

PRESYS®



Universal
Process
Calibrator
MCS-XV-IS

TECHNICAL MANUAL



Important Safety Instructions MCS-XV-IS



When entering a hazardous area, remove the protective film from the display first.



Perform a full battery charge in a NON-classified area.



Press the **ON/OFF** key only once and wait a few seconds.



When pressing the **ON/OFF** key, the display lights up quickly and then turns off completely for a few seconds. After this interval, the display restarts automatically.



Turn on the calibrator and configure the desired inputs and outputs before connecting the calibrator to the process.

www.presys.com.br

IMPORTANT INSTRUCTIONS:

- This manual contains instructions for the MCS-XV-IS designed for use in hazardous areas. Read the entire manual before using the calibrator.
- Before using the calibrator, carefully read the section “Special conditions for safe use”.
- Keep the calibrator in a dry environment whenever possible.
- In case of failure or suspected failure, especially in safe operation, send the instrument for repair to the factory., always send the instrument to the factory for repair.
- When not in daily use, before starting up, let the calibrator be turned on for at least one hour.

The warranty conditions are available on our website:
www.presys.com.br/warranty

Warning: The information contained in this technical manual was current as the time of printing and applies to specific versions.
Changes may be made for the purpose of continuous products improvement.

Table Of Contents

Marking Details	3
Special conditions for safe use.....	4
1 - Introduction.....	5
1.1. General Description.....	5
1.2. Specifications – Inputs	6
1.3. Specifications – Outputs.....	9
1.4. Optional Items	12
1.5. General Specifications	14
1.6. Special Software Features	16
1.7. Order Code	17
2 - Operation.....	18
2.1. Parts Identification.....	18
2.2. Battery and charger.....	21
2.3. Using MCS-XV-IS: Basic Functions	23
2.4. Calibrator.....	24
2.4.1. Measurement or Input Functions	26
2.4.2. Generation or Output Functions	40
2.4.3. Available Power Supplies	46
2.4.4. Input Special Functions	47
2.4.5. Output Special Functions.....	51
2.4.6. Saving Current Configuration (Memory Manager)	57
2.4.7. AD/Ratio	59
2.4.8. Bargraph.....	60
2.4.9. Calibration Examples.....	62
2.5. HART®	68
2.5.1. HART® Connections.....	68
2.5.2. Starting Communication	72

2.5.3. Adjusting the Measurement Range of a HART® Transmitter (CH Option)	74
2.5.4. Adjusting the Measurement Range of a HART® Transmitter with Reference (CH Option)	76
2.5.5. Checking / Adjusting HART® Transmitter mA Output (CH Option)	78
2.5.6. Full HART® Configurator (Option FH)	80
2.6. Data Logger	84
2.7. Automatic Tasks	86
2.7.1. Creating Tasks	86
2.7.2. Executing Tasks	91
2.7.3. Viewing Results	92
2.7.4. Task Advanced Options	96
2.8. Help Desk	97
3 - Settings	99
3.1. Date and Time	99
3.2. Network	100
3.3. Services	100
3.3.1 File Sharing and USB host control	101
3.3.2. Server Communication	102
3.4. System	102
4 - Adjust	106
4.1. Inputs Adjustment	108
4.2. Outputs Adjustment	111
4.3. Probe Adjustment	112
4.4. CJC Adjustment	113
5 - Pressure sensor installation and adjustment	114
5.1. Installation	115
5.2. Parameters Configuration	115
5.2.2. mV Adjustment	119
5.2.3. Pressure Adjustment	121
6 - Pressure Units Conversion	123

MCS-XV-IS Marking Details

Certificate number	NCC 12.1094X
Equipment Model	MCS-XV-IS
Manufacturer	PRESYS Instrumentos e Sistemas Ltda. R. Luiz da Costa Ramos, 260 - Saúde - São Paulo - SP - Brasil CEP 04157-020 - Tel.: 11 5073.1900 - Fax: 11 5073.3366 www.presys.com.br - vendas@presys.com.br
Marking	Ex ia IIC T4 Ga
Protection Type Intrinsically Safe	
Equipment Group Explosive gas atmospheres, Groups IIC, IIB and IIA	
Temperature Class Maximum surface temperature of 135 °C	
Equipment Protection Level Very high use in zones 0, 1 and 2	

Note.: The Ex Compliance Certificate is sent 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 charger provided. To avoid explosion or fire, use only the battery (BTXV-IS) and charger (CGXV-IS) specified by Presys.
- Never replace the battery in a hazardous area.
- Do not use the serial communication port in an explosive atmosphere.
- The calibrator's aluminum metallic enclosure is protected by a leather case (BCXV-IS) that should always house it when in a hazardous area.
- 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 items 2.4, 2.5 and 2.6 - Operation.
- To avoid damage to the instrument and invalidate the Ex certification, never apply a voltage greater than 30 V between the terminals and the metallic enclosure of the instrument.
- Never open the calibrator. Opening the enclosure may void the calibrator Ex certification.
- Do not use tools on the calibrator that may cause sparks; this practice can cause an explosion.
- Never perform maintenance on the 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

MCS-XV-IS Process Calibrator enables measurement and generation of signals used in instrumentation and process control. Provides all features required for easier calibration and adjustment services on process instruments. It has high levels of accuracy, including aspects relating to changes in room temperature and maintains the specifications over long periods of time.

Designed for field use, includes useful items as: carrying case, holders with fastener rings or belts for a hands-free operation, 5.7" display with LED backlight for a better viewing in poor lighting conditions, rechargeable battery and large memory capacity to store the values obtained during calibrations enabling the transfer of these to the PC when needed.

Incorporates state-of-the-art concepts of automatic calibration and adjustment via computer. Instrument and computer share measurement data obtained for a more efficient handling of information such as report and certificate issues, automatic work management, data sorting and storage, for an overall coverage of quality procedure requirements, especially those related to ISO-9000. It has HART[®] communication for reading and setting parameters of field devices that have this protocol.

Can be supplied with up to two pressure sensors. Thus, a single calibrator can have different ranges of pressure, for example vacuum, 0 to 100 psi, 0 to 1,000 psi and 0 to 3,000 psi, or any combination of available ranges.

Another optional item is a high accuracy sensor, which among its many functions can work as a standard thermometer. Thus, while indicating the reference temperature, allows the calibration of another temperature sensor.

1.2. Specifications – Inputs

Input Ranges	Resolution	Accuracy	Remarks
millivolt -500 mV to -150 mV -150 mV to 150 mV 150 mV to 2450 mV	0.01 mV 0.001 mV 0.01 mV	$\pm 0.02\%$ FS* $\pm 0.01\%$ FS $\pm 0.02\%$ FS	$R_{\text{input}} > 10\text{ M}\Omega$ auto-ranging
volt -10 V to 11 V 11 V to 30 V	0.0001 V 0.0001 V	$\pm 0.02\%$ FS $\pm 0.02\%$ FS	$R_{\text{input}} > 1\text{ M}\Omega$
mA -5 mA to 24,5 mA	0.0001 mA	$\pm 0.01\%$ FS	$R_{\text{input}} < 120\ \Omega$
resistance 0 to 400 Ω 400 to 2500 Ω	0.01 Ω 0.01 Ω	$\pm 0.01\%$ FS $\pm 0.03\%$ FS	Excitation current 0.31 mA, auto-ranging
frequency** 0 to 600 Hz 600 to 1300 Hz 1300 to 5000 Hz	0.01 Hz 0.1 Hz 1 Hz	$\pm 0.04\text{ Hz}$ $\pm 0.2\text{ Hz}$ $\pm 2\text{ Hz}$	$R_{\text{input}} > 50\text{ k}\Omega$ Voltage DC _{max} = 30 V AC Signal from 0.3 to 30 V auto-ranging
counter** 0 to 10^8 – 1 count	1 count	-----	Same as frequency. Pulse frequency < 3000 Hz

(*) FS = Full Scale.

(**) Function available since the frequency output is not configured.

Input Ranges		Resolution	Accuracy	Remarks
Pt-100	-200 to 850 °C / -328 to 1562 °F	0.01 °C / 0.01 °F	± 0.1 °C / ± 0.2 °F	IEC 60751
Pt-1000	-200 to 400 °C / -328 to 752 °F	0.1 °C / 0.1 °F	± 0.1 °C / ± 0.2 °F	IEC 60751
Cu-10	-200 to 260 °C / -328 to 500 °F	0.1 °C / 0.1 °F	± 2.0 °C / ± 4.0 °F	Minco 16-9
Ni-100	-60 to 250 °C / -76 to 482 °F	0.1 °C / 0.1 °F	± 0.2 °C / ± 0.4 °F	DIN-43760
probe*	-200 to 850 °C / -328 to 1562 °F	0.01 °C / 0.01 °F	± 0.1 °C / ± 0.2 °F	IEC 60751
TC-J	-210 to 1200 °C / -346 to 2192 °F	0.1 °C / 0.1 °F	± 0.2 °C / ± 0.4 °F	IEC 60584
TC-K	-270 to -150 °C / -454 to -238 °F	0.1 °C / 0.1 °F	± 0.5 °C / ± 1.0 °F	IEC 60584
TC-K	-150 to 1370 °C / -238 to 2498 °F	0.1 °C / 0.1 °F	± 0.2 °C / ± 0.4 °F	IEC 60584
TC-T	-260 to -200 °C / -436 to -328 °F	0.1 °C / 0.1 °F	± 0.6 °C / ± 1.2 °F	IEC 60584
TC-T	-200 to -75 °C / -328 to -103 °F	0.1 °C / 0.1 °F	± 0.4 °C / ± 0.8 °F	IEC 60584
TC-T	-75 to 400 °C / -103 to 752 °F	0.1 °C / 0.1 °F	± 0.2 °C / ± 0.4 °F	IEC 60584
TC-B	50 to 250 °C / 122 to 482 °F	0.1 °C / 0.1 °F	± 2.5 °C / ± 5.0 °F	IEC 60584
TC-B	250 to 500 °C / 482 to 932 °F	0.1 °C / 0.1 °F	± 1.5 °C / ± 3.0 °F	IEC 60584
TC-B	500 to 1200 °C / 932 to 2192 °F	0.1 °C / 0.1 °F	± 1.0 °C / ± 2.0 °F	IEC 60584
TC-B	1200 to 1820 °C / 2192 to 3308 °F	0.1 °C / 0.1 °F	± 0.7 °C / ± 1.4 °F	IEC 60584

(*) **probe** is an input for a reference RTD in order to use as standard thermometer. The accuracy is related only to MCS-XV-IS.

Input Ranges	Resolution	Accuracy	Remarks
TC-R -50 to 300 °C / -58 to 572 °F	0.1 °C / 0.1 °F	± 1.0 °C / ± 2.0 °F	IEC 60584
TC-R 300 to 1760 °C / 572 to 3200 °F	0.1 °C / 0.1 °F	± 0.7 °C / ± 1.4 °F	IEC 60584
TC-S -50 to 300 °C / -58 to 572 °F	0.1 °C / 0.1 °F	± 1.0 °C / ± 2.0 °F	IEC 60584
TC-S 300 to 1760 °C / 572 to 3200 °F	0.1 °C / 0.1 °F	± 0.7 °C / ± 1.4 °F	IEC 60584
TC-E -270 to -150 °C / -454 to -238 °F	0.1 °C / 0.1 °F	± 0.3 °C / ± 0.6 °F	IEC 60584
TC-E -150 to 1000 °C / -238 to 1832 °F	0.1 °C / 0.1 °F	± 0.1 °C / ± 0.2 °F	IEC 60584
TC-N -260 to -200 °C / -436 to -328 °F	0.1 °C / 0.1 °F	± 1.0 °C / ± 2.0 °F	IEC 60584
TC-N -200 to -20 °C / -328 to -4 °F	0.1 °C / 0.1 °F	± 0.4 °C / ± 0.8 °F	IEC 60584
TC-N -20 to 1300 °C / -4 to 2372 °F	0.1 °C / 0.1 °F	± 0.2 °C / ± 0.4 °F	IEC 60584
TC-L -200 to 900 °C / -328 to 1652 °F	0.1 °C / 0.1 °F	± 0.2 °C / ± 0.4 °F	DIN-43710
TC-C 0 to 1500 °C / 32 to 2732 °F	0.1 °C / 0.1 °F	± 0.5 °C / ± 1.0 °F	W5Re / W26Re
TC-C 1500 to 2320 °C / 2732 to 4208 °F	0.1 °C / 0.1 °F	± 0.7 °C / ± 1.4 °F	W5Re / W 26Re

1.3. Specifications – Outputs

Output Ranges	Resolution	Accuracy	Remarks
millivolt -10 mV to 110 mV	0.001 mV	$\pm 0.02\%$ FS	$R_{\text{output}} < 0.3\ \Omega$
volt -0.5 V to 12 V	0.0001 V	$\pm 0.02\%$ FS	$R_{\text{output}} < 0.3\ \Omega$
mA 0 to 24 mA	0.0001 mA	$\pm 0.02\%$ FS	$R_{\text{max}} = 250\ \Omega$
(XTR) 2-wire Transmitter 4 mA to 24 mA	0.0001 mA	$\pm 0.02\%$ FS	$V_{\text{max}} = 60\text{ V}$
Resistance 0 to 400 Ω 0 to 2500 Ω	0.01 Ω 0.1 Ω	$\pm 0.02\%$ FS $\pm 0.03\%$ FS	For external excitation current of 1.0 mA
Frequency * 0 to 100 Hz 0 to 10000 Hz	0.01 Hz 1 Hz	$\pm 0.02\text{ Hz}$ $\pm 2\text{ Hz}$	Peak value: 22 V / 25 mA max.
Pulse * 0 to 10^8 – 1 pulses	1 pulse	-----	Peak value: 22 V / 25 mA max. Pulses frequency up to 10000 Hz
Pt-100 -200 to 850 $^{\circ}\text{C}$ / -328 to 1562 $^{\circ}\text{F}$	0.01 $^{\circ}\text{C}$ / 0.01 $^{\circ}\text{F}$	$\pm 0.2\text{ }^{\circ}\text{C}$ / $\pm 0.4\text{ }^{\circ}\text{F}$	IEC 60751
Pt-1000 -200 to 400 $^{\circ}\text{C}$ / -328 to 752 $^{\circ}\text{F}$	0.1 $^{\circ}\text{C}$ / 0.1 $^{\circ}\text{F}$	$\pm 0.1\text{ }^{\circ}\text{C}$ / $\pm 0.2\text{ }^{\circ}\text{F}$	IEC 60751
Cu-10 -200 to 260 $^{\circ}\text{C}$ / -328 to 500 $^{\circ}\text{F}$	0.1 $^{\circ}\text{C}$ / 0.1 $^{\circ}\text{F}$	$\pm 2.0\text{ }^{\circ}\text{C}$ / $\pm 4.0\text{ }^{\circ}\text{F}$	Minco 16-9
Ni-100 -60 to 250 $^{\circ}\text{C}$ / -76 to 482 $^{\circ}\text{F}$	0.1 $^{\circ}\text{C}$ / 0.1 $^{\circ}\text{F}$	$\pm 0.2\text{ }^{\circ}\text{C}$ / $\pm 0.4\text{ }^{\circ}\text{F}$	DIN-43760

(*) Function available since the frequency input is not configured.

Output Ranges	Resolution	Accuracy	Remarks
TC-J -210 to 1200 °C / -346 to 2192 °F	0.1 °C / 0.1 °F	± 0.4 °C / ± 0.8 °F	IEC 60584
TC-K -270 to -150 °C / -454 to -238 °F	0.1 °C / 0.1 °F	± 1.0 °C / ± 2.0 °F	IEC 60584
TC-K -150 to 1370 °C / -238 to 2498 °F	0.1 °C / 0.1 °F	± 0.4 °C / ± 0.8 °F	IEC 60584
TC-T -260 to -200 °C / -436 to -328 °F	0.1 °C / 0.1 °F	± 1.2 °C / ± 2.4 °F	IEC 60584
TC-T -200 to -75 °C / -328 to -103 °F	0.1 °C / 0.1 °F	± 0.8 °C / ± 1.6 °F	IEC 60584
TC-T -75 to 400 °C / -103 to 752 °F	0.1 °C / 0.1 °F	± 0.4 °C / ± 0.8 °F	IEC 60584
TC-B 50 to 250 °C / 122 to 482 °F	0.1 °C / 0.1 °F	± 5.0 °C / ± 10.0 °F	IEC 60584
TC-B 250 to 500 °C / 482 to 932 °F	0.1 °C / 0.1 °F	± 3.0 °C / ± 6.0 °F	IEC 60584
TC-B 500 to 1200 °C / 932 to 2192 °F	0.1 °C / 0.1 °F	± 2.0 °C / ± 4.0 °F	IEC 60584
TC-B 1200 to 1820 °C / 2192 to 3308 °F	0.1 °C / 0.1 °F	± 1.4 °C / ± 2.8 °F	IEC 60584
TC-R -50 to 300 °C / -58 to 572 °F	0.1 °C / 0.1 °F	± 2.0 °C / ± 4.0 °F	IEC 60584
TC-R 300 to 1760 °C / 572 to 3200 °F	0.1 °C / 0.1 °F	± 1.4 °C / ± 2.8 °F	IEC 60584
TC-S -50 to 300 °C / -58 to 572 °F	0.1 °C / 0.1 °F	± 2.0 °C / ± 4.0 °F	IEC 60584
TC-S 300 to 1760 °C / 572 to 3200 °F	0.1 °C / 0.1 °F	± 1.4 °C / ± 2.8 °F	IEC 60584
TC-E -270 to -150 °C / -454 to -238 °F	0.1 °C / 0.1 °F	± 0.6 °C / ± 1.2 °F	IEC 60584
TC-E -150 to 1000 °C / -238 to 1832 °F	0.1 °C / 0.1 °F	± 0.2 °C / ± 0.4 °F	IEC 60584

Output Ranges	Resolution	Accuracy	Remarks
TC-N -260 to -200 °C / -436 to -328 °F	0.1 °C / 0.1 °F	± 2.0 °C / ± 4.0 °F	IEC 60584
TC-N -200 to -20 °C / -328 to -4 °F	0.1 °C / 0.1 °F	± 0.8 °C / ± 1.6 °F	IEC 60584
TC-N -20 to 1300 °C / -4 to 2372 °F	0.1 °C / 0.1 °F	± 0.4 °C / ± 0.8 °F	IEC 60584
TC-L -200 to 900 °C / -328 to 1652 °F	0.1 °C / 0.1 °F	± 0.4 °C / ± 0.8 °F	DIN-43710
TC-C 0 to 1500 °C / 32 to 2732 °F	0.1 °C / 0.1 °F	± 0.5 °C / ± 1.0 °F	W5Re / W26Re
TC-C 1500 to 2320 °C / 2732 to 4208 °F	0.1 °C / 0.1 °F	± 0.7 °C / ± 1.4 °F	W5Re / W 26Re



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.

1.4. Optional Items

Pressure Sensors

Can be placed up to 2 pressure sensors in MCS-XV-IS, with ranges between 250 mmH₂O and 10,000 psi.

Ranges *	Resolution	Accuracy	Remarks
(0) 0 – 25 mbar	0.0001	± 0.05 % FS**	Gauge pressure. Used with air or inert gases.
(1) 0 – 70 mbar	0.001	± 0.05 % FS	
(2) 0 – 350 mbar	0.01	± 0.025 % FS	
(3) 0 – 1 bar	0.00001	± 0.025 % FS	Gage or absolute pressure. Used with fluids (gases or liquids) compatible with INOX 316 L stainless steel.
(4) 0 – 2 bar	0.00001	± 0.025 % FS	
(5) 0 – 7 bar	0.0001	± 0.025 % FS	
(6) 0 – 20 bar	0.0001	± 0.025 % FS	
(7) 0 – 35 bar	0.001	± 0.025 % FS	
(8) 0 – 70 bar	0.001	± 0.025 % FS	
(9) 0 – 210 bar	0.001	± 0.025 % FS	
(10) 0 – 350 bar	0.01	± 0.025 % FS	
(11) 0 – 700 bar	0.01	± 0.05 % FS	
(12) Others upon request			

(*) Gauge pressure, absolute pressure (from range 3 to 8), vacuum (only for range 3), compound (from range 3 to 8) and differential (from range 0 to 2).

(**) FS = Full Scale.

The differential sensor occupies two pressure outlets.

Note: Optional **BR (Barometric Reference – 1 barA)**

Sensor for ambient pressure measurement. Can be used for simulated indication of absolute pressure on the other sensors. Accuracy: ± 0.02 % FS (1 bar).

Pressure accuracy values are valid within one year and temperature range of 20 to 26 °C. Outside these limits add 0.005 % FS/ °C taking 23 °C as the reference temperature. These values are obtained through algorithms of temperature compensation on pressure measurements.

Probe

Probe is a high accuracy 4-wire Pt-100 available under ordering. The calibrator input accepts Callendar-Van Dusen and ITS-90 curve correction coefficients.

1.5. General Specifications

Five minutes warm-up time.

Regulated transmitter power supply (TPS): 15 Vdc, with protection for short circuit (30 mA).

5.7" VGA (640x480) TFT LCD module with resistive touchscreen and adjustable display intensity.

RTD input for 2, 3 and 4 wires. Table IEC 60751, Callendar-Van Dusen or ITS-90 user-configurable.

Contact input for calibration of switches (pressure switch, thermo switch etc.).

50 Vdc in/out insulation.

Operating Conditions: Temperature range → 0 to 50 °C / Relative Humidity → 0 to 90 % RH.

Pneumatic Connection: 1/4" NPTF (1/8" NPTF only for the range 0 – 700 bar or above).

Overpressure: up to twice the sensor full scale pressure (for sensors up to 5,000 psi).

Engineering units

Pressure: psi, bar, mbar, MPa, kPa, Pa, atm, at, mH₂O, mH₂O@4°C, mmH₂O, mmH₂O@4°C, cmH₂O, cmH₂O@4°C, ftH₂O, ftH₂O@4°C, inH₂O, inH₂O@4°C, inH₂O@60°F, torr, mmHg, mmHg@0°C, cmHg, cmHg@0°C, inHg, inHg@0°C, inHg@60°F, gf/cm², kgf/cm², kgf/m².

Temperature: °C, °F, K.

Communication by USB port or Wi-Fi (with optional adapter)

Battery pack type: rechargeable Ni-MH cells, 4000 mAh / 9.6 V.

HART® Communication Protocol (optional).

Calibration Certificate (optional).

One-year warranty, except for rechargeable battery.

Accessories included: Includes technical manual, test leads, USB-A x USB-B cable, carrying case and battery charger.

Dimensions: 137 mm x 227 mm x 73 mm (HxWxD).

Weight: 2.7 kg approx.

NOTES



this manual.

- MCS-XV-IS and ISOPLAN® are Presys trademarks.
- HART® is a FieldComm Group trademark.
- Changes can be introduced in the instrument, altering specifications in

1.6. Special Software Features

- Special Functions:

- 1) **SCALE**: makes the scaling of both input and output.
- 2) **CONV**: converts any input to any output, galvanically isolated.
- 3) **RAMP**: increasing or decreasing ramps with configurable ramp time and level mark.
- 4) **STEP**: steps or setpoints with configurable time.

- **Memory Manager**: stores configuration types predefined by the user.

- **Automated Tasks**: creating of calibration work orders and automatic execution of calibration services, storage of data and reporting.

- **Data Logger**: monitoring of input or output signals, storage, and visualization of data in chart or table.

- **Help Desk**: storage and viewing videos and documents on the calibrator screen.

1.7. Order Code

Model _____

MCS-XV-IS - Universal Process Calibrator Portable

HART® Communication _____

NH - No HART® Communicator

CH - HART® Calibrator (basic commands: zero, span, trim mA)

FH - Full-HART® Configurator, with DD library from FieldComm Group

Number of Pressure Inputs _____

0 - no pressure sensors

1 - one sensor

2 - two sensors

RANGE	INPUT 1	RESOLUTION	ACCURACY	REMARKS
(0)	0 – 25 mbar	0.0001	± 0.05 % FS*	Gauge pressure.
(1)	0 – 70 mbar	0.001	± 0.05 % FS	Used with air or inert
(2)	0 – 350 mbar	0.01	± 0.025 % FS	gases.
(3)	0 – 1 bar	0.00001	± 0.025 % FS	
(4)	0 – 2 bar	0.00001	± 0.025 % FS	
(5)	0 – 7 bar	0.0001	± 0.025 % FS	Gauge or absolute pressure.
(6)	0 – 20 bar	0.0001	± 0.025 % FS	Used with fluids
(7)	0 – 35 bar	0.001	± 0.025 % FS	(gases or liquids)
(8)	0 – 70 bar	0.001	± 0.025 % FS	compatible with
(9)	0 – 210 bar	0.001	± 0.025 % FS	INOX 316 L stainless steel.
(10)	0 – 350 bar	0.01	± 0.025 % FS	
(11)	0 – 700 bar	0.01	± 0.05 % FS	
(12)	Others upon request			

Pressure Type Input 1 (Only for version with one sensor or more) _____

A - Absolute (Only for ranges 3 to 8) C - Compound*** (Only for ranges 3 to 8)

G - Gauge (Ranges 0 to 11) D - Differential**** (Only for ranges 0 to 2)

V - Vacuum (Only for range 3)

RANGE Input 2** (Only for version with two sensors) _____

Pressure Type Input 2** _____

(*) Full Scale. (**) Same code as input 1.

(***) From -1 bar to full scale of range. (****) The differential sensor occupies two pressure outlets.

2.1. Parts Identification

Front Panel

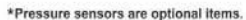
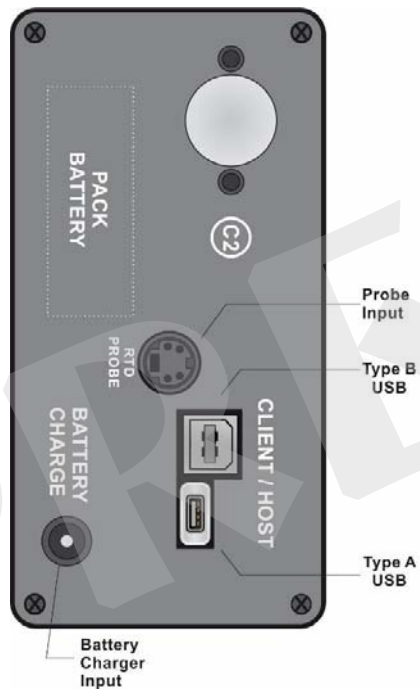


Fig. 01 - Front Panel – MCS-XV-IS

Left side view panel



Right side-view panel



Fig. 02 - Side Panels

How to use the carrying



Fig. 03 - Using the carrying case

Accessories: The bag has three compartments; one for accommodate the calibrator and the others to hold various accessories including test leads, adapter for connecting thermocouple wires, handles for transport and field use and technical manual.

Optional items: MCS-XV-IS optional items are the accurate temperature sensor (**PROBE**), pressure sensors and **ISOPLAN**® software. The optional items are described in specific manuals.

2.2. Battery and charger

The MCS-XV-IS is supplied with rechargeable battery which enables up to 8 hours of continuous use. This autonomy is reduced according to the active functions. A battery charger that can be plugged into power supply from 100 to 240 Vac is included. The time for a full battery charge is 12 hours with the calibrator turned off.

Charge the battery only in a non-hazardous area.

The battery level is displayed in the main menu, as shown below.

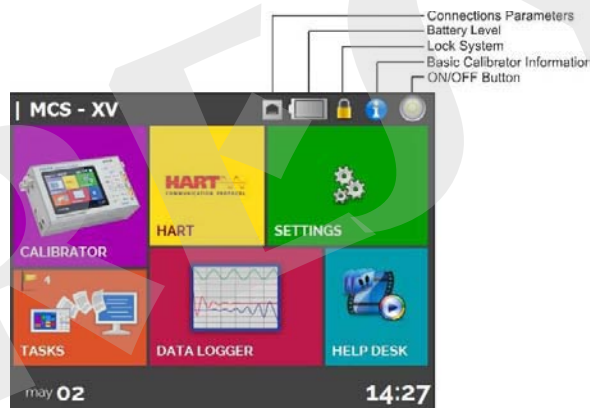


Fig. 04 - Main Menu

Clicking on the battery icon, the following screen is shown. This screen shows the battery power (in percent) and the voltage (which has a decreased value as the calibrator is unloaded).



Fig. 05 - Battery Status

The charger provides the battery charge while it feeds the calibrator, thus permitting the calibrator to be used normally while the battery is being charged.

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 as their preceding batteries made of Nickel Cadmium (Ni-Cd).

To prevent explosion or fire, use only the battery charger supplied by Presys. Do not short circuit or damage the battery.

2.3. Using MCS-XV-IS: Basic Functions

When powered on, the calibrator goes through a self-test routine and shows the last adjustment date. In case of failure, it displays a message to indicate error; if that occurs, the instrument should be sent to manufacturer for repair.

After the self-test is completed, the display shows the main menu, as showed in **Fig. 04**. The main menu is divided into 06 functions:

CALIBRATOR – selects the input/output functions, see section 2.4.

HART® – optional module that allows communication with devices that have HART® protocol, see section 2.5.

SETTINGS – general instrument settings, see section 3.

TASKS – performs calibrations automatically, see section 2.7.

DATA LOGGER – record measurements, enabling visualization in chart or table, see section 2.6.

HELP DESK – features videos made by Presys to assist in the use of the calibrator and can also store videos and documents made by the user, see section 2.8.


2.4. Calibrator

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



Fig. 06 - Calibrator Functions

At the top is shown the Channel 1 and at the bottom the Channel 2. It can be changed in **Layout** option on Quick Navigator menu.


The icon  shows a **Quick Navigator**, with the options for Main Menu (**HOME**), **Data-Logger**, **Tasks** and an option to enable the Channel 2). By pressing **MORE OPTIONS**, there are options for the selection of display **Layout**, **Memory Manager** (see section 2.4.6), **AD/RATIO** (see section 2.4.7) and **BARGRAPH** (see section 2.4.8).

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



Fig. 07 - Quick Navigator and Secondary Menu

The Channel 1 can be configured only as an input. The Channel 2 can be configured as an output (default setting) or as PROBE or PRESSURE input. An example of Channel 2 used as input is the calibration of a pressure transmitter, when you want to measure the transmitter current (mA input on CH-1) and the pressure (**PRESSURE** input in CH-2).

To enable Channel 2 as input, press the icon  and enable the CH-2 option. To enable Channel 2 as output, disable CH-2 option. To return to the Calibrator screen press the **BACK** button. To go to the main menu, press the **HOME** button.

2.4.1. Measurement or Input Functions

a) Input Type Configuration

Press **Input CH-1**, select through the menu the type of signal to be measured and use the corresponding terminals (see **Fig. 15 – Input Connections** or press the **HELP** button).




Fig. 08 - Input Type Selection

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

In **FREQ.** option, you can select the frequency or counter input. For counter input must also set the time (in seconds). If time is zero there is a continuous count of pulses received at the input. If the value is not zero, the count is done only during this time (window). The count starts immediately after pressing the **OK** button.

For **RTD** input, you must choose the standard table type used, the number of lead wires (2, 3 or 4 wires) and the temperature scale (ITS-90 or IPTS-68).

You can also set the Callendar-Van Dusen or ITS-90 sensor coefficients by selecting the CVD or ITS-90 option and the desired curve from the ID list.

To create new CVD or ITS-90 coefficients or edit existing ones, select between the two options, and press the edit button  → **ADD**. The curves you create appear in the list ordered by the **ID**. Select **CONFIGURATION** to enter an ID or tag for the sensor in **ID** and inform the sensor range in **MIN** and **MAX**. Select **PARAMETERS** to enter the sensor curve, usually informed on the sensor calibration certificate.

For Callendar-Van Dusen: Fill in the value of R0 (Resistance at 0 °C) and the parameters A, B and C together with their exponents.

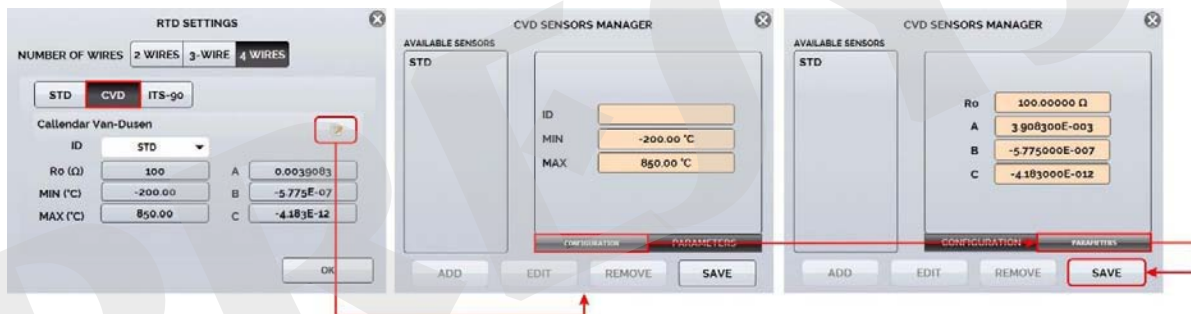


Fig. 09 - Callendar-Van Dusen Coefficient Configuration

For ITS-90: Fill in the value of RPTW (Resistance at 0.01 °C) and select the range for negative and / or positive curve before entering the parameters together with their exponents.

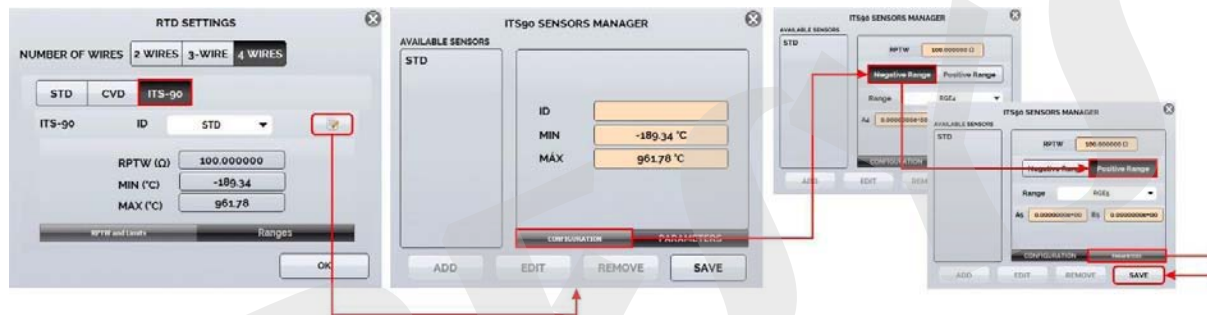


Fig. 10 - ITS-90 Coefficient Configuration

Negative Range: Accesses the coefficients to be used for temperatures below or equal to 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 °C to 0.01 °C	A5 , B5

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

Recommended Temperature Range (Positive)		Coefficients
Range 6	0.01 °C to 961.78 °C	A6 , B6 , C6 , D6
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, D: ITS-90 coefficients


Note that the **Positive** and **Negative** groups include a common range: **Range 5**. If you need to use their coefficients for the positive and negative ranges, set the coefficients equally for the positive and negative ranges. The coefficient values can be found in the reference sensor certificate.



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

PROBE refers to temperature measurement with an optional 4-wire Pt-100. Using the probe you can measure the temperature with high accuracy. There is also the option to configure the Callendar-Van Dusen or ITS-90 sensor coefficients, which follows the same procedure for the RTD input sensors as above.

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

In **Internal** option, the compensation is done internally; In **Manual** you must set the value of the temperature of the cold junction to the calibrator.

You can also enter thermocouple curves as well as RTD curves. Select **CUSTOM** and choose one of the registered thermocouples from the list. To enter or edit data from a sensor, press the edit button  and save or change the parameters of the sensors.

PRESSURE option relates to pressure measurement with the MCS-XV-IS through the optional pressure sensors. It should also select the pressure sensor to be read (C1 or C2). To use the optional BR - Barometric to indicate the pressure of any other sensor in Absolute mode, use Channel 2 (Enable Channel 2 in the Quick Menu  → **CH-2**). Select the sensor to use, click gear icon  and select **ABS**.

The **SWITCH** input is a measurement of continuity of an external contact connected to the input (between RTD1 and RTD4) of MCS-XV-IS. When there is continuity, the input shows **CLOSED**, otherwise it shows **OPEN**.

b) Pressure switch test

31

pre-selecting the pressure indication on Channel 2, in **SWITCH** the automatic pressure test function is enabled. In this function it is possible to check the contact opening and closing values of pressure switches. This requires a pressure source that varies at a slower ramp for greater accuracy. For these tests, it is recommended to increase the read rate of the A/D to **FAST** converter. See more information in section **2.4.7 - A/D RATIO**.

Select **SWITCH** then **PRESSURE SWITCH TEST**. The following screen is shown. Fill in the pressure switch identification fields and values for **TRIP** (value for closing/ opening of the pressure switch relay), **DEAD ZONE** (pressure hysteresis value) and **TRIP ERROR / DEAD ZONE ERROR** (tolerance values for trip and zone error dead for PASS/FAIL of pressure switch). For test reporting, use the **TASKS** function.

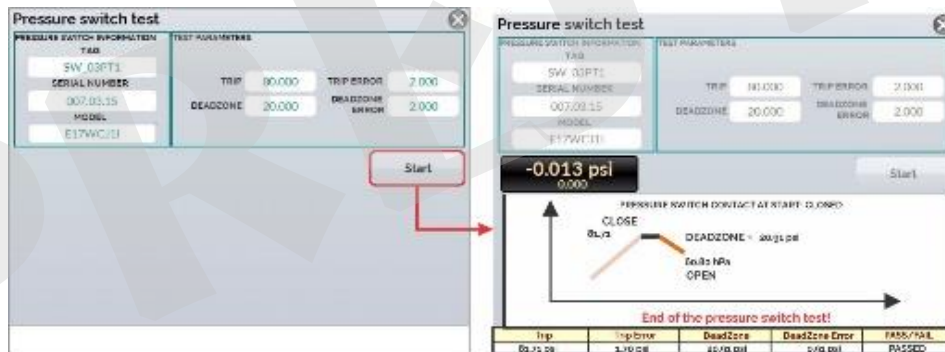


Fig. 11 - Pressure Switch Automatic Test

c) Burnout warning

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

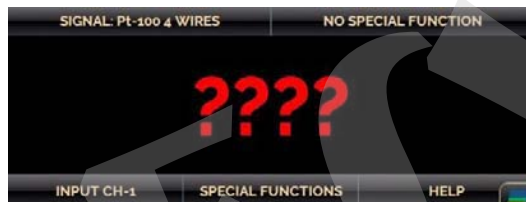


Fig. 12 - Burn-out Warning

Whenever the input signal is above or below the input ranges established in Section 1.2 - Specifications, the display indicates **OVER** or **UNDER**, respectively.

d) Engineering Unit Selection

The units of temperature and pressure can be changed by clicking on the engineering unit (°C, °F, psi, atm etc.) and selecting the desired option.

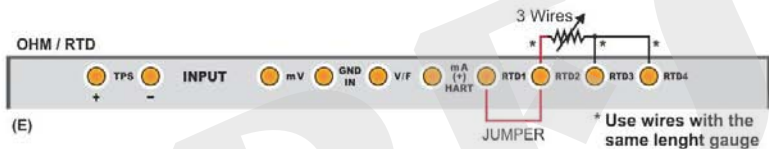


Fig. 13 - Selecting the Engineering Unit

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



$U_i = 30 \text{ V}$	$U_o = 5.88 \text{ V}$
$I_i = 100 \text{ mA}$	$I_o = 32.82 \text{ mA}$
$P_i = 750 \text{ mW}$	$P_o = 0.05 \text{ W}$
$C_i = 0 \text{ nF}$	$C_o = 33 \text{ nF}$
$L_i = 400 \text{ }\mu\text{H}$	$L_o = 0.6 \text{ mH}$

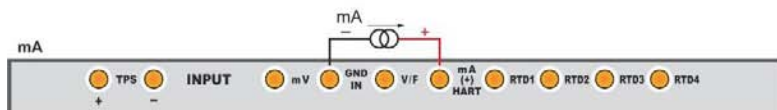


$U_i = 30 \text{ V}$	$U_o = 5.88 \text{ V}$
$I_i = 100 \text{ mA}$	$I_o = 32.82 \text{ mA}$
$P_i = 750 \text{ mW}$	$P_o = 0.05 \text{ W}$
$C_i = 0 \text{ nF}$	$C_o = 33 \text{ nF}$
$L_i = 400 \text{ }\mu\text{H}$	$L_o = 0.6 \text{ mH}$



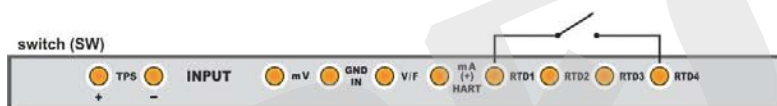
$U_i = 30 \text{ V}$	$U_o = 5.88 \text{ V}$
$I_i = 100 \text{ mA}$	$I_o = 32.82 \text{ mA}$
$P_i = 750 \text{ mW}$	$P_o = 0.05 \text{ W}$
$C_i = 0 \text{ nF}$	$C_o = 33 \text{ nF}$
$L_i = 400 \text{ }\mu\text{H}$	$L_o = 0.6 \text{ mH}$

Fig. 14 - (Cont.) Input Connections



(G)

$U_i = 30 \text{ V}$	$U_o = 28.35 \text{ V}$
$I_i = 100 \text{ mA}$	$I_o = 158.19 \text{ mA}$
$P_i = 750 \text{ mW}$	$P_o = 1.12 \text{ mW}$
$C_i = 0 \text{ nF}$	$C_o = 33 \text{ nF}$
$L_i = 400 \text{ } \mu\text{H}$	$L_o = 0.4 \text{ mH}$



(H)

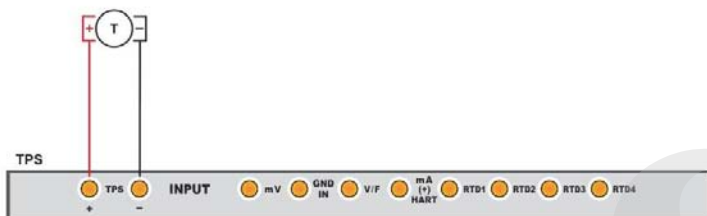
$U_i = 30 \text{ V}$	$U_o = 5.88 \text{ V}$
$I_i = 100 \text{ mA}$	$I_o = 26.88 \text{ mA}$
$P_i = 750 \text{ mW}$	$P_o = 0.04 \text{ W}$
$C_i = 0 \text{ nF}$	$C_o = 33 \text{ nF}$
$L_i = 400 \text{ } \mu\text{H}$	$L_o = 0.6 \text{ mH}$



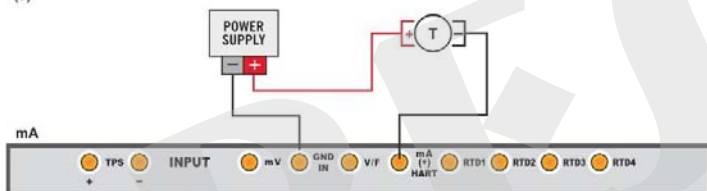
(I)

$U_i = 30 \text{ V}$	$U_o = 5.4 \text{ V}$
$I_i = 100 \text{ mA}$	$I_o = 0.55 \text{ mA}$
$P_i = 750 \text{ mW}$	$P_o = 0.73 \text{ mW}$
$C_i = 0 \text{ nF}$	$C_o = 33 \text{ nF}$
$L_i = 400 \text{ } \mu\text{H}$	$L_o = 1.6 \text{ mH}$

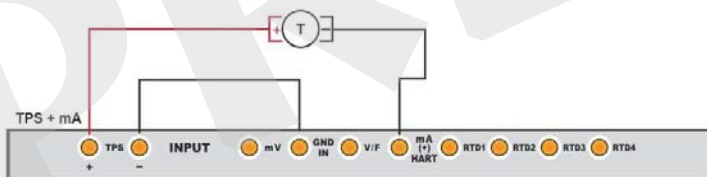
Fig. 14 - (Cont.) Input Connections



(J)



(K)



(L)

$U_i = 30 \text{ V}$	$U_o = 17.1 \text{ V}$
$I_i = 100 \text{ mA}$	$I_o = 90.6 \text{ mA}$
$P_i = 0.75 \text{ W}$	$P_o = 0.39 \text{ W}$
$C_i = 0 \text{ nF}$	$C_o = 33 \text{ nF}$
$L_i = 0 \text{ } \mu\text{H}$	$L_o = 0.4 \text{ mH}$

$U_i = 30 \text{ V}$	$U_o = 28.35 \text{ V}$
$I_i = 100 \text{ mA}$	$I_o = 60.93 \text{ mA}$
$P_i = 750 \text{ mW}$	$P_o = 0.43 \text{ W}$
$C_i = 0 \text{ nF}$	$C_o = 33 \text{ nF}$
$L_i = 400 \text{ } \mu\text{H}$	$L_o = 400 \text{ } \mu\text{H}$

$U_i = 0 \text{ V}$	$U_o = 28.35 \text{ V}$
$I_i = 0 \text{ mA}$	$I_o = 90 \text{ mA}$
$P_i = 0 \text{ W}$	$P_o = 0.52 \text{ W}$
$C_i = 0 \text{ nF}$	$C_o = 33 \text{ nF}$
$L_i = 400 \text{ } \mu\text{H}$	$L_o = 2.1 \text{ mH}$

Fig. 14 - (Cont.) Input Connections

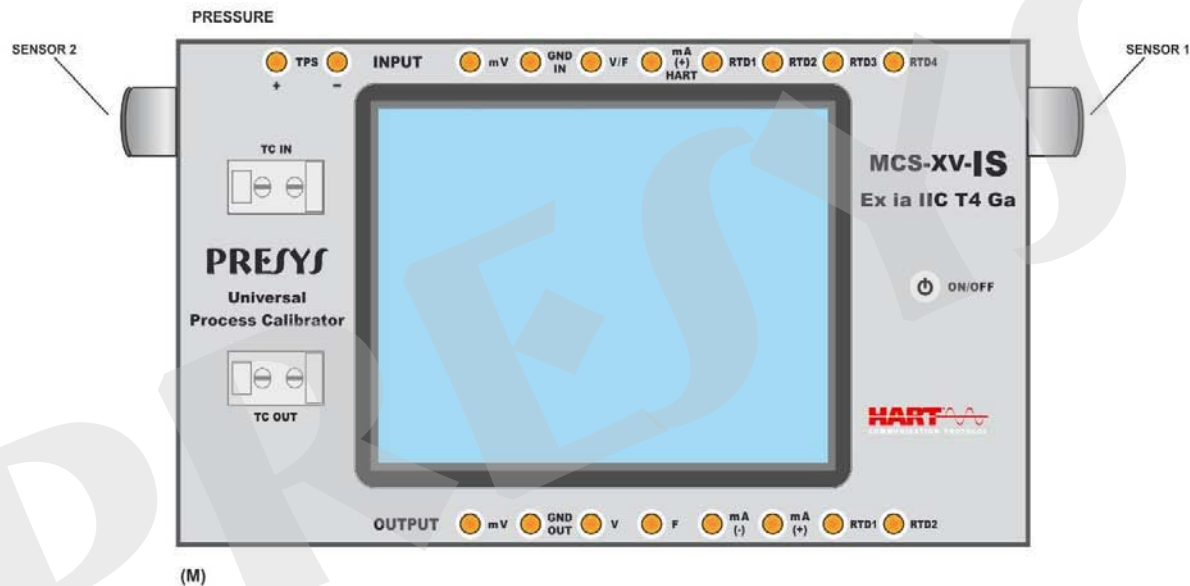


Fig. 14 - (Cont.) Input Connections

f) Probe Connection (optional).

Connect the **PROBE** to MCS-XV-IS so that polarity identifications match. See figure below.

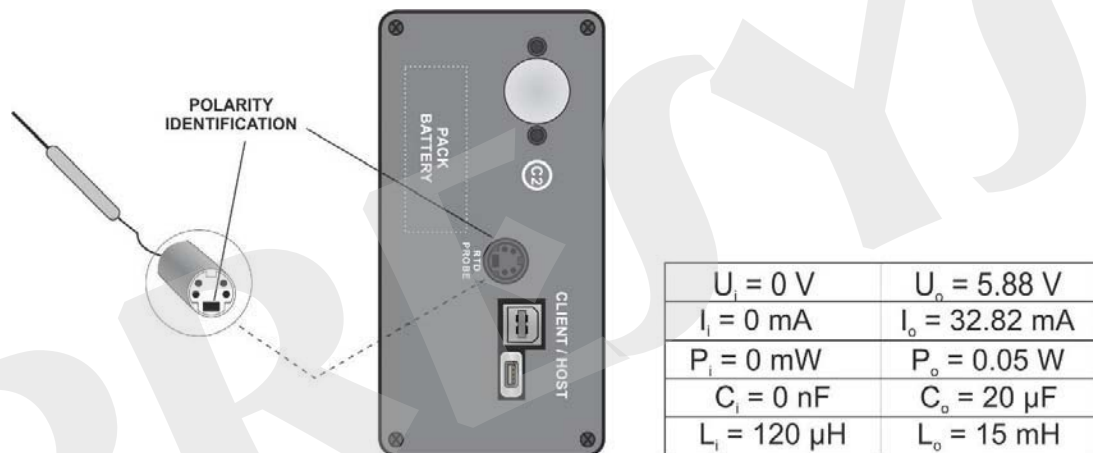


Fig. 15 - Probe Connection

NOTES:



- HOST connector: Used for updating firmware and adding DD HART® libraries (when available) to the calibrator.
- CLIENT connector: Used for communication with a personal computer

(PC).

2.4.2. Generation or Output Functions

a) Output Type Configuration

Press the **OUTPUT** button, select through the menu the type of signal to be generated and use the corresponding terminals (see **Fig. 18 - Output Connections** or press the **HELP** button).



Fig. 16 - Output Type Selection

The **FREQ.** option allows the selection of the frequency or pulse generation. For the frequency generation, it must be chosen between the bands of 100 Hz or 10000 Hz. It can also be adjusted the amplitude, which varies from 0 to 22 V.





For the pulse generation (square wave) in addition to the amplitude and the number of pulses, one must provide the rate at which the pulses should be sent, given in Hz. The pulse sequence is sent as soon as **OK** is pressed.

For the **RTD** or **OHM** generation, the calibrator simulates electronically a resistance value, i.e., there is no resistor but an electronic circuit which behaves as a resistor. It was designed specifically with the purpose of simulating RTD so that the calibrator can be connected to instruments such as indicators, transmitters, temperature controllers, with an excitation current within the range of 150 μA to 5 mA. For **OHM** generation, you should choose between the range of 400 Ω and 2,500 Ω .

For the thermocouple (**TC**) generation, you must choose the type of thermocouple and the type of cold junction compensation.



NOTE: For both RTD and TC outputs it is possible to configure correction curve coefficients (see item 2.4.1.a. to configure the curves).

To change the value of the output, press on the number and type the desired value on the keyboard. Another way to change the output value is to modify each digit separately in fixed steps. To do this, hold the output value for at least 3 seconds, choose the digit to be changed (the selected digit is indicated with arrows  and ) and press the buttons  and  to change the setpoint.

To exit this edit mode, hold down the output value for at least 3 seconds.

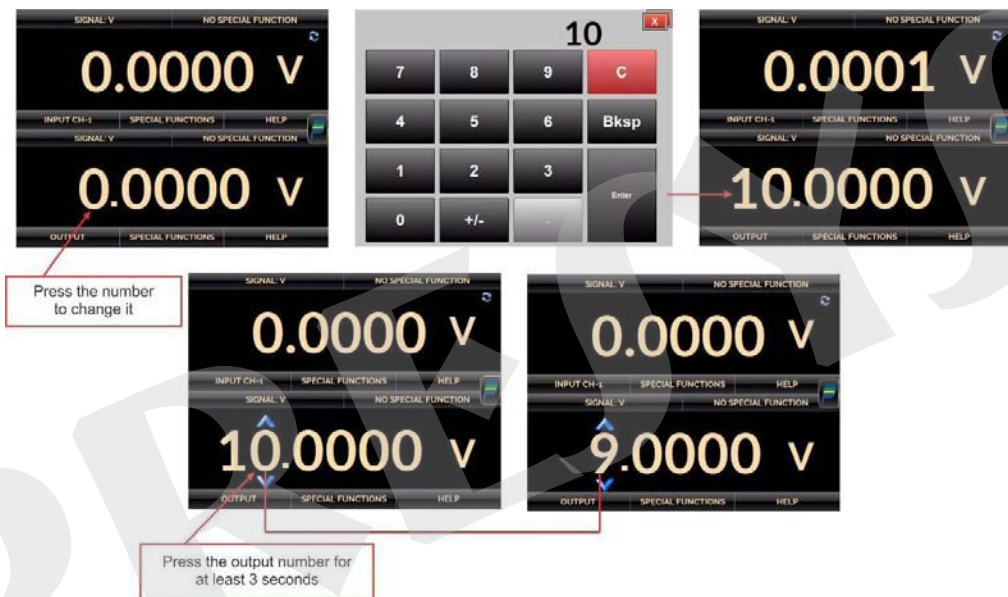
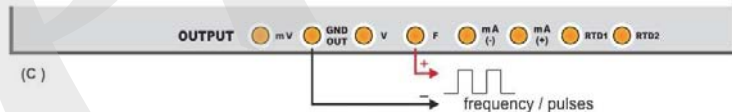
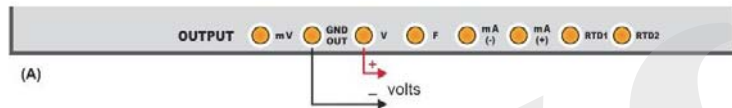


Fig. 17 - Changing the Output Value

The temperature units can be changed by clicking on the unit and selecting the desired option. The **NONE** option disables the output function.

b) Output or Generation Connections



$U_i = 30 \text{ V}$	$U_o = 17.1 \text{ V}$
$I_i = 100 \text{ mA}$	$I_o = 18.27 \text{ mA}$
$P_i = 750 \text{ mW}$	$P_o = 0.08 \text{ W}$
$C_i = 0 \text{ nF}$	$C_o = 33 \text{ nF}$
$L_i = 400 \text{ }\mu\text{H}$	$L_o = 0.6 \text{ mH}$

$U_i = 30 \text{ V}$	$U_o = 5.4 \text{ V}$
$I_i = 100 \text{ mA}$	$I_o = 12.18 \text{ mA}$
$P_i = 750 \text{ mW}$	$P_o = 0.02 \text{ W}$
$C_i = 0 \text{ nF}$	$C_o = 33 \text{ nF}$
$L_i = 400 \text{ }\mu\text{H}$	$L_o = 1.1 \text{ mH}$

$U_i = 30 \text{ V}$	$U_o = 17.1 \text{ V}$
$I_i = 40 \text{ mA}$	$I_o = 90.06 \text{ mA}$
$P_i = 300 \text{ mW}$	$P_o = 0.39 \text{ W}$
$C_i = 0 \text{ nF}$	$C_o = 33 \text{ nF}$
$L_i = 0 \text{ }\mu\text{H}$	$L_o = 1.0 \text{ mH}$

Fig. 18 - Output Connections



(D) (Front Connection)
Use TC compensation wires



(E)
* R_L = Load Resistance
mA (active mode)



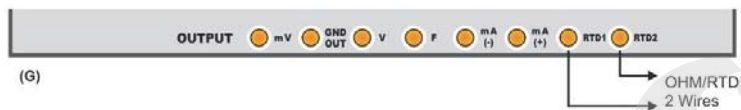
(F)
mA (passive mode)

$U_i = 30 \text{ V}$	$U_o = 5.4 \text{ V}$
$I_i = 100 \text{ mA}$	$I_o = 12.18 \text{ mA}$
$P_i = 750 \text{ mW}$	$P_o = 0.02 \text{ W}$
$C_i = 0 \text{ nF}$	$C_o = 33 \text{ nF}$
$L_i = 400 \text{ } \mu\text{H}$	$L_o = 1.1 \text{ mH}$

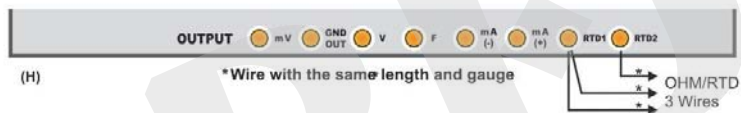
$U_i = 30 \text{ V}$	$U_o = 17.1 \text{ V}$
$I_i = 70 \text{ mA}$	$I_o = 90.06 \text{ mA}$
$P_i = 525 \text{ mW}$	$P_o = 0.39 \text{ W}$
$C_i = 0 \text{ nF}$	$C_o = 33 \text{ nF}$
$L_i = 400 \text{ } \mu\text{H}$	$L_o = 0.4 \text{ mH}$

$U_i = 30 \text{ V}$	$U_o = 5.88 \text{ V}$
$I_i = 100 \text{ mA}$	$I_o = 1.19 \text{ mA}$
$P_i = 750 \text{ mW}$	$P_o = 1.75 \text{ mW}$
$C_i = 0 \text{ nF}$	$C_o = 33 \text{ nF}$
$L_i = 400 \text{ } \mu\text{H}$	$L_o = 1.6 \text{ mH}$

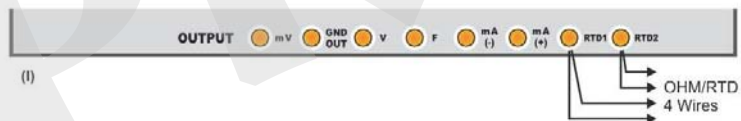
Fig. 18 - (Cont.) Output Connections



$U_i = 30 \text{ V}$	$U_o = 11.1 \text{ V}$
$I_i = 100 \text{ mA}$	$I_o = 41.17 \text{ mA}$
$P_i = 750 \text{ mW}$	$P_o = 0.11 \text{ W}$
$C_i = 0 \text{ nF}$	$C_o = 33 \text{ nF}$
$L_i = 400 \text{ }\mu\text{H}$	$L_o = 0.5 \text{ mH}$



$U_i = 30 \text{ V}$	$U_o = 11.1 \text{ V}$
$I_i = 100 \text{ mA}$	$I_o = 41.17 \text{ mA}$
$P_i = 750 \text{ mW}$	$P_o = 0.11 \text{ W}$
$C_i = 0 \text{ nF}$	$C_o = 33 \text{ nF}$
$L_i = 400 \text{ }\mu\text{H}$	$L_o = 0.5 \text{ mH}$



$U_i = 30 \text{ V}$	$U_o = 11.1 \text{ V}$
$I_i = 100 \text{ mA}$	$I_o = 41.17 \text{ mA}$
$P_i = 750 \text{ mW}$	$P_o = 0.11 \text{ W}$
$C_i = 0 \text{ nF}$	$C_o = 33 \text{ nF}$
$L_i = 400 \text{ }\mu\text{H}$	$L_o = 0.5 \text{ mH}$

OBS.: There is no polarity for resistance output.

Fig. 18 - (Cont.) Output Connections

2.4.3. Available Power Supplies

The MCS-XV-IS has a galvanically isolated 15V DC input and output voltage source (TPS) with short circuit protection (short circuit current limited to 30 mA, open circuit voltage equal to 15V).

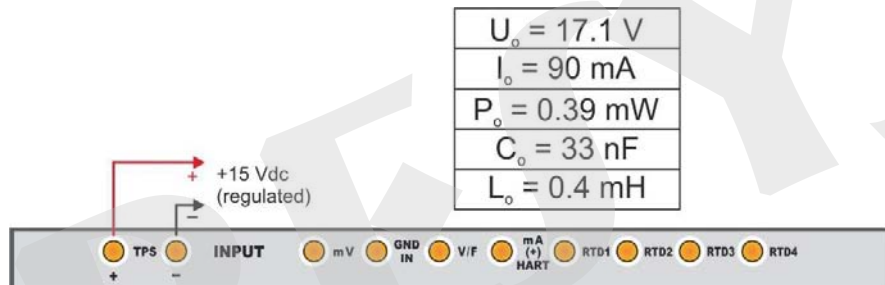


Fig. 19 - Power Supply

2.4.4. Input Special Functions

Selecting **SPECIAL FUNCTIONS** in the input Channel, the display will show:



Fig. 20 - Input Special Functions

The selected special function will act on the previously selected input.

After selecting and configuring the special function, to enable it change to on the key status ☒ ON and confirm in **OK**. To disable it change the key to ☐ OFF. To change the state of the key, just click on it.

When there is no active special function, the screen displays the message **NO SPECIAL FUNCTION** at the top.

a) SCALE Function

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

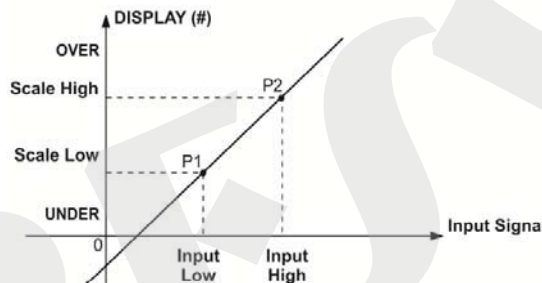


Fig. 21 - SCALE Function (LINEAR)

The configuration menu is shown in the next image:



Fig. 22 - SCALE Function configuration menu

The scaled indication at the display (#) may be changed to represent any engineering unit, such as: m/s, m³/s, % 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.

The counter and the contact inputs cannot be scaled.

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:

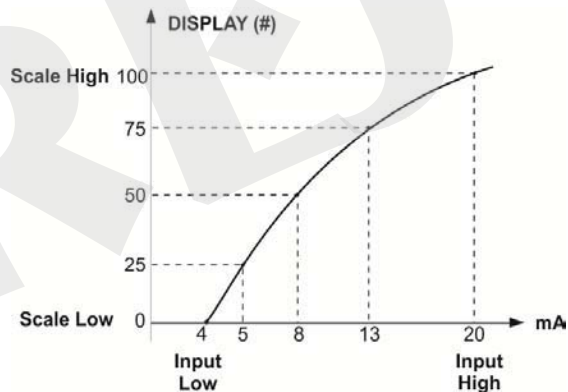


Fig. 23 - SCALE Function (FLOW)

b) CONV Function

By using the **CONV** function, the calibrator may convert any input signal into any output signal with galvanic isolation. It may, therefore, behave as a real transmitter.

Once the calibrator input and output have been selected, fill in the four parameters shown in the graphic below:

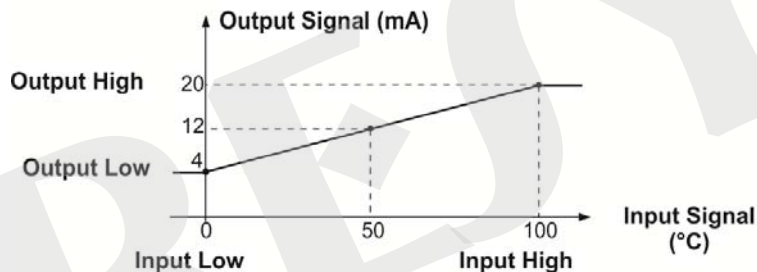


Fig. 24 - CONV Function

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, may be obtained.

The following image shows the configuration menu for the CONV function.



Fig. 25 - CONV Function configuration menu



2.4.5. Output Special Functions

Selecting **SPECIAL FUNCTIONS** in the output Channel, the display will show:



Fig. 26 - Output Special Functions

The selected special function will act on the previously selected output.




After selecting and configuring the special function, to enable it change to on the key status  and confirm in **OK**. To disable it change the key to . To change the state of the key, just click on it.

When there is no active special function, the screen displays the message **NO SPECIAL FUNCTION** at the top.

a) RAMP Function

By using this programming, the MCS-XV-IS output varies automatically, producing ramps and level marks which may be programmed to actuate once or continuously.

It must be entered the start and the end values of the range within which the output will vary (**MIN** and **MAX**), and the **TIME** value (in seconds) required for a complete ramp within the range. Another value that may be configured is how long it should dwell at the level mark (**WAIT**), i.e., the time during which the output remains constant between two ramps.

After setting up the special function and activate it (change the key  in special function) and press **OK**. To start the ramp press the chronometer icon . The ramp runs continuously in accordance with the defined strategy (↑ ↓ ↑↓). To stop the ramp, press .

The following image shows the **RAMP** function parameterization menu.



Fig. 27 - RAMP function

b) STEP Programming

The **STEP** programming makes the calibrator output vary in pre-defined steps. It is useful in calibrations where some scale points are verified; for example 0% - 25% - 50% - 75% - 100%.

To generate setpoints, you must set the minimum and maximum range points (**MIN** and **MAX**), the output percentage change for each step (%), and generate the list (📋 button).

There is also the option to manually add or delete any point to the list of setpoint values (⊕ button: adds a point to the list, ✖ button deletes the selected point, 🗑 button deletes all points).

If you want each step is achieved automatically after a preset time, you must set the **TIME** in seconds. In this situation the steps are generated automatically and continuously. Activating the function and pressing **OK**, the output starts executing the **STEP** program, always starting from the beginning of the range.





To move to the next step you must press . Pressing  it goes to the previous step. Pressing , the steps are automatically and continuously generated according to the set time. To stop, press .



Fig. 28 - STEP function

c) SCALE Function

The scaling of the output from MCS-XV-IS allows it to simulate the operation of a transmitter. In this case, the display scaled indication (#) simulates the transmitter input (which can be changed by pressing the number indicated on the display and entering the desired value), and as output signal it can have any of the signals generated by the MCS-XV-IS (e.g. 4 to 20 mA).

SCALE output function relates the output signal generated by the MCS-XV-IS with what is shown on the display as the example shown below.

The scaled indication at the display (#) may be changed to represent any engineering unit, such as: m/s, m³/s, % etc.

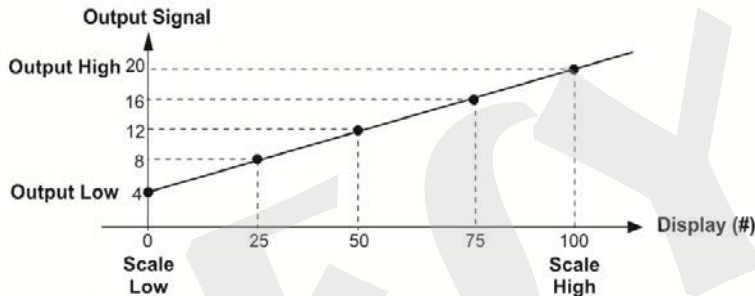


Fig. 29 - SCALE Function (LINEAR)

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, as long as they are not equal. Thus direct or reverse relationships may be established.

Any type of output can be scaled, except the pulse output.

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

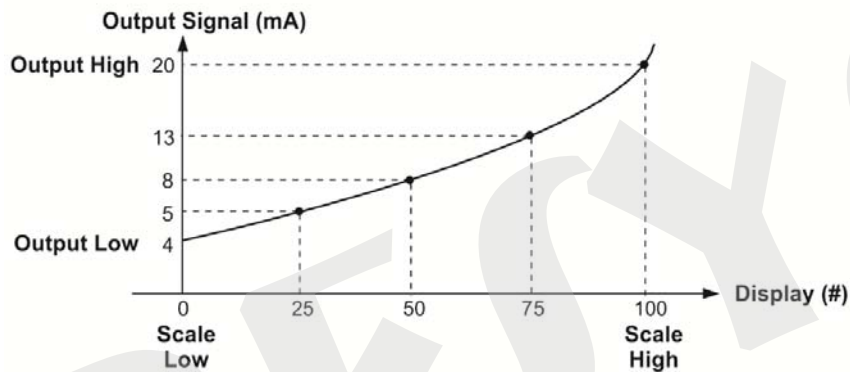



Fig. 30 - SCALE Function (FLOW)

2.4.6. Saving Current Configuration (Memory Manager)

The MCS-XV-IS multicalibrator admits 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, output type or special functions), press the icon  → **MORE OPTIONS**, and the button **MEMORY MANAGER**. On the bottom of the screen, type a name for this configuration and a description. Press the **SAVE** button.

The operation that was being performed by the MCS-XV-IS shall be stored in memory identified by the name given to it. To use it again, even after the MCS-XV-IS 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 MCS-XV-IS is turned on, this will be the initial configuration of the calibrator.

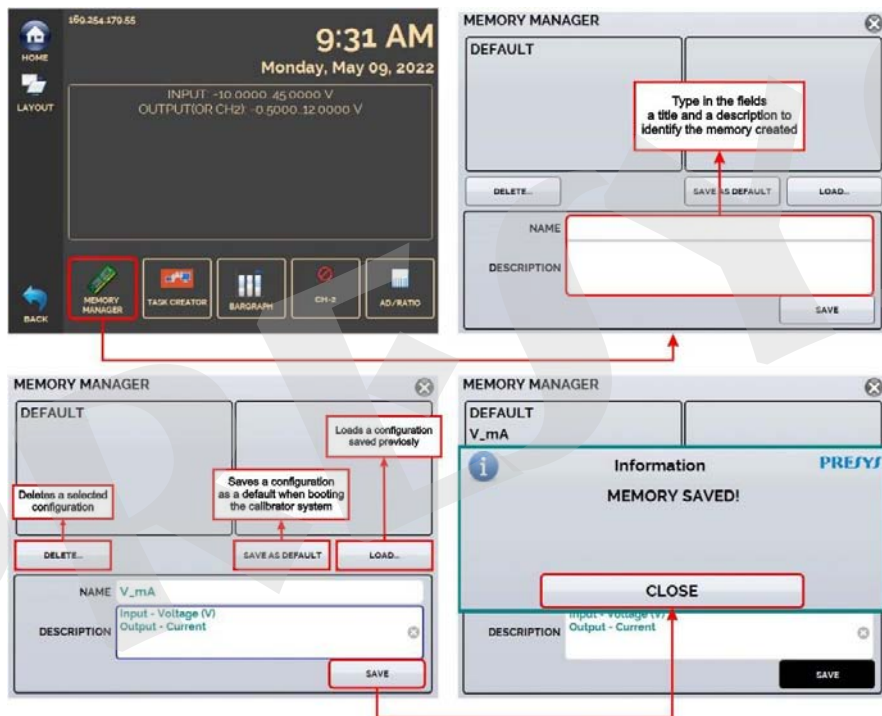


Fig. 31 - Memory Manager

2.4.7. AD/Ratio

The MCS-XV-IS allows you to change the conversion rate of the Analog/ Digital Converter. At faster rates, the readings indicated in measure mode update more often, and at slower rates the calibrator takes more readings and updates the values at a lower frequency.

For tests where read speed is important, such as **Pressure Switches** testing, it is recommended to use a faster rate that can “capture” the nearest relay open / close value. For calibrations and other tests, it is recommended to use a slower conversion rate, which provides more accurate readings.


To change the conversion rate, press the icon  → **MORE OPTIONS**, and the AD/ RATIO button. Select between **FAST**, **MEDIUM**, and **SLOW** and confirm in **OK**.




Fig.32 - AD/Ratio

2.4.8. Bargraph

The MCS-XV-IS allows to monitor an input and include HIGH and LOW alarms for the range.

To set up the alarm, press the button  → **MORE OPTIONS**, and the **BARGRAPH** button. Select from high and/or low alarms. Press **SOUND** to activate the calibrator beep when in alarm. In **EVENTS** you can check a list of times when the alarm detects values outside the registered tolerance.

Press the icon  to return to the Calibrator menu, keeping the monitoring bar next to it.

By pressing the icon , a screen for stability/leak testing is displayed. Select the time in seconds and click **START** to run the test. Choose which unit the results will be displayed in engineering unit for seconds (S), minutes (M), or hours (H). To use this feature, be sure to pre-configure the calibrator input for pressure reading.

During testing, you can increase the test time by pressing the +20s button. The S, M, and H buttons change the time unit in seconds, minutes, and hours, respectively. The display shows the signal variation between the first and last reading (Δv , in input unit) and the increasing and decreasing rate is calculated (average, in input unit / unit of time).



Fig. 33 - Bargraph function

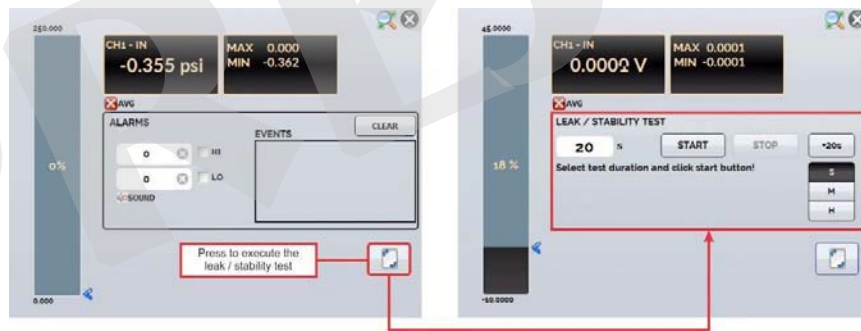


Fig. 34 - Stability test

2.4.9. Calibration Examples

a) Calibration of a Temperature Transmitter (RTD Input and 4-20 mA Output)

Through the menus, you can configure the MCS-XV-IS for mA input and output in RTD. The TPS, which means Transmitter Power Supply, is a source of 15 Vdc that provides power to the transmitter.

In the example, the connection of the RTD is made using three wires and being simulated by the MCS-XV-IS. With this form of connection, there is no measurement error due to the resistance of the wires, since these have the same length and gauge.

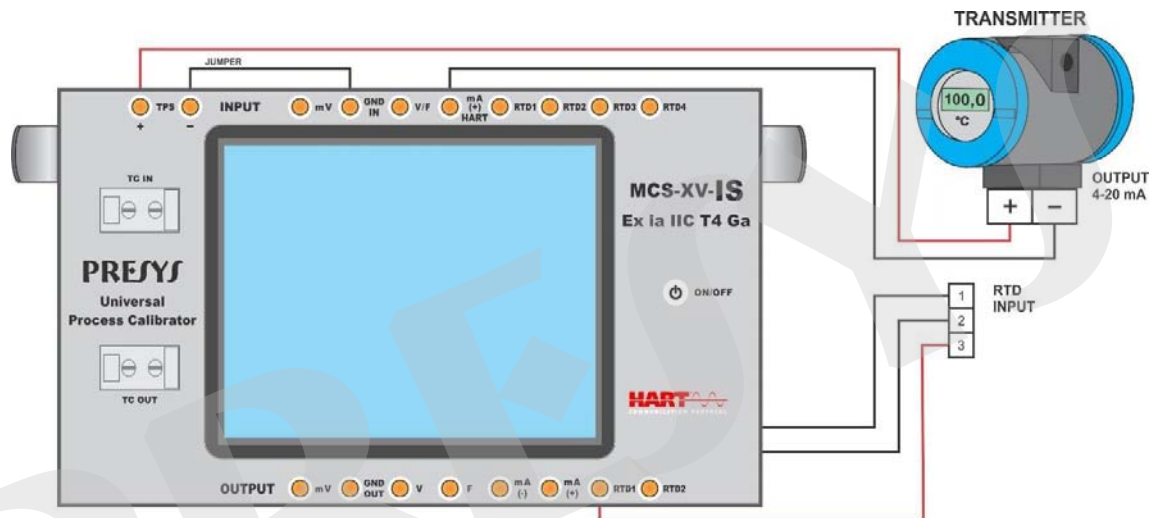


Fig. 35 - Calibration of a Temperature Transmitter 3-wire RTD Input

b) Calibration of a 4-wire Temperature Transmitter (110/220 Vac Power Supply - Thermocouple Input and 1-5 Vdc Output)

Setup the MCS-XV-IS as volts input and TC output and select the **TC** type. For the cold junction compensation, you can use compensating wires TC to connect the transmitter to the MCS-XV-IS and choose the option of **Internal** cold junction compensation, or you can measure the temperature of the terminal of the transmitter and enter this value in the **Manual** option in the calibrator, thus eliminating the use of compensating wires.

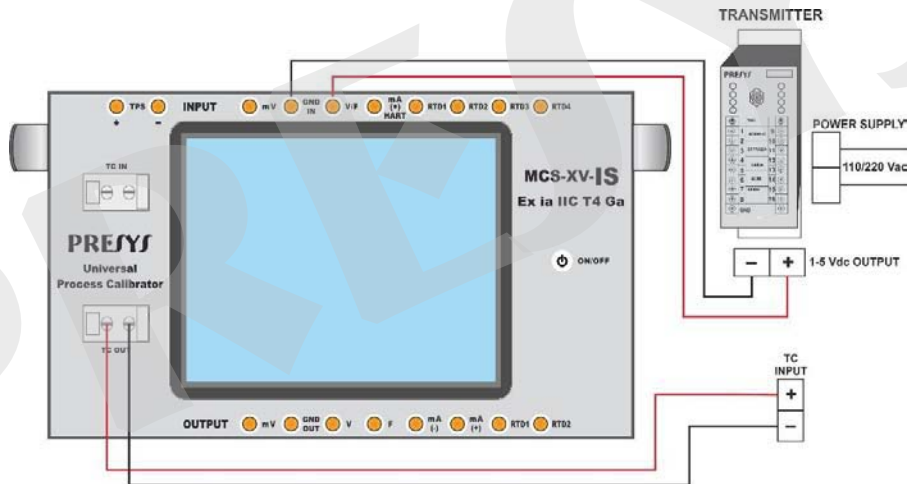



Fig. 36 - Calibration of a Temperature Transmitter (Thermocouple Input and 1-5 Vdc Output)

c) Pressure Transmitter Calibration

Use **TPS** MCS-XV-IS source to power the two-wire transmitter 15 Vdc and connect the current as illustrated below. Select **mA** (current) in the Input menu of the CH-1 and **Pressure** Input on CH-2 menu.

To enable Channel 2 as input, press the icon  and enable the CH-2 option. To return to the Calibrator screen press the **BACK** button.

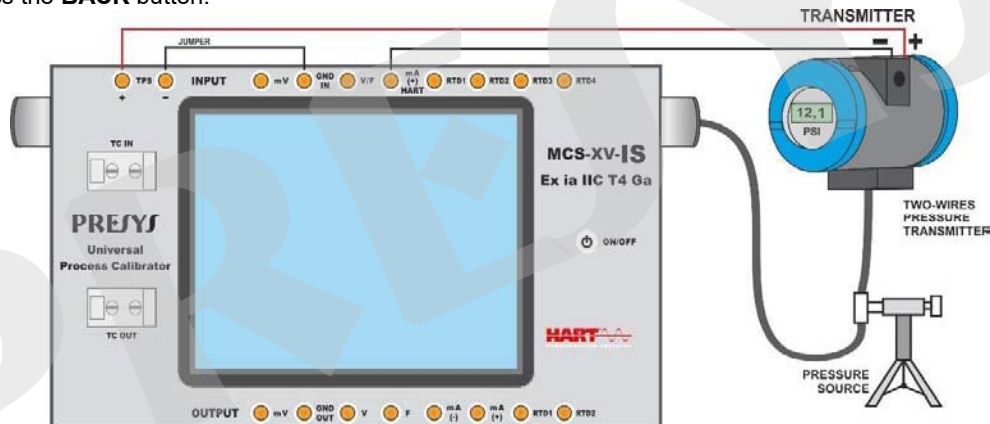


Fig. 37 - Pressure Transmitter Calibration

Readings of mA input can be scaled to pressure through the **SCALE** option (see item **2.4.4.a**). Thus the error between the input and the output of the pressure transmitter is easily calculated.

d) Pressure Switch Verification

Pressure switches are devices that receive a pressure signal and have relay alarm. The relay is activated whenever the pressure passes above or below a certain setpoint alarm. Connect the pressure switch output to the switch input of MCS-XV-IS, **RTD1** and **RTD4** terminals, and make the pneumatic connections as illustrated in the figure below:

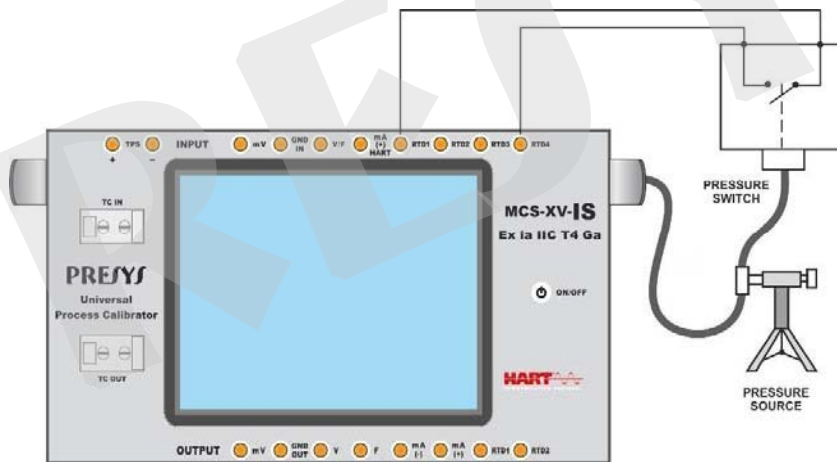


Fig. 38 - Pressure Switch Verification

Channel 2 must be enabled and selected **PRESSURE**. You must select the corresponding sensor. On Channel 1, select **SWITCH** input and enter **PRESSURE SWITCH TEST**.

The MCS-XV-IS shows the pressure measurement and the contact status (open or closed). Press **RUN** to start the test after filling in all required fields.

Vary the pressure manually or with the help of an automatic pressure controller. The instant the relay changes position, it is shown on the display the alarm setpoint pressure switch, so the change from open to closed or from closed to open.

2.5. HART®

The MCS-XV-IS 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 MCS-XV-IS) 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 calibrator has two versions: **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.

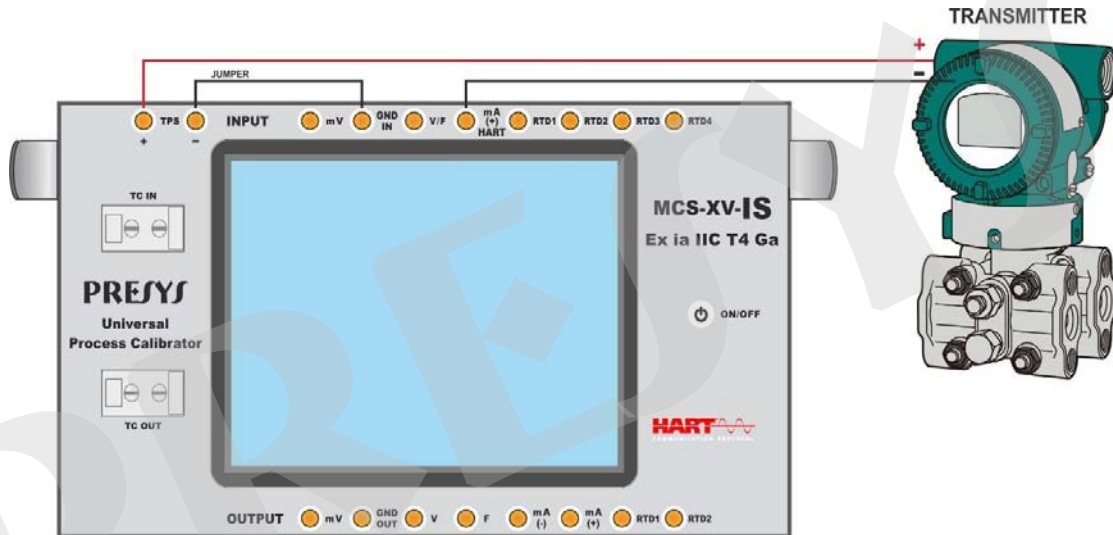
The description presented below is valid to the **CH** and **FH** options.

2.5.1. HART® Connections

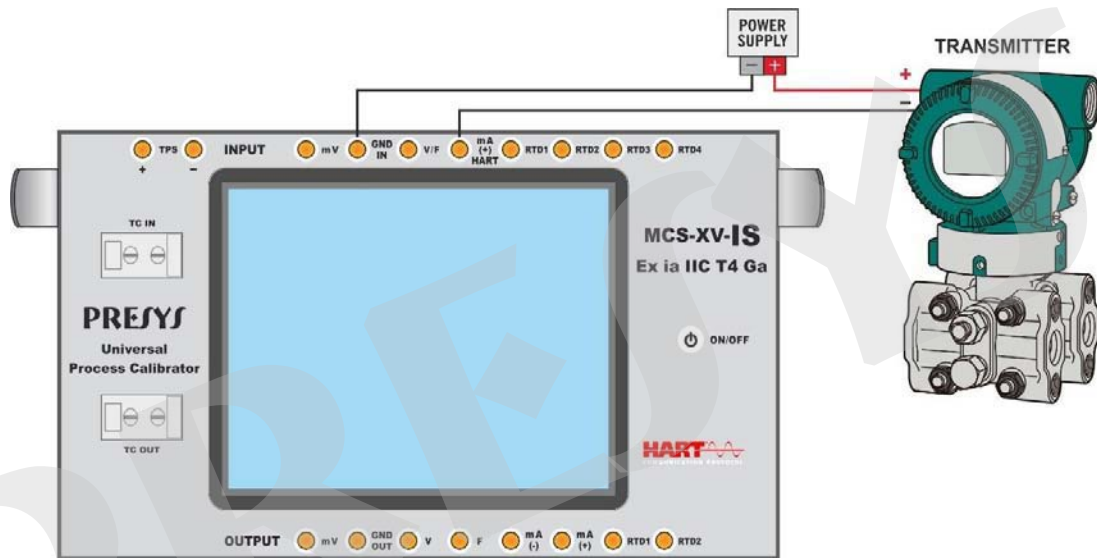
When selecting HART® from the main menu the **mA INPUT + HART®** and **ONLY HART® (INCLUDING NETWORK)** options are shown. Can also be enabled or not the internal resistor (250 Ω).

The option must be chosen according to the type of connection to be made.

a) mA Input + HART®



**Fig. 39 - Transmitter Powered by the Calibrator Itself (TPS)
mA INPUT + HART® (Internal Resistor Enabled)**



**Fig. 40 - Transmitter Powered by an External Power Supply
mA INPUT + HART® (Internal Resistor Enabled)**

To the connections shown in **Fig. 39** and **Fig. 40**, 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 the **TPS MCS-XV-IS** source (**Fig. 39**) or an external source (**Fig. 40**).

b) ONLY HART[®] (INCLUDING NETWORK)

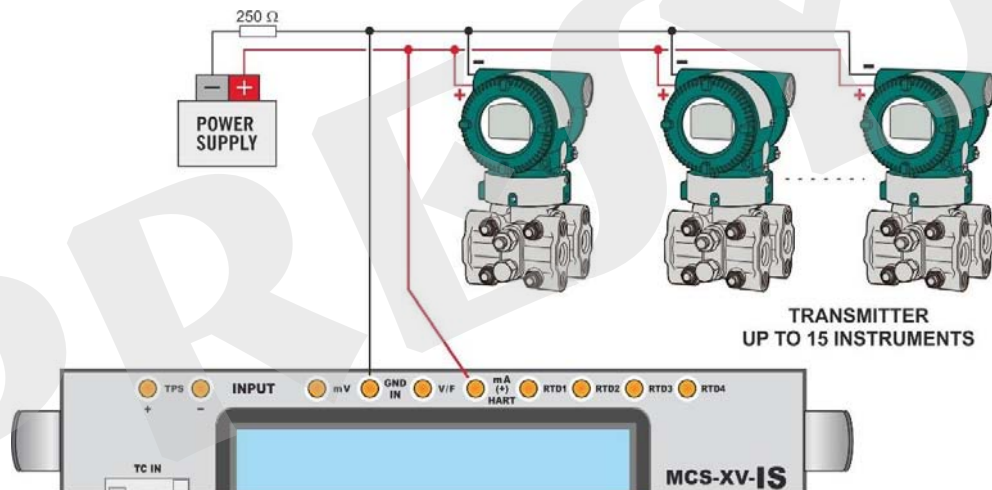


Fig. 41 - Only HART[®]



ATTENTION: Before connecting the calibrator to the transmitter as shown above, ensure that the mA Input is not selected in the MCS-XV-IS (enter in the Calibrator menu, and select any CH-1 Input other than mA or none).

For the connection shown in **Fig. 41**, use the option **ONLY HART®**. In this mode, the internal resistor and the mA input are disabled. The HART® resistor (at least 250 Ω) must be externally inserted in series with the power source and the transmitter.



IMPORTANT: In this case, the calibrator **DOES NOT PERFORM** the measurement of the transmitter current but can read and configure its parameters via HART®.

2.5.2. 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.).

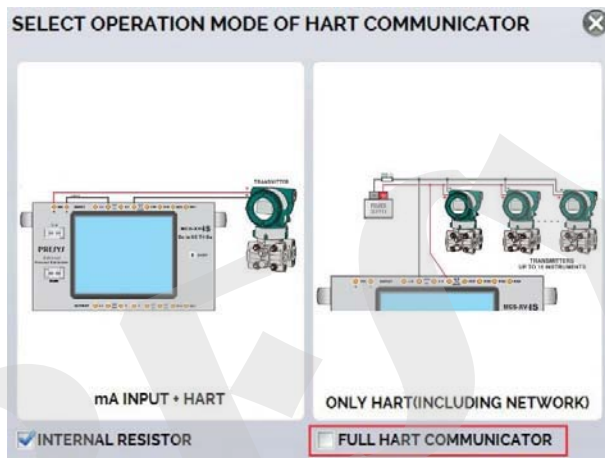



Fig. 42 - Enabling FH option

Then, define the Internal Resistor (250 Ω) and the configuration of HART[®] connection type (**mA input + HART[®]** or **ONLY HART[®]**). For the **CH** option, insert the **ADDRESS** of the HART[®] device and press the **CONNECT** button. If the instrument address is unknown, can be used the **SEARCH** button , which will search the device in the address range from 0 to 15. For the **FH** option, the device is automatically found.

Up to 15 devices on a HART[®] network (addresses 1-15) are allowed. In connection with a single field instrument with poll address 0 and **mA INPUT + HART[®]** connection, the primary variable can be read either in analog

(4-20 mA) and digital form (HART®). In networking, the only way to read the primary variable is digitally (**ONLY HART®**).



NOTE: Up to 15 instruments are supported in a HART® network (addresses 1-15). In a connection with a single field instrument, the address value will be 0 (zero). 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)

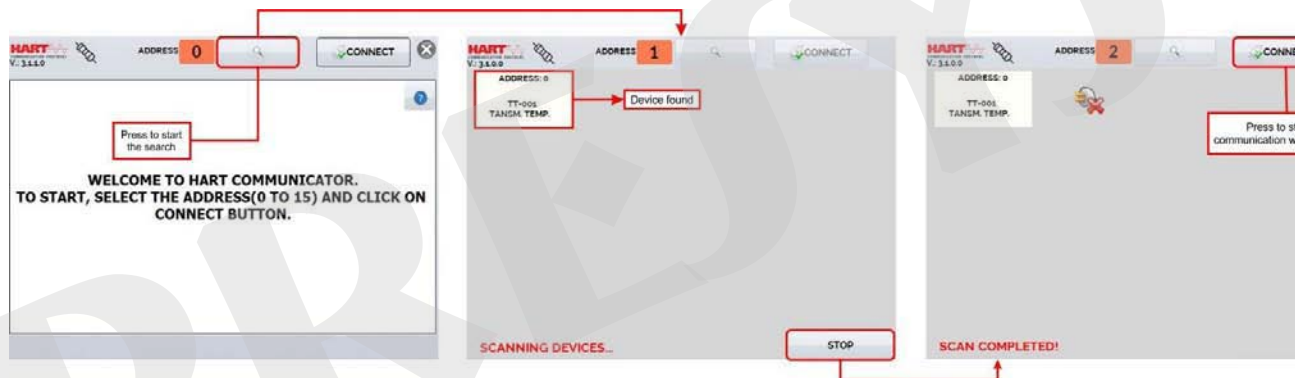


Fig. 43 - Communicating with device

2.5.3. Adjusting the Measurement Range of a HART® Transmitter (CH Option)

When connecting, appears in the **DESCRIPTION** tab data identifying the instrument, such as TAG, manufacturer, description, message, date, measuring range and input filter (damping). Some of these parameters can be changed in the **DEFAULT SETTINGS**.

In **DESCRIPTION** 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).

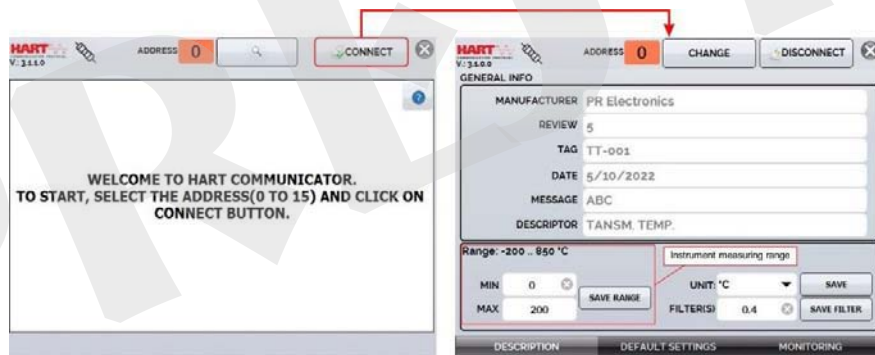


Fig. 44 - Adjusting the measuring range of the HART® transmitter

2.5.4. 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 MCS-XV-IS itself. For this, before connecting the HART® instrument, from the main menu, select **CALIBRATOR**, and select on **Channel 2** the type of desired signal.

For instance, to adjust the range of a Pt-100 temperature transmitter, select in **CALIBRATOR** menu **RTD Pt-100** as output and connect it to the transmitter input. For a pressure transmitter, Channel 2 must be set as **PRESSURE** input and the pressure must be generated manually with a pump, e.g., and connected to the MCS-XV-IS.





To enable Channel 2 as input, press the icon  and enable the **CH-2** option. To enable Channel 2 as output, disable **CH-2** option. To return to the calibrator screen press the **BACK** button. The signal measurement or generation of **CH-2** will work as the standard value for the adjustment range of the instrument.



Fig. 45 - Quick HART® Adjustment with Reference

Generate the signal to the transmitter input corresponding to the lower range value and press the  button. Transmitter will generate 4 mA to this value. Generate the signal to the transmitter input corresponding to the upper range value and press  button. 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 MCS-XV-IS (**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.

In **MONITORING** screen, beyond stating the primary variable PV and the transmitter current, is shown the measured or generated value by the MCS-XV-IS in **CH-2**. If the **CH-2** is configured as an output, click on the number to change the value of output.

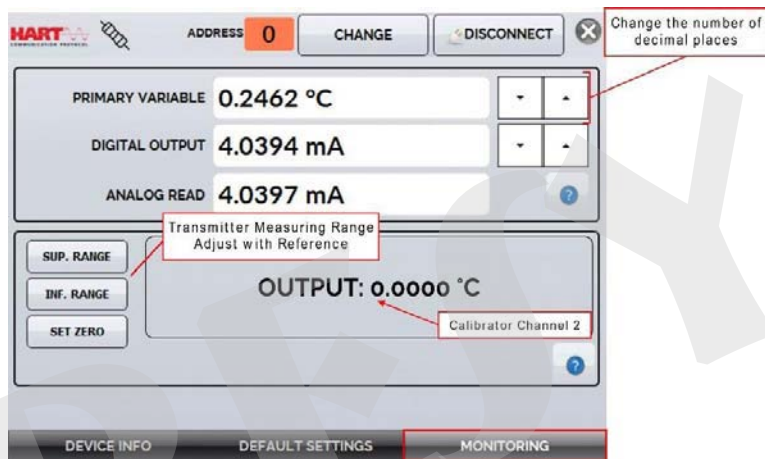


Fig. 46 - Adjusting the Measuring Range of the HART® Transmitter with Reference

2.5.5. Checking / Adjusting HART® Transmitter mA Output (CH Option)

In **DEFAULT SETTINGS** tab can be adjusted the output current of the HART® transmitter (output trim) according to current measured by MCS-XV-IS. You can make this adjustment only when the MCS-XV-IS 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), make the measurement of these points, and adjust the output (trim). The adjustment is completed when **D/A Adjustment Completed** message appears.

The **LEAD TIME** field sets the time (in seconds) of each point stabilization time.

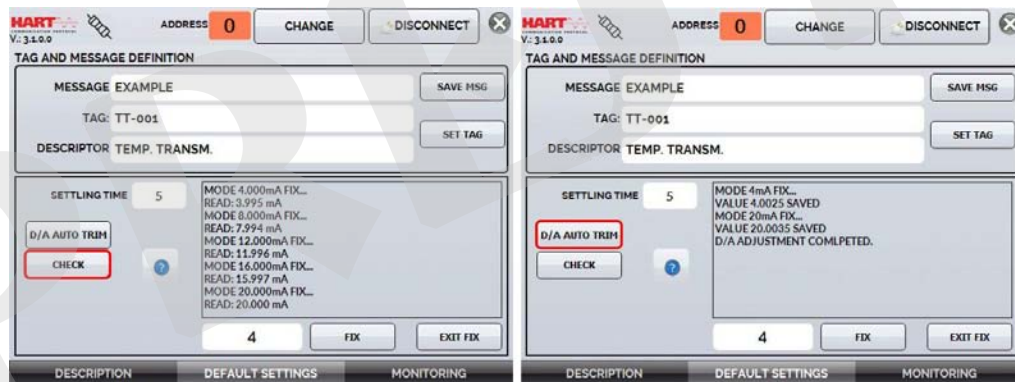
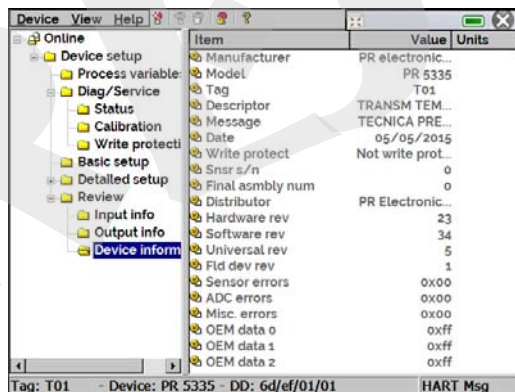


Fig. 47 - Checking / Adjusting the mA HART® Transmitter Output

2.5.6. Full HART® Configurator (Option FH)

If the **HART® CONFIGURATOR** option is enabled the **FH** Software is launched. For this option, the device is automatically found and the screen shows the basic, universal and specific parameters (DD library).

To start the HART® configurator you should wait the MCS-XV-IS to read the device parameters. The MCS-XV-IS will show the message **Reading device information. Please wait...** After connecting, at the bottom of the screen it shows the TAG, connected instrument model and the DD file (Device Description) used. You can open the instrument configuration tree, located on the left side of the screen. This configuration tree changes according to the instrument, as each HART® transmitter has its specific commands.




The screenshot shows the HART Configurator software window. On the left is a tree view of the configuration options, with 'Device info' selected. The main area displays a table of device parameters. At the bottom, a status bar shows 'Tag: T01', 'Device: PR 5335', 'DD: 6d/ef/01/01', and 'HART Msg'.



Item	Value	Units
Manufacturer	PR electronic...	
Model	PR 5335	
Tag	T01	
Descriptor	TRANSM TEM...	
Message	TECNICA PRE...	
Date	05/05/2015	
Write protect	Not write prot...	
Snr s/n	0	
Final asbly num	0	
Distributor	PR Electronic...	
Hardware rev	23	
Software rev	34	
Universal rev	5	
Fld dev rev	1	
Sensor errors	0x00	
ADC errors	0x00	
Misc. errors	0x00	
OEM data 0	0xff	
OEM data 1	0xff	
OEM data 2	0xff	

Tag: T01 Device: PR 5335 DD: 6d/ef/01/01 HART Msg

Fig. 48 - 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 MCS-XV-IS mA input value or change the output setpoint, press the  button:

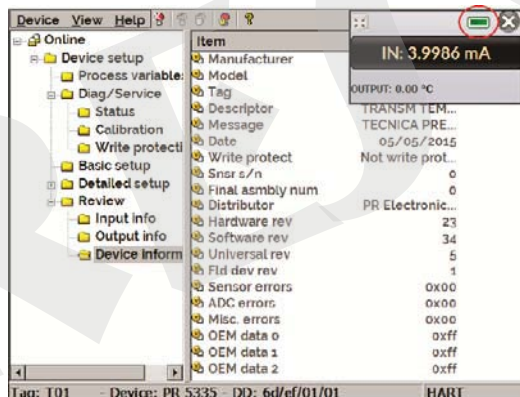


Fig. 49 - MCS-XV-IS Input and Output Values

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

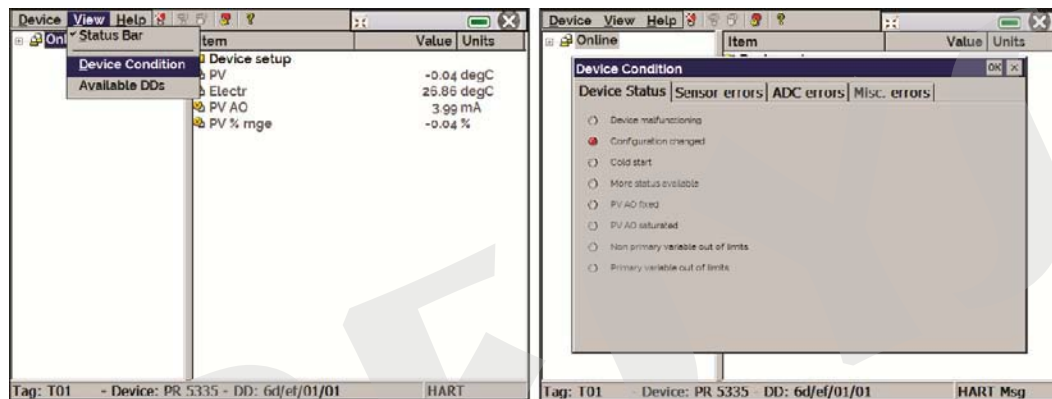


Fig. 50 - Device Condition

2.5.6.1 Saving the HART® instrument configuration

To save all the configuration of a HART® instrument connected to the MCS-XV-IS, can be used the **Document Device** function, from the **Device** menu. This function is useful to save the configuration of an instrument for later download to another instrument of the same model, or else just to make a backup of the settings made.

Press **Device** → **Document Device**, fill in the **File Name** blank and press **Save Device Config**. Optionally, it can be given a description of the configuration file in the **Notes** blank.

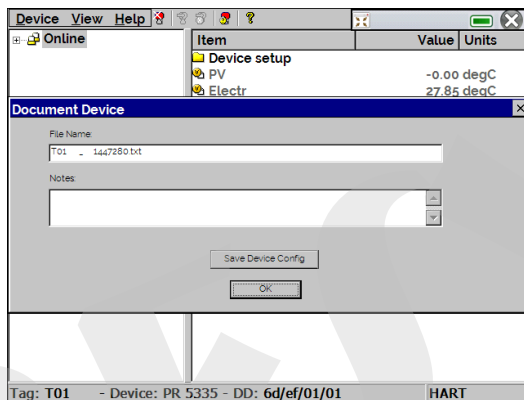



Fig. 51 - Saving a Device Configuration

When you want to download a saved configuration for an instrument, access the menu **Device** → **Download / View**. To select the desired configuration file, double-click 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**. To proceed, press **OK**. At the end of configuration, the **Configuration Write Complete** message appears.

2.6. Data Logger

The MCS-XV-IS 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.


For measurements to be saved, you must press the **REC** button (see **Fig. 52**). With this option selected, all points (measurement and time) are saved in an internal file in MCS-XV-IS, which can be used to generate a table or chart.



Fig. 52 - Data Logger




Fig. 53 - Data-Logger Configuration Menu

Entering in the Configuration Menu (indicated by the icon ) , in **CONFIG** option, 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 in MCS-XV-IS.

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 MCS-XV-IS, you can choose between saving in the internal SD card or the Pen Drive.

2.7. Automatic Tasks

The MCS-XV-IS 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.

2.7.1. Creating Tasks

a) Tasks 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.

The screenshot shows a software window titled "OPEN TEMPLATE" with a close button (X) in the top right corner. The window contains several input fields for task information. The fields "SERIAL NO.", "TAG", "SETTLING TIME(S)", and "MAX ERROR (%)" are highlighted in yellow, indicating they are mandatory. The "ERROR SOURCE" field is a dropdown menu currently set to "SPAN". At the bottom of the window, there are three tabs: "Task info", "AsFound/AsLeft", and "Review and Save".

CREATED BY	Smith, John	[X]	[?]
MANUFACTURER	Presys	[X]	[?]
MODEL	TT223	[X]	[?]
MESSAGE	Example	[X]	[?]
AREA			[?]
CUSTOMER	Presys Instrumentos	[X]	[?]
SERIAL NO.	182.05.14	[X]	[?]
TAG	T05	[X]	[?]
ERROR SOURCE	SPAN		[?]
SETTLING TIME(S)	15		
MAX ERROR (%)	0.250		

Task info AsFound/AsLeft Review and Save

Fig. 54 - 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 (expected Channel 1 - calibrator 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.

AS FOUND

EXPECTED	mA	0.00	4.0000
POINT	°C	75.00	8.0000
		150.00	12.0000
		225.00	16.0000
		300.00	20.0000

REPETITIONS: 0 AUTO

STRATEGY: [Up] [Down] [Auto] [Hold]

AS LEFT

EXPECTED	mA	0.00	4.0000
POINT	°C	75.00	8.0000
		150.00	12.0000
		225.00	16.0000
		300.00	20.0000

REPETITIONS: 3 AUTO

STRATEGY: [Up] [Down] [Auto] [Hold]

RANGE: 4.0000 mA .. 20.0000 mA

Task Info AsFound/AsLeft Review and Save

Fig. 55 - 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

TASK DETAILS

CREATED ON: 09/05/22
CUSTOMER: Presys Instrumentos
ADDRESS: Rua Luis da Costa Ramos, 250 - Saúde - São Paulo - SP
INSTRUMENT DETAILS:
TAG: To5
SERIAL NUMBER: 102.05.14
MODEL: TIC-X
MANUFACTURER: Presys
INPUT RANGE: 0 to 300 °C (RTD)
OUTPUT RANGE: 4 to 20 mA
SETTLING TIME: 15 SECONDS

IDENTIFICATION

OS01

SAVE TEMPLATE CREATE

Task info AsFound/AsLeft Review and Save

Fig. 56 – Reviewing and Saving the Task

2.7.2. Executing Tasks

To perform a task created from the main menu select **TASKS** → **EXPLORE TASKS**. A list identifying the created work orders 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 instrument to be calibrated and press **START**.

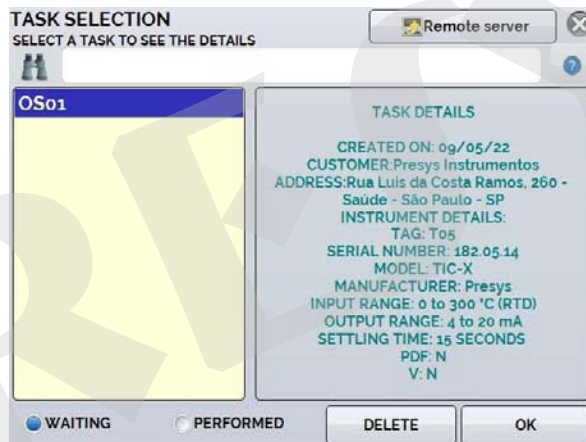


Fig. 57 - Viewing task information

The MCS-XV-IS automatically starts to do the calibration generating setpoints registered on task and reading the instrument to be calibrated.



IMPORTANT: If **NONE** is selected for the calibrator input or output, the calibrator prompts you to enter the data manually. The result is shown on the screen, a progress bar indicates the remaining calibration time.

At the end of the calibration, a report is shown with the generated values, the obtained values, the expected values, and the error verified. If the error is higher than the registered value for the task, the line appears in **red**.

The first time a task is executed, it is saved as **found** (before adjustment). If it is run again, it will be saved as **left** (after adjustment). Tasks created with only **As left** are run only once. The results are saved in the calibrator and can be viewed at any time in the **PERFORMED** option.

2.7.3. Viewing Results

Once a task has been performed, it remains saved in the calibrator. To view the results of a calibration in MCS-XV-IS, in the main menu select **TASKS** → **EXPLORE TASKS**.


Select the ● **PERFORMED** option. The list will now display only those tasks that have already been performed. Select the desired work order and press **OK**. The next screen will show the report with the calibration points, the obtained values, expected values and the verified errors. If the error is above the value registered for the task, the line appears in **red**.



POINT	EXPECTED	OBTAINED	ABS. ERR.	SPAN ERR.
0.00 °C	4.0000 mA	3.9950 mA	-0.0050 mA	-0.031%
125.00 °C	8.0000 mA	7.9936 mA	-0.0064 mA	-0.040%
250.00 °C	12.0000 mA	11.9977 mA	-0.0023 mA	-0.014%
375.00 °C	16.0000 mA	16.0020 mA	0.0020 mA	0.013%
500.00 °C	20.0000 mA	20.0063 mA	0.0063 mA	0.039%
500.00 °C	20.0000 mA	20.0067 mA	0.0067 mA	0.042%
375.00 °C	16.0000 mA	16.0030 mA	0.0030 mA	0.019%
250.00 °C	12.0000 mA	11.9988 mA	-0.0012 mA	-0.007%
125.00 °C	8.0000 mA	7.9946 mA	-0.0054 mA	-0.034%
0.00 °C	4.0000 mA	3.9959 mA	-0.0041 mA	-0.026%

Fig. 58 - Tasks Results

CREATE DOCUMENT option saves the job data as a .pdf extension file to the calibrator's internal memory (SD card), which can be printed or accessed via a computer.

To print the Calibration Report, press the icon . The printer must have been previously configured in **SETTINGS** → **SYSTEM** tab → **PRINTER CONFIG.** (See section 3.4 – **System**) and connected to the MCS-XV-IS USB Host port (see Fig. 02). Tasks are saved in the **TASKS/REPORTS** folder, identified by the number of the registered TAG.

To save all the tasks in a Pen Drive or external HD connected to the calibrator, enter the **TASK** → **ADVANCED TASK OPTIONS** → **EXPORT FILES TO USB FLASHDRIVE.**

The logo can be changed to one of your own company. To do so, plug a Pen Drive with the logo file into the MCS-XV-IS USB port. Enter the **TASKS** → **ADVANCED TASK OPTIONS** → **ADVANCED** → **CERTIFICATE MODEL MANAGER** → **LOGO** and select the file by its name (must have the extension .jpg). We recommend an image size of approx. 200 x 200 pixels.

To add your sign to the Report, create a user with a signature in **System** menu (See section 3.4.5 – Security Options) and enable the **Protected Access** with password.

Calibration report for tag TT01**PRESYS**

TASK DETAILS

CREATED IN: 03/02/2016
 INSTRUMENT DETAILS:
 TAG: TT01
 SERIAL NUMBER: 001.01.15
 MODEL: RTD Transmitter
 MANUFACTURER: Presys
 INPUT RANGE: 0 TO 100 °C (RTD)
 OUTPUT RANGE: 4 TO 20 mA
 MAX ERROR = 0,1% SPAN (SPAN = 16 mA)
 LEAD TIME: 10 SECONDS

As-found performed by: John A.

POINT	EXPECTED	OBTAINED	ERROR	SPAN ERR.	PASS/FAIL
0.00 °C	4.0000 mA	3.9955 mA	-0.0045 mA	-0.028%	Pass
25.00 °C	8.0000 mA	7.9907 mA	-0.0093 mA	-0.058%	Pass
50.00 °C	12.0000 mA	11.9897 mA	-0.0103 mA	-0.064%	Pass
75.00 °C	16.0000 mA	15.9934 mA	-0.0066 mA	-0.041%	Pass
100.00 °C	20.0000 mA	19.9968 mA	-0.0032 mA	-0.020%	Pass

As-left performed by: John A.

POINT	EXPECTED	OBTAINED	ERROR	SPAN ERR.	PASS/FAIL
0.00 °C	4.0000 mA	4.0001 mA	0.0001 mA	0.001%	Pass
25.00 °C	8.0000 mA	7.9949 mA	-0.0051 mA	-0.032%	Pass
50.00 °C	12.0000 mA	11.9911 mA	-0.0089 mA	-0.056%	Pass
75.00 °C	16.0000 mA	15.9932 mA	-0.0068 mA	-0.042%	Pass
100.00 °C	20.0000 mA	19.9957 mA	-0.0043 mA	-0.027%	Pass
100.00 °C	20.0000 mA	19.9983 mA	-0.0017 mA	-0.011%	Pass
75.00 °C	16.0000 mA	15.9995 mA	-0.0005 mA	-0.003%	Pass
50.00 °C	12.0000 mA	11.9924 mA	-0.0076 mA	-0.047%	Pass
25.00 °C	8.0000 mA	7.9975 mA	-0.0025 mA	-0.016%	Pass
0.00 °C	4.0000 mA	3.9981 mA	-0.0019 mA	-0.012%	Pass

Standard serial number: 112.11.15

Standard last calibration: 13/11/2015

Operator signature: _____

Fig. 59 - Calibration Report Example

2.7.4. Task Advanced Options

In the **Advanced Task Options** menu, by clicking on **ADVANCED** it is possible to configure/ register the following options: Costumer Manager, export task files to an USB flash drive and enable or disable the files encryption.

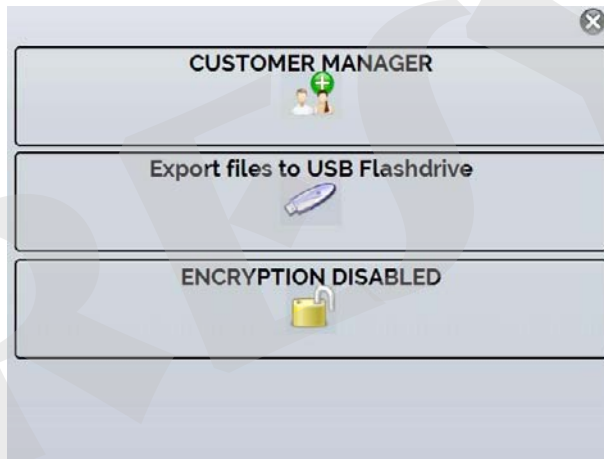


Fig. 60 - Task Advanced Options

2.8. Help Desk

MCS-XV-IS 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. 61 - 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 (type A USB) and to the MCS-XV-IS (Type B USB, see **Fig. 02**). 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.

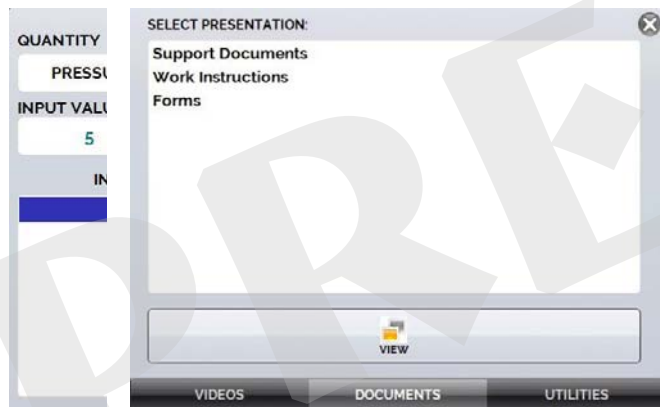


Fig. 62 - Documents tab

Fig. 63 - Utilities tab

3 - Settings

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

3.1. 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. 64 - Date and Time configuration

3.2. Network



IMPORTANT: In the case of the MCS-XV-IS, designed for use in hazardous areas, the ethernet port has been removed from the calibrator, so the network-related settings do not apply.

3.3. Services

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




Fig. 65 - Services configuration

3.3.1 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  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.

3.3.2. Server Communication

The Isocal MCS-XV-IS 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.

3.4. 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 MCS-XV-IS 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. 66 - 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 **4 - Adjust** for more information.

4 - Adjust



ATTENTION: To prevent potential damage to the instrument's calibration due to improper adjustment, the access password must be requested from Presys Instrumentos e Sistemas.

Access password for adjustment procedure:

To perform input adjustments, the calibrator owner must contact Presys, providing the equipment's serial number. In this case, they will receive the password allowing access to the adjustment.

>>> **Contact:** assistencia.tecnica@presys.com.br



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 MCS-XV-IS 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.

After entering the password, the screen displays the **GENERAL**, **INPUTS**, and **OUTPUTS** 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. For adjustment, choose between inputs, outputs and pressure adjustment (**General** tab).



Fig. 67 - Adjust Options



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.

4.1. Inputs Adjustment

a) V, mV, and mA Inputs

In the Inputs tab, select one of the inputs to perform the adjustment. Press the **START** button and then, in the blank field, enter the value corresponding to the point. Also notice that the screen presents the requested points to help make the input adjustment more intuitive.

After applying the signal, record the values at the 1st and 2nd calibration points (PNT1 and PNT2).

V Input	PNT1 – Adjust Value	PNT2 – Adjust Value
Single range	0,0000 V	11,0000 V

mV Input	PNT1 – Adjust Value	PNT2 – Adjust Value
G 4	0,000 mV	70,000 mV
G 3	0,000 mV	120,000 mV
G 2	0,000 mV	600,00 mV
G 1	600,00 mV	2400,00 mV

mA Input	PNT1 – Adjust Value	PNT2 – Adjust Value
Single range	0,0000 mA	20,0000 mA

The image below shows the mA adjustment process, use it as an example for the other inputs.

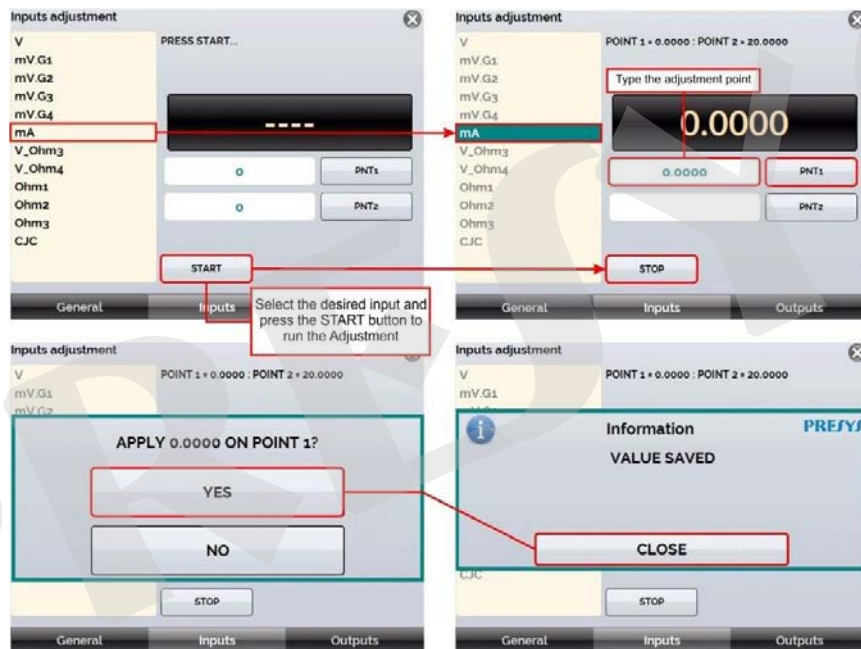


Fig. 68 - Adjustment flow process example

b) OHMS Input

The Ω input adjustment is done in two steps:

Step 1: mV Signal Application

For the adjustment below, short-circuit the RTD3(+) and RTD4(+) terminals.

mV Signal	Terminals	PNT1	PNT2
V_OHM3	RTD3(+) e GND IN (-)	90,000 mV	120,000 mV
V_OHM4	RTD4(+) e GND IN (-)	90,000 mV	120,000 mV

Etapa 2: Resistance Application

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

Resistors	PNT1	PNT2
OHM3	20,000 Ω	50,000 Ω
OHM2	100,000 Ω	500,000 Ω
OHM1	500,000 Ω	2000,000 Ω

c) CJC Adjustment

Measure the GND IN terminal's internal temperature and record at point 1.

Cold Junction	PNT1
CJC	32,03 °C (measured temperature)

4.2. Outputs Adjustment

The outputs (except for CJC and Probe) are adjusted in steps. For each step, the calibrator generates a signal to be measured that must be registered by the user during the adjustment process.

a). V, mV, and mA Outputs

For these output ranges the screen will display three buttons: **STEP1**, **STEP2**, and **STEP3**. Select **STEP1**. The generated signal should be measured by a standard and the value should be saved by pressing the **SAVE** button. Repeat the procedure for **STEP2** and **STEP3**.

b). OHM Output

Due to accuracy considerations, the resistance output must be measured by a standard using a 4-wire connection. The polarity of the wires is initially not important since the excitation current can flow in both directions - from terminal RTD1 to RTD2 or from terminal RTD2 to RTD1.

The adjustment should be made in both ranges: 400 (OHM-400) and 2500 (OHM-2500).

For these output ranges, the display shows the buttons: **STEP1**, **STEP2**, **STEP3**, and **STEP4**. Select **STEP1**. The generated signal should be measured by a standard, and the value should be saved by pressing the **SAVE** button.

Repeat the procedure for **STEP2** and **STEP3**. Change the leads order connected to the **RTD1** terminal with those connected to the **RTD2** terminal and select **STEP4**. Measure the generated signal and save the measured value by default.

4.3. Probe Adjustment

First, identify the connector pins for the Probe according to the figure below.

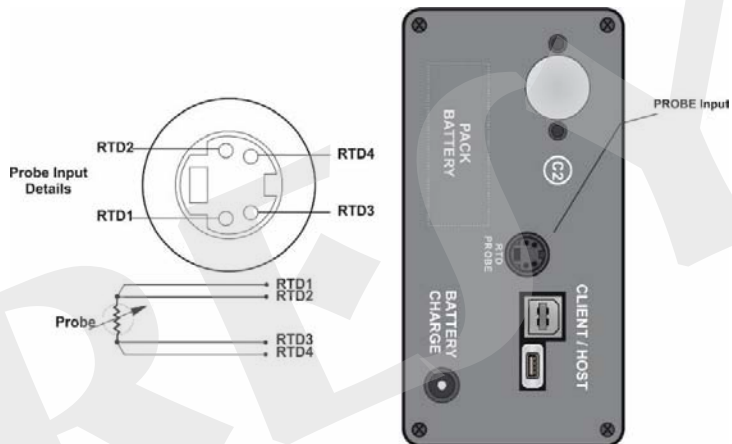


Fig. 69 - Probe Input Connector

The **PROBE** adjustment is performed in two steps:

a) Application of mV Signal:

mV Signal	Terminals	Bornes	PNT1	PNT2
V_2	RTD2(+)*	GND OUT (-)	70.000mV	120.000 mV
V_1	RTD2(+)*	GND OUT (-)	120.000mV	600.00 mV

(*) RTD2, for **PROBE** adjustment, refers to the drawing shown in **Fig. 69**. If required, you can purchase a connector adapter with J121 (female) terminals to ease the adjustment. Order code: 06.07.0017-00.

b) Application of Standard Resistors:

Connect a decade box or standard resistor to the probe connector, at positions RTD1, RTD2, RTD3 and RTD4, as shown in **Fig. 69**.

resistors	PNT1	PNT2
R_2	20.000 Ω	50.000 Ω
R_1	100.0 Ω	500.0 Ω

4.4. CJC Adjustment

The adjustment of the cold junction related to the thermocouple output is similar to the one related to the thermocouple input. But the temperature should be taken at the GND OUT terminal.

5 - Pressure sensor installation and adjustment

The MCS-XV-IS calibrator allows the installation of new pressure sensors, as well as the adjustment of the capsules already installed. To perform the operations described in this section, please observe the recommendations and warnings.



ATTENTION! Only perform the procedures described in this section after fully understanding the information provided 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 responsible for any damage caused to the MCS-XV-IS due to non-compliance with the information provided.



ATTENTION: We recommend the use of standards with an accuracy three or four times superior to the technical specifications of this calibrator, as well as the execution of the adjustment in an environment where temperature and humidity are the closest possible to the laboratory characteristics, being: temperature of 23 ± 2 °C and controlled humidity close to $55 \pm 20\%$.



ATTENTION: For absolute, gauge, and vacuum pressure sensors, perform the adjustment in at least 6 POINTS throughout the range. For low-pressure and/or differential sensors, adjust by at least 11 POINTS.



IMPORTANT: In some cases, the value entered the calibrator 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.

5.1. Installation

To install a new sensor on the MCS-XV-IS, **turn off the calibrator** and remove the screws corresponding to the side where the sensor will be installed (C1 or C2). Then gently pull the cover off.

Inside the calibrator, there is a connector available for each uninstalled capsule. Check its location and connect the capsule to the calibrator. If necessary, disconnect the fuse holder from the mA input for easy access when installing on the right side of the calibrator (slots for C1 and C2 available).



ATTENTION: Pay attention to the polarity between the sensor and the calibrator connectors. A white stripe indicates the correct polarity.



IMPORTANT: It is not necessary to perform any pressure or voltage adjustment procedures on the inserted sensor, you only need to set up the capsule information and parameters.

After the connection between the sensor and the calibrator, fix it in the housing of the equipment through the two screws that come with it.

5.2. Parameters Configuration

a) Sensor Information

In the Main Menu, press **SETTINGS** and then select the **SYSTEM** tab. In the top corner of the screen, press the **ADJUST CAL.** field. A pop-up will appear prompting you for a password, so type and press **ENTER**, then **OK**.

To obtain the password, contact assistencia.tecnica@presys.com.br



Fig. 70 - Adjust Menu Access

In the next window, press the Pressure Adjustment button. Then the **PRESSURE SETTINGS** screen will open, access the item **PARAMETERS CONFIGURATION**.

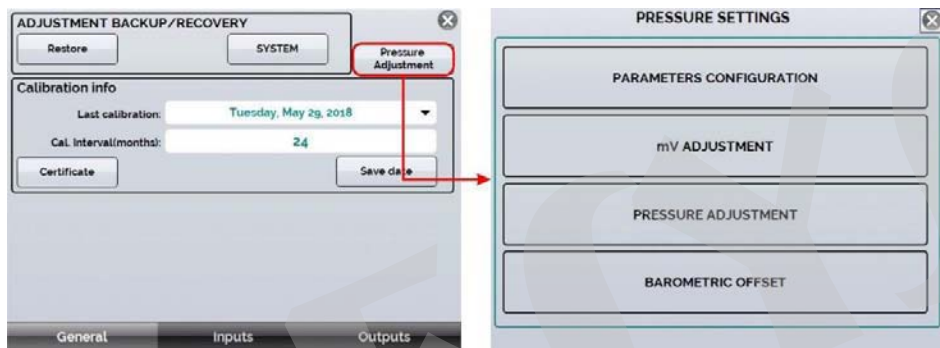


Fig. 71 - Accessing the parameters configuration

Right in the **CAP. INFO** tab it is possible to change or enter new data for a determined sensor. To change the information of the newly installed sensor, select its position (C1 or C2).

Press the **EDIT** button to change the entered fields (serial number, scale start and scale end). After you finish editing the values, press **ENTER** to save.



IMPORTANT: If a barometric pressure sensor is installed in slot C4, mark the checkbox.

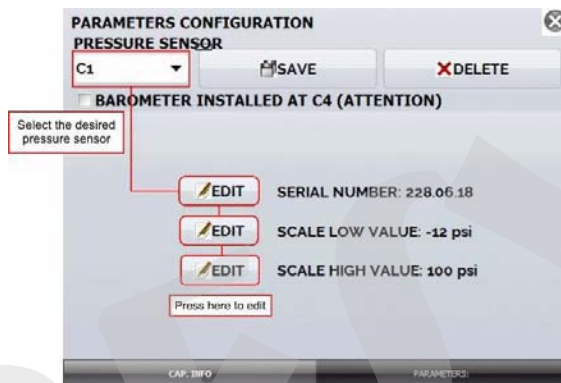


Fig. 72 - Changing information

Through the **PARAMETERS** tab the pressure sensors parameterization files are installed. Before starting this procedure, make sure that the parameters file (.cap extension) is duly stored in the calibrator memory in a folder named **PARAMETERS**.



IMPORTANT: The .cap file should be sent together with the purchased capsule. If you have not received it, please contact one of our representatives' sales.

In the **PRESSURE SENSOR** drop-down list, select the pressure sensor to perform the parameters installation. Then, in the **FILE INSTALLED** drop-down list, select the corresponding file. In the right corner of the screen, you should see the capsule actuation curve parameters, press **SAVE** to save the data or **DELETE** to remove it.

When the **SAVE** button is pressed, a confirmation pop-up will be displayed. Press **YES** to continue and **NO** to cancel the operation.

5.2.2. mV Adjustment

To perform the mV adjustment of a pressure sensor, use a connection jig as indicated in the picture below. Connect the jig to the sensor connector observing polarity.



Fig. 73 - Adjustment Jig

Then connect the jig terminals to a standard signal generator and a multimeter.



IMPORTANT: The standard electrical signal generator to be used in this adjustment process must have an accuracy of three or four times the accuracy described in the technical specifications of this calibrator.



ATTENTION: Do not insert any voltage signal to the pressure sensor before accessing the adjustment menu.

Access the **PRESSURE SETTINGS** and press the **mV ADJUSTMENT** button. On the next screen, select **G2** in the **GAIN** field and press the **START** button. Follow the steps below to perform the adjustment:

- Note the **SAVED POINT** field, this field indicates which signal in mV should be inserted into the pressure capsule;
- Select **Point 1** from the drop-down list. Note that in the case of the 0.000 mV point it is possible to short-circuit the terminals of the Adjustment Jig;
- Press **ADJUST POINT** to enter the required point;



IMPORTANT: Make sure to generate the requested signal through your standard and monitor that the value is correct using a high accuracy multimeter.

- Repeat the point adjustment for at least two times to ensure that the point value will be saved correctly;
- Go to the **POINT** drop-down list and select Point 2;
- Repeat all the above steps until you have finished Point 2.
- After finishing, in the **GAIN** drop-down list, select **G1** and adjust the required points in Point 1 and Point 2 and press the **STOP** button.

5.2.3. Pressure Adjustment



ATTENTION: For absolute, gauge, and vacuum pressure sensors, make the adjustment at a minimum of 6 (six) POINTS across the range. For low pressure and/or differential sensors, make the adjustment at least 11 (eleven) POINTS.



IMPORTANT: We recommend the application of pressure close or equivalent to the full scale of the adsensorsbeing adjusted for at least 5 (five) minutes before performing the procedure.

Pressure adjustment is performed by the calibrator in psi, so be sure to use the same engineering unit in your pressure standard.

In the **PRESSURE SETTING CENTER**, select the **PRESSURE ADJUST** option and on the next screen select from the **PRESSURE SENSOR** drop-down menu which sensor will be adjusted (choose among C1 and C2). Note that only the installed sensors will be shown in the list.

- Press the **START** button and observe the **SAVED POINT** field to identify each pressure value to be entered.

IMPORTANT: For the 0.0000 psi point, keep the sensor open to the atmosphere.

- Press the **SAVE** button at least twice to make sure that the current point will be saved;
- From the **POINT** pull-down menu, select the next point to be adjusted and repeat the steps above, making sure that the values entered are correct and waiting at least one minute before starting the point adjustment;
- After finishing the adjustment of the current sensor, press the **STOP** button and go to the **PRESSURE SENSOR** drop-down menu again to select the next sensor (if any);
- Repeat these steps until all sensors are adjusted.

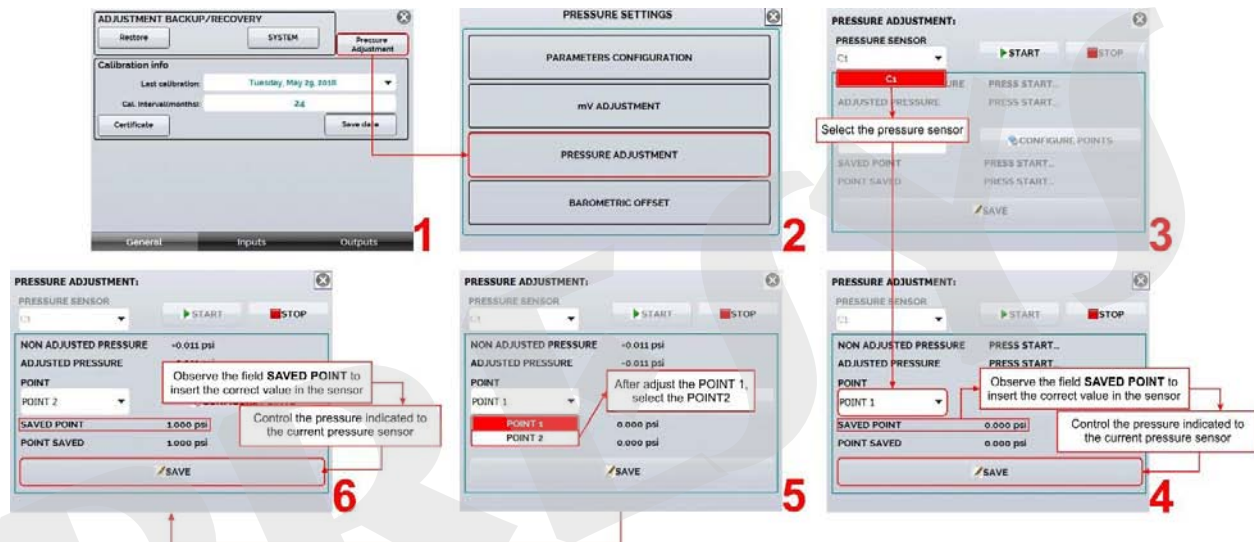


Fig. 74 - Pressure Adjustment

6 - Pressure Units Conversion

psi	bar	mbar	MPa	kPa
1	0.06894757	68.94757	0.006894757	6.894757

psi	hPa	Pa	atm	at
1	68.94757	6894.757	0.06804605	0.07030696

psi	mmH₂O	mmH₂O@4°C	cmH₂O	cmH₂O@4°C
1	703.0696	703.0889	70.30696	70.30889

psi	mH₂O	mH₂O@4°C	ftH₂O	ftH₂O@4°C
1	0.7030696	0.7030889	2.306659	2.306726

psi	inH₂O	inH₂O@4°C	inH₂O@20°C	inH₂O@60°F
1	27.67990	27.68067	27.72977	27.70759

psi	torr	mmHg	mmHg@0°C	cmHg
1	51.71500	51.71500	51.71507	5.171500

psi	cmHg@0°C	inHg	inHg@0°C	inHg@60°F
1	5.171507	2.036024	2.036026	2.041772

psi	gf/cm²	kgf/cm²	kgf/m²	
1	70.30696	0.07030696	703.0696	

Notes

- Adjusting procedures for MCS-XV-IS must be performed under the reference conditions of temperature and humidity.
- Better calibration results are achieved if warm-up time is at least two hours and if the battery charger remains disconnected from the calibrator for one hour, at least, before its usage.
- The standards used to adjust MCS-XV-IS should have accuracy at least 3 times better than the accuracy values provided in this manual.

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