item in the menu, the START/STOP key will confirm (OK) the choice while the MODE key will not confirm the choice (NO).

Press START/STOP and the LCD will show OPERATION and the first menu option; pressing the arrow keys will move you through the menu choices which are:

SETUP	(see section 9.1)
CHARGE BATTERY	(see section 9.2)
AUTOTEST	(see section 9.3)
SET HEADING	(see section 9.4)
SET CLOCK	(see section 9.5)

9.1 Setup

This option allows you to change many features of the unit.
With the LCD showing OPERATION / SET UP, press START/STOP to confirm, and the LCD will display the first option.

PAGE IN AUTO MODE : 1

Press the arrow keys to change between one page (factory setup) or two pages in Auto mode. This allows two pages of ECG tracing (8 sec. of recording per lead or group instead of 4). Pressing START/STOP will confirm your choice and move you to the next option; pressing MODE will not confirm the choice and exit from this function.

MAN 3 LEADS ENABLED

This option permits to enable or disable the possibility of printing, in MANUAL mode, also in the three channels format.

STANDBY MODE ENABLED

This option permits to enable or disable the automatic switch off of the unit after three minutes of non use.

DRIFT FILTER ON

The Drift Filter is designed to control baseline wandering caused by breathing or movement of the patient during recording. Press the arrow keys to change between ON (factory setup) or OFF.

HUMM FILTER 50 Hz

The Humm filter is designed to control AC related interference (50 or 60 Hz); being a very accurate digital filter, it will not interfere with the recording shape or amplitude. The filter is factory set at 50 Hz for all 200/240 V units and at 60 Hz for all 110/120 V units.

PAPER TYPE: Z-FOLD

This options allows to choose between the type of paper that the unit may use: Z-FOLD or ROLL.

STRESS TEST LEAD II - aVF - V5

This option gives the possibility to choose the preferred group of three leads to be used in Stress Test. The choice is between two three leads groups: II - aVF - V5 or V2 - V4 - V6.

AUTORANGE OF V
LEADS : ENABLED

This function, when enabled, will automatically (both in manual or automatic mode) cut in half the sensitivity of the V leads when they exceed 50 mm of height. This function can be described as automatic gain/ sensitivity of the V leads and, when ENABLED, will be active both in MANUAL and AUTO modes.

STARTUP DEFAULT :
CURRENT CONFIG

This function allows the user to choose what the unit's first mode of operation will be each time it is turned on. CURRENT CONFIG will turn on the unit with the recording parameters (mode, speed, amplitude, filters) which have been chosen in the last setup performed. TURN OFF CONFIG will turn on the unit with the recording parameters (mode, speed, amplitude, filters) the way they were set when the unit was turned off last.

KEYCLICK :
ON

This function controls whether you want to hear a sound when a key is pressed (ON) or not (OFF).

SAVE CHANGES :
yes - save

To terminate the Config you still have three options:
1) YES-SAVE : will confirm all of the choices you made during your setup and save them even when the unit is turned off.
2) YES-DON'T SAVE : will confirm all the choices you have made during your setup only until the unit is turned off. When you turn on the unit again, it will have the same setup you had before all the changes.
3) NO-USE OLD SET: will not consider all the changes apported, by returning the unit to the same setup you had before all the changes.

9.2 Charge battery

To select this menu option, follow the procedure described in section 9. (MENU). This operation is not necessary under normal operations since the unit will automatically recharge itself during normal use; it might be useful, however when the battery has discharged completely. The LCD shows:

BATTERY CHARGER
□□□□□▪▪▪▪▪ 00 : 00

Pressing "Start/Stop" will start forced recharge of the battery. The squares on the left indicate battery level; the digits on the right indicate how much time has passed since the beginning of the charge.

9.3 Autotest

To select this menu option, follow the procedure described in chapter 9. (MENU). The proper functioning of the unit can be checked with these autotest functions. You will probably be asked to perform this test function by service technicians, if you ever have problems with your unit. There are five tests available:

FAST AUTOTEST
DISPLAY / KEYBOARD
PRINTER
POWER SUPPLY
EXIT AUTOTEST

Each of this is explained as follows.

a) FAST AUTOTEST: makes a memory test. It is the same test made automatically at switching on.

b) DISPLAY/KEYBOARD: it checks proper functioning of both the LCD display and of the keyboard. Press "START/STOP" and the LCD show:

FONT DISPLAY
PRESS START

Press START/STOP again and the LCD will display sequentially all of the available fonts; check that no empty fonts or incomplete characters appears on the LCD. After this test, the LCD will show:

KEYBOARD TEST
PRESS ANY KEY

Pressing keys on the keyboard will allow you to check wether the key you press functions properly or not. Pressing START/STOP will bring you out from this test.

c) PRINTER TEST: it performs a test of the printer; press once START/STOP to perform the test. Check that no empty points appear on the line during this test; if it happens it means that some dots of the thermal head are not working properly. Press START/STOP a second time to end this test and go back to Operational Modes. If you do not want to perform this test yet move to the next test option, press the arrow key.

d) POWER SUPPLY: it performs several tests of the power supply, press START/STOP to perform each test. Some temperatures, a legend of tensions and their relative values will appear on the LCD consequencially; when the last test is performed, the LCD show EXIT AUTOTEST.

e) EXIT AUTOTEST: this option gives the possibility, by pressing START/STOP, to exit the testing functions.

Note :
At the end of FAST AUTOTEST and PRINTER tests the unit will be immediately and automatically ready to work in the default mode. At the end of DISPLAY/KEYBOARD and POWER SUPPLY tests the unit will bring you automatically to the AUTOTEST sub-Menu.

9.4 Set heading

This function allows you to insert some text (i.e. your name, the name of your medical center etc.) and have it printed on the top left end side of each sheet.
When the LCD shows OPERATION: SET HEADING, press START/STOP until the LCD shows:

```
CHAR 1          (...21)
A  (B C ... Z ... 3 4 ...)
```

Press the arrow keys until the first character that you want to select appears on the bottom of the LCD. When it does, press START/STOP to confirm your choice; now CHAR 2 (character number 2) will appear on the top of the LCD. If you made a mistake, press "AUTO/MNL" to go back and make the correction. Press the arrow keys until the second character that you want to select appears on the bottom of the LCD. When it does, press START/STOP to confirm your choice; now CHAR 3 will appear on the top of the LCD. Repeat these operations for up to 21 characters (empty spaces count as characters) to compose the text you want.

9.5 Set clock

This function allows changes to the internal unit's clock when you live in a time zone different from where the unit was last setted.
When the LCD shows OPERATION / SET CLOCK you can select (with the arrow keys) among the following options:

- NO CHANGES: press START/STOP to exit from SET CLOCK
- MINUTES: press START/STOP to enter this function; use arrow keys to change the minutes. Press START/STOP to confirm
- HOURS: press START/STOP to enter this function; use arrow keys to change the hours. Press START/STOP to confirm
- DAY: press START/STOP to enter this function; use arrow keys to change the day. Press START/STOP to confirm
- MONTH: press START/STOP to enter this function; use arrow keys to change the month. Press START/STOP to confirm
- YEAR: press START/STOP to enter this function; use arrow keys to change the year. Press START/STOP to confirm.

10. Operative instructions: I version

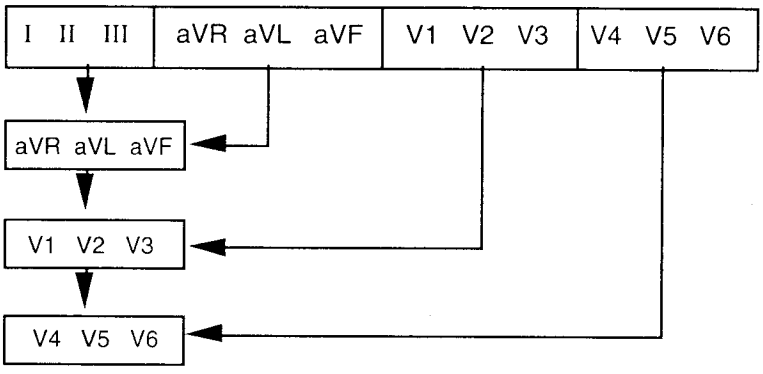
There are five modes to operate with Delta 1 Plus Interpretive version.

a) AUTO 1 MODE
It gives the possibility of recording the singles 12 leads, in sequential way, in real time. Proceed as indicated below.

- press the MODE key to select AUTO 1;
- select recording speed with the SPEED key;
- select recording sensitivity with the SENS key;
- insert, if requested, a filter by chossing it pressing the FILTER key;
- start recording with the START/STOP key;
- recording stops automatically when all 12 leads have been printed.

b) AUTO 2 MODE
It gives the possibility of recording the 12 leads in a 3-channels format. The leads groups recording is effectued in synchrone way and this recording stores automatically the trace in the buffer memory, completed by the Patient Datas, if previously entered. Proceed as indicated below.

- press the MODE key to select AUTO 2;
- select recording speed with the SPEED key;
- select recording sensitivity with the SENS key;
- insert, if requested, a filter by chossing it pressing the FILTER key;
- start recording with the START/STOP key;
- recording stops automatically when all 4 groups have been printed.



COPY function
When one ECG is stored in the buffer memory, it is possible to ask for one or more copies of it. Before printing the copy it is possible to modify:

- recording speed (SPEED key);
- recording sensitivity (SENS key);
- activation of muscular filters (FILTER key).

Press the COPY key to start printing the copy. Printer will stop automatically when recording is completed.
Please note that the Heart Rate indicated on the copy pages is the averaging of the 10 seconds stored signal. For this reason the Heart Rate of the real time recording may differ from the HR indicated on its copy.

INTERPRETATION function
It is possible to perform the Interpretation on the ECG stored in the buffer memory. Proceed as follows
- When the ECG is in the memory an E on the upper right side of the display will inform you that there is an ECG in memory.
- Press MENU. Press >LEAD until the message CP/I appears. Confirm with START/STOP and the analysis will be progressed.

Note : In AUTO 1 and AUTO 2 modes, during recording with printer active, it is never possible to modify the recording parameters. The modifications to the parameters, displayed immediately on the LCD, will be made active just after that the recording comes to a complete stop.

Recording time prolongation.
It is possible from SETUP to decide if printing 1 or 2 pages for each single lead (or group of leads). See section 9. Menu for further informations.

c) MANUAL MODE
It gives the possibility of recording any of the 12 leads in real time and in continuous. Proceed as indicated below.
- press the MODE key to select MANUAL;
- select recording speed with the SPEED key;
- select recording sensitivity with the SENS key;
- insert, if requested, a filter by chossing it pressing the FILTER key;
- start recording with the START/STOP key;
- change the lead to be recorded with the >LEAD and <LEAD keys;
- stop recording with the START/STOP key.

Note :
During MANUAL recording it is possible, in real time, to:
- modify recording speed (SPEED key);
- insert calibration (1 mV) marker (CALIB key);
- center traces, in case of drift, with INST key;
- modify recording sensitivity (SENS key);
- insert filters (FILTER key)
- change lead.

The following table indicates all the possibilities of manual recordings that Delta 1 Plus is able to perform. Please note that it is possible to declare disabled from SETUP the possibility of printing in 3-channels format.
i 12 single leads (I, II, III, aVL, aVR, aVF, V1, V2, V3, V4, V5, V6)
ii 2 single external ch. (only with opt. interface board: EXT1 and EXT2)
iii 4 groups of three leads (I-II-III, aVL-aVR-aVF, V1-V2-V3, V4-V5-V6)
iv 1 group with DII and two external channels (only with opt. interf. board)
v 1 group of SPARE leads (selectable from MENU)
vi 1 single STD
vii 1 group of three STD

In MANUAL there are two particular recording options available:
1 - SPARE
It gives the possibility of recording a group of three free leads, called SPARE leads (see SETUP procedure for selection). To operate proceed as follows. In MANUAL mode press key >LEAD (or <LEAD) until the SPARE message appears on the LCD. Start recording by pressing the START/STOP key (use this same key for stopping recording).

2 - EXT

This program is active only in presence of the optional Interface board. It gives the possibility of recording traces coming from external equipments (phono, doppler, etc.) together with the DII ECG lead. To operate proceed as follows. In MANUAL mode press key >LEAD (or <LEAD) until the EXT message appears on the LCD (EXT). Start recording by pressing the START/STOP key (use this same key for stopping recording).

d) AUTO ARRHYTHMIAS MODE

It gives the possibility of recording the SPARE leads in continuous when the unit detects an arrhythmia. Proceed as indicated below.

- press the MODE key to select AUTO ARRHYT.;
- select recording speed with the SPEED key;
- select recording sensitivity with the SENS key;
- insert, if requested, a filter by chossing it pressing the FILTER key;
- start with the START/STOP key: the unit now displays the message ARR. WAITING and positions the paper ready to record;
- when the unit detects an arrhythmia it starts automatically the recording;
- stop recording with the START/STOP key.

The ECG will be recorded starting from 5 seconds before the arrhythmia detection, thanks to the internal memory of Delta 1 Plus; in this way the printout will be made not in real time, but delayed of 10 seconds.

e) AUTO CP/I

It gives the possibility of recording the 12 leads in a 3-channels format, followed by the complete analysis of the trace (Averaged complex, measurement tables, patient data and global measures, interpretation commentary). The leads groups recording is effectued in synchrone way. Proceed as indicated below.

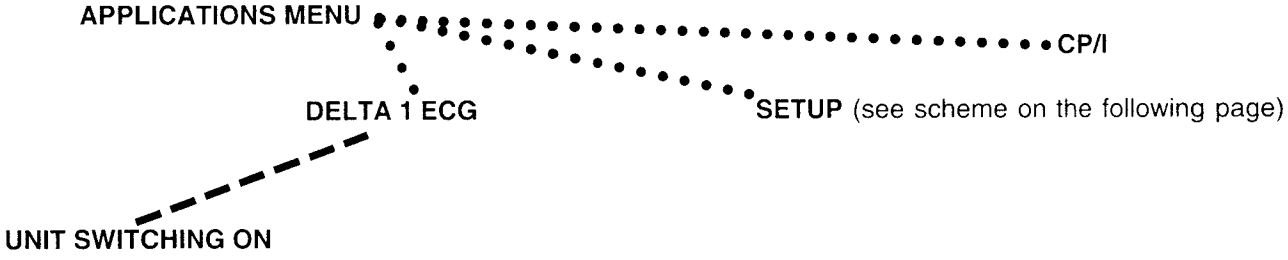
- press the MODE key to select AUTO CP/I;
- select recording speed with the SPEED key;
- select recording sensitivity with the SENS key;
- insert, if requested, a filter by chossing it pressing the FILTER key;
- start recording with the START/STOP key;
- recording stops for few seconds when all 4 groups have been printed, the display shows a row of points in progression;
- recording continues with the printout of the analysis;
- recording stops automatically when all analysis has been printed (according to the indications selected from Set Up, point 9.5 CP/I).

IMPORTANT:

The interpretation is always considering 10 seconds of ECG signal. This means that is necessary not to interrupt the connection with the patient even during the waiting time which follows the ECG printout and allows the unit to progress the analisys.

11. Menu: I version

The main menu of Delta 1 Plus Interpretive version, and 'heart' of the unit, is the Applications Menu. This is composed by three options: DELTA 1 ECG, CP/I and SETUP. DELTA 1 ECG allows to reach the operative modes of the unit, that is to say the real ECG unit for working. CP/I allows to progress and print the Analysis, and Parameters Calculation, on the ECG stored in the buffer memory. SETUP gives the possibility of entering the SETUP MENU, described in the following pages.
Let's see the APPLICATIONS MENU in the following scheme.



Some basic functions of the Delta 1 Plus ECG unit, programmed in origin in the factory, may be modified by the user. For entering the SETUP MENU press the MENU key for entering the APPLICATIONS MENU. On the display the following message appears:

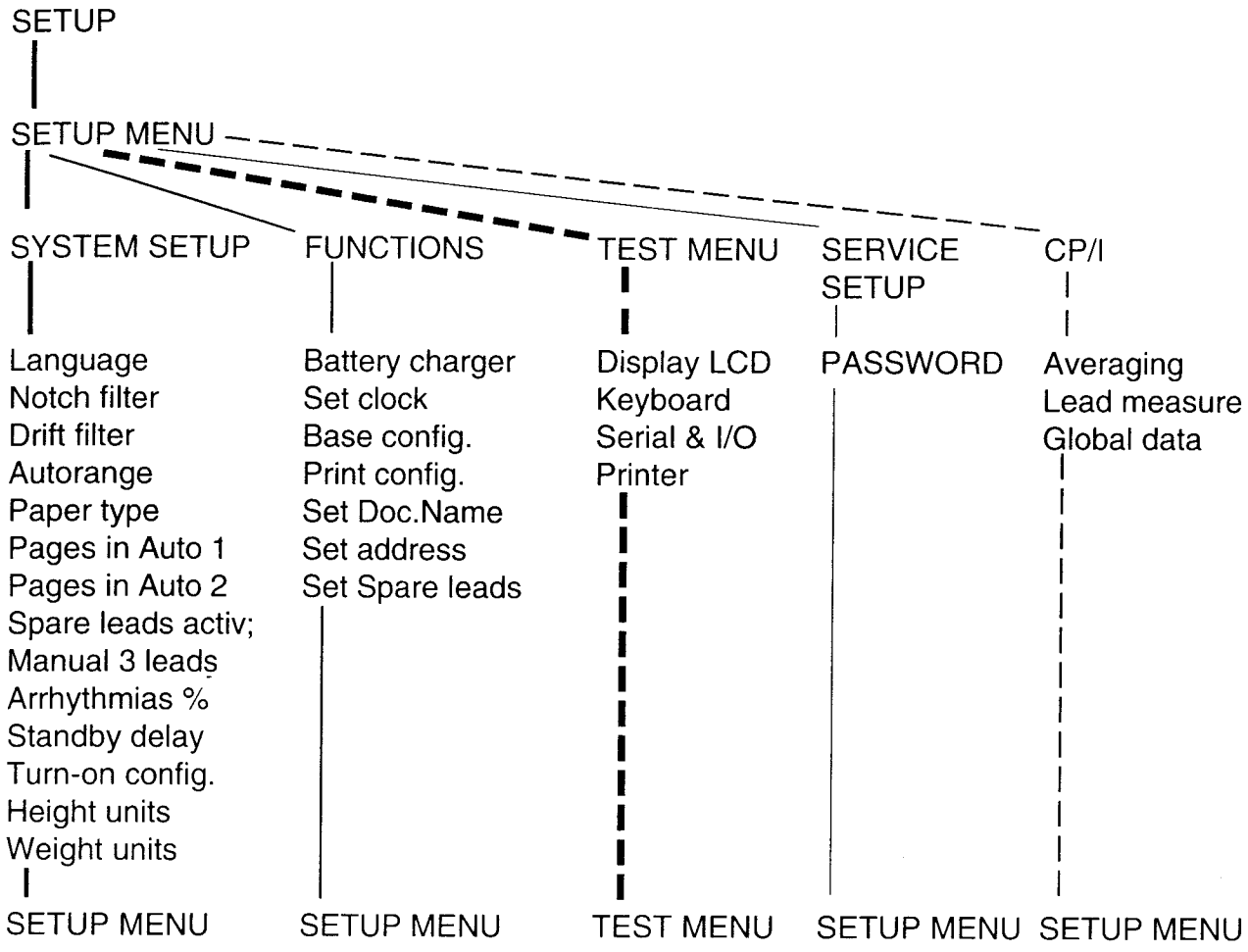
APPLICATION: SETUP

Press START/STOP if you want to enter the setup, press the arrow keys (>LEAD and<LEAD) to select the other two choices: CP/I and DELTA 1 ECG. As already explained, CP/I gives the possibility of making the interpretation of the ECG freezed or stored in the buffer memory, DELTA 1 ECG of coming back to the operative modes.

When SETUP has been selected, the arrow keys (>LEAD and<LEAD) will move you to the different options of each item in the menu, the START/STOP key will confirm the choice while the MENU key will bring you to the previous selection.
The SETUP MENU includes different options; pressing the arrow keys will move you through them, which are:

SYSTEM SETUP	(see section 9.1)
FUNCTIONS	(see section 9.2)
TEST MENU	(see section 9.3)
SERVICE SETUP	(see section 9.4)
CP/I	(see section 9.5)

In the following page a functional scheme of the SETUP MENU is described, with all the Sub-Menus indicated.



Please note that for confirmation is always used the START/STOP key, with the exceptions of the text entry (i.e. Set clock or Set address, ect.) when the START/STOP key is used for confirming every single character, and for the confirmation of the full information it must be used together with the FEED key.

Inside the MENUS it is possible to reach the position DELTA 1 ECG in the APPLICATIONS MENU (for coming back to the operational modes) by simply pressing the MENU key, once or twice.

11.1 System Setup

This option allows you to change many features of the unit.
With the LCD showing SETUP MENU / SYSTEM SET UP, press START/STOP to confirm, and the LCD will display the first option.

```
LANGUAGE :
ENGLISH
```

The available languages are five: English, Italian, French, Spanish and German. If they are not available immediately on your unit, we are working on them !!

```
NOTCH FILTER :
50 Hz
```

The Notch Filter is designed to control AC related interference (50 or 60 Hz); being a very accurate digital filter, it will not interfere with the recording shape or amplitude. The filter is factory set at 50 Hz for all 200/240 V units and at 60 Hz for all 110/120 V units.

```
DRIFT FILTER
ON
```

The Drift Filter is designed to control baseline wandering caused by breathing or movement of the patient during recording. Press the arrow keys to change between ON (factory setup) or OFF.

```
AUTORANGE :
OFF
```

This function, when enabled, will automatically (both in manual or automatic mode) cut in half the sensitivity of the leads when they exceed 50 mm of height. This function can be described as automatic gain/sensitivity and, when ON, will be active in all the modes.

```
PAPER TYPE:
Z-FOLD
```

This options allows to choose between the type of paper that the unit may use: Z-FOLD or ROLL.

```
PAGES IN AUTO 1 :
1 PAGE
```

and

```
PAGES IN AUTO 2 :
1 PAGE
```

Press the arrow keys to change between one page (factory setup) or two pages in Auto modes. This allows two pages of ECG tracing (8 sec. of recording per lead, in Auto 1, or per group, in Auto 2, instead of the standard 4). Pressing START/STOP will confirm your choice and move you to the next option; pressing MODE will not confirm the choice and exit from this function.

SPARE LEADS :
ON

This option gives the possibility to choose if it is suitable the presence, in MANUAL mode, of the SPARE LEADS or not.

MAN 3 LEADS
ENABLED

This option permits to enable or disable the possibility of printing, in MANUAL mode, also in the three channels format.

ARRHYTHMIAS :
VARIATION AT 25%

This option permits to choose the sensibility of the unit regarding the arrhythmias in the AUTO ARRHYT. mode. The choices are 15, 20, 25 or 30 %. This means that the unit will recognize as arrhythmia a detected change in the R-R interval of a 15 (or 20, or 25, or 30) percent compared to the previous one.

STANDBY DELAY :
5 MINUTES

This option gives the possibility to choose if the user prefers to have the automatic switch off of the unit after 5 or 10 minutes of no-use, or if he prefers to have this option disabled (OFF).

TURN-ON CONFIG :
DEFAULT CONFIG

This function allows the user to choose what the unit's first mode of operation will be each time it is turned on. DEFAULT CONFIG will turn on the unit with the recording parameters (mode, speed, amplitude, filters) which have been chosen in the last setup performed. TURN-OFF CONFIG will turn on the unit with the recording parameters (mode, speed, amplitude, filters) the way they were set when the unit was turned off last.

HEIGHT UNITS :
CM

and

WEIGHT UNITS :
KG

These options permit to choose between CM or INCHES and KG or OZ.

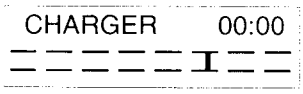
After this function the display will show the message WAITING... while it is saving the settings. Then it comes back to the starting position.

IT IS IMPORTANT TO NOT SWITCH OFF THE UNIT DURING THE MESSAGE WAITING... IS DISPLAYED.

11.2 Functions

The Functions list comprehends the following options:

a) BATTERY CHARGER
This operation is not necessary under normal operations since the unit will automatically recharge itself during normal use; it might be useful, however when the battery has discharged completely. The LCD shows:



The forced recharge of the battery is ON. The marker indicates the battery level; the digits on the right indicate how much time has passed since the beginning of the charge.

b) SET CLOCK
Enter this function if the time and date are wrong. Delete the numbers which appear one by one and enter the new values. In order there appear HOURS, MINUTES, YEAR, MONTH, DAY. All of them must be composed by 2 digits and each of them must be confirmed with the keys FEED + START/STOP (i.e. 2nd of February 1995, 12 h and 7 mins: 12 FEED+START/STOP, 07 FEED+START/STOP, 95 FEED+START/STOP, 02 FEED+START/STOP, 02 FEED+START/STOP).

c) BASE CONFIG.
This function is used for resetting the unit to the former factory's configuration.

d) PRINT CONFIG.
This function prints some informations about the actual configuration of the unit.

e) SET DOCTOR NAME
and
f) SET ADDRESS
Using the alphanumerical keys it is possible, through this function, to enter the name and the address of the user. Confirmation is made always with the keys FEED+START/STOP.

g) SET SPARE LEADS
Through this function it is possible to select, in a completely free way, the three leads which will form the SPARE leads group. The unit asks for LEAD 1: change the indicated lead with the arrow keys (<LEAD and >LEAD) until the desired lead 1 of the group is selected. Proceed in the same way for the other two. It is possible to have less than three leads by simply select the message END OF LEADS at the place of LEAD 2 (for having a single channel Spare Group) or of LEAD 3 (for having a two channel Spare Group). To confirm here is always used the START/STOP key.

11.3 Test Menu

To select this menu option, follow the procedure described in chapter 9. (MENU). The proper functioning of the unit can be checked with these autotest functions. You will probably be asked to perform this test function by service technicians, if you ever have problems with your unit. There are five tests available.

DISPLAY LCD
KEYBOARD
SERIAL & I/O
PRINTER

Each of this is explained as follows.

a) DISPLAY/KEYBOARD: it checks proper functioning of the LCD display. Press START/STOP and the LCD show:

DISPLAY TEST
PRESS A KEY

Press any key and the LCD will get completely dark (for checking the display conditions), press again and it will display sequentially all of the available fonts; check that no empty fonts or incomplete characters appears on the LCD. Then it says END OF DISPLAY TEST and comes back.

b) KEYBOARD: it checks proper functioning of the keyboard. Press START/STOP and the LCD show:

PRESS THE KEY
FILTER

Pressing the requested keys on the keyboard will allow you to check wether the key you press functions properly or not. After having pressed START/STOP, the display will show END OF TEST and will bring you out from this test.

c) SERIAL & I/O: this option gives the possibility of checking the optional auxiliary inputs/outputs and serial port board. It will be used only by Authorized Technicians correctly equipped.

d) PRINTER TEST: it performs a test of the printer; press once START/STOP to perform the test. Check that no empty points appear on the line during this test; if it happens it means that some dots of the thermal head are not working properly. Press START/STOP a second time to stop the printing and then the MENU key to end this test and go back to Tets Menu.

11.4 Service Set Up

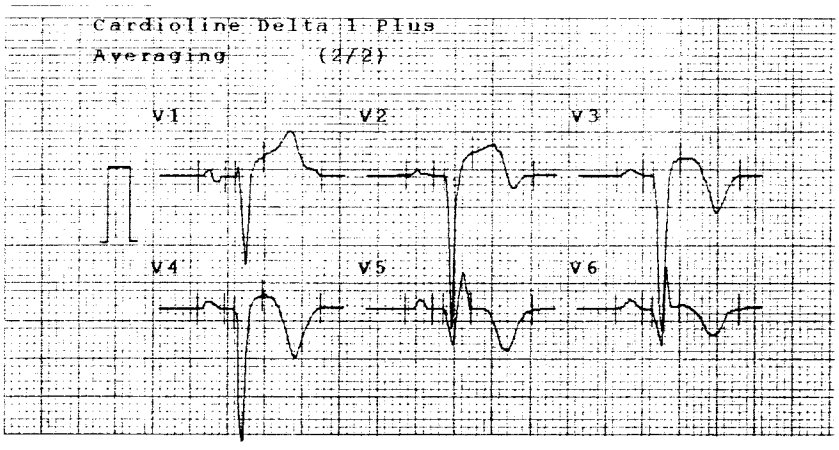
This function is used only by the Cardioline Technical Service. For this reason it is protected by a Password. In any case it is not a Function concerning the use of the unit.

11.5 CP/I

This function allows to select and customize the printout document for the Interpretation.

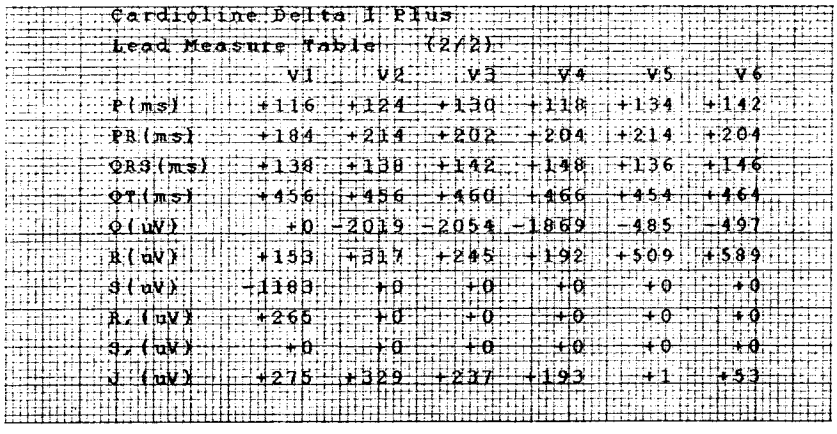
AVERAGING :
ON

Select ON or OFF with the arrow keys if you want this page to be printed in the Interpretation document.



LEAD MEASURE :
ON

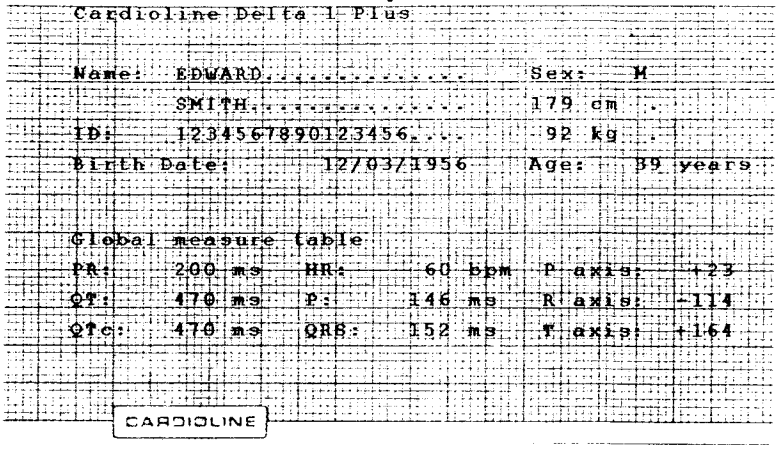
Select ON or OFF with the arrow keys if you want this page to be printed in the Interpretation document.



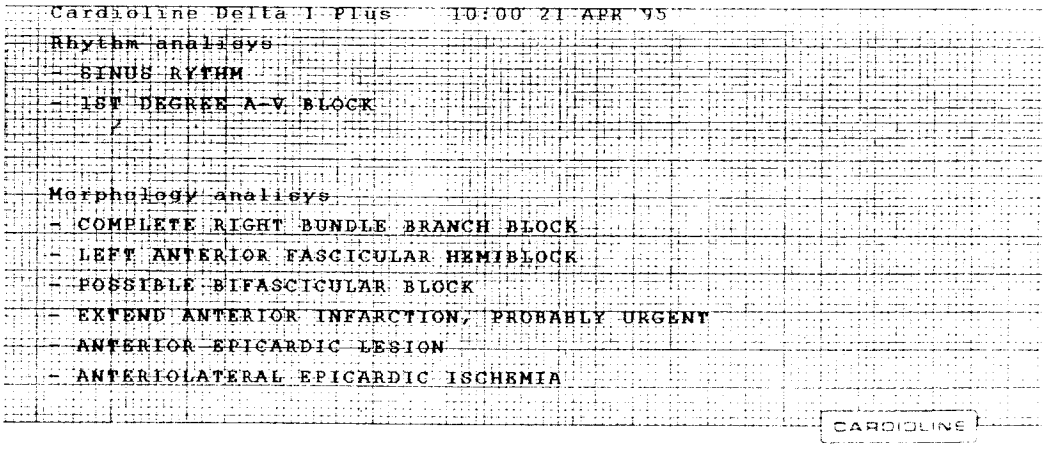
	V1	V2	V3	V4	V5	V6
P(ms)	+116	+124	+130	+118	+134	+142
PR(ms)	+184	+214	+202	+204	+214	+204
QRS(ms)	+138	+138	+142	+148	+136	+146
QT(ms)	+456	+456	+460	+466	+454	+464
Q(uV)	+0	-2019	-2054	-1869	-485	-497
R(uV)	+153	+317	+245	+192	+509	+589
S(uV)	-1180	+0	+0	+0	+0	+0
R'(uV)	+265	+0	+0	+0	+0	+0
S'(uV)	+0	+0	+0	+0	+0	+0
J (uV)	+275	+329	+237	+193	+1	+53

GLOBAL DATA:
ON

Select ON or OFF with the arrow keys if you want this page to be printed in the Interpretation document.



IMPORTANT:
In any case the Interpretation Commentary page will be printed if the analysis of the signal is requested. This Interpretation is given by the CARDIOLINE Interpretive Software, developed according to the European Standard SCP Indications.



12. The serial & I/O interface

The optional interface board (Cod. 888.9304) allows the connection between any version of Delta 1 Plus with an external unit or/and a Personal Computer. The board furnish the equipment with 2 external analogical inputs signals, 3 analogical outputs signals and the possibility of digital communication (serial).
Is important to note that any unit that has to be connected to the electrocardiograph must respect the biomedical equipment safety regulations, if not it must be isolates with an Isolation Transformer.

12.1 Analogical signal input

The external input channels available are two: EXT1 and EXT2. The two signals may be displayed, recorded and stored in the same modalities of the ECG tracings. The input channels are not filtered seen that, generally, any equipment has the possibility of filters on the output signal.

12.2 Analogical signal output

Thanks to the possibility of having the analogical three ECG channels output, it is possible, with the optional interface board, to connect Delta 1 Plus with the ECG 3 channel memory monitor GMI3, from Cardioline. For the base version of Delta 1 Plus the displaying modalities are: with printer in use, the output ECG leads are the real time printed ones; with printer not in use, the output leads are the selected ones in the Manual mode, even if another mode is currently selected. In the I version le output leads are always the ones selected in the Manual mode (indipendently from the mode currently in use); in the case of using the Spare Leads group, with the group itself composed by only one or two leads, the output leads will only be one or two (therefore the missing leads will give plain line on the GMI3 monitor).

12.3 Digital communication

The serial port contained in the optional interface board gives Delta 1 Plus the possibility of connecting to the LCD graphic display DELTAVIS and/ or of operating a bidirectional communication with a Personal Computer.

Regarding DELTAVIS, the Cardioline LCD graphic display, please refer to its User Manual for all the operating instructions for both display and ECG unit connected.

The Cardioline Delta Link optional software permits to manage the communication between ECG unit and Personal Computer. Remaining the importance of the following Particular Note, the board gives the possibility of a complete Remote Control of the ECG unit from the PC and the function of monitoring the traces on the PC screen. The monitoring modalities are different according to the Delta 1 Plus version: with the base version it will be possible to see only three leads at once and the displaying will be interrupted when the printer is in use; with the I version the displaying is anyway continuous and allows to see up to all the 12 leads. The Delta Link software permits also the creation and management of a traces archive, thanks to the possibility of the interface board to send and/or receive a copy of an entire 10 seconds ECG tracing. Please refer to the product documentation concerning the Cardioline Delta Link Software for additional description of its performances and for the characteristics of the digital communication that the Delta 1 Plus interface board provides.

PARTICULAR NOTE FOR P.C. CONNECTION

WARNING: the safety regulations prescribe the complete isolation of the patient from any electrical equipments not complying the regulations (like the PC), therefore the connection results according to the safety regulations only if the Personal Computer is a portable Laptop, battery operating; in the opposite case THE CONNECTION MUST BE DONE THROUGH AN OPTICAL FIBRE CABLE (Cod. 895.0529). In the case the cable is not available, the connection between the ECG unit and the PC must be effectued only AFTER having disconnected the patient from the ECG unit.

13. Special notice

IF THE MAINS SYSTEM OR THE POWER SUPPLY CABLE ARE IN POOR CONDITIONS, USE THE EQUIPMENT ONLY ON BATTERY.

A) Use with high frequence Electro-bisturi:
   - disconnect patient cable.

B) Use with pace-maker:
   - the electrocardiograph may be used in presence of a pace-maker: it will record the relative impulses.

C) Use with other electro-stimulators:
   - before using, consult the nearest Cardioline Service Point.

D) Equipotentiality:
   - for using the connection dispositive between the equipment and the equipotentiality network please read the instructions coming with the equipotentiality plug.

If the electrocardiograph remains unused for long period is necessary to take out the battery pack before: for this operation please contact authorized personnel

Cleaning and Sterilization

For cleaning and disinfection of the equipment's surface it may be used the sterilizant detergent solution generally used in hospitals, with low alcohol content. The unit's surface may be cleaned with a wet tissue, and the liquid must never infiltrate inside the equipment! Wash the electrodes with water and/or use only cool sterilization.

Maintenance

Is suggested a general control of the unit every 2 years at least.

13.1 Use with defibrillator

Follow carefully the following instructions for using a defibrillator at the same time of the electrocardiograph:
- the ECG unit is protected against defibrillation discharge;
- the defibrillator's electrodes must be kept clearly separated from the electrocardiograph's ones;
- do not touch patient during defibrillation.

Reprise after defibrillation.
The defibrillation discharge will bring to the electrocardiograph a temporary saturation on input channels (ECG saturated).
To obtain a fast return to operation of the unit, press the START/STOP key after defibrillation. The unit will make an automatic INST and, within 5 seconds, will proceed to the ECG recording. Waiting time will be marked with an acoustic continuous beep.

14. Specifications

Lead	12 standard lead with continuous and simultaneous acquisition
Channels	1/3
Recording modes	2 automatic programs ; 1 manual program In addition in the interpretive version: 1 automatic program for arrhythmia detection 1 Interpretation program
Writing system	thermal head 8 dot/mm
Recording paper	thermosensitive in roll or Z-Fold of 60 mm x 30 m
Recording speed	6,25 - 12,5 - 25 - 50 mm/s
Sensitivity	5 - 10 - 20 mm/mV
LCD display	Alphanumeric display for operative status and alarm messages
Digital filters	50/60 AC filter 0,5 Hz anti drift filter 3 muscolar filter
Input - Output	serial interface RS-232 2 aux DC input 0,25 - 0,5 - 1 V/cm 3 aux output 0,25 - 0,5 - 1 V/mV
Freequency response	0,05 - 120 Hz (-3 dB)
Time constant	> 3,2 s
C.M.R.R.	> 100 dB
Input impedence	> 100 MΩ
Leakage current	< 10 μA
Defibrillation protection	according to IEC 601-1 requirements
Power supply	230 V ±10%, 50 Hz - 115 V ±10%, 60 Hz; built-in recharg. accumulators with selectable automatic switch-off
Fuses	2 fuses type T250 mA, 5x20 mm (230 V) 2 fuses type T500 mA, 5x20 mm (115 V)
Power consumption	30 VA
Autotest	functions test and printer test
Safety regulations	IEC 601-1 & 62D-17 / class I type CF
Dimensions	313 x 239 x 61 mm
Weight	Kg 2

15. Standard accessories

895.0585 (895.0586	Patient cable EUROPEAN standard upon request, as alternative, U.S.A. standard)	1
873.3406	Limb electrodes	4
873.3405	Chest electrodes	6
894.0438	Rubber straps	4
894.0040	Heart rate rule	1
874.5556	Paper Z-fold pack	1
895.0451 (895.0449	Power supply cable upon request, as alternative, U.S.A. standard)	1
894.3456	Conductive gel tube	1
	User manual	1