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Octave Ultrasonic Water Meters **Installation Manual**



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Introduction

General and Safety

- Do not install, operate or maintain this flow meter without reading, understanding and following the factory supplied instructions. Otherwise, injury or damage may result.
- Read these instructions carefully before beginning installation and save them for future reference.
- Observe all warnings and instructions marked on the product.
- Consider handling and lifting instructions to avoid damage.
- If the product does not operate normally, refer to the service instructions or to a qualified ARAD service engineer.
- There are no operator-serviceable parts inside this product.

Items Included With Order

- One Octave ultrasonic flow meter, size as indicated on the packaging box, pieced together into a complete compact system (flow tube plus electronics).
- One output module, either digital or analog (based on the customer's order).

Supplied Documentation

- Condensed installation and user manual.
- Report of factory meter settings.
- Certificate of calibration data.

Unpacking and Inspection

- This product has been thoroughly inspected and tested before shipment and is ready for operation.
- After carefully unpacking the meter, inspect for shipping damage before attempting to install. If any indication of mechanical damage is found, immediately contact the responsible transportation service and your local Arad Ltd. representative.

System Description and Measurement Method

- The Octave's measurement method is based on an ultrasonic, transit-time, dual-beam sensors which determines the length of time it takes an ultrasonic sound wave to travel the distance between the two sensors located on the meter's body. The sensors function as both the sender and the receiver, each one alternating these functions so that the ultrasonic wave travels both with and against the direction of the flow. Since the ultrasonic wave travels slower against the flow than with the flow, the time difference of two waves traveling with and against the flow leads to determining the velocity of the water.
- The Octave Ultrasonic Flow Meter is a battery-powered precision flow meter designed for linear, bidirectional flow measurement of water.
- Flow measurement values can be transferred through the standard communication – digital or analog output.
- The Octave can be set up for a wide range of applications.

Introduction

Notes

- For proper flow measurements, the Octave's measuring tube should be completely full at all times. Non-wetted sensors show loss of signal. Though this will not cause damage to the meter, it will, however, not measure flow and display zero.
- Flow direction: The Octave is a bidirectional flow meter. Note the indicating arrow on the Octave's display for forward and backward flows.
- In case of direct sunlight exposure, it is recommended to keep the lid closed, though no direct damage will occur with the lid open.
- Do not expose the Octave to excessive vibration. To avoid vibration, support the pipeline on both side of the meter.
- Ambient working temperature: -25 to +55°C.
- Water working temperature: 0.1 to +50°C.
- NMI approved to zero upstream and zero downstream straight length of pipe.
- To avoid measuring errors due to air in the flow tube, observe the following precautions:
 - Since air collects at the highest point of the system, installation of the flowmeter should be at the lowest point.
 - Always install control valves downstream of the meter in order to avoid cavitation.
 - Never install the meter on a pump suction side in order to avoid cavitation.

Counter Flanges

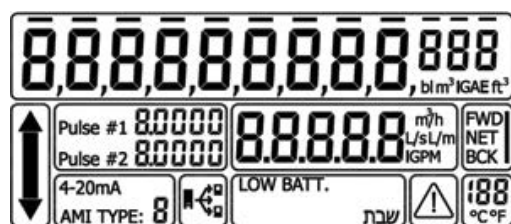
- Refer to the standard dimensional drawings for flange spacing, accommodating for the thickness of gaskets.
- Install meter in line with the pipe axis. The flange faces must be parallel to each other.
- Permissible length deviation: $L_{max} - L_{min}$ 0.5mm (0.02").

Start-up

- Check that the meter has been installed correctly (as per this manual).
- Check that the flow rate and volume units are correctly preprogrammed on the display.
- Check that the output module is correctly attached.

Technical Information

Digital Display



↑	Flow Direction	⚠	System Error
m³/h L/s/L/m IGPM	Flow Rate Units	4-20mA AMI TYPE: 8	Output Mode
FWD NET BCK	Accumulator Mode	m³ IGAE ft³	Volume Units
⚡	Communication Mode	Pulse #1 888888 Pulse #2 888888	Pulse Resolution
LOW BATT.	Low Battery Alert		



Sleep Mode

After 24h (or according to any default choosen) of empty pipe line/ pipe without water the meter will switch to sleep mode.

Mechanical Data

PERFORMANCE SPECIFICATIONS

Maximum Working Pressure	16 bar
Liquid Temperature	0.1 up to 50 °C
Precision Class	ISO 4064 rev.2014, Accuracy class 2
Configuration	Compact - The display is built in to the unit
Power Source	2 D size Li-battery: up to 15 years life time
Environmental Protection	IP 68, Ambient operation temp. -25°C up to +55°C
Volume Display Options	1. Net (Forward less reverse) 3. Reverse only 2. Forward only 4. Forward & reverse alternating
Data Logger	Volumes and alarms data (48KB, 4130 data points)
Connections	1½"-2" threaded: with couplings to NPT/ BSP 2"-12" flanged: flanges according to ISO, BS 10 and ANSI 150
Severity levels	Mechanical class M1 Electromagnetic environment class E1
Pressure Loss	ΔP 0.16 bar

Technical Information

Outputs

OUTPUT INFORMATION

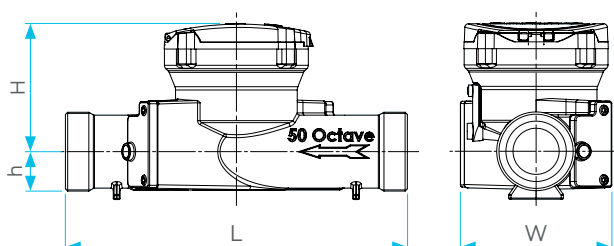
Analog Output	<p>The Analog Output shows the currently measured flow rate.</p> <p>This output is a 4 – 20 mA current loop (the end user must supply power to the unit).</p> <p>The Analog Output is programmable for forward and reverse flow (see Operation Manual for more details).</p> <p>The 20mA point is programmable per customer request (To any flow lower than the max flow of the meter).</p>										
Digital (pulse) Output	<p>The Digital (pulse) Output is an open drain transistor output that provides pulse per quantity with these options:</p> <ol style="list-style-type: none"> Two scaled forward and/or reverse mode pulses One scaled forward pulse and one alarm frequency output Measuring units of the output can be programmed different than displayed units <p>Pulse resolution will be shown on the display for each pulse separately.</p>										
Dry Contact	<p>Output The Dry Contact Output is a dual mechanical relay output that provides pulse per quantity with these options:</p> <ol style="list-style-type: none"> Two scaled forward and/or reverse mode pulses One scaled forward pulse and one alarm frequency output Measuring units of the output can be programmed different than displayed units <p>Pulse resolution will be shown on the display for each pulse separately.</p> <p>Onsite power supply of 5-35 VDC is needed.</p>										
SSR (Solid State Relay)	<p>The SSR is a dual electronic relay output that provides pulse per quantity with these options:</p> <ol style="list-style-type: none"> Two scaled forward and/ or reverse pulses One scaled forward and one alarm frequency output Measuring units of the output can be programmed different than displayed units <p>Pulse resolution will be shown on the display for each pulse separately.</p> <p>Onsite power supply of 5-35 VDC is needed.</p>										
Encoder Output	<p>The Encoder Output is a serial communication protocol utilizing UI1203 or UI1204 (Sensus protocol).</p> <p>Additional pulse output is available as an option.</p>										
Modbus Protocol Output / M-Bus	<p>The Modbus Protocol Output has the following available functions:</p> <table> <tr> <td>1. Alarms (battery, empty pipe)</td><td>6. Current flow</td></tr> <tr> <td>2. AMR serial number</td><td>7. Flow direction</td></tr> <tr> <td>3. Real Time Clock (RTC)</td><td>8. Forward and reverse volumes</td></tr> <tr> <td>4. Volume units</td><td>9. Flow and volume resolution</td></tr> <tr> <td>5. Flow rate units</td><td></td></tr> </table>	1. Alarms (battery, empty pipe)	6. Current flow	2. AMR serial number	7. Flow direction	3. Real Time Clock (RTC)	8. Forward and reverse volumes	4. Volume units	9. Flow and volume resolution	5. Flow rate units	
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3. Real Time Clock (RTC)	8. Forward and reverse volumes										
4. Volume units	9. Flow and volume resolution										
5. Flow rate units											
Output Extension Cable	5m extension cable for installation in pits and vaults										

Technical Information

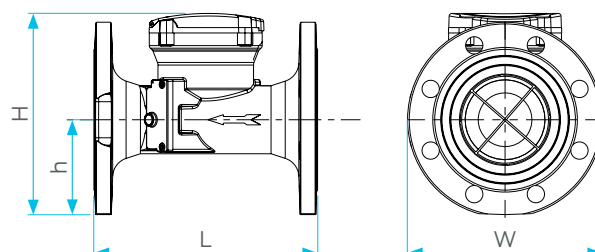
Dimensions

MODEL		OCTAVE ULTRASONIC WATER METER										STAINLESS STEEL			
Nominal Size	mm	40 Threaded	50 Threaded	50	65	80	100	150	200	250	300	50	80	100	150
	inch	1½ Threaded	2 Threaded	2	2.5	3	4	6	8	10	12	2	3	4	6
L - Length without couplings (mm)		300	300	200	200	225	250	300	350	449	499	200	225	250	300
W - Width (mm)		113	113	165	185	200	220	285	340	406	489	165	200	220	285
H - Height (mm)		155	155	194	210	210	223	282	332	383	456	194	210	223	282
h - Height (mm)		35	35	40	90	90	103	140	165	203	245	40	90	103	140
Weight (kg) – Cast Iron Body			8	9	11.5	13	15	32	45	68	96				
Weight (kg) – Polymer Body		1.4	1.45												
Weight (kg) – Stainless Steel body												6	7	9.5	16

Threaded



Flanged



Installation

Handling the Flow Meter

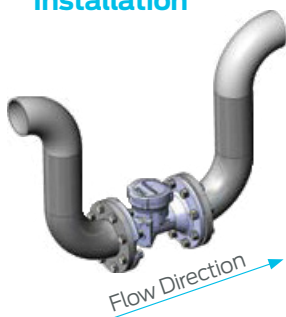
Important handling information:

- Do not lift the Octave by the electronic housing.
- Do not carry the Octave by its lid.
- Do not place the Octave on the electronic housing.
- When handling the Octave, avoid hard blows, jolts or impacts.

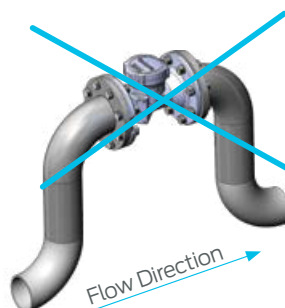
General Installation – Location and Position

Note: The Octave needs to operate with downstream back pressure of minimum 0.5-0.7 Bar. Do not install the meter with a fully open downstream pipe (with no back pressure).

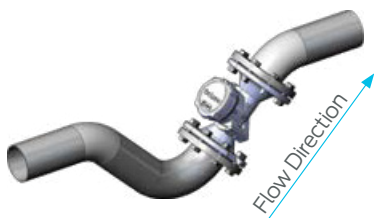
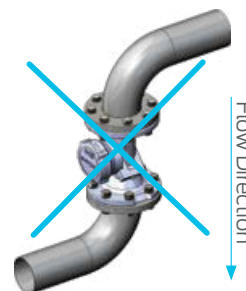
Recommended Installation



Conditional Installation



Wrong Installation



Recommended: If this is not the highest point in the system or a hydraulic jump has been installed to keep the flow meter full.

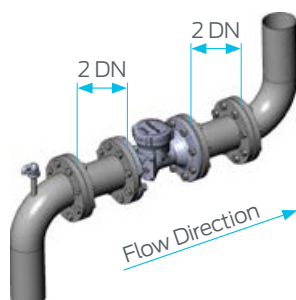
Not recommended: If this is the highest point in a system or if pipeline and/or flow meter is subject to being emptied between uses avoid this installation.

Installation

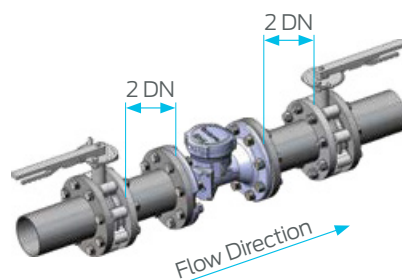
The Following Examples are Arad's Recommendations For Achieving Top Performance

- When installing the Octave downstream of any hydraulic component (valve, pump) the recommended installation requirements are no less than the drawings recommendations. For upstream and downstream straight pipes please use as much as installation site will allow (the longer the better).
- When installing Pressure Breaker after the meter – the pipe length should be at least 2 pipe diameter (the longer the better).
- NMI approved to zero upstream and zero downstream straight length of pipe.

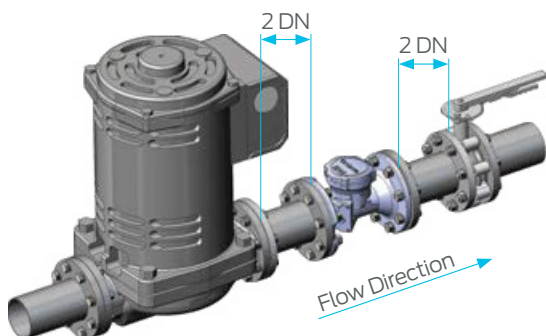
**Two pipe diameters
before and after elbows (90°)**



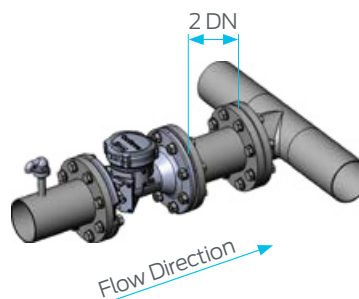
**Minimum of two pipe diameters
before and after**



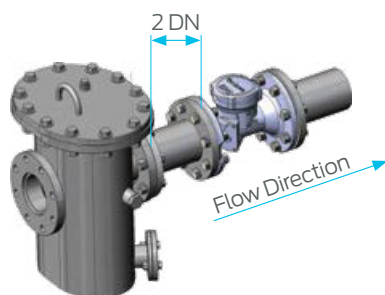
**Minimum of ten pipe
diameters after pumps**



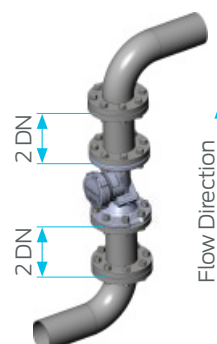
**Minimum of two pipe diameters
before T connections**



**Minimum of two pipe diameters
after strainers**



**Two pipe diameters before and after elbows
(90°) in vertical installations**



Installation

Polymeric Octave Installation – General Instructions

Please follow the general instructions for water meters (Check Valve, upstream and down stream and system flushing on new installations).

Existing and new installations

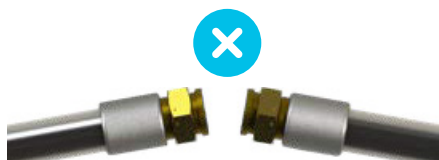
1. It is recommended that the meter will NOT be installed in the middle of the system, so the meter will not suffer from the load of all the installed fixtures.



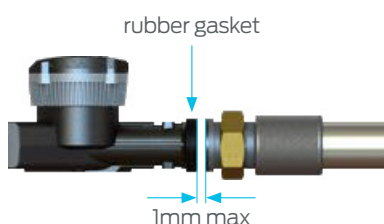
2. It is recommended that at least one side of meter will be connected to a PVC (or plastic) pipe.



3. Please make sure that the end connections are parallel and inline to each other.



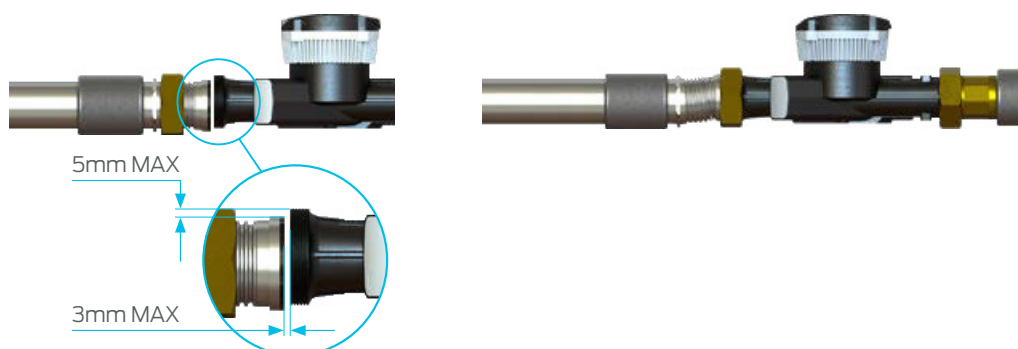
4. When using standard tail piece, please use rubber gaskets only (not fiberglass)! After adding the gaskets the gap between the end connection and the meter should not exceed 1mm.
 - Please unscrew the end connection in order to keep the recommended distance.
 - Please do not use force in order to close the gap.
 - Please don't do any welding while the meter is connected to the pipe.



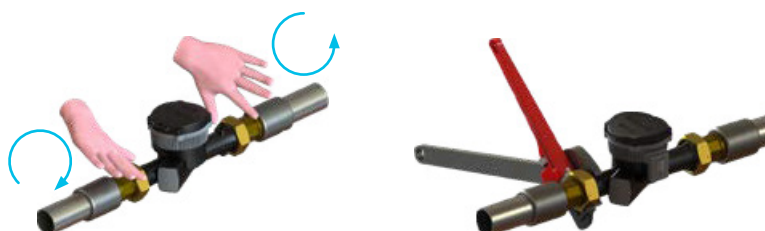
Installation

5. If it is not possible to use plastic connections on one side of the meter, please consider the use of our flexible couplings. These couplings were especially developed for the Polymeric Octave Meters.

You will need to use this coupling only on one side of the meter – please install the coupling on the outlet, if possible – as described in the below diagrams.



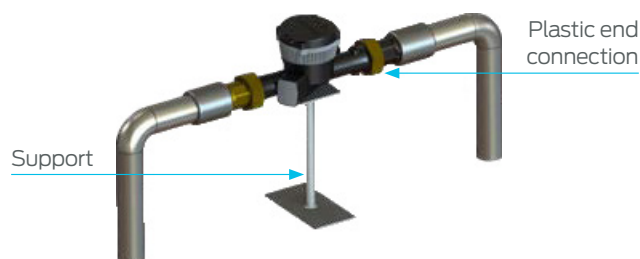
6. Please start to tighten the end connections by hand. Final tightening will be with no more than 100Nm torque.



7. Please don't do any welding while the meter is connected to the pipe.



8. In case it is not possible to use plastic end connections (at least on one side), please support the meter as shown in the drawing below.



Installation

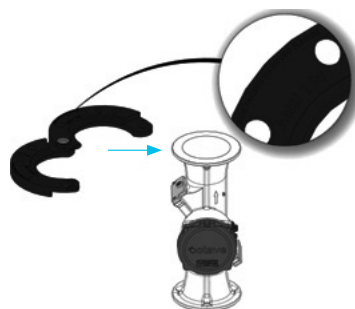
Stainless Steel Installation

Installation Method #1

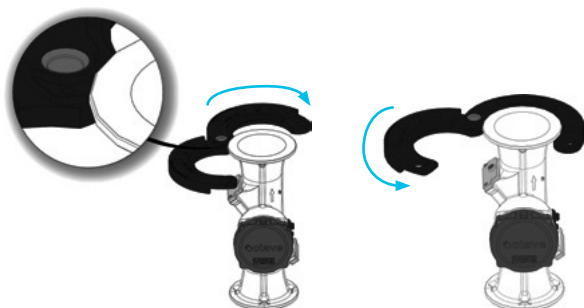
If flanges were previously installed on the Octave, proceed to step 4.

Step 1

1. Place the meter vertically on one of its ends.
2. Hold the floating flange in a way that the standard marking is facing up.

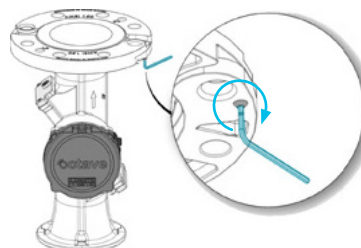
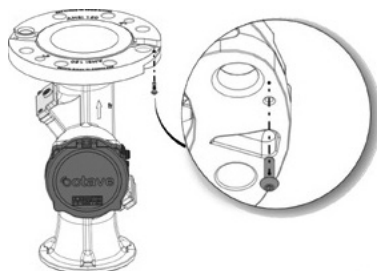


3. Assemble the floating flange on the meter so its ribs are located between the meter's ribs and the upper end.



Step 2

1. Insert M5 bolt as shown.
2. Seal the floating flange by screwing the attached M5 bolt at the designate thread.

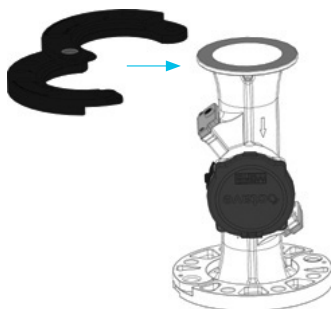


Installation

Installation Method #1

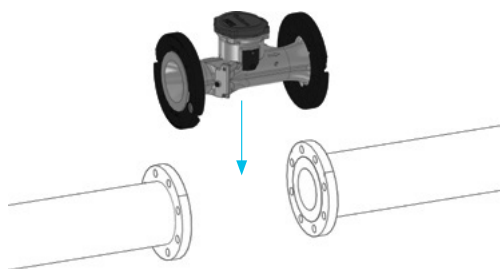
Step 3

1. Turn the meter over and repeat steps 1 to 2 for the other side of the meter.

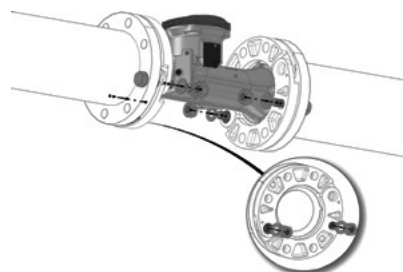


Step 4

1. Lower the meter into the pipeline.
2. Connect the floating flanges two lowest bolts to the pipeline flanges.

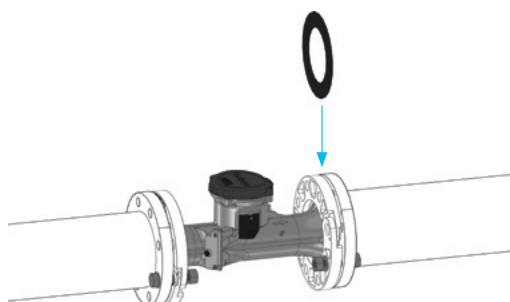


Note: the nuts should be tightened only one rotation to prevent the bolts from sliding out.



Step 5

1. Insert a gasket between the floating flange and the pipeline flange.

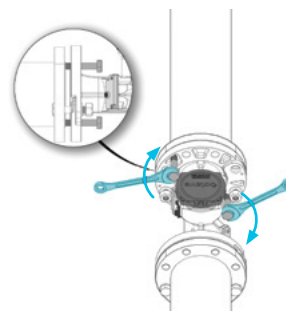
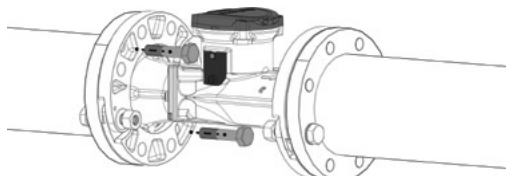


Installation

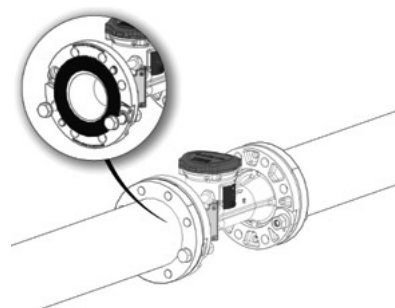
Installation Method #1

Step 6

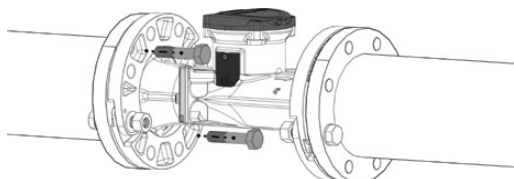
1. In order to easily insert a gasket, screw two "pushing" bolts at the floating flange designate threads.
2. Tighten the bolts in order to enlarge the gap between the meter and the pipeline.



3. Insert a gasket between the floating flange and the pipeline flange.
4. The gasket will then sit between the flanges as shown.

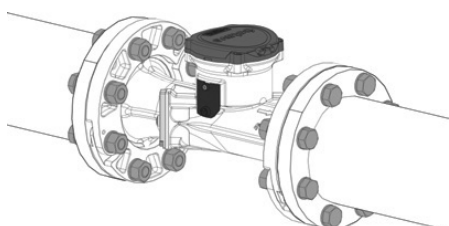


5. Unscrew the "pushing" bolts from the designated threads.



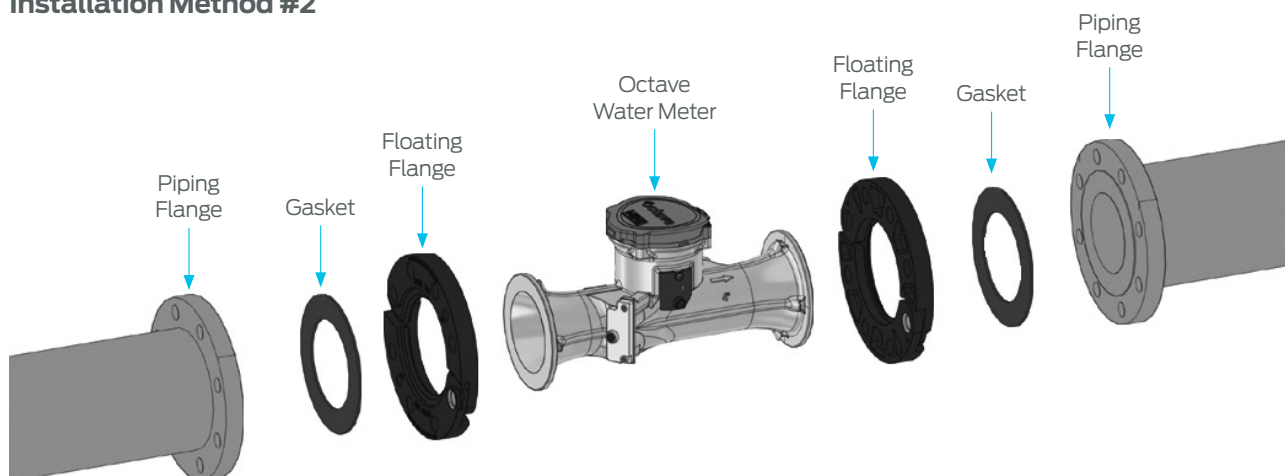
Step 7

1. Install the remaining nuts and bolts to the flanges and tighten them all the way.



Installation

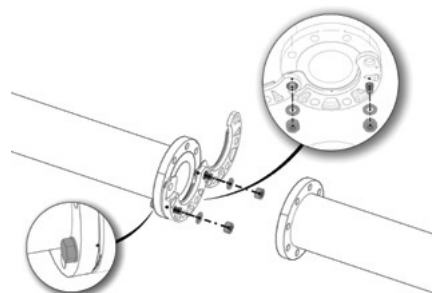
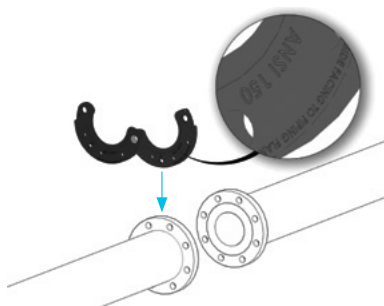
Installation Method #2



Step 1

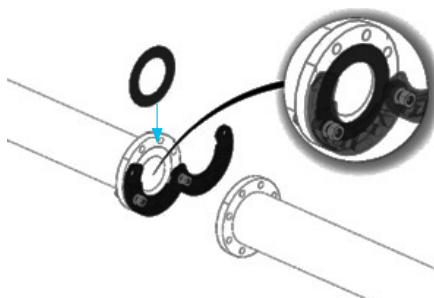
1. Place the first floating flange on the pipeline in a way that the standard marking is facing to the pipeline and the threads are vertical.
2. Connect floating flanges two lowest bolts to the pipeline flanges.

Note: the nuts should be tightened only one rotation to prevent the bolts from sliding out.



Step 2

1. Insert a gasket between the floating flange and the pipeline flange.

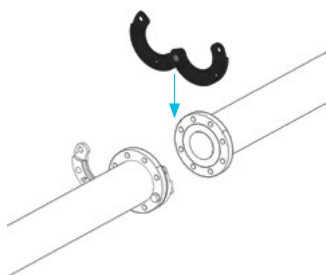


Installation

Installation Method #2

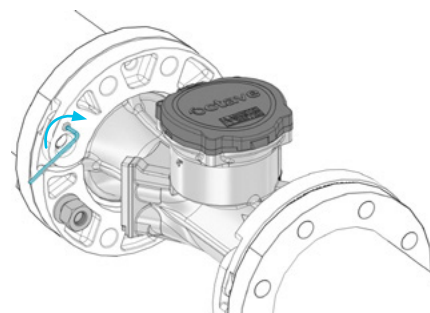
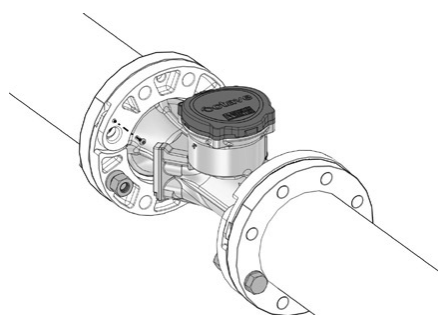
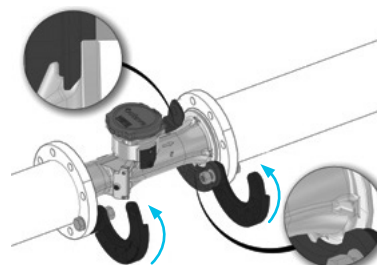
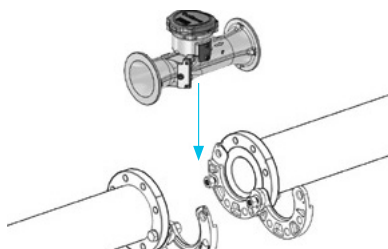
Step 3

1. Place the second floating flange on the pipeline in a way that the standard marking is facing to the pipeline and the threads are horizontal.
 2. Connect floating flanges two lowest bolts to the pipeline flanges.
- Note:** the nuts should be tightened only one rotation to prevent the bolts from sliding out.



Step 4

1. Lower the meter to the pipeline.
2. Close the floating flanges.
3. Insert M5 bolt as shown.
4. Seal the floating flange by screwing the attached M5 bolt at the designate thread. Repeat actions 3 to 4 for the other side of the meter.

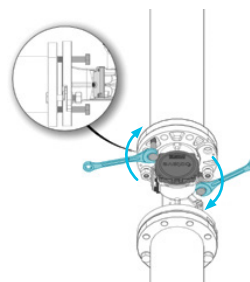
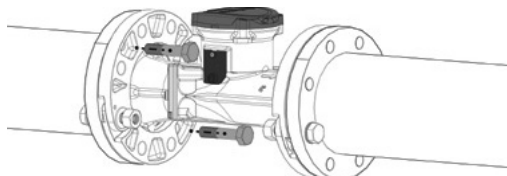


Installation

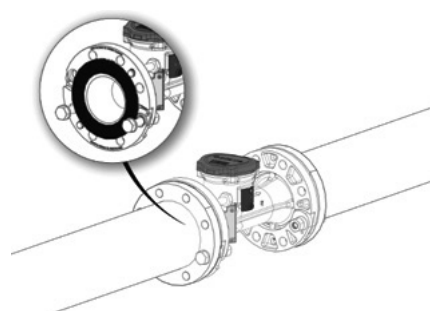
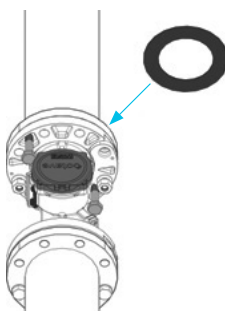
Installation Method #2

Step 5

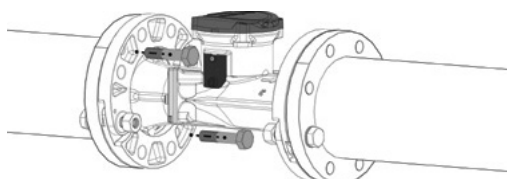
1. In order to easily insert a gasket, screw two "pushing" bolts at the floating flange designate threads.
2. Tighten the bolts in order to enlarge the gap between the meter and the pipeline.



3. Insert a gasket between the floating flange and the pipeline flange.
4. The gasket will then sit between the flanges as shown.

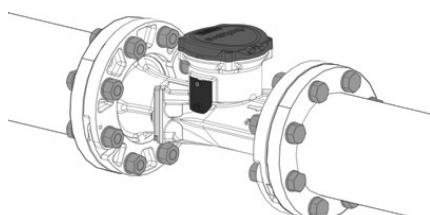


5. Unscrew the "pushing" bolts from the designated threads.



Step 6

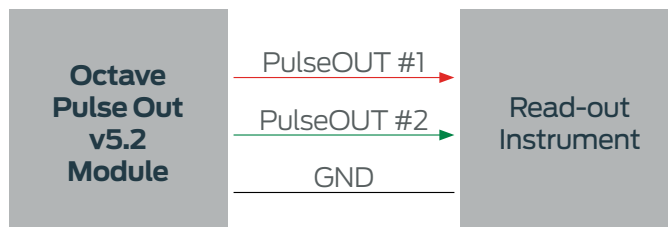
1. Install the remaining nuts and bolts to the flanges and tighten them all the way.



Electrical Outputs

Open Drain Dual Output

Connections Diagram



Cables

Signal connection polarity is mandatory!

Long Cable	Wire	Function
	Red	PulseOUT #1
	Green	PulseOUT #2
	Black	GND

Output Characteristics

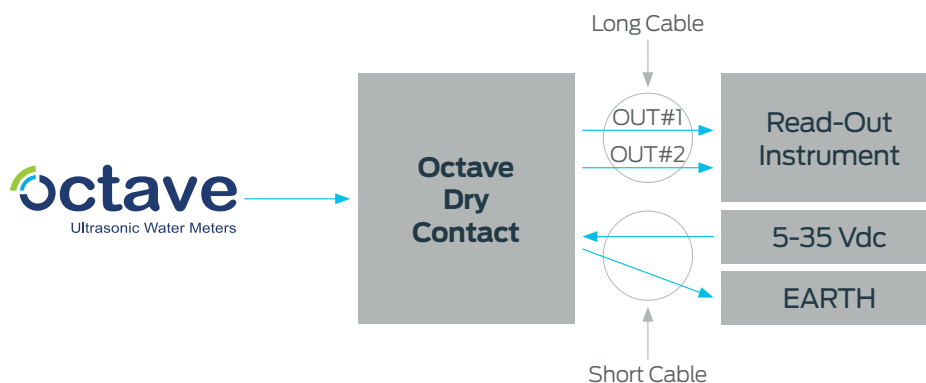
OUTPUT TYPE	OPEN DRAIN
Cable Length – Supplied	1.5/5 [meter]
Maximum Cable Length*	500 [meter]
Maximum Applied Voltage	35 [Vdc]

* Cable Teldor PN 8005003101 or similar

Electrical Outputs

Dry Contact Dual Output

Connections Diagram



Cables

*Signal connection polarity is mandatory!

	Wire	Function
Long Cable	Red + Orange	OUT#1
	Black + Brown	OUT#2
Short Cable*	Red	5-35V+
	Black	5-35V-
	Yellow	Earth

Output Characteristics

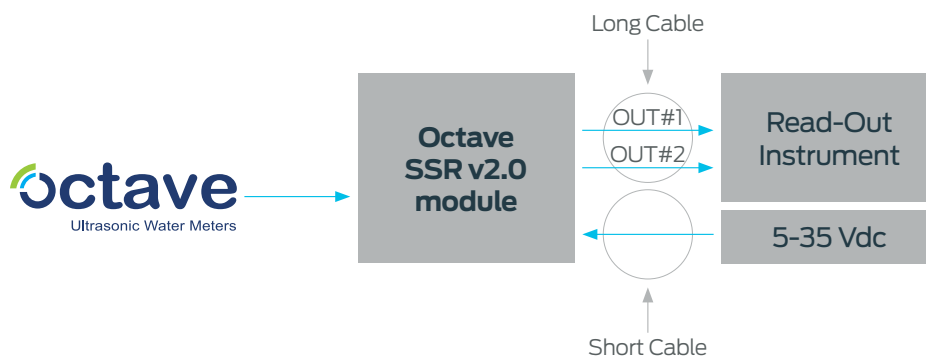
OUTPUT TYPE	DRY CONTACT
Cable Length – Supplied	1.5/5 [meter]
Maximum Cable Length*	500 [meter]
Supply Voltage	5-35 [Vdc]
Switching Power – Maximum	15 [Watt]
Life Expectancy	10 ⁹ [Cycles]

* Cable Teldor PN 8005003101 or similar

Electrical Outputs

SSR Dual Output

Connections Diagram



Cables

*Signal connection polarity is mandatory!

	Wire	Function
Long Cable	Red + Orange	OUT#1
	Black + Brown	OUT#2
Short Cable*	Red	5-35V+
	Black	5-35V-

*Optional

Output Characteristics

OUTPUT TYPE	BI-DIRECTIONAL SOLID STATE RELAY
On-Resistance – Maximum	25 [Ω]
Minimum Pulse Width	10 [msec]
Output current – Maximum	120 [mA]
Total Power Dissipation – Maximum	800 [mW]
Supply Voltage	5-35 [Vdc]
Cable Length – supplied	1.5 [meter]
Maximum Cable Length*	500 [meter]

* Cable Teldor PN 8005003101 or similar

Electrical Outputs

SSR Dual Output

The SSR module is powered by internal battery. External power supply in a range of 5-35Vdc could be used for certain Pulse parameters and Flow Rate combination. Pulse resolution or Pulse width are directly affect the internal battery lifetime.

The following setup examples showing the calculated internal battery lifetime for 10 and 5 years:

10 YEARS	NO. OF OUTPUTS	Q4 [m3/h]	PULSE RESOLUTION [m3/pulse]	PULSE WIDTH [msec]	CALCULATED BATTERY LIFETIME [YEARS]
DN-50	2	50	0.01	30	11.4
	2	50	0.01	30	11.4
DN-80	2	80	0.01	20	10.7
DN-100	2	125	0.01	12	11.4

5 YEARS	NO. OF OUTPUTS	Q4 [m3/h]	PULSE RESOLUTION [m3/pulse]	PULSE WIDTH [msec]	CALCULATED BATTERY LIFETIME [YEARS]
DN-50	2	50	0.01	7	5.1
	2	50	0.01	70	5.1
DN-80	2	80	0.01	45	5.0
DN-100	2	125	0.01	30	4.8

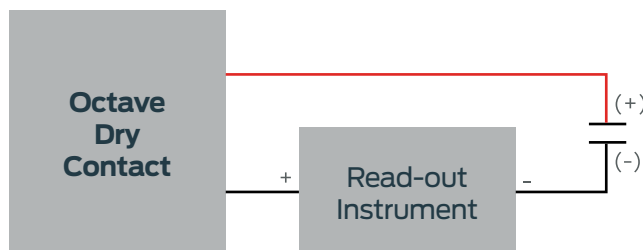
Electrical Outputs

Analog Output (4-20mA)

- The current output is a passive 4-20mA. Power needs to be supplied by the customer.
- 4mA is always "0" (zero) flow and the 20mA is programmable according to the customer requirements. (If the customer did not specify, the 20mA will be the maximum flow rate).

Indoor Installation

Connections Diagram



Cables

*Signal connection polarity is mandatory!

Wire	Function
Red	Current Loop +
Black	Current Loop -

Output Characteristics

OUTPUT TYPE	4-20mA CURRENT OUTPUT
Supplied Cable Length	1.5 [meter]
Maximum Cable Length*	500 [meter]
Loop Supply Voltage	12 - 24 [Vdc]
Output Impedance	25 [MΩ] typ

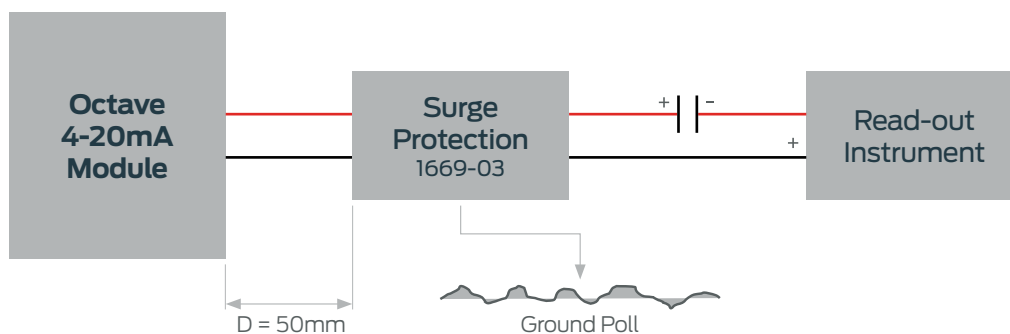
* Cable Teldor PN 8005003101 or similar

Electrical Outputs

Analog Output (4-20mA)

Outdoor Installation

Connections Diagram



Cables

*Signal connection polarity is mandatory!

Wire	Function
Red	Current Loop +
Black	Current Loop -

Surge Protector

In regions with potential surge and lightnings it is suggested to add Surge Protector of type – Bourns 1669-03.

Important: Assembly distance from the Octave 20-4mA module - no more than 100mm!

- The protector wiring is AWG #20 (0.5 mm²).
- The solid colored red and black wires are to be connected to the 4-20mA module output, while the striped red/white and black/white wires (the 'protected' output) connect to the terminals of the field device.
- Minimize looping of the solid colored input and ground conductors to reduce field coupling of surges into the protected output.

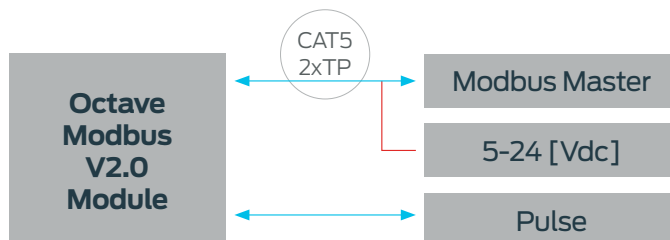
Grounding

- The protector body (stainless steel nipple) and green wire are electrically common.
- The green wire should connect to a grounding pole verified by the electricity local company.
- The green ground wire should be a 2.5 mm diameter at least.

Electrical Outputs

Modbus Output

Connections Diagram



Cables

	Wire	Function
ModBus	Blue	D0/A/Tx+
	White / Blue	D1/B/Tx-
	Orange	5-24Vdc
	White/Orange	Ground
Pulse*	Red	Pulse Out
	Black	Ground

*Optional

Output Characteristics

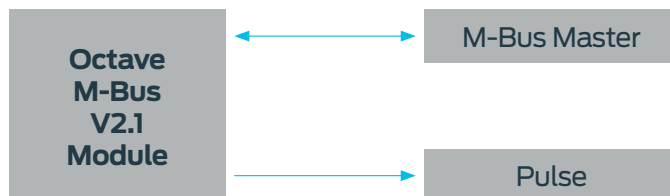
OUTPUT TYPE	RS485
Max Baud Rate	9600 [BPS]
Max Power Consumption	80 [mW]
Supply Voltage Range	5 - 24 [Vdc]
Max Cable Length	1000 [Meter]

* Cable Teldor PN 8005003101 or similar

Electrical Outputs

M-Bus Output

Connections Diagram



Cables

M-Bus	Wire	Function
	Red	BUSL1
Pulse*	Red	Pulse Out
	Black	Ground

*Optional

Output Characteristics

OUTPUT TYPE	RS485
Maximum Baud Rate	9600 [BPS]
Maximum Power Consumption	80 [mW]
M-Bus Voltage	24 – 36 [Vdc]
Maximum Cable Length*	3 [Meter]

* Cable Teldor PN 8005003101 or similar

Module Replacement / Mounting Manual

Instructions

1. Properly dry the area of the connector.



2. Remove seal cover from the screw using tool with sharp edge.
3. Remove the screws using Allen key 3mm.
4. Remove the module/cover.
5. Properly dry again the area of the connector.
6. Make sure the module o-ring is in position.
If not, Insert new o-ring into the module. The o-ring must be lubricated (silicone grease).



7. Attach module to the connector.



8. Tight both screws by hand only, using Allen key 3 mm to achieve symmetric o-ring pressure, then apply the torque 2 N*m with torque wrench.



9. Insert seal cover onto the screw.





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