Microprocessor Calibrator

Memocal 81 B

Service Manual

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M E M O C A L 81 B

INSTRUCTION MANUAL

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MEASURED and/or SIMULATED THERMOCOUPLES (Thermocouple Calibrator or Generator Mode Load 2000 Ohm)
IEC 584

TC	INPUT	RANGE	ACCURACY ± (*)	RESOLUTION
J	Iron/Constantan	-150 ÷ 1200 °C -238 ÷ 2190 °F	0,3°C ≤ 430°C > 0.5°C 0.6°F ≤ 806°F > 1°F	0.1°C ≤ 430°C > 0.5°C 0.5°F ≤ 1600°F > 1°F
K	Chromel/Alumel	-150 ÷ 1370 °C -238 ÷ 2284 °F	0.3°C ≤ 290°C > 0.5°C 0.8°C over 1230°C 0.6°F ≤ 1999.5°F > 1.0°F 1.5°F over 2250°F	0.1°C ≤ 290°C > 0.5°C 1°C over 1230°C 0.5°F ≤ 1999.5°F > 1°F 2°F over 2250°F
T	Copper/Constantan	-160 ÷ 400 °C -258 ÷ 750 °F	0.5°C ≤ 0°C ≤ 0.3°C 1°F ≤ 0°F ≤ 0.6°F	0.2°C ≤ -100°C > 0.1°C 0.5 °F
E	Chromel/Constantan	-200 ÷ 1000 °C -330 ÷ 1830 °F	0.4°C ≤ 0°C ≤ 0.3°C 0.5°C over 330°C 0.8°F ≤ 0°F < 0.6°F 1°F over 630°F	0.2°C ≤ -150°C > 0.1°C 0.5°C over 330°C 0.5°F ≤ 1210 °F > 1°F
R	Platinum/Platinum 13% Rhodium	- 50 ÷ 1770 °C - 58 ÷ 3218 °F	1.0°C 2°F	1°C ≤ 100°C ≥ 0.5°C 2°F ≤ 200°F ≥ 1°F
S	Platinum/Platinum 10% Rhodium	- 50 ÷ 1770 °C - 58 ÷ 3218 °F	1.0°C 2°F	1°C ≤ 100°C ≥ 0.5°C 2°F ≤ 200°F ≥ 1°F
B	Platinum 30% Rhodium Platinum 6% Rhodium	0 ÷ 1820°C 32 ÷ 3300°F	1.0°C 2°F	1°C over 300°C 2°F from 580°F to 1100°F over 1°F

MEASURED and/or SIMULATED THERMOCOUPLES (Thermocouple Calibrator or Generator Mode Load 2000 Ohm)
DIN 43710/1961

TC	INPUT	RANGE	ACCURACY ± (*)	RESOLUTION
J	Iron/Constantan	-150 ÷ 900 °C -240 ÷ 1650 °F	0,3°C ≤ 430°C > 0.5°C 0.6°F ≤ 806°F > 1°F	0.1°C ≤ 430°C > 0.5°C 0.5°F ≤ 1560°F > 1°F
K	Chromel/Alumel	0 ÷ 1300 °C 32 ÷ 2272 °F	0.3°C ≤ 290°C > 0.5°C 0.8°C over 1230°C 0.6°F ≤ 1999.5°F > 1.0°F 1.5°F over 2250°F	0.1°C ≤ 290°C > 0.5°C ≤ 1230°C > 1°C 0.5°F ≤ 1999.5°F > 1°F 2°F over 2250°F
T	Copper/Constantan	-160 ÷ 600 °C -255 ÷ 1110 °F	0.5°C ≤ 0°C ≤ 0.3°C 1°F ≤ 0°F ≤ 0.6°F	0.2°C ≤ -150°C 0.1°C ≤ 440°C > 0.5°C 0.5°F
E	Chromel/Constantan	-200 ÷ 1000 °C -330 ÷ 1830 °F	0.4°C ≤ 0°C ≤ 0.3°C 0.5°C over 330°C 0.8°F ≤ 0°F < 0.6°F 1°F over 630°F	0.2°C ≤ -150°C > 0.1°C ≤ 330°C > 0.5°C 0.5°F ≤ 1210 °F > 1°F
R	Platinum/Platinum 13% Rhodium	0 ÷ 1700 °C 32 ÷ 2910 °F	1.0°C 2°F	1°C ≤ 100°C > 0.5°C 2°F ≤ 200°F > 1°F
S	Platinum/Platinum 10% Rhodium	0 ÷ 1600 °C 32 ÷ 2910 °F	1.0°C 2°F	1°C ≤ 100°C > 0.5°C 2°F ≤ 200°F > 1°F
B	Platinum 30% Rhodium Platinum 6% Rhodium	0 ÷ 1800°C 32 ÷ 3270°F	1.0°C 2°F	1°C over 300°C 580°F > 2°F ≤ 1100°F > 1°F

MEASURED RTD (Calibrator Mode)

DESIGNATION	INPUT	RANGE	ACCURACY ± (*)	RESOLUTION
Pt	Platinum 100 Ohm RTD	-200 ÷ 850 °C -330 ÷ 1560°F	0.3°C≤315°C ≻ 0.5 °C 0.6°F ≤ 600°F≻1°F	0.1°C ≤ 315°C ≻ 0.5°C 0.5.°F
Ohm	Resistor	0.0 ÷ 600.0 Ohm	0.1 Ohm ≺ 350 ≻ 0.2 Ohm	0.1 Ohm ≺ 350 ≻ 0.2 Ohm

SIMULATED mV (Voltage generator mode) Accuracy(*) ± 0.02% of full scale value up to 1000mV, ± 0.1% over 1000 mV

RANGE	RESOLUTION	MAX. ALLOWED LOAD
± 10 mV	5 uV	200 Ohm/mV LOAD RESISTOR
± 100 mV	50 uV	
± 1 V	0.5mV	MAXIMUM CURRENT 5mA
± 10 V	5mV	

SIMULATED mA (Current generator mode) Accuracy (*) ± 0.02% of full scale value

RANGE	RESOLUTION
0 ÷ 50 mA	10 uA ≤ 20mA ≻ 20 uA

RTD SIMULATION - With OhmERO plug-in module - max admitted load 10mA

DESIGNATION	INPUT	RANGE	ACCURACY ± (*)	RESOLUTION
RTD	3 WIRES RTD DIN 43760	-200 ÷ +850°C -330 ÷ +1560°F	0.5°C 1°F	0.1°C 0.5°F

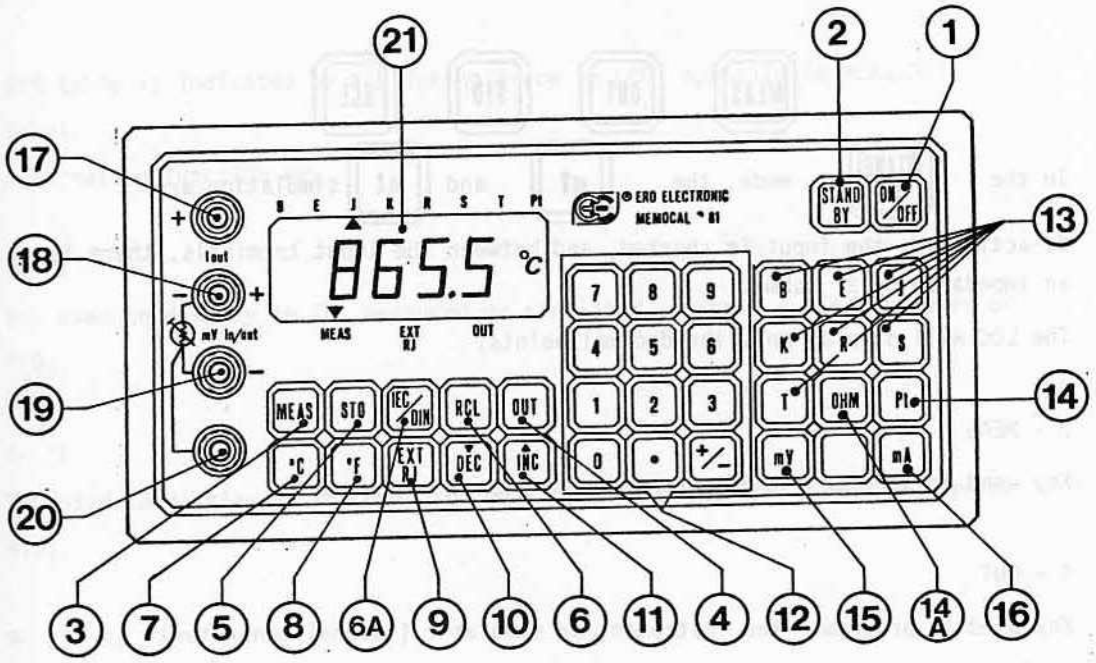
MEASURED mA (Current Calibrator mode) Accuracy (*) ± 0.02% of full scale value

RANGE	RESOLUTION	IMPEDANCE
-10 ÷ +10 mA	5 uA	10 Ohm
-130 ÷ +130 mA	50uA≤±100mA≥0.5mA	

MEASURE mV AND V (Voltage calibrator mode) Accuracy (*) ± 0.02% of full scale value up to 1000mV, ± 0.1% over 1000 mV

RANGE	RESOLUTION	IMPEDANCE
-10 ÷ +10 mV	5 uV	100 MOhm
-100÷ +100mV	50 uV	100 MOhm
-1 ÷ +1 V	0.5 mV	100 MOhm
-10 ÷ +10 V	5 mV	2 MOhm

(*)ACCURACY includes max linearization error. Also include A/D conversion error, internal instrument noise for 24 hours without zero or scale adjustment.
Add to the max error ± resolution bits.
All contributing errors are added together to produce the worst case conditions on instrument accuracy.



KEYBOARD DESCRIPTION

1- ON/OFF

Key used to switch instrument on or off.

The "On" condition is indicated by the appearance of the decimal points on the LCD display, and the instrument self-programmes to the lowest consumption state (the mV or mA simulation being de-activated).

The input is shorted, and between the input terminals, there is an impedance of 2 Mohms.

2- STAND BY

Key used to de-activate the instrument, putting it into the lowest current consumption state.

Before it can operate, the instrument must be given one of the following function instructions:

MEAS OUT STO RCL

In the STAND BY mode, the mV and mA simulation are de-activated, the input is shorted, and between the input terminals, there is an impedance of 2 Mohms.

The LDC will display only the decimal points.

3 - MEAS

Key used to program the instrument for signal measurement.

4 - OUT

Key used to program the instrument as simulator (signal generator).

5 - STO

Key used to store, only in simulation mode, a fixed value and function, on the addressable file from 0 to 9.

6 - RCL

Key used to recall, only for simulation, a previously set value and function, from the addressable file from 0 to 9.

6A - ANSI C96 / IEC 584 - DIN 43710

Key used to select ANSI / IEC or DIN linearization tables during thermocouple measurement or simulation.
ANSI/IEC tables are indicated by a fixed arrow on LCD, opposite to MEAS/OUT label.

DIN table is indicated by a blinking arrow on LCD, opposite to MEAS/OUT label.
Alternating function key.

7- °C
Key used to display in °C, measured or simulated signals (thermocouples or RTD).

8- °F
Key used to display in °F, measured or simulated signals (thermocouples or RTD).

9- EXT RJ
Key used to select internal or external reference junction during thermocouple measurement or simulation. External mode is signalled by presence of arrow on LCD, opposite "Ext Rj" label.
Alternating funtion type key.

10- DEC
Key used to decrease the simulated signal.

11- INC
Key used to increase the simulated signal.

12- Numerical keyboard, with decimal point and polarity keys. The +/- key is an alternating function type, and is used to set the numerical value polarity.

13- B-E-J-K-R-S-T

Key used to select the thermocouple type for measurement or simulation.

14- Pt

Key used to select RTD measurement (Pt 100 ohm at 0°C).

14A-

Key used to select Ohm measurement.

15- mV

Key used to program instrument for MILLIVOLTS in measurement or simulation modes.

16- mA

Key used to program instrument for MILLIAMPS in measurement or simulation modes.

17-

Positive terminal during mA simulation.

18-

Negative terminal during mA simulation.

Positive terminal during mA or mV measurement.

Positive terminal during RTD and ohm measurement.

Positive terminal during mV simulation.

19-

Negative terminal during mV or mA measurement.

Negative terminal during RTD and ohm measurement.

Negative terminal during mV simulation.

20-

Terminal for third wire during RTD and ohm measurement.

NOTE: For correct terminal board connections, see different function descriptions on figs. 2÷10.

21-

4½ digit Liquid Crystal Display, with polarity and engineering units (°C, °F, mV, mA, ohm).

Upper arrow to show function selected (thermocouple or RTD).

Lower arrows to show (a) function type selected (measurement or simulation) and (b) Internal or External reference junction.

"LO BAT" display for battery status.

PRELIMINARY OPERATION

The battery has been completely charged before shipment. To avoid accidental or auto-discharge of the battery, due to a long period of storage, the instrument is delivered with the battery disconnected.

1) take off the screws, remove the back panel (see drawing) and connect to the ⊕ pole of the battery the orange colored disconnected cable. Re-mount the panel and take care not to screw tight the screws.

2) Before using, charge the battery for about 10 hours.
3) We suggest to maintain the instrument with the battery always charged .

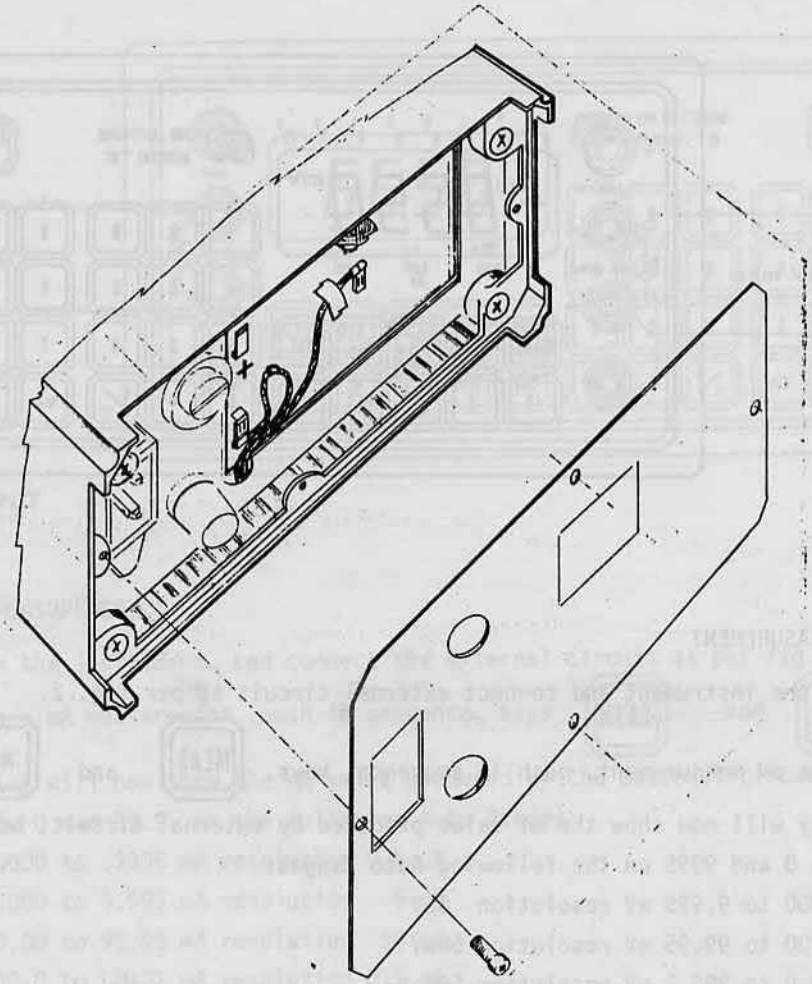
Switch on the instrument by pressing the ON/OFF key.
The instrument is now in STAND-BY mode, and all decimal points should be displayed on the LCD.
Before setting any function, it is essential to check the battery status by means of the " LO BAT" indication on the LCD.

NOTE: If the battery is in a discharged condition, the "LO BAT" indication will appear automatically.
- switch off instrument, check that the voltage selector switch is in a correct position, and then plug the instrument into the mains power supply, using the power supply cable, in order to recharge the battery.
- All instruments are shipped set for 220V AC.
- Recharging time 12 hours.

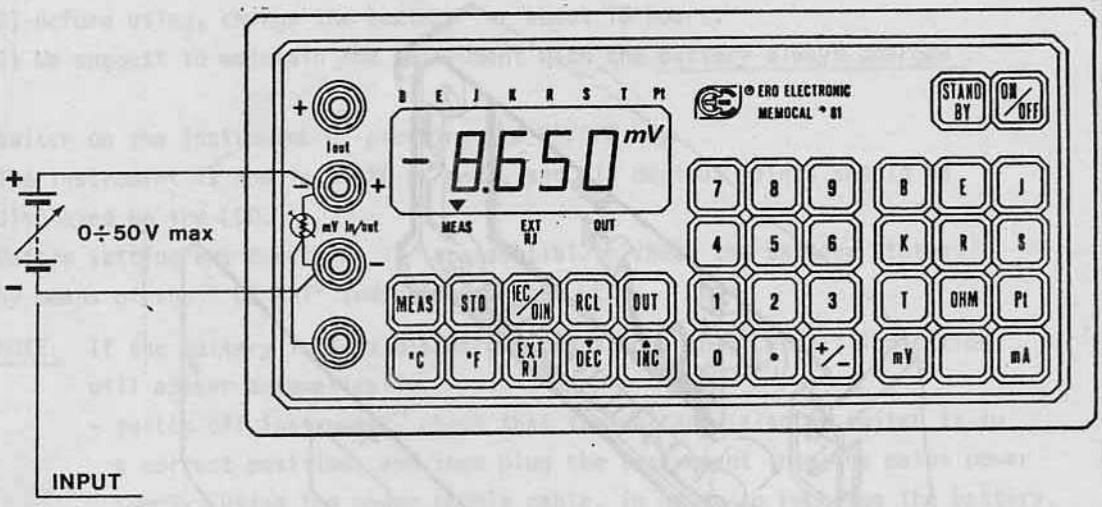
4 FUNCTIONS ARE PROVIDED:

A- SIGNAL MEASUREMENT (T/C, RTD, mV and mA)
B- SIGNAL SIMULATION (T/C, mV and mA)
C- FUNCTION STORAGE
D- RECALL AND SIMULATION OF STORED FUNCTIONS.

NOTE: Before setting any function, put the instrument into STAND-BY status, and make the appropriate external circuit connections, according to figures 2 ÷ 10.



DRAWING FOR BATTERY CONNECTION



A1 - mV MEASUREMENT

Switch on the instrument and connect external circuit as per fig. 2.

To obtain a mV measurement, push in sequence, keys MEAS and mV

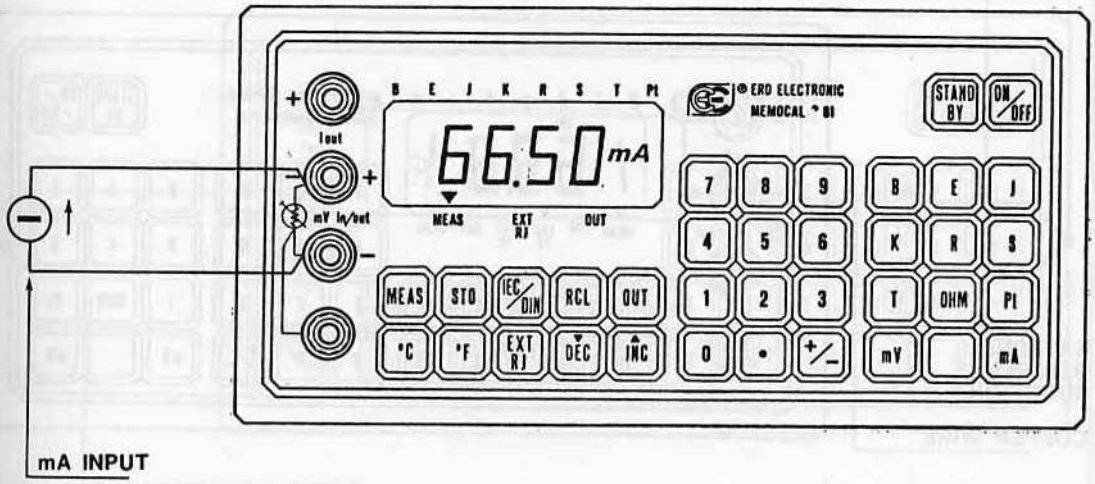
The display will now show the mV value produced by external circuit, between the levels 0 and 9995 on the following Auto Ranges:

- from 0.000 to 9.995 mV resolution 5µV
- from 10.00 to 99.95 mV resolution 50µV
- from 100.0 to 999.5 mV resolution 500µV
- from 1000 to 9995 mV resolution 5 mV

NOTE: above ranges are valid for either positive or negative values.

CAUTION:

Check that the input signal does not exceed 50V, otherwise damage to the input circuit could result.



A 2- mA MEASUREMENT

Switch on the instrument, and connect the external circuit as per fig. 3.

To obtain a mA measurement, push in sequence, keys MEAS and mA

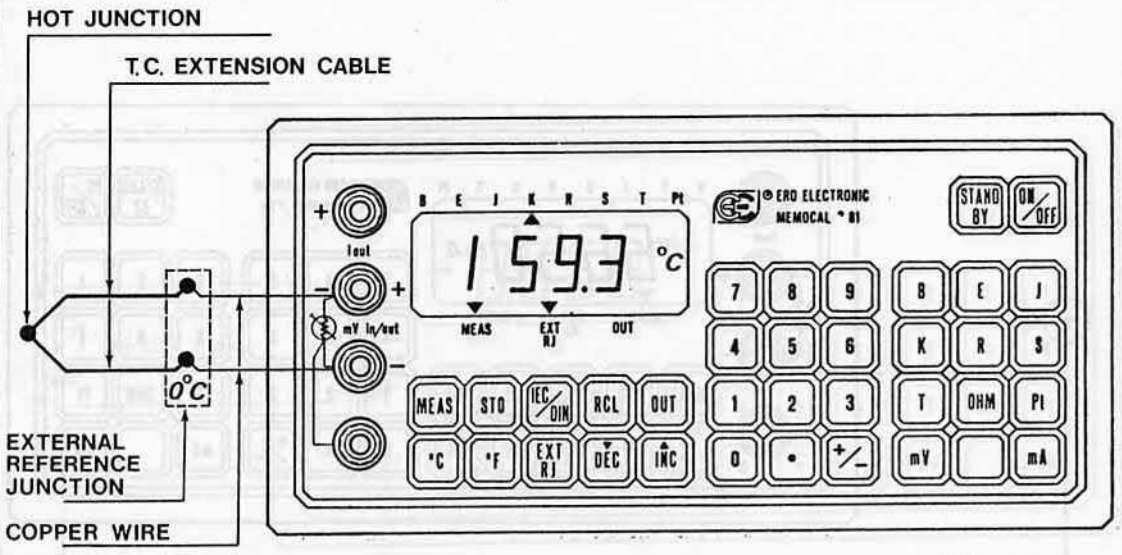
The display will now show the mA value produced by the external circuit between the levels 0 and 99.95 on the following Auto Ranges:

- from .0000 to .9995 mA resolution 0,5 µA
- from 1.000 to 9.995 mA resolution 5 µA
- from 10.00 to 99.95 mA resolution 50 µA
- from 100.0 to 130.0 mA resolution 0,5 mA

NOTE: Above ranges are valid for either positive or negative values.

CAUTION:

Check that the input signal does not exceed 130 mA, over this value the instrument disconnects the input circuit and automatically returns in STAND-BY condition.



A3 - THERMOCOUPLE MEASUREMENT USING EXTERNAL RJ

Switch on the instrument, and connect the external circuit as per fig. 4.

NOTE: for a correct measurement, using the external reference method, remember that the external reference junction temperature must be kept at exactly 0°C (32°F) and that the connections between the external cold junction and the instrument terminals must be made in copper wire.

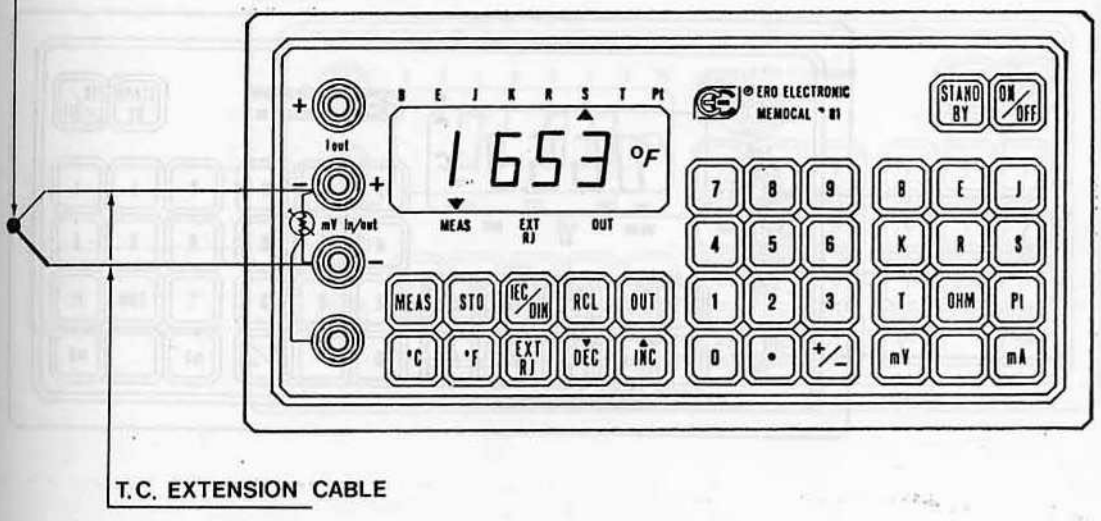
To obtain a temperature measurement, push in sequence, keys MEAS and EXT RJ followed by the key for the appropriate thermocouple type.

The display will now show the thermocouple hot-junction temperature in °C.

using the °C and °F keys, the operator can preset the readout temperature in either °C or °F.

DIN/IEC Key allows the operator to choose ANSI/IEC or DIN linearization tables.

NOTE: Selection of °C/°F and/or ANSI-IEC/DIN can be made at any time during measurement.



A 4 - THERMOCOUPLE MEASUREMENT USING INTERNAL RJ

Switch on the instrument, and connect the external circuit as per fig. 5.

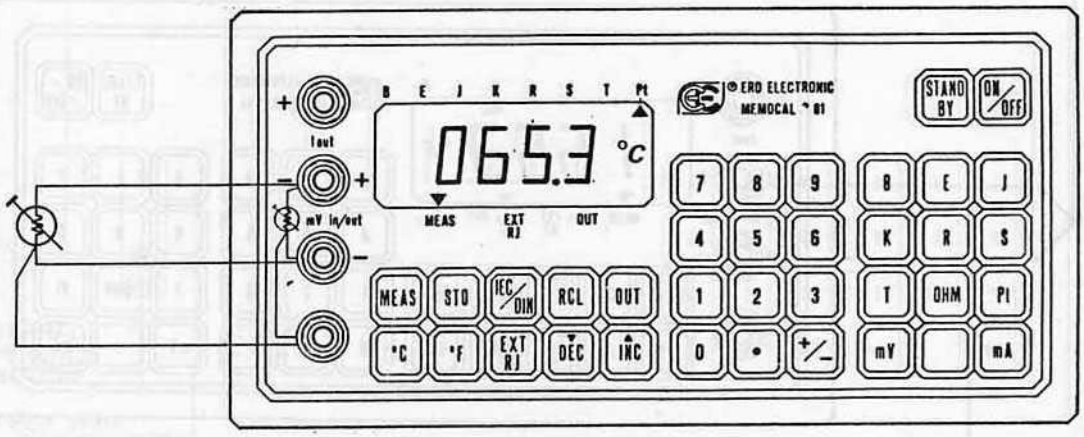
NOTE: for a correct measurement, using the internal reference junction, thermocouple extension cable of the correct type must be used and must be correctly connected, according to polarity and colour code.

To obtain a temperature measurement, push in sequence, key MEAS followed by the key for the appropriate thermocouple type i.e. B or K

The display will now show the thermocouple hot-junction temperature in °C.

Using the °C or °F keys, the operator can preset the readout temperature in either °C or °F.

NOTE: Selection of °C or °F can be made any time during measurement.



A5- RTD (Pt 100) MEASUREMENT

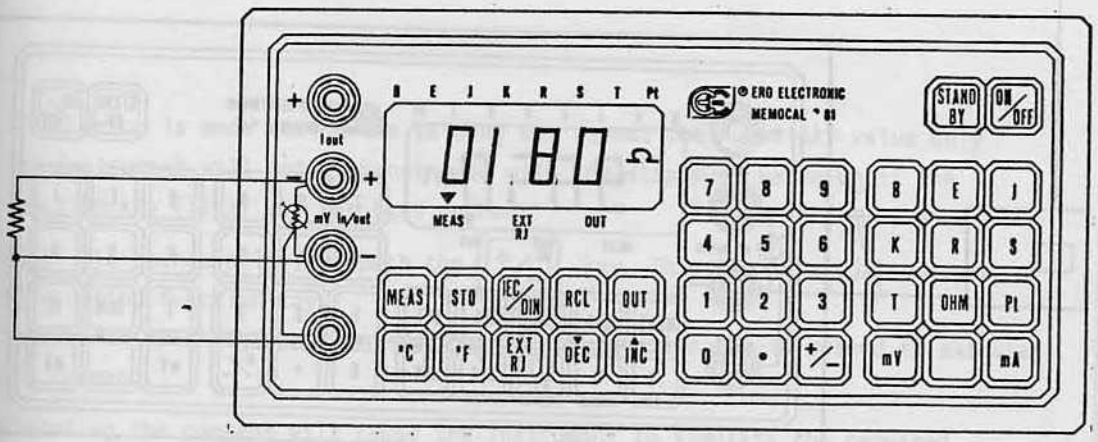
Switch on the instrument, and connect the external circuit as per fig. 6 .

NOTE: use 3-core copper cable.

To obtain a temperature measurement, push in sequence, keys [MEAS] and [Pt] the display will now show the temperature being detected by the RTD in °C.

Using the [°C] or [°F] keys, the operator can preset the readout temperature in either °C or °F.

NOTE: Selection of °C or °F can be made at any time during measurement.



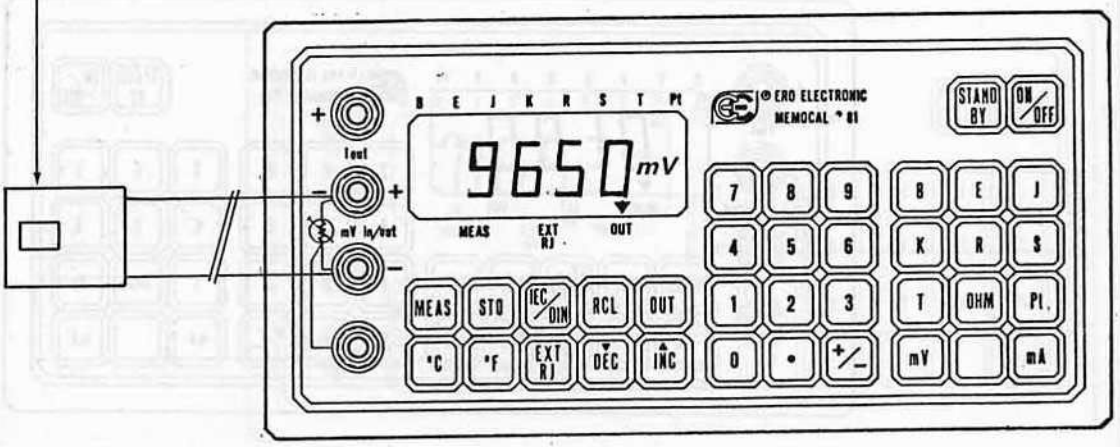
A6 - RESISTANCE MEASUREMENT

Switch on the instrument and connect the external circuit as per fig. 6A

NOTE: use 3-core copper cable

To obtain a resistance measurement push in sequence MEAS and OHM keys.
The display will now show Ohm measurement.

INSTRUMENT TO BE CALIBRATED



B 1- mV SIMULATION

Switch on the instrument, and connect to the user device being calibrated as per fig. 7.

The instrument can generate signal levels between -9995 mV and +9995 mV, over the following Auto Ranges:

- from 0.000 to 9.995 mV resolution 5µV
- from 10.00 to 99.95 mV resolution 50µV

} load resistance > 200 ohm/mV

- from 100.0 to 999.5 mV resolution 500µV
- from 1000 to 9995 mV resolution 5mV

} max current 5 mA

To enable simulation, push in sequence, key OUT followed by entry of the numerical value via the numerical keyboard, and then execute the command by pushing mV key.

If an error is made during the setting up; repeat the numerical value only. The instrument will not be programmed with the displayed value until the function key (i.e. mV) has been pushed.

NOTE: To change polarity, push the 

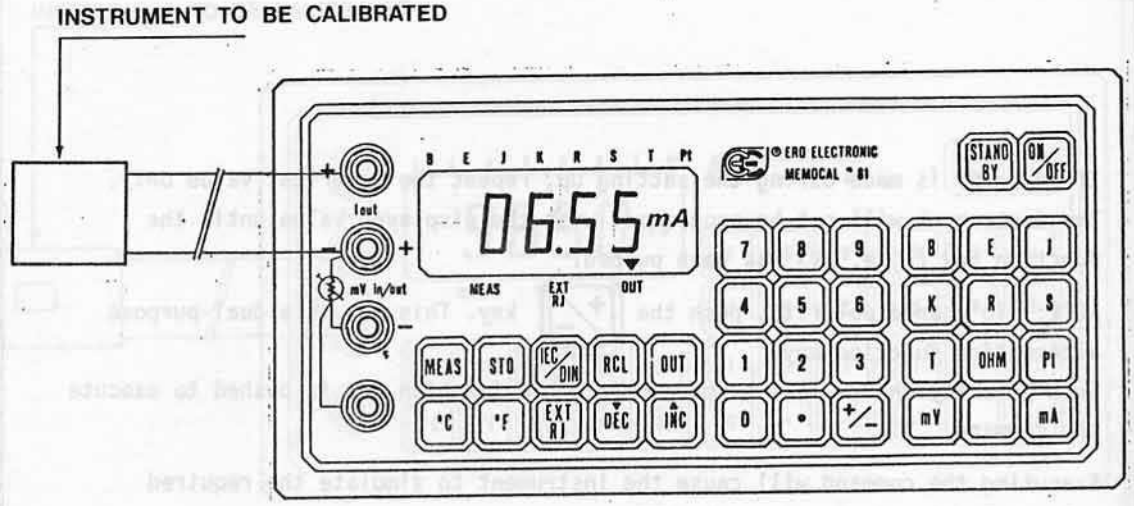
key. This key is a dual-purpose alternating function key.
Such polarity change must be made before the function key is pushed to execute the command.

Executing the command will cause the instrument to simulate the required value which is displayed on the LCD.

An increase or decrease in output value be achieved by pushing the respective 

or 

key, and holding until the required value is reached.



B 2- mA SIMULATION

Switch on the instrument, and connect to the user device being calibrated , as per fig. 8.

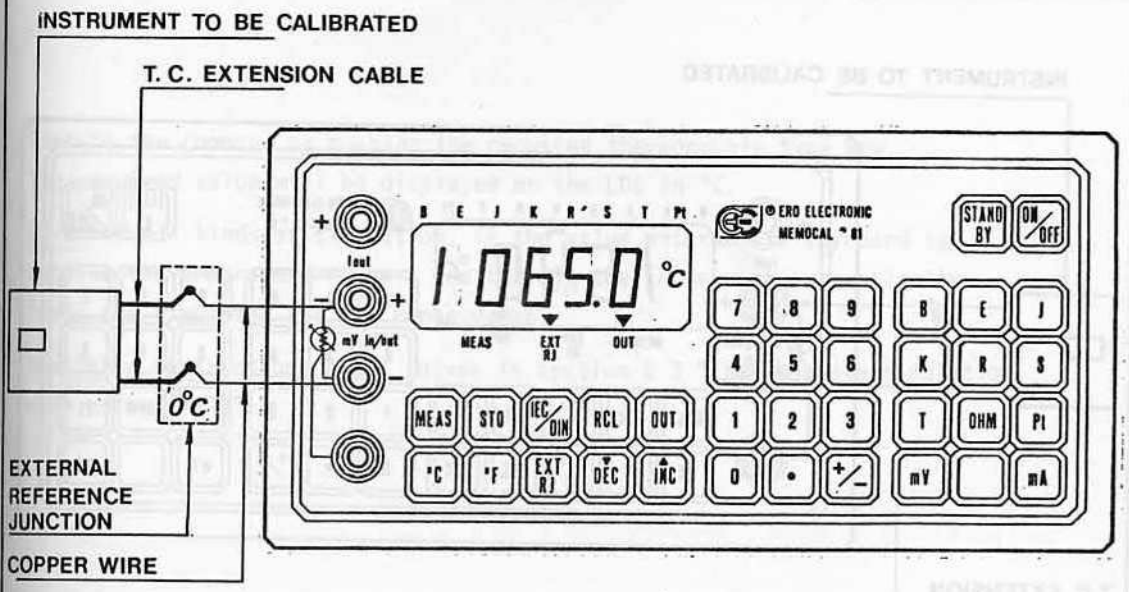
The instrument can generate any signal between 0 and 50 mA (accuracy 10 µA up to 20 mA, 20 uA from 20 to 50 mA) with max load of 500 Ohm up to 20 mA and 200 Ohm up to 50 mA.

Maximum drop voltage accross the load 10,0V.

To enable simulation, push in sequence, key [OUT] followed by entry of the numerical value via the numerical keyboard, and then execute the command pushing the [mA] key. The required value will be displayed on LCD.

How to correct an error, or increase or decrease the value is described in section B1 mV simulation.

NOTE: the instrument generates positive signals only.



B 3 - THERMOCOUPLE SIMULATION WITH EXTERNAL RJ

Switch on the instrument, and connect to the user device being calibrated with a °C reference unit as per fig. 9.

The instrument can generate a mV signal corresponding to the set temperature value, within ranges shown on the range table.

Values relate to a Cold Junction Temperature on °C (32°F) min. ext. impedance 2000 ohm.

To enable simulation, push in sequence, key OUT and EXT RJ then enter the temperature value via the numerical keyboard.

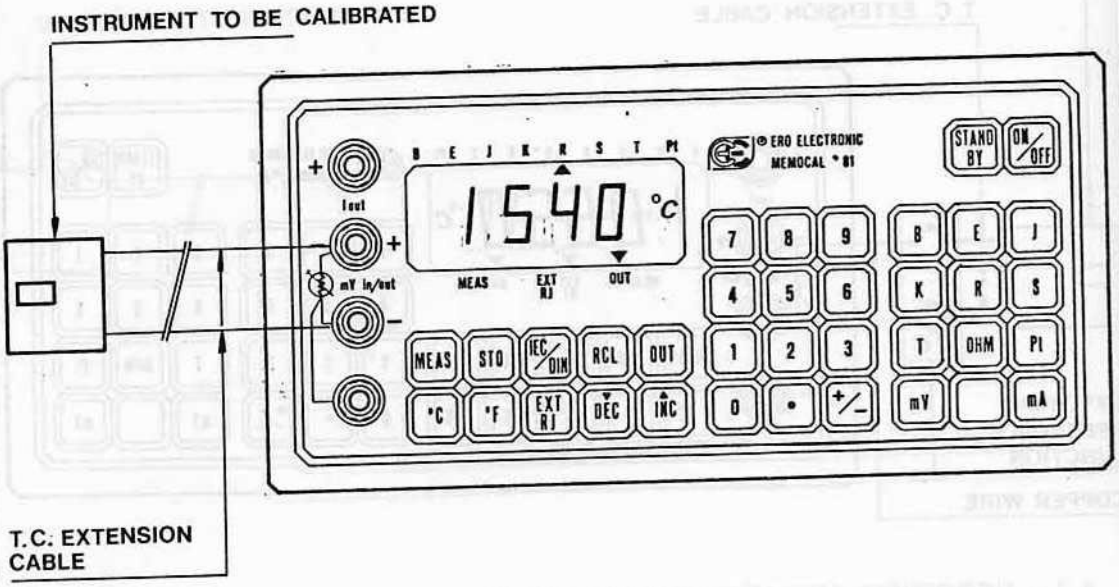
Execute the command by pushing the required thermocouple type key.

The required value will be displayed on the LDC, in °C.

Using the °C and °F keys, the operator can preset the readout temperature in either °C or °F.

NOTE: selection of °C/°F and/or ANSI-IEC/DIN can be made at any time during simulation.

How to correct an error, or increase and decrease the values is described in section B1 - mV simulation.



B 4 - THERMOCOUPLE SIMULATION WITH INTERNAL RJ

Switch on the instrument, and connect to the user device being calibrated as per fig. 10.

NOTE: for correct simulation, using the internal reference method, thermocouple extension cable of the correct type must be used, and it must be correctly connected, according to polarity and colour code.

The instrument can generate a mV signal corresponding to the set temperature value within ranges shown on the range table. This mV signal will be automatically adjusted to the ambient temperature at the Memocal terminals. Min. ext. impedance 2000 ohm.

To enable simulation, push the OUT key, and then enter the temperature value via the numerical keyboard.

Execute the command by pushing the required thermocouple type key.
The required value will be displayed on the LDC in °C.

NOTE: For all kinds of simulation, if the value entered via keyboard is outside the programmed range (see table), the instrument automatically loads and simulates the max range value.

Remaining instructions are given in section B 3 "Thermocouple simulation with external RJ".

C 1 FUNCTION STORAGE

The instrument can store up to ten functions, in the simulation mode only.

Switch on the instrument. Push [STO] key to enable storage, then enter numerical value via the numerical keyboard. If the value refers to temperature, the appropriate engineering units (°C/°F) must also be chosen, along with internal or external compensation.

If not previously programmed, the instrument will self-programme for °C and internal reference junction automatically.

When the numerical value has been set, choose the function type, and execute the command by entering the file number (0 to 9), in which the function is to be stored, via the numerical keyboard.

NOTE: Remember that if a particular file has been used previously to store another function, re-addressing it as above will delete the previous function automatically, and the new function will be loaded in its place.

CAUTION:
Functions stored in the instrument memory will be lost if the instrument is switched OFF.

D 1 - FUNCTION SIMULATION RECALL

To recall and simulate a previously stored function.

Push the RCL key and enter the file number (0 to 9) via the numerical keyboard, in which the function was previously stored. This will execute the command, the instrument will display values, engineering units and operating mode on the LDC. The instrument will then simulate whatever was programmed into that particular file.

Before recalling the function, it will be necessary to connect the appropriate external circuit in accordance to figure 7 to 10 in section B.

NOTE: If two or more consecutive simulations are required (without calling STAND-BY condition), the previous simulated value will not be removed from the terminal until the new simulated value is output.
It is not possible to display a stored function without simulation.

ERRORS

E.1) - OVERRANGE OF A MEASURED SIGNAL

If the input signal exceeds the maximum value shown in the standard range tables the instrument will display the following:

1.....

E.2) - UNDERRANGE OF A MEASURED SIGNAL

If the input signal is below the minimum value shown in the standard range tables, the instrument will display the following:

-1.....

E.3) - OPEN CIRCUIT

Before thermocouple measurement, the instrument will make a check of the input line.
If the input line is open, or presents an impedance of more than 10 Kohm, the instrument will display the following:

EE.OC

E.4) - OVERRANGE OF ROOM TEMPERATURE

If the room (or ambient) temperature, as measured at the internal re-reference junction, is higher than 60°C, the instrument will display the following:

CCCC

E.5) - UNDERRANGE OF ROOM TEMPERATURE

If the room (or ambient) temperature, as measured at the internal reference junction, is lower than - 20°C, the instrument will display the following:

-CCCC

NOTE: The above type of errors (E.4 and E.5) are detected by the instrument during thermocouple measurement or simulation only when the internal reference junction is used.

E.6) - OVERLOAD OF NEGATIVE SIGNAL SIMULATION

If the external load, during a negative signal simulation, exceedes the max load, the instrument will display the following:

-1.....

The output value present on terminal will be function on the applied load.

E.7) - OVERLOAD OF POSITIVE SIGNAL SIMULATION

If the external load, during a positive signal simulation, exceedes the max load, the instrument will display the following:

+1.....

The output value present on terminal will be function on the applied load.

E.8) - MISCELLANEOUS ERRORS

If errors are made during entry of OUTPUT, STORAGE, or RECALL functions, the instrument will display the following:

EEEE

Function and entered values will be cancelled, and the instrument automatically programmes to STAND-BY status.
The instrument can display the following setting errors:

- Set value with too many decimal places (in °C)
- Set value three decimal places (in mA)
- Attempt to simulated RTD or Ohm
- Recall of a function from an empty address file.

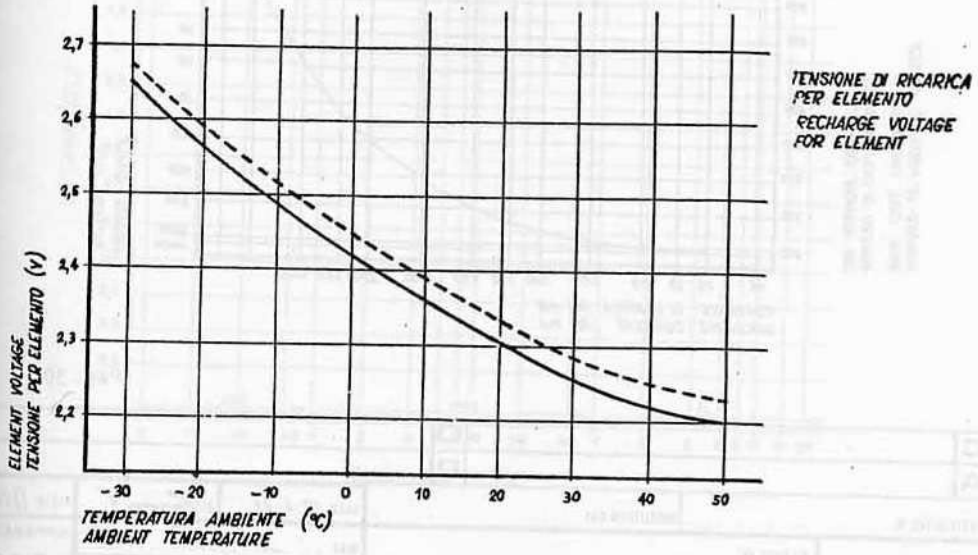
BATTERY SPECIFICATIONS

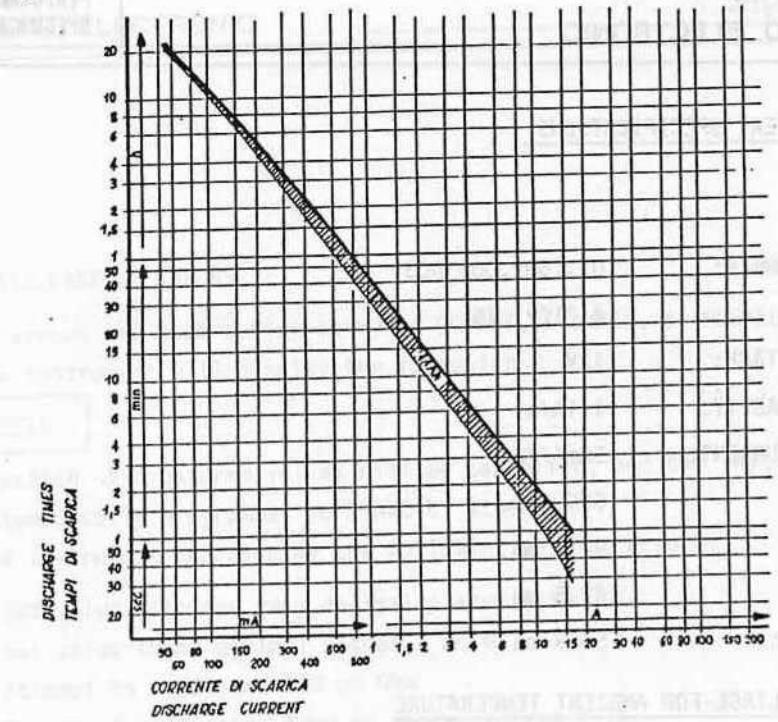
ERO PART NUMBER:	021.502.000.003
TYPE:	A 212/1.1S
NOMINAL VOLTAGE:	12V
NOMINAL CAPACITY:	1.1A/h
DISCHARGE CURRENT:	50mA/20h
WEIGHT:	555 grs.
LENGHT:	97.5 mm
WIDTH:	49.5 mm
HEIGTH MAX.:	54.9 mm

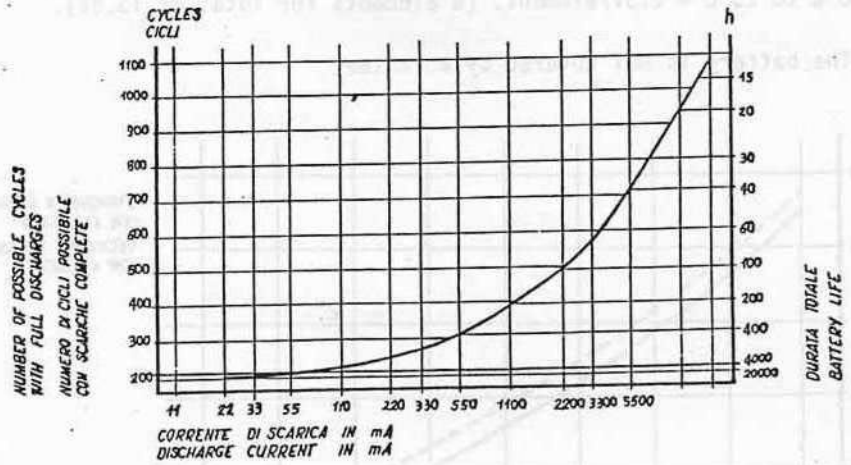
RECHARGE VOLTAGE FOR AMBIENT TEMPERATURE

From 20°C to 25°C = 2.3V/element. (6 elements for total of 13.8V).

NOTE: The battery is NOT covered by warantee.







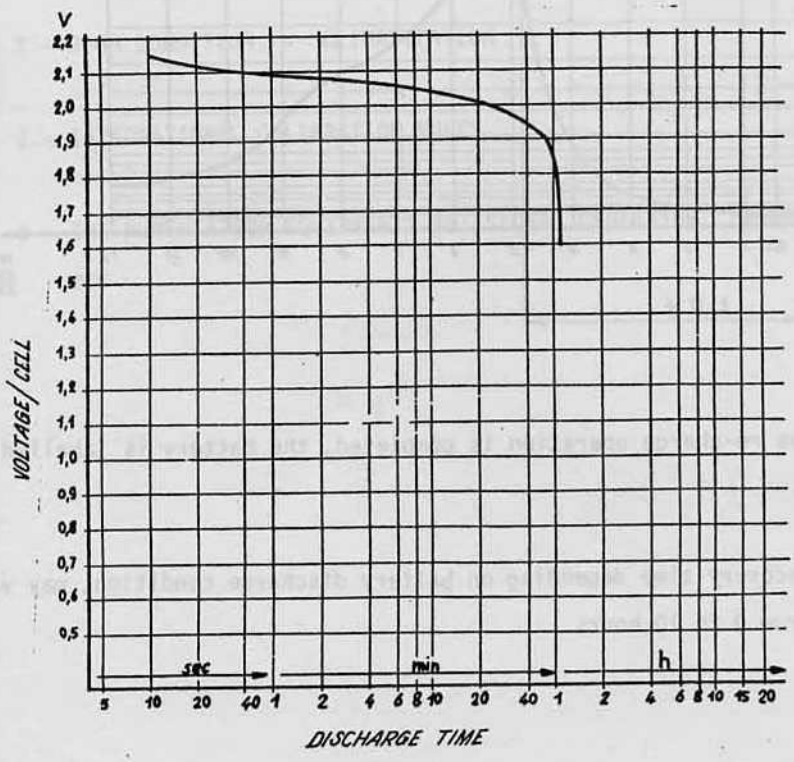
C		D	
A		B	
SOSTITUISCE IL	SOSTITUITO DAL	DATA 22-4-82.	DIS.	VISTO
TITOLO: SPECIFICHE BATTERIA SONNENSCHEIN SPECIFICATIONS OF SONNENSCHEIN BATTERY.		MAT.		APPARECCHIO SCC
		TRATT.		
		SCALA:	DIS. Nº 021.502.000.003	

ERO INCOMING BATTERY CHECK

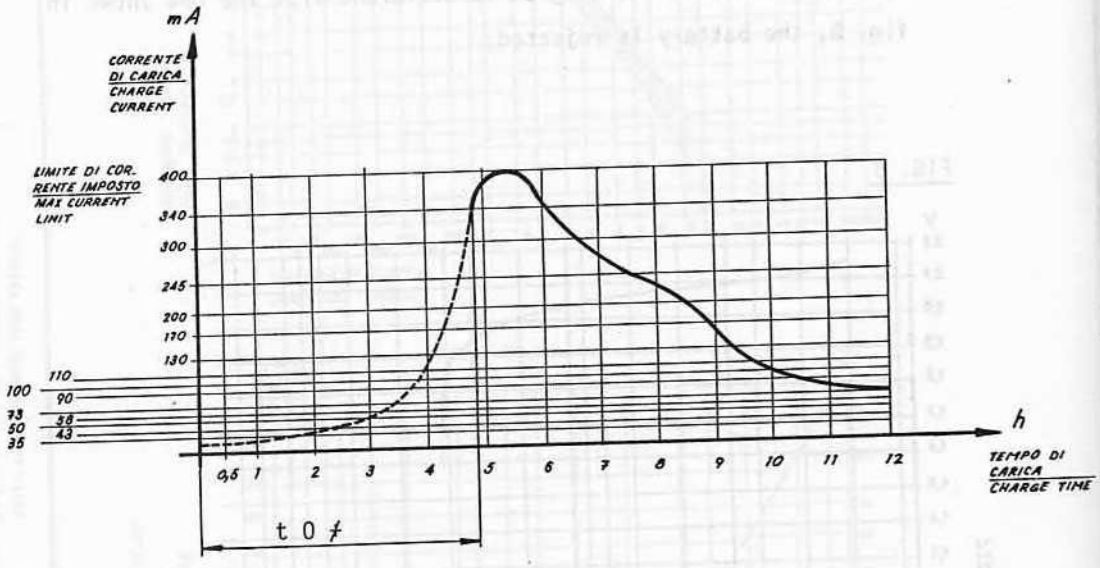
Every battery is submitted to an incoming test procedure, as follows:

1) The battery is completely discharged on a resistive load of 22 Ohm for 30 minutes and the discharge curve is recorded on a multi-pen-recorder.
   If under this test the diagram is different from the one shown in fig. B, the battery is rejected.

FIG. B



2) The battery is then submitted to a constant recharge voltage of 2.3V each element at an ambient temperature of 20°C ÷ 25°C.
The recharge procedure is under continuos monitoring of a multi-pen-recorder and the current trend must be close to the following diagram.



When the re-charge operation is completed, the battery is labelled and stored.

≠ t 0 : recovery time depending on battery discharge condition, may vary from 0 to 10 hours.

INTRODUCTION

MEMOCAL 81 B is an electronic DC Calibrator, consequently for this reason all testing to check his functionality, must be made only if following points are satisfied:

1 - ROOM CONDITION - CLIMATIZATION

2 - INTERNATIONAL CALIBRATION RULES

3 - INSTRUMENTATION EQUIPMENTS AS: SIGNAL GENERATOR, INSTRUMENT SAMPLE etc.

1 - ROOM CHARACTERISTICS

The laboratory where MEMOCAL should be calibrated, must have following specifications:

a) - fixed room temperature between 20°C to 30°C.
No ventilation ,also if conditioned, must be existed, expecially where MEMOCAL is located for testing.

b) - relative humidity between 40 to 65% RH.

c) - Min. required time of climatization is 30', if MEMOCAL is coming from an ambient with a room temperature quite similar to the laboratory.
Otherwise the min. required time is 60'.

d) - All nojses or interferences generated by magnetic field or by radio frequency, must be drastically avoided.

2 - CALIBRATION PROCEDURE

Each MEMOCAL is calibrated to generate or to measure thermocouple as per following International Calibration Rules:

ANSI C96-1 IEC 584 and DIN 43710 1961

To check the calibration in generation or measurement of thermocouple, the mV versus °C tables, must be followed according to the calibration type used for MEMOCAL under testing.
All connections must be made only with extension wire, according to the thermocouple type used on MEMOCAL calibration.

3 - INSTRUMENTATION EQUIPMENTS

DIGITAL MULTIMETER

A multimeter must be used during mV and mA measurement with the following specifications:

DISPLAY:	4 ½ digits 19.999 reading point
Min. SPAN:	20mV
RESOLUTION:	1uV
ACCURACY:	0.005% full scale value
OFFSET:	± 2uV for mV measurement
	± 2uA for mA measurement
INPUT IMPEDANCE:	>100 Mohm for 1mV of full scale

NOTE/ a multimeter HP 3465 or equivalent model is suggested.

SIGNAL GENERATION

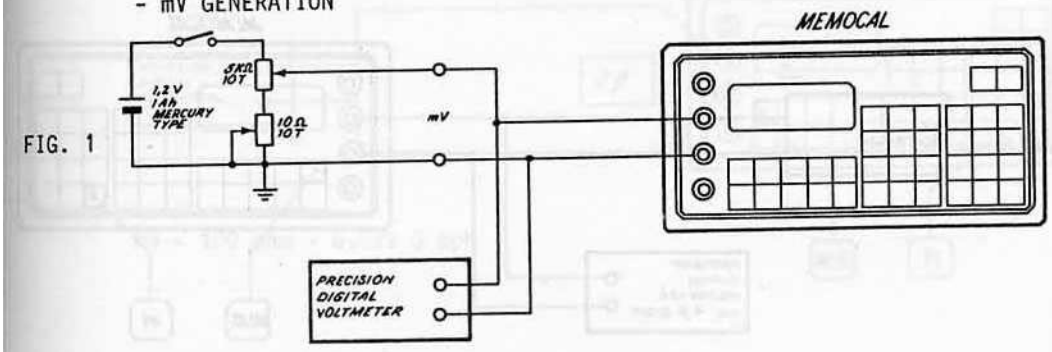
To generate signal in mV or mA should be used a generator FLUKE TYPE 5100B.

If not available , we would suggest to provide a similar generator as shown on the following diagrams.

SOME DIAGRAMS FOR TEST CHECKING

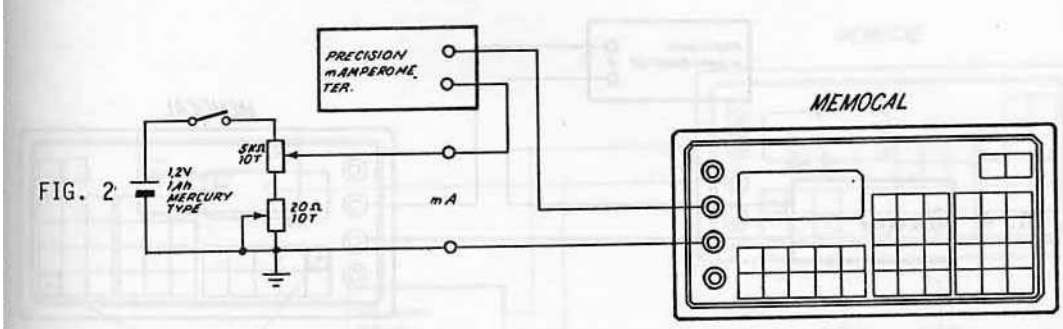
- mV GENERATION

FIG. 1



- mA GENERATION

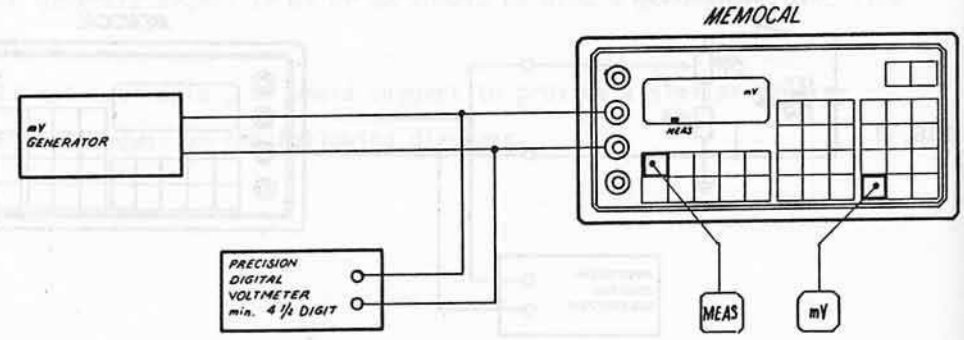
FIG. 2



SOME DIAGRAMS FOR TEST CHECKING

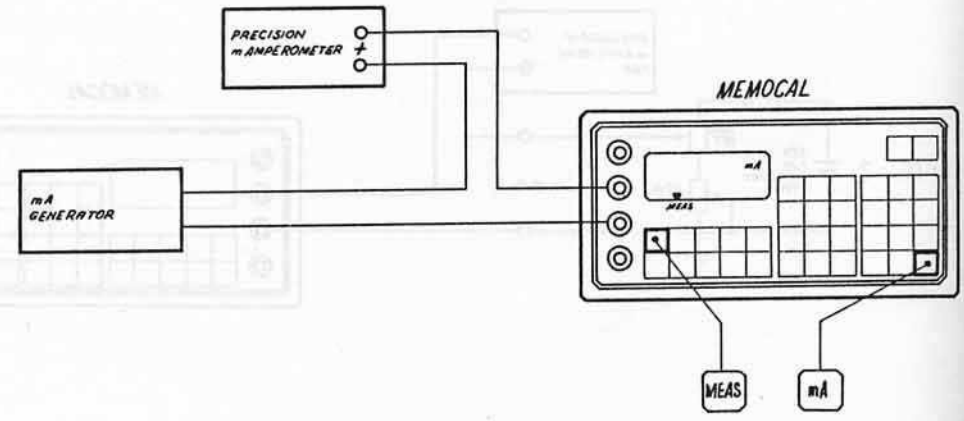
- mV MEASUREMENT CHECKING

FIG 3



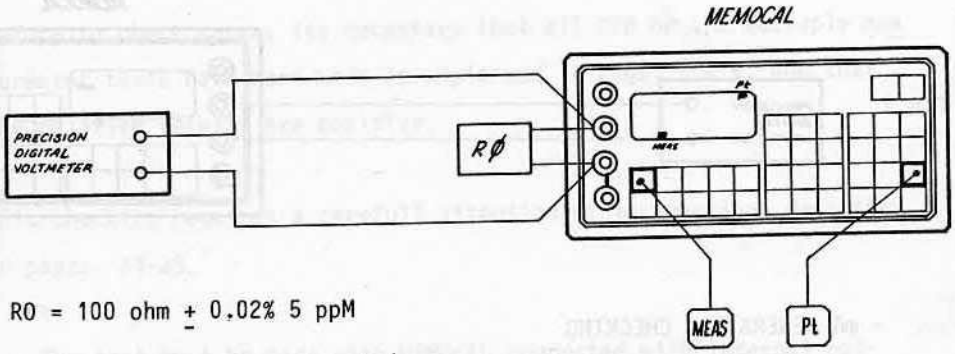
- mA MEASUREMENT CHECKING

FIG. 4



- RTD - Pt 100 ohm MEASUREMENT CHECKING

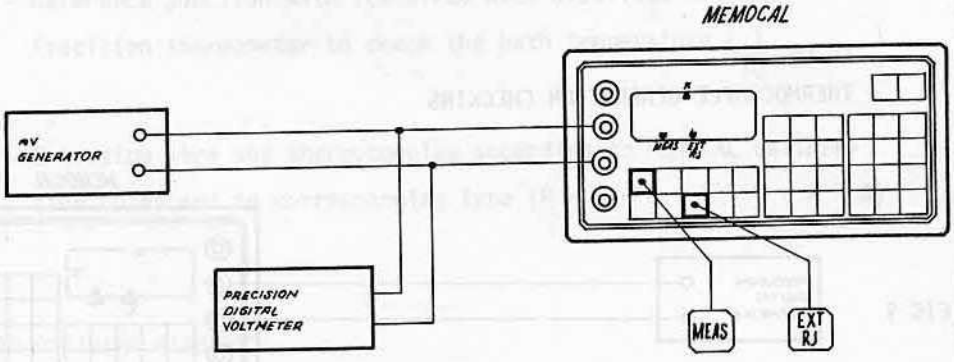
FIG 5



RO = 100 ohm ± 0.02% 5 ppM

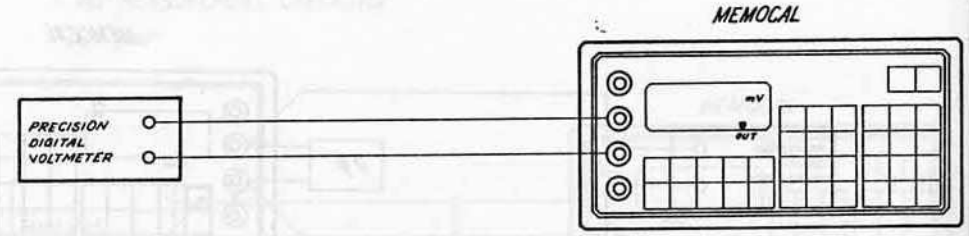
- THERMOCOUPLE MEASUREMENT CHECKING

FIG 6



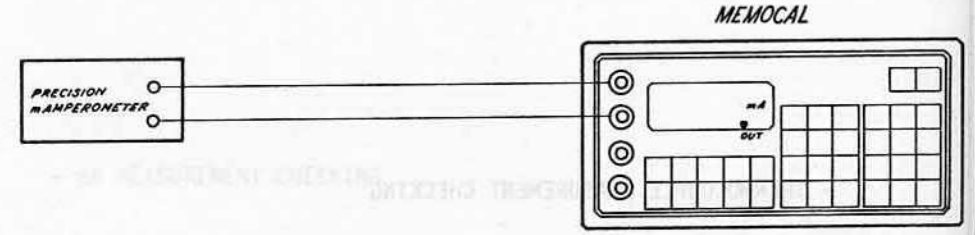
- mV GENERATION CHECKING

FIG 7



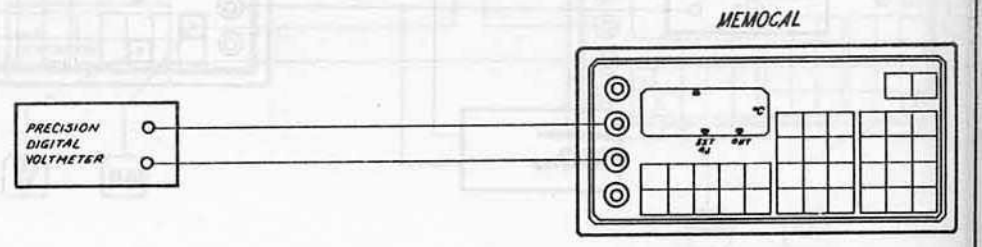
- mA GENERATION CHECKING

FIG. 8



- THERMOCOUPLE GENERATION CHECKING

FIG 9



CHECKING OF COLD JUNCTION COMPENSATION ON ROOM TEMPERATURE

Before to check above, its necessary that all RTD or thermocouple measurement tests have been made as explained in Figs. 5 - 6, and that the relative results are positive.

This checking requires a carefull attention of instructions described on pages 34-35.

1 - The test must be made with MEMOCAL connected with internal battery.

2 - Min.pre-heating time 5'

3 - Room temperature 23° ± 5°C

4 - Reference junction with ice mixed with distilled water.
Precision thermometer to check the bath temperature ($\frac{1}{10}$ of °C)

5 - Extension wire and thermocouples according to MEMOCAL calibration rules and to corresponding type (R - S - J - T - E - K - B)

see enclosed diagrams

- AUTOMATIC COLD JUNCTION COMPENSATION CHECKING

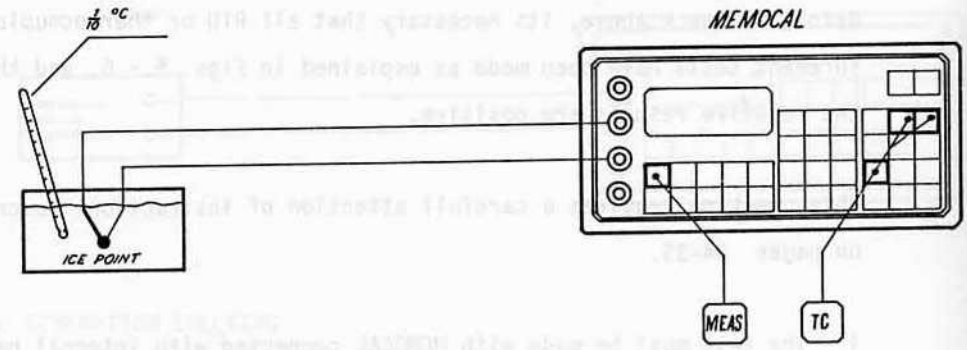


FIG 10

the LCD must display 0.0°C ± 0.3°C MAX

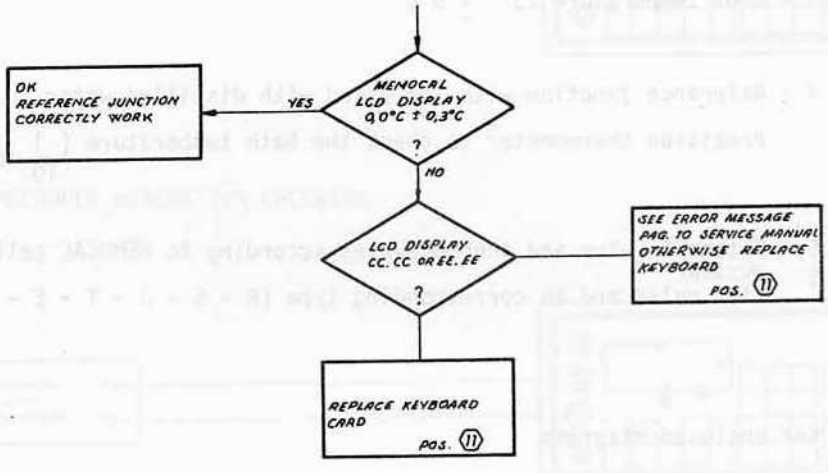
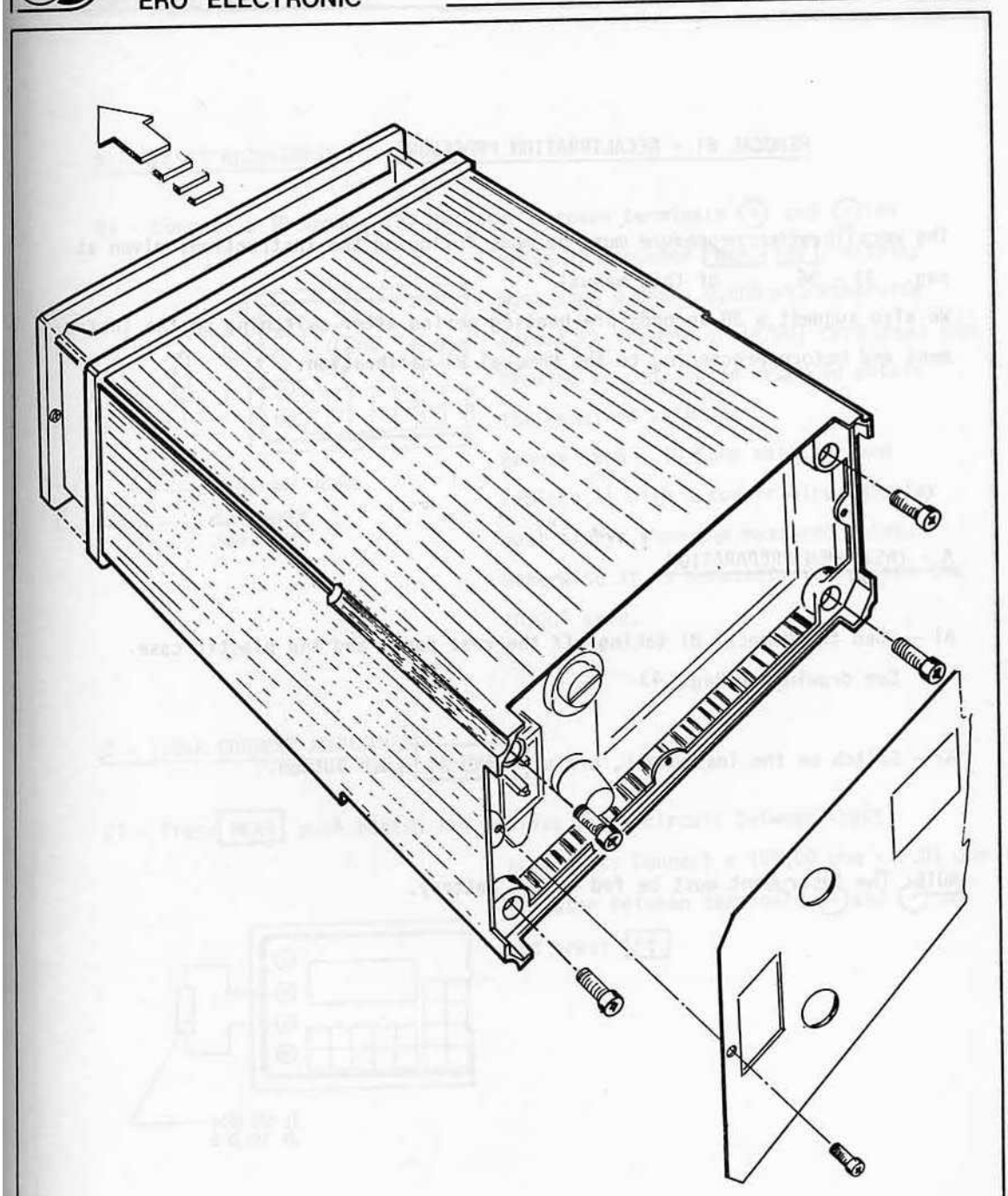


FIG 11



MEMOCAL 81 - RECALIBRATION PROCEDURE

The recalibration procedure must be made following the instructions given at pag. 33 - 36 of this manual
We also suggest a 30 seconds pre-heating period after switching on the instrument and before proceeding to the Memocal 81 calibration.

A - INSTRUMEN PREPARATION

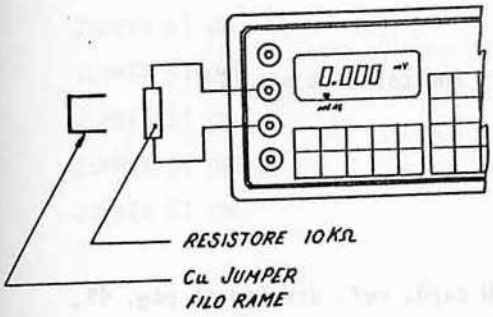
A1 - Open the Memocal 81 taking off the rear panel and the plastic case.
See drawing at Pag. 43

A2 - Switch on the instrument, press STAND BY push button.

NOTE: The instrument must be fed by the battery.

B - OFFSET ADJUSTMENT

B1 - Connect a 10 Kohm ± 10% resistor between terminals ⊕ and ⊖ mV.

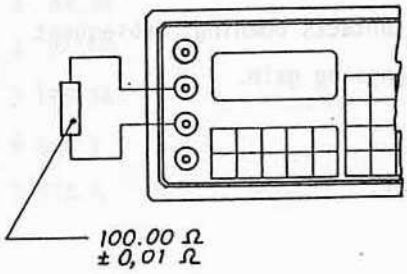


Press in sequence [MEAS] [mV]: display must show 0.000 ± 0.005 mV. Otherwise adjust P1 trimmer of IN/OUT card upper mod. see drawing at pag. 49 in order to obtain the required value.

Remove the 10 Kohm resistor and replace it with a copper wire: display must always show the measured value. Otherwise it is necessary to replace the IN/OUT card.

C - 100µA CURRENT ADJUSTMENT

C1 - Press [MEAS] push button and relieve short circuit between input terminals. Connect a 100,00 ohm ± 0.01 ohm resistor between terminals ⊕ and ⊖ mV and press [Pt.]



C2 - Adjust P1 trimmer of IN/OUT card, lower module see drawing at pag.49; until reading with precision mVoltmeter a voltage drop corresponding to 9.999mV + Ø - 0.003 mV at the 100.00 ohm resitance terminals.

D - SPAN CONVERTER ADJUSTMENT

(Essential after the previous adjustment indicated at par. C)

D1 - Disconnect the 100.00 ohm resistor

D2 - Switch off the Memocal 81

D3 - Short circuit contacts n° S1 of CPU card, ref. drawing at pag. 49, by means of a jumper.

D4 - Switch on the Memocal 81

D5 - Adjust P2 on IN/OUT BOARD lower module, to read 2.000V between pin 39 and pin 36 of A/D converter.

NOTE: Switching the Memocal on with DC jumper between S1 contacts of CPU card, the Memocal will operate with a special calibration showing directly on the LCD display the converter bits.
The Gain change is obtained with a contacts opening. Subsequent opening and closing cause cyclic change og gain.

EXAMPLE:

MEMOCAL OFF	GAIN
JUMPER S1 ON	
MEMOCAL ON	12.5
JUMPER S1 OFF	25
JUMPER S1 ON	50
JUMPER S1 OFF	200
JUMPER S1 ON	500
JUMPER S1 OFF	100
JUMPER S1 ON	1000

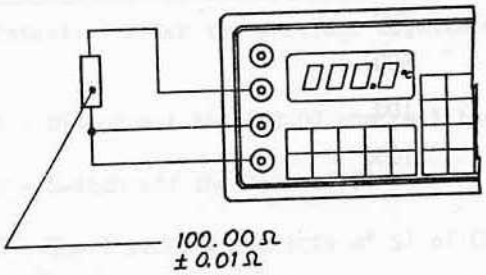
D6 - Set to input terminals the calibration voltage for the relative gain as shown below

	VOLTAGE INPUT (mV)	FULL SCALE INPUT VOLTAGE (mV)	ADJUST TRIMMER PX FOR 4000 BITS
1	12.21	12,5	P3
2	24.42	25	P4
3	48.84	50	P5
4	97.68	100	P6
5	195.36	200	P7
6	488.4	500	P8
7	976.8	1000	P9

E - 200 µA CURRENT ADJUSTMENT

E1 - Press [STAND BY]

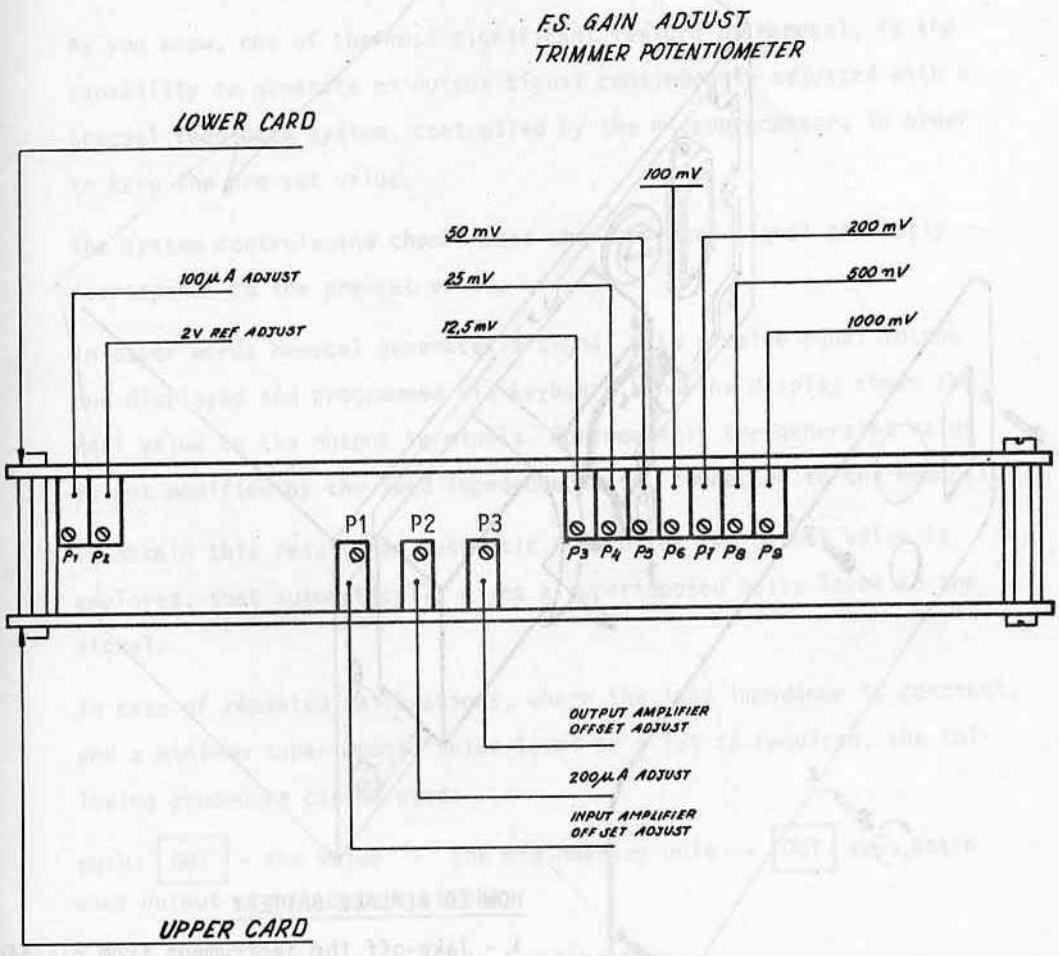
Connect as shown in drawing here under a 100.00 ohm ± 0.01 ohm resistor.

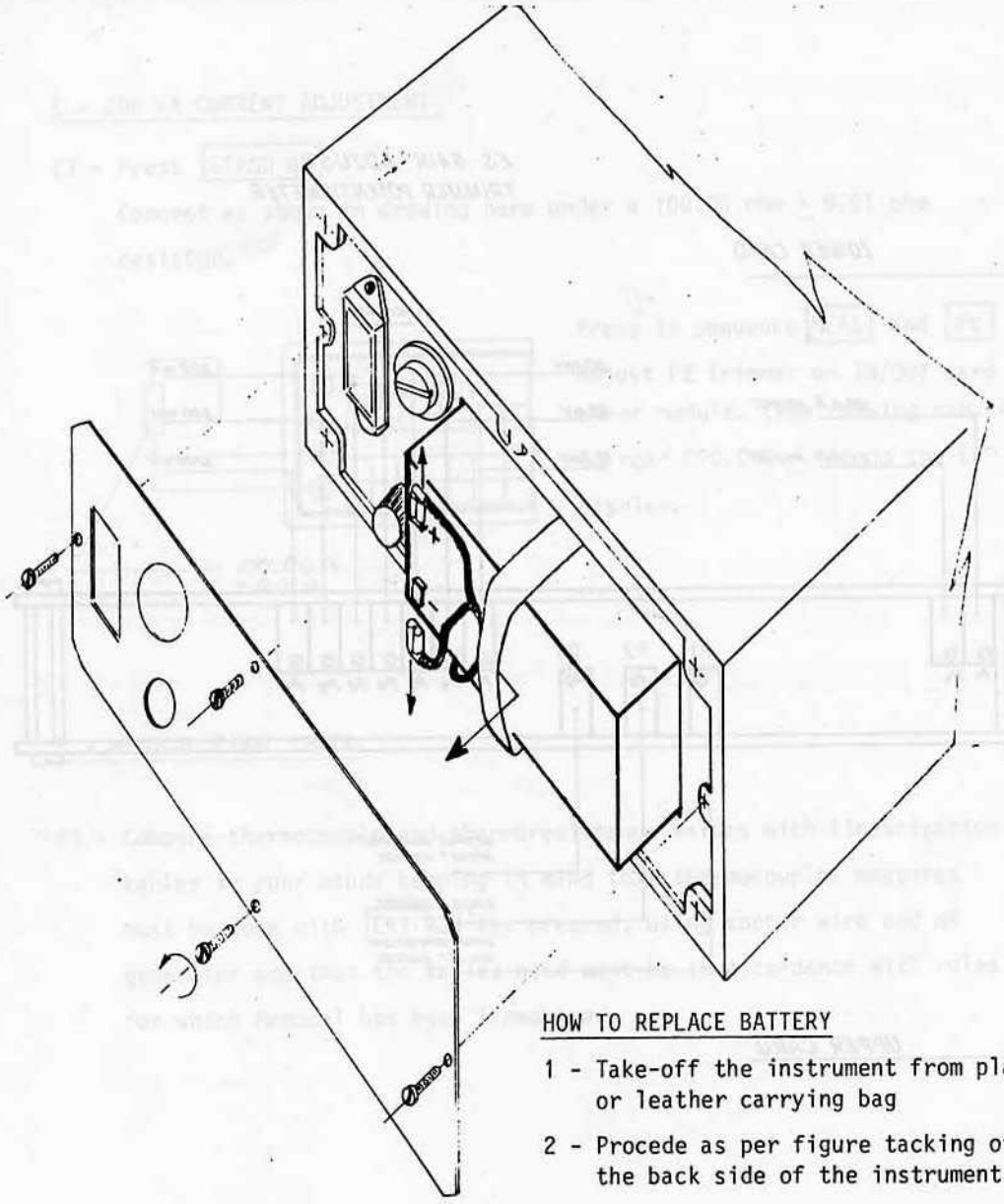


Press in sequence [MEAS] and [Pt]
Adjust P2 trimmer on IN/OUT card upper module. (see drawing pag. 49).
to read 000.0°C ± 1°C on the LCD display.

F - MEMOCAL FINAL CHECK

F1 - Compare thermocouple and thermoresistance values with linearization tables in your hands keeping in mind that thermocouples measures must be done with [EXT RJ] key pressed, using copper wire and mV generator and that the tables used must be in accordance with rules for which Memocal has been linearized.


F.S. GAIN ADJUST
TRIMMER POTENTIOMETER
LOWER CARD
100 mV
50 mV
200 mV
100 µA ADJUST
25 mV
500 mV
2V REF ADJUST
12,5 mV
1000 mV
P1 P2
P1 P2 P3
P3 P4 P5 P6 P7 P8 P9
OUTPUT AMPLIFIER
OFFSET ADJUST
200 µA ADJUST
INPUT AMPLIFIER
OFFSET ADJUST
UPPER CARD



HOW TO REPLACE BATTERY

1 - Take-off the instrument from plastic or leather carrying bag

2 - Procede as per figure tacking off the back side of the instrument

SUPERIMPOSED NOISE LEVEL ON THE GENERATED SIGNAL

As you know, one of the most significant feature of Memocal, is the capability to generate on output signal continuously adjusted with a special feed-back system, controlled by the microprocessor, in order to keep the pre-set value.

The system controls and checks that the generated signal perfectly corresponds to the pre-set value.

In other words Memocal generates a signal with a value equal to the one displayed and programmed via keyboard, and the display shows the real value on the output terminals. Consequently the generated value is not modified by the load impedance value, connected to the Memocal.

To obtain this result, an automatic control of the output value is employed, that automatically gives a superimposed noise level to the signal.

In case of repeated calibrations, where the load impedance is constant, and a minimum superimposed noise level or $\pm$ 1uV is required, the following procedure can be used:

push: [OUT] - the value - the engineering unit - [OUT] keys again when output signal become stable.

It can be useful for some kind of calibration.

The istrument is protected with 2 different models of fuses, arranged as follows:
1) for the protection of supply circuit is foreseen a rapid fuse 6x30 160mA (see drawing 08.094.03 pos. (28) (29)).

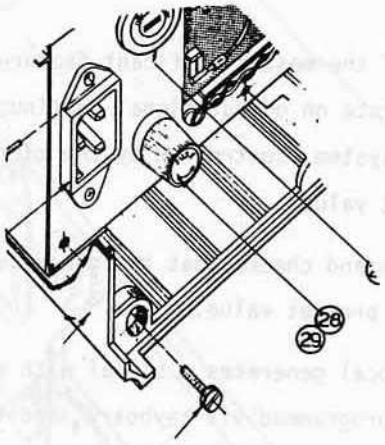


Fig.1

2) For the protection of battery circuit is foreseen a delayed fuse 6x30 1A mounted on base card. See fig.2.

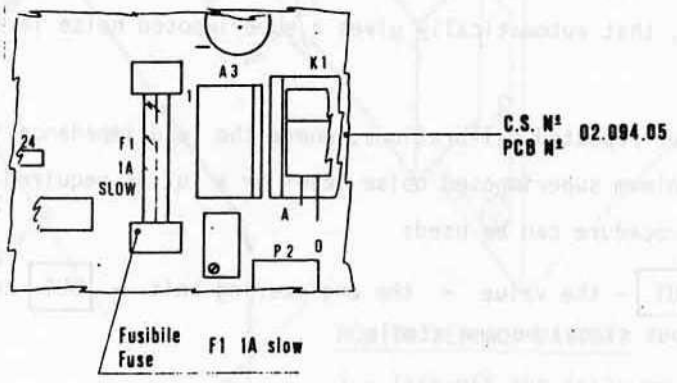


Fig.2

A spare of a.m. fuses is supplied with Memocal. "
Require directly to ERO ELECTRONIC SpA stating following code numbers:
021.104.110.006 rapid fuse 6x30 160mA (power supply)
021.104.020.004 delayed fuse 6x30 1A

for other parts.