MSC MULTIFUNCTION SMART CALIBRATOR



USER MANUAL

LRI Distribuída no Brasil pela LRI | vendas@lri.com.br | 51 2129-3000

Distribuída no Brasil pela LRI | vendas@lri.com.br | 51 2129-3000

MSC

MULTIFUNCTION SMART CALIBRATOR

SENECA

LRI Distribuída no Brasil pela LRI | vendas@lri.com.br | 51 2129-3000

Distribuída no Brasil pela LRI | vendas@lri.com.br | 51 2129-3000

TABLE OF CONTENTS

PRODUCT DESCRIPTION	**P.06**
SAFETY INFORMATION	**P.10**
USER GUIDE	**P.12**
CALIBRATOR FUNCTIONS	**P.15**
ERRORS TABLE APP	**P.35**
CONNECTION DIAGRAMS	**P.36**
USING THE APP	**P.40**
SUMMARY OF FEATURES	**P.50**
TECHNICAL SPECIFICATIONS	**P.52**
USER INTERFACE	**P.54**
TROUBLESHOOTING	**P.56**
FIRMWARE UPDATE	**P.59**

LRI Distribuída no Brasil pela LRI | vendas@lri.com.br | 51 2129-3000

PRODUCT DESCRIPTION

The MSC calibrator is a portable multi-function instrument for the generation and measurement of signals commonly found in automation environments.
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 using the user's smartphone, tablet or Windows PC (via the USB cable) for 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.
In addition to the functions described in the "FUNCTIONS" paragraph (page 15), the calibrator has the following characteristics:

- Input/output terminal for thermocouples (TC) and isothermal internal block with automatic temperature compensation of the reference junction.
- 4 standard 4mm diameter bushings for 2-3-4 wire sizes.
- Protection against overvoltages up to 250 Vac.
- Lithium battery power supply, with up to 14h autonomy.
- Bluetooth connection with tablet and smartphone.
- Management of universal signals (analogue, digital, pulse, electrical, weight, temperature)
- High accuracy class: 0.05% basic class for each type of input/output.
- Data always available thanks to the dedicated app.

LRI Distribuída no Brasil pela LRI | vendas@lri.com.br | 51 2129-3000

- Micro USB connector for power supply and PC connection.

The analogue signals managed both in measurement and generation are:

- Milliamperes (dc)
- Volts, millivolts (dc)
- 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 simplicity of use of the connections and the protections against overload make the device suitable even for the less experienced and in a hobby and educational environment.
It is possible to connect multiple calibrators to a smartphone and control them individually.



Electrical and electronic waste disposal (applicable in the European Union and other countries with recycling). The symbol on the product or its packaging shows the product must be surrendered to a collection centre authorized to recycle electrical and electronic waste.



Damaged parts must be replaced by the manufacturer, who is also responsible for repairing the device. The product is sensitive to electrostatic discharges. Take appropriate measures during any operation.

LRI Distribuída no Brasil pela LRI | vendas@lri.com.br | 51 2129-3000

PRODUCT DESCRIPTION

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 ON/OFF button

⑦ Bluetooth RESET button

⑧ PWR ON Led

⑨ Established connection Bind Led

⑩ Battery status indicator Led

⑪ Bluetooth/USB communication Led

⑫ Data recording Led

⑬ Error message Led

⑭ Power/communication micro USB connector

LRI Distribuída no Brasil pela LRI | vendas@lri.com.br | 51 2129-3000

⑮ RESET button

⑯ Battery charge warning Led



Distribuída no Brasil pela LRI | vendas@lri.com.br | 51 2129-3000

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.

LRI Distribuída no Brasil pela LRI | vendas@lri.com.br | 51 2129-3000

⚠ 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.

LRI Distribuída no Brasil pela LRI | vendas@lri.com.br | 51 2129-3000

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

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 and connect with the APP via Bluetooth.
- Wait 5 minutes for the appliance temperature to stabilize.
- Connect the cables correctly, according to the type of measurement/generation to be carried out: refer to the connection diagrams on p. 36.

It is however necessary, before use, to make sure that the battery is fully charged so as to guarantee its life for 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, as shown in the diagram on page 9.
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) by notifying it on the APP.

⚠ 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.

LRI Distribuída no Brasil pela LRI | vendas@lri.com.br | 51 2129-3000

Be careful when using the calibrator with devices that have earth connections. Connections 1 and 2, shown in FIG. 1, can exist, but not simultaneously.
This working condition can interfere with the correct operation of the calibrator and the Bluetooth connection.
If this connection is made during the generation of an electrical quantity, internal protections may intervene, in which case, once the correct electrical connection between the devices has been restored, it is necessary to leave the calibrator inactive for about 15-20 minutes to go back to normal conditions.
In order to achieve proper PC//measurement systems (EUT) isolation and to protect the USB port of your PC, you must use the USB-ISO accessory as shown in Fig. 2.

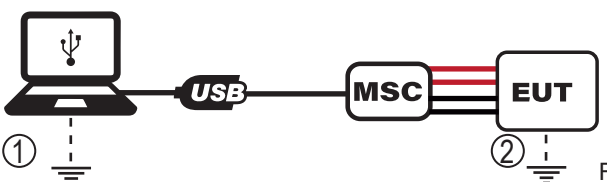


FIG. 1

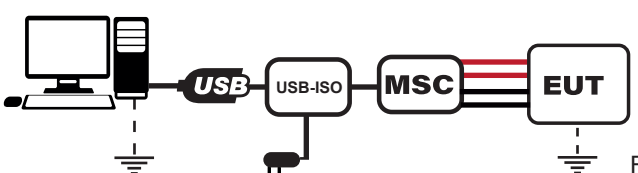
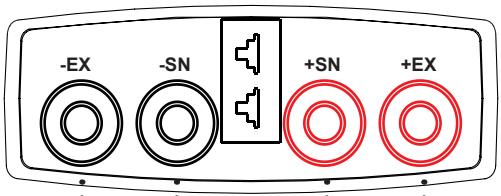


FIG. 2

LRI Distribuída no Brasil pela LRI | vendas@lri.com.br | 51 2129-3000



CABLES SUPPLIED

BLACK CABLE WITH 4MM BLACK PLUG

WHITE CABLE WITH 4MM BLACK PLUG

WHITE CABLE WITH 4MM RED PLUG

RED CABLE WITH 4MM RED PLUG

LRI Distribuída no Brasil pela LRI | vendas@lri.com.br | 51 2129-3000

CALIBRATOR FUNCTIONS

MEASUREMENT FUNCTIONS:

The MSC calibrator allows measuring the following signals:

- passive current
- active current
- HiRange voltage
- LowRange voltage
- thermocouple
- resistance thermometer
- load cell
- frequency/pulses

For correct measurement, connect the cables as shown in the diagrams on page 36 and page 37.

GENERATION FUNCTIONS:

The MSC calibrator allows measuring the following signals:

- passive current
- active current
- HiRange voltage
- LowRange voltage
- thermocouple
- resistance thermometer
- load cell
- frequency/pulses

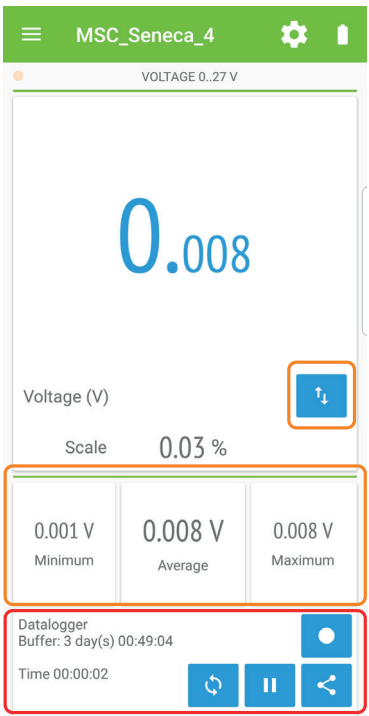
For correct measurement, connect the cables as shown in the diagrams on page 38 and page 39.

LRI Distribuída no Brasil pela LRI | vendas@lri.com.br | 51 2129-3000

Checks common to all measurements

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

Sample screen from the APP:



The images and diagrams shown must be considered as indicative and not binding since they are subject to possible updates.

Distribuída no Brasil pela LRI | vendas@lri.com.br | 51 2129-3000

In the sample screen it is possible to distinguish the checks that are common to all the measurements (red) and those common to analogue measurements (orange) only.
In red you can identify the checks that have the following meanings:

- • Zeroing of MIN / AVG / MAX measurements, for analogue measurements
- • Count zeroing for pulse measurement
- • Pausing of analogue or digital measurements
- • Sharing the measurements taken. This button allows for example sharing a memo of the measurements just made.
- • Datalogger: the activation of this function allows starting to record the measurements that are being taken.

The MIN / AVG / MAX measurements are identified in orange and the check allows changing the display from primary to secondary measurement and vice versa.

Distribuída no Brasil pela LRI | vendas@lri.com.br | 51 2129-3000

CURRENT / VOLTAGE MEASUREMENTS

The calibrator can measure voltages and currents that are applied to the two innermost bushings (SN+ SN-) according to the following ranges.

For the voltages, two measurement scales are available:
- Voltage -10÷90 mV (LowRange)
- Voltage 0÷27 V (HiRange)

To carry out the voltage measurement, connect the calibrator according to figures M5 or M7 while, to make a current measurement, connect the calibrator according to FIG. M1 or M3 (page 36).

Once the calibrator is connected and the Bluetooth connection is working, press M (Measurement) on the Home screen of the APP and select "CURRENT / VOLTAGE".
Then select the desired size.
Since the measurements are homogeneous in the way they are presented by the APP, a measurement is then taken into consideration; then choose "VOLTAGE 0.27 V".
The calibrator starts displaying the values related to the voltage applied to the input bushings in Volts. The default value displayed is in Volts. The measurement can be displayed as a percentage of the full scale by pressing the P9 button (double arrow symbol)

If the measurement is unstable, filtering can be applied. To activate it, follow the following steps by pressing:

1. Settings (refer to image on page 47)
2. AVG filter settings

Then select the desired filtering time between: 0.25, 0.5, 1, 2, 4, 8 seconds.

LRI Distribuída no Brasil pela LRI | vendas@lri.com.br | 51 2129-3000

FREQUENCY MEASUREMENTS

The calibrator allows the measurement of the voltage pulses applied in the two innermost bushings (SN+ SN-). The electrical connections are shown in FIG. M8

Once the calibrator is connected and the Bluetooth connection works, press M (Measurement) on the APP Home screen and then choose "FREQUENCY"
To correctly detect a frequency of a voltage signal applied to the bushings, it is important to choose an appropriate trigger threshold by going to:

1 Settings
2 Set trigger level

The calibrator shows the frequency in Hz.

LRI Distribuída no Brasil pela LRI | vendas@lri.com.br | 51 2129-3000

THERMOCOUPLE MEASUREMENTS

The calibrator allows the temperature measurement with thermocouples which are connected via connector 1 (diagram on page 9). The electrical connections are shown in FIG. M2 (page 36).
For the types of supported thermocouples, refer to TAB 1 (page 50).

Once the calibrator is connected and the Bluetooth connection works, press M (Measurement) on the APP Home screen and then choose "THERMOCOUPLE". Then select the type of thermocouple you wish to take the measurement with.

In measurement mode the temperature value in °C (and mV) is shown. The displayed temperature value is the real temperature measured by the thermocouple, including the cold junction compensation (depending on the set configuration). This last value is shown on the display with the wording
“C.J. Read”.
On the other hand, the value in mV is the real voltage value read by the terminals without any compensation.
If the measurement is unstable, filtering can be applied.
To activate it, follow the following steps by pressing:

1. Settings
2. AVG filter settings

Then select the desired filtering time between: 0.25, 0.5, 1, 2, 4, 8 seconds.

Distribuída no Brasil pela LRI | vendas@lri.com.br | 51 2129-3000

CAUTION

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

CAUTION

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.

LRI Distribuída no Brasil pela LRI | vendas@lri.com.br | 51 2129-3000

RESISTANCE THERMOMETER MEASUREMENTS (RTD)

The calibrator allows the measurement of the temperature with resistance thermometers connected with 2, 3 or 4 wires that are connected to the bushings, according to the types indicated in TAB 1 (page 50). The electrical connections are shown in FIG. M4 (page 36).

Once the calibrator is connected and the Bluetooth connection works, press M (Measurement) on the APP Home screen and then choose "RTD". Then select the type of resistance thermometer you want to measure.

In RTD measurement mode, the temperature value in °C is shown according to the type of resistance thermometer selected, along with the value measured in Ω.

If the measurement is unstable, filtering can be applied. To activate it, follow the following steps by pressing:

1. Settings
2. AVG filter settings

Then select the desired filtering time between: 0.25, 0.5, 1, 2, 4, 8 seconds.

LRI Distribuída no Brasil pela LRI | vendas@lri.com.br | 51 2129-3000

PULSE MEASUREMENTS

The calibrator allows the measurement of the voltage pulses applied in the two innermost bushings (SN+ SN-). The electrical connections are shown in FIG. M8 (page 37).
Once the calibrator is connected and the Bluetooth connection works, press M (Measurement) on the APP Home screen and then choose "PULSE" followed by the mode in which the pulse is to be detected: "POSITIVE FRONT SIGNAL WITH PULSES" or "NEGATIVE FRONT SIGNAL WITH PULSES" (the pulse is detected on the rising or falling edge when crossing the set trigger threshold)

To correctly detect the pulses it is important to choose an appropriate trigger threshold by going to:

1. Settings
2. Set trigger level

It is possible to filter the pulses applied to the input bushings by applying the pulse minimum duration filter. The pulse is then detected only if its duration is greater than or equal to the set value.

To change this parameter follow the following steps:

1. Settings
2. Set minimum pulse duration

then set the value expressing it in micro seconds.

LRI Distribuída no Brasil pela LRI | vendas@lri.com.br | 51 2129-3000

MEASUREMENTS WITH LOAD CELLS

The calibrator is compatible with load cells having a rated resistance of 350 Ω.

Be sure to follow the guidelines for use to take measurements correctly.

By activating this measurement function, the device supplies the load cell through the outermost terminals (+EX -EX) while the generated signal is read via the innermost terminals (+SN -SN)

To take the measurement, connect the calibrator according to fig. M6 (page 37); on the Home screen, press M (Measurement) and then "Load Cell".
The measurement of the load cell is displayed in two ways:

- mV/V ratio
- weight in Kg

To set the sensitivity of the load cell sensor or set the tare and full scale in Kg press:

1. Settings
2. Options

In the "load cell settings" screen you can:

- Set the unit of measurement
- Set cell sensitivity [mV/V]
- Set the load cell capacity [Kg]
- Zero the tare: before proceeding to zero the tare, make sure

LRI Distribuída no Brasil pela LRI | vendas@lri.com.br | 51 2129-3000

that the measurement on the display is stable then proceed with resetting using the reset button: TARE

If the measurement is unstable, filtering can be applied. To activate it, follow the following steps by pressing:

3. Settings
4. AVG filter settings

Then select the desired filtering time between: 0.25, 0.5, 1, 2, 4, 8 seconds.

CAUTION

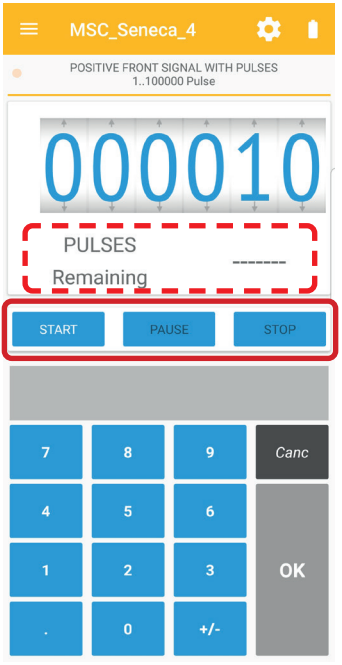
The 4-wire measurement of the load cell is influenced by the resistance of the conductors supplying it. If it is not possible to shorten the connections between the load cell and the MSC calibrator, by measuring the resistance only of the conductors that supply the

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

load cell (conductors +EX and -EX), the correction coefficient can be calculated:
The obtained coefficient must be multiplied with the value measured by the calibrator to obtain the real value.

The following are the checks that are common to all measurements:
APP sample screen:





LRI Distribuída no Brasil pela LRI | vendas@lri.com.br | 51 2129-3000

The images and diagrams shown must be considered as indicative and not binding since they are subject to possible updates.

In the sample screen, a distinction is made between the checks common to all analogue generations (in orange) and those of the pulse generation only (in red).

In Orange it is possible to identify the area where the generation value can be set by using the up/down swipe and the keyboard to enter the desired value. The other checks are listed below:

- ON • Button indicating the status of the generation (active or not). Pressing it, the output is deactivated and the button changes status.
- ↑↓ • Command to reverse the primary and secondary measurements and vice versa
- ~ • Ramp function start button.

In red we can identify the elements that concern the generation of pulses; in the example we can identify the 8 remaining pulses to be generated and the three buttons:

- START: starts the generation of voltage pulses
- PAUSE: temporarily interrupts the generation of pulses
- STOP: cancels the current pulse generation session

LRI Distribuída no Brasil pela LRI | vendas@lri.com.br | 51 2129-3000

CURRENT / VOLTAGE GENERATION

The calibrator can operate as a voltage or current generator. These quantities are supplied by the innermost bushings (SN+ SN-) according to the following ranges.
For the voltages two generation scales are available:

- Voltage -10÷90 mV
- Voltage 0÷27 V

To carry out voltage generation, connect the calibrator according to figure G7 (page 39), while to generate a current, connect the calibrator according to figures G1 or G3 (page 38) depending on whether you want to generate a passive or active current.

Once the calibrator is connected and the Bluetooth connection works, press G (signal Generator) on the APP Home screen and choose "CURRENT / VOLTAGE".
Then select the desired voltage or current generation.

Since the generations are homogeneous in the way they are presented by the APP, the following shows a sample generation.
Select "VOLTAGE 0.27 V".
The generation screen is displayed and the calibrator starts supplying the output bushings with the preset voltage of 0 V. To change this value, simply enter the desired value using the numeric keypad and confirm with OK.

LRI Distribuída no Brasil pela LRI | vendas@lri.com.br | 51 2129-3000

THERMOCOUPLE SIMULATION

The calibrator can simulate a thermocouple. To see which types of thermocouples are supported, refer to TAB 1 (page 50). The simulation of thermocouples is made possible by the CONN. TC, of the diagram on page 9 or through the SN+ and SN- terminals. The electrical connections are shown in FIG G2 (page 38). Once the calibrator is connected and the Bluetooth connection works, press G (signal Generator) on the APP Home screen and choose "THERMOCOUPLE".

Then select the type of thermocouple you want to simulate; the following is an example of the simulation of a type K thermocouple. A screen relative to the simulation of type K thermocouples is displayed on the APP. It is possible to enable or disable the compensation in the cold junction, by default automatically set on internal temperature. It is possible to change this setting by going to:

1 Settings
2 Cold junction setting
3 Enable the "Manual setting" control
4 Set the temperature value for the cold junction and then confirm

⚠ CAUTION

Wait until the device reaches a stable thermal condition before simulating a thermocouple.

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.

LRI Distribuída no Brasil pela LRI | vendas@lri.com.br | 51 2129-3000

RESISTANCE THERMOMETER SIMULATION (RTD)

The calibrator is able to simulate a resistance thermometer (RTD) connected to the 2, 3 or 4 wire bushings. The types of supported RTDs are listed in TAB 1 (page 50).
To carry out RTD simulation, connect the calibrator according to FIG.G4 (page 38).
Once the calibrator is connected and the Bluetooth connection works, press G (signal Generator) on the APP Home screen and choose "RTD".
Then select the type of RTD that you want to simulate; the simulation of a PT100-type resistance thermometer is shown as an example.

Then enter the desired value in °C and confirm; it is possible to switch the display of the unit of measurement from °C to Ω.

⚠ CAUTION

Thermal resistance generation can be divided into two scales; the PT100 scale and the PT1000 scale (which includes the PT500). For these two scales the excitation current from the external instrument must remain within a certain range (see table on page 50) . If this condition is not met, an Generation error is signalled, indicating the possibility that the simulated resistive value is not correct.

LRI Distribuída no Brasil pela LRI | vendas@lri.com.br | 51 2129-3000

LOAD CELL SIMULATION

The calibrator can simulate a load cell (LOAD CELL) with a nominal resistance of 350 Ω. The connection is made by 4 wires through the bushings EX+ EX-, SN+ SN-. The supply voltage applicable to the external bushings has a range from 5V to 10V. To simulate a load cell, connect the calibrator according to FIG. G6 (page 39). Once the calibrator is connected and the Bluetooth connection works, press G (signal Generator) on the APP Home screen and then select "LOAD CELL".

From the load cell screen, proceed to set the parameters by following the steps below:

1 Settings

2 Options

3 Set the parameters "Unit of measurement", "Load cell gain" in mV/V, and then the full scale of the load cell.

For instance, once the sensitivity is set to 2 mV/V, the scale to Kg and the full scale to 1000 Kg, simply confirm the parameters, then return to the main page of the load cell simulation and enter the value in Kg that you wish to simulate. The value can also be entered as mV/V

⚠ CAUTION

Wait until the device reaches a stable thermal condition before simulating a load cell.

LRI Distribuída no Brasil pela LRI | vendas@lri.com.br | 51 2129-3000

FREQUENCY GENERATION

The calibrator can generate a square wave voltage signal with 50% duty cycle and settable frequency and peak voltage values. The generated signal is taken out to the bushings (SN+ SN-).
The definable properties of the pulses are:

- Value ON: value in Volts assigned to the square wave when the signal is at high logic level
- Value OFF: value in Volts assigned to the square wave when the signal is at low logic level.

To generate a voltage square wave signal, connect the calibrator according to FIG. G8 (page 39).
Once the calibrator is connected and the Bluetooth connection works, press G (signal Generator) on the APP Home screen and then select "FREQUENCY".

To proceed with the generation, set the band parameters of the square wave by following the following steps:

1 Settings
2 Set Pulse Parameter
3 Enter the desired Value ON / Value OFF band values and confirm with OK

Then set the desired frequency using the numeric keypad and make sure that the output enable button is turned to ON.

The primary measurement unit of the signal is in Hz, switchable to seconds to show the length of the period.

LRI Distribuída no Brasil pela LRI | vendas@lri.com.br | 51 2129-3000

CAUTION

It is important to note that 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:

$$FOUT=\frac{1}{133X50\ \mu s} = 150.37\ Hz$$

The APP will automatically show the value actually generated.

Distribuída no Brasil pela LRI | vendas@lri.com.br | 51 2129-3000

PULSE GENERATION

The calibrator can generate a train of voltage pulses available at the two innermost bushings (SN+ SN-).
The definable properties of the pulses are:

- Value ON / Value OFF: values in V relative to the pulse value and to the value of the steady state of OFF respectively.
- Time ON / Time OFF: values in ms that define the period T of the pulse. (T=TimeON + TimeOFF).
  Time ON is the time in which the pulse remains at the Value ON value in ms.

To generate voltage pulses, connect the calibrator according to FIG. G8 (page 39).
Once the calibrator is connected and the Bluetooth connection works, press G (signal Generator) on the APP Home screen and then select "PULSE".

To proceed with the generation, set the time and band parameters of the pulse by following the following steps:

1. Settings
2. Set Pulse Parameter
3. Enter the desired band Value ON / Value OFF values and the times corresponding to the Time ON / Time OFF pulse period and confirm with OK

Then set the number of pulses and press start to start the generation; the remaining pulses are displayed at the same time. During this phase it is possible to pause and then resume the generation by pressing PAUSE or cancel it by pressing STOP.

LRI Distribuída no Brasil pela LRI | vendas@lri.com.br | 51 2129-3000

ERRORS APP

ERROR SIGNALS ON APP / LEDSTATUS		
ERROR MESSAGE	MEANING	LED STATUS
Generation Error	The set generation is not guaranteed	Error Led ON (Red)
Measure Error	Signal out of scale	Error Led ON (Red)
Loop Error	Only for current supplied by an external generator. (if V_{Loop} > 29 V)	Error Led ON (Red)
	Low Battery	Low Battery Led ON blinking (Amber)

LRI Distribuída no Brasil pela LRI | vendas@lri.com.br | 51 2129-3000

FIGURE M1:
PASSIVE CURRENT METER
(4-wire transmitter)

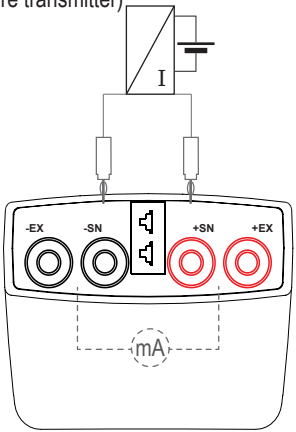


FIGURE M2:
TEMP. METER WITH THERMOCOUPLE

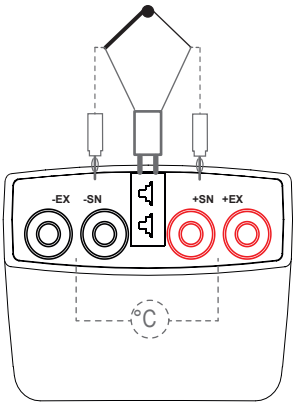


FIGURE M3:
ACTIVE CURRENT METER
(2-wire transmitter)

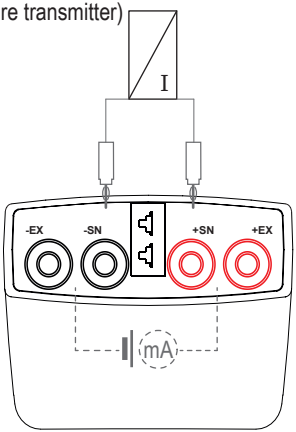
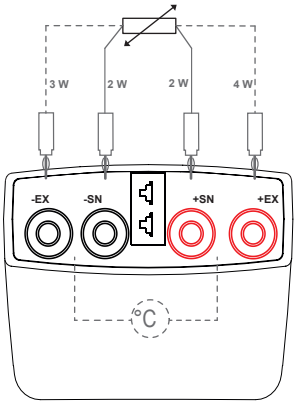


FIGURE M4:
RESISTANCE TEMPERATURE METER



LRI Distribuída no Brasil pela LRI | vendas@lri.com.br | 51 2129-3000

FIGURE M5:
HiRange VOLTAGE METER

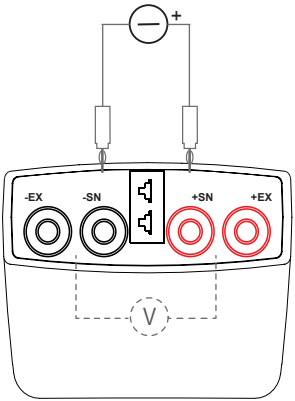


FIGURE M6:
LOAD CELL METER

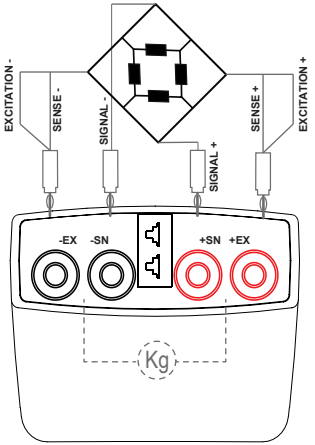


FIGURE M7:
LowRange VOLTAGE METER

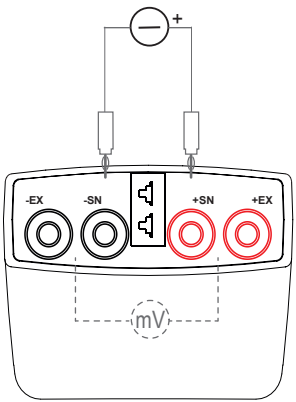
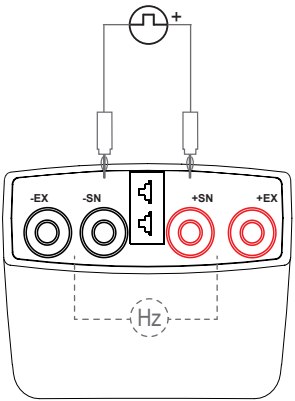


FIGURE M8:
FREQUENCY/PULSE METER



LRI Distribuída no Brasil pela LRI | vendas@lri.com.br | 51 2129-3000

FIGURE G1:
PASSIVE CURRENT GENERATOR

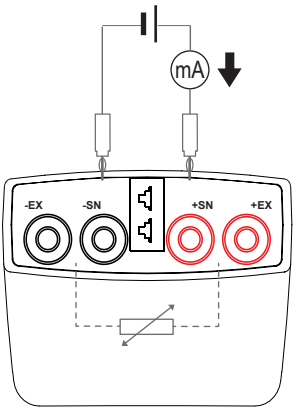


FIGURE G2:
THERMOCOUPLE SIMULATOR

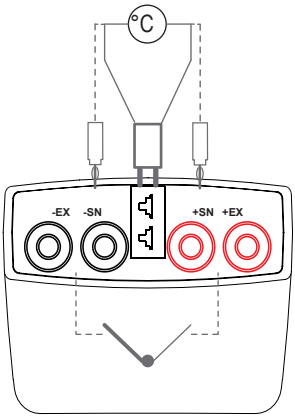


FIGURE G3:
ACTIVE CURRENT GENERATOR

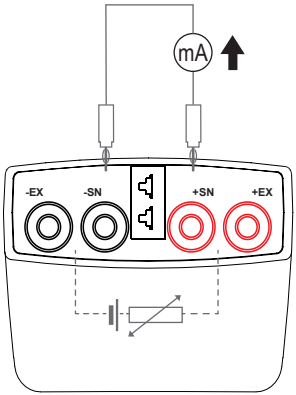
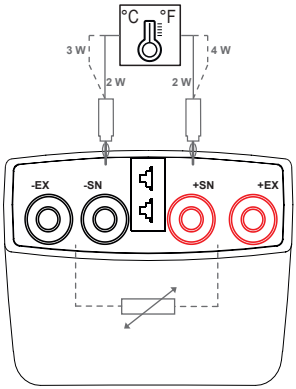


FIGURE G4:
RESISTANCE TEMPERATURE
SIMULATOR



LRI Distribuída no Brasil pela LRI | vendas@lri.com.br | 51 2129-3000

FIGURE G5:
HiRange VOLTAGE GENERATOR

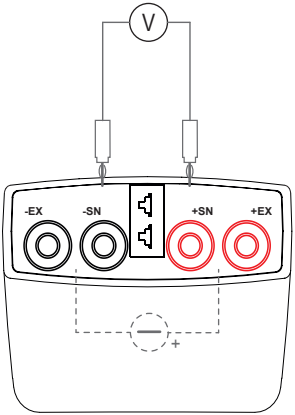


FIGURE G6:
LOAD CELL SIMULATOR

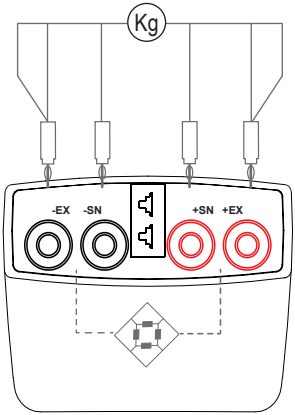


FIGURE G7:
LowRange VOLTAGE GENERATOR

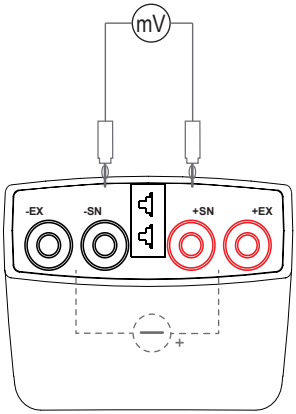
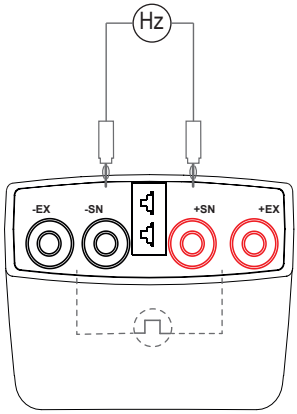


FIGURE G8:
FREQUENCY/PULSE GENERATOR



Distribuída no Brasil pela LRI | vendas@lri.com.br | 51 2129-3000

USING THE APP FROM A MOBILE

To use the MSC calibrator, you need to install the free "MSC by Seneca" APP available for iOs and Android devices on your smartphone or tablet and register your details.
Ensure that your tablet and / or smartphone is equipped with Bluetooth 4.1 or higher.
To install the App on a smartphone or tablet, scan the QR code shown and enter the required details in the registration page.
When the application starts, select "Search" and, in the list of available devices, select the desired device to start the synchronization with your smartphone.
To ensure the calibrator is working properly, make sure you have selected the correct device.

GET IT ON Google Play

Available on the App Store

LRI Distribuída no Brasil pela LRI | vendas@lri.com.br | 51 2129-3000

MAIN SCREEN:

① Navigation menu

② “Search” command

When the application starts, select the “Search” command to view the devices to be associated.



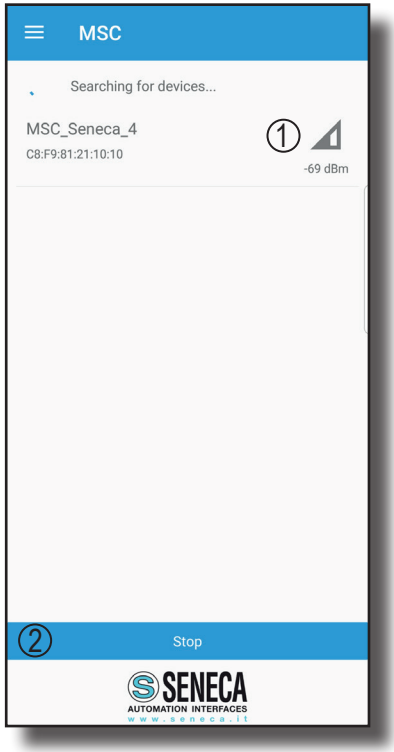
LRI Distribuída no Brasil pela LRI | vendas@lri.com.br | 51 2129-3000

DEVICE SEARCH

① Devices detected

When the app is opened, the device will automatically recognize the terminal to join. To complete the operation simply select the device you want to interface with.

② Stops the search



LRI Distribuída no Brasil pela LRI | vendas@lri.com.br | 51 2129-3000

OPTIONS

① Activates the sound signal in the event of an alarm

② Activates the sound signal on overflow in generation

③ Activates the sound signal on turning on

④ Activates the sound signal during data recording

⑤ If selected, once the available memory is full, the instrument will write the data on the recordings already made

⑥ Auto power OFF function: this function allows setting a measurement time or signal generation, at the end of the operation the instrument will automatically turn off.

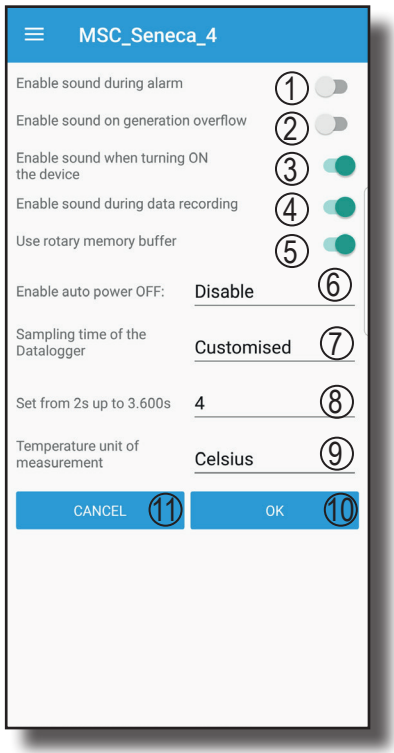
⑦ Allows setting the desired sampling time

⑧ Space dedicated to setting the desired sampling time

⑨ Unit of measurement setting

⑩ Setting confirmation

⑪ Cancels the settings



LRI Distribuída no Brasil pela LRI | vendas@lri.com.br | 51 2129-3000

HOME SCREEN

① Navigation menu

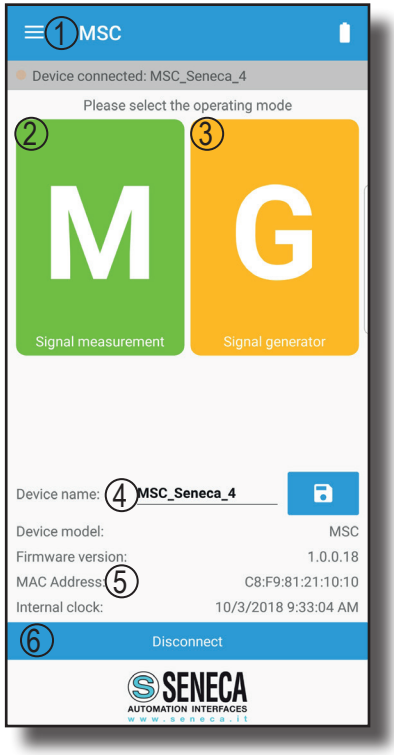
② Meter mode

③ Generator/simulator mode

④ Instrument name

⑤ Calibrator characteristics

⑥ Device disconnect button



LRI Distribuída no Brasil pela LRI | vendas@lri.com.br | 51 2129-3000

MEASUREMENT CONTROLS

① Calibrator battery level

② Access to the last measurement taken

③ Current / voltage meter

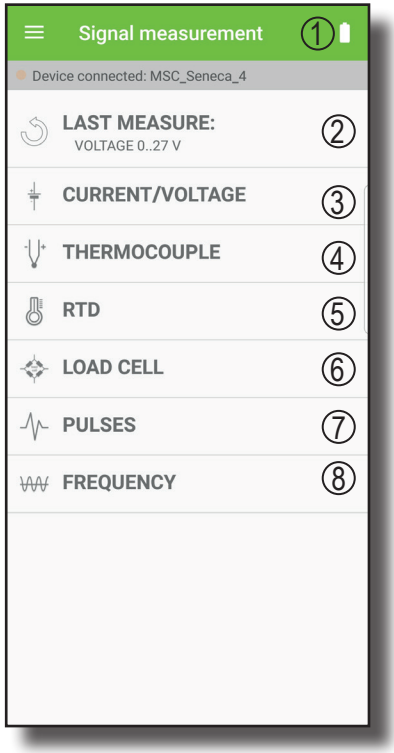
④ Thermocouple meter

⑤ Resistance temperature meter

⑥ Load cell meter

⑦ Pulse meter

⑧ Frequency meter



LRI Distribuída no Brasil pela LRI | vendas@lri.com.br | 51 2129-3000

GENERATION/SIMULATION CONTROLS

① Access to the last generation carried out

② Current / voltage generator

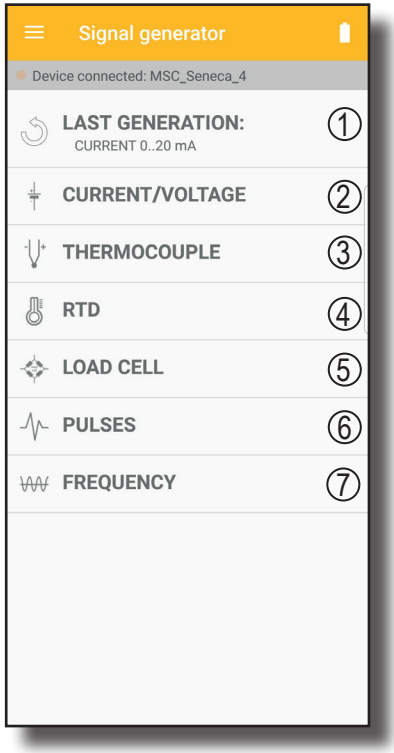
③ Thermocouple simulator

④ Resistance temperature simulator

⑤ Load cell simulator

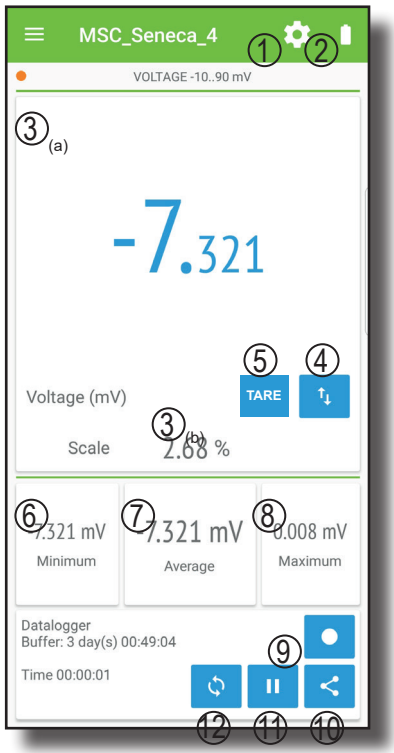
⑥ Pulse generator

⑦ Frequency generator



LRI Distribuída no Brasil pela LRI | vendas@lri.com.br | 51 2129-3000

METER READING SCREEN



1. Meter setting
2. Calibrator battery level
3. (a) Reading screen: primary measurement
3. (b) Reading screen: secondary measurement
4. Command to reverse the primary and secondary measurements and vice versa
5. TARE command
6. Minimum measurement
7. Medium measurement
8. Maximum measurement
9. Datalogger function: by selecting this function, measurement recording starts.
10. Share minimum, medium and maximum value measurements
11. Suspend minimum, medium and maximum value measurements
12. Update minimum, medium and maximum value measurements

Distribuída no Brasil pela LRI | vendas@lri.com.br | 51 2129-3000

GENERATOR/SIMULATOR READING SCREEN

① Generator settings

② Set value

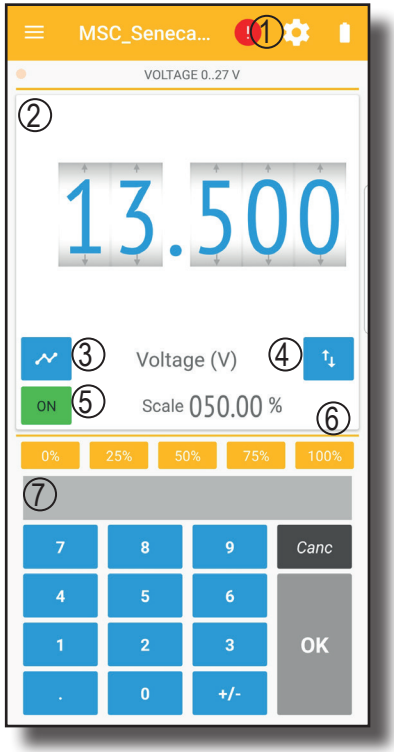
③ Ramp start

④ Unit of measurement management

⑤ Status indicator

⑥ Quick output levels

⑦ Setting keypad output



Distribuída no Brasil pela LRI | vendas@lri.com.br | 51 2129-3000

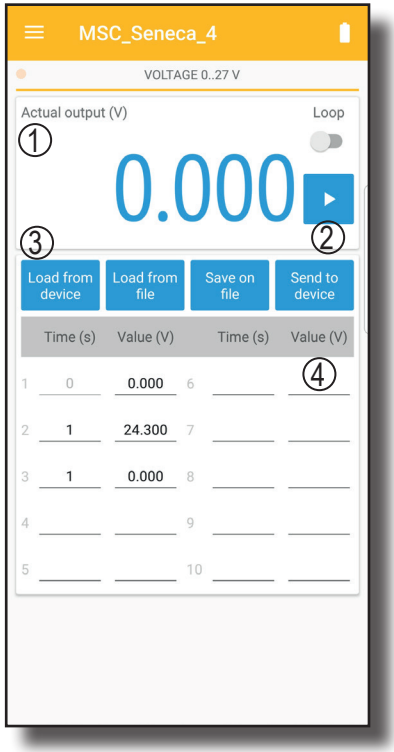
RAMP READING SCREEN

① Generated signal

② Ramp generation start/ pause

③ Ramp management

④ Table to define the points for ramp creation



LRI Distribuída no Brasil pela LRI | vendas@lri.com.br | 51 2129-3000

Distribuída no Brasil pela LRI | vendas@lri.com.br | 51 2129-3000

FEATURE SUMMARY

		GENERATION				MEASURE					
FUNCTION	U.M	RANGE	PRECISION *	RESOLUTION	Note	RANGE	PRECISION *	RESOLUTION	RULE	Note	CMRR-NMRR
VOLTAGE [hi range]	[dc V]	0÷26 min	0,02 % + 3 mV	1 mV	1	0÷26 min	0,02 % + 3 mV	1 mV		9	>100 dB
VOLTAGE [lo range]	[dc mV]	-10÷90	0,03 % + 15 uV	5 uV	2	-10÷90	0,02 % + 10 uV	5 uV		9	>100 dB
ACTIVE CURRENT	[dc mA]	0,1÷24	0,04 % + 3 uA	1 uA	3	0÷24	0,04 %+ 0,01uA	1 uA		17	>60 dB
PASSIVE CURRENT	[dc mA]	0,1÷24	0,04 % + 3 uA	1 uA	4,21,22	0÷24	0,04% + 0,01uA	1 uA		18	>60 dB
Pt100	[°C]	-200÷859	0,03 % + 0,2°C	0,1 °C	5,19	-200÷850	0,03 % + 0,2°C	0,03°C	IEC 60751	6	>140 dB
Pt500	[°C]	-200÷859	0,03 % + 0,2°C	0,1 °C	5,20	-200÷850	0,03 % + 0,2°C	0,1°C	IEC 60751	6	>140 dB
Pt1000	[°C]	-200÷859	0,03 % + 0,2°C	0,1 °C	5,20	-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	0,1 °C	15,19	-180÷200	0,03 % + 0,2°C	0,06°C, 0,03°C	GOST 6651-2009	6,15	>140 dB
NI100, NI120	[°C]	-80÷260	0,03 % + 0,2°C	0,1 °C	16,19	-60÷250	0,03 % + 0,2°C	0,02°C	DIN 43760	6,16	>140 dB
THERMOCOUPLE J	[°C]	-210÷1200	0,03 % + 0,2°C	0,1 °C	12,2	-210÷1200	0,03 % + 0,2°C	0,01°C	EN 60584-1:1997	9,12	>100 dB
THERMOCOUPLE K	[°C]	-270÷1372	0,03 % + 0,2°C	0,1 °C	12,2	-200÷1372	0,03 % + 0,2°C	0,05°C	EN 60584-1:1997	9,12	>100 dB
THERMOCOUPLE T	[°C]	-270÷400	0,03 % + 0,1°C	0,1 °C	12,2	-200÷400	0,03 % + 0,1°C	0,02°C	EN 60584-1:1997	9,12	>100 dB
THERMOCOUPLE E	[°C]	-270÷1000	0,03 % + 0,2°C	0,1 °C	12,2	-200÷1000	0,03 % + 0,2°C	0,05°C	EN 60584-1:1997	9,12	>100 dB
THERMOCOUPLE N	[°C]	-270÷1300	0,03 % + 0,2°C	0,1 °C	12,2	-200÷1300	0,03 % + 0,2°C	0,05°C	EN 60584-1:1997	9,12	>100 dB
THERMOCOUPLE R	[°C]	-50÷1768	0,03 % + 0,3°C	0,5 °C	12,2	-50÷1768	0,03 % + 0,3°C	0,05°C	EN 60584-1:1997	9,12	>100 dB
THERMOCOUPLE S	[°C]	-50÷1768	0,03 % + 0,3°C	0,5 °C	12,2	-50÷1768	0,03 % + 0,3°C	0,05°C	EN 60584-1:1997	9,12	>100 dB
THERMOCOUPLE B	[°C]	0÷1820	0,03 % + 0,3°C	0,5 °C	12,2	250÷1820	0,03 % + 0,3°C	0,05°C	EN 60584-1:1997	9,12	>100 dB
THERMOCOUPLE L	[°C]	-200÷800	0,03 % + 0,15°C	0,1 °C	12,2	-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÷3	0,05%	0,001	13,8	-0,2÷2,4	0,05%	0,001		9,14	>100 dB
PULSES / FREQUECY	[Hz]	0,1÷1000	0,02%	see manual	1	0,1÷10000	0,03% + 3 LSD	10e-6 Hz		10,11	

TAB. 1

(*) % of the measure, within one year

OTHER DATA

Typical temperature drift:	50 ppm/fs
Output response times:	< 100 ms between displayed command and 90% output
Operating temperature:	-20..50°C (not under charge), 0-45°C during charging
Storage temperature:	0..35°C
Weight:	330 g ca.

NOTES ON TABLE 1

1 - IoutMAX = 20 mA per V < 20; IoutMAX =10 mA per 20 < V <25; IoutMAX = 5mA per V > 25; output impedance < 50 mΩ
2 - IoutMAX = 10 mA; output impedance < 100 mΩ
3 - RLoad < 1 KΩ
4 - 3V minimum loop voltage, 28 V maximum
5 - α=0.00385
6 - Measurement current: 1 mA
7 - Measurement current: 250 uA
8 - Maximum 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 Ohm
14 - Excitation voltage < 8V
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 polarity respected
20 - Accuracy defined with 250 uA measurement current
21 - Output impedance: 3.75 MΩ
22 - Precision defined with 26 V loop power supply voltage

Distribuída no Brasil pela LRI | vendas@lri.com.br | 51 2129-3000

TECHNICAL SPECIFICATIONS

GENERAL DATA	
Power supply from the network	From 100-240 Vac network via standard USB battery charger
Battery power supply	3400 mAh LiPo battery; 8 hours' autonomy (minimum @ max load), 20 hours (max)
Protection rating	IP20
Operating temperature	-20..50°C (not under charge), 0-40°C during charging
Storage temperature	0..35°C
Humidity	30..90 % non condensing
Insulation	Intrinsically insulated battery powered instrument No isolation of the USB port
Overvoltage protection	240 Vac max without permanent damage
Rejection	50/60 Hz
Freq. Sampling	20 Hz
Dimensions	147 x 88 x 25 mm
Weight	330 g
Supplied	Connecting cables (4), battery charger, USB cable
Calibration report	On request
Type approval	CE
Standards	EN61326-1; EN61010-1

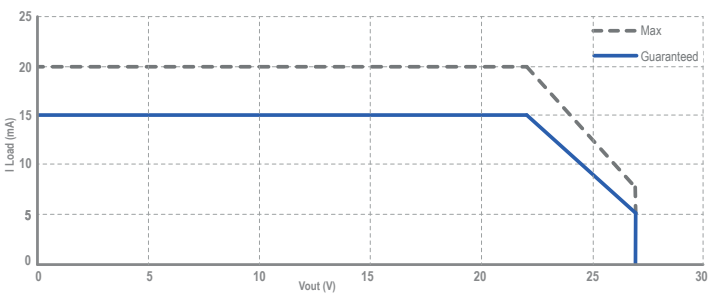
TAB. 2

LRI Distribuída no Brasil pela LRI | vendas@lri.com.br | 51 2129-3000

INTERFACES AND WARNINGS	
Buttons	On / Off Bluetooth reset
LED	Start-up Led Communication Led Error Led PAIRING BT Led Battery status Led
Buzzer	Overload buzzer and impossibility to simulate the value requested
Standard bushings	No. 4 x 4mm bushings
Thermocouple attachment	Mini plug (7.9mm) for thermocouple measurement and simulation
Micro USB	for fw update or modbus communication (virtual com); charge / supply / PC connection
Wireless communication	Bluetooth Low Energy 4.1 to Windows PC, Smartphone and Android or Ios Tablet

TAB. 3

Current that can be supplied in voltage generation:



Distribuída no Brasil pela LRI | vendas@lri.com.br | 51 2129-3000

USER INTERFACE

The MSC calibrator has LED indicators and a buzzer to indicate different operating states.

Explanatory table of the buzzer signals:

NUMBER OF BEEPS	MEANING
2	Corrupted parameters, correct operation is not guaranteed
3	Correct start-up
INTERMITTENT CONTINUOUS	Firmware update mode activated. To activate the firmware update mode follow the instructions on page 59

TAB. 4

Led operation table:

FUNCTION	LED COLOUR	STATUS
PWR	GREEN	ON: instrument ON
BATTERY	AMBER	ON: battery charged Flashing: low battery
DATA LOGGER	RED	ON: data logger enabled OFF: data logger disabled
BIND	BLUE	Flashing: connected OFF: disconnected
COMM	AMBER	Flashing: communicating OFF: no communication
ERROR	RED	ON: error underway OFF: no error
RECHARGE (NEAR USB SOCKET)	AMBER	ON: battery charging

TAB. 5

LRI Distribuída no Brasil pela LRI | vendas@lri.com.br | 51 2129-3000

TROUBLESHOOTING

The following section lists the solutions to some common problems:

Switching on/Recharging:

PROBLEM	CAUSE	SOLUTION
The yellow LED (named "16" in the "product description" diagram on page 11) does not light up while the battery is charging	- The battery may already be charged	
	- The supplied USB power unit may be faulty	- check that the charger works with another device
The MSC calibrator does not turn on	- the battery may be flat	- charge the battery
The MSC calibrator does not turn off	- the MSC calibrator may be blocked	- press the reset button and check that the MSC calibrator turns on and off correctly using the dedicated button.

TAB. 6

LRI Distribuída no Brasil pela LRI | vendas@lri.com.br | 51 2129-3000

Bluetooth/APP connection:

PROBLEM	CAUSE	SOLUTION
The MSC calibrator does not connect to the smartphone device via Bluetooth	- The device may not be turned on	- turn the MSC calibrator on
	- the distance between the smartphone and the MSC calibrator is excessive	- reduce the distance between the MSC calibrator and the smartphone
	- the smartphone returns "assignation rejected" when direct connection is attempted	- make sure you have downloaded and installed the APP on your smartphone or tablet
The smartphone is connected to the MSC calibrator but, when connecting the cables to the terminals, the connection is interrupted	- possible electrostatic charge accumulated in your body or in the device to be tested that is transferred to the MSC calibrator	- discharge the excessive electrostatic charge from yourself or the device in order not to transfer it via the wiring to the MSC calibrator
The MSC calibrator does not respond to the commands set on the APP	- the area in which you intend to operate is subject to strong electromagnetic interference or interference from other Bluetooth or WiFi devices	- reduce the distance between the smart phone and the MSC calibrator or, if possible, move to a less disturbed area
The MSC calibrator only responds to some commands	- connection was made to another MSC calibrator	- connect to the correct MSC calibrator
The MSC calibrator is disconnected from the APP and a new connection cannot be made		-1 Restart the MSC calibrator -2 Restart the smartphone or tablet or PC -3 make a new connection
The calibrator runs abnormally		- in case of malfunction, press the BT Reset button to release the calibrator from the device to which it is connected

TAB. 7

LRI Distribuída no Brasil pela LRI | vendas@lri.com.br | 51 2129-3000

Measurement and generation/simulation problems

PROBLEM	CAUSE	SOLUTION
The measurement displayed by the APP is not consistent with the actual input /output signal to/from the MSC calibrator	- the area in which you intend to operate is subject to strong electromagnetic interference or interference from other Bluetooth or WiFi devices	- reduce the distance between the smartphone and the MSC calibrator or, if possible, move to a less disturbed area
	- the battery may be flat	- charge the battery
The message "out of scale" is displayed on the APP screen	- the electrical signal or quantity to be measured is outside the measuring range of the MSC calibrator	- bring the electrical signal to be measured within the ranges listed in the technical specifications
The message "generation error" is displayed on the APP screen	- the load connected to the output terminals of the MSC calibrator is excessive	- connect a load or device compatible with what is stated in the technical specifications
The message "Supply voltage" is displayed on the APP screen	- the voltage supplied externally to the MSC calibrator terminals is too high and affects the internal supply voltages	- possible external power supply not intended for power generation - if intended, reduce the value of the external voltage according to what is stated in the technical specifications and wait 15-20 minutes for the internal protections to reach normal temperature conditions
The measured value is not consistent with the measurement taken or the generated / simulated signal	- possible connection error	- make sure that the electrical connections are consistent with the type of simulation / generation to be carried out (see diagrams on page 36)
	- possible presence of a ground connection between USB power supply and device to be tested	- use the USB power supply or make sure you have connected the calibrator in compliance with the instructions given on page 13

TAB. 8

LRI Distribuída no Brasil pela LRI | vendas@lri.com.br | 51 2129-3000

General problems

PROBLEM	CAUSE	SOLUTION
The APP screen does not update the measurements taken or to be generated	- the area in which you intend to operate is subject to strong electromagnetic interference or interference from other Bluetooth or WiFi devices	- reduce the distance between the smart phone and MSC calibrator or, if possible, move to a less disturbed area
	- the battery may be flat	- charge the battery
The measures, or generations, do not match what was expected	- electrical connections may be incorrect	- make sure that the electrical connections are consistent with the type of simulation / generation to be carried out (see diagrams on page 38)
	- electrical connections may not be allowed	-Use the USB power supply or make sure you have connected the calibrator as shown in Figure 1
	- connection made to another MSC calibrator	- connect to the correct MSC calibrator

TAB. 9

LRI Distribuída no Brasil pela LRI | vendas@lri.com.br | 51 2129-3000

FIRMWARE UPDATE

To perform the firmware update of the MSC device, follow the procedure below:

• Download and install the MSC desktop APP from www.seneca.it/msc;

• Connect the calibrator to the PC using the USB cable;

• Turn the instrument on by pressing the ON / OFF button and keep it pressed for about 5/6 seconds until the buzzer starts to emit an intermittent and continuous sound;

• At this point release the button;

• During the update phase, the calibrator will have the PWR, ERROR and COMM LEDs lit;

• Start the MSC desktop program;

• Select the “ Upgrade” button

• Select the serial communication port;

• Start the "Upgrade" procedure using the “Upgrade” button;

• Wait for the end of the firmware upload by looking at the Log buffer;

• Once the firmware "Upload" has been completed, restart the calibrator using the PWR key.

If the procedure has been carried out correctly when the instrument is started up, three beeps will sound as indicated in table 4 on page 54.

LRI Distribuída no Brasil pela LRI | vendas@lri.com.br | 51 2129-3000

Distribuída no Brasil pela LRI | vendas@lri.com.br | 51 2129-3000

Distribuída no Brasil pela LRI | vendas@lri.com.br | 51 2129-3000

SENECA s.r.l.
Via Austria, 26 – 35127 – PADOVA – ITALY
Tel. +39.049.8705359 - 8705355 - Fax +39.049.8706287

The information in this document can be modified or supplemented without notice for technical or commercial reasons. The figures and diagrams are indicative and not binding. Neither can inconsistencies or imperfections be excluded, in spite of the continuous search for perfection. The content of this document undergoes a periodical update anyway. Any unauthorised reproduction is strictly forbidden.

LRI Distribuída no Brasil pela LRI | vendas@lri.com.br | 51 2129-3000