# LogBox Wi-Fi

**INSTRUCTION MANUAL V1.0x H**

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| ⚠ | **Applies to devices with firmware version up to V1.0x.** |

## FCC

This device has been tested and complies with the parameters for a Class A digital device, pursuant to Part 15 of the FCC Rules. Such limits are designed to provide reasonable protection against harmful interference when the device is operated in a commercial environment. This device generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instructions in this manual, may cause harmful interference to radio communications.

Any changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate the device.

RF Exposure: It is necessary to keep 20 cm between the antenna and the user and the transmitter module cannot be co-located with any other transmitter or antenna.

## Canada

This Class A device complies with Canadian standard ICES-003.

*Cet appareil numérique de la classe A est conforme à la norme NMB-003 du Canada.*

## CE Mark

This is a Class A device. In a domestic environment, it may cause radio interference and require the user to take proper measures.

## ANATEL

This device is homologated by ANATEL, in accordance with the procedures regulated by Resolution 242/2000, and meets the technical requirements applied.

This device is operated in a secondary fashion, that is, it is not entitled to protection against harmful interference, even from the same type of stations, and it cannot cause interference to systems operating on a primary basis.

For more information, see the ANATEL website www.anatel.gov.br.

# 1. SAFETY ALERTS

The symbols below are used throughout this manual to draw the user's attention to important information regarding safety and use of the device.

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| **CAUTION**<br>Read the manual fully before installing and operating the device. | **CAUTION OR HAZARD**<br>Risk of electric shock. | **ATTENTION**<br>Material sensitive to static charge. Check precautions before handling. |

Safety recommendations should be observed to ensure user safety and to prevent damage to the device or system. If the device is used in a manner other than that specified in this manual, the safety protections may not be effective.

# 2. INTRODUCTION

**LogBox Wi-Fi** is an electronic wireless data register, also known as a *data logger*, which comprises three analog sensors and one digital sensor, respectively called the "analogue measuring channel" and the "digital measuring channel". With a memory capacity for up to 140,000 logs, it allows the use of batteries, to keep its autonomy and continue to log data even during external power outages. It features a large display that offers a comfortable view of measured variables and general device information. Furthermore, the device's enclosure has a protection cover for the connections, a sealing ring and a holder that allows its attachment to a wall or metal surface by means of the optional bracket with magnetic inserts.

The analog inputs accept any type of temperature sensor, such as thermocouples, Pt100 or sensors for any other quantities with current or voltage signals. The digital channel can log the time of events, such as opening a door, or counting pulses from a flow sensor. **LogBox Wi-Fi** also has the following internal sensors: temperature, battery voltage, and external power supply voltage, which can also log the values in the memory, taking the place of any of the available measurement channels. Its wide display allows you to view up to three variables simultaneously, and displays indications such as alarms, communication status, enabled channels, battery voltage level, among other information.

**LogBox Wi-Fi** also has a buzzer for audible alerts and a digital output that can be used as an alarm output or as an electronic key to power sensors and can be controlled by several protocols, such Modbus-TCP and MQTT, for example.

The device's configuration can be accessed through a desktop or a notebook connected to its USB interface. For use with computers, NOVUS provides the **NXperience** software in your website's download area. **NXperience** enables the logs' configuration, download, and analysis.

# 3. DISPLAY AND NAVIGATION

## 3.1 DISPLAY INFORMATION

**LogBox Wi-Fi** has an LCD display with 3 numerical lines of 4 ½ digits, to display the current value of all enabled channels, as well as the minimum and maximum values thereof. At the same time, it is possible to display the current value of up to three analog channels and, in a second screen, if enabled, the digital input current value. In addition to channel information, **LogBox Wi-Fi** has 7 screens with a variety of information and features and 24 symbols that allow for easy information visualization and diagnostics.

See below an illustration of the display with a description of each symbol's functionality.

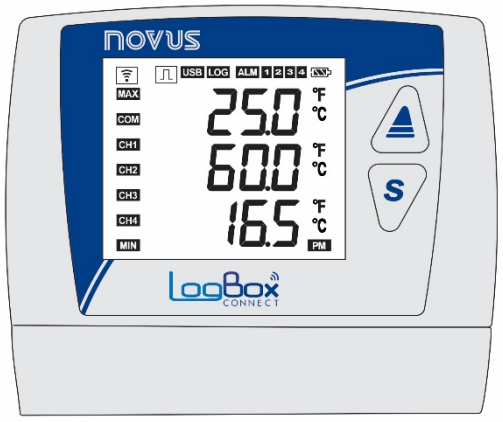



**Fig. 01** – **LogBox Wi-Fi** Display Information

- : It remains lit while **LogBox Wi-Fi** has a valid IP on the wireless network to which you are connected. If the device is set to wake up by keyboard, it will remain on while the interface remains available.
- : When the digital channel is disabled, it remains off. When set to "Pulse Count" mode, it will remain on. When set in the "Event Log" or "Logs Control" modes, it will remain lit, flashing when an event is detected at the digital input.
- **USB**: Lights up when the USB cable is connected. Turns off when the USB cable is disconnected.
- **LOG**: It remains lit from the moment the device registers the first log until the moment it stops logging. When set to "Daily" mode, which must start and end daily at a predetermined time, it will remain lit within the set time. It will flash while logging, turn off at the time of a log and restart.
- **ALM**: Lights up and stays on when entering an alarm condition. Turns off when a new configuration is received, or the alarm status is cleared. Indicates to the user that, at some point, an alarm has been triggered.
- **1**, **2**, **3**, **4**: Light up while the alarm conditions of the corresponding channels are satisfied: 1 (analog channel 1), 2 (analog channel 2), 3 (analog channel 3) and 4 (digital channel). When you exit the alarm condition, the flag will be cleared.
- : Indicates the battery voltage level. This symbol is updated next to the log range (even if the device is not logging), with a minimum of 5 minutes. Thus, if the device is configured to log every 1 second, the battery indicator will refresh every 5 minutes. If the logging interval is longer than 5 minutes, the battery indicator will update with the same log range.
  - : Battery over 75%;
  - : Battery over 50%;
  - : Battery over 25%;
  - : Battery below 25% (provide battery replacement).
- **MAX**: Lights up while the "Maximum" values information reached in each channel are being displayed.
- **COM**: Flashes to inform the receipt of valid data packet from one of the available communication interfaces.
- **CH1**, **CH2**, **CH3**, **CH4**: Indicates which channels are enabled.
- **MIN**: Lights up while the "Minimum" amount of information is being displayed.
- **°F**, **°C**: If the channel unit is set to °F or °C, one of the symbols will light up during channel display. Otherwise, no unit symbol will be displayed.
- **PM**: If the clock is set in the 12-hour format, the PM symbol will light up when the clock is displayed, and the time is later than 1 pm.

## 3.2 OPERATION KEYS

To navigate between the screens, **LogBox Wi-Fi** has 2 keys:  . Each key, depending on the current navigation screen, has two or more features:

- Short touch (less than 2 seconds):
  - Proceeds to the next screen if the current screen mnemonic is being displayed.
  - Displays the mnemonic of the current screen again if the screen information is being displayed.
- Long touch (longer than 2 seconds or held down):
  - Takes an action within the current screen.
- Both keys held down (longer than 2 seconds or held down):
  - Takes a second action within the current screen.

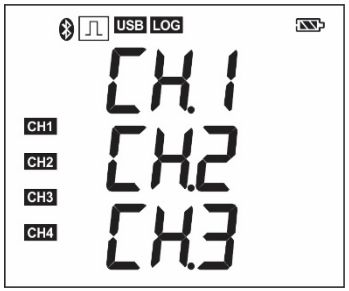
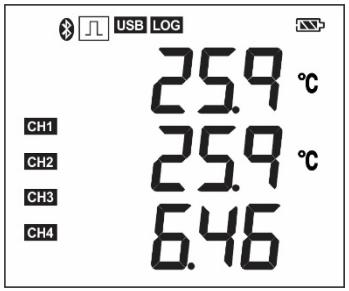
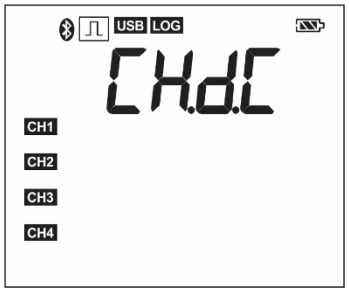
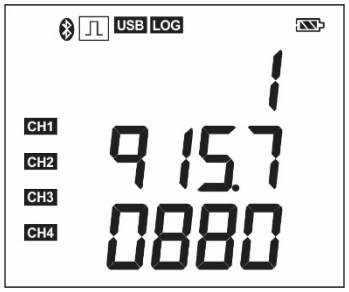
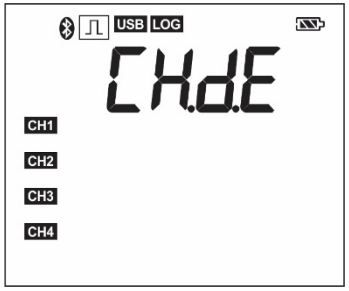
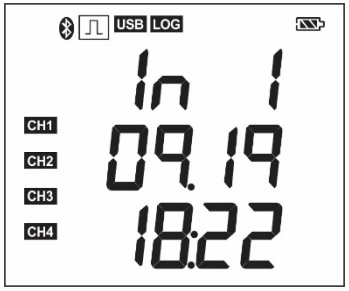
If the buzzer is active, pressing any key will mute it.

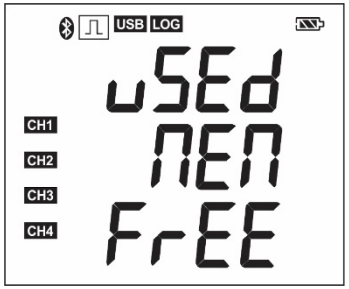
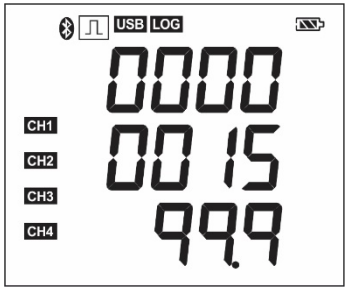
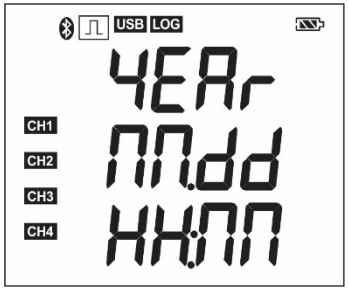
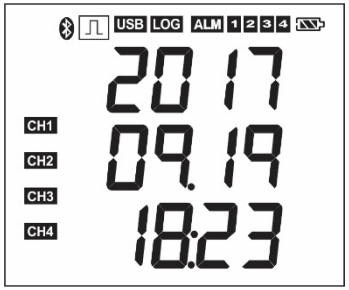
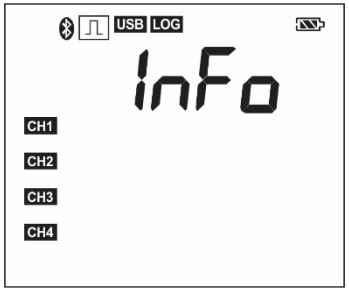
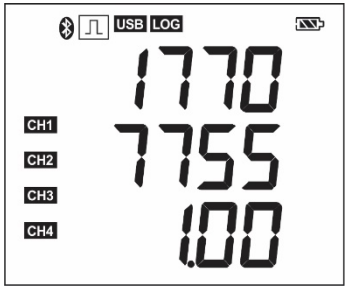
## 3.3 NAVIGATION KEYS

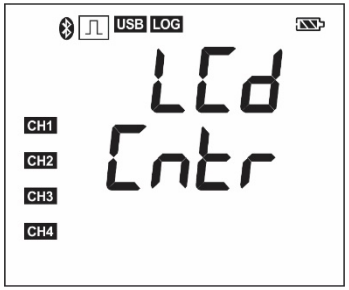
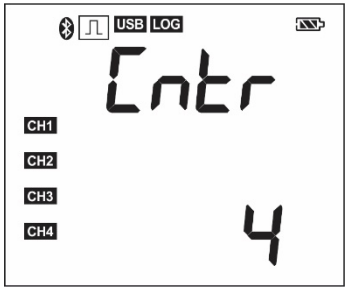
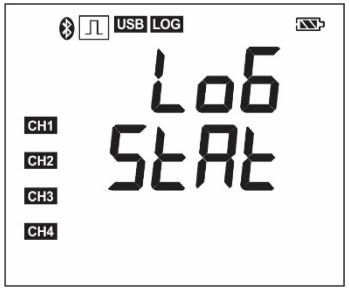
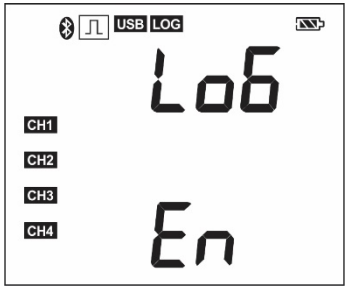
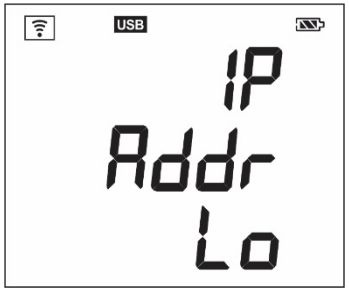
To streamline information identification on each screen, a mnemonic, which will remain visible for two seconds, will be displayed when pressing a key. If no key is pressed for this period, the information on the current screen will be displayed. If the  key or the  key is pressed while a mnemonic is being displayed, the device will advance to the next screen or return to the previous one, which will be properly specified by their mnemonics.

When the device is displaying the information on a screen, simply press any of the two keys to make the mnemonic appear again. To access the desired screen, just wait two seconds.

The table below shows all screens, mnemonics, and information about them, the description of each information and keys function of each screen available in the device.

| SCREEN | MNEMONIC | INFORMATION | DESCRIPTION | KEYS FUNCTION |
|---|---|---|---|---|
| **1. Analog Inputs** |  <br>Displayed for two seconds before accessing the "Analog Inputs" screen. |  <br>This screen will be updated by the log range and/or by the display update. | Displays the current value of the analog channels and allows the display of the maximum and minimum values reached by each channel.<br>Line 1: Analog channel 1 value.<br>Line 2: Analog channel 2 value.<br>Line 3: Analog channel 3 value. | Key held down or long touch: Informs the maximum value reached in each analog channel.<br>Key held down or long touch: Informs the minimum value reached in each analog channel.<br>Both keys held down: Clears the alarm statuses and the minimum and maximum values reached by each analog channel. |
| **2. Digital Input**<br>**a. Pulse Count** |  <br>Displayed for two seconds before accessing the "Digital Input - Pulse Count" screen. |  <br>This screen will be updated by the logs range. | When enabled and configured on Pulse Count mode, it displays the flow recorded in the pulse count of the last record period for the digital channel. If this option is not configured, this screen will not be shown.<br>Uses the three display lines to display the flow in the user unit with the number of configured decimal places. | Key held down or long touch: Informs the maximum flow reached in the pulse count for the digital input.<br>Key held down or long touch: Informs the minimum flow reached in the pulse count for the digital input.<br>Both keys held down: Clears the alarm statuses and the minimum and maximum values reached in the pulse count for the digital input. |
| **2. Digital Input**<br>**b. Event Log or Logs Control** |  <br>Displayed for two seconds before accessing the "Digital Input - Event Log or Record Control" screen. |  <br>This screen will be updated for each event detected at the digital input. | When enabled and configured in the "Event Log" or "Record Control" modes, it displays the last detected event on the digital input. If these options are not configured, this screen is not displayed.<br>Line 1: Edge detected in event: 0 – Falling edge; 1 – Rising edge.<br>Line 2: Month.Day of the event.<br>Line 3: Hour:Minute of the event. | Key held down or long touch: No action.<br>Key held down or long touch: No action.<br>Both keys held down: No action. |

| SCREEN | MNEMONIC | INFORMATION | DESCRIPTION | KEYS FUNCTION |
|---|---|---|---|---|
| **3. Log Memory** |  <br>Displayed for two seconds before accessing the "Log Memory" screen. |  <br>This screen will be updated by the logs range. | Displays the number of logs in the memory and free memory percentage.<br>Line 1 and 2: Number of logs recorded in the memory.<br>Line 3: Free memory percentage. | Key held down or long touch: No action.<br>Key held down or long touch: No action.<br>Both keys held down: No action. |
| **4. Date/Time** |  <br>Displayed for two seconds before accessing the "Date/Time" screen. |  <br>This screen will be updated by the log range and/or by the display update. | Displays the device's current date and time.<br>Line 1: Year.<br>Line 2: Month.Day.<br>Line 3: Hour:Minute. | Key held down or long touch: No action.<br>Key held down or long touch: No action.<br>Both keys held down: No action. |
| **5. Information** |  <br>Displayed for two seconds before accessing the "Information" screen. |  <br>This screen is static and always has the same value for the same device. | Displays device information.<br>Line 1 and 2: Serial Number.<br>Line 3: Firmware Version. | Key held down or long touch: No action.<br>Key held down or long touch: No action.<br>Both keys held down: No action. |

| SCREEN | MNEMONIC | INFORMATION | DESCRIPTION | KEYS FUNCTION |
|---|---|---|---|---|
| **6. Display Contrast Adjustment** |  <br>Displayed for two seconds before accessing the "Display Contrast Adjustment" screen. |  <br>This screen will be updated whenever the display contrast is adjusted. | Displays the contrast level configured for the display and allows adjustment of the display.<br>Line 3: Current contrast value. Can be adjusted from 0 to 7. |  Key held down or long touch: Increases contrast (maximum of 7).<br>  Key held down or long touch: Decreases contrast (minimum of 0).<br>  Both keys held down: No action. |
| **7. Log Status** |  <br>Displayed for two seconds before accessing the "Log Status" screen. |  <br>This screen will be updated whenever the current log status is changed. | Displays the current log status and allows them to be started and/or paused if the device is configured to allow keyboard start and/or end.<br>**En** – Enabled logs.<br>**d IS** – Disabled logs. |  Key held down or long touch: Initiates logs if "By Keyboard" start mode is enabled.<br>  Key held down or long touch: Pause records if the "By Keyboard" end mode is enabled.<br>  Both keys held down: No action. |
| **8. IP Low** |  <br>Displayed for two seconds before accessing the "IP Low" screen. |  <br>This screen will be updated whenever the IP is changed. | Displays the last two octets of the configured IP address. |  Key held down or long touch: No action.<br>  Key held down or long touch: No action.<br>  Both keys held down: No action. |

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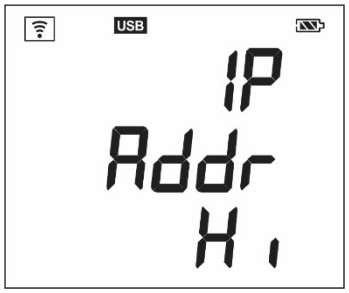
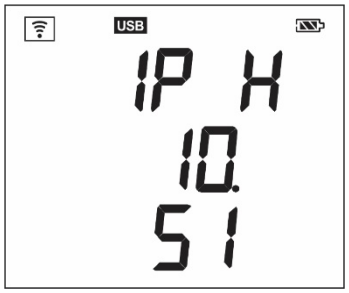
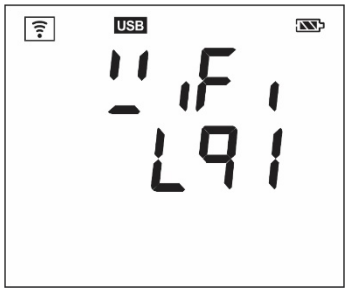
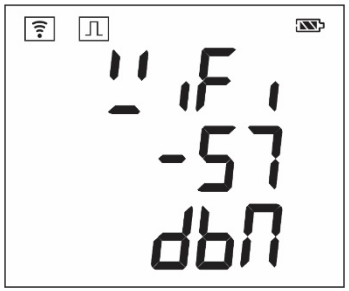
|---|---|---|---|---|
| **9. IP High** |  <br>Displayed for two seconds before accessing the "IP High" screen. |  <br>This screen will be updated whenever the IP is changed. | Displays the first two octets of the configured IP address. | Key held down or long touch: No action.<br>Key held down or long touch: No action.<br>Both keys held down: No action. |
| **10. Wi-Fi Signal Strength** |  <br>Displayed for two seconds before accessing the "Wi-Fi LQI" screen. |  <br>This screen will be updated according to the Wi-Fi signal strength. | Displays the signal strength between the device and the Wi-Fi access point. | Key held down or long touch: No action.<br>Key held down or long touch: No action.<br>Both keys held down: No action. |

**Table 01** – Navigation Keys

# 4. OPERATION AUTONOMY

**LogBox Wi-Fi** is powered by an external power supply, with a 10 to 30 VDC input, or USB port. The device can optionally be powered by four standard "AA" batteries (1.5 V each) which, in the event of a power failure in the power supply source, will keep it running for at least two years. In this case, to reduce consumption, the Wi-Fi interface will be disabled. All other features, however, will remain in operation for at least one year. When power from the power supply source is restored, the Wi-Fi interface will be activated, and the data logged in memory during the power interruption will be published in the services that support backup.

While the device is operated by batteries, very high temperatures (above 30 °C) or too low (below 10 °C) will cause battery chemistry to react outside typical operating characteristics, reducing battery life. Thus, when operating the device in these ranges, consider that the two-year expectation can be reduced considerably.

While the device is operating on batteries, temperatures too high (above 30 °C) or too low (below 10 °C) will make the **LogBox Wi-Fi** circuit greatly increase its consumption. Thus, when operating the device in these ranges, consider that the two-year expectation can be reduced considerably.

Some scenarios can also increase **LogBox Wi-Fi** consumption, considerably reducing battery life expectancy. Here are some examples of situations that may decrease battery life:

- **Alarm:** Alarm occurrences more than once a day and with a buzzer duration over 30 seconds.
- **Event Log:** Events that occur with a frequency greater than once every hour.

When necessary, the batteries can be replaced with any model that has characteristics like alkaline batteries (1.5 V). However, replacement with *Energizer E91* units (identical to those accompanying the device) or *Energizer L91* (which has a higher operating temperature range) is recommended to ensure the expected battery life expectancy and specified working temperature. If you choose another battery model, it is necessary to check its working temperature and life expectancy.

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|---|---|
|  | **Never mix batteries of different models, or new batteries with used ones. Whenever you are replacing the batteries, replace all of them at the same time.**<br>**Check battery polarity before inserting it into the device. Never use an inverted battery.**<br>**While the LogBox Wi-Fi is powered by batteries, and to reduce power consumption, the Wi-Fi interface will remain disabled.** |

# 5. INPUT SIGNALS READING

**LogBox Wi-Fi** allows users to choose, in addition to the channels to be registered and sensor types, some configurations that provides flexibility to several applications, offering the possibility of weighing the energy resources (battery life) and data storage (length of log memory). Thus, it is possible to configure the device with the following parameters:

- **Log Range:** Shows frequency, in seconds, with which an acquisition must be made and logged in the memory. A low periodicity will increase battery consumption and fill up the memory faster.
  - **Minimum Range:**
    - 1 second (if no channel is configured to operate on average);
    - 10 seconds (if a channel is configured to operate on average).
  - **Maximum Range:** 18 hours.
- **Display Update Range:** Shows frequency, in seconds, with which an acquisition must be made and updated on the display. It allows you to save memory by configuring it to a larger range of logs without damaging the Display update rate. Low frequency increases battery consumption. This range can be disabled if set to '0'. Thus, the display update will take place in the log range.
  - **Minimum Range:** 1 second;
  - **Maximum Range:** 1 hour.

When configuring a Display Update Range, it should be less than the Log Range. Otherwise, it will be ignored, and the display will be updated at the same Log Range.

The Display Update Range only updates Analog Channels that are not configured to operate on average. Thus, the Digital Channel that is configured to operate in counting mode and the Analog Channels that are configured to operate on average will only have their information updated at each log range.

If the digital channel is operating in the "Event Log" mode, each event will update its respective information on the display.

## 5.1 ANALOG INPUTS

**LogBox Wi-Fi** has three channels for reading analog signals. The types of signals and sensors accepted by them are:

- **Temperature Sensors:**
  - Thermoresistance Pt100;
  - Thermocouples J, K, T, N, E, R, S, and B;
  - Internal Temperature Sensor.
- **Linear Sensors:**
  - 0 to 50 mV;
  - 0 to 5 V;
  - 0 to 10 V;
  - 0 to 20 mA;
  - 4 to 20 mA.
- **Internal Diagnostic Sensors:**
  - Battery Voltage;
  - External Power Supply Voltage.

Each type has specific operation configurations and characteristics. Its configurations and characteristics are described below:

- **Temperature Sensors:**
  - Inform the measured temperature within the possible measuring range of each sensor;
  - The maximum resolution for the Temperature Sensors is 0.1 °C;
  - You can configure them to be displayed with one or no decimal places;
  - You can configure them to be displayed in units of measure °C or °F.
- **Linear Sensors:**
  - Inform you of some magnitude in the range required by the user (defined in the parameter "User Range"), as configured in the "Lower Limit", "Upper Limit", and "Number of Decimal Places" parameters.
    - **Number of Decimal Places:** Allows you to choose to use 0, 1, or 2 decimal places.
    - **Lower Limit:** Corresponds to the value configured to represent the minimum value of the chosen sensor:
      - Minimum -19999 to 0 decimal places;
      - Minimum -1999.9 to 1 decimal place;
      - Minimum -199.99 to 2 decimal places.
    - **Upper Limit:** Corresponds to the value configured to represent the maximum value of the chosen sensor:
      - Maximum 19999 to 0 decimal places;
      - Maximum 1999.9 to 1 decimal place;
      - Maximum 199.99 to 2 decimal places.

- You can configure them to be displayed in units of measurement °C, °F or in a custom unit of up to 8 characters, which will not show on the display;
- The maximum resolution for linear sensors corresponds to a ratio between the user range and the maximum resolution of the chosen sensor.

- **Internal Diagnostic Sensors:**
  - Inform the voltage of the possible **LogBox Wi-Fi** power supply sources;
  - The maximum resolution for the internal diagnostic sensors is 0.01 V;
  - You can configure them to be displayed with 0, 1, or 2 decimal places;
  - The unit of measure for these sensors is Volts and no unit symbol is displayed.

Refer to the Technical Specifications chapter to check these signals' accuracy. Refer to the Installation chapter to check these signals' connection.

An analog/digital (A/D) converter with high resolution and accuracy is used to read the sensors connected to the analog channel inputs. In the desired scan range, all the analog channels enabled will be read.

Each type of input signal has a valid measuring range (refer to chapter Technical Specifications) for more information. However, the device can typically measure signals which slightly exceed the limits of this range. The amount it can measure beyond it, however, depends on the type of input configured and can vary between different devices.

The following table describes the input types supported by the device, the device's signal conditions and their respective indications.

### 5.1.1 MEASUREMENT AND INDICATION OF INPUT TYPES

| INPUT TYPE | INPUT SIGNAL CONDITION | INDICATION |
|---|---|---|
| **Pt100** | Within range | Read input value |
| | Pt100 with one or more wires disconnected | ---- will be displayed |
| | Slightly above the upper limit | -22000 will be logged in the memory |
| | Slightly under the lower limit | Read input value * |
| | Far above the upper limit | UUUU will be displayed<br>32767 will be logged in the memory |
| | Far under the lower limit | nnnn will be displayed<br>-32000 will be logged in the memory |
| **Thermocouples J, K, T, E, N, R, S, and B** | Within range | Read input value |
| | Open Thermocouple | ---- will be displayed<br>-22000 will be logged in the memory |
| | Slightly above the upper limit | Read input value * |
| | Slightly under the lower limit | Read input value * |
| | Far above the upper limit | UUUU will be displayed |
| | Far under the upper limit | nnnn will be displayed<br>-32000 will be logged in the memory |
| **Voltage 0 to 50 mV** | Within range | Read input value converted into User Range |
| | Disconnected signal | ---- will be displayed<br>-22000 will be logged in the memory |
| | Slightly above the upper limit | Read input value converted into User Range * |
| | Slightly under the lower limit | Read input value converted into User Range * |
| | Far above the upper limit | UUUU will be displayed<br>32767 will be logged in the memory |
| | Far under the lower limit | nnnn will be displayed<br>-32000 will be logged in the memory |
| **Voltage 0 to 5 V 0 to 10 V** | Within range | Read input value |
| | Disconnected signal | 0 V value converted into User Range |
| | Slightly above the upper limit | Read input value converted into User Range * |
| | Slightly under the lower limit | Read input value converted into User Range * |
| | Far above the upper limit | UUUU will be displayed<br>32767 will be logged in the memory |
| | Far under the lower limit | nnnn will be displayed<br>-32000 will be logged in the memory |

| INPUT TYPE | INPUT SIGNAL CONDITION | INDICATION |
|---|---|---|
| **Current 0 to 20 mA** | Within range | Read input value converted into User Range |
| | Disconnected signal | 0 mA value converted into User Range |
| | Slightly above the upper limit | Read input value converted into User Range * |
| | Slightly under the lower limit | It is not possible to decrease beyond the lower limit |
| | Far above the upper limit | UUUU will be displayed<br>32767 will be logged in the memory |
| | Far under the lower limit | It is not possible to decrease beyond the lower limit |
| **Current 4 to 20 mA** | Within range | Read input value converted into User Range |
| | Disconnected signal | ---- will be displayed<br>-22000 will be logged in the memory |
| | Slightly above the upper limit | -22000 will be logged in the memory |
| | Slightly under the lower limit | Read input value converted into User Range * |
| | Far above the upper limit | UUUU will be displayed<br>32767 will be logged in the memory |
| | Far under the lower limit | nnnn will be displayed<br>-32000 will be logged in the memory. |

**(*) Note**: The analog channel indication continues slightly beyond the limits specified for the selected input type. However, in this condition, accuracy is not guaranteed.

**Table 02** – Measurement and indication of input types by **LogBox Wi-Fi**

**LogBox Wi-Fi** allows you to configure settings to be applied to analog sensor readings. These settings can be used to correct errors in the sensor or process in which the sensor is installed and applied individually for each analog channel. Two adjustment modes are provided by the device:

- **Offset**: Allows each analog channel to choose an Offset value to be added to the channel reading indication. It is a simple and fast feature to adjust the display throughout the range.
- **Custom Calibration**: Allows you to enter up to 10 set points for each channel to correct distortions in reading these channels at these points. We call this characteristic a "custom calibration" because it allows the user to adjust the indication at the desired points by zeroing their errors. The adjustment is made linearly between the points entered, according to the values entered.

It is important to note that both the Offset adjustment and the insertion of custom calibration points are optional, only indicated for those who wish to adjust the indication to a local standard, since the **LogBox Wi-Fi** has already been calibrated at the factory.

**Whenever you change the input type, make sure that the custom calibration points of the previous input are deleted!**

For each analog channel, a unique (Tag) name must be assigned, which will be used to reference the channel. You should also choose the type of input (sensor) that will be connected to that channel. In addition to that, you can assign the unit of measured value: for temperature sensors (Pt100 or thermocouples), degrees Celsius (°C) or Fahrenheit (°F); for linear sensors (current or voltage), you can enter the desired unit.

In the case of linear input types, one must choose the sensor indication range, that is, what the channel should indicate when the input is at its minimum value and what it should indicate when it is at its maximum value (minimum and maximum values considering the **LogBox Wi-Fi** working range for the chosen input type). Once the 4 to 20 mA input type is chosen, for example, a pressure transmitter from 0 to 2 bars will be connected. In this case, "0.0" must be chosen as the minimum value and "2.0" as the maximum value in the input configuration. All resolution and accuracy available will be contained within the chosen range.

When a simulator is used on analog inputs that are connected to the mains (e.g. a thermocouple or voltage simulator) and it is not isolated, it is recommended to use a different reading interface than USB. In some cases, the occurrence of noise and read Offsets has already been detected due to the influence of the USB cable connection, probably by ground loops.

**LogBox Wi-Fi**, when operated by batteries, keeps the entire analog circuit switched off while no acquisition is being made. This strategy is necessary so that it can operate for more than two years without needing to change batteries. This characteristic may cause some undesirable effects during calibration, as some analog signal simulators (e.g., thermocouples simulator or a Pt100) may not operate properly, causing false reading Offsets and oscillations. Should such a problem be identified, it is recommended to power the **LogBox Wi-Fi** By external source or USB cable while using a simulator.

Setting the local network frequency (50 Hz or 60 Hz) is important as it helps improve the performance of reading analog channels even while the device is running on battery power. Usually, the power grid causes interference in the signal read from the sensors, which can be more easily mitigated if we know the frequency.

## 5.2 DIGITAL INPUT

**LogBox Wi-Fi** has a Digital Input channel that can be configured for "Pulse Count", "Event Log", or even for "Logs Control" modes. This Digital Input can be disabled.

Regardless of the function for which it will be used, you must configure the type of sensor output that will be connected to the input: PNP, NPN, or Dry Contact (refer to chapter Installation to see how the sensors should be connected). In addition to that, it is necessary to select the edge of interest of the digital signal to generate the count, event, or start/end of logs: rising edge, falling edge, or both edges.

| Relationship between Sensor Type, Sensor Status, and Logical Level obtained in LogBox Wi-Fi | | |
|---|---|---|
| **Sensor Type** | **Sensor State** | **Logical Level** |
| **PNP** | Open | 0 |
| | Closed | 1 |
| **NPN** | Open | 1 |
| | Closed | 0 |
| **Dry Contact** | Open | 1 |
| | Closed | 0 |

**Table 03** - Digital Input

For Dry Contact sensors, it is necessary to set a *debounce* time of at least 50 ms (sensor stabilization time / time in which the sensor must remain in the state of interest for it to be considered valid). For PNP or NPN type sensors, if configured in "Pulse Count" mode, it is not necessary to set a *debounce* time. However, if the digital input is configured for the "Event Log" or "Logs Control" modes, a minimum *debounce* of 50 ms is required to prevent any noise from generating a false event. In the "Event Log" and "Logs Control" modes, events will be generated after the end of the *debounce* time.

### 5.2.1 PULSE COUNT

By setting the Digital Input on the "Pulse Count" mode, it will be possible to count the number of pulses occurring within a period and to log the average flow rate. **LogBox Wi-Fi** has a 16-bit register for accumulating the number of pulses within a given range and logging it in the memory. Thus, at each log range, **LogBox Wi-Fi** captures the number of pulses and logs it in the memory, zeroing the register to accumulate the pulses for the next interval.

If the sensor is a Dry Contact sensor type, the **LogBox Wi-Fi** will be able to count to 10 pulses per second. For PNP and NPN sensors, 2000 pulses per second. However, it is important to note that these pulses will accumulate within the log range. Thus, it is necessary to evaluate the sensor maximum frequency so that it does not exceed 65535 counts (16 bits) within the log range and *overflow* the register that accumulates them.

If the maximum sensor frequency is 2 kHz, the **LogBox Wi-Fi** will accumulate 2000 pulses per second for up to 32 seconds. By exceeding this range, the number of accumulated pulses will exceed 65535 counts, resulting in *overflow* in the accumulator register. For a sensor that can reach 2000 pulses per second, it is recommended that the log frequency be less than 32 seconds.

In typical applications, such as flow and volume measurement, simple pulse counting is not enough, being necessary to convert these pulses into a flow unit. For this, one can select the desired flow unit and a conversion factor which will transform the number of pulses generated by the connected transmitter in flow information. The pulse conversion logged in the range for the flow unit configured by the user will occur every time the logged data is displayed.

To streamline the digital channel configuration in "Pulse Count" mode and the conversion to flow in the unit required, **LogBox Wi-Fi** provides the following units of measure:

| Flow Units | Sensor Units |
|---|---|
| l/s,<br>l/min,<br>l/h,<br>gal/s,<br>gal/min,<br>gal/h,<br>$m^3/s$,<br>$m^3/min$,<br>$m^3/h$. | pulses/l,<br>pulses/gal,<br>pulses/$m^3$. |

**Table 04 –** Units of Measure

If the user uses any of the flow and sensor units, it is necessary to inform the sensor factor. If none of the available units are required, you will need to calculate the user factor by relating the parameters "User Unit", "Sensor Unit" and "Sensor Factor", and fill it in so that the device correctly converts the pulses to the required unit. In this case, **LogBox Wi-Fi** will convert the pulses to the user unit as follows:

- User Value = (Count)/(Sensor Factor)*(User Factor)
  - It is necessary to consider that the log range is 1 second and will not influence the calculation. Internally, **LogBox Wi-Fi** always considers the log range.

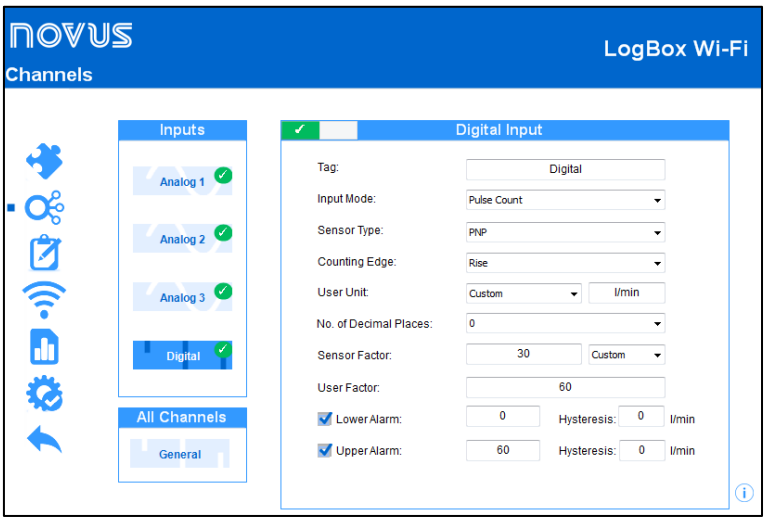



**Fig. 02** – Digital Input Screen

Let's say, for example, that an application has a PNP-type sensor that computes a produced part every 30 rising-edge pulses and that the user wants to visualize the production in parts per minute. The following parameters must have been configured on the device's digital input:

- **Log Range:** It must be configured to log the maximum sensor frequency.
- **Input Mode:** Pulse Count.
- **Sensor Type:** PNP.
- **Counting Edge:** Rise.
- **Unit and Sensor Unit:** Custom.
- **Sensor Factor:** 30 (pulses/part).
- **User Factor:** 60 (conversion of parts per second to parts per minute).

Thus, **LogBox Wi-Fi** will record the number of pulses occurring within that period at each log range, and every time the data is displayed, it will transform those pulses into the number of parts produced per minute (user-customized unit).

In the same example, it is possible to assume that the log range is 20 seconds. Thus, if the sensor gives 20 pulses per second, the **LogBox Wi-Fi** will register 400 pulses per range, displaying 40 parts per minute (((20 pulses/s)/(30 pulses/part)) * 60 (1 min) = 40) for the user.

### 5.2.2 EVENT LOG

If the digital input is configured in the "Event Log" mode, each selected edge will create a log in memory, informing the event and the instant that it occurred. This log will not be synchronized with the periodic logs, but will respect the logs beginning and end modes. Events will be logged after the end of the *debounce* time set and will be logged with the *debounce* time delay. **LogBox Wi-Fi** can log up to 10 events within 1 second.

### 5.2.3 LOGS CONTROL

It is possible to use the digital input to start and/or pause the logs of the other input channels. Once configured in the "Logs Control" mode, each selected edge will start or stop the process of in-memory logs. As in the "Event Log" mode, detected events will only act after the configured *debounce* time expires. Thus, the start/pause of the logs will be performed with the *debounce* time delay.

# 6. DIGITAL OUTPUT

The **LogBox Wi-Fi** has a PNP-type Digital Output which when triggered places the voltage from the external power supply to the respective terminal and can be disabled or configured to operate in one of the modes described below:

- **Auxiliary Electronic Switch:** Allows you to control the power supply of external instruments during analog channel readings.

  4-20 mA transmitters, for example, can be fed by the digital output pin, so that they are only turned on when they are read – which would save energy from the **LogBox Wi-Fi** external power supply, which can be a 12 V battery. In the "Auxiliary Electronic Switch" mode, it will be necessary to configure how long before each acquisition the digital output must be triggered.

  - **Drive Time:** It defines, in seconds, how long before each acquisition the digital output must be triggered. It will be deactivated when the acquisition is ready. Such time cannot be longer than the lowest acquisition range (Instant, Average = 1/10 of the snapshot, Interval of Display Range). If equal to 0, the Auxiliary Electronic Switch will be enabled at the exact moment of an acquisition. If greater than or equal to the lowest acquisition range, the Auxiliary Electronic Switch will remain be enabled.
- **Alarm Status:** Allows you to follow the current general alarm status. If any channel is in an alarm situation, the Digital Output will be triggered. If no channel is set to alarm, the Digital Output will be disabled.

# 7. MQTT PROTOCOL

**LogBox Wi-Fi** is compatible with the Message Queue Telemetry Transport (MQTT) protocol, a protocol designer for low data bandwidth consumption and which uses the Publish/Subscribe paradigm for message exchange.
Acting as a Publisher/Subscriber MQTT, **LogBox Wi-Fi** requires a middleware named Broker, responsible for sending messages from Publishers to Subscribers, to operate. **LogBox Wi-Fi** is, simultaneously, a Publisher, with 7 publication topics, to provide information about sensors and several device statuses and a Subscriber, with 1 inscription topic, to receive possible parameters alterations and to remotely offer a certain control level to the user.

## 7.1 PUBLICATION TOPICS

When connected to a Broker, the **LogBox Wi-Fi** can register up to seven topics, which will be presented below. Check the Frame Parameters section of this chapter for more information about the frames that molded the responses to each publication topic.

The message sent in each topic corresponds to a JSON frame, which encapsulates several parameters. In the frame, these parameters correspond to strings. Values of each parameter, however, must be processed differently.

### 7.1.1 STATUS TOPICS

- **novus/<sn>*/status/channels:** Topic for the publication of the **last** log of the analog channels and digital channel in "Pulse Count" mode.
  **Example:** {"n_channels":4,"timestamp":43277.69538194,"battery":5.69, "value_channels":[0.000,24.200,0.000,24.200], "alarm_low":[0,1,0,0], "alarm_high":[0,0,0,1],"buzzer_state":0}
- **novus/<sn>*/status/event:** Topic for the publication of the **last** log of the digital channel in "Event Log" mode.
  **Example:** {"timestamp":43277.82236111, "event_type":"down", "millisecond":630}

### 7.1.2 LOGS TOPICS

- **novus/<sn>*/log/channels:** Topic for the publication of **all** logs of the analog channels and digital channel in "Pulse Count" mode. Used mainly when there is loss of communication link with the Broker or lack of external power, as it will receive all historical logs.
  **Example:** {"n_channels":4, "timestamp":43277.69538194, "battery":5.69, "value_channels":[0.000,24.200,0.000,24.200], "alarm_low":[0,1,0,0], "alarm_high":[0,0,0,1], "buzzer_state":0}
- **novus/<sn>*/log/event:** Topic for the publication of **all** logs of the analog channels and digital channel in "Event Log" mode. Used mainly when there is loss of communication link with the Broker or lack of external power, as it will receive all historical logs.
  **Example:** {"timestamp":43277.82236111,"event_type":"down","millisecond":630}

### 7.1.3 CONFIGURATION TOPIC

- **novus/<sn>*/config:** Topic for the publication of the device configuration. It shall be published at the latest every five minutes.
  **Example:** {"n_channels":4, "timestamp":43277.56898148, "frame_format":"array_static", "channels_enabled":[0,1,0,1], "hash":"C071DA88ABA151A607AAB1527000E0017335FF08", "gmt":-180, "tag_channels":["","Analog1","","Analog3"], "tag_units":["","Celsius","","Celsius"], "sp_alarm_low":[0.000,40.500,0.000,0.000], "sp_alarm_high":[0.000,0.000,0.000,20.000]}

### 7.1.4 RESPONSE TOPIC

- **novus/<sn>*/response:** Topic for the publication of the commands response received by the device. **Table 06** lists the permissible error responses for this topic.
  **Example:** {"config_receive":"ok","error_type":"none","parameter":"none"}

### 7.1.5 IDENTIFICATION TOPIC

- **novus/neighbor:** Topic for the publication of the identify from the device(s) connected to the Broker. It shall be published at the latest every five minutes.
  **Example:** {"model":"LogBox Wi-Fi", "serial":12345678, "ip":"192.168.88.10", "mac":"B0:38:29:5D:FE:B1" ,"lqi":-40,"firmware_version":1.00}

* The <*sn*> is the device serial number. That way, there will be no clash of topics in the Broker.

## 7.2 INSCRIPTION TOPIC

When connected to a Broker, **LogBox Wi-Fi** can receive commands that will be answered through the **novus/<sn>*/response** topic, as can be seen below.

**Commands in this topic can only be sent to the Broker if they have write permission enabled in the NXperience software (see MQTT Protocol section of the Configuration Software chapter).**

- **novus/<sn>*/command:** Topic for receiving commands sent via MQTT.
  **Example:** {"buzzer_state":0}

| Command | Type | Example | Description |
|---|---|---|---|
| anl1_spa_high | Double | {"anl1_spa_high":10} | Allows you to change the channel 1 higher alarm setpoint if the device is configured to allow such a configuration (see Analog Channels Parameters section of the Configuration Software chapter). |
| anl1_spa_low | Double | {"anl1_spa_low":0} | Allows you to change the channel 1 lower alarm setpoint if the device is configured to allow such a setting (see Analog Channels Parameters section of the Configuration Software chapter). |
| anl2_spa_high | Double | {"anl2_spa_high":10} | Allows you to change the channel 2 higher alarm setpoint if the device is configured to allow such a configuration (see Analog Channels Parameters section of the Configuration Software chapter). |
| anl2_spa_low | Double | {"anl2_spa_low":0} | Allows you to change the channel 2 lower alarm setpoint if the device is configured to allow such a setting (see Analog Channels Parameters section of the Configuration Software chapter). |
| anl3_spa_high | Double | {"anl3_spa_high":10} | Allows you to change the channel 3 higher alarm setpoint if the device is configured to allow such a configuration (see Analog Channels Parameters section of the Configuration Software chapter). |
| anl3_spa_low | Double | {"anl3_spa_low":0} | Allows you to change the channel 2 lower alarm setpoint if the device is configured to allow such a setting (see Analog Channels Parameters section of the Configuration Software chapter). |
| dig_spa_high | Double | {"dig_spa_high":1} | Allows you to change the higher alarm setpoint of the digital channel if the device is configured to allow such a configuration (see Analog Channels Parameters section of the Configuration Software chapter). |
| dig_spa_low | Double | {"dig_spa_low":0} | Allows you to change the lower alarm setpoint of the digital channel if the device is configured to allow such a configuration (see Analog Channels Parameters section of the Configuration Software chapter). |
| buzzer_state | Booleana | {"buzzer_state":1} | It informs the current state of the buzzer, according to the parameter established in the Boolean settings of the sent command.<br>See the Boolean Format section of this chapter for more information about Boolean types and formats. |
| internal_clock | Unix Timestamp or TDateTime | {"internal_clock":1533294048}<br>If Unix format<br>{"internal_clock":43277.40465278}<br>If TDateTime format | Displays the device's internal clock.<br>This parameter must be written with the same Timestamp format defined in **NXperience**.<br>See the Timestamp section of this chapter for more information on the formats supported by the device. |
| set_download | Unix Timestamp or TDateTime | {"set_download":1533294048}<br>If Unix format<br>{"set_download":43277.40465278}<br>If TDateTime format | Command used to request that **LogBox Wi-Fi** resend all logs from the requested date in the "**/log/channels**" and "**/log/event**" topics (see Logs Topics section of this chapter).<br>This parameter must be written with the same Timestamp format defined in **NXperience**.<br>See the Timestamp section of this chapter for more information on the formats supported by the device. |

**Table 05** – Command list

If successful, the device will send a message that can be viewed in the response topic **novus/<sn>*/response**, as described in the Response Topic section of this chapter.

If there is any kind of error during the command request, the device will still send a response via the **novus/<sn>*/response** topic, but it will inform the type of error found, as described in **Table 6**.

**Example:**

**Command:** {"buzzer_state":0}

**Answer:** {"config_receive":"fail","error_type":"NOT_AUTHORIZED_ERROR","parameter":"buzzer_state"}

* The <*sn*> is the device serial number. That way, there will be no clash of topics in the Broker.

| Error Type | Description |
|---|---|
| NOT_AUTHORIZED_ERROR | Unauthorized parameter for writing. |
| HIGH_RANGE_ERROR | Error in the setpoint value of the upper alarm of a channel. |
| LOW RANGE ERROR | Error in the value of the lower alarm setpoint of a channel. |
| INVALID_VALUE_ERROR | Error for values outside parameter range. |
| ALARM_DISABLED_ERROR | Error resulting from attempting to change the setpoint of an alarm disabled. |
| CHANNEL_DISABLED_ERROR | Error resulting from attempting to change the alarm setpoint of a disabled channel. |
| EVENT_CHANNEL_ERROR | Error resulting from attempting to change the setpoint on the digital channel when it is set to "Event Log". |
| INVALID_STRING_ERROR | Error resulting from attempting to place an invalid key in the parameter. |
| PARSE_ERROR | Error in the JSON frame parse. |

**Table 06** – Error type

## 7.3 FRAME PARAMETERS

The following is a list of permissible parameters within each frame:

| PARAMETER | DESCRIPTION |
|---|---|
| alarm_high | Informs which channels are in alarm. See the Boolean Format section of this chapter for more information on how boolean variables work. |
| alarm_low | Informs which channels are in the upper alarm. See the Boolean Format section of this chapter for more information on how boolean variables work. |
| battery | Informs the current voltage of the battery in volts and with two decimal places. |
| buzzer_state | Informs whether or not the buzzer is in alarm. See the Boolean Format section of this chapter for more information on how boolean variables work. |
| channels_enabled | Reports the number of active channels on the device.<br>If it is active or configured as static, the digital channel in "Pulse Count" mode will always be the first item in the array. The array order of the channels is: Digital channel, analog channel 1, analog channel 2 and analog channel 3.<br>See the Boolean Format section of this chapter for more information on how boolean variables work. |
| config_received | Informs if the configuration was successfully sent or if there was an error during the process. |
| event_type | Informs the event counting edge: Rising edge, Rising edge, or both edges.<br>Permissible only for the digital channel and configurable through the **NXperience** software (see the chapter Configuration Software). |
| error_type | Reports the type of error encountered during the attempt to execute the command. See **Table 06** in this chapter for more information on error types. |
| firmware_version | Informs the firmware version of the device. |
| frame_format | Informs the type of JSON format defined for the frame. See the JSON Format section from the chapter for more information on frame formats. |
| gmt | Informs GMT in minutes. |
| hash | Informs the generated key by setting or changing any device parameters. It acts as a kind of configuration password applied to the device and is widely used in validated systems. |
| ip | Informs the IP device. |
| lqi | Informs the quality of your Wi-Fi connection. |
| mac | Informs the MAC address of the device. |
| model | Informs the device model. |
| millisecond | Informs in how many milliseconds the log event happened. You can supplement the timestamp parameter. |
| n_channels | Informs the numbers of the device channels. |
| parameter | Informs the parameter in which was change according to the sent topic. |
| serial | Informs the device's serial number. |
| sp_alarm_low | Informs the lower alarm setpoint. |
| sp_alarm_high | Informs the upper alarm setpoint. |
| tag_channels | Informs the defined tag for each channel through **NXperience** software. See the Configuration Software chapter for more information on how to set the tag for each channel. |
| tag_units | Informs the unit tag defined for each channel using the **NXperience** software: Celsius (°C) or Fahrenheit |

| | |
|---|---|
| | (°F). See the Configuration Software chapter for more information about the drives supported by the device. |
| timestamp | Informs the log date and time in Unix Timestamp or TDateTime format, as defined in the MQTT tab of **NXperience** software. See the Timestamp section of this chapter for more information on both formats or the MQTT Protocol section of the Configuration Software chapter to find out how to set up the Timestamp. |
| value_channels | Informs the values read by the active channels, always using three decimal places to do it. |

**Table 07 – Frame Parameters**

### 7.3.1 TIMESTAMP

The frame timestamp parameter informs the timestamp of the device in UNIX Timestamp or TDateTime format, as configured in the **NXperience Time Format** parameter (check the MQTT Protocol section of the Configuration Software chapter).

In an example where the date and time of a log are 18/07/2018 and 20:25:58, respectively, the MQTT protocol would convert them to:

- **UNIX Timestamp:** 1531945548.
- **TDateTime:** 43299.8512615.

## 7.4 MQTT PROTOCOL CONFIGURATION IN SOFTWARE NXPERIENCE

The user can enable and configure the MQTT protocol through the **NXperience** software, as can be seen in the Configuration Software chapter. Below are pertinent information and concepts about the MQTT protocol and that will later be essential for its configuration in **NXperience**.

### 7.4.1 QoS

The Quality of Service (QoS) serves to indicate the quality of the service in relation to the delivery of the data packets.

| QoS | Delivery Type |
|---|---|
| 0 | At most once. Known as "best effort". It resembles the UDP transport protocol, where there are no acknowledgments of message delivery to the sender. The sender has no obligation to keep the message stored for future retransmissions. |
| 1 | At least once. There is a message confirmation of delivery. It addresses situations where the sender of the message ends up generating several identical messages, possibly due to a delay in the arrival of the confirmation of receipt. This type of delivery ensures that at least one of them is able to perform the recognition. The message will be stored by the sender until there is a further confirmation of receipt from the recipient. |
| 2 | Exactly once. It ensures that the message is delivered exactly once, also guaranteeing the sending of confirmations of receipt and confirmations of receipt of the own confirmations of receipt. There are confirmations in two directions for everything that is trafficked. As long as a message is not acknowledged by the recipient, it is maintained by the sender. |

**Table 07** – QoS

### 7.4.2 JSON FORMAT

The **NXperience JSON Format** parameter allows you to change the formatting of the JSON frame as required by the supervisory software, as shown in the examples below, which propose a situation where analog channels 1 and 3 are enabled.

- **Static Array:** Send information about all variables, even those that are not enabled, grouping each parameter inside brackets.
  - **Status:**
    {"n_channels":4,"timestamp":43277.40465278,"battery":5.69,"value_channels":[0.000,22.300,0.000,22.300],"alarm_low":[0,1,0,0],"alarm_high":[0,0,0,1],"buzzer_state":0}
  - **Config:**
    {"n_channels":4,"timestamp":43277.57437500,"frame_format":"array_static","channels_enabled":[0,1,0,1],"hash":"1C0606FF77D68DD1DBDD6D25AC773C76AF42D3BB","gmt":-180,"tag_channels":["","Analog1","","Analog3"],"tag_units":["","Celsius","","Celsius"],"sp_alarm_low":[0.000,40.500,0.000,0.000],"sp_alarm_high":[0.000,0.000,0.000,20.000]}
- **Dynamic Array:** Send information only about the enabled variables, grouping each parameter inside brackets.
  - **Status:**
    {"n_channels":2,"timestamp":43277.40706019,"battery":5.69,"value_channels":[22.300,22.300],"alarm_low":[1,0],"alarm_high":[0,1],"buzzer_state":0}
  - **Config:**
    {"n_channels":2,"timestamp":43277.57538194,"frame_format":"array_dynamic","channels_enabled":[1,1],"hash":"9401ACBDFFD105D653DAE5222470B47127455BBC","gmt":-180,"tag_channels":["Analog1","Analog3"],"tag_units":["Celsius","Celsius"],"sp_alarm_low":[40.500,0.000],"sp_alarm_high":[0.000,20.000]}
- **Static Descriptive:** Send information about all variables, even those that are not enabled, grouping each variable in unit mode.
  - **Status:**
    {"n_channels":4,"timestamp":43277.40924769,"battery":5.69,"ch_dig":0.000,"ch_analog_1":22.600,"ch_analog_2":0.000,"ch_analog_3":22.600,"alarm_low_dig":0,"alarm_low_analog_1":1,"alarm_low_analog_2":0,"alarm_low_analog_3":0,"alarm_high_dig":0,"alarm_high_analog_1":0,"alarm_high_analog_2":0,"alarm_high_analog_3":1,"buzzer_state":0}

- **Config:**
  {"n_channels":4,"timestamp":43277.57784722,"frame_format":"descriptive_static","enabled_dig":0,"enabled_analog_1":1,"enabled_analog_2":0,"enabled_analog_3":1,"hash":"9401ACBDFFD105D653DAE5222470B47127455BBC","gmt":-180,"tag_dig":"","tag_analog_1":"Analog1","tag_analog_2":"","tag_analog_3":"Analog3","unit_dig":"","unit_analog_1":"Celsius","unit_analog_2":"","unit_analog_3":"Celsius","sp_alarm_low_dig":0.000,"sp_alarm_low_analog_1":40.500,"sp_alarm_low_analog_2":0.000,"sp_alarm_low_analog_3":0.000,"sp_alarm_high_dig":0.000,"sp_alarm_high_analog_1":0.000,"sp_alarm_high_analog_2":0.000,"sp_alarm_high_analog_3":20.000}

- **Dynamic Descriptive:** Send information only about the enabled variables, grouping each variable in a unitary manner.
  - **Status:**
    {"n_channels":2,"timestamp":43277.41043981,"battery":5.69,"ch_analog_1":22.800,"ch_analog_3":22.800,"alarm_low_analog_1":1,"alarm_low_analog_3":0,"alarm_high_analog_1":0,"alarm_high_analog_3":1,"buzzer_state":0}
  - **Config:**
    {"n_channels":2,"timestamp":43277.58234954,"frame_format":"descriptive_dynamic","enabled_analog_1":1,"enabled_analog_3":1,"hash":"9401ACBDFFD105D653DAE5222470B47127455BBC","gmt":-180,"tag_analog_1":"Analog1","tag_analog_3":"Analog3","unit_analog_1":"Celsius","unit_analog_3":"Celsius","sp_alarm_low_analog_1":40.500,"sp_alarm_low_analog_3":0.000,"sp_alarm_high_analog_1":0.000,"sp_alarm_high_analog_3":20.000}

### 7.4.3 BOOLEAN FORMAT

A Boolean data consists of a data type that basically has two values: 0 or 1 or false or true, with 0 being false and 1 being true. Both the MQTT protocol and **NXperience** software support that, according to the pattern chosen by the user, boolean values are displayed in numeric format or in string format.

The **NXperience Boolean Format** parameter (see MQTT Protocol section of the Configuration Software chapter) tells you how Boolean variables will be displayed within the JSON frame, as you can see in the examples below.

- **Numeric**:
  {"n_channels":4,"timestamp":43277.45657407,"battery":5.69,"value_channels":[0.000,23.400,0.000,23.400],"alarm_low":[**0**,**1**,**0**,**0**],"alarm_high":[**0**,**0**,**0**,**1**],"buzzer_state":**0**}
- **String**:
  {"n_channels":4,"timestamp":43277.45446759,"battery":5.69,"value_channels":[0.000,23.300,0.000,23.300],"alarm_low":[**false**,**true**,**false**,**false**],"alarm_high":[**false**,**false**,**false**,**true**],"buzzer_state":**false**}

# 8. MODBUS-TCP PROTOCOL

The **LogBox Wi-Fi** is compatible with the Modbus-TCP protocol, a data communication protocol used to connect the device to supervisory control and data acquisition (SCADA). It supports up to 5 simultaneous connections and allows up to 5 Modbus-TCP masters to monitor it at the same time.
In addition to enabling the **LogBox Wi-Fi** monitoring, if enabled in the configuration, it is possible to configure some parameters described in **Table 9**. It is also possible to complete the configuration and logs download of **LogBox Wi-Fi** through the TCP/IP network. In order to do this, however, it is necessary to use the **NXperience** configurator software (see the Configuration Software chapter for more information).

## 8.1 COMMANDS

It is important to note that the "Slave ID" parameter of the Modbus-TCP protocol can be filled with any value between 0 and 255. **LogBox Wi-Fi** is not a gateway, so it is only necessary to enter the IP address to perform the communication.

### 8.1.1 READ HOLDING REGISTERS – 0X03

This command can be used to read the value of one or even the maximum number of consecutive registers, as shown in **Table 08**.

### 8.1.2 WRITE HOLDING REGISTERS – 0X06

This command can be used to write in a register, as shown in **Table 09**.

### 8.1.3 WRITE MULTIPLE HOLDING REGISTERS – 0X16

This command can be used to write in a multiples registers, as shown in **Table 09**.

## 8.2 REGISTERS TABLE

Following is the table of registers supported by the device for the READ HOLDING REGISTERS commands:

| ADDRES | MNEMONIC | DESCRIPTION | INFORMATION |
|---|---|---|---|
| 0 | SERIAL_NUMBER_H | Device serial number (High part). | |
| 1 | SERIAL_NUMBER_L | Device serial number (Low part). | |
| 2 | PRODUCT_CODE | Device code. | |
| 3 | FIRMWARE_VERSION | Firmware version. | Unit with two decimal places. |
| 5 | MAC_ADDR_WiFi_0_1 | MAC Address Wi-Fi. | (XX:XX:00:00:00:00) |
| 6 | MAC_ADDR_WiFi_2_3 | MAC Address Wi-Fi. | (00:00:XX:XX:00:00) |
| 7 | MAC_ADDR_WiFi_4_5 | MAC Address Wi-Fi. | (00:00:00:00:XX:XX) |
| 15 | POWER_SUPPLY | Power supply. | **1.** Battery;<br>**2.** USB;<br>**3.** External source. |
| 21 | USB_STATUS | USB Interface status. | **1.** Active USB voltage;<br>**2.** Inactive USB voltage;<br>**3.** COM port closed;<br>**4.** COM port open. |
| 32 | NUMBER_OF_ACTIVE_CHANNELS | Number of active channels. | |
| 34 | RECORDS_STARTED_INTERFACE | Indicates the interface responsible for initiating logs. | **1.** Immediately start;<br>**2.** Start by date/time;<br>**3.** Start by keyboard;<br>**4.** Start by digital input;<br>**5.** Periodical start (Diary);<br>**6.** Start by software. |
| 35 | RECORDS_STOPPED_INTERFACE | Indicates the interface responsible for stopping the logs. | **1.**<br>**2.** Finish by date/time;<br>**3.** Finish by keyboard;<br>**4.** Finish by digital input;<br>**5.** Periodical finish (Diary);<br>**6.** Finish by software. |
| 36 | STATUS_OF_RECORDS | Status of records. | **1.** Stopped logs;<br>**2.** Logging. |
| 37 | NUMBER_OF_RECORDS_H | Number of records in memory (High part). | |
| 38 | NUMBER_OF_RECORDS_L | Number of records in memory (Low part). | |
| 39 | NUMBER_OF_FREE_RECORDS_H | Number of records available in memory (High part). | |
| 40 | NUMBER_OF_FREE_RECORDS_L | Number of records available in memory (Low part). | |
| 43 | FIRST_YEAR | Year of first log. | |

| | | | |
|---|---|---|---|
| 44 | FIRST_MONTH | Month of first log. | |
| 45 | FIRST_DAY | Day of first log. | |
| 46 | FIRST_HOUR | Hour of first log. | |
| 47 | FIRST_MINUTE | Minute of first log | |
| 48 | FIRST_SECOND | Second of first log. | |
| 51 | CURRENT_YEAR | Year of last log. | |
| 52 | CURRENT_MONTH | Month of last log. | |
| 53 | CURRENT_DAY | Day of last log. | |
| 54 | CURRENT_HOUR | Hour of last log. | |
| 55 | CURRENT_MINUTE | Minute of last log. | |
| 56 | CURRENT_SECOND | Second of last log. | |
| 61 | CHD_LAST_EVENT_YEAR | Year of last digital input event. | |
| 62 | CHD_LAST_EVENT_MONTH | Month of last digital input event. | |
| 63 | CHD_LAST_EVENT_DAY | Day of last digital input event. | |
| 64 | CHD_LAST_EVENT_HOUR | Hour of last digital input event. | |
| 65 | CHD_LAST_EVENT_MINUTE | Minute of last digital input event. | |
| 66 | CHD_LAST_EVENT_SECOND | Second of last digital input event. | |
| 67 | ALARM_STATUS | Alarm status at the current time. | **0.** Inactive alarm;<br>**1.** Active alarm. |
| 68 | BUZZER_STATUS | Current buzzer status. | **0.** Inactive buzzer;<br>**1.** Active buzzer. |
| 70 | DIGITAL_OUT_VALUE | Digital output status. | **0.** Inactive output;<br>**1.** Active output. |
| 71 | CHD_LAST_EVENT_EDGE | Edge of the digital channel where the last event occurred. | **0.** Descent edge;<br>**1.** Rising edge. |
| 72 | CHD_ALARM_STATUS | Current channel alarm status. | **0.** No alarm;<br>**1.** Minimum alarm;<br>**2.** Maximum alarm. |
| 73 | CHD_STATUS | Digital channel status. | **1.** Ok;<br>**2.** Underflow;<br>**3.** Overflow. |
| 74 | CHD_VALUE | Value of the last digital channel log. | In counts, if set to "Pulse Count" mode, or 1 or 0, if set in "Event Log" or "Record Control" modes, according to the logic level of the circuit. |
| 75 | CHD_VALUE_USER_UNIT_FLOAT_HIGH | Digital channel value in user unity (Float – high part). | |
| 76 | CHD_VALUE_USER_UNIT_FLOAT_LOW | Digital channel value in user unity (Float – low part). | |
| 77 | CHD_VALUE_MIN | Minimum value registered on digital channel. | |
| 78 | CHD_VALUE_MAX | Maximum value registered on digital channel. | |
| 79 | CHD_ALARM_MIN_STATUS | Minimum alarm status on digital channel. | Stores information if the channel ever reached the minimum alarm.<br>**0.** Never alarmed;<br>**1.** Already alarmed. |
| 80 | CHD_ALARM_MAX_STATUS | Maximum alarm status on digital channel. | Stores information if the channel ever reached the maximum alarm.<br>**0.** Never alarmed;<br>**1.** Already alarmed. |
| 81 | CH1_STATUS | Analog channel status 1. | **1.** Ok;<br>**2.** Underflow;<br>**3.** Overflow;<br>**4.** Cold joint error;<br>**5.** Open sensor. |

| | | | |
|---|---|---|---|
| 82 | CH1_VALUE | Current value of analogue channel 1. | Decimal places:<br>**1.** For temperature sensors and the cold joint;<br>**2.** For battery voltage and external power supply.<br>For linear sensors, the decimal point is configured. |
| 83 | CH1_VALUE_MIN | Minimum value registered on analog channel 1. | Decimal places:<br>**1.** For temperature sensors and the cold joint;<br>**2.** For battery voltage and external power supply.<br>For linear sensors, the decimal point is configured. |
| 84 | CH1_VALUE_MAX | Maximum value registered on analog channel 1. | Decimal places:<br>**1.** For temperature sensors and the cold joint;<br>**2.** For battery voltage and external power supply.<br>For linear sensors, the decimal point is configured. |
| 85 | CH1_ALARM_MIN_STATUS | Analog channel 1 minimum alarm status. | Stores information if the channel ever reached the minimum alarm.<br>**0.** Never alarmed;<br>**1.** Already alarmed. |
| 86 | CH1_ALARM_MAX_STATUS | Analog channel maximum alarm status 1. | Stores information if the channel ever reached the maximum alarm.<br>**0.** Never alarmed;<br>**1.** Already alarmed. |
| 87 | CH1_ALARM_STATUS | Analog channel 1 current alarm status. | **0.** No alarm;<br>**1.** Minimum alarm;<br>**2.** Maximum alarm. |
| 89 | CH2_STATUS | Analog channel status 2. | **1.** Ok;<br>**2.** Underflow;<br>**3.** Overflow;<br>**4.** Cold joint error;<br>**5.** Open sensor. |
| 90 | CH2_VALUE | Analog channel 2 current value. | Decimal places:<br>**1.** For temperature sensors and the cold joint;<br>**2.** For battery voltage and external power supply.<br>For linear sensors, the decimal point is configured. |
| 91 | CH2_VALUE_MIN | Minimum value registered on analogue channel 2. | Decimal places:<br>**1.** For temperature sensors and the cold joint;<br>**2.** For battery voltage and external power supply.<br>For linear sensors, the decimal point is configured. |
| 92 | CH2_VALUE_MAX | Maximum value registered on analogue channel 2. | Decimal places:<br>**1.** For temperature sensors and the cold joint;<br>**2.** For battery voltage and external power supply.<br>For linear sensors, the decimal point is configured. |
| 93 | CH2_ALARM_MIN_STATUS | Analog channel minimum alarm status 2. | Decimal places:<br>**1.** For temperature sensors and the cold joint;<br>**2.** For battery voltage and external power supply.<br>For linear sensors, the decimal point is configured. |

| | | | |
|---|---|---|---|
| 94 | CH2_ALARM_MAX_STATUS | Analog channel maximum alarm status 2. | Decimal places:<br>**1.** For temperature sensors and the cold joint;<br>**2.** For battery voltage and external power supply.<br>For linear sensors, the decimal point is configured. |
| 95 | CH2_ALARM_STATUS | Analog channel 2 current alarm status. | **0.** No alarm;<br>**1.** Minimum alarm;<br>**2.** Maximum alarm. |
| 97 | CH3_STATUS | Analog channel status 3. | **1.** Ok;<br>**2.** Underflow;<br>**3.** Overflow;<br>**4.** Cold joint error;<br>**5.** Open sensor. |
| 98 | CH3_VALUE | Analog channel current value 3. | Decimal places:<br>**1.** For temperature sensors and the cold joint;<br>**2.** For battery voltage and external power supply.<br>For linear sensors, the decimal point is configured. |
| 99 | CH3_VALUE_MIN | Minimum value recorded on analogue channel 3. | Decimal places:<br>**1.** For temperature sensors and the cold joint;<br>**2.** For battery voltage and external power supply.<br>For linear sensors, the decimal point is configured. |
| 100 | CH3_VALUE_MAX | Maximum value recorded on analogue channel 3. | Decimal places:<br>**1.** For temperature sensors and the cold joint;<br>**2.** For battery voltage and external power supply.<br>For linear sensors, the decimal point is configured. |
| 101 | CH3_ALARM_MIN_STATUS | Analog channel minimum alarm status 3. | Stores information if the channel ever reached the minimum alarm.<br>**0.** Never alarmed;<br>**1.** Already alarmed. |
| 102 | CH3_ALARM_MAX_STATUS | Analog channel maximum alarm status 3. | Stores information if the channel ever reached the maximum alarm.<br>**0.** Never alarmed;<br>**1.** Already alarmed. |
| 103 | CH3_ALARM_STATUS | Current analog channel alarm status 3. | **0.** No alarm;<br>**1.** Minimum alarm;<br>**2.** Maximum alarm. |
| 106 | BATTERY_VOLTAGE_VALUE | Current value of battery voltage. | Unit in volts with two decimal places. |
| 107 | BATTERY_VOLTAGE_VALUE_MIN | Minimum battery voltage value. | Unit in volts with two decimal places. |
| 108 | BATTERY_VOLTAGE_VALUE_MAX | Maximum battery voltage value. | Unit in volts with two decimal places. |
| 109 | BATTERY_PERCENTAGE_OF_LIFE | Battery life. | Unit in volts with two decimal places. |
| 113 | EXTERNAL_VOLTAGE_VALUE | External voltage value. | Unit in volts with two decimal places. |
| 114 | EXTERNAL_VOLTAGE_VALUE_MIN | Minimum registered voltage of external source voltage. | Unit in volts with two decimal places. |
| 115 | EXTERNAL_VOLTAGE_VALUE_MAX | Maximum recorded value of external source voltage. | Unit in volts with two decimal places. |
| 121 | MQTT_LAST_UPDATE_YEAR | Year of last submission to the MQTT Broker. | |
| 122 | MQTT_LAST_UPDATE_MONTH | Month of last submission to the MQTT Broker. | |
| 123 | MQTT_LAST_UPDATE_DAY | Day of last submission to the MQTT Broker. | |
| 124 | MQTT_LAST_UPDATE_HOUR | Hour of last submission to the MQTT Broker. | |

| | | | |
|---|---|---|---|
| 125 | MQTT_LAST_UPDATE_MINUTE | Minute of last submission to the MQTT Broker. | |
| 126 | MQTT_LAST_UPDATE_SECOND | Second of last submission to the MQTT Broker. | |
| 136 | WIFI_IRSS | Signal quality between the device and the Wi-Fi Gateway. | Unit with signal in dB with two decimal places. |
| 137 | WIFI_GATEWAY_COM_STATUS | Wi-Fi communication status. | **0.** Disconnected Gateway;<br>**1.** Connected Gateway;<br>**2.** Gateway password error;<br>**3.** Gateway not found;<br>**4.** Error receiving IP via DHCP;<br>**5.** Authentication error. |
| 138 | WIFI_MQTT_STATUS | Communication status with MQTT Broker. | **0.** Disconnected Broker;<br>**1.** Connected Broker;<br>**2.** Error resolving DNS;<br>**3.** Error when posting a message in Broker;<br>**4.** Error when subscribing to topic. |
| 140 | WIFI_IP_ADDR_0_1 | Address of the device on the network (High part). | XXX.XXX.000.000 |
| 141 | WIFI_IP_ADDR_2_3 | Address of the device on the network (Low part). | 000.000.XXX.XXX |
| 142 | WIFI_MASK_ADDR_0_1 | Network mask (High part). | XXX.XXX.000.000 |
| 143 | WIFI_MASK_ADDR_2_3 | Network mask (Low part). | 000.000.XXX.XXX |
| 144 | WIFI_GATEWAY_ADDR_0_1 | Network Gateway address (High part). | XXX.XXX.000.000 |
| 145 | WIFI_GATEWAY_ADDR_2_3 | Network Gateway address (Low part). | 000.000.XXX.XXX |

**Table 09** – Registers Table

Below is the table of registers supported by the WRITE HOLDING REGISTERS and WRITE MULTIPLE HOLDING REGISTERS commands:

| ADDRESS | MNEMONIC | DESCRIPTION | INFORMATION |
|---|---|---|---|
| 68 | BUZZER_STATUS | Current buzzer status. | **0.** Inactive buzzer;<br>**1.** Active buzzer. |
| 1044 | SETTING_YEAR | Year setting in UTC (GMT 0). | |
| 1045 | SETTING_MONTH | Month setting in UTC (GMT 0). | |
| 1046 | SETTING_DAY | Day setting in UTC (GMT 0). | |
| 1047 | SETTING_HOUR | Hour setting in UTC (GMT 0). | |
| 1048 | SETTING_MINUTE | Minute setting in UTC (GMT 0). | |
| 1049 | SETTING_SECOND | Second setting in UTC (GMT 0). | |
| 1100 | CHD_ALARM_MIN | Setting the digital channel minimum alarm. | Unit in counts. |
| 1101 | CHD_ALARM_MAX | Setting the digital channel maximum alarm. | Unit in counts. |
| 1123 | CH1_ALARM_MIN | Analog channel 1 minimum alarm setting. | Decimal places:<br>**1.** For temperature sensors and the cold joint;<br>**2.** For battery voltage and external power supply.<br>For linear sensors, the decimal point is configured. |
| 1124 | CH1_ALARM_MAX | Analog channel 1 maximum alarm setting. | Decimal places:<br>**1.** For temperature sensors and the cold joint;<br>**2.** For battery voltage and external power supply.<br>For linear sensors, the decimal point is configured. |
| 1176 | CH2_ALARM_MIN | Analog channel 2 minimum alarm setting. | Decimal places:<br>**1.** For temperature sensors and the cold joint;<br>**2.** For battery voltage and external power supply.<br>For linear sensors, the decimal point is configured. |

| | | | |
|---|---|---|---|
| 1177 | CH2_ALARM_MAX | Analog channel 2 maximum alarm setting. | Decimal places:<br>**1.** For temperature sensors and the cold joint;<br>**2.** For battery voltage and external power supply.<br>For linear sensors, the decimal point is configured. |
| 1229 | CH3_ALARM_MIN | Analog channel 3 minimum alarm setting. | Decimal places:<br>**1.** For temperature sensors and the cold joint;<br>**2.** For battery voltage and external power supply.<br>For linear sensors, the decimal point is configured. |
| 1230 | CH3_ALARM_MAX | Analog channel 3 maximum alarm setting. | Decimal places:<br>**1.** For temperature sensors and the cold joint;<br>**2.** For battery voltage and external power supply.<br>For linear sensors, the decimal point is configured. |

**Table 10** – Registers table that allow writing

# 9. DATA LOGGING

Data logging will be done in the **LogBox Wi-Fi** internal memory. The internal memory capacity is up to 140,000 logs. The number of logs that can be stored in the internal memory depends basically on the number of input channels that are enabled, as well as factors such as recording or not recording the digital input event.

Any channel types (analog and digital in the "Pulse Count" or "Event Log" modes) can be logged in memory. In the case of analog channels logs or digital input in "Pulse Count" mode, the logging will be periodic and will have its range configured through the configurator software. At the end of each log range, the current values of the enabled channels will be logged in the memory. In case the digital input is configured in the "Event Log" mode, the detected logs detected will be performed asynchronously to the periodicity of the other channels and will be performed when the event occurs.

There are several ways to start and end logs and many of them can be combined freely. During logging, all selected channels will be logged in the memory and the range between logs will be respected.

Depending on the type of start and end selected, there may be log "snippets" in the memory and, therefore, periods with no logged data. This is fully compatible with the device and is not a problem at all.

The device works with circular memory, which allows records to be continuously made. Once the memory is full, the oldest data will be paid so that the most recent data can be saved.

First, you must configure the start mode, chosen from the options below:

- **Immediate Start:** Allows logs to be started shortly after the device is reconfigured.
- **Date/Time:** Allows logs to be started at the configured date/time.
- **By Keyboard:** In a screen in the display, you can change the logs status to *enabled,* which start the logs (in case they had not been started yet).
- **By Digital Input:** Allows logs to be initiated from the digital input. For this option to be available, the digital input channel must have been set to "Logs Control" mode. There are four modes for controlling the digital input:
  - Start the logs at each rising edge;
  - Start the logs at each descent edge;
  - Log at logical level '1', which logs while at logical level '1';
    - In this mode, the configured end mode should be "Logical level pause '0'".
  - Log at logical level '0', which logs while at logical level '0';
    - In this mode, the configured end mode should be "Logical level pause '1'".
- **By Software:** Allows logs to be started using an **NXperience** command.
- **Daily:** It allows the logs to be started every day and at the configured time. The "Daily" log start mode also requires a "Daily" log end mode.

And you must configure the end mode, chosen from the options below:

- **Never:** Allows logs to continue indefinitely. When filling memory, the oldest data will be deleted so that the most recent ones can be saved.
- **Date/Time:** Allows logs to be ended at the configured date/time.
- **By Keyboard:** In a screen in the display, you can change the logs status to *disabled,* which start the logs (in case they had not been started yet).
- **By Digital Input:** Allows logs to be ended from the digital input. For this option to be available, the digital input channel must have been set to "Logs Control" mode. There are four modes for controlling the digital input:
  - Pause logs at each rising edge;
  - Pause logs at each falling edge;
  - Pause at logical level '0', which pauses while at logical level '0';
    - In this mode the configured start mode should be "Logs in Logical level '1'".
  - Pause at logical level '1', which pauses while at logical level '1';
    - In this mode the configured start mode should be "Logs in Logical level '0'".
- **By Software:** Allows logs to be started using an **NXperience** command.
- **Daily:** It allows the logs to be paused every day and at the configured time. The "Daily" log end mode also requires a "Daily" log start mode.

| Number of Channels and Logs Maximum Capacity | |
|---|---|
| **Number of Enabled Channels** | **Logs Maximum Capacity** |
| 1 | 143,147 logs from 1 channel |
| 2 | 111,336 logs from 2 channels |
| 3 | 91,093 logs from 3 channels |
| 4 | 77,079 logs from 4 channels |

**Table 11** – Data Logging

# 10. ALARMS

**LogBox Wi-Fi** has four channels. It is possible to set a minimum alarm and a maximum alarm for each channel. Alarms will be displayed and can be configured to trigger an internal Buzzer for audible warning and a Digital Output for user control.

The alarm configuration general parameters are described below:

- **Buzzer Runtime:** Allows you to set a buzzer runtime for each time the device enters an alarm situation. The configuration will be performed in seconds, from 0 to 65000 s, where 0 means that the buzzer should not be triggered. The longer the buzzer runtime, the greater the battery consumption during the alarm situation.
- **Digital Output Mode:** Allows you to configure the digital output to follow an alarm situation. This way, whenever the alarm situation is satisfied, the Digital Output will be activated. The digital output will be disabled if no channel is an alarm situation.

When an alarm condition is satisfied, the ALM symbol will light up along with the 1, 2, 3, 4 symbols, which correspond to the channels that satisfy the current state alarm situation. The 1, 2, 3, 4 symbols indicate that the channel is currently in an alarm situation. The ALM symbol indicates that since the device was powered on or since the last alarm status was cleared, an alarm occurred. The retentive alarm statuses of each channel can be cleared through the display screens or through **NXperience**.

For each enabled channel, it is possible to enable a minimum alarm and a maximum alarm, according to the following parameters:

- **Setpoint:** Shows the value to be exceeded for the channel to satisfy the alarm situation.
- **Hysteresis:** Shows the barrier to be exceeded for the channel to exit the alarm situation.

After the alarms are enabled, they behave as follows:

- **Maximum Alarm:** The channel will enter the Maximum Alarm when the current value is greater than the Maximum Alarm Setpoint and will exit the maximum alarm when the current value is less than or equal to the Maximum Alarm Setpoint minus the Maximum Alarm hysteresis.
- **Minimum Alarm:** The channel will enter the Minimum Alarm when the current value is lower than the Minimum Alarm Setpoint and will exit the minimum alarm when the current value is greater than or equal to the Minimum Alarm Setpoint plus the Minimum Alarm hysteresis.

The alarm status information, as well as the maximum and minimum values reached in each channel, will be updated by any events that trigger an acquisition, which may be readings within the log range or in the display update range. If a channel reaches a minimum or maximum value or an alarm condition during an acquisition other than the log range, it may not be logged in the memory. Thus, statuses may indicate that the channel has already reached one of these situations and the information is not available in a download.

# 11. CONFIGURATION SOFTWARE

The **NXperience** software is the main tool for configuring, downloading and analyzing data for **LogBox Wi-Fi**. It allows for exploring all features and features of the device by communicating through its USB interface. It is also a complete tool for analyzing data logged by the **LogBox Wi-Fi**, allowing for joint graphic analysis of multiple data, performing mathematical calculations, issuing reports, and exporting data to several formats.

**NXperience** is a complete configuration tool for the new NOVUS device line. This manual describes the software's generic features. For instructions about device configuration, refer to the specific operating manual. The software can be downloaded free of charge from our website www.novusautomation.com, in the Downloads area.

| | |
|---|---|
| ⚠ | **Each time the device receives a new configuration through NXperience, the data in the logs internal memory will be erased and, therefore, there will be no publication By MQTT until new data is logged.**<br>**When a memory download is performed by NXperience, there will be a pause in the MQTT publication until the download is finished.** |

## 11.1 CONFIGURING LOGBOX WI-FI WITH NXPERIENCE

**LogBox Wi-Fi** is configured by **NXperience**. See below a description of each possible configuration parameters grouped by sections.

### 11.1.1 GENERAL PARAMETERS

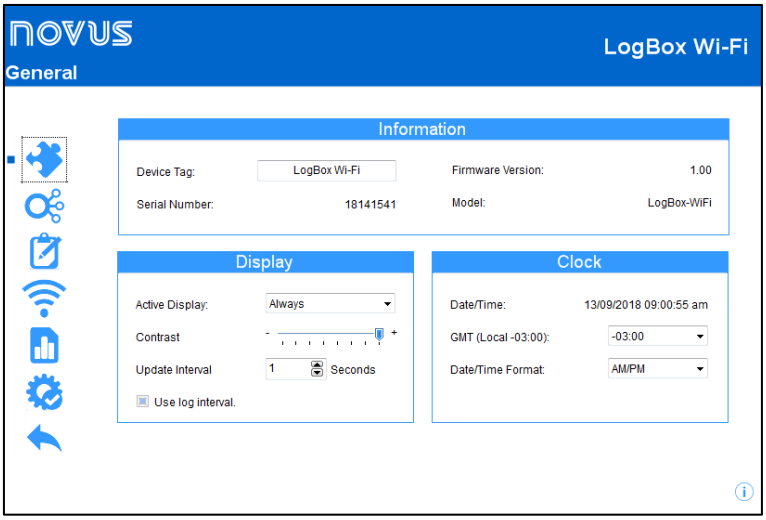



**Fig. 03** – General Parameters Screen

#### 11.1.2.1 INFORMATION

- **Device Tag**: Allows you to set a name, which will be used as channel identification during a download, for the digital channel. The field accepts up to 16 characters.
- **Serial Number**: Shows the device unique identification number.
- **Firmware Version**: Shows the firmware version recorded in the device.
- **Model**: Displays the device model name.

#### 11.1.2.2 DISPLAY

- **Active Display**: Allows you to configure when the display should become active.
  - **Always**: If configured, it will keep the display active, following the configured contrast and update range.
  - **By Keyboard**: If configured, the display will be activated whenever a key is pressed and will remain active for 1 minute (until a key is pressed again). This setting will follow the configured contrast.
  - **Never**: If configured, it will keep the display off.
- **Contrast**: Allows you to configure the display contrast level. There are eight levels of contrast. The lowest level simplifies viewing at the upper and lower viewing angles and the higher-level simplifies viewing at the front viewing angle.
- **Update Interval**: Allows you to configure how often the display information will be updated.
  - **Use the interval of records**: If configured, it will cause the display information to be updated at each log range.
  - **Interval**: Allows you to set a display update range in seconds that is smaller than the log range. This way, the input channels will be read and will update the display at this range. The minimum range is 1 second; the maximum range is 18 hours.

#### 11.1.2.3 CLOCK

- **Date/Time**: Allows you to set the date/time used to set the device clock.
- **GMT**: Allows you to configure the GMT of the place where the device will be used (preferably during first use). By default, **LogBox Wi-Fi** is set to GMT 0.
- **Date/Time Format**: Allows you to configure the clock format to 24 hours or AM/PM.

### 11.1.2 ANALOG CHANNELS PARAMETERS

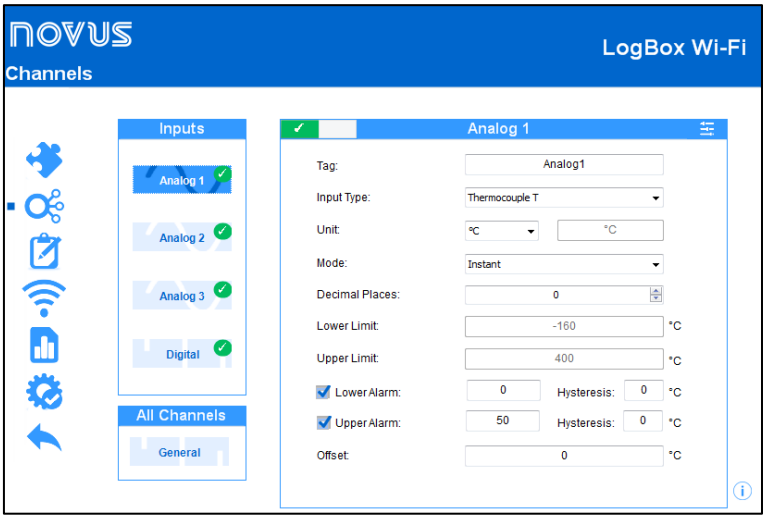



**Fig. 04** – Analog Channel Screen

- **Tag:** Allows you to set a name, which will be used as channel identification during a download, for the digital channel. The field accepts up to 16 characters.
- **Input Type:** Allows you to configure the type of sensor to be used in each analog channel.
- **Unit:** Allows you to configure the unit for each analog channel. In the case of temperature sensors, it is possible to select the units °C or °F. For other sensors, it is possible to describe the unit with up to eight characters.
- **Mode:** Allows you to configure the operation mode to use for each analog channel. If "Instant" mode is selected, the channel is read, and the value will be logged at each log range. If "Average" mode is selected, the device will take 10 channel readings within the log range and at each log range the average of these 10 readings will be logged.
- **Decimal Places:** Allows you to configure the number of decimal places of each analog channel. Temperature Sensors can be configured to show up to one decimal place. Other sensor types can be configured to show up to two decimal places.
- **Lower Limit:** If the sensor configured for the channel is a temperature or internal diagnostic sensor, the lower limit will be filled by the software with the sensor's lower limit. If the sensor configured for the channel is of the linear sensor type (mV, V, or mA), it will be necessary to fill in the desired value to represent the minimum value of the chosen sensor.
- **Upper Limit:** If the sensor configured for the channel is a temperature or internal diagnostic sensor, the upper limit will be filled by the software with the sensor's upper limit. If the sensor configured for the channel is of the linear sensor type (mV, V, or mA), it will be necessary to fill in the desired value to represent the maximum value of the chosen sensor.
- **Lower Alarm:** Allows you to enable and configure a lower alarm Setpoint for each channel.
  - **Hysteresis:** Allows you to configure a lower alarm hysteresis for each channel.
- **Upper Alarm:** Allows you to enable and configure an upper alarm Setpoint for each channel.
  - **Hysteresis:** Allows you to configure an upper alarm hysteresis for each channel.
- Offset**:** Allows you to make small adjustments to the readings of each channel. The configured Offset will be added to all readings performed on the configured channel.

#### 11.1.2.1 CUSTOM CALIBRATION

The  icon opens the custom calibration screen, which allows you to adjust up to 10 measurement points for each channel. When a custom calibration has been configured, the minimum number of setpoints is two points.

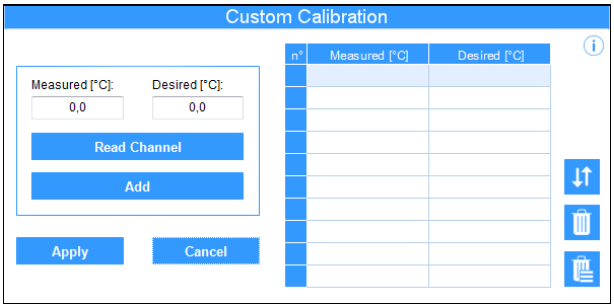



**Fig. 05** – Customized Calibration Screen

- **Measured:** Displays the device's read value for which a correction is desired. It can be obtained by clicking the "Read Channel" button or manually filled in.
- **Desired:** Shows the user's desired value for the device measured value. It must be filled manually.
- **Read Channel:** Allows you to obtain the device's values during a custom calibration.
- **Add:** Allows you to enter the "Measured" and "Desired" pair in the Custom Calibration table.
- **Modify:** Allows you to modify the "Measured" and "Desired" pair in the Custom Calibration table.

- **Organize** : Allows you to sort the Custom Calibration table.
- **Delete** : Allows you to delete the selected line from the Custom Calibration table.
- **Delete All** : Allows you to clear the entire Custom Calibration table.
- **Apply:** Allows you to apply the custom calibration to the channel being configured.
- **Cancel:** Allows you to cancel the Custom Calibration operation.

### 11.1.3 DIGITAL CHANNEL PARAMETERS

#### 10.1.3.1 PULSE COUNT MODE

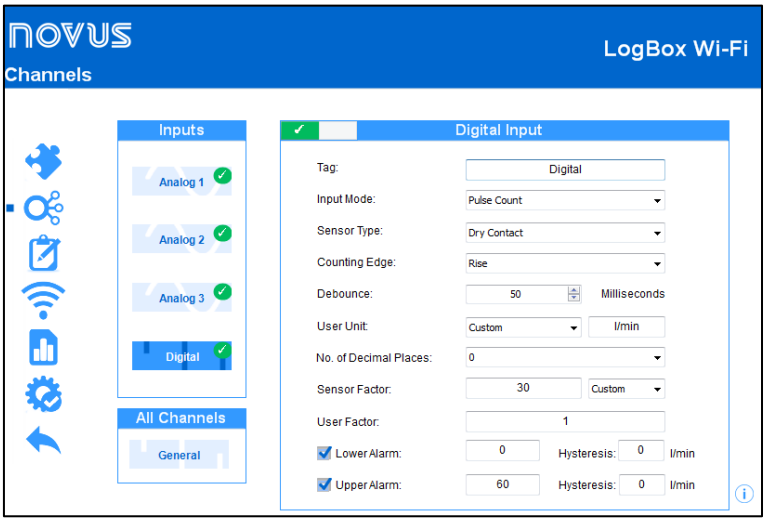



**Fig. 06** – Digital Input Screen: Pulse Count Mode

- **Tag:** Allows you to set a name, which will be used as channel identification during a download, with up to 16 characters, for the digital channel.
- **Input Mode:** Allows you to select the digital input mode. The "Pulse count" option is set by *default*.
- **Sensor Type:** Allows you to configure the sensor type to be connected to the digital input: PNP, NPN, or Dry Contact.
- **Counting Edge:** Allows you to configure the desired counting edge. This way, the device will increment counts whenever the configured edge is detected at the digital input. You can perform counting on the rising edge, the descent edge, or both.
- ***Debounce*:** If the sensor type configured is Dry Contact, it is necessary to set a *debounce* time for edge detection. *Debounce* refers to the sensor stabilization time – the minimum time at which the sensor must remain at the logical level of interest so that the detected edge is considered valid. The minimum configurable *debounce* time is 50 milliseconds; the maximum are 6 seconds.
- **User Unit:** Allows you to configure the flow unit related to the pulses counted in the Digital Input. **LogBox Wi-Fi** provides nine flow units**.** If one of them is selected, simply configure the sensor factor and its respective unit so that the device performs the counts and displays the flow rate on the configured unit. You can select the custom unit option to meet any need not previously listed by the device.
  - **Custom:** Allows you to configure a custom unit for the digital input. Allows description of the unit in up to eight characters. If you configure a custom unit, it will be necessary to configure the "User Factor" parameter.
- **No. of Decimal Places:** Allows you to configure the desired number of decimal places to display the digital input calculated value, in flow.
- **Sensor Factor:** Allows you to configure the sensor factor used at the digital input. This parameter can be found in the sensor manual as *k-factor*. **LogBox Wi-Fi** provides three units for the sensor. You can select the custom unit option to meet any need not previously listed by the device.
- **User Factor:** If the "User Unit" or "Sensor Factor" parameters are configured according to the "Custom" mode, you must configure the "User Factor" parameter. The User Factor must relate the required unit to the Sensor Unit and the Sensor Factor. It will be used as a factor to be multiplied in the read counts of the digital input. Refer to chapter Input Signals Reading for more information.
- **Lower Alarm:** Allows you to enable and configure a lower alarm Setpoint.
  - **Hysteresis:** Allows you to configure a hysteresis for the lower alarm.
- **Upper Alarm:** Allows you to enable and configure an upper alarm Setpoint.
  - **Hysteresis:** Allows you to configure a hysteresis for the upper alarm.

### 10.1.3.2 EVENT LOG OR LOGS CONTROL MODE

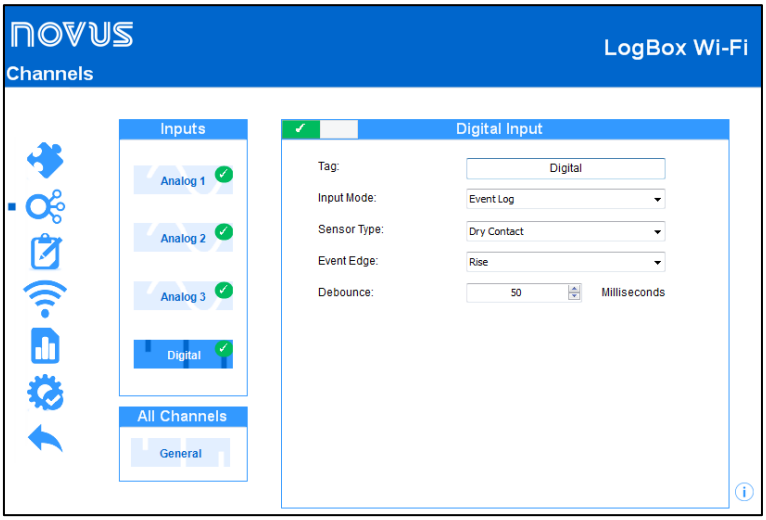



**Fig. 07** – Digital Input Screen: Event Log Mode

- **Tag:** Allows you to set a name, which will be used as channel identification during a download, for the digital channel. The field accepts up to 16 characters.
- **Input Mode:** Allows you to select the digital input mode, which has the options "Pulse Count", "Event Log", or "Logs Control". If the "Logs Control" mode is selected, the "By Digital Input" mode must be selected in the "Start Mode" and "End Mode" parameters in the "Data Logs" screen. Otherwise, the configuration will have no effect.
- **Sensor Type:** Allows you to configure the sensor type to be connected to the digital input: PNP, NPN, or Dry Contact.
- **Event Edge:** Allows you to configure the desired event edge. This way, the device will log events whenever the configured edge is detected at the digital input. In the "Event Log" mode, you can configure so that the logs are made during the Rising, Falling, or Both edges. In the "Logs Control" mode, it is possible to select to control logs at the Rising, Falling, or Both edges, logging at logic level '1' or logical level '0'.
- ***Debounce*:** It will be necessary to configure a *debounce* time for edge detection. *Debounce* refers to the sensor stabilization time – the minimum time at which the sensor must remain at the logical level of interest so that the detected edge is considered valid. The minimum configurable *debounce* time is 50 milliseconds; the maximum are 6 seconds. The device will only register the event after the end of the *debounce* time.

## 11.1.4 CHANNELS' GENERAL PARAMETERS

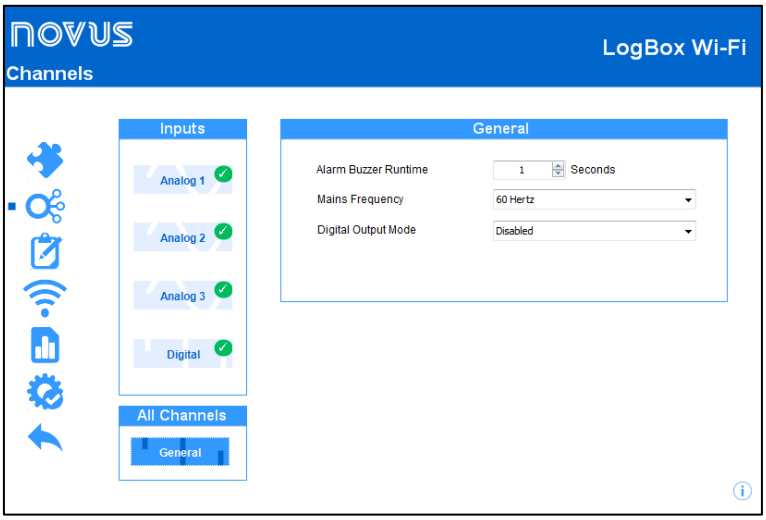



**Fig. 08** – Digital Input Screen: General Configuration

- **Alarm Buzzer Runtime:** Allows you to set the buzzer runtime for each time the device enters an alarm situation. The configuration will be performed in seconds, from 0 to 65000 s, where 0 means that the buzzer should not be triggered.
- **Power Grid Frequency:** Allows you to set the local power grid frequency (50 Hz or 60 Hz) for the device to perform better.
- **Digital Output Mode:** Allows you to configure the digital output mode, which can be configured as Disabled, Auxiliary Electronic Switch, or Alarm Status.
  - **Auxiliary Electronic Switch**: Allows you to control the power supply of external instruments during analog channel readings.
    - **Drive Time**: Allows you to configure, in seconds, how long before each acquisition the digital output must be triggered. The minimum configurable time is 0 seconds; the maximum time is 15 minutes (900 seconds). If equal to 0, the Auxiliary Electronic Switch will be enabled at the exact moment of an acquisition. If greater than or equal to the lowest acquisition range, the Auxiliary Electronic Switch will remain continuously enabled.
  - **Alarm Status:** In this mode, the digital output will follow the current and general alarm status. If any channel is in an alarm situation, the Digital Output will be enabled. If no channel is set to alarm, the Digital Output will be disabled.

### 11.1.5 DATA LOGGING CONFIGURATION

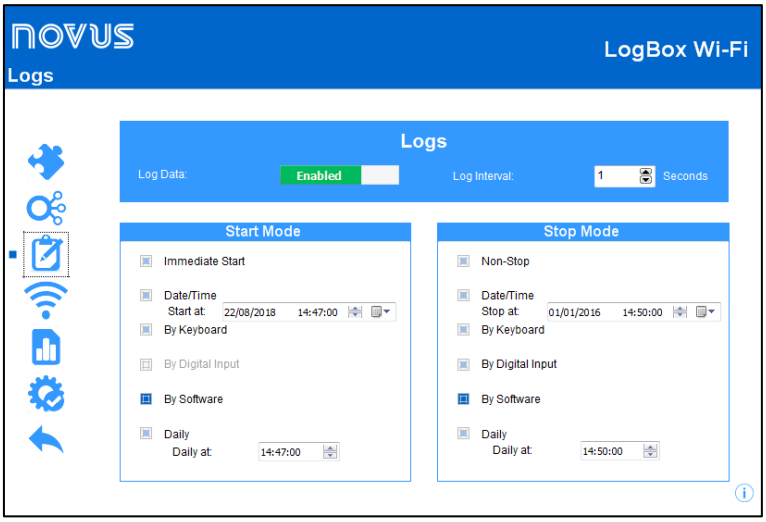



**Fig. 09** – Data Logging Screen

#### 11.1.5.1 LOGS

- **Log Data:** Enables or disables the device data logging.
- **Log Interval:** Allows you to select the frequency, in seconds, with which an acquisition must be made and logged in the memory.
  - **Minimum Range:**
    - 1 second - if no channel is configured to operate on average;
    - 10 seconds - if a channel is configured to operate on average.
  - **Maximum Range:** 18 hours.

#### 11.1.5.2 START MODE

- **Immediate Start:** Allows logs to be started shortly after the device is reconfigured.
- **Date/Time:** Allows you to set the date/time when the logs are to be started.
- **By Keyboard:** In a screen in the display, you can change the logs status to *enabled,* which start the logs (in case they had not been started yet).
- **By Digital Input:** Allows logs to be initiated from the digital input. This parameter is available if the digital input is enabled and configured in the "Logs Control" mode. This way, the logs will be started the moment the digital input is triggered. The log edge shall be configured in the digital input parameters.
- **By Software:** Allows logs to be started using an **NXperience** command.
- **Daily:** It allows the logs to be started every day and at the configured time. The "Daily" log start mode also requires "Daily" log end mode.

#### 11.1.5.3 STOP MODE

- **Never:** Allows logs to continue indefinitely. When filling the memory, the oldest data will be deleted so that the most recent ones can be saved.
- **Date/Time:** Allows you to set the date/time when the logs are to be ended.
- **By Keyboard:** Allows you to change logs status to *disabled* on a screen in the display by instantly closing the logs.
- **By Digital Input:** Allows logs to be paused from the digital input. This parameter is available if the digital input is enabled and configured in the "Logs Control" mode. This way, the logs will be paused the moment the digital input is triggered. The log edge shall be configured in the digital input parameters.
- **By Software:** Allows logs to be ended using an **NXperience** command.
- **Daily:** It allows the logs to be ended every day and at the configured time. The "Daily" log start mode also requires "Daily" log end mode.

The combinations allowed for starting and ending logs are as follows:

| Start Mode | Stop Modes |
|---|---|
| **Immediate** | Never or Date/Time or Keyboard or Software or Digital Input |
| **Date/Time** | Never or Date/Time or Keyboard or Software or Digital Input |
| **Digital Input** | Never or Digital Input |
| **Keyboard** | Never or Keyboard |
| **Software** | Never or Software |
| **Daily** | Daily |

**Table 12** – Logs End Modes

### 11.1.6 COMMUNICATION PARAMETERS

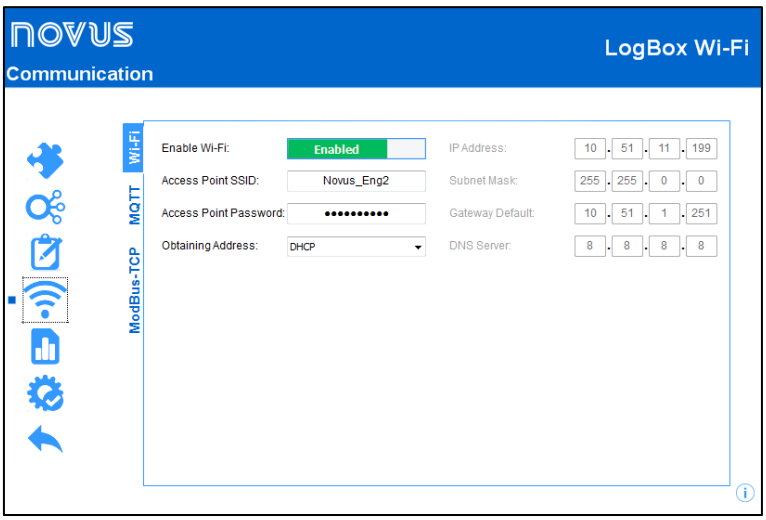



**Fig. 10** – Configuration Screen

#### 11.1.6.1 WI-FI CONFIGURATION

- **Enable Wi-Fi**: Allows you to enable or disable this communication interface. When disabled, the MQTT parameters will remain disabled. When the **LogBox Wi-Fi** does not have an external power supply and is running on batteries, this interface will be automatically disabled.
- **Access Point SSID**: Allows you to enter the name of the Wi-Fi network to which **LogBox Wi-Fi** will try to connect to. The field accepts up to 32 alphanumeric characters.
- **Access Point Password**: Allows you to enter the Wi-Fi network password to which **LogBox Wi-Fi** will try to connect to. The field accepts up to 40 alphanumeric characters.
- **Obtaining Address**: Allows you to determine how **LogBox Wi-Fi** will try to acquire an IP: DHCP (*Dynamic Host Configuration Protocol*), protocol that allows the device's IP (*Internet Protocol*) to be assigned by the network server, or Static, which allows the user to set the IP address, subnet mask, and default gateway for the connection. In this case, you can also set the DNS (*Domain Name System*).
- **IP Address**: Refers a device identification (computer, printer, etc.) on a local or public network. Each computer or device on the Internet or on an internal network has a unique IP. This is a required field when "Address Acquisition" is marked as "Static".
- **Subnet Mask**: Also known as *subnet mask* or *netmask*, it allows you to divide a specific network into smaller subnets, making it more effective to use a particular IP address space. This is a required field when "Address Acquisition" is marked as "Static".
- **Default Gateway**: Refers to the device address on the network that connects your computers to the internet. This is a required field when "Address Acquisition" is marked as "Static".
- **DNS Server**: Refers to a hierarchical and distributed name management system for computers, services, or any resource connected to the Internet or a private network. This is an optional field when "Address Acquisition" is marked as "Static".

#### 11.1.6.2 MQTT PROTOCOL

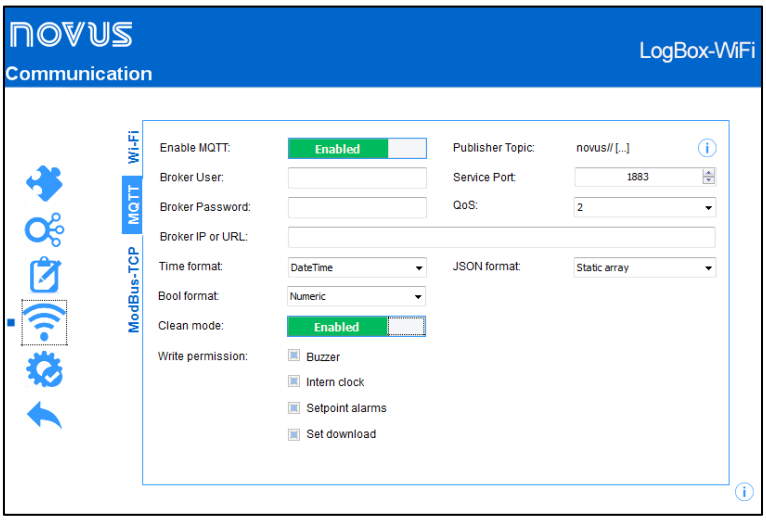



**Fig. 11** – Configuration Screen: MQTT

- **Enable MQTT**: Enables or disables data submission by MQTT protocol. When the **LogBox Wi-Fi** does not have an active external power supply and is running on batteries, the Wi-Fi interface will remain disabled and, therefore, sending data through this protocol as well.
- **Broker User**: Allows you to enter the registered user's login on the Broker. The field accepts up to 40 characters. If the field is empty, the connection will be made in anonymous mode.
- **Broker Password**: Allows you to enter the registered user's password on the Broker. The field accepts up to 40 characters. If the field is empty, the connection will be made in anonymous mode.

- **Broker URL or IP**: Allows you to enter the Broker address, which can be a URL (*Uniform Resource Locator*) or an IP. The field accepts up to 60 characters.
- **Time Format**: Allows you to choose the time format to display: DateTime or Unix Timestamp. Changes the sent date/time format of the JSON frame.
- **Boolean Format:** Indicates how Boolean variables will be displayed in the JSON frame. For more information, check the Boolean Format section of the MQTT Protocol chapter.
- **Clean Mode:** When enabled, it indicates to the Broker that it is necessary to story only the last data of each topic. By disabling this option, the Broker, if configured, will keep all historical data stored.
- **Write Permissions:** Selects which commands will be available for user writing via MQTT.
- **Publication Topic:** Allows you to view the subscription and publication topic formats.
- **Service Port**: Allows you to define the port number used to connect to the Broker.
- **QoS**: The "Quality of Service" parameter allows you to select the level of quality of service used to send MQTT messages. Your options are 0, 1, or 2. For more information, check the QoS section of the MQTT Protocol chapter.
- **JSON Format**: Changes the formatting of the JSON frame as required by the supervisor. For more information, check the JSON Format section of the MQTT Protocol chapter.

#### 11.1.6.3 MODBUS-TCP PROTOCOL

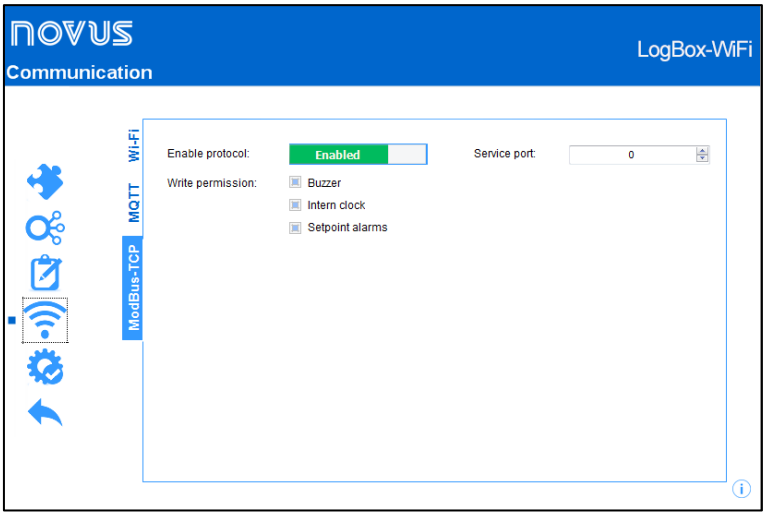



**Fig. 12** – Configuration Screen: Modbus-TCP

- **Enabled Protocol:** Enables the Modbus-TCP service.
- **Service Port:** Allows you to define the TCP port on which the service will be available.
- **Write Permission:** Allows you to select which logs will be available for user writing via Modbus-TCP.

## 11.2 DIAGNOSTICS

On the **LogBox Wi-Fi** configuration screen in **NXperience**, there is the "Diagnostics" screen. By clicking on it, the software will monitor some device states. The information update range is 1 second. See below for more details on monitored information:

### 11.2.1 DATA LOGGING

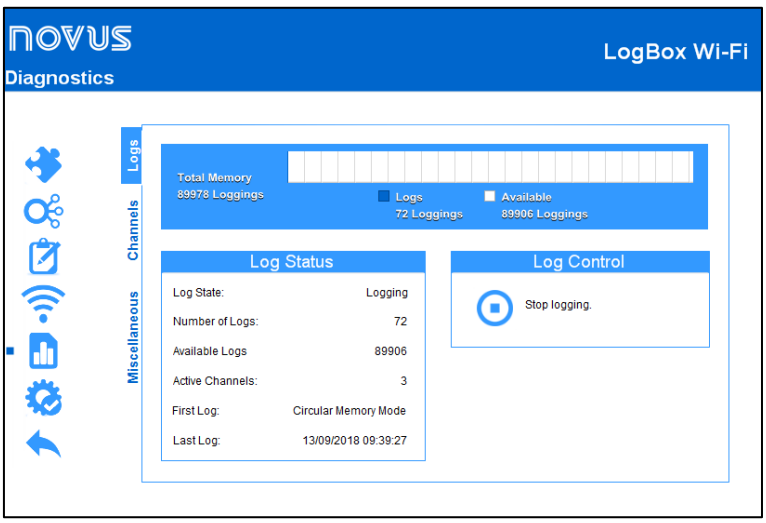



**Fig. 13** – Diagnostics Screen: Logs

- **Log Status:** Displays information about the logs status, such as the number of recorded logs, the available memory, the number of active channels, and the date of the first and last log in the **LogBox Wi-Fi** memory.
- **Log Control:** Allows you to start or pause **LogBox Wi-Fi** data logging. In order for this option to be active, the "By Software" parameter must be enabled in start and/or end of log mode.

### 11.2.2 CHANNELS

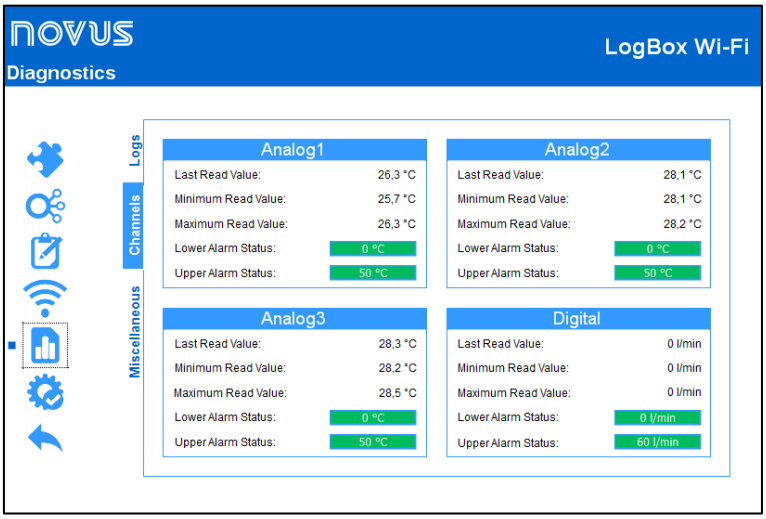



**Fig. 14** – Diagnostics Screen: Channels

- **Analog Channels and Digital Channel:** Displays information about the acquisitions made by the device on the analog channel sensors and on the digital channel sensor.
  - **Last Read Value:** Displays the value of the last acquisition performed by the device on the corresponding channel sensor. The displayed value may have been updated by a display update frequency and not logged in the memory.
  - **Minimum Read Value:** Displays the minimum red value by the device on the corresponding channel sensor. The displayed value may have been read by a display update frequency and not logged in the memory.
  - **Maximum Read Value:** Displays the maximum value read by the device on the corresponding channel sensor. The displayed value may have been read by a display update frequency and not logged in the memory.
  - **Minimum Alarm Status:** Displays the configured minimum alarm Setpoint information and informs if the device has entered a minimum alarm condition on the corresponding channel. The alarm may have been detected by a display update frequency and not logged in the memory.
  - **Maximum Alarm Status:** Displays the configured maximum alarm Setpoint information and informs whether the device has entered the maximum alarm condition on the corresponding channel. The alarm may have been detected by a display update frequency and not logged in the memory.

### 11.2.3 MISCELLANEOUS

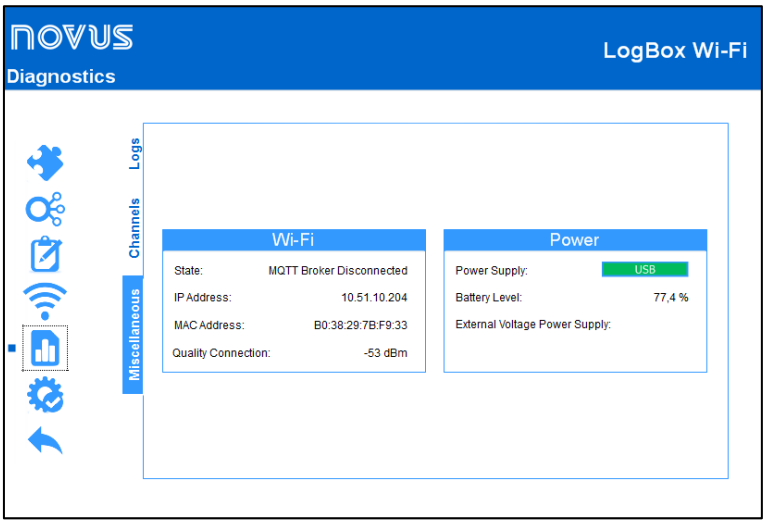



**Fig. 15** – Diagnostics Screen: Miscellaneous

- **Power:** Displays the device's power information.
  - **Power Supply:** Displays the current power supply of the device.
  - **Battery Level:** Displays the current battery level status. This information is updated in the logs frequency with a minimum frequency of 5 minutes.
  - **External Power Supply Voltage:** Displays the external power supply voltage of the device. This information is updated in the logs frequency with a minimum frequency of 5 minutes.

- **Wi-Fi:** Displays information about the device's Wi-Fi connection.
  - **State:** Displays information about the device's current state.
  - **IP Address:** Displays information about the device's IP address.
  - **MAC Address:** Displays information about the device's MAC address.
  - **Quality Connection:** Displays information about the connection quality.

# 12. INSTALLATION

## 12.1 MECHANICAL INSTALLATION

**LogBox Wi-Fi** has a high-quality casing, built in ABS + PC and with IP40 protection index.

To streamline the **LogBox Wi-Fi** attachment, the device comes with a fixing bracket, indicated and developed for any type of wall, which has three oblong holes, arranged in a triangle, made to fix it using screws. Optionally, to facilitate the fixation on metal surfaces, it is possible to purchase the device model that comes with a fixing bracket with magnetic inserts.

To assist in the installation aesthetics, two openings in the lower part of the fixing bracket can be used to pass the sensors that are connected to the device. In addition to that, this bracket has a ring that allows the placement of a padlock preventing **LogBox Wi-Fi** from being removed from the installation location.

With the help of two screwdrivers and through two lateral fittings, it is possible to fix or remove the **LogBox Wi-Fi** from the bracket.

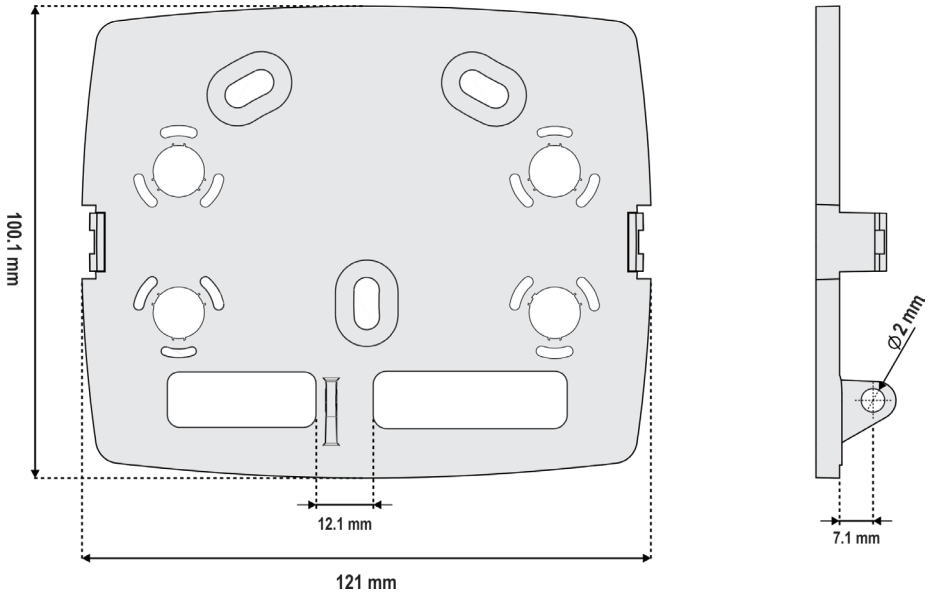



**Fig. 16** – Mounting bracket

To improve the device installation aesthetics, the **LogBox Wi-Fi** comes with a protection cover for the connections, which is dockable in the bottom of the device and that hides its sensors. This protection cover has four detachable cavities to facilitate sensor installation.

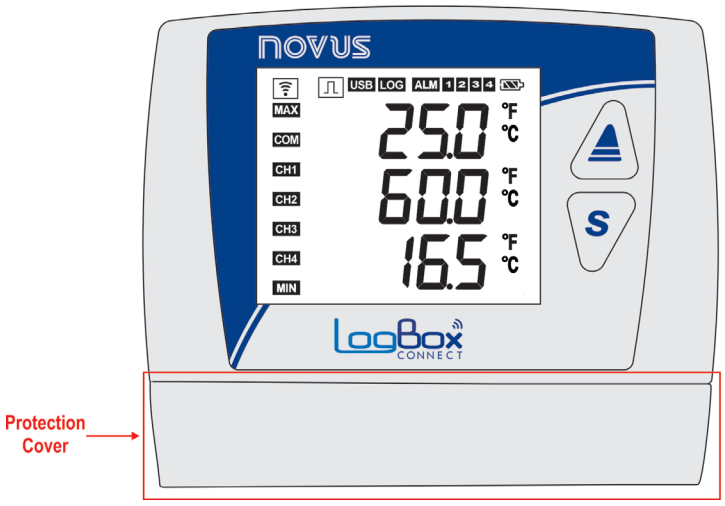



**Fig. 17** – Connections' Protection Cover

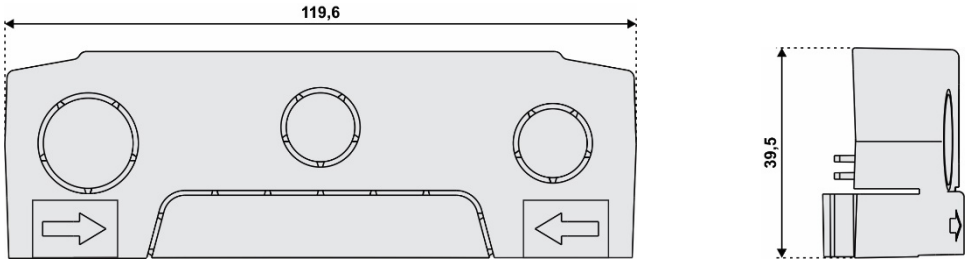



**Fig. 18** – Dimensions of protection cover detachable connections and cavities

To detach the protection cover, you must press the sides, one side at a time.

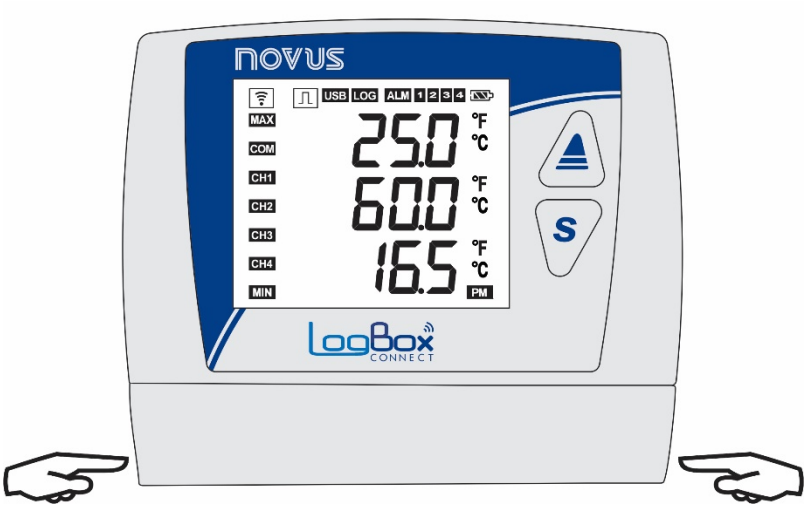



**Fig. 19** – Removing the protection cover

To attach the protection cover, it is necessary to press the area designated by the arrows and push one side at a time from the outside.

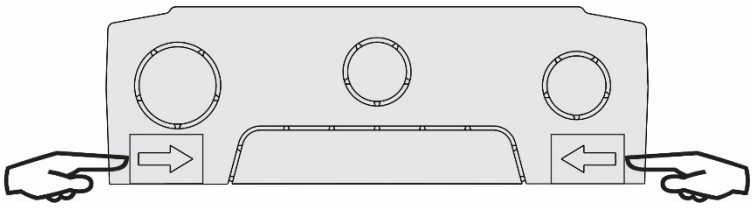


**Fig. 20** – Fitting the protection cover

## 12.1.1 DIMENSIONS

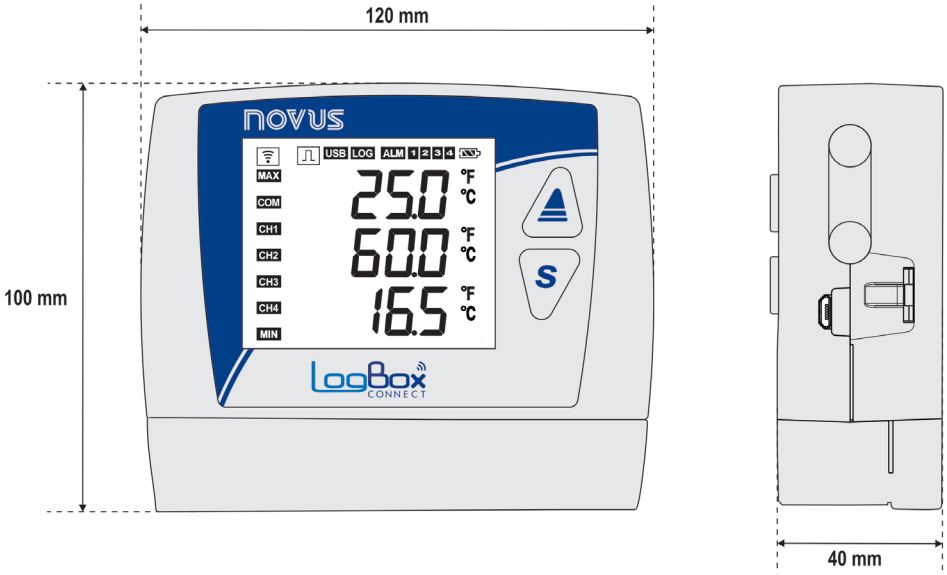



**Fig. 21** – **LogBox Wi-Fi** dimensions

To open the battery compartment, press the cover in the arrows region and push it in from the inside out.

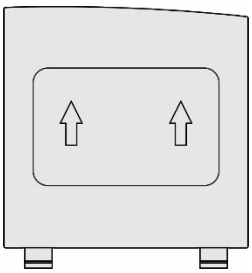


**Fig. 22** – Batteries cover

## 12.2 ELECTRICAL INSTALLATION

### 12.2.1 INSTALLATION RECOMMENDATIONS

- Electronic and analog signal drivers must run the plant separately from the output and power supply conductors. If possible, in grounded conduits.
- The power supply for electronic instruments must come from an appropriate grid for instruments.
- RC FILTERS (noise suppressors) are recommended in contactor coils, solenoids, etc.
- In control applications, it's essential to consider what could happen when some part of the system fails. The device's internal devices do not ensure total protection.
- The electrical connection terminal blocks must be made with the device's marked connection terminals. Before connecting them, make sure that the connections have been made correctly.
- Remember to wrap all wires inside the desired openings, designed for their passage, before making any electrical connections.

### 12.2.2 SPECIAL PRECAUTION

By being an electronic module, **LogBox Wi-Fi** needs some care when handling:

- When opening the cover that provides access to the connector for battery replacement, due to the risk of damage caused by static electricity, avoid contact of the connection terminal blocks with them and with the electronic circuit.
- The device should not be opened due to the risk of damage caused by static electricity when the device has its electronic circuit exposed.
- Pay close attention to the sensor wires, the digital input, the digital output, and the external source connections.

### 12.2.3 ELECTRICAL CONNECTIONS

**LogBox Wi-Fi** has 4 detachable connection terminal blocks for connection of external power supply, digital output load, digital input sensor, and analog sensors for each of the 3 available analog channels. **Fig. 23** illustrates electrical connections in a basic way:

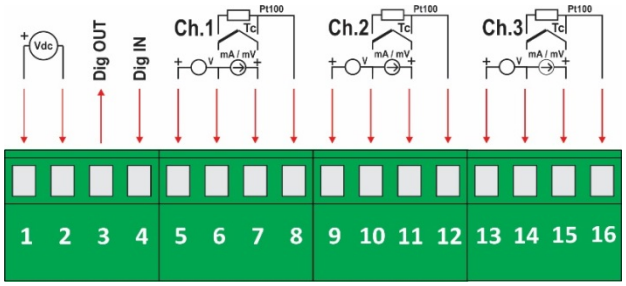
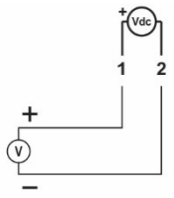



**Fig. 23** – Electrical connections

For the sensors connection, it is recommended that the connection terminal blocks be previously detached from the device. To streamline the sensors connection, it is necessary to use the enumeration printed on the connectors and the Electrical Connections image in **Fig. 23**, and in the Connections' Protection Cover.

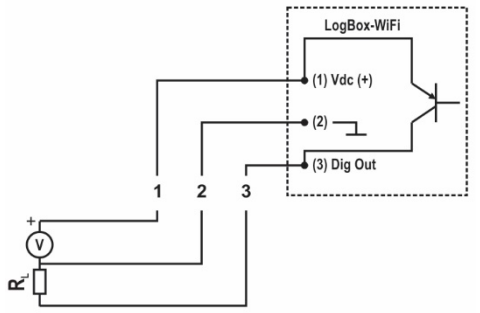
| | |
|---|---|
|  | **The power supply, digital output, digital input, and analog inputs terminals are not isolated from each other!**<br>**Therefore, analog and digital signals from the same voltage source must not be used, otherwise the device will malfunction.** |

#### 12.2.3.1 POWER SUPPLY

| | |
|---|---|
|  | The connection to the Power Supply is made at the terminals according to the following image. The power supply used must be of the direct current type, with a voltage between 10 and 30 V and provide a minimum current of 15 mA when no load is connected to the digital output. If the load is connected to the digital output, the source used must be able to provide current compatible with the load used. |

## 12.2.3.2 DIGITAL OUTPUT

**Alarm Status Mode Connection**




The connection to the Digital Output in the "Alarm Status" mode is made at the terminals according to the following image. To use the Digital Output, you must power the device with an external power supply. The power supply used must be capable of supplying current compatible with the load used in the Digital Output.

**Connection in "Auxiliary Electronic Switch" Mode**

The connection to the Digital Output in the "Auxiliary Electronic Switch" mode, used to power current transmitters, is made at the terminals according to the figure on the side. To use the Digital Output, you must power the device with an external power supply. The source used must be able to provide current compatible with the number of transmitters used.

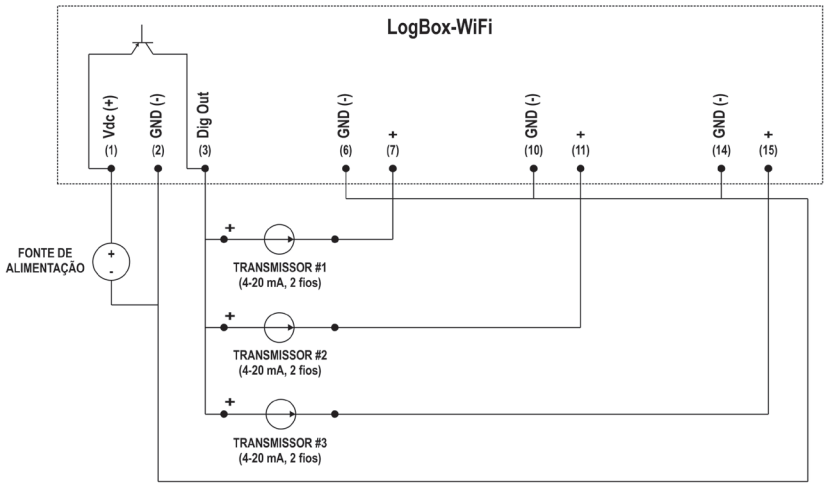
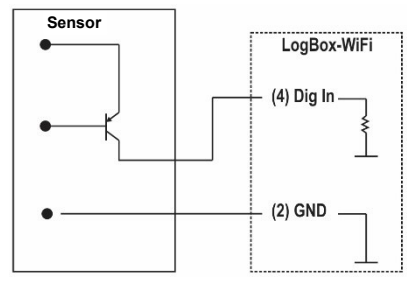



**Fig. 24** – Connection in "Auxiliary Electronic Switch" Mode

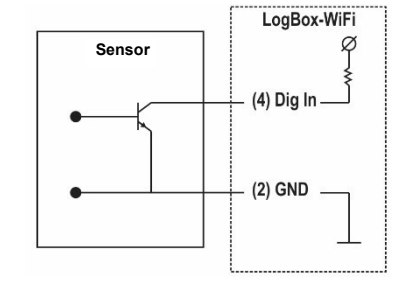
## 12.2.3.3 DIGITAL INPUT

**PNP Connection**



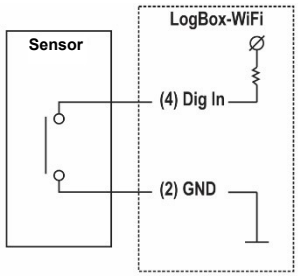

The connection to the Digital Input with a PNP-type sensor is made at the terminals according to the following image.

**NPN Connection**



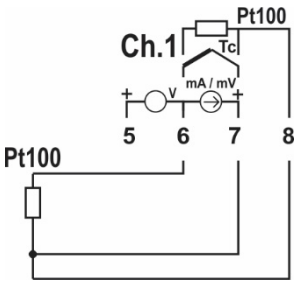

The connection to the Digital Input with a NNP-type sensor is made at the terminals according to the following image.

**Dry Contact Connection**

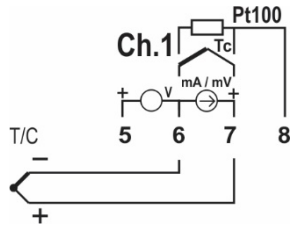
| | |
|---|---|
|  | The connection to the Digital Input with a Dry Contact-type sensor is made at the terminals according to the following image. |

## 12.2.3.4 ANALOG INPUTS

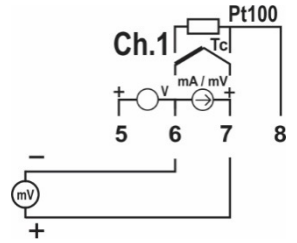
**Pt100 Connection**

| | |
|---|---|
|  | The connection to the channels is made at the terminals according to the following image. The three-wire connection from the Pt100 sensor element to the **LogBox Wi-Fi** input guarantees the error cancellation caused by the wires resistance. The three wires should have the same gauge and length.<br>For two wire PT100, connect the RTD to terminals 6+7 and link 7 to 8. |

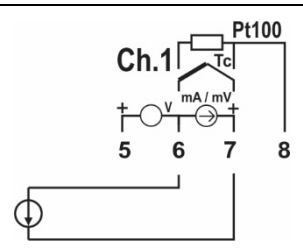
**Thermocouples Connection**

| | |
|---|---|
|  | The connection to the channels is made at the terminals according to the following image. You must observe a correct connection polarity.<br>Cables used for thermocouples connection must have the same thermoelectric characteristics of the thermocouple used (compensation cable or extension cable), and must be connected with the correct polarity.<br>Failure to use compensation cables or their use with incorrect polarity can lead to large measurement errors. |

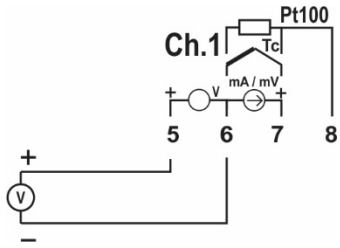
**Voltage Connection (mV)**

| | |
|---|---|
|  | The connection to the channels is made at the terminals according to the following image. You must observe a correct connection polarity. |

**Current Connection (mA)**

| | |
|---|---|
|  | The connection to the channels is made at the terminals according to the following image. You must observe a correct connection polarity. |

**Voltage Connection (V)**

| | |
|---|---|
|  | The connection to the channels is made at the terminals according to the following image. You must observe a correct connection polarity. |

#### 12.2.3.4.1 EXAMPLE OF CONNECTION OF 4-20 mA TRANSMITTERS POWERED BY THE CURRENT LOOP

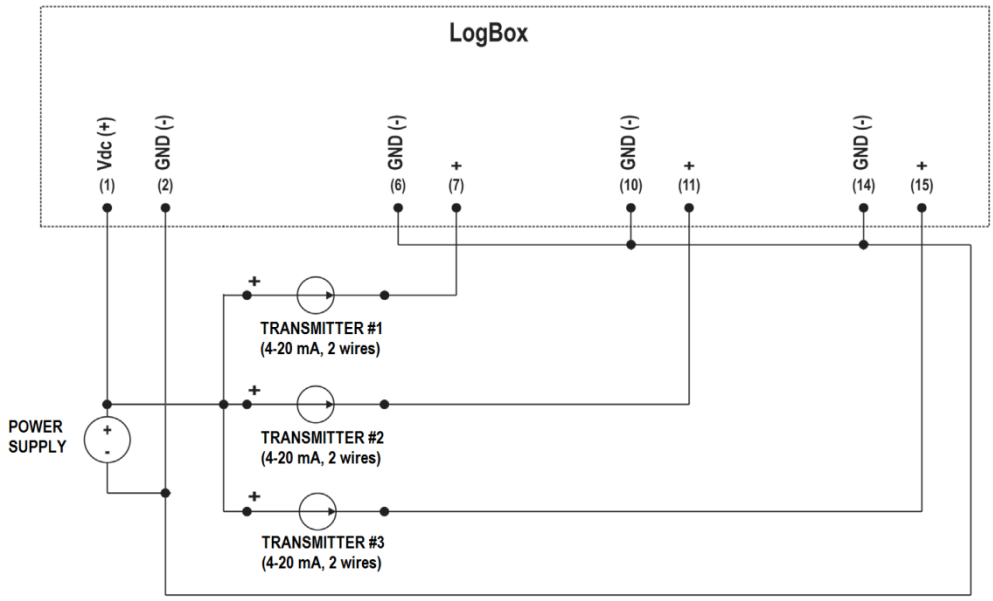



**Fig. 25** - Example of connecting transmitters that are fed by the loop

# 13. COMMUNICATION INTERFACES

## 13.1 USB

The USB interface is the preferred interface for configuring, monitoring, and downloading device logs. It is the only interface which can never be disabled. To access it, you must install **NXperience** for Windows. This way, the USB driver will be installed (see chapter NXperience for more information). A standard micro-USB cable (not supplied) must be used for desktop or notebook connection.

When connecting the USB cable, the respective icon should light up on the device's display, indicating that its interface is ready for use. On first use, you must wait for Windows to automatically install the driver already preinstalled by **NXperience**. The device's configuration, monitoring and data download, made through the USB interface, must be performed by **NXperience**.

| | |
|---|---|
|  | **The USB interface is NOT insulated.**<br>**Its purpose is temporary use during CONFIGURATION, MONITORING and LOG DOWNLOAD. For the safety of people and devices, it should only be used when the device is disconnected from the external power supply.**<br>**It is possible to use the USB interface in any other connection condition, although the decision requires a careful analysis by the person in charge of installation.** |

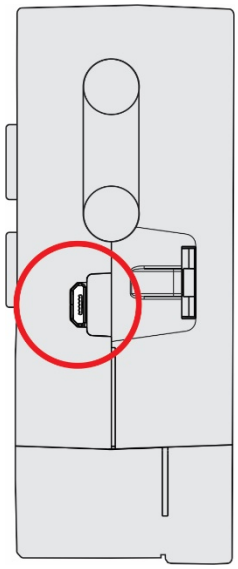


**Fig. 26** – USB cable connection

## 13.2 WI-FI

**LogBox Wi-Fi** has an 802.11 interface in 2.4 Ghz b/g/n standards for sending registered data through protocols compatibles with the device. The Wi-Fi interface also sends some device's configuration parameters of the **LogBox Wi-Fi** through these same protocols.

If the Wi-Fi interface is enabled and the device is connected to a Wi-Fi network, the symbol will remain lit. While data is being sent through this interface, the symbol will remain lit.

| | |
|---|---|
|  | **While the LogBox Wi-Fi is operating on batteries and in order to reduce power consumption, Wi-Fi will remain disabled. All other features of the device, however, remain operable for at least one year.**<br>**When power from the power supply is restored, the Wi-Fi interface will be activated and the data recorded in memory during the power interruption will be published.** |

# 14. CFR 21 REGULATION

## 14.1 SUPPORT FOR CFR 21 PART 11 AND RDC 17:2010 VALIDATION

**LogBox Wi-Fi** can be part of a validated system by offering the following features for compliance support:

- Device development follows the company's quality standard. It has the ISO 9001 certification and follows good manufacturing practices, the basis for compliance with GAMP 5 requirements in validation model V.
- Device usage documentation will be available during the validation process, functional specification, and final acceptance testing.
- The produced devices, identified by a serial number that allows tracking at the factory and that makes it possible to identify their calibration report and other production information.
- All data recorded in the device's memory, whether of basic configuration, calibration, or involving the inputs readings, are protected against improper tampering.
- Access to the basic configuration and calibration parameters is done only by **NXperience** and with access credentials. These credentials are unique and, for traceability purposes, should be associated with a person in charge.
- The memory containing the basic configuration and calibration is protected by a mechanism that detects any improper changes. The mechanism is composed of an electronic signature (*hash*). Any change in the parameters will be identified by a change in the electronic signature, accessible for reading by the monitoring system.
- Access to the data of the entries registered in the device's memory is done only through **NXperience** and By access credentials. This data is illegibly present in the memory and can be exported to readable formats while keeping the font unchanged.
- The device allows only the modification of the operational parameters, which audit changes trail must be built in the supervisory system. These parameters consist of alarm Setpoint*s* and the action of enabling or disabling the buzzer on the device.

# 15. TROUBLESHOOTING

## 15.1 START/STOP MODES

Depending on the Start/Stop rule with which the device is configured, it may lose information if it is to continue registering during a power outage.

- **Start/Stop By Keyboard:** A Modbus command or digital input may be lost during the device's power-up.
- **Immediate Start:** "Date/Time" or "Daily" parameters will return when the device is powered up again and is able to resume the clock.

## 15.2 CLOCK

In the case of a power outage, **LogBox Wi-Fi** cannot reset the clock on its own. Thus, if the clock information is lost, the device will not log until the clock is reset.

## 15.3 ALARM INFORMATION

Alarm information, maximum and minimum values reached in each channel, as well as Date/Time of the last event are data that can be lost if the device is left out of power for more than 30 minutes. The data logged in the periodicity of logs or the digital input events, if it is configured for Event Log, are the only ones that are certainly not lost (unless a new configuration is applied, or the user chooses to clear the memory).

**NXperience** has the functionality of reporting the maximum and minimum values logged, as well as informing all logs in an alarm situation.

## 15.4 ANALOG INPUTS

- When a device that is connected to the mains (a thermocouple or voltage simulator, for example) is used in the analog inputs and is not isolated, it is recommended to use a different reading interface than USB. In some cases, due to the influence of the USB cable connection (probably by ground loops), the occurrence of noise and reading Offsets have been detected.
- When operated by batteries and no acquisition is being performed, **LogBox Wi-Fi** will keep the analog circuit switched off. This strategy is necessary so that it can operate for more than two years without needing to change batteries. However, some analog signal simulators (thermocouple simulator or Pt100, for example) may not be able to operate correctly with this characteristic, causing false Offsets and oscillations in the readings. If such a problem is identified, it is recommended to power the **LogBox Wi-Fi** By external power supply or By USB port while using the simulator.
- Setting the local network frequency (50 Hz or 60 Hz) is important to improve the analog channels' reading performance, even if the device is running on battery power. Usually, the power grid causes interference, which can be more easily mitigated if its frequency is known on the signal read by the sensors.

## 15.5 UNREGISTERED ALARMS

The alarm status information, as well as the maximum and minimum values reached in each channel, is updated by any events that trigger an acquisition, which may be a read in the log range or in the display update range. If a channel reaches a minimum or maximum value or an alarm condition during an acquisition that does not occur during the log range, it may not be logged in the memory. Thus, statuses may indicate that the channel has already reached one of these situations and the information is not available in a download.

The log range must be configured according to the maximum period allowed by the process being monitored, so that no important information is lost (and no longer being logged).

## 15.6 COMMUNICATION LINK LOSS

If there is a loss of the communication link between the Broker and any of the Subscribers or the possible lack of electricity, it is possible that Subscriber will lose some of the logs subsequently published by **LogBox Wi-Fi**. If this occurs, the set_download topic allows you to request that the device resend the logs that were lost during that period, by setting a start date for it (see Inscription Topic section of the MQTT Protocol chapter).

# 16. TECHNICAL SPECIFICATIONS

| CHARACTERISTICS | LOGBOX WI-FI | |
|---|---|---|
| **Input Channels** | 3 analog inputs<br>1 digital input | |
| **Compatible Analog Signals** | Thermocouple J, K, T, N, E, R, S and B, Pt100, 0-50 mV, 0-5 V, 0-10 V, 0-20 mA, 4-20 mA | |
| **Internal Measurements** | Internal Temperature (NTC)<br>Battery Voltage<br>External Power Supply Source Voltage | |
| **Analog Channels Input Impedance** | Thermocouples / Pt100 / mV: > 2 MΩ<br>mA: 15 Ω + 1.5 V<br>V: 1 MΩ | |
| **Pt100** | Maximum cable offset resistance: 25 Ω<br>Excitation Current: 166 µA<br>Used Curve: $\alpha$= 0.00385 | |
| **Digital Input** | **Logical Levels** | Logical Level "0": from 0 to 0.5 VDC<br>Logical Level "1": from 3 to 30 VDC |
| | **Maximum Voltage** | 30 VDC |
| | **Input Impedance** | 270 kΩ |
| | **Input Current @ 30 VDC (typical)** | 150 µA |
| | **Maximum Frequency (squared wave)** | Dry Contact: 10 Hz<br>PNP: 2 kHz<br>NPN: 2 kHz |
| | **Minimum Pulse Duration** | Dry Contact: 50 ms<br>PNP: 250 µs<br>NPN: 250 µs |
| **Digital Output** | 1 PNP-type output<br>Maximum current that can be switched at the output: 200 mA | |
| **Display** | 3 lines, 4½ digits | |
| **Resolution** | Analog Signals: 15 bits (32768 levels)<br>Digital Signal: 16 bits (65536 levels) | |
| **Memory Capacity** | 140000 logs (total) | |
| **Log Range** | 1 second to 18 hours | |
| **Log Type** | Instant or Medium | |
| **Log Trigger** | Date/Time, Start button, digital input or software command | |
| **Alarms** | 8 available alarms, two by channel<br>Min. (*low*) and Max. (*high*) | |
| **Internal Buzzer** | Yes, it can be used for alarms | |
| **Communication Interfaces** | USB<br>802.11b/g/n 2.4 GHz | |
| **Software** | **NXperience** (By USB or by TCP/IP network for desktops and notebooks) | |
| **Power supply** | **Power Supply Source** | Voltage: 10 VDC to 30 VDC<br>Maximum Consumption: 15 mA<br>Typical Consumption: 2 mA |
| | **Batteries** | 4 "AA" type alkaline batteries (included) (WiFi interface disabled) |
| **Estimated Battery Life** | Maintenance of batteries is required (typically every 2 years, considering a 5-minute recording interval with WiFi interface disabled | |
| **Operation Temperature** | Using the included batteries: -10 to 50 °C<br>Using *Energizer L91* batteries: -20 to 60 °C<br>Using external power supply: -20 to 70 °C * | |
| **Casing** | ABS+PC | |
| **Protection Index** | IP40 | |
| **Dimensions** | 120 x 100 x 40 mm | |
| **Certifications** | CE, FCC, CAN ICES-3 (A) / NMB-3 (A), ANATEL (07034-17-07089) | |

**Table 13** – Technical specifications

*** Caution with the batteries operation temperature. Extremely high or low temperatures can cause ruptures and leaks and cause damage to the device.**

## 17.1 SENSORS RANGE AND ACCURACY

| | Sensor | Sensor Minimum Value | Sensor Maximum Value | Sensor Resolution | Accuracy (%) |
|---|---|---|---|---|---|
| **Thermocouples** | J | -100.0 °C<br>-148.0 °F | 760.0 °C<br>1400.0 °F | 0.1 °C<br>0.2 °F | 0.15 % (F. E.) ± 0.5 °C |
| | K | -150.0 °C<br>-238.0 °F | 1370.0 °C<br>2498.0 °F | 0.1 °C<br>0.2 °F | 0.15 % (F. E.) ± 0.5 °C |
| | T | -160.0 °C<br>-256.0 °F | 400.0 °C<br>752.0 °F | 0.1 °C<br>0.2 °F | 0.15 % (F. E.) ± 0.5 °C |
| | N | -270.0 °C<br>-454.0 °F | 1300.0 °C<br>2372.0 °F | 0.1 °C<br>0.2 °F | 0.15 % (F. E.) ± 0.5 °C |
| | E | -90.0 °C<br>-130 °F | 720.0 °C<br>1328.0 °F | 0.1 °C<br>0.2 °F | 0.15 % (F. E.) ± 0.5 °C |
| | R | -50.0 °C<br>-58.0 °F | 1760.0 °C<br>3200.0 °F | 0.3 °C<br>0.5 °F | 0.15 % (F. E.) ± 0.5 °C |
| | S | -50.0 °C<br>-58.0 °F | 1760.0 °C<br>3200.0 °F | 0.4 °C<br>0.7 °F | 0.15 % (F. E.) ± 0.5 °C |
| | B | 500.0 °C<br>932.0 °F | 1800.0 °C<br>3272.0 °F | 0.4 °C<br>0.7 °F | 0.15 % (F. E.) ± 0.5 °C |
| **Pt100** | Pt100 | -200.0 °C<br>-328.0 °F | 650.0 °C<br>1202.0 °F | 0.1 °C<br>0.2 °F | 0.15 % (F. E.) |
| **Linear** | 0 to 50 mV | 0.000 | 50.000 | 0.003 mV | 0.15 % (F. E.) |
| | 0 to 5 V | 0.000 | 5.000 | 0.6 mV | 0.15 % (F. E.) |
| | 0 to 10 V | 0.000 | 10.000 | 0.6 mV | 0.15 % (F. E.) |
| | 0 to 20 mA | 0.000 | 20.000 | 0.001 mA | 0.15 % (F. E.) |
| | 4 to 20 mA | 4.000 | 20.000 | 0.001 mA | 0.15 % (F. E.) |
| **Digital Input** | Count Mode | 0 | 65535 | | 0.01 % (F. E.) |
| **Internal Sensors** | Temperature (NTC) | -40 °C<br>-40 °F | 125.0 °C<br>257.0 °F | 0.1 °C<br>0.1 °F | 0.15 % (F. E.) ± 0.5 °C |
| | Battery Voltage | 3.6 | 6.5 | 0.01 V | 2 % (F. E.) |
| | External Power Supply Voltage | 10.00 | 30.00 | 0.01 V | 2 % (F. E.) |

* **F. E. = Full Scale =** ***Span***

**Table 14** – Sensors Range and Accuracy

**Accuracy**: The sensor accuracy reading is measured in relation to the Full Scale and is proportional to the maximum measuring range of each sensor. For a Pt100 sensor, for example, which the **LogBox Wi-Fi** can read in the range of -200 °C to 650 °C, with a precision of 0.15%, the accuracy in °C will be (650 °C – (-200 °C)) * 0.15% = 1.28 °C.

**Thermocouples**: The analog input circuit for the **LogBox Wi-Fi** guarantees the accuracy specified in the Thermocouple sensors reading with a maximum cable impedance of 100 Ω. Thermocouple sensors with impedance above 100 Ω are read by **LogBox Wi-Fi**. Accuracy, however, is not guaranteed. For reading the thermocouple sensors, the **LogBox Wi-Fi** uses the internal temperature sensor for Cold Joint compensation (NTC). Just as with the internal temperature sensor, thermocouples may present a greater error than specified when there are sudden variations in ambient temperature. The specified accuracy is only guaranteed when the device is installed in an environment with a stable temperature for a time greater than one hour.

**Pt100**: The **LogBox Wi-Fi** analog input circuit guarantees the accuracy specified in the reading of PT100 type sensors with a maximum cable resistance of up to 25 Ω. The device can read sensors with cables that have resistance above 25 Ω. In these cases, the accuracy and measurement range are not guaranteed. The **LogBox Wi-Fi** performs the cable resistance compensation internally, if it is the same in the three wires that connect the device to the sensor.

**Linear 0 to 50 mV:** The analog input circuit of the **LogBox Wi-Fi** guarantees the specified accuracy when reading electrical quantities of voltage type 0 to 50 mV with a maximum cable impedance of up to 100 Ω. Voltage sources with series impedance above 100 Ω can be read by **LogBox Wi-Fi**. Accuracy, however, is not guaranteed.

**Linear 0 to 5 V and 0 to 10 V:** The analog input circuit of the **LogBox Wi-Fi** guarantees the specified accuracy when reading electrical quantities of voltage type 0 to 5 V and 0 to 10 V with a maximum cable impedance of up to 200 Ω. Voltage sources with series impedance above 200 Ω can be read by **LogBox Wi-Fi**. Accuracy, however, is not guaranteed.

**Linear 0 to 20 mA and 4 to 20 mA:** All **LogBox Wi-Fi** input channels have common ground with each other as well as with the power supply source. Thus, for the **LogBox Wi-Fi** to be able to correctly measure the current transmitters, it is necessary that they are fed by isolated sources or by using all current transmitters with the interconnected earth.

**Digital Input**: All **LogBox Wi-Fi** input channels have common ground with each other as well as with the power supply source. For the **LogBox Wi-Fi** to correctly measure the Digital Input sensor, such characteristic must be considered. For the logic levels of the sensor connected to the digital input to be correctly detected, it is recommended that the maximum series impedance with the sensor is less than 10 kΩ.

**Internal Temperature Sensor**: The **LogBox Wi-Fi** has an internal temperature sensor of the NTC type that can be used for monitoring the ambient temperature. This sensor is used for the Thermocouples Cold Joint compensation. Because it is located inside the device's casing, it may present a greater error than specified when there are abrupt variations in ambient temperature. The specified accuracy is only guaranteed when the device is installed in an environment with a stable temperature for a time greater than one hour. The sensor allows readings in a range of -40 °C to 125 °C. The temperature, however, is limited to the device's operating range.

# 17. WARRANTY

The warranty conditions are set forth on our website www.novusautomation.com/warranty.