Operating Manual

Dry Block Temperature Calibrator

PULSAR-35CU • PULSAR-50 • PULSAR-65

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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.

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 instructions for the use and maintenance of the following equipment:
Portable Temperature Calibration mod.: **PULSAR-35CU / PULSAR-50 / PULSAR-65.**

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

2.2 - Technical data:

Environmental range: temperature +10 ÷ +35°C, R.H. max. 90%.

Standard model with aluminium block measuring 50mm diameter

- Operative range : Environment ÷ +550°C**
- Stability : ±0.05°C a 450°C **
- Display resolution : 0,01/0,1°C
- Reading accuracy : ±0,3°C a 450°C
- Regulation & reading probe : Pt 100 class A din43760
- Auxiliary input : Pt100 and Tc J, K, N, R, S(only for Model 2I)
- Reading : °C or °F
- Interface : RS 232
- Maximum ascent rate : 20°C/1' **
- Maximum descent rate : 20÷25°C/1' ** (depending on the starting temperature)
- Test wells : 4 holes ø4,5-6,5-9,5-17 x 185mm
- Temperature ramps : minimum 0,1°C/1'
- Thermostat test : 12 Vcc.
- Power supply : 230V 50/60Hz (110/115V by request)
- Power : 800VA.
- Size : 140x370 x 330 mm
- Case size : 330x520 x H. 500 mm
- Weight of calibrator : 10 Kg (17Kg including carrying case and accessories).

☞ **Model with aluminium-bronze block measuring 50mm diameter**

- Operative range : Environment ÷ +600°C**
- Stability : ±0.1°C a 450°C **
- Reading accuracy : ±0,6°C a 450°C
- Maximum ascent rate : 20÷22°C/1' **
- Maximum descent rate : 8÷12°C/1' ** (Δt = 300°C).
- Weight of calibrator : 17Kg
- Test wells with perforation standard or by request

☞ **Model with aluminium block measuring 65mm diameter:**

- Operative range : Environment ÷ +550°C**
- Stability : ±0.1°C a 450°C **
- Reading accuracy : ±0,4°C a 450°C
- Maximum ascent rate : 15÷20°C/1' **
- Maximum descent rate : 3÷5°C/1' ** (Δt = 300°C).
- Weight of calibrator : 10Kg
- Test wells with perforation by request

☞ **Model with aluminium-bronze block measuring 65mm diameter:**

- Operative range : Environment ÷ +600°C**
- Stability : ±0.1°C a 450°C **
- Reading accuracy : ±0,7°C a 450°C
- Maximum ascent rate : 15÷20°C/1' **
- Maximum descent rate : 3÷5°C/1' ** (Δt = 300°C).
- Weight of calibrator : 17Kg
- Test wells with perforation by request

- Structure in flanged plate with rotating handle.
- Micro-processor operated temperature regulator.
- Safety thermostat with thermocouple.
- Switch test.
- Internal oven in stainless steel.
- Electronic control components thermally insulated.
- Forced air cooling 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 EN50081-2
  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 ø4.5mm 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.
* Resolution : 0.01°C/0.1°C.
* 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 **Pulsar** 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 Windows™ Software 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:

- PULSAR and/or PULSAR-35CU

2.7 - List of first equipment accessories:

- Standard equipment
  * PULSAR calibrator
  * Electric power cable
  * Fuse kit
  * Thermostat testing connection cables
  * Instructions manual
  * Calibration certificate traceable to National standard
  * Tweezers for removing inserts
- Optional Accessories
  * Travelling-case (soft bag or alu case)
  * Blank insert
  * Insert with 1 hole ø9.5mm
  * Tweezers for removing inserts
- Moreoptional accessories
  * Special inserts available on request
  * RS232 cable with software AQ2sp
- Order code **PULSAR** [ ] — [ ] — [ ]

  [ ]: 1 - 110V; 2 - 230V
  [ ]: 00 - STANDARD VERSION; 2I - VERSION WITH 2 INPUTS
  [ ]: 0394 – Block with standard well; 50AL – Aluminium block ø50.; 50BA – Aluminium-bronze block ø50.; 65AL – Aluminium block ø65.; 65BA – Aluminium-bronze block ø65 in bronzo d'alluminio.; 35CU – Copper block diam. 35 mm
- 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.

- Position of the probe:
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
  1. at least 0.5mm bigger than the diameter of the probe for diameter of the probe up to 8mm,
  2. at least 0.7mm bigger than the diameter of the probe for diameter of the probe up to 12mm,
  3. at least 0.5mm bigger than the diameter of the probe for diameter of the probe up to 8mm . If this is not the case If this is not the case use the reduction wells with the above-mentioned tolerances (fig.1).
- Avoid using holes that are too accurate and do not force the probes into the block.
- Put the probe or the insert in the block only at ambient temperature; for reduction insert using the tweezer
- Insert the probe up to the bottom of the block: the sensitive element is in the optimal calibration zone (fig. 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 (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

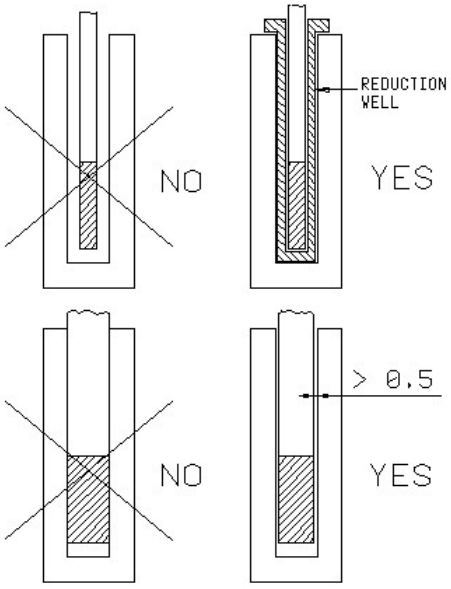


Fig.1

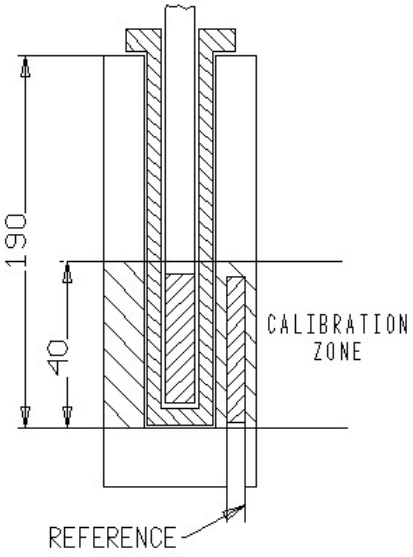


Fig.2

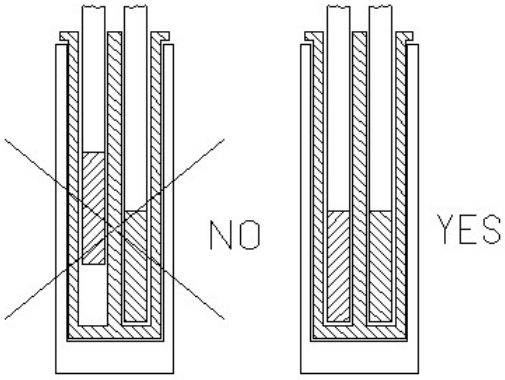


Fig.3

- 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.

REMEMBER TO SET UP AMBIENT TEMPERATURE AND LEAVE COOLING DOWN BEFORE SWITCHING OFF THE CALIBRATOR

4 - SAFETY INSTRUCTIONS

ATTENTION:

- Due to the fact that the calibrator 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.

- 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. Don't switch off the calibrator when it works at high temperature because the protection grid and the carpentry may overheat.

- Never put any type of liquid inside the block.
- Don't change absolutely the configuration parameters
- Don't put anything on the top of the calibrator.
- **Do not connect any voltage higher then 5V to the input 4-5-15**
- Don't put fuel objet near the calibrator.

..... use common sense any time.

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

- Max. temperature safety thermostat (10) to disconnect the heating system.
- Protection grid to avoid any contact with the internal oven.
- Protection fuses (3)
- Ground conductor.

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.

5.1.2 - Positioning the calibrator

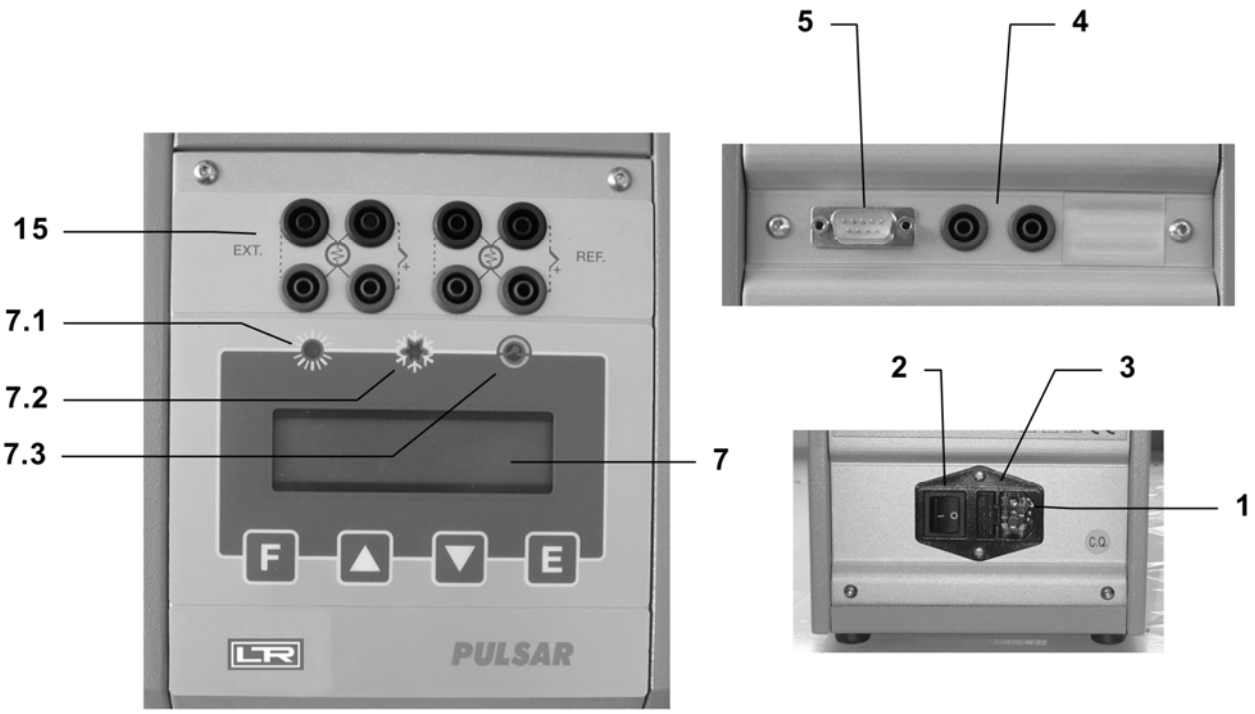
Position the calibrator in a safe clean place; leave enough space around the calibrator to allow the air to circulate well.

****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)

* **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 (115V by request), 50/60Hz.
A 2.5mt. cable is supplied with the calibrator fitted with 2 conductors plus earth.
Make sure that the plant is earthen correctly before switching the instrument on.



COMMAND LIST

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

6 - OPERATION PROCEDURE

6.1 - Operation description

The **PULSAR** calibrator consist of an anticorodal block fitted with holes into which the sensors to be calibrated are inserted.
A heater element heats the block and an electronic µcontroller with Triac output checks and regulates the temperature.
A fan mounted in the rear side generates a constant air flow that reduces the temperature of the case.

6.2 - Description of instrument

6.2.1 - Thermoregulator

The thermo-regulator (7) is a PID microprocessor, which can be set from 0 to 550°C.(600 for model BA)

- 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 voltage cable, the main switch and two fuses as for the following table:

MODELLO	V230	V110/115
PULSAR0394- PULSAR849- PULSAR50AL- PULSAR50BA-	5A	10A
PULSAR65AL- PULSAR65BA-	8A	10A

Note: use only fuses F. 5x20mm. All the electrical part is found below the main switch.

6.2.3 - Carrying handle

The calibrator is fitted with a carrying handle .

6.2.4 - Heating resistance

The resistance (13) is stainless steel made; the max. power is 800W (☞ 1200W for the ¢65, 230V models) and it can reach temperatures approaching 600°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.

6.2.5 - Equalising block

The function of this block is to make the temperature uniform on calibration zone.
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 The equalising block is in aluminium; holes have been made on the inside to make it possible to fit various types of probes.

6.2.6 - 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.

6.2.7 - 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 560°C ±5°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.

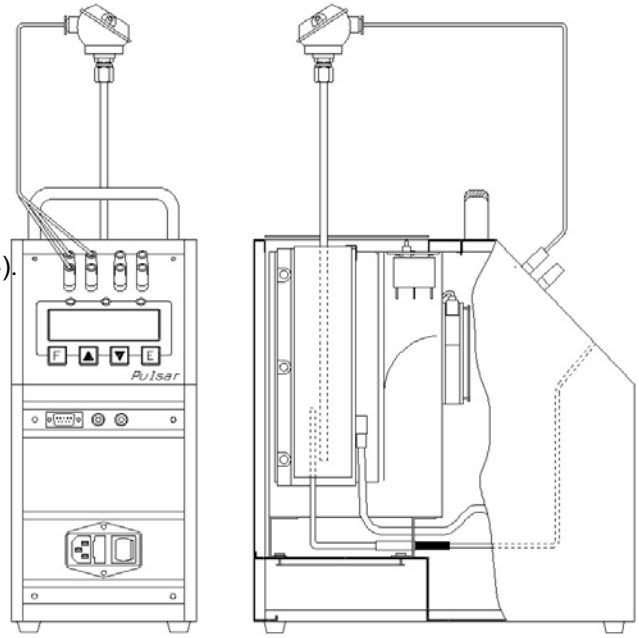


Fig.4

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.

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.1-3)

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.1-3).

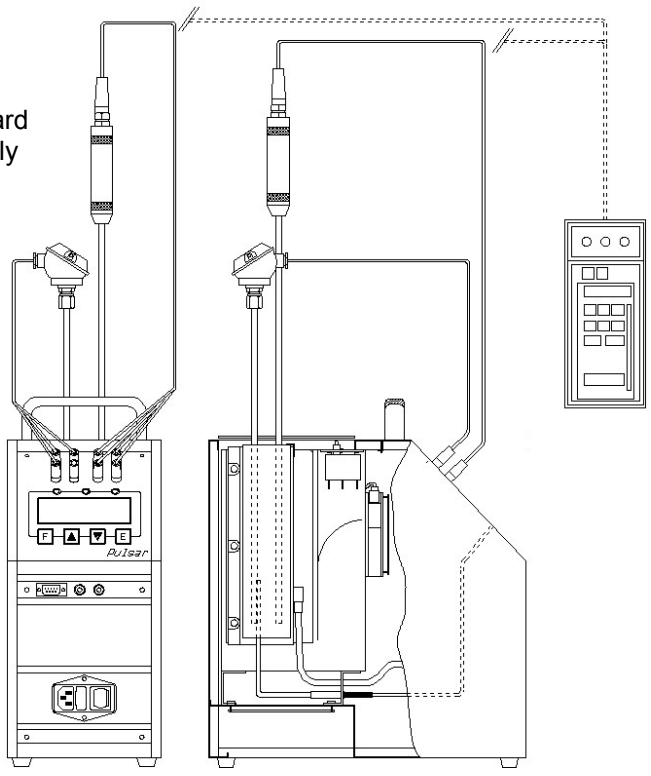


Fig.5

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 1-3).
- 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 the chosen value**

- Wait for the stabilisation of the oven before starting any calibration (symbol ÷ on the fist 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 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 traceable 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.

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**; 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.

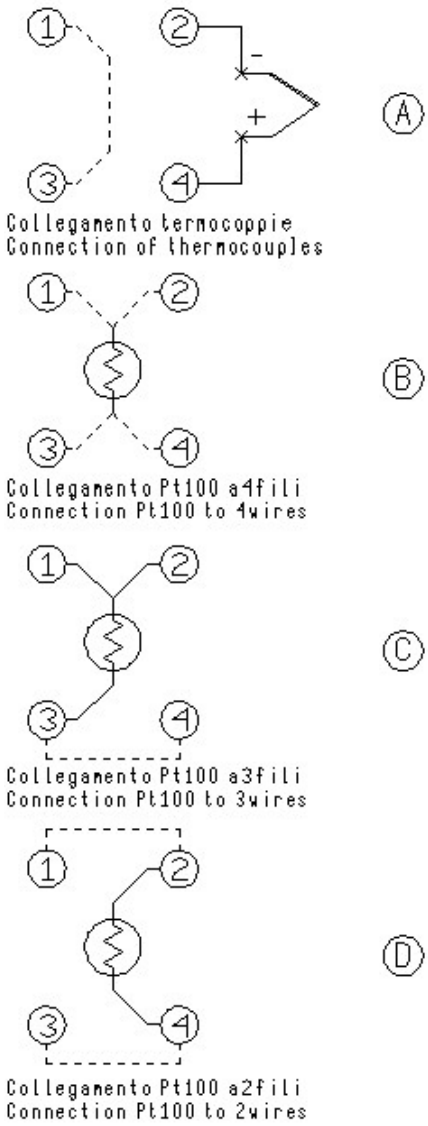


Fig. 7

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 (7.1).
- 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).

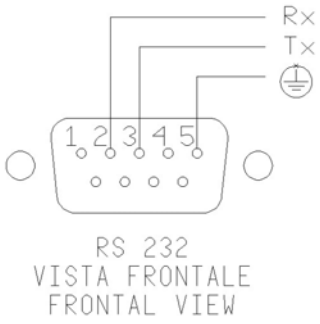


Fig.8

The external PC must be conform to the IEC950 standard.

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.

8 - SEQUENCE OF MAINTENANCE

- Not applicable

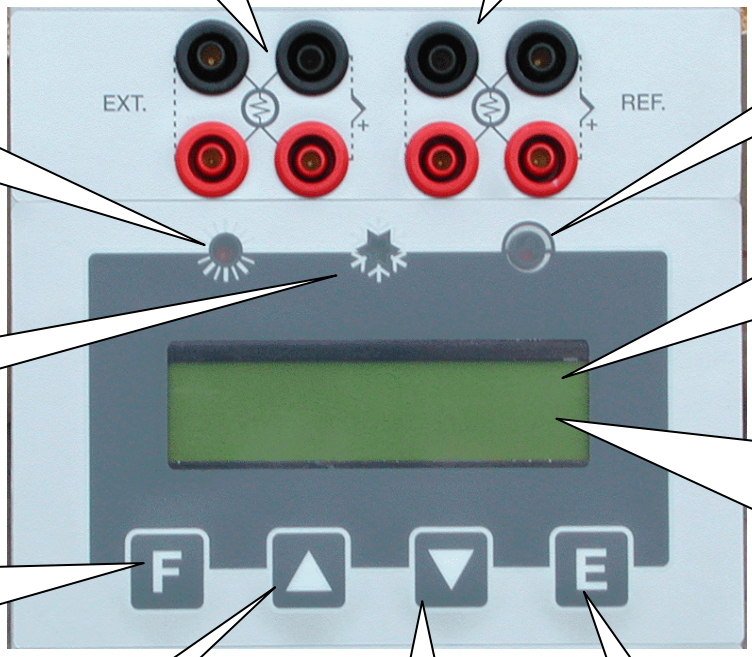
9 - TYPICAL FAULTS

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 power card is faulty.	- Replace the power card.
3	The control panel is working properly but the temperature does not increase.	- - The thermoregulator (7) is faulty. - The static relay on the supply card (11) is faulty. - The heating element is cut off. - The safety thermostat (10) has been triggered.	- Replace the supply card. - Replace the thermoregulator. - Replace the heating resistor - Reset the thermostat (ref. to 6.2.8)
4	The display indicates a different temperature from the one measured in the block.	- The probe (9) is faulty. - The thermo regulator (7) is faulty.	- Replace the probe. - Replace the thermo regulator.
5	The temperature does not stop at the value of the point that has been set.	- The supply card (11) 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 (6) is faulty.	- Replace the thermo regulator. - Replace the fan
7	The display indicates “Overrange” or RTD failure	- The control probe (9) is cut off or is in short circuit. - The thermo regulator (7) is faulty.	- Replace the thermocouple. - Replace the thermo regulator

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 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; temperature set which the oven has to reach following technical specifications

- **SP2**
  SET POINT2; temperature set which the oven reaches with the set gradient and the ongoing launched ramp procedure.

- **GRAD**
  GRADIENT; set point variation speed during the change from one temperature value to the SP2 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 ON-OFF**
  Ramp procedure enabling/disabling.
  Select ON by the ▲ or ▼ key and confirm the choice by pressing the "**E**" key; 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 confirm the choice.
  - Press the **F** key and set **GRAD** to 1°C/min using the ▲ or ▼ keys. Press the **E** key to confirm the choice.
  - Press the **F** key and set **RAMP** to **ON** using the ▲ or ▼ keys. Press the **E** key to confirm the choice. After pressing the E key to confirm the ramp start, the oven 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 one.

- **RIS. 0.1/0.01**
  Display reading resolution; the values admitted are **0.1°C** and **0.01°C** and they can be selected by the ▲ or ▼ keys. For this parameter it is not necessary to confirm the choice.

- **SW. ON**
  Switch on; it displays the temperature at which the thermostat's contact tied to the "SWITCH TEST" bushes is closed.

- **SW. OFF**
  Switch off; it displays the temperature at which the thermostat's contact tied to the "SWITCH TEST" bushes 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 bushes of the input 1 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 2 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 inputs 1 and 2 are enabled to read the sensors tied to them, whose value is indicated at the bottom of the Display.

2nd LEVEL FUNCTIONS

FUNCTIONS THAT CAN BE SELECTED BY PRESSING THE "**F** AND ▲" KEYS AT THE SAME TIME. ONCE THE SECOND LEVEL OF PARAMETER IS ENTERED, THESE FUNCTION CAN BE SELECTED ONLY BY PRESSING THE "**F**" KEY; IN ORDER TO COME BACK TO THE FIRST LEVEL, PRESS THE "**F** AND ▲" KEYS AT THE SAME TIME OR WAIT FOR ABOUT 20 SECONDS.

- **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**
  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 for the third programming level. By the ▲ or ▼ keys it is possible to set the number recorded in the "*ACCESS KEY*" parameters at the second level, and by pressing the "**F**" and ▲keys at the same time (*it is not necessary to confirm the choice by pressing the E key*), it is possible to enter to the third level parameters related to serial transmission and instrument configuration. The acceptable values are from 1 to 99; **the default value set by the manufacturer is 2.**

3rd LEVEL FUNCTIONS

FUNCTIONS THAT CAN BE SELECTED BY PRESSING THE "**F** AND ▲" 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. ONCE THE THIRD LEVEL OF PARAMETER IS ENTERED, THESE FUNCTION CAN BE SELECTED ONLY BY PRESSING THE "**F**" KEY; IN ORDER TO COME BACK TO THE FIRST LEVEL, PRESS THE "**F** AND ▲" KEYS AT THE SAME TIME OR WAIT FOR ABOUT 20 SECONDS.

- **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

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

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

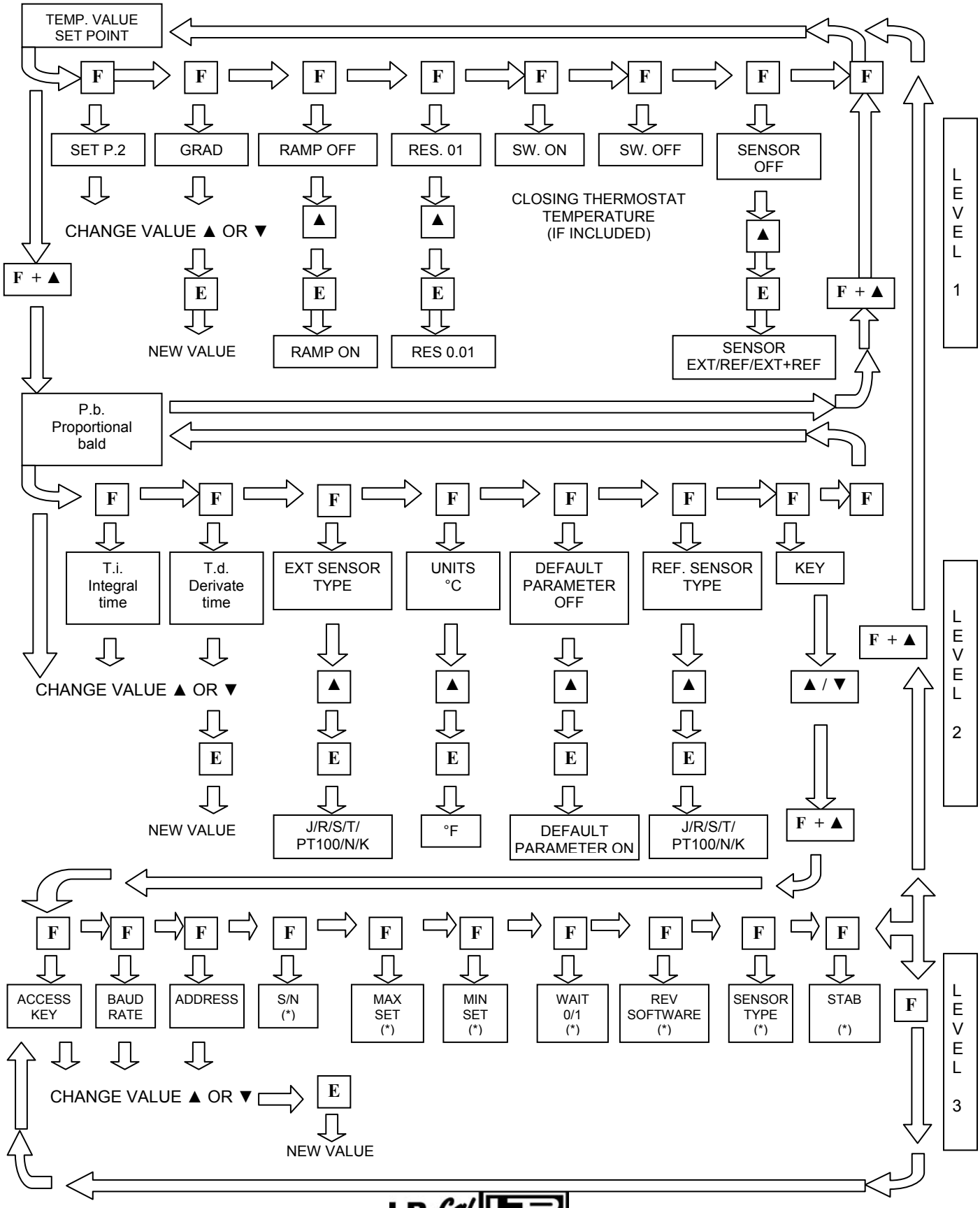
- **WAIT 0/1**
  initial waiting procedure. If the value "0" is set, when it is started up and after having carried out the general check procedure, the calibrator immediately run to the last set point value chosen after turning off when it is started up and after having carried out the general check procedure. If the value "1" is set, when it is started up and after having carried out the general check procedure, the calibrator goes on the waiting position and makes the second reader line flash. It is necessary to press any key in order to move it from the waiting position and to choose the desired parameter or value.

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

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

- **STAB: +/-0,05°C**
  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 - List of spare parts: 230V model

(Numerical references related to the enclosed drawings)

POS.	DESCRIPTION	CODE
1-3	SOCKET WITH 6A FILTER	3SCH28366
3	5A F. PROTECTION FUSES FOR 230V MODELS 8A F. PROTECTION FUSES FOR ø65 - 230V MOD.	fuse 5X20 5A fuse 5X20 8A
3.1	ø20 VARISTOR FOR 230V	4MRC20D391
6	230V – 50/60Hz FAN	3PPS-3956
7	MICROPROCESSOR CARD + DISPLAY	4ED20048
9	PT100 PROBE	3DC065
10	SAFETY THERMOSTAT + TYPE K THEROCOUPLE	4ED10085 3D2417
11	POWER SUPPLY CARD FOR 230V	4020-99-DS
12	ELECTRIC POWER CABLE	3NEP5942AW
13	RESISTOR: ø50mm ø65mm	3DC059-00A 3DC116-00A
15	AUXILIARY INPUT CARD	4ED20011
	TWEEZER FOR REMOVING INSERTS	2DC535
	SWITCH TEST CABLES	3MRC372124 + 3MRC212320956

List of spare parts: 115V

POS.	DESCRIPTION	CODE
1-3	SOCKET WITH 10A FILTER	3SCH283106
3	10A PROTECTION FUSES FOR 115-110V MODELS	fuse 5X20 10A
3.1	ø20 VARISTOR FOR 115-100V	4MRC20D271
4	115V-50/60Hz FAN	3PPS-3906
13	RESISTOR: ø50mm ø65mm	3DC059-00B 3DC116-00B

10.5- Declaration of conformity and check report

The declaration of conformity CE is at the end of the manual (next page), the test report is included with the calibrator

10.6 - Drawing and wiring diagram

The drawings are at the end of the manual

"Declaration of conformity"

DRUCK & TEMPERATUR Leitenberger GmbH [LR-Cal]
Bahnhofstr. 33
D-72138 Kirchentellinsfurt
GERMANY
Phone: +49-7121-90920-0
Fax: +49-7121-90920-99
E-Mail: dt-export@leitenberger.de
Internet: www.druck-temperatur.de

Declares that the: **THERMOSTATIC CALIBRATOR PULSAR**

is conforms with the requirements of the following European directive:

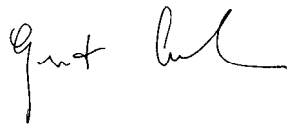
- Low voltage directive 73/23/EEC amended by 93/68/EEC
- EMC directive 89/336/EEC

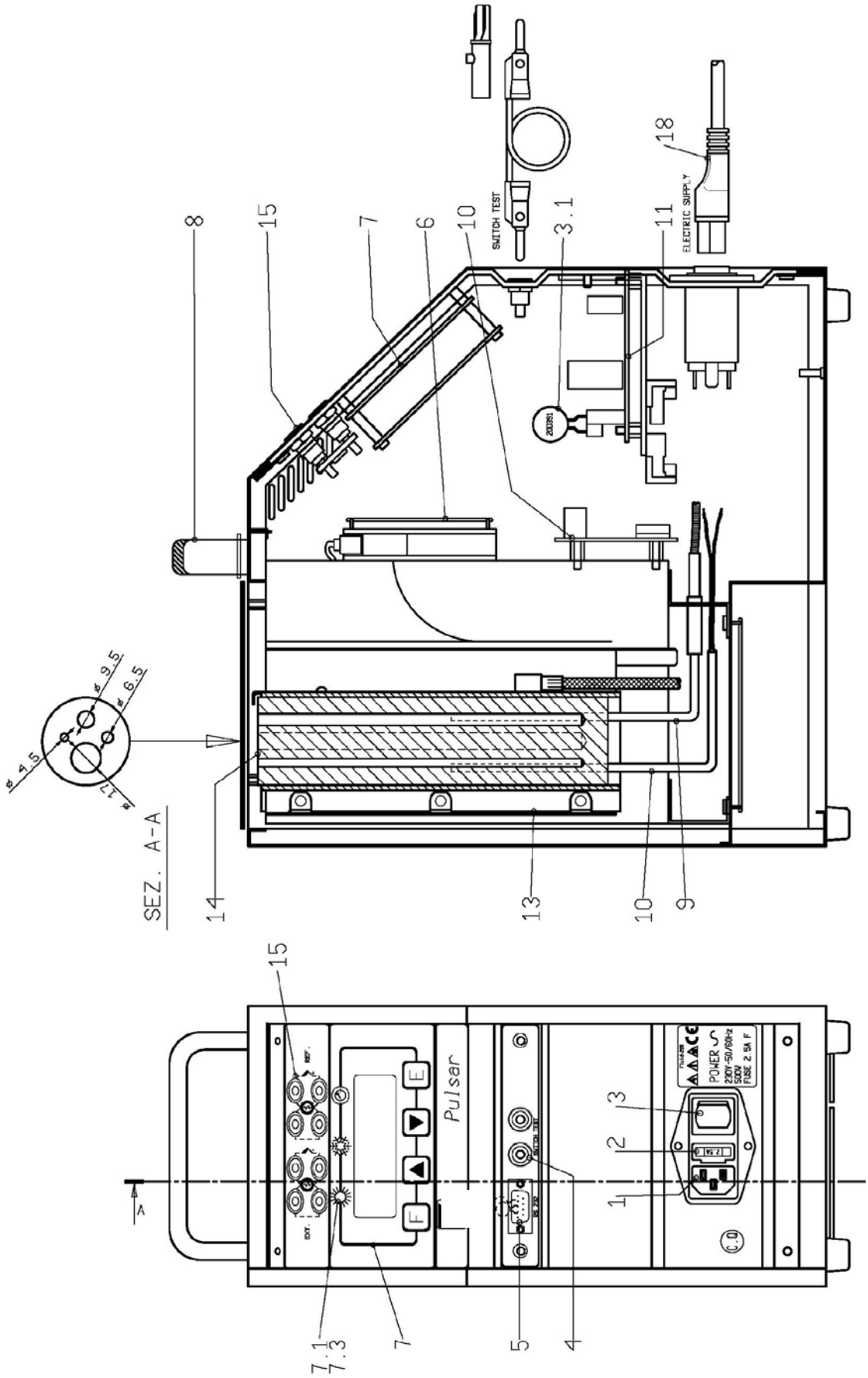
and that it has been designed in accordance with the following harmonised regulation:

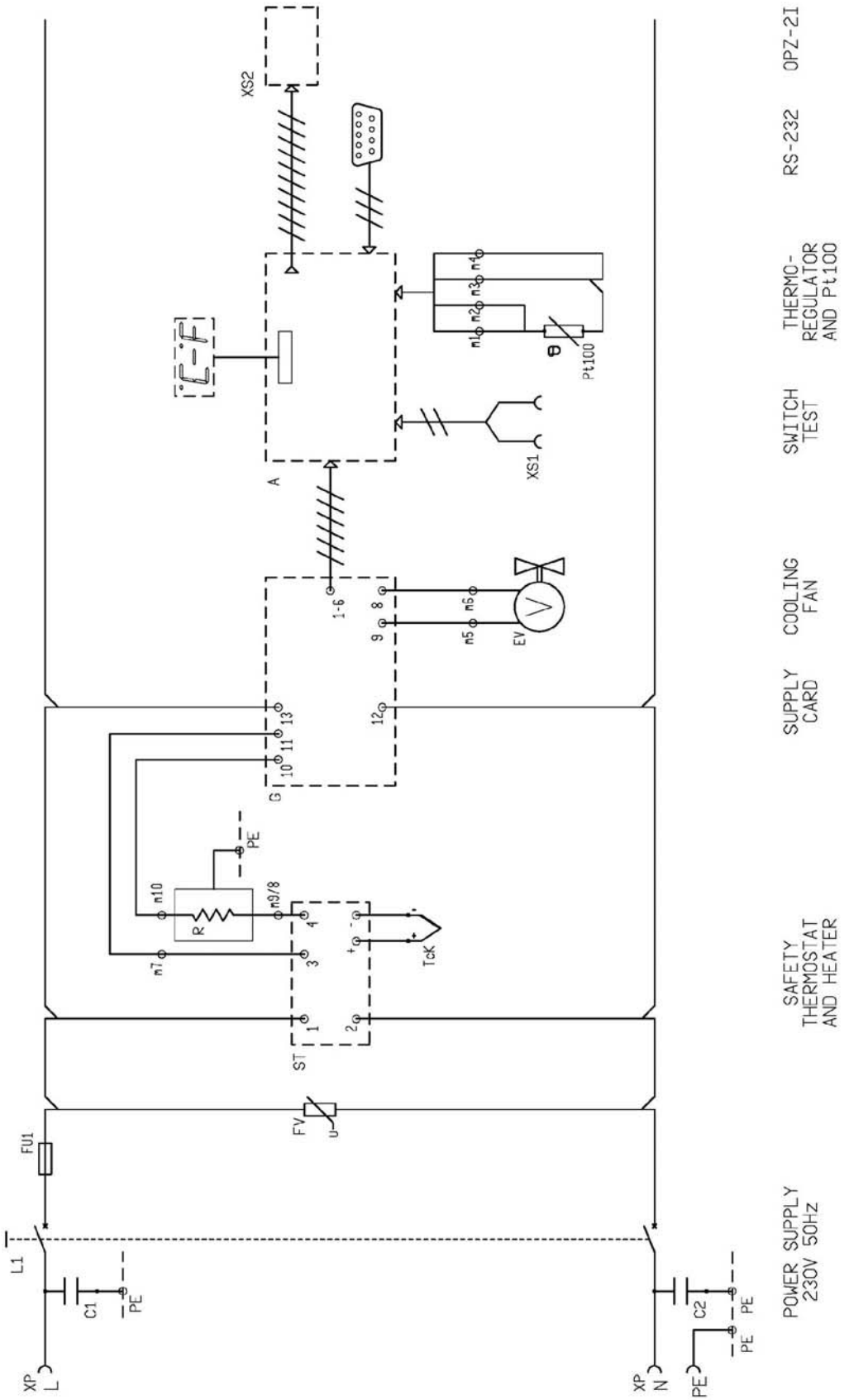
- EN 50081-1 emission.
- EN 50082-1 immunity.
- EN 6101-1 safety requirements for electrical equipment

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

DRUCK & TEMPERATUR
Leitenberger GmbH
26. July 2007




SWITCH TEST
ELECTRIC SUPPLY
8
15
7
6
10
3.1
11
18
SEZ. A-A
ø 9.5
ø 6.5
ø 4.5
ø 17
14
13
10
9
15
Pulsar
E
F
POWER
230V~50/60Hz
500W
FUSE 2 5A F
3
2
1
7.1
7.3
7
5
4


XS2
RS-232
OPZ-2I
THERMO-
REGULATOR
AND Pt100
Pt100
SWITCH
TEST
XS1
A
COOLING
FAN
EV
SUPPLY
CARD
SAFETY
THERMOSTAT
AND HEATER
TcK
ST
FV
FU1
POWER SUPPLY
230V 50Hz
L1
C1
C2
PE
XP
L
N

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