CAPPO 200
USER MANUAL

State-of-the-art multicalibrator, meets the measurement and calibration needs of temperature, electrical quantities and pressure

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With 94 years of history, Ecil is a national leader in industrial temperature measurement and control. We are specialists in offering the most complete solutions for temperature measurement and control in the most demanding segments such as: Oil & Gas, Steel, Metallurgical, Chemical, Cement, Food, Pharmaceutical, Plastic, Glass, Pulp and Paper, etc.

We offer the market a wide range of products consisting of temperature sensors, such as thermocouples, resistance thermometers, infrared thermometers and other instruments for measuring, transmitting, insulating, controlling, recording and calibrating temperature. Pressure calibrators and flue gas analyzers are also part of our line of instruments.

Our Metrology Laboratory was the first to be accredited by Cgcre (Brazilian accreditation body), and offers its customers Temperature Calibration, Electrical Measurements and Infrared Pyrometers services. This Laboratory is also used for testing raw materials for the manufacture of temperature sensors and for calibrating and testing instruments. And in early 2018, we started the certification of flue gas calibration.

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1. IMPORTANT INFORMATION

1.1 Information about this manual

This manual describes the operation, features and maintenance of the Cappo 200 multicalibrator.

Read this operation and maintenance manual before using the instrument. The operator must be familiar with the instrument and follow the instructions carefully.

This operation and maintenance manual is subject to change due to technical improvements - the manufacturer assumes no responsibility for any failure or misprint.

2. OPERATING PRINCIPLES

2.1 General Description

Ecil Produtos presents the Cappo 200 series portable calibrator, which was developed with its own technology and local manufacturing.

The calibrator is compact and lightweight, powered by 3.7V@5200mA rechargeable lithium batteries, housing with modern design, color and backlit TFT graphic display (480x272) with Touchscreen.

To use the touch screen more effectively, it is recommended that you use a soft, fine-tipped, non-piercing object for color adjustment.

The instrument has two universal channels, simultaneous, independent and isolated from each other. The Input channel is used for measurement, and the Output channel is used for simulation, both accept the following types of signals: Thermocouples, RTDs, mV, V, mA, Ohmic Resistance, pulses and frequency. Each channel has a 24V/30mA source, also isolated from each other.

As an option, the instrument also has 2 channels for measuring pressure and a channel for using Smart Probes, all configurable.

All measurements and simulations are carried out using high-resolution integrated circuits, with a sophisticated conditioning, filtering and amplification system that provide the product with excellent accuracy and thermal stability over time.

The Cappo 200 is supplied with a calibration certificate accredited by Cgcre (Brazilian accreditation body).

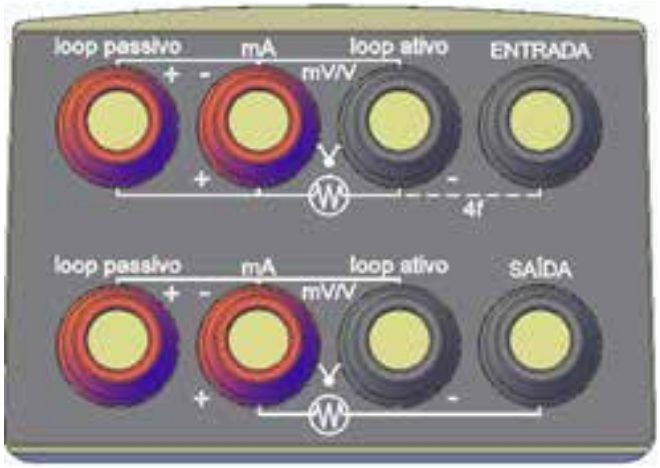
2.2 Components Description

2.2.1 Components Description> Screen

All parameters are visualized on a 480x272 TFT color touchscreen display, backlit and with ample useful area to facilitate the visualization of measurements and configuration of operating parameters.

2.2.2 Components Description > Connections

The input and output channels have 4 golden terminals which are labeled as shown below.



There are two inputs for external pressure modules, CPl and CP2, both on the bottom side of the instrument. At the top is the input to the Smart Probe.

Bottom

Top

On the side there is a USB type-B port for charging the instrument's battery.

There is also an optional Bluetooth connection. If this option is chosen when purchasing the instrument, the user receives the open protocol to use as he/she wishes. When Bluetooth is enabled, an antenna symbol appears in the lower left corner of the Home Screen, as shown below:

3. TECHNICAL SPECIFICATIONS

Input/Output – Voltage mV and V

Range	Resolution	Accuracy
-21 to 210mV	1µV	± 0.02% of reading + 3µV
-210 to 2,100mV	10µV	± 0.02% of reading + 10µV
-2 to 20V	100µV	± 0.02% of reading + 0.1mV

Input – Current mA

Range	Resolution	Accuracy	Observation
0 to 21mA	0.1µA	± 0.02% of reading + 0.4µA	Passive Loop
0 to 51mA	0.1µA	± 0.02% of reading + 0.4µA	Active Loop

Passive Loop: considers that the Calibrator is being used in a non-energized circuit, that is, the Calibrator is the one who will power the circuit, therefore the 24V source on terminal 4 of the input channel will be turned on and the maximum current in the measurement will be 21mA.

Active Loop: considers that the Calibrator is being used in an energized circuit, that is, the circuit is powered by a source external to the Calibrator, therefore the 24V source on terminal 4 of the input channel will be turned off and the maximum current in the measurement will be 51mA.

Output – Current mA

Range	Resolution	Accuracy	Observation
0 to 51mA	0.1µA	± 0.02% of reading + 0.4µA	Active or Passive Loop

Note: For the Output channel, both in the Passive Loop and in the Active Loop, the 24V source will always be connected to terminal 4 of the output channel and the maximum current to be simulated will always be from 0 to 51mA.

Input – Resistance Ω

Range	Resolution	Accuracy	Observation
0 to 500 Ω	1mΩ	± 0.02% of reading + 20mΩ	3 to 4 wires Input
0 to 4,000 Ω	10mΩ	± 0.02% of reading + 200mΩ	3 to 4 wires Input

Output – Resistance Ω

Range	Resolution	Accuracy	Observation
0 to 500 Ω	1mΩ	± 0.02% of reading + 20mΩ	2 wires Output
0 to 4000 Ω	10mΩ	± 0.02% of reading + 200mΩ	2 wires Output

Input/Output – Resistance Thermometer

RT Type	Range	Resolution	Accuracy
Pt100 IEC	-200ºC (-328ºF) to 850ºC (1,562ºF)	0.01ºC/F	± 0.02% of reading + 0.05ºC (0.09ºF)
Pt100 JIS	-200ºC (-328ºF) to 600ºC (1,112ºF)	0.01ºC/F	± 0.02% of reading + 0.05ºC (0.09ºF)
Pt100 SAMA	-200ºC (-328ºF) to 600ºC (1,112ºF)	0.01ºC/F	± 0.02% of reading + 0.05ºC (0.09ºF)
Pt1000 IEC	-200ºC (-328ºF) to 600ºC (1,112ºF)	0.01ºC/F	± 0.02% of reading + 0.05ºC (0.09ºF)
Cu10	-100ºC (-148ºF) to 260ºC (500ºF)	0.10ºC/F	± 0.02% of reading + 0.40ºC (0.72ºF)
Ni120	-80ºC (-112ºF) to 260ºC (500ºF)	0.01ºC/F	± 0.02% of reading + 0.05ºC (0.09ºF)

Input/Output – Thermocouples

TC Type	Range	Resolution	Accuracy
J	-210ºC (-346ºF) to 1,200ºC (2,192ºF)	0.01 ºC/F	± 0.02% of reading + 0.1ºC (0.18ºF)
K	-270ºC (-454ºF) to 1,372ºC (2,501.60ºF)	0.01 ºC/F	± 0.02% of reading + 0.1ºC (0.18ºF)
N	-270ºC (-454ºF) to 1,300ºC (2,372ºF)	0.01 ºC/F	± 0.02% of reading + 0.1ºC (0.18ºF)
E	-270ºC (-454ºF) to 1,000ºC (1,832ºF)	0.01 ºC/F	± 0.02% of reading + 0.1ºC (0.18ºF)
T	-210ºC (-346ºF) to 400ºC (752ºF)	0.01 ºC/F	± 0.02% of reading + 0.1ºC (0.18ºF)
R	-50ºC (-58ºF) to 1,768ºC (3,214.40ºF)	0.10 ºC/F	± 0.02% of reading + 0.2ºC (0.36ºF)
S	-50ºC (-58ºF) to 1,768ºC (3,214.40ºF)	0.10 ºC/F	± 0.02% of reading + 0.2ºC (0.36ºF)
B	0ºC (32ºF) to 1,820ºC (3,308ºF)	0.10 ºC/F	± 0.02% of reading + 0.3ºC (0.54ºF)

Note: types J, K, N, E and T thermocouples accuracy, in temperatures below -200°C (-328°F), will be ± 0,02% of the reading +1.0°C (+ 1.8°F). The error limits stand for 360 days for operation between 18°C (64.4°F) to 28°C (82.4°F), out of this range the thermal stability is of 0.001 % FS / °C/F.

Input/Output – Frequency and Pulses

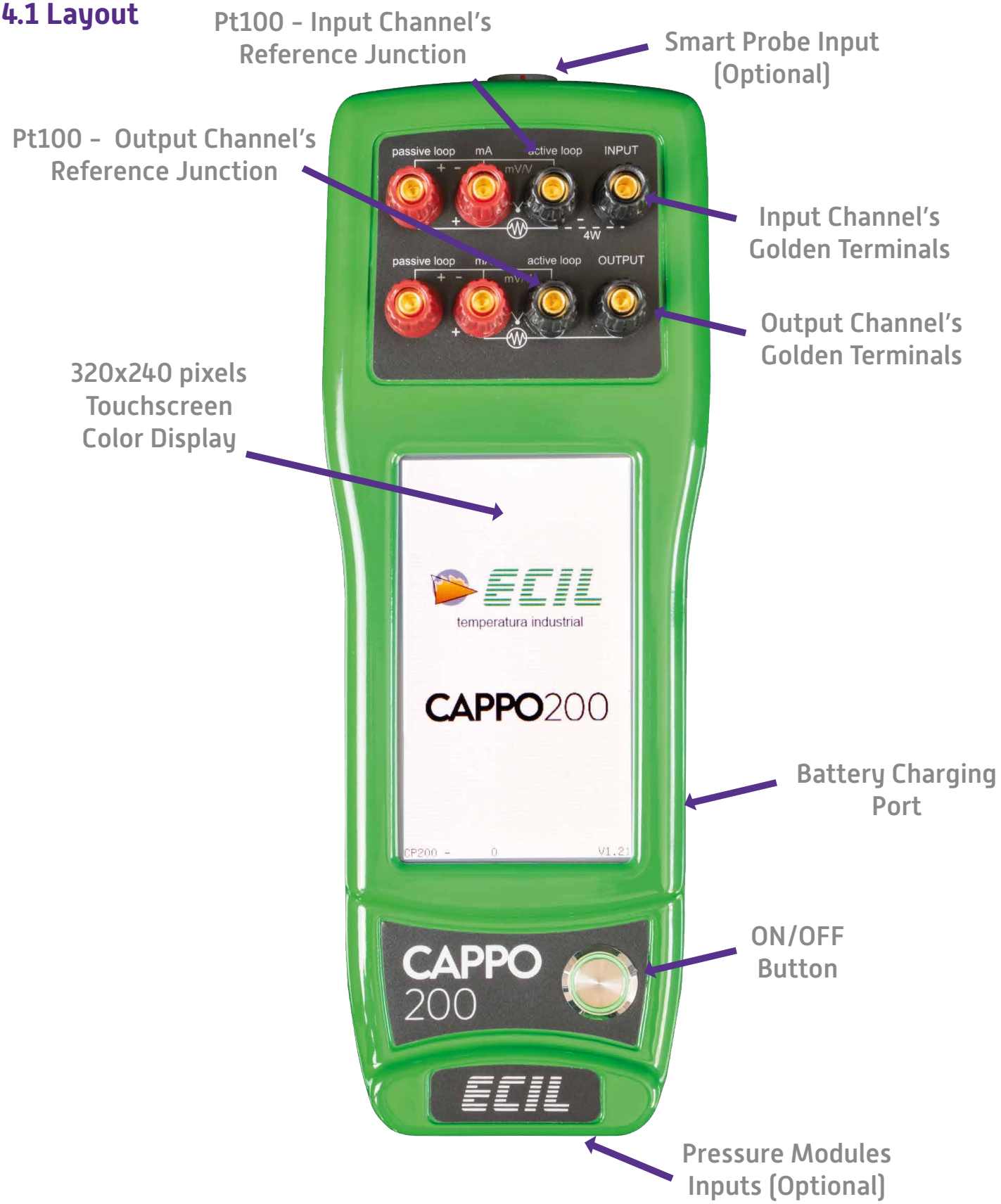
Range	Resolution	Accuracy
1 to 999 Hz	0.001 Hz	±0.005% of reading + 0.005 Hz
1,000 to 9,999 Hz	0.01 Hz	±0.005% of reading + 0.05 Hz
10,000 to 50,000 Hz	0.1 Hz	±0.005% of reading + 0.5 Hz

External Pressure Module

Range	Resolution	Accuracy
-100 to 100 mbar	0.001mbar	±0.025 % F.S.
-500 to 500 mbar	0.01mbar	±0.025 % F.S.
-1 to 2 bar	0.01mbar	±0.025 % F.S.
0 to 2 bar (ABS)	0.01mbar	±0.025 % F.S.
-1 to 10 bar	0.1mbar	±0.025 % F.S.
-1 to 20 bar	0.1mbar	±0.025 % F.S.
0 to 20 bar (ABS)	0.1mbar	±0.025 % F.S.
-1 to 40 bar	1 mbar	±0.025 % F.S.
0 to 70 bar	1 mbar	±0.025 % F.S.
0 to 150 bar	1 mbar	±0.025 % F.S.
0 to 350 bar	10 mbar	±0.025 % F.S.
0 to 700 bar	10 mbar	±0.025 % F.S.
0 to 1,000 bar	10 mbar	±0.025 % F.S.

4. PRESENTATION

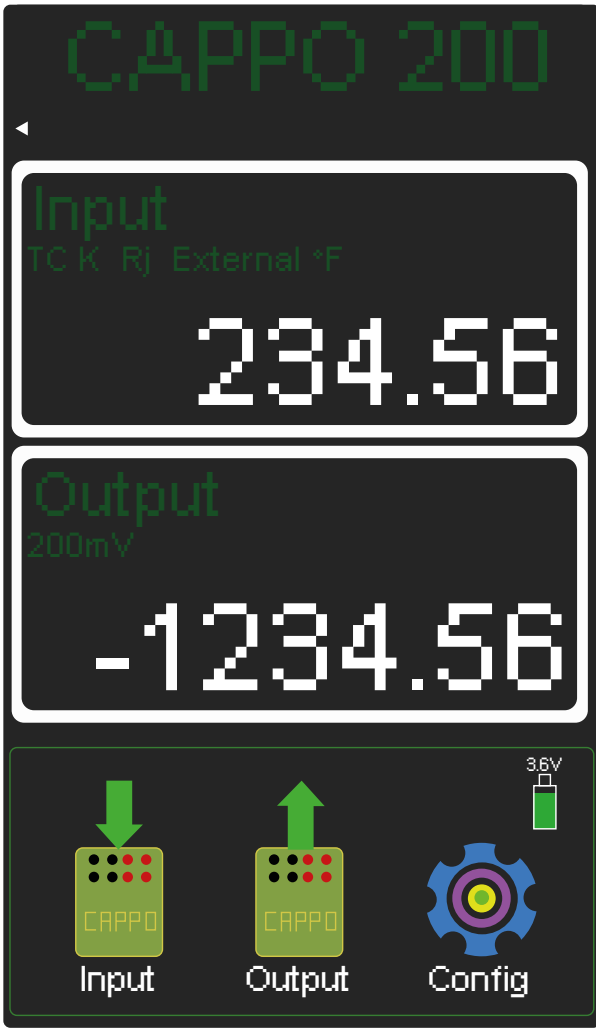
4.1 Layout



4.2 Display

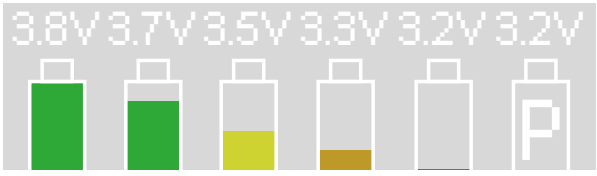
All parameters are visualized on a 320x240 graphic display, backlit and with ample useful area to facilitate the visualization of measurements and configuration of operating parameters.

The display is divided into two parts defined as **Upper** and **Lower** Display to show two variables simultaneously.



Upper Display

Lower Display



The first line of the Upper or Lower display identifies the type of variable being displayed, the working range, unit and other details relating to the type of variable.

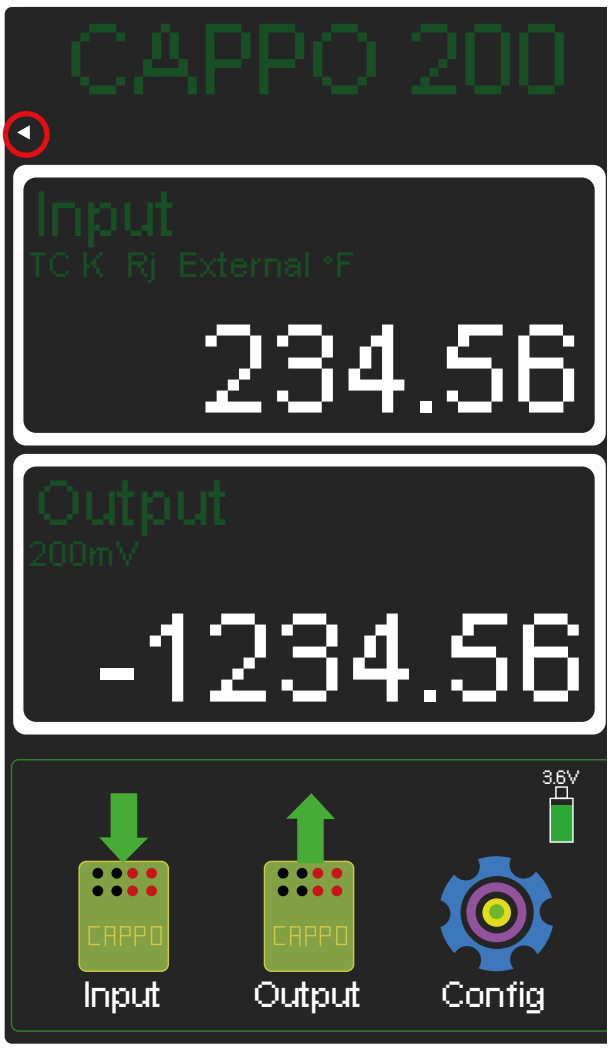
In the lower right corner, just below the lower display and above the Configuration icon, an icon is dynamically shown that indicates the battery charge level. The icon with the letter P indicates that the instrument is connected to the battery charger.

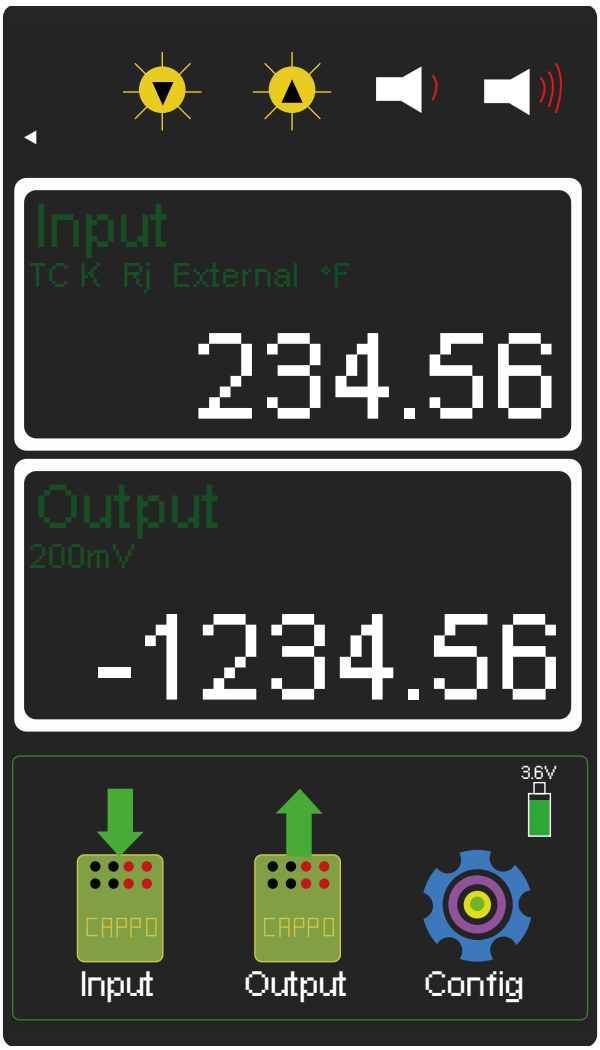
When the battery reaches the critical level (first icon = empty battery), the message “BATTERY LOW” is displayed and the instrument is automatically turned off.

A battery charger, input 110/220Vac and output 9V@1A is supplied with the instrument, the typical recharge time is 6 hours with the instrument turned off.

Battery autonomy is approximately 6h for Input/Output in Thermocouple, Thermosisistance, mV and V or 3h for 20mA current simulation in Passive mode.

To configure the screen brightness and instrument beep volume, just click on the small triangle located in the lower left corner of the Main Screen header, thus displaying the icons for increasing and decreasing brightness and increasing and decreasing the beep volume:

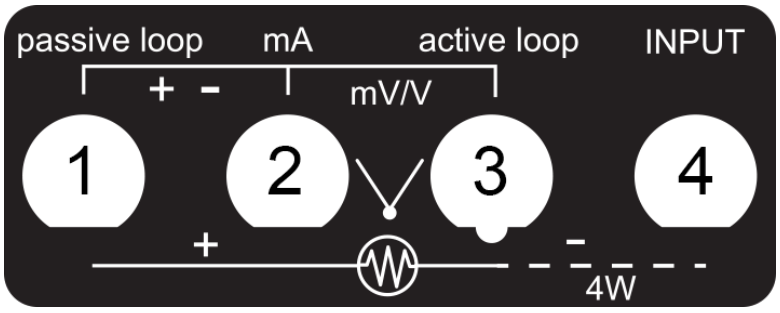


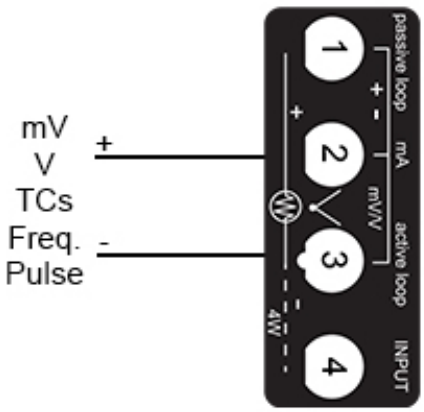


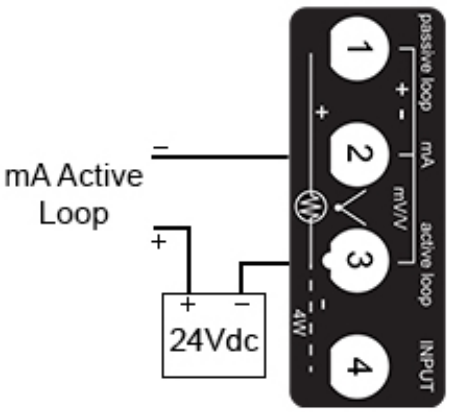
5. START

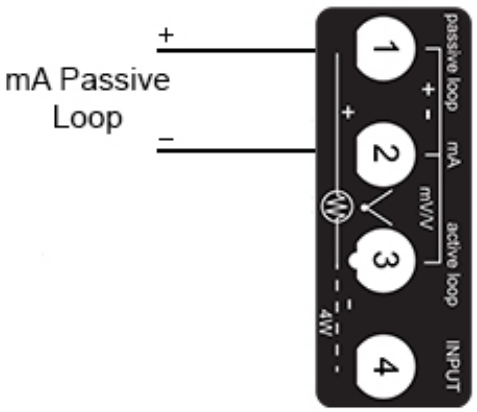
5.1 Wiring Diagrams – Input

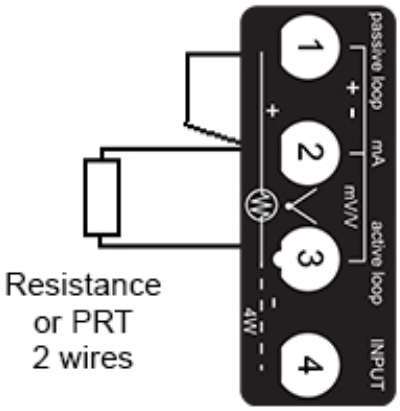
The input channel has 4 golden terminals that are identified according to the label below and, to facilitate the connections, we have numbered the terminals from 1 to 4.

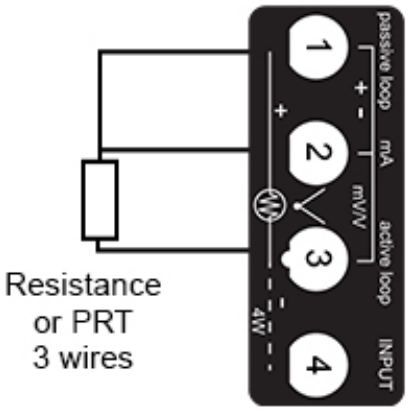


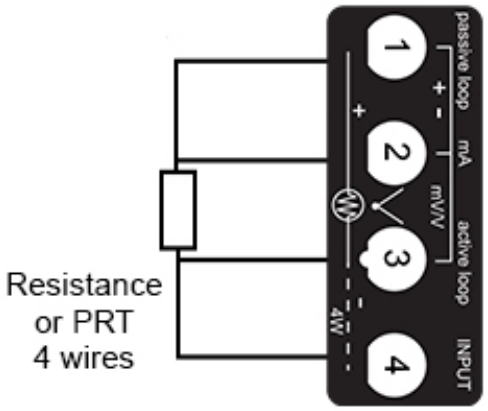






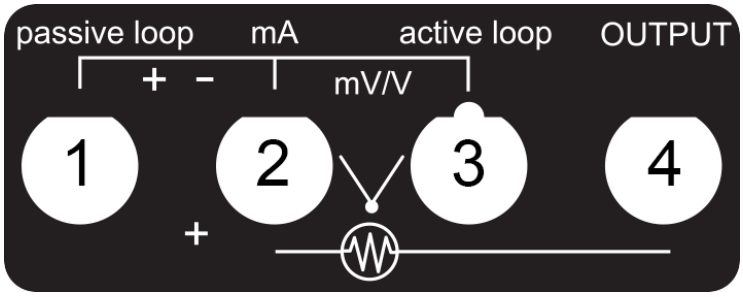


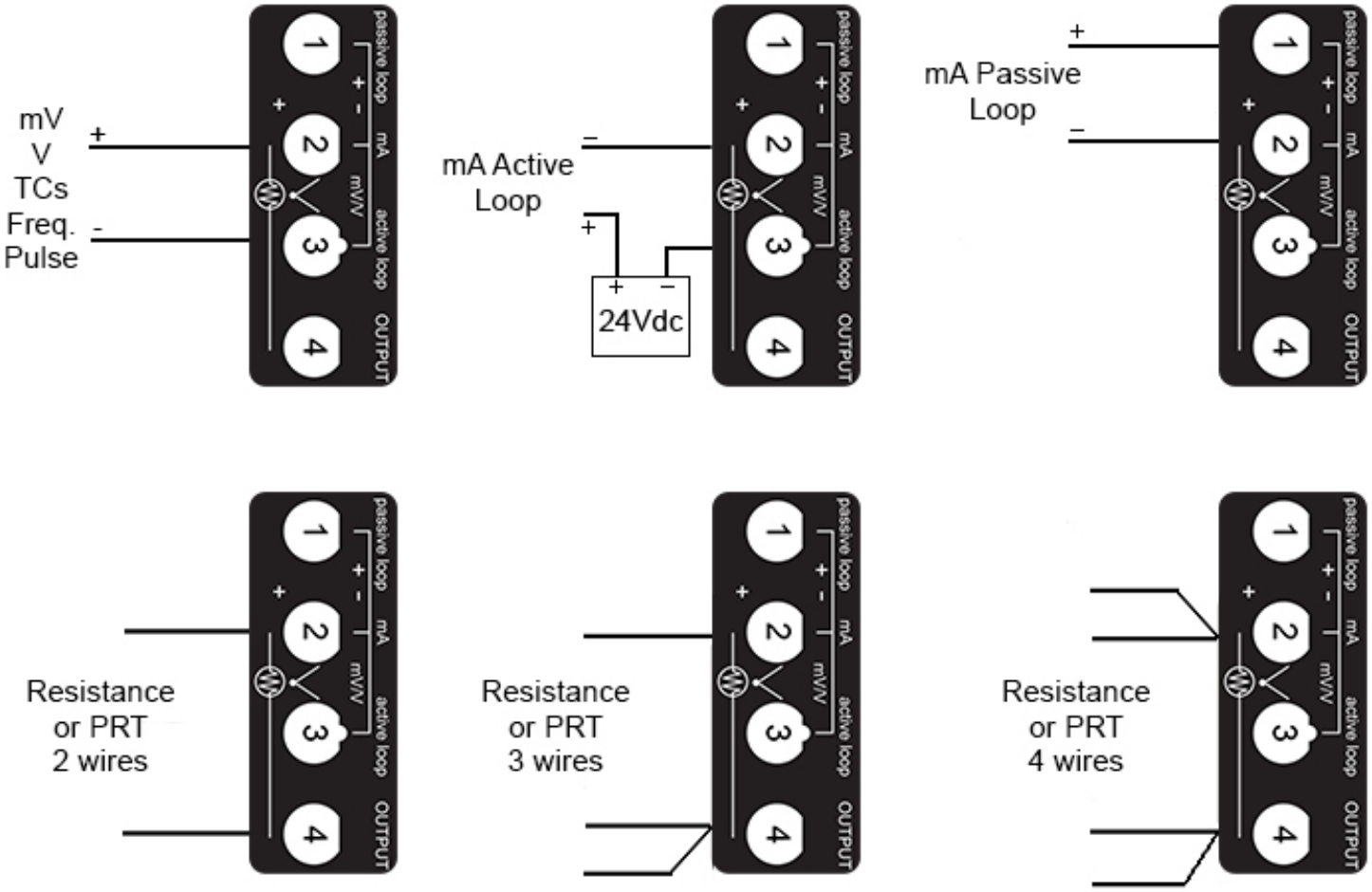




5.2 Wiring Diagrams – Output

The output channel has 4 golden terminals that are identified according to the label below and, to facilitate the connections, we have numbered the terminals from 1 to 4.





Important Note: The resistance simulation is carried out electronically, that is, a voltage drop will be simulated between terminals 1 and 3 that will be proportional to the excitation current and the resistance to be simulated, according to V = Rsimul x Iexcit.

The excitation current supplied by the instrument that will measure the resistance, must enter through terminal 3 and leave through terminal 1, the inversion of the direction of the current can introduce an error in the simulation.

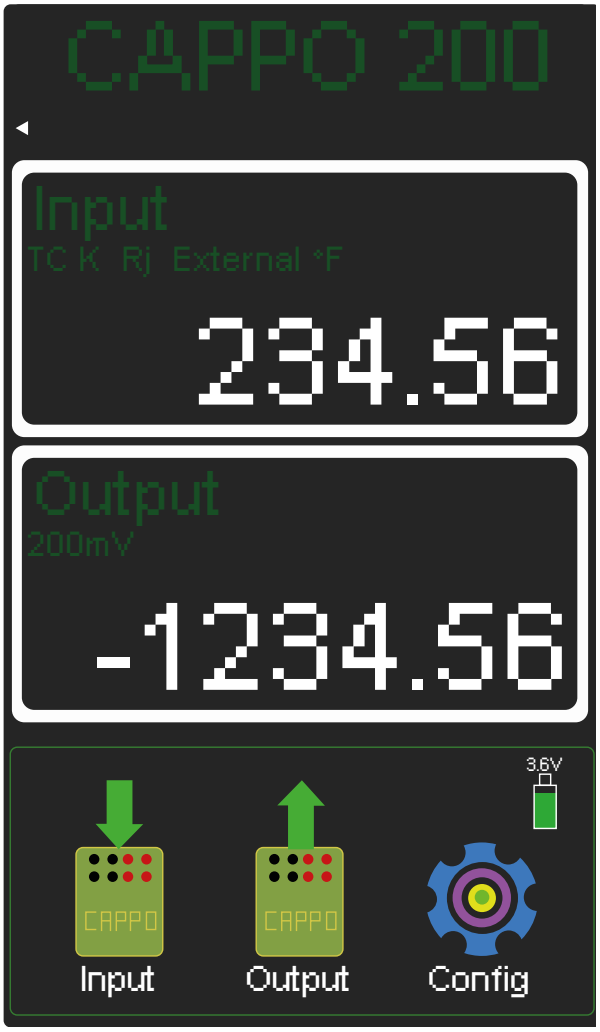
The excitation current for the 0 to 500Ω range must be in the 150uA to 3mA range and for the 0 to 4KΩ range it must be in the 100uA to 400uA range.

5.3 ON / OFF

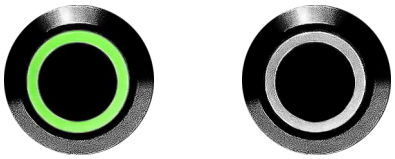
To turn on the instrument, just press the On/Off button:

And the boot screen will be displayed:

Just tap anywhere and the Home Screen will be displayed:



To turn off the instrument, just press the On/Off button:



And the shutdown screen will be displayed:

5.4 Built-In Help

The Cappo 200 comes with Help screens built into the system, through which it is possible to obtain technical and operational information about the Instrument. The first one is introductory and can be accessed through the boot screen; Just press the Info button at the bottom of the touchscreen.

After pressing the Info button, the New Cappo 200 Introduction screen will be displayed:

Ecil Produtos introduces the Cappo 200 portable calibrator, totally developed with in-house technology and locally manufactured.

The calibrator is compact, powered by 3.7Vdc @ 5200mA Li-Ion batteries, giving the instrument an estimated 6 hours of average autonomy.

The charger and USB cable are supplied with the instrument and due to the high charging current, it is not recommended to charge the instrument using a computer's USB ports, that been said, for a better performance, always use the charger and cable provided in the box.

The battery icon shown on the main screen indicates both the charge level and battery voltage value. When this level reaches 3.2V, the LED ON/OFF button's LED lighting starts to flash and when the voltage reaches the 3.1V level, the instrument will be automatically turned off. To turn the instrument on again, connect the battery charger and press the ON/OFF button.

The plastic outer casing has a modern design, with a touchscreen, 65,536 colors, 272x480 pixels graphic display. It also has a 5 buttons tactile keyboard, giving the user an alternative way to navigate the menus.

For greater durability in industrial applica-

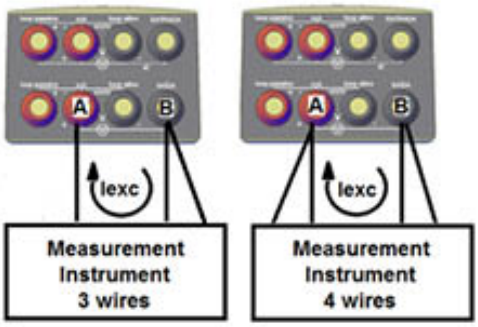
The other help screens are accessed by holding down any of the icons on the Input, Output and Configuration screens for three seconds. Below is an example of the help for the resistance thermometer output icon:

RTD Output Icon

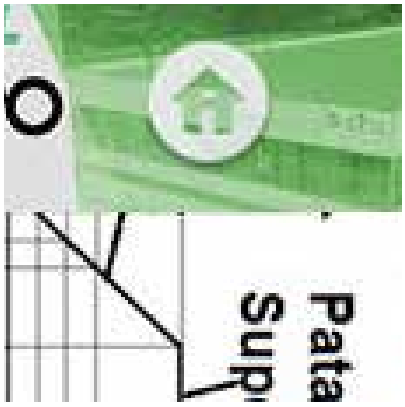
It configures the output to simulate Ohmic resistance proportional to the temperature set by the user.

The adjusted temperature will be linearized according to the RTD's type and finally converted to ohms that will be applied on the output terminals.

Type	Range
Pt100 IEC	-200,00 to 850,00 °C
Pt100 JIS	-200,00 to 600,00 °C
Pt100 SAMA	-200,00 to 600,00 °C
Pt1000 IEC	-200,00 to 600,00 °C
Cu10	-100,0 to 260,0 °C
Ni120	-80,00 to 260,00 °C

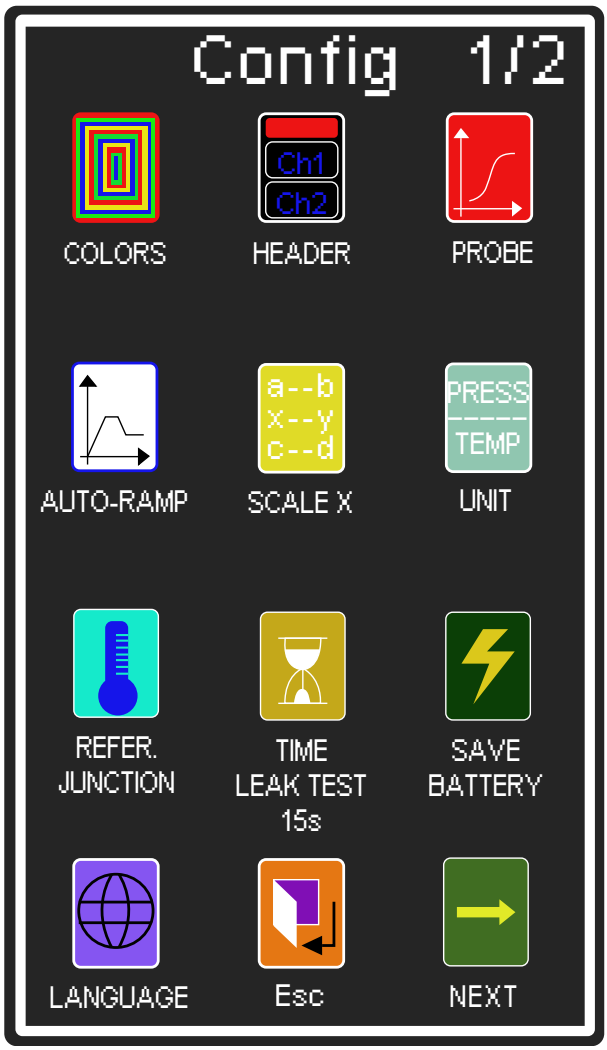


Many of the screens, like the one shown above, have more than one page, to move between them just swipe up and down. To exit any help screen, simply click on the Home icon in the center of the header at the top of the screen.



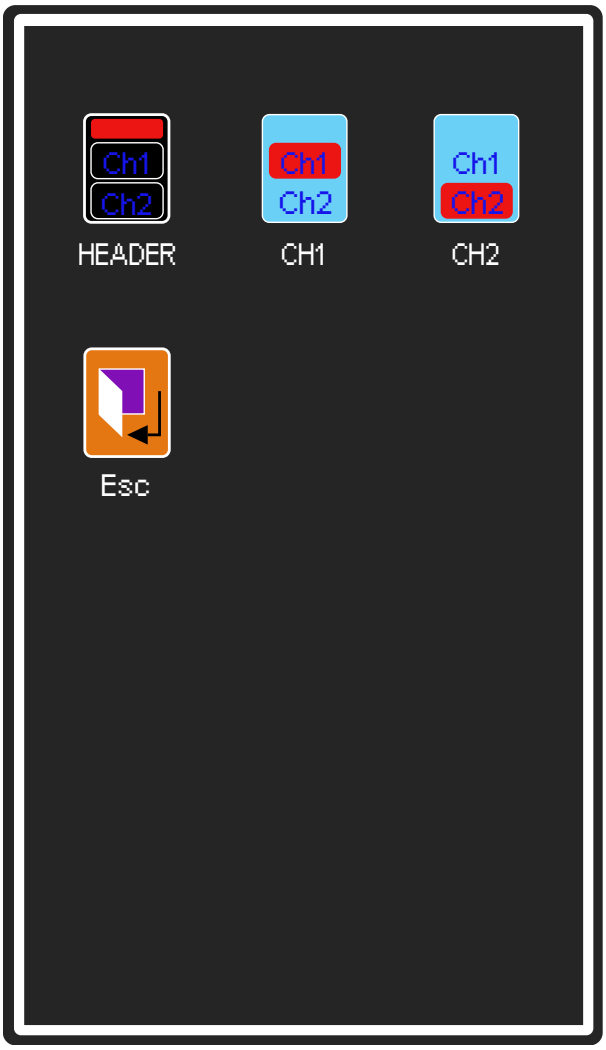
6. SETTINGS

On the Home Screen at the bottom, click the Config Icon and the following screen will be displayed. To go to the next page, just click on the NEXT icon.



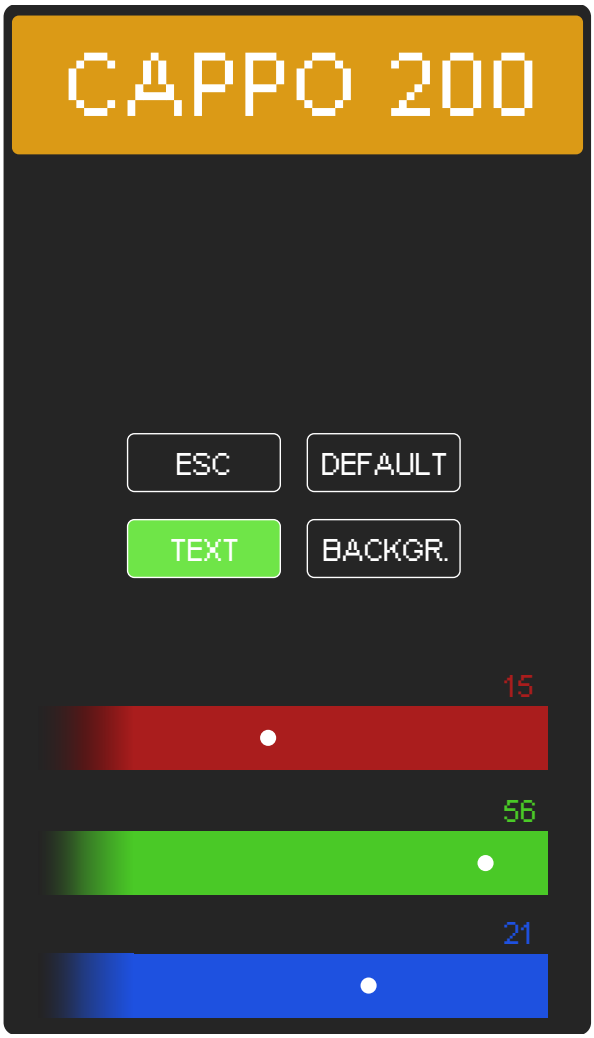
6.1 Colors

On the Settings screen, click on the COLORS icon and the following screen will be displayed:

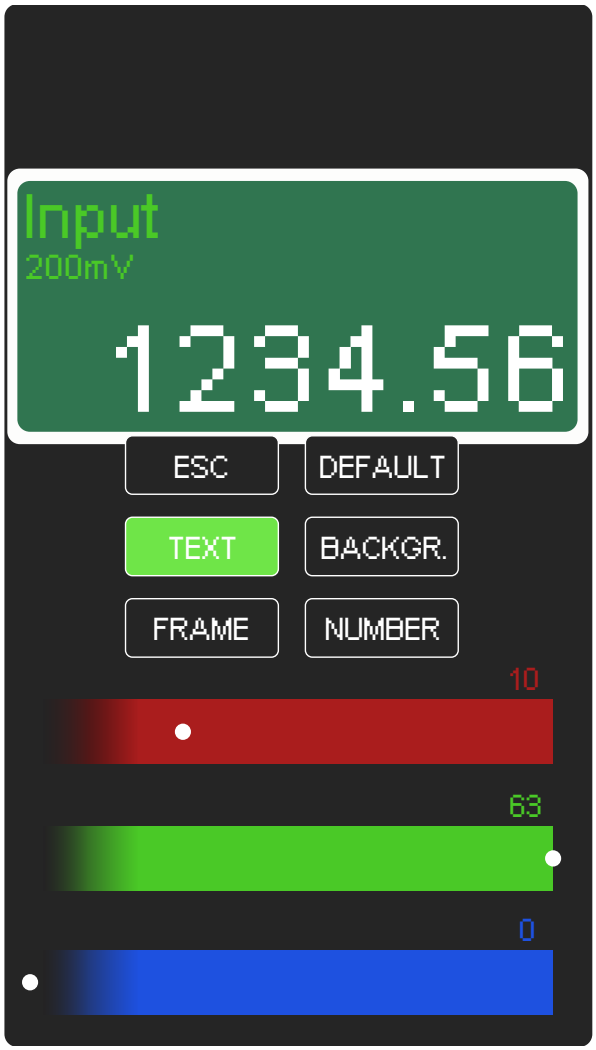


This screen allows the header, input channel and output channel colors on the Home Screen to be selected.

Header



Channel 1 or Channel 2



Through 3 color bars, in red, green and blue colors, up to 65,000 color combinations can be adjusted, note that each bar can be adjusted independently of each other.

Just touch the bar of one of the colors and drag the white ball to the desired intensity, checking the result in the model shown above the bars.

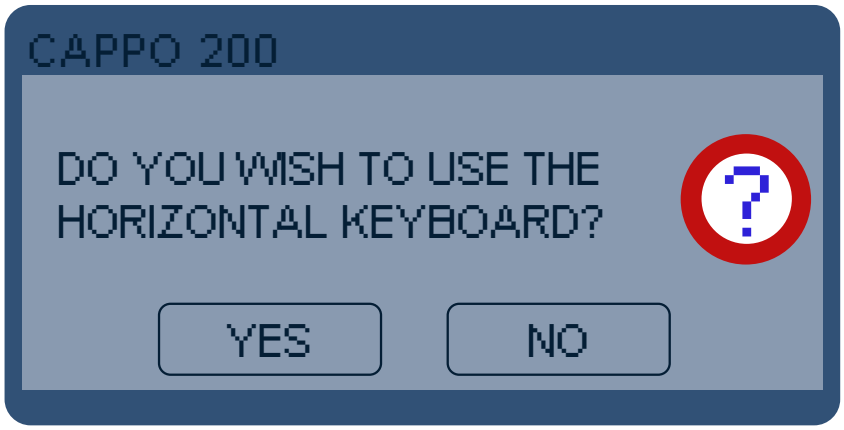
For the header, the text and background colors can be adjusted.

For the input and output channel, the text color, background, frame and number of each of the channels can be adjusted independently.

The DEFAULT option recovers the original colors defined at the factory and the EXIT option finalizes the configuration, in the sequence it is possible to choose whether or not to save the modifications made.

6.2 Header

On the Settings screen, click on the HEADER icon and the following dialog box will be displayed:



When clicking on the YES option, a horizontal keyboard will appear on the screen so that the header text can be edited with the following settings:

Size X1: Two lines of 30 characters each
Size X2: Two lines of 15 characters each
Size X3: One line with 11 characters
Size X4: One line with 8 characters

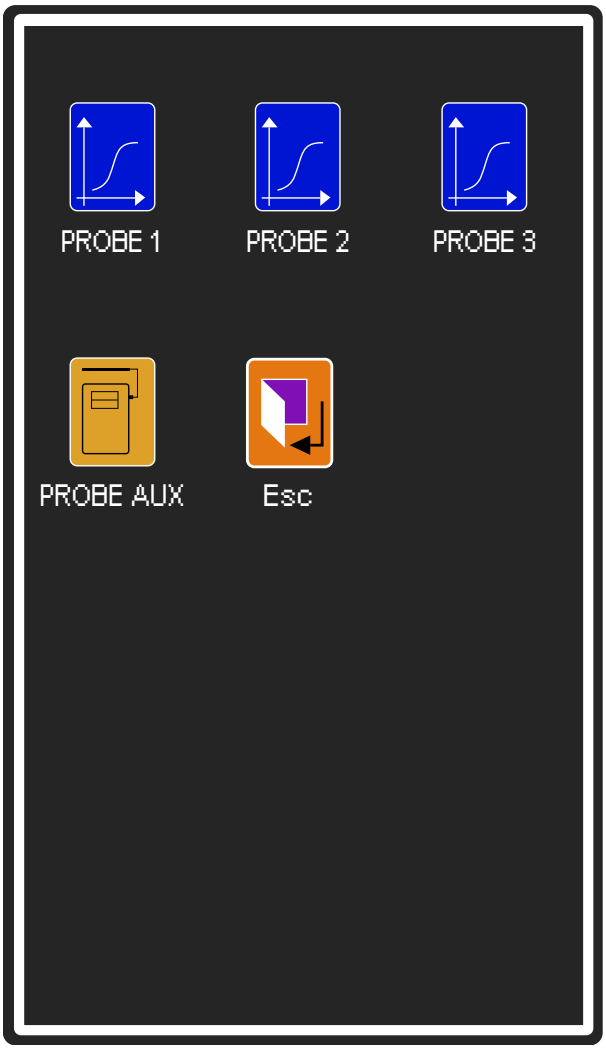
An alphanumeric keyboard showed horizontally on the display must be used to enter the desired text.

As the keys are small in size, it is recommended to use a soft, non-perforating object with a fine point for typing text.

The ESC key finishes the configuration and, in the sequence, it is possible to choose whether or not to save the changes made.

6.3 Probe

On the Settings screen, click on the PROBE icon and the following screen will be displayed:



When clicking on one of the first four icons, the following screen will be displayed with the parameters that must be defined for the chosen Probe:

In addition to the Auxiliary Probe (Smart Probe), where you can only configure the Tag and perform the test, up to 3 (three) other Probes can be configured, and for each one the following must be defined:

Type: Thermocouple type R or S or Pt100 IEC.

Tag: Through the horizontal alphanumeric keyboard, you can define a tag (name) to identify the Probe with up to 8 characters.

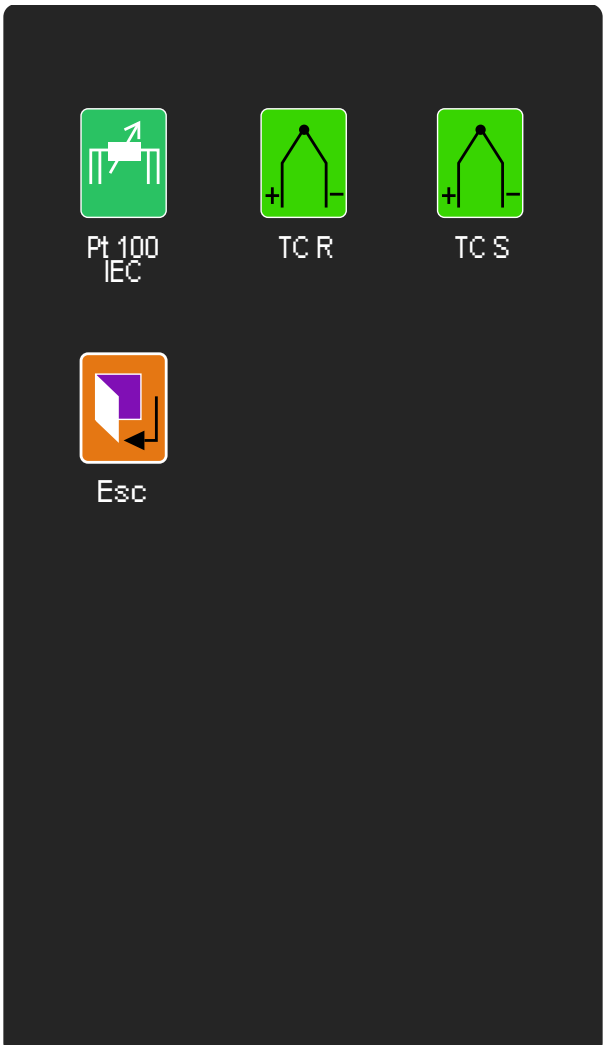
Coefficient A: As stated on the thermocouple or Pt100 sensor calibration certificate, being a number in scientific notation format (mantissa+exponent) in the range of +9.99999E+33 to -9.99999E-33.

Coefficient B: Same as coefficient A

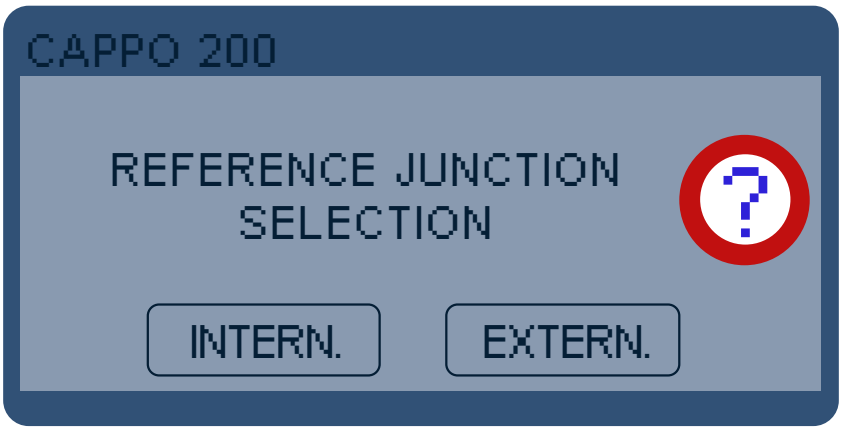
Coefficient C: Same as Coefficient A

Coefficient R0: Same as coefficient A, however it is only shown if the type is Pt100.

When clicking on the TYPE icon, the following screen will be displayed:

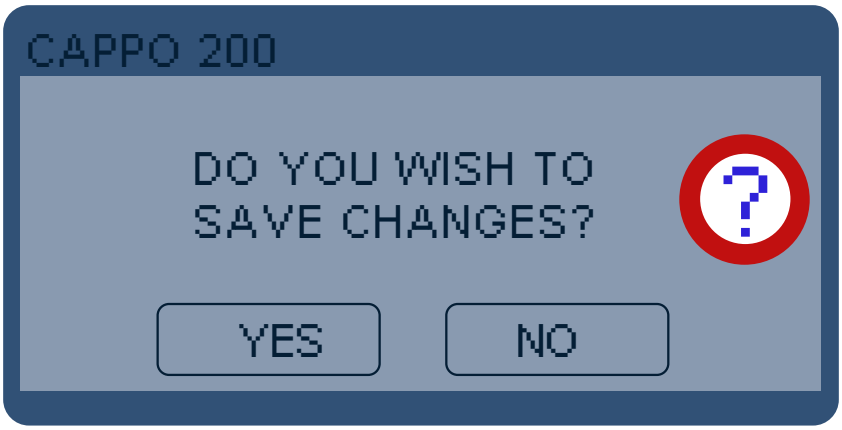


Just click on the desired sensor type, if you choose a thermocouple, you will have to choose the type of reference junction, internal or external, through a dialog box like the one below:

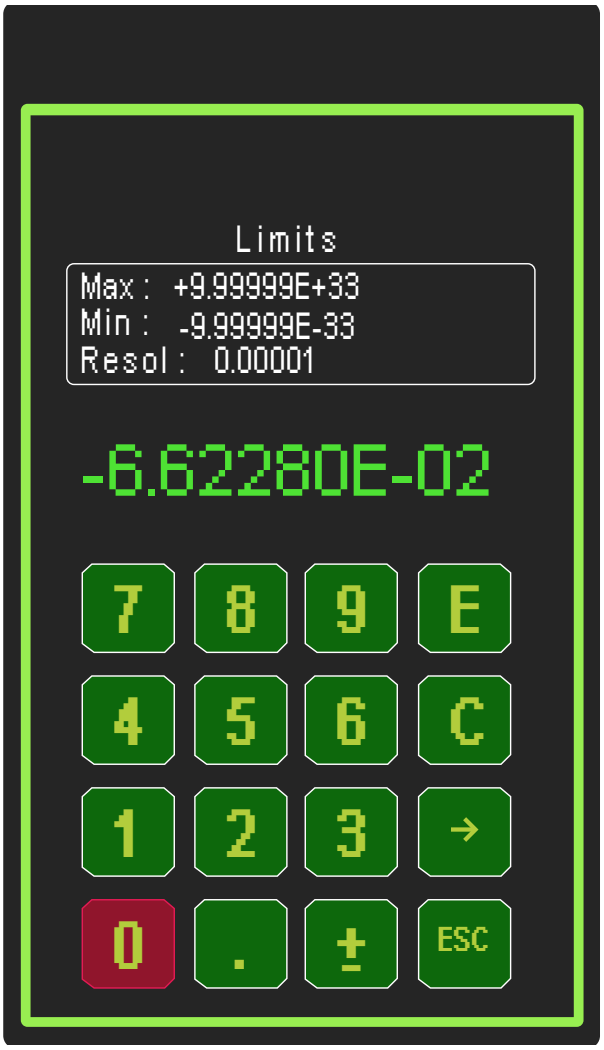


When clicking on the TAG icon, a horizontal keyboard will be displayed to enter the TAG for the probe:

After finishing, just click ESC and choose to save or not in the dialog box that will be displayed:

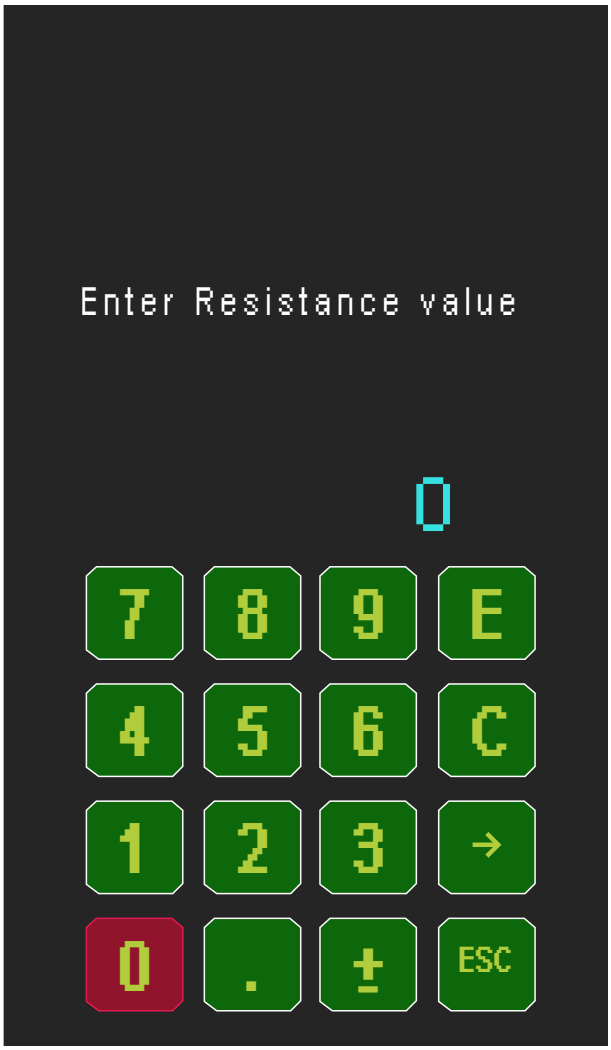


The next step is to define the coefficients A, B, C and R0 (For resistance thermometers), to do so just click on one of the icons and the following screen will be displayed:



Use the numeric keypad to set the value, E to confirm, C to clear, the arrow to navigate between digits and ESC to cancel.

Once the coefficients are configured, the TEST icon allows a quick test, typing in the EMF of the thermocouple sensor or Resistance of the Pt100 sensor and comparing the calculated temperature with the expected temperature.

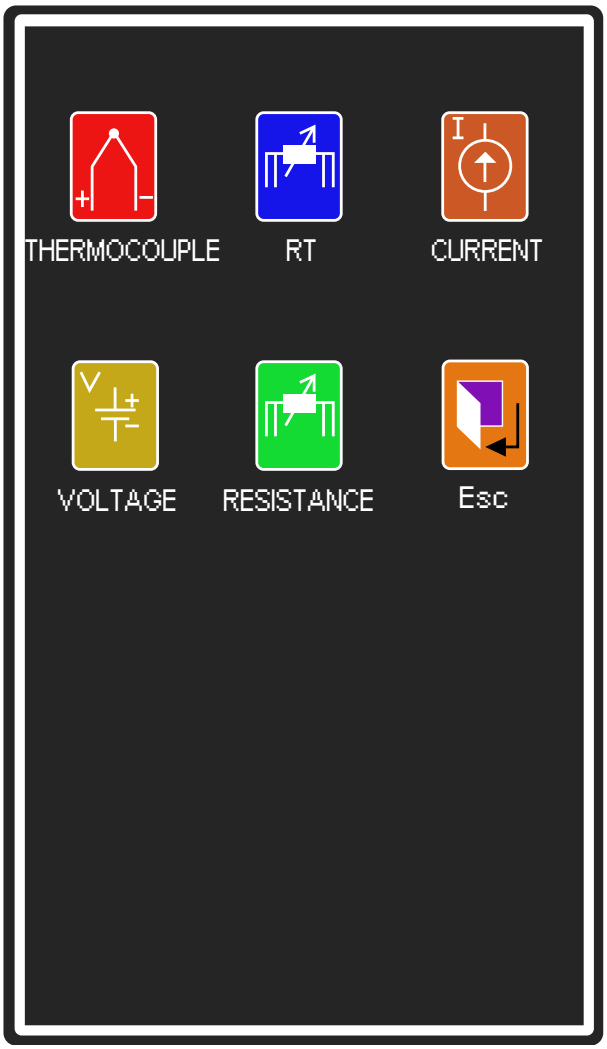


6.4 Auto-Ramp

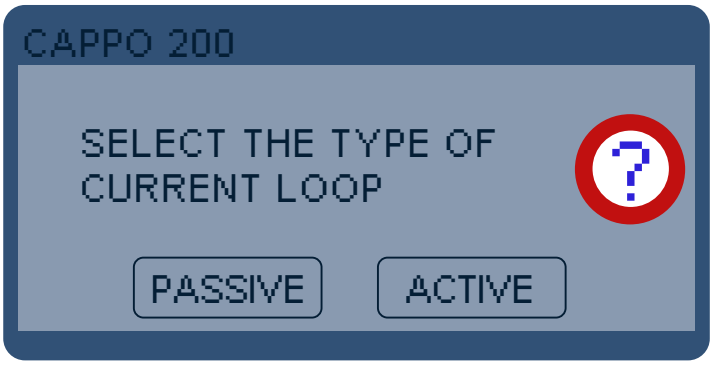
The Auto-Ramp function allows the generation of an output that will automatically follow a curve predefined by the user.

On the Settings screen, click on the AUTO-RAMP icon and the following screen will be displayed, with the icons that give access to parameter configuration in the upper part and a table containing the established parameters in the lower part:

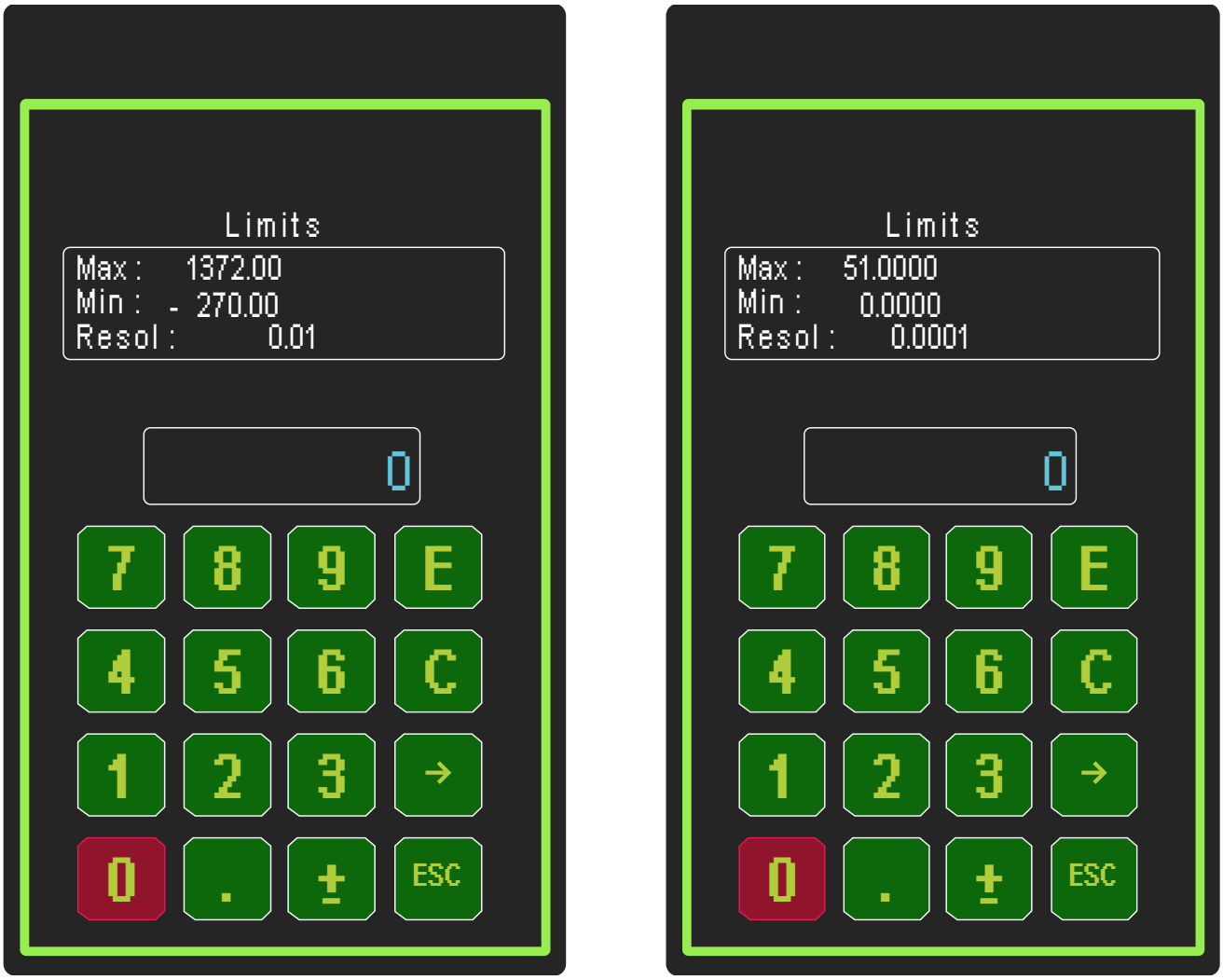
At first, it is necessary to choose the type of Auto-Ramp output signal, to do so just click on the TYPE icon, and the following screen will be displayed:



Just navigate through the screens and choose the output signal; However, if you choose Thermocouple or Current, you will need to choose the type of reference junction for the chosen thermocouple type and between passive or active current loop, through the dialog boxes below:



To configure the other parameters, just click on the respective icons and use the numerical keyboard as shown below:

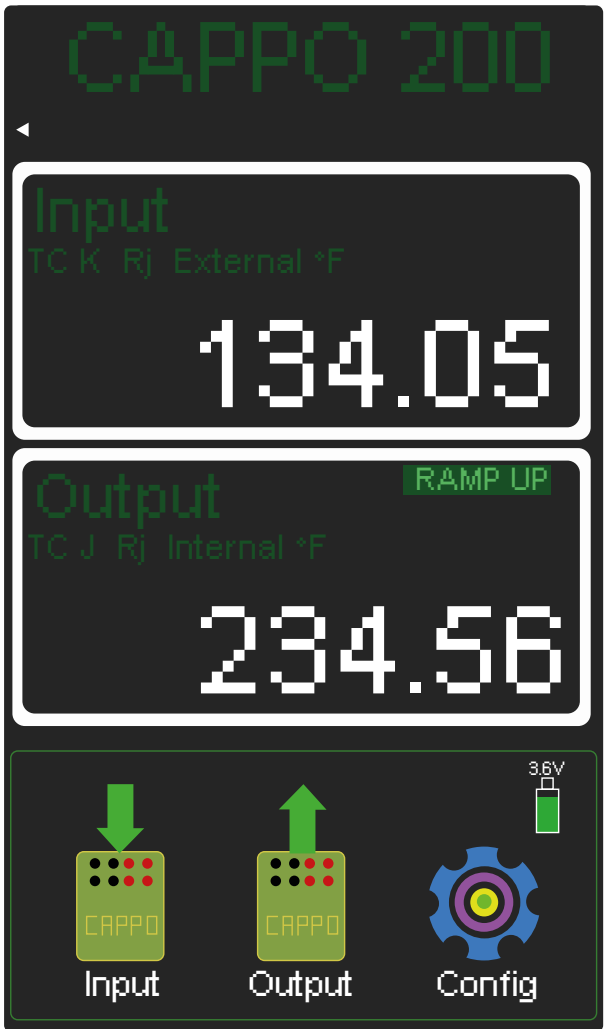


Use the numeric keypad to set the value, E to confirm, C to clear, the arrow to navigate between digits and ESC to cancel. Below is the description of the selectable parameters:

Parameter	Function
START	Ramp's starting point value
END	Ramp's ending point value
STEP	Value for each step of the upward or downward ramp
TSTPUP	Time for each step of the upward Ramp
TSTPDWN	Time for each step of the downward Ramp
TSOAKUP	Time for the upper level
TSOAKDWN	Time for the lower level
CYCLES	Numbers of iterations of the curve

All time values are in seconds.

To trigger the Auto-Ramp, just go to the Output Menu, click on the AUTO-RAMP icon and be redirected to the Home Screen, where in the upper right corner of the output part it will be indicated that the Ramp is being executed, as shown below:



6.5 Scale X

The X Scale function allows you to display an input or simulate an output in user-defined engineering units through correlation (linear interpolation).

Through this function, the user can show on the display a linear input or output such as Voltage or Current scaled according to their needs, using the following equation:

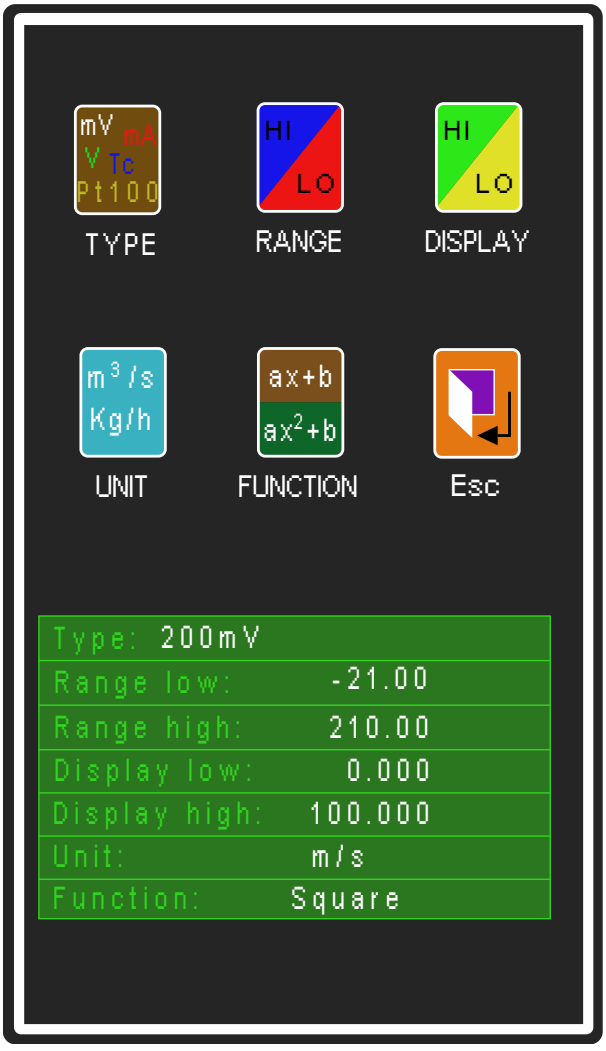
$$V = X\%. (DispHi - DispLo) + DispLo$$

Start of input range **(RangeLo)**	Start value to display **(DispLo)**
Measured value **(X)**	Displayed value **(Y)**
End of input range **(RangeHi)**	Final value to display **(DispHi)**

Input= **RangeLo** = 0% Start of input range
Input =**X**= X% Value between 0 and 100%
Input= **RangeHi** = 100% End of input range

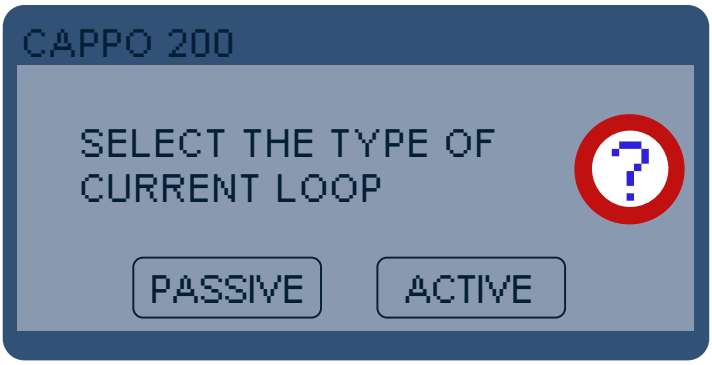
The position of the decimal point of the value to be shown on the display is freely configurable and a 4-character unit can also be assigned to the displayed value.

On the Settings screen, click on the SCALE X icon and the following screen will be displayed, with icons that give access to parameter configuration at the top and a table containing the parameters established at the bottom:



Initially, it is necessary to choose the type of output signal from the Scale X, to do so simply click on the TYPE icon, and the following screen will be displayed:

Just scroll through the screens and choose the exit signal; However, if you choose Current, you will need to choose between passive or active loop through the dialog boxes below:

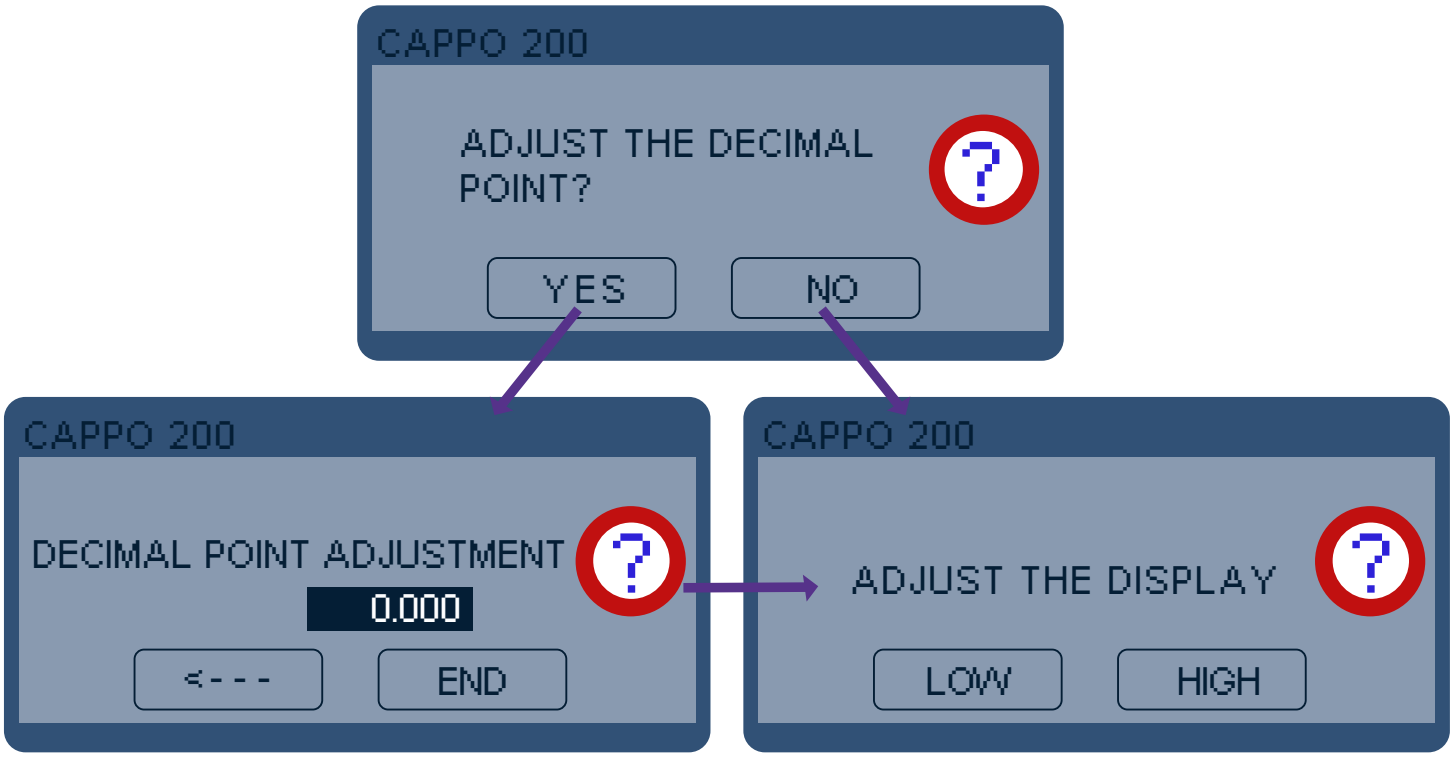


To configure the start and end of the input range, simply click on the RANGE icon and a dialog box will be displayed:

Having chosen the beginning or end of the input range, to continue you must use the numeric keypad as displayed below:

Use the numeric keypad to set the value, E to confirm, C to clear, the arrow to navigate between digits and ESC to cancel.

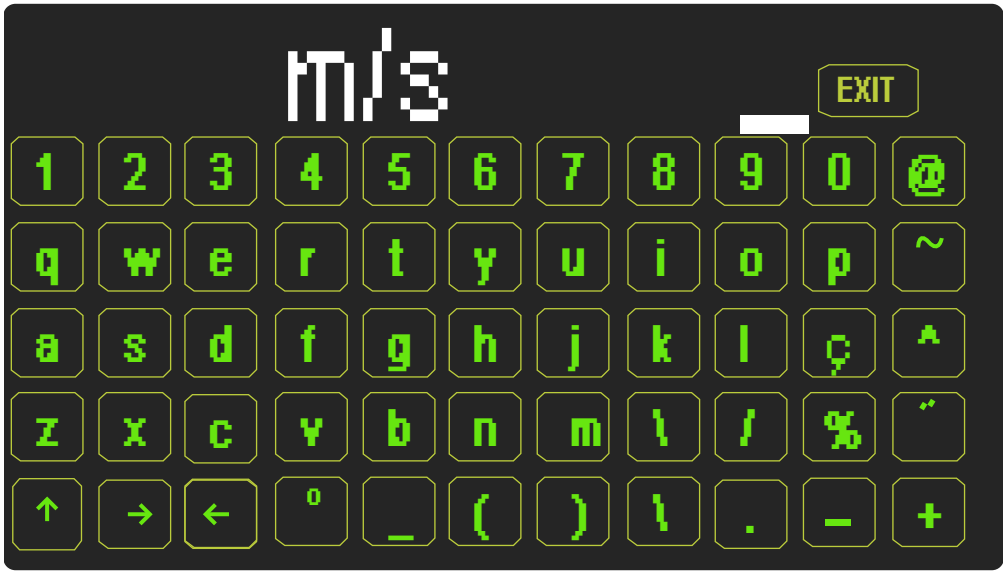
To configure the initial and final values for the Display, simply click on the DISPLAY icon, and a dialog box will be displayed asking if you want to choose the position of the decimal point first.



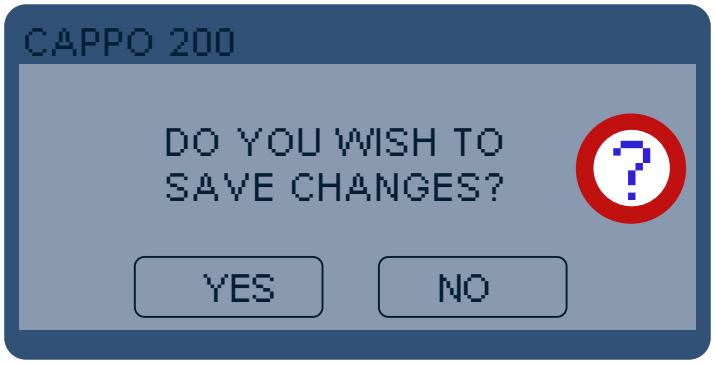
Having chosen the beginning or end of the input range, to continue you must use the numeric keypad as displayed below:

Use the numeric keypad to set the value, E to confirm, C to clear, the arrow to navigate between digits and ESC to cancel.

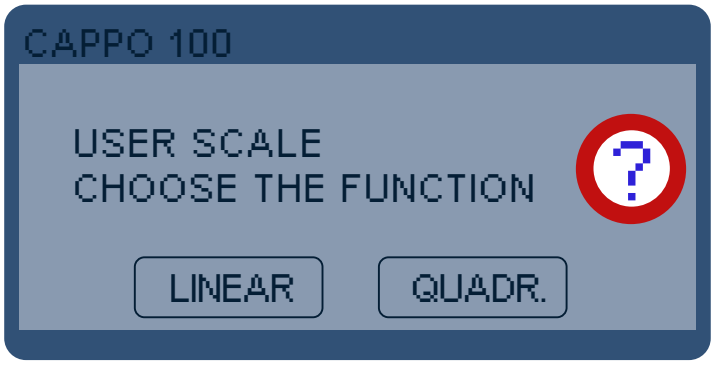
When clicking on the UNIT icon, a horizontal keyboard will be displayed to enter the scale unit:



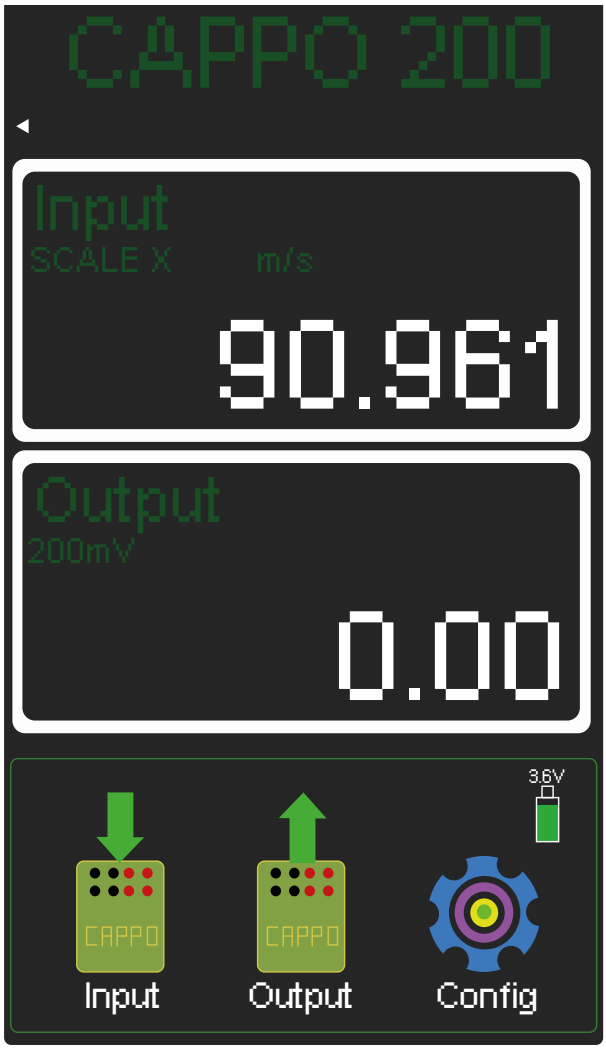
After finishing, just click EXIT and choose to save or not in the dialog box that will be displayed:



When clicking on the FUNCTION icon, a dialog box will be displayed to choose the type of scale function:

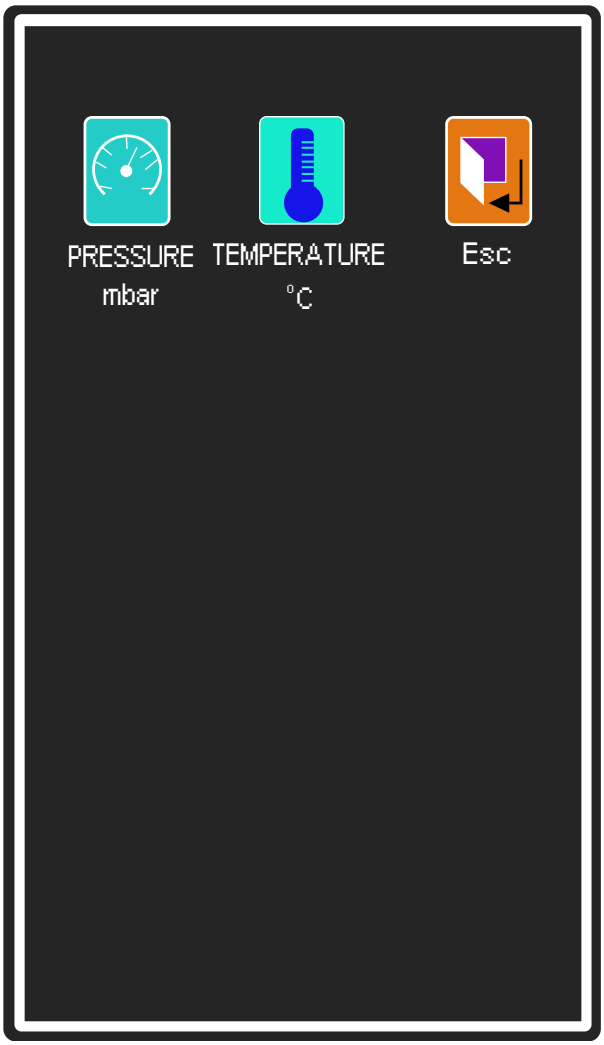


To use the created scale, simply access the Input Menu or the Output Menu and click on the Scale X icon and be redirected to the Home Screen, where whether in the Input, Output or both, your scale will be displayed:

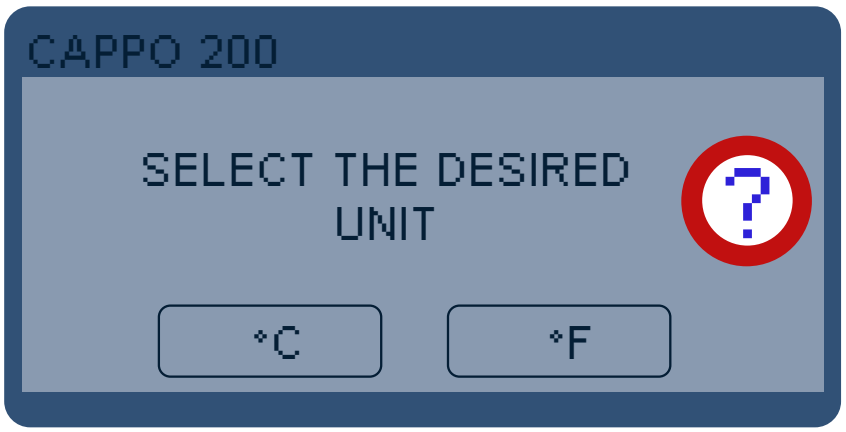


6.6 Units

This function is used to change the instrument's temperature and pressure measurement units. On the Settings screen, click on UNIT and the following screen will be displayed:



To choose the temperature unit, simply click on the TEMPERATURE icon and the following dialog box will be displayed:



Just choose one of the measurement units.

To choose the pressure unit, simply click on the PRESSURE icon and the following screen will be displayed:

Just scroll through the screens and choose the unit.

6.7 Reference Junction

The Reference Junction function allows you to view the temperatures measured on the Pt100 sensors installed on terminals 2 of the Input channel and Output channel.

The temperature measured in these sensors will be used as reference junction compensation in case the channel (Input and/or Output) is configured as a thermocouple and Rji (Internal Reference Junction).

When the Rje (External Reference Junction) option is used, the temperature used as compensation is adjusted in this menu.

See chapters 7.1. Thermocouple Input and 8.1. Thermocouple Output for more information on selecting the Internal or External Reference Junction.

To adjust the temperatures to be used as compensation for the thermocouple reference junction of the Input and/or Output channel when the Rje option is selected and to view the temperatures read on terminals 2 of the Input and/or Output channels when the option Rji is selected, just click on the REFER. JUNCTION icon. the following screen will be displayed:

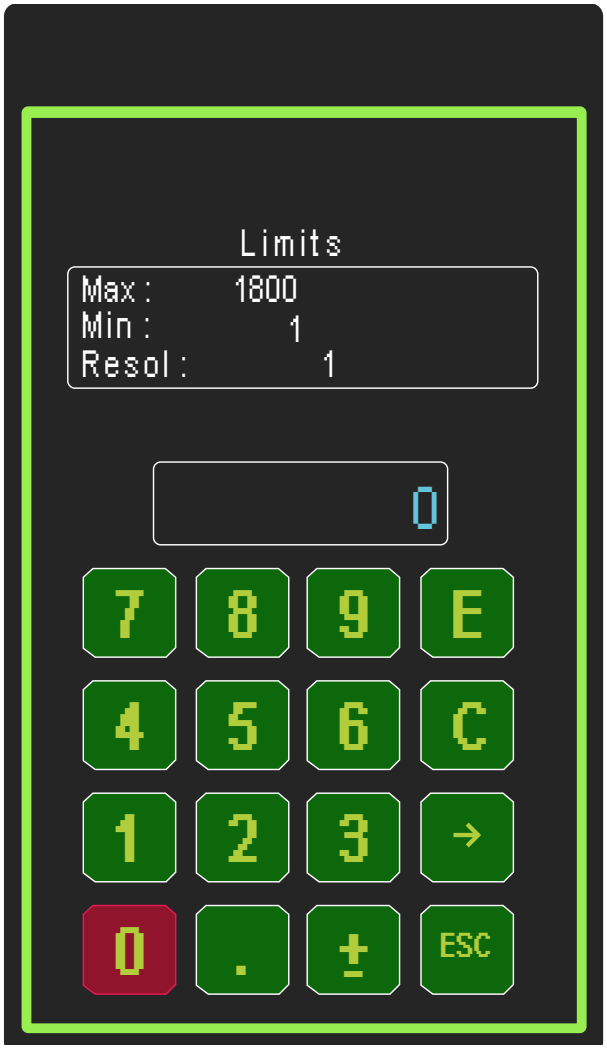
To adjust the temperatures to be used as compensation when choosing Rje, simply click on one of the first two icons on the top line, CH1 EXT and CH2 EXT, using a numeric keypad like the one below:

Use the numeric keypad to set the value, E to confirm, C to clear, the arrow to navigate between digits and ESC to cancel.

6.8 Leak Test Time

This function allows you to enter a number from 1 to 1800 seconds which will be the duration of the Leak Test.

To set this time, simply click on the TIME LEAK TEST icon and a screen with a numeric keypad like the one below will be displayed:

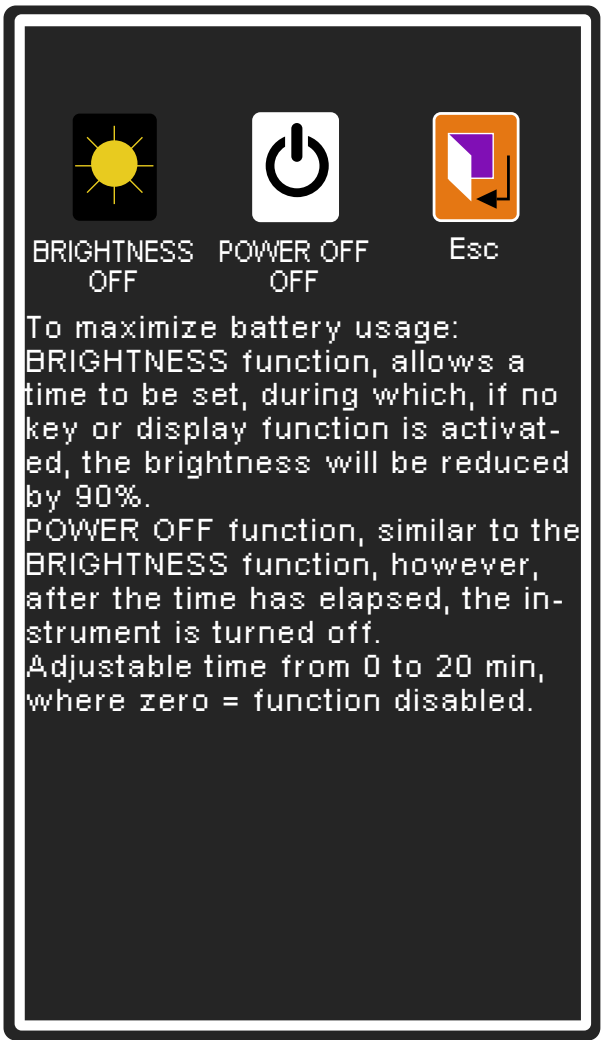


To launch the test, simply go to the Input Menu and click on the LEAK TEST icon and be redirected to the Home Screen, where in the Input part the test will be carried out within the time stipulated here.

There will be more information about the test in chapter 7.8 Leak Test, in the Input section.

6.9 Battery Saving

To maximize battery usage, there are two icons, BRIGHTNESS and POWER OFF, which allow a time from 0 to 20 minutes to be entered for each of them. To set this time, simply click on the SAVE BATTERY icon and the screen below will be displayed:



BRIGHTNESS: After the time for this icon has elapsed and if no keyboard key or display function is activated, the brightness will be reduced to 10% of the original value.
By activating the keyboard or display function, the original brightness will be restored.

POWER OFF: After the time for this icon has elapsed and if no keyboard key or display function is activated, the instrument will turn off.

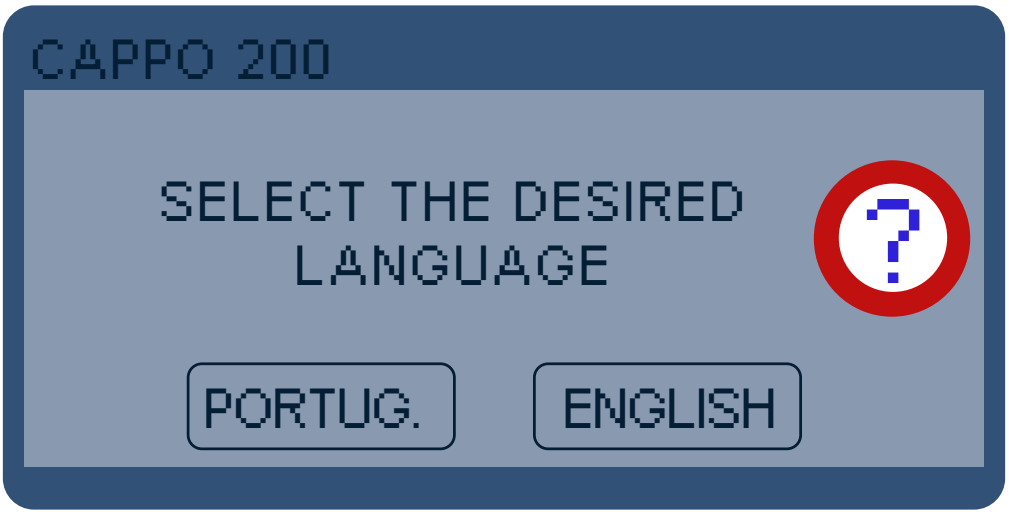
The charger and USB cable are supplied with the instrument and due to the high charging current, it is not recommended to charge the instrument using a computer, that is, for better performance, always use the charger and cable provided for this function.

The battery icon displayed on the main screen indicates the charge level and voltage value, when the level reaches 3.2V the on/off button LED starts flashing and when the voltage reaches 3.1V, the instrument will automatically turned off. To start it again, connect the battery charger.

To set the times, simply click on one of the two available icons, BRIGHTNESS OFF and POWER OFF OFF, and a screen will be displayed with a numeric keypad like the one below:

6.10 Language

Using this function, it is possible to define the instrument's operating language. In Settings, simply click on the LANGUAGE icon and through the dialog box below choose the desired option:



6.11 Protection

Through this function, it is possible to define which Configuration Menu icons will be displayed or not, to access this icon you must know the input password. To access, simply click on the PROTECTION icon and the screen below will be displayed:

Use the numeric keypad to set the password, E to confirm, C to clear, the arrow to navigate between digits and ESC to cancel.

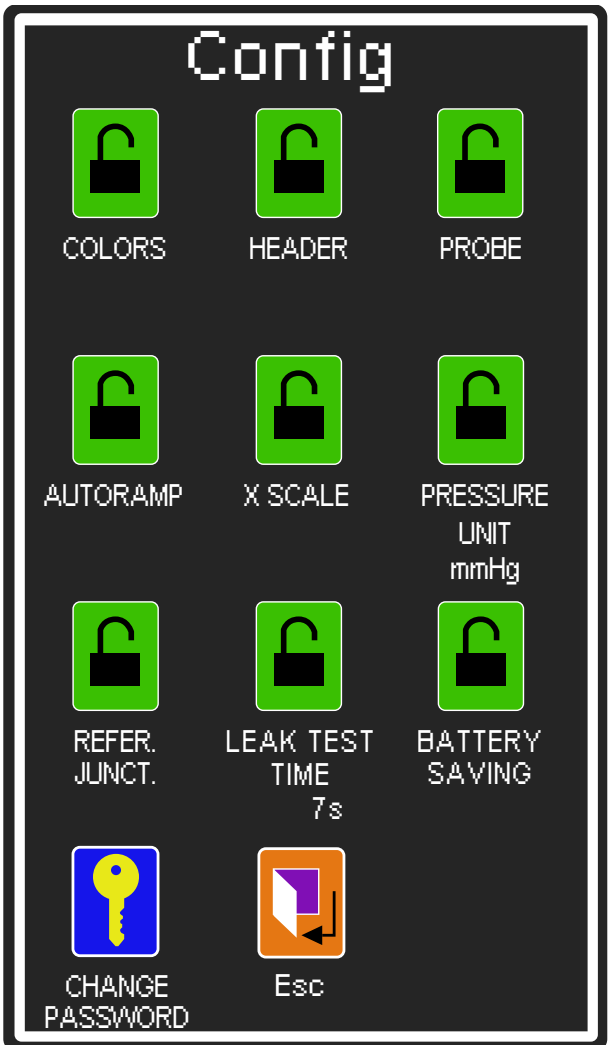
If the password is entered correctly, the 9 Configuration Menu icons will be available, namely:

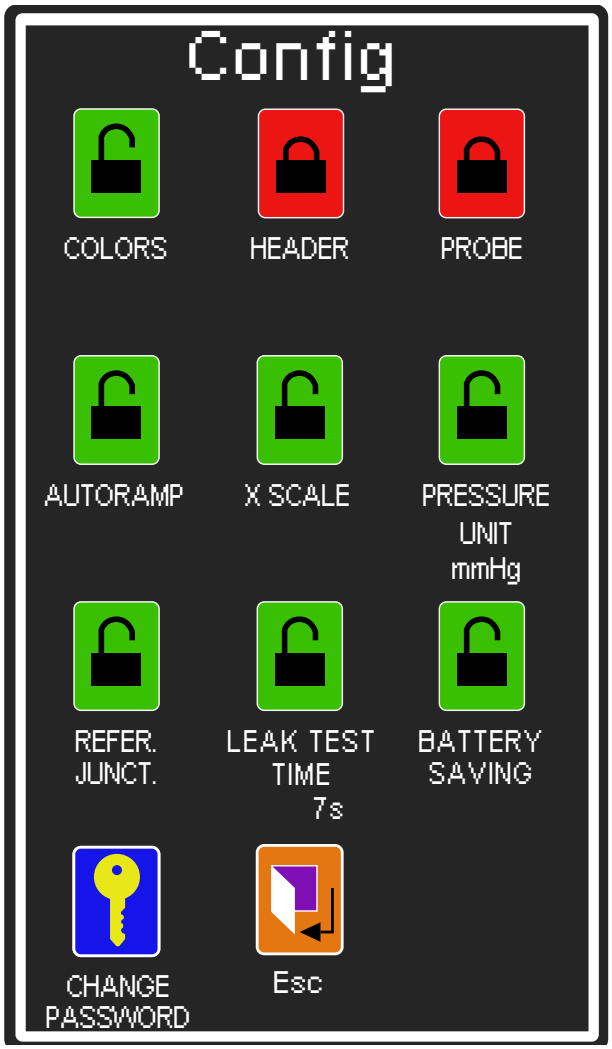
Colors, Header, Probe, AutoRamp, Scale X, Pressure Unit, Reference Junction, Leak Test Time and Save Battery.

Each icon will be shown according to its status:

Locked: Red color and padlock closed
Released: Green color and open padlock

By touching the icon or using the keyboard, using the ENTER key, you can change the status of the selected icon from Blocked to Released and vice versa.





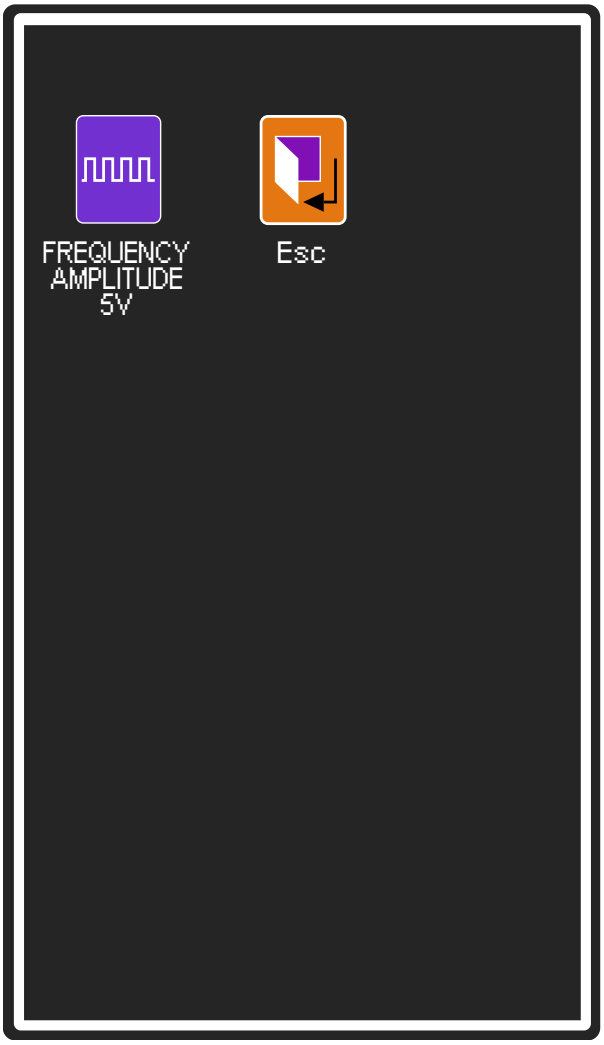
A tenth icon, Change Password, will also be shown and allows the password to be changed. To do so, it will be necessary to type the same sequence of numbers from 1 to 6 digits twice, without a decimal point or polarity sign (±).

After two valid sequences, confirmation will be asked to save the new password. If the YES option is selected, the new password will be saved.

Make a note of the new password, as if you forget it, access to the Config Menu may be limited.

6.12 Frequency Output

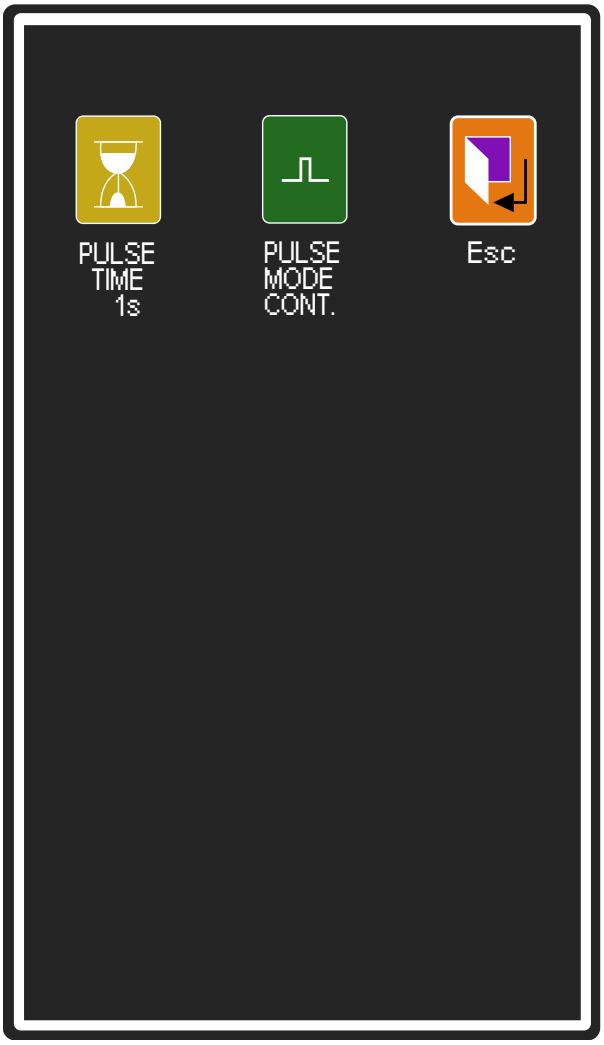
Through this function it is possible to configure the instrument's Frequency Output. In Settings, simply click on the FREQUENCY OUTPUT icon and the following screen will be displayed:



To configure the amplitude of the frequency output in V, simply click on the FREQUENCY AMPLITUDE icon, and a numeric keyboard for entering the value will be displayed:

6.13 Pulse Input

Through this function it is possible to configure the instrument's Pulse Input. In Settings, simply click on the PULSE INPUT icon and the following screen will be displayed:

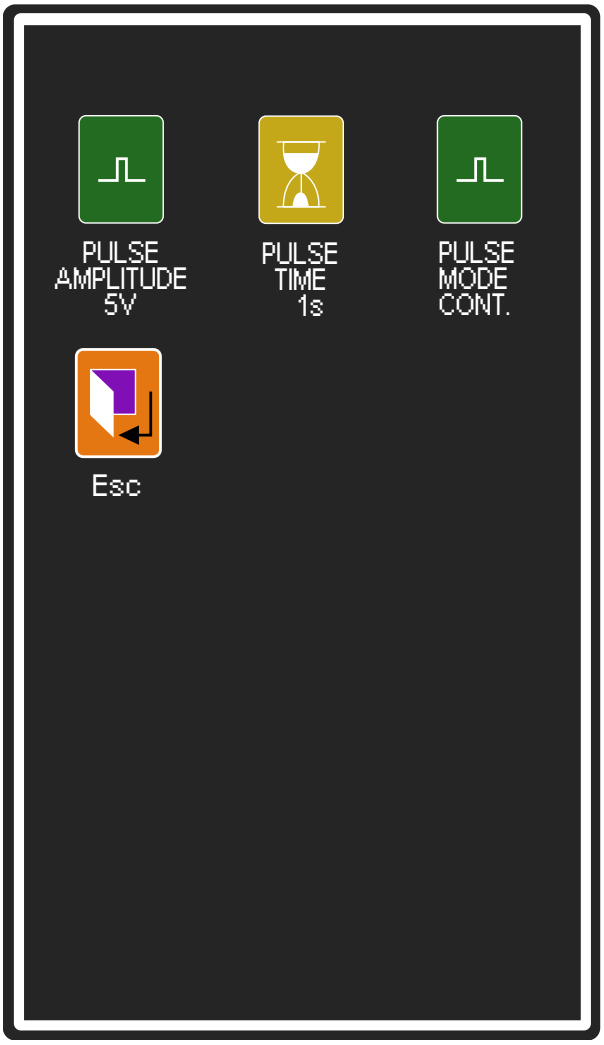


To configure the pulse interval time in seconds, simply click on the PULSE TIME icon, and a numeric keyboard for entering the value will be displayed:

To configure the pulse operating mode between Continuous and One Shot, simply click on PULSE MODE and the dialog box below will be displayed for you to choose from:

6.14 Pulse Output

Using this function, it is possible to configure the instrument's Pulse Output. In Settings, simply click on the PULSE OUTPUT icon and the following screen will be displayed:



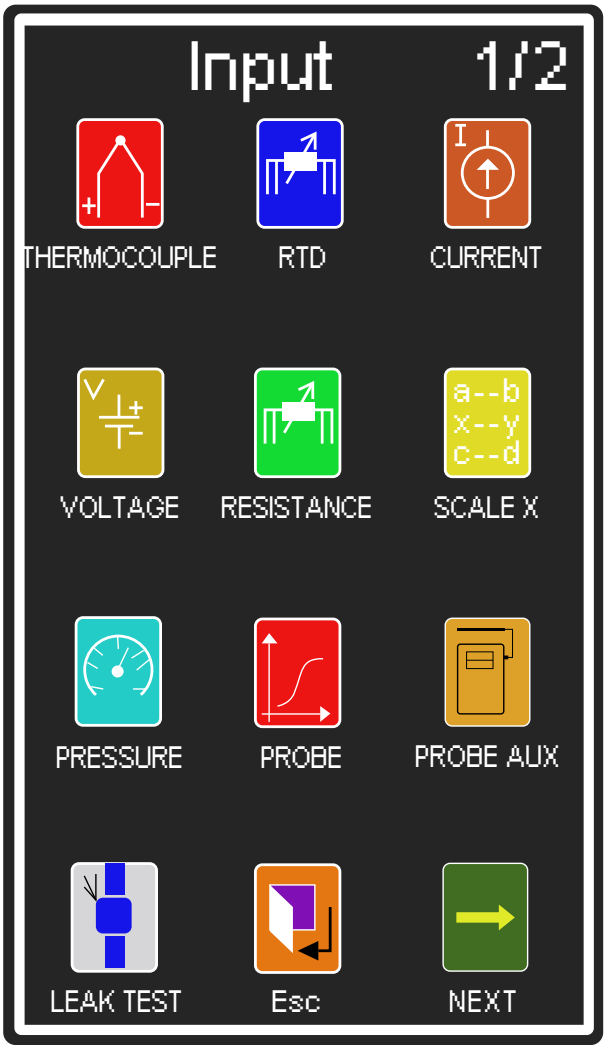
To configure the amplitude of the pulse output in V, simply click on the PULSE AMPLITUDE icon, and a numeric keyboard for entering the value will be displayed:

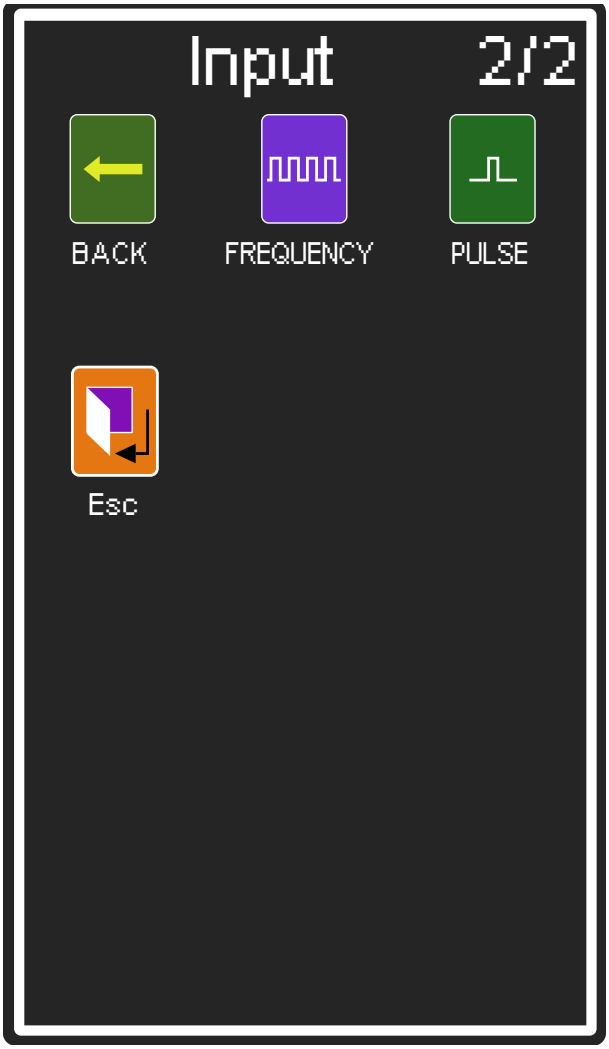
To configure the pulse interval time in seconds, simply click on the PULSE TIME icon, and a numeric keyboard for entering the value will be displayed:

To configure the pulse operating mode between Continuous and One Shot, simply click on PULSE MODE and the dialog box below will be displayed for you to choose from:

7. INPUT

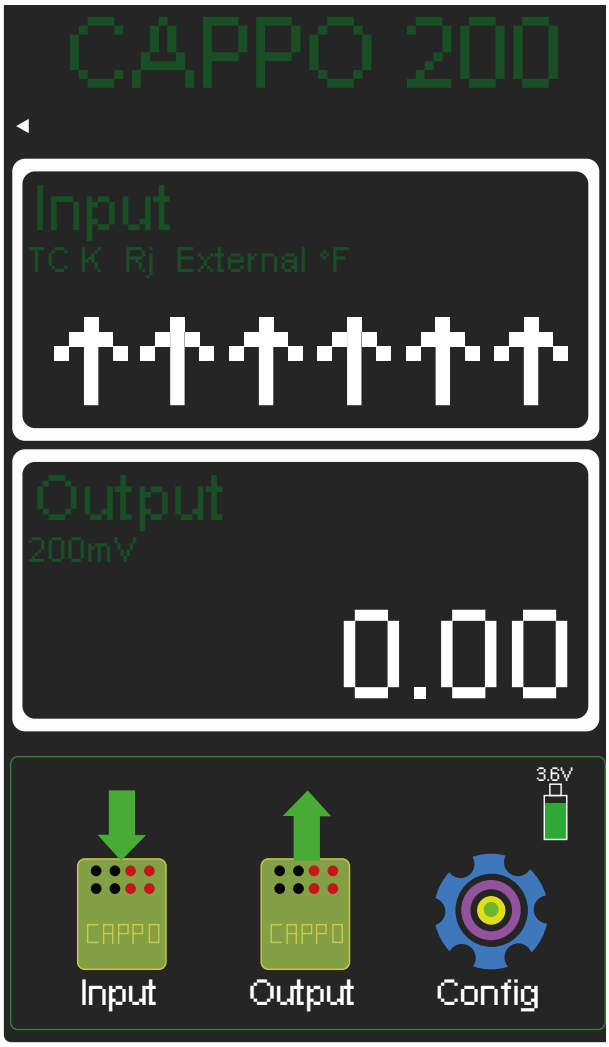
On the Home Screen, at the bottom, click on the Home Icon and the following screen will be displayed. To access the second page, simply click NEXT.





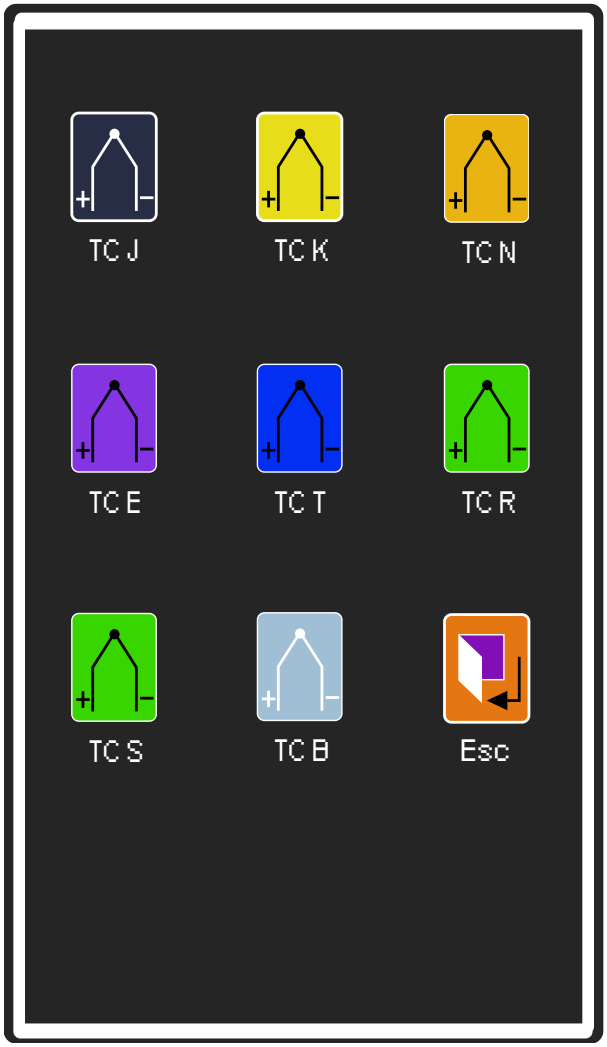
Click on the desired option from the 12 input channel options.

If there is no instrument connected, generating no input signal, upward arrows will be shown instead of any measured value.



7.1 Thermocouple Input

To configure the instrument input for Thermocouple sensors, simply click on the THERMOCOUPLE icon and the following screen will be displayed:



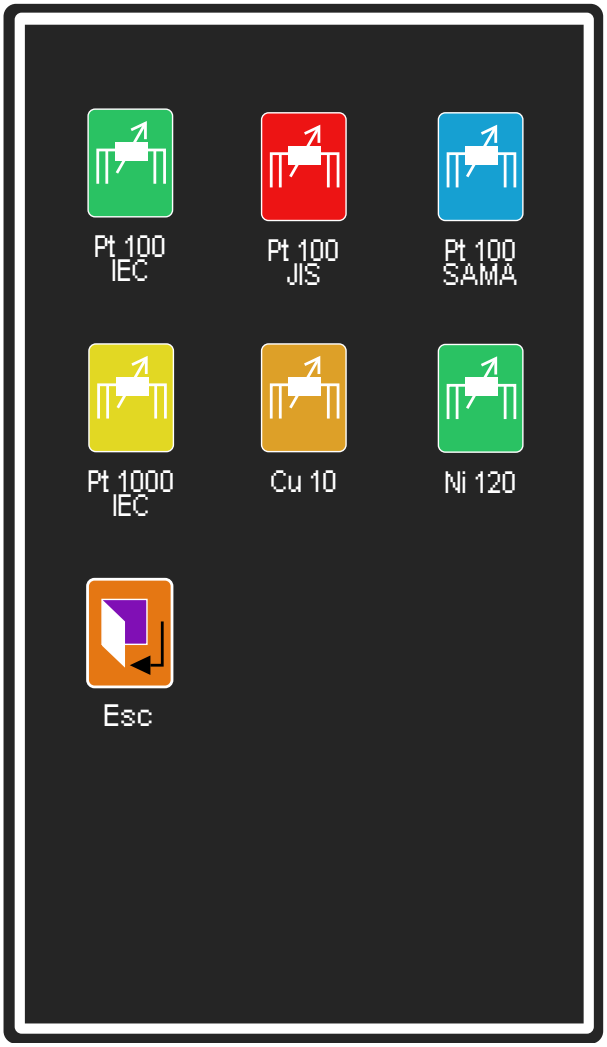
To choose the type of thermocouple, simply click on one of the icons. After choosing, a dialog box will give the option to choose the Reference Junction, internal or external.

When the Internal RJ option is selected, the ambient temperature will be measured through a Pt100 installed on terminal 2 of the input channel, (see Chapter 4.1 Layout) and will be used to compensate the reference junction of the thermocouple to be measured.

When the option is External RJ, compensation will be carried out using the value defined by the user in the range from -50.00 to +50.00 ºC in the Configuration Menu, Reference Junction option, Ext item, see chapter 8.5 Reference Junction for more information .

7.2 RTD Input

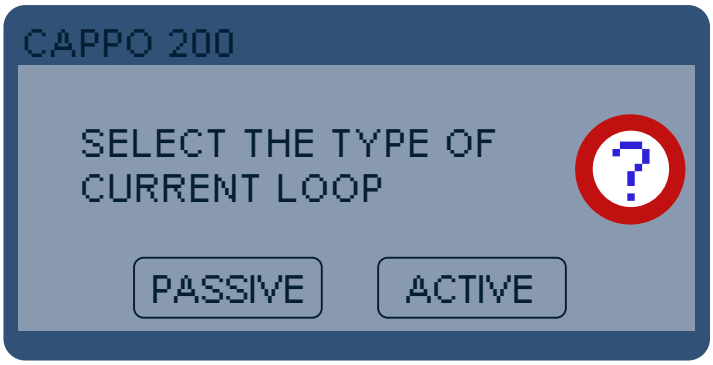
To configure the instrument input for RTD sensors, simply click on the RTD icon and the following screen will be displayed:



To choose the type of RTD, simply click on one of the icons. After choosing, a dialog box will give the option to choose the number of wires for the connection. For more information on connecting RTDs, see chapter 5.1 Connection Diagrams.

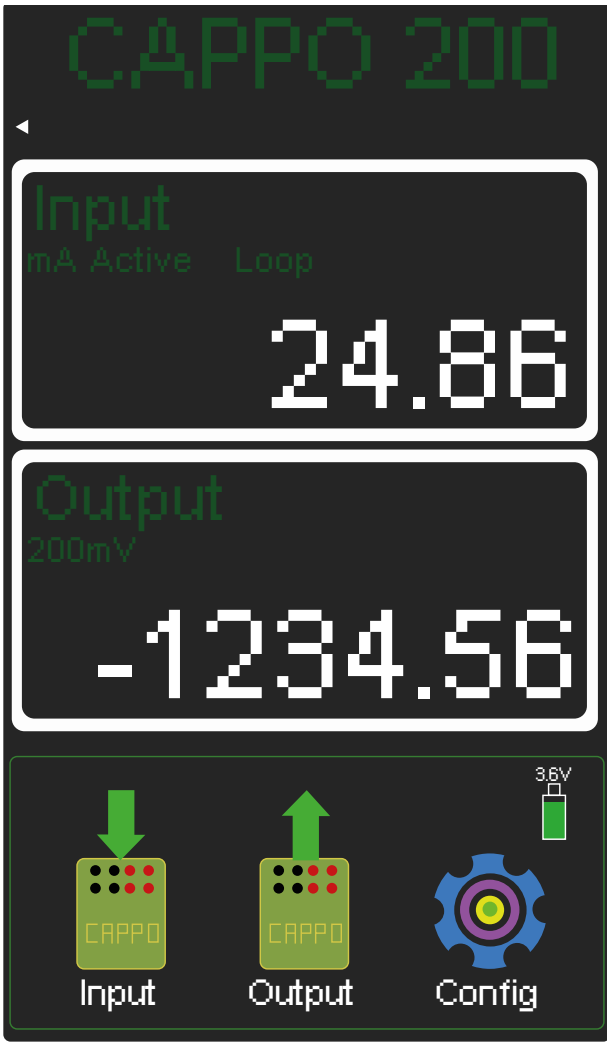
7.3 Current Input

To configure the instrument input for Electric Current, simply click on the CURRENT icon and a dialog box will be displayed to choose the type of current loop:



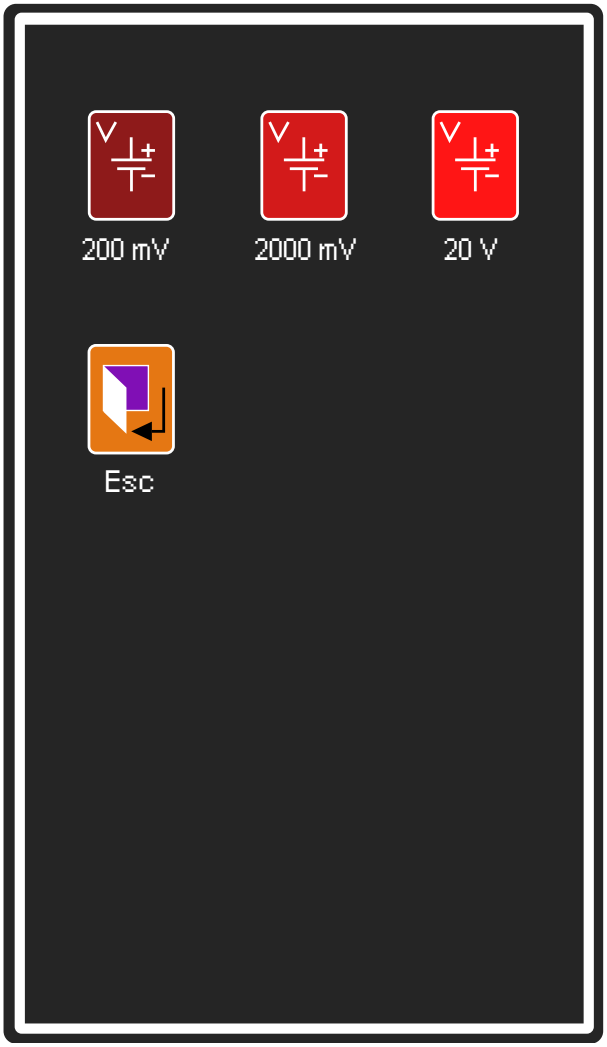
Passive Loop: considers that the Calibrator is being used in a non-energized circuit, that is, the Calibrator is the one that will power the circuit, therefore the 24V source at terminal 4 of the input channel will be turned on and the maximum measurement current will be 21mA.

Active Loop: considers that the Calibrator is being used on an energized circuit, that is, the circuit is powered by a source external to the Calibrator, therefore the 24V source at terminal 4 of the input channel will be turned off and the maximum current in the measurement will be of 51mA.



7.4 Voltage Input

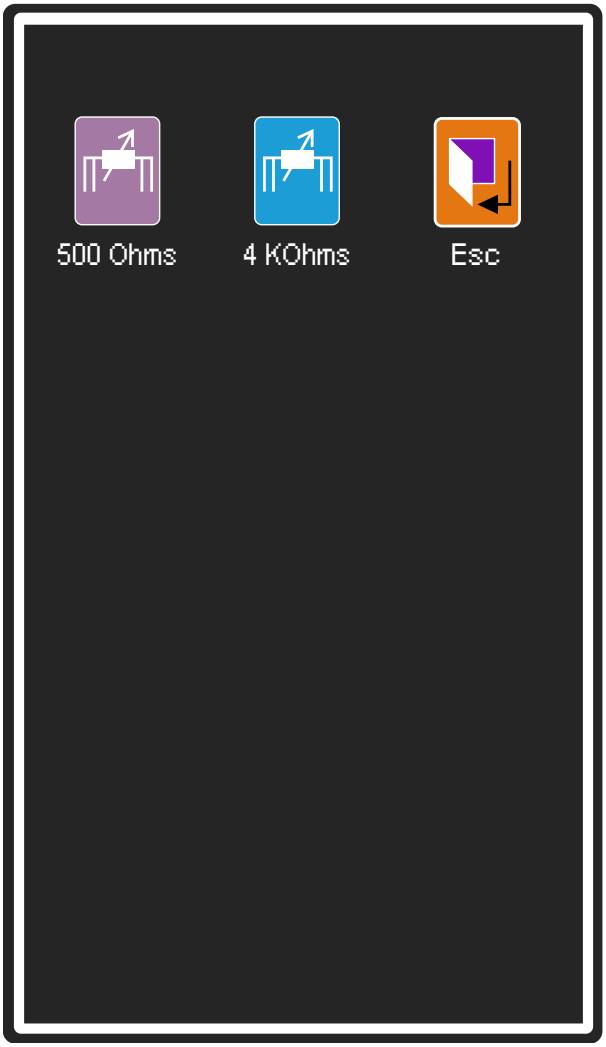
To configure the instrument input for Electrical Voltage, simply click on the VOLTAGE icon and the following screen will be displayed:



To choose the voltage range, simply click on one of the icons.

7.5 Resistance Input

To configure the instrument input for Electrical Resistance, simply click on the RESISTANCE icon and the following screen will be displayed:



To choose the type of resistance, simply click on one of the icons. After choosing, a dialog box will give the option to choose the number of wires for the connection. For more information on connecting resistance thermometers, see chapter 5.1 Connection Diagrams.

7.6 Scale X Input

The Scale X function allows you to display an input in user-defined engineering units through correlation (linear interpolation).

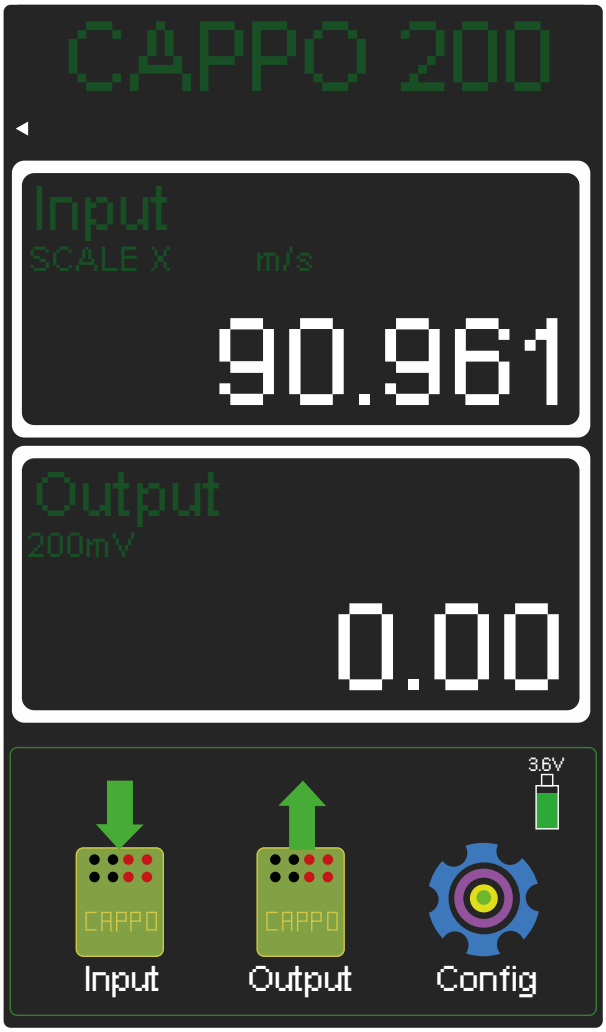
Through this function, the user can simulate Voltage or Current values, according to the following equation:

Y = X%. (DispHi - DispLo) + DispLo

Start of Output Range **(RangeLo)**	Output Channel Start Value **(DispLo)**
Value to be simulated **(X)**	Adjusted Value on the Output Channel **(Y)**
End of Output Range **(RangeHi)**	Output Channel End Value **(DispHi)**

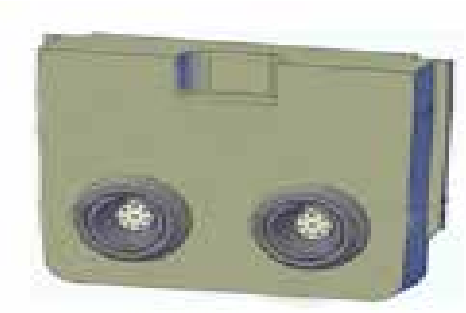
Output= **RangeLo** = 0% Start of output range
Output =**X**= X% Value between 0 to 100%
Output= **RangeHi** = 100% End of output range

The Scale must be configured in Chapter 6.5 Scale X Configuration. To define the Scale X as the instrument input, simply click on the X SCALE icon in the Input Menu.



7.7 Pressure Input

Configures the channel for reading an external pressure module. Note that pressure measurement is an option that must be defined at the time of purchase.

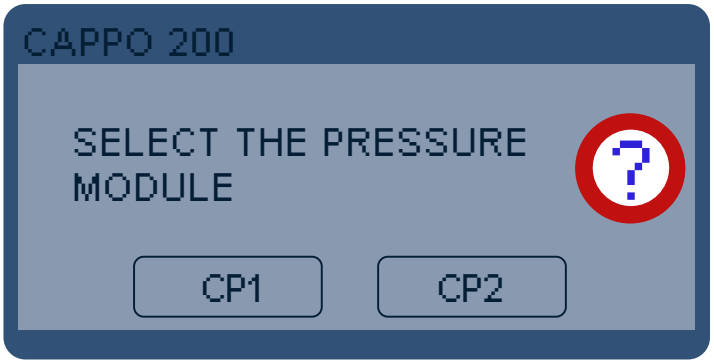


The pressure unit to be displayed is configured in the Configuration Menu, with 14 different units.

On the display there is a button called ZERO that can be used to reset the pressure at a certain point, thus generating an offset in the indicated pressure.

When the ZERO function is activated, on the left side of the button (Z) is shown, by pressing the ZERO button again, the offset is turned off and the indication (Z) is removed.

To configure the instrument input for Pressure, simply click on the PRESSURE icon and a dialog box will be displayed to choose the pressure module to be chosen:



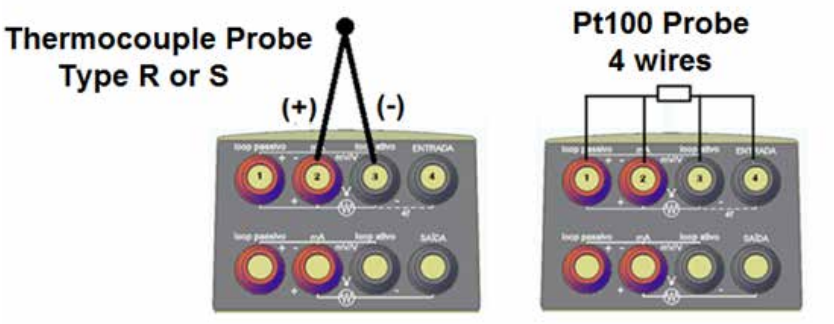
7.8 Probe Input

Through the coefficients A, B, C and R0, a Probe type R or S or Pt100 will be linearized according to its own characteristic curve, eliminating calibration errors.

The Ecil Metrology Laboratory can provide calibrated sensors, informing the coefficients A, B, C and R0 for automatic correction of errors through the Probe function.

Next, the user must select Probe 1 or Probe 2 or Probe 3, which must be previously configured in the Configuration Menu.

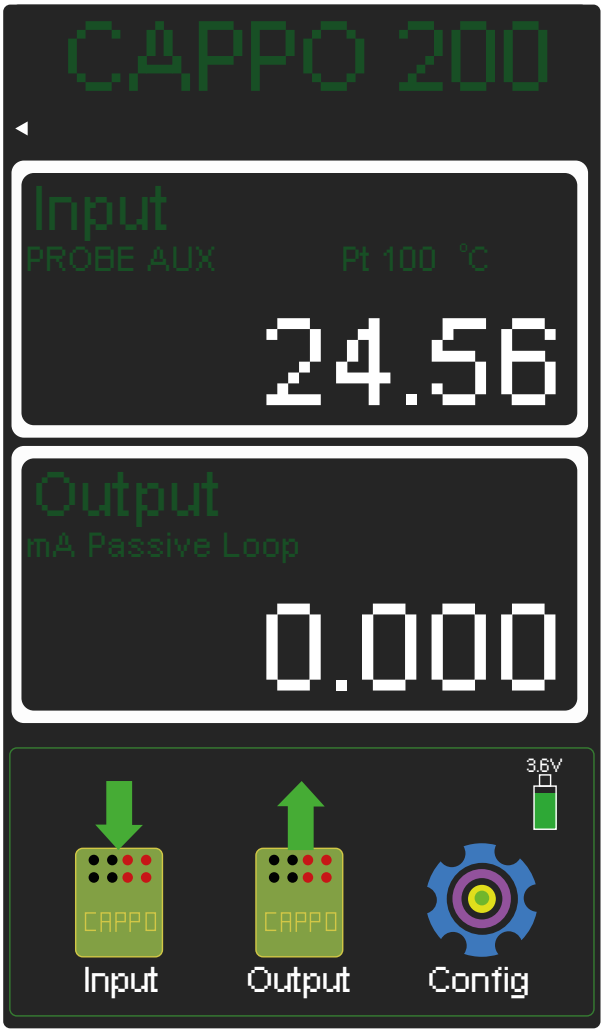
Note that in order to increase accuracy, the Probe Pt100 is always connected to 4 wires.



To set the instrument input for Probes, simply click on the PROBE icon and the following screen will be displayed:

7.9 Smart Probe Input

The Smart Probe, or Auxiliary Probe, is an Ecil standard thermocouple or thermoresistance which is a probe already configured according to its characteristic curve obtained in its calibration. To use this accessory, simply connect it to the top of the instrument and in the Input menu, click on PROBE AUX which will take you to the main screen like the one below:



7.10 Leak Test

For an active pressure module (CP1) or (CP2) connected to the input channel, this function shows the initial pressure, final pressure and the difference (initial – final), after the Leak Test time configured in the Configuration Menu has elapsed.

The time starts counting by touching the START symbol on the display.

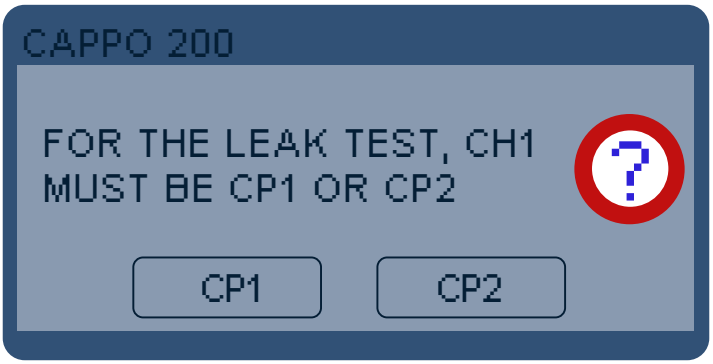
During time counting, by touching the RESET symbol on the display, the time is reset.

If the chosen pressure module CP1 or CP2 is inactive, this function is not executed.

The Leak Test function is turned off when one of the Input, Output or Configuration menus is accessed.

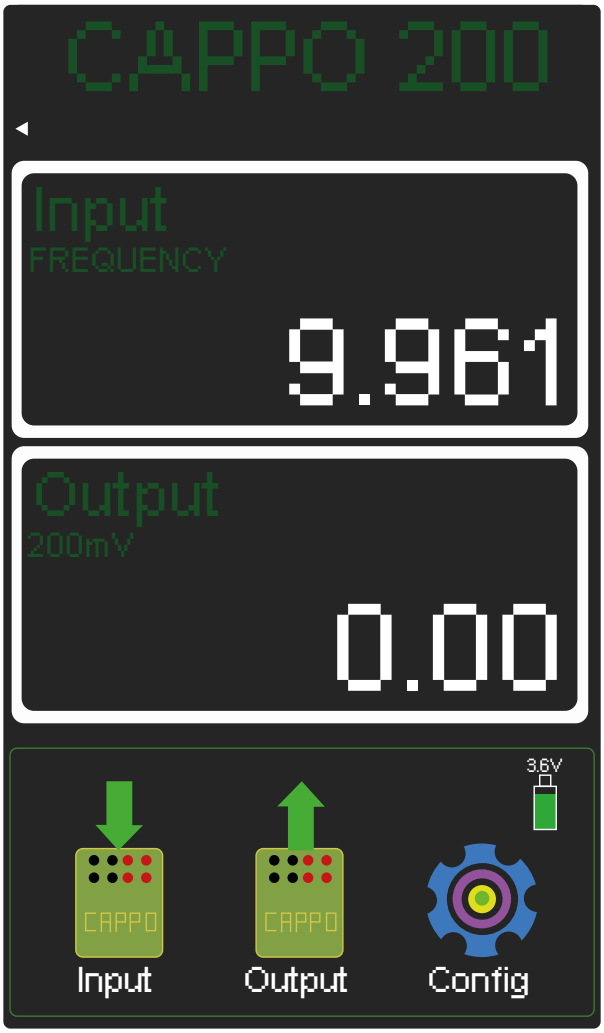
Note: During the Leak Test, the Auto Power Off function will be disabled so that the instrument is not automatically turned off before the end of the test.

To configure the instrument input for the Leak Test, simply click on the LEAK TEST icon and if the Input is not yet configured for any of the pressure modules, a dialog box will be displayed so that a module can be chosen:



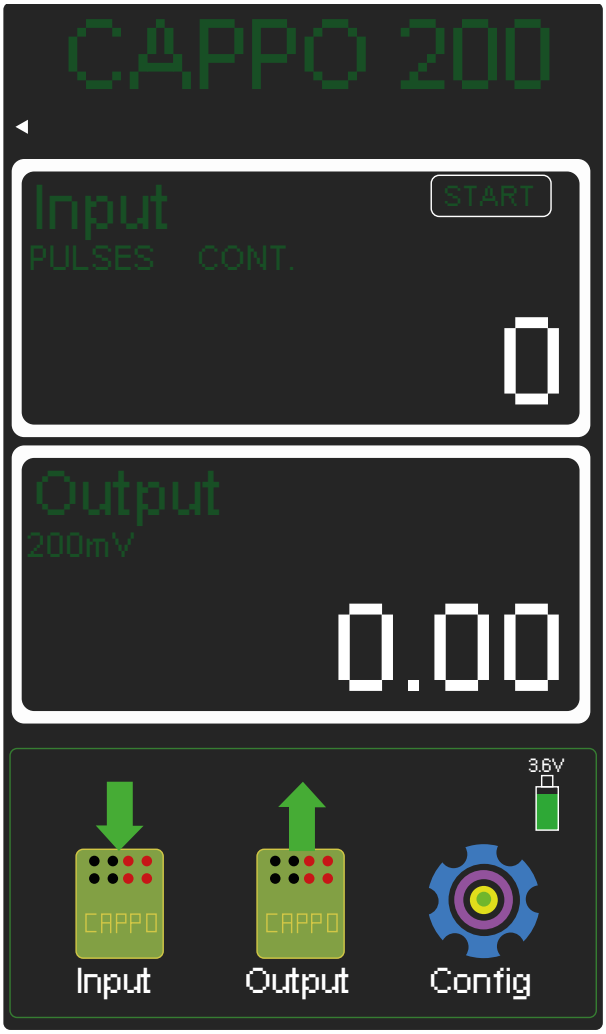
7.11 Frequency Input

In the Input menu, on the first page, if the FREQUENCY option is selected, the instrument will configure its input to frequency and the following start screen will be displayed:



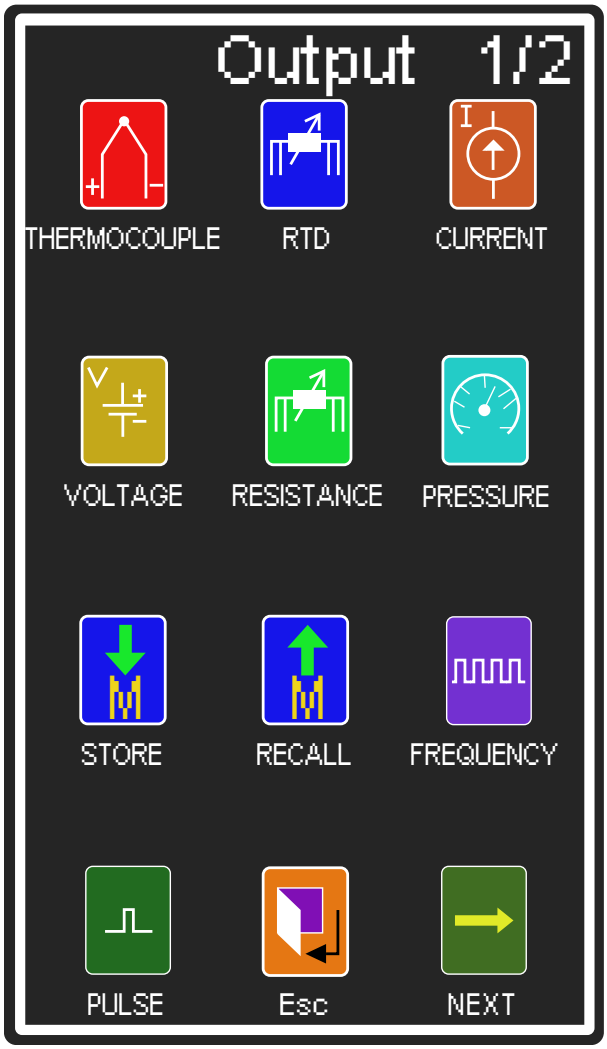
7.12 Pulses Input

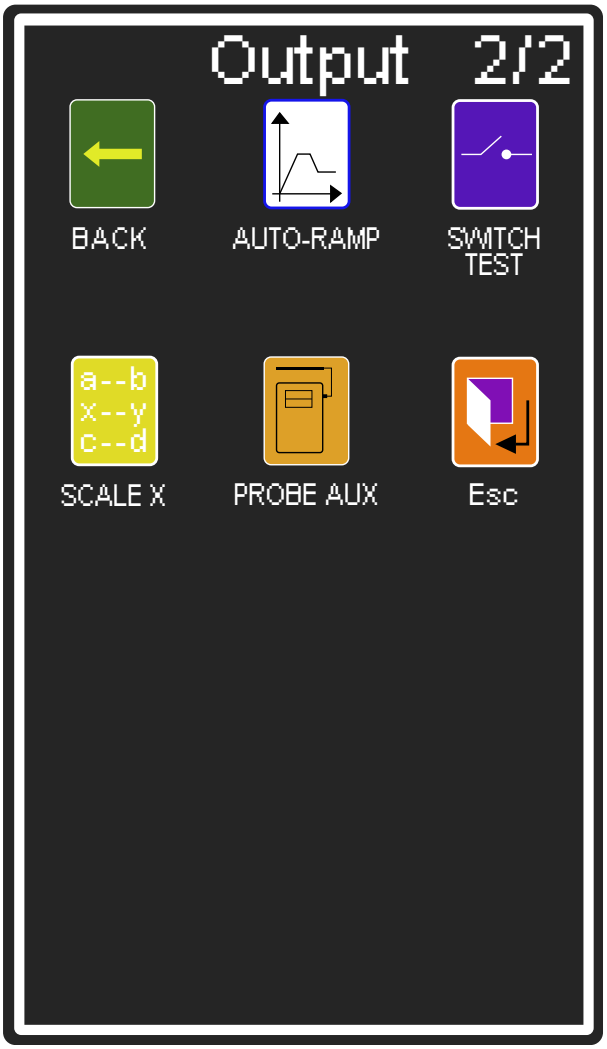
After configuring the Pulse Input in the Settings Menu (6.13). In the Input menu, on the first page, if the PULSE option is selected, the instrument will configure its input for pulses and the following start screen will be displayed:



8. OUTPUT

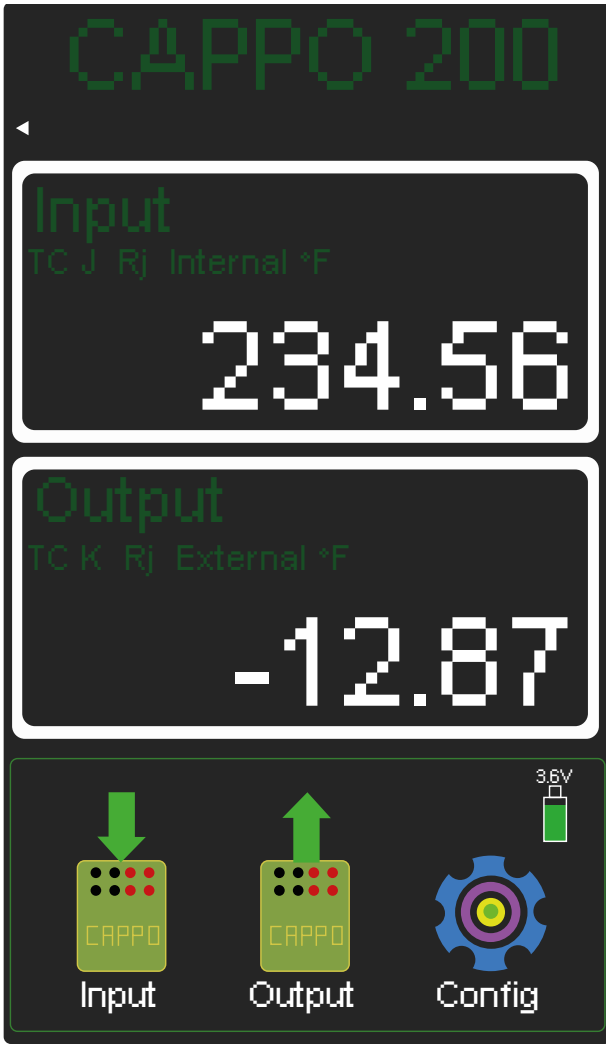
On the Home Screen, at the bottom, click on the Output Icon and the following screen will be displayed. To access the second page, simply click NEXT.





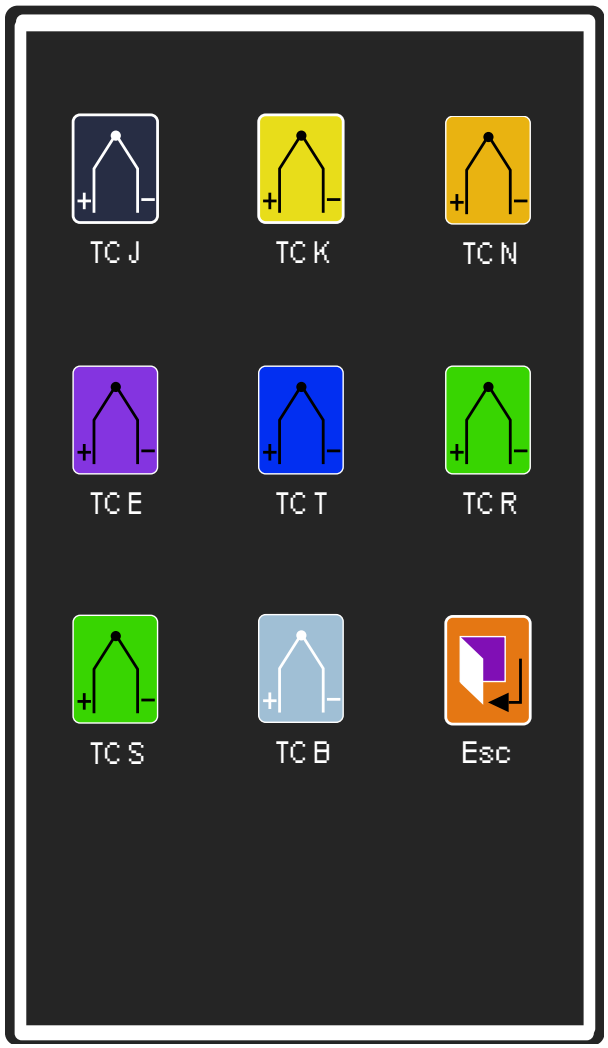
Click on the desired option.

To enter the desired output value, simply tap the touchscreen anywhere within the output box at the bottom of the Home Screen. When doing so, simply use the numeric keypad that will be displayed, where E is to confirm, C to clear, the arrow is to navigate between digits and ESC to cancel.

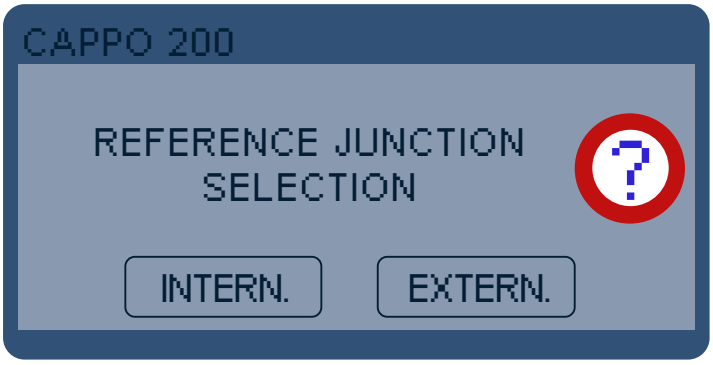


8.1 Thermocouple Output

To configure the instrument output for Thermocouple sensors, simply click on the THERMOCOUPLE icon and the following screen will be displayed:



To choose the type of thermocouple, simply click on one of the icons. After choosing, a dialog box will give the option to choose the Reference Junction, internal or external.

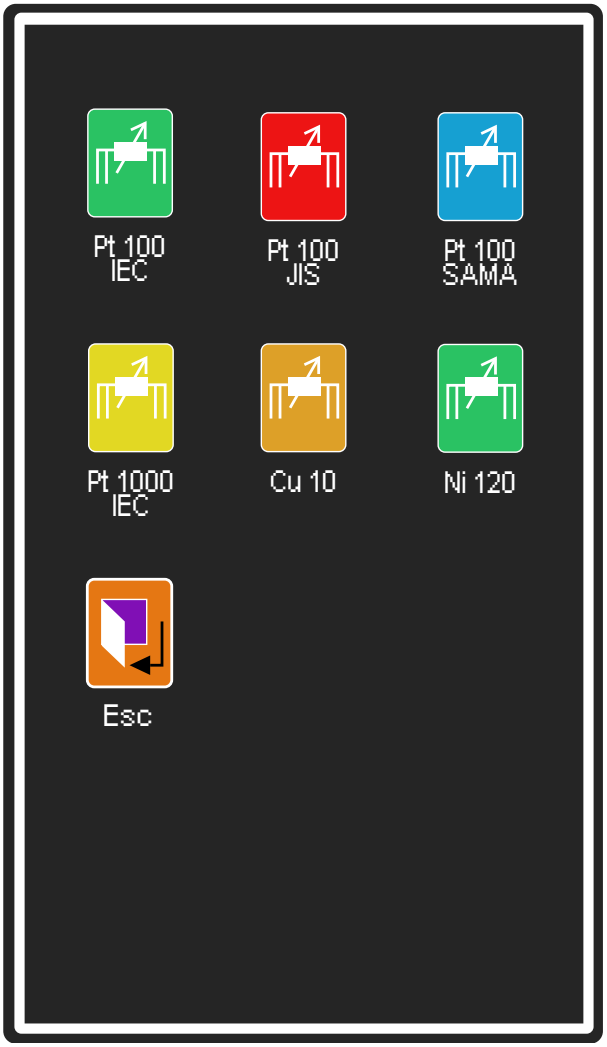


When the Internal RJ option is selected, the ambient temperature will be measured through a Pt100 installed on terminal 2 of the input channel, (see Chapter 4.1 Layout) and will be used to compensate the reference junction of the thermocouple to be measured.

When the option is External RJ, compensation will be carried out using the value defined by the user in the range from -50.00 to +50.00 ºC in the Configuration Menu, Reference Junction option, Ext item, see chapter 8.5 Reference Junction for more information .

8.2 RTD Output

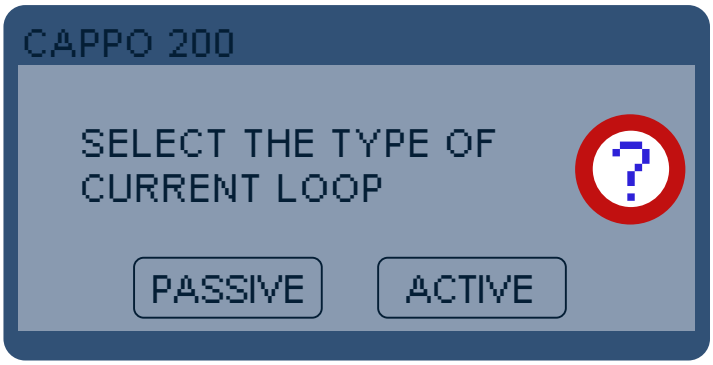
To configure the instrument output for RTD sensors, simply click on the RTD icon and the following screen will be displayed:



To choose the type of thermoresistance, simply click on one of the icons.

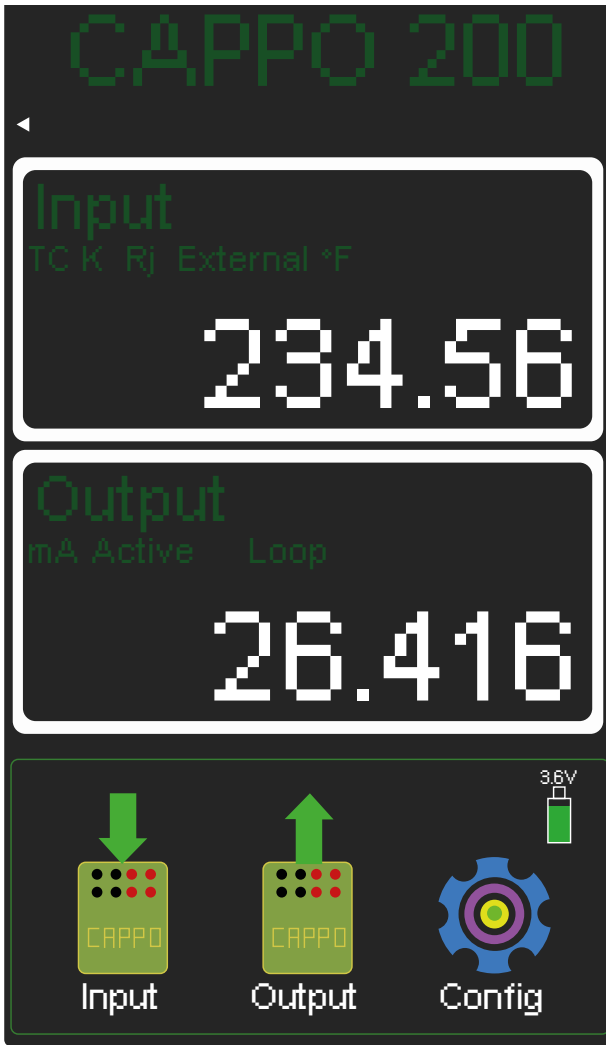
8.3 Current Output

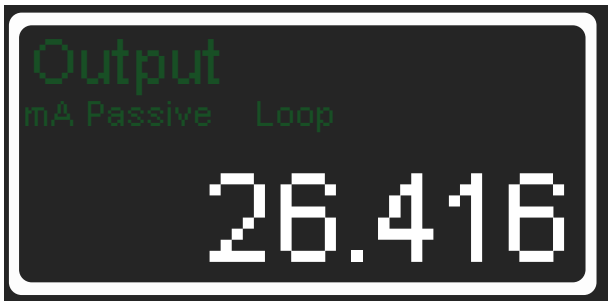
To configure the instrument's output for Electrical Current, simply click on the CURRENT icon and a dialog box will be displayed to choose the type of current loop:



Passive Loop: considers that the Calibrator is being used in a non-energized circuit, that is, the Calibrator is the one that will power the circuit, therefore the 24V source at terminal 4 of the input channel will be turned on and the maximum measurement current will be 21mA.

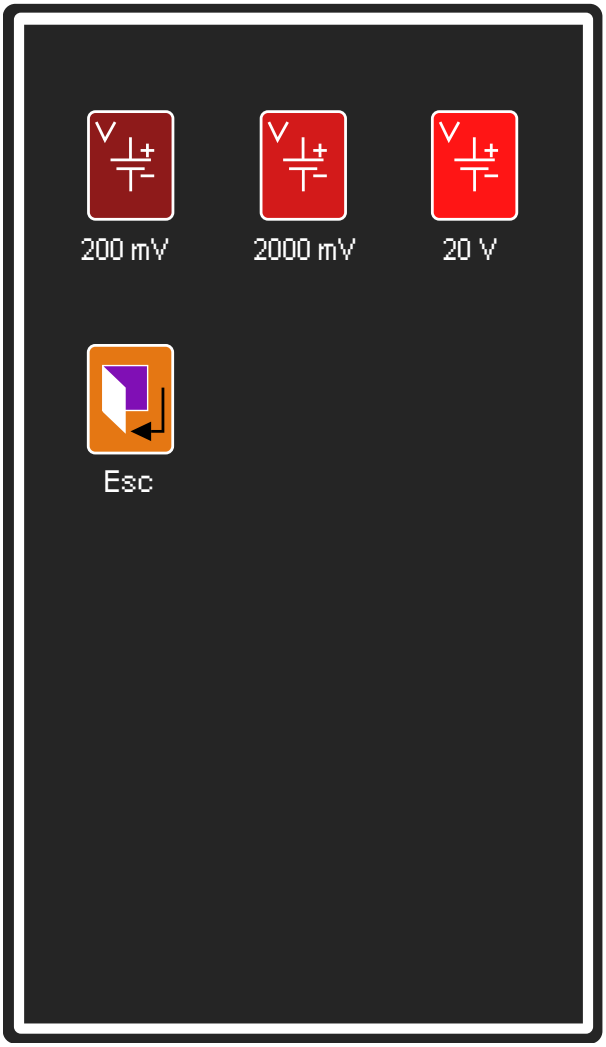
Active Loop: considers that the Calibrator is being used on an energized circuit, that is, the circuit is powered by a source external to the Calibrator, therefore the 24V source at terminal 4 of the input channel will be turned off and the maximum current in the measurement will be of 51mA.





8.4 Voltage Output

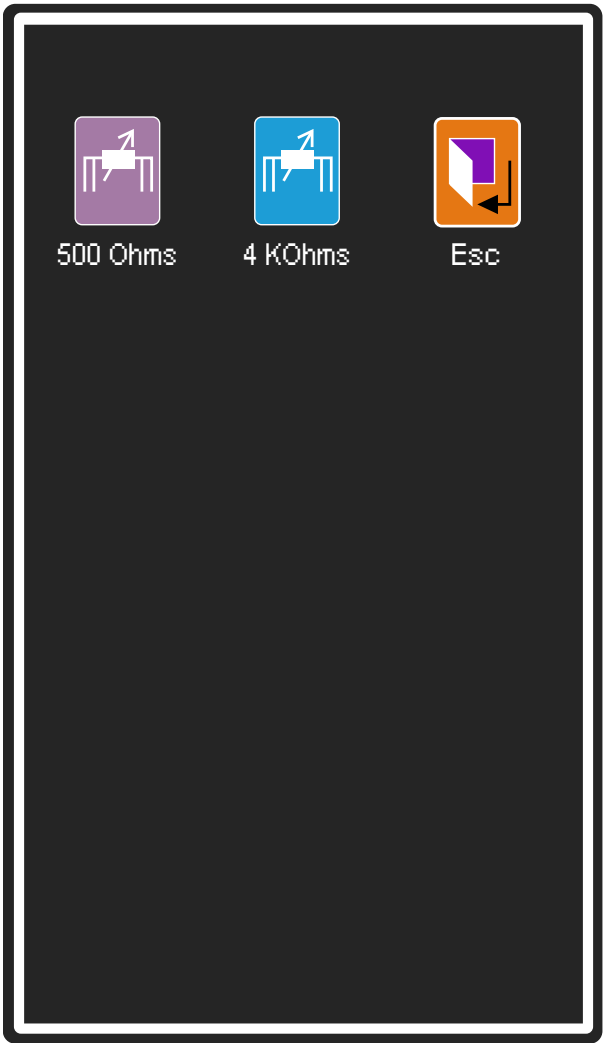
To configure the instrument output for Electrical Voltage, simply click on the VOLTAGE icon and the following screen will be displayed:



To choose the voltage range, simply click on one of the icons.

8.5 Resistance Output

To configure the instrument output for Electrical Resistance, simply click on the RESISTANCE icon and the following screen will be displayed:



To choose the type of resistance, simply click on one of the icons.

8.6 Pressure Output

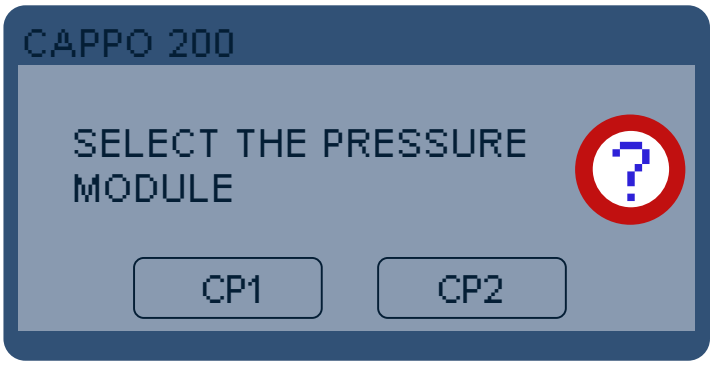
With the help of pressure generation accessories, configure the output channel of a pressure module. Note that pressure measurement is an option that must be defined at the time of purchase.

The pressure unit to be displayed is configured in the Configuration Menu, with 14 different units.

On the display there is a button called ZERO that can be used to reset the pressure at a certain point, thus generating an offset in the indicated pressure.

When the ZERO function is activated, on the left side of the button (Z) is shown, by pressing the ZERO button again, the offset is turned off and the indication (Z) is removed.

To configure the instrument output for Pressure, simply click on the PRESSURE icon and a dialog box will be displayed to choose the pressure module:



If the user wants to have two different inputs, it is possible to do so by connecting two pressure modules. To do this, simply click on PRESSURE on the second page of the Output Menu and the following screen will be displayed:

Note that now, in addition to the instrument displaying two Inputs instead of one Input and one Output, two new buttons have appeared located in the final third of the screen. The pressure differential button and the chart button.

When clicking on the pressure differential button, a new home screen will be displayed so that the differential is displayed below the two Inputs, as in the screen below:

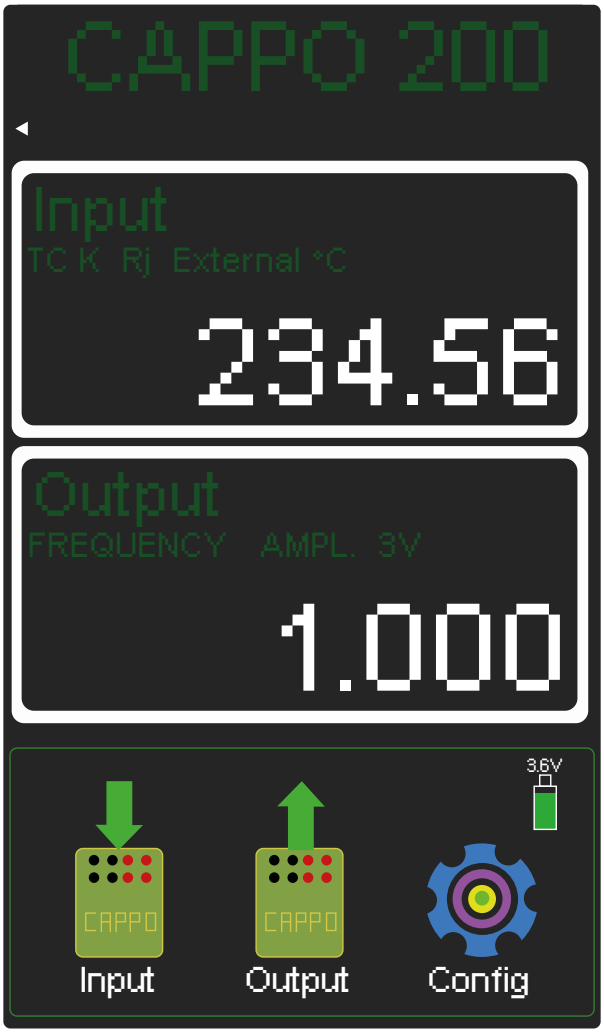
Just click the button again to return the screen to how it was previously.

When clicking on the chart button, a new screen will be displayed where you can view and configure the plotted chart, as in the screen below:

The RESET button resets the charts, the ZOOM (+) and ZOOM (-) buttons configure the chart zoom (the value is informed below the RESET button) and the BACK button returns to the Home Screen.

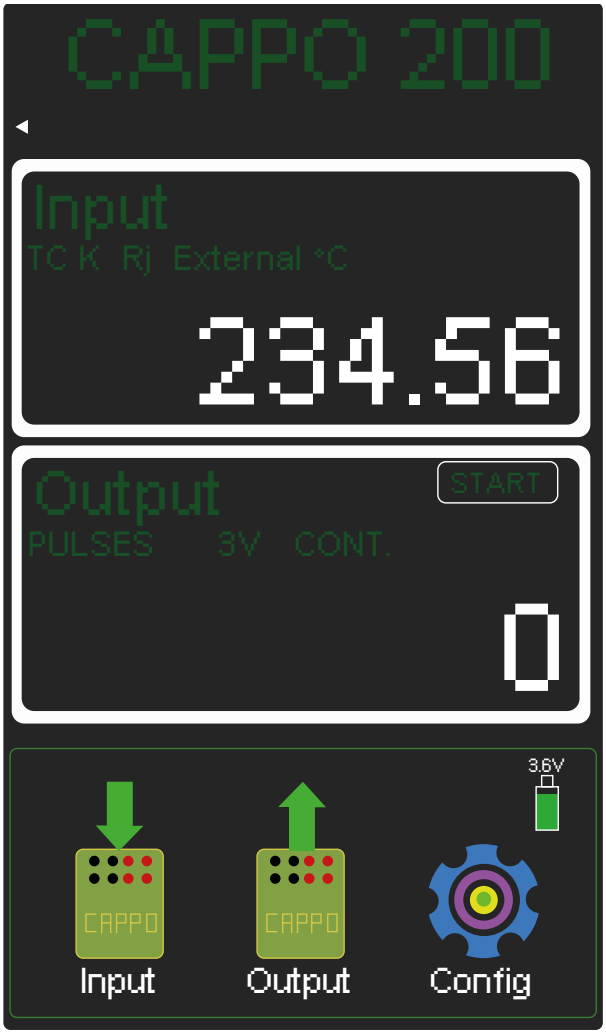
8.7 Frequency Output

After configuring the Frequency Output in the Settings Menu (6.12). In the Output menu, on the first page, if the FREQUENCY option is selected, the instrument will configure its output to frequency and the following home screen will be displayed:



8.8 Pulses Output

After configuring the Pulse Output in the Settings Menu (6.14). In the Output menu, on the first page, if the PULSE option is selected, the instrument will configure its output for pulses and the following home screen will be displayed:



8.9 Auto-Ramp Output

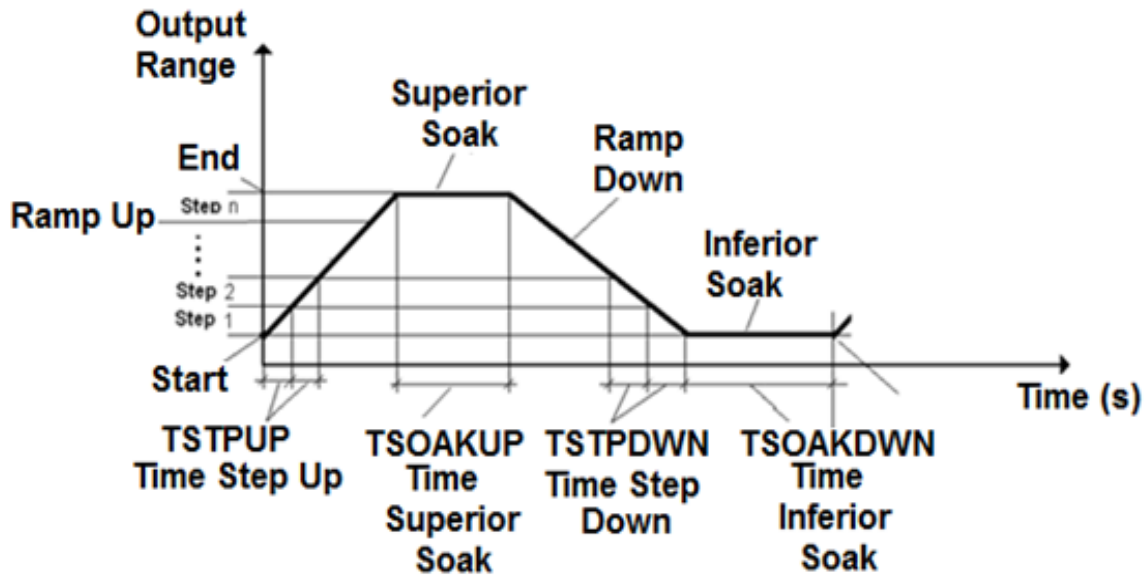
The Auto-Ramp function allows the generation of an output that will automatically follow a pre-defined curve.

The user can define the type of output signal, the rate of ramp up and ramp down, the soak times and the number of repetitions.

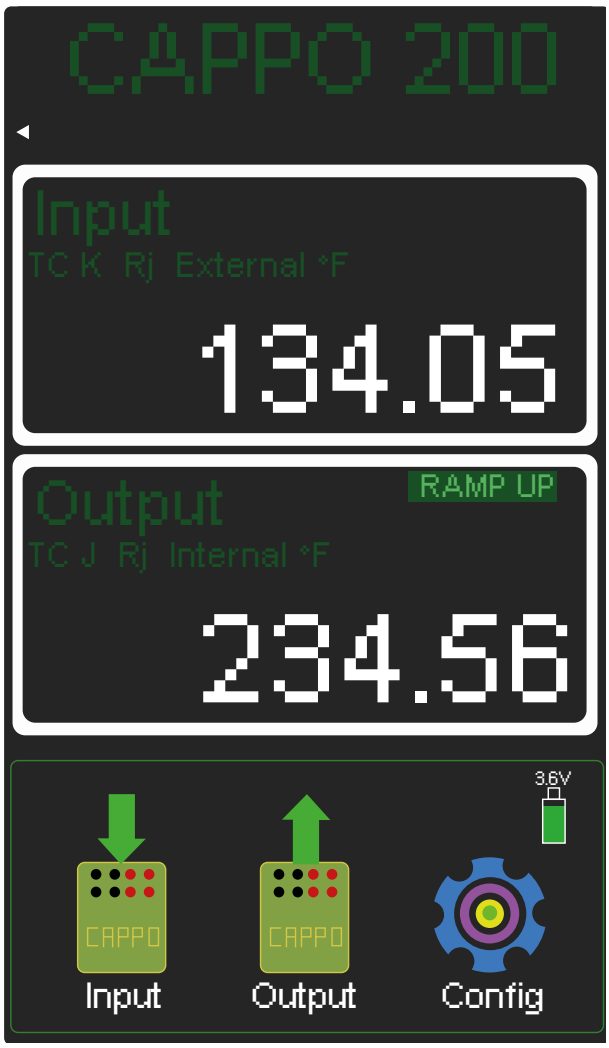
These parameters must be configured in Chapter 6.4 Auto-Ramp Configuration.

The Auto-Ramp Function is turned off when one of the Input, Output or Configuration menus is accessed.

Note: During the execution of the Auto-Ramp, the Auto Power Off function will be disabled so that the instrument does not turn off automatically before the end of the ramp.

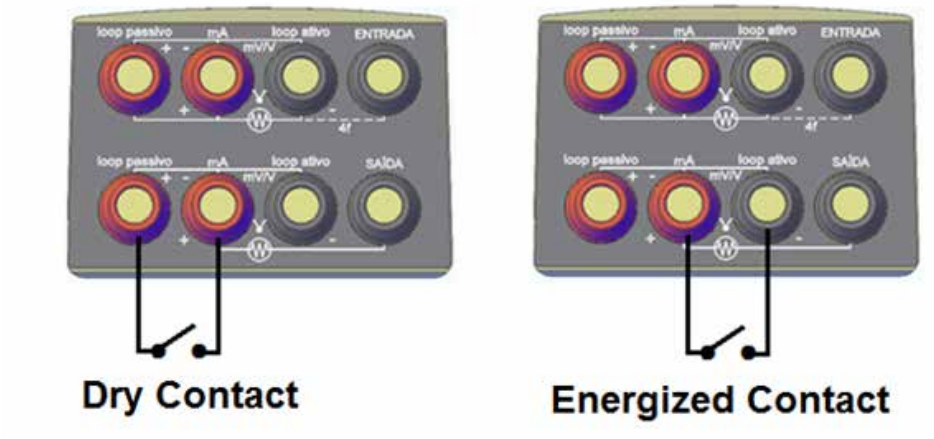


To trigger the Auto-Ramp, simply click on the AUTO-RAMP icon and be redirected to the Home Screen, where in the upper right corner of the output part it will be indicated that the Ramp is being executed, as shown below:

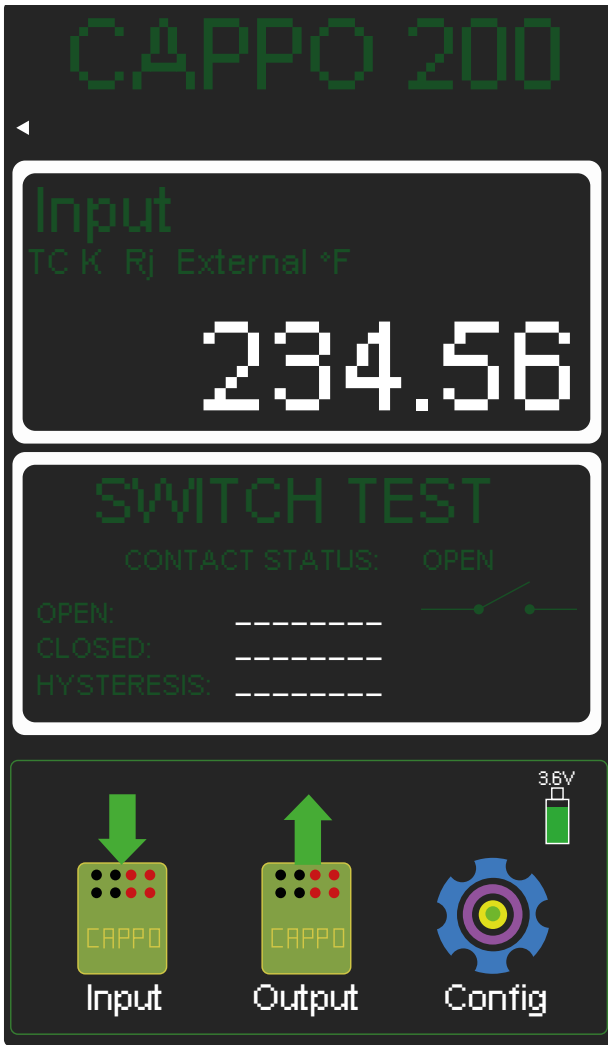


8.10 Switch Test

Function used for calibrating thermostats and pressure switches, showing the status (open or closed) of a dry or energized contact with a maximum voltage of 24Vdc.



The display will show the status of the contact and memorize the value read on the input channel at the moment the contact was opened or closed, also showing the difference (hysteresis = closed - open).



The Switch Test function is turned off when one of the Input, Output or Configuration menus is accessed.

8.11 Scale X Output

The X Scale function allows you to simulate an output in user-defined engineering units through correlation (linear interpolation).

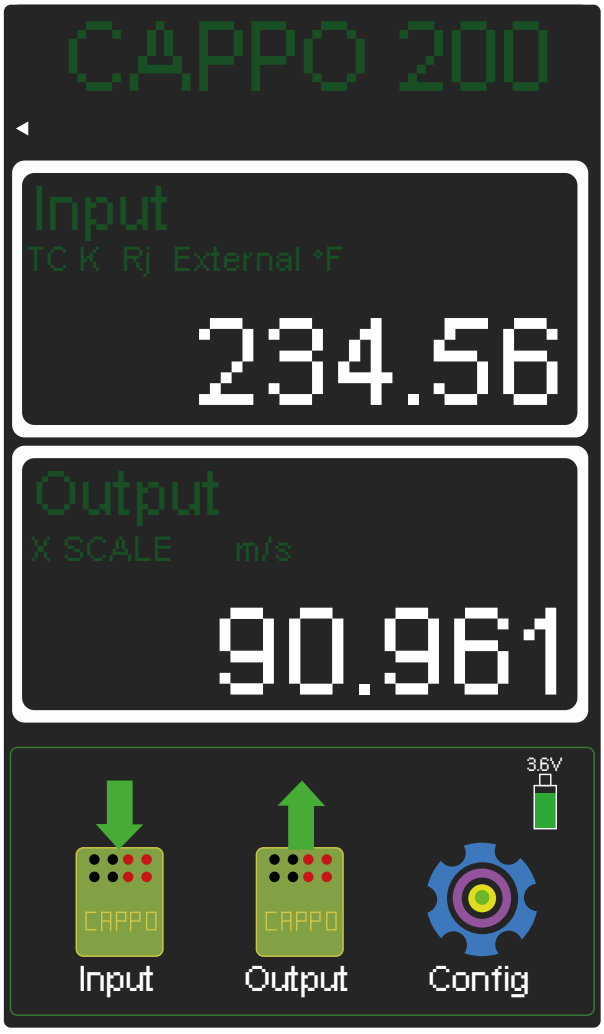
Through this function, the user can show on the display a linear output such as Voltage or Current scaled according to their needs, using the following equation:

X = Y%. (RangeHi - RangeLo) + RangeLo

Start of input range **(RangeLo)**	Start value to display **(DispLo)**
Measured value **(X)**	Displayed value **(Y)**
End of input range **(RangeHi)**	Final value to display **(DispHi)**

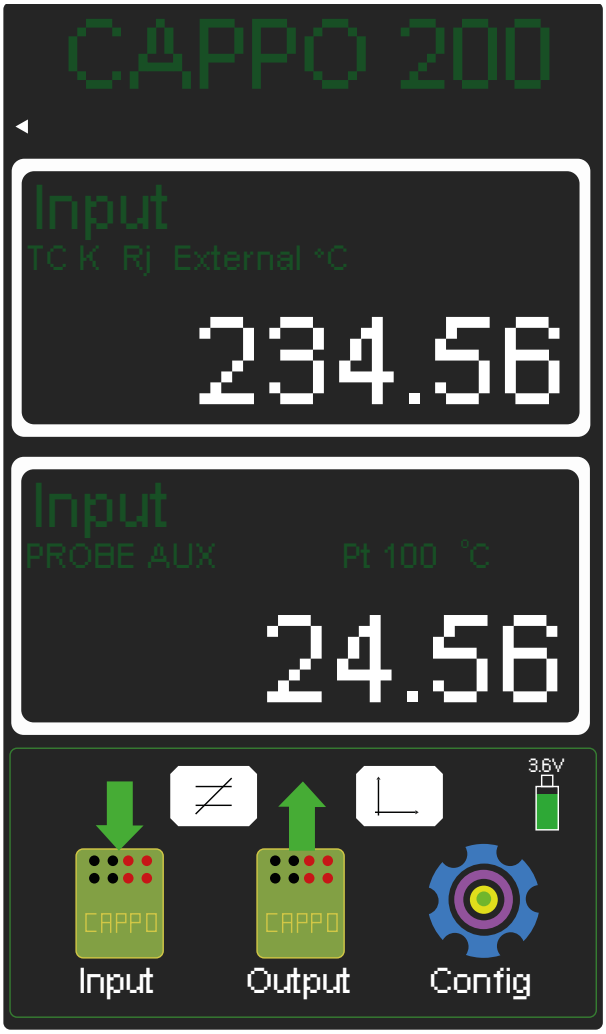
Output= **RangeLo** = 0% Start of output range
Output =**X**= X% Value between 0 to 100%
Output= **RangeHi** = 100% End of output range

The Scale must be configured in Chapter 6.5 X Scale Configuration. To define the X Scale as the instrument's input, simply click on the X SCALE icon in the Output Menu.



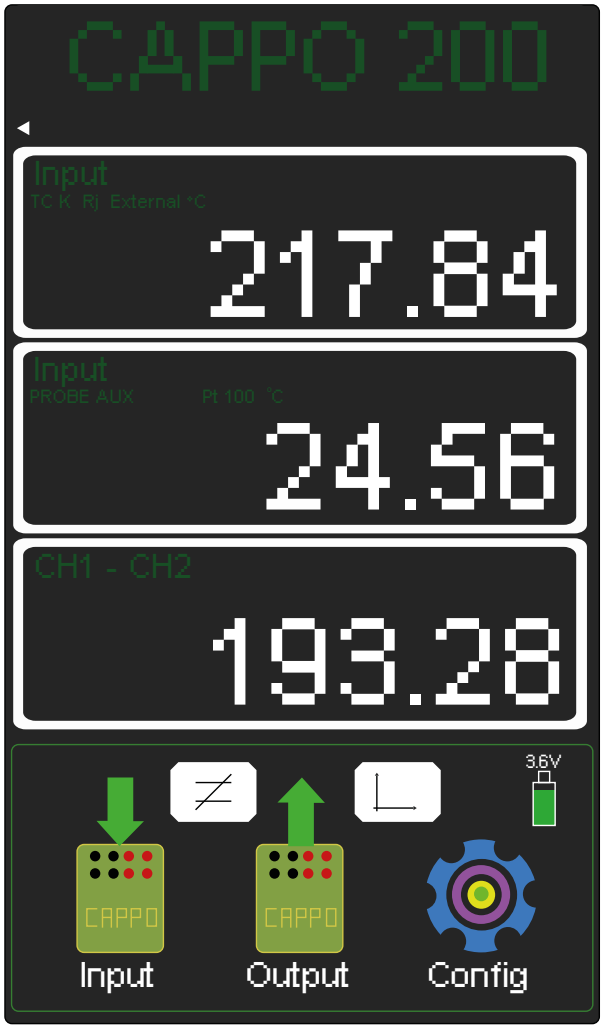
8.12 Smart Probe Output

If the user wants to have two different inputs, it is possible to do so using a Smart Probe at its specific input in conjunction with a sensor connected to the terminals. To do this, simply click on PROBE AUX on the second page of the Output Menu and the following screen will be displayed:



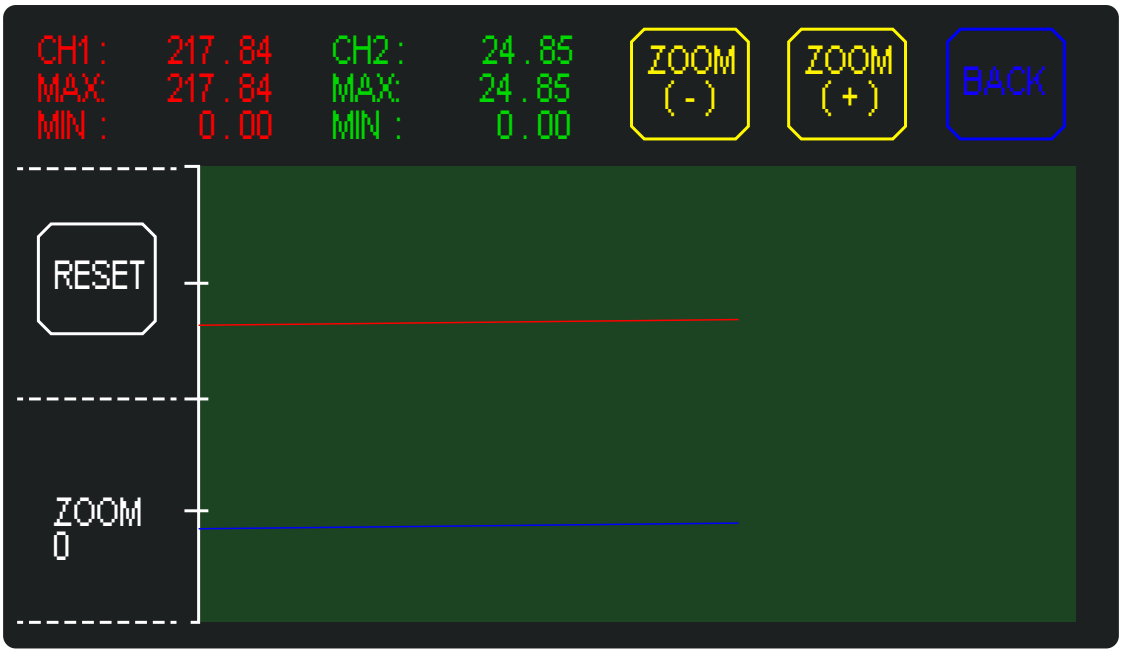
Note that now, in addition to the instrument displaying two Inputs instead of one Input and one Output, two new buttons have appeared located in the final third of the screen. The temperature differential button and the chart button.

When clicking on the temperature differential button, a new home screen will be displayed so that this differential is displayed below the two Inputs, as in the screen below:



Just click the button again to return the screen to how it was previously.

When clicking on the graph button, a new screen will be displayed where you can view and configure the plotted chart, as in the screen below:



The RESET button resets the charts, the ZOOM (+) and ZOOM (-) buttons configure the chart zoom (the value is informed below the RESET button) and the BACK button returns to the Home Screen.

9. MEMORY

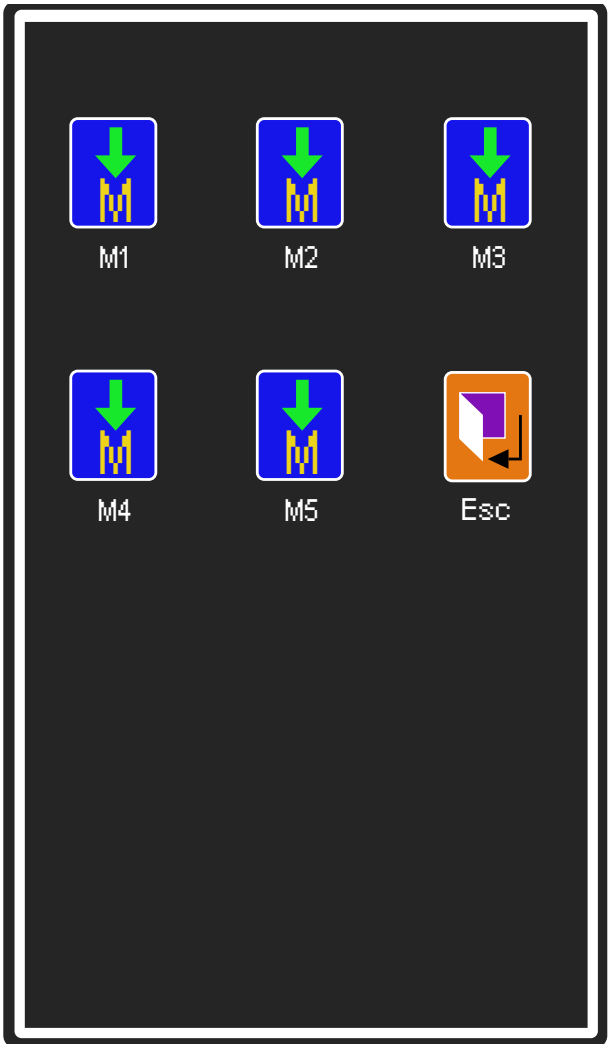
Function divided into two icons located in the Output Menu, Store and Recall. Allowing up to 5 output configurations to be stored (Store) or recalled (Recall).

The type of output signal and its respective value can be stored or read in 5 memories defined as M1, M2, M3, M4 and M5.

The memories are useful to facilitate adjustments in the calibration of instruments, which have interactive zero and span, in addition to making other intermediate points available for calibration verification.

Stored values are retained in non-volatile flash memory.

To store the current output value in a memory space, simply click on the STORE icon and on the screen that appears, click on the icon of the memory space to be used, and to retrieve and use a stored value as an output signal, simply click on the RECALL icon and click on the memory space icon where the desired value is allocated:



10. SERVICES AND ASSISTANCE

10.1 Services

CALIBRATION LABORATORY

The Ecil Metrology Laboratory is accredited by Cgcre (Brazilian accreditation body) for calibration in the following areas and services:

Temperature: thermoresistance, thermocouple, analog/digital thermometer with thermocouple or thermoresistive sensor, compensation/extension cable, liquid-in-glass thermometer, infrared pyrometer, blackbody cavity, simulator, indicator or analog/digital controller for thermocouple or thermoresistive sensor and temperature transmitters.

Electricity: DC voltage source/meter, DC current source/meter, resistive decade and resistance meter.

GASES LABORATORY

The Ecil Gas Laboratory provides calibration services for portable combustion gas analyzers. At the beginning of 2018, we began certifying the calibration of combustion gases, accredited by Cgcre (Brazilian accreditation body).

Our structure has primary standards, in some concentrations of: O2, CO, NO, NO2, SO2, HC (CxHy) and CO2.

10.2 Assistance

TECHNICAL ASSISTANCE

Always aiming to offer complete solutions to its customers, Ecil has its own technical assistance that carries out maintenance on the entire line of instruments manufactured or represented, within or outside the warranty period.

CONTACT

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