Operating Manual

Dry Block Temperature Calibrator

QUARTZ-35 & QUARTZ-50

LR-Cal

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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 dependant 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 can not 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: **QUARTZ-35/50 and QUARTZ-35/50-2I**

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 **QUARTZ,** including accessories, as listed. (reference to paragraph 2.7)

2- Technical data QUARTZ-35 (model QUARTZ-50 pls. refer to datasheet)

Environmental range: temperature +5 a +45°C, U.R. max. 10-50%

- Operative range : -27÷ +150°C @ 22°C
- Stability : ±0.02°C ** (@ –15 and 150°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(only for Model 2I)
- Reading : °C or °F
- 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.

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 **Quartz** 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 - Constructor:

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6 - N° of correspondent catalogue sheet:

- QUARTZ-35 / QUARTZ-50

7 - List of first equipment accessories

- Standard equipments (code: QUARTZ-35 /-50)
  - * QUARTZ calibrator
  - * Electric power cable
  - * Fuse kit
  - * Thermostat testing circuit connection cables
  - * Instructions manual
  - * Calibration certificate traceable to national standard
  - * Tweezers for removing inserts
  - * Insert with 6 holes ø 4-4,5-5,5-6,5-8,5 e 10,5
  - * Kit of clamp-screw adapter for bushes (only version 2I)
- Accessories kit (code: KIT-QUARTZ-1)
  - * Travelling-case
  - * Blank insert
- Accessories on request
  - * Special inserts available on request
  - * RS232 cable
  - * Standard probe Pt100 type
  - * Software AQ2sp with RS232 cable
- Ordering code
  - * **QUARTZ** -35 [ ] [ ]
    - [ ]: 0 - 100V; 1 - 115V; 3 - 230V
    - [ ]: 00– Base version; 2I– Version with two inputs

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.

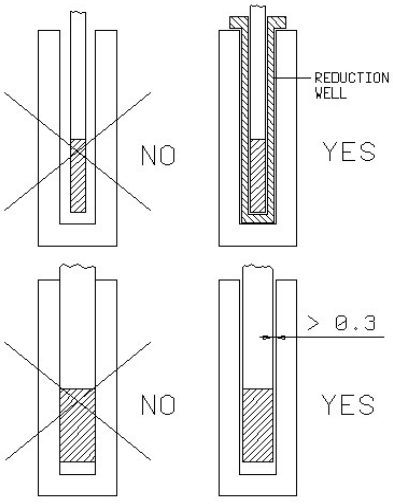


Fig.1

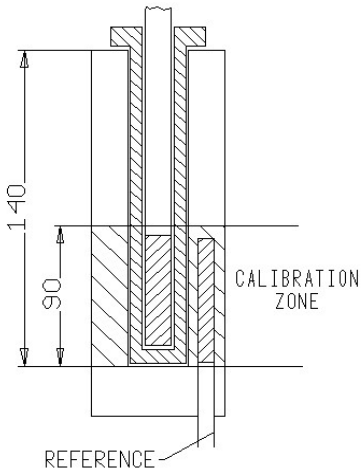


Fig.2

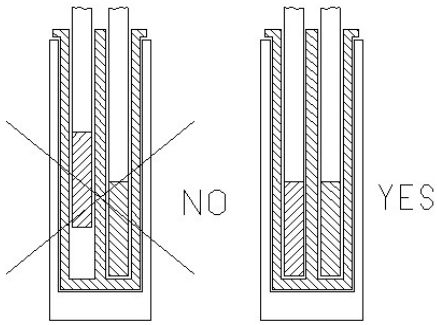


Fig.3

- 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

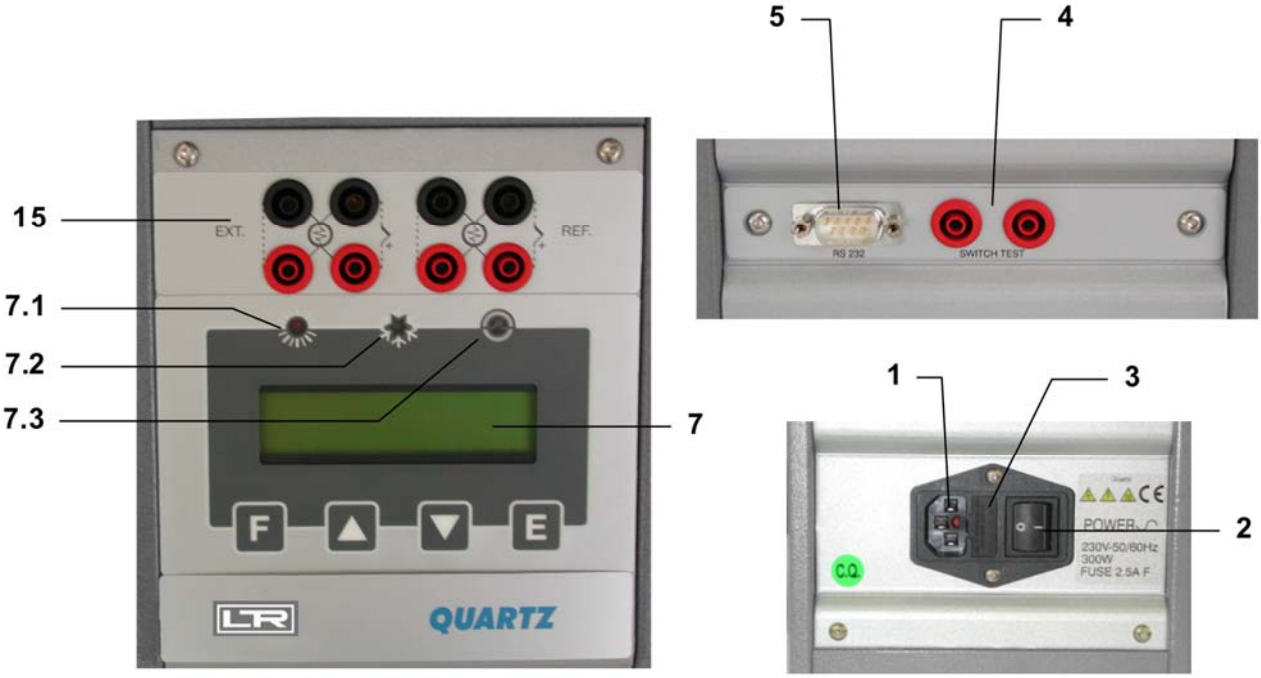
Position the calibrator in a safe clean place; make sure that the fan on the bottom of the calibrator runs free.

****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, at type QUARTZ-35-2I)

6 - OPERATION PROCEDURE

6.1 - Operation description

The **QUARTZ** 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.

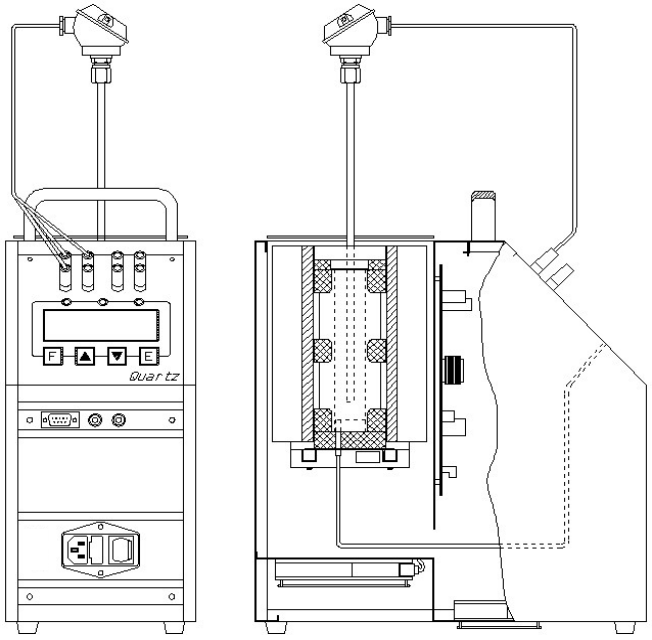


Fig.4

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.

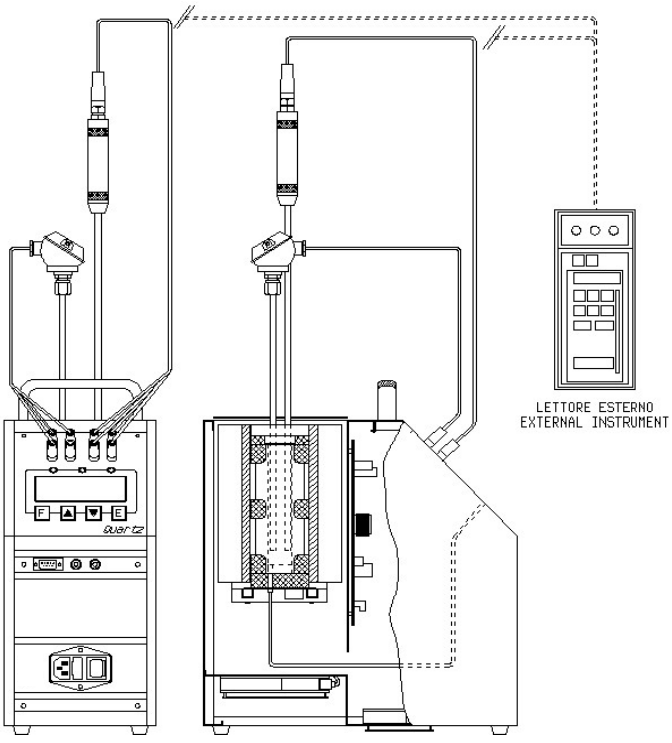


Fig.5

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.

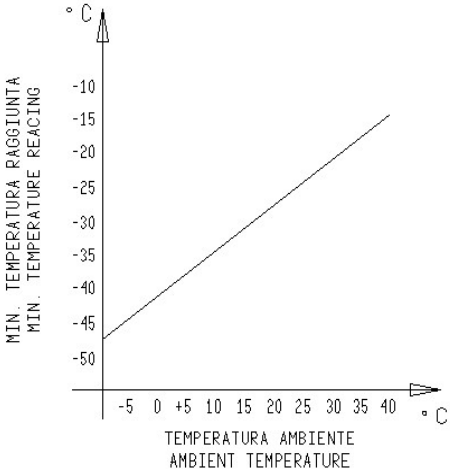
  ◊ Press the ▼ key to decrement the set point value.

  ◊ **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 traceable 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 (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 (only for model –2I)

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 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**; 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.

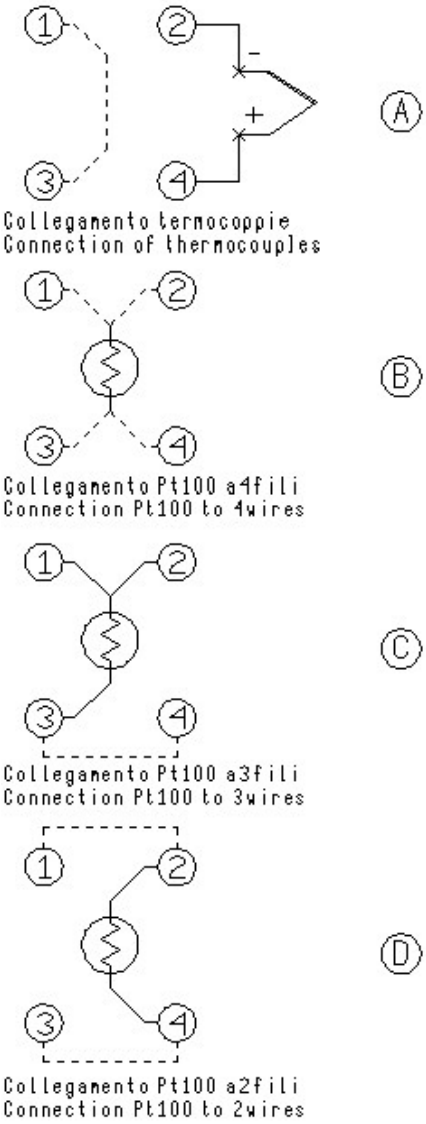


Fig. 7

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).

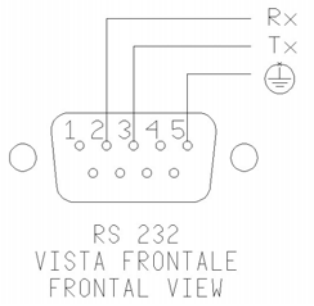


Fig.8

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 instrument is necessary to have a standard temperature instrument with traceable certification, the software 'CALIBRA' (available on request) and follow the instructions of the software.

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 block of the insert 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 fans 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

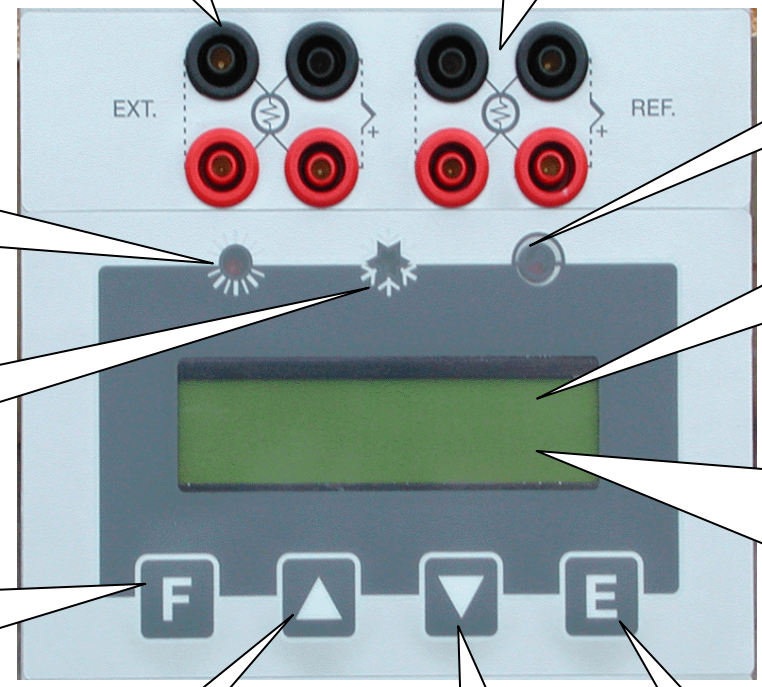
9 - TYPICAL FAULTS

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 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 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 THE FUNCTIONS

The calibrator has three-function level(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 and for the regulation of the calibrator
at the third level there are the typical functions for each calibrator

1st LEVEL FUNCTION
FUNCTIONS TO BE SELECTED BY PRESSING THE **F** KEY

- SP
SET POINT; reserved temperature which the oven reaches with the maximum gradient

- SP2
SET POINT2; Reserved temperature which the oven reaches with selected gradient and with the launched ramp procedure

- GRAD
GRADIENT; variation speed of the set point when passing from a temperature value to the SP2 value. The set gradient must be negative in falling ramps.
N.B: the gradient values must be lower than the values indicated on technical date chapter 2 (max. cooling gradient: -3÷4°C/min.; max. heating gradient 5°C/min.)

- RAMP ON-OFF
Ramp procedure switch-on/switch-off.
By being in the ON position using the ▲ or ▼ keys and by confirming the datum by means of key **E** , the oven will reach the temperature reserved with SP2 with the selected gradient starting from the temperature at which the ramp confirmation was received. The starting temperature does not depend on the Set Point temperature.
If a negative ramp is set but the positive gradient and/or SP2 is higher than the current temperature, the oven will stop the ramp from starting by sounding a warning signal.
When the ramp is activated, the message "**Ramp:.....**" will appear on the second line of the screen followed by the Set Point value which will translate at the speed dictated by the set gradient.
When the temperature reaches the temperature set with SP2 the oven will sound a warning signal and will automatically switch off the ramp procedure; the SP2 value will be considered valid as the set point and the oven will stabilise at that temperature.
During the ramp phase, the shunt parameter is not taken into consideration.

RAMP PROCEDURE EFFECTIVE EXAMPLE
Let's say that ambient temperature exists and that we wish to increase this to 100°C with a gradient of 0.5°C/min.

- Push **F** and set **SP 2** at 100°C using keys ▲ or ▼ Push **E** to confirm the datum.
- Push **F** and set **GRAD** at 0.5°C/min using keys ▲ or ▼ . Push **E** to confirm the datum.
- Push **F** and set **RAMP** on **ON** using the keys ▲ or ▼ . Push **E** to confirm the datum.

Once key E has been pressed to confirm ramp start, the oven will raise with the indicated gradient. Logically, in the first part of the ramp oscillations will exist which are not compatible with the ramp's gradient. If the Proportional Band and Integral Time parameters have been correctly loaded, the oven's temperature will follow the ramp set point temperature within a short time.

- RIS. 0.1/0.01
Display reading resolution: the permitted values are 0.1°C and 0.01°C which can be selected using keys ▲ or ▼. It is not necessary to confirm the datum for this parameter.

- SW.ON
Switch on; it displays the contact switch-off temperature of a thermostat connected to the "SWITCH TEST" inlets. The value is reset every time power is cut. The parameter is updated every time a new contact is recorded following a contact switch-off.

- SW.OFF
Switch off; it displays the switch-on temperature of a thermostat connected to the "SWITCH TEST" inlets. The value is reset every time the power is cut. The value is updated every time a contact switch-off is recorded.

- **SENSOR (OFF/EXT/REF/EXT+REF) (only for model –2I)**
This parameter allows enabling the reading of sensors on the auxiliary inputs:
OFF no input is enabled to read the sensors' value.
EXT the four bushes 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 bushes 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 bushes of the two inputs are enabled to read the sensors tied to them, whose value is indicated at the bottom of the Display. (Ref. to chapter 6.5.1)

2nd LEVEL FUNCTION

NCTIONS SELECTED BY PRESSING KEYS "**F**" AND "▲" AT THE SAME TIME. ONCE THE SECOND LEVEL OF PARAMETERS HAS BEEN REACHED, FUNCTIONS ARE SELECTED BY PRESSING KEY "**F**" ONLY; TO RETURN TO THE FIRST LEVEL PUSH KEYS "**F**" AND "▲" AT THE SAME TIME AT ANY POINT, OR WAIT APPROXIMATELY 20 SECONDS.

- P.B
Proportional Band value expressed as a percentage of the full scale. By proportional band we mean the interval in the measuring field within which a variation in the out-going signal of the regulating probe takes place and consequently regulation of the power of the heating element.

- T.I.
Integral Time Value expressed in seconds. The integrating action reduces the error between the set point chosen and the temperature reached by means of only the proportional action to zero. By Integral Time we mean the time required for the integrating action to double the proportional action.

- T.D.
Shunt Time Value expressed in seconds. When a temperature step variation takes place, the shunt action causes an extensive initial regulation in order to provide the oven with higher power than it would normally receive by a single proportional-integral action. When an error exists the shunt action reduces its action leaving it to the integrating action the job of reducing the error.

- **EXT SENSOR TYPE: N, K, J, R, S, Pt3W, Pt.** (Pt=Pt100 with 4 wires, Pt3W=Pt100 with 3 wires)
This parameter allows selecting the kind of sensor read by the display and connected to the four EXT terminals. (item 6.5.1)

- Units C°/F°
Parameter, which makes it possible to select the temperature-measuring unit. By selecting "**°C**", all the temperatures will be expressed in degrees Celsius; by selecting "F" all the temperatures will be expressed in degrees Fahrenheit.

- 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 default parameters will be turned on again.

- REF SENSOR TYPE: N, K, J, R, S, Pt3W, Pt. (Pt=Pt100 with 4 wires, Pt3W=Pt100 with 3 wires)
This parameter allows selecting the kind of sensor read on the display and connected to the four REF Sensor terminals. (item 6.5.1)

- KEY
Access key to the third programming level. By selecting the number memorised in the "ACCESS KEY" parameter in the third level with keys ▲ or ▼, and pressing keys "**F**" and ▲ together (*there is no need to confirm the value by pressing E*), access is given to the third level parameters concerning serial transmission and instrument configuration. Permitted values range from 1 to 99; **the value loaded in the factory is 2.**

3rd LEVEL FUNCTION

FUNCTIONS SELECTED BY PRESSING KEYS "**F**" AND "▲" TOGETHER WHEN YOU ARE IN THE SECOND LEVEL AT PARAMETER "***KEY***" AND WITH THE SET VALUE CORRESPONDING TO THE VALUE IN MEMORY. ONCE IN THE THIRD LEVEL OF PARAMETERS, THE FUNCTIONS ARE SELECTED BY PRESSING KEY "**F**" ONLY. TO RETURN TO THE FIRST LEVEL PRESS KEYS "**F**" AND "▲" TOGETHER AT ANY POINT, OR TO WAIT APPROXIMATELY 20 SECONDS.

- ACCESS KEY
Access key; numeric value from 1 to 99, which makes it possible to pass to the third level of parameters. **The factory value is 2.**

- BAUD RATE
Speed of data transmission from the computer. The values range from 300 to 19200 **(default value 9600).**

- ADDRESS
Communication address. The value of this parameter is necessary for communication from computers with more than one instrument. The values permitted range from 1 to 32 and once they are loaded with keys ▲ or ▼ confirmation must be given with key **E**.

- S/N
Serial number of the equipment. This is loaded in the factory and cannot be changed by the user.

- MAX. SET.
Maximum value at which Set Point can be set. This is set in the factory and cannot be changed by the user.

- MIN. SET.
Minimum value at which Set Point can be set. This is set in the factory and cannot be changed by the user.

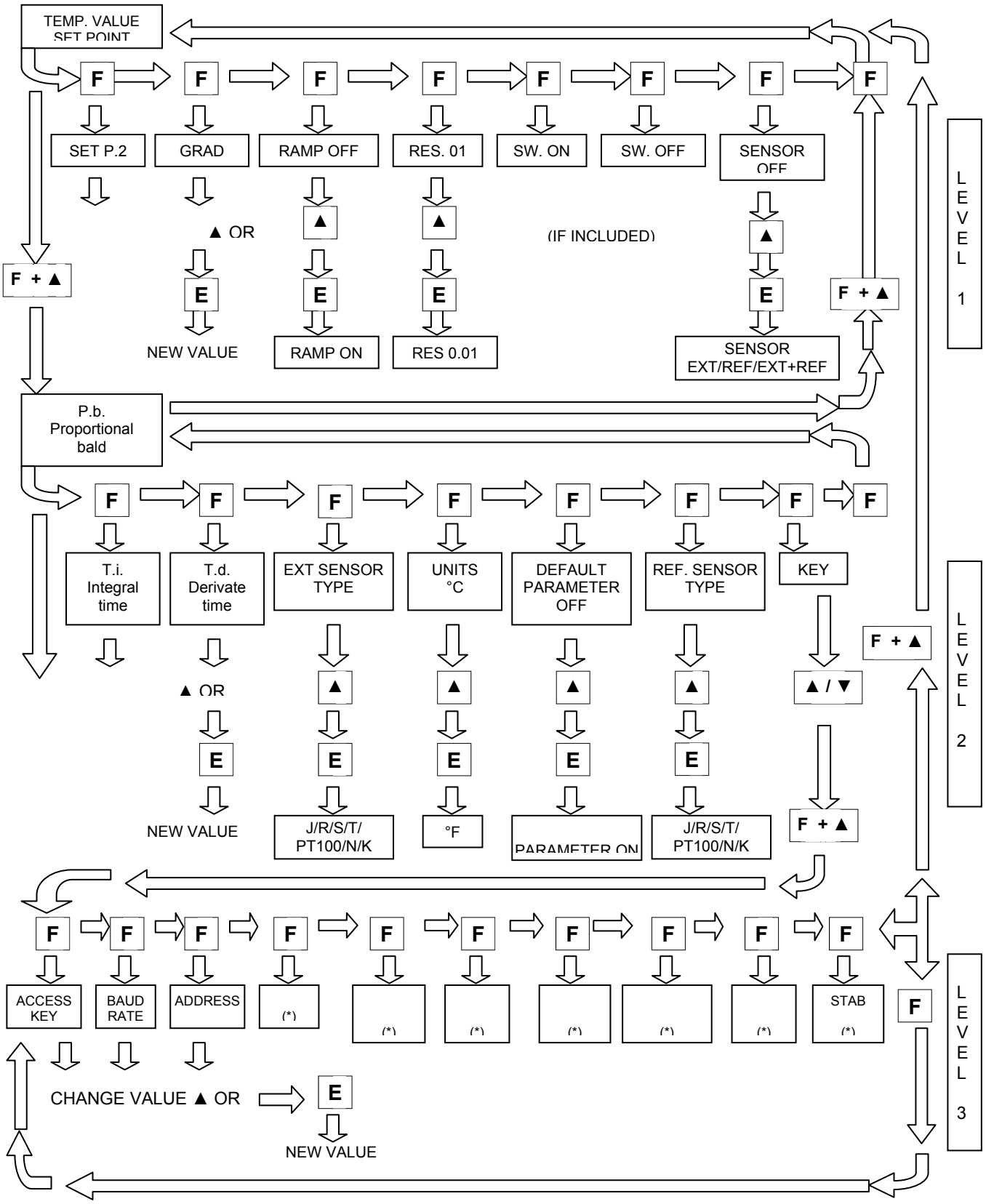
- WAIT 0/1
Initial waiting procedure. When the oven has been switched on and after carrying out the general check, if "0" is selected, the calibrator immediately moves to the last set point value set before the equipment was switched off.
If "1" is chosen, when it has been switched on and after carrying out the general check, the oven will place itself in the waiting position, and will flash the second line on the display screen. By pressing any key the waiting phase is ended and the desired parameter or value can be selected.

- REV. SOFTWARE
N. of release of the internal software.

- SENSOR TYPE
It indicates the type of the main sensor designed to adjust the temperature

- 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.

10.2 - Microprocessor regulator: control description



(*) DEFAULTS VALUES, SET BY THE MANUFACTURER

Note: after 20 seconds the set poit value is showed at the bottom line of the 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 witch 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)**
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)**
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

***

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

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**
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
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

QUARTZ-XXX-X

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 this manual, the test report is included with the calibrator

10.6 - Drawing and wiring diagram

The drawings are at the end of this manual

"Declaration of conformity"

DRUCK & TEMPERATUR Leitenberger GmbH (LR-Cal)
Bahnhofstr. 33, D-72138 Kirchentellinsfurt, GERMANY

Declares that the: **THERMOSTATIC CALIBRATOR QUARTZ-35 / QUARTZ-50 (incl. -2l)**

is conforms with the requirements of the following European directive:

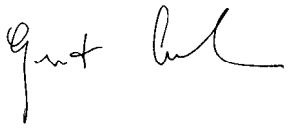
- Low voltage directive 73/23/EEC amended by 93/68/EEC
- EMC directive 89/336/EEC

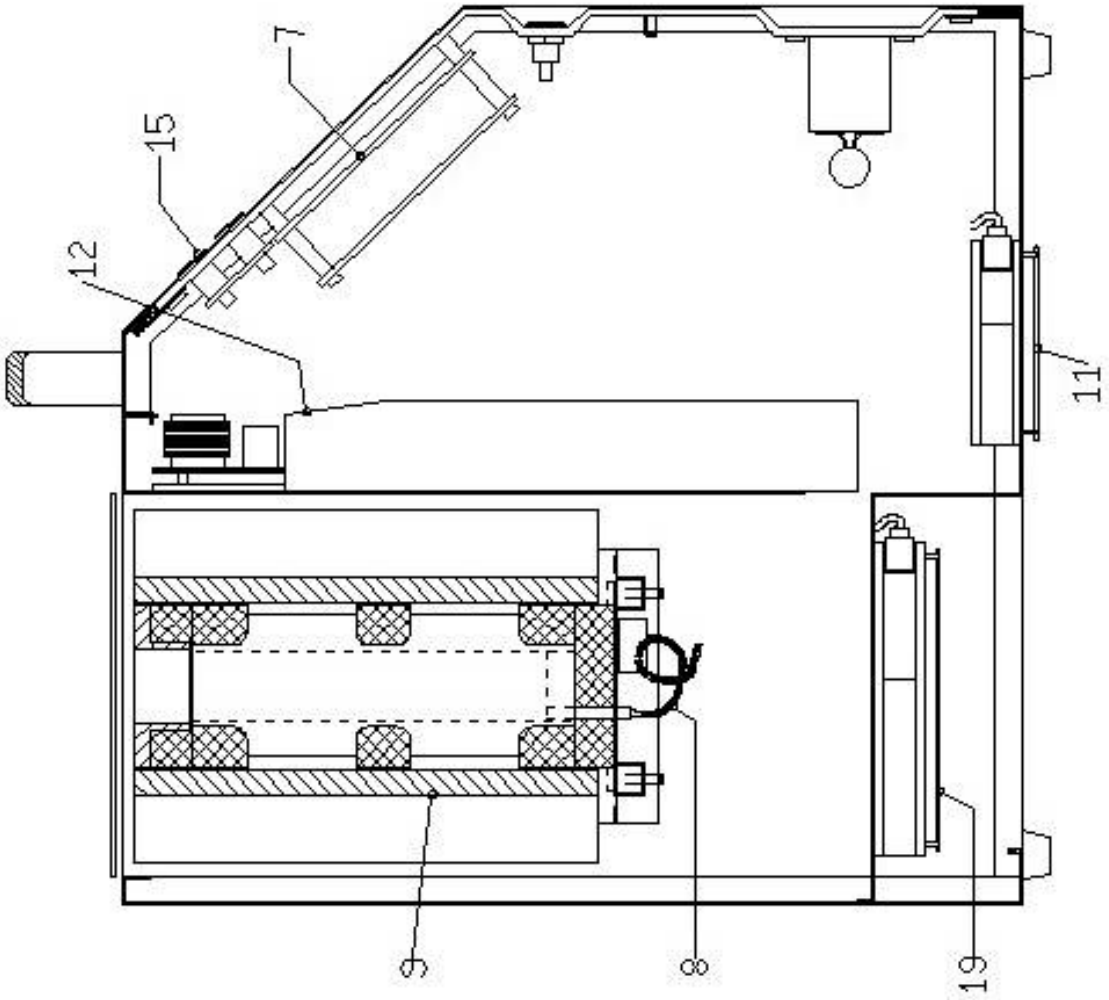
and that it has been designed in accordance with the following harmonised regulation:

- EN 50081-1 emission.
- EN 50082-1 immunity.
- EN 6101-1 safety requirements for electrical equipment

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

DRUCK & TEMPERATUR
Leitenberger GmbH
26. July 2007

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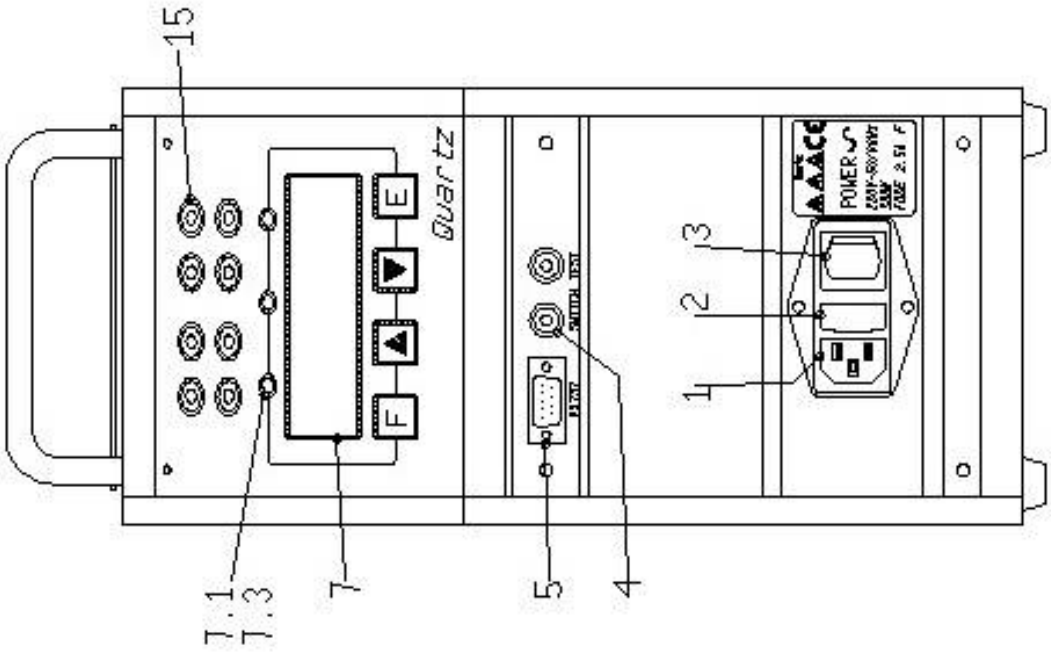
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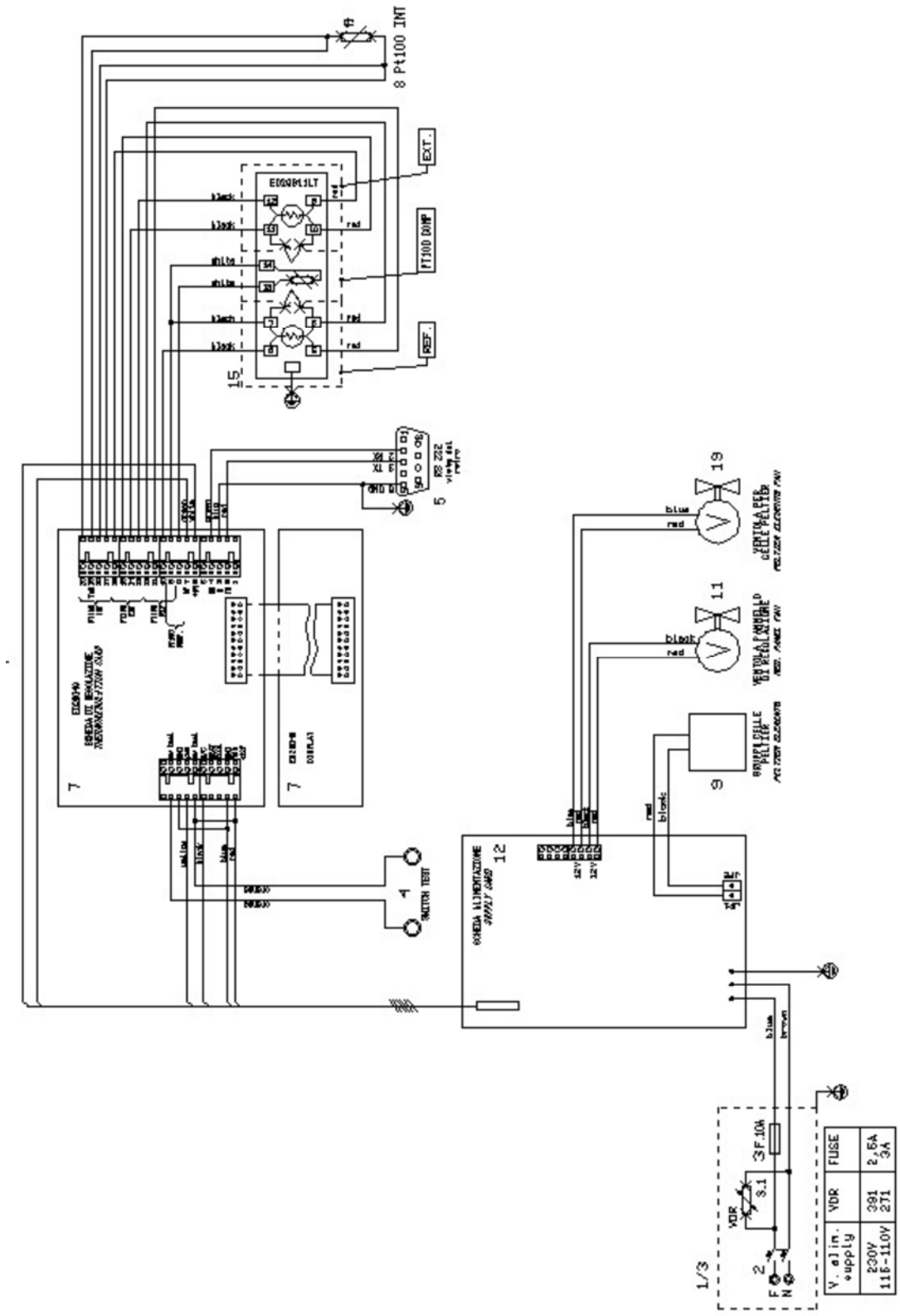
8 Pt100 INT
EXT.
Pt100 DUMP
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SWITCH TEST
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V. alin. supply
230V
115-110V
VDR
391
271
FUSE
2,5A
3A

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