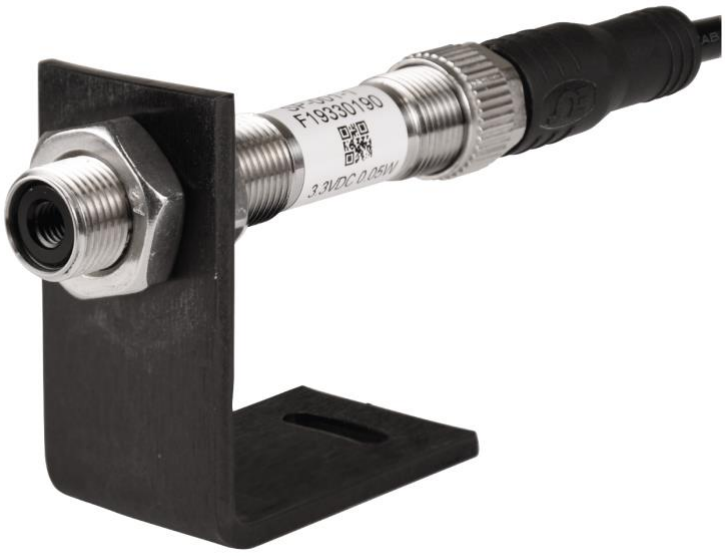
1 YEAR WARRANTY

OMEGA™

User's Guide



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SP-001 / SP-002

Ultra-Miniature IR Smart Probe

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Table of Contents

1 Notes, Warnings, and Cautions

If the equipment is used in a manner not specified in this manual, the protection by the equipment may be impaired.

Do not operate the equipment in flammable or explosive environments.

It is important to read and follow all precautions and instructions in this manual before operating or commissioning this device as it contains important information relating to safety and EMC. Failure to follow all the safety precautions may result in injury and/or damage to the equipment.

The following labels identify information that is especially important to note:

Note: Provides information that is important to successfully set up and use the Omega Link device.

Caution or Warning: Informs about the risk of electrical shock.

Caution, Warning, or Important: Informs of circumstances that can affect the functionality of the instrument and must refer to accompanying documents.

2 Introduction

The Omega IR Temperature Smart Probe is a miniature infrared sensor that measures the surface temperature of a solid or liquid without contact. It can measure non-metal surfaces between -70 to 380°C (-94 to 716°F). It also features a built-in sensor to measure the ambient temperature of the probe itself. Materials including paper, thick plastics, rubber, food and organic materials, as well as painted metals and most dirty, rusty or oily surfaces, are measured accurately, safely and cleanly.

The Smart Probe is packaged into a rugged 12 mm OD x 67 mm long compact, stainless steel, IP67 (NEMA 6) housing - designed for heavy industrial use while taking up the least amount of space for easy installation. Standard features include: easy configuration through free Sync configuration software, adjustable emissivity and filtering, and a wide operating temperature range of -40°C to 85°C.

The Omega Link SP-001/SP-002 features 2 configurable discrete I/O pins. These can be used for a myriad of applications including driving relays, physical alarms, or sensing dry contacts like door switches. The SP-001/SP-002 can also be utilized as an edge controller, with autonomous independent decision-making capabilities to generate local alarms or provide control outputs based on sensor inputs.

Included with the SP-001/SP-002

- SP-001/SP-002 Unit
- Quick Start Guide
- Two mounting nuts

Additional Material Needed

- An Omega Link Smart Interface
- A Windows 7,8, 9, 10, or 11 OS PC or laptop with Omega's free SYNC configuration software
- A compatible Omega Link Gateway
- An Omega Link Cloud account or a qualifying Omega Enterprise Gateway license tier (Pro, Business, or Business Pro)

Figure 1: SP-001 unit

Optional Materials

- Secondary temperature measurement device
- M12.8-T-SPLIT Sensor Splitter
- M12.8-S-M-FM Screw Terminal Accessory
- SP-001-MB Mounting Bracket

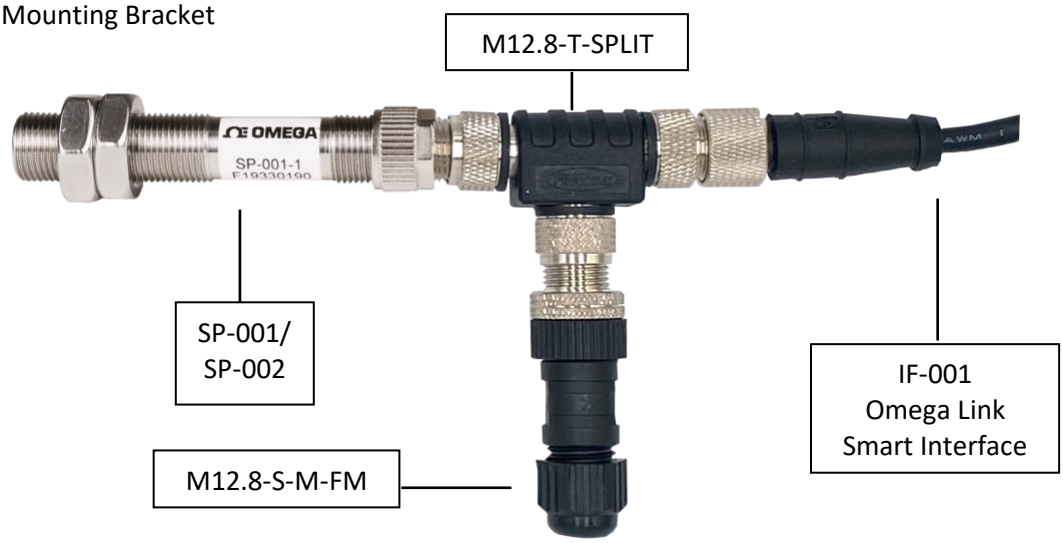


Figure 2: Example SP-001 optional discrete I/O setup

3 Specifications

Temperature Range: -70 to 380°C (-94 to 716°F)
Accuracy @ Ambient of 0 to 50°C (32 to 122°F): 1°C (1.8°F) or 1% of reading, whichever is greater
Accuracy Over Entire Ambient Operating Range: 4°C (7.2°F) or 3% of reading, whichever is greater
Repeatability: 1°C (1.8°F) or 1% of reading
Emissivity: 0.01 to 1.00, software adjustable
Response Time: 1 second
Spectral Response: 5.5 to 14 microns
Supply Power: 3.3 V DC, 0.05 W max
Field of View: SP-001 is 6:1, SP-002 is 10:1

Mechanical

Construction: Stainless Steel
Sensor Length: 12 mm OD x 67 mm L (0.47” x 4.49”)
Thread Mounting Dimensions: 12 mm OD x 33.5 mm L (0.47” x 1.31”)
Weight: 35 g (1.2 oz)

Environmental

Environmental Rating: NEMA 6 IP67
Operating Temperature: -40 to 85°C (-40 to 185°F) less than 95% RH, noncondensing
Vibration: 10 Gs from 10 Hz to 500 Hz

Vibration Test	
Frequency Range	10 Hz to 500 Hz
Acceleration	10 g
Duration	45 min per axis
Sweep	1 octave/min

General

Agency Approvals: CE, UKCA
Configuration: Configurable via Omega Link Smart Interface and SYNC configuration software
Software: Compatible with OEG and SYNC configuration software

4 Hardware Setup

4.1 Connecting to an Omega Link Smart Interface

The SP-001/SP-002 requires an Omega Link Smart Interface to connect to a computer. Use the M12 8-Pin Connector diagram below to connect the SP-001/SP-002 to an Omega Link Smart Interface.

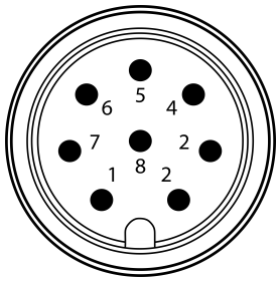


Figure 3: M12 8-Pin Male Connector Front View

Pin	Name	Function
Pin 1	DIO 0	Discrete I/O Signal 0
Pin 2	INTR	Interrupt Signal
Pin 3	SCL	I2C Clock Signal
Pin 4	SDA	I2C Data Signal
Pin 5	Shield	Shield Ground
Pin 6	DIO 1	Discrete I/O Signal 1
Pin 7	GND	Power Ground
Pin 8	3.3VDD	Power Supply

4.1.1 Discrete I/O

If the smart probe discrete I/O will be utilized, an M12.8-T-SPLIT and an M12.8-S-M-FM will need to be connected between the Smart Interface and Smart Probe. Refer to the previous pin diagram and the wiring diagram below to connect the accessories:

5 Optical Field of View Chart

The optical chart below indicates the nominal target spot diameter at any given distance from the sensing head and assumes 90% energy. **Figure 4** reflects the SP-001 with a field of view of 6:1. **Figure 5** reflects the SP-002 with a field of view of 10:1.

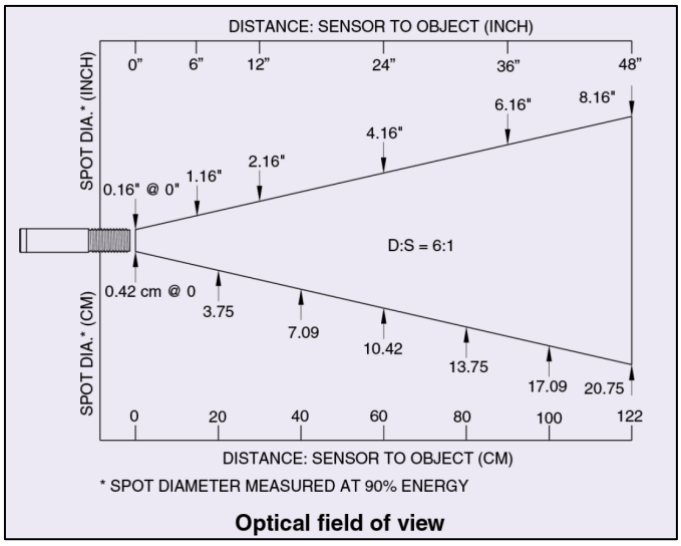


Figure 4: Optical Field of View Chart 6:1

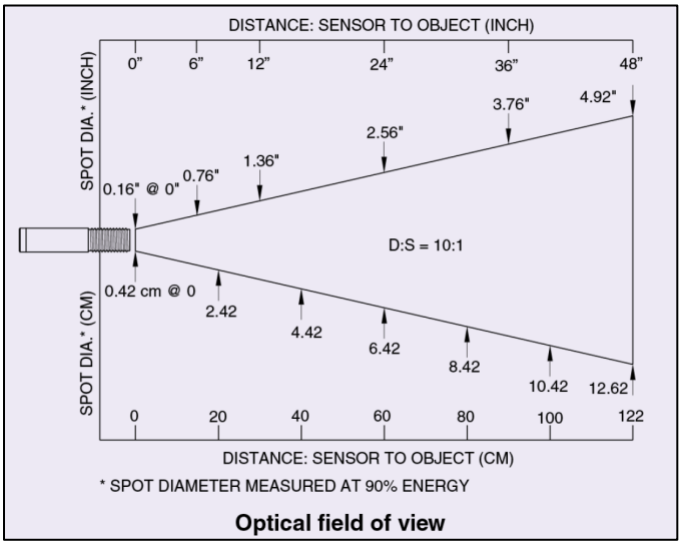


Figure 5: Optical Field of View Chart 10:1

6 Mechanical Installation

The SP-001 / SP-002 requires a Smart Interface (IF-001-0) or Wireless Transmitter to connect to your computer. Locate the position of the keyway as a guide on the SP-001 / SP-002 prior to making the connection. See **Figure 6.**

Figure 6: SP-001 to IF-001 wired setup

The sensor can be mounted on brackets, clamps or cutouts of your own design or you can use the fixed and adjustable Omega mounting bracket accessory: SP-001-MB.

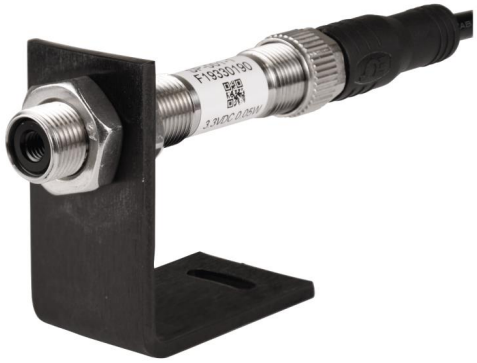


Figure 7: SP-001 setup on the SP-001-MB mounting bracket

Note **Note:** The SP-001-MB accessory is sold separately

7 SYNC Configuration

Omega Link Smart Probes are easily configurable through Omega's SYNC configuration software. Ensure SYNC is running on a Windows OS computer before continuing. Connect the SP-001/SP-002 to a computer running SYNC through an Omega Link Smart Interface to begin.

Note: SYNC is available to download for free on the Omega website.

7.1 Connecting to SYNC – Automatic Detect

Once the SP-001/SP-002 and Omega Link Smart Interface are connected to a computer, SYNC will automatically detect the device and display readings.

Note: If live readings from the SP-001/SP-002 are displayed on SYNC, skip ahead to section **7.3 Input Configuration**.

7.2 Connecting to SYNC – Manual

If SYNC does not automatically detect the device, follow these instructions to manually connect it.

Step 1: Click on the ➕ icon located on the top left of the SYNC interface.

Step 2: Proceed through the **Add Device Wizard** and click **End Device/Probe**.

7.2.1 Communication Interface

Set the communication parameters for the Omega Link Smart Interface that will be connected.

Note: The connection type and parameters must be accurate for a proper connection to be established. Failure to accurately set up communication parameters may result in communication errors.

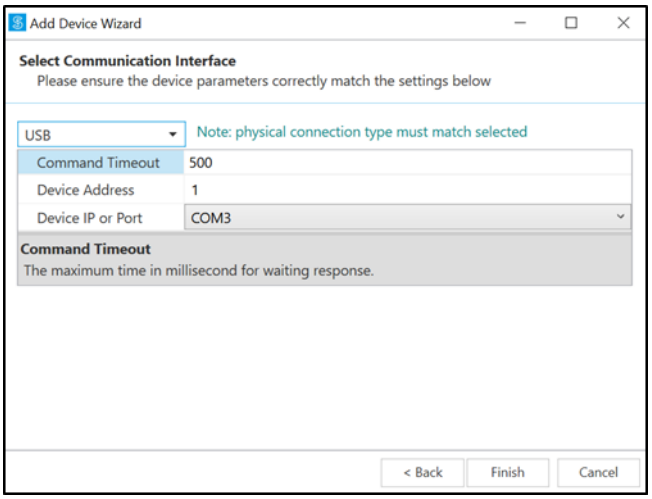


Figure 8: USB Communication Interface

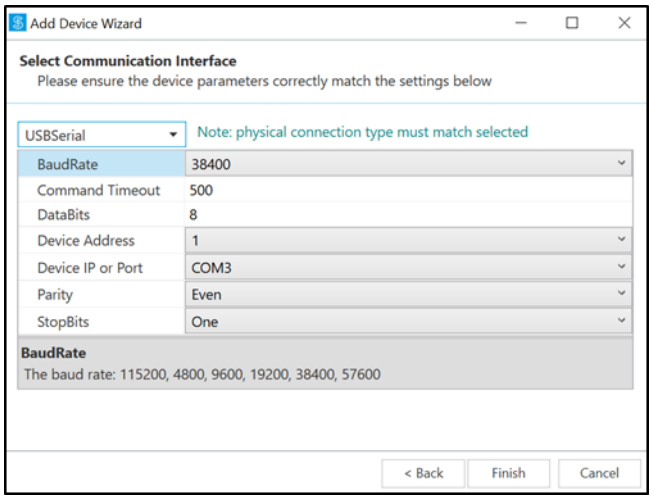


Figure 9: USB Serial Communication Interface

- **Connection Type:** Select the type of connection that is established between the SP-001/SP-002 and the computer.
- **Command Timeout:** The maximum time (in milliseconds) for a command to be completed before the command is aborted.

Note: The default command timeout is 500 milliseconds. It is recommended that this section be left unchanged to avoid communication errors.

- **Device Address:** The default device address is 1. The numerical value will automatically increase to the next available device address for every new device added to prevent duplicate addresses.

- **Device IP or Port:** The COM port number that the device is connected to on the computer.
- **BaudRate:** Controls bits per second
- **DataBits:** The number of bits in each character sent.
- **Parity:** A means of checking the correctness of a character by adding an extra bit to the character and setting the value based on all the other bits in the character.
- **StopBits:** The number of bits used to indicate the end of the character.

When the user has completed setting the communication parameters for the device, click **Finish**.

7.3 Input Configuration

When the SP-001/SP-002 is connected to SYNC, users may configure the emissivity and adjust spike and noise suppression with a filter. To configure these features, follow see the subsections below.

7.3.1 Setting Emissivity

The default factory setting for emissivity is set to 1.

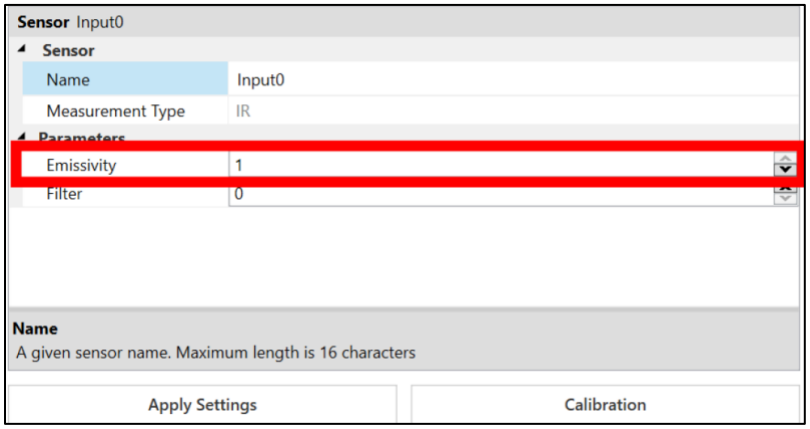


Figure 10: SYNC Emissivity Calibration

7.3.1.1 Known Emissivity Value

If the emissivity of the target material is already known, you may enter it in the **Emissivity Dropdown** and click **Apply Settings** to finalize changes. See **Figure 10**.

7.3.1.2 Setting Emissivity via Emissivity Table

For a list of reference materials and their corresponding emissivity values, refer to the **Emissivity Table** in **Appendix A**. Enter the corresponding value in the **Emissivity Dropdown** and click **Apply Settings** to finalize. See **Figure 10**.

7.3.1.3 Setting Emissivity via Secondary Temperature Device

Note: Ensure the SP-001 / SP-002 is connected to SYNC and pointed at the material being measured at a distance that covers the entire field of view.

Step 1: Click Calibration. See **Figure 11.**

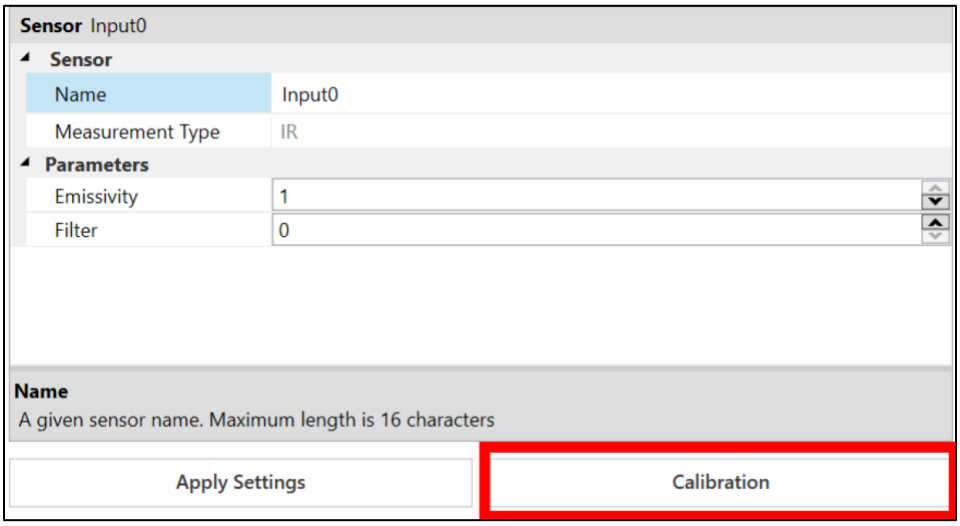


Figure 11: SYNC Calibration button

Step 2: Use a secondary device to measure the temperature of the target material being measured by the SP-001 / SP-002.

Note: Recommended devices to measure the temperature of the target material include a thermocouple, RTD, etc.

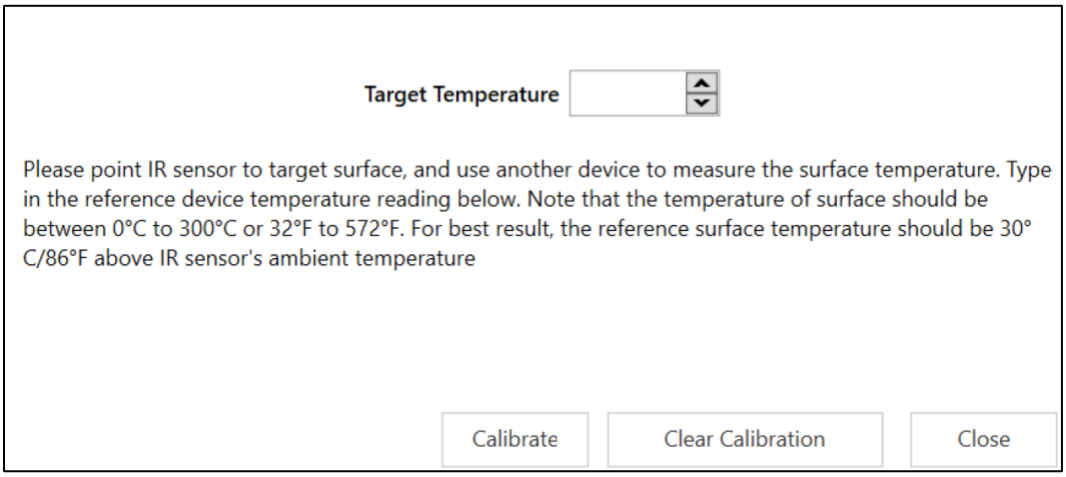


Figure 12: SYNC Interface Target Temperature Calibration

Step 3: Once the target temperature has been determined, enter the target temperature into SYNC. See **Figure 12**.

Step 4: Click **Calibrate** to set the emissivity changed and exit out of the calibration pop-up. Click **Apply Settings** to finalize.

Note: When you click Calibrate, the emissivity value in Figure 11 will change according to the value of the Target Surface Temperature entered.

7.3.2 Adjusting Spike and Noise Suppression with Filters

The filter settings can be adjusted in SYNC to adjust for spikes and noise. The default factory settings is Low with a response time of 0.4 seconds according to the following table:

Filter Settings		Response Time (seconds)
Off	0	0.3
Low	1	0.4
Medium	2	0.5
High	3	1.5

To change the Filter settings, click the corresponding dropdown displayed in Figure 14 and refer to the table provided above. Click Apply Settings to finalize.

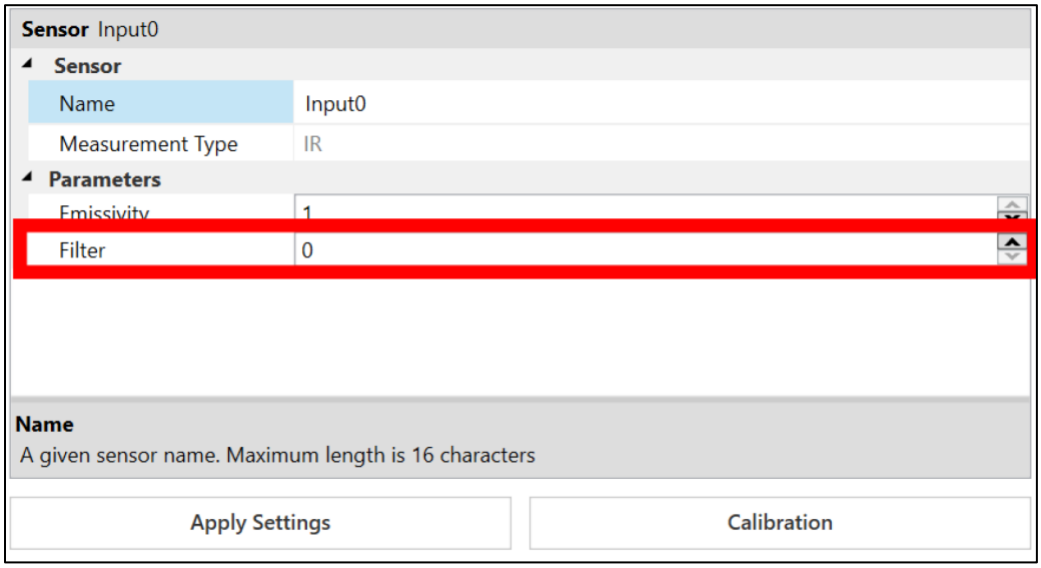


Figure 13: SYNC Filter Configuration

7.3.3 Discrete Input/Output (DIO)

The Omega Link SP-001/SP-002 features 2 configurable discrete I/O pins. These can be used for a myriad of applications including driving relays, physical alarms, or sensing dry contacts like door switches. The user may configure the polarity of the inputs (active **HIGH** or active **LOW**) or **Disable** the DIO to utilize the outputs (ON/OFF, PWM, SERVO).

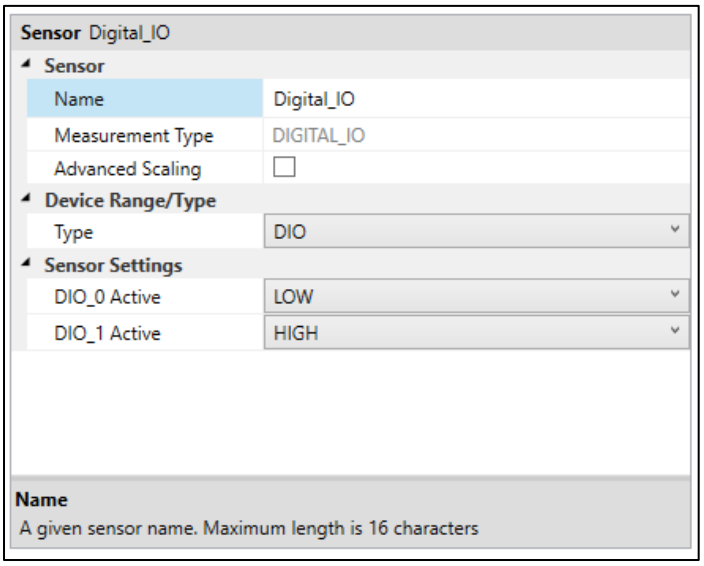


Figure 14: SYNC interface discrete I/O input configuration

The Discrete I/O input shares the output circuitry. The internal process drives the output control signal to turn on the output driver which will force the output low. When the state of the DIO input signal is to be read the processor applies 3.3 V_{DC} to the Input Bias signal and reads the level detected at the Input Sense. If the output is inactive an external signal may be used to force the input level low. A diode protects external positive voltages, allowing the output driver to activate loads greater than the internal 3.3 V_{DC}.

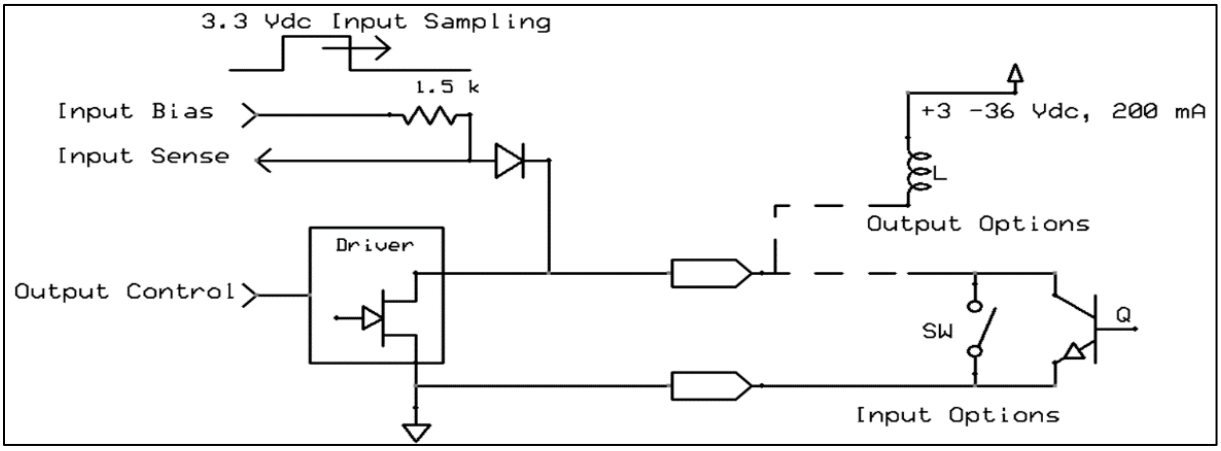


Figure 15: Digital/Discrete I/O circuitry

7.3.3.1 *Setting DIO as an Input*

To use a DIO pin as an input, make sure it is set to **Active Low** (default) in the **Output Tab** in SYNC.

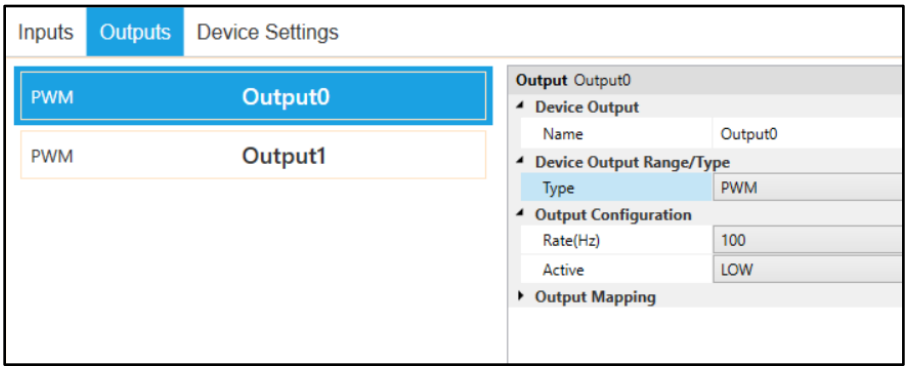


Figure 16: SYNC interface outputs tab

Then, in the **Input Tab**, select a **Type** from the drop-down which includes DIO. Each DIO pin has an internal pull-up, but to save power, the internal pull-up is only active when the unit takes a reading.

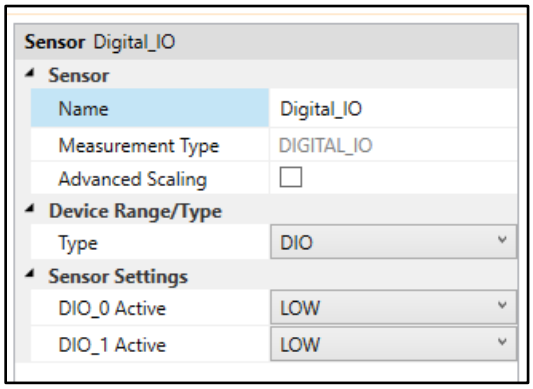


Figure 17: SYNC interface Digital_IO

7.3.4 Advanced Scaling Options

The Omega Link SP-001/SP-002 allows for advanced scaling options on process and pulse inputs only. The **Advanced Scaling** checkbox can be selected to expand additional configuration options. A gain and/or offset can be applied to the input reading and the displayed unit can be changed.

To apply a gain or offset to the input, expand the **Scaling** menu and ensure that **Apply Scaling** is checked. There, the gain and offset values can be adjusted. Both positive and negative values may be entered as well as decimal numbers. The equation for the scaled input value is given below.

$$\boldsymbol{Input_{Scaled} = (Input_{Raw} \times Gain) + Offset}$$

The displayed units can be changed by entering a new value in the **Unit** field and clicking **Apply Settings**. This field is limited to a maximum of 4 characters. Note that changing the Unit field does not change the base unit type, only the display name. The **Lock** checkbox must be selected to use the user-defined Unit field. Unchecking the Lock checkbox and clicking **Apply Settings** will revert the unit display back to the default setting.

7.4 Output Configuration

The SP-001/SP-002 offers two discrete outputs that share circuitry with the discrete inputs. If an output is to be used then the corresponding input pin must be set to **Disable**. See section ***5.3.1 Discrete Input/Output (DIO)*** for more information.

There are three types of output options – On/Off, Pulse-Width Modulation (PWM), or Servo. See section **5.4.1** for more information on each type.

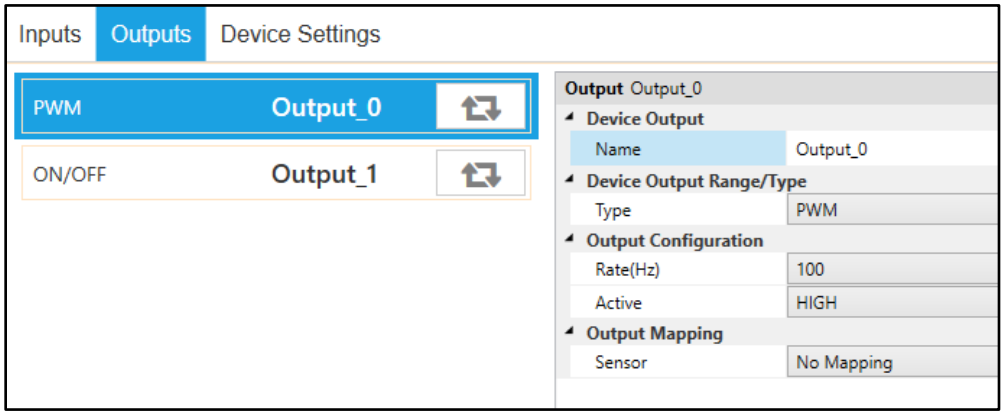


Figure 18: SYNC interface Output Configuration

Outputs may be configured as either *Active High* or *Active Low*. When configured as Active High the output conducts normally and becomes high impedance when activated. When configured as Active Low the Open-Drain output is high impedance normally and will conduct when activated.

Option	Value	Description
Active	LOW	When the output is inactive, it is in a high impedance state.
	HIGH	When the output is active, it is in a high impedance state.

An output may be controlled in one of three ways – a scaled mapping to an input, an on/off control from an input setpoint, or as an input alarm. Sections **5.4.2** through **5.4.4** describe these output control methods.

7.4.1 Device Output Range/Types

There are three types of output options – On/Off, Pulse-Width Modulation (PWM), or Servo. This section describes these output options.

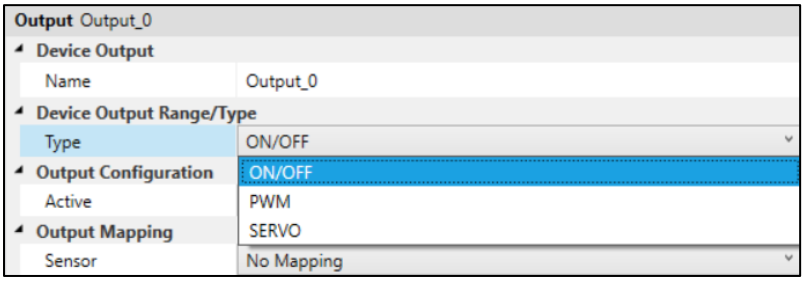


Figure 19: SYNC interface output type selection

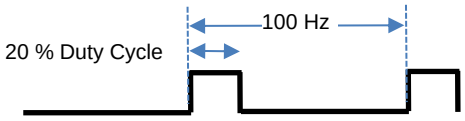
7.4.1.1 ON/OFF Output Type

The ON/OFF output mode switches the output to be a binary ON or OFF. Depending on if the output is configured as Active Low or Active High, the ON/OFF mode can correspond to different polarities.

7.4.1.2 Pulse-Width Modulation (PWM) Output Type

Pulse-Width Modulation (PWM) controls the amount of power given to a device by cycling the on/off phases of a digital signal. PWM consists of a duty cycle and frequency. The Duty Cycle measures the amount of time a signal is in the ON state as a percentage. The frequency controls how fast the PWM cycle is repeated. Users can select between the following settings:

Option	Value	Description
Rate	100 Hz	Signal has a constant 100 Hz frequency with 0-100% Duty Cycle
	10 Hz	Signal has a constant 10 Hz frequency with 0-100% Duty Cycle
	1 Hz	Signal has a constant 1 Hz frequency with 0-100% Duty Cycle
	0.1 Hz	Signal has a constant 0.1 Hz frequency with a 0-100% Duty Cycle
Signal Type	Active LOW	When the output is active, it is pulled to ground (LOW)
	Active HIGH	When the output is active, it is in a high impedance state



Example shows a PWM output signal configured with a 100 Hz frequency and active HIGH outputs. The duty cycle has been set to 20%.

Figure 20: PWM function diagram

7.4.1.3 SERVO Output Type

The SERVO output allows driving servo motors that control position. A Servo output is a special case of the PWM output, where the ON time varies between 1.0 msec and 2.0 msec or between 0.5 msec and 2.5 msec, with the lower bound representing 0 degrees and the upper bound representing 180 degrees of angular travel. The typical non-critical frequency is 50 or 100 Hz. Servo outputs are always active high.

Option	Value	Description
Rate	100 Hz	Signal has a constant 100 Hz frequency
	50 Hz	Signal has a constant 50 Hz frequency
Pulse Width Range	1.0-2.0 msec	On time varies between 1 and 2 msec
	0.5-2.5 msec	On time varies between 0.5 and 2.5 msec

Example: For the percent of angular travel, if the pulse width range is set to a range of 1.0-2.0 msec, then selecting 50% of angular travel represents 1.5 msec or 90 degrees of travel.

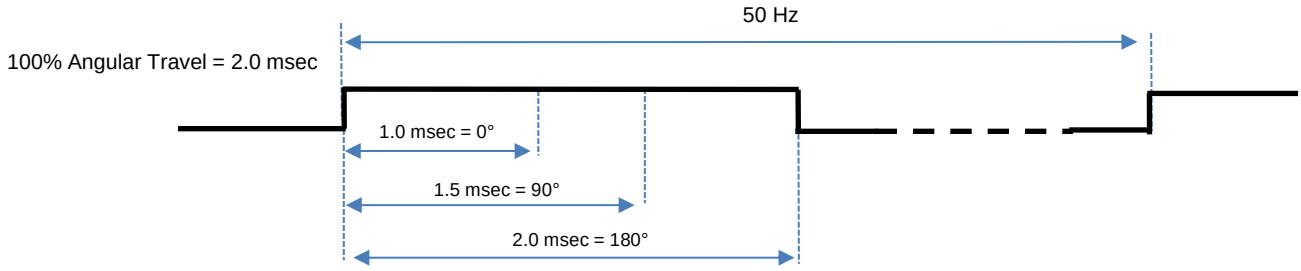


Figure 21: SERVO output example

7.4.2 ON/OFF Control Module

To configure an ON/OFF control module on a device, first ensure that the desired output pin is not associated with any input alarms and that it is set as **No Mapping** in the Output Mapping menu in the **Outputs** tab. The ON/OFF control module can be used with any selected output type including ON/OFF, PWM, and SERVO. When enabled in PWM mode, ON corresponds to 100% duty cycle. When enabled in SERVO mode, ON corresponds to 100% angular travel.

In the **Outputs Tab** in SYNC click on the  icon located to the right of the available outputs. Clicking the icon will open the **Define ON/OFF Control** dialog box as seen below.

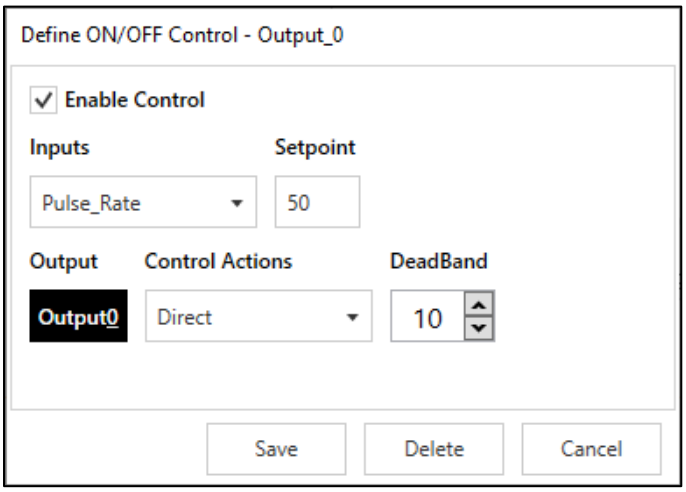


Figure 22: SYNC interface ON/OFF control module functions

The **Enable Control** checkbox enables the ON/OFF control module. If this box is unchecked, the output will be disabled but the module with all its settings will remain available to be enabled at a later time.

The **Inputs** dropdown lists the available input sources and will depend on how the device is configured in the Inputs tab.

The **Setpoint** field sets the threshold for activating the ON/OFF control module. The unit of the Setpoint field will be the same as the unit of the chosen Input.

The **Control Actions** dropdown has options for direct or reverse control. In direct mode, once the Setpoint value is reached then the output will be set to ON. In reverse mode, once the Setpoint value is reached then the output will be set to OFF.

The **DeadBand** field together with the direct or reverse control action configures a deadband range around the

Setpoint where the ON/OFF control does not toggle. The unit of the DeadBand field will be the same as the unit of the chosen Input.

- Example 1: the setpoint is configured for a 50 Hz rate input with a deadband of 10 Hz with direct control action. The output will activate if the input rises above 60 Hz. Conversely, the output will become inactive if the input falls below 50 Hz.

- Example 2: the setpoint is configured for a 50 Hz rate input with a deadband of 10 Hz with reverse control action. The output will activate if the input falls below 40 Hz. Conversely, the output will become inactive if the input rises above 50 Hz.

The **Save** button saves and applies the configurations settings to the ON/OFF control module. The **Delete** button only appears for a previously saved ON/OFF control module and it removes the module and allows other output types to be configured such as an alarm or mapping.

7.4.3 Setting an Alarm

Alarms are set by clicking the  icon in SYNC on the desired input signal found in the **Input Tab**.

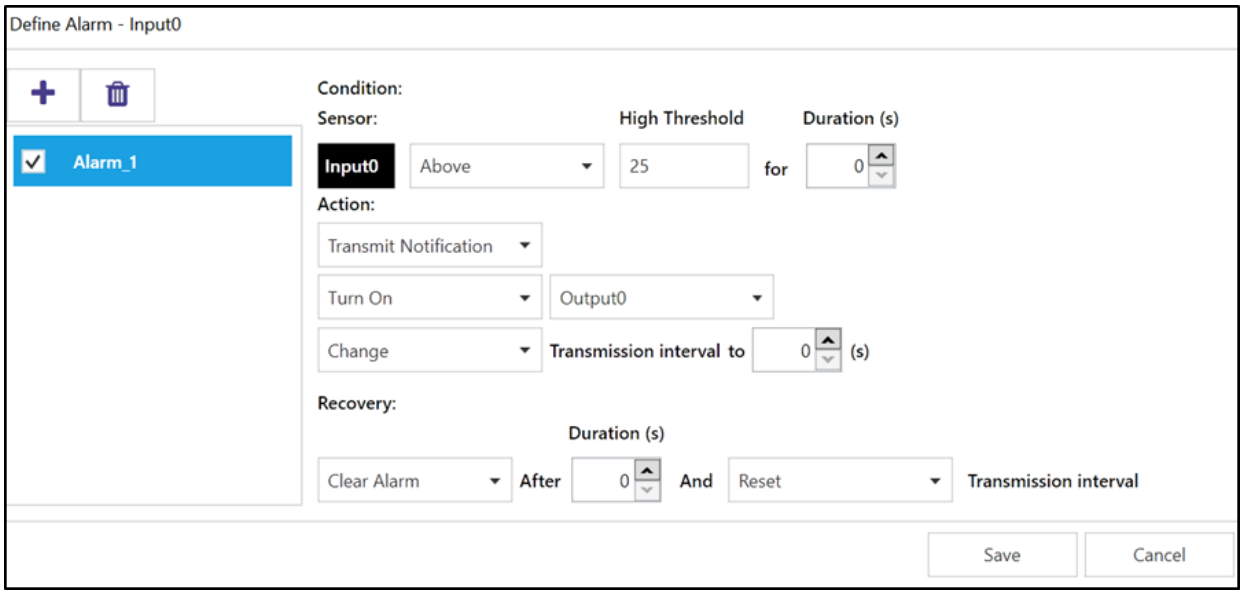


Figure 23: SYNC alarm configuration interface

Configure the **Condition** that triggers the alarm by selecting an option from the drop down such as Above or Below. The **Threshold** field(s) will change to display whatever is appropriate for the option chosen such as a High Threshold for an Above condition or a Low Threshold for a Below condition. A **Duration** can be set for the trigger as well where the condition must be met for a certain amount of time before the alarm flags.

Under the **Action** menu, the option to transmit or not transmit a notification can be set. The option to enable an output can also be set. The output chosen must not be currently used in a sensor mapping or ON/OFF control module. The data transmission interval may also be changed upon triggering an alarm, e.g. increate the rate of transmission if an excessive value is detected.

The **Recovery** menu allows the option to clear the alarm after a certain **Duration** once the trigger condition is no longer met. The transmission interval can also be reset to the normal system setting once the alarm is cleared.

To create a new alarm, click the plus icon  and a new alarm will be added. To remove an alarm once it is created, select the alarm in question on the left side of the alarm panel and click the delete icon  .

8 Pairing a Sensing Device to an Omega Link Gateway

Refer to either the Wired or Wireless instructions to pair an Omega Link Smart Probe & Interface to an Omega Link Gateway. Before continuing to the pairing instructions, ensure the following prerequisites are met:

- Ensure that the Omega Link Gateway has been properly setup, powered on, and in close physical proximity.
- (*For Wired pairing*) Ensure the user has access to a PC and the internal Gateway UI (*refer to the Omega Link Gateway manual for instructions on how to access the internal Gateway UI*).

8.1 Wireless Pairing

Pairing a wireless Smart Interface (IF-006) with probe attached is made easy with a one-button pairing system between the IF-006 and the Omega Link Gateway.

Step 1: When the Smart Probe and relevant accessories have been securely connected to the IF-006, push the pairing button once on the IF-006. The LED status indicator will blink green indicating the device is in Pairing Mode.

Step 2: Quickly push the pairing button on the Omega Link Gateway. The LED on the Gateway will blink green indicating the Gateway is in Pairing Mode.

When the IF-006 or Smart Sensor has been successfully paired to the Omega Link Gateway, the LED will stop blinking on both devices. Readings for the newly added device will then appear on the Omega Link Cloud or OEG interface.

8.2 Wired Pairing

Wired Smart Probes connected directly to an Omega Link Gateway with an IF-001 cable or IF-002 will need to be added to the Gateway Internal User Interface.

The **Connected Devices** tab is the default page set once you are signed in to the internal gateway UI. From here, you can add devices to your gateway to have them appear in your Omega Link Cloud account.

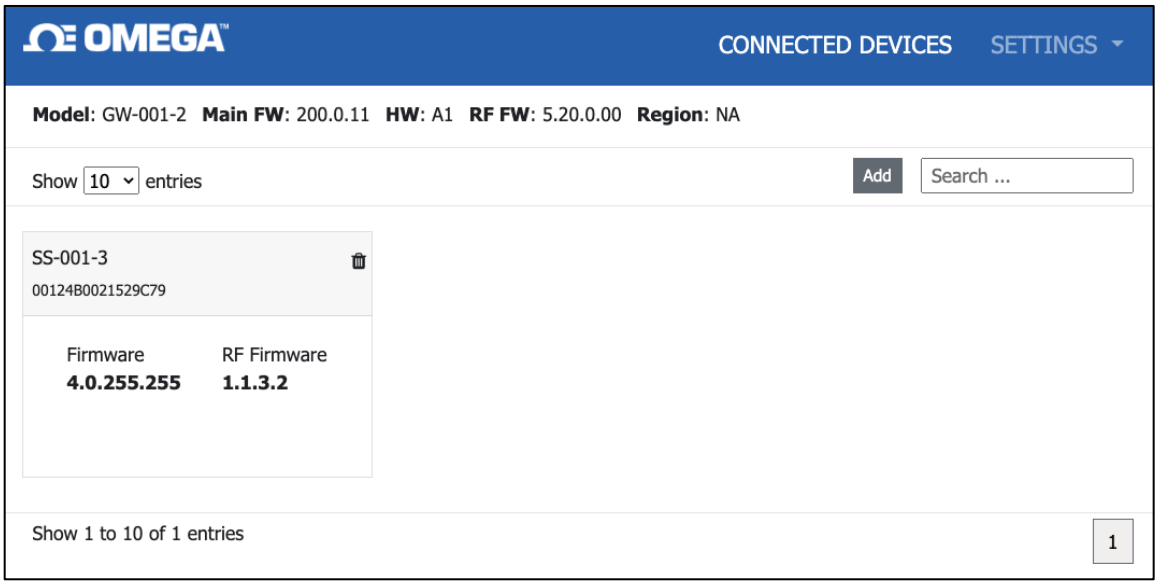


Figure 24: Gateway Internal User Interface

To add a device to your gateway from the internal gateway web UI, begin by clicking the 

button at the top right of the web page. Fill out the Add Device menu with the parameters of the Smart Probe connection.

WARRANTY/DISCLAIMER

OMEGA ENGINEERING, INC. warrants this unit to be free of defects in materials and workmanship for a period of **13 months** from date of purchase. OMEGA's WARRANTY adds an additional one (1) month grace period to the normal **one (1) year product warranty** to cover handling and shipping time. This ensures that OMEGA's customers receive maximum coverage on each product.

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FOR **WARRANTY** RETURNS, please have the following information available BEFORE contacting OMEGA:

1. Purchase Order number under which the product was PURCHASED,
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3. Repair instructions and/or specific problems relative to the product.

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1. Purchase Order number to cover the COST of the repair,
2. Model and serial number of the product, and
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