



# User's Guide

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## Series FTB-1400 Turbine Flow Meter



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The information contained in this document is believed to be correct, but OMEGA accepts no liability for any errors it contains, and reserves the right to alter specifications without notice.

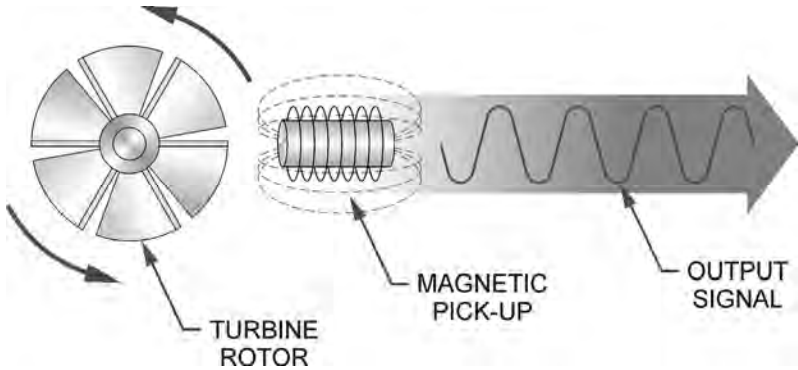
**WARNING:** These products are not designed for use in, and should not be used for, human applications.

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# INTRODUCTION

Fluid entering the meter passes through the inlet flow straightener which reduces its turbulent flow pattern and improves the fluid's velocity profile. Fluid then passes through the turbine blades causing it to rotate at a speed proportional to the fluid velocity. As each blade passes through the magnetic field, created at the base of the pickoff transducer, AC voltage (pulse) is generated in the pick-up coil (see **Figure 1**). These impulses produce an output frequency proportional to the volumetric flow through the meter. The output frequency is used to represent flow rate and/or totalization of fluid passing through the turbine flow meter.

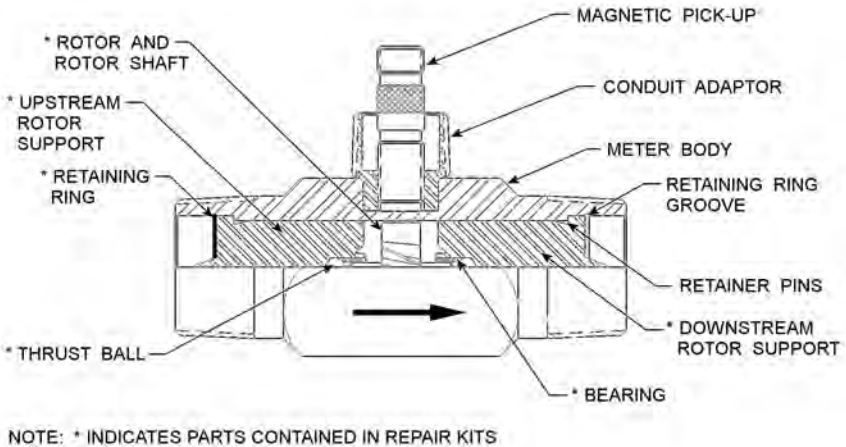


**FIGURE 1**  
**Schematic illustration of electric signal generated by rotor movement**

# TURBINE METER

The FTB-1400 Series Turbine Flow Meter is designed to withstand the rigorous demands of the most remote flow measurement applications. The FTB-1400 Series Flow Meter maintains measurement accuracy and mechanical integrity in the corrosive and abrasive fluids commonly found in oil field waterflood project pipelines, in-situ mining operations, offshore facilities and plant locations. Simple to install and service, it can operate in any orientation (horizontal to vertical) as long as the

“flow direction” arrow is aligned in the same direction as the actual line flow. For optimum performance, the flow meter should be installed with a minimum of 10 diameters upstream pipe length and 5 diameters downstream pipe length.



**FIGURE 2**  
**Typical cross-section of FTB-1411 through**  
**FTB-1441 turbine flow meter**

# SPECIFICATIONS

## ***MATERIALS of CONSTRUCTION:***

**Body:** 316 Stainless Steel

**Rotor:** CD4MCU Stainless Steel

**Rotor Support and Bearings:** 316 Stainless Steel

**Rotor Shaft:** Tungsten Carbide

## ***OPERATING LIMITATIONS:***

**Temperature:** -150 °F to +350 °F (-101 °C to +177 °C) The meter should not be subjected to temperatures above +350° F (177° C), or below -150° F (-101° C) or the freezing point of the metered liquid. High temperatures will damage the magnetic pick-up, while lower temperatures will limit the rotation of the rotor.

**Pressure:** Maximum pressure ratings as follows:

5,000 psi — all NPT meters up to 2"

2,000 psi — 3" male NPT

1,500 psi — 4" male NPT

1,000 psi — 6" male NPT

800 psi — all grooved end meters

**Note:** Consult factory for pressure ratings for flanged meters.

***WARNING:*** *Pressure in excess of allowable rating may cause the housing to burst and cause serious personal injury.*

**Accuracy:** ± 1.0% of reading

**Repeatability:** ± 0.1%

**Calibration:** Water (NIST Traceable Calibration)

**Corrosion:** All FTB-1400 series turbine meters are constructed of stainless steel and tungsten carbide. The operator must ensure that the operating fluid is compatible with these materials. Incompatible fluids can cause deterioration of internal components and cause a reduction in meter accuracy.

### **Pulsation and**

**Vibration:** Severe pulsation and mechanical vibration will affect accuracy and shorten the life of the meter

**Filtration:** If small particles are present in the fluid, it is recommended that a strainer be installed upstream of the meter (see **Table 1** on page 8 for filtration recommendations).

### ***FLOW MONITOR:***

For a complete flow monitor package, Omega offers the FTB-1400 Series Flow Monitors (see Appendix B on page 12 for flow monitor information). These digital signal processing displays utilize the low-level frequency input from the FTB-1400 Series Turbine Meters to calculate flow rate and total. When ordered with an Omega FTB-1400 Series Turbine Meter, the included factory calibration will provide dependable and accurate flow information.

### ***REPAIR KIT:***

The FTB-1400 Series Turbine Meter Repair Kit is designed for easy field service of a damaged flow meter, rather than replacing the entire flow meter (see Appendix B on page 12 for repair kit information). Repair parts are constructed of stainless steel alloy and tungsten carbide and are factory calibrated to ensure accuracy throughout the entire flow range. Each kit is complete and includes the calibrated K-factor which is used to recalibrate the flow monitor or other electronics to provide accurate output data.

## **INSTALLATION INSTRUCTIONS**

Prior to installation, the flow meter should be checked internally for foreign material and to ensure the turbine rotor spins freely. Fluid lines should also be checked and cleared of all debris.

The flow meter must be installed with the flow arrow, etched on the exterior of the meter body, pointing in the direction of fluid flow. Though the meter is designed to function in any position it is recommended, where possible, to install horizontally with the magnetic pick-up facing upward.

The liquid being measured should be free of any large particles that may obstruct rotation of the rotor. If particles are present, a mesh strainer should be installed upstream before operation of the flow meter. (See **Table 1** on page 8.)

PART NUMBER	STRAINER MESH	CLEARANCE	FILTER SIZE
FTB-1411, FTB-1421	60 × 60	.0092	260 Micron
FTB-1412, FTB-1422	60 × 60	.0092	260 Micron
FTB-1413, FTB-1423	60 × 60	.0092	260 Micron
FTB-1424	60 × 60	.0092	260 Micron
FTB-1425	60 × 60	.0092	260 Micron
FTB-1431	20 × 20	.0340	.86mm
FTB-1441	20 × 20	.0340	.86mm

**TABLE 1**  
**Strainer Mesh Installation Details**

The preferred plumbing setup is one containing a by-pass line (**Figure 3** on page 10) that allows meter inspection and repair without interrupting flow. If a by-pass line is not utilized, it is important that all control valves be located downstream of the flow meter (**Figure 4** on page 10).

**CAUTION:** *Damage can be caused by striking an empty meter with a high velocity flow stream.*

This is true with any restriction in the flow line that may cause the liquid to flash. If necessary, air eliminators should be installed to ensure that the meter is not incorrectly measuring entrained air or gas.



It is recommended that a minimum length, equal to ten (10) pipe diameters of straight pipe, be installed on the upstream side and five (5) diameters on the downstream side of the flow meter. Otherwise, meter accuracy may be affected. Piping should be the same size as the meter bore or threaded port size.

Do not locate the flow meter or connection cable close to electric motors, transformers, sparking devices, high voltage lines, or place connecting cable in conduit with wires furnishing power for such devices. These devices can induce false signals in the flow meter coil or cable, causing the meter to read inaccurately.

If problems arise with the flow meter and monitor, consult **Appendix A** (Troubleshooting Guide) on page 11. If further problems arise, consult the factory.

If the internal components of the turbine flow meter are damaged beyond repair, turbine meter repair kits are available. Information pertaining to the turbine meter repair kits is referenced in **Appendix B** on page 12.

## **OPERATIONAL START-UP**

The following steps should be followed when installing and starting the meter.

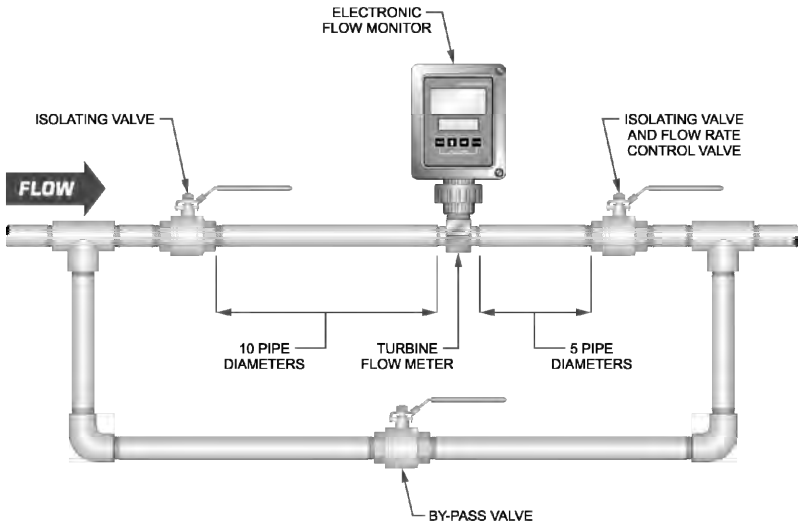
***WARNING:*** *Make sure that fluid flow has been shut off and pressure in the line released before attempting to install the meter in an existing system.*

1. After meter installation, close the isolation valves and open the by-pass valve. Flow liquid through the by-pass valve for sufficient time to eliminate any air or gas in the flow line.

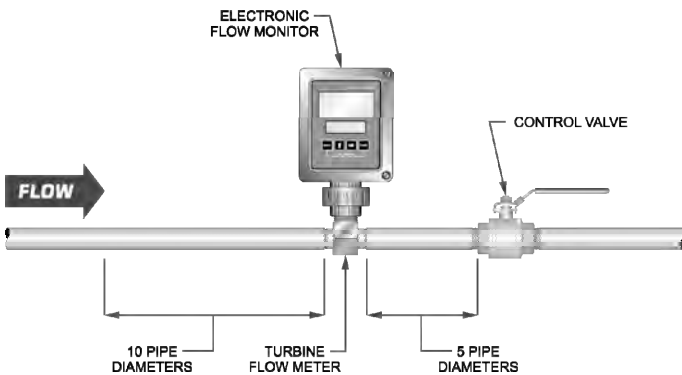
***CAUTION:*** *High velocity air or gas may damage the internal components of the meter.*

2. Open upstream isolating valve slowly to eliminate hydraulic shock while charging the meter with the liquid. Open the valve to full open.

3. Open downstream isolating valve to permit meter to operate.
4. Close the by-pass valve to a full closed position.
5. Adjust the downstream valve to provide the required flow rate through the meter. Note: The downstream valve may be used as a control valve.



**FIGURE 3**  
**Meter installation utilizing a by-pass line**  
**(Shown with an FTB-1400 Series Flow Monitor)**



**FIGURE 4**  
**Meter installation without utilizing a by-pass line**  
**(Shown with an FTB-1400 Series Flow Monitor)**

## APPENDIX A

### TROUBLESHOOTING GUIDE

<b>Trouble</b>	<b>Possible Cause</b>	<b>Remedy</b>
Meter indicates higher than actual flow rate	<ul style="list-style-type: none"> <li>-Cavitation</li> <li>-Debris on rotor support</li> <li>-Build up of foreign material on meter bore</li> <li>-Gas in liquid</li> </ul>	<ul style="list-style-type: none"> <li>-Increase back pressure</li> <li>-Clean meter</li> <li>-Clean meter</li> <li>-Install gas eliminator ahead of meter</li> </ul>
Meter indicates lower than actual flow rate	<ul style="list-style-type: none"> <li>-Debris on rotor</li> <li>-Worn bearing</li> <li>-Viscosity higher than calibrated</li> </ul>	<ul style="list-style-type: none"> <li>-Clean meter and add filter</li> <li>-Clean meter and add filter</li> <li>-Recalibrate monitor</li> </ul>
Erratic system indication, meter alone works well (remote monitor application only)	Ground loop in shielding	Ground shield one place only. Look for internal electronic instrument ground. Reroute cables away from electrical noise
Indicator shows flow when shut off	Mechanical vibration causes rotor to oscillate without turning	Isolate meter
No flow indication. Full or partial open position	Fluid shock, full flow into dry meter or impact caused bearing separation or broken rotor shaft	Rebuild meter with repair kit and recalibrate monitor. Move to location where meter is full on start-up or add downstream flow control valve
Erratic indication at low flow, good indication at high flow	Rotor has foreign material wrapped around it	Clean meter and add filter
No flow indication	Faulty pick-up	Replace pick-up
System works perfect, except indicates lower flow over entire range	By-pass flow, leak	Repair or replace by-pass valves, or faulty solenoid valves
Meter indicating high flow, upstream piping at meter smaller than meter bore	Fluid jet impingement on rotor	Change piping
Opposite effects of above	Viscosity lower than calibrated	Change temperature, change fluid or recalibrate meter

# APPENDIX B

## FTB-1400 SERIES FLOW MONITOR

### Simplified Version

- Displays rate and/or total
- Large 8 digit by 3/4" display
- Front panel programming
- NEMA 4X enclosure
- Five selectable units of measure
- Programs in seven simple steps

#### Part Number Information

**FTB - 1400 - X D**

**Mounting Style**

**M** = Meter Mount

**R** = Remote Mount

**S** = Swivel Mount

### Advanced Version

- Displays rate and/or total
- Large 8 digit by 3/4" display
- Front panel programming
- NEMA 4X enclosure
- Thirteen selectable units of measure
- Selection of time intervals for rate measurement
- Ten point linearization
- Provides additional programming options

#### Part Number Information

**FTB - 1400 - X D - A**

**Mounting Style**

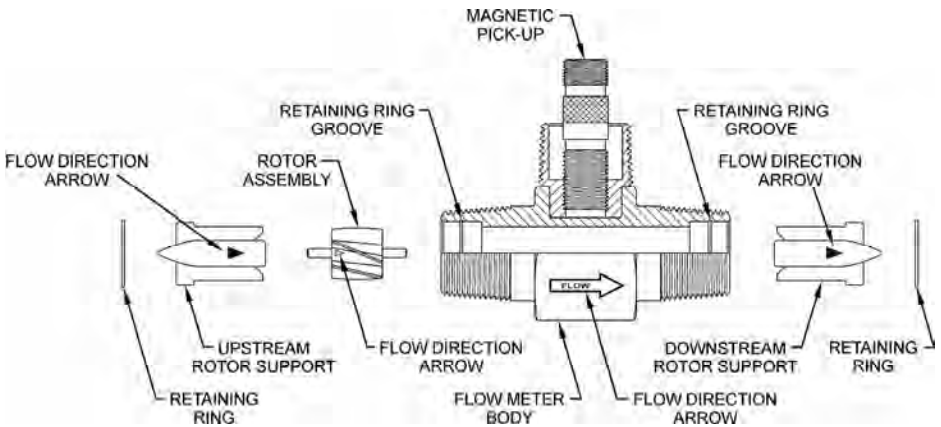
**M** = Meter Mount

**R** = Remote Mount

**S** = Swivel Mount

## FTB-1400 REPAIR KIT

Flow Meter Size	Repair Kit Fits Meter Part Number	Repair Kit Part Number
3/8"	FTB-1411, FTB-1421	FTB-1400A-RK
1/2"	FTB-1412, FTB-1422	FTB-1400B-RK
3/4"	FTB-1413, FTB-1423	FTB-1400C-RK
7/8"	FTB-1424	FTB-1400D-RK
1"	FTB-1425	FTB-1400E-RK
1-1/2"	FTB-1431	FTB-1400F-RK
2" Low	FTB-1441	FTB-1400F-RK
Standard Magnetic Pick-up	All Meter Sizes	FTB-1400-MP



**Figure 5**  
**Typical turbine meter component directory**

## NOTES

## WARRANTY/DISCLAIMER

OMEGA ENGINEERING, INC. warrants this unit to be free of defects in materials and workmanship for a period of **13 months** from date of purchase. OMEGA's WARRANTY adds an additional one (1) month grace period to the normal **one (1) year product warranty** to cover handling and shipping time. This ensures that OMEGA's customers receive maximum coverage on each product.

If the unit malfunctions, it must be returned to the factory for evaluation. OMEGA's Customer Service Department will issue an Authorized Return (AR) number immediately upon phone or written request. Upon examination by OMEGA, if the unit is found to be defective, it will be repaired or replaced at no charge. OMEGA's WARRANTY does not apply to defects resulting from any action of the purchaser, including but not limited to mishandling, improper interfacing, operation outside of design limits, improper repair, or unauthorized modification. This WARRANTY is VOID if the unit shows evidence of having been tampered with or shows evidence of having been damaged as a result of excessive corrosion; or current, heat, moisture or vibration; improper specification; misapplication; misuse or other operating conditions outside of OMEGA's control. Components in which wear is not warranted, include but are not limited to contact points, fuses, and triacs.

**OMEGA is pleased to offer suggestions on the use of its various products. However, OMEGA neither assumes responsibility for any omissions or errors nor assumes liability for any damages that result from the use of its products in accordance with information provided by OMEGA, either verbal or written. OMEGA warrants only that the parts manufactured by the company will be as specified and free of defects. OMEGA MAKES NO OTHER WARRANTIES OR REPRESENTATIONS OF ANY KIND WHATSOEVER, EXPRESSED OR IMPLIED, EXCEPT THAT OF TITLE, AND ALL IMPLIED WARRANTIES INCLUDING ANY WARRANTY OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE ARE HEREBY DISCLAIMED. LIMITATION OF LIABILITY: The remedies of purchaser set forth herein are exclusive, and the total liability of OMEGA with respect to this order, whether based on contract, warranty, negligence, indemnification, strict liability or otherwise, shall not exceed the purchase price of the component upon which liability is based. In no event shall OMEGA be liable for consequential, incidental or special damages.**

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## RETURN REQUESTS/INQUIRIES

Direct all warranty and repair requests/inquiries to the OMEGA Customer Service Department. **BEFORE RETURNING ANY PRODUCT(S) TO OMEGA, PURCHASER MUST OBTAIN AN AUTHORIZED RETURN (AR) NUMBER FROM OMEGA'S CUSTOMER SERVICE DEPARTMENT (IN ORDER TO AVOID PROCESSING DELAYS).** The assigned AR number should then be marked on the outside of the return package and on any correspondence.

The purchaser is responsible for shipping charges, freight, insurance and proper packaging to prevent breakage in transit.

FOR **WARRANTY** RETURNS, please have the following information available BEFORE contacting OMEGA:

1. Purchase Order number under which the product was PURCHASED,
2. Model and serial number of the product under warranty, and
3. Repair instructions and/or specific problems relative to the product.

FOR **NON-WARRANTY** REPAIRS, consult OMEGA for current repair charges. Have the following information available BEFORE contacting OMEGA:

1. Purchase Order number to cover the COST of the repair,
2. Model and serial number of the product, and
3. Repair instructions and/or specific problems relative to the product.

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