1 YEAR WARRANTY

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SP-010

Load Cell Smart Probe

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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 your equipment.

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

Note: Provides you with information that is important to successfully setup and use the SP-010.

Caution or Warning: Tells you about the risk of electrical shock.

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

2 Introduction

The Layer N SP-010 Load Cell Smart Probe provides an easy way to integrate your bridge devices to the Layer N Ecosystem. The SP-010 accepts 4-wire bridge sensors through its M12 4-pin connector and Layer N Smart Interfaces through its M12 8-pin connector. The M12-S-M-FM accessory connector can be utilized to easily connect wire leads to your SP-010.

The Load Cell interface supports most common load cell impedances and sensitivities. The SP-010 uses a constant current for excitation based on the bridge impedance. The bridge impedance is automatically detected when the SP-010 is first turned on and can be re-tuned at any time using the free SYNC software package. The excitation current is only applied during measurements to limit self-heating effects and allow for battery powered operation.

The SYNC software also allows customizing the *sensitivity* of the bridge in mV/V and the maximum ***range*** of the bridge in the specific units of measure. The default unit of measure is **kg** and can also be customized. TARE and 2 Point Linearization are also available through SYNC.

The Layer N SP-010 features 2 configurable digital I/O pins. These can be used for a myriad of applications including initiating the TARE function, driving relays, physical alarms, or sensing dry contacts like door switches. The SP-010 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 your SP-010
SP-010 Unit
Quick Start Guide

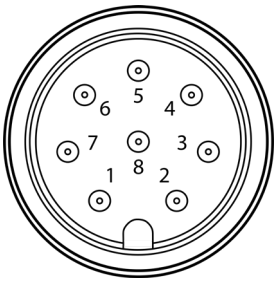
Additional Material Needed
Layer N Smart Interface
Computer with Windows OS
SYNC configuration software
Strain Bridge or Load Cell

Optional Materials
M12-S-F-FM Screw Terminal Accessory

3 Hardware Setup

3.1 Connecting your Layer N Smart Interface

The SP-010 requires a Layer N Smart Interface to connect to your computer. Use the M12 8-Pin Connector diagram below to connect your inputs and outputs to the SP-010.

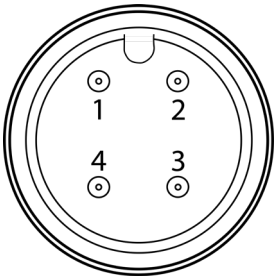


M12 8-Pin Connector

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

3.2 Bridge Sensor Wiring

The SP-010 accepts 4-wire bridge sensors through its M12 4-pin connector. Use the M12 4-Pin Connector diagram below to connect your bridge sensor to your SP-010.



M12 4-Pin Connector

Pin	Name	Function
Pin 1	Exc -	Excitation Return
Pin 2	Sense +	Bridge Output
Pin 3	Sense -	Bridge Output
Pin 4	Exc +	Bridge Excitation

4 SYNC Configuration

Layer N Smart Probe products are easily configurable through SYNC configuration software. Ensure SYNC is running on your Windows OS computer before continuing. Connect your SP-010 to your computer through your Layer N Smart Interface.

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

4.1 Connecting to SYNC - Automatic Detect

Once the SP-010 and Layer N Smart Interface are connected to your computer, SYNC will automatically detect it and begin displaying readings.

Note: If you have successfully connected your SP-010 to SYNC and have readings appearing in SYNC, skip ahead to the section titled Load Cell Interface.

4.2 Connecting to SYNC – Manual

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

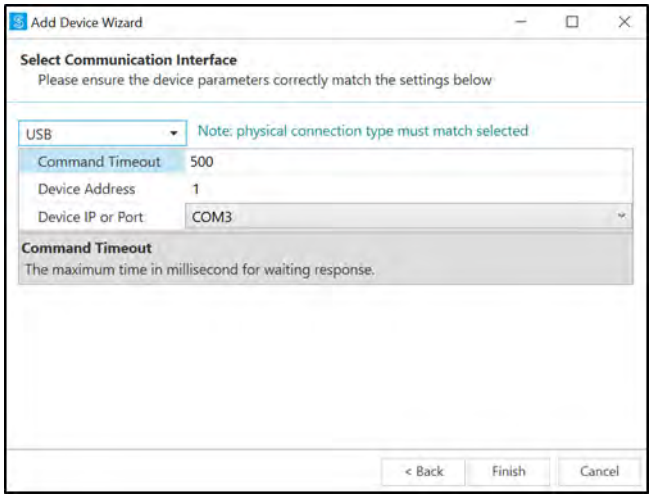
Step 1: Click on the ⊞ icon located on the top left of the SYNC interface.

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

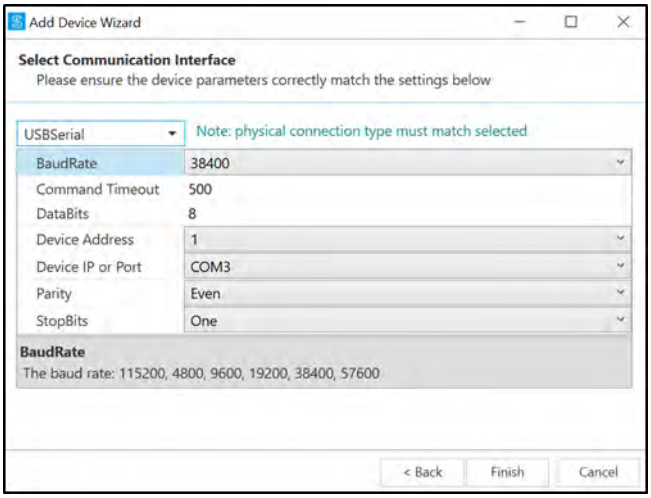
4.2.1 Communication Interface

Set the communication parameters for the Layer N Smart Interface that you are connecting.

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



USB Communication Interface



USB Serial Communication Interface

- **Connection Type:** Select the type of connection you have between your SP-010 and your 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 alone to avoid communication errors.

- **Device Address:** If your Smart Interface is part of a Network, enter the Network Address here. The default network address is 1 for most devices. Please refer to the manual of your Smart Interface for more information.

Note: The default Device Address is 1.

- **Device IP or Port:** The COM port number that your device is connected to on your computer.

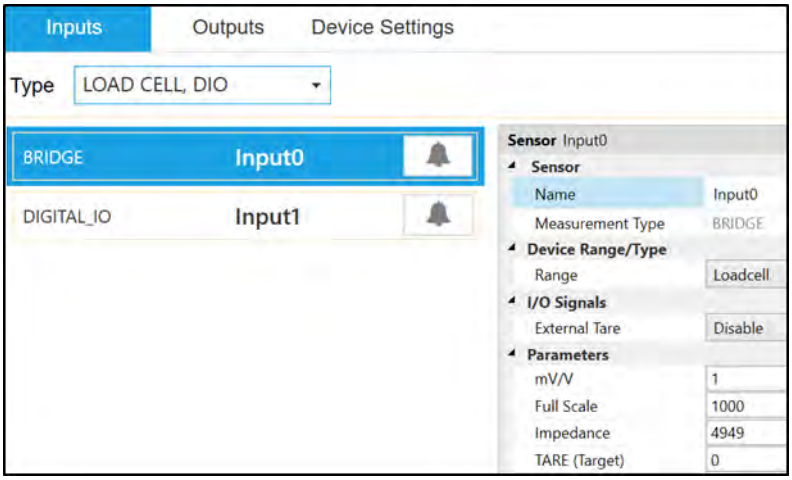
Important: The following parameters should **NOT** be changed. These settings should **NOT** be changed unless the configuration has been done on the interface.

- **BaudRate:** Controls bits per second
- **DataBits:** The number of 'bits' in each character sent.
- **Parity:** A means of checking correctness of 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.

Once you have completed setting the communication parameters for your device, click **Finish**.

4.3 Load Cell Interface

The SP-010 measures the bridge voltage to determine the applied force using bridge characteristics provided by the user. To configure the settings on your SP-010, follow these instructions:



Step 1: Click the **Input Configuration Tab** in SYNC and select the **Load Cell** input type form the **Type** drop down.
Step 2: Set the Parameters of your Load Cell to your preferred settings.

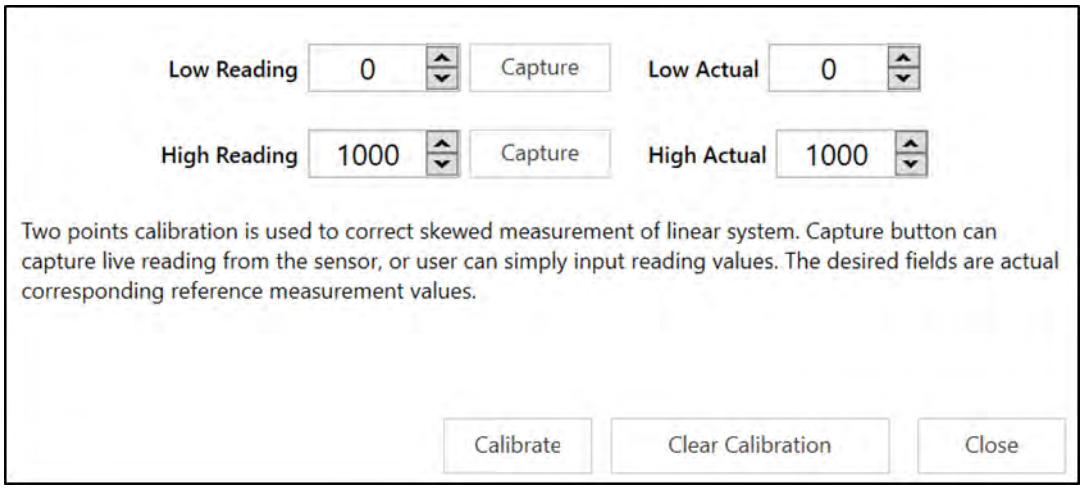
Parameter	Description
mV/V	Bridge output at full scale
Full Scale	Bridge maximum load
Impedance	Bridge Impedance
TARE (Target)	Update this parameter to TARE bridge

If the Bridge Impedance is set to 0 the SP-010 will automatically calculate the impedance on the next device reset or power cycle.

4.3.1 2-Point Calibration

A 2-point linearization correction may be applied using either known scaling values or reference weights. 2-Point Calibration can be performed as described below:

Step 1: From the **Load Cell Input** interface on SYNC, click **Calibrate**.



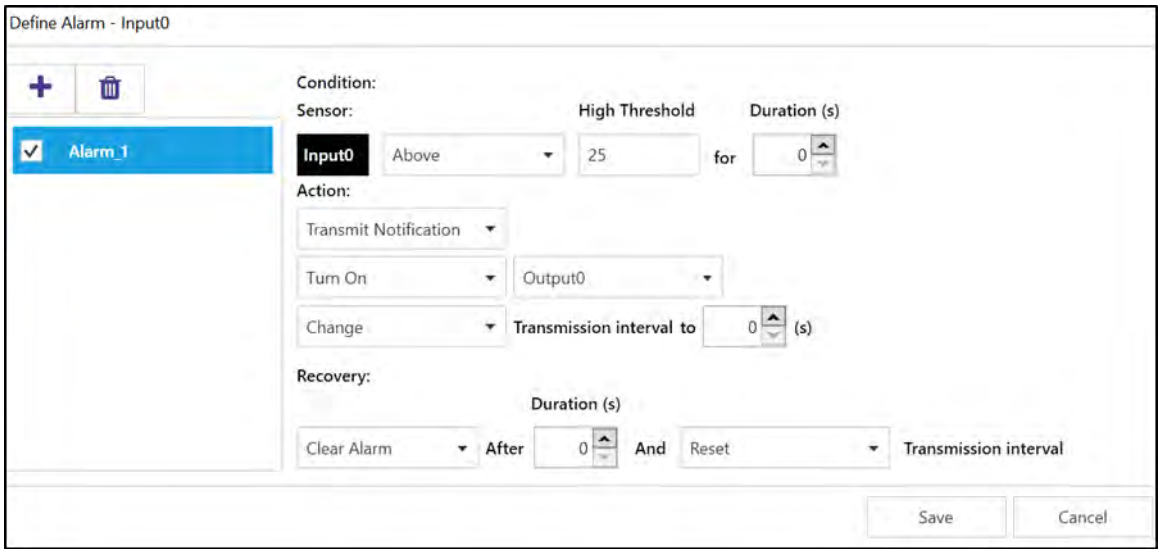
Step 2: Place your low reference and click **Capture** next to **Low Reading**. This will capture the measurement for the low reference in the low reading box. Enter your actual low reference weight in the **Low Actual** Box.

Step 3: Place your high reference and click **Capture** next to **High Reading**. This will capture the measurement for the high reference in the high reading box. Enter your high reference weight in the **High Actual** Box.

Step 4: Click **Calibrate** to save your calibration.

Note: Clicking **Calibrate** or **Clear Calibration** will clear the TARE offset.

4.4 Setting Alarms



Alarms are set by clicking the  icon in SYNC on the desired input signal found in the **Inputs Configuration Tab**. Setup the threshold and alarm type in the **Condition** section and then select which output to turn on in the **Action** section. The alarm can be set to be latching or non-latching in the **Recovery** section.

4.5 ON/OFF Control

To configure ON/OFF Control on a device, navigate to the **Output Configuration Tab** in SYNC and click on the  icon located to the right of the available outputs. Clicking the icon will open **Define ON/OFF Control** dialog box as seen below. Choose the input with the active alarm that you would like to control and set your preferred parameters.

5 Appendix: SP-010 Registers

The following Appendix provides the registers and list index for the SP-010. This information is intended to aid users who will be making configurations and adjustments to their Layer N SP-010 Load Cell Smart Probe through the Command Line Interface or other custom interfaces.

Smart Probe devices share a common platform architecture that provides extensive monitoring and control capabilities thru a set of platform generic registers. These registers may be accessed using I2C based commands directly to the Smart Probe devices or thru a set of Modbus based registers when using Omega Interface devices. Refer to the *Smart Sensor Device Interface* manual for further information.

When powered on or after a device reset each Smart Sensor based device will enumerate 1 or more sensor instances which are described by the device specific Sensor Descriptors which include configuration options, measurement type and units of measure for the corresponding sensor values. Additional sensor information is provided in sensor specific IPSO object descriptions which include extended measurement type, precision and tracking of minimum/maximum readings.

5.1 Load Cell Descriptor

The SP-010 Load Cell descriptor is at base address 0x0060 (Modbus 0xf030).

Offset	Name	Value	Description
0x00	Measurement Type	0x27	Mass (kg)
0x01	Data Type/Format	0x26	Float
0x02	Configuration	0x4?	Lock and Scaling bits only
0x03	Sensor Device	0x??	Enables DIO TARE signals
0x04..0x08	UOMR	“kg”	Units of measure

5.1.1 Load Cell Measurement Type

The Load Cell interface provides a measurement of weight in **kg**.

Sensor Type	SI Derived Units	Measurement
0x27	kg	Mass

5.1.2 Load Cell Input Data Type/Format

All data values are returned as 32-bit floating point values.

Load Cell Input Data Type							
7	**6**	**5**	**4**	**3**	**2**	**1**	**0**
Smart Sensor	Sensor Writable	Factory Calibrate	Reserved	Data Type			
0	0	?	0	0x06 == FLOAT			

5.1.2.1 Data Type

The 4-bit Data Type field determines the type of data of the specific sensor.

5.1.2.2 Factory Calibrate

The Factory Calibrate bit is used during factory calibration. If set, the factory calibration attributes are applied to the sensor reading before the sensor scaling. If clear, not factory calibration attributes are applied. If the sensor does not support factory calibration the Factory Calibrate bit is ignored and will always read as 0.

5.1.2.3 Sensor Writeable

If the Sensor Writeable bit is set the sensor value may be overwritten with a preset value. This capability is useful in sensors such as up/down counters, where a preset, or possibly a zero value must be written to the sensor value.

5.1.2.4 Smart Sensor

Refer to the *Smart Sensor Device Interface* documentation.

5.1.3 Load Cell Configuration

Load Cell Configuration							
7	**6**	**5**	**4**	**3**	**2**	**1**	**0**
Available	Assigned	Apply Scaling	Lock	Sensor Type (Range) (Not Used)			
0	*	?	?				

5.1.3.1 Apply Scaling

If set, the user defined Offset and Gain values will be used to adjust the sensor reading:

Result = (Raw Reading * Gain) + Offset

5.1.3.2 Lock

If set, the user specified units of measure string (4-character maximum) will be used in place of the default units of measure.

5.1.3.3 Assigned

Refer to the *Smart Sensor Device Interface* documentation.

5.1.3.4 Available

Refer to the *Smart Sensor Device Interface* documentation.

5.1.4 Load Cell Device Byte

The Sensor Device byte determines whether the DIO TARE function is enabled for devices with DIO available. If the bit is enabled than the corresponding DIO signal will act as a remote TARE trigger. The Open Detect bit allows enabling the open circuit detection function.

Load Cell Device Byte							
7	**6**	**5**	**4**	**3**	**2**	**1**	**0**
0	0	0	Open Circuit Detect	DIO TARE ENABLE			
			0 Disabled	0	0	DIO_1	DIO_0
			1 Enabled				

5.1.5 Load Cell Parameters

The SP-010 provides 3 Sensor Parameters which may be updated based on the specific load cell being used.
The Load Cell sensors maps to Sensor 0 of the SP-010. The SP-010 Load Cell Sensor Parameter base address is 0x08c0 (Modbus 0xf460). All values are 32-bit float values.

Parameter	Offset	Name	Range	Factory Default	Description
0	0x00	Sensitivity	0.1 to 100	1.0	Sensitivity in mV/V
1	0x10	Range	1 to 100000	1000	Specified full scale range
2	0x20	Impedance	0 to 15000	0	Setting to 0 allows auto measurement
2	0x30	TARE	+/- 100000	0	Write 'actual' value (ie: 0 to Tare)

5.1.5.1 Sensitivity

The Load Cell sensitivity is typically given as a mV/V ratio and indicates the expected signal generated per applied bridge excitation voltage when a the rated load is applied. For example, a load cell with a sensitivity of 10 mV/V and a rated Range of 1000 kg will generate 10 mV if 1 volt is applied to the bridge excitation signals with a load of 1000 kg.

5.1.5.2 Range

The Load Cell range is specified in kg, lbs, or other weigh units of measurement. The SP-010 assumes all weights are provided in kilogram (kg). When entering the full-scale range, it is recommended that the value is converted to kg. An alternative is to change the ***units of measure***, enter appropriate scale factors and set the lock bit in the sensor descriptor field. Typical load cells also specify a maximum 'overload' value. The SP-010 will set the maximum measurement value to 150% of the specified range.

5.1.5.3 Impedance

The Load Cell impedance is specified in ohms. If this value is set to 0 the device will measure the attached load cell on the next power or device.

5.1.5.4 TARE

When a value is written to the TARE register an adjustment factor is calculated and stored for subsequent measurements. It is typically used to 'zero out' weights associated with tote boxes and other discrepancies in a weighing system.

$$T_{factor} = T_{value} - R_{raw}$$
$$R_{final} = R_{raw} + T_{factor}$$

Where:
T_{value} is specified TARE value
R_{raw} is the unadjusted reading
R_{final} is the final, adjusted reading

For example, if the current reading is 1.2 and the TARE value is 0.0, the internal adjustment value will be set to -1.2
The TARE adjustment is made after the User Calibration scaling. Writing to the TARE value during User Calibration is ignored. SP-010-1 units that offer DIO signals may be configured to allow an external digital signal to 'trigger' a TARE function.

5.1.6 Load Cell User Calibration Parameters

The SP-010 provides four User Calibration registers that allow setting a 2-point calibration / linearization of the specific load cell. The four parameters may only be set while the device is in the ***User Calibrate mode***. When the calibration function is triggered the device will calculate the Gain and Offset used in the linearization process.

The calibration process is performed by the following steps:

Step 1: Send Sensor Function ***Calibrate Mode*** trigger to set device to calibration mode.
Step 2: Apply a known weight and record in the User Calibration register 1 (Actual Low).
Step 3: Record the measured value in User Calibration register 0 (Reading Low).

Note: A Sensor "Capture Low" trigger function allows automatically capturing the value.

Step 4: Apply a 2nd known weight and record in the User Calibration register 3 (Actual High).
Step 5: Record the measured value of the 2nd weight in User Calibration register 2 (Reading High).

Note: A Sensor "Capture High" trigger function allows automatically capturing the value.

Step 6: Send Sensor Function "Start Calibrate" trigger generate the Gain and Offset values.

The four calibration parameters represent two sets of reading, where X = actual applied load and Y represents the reading captured by the device after the calibration process:

User Calibration Parameter	Name	Range	Factory Reset	Description
0	Low Reading (X1)	+/- 100000	0.0	Value read by SP010 (lower value)
1	Low Actual (Y1)	+/- 100000	0.0	Actual applied load (lower value)
2	High Reading (X2)	+/- 100000	Full Scale	Value read by SP010 (higher value)
3	High Actual (Y2)	+/- 100000	Full Scale	Actual applied load (higher value)

$$\text{Result} = \text{Reading} * \textit{Gain} + \textit{Offset},$$

Where:
Gain = (Y2 – Y1) / (X2 – X1)
Offset = (X1 * Gain) – Y1

Note: The device must be put into the 'Calibration' mode to access the User Calibration parameters. While in the Calibration mode the raw Reading value will be displayed, and the TARE offset is ignored.

5.1.7 Load Cell IPSO Definition

The Load Cell sensor IPSO definition provides signal range, measured min/max values, IPSO object type information. The Range information is Load Cell Type dependent. The SP-010 Load Cell IPSO definition is at base address 0x08a8.

Offset	Name	Value	Description
0x00	Sensor Type	3322	Load
0x02	Precision	??	Provides reading of xxx.x. Set to support 0.1% full scale reading. For example, if full scale is 100, Precision is set to 1 (xxx.x)
0x04	Sensor Trigger	??	Write 0x0001 to force reset of min / max
0x08	Min Measured	??	Minimum reading since last reset
0x0c	Max Measured	??	Maximum reading since last reset
0x10	Min Range	??	Set to 1.5 X Full scale reading
0x14	Max Range	??	Set to -1.5 X Full scale reading

5.1.7.1 Sensor Trigger Function

The Sensor Trigger function is used to reset the IPSO min/max values as well as control the Calibration process.

Sensor Trigger Function							
7	6	5	4	3	2	1	0
0	0	0	0	0	0	0	Reset Min/Max
15	14	13	12	11	10	9	8
0	0	Calibration Reset	Calibration Status	Calibration Mode	Capture High	Capture Low	Calibration Start

The Calibration mode is entered by writing a 1 to the Calibration Mode bit. While in the calibration mode the calibration registers may be accessed, the Capture High/Low may be used to capture real time values and the Calibration Start may be set.

When the Calibration Start bit is set the Calibration Status bit will remain set until the calibration process is complete.

Setting the Calibration Reset bit will clear the calculated Gain, Offset and Tare values.

5.2 Digital Input / Output Interface

The DIO Interface provides 2 digital inputs which are hardwired to the Digital outputs. These may be used to detect the state of external switches (output off) or to monitor the state of the outputs. The DIO Input descriptor is at base addresses 0x0068.

5.2.1 DIO Descriptor

Offset	Name	Value	Description
0x00	Sensor Type	0x18	Digital Type (Bit mapped)
0x01	Data Type/Format	0x46	Configurable, Float type
0x02	Configuration	0x23	Scaling applied, Bits 0 and 1 enabled
0x03	Sensor Device	0x0f	DIN bits enabled / inverted
0x04..0x08	UOMR	“DIN”	Units of measure

5.2.1.1 DIO Sensor Type

The interface provides a bit mapped input of the 2 digital signal lines.

Sensor Type	SI Derived Units	Measurement
0x18	DIN	Bit mapped digital inputs

5.2.1.2 DIO Data Type/Format

DIO Data Type							
7	**6**	**5**	**4**	**3**	**2**	**1**	**0**
Smart Sensor	Sensor Writable	Factory Calibrate	reserved	Data Type			
0	0	0	0	6 == Floating point			

Note: Please refer to the Smart Sensor Interface Technical Guide for more information regarding this descriptor.

5.2.1.3 Data Type

The 4-bit Data Type field determines the type of date of the specific sensor.

5.2.1.4 Factory Calibrate

The Factory Calibrate bit is not used for DIO types.

5.2.1.5 Sensor Writeable

If the Sensor Writeable bit is set the sensor value may be overwritten with a preset value. This capability is useful in sensors such as up/down counters, where a preset, or possibly a zero value must be written to the sensor value.

5.2.1.6 Smart Sensor

Refer to the *Smart Sensor Device Interface* documentation.

5.2.2 DIO Input Configuration

DIO Input Configuration							
7	**6**	**5**	**4**	**3**	**2**	**1**	**0**
Available	Assigned	Apply Scaling	Lock	Sub Channel Selection			
0	0	1	?	0x03 == bits 0 and 1			

5.2.2.1 Lock

If set, the user specified units of measure string (4-character maximum) will be used in place of the default **DIN.**

5.2.2.2 Apply Scaling

If set, the user defined Offset and Gain values will be used to adjust the sensor reading:
Result = (Raw Reading * Gain) + Offset

5.2.2.3 Assigned

The Assigned bit will always read as 0. Refer to the *Smart Sensor Device Interface* documentation for further information.

5.2.2.4 Available

The Available bit will always read as 0. Refer to the *Smart Sensor Device Interface* documentation for further information.

5.2.3 DIO Device Configuration

The DIO Device Configuration allows enabling each of the 2 input bits and selecting whether the input is active HIGH or active LOW. If the Invert Bit is set the signal will be Active Low.

DIO Device Configuration							
7	**6**	**5**	**4**	**3**	**2**	**1**	**0**
Reserved				DIN 1		DIN 0	
0	0	0	0	ENABLE	INVERT	ENABLE	INVERT
				1	1	1	1

5.2.4 DIO IPSO Definition

The DIO input IPSO definition provides signal range, measured min/max values, IPSO object type information. The SP-010 DIO IPSO definition is at base address 0x08a8.

Offset	Name	Value	Description
0x00	Sensor Type	3349	Bit Mapped Digital
0x02	Precision	0	Provides reading of xxx
0x04	Reset Min/Max	??	Write any value to force reset of min / max
0x08	Min Measured	??	Minimum reading since last reset
0x0c	Max Measured	??	Maximum reading since last reset
0x10	Min Range	0	Minimum reading
0x14	Max Range	3	Maximum reading

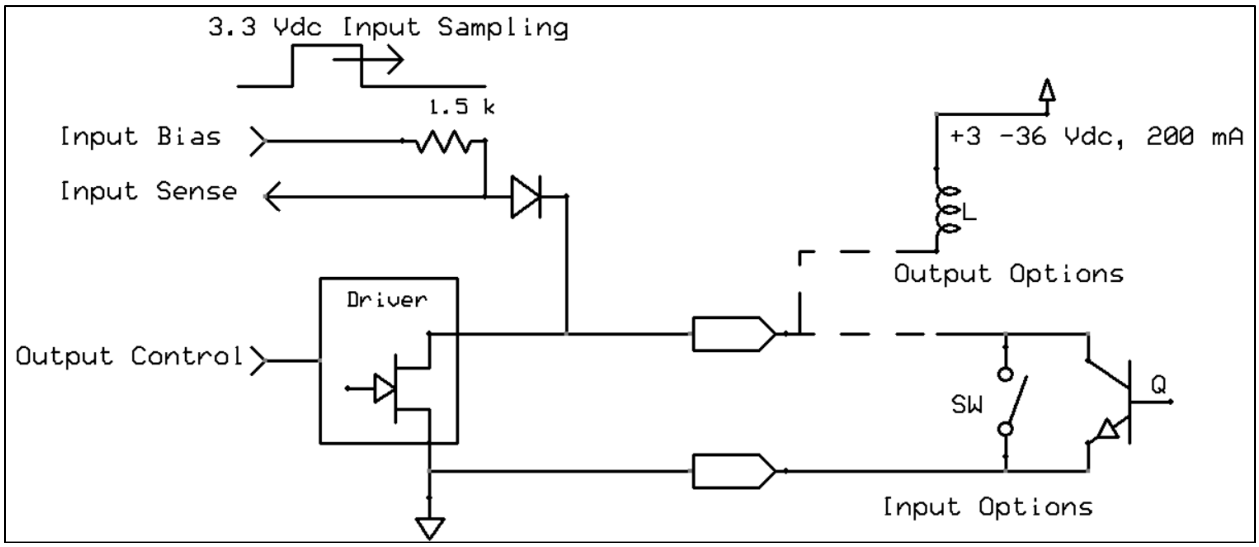
5.2.4.1 Sensor Trigger Function

The Sensor Trigger function is used to reset the IPSO min/max values.

Sensor Trigger Function							
7	6	5	4	3	2	1	0
0	0	0	0	0	0	0	Reset Min/Max
15	14	13	12	11	10	9	8
0	0	0	0	0	0	0	0

5.2.5 DIO Input Circuitry

The DIO input circuitry shares the output circuitry. The internal processor 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 3.0 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 provides protection of external positive voltages, allowing the Output driver to activate loads greater than the internal 3.3 V_{DC}.



5.3 Outputs

Two output signals are available which may be configured for ON/OFF or PWM outputs through the Output Configuration registers 0x0124 and 0x0126 (Modbus 0xf092 and 0xf093).

Note: The Output Drive Type (Open Drain, inverting driver) is fixed.

Outputs

7	6	5	4	3	2	1	0
Output Driver			**Active State**			**PWM Rate**	
0	Open Drain, Non inverting Driver		LOW 0			100 Hz 0 0	
1	Open Drain, Inverting Driver		HIGH 1			10 Hz 0 1	
						1 Hz 1 0	
3	**Open Drain, Inverting Driver**					0.1 Hz 1 1	

15	14	13	12	11	10	9	8
				Output Type			

Null	**0**	**0**	**0**	**0**
ON/OFF	**0**	**0**	**0**	**1**
PWM	**0**	**0**	**1**	**0**
Reserved	**x**	**1**	**x**	**x**
	1	**x**	**x**	**x**

5.3.1 PWM Rate

The SP-010 probe outputs support the following PWM frequencies:

PWM Rate	Name	Description
0	100 Hz	PWM signal has constant 100 Hertz frequency (10 msec repetition rate) with 0 – 100 % duty cycle
1	10 Hz	PWM signal has constant 10 Hertz frequency (100 msec repetition rate) with 0 – 100 % duty cycle
2	1 Hz	PWM signal has constant 1 Hertz frequency (1 second repetition rate) with 0 – 100 % duty cycle
3	0.1 Hz	PWM signal has constant 0.1 Hertz frequency (10 second repetition rate) with 0 – 100 % duty cycle

5.3.2 Active State

The SP-010 probe outputs may be configured as Active HIGH or Active LOW. When set to 1 (Active HIGH), the output will be high impedance when active. When set to 0 (Active LOW), the output will be low impedance when active. The Factory reset value is 0.

5.3.3 Output Drive

The Output Drive is permanently set to 3, indicating that the output is configured as an Open Drain driver, allowing the DIN signal to override and read back the state of the output signal.

5.3.4 Output Type

The SP-010 probe supports NULL (0), ON/OFF (1) or PWM (2) outputs. When set to NULL the output signal will be left in a high impedance state. When set to ON/OFF the Rate information has no affect.

6 Specifications

INPUT POWER

Voltage: 2.8 V_{DC} - 3.3 V_{DC}

DIO DIGITAL INPUTS

$V_{inHighThreshold}$ = 2.2 V_{MAX}

$V_{inLowThreshold}$ = 0.3 V_{MIN}

V_{inMAX} = 30 V_{DC}

DIO DIGITAL OUTPUTS

2x Open Drain 100 mA max

V_{MAX} = 30 V_{DC}

ACCURACY

Linearity Error: ±0.03% FSO @25°C

Thermal Error: ±0.005% FSO/C

ENVIRONMENTAL

Operating Temperature: -40 to 85°C (-40 to 185°F)

Rating: IP67 when mated

MECHANICAL

Dimensions: 22.1 mm W x 96.7 mm L (0.87” x 3.80”) not including mounting tabs

GENERAL

Agency Approvals: CE, EMC 2014/30/EU, LVD 2014/35/EU

Compatibility: Compatible with OEG, SYNC configuration software, Layer N Cloud, and Modbus Networks

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.

If the unit malfunctions, it must be returned to the factory for evaluation. OMEGA's Customer Service Department will issue an Authorized Return (AR) number immediately upon phone or written request. Upon examination by OMEGA, if the unit is found to be defective, it will be repaired or replaced at no charge. OMEGA's WARRANTY does not apply to defects resulting from any action of the purchaser, including but not limited to mishandling, improper interfacing, operation outside of design limits, improper repair, or unauthorized modification. This WARRANTY is VOID if the unit shows evidence of having been tampered with or shows evidence of having been damaged as a result of excessive corrosion; or current, heat, moisture or vibration; improper specification; misapplication; misuse or other operating conditions outside of OMEGA's control. Components in which wear is not warranted, include but are not limited to contact points, fuses, and triacs.

OMEGA is pleased to offer suggestions on the use of its various products. However, OMEGA neither assumes responsibility for any omissions or errors nor assumes liability for any damages that result from the use of its products in accordance with information provided by OMEGA, either verbal or written. OMEGA warrants only that the parts manufactured by the company will be as specified and free of defects. OMEGA MAKES NO OTHER WARRANTIES OR REPRESENTATIONS OF ANY KIND WHATSOEVER, EXPRESSED OR IMPLIED, EXCEPT THAT OF TITLE, AND ALL IMPLIED WARRANTIES INCLUDING ANY WARRANTY OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE ARE HEREBY DISCLAIMED. LIMITATION OF LIABILITY: The remedies of purchaser set forth herein are exclusive, and the total liability of OMEGA with respect to this order, whether based on contract, warranty, negligence, indemnification, strict liability or otherwise, shall not exceed the purchase price of the component upon which liability is based. In no event shall OMEGA be liable for consequential, incidental or special damages.

CONDITIONS: Equipment sold by OMEGA is not intended to be used, nor shall it be used: (1) as a "Basic Component" under 10 CFR 21 (NRC), used in or with any nuclear installation or activity; or (2) in medical applications or used on humans. Should any Product(s) be used in or with any nuclear installation or activity, medical application, used on humans, or misused in any way, OMEGA assumes no responsibility as set forth in our basic WARRANTY/DISCLAIMER language, and, additionally, purchaser will indemnify OMEGA and hold OMEGA harmless from any liability or damage whatsoever arising out of the use of the Product(s) in such a manner.

RETURN REQUESTS/INQUIRIES

Direct all warranty and repair requests/inquiries to the OMEGA Customer Service Department. BEFORE RETURNING ANY PRODUCT(S) TO OMEGA, PURCHASER MUST OBTAIN AN AUTHORIZED RETURN (AR) NUMBER FROM OMEGA'S CUSTOMER SERVICE DEPARTMENT (IN ORDER TO AVOID PROCESSING DELAYS). The assigned AR number should then be marked on the outside of the return package and on any correspondence.

The purchaser is responsible for shipping charges, freight, insurance and proper packaging to prevent breakage in transit.

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

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

FOR **NON-WARRANTY** REPAIRS, consult OMEGA for current repair charges. Have the following information available BEFORE contacting OMEGA:

1. Purchase Order number to cover the COST of the repair,
2. Model and serial number of the product, and
3. Repair instructions and/or specific problems relative to the product.

OMEGA's policy is to make running changes, not model changes, whenever an improvement is possible. This affords our customers the latest in technology and engineering.

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- Laboratory Heaters

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- Refractometers
- Pumps & Tubing
- Air, Soil & Water Monitors
- Industrial Water & Wastewater Treatment
- pH, Conductivity & Dissolved Oxygen Instruments

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