PRESYS ®

Temperature Calibrator for Surface Sensors
T-500PS

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.

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 does not jam each other. If, by chance, a jamming situation happens, refer to item 8.2 - Instructions for Insert Jamming to proceed properly.

Table of Contents

1.0 - Introduction

T-500PS

T-500PS Surface Sensors and Thermometers Calibrator produces temperature values to allow the calibration of surface sensors and thermometers, such as RTD, thermocouples, thermistors and tape sensors. The generated temperatures have high accuracy and its rectified aluminum surface ensures a perfect physical contact between the sensor and the measurement area. The calibrator also has a large uniform temperature area, allowing calibration of more than one sensor at a time.

This calibrator has input for thermocouples and RTD, in addition to the current meter function. It is possible to use a Pt-100 sensor read by the RTD input of the calibrator, adjusted with Callendar-Van Dusen coefficients.

The calibrator also includes an external probe input to allow temperature reading from a standard PRT sensor (optional) inserted in a hole under the calibration surface which extends to the center of the measurement area. The sensor calibration curve is configured according to the *Callendar-Van Dusen* parametrization.

- The T-500PS calibrator generates temperatures from ambient to 500 °C.
- It has input for thermocouples, thermoresistances and thermostats.
- Allows the reading of surface temperature by using an external probe (optional). The temperature calculation uses *Callendar-Van Dusen* coefficients.
- The use of an external standard thermometer is not required.
- Perform automatic calibrations with or without the use of the computer.
- Accuracy up to 0.4 ºC + 0.1 % of reading, stability of 0.2 ºC and resolution of 0.01 ºC.
- Communication with computer and ISOPLAN software.
- Portable, compact, provided with straps and carrying case.

It has a wide variety programming capabilities, where the calibrator is programmed to generate preconfigured temperatures.

Compatible with automatic and documented calibration programs, by means of ISOPLAN Calibration Software for PC/Windows™, which uses RS-232 or RS-485 serial communication to connect the computer to the calibrator. 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-500PS has also many other features, such as:

- The electric signal calibrator is independent from the temperature generation 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.
- Configurable RTD and external probe readings with *Callendar-Van Dusen* coefficient adjustments.
- Internal regulated 24 Vdc power supply for 2-wire transmitters.
- Internal rechargeable battery and battery charger included in the electric signal calibrator.
- Independent circuit for protection and safety for high temperature.

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

1.1 - Technical Specifications

Operating Range	Ambient to 500 °C (932 °F)
Power Supply	110 Vac or 220 Vac 50/60 Hz, according to order code
Surface Diameter	80 mm
Resolution	0.01 ºC or 0.01 ºF
Accuracy (internal reference) (external reference)	$\pm$ (0.4 ºC + 0.1 % of reading) TC-N: $\pm$ 0.2 °C / Pt-100: $\pm$ 0.1 °C *
Stability (after 10 minutes)	$\pm$0.2 ºC
Electrical Power	1000 W
Heating Time	30 minutes (50 ºC to 500 ºC)
Cooling Time	30 minutes (500 ºC to 100 ºC)
Dimensions (H,W,D)	250 x 180 x 270 mm
Weight	9.0 kg
Warranty	One year (except for rechargeable batteries)

* Accuracy refers only to electrical calibrator inputs.

1.1.1 - Input Technical Specifications

Input Ranges		Resolution	Accuracy	Remarks
millivolt	-150 to 150mV 150 to 2450mV	0.001 mV 0.01 mV	± 0.01 % FS ± 0.02 % FS	R input > 10M Ω auto-ranging
mA	-1 to 24.5mA	0.0001 mA	± 0.02 % FS	R input < 160 Ω
Resistance	0 to 400 Ω > 400 to 2500 Ω	0.01 Ω 0.01 Ω	± 0.01 % FS ± 0.03 % FS	excitation current 0.9mA (auto-range)
Pt-100	-200 to 850 ºC / -328 to 1562 ºF	0.01 ºC / 0.01 ºF	± 0.1 ºC / ± 0.2 ºF	IEC-60751
Pt-1000	-200 to 400 ºC / -328 to 752 ºF	0.1 ºC / 0.1 ºF	± 0.1 ºC / ± 0.2 ºF	IEC-60751
Cu-10	-200 to 260 ºC / -328 to 500 ºF	0.1 ºC / 0.1 ºF	± 2.0 ºC / ± 4.0 ºF	Minco 16-9
Ni-100	-60 to 250 ºC / -76 to 482 ºF	0.1 ºC / 0.1 ºF	± 0.2 ºC / ± 0.4 ºF	DIN-43760
TC-J	-210 to 1200 ºC / -346 to 2192 ºF	0.1 ºC / 0.1 ºF	± 0.2 ºC / ± 0.4 ºF	IEC-60584
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-60584
TC-T	-260 to -200 ºC / -436 to -328 ºF -200 to -75 ºC / -328 to -103 ºF -75 to 400 ºC / -103 to 752 ºF	0.1 ºC / 0.1 ºF 0.1 ºC / 0.1 ºF 0.1 ºC / 0.1 ºF	± 0.6 ºC / ± 1.2 ºF ± 0.4 ºC / ± 0.8 ºF ± 0.2 ºC / ± 0.4 ºF	IEC-60584
TC-E	-270 to -150 ºC / -454 to -238 ºF -150 to 1000 ºC / -238 to 1832 ºF	0.1 ºC / 0.1 ºF 0.1 ºC / 0.1 ºF	± 0.3 ºC / ± 0.6 ºF ± 0.1 ºC / ± 0.2 ºF	IEC-60584
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-60584
TC-L	-200 to 900 ºC / -328 to 1652 ºF	0.1 ºC / 0.1 ºF	± 0.2 ºC / ± 0.4 ºF	DIN-43710

1.2 - Order Code

T - 500PS - ☐ - ☐

Power Supply
1 - 110 Vac
2 - 220 Vac

Reference Probe
0 - No Reference Thermometer
1 - Secondary Pt-100 Sensor
2 - "N" type Thermocouple Sensor

1.3 - Accessories

- **Communication Interfaces:**

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

- **Soft Carrying Case.** Order Code: 06.01.0006-00.

- **ISOPLAN Software.**

- **Calibration Certificate.**

2.0 - T-500PS Calibrators Operation

T-500PS calibrator keeps the temperature of the measurement area controlled and is suitable for calibration of surface thermometers and sensors.

The calibrators have 3 operating modes:

- *Manual Mode* to select the block temperature directly from the keypad.

- *Programmable Mode*: 6 different programs with 11 temperature set point values. The block temperature is selected among the programmed values by the keys ⇧ and ⇩. The *Programmable Mode with Timer* scans automatically the temperature set points.

- *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:

```
⇨ IN            EXEC
  CONF          CAL           COM
```

By means of keys ⇧, ⇩, ⇦ and ⇨, choose the menu options and press **ENTER**.
IN: selection of the calibrator signal input. Choose among mV, Ohms, thermocouples, RTDs, 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 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 ISOPLAN software). More details in item *2.5 - Automatic Operating Mode*.

2.1 - Menu IN

```
⇨ mV        OHM        TC
  RTD       mA         SW         NO
```

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.

```
⇨ 2-WIRE              3-WIRE
  4-WIRE
```

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

```
⇨ INTERNAL
  MANUAL
```

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 thermo resistance used. Choose from **PT100**, **NI100**, **CU10** and **PT1000** types. Choose also if the wiring is 2, 3 or 4-wire.
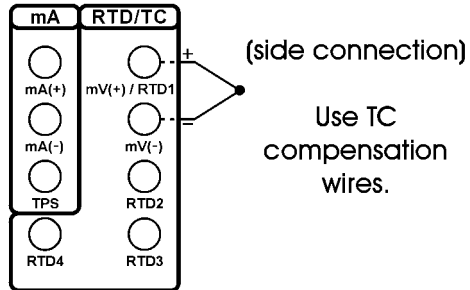
NO: Disables reading of external signal.

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

2.1.1 - Input Connections Diagrams
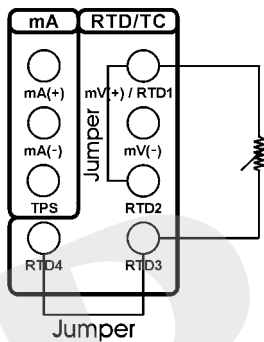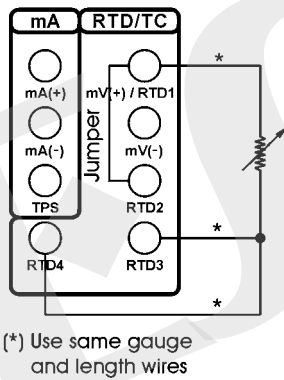
Millivolts

Thermocouple (TC)

(side connection)

Use TC
compensation
wires.
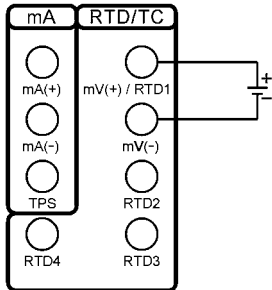
Ohm / RTD
(2-wire)

Ohm / RTD
(3-wire)

Ohm / RTD
(4-wire)

Jumper

(*) Use same gauge
and length wires
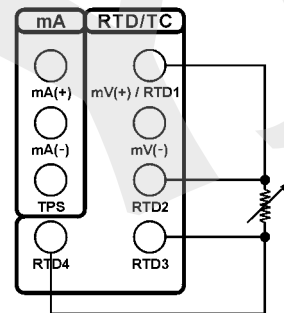
mA
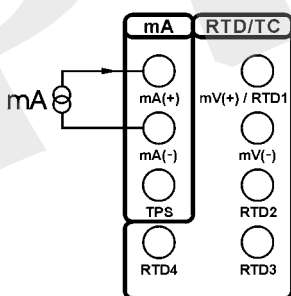
mA with power supply
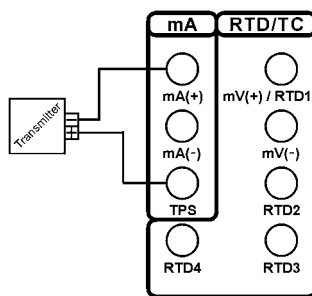
Switch (SW)

2.1.2 - External Probe Connection

Place the 4-wire Pt-100 standard sensor into the insert and plug the mini-DIN connector to the external probe input (**EXT. PROBE**) located on the calibrator front panel, as illustrated in the figure below:

To read the temperature, the external probe must be enabled by the **PRBe** option of the **PRG** menu. More details in item *2.2 - Menu CONF*.

2.2 - Menu CONF

```
⇨ CF        PRG        MEM        DSP
   SC        BT        DT    BZ    TU
```

CF: Selects the temperature unit between ºC and ºF. The ITS-90 or IPTS-68 temperature scales are selected for both the thermo-element input and for the internal reference of the measuring surface

```
⇨ ºC-90              ºF-90
   ºC-68              ºF-68
```
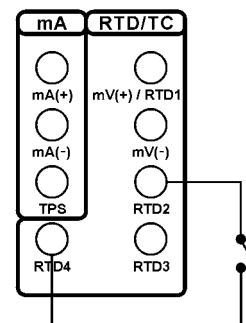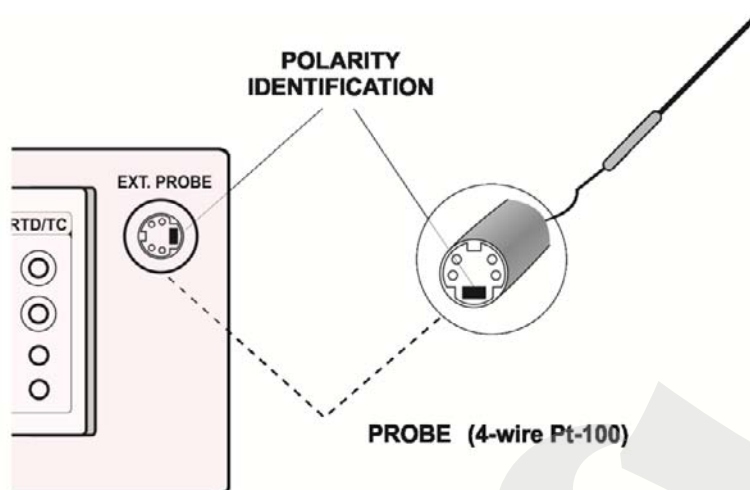
If the Pt-100 RTD input has been previously selected, this menu changes by adding the options °C-CvD and °F-CvD:

```
   ºC-68              ºF-68
⇨ ºC-CvD             ºF-CvD
```

In these options it is possible to configure the Callendar-Van Dusen curve parameters for the Pt-100 RTD input. These coefficients belong to the equation described below:

$$R(t) = R0.\{1 + A.t + B.t2 + C.t3.(t\text{-}100)\}, C = 0 \text{ for } t \geq 0°C$$

This equation is generally used in the IPTS-68 temperature scale, where t refers to the temperature in this scale and R_0 to the resistance at 0 °C. However, it can also be used in the ITS-90 scale.

Set the coefficients R0, A, B and C and their respective exponents in E_A, E_B, E_C.

```
⇨ R0        A        B        C
   E_A        E_B        E_C
```

To enter the value of a coefficient, it must be split into a mantissa and an exponent as it is used in scientific notation. For a C coefficient equal to -3.151052×10^{-2}, for example, type its mantissa (na integer and a fractional part with six digits) in the **C** mnemonic and its exponent, as an absolute value, in the **E_C** mnemonic. In this way, **C** = -3.151052 and **E_C** = 2.

Note that the signal can be inverted by pressing the key **ZERO** when the number on the display is zero. This changes the signal from **+** to **-**, or vice-versa.

The coefficients for the ITS-90 scale according to the IEC-60751 standard are shown below:

$R_0 = 100.00000$	
A = +3.908300	E_A = 03
B = -5.775000	E_B = 07
C = -4.183000	E_C = 12

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 when the calibrator 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 ISOPLAN, 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 ISOPLAN 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 set point 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 heating. More details in section *6 - PID Control Parameters*.

⇨ K	I	D	FACT

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	DEC_PRB
SP	PRBe

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

```
⇨ DEFAULT
   0        1        2        3        4
```

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

```
   0        1        ⇨ 2
```

SP: 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 set point configuration.

```
⇨ 10%          20%          25%
   VARIABLE
```

Change the configuration to 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 **SET POINT HIGH** and **SET POINT 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 set point, 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 **SET POINT HIGH** and **SET POINT LOW**.

PRBe: This option enables the use of an external probe for the reading of the dry block temperature when selecting **YES**. In order to disable it, select **NO**. When enabling the external probe, configure the probe calibration parameters in the **PARAM** menu and the temperature unit in **CF** as degrees Celsius or Fahrenheit. The calibration parameters correspond to the R_0, A, B, and C coefficients of the Callendar-Van Dusen equation, which must be configured as described for the **CF** option of the **CONF** menu.

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 desired number of decimals and the

maximum and minimum values of the transmitter scale. The scaled value is shown on the display with the **#** unit.

For example, for a temperature transmitter with 0-100 ºC input and 4-20 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-500PS 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**).

```
⇨ WRITE              RECALL
  CLEARALL
```

Selecting the option **WRITE** or **RECALL**, the display 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 indicates the value of the selected temperature value in the block, in addition to the current surface temperature value or the indication of the input selected in the calibrator.

There are 6 ways to show the information, covering the calibrator input value (**IN**), the block temperature (**PRBi**, measured by the internal probe), the external probe temperature (**PRBe**) and the temperature set point (**SET**). The key ⇦ interchanges the display presentation mode:

```
IN = 23.456 mV
PRBi = 25.01 ºC
```

```
PRBi = 25.01 ºC
SET = 25.00 ºC
```

```
23.456 mV
```

```
25.01    PRi
         ºC
```

```
25.10    PRe
         ºC
```

```
IN = 23.456 mV
PRBe = 25.10 ºC
```

The temperature set point 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 set point.

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

The key ⇨ does not have function in the manual operating mode of the T-500PS calibrators.

2.4 - Programmable Operating Mode

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

The display shows **STEPn** beside the block temperature set point value in the programmable mode. The number of the program is indicated by **n**. Using the keys ⇧ and ⇩, the programmed values of temperature set point 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 ±0.15 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-500PS calibrators. The configuration, as well as the calibration verification is carried out by the calibrator itself. Also it is possible to use the ISOPLAN software and its work orders, like a CAC - Computer Aided Calibration.

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

```
  TAG          EXEC          VERIF
  ADDRESS          ⇨ TAGMAN
```

Before you start programming, configure the signal that will be read by the calibrator in the menu **IN**. To calibrate thermometers with local indication, 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 temperature generation 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 set point 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-500PS calibrator. 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 ISOPLAN 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 ISOPLAN, 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-500PS 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 ISOPLAN software, configure **ADDRESS** to 1.

3.0 - Usage recommendations

The surface sensors generally have a fast reading response. To carry out the measurements, simply place the surface of the thermocouple in the measuring area of the calibrator and wait a few moments until its stabilization.

As the T-500PS calibrator works at high temperatures, always have a suitable place for sensor rest after the readings to avoid risk of accidents until they return to room temperature.

It is recommended the use of the T-500PS calibrator in a controlled temperature environment. Do not allow fans or air conditioner outputs to be directed to the temperature surface.

To increase the accuracy of the temperature display, an external sensor can be purchased as an option. An RTD sensor can be supplied with the *Callendar-Van Dusen* curve parameters that can be configured for the T-500PS Calibrator RTD input or for the external probe input.

4.0 - 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.

5.0 - Calibrator Warning Messages

Warning	Meaning	Procedure
RAM ERROR READ MANUAL	Problem in RAM memory	Turn the calibrator off and on. If the error persists, contact technical support
EEPROM ERROR READ MANUAL	Problem in EEPROM memory	Same as the previous item
LOW BATTERY	Level of battery voltage is low	Check the 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

6.0 - PID Control Parameters

The T-500PS surface sensor calibrator has a PID control algorithm to calculate the control output of the measurement area.

The 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 set point 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 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 set point control. While an error persists between the set point 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. If 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
```

Choose the input range (**IN**). 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 of the range.

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 with a thermometer. Store only the 1st point.

Cold Junction	1st point
CJC	32.03 ºC (measured value)

7.2 - Probe Calibration

The options of calibration / probe are:

⇨ ºC	RESTORE

ºC: Adjust of the internal temperature sensor.

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

To readjust the internal probe, it is necessary to make a comparison between the value indicated by the calibrator (Probe) and the temperature value of another external probe of very high accuracy measured in a super thermometer (ST) and inserted in the lateral hole of the measurement area ($\varnothing$ 3 mm).
The option to adjust the internal sensor has seven points of adjustment. These points are recorded via keys 1 to 7.
Before starting the 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 (set points from the table), writing down the value indicated by the super thermometer (ST). Now, go back to the option Calibration/ Probe / ºC and record the values indicated by the super thermometer.

Set point of the temperature generated (ºC)	Initial value to record (ºC)	ST indication	New value to record	New indication of the ST	key
50	50.00	49.971	49.97	49.995	key 1
125	125.00	124.964	124.96	124.995	key 2
200	200.00	199.943	199.94	199.990	key 3
275	275.00	274.906	274.91	275.009	key 4
350	350.00	349.847	349.85	350.000	key 5
425	425.00	424.815	424.82	424.995	key 6
500	500.00	499.782	499.78	500.005	key 7

8.0 - Maintenance

8.1 - Hardware Instructions

There are no parts or components in the T-500PS temperature calibrators that can be repaired by the user. Only the 6.3 Amp fuse, placed within the socket on the rear can be replaced by the user

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. Contact the Presys Technical Support in this case.