

Owners Installation, Operation, and Safety Manual

FILL-RITE®

TN700 and TN800 Series Nutating Disc Meters

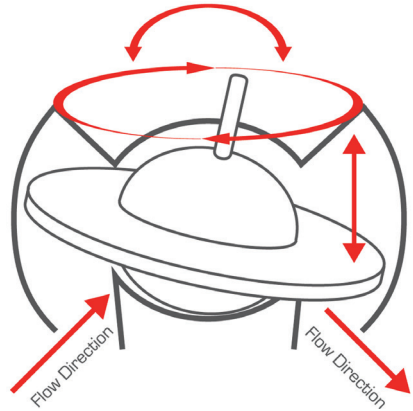
Anodized aluminum case, PPS measuring chamber, Viton seals.

Principle of Operation

All positive displacement flow meters utilize either rotors or vanes to separate meter inlet & outlet. These rotors/vanes divide the liquid stream into clearly defined segments, which can be counted.

The nutating disc metering principle is based on a 'wobble plate' rotor with a ball in the center, and a drive shaft at 90° centered in the ball. As liquid is pushed through the measuring chamber, the plate wobbles on the center, turning the drive shaft in a circular motion. This motion is used to either drive a mechanical register, or turn a magnet under the pulse pick-up in the electronic version of the flow meter.

Nutating disc meters are sensitive to viscosity changes. Each meter is factory calibrated for operation in a specific viscosity range.



Operating Conditions, Fluid Compatibility & Pressure/Temperature

Operating the flow meter in excess of its maximum design capacity, can cause excessive wear or premature failure.

In many cases it is necessary to consider all operating conditions in combination. In addition to liquid, pressure & flow rate, correct material/seal selection often depends upon % concentration, pH value & operating temperature.

If in doubt about compatibility of a specific fluid, please refer to the Chemical Compatibility List, or consult with Customer Care to verify compatibility of chemicals with the wetted materials.

The flow meter should not be operated in excess of pressure rating. Care should be taken to eliminate the possibility of thermal or hydraulic shock conditions.

At elevated temperatures (> 120°F = 50°C), meter pressure rating is reduced. Please consult with Customer Service for pressure rating at higher operating temperatures.

All TN700 & TN800 Series models are factory calibrated for service on liquids with viscosity within a specific range. To use a flow meter on a another liquid with different viscosity characteristics, will typically require a different set of gears in the ratio gear plate, plus calibration.

Installation & Operation

SAFETY INSTRUCTIONS SAFETY INSTRUCTIONS SAFETY INSTRUCTIONS

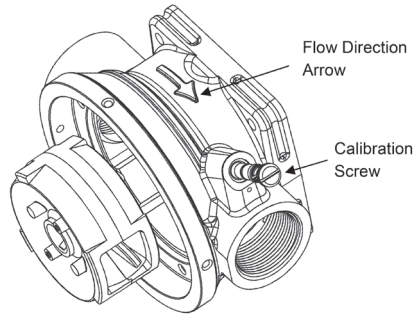
Make sure that all necessary safety precautions have been taken. Wear proper clothing, personal safety equipment and prepare fire safety equipment if required. Before Start-Up of the flow meter, make certain that:

- 1** The flow meter is properly mounted, secured and piped. See Installation Instructions.
- 2** All connections are tight.
- 3** All bleed and drain valves are closed.
- 4** Do NOT smoke near the flow meter, or use the flow meter, near an open flame when metering flammable liquids. Fire or Explosion could result.
- 5** This flow meter is not intended for use in systems requiring 3A sanitary equipment.

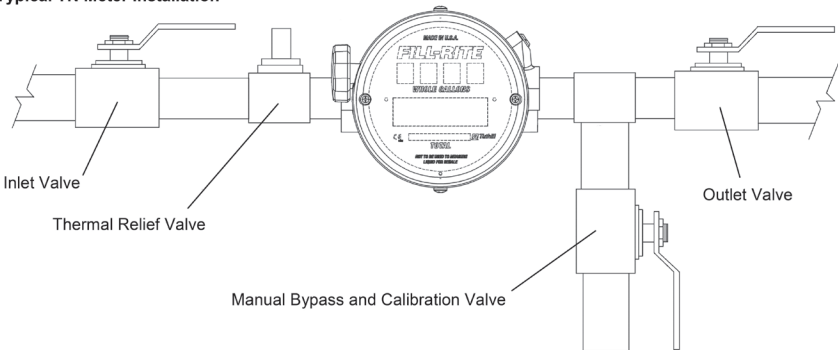
Installation Instructions

When designing the pipe system, it is important to include following considerations:

- How to keep air out of the system once operating. PD meters will run on air, but air is recorded as liquid and it may result in damage to flow meter. Presence of air is a contributing factor to 'water hammer' conditions.
- Hydraulic shock can damage system components, either directly or as cumulative effect of many small shocks. Design the system to avoid excessive liquid velocity, long supply lines & sudden valve closure.
- Liquid expansion due to minor temperature changes can result in line pressure many times normal, if relief valves are not installed. A **thermal relief valve** is required in any system segment, where the meter can be trapped between two closed valves.
- Direction of flow can be Left-to-Right, Right-to-Left or Up. The flow meter can face either up or out. However, do NOT run this flow meter backwards (see "Flow Direction Arrow" on meter case).
- In critical process service, block valves and a bypass are recommended. This allows the flow meter to be serviced without interruption of flow.
- Means for flow meter calibration should be included. This can be:
 - A single connection to divert liquid into a proving can.
 - A dual connection separated by a valve, to permit hook-up of a master meter.
- Future maintenance and service for both flow meter & strainer; both components can be serviced in-line, provided that there is room to work.



Typical TN Meter Installation



Positive displacement (PD) meters are designed to operate full of liquid. The meter should be installed in a location, where it remains **full of liquid** at all times. It may be installed in vertical lines, provide that liquid flows up.

Use a strainer on inlet side of PD meters, as protection against foreign particles. This strainer is not intended to clean up general contamination, but to catch welding slag, pipe scale or similar, which might damage or jam the flow meter.

Protective caps installed in meter ports should be left in place, until you are ready to install in the piping system. Before installation, check that no packing material has entered the flow meter.

Installation (continued)

The flow meter must be installed in the system free of pipe stress. Pipe stress can deform the flow meter chamber, resulting in loss of accuracy. TN Series meters should be secured to a mounting support. Never use the piping as the sole source of support.

Apply pipe compound to the male threads. **Do NOT use PTFE sealing tape.**

Flush the system prior to installation of the flow meter.

Start-Up & Operation

SLOWLY fill the system with liquid, to avoid operation on air or vapors. Do **NOT** pump at full capacity until all air has been purged. We recommend that:

- Throttle the valve on flow meter inlet side, and allow the system to fill slowly by gravity.
- Open the outlet valve. Start the pump, and then slowly open the inlet valve. In this manner slowly fill the flow meter before fully operating the inlet and outlet valves.

The flow meter is not designed to operate on air, but the design and materials of construction allow for operation on vapor for short periods of time, without damage to flow meter internals. Overspeeding and operation with 'water hammer' conditions are likely to cause damage to the flow meter.

Shutdown Instructions

If the meter is to be shut down for an extended period of time, it is recommended that the measuring chamber of the meter be thoroughly flushed out to prevent the settling out of un-dissolved chemicals or the accumulation of corrosive deposits.

Flow Meter Calibration

- Fill-Rite Meters are calibrated prior to shipment. TN Series meters are calibrated for viscosity of a specific liquid, but we recommend flow meters be recalibrated after installation. Please see procedure outlined below.
- There are no fixed rules for frequency of re-calibration. Flow meter wear is a function of flow rate vs. model size, total volume metered, liquid lubricity and liquid viscosity. An annual re-calibration is often suggested, but from 6 to 36 months could be correct.
- Maintain records of re-calibration data. By tracking degree of change in each re-calibration, you can monitor when the flow meter should be serviced with a new measuring chamber (when degree of change increases significantly).
- When re-calibrating, we recommend testing the flow meter on the normal fluid of operation. If system flow rate is constant, you can test at this flow rate only. If system flow rate fluctuates, you should test at high, intermediate and low flow rates.

Mechanical Register:

1. You can test against a prover, a master meter or a scale. To test against a scale, select a calibration vessel with capacity equal to at least 60 seconds of flow. **Short run tests are not acceptable for re-calibration purposes.**
2. Run 3 tests at each flow rate, and use the average value to calculate flow meter error (see below). The calibration screw has approx. 6% range (+/-3%). If meter error exceeds 3%, a gear change is necessary.
 - If the register is showing **too little**, turn the calibration screw to the **right**.
 - If the register is showing **too much**, turn the calibration screw to the **left**.
3. Run 1-2 more tests to confirm that the flow meter is now in calibration.

Calculating meter error:

Test 3 times, so any test with operator error will stand out. Reject such results, and use the average of the remaining results for calculation purposes.

Maintenance

Preventative Maintenance

Preventative maintenance consists of periodic inspection and cleaning procedures. The procedures should be performed at regular intervals and any defects discovered should be corrected before further operation of the flow meter.

Periodic Inspection

Visually inspect the flow meter for missing hardware, loose or leaking connections, broken register glass, or other signs of wear or deterioration. Repair or replace components as required.

Cleaning

Clean all dust, dirt, grease, moisture, or other foreign materials from the exterior of the flow meter and any applicable accessories.

Servicing

The following instructions are for removal, inspection, and installation of flow meter parts or assemblies. Refer to illustrations on the parts / kits list (pages 6-8) for component numbers. The TN series meter is designed to be easy to service, with the meter body remaining

Meter Assembly

1. Shut off flow to the meter. Place a container under the meter of sufficient size and correct material to capture any fluid that escapes during pressure relief and removal.
2. Open the Manual Bypass Valve (see diagram page 3)
3. Disassemble the meter by removing the reset knob on the side of the meter, then remove the two Phillips head screws holding the register housing (#4 on diagram page 6). This will allow access to the register (item #3) to service those components.

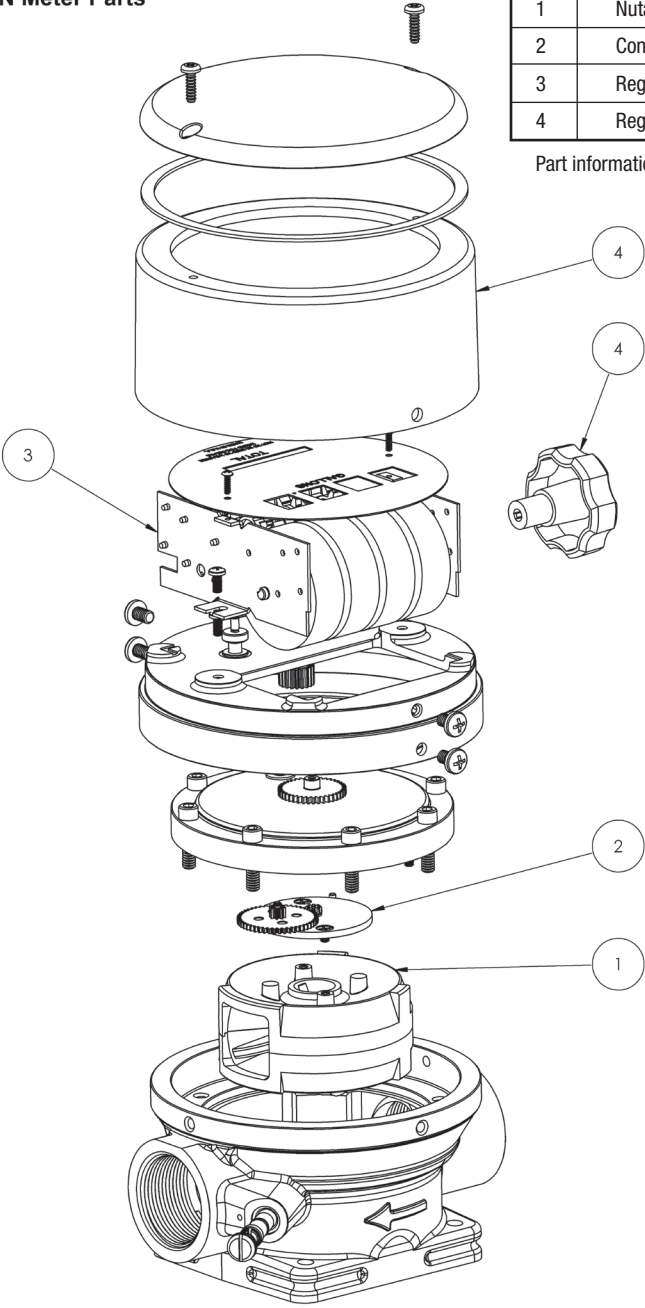
Troubleshooting

Condition	Probable cause and Solution
Liquid is flowing slower or has stopped flowing.	<ul style="list-style-type: none">• Clogged strainer upstream of the flow meter. Clean strainer.• Partially or fully closed valve upstream or downstream of flow meter. Open valve.• Malfunctioning valve upstream or downstream of flow meter. Service valve.• Pump failure. Service pump.• Meter jammed by foreign particles. Clean meter and add strainer upstream.• Meter frozen by chemicals or water seepage into the meter. Open meter and clean components; inspect for damage and repair as necessary.
Cracks in control plate assembly.	<ul style="list-style-type: none">• Drive gear has come unscrewed from flow meter being operated with flow reversed. Replace damaged components and reinstall flow meter to insure correct flow direction.• Pump bypass not adjusted properly. Re-adjust as necessary.• Overspeeding or water hammer conditions.
Leakage from meter cover.	<p>Seal has been damaged, usually due to:</p> <ul style="list-style-type: none">• Shock pressure. Replace seal and inspect cover for damage.• Seal has been pinched or nicked. Replace seal (PTFE seals should be replaced anytime the meter is opened).• Chemical attack. Check seal material against liquid for compatibility. Replace seal as required with compatible seal.• Cover bolts not tightened sufficiently. Re-torque as necessary.
Liquid is flowing but flow is not registering.	<ul style="list-style-type: none">• Drive gear has come unscrewed from flow meter being operated with flow reversed. Reassemble drive train and reinstall flow meter to insure correct flow direction.
Liquid is flowing but register is not reading correctly, % error is constant.	<ul style="list-style-type: none">• A large error indicates register is not calibrated correctly or is calibrated in a different volume. Check gearing in the gear plate assembly.• A smaller error can be the result of failure to not being calibrated to the fluid being metered or meter wear. Check calibration per instructions on page 3.
Liquid is flowing but register is not reading correctly, % error fluctuates.	<ul style="list-style-type: none">• Air in the lines. Check system design and correct as necessary.• Meter may have been damaged by a shock condition, stripping gear teeth on cover plate assembly. Inspect and replace cover plate assembly as necessary.

TN Meter Parts

Item	Description
1	Nutating Disc Assembly
2	Control Plate Assembly
3	Register
4	Register Housing and Reset Knob

Part information details on page 7



TN Meter Parts (cont'd)

TN 740 / TN 760 Series Meters

Model	Pressure	125-5000 cSt	5-50,000 cSt	Fluid
TN740A	1000 PSI / 169 BAR	1-10 GPM (4-40 LPM)	0.4-4 GPM (1.5-15 LPM)	Hydraulic & Lube Oils
TN760A	400 PSI / 28 BAR	1.5-15 GPM (6-57 LPM)	0.6-6 GPM (2.3-23 LPM)	Hydraulic & Lube Oils

The calibration screw can correct for normal flow meter wear, and for other liquids within the group identified above. This flow meter cannot be used on other liquids with significantly different viscosity.

Item *	Qty.	TN740A	TN760A	Description
1	1	MC8600	MC8800	Nutating Disc Assembly / Measuring Chamber
2	1	RK8101	RK8101	Control Plate Assembly
3	1	RG3000	RG3000	Register Assembly
4	1	RK3700	RK3700	Register Housing and Reset Knob

Reference diagram on page 6 for Item numbers.

TN 860 Series Meters

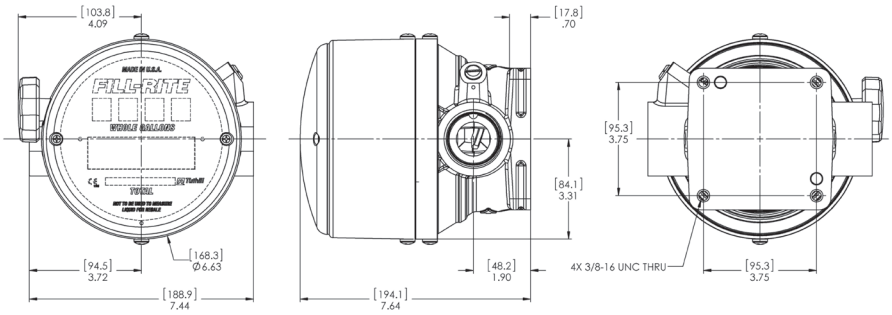
Model	Pressure	1-2 cSt	3-25 cSt *	Fluid
TN860A	150PSI/10 BAR	6-60 GPM (23-230 LPM)	6-60 GPM (23-230 LPM)	Water, gasoline, solvents, E85 *Diesel, kerosene, light fuel oil

This flow meter has been calibrated for use on a specific liquid viscosity range. The calibration adjuster can correct for normal meter wear, but not for use on other liquids with significantly different viscosity. To change service to a different liquid may require different drive & transfer gears (change requires a special tool) and re-calibration.

Item *	Qty.	TN860A	Description
1	1	MC8800	Nutating Disc Assembly / Measuring Chamber
2	1	RK8101	Control Plate Assembly (Fluorocarbon seals)
3	1	RG3000	Register Assembly
4	1	RK3700	Register Housing and Reset Knob

* Reference diagram on page 6 for Item numbers.

Dimensional Information



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Find out more about fuel transfer & lubrication we have.