PTB 150/PTB 157
Portable Temperature Calibrators
Instruction Manual

Certificate Number 9309
ISO 9001

Eurotron Instruments (UK) Ltd
Unit 18Austin Way,
Royal Oak Industrial Estate
NN11 8QY- Daventry, United Kingdom
T+ 0044 (0) 1327 871044

www.ei-uk.com
sales@eurotron-uk.com

INDEX

WARNING

Hazardous voltages are present in this electrical equipment during operation.
Non-observance of the safety instruction can result in severe personal injury or property damage.
Only qualified personnel should work on or around this equipment after becoming familiar with all warnings, safety notices, and maintenance procedures contained herein.
Only qualified personnel or our personnel should work on this equipment for maintenance operation.
The successful and safe operation of this equipment is dependent on proper handing, operation and maintenance.
Don not use the instrument for any application other than calibration of temperature, any other use of the instrument may cause hazards to the user.
Use the instrument only in normal environmental conditions.

Electrical and electronic equipments with this symbol cannot be thrown away in public dump sites. According to the EU directive 2002/96/EC, the European users of electrical and electronic equipment have the opportunity to return to the distributor or manufacturer used equipment purchasing a new equipment. The illegal disposal of electrical and electronic equipments is punished by pecuniary administrative sanction.

SYMBOLS BEING USED IN THIS MANUAL OR ON THE INSTRUMENT

CAUTION: HOT SURFACE OR PART

CAUTION: REFER TO ACCOMPANING DOCUMENTS

CAUTION: RISK OF ELECTRICAL SHOCK

Note:
In this manual: where not specified, the numbers in parentheses make reference to the annexed drawing.

1 - INTRODUCTION

1.1 - Purpose and summary of instructions

This manual contains the use and maintenance instructions valid for the following equipment:
Portable Temperature Calibration model: **PTB150-157**

The instructions reported in this manual, for the above mentioned equipment, are those relevant to:

- Start-up preparation
- Operation description
- Using of the equipment
- Re-calibration procedure
- Preventive maintenance
- Typical faults and their remedies

Users must observe all the usual safety rules out in this manual for own security and to avoid equipment failure.

2 - SCOPE OF SUPPLY

1 - Name:

- Portable Temperature Calibrator **PTB150,** including accessories, as listed. (reference to paragraph 2.7)

2- Technical data:

- Operative range (PTB150) : -27÷ +150°C @ 22°C
- Operative range (PTB157) : -50÷ +150°C @ 22°C
- Stability : ±0.02°C
- Resolution : 0,01/0,1°C
- Reading accuracy : ±0,15°C **
- Regulation & reading probe : Pt 100 class A din43760
- Auxiliary inputs : Pt100 and Tc J, K, N, R, S, E(TC version only)
- Reading : °C, °F, K
- Serial communication : RS 232
- Increase gradient : 20°C/1' **
- Heating time : 15' from 20 to 140°C (+ 6' for stability)
- Decrease gradient : 22°C/1' **
- Cooling time : 12' From 140 to 20°C (+ 6' for stability)
- Cooling time : 15' From 20 to -25°C (+ 6' for stability)
- Standard block : Ø35 x 135mm
- Temperature ramps : min. 0,1°C/1'
- Thermostat test : 12 Vcc.
- Voltage : 230V 50Hz (100/115V by required) 50/60Hz.
- Power : 300VA.
- Electric protection : 2,5A T. fuse (3A F for 100-115V)
- Calibrator measurements : 160x370 x h. 330 mm
- Measurements of case : 520x330 x h. 500 mm
- Weight : 10 Kg only calibrator; 17Kg with travelling-case.

- Structure in flanged plate with rotating handle.
- Thermostatic well in aluminium with a hole ø35mm.
- Reducer inserts: ø34,7x135mm.
- Regulation of the temperature with PID μcontroller.
- Switch test.
- Internal cryostat with Peltier elements.
- Electronic control components thermally insulated with forced air system.
- Removable upper protection grid.
- Total absence of environmentally harmful cooling liquids.
- Socket with main cable and protection fuses.
- Display back light control.
- Electromagnetic compatibility : Emission EN50081-1
  Immunity EN50082-2

NOTE: **The data marked with ** has been recorded at an ambient temperature of 20°C±3, power supply 230V±10%, with Pt100 ø6 inserted in the block.**
The above-mentioned data keep valid for one year after the issuing of the calibrating certificate; afterwards it is necessary to carry out the oven re-calibration.
Environmental range: temperature +5 a +45°C, U.R. max. 80%

μCONTROLLER DATA
* Display : 2 lines 20ch x line (3,2x5,5) back lighting.
* μprocessor : 80C552 (family 80C51 CMOS).
* A/D converter **Σ-Δ 24 bits**
* E2PROM memory.
* Serial communication RS232 insulated.

3 - Services (function):

The portable temperature calibrator **PTB150-157** has been designed for:

- Control and calibration of temperature sensors, in the laboratory and in the field, in conformity with ISO 9000 standards.
- Calibration of thermostats with light indication when electric contact close.
- Thermal test on materials.
- Possibility to set temperature ramps.

The calibrator has been designed to reduce the EMC effect in accordance with the harmonised regulation for residential, commercial, light industry and heavy industry.

N.B: The Pulsar with the software AQ2sp for Windows™ can carry out:

- ◊ complete control of the oven from the PC
- ◊ manual or automatic calibration of one or more probes
- ◊ cyclic life or stress test on temperature sensors
- ◊ automatic threshold thermostat test
- ◊ filling and printing of the results obtained, guaranteeing that the ISO 9000 standard are observed

4 - Quantity:

- 1 piece.

5 - Manufacturer:

Eurotron Instruments (UK) Ltd
Unit 18 Austin Way, Royal Oak Industrial Estate
NN11 8QY- Daventry, United Kingdom
T+ 0044 (0) 1327 871044 F: 0044 (0)1327 301 255
www.eurotron-uk.com
info@eurotron-uk.com

6 - N° of correspondent catalogue sheet:

- PTB-D-V02 (15112011)

7 - List of first equipment accessories

PTB150-TS-230-UK	Temperature Calibrator, -48/150 ºC TS version 230 VAC
PTB150-TS-115-US	Temperature Calibrator, -48/150 ºC TS version 115 VAC
PTB150-TS-230-EU	Temperature Calibrator, -48/150 ºC TS version 230 VAC
PTB150-TC-230-UK	Temperature Calibrator, -48/150 ºC TC version 230 VAC
PTB150-TC-115-US	Temperature Calibrator, -48/150 ºC TC version 115 VAC
PTB150-TC-230-EU	Temperature Calibrator, -48/150 ºC TC version 230 VAC
PTB157-TS-230-UK	Temperature Calibrator, -70/150 ºC TS version 230 VAC
PTB157-TS-115-US	Temperature Calibrator, -70/150 ºC TS version 115 VAC
PTB157-TS-230-EU	Temperature Calibrator, -70/150 ºC TS version 230 VAC
PTB157-TC-230-UK	Temperature Calibrator, -70/150 ºC TC version 230 VAC
PTB157-TC-115-US	Temperature Calibrator, -70/150 ºC TC version 115 VAC
PTB157-TC-230-EU	Temperature Calibrator, -70/150 ºC TC version 230 VAC

PTB150-INS-01	blank insert DN.35x135 mm
PTB150-INS-02	Insert 35x135 mm 6 holes: φ.3,5-4.5-5.5-6,5-8,5-10,5 mm.
PTB150-INS-03	Insert DN35x135 mm custom (1 to 3 holes from 3,5 to 20mm)
PTB150-INS-04	Insert DN 35x135 mm custom (4 to 6 holes from 3,5 to 20mm)
PTB150-INS-05	Insert DN.35x135 mm custom (7-10 holes from 3,5 to 20mm)
PTB150-INS-06	Multi-hole insert DN35x135 mm with 2 holes: φ 6.5- 19.5 mm.
PTB150-INS-IR	Black body Insert DN 35x135 c/w Reference Sensor
PTB150-TC-OPT-01	SRS-PRT-03-A168B reference sensor and special UKAS Cal

PTB-CASE-02	Aluminium Transport Case with space for accessories(PTB/PLB)
PTB-CASE-01	Vinyl Case with Pockets for accessories (PTB/PLB)

3 - GENERAL RECOMMENDATIONS

➔ **ATTENTION**

The μprocessor regulator has been configured in factory with the parameters suited to work in the respect of the technical specifications.
Don't change these parameters to avoid malfunction or breaking of the calibrator with risks of serious personal injury.

- Position of the probe:
To obtain the best result, follow the advises:

- Measure the diameter of the probe being checked.
- Use the reduction insert; check that the diameter of the hole is at least 0.3mm bigger than the diameter of the probe (figure1).
- Put the insert in the equaliser block only at ambient temperature, using the tweezers.
- Avoid using holes that are too accurate and do not force the probes into the block.
- Insert the probe up to the bottom of the block: the sensitive element is in the optimal calibration zone (figure 2)
- Calibration with a reference: take care to position the two probes, the standard one and the calibration one, at the same dept and as close together as possible (figure 3).
- Always verify the range of the probes to be calibrated before using; the maximum temperature of the probes should be higher then the temperature of the liquid otherwise the probe could break.

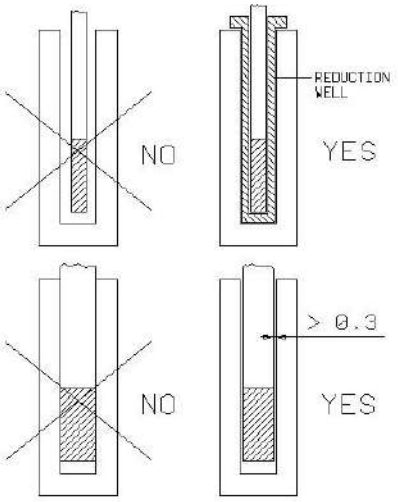


Fig.1

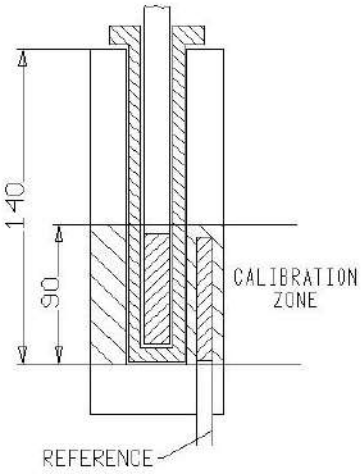


Fig.2

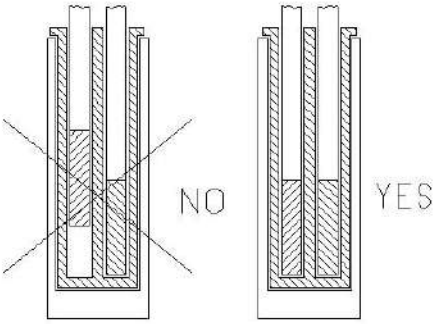


Fig.3

- Advises:

- The temperature difference is proportional to the difference between the diameter of the probe and the diameter of the hole.
- Do not insert the probe when the instrument has already reached the set temperature; thermal shock causes instability and breakage of the sensitive element.
- For the calibration of temperature transducers with special execution, call our technical office and ask for equaliser blocks with special drillings.
- Inserting a 6mm diameter 20°C probe at 121°C takes about 10 minutes to achieve maximum stability.
- To reduce the errors it is advisable to insert the probes and the standard probe together in the insert, if you insert the standard probe in the side hole and the probes in the insert the error at 121°C is about 0,2°C

4 - SAFETY INSTRUCTIONS

ATTENTION:

- Due to the fact that the thermostat is a portable instrument to be used in the field, it is very important to ensure that the socket has been earthed correctly when connecting it to the electricity supply.
- Carry out the maintenance and repair operation only with the equipment at ambient temperature and disconnected from the electric power.

- During the use of the calibrator, the upper protection grid may overheat.
- Don't touch the probe to calibrate when it's in the block.
- After using wait for the stabilisation at ambient temperature before returning the calibrator to its carrying case.

- Never put any type of liquid inside the well.
- Don't change absolutely the configuration parameters.
- Don't put anything on the top of the calibrator.
- Do not operate the instrument in an excessively wet, oily, dusty, or dirty environment.
- Do not connect any voltage higher to 5V to the input 4-5-15
- Don't put fuel objects near the calibrator.

..... use common sense any time.

The equipment adopt the following devices to protect operation from hazard:

- Protection grid and cap-block to avoid any contact with the internal block.
- Protection fuses (3)
- Ground conductor.

AFTER EVERY USE AT SUB-ZERO TEMPERATURES REMEMBER TO SET UP 70°-80°C FOR ONE HOUR IN ORDER TO EVAPORATE THE WATER IN THE WELL THEN SET AMBIENT TEMPERATURE AND LEAVE FOR SAME MINUTES BEFORE SWITCHING OFF

5 - PREPARATION OF OPERATION

- Remove the calibrator from the carrying case and place it on a flat surface.
- Make sure that the instrument has been correctly earthen.
- Supply the oven with line 230V, 50/60Hz (115 o 100V where required) + earth, 3A
- Before start the calibration read with attention the instruction manual, specially the paragraph 3: - General recommendation -.

5.1 - Installation

5.1.1 - Removal of packaging

The calibrator is equipped with packaging suitable for transport and traditional shipping systems. Any damage caused during transport must be notified immediately to the transporters and a claim must be made.

5.1.2 - Positioning the calibrator

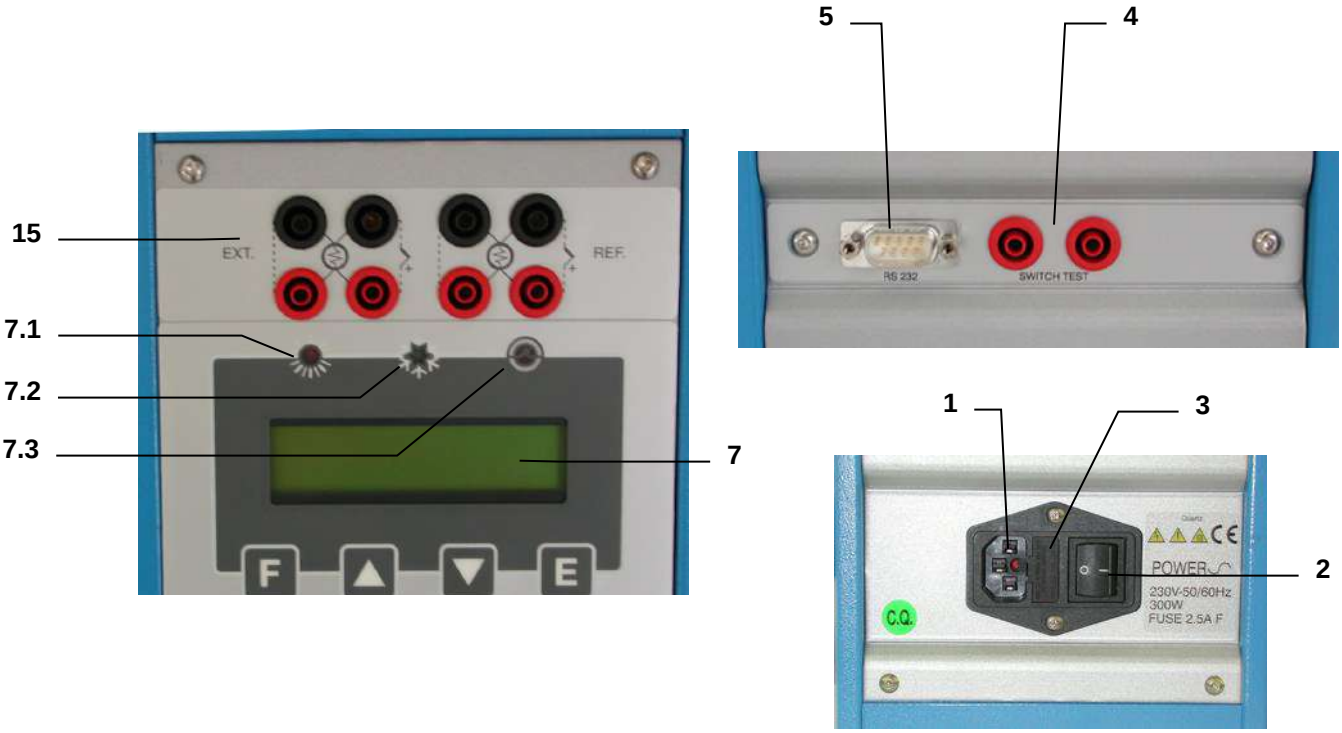
Position the calibrator in a safe clean place; make sure that the fan on the bottom of the calibrator runs free.

****DANGER**: The calibrator is suitable for operating at high temperatures with the consequent danger of fire. Keep it away from any type of inflammable materials and never put any type of liquid inside the block (reference to paragraph 4).

* **WARNING**: To avoid any smell in the room it is better to switch on the calibrator outside the room for the first time

5.1.3 - Supply

The calibrator runs on a voltage of 230 Vac (115-100V by request), single-phase, 50/60Hz. A 2.5mt. cable is supplied with the calibrator fitted with 2 conductors plus earth (2.5mm^2). Make sure that the plant is earthen correctly before switching the instrument on.



COMMANDS LIST

POS.	DESCRIZIONE
1	SUPPLY SOCKET
2	MAIN SWITCH
3	PROTECTION FUSES
4	SWITCH TEST BUSHES
5	RS-232 SOCKET
7	THERMOREGULATOR +DISPLAY
7.1	HEATING LED
7.2	COOLING LED
7.3	SWITCH TEST LED
15	EXTERNAL PROBES SOCKETS (OPTIONAL)

6 - OPERATION PROCEDURE

6.1 - Operation description

The **PTB** calibrator consists of an anticorodal block fitted with ø35mm, into which the sensors to be calibrated are inserted.
Four Peltier elements provided to heating / cooling the block; a PID μcontroller provided to regulate the temperature. The regulator control an AC/DC converter the supply the Peltier elements.
A fan mounted in the rear side generates a constant airflow that reduces the temperature of the case; the fun mounted in the bottom side generates a constant airflow that reduces the temperature of the block during the cooling.

6.2 - Description of instrument

6.2.1 - Thermo regulator

The thermo-regulator (7) is a PID microprocessor, which can be set from -50 to 150°C.

- DISPLAY UPPER LINE: indication of the temperature measured inside the block.
- DISPLAY LOWER LINE: indication of the set point; external probes if selected, setting parameters.
- ▲ ▼ KEY: used to increment (decrement) any numerical parameter. The increment (decrement) speed is proportional to the time the key remains depressed.
- F KEY: allow access to the various parameters (repeatedly press), access to the various phases of configuration (press F + ▲).
- E KEY: allow confirming the set parameter.

The calibrator is endowed with eight terminals (optional) that can be set as Pt100 or Tc.

6.2.2 - Signalling lamps

Heating lamp (7.1): it indicates the operation of the Peltier heating system.
Cooling lamp (7.2): it indicates the operation of the Peltier cooling system.
Sw. Test lamp (7.3): it indicates the activation of the contact of the thermostat under test connected at the plugs (4)

6.2.3 - Main switch

The main switch (2) is frontal of the instrument; it is fitted with a socket for the voltage cable and two fuses: 2,5A S for 230V mod. & 3A T for 100-115V models.
Note: use only fuses F. 5x20mm. All the electrical part is found below the main switch.

6.2.4 - Carrying handle

The calibrator is fitted with a carrying handle

6.2.5 - Heating & cooling system

Four Peltier elements provided to heating / cooling the block; this system can reach the max. temperature of 150°C & the min. temperature of -30°C.
Bear in mind, however, that constant use at extreme temperatures reduces the life of the Peltier elements. Limit the number of hours at which the instrument is used at maximum temperatures to the time required by the calibration in order to prolong the life of the cells.

6.2.6 - Equalising block

The equalising block is in aluminium with the hole for the reduction insert. Holes have been made on the reduction insert to make it possible to fit various types of probes. The function of the block is to make uniform the temperature on calibration zone.
If you want to fit the calibrator with a block or insert with different holes we recommend that you should contact the technical support department who will check to see if it is feasible. This will avoid any unfortunate problems, which might arise if the wrong tolerances are used

6.2.7 - Temperature sensors

The temperature sensor used for the reading and thermoregulation is a PT100Ω probe; the probe is inserted directly into the equalising block.

6.3 - Start-up instructions

ATTENTION:

- The calibrator can only be used correctly if the user has a good knowledge of its basics.
- Before starting with the calibration following the installation procedures (paragraph 5); read the instruction on paragraph 3 & 4.

To calibrate the probe it is possible to follow two ways: calibration with internal indicator (8), or calibration with external reference.

Calibration with the internal indicator (8):
Make reference to the temperature value of the display (8) (figure 4).
It is opportune to refer the value to the test report to compensate the error of the display.

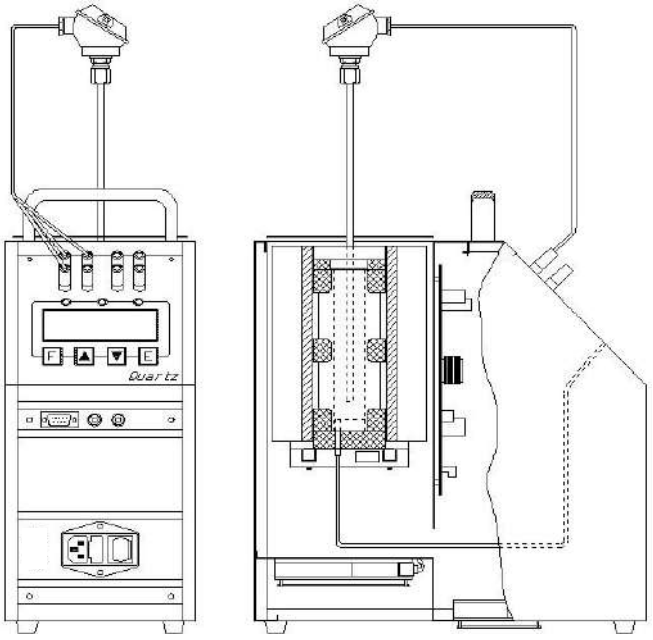


Fig.4

Calibration with external reference and reading on the calibrator display:
The reference temperature value is given by the external reference introduced in the block and directly connected to Quartz (figure 5); the temperature can be read on the second line of the display (for the configuration of the sensor, see the paragraph 10.1). When possible, it is advisable to place two probes at the same level and as closest as possible (reference figure 1-3).

Calibration with external reference and reading on an external instrument:
The reference temperature value is given by the external reference introduced in the tank and connected to an external instrument. When possible, it is advisable to place two probes at the same level and as closest as possible (reference figure 1-3).

Note: Figures 4 and 5 refer to the calibrator in version 2I with external sensors plugs.

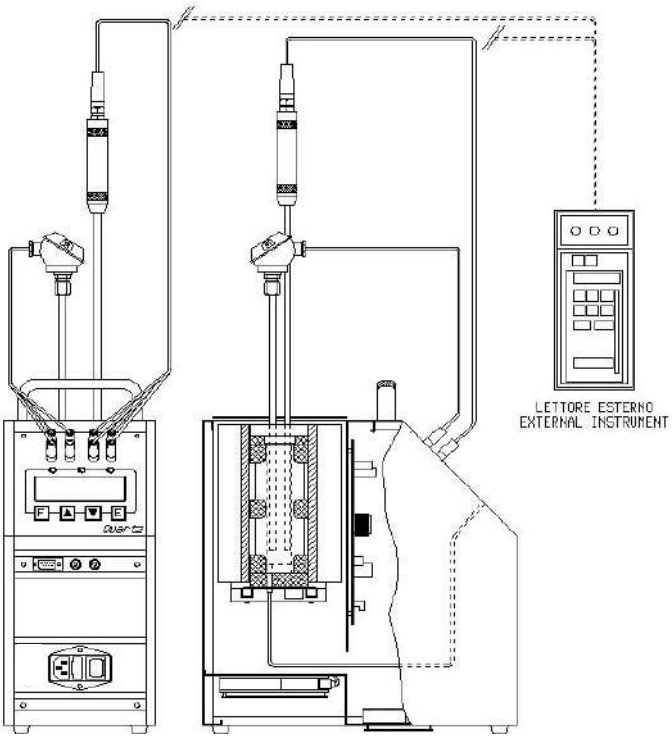


Fig.5

Before any calibrations follow the general recommendation (chapter 3):

- Starting the calibration only at ambient temperature: thermal shock can break the sensitive element of the probe and cause harm to operator.
- Put the probe to check into the equaliser block: reference to chapter 3. (fig 1-2).
- Switch on the calibrator with the main switch (2); waiting for the end of auto test procedure.
- Set the required temperature value on the display:

  ◊ Press the ▲ key to increment the set point value.

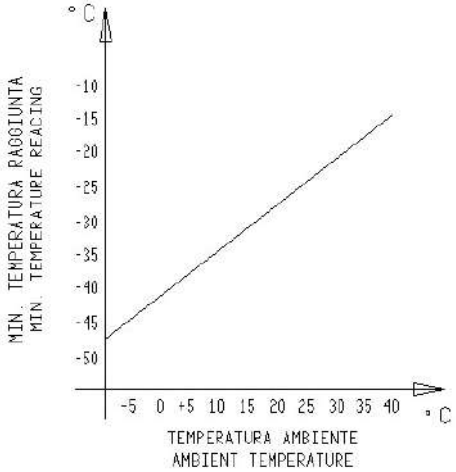
  ◊ Press the ▼ key to decrement the set point value.

  ◊ **Press the - E - key to confirm the input value.**

- Wait for the stabilisation of the oven before starting any calibration.
- The time to reach the stability(±0,02°C) from 20 to 100°C is about 20 minutes and from 100 to 0°C it is about 30 minutes.
- The display shows the temperature of the calibrator and the set point, when the temperature is reached and it is stable, the display shows the symbol ÷
- To working at different temperatures set the set point at the new value and wait for the stabilisation.
- When the set point is changed, the temperature read on the display and that measured in the block may not proceed at the same speed; this is because there are differences between the sensors used and the position of the same inside the block.
- We suggest to insert one primary standard with SIT certificate in the ø6.5 hole of the block; compare the measure with the values indicated by the standard.
  If you don't always want to make use of the primary standard: it's possible to calibrate the instrument to more significant points, comparing the displayed temperature with that temperature of standard.
  In case the Quartz is connected with an external probe SIT certificated (ref. 6.5.1), the system is considered a primary standard.

- The minimum temperature depends to the ambient temperature: to do references to the graphic on fig. 6

Fig.6



N.B: To modify the regulation parameter or to set the ramp, see the instructions on chapter 10.1.

ATTENTION

- At the end of the calibration DO NOT remove the probe if it is still at high temperature. Always allow the calibrator to cool off with the probe still inserted in order to avoid thermal shock to the probe itself and harm to people or things.
- Before returning the calibrator to its case makes sure that the temperature of the block is almost the same as ambient temperature.

6.4 - Use of the functions

6.4.1 - Reading of external probes (TC version only)

It is possible to display one or two probes tied to the EXT and REF inputs.
The following probes can be connected:
1. THERMOCOUPLES TYPE J, K, R, S, N, E with automatic compensation of the terminal clamp temperature.
2. THERMAL RESISTANCE Pt 100 to 2, 3 or 4 wires.

- Connect the probe's wires to the clamps (15) as it is indicated in the figures.
  - ◊ Thermocouple – connect the wires to the clamps 2-4 to make attention to the polarity; connect the clamps 1-3 as indicated. Reference to figure 7-A and select the thermocouple.
  - ◊ Pt100 to 4 wires – connect the clamps 1-2-3-4 as indicated in figure 7-B and select Pt100.
  - ◊ Pt100 to 3 wires – connect the wires to clamps 1-2-3; connect the clamps 3-4 and select Pt100 3W. Reference to figure 7-C
  - ◊ Pt100 to 2 wires – connect the wires to clamps 2-4; connect the clamps 1-2 & 3-4; select Pt100. In case of two wires connections remembers to us shortest wires possible. Refer to figure 7-D

- In order to read the probes' temperature refers to the procedure explained in paragraph 10.1 till **SENSOR**; the temperature will be displayed on at the bottom of the display.
- In order to read in the '°F' way, refer to the procedure explained in paragraph 10.1 till **Units°C/°F/K**; the conversion of the new scale will be carried out at once.

NOTE: The calibrator always thermally adjusts with the control probe situated inside the block.

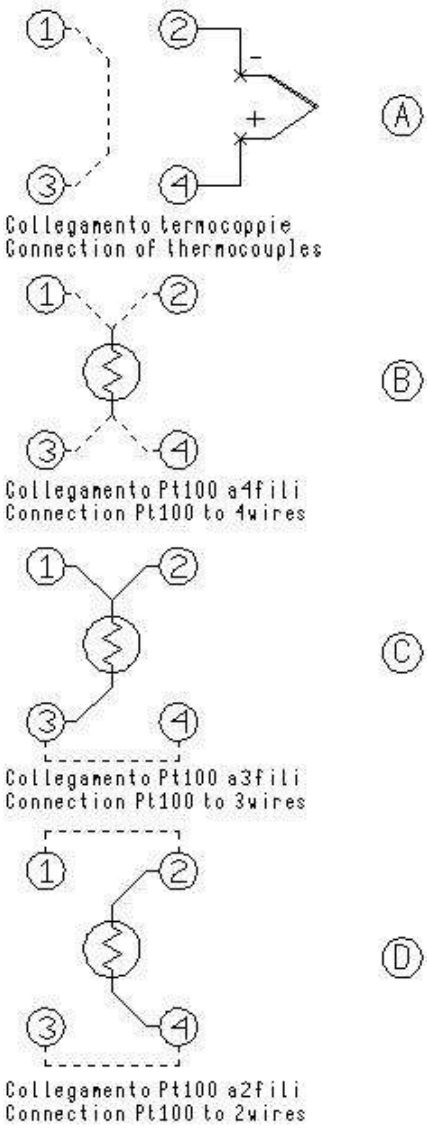


Fig. 7

6.4.2 - Switch test

You can test the operating point of the thermostats by the 'SWITCH TEST' function.
- Put the thermostat in the most suitable hole of the block (see the note in paragraph 3).
- Connect the terminals of the thermostat to the socket (4).
- Switch on the calibrator.
- Set the test temperature upper to the operating temperature of the thermostat: the lamp (7.3) will come on when the thermostat electric contact works.
- The instrument stores the switch test value. Follow the instruction and the flow chart on chapter 10.1, up to SW ON - SW OFF to display the stored values.
- Push on together the ▲ & ▼ keys to reset the value of 'SW. ON - SW. OFF'.
- See chapter 10.1 for ramp generation.

6.4.3 - Serial communication

For PC control use the serial communication RS 232 (5) (references fig.8)
With RS232 you can read and/or change the operative parameters, for example: set point, external probe, slope rate etc..
Reference to communication protocol instruction (chapter 10.2).

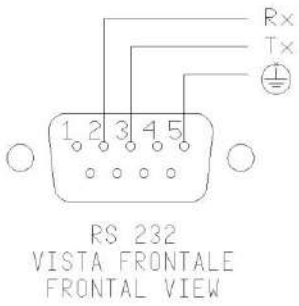


Fig.8

The external PC must be conform to the IEC950 standard

7 - MAINTENANCE INSTRUCTIONS

To have instrument always efficient is opportune to re-calibrate it periodically.
Frequency of re-calibration is depending to the use of instrument; however we suggest to re-calibrate instrument every year.
To re-calibrate the instrument is necessary to have a standard temperature instrument, the software 'CALIBRA' and follow the instructions of the software or alternately follow the instructions of item 10.1.

Use at subzero temperatures generates the formation of ice and mist.
In order to keep inserts always clean, at the end of every use at subzero temperatures please remember to set the furnace temperature at 70-80 °C for 1 hour so as to let water evaporate, then set the room temperature and let the calibrator cool down, before stopping it.
Water remaining in inserts generates aluminium oxidation resulting in the hole; in order to avoid this problem, please remember to let water evaporate and to remove inserts from the calibrator at the end of use.

Check the power supply cable and replace it if damaged.

Remove dust from the calibrator and avoid the fan sucking dirt from the bottom of the machine; if necessary, clean the heat sink, by blowing air from above the grating by means of an airgun.

8 - MAINTENANCE SEQUENCE

Not applicable

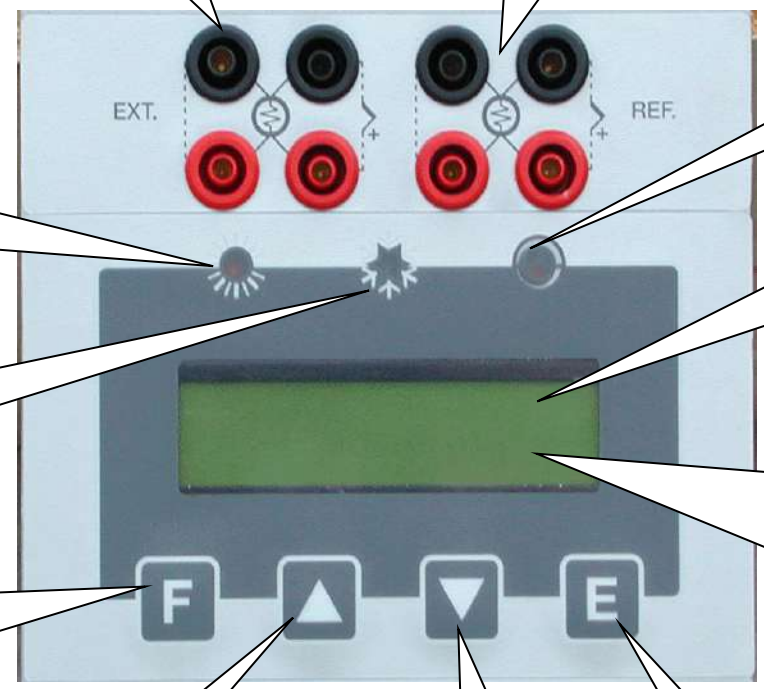
9 - TYPICAL FAULTS

Before carrying out these operations the instrument must be disconnect from the electricity supply.

N°	FAULT DESCRIPTION	FAULTY COMPONENT OR FUNCTION	METHOD FOR REMOVAL
1	The calibrator does not work when the power cable is connected and the main switch is turned on.	- The fuse (2) is cut off. - The power cable is cut off. - The main switch is faulty.	- Replace the fuses. - Replace the power cable with a similar one. - Replace the cup socket (1-3)
2	The fuses (3) are triggered when the power cable is connected and the main switch is turned on.	- There is a short circuit in the supply card (12). - The main switch is faulty.	- Replace the supply card. - Replace the cup socket.
3	The control panel is working properly but the temperature does not increase or decrease.	- The supply card (12) is faulty. - The regulation card (7) is faulty. - One or more Peltier elements are faulty.	- Replace the supply card. - Replace the regulation card - Replace the equaliser block.
4	The display show a different temperature from the one measured in the block.	- The Pt100 (8) is faulty. - The thermoregulator (7) is faulty.	- Recalibration of the probe; otherwise replace it. - Replace the thermoregulator.
5	The temperature does not stop at the value of the point, which has been set.	- The thermoregulator (7) is faulty.	- Replace the regulation card. - Replace the thermoregulator.
6	The calibrator doesn't work at the temperatures indicated in the technical data.	One or more Peltier elements are damaged.	Replace the equaliser block.
7	The display shows "MEMORY FAIL"	The memory lost the data for electrical troubles	Replace the thermoregulation card and/or re-calibrate the Quartz
8	The display shows "Internal sensor fail"	Short circuit on the PT100 RTD (8).	- Replace the PT100 RTD and re-calibrate the Quartz
9	When switch on the calibrator, the fan (5) doesn't work	- The supply card (12) is faulty. - The thermoregulation card (10.1) is damaged. - The fan (19) is damaged.	- Replace the supply card. - Replace the thermoregulator. - Replace the fan (5).
10	The calibrator doesn't stabilise at the high temperatures.	- The P.B. value is narrow	- Set the P.B. to 6%

10 - APPENDICES

10.1 - Frontal panel description



EXTERNAL PROBE INPUT
Selectable between Pt100, Pt100 3W, Tc K, Tc S, Tc N, Tc J, Tc R, Tc E type according to the probe you calibrate

REFERENCE PROBE INPUT
Selectable between Pt100, Pt100 3W, Tc K, Tc S, Tc N, Tc J, Tc R, Tc E type according to the probe you calibrate

SWITCH TEST LED
When the led is on the thermostat's contact is closed

HEATING LED
When the led is on the calibrator increase the temperature

DISPLAY 1
It shows the value of the temperature in the block

COOLING LED
When the led is on the calibrator decrease the temperature

DISPLAY 2
Indication of the value of the set point.
Indication of the external probe if selected.
During the program operation it shows the parameter selected by the 'F' key.

Access to the function menu.
Pressed with the key ▲ it let you enter to the 'Set Up' menu

It increase the value showed on the display 2. If you keep pressed the key "UP" the speed of increase rises

It reduce the value showed on the display 2. If you keep pressed the key "DOWN" the speed of reduce rises

Confirmation of the values

DESCRIPTION OF REGULATOR'S MENU
The calibrator has three menu levels(see image 10.2):
at the first level there are the functions for the continuous usage,
at the second level there are more specific functions for the regulation of the calibrator,
at the third level there are the typical functions for each calibrator and the calibration procedures.

1st MENU LEVEL
PRESS THE **F** KEY TO STEP THROUGH THE MENU

- **SP**
  SET POINT: temperature set which the oven has to reach following technical specifications, press the ▲ or ▼ key to adjust the set point and press **E** key to accept new the new value.

- **SP2**
  SET POINT2: temperature set which the oven reaches with the set gradient and the ongoing launched ramp procedure, press the ▲ or ▼ key to adjust the set point and press **E** key to accept new the new value.

- **GRAD**
  GRADIENT: set point variation speed during the change from one temperature value to the SP2 value, press the ▲ or ▼ key to adjust the set point and press **E** key to accept new the new value.
  The set gradient must be negative for descent ramps.
  NOTE: gradient values to be set must be lower than the ones stated in the technical data, at point 2.2 (cooling grad. max.: -7°C/min.; heating grad. max. 18°C/min).

- **RAMP**
  Ramp procedure enabling/disabling.
  Select ON or OFF by the ▲ or ▼ key and press **E** key to accept; the oven will reach the set SP2 temperature with the set gradient, starting from the same temperature as the one with which the ramp has been confirmed. The starting temperature does not depend on the Set Point temperature.
  If a negative ramp is set put the gradient is left positive and/or the SP2 is higher than the current temperature, the little over will not accept the ramp start and an alarm will begin running.
  When the ramp is on, the display will show the word "**Ramp:.....**" followed by the Set Point value on the second line of the text. The Set Point value will reach the speed related to the set gradient.
  When the block temperature reaches the SP2 set temperature, the oven will produce an alarm and the ramp procedure will be automatically set off; the SP2 value will be considered as the new set point value and the oven will be steadily set at that temperature.
  During the ramp process, the derivative parameter will not be considered.

  RAMP PROCEDURE EFFECTIVE EXAMPLE
  Let's say that the set temperature is the ambient one and that it is necessary to reach 400°C with a gradient of 2°C/min.
  - Press the **F** key and set **SP2** to 400°C using the ▲ or ▼ keys. Press the **E** key to accept.
  - Press the **F** key and set **GRAD** to 1°C/min using the ▲ or ▼ keys. Press the **E** key to accept.
  - Press the **F** key and set **RAMP** to **ON** using the ▲ or ▼ keys. Press the **E** key to accept.
    After pressing the E key to confirm the ramp start, the oven temperature will ascend with the set slope. Of course, there will be some oscillations at the beginning since the ramp slope will not be suitable but they will stop in a short time and then the oven temperature will follow the ramp's set point.

- **RIS. 0.1/0.01**
  Display reading resolution; Press the ▲ or ▼ key to select 0,1 or 0,01 and press **E** key to accept.

- **SW. ON**
  Switch on; displays the temperature at which the thermostat connected to the terminals "SWITCH TEST" is closed.

- **SW. OFF**
  Switch off; it displays the temperature at which the thermostat connected to the terminals "SWITCH TEST" is open. The value is reset each time the power supply fails or by pressing the two "▲ ▼" keys at the same time. The value is updated every time that the contact closing is detected.

- **SENSOR (OFF/EXT/REF/EXT+REF)**
  This parameter allows enabling the reading of sensors on the auxiliary inputs:
  OFF no input is enable to read the sensors' value.
  EXT the four terminals of the input EXT are enabled to read the sensor tied to them, whose value is indicated at the bottom of the Display.
  REF the four terminals of the input REF are enabled to read the sensor tied to them, whose value is indicated at the bottom of the Display.
  EXT+REF the eight terminals of inputs 1 and 2 are enabled to read the sensors tied to them, whose value is indicated at the bottom of the Display.

2nd MENU LEVEL

PRESS THE **F** + ▲ KEYS AT THE SAME TIME TO ACCES THE SECONDARY MENU.
PRESS THE **F** KEY TO STEP THROUGH THE MENU.
PRESS THE "**F** + ▲ KEYS AT THE SAME TIME OR WAIT FOR ABOUT 20 SECONDS TO COME BACK THE PRIMARY MENU

- **P.B.**
  Value of the Proportional Band expressed in percentage of the value of the end of the scale. Proportional band means the length of time in the measure field within which there is the variation of the regulation probe exit alarm and therefore the adjustment of the heating element power.

- **T.I.**
  Integral Time value expressed in seconds. The integrating action cancel the error between the chosen set point and the temperature reached only by the proportional action. Integral time means the length of time necessary to the integrative action to double up the proportional action

- **T.D.**
  Derivative Time expressed in seconds. When there is a step variation of temperatures, the derivative action induces an greater initial adjustment, so that the oven will have a greater power than it usual has due to the proportional and integral action only. Since the error keeps existing, the derivative action reduces the impact giving the integrative action the task of reducing the error.

- **EXT SENSOR TYPE: J, R, S, N, K, E, Pt100, Pt100 3wires**
  This parameter allows selecting the kind of sensor read by the display and connected to the four Ext. terminals.(item 6.4.1)

- **Units °C/°F/K**
  This parameter allows selecting the temperature measuring unit. By selecting "**°C**" all temperatures will be expressed in Celsius degrees; by selecting "**°F**" all temperatures will be expressed in Fahrenheit degrees.

- **Def. Par. ON/OFF**
  Default Parameter; this function allows choosing to set the thermoregulator with the P.B., T.I., T.D. parameters either as a default or as a customisable adjustment. By selecting the "**OFF**" parameter and confirming by the "**E**" key it is possible to modify the adjustment parameters, which will keep operational even if the calibrator is turned off. By selecting the "**ON**" key (followed by the confirmation by pressing the "**E**" key) the adjustment values will be set on the default ones recorded by the manufacturer, and therefore not allowing to be changed. By turning the calibrator off the parameter will set on OFF but the default parameters will be kept recorded.

- **REF SENSOR TYPE: J, R, S, N, K, E, Pt100, Pt100 3wires**
  This parameter allows selecting the kind of sensor read on the display and connected to the four REF. Sensor terminals.(item 6.4.1)

- **KEY**
  This is the key to step the third menu level. Press ▲ or ▼ key to set the number recorded in the " **ACCESS KEY** parameters at the third menu level, and press "**F**" + ▲keys at the same time (*it is not necessary to confirm the choice by pressing the E key*) to step to the third menu level. The acceptable values are from 1 to 99: **the default set value is 2. If you lost the access key remember that it is possible to have the number by reading the register 13 (item 10.3)**

3rd MENU LEVEL

MENU THAT CAN BE SELECTED BY PRESSING THE "**F** + ▲" KEYS AT THE SAME TIME WHEN THE **KEY** PARAMETER IS REACHED AT THE SECOND LEVEL AND WHEN THE SET VALUE CORRESPONDS TO THE RECORDED ONE.
PRESS THE **F** KEY TO STEP THROUGH THE MENU.
PRESS THE "**F** + ▲ KEYS AT THE SAME TIME OR WAIT FOR ABOUT 20 SECONDS TO COME BACK THE PRIMARY MENU

- **ACCESS KEY**
  Access key; numerical value from 1 to 99 that enables passing to the third parameter level. **The default value is 2**

- **BAUD RATE**
  Data transmission speed from the computer. Values are from 2400 to 19200 **(default value is 9600).**

- **ADDRESS**
  Communication address. The value of this parameter is necessary to communicate from the computer to many instruments. The admitted values are from 1 to 32 and once the value is set by using the ▲ or ▼ keys it is necessary to confirm the choice by the **E** key

- **S/N**
  Equipment serial number. It is set by the manufacturer and cannot be changed by the user.

- **Board S/N**
  Serial number of the board. It is set by the manufacturer and cannot be changed by the user.

- **MAX. SET.**
  Maximum value of the Set Point. It is set by the manufacturer and cannot be changed by the user.

- **MIN. SET.**
  Minimum value of the Set Point. It is set by the manufacturer and cannot be changed by the user.

- **WAIT**
  initial waiting procedure. If the value "**0**" is set, when it is started up, the calibrator immediately run to the last set point value chosen after turning off. If the value "**1**" is set, when it is started up, the calibrator goes on the waiting position and the **SP** flash. It is necessary to press any key in order to move it from the waiting position and to choose the desired Set Point value. It is possible to set the WAIT value only by the serial communication.

- **REV. SOFTWARE**
  Internal software's release number.

- **SENSOR TYPE**
  It indicates the type of the internal probe.

- **STAB:**
  It indicates the swinging value of the temperature, which has been set to see on the Display the symbol of the oven ÷ steadiness. The symbol light on when the temperature is stable for over 6 minutes.

- **Cal_chnl**:
  Chooses the channel to be calibrated. It can assume three values: INT, EXT, REF. Press the ▲ or ▼ key to select INT, EXT or REF and press E key to accept

- **P1:**
  First Calibration point. Press the ▲ or ▼ key to set the value read with the standard thermometer and press E key to accept

- **P2:**
  Second Calibration point. Press the ▲ or ▼ key to set the value read with the standard thermometer and press E key to accept.

- **CAL: INT (Y/N):**
  This writing can have three different configurations.
  CAL: INT (Y/N) if Cal_chnl is set on INT
  CAL: EXT (Y/N) if Cal_chnl is set on EXT
  CAL: REF (Y/N) if Cal_chnl is set on REF
  Press the ▲ or ▼ key to set Yes or Not and press E key to accept.

EXAMPLE OF RE-CALIBRATION

The appliance can have a complete or partial re-calibration yearly or when chosen by the user.
Calibration can be carried out using CALIBRA ED200 software or directly on the keyboard of the appliance.
The calibration of the INTERNAL probe is done by adjusting the internal probe at two points of the range using a standard thermometer.
The calibration of the EXTERNAL and the REFERENCE inputs is done by adjusting the inputs of the controller at two points of the range using a mV/ohm standard generator.
The calibration is possible only by setting the temperature in °C.

CALIBRATION OF THE **INTERNAL PROBE**
The purpose of re-calibration is to correct the error between the temperature indicated and the value of a standard thermometer.
To calibrate the internal probe it is necessary to have a standard thermometer with precision greater than that of the appliance and then to follow the instructions:

1. Insert the standard thermometer probe in the temperature bath or in the most suitable hole of the calibrator.
2. Choose two calibration points depending on the appliance range or the field where one wishes to carry out calibration. For example the points 0 and 120°C are recommended for the QUARTZ.
3. Set the first calibration point and wait for the appliance to be stable (see symbol **÷)**
4. Enter the third menu level (see instructions) and select Cal_chnl= INT. Press E to confirm.
5. Press F to select P1, press the ▲ or ▼ key to set the value read with the standard thermometer and press **E** Key to accept**.** Confirmation is indicated by the symbol * which appears on the display after about 5 seconds.
6. Return to the first menu level and set the second set point. Then wait for the appliance to be stable (see symbol **÷).**
7. Enter the third menu level (see instructions) and select P2, press the ▲ or ▼ key to set the value read with the standard thermometer and press **E** Key to accept. Confirmation is indicated by the symbol * which appears on the display after about 5 seconds.
8. Select **CAL: INT** set **Y**es and confirm by pressing **E** key . Calibration begins. The procedure takes a few seconds, at the end of which there is a Beep.

CALIBRATION OF THE **EXT** + **REF** INPUTS with a signal calibrator

The purpose of the re-calibration is to correct the EXT and REF inputs error together.
To calibrate the two inputs, it is necessary to have a Pt100 calibrator and/or a thermocouples calibrator depending on what is to be calibrated.
Calibration of the EXT input automatically reproduces the same calibration on the REF input:

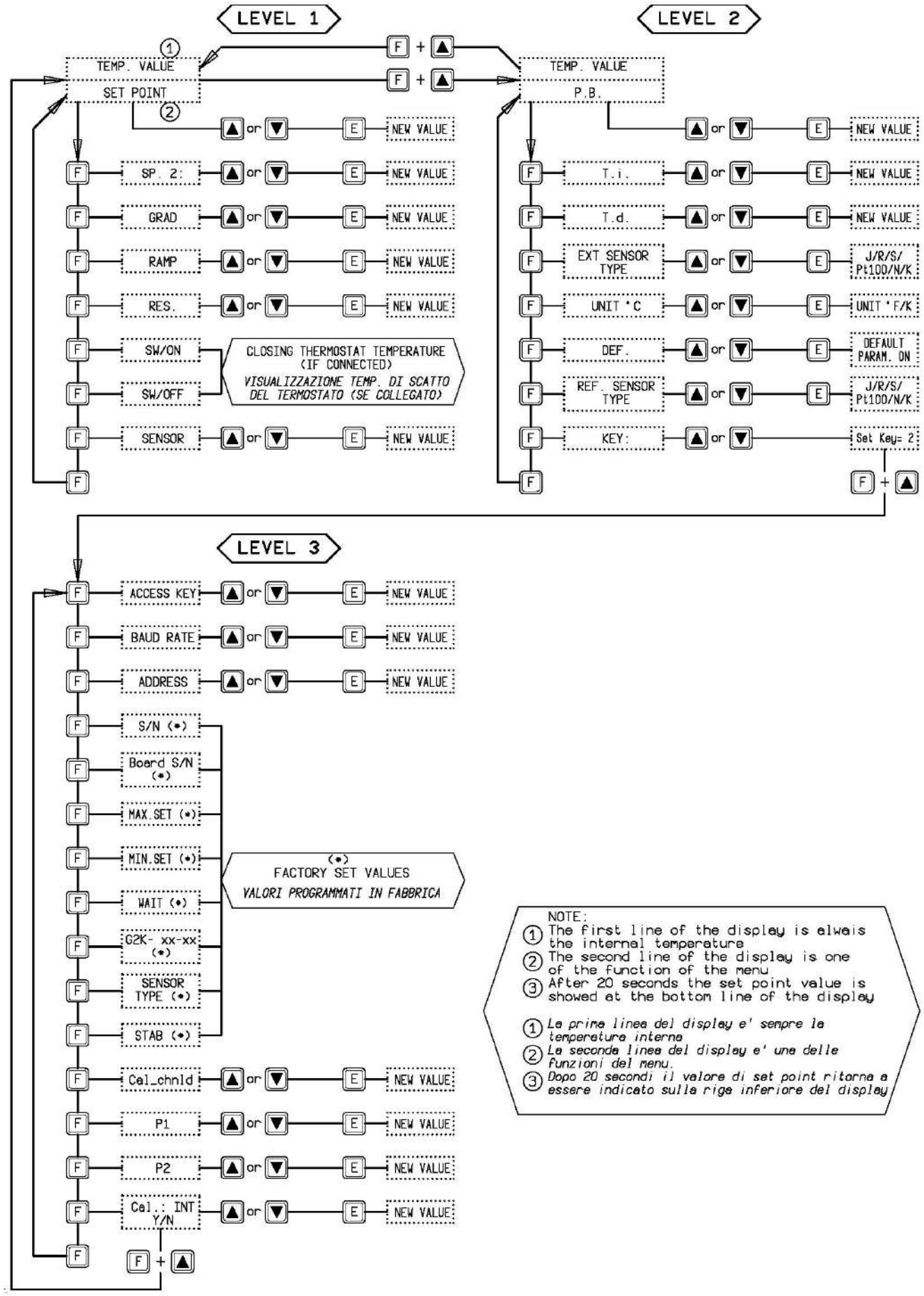
1. On the second menu level, select the type of EXT input to calibrate (Pt100, Tc K, Tc J, Tc N, TcR, Tc S, Tc E) following the instructions in the manual. Press E key to confirm.
2. Enter the third menu level (see instructions) and press the ▲ or ▼ key to set Cal_chnl= **EXT**. Press E to accept.
3. Choose two calibration points depending on the appliance range or the field where one wishes to carry out calibration. (For example 0 and 450°C for PT100, 200 and 800°C for the thermocouples).
4. Connect the signal generator to the EXT input, generating the first calibration value. See the instructions for the connection.
5. Select P1 and press the ▲ or ▼ key to set the first value (for example 0°C). Press E Key to confirm. Confirmation is indicated by the symbol * which appears on the display after about 5 seconds.
6. Generate the second calibration value with the signal generator. See the instructions for the connections.
7. Select P2 and press the ▲ or ▼ key to set the second value (for example 450°C). Press E Key to confirm. Confirmation is indicated by the symbol * which appears on the display after about 5 seconds.
8. Select **CAL: EXT** Set **Y**es and confirm pressing E Key. The procedure takes a few seconds. At the end there is a Beep.

CALIBRATION OF THE **REF** INPUT with a with probe connected

This operation adapts the value indicated by the REF input to the value indicated by the probe connected to it, compensating its errors.
To carry out the calibration it is necessary to connect the probe to the REF terminals and to have a standard thermometer

1. Connect the probe to the **REF** input following the instructions in the manual.
2. Insert the probe in the suitable hole in the appliance.
3. Insert the standard thermometer in the appliance.
4. Set the first calibration point and wait for the appliance to be stable (see symbol **÷)**
5. Enter the third menu level (see instructions) and select Cal_chnl= **REF**. Press E key to accept.
6. Select P1 and press the ▲ or ▼ key to set the value read with the standard thermometer. Press E key to accept. Confirmation is indicated by the symbol * which appears on the display after about 5 seconds.
7. Return to the first menu level and set the second set point. Then wait for the appliance to be stable (see symbol **÷).**
8. Enter the third menu level (see instructions), select P2 and press the ▲ or ▼ key to set the value read with the standard thermometer. Press E Key to accept. Confirmation is indicated by the symbol * which appears on the display after about 5 seconds.
9. Select **CAL: REF** Set **Y**es and confirm pressing E Key. Calibration begins. The procedure takes a few seconds. At the end there is a Beep.

10.2 - Microprocessor regulator: control description


LEVEL 1
LEVEL 2
LEVEL 3
TEMP. VALUE
SET POINT
P.B.
NEW VALUE
SP. 2:
GRAD
RAMP
RES.
SW/ON
SW/OFF
SENSOR
CLOSING THERMOSTAT TEMPERATURE
(IF CONNECTED)
VISUALIZZAZIONE TEMP. DI SCATTO
DEL TERMOSTATO (SE COLLEGATO)
T.i.
T.d.
EXT SENSOR TYPE
J/R/S/ Pt100/N/K
UNIT °C
UNIT °F/K
DEF.
DEFAULT PARAM. DN
REF. SENSOR TYPE
KEY:
Set Key= 2
ACCESS KEY
BAUD RATE
ADDRESS
S/N (*)
Board S/N (*)
MAX.SET (*)
MIN.SET (*)
WAIT (*)
G2K- xx-xx (*)
SENSOR TYPE (*)
STAB (*)
(*)
FACTORY SET VALUES
VALORI PROGRAMMATI IN FABBRICA
Cal_chnld
P1
P2
Cal.: INT Y/N
NOTE:
1 The first line of the display is alwais the internal temperature
2 The second line of the display is one of the function of the menu
3 After 20 seconds the set point value is showed at the bottom line of the display
1 La prima linea del display e' sempre la temperature interna
2 La seconda linea del display e' una delle funzioni del menu.
3 Dopo 20 secondi il valore di set point ritorna a essere indicato sulla riga inferiore del display

10.3 - Communication Protocol Rs232/C

General characteristics:

Baud Rate: *9600* Parity: *No*

N. Bit: *8* Bit of stop: 1

The communication runs in half duplex way which means that is transmission and reception could not be contemporaneously present.
The regulator replies only after receiving command; it never replies itself.
The command and reply are ASCII character string, as detailed forward. The communication program will be able to convert ASCII to decimal to extract numeric values. The default address is 1.
Baud rate: 2400, 4800, 9600 e 19200 baud, the Default value is 9600; the other parameters are standard.

VARIABILES AVAILABLE IN READING	
0	Set point
1	Ramp ON/OFF
2	Set point 2
3	Gradient
4	Resolution
5	Prop. Band
6	Integral time
7	Derivative time
8*	**Sensor input selection**
9	Title
10***	**Units (°C/°F/K)**
13	Access key
14	Baud rate
15	Address
16	Serial number
18	Mx. set point
19	Min. set point
21	Wait ON/OFF
22	Switch on temperature
23	Switch off temperature
24	Version
25**	**Ext. Sensor type**
26**	**Ref. Sensor type**
28	Stability range
29	Symbol of steadiness
100	Temperature
105	Ext. temperature
106	Ref. temperature

VARIABILES AVAILABLE IN WRITING	
0	Set point
1	Ramp ON/OFF
2	Set point 2
3	Gradient
4	Resolution
5	Prop. band
6	Integral time
7	Derivative time
8*	**Sensor input selection**
9	Title
10***	**Units (°C/°F/K)**
13	Access key
15	Address
25**	**Ext. Sensor type**
26**	**Ref. Sensor. type**

*

8* Sensor input selection	
1	Correspond to the INTERNAL probe
2	Correspond to the INTERNA+EXT probe
3	Correspond to the INTERNA+REF probe
4	Correspond to the INTERNA+EXT +REF probe

**

25/26 Ext. Sensor type/ Ref. Sensor type**	
0	Correspond to the Pt 100 4 wires
1	Correspond to the N thermocouple
2	Correspond to the K thermocouple
3	Correspond to the J thermocouple
4	Correspond to the R thermocouple
5	Correspond to the S thermocouple
6	Correspond to the Pt100 3 wires
7	Correspond to the E thermocouple

***

10*Units (°C/°F)**	
0	Correspond to the °C
1	Correspond to the °F
2	Correspond to Kelvin temperature

* the variable 8 is available only for the models SOLAR-2I-X; the value of the variable corresponds to the table.
** the variable 25/26 is available only for the models SOLAR-2I-X; the value of the variable corresponds to the table.
*** the value of the variable 10 corresponds to the table.

Each commands string are ASCII character succession.
First is $ character; the next must indicate the instrument address (default 1) and than is the command (4 characters).
Possibility:

RVAR (data reading)
WVAR (data writing)

The ultimate part of string is depending of a type command. The character (cr) concludes the sequence

DATA READING:

Example 1) reading of the Set Point (0 variable):
the command string is: **$1RVAR0_<cr>**

Each characters means:

$	beginning of message
1	instrument address
RVAR	reading command
0	number of the variable to read (see the table of the “VARIABILES” on the previous page)
_	space
<cr>	end of message

the response string is: ***1_110,0** (110,0 is only for example)
The character <cr> concludes the message.

Command to read the temperature of an external probe (index 25):

Example 2) reading of the EXT sensor (105 variable):

the command string is: **$1RVAR105_<cr>**
the response string is: ***1_123,4** (123,4 is only for example)
The character <cr> concludes the message.

The response does not include the measure unity, to read the unity read the variable 10:
the command string is: **$1RVAR10_<cr>**
the response string is: ***1_0 for °C**
the response string is: ***1_1 for °F**

DATA WRITING:

FLOAT VARIABLES

For writing you use the command WVAR.

Examples 1) writing of the Set point to 132,5°C

If the unity of measure of the temperature is already °C it is enough to write the SET POINT (see the table of the "VARIABILES" on the previous pages).

the command string is: **$1WVAR0_132,4<cr>**

Each characters means:

$	beginning of message
1	instrument address
WVAR	writing command
0	number of the variable to read (see the table of the "VARIABILES" on the previous pages)
_	space
132,4	numerical value of a data with the character **.** to separate the decimal part of the number
<cr>	end of message

At reception of the command, the answer of the instrument is:

*1<cr>

This string shows the recognition of the command.

If the unity of measure of the temperature is not °C You should write first the variable 10 UNITS to 0(see the table of the "VARIABILES" on the previous pages).

INTEGER VARIABLES

We have just shown the procedure for the writing of a float data.
The variables 1, 4, 8, 10, 25, 26 have two or more states (for example, the resolution by tenth or hundredth of °C) and to activate them it is necessary to assign to the variable number the number corresponding to that one which should be set, according to the table indicated below:

1	Ramp	ON = **1**	OFF = **0**		
4	Resolution	0.1°C = **0**	0.01°C = **1**		
8	Sensor input selection	INT = **1**	INT+EXT = **2**	INT+REF = **3**	INT+EXT+REF = **4**
10	Units	°C = **0**	°F = **1**	K=**2**	
25	Ext. Sensor type	**0** = Pt 100	**1** = Tc N	**2** = Tc K	**3** = Tc J **4** = Tc R
		5 = Tc S	**6** = Pt 100 3 wires	7 = Tc E	
26	Ref. Sensor type	as for the variable 25			

Example 1: the variable 1 corresponds to the activation of the ramp. If you want to set it to ON in order to activate the ramp, you should assign the value 0, otherwise the value 1.

the command string is: **$1WVAR1_0<cr>**

Example 2: the variable 8 corresponds to the activation of the sensor reading which can be connected to the bushes of the external inputs. If you want to read the thermocouple K connected to the Ref. input, you should set the variable 26 to the number corresponding to the type of sensor which you want to read (2 for the thermocouple K) and then set the variable 8 to 3.
the command strings are: **$1WVAR26_2<cr>** **$1WVAR8_3<cr>**

Do likewise for the other variables.

10.4 - Standard equipment spare parts list

PTB 150-PTB157

Reference number referring to the enclosed drawings

POS.	DESCRIPTION	SPARE PARTS CODE
1-3	FILTERED CUP SOCKET 2,5A FOR 230V	3SCH28366
3	2,5A T PROTECTION FUSE FOR 230V 3A T PROTECTION FUSE FOR 115-100V	3OMGSF520225 3OMGSF520231
4	SWITCH TEST PLUG-IN	3B&BPAN10A
5	RS-232	4MRCRS232
7	TEMPERATURE REGULATION CARD + DISPLAY	4ED20048
8	PT100 PROBE	3DC534
9	COMPLETE EQUALIZER BLOCK	0D2070-35
11	FAN ∅60	3PPS-8412NG
12	SUPPLY CARD FOR QUARTZ 100÷230V	4PRMPPGIUS20
15	AUXILIARY INPUT CARD	4ED20011
18	ELECTRIC POWER CABLE	3NEP5942AW
19	FAN ∅120	3PPS-4312

10.5 - Declaration of conformity and check report

The declaration of conformity CE is at the end of the English manual, the test report is included with the calibrator

10.6 - Drawing and wiring diagram

The drawings are at the end of the English manual

"CE Declaration of conformity"

Eurotron Instruments (UK) Ltd
Unit 18 Austin Way, Royal Oak Industrial Estate, NN11 8QY Daventry

Declares that the: **PTB150/PTB157 TS and TC Portable Temperature Calibrators**

are conforms with the requirements of the following European directive:

- Low voltage directive 2006/95/CE
- EMC directive 2004/108/CE

and that it has been designed in accordance with the following harmonised regulation:

- EN 61000-6-3 emission.
- EN 61000-6-2 immunity.
- EN 61010-1/61010-2-010 safety requirements for electrical equipment

The conformity with the above-mentioned requirements is certified by affixing the CE Mark on the product.

Eurotron Instruments (UK) LTD
Massimiliano Moltrasio

Managing Director

RAPPORTO PROVA ESEGUITO E REDATTO DA:
CENTRO MISURE RADIOELETTRONICHE P.M.M. IN DATA 07/03/2000 E SEGUENTI
CENTRO SIT N°08/E

ENTE EMITTENTE: QUALITÀ

Date: 17/04/1996
Revision. April/2010