

**.1 YEAR**  
WARRANTY

# **Ω OMEGA<sup>®</sup>** **User's Guide**

**Shop online at**  
**omega.com<sup>SM</sup>**

**e-mail: [info@omega.com](mailto:info@omega.com)**  
**For latest product manuals:**  
**[www.omegamanual.info](http://www.omegamanual.info)**



## **FTB-400A Series** **Sanitary Turbine Flowmeters**



omega.com info@omega.com

**Servicing North America:**

**U.S.A.  
Headquarters:**

Omega Engineering, Inc.  
Toll-Free: 1-800-826-6342 (USA & Canada only)  
Customer Service: 1-800-622-2378 (USA & Canada only)  
Engineering Service: 1-800-872-9436 (USA & Canada only)  
Tel: (203) 359-1660 Fax: (203) 359-7700  
e-mail: info@omega.com

**For Other Locations Visit [omega.com/worldwide](http://omega.com/worldwide)**

# CONTENTS

1.	Introduction.....	1
1.1	Specification .....	1
1.2	Model Number.....	2
2.	Operation .....	2
2.1	Principle.....	3
2.2	Precautions.....	4
3.	Installation .....	5
3.1	General Piping .....	5
3.2	Strainers/Filters.....	7
3.3	Flow Straighteners and Installation Kits.....	7
4.	Maintenance.....	8
4.1	General.....	8
4.2	Cleaning Procedures .....	8
4.2.1	Chemical Cleaning.....	8
4.2.2	Steam Cleaning .....	8
4.3	Pickup Coil Testing .....	10
4.4	Trouble Shooting .....	11
Appendix A: Drawing		
	Typical Assembly Sanitary Flowmeter with Installation Kit.....	12

# 1. Introduction

The following information is provided for the proper installation and maintenance of your instrument.

## 1.1 Specifications

Linearity:	$\pm 0.5\%$ of reading over linear flow range
Repeatability:	$\pm 0.1\%$ of reading
Flow Range:	0.35 to 650 gpm
Temperature Range:	-450 °F to +450 °F w/ Standard MAG coil
Signal Output:	10 mVrms or greater into 10K ohm load at minimum flow rate.
Materials of Construction:	316/316L Dual Rated Stainless Steel Rotor 17.4 PH SS Retaining Ring 15.7 MO PH SS
Bearings:	Hard Carbon Composite
Surface Finish:	32 micro inch finish
End Fitting:	Tri-Grip® Sanitary Type

## 1.2 Model Number

Model No.	Fittings	Linear Flow Range Water		Max Pressure Drop (psid)	Length mm (in)	Nominal K-factor Pulses/Gal	Weight kg (lb)
		LPM	GPM				
FTB-401A	11/2" TRI	1.32 to 13.2	0.35 to 3.5	3.0	90.4 (3.56)	15,000	3 lbs
FTB-402A	11/2" TRI	2.84 to 28.4	0.75 to 7.5	5.0	90.4 (3.56)	8,900	3 lbs
FTB-403A	11/2" TRI	4.73 to 36	1.25 to 9.5	5.2	90.4 (3.56)	5,800	3 lbs
FTB-404A	11/2" TRI	6.62 to 61	1.75 to 16	3.0	90.4 (3.56)	5,200	3 lbs
FTB-405A	11/2" TRI	9.5 to 110	2.5 to 29	5.0	82.5 (3.25)	2,200	3 lbs
FTB-406A	11/2" TRI	15 to 227	4 to 60	5.1	90.4 (3.56)	840	3 lbs
FTB-407A	11/2" TRI	23 to 352	6 to 93	4.3	116.5 (4.59)	400	4 lbs
FTB-408A	11/2" TRI	30 to 492	8 to 130	3.0	116.5 (4.59)	230	4 lbs
FTB-409A	2" TRI	57 to 852	15 to 225	3.3	154 (6.06)	120	7 lbs
FTB-410A	3" TRI	95 to 1514	25 to 400	4.0	254 (10)	97	8 lbs
FTB-411A	4" TRI	151 to 2460	40 to 650	4.0	254 (10)	45	12 lbs

Note: Operating pressure is limited by the TRI fitting.

## **2. Operation**

### **2.1 Principle**

The turbine flow sensor consists of a rotor assembly which is supported on a shaft held in place by triple tube clusters and secured with locking nuts within the flowmeter housing.

The rotor is free to spin on a self lubricated ceramic ball bearing. A magnetic type pickup coil is attached on the exterior of the flowmeter housing.

A low mass rotor design allows for rapid dynamic response. The deflector cones eliminate downstream thrust on the rotor and allows for dynamic positioning of the rotor between deflector cones.

The dynamic positioning of the low mass rotor provides wider rangeability and longer bearing life than that of conventional turbine flowmeters. Integral flow straightening tubes minimize the effects of upstream flow turbulence.

As the liquid flows through the flowmeter the rotor spins at rate proportional to the volumetric liquid flowrate.

Each rotor blade passing through the pickup coil generates an electrical pulse. The frequency of the pulses is proportional to flowrate. The summation of pulses represents total amount of liquid volume passed through the meter.

The number of pulses generated per unit of volume is called the calibration factor or K-Factor. This calibration factor is used to calculate flowrate and total amount of flow.

### **Material Selection and Construction**

The housing is made of 316 stainless steel. The rotor is made of 17.4 pH stainless steel. Bearings are composite hard carbon, FDA approved.

## Flowmeter Calibrations

The standard calibration provided with an Omega turbine flowmeter consists of a 10-point water calibration that is traceable to NIST. Based on this water calibration, we derive an average k-factor for water for the flowmeter.

The uncertainty of this calibration is typically 0.1%.

The K-factor on turbine flowmeters used on liquid service is NOT density dependent.

## 2.2 Precautions

- ◆ Do not drop the meter. Dropping the meter may result in damage to the meter housing and/or internals.
- ◆ Do not operate the meter at flowrates greater than the maximum flowrate marked on the meter. Operating at flowrates greater than the maximum flowrate may over-spin the meter. Over-spinning may result in damage to the meter.

**CAUTION:** *Avoid over-spinning the meter. Over-spinning the meter may result in damage to the meter internals and lead to meter failure.*

### 3. Installation

**CAUTION:** *Turbine meter has to be installed with pickup coil pointing down (see Appendix A) to ensure proper cleanability.*

Inspect all packages for any indications of damage which may have occurred during shipment.

Verify that all meter parts or auxiliary components have arrived with the shipment. Refer to the packing list/invoice for a detailed list of items included in the shipment.

#### 3.1 General Piping

It is required to install meter with a minimum straight run of pipe approximately 10 pipe diameters ahead of the inlet and 5 pipe diameters following the outlet to avoid any effect of fluid swirls.

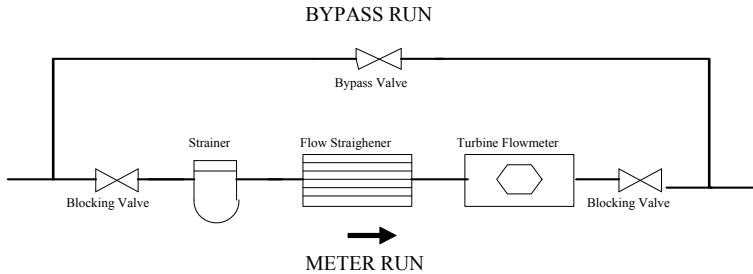
The meter housing is marked by a flow direction arrow and the inlet is marked 'IN' and the outlet is marked 'OUT'. The meter must be installed in the piping in the correct orientation to ensure the most accurate operation.

Install meter with adequate distance and isolation from electric motors, transformers, welding equipment and solenoids to avoid any electromagnetic interference from ambient electrical field.

When it is expected that flow will be intermittent, the meter should not be mounted at a low point in the piping system. Solids which settle or congeal in the meter may affect meter performance.



A typical flowmeter installation is shown below:



### Typical Flowmeter Installation

Blocking and Bypass valves should be installed if it is necessary to do preventive maintenance on the flowmeter without shutting down the flow system. The Bypass valve can be opened before the Blocking valves are closed allowing the flow to continue while removing the turbine flowmeter for service.

---

**IMPORTANT:** All flow lines should be purged prior to installing the meter. To prevent possible damage to the meter, install the meter **ONLY** in flow lines that are clean and free of debris.

---

Upon initial start-up of the system a spool piece should be installed in place of the flowmeter so that purging of the system can be performed to remove all particle debris which could cause damage to the meter internals. In applications where meter flushing is required after meter service, care should be taken as to not over-spin the meter, as severe meter damage may occur.

**CAUTION:** Avoid over-spinning the meter. Over-spinning the meter may result in damage to the meter internals and lead to meter failure.

To maintain an accurate flow measurement it is necessary to maintain a downstream pressure sufficient to prevent flashing/cavitation. Flashing of the liquid will result in an indication of flow significantly higher than the actual flow. In order to eliminate this condition adequate downstream pressure must be maintained. The minimum required downstream pressure may be calculated using the following equation:

$$\text{Minimum Pressure} = (2 \times \text{Pressure Drop}) + (1.25 \times \text{Vapor Pressure})$$

Downstream pressure may be maintained by a downstream valve that provides the necessary downstream pressure to prevent flashing/cavitation in the metering run.

### 3.2 Strainers/Filters

Turbine flowmeters are designed for use in a clean fluid service. However, the service fluid may carry some particulate material which would need to be removed before reaching the flowmeter. Under these conditions a strainer/filter may be required to reduce the potential hazard of fouling or damage that may be caused by foreign matter.

METER SIZE	MESH SIZE	PARTICLE SIZE (Maximum)
¼" to ½"	100	.0055
⅝" to 1¼"	70	.008
1½" to 3"	40	.015

If a strainer/filter is required in the system, it should be located upstream of the flowmeter taking care that the proper minimum distance is kept between the strainer and flowmeter.

### 3.3 Flow Straighteners and Installation Kits

Proper application of the Omega FTB-400A Series Flowmeter requires a minimum inlet straight pipe run of 10 pipe diameters and a minimum outlet straight pipe run of 5 pipe diameters.

Installation kits for the Omega FTB-400A Series Flowmeter consist of two lengths of appropriate tubing cut to a length appropriate for the upstream and downstream straight pipe run with appropriate end fittings. Flow straightening sections may be provided within the installation kit.

## 4. Maintenance

### 4.1 Cleaning Procedures

The Omega FTB-400A Series flowmeters have been designed to allow for cleaning by commercially accepted practices. These include removing the flowmeter from the line for cleaning in an approved fluid, flushing the line with an approved cleaning solution, and steam cleaning. With all cleaning methods, care must be taken to not over-spin the meter, as severe meter damage may occur.

**CAUTION:** *Avoid over-spinning the meter. Over-spinning the meter may result in damage to the meter internals and lead to meter failure.*

#### 4.2.1 Chemical Cleaning

The flowmeters may be chemically cleaned using an approved cleaning solution by removing the meter from the service line and using a bath or by flushing the meter in place.

The hard carbon composite bearing designs used have been tested and found to be compatible with the following CIP fluids manufactured by Klenzade; Mandate, AC-300, AC-101, Principle, and XY-12.

Following the cleaning operation, the cleaning solution should be flushed from the meter and/or service line with potable water to remove the chemically active cleaning solution.

Care should be taken to ensure that flowrates occurring during chemical cleaning do not exceed the flow capacity of the flowmeter.

#### 4.2.2 Steam Cleaning

Steam cleaning is only recommended for meters with hard carbon composite bearings.

The steam flow velocity during the cleaning should not exceed 1/3 of the maximum liquid flow capacity of the flowmeter.

## Steam Cleaning Rates at Various Steam Pressures

<b>Meter Size</b>	<b>50 psig PPH<sup>1</sup></b>	<b>75 psig PPH<sup>1</sup></b>	<b>100 psig PPH<sup>1</sup></b>	<b>125 psig PPH<sup>1</sup></b>	<b>Velocity FPS<sup>2</sup></b>	<b>Rate GPM<sup>3</sup></b>
1/4	1.25	1.70	2.25	2.50	1.72	1.05
3/8	2.70	3.67	4.75	5.39	3.68	2.25
1/2	3.50	4.73	6.14	7.00	4.74	2.90
5/8	5.78	7.82	10.20	11.50	5.02	4.80
3/4	10.50	14.20	18.40	20.90	6.32	8.70
1	21.70	29.40	38.10	43.10	7.35	18.00
1 ¼	33.70	45.70	59.30	67.10	7.32	28.00
1 ½	47.00	63.60	82.50	93.50	7.08	39.00
2	81.30	110.10	142.80	162.00	6.89	67.50
2 ½	144.60	196.00	254.00	288.00	7.84	120.00
3	235.00	318.00	412.60	467.00	8.85	195.00

---

### NOTES

1. PPH = Pounds Per Hour
2. The velocity is expressed for a line size equal to the inlet bore of the flowmeter.
3. The apparent GPM is provided since many applications have a flow rate indicator which can be used to set a safe flow rate during the steam cleaning cycle.

### 4.3 Pickup Coil Testing

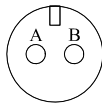
Testing the MAG and MCP (RF) coils consists of measuring the resistance with an ohmmeter. Resistance measurements are to be made only when there is no flow through the meter.

1. Measure the resistance between pin A and pin B. The resistance should be approximately as listed in the following table of some common coils.
2. The resistance from any pin to the case should be greater than 1 Mohm.

COIL*	DC RESISTANCE (Ohms)
MC2PAHT	15.0 ±10%
MCP3A	11.5 ±10%
PC13-74G	1800 ±10%
PC13-74S	1850 ±15%
PC24-45G	1350 ±10%
PC24-45S	1850 ±15%
PC28-13G	120 ±20%
PC28-14G	180 ±20%

If either resistance measurement fails, replace the pickup coil. Firmly seat the new coil in the flowmeter and tighten the locking nut.

### Pickup Connections



MAG

A - Signal (+)  
B - Common (-)



MCP (RF)

A - Signal (+)  
B - Common (-)  
C - N/C



RediPulse

A - 8 - 30 Vdc  
B - Common (-)  
C - Pulse Output

\* For specific coils not listed contact the HFC Customer Service Department for the approximate resistance readings.

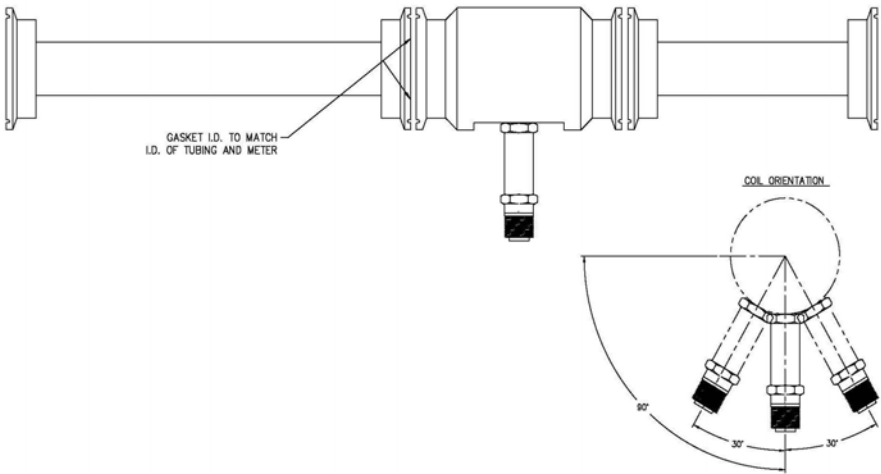
## 4.4 Troubleshooting

Refer to the following troubleshooting guide for assistance with possible meter malfunctions:

<b>TROUBLE</b>	<b>CAUSE</b>	<b>REMEDY</b>
Fluid will not flow through the meter	<ul style="list-style-type: none"><li>▪ Meter clogged.</li><li>▪ Line to meter blocked.</li></ul>	Clean meter. Clean line to meter.
Reduced flow through the meter	<ul style="list-style-type: none"><li>▪ Meter partially clogged.</li><li>▪ Line to meter partially blocked.</li></ul>	Clean meter. Clean line to meter.
Meter readings inaccurate	<ul style="list-style-type: none"><li>▪ Fluid flowrate is not within meter flow range.</li><li>▪ Meter drag due to improper installation</li></ul>	See “Specifications” for min and max flowrates. Replace internals.

# DRAWING

## Typical Assembly Sanitary Flowmeter with Installation Kit



## 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.**

CONDITIONS: Equipment sold by OMEGA is not intended to be used, nor shall it be used: (1) as a "Basic Component" under 10 CFR 21 (NRC), used in or with any nuclear installation or activity; or (2) in medical applications or used on humans. Should any Product(s) be used in or with any nuclear installation or activity, medical application, used on humans, or misused in any way, OMEGA assumes no responsibility as set forth in our basic WARRANTY/DISCLAIMER language, and, additionally, purchaser will indemnify OMEGA and hold OMEGA harmless from any liability or damage whatsoever arising out of the use of the Product(s) in such a manner.

## 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.

OMEGA's policy is to make running changes, not model changes, whenever an improvement is possible. This affords our customers the latest in technology and engineering.

OMEGA is a registered trademark of OMEGA ENGINEERING, INC.

© Copyright 2016 OMEGA ENGINEERING, INC. All rights reserved. This document may not be copied, photocopied, reproduced, translated, or reduced to any electronic medium or machine-readable form, in whole or in part, without the prior written consent of OMEGA ENGINEERING, INC.



# Where Do I Find Everything I Need for Process Measurement and Control? **OMEGA...Of Course!** *Shop online at [omega.com](http://omega.com)<sup>SM</sup>*

## **TEMPERATURE**

- ☑ Thermocouple, RTD & Thermistor Probes, Connectors, Panels & Assemblies
- ☑ Wire: Thermocouple, RTD & Thermistor
- ☑ Calibrators & Ice Point References
- ☑ Recorders, Controllers & Process Monitors
- ☑ Infrared Pyrometers

## **PRESSURE, STRAIN AND FORCE**

- ☑ Transducers & Strain Gages
- ☑ Load Cells & Pressure Gages
- ☑ Displacement Transducers
- ☑ Instrumentation & Accessories

## **FLOW/LEVEL**

- ☑ Rotameters, Gas Mass Flowmeters & Flow Computers
- ☑ Air Velocity Indicators
- ☑ Turbine/Paddlewheel Systems
- ☑ Totalizers & Batch Controllers

## **pH/CONDUCTIVITY**

- ☑ pH Electrodes, Testers & Accessories
- ☑ Benchtop/Laboratory Meters
- ☑ Controllers, Calibrators, Simulators & Pumps
- ☑ Industrial pH & Conductivity Equipment

## **DATA ACQUISITION**

- ☑ Communications-Based Acquisition Systems
- ☑ Data Logging Systems
- ☑ Wireless Sensors, Transmitters, & Receivers
- ☑ Signal Conditioners
- ☑ Data Acquisition Software

## **HEATERS**

- ☑ Heating Cable
- ☑ Cartridge & Strip Heaters
- ☑ Immersion & Band Heaters
- ☑ Flexible Heaters
- ☑ Laboratory Heaters

## **ENVIRONMENTAL MONITORING AND CONTROL**

- ☑ Metering & Control Instrumentation
- ☑ Refractometers
- ☑ Pumps & Tubing
- ☑ Air, Soil & Water Monitors
- ☑ Industrial Water & Wastewater Treatment
- ☑ pH, Conductivity & Dissolved Oxygen Instruments