PSG BIOTECH

SumoFlo Single-Use Coriolis Flow Meter CPFM-8103 Series

User Manual

Copyright

Subject to Technical Changes

Owing to our policy of continuous product development, the illustrations and technical data contained in this document may differ slightly from the current version of the device.

Legal Manufacturer

Malema Engineering Corp. or Malema Sensors
1060 S Rogers Circle, Boca Raton FL 33487

Telephone: +1 408-970-3419 or 1-800-637-6418

Certifications/Compliances

CE Compliance via the following testing:
1. EN61000-4-2: Electrostatic Discharge
2. EN61000-4-3: Radiated Immunity (and Radiated Emissions)
3. EN61000-4-4: Electrical Fast Transients
4. EN61000-4-5: Surge - Power Line
5. EN61000-4-6: Conducted Immunity

Support Email Address

Please contact the Malema Customer Support Team at the email addresses below,

General Support:
Malema.GeneralSupport@psgdover.com

Customer Support:
Malema.CustomerSupport@psgdover.com

Order Support:
Malema.OrderSupport@psgdover.com

Quote Support:
Malema.QuoteSupport@psgdover.com

Technical Support:
Malema.TechnicalSupport@psgdover.com

Index

Index

1.00 Introduction

1.01 Safety Precautions

- Turn off and lockout / tag-out the electrical supply and any hazardous chemical sources to the tool during the installation.
- Flush the flow path (pumps, piping, tubing) with water prior to disconnecting any plumbing.

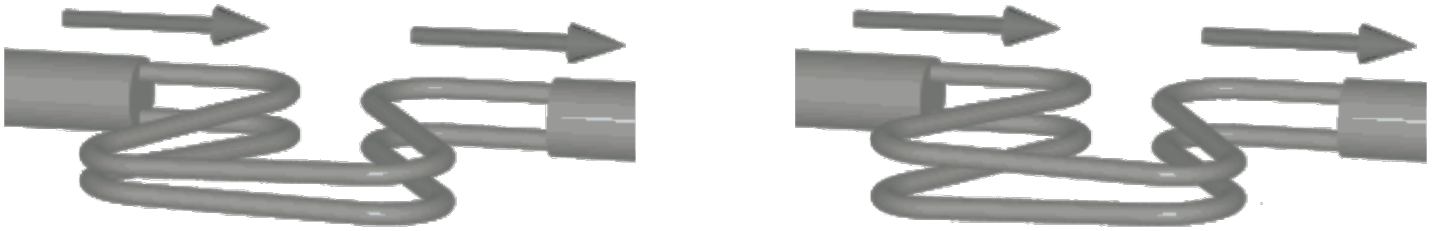
1.02 Overview

The SumoFlo CPFM-8103 series Single-Use Coriolis Flow Meter from PSG Biotech is specifically designed for measuring liquids in bio-pharmaceutical and other applications that require all gamma-stable wetted surfaces. The fluid contacting surfaces are made of unreinforced Polyether Ether Ketone (PEEK) that meets USP Class VI, USP 661, and USP 788 standards.

A SumoFlo Coriolis flow meter consists of three components: the Single-Use Coriolis flow sensor, the durable transmitter, and the durable mounting cradle. When properly installed in the mounting cradle, the SumoFlo flow meter meets CE specifications.

Fluid flows into the sensor consisting of two flow sensitive elements which are vibrated relative to one another - like the tines of a tuning fork. Fluid interacts with the sensor dynamically in such a way that the sensor's response is immune to the fluid's chemical and physical properties, flow regime, or variations in flow velocity profile. Fluid mass flow rate is determined by measuring the relative motion of the vibrating flow sensitive elements.

The Inlet and outlet of the tubes vibrate in phase when there is no flow present.



When flow is present, the inlet and outlet ends of the tube vibration are out of phase. The degree of phase shift is proportional to mass flow rate.

1.03 Storage Conditions

Store the product under packed conditions in an anti-static bag. The storage place should be free from moisture, mechanical shock and vibration. The storage temperature should be between 10°C and 35°C and the humidity between 5% and 80% R.H. without condensation.

If the sensor has been gamma irradiated, do not open the inner bag until ready to install in the Single-Use assembly.

1.04 Unpacking and Product Inspection

Upon delivery, inspect the product for damage. Confirm that the model code on the label matches the specification in the purchase order.

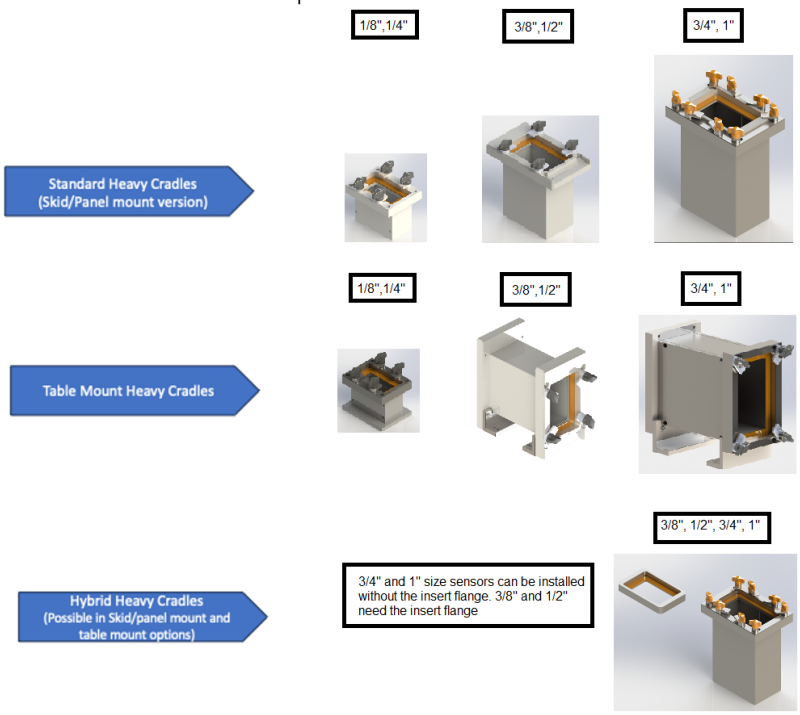
2.00 Installation

The following must be considered when selecting the installation location of the flow sensor:

1. Ambient Temperature: 0°C to 50°C (32°F to 122°F), protected from direct sunshine.
2. Free from electromagnetic interference. Keep away from such heavy inductive devices as motors, pumps, power-relays, and solenoid valves.
3. Free from vibrational interference. Keep away from sources of vibration such as motors, pumps, actuators, or vehicular traffic.
4. The location of the device must be protected from water jets or corrosive gases.
5. The location of the device should allow easy access for maintenance.

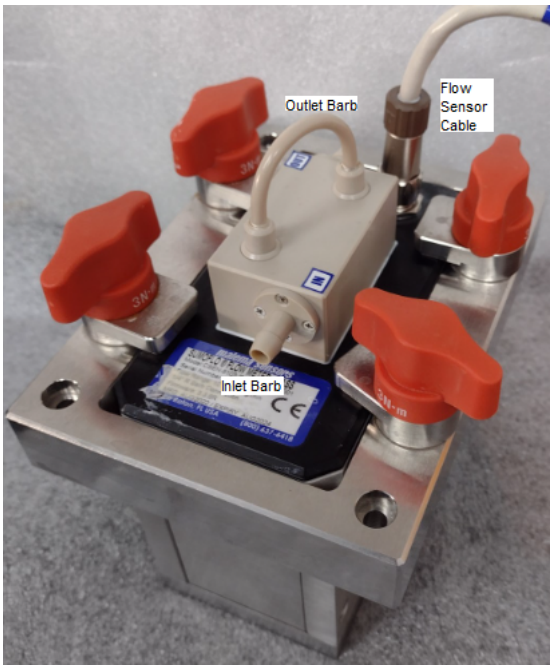
2.01 Mounting of Flow Sensor

1. Place the sensor inside the cradle. Use the clamps to secure the sensor.



2.02 Plumbing Connections

1. Attach tubing to the inlet and outlet barbs on the sensor. Make sure that the barb size on the sensor matches the tubing. Typical sizes are 1/4", 1/2" and 3/4".
2. Tighten all connections with either cables ties or hose clamps.



2.00 Installation

⚠ CAUTION

To avoid stress on the flow tube/housing interface, follow the precautions below:

- Tube should be held firmly while working on the hose barb fittings during installation.
- There should not be any relative displacement/movement between the tube and the housing at any point in time.
- Do not overtighten hose clamps, as this may cause damage.

2.03 Electrical Connections of CELE-8103-C with DIN Rail Mounting

Analog Output: Analog output for flow rate is 4-20 mA by default and on pins 12 and 11.

Remote Zero: To zero the meter remotely, momentarily connect, or short, pin 3 (ZERO) to pin 1 (24V+). Wait 10 seconds for this procedure to complete and for the LEDs to stop blinking before continuing operation. PLC digital outputs can be used to perform remote zeroing.

PC GUI: The Configuration Port is for GUI communication via CBL- CS2-006.

Chassis Ground: CE Compliance requires the transmitter chassis be connected to earth ground. The screw near the bottom of the transmitter is available for this purpose.

Maintenance

Single-Use Coriolis flow sensor requires no daily maintenance since it has no moving parts that can be subject to wear and tear. However, we recommend the following checks to ensure smooth and reliable operation.

Connection of Flow Detector

1. Check for leakage around pipe connections or liquid penetration into Flow Detector tube.
2. Check for any loose nuts.
3. Make sure that the connection ports are leak free.

Installation of Flow Detector

1. Check for mechanical stress to the Single-Use flow sensor caused by possible warping of connecting pipes or loose connections caused by heavy pipe vibration.
2. Check to ensure tube movement caused by pumps or other equipment are not transferred to the flow sensor.

CONNECTION DETAIL [1 ANALOG, 1 or 2 D/O]

CELE-8103-C-T1
CELE-8103-C-T2

PIN	WIRE COLOR	FUNCTION
1	RED	POWER +24V
2	BLACK	POWER GND
3	PINK	REMOTE ZERO
4	GRAY	DIO OUT 1
5	BLUE	DO NOT CONNECT
6	WHITE	DIO GND
7	RED/BLACK	DIO IN 1+
8	WHITE/BLACK	DIO OUT 2
9	YELLOW	DIO IN 1-
10	BROWN	ALARM OUT O/C
11	GREEN	CL-
12	VIOLET	CL+

MALEMA

LABEL-CMETER 022

CONNECTION DETAIL [1x ANALOG, 1x D/O, MODBUS]

CELE-8103-C-T3

PIN	WIRE COLOR	FUNCTION
1	RED	POWER +24V
2	BLACK	POWER GND
3	PINK	REMOTE ZERO
4	GRAY	DIO OUT 1
5	BLUE	DO NOT CONNECT
6	WHITE	DIO GND
7	RED/BLACK	RS485 A+
8	WHITE/BLACK	RS485 GND
9	YELLOW	RS485 B-
10	BROWN	ALARM OUT O/C
11	GREEN	CL-
12	VIOLET	CL+

MALEMA

LABEL-CMETER 021

CONNECTION DETAIL [4x ANALOG OPTION]

CELE-8103-C-T7

PIN	WIRE COLOR	FUNCTION
1	RED	POWER +24V
2	BLACK	POWER GND
3	PINK	REMOTE ZERO
4	GRAY	ALARM OUT O/C
5	BLUE	VOL FLOW 4-20 mA (-)
6	WHITE	VOL FLOW 4-20 mA (+)
7	RED/BLACK	DENSITY 4-20 mA (-)
8	WHITE/BLACK	DENSITY 4-20 mA (+)
9	YELLOW	TEMP 4-20 mA (-)
10	BROWN	TEMP 4-20 mA (+)
11	GREEN	MASS FLOW 4-20 mA (-)
12	VIOLET	MASS FLOW 4-20 mA (+)

MALEMA

GL1-CS1-003

CONNECTION DETAIL [2x ANALOG, 1x D/O, MODBUS]

CELE-8103-C-T8

PIN	WIRE COLOR	FUNCTION
1	RED	POWER +24V
2	BLACK	POWER GND
3	PINK	REMOTE ZERO
4	GRAY	ALARM OUT O/C
5	BLUE	ANALOG 1 4-20mA (-)
6	WHITE	ANALOG 1 4-20mA (+)
7	RED/BLACK	RS485 A+
8	WHITE/BLACK	RS485 GND
9	YELLOW	RS485 B-
10	BROWN	DIO 1 (REF PWR GND)
11	GREEN	ANALOG 0 4-20mA (-)
12	VIOLET	ANALOG 0 4-20mA (+)

MALEMA

GL1-CS3-003

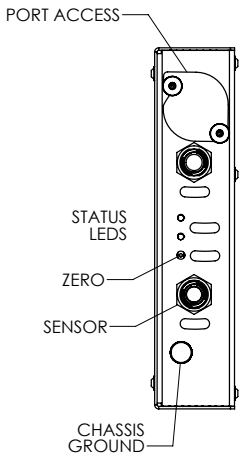
CONNECTION DETAIL [3x ANALOG, 1x DIGITAL]

CELE-8103-C-T9

PIN	WIRE COLOR	FUNCTION
1	RED	POWER +24V
2	BLACK	POWER GND
3	PINK	REMOTE ZERO
4	GRAY	ALARM OUT O/C
5	BLUE	ANALOG 1 4-20mA (-)
6	WHITE	ANALOG 1 4-20mA (+)
7	RED/BLACK	ANALOG 2 4-20mA (-)
8	WHITE/BLACK	ANALOG 2 4-20mA (+)
9	YELLOW	DO NOT CONNECT
10	BROWN	DIO 1 (REF PWR GND)
11	GREEN	ANALOG 0 4-20mA (-)
12	VIOLET	ANALOG 0 4-20mA (+)

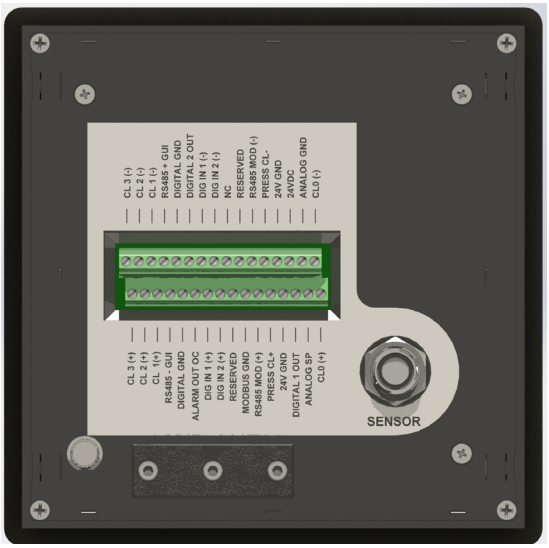
MALEMA

GL1-CS2-003

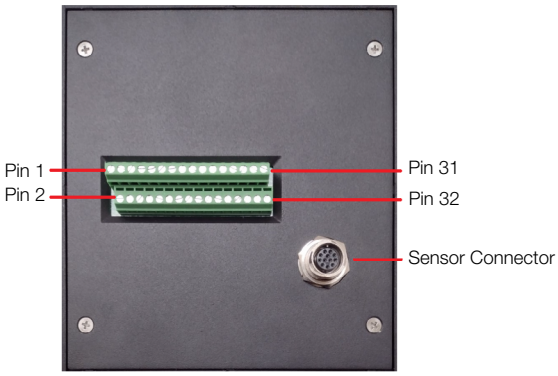


2.00 Installation

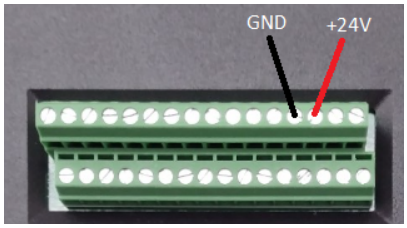
2.04 Electrical Connections of CELE-8103-D with Display



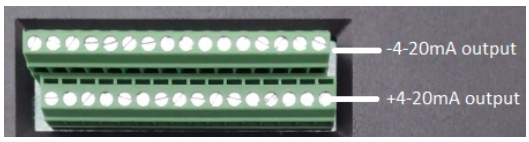
1. All electrical connections use the terminal block mounted in the rear of the transmitter.



2. Refer to Appendix I for pin-out and description.
3. Recommend using 24 AWG wire for all connections.
4. Connect power to the transmitter. (+24 V DC) to pin 27 and (Ground) to pin 25.



5. If monitoring the analog 4-20 mA output (CL0), connect +(4-20 mA) to pin 32, (4-20 mA) to pin 31 to a multimeter or analog input module.



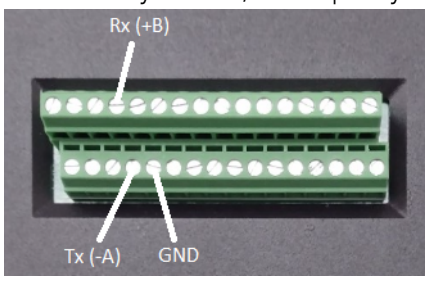
6. Connect the flow sensor cable, CABLE-CMETER 047. The female end on the cable goes to the sensor. The male end on the cable goes to the electronics. Follow the connector labels on both the sensor and electronics.
7. Connect the appropriate temperature sensor cable, if applicable. This cable must be connected for the Temperature Compensation algorithm to work properly. This **cable is reusable and is not single-use.**
8. An external converter is needed for communication with the PC GUI. If you do not have a preferred model, PSG Dover recommends ULinx model USOPTL4 that can be ordered.
   Configure dipswitch settings of USOPTL4 as shown.

2.00 Installation

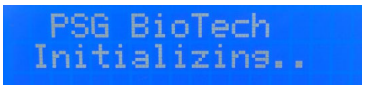
2.04 Electrical Connections of CELE-8103-D with Display (continued)

9. Connect the GUI communication cable to the connector on the rear panel to an RS-485/USB adapter, TDA(-) to pin 8, TDB(+) to pin 7, GND to pin 10.

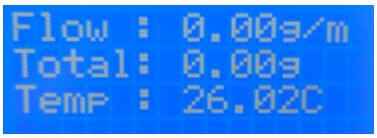
Note: Hardware internally configured for RS485 by default, must specify for RS232.



10. Turn power ON to the flow meter (i.e. the electronics) after priming to ensure the sensor is filled with liquid. The red and green status LEDs will blink during initialization. When initialization is complete, the green LED will remain ON while the red LED will turn OFF.



11. After the initialization the display should display Flow, Total, Temp, Density (if enabled).

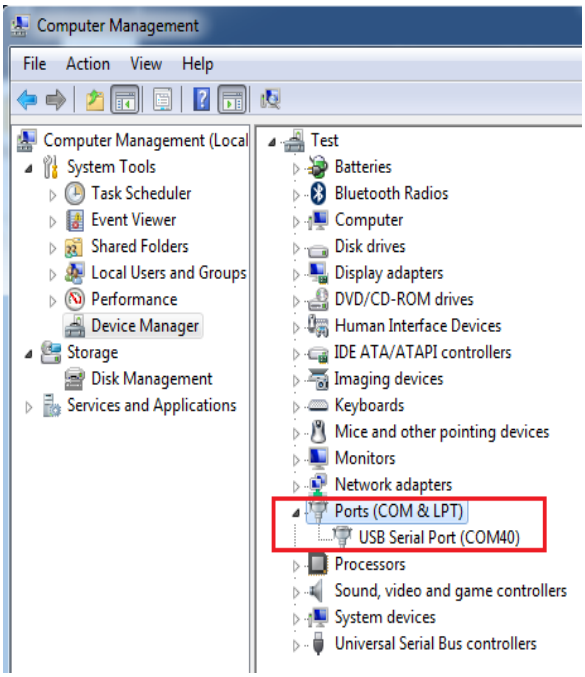


Note: Allow 30 minutes for the sensor and transmitter to warm-up.

2.05 PC Software/GUI Communication

If using the Malema, a PSG brand, Coriolis GUI to monitor or log flow meter performance, follow the following steps:

1. Make sure the converter is installed on the PC by checking its COM port in Device Manager. If there is a yellow exclamation mark on the device in Device Manager, install the proper driver from the device manufacturer. The driver package for ULinx USOPTL4 driver is available for download from the web.

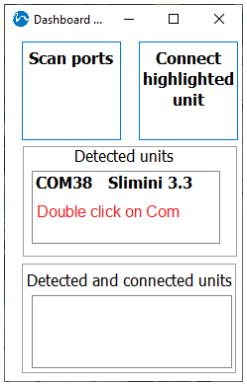


2.00 Installation

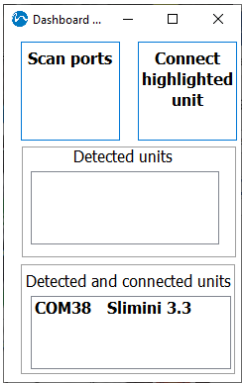
2.05 PC Software/GUI Communication (Continued)

2. Copy the PSG Dover Malema software GUI (an .exe executable file) to a folder on the local drive. The software GUI is available for download.
3. Double-click the .exe to open the GUI. A COM port should appear in the upper-right box.
4. Double-click the COM port to connect to the flow meter. If the connection is successful, the Main GUI window will appear.

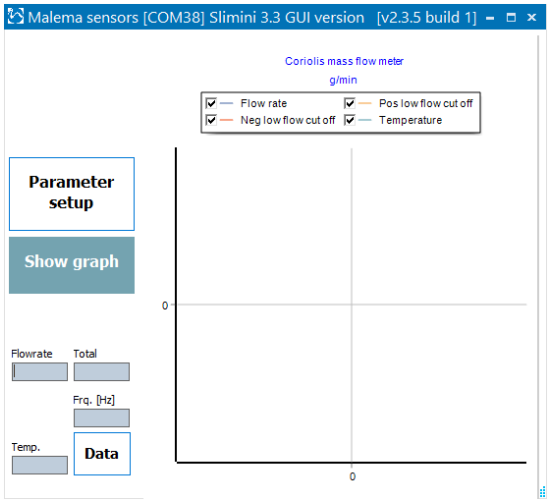
Not connected



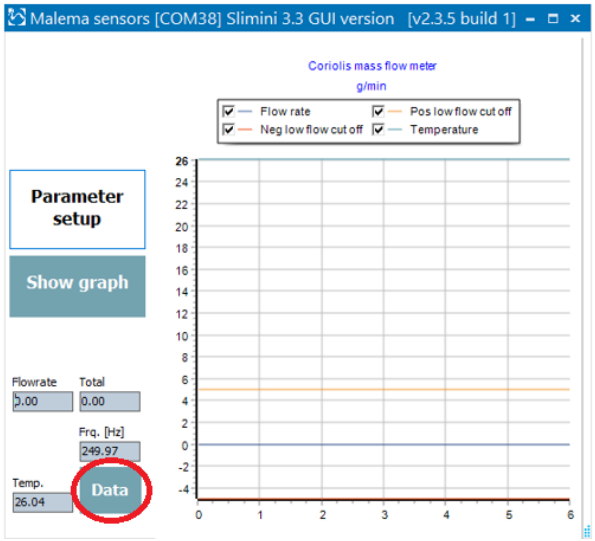
Connected



5. Main GUI window.



6. Click the "Data" button to start monitoring the flow rate.

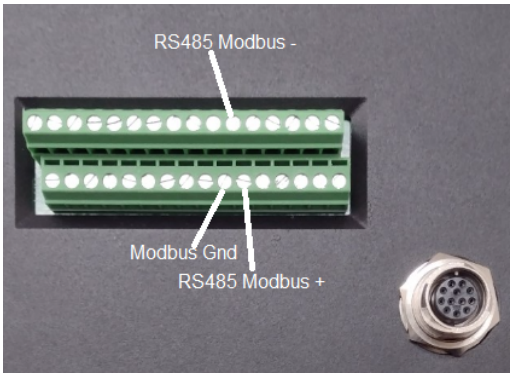


2.00 Installation

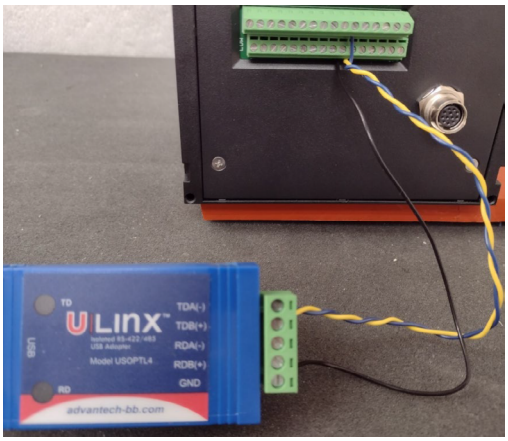
2.05 PC Software/GUI Communication (Continued)

7. RS-485 / MODBUS COMMUNICATION

   - An external converter is needed for communication for Modbus – USOPTL4.
   - Connect pin 22 of the User I/O cable to the TDB+ terminal of your RS-485 module.
   - Connect pin 21 of the User I/O cable to the TDA- terminal of your RS-485 module.
   - Connect pin 20 of the User I/O cable to the GND terminal of your RS-485 module.
   - Recommend the 2 terminal wires (B+, A-) are twisted pair.



8. Modbus feature must be activated in the Factory GUI for Modbus operation.
9. For Modbus operation, refer to Malema Modbus Description 1.0F for Modbus protocol.



2.06 Start Up

The SumoFlo Series Coriolis flow meter system requires a full tube of liquid medium at rest before a successful startup can be completed.

Preliminary Checks

1. Make all the necessary electrical connections as per the connection details above.
2. Ensure that the power supply rating is 24 V DC ± 10%, 300 mA.
3. Confirm that the inlet and outlet ports are connected to the tubing reflecting the physical flow direction.

Start Up Process

1. Turn on the power. The instrument will go through the initialization process and start measuring flow.

Note: It is not necessary to power cycle the transmitter after changing a Single-Use sensor.

2. Please allow the instrument to warm up for about 45 minutes only on initial startup or when starting cold.
3. Verify that the flow tube is full of stationary liquid without bubbles in the flow sensor.
4. Perform a Zero Reset if necessary (Refer to Section Zero Set).
5. The flow meter is now ready for making valid measurements.

2.00 Installation

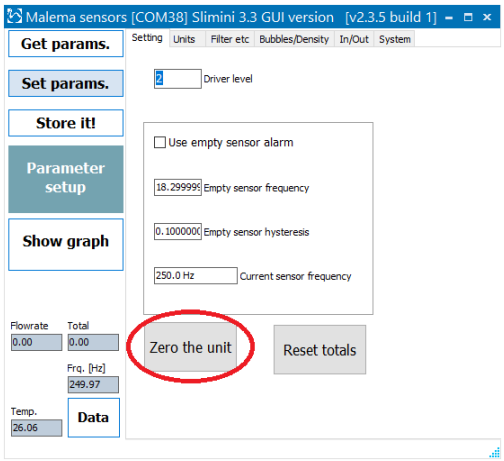
2.07 Zero Reset

1. Purge all air in the sensor and the hoses by running the pump at a high flow rate (ex. 50% of flow range).
2. Turn off the pump and close all valves, if possible, to ensure no actual flow.

Note: Whenever the measured flow rate is below a "low-flow threshold" (typically 2% of flow range) the Coriolis Meter will perform zero-flow calibrations automatically, if Autozero is enabled. Autozero is enabled by default.

Note: Fluid flowing through the sensor (or air pockets in the sensor) while performing a zero flow calibration will result in an inaccurate zero setting and therefore, inaccurate flow rate readings. Make sure there is no fluid flow in the sensor during zeroing.
If the application does not permit closing an upstream or downstream valve to obtain an accurate zero flow calibration, there may be a possibility that fluid may flow even though its value is below the factory preset low flow cutoff. In such situations, an incorrect zero-flow value can result, and it may be desirable to disable the "Autozero" feature. Zero flow calibration updates may be required in the field if an application's fluid varies significantly with temperature.

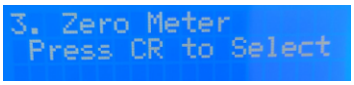
3. Perform a zero calibration by pressing the "zero cal" button on the electronics or clicking the "Re-zero the unit" button on the left side of the GUI (shown below). Zero calibration may also be performed remotely by momentarily touching the pink wire (pin 3) to +24 V (pin 1).



Zero the meter from GUI

Zero the meter from transmitter front panel button

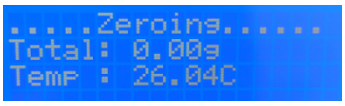
- Press the up/down button until "Zero Meter" is displayed, press CR ↵



- Press the ACK button.

- Enter password

- Click the left button 2 times.
- Click the ACK button.
- Click the right button 2 times.
- Displays show zeroing.



Zero meter using digital input terminal.

- Set digital input 2 to "Force auto zero on 1 to 0 transition".
- Connect ground to pin 15 Digital input 2 (-).
- Momentarily connect +24Vdc to pin 16 Digital input 2 (+)

Zero the meter through Modbus.

- Refer to Malema Modbus Description 1.0F for Modbus protocol.

4. This zero-calibration procedure will take 10 seconds to complete. During calibration, the red status LED on the electronics will be blinking. The red LED will turn off when calibration is complete.

2.00 Installation

2.08 Hot Swappable Sensors

Changing flow sensors by turning power OFF to the transmitter or disconnecting the sensor cable with power ON, either is acceptable. The new flow sensor shall initialize the transmitter when the sensor is connected or when power is turned ON to the transmitter. This is to ensure all settings are loaded into the transmitter when the new sensor is installed.

Display shows when the sensor is disconnected.

2.09 Appendices

APPENDIX I CELE-8103-D Transmitter Connector Pin Out

Pin #	Signal Name	Pin #	Signal Name
1	CL3-	**2**	CL3+
3	CL2-	**4**	CL2+
5	CL1-	**6**	CL1+
7	RS485 + GUI	**8**	RS485 - GUI
9	DIO GND	**10**	DIO GND
11	DIO Out 2 OC	**12**	Alarm Out OC
13	DIO In 1 (-)	**14**	DIO In 1 (+)
15	DIO In 2 (-)	**16**	DIO In 2 (+)
17	N/C	**18**	Reserved
19	Reserved	**20**	Modbus Gnd
21	RS485 - Mod	**22**	RS485 + Mod
23	Press CL-	**24**	Press CL+
25	24 V Gnd	**26**	24 V Gnd
27	24 V DC	**28**	DIO Out 1 OC
29	Analog GND	**30**	Analog SP
31	CL0-	**32**	CL0+

Analog Outputs

The analog output signal can be set for Mass, Volumetric, Density, Temperature, or Pressure (controller series only)

Analog output CL0 is normally set for 4-20 mA , Mass flowrate by default and on pins 31 and 32.

All 4 analog outputs (CL0, CL1, CL2, and CL3) are configurable for 4-20 mA, 0-5V, 0-10V, 1-5V. Analog output CL0 is the only output which supports passive output.

Additional analog output CL1, CL2, and CL3 are optional. Please consult Malema PSG Dover Sales Rep for details.

2.00 Installation

2.09 Appendices (Continued)

APPENDIX 2 LED Status Lookup Table - Display Version Only

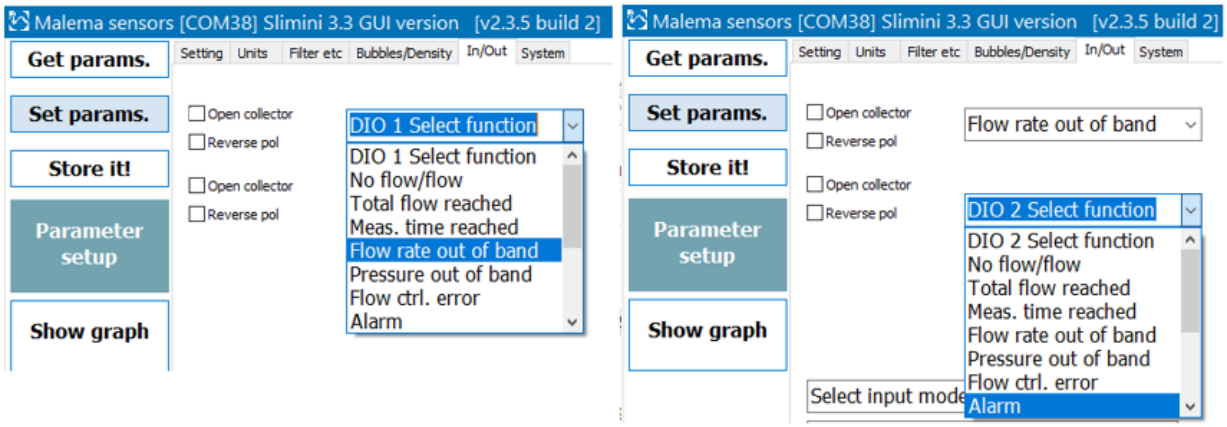
Meaning	Red	Green	Blue
Power up: Initialization	Blink	Blink	OFF
Normal operation	OFF	ON	OFF
Forced auto zeroing	OFF	OFF	Blink
Sensor disconnected	ON	OFF	OFF
Cable error or other	Blink	OFF	OFF

APPENDIX 3 Setup Digital Inputs/Outputs

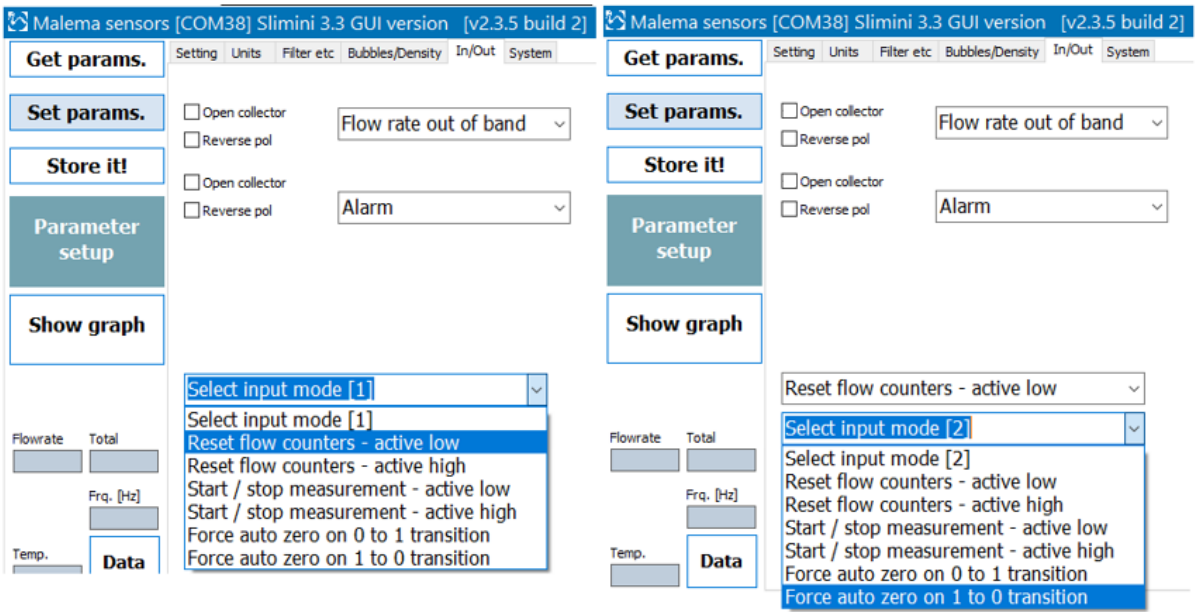
Digital outputs 1 and 2 are set as open collectors, not configurable. Signals are referenced to 24V Gnd. Internal GUI settings must be set as shown below for DIO 1 and DIO 2 for active drive output.

Click "Set params." to activate any changes then click "Store it! " to save to non-volatile memory".

Selecting Digital Outputs 1 and 2



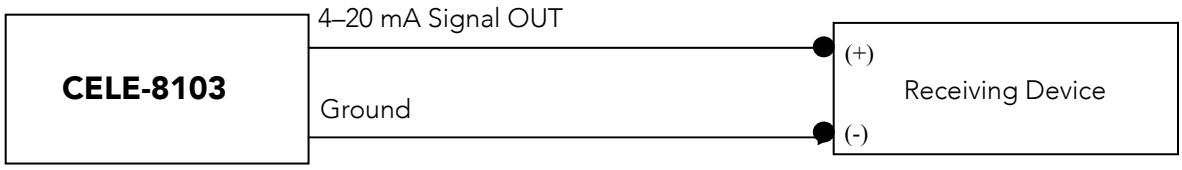
Selecting Digital Inputs 1 and 2



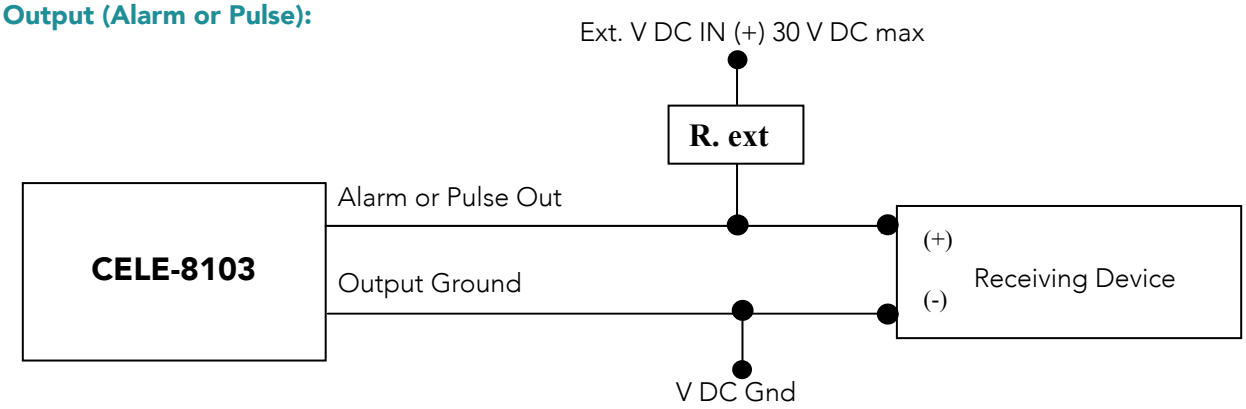
2.00 Installation

2.10 Electrical Wiring

Analog 4-20 mA Active Current Output:

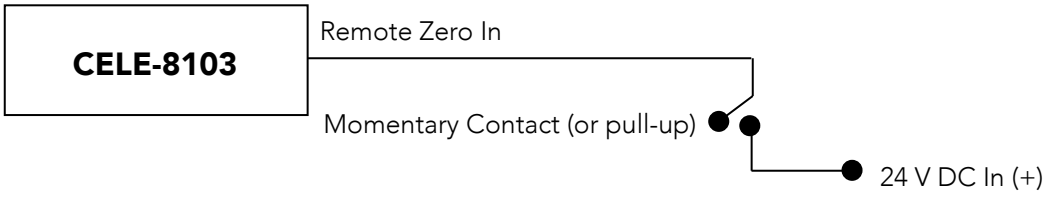


Digital Output (Alarm or Pulse):



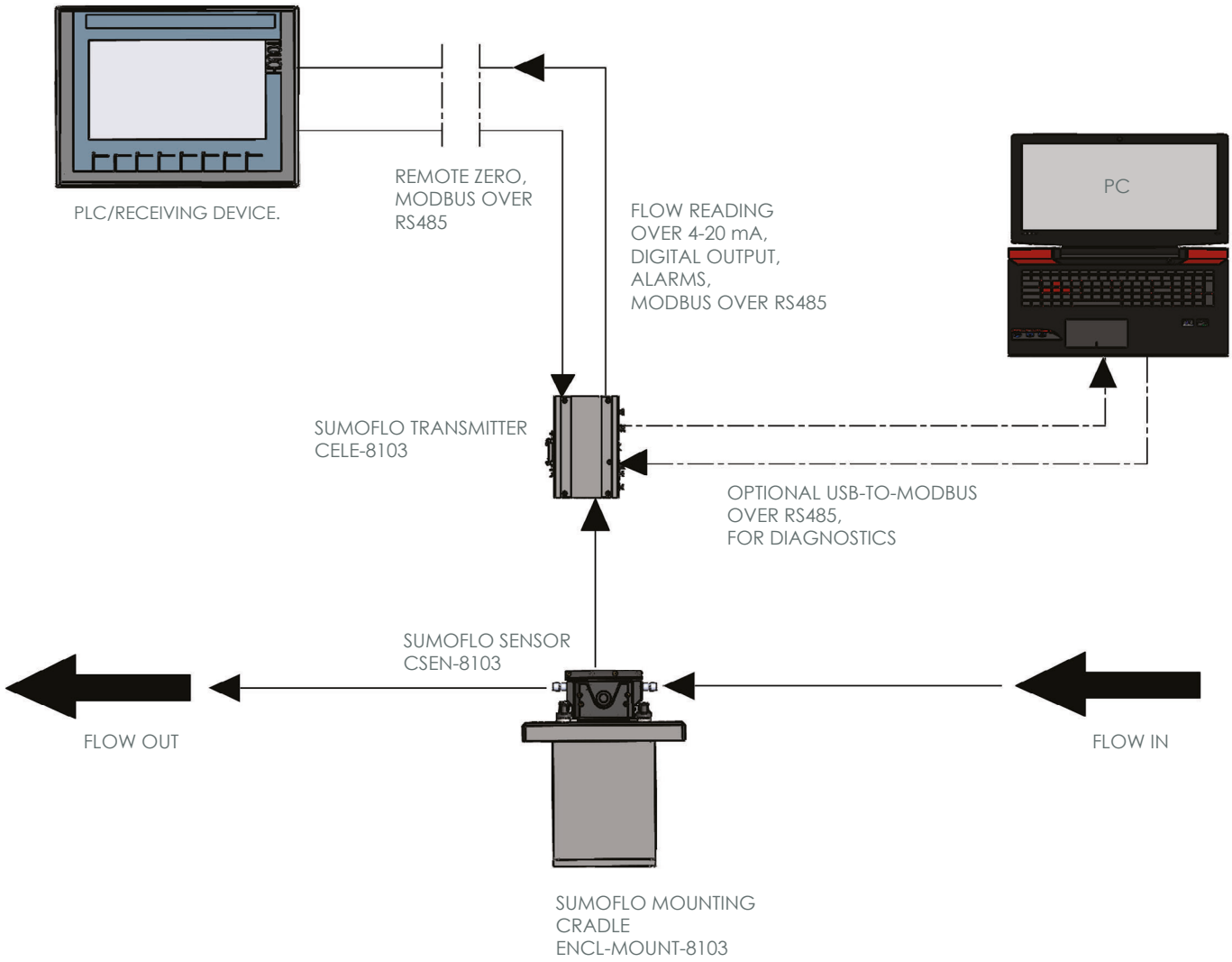
R. Ext is an external resistor that may be needed for some installations.
Choose R. ext so that the maximum current through the terminal does not exceed 200 mA.
R. Ext can be calculated as follows:
R. Ext (kΩ) = Ext. V DC In / Max. Current (mA)

Remote Zero In:



2.00 Installation

2.11 Block Diagram



A SumoFlo CPFM-8103-Series Coriolis flow meter consists of three components: the Single-Use Coriolis flow sensor, the durable transmitter, and the durable mounting cradle, as well as the durable cables to connect the transmitter to the sensor and the transmitter to the system control device. When properly installed in the mounting cradle, the SumoFlo flow meter meets CE specifications.

Optional durable components include RS485-to-USB connector, and a Windows 11 Pro Laptop Computer running the PSG Biotech Coriolis GUI. Stand-alone remote displays are also available. Contact PSG Malema for additional information if needed.

Sensor Type	Description	Electrical Connections	Fluid Connections
C	Cradle-Mount Sensor	Top (same side as fluid connections)	6° from vertical
P	Panel-Mount Sensor	Bottom (opposite side as fluid connections)	6° from vertical
R	Standard Inline Sensor	Either top or bottom	Inline (90° from vertical)
T	Tall Inline Sensor	Bottom	Inline (90° from vertical)

3.00 Specification

3.01 Transmitter Type

Transmitter	Description	Electrical Connections	Power Supply	Display
CELE-8103-C	DIN Rail Mounting (Non Display Only; CE)	Standard 12-pin I/O cable	24 V DC	No
CELE-8103-D	1/2 DIN Cutout Panel Mount with 4-line Display	32-pin terminal block	24 V DC	Yes
CELE-8103-B	1/2 DIN Cutout Panel Mount with 4-line Display Mounted in NEMA 4X Stainless Steel Enclosure	Standard 12-pin I/O cable	100 - 220 V AC	Yes
CELE-8103-I	1/2 DIN Cutout with 4-line Display mounted in NEMA 4X Stainless Steel Enclosure with Integral Sensor Cradle ENCL-MOUNT-8103-03	Standard 12-pin I/O cable	100 - 220 V AC	Yes

3.02 Measurement Specification

Model CSEN-8103-*	031	032	062	063	082	151	152	153
Mass Flow Accuracy	±1% of rate for 10% to 100% of full scale rated flow rate ±(1% of rate + Z.O.S) for < 10% of full scale rated flow rate							
Density Accuracy	±1%							
Temperature	Ambient: 0°–50°C Fluid: 4°–40°C For applications involving temperatures below 10°C, consult factory for special calibration.							
Operating Pressure	45 psig (3.10 Bar G) max.	60 psig (4.14 Bar G) max.	80 psig (5.51 Bar G) max.					
Flow Range *	0.05 – 1.5 kg/min	0.02 – 3 kg/min	0.5 – 5 kg/min	0.9 – 9 kg/min	2 – 20 kg/min	4 - 40 kg/min	6 – 60 kg/min	0 – 100 kg/min
Zero Offset Stability (Z.O.S.)	0.0023 kg/min		0.00375 kg/min	0.007 kg/min	0.015 kg/min	0.03 kg/min	0.045 kg/min	

* Lower minimum flow rates available with special calibration fee.
Note: All specifications for liquids are based on reference conditions of water at 68 to 77 °F (20 to 25 °C) and 15 to 30 psig (1 to 2 bar), unless otherwise noted.

3.03 Material Specification

Model CSEN-8103-*	031	032	062	063	082	151	152	153
Process Connections *	1/8" barb	1/8" barb 1/4" barb	1/4" barb	3/8" barb 3/8" Mini TC	1/2" barb 1/2" Mini TC	3/4" barb 3/4" Mini TC	3/4" barb 3/4" Mini TC	1" barb 1"-1.5" TC
Wetted Materials	Unreinforced PEEK (Polyether Ether Ketone), 316L Stainless Steel (for temperature sensor only), Silicone. All polymeric wetted materials are USP Class VI compliant.							
Interconnecting Cable Length	Standard 3m; Maximum up to 3m							
Ingress Rating For Connectors	IP65							
Shelf life	If the SumoFlo Sensor is gamma irradiated, it can be stored under the same conditions for up to 2 years following the date of gamma irradiation or up to 2 years following the date of gamma irradiation or up to 3 years from the date of manufacture, whichever is shorter.							

* Please consult the factory for other types of process connection options.

3.00 Specification

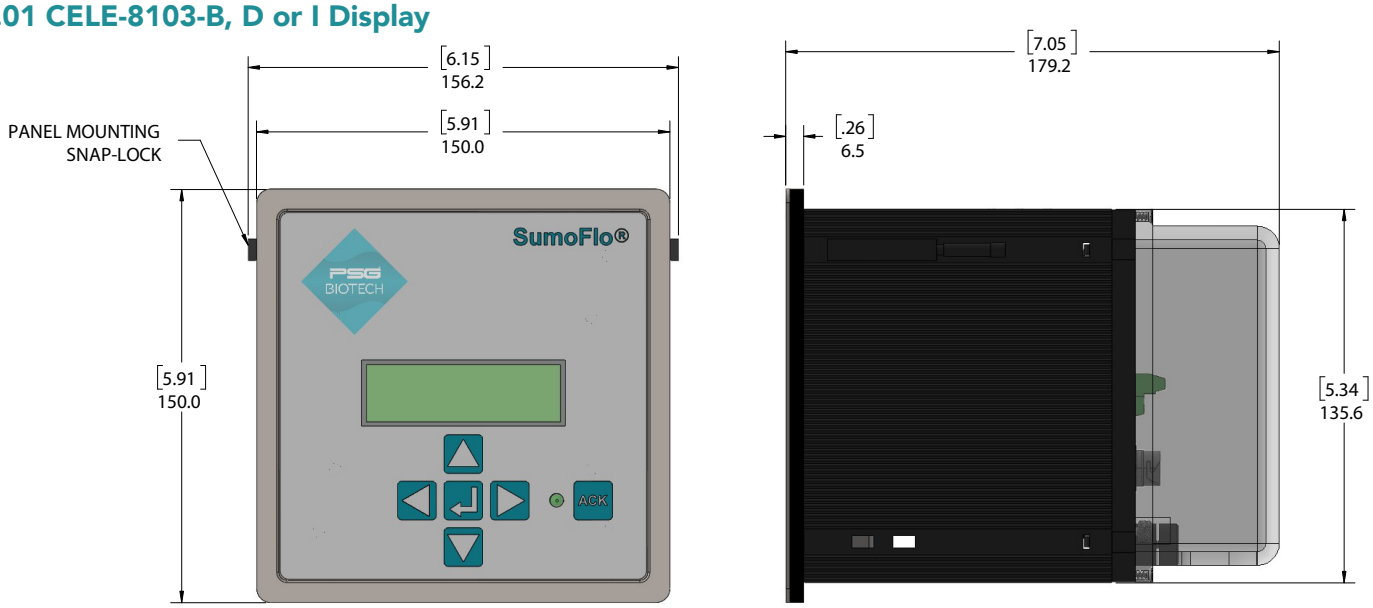
3.04 Electrical Specification

CELE-8103-C and D	
Supply Voltage	24V DC ± 10%
Power Consumption	CELE-8103-C: Max 6W. CELE-8103-D: Max 7.5 W
Programming	Operator Parameter configuration through configuration port with a PC
Analog Output Module	1x 4–20 mA, 2x 4–20 mA, 3x 4–20 mA, or 4x 4–20 mA; configurable as Mass Flow Rate, Temperature
Digital Input/Output Module	0x D/O, 1x D/O, or 2x D/O; Configurable as Frequency or Digital I/O
Frequency Output	0 to 10 kHz proportional to flow rate
Digital Output over MODBUS *	Mass Flow Rate, Volumetric Flow Rate**, Density**, Temperature***, Rezeroing, Totalizer Reset; via MODBUS RTU/ASCII over RS485
* Requires CELE-8103 model configured for MODBUS communications.	
** Requires CELE-8103 and CSEN-8103 models configured for density measurement.	
*** Requires CELE-8103 and CSEN-8103 models configured for temperature compensation.	

CELE-8103-B and I	
Supply Voltage	100 - 240 V AC, 50/60 Hz
Power Consumption	Max 15 W
Programming	Graphical User Interface on Windows 11 PC through USB port for operation programming and reporting
Analog Output Module	1x 4–20 mA or 2x 4–20 mA
Digital Input/Output Module	1x D/O or 2x D/O; Configurable as Frequency or Digital I/O; 1 D/I for sensor zeroing
Frequency Output	0 to 10 kHz proportional to flow rate
Digital Output over MODBUS *	Mass Flow Rate, Volumetric Flow Rate*, Density*, Temperature**, Rezeroing, Totalizer Reset; via MODBUS RTU/ASCII over RS485
* Requires CELE-8103 and CSEN-8103 models configured for density measurement.	
** Requires CELE-8103 and CSEN-8103 models configured for temperature compensation.	

4.00 Dimension Drawing

4.01 CELE-8103-B, D or I Display

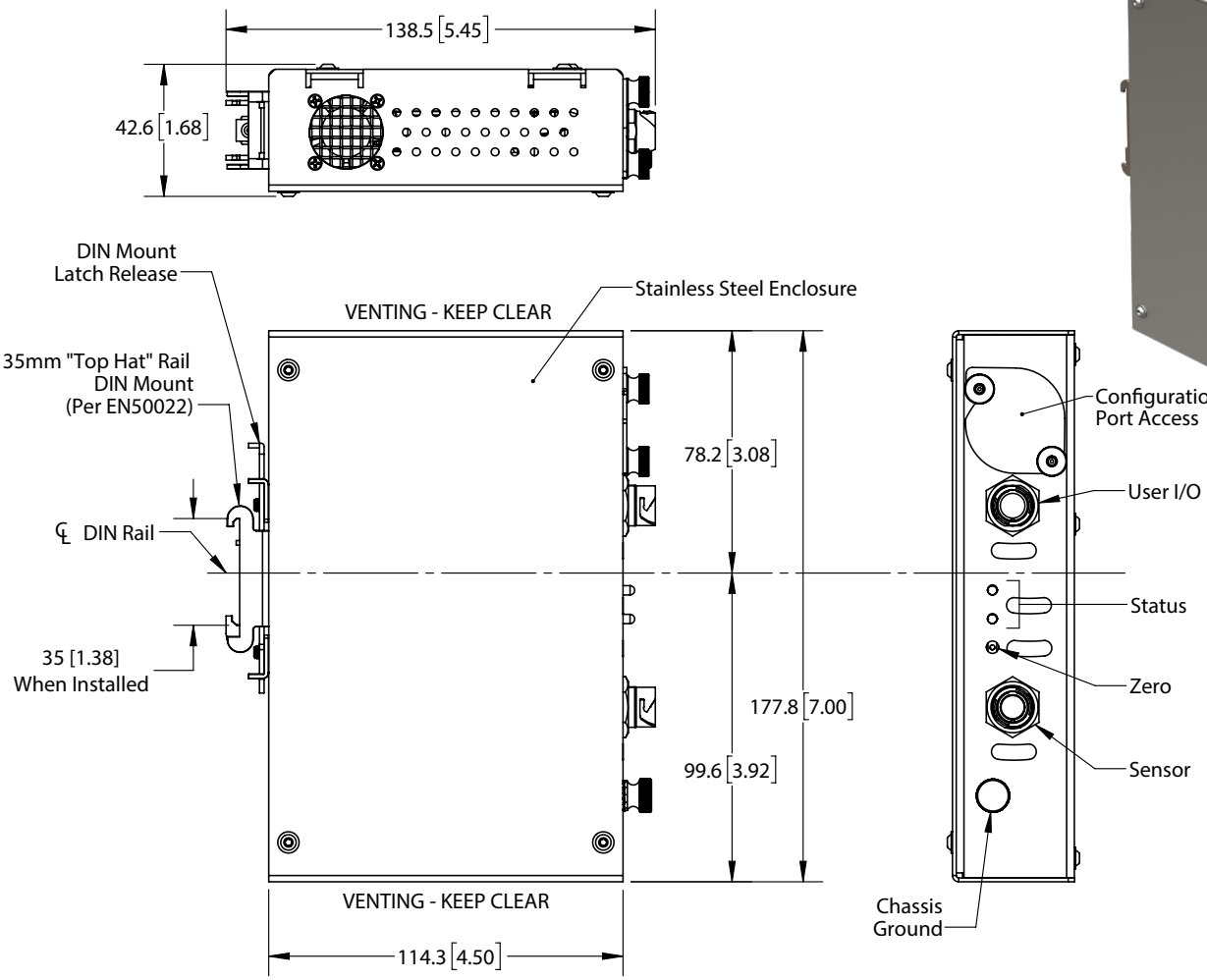


DIMS ARE IN: MM [IN]

4.02 Transmitter Dimension

For Reference Only

CELE-8103-C Transmitter



4.00 Dimension Drawing

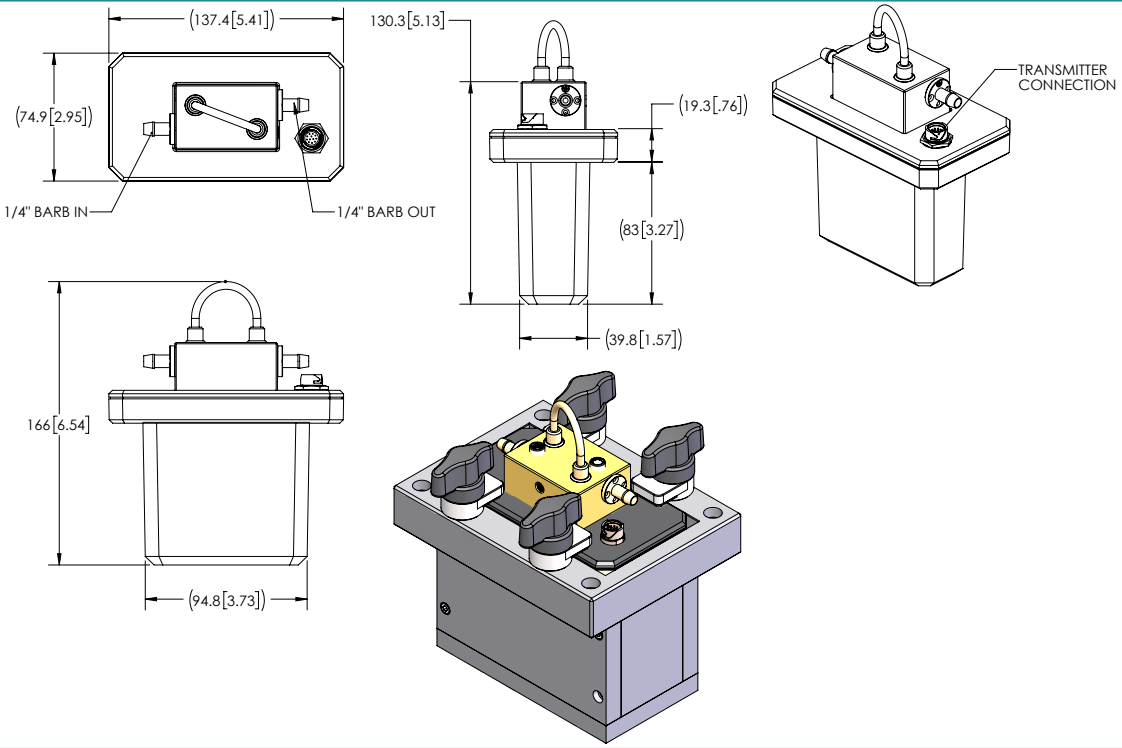
4.03 Single-Use Sensor Dimensions

For Reference Only

Note: Mounting Cradle is required for CE compliance.

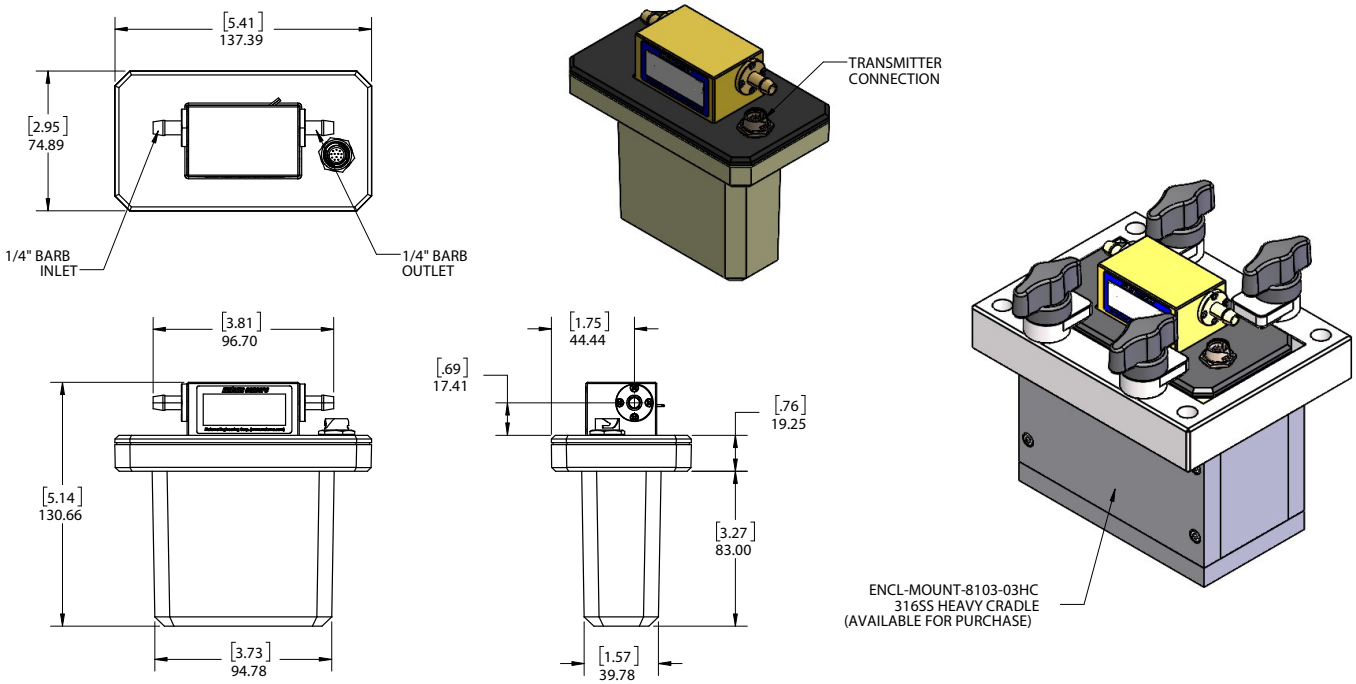
CSEN-8103-RA031 Sensor

1/4" Barb Connections, Standard Inline Configuration



CSEN-8103-RA032 Sensor

1/4" Barb Connections, Standard Vertical Inlet Configuration



4.00 Dimension Drawing

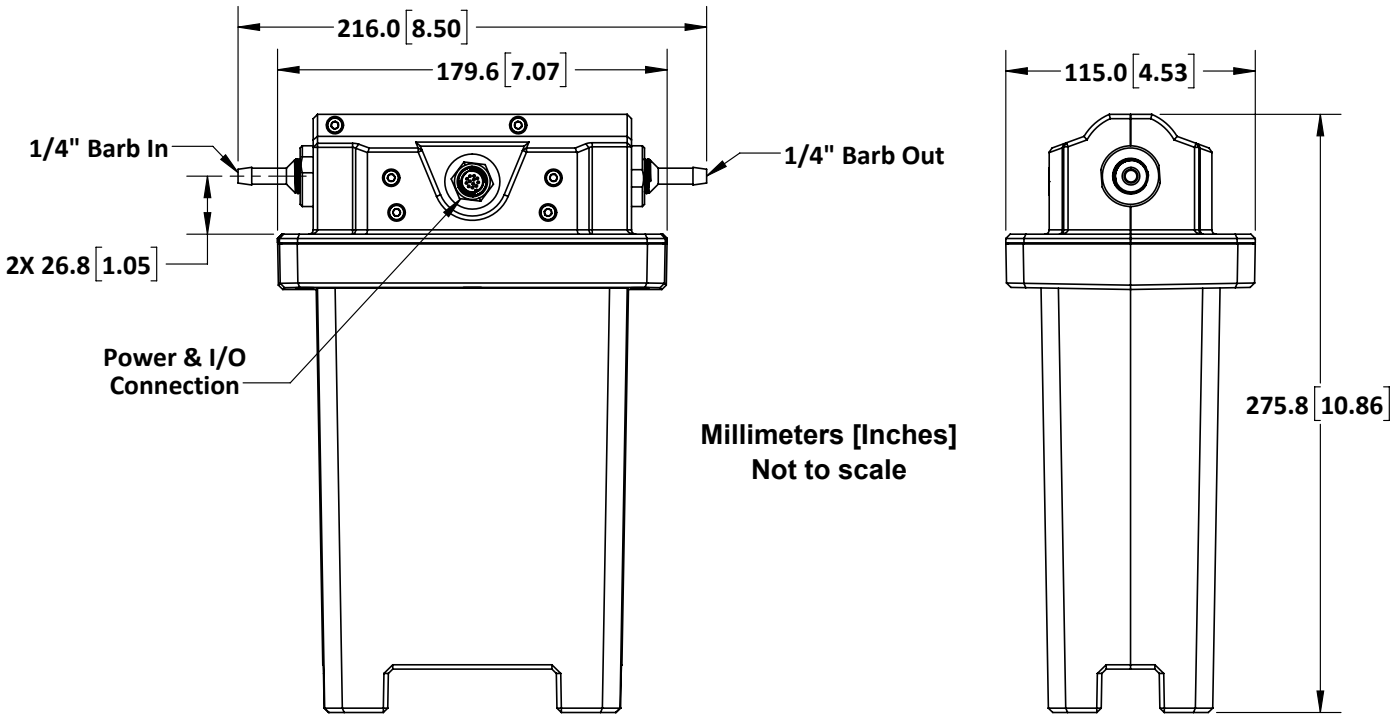
4.03 Single-Use Sensor Dimensions (Continued)

For Reference Only

Note: Mounting Cradle is required for CE compliance.

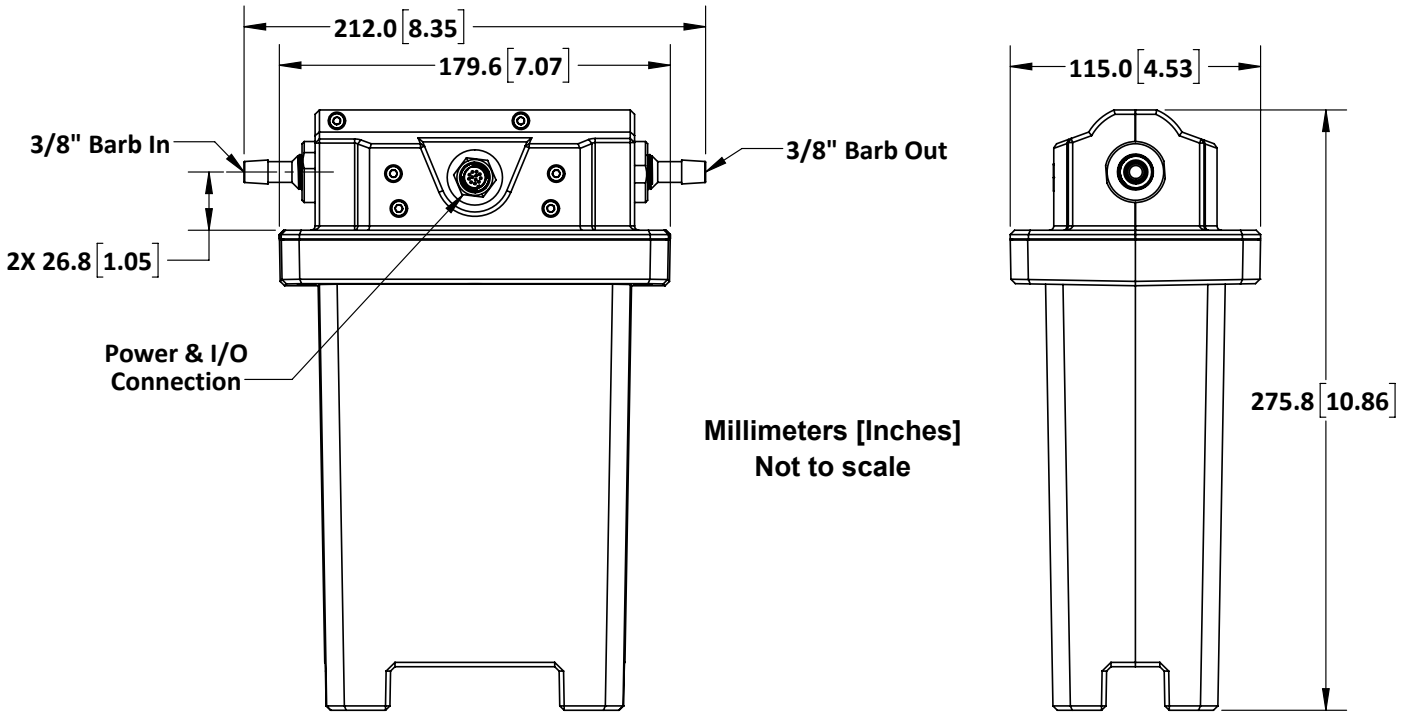
CSEN-8103-R-062 Sensor

1/4" Barb Connections, Inline Configuration



CSEN-8103-R-063 Sensor

3/8" Barb Connections, Inline Configuration



4.00 Dimension Drawing

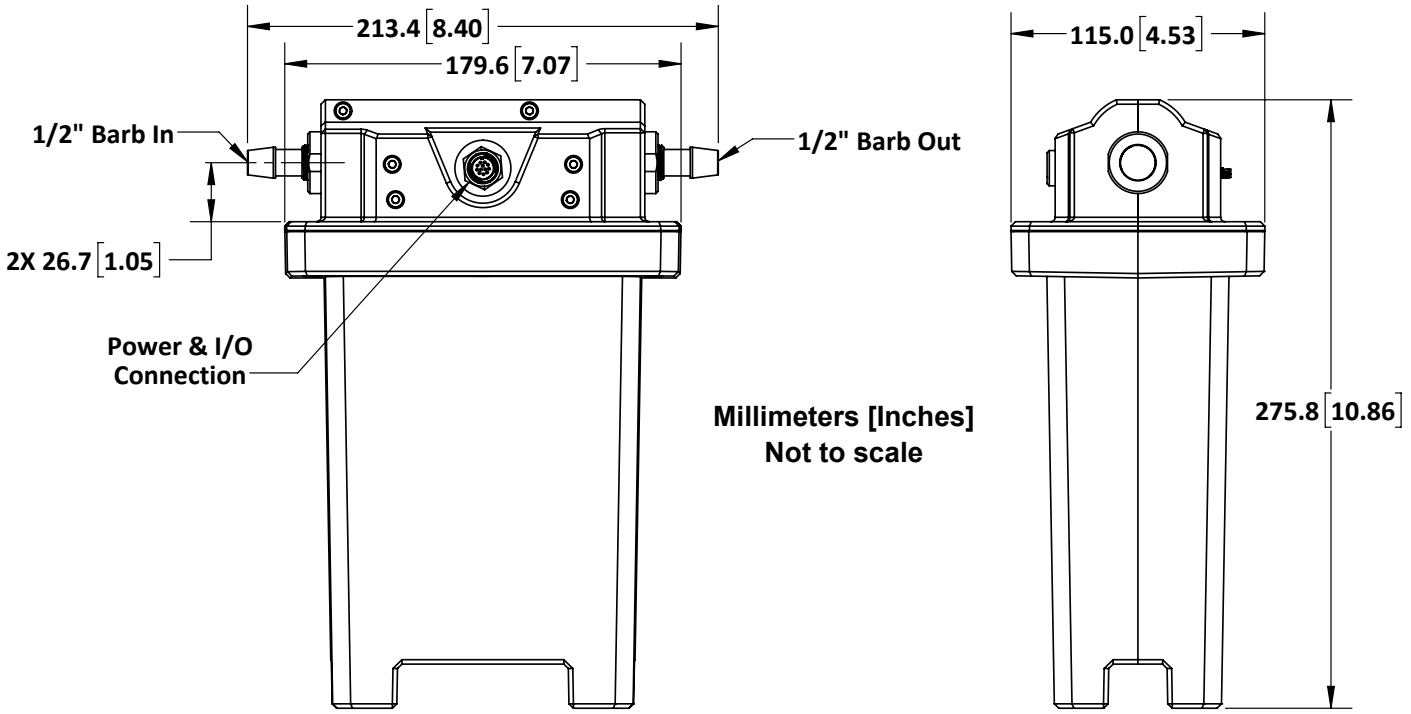
4.03 Single-Use Sensor Dimensions (Continued)

For Reference Only

Note: Mounting Cradle is required for CE compliance.

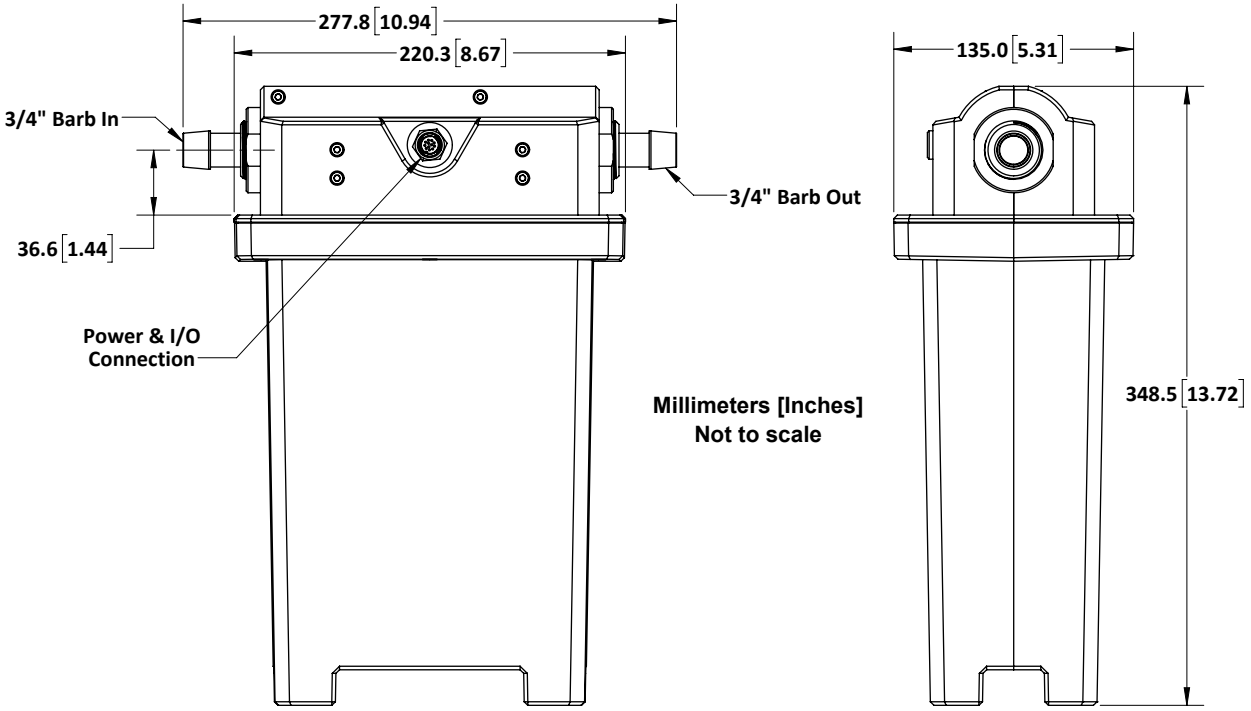
CSEN-8103-R-082 Sensor

1/2" Barb Connections, Inline Configuration



CSEN-8103-R-152 Sensor

3/4" Barb Connections, Inline Configuration



4.00 Dimension Drawing

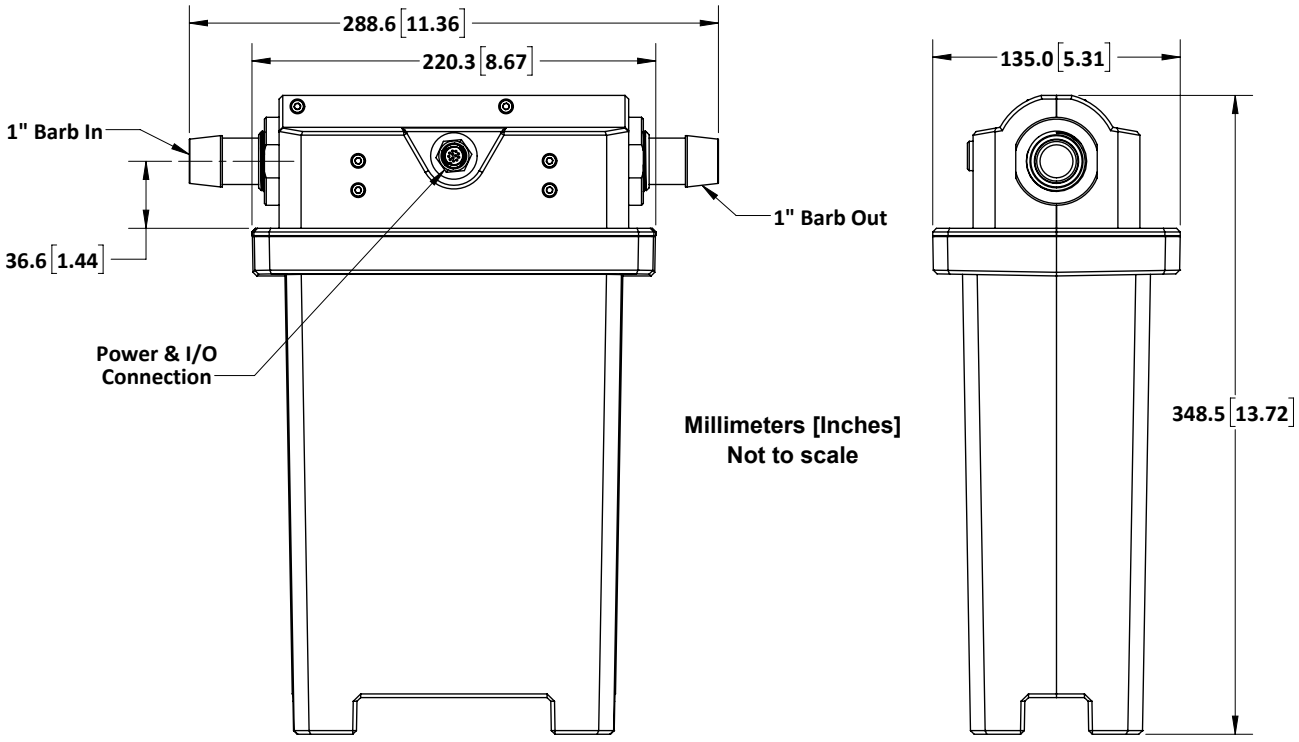
4.03 Single-Use Sensor Dimensions (Continued)

For Reference Only

Note: Mounting Cradle is required for CE compliance.

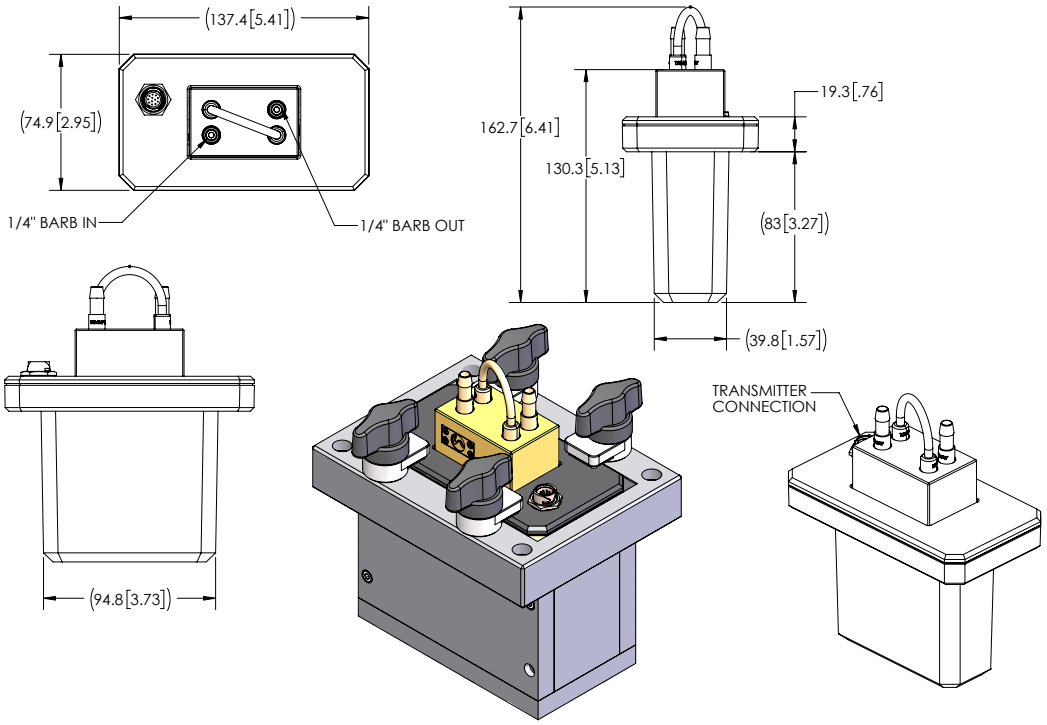
CSEN-8103-R-153 Sensor

1" Barb Connections, Inline Configuration



CSEN-8103-CA031 Sensor

1/4" Barb Connections, Standard Vertical Inlet Configuration



4.00 Dimension Drawing

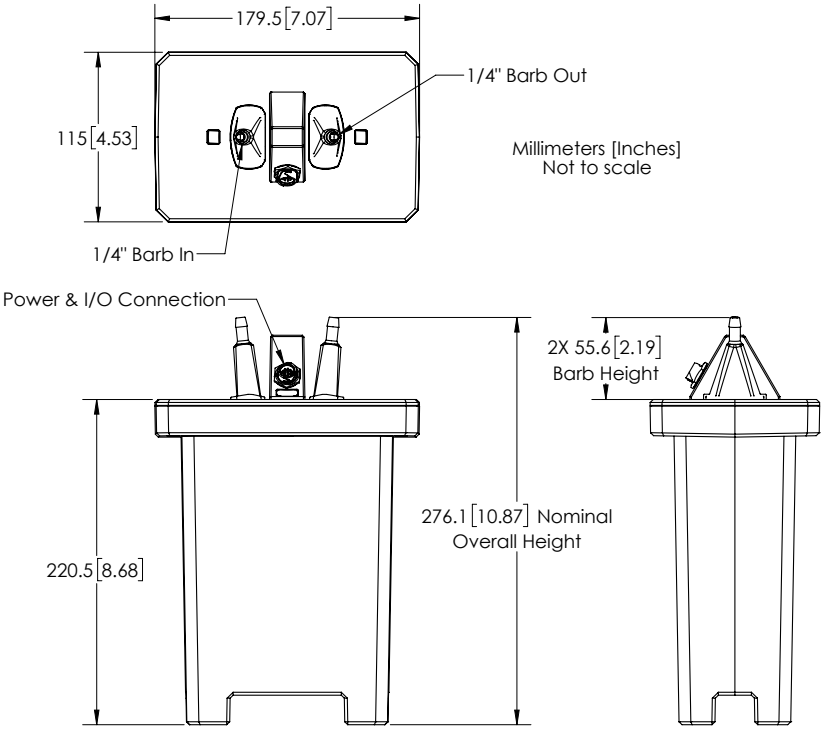
4.03 Single-Use Sensor Dimensions (Continued)

For Reference Only

Note: Mounting Cradle is required for CE compliance.

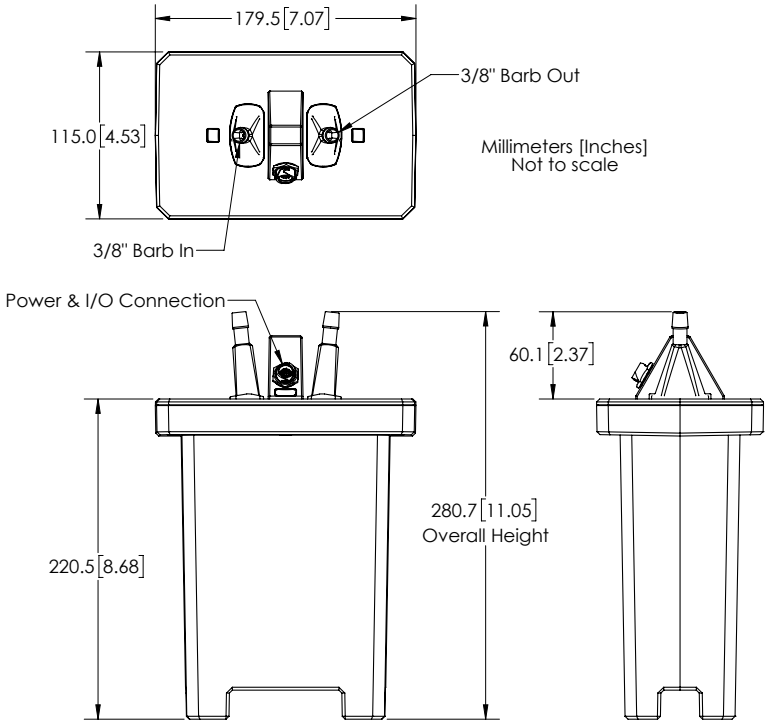
CSEN-8103-C-062 Sensor

1/4" Barb Connections, Standard Vertical Inlets Configuration



CSEN-8103-C-063 Sensor

3/8" Barb Connections, Standard Vertical Inlets Configuration



4.00 Dimension Drawing

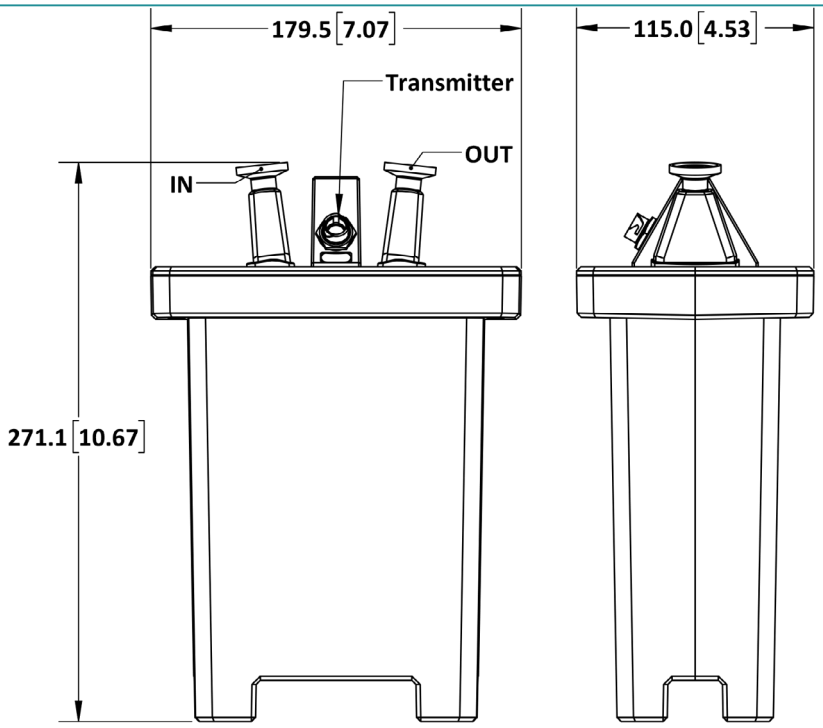
4.03 Single-Use Sensor Dimensions (Continued)

For Reference Only

Note: Mounting Cradle is required for CE compliance.

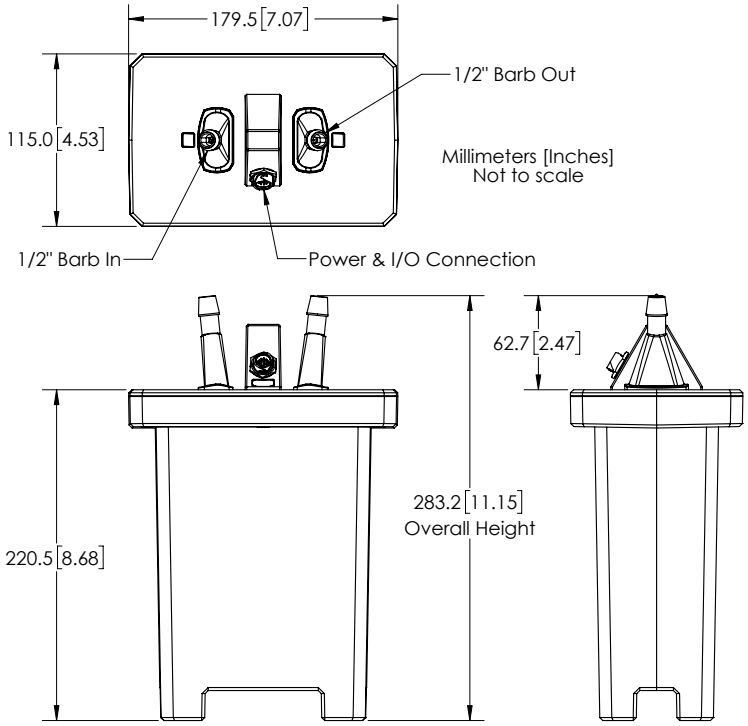
CSEN-8103-C-082 Sensor

1/2" Mini-Tri-Clamp Connections, Standard Vertical Inlets Configuration



CSEN-8103-C-082 Sensor

1/2" Barb Connections, Standard Vertical Inlets Configuration



4.00 Dimension Drawing

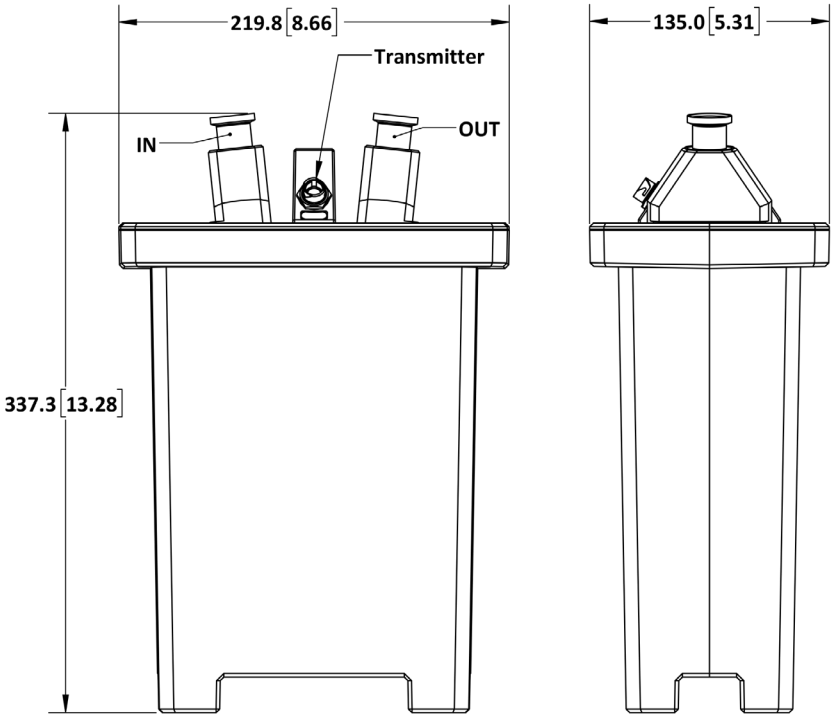
4.03 Single-Use Sensor Dimensions (Continued)

For Reference Only

Note: Mounting Cradle is required for CE compliance.

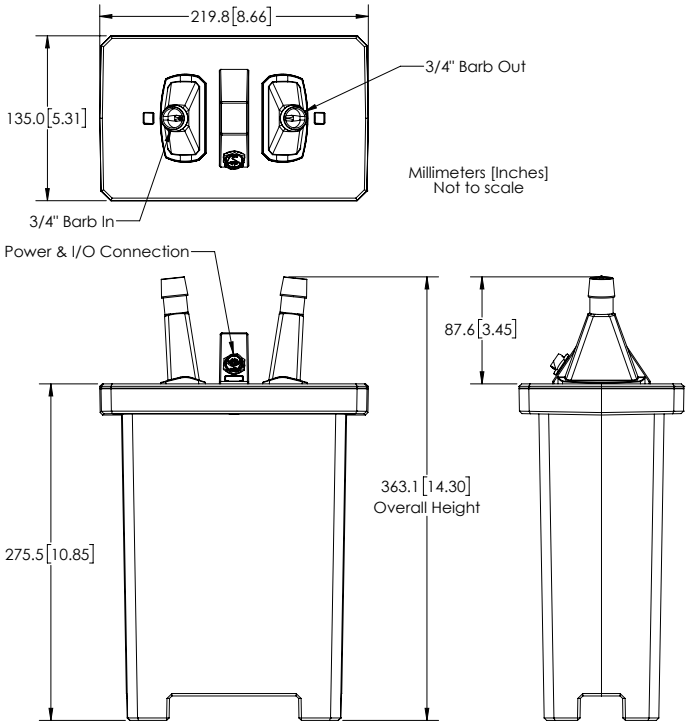
CSEN-8103-C-152 Sensor

3/4" Mini-Tri-Clamp Connections, Standard Vertical Inlets Configuration



CSEN-8103-C-152 Sensor

3/4" Barb Connections, Standard Vertical Inlets Configuration



4.00 Dimension Drawing

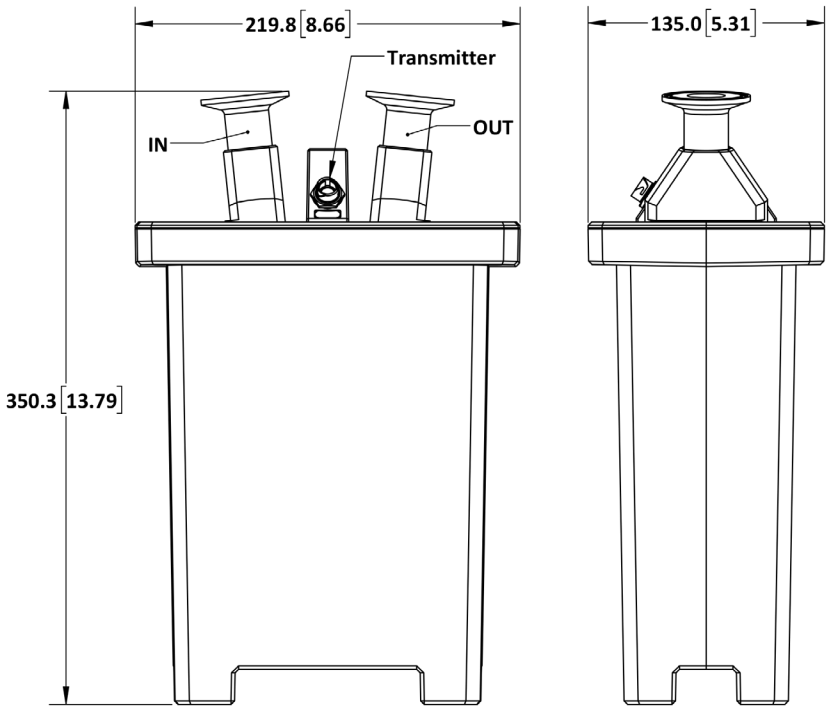
4.03 Single-Use Sensor Dimensions (Continued)

For Reference Only

Note: Mounting Cradle is required for CE compliance.

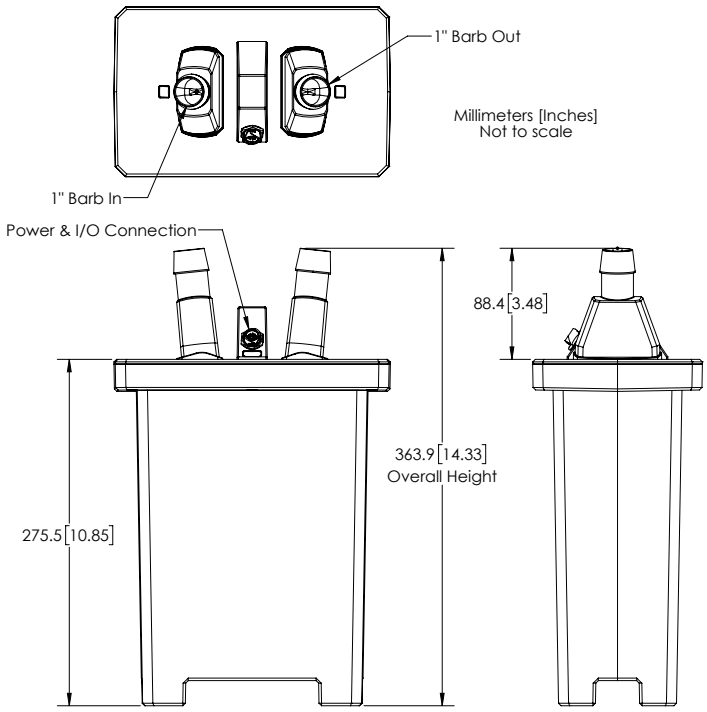
CSEN-8103-C-153 Sensor

1″ - 1 1/2″ Tri-Clamp Connections, Standard Vertical Inlets Configuration



CSEN-8103-C-153 Sensor

1″ Barb Connections, Standard Vertical Inlets Configuration



4.00 Dimension Drawing

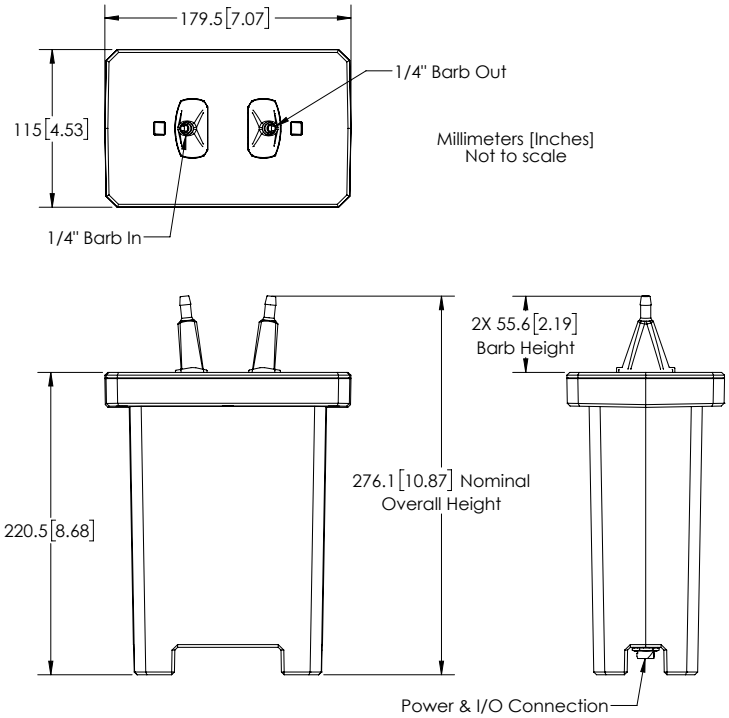
4.03 Single-Use Sensor Dimensions (Continued)

For Reference Only

Note: Mounting Cradle is required for CE compliance.

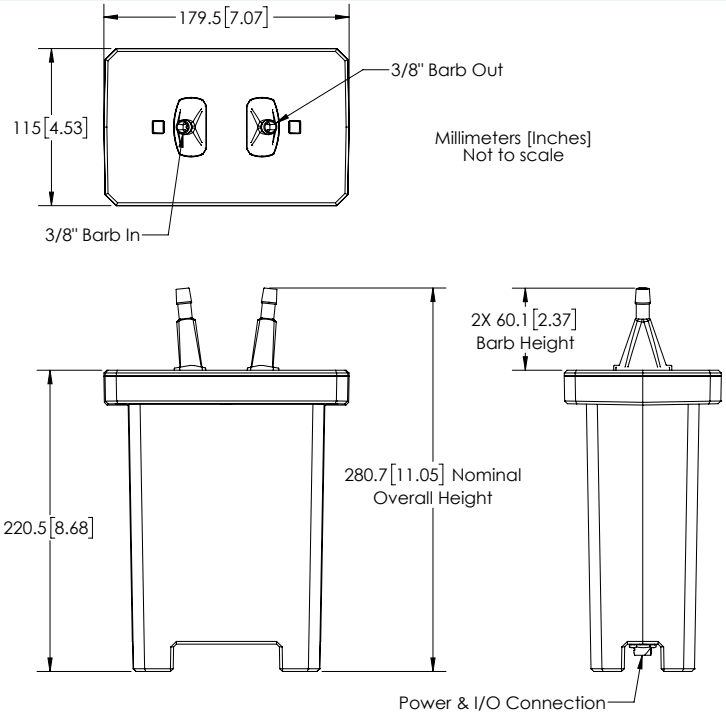
CSEN-8103-P-062 Sensor

1/4" Barb Connections, Panel Mount Configuration



CSEN-8103-P-063 Sensor

3/8" Barb Connections, Panel Mount Configuration



4.00 Dimension Drawing

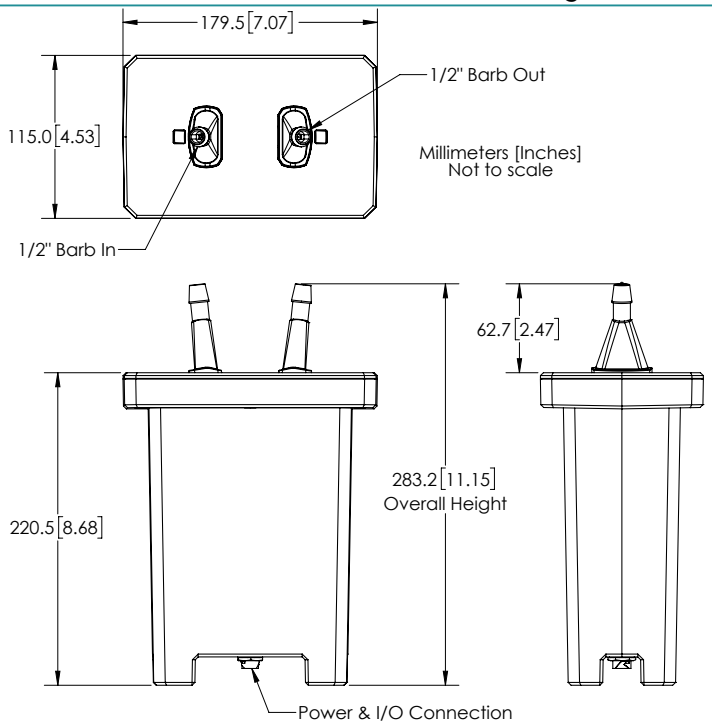
4.03 Single-Use Sensor Dimensions (Continued)

For Reference Only

Note: Mounting Cradle is required for CE compliance.

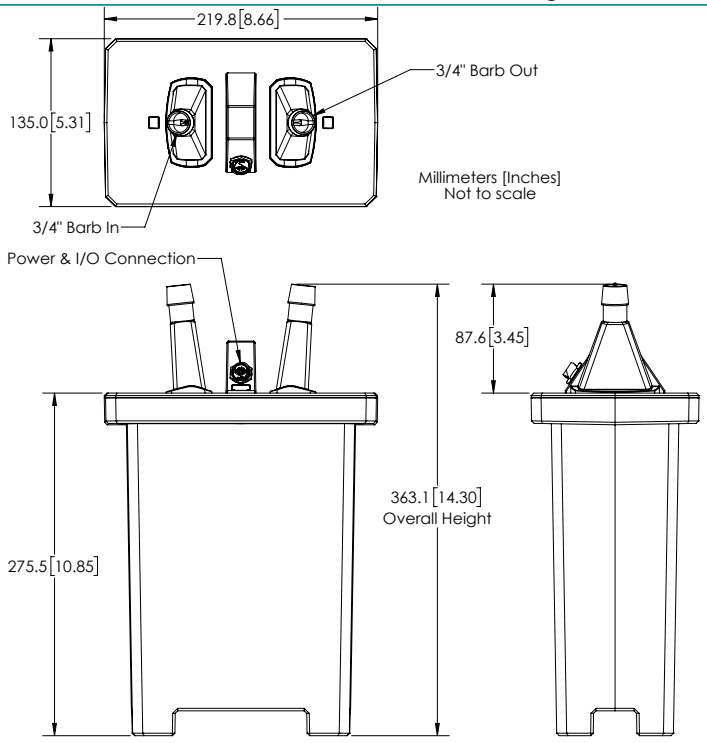
CSEN-8103-P-082 Sensor

1/2" Barb Connections, Panel Mount Configuration



CSEN-8103-P-152 Sensor

3/4" Barb Connections, Panel Mount Configuration



4.00 Dimension Drawing

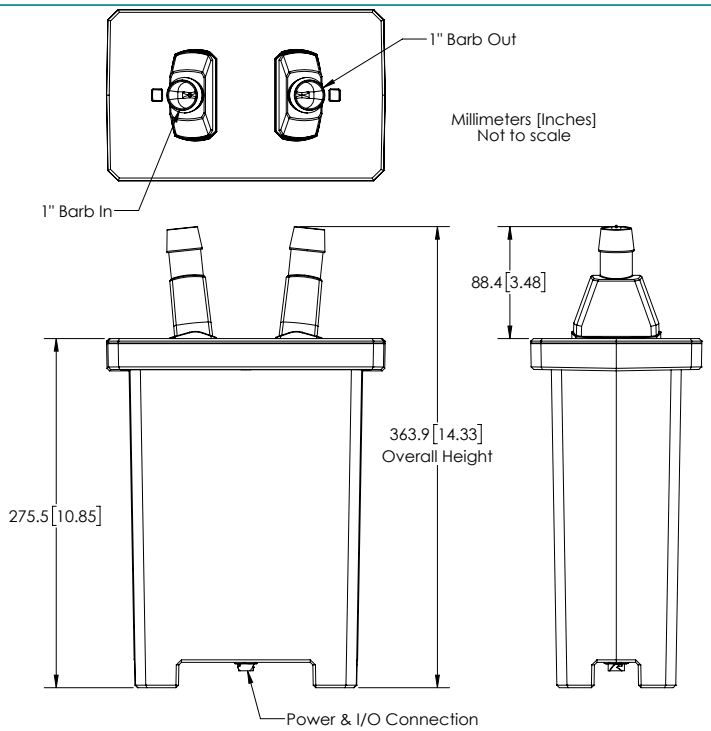
4.03 Single-Use Sensor Dimensions (Continued)

For Reference Only

Note: Mounting Cradle is required for CE compliance.

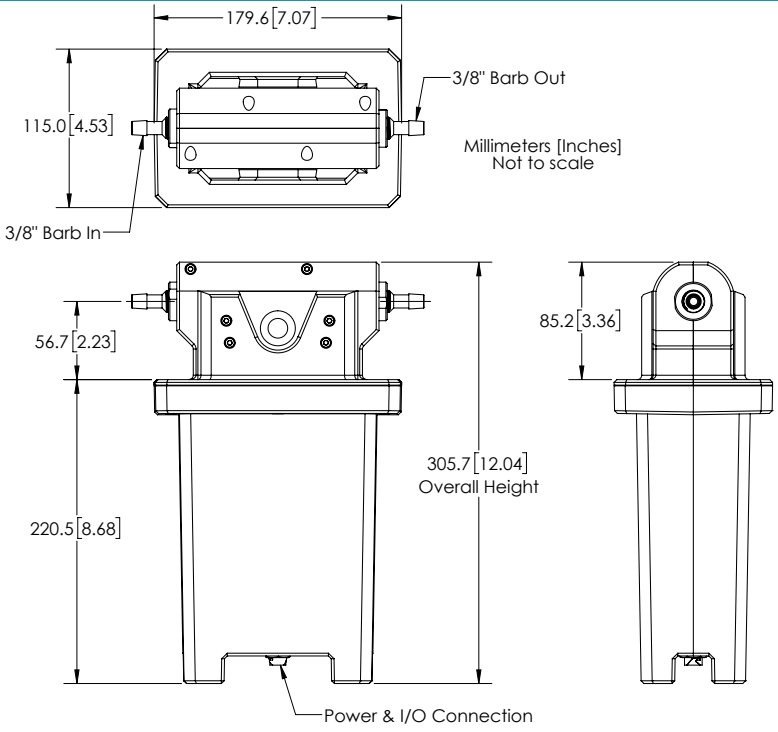
CSEN-8103-P-153 Sensor

1" Barb Connections, Panel Mount Configuration



CSEN-8103-T-063 Sensor

3/8" Barb Connections, Added Height Inline Configuration



4.00 Dimension Drawing

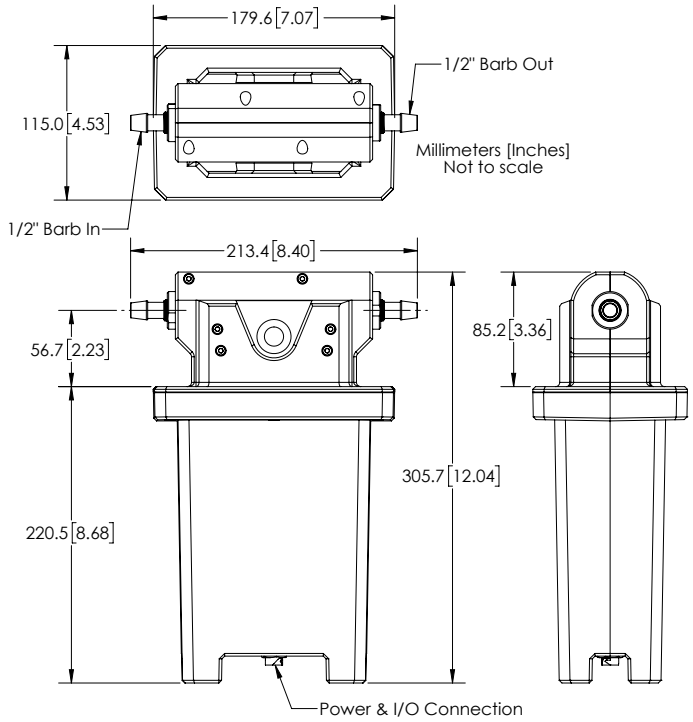
4.03 Single-Use Sensor Dimensions (Continued)

For Reference Only

Note: Mounting Cradle is required for CE compliance.

CSEN-8103-T-082 Sensor

1/2" Barb Connections, Added Height Inline Configuration



4.00 Dimension Drawing

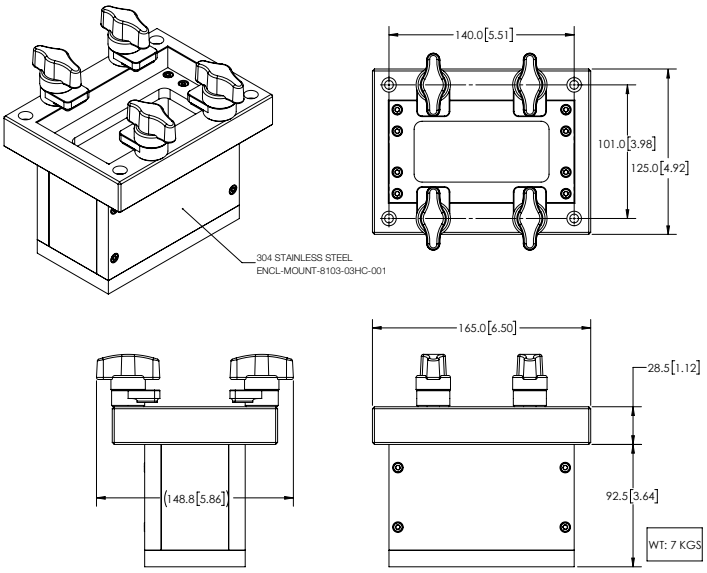
4.04 Mounting Cradle Dimensions

For Reference Only

Note: Mounting Cradle is required for CE compliance.

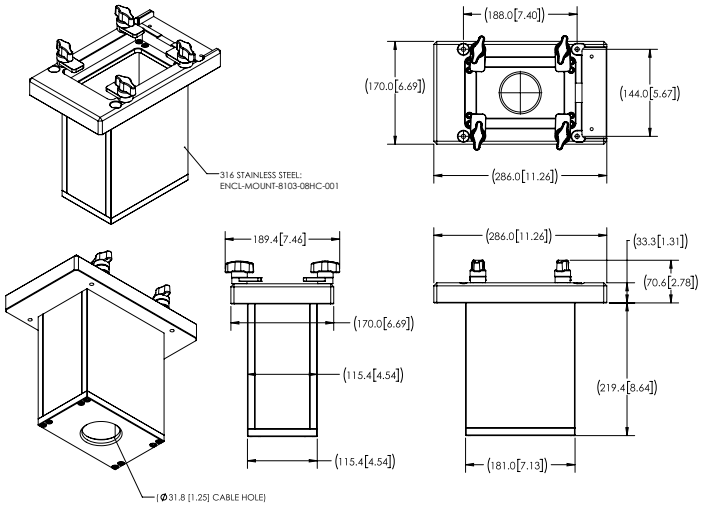
ENCL-MOUNT-8103-03HC-001

Mounting Cradle for 1/8" Sensors



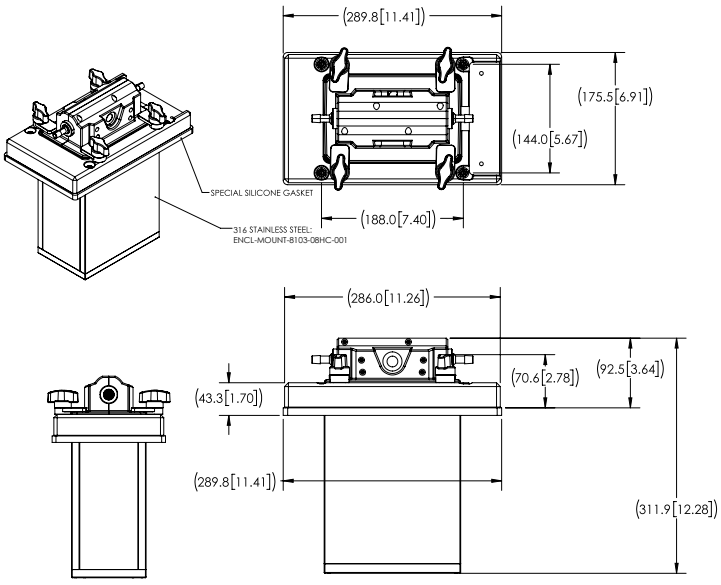
ENCL-MOUNT-8103-08HC-001

Standard Mounting Cradle for 1/4, 3/8, and 1/2" Sensors



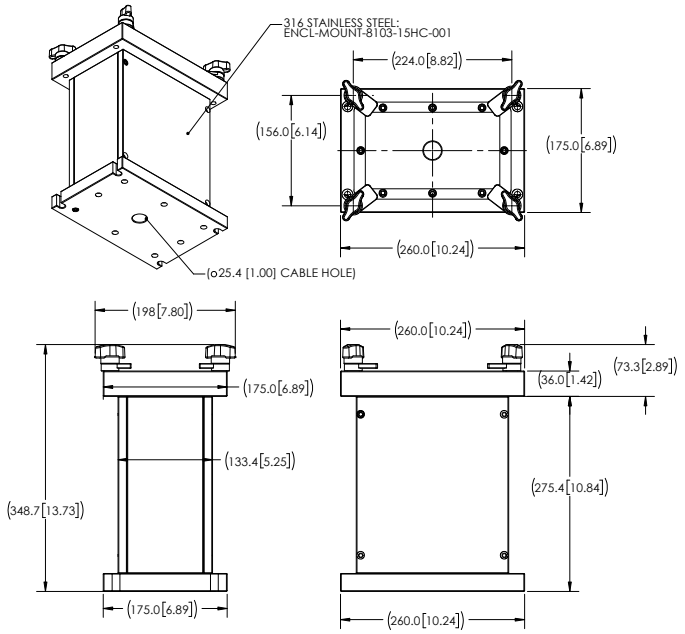
ENCL-MOUNT-8103-08HC-002

Standard Mounting Cradle for 1/4, 3/8, and 1/2" Sensors



ENCL-MOUNT-8103-08HC-002

Standard Mounting Cradle for 1/4, 3/8, and 1/2" Sensors



4.00 Dimension Drawing

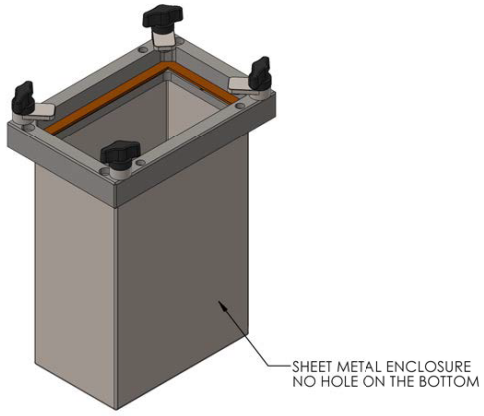
4.04 Mounting Cradle Dimensions

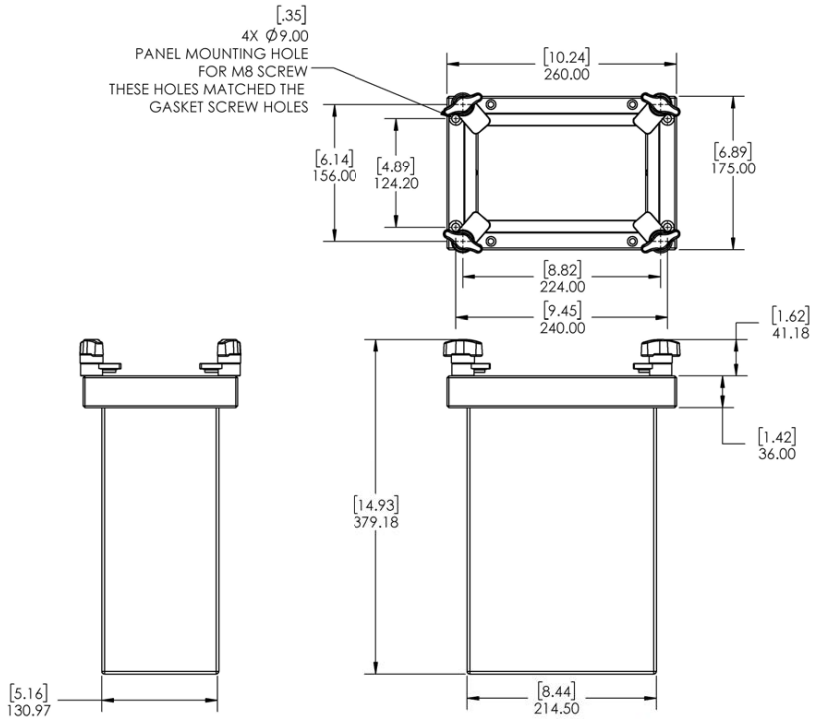
For Reference Only

Note: Mounting Cradle is required for CE compliance.

ENCL-MOUNT-8103-15HC-004

Mounting Flange for 3/4" and 1" Sensors





5.00 Testing

5.01 Pressure Drop in DI Water

Test Conditions: DI Water at 25°C

Sensor Range Code 031 (1/8" & 1/4")	
Flow Rate	**Pressure Drop**
50 g/min	0.01 psi (0.00069 Bar)
150 g/min	0.10 psi (0.0069 Bar)
400 g/min	0.71 psi (0.049 Bar)
800 g/min	2.84 psi (0.20 Bar)
1200 g/min	6.40 psi (0.44 Bar)
1500 g/min	10.00 psi (0.69 Bar)

Sensor Range Code 062 (1/4" barb)	
Flow Rate	**Pressure Drop**
500 g/min	0.10 psi (0.0069 Bar)
750 g/min	0.23 psi (0.016 Bar)
1500 g/min	0.90 psi (0.062 Bar)
2500 g/min	2.50 psi (0.17 Bar)
3750 g/min	5.63 psi (0.39 Bar)
5000 g/min	10.00 psi (0.69 Bar)

Sensor Range Code 082 (1/2" barb)	
Flow Rate	**Pressure Drop**
2000 g/min	0.10 psi (0.0069 Bar)
5000 g/min	0.63 psi (0.043 Bar)
7500 g/min	1.41 psi (0.097 Bar)
10000 g/min	2.50 psi (0.17 Bar)
15000 g/min	5.63 psi (0.39 Bar)
20000 g/min	10.00 psi (0.69 Bar)

Sensor Range Code 153 (1" barb)	
Flow Rate	**Pressure Drop**
10000 g/min	0.10 psi (0.0069 Bar)
20000 g/min	0.40 psi (0.028 Bar)
50000 g/min	2.50 psi (0.17 Bar)
75000 g/min	5.63 psi (0.39 bar)
87000 g/min	7.57 psi (0.52 bar)
100000 g/min	10.00 psi (0.69 bar)

Sensor Range Code 032 (1/4" barb)	
Flow Rate	**Pressure Drop**
300 g/min	0.17 psi (0.012 Bar)
600 g/min	0.55 psi (0.038 Bar)
900 g/min	1.14 psi (0.079 Bar)
1200 g/min	1.89 psi (0.13 Bar)
1500 g/min	2.83 psi (0.20 Bar)
1800 g/min	3.92 psi (0.27 Bar)
2100 g/min	5.29 psi (0.36 Bar)
2400 g/min	6.8 psi (0.47 Bar)
2700 g/min	8.47 psi (0.58 Bar)
3000 g/min	10.38 psi (0.72 Bar)

Sensor Range Code 063 (3/8" barb)	
Flow Rate	**Pressure Drop**
900 g/min	0.10 psi (0.0069 Bar)
1688 g/min	0.35 psi (0.024 Bar)
3375 g/min	1.40 psi (0.097 Bar)
5063 g/min	3.16 psi (0.22 Bar)
6750 g/min	5.63 psi (0.39 Bar)
9000 g/min	10.00 psi (0.69 Bar)

Sensor Range Code 151 & 152 (3/4" barb)	
Flow Rate	**Pressure Drop**
6000 g/min	0.10 psi (0.0069 Bar)
12000 g/min	0.40 psi (0.027 Bar)
21000 g/min	1.23 psi (0.085 Bar)
35000 g/min	3.40 psi (0.24 Bar)
50000 g/min	6.94 psi (0.48 Bar)
60000 g/min	10.00 psi (0.69 Bar)

Part Number	Hold Up Volume
CSEN-8103-RC031 1/4"	6 ml
CSEN-8103-RA032 1/4"	5.1 ml
CSEN-8103-RC062 1/4"	25 ml
CSEN-8103-RC063 3/8"	25 ml
CSEN-8103-RC082 1/2"	52 ml
CSEN-8103-RC151&152 3/4"	249 ml
CSEN-8103-RC153 1"	261 ml

6.00 Troubleshooting

Noted Symptom	Possible Cause	Follow Up Checks and Possible Fix
Problem Statement: No analog flow output even with physical flow running		
Flow readings on Malema GUI are zero	Incorrect flow direction	Ensure physical flow direction is in accordance with the labels on the flowmeter.
	Huge zero offset	Zeroing must be done properly - zeroing should be done with any liquid (DI Water or WFI for example), preferably without bubbles in the line. Refer to Section Zero Reset.
	Incorrect parameters	Ensure sensor parameters have not been accidentally changed. If needed, contact PSG Biotech for factory parameters and reset the parameters.
	Faulty Electronics	Open Malema GUI and monitor Flow readings. If readings drop to zero sporadically (intermittent readings), check and record a sequence of events how such drop occurs and how it recovers, e.g. flow rate change, pump speed change, liquid temperature change, power cycle, etc. and communicate to PSG Biotech for further guidance.
Flow readings on Malema GUI shows valid and stable flow rates	Analog output wiring connection is incorrect	Check analog output wiring to tool's input/output interface. Make sure, wiring is connected correctly, and all terminals are clean and secured. Note - If the analog output is wired incorrectly, permanent damage can be caused to the sensor circuit board.
	Load resistance or impedance of input/output terminal not within specification	Confirm if load resistance or impedance of external input/output terminal is within specification. Max. Load < 900 ohms in case of current output and min. impedance > 10 K Ohm in case voltage output.
	Analog output of the transmitter is bad	Check analog signal directly on analog output wires of the transmitter (with the wires not connected to tool's input/output interface). Please consult factory if the analog output is bad or incorrect.
Flow readings on Malema GUI shows an unstable flow rate	Bubbles in the line	Check for large bubbles in the line (in excess of 30% by volume) and if needed purge the line.
	Actual flow is unstable	Check flow and pressure stability and take necessary actions to fix it
	Electrical noise in tool analog input/output board	Check signal with oscilloscope; if noisy, find source of noise and repair.
	Issues with Power supply	Make sure power supply can able to supply required current; 24 V DC supplied is stable and clean; if required repair or replace power supply.
Problem Statement: Accuracy is off - unacceptable difference between flow readings and observed flow rate		
Flow readings on GUI are different from what's transmitted to tool software interface	Analog output wiring connection is incorrect	Check the analog output wiring to tool's input/output interface. Make sure wiring is connected correctly and all terminals are clean and secured. Note - If the analog output is wired incorrectly, permanent damage can be caused to the sensor circuit board.
	Load resistance or impedance of input/output terminal not within specification	Confirm if load resistance or impedance of external input/output terminal is within specification. Max. Load< 900 ohms in case of current output and min. impedance> 10 K Ohm in case voltage output.
	Analog output of the flowmeter is bad	Check the analog signal directly on analog output wires of the meter (with the wires not connected to tool's input/output interface). Please consult factory if the analog output is bad or incorrect.
	Wrong parameter settings	Check parameter settings of the meter such as full scale and flow unit, flow meter analog output specification (e.g. voltage vs. current outputs), scaling setting on tool's software, etc.
Flow readings on GUI are identical to what's transmitted to tool software interface	Huge Zero offset	Zero must be done properly - zeroing should be done with any liquid (DI Water or WFI for example), preferably without bubbles in the line. Refer to Section Zero Reset.

7.00 Order Information

7.01 DIN-Rail Mount Electronics Without Display (Only CELE-8103-C)

Model Ordering Code															Description
CELE-8103	**-**	*****	**-**	*****	*****	*****	*****	*****	**X**	**X**	**X**	**-**	*****	*******	**Transmitter**
		C													DIN Rail mounting (non display only CE)
		Z													Custom (please consult factory)
			-												
Temperature Compensation				**T**											Use with temperature comp sensors
				Z											Custom (please consult factory)
Output					**1**										1x 4-20 mA, 1x D/O
					2										1x 4-20 mA, 2x D/O
					3										1x 4-20 mA, 1x D/O, MODBUS (RS485)
					7										4x 4-20 mA, 0x D/O
					8										2x 4–20 mA, 1x D/O, MODBUS (RS485) (i.e. analog for flow rate and density)
					9										3x 4–20 mA, 1x D/O (i.e. analog output for flow rate, density, temperature)
					Z										Custom (please consult factory)
I/O Cable						**0**									Standard I/O cable
						Z									Custom (please consult factory)
I/O Cable Length							**A**								3m
							Z								Custom (please consult factory)
Interconnecting Cable Length								**A**							3m
								Z							Custom (please consult factory)
Measurement									**X**						For use with sensors calibrated for mass flow rate only
									D						For use with sensors calibrated for density and/or volumetric flow rate
										X					Reserved for factory
											X				Reserved for factory
Firmware												**–**	**A**		Version 3.3.0R
													B		Version 3.3.2R
													C		Version 3.3.5R
													D		Compatible with Versions 3.3.5R, 3.3.6R, 3.3.7R, 3.3.8R
														XXX	Unique PN identifier

7.00 Order Information

7.02 Panel or Bench Top Mount Electronics Display (Only CELE-8103-D, B and I)

Model Ordering Code													Description
CELE-8103	**-**	*	*	*	*	*	*	*	*	*	-*	***	
Series Code	**8103**												To be used with CSEN-8103
Mounting	**D**												1/2 DIN Cutout panel mount 4-line display
	B												1/2 DIN Cutout with 4-line display mounted in NEMA 4X stainless steel enclosure
	I												1/2 DIN Cutout with 4-line display mounted NEMA 4X stainless steel enclosure with intergral sensor cradle ENCL-MOUNT-8103-03
	Z												Custom (please consult factory)
Temperature Compensation		**T**											Use with temperature comp sensors
		Z											Custom (please consult factory)
Output			**D**										4x 4-20 mA, 2 D/O, MODBUS (RS485) 32-pin connector (CELE-8103-D only)
			3										1x 4-20 mA, 1 D/O, MODBUS (RS485) 12-pin Hirose connector (CELE-8103-B and I only)
			8										2x 4-20 mA, 1 D/O, MODBUS (RS485) 12-pin Hirose connector (CELE-8103-B and I only)
			Z										Custom (please consult factory)
I/O Cable				**0**									No I/O cable
				I									I/O cable included for mounting version B and I (For mounting version B and I Only)
				Z									Custom (please consult factory)
I/O Cable Length					**0**								No I/O cable supplied
					3								3m I/O cable with 90° connector on transmitter side and free leads on the other side (For mounting version B and I Only)
					Z								Custom (please consult factory); where Z = Length in m
Interconnecting Sensor Cable Length						**1**							1m Interconnecting cable with 90° connector at transmitter end
						3							3m Interconnecting cable with 90° connector at transmitter end
						Z							Custom (please consult factory); where Z = Length in meters
Density							**D**						Density measurement enabled
							X						Density not enabled
Power Cable and Plug								**B**					Type B NEMA 5-15 AC power cable (US), 2m length (For mounting version B and I Only)
								E					Type E/F Hybrid CEE 7/7 AC power cable (EU), 2m length (For mounting version B and I only)
								G					Type G BS1363 AC power cable (UK), 2m length (For mounting version B and I only)

7.00 Order Information

7.02 DIN-Rail Mount Electronics Display (Only CELE-8103-D, B and I) (Continued)

Model Ordering Code													Description
CELE	**-**	*	*	*	*	*	*	*	*	*	-*	***	
Power Cable and Plug									**X**				No cable provided
									*				For other options, please consult factory
Reserved										**X**			Reserved
											-X		Reserved
Unique ID												**S01**	Standard configuration
												XXX	For customized options the factory will assign a 3-digit ID instead of XXX

7.03 Mounting Cradle

Model Ordering Code					Description
ENCL-MOUNT-8103	**-**	**	-	**	Mounting cradle
Size		**03**			For use with sensor Range Code 031, 032
		08			For use with sensor Range Code 061, 062, 063, 082
		15			For use with sensor Range Code 152, 153
			XXX		Unique configuration code
				XXX	Unique PN identifier

7.04 Sensor

Model Ordering Code												Description
CSEN-8103	**-**	*	**-**	***	*	*	*	*	*	*	***	**PEEK Sensor**
Sensor Type		**C**										Standard vertical inlet and outlet ports
		P										Panel mount vertical inlet and outlet ports
		R										Inline inlet and outlet ports
		T										Tall inline inlet and outlet ports (-063 and -082 only)
Electrical Connector			**A**									Electrical connection on lid (top)
			V									Electrical connection on cup (bottom)
Range Code				**031**								0.05 - 1.5 kg/min
				032								0.02 - 3 kg/min
				062								0.5 - 5 kg/min for C & P, 0.15 - 5 kg/min for R
				063								0.9 - 9 kg/min for C & P, 0.18- 9 kg/min for R & T
				082								2 - 20 kg/min for C & P, 0.4 - 20 kg/min for R & T
				151								4 - 40 kg/min
				152								6 - 60 kg/min
				153								10 - 100 kg/min
Temperature Sensor					**I**							Integrated internal temp sensor (all other Range Codes)
Sterilization						**0**						No sterilization

7.00 Order Information

7.04 Sensor (Continued)

Model Ordering Code												Description
CSEN-8103	**-**	*****	**-**	*******	*****	*****	*****	*****	*****	*****	*******	**PEEK Sensor**
Sterilization						**1**						Gamma irradiated to 25 - 40 kGy
						Z						Other requests (please consult factory)
Fluid Connection							**A**					1/8" Hose barb (Range Code 031, 032)
							B					1/8" Hose barb with tubing (Range Code 031, 032)
							E					1/4" Barb (Range Code 031, 032 & 062)
							F					1/4" Barb with tubing (Range Code 031, 032 & 062)
							H					3/8" Barb (Range Code 063)
							J					3/8" Barb with tubing (Range Code 063)
							K					3/8" to Mini TC (Range Code 063)
							L					1/2" Barb (Range Code 082)
							M					1/2" Barb with tubing (Range Code 082)
							N					1/2" to Mini TC (Range Code 082)
							P					3/4" Barb (Range Code 151 & 152)
							Q					3/4" Barb with tubing (Range Code 151 & 152)
							R					3/4" to Mini TC (Range Code 151 & 152)
							S					1" Barb (Range Code 153)
							T					1" Barb with tubing (Range Code 153)
							U					1" to 1–1.5" TC (Range Code 153)
							Z					Custom fluid connection (please consult factory)
Mounting Orientation								**H**				Horizontal mount with upwards flow*
								D				Horizontal mount with downwards flow
								R				Horizontal mount with flow right to left
								L				Horizontal mount with flow left to right
								V				Vertical mount**
Calibrations and Outputs									**1**			Calibrated for mass flow rate only
									2			Density measurement enabled, analog output for volumetric flow rate
									3			Density measurement enabled, analog output for density
									4			Density measurement enabled, analog output for mass flow rate
Firmware										**A**		Version 3.3.0R
										B		Version 3.3.2R
										C		Version 3.3.5R
										D		Compatible with Versions 3.3.5R, 3.3.6R, 3.3.7R, 3.3.8R
											XXX	Unique PN identifier

* Factory recommended option for all sizes except Range Code 031
** Factory recommended option for Range Code 031

8.00 Appendix Coriolis Meter - Serial MODBUS Version 1.0G

8.01 Technical data

Interface		
Bit rate RS485 [kbps] Index	19.2, 4.8, 9.6, 38.4, 57.6, 115.2 0 1 2 3 4 5	8 databits, 1 stopbit, even parity
Bit rate RS232 over USB [kbps]	115.2, 8 databits, 1 stopbit, no parity	
Protocol	MODBUS RTU or ASCII	
Maximum systems on one bus. RS485 only	256 including the client (master)	
Address range	MODBUS: 1.247	
Transmission protocol	Half duplex, asynchronous	
Bus access	Server (slave)	
Cable and terminals	RS485: Screened twisted pair, push'n lock terminals USB: Mini B connector, screened.	
Distances	RS485: Up to ~4000ft (1.2km), depending on the bit rate and cable quality.	

8.02 Technical Specification

RS485: Meets or exceeds TIA/EIA RS-485.

For correct operation of MODBUS in half duplex in single or multipoint communication, it is recommended that terminating resistor is added to both the far ends of the line.

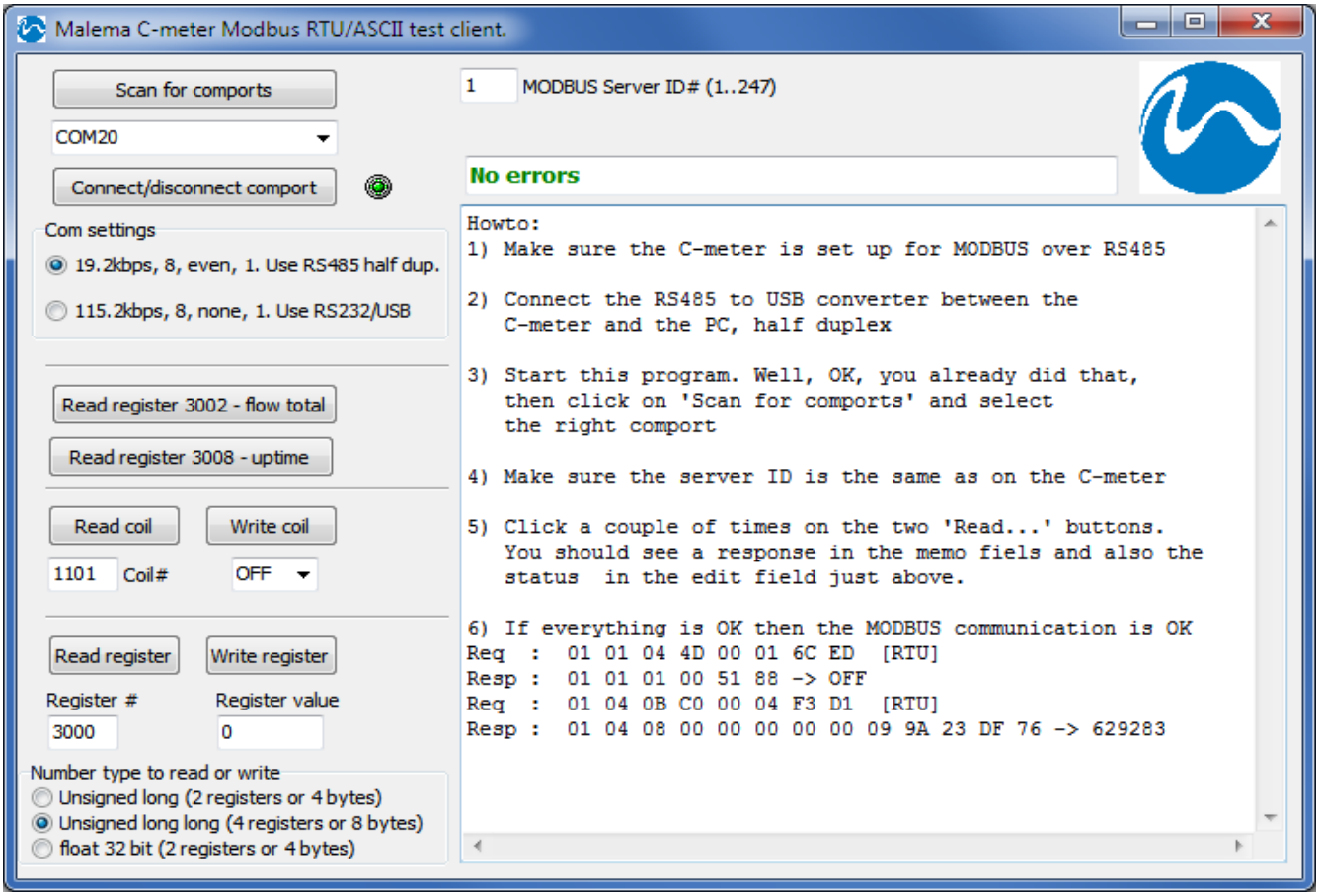
8.03 Default Settings

Slave address	1. Range 1.247. Always answer to address 0x7F
Protocol	RTU
Bit rate	19.2 kbps (Index = 0)
Parity	Even
Data format	Big endian
Transmission delay	3.5T
Stop bits	1

8.00 Appendix Coriolis Meter - Serial MODBUS Version 1.0G

8.04 Getting started with the MODBUS communication

- Connect the RS485 interface in half duplex mode.
- Connect a RS485 to USB converter between the meter and a PC.
- Power up the Coriolis meter and wait till the meter is in normal mode – green LED on, red LED off.
- Open the PC program ModbusTester_2.exe and select the comport number assigned to the RS485 to USB converter.



- Click on 'Connect/Disconnect comport' and observe the green "LED" turns on.
- Click on one of the 'Read...' buttons and observe the request and response packets in the text window.

The first set of request/response was 'Read coil', coil # 1101 (test coil).

The second set was 'Read register 3008' (uptime in ms). Note: to interpret the received data packet, change the number type to 'Unsigned long'.

The Modbus Tester program can be used to alter a few parameters if needed. See the description of each coil and holding registers.

8.00 Appendix Coriolis Meter - Serial MODBUS Version 1.0G

8.05 MODBUS protocol

Note: The Coriolis mass flow meter/ flow controller uses protocol addresses. This means the register address listed is the actual number required in the MODBUS command.

Addressing

The used MODBUS protocol registers are addressed and divided into functional equivalent groups:

Coil registers	1000/11000	Read/Write
Input registers	3000 /43000	Read only
Holding registers	5000/35000	Read/Write single register sets
Holding registers	6000 /Not used	Read/Write multiple register sets

Each group may be divided into smaller logical groups,

Multi-words are transmitted using big endian, most significant word first and most significant byte first.

Floating point is in IEEE754 format.

Overview of supported functions

Function code	Name	Access to
Hex / Dec		
01 / 01	Read single coil	Status, Flow/No flow,
03 / 03	Read holding register	Parameters
04 / 04	Read input register	Flow rates, totals, status
05 / 05	Write single coil	Zero meter, reset totalizers, auto zero on/off,
06 / 06	Write single register	
08 / 08	Diagnostics	TBD
10 / 16	Write multiple registers	Totalizer compare, zero offset, parameters, digital set point

Coil registers

Read / Write. Function code 0x01. ONLY read one coil at a time.

PDU Register address (dec)	Description	Settings		
1000/11000	Zero meter	Write	ON	Start to zero the meter
		Write	OFF	No effect
		Read	ON	Meter is in forced zeroing state or flow rate is above low flow cut off settings
		Read	OFF	Meter is zeroed

8.00 Appendix Coriolis Meter - Serial MODBUS Version 1.0G

8.05 MODBUS protocol (Continued)

Coil registers

PDU Register address (dec)	Description	Settings		
1001/11001	Reset totals Resets: - mass and volume totals - flow time - avg. flow rate - etc.	Write	ON	Reset all totals
		Write	OFF	No effect
		Read	ON	Totals are at zero
		Read	OFF	One or more totals are not zero
1002/11002	Start / Stop measuring	Write	ON	Start measuring
		Write	OFF	Stop measuring
		Read	ON	Measuring is ON
		Read	OFF	Measuring is OFF
1003/11003	Auto zero	Write	ON	Set Auto zero to ON
		Write	OFF	Set Auto zero to OFF
		Read	ON	Auto zero is ON
		Read	OFF	Auto zero is OFF
1004/11004	Store current setting and parameters in non-volatile RAM.	Write	ON	Store parameters
		Write	OFF	No effect
		Read	OFF	Always reads OFF
1005/11005	Activate digital output 2 to signal when the preset Totalizer value is reached.	Write	ON	Digital output 2 will indicate when preset totalizer value has been reached
		Write	OFF	Digital output 2 function will be disabled
		Read	ON	Digital output 2 function is enabled
		Read	OFF	Digital output 2 function is disabled
1006/11006	Use flow control	Write	ON	Use the flow controller functions
		Write	OFF	Do not use the flow controller functions
		Read	ON	Flow controller is active
		Read	OFF	Flow controller is inactive
1007/11007	Close valve when totalizer value is reached	Write	ON	The valve will close as soon the totalizer value has been reached. Flow control will be disabled and must be reactivated again. Use PDU register address 1006.
		Write	OFF	The valve will not close when totalizer value has been reached.
		Read	ON	Active on totalizer value
		Read	OFF	Inactive on totalizer value

8.00 Appendix Coriolis Meter - Serial MODBUS Version 1.0G

8.05 MODBUS protocol (Continued)

Coil registers

PDU Register address (dec)	Description	Settings		
1008/11008	Select flow controller set point source	Write	ON	Analog input is selected
		Write	OFF	Digital set point is selected. See holding register 5018
		Read	ON	Indicates analog set point is the source
		Read	OFF	Indicates digital set point is the source
1009/11009	Use 4-20mA input range. (The 4-20mA or 0-10V input is on the same pins)	Write	ON	Use 4-20mA input as 0 to 100% flow control set point
		Write	OFF	Use 0-10V input as 0 to 100% set point
		Read	ON	Indicates 4-20mA set point
		Read	OFF	Indicates 0-10V set point
1010/11010	0V (4mA) stops the motor	Write	ON	If 0% analog flow rate set point is detected, the valve motor will stop in it's current position. Flow controller is disabled
		Write	OFF	Normal flow controller function
		Read	ON	The valve motor will stop when 0% flow rate is detected
		Read	OFF	Normal flow controller function
1011/11011	Open the valve to 100% flow rate	Write	ON	The valve will open up 100%. Use flow control is disabled. Write ON to coil 1006 to enable again.
		Write	OFF	No effect
1012/11012	Close the valve to 0% flow rate	Write	ON	The valve will close to 0%. Use flow control is disabled. Write ON to coil 1006 to enable again.
		Write	OFF	No effect
1013[2]/11013	Reset frequency and then zero the transmitter	Write	OFF	No effect
		Write	ON	The current sensor frequency is reset to the stored frequency in sensor memory.
		Read	OFF	Always OFF
1014/11014	Empty sensor	Read	ON	The sensor is empty
1100/11100	Restart meter	Write	ON	Restarts the Coriolis flow meter
		Write	OFF	No effect
1101/11101	Test	Write/ Read		Can be used to test communication
1199/11199	Terminate MODBUS session	Write	ON	If MODBUS is using RS232 over USB, this command will terminate the MODBUS session and return to normal PC control mode. If using RS485, this command will have no effect.

[2]Coils 1013 and up to coil 1100 are implemented in firmware versions 2.0.15 and 3.3.7.

8.00 Appendix Coriolis Meter - Serial MODBUS Version 1.0G

8.05 MODBUS protocol (Continued)

Input registers

PDU Register address (dec)	Description and Setting		Type	# of registers
3000/43000	**Mass** Flow rate [selected units][4]		Float	2
3002/43002	**Mass** Flow total [selected unit]		Float	2
3004/43004	**Vol.** Flow rate [selected units]		Float	2
3006/43006	**Vol.** Flow total [selected unit]		Float	2
3008/53008	ms since power up / restart		Unsigned long	4
3012/43012	Flow time in ms		Unsigned long	4
3016/43016	Status word		Unsigned long	2
	LEFT SENSOR ERROR	0x00000001		
	RIGHT SENSOR ERROR	0x00000002		
	ZEROFLOWCOND	0x00000008		
	LR GAIN ERROR	0x00000010		
	SENSOR CABLE ERROR	0x00000200		
	DRIVER CABLE ERROR	0x00000400		
	BUBBLES DETECTED	0x00001000		
	FLOW CTRL ERROR	0x00002000		
	POSITION ENCODER ERR	0x00010000		
	MOTOR ERROR	0x00020000		
	LEAK DETECTED	0x00040000		
	SENSOR DISCONNECTED	0X20000000		
	Some bits are only internal status bits, and therefore omitted here			
3018/43018	Read general I/O pins. Reserved		Unsigned long	2
3020/43020	Read density		Float	2
3022/43022	Read temperature		Float	2
3028[5]/43028	Read L/R phase shift		Double	4
3032/43032	Read extended status word		Unsigned long	2
	EMPTY_SENSORFLAG	0x00000001		
	NEGFLOWRATEWARNING	0x00000002		

Example: Read mass flow total from register 3002 (0x0BBA) on server #1:

RTU: 01 04 0B BA 00 02 52 0A

ASCII: ':01040BBA000234 crlf'

Response from server:

RTU: 01 04 04 00 00 00 00 FB 84

ASCII: ':01040400000000F7 crlf'

[4]Selected units (g,kg, lb, ccm, liters etc. and s,min, h etc) as configured in the transmitter, Can currently only be changed using the GUI and not via MODBUS.

[5]Input registers from 3024 and above is implemented in firmware versions 2.0.15 and 3.3.7.

8.00 Appendix Coriolis Meter - Serial MODBUS Version 1.0G

8.05 MODBUS protocol (Continued)

Holding registers

Read / Write. Function codes 0x03 or 0x04 for read, 0x10 for write. One register set at a time.

PDU Register address (dec)	Description and Setting	Type	# of registers
5000/35000	Totalizer compare value	Float	2
5002/35002	Filter time constant (RC time constant) [ms]	Unsigned long	2
5004/35004	Positive low flow cutoff value	Float	2
5006/35005	Negative low flow cutoff value	Float	2
5008/35008	Number of samples between calculations	Unsigned long	2
5010/35010	Zero offset	Float	2
5012/35012	Density	Float	2
5014/35014	Bit rate index. See technical data for index#	Unsigned long	2
5016/35016	Server ID. 1..247	Unsigned long	2
5018/35018	Digital set point	Float	2
5020/35020	Set Dir. Gen. I/O bits. Reserved	Unsigned long	2
5022/35020	Set Gen. I/O bits. Reserved	Unsigned long	2
6000/36000	Other parameters.	Mixed	TBD

Example: Write 500.0 (0x43FA0000) to register 5000 (0x1388) on server #1:

RTU: 01 10 13 88 00 02 04 43 FA 00 00 16 EC

ASCII: ':0110138800020443FA000011 crlf'

Response from server:

RTU: 01 10 13 88 00 02 C5 66

ASCII: ':01101388000252 crlf'

Note: When writing to the holding registers, the values are not automatically saved to the non-volatile RAM. Use coil register 1004 to store the parameters in the non-volatile RAM.

9.00 Warranty

PSG Biotech warrants to the buyer that its products are free from defects in materials and workmanship at the time of shipment and during the WARRANTY PERIOD. Seller's obligation under this warranty is limited to the replacement of the product(s) by same product(s) manufactured by PSG or repair of the product(s) at the facility.

PSG Biotech products are sold with the understanding that the buyer has determined the applicability of the product(s) to its intended use. It is the responsibility of the buyer to verify acceptability of performance to the actual conditions of use. Performance may vary depending upon these actual conditions.

Warranty Period

This warranty is in effect for twelve (12) months from the date of shipment from PSG manufacturing location.

Warranty Claim

If PSG Biotech products are found to be defective in materials or workmanship within twelve (12) months of the date of shipment, they will be repaired or replaced with same product at the discretion of PSG at its place of business at no charge to the buyer.

10.00 Service Contacts

For service support or technical assistance, please contact the PSG Biotech Technical Support Team at:

Telephone: +1 (800) 637-6418
+1 (408) 970-3419
E-mail: Malema.technicalsupport@psgdover.com

11.00 Service and Repair

To return the products, please obtain an RMA number for the product by contacting 2329 Zanker Road, San Jose CA 95131, at +1 (800) 637-6418 or +1 (408) 970-3419, or email Malema.technicalsupport@psgdover.com

Unless otherwise specified with the RMA number, all equipment must be returned to the following address:

PSG San Jose
2329 Zanker Road
San Jose, CA 95131, USA

Note: Flow sensors cannot be returned once exposed to gamma radiation.