

# PRESYS®



## Calibration Bath Stirred Liquid or Dry Block Extra Large Calibration

### TA-35NLL



## Technical Manual

EM0455-00



## WARNING!

Avoid electric shock risk on touching the equipment:  
- Use only suitable power cable with earth connection;  
- Never power the equipment to the mains socket with no earth connection.



## WARNING!

High voltage is present inside these equipments. 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 these equipments.  
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!

The instruments described in this technical manual are equipment for use in specialized technical area.  
The user is responsible for configuration and selection of values of the parameters of the instruments.  
The manufacturer warns against the risk of incidents with injuries to both persons and property, resulting from the incorrect use of the instrument.



## 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. If, by chance, it happens a jamming situation, refer to item 6.2 - *Instructions for Insert Jamming* to proceed properly.

## Disposal calibrator:



### NO HOUSEHOLD WASTE!

The calibrator of the series TA Calibrator consist of various different materials. It must not be disposed of with household waste.

The warranty conditions are available in our sites:  
[www.presys.com.br/warranty](http://www.presys.com.br/warranty)

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## 1 - Introduction



### TA-35NLL

The Temperature Advanced Calibrator **TA-35NLL** generates temperatures from -35 °C to 140 °C in the insert in order to calibrate thermocouples, RTDs, glass thermometers, thermo-switches. Besides providing high accuracy temperature values, it also allows the measurement of signals generated by the thermo-element which is 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 mA, stirred liquid and blackbody source.

The calibrator also provides an input for an external probe to perform the temperature control from a standard sensor (optional) inserted in the same measuring zone of the sensor to be calibrated, increasing the accuracy and decreasing setpoint errors and loading effects. The standard sensor calibration curve follows the parameterization of Callendar-Van Dusen or ITS-90.

They present a wide variety of programming resources, allowing the performance of automatic calibrations. In this case, the sensor is placed in the insert and its electrical terminals are connected to the embedded calibrator. The operator defines the calibration points and the number of repetitions (task), then the process is started, and all the sequence is automatically accomplished. After completing the task, a Calibration Report is issued, and it can be printed directly on a USB connected printer or a PDF document can be generated.

It has HART® communication (optional) for reading and setting parameters of field devices that have this protocol.

Another way of performing automatic documented calibrations is by means of Calibration Software for PC/Windows™, which uses USB communication or Ethernet to connect the computer.



**TA Calibrators** have also many other features, such as:

- RTD input for 2, 3 and 4 wires. Table IEC 60751, JIS or *Callendar-Van Dusen* and ITS-90 user-configurable. Engineering units configurable to °C, °F and K.
- Present inputs for mA, thermocouples, and thermo-switches.
- Thermo-element reading scaled to ITS-90 or IPTS-68.
- Use of internal standard thermometer.
- Display accuracy to 0.1 °C, stability better than 0.01 °C and resolution of 0.01°C.
- Carry out completely automatic calibrations without the use of a computer.
- Built in Web Server, Ethernet communication and USB serial Communication.
- USB port for software/firmware upgrade.
- HART® Communication Protocol (optional) with internal resistance configurable, transmitter power supply and latest DD as option.
- The electric signal calibrator is independent from the dry block function.
- Display indication when the temperature reaches the desired value.
- 5.7 inches touchscreen display that eases the operation and configuration of the calibrator.
- Internal regulated 24 Vdc power supply for 2-wire transmitters.
- Independent circuit for over-temperature protection and safety.
- Insert to choose, soft carrying case, handles and test leads included.

### 1.1 - Technical Specifications

<b>TA-35NLL</b>	
<b>Operating Range</b>	-35 °C to 140 °C <sup>(1)</sup>
<b>Display Accuracy</b>	± 0.1 °C
<b>Resolution</b>	± 0.01 °C
<b>Stability</b>	better than ± 0.01 °C
<b>Radial Uniformity:</b> (homogeneity)	< 0.007 °C (Stirred Liquid)
<b>Axial Uniformity</b> (homogeneity)	< 0.008 °C (Stirred Liquid)
<b>Heating Time</b>	60 minutes (25 °C to 140 °C)
<b>Cooling Time</b>	70 minutes (25 °C to -35 °C)
<b>Electric Power</b>	450 W
<b>Well Diameter x Depth</b>	∅ 59 mm x 170 mm
<b>Weight</b>	14,8 kg
<b>Dimension (HxWxD)</b>	399x 199 x 353 mm

(1) Ambient Temperature: up to 23 °C.



**NOTE:** Continuous use at temperatures above 140 °C may lead to reduced efficiency and service life of the calibrator heating/cooling system.

### 1.1.1 - Input Technical Specifications

	Input Ranges	Resolution	Accuracy	Remarks
<b>Ext. Probe<sup>1</sup></b>	0 to 400 Ω	0.01 Ω	± 0.005 % FS	
<b>Ext. Probe<sup>1</sup></b>	-200 to 850 °C / -328 to 1562 °F	0.01 °C / 0.01 °F	± 0.05 °C / ± 0.1 °F	IEC-60751
<b>millivolt</b>	-150 mV to 150 mV 150 mV to 2450 mV	0.001 mV 0.01 mV	± 0.01 % FS* ± 0.02 % FS	R <sub>input</sub> > 10 MΩ auto-ranging
<b>mA</b>	-1 mA to 24.5 mA	0.0001 mA	± 0.01 % FS	R <sub>input</sub> < 120 Ω
<b>resistance</b>	0 to 400 Ω 400 to 2500 Ω	0.01 Ω 0.01 Ω	± 0.01 % FS ± 0.03 % FS	Excitation current 0.85 mA auto-ranging
<b>Pt-100</b>	-200 to 850 °C / -328 to 1562 °F	0.01 °C / 0.01 °F	± 0.1 °C / ± 0.2 °F	IEC 60751
<b>Pt-1000</b>	-200 to 400 °C / -328 to 752 °F	0.1 °C / 0.1 °F	± 0.1 °C / ± 0.2 °F	IEC 60751
<b>Cu-10</b>	-200 to 260 °C / -328 to 500 °F	0.1 °C / 0.1 °F	± 2.0 °C / ± 4.0 °F	Minco 16-9
<b>Ni-100</b>	-60 to 250 °C / -76 to 482 °F	0.1 °C / 0.1 °F	± 0.2 °C / ± 0.4 °F	DIN-43760
<b>TC-J</b>	-210 to 1200 °C / -346 to 2192 °F	0.1 °C / 0.1 °F	± 0.2 °C / ± 0.4 °F	IEC 60584
<b>TC-K</b>	-270 to -150 °C / -454 to -238 °F	0.1 °C / 0.1 °F	± 0.5 °C / ± 1.0 °F	IEC 60584
<b>TC-K</b>	-150 to 1370 °C / -238 to 2498 °F	0.1 °C / 0.1 °F	± 0.2 °C / ± 0.4 °F	
<b>TC-T</b>	-260 to -200 °C / -436 to -328 °F	0.1 °C / 0.1 °F	± 0.6 °C / ± 1.2 °F	IEC 60584
<b>TC-T</b>	-200 to -75 °C / -328 to -103 °F	0.1 °C / 0.1 °F	± 0.4 °C / ± 0.8 °F	
<b>TC-T</b>	-75 to 400 °C / -103 to 752 °F	0.1 °C / 0.1 °F	± 0.2 °C / ± 0.4 °F	
<b>TC-B</b>	50 to 250 °C / 122 to 482 °F	0.1 °C / 0.1 °F	± 2.5 °C / ± 5.0 °F	IEC 60584
<b>TC-B</b>	250 to 500 °C / 482 to 932 °F	0.1 °C / 0.1 °F	± 1.5 °C / ± 3.0 °F	
<b>TC-B</b>	500 to 1200 °C / 932 to 2192 °F	0.1 °C / 0.1 °F	± 1.0 °C / ± 2.0 °F	
<b>TC-B</b>	1200 to 1820 °C / 2192 to 3308 °F	0.1 °C / 0.1 °F	± 0.7 °C / ± 1.4 °F	
<b>TC-R</b>	-50 to 300 °C / -58 to 572 °F	0.1 °C / 0.1 °F	± 1.0 °C / ± 2.0 °F	IEC 60584
<b>TC-R</b>	300 to 1760 °C / 572 to 3200 °F	0.1 °C / 0.1 °F	± 0.7 °C / ± 1.4 °F	
<b>TC-S</b>	-50 to 300 °C / -58 to 572 °F	0.1 °C / 0.1 °F	± 1.0 °C / ± 2.0 °F	IEC 60584
<b>TC-S</b>	300 to 1760 °C / 572 to 3200 °F	0.1 °C / 0.1 °F	± 0.7 °C / ± 1.4 °F	
<b>TC-E</b>	-270 to -150 °C / -454 to -238 °F	0.1 °C / 0.1 °F	± 0.3 °C / ± 0.6 °F	IEC 60584
<b>TC-E</b>	-150 to 1000 °C / -238 to 1832 °F	0.1 °C / 0.1 °F	± 0.1 °C / ± 0.2 °F	
<b>TC-N</b>	-260 to -200 °C / -436 to -328 °F	0.1 °C / 0.1 °F	± 1.0 °C / ± 2.0 °F	IEC 60584
<b>TC-N</b>	-200 to -20 °C / -328 to -4 °F	0.1 °C / 0.1 °F	± 0.4 °C / ± 0.8 °F	
<b>TC-N</b>	-20 to 1300 °C / -4 to 2372 °F	0.1 °C / 0.1 °F	± 0.2 °C / ± 0.4 °F	
<b>TC-L</b>	-200 to 900 °C / -328 to 1652 °F	0.1 °C / 0.1 °F	± 0.2 °C / ± 0.4 °F	DIN-43710
<b>TC-C</b>	0 to 1500 °C / 32 to 2732 °F	0.1 °C / 0.1 °F	± 0.5 °C / ± 1.0 °F	W5Re / W26Re
<b>TC-C</b>	1500 to 2320 °C / 2732 to 4208 °F	0.1 °C / 0.1 °F	± 0.7 °C / ± 1.4 °F	

(1) Accuracy referring only to input for external probe. The value does not include sensor accuracy or errors resulting from the sensor characterization.



**NOTE:** Accuracy values are valid within one year and temperature range of 20 to 26 °C. Outside these limits add 0.001 % FS / °C taking 23 °C as the reference temperature. For thermocouples, using the internal cold junction compensation add a cold junction compensation error of ± 0.2 °C or ± 0.4 °F max.





### 1.3 - Accessories

- **Dry Block Insert:**

Inserts	Holes	Order Code
IN01	7 x 6.0 mm and 1x 1/4"	06.04.0189-00
IN02	8 x 1/4"	06.04.0190-00
IN03	2 x 3.0 mm, 2x 6.0 mm, 2 x 1/4" and 2 x 8.0 mm	06.04.0091-00
IN04	2 x 6.0 mm, 2x 8.0 mm, 2 x 3/8" and 1 x 1/4"	06.04.0192-00
IN10	Other, under ordering	-----

Description	Order Code
Soft Carrying Case for TA-NLL models	06.01.1032-00
Insert Extractor	02.06.0085-20
Lead Cable Kit	06.07.0018-00
Power Cable Type J – Brazil	01.14.0008-21
Power Cable Type B – US	01.14.0100-21
Power Cable Type F – Europe Universal	01.14.0089-21
Power Cable Type J – UK	01.14.0117-21

**Accessories included:**

- 01 x Soft Carrying Case;
- 01 x Insert;
- 01 x Isolation for Insert;
- 01 x Power Cable;
- 01 x Probe Adapter;
- 01 x Lead Cable Kit;
- 01 x Ethernet Cable;
- 01 x Wi-Fi Adapter;
- Technical Manual;
- 01 x Factory Calibration Certificate.

**Stirred Liquid Kit Insert (Optional)**

Order Code: **AG**

**Kit Includes:** magnetic stirrer, sensor guide, support kit for sensors, specific kit for glass thermometers and carrying case. For use with two or more different fluids, it is recommended to purchase a kit for each fluid. This reduces the time spent with fluid exchange and kit cleaning.

**Black Body Insert (Optional)**

Order Code: **BB**

**Kit Includes:** Insert type jug completely anodized - wall and special bottom in black, creating a cavity of high-emissivity blackbody for calibration of infrared thermometers.

**Surface Insert (Optional)**

Order Code: **SI-59-170**

**Includes:** Insert - Dimensions: length: 215mm / Diameter: 59mm

Wells for standard - Diameter: 3mm / 4mm / 1/8".



### 1.4 - Parts Identification

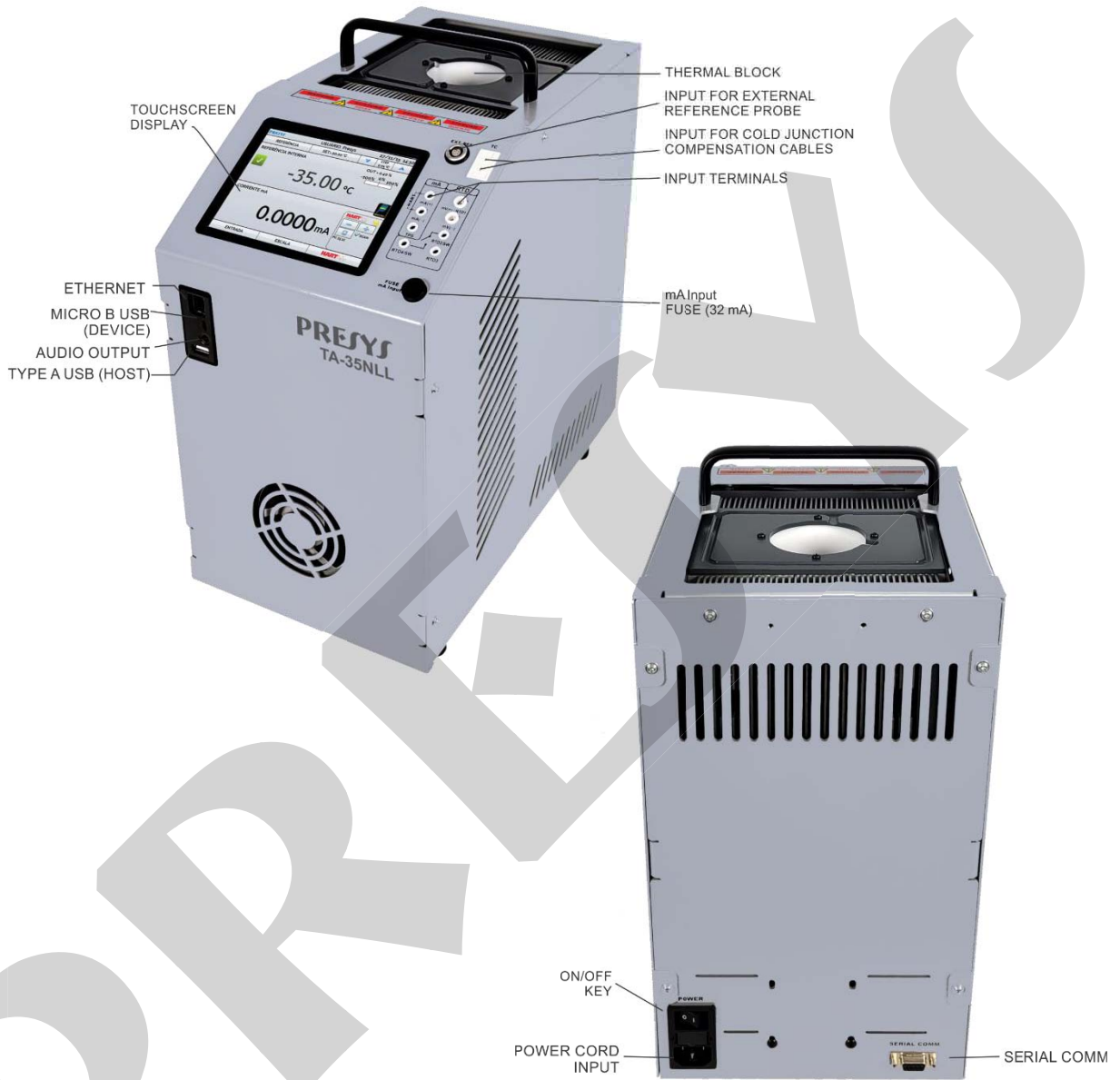
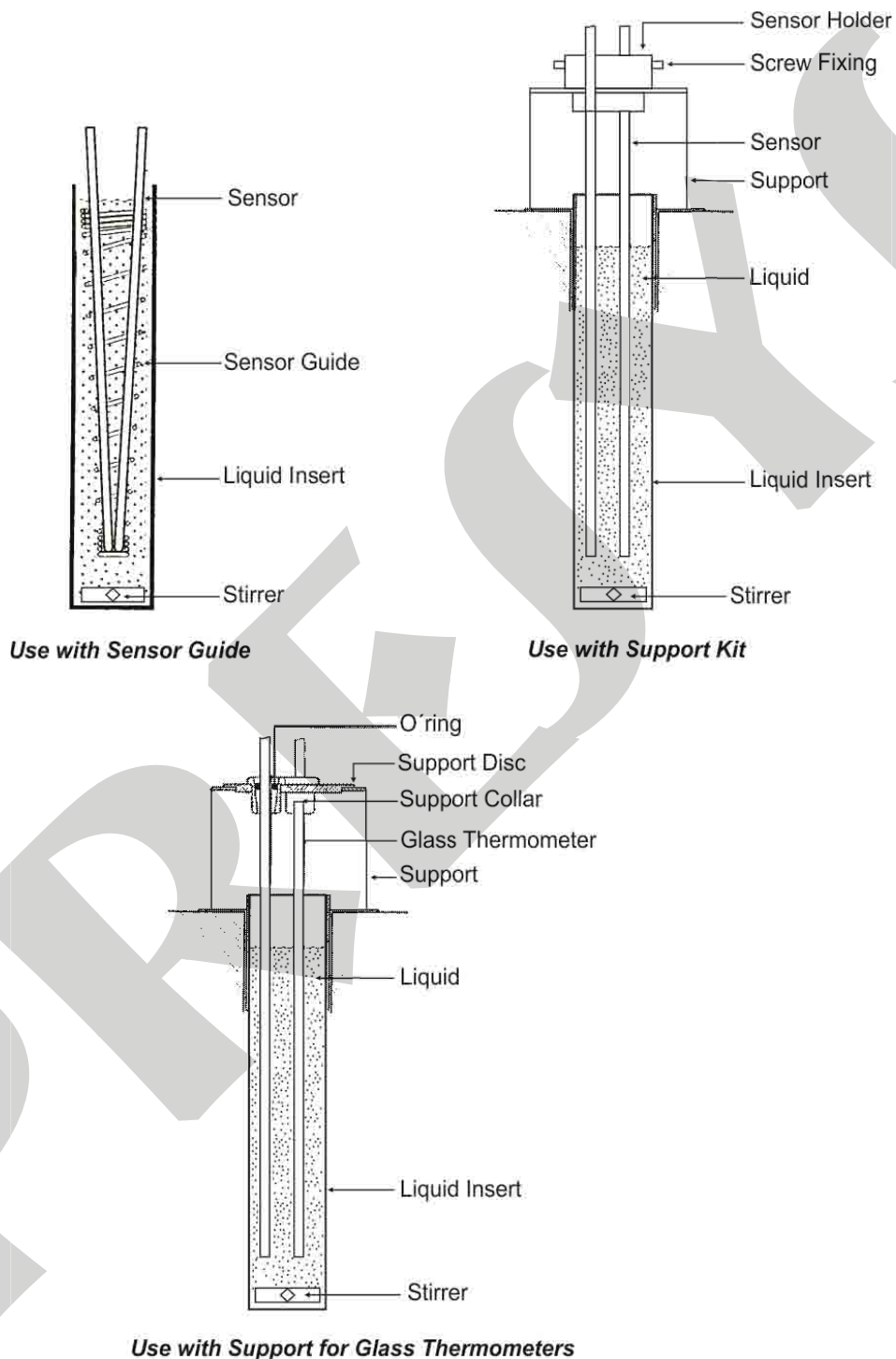


Fig. 01 - Parts Identification

### 1.5 - Instructions for Optional

- **Stirred Liquid Kit**




**Fig. 02 - Uses of Stirred Liquid Kit**

**Thermal Fluids suitable for use with the insert (AG)**

Low viscosity and safe operating temperature are the most important characteristics when choosing a heat transfer fluid to produce high homogeneity in the bath. How less viscous, how better the fluid circulation will be and homogeneous heat produced in the middle.

We recommend using the following heat transfer fluids for models TA-35NLL:

Viscosity	Fluid	Flash point*	Useful range
 Viscosity increases	Ethyl alcohol	16 °C	-50 °C to 15 °C
	Mixture of ethylene glycol and water (50% of each)	-----	-30 °C to 90 °C
	Water	-----	5 °C to 90 °C
	Silicone oil type 200.05	133 °C	-40 °C to 130 °C
	Silicone oil type 200.10	211 °C	-30 °C to 209 °C



**NOTE:** Flash point is the temperature at which a vapor will ignite if exposed to a flame. When the flame is removed, the vapor stops burning.

At temperatures near the lower end of the range, the thermal fluid becomes very viscous. It can disturb the circulation and increase the cooling time. Above the upper end, there is high evaporation of the fluid compromising the stability of the thermal medium.

If you use the insert with stirred liquid, it is necessary to insert the magnetic stirrer (cross shape) at the bottom of the provided insert. The speed of the stirrer is regulated through the **STIRRER** option in Calibrator mode. Press **STIRRER** to turn on and off the stirrer, and select the speed between Low, Medium, and High options in - and + buttons.

A good fit ensures good uniformity for various types of fluids: alcohol (low temperature), silicone oil (high temperature) etc. Be careful not to accelerate too much the motor so that the magnetic stirrer stops rotating at the bottom of the insert. This will worsen the good homogeneity of the calibrator.

To use the insert with the stirred liquid a good practice is to place first the sheath of the probes or thermometers to be calibrated and then fill up the fluid to a level around 2.5 cm below the top of the insert. This ensures that no overflow occurs either by the introduction of sensors, or by thermal expansion of the fluid. If the level starts to fall during use due to evaporation of the fluid, fill up again adding more fluid. Thus, the minimum immersion will not be compromised.

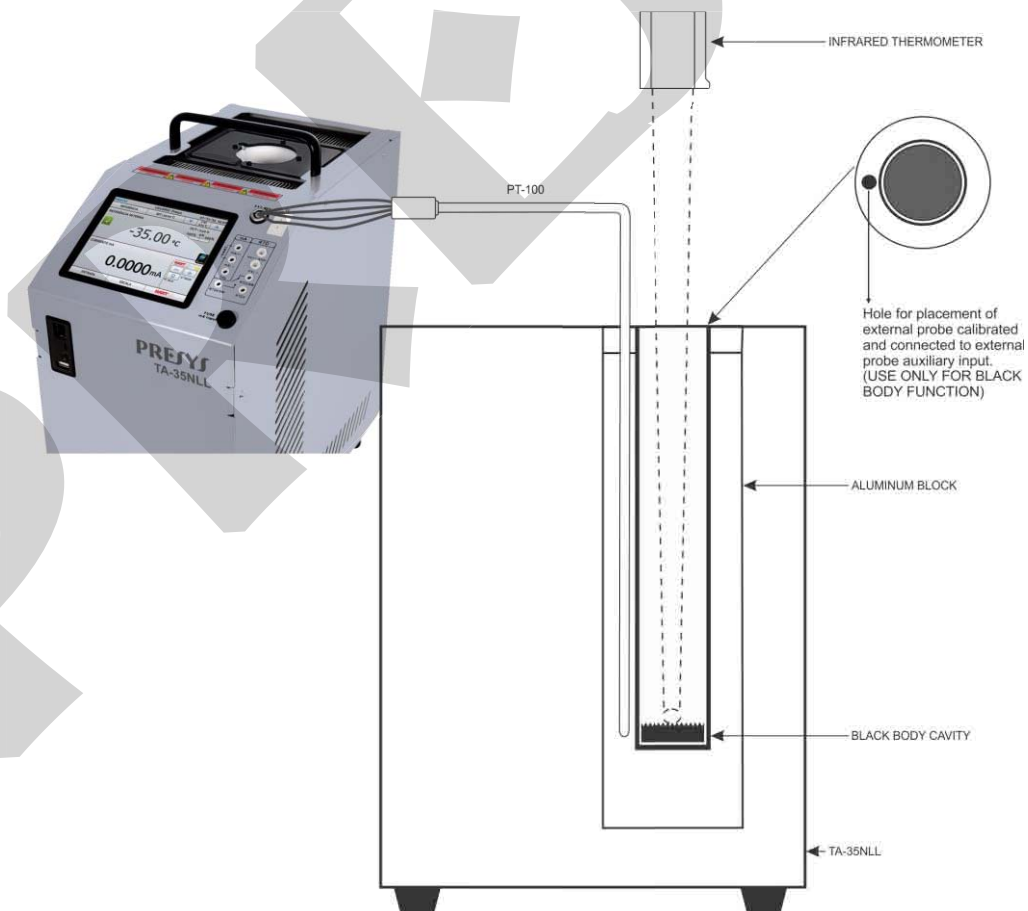
For more accurate measurements use a calibrated probe placed together with the sensors to be calibrated and connected to the external probe input. The calibrator will now control the temperature of the block using this temperature as reference (see item 2.1.2 - External Probe Connection). It is also possible to read the indication of this probe in the RTD Pt-100 auxiliary input.

**Black Body Insert (BB)**

Placing the insert BB inside the well of the block of the calibrator provides it with a good black-body cavity with emissivity above 0.95, suitable for calibration of infrared thermometer.

For more accurate measurements use a calibrated probe placed in the side hole of the bath and connected to the external probe input. The calibrator will then control the block temperature using this temperature as a reference. It is also possible to read the indication of this probe in the Pt-100 RTD auxiliary input.

Align the infrared thermometer to be calibrated with a black body cavity of the calibrator in a vertical position. The distance of the thermometer to be calibrated in relation to the bottom of the blackbody cavity should comply with specification of its technical manual.



**Fig. 03 - Schematic View of the Black Body Insert Assembly**



## 1.6 - Instructions for Top Insulation

Always use the insulation on top of the insert to ensure that calibrations are performed correctly. Note that the sensors to be tested must go through the insulator and deeper into the metal insert for a correct temperature measurement.

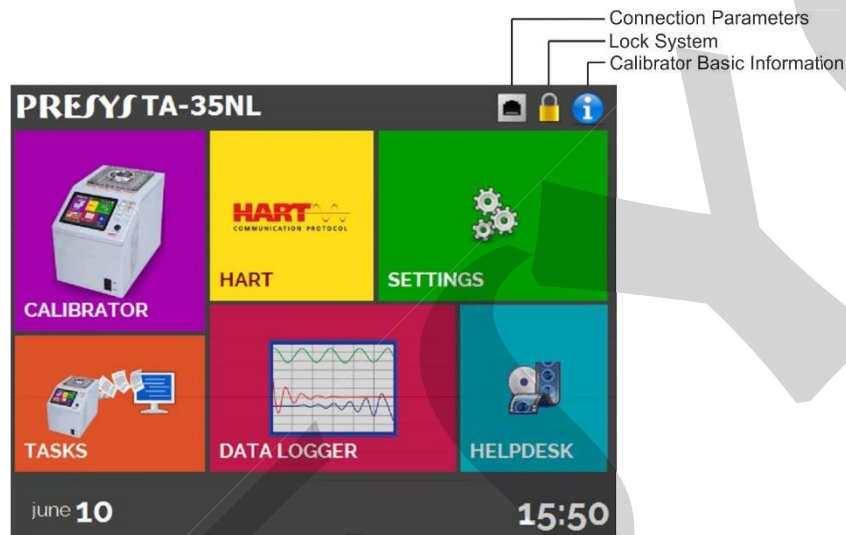


Fig. 04 - Top Insulation

## 2 - Calibrator Operation

When powered on, the calibrator goes through a self-test routine and shows the last adjustment date, and it is ready to operate.

After the self-test is completed, the display shows the main menu:



**Fig. 05 - Main Menu**

The main menu is divided in 06 (six) functions:

**CALIBRATOR** - selects the probe and input functions, see section 2.1

**HART®** - optional module that allows communication with devices that have HART® protocol, see section 2.2.

**TASKS** - performs calibrations automatically, see section 2.3.

**DATA LOGGER** - record measurements, enabling visualization in chart or table, see section 2.4.

**HELP DESK** - help videos and documents to assist the user, see section 2.5.

**SETTINGS** - general instrument settings, see section 2.6.

## 2.1 - Calibrator Menu

To select the probe set point or electrical input functions, from the main menu, press the **CALIBRATOR** button. The following screen is displayed.

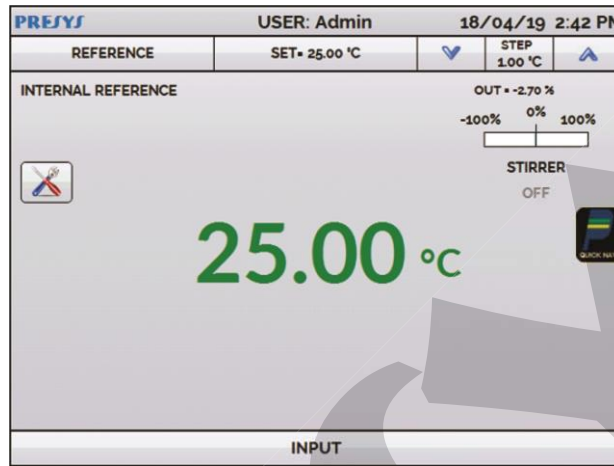


Fig. 06 - Calibrator Function

At the top is shown the probe settings and values. The centered value shows the block temperature. The **GREEN** color indicates that the temperature is stable, otherwise it is **RED**.

The set point value appears on the top. Touch in the **SET** bar to change it or touch on the block Temperature value. Pressing on the temperature unit it can be changed between °C (Celsius), °F (Fahrenheit) or K (Kelvin).

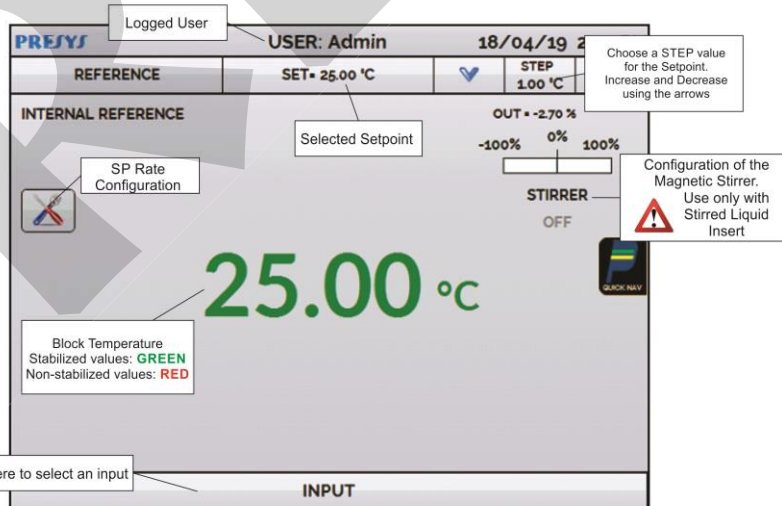




Fig. 07 - Calibrator Mode

In the **STEP** function, a step value can be configured, and the steps can be changed through the up and down arrows.

In  (SP RATE configuration) the user can change the heating / cooling rate of the block temperature. The value must be inserted in temperature unit per minute (°C/min; °F/min; K/min) depending on the temperature unit previously selected.

In **REFERENCE** menu, you can configure the type of probe reference (see section 2.1.1 – Probe Settings). The chosen reference appears just below the **REFERENCE** button.

At the bottom, an input can be configured. When the input is selected, the screen will split automatically. To select an input, just touch the **INPUT** bar.

The icon  shows a **Quick Navigator**, with the options for Main Menu (**HOME**), **Data-Logger** and **Tasks**. Pressing the **MENU** button, there is an option for the **Memory Manager** (see section 2.1.4 – Saving Current Configuration).

Furthermore, it brings information about the probe/auxiliary input configuration and IP address. Press **BACK** to return to Calibrator Mode or **HOME** to go to Main Menu.



Fig. 08 - Quick Navigator and Secondary Menu

### 2.1.1 - Probe Settings

There are two different references to control the thermal block: **Internal Reference** and **External Reference**.

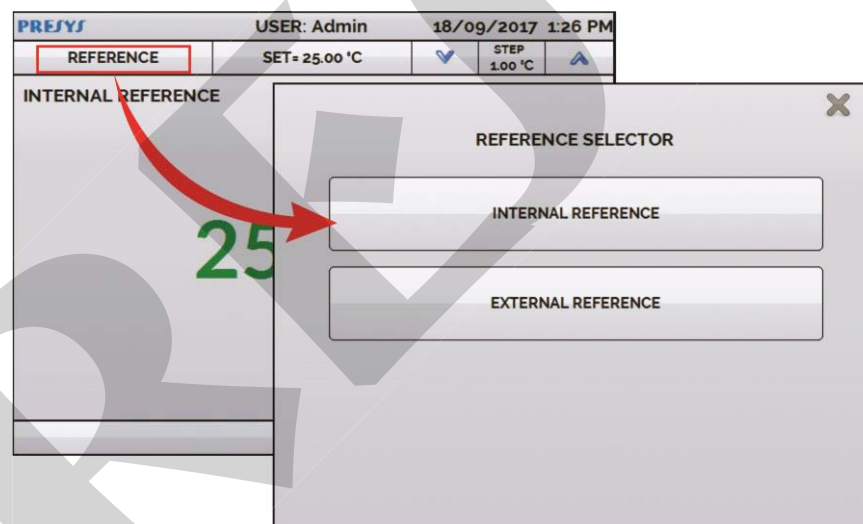
The **Internal Reference** is a sensor built into the block.

The **External Reference** is an option for more accurate measurements. The control reference comes from a Standard Sensor placed inside the insert, among the DUT (devices under test). This Standard Sensor, with *Callendar-Van Dusen* or ITS-90 parameters, eliminates adjustment errors and block loading effects.

It can be used both in control and measurement mode. When used in measurement mode, the probe indication is displayed on the screen and the control is made by the internal probe.



**NOTE:** the values corresponding to controlled temperatures appear in **GREEN** or **RED**. Values that show only the sensor indication appear in **BLACK**.



**Fig. 09** - Choosing the Type of Temperature Reference

To select the Reference between Internal and External, touch the **REFERENCE** bar. When selecting External Reference, a sensor for reference must be chosen. Then, select if the control will use the external probe or not. See below how to add sensors by setting their parameters for *Callendar-Van Dusen* or ITS-90 curves.

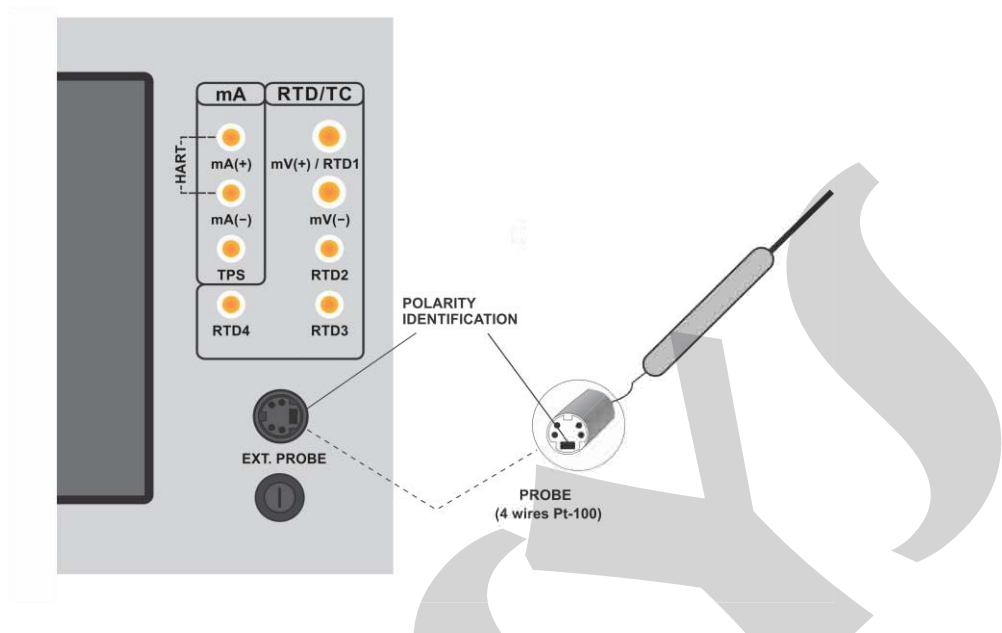


Fig. 10 - Connecting the Standard Sensor for the External Reference

### 2.1.1.1 - Adding a new sensor with coefficients

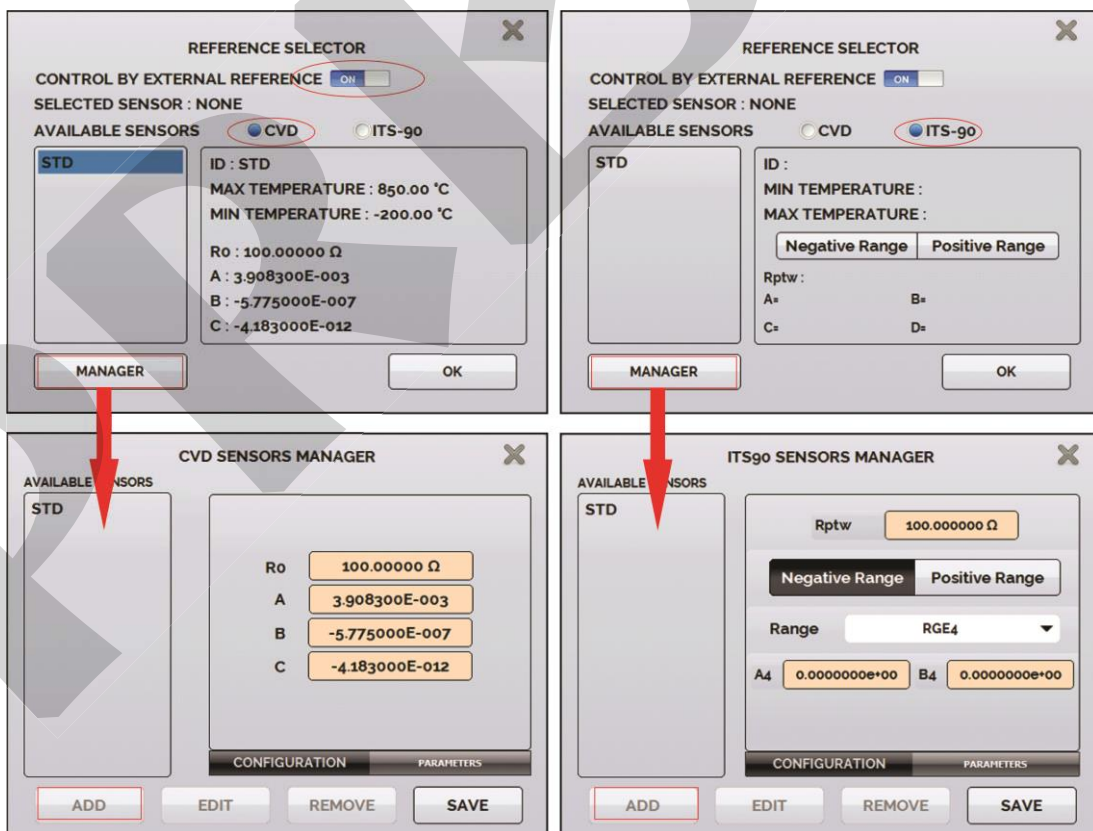


Fig. 11 - Adding a new Reference Sensor

### Callendar-Van Dusen Coefficients



**Configuration tab:**

**ID:** Set an identification for the sensor

**MIN (°C):** Lower value of the reference sensor calibrated range

**MAX (°C):** Higher value of the reference sensor calibrated range

**Parameters tab**

**R0 (Ω):** The last resistance measurement in 0 °C of the sensor

**A, B, C:** Callendar-Van Dusen coefficients

The coefficient values can be found in the Reference Sensor Certificate.

After filling the blanks, click on **SAVE** button and confirm. The new sensor is now available to be chosen in the list. To edit data from a sensor, select it and press **MANAGER** button. To remove a sensor, select it and press **REMOVE**.

**ITS-90 Coefficients:**

**Configuration tab:**

**ID:** Set an identification for the sensor

**MIN (°C):** Lower value of the reference sensor calibrated range

**MAX (°C):** Higher value of the reference sensor calibrated range

**Parameters tab:**

**Rptw (Ω):** The last resistance measurement in 0,01 °C (Triple point of Water) of the sensor

**Negative Range:** Accesses the coefficients to be used for temperatures below or equal to the temperature of the triple point of water (0.01°C).

Recommended Temperature Range (Negative)		Coefficients
Range 4	-189.3442 °C to 0.01 °C	A4 , B4
Range 5	-38.8344 to 0.01 °C	A5 , B5

**Positive Range:** Accesses the coefficients to be used for temperatures above the temperature of the triple point of water (0.01°C).

Recommended Temperature Range (Negative)		Coefficients
Range 6	0.01 °C to 961.78 °C	A6 , B6 , C6 , D
Range 7	0.01 °C to 660.323 °C	A7 , B7 , C7
Range 8	0.01 °C to 419.527 °C	A8 , B8
Range 9	0.01 °C to 231.928 °C	A9 , B9
Range 10	0.01 °C to 156.5985 °C	A10
Range 11	0.01 °C to 29.7646 °C	A11
Range 5	0.01 °C to 29.7646 °C	A5 , B5

**A, B, C:** ITS-90 coefficients

Note that the **POSITIVE** and **NEGATIVE** groups include a common range: Range 5. In case it is required to use its coefficients for the positive and negative ranges, configure the coefficients as usual for both the positive and negative ranges.

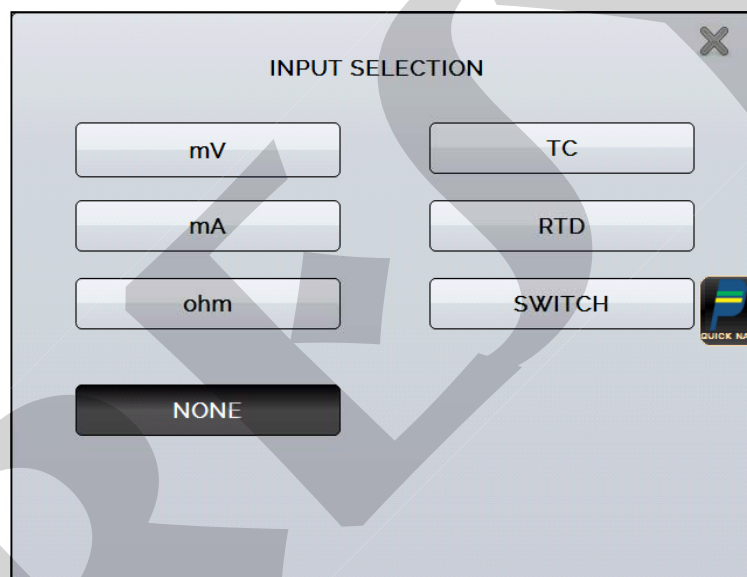
The coefficient values can be found in the Reference Sensor Certificate.

After filling the blanks, click on **SAVE** button and confirm. The new sensor is now available to be chosen in the list. To edit data from a sensor, select it and press **MANAGER** button. To remove a sensor, select it and press **REMOVE**

Further details on the International Temperature Scale and the interpolation methods used for the coefficients above, refer to: Mangum, B.W. and Furukawa, G.T., "Guidelines for Realizing the International Temperature Scale of 1990 (ITS-90)", NIST Technical Note 1265, National Institute of Standards and Technology, 1990.

### 2.1.2 - Input Settings

The **INPUT** menu has the following options:



**Fig. 12** - Input Menu Options

For **OHM** measurement, you should also select between 2, 3 or 4 wires options.

For **RTD** input, it should be chosen the type between Pt-100, Pt-1000, Cu-10 or Ni-100 (standard table used), the number of lead wires (2, 3 or 4 wires) and the temperature scale (ITS-90 or IPTS-68).

There is also the option to configure the *Callendar-Van Dusen* coefficients of the sensor, selecting the option **CVD** and the desired curve in the list.

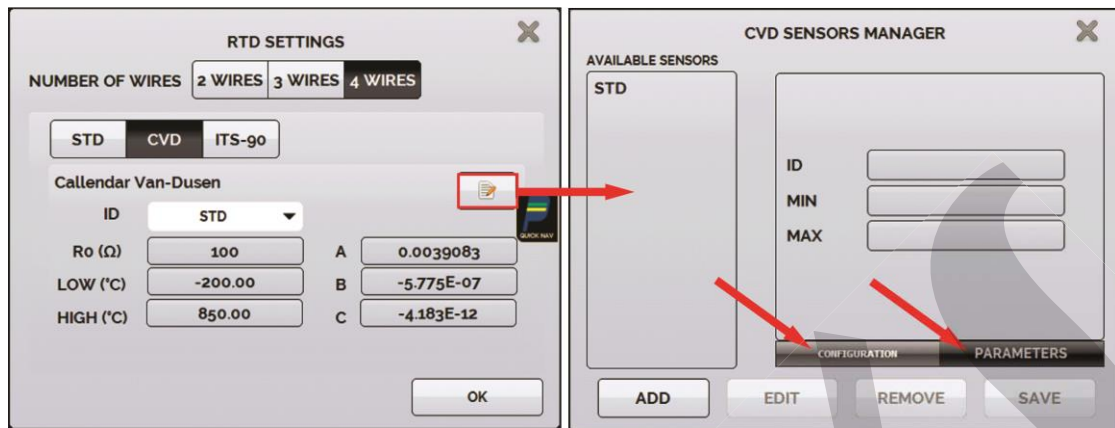



Fig. 13 - Options for RTD Input

To create new CVD or ITS-90 coefficients, press  (**edit**), and **ADD** button. The curves appear in the created list as identified in ID. To configure them, please check the item

For **TC** (thermocouple), you must select the thermocouple type and the type of cold junction compensation (CJC): **Internal** or **Manual**.

In **Internal** option, the compensation is done internally by a temperature sensor embedded in the calibrator and the algorithm.

In **Manual** you must provide the value of the temperature of the cold junction to the calibrator. In **STD**, standard curves are used for the thermocouples (ITS-90; IPTS-68). Selecting **CUSTOM**, the user can configure a customized curve with thermocouple calibration coefficients.

The configuration of the thermocouple calibration coefficients (C0, C1, C2 and C3) corrects the electromotive force (E) given by the linearization table of the thermocouple by the IEC-60584 standard. After correction, the electromotive force of the thermocouple follows this formula:

$$E' = E + C0 + C1.t + C2.t^2 + C3.t^3, \text{ where } t \text{ is the temperature in } ^\circ\text{C} \text{ and } E' \text{ and } E \text{ the electromotive force in mV.}$$

The option **SWITCH** has two ways to be used. When entering the **SWITCH** function, the input works as a continuity measurement between **RTD2** and **RTD4** terminals. When there is continuity, the input shows **CLOSED**, if not, indicates **OPEN**. The input also records the temperature value of the block at the time of contact opening / closure.

Using the option **THERMOSWITCH AUTO TEST**, the calibrator performs cycles registering the thermoswitch opening and closure interactively, in order to find the setpoint temperature of the thermoswitch and its respective hysteresis. In Setpoint Hi set a temperature above the opening of the thermoswitch contact. In Setpoint Lo, use a value below the setpoint discounted hysteresis. E.g.: To test a thermostat of 50 °C setpoint and 5 °C hysteresis, Setpoint HI can be set to 55 °C and Setpoint LO to 45 °C.

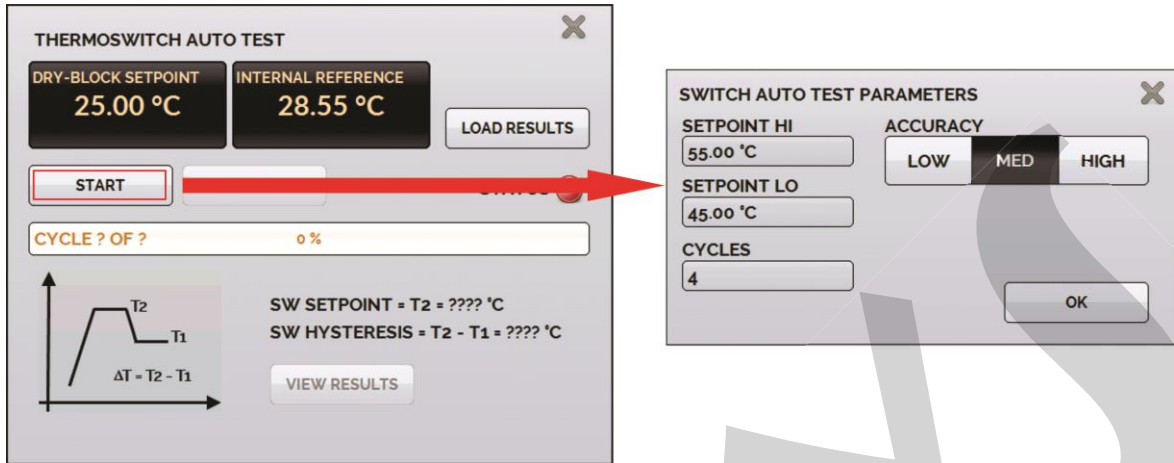


Fig. 14 - Switch Auto Test Parameters

It is important that the number of cycles be at least 3. By selecting this amount, you can check the repeatability of the thermoswitch. For the accuracy, when choosing higher accuracy levels, the temperature ramp times will be higher too. If a Report is needed for this test, use the **TASK** function.

The **NONE** option turns off the input function.

When the input sensor breaking occur (RTD, resistance or probe) the display will show the burn-out warning identified by question marks illustrated below:

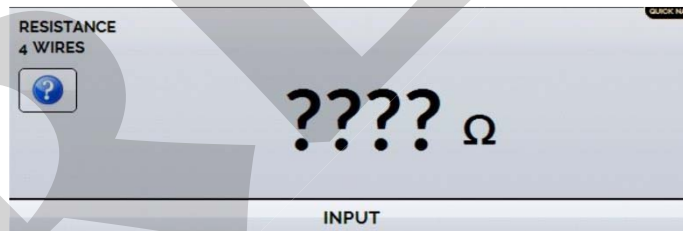


Fig. 15 - Burn-out Warning

If an out-of-range signal is injected, a message of **UNDER** or **OVER** range appears.

### 2.1.2.1 - Input Connections Diagrams

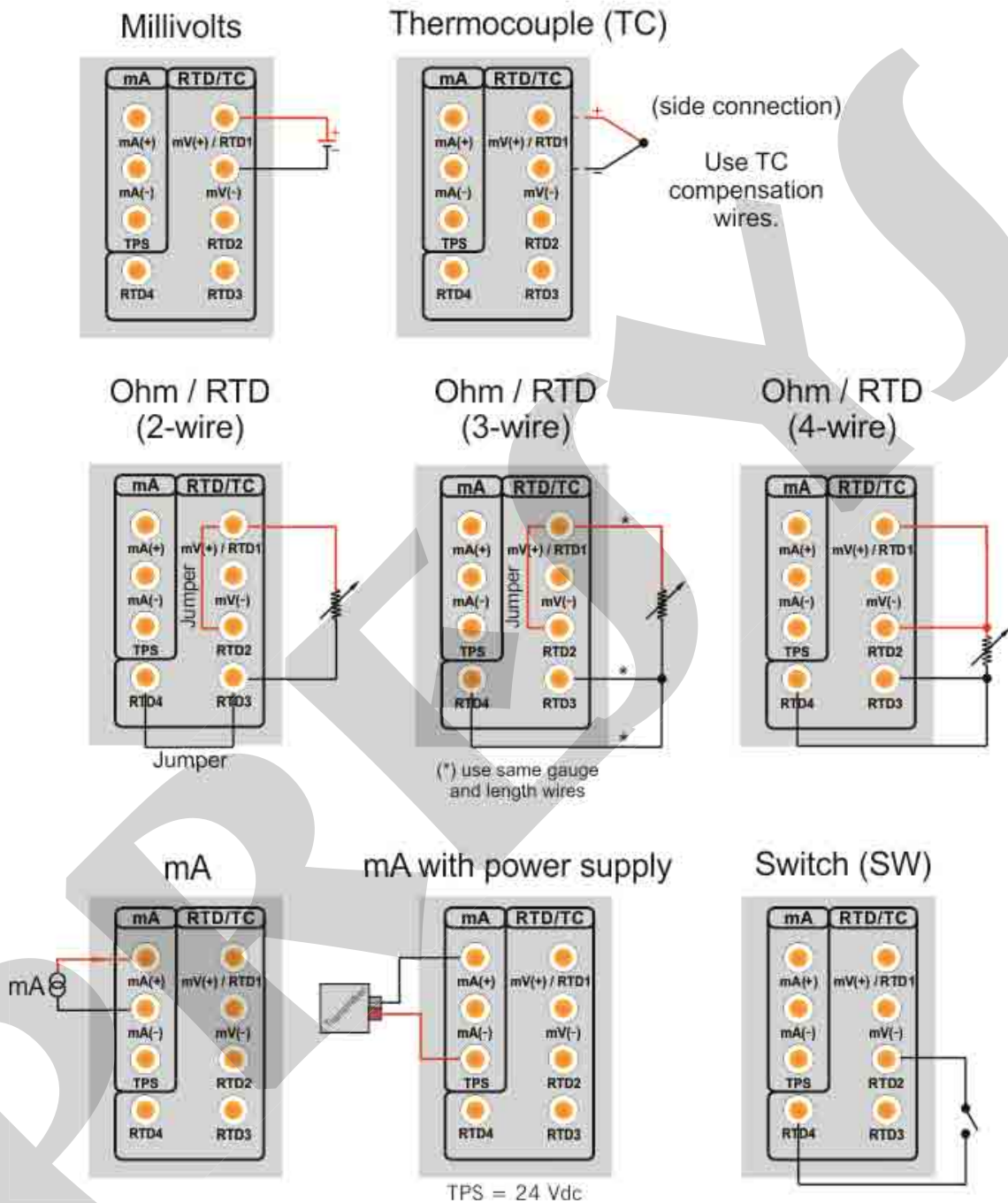


Fig. 16 - Input Connections

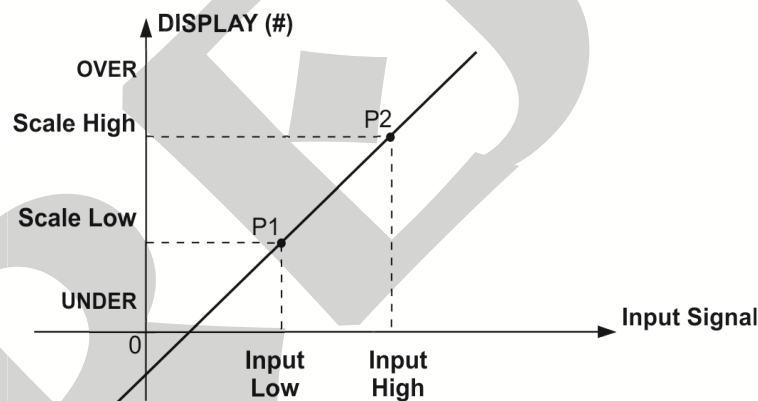
### 2.1.3 - Special Function

**SCALE:** For the current input, it is possible to use the scale function:



**Fig. 17** - Option for mA Input: SCALE

It establishes a linear relationship between the mA input signal and what is shown at the display, according to the graphic below:



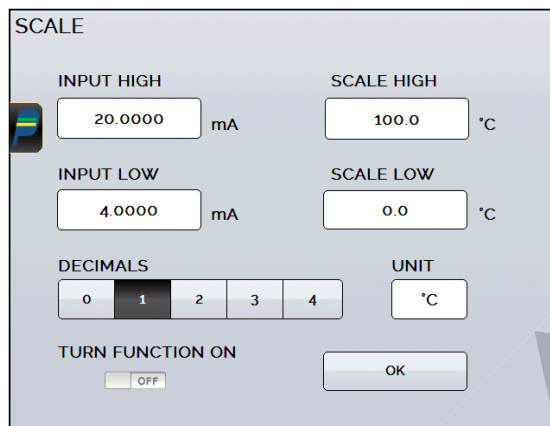
**Fig. 18** - SCALE Function (LINEAR)

The scaled indication at the display (#) may represent any engineering unit, such as: °C, % etc.

The number of decimals, up to 4, shown at the display may be configured.

The value for **Input High** must be necessarily higher than **Input Low**. On the other hand, **Scale High** and **Scale Low** may have any relationship between themselves: higher than, lower than or equal to, and they may have a signal before them. Thus direct or reverse relationships may be established.





SCALE

INPUT HIGH	SCALE HIGH
<input type="text" value="20.0000"/> mA	<input type="text" value="100.0"/> °C
INPUT LOW	SCALE LOW
<input type="text" value="4.0000"/> mA	<input type="text" value="0.0"/> °C
DECIMALS	UNIT
<input type="radio"/> 0 <input checked="" type="radio"/> 1 <input type="radio"/> 2 <input type="radio"/> 3 <input type="radio"/> 4	<input type="text" value="°C"/>
TURN FUNCTION ON	<input type="button" value="OK"/>
<input type="checkbox"/> OFF	


Fig. 19 - Scale Function Configuration



**NOTE:** To enable the Scale Function, turn the function **ON** before touching OK button. To disable, turn the function **OFF**.

### 2.1.4 - Saving Current Configuration (Memory Manager)

The TA Series calibrators admit several special functions that may become of frequent use. In these situations, it is useful to store such settings in the instrument in order to save time.

After setting the desired calibration mode (input type, probe reference or special function), press the icon  → **MENU**, and the button **MEMORY MANAGER**. On the option **CREATE NEW** can be given a name for this configuration and a description. Press the **SAVE** button.

The operation that was being performed by the TA Calibrator shall be stored in memory identified by the name given to it. To use it again, even after the calibrator is turned off and on, select the name of the desired setting and press the **LOAD** button.

The **SAVE AS DEFAULT** button sets the current configuration as the default configuration of the calibrator. Thus, every time the calibrator is turned on, this will be the initial configuration of the calibrator.

## 2.2 - HART®

The TA Series Calibrators can be used to read and set parameters in devices that have HART® Communication Protocol. The HART® Protocol allows digital communication between master (in this case, the TA Calibrator) and the slave (field instrument) superimposed on the 4-20 mA analog signal. To access this function from the main menu, select the **HART®** option.

The HART® Communication of TA Calibrators is an optional module. The calibrator has three versions: **NH** (without HART® Communication), **CH** (HART® Calibrator) and **FH** (Full-HART® configurator with DD library).

The **CH** option has basic and universal commands for HART® communication (zero, span, trim mA etc.) that allow you to adjust the range of the instrument, monitoring the primary variable, current adjustment etc. The **FH** option, in addition to basic and universal commands, is provided with the DD library (Device Description) from *FieldComm Group* and allows the setting of specific parameters of each instrument.



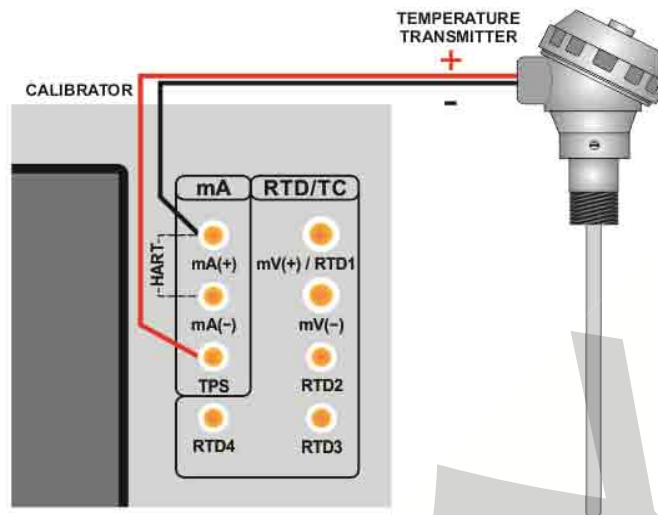
**IMPORTANT:** Up to 15 instruments are allowed in a HART® network (addresses 1 to 15). In a connection to a single field instrument, the address value will be 0, on the INPUT mA + HART® connection, the primary variable can be read both analog and digitally (HART®).

The following description is valid for **CH** and **FH** options.

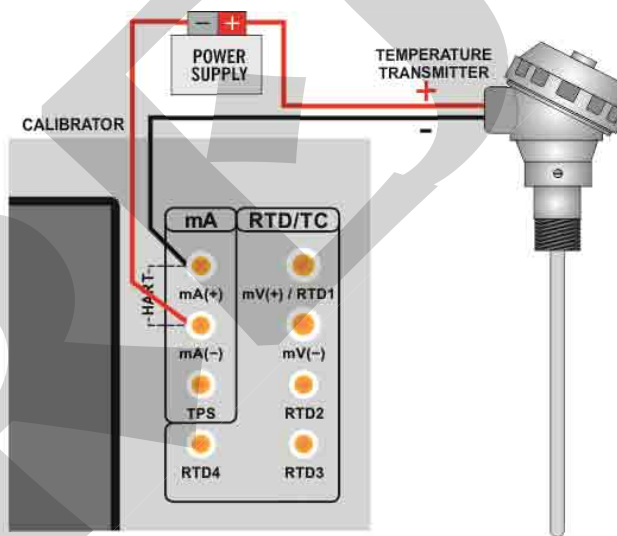
### 2.2.1 - HART® Connections

To the connections shown in **Fig. 14** and **15**, use the **mA INPUT + HART®** option and **INTERNAL RESISTOR** enabled. In this mode, the 250 Ω resistor is activated internally in series with the calibrator mA input. The calibrator can measure current from the transmitter and also read and set parameters via HART®.

If the internal resistor is not enabled, an external resistor of at least 150 Ω must be inserted in series with the mA input. To power the transmitter, can be used **TPS** source (**Fig. 20**) or an external source (**Fig. 21**).



**Fig. 120 - Transmitter Powered by the Calibrator Itself (TPS)  
mA INPUT + HART® (Internal Resistor Enabled)**



**Fig. 21 - Transmitter Powered by an External Power Supply  
mA INPUT + HART® (Internal Resistor Enabled)**

### 2.2.2 - Starting Communication

Entering the **HART®** menu, the following screen is shown. Enabling the **HART® CONFIGURATOR** option (only for **FH** version), you have access to the Full-Hart software (DD library) with all device parameters.

Disabling this option, the **CH** software is launched with basic and universal commands for HART® communication (zero, span, trim mA etc.).

Enable the use of the internal resistor (250 Ω) and the HART® connection type configuration (**mA Input + HART®** or **HART® only**). For CH mode, in the next window, select the address of the instrument to establish the communication. If the address of the instrument is unknown, tap the **SEARCH** button. The calibrator will then perform a scan for all devices that are connected in an address range from 0 to 15. If the calibrator has found the device, you can press the **STOP** button, located in the lower right corner of the screen to cancel the scan.



**NOTE:** Up to 15 instruments are allowed in a HART® network (addresses 1-15). In a connection with a single field instrument, the address value will be 0. In the mA + HART® INPUT connection, the primary variable can be read either analog (4 to 20 mA) or digital (HART®). In the network connection, the only way to read the primary variable is digitally (HART® ONLY)

### 2.2.3 - Adjusting the Measurement Range of a HART® Transmitter

In **DEVICE INFO** tab, the **MIN** and **MAX** fields indicate the measuring range of the HART® transmitter. For PV (primary variable) equal to the **MIN** value, the transmitter should generate 4 mA. For PV (primary variable) equal to **MAX** value, the transmitter should generate 20 mA.

The maximum allowable range of the transmitter is shown just above (**RANGE ...**). To edit the range of the transmitter, just change the **MIN** and **MAX** values and press the **SAVE RANGE** button.

On this screen you can also edit the unit of the primary variable and the input filter (damping).



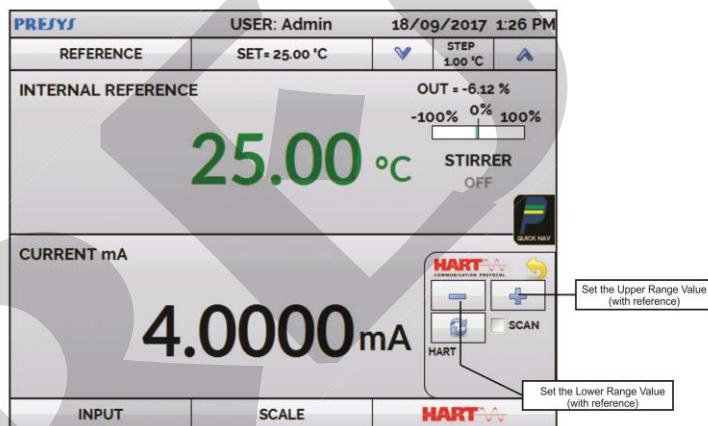
**Fig. 22** - Adjusting the measuring range of the HART® transmitter

### 2.2.4 - Adjusting the Measurement Range of a HART® Transmitter with Reference (CH Option)

The range of the transmitter can also be adjusted generating the minimum and maximum values of the desired range in the transmitter input and adjusting these values as minimum and maximum (**set by reference**).

Select Input mA and press the **HART®** button. Connect the transmitter to the mA input. The reference value inserted in the transmitter input can be generated or measured by the TA-35NLL itself. For this, before connecting the HART® instrument, from the main menu, select **CALIBRATOR**, and select on **Channel 2** the type of desired signal.

Example: To adjust the range of a Pt-100 temperature transmitter, select the **Pt-100 output option from the CALIBRATOR** menu and connect to the transmitter input. For a pressure transmitter, Channel 2 must be set to **Pressure** input and the pressure must be generated manually (with a pump, for example) and connected to the TA-35NLL.



**Fig. 23 - Quick HART® Adjustment with Reference**

Using the calibrator's output or other generator pattern, enter the signal corresponding to the lower value of the range into the transmitter input and press the **-** button and the transmitter should generate 4 mA for this value. Then generate the signal corresponding to the top value of the range and press the **+** button and the transmitter will generate 20 mA for this value.

Another way of doing the range adjustment by reference is entering in the **HART®** option. Back to the main menu by pressing the icon and the **HOME** button. Select **HART®**, set the connection type, address, and then press **CONNECT**.

For this setting, select the **MONITORING** tab. In this screen are shown the value of the primary variable (PV) read by HART® (digital), the current that the transmitter

wants to generate (**AO - DIGITAL OUTPUT**), and the current measured by the TA-35NLL (**ANALOG READ**).

To adjust the range of the transmitter, generate the signal to the transmitter input corresponding to the lower range value and press the ↓ **Inf Range** button. Transmitter will generate 4 mA to this value. Generate the signal to the transmitter input corresponding to the upper range value and press ↑ **Sup. Range**. Transmitter will generate 20 mA for this value.

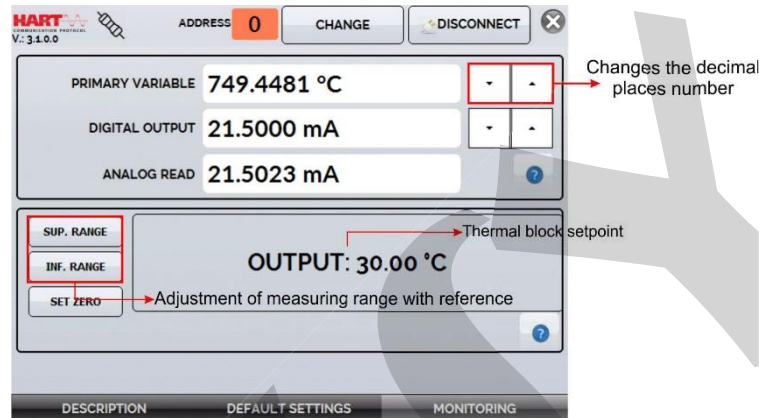


Fig. 24 - Adjusting the Measuring Range of the HART® Transmitter with Reference

### 2.2.5 - Checking / Adjusting HART® Transmitter mA Output

In **DEFAULT SETTINGS**, the output current of the HART® transmitter (output trim) can be adjusted according to current measured by the TA Calibrator. You can make this adjustment only when the TA Calibrator is connected to a single transmitter with address 0, in the **mA INPUT + HART®** option of connection, since the calibrator needs to measure the current to make the adjustment.

Before performing the adjustment, a transmitter output current check can be performed by pressing the **CHECK** button. The transmitter will generate fixed current (4, 8, 12, 16, 20 mA) and the calibrator will show the measured values for each point.

To adjust automatically, simply press the **AUTO** button. The calibrator will send the command to the transmitter to generate 4 and 20 mA (fix), makes the measurement of these points, and adjusts the output (trim). The adjustment is completed when **D/A Adjustment Completed** message appears. The **LEAD TIME** sets each points stabilization time (in seconds).



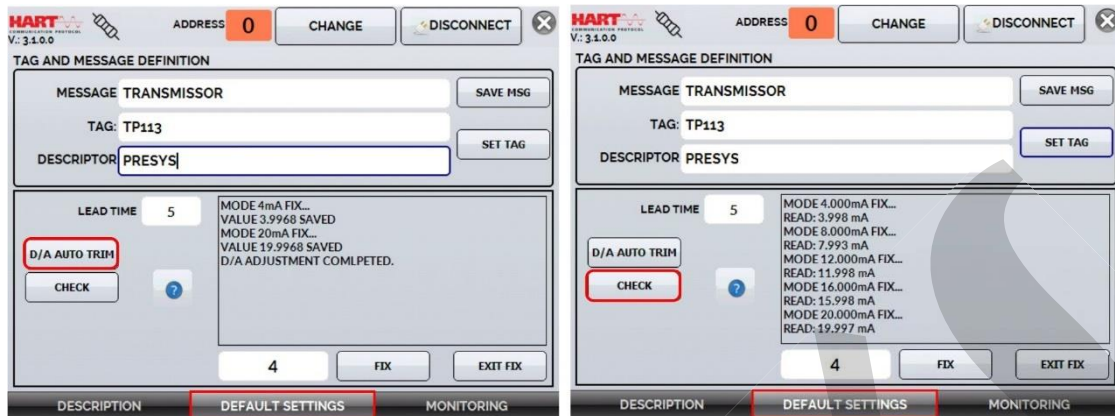


Fig. 25 - Checking / Adjusting the mA HART® Transmitter Output

### 2.2.6 - FULL HART® Configurator (FH)

If the **FULL HART® CONFIGURATOR** option is enabled, the FH software starts to run. In this mode, the device is automatically found, and the screen presents the complete parameters tree of the connected device.

To use Full HART® mode, on the home screen, press the **HART®** button and then make the electrical connection of the instrument to the calibrator terminals, select the operation mode, from the available options and select the option Full HART® Communicator in the check box located in the lower right corner of the screen.

To start the HART® configurator, wait for the TA-35NLL to identify and read all instrument parameters. The TA-35NLL will display the message: **Reading device information. Please wait...**

Once connected, information such as TAG, connected instrument model, and Device Description (DD) file will be displayed in the bottom corner of the screen.

To open the instrument configuration tree, select the Device Setup folder by pressing it twice in a row to navigate between the parameters available for your device, switch between folders, and change the information you want. The configuration tree changes according to the instrument, as each HART® transmitter has specific commands.



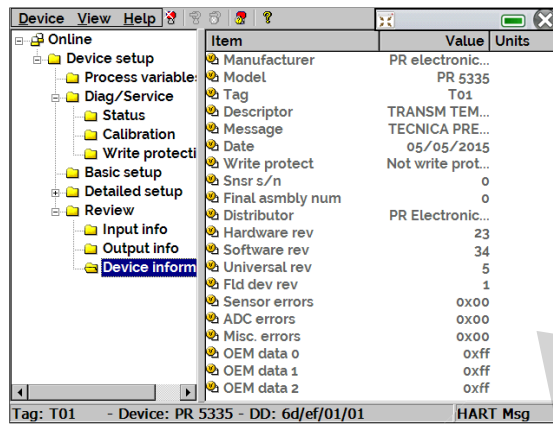




Fig. 26 – Device Parameters

Double-click the parameter you want to change and edit the desired value.

Parameters identified with the icon  have methods. To change them, just double-click the parameter and follow the steps shown.

For other parameters, after editing the value the field becomes yellow, indicating that it has been changed, but not saved in the transmitter yet. To confirm click on the button . To cancel, press .

To view the TA-35NLL mA input value or change the output setpoint, press the  button:

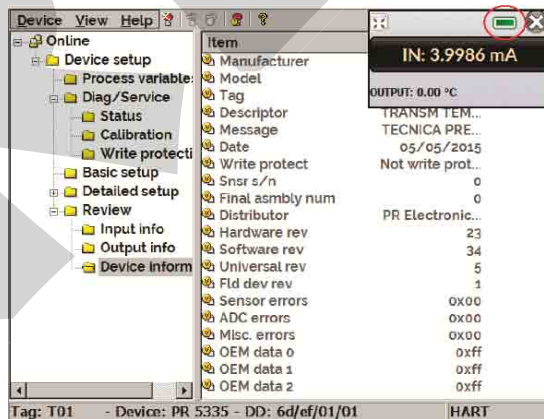


Fig. 27 - TA-35NLL Input and Output Values

To view the device status, press the **VIEW** menu and **DEVICE CONDITION**:

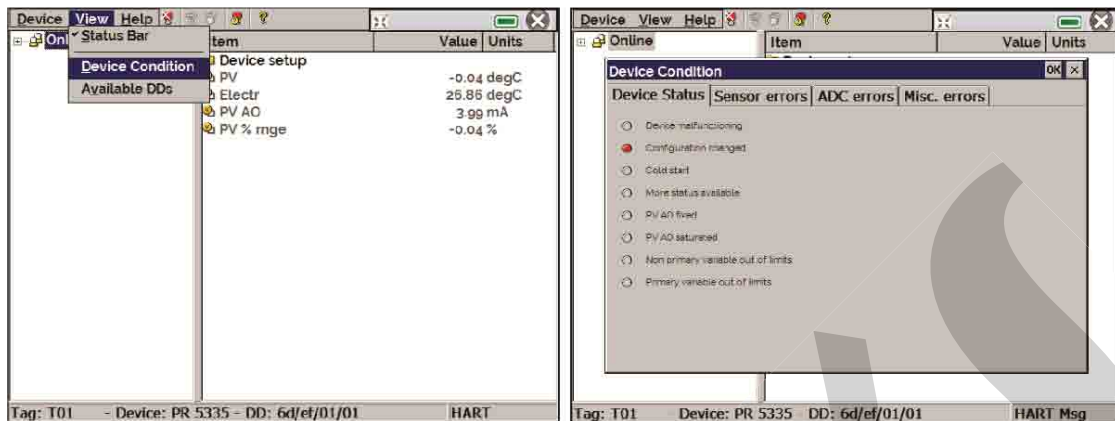


Fig. 28 – Device status

### 2.5.6.1 - Saving a device configuration in FULL HART®

To save the settings of a HART® device connected to the calibrator, use the Document Device function. This function is intended to save the configuration of an instrument for later download on another device of the same model or to perform a backup of the applied settings.

Press the **Device** menu, located in the upper-left corner of the Full-HART® configurator window, then press the Document **Device** option. In the following pop-up, change the file name and write a note about it. To save it, press **Save Device Config** and then a new pop-up will appear on the screen stating that the configuration storage has been completed. Press the **OK** button to exit the windows.

When you need to upload the saved information to an instrument, go to the Device menu and then download/view. To select the configuration file, double-click on it. Press the **WRITE** button to download the configuration file for the connected instrument.

Before the instrument is fully configured, some confirmation messages will be displayed. To cancel, press **X** and to proceed with the operation, press **OK**. At the end of the configuration, the Configuration Write Complete message appears.

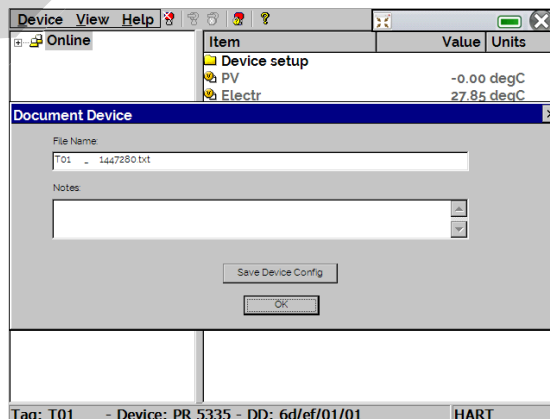
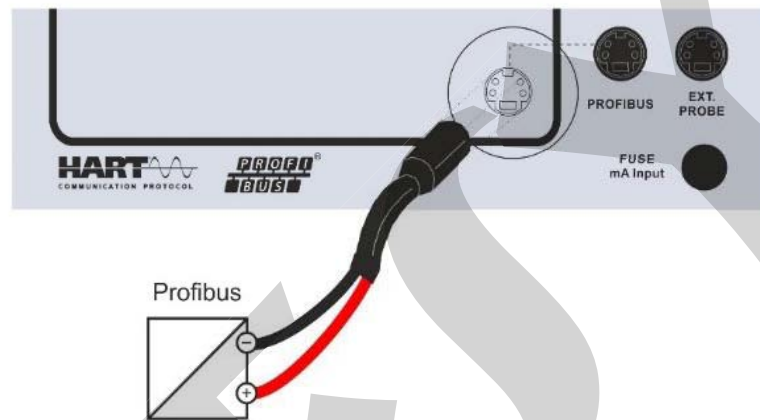


Fig. 29 - Saving the device configuration

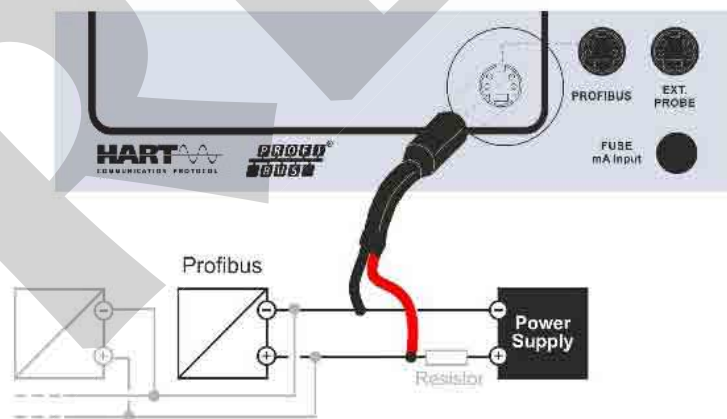
### 2.3 - Profibus®

You can connect the TA-35NLL to devices in two ways: using the internal power supply or an external power supply. When using an external power supply, it may be necessary to use a 50 Ω resistor, in these cases, check the technical manual of the device you want to calibrate.

However, when defining the use of a power supply in accordance with Profibus®, or the internal power supply of the calibrator, the installation of the resistor will not be necessary. Below, **Fig. 30** and **Fig. 31** indicate the necessary connections.



**Fig. 30** - Connecting through the internal source



**Fig. 31** - Connecting through an external source

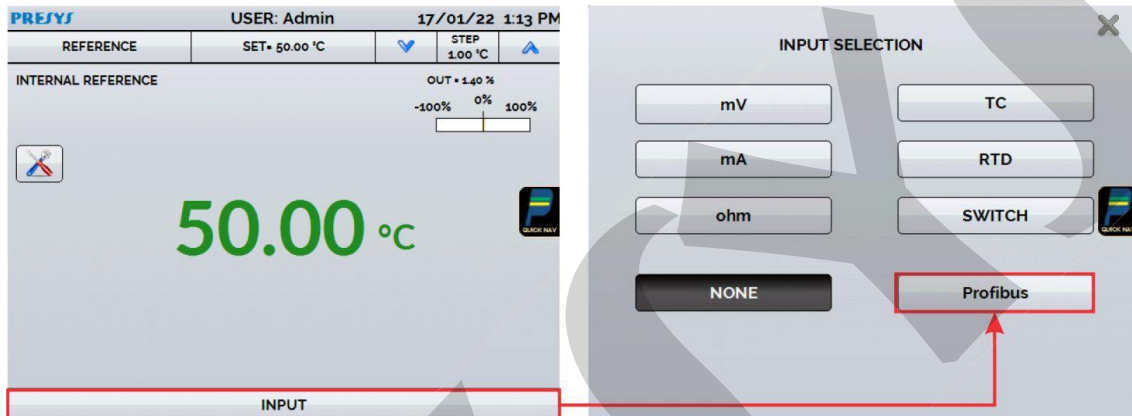
**⚠ ATTENTION:** Do not connect two master devices at the same time in the same segment. This action may make Profibus® communication unstable.

**⚠ ATTENTION :** By default, the internal 24Vdc font is enabled for use. If an external source is required, disable the function by pressing the selection key, as indicated in **Fig. 34**.

### 2.3.1 - Profibus® Communication

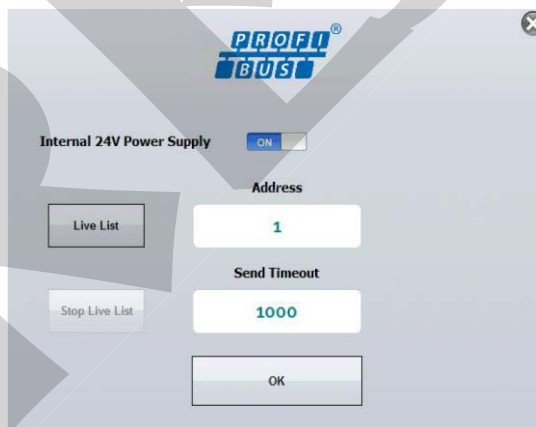
The TA-35NLL allows the calibration of instruments that have Profibus® communication protocol. Through an easy and intuitive menu, it is possible to calibrate one or more devices at the same time without the need for an external power supply.

To configure Profibus® input, on start page press the **Calibrator** menu and then the **INPUT** bar, located in the lower corner. Find the Profibus® option and select it.



**Fig. 32 - Profibus® input selection**

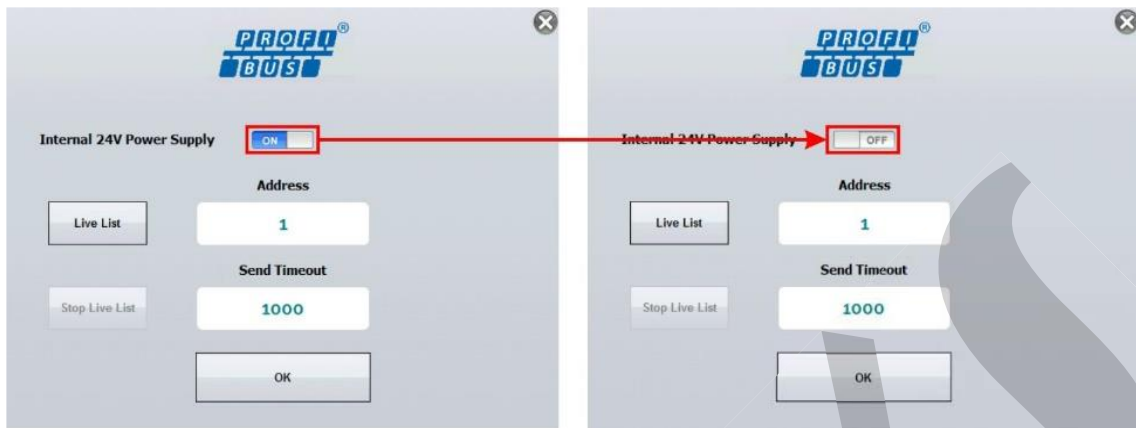
On the next screen, the Profibus® configuration panel will be displayed.



**Fig. 33 - Profibus® Configuration Screen**

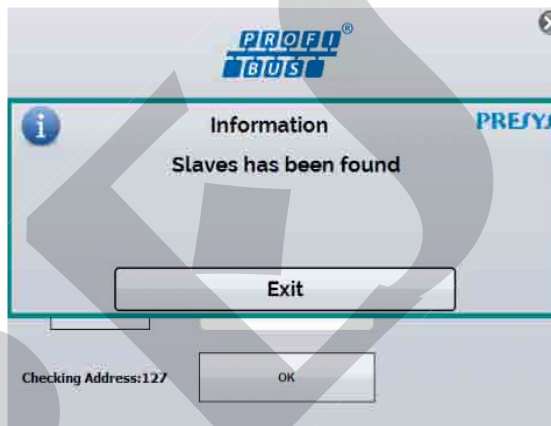
The **Internal 24 V Power Supply** selection chooses whether internal 24 Vdc supply is used or not. When using an external power supply, ensure communication by using a Profibus® compliant power supply or add a resistor between the power supply and the bus.

Press the **Live List** button to start scanning for devices on the network. Press the **Stop Live List** button to cancel the scan.



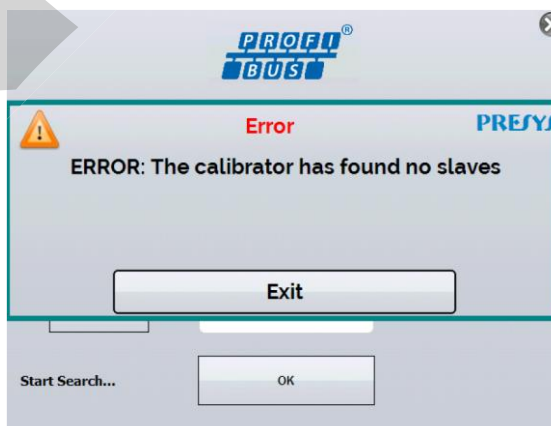
**Fig. 34 - Enabling the internal power supply**

If the calibrator finds a device, a confirmation message appears.



**Fig. 35 - Confirmation message**

If there is a problem while searching for devices, an error message appears.



**Fig. 36 - Error message**

If the calibrator identifies a device, its address field is set automatically. You can also enter the address manually by pressing the addressing field. After setting up, press the **OK** button.



Fig. 37 - Profibus® screen

Configure the number of decimal places of the variable displayed by the connected device. Press the button **SIGNAL: PROFIBUS®**, located in the upper left corner of the screen and select the desired number of decimal places. Then press **HIDE STATUS** to close the menu.

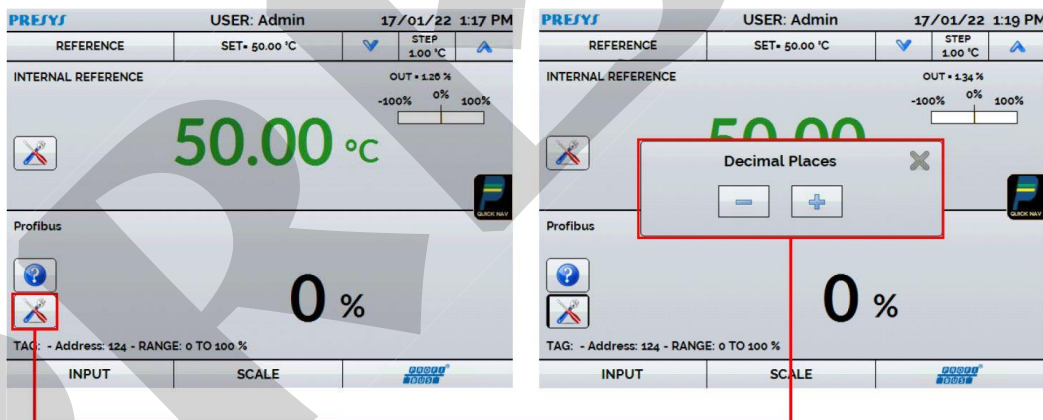
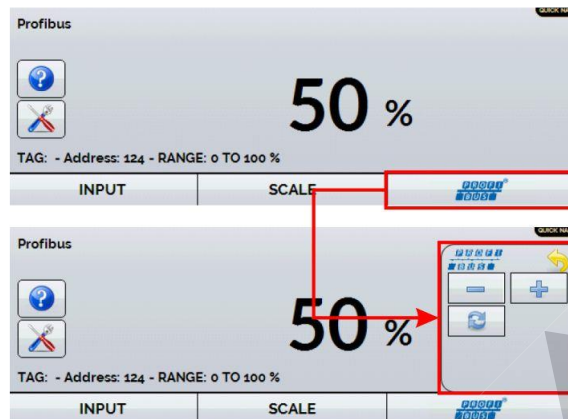





Fig. 38 - Decimal places configuration

Press the Profibus® icon to adjust some Analog Input (AI) parameters:

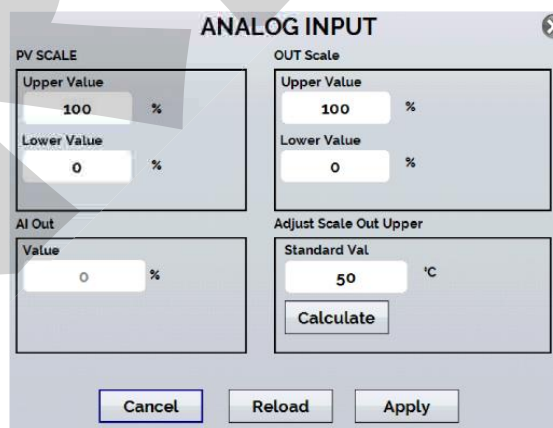


**Fig. 39 - Profibus® parameters selection**

Each button function is described below:

-  Opens the analog input configuration screen to adjust the lower parameters of the block.
-  Opens the analog input configuration screen to adjust the block's upper parameters.
-  Forces reset of Profibus® module. This function can help to solve some problem in communication with the instrument. After pressing this button, wait for a few seconds to view the variable again.

The analog input block (AI) configuration screen is shown in the following figure. Only some (AI) block parameters can be changed by Presys calibrators.



**Fig. 40 - Analog Input Parameters Screen**

The parameters that can be adjusted by Presys calibrators are as follows:

**PV Scale:** Adjusts the PV\_SCALE parameter of the Profibus specification where **Upper Value** corresponds to a value in engineering unit of the transducer block that will be defined as 100% of the instrument's operating scale. The **Lower Value** parameter



corresponds to a value in engineering unit that will be defined as 0% of the operating scale.

**Out Scale:** Adjusts the OUT\_SCALE parameter of the Profibus specification where **Lower Value** and **Upper Value** correspond to the effective lower and upper value that will appear on the output of the analog input block. These values are related to the values of the PV Scale parameters where in simpler cases the values of PV Scale and Out Scale are equal.

**AI Out:** Shows the OUT value of the Profibus specification. This value will be used as the instrument's digital output value. **This value is read-only and cannot be changed.**

The above parameters can be changed, and the changes can be sent to the instrument using the **Apply** button. The instrument will be placed in **Out of Service mode** before attempting to save these parameters to the instrument. After saving the instrument is put back into **AUTO mode**. The **Reload** button allows to force a new reading of the values present in the instrument.

**Adjust Scale Out:** Value indicated by the Presys standard used normally to be compared with the AI Out value of the instrument. **Note that this parameter is not from the instrument being calibrated.**

Presys calibrators can help correct the value of the AI OUT parameter so that the value of the AI Out is closer to the standard value. This correction is performed as follows:

**Step 1:** Enter in the calibrator screen which shows the values at the input and output of the calibrator. Note that the calibrator input must present the value of the instrument's digital output.

**Step 2:** Change the calibrator output to generate the value defined in Lower Value of the PV Scale parameter, for example, 0°C.

**Step 3:** Wait some time for the Profibus instrument to stabilize.

**Step 4:** Press on the Profibus logo and then on the “-” button to return to the AI block parameters screen.

**Step 5:** If the standard is showing a correct indication, the **AI Out** value and **Standard Val** values must be close according to the instrument's tolerance. If there is divergence in the values, press the **Calculate** button where the calibrator will calculate the value of the **Lower Value** parameter, subtracting the indication error according to the formula below.

$$LV_{NEW} = LV - (AIOUT - Standard)$$

**Where:**

**LVNEW:** new value of the Out Scale parameter **Lower Value** where the error of the instrument's digital output was discounted.

**LV:** current value of the Out Scale parameter **Lower Value**.

**Standard:** Standard value read by the Presys calibrator or entered by the user if the output of the Presys calibrator is not being used.

**Step 6:** Check the calculated value and press the **Apply** button to save the data in the instrument. If necessary, you can try to repeat the previous steps to make a new adjustment.

The same procedure described in the steps above can be done for the value of Out Scale **Upper Value**.

## 2.4 - Automatic Tasks

The TA-35NLL can generate and performing automatic calibration tasks. This function can be used to generate work orders for several instrument types, as well as integrate with ISOPLAN® calibration management software, integrating reliability and convenience to the main activities involved.

The tasks can be generated from the calibrator or through a computer connection. It is also possible to add other methods of automatic task generation using the ISOPLAN®, proprietary applications, .xml files that contain calibration instructions, remote servers, and even programs generated by Excel VBA.

In addition to automatically performing work orders, the Tasks section is also capable of autonomously generating reports, storing them, and remotely printing them. All these features are protected by end-to-end encryption, ensuring the security of the files generated during the calibrations.

### 2.4.1 - Creating Tasks


To create tasks from the main menu, select **CALIBRATOR**. Select the desired type of input and probe configuration. For example, to calibrate a temperature transmitter, select the probe configuration (Internal or External Reference) and mA input (which will be connected to the current output of the transmitter). For a temperature indicator, e.g., selected **NONE** for the input.

Press the  icon and select **TASKS** and **CREATE NEW TASK**.

Fill at least the serial number of the instrument to calibrate, instrument TAG, lead time (time, in seconds, for the complete stabilization of the system), maximum error allowed for the instrument to be calibrated (in % of the span, reading or full scale), calibration range (highlighted fields). For the SWITCH tasks, the error fields are filled in the next step.

#### a) Task Information

To create tasks from the main menu, select **CALIBRATOR**. Select the desired type of signal on channel 1 and channel 2. For example, to calibrate a thermocouple temperature transmitter, select TC output (which will be connected to the transmitter input) and mA input (which will be connected to the current output of the transmitter). For a voltage indicator, e.g., selected output V (which is connected to the indicator input) and NONE for the input (the instrument reading will be inserted manually).

Press the icon , select **TASKS** → **CREATE NEW TASK**. In the Task Info., insert in the indicated fields the data related to the calibration procedure relevant to the task report, the fields in yellow are mandatory.

Fill at least the serial number of the instrument to be calibrated, instrument TAG, stabilization time for each point (waiting time in seconds) and the maximum error allowed for the instrument to be calibrated (in % of the span, reading or full scale).

**!** **IMPORTANT:** By filling the stabilization time with the value 0 (zero), the calibrator requests to the operator to manually confirm point acquisition.

Fig. 41 - Task Information

### b) Defining Points and Strategy

After finishing setting up the device under test and the procedure information, select in the lower corner the AsFound/AsLeft tab to determine the method of task execution.

- **Expected:** expected value at the auxiliary input.
- **Point:** defined point for calibration execution.
- **Rep:** number of repetitions of the calibration cycle.
- **Strategy:** method by which the calibration is performed, following a logical sequence to go through the points, which can be from minimum point to maximum point (↑), from maximum point to minimum point (↓) etc.

**!** **IMPORTANT:** If the As Found repetitions method are set to 0 (zero), the task will contain only As Left calibration.

Add each calibration point and corresponding expected value for each auxiliary input, both As found (calibration done before adjustment) and As left (calibration done after adjustment, **if it is used**).

The points can also be generated with the help of the **AUTO** button. By pressing this button, just enter the maximum and minimum values of the calibration range and the number of points and a list of points will be generated considering equal steps and a linear scale.

Also fill in the number of repetitions (rep.) of the readings, and the calibration strategy (start to end point ↑, end to start point ↓, etc.). By filling the as found **REP** field of the with the value 0, the task will only have the As left calibration. The **REP** field of the as left calibration must be filled in with the minimum value 1.

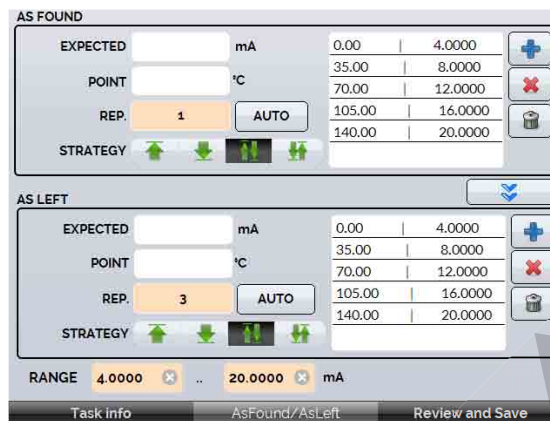


Fig. 42 – Task Points and Strategy

Select the **Review and Save** bar. Choose a name/identification number for the task. To save the template of this task for later use in creating other service orders, press **SAVE TEMPLATE** and name it. To open this template again, in the task creation screen, press **OPEN MODEL**.

Click **CREATE** to save the task. The task is now saved in the calibrator and can be executed.

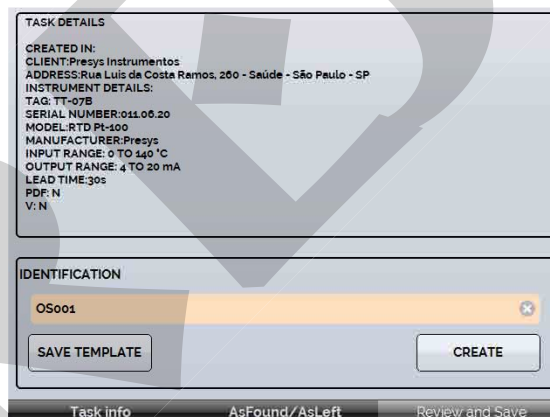


Fig. 43– Reviewing and Saving the Task

### 2.4.1.1 - Thermoswitch Tasks

For **SWITCH** tasks, the screen is different, as shown in the figure below. It must be filled the **TRIP POINT** of the thermoswitch and its **DEADBAND**, as well as their respective error. The **TIME RAMP** is the time in seconds that the calibrator will take to tour the range and find the value of opening and closing the thermoswitch. The minimum value for this field is 300 s.



**NOTE:** If the Trip Point and deadband are not known, try the **THERMOSWITCH TEST** to find an approximate value before creating the task.

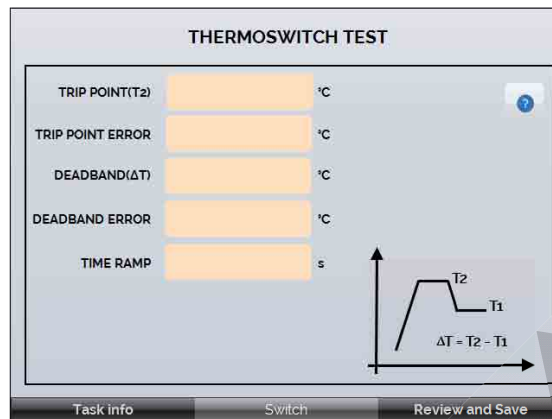


Fig. 44 - SWITCH Task Parameters

### 2.4.2 - Performing Tasks

To perform a task created from the main menu select **TASKS** → **EXPLORE TASKS**. A list of the created W.O. that have not been performed yet (● **WAITING**) is shown. Select the desired task and press **OK**. Make the necessary connections between the calibrator and the UUT and press **START**.

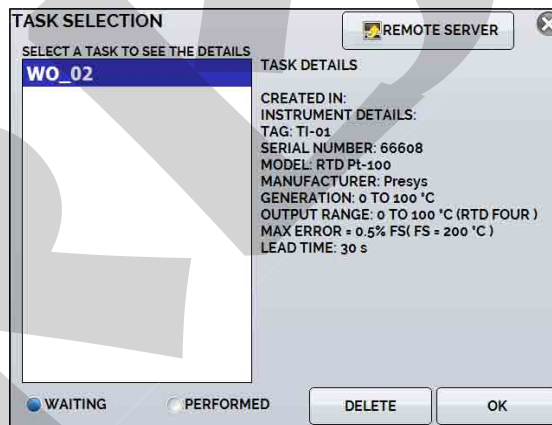


Fig. 45 - Exploring Tasks

The TA Calibrator automatically starts the execution of the calibration, generating the registered setpoints, waiting the stabilization of the system and reading the associated input values. If you selected the option **NONE** as input, for each generated point, the calibrator would require digiting the value of the temperature indicated by the instrument (thermometer, indicator...).

The result will be displayed on the screen, and a progress bar indicates the calibration remaining time. At the end of the calibration, a report is showed with the generated values, the obtained values, the expected values, and the error. If the error is higher than the registered value for the task, the line appears in red.

The first time that a task is performed, it will be saved as **As-found** (before adjustment). If it runs again, it will be saved as **As-left** (after adjustment). The results are saved in the calibrator and can be viewed at any time.

### 2.4.3 - Viewing Results

Once a task has been performed, it remains saved in the calibrator. To view the results of a calibration by the calibrator, in the main menu select **TASKS**.

Enable the option **PERFORMED**. The list will show only the tasks that have been performed. Select the desired work order and press **OK**. On screen, the report with the calibration points, the obtained values, expected values and the errors will be shown. If the error is higher than the value registered for the task, the line appears in red.


POINT	EXPECTED	OBTAINED	ABS. ERR.	READING ERR.
30.00 °C	30.00 °C	29.73 °C	-0.27 °C	-0.900%
50.00 °C	50.00 °C	49.70 °C	-0.30 °C	-0.600%


PERFORMED BY: VI Pe

Buttons: PRINT, USB, CLEAR AS-LEFT

Bottom navigation: AS-FOUND, AS-LEFT, AS-FOUND ERR., AS-LEFT ERR., DETAILS

**Fig. 46 - Task Results**

The task data is saved in a PDF file in the internal memory card of the Calibrator and can be accessed connecting the calibrator to a computer. To save the data in a PenDrive or External HD on the host USB, press the PenDrive icon  .


To print the Calibration Report, press the printer icon  . The printer must have been previously configured in **SETTINGS** → **SYSTEM** → **PRINTER CONFIG**.



**IMPORTANT:** The Report logo can be changed for one of your own company. For this, connect a USB cable between TA Calibrator USB Device port and a computer. Change the file LOGO.bmp for your logo file (must be .bmp extension). We recommend an image close to 200 x 200 pixels.



**CALIBRATION REPORT  
TEST**



TAG: TS1		MODEL:			
SERIAL NUMBER: 029		MANUFACTURER:			
OUTPUT RANGE 30 TO 50 °C (RTD FOUR )		MAX ERROR =1% READING			
INPUT RANGE: 30 TO 50 °C					
<b>STANDARD:</b>					
<i>MANUFACTURER</i>	<i>SERIAL NUMBER</i>	<i>MODEL</i>	<i>NEXT CAL</i>	<i>CERTIF. NUMBER</i>	
PRESYS	375.04.19	TA-45NL	---	---	

As-found performed by: John					DATE 11/29/2016
POINT	EXPECTED	OBTAINED	ERROR	READING ERR.	PASS/FAIL
30.00 °C	30.00 °C	29.73 °C	-0.27 °C	-0.900%	Pass
50.00 °C	50.00 °C	49.70 °C	-0.30 °C	-0.600%	Pass

As-left performed by: John					DATE 11/29/2016
POINT	EXPECTED	OBTAINED	ERROR	READING ERR.	PASS/FAIL
30.00 °C	30.00 °C	29.81 °C	-0.19 °C	-0.633%	Pass
50.00 °C	50.00 °C	49.77 °C	-0.23 °C	-0.460%	Pass


DOCUMENT CREATED : 18/04/19	RESPONSIBLE 
--------------------------------	--

Fig. 47 - Example of a Printed Calibration Report

The TA-35NLL allows you to record series of measurements over time to display data in chart or table format. Select **CALIBRATOR** from the main menu and select the desired type of signal on channel 1 and channel 2.

Press the icon  and select **DATA LOGGER**. The calibrator automatically starts the measurements and displays each measured point on the chart.

To save the measurements, press the **REC** button (see Fig. 67), with this function, the collected data is saved in a file in the internal memory and can be used to generate graphs or tables.

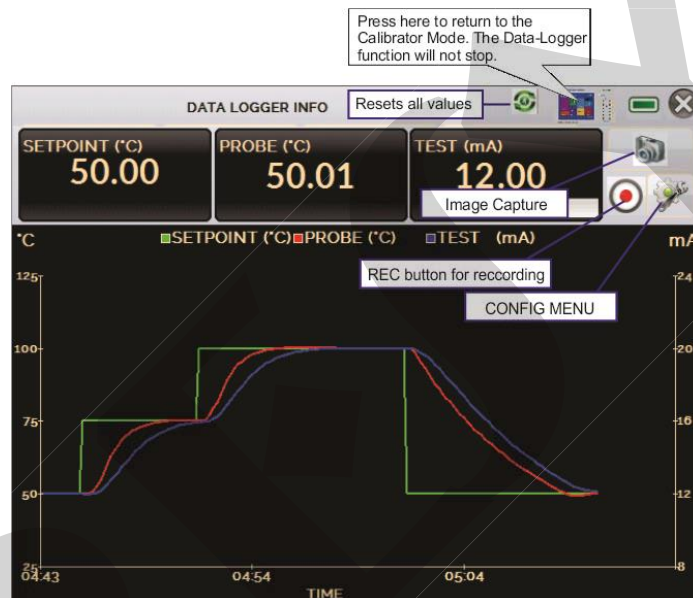



Fig. 48 - Data Logger




Fig. 49 - Data-Logger Configuration Menu

In configuration menu (icon ) , you can edit the background color of the chart, color and line thickness, sampling rate (in seconds) and set the x (time) and y (measurements) axis of the chart.

Recording can also be programmed to start at a certain date and time in the **LOGGER** option. Just set the start time and end time of recording. During the defined range, the measured points are saved in an internal file.

To view a saved file, press the **OPEN** button, select the desired file, and press **LOAD**. The file name contains the date and time of the measurements.

The **SHEET** button allows the visualization of data in table format, with the date and time of the measurement and the measured values.

If the user wants to export the current data to a .csv file that can be opened in spreadsheet software, press the **SAVE** button, and indicate the name and where it will be saved. The button  saves the current screen image as a .png file. All saved screens can be viewed in the **IMAGE** menu.

These files are saved in the internal SD card of the calibrator. If a USB Pen Drive is connected to TA-35NLL, you can choose between saving in the internal SD card or the Pen Drive.

## 2.6 - Help Desk

The TA-35NLL calibrator has a video player and documents viewer. These videos can be viewed while a calibration is performed and are designed to assist in the use of the calibrator. Documents can be, for example, procedures or instructions that can be stored and viewed on the calibrator itself.

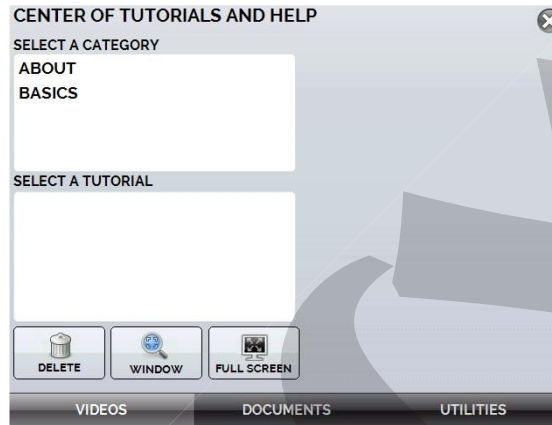


Fig. 50 - Help Desk

From the main menu, selecting **HELP DESK** and the tab **VIDEOS** a list of video categories appears. Select the category and the desired video. Press the button **FULL SCREEN** to view the video in full screen and the button **WINDOW** to reduced screen.

To add recent videos on the calibrator, connect the USB cable to the computer and to the TA-35NLL. Open **VIDEOS** folder. Copy the new video to any sub-folder (category) of the **VIDEOS** folder. If you prefer to create a new category, simply create a new folder inside **VIDEOS** with the name of the desired category and copy the video to this folder.

To insert documents, such as procedures or instructions, files must be converted to .pdf and be saved into the SD card **HELP** folder. We recommend that the file be in presentation format, for better viewing on the calibrator screen.

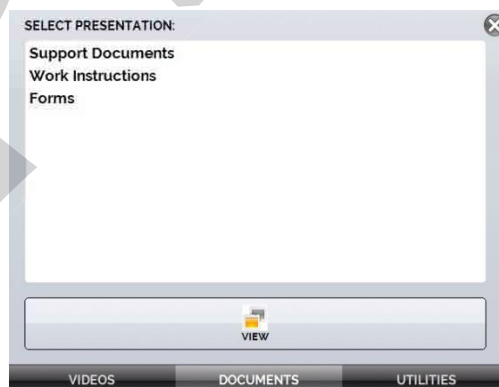


Fig. 51 – Documents tab

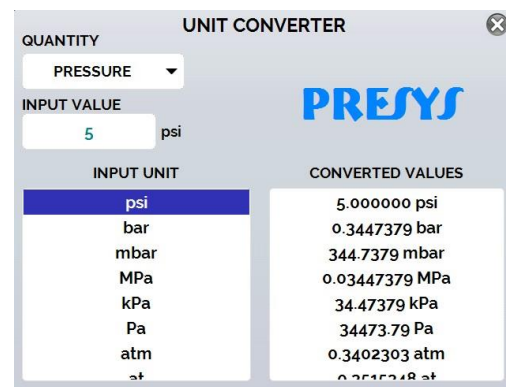


Fig. 52 – Utilities tab

## 2.7 - Settings

The **SETTINGS** menu has four divisions (tabs at the bottom): **DATE AND TIME**, **NETWORK**, **SERVICES** and **SYSTEM**, described below:

### 2.7.1 - Date and Time

In the Date and Time bar you can set the date and time, time zone for the calibrator, as well as the time format from the available options. You can also set the decimal separator for CSV files between comma and period.

After finishing your changes, press **OK** to store the new configuration parameters.



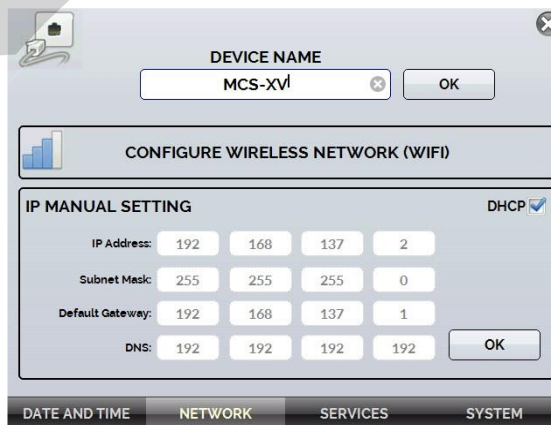
**Fig. 53** – Date and Time configuration

### 2.7.2 - Network

In the **NETWORK** tab you can configure the calibrator IP address for communication with the computer and Wi-Fi (wireless) network.



**NOTE:** The IP address can be dynamically configured (**DHCP**) or can be fixed address (Disable DHCP and change desired addresses).



**Fig. 54** – Network configuration

#### a) Naming the Calibrator

To name the calibrator to make it easier to find it in a network with many devices, press the **DEVICE NAME** field, alter the value, and press the **OK** button. Then, restart the calibrator to store the added information.

### b) Altering the IP Address

In the **IP MANUAL SETTING** field, select the check box  **DHCP** to enable the dynamic IP configuration, so the calibrator will set it automatically.



To manually configure the calibrator IP, clear the check box  **DHCP** and enter the desired values in the **IP Address**, **Subnet Mask**, **Default Gateway**, and **DNS** fields, if required. Then press the **OK** button. To store the current information, restart the calibrator.

### c) Setting up Wireless Network (Wi-Fi)

Communication via Wi-Fi is performed through the USB/WIFI adapter. To set up access to a wireless network, press the **CONFIGURE WIRELESS NETWORK (WIFI)** button. On the next screen, search in the field **VISIBLE NETWORKS** the Wi-Fi network you wish to connect to and press the **CONNECT** button. Enter the network password and change the WPA type (if required), press **OK** to store the information.

When you are done configuring, the connected network will be displayed in the **KNOWN NETWORKS** field. To delete a saved network, simply select it and press the **DELETE NETWORK** button.

### d) Viewing the IP Address

When the calibrator is connected to the network it is possible to view and print Task Reports from your computer. Press the network icon  to access the configured IP address once connected to the network. When connected to a wireless network, the Wi-Fi network icon  will be visible.

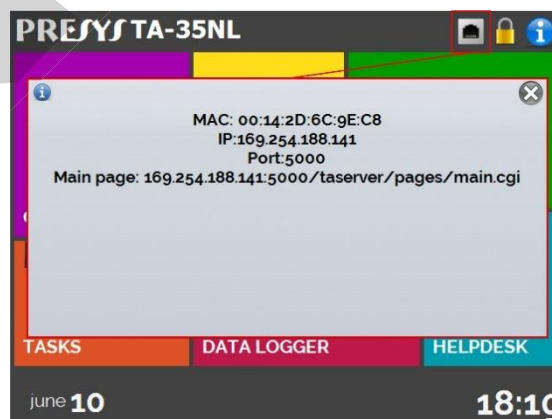


Fig. 55 – IP Address

## 2.7.3 - Services

In the **SERVICES** the user can configure the calibrator's communication types, among other settings.

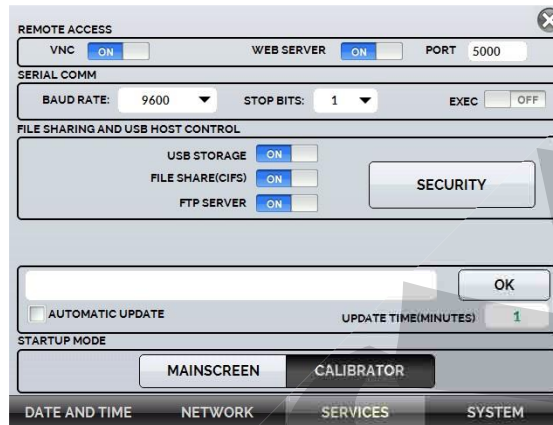


Fig. 56 – Services configuration

### 2.7.3.1 - Remote Access

#### a) VNC

Virtual Network Computing (or **VNC**) is a graphical desktop sharing system that uses the Remote Frame Buffer Protocol (RFB) to remotely control another computer or device. By enabling this option, the calibrator's screen can be accessed directly on the computer.

For access via VNC you need to download and install a VNC viewer program, some are freely available on the internet. Connect the calibrator to the network via Ethernet cable or Wi-Fi. Configure in the VNC viewer the IP address indicated in the network icon (see Fig. 55) and connect.

When prompted, use the password "adm". This password can be changed later in **NETWORK** → **FILES SHARING AND USB HOST CONTROL** → **SECURITY**.

#### b) Web Server

To access the calibrator's integrated Web Server, enable the option in the **NETWORK** tab. Connect the calibrator to the network via Ethernet cable or Wi-Fi and configure the communication port, if required

To access the Web Server, open the browser on your computer and enter the following address. To check the IP address.

**<calibrator\_IP\_address>:5000/taserver/pages/main.cgi>**

User: *admin*

Password: *xvmaster*



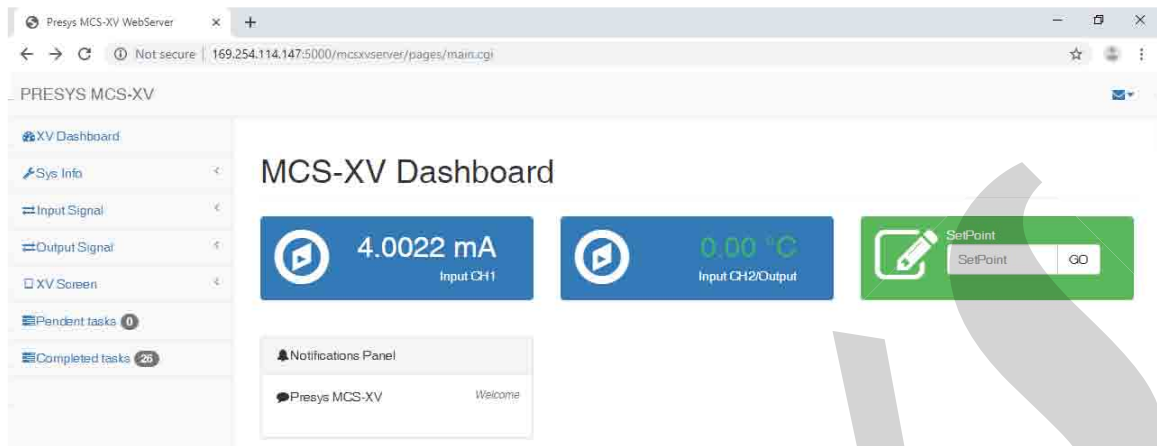


Fig. 57 - Web Server page

On the Web Server, it is possible to monitor the calibrator screen, change the output type and value, and read signals from the inputs.

### 2.7.3.2 - Serial Communication

The TA-35NLL allows the control of some functions by using the SCPI commands connect a serial cable to the TA Calibrator USB HOST port (see Fig. 01 – Parts Identification). Connect the cable to the serial port of the computer. At the menu **Settings** → **Services** → **Serial Comm**, enable the **SERIAL COMM** (RUN switch to **ON** ).

To enable the function, set the parameters and then press the **EXEC** key to the **ON** position to control the calibrator.

**Communication Parameters:**


Parity: none

Data bits: 8

Baud rate: configurable at the menu **Settings** → **Services** → **Serial Comm**

Stop Bits: configurable at the menu **Settings** → **Services** → **Serial Comm**



**NOTE:** When enabled, the icon  will be displayed on the Calibrator Main Screen.

**a) SCPI Commands List**

**Communication Parameters:**

Parity: none

Data bits: 8

Baud rate and Stop Bits: configurable on the **SERIAL COMM** menu.

Here are some examples of SCPI commands from the TA-35NLL calibrator. For a complete list, please consult Presys.

**\*IDN?**

**Description:** Instrument Identification.

**Parameters:** ---

**Response:** Manufacturer, ID, Serial Number, Software Version

**\*CLS**

**Description:** Clears the errors list.

**Parameters:** ---

**Response:** ---

**CALibration:DATE:LAST?**

**Description:** Shows the last calibration date

**Parameters:** ---

**Response:** <AAAA>,<MM>,<DD> e.g. 2018,05,30

**CALibration:DATE:NEXT?**

**Description:** Shows the next calibration date

**Parameters:** ---

**Response:** <AAAA>,<MM>,<DD> e.g. 2019,05,30

**SOURce:READ?**

**Description:** Shows the controlled temperature. Can be internal or external, depends on the sensor that is controlling

**Parameters:** ---

**Response:** 52.13

**SOURce:MEAS?**

**Description:** Reads the internal and external probe temperature. If the external probe is not configured, it shows the value 0 (zero).

**Parameters:** ---

**Response:** 52.13,53.14

**SYSTEM:ERRor?**

**Description:** Shows the last error code

**Parameters:** ---

**Response: Error code:**

Command does not exist = "0x001";

Error deleting list of errors = "0x002";

Error reading calibrator information = "0x003";

Error reading last calibration date = "0x004";

Error reading date of next calibration = "0x005";

Error changing setpoint = "0x006";

Error reading setpoint = "0x007";

Error reading control temperature = "0x008";

Error reading probes value = "0x009";  
 Error setting up and reading auxiliary input = "0x00A";  
 Error trying to set auxiliary input = "0x00B";  
 Error reading configured auxiliary input = "0x00C";  
 Error trying to turn the control on = "0x00D";  
 Error trying to turn the control off = "0x00E";  
 Error while trying to go to local mode = "0x00F";  
 Error while trying to go to remote mode = "0x010";  
 Error trying to read error list = "0x011";

## READ?

**Description:** Reads the value of the configured auxiliary input (For this command you must send a CONF command initially). This command returns unity

**Parameters:** ---

**Response:** 1.005 mV

## MEASure:<InputType>?

**Description:** Sets the input and reads the value at once

**Parameters:** InputType: None → NONE

Current → CURRent

mV → VOLTage

Switch → Switch

Resistance → RESistance <NumberofWires>

NumberofWires → 2, 3 or 4

RTD → RTD <RTDType> <scale> < NumberofWires >

RTDType → Pt-100 (except GOST), Pt-1000 (except GOST), Ni-100, Cu-10 (does not need scale), Pt-100(385) (only for GOST), Pt-100(392) (only for GOST), Ni-100, Cu-100(428) (only for GOST), Cu-100(426) (only for GOST)

Scale → IEC-751(90), IEC-751(68), GOST

NumberofWires → 2, 3 and 4 (Except for TA-1200PLAB)

TC → TC <TCType> <scale> <CJCType> <CJCValue>

TCType → all types of the manual in the format TC-J, e.g.

Scale → ITS-90, IPTS-68 or GOST

CJCType → MANUAL or INTERNAL

CJCValue → If MANUAL, send the compensation value

**Response:** 1.005 mV (This command returns unity)

**SOURce:SetPOint <SP>**

**Description:** Change Setpoint

**Parameters:** <SP> -> Setpoint value, without temperature unit e.g. 50.00

**Response:** ---

**SOURce:SetPOint?**

**Description:** Read Setpoint

**Parameters:**

**Response:** Resposta: <SP> e.g. 50.00

**SOURce:OUTPut OFF**

**Description:** Control OFF

**Parameters:** ---

**Response:** ---

**SOURce:OUTPut ON**

**Description:** Control ON

**Parameters:** ---

**Response:** ---

**SYSTem:LOCal**

**Description:** Go to Local Mode

**Parameters:** ---

**Response:** ---

**SYSTem:REMote**

**Description:** Go to Remote Mode

**Parameters:** ---

**Response:** ---

### 2.7.3.2 File sharing and USB host control

Edit the sharing and security settings for access to the calibrator using the options available in this section.

#### a) Enabling file sharing


Change the state of the key  ON  to enable or disable the following functions:

- **USB STORAGE:** Access to the calibrator internal storage (SD Card). With this function enabled, when connecting the calibrator to the computer through a USB cable, the files stored in the internal memory can be accessed, changed and/or removed by the user. Disable to block access.
- **FILE SHARE (CIFS):** Allows the access to the calibrator's internal storage files via CIFS (Common Internet File System). Disable to block access.

- **FTP SERVER:** Allows access to files stored in the internal memory of the calibrator by applications that allow file transfer from one device to another, such as FileZilla, for example. Disable to block access.

### b) Security

Press the **SECURITY** button to get access to the password setting for access to the File Share (CIFS), FTP Server and VNC sharing services.

To set a password, enter the desired value and repeat to confirm. Then press the **APPLY** button to save it. Press the button  to enable security. The calibrator must be restarted to enable access protection.

### c) Server Communication


The TA-35NLL calibrator allows connection to a remote server or application by simply typing the path in the address field and pressing the **OK** button. By checking the **AUTOMATIC UPDATE** checkbox and setting the time between checks (in minutes), the communication is updated according to specifications and independently.

## 2.7.4 - SYSTEM

In the **SYSTEM** tab, configure options such as screen brightness and settings, calibrator identification, printer settings, security options, sound options, and language. You can also access the advanced system settings via this menu.

### a) Touchscreen Options

Press the **ADJUST TOUCHSCREEN** button to calibrate the screen, by touching the center of the + signs on the screen (the use of a touch screen stylus is recommended). After calibration, press the screen again at any point. Confirm the adjustment and return to the **SYSTEM** screen.

Set the screen orientation by pressing the **ROTATE SCREEN (180°)** button. With each touch, the screen will rotate by 180°. Press  to exit the adjustment mode.

### b) Screen Brightness

Adapt the screen brightness to the ambient conditions in this menu. The available adjustment options are: 25%, 50%, 75% and 100%.



### c) Calibrator Identification

Define information such as location, owner, and calibrator tag. To change the data, press the blank field and type the desired content using the virtual keyboard. To save the information, press **SAVE INFO**, the **CANCEL** button aborts the operation.

**d) Print Configuration**

Press the **PRINTER CONFIG.** button to access the printer settings menu. Select the **DRAFT** check box to change the print quality. Press **OK** to save the information and the **CANCEL** button to cancel the operation.

**e) Security Options**

Security options allow the user to set access rules for users that use the calibrator. Initially, the Isocal TA-35NLL has no password access. This setting can be changed in **SECURITY OPTIONS**. To create a user, press the  icon and then the user icon . Select **NEW**, fill in the blanks and press **CREATE**. In the next window you can see the **User Manager**.



You can add a signature to be used when issuing the **TASKS** function reports and certificates. To do so, select the user and press **SIGN**. In the same way, an image can be associated with the user, to add it, connect a pen drive and press the **IMAGE** button, then select the image and save it.





**Fig. 58** – Users Manager

Please note the functions that each user level has access to in the table below:

User Level	Function				
	Calibrator	Tasks	Hart®	Data-Logger	Configurations
Operator	✓	✓	✗	✗	✗
Tec	✓	✓	✓	✓	✗
Admin	✓	✓	✓	✓	✓

To limit access to the system, press the key icon  and then the padlock icon  in the **SETTINGS** → **SYSTEM** menu.

The next time the Calibrator is started, you will be prompted for login and password. To unlock the system, log in as an Admin level user and press the padlock icon until it is open again.

 **IMPORTANT:** If no user has been registered, when pressing the  button and enabling security, the default user Admin is selected. When restarting the calibrator, it will ask for a password, type **123** to release it.

 **ATTENTION:** Never delete all Admin level users when using password access!

#### f) Adjust Cal.

Adjustment Level, password protected. See section **5 – Calibration (Adjustment)** for more information.



### 3 - Safety Instructions



**ATTENTION!** 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 so that the heterogeneous cooling of the parts do not jam each other.

### 4 - Recommendations as regards Accuracy of Measurements

Presys Temperature Advanced 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 cannot move or swing inside but it should not enter by force to get jammed.
- In the specific case of generating negative temperature, the calibrations should be performed in a descending temperature order. This procedure is useful because in negative temperatures ice is formed in the insert surface and between the insert and the thermo-element being calibrated. This humidity changes the thermal contact and cause error in the calibration. After finishing the use of the insert below 0 °C, increase the set point to a positive temperature value, remove the insert from the block and the sensor and dry completely all these parts before continuing the calibration. This procedure guarantees accuracy next to  $\pm 0.1$  °C. In case you can accept higher values of accuracy, like  $\pm 0.2$  °C or more, these cares can be left apart.
- It is recommended to use the insulation. The use of the insulation on the insert reduces the formation of condensed water / ice. It can be used in both negative and positive temperatures up to the maximum of the dry-block range.

## 5 - Calibration (Adjustment)



**ATTENTION!** Only perform the procedures in this section after you fully understand the information in this section. Failure to follow the warnings and information contained in these instructions may result in damage to the calibrator.



**ATTENTION!** Presys Instruments and Systems is not liable for any damage to the TA-35NLL due to failure to follow the information provided.



**ATTENTION:** Be sure to use properly adjusted and calibrated standards. Failure to observe this recommendation may lead to loss of factory set points.



**IMPORTANT:** In some cases, the value entered into the instrument will not be saved on the first confirmation (button pressed), this condition can be easily noticed because the display indicates different values in relation to the point entered. In these occasions, perform the point saving operation a few more times using the PNT key. This condition repeats itself for other inputs.

To perform the calibration of the auxiliary inputs, in the **Main Menu**, press the **SETTINGS** button and go to the **SYSTEM** tab. Then press the **ADJUST CAL.** button located at the top of the screen. Enter the required password (**9875**) and press OK.

After entering the password, the screen displays the **GENERAL, INPUT, PROBE** and **STATS** options. In the **GENERAL** option you can restore the factory adjustment file and change the date of the last calibration, if any adjustments have been made.



**IMPORTANT:** Note that the thermocouples are only adjusted after the mV and cold junction (CJC) adjustments have been made. Only in the case of OHM or RTD is it necessary to perform the mV adjustment first.

### 5.1 - Input Calibration

Select the corresponding auxiliary input and then, apply the signals presented in the tables below.

Once the signal has been applied, store the values of the calibration points 1 and 2. Press **SAVE** to save the typed values

mV Input	Point 1	Point 2
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	Point 1	Point 2
Single range	0.0000 mA	20.0000 mA

Input calibration for  $\Omega$  is performed in two steps:

### Step 1: mV Signal Application

For the calibration below, leave terminals RTD3 (+) and RTD4 (+) short-circuited.

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

### Step 2: Standard Resistors Application

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

resistors	Point 1	Point 2
OHM3	20.000 $\Omega$	50.000 $\Omega$
OHM2	100.000 $\Omega$	500.000 $\Omega$
OHM1	500.000 $\Omega$	2200.000 $\Omega$

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

Cold Junction	Point 1
CJC	32.03 $^{\circ}\text{C}$ (measured value)

## 5.2 - Probe Calibration



**IMPORTANT:** It is recommended to start the adjustment from the highest temperature point (point 7: 140  $^{\circ}\text{C}$ ) so that the humidity of the air does not interfere in the results.

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

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

Before starting the calibration (adjustment), record in these points the respective initial storing values, according to the table as follows:

## For the TA-35NLL

Calibration Point	Initial value to record (°C)	Standard indication	New value to record	New indication of the Standard
Point 1: -35 °C	-35.00	-34.780	-34.78	-34.995
Point 2: -2 °C	-2.00	-2.103	-2.10	-2.005
Point 3: 30 °C	30.00	29.910	29.91	29.990
Point 4: 60 °C	60.00	59.771	59.77	60.009
Point 5: 90 °C	80.00	89.770	89.77	90.000
Point 6: 120 °C	120.00	119.630	119.63	119.995
Point 7: 140 °C	140.00	139.539	139.54	140.005
Point 7: 140 °C	140.00	139.539	139.54	140.005

Select the calibration point and then press **CHANGE TEMPERATURE**. Wait for the complete stabilization of the point. On the field **Adjusted Point**, write the value presented in the standard thermometer and confirm in **SAVE** button. Go to the next point and continue the adjustment until the last point.

## 6 - Maintenance

### 6.1 - Instructions for Hardware Maintenance

There are no parts or components inside the temperature calibrator that can be repaired by the user. Only the 10 Amp fuse for 115V models or 6 Amp fuse for 230 V models, placed within the socket on the rear can be replaced in case of blow.

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. In this case, contact the Presys technical support.

In case of malfunction of mA input, the input fuse (250 V/32 mA) can be exchanged.



**Fig. 59** – Replacing the Power Fuse

## 6.2 - Instructions for Insert Jamming

If it happens that an insert jams inside the block proceed as follows:

### Step 1

Apply a lubricant oil between the parts.

### Step 2

Apply cooling liquid inside the insert wells in order to contract the insert.

### Step 3

Try again to withdraw the insert.

After taking the insert out, sand both the surfaces with thin sandpaper, polish them with an suitable paste and finally clean the parts using alcohol or solvent.



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