Octave Installation Guide

Category: C & I Metering

Type: Installation Manual

Issue: Operation

Version 04.16

Table of Contents

1.1 Introduction

Thank you for choosing Master Meter's Octave Ultrasonic Meter. This unique design delivers precise flow measurement without any moving parts for long life, sustained accuracy and exceptional performance. The following information within this guide will help you gain a better understanding of the many features and capabilities your new Octave Ultrasonic meter has to offer.

1.2 Package Contents and Documentation

- One complete Octave Ultrasonic Flow Meter (meter body with integral electronics), size as indicated on the packaging box.
- Condensed Octave User Installation Guide.
- Certificate of calibration data
- (Optional) If specified at the time of order; one output module for either encoder, pulse or 4-20 mA communication will come factory attached the Octave.

1.3 General Safety

Prior to installation of your new Octave Ultrasonic Meter please consider the following;

- 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 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 Master Meter representative.
- There are no operator-serviceable parts inside this product.

1.4 Unpacking Instructions and Inspection

This product has been thoroughly inspected and tested prior to shipment and is ready for operation. After carefully unpacking the meter, inspect all contents for shipping damage before attempting to install. If here is any indication of physical damage found, immediately contact the responsible transportation service and your local Master Meter representative. **Note**: *The LCD display remains active for the life of the meter. If the display is not on, this may be an indication of damage during shipment.*

2.1 Measurement Method

The Octave's measurement method is based on an ultrasonic, transit time, wide beam sensor array which determines the length of time it takes an ultrasonic sound wave to travel the distance between the two sensors located in the meter's body. The two sensors function as both the transmitter and the receiver, each one alternating these functions so that the ultrasonic wave travels both with and against the direction of the flow. Ultrasonic waves travel slower against the flow than with the flow, thus the time difference of two waves traveling with and against the flow leads to determining the velocity and volume of the water.

Note: These sensors are ultra-sensitive; they are not designed to be modified by the user. Any modifications void warranty on this product.

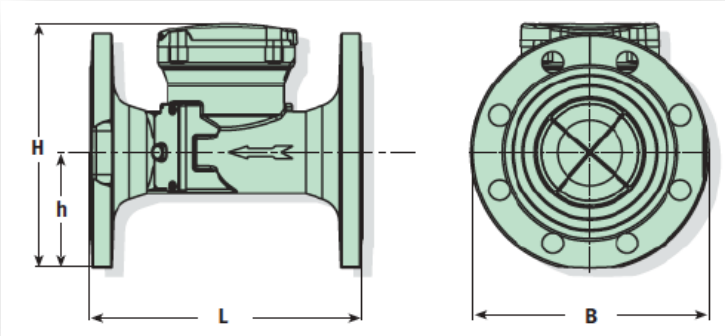
- The Octave ultrasonic flow meter is a battery-powered, precision flow meter designed for linear, bidirectional flow measurement of water.
- Flow measurement data is communicated through standard digital pulse or analog output.
- The Octave can be set up for a wide range of applications.

2.2 Mechanical Data

Maximum Working Pressure	175 PSI
Liquid Temperature	32° F - 122° F (0° C to 50° C)
Referenced Standards	Meets ANSI / AWWA Standard C750-10, ISO 4064 rev. 2005
Configuration	Compact - Display built into unit
Power Source	2 x D size Lithium Thionyl Chloride batteries - 10 year warranted life time
Environmental Protection	NEMA 6P+ (IP68+), Ambient operation temperature -13° F to 131° F (-25° C to 55° C) for the display
Data Units	Multi-line 12 digit Liquid Crystal Display (LCD) - *Programmable USG, Imperial Gallons, Cubic Feet, Cubic Meters, Barrels, Acre Feet or Acre Inch for Volume and GPM, Lt/s,Lt/m or M^3/h for rate of flow.*
Volume Display Options	1. Net Volume (Forward measurement minus reverse) 2. Forward Only 3. Alternating Flow (Forward and Reverse flow displayed separately)
Flanges	ANSI / AWWA C702 • 2" Oval Type • 3" – 12" Round Type
Meter Body Construction	Epoxy coated Ductile Iron or Grade 316 Stainless Steel
Output (optional)	1. Dual Digital Pulses (Open Drain or Dry Contact) 2. 4-20 mA (Powered loop) 3. Encoder Output (up to 8 digit encoded readings)

2.3 Dimensions

Model	Octave							
Nominal Size	2" SS (50 mm)	2" DI (50 mm)	3" (80 mm)	4" (100 mm)	6" (150 mm)	8" (200 mm)	10" (250 mm)	12" (300 mm)
L - Length	10" (250 mm)	17" (432 mm)	12" (305 mm)	14" (356 mm)	18" (457 mm)	20" (508 mm)	17 3/4" (451 mm)	19 3/4" (502 mm)
B - Width	5 3/4" (146 mm)	5 3/4" (146 mm)	7 1/2" (190 mm)	9" (229 mm)	11" (280 mm)	13 1/2" (343 mm)	16" (406 mm)	19 3/4" (502 mm)
H - Height	6 3/4" (172 mm)	6 3/4" (172 mm)	8 1/2" (216 mm)	9 7/8" (250 mm)	10 7/8" (276 mm)	12 7/8" (327 mm)	16 1/2" (419 mm)	19 3/4" (502 mm)
h - Height	2 1/8" (54 mm)	2 1/8" (54 mm)	3 1/2" (90 mm)	4 1/2" (115 mm)	5 1/8" (130 mm)	6 3/8" (162 mm)	8" (203 mm)	9 7/8" (251 mm)
Weight - Ductile Iron	N/A	24 lbs. (11 kg)	36 lbs. (16 kg)	48.5 lbs. (22 kg)	76 lbs. (34 kg)	108 lbs. (49 kg)	150 lbs. (68 kg)	210 lbs. (96 kg)
Weight - Stainless Steel	15 lbs (7 kg)	N/A	28 lbs (13 kg)	40 lbs. (18 kg)	62 lbs. (28 kg)	88 lbs. (40 kg)	N/A	N/A



2.4 Pipe Flanges

Refer to dimensional chart for flange spacing and allow for thickness of gaskets. Install flow meter in line with pipe center line. Pipe flange faces must be parallel to each other. Permissible lay length variation: Lmax - Lmin ≤ 0.02” (0.5 mm).

3.1 Pre-Installation

Prior to installation check the following:

- Flow rate and volume units are correctly programmed.
- The flow meter is correctly installed per the installation location and position recommendations.
- Output modules are correctly attached.

3.2 Handling of Octave

IMPORTANT:

- **DO NOT** use chains or wire cable to lift the Octave. To protect the epoxy coating, *only use a nylon lifting strap* with appropriate weight capacity.
- **DO NOT** lift the Octave by the electronic housing unit.
- **DO NOT** carry the Octave by its lid.
- **DO NOT** use bolt holes for grip when carrying the Octave.
- **DO NOT** position the flow meter on its electronic housing unit.
- When bolting the meter to pipe flanges, **use washers on both nuts and bolts** to protect the epoxy coating of the Octave.
- When handling the flow meter **avoid hard blows**, jolts or impact.

3.3 Installation Notes

The measuring tube should be completely full at all times for proper flow measurements. When sensors are not wet this will show a loss of signal. However, there is no damage when this occurs and the meter will not measure.

FLOW DIRECTION: The Octave is a bi-directional flow meter. **Note** the indicating arrow for forward and backward flows.

Master Meter recommends keeping the lid closed in case of direct sunlight exposure. However, no direct damage will occur while the lid is open temporarily.

Do not expose the meter to excessive vibration. To prevent this from occurring, support the connection pipe spools on both ends of the flow meter.

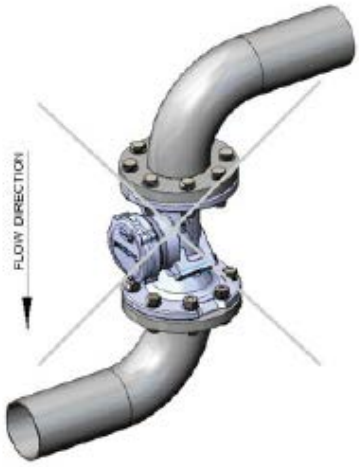
To avoid measuring errors and malfunctioning of the flow meter due to air or an empty pipe, please observe the following precautions:

- Installation of the flow meter should be at the lowest point of the system, if possible, since air will be collected at the highest point of a system.
- If possible, maintain positive back pressure in meter outlet piping.
- In order to avoid cavitation, always install control valves downstream of the flow meter and never install the flow meter on a pump suction side.

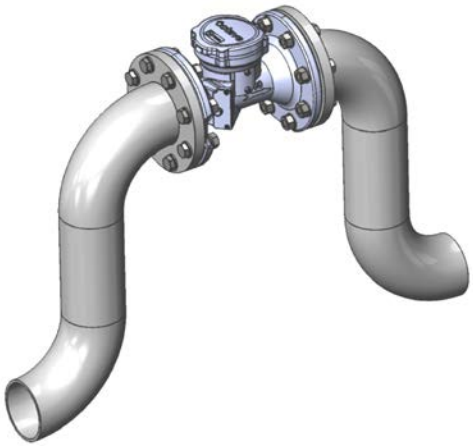
3.4 Installation Location & Position

Proper Installation

Improper Installation



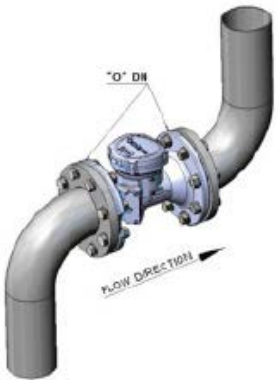
Conditional Installation



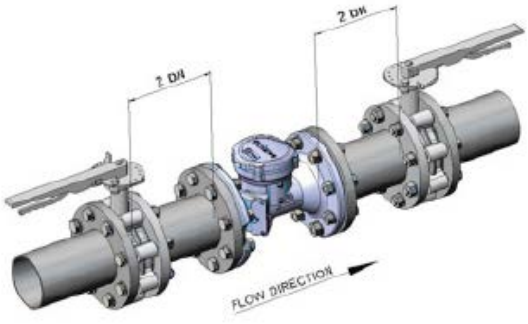
Proper Installation: If this is not the highest point in the system or a hydraulic jump has been installed to keep the flow meter full. **T**he system has back pressured.

Improper Installation: 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.

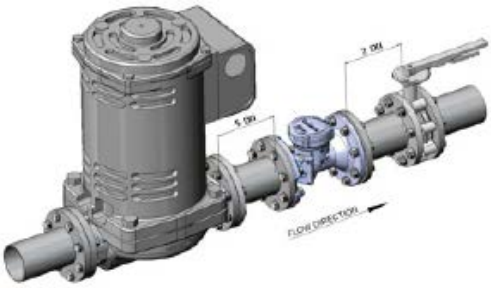
3.5 Additional installation requirements



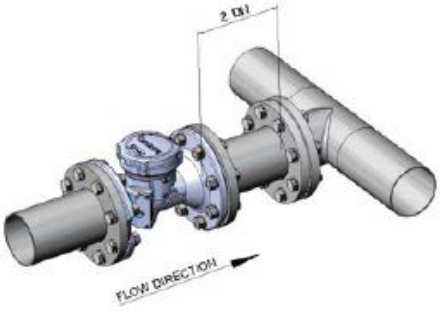
Zero (0) pipe diameters permitted before & after elbows (90°)



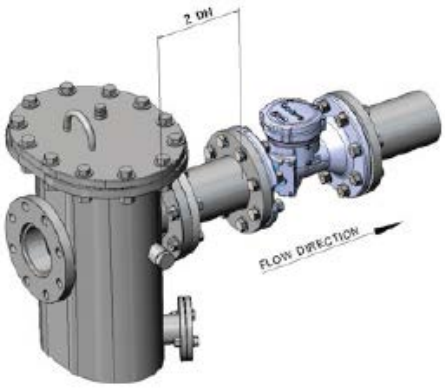
Minimum of two (2) pipe diameters before or after isolation valves Open bore valves, such as resilient wedge gate valves can be bolted directly to the meter.



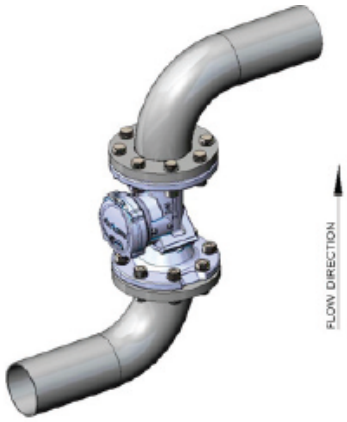
Minimum of five (5) pipe diameters after pump discharge.



Minimum of two (2) pipe diameters before tee connections, including test tees.



Minimum of two (2) pipe diameters before or after strainers for ISO version Octaves (primarily sold outside North American Market). AWWA length Octaves (primarily sold in North American markets) may be bolted directly to a strainer.

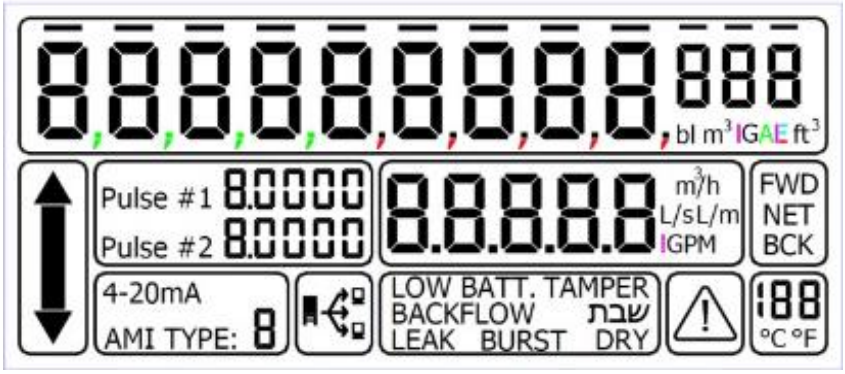


Zero (0) pipe diameters before and after elbows (90°) in vertical installations

4.1 Digital Display

The Octave meter comes with a factory programmable digital display built to your specifications. At the time of order you can select:

- **Volume units** in US gallons, Imperial gallons, Cubic Feet, Cubic Meters, Barrels, Acre Feet or Acre Feet
  - US Gallons will display a constant GAL in the top right corner of the LCD
  - Imperial Gallons will display a constant IGAL in the top right corner of the LCD
- **Rate of flow measurement** in US Gallons per Minute, Imperial Gallons per Minute, Liters per Second, Liters per Minute or Cubic Meters per Hour
- **A programmable decimal** with flow measurement as low as 0.001, 1/1000th of a measurement unit.
- **Single output mode** in either encoder (UI1203), digital pulse for open drain or dry contact, 4-20 mA, or no output mode
- **Volume Display Option** in either Net Flow, Forward Only, or Alternating.




Flow Direction


Communication

Volume Units

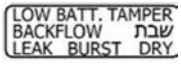
Flow Rate Units


Empty Pipe / Error

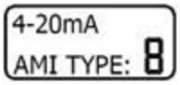
Pulse Resolution

Accumulation Mode

Water Temperature



Alarms / Alerts

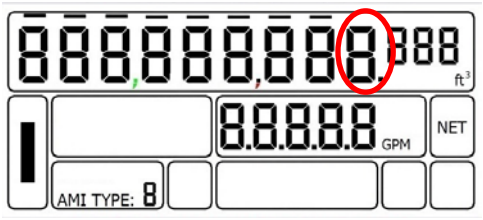


Additional Output Modes

4.2 Display Resolution

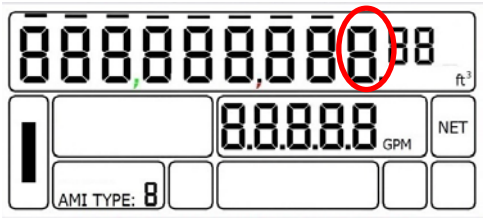
The Octave meter comes with 12 digit resolution; leading zeros will be displayed. At the time of purchase you can select one of the following options for display resolution.

1) Default Display - (lowest resolution = 0.001 unit)



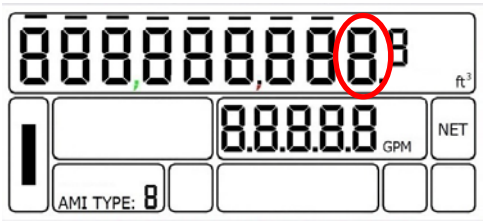
The circled value equals 1 USG, IGAL, ft^3, m^3, Barrel, AI, or AF

2) Optional Display - (lowest resolution = 0.01 unit)



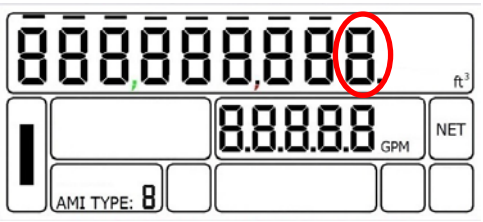
The circled value equals 1 USG, IGAL, ft^3, m^3, Barrel, AI, or AF

3) Optional Display - (lowest resolution = 0.1 unit)



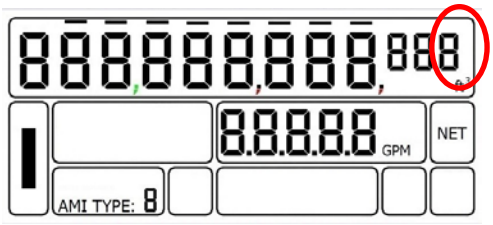
The circled value equals 1 USG, IGAL, ft^3, m^3, Barrel, AI, or AF

4) Optional Display - (lowest resolution = 1 unit)



The circled value equals 1 USG, IGAL, ft^3, m^3, Barrel, AI, or AF

5) Optional Display - (lowest resolution = 1 unit)
Only available in Octave Firmware 4.01 or greater



The circled value equals 1 USG, IGAL, ft^3, m^3, Barrel, AI, or AF

4.3 Volume Display Options

The Octaves offers the ability to choose how volume is measured. At the time of purchase, you may select one of the following.

i. **Net Volume (Master Meter Default)** – The meter measures both forward and reverse flow. If backward flow is detected, the totalizer will begin to decrease.

ii. **Forward Flow Only** – The meter measures forward flow only. Reverse flow is disregarded.

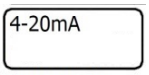
iii. **Alternating Flow** – The totalizer will display only forward flow, then toggle to display only reverse flow. The timing of the how long each measurement is displayed is programmable with this software version.

4.4 Communication Output Modes

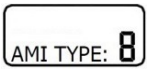
All Octave flow meters are available with one of the optional data output array listed below. This section describes the visual representation on the register display to determine the communication output mode of the flow meter.

i. **Pulse Output (See Section 4.5 for Open Drain and Section 4.6 for Dry Contact)** – When the Octave is in Pulse output, this icon will always be illuminated.

ii. **4-20 mA Output (See Section 4.7)** – When the Octave is in 4-20 mA output, this icon will always be illuminated.



iii. **Encoder Output (See Section 4.8)** – When the Octave is in encoder output, this icon will always be illuminated.

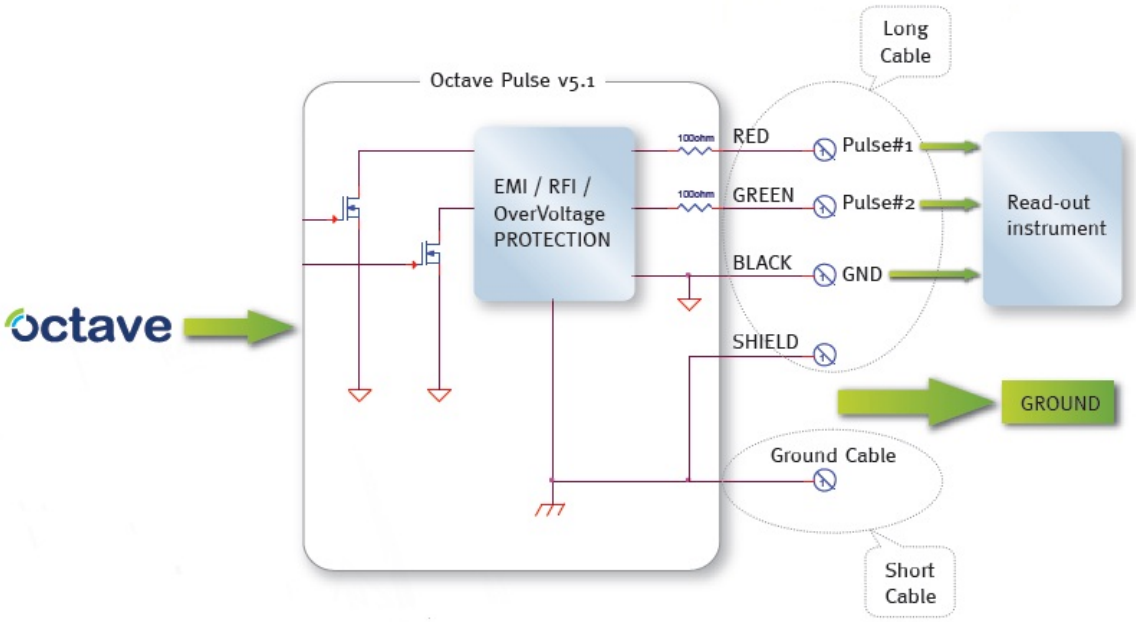


iv. **No Output (See Section 4.9)** – When the Octave is not sending a communication signal, this box will be empty.

4.5 Pulse Output (Open Drain)

Pulse #1 8.0000
Pulse #2 8.0000

Pulse Type: Open Drain that allows current loading of 200 mA, and up to 30 VDC.



Pulse Module Wire Colors

	Wire Color	Function
Long cable	Red	Pulse Out #1
	Green	Pulse Out #2
	Black	Common
	Bare Wire	Shield
Short cable	Ring Terminal	Ground

Warning: Signal connection polarity is mandatory

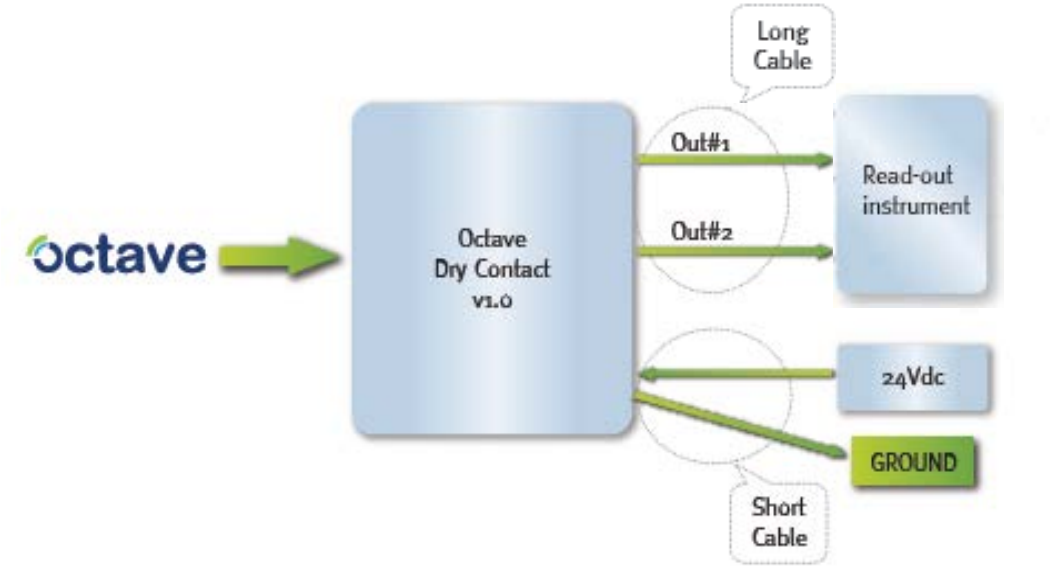
Output Characteristics

Output Type	Open drain
Cable Length - Supplied	4 feet
Maximum Cable Length*	1,640 feet
Maximum Supply Voltage	30 VDC

* The maximum cable length depends on: cable type, controller, and electrical noise level.

4.6 Pulse Output (Dry Contact)

Pulse Type: Dry Contact that allows current loading of 200 mA, and up to 24 volts.



Pulse Module Wire Colors

	Wire Color	Function
Long cable	Red	Output #1
	Orange	Output #1
	Black	Output #2
	Brown	Output #2
Short cable	Red	24V +
	Black	24V -
	Yellow	GROUND

Warning: Signal Polarity is mandatory on Short Cable wires but is not mandatory on Long Cable wires.

Output Characteristics

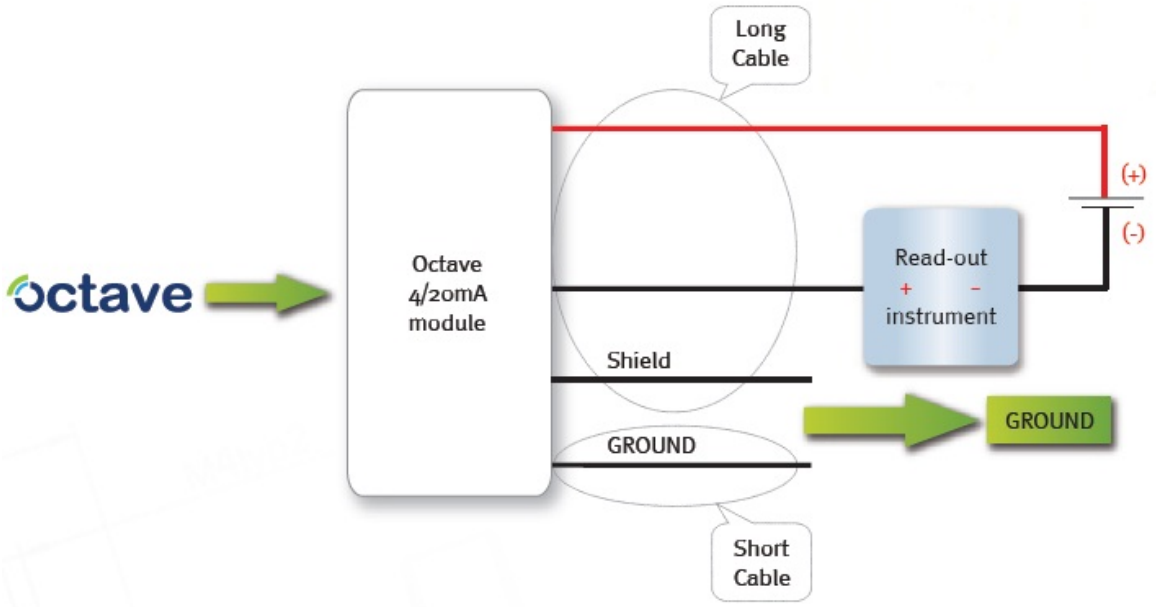
Output Type	Dry Contact
Cable Length - Supplied	4 feet
Maximum Cable Length*	1,640 feet
Maximum Supply Voltage	24 VDC

* The maximum cable length depends on: cable type, controller, and electrical noise level.

4.7 4-20 mA Output (Analog Communication)

4-20mA

The current output is a passive 4-20 mA. 4 mA is always "0" (zero) flow and the 20 mA is factory programmable according to the customer's requirements. (If the customer has not specified the 20 mA at the time of order, the Octave will be programmed with the 20 mA at the max flow of the meter.)



4-20 Module Wire Colors

	Wire Color	Function
Long cable	Red	Current loop +
	Black	Current loop -
	Bare Wire	Shield
Short cable	Ring Terminal	Ground

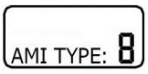
Warning: Signal connection polarity is mandatory

Output Characteristics

Output Type	4-20 mA passive current output
Cable Length - Supplied	4 feet
Maximum Cable Length*	1,640 feet
Loop Supply Voltage	12 - 24 VDC
Output Impedance	25 (mΩ) typ.

* The maximum cable length depends on: cable type, controller, and electrical noise level.

4.8 Encoder Output



- UI1203 encoder open communication, with a maximum reading up to 8 digits, depending on the output of the externally attached module
- Encoder digits are represented by lines above each digit transmitted to an AMR or AMI.
- Serial communication collector
- Data output line is a solid state switch requiring external pull-up
- AMI Type for Encoder is : 0

Encoder Module Wire Colors

Wire	Function
Red	**Power**
Green	**Data**
Black	**Ground**

Output Characteristics

Output Type	Encoder
Cable Length - Supplied	4 feet
Maximum Supply Voltage	15 Vdc
Maximum Power Load	.04 Vdc

4.9 No Output (Manual Read)

The Octave meter can be programmed to not send a communication signal at the customer's request; however Master Meter recommends selecting a communication mode for future migration to AMR or AMI.

4.10 Output Module Installation (Optional)

All Octave water meters are shipped with either a cover plate or communication module installed on the side of each meter. Even if the meter is not going to be read by radio or some other electronic unit, it is important to leave one of these devices installed on the Octave to prevent damage to the communication port. **Installing an Octave without a cover plate or communication module would void any warranty.**

If you received an Output Module separate from your Octave meter, please follow the steps below to ensure proper installation of the module. Read through these instructions before attempting to remove the cover plate. Your module came as a complete installation kit with the supplies shown in Pic. 1.

Octave Output Module Installation Parts

Pic. 1

Step 1: Remove the Sealing Cap from the cover plate (Pic. 2).

Step 2: Using the 3mm Allen Key provided, remove the cover plate (Pic. 3). Keep the cover plate and 3mm x 15mm screws for future use. The communication port is now exposed. (Pic. 4)

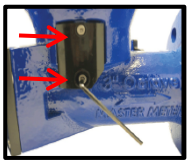
Step 3: Place O-Ring around the 4-prong plug of the output module. (Pic. 5 & 6)

Step 4: Insert Output Module into the communication port (Pic. 7), with the cable pointing down. This will allow the slot inside the communication port to align with the groove on the module. Do not force the module into the communication port. This may cause damage to the pins. Secure into place using the 3mm x 20mm screws provided. Tighten until the screws stop. (Pic. 8)

Step 5: Push the Sealing Cap into the lower screw hole (Pic. 9). Lock the Sealing Cap in place by firmly pushing in into place or gently tapping it in with a small hammer.

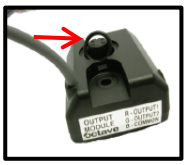
Note: If at any time the module needs to be removed, take caution not to allow dirt or water into the communication port. If the module is going to be removed for an extended period of time, reinstall the cover plate and the 3mm x 15mm screws.

Pic. 2



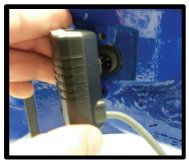
Pic. 3

Pic. 4

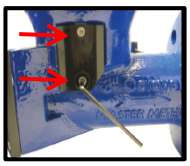


Pic. 5

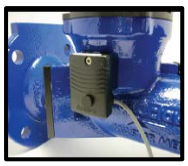
Pic. 6



Pic. 7



Pic. 8



Pic. 9

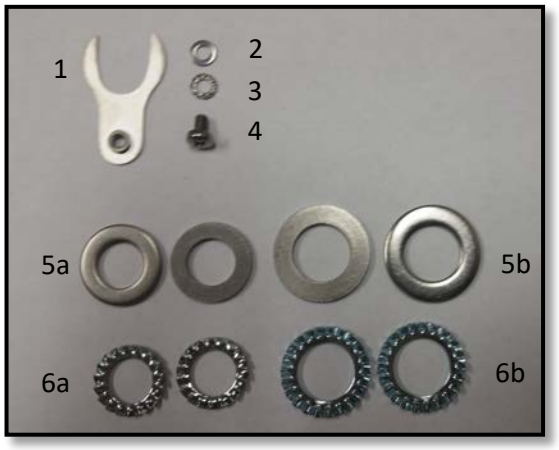
4.11 Ground Mounting Clip Installation (Available only on Pulse and 4-20 Output Modules)

All Pulse modules and 4-20 Modules have a GROUND cable that must be installed to prevent the interference of electronic noise. GROUND cables are not included on encoder modules. Please follow the steps below to ensure proper installation of the GROUND cable.
**Note – GROUND cables do not have an effect on accurate flow measurement from the meter. These GROUND cables are provided to stabilize electrical outputs.*

Ground Cable Installation Parts

1. Fork Terminal Lug
2. 5 mm flat washer
3. 5 mm lock washer
4. 5 mm screw

5a. 16 mm flat washer (qty. 2)
5b. 20 mm flat washer (qty. 2)
6a. 16 mm lock washer (qty. 2)
6b. 20 mm lock washer (qty. 2)



Pic. 1

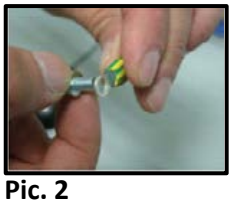
Step 1: Insert 5 mm screw into the ring terminal from the output module. (Pic.2)

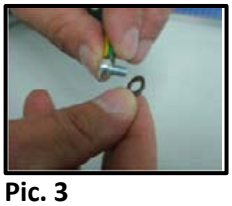
Step 2: Insert 5 mm flat washer (Pic 3), then 5 mm locking washer (Pic. 4) onto screw.

Step 3: Attach the flat end of the Fork Terminal Lug to the screw. Tighten with a Phillips Head screwdriver (Pic. 5)

Step 4: Select either the 16 mm or 20 mm flat and locking washers, use the size that best fits the bolts used for attaching the meter to the flange (bolts not provided). Insert flat washer then locking washer onto the bolt. Insert bolt into the hole on the pipe side of the flange.

Step 5: Insert Fork Terminal Lug in-between the flat washer and the lock washer on the flange side. Inserting a flat washer on opposite end and tightening in place with a nut (not provided). Do not use other locking nut on epoxy coated Octaves. For continuity, make sure fork terminal is in contact with metal and not a painted or epoxied pipe.


Pic. 2


Pic. 3


Pic. 4


Pic. 5

4.12 Wire Connectivity Chart

The following chart is designed to assist in wiring the Octave module to various AMR/AMI Radios. The Octave transmits up to 8 digit output encoder output. Pulse output resolution is available in resolutions of x0.1, x1, x10, x1,000, or x10,000.

By default Octave encoder modules are provided with Nicor connectors, however you may also select Itron Connectors, magnetic inductor coils for wall or pit mount, for bare wire. Nicor connectors are factory potted. All other connectors are spliced with water resistant heat shrink wrap.

Manufacturer	Model	Communication Type	Octave Red Wire	Octave Green Wire	Octave Black Wire
Aclara	Star 3000 Series	Encoder	Red	White	Black
	Star 3000 Series	Pulse	Red	N/A	Black or White
Badger	Orion	Encoder	Red	Green	Black
Datamatic	Firefly	Encoder	Red	White	Black
	Mosaic	Encoder	Red	Green	Black
Elster	MTU	Encoder	White	Red	Black
	MTU	Pulse	Red	White	Green
Hersey	Hot Rod	Encoder	Red	Green or White	Black
Itron	60w	Encoder	Green	Red	Unshielded
	60wp	Pulse	Red	N/A	White
	100w	Encoder	Grey	Brown	Yellow
Kemp Meeks	Visu-Link VL-9S	Pulse	Polarity does not matter - Connect Red and Black Wires to either terminal, disregard green wire		
	Visu-Link VL-9	Encoder	Red	Green	Black
Master Meter	Universal XTR	Encoder	Red	Green	Black
	Fast Pulse XTR	Pulse	Red	N/A	Black
	ReadPad		Red	N/A	Black
Metron Farnier (T2)	T2 M2w	Encoder	Red	Green	Black
Neptune	R900	Encoder	Black	Red	Green
Sensus	MXU Pit Unit	Encoder	Red	Green	Black
	MXU Wall Unit	Encoder	Red	Green	Black
	Touch Pad	Encoder	Red	Green	Black

**Note – when connecting to Master Meter's XTR, the Octave will typically output an 8 digit reading, unless otherwise specified. When connecting to another manufacturer's radio or read device, it is recommended to confirm with that provider what the actual reading resolution of the connecting device is.*