Actuators
Selection Considerations

Important criteria must be identified when selecting a Turbo Probe® actuator. The following is a guide to help you select the proper model numbers based on your application requirements. Refer to the product specifications to determine pressure and temperature limits of the components.

Flow Technology's Application Department, or any of our sales representatives throughout the world, are always available to assist you in identifying the proper flowmetering equipment to ensure a successful installation.

Type & Size

Retractable _____ Temperature _____ Pressure _____

Size & Configuration

Line Size _____ Mounting Tee _____
End Fittings _____ Mounted Electronics _____

Pickoff

Type _____ Flow Range _____
Bearing _____ Temperature _____

Model Numbering

Flow Technology offers two main types of Turbo Probe® actuators, the fixed and retractable. Fixed Turbo Probe® actuators offer a low-cost alternative to flow measurement but do not allow adjustment of insertion depth or removal from the line without shutting down the process.

The retractable Turbo Probe® actuator allows the user to insert the turbine flowmeter capsule element to a selected or desired depth. If installed in conjunction with a valve, it permits removal of the probe without stopping the process.

It also offers the capability to traverse the entire diameter of the process line and characterize the velocity profile. Flow profiling is a method of determining proper positioning for a more accurate flow measurement.

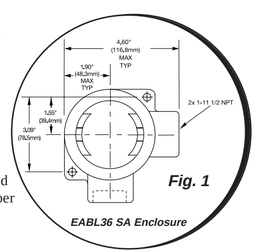


Fig. 1

EABL36 SA Enclosure

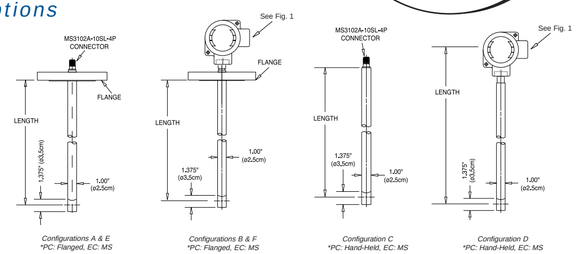
Model Descriptions

TPA – – – – – –

Length
12 = 12" (30.5cm)
24 = 24" (61cm)
36 = 36" (91cm)
48 = 48" (122cm)

Configuration
A = 3" 150# Flanged–MS
B = Flanged–NPT
C = Hand-held–MS
D = Hand-held–NPT
E = DN80 PN16 Flanged–MS
F = DN80 PN16 Flanged–NPT

Pickoff
A = STD RF
B = STD MAG
C = HI-TEMP RF
D = HI-TEMP MAG



Configurations A & E
**PC: Flanged, EC: MS*

Configurations B & F
**PC: Flanged, EC: MS*

Configuration C
**PC: Hand-Held, EC: MS*

Configuration D
**PC: Hand-Held, EC: MS*

Fixed Turbo Probes®

The insertion depth of these probe actuators is fixed, since the strut is welded to a flange that is used to mount the device on the user's process line. The pressure rating is dependent upon the flange.

Hand-Held Turbo Probes®

These probe actuators do not contain any means of installation on a process line. They are meant to be used manually or installed with user-provided hardware.

*PC = Process Connection; EC = Electrical Connection

Model Descriptions (cont'd)

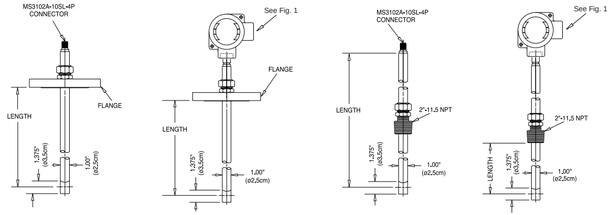
Drawings not to scale.

TSA – – – – – –

Length
12 = 12" (30.5cm)
24 = 24" (61cm)
36 = 36" (91cm)
48 = 48" (122cm)

Configuration
A = 3" 150# Flanged – MS
B = 3" 150# Flanged – NPT
C = NPT–MS
D = NPT–NPT
E = DN80 PN16 Flanged–MS
F = DN80 PN16 NPT

Pickoff
A = STD RF
B = STD MAG
C = HI-TEMP RF
D = HI-TEMP MAG



Configuration A & E
**PC: Flange, EC: MS*

Configuration B & F
**PC: Flange, EC: MS*

Configuration C
**PC: NPT, EC: MS*

Configuration D
**PC: NPT, EC: NPT*

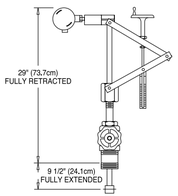
The TS Model Turbo Probe® actuator adjusts the insertion depth manually by inserting the probe strut to the desired location and tightening the Swagelok fitting at the neck of the seal housing. The Swagelok fitting provides the only means of sealing against leakage of the process fluid. This seal can hold up to 19 BAR (275 psi).

TLA – – – – – –

Length
08 = 8.5" (21.6cm)

End Fittings
A = 3" 150# Flange
B = NPT
C = Weldolett
D = 3" 300# Flange
E = DN80 PN16 Flange
F = DN80 PN40 Flange

Pickoff
A = STD RF
B = STD MAG
C = HI-TEMP RF
D = HI-TEMP MAG



Configuration B
**PC: NPT*

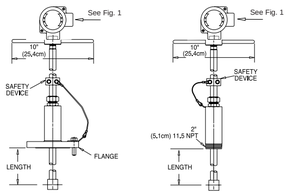
This Turbo Probe® actuator uses a scissors-type insertion mechanism, designed to allow it to be mounted in applications where space (height) is at a premium.

TBA – – – – – –

Length
12 = 12" (30.5cm)
24 = 24" (61cm)
36 = 36" (91cm)
48 = 48" (122cm)

Configuration
A = 3" 150# Flanged – NPT
B = NPT – NPT
C = DN80 PN16 Flanged – NPT

Pickoff
A = STD RF
B = STD MAG
C = HI-TEMP RF
D = HI-TEMP MAG



Configuration A & C
**PC: Flange, EC: NPT*

Configuration B
**PC: NPT, EC: NPT*

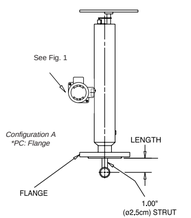
The TB Model Turbo Probe® actuator also adjusts the insertion depth manually similar to the TS Series. In addition, the TB Series allows the user to pull the capsule completely out of the flow path while installed. The TB Series can hold up to 19 BAR (275 psi). A safety cable is attached as a means of preventing the probe from moving outward under pressure.

T8A – – – – – –

Length
24 = 24" (61cm)
36 = 36" (91cm)
48 = 48" (122cm)
60 = 60" (152cm)
72 = 72" (183cm)

Configuration
A = 3" 150# Flange
B = 3" 300# Flange
C = 3" 600# Flange
E = DN80 PN16 Flange
F = DN80 PN40 Flange
G = DN80 PN100 Flange

Pickoff
A = STD RF
B = STD MAG
C = HI-TEMP RF
D = HI-TEMP MAG



Configuration A
**PC: Flange*

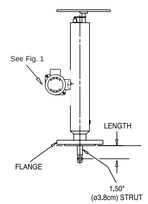
The probe insertion mechanism is fully enclosed. The probe is inserted by turning a handwheel. The T8 is offered with a standard 1" (2.5 cm) diameter strut.

T9A – – – – – –

Length
36 = 36" (91cm)
48 = 48" (122cm)
72 = 72" (183cm)
96 = 96" (244cm)

Configuration
A = 3" 150# Flange
B = 3" 300# Flange
C = 3" 600# Flange
F = DN80 PN40 Flange
G = DN80 PN100 Flange

Pickoff
A = STD RF
B = STD MAG
C = HI-TEMP RF
D = HI-TEMP MAG



The T9 is similar to the T8, but uses a 1.5" (3.8 cm) diameter strut for applications where longer insertion depths and measurement of high velocity and dense fluids are required. Both the T8 & T9 pressure ratings are limited by the process connection. The T8 & T9 can be completely removed from the line without stopping flow if mounted on an isolation valve.

Local Representative:

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DB 62047 Rev E

Printed in USA

FTI FLOW TECHNOLOGY™

Turbo Probe®

Insertion Turbine Flowmeters

Turbo Probe®
Insertion Turbine Flowmeters

Description

The Turbo Probe® consists of an axial turbine flowmeter capsule secured in a protected shroud and fixed to the end of a strut which can be mounted in the form of a retractable or fixed probe. The flow velocity is sensed by a turbine rotor as it rotates under the force of the flowing fluid. An electronic sensor, referred to as a pickoff, is located in the strut. The passage of each rotor blade by the pickoff produces an electrical pulse and can be thought of as representing a discrete volume of fluid. The frequency of this signal is proportional to the velocity or volume of the liquid or gas passing through the pipe line. This pulse output is fed to the appropriate electronics for a variety of computing and displaying functions.

Applications

Turbo Probe® insertion flowmeters offer an attractive combination of performance and economy when an inline flowmeter is too costly for making flow measurements in large pipes, ducts and channels. Applications include either gas or liquid, and Turbo Probe® insertion meters can be mounted in a flanged or threaded pipe section with the probe depth either fixed or adjustable. Insertion flowmeters offer an advantage if removal of the meter is required without interrupting flow. Maintenance is simplified by utilizing calibrated rotor capsules which are easy to store and replace in the field.

Accuracy

The Turbo Probe® is a flow velocity sampling device capable of providing accuracies of ±1.0% of reading or better, with a repeatability of ±0.25%. Accuracy is dependent upon proper understanding of the flow stream, whether it is liquid or gas, and placement of the probe itself. Generally, the probe should be inserted to a depth equal to 12% of the inside diameter of the pipe for lines 6" and larger; or at the pipe center for lines 4" and smaller. Ultimate accuracy is achieved by profiling the flow stream to determine the mean flow velocity location.

Rotor Configurations

Calibrated rotor capsules are offered in a variety of bearing configurations, such as ball bearing, journal or pivot, to meet your measurement requirements.

Features

- Signal is proportional to the velocity or volume of the liquid or gas
- Measures flow velocity in liquids from 6 to 6,000 FPM (0.03 to 30.0 m/s) and gas flows from 90 to 18,000 FPM (0.46 to 91.0 m/s)
- Available in fixed, hand-held or retractable designs
- Provides accuracies of ±1.0% of reading, with repeatability of ±0.25%
- Perfect for lines ranging from 2 to 72 inches
- Creates minimal pressure drop

Capsule Assemblies

Configurations

There are three basic Turbo Probe® configurations:

- Fixed Probe
- Adjustable Compression Fitting
- Retractable

Selection Configurations

Important criteria must be indentified when selecting a Turbo Probe® Capsule Assembly. The following is a guide to help select the proper model numbers based on your application requirements. Refer to the product specifications to determine proper components. Flow Technology's Application Department or any of our sales representatives throughout the world are always available to assist you in identifying the proper flowmetering equipment to ensure a successful installation.

Materials of Construction/Bearings

C A – ☐ ☐ – ☐ ☐ – ☐ ☐ – ☐ ☐ ☐

Fluid Compatibility _____ Pickoff Type _____ Flow Range _____

Blade Angle & Service

C A – ☐ ☐ – ☐ ☐ – ☐ ☐ – ☐ ☐ ☐

Flow Range _____ Linearity _____ Fluid _____

Calibration Code

C A – ☐ ☐ – ☐ ☐ – ☐ ☐ – ☐ ☐ ☐

Flow Range _____ Bearing Type _____ Fluid Type _____
Units _____ Pickoff Type _____ System Accuracy _____

Model Numbering

The capsule assemblies are required components to the Insertion Turbo Probes®. Each actuator, combined with a capsule assembly, is the configuration known as the Insertion Turbo Probe®.

The capsules are primarily distinguished by the type of bearing used, and the blade angle of the rotor. Three bearing types are available for liquid flows, while two types are used in gas configurations. Each bearing has specific features and benefits.

Upon determining a bearing configuration, a blade angle must be chosen which correlates to the flow range required. The fifth and sixth digits in the model number specify the blade angle in degrees. The capsule assembly chart lists the flow range associated with each bearing and blade angle.

Jewel Bearings

The jewel bearings are recommended for both liquid and gas applications. They are constructed of two sapphire cups and a tungsten carbide shaft. These bearings have very low friction which improves the low end measurement capability. Jewel bearings are sensitive to shock and over range and must be treated with care.

Ball Bearings

The ball bearings are constructed of 440 C and are resistant to many mild liquids, including most hydrocarbons. Water will attack the 440 C and is not recommended. Ball bearings are common on gas applications. These bearings are rugged and offer a wide rangeability.

Journal Bearings

The standard journal bearing is constructed of ceramic and is only available for liquids. It is a durable, dependable bearing used in water and other corrosive liquids.

MODEL NUMBERING SYSTEM

C A – ☐ ☐ – ☐ ☐ – ☐ ☐ – ☐ ☐ ☐

Basic Model Number

Construction & Bearing Material
HC = Jewel Pivot
17-4 PH SS Rotor
EA = Ball Bearing
430 F SS Rotor
HG = Ceramic Journal
17-4 PH SS Rotor
HD = Tungsten Carbide Journal
17-4 PH SS Rotor
Note: Flow range and blade angles for tungsten carbide are the same as ceramic journal.

Blade Angle
XX = See Capsule Assembly Chart

Range Number
X = See Capsule Assembly Chart

Fluid Type
L = Liquid
G = Gas

Calibration
XX = See Capsule Calibration Chart

Special Designator
U = Units
R = Range
B = Both

Capsule Assemblies

FLOW RANGE – LIQUID – JEWEL BEARING

			(10:1) Range						Ext. Flow Range					
		RF				MAG			RF				MAG	
Model Number	Linearity (±%FS)	FPM		m/s		FPM		m/s	FPM		m/s		FPM	m/s
CA-HC-43-2L	2.0	8	80	.04	.40	N/A		N/A	6	100	.03	.50	N/A	N/A
CA-HC-43-1L	2.0	30	300	.15	1.5	N/A		N/A	10	300	.05	.15	N/A	N/A
CA-HC-35-1L	2.0	60	600	.30	3.0	8	120	.04 .61	25	1000	.13	5.0	120 1000	.61 5.0
CA-HC-30-1L	2.0	120	1200	.61	6.1	150	1200	.76 6.1	60	1500	.30	7.6	150 1500	.76 7.6
CA-HC-20-1L	1.5	180	1800	.91	9.1	180	1800	.91 9.1	90	2000	.46	10	180 2000	.91 10
CA-HC-10-1L	1.5	300	3000	1.52	15	300	3000	1.5 15	120	3000	.61	15	300 3000	1.5 15
CA-HC-05-1L	1.5	600	6000	3.0	30	600	6000	3.0 30	240	6000	1.2	30	600 6000	3.0 30
FLOW RANGE – LIQUID – BALL BEARING														
CA-EA-43-4L	2.0	10	100	.05	.52	N/A		N/A	10	1200	.05	6.1	N/A	N/A
CA-EA-43-3L	2.0	30	300	.15	1.5	N/A		N/A	10	1200	.05	6.1	N/A	N/A
CA-EA-43-2L	2.0	60	600	.30	3.0	120	600	.61 3.0	10	1200	.05	6.1	N/A	N/A
CA-EA-40-1L	2.0	120	1200	.61	6.1	120	1200	.61 6.1	10	1200	.05	6.1	120 1200	.61 6.1
CA-EA-20-1L	1.5	180	1800	.91	9.1	180	1800	.91 9.1	120	2200	.61	11.2	180 2200	.91 11.2
CA-EA-13-1L	1.5	300	3000	1.5	15	300	3000	1.52 15	150	3500	.76	17.8	300 3500	1.5 17.8
CA-EA-07-1L	1.5	600	6000	3.0	30	600	6000	3.0 30	300	6000	1.5	30.0	600 6000	3.0 30.0
FLOW RANGE – LIQUID – JOURNAL BEARING														
CA-HG-43-4L	2.0	15	150	.076	.76	120	1200	.61 6.1	15	1200	.07	6.1	N/A	N/A
CA-HG-43-3L	2.0	30	300	.15	1.5	120	1200	.61 6.1	15	1200	.07	6.1	N/A	N/A
CA-HG-43-2L	2.0	60	600	.30	3.0	120	1200	.61 6.1	15	1200	.07	6.1	N/A	N/A
CA-HG-43-1L	2.0	120	1200	.61	6.1	120	1200	.61 6.1	15	1200	.07	6.1	120 1200	.61 6.1
CA-HG-20-1L	1.5	180	1800	.91	9.1	180	1800	.91 9.1	150	2200	.76	11.2	180 2200	.91 11.2
CA-HG-13-1L	1.5	300	3000	1.5	15	300	3000	1.5 15	200	3500	1.0	17.8	300 3500	1.5 17.8
CA-HG-07-1L	1.5	600	6000	3.0	30	600	6000	3.0 30	400	6000	2.0	30.0	600 6000	3.0 30.0
FLOW RANGE – GAS – JEWEL BEARING														
CA-HC-43-1G	11.0	90	600	.046	3.0	90	1000	N/A N/A	N/A	N/A	.46	5.0	N/A	N/A
CA-HC-30-1G	7.0	120	1200	.61	6.1	200	1200	1.0 6.1	100	1500	.50	7.6	N/A	N/A
CA-HC-20-1G	5.0	180	1800	.91	9.1	200	1800	1.0 9.1	125	2000	.64	10	N/A	N/A
CA-HC-10-1G	5.0	300	3000	1.5	15	400	3000	2.0 15	150	4000	.76	20	N/A	N/A
CA-HC-05-1G	4.0	600	6000	3.0	30	600	6000	3.0 30	300	6000	1.5	30	N/A	N/A
CA-HC-03-1G	4.0	1200	12000	6.1	61	1200	12000	6.1 61	600	12000	3.0	61	N/A	N/A
FLOW RANGE – GAS – BALL BEARING														
CA-EA-43-2G	3.0	180	1800	.91	9.1	N/A	N/A	N/A N/A	N/A	N/A	N/A	N/A	N/A	N/A
CA-EA-43-1G	2.0	300	3000	1.5	15	400	3000	2.0 15	300	4000	1.5	20	N/A	N/A
CA-EA-20-1G	2.0	600	6000	3.0	30	600	6000	3.0 30	500	6000	2.5	30	N/A	N/A
CA-EA-13-1G	2.0	1200	12000	6.1	61	1200	12000	6.1 61	1000	12000	5.0	61	N/A	N/A
CA-EA-07-1G	2.0	1800	18000	9.1	91	1800	18000	9.1 91	1500	18000	7.6	91	N/A	N/A

LIQUID

GAS

Black = English (US) Units
Blue = Metric (SI) Units

FPM = Feet Per Minute
m/s = Meters/Second

Calibrations

Capsule assemblies are typically supplied with factory calibrations. The Turbo Probe® calibration chart provides two-letter codes which describe the standard calibrations. In liquids, choices include water and solvent calibrations, or an oil blend which is matched to the process fluid viscosity. In gases, an air calibration at atmospheric conditions is standard. For increased accuracies in high-pressure applications, an equivalent Reynolds Number calibration is available.

CODE	DESCRIPTION
NA	10-point, normal 10:1 range, in air
NW	10-point, normal 10:1 range, in water
NS	10-point, normal 10:1 range, in solvent
NB	10-point, normal 10:1 range, in oil blend
XA	10-point, extended range, in air
XW	10-point, extended range, in water
XS	10-point, extended range, in solvent
XB	10-point, extended range, in oil blend
TA	20-point, normal 10:1 range, in air
TW	20-point, normal 10:1 range, in water
TS	20-point, normal 10:1 range, in solvent

CODE	DESCRIPTION
TB	20-point, normal 10:1 range, in oil blend
YA	20-point, extended range, in air
YW	20-point, extended range, in water
YS	20-point, extended range, in solvent
YB	20-point, extended range, in oil blend

CODE	REYNOLDS NUMBER ONLY
R1	10-point, 1 pressure, Reynolds No. Cal.
E1	20-point, 1 pressure, Reynolds No. Cal.

Special Designator Calibration Code

The third digit of the calibration designator is normally not used. When required, the following codes are used:

U — To signify required units of measure other than GPM or ACFM

R — To signify special calibration flow range other than normal 10:1 or extended range

B — To signify both changes in units and special flow range

Specifications

Liquid Service

Performance specifications are based on tests with water at normal conditions (viscosity of 1.0 centistoke).

Calibration Accuracy ±0.05% of reading (accuracy of primary flow calibration standard directly traceable to NIST)

Repeatability ±0.25% of reading

Linearity As per capsule calibration chart

Note: Linearity of ±0.1% of reading can be obtained with our linearizing electronics.

Dynamic Response Less than 10 milliseconds for a 90% step change of flow rate

Gas Service

Performance specifications are based on air at standard conditions (1 BAR and 20° C).

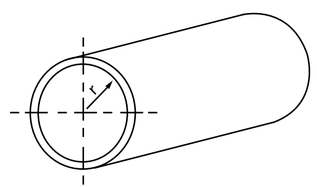
Calibration Accuracy ±0.75% of reading (accuracy of secondary flow calibration standard directly traceable to NIST)

Repeatability ±0.25% of reading

Linearity As per capsule calibration chart

Note: Linearity of ±0.1% of reading can be obtained with our linearizing electronics.

Velocity to Volume Calculation



πr^2 = Cross Sectional Area
Volume = Cross Sectional Area x Velocity

Example:
8" Schedule 40 pipe, I.D. = 7.981"
Cross Sectional Area = πr^2 = 0.3474 ft²
Velocity = 30 to 300 FPM
Volume = 0.3474 ft² x (30 to 300 FPM) = 10.42 to 104.22 ft³/min.
Conversion to GPM = (10.42 to 104.22 ft³/min.) x 7.48 gal./ft³ = 77.9 to 779.6 GPM

Applicable to Both Liquid and Gas Flowmeters

Materials of Construction

Strut	300 Series SS
Rotor	17-4 PH SS or 430 F SS

Other materials of construction optional (consult factory).

Operating Temp. Range Defined by bearing and pickoff selection (see below)

Bearing Type Temperature Limits:

Jewel	-60° F to 600° F (-50° C to 315° C)

Note: The standard maximum operating temperature of the jewel bearing is 300° F. Maximum operating temperatures up to 600° F are available as a special.

Journal Bearing	-100° F to 1200° F (-75° C to 650° C)
Ball Bearing	-450° F to 300° F (-270° C to 150° C)

Pickoff Type Temperature Limits:

Magnetic	-430° F to 350° F (-260° C to 177° C)
High Temp. Magnetic	-430° F to 750° F (-260° C to 400° C)
Modulated Carrier (RF)	-300° F to 350° F (-185° C to 177° C)
High Temp. (RF)	-300° F to 700° F (-185° C to 370° C)

Pickoff Electronic Connections

MS Connector *2-pin, standard pickoff:*	15-89515-101
Threaded Connection with Leads *Junction Box with Terminal:*	73-31836-105

Operating Pressure Range Dependent on actuator and end fittings

Filter Recommendations 100 micron or better

Certifications Canadian Registration Number (CRN) OF1677.2

Specifications are for reference only and are subject to change without notice.