PRESYS®

Dry Block Calibrator

T-1200PH

Technical Manual

WARNING!

Avoid electric shock risk when touching the equipment:
- Use only suitable power cable with earth connection;
- Never power the equipment to the mains socket without earth connection.

WARNING!

High voltage is present inside this equipment.
It can cause great damages and injuries.

Do not make any repair service inside the equipment without removing the plug from the supply.

WARNING!

Much electromagnetic noise can cause instability to the equipment.

The equipment is provided with electromagnetic interference filters that protect not only the mains but also the equipment itself against noise. These filters have no function if the unit is not earthed properly.

WARNING!

High temperatures are achieved in this equipment.
Risk of fire and explosion are present in case safety measures are not taken. Sign by means of warnings the hazardous areas at high temperatures.
Do not place the dry-block on inflammable surfaces or even on materials that can be deformed due to high temperatures.
Do not obstruct any air-vent to avoid risk of fire in the equipment.

CAUTION!!

The instrument described in this technical manual is intended to be used in a specialized technical area. The user should be responsible by its configuration and the parameter values entered. Factory warns about risks of personal injury or ambient damage as a result of its incorrect use.

CAUTION!!

Do not raise the setpoint in steps higher than 500 °C in order to increase heater lifetime.

CAUTION!!

Before first use, after transportation and whenever the dry block is not used within a 10-day period, the instrument should be heated to 600 °C for 1 or 2 hours.

CAUTION!!

This equipment contains ceramic fiber components. Persons in direct contact with surch materials should take preventive measures when handling them.

WARNING!

Never remove the insert from the dry-block or the thermo-elements from the insert, while they are in temperatures far from the ambient. Wait until they reach the ambient temperature so that the heterogeneous cooling of the parts do not jam each other.

The warranty conditions are available in our sites:
www.presys.com.br/warranty

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1 - Introduction

T-1200PH

T-1200PH dry block calibrators control temperature of an insert in order to calibrate thermocouples, thermoresistances, glass thermometers, thermoswitches etc. Besides providing high accuracy temperature values, they also allow the measurement of signals generated by thermo-elements like thermocouples, thermoresistances and thermoswitches, which are being calibrated. This is possible due to an embedded calibrator specific for these types of signal, including 4-20 mA. Thus, they incorporate the functions of dry block, standard thermometer and calibrator for RTD, TC and also mA.

- T-1200PH calibrators model generate temperatures from 50 ºC (122 ºF) to 1200 ºC (2192ºF).
- Present input for thermocouples, thermoresistances, thermoswitches. Besides generating temperature, they measure the signal from the sensor being calibrated.
- Carry out completely automatic calibrations with or without the use of a computer.
- Accuracy to ±3 ºC of reading, stability of 0.2 ºC and resolution of 0.1 ºC.
- Documenting capabilities: communication with computer and ISOPLAN Calibration Software.
- Portable, compact and, provide interchangeable inserts.

They present a wide variety of programming resources, allowing the performance of automatic calibrations of thermocouples, thermoresistances, thermoswitches. In this case, the sensor is placed in the insert and their electrical terminals are connected to the embedded calibrator. The operator defines the calibration points and the number of repetitions, then the process is started and all the sequence is automatically accomplished.

Another way of performing automatic documented calibrations is by means of ISOPLAN Calibration Software for PC/Windows™, which uses RS-232 or RS-485 serial communication to connect the computer to the dry block. With ISOPLAN it is possible to register sensors and instruments of a factory, generate work orders, create and print calibrations certificates and reports, that is, it brings all advantages of computer data management to the calibration environment.

T-1200PH have also many other features, such as:

- The electric signal calibrator is independent from the dry block function.
- Internal buzzer beeps when the temperature reaches the desired value.
- Keypad that eases the operation and configuration of the calibrator.
- OLED graphic display for presenting large digits.
- Thermo-element reading scaled to ITS-90 or IPTS-68.
- Internal regulated 24 vdc power supply for 2-wire transmitters.
- Internal rechargeable battery and battery charger included in the electric signal calibrator.
- Independent circuitry for overtemperature protection and safety.
- Insert to choose, carrying case, strap and test leads included. If the insert is not specified, it will be provided the insert type BP06.

The calibrator operates with Nickel-Metal Hydride (Ni-MH) batteries.

1.1 - Technical Specifications

	T-1200PH
Operating Range	50 ºC (122 °F) to 1200 °C (2192 °F)
Power Supply	110 Vac or 220 Vac 50/60Hz, according to order code.
Resolution	0.1 ºC or 0.1 ºF
Accuracy	± 3.0 °C
Stability	± 0.2 ºC
Power Consumption	2300 W
Heating Rate	45 minutes (100 ºC to 1200 ºC)
Cooling Rate	5 h (1200 ºC to 200 ºC)
Calibration Volume	∅ 34 mm / 130 mm depth
Standard Insert coming with the furnace	2 holes of ∅ 6 mm and 2 holes of ∅ ¼" x 80 mm depth
Homogeneity	± 0.2 °C
Dimensions (H,W,D)	215 x 390 x 310mm
Weight	10,3 kg
Warranty	1 year

1.1.1 - Input Technical Specifications

Input Ranges		Resolution	Accuracy	Remarks
millivolt	-150 to 150 mV -500 to -150 mV 150 to 2450 mV	0.001 mV 0.01 mV 0.01 mV	± 0.01 % FS ± 0.02 % FS ± 0.02 % FS	R_{input} > 10 M Ω auto-ranging
mA	-5 to 24.5 mA	0.0001 mA	± 0.02 % FS	R_{input} < 160 Ω
Resistance	0 to 2500 Ω	0.01 Ω	± 0.008 % FS	excitation current 0.9 mA
Pt-100	-200 to 850 ºC / -328 to 1562 ºF	0.01 ºC / 0.01 ºF	± 0.1 ºC / ± 0.2 ºF	IEC-751
Pt-1000	-200 to 400 ºC / -328 to 752 ºF	0.1 ºC / 0.1 ºF	± 0.1 ºC / ± 0.2 ºF	IEC-751
TC-B	50 to 250 ºC / 122 to 482 ºF 250 to 500 ºC / 482 to 932 ºF 500 to 1200 ºC / 932 to 2192 ºF 1200 to 1820 ºC / 2192 to 3308 ºF	0.1 ºC / 0.1 ºF 0.1 ºC / 0.1 ºF 0.1 ºC / 0.1 ºF 0.1 ºC / 0.1 ºF	± 2.5 ºC / ± 5.0 ºF ± 1.5 ºC / ± 3.0 ºF ± 1.0 ºC / ± 2.0 ºF ± 0.7 ºC / ± 1.4 ºF	IEC-584 IEC-584 IEC-584 IEC-584
TC-J	-210 to 1200 ºC / -346 to 2192 ºF	0.1 ºC / 0.1 ºF	± 0.2 ºC / ± 0.4 ºF	IEC-584
TC-K	-270 to -150 ºC / -454 to -238 ºF -150 to 1370 ºC / -238 to 2498 ºF	0.1 ºC / 0.1 ºF 0.1 ºC / 0.1 ºF	± 0.5 ºC / ± 1.0 ºF ± 0.2 ºC / ± 0.4 ºF	IEC-584 IEC-584
TC-N	-260 to -200 ºC / -436 to -328 ºF -200 to -20 ºC / -328 to -4 ºF -20 to 1300 ºC / -4 to 2372 ºF	0.1 ºC / 0.1 ºF 0.1 ºC / 0.1 ºF 0.1 ºC / 0.1 ºF	± 1.0 ºC / ± 2.0 ºF ± 0.4 ºC / ± 0.8 ºF ± 0.2 ºC / ± 0.4 ºF	IEC-584 IEC-584 IEC-584
TC-R	-50 to 300 ºC / -58 to -572 ºF 300 to 1760 ºC / 572 to 3200 ºF	0.1 ºC / 0.1 ºF 0.1 ºC / 0.1 ºF	± 1.0 ºC / ± 2.0 ºF ± 0.7 ºC / ± 1.4 ºF	IEC-584 IEC-584
TC-S	-50 to 300 ºC / -58 to -572 ºF 300 to 1760 ºC / 572 to 3200 ºF	0.1 ºC / 0.1 ºF 0.1 ºC / 0.1 ºF	± 1.0 ºC / ± 2.0 ºF ± 0.7 ºC / ± 1.4 ºF	IEC-584 IEC-584

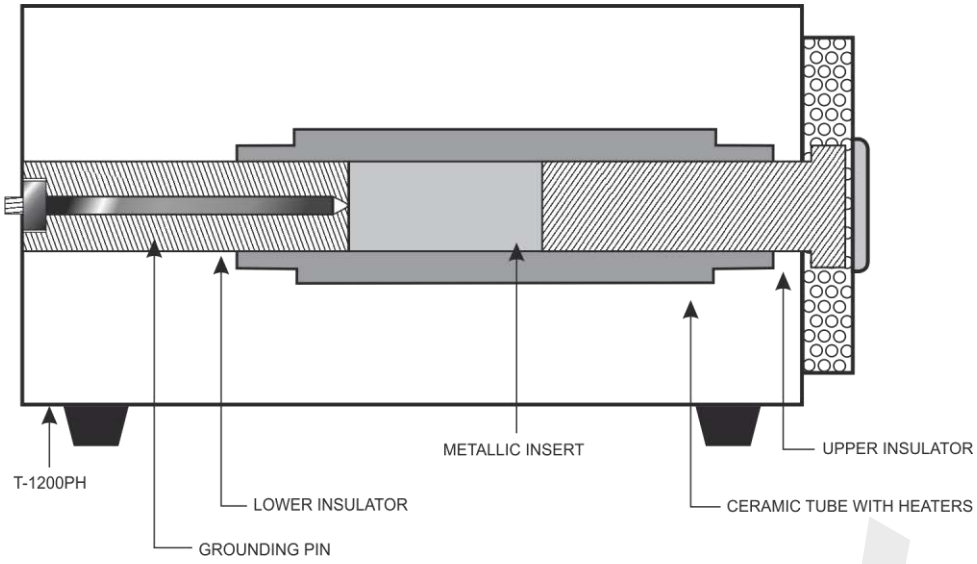
1.2 - Initial Usage

Identify if the following parts are present:

- Dry block T-1200PH;
- Metallic insert;
- Inferior insulator of the insert (only one central hole);
- Superior insulator of the insert (usually more than one hole);
- Power cable;
- Technical Manual.

1.3 - Mounting the insert inside the furnace

The core of the T-1200PH consists of a ceramic tube. Thus, for safety reasons, the insert and isolators are separate. To mount the assembly, you must first slide the rear insulator smoothly through the ceramic tube. Then, with the metal insert secured by the insert puller, slide it through the ceramic tube. After the metal insert, place and finish the front insulator closing the lid and screwing it, preventing the front insulator from falling. The sensor to be tested can then be inserted, observing that it must pass through the front isolator and deepen inside the metal insert to obtain a correct temperature measurement.



SCHEMATIC VIEW FOR INSERT MOUNTING

1.4 - Instruction for use of the optional Black Body insert

- ***Insert of the Black Body***

  Identify the following parts and proceed to the mounting as explained:

  - Cylindrical Thermal insulator – Mounted in the lower part of the pit of the furnace.
  - Metallic Insert type Black Body cavity – Must be introduced in the pit joined with a thermocouple type N mounted laterally.

  ⚠ Careful when entering the thermocouple in the cavity to not force the fragile ceramic wall pit.

  - Ring-shaped cylindrical Insulator - mounted on top of the pit of the furnace

  ⚠ Note that the position of the slit of insulation should match the type N thermocouple sheath laterally.

  - Connect the terminals of the thermocouple type N to the auxiliary input side of the furnace T-1200PH and set the reading of the IN input to N type thermocouple.

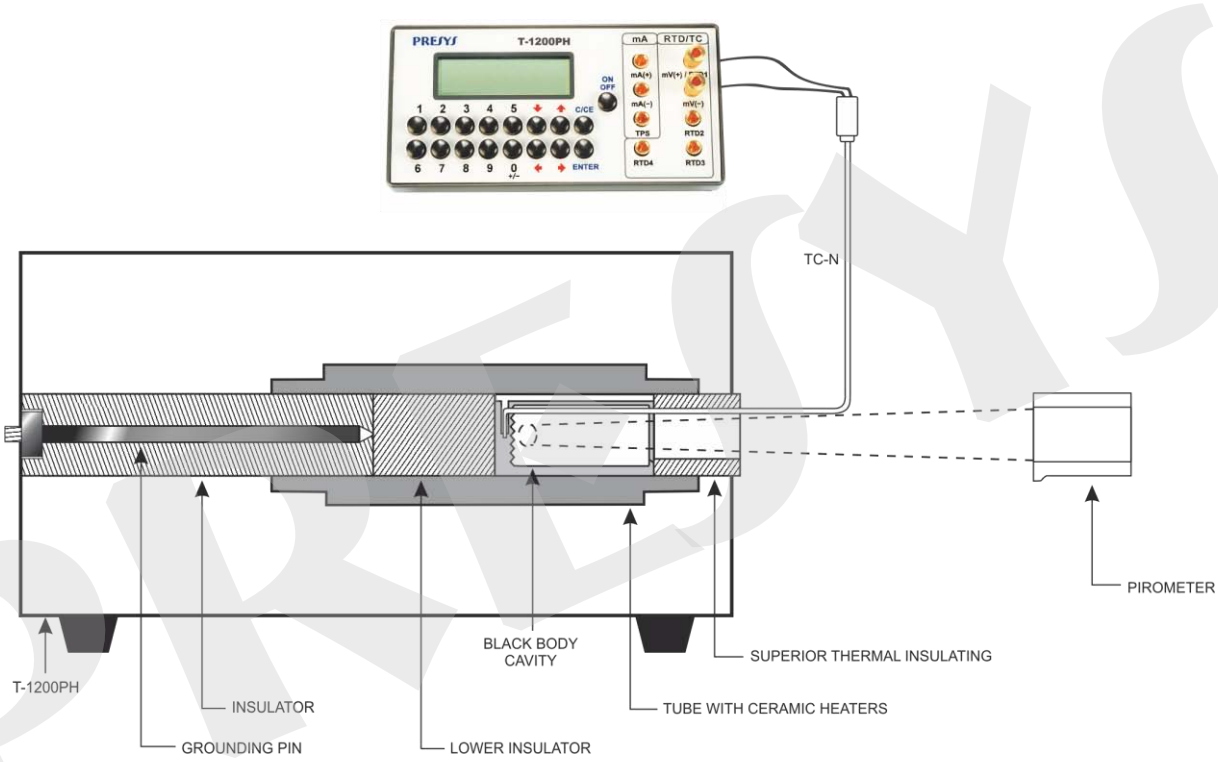
The combination constitutes an excellent mounted cavity blackbody with emissivity of 0.99 for a wave-length from 1 µm to 14 µm.

Align the pyrometer to be calibrated with a black body cavity in the furnace in a vertical position.

Observe the distance of the pyrometer to be calibrated against the background of the black body cavity and the size of the actual target (Ø 20 mm) as specified in the technical manual optical pyrometer.

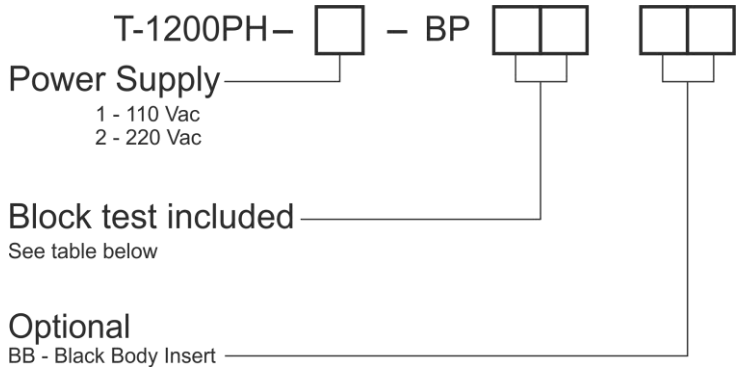
Remember that the area targeted by the pyrometer to be calibrated must be less than or equal to the effective target spot size of the blackbody in order to not introduce measurement errors.

Use the certificate of calibration of the thermocouple type N to correct the readings from the IN input of the calibrator and comparing the reading of the optical pyrometer.



SCHEMATIC VIEW FOR MOUNTING OF THE BLACK BODY CAVITY

1.5 - Order Code



1.6 - Accessories

- **Insert:**

Inserts	Holes (insert external diameter: 1")	Order Code
BP01	1 x 3/4"	06.04.0031-00
BP02	1 x 1/2"	06.04.0032-00
BP03	1 x 6.0 mm and 3 x 1/4"	06.04.0033-00
BP04	3 x 6.0 mm and 1 x 1/4"	06.04.0034-00
BP05	4 x 6.0 mm	06.04.0035-00
BP06	2 x 6.0 mm and 2 x 1/4"	06.04.0036-00
BP07	1 x 6.0 mm, 1 x 8.0 mm and 1 x 3/8"	06.04.0037-00
BP08	1 x 6.0 mm, 1 x 3.0 mm and 2 x 1/4"	06.04.0038-00
BP09	without hole, to be drilled by the client.	06.04.0039-00
BP10	Others, under ordering.	06.04.0040-00

* depth = 80 mm

Note: When asked, the calibration certificate will be provided for the first insert ordered.

- **Black Body Insert**

Order code : BB-06.04.0074-00 *Black Body*
Special geometry pen type Insert and effective target ∅ 20 mm made of refractory material. Constitutes a high emissive blackbody cavity for calibration of optical pyrometers.

- **Communication Interface:**

Description	Order Code
RS-232 - 9 way D type Connector (COM1)	06.02.0002-00
RS-232 - 25 way D type Connector (COM2)	06.02.0004-00
RS-485	06.02.0006-00

- **Carrying Case.** Order Code: 06.01.0006-00.
- **ISOPLAN Software.**
- **Calibration Certificate.**

2 - T-1200PH Calibrators Operation

The T-1200PH calibrators keep the block temperature controlled and allow the reading of a thermo-element connected to its terminals. It is possible to verify the thermocouple, thermoresistances, temperature transmitters etc together with the block temperature value and temperature setpoint.

The calibrators have 3 operating modes:

- *Manual Mode* to select the block temperature straight from the keypad.
- *Programmable Mode*: 6 different programs with 11 temperature setpoint values. The block temperature is selected among the programmed values by the keys ⇧ and ⇩. The *Programmable Mode with Timer* scans automatically the temperature setpoints.
- *Automatic Mode* to calibrate thermo-elements. The thermo-elements calibration is performed in an automatic way by the calibrator: the schedule and the calibration results, besides the thermo-element readings are stored in the calibrator memory.

When powered on (**ON/OFF** key), the calibrator goes through a self-test routine and shows the last calibration date and the value of the battery voltage. The battery voltage is constantly monitored and the low battery warning is provided. After the self-test is completed, the display shows the starting menu.

The initial setpoint is 50.00 ºC:

By means of keys ⇧, ⇩, ⇦ and ⇨, choose the menu options and press **ENTER**.

IN: selection of the calibrator signal input. Choose among mV, Ohms, thermocouples, thermoresistances, mA, switch or none. More details in item *2.1 - Menu IN*.

EXEC: The calibrator enters the manual or programmable operating mode.

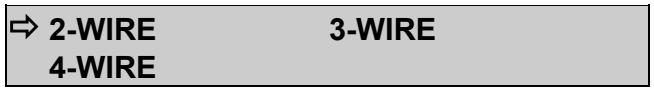
CONF: Accesses the calibrator configuration options. More details in item *2.2 - Menu CONF*.

CAL: This option accesses the T-1200PH calibrator adjust functions, protected by password. More details in section *7 - Calibration*.

COM: Accesses the automatic calibration parameters. It is possible to perform a calibration without a computer or using it (via CS-504 software). More details in item *2.5 - Automatic Operating Mode*.

2.1 - Menu IN

mV, **mA**, **SW**: selects millivolt, milliampere or switch input, respectively.
OHM: selects ohms input. Following, choose from the menu the wiring in 2, 3 or 4-wire.



TC: selects thermocouple input. Choose among the **B**, **J**, **K**, **N**, **R** and **S** types. In the next menu, the internal or manual cold junction compensation is chosen.

If the internal compensation is selected, the cold junction temperature value is displayed by the calibrator. If the **MANUAL** option is selected, the cold junction must be supplied by the operator. After confirming the value, by pressing **ENTER**, the calibrator goes back to the operating mode.

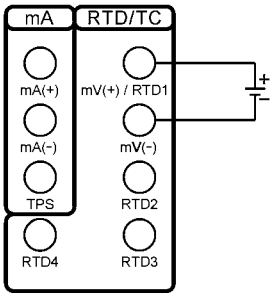
RTD: Selects the type of thermoresistance used. Choose from **PT100**, **NI100**, **CU10** and **PT1000** types. Choose also if the wiring is 2, 3 or 4-wire.

NO: Disables reading of external signal.

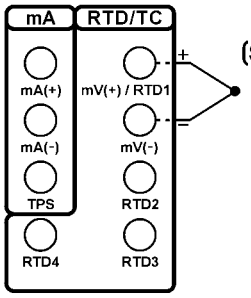
Selecting one of the options above, the calibrator goes straight to the manual operating mode, with no need to select the **EXEC** option.

2.1.1 - Input Connections Diagrams

Millivolts



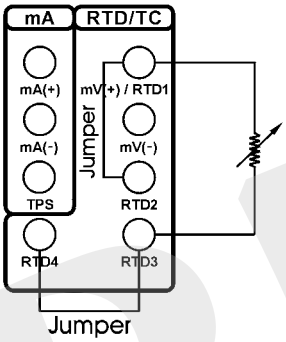
Thermocouple (TC)



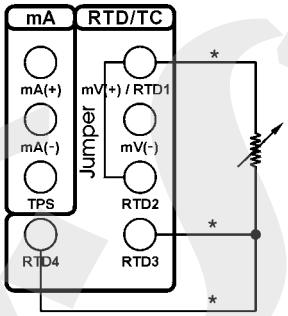
(side connection)

Use TC compensation wires.

Ohm / RTD (2-wire)

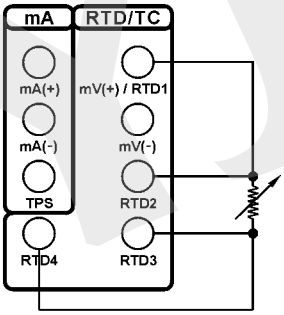


Ohm / RTD (3-wire)

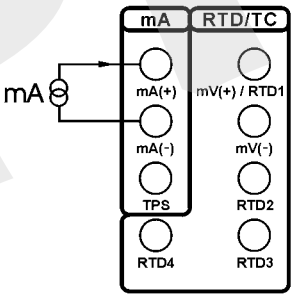


(*) Use same gauge and length wires

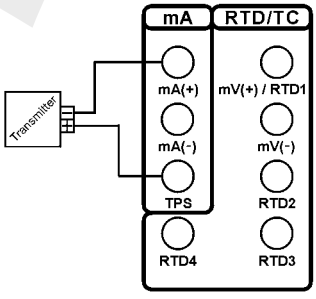
Ohm / RTD (4-wire)



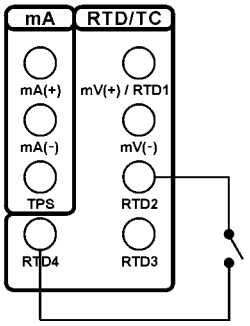
mA



mA with power supply



Switch (SW)



2.2 - Menu CONF

⇨ CF	PRG	MEM		DSP
SC	BT	DT	BZ	TU

CF: Selects the temperature unit between ºC or ºF. The ITS-90 or IPTS-68 temperature scales are selected for both the thermo-element and for the internal block reference readings purpose.

⇨ ºC-90	ºF-90
ºC-68	ºF-68

DSP: This option sets the OLED display contrast. Use the keys ⇧ and ⇩ until you get a better contrast and finish the operation by pressing the key ENTER.

BT: Shows the battery or the battery charger voltage value if the dry block is turned off or on, respectively.

Battery level	Battery state	Display
4.0 to 7.0 V	normal	----------
< 4.0 V	low	LOW BATTERY

DT: Updates the date and time of the calibrator. Thus, when the calibrator performs a calibration in the automatic mode via CS-504, all data are registered together with date and time of occurrence. Every time the calibrator is powered off, the internal clock does not continue to be updated. However, the CS-504 software can automatically update the calibrator date and time with the computer internal clock. Otherwise, use keys ⇧ and ⇩ to change the field that blinks and the keys ⇨ and ⇦ to go to another field. The key **ENTER** confirms the last selection.

BZ: Menu that configures the piezoelectric buzzer.

⇨ NO	YES	ENDCAL

NO: Disables the buzzer.

YES: The buzzer beeps when the block reaches the setpoint and stabilizes.

ENDCAL: The buzzer beeps only at the end of a calibration in the automatic operating mode.

TU: Menu that configures the PID control parameters for the heating side. More details in section *6 - PID Control Parameters*.

K: Proportional gain

I: Integral gain

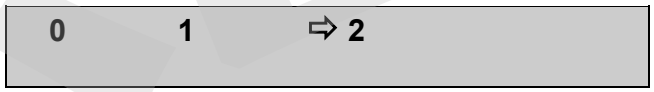
D: Derivative gain

FACT: Restore the control parameters to the factory values.

PRG: Menu that programs the calibrator.

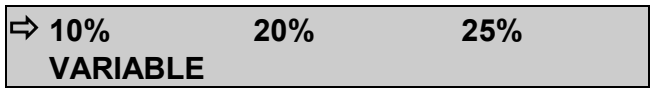
DEC_IN: Selects the number of decimals of the thermo-element reading. The default value depends on the input signal.

DEC_PRB: Selects the number of decimals of the block temperature and the setpoint value. The default number is 2.



SETPOINT: Enables the calibrator *Programmable Operating Mode*, and allows the configuration of programmed values. The selected program is indicated by the selection arrow. Choose one of the **6** temperature programs or **NO** to disable this *Programmable Mode*.

Select any of the 6 programs and confirm with the key **ENTER.** Following, it is shown the menu of temperature setpoint configuration.



Change the configuration to steps (STEPS) of **10%**, **20%**, **25%**, **VARIABLE** or press **C/CE** to maintain the configuration already stored in memory. The temperature range of the program must be configured through the values in **SETPOINT HIGH** and **SETPOINT LOW** in case of **10%**, **20%** or **25%** fixed steps of the range. The option **VARIABLE** allows the user to define from 2 to 11 values of temperature setpoint, not necessarily in ascending order.

To verify the step values of a program, select the **VARIABLE** option and confirm the values shown in the display with the key **ENTER**. The **10%**, **20%** and **25%** options change the number of steps automatically and recalculate the values according to **SETPOINT HIGH** and **SETPOINT LOW**.

SC: This function scales the input reading. The scaling is very useful in temperature transmitter calibration, for instance, because it displays the current temperature and the transmitter reading (mA) in the same unit. Thus, the error can be verified directly in ºC or ºF. Select the option **SC** and press **ENTER**. If no input is selected in **IN**, the calibrator will show the **SELECT INPUT FIRST** message. In this case, go to menu **IN** and select the input signal type.

The function **SC** will show **IN** or **NO.** Confirm **IN** to configure the scaling or **NO** to disable the **SC** function, with the key **ENTER**.

The scaling is performed via the **INPUT HIGH** and **INPUT LOW** parameters, corresponding to the maximum and minimum values of the calibrator signal input, in the engineering unit of this signal. Next, configure the **SCALE DEC (0-4)**, **SCALE HIGH** and **SCALE LOW** parameters according to the maximum and minimum values of the transmitter scale and the desired number of decimals. The scaled value is shown on the display with the **#** unit.

For example, temperature transmitter with 0 to 100 ºC input and 4 to 20 mA output. The scaling with one decimal would be:

INPUT HIGH: 20.0000 mA
INPUT LOW: 4.0000 mA
SCALE DEC (0-4): 1
SCALE HIGH: 100.0 #
SCALE LOW: 0.0 #

MEM: The T-1200PH calibrators allow many special programs and functions that can be of frequent use. In situations like this, it would be useful to store the current configuration in memory in order to save time. Up to 8 configurations can be stored in memory.

Selecting the option **MEM**, it is possible to store the current configuration (**WRITE**), restore a previous stored configuration (**RECALL**) or erase the 8 configurations from memory (**CLEAR ALL**).

Selecting the option **WRITE** or **RECALL** will present a new menu with numbers 1 to 8, representing each one of the memory positions. Choose one of the positions and press **ENTER**. The writing operation (**WRITE**) can be made in an already used memory position. The calibrator asks for the overwriting confirmation with the message **OVERWRITE MEMORY?**. The **CLEAR ALL** operation shows a confirming message **ARE YOU SURE?**. In both cases, press **ENTER** to confirm the operation or **C/CE** to cancel.

2.3 - Manual Operating Mode

The display shows the selected temperature value of the block and also the current block temperature or thermo-element temperature value.

There are 4 ways in which the information are shown, covering the calibrator input value (**IN**), the block temperature (**PROB**) and the temperature setpoint (**SET**). The key ⇦ interchanges the display presentation way:

IN = 23.456 mV **PROB= 300.0 ºC**
PROB= 300.1 ºC **SET = 300.0 ºC**
23.456 **IN = Voltage (mV)**
300.1 **SET = 300.0 ºC**

The block temperature setpoint is selected directly by the keypad, even if the message **SET** is not being displayed. The numeric keypad enables the **SET** selection in any of the display presentation ways, to change the setpoint.

The setpoint value is increased by key ⇧ and decreased by key ⇩. While the keys are kept pressed, the setpoint continues to be increased or decreased.

The key ⇨ does not have function in the manual operating mode of the T-1200PH calibrators.

Intermally, the setpoint changes at a limited rate to make possible a safer and more homogeneous heating of the internal ceramic tube. Besides, the PID parameters and algorithm were adjusted to assure a minimal stabilization time and overshoot.

2.4 - Programmable Operating Mode

Pre-configured programs can be loaded from the calibrators memory, enabling the programmable operating mode. The temperature programmed values of the block are used directly, with no need to enter the setpoint.

The display shows **STEPn** beside the block temperature setpoint value in the programmable mode. The number of the program is indicated by **n**. Using the keys ⇧ and ⇩, the programmed values of temperature setpoint are changed. The numeric keypad continues available for manual selection of the block temperature in the same way of the manual operating mode.

The automatic scan over the programmed temperatures is implemented by defining the stabilization time of the thermo-element in the block.

The key ⇨ enables the automatic scan over the points. When pressed, the message **STEPn** gives place to **0s** and the calibrator waits for the stabilization time

configured from 1 to 9 minutes, by the keys **1** to **9**. The automatic scan is disabled by pressing key ⇨ again.

A countdown of the stabilization time is only started when the block temperature reaches the programmed temperature and stabilizes within a range of approximately ±0.20 ºC. At this time the buzzer beeps, in case it is configured to **YES**.

2.5 - Automatic Operating Mode

The thermo-element calibration is performed in an automatic way by the T-1200PH calibrators. The configuration, as well as the calibration verification is carried out by the calibrator itself. Also it is possible to use the CS-504 software and its work orders, like a CAC - Computer Aided Calibration.

The independent automatic calibration, without the use of CS-504, is planned in the option **TAGMAN** from menu **COM**.

TAG	**EXEC**	**VERIF**
ADDRESS	⇨ **TAGMAN**	

Before you start programming, configure first the signal that will be read by the calibrator in the menu **IN**. To calibrate glass thermometers, for example, there is no electric signal to be read. In this case, option **IN** from the menu must be configured to **NO** and the calibrator will ask to enter the value indicated by the thermometer, at the end of the stabilization time of each calibration point.

The data for an automatic calibration concern:

- **TAG**: the thermo-element tag identification.
- **SP**: the block temperature reference values for the calibration (calibration points).
- **TOL**: the maximum tolerance for the thermo-element operation.
- **STB**: the stabilization time, in seconds, so that the thermo-element temperature indicates correctly. This timer starts just after the block reaches and stabilizes at the setpoint temperature.
- **STR**: the calibration strategy of the programmed reference values. The available strategies are: ⇧ (UP), ⇩(DOWN), ⇧⇩ (UP - DOWN), ⇩⇧ (DOWN - UP), ⇧⇩⇧ (UP - DOWN - UP) and ⇩⇧⇩ (DOWN - UP - DOWN).
- **RP**: the strategy number of repetitions.
- **RGI**: the thermo-element indication range.
- **RGO**: the operating temperature range that corresponds to the indication range above.

The automatic calibration begins when the option **EXEC** from menu **COM** is selected. All the operations are automatically performed by the T-1200PH calibrators. The keypad does not work until the end of the calibration.

At the end of the stabilization time, the calibrator stores the thermo-element reading in memory and goes to the next point, in case some input signal has been previously configured in the menu **IN** and connected to the calibrator terminals.

The **CALIBRATION END** message appears on the display at the end of the automatic calibration. Press **ENTER** to confirm. The results can be verified in option **VERIF** from menu **COM**.

The first message in option **VERIF** informs the calibration result, with the number of points that have succeeded. Following, press **ENTER** to verify each one of the readings performed by the calibrator. The keys ⇨ and ⇦ interchange 2 screens: one that displays the block and thermo-element temperature value and the other displays a message indicating the calibration point number and its state (**OK** or **FAIL**), besides the error value in %.

The option **TAG** from menu **COM** can present a list of up to 4 tags that have been downloaded or uploaded with CS-504 software. The key **ENTER** selects the tag to be calibrated from the tag list. The automatic calibration starts by the option **EXEC** from menu **COM** and the calibration data can be verified in option **VERIF**. To calibrate automatically not using the CS-504, there is a reserved place for one manual tag. The selection of the manual tag is performed by confirming the option **TAGMAN** with the key **ENTER**.

The option **ADDRESS** selects the communication address of the T-350P/ T-650P calibrators. The communication protocol used is ModBus - RTU, with no parity and baud rate of 9600. The calibrator communication with the computer can use RS-232 or RS-485, for network option, according to the communication interface used. In order to communicate with CS-504 software, configure **ADDRESS** to 1.

3 - Recommendations as regards Accuracy of Measurements

PRESYS dry block temperature calibrators are instruments of high accuracy level, requiring the observation of all the procedures described in this section, in order to achieve the necessary conditions to get the accuracy levels during the calibrations.

- Special attention should be paid in relation to the insert cleanliness. When necessary, it should always be washed with water and soap, well rinsed and dried. Oil, grease, solid particles can hinder the heat transference to the insert and even jam the insert inside the block.

- The sensor to be calibrated must fit snugly into the appropriate well. In case the sensor is loose, the measurement accuracy meaning can be completely senseless. The meaning of clearance between the sensor and the respective well should be understood in a subjective way and the common sense is very important. Thus, the sensor should enter the insert well (both completely clean) in such a way to stay snugly enough so that it can not move or swing inside but it should not enter by force to get jammed.

3.1 - Getting a Better Accuracy from the Dry Block

The temperature control is based in the temperature measurement of an internal sensor placed in the block.

This control probe is adjusted in factory by means of another sensor with high accuracy (probe) connected to a superthermometer, as described in item *7.2 - Probe Calibration*. So, at factory, the accuracy of the superthermometer is transferred to the dry block calibrator. The transference will be well performed only when there is a perfect temperature equilibrium between the internal control sensor and the superthermometer probe. Therefore, it should not have any clearance between the insert and the block or between the probe and the insert. Both the internal sensor and the probe should also be at the same depth.

The user will get the best accuracy from the dry block, provided in this technical manual, in case one succeeds in reproducing the same conditions of the factory adjustment, that is, the same insert used in factory, no clearance, same depth etc.

Summing up, the important thing to get the best accuracy from the dry block is to reproduce the process used by the factory to adjust the dry block itself.

When a higher accuracy than that mentioned in the technical manual is necessary, one should use an external superthermometer as a reference or standard to compare with the thermo-element under calibration.

In this case, the dry block is only used as a heat generator, not as a standard temperature calibrator. The user can use the fact that the dry block stability value is much lower than its accuracy value. So, placing the superthermometer sensor and the thermo-element under calibration in a two-hole-insert, it is possible to compare both temperature measurement.

4 - Safety Instructions

- If the calibrator is turned on, do not leave the room without an identification or warning about the high temperature hazard.
- Before turning the calibrator off, return the block temperature to values close to the ambient temperature.
- Never remove the insert from the dry block or the thermo-elements from the insert, while they are in temperatures far from the ambient. Wait until they reach the ambient temperature.
- Never transport the dry block with the metallic insert inside it, as the metallic insert can hit the ceramic tube damaging it permanently.

5 - Calibrator Warning Messages

Warning	Meaning	Procedure
RAM ERROR READ MANUAL	Problem in RAM memory	Turn the calibrator off and on. If the error persists, send the instrument to the factory
EEPROM ERROR READ MANUAL	Problem in EEPROM memory	Same as the previous item
LOW BATTERY	Level of battery voltage is low	Check the T-1200PH calibrator power supply
UNDER / OVER	Input signal out of specifications or scaling range	See item 1.1.1 on Input Specifications
????.??ºC	Input sensor is open	Check input connections and sensor

6 - PID Control Parameters

The T-1200PH temperature calibrators have a PID control algorithm to calculate the block control output.

The dry block stability and response time features are related to the PID parameters, explained below:

The K parameter (proportional gain) amplifies the error signal between the setpoint and the block temperature to establish the output signal. When this parameter is very high, the output reaction is very quick, however this can take the system into oscillation. Decreasing this parameter, the dry block would not be able to react quickly enough to external variations, giving the impression of a sudden out of control.

The I parameter (integral gain) is responsible for the integral action and it is the most important part in the setpoint control. While an error persists between the setpoint and the block temperature, the integral action will actuate on the output signal until the error is brought to zero.

The D parameter (derivative gain) is responsible for the derivative action that provides a quick response at the control output resulting from any rapt variation in the block temperature. It is used to eliminate oscillations. However, it can cause oscillations in the presence of much noise.

All temperature calibrators are tuned in factory and the parameters are close to the optimum ones. In case one wants to improve a specific feature of the calibrator (stabilization time or response time, for instance), make sure the alteration is made reasonably.

7 - Calibration

ATTENTION: To prevent potential damage to the instrument's calibration due to improper adjustments, the access password must be requested from your local distributor.

Adjustment procedure access password: To perform input or output adjustments, the owner of the calibrator must contact the local distributor, providing the equipment's **serial number** to receive the password that allows access to the adjustment.

WARNING: Enter the following options only after understanding them completely. Otherwise, it may be necessary to return the instrument to the factory for recalibration!

Select **CAL** option from the main menu and press the **ENTER** key. You should then enter the password (**PASSWORD**) to access the calibration menu.

The password functions as a protection to calibration ranges. After the password is entered, the menu displays the options:

⇨ IN	OUT	DATE

You should then choose the input range (**IN**) as the output range (**OUT**) is not available for the user. **DATE** is an option which allows you to record the date on which the calibration was performed and once it has been filled in, it will be displayed every time the calibrator is turned on.

Options for **IN** calibration are:

⇨ mV	mA	OHM	CJC	PROBE

7.1 - Input Calibration

Select the corresponding mnemonic and apply the signals presented in the tables below.

When calibrating inputs, the display shows on the 2nd line the value measured by the calibrator and on the 1st line the same value is expressed as a percentage.

Note that the applied signals just need to be close to the values shown in the table.

Once the signal has been applied, store the values of the 1st and 2nd calibration points, by pressing keys 1 (1st point) and 2 (2nd point).

mV Input	1st point	2nd point
G4	0.000 mV	70.000 mV
G3	0.000 mV	120.000 mV
G2	0.000 mV	600.000 mV
G1	600.000 mV	2400.000 mV

mA Input	1st point	2nd point
Single range	0.0000 mA	20.0000 mA

Input calibration for Ω is performed in two steps:

a) Application of mV signal:
For the calibration below, leave terminals RTD3 (+) and RTD4 (+) short-circuited.

mV Signal	Terminals	1st point	2nd point
V_OHM3	RTD3(+) and mV(-)	90.000 mV	120.000 mV
V_OHM4	RTD4(+) and mV(-)	90.000 mV	120.000 mV

b) Application of standard resistors:
Connect a decade box or standard resistors on terminals RTD1, RTD2, RTD3 and RTD4 (4-wire connection).

resistors	1st point	2nd point
OHM3	20.000 Ω	50.000 Ω
OHM2	100.000 Ω	500.000 Ω
OHM1	500.000 Ω	2200.000 Ω

The cold junction calibration (CJC) is performed measuring the mV(-) terminal temperature. Store only the 1st point.

Cold Junction	1st point
CJC	32.03 ºC

7.2 - Probe Calibration

The options of calibration / probe are:

ºC: Adjust of the internal temperature sensor (internal Probe).

RESTORE: Restores the internal temperature sensor calibration parameters to the factory values.

To readjust the internal Probe it is necessary to compare the value indicated by the calibrator (Probe) and the temperature value from an external probe placed in the dry block insert. The temperature of the external probe should have high accuracy and should be measured by a superthermometer (ST).

The option to adjust the internal sensor has seven points of adjustment. These points are recorded via keys 1 to 7.

Before starting the calibration (adjustment), record in these points the respective initial storing values, according to the table below.

Go to the manual operating mode (menu **EXEC**) and generate all the seven levels of temperature (setpoints from the table), writing down the value indicated by the

superthermometer (ST). Now, go back to the option Calibration/ Probe / ºC and record the values indicated by the superthermometer.

For T-1200PH:

Setpoint of the temperature generated (ºC)	Initial value to record (ºC)	ST indication	New value to record	New indication of the ST	key
150	150.0	149.96	150.0	150.01	key 1
350	350.0	349.93	349.9	349.99	key 2
600	600.0	598.03	598.0	600.02	key 3
750	750.0	745.32	745.3	749.99	key 4
850	850.0	843.13	843.1	850.03	key 5
1000	1000.0	990.45	990.4	999.97	key 6
1100	1100.0	1087.11	1087.1	1100.05	key 7

8 - Maintenance

8.1 - Instructions for Hardware

There are no parts or components in the T-1200PH temperature calibrators that can be repaired by the user. Only the 6Amp fuse, placed within the socket on the rear can be replaced by the user (10Amp fuse for model T-1200PH 220VAC).

The fuse may blow due to a voltage spike in the mains or a calibrator component fault. Replace the fuse once. If a second fuse blows again, it is because the fault is not that simple. Send the calibrator to the factory for repair.

9 - Instructions for Fitting the Strap for Transport

The strap for transport is included together with the dry block. It is very useful during the transport period and its fitting is very simple. Just manually screw the screws on each tip of the strap in the holes located on the dry block sides. See illustration below.