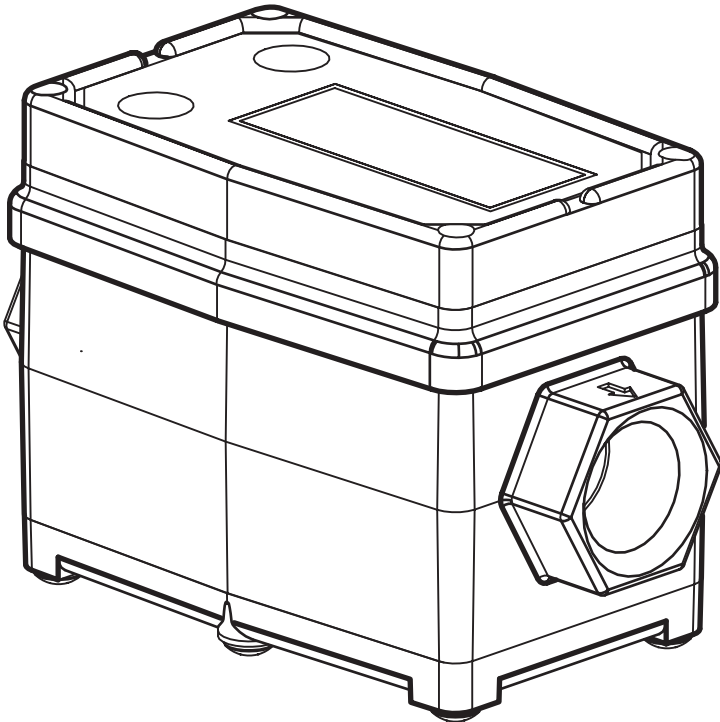




Series TTMS Metal Electronic Totalizing Flowmeter

Specifications - Installation and Operating Instructions

## Series TTMS Metal Electronic Totalizing Flowmeter



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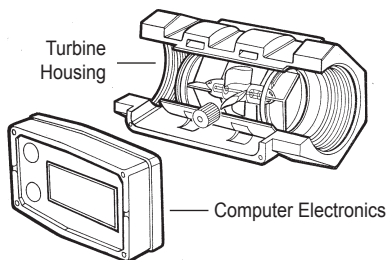
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## GENERAL INFORMATION

This manual will assist you in installing and maintaining your Series TTMS. (See Figure 1) Information on computer electronics and accessory modules are contained in other manuals. Please reference those as necessary.

Figure 1



For best results, take the time to fully acquaint yourself with all information about all components of your Series TTMS prior to installation and use. If you need assistance, contact Dwyer Instruments, Inc.



This symbol is used throughout the manual to call your attention to safety messages.

### WARNING

**Warnings** alert you to the potential for personal injury.

### CAUTION

**Cautions** call your attention to practices or procedures which may damage your equipment.

**Notes** give information that can improve efficiency of operations.

It is your responsibility to make sure that all operators have access to adequate instructions about safe operating and maintenance procedures.

## Read Me!

For your safety, review the major warnings and cautions below before operating your equipment.

### WARNING

The apparatus enclosure may contain aluminum and is considered to constitute a potential risk of ignition by impact or friction. Care must be taken into account during installation and use to prevent impact or friction.

### WARNING

Part of the enclosure is constructed from plastic. To prevent the risk of electrostatic sparking the plastic surface should only be cleaned with a damp cloth.

1. Use **only fluids** that are compatible with the housing material and wetted components of your turbine.
2. When measuring flammable liquids, observe precautions against fire or explosion.
3. When handling hazardous liquids, always follow the liquid manufacturer's safety precautions.
4. When working in hazardous environments, always exercise appropriate safety precautions.
5. Always dispose of used cleaning solvents in a safe manner according to the solvent manufacturer's instructions.
6. During turbine removal, liquid may spill. Follow the liquid manufacturer's safety precautions for clean up of minor spills.
7. Do not blow compressed air through the turbine.
8. Do not allow liquids to dry inside the turbine.
9. Handle the rotor carefully. Even small scratches or nicks can affect accuracy.
10. When tightening the turbine, use a wrench only on the wrench flats.
11. For best results, always verify accuracy before use.

## Product Description

Series TTMS is identified by the internal diameter of the inlet and outlet.

- TTMS-1 – 1/2 inch
- TTMS-2 – 3/4 inch
- TTMS-3 – 1 inch
- TTMS-4 – 1-1/2 inch
- TTMS-5 – 2 inch

Each turbine is designed to work with onboard computer electronics and/or with one of several accessory output modules.

Liquid flows through the turbine hous-

ing causing an internal rotor to spin. As the rotor spins, an electrical signal is generated in the pickup coil. This signal is converted into engineering units (gallons, liters, etc.) on the local display. Accessory modules can be used to export the signal to other equipment.

Upon receipt, examine your meter for visible damage. The turbine is a precision measuring instrument and should be handled as such. Remove the protective plugs and caps for a thorough inspection. If any items are damaged or missing, contact Dwyer Instruments, Inc.

Make sure the turbine model meets your specific needs. Refer to the Specifications Section and confirm the following:

1. The flowrate is within the limits of your model.
2. The liquid is compatible with the turbine's wetted components.
3. The system's pressure does not exceed the turbine's maximum pressure rating.

Information specific to your particular turbine, including serial number, model number, manufacturing date, and K-factor is etched on the meter. Be prepared to provide this information if you call customer service.

**SN = Serial Number**, a 6-digit number that identifies this particular turbine.

**MODEL = Model Number** begins with TTMS- followed by a digit indicating the turbine size.

- 1 = 1/2 inch
- 2 = 3/4 inch
- 3 = 1 inch
- 4 = 1-1/2 inch
- 5 = 2 inch

A dash and two characters follow

the size code indicating the material and fittings.

- RI = Stainless Steel ISO
- RN = Stainless Steel NPT
- RS = Stainless Steel Sanitary Fitting

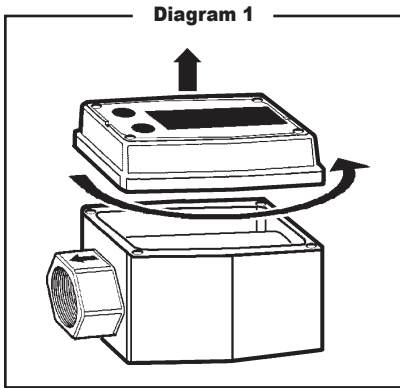
**MFG DATE = Manufacturing Date** indicating the week and year of manufacture.

**KF = K-Factor** given in pulses per gallon (PPG).

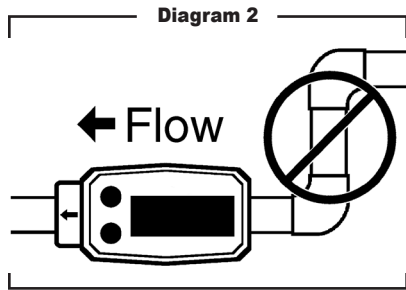
For your future reference, it might be useful to record this information in the manual in case it becomes unreadable on the turbine.

## INSTALLATION

All TTMS turbines are designed to measure flow in only one direction. The direction is indicated by the arrow, cast-molded in the turbine. If the computer display is upside down, remove the four screws, turn the display 180 degrees and reinstall the screws. See Diagram 1.

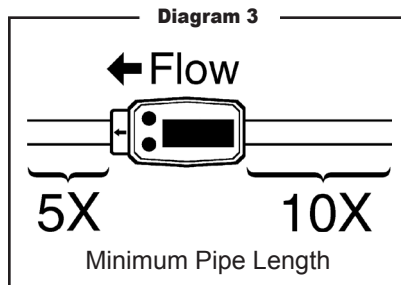


Flow altering devices such as elbows, valves, and reducers can affect accuracy. See Diagram 2. The following recommended guidelines are given to enhance accuracy and maximize performance. Distances given here are minimum requirements; double them for desired straight pipe lengths.



Upstream from the turbine, allow a minimum straight pipe length at least 10 times the internal diameter of the turbine. For example, with the 1 inch turbine, there should be 10 inches (25.4 cm) of straight pipe immediately upstream. The desired upstream straight pipe length is 20 inches (50.8 cm).

Downstream from the turbine, allow a minimum straight pipe length at least 5 times the internal diameter of your turbine. For example, with the 1 inch turbine, there should be 5 inches (12.7 cm) of straight pipe immediately downstream. The minimum downstream distance is 10 inches (25.4 cm). See Diagram 3.



A typical back pressure of 5 to 50 PSI (0.34 to 3.4 bar) will prevent cavitation. Create back pressure by installing a control valve on the downstream side of the meter at the proper distance detailed above.

Foreign material in the liquid being measured can clog the turbine's rotor and adversely affect accuracy. If this problem is anticipated or experienced, install screens to filter impurities from incoming liquids.

### Models 1/2 in., 3/4 in. and 1 in.:

Maximum Particulate Size	
Inches:	0.005
Microns:	125
Mesh:	55
Standard Sieve:	125 $\mu\text{m}$
Alternative Sieve:	No. 120

### Models 1-1/2 in. and 2 in.:

Maximum Particulate Size	
Inches:	0.018
Microns:	500
Mesh:	28
Standard Sieve:	500 $\mu\text{m}$
Alternative Sieve:	No. 35

To ensure accurate measurement, remove all air from the system before use.

Each turbine contains a removable back coverplate. Leave the coverplate installed unless accessory modules specify removal.

## Connections

1. To protect against leakage, seal all threads with an appropriate sealing compound. Make sure the sealing compound does not intrude into the flow path.
2. Make sure the arrow on the outlet is pointed in the direction of the flow.
3. Tighten the turbine onto the fittings. Use a wrench only on wrench flats.

**Note:** If connecting to new male threads, burrs and curls can adversely effect accuracy. Correct the problem prior to turbine installation.

Verify accuracy after connections are complete. See Operation section.

## OPERATION

### Verify Accuracy

Before use, check the turbine's accuracy and verify calibration.

1. Make sure there is no air in the system.
2. Measure an exact known volume into an accurate container.
3. Verify the volume against the readout or recording equipment.

**Note:** If necessary, use a correction factor to figure final volume.

For best results, accuracy should be verified periodically as part of a routine maintenance schedule.

## MAINTENANCE

### Remove the Turbine

#### WARNING

During turbine removal, liquid may spill. Follow the liquid manufacturer's safety precautions for clean up of minor spills.

1. Drain all liquid from the turbine. Wear protective clothing as necessary.
2. Loosen both ends of the turbine. Use a wrench only on the turbine's wrench flats.
3. If the turbine is not immediately installed again, cap lines as necessary.

### Clean the Turbine

During use, the turbine should be kept full of liquid to ensure that drying does not occur inside the turbine. If drying or caking should occur, the rotor will stick or drag, affecting accuracy. To determine if the rotor is stuck or dragging, gently blow air through the meter and listen for the quiet whirl of the rotor.

**⚠ CAUTION**

**Never blow compressed air through the meter. It could damage the rotor.**

1. Remove the turbine from the system following the directions below.
2. Carefully clean residue off all parts. Remove internal parts as detailed above. Note orientation carefully for correct assembly. Internal parts can be soaked for 10 to 15 minutes in compatible cleaning solutions. Use a soft brush or small probe to *carefully* remove residue from the rotor.

**⚠ WARNING**

**Follow the liquid manufacturer's instructions for the disposal of contaminated cleaning solvents.**

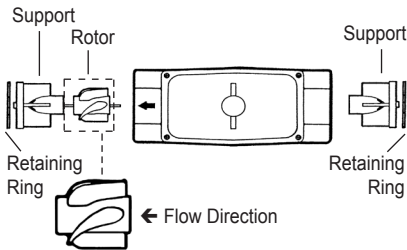
3. When the rotor turns freely, assemble and install it again following the instructions above.
4. Check accuracy after cleaning.

## Replace Internal Parts

1. Remove the turbine from the system as detailed above.

**Note:** Carefully notice the orientation of all internal parts as they are removed, especially the orientation of the rotor to the flow direction arrow. See Figure 2.

**Figure 2**



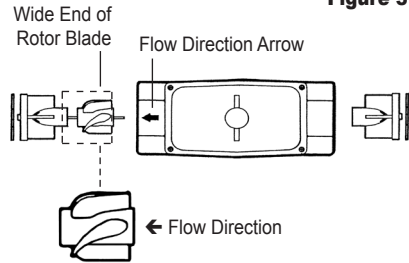
2. Using a small tool such as a screwdriver or awl, gently pry one retaining ring from its groove. Remove the support. If necessary, use needle nose pliers. Little or no force should be required.
3. Carefully remove the rotor.

**⚠ CAUTION**

**Handle the rotor carefully. Even small scratches or nicks can affect accuracy.**

4. Turn the turbine over and remove the other retaining ring. Remove the other support.
5. Clean, as detailed below, or discard as necessary.
6. Replace one support and retaining ring. Parts should drop easily into place with little or no force.
7. Install the rotor. Make sure the wide end of the rotor's blades faces the flow direction. See Figure 3.

**Figure 3**



8. Turn the turbine over and drop the second support into place. Put the final retaining ring into position.
9. Reinstall the turbine, purge the system of air, and verify accuracy before use.

## TROUBLESHOOTING

Symptom	Probable Cause	Solution
A. MEASUREMENT IS NOT ACCURATE	<ol style="list-style-type: none"> <li>1. Turbine operated below minimum rate</li> <li>2. Turbine partially clogged with dried liquid</li> <li>3. Turbine bearings partially clogged with dried liquid</li> <li>4. Sealant wrapped around rotor</li> <li>5. Installed too close to fittings</li> <li>6. Improper connections to recording device</li> <li>7. Accuracy needs verification</li> </ol>	<p>Increase flowrate. See Specifications</p> <p>Remove turbine. Clean carefully. Make sure rotor spins freely.</p> <p>Remove turbine. Clean carefully. Make sure rotor spins freely.</p> <p>Remove turbine. Clear material from rotor. Make sure rotor spins freely.</p> <p>Install correctly. See Installation Section.</p> <p>Check all electrical connections. Reference appropriate installation instructions.</p> <p>Complete normal accuracy verification procedures. Repeat periodically.</p>

## MODEL NUMBER CHART

Normal Range GPM Water	Normal Range LPM Water	Inlet / Outlet Size NPT	Stainless Steel	Stainless Steel Sanitary Fitting
1 - 10	3.8 - 37.9	1/2 in.	TTMS-1R	TTMS-1RS
2 - 20	7.6 - 75.7	3/4 in.	TTMS-2R	TTMS-2RS
5 - 50	18.9 - 190	1 in.	TTMS-3R	TTMS-3RS
10 - 100	38 - 380	1-1/2 in.	TTMS-4R	TTMS-4RS
20 - 200	76 - 760	2 in.	TTMS-5R	TTMS-5RS

## SPECIFICATIONS

All data on Models 1/2 inch, 3/4 inch, and 1 inch determined with 1 centipoise solvent test fluid at 70° F (21° C). Data on Models 1-1/2 inch and 2 inch is determined with water at 70° F (21° C).

Model Size	1/2 in.	3/4 in.	1 in.	1-1/2 in.	2 in.
Linear Flow Range					
Gallons/minute (GPM)	1-10	2-20	5-50	10-100	20-200
Liters/minute (LPM)	3.8-37.9	7.6-75.7	18.9-190	38-380	76-760
Maximum Flow <sup>1</sup>					
Gallons/minute (GPM)	15	30	75	150	300
Liters/minute (LPM)	56.8	113.6	284	568	1,136
Maximum Pressure Drop in 10:1 Range					
PSIG	8	6	10	4	7
bar	0.55	0.5	0.34	0.28	0.28
Frequency Range in Linear Flow Range	42-420 Hz	37-370 Hz	47-470 Hz	36-360 Hz	33-330 Hz
Connections					
NPT or ISO Threads	Yes	Yes	Yes	Yes	Yes
Female	Yes	Yes	Yes	Yes	Yes
Inlet/Outlet Size	1/2 in.	3/4 in.	1 in.	1-1/2 in.	2 in.
Wrench Size:					
Inch	1-1/16 in.	1-5/16 in.	1-5/8 in.	2-3/8 in.	3 in.
Millimeter	27 mm	33 mm	41 mm	60 mm	75 mm
Weight*					
Pounds	1.8 lbs.	2.0 lbs.	2.4 lbs.	4.0 lbs.	6.3 lbs.
Kilograms	0.8 kg	1.0 kg	1.1 kg	1.8 kg	2.9 kg

\* Computer electronics add 0.2 lbs. (0.1 kg) to total weight.

<sup>1</sup> The meter can operate up to this flowrate without damage. Continuous operation will severely degrade meter life and performance.

### Performance

Linear Range for 1/2 in.: 10:1 @ ±2.0% of reading  
 Linear Range for 3/4 in. and 1 in.: 10:1 @ ±1.5% of reading  
 Linear Range for 1-1/2 in. and 2 in.: 10:1 @ ±1.0% of reading  
 Repeatability: ±0.1%

**Pressure Rating** 1,500 PSIG (102 bar) – Standard Stainless Steel Meter

### Wetted Components

Housing: 316 Stainless Steel  
 Journal Bearings: Ceramic (96% Alumina)  
 Shaft: Tungsten Carbide  
 Rotor and Supports: PVDF  
 Retaining Rings: 316 Stainless Steel

**Temperature Range** -40° F to +250° F (-40° C to +121° C)

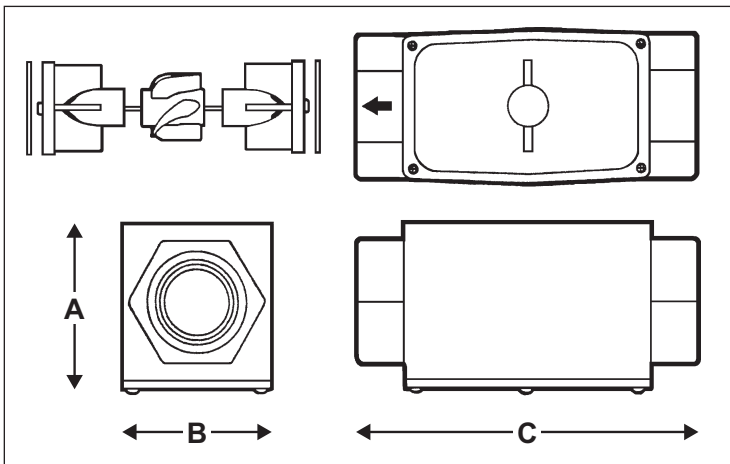
These temperatures apply to operations and storage. They are only for the turbine without computer electronics. Final operational temperature range is determined by computer electronics or accessory modules.



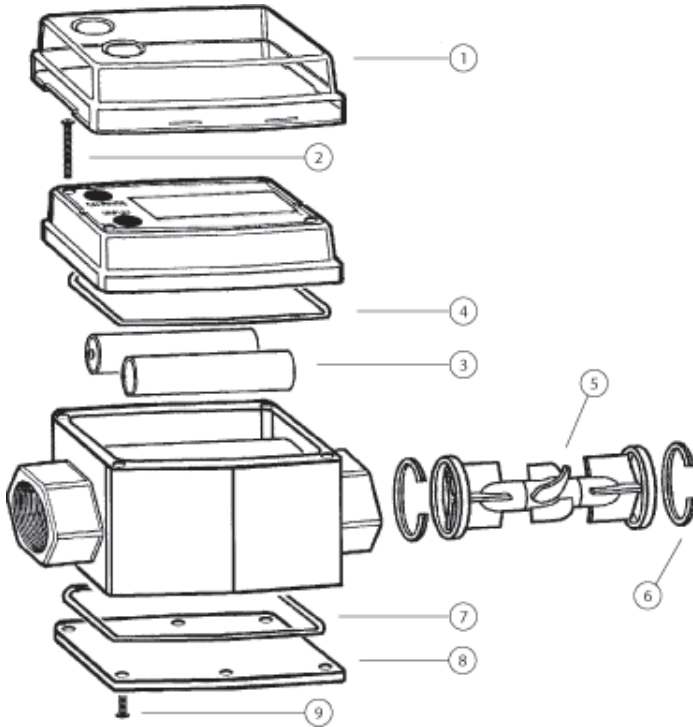
## Dimensions

Model Size	1/2 in.	3/4 in.	1 in.	1-1/2 in.	2 in.
<b>A = Height:</b>					
Inches	1.8 in.	2.0 in.	2.2 in.	2.8 in.	3.2 in.
Centimeters	4.6 cm	5.1 cm	5.6 cm	7.1 cm	8.2 cm
<b>B = Width</b>					
Inches	2.0 in.	2.0 in.	2.0 in.	2.7 in.	3.3 in.
Centimeters	5.1 cm	5.1 cm	5.1 cm	6.9 cm	8.4 cm
<b>C = Length</b>					
Inches	4.2 in.	4.3 in.	4.5 in.	5.3 in.	6.3 in.
Centimeters	10.7 cm	10.9 cm	11.4 cm	13.5 cm	16.0 cm

Computer electronics add 0.7 in. (1.8 cm) to height of turbine.



# ILLUSTRATED PARTS DRAWING

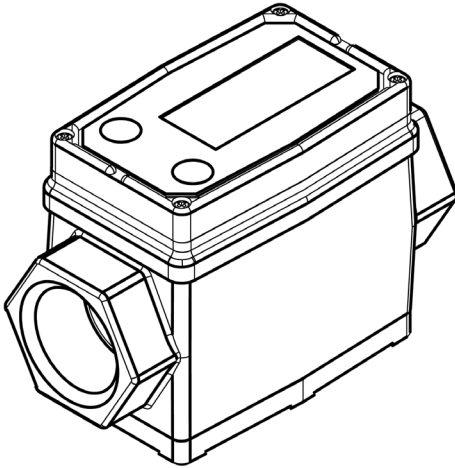


Item No.	Description	No. Req'd.
1	EDM Cover Single Access Port (optional) - Fits 1/2 in., 3/4 in. and 1 in. only.....	1
	EDM Cover Dual Access Port (optional) - Fits 1/2 in., 3/4 in. and 1 in. only .....	1
2	Screw.....	4
3	Battery (2 required).....	2
4	Seal, Computer.....	1
5	1/2-inch Rotor/Support Replacement Kit (includes rotor assembly, support assembly & retaining rings) .....	1
	3/4-inch Rotor/Support Replacement Kit (includes rotor assembly, support assembly & retaining rings) .....	1
	1-inch Rotor/Support Replacement Kit (includes rotor assembly, support assembly & retaining rings) .....	1

Item No.	Description	No. Req'd.
	1-1/2-inch Rotor/Support Replacement Kit (includes rotor assembly, support assembly & retaining rings) 1	1
	2-inch Rotor/Support Replacement Kit (includes rotor assembly, support assembly & retaining rings) .....	1
6	One - 1/2-inch Retaining Ring .....	2
	One - 3/4-inch Retaining Ring .....	2
	One - 1-inch Retaining Ring .....	2
	One - 1-1/2-inch Retaining Ring .....	2
	One - 2-inch Retaining Ring .....	2
7	Back Coverplate O-Ring.....	1
8	Back Coverplate .....	1
9	Back Coverplate Screws .....	6

For replacement parts,  
contact Dwyer Instruments, Inc.

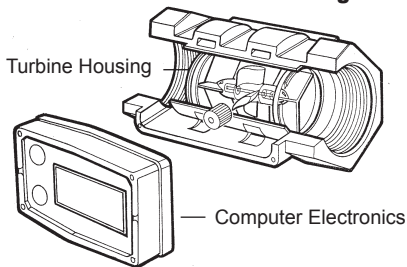
# Industrial Grade Computer Electronics



## GENERAL INFORMATION

This manual will assist you in operating and maintaining the Computer Electronics of the Industrial Grade Meters. (See Figure 1) Calibration details are given in this manual. Information on turbine housings and accessory modules are contained in other manuals. Please reference those as necessary.

Figure 1



## Before Getting Started

Take the time to fully acquaint yourself with all information about the components of your Electronic Digital Meter. If you need assistance, contact Dwyer Instrument, Inc.

## SAFETY INSTRUCTIONS

It is your responsibility to make sure that all operators have access to adequate instructions about safe operating and maintenance procedures.

### Read Me!

For your safety, review these major warnings and cautions before operating your equipment.

**⚠ WARNING** The apparatus enclosure may contain aluminum and is considered to constitute a potential risk of ignition by impact or friction. Care must be taken into account during installation and use to prevent impact or friction.

**⚠ WARNING** Part of the enclosure is constructed from plastic. To prevent the risk of electrostatic sparking the plastic surface should only be cleaned with a damp cloth.

**⚠ WARNING** This product should never be electrically connected to any other device while in the hazardous location. Consult manufacturer for exceptions.

**⚠ WARNING** Compatibility of this product's material and the process fluid and/or environment should be considered prior to putting into service.

**⚠ WARNING** Product should never be operated outside its published specifications for temperature or pressure.

**⚠ WARNING** Make sure flow and pressure have been eliminated from process pipe prior to installing or removing product.

**⚠ WARNING** Always use appropriate thread sealant or flange gaskets when connecting product to process piping.

**⚠ WARNING** (Battery) – Avoid mechanical or electrical abuse. Batteries may explode or cause burns, if disassembled, crushed or exposed to fire or temperatures in excess of 212° F (100° C). Do not short circuit or install with incorrect polarity. DO NOT INCINERATE.

**⚠ WARNING** When measuring flammable liquids, observe precautions against fire or explosion.

**⚠ WARNING** When handling hazardous liquids, always follow the liquid manufacturer's safety precautions.

**⚠ CAUTION** Batteries should ONLY be replaced with batteries of the same type and rating. Do not mix old with new. Do not mix manufacturers or technologies.

## Safety Instructions

- When working in hazardous environments, always exercise appropriate safety precautions.
- Open battery cells should be disposed of in accordance with local regulations. Lithium batteries are best disposed of as a non-hazardous waste when fully or mostly discharged. EPA does not list or exempt lithium as a hazardous waste. If waste lithium batteries are still fully charged or only partially discharged, they can be considered a reactive hazardous waste because of unconsumed lithium remaining in the battery. Such batteries may qualify as "Universal Waste" in many jurisdictions within the U.S. and thus can be shipped for disposal or recycling in accordance with Universal Waste requirements.

## Product Listings

IP-65

Enclosure Equivalent to NEMA type 4

## RoHS Compliant (2011/65/EU)

This product is in compliance with the RoHS Directive of the European Parliament and of the Council on the Restriction of the Use of Certain Hazardous Substances in Electrical and Electronic Equipment.

## Product Description

These computer electronics are designed specifically for use on Industrial Grade Turbine Housings. They are also designed to work with several accessory output modules.

The CMOS, microprocessor-based electronics have extremely low power requirements and data retention capabilities in both RAM and ROM. Information is clearly displayed on a large 6-digit LCD readout with two-point floating decimal for totals from .01 to 999,999. All operations are easily accessed with the two buttons on the front panel.

Liquid flows through the turbine housing causing an internal rotor to spin. As the rotor spins, an electrical signal is generated in the pickup coil. This pulse data is translated from the turbine into calibrated flow units shown on the computer's readout.

Upon receipt, examine your equipment for visible damage. The computer is a precision measuring instrument and should be handled as such. If any items appear damaged or missing, contact Dwyer Instruments, Inc.

Make sure your computer model meets your specific needs. Refer to the Specifications Section to confirm required features. The model number of your computer is displayed on the lower front side of the computer and also underneath a battery.

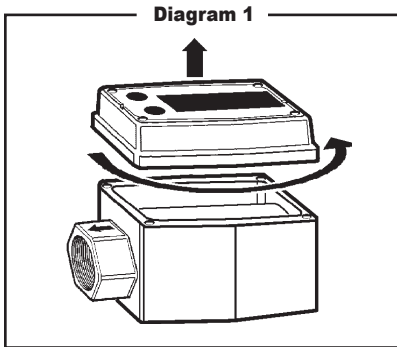
## INSTALLATION

If you ordered your computer electronics with a turbine housing, it is installed at the factory.

If you ordered your computer separately from your turbine, simply mount the computer on the turbine with the four screws at the corners of the faceplate. Make sure the seal is fully seated before tightening the screws.

If you ordered the computer with turbine and an accessory module, please review and thoroughly understand all installation instructions before proceeding.

All turbines are designed to measure flow in only one direction. The direction is indicated by the arrow cast-molded in the turbine outlet. If the computer display is upside down, remove the four screws, turn the display 180 degrees and reinstall the screws. (See Diagram 1)



Avoid electronically “noisy” environments. Install at least 6 inches (15.2 cm) away from motors, relays, or transformers.

For best results, always verify accuracy before use.

To ensure accurate measurement, remove all air from the system before use. Then measure an exact known volume into an accurate container and verify the volume against the readout or recording equipment. If necessary, use a correction factor to figure final

volume. For best results, accuracy should be verified periodically as part of a routine maintenance schedule.

## OPERATION

### Computer Display

All operations are reflected in the LCD readout. The large center digits indicate amounts, where smaller words or “icons” located above and below indicate specific information regarding totals, flow, calibration and units of measure.

### Activate the Meter

Computer is on continuously and always ready to perform. The computer is powered by field replaceable batteries. When display becomes dim, faded or the low battery message appears (see below), the batteries need to be replaced. Reference the Maintenance Section for details.

# LobAtt

### Batch and Cumulative Totals

The computer maintains two totals. The Cumulative Total provides continuous measurement and cannot be manually reset. The Batch Total can be reset to measure flow during a single use. The Cumulative Total is labeled with TOTAL 1, Batch Total is labeled TOTAL 2 BATCH.

When the Cumulative Total reaches a display reading of 999,999 the computer will highlight an X10 icon. This indicates to the operator that a zero must be added to the 6 digits shown. When the next rollover occurs, the computer will highlight an X100 icon. This indicates to the operator that two zeroes must be added to the 6 digits shown.

Press the DISPLAY button briefly to switch between the TOTAL 1, TOTAL

2 BATCH and FLOWRATE. Press DISPLAY briefly to display the TOTAL 2 BATCH. Hold the DISPLAY button for 3 seconds to reset the Batch Total to zero.

When fluid is flowing through the meter, a small propeller icon is highlighted.

NOTE: Totalization counts total units without differentiating between gallons, liters or field calibrated units.

## Flowrate Feature (some models)

To use this feature, press and release DISPLAY until FLOWRATE icon appears. The factory set time base will be highlighted to the right of FLOWRATE (M = minutes, H = hours, D = days). When FLOWRATE is invoked, the display will be indicating rate of flow.

## Factory and Field Calibration

All calibration information is visible to the user as icons on the top line of the display, above the numeric digits.

All units are configured with a “factory” calibration. Both gallons and liters are available (“GL” or “LT” will be displayed). While holding the CALIBRATE button, briefly press DISPLAY to toggle between gallons and liters. This factory calibration (indicated with FAC) is permanently programmed into the computer and is not user adjustable.

NOTE: Your computer may have other units of measure programmed into it. If so, holding the CALIBRATE button and momentarily pressing the DISPLAY button will toggle through all factory set units. Other possible units are: IGL (imperial gallon), QT (quart), CF (cubic feet), CM (cubic meter), BL (42 gal. barrel), CC (cubic centimeter) or OZ (ounce).

Switching between different units will not corrupt the Total's contents. For example, in GL mode, the computer totalizes 10.00 gallons, if the user switches to LT mode, the display will read 37.85 liters (the same volume, different unit).

The “field” calibration may be set by the user, and can be changed or modified at any time using the calibration procedure described in the Calibration Section. Totals or flowrate derived from the field calibration are invoked when the FAC icon is no longer visible on the top line of the display.

## CALIBRATION

### Verify Accuracy Before Beginning Field Calibration

For the most accurate results, dispense at a flowrate which best simulates your actual operating conditions. Avoid “dribbling” more fluid or repeatedly starting and stopping the flow. This can result in less accurate calibrations.

Make sure you meet the meter's minimum flowrate requirements:

1/2 in. meter	1 GPM (3.8 LPM)
3/4 in. meter	2 GPM (7.6 LPM)
1 in. meter	5 GPM (18.9 LPM)
1-1/2 in. meter	10 GPM (37.9 LPM)
2 in. meter	20 GPM (75.7 LPM)

The use of a uniformly dependable, accurate calibration container is recommended for the most accurate results. For best results, the meter should be installed and purged of air before field calibration.

Due to high flowrate on the 2 inch meter, it is strongly recommended that Field Calibration be completed with a combination of volume and weight determined with a fine resolution scale.

### Field Calibration Necessity

Field Calibration and Factory Cali-

bration are defined in the Operation Section. Factory calibration settings are programmed into each computer during manufacturing, using stoddard test solvent at 70° F (21° C) for low flow and 1-inch meters and water at 70° F (21° C) for 2-inch meters. Settings are correct for light liquids such as water, gasoline or diesel. Readings using the Factory Calibration (FAC) may not be accurate in some situations, for example, “heavy” liquids such as motor oil, under extreme temperature conditions, non-standard plumbing configurations or with fluids other than mentioned above.

For improved accuracy under such conditions, the computer allows for “field” calibration, that is, user entry of custom calibration parameters. A “single point” calibration may yield acceptable accuracy when used in a non-standard application.

### **Field Calibration Procedures (Correction Factor Method)**

1. To calibrate, press and hold the CALIBRATE and DISPLAY buttons for about 3 seconds until you see FLdCAL. Release both buttons and you will see CF - 00.0. You are now in the field calibration mode and values from -99.9% to +99.9% can be entered.
2. The +/- position appears either as an “underscore” character for plus, or as a “hyphen” character for minus. The DISPLAY button selects the position and the CALIBRATE button toggles this character.
3. The DISPLAY button can then be pushed to select the numeric positions. Press the CALIBRATE button to scroll from 0 to 9. Enter the percentage of change you want the display to correct. When satisfied with the value, press both CALIBRATE and DISPLAY buttons simultaneously. CALEnd will be displayed and unit will go

back to normal operation, less the FAC (factory calibration) icon.

4. All enabled units-of-measure remain visible and selectable – the entered correction will be applied to all enabled units.
5. To return to factory calibration (FAC), press and hold both CALIBRATE and DISPLAY buttons for about 3 seconds until FACCAL is displayed. Then release buttons. Unit should return to normal operation and FAC icon is visible.

## **USER CONFIGURATION**

The computer display has been programmed with many new features, most of which can be enabled by the end user by way of a configuration process. By disabling “unnecessary” features, day-to-day flowmeter operation can be greatly simplified, making the unit easier to use. There are several features that are disabled by default when shipping standard meters. (For example, K-factor Entry Field Calibration, described below.) For more advanced users, it may be desirable to enable ALL possible features. User configurable features include:

- Totalizers/Modes Enabled (Cumulative Total, Batch 2 Total, Flowrate Mode)
- Flowrate Timebase (Units per Minutes, Hours and Days)
- Factory Calibration Curve Units Enabled (Gallons, Imperial Gallons, Liters, Quarts, Ounces, Cubic Feet, Cubic Centimeters, Cubic Meters or Barrels (42 gal.)
- Dispense/Display or K-factor Entry Calibration

### **Changing Configuration Settings**

Access to the configuration process is restricted for security until a “pass-

word” is entered. Contact Dwyer Instruments, Inc. to get the password and instructions to unlock and reset configuration settings. Configurations are entered and stored as six-digit “codes” where each digit represents a setting for one of the configuration options. New configuration settings are stored in the computer’s long-term memory and will not be lost either in OFF mode or during battery change.

## K-factor Entry Field Calibration

Presently all computers are programmed with three different field calibration methods, only one of which is active, the “correction/factor” calibration procedure described above. It is possible to activate “K-factor entry” or “dispense/display” field calibration by changing configuration settings. Contact Dwyer Instruments, Inc. to get the correct password, configuration code, and instructions for this calibration method.

## MAINTENANCE

The computer electronics is powered by lithium batteries. Removing the batteries before storing the meter will extend battery life. If the meter’s readout should become dim, blank or the low battery message appears (see below), the batteries should be replaced. See details in the Parts Section.

## LobAtt

When batteries are disconnected or fail, the Batch and Cumulative Totals will maintain the value they had. Factory and Field Calibration Curves are retained in the meter’s computer when power is lost.

It is strongly recommended that

battery check and terminal cleaning be a part of a routine maintenance schedule. Battery terminals should be cleaned annually. Batteries can be replaced without removing the meter from the piping system.

## Replace Batteries

1. Remove the corner screws from the meter face and lift the computer electronics from the turbine.
2. Remove the batteries.
3. Check the battery terminals and remove any corrosion.
4. Install the new batteries and make sure the positive posts are positioned correctly. When the batteries are installed correctly, the computer powers on automatically and the readout displays information.
5. Make sure the seal is fully seated before placing the computer electronics on the turbine. Tighten the four screws.
6. Do not clean exterior of computer assembly with Isopropyl Alcohol.



## TROUBLESHOOTING

Symptom	Probable Cause	Corrective Action
A. METER IS NOT ACCURATE	<ol style="list-style-type: none"> <li>1. Field Calibration not performed properly</li> <li>2. Factory Calibration not suitable for liquid being measured</li> <li>3. Meter operated below minimum flowrate</li> <li>4. Meter partially clogged with dried liquid</li> <li>5. Turbine bearings partially clogged with dried liquid</li> <li>6. Sealant material wrapped around rotor</li> <li>7. Installed too close to fittings</li> <li>8. Installed too close to motors or electrically "noisy" environment</li> </ol>	<p>Field calibrate again or select Factory Calibration.</p> <p>Perform a Field Calibration according to Calibration Section.</p> <p>Increase flowrate.</p> <p>Remove meter. Clean carefully. Make sure rotor spins freely.</p> <p>Remove meter. Clean carefully. Make sure rotor spins freely.</p> <p>Remove meter. Make sure rotor spins freely.</p> <p>Install correctly.</p> <p>Install correctly.</p>
B. READOUT FADED OR BLANK	<ol style="list-style-type: none"> <li>1. Batteries weak, dead, or not connected</li> <li>2. Computer defective</li> </ol>	<p>Remove computer, check and replace batteries if necessary.</p> <p>Contact the factory.</p>
C. NORMAL FLOWRATE BUT METER DOES NOT COUNT	<ol style="list-style-type: none"> <li>1. Field Calibration not performed correctly</li> <li>2. Rotor stuck or damaged</li> <li>3. Sealant material wrapped around rotor</li> <li>4. Computer defective</li> </ol>	<p>Field Calibrate again or select Factory Calibration.</p> <p>Remove meter. Make sure rotor spins freely.</p> <p>Remove meter. Make sure rotor spins freely.</p> <p>Contact the factory.</p>
D. REDUCED FLOWRATE AND METER DOES NOT COUNT	<ol style="list-style-type: none"> <li>1. Meter clogged with dried liquids</li> <li>2. Below minimum flowrate</li> </ol>	<p>Remove meter. Clean carefully. Make sure rotor spins freely.</p> <p>Increase flow.</p>
E. CANNOT GET METER INTO FIELD CALIBRATION	<ol style="list-style-type: none"> <li>1. Wrong button sequence</li> <li>2. Computer circuit board defective</li> <li>3. Button defective</li> </ol>	<p>Proceed with calibration according to the Calibration Section.</p> <p>Replace computer. Contact the factory.</p> <p>Replace computer. Contact the factory.</p>

## SPECIFICATIONS

### Standard Features Include:

- 2 Totalizing Registers
- 1 Factory Calibration Curve
- 1 Field Calibration Curve
- Rate of Flow Feature
- Flowrate Time Base in Minutes

### Input Pulse Rate:

Minimum Pulse In: DC  
 Minimum Coil Input: 10 Hz  
 Maximum Raw: 1,000 Hz

### K-factor:

Minimum: .01 pulses/unit  
 Maximum: > 999,999 pulses/unit

### Field Calibration Correction:

Minimum: -99.9%  
 Maximum: +99.9%

### Readout Totals:

Min. Display: 0.01  
 Max. Display: 999,999 (x100)

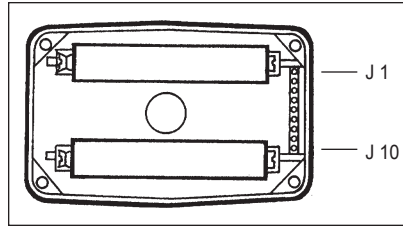
### Temperatures:

Operational: +0° to +140° F  
 (-18° to +60° C)  
 Storage: -40° to +158° F  
 (-40° to +70° C)

### Power:

Internal Power Supply: 2 Lithium Batteries at 3 volts each  
 Battery Life: 5 years  
 Optional External Power Module: 7-30-volts DC

## Computer Electronics Terminal Connections



**J-1 Reset**  
 Programming interfaces. Not accessible to user.

**J-2 Pulse Signal Output**  
 This supplies a high-level amplified open collector signal. Output will withstand a maximum open-circuit voltage of 60-volts DC and a maximum closed-circuit of 100 mA.

**J-4 Pulse Signal Input**  
 Requires a sine or square wave with open-circuit voltage of 3-30 volts P-P, a maximum rise/fall rate of 0.01 V/ $\mu$  second and a maximum frequency of 750 Hz.

**J-5 Power Input**  
 When used with Ground (J1-6), this has reverse polarity protection, but no on-board voltage regulation. Supplied voltage may be 5-volts to 10-volts DC.

**J-6 Ground**

**J-7, 8, 9, 10** Programming interfaces. Not accessible to user.

## PARTS: "09" ELECTRONICS

The factory, when provided with model number and serial number, can replace your entire Computer Electronics Assembly.

For replacement parts contact Dwyer Instruments, Inc.

## SERVICE

For warranty consideration, contact Dwyer Instruments, Inc. during normal business hours.

To obtain prompt, efficient service, always be prepared with the following information:

1. The model number of your turbine and/or computer electronics.
2. The serial number or manufacturing date code of your turbine and/or computer electronics.
3. Specific description of part needed.

For warranty work always be prepared with your original sales slip or other evidence of purchase date.

## Returning Parts

Please contact Dwyer Instruments, Inc. before returning any parts. It may be possible to diagnose the trouble and identify needed parts in a telephone call. Dwyer Instruments, Inc. can also inform you of any special handling requirements you will need to follow covering the transportation and handling of equipment which has been used to transfer hazardous or flammable liquids.

## ⚠ CAUTION

Do not return turbines, computer electronics or meters without specific authority from the Dwyer Instruments, Inc. Due to strict regulations governing transportation, handling, and disposal of hazardous or flammable liquids, Dwyer Instruments, Inc. will not accept computer electronics or meters for rework unless they are completely free of liquid residue.

## ⚠ CAUTION

Turbines and meters not flushed before shipment can be refused and returned to the sender.

## WEEE DIRECTIVE



The Waste Electrical and Electronic Equipment (WEEE) directive (2002/96/EC) was approved by the European Parliament and the Council of the European Union in 2003. This symbol indicates that this product contains electrical and electronic equipment that may include batteries, printed

circuit boards, liquid crystal displays or other components that may be subject to local disposal regulations at your location. Please understand those regulations and dispose of this product in a responsible manner.

## **Maintenance / Repair**

Upon final installation of the Series TTMS Electronic Totalizing Meter, no routine maintenance is required. The Series TTMS is not field serviceable. Field repair should not be attempted and may void the warranty

## **Warranty / Return**

Refer to "Terms and Conditions of Sale" in our catalog and on our website. Contact customer service to receive a Return Goods Authorization number before shipping the product back for repair. Be sure to include a brief description of the problem plus any additional application notes.

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