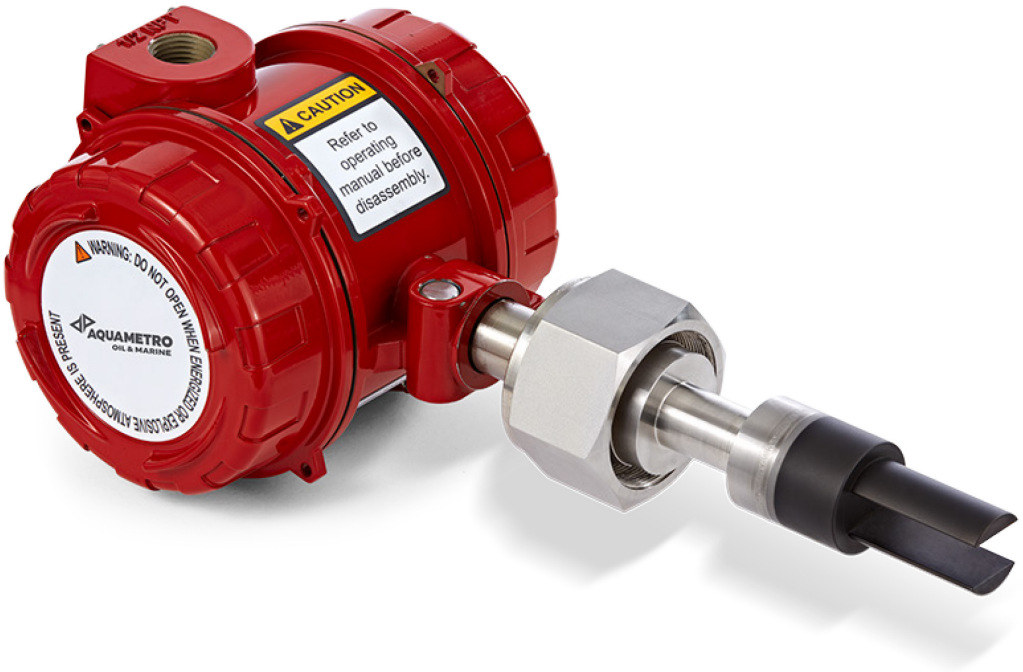
Version: VD 7-425 02.2021

Installation and Operation Manual

Viscosity Control System
Viscomaster™ / Viscomaster™ Dynamic

Fuel Viscosity System



Content

1 Introduction

Thank you for your decision to work with Aquametro Oil & Marine Viscosity System (VM).
This manual describes the installation, commissioning and use of Viscomaster™ Sensor of the Aquametro Viscosity System. For additional information, please contact your local sales agent.

1.1 Liability Disclaimer

The manufacturer cannot monitor the compliance to this manual as well as the conditions and methods during the installation, operation, usage and maintenance of the system regulator.
Improper installation can cause damages and endanger people. Therefore, we assume no responsibility and liability for losses, damages or costs that result due to incorrect installation, improper operation, usage and maintenance or in any manner associated therewith. Similarly, we assume no responsibility for patent right or other right infringements of third parties caused by usage of this system regulator. The manufacturer reserves the right, without prior notification, to make modifications concerning the product, technical data or installation and operating manual.

1.2 Safety precautions

Viscosity Control System components must only be used for their intended purpose and comply with local and international safety regulations. All documentation is to be followed exactly. None of the information stated here or elsewhere releases planners, installers and operators from their own careful and comprehensive assessment of the respective plant configuration in terms of functional capability and operational safety.

- Local applicable working regulations must be complied with, during all work on the plant and/or ship.
- All safety-, installation- and operation instruction as described in this manual must be followed.
- Sensors, actuators and control valves are sensitive instruments and should be treated carefully.
- When removing or reinstalling sensors or components from the Viscomaster System, safety instructions in the respective operating manual must be followed.
- Check the Viscosity Control System parts periodically for tightness of the connections and for proper functioning.
- The unit must be installed to 110 VAC or 230 VAC according to wiring diagram.
- Electrical wiring and installations are subject to statutory regulations, which must be taken into account when planning the system.
- Viscosity Control System is not for installation in zones subject to explosion hazards.
- If work is to be done on the installation, before each intervention release the pressure in the installation

This manual provides instruction for installation, start-up and operation of Aquametro Viscosity Control System part Viscomaster™ Sensor.

It is essential that this manual be thoroughly reviewed, with full comprehension of the matters explained herein, before attempting installation and start-up.

The materials and workmanship incorporated into the Aquametro Oil & Marine Viscosity Control System are designed to provide trouble-free service throughout the equipment lifetime. However, like any rotating equipment, satisfactory performance depends on correct initial sizing, proper installation and periodic inspection, monitoring of operating conditions (pressure, temperature, vibration, flow and electric power) and prescribed maintenance. This Manual has been prepared to assist the operator in understanding the workings of the Viscomaster® Sensor and provide direction for proper installation, start-up, operation and maintenance.

IMPORTANT SAFETY INFORMATION

WORK SAFE SYMBOL

This symbol will appear in this manual at all remarks for operational safety, where risks for health and life of personnel exist. Observe these points and proceed with caution in these cases.
Cautions should be identified to other users.

ATTENTION NOTICE

This symbol will appear in this manual where special attention must be paid in order to maintain a correct operating procedure and to avoid damage to the Viscosity Control System components and/or other plant equipment.

1.3 Receiving and Storage Requirements

Inspect Viscosity Control System components and separate delivered parts as soon as it is received.
Make notes and photos of damage (also package damages) or missing items.
File any claims with the transportation company immediately and notify vendor of the damages.

Normal packaging is designed to protect Viscosity Control System components and separate parts during shipping and storage. Upon receipt at customers' warehouse, store Viscomaster™ System components and separate parts indoors, in a sheltered and dry location.

2 Application

The Aquametro Oil & Marine Viscomaster Sensor is built to tackle the most demanding process and marine applications in viscosity control systems. It is built for the use in fuel oil systems to achieve high accurate measurements and control of the fuel oil viscosity.
Rugged and reliable with very low maintenance, the sensor provides fully integrated "fit and forget" viscosity measurement.
With available Retrofit kits for easy replacement of existing viscosity meter the greatest installation flexibility is given.

A Viscomaster™ may be part of a complete Aquametro Viscosity Control System. For instructions covering the other components of this system, refer to the separate MBA as supplied with these components.

2.1 Description of Viscomaster™ Sensor

The Aquametro HFVM Viscosity sensor family is a proven technology for the accurate, continuous real-time measurement and control of liquid viscosity. The HFVM Viscosity sensor has been designed for installation in fuel oil applications that supply engines, turbines, and burners in onshore and off-shore applications.
As part of its unique and rugged design, the HFVM Viscosity sensor directly measures dynamic viscosity and temperature/density. The meter is also programmable to output calculated density and kinematic viscosity measurements.
The HFVM Viscosity sensor can easily cope with a range of fuels from heavy fuel oil (HFO) to marine gas oil (MGO) and has worldwide marine industry approvals including Lloyds Register, GL, DNV, ABS, and BV.

Advantages

- Fully integrated “fit and forget” digital viscosity and temperature measurement for monitoring and control
- Two 4–20 mA outputs of kinematic viscosity and temperature/density
- Modbus/RS-485 communications output of all parameters, including calculated density and calculated kinematic viscosity at operating temperature
- Continuous measurement
- No moving parts means virtually no maintenance
- PFA-coated tines for asphaltene rich fuels
- Integral Class B PT100 temperature sensor
- Hazardous-area approved (ATEX and CSA)
- Insensitive to vibration
- Direct insertion meter suitable for high-line pressure
- PC configuration tools for diagnostics and data logging
- Controller with preadjusted selectable functions
- Adapter for existing Viscosity system or direct insertion
- Matched components for easy installation

Scope of Supply

Viscomaster	HFVM-B	Viscosity Sensor Dynamic For viscosity and temperature measurements
	HFVM-R	Viscosity Sensor For viscosity and density measurements
Standard Adapter	In-Line	The In-Line viscosity retrofit kit provides a simple, direct replacement for existing meters and the installation solution for new building
	Flow Through Chamber	The capillary viscosity retrofit kit provides a simple, direct replacement for existing capillary meters
	Flange	The flange adapter viscosity retrofit kit provides a simple, direct replacement for existing VAF or Nakakita viscosity meters

3 Viscosity Sensor installation / implementation

3.1 Planning

Topics covered in this chapter:

- Installation checklist
- Best practices
- Power requirements
- Other installation considerations
- Recommended installations for the HFVM
- Perform a pre-installation meter check

3.1.1 Installation checklist

- Verify the contents of the product shipment to confirm that you have all parts and information necessary for the installation.
- Verify that the meter calibration-type code corresponds to the pipe size. If it does not, measurement accuracy may be reduced due to the boundary effect.
- Make sure that all electrical safety requirements are met for the environment in which the meter will be installed.
- Make sure that the local ambient and process temperatures and process pressure are within the limits of the meter.
- Make sure that the hazardous area specified on the approval tag is suitable for the environment in which the meter will be installed.
- Make sure that you will have adequate access to the meter for verification and maintenance.
- Verify that you have all equipment necessary for your installation. Depending on your application, you may be required to install additional parts for optimal performance of the meter.

3.1.2 Best practices

The following information can help you get the most from your meter.

- Handle the meter with care. Follow local practices for lifting or moving the meter.
- If you have an HFVM with calibration code B (viscosity and density calibration), perform a Known Density Verification (KDV) check of the meter prior to installing the meter.
- For the DLC-coated tines, always fit the protective cover over the tines when the meter is not in use. The tine coating is not resistant to impact damage.
- Always store and transport the meter in its original packaging.
- Do not use liquids that are incompatible with the materials of construction.
- Do not expose the meter to excessive vibration (greater than 0.5 g continuously). Vibration levels in excess of 0.5 g can affect the meter accuracy.
- For optimal performance of the meter, ensure that operating conditions correspond to the meter calibration-type code and boundary.
- Ensure that all piping connections conform to the local and national regulations and codes of practice.
- Follow fluid velocity guidelines and install the tines vertically for side insertion.
- Properly tighten the transmitter housing cover after wiring to maintain ingress protection and hazardous area approvals.
- After installation, pressure test the meter and the associated pipework to 1½ times the maximum operating pressure.
- Install thermal insulation in the meter, the inlet, and the bypass-loop pipeline to maintain stable temperatures. The thermal insulation should cover the process connection.

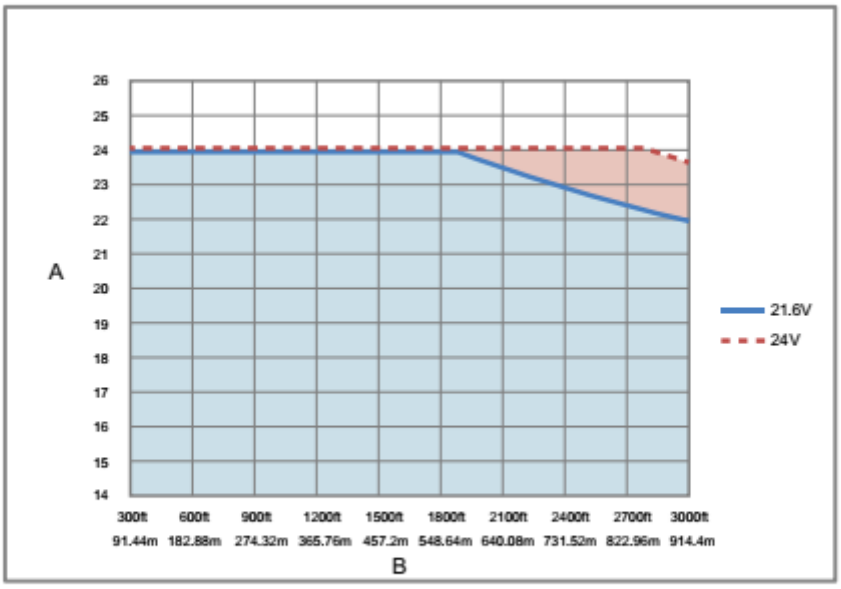
3.1.3 Power requirements

Following are the DC power requirements to operate the meter:

- 24 VDC, 0.65 W typical, 1.1 W maximum
- Minimum recommended voltage: 21.6 VDC with 1000 ft of 24 AWG (300 m of 0.20 mm^2) power-supply cable
- At startup, power source must provide a minimum of 0.5 A of short-term current at a minimum of 19.6 V at the power-input terminals.

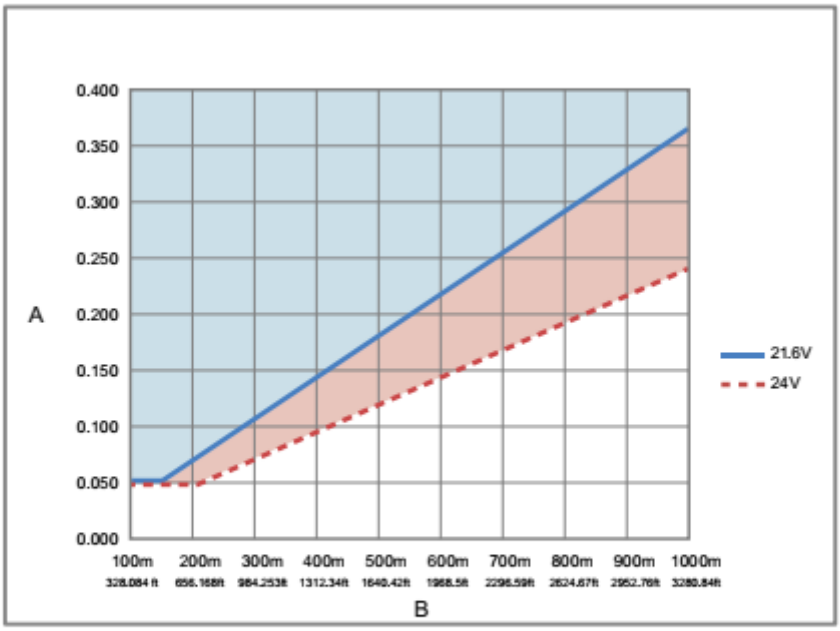
Power cable recommendations for explosion-proof/flameproof meters

Figure 1-1: Minimum wire gauge (AWG per foot or meter)



A. AWG maximum
B. Distance of installation

Figure 1-2: Minimum wire area (mm² per meter or foot)



A. Minimum wire area (mm²)
B. Distance of installation

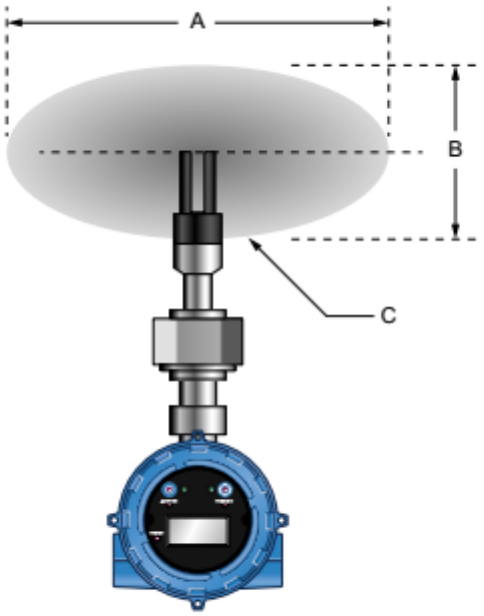
3.1.4 Other installation considerations

Numerous external factors can affect the meter's successful operation. To ensure that your system works correctly, consider the factors covered in this section when designing your installation.

3.1.4.1 Boundary effect

Boundary effect refers to the distortion in the wave forms in the process fluid that are caused by reflections from the pipe wall. If the pipe wall is within the meter's effective measurement region, the boundary effect produces measurement inaccuracy.

Figure 1-3: Region of measurement boundary or sensitivity (plan view)



A. Long axis
B. Short axis
C. Sensitive, or effective, region

The factory calibration compensates for the boundary effect. The meter can be calibrated for 2-inch, 2.5-inch, or 3-inch pipe. If the meter is installed in a pipe, that does not match the calibration size, the compensation will be inaccurate, and process measurement will be inaccurate.
Verify that the meter was calibrated for the pipe size you plan to use.

3.1.4.2 Flow rates

Maintain constant flow rates and velocities that are within the limits specified for the meter. The fluid flow provides a steady heat flow into the meter installation, and the flow rate influences the self-cleaning of the meter tines, the dissipation of bubbles, and the solid contaminants around the meter.
If you install the meter in a bypass configuration (such as in a flow-through chamber), use a pressure drop, pitot scoop, or a sample pump to maintain flow. When using a sample pump, place the pump upstream from the meter.

3.1.4.3 Entrained gas

Entrained gas, or gas pockets, can disrupt the measurement of a fluid. A brief disruption in the signal caused by transient gas pockets can be corrected in the meter configuration, but you must avoid more frequent disruptions or serious gas entrainment to ensure accurate and reliable fluid measurement.

To minimize the possibility of entrained gas:

- Keep pipelines full of fluid at all times.
- Vent any gas prior to the meter installation location.
- Avoid sudden pressure drops or temperature changes that may cause dissolved gases to break out of the fluid.
- Maintain a back pressure on the system that is sufficient to prevent gas breakout.
- Maintain flow velocity at the sensor within the specified limits.

3.1.4.4 Solid contamination

To avoid issues related to solids contamination:

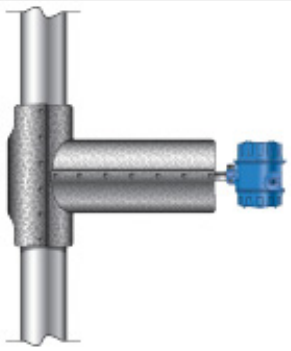
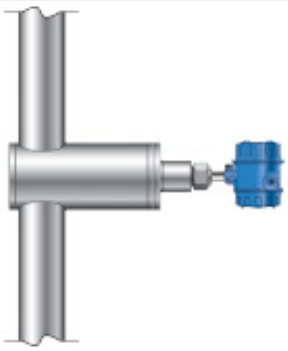
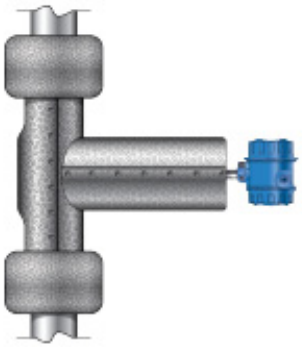
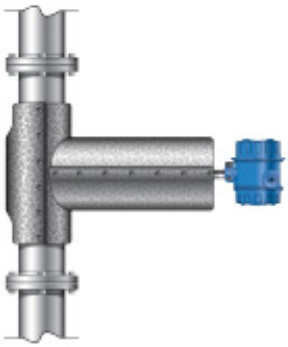
- Avoid sudden changes of the fluid velocity that may cause sedimentation.
- Install the meter far enough downstream from any pipework configuration that may cause centrifuging of solids (such as at a pipe bend).
- Maintain flow velocity at the meter installation that is within the specified limits.
- Use filtration in your process, if necessary.

3.1.4.5 Temperature gradients and insulation

For high-viscosity fluids, minimize any temperature gradients in the fluid, and in the piping and fittings immediately upstream and downstream of the meter. Minimizing temperature gradients reduces the effect of viscosity changes. Aquametro Oil & Marine recommends using the following guidelines to reduce the thermal effects to your meter installation:

- Always insulate the meter and surrounding pipework thoroughly.
  - Avoid insulating the transmitter housing.
  - Use rock wool or any equivalent heat jacket material that is at least 1 inch (25 mm) thick, but preferably 2 inches (50 mm) thick.
  - Enclose insulation in a sealed protective casing to prevent moisture ingress, air circulation, and crushing of the insulation.
  - For flow-through chamber installations, use the special insulation jacket provided by Aquametro Oil & Marine.
- Avoid direct heat or cold on the meter or on the associated upstream or downstream pipe work that is likely to create temperature gradients.
- If it is necessary to protect against cooling because of flow loss, you can apply electrical-trace heating. If you use electrical-trace heating, use a thermostat that operates below the minimum operating temperature of the system.

Table 1-1: Insulation best practices

Recommended	Not recommended
	
	

ATTENTION !

ATTENTION!

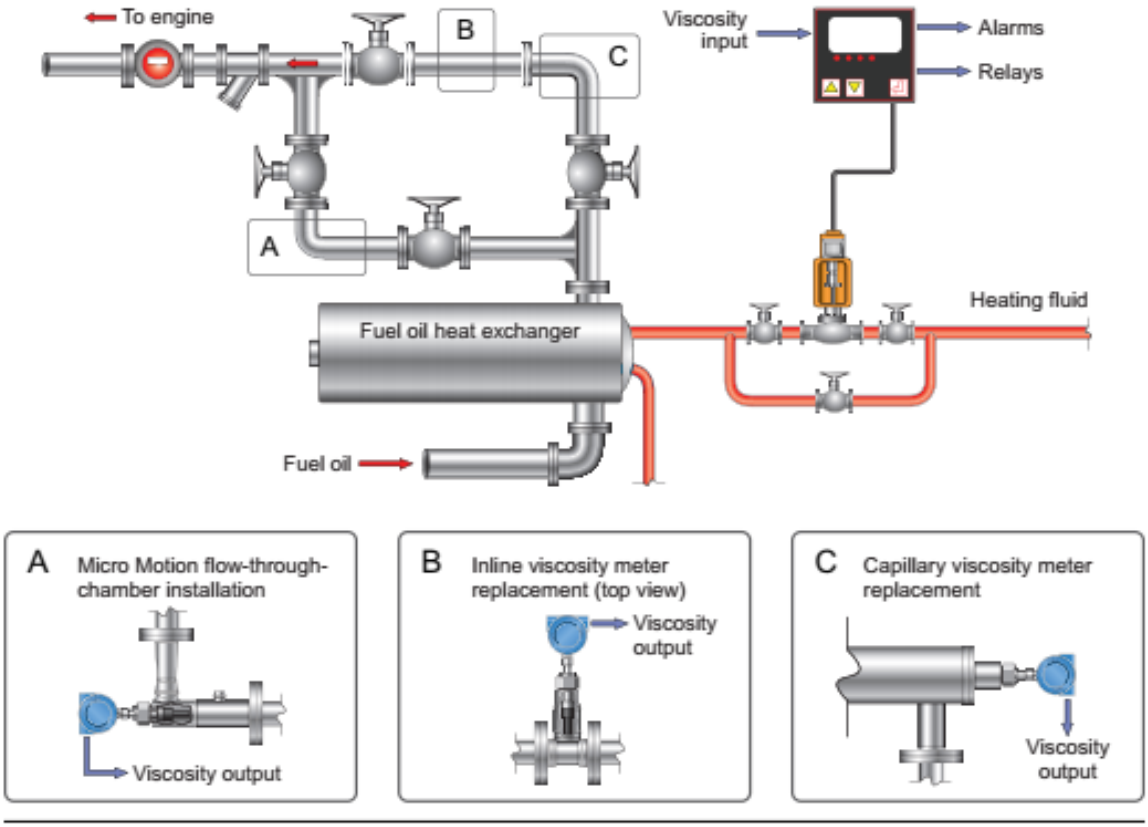
Insulation must be carried out to minimize any temperature gradients in the fluid, and in the piping and fittings immediately upstream and downstream of the meter

Table 1-2: Standard HFVM installation types

Type	Characteristics		Advantages
Inline viscosity	Placement	Tines are contained in a side pocket off the main flow, recessed by 25.4 mm (1 in)	» **Simple replacement of torsional meter** » **Fast response** » **Good flow and temperature conditioning**
	Flow rate(1)	10 to 330 l/min (0.6 to 20 m^3/hr) (2.6 to 87 US gal./min)	
	Viscosity	Up to 100 cSt	
	Temperature	–50 °C to 200 °C (–58 °F to 392 °F)	
	Main flow pipe size	50 mm (2 in)	
Flow-through chamber	Placement	Tines are contained in a flow-through chamber where fluid is circulated from the main flow	» **Adaptable installation to any diameter main pipe and for tank applications** » **Ideal for flow and temperature conditioning** » **Fast response**
	Flow rate(1)	10 to 330 l/min (0.6 to 20 m^3/hr) (2.6 to 87 US gal./min)	
	Viscosity	Up to 100 cSt	
	Temperature	–50 °C to 200 °C (–58 °F to 392 °F)	
	Main flow pipe size	50 mm (2 in)	

Capillary viscosity	Placement	Tines project into adapter kit with 63.5 mm (2.5 in) Schedule 40 boundary	» **Simple replacement of capillary meter** » **Fast response** » **Good flow and temperature conditioning**
	Flow rate(1)	10 to 330 l/min (0.6 to 20 m^3/hr) (2.6 to 87 US gal./min)	
	Viscosity	Up to 100 cSt	
	Temperature	–50 °C to 200 °C (–58 °F to 392 °F)	
	Main flow pipe size	Defined by capillary meter chamber	
Direct Insertion	Placement	The fork should be fully inserted into the main flow path up to the weld bead	» **The AM Viscomaster is not calibrated for direct insertion**
	Flow rate	Velocity < 1.5ft/sec (0.5m/s)	
	Viscosity	Up to 100cSt	
	Temperature	–50 °C to 200 °C (–58 °F to 392 °F)	
	Main Flow Pipe size	6" or larger vertical pipe or side of 4" or larger horizontal pipe	

Figure 1-4: HFVM installation options



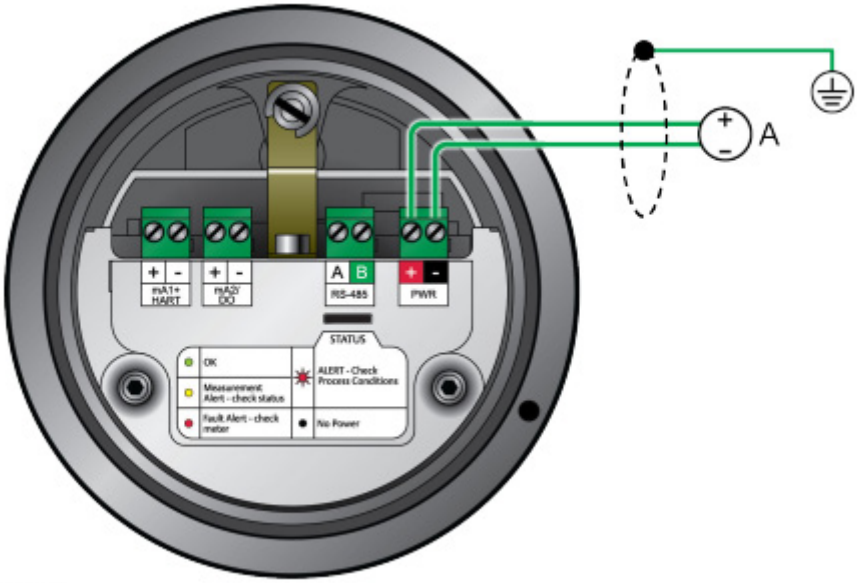
3.1.5 Perform a pre-installation meter check

1. Remove the meter from the box.

CAUTION!
Handle the meter with care. Follow all corporate, local, and national safety regulations for lifting and moving the meter.

2. Visually inspect the meter for any physical damage. If you notice any physical damage to the meter, immediately contact Aquametro Oil & Marine support at hro@aqametro-oil-marine.com.
3. Connect the power wiring, and power up the meter. Remove the back transmitter housing cover to access the PWR terminals.

Figure 1-5: Power supply wiring terminals



A. *24 VDC*

4. If you have an HFVM with calibration code B (viscosity and density calibration), perform a Known Density Verification (KDV) check. Use the Known Density Verification procedure to match the current meter calibration with the factory calibration. If the meter passes the test, then it has not drifted or changed during shipment.

3.2 Mounting

Topics covered in this chapter:

- Prepare the installation
- Mount the meter
- Install thermal insulation
- Rotate the electronics on the meter (optional)
- Rotate the display on the transmitter (optional)

3.2.1 Prepare the installation

Before you can install the meter and fit the thermal insulation, verify that the system is stable and leak free.

1. Fit a blanking compression nut to the meter mounting, pressurize, and flush the system.
2. Isolate the system, depressurize, and remove the blanking compression nut.

ATTENTION !

Adjustment of and work on the Meter may only be done by skilled labor. Observe local instructions and safety regulation.

3.2.2 Mount the meter

There are three (plus one) ways to mount the meter.
Related information

- » Mount with a flow-through chamber
- » Mount with an inline viscosity retrofit kit
- » Mount with a capillary viscosity retrofit kit

3.2.2.1 Mount with a flow-through chamber

Flow-through chambers are manufactured by Aquametro Oil & Marine, and are available with either of the following:

- » Welded ends or compression fittings that connect into the process pipelines
- » 1- inch, 2-inch, or 3-inch inlet and outlet pipes

IMPORTANT

Do not alter the length of the inlet and outlet pipes. Pipe alterations can adversely affect the fitting, temperature response and stability.

Prerequisites

Verify the following conditions:

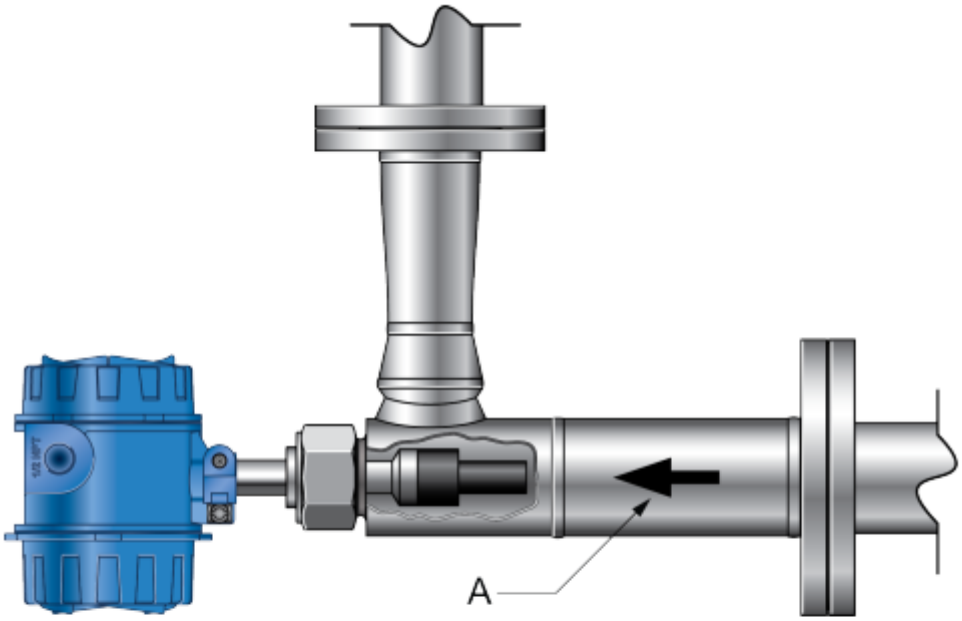
Flow	• 5–40 l/min for 2-inch Schedule 40 calibration bore section (1.5 - 10.5 gal/min) • 5–300 l/min for 3-inch Schedule 80 calibration bore section (1.5 – 80 gal/min)
Viscosity	0.5 to 100 cSt
Temperature	–50 °C to 200 °C (–58 °F to 392 °F)
	–40 °C to 200 °C (–40 °F to 392 °F) in hazardous areas
Pressure	70 bar @ 204 °C, subject to process connections

IMPORTANT

- » To ensure that the fluid within the pocket is refreshed in a timely manner, verify that flow velocity at the pipe wall and fluid viscosity are within the limits described in this table.
- » The thermal mass of the flanges may affect the response time of the meter to temperature changes.

Procedure

Figure 2-1: Flow-through chamber meter installation



A. *Flow direction*

Note

- *This flow-through chamber is a direct-insertion type chamber that does not have a thermowell, and uses a 1-½-inch threaded cone-seat connection.*
- *The three compression fittings on the flow pockets (½-inch drain, ¾-inch temperature probe, and 1-½-inch mounting nut for the meter) are rated to above the working pressure of the flow pocket. The fittings may be Swagelok or Parker.*

3.2.2.2 Mount with an inline viscosity retrofit kit

The inline viscosity retrofit kit provides a simple, direct replacement for existing meters.
Typically, the flange-to-flange distance is 150 mm (5.9 in), although Aquametro Oil & Marine can accommodate larger versions. Usually, no pipework changes are necessary.

CAUTION!
Observe all corporate and government safety regulations. Wear protective clothing, safety glasses, and gloves to prevent burns and the absorption of hot oil.

Prerequisites

Verify the following conditions:

Temperature	–50 °C to 200 °C (–58 °F to 392 °F)
Flow	40 to 330 l/min 2.5 to 20 m^3/hr 11 to 87 US gal/min
Viscosity	Up to 100 cSt
Pressure	As defined by process flanges
Calibration boundary	2.5 in Schedule 40

Procedure

1. Check that the isolation valves are fully closed.
2. Remove insulation and allow the equipment to cool to a safe level.
   Cooling reduces retained pressure.
3. If you have a drain or a pressure-relieving valve, depressurize the system.
4. Slacken the lock nut 1 ½ to 2 turns so that you can rock the sensor.
   If necessary, use your hand to jolt the meter loose from the amplifier housing. This breaks the seal between the sensor and the chamber retrofit kit. Do not slacken the lock nut further unless the seal is broken and the sensor is obviously loose in the fitting.

NOTE!

If the system is still pressurized, you will be able to lift and hold the meter against the retaining nut. Rocking and alternately pushing the sensor in and out of the pocket within the limits allowed by the slackened nut breaks the seal and allows oil under pressure to seep past the lock nut. If this leakage is excessive, re-tighten the lock nut and take further action to depressurize the system.

5.

CAUTION

Keep all parts of your body away from the direction in which you will remove the sensor. Pressure caused by a valve failure or a poorly placed lock nut can eject the instrument from the flow chamber and cause serious injury.

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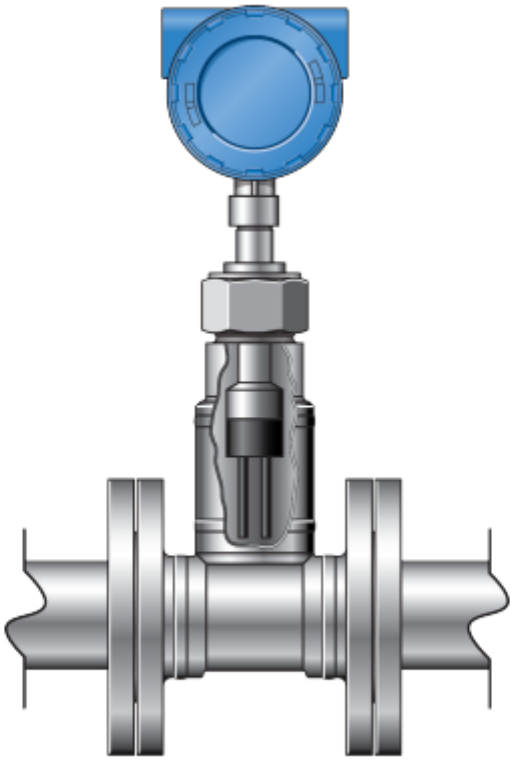
6. Retrofit the meter per the following diagram.

Figure 2-2: Inline viscosity retrofit (plan view)



Note

The HFVM inline viscosity meter is mounted 25 mm (0.98 in) away from the main flow line, allowing good product mixing, sensor protection, and stable measurement conditions.

3.2.2.3 Mount with a capillary viscosity retrofit kit

The capillary viscosity retrofit kit provides a simple, direct replacement for existing capillary meters. Typically, capillary meters operate with their own measurement chamber that attaches to the HFVM. No pipework changes are necessary.

CAUTION

Observe all corporate and government safety regulations. Wear protective clothing, safety glasses, and gloves to prevent burns and the absorption of hot oil

Prerequisites

Verify the following conditions:

Temperature	–50 °C to 200 °C (–58 °F to 392 °F)
Flow	40 to 330 l/min 2.5 to 20 m^3/hr 11 to 87 US gal/min
Viscosity	Up to 100 cSt
Pressure	As defined by process flanges
Calibration boundary	2.5 in Schedule 40

Procedure

1. Check that the isolation valves are fully closed.
2. Remove insulation and allow the equipment to cool to a safe level.
   Cooling reduces retained pressure.
3. If you have a drain or a pressure-relieving valve, depressurize the system.
4. Slacken the lock nut 1 ½ to 2 turns so that you can rock the sensor.
   If necessary, use your hand to jolt the meter loose from the amplifier housing. This breaks the seal between the sensor and the chamber retrofit kit. Do not slacken the lock nut further unless the seal is broken and the sensor is obviously loose in the fitting.

NOTE!

If the system is still pressurized, you will be able to lift and hold the meter against the retaining nut. Rocking and alternately pushing the sensor in and out of the pocket within the limits allowed by the slackened nut breaks the seal and allows oil under pressure to seep past the lock nut. If this leakage is excessive, re-tighten the lock nut and take further action to depressurize the system.

5. 

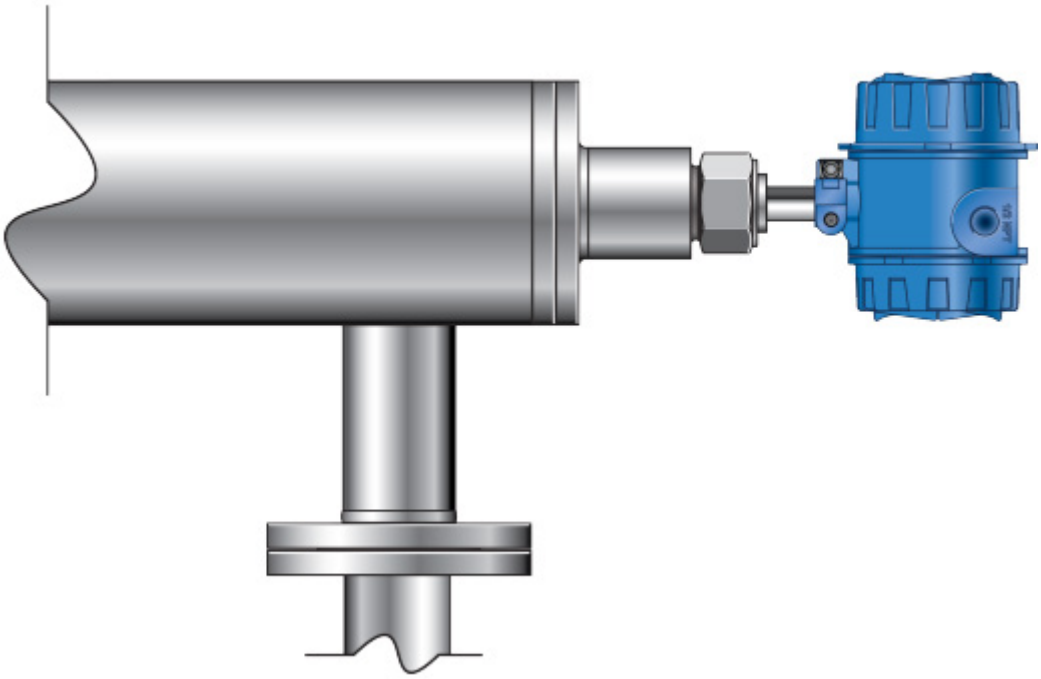
   CAUTION

   Keep all parts of your body away from the direction in which you will remove the sensor. Pressure caused by a valve failure or a poorly placed lock nut can eject the instrument from the flow chamber and cause serious injury.

   Remove the lock nut if you can rock the meter in the flow chamber, and there is no serious or continuous escape of oil.

6. Retrofit the meter per the following diagram.

Figure 2-3: Capillary viscosity retrofit



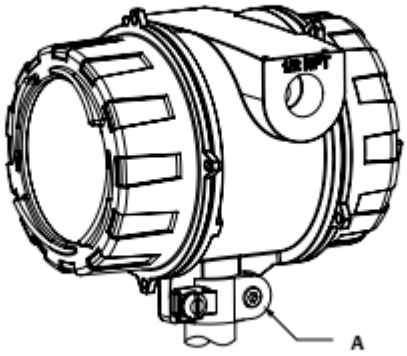
3.2.2.4 Mount as direct insertion

The direct insertion retrofit is not recommendable due to severe restrictions about the flow rate and calibration boundaries. For Direct Insertion Aquametro Oil & Marine does not take any responsibility for accuracy and lifetime. For direct insertion, no adapter is available.

3.2.3 Rotate the electronics on the meter (optional)

You can rotate the transmitter on the meter up to 90°.
1. Using a 4 mm hex key, loosen the cap screw that holds the transmitter in place.

Figure 2-4: Component to secure transmitter in place



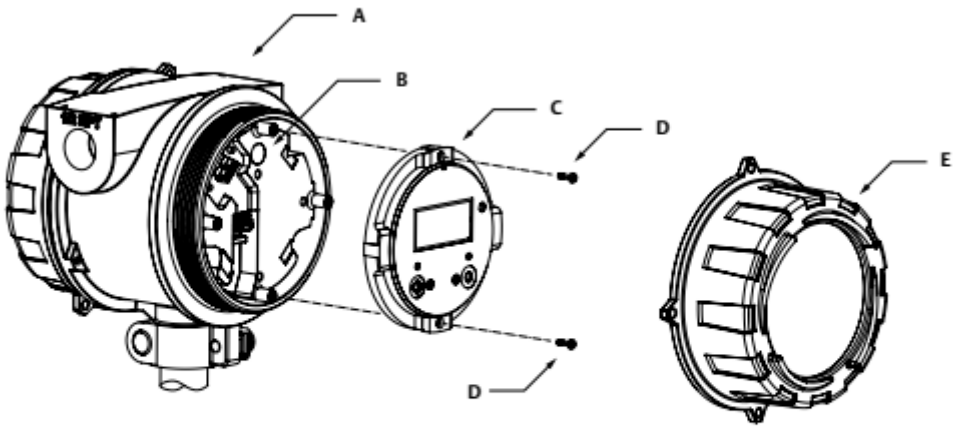
A. M5 socket-head cap screw

2. Rotate the transmitter clockwise to the desired orientation up to 90°.
3. Secure the cap screw in place and tighten to 60 lb·in (6.8 N·m).

3.2.4 Rotate the display on the transmitter (optional)

The display on the transmitter electronics module can be rotated 90° or 180° from the original position.

Figure 2-5: Display components



A. Transmitter housing
B. Sub-bezel
C. Display module
D. Display screws
E. Display cover

Procedure

1. If the meter is powered up, power it down.
2. Turn the display cover counterclockwise to remove it from the main enclosure.
3. Carefully loosen (and remove if necessary) the semi-captive display screws while holding the display module in place.
4. Carefully pull the display module out of the main enclosure until the sub-bezel pin terminals are disengaged from the display module.

NOTE!
If the display pins come out of the board stack with the display module, remove the pins and reinstall them.

5. Rotate the display module to the desired position.
6. Insert the sub-bezel pin terminals into the display module pin holes to secure the display in its new position.
7. If you have removed the display screws, line them up with the matching holes on the sub-bezel, then reinsert and tighten them.
8. Place the display cover onto the main enclosure.
9. Turn the display cover clockwise until it is snug.
10. If appropriate, power up the meter.

3.3 Wiring

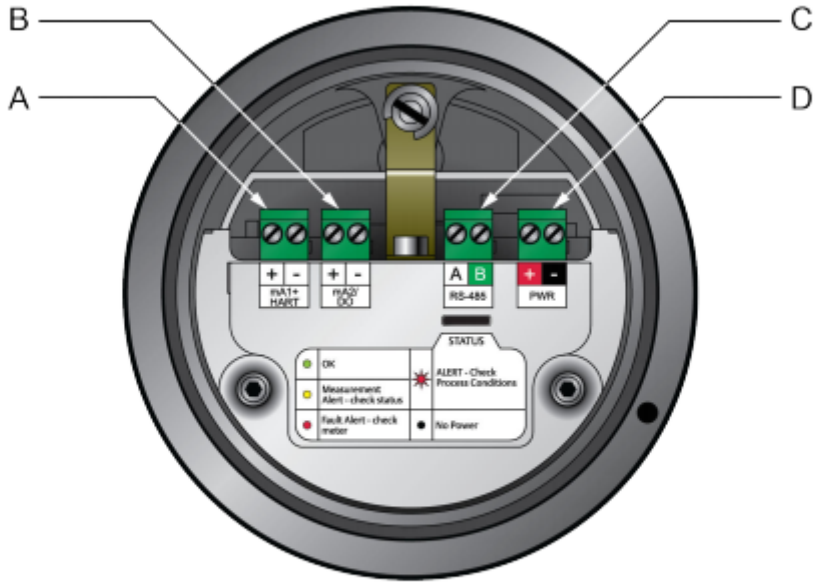
Topics covered in this chapter:
- Terminals and wiring requirements
- Wire power and outputs in a HART single-loop environment
- Wiring to external devices (HART multidrop)

3.3.1 Terminals and wiring requirements

Three pairs of wiring terminals are available for transmitter outputs. A fourth pair is used for power wiring. These outputs vary depending on your transmitter output option ordered. The mA outputs require external power, and must be connected to an independent 24 VDC power supply.
The screw connectors for each output terminal accept a maximum wire size of 14 AWG (2.5 mm^2).

IMPORTANT
- Output wiring requirements depend on whether the meter will be installed in a safe area or a hazardous area. It is your responsibility to verify that this installation meets all corporate, local, and national safety requirements and electrical codes.
- If you will configure the meter to poll an external temperature or pressure device, you must wire the mA output to support HART communications. You may use either HART/mA single-loop wiring or HART multi-drop wiring.

Figure 3-1: Transmitter outputs



A. Channel A (4-20 mA + HART)
B. Channel B (4-20 mA)
C. Channel C (RS-485)
D. Power terminals

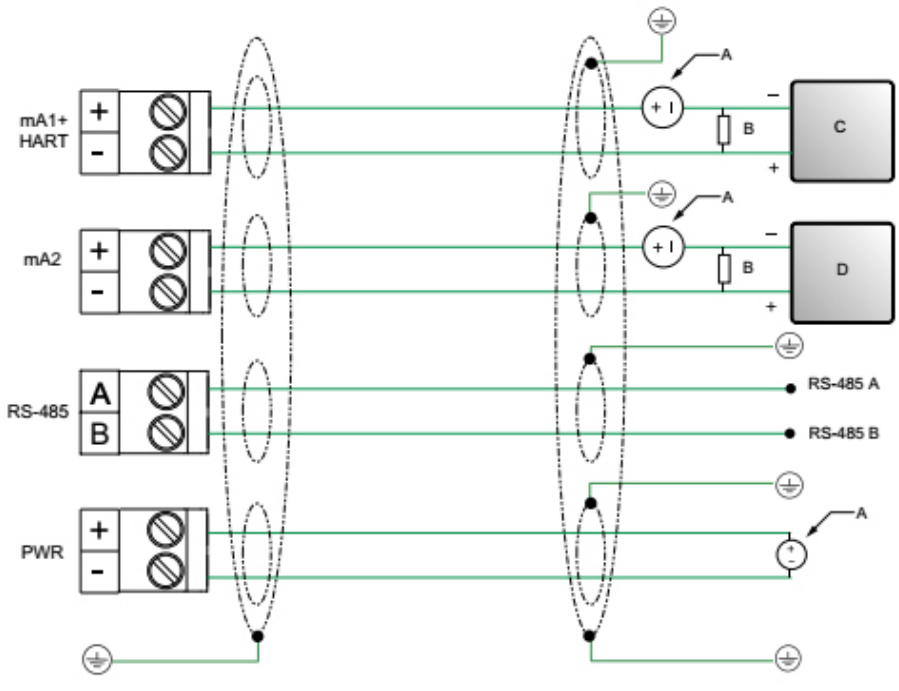
3.3.2 Wire power and outputs in Signal device and Modbus Environment

CAUTION
Meter installation and wiring should be performed by suitably trained personnel only, in accordance with the applicable code of practice.

Procedure

Wire to the appropriate power and output terminals and pins (see Figure 3-2).

Figure 3-2: Wire power and outputs in a HART single-loop environment



A. *24 VDC*
B. *R_{load} (250 Ω resistance)*
C. *Signal device*
D. *D. Signal device*

NOTE!
For operating the milliamp outputs with a 24V supply, a maximum total loop resistance of 657 Ω is allowed.

CAUTION
- To meet the EC Directive for Electromagnetic Compatibility (EMC), use a suitable instrumentation cable to connect the meter. The instrumentation cable should have individual screens, foil or braid over each twisted pair, and an overall screen to cover all cores. Where permissible, connect the overall screen to earth at both ends (360° bonded at both ends). Connect the inner individual screens at only the controller end.
- Use metal cable glands where the cables enter the meter amplifier box. Fit unused cable ports with metal blanking plugs.

3.3.3 Grounding

The meter must be grounded according to the standards that are applicable at the site.
The customer is responsible for knowing and complying with all applicable standards.

Prerequisites

Aquametro Oil & Marine suggests the following guides for grounding practices:
- In Europe, EN 60079-14 is applicable to most installations, in particular Sections 12.2.2.3 and 12.2.2.4.
- In the U.S.A. and Canada, ISA 12.06.01 Part 1 provides examples with associated applications and requirements.
- For IECEx installations, IEC 60079-14 is applicable.

If no external standards are applicable, follow these guidelines to ground the meter:
- Use copper wire, 18 AWG (0.75 mm^2) or larger wire size.
- Keep all ground leads as short as possible, less than 1 Ω impedance.
- Connect ground leads directly to earth, or follow plant standards.

CAUTION
Ground the meter to earth, or follow ground network requirements for the facility. Improper grounding can cause measurement error.

Procedure

Check the joints in the pipeline or tank installation.
- If the joints in the pipeline or tank are ground-bonded, the meter is automatically grounded and no further action is necessary (unless required by local code).
- If the joints in the pipeline or tank are not grounded, connect a ground wire to the grounding screw located on the meter electronics.

4 Viscomaster Operation

Default values

Default values for your meter are configured at the factory. The specific values are determined by the options that were specified on the purchase order. These are provided on the configuration sheet that was shipped with your meter.

4.1 Putting into Operation

The transmitter must be powered up for all configuration and commissioning tasks, or for process measurement.

1. Ensure that all transmitter and sensor covers and seals are closed.

WARNING!
To prevent ignition of flammable or combustible atmospheres, ensure that all covers and seals are tightly closed. For hazardous area installations, applying power while housing covers are removed or loose can cause an explosion.

2. Turn on the electrical power at the power supply.

The transmitter will automatically perform diagnostic routines. During this period, Alert 009 is active. The diagnostic routines should complete in approximately 30 seconds.

Post requisites

Although the sensor is ready to receive process fluid shortly after power-up, the electronics can take up to 10 minutes to reach thermal equilibrium. Therefore, if this is the initial startup, or if power has been off long enough to allow components to reach ambient temperature, allow the electronics to warm up for approximately 10 minutes before relying on process measurements. During this warm-up period, you may observe minor measurement instability or inaccuracy.

4.2 Check meter status

Check the meter for any error conditions that require user action or that affect measurement accuracy.

1. Wait approximately 10 seconds for the power-up sequence to complete. Immediately after power-up, the transmitter runs through diagnostic routines and checks for error conditions. During the power-up sequence, Alert A009 is active. This alert should clear automatically when the power-up sequence is complete.
2. Check the status LED on the transmitter.

Transmitter status reported by status

LED state	Description	Recommendation
Green	No alerts are active.	Continue with configuration or process measurement.
Yellow	One or more low-severity alerts are active.	A low-severity alert condition does not affect measurement accuracy or output behavior. You can continue with configuration or process measurement. If you choose, you can identify and resolve the alert condition.
Flashing yellow	Calibration in progress, or Known Density Verification in progress.	A low-severity alert condition does not affect measurement accuracy or output behavior. You can continue with configuration or process measurement. If you choose, you can identify and resolve the alert condition.
Red	One or more high-severity alerts are active	A high-severity alert condition affects measurement accuracy and output behavior. Resolve the alert condition before continuing

4.3 Configure Modbus communication

Overview

Modbus communications parameters control Modbus communications with the transmitter. Modbus support is implemented on the RS-485 physical layer via the RS-485 terminals.

IMPORTANT

Your device automatically accepts all connection requests within the following ranges:

- Protocol: Modbus RTU (8-bit) or Modbus ASCII (7-bit) unless Modbus ASCII Support is disabled
- Parity: odd or even
- Stop bits: 1 or 2
- Baud: 1200, 2400, 4800, 9600, 19200, 38400

You do not need to configure these communications parameters on the device.

Procedure

1. Enable or disable Modbus ASCII Support as desired.
   The setting of this parameter controls the range of valid Modbus addresses for your device.

Integrate the meter with the control system

Modbus ASCII support	Available Modbus addresses
Enabled	1–15, 32–47, 64–79, and 96–110
Disabled	1–127, excluding 111 (111 is reserved to the service port)

2. Set Modbus Address to a unique value on the network.
3. Set Floating-Point Byte Order to match the byte order used by your Modbus host.

Code	Byte order
0	1–2 3–4
1	3–4 1–2
2	2–1 4–3
3	4–3 2–1

See the following table for the bit structure of bytes 1, 2, 3, and 4.
Bit structure of floating-point bytes Table 6-7:

Byte	Bits		Definition
1	SEEEEEEE		S=Sign E=Exponent
2	EMMMMMMM		E=Exponent M=Mantissa
3–4	MMMMMMMM		M=Mantissa

4. (Optional) Set Additional Communications Response Delay in delay units.
   A delay unit is 2/3 of the time required to transmit one character, as calculated for the port currently in use and the character transmission parameters.

Additional Communications Response Delay is used to synchronize Modbus communications with hosts that operate at a slower speed than the device. The value specified here will be added to each response the device sends to the host.

- Default: 0
- Range: 0 to 255

TIP

Do not set Additional Communications Response Delay unless required by your Modbus host.

5 Maintenance and Repair

5.1 Calibration

All our Viscomaster Systems are calibrated in the factory.

An accuracy check and recalibration is offered at Aquametro Oil & Marine, this is usually dependent on customer, operator or regulation requirements. This interval depends largely on the operating conditions, process liquid and the application the system is installed in.

5.2 Service maintenance

CAUTION

The surfaces of the device/system and the medium may be hot.

Risk of burns!

- Carry out work only on cooled devices/systems.
- Work may only be performed by authorized specialists in accordance with the applicable regulations.
- Use appropriate protective equipment.

WARNING

The device/system may be under pressure.

Risk of severe injury!

- Carry out work only on non-pressurized devices/systems.
- When working on the device/system watch out for leaking medium.
- Work may only be performed by authorized specialists in accordance with the applicable regulations.
- Use appropriate protective equipment, particularly safety goggles

WARNING

The device/system may be under high voltage.

Risk of severe injury!

- Carry out work only on non-powered devices/systems.
- When working on the device/system watch out for faulty isolation or open cable cores and ends.
- Work may only be performed by authorized specialists in accordance with the applicable regulations.
- Use appropriate protective equipment

Use of unsuitable cleaning agents and procedures.

Risk of malfunction or damage!

Follow the cleaning instructions on the next page.

Before working on the hydraulics:

- put the system or section out of operation
- close the stop valves
- release the pressure
- put a suitable tray underneath the connection to be worked on
- be prepared for spillage, have absorbent at hand

Cleaning of Viscomaster™:

- do not use any aggressive solvents
- rinse hydraulic part of flow meter thoroughly

Aquametro Oil & Marine recommends to use the following cleaning solvents:

- Gasoline used for cleaning purposes
- Cleaner's naphtha
- Petroleum ether

Bevor working on the electronic

- For repair remittance remove plug board with connected leads on the rear side, loosen fastening devices and remove controller from the panel.
- In case of remittance, please give precise details of the fault to reduce time and cost of repair.

To restart the system:

- slowly open the stop valves, avoiding pressure surges ("water hammer")
- vent the pipe well check tightness

Maintenance

Use of unsuitable cleaning agents and procedures.

Risk of malfunction or damage!

Follow the cleaning instructions listed above.

Check connections periodically for tightness and if necessary retighten.
Check insulation periodically for completeness and functionality and reattach if necessary.

Steam valve spindle has to be kept clean and lubricated, if necessary, lubricate the spindle with Molykote including grease.
Following the initial temperature and pressure load, retighten the screws of all flange connections (also cover and connection piece flanges), the valve cone should be located in the center

All electronic controllers in the product range of the manufacturer are virtually maintenance-free.
Provided that the controller is correctly installed and put into operation and is protected against mechanical damage and inadmissible operating conditions, it should give years of trouble-free service. In case of faults, repair work by the customer should be restricted to the externally accessible leads and connections and components the customer is expressly permitted to deal with himself (bridge circuits, fuses).
All further work, especially on internal components will terminate warranty, makes subsequent inspection and fault repair more difficult and can cause considerable damage to the circuitry.

5.3 Spare Parts

Use of wrong Spare Parts

Risk of malfunction or damage!

Use only original spare parts, supplied by Aquametro Oil & Marine

Spare part list and Maintenance instruction may be requested from Aquametro Oil & Marine.

6 Troubleshooting

Viscosity measurement problems and recommended actions

Problem	Possible causes	Recommended actions
Viscosity reading erratic	» Normal process noise » Two-phase flow » Deposition or coating, especially asphaltenes, on the tines » Contaminants in the process fluid » Vibration in the pipeline	» Check your process conditions. » Check for two-phase flow, stratification, or settling. Install a pump. Check for environmental conditions that produce stratification (e.g., a heat source). » Increase back pressure to minimize bubble formation. » Clean the tines. » Minimize vibration in the pipeline.
Viscosity reading inaccurate	» Incorrect calibration factors » Flow rate too low or too high » Bypass not fully closed » Deposition or coating, especially asphaltenes, on the tines » Fork laminate damaged » Defective thermal insulation » Boundary effect	» Verify the calibration factors. Ensure that the viscosity ranges are appropriate for your process fluid. » Adjust the flow rate or the diameter of the flow-through chamber. Refer to the installation manual for flow requirements and best practices. » Ensure that the installation type matches the calibration. Refer to the installation manual. » Close the bypass. » Clean the tines. » Check for physical damage to the tines or laminate. » Repair or replace the thermal insulation. » Check the pump delivery and service the pump as required.
Viscosity reading NaN (Not a Number)	» Viscosity above the highest calibration range or below the lowest calibration range	» Return the device to Aquametro Oil & Marine for recalibration for the ranges you need.
Referred viscosity reading inaccurate	» Inaccurate line viscosity measurement » Inaccurate line temperature measurement » Incorrect referred viscosity configuration » Inaccurate measurement of laboratory sample	» Ensure that line viscosity measurement is as accurate as possible. » Ensure that the temperature value used in referred viscosity measurement is as accurate as possible. » Verify the configuration of referred viscosity measurement. » Repeat the laboratory measurement, ensuring that reference conditions match.

Density measurement problems and recommended actions

Problem	Possible causes	Recommended actions
Erratic density reading	» Normal process noise » Two-phase flow » Flow rate too high » Deposition on the tines	» Check your process conditions. » Increase the density damping value. » Reduce the flow rate. » Check for two-phase flow.

	» Contaminants or suspended solids in the process fluid » Vibration in the pipeline » Erosion or corrosion	» Ensure that line pressure or sample pressure meets installation requirements. » Increase back pressure to minimize bubble formation. » Clean the tines. » Minimize vibration in the pipeline. » Install a flow control method (bypass, flow chamber, expander, etc.).
Inaccurate density reading	» Inaccurate temperature measurement » Incorrect calibration factors » Deposition on the tines » Boundary effect (incorrect installation)	» Verify the temperature reading from the RTD (on-board temperature sensor). » Verify the temperature reading from the external temperature device, if applicable. » Clean the tines. » Increase the flow rate. » Install a thermal insulation jacket. » Verify the calibration factors. » Perform Known Density Verification. » Change the location of the fork.
Inaccurate calculated density	» Incorrect reference density	» Verify the value configured for reference density.
Density reading too high	» Deposition on the tines	» Clean the tines.
Density reading too low	» Leaks in the pipework or fittings » Two-phase flow	» Check for two-phase flow.
Cyclic inaccuracy in density reading	» Stirrer rotation rate too high » Tank flow rate too high » Fork in poor location » Stirrer creating bubbles » Solids in tank	» Reduce the stirrer rotation rate. » Reduce the tank flow rate. » Move the fork to a location with a lower flow profile. » Install a sample bypass. » Replace the device with a CDM.
Density reading from device does not match laboratory value	» Incorrect calibration factors » Laboratory conditions do not match sample conditions	» Verify the calibration factors. » Ensure that the two fluids are being compared at the same temperature.

Temperature measurement problems and recommended actions

Problem	Possible causes	Recommended actions
Temperature reading significantly different from process temperature	» RTD failure » Line temperature in bypass does not match temperature in main line	
Temperature reading slightly different from process temperature	» Sensor temperature not yet equalized » Sensor leaking heat	» If the error is within the temperature specification for the sensor, there is no problem. If the temperature measurement is outside the specification, contact Aquametro Oil & Marine » The temperature of the fluid may be changing rapidly. Allow sufficient

		time for the sensor to equalize with the process fluid. » The electrical connection between the RTD and the sensor may be damaged. This may require replacing the sensor.
Inaccurate temperature data from external device	» Wiring problem » Problem with input configuration » Problem with external device » Problem with input configuration	» Verify the wiring between the transmitter and the external device. » Verify that the external device is operating correctly. » Verify the configuration of the temperature input. » Ensure that both devices are using the same measurement unit.

Milliamp output problems and recommended actions

Problem	Possible causes	Recommended actions
No mA output	» Output not powered » Wiring problem » Circuit failure	» Verify that the output loop is powered externally. » Check the power supply and power supply wiring. » Verify the output wiring » Contact Aquametro Oil & Marine
mA output below 4 mA	» Open in wiring » Bad output circuit » Process condition below LRV » LRV and URV are not set correctly » Bad mA receiving device	» Check your process conditions against the values reported by the device. » Verify the receiving device, and the wiring between the transmitter and the receiving device. » Check the settings of Upper Range Value and Lower Range Value.
Constant mA output	» Incorrect process variable assigned to the output » Fault condition exists	
mA output below 3.6 mA or above 21.0 ma	» Incorrect process variable or units assigned to output » Fault condition if Fault Action is set to Upscale or Downscale » LRV and URV are not set correctly	» Verify the output variable assignments. » Verify the measurement units configured for the output. » Check the Fault Action settings. » Check the settings of Upper Range Value and Lower Range Value.
Consistently incorrect mA measurement	» Loop problem » Output not trimmed correctly » Incorrect measurement unit configured for process variable » Incorrect process variable configured » LRV and URV are not set correctly	» Verify that the measurement units are configured correctly for your application. » Verify the process variable assigned to the mA output. » Check the settings of Upper Range Value and Lower Range Value.
mA output correct at lower current, but incorrect at higher current	» mA loop resistance may be set too high	» Verify that the mA output load resistance is below the maximum supported load (see the installation manual for your transmitter).

7 Decommissioning, Dismantling and Disposal

CAUTION

The surfaces of the device/system and the medium may be hot.

Risk of burns!

- Carry out work only on cooled devices/systems.
- Work may only be performed by authorized specialists in accordance with the applicable regulations.
- Use appropriate protective equipment.

WARNING

The device/system may be under pressure.

Risk of severe injury!

- Carry out work only on non-pressurized devices/systems.
- When working on the device/system watch out for leaking medium.
- Work may only be performed by authorized specialists in accordance with the applicable regulations.
- Use appropriate protective equipment, particularly safety goggles

7.1 Decommissioning

Disconnect all sources of energy.
Remove the devices from the system.
Pay particular attention to the disposal instructions in section 7.4.

7.2 Dismantling

Not required.

7.3 Return of materials

Never send a device/system back if you are not absolutely certain that all traces of hazardous substances have been removed, e.g. substances which have penetrated crevices or diffused through plastic.
Costs incurred for waste disposal and injury (burns, etc.) due to inadequate declaration and/or cleaning will be charged to the delivering company or the operator.

For a device that is sent back to Aquametro Oil & Marine for repair or calibration the following point are an absolute must:

- Always quote type and serial number when contacting an Aquametro Oil & Marine office or an Aquametro Oil & Marine representative.
- Always enclose a duly completed "Declaration of decontamination" form (FO0451e).
- Only in special cases (e.g. for the reconstruction of causes of errors) and only with the prior consent of the Aquametro Oil & Marine, equipment must be returned in the impurified state. In this case also the contact person at Aquametro Oil & Marine, which has granted the approval to return a crude device must be stated.

7.4 Disposal

At the end of its life cycle, this product should be disposed of according to local regulations regarding waste recycling or disposal.
Batteries and rechargeable batteries shall be recycled separately.

The separate collection and recycling of used products will help to conserve natural resources, and ensures that they are disposed of in a way that does not cause damage to the environment and nature.

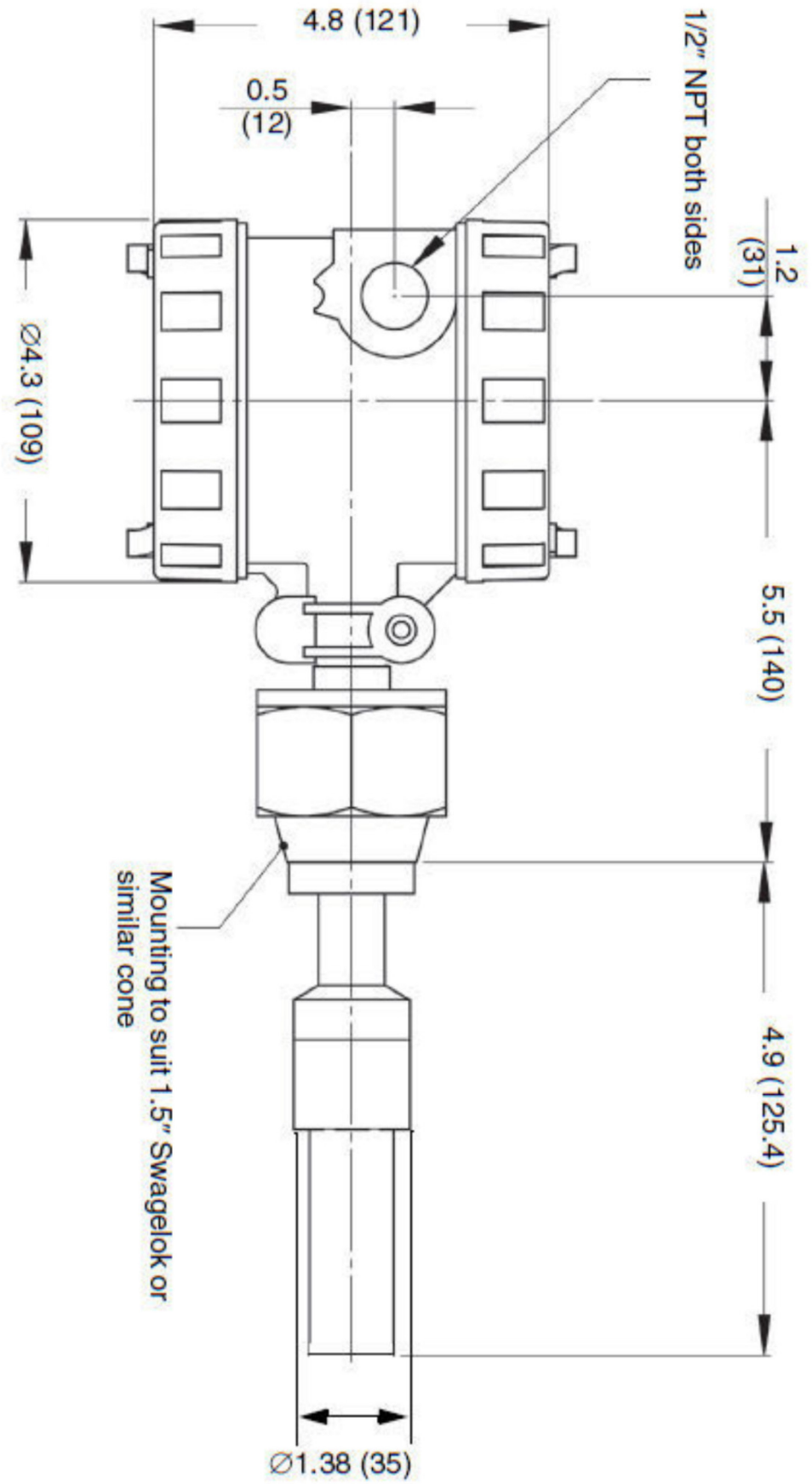
8 Technical Data

8.1 Viscomaster

Viscosity Sensor		
Hardware		
	Body	Aluminium alloy Red (-40°C < Ta < +110°C)]
	Pressure Range	PN16
	Placement	Tines are contained in a side pocket off the main flow, recessed by 25.4 mm (1 in)
	Process connection	1 1/2-inch Cone Seat Compression fitting 316/316L
	Cable duct	½" NPT
Operating Range		
	Viscosity	Up to 100 cSt
	Density	Up to 3000 kg/m^3
	Temperature	–50 °C to 200 °C
	Ambient temperature	-40...60°C (Electronics)
	Flow rate	10 to 330 l/min
	Max. Pressure	207bar
Electrical		
	Supply range	24VDC
	Power consumption	0.65 W typical, 1.1 W maximum
	Output	2x 4-20mA Signal RS 485 Terminal
	Sensor Range and Performance	Viscosity accuracy ±0.2cP (0-10cP range) then ±1% FS of calibrated range, Viscosity limit 20,000cP
Signal Output (dependent on sensor type)		
Full	Viscosity mA1+	4mA = 0cSt - 20mA = 50cSt
	Density mA1+	4mA = 500kg/m^3 - 20mA = 1500kg/m^3
Dynamic	Viscosity mA1+	4mA = 0cSt - 20mA = 50cSt
	Temperature mA2+	4mA = 0°C - 20mA = 200°C
Density	Density mA1+	4mA = 500kg/m^3 - 20mA = 1500kg/m^3
	Temperature mA2+	4mA = 0°C - 20mA = 200°C

8.2 Dimensional drawings

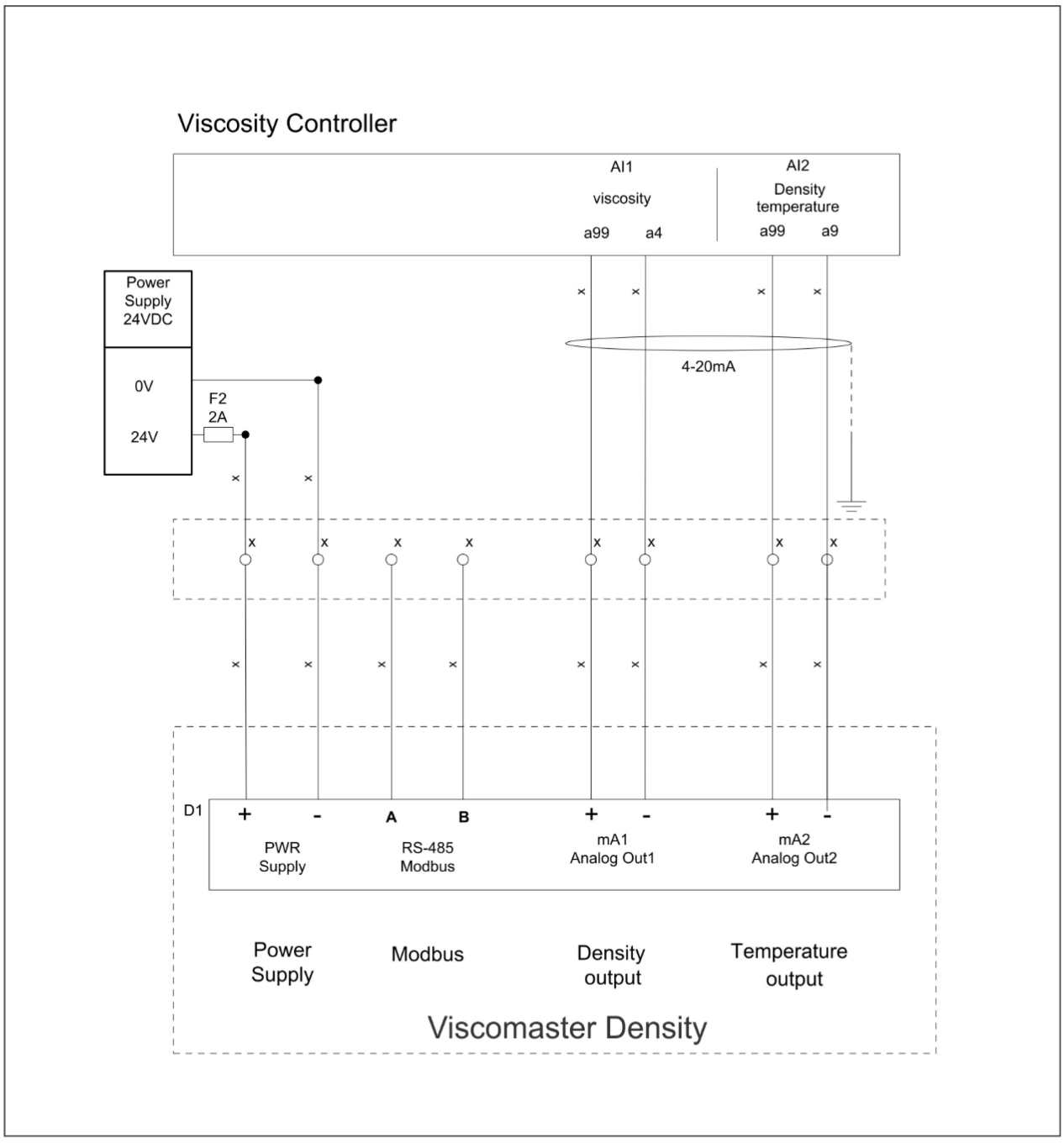
Detailed dimensional drawing is made in project drawings.

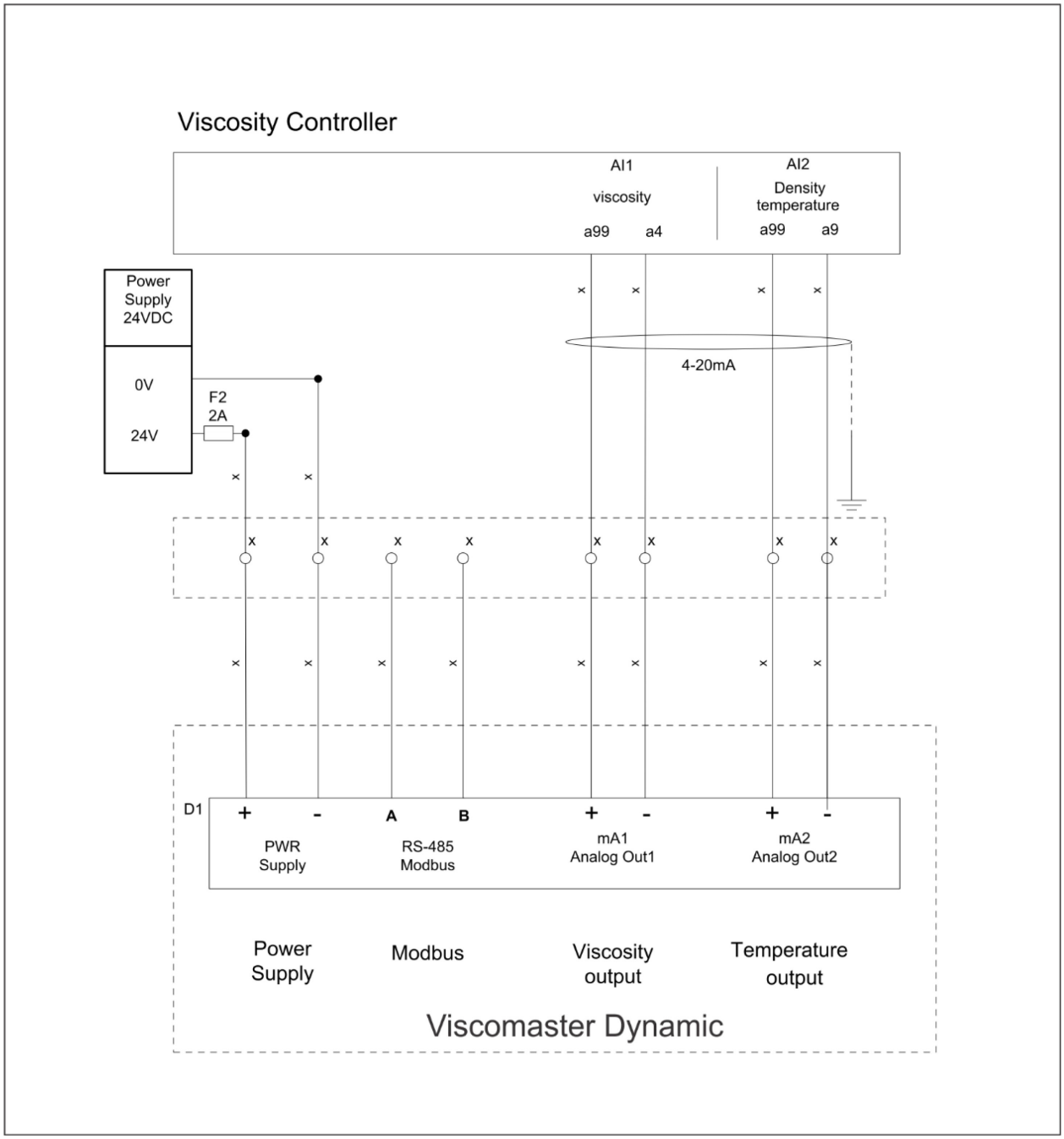


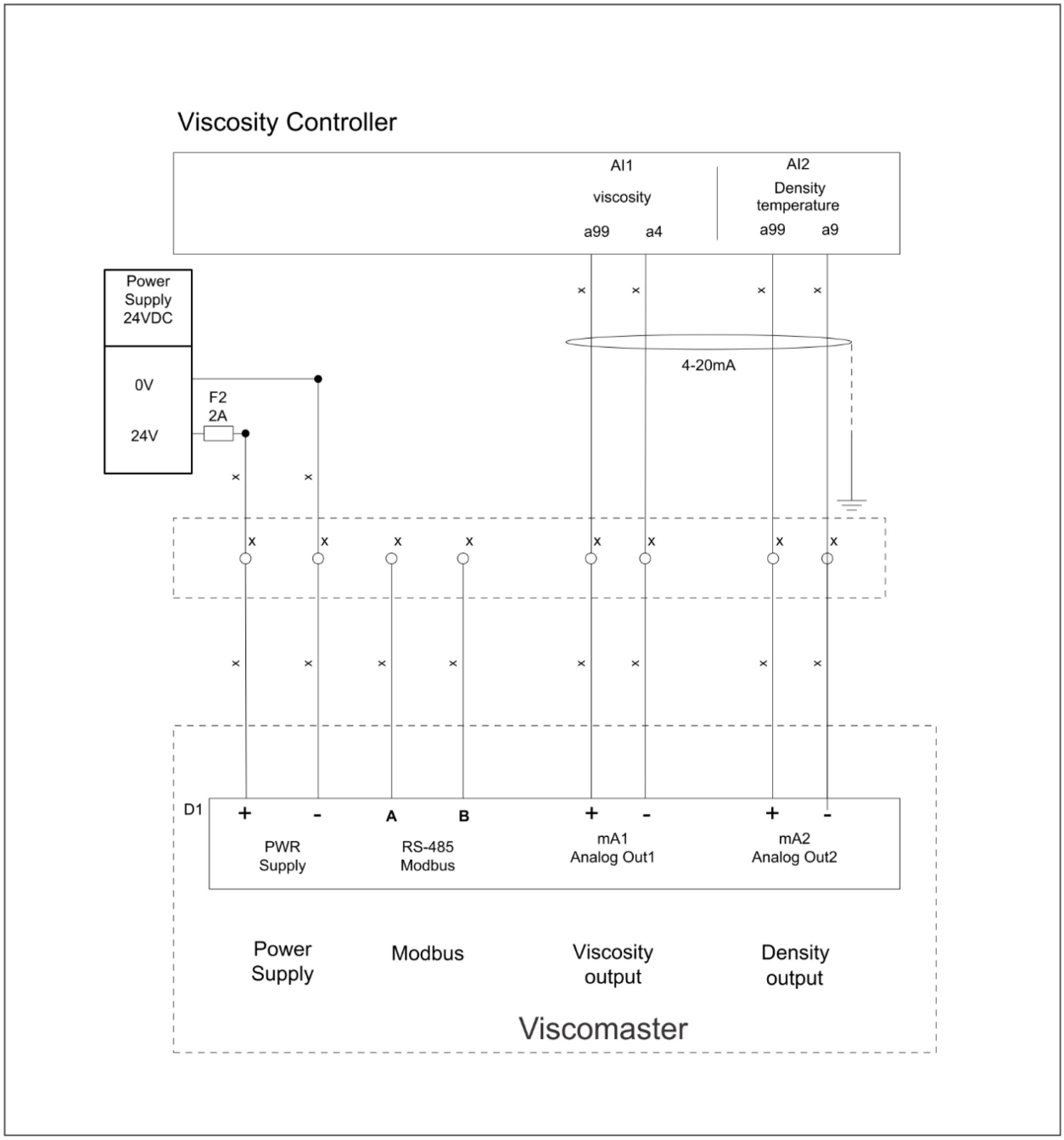
8.3 Electrical Connection diagrams

Detailed connection diagram is made in project drawings.

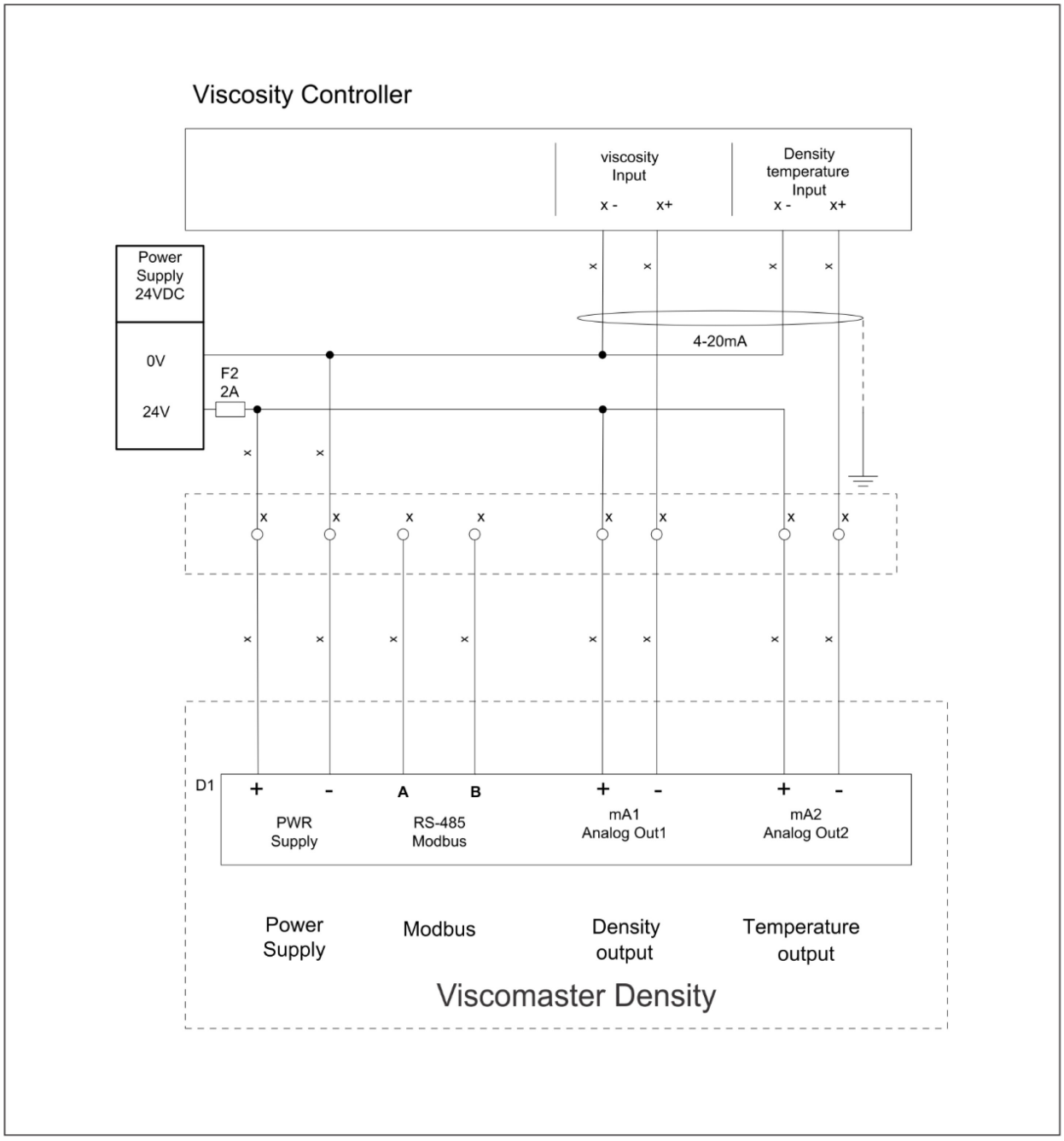
For connection with active power supply via controller, sensor passive.

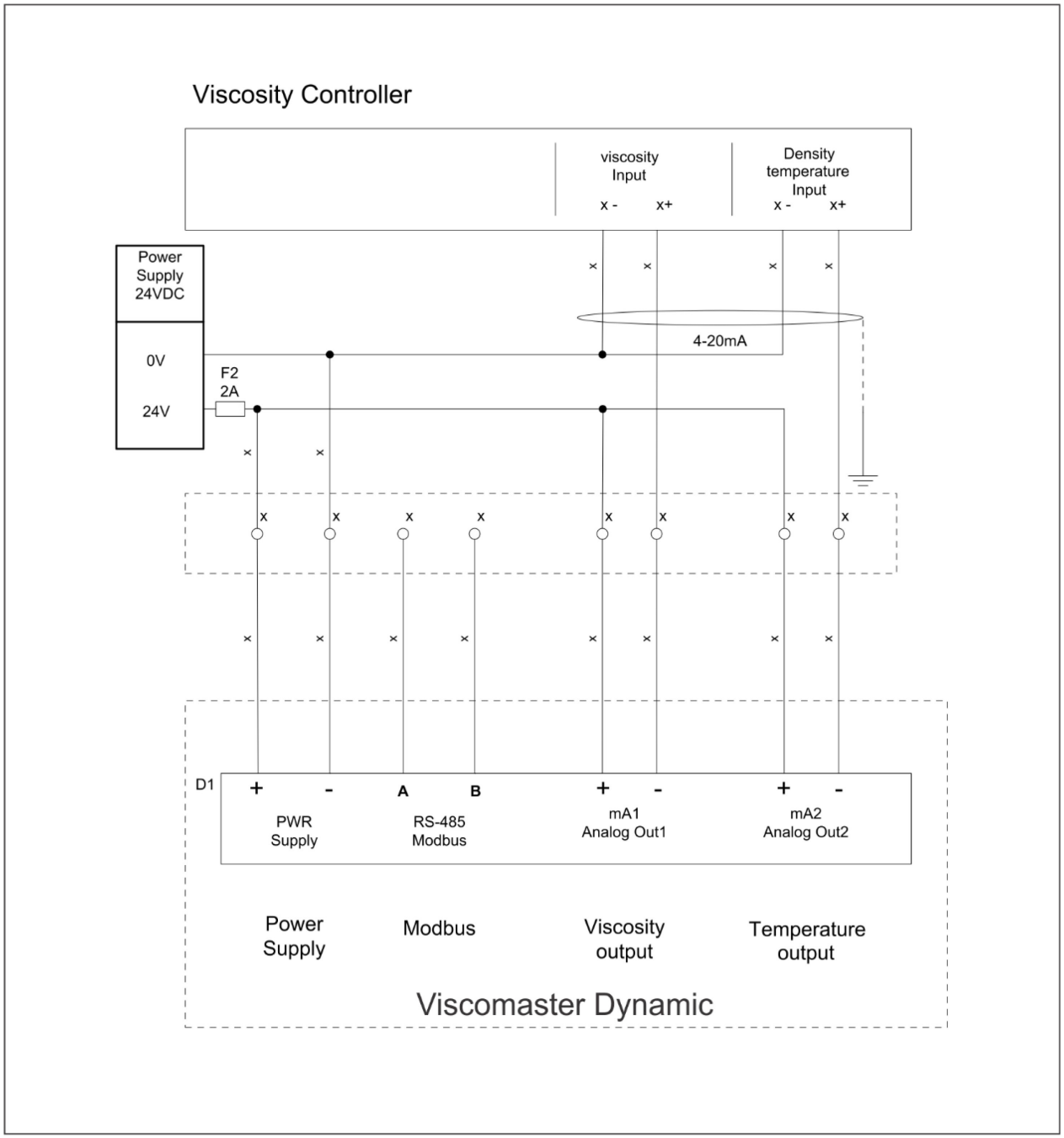


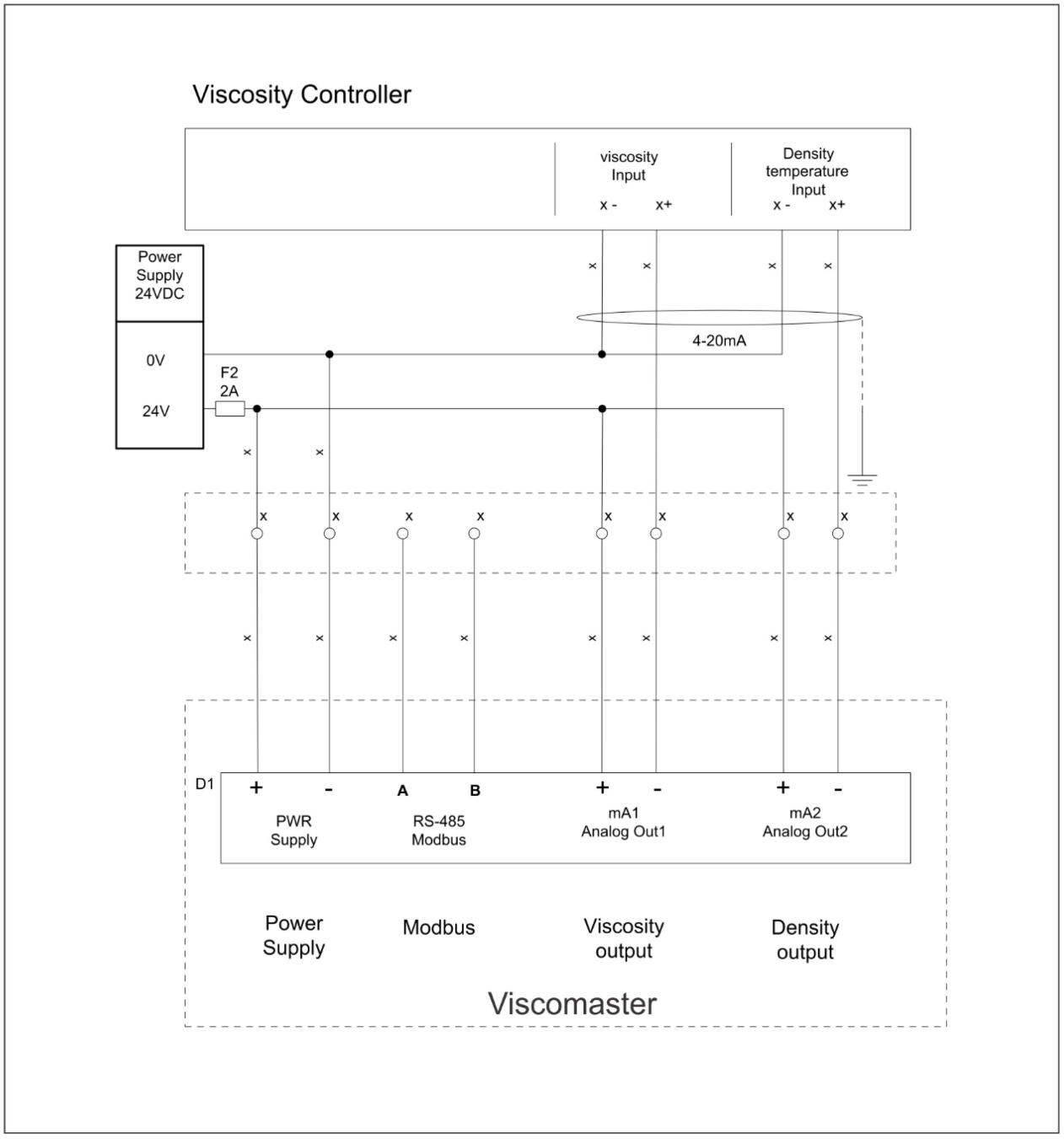

Viscosity Controller
AI1
viscosity
a99
a4
AI2
Density
temperature
a99
a9
Power
Supply
24VDC
0V
24V
F2
2A
4-20mA
D1
+
-
A
B
+
-
+
-
PWR
Supply
RS-485
Modbus
mA1
Analog Out1
mA2
Analog Out2
Power
Supply
Modbus
Viscosity
output
Temperature
output
Viscomaster Dynamic


Viscosity Controller
AI1
viscosity
a99
a4
AI2
Density
temperature
a99
a9
Power
Supply
24VDC
0V
24V
F2
2A
4-20mA
D1
+
-
A
B
+
-
+
-
PWR
Supply
RS-485
Modbus
mA1
Analog Out1
mA2
Analog Out2
Power
Supply
Modbus
Viscosity
output
Density
output
Viscomaster

For connection with external power supply controller and sensor passive.




Viscosity Controller
viscosity
Input
x -
x+
Density
temperature
Input
x -
x+
Power
Supply
24VDC
0V
24V
F2
2A
4-20mA
D1
+
-
A
B
+
-
+
-
PWR
Supply
RS-485
Modbus
mA1
Analog Out1
mA2
Analog Out2
Power
Supply
Modbus
Viscosity
output
Temperature
output
Viscomaster Dynamic

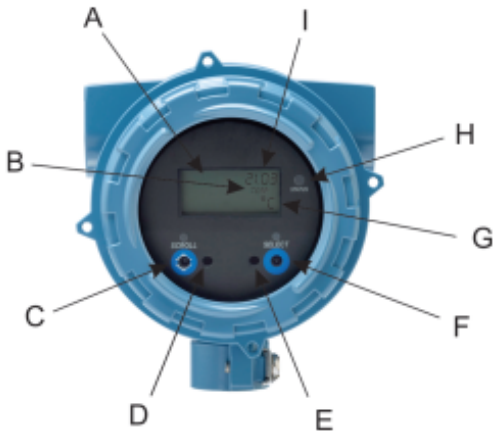

Viscosity Controller
viscosity
Input
x -
x+
Density
temperature
Input
x -
x+
Power
Supply
24VDC
0V
24V
F2
2A
4-20mA
D1
+
-
A
B
+
-
+
-
PWR
Supply
RS-485
Modbus
mA1
Analog Out1
mA2
Analog Out2
Power
Supply
Modbus
Viscosity
output
Density
output
Viscomaster

9 Appendix

9.1 Using the transmitter display (Option)

9.1.1 Components of the transmitter interface

The transmitter interface includes the status LED, the display (LCD panel), and two optical switches.



A. *Display (LCD panel)*
B. *Process variable*
C. *Scroll optical switch*
D. *Optical switch indicator: turns red when Scroll is activated*
E. *Optical switch indicator: turns red when Select is activated*
F. *Select optical switch*
G. *Unit of measure for process variable*
H. *Status LED*
I. *Current value of process variable*

9.1.2 Use the optical switches

Use the optical switches on the transmitter interface to control the transmitter display.
The transmitter has two optical switches: Scroll and Select.
To activate an optical switch, block the light by holding your thumb or finger in front of the opening.

TIP
You can activate the optical switch through the lens. Do not remove the transmitter housing cover.

The optical switch indicator lights up when the transmitter senses that an optical switch has been activated.

Optical switch indicator	State of optical switches
Solid red	One optical switch is activated.
Flashing red	Both optical switches are activated.

9.1.3 Access and use the display menu system

The display menu system is used to perform various configuration, administrative, and maintenance tasks.

TIP

The display menu system does not provide complete configuration, administrative, or maintenance functions. For complete transmitter management, you must use another communications tool.

Prerequisites

To access the display menu system, operator access to either the Off-Line menu or the Alert menu must be enabled. To access the complete menu system, operator access must be enabled for both the Off-Line menu and the Alert menu.

Procedure

1. At the transmitter display, activate the Scroll and Select optical switches simultaneously until the display changes.
   You will enter the Off-Line menu at any of several locations, depending on several factors.
   - » If an alert is active and access to the Alert menu is enabled, you will see SEE ALARM.
   - » If no alert is active, you will see OFF-LINE MAINT.
2. If CODE? appears on the display when you make a choice, enter the value that is configured for Off-Line Password.
   a. With the cursor flashing on the first digit, activate Scroll until the correct digit is displayed, then activate Select.
   b. Repeat this process for the second, third, and fourth digits.

TIP

If you do not know the correct value for Off-Line Password, wait 30 seconds. The password screen will time out automatically and you will be returned to the previous screen.

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3. Use the Scroll and Select optical switches to navigate to your destination in the display menu system.
   - » Use Scroll to move through a list of options
   - » Use Select to choose the current option.
4. If Scroll flashes on the display, activate the Scroll optical switch, then the Select optical switch, and then the Scroll optical switch again.
   The display will prompt you through this sequence. The Scroll-Select-Scroll sequence is designed to guard against accidental activation of the off-line menu. It is not designed as a security measure.
5. To exit a display menu and return to a higher-level menu:
   - » Activate Scroll until the EXIT option is displayed, then activate Select.
   - » If the EXIT option is not available, activate Scroll and Select simultaneously and hold until the screen returns to the previous display.
6. To exit the display menu system, you can use either of the following methods:
   - » Exit each menu separately, working your way back to the top of the menu system.
   - » Wait until the display times out and returns to displaying process variable data

9.2 Display operation

9.2.1 View process variables using the display

View the desired process variable(s).
The display shows the configured display variables. For each display variable, the display reports the abbreviated name of the process variable (for example, DENS for density), the current value of that process variable, and the associated unit of measure (for example, G/CM3).

If Auto Scroll is enabled, the display cycles through the display variables, showing each display variable for a user-specified number of seconds. Whether or not Auto Scroll is enabled, you can activate Select to move to the next display variable.

9.2.2 View and acknowledge status alerts

The transmitter posts status alerts whenever a process variable exceeds its defined limits or the transmitter detects a fault condition. You can view active alerts, and you can acknowledge alerts. Acknowledging alerts is not required.

View and acknowledge alerts using the display

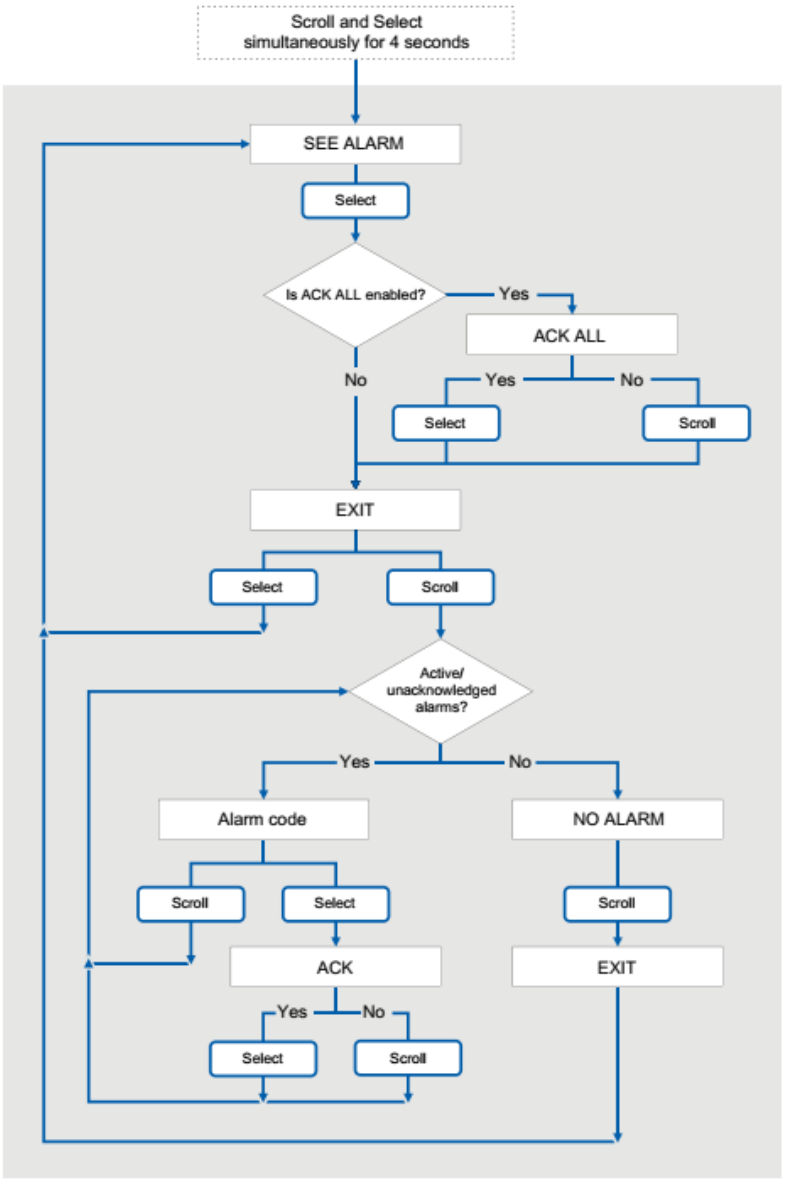
You can view a list containing all alerts that are active, or inactive but unacknowledged.

NOTE!
Only Fault and Informational alerts are listed. The transmitter automatically filters out alerts with Status Alert Severity set to Ignore.

Prerequisites

Operator access to the alert menu must be enabled (default setting). If operator access to the alert menu is disabled, you must use another method to view or acknowledge status alerts.

Procedure



Post requisites

- To clear A010, A011, A012, A013 alerts, you must correct the problem, acknowledge the alert, then repeat the calibration.
- To clear A001, A002, A029, A031 alerts, you must correct the problem, acknowledge the alert, then power-cycle the transmitter.
- For all other alerts:
- If the alert is inactive when it is acknowledged, it will be removed from the list.
- If the alert is active when it is acknowledged, it will be removed from the list when the alert condition clears.

Table 5-1: Status alerts and Status Alert Severity

Alert number	Alert title	Default severity	User can reset severity
A001	EEPROM Error	Fault	No
A002	RAM Error	Fault	No
A003	No Sensor Response	Fault	Yes
A004	Temperature Overrange	Fault	No
A006	Characterization Required	Fault	Yes

A008	Density Overrange	Fault	Yes
A009	Transmitter Initializing/Warming Up or Significant Process Instability	Ignore	Yes
A010	Calibration Failure	Fault	No
A014	Transmitter Failure	Fault	No
A016	Sensor Temperature (RTD) Failure	Fault	Yes
A020	Calibration Factors Missing	Fault	Yes
A021	Transmitter/Sensor/Software Mis match	Fault	No
A029	Internal Electronics Failure	Fault	No
A030	Incorrect Board Type	Fault	No
A036	Viscosity Overrange	Fault	No
A037	Sensor Check Failed	Fault	Yes
A038	Time Period Signal Out of Range	Fault	No
A100	mA Output 1 Saturated	Informational	To Informational or Ignore only
A101	mA Output 1 Fixed	Informational	To Informational or Ignore only
A102	Drive Overrange	Informational	Yes
A104	Calibration in Progress	Informational	To Informational or Ignore only
A105	Two-Phase Flow	Informational	Yes
A106	Burst Mode Enabled	Informational	To Informational or Ignore only
A107	Power Reset Occurred	Informational	Yes
A113	mA Output 2 Saturated	Informational	To Informational or Ignore only
A114	mA Output 2 Fixed	Informational	To Informational or Ignore only
A115	No External Input or Polled Data	Informational	To Informational or Ignore only
A116	Temperature Overrange (API Referral)	Informational	Yes
A117	Density Overrange (API Referral)	Informational	Yes
A118	Discrete Output 1 Fixed	Informational	To Informational

			or Ignore only
A122	Pressure Overrange (API Referral)	Informational	Yes
A132	Sensor Simulation Active	Informational	Yes
A133	EEPROM Error (Display)	Informational	Yes
A136	Incorrect Display Type	Informational	Yes

9.2.3 You can control the process variables shown on the display and a variety of display behaviors.

» Configure the language used for the display
- Overview
  Display Language controls the language used for process data and menus on the display.
- Procedure
  Select the language you want to use.
  The languages available depend on your transmitter model and version.

Display	**OFF-LINE MAINT > OFF-LINE CONFG > DISPLAY > LANG**

» Enable or disable automatic scrolling through the display variables (Section 5.1.5)
- Overview
  You can configure the display to automatically scroll through the configured display variables or to show a single display variable until the operator activates Scroll. When you set automatic scrolling, you can also configure the length of time each display variable is displayed.
- Procedure
  Enable or disable Auto Scroll as desired.

Display	**OFF-LINE MAINT > OFF-LINE CONFG > DISPLAY > AUTO SCRLL**

» Enable or disable the Acknowledge All Alerts display command
- Overview
  You can configure whether or not the operator can use a single command to acknowledge all alerts from the display overview
- Procedure
  1. Ensure that the alert menu is accessible from the display.
     To acknowledge alerts from the display, operators must have access to the alert menu.
  2. Enable or disable Acknowledge All Alerts as desired.

Display	**OFF-LINE MAINT > OFF-LINE CONFG > DISPLAY > ACK**

9.3 Display codes and abbreviations

Code	Definition	Units
Standard		
DENS	Line Density	kg/m^3
TEMP	Line Temperature	°Celsius; °Fahrenheit; °Kelvin
EXT T	Line Temperature (External)	°Celsius; °Fahrenheit; °Kelvin
DGAIN	Drive Gain	%
UCALC	User-Defined Calculation Output	

Viscosity measurement		
DYNV	Line Dynamic Viscosity	Centiposse (cP)
KINV	Line Kinetic Viscosity	Centistokes (CSt)
RVISC	Referred Viscosity	
SRVIS	Secondary Referred Viscosity	
API referral		
RDENS	Referred Density (API)	
CCAI	Calculated Carbon Aromaticity Index	
CII	Calculated Ignition Index	
System variables		
AO 1	mA Output 1	
AO 1 SRC	mA Output 1 Source	
AO 2	mA Output 2	
AO 2 SRC	mA Output 2 Source	
DRIVE	Drive Gain	
Q FCTOR	Quality factor	
RANG	Range	
Language Codes		
FREN	French	
GER	German	
ENGL	English	
SPAN	Spanish	

ABORT	Abort
ACCPT	Accept
ACK	Acknowledge
ACK ALL?	Acknowledge all
ACTIV	Active
ALARM	Alert
ALL	All
APPLY	Apply
AUTO	Auto
AUTOSCRL	Auto Scroll
AVG	Average
DISBL	Disabled
DISPLAY	Display
DSPLY	Display
ENABL	Enabled
ENTER	Enter
EXIT	Exit
NO	No
OFF	Off
OFFSET	Offset
ON	On
OOR	Out of range
PASSW	Password or passcode
RESTORE	Restore
RESULT	Result
RTEMP	Reference temperature
RUN	Run

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