TechnipFMC

Smith Meter® PRIME 4

Installation and Operation Manual

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November 2020

Important

All information and technical specifications in this document have been carefully checked and compiled by the author; however, we cannot completely exclude the possibility of errors. TechnipFMC is always grateful to be informed of any errors; contact us on TechnipFMC.com.

Caution

Read instructions carefully before attempting to operate. Claims for damage caused by air, line contamination, or pressure shock waves during start-up will not be accepted by TechnipFMC Measurement and Production Solutions Inc.

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Literature Library
http://info.smithmeter.com/literature/

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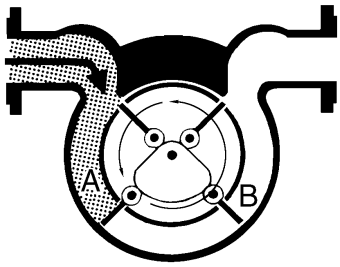
1 Overview

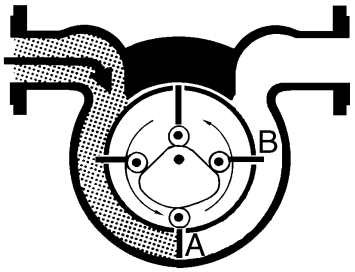
The Smith Meter PRIME 4 meter is a rotary positive-displacement meter that measures product flow in two directions. The accurately machined housing contains a rotor which revolves on tungsten carbide bearings and carries two evenly spaced Polyketone blades. As liquid flows through the meter, the rotor and blades revolve about a fixed cam, causing the blades to reciprocate. The successive movement of the blades forms a measuring chamber of precise volume between the two blades, the rotor, the housing, the bottom, and the top covers. A continuous series of these closed chambers is produced as the rotor revolves. Neither the blades nor the rotor contact the stationary walls of the measuring chamber.

1.1 Principle of Operation

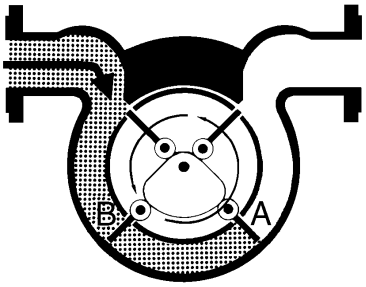
One of the outstanding features of the PRIME 4 meter is that product flow is undisturbed while it is being metered. Energy is not wasted by unnecessary hydraulic bending of the liquid.



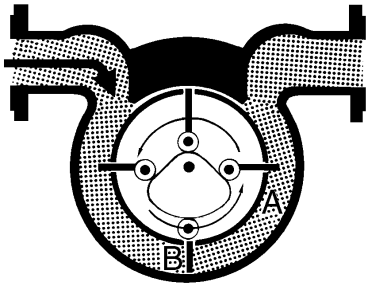
Unmeasured liquid (represented by the dark area in the drawing below) is shown entering the meter, causing the meter's rotor and blades to turn counter-clockwise. Blades A and B are fully extended, forming the measuring chamber; the opposite ends of blades are retracted and flush with the rotor.



In the drawing below, the rotor and blades have made a one-eighth revolution. Blade A is fully extended; blade B is partially drawn back; and the opposite end of blade B is starting to extend.



In the example below, a quarter revolution has been made. Blade A is still extended and blade B is now fully extended. An exact known volume of new liquid is now in the measuring chamber.



One-eighth of a revolution later, the measured liquid moves out of the meter. Blade A retracts on the outlet side and starts to extend on the inlet side to form another measuring chamber. A second measuring chamber forms between blades B and A as the rotor rotates around the cam.

In one-half revolution, two measuring chambers have formed and the third is forming. This cycle is repeated as long as liquid flows.

The rotation of the rotor is converted into electronic pulses by means of an exciter gear—an integral part of the rotor—and a pulse pick-up located in a well on the side of the meter cover. The meter produces approximately 50 pulses per gallon (13 pulses per liter).

2 Installation

2.1 Overview

The PRIME 4 meter is a precision instrument and should be treated accordingly. Prior to installation, it should be protected from adverse weather conditions and accidental abuse. Adequate pipe support must be provided close to the meter because the meter is supported by the flanges. Piping must not produce an undue strain on the meter. Dimensional outline drawings of the meter are available. See specifications document SS01096 for dimensional outline drawings of the meter.

2.2 Preparing the Meter for Installation

Complete the following steps to prepare the PRIME 4 meter for installation:

- Flush the meter with a light lubricating oil if it has been left idle or stored.
- Use a carpenter's level on a flat surface of the meter housing to ensure the rotor is level (for example, on the cover around the bolt circle or on the nameplate pad). This is important because the meter rotor must not gravitate to one side.
- Ensure the drain plug is accessible, but the meter cannot be accidentally drained of product.
- Use a relief valve to protect the meter and system against the effects of thermal expansion.

> **WARNING:** Thermal expansion of liquid in this equipment can cause high-pressure damage. A thermal pressure relief valve may be necessary in the system.

- Install a deaerator or air eliminator, when necessary, to keep air and vapor out of the meter.
- Clean all piping internally before the meter is put into operation.
- Completely remove any rust, dirt, welding shot, and other foreign material from the meter.
- Remove the meter and install a spool piece if the system will be pressure-tested with water or if debris will be flushed from the system.
- Protect the meter with at least a 40-mesh strainer, when necessary.
- Install a flow-limiting valve, when necessary, downstream of the meter to protect it from excessive flow rates.
- Do not calibrate the meter with water or allow water to stand in the meter.

2.3 ATEX- and IECEx-Approved Installations

Standards used:

- IEC 60079-0 7th Edition, EN 60079-0:2018

- IEC 60079-1 7th Edition, EN 60079-1:2014

All cable entries, stopping boxes, or plugs should be certified according to the requirements in EN 60079-1 with 3/4-inch 14 NPT threaded entry. Wiring conductors and cable glands, if used, must have a temperature rating of at least 70 ºC.

> Repairs to the sensor housing may only be made by the manufacturer or Ex d certified repair shops for the 3/4-inch 14 NPT or 1/16-inch 27 NPT flame-proof joints.
>
> Repairs on the basis of the values in Tables 2 and 3 of EN/IEC 60079-1 are not permitted.

For wiring systems using cable glands, the gland or thread adapter must be installed in accordance with EN/IEC 60079-1 Section 13. The cable end must be securely installed and, depending on the cable type, be properly protected from mechanical damage. Select wiring and cable glands suitable for 70 ºC ambient operation.

For wiring systems using conduit, an Ex d certified sealing device must be used immediately at the entrance of the J-Box enclosure. It is an end-user requirement to ensure that any unused entries must be suitably blocked with an Ex d IIC IP with Ingress protection matching the name plate markings.

Equipotential bonding or earthing must be safeguarded by the way the sensor is connected with the complete system.

Electrical Ratings: 28 VDC, 50 mA max.

CE 0539 Ex II 2G

Table 1: ATEX- and IECEx-Approved Installations

Marking	Equipment Covered	Certificate
Ex db IIB T5...T6 Gb IP65 or IP66 -50 °C ≤ Ta to ≤ +70 °C $T_{process}$ = -20 °C to 93 °C T5 ≤ 93 °C / T6 ≤ 80 °C	Type SG Sensor	DEMKO 19 ATEX 2266X IECEx TUN 15.0029X

2.4 UL Brazil-Approved Installations

> Repairs to explosion-proof joints may only be carried out in accordance with the manufacturer's design specifications. Repair based on the values in tables 2 and 3 of ABNT NBR IEC 60079-1 is not allowed. Repairs should only be done by the manufacturer or an Ex certified repair shop

Installed or connected components (e.g., terminal compartments, bushes, plugs, cable glands, connectors) must have construction features that meet technical specifications for the CoC. They must be suitable for the operating conditions and be separately certified. The special conditions specified for the components must be met. This applies also to components shown and mentioned in the technical description. The terminal compartment can be connected to suitable conduit systems that comply with the NBR IEC 60079-1 requirements and for which a separate certificate has been issued.

Openings in the enclosure that are not used must be closed/sealed in accordance with ABNT NBR IEC 60079-1 (for example, with the use of separately certified plugs).

For wiring systems using cable glands, the cable ends must be installed securely and, depending on the type of cable, they must be adequately protected against mechanical damage.

This requirement may be ignored when a cable gland and connecting cable are used in such a way that there is no risk of mechanical damage to the installation.

The connection cable must be of a quality that meets the thermal requirements under field service conditions.

The equipotential/ground connection must be ensured with the installation of the sensor connected to the complete electrical system of the installation.

Electrical ratings: 28V DC, 50 mA Max.

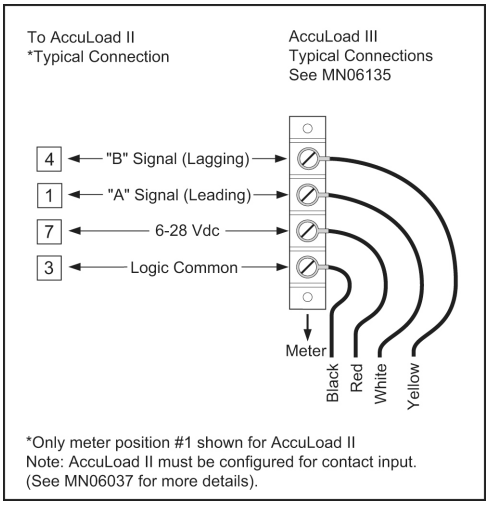
> To avoid igniting an explosive atmosphere, do not open the enclosure unless you are sure it is not a hazardous area. To prevent ignition of an explosive atmosphere and to avoid electric shock, disconnect the power circuits before opening the enclosure. While the electrical circuits are energized, during operation, keep the enclosure properly closed.

Table 2: UL Brazil-Approved Installations

Marking	Equipment Covered	Certificate
Ex db IIC T5 …T6 Tamb = - 50 °C ≤ Tamb ≤ + 70 °C IP65 or IP66 $T_{process}$ = -20 °C to +93 °C T5 ≤ 93 °C / T6 ≤ 80 °C	Type SG Sensor	UL-BR 19.1164X

2.5 Wire Connections

2.5.1 Quadrature (Two Channel) Installations



For quadrature (two channel) meter installations with reverse flow direction, refer to the following wiring diagram and reverse white and yellow wire connections. Yellow wire becomes the "A" signal and white wire becomes the "B" signal.

3 Operation

3.1 Start-Up Procedure

When the PRIME 4 meter is first installed in the line, air is in both the line and inside the meter's rotor. The air takes some time to work out. If the meter is subjected to hydraulic shock during this vulnerable time, the rotor can pinch down on the blades and cause blade breakage or cam shaft rotation. By following the procedure outlined below, the likelihood of meter damage should be greatly reduced.

This procedure should be repeated whenever air has been introduced to the line or meter.

1. If possible, gravity head should be used to initially fill the meter. The upstream valve should be slowly opened as product is gravity fed through the meter and air is vented from the high point of the meter or system.
2. After gravity feeding the meter is complete and all air that can be removed during this step has been removed, close the upstream isolation valve and energize the pump.
3. Slowly open the upstream isolation valve until the meter and flow control valve are just pressurized. It is important that the upstream valve be just barely open to ensure that the meter is operated between 50 to 75 gallons per minute (gpm).
4. Initiate low flow between 50 and 75 gpm using the electronic preset. It is recommended that multiple batches of at least 300 gallons be run to ensure all air from the system is expelled.
5. Vent air from the high-point vent until no sign of air being vented is evident.

> Air trapped inside the rotor takes time to be displaced.

6. After all of the air has been bled from the system, gradually open the isolation valve and initiate normal operation.

3.2 General Operating Information

The PRIME 4 meter has been tested on kerosene and the meter median K-factor has been attached. To obtain maximum service from Smith Meter meters, it is suggested that detailed records be maintained.

Data about the meter—such as the model, serial number, operating rate, type of product, meter clearances, totalizer readings, meter factor, and other pertinent information—should be recorded. Such information is an excellent guide in scheduling a preventive maintenance program.

4 Referenced Publications

The following publications from the American Petroleum Institute are referenced in this manual:

- Manual of Petroleum Measurement Standards
- API Chapter 4—Proving Systems
- API Chapter 5, Section 5.2—Measurement of Liquid Hydrocarbons by Displacement Meter Systems

API Chapter 12, Section 2 Field Manual—Instructions for Calculating Liquid Petroleum Quantities Measured by Turbine or Displacement Meters

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