PRESYS


# PC-507-**IS** Pressure Calibrator

## TECHNICAL MANUAL

# IMPORTANT INSTRUCTIONS:

- This manual contains instructions for PC-507-IS (just called calibrator in the rest of the manual) designed for use in hazardous areas. Read the entire manual before using the calibrator.
- Before using the calibrator carefully read the "Special Conditions for Safe Use” section.
- Whenever possible, keep the calibrator in a dry environment.
- In case of failure or suspected failure, especially in the safe operation, always send the instrument to the factory for repair.
- When not in daily use, before starting up, let the calibrator turned on for at least one hour.

## TABLE OF CONTENTS

PC-507-IS

## Marking details

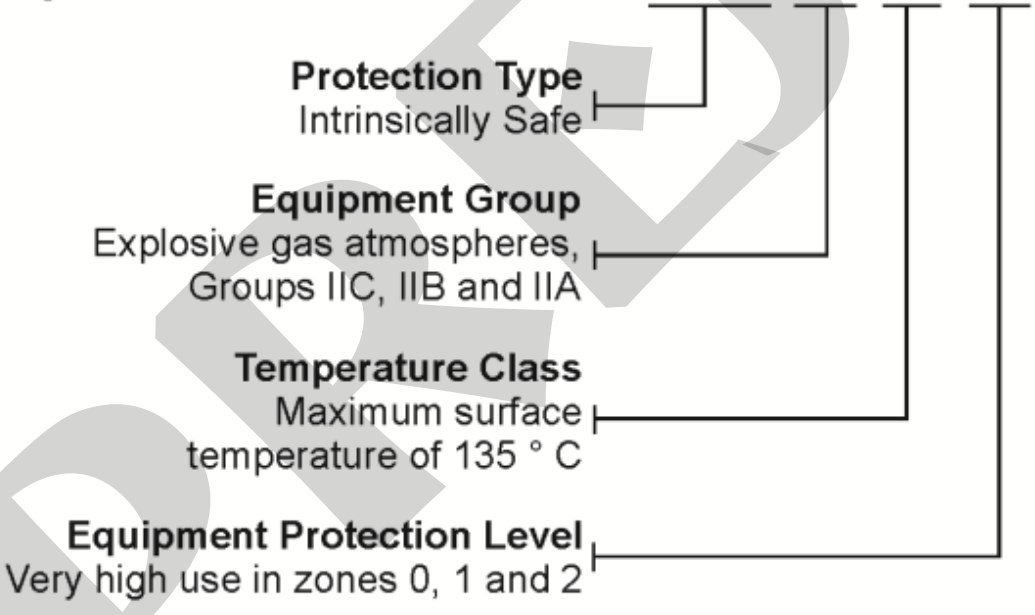
Certificate number ..... NCC 12.1094X

Equipment Model ..... PC-507-IS

Manufacturer ..... PRESYS Instrumentos e Sistemas Ltda.

R. Luiz da Costa Ramos, 260 - Saude - Sao Paulo - SP - Brazil
Zip 04157-020 Phone: +55 11 3056.1900 Fax: +55 11 5073.3366
www.presys.com.br - vendas@presys.com.br

Marking ..... Ex ia IIC T4 Ga




**Note:** The Ex Certificate is sent together with the instrument and its accessories.

# Special Conditions for Safe Use

- Use the calibrator only as described in this technical manual.
- The battery should only be charged in a safe area, using the supplied charger. To prevent explosion or fire, use only the battery BT507-IS and the charger CG507-IS specified by Presys.
- Never replace the battery in hazardous areas.
- Do not use the serial communication port in hazardous atmospheres.
- The calibrator aluminum metal enclosure is protected by a leather bag (BC507-IS) that should always be used when in hazardous areas.
- The intrinsic safety of the instrument is only valid for the connections shown in this manual, respecting the intrinsically safe input and output parameters. The entity parameters and connections are illustrated in the items "2.4, 2.5 and 2.6 - Operation".
- To prevent damage to the instrument and validate the Ex certification, never apply a voltage greater than 30 V between the terminals and the metal enclosure of the instrument.
- Never open the calibrator enclosure. The opening of the enclosure may void the Ex certification.
- Do not use tools that may cause spark in the calibrator; this practice can cause explosion.
- Never do any maintenance on calibrator; the components used are specified and cannot be changed.
- Never use the Calibrator in an area close to explosive dust.

# 1 - Introduction

## 1.1. General Description

The PC-507-IS is a pressure calibrator designed to be used in hazardous areas where there is presence of flammable or explosive vapors. It is an instrument of small dimensions, compact; it operates with rechargeable battery and comes with a leather carrying case. Its technical features indicate performance levels comparable only to laboratory standards; it presents accuracy of 0.025% of full scale. Can be provided with one, two, three or four pressure sensors. Thus, in a single calibrator may be have different pressure ranges, e.g. vacuum, 0 to 100 psi, 0 to 1000 psi and 0 to 3,000 psi, or any combination of available ranges. The calibrator may be purchased with a certain number of sensors, which may be later increased. Designed for field use, it contains useful items as a high contrast LCD for a better viewing in poor lighting conditions, besides presenting measured and generated signals with large digits so that they can be seen far away, rechargeable battery and large memory capacity to store the values making it possible to transfer them to the PC, when necessary. Besides these, may be mentioned several other constructive factors which add to the calibrator quality and efficiency, including providing its use not only in the field as workbench.

It incorporates the most modern concepts of calibration via computer, where data are shared between instrument and computer, improving efficiency in handling information through report and certificate issues, automatic tasks management, data organization and storage, for an overall coverage of quality procedure requirements, especially those related to ISO 9000.

When connected to a computer it can be used for on-line data acquisition (only in safe area).

## 1.2. Specifications

### - volt and mA Inputs

| Input Ranges | | Resolution | Accuracy | Remarks |
|---|---|---|---|---|
| **volt** | 0 to 11 V<br>11 V to 30 V | 0.0001 V<br>0.0001 V | ± 0.02 % FS<br>± 0.02 % FS | $R_{input}$ > 1 MΩ |
| **mA** | 0 to 24.5 mA | 0.0001 mA | ± 0.02 % FS | $R_{input}$ < 65 Ω |

### - volt and mA Outputs

| Input Ranges | | Resolution | Accuracy | Remarks |
|---|---|---|---|---|
| **volt** | 0 to 11 V | 0.0001 V | ± 0.02 % FS | $R_{output}$ < 0.3 Ω |
| **mA** | 0 to 22 mA | 0.0001 mA | ± 0.02 % FS | $R_{max}$ = 450 Ω |
| **2-Wire Transmitter (XTR)** 4 mA to 22 mA | | 0.0001 mA | ± 0.02 % FS | $V_{max}$ = 30 V |

### - Probe

| Probe Range | Resolution | Accuracy* | Remarks |
|---|---|---|---|
| Pt-100 -200 °C to 850 °C /<br>-328 °F to 562 °F | 0.01 °C /<br>0.01 °F | ± 0.1 °C<br>± 0.2 °F | IEC-60751 |

(*)The accuracy is related only to PC-507-IS input.

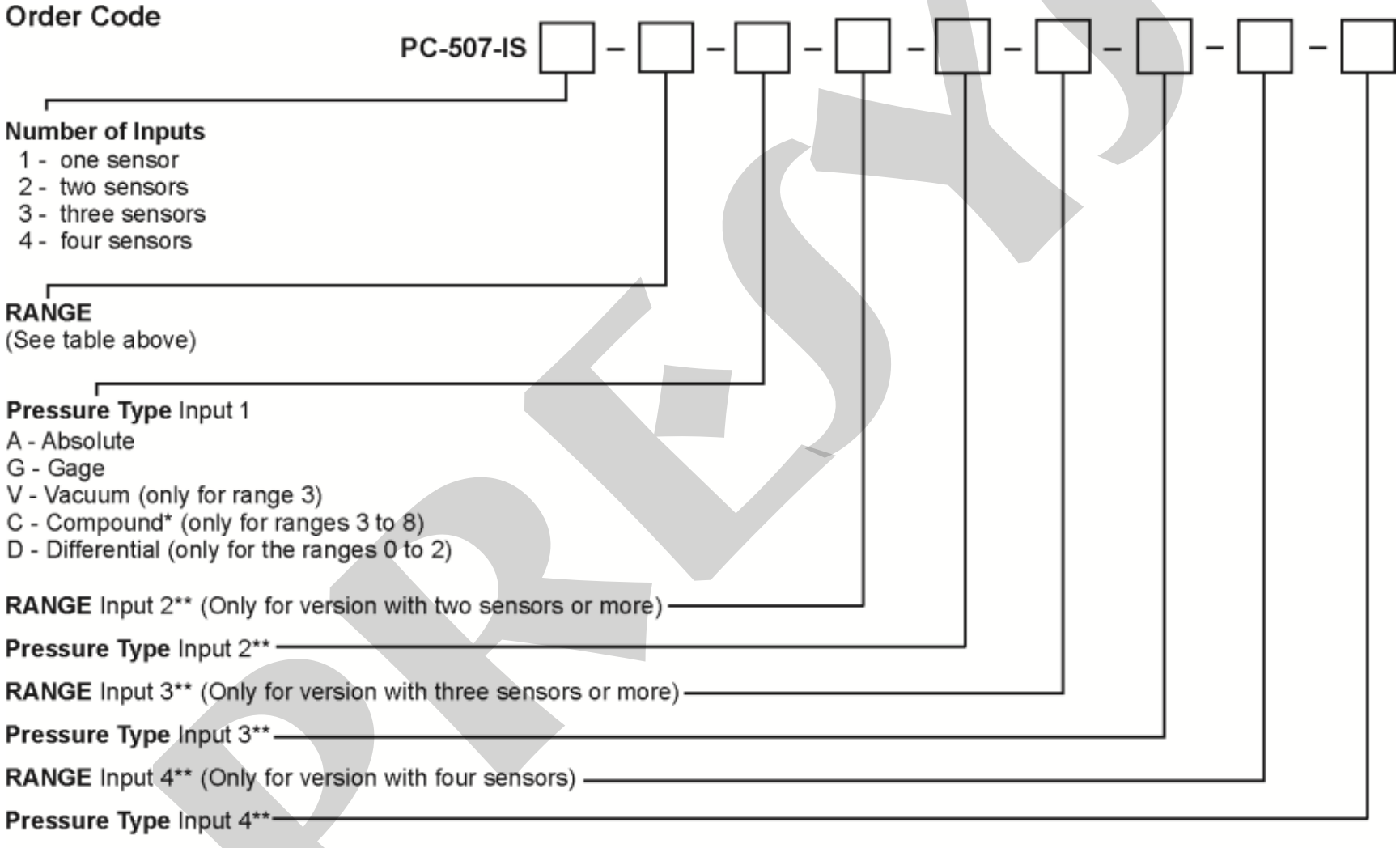
## - Pressure Inputs

| Ranges * | Resolution | Accuracy** | Remarks |
|---|---|---|---|
| (0) 0 – 250 $mmH_2O$ | 0.001 | ± 0.05 % | Gage pressure. Used with air or inert gases. |
| (1) 0 – 1 psi | 0.0001 | ± 0.05 % | |
| (2) 0 – 5 psi | 0.0001 | ± 0.025 % | |
| (3) 0 – 15 psi | 0.0001 | ± 0.025 % | Gage or absolute pressure. Used with fluids (gases or liquids) compatible with 316 L stainless steel. |
| (4) 0 – 30 psi | 0.0001 | ± 0.025 % | |
| (5) 0 – 100 psi | 0.001 | ± 0.025 % | |
| (6) 0 – 250 psi | 0.001 | ± 0.025 % | |
| (7) 0 – 500 psi | 0.01 | ± 0.025 % | |
| (8) 0 – 1000 psi | 0.01 | ± 0.025 % | |
| (9) 0 – 3000 psi | 0.01 | ± 0.025 % | |
| (10) 0 – 5000 psi | 0.1 | ± 0.025 % | |
| (11) 0 – 10000 psi | 0.1 | ± 0.05 % | |
| (12) Other, upon request | | | |

(*) Gage pressure, vacuum (only for range 3), differential (from range 0 to 2), absolute or compound (from range 3 to 8).
(**) Full Scale percentage.

Accuracy values are valid within one year and ambient temperature of 20 to 26 °C. Outside these limits add 0.005 % FS / °C, using 23 °C as the reference temperature.

# 1.3. Order Code




(*) From -15 psi to the range full scale.
(**) Same code as Input 1.

**Special Software Functions**

**- Any output programmable in::**

**1) STEP:** 10%, 20%, 25% or up to 11 programmable set-points via keyboard or adjustable time.

**2) RAMP:** up and down ramps with programmable travel and dwell time.

**- Special Functions:**

**1) SCALE:** makes the scaling of both input and output in 6 digits with signal and allows the configuration of decimal.

**2) CAL:** scales any input in the same unit of output.

**3) CONV:** converts any input into any output.

- **Mem Command:** It can store up to 8 types of configuration chosen by the user.

Warm-up time: 30 minutes.
Compensated temperature range: 0 to 40 ºC (32 to 104 ºF).
Operating ambient: 0 to 50ºC and 90% maximum relative humidity.
Pneumatic connection: 1/4" NPTF (1/8" only for the range 0 - 10,000 psi).
Overpressure: up to twice the sensor full scale pressure (to sensors up to 5,000 psi).
Engineering units: psi, atm, kgf/cm$^2$, in$H_2O$, m$H_2O$, cm$H_2O$, mm$H_2O$, inHg, cmHg, mmHg, bar, mbar, Pa, kPa and torr.

Battery operation:
- 27 hours (nominal).
- 6 hours (when generating mA or using 2-wire transmitter power supply - TPS).

Serial Communication: Modbus® RTU Protocol (RS-232 / RS-485). (use only in safe area).

Includes technical manual, Ex Certificate, test leads, leather carrying case (BC507-IS), rechargable battery (BT507-IS) and battery charger (CG507-IS).

Calibration Certificate (Optional).

Dimensions: 115 mm x 144 mm x 72 mm (HxWxD).

Weight: 1.5 kg nominal.

Enclosure Protection Grade: IP20.

Warranty: 1 year, except for rechargeable battery.

**Notes:**

1 - PC-507-IS and ISOPLAN are Presys trademarks.

# 2 - Operation

## 2.1. Parts Identification

### Front Panel

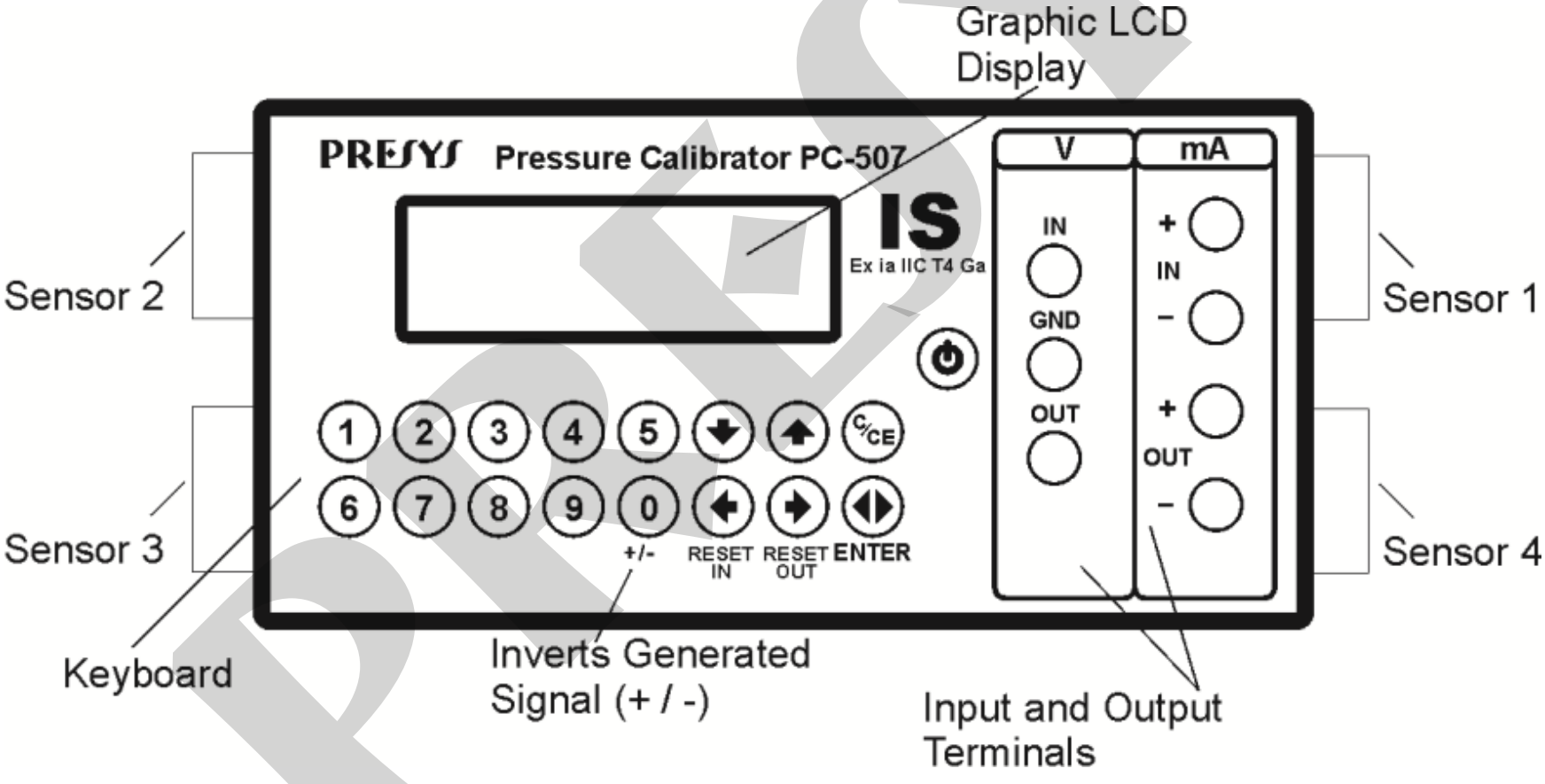



**Fig. 01** – Front Panel

**Left side-view Panel**

**Right side-view Panel**

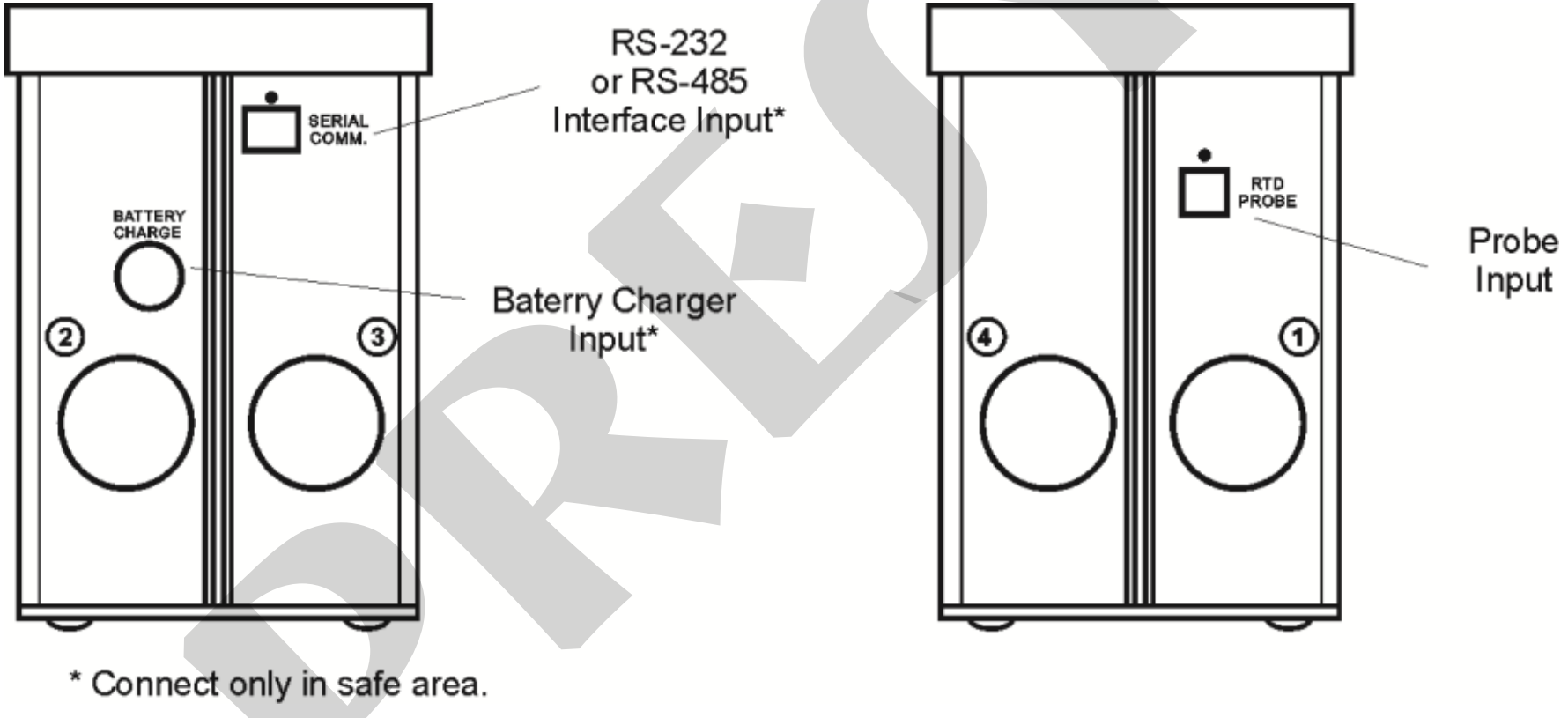



**Fig. 02** – Side Panels

**Accessories:** The leather carrying case has two compartments, one is used to accommodate the calibrator and the other is used to keep several accessories such as test leads, handles for transport and field use and the technical manual.
**In hazardous areas is mandatory to use the carrying case specified by Presys (BC570-IS).**

**Optional Items:** are optional items the Probe for temperature measurement, RS-232 or RS-485 interface, and ISOPLAN calibration software. The optional items are described in specific manuals.

## 2.2. Battery and Charger

The calibrator is supplied with rechargeable battery which enables up to 27 hours of continuous use, or less, especially when the 4-20 mA output is used. A charger is provided, which can be connected to 110 or 220 Vac. Attention to change the selection key 110-220 Vac in the charger. Time required for a full charge is 14 hours. When the display indicates **LOW BAT**, the battery level is low and it is necessary to recharge it. It is possible to use the calibrator while charging the battery, however, to increase the load speed is advisable to leave the calibrator off.

**The battery should only be charged in a safe area. They should be used only charger (CG507-IS) and the battery (BT507-IS) specified by Presys, otherwise there is risk of fire or explosion**

The batteries used by the calibrator are made of Nickel-Metal Hydride (Ni - MH). This new technology for rechargeable batteries does not have the undesirable characteristics of memory effect and environmental pollution as their preceding batteries made of Nickel Cadmium (Ni-Cd).

## 2.3. Using the Calibrator: Basic Functions

When the calibrator is powered on, the display shows:

| | |
|---|---|
| ⇨ **OFF** | **ON** |

If the user does not select ON and press ENTER within 12 seconds, the instrument will turn itself off. The purpose is to save battery from turning the instrument on accidentally while in the bag.

When **ON** is confirmed, the calibrator goes through a self-test routine and shows the last adjustment date and the value of the battery voltage; in case of failure, it displays a message to indicate RAM error or E2PROM error; if that occurs, the instrument should be sent for repair.

After the self-test, the display shows the starting menu:

| | | |
|---|---|---|
| ⇨ **IN** | **OUT** | **EXEC** |
| **CONF** | **ADJ** | **COM** |

**IN / OUT** - selects the input/ output functions.

**ADJ** - selects functions for the adjustment of the calibrator itself (See adjustment section). Do not enter in **ADJ** option before reading the warning in section 4 - Adjustment.

**COM** - refers to the communication with the computer, described in an appropriate manual.

**EXEC** - used to activate an input or output option which has been previously selected.

**CONF** – shows the sub-menu:

| | | | | |
|---|---|---|---|---|
| ⇨ **CF** | **PRG** | **MEM** | | **OF** |
| **FN** | **BT** | **LCD** | **P** | **DT** |

**CF** changes both input and output temperature units from ºC to ºF and vice-versa. It allows choosing the temperature scale between IPTS-68 and ITS-90. It follows the encoding scheme described below:

**ºC-90** ITS-90 temperature scale in Celsius degrees.

**ºF-68** IPTS-68 temperature scale in Fahrenheit degrees.

**OF** - The calibrator incorporates energy saving resources (battery) through the automatic power off option (auto-OFF). This option has the following sub-menu:

| | | |
|---|---|---|
| ⇨ **NO** | **5MIN** | |
| **15MIN** | **30MIN** | |

If **NO** is selected, the energy saving option is disabled.

If **5**, **15** or **30 min** is selected, the calibrator will turn off automatically after this period if the keyboard is not used.

**BT** shows battery voltage level; if the battery voltage level is low the display shows LOW BATTERY and you need to recharge it.
**Remember that you are only allowed to charge it in safe area.**

| Battery Level | Battery State | Display |
|---|---|---|
| 6.0 to 9.0 V | normal | ---------- |
| <6.0 V | low | **LOW BATTERY** |

**LCD** performs the setting of the display contrast using the arrow keys ⬆ and ⬇. The last selection is saved by pressing the ENTER key.

**P** - Shows the sub-menu:

| ⇨ **UNITIN** | | **UNITOUT** |
|---|---|---|
| **P1** | **P2** | **PARAM.** |

**P1** and **P2 -** associates one pressure sensor (C1, C2, C3 or C4) to the mnemonic P1 or P2. Then, reading of the pressure sensor associated to P1 or P2 is performed after being enabled through **IN** or **OUT** menu.

**UNITIN** and **UNITOUT** - contain lists of all pressure engineering units which can be shown in a measurement by the Calibrator. **UNITIN** defines the unit of the pressure value shown in the upper line of the display (pressure chosen through **IN** option of main menu) and **UNITOUT** is related to the pressure value shown in the

lower line of the display (chosen in **OUT**). Note that the units are distributed in several lines. In order to move the cursor through the units use the keys: ↓, ↑, ← and →. After selecting the unit, press ENTER.

The available units are written below between parentheses beside the corresponding mnemonics presented in the calibrator display:

| | | | | | |
|---|---|---|---|---|---|
| **PSI** | (psi) | **ATM** | (atm) | **KG** | ($kgf/cm^2$) |
| **INW** | ($inH_2O$) | **MW** | ($mH_2O$) | **CMW** | ($cmH_2O$) |
| **MMW** | ($mmH_2O$) | **INH** | (inHg) | **CMH** | (cmHg) |
| **MMH** | (mmHg) | **BAR** | (bar) | **MBA** | (mbar) |
| **KPA** | (kPa) | **TOR** | (torr) | **PA** | (Pa) |

**PARAM** - configures the calibration parameters of the pressure sensors provided by the manufacturer.

**DT -** updates the date and time for the calibrator. Thus, when it performs a calibration within the communication option, calibration data is recorded together with their date and time of occurrence.

Whenever the calibrator is turned off, the date and time are not updated any longer. Thus, if you want them to be recorded with the calibration, you should update them. Use the vertical arrow keys ↑ and ↓ to change the value which is blinking and the horizontal arrow keys ← and → to go to another value. The ENTER key confirms the last selection

**PRG, FN** and **MEM** are special features of the calibrator described in other sections below.

## 2.4. Measurement or Input Functions

Select the type of signal to be measured by using the menus and use the corresponding terminals:

**a)** **IN** Selects the input functions:

| | | | |
|---|---|---|---|
| ⇨ | **V** | **mA** | **PROBE** |
| | **Pressure** | **SW** | **NO** |

Press ENTER to select volt measurement; press 🡻, 🡹, 🡸 and 🡺 to select another signal.

**IN = x.xxxx V** Display indicates volt input in large digits.
**C/CE** Returns to the previous menu.

The remaining quantities follow the same selection process.

## b) Entity parameters and connections of input or measurement

b.1) Voltage (V) Input:

| | |
|---|---|
| $U_i$ = 30 V | $U_o$ = 5.4 V |
| $I_i$ = 100 mA | $I_o$ = 6 µA |
| $P_i$ = 750 mW | $P_o$ = 9 µW |
| $C_i$ = 0 nF | $C_o$ = 21.9 nF |
| $L_i$ = 400 µH | $L_o$ = 1.75 mH |

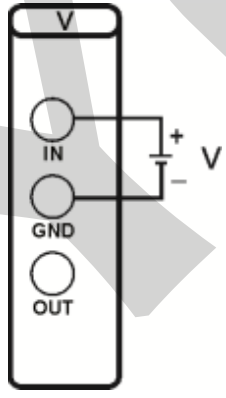



**Fig. 03** – V Input

b.2) Current (mA) Input:

| | |
|---|---|
| $U_i$ = 30 V | $U_o$ = 3.5 V |
| $I_i$ = 100 mA | $I_o$ = 5.9 mA |
| $P_i$ = 750 mW | $P_o$ = 8.7 mW |
| $C_i$ = 0 nF | $C_o$ = 24.6 nF |
| $L_i$ = 400 µH | $L_o$ = 1.35 mH |

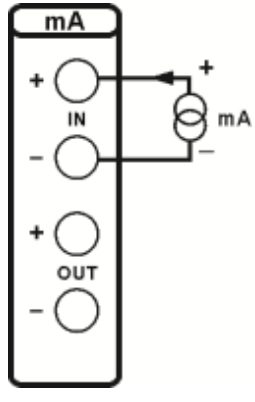



**Fig. 04** – mA Input

b.3) Current (mA) Input with power supply:

| |
|---|
| $U_o$ = 18.1 V |
| $I_o$ = 79 mA |
| $P_o$ = 318 mW |
| $C_o$ = 88 nF |
| $L_o$ = 2.44 mH |

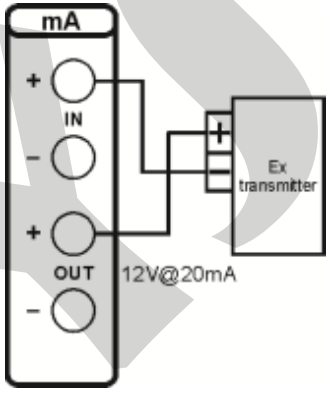



**Fig. 05** – mA Input with power supply

b.4) Switch (SW) Input:

| |
|---|
| $U_o$ = 18.1 V |
| $I_o$ = 19 µA |
| $P_o$ = 83 µW |
| $C_o$ = 151 nF |
| $L_o$ = 499 mH |

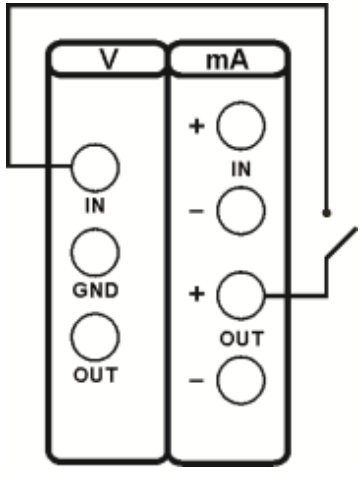



**Fig. 06** – Switch (SW) Input

The contact input **(SW)** is used to measure the continuity of an external contact connected to calibrator V IN and mA OUT (+) terminals. When there is continuity the input indicates **CLOSED**; otherwise, **OPEN** is indicated.

**c) Probe Connection**

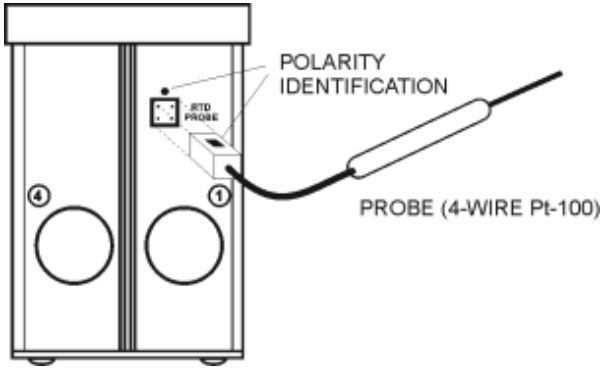
**Probe** is an input for temperature measurement with an optional 4-wire Pt-100 probe. When using the Probe, temperature ranging from -200.00 °C to 850.00 °C can be measured with high accuracy.

When **Probe** input sensor breaking occurs, the display shows the burn-out warning identified by the symbol illustrated below:

**PROB = ????.?? °C**

Connect the probe to the calibrator so that polarity identifications (white mark) match. In the figure below are the probe connections:

c.1) Probe Input:




**CAUTION:** In Probe Input is only allowed simple elements connection with negligible capacitance and inductance.

**Fig. 07** – Probe Input

## d) Pressure Connection

**Pressure** option is related to pressure measurements. After its selection the display shows:

| ⇨ **P1** | **P2** | **P1 - P2** |
|---|---|---|

P1 and P2 correspond to the indication of pressure from two of the sensors chosen by the user from **P** option in **CONF** menu and P1-P2 is related to the difference between pressure 1 and 2. Select any of these three options and press ENTER to enable the selected pressure.

**<u>Warning:</u> Before each pressure measurement, it is necessary to keep the sensor open to air and set the pressure indication to zero. Use the arrow key ⬅ to set pressures read by the input (IN option) to zero and the arrow key ➡ to set pressures read by the output (OUT option) to zero.**

Whenever the input signal (**IN**) is under or over the input ranges established in item 2.2. - Specifications, the display will show **UNDER** or **OVER**, respectively.

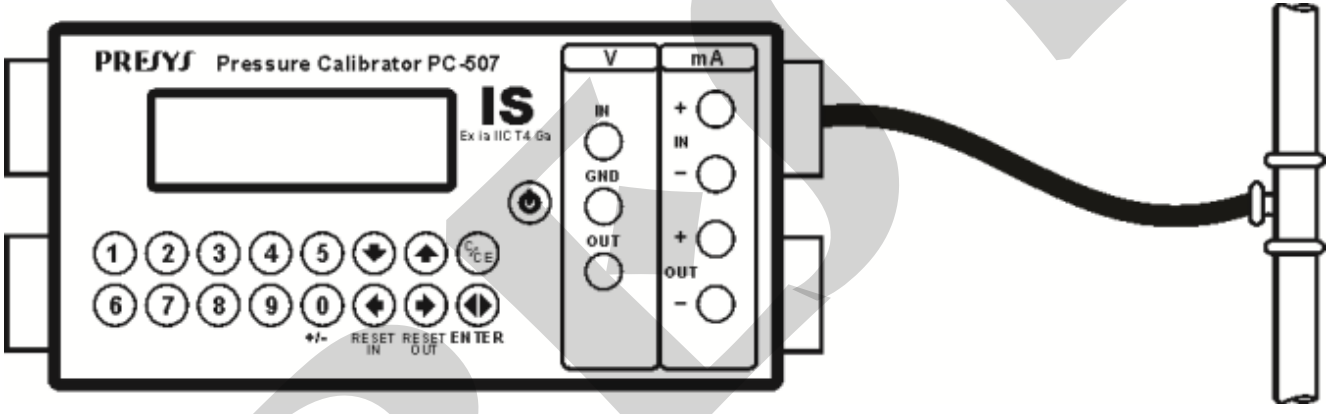



**Fig. 08** – Pressure Measurement

## 2.5. Generation or Output Functions

Select through the menus the signal type to be generated and use the corresponding terminals.

**a)** **OUT** Selects the output functions.

| | | | |
|---|---|---|---|
| ⇨ | **V** | **mA** | **PROBE** |
| | **Pressure** | **NO** | |

Press ENTER to select voltage generation. Press ↓, ↑, ← and → to select another signal.

**OUT = x.xxxx V** Display indicates the value of the output in volts in large digits. The sign can be inverted with the key **0 (+ / -)**

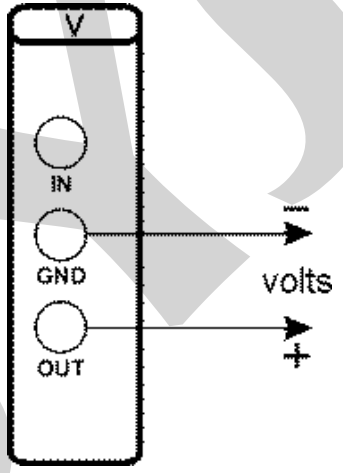
**C/CE** Returns to the previous menu.

The **NO** option disables the output function.

## b) Entity parameters and connections of output or generation

b.1) Voltage (V) Output:

| | |
|---|---|
| $U_i$ = 30 V | $U_o$ = 17.1 V |
| $I_i$ = 100 mA | $I_o$ = 22.3 mA |
| $P_i$ = 750 mW | $P_o$ = 76.5 mW |
| $C_i$ = 0 nF | $C_o$ = 33 nF |
| $L_i$ = 400 µH | $L_o$ = 1.18 mH |




**CAUTION:** Always connect the terminal V OUT to the positive and the terminal V GND to the negative in order to not invalidate the protection mode.

**Fig. 09** – V Output

b.2) Current (mA) output active mode:

| |
|---|
| $U_o$ = 18.2 V |
| $I_o$ = 49 mA |
| $P_o$ = 207 mW |
| $C_o$ = 85 nF |
| $L_o$ = 6.7 mH |

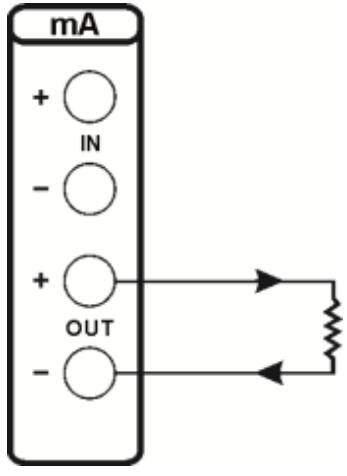
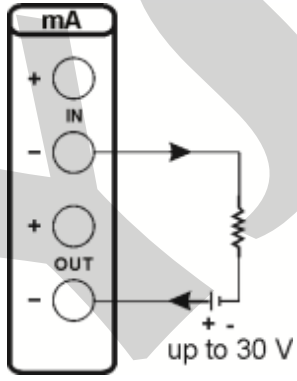



**Fig. 10** – mA Output active mode

b.3) Current (mA) output passive mode:

| | |
|---|---|
| $U_i$ = 30 V | $U_o$ = 17.1 V |
| $I_i$ = 100 mA | $I_o$ = 31 mA |
| $P_i$ = 750 mW | $P_o$ = 27 mW |
| $C_i$ = 0 nF | $C_o$ = 33 nF |
| $L_i$ = 400 µH | $L_o$ = 1 mH |




**CAUTION:** Always connect the terminal mA OUT(-) to the positive and the terminal mA IN (-) to the negative in order to not invalidate the protection mode.

**Fig. 11** – mA Output passive mode

## 2.6. Available Power Supply (TPS)

The Calibrator has a 12V@20mA regulated power supply (TPS), with short-circuit protection (current limited to 30 mA).

| |
|---|
| $U_o$ = 17.1 V |
| $I_o$ = 73 mA |
| $P_o$ = 309 mW |
| $C_o$ = 120 nF |
| $L_o$ = 2.93 mH |

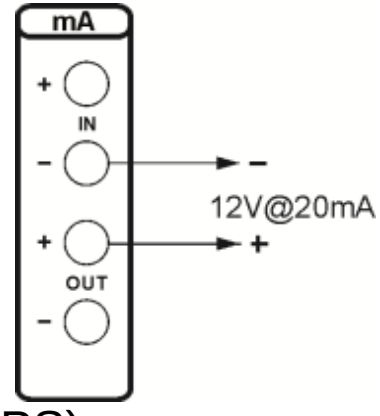



**Fig. 12** – Power Supply (TPS)

## 2.7. Application Examples

Despite its capability of showing simultaneously input and output functions in the display, there is no isolation between V and mA input and output signals. This means that when the calibrator is connected to a converter (I / V, V / I, I / I or V / V) it may not work properly or the set could be damaged, in case the converter is not galvanically isolated. Therefore, when using the calibrator input and output connected to a converter, it is important to make sure the converter (repeater) is isolated (independent grounds).

**It is worth mentioning that all calibrator connections must be made with equipment to meet the safety standards for hazardous areas.**

a) **4-wire Transmitter Calibration**

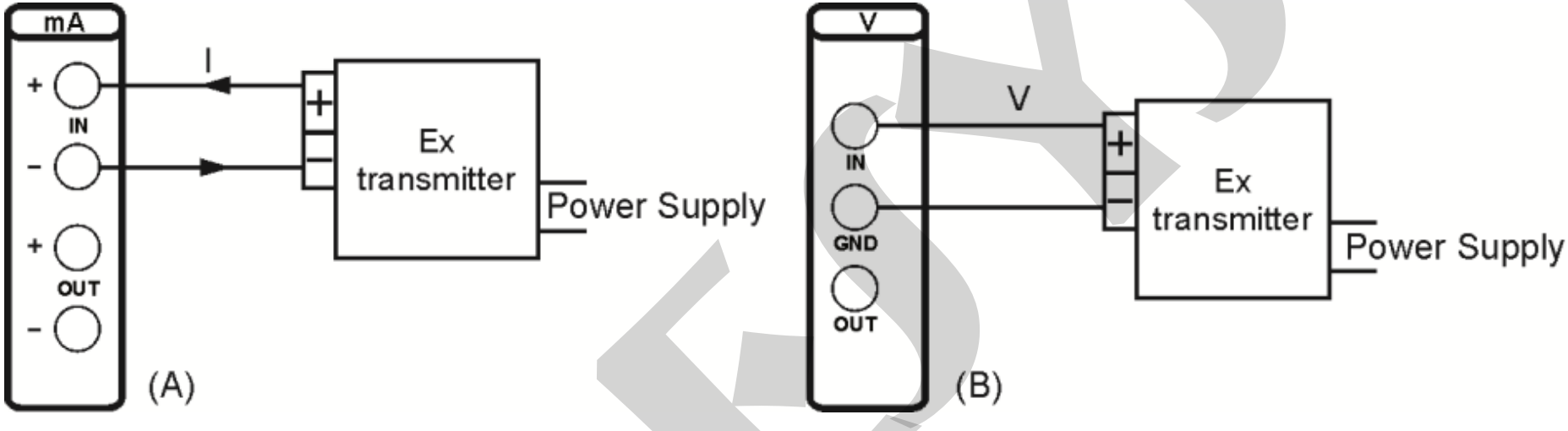



**Fig. 13** – 4-WIRE Transmitter Calibration

## b) 2-wire Transmitter Calibration

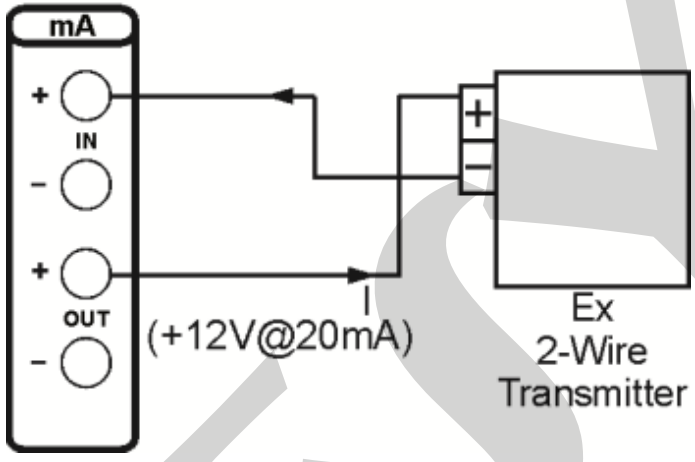



**Fig. 14** – 2-WIRE Transmitter Calibration

## c) Current Supply

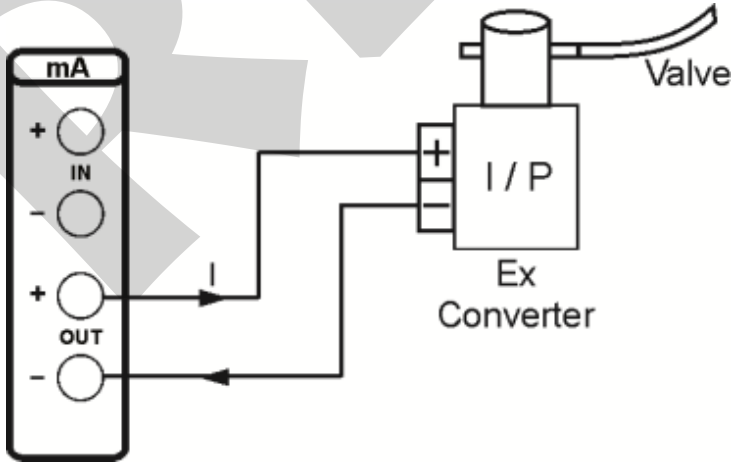



**Fig. 15** – Current Supply

## d) 2-Wire Transmitter Simulation (XTR)

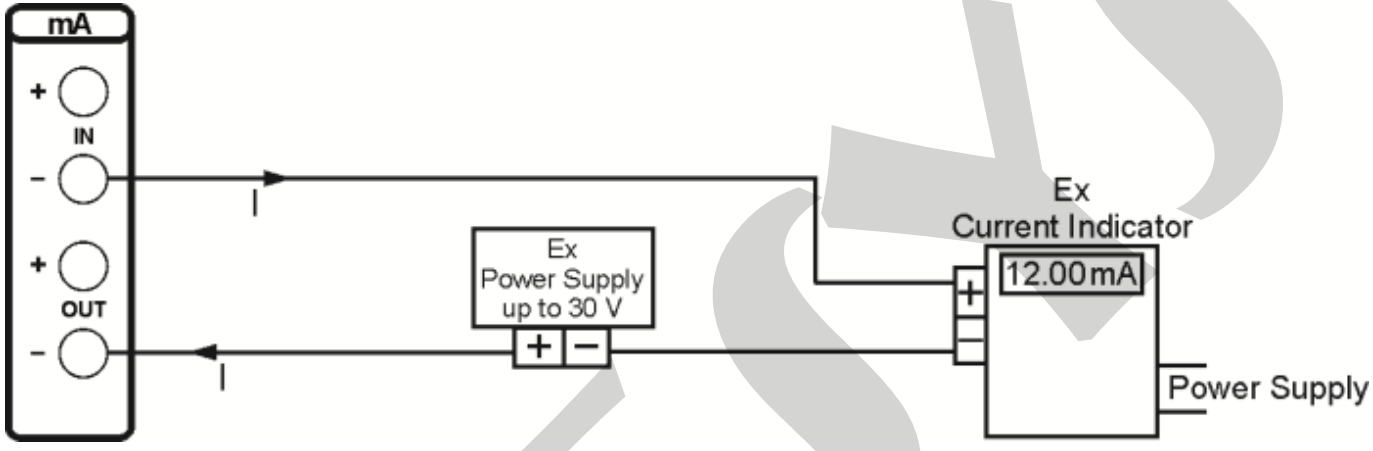



**Fig. 16** – 2-Wire Transmitter Simulation (XTR)

## e) I/V Converter (Isolated)

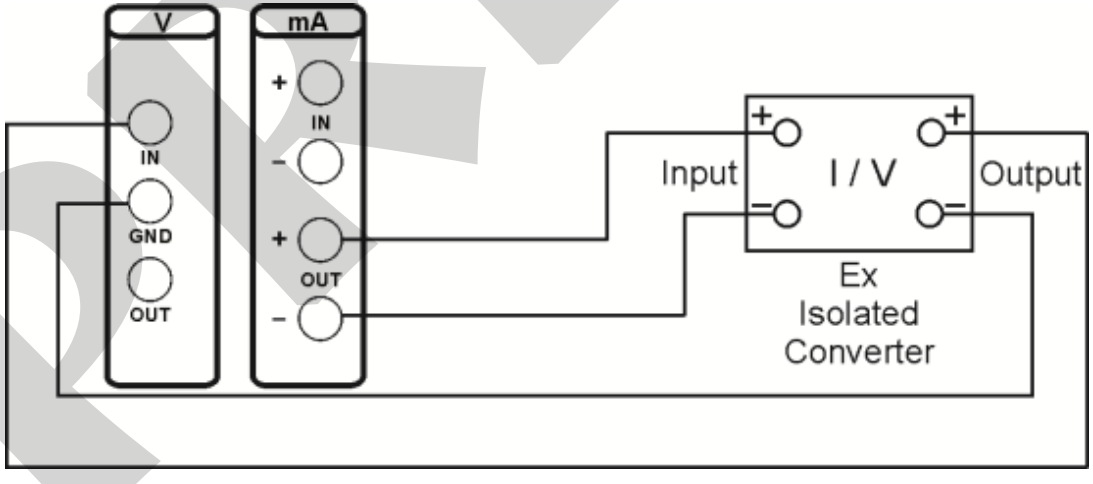



**Fig. 17** – I/V Converter (isolated)

## f) 2-wire Pressure Transmitter Calibration.

Use the 12V@20mA power supply from the calibrator (**TPS**) to power a 2-wire transmitter and make the connection of current as follows.

Select **mA** (current) from the input menu of the calibrator and **Pressure** from the output menu. Input current readings can be scaled to pressure unit through the special function **CAL** (see item about Special Functions). In this way, the deviation between the input and the output of the pressure transmitter can be easily calculated.

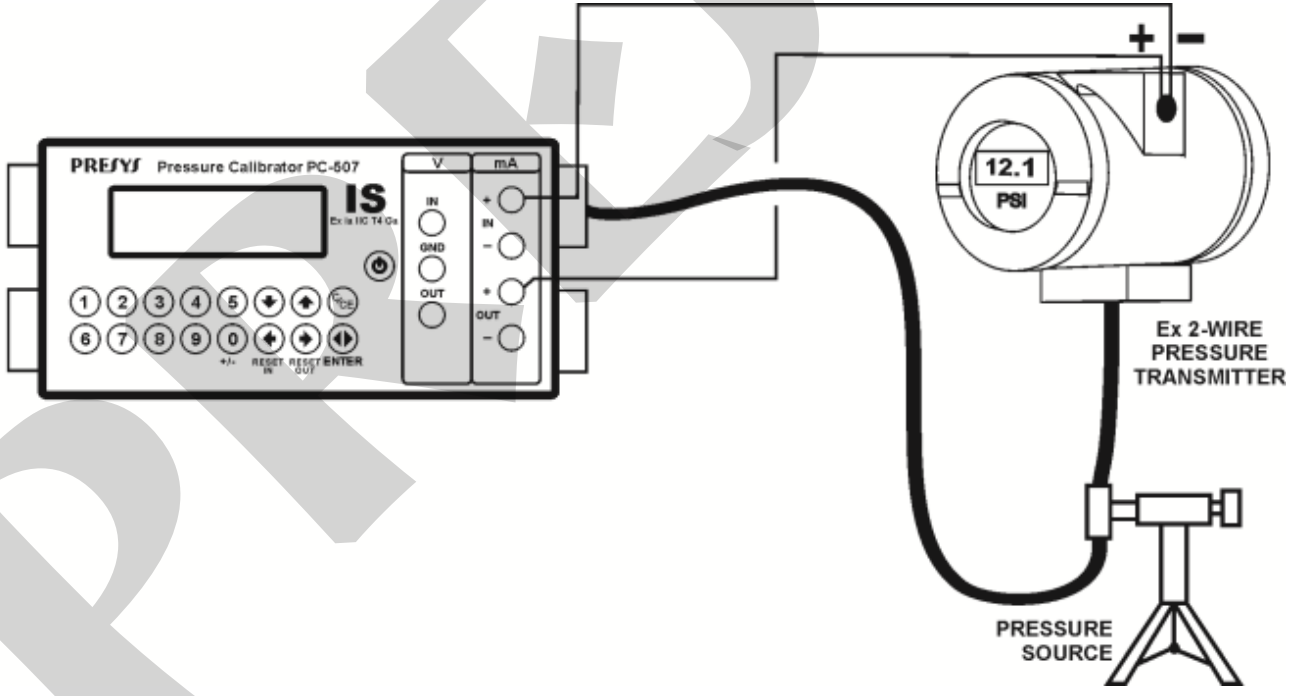



**Fig. 18** – 2-wire Pressure Transmitter Calibration

## g) I/P Converter Calibration.

I/P converters are easily adjusted with the calibrator by using the connections shown below. Select **Pressure** from the input menu of calibrator and **mA** (current) from the output menu.

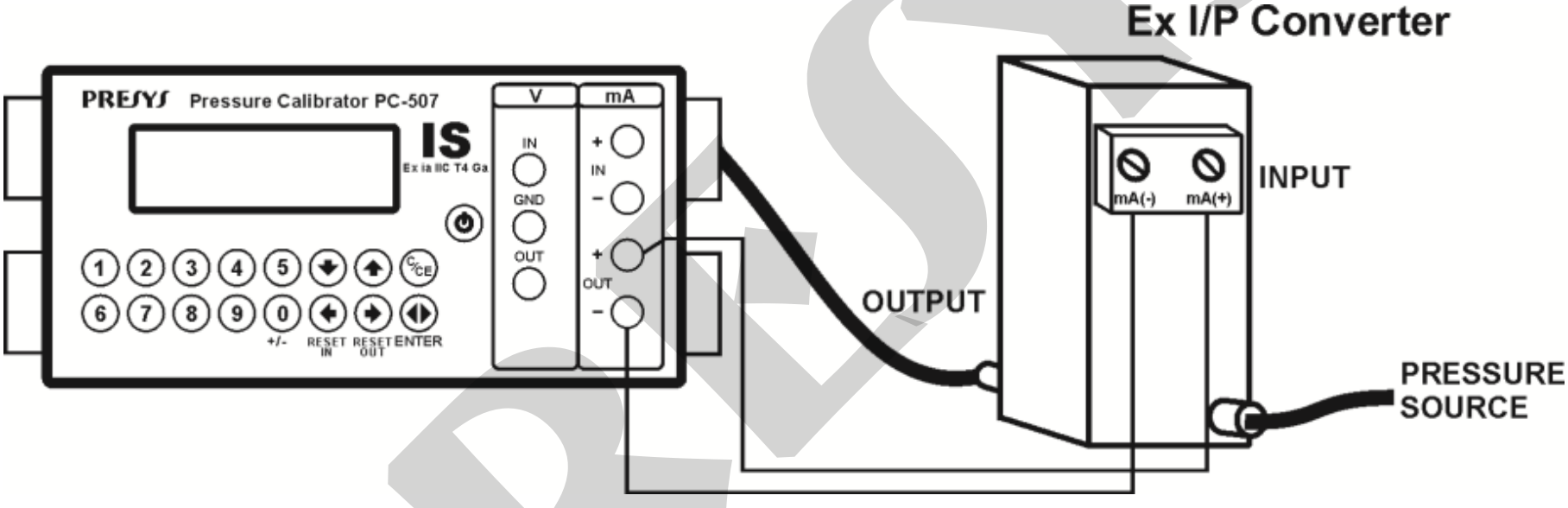



**Fig. 19** – I/P Converter Calibration

## h) Pressure Switches

Pressure switches are devices that receive a pressure signal and have relay alarm. The relay is activated whenever input pressure reaches a certain alarm setpoint.

Connect the pressure switch relay output to the contact input of the Calibrator, V IN and mA OUT (+) terminals, and make the pneumatic connections illustrated in the figure below.

Select **SW** (switch) from the input menu of the calibrator and **Pressure** from the output menu.

Vary the pressure manually. The contact input will track the output pressure reading until the relay position changes. At this time, the relay input reading will 'freeze' with the **LOCK** message in the upper line of the display. The value next to the **LOCK** message is the pressure switch alarm setpoint.

To unlock the input, press the arrow key ←.

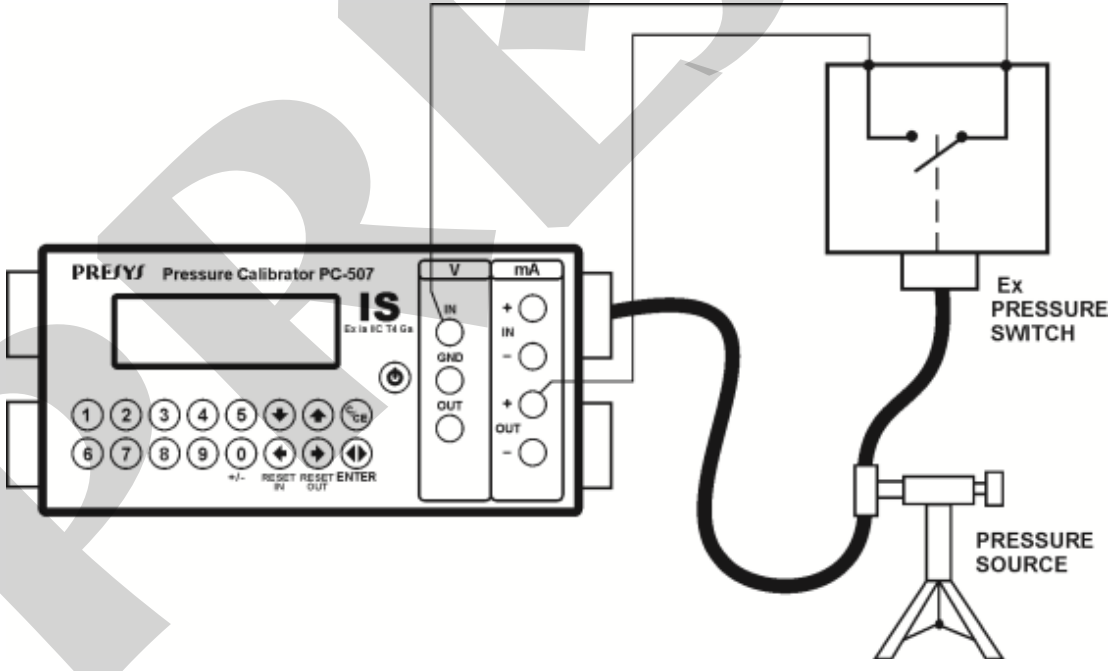



**Fig. 20** – Pressure Switch

## 2.8. Special Programming

When **PRG** is selected, the display shows:


This option allows the selection of special programming features for **INPUT** or **OUTPUT**. **INPUT** is provided with **FILTER**, **DECIMAL** and **SPEED** options. **OUTPUT** is provided with **STEP** and **RAMP** options.

### 2.8.1. FILTER Programming

The value of this parameter (in seconds) configures the time constant of a first order digital filter coupled with the selected input. When the filtering of the measured signal is not required, just set this parameter as **0** (zero).

### 2.8.2. DECIMAL Programming

The value of this parameter (**0**, **1**, **2**, **3** or **DEFAULT**) indicates the number of decimals that the value measured at the input will be displayed.

Note: **DEFAULT** corresponds to the maximum decimals the calibrator may display in an input measurement, in accordance with its resolution.

## 2.8.3. SPEED Programming

This program lets you modify the conversion rate of the input pressure. By selecting **YES,** the conversion rate becomes twice as fast as without this option.

## 2.8.4. STEP Programming

The **STEP** programming makes the calibrator output vary in pre-defined steps. It is useful in calibrations where certain scale points are verified, e.g., 0% - 25% - 50% - 75% - 100%.

To enable this programming through to the main menu, select **CONF** (ENTER), **PRG** (ENTER), **OUTPUT** (ENTER) and **STEP** (ENTER). After this sequence, there will have the options **10%**, **20%**, **25%** and **VARIABLE**; these options define the percentage of variation at the output for each step. The **VARIABLE** option allows the programming of the setpoint values for each step, up to a maximum of eleven values.

The output type must be previously configured; otherwise a **SELECT OUTPUT FIRST** message will be displayed. In this case, press **C/CE** to go back to the main menu and select the output type.

After completing the selection of the step variation percentage, the start and the end values of the range in which the output will vary (**Setpoint High and Low**) are requested.

To continue, go back to the main menu and activate the function in **EXEC**, the output now performs the **STEP** programming, always starting from the beginning of

the range, and the arrow keys ↑ or ↓ must be pressed when you want to proceed to the following output steps.

By pressing the arrow key →, each step will be reached automatically after a preset time, which is defined through the keys: **1**(10s), **2** (20s), **3** (30s), **4** (40s), **5** (50s), **6** (60s), **7** (70s), **8** (80s) and **9** (90s). These time steps are only enabled once the arrow key → has been pressed, what changes the STEP mnemonic to 0s. Under this situation, the steps are automatically and continuously scanned. To quit this mode (STEP set by time), just press the arrow key →.

## 2.8.5. RAMP Programming

By using this programming, the calibrator output varies automatically, thus producing ramps and level marks which can be programmed to work once or continuously.

From the main menu, select **CONF** (ENTER), **PRG** (ENTER), **OUTPUT** (ENTER) and **RAMP** (ENTER). Then you must enter the start and the end values of the range in which the output will vary (**Setpoint High** and **Low**), and also the value of time (in seconds) required for a complete ramp within the range (**Ramp Time**). Another value that may be configured is how long it should dwell at the level mark (**Dwell Time**), i.e., the time during which the output remains constant between two ramps.

After the configuration is done, go back to the main menu and press **EXEC**; then the output goes to the starting value of the configured range. When the arrow key ↑

is pressed, an ascending cycle starts, and by pressing 🡻, a descending cycle begins, only once. Pressing 🡹 and 🡻, the cycles are repeated continuously.

## 2.9. Special Functions

Selecting **FN** the display shows:

| ⇨ **INPUT** | **OUTPUT** |
|---|---|

Through these options, you may select special functions related to the **INPUT** or the **OUTPUT**.

INPUT has the **SCALE**, **CAL** and **NO** options.

The input type must be previously configured; otherwise the **SELECT INPUT FIRST** message will be displayed. In this case, press **C/CE** to go back to the main menu and select the input type.

### 2.9.1. SCALE Function (IN)

It establishes a linear relationship between the calibrator input signal and what is shown on the display, according to the graphic below.

The scaled display indication (#) may represent any engineering unit, such as m/s, $m^3/s$, % etc.

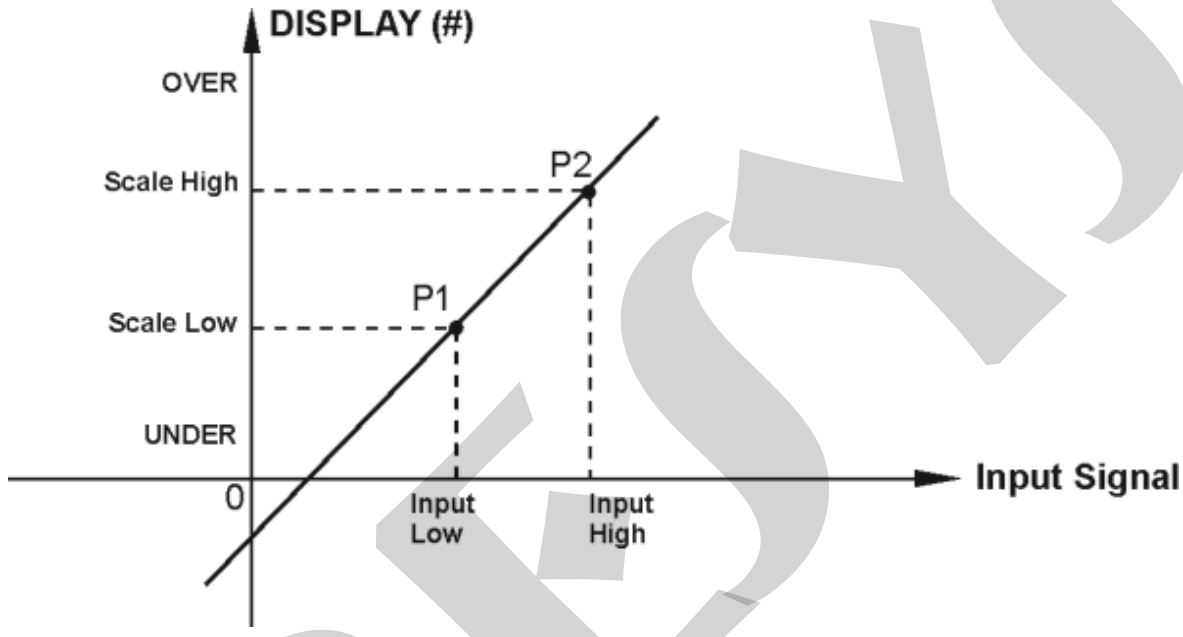



**Fig. 21** – Function SCALE (LINEAR)

The number of decimals (up to 4) shown on the display may be configured by using **Scale Dec** parameter.

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.

For the current input, a linear relationship may be established as it has been previously shown or it may be squared **(FLOW)** as illustrated below:

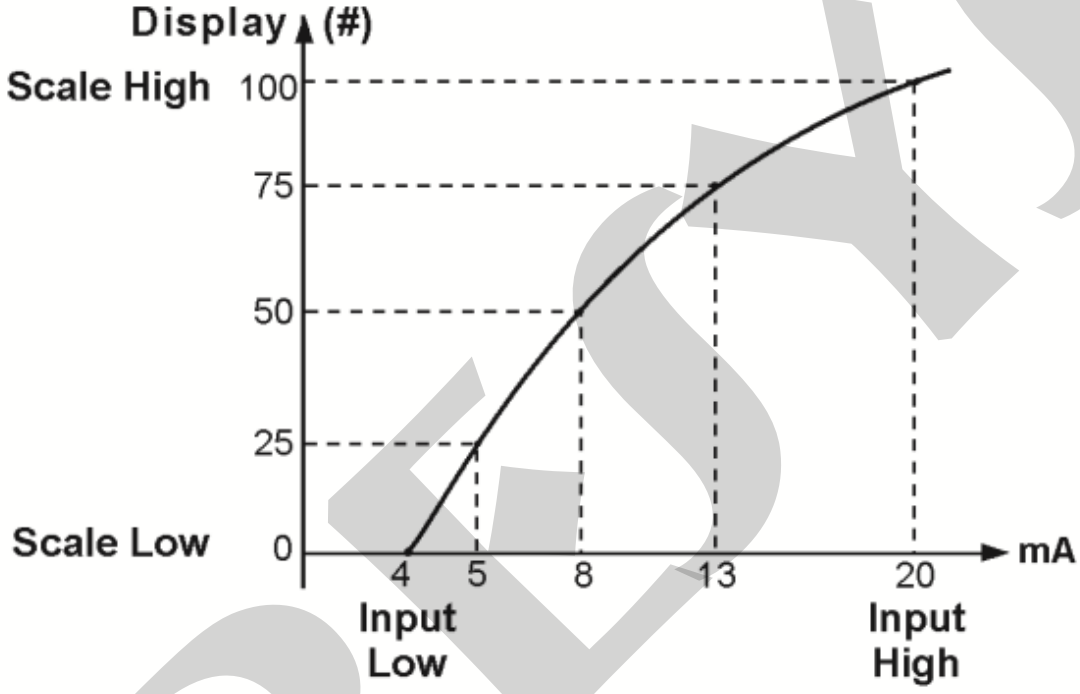



**Fig. 22** – SCALE Function (FLOW)

## 2.9.2. CAL Function

The calibrator may be used to calibrate or check isolated converters. In a typical application, it would “generate” a pressure signal and measure the current signal from a pressure transmitter. Due to reasons of quickness and easiness to compare errors at the input and output of the converter, the reading of the calibrator current input can be displayed in the same unit of the generated signal, i.e., pressure

unit. Thus, both readings of calibrator input and output are scaled in pressure unit, and the error can be promptly calculated.

To activate this function, just fill the four parameters shown in the graphic below. To access these parameters press ENTER after **CAL** is indicated on the display.

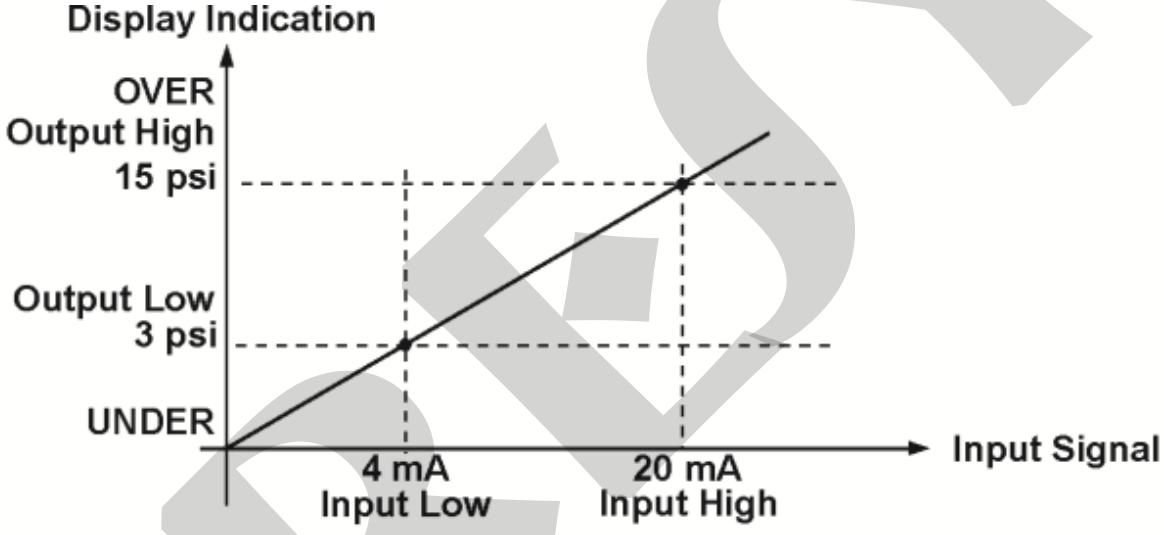



**Fig. 23** – CAL Function (LINEAR)

Note that when **CAL** function is active, the display will indicate **CAL** instead of **IN**, as illustrated below:

**CAL = 12.1000 psi**
**OUT = 12.0000 psi**

To disable **SCALE** or **CAL** functions, just select **NO** option from the menu below and press ENTER.

| **SCALE** | **CAL** | **⇨ NO** |
|---|---|---|

**OUTPUT** has the **SCALE**, **CONV** and **NO** options, described as follows.

The output type must be previously configured; otherwise the **SELECT OUTPUT FIRST** message will be displayed. In this case, press **C/CE** to go back to the main menu and select the output type.

## 2.9.3. SCALE Function (OUT)

Scale function of the calibrator output allows it to simulate the operation of a transmitter. Transmitter input is made directly by keyboard, and it can generate voltage or current as output signal.

**SCALE** output function relates to the output signal generated by the calibrator to the value shown on display, according to the example shown below.

The scaled display indication (#) may represent any engineering unit, such as m/s, $m^3/s$, % etc.

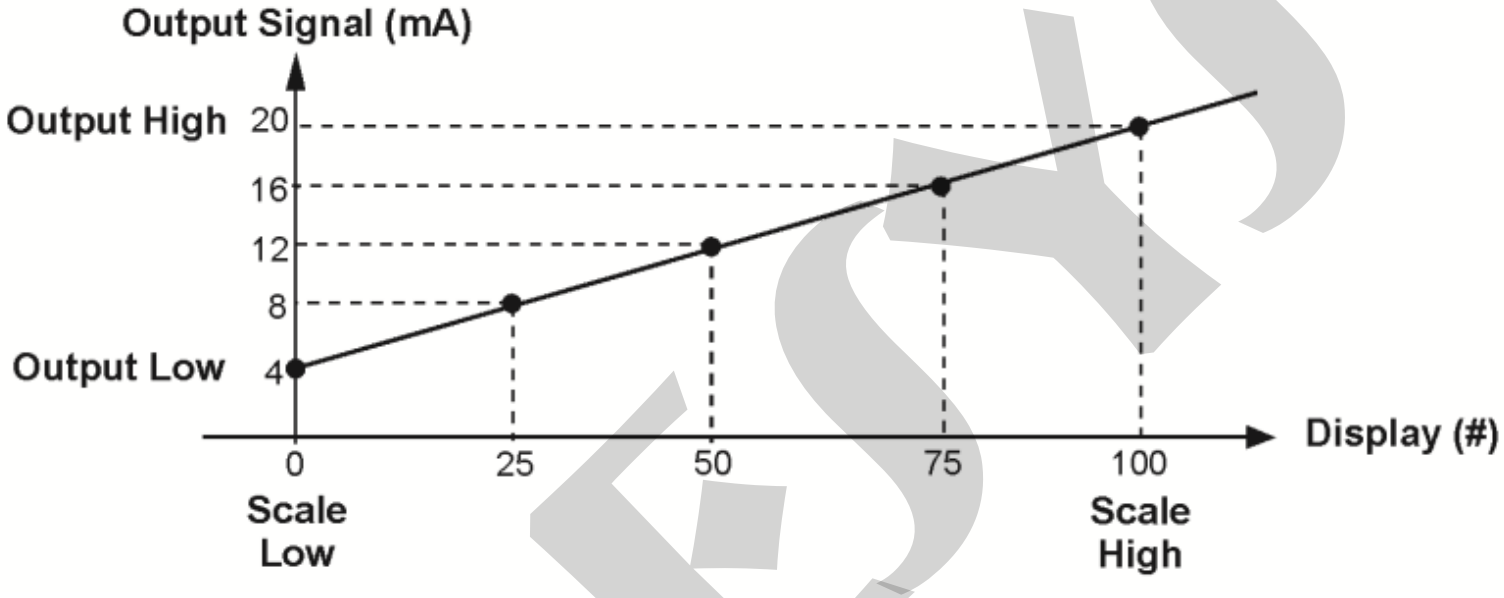



**Fig. 24** – SCALE Function (LINEAR)

**Scale Dec** parameter configures the decimals presented on the display.

The value of **Output High** must always be higher than **Output Low**. **Scale Low** and **Scale High** parameters may have any relationship between them, provided that they are different. Thus, direct or reverse relationships may be established.

In case of current output, as well as for the input, a linear or squared (FLOW) relationship may be established, as shown below.

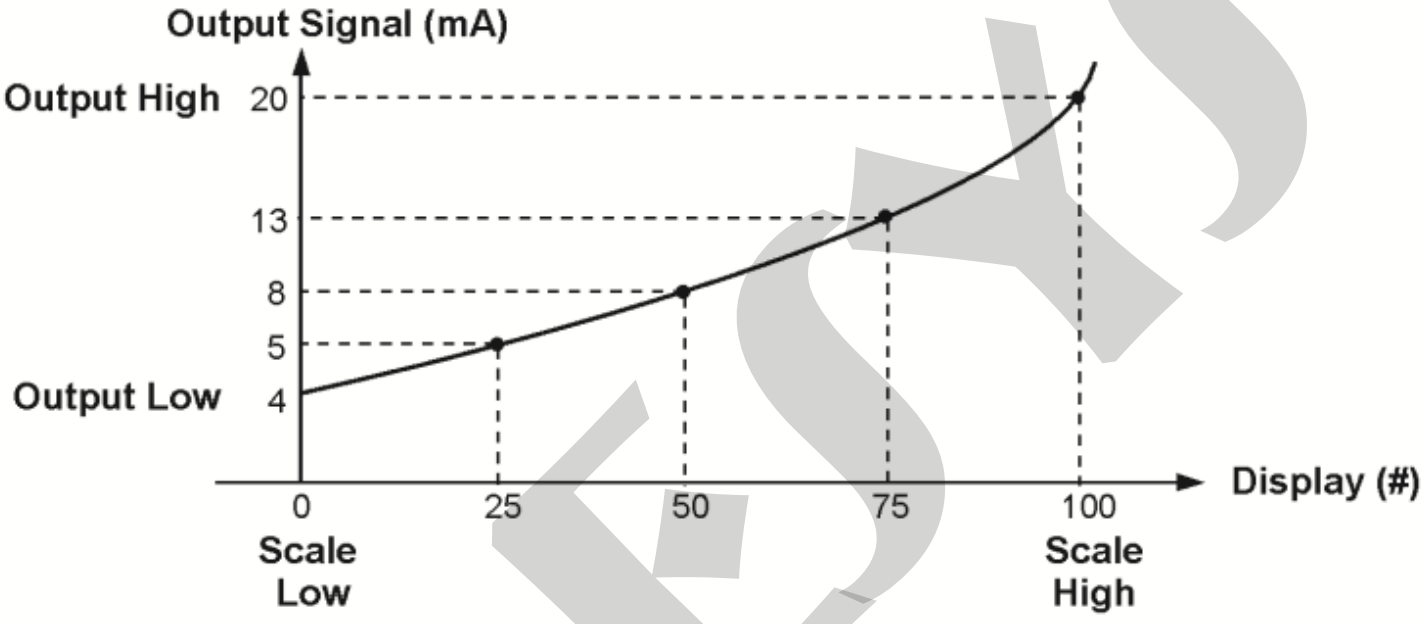



**Fig. 25** – SCALE Function (FLOW)

## 2.9.4. CONV Function

By using the **CONV** function, calibrator may convert any input signal into mA or V output signal. It may therefore work as a non-isolated converter.

Once input and output have been selected, you must fill in the four parameters shown in the next figure. To access these parameters press ENTER after **CONV** is shown on the display.

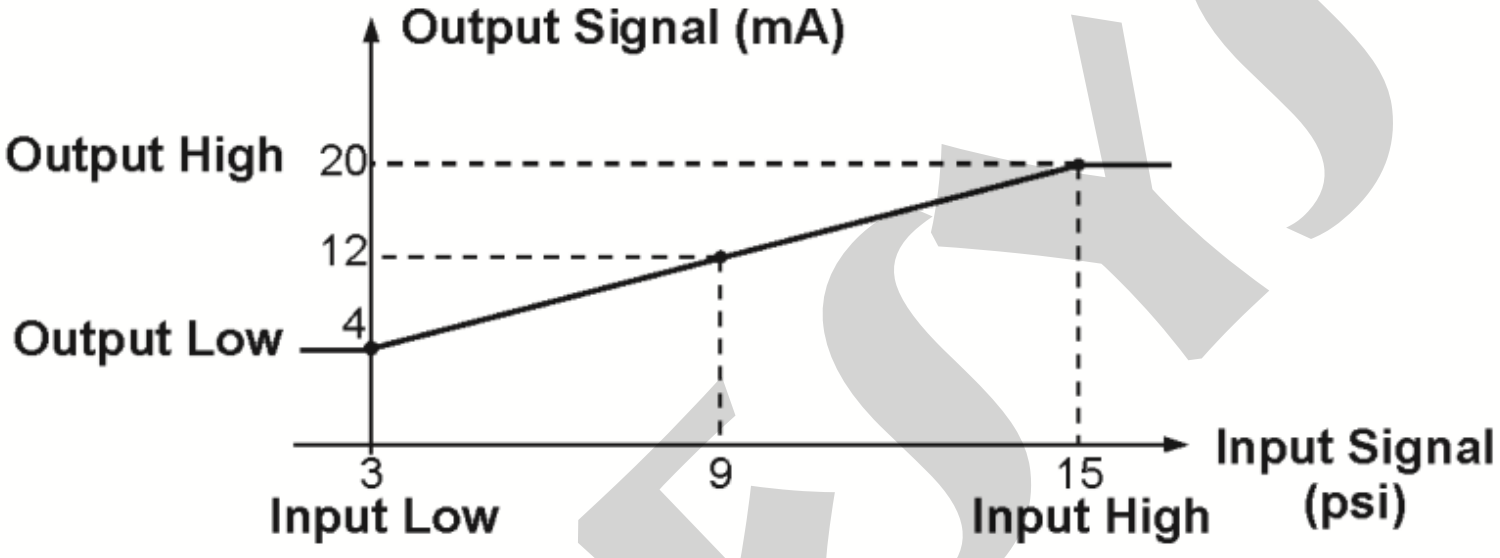



**Fig. 26** – CONV Function

The value of **Output High** must always be higher than **Output Low**. **Input High** and **Input Low** parameters must never be equal. Thus, any type of direct or reverse retransmission from input to output can be obtained.

**Scale** and **Conv** functions may be disabled by selecting the **NO** option and pressing ENTER, as shown below:

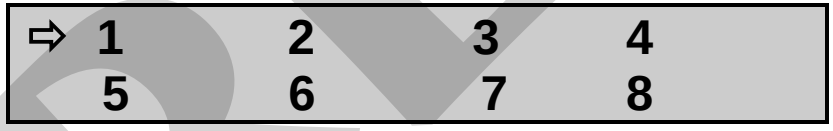
| | | |
|---|---|---|
| **SCALE** | **CONV** | **⇨ NO** |

## 2.10. MEM Command

The calibrator offers several programming and special functions that can be often used. In this case, storing these configurations in the calibrator saves time. One can have up to eight sequences stored in memory.

After making a specific operation in the calibrator through the keyboard, return to the menu **CONF**. Select **MEM** and press ENTER. The display will show:


Select **WRITE** and press ENTER. The display will show:




The numbers shown above represent eight memory positions. Select any of them and press ENTER. The calibrator preset configuration is stored in the chosen memory. In order to call it back, even though the calibrator has been turned off and on, select **RECALL** (ENTER) and the memory number that stored the previous configuration. Press ENTER.

Any new configuration can be written over an already used memory location.

When you want to clear all eight memory locations, select **CLEAR ALL** and press ENTER.

## 2.11. Calibrator Warning Messages

| Warning | Meaning | Procedure |
|---|---|---|
| **RAM ERROR READ MANUAL** | Problem in RAM memory | Turn off and on the calibrator if the error persists, send the instrument to factory |
| **EEPROM ERROR READ MANUAL** | Problem in EEPROM memory | Same as above |
| **CHK LOOP** | mA output opened | Check the loop continuity |
| **LOW BATTERY** | Level of battery voltage is low | Connect the charger to the calibrator (only in safe area) |
| **UNDER / OVER** | Input signal out of specifications or scaling range | See item 2.2.Input Specifications |
| **LOW RES** | Short-circuit in V output | Check the impedance of the input circuit connected to calibrator |
| **????.??°C** | Temperature sensor is open | Check the probe connection polarity |

## 3 - Adjustment

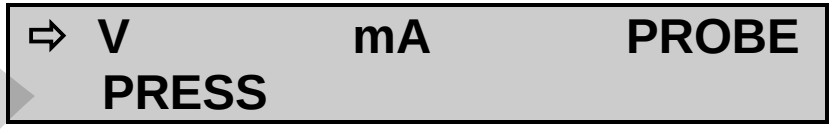
**Warning: Enter the following options only after understanding them completely. Otherwise, it may be necessary to return the instrument to the factory for readjustment!**

Select **ADJ** option from the main menu and press ENTER. Enter the **PASSWORD** 9875 to access the calibration menu.

The password works as a protection to adjustment ranges. After entering the password, the menu displays the options:


Then, choose if the calibration will be performed over an input range (**IN**) or an output range (**OUT**). **DATE** is an option which allows you to record the date in which the calibration is performed and once it has been filled in, it will be displayed every time the instrument is turned on. The date can only be updated after an adjustment operation.

Options for **IN** adjustment are:



Options for **OUT** adjustment are:

| ⇨ **V** **mA** |
|---|

There is no order or interdependence between the adjustments.

## 3.1. Input Adjustment

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

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

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

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

| **V Input** | **1st point** | **2nd point** |
|---|---|---|
| Single range | 0.00000 V | 11.00000 V |

| **mA Input** | **1st point** | **2nd point** |
|---|---|---|
| Single range | 0.0000 mA | 20.0000 mA |

## Probe Adjustment.

First identify the connector pins of **Probe** input according to the figure below:

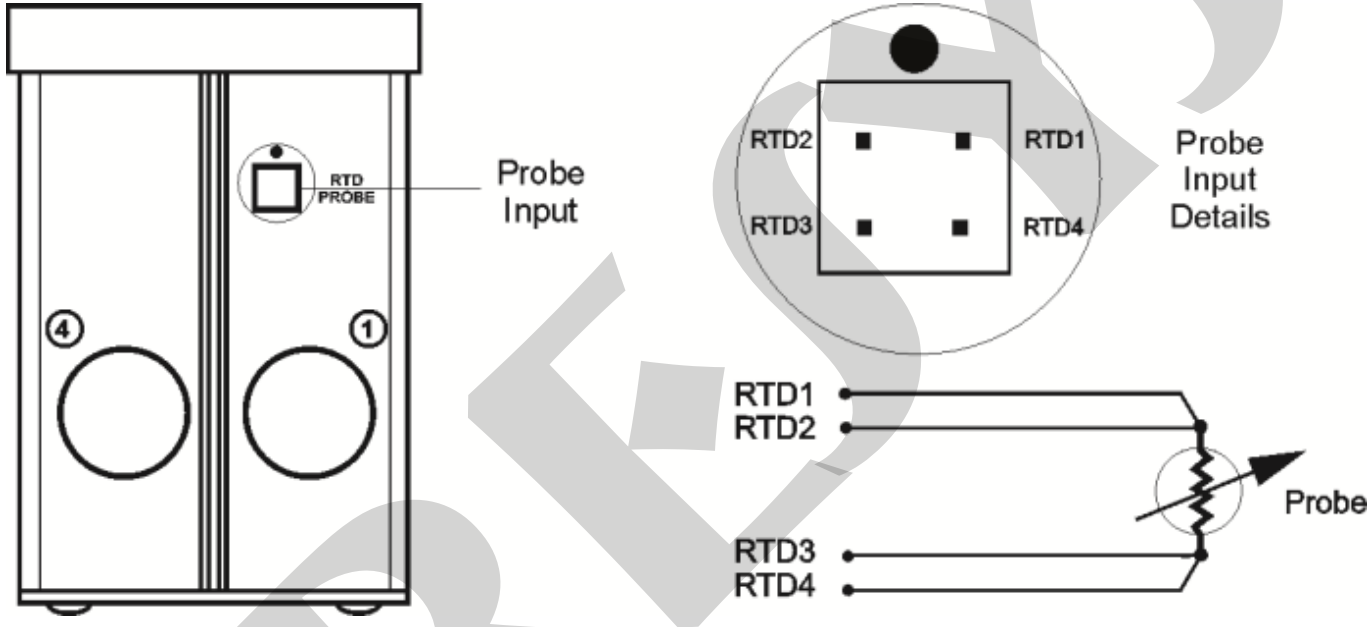



**Fig. 27** – Probe Adjustment

**Probe** adjustment is performed in two steps:

### a) mV Signal Application:

| mV signal | Terminals | 1st point | 2nd point | mV signal |
|---|---|---|---|---|
| V_2 | RTD2(+) | V GND | 100.000 mV | 120.000 mV |
| V_1 | RTD2(+) | V GND | 120.000 mV | 600.000 mV |

**b) Standard Resistors Application:**

Connect a decade box or standard resistors to the **Probe** connector, at positions RTD1, RTD2, RTD3 and RTD4, as shown above.

| Resistors | 1st point | 2nd point |
|---|---|---|
| R_2 | 20.000 Ω | 50.000 Ω |
| R_1 | 100.000 Ω | 500.000 Ω |

**Pressure Adjustment**

By selecting **Press** (ENTER), it shows the sub-menu:

| | |
|---|---|
| ⇨ **V_1** | **V_2** |
| **P1** | **P2** |

**Pressure** input adjustment is only completed after calibrating the options: **V_1**, **V_2**, **P1** and **P2**. Note that **P1** and **P2** refer to two pressure sensors chosen from **P** option in **CONF** menu

The **V_1** and **V_2** adjustment is performed only at the factory.

The calibrations of the sensors associated to mnemonics **P1** and **P2** consist of the application of two pressure values close to zero and full scale (FS) of the pressure sensor. Store the values of the 1st and 2nd calibration points by means of keys 1 (1st point) and 2 (2nd point).

## Gauge, Absolute or Differential Pressure Adjustment

| Pressure Sensor | Applied Pressure | Stored Value |
|---|---|---|
| 250 mmca | 0.0000 mmca<br>250.0000 mmca | 0.000 mmca (key 1)<br>250.000 mmca (key 2) |
| 1 psi | 0.000 mmca<br>703.070 mmca | 0.00 mmca (key 1)<br>703.07 mmca (key 2) |
| 15 psi(*) | 0.00000 psi<br>15.00000 psi | 0.0000 psi (key 1)<br>15.0000 psi (key 2) |

(*)Other pressure ranges follow the same procedure by altering full scale from 15 psi to the full scale of the used sensor (unit in psi).

## Vacuum Sensor

| Pressure Sensor | Applied Pressure | Stored Value |
|---|---|---|
| Vacuum | 1.00000 psi (absolute)<br>13.00000 psi (absolute) | -12.5000 psi (key 1)<br>-0.5000 psi (key 2) |

## 3.2. Output Adjustment

Select the corresponding mnemonic, choose the setpoint explained as follows, measure the signal generated by the calibrator and store this value as detailed in the following tables.

For adjustment of outputs, the display shows three values:

| | |
|---|---|
| | **SP = 50,000%** (1) |
| **49,999** (2) | **5,00000** (3) |

First Field (1) is the value of the setpoint as a percentage (%) of the output range required by the user and it is selected by pressing key "0" (zero).

Second Field (2) is the value measured by the calibrator expressed in percentage (%) of the output range. Before providing the 1st, 2nd and 3rd adjustment points, one must wait until this value stabilizes.

Third Field (3) is the value entered by the user after the output has been measured and the values corresponding to the two setpoints have been stored: 1st point (key 1), 2nd point (key 2) and 3rd point (key 3).

| V output | 1st point | 2nd point | 3rd point |
|---|---|---|---|
| Single range | SP = 10.000% | SP = 60.000% | SP = 80.000% |

| mA output | 1st point | 2nd point | 3rd point |
|---|---|---|---|
| Single range | SP = 10.000% | SP = 60.000% | SP = 80.000% |

# 4 - Unit Conversion

| psi | atm | kgf/cm$^2$ | in$H_2O$(1) | m$H_2O$(1) | cm$H_2O$(1) | mm$H_2O$(1) | torr(2) |
|---|---|---|---|---|---|---|---|
| 1 | 6.804605 x 10 $^{-2}$ | 7.030696 x 10 $^{-2}$ | 2.767990 x 10 $^{1}$ | 7.030696 x 10 $^{-1}$ | 7.030696 x 10 $^{1}$ | 7.030696 x 10 $^{2}$ | 5.171500 x 10 $^{1}$ |

| psi | inHg(2) | cmHg (2) | mmHg(2) | bar | mbar | kPa | Pa |
|---|---|---|---|---|---|---|---|
| 1 | 2.036024 | 5.171500 | 5.171500 x 10 $^{1}$ | 6.894757 x 10 $^{-2}$ | 6.894757 x 10 $^{1}$ | 6.894757 | 6.894757 x 10 $^{3}$ |

(1) For water at 4 °C (39.2 °F)
(2) For mercury at 0 °C (32 °F)

Note: Table based on DOQ-CGCRE-017 document - Revision 02 - February / 2010 - INMETRO.

## Notes

- The readjustment of the calibrator must be performed in conditions of temperature and humidity reference.

- The minimum warm-up is two hours.

- The battery charger must be disconnected.

- The Standards presented to the calibrator during the readjustment should have an accuracy at least 3 times better than the accuracies of the calibrator provided in this manual.

PRESYS | Instruments Inc.

www.presys.com.br

Calibração NBR ISO/IEC 17025

CAL 0193

SISTEMA DE GESTÃO QUALIDADE

TÜVRheinland

Brasil NBR ISO 9001

Safety

INMETRO OCP 0034

Ex ia IIC T4 Ga

NCC 12.1094X