USER MANUAL

MSC-D

SENECA S.r.l.
Via Austria 26 – 35127 – Z.I. - PADOVA (PD) - ITALY
Tel. +39.049.8705355 – 8705355 Fax +39 049.8706287
www.seneca.it

ORIGINAL INSTRUCTIONS

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CONTACT US	
Technical support	supporto@seneca.it
Product information	commerciale@seneca.it

Document revisions

DATE	REVISION	NOTES	AUTHOR
28/01/2025	0	First revision	MM

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1. PRELIMINARY WARNINGS

⚠ ATTENTION!

In any case, SENECA s.r.l. or its suppliers will not be responsible for the loss of data/revenue or consequential or incidental damages due to negligence or bad/improper management of the device, even if SENECA is well aware of these possible damages.

SENECA, its subsidiaries, affiliates, group companies, suppliers and distributors do not guarantee that the functions fully meet the customer's expectations or that the device, firmware and software should have no errors or operate continuously.

2. DEVICE HARDWARE REVISION

With a view to continuous improvement, Seneca updates and makes the hardware of its devices increasingly more sophisticated. It is possible to know the hardware revision of a product via the label on the side of the device.
A label example is for instance:

The label also shows the firmware revision present in the device (in this case 2.0.1.0) at the time of sale, the hardware revision (in this case) is E00.
To improve performance or extend functionality, Seneca recommends updating the firmware to the latest available version (see the section dedicated to the product on www.seneca.it).

3. CALIBRATOR ACCURACY AND RESOLUTION

The accuracy and resolution of the signals are represented in the following tables:

SIGNAL GENERATION

FUNCTIONS	M.U.	RANGE (Generation)	ACCURACY* (Generation)	RESOLUTION (Generation)	Note	STANDARD	CMRR-NMRR
VOLTAGE [hi range]	[dc V]	0-26 (minimum)	0.02% + 3 mV	1 mV	1	-	>100 dB
VOLTAGE [lo range]	[dc mV]	-10 +90	0.03% + 15 µV	5 µV	2	-	>100 dB
ACTIVE CURRENT	[dc mA]	0.1 ÷ +24	0.04% + 3 µA	1 µA	3	-	>60 dB
PASSIVE CURRENT	[dc mA]	0.1 ÷ +24	0.04% + 3 µA	1 µA	4, 21, 22	-	>60 dB
Pt100	[°C]	-200 ÷ +859	0.03% + 0.2 °C	0.1 °C	5, 19	IEC 60751	>140 dB
Pt500	[°C]	-200 ÷ +859	0.03% + 0.2 °C	0.1 °C	5, 20	IEC 60751	>140 dB
Pt1000	[°C]	-200 ÷ +859	0.03% + 0.2 °C	0.1 °C	5, 20	IEC 60751	>140 dB
CU50, CU100	[°C]	-180 ÷ +200	0.03% + 0.2 °C	0.1 °C	15, 19	GOST 6651-2009	>140 dB
Ni100, Ni120	[°C]	-80 ÷ +260	0.03% + 0.2 °C	0.1 °C	16, 19	DIN 43760	>100 dB
TERMOCUPLE J	[°C]	-210 ÷ +1200	0.03% + 0.2 °C	0.1 °C	12, 2	EN 60584-1:1997	>100 dB
TERMOCUPLE K	[°C]	-270 ÷ +1372	0.03% + 0.2 °C	0.1 °C	12, 2	EN 60584-1:1997	>100 dB
TERMOCUPLE T	[°C]	-270 ÷ +400	0.03% + 0.1 °C	0.1 °C	12 2	EN 60584-1:1997	>100 dB
TERMOCUPLE E	[°C]	-270 ÷ +1000	0.03% + 0.2 °C	0.1 °C	12 2	EN 60584-1:1997	>100 dB
TERMOCUPLE N	[°C]	-270 ÷ +1300	0.03% + 0.2 °C	0.1 °C	12, 2	EN 60584-1:1997	>100 dB
TERMOCUPLE R	[°C]	-50 ÷ +1768	0.03% + 0.3 °C	0.5 °C	12, 2	EN 60584-1:1997	>100 dB
TERMOCUPLE S	[°C]	-50 ÷ +1768	0.03% + 0.3 °C	0.5 °C	12, 2	EN 60584-1:1997	>100 dB
TERMOCUPLE B	[°C]	0 ÷ +1820	0.03% + 0.3 °C	0.5 °C	12, 2	EN 60584-1:1997	>100 dB
TERMOCUPLE L	[°C]	-200 ÷ +800	0.03% + 0.15 °C	0.1 °C	12, 2	GOST 8.585-2001	>140 dB
LOAD CELL 350 Ohm	[mV/V]	0 ÷ +3	0.05%	0.001	13, 8	-	>100 dB
PULSES/FREQUECY	[Hz]	0.1÷1000	0.02%	SEE MANUAL	1	-	-

SIGNAL MEASUREMENT

FUNCTIONS	M.U.	RANGE (Measurement)	ACCURACY (Measurement)	RESOLUTION (Measurement)	STANDARD	Notes (Measurement)	CMRR-NMRR
VOLTAGE [hi range]	[dc V]	0-26 (minimum)	0.02% + 3 mV	1 mV	-	9	>100 dB
VOLTAGE [lo range]	[dc mV]	-10 +90	0.02% + 10 µV	5 µV	-	9	>100 dB
ACTIVE CURRENT	[dc mA]	0 ÷ +24	0.04% + 0.01 µA	1 µA	-	17	>60 dB
PASSIVE CURRENT	[dc mA]	0 ÷ +24	0.04% + 0.01 µA	1 µA	-	18	>60 dB
Pt100	[°C]	-200 ÷ +850	0.03% + 0.2 °C	0.03 °C	IEC 60751	6	>140 dB
Pt500	[°C]	-200 ÷ +850	0.03% + 0.2 °C	0.1 °C	IEC 60751	6	>140 dB
Pt1000	[°C]	-200 ÷ +850	0.03% + 0.2 °C	0.03 °C	IEC 60751	7	>140 dB
CU50, CU100	[°C]	-180 ÷ +200	0.03% + 0.2 °C	0.06 °C, 0.03 °C	GOST 8651-2009	6, 15	>140 dB
Ni100, Ni120	[°C]	-60 ÷ +250	0.03% + 0.2 °C	0.02 °C	DIN 43760	6, 16	>100 dB
TERMOCUPLE J	[°C]	-210 ÷ +1200	0.03% + 0.2 °C	0.01 °C	EN 60584-1:1997	9, 12	>100 dB
TERMOCUPLE K	[°C]	-200 ÷ +1372	0.03% + 0.2 °C	0.05 °C	EN 60584-1:1997	9, 12	>100 dB
TERMOCUPLE T	[°C]	-200 ÷ +400	0.03% + 0.1 °C	0.05 °C	EN 60584-1:1997	9, 12	>100 dB
TERMOCUPLE E	[°C]	-200 ÷ +1000	0.03% + 0.2 °C	0.05 °C	EN 60584-1:1997	9, 12	>100 dB
TERMOCUPLE N	[°C]	-200 ÷ +1300	0.03% + 0.2 °C	0.05 °C	EN 60584-1:1997	9, 12	>100 dB
TERMOCUPLE R	[°C]	-50 ÷ +1768	0.03% + 0.3 °C	0.05 °C	EN 60584-1:1997	9, 12	>100 dB
TERMOCUPLE S	[°C]	-50 ÷ +1768	0.03% + 0.3 °C	0.05 °C	EN 60584-1:1997	9, 12	>100 dB
TERMOCUPLE B	[°C]	250 ÷ +1820	0.03% + 0.3 °C	0.05 °C	EN 60584-1:1997	9, 12	>100 dB
TERMOCUPLE L	[°C]	-200 ÷ +800	0.03% + 0.15 °C	0.05 °C	Gost 8.585-2001	9, 12	>140 dB
LOAD CELL 350 Ohm	[mV/V]	0 ÷ +2.4	0.05%	0,001	-	9, 14	>100 dB
PULSES/FREQUECY	[Hz]	0.1÷10000	0.03% + 3 LSD	10e-6 Hz	-	10, 11	-

NOTE

1 - IoutMAX = 20 mA per V < 20; IoutMAX =10 mA per 20 < V <25; IoutMAX = 5 mA per V > 25; output impedance < 50 mΩ
2 - IoutMAX = 10 mA; output impedance < 100 mΩ
3 - RLoad < 1KΩ
4 - 3 V minimum loop voltage, 28 V maximum
5 - α =0.00385
6 - Measurement current: 1 mA
7 - Measurement current: 250 uA
8 - Excitation voltage: from 5 to 10 V
9 - Input impedance: ~ 10 MΩ
10 - Input impedance: 1 MΩ; Voltage from 1 to 24 V
11 - Max frequency measurement 1 kHz
12 - Cold junction error: 1 °C between 10 and 35 °C ambient, 2 °C between -20 and 10 °C and between 35 and 50 °C ambient
13 - Output impedance: 300 Ω
14 - Excitation voltage < 8 V
15 - α = 0.00428
16 - α = 0.006178
17 - Voltage drop < 3.5 V
18 - Minimum voltage supplied: 24 V
19 - Accuracy defined with 1 mA measurement current and respected polarity
20 - Accuracy defined with 250 uA measurement current and respected polarity
21 - Output impedance: 3.75 MΩ
22 - Accuracy defined with 26 V loop supply voltage

4. SAFETY INFORMATION

This manual contains safety rules that must be complied with to safeguard personal safety and to prevent damage to property. The indications to be followed to guarantee personal safety are highlighted by a triangle with the following meanings:

⚠WARNING

The symbol associated with the word 'warning' indicates conditions or actions that put the user's safety at risk.

⚠CAUTION

The symbol associated with the word 'caution' indicates conditions or actions that might damage the calibrator or equipment tested.

⚠QUALIFIED PERSONNEL

The product covered by this documentation may only be used by qualified personnel for the respective assigned task, in compliance with the documentation relating to the task, and especially with the safety warnings and the precautions contained therein. By virtue of their training and experience, qualified personnel can recognize the risks related to the use of this product and avoid possible dangers.

⚠DISCLAIMER

We have checked that the contents of this documentation correspond to the hardware and software described. However, since we cannot rule out any differences, we cannot guarantee a perfect match. However, the content of this documentation is periodically checked and any corrections or changes are inserted in subsequent editions.

⚠WARNING

- ***Do not apply different voltages or higher voltages than indicated between terminals, or between any terminal and earth (voltages greater than 50Vdc)***
- ***Do not use the calibrator if damaged, or if signs of possible damage are visible on it.***
- ***Do not remove the internal battery.***
- ***Do not use the calibrator if it runs abnormally.***
- ***Use the reset button if there is an anomaly in the operation.***
- ***Do not touch the calibrator terminals during use***
- ***To carry out the measurements, use the cables supplied or anyway adequate for the measurements to be taken.***
- ***Select the appropriate range for the desired measurement or generation.***

⚠CAUTION

- ***Make sure the internal battery is charged if you intend to use the calibrator without power from the USB port***
- ***Use the calibrator as described in this manual.***
- ***Before each measurement or generation, refer to the electrical connections shown in the manual.***
- ***Do not use the calibrator in environments containing combustible/explosive dust, gas or vapour.***

The MSC calibrator has been designed according to EN 6101-1 standards

5. DESCRIPTION

The MSC calibrator is a portable multi-function instrument for the generation and measurement of signals commonly found in automation systems.
It was designed to help professionals who have to verify and develop signal processing equipment connected to automatic control devices.
Unlike what the market offers, the MSC calibrator combines simulations and measurements in one instrument through an intuitive and modern interface.

The MSC multifunction process calibrator is a hand-held instrument, powered by rechargeable batteries, used to measure and generate electrical quantities.

Calibrator also has the following characteristics:

- Input/output terminal for thermocouples (TC) and isothermal internal block with automatic temperature compensation of the reference junction.
- 4 standard 4 mm diameter bushings for 2-3-4 wire sizes. Protection against overvoltages up to 250 Vac.
- Ethernet and Wi-Fi connection.
- Management of universal signals (analog, digital, pulse, electrical, weight, temperature)
- High accuracy class: 0.05% basic class for each type of input/output.
- Micro USB connector for power supply.
- Ethernet port and Wi-Fi for connection to PCs or mobile devices
- Modbus TCP-IP protocol supported
- Colour touch screen

The analog signals managed both in measurement and generation are:

- mA (dc) current
- V, mV (dc) voltage
- Thermocouples, two/three or four-wire heating elements
- 350 Ω bridge extensometer (LOAD CELL)

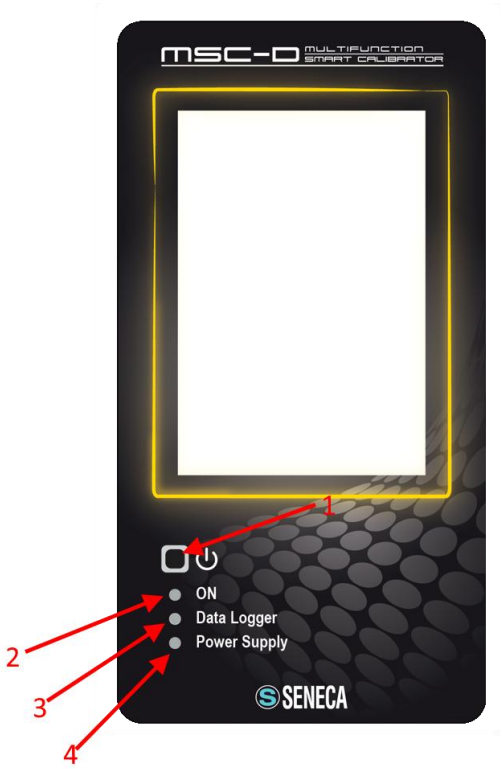
The following are also managed:

- Pulse generation with duration, voltage amplitude and variable duty cycle
- Pulse measurement with adjustable threshold
- Frequency measurement and generation

The device is protected against damage due to incorrect connections such as short circuits and overvoltages applied to the inputs (e.g. 230 Vac).
The device supports the industrial Modbus TCP-IP protocol and can therefore be controlled via Ethernet or Wi-Fi from machines external to the device.
Also via the Ethernet or Wi-Fi port it is also possible to connect multiple calibrators to the devices and control them individually.

5.1. LEDS, BUTTONS, PORTS AND BUSHINGS

5.1.1. ON/OFF BUTTON AND LED



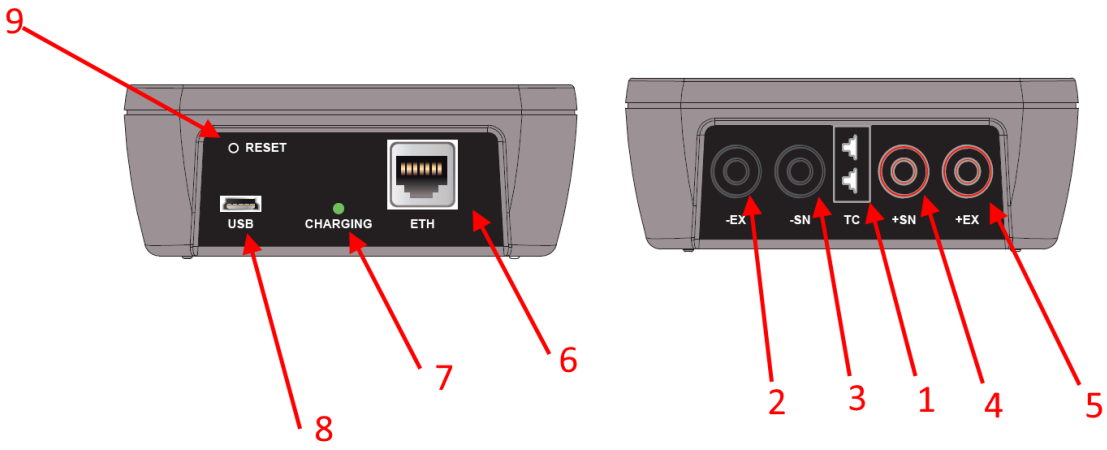
1 Power button, press the button until the screen lights up and then release.
Press again for a few seconds to turn off the calibrator.

2 Device Power LED

3 Active datalogger LED

4 External Power Supply LED

5.1.2. PORTS, SOCKETS AND BUSHINGS



1 Socket for thermocouple measurement/generation

2 Measurement/generation bushing -EX

3 Measurement/generation bushing -SN

4 Measurement/generation bushing +SN

5 Measurement/generation bushing +EX

6 10/100Mbit Ethernet port

7 LED status of internal battery charging, it lights up if the battery is charging, it turns off if charging is complete

8 Micro USB connector for power supply

9 Reset button

6. USER GUIDE

The calibrator is a device that can measure or generate electrical quantities to test devices.
To proceed with the correct use of the instrument, make sure to follow the following steps:

- Turn on the device.
- Wait at least 5 minutes for the appliance temperature to stabilize.
- Connect the cables correctly, according to the type of measurement or generation to be carried out: refer to the connection diagrams.

It is however necessary, before use, to make sure that the battery is fully charged so as to guarantee its life of the generations or measurements that will be carried out. Before each use it is advisable to recharge the instrument using the USB cable supplied, until the LED battery charge indicator on the bottom of the calibrator goes off.
The calibrator can maintain the signals to be generated (set by the user) within a determined error range.
During generation, the calibrator will constantly check the generated signal, warning about any generation error (where provided for).

⚠CAUTION

The calibrator is protected against the risk of applying temporary overvoltages. However, it is good to remember that in this case the device needs 15-20 minutes to restore the normal conditions. If this period of time is not observed, the accuracy of the measurements and/or generations cannot be guaranteed.

⚠CAUTION

Since the negative of the MSC-D device is not at the same potential as the negative of the USB port, it is not advisable to connect it to the USB port of a PC, since this working condition may interfere with the correct operation of the calibrator.

7. USING THE DISPLAY

The display is equipped with capacitive touch and allows access to the device's functions.

7.1. Home screen

The home screen is as follows:

Where:

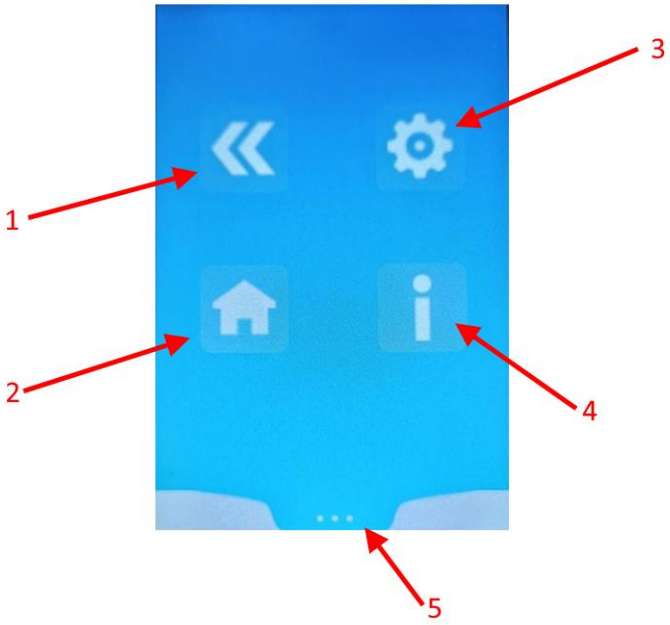
1 Icon of the type of port enabled between Ethernet, Wi-Fi Station or Wi-Fi Access Point
2 Icon with the battery charge level
3 Button for the signal measurement function menu
4 Button for the signal generation function menu
5 Scrolling menu

In addition to this, there is some basic information about the device.

7.1.1. THE SCROLLING MENU

The scrolling menu is always present in the device pages:

Once pressed, it allows you to select the following icons:



Where:

1 Returns to the previous screen
2 Returns to the main screen
3 Enters the options (the options change depending on the screen)
4 Displays the connection information (depending on the type of generation / measurement being performed)
5 Closes the scrolling menu

8. MAIN MENU

The main menu can be accessed from the calibrator's main page by pressing the scrolling menu button:

And then by pressing the  icon

The menu allows you to select 3 different categories of configurations:

8.1. GENERAL SETTINGS

Groups the following general settings:

LANGUAGE
Allows you to choose the interface language

ENABLE ERROR SOUND ALARM
Enables or disables the sound alarm in the event of a measurement/generation error

ENABLE BATTERY SOUND ALARM
Enables or disables the sound alarm in the event of a low battery

ENABLE SOUND DURING SWITCH-ON
Enables or disables the emission of a sound during switch-on

TYPE OF SWITCH-ON
Allows you to select whether the switch-on is Portable or Automatic.
In the case of Portable switch-on, even if external power is supplied, the device will not switch on unless the appropriate button is pressed. To switch off, you must also press the appropriate button.
In the case of Automatic switch-on, the device will switch on automatically once the power cable is inserted and will switch off once the external power is disconnected (to be used on automatic testing machines).

USE ROTARY MEMORY BUFFER
When using the datalogger the device saves the data in an internal memory, once finished the instrument can overwrite (rotary buffer ON) or not (rotary buffer OFF) the data on the recordings already made.

BRIGHTNESS
Sets the screen brightness, the higher the brightness the shorter the battery life.

ENABLE AUTO POWER OFF
This function allows you to set a time after which, if there are no interactions with the screen, the instrument will automatically turn off.

DATALOGGER SAMPLING TIME
Sets the datalogger sampling time

TEMPERATURE MEASUREMENT UNIT
Selects the temperature measurement unit

DISPLAY OFF

Selects the time in minutes after which the screen turns off if it has not been touched. Once the screen is off, to turn it back on just touch it. This parameter is important for battery life.

REMOTE CONTROL

Allows you to enable or disable the remote control function from the device's web server.
When the remote control function is active, it is not possible to modify the generation or measurement of signals locally; when the function is deactivated, it is not possible to modify the generation or measurement of signals locally. The basic functions of the web server (firmware update, configuration and download of log files) are, however, always available.

8.2. ETH. SETTINGS

Allows you to set the configuration of the Ethernet port

⚠CAUTION

The Ethernet port and WIFI port cannot be enabled at the same time

Ethernet Enabled
Enables or disables the Ethernet port

DHCP
Enables the DHCP client to retrieve the IP address automatically, if disabled the IP is static and it is possible to set the parameters:

IP
IP static address of the Ethernet port

MASK
Mask of the Ethernet port

GW
Ethernet port Gateway

DNS
Ethernet port Domain Name System

8.3. WI-FI SETTINGS

Allows you to set the configuration of the WI-FI port

⚠CAUTION

The Ethernet port and WIFI port cannot be enabled at the same time

The calibrator's Wi-Fi port can be configured in Wi-Fi "Station" and Wi-Fi "Access Point" modes.
In Station mode, the Wi-Fi port connects to an existing Wi-Fi router (access point).
In Access Point mode, the Wi-Fi port accepts connections from other devices, allowing Wi-Fi connections from devices such as PCs or mobile devices equipped with Wi-Fi.

8.4. WI-FI STATION

It allows the calibrator to connect to an existing Wi-Fi network through a router set in access point mode. When the mode is activated, it is possible to manually enter the configuration of the router to connect to.

8.5. WI-FI ACCESS POINT

It allows the creation of a new Wi-Fi network to which Wi-Fi devices such as PCs or tablets, cell phones etc. can be connected.
The calibrator's IP address is:

192.168.4.1

8.6. WI-FI SCAN

When the Station or Access Point mode is activated, it is possible to scan the network to connect the device to an existing Wi-Fi network.
Press the "SCAN" button and wait for the found networks to be displayed. Then enter the network password (the other parameters are automatically retrieved).
At this point the calibrator will restart in Wi-Fi Station mode and connect to the indicated network.

⚠CAUTION

It is not possible to activate WI-FISCAN mode without first activating the WI-FI port in Station or Access Point mode

8.7. RTC SETTINGS

Allows you to set the date and time of the device to be used for the datalogger's time tag.

8.8. FACTORY SETTINGS

Resets all configuration parameters to default.

9. CALIBRATOR FUNCTIONS

MEASUREMENT FUNCTIONS:

The MSC calibrator allows measuring the following signals:

- Passive current (with power supplied externally to the calibrator)
- Active current (with power supplied by the calibrator)
- Voltage 0 V/ +27 V
- Voltage -10 mV/ +90 mV
- Thermocouple
- Thermoresistance
- Load cell (strain gauge)
- Frequency/pulses

GENERATION FUNCTIONS

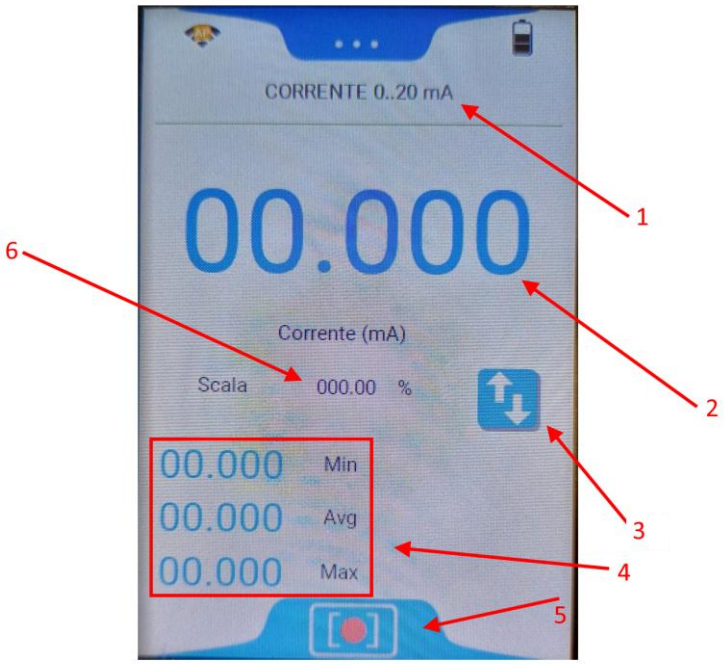
The MSC calibrator allows generating the following signals:

- Passive current (with power supplied externally to the calibrator)
- Active current (with power supplied by the calibrator)
- Voltage 0 V/ +27 V
- Voltage -10 mV/ +90 mV
- Thermocouple
- Thermoresistance
- Load cell
- Frequency/pulses

9.1. HOW THE CALIBRATOR WORKS AS A SIGNAL METER

9.1.1. CHECKS COMMON TO ALL MEASUREMENTS

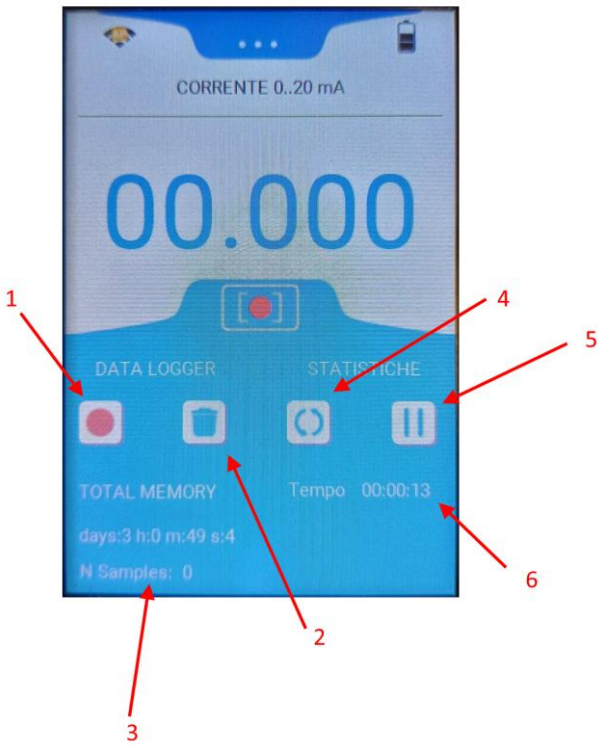
The following are the checks that are common to all measurements:



Where:

1 Type of measurement
2 Primary measured value
3 Button to switch between primary and secondary measurement
4 Minimum average maximum statistical values
5 Datalogger/Statistics menu button
6 Secondary measured value

Pressing the Datalogger/Statistics menu button gives:



Where:

1 Start/Stop button of the data logger
2 Button to delete all logs in the memory
3 Display of the statistics of the data logger
4 Resets the Minimum Average Maximum values
5 Pauses or restarts the calculation of the Minimum Average Maximum values

In all measurements by pressing the button:

It is possible to press the  icon and access a whole series of configuration parameters relating to the measurement in use such as the measurement filtering setting, the type of cold junction etc.

⚠ATTENTION!

Wait until the device reaches a stable thermal condition before taking measurements with the thermocouples (typically at least 30 minutes).

⚠ATTENTION!

If the thermocouple does not have its own connector, use the innermost bushings SN+ SN- as an alternative, bearing in mind that the compensation of the cold junction in this case may be less precise.

⚠ATTENTION!

The 4-wire measurement of the load cell is influenced by the resistance of the conductors supplying it. If it is not possible to shorten the connections between the load cell and the MSC calibrator, by measuring the resistance only of the conductors that supply the load cell (conductors +EX and -EX), the correction coefficient can be calculated:

$$K = \frac{350 + R_{+EX} + R_{-EX}}{350}$$

The obtained coefficient must be multiplied with the value measured by the calibrator to obtain the real value.

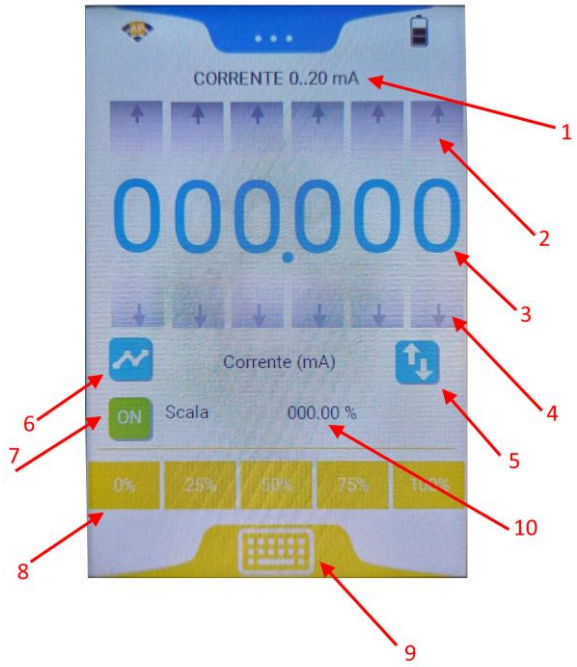
9.1.2. DATALOGGER

The calibrator allows you to perform recording sessions using the appropriate button as already described.
The minimum acquisition time is 1 second.
The download of the datalogger file in csv text format is possible via the appropriate webserver page.

9.2. OPERATION OF THE CALIBRATOR AS A SIGNAL GENERATOR

9.2.1. CHECKS COMMON TO ALL GENERATIONS

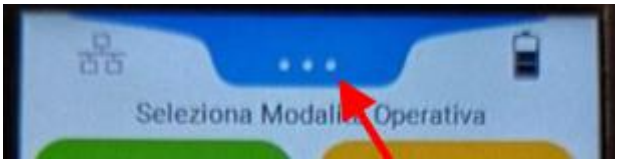
The following are the checks that are common to all generations:



Where:

1 Generation type
2 Buttons to increase the value of the single digit
3 Output generated value
4 Buttons to decrease the value of the single digit
5 Button to switch between primary and secondary generation value
6 Ramp menu
7 Enables or disables the output
8 Quick keys to generate the output in percentage
9 Keyboard to enter the value to generate
10 Secondary value generated

In all generations by pressing the button:



You can press the  icon and access a whole series of configuration parameters relating to the generation in use.

⚠ATTENTION!

It is important to note that in frequency generation the time resolution according to which the square wave signal is generated is 50 µs.

This implies an error that is dependent on the numeric value set.

For instance, you want to generate a signal with a frequency of 150 Hz whose corresponding period is 6,666 ms; the number of counts necessary to obtain this frequency is obtained through:

6,666 MHz /50 µs=133.33

The system then rounds off to the nearest whole number (133) which it will use to generate the output signal.

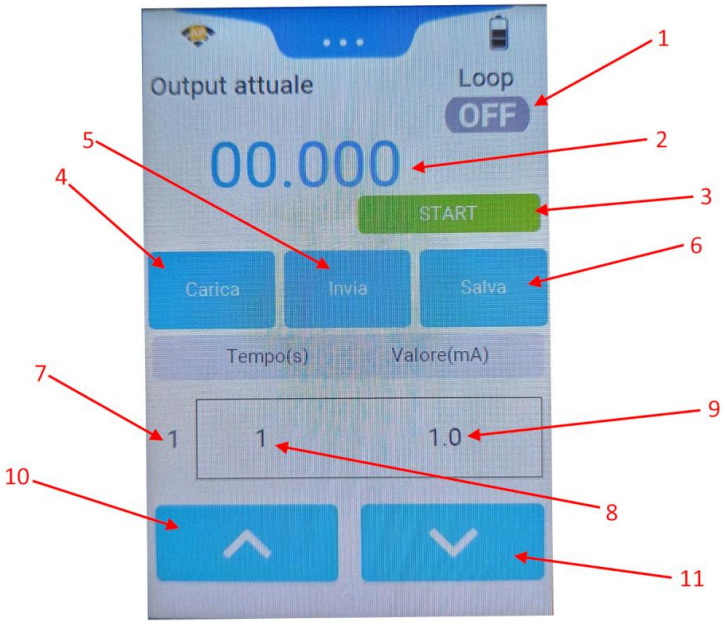
The output frequency will have the value:

$$Fout = \frac{1}{133 * 50\ \mu s} = 150.37\ Hz$$

The firmware will automatically show the value actually generated.

9.2.2. THE RAMP GENERATOR

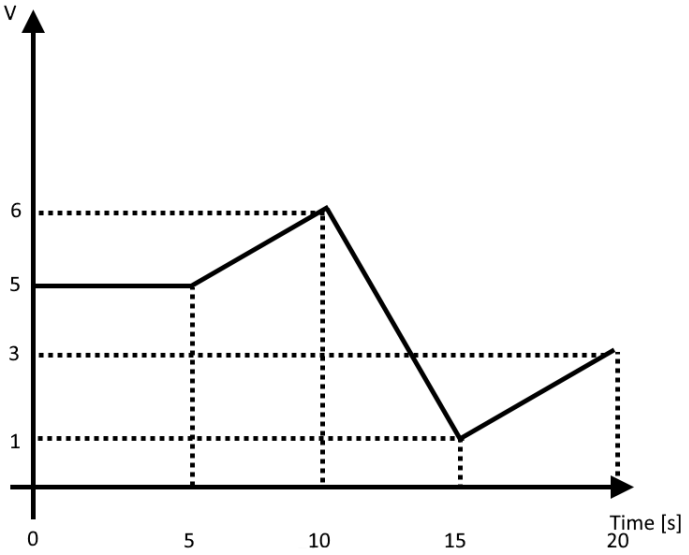
The calibrator allows you to generate ramps through the interface described here



Where:

1 Activates or deactivates the ramp loop (if OFF once the ramp is finished it does not restart automatically)
2 Currently generated value
3 Start/Stop ramp
4 Loads a ramp configuration from a previously saved file
5 Sends the current ramp configuration to the motherboard
6 Saves the current ramp configuration to a file
7 N-th ramp point
8 Time in seconds
9 Value that the output value must take on
10 Previous ramp point
11 Next ramp point

For example, we want to generate a voltage ramp of the type:



We then enter the coordinates of the points, the starting point of the ramp (time = 0) has the value of 5 V, we then enter point 1 with time = 0s, Value = 5V

After 5 seconds the value is stable at 5V so we enter time = 5s, value = 5V

After another 5 seconds the value goes from 6V so we enter time = 5s, value = 6V until we obtain the following table:

Point Number	*Time [s]*	*Value [V]*
1	0	5
2	5	5
3	5	6
4	5	1
5	5	3

Now we can save this ramp in the file from 1 to 5 so that we can load it in the future with the “Save” button.

Now we send the ramp to the motherboard with the “Send” button.

At this point we are ready to generate the ramp with the “Start” button.

To repeat the execution of the same ramp it is not necessary to send the ramp to the motherboard again but it will be enough to press the “Start” button again.

10. THE WEBSERVER

The calibrator has a webserver that allows you to:

- Control and configure the calibrator remotely
- Download the data from the datalogger in CSV text format
- Update firmware

10.1. LOCAL/REMOTE CONTROL OF THE CALIBRATOR

The webserver allows you to remotely control and configure the generator using a web browser. Using Wi-Fi, for example, you can control the calibrator from a mobile phone.

The graphic interface is similar to that of the display and allows the same functions.
To control the calibrator remotely, you need to set the “Remote Control” parameter in the “General Settings” menu to “ON”.

⚠CAUTION

It is not possible to control the calibrator simultaneously from the local display and from the webserver.
If the “Remote Control” parameter is “ON” the message “REMOTE MODE” appears on the initial page of the display. To restore the display operation, it is necessary to return the “Remote Control” parameter to “OFF”.

10.2. ACCESS TO THE WEB SERVER

To access the webserver, you need to know the IP address of the device and have a web browser (for example Chrome).

In the case of connection via ethernet port with the default address, access to the webserver occurs at the address:

http://192.168.90.101

In case of connection via Wi-Fi port with the calibrator in Access Point mode, the calibrator web server address is:

http://192.168.4.1

In the case of connection via Wi-Fi port with the calibrator in Station mode, the IP address is typically provided by the router's DHCP server. To find out the set IP address, access the WI-FI Station menu of the display's main menu.

Once you have accessed the webserver, when prompted for the user name and password, enter:

User name: admin
Password: admin

11. MEASUREMENT AND GENERATION ERRORS

The calibrator can detect errors both in generation and measurement of a signal.
The table shows the types of errors detected:

TYPE OF ERROR	*MEANING*
Generation error	The set generation is not guaranteed within the declared error
Measurement error	The measured signal is out of range

An error is also detected when the externally generated loop voltage exceeds 29 V.

12. ETHERNET PORT

The factory configuration of the Ethernet port is:

STATIC IP: 192.168.90.101
SUBNET MASK: 255.255.255.0
GATEWAY: 192.168.90.1

Multiple devices must not be inserted on the same network with the same static IP.

⚠ ATTENTION!

DO NOT CONNECT 2 OR MORE FACTORY-CONFIGURED DEVICES ON THE SAME NETWORK, OR THE DEVICE WILL NOT WORK
(CONFLICT OF IP ADDRESSES 192.168.90.101)

13. FIRMWARE UPDATE

In order to improve, add or optimize the functions of the product, Seneca releases firmware updates on the device section on the www.seneca.it website.

The firmware update is performed via the webserver.

⚠ ATTENTION!

IN ORDER NOT TO DAMAGE THE DEVICE, THE BATTERIES MUST BE CHARGED AND THE EXTERNAL POWER SUPPLY MUST BE PRESENT.

It is possible to update both the display board firmware and the motherboard firmware.

The display board firmware update can be done directly from the webserver, the motherboard update is done via a command sent from the webserver and then connecting the USB port of the device to a software on the PC.

14. SUPPORTED MODBUS COMMUNICATION PROTOCOLS

The Modbus communication protocols supported are:

- Modbus TCP-IP Server (from Ethernet port or Wi-Fi) with support for up to 8 remote Modbus TCP-IP Clients

For more information on these protocols, see the website:
http://www.modbus.org/specs.php.

14.1. SUPPORTED MODBUS FUNCTION CODES

The following Modbus functions are supported:

- Read Holding Registers (function 3)
- Write Single Register (function 6)
- Write Multiple Registers (function 16)

ATTENTION!

All 32-bit variables are contained in 2 consecutive Modbus registers

All 64-bit variables are contained in 4 consecutive Modbus registers

15. INFORMATION ABOUT MODBUS REGISTERS

The following abbreviations are used in the following chapter:

MS	Most Significant
LS	Least Significant
MSBIT	Most Significant Bit
LSBIT	Least Significant Bit
MMSW	“Most” Most Significant Word (16bit)
MSW	Most Significant Word (16bit)
LSW	Least Significant Word (16bit)
LLSW	“Least” Least Significant Word (16bit)
RO	Read Only
RW*	Read-Write: REGISTERS CONTAINED IN FLASH MEMORY: WRITABLE ABOUT 10,000 TIMES MAXIMUM
RW**	Read-Write: REGISTERS THAT CAN BE WRITTEN ONLY AFTER WRITING THE COMMAND "ENABLE WRITE CUSTOM ENERGIES = 49616"
UNSIGNED 16 BIT	Unsigned integer register that can assume values from 0 to 65535
SIGNED 16 BIT	Signed integer register that can take values from -32768 to +32767
UNSIGNED 32 BIT	Unsigned integer register that can assume values from 0 to 4294967296
SIGNED 32 BIT	Signed integer register that can take values from -2147483648 to 2147483647
UNSIGNED 64 BIT	Unsigned integer register that can assume values from 0 to 18.446.744.073.709.551.615
SIGNED 64 BIT	Signed integer register that can assume values from -2^63 to 2^63-1
FLOAT 32 BIT	32-bit, single-precision floating-point register (IEEE 754) https://en.wikipedia.org/wiki/IEEE_754
BIT	Boolean register, which can take the values 0 (false) or 1 (true)

15.1. NUMBERING OF "0-BASED" OR "1-BASED" MODBUS ADDRESSES

According to the Modbus standard the Holding Registers are addressable from 0 to 65535, there are 2 different conventions for numbering the addresses: "0-BASED" and "1-BASED".
For greater clarity, Seneca shows its register tables in both conventions.

ATTENTION!

CAREFULLY READ THE DOCUMENTATION OF THE MODBUS MASTER DEVICE IN ORDER TO UNDERSTAND WHICH OF THE TWO CONVENTIONS THE MANUFACTURER HAS DECIDED TO USE
SENECA USES THE "1 BASED" CONVENTION FOR ITS PRODUCTS

15.2. NUMBERING OF MODBUS ADDRESSES WITH "0-BASED" CONVENTION

The numbering is:

HOLDING REGISTER MODBUS ADDRESS (OFFSET)	*MEANING*
0	FIRST REGISTER
1	SECOND REGISTER
2	THIRD REGISTER
3	FOURTH REGISTER
4	FIFTH REGISTER

Therefore, the first register is at address 0.
In the following tables, this convention is indicated with ***"ADDRESS OFFSET".***

15.3. NUMBERING OF MODBUS ADDRESSES WITH "1 BASED" CONVENTION (STANDARD)

The numbering is that established by the Modbus consortium and is of the type:

HOLDING REGISTER MODBUS ADDRESS 4x	*MEANING*
40001	FIRST REGISTER
40002	SECOND REGISTER
40003	THIRD REGISTER
40004	FOURTH REGISTER
40005	FIFTH REGISTER

This convention is indicated with ***"ADDRESS 4x"*** since a 40000 is added to the address so that the first Modbus register is 40001.
A further convention is also possible where the number 4 is omitted in front of the register address:

HOLDING MODBUS ADDRESS WITHOUT 4x	*MEANING*
1	FIRST REGISTER
2	SECOND REGISTER
3	THIRD REGISTER
4	FOURTH REGISTER
5	FIFTH REGISTER

15.4. BIT CONVENTION WITHIN A MODBUS HOLDING REGISTER

A Modbus Holding Register consists of 16 bits with the following convention:

BIT 15	BIT 14	BIT 13	BIT 12	BIT 11	BIT 10	BIT 9	BIT 8	BIT 7	BIT 6	BIT 5	BIT 4	BIT 3	BIT 2	BIT 1	BIT 0

For instance, if the value of the register in decimal is
12300
the value 12300 in hexadecimal is:
0x300C

the hexadecimal 0x300C in binary value is:
11 0000 0000 1100

So, using the above convention, we get:

BIT 15	BIT 14	BIT 13	BIT 12	BIT 11	BIT 10	BIT 9	BIT 8	BIT 7	BIT 6	BIT 5	BIT 4	BIT 3	BIT 2	BIT 1	BIT 0
0	0	1	1	0	0	0	0	0	0	0	0	1	1	0	0

15.5. MSB and LSB BYTE CONVENTION WITHIN A MODBUS HOLDING REGISTER

A Modbus Holding Register consists of 16 bits with the following convention:

BIT 15	BIT 14	BIT 13	BIT 12	BIT 11	BIT 10	BIT 9	BIT 8	BIT 7	BIT 6	BIT 5	BIT 4	BIT 3	BIT 2	BIT 1	BIT 0

LSB Byte (Least Significant Byte) defines the 8 bits ranging from Bit 0 to Bit 7 included, we define MSB Byte (Most Significant Byte) the 8 bits ranging from Bit 8 to Bit 15 inclusive:

BIT 15	BIT 14	BIT 13	BIT 12	BIT 11	BIT 10	BIT 9	BIT 8	BIT 7	BIT 6	BIT 5	BIT 4	BIT 3	BIT 2	BIT 1	BIT 0
BYTE MSB								BYTE LSB							

15.6. REPRESENTATION OF A 32-BIT VALUE IN TWO CONSECUTIVE MODBUS HOLDING REGISTERS

The representation of a 32-bit value in the Modbus Holding Registers is made using 2 consecutive Holding Registers (a Holding Register is a 16-bit register). To obtain the 32-bit value it is therefore necessary to read two consecutive registers:
For example, if register 40064 contains the 16 most significant bits (MSW) while register 40065 contains the least significant 16 bits (LSW), the 32-bit value is obtained by composing the 2 registers:

BIT 15	BIT 14	BIT 13	BIT 12	BIT 11	BIT 10	BIT 9	BIT 8	BIT 7	BIT 6	BIT 5	BIT 4	BIT 3	BIT 2	BIT 1	BIT 0
40064 MOST SIGNIFICANT WORD															

BIT 15	BIT 14	BIT 13	BIT 12	BIT 11	BIT 10	BIT 9	BIT 8	BIT 7	BIT 6	BIT 5	BIT 4	BIT 3	BIT 2	BIT 1	BIT 0
40065 LEAST SIGNIFICANT WORD															

$$Value_{32bit} = Register_{LSW} + (Register_{MSW} * 65536)$$

In the reading registers it is possible to swap the most significant word with the least significant word, therefore it is possible to obtain 40064 as LSW and 40065 as MSW.

16. MANAGING MSC-D FROM MODBUS REGISTERS

⚠CAUTION

To control the calibrator from Modbus registers, the "Remote Control" parameter must be set to "ON" and the webserver must be disconnected and not interacting with the device.

16.1. DESCRIPTION

The MSC product has Modbus registers that allow you to control the device and read or generate electrical quantities.
The protocol supported by MSC is Modbus TCP-IP server.
The purpose of this chapter is to provide information for the complete control of MSC so that it can be integrated into third-party software.
For .NET developers, various libraries for the Modbus protocol are available.
An example, the Open Source Modbus library is available at this address:

https://github.com/NModbus/NModbus

16.2. USE OF MSC TO TAKE MEASUREMENTS

16.2.1. MEASUREMENT MIN/MAX/AVG VALUES

To reset the Min/Max/Avg values, write the value 5 on CMD register
To pause the Min/Max/Avg values write the value 10 in the CMD register

REGISTER ADDRESS	*REGISTER (OFFSET)*	*REGISTER NAME*	*REGISTER TYPE*
40108	107	CMD	16 bit without a sign

16.2.2. DATALOGGER

It is possible to control the datalogger start/stop in this way:

COMMAND	*AUX1 REGISTER WRITING VALUE*	*CMD REGISTER WRITING VALUE*
DATALOGGER START	1	3
DATALOGGER STOP	0	3

REGISTER ADDRESS	*REGISTER (OFFSET)*	*REGISTER NAME*	*REGISTER TYPE*
40108	107	CMD	16 bit without a sign
40109	108	AUX1	16 bit without a sign

REGISTER ADDRESS	*REGISTER (OFFSET)*	*VARIABLE*	*VARIABLE TYPE*	*Unit of Measure*
40195-196	194-195	Dimensions of the datalogger file in bytes	32 bit without a sign	Byte

16.2.3. DIAGNOSTICS REGISTER FOR MEASUREMENTS

The reading diagnostics register is:

REGISTER ADDRESS	*REGISTER (OFFSET)*	*VARIABLE*	*VARIABLE TYPE*	*Unit of Measure*
40103	102	Diagnostics	16 bit without a sign	-

The bit indicating a measurement error is

BIT 16	BIT 15	BIT 14	BIT 13	BIT 12	BIT 11	BIT 10	BIT 9	BIT 8	BIT 7	BIT 6	BIT 5	BIT 4	BIT 3	BIT 2	BIT 1
-	-	MEASUREMENT ERROR	-	-	-	-	-	-	-	-	-	-	-	-	-

Where if the MEASUREMENT ERROR bit:
is 1 -> Measurement error
is 0 -> Measurement OK

16.2.4. CURRENT/VOLTAGE MEASUREMENTS

The type of measurement is selected by writing the AUX1 register followed by the CMD register

REGISTER ADDRESS	*REGISTER (OFFSET)*	*REGISTER NAME*	*REGISTER TYPE*
40108	107	CMD	16 bit without a sign
40109	108	AUX1	16 bit without a sign

The values to write in the registers for the different types of measurement are:

TYPE OF MEASUREMENT	*AUX1 REGISTER WRITING VALUE*	*CMD REGISTER WRITING VALUE*
CURRENT PASSIVE MEASUREMENT 0..20 mA	1	1
CURRENT ACTIVE MEASUREMENT 0..20 mA	2	1
VOLTAGE 0..27 V	3	1
VOLTAGE -10..90 mV	4	1

Reading registers:

REGISTER ADDRESS	*REGISTER (OFFSET)*	*VARIABLE*	*VARIABLE TYPE*	*Unit of Measure*
40137-40138	136-137	Measurement value	Floating Point	mA / V / mV
40133-40134	132-133	Minimum value	Floating Point	mA / V / mV
40135-40136	134-135	Maximum value	Floating Point	mA / V / mV
40171-40172	170-171	Medium value	Floating Point	mA / V / mV

16.2.5. THERMOCOUPLE MEASUREMENTS

The type of thermocouple is selected by writing the AUX1 register followed by the CMD register

REGISTER ADDRESS	*REGISTER (OFFSET)*	*REGISTER NAME*	*REGISTER TYPE*
40108	107	CMD	16 bit without a sign
40109	108	AUX1	16 bit without a sign

The values to write in the registers to select the type of thermocouple are:

THERMOCOUPLE TYPE	*AUX1 REGISTER WRITING VALUE*	*CMD REGISTER WRITING VALUE*
J	5	1
K	6	1
T	7	1
E	8	1
L	9	1
N	10	1
R	11	1
S	12	1
B	13	1

Reading registers:

REGISTER ADDRESS	*REGISTER (OFFSET)*	*VARIABLE*	*VARIABLE TYPE*	*Unit of Measure*
40137-40138	136-137	Temperature	Floating Point	°C
40117-40118	116-117	Cold junction voltage	Floating Point	mV
40127-40128	126-127	Cold junction temperature	Floating Point	°C
40133-40134	132-133	Minimum temperature	Floating Point	°C
40135-40136	134-135	Maximum temperature	Floating Point	°C
40171-40172	170-171	Average temperature	Floating Point	°C

16.2.6. RESISTOR E TEMPERATURE METER

The type of resistance thermometer is selected by writing the AUX1 register followed by the CMD register

REGISTER ADDRESS	*REGISTER (OFFSET)*	*REGISTER NAME*	*REGISTER TYPE*
40108	107	CMD	16 bit without a sign
40109	108	AUX1	16 bit without a sign

The values to write in the registers to select the type of resistance thermometer are:

RESISTANCE TEMPERATURE METER	*AUX1 REGISTER WRITING VALUE*	*CMD REGISTER WRITING VALUE*
PT100 2 WIRES	14	1
PT100 3 WIRES	15	1
PT100 4 WIRES	16	1
PT500 2 WIRES	17	1
PT500 3 WIRES	18	1
PT500 4 WIRES	19	1
PT1000 2 WIRES	20	1
PT1000 4 WIRES	22	1
PT1000 4 WIRES	22	1
PT1000 4 WIRES	22	1
CU50 2 WIRES	23	1
CU50 3 WIRES	24	1
CU50 4 WIRES	25	1
CU100 2 WIRES	26	1
CU100 3 WIRES	27	1
CU100 4 WIRES	28	1
NI100 2 WIRES	29	1
NI100 3 WIRES	30	1
NI100 4 WIRES	31	1
NI120 2 WIRES	32	1
NI120 3 WIRES	33	1
NI120 4 WIRES	34	1

Reading registers:

REGISTER ADDRESS	*REGISTER (OFFSET)*	*VARIABLE*	*VARIABLE TYPE*	*Unit of Measure*
40137-40138	136-137	Temperature	Floating Point	°C
40131-40132	130-131	Resistance	Floating Point	Ohm
40133-40134	132-133	Minimum temperature	Floating Point	°C
40135-40136	134-135	Maximum temperature	Floating Point	°C
40171-40172	170-171	Average temperature	Floating Point	°C

16.2.7. LOAD CELL MEASUREMENT

The type of load cell measurement is selected by writing the AUX1 register followed by the CMD register

REGISTER ADDRESS	*REGISTER (OFFSET)*	*REGISTER NAME*	*REGISTER TYPE*
40108	107	CMD	16 bit without a sign
40109	108	AUX1	16 bit without a sign

The values to write in the registers to select the type of load cell measurement are:

TYPE OF MEASUREMENT	*AUX1 REGISTER WRITING VALUE*	*CMD REGISTER WRITING VALUE*
LOAD CELL MEASUREMENT	35	1

The measurement is expressed in mV/V and is only gross (tare + net weight):

Reading registers:

REGISTER ADDRESS	*REGISTER (OFFSET)*	*VARIABLE*	*VARIABLE TYPE*	*Unit of Measure*
40137-40138	136-137	Cell unbalance measurement	Floating Point	mV/V

If the cell is completely unbalanced the measurement is 2 mV/V so the gross weight coincides with the full scale of the cell.

The gross weight can then be calculated according to the formula:

Gross Weight [Kg] = (Cell Full Scale [Kg] * Cell Unbalance Measurement [mV/V]) / 2

For example, if the load cell has a full scale of 100 kg and the unbalance measurement is 1 mV/V you will have:

Gross Weight [Kg] = (100 Kg * 1 mV/V) / 2 = 50 Kg

16.2.8. FREQUENCY MEASUREMENT

The type of frequency measurement is selected by writing the AUX1 register followed by the CMD register

REGISTER ADDRESS	*REGISTER (OFFSET)*	*REGISTER NAME*	*REGISTER TYPE*
40108	107	CMD	16 bit without a sign
40109	108	AUX1	16 bit without a sign

The values to write in the registers to select the type of load cell measurement are:

TYPE OF MEASUREMENT	*AUX1 REGISTER WRITING VALUE*	*CMD REGISTER WRITING VALUE*
LOAD CELL MEASUREMENT	36	1

Reading registers:

REGISTER ADDRESS	*REGISTER (OFFSET)*	*VARIABLE*	*VARIABLE TYPE*	*Unit of Measure*
40165-166	164-165	Frequency	Floating Point	Hz

16.2.9. PULSE NUMBER MEASUREMENT

The type of pulse measurement is selected by writing the AUX1 register followed by the CMD register

REGISTER ADDRESS	*REGISTER (OFFSET)*	*REGISTER NAME*	*REGISTER TYPE*
40108	107	CMD	16 bit without a sign
40109	108	AUX1	16 bit without a sign

The values to write in the registers to select the type of pulse measurement are:

TYPE OF MEASUREMENT	*AUX1 REGISTER WRITING VALUE*	*CMD REGISTER WRITING VALUE*
LOAD CELL MEASUREMENT	37	1

Reading registers:

REGISTER ADDRESS	*REGISTER (OFFSET)*	*VARIABLE*	*VARIABLE TYPE*	*Unit of Measure*
40153-154	152-153	Pulse number with Positive Fronts	32 bit without a sign	Pulse No.
40151-152	150-151	Pulse number with Negative Fronts	32 bit without a sign	Pulse No.

To reset the pulse value counted, write the value 5 in the CMD register
To pause the count of the pulses, write the value 10 in the CMD register

REGISTER ADDRESS	*REGISTER (OFFSET)*	*REGISTER NAME*	*REGISTER TYPE*
40108	107	CMD	16 bit without a sign

16.3. USE OF MSC TO GENERATE SIGNALS

16.3.1. DIAGNOSTICS REGISTER FOR GENERATIONS

The generation diagnostics register is:

REGISTER ADDRESS	*REGISTER (OFFSET)*	*VARIABLE*	*VARIABLE TYPE*	*Unit of Measure*
40103	102	Diagnostics	16 bit without a sign	-

The bit indicating a measurement error is

BIT 16	BIT 15	BIT 14	BIT 13	BIT 12	BIT 11	BIT 10	BIT 9	BIT 8	BIT 7	BIT 6	BIT 5	BIT 4	BIT 3	BIT 2	BIT 1
GENERATION ERROR	SELF-READING ERROR	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Where if:
The SELF-READING ERROR bit:
is 1 -> Self-reading error of the current generation
is 0 -> Generation OK

The GENERATION ERROR bit:
is 1 -> Generation error
is 0 -> Generation OK

16.3.2. CURRENT AND VOLTAGE GENERATION

The type of generation is selected by writing the AUX1 register followed by the CMD register

REGISTER ADDRESS	*REGISTER (OFFSET)*	*REGISTER NAME*	*REGISTER TYPE*
40208	207	CMD	16 bit without a sign
40209	208	AUX1	16 bit without a sign

The values to write in the registers for the different types of measurement are:

GENERATION TYPE	*AUX1 REGISTER WRITING VALUE*	*CMD REGISTER WRITING VALUE*
PASSIVE CURRENT 0..20 mA	101	1
ACTIVE CURRENT 0..20 mA	102	1
VOLTAGE 0..27 V	103	1
VOLTAGE -10..90 mV	104	1

Writing registers (the written value is generated to the terminals) for the currents:

REGISTER ADDRESS	*REGISTER (OFFSET)*	*VARIABLE*	*VARIABLE TYPE*	*Unit of Measure*
40137-40138	136-137	Current value to be generated	Floating Point	mA

Writing registers (the written value is generated to the terminals) for the voltages:

REGISTER ADDRESS	*REGISTER (OFFSET)*	*VARIABLE*	*VARIABLE TYPE*	*Unit of Measure*
40213-40214	212-2016	Voltage value to be generated	Floating Point	V / mV

16.3.3. THERMOCOUPLE SIGNAL GENERATION

Configuration of the cold junction:

COLD JUNCTION	*AUX1 REGISTER WRITING VALUE*	*AUX2 REGISTER WRITING VALUE*	*CMD REGISTER WRITING VALUE*
INSIDE MSC	2	1	2
OUTSIDE MSC	1	1	2

Where:

REGISTER ADDRESS	*REGISTER (OFFSET)*	*REGISTER NAME*	*REGISTER TYPE*
40209	208	AUX1	16 bit without a sign
40210	209	AUX2	16 bit without a sign
40208	207	CMD	16 bit without a sign

In case of manual cold junction compensation, it is possible to enter the compensation value in mV in the register:

REGISTER ADDRESS	*REGISTER (OFFSET)*	*VARIABLE*	*VARIABLE TYPE*	*Unit of Measure*
40241-40242	240-241	Manual cold junction value	Floating Point	mV

The type of thermocouple is selected by writing the AUX1 register followed by the CMD register

REGISTER ADDRESS	*REGISTER (OFFSET)*	*REGISTER NAME*	*REGISTER TYPE*
40208	207	CMD	16 bit without a sign
40209	208	AUX1	16 bit without a sign

The values to write in the registers to select the type of thermocouple are:

THERMOCOUPLE TYPE	*AUX1 REGISTER WRITING VALUE*	*CMD REGISTER WRITING VALUE*
J	105	1
K	106	1
T	107	1
E	108	1
L	109	1
N	110	1
R	111	1
S	112	1
B	113	1

Writing Registers of the value to be generated:

REGISTER ADDRESS	*REGISTER (OFFSET)*	*VARIABLE*	*VARIABLE TYPE*	*Unit of Measure*
40221-40222	220-221	Temperature to be generated	Floating Point	°C

16.3.4. RESISTANCE THERMOMETER SIGNAL GENERATION

The type of resistance thermometer is selected by writing the AUX1 register followed by the CMD register

REGISTER ADDRESS	*REGISTER (OFFSET)*	*REGISTER NAME*	*REGISTER TYPE*
40208	207	CMD	16 bit without a sign
40209	208	AUX1	16 bit without a sign

The values to write in the registers to select the type of resistance thermometer are:

RESISTANCE TEMPERATURE METER	*AUX1 REGISTER WRITING VALUE*	*CMD REGISTER WRITING VALUE*
PT100 2 WIRES	114	1
PT500 2 WIRES	117	1
PT1000 2 WIRES	120	1
CU50 2 WIRES	123	1
CU100 2 WIRES	126	1
NI100 2 WIRES	129	1
NI120 2 WIRES	132	1

Writing Registers of the value to be generated:

REGISTER ADDRESS	*REGISTER (OFFSET)*	*VARIABLE*	*VARIABLE TYPE*	*Unit of Measure*
40229-40230	228-229	Temperature	Floating Point	°C

16.3.5. LOAD CELL GENERATION

The type of load cell generation is selected by writing the AUX1 register followed by the CMD register

REGISTER ADDRESS	*REGISTER (OFFSET)*	*REGISTER NAME*	*REGISTER TYPE*
40208	207	CMD	16 bit without a sign
40209	208	AUX1	16 bit without a sign

GENERATION TYPE	*AUX1 REGISTER WRITING VALUE*	*CMD REGISTER WRITING VALUE*
LOAD CELL	135	1

The unbalance of the cell must be entered in the register:

REGISTER ADDRESS	*REGISTER (OFFSET)*	*VARIABLE*	*VARIABLE TYPE*	*Unit of Measure*
40215-40216	214-215	Cell unbalance	Floating Point	mV/V

To generate a value in Kg (gross), use the following relation:

Cell unbalance [mV/V] = (gross Kg to be generated * 2) / Cell Full Scale [Kg]

For example, if you want to simulate a load cell with 100 kg full scale and want to generate 25 gross kg, you will have:

Cell unbalance [mV/V] = (25 Kg * 2) / 100 Kg = 0.5 mV/V

16.3.6. FREQUENCY GENERATION

The type of frequency generation is selected by writing the AUX1 register followed by the CMD register

REGISTER ADDRESS	REGISTER (OFFSET)	REGISTER NAME	REGISTER TYPE
40208	207	CMD	16 bit without a sign
40209	208	AUX1	16 bit without a sign

GENERATION TYPE	AUX1 REGISTER WRITING VALUE	CMD REGISTER WRITING VALUE
FREQUENCY	136	1

The frequency value to generate is obtained by writing four registers:

REGISTER ADDRESS	REGISTER (OFFSET)	REGISTER NAME	REGISTER TYPE
40255-40256	254-255	TICK1	32 bit without a sign
40257-40258	256-257	TICK2	32 bit without a sign
40263-40264	262-263	% HIGH VOLTAGE	Floating Point 32 bit
40265-40266	264-265	% LOW VOLTAGE	Floating Point 32 bit

Where:

TEMP = Math.Round((20000/ Frequency to generate [Hz]),0)
TICK1 = Math.Floor(TEMP/2)
TICK2 = TEMP-TICK1
% HIGH VOLTAGE is the voltage percentage value of when the signal must be low (0.0 = 0%, 1.0 = 100%) referred to 27V (100%)
% LOW VOLTAGE is the voltage percentage value of when the signal must be low (0.0 = 0%, 1.0 = 100%) referred to 27V (100%)

COMMAND	AUX1 REGISTER WRITING VALUE	CMD REGISTER WRITING VALUE
GENERATION START	1	9

Example:
If you want to generate a 100 Hz frequency with 0-5V band:
TEMP = Math.Round((20000/ 100 [Hz]),0) = 200
TICK1 = Math.Floor(200/2) = 100
TICK2 = 200-100=100
% HIGH VOLTAGE = 0
% LOW VOLTAGE = 0.185

16.3.7. NUMBER OF PULSES GENERATION

The type of pulse generation is selected by writing the AUX1 register followed by the CMD register

REGISTER ADDRESS	*REGISTER (OFFSET)*	*REGISTER NAME*	*REGISTER TYPE*
40208	207	CMD	16 bit without a sign
40209	208	AUX1	16 bit without a sign

GENERATION TYPE	*AUX1 REGISTER WRITING VALUE*	*CMD REGISTER WRITING VALUE*
FREQUENCY	137	1

The number of pulses to generate is obtained by writing 5 registers:

REGISTER ADDRESS	*REGISTER (OFFSET)*	*REGISTER NAME*	*REGISTER TYPE*
40253-40254	252-253	PULSE No. (x2)	32 bit without a sign
40255-40256	254-255	TICK1	32 bit without a sign
40257-40258	256-257	TICK2	32 bit without a sign
40263-40264	262-263	% HIGH VOLTAGE	Floating Point 32 bit
40265-40266	264-265	% LOW VOLTAGE	Floating Point 32 bit

Where:

No. OF PULSES (x2) = Number of pulses to generate multiplied by 2
TICK1 = Duration of the High pulse in how many 50 ms
TICK2 = Duration of the Low pulse in how many 50 ms
% HIGH VOLTAGE is the voltage percentage value of when the signal must be low (0.0 = 0%, 1.0 = 100%) referred to 27V (100%)
% LOW VOLTAGE is the voltage percentage value of when the signal must be low (0.0 = 0%, 1.0 = 100%) referred to 27V (100%)

COMMAND	*AUX1 REGISTER WRITING VALUE*	*CMD REGISTER WRITING VALUE*
GENERATION START WITH LOW START	2	9
GENERATION START WITH HIGH START	3	9
PAUSE / START	4	9

The number of pulses still to generate is represented in the reading register:

REGISTER ADDRESS	*REGISTER (OFFSET)*	*REGISTER NAME*	*REGISTER TYPE*
40251-40252	250-251	REMAINING PULSES / 2	32 bit without a sign

This value must be divided by 2 to obtain the number of remaining registers.

Example:

If you want to generate 500 pulses lasting 500ms High and 500ms Low with 0-10V band:
No. OF PULSES (x2) = 1000
TICK1 = 10
TICK2 = 10
% HIGH VOLTAGE = 0.37
% LOW VOLTAGE = 0.0