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## ► Positive Displacement Gear Meters

### Installation, Operating & Maintenance Manual

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# Safety Definitions and Information

Do not attempt to install or use your AW Gear Meters product until you have read the safety instructions in this section. Save this manual and keep it in an easily accessible place.

## Unpacking

Separate the flow meter from packaging materials and check for any visual signs of damage. If you determine there has been damage caused by shipping, file a claim with the shipping company. If the flow meter appears to have been improperly assembled or does not operate properly, return the product for replacement or repair (see Limited Warranty information at the end of this manual).

## Quick Start

To set up, install and operate your flow meter quickly, follow these step-by-step instructions. Detailed installation, operational, and maintenance instructions begin on page 5 in this manual. More information is also available in the Maintenance Guide appropriate for your flow meter.

### Install Pickup Sensor

Before attaching the sensor to the flow meter, check for any potential clearance issues. It may be easier to install the sensor after you have installed the flow meter in the line.

**CAUTION: Whether the sensor requires tool or hand installation, tighten with hand-tighten torque only.**

*NOTICE: Some flow meters are shipped with the sensor already installed.*

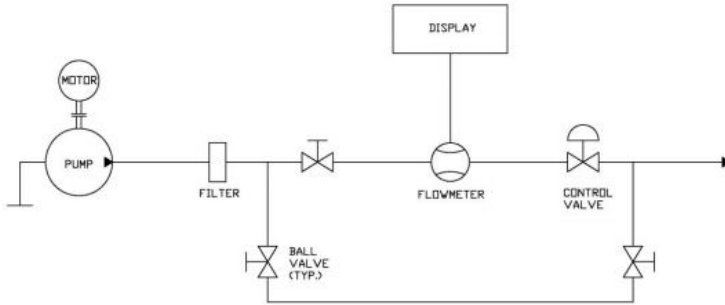
### Flush Piping

If feasible, flush piping to remove dirt and debris before installing flow meter.

### Filtration

Filtration is recommended to prevent contaminants from entering the flow meter.

Figure 1: Typical flow meter installation with bypass



See flow meter Data Sheet for specific filter, including mesh weight and size.

## Location

It's best to install the flow meter upstream from control valves and fluid regulators, if possible. See Figure 1.

## Orientation

Positive displacement gear flow meters can be installed either a horizontal or vertical (flow up) orientation. 2-3 psi of backpressure is required to assure the meter is always full of fluid. No straight run pipe is required upstream or downstream of the meter.

Figure 2: Flow meter with direction of flow marked with arrow



## Flow Direction

Flow direction is marked with an arrow on the flow meter. See Figure 2.

# Product Description and Principle of Operation

AW Gear Meters positive displacement gear flow meters are similar in design to the gear pump. However, the principle of operation is reversed: instead of the gears driving the medium, the medium drives the gears. A non-intrusive sensor detects the movement of the gear. As each tooth passes the sensor, the sensor produces a square-wave pulse and measures a discrete volume of liquid. The resulting pulse train is proportional to the actual flow rate, providing a highly accurate representation of the fluid flow. All flow meters are designed with highly wear-resistant moving parts to provide exceptionally long service life. The materials of construction are:

- stainless steel or high-strength aluminum housing
- stainless steel gears
- either tungsten carbide sleeve bushings or stainless steel ball bearings (depending on model)

The fluids you are metering should be compatible with these materials.

## Filtration

Filtration depends on the model. Make sure to follow proper filtration requirements for your specific model. Because the internal assembly has very small clearances, small filter sizes are required, especially for ball-bearing flowmeter versions.

*NOTE: Filters are meant to filter out impurities in the fluid stream. If you are measuring fluids with fillers, even if the fillers are smaller than the maximum recommended filter size, please consult the factory for correct meter selection.*

# Installation

## Preferred Flow Direction

The preferred flow direction is marked with an arrow on the meter showing the flow direction in which the flow meter was calibrated (see figure 2). However,

the flow meters have bi-directional flow capabilities and are often used for bi-directional flow applications. Since the meters indicate flow in both directions, if reverse flow detection is not desired, install a check valve up-stream of the flowmeter.

## Preferred Orientation

The preferred orientation for mounting gear meters, especially in low flow and or low viscosity applications, is so that the internal shaft/gear assembly is in a horizontal orientation (housing bolts facing sideways, not up/down). This allows for the least amount of internal drag due to mass of gears.

## Location

It is important to make sure that the flowmeter is always full of fluid and never partially filled. Do this by making sure there is always a small amount of backpressure on the meter, usually 2 to 5 psi minimum.

Create backpressure by making sure there is some flow restriction downstream from the flowmeter such as a check valve, regulator, or piping rising above location of flowmeter. See Figure 1.

Backpressure from control valving is beneficial for stable running. In similar fashion, if a flowmeter is installed with fluid flow in a downward direction, the fluid cannot exit the flowmeter directly into a container with no restriction due to the fact the meter will not be full of fluid, causing inaccurate measurement.

**CAUTION: Eliminate all dirt, debris and metal shavings from the piping, as the liquid must be free from any particles larger than what the manufacturer's specifications allow. Install any recommended filtration before operation, as potential plugging most often occurs at startup.**

## Installing a Bypass

If possible, install a bypass around the flow meter, and flush existing piping with the appropriate liquid before first use. See Figure 1.

## Pickup Sensor

Review the pickup instructional guide prior to installation.

## Location

Locate the pickup and wiring away from A/C motors, actuators, heaters, relays, etc. Use only shielded cable and if possible, a dedicated power supply for the electronics. If sharing power with other devices in the system, be aware that power-draw spikes from other equipment could cause a surge into the sensor, which in turn can cause sensor to give erroneous pulses. Ensure clean power supplies that utilize a true earth ground. Install Intrinsic Safety Barriers if the circuit is intended to be intrinsically safe.

## Installation

Before attaching the sensor to the flow meter, check for any potential clearance issues. It may be easier to install the sensor after the flow meter has been installed in the line.

**CAUTION: Do not use a wrench or Channellock®\* to aid in hand installing the pickup sensor.**

**CAUTION: Whether the sensor requires a tool to install or is hand installed, tighten to hand-tighten torque only. Over tightening may cause damage to the sensor and as a result it may not function properly.**

Figure 3: Flow meter with pickup sensor installed



\*Channellock® is a registered trademark of Channellock, Inc.

# Operation

**CAUTION: Before installing, operating or attempting maintenance on a flow meter, read the appropriate Maintenance Guide. As with any precision-engineered device, always operate and maintain the equipment in accordance with the manufacturer's instructions.**

## Overview

Flow meters are designed to measure the flow of liquids, which assist in cooling and lubrication. Always close meters to air except when air is part of an automated purge cycle, such as certain paint systems. In this case, the air segments are typically under 1 or 2 seconds and are interspersed with lubrication liquid for a scrubbing effect; in addition, the air segments are short enough that the flow meter does not dry out.

**CAUTION: Do not dry lines using only pressurized air, as this will lead to premature wear.**

## Running the Flow meter

Never run the flow meter dry or spin with air only. Gear flow meters are precision-engineered flow devices. Always maintain them in a clean, lubricated condition with the internal parts wet at all times. Do not allow air or water to contact the internal parts except in short (1-2 second) cycles as part of an automated flush. If you flush meter with water, make sure to run non-corroding fluid through the meter afterwards. Even stainless steel meters will stain or corrode from the minerals in most water.

## Ramp Up

Do not increase flow to a full flow condition instantaneously. Gear flow meters are rugged yet precise instruments that respond almost instantaneously to changes in fluid flow. To avoid damage to the system, increase flow to maximum over a few seconds rather than instantaneously and do not inject high flow speeds into an empty flow meter.

## Regular Cleaning

Designing and maintaining a flush procedure that keeps the flow meter internals clean and wet is critical to optimum performance and minimum maintenance. Cleaning cycles vary due to the differences in coatings, equipment, and cleaning fluids, and some testing may be prudent to determine the most efficient method.



More corrosive fluids may also require more frequency flush cycles, or if meter sits idle for longer periods of time, such as between shifts, flushing may also be required more often. Consult with the fluid manufacturer for recommended cleaning fluids.

*NOTE: During line shutdowns such as overnight and over weekends, flush and leave meters filled with proper cleaning fluid under pressure to allow any residue that may have built up to soak and dissolve.*

## End of Shift and Overnight Preparations

At the end of a shift or overnight, leave cleaning fluid in the flow meter under pressure, to soak. This helps keep unflushed residual fluids from drying, and facilitates subsequent startups. Opening a flow meter after a flush cycle helps determine if the purge is thoroughly cleaning the flow meter.

## Breakdown

*NOTE: Full breakdown instructions are included in the Maintenance Guide.*

*NOTE: If you remove a flow meter from the line during maintenance, do not allow fluids to dry inside. Clean the internals immediately, lubricate them, and cap the fluid ports.*

*NOTE: Clean the carbide surfaces at the point where the gear rotates on the shaft. Buildup here may occur as a thin smear and may be difficult to see, but causes friction and accelerate additional buildup later when the gears are reinstalled. Spin the gears by hand to verify that they rotate freely on the shaft and apply a suitable lubrication fluid before closing the flow meter. After tightening the bolts, a short squirt of shop air will briefly spin the gears, which should be easily audible.*

**CAUTION: Do not overspin gears if using shop air to verify free rotation of gears prior to installation**

**CAUTION: Do not use wrenches or a Channellock to aid in re-installing the pickup sensor by hand. Whether you are installing the sensor with a tool or by hand, tighten to hand-tighten torque only.**

## Plugging

In the event of plugging, the flow meter passes a reduced volume of fluid with an increased backpressure and no frequency output. Careful installation is important because this is the time when contaminants such as tape or metal shavings can enter the flow meter. Filters should be in line to prevent oversized particles from entering the flow meter.

In the event the flow meter needs to be returned to the factory for further evaluation, flush the flow meter in place and cap the ports. Pack carefully (with

original packing materials, if possible) prior to shipping to prevent damage.

## Filtration

Filtration is recommended to prevent contaminants from entering the flow meter. If the flow meter is plugged, a reduced flow can still be observed from the nozzle or outlet, as fluid pressure squeezes fluid through the flow meter. Should this occur, review the cleaning and maintenance procedures in the following sections.

# Maintenance

Follow these general guidelines for operating and maintaining your positive displacement flow meter.

## Use the Maintenance Guides

Always review the Maintenance Guides provided with the flow meter (download additional copies at [www.awgarmeters.com](http://www.awgarmeters.com) ) prior to attempting any maintenance work. The majority of down time and repairs is the result of breakages due to improper maintenance actions, lack of training or rough handling.

## Flow Testing

**Do not use water for flow testing.** The viscosity of water is too low to produce accurate results unless the flow rate is elevated, and the internals would then have to be dried and lubricated to avoid corrosion or scaling. If system calibration is necessary, the preferred calibration fluid is the actual fluid to be metered. Alternatively, using a fluid with a viscosity of approximately 30 cSt<sup>o</sup> such as mineral oil or thinned glycerin is recommended.

## Plugging and Filtration

Filtration is recommended to prevent contaminants from entering the flow meter. Should the flow meter become plugged, a reduced flow may still be observed from the outlet as fluid pressure will squeeze fluid through the flow meter – visual flow does not necessarily mean that the flow meter's gears are turning. If contaminants are causing the plugging, install filtering. If particle buildup repeatedly causes plugging, review the cleaning and maintenance procedures in the Regular Cleaning section on page 8. Because of the considerable differences in fluid types and in-plant procedures, some trial and error may be required to determine the ideal flushing or cleaning regimen.

*\*cSt is a unit of kinematic viscosity that equals one hundredth of a stoke.*

## Calibration

A calibration factor (k-factor) is established at the factory on a preferred calibrating fluid. This number, which is provided with the flow meter either on a Calibration Data Sheet or on a tag attached to the flow meter, is usually accurate for a wide variety of fluids and should not usually be changed. Should the data sheet become lost, contact the factory for a duplicate copy. See the Calibrations section on page 12 for a calibration verification procedure.

## Storage

When the flow meter is idle or stored for any extended period, perform the following:

1. Clean the internals thoroughly with the appropriate fluid
2. Lubricate with a light oil or other non-corrosive fluid
3. Cap or plug the ports to prevent drying

## Flow Meter Do's and Don'ts

**DO:** Leave flushing fluid in the lines overnight or during extended off-times. This keeps internals wet, prevents residual fluids from drying, and facilitates startups.

**DO:** Follow the Maintenance Guide instructions when opening and cleaning a flow meter. During cleaning, separate the gears from the shafts. On carbide bearings, clean inside the center of the gear bearing and on the outer surface of the shafts at the point where the gear rotates on the shaft. Apply a suitable lubricating fluid before closing the flow meter. After tightening the bolts, a short squirt of shop air will briefly spin the gears, which should be easily audible.

**DO:** Install and maintain filters. Install the recommended filter to eliminate potential plugging. Should plugging occur, the flow meter will still pass fluid but with no signal output.

**DO:** Check electrical compatibility between the flow meter's output signal and the input of the PLC. If signals are not being detected at startup, first check wiring and electrical compatibility.

**DO:** Verify reliable grounding of electrical parts, as per installation guidelines. A dedicated power supply is recommended. Voltage spikes on shared power lines, negligent grounding and sloppy wiring will likely produce erratic readings and chronic maintenance.

**DO:** Install the flow meter immediately upstream of the regulator or control valve. The control valve provides backpressure, which stabilizes the flow.

**DON'T:** Allow air into the flow meter. Always keep the flow meter internally wet.

**DON'T:** Dry lines using pressurized air. Flow meters are designed to flow liquids. Close meters to air except when air is part of an automated purge cycle. Do not dry lines after purging.

**DON'T:** Allow materials to dry inside the flow meter. When a flow meter is removed from the line during maintenance, clean the internals immediately, lubricate the gears, and cap the fluid ports.

**DON'T:** Over tighten the pick-up sensor beyond hand tight. When installing the pickup sensor, turn it in lightly to a hand-tight torque. Do not use a wrench on the pickup as over tightening may cause a dimple of metal under the sensor nose to protrude into the gear cavity and interfere with the gear's rotation.

**DON'T:** Use water or solvent for calibration or test purposes. Water or solvent may not turn the gears at low flow and may leave the impression that the flow meter is not functioning. A calibration factor (kfactor) is issued with the flow meter, which is valid for most fluids except water or equivalent viscosities.

## Calibrations

Each flow meter is calibrated and given a "k-factor" using a standard calibrating fluid at the factory. This number is accurate for all fluids with most viscosities, except the most water-like. There should be no need to change this except for fluid viscosities below 30cSt.

### If flow readings are too high

If the display shows significantly more than the volume actually dispensed or shows flow when there is definitely no flow, this most likely indicates an electrical noise problem. In such cases, turn off nearby motors, heaters or relays, check cable shielding, and establish a clean ground independent of other electrical devices before repeating accuracy tests. If the problem continues, it may be necessary to relocate the offending device or reroute cabling away from noise sources.

## If flow readings are too low

If the display shows significantly less than the volume actually dispensed, most likely the flow meter has a high slippage factor, and the fluid is bypassing the gears and the k-factor may require adjustment. Dirt or dried material can also keep gears from rotating freely.

## If it is necessary to adjust the existing k-factor

Trigger at least 500ml of your sample fluid in a steady stream at approximately the desired flow rate into a graduated beaker. Compare the volume in the beaker to the volume on the display. Do not time the operation; merely measure the volume dispensed. Repeat the sample 3 times and take an average. If the result is outside an acceptable margin, adjust the k-factor by the percentage of difference between the average beaker sample and the average displayed total. If the error is not rectified, clean the flow meter thoroughly and repeat the procedure. Do not use water for this test. For most accuracy results, calibrate using fluid to be measured with flowmeter.

## If it is necessary to re-calculate a new k-factor

You will first need a data-collecting instrument to count pulses produced by the flow meter. An AW display may be used in totalizer mode provided the KFT is set to count each pulse (KFT = 10000). Trigger at least 500ml of your sample fluid in a steady stream at approximately the desired flow rate into a graduated beaker. Divide the number of pulses by the volume dispensed and the result is your new kfactor in the units of your sample. In the example above, the k-factor units would be impulses/ml.

# Trouble-Shooting Guide

PROBLEM	POSSIBLE CAUSE	SOLUTION
Flow meter indicates lower than actual.	Viscosity of fluid is less than 30 cst.	Decrease the k-factor by percent error.
	Excessive pressure differential across flow meter, causing gears to bind.	Reduce flow rate, reduce fluid viscosity.
	Debris in measuring chamber.	Clean flow meter; change or add filter.
	Upper housing has dimple from over tightening sensor.	Replace upper housing.
Flow meter indicates higher than actual.	Air in lines.	Add air eliminator.
	Electro-magnetic interference.	Ground flow meter and all electronics.
	Reverse fluid flow.	Add check valve.
Indicator shows flow when there is no flow.	Fluid oscillates.	Check pump, add check valve, increase backpressure.
	Electro-magnetic interference.	Ground flow meter and all electronics. Use shielded cable and relocate away from electrical noise.
No flow indication.	No fluid flow.	Check pump.
	Debris in measuring chamber or gears.	Clean flow meter, change or add filter.
	Sensor not installed properly.	Check sensor is installed to hand tight. Review sensor guide.
	Faulty wiring.	Check sensor connection and readout connection.
	Faulty sensor.	Replace sensor.
	Upper housing has dimple from over-tightening sensor.	Replace upper housing.
Erratic system indication.	Ground loop in shielding.	Ground shield one place only. Re-route cables from electrical noise.
	Pulsating fluid flow.	Add pulse dampener.





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