Operating Manual

Dry Block Temperature Calibrator

LR-*Cal* SOLAR

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VALID FROM SERIAL NUMBER **J810 09**

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 dependant on proper handing, operation and maintenance.

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 instructions for the use and maintenance of the following equipment:
Portable Temperature Calibration mod.: **LR-*Cal* SOLAR.**

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 ways of 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

2.1 - Name:

Portable Temperature Calibrator **LR-*Cal* SOLAR**,
including accessories, as listed (reference to paragraph 2.7)

2.2 - Technical data:

Environmental range: : temperature +10÷+45°C, R.H. max. 80%.

- Operative range : 200÷+1100°C **. (1000°C for model at 100V)
- Stability : ±0.3°C**.
- Display resolution : 0,1/0,01°C
- Reading precision : ±0.3% ±1 digit V.F.S.
- Internal probe : Tc type N
- Auxiliary inputs : Pt100 and thermocouples type J, K, R, S, N(only for version 2I)
- Interface : RS 232
- Reading : °C/ °F/K
- Maximum ascent rate : 18°C/min.**(from 20 to 900°C)
  (12°C/min up to 500°C for model with supply 100V,
  5°C/min up to 900°C, 2°C/min up to 1060°C)
- Maximum descent rate : 6/7°C/min.**(from 1000 to 600°C)
  3.8°C/min**(from 700 to 400°C)
- Temperature ramps : min. 0,1°C/1'
- Stability time : 25 min. (700°C)
- Dimension of internal oven : ø44x300mm
- Thermostat test :12 V dc.
- Radial uniformity@1000°C : ±0.4°C at 40mm from the bottom of the holes
- Axial uniformity@1000°C : ±0.4°C (extended for 60mm from the bottom of the holes)
- Power supply : 230V 50/60Hz (115/ by request) 850 VA(650VA @100V)
- Size : 170x330xh.450 mm
- Weight of the calibrator : 11 Kg
- Structure in flanged plate with handle.
- Micro-processor operated temperature regulator.
- Manual resetting safety thermostat.
- The internal oven consists of a quartz or ceramic tube heated by a ceramic resistance, aluminium structure.
- Standard insert Inconel made, ø44mmx175mm dept, fitted with 4 holes 7-9-11-13.5mm in diameter, 155 mm deep. Possibility of special drilling.
- Thermocouple for regulation and reading.
- Forced air-cooling system.
- Upper protection grid.
- Socket with main cable and protection fuses.
- 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%, thermocouples 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.

MICROPROCESSOR DATA

* Display : 2 lines 20ch x line (3.2x5.5) back lighting.
* processor : 80C552
* A/D converter : Σ-Δ 24 bits
* E2PROM memory for recording parameters.
* RS232 Single serial output.

2.3 - Service (function):

The portable temperature calibrator **LR-*Cal* Solar** has been designed for:

- Control & calibration of thermocouples, temperature sensors... , in the laboratory and in the field, in conformity with ISO 9000 standard.
- Thermal test on materials.

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: Pulsar endowed with optional Windows™ Software **AQ2sp** is designed to:

- ◊ completely check the oven by PC
- ◊ automatically or manually calibrate many probes
- ◊ cyclically check temperature sensor long life or stress condition
- ◊ register and print results obtained according to ISO 9000 standards.

2.4 - Quantity:

1 piece.

2.5 - Constructor:

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2.6 - N° of correspondent catalogue sheet:

SOLAR

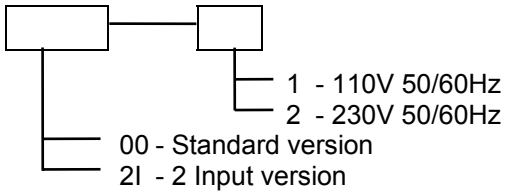
2.7 - List of first equipment accessories:

Standard equipment

* **LR-*Cal* SOLAR** calibrator
* Standard block Inconel 600 with 4 holes: ø7-9-11-13.5 x155mm.
* Top insulation with 4 holes, h=60mm
* Block extractor
* Electric power cable with CEE plug
* Fuses kit
* Thermostat testing connection cables
* Software AQ2sp Light version
* Instructions manual
* Calibration certificate traceable to SIT standard
* Kit of clamp-screw adapter for bushes (only version 2I)

- Accessories (optional)
  * Special inserts available on request.
  * Software **AQ2sp**
  * TcS sample probe
  * DKD certificate: sample probe connected to **LR-*Cal* Solar**
  * Carrying case

- How to order * **SOLAR**



Code 511.0.000.1100.0 = standard version, 230 VAC
Code 511.0.111.1100.0 = 2 input version, 230 VAC

- Certification: all the instruments are supplied with final testing, stability and accuracy certification traceable to national standards.

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.

This unit is equipped with a power supply cable with polarized plug for alternating current. This cable allows You to insert the plug in just the right way with the phase lead in a position defined.
To avoid electric shock, use only the polarized plug of equipment. If necessary, use only polarized extension cords. Do not use reductions for Shuko plugs or whatever. Do not use other cables with plugs different from that supplied

- Position of the probe:

N.B: For the positioning of the insert inside the oven, follow the instruction on paragraph 5.

To obtain the best results, follow the advises:

- Measure the diameter of the probe being checked.
- Check that the diameter of the hole in the calibration block is at least 1mm bigger than the diameter of the probe. If this is not the case, use the block with the above-mentioned tolerances (fig.1).
- Avoid using holes which 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 (fig. 2).
- When calibrating using probes shorter than the length of the hole in the block, position the sample reference sensor at the same height as the sensor which is to be checked
- 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 (fig. 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.

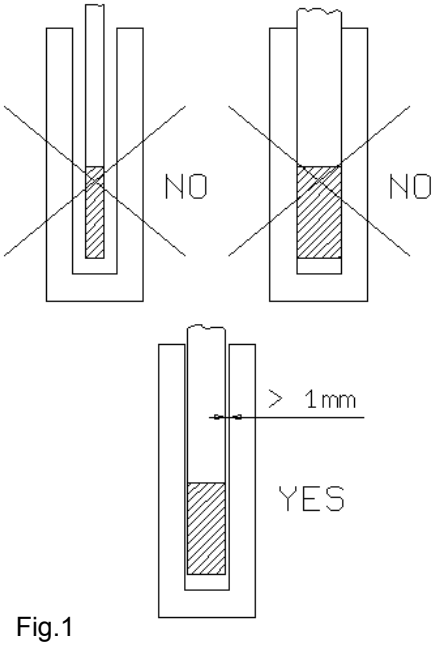


Fig.1

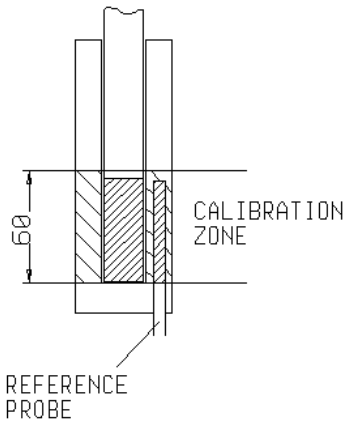


Fig.2

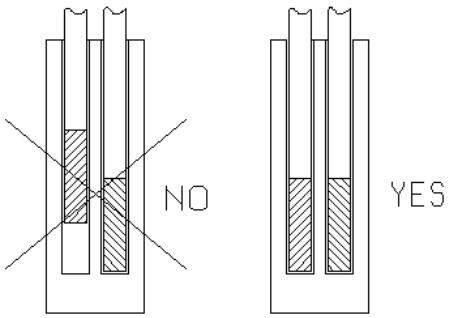


Fig.3

- Advice:

- 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 transducer with special execution, call our technical office and ask for equaliser block with special drillings.

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 earthen correctly when connecting it to the power supply.
- Carry out the maintenance and repair operation only with the equipment at ambient temperature and disconnected from the electric power.
- **Do not touch absolutely the metal sheath of the probes when the temperature is higher than 900°C**

- Don't touch the probe to calibrate when it's in the block.
- After using wait for the stabilisation at ambient temperature before switch off the calibrator.
- Don't switch off the calibrator when it works at high temperature because the protection grid and the carpentry may overheat.
  Don't put anything near the fan-exit (19) because of the hot air when oven is on.

- When the calibrator must to be moved, remove the block from the quartz or ceramic tube in order to prevent breakage of the tube.
- It is a good idea if these operations are carried out with the calibrator as close to ambient temperature as possible.
- Never put any type of liquid inside the block.
- Don't change absolutely the configuration parameters.
- **Do not connect voltage higher then 5V to the input 4-5-15**
- Don't put anything on the top of the calibrator.
- ..... use common sense any time.

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

- When there is a breakage in the temperature sensor (8) this is recognised by the thermo-regulator, which switches off the heat output.
- Max. temperature safety thermostat (10), with a thermocouple, to disconnect the heating resistance each time the temperature exceeds 1120°C.
- Max temperature safety thermostat (11) that disconnect the heating power to protect the electrical board in the case the fan coil breaks
- Protection grid to avoid any contact with the internal oven.
- Protection fuses (3).
- Ground conductor.

AFTER EVERY USE AT HIGH TEMPERATURE REMEMBER TO SET UP AMBIENT TEMPERATURE IN ORDER TO COOL DOWN THE CALIBRATOR BEFORE SWITCHING OFF

WARNING: at high temperature near to 1100°c the oven could have a leakage current of some mA that opens the high sensibility differential main switches. in this case use a differential switch with sensibility of 30ma or reduce the Mx. temperature

5 - PREPARATION OF OPERATION

- Remove the calibrator from the packaging (5.1.1) and place it on a flat surface (5.1.2).
- Make sure that the instrument has been correctly earthen.
- Supply the oven with line 230V, 50Hz + earth (5.1.3).
- Insert the equalising block into the furnace: reference at the instruction on paragraph 5.1.4
- 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 carrier and a claim must be made.
The equalising block is packed separately to avoid breaking the quartz or ceramic tube during transport. The block must be fitted into the calibrator when it is ready to be used.

5.1.2 - Positioning the calibrator

Position the calibrator in a safe clean place; leave enough space around the calibrator to allow the air to circulate well.

****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)

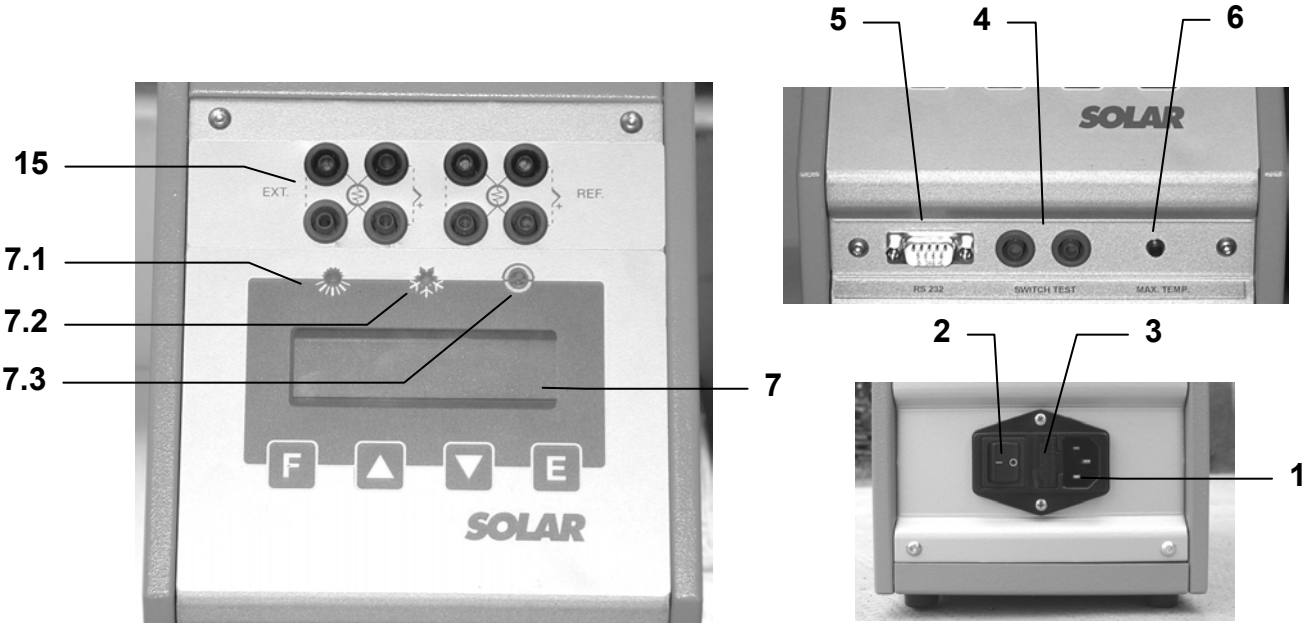
5.1.3 - Supply

The calibrator runs on a voltage of 230 Vac (115V by request), 50/60Hz.
A 2.5mt. cable with CEE polarized plug is supplied with the calibrator fitted with 2 conductors plus earth.
This safety device with polarized plug is designed to reduce the risk of electric shock polarizing the phase of the power.
Make sure that the plant is earthen correctly before switching the instrument on.

5.1.4 - How to fit the equalising block

After the furnace generally been installed, the equaliser block and the ceramic fiber insulation may be inserted. Carefully insert the block and the upper insulation into the Quartz or ceramic tube (see annexed drawing). Care must be taken to prevent dirt or other foreign materials between the block and the quartz or ceramic tube or it might break during heat up due to thermal expansion differences. The fit between the block and the tube is typically loose in order to accommodate this expansion.
A handle is provided to insert the block. It consists of a stainless steel rod with a threaded end, which is screwed into the top of the block. The block is then lowered down over the control and cutout sensor using the handle allowed to rest on the ceramic fiber insulation on the bottom of the well. There are grooves on either side of the block for the sensor to slide into. The grooves have a tapered opening at the bottom to facilitate entry of the sensor.
Insert the ceramic fiber insulation on the top of the block, using the block extractor.
Centre the holes of the upper insulation with the holes of the equalisation block.

*** WARNING**: To avoid any smell in the room it is better to switch on the calibrator outside the room for the first time.
Whenever the calibrator has to be moved, remove the block from the quartz or ceramic tube in order to prevent breakage of the tube.
It is a good idea if these operations are carried out with the calibrator as close to ambient temperature as possible.



COMMAND LIST

POS.	DESCRIPTION
1	SUPPLY SOCKET
2	MAIN SWITCH
3	PROTECTION FUSES
4	SWITCH TEST BUSHES
5	RS-232 SOCKET
6	MAX TEMPERATURE LAMP
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 **LR-*Cal* SOLAR** calibrator consist of an equaliser block INCONEL made fitted with holes into which the sensors to be calibrated are inserted.
A heater element heats the block and an electronic μcontroller with static relay output checks and regulates the temperature.
A fan is fitted inside the regulating container, which prevents the metal structure from heating.

6.2 - Description of instrument

6.2.1 – Thermo regulator

The thermo-regulator (7) is a PID microprocessor, which can be set from 0 to 1100°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 - Main switch

The main switch (2) is fitted with a socket for the supply voltage cable, a main switch and two fuses of 5A for 230V mod. & 10A for 115V models.
Note: use only fast fuses F. 5X20mm to prevent any danger of fire.
All the electrical parts are protected by the main switch; we recommend allowing the calibrator to cool before switching it off (reference to paragraph 4)

6.2.3 - Overheating warning light

If the light (6) is “on”, the temperature inside the oven is over in the maximum and the heating power is off.
The reset of the thermostat is manual:

- Wait the temperature of the oven to about 900°C or less.
- Switch off the main switch (2) for few seconds; then switch “on” again to allow the reset of the thermostat.

6.2.4 - Ventilation holes

On the base and at the rear of the calibrator holes have been made so that air may circulate inside the calibrator; do not obstruct these ventilation holes.

6.2.5 - Heating resistance

The resistance is made in ceramic fibre with a spiral-heating element. The power of the resistance is 850W and it can reach temperatures approaching 1100°C. **Bear in mind, however, that constant use at extreme temperatures reduces the life of the resistance itself. Limit the number of hours at which the resistance is used at maximum temperatures to the time required by the calibrator in order to prolong the life of the resistance.**

6.2.6 - Equalising block

The equalising block is made in INCONEL; holes have been made on the inside to make it possible to fit various types of probes. The function of this block is to make the temperature uniform throughout the depth of the holes so as to be able to calibrate using probes of different lengths.
Two slots have been made in the block into which the regulating and safety probes are inserted. In addition to the holes for the test probes, a threaded hole has been made for screwing the extractor.
If you want to fit the calibrator with a block 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 temperatures sensors used for regulating and protect the instrument are thermocouples. Both are inserted directly into the equalising block so as to supply a temperature value close to the real value in the block. There could, however, be some differences due to the tolerances of the sensors themselves.

6.2.8 - Safety thermostat

The calibrator is supplied with max. temperature safety thermostat (10) that disconnect the heating system.
In case the thermostat intervenes:

- ◊ Waiting the cooling of calibrator: the temperature must decrease at least 60÷80°C respect to maximum set point.
- ◊ Switch off the calibrator then switch on again a few second later on.

If problem persist: disconnect the electrical cable to the oven and proceeding to repair of eventual faults (reference to paragraph 4); therefore switch on the oven. Consulting chapter 9 – typical faults – for any problems on the thermostat.
N.B.: the thermostat mounted on standard ovens has been calibrated in factory to intervene at 1120°C ±10°C

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 instructions for the positioning of the equalising block (paragraph 5); carefully read paragraph 3 and 4.

To calibrate the probe it is possible to follow two ways: calibration with internal indicator (7), or calibration with external reference.

Calibration with the internal indicator (7):
Make reference to the temperature value of the display (7: fig.4).
It is opportune to refer the value to the test report to compensate the error of the display.

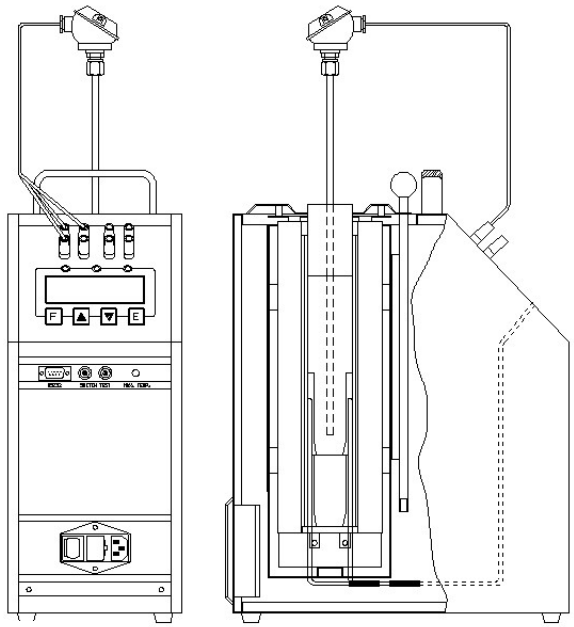


Fig.4

Calibration with external reference and reading on the calibrator display:
Make reference to the temperature value of the external standard instrument inserted in the equalizer block and connected directly to the Solar (Fig.5); temperature is read on the second line of display (for the configuration of the external reference seeing 10.1). When possible: put the sensitive elements of the probes near and at the same dept (reference to Fig.3)

Calibration with external reference and reading on an external instrument:
Make reference to the temperature value of the external standard instrument inserted in the equalizer block and connected to an external instrument (Fig. 5). When possible: put the sensitive elements of the probes near and at the same dept (reference to fig.3).

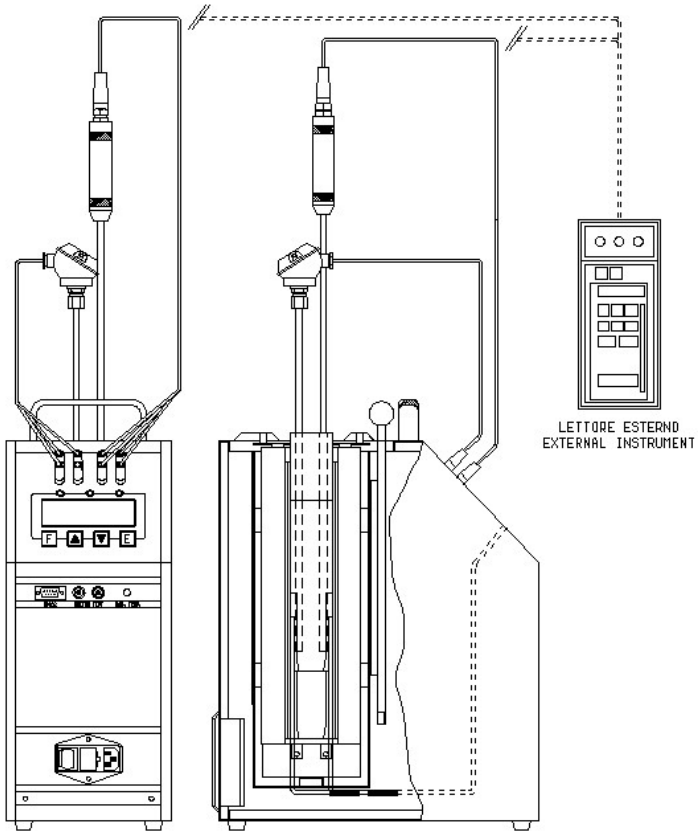


Fig.5

Before any calibration follow the general recommendation:

- Starting the calibration only at ambient temperature: thermal shock can break the sensitive element of the probe and cause harm to operator.
- To fit the equaliser block inside the oven: reference to paragraph 5.1.4.
- Put the probe to check into the equaliser block: reference to chapter 3 (fig 1-2).
- Push on the main switch (2) and waiting for the end of autotest procedure.
- Set the required temperature value on the set point following the instructions below:

  ◊ Press the ▲ key to increment the set point value.
  ◊ Press the ▼ key to decrement the set point value.
  ◊ **Press the E key to confirm**

- Wait for the stabilisation of the oven before starting any calibration (symbol ÷ on the first line of the display).
- 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.
- The temperature indicated by display, during the item above, must not be considered as a reference temperature but only as a general indication of the temperature inside the block.
  We suggest to insert a primary standard with SIT certificate in the block; compare the measure with the values indicated by the standard.
  Don't ever use the primary standard: it's possible to calibrate the instrument to more significant points, comparing the displayed temperature with the temperature of the primary standard.

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 switch off the calibrator make sure that the temperature of the block is almost the same as ambient temperature.

Cooling:
To reduce the oven's temperature, change the set point and wait for the cooling.

☞ By request the **LR-*Cal* Solar** with the standard block may be completed with the cooling device using only with max. temperature of 650°C.
How to use:
- Insert in the block the cooling device only with the temperature under 650°C
- Supply with forced air at 3 bar.
- Set the airflow with the pin valve.

The diagram reported below shows the cooling times with and without the cooling device.

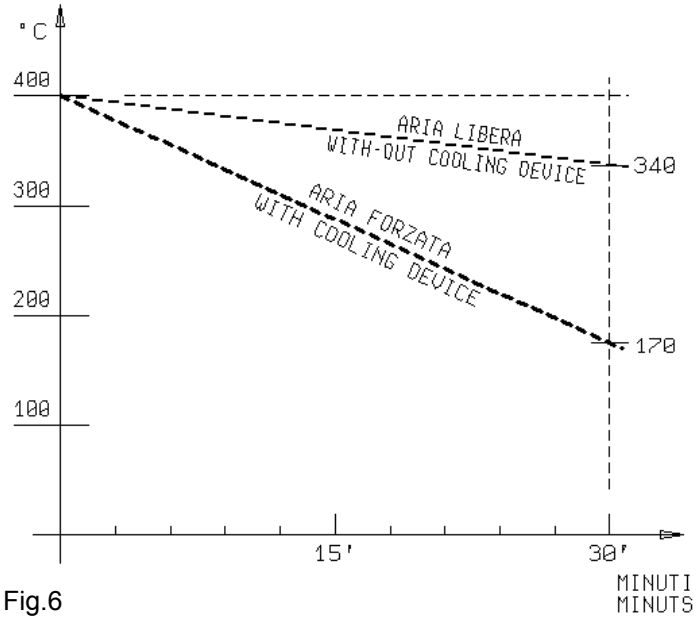


Fig.6

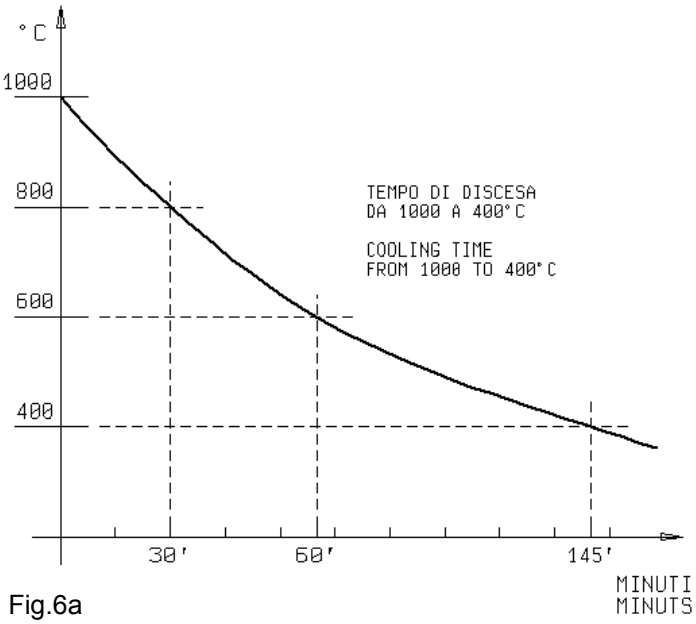


Fig.6a

6.4 - Use of the functions

6.4.1 - Reading the 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 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 Fig. 7-A
  - ◊ Pt100 to 4 wires – connect the clamps 1-2-3-4 as indicated in Fig. 7-B
  - ◊ Pt100 to 3 wires – connect the wires to clamps 1-2-3; connect the clamps 3-4. Reference to Fig. 7-C
  - ◊ Pt100 to 2 wires – connect the wires to clamps 2-4; connect the clamps 1-2 & 3-4. In case of two wires connections remembers to us shortest wires possible. Refer to Fig. 7-D

- In order to read the external probe's temperature press the **F** key up to read SENSOR, select EXT or REF or EXT + REF then confirm with E key. Press the ▲ and **F** keys together to jump to the second level of the parameters, press **F** to read EXT SENSOR TYPE and REF SENSOR TYPE and press the ▼ and the ▲ keys to select the probe; the temperature will be displayed on the at the bottom of the display.
- Press the ▲ and **F** keys together to jump to the first level again , the temperature will be indicated on 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.

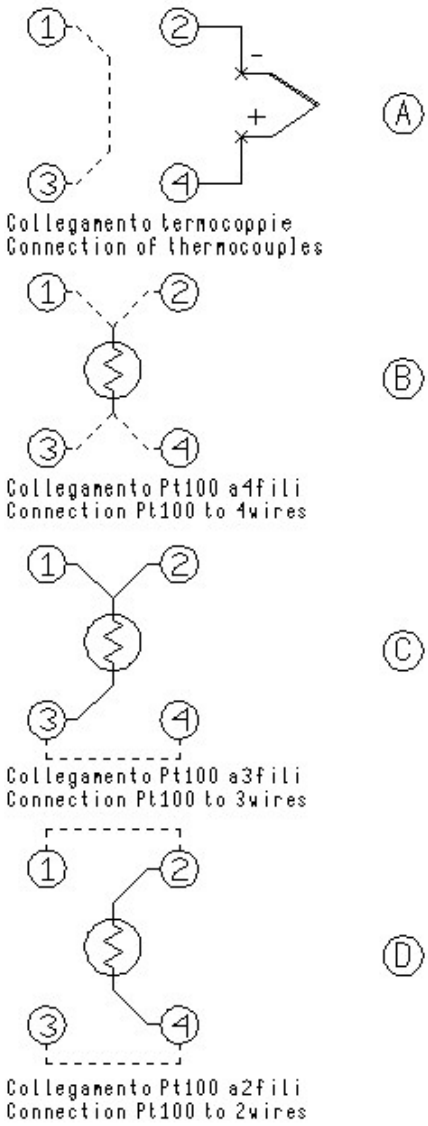


Fig. 7

MESSAGE OF ERROR OF THE EXTERNAL PROBES DISPLAY
The display in the case of connection or configuration errors indicates:
EST SENSOR FAIL : wrong connection or configuration of the EXT probe
REF SENSOR FAIL: wrong connection or configuration of the REF probe
SENSORS FAIL: wrong connection or configuration of the REF and EXT probes

6.4.2 - Switch test (SW. ON SW. OFF)

It is possible to control the intervention point of thermostats by the 'SWITCH TEST' function.

- Insert the thermostat's end in the most suitable hole of the calibrator pit (refer to notes in paragraph 3).
- Connect the thermostat's electrical terminals to the bushes terminals (4).
- Turn the equipment on.
- Sent the thermostat intervention temperature and check the release by the lighting of the indication light (7.3).
- The thermostat's release values are recorded. In order to display the recorded value, refer to the procedure explained in paragraph 10.1 till 'SW ON - SW OFF'.
- Press the ▲ and ▼ keys at the same time in order to reset the 'SW.ON - SW.OFF' values.
- Refer to paragraph 10.1 to set the ascent and descent ramps.

6.4.3 - Serial communication

On the front of the calibrator there is a 9 pole socket (5) connected to the thermo-regulator, which enables the calibrator to be completely controlled by a PC (reference to fig.8). The standard adopted RS-232 (contact the technical department for the communication number).

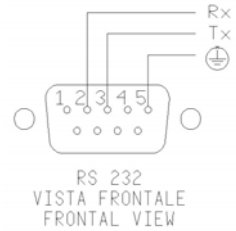


Fig.8

⚠ The external PC must be conform to the IEC950 standard.

6.5 - Re-calibration methods

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 the furnace every year.

7 - MAINTENANCE INSTRUCTIONS

7.1 - Routine inspections instructions

- Check that the holes of the calibrator are cleaned, any liquid or oil inside the hole could make oxides or dirty during the use at high temperature.
- Check once a year the calibration date. Frequency of calibration is depending to the use of instrument; however we suggest to calibrate the 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.

8 - SEQUENCE OF MAINTENANCE

Not applicable

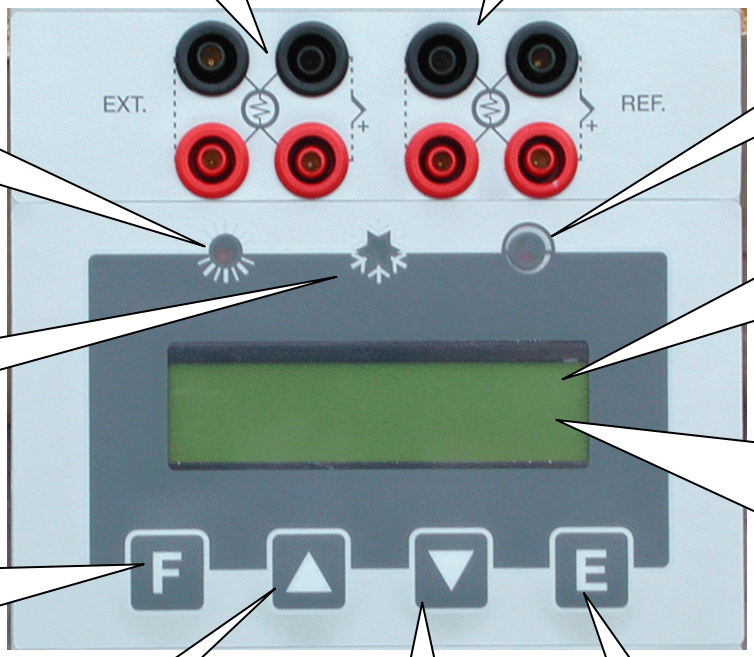
9 - TYPICAL FAULTS

Before carrying out these operations the instrument must be disconnect from the electricity supply; the equaliser block must be at ambient temperature.

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 (3) 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.	- The main switch is faulty. - There is a short circuit in the heating element.	- Replace the cup socket. - Contact our technical office.
3	The control panel is working properly but the temperature does not increase.	- The static relay on the supply card (12) is faulty. - The heating element is cut off. - The safety thermostat (10) has been triggered. - The thermo regulator (7) is not generating a signal.	- Replace the supply card. - Contact our technical office. - Replace the thermo regulator.
4	The display indicates a different temperature from the one measured in the block.	- The thermocouple (8) is faulty. - The thermo regulator (7) is faulty.	- Replace the thermal element. - Replace the thermo regulator.
5	The temperature does not stop at the value of the point that has been set.	- The supply card (12) is faulty.	- Replace the supply card.
6	The temperature does not decrease to the set value as quickly as it should.	- The thermo regulator (7) is faulty. - The cooling fan (19) is faulty.	- Replace the thermo regulator. - Contact our technical office.
7	The display indicates 1300°C	- The control probe (8) is cut off or is in short circuit. - The adjustment element is in fault	- Replace the thermocouple. - Replace the adjustment schedule
8	The alarm light (6) is on.	The safety thermostat is working	Wait for the temperature to decrease and then try to turn the device off and then on again. If the fault continues, carry out the necessary repair procedure
9	The grid (16) and the oven is very hot.	The fan (19) is obstruct or block. The fan is faulty.	- Remove the obstruction - Change the fan

10 - APPENDICES

10.1- Regulation Front Panel



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 variable temperature or the engineer unit

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 item10.2):
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, 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, 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 **Y**es or **N**ot 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 (available on special request) 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) 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.

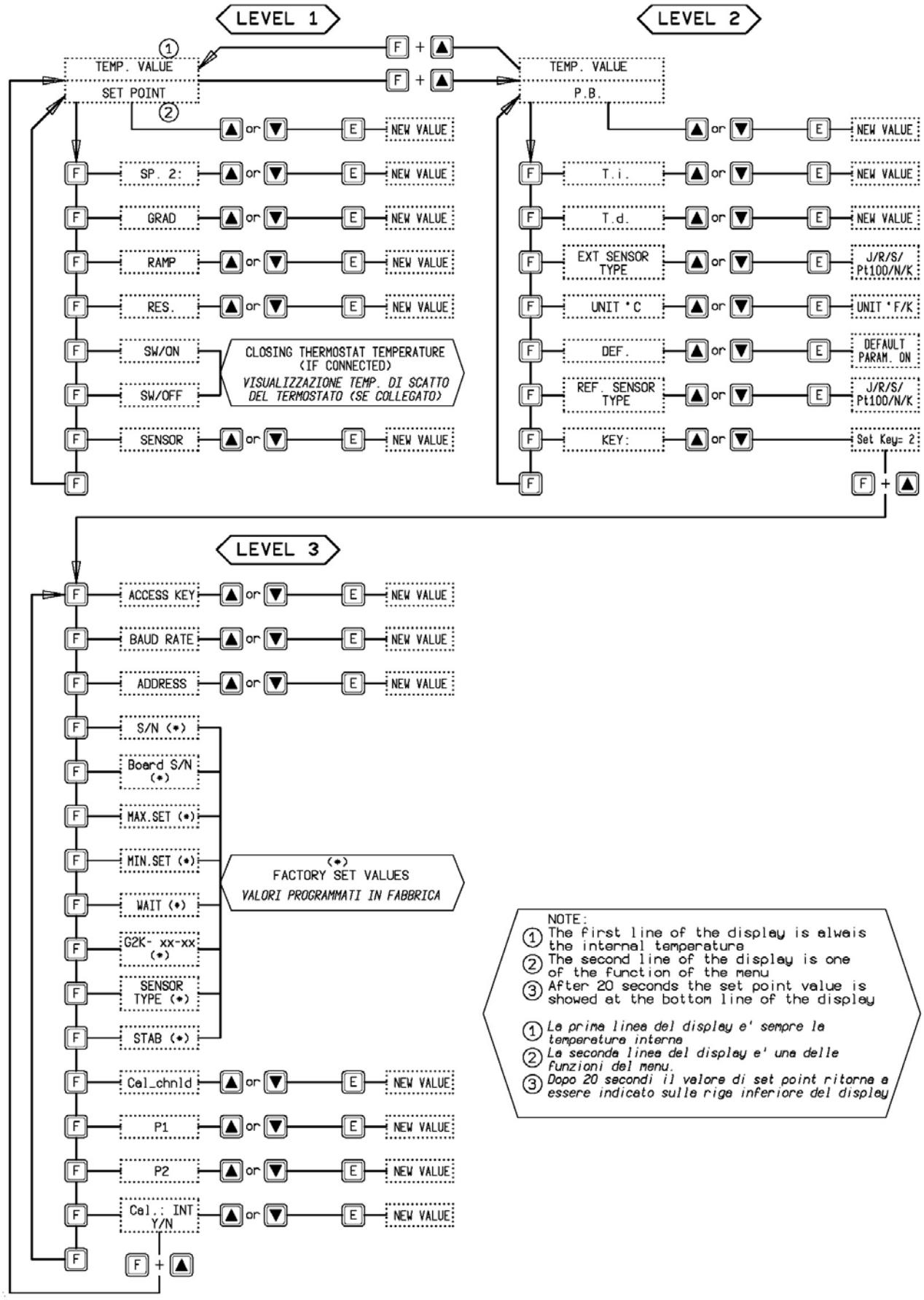
3. Choose two calibration points depending on the appliance range or the field where one wishes to carry out calibration. (For example 0 and 450°C for PT100, 200 and 800°C for the thermocouples).
4. Connect the signal generator to the EXT input, generating the first calibration value. See the instructions 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



10.3 - Communication Protocol RS 232/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

***

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 LR-*Cal* SOLAR-2I-X; the value of the variable corresponds to the table.
** the variable 25/26 is available only for the models LR-*Cal* 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
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 - List of spare parts: 230V model

(Numerical references related to the enclosed drawings)

POS.	DESCRIPTION	
1-3	CUP SOCKET + 6A FILTER	3SCH28366
3	5A FAST PROTECTION FUSES	fuse 5X20 5A
3.1	VARISTOR - DIAM. 14	3MRC14D391
4	SWITCH TEST PLUG-IN	3B&BPAN10A
5	RS-232	3ICIDSUB09PS
6	Mx. TEMP. SIGNAL LAMP	3RSC3693267
7	MICROPROCESSOR REGULATOR + DISPLAY	4ED20048
8	THERMOCOUPLE FOR REGULATION Connected to thermo regulator	3DC706
9	THERMOCOUPLE FOR THERMOSTAT Connected to thermostat N.10	3DC706
10	SAFETY THERMOSTAT	4ED10085
11	SURFACE SAFETY THERMOSTAT	3RSC331528
12	POWER SUPPLY CARD	4020-99-DS
13	HEATING RESISTANCE	3D150400B
14	STANDARD INSERT with 4 holes of diam. 7-9-11-13,5mm	2D895
14.1	UPPER INSULATOR	7DC727
14.2	LOWER INSULATOR	7DC728
15	AUXILIARY INPUT CARD	4ED20011
16	QUARTZ OR CERAMIC TUBE ø44x50mm L.300mm	1LWK
17	BLOCK EXTRACTOR	2D1049
18	ELECTRIC POWER CABLE WITH CEE PLUG	3NEP5942AW
19	230V-50/60Hz FAN	3PPS-3956

List of spare parts: 115V and 100V models

POS.	DESCRIPTION	CODE
3	PROTECTION FUSE 10A	fuse 5X20 10A
3.1	VARISTOR - DIAM. 20	4MRC20D271
13	HEATING RESISTANCE	3D150400A
19	FAN	3PPS-3906

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 **LR-*Cal* SOLAR** calibrator.

10.6 - Drawing and wiring diagram

The drawings is on the last page of this manual

"Declaration of conformity"

DRUCK & TEMPERATUR Leitenberger GmbH, Bahnhofstr. 33, 72138 Kirchentellinsfurt, GERMANY

declares that the: **THERMOSTATIC CALIBRATOR LR-*Cal* SOLAR**

is 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:

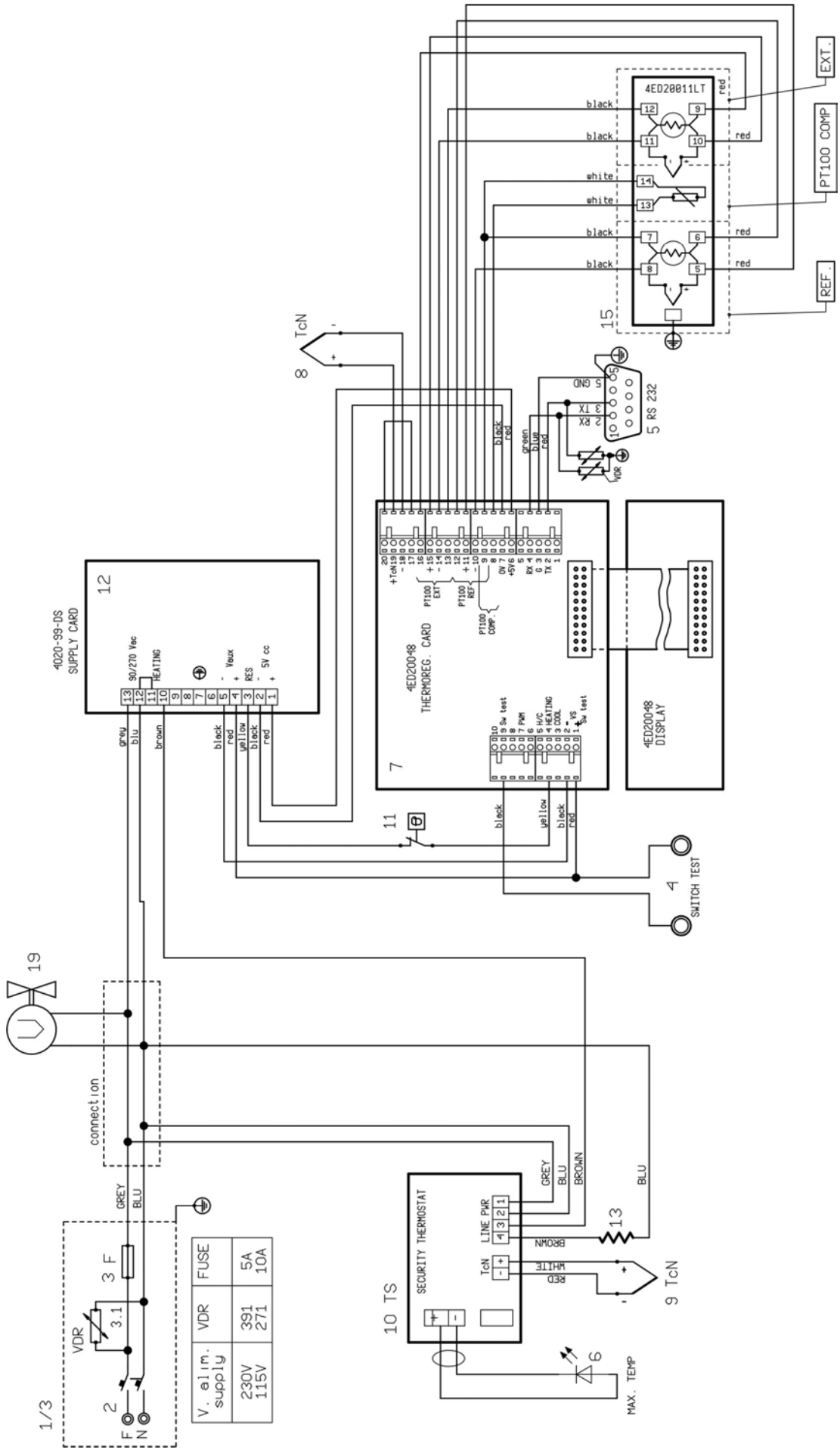
- EN 50081-1 emission.
- EN 50082-1 immunity.
- EN 6101-1 safety requirements for electrical equipment

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

DRUCK & TEMPERATUR
Leitenberger GmbH

(Gerd Broglie / Sales Director))

NOTES: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8 TcN
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