

SERIES 504FTB

IN-LINE MASS FLOW TRANSMITTERS



Timelines



Fps

SERIES 504FTB

IN-LINE MASS FLOW TRANSMITTERS

DESCRIPTION

The Series 504FTB has many improvements and features that greatly enhance the performance of the original Series 504FT. These include a Patented digital thermal anemometer circuit, a more convenient optional remote electronics mounting bracket, a one-piece PCB for improved reliability and ease-of-use, two relays, and many other unique Kurz engineering and functional features. More convenient Directly Attached or Remotely Attached Electronic Enclosure Configurations are standard. The Series 504FTB is powered by +24 VDC or 85 to 265 VAC, 47 to 63 Hertz. The new 504FTB has 10 Models covering Mass Flow ranges to 1000 SCFM, in-line sizes from 1/2" to 4" pipes. Models have CE Compliance which meets all EC directives at the time of sale. All models have Non-Incendive and Explosion-Proof/Flame-Proof Safety Approvals and are IP66 NEMA 4X/7 Rated. Kurz is an ISO 9001 Quality Manufacturer.

KEY FEATURES

- Constant temperature sensor control circuit.
- Sensors and Electronics (single PCB) are interchangeable. No matched sets.
- 3 Year Warranty. All components pass an extensive accelerated stress test for high reliability.
- Multi-Point calibration correction factors for Flow and Temperature.
- Zero velocity is a valid data point.
- Fastest response to temperature and velocity changes in the industry.
- Process Temperature Rating of -40°C to $+125^{\circ}\text{C}$.
- Process Pressure Rating up to 300 PSIG.
- Electronics operating temperature range of -40°C to $+65^{\circ}\text{C}$, non-condensing.
- Easy-to-use menus for display and configuration including basic setup "Wizard".
- User configurable scrolling or static displays of Flow process variables.
- Configuration upload/download software using a PC with USB connection, RS-485 or TCP/IP Modbus.
- Adjustable two-line LCD/Keypad allowing ease of reading the display for horizontal or vertical installations.
- User selected English or Metric units (SFPM, SCFM, SCFH, PPM, PPH, $^{\circ}\text{F}$; SMPS, NMPS, NLPM, NCMH, SLPM, SCMh, KGM, KGH, $^{\circ}\text{C}$).
- USB port for terminal operation.
- Modbus ASCII or RTU communications.
- HART 7 communication option.
- Alloy C-276 all-welded sensor construction.
- Integral or Remote Electronics Enclosure.
- IP66/NEMA 4X/7 dual chamber epoxy painted electronics enclosure.
- Input power options of 85 to 265 VAC 47/63 Hz or 24 VDC.
- Two optically isolated loop-powered 4-20 mA outputs which are user configurable. Typically, one is configured for mass flow rate or mass velocity and the other for process temperature or for PID application (Flow transmitters with the HART communication option have only one 4-20mA output).
- Two optically isolated solid-state alarm/relays (optional).
- One 4-20mA input (optional).
- Pulsed output for use as a remote flow totalizer (optional).
- Meets EPA Mandatory GHG Certification Requirement in CFR98.34(c)(1).
- 4-20 mA outputs meet NAMUR NE43 recommendations.
- User programmable Access Codes.

- User may change STP reference condition without affecting factory calibration data.
- Sensor lead length independent circuitry.
- User-selectable digital filtering.
- Programmable alarm functions.
- Built-in flow totalizers and elapsed time.
- Flow Body orientation independent.
- CE Compliance, including EMC, ATEX, LVD, PED, WEEE and ROHS EU Directives.
- Non-Incendive and Explosion-Proof/Flame-Proof Safety Approvals (CSA/ATEX/IECEX).

APPLICATIONS

- Industrial and process gas mass flow
- Fuel flow for burners and fuel cells
- NO_x control using ammonia
- Aeration air and Digester gas for waste water treatment facilities
- Compressed air
- Natural gas
- Combustion air
- Metering semi-conductor gases
- Chlorine metering in the paper industry
- Solvent and VOC recovery
- Air sampling
- General purpose mass flow, R&D
- Flow calibration standards
- Nuclear power plants
- Air sampling in D.O.E. facilities
- O.E.M. applications

SERIES 504FTB IN-LINE MASS FLOW TRANSMITTERS

PRINCIPLE OF OPERATION

The Series 504FTB uses the well-proven Kurz thermal convection mass flow measurement method by detecting the heat transfer from the self-heated RTD sensor (R_p) referenced to the temperature of the ambient gas stream RTD sensor (R_{tc}). A constant temperature difference between the heated sensor and the temperature sensor is maintained by a Patented digital Wheatstone Bridge circuit in which the heated sensor is the controlled element. This provides unexcelled speed of response and the many other advantages of constant temperature thermal anemometry. The microprocessor-based electronics measures the heat transfer, computes the standard velocity and ambient gas temperature, and allows the user to configure and set-up the 504FTB to fit all flow requirements. Display screens are easy-to-use and provide all the flow, temperature and diagnostic information. For a more detailed description of Kurz technology, please see Document Number 364003 "Theory and Application of Kurz Thermal Convection Mass Flow Meters," or by visiting our web site.

CALIBRATION CURVE

Figure 1—The basic calibration curve is non-linear, having a non-zero output (live zero) at zero flow and a nearly constant percent of reading accuracy. Zero is a valid data point for a Kurz meter. The 504FTB provides a linear output.

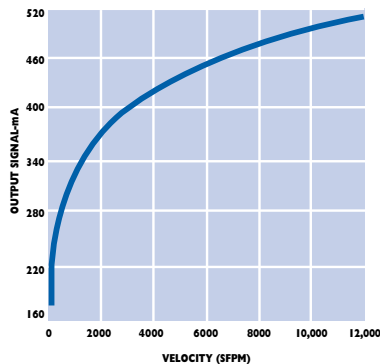


Fig. 1

FLOW ELEMENT CONSTRUCTION

Figure 2—Shows a typical cross-section of Model 504FTB-6A thru 504FTB-16.

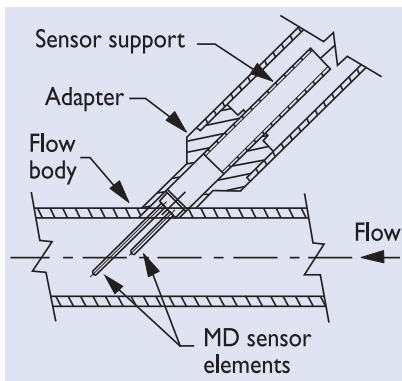


Fig. 2

TIME RESPONSE TO FLOW AND TEMPERATURE CHANGES

Figure 3—Shows the response of a Kurz sensor to a step change in velocity at a constant process gas temperature.

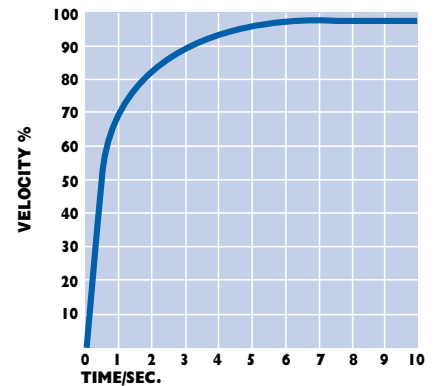


Fig. 3—Sensor Flow Response.

Figure 4—Shows a typical response to a step change in temperature at a constant mass flow rate.

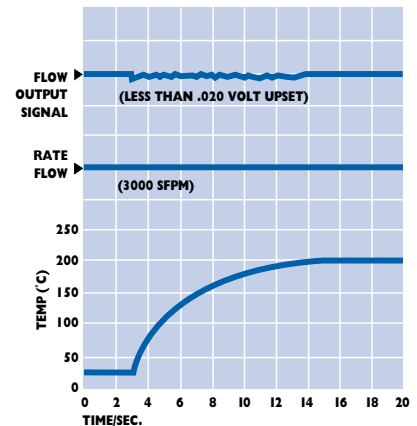


Fig. 4—Sensor Temperature Response.

OUR MISSION

To manufacture and market the best thermal mass flow meters available and to support our customers in their efforts to improve their business.

SPECIFICATIONS

Process Gas Temperature

Rating:
-40°C to +125°C

Process Gas Pressure Rating:

Up to 300 PSIG (20 BARg)

Sensor Material:

Alloy C-276

Flow Body Material:

316L SS

Repeatability: 0.25%

Velocity Time Constant:

1 second for velocity changes at 6000 SFFM at a constant temperature and 1 second for temperature changes at a constant velocity of 6000 SFFM.

Process Temperature Time

Constant: 8 seconds at a velocity of 6000 SFFM.

Flow Accuracy: See Feature 4 for overall accuracy including temperature effects.

Temperature Accuracy:

±(1/2% of reading +1°C) for velocities above 100 SFFM.

Power: +24VDC ±10%, 85-265

VAC ±10% 47-63 Hz; 24 watts max.

Enclosure Temperature:

Rating: -25°C to +65°C for all configurations; -40°C to +65°C for DC units without LCD/Keypad.

Enclosure: Dual-Chamber and Single-Chamber Epoxy-Painted aluminum, IP66/NEMA 4X/7 with glass window for display option.

Solid-State Relays:

Two, optically isolated, .8 ampere, 24 VAC/VDC maximum.

Analog Outputs (4-20 mA):

Optically isolated, user loop-powered, 12 bit resolution and accuracy, maximum loop-resistance is 500Ω at 18VDC, 800Ω at 24 VDC, 1400Ω at 36 VDC; meets NAMUR NE43 recommendations.

Analog Input (4-20mA):

One non-isolated.

Meter Filter Time Constant:

Selectable 0 to 600 seconds.

Continued on next page

TECHNICAL DESCRIPTION

SENSOR DESIGN

Series 504FTB In-Line Mass Flow Transmitters use the Kurz MetalClad™, “MD” and “FD2” all-welded Alloy C-276 sensors. In this design, the temperature sensor and velocity sensor are mounted in separate tubes (or “stings”), providing exceptional thermal isolation from the sensor support structure and a fast response to process temperature changes.

PROCESS TEMPERATURE COMPENSATION

The influence of temperature on the thermal properties of gases requires temperature compensation for repeatable and accurate measurements. Kurz temperature compensation is the most advanced and is exceptional.

GAS CALIBRATION

The customer has a choice of a laboratory calibration or a gas correlation calibration for most industrial gases.

SENSOR PROTECTION

The 504FTB circuitry includes circuitry to prevent an over-temperature condition caused by a sensor, wiring or component failure. Kurz sensors will not overheat at zero flow, unlike most competitive devices because of the constant temperature sensor control and the power limiting design.

SENSOR ELECTRONICS

The Series 504FTB has several innovations which improve performance and provides extraordinary flexibility. A new constant temperature digital bridge circuit (US Patent 7,418,878) includes an efficient switching power supply. The single bridge PCB has an EEPROM loaded with the PCB serial number, calibration coefficients, and component values which insures the safety of the data. The sensor electronics includes a sensor lead resistance compensation circuit which is extremely important for long sensor wires, rapid gas temperature changes and large temperature gradients between the sensor and the ambient air.

FIRMWARE

The onboard menu system is easy to use and intuitive. The flow meter data (e.g. velocity, mass rate, volumetric rate, and temperature) can be displayed in a user selectable form and viewed through the window in the cover. A local keypad can be accessed to navigate through the on board menu system to display various flow and diagnostic data as well as enter basic and advanced setup options. A user code is required for programming and entering configuration data or performing test and diagnostic utilities.

SELF-DIAGNOSTICS

The 504FTB performs an extensive systems check upon power-up, and continuously monitors the sensor inputs/outputs and verifies the integrity of the sensor wiring, and the measurements.

PROGRAMMABLE CORRECTION FACTORS

A Multi-Point Variable Correction Factor may be used to correct the flow calibration data to meet in-situ or laboratory flow tests. A Bias Correction Factor (BCF) may also be selected.

METER FILTER TIME CONSTANT

A digital filter time constant may be set for the flow calculation which affects the displayed values and the 4-20 mA outputs. The time constant can be set from 0 to 600 seconds.

SELECTABLE STP CONDITIONS

The mass flow calibration data is referenced to the Kurz laboratory standard of 77°F/14.69 PSIA (25°C/101.325 kPa). The user may change the STP conditions without affecting the calibration data.

COMPATIBILITY WITH SERIES 155 MASS FLOW COMPUTERS

The 504FTB is fully compatible with the inputs and features of the Series 155 Mass Flow computer. DC powered units can be directly powered by the 155 Computer. This Feature is used when two or more Model 504FTBs are used in a multi-point velocity array. (Please see the Series 155 brochure).

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SPECIFICATIONS cont'd.

Safety Approvals:

CSA Non-Incendive Approval:
IEC 79-15 and EN60079-0/15
ATEX Non-Incendive Approval:
EN60079-0/15 and EN61241-1
CSA Explosion-Proof Approval:
IEC 79-01 and EN60079-01
ATEX Flame-Proof Safety Approval:
EN 60079-0/1

Note: See Kurz website for the complete Safety Approvals Specifications.

CE Directives:

EMC, ATEX, LVD, WEEE and ROHS Directives for all models. PED Directives only for Models 504FTB-06, -06A -08, -12, -16, -24, -32 Consult Kurz for details.

Serial Port Baud Rate:

User selectable: 9600, 14,400, 19,200, 38,400, 57,600.

Communication Ports:

RS485 Modbus ASCII or RTU Mode, and USB.

LCD: Back-lit two-line alphanumeric with 16 characters per line.

LCD Update:

Every two seconds.

Keypad: 20-button membrane mounted inside enclosure.

LCD/Keypad Orientation:

Adjustable in 90° increments to accommodate user viewing angle.

Memory: EEPROM for all important data, with automatic sensor identification; Flash EEPROM for Program Memory.

Net Weight:

See Outline Drawings

TECHNICAL DESCRIPTION cont'd.

GREENHOUSE GAS REPORTING

Beginning in 2010, the EPA requires certain facilities to report GHG emissions. This rule is contained in US Code of Federal Regulations Title 40, Part 98. Kurz thermal mass flow meters meet the certification requirement in 40 CFR 98.34(c)(1) required by the Mandatory GHG Reporting regulation and are approved for this application.

NAMUR NE43 COMPLIANCE

Kurz meets the NAMUR NE43 recommendation for the 4-20 mA outputs to indicate a sensor or system fault. An NE43 alarm may be selected as high or low (but not both). This feature frees up the alarm/relays so that the user can set-up the relays for other needs.

4-20 mA OUTPUTS

The 4-20mA outputs may be wired as optically isolated loop-powered outputs or non-isolated, self powered outputs. The user may easily re-calibrate the 4-20 mA outputs using the CALIBRATE ANALOG OUTPUT menu in the onboard menu system or through the HART interface.

RELAYS – ALARMS/PULSED TOTALIZER OUTPUT/PURGE OUTPUT

The 504FTB can be ordered with up to 2 solid-state optically isolated relays. The relay outputs can be user configured to the following functions: alarm outputs or pulsed totalizer output. If no relays are ordered, the alarm functions are displayed on the LCD. Totalizers may be automatically reset at a specific total quantity (i.e., 10,000 SCF).

ANALOG INPUT

One non-isolated 4-20mA input for use as a remote set-point for the built-in PID Flow Controller.

PID FLOW CONTROLLER

The 504FTB includes the capability of controlling the velocity or flow rate through the use of the user's control valve, damper or position commanded 4-20 mA interface device. The Set-Point may be internal or remote.

USB PORT

A USB port for terminal operations includes a COM emulator driver which can be accessed using a PC terminal emulator program to remotely "echo" the LCD and keypad functions and upload/download the system configuration and calibration data files using XMODEM protocol. Process data may be initiated manually through the Log Mode menu from the remote terminal/keyboard or the local LCD/keypad. The information may also be obtained automatically by configuring the Serial Data Logging through the onboard menu system.

HART

The Series 504FTB can be ordered with the HART communication interface. The HART protocol is a recognized and accepted standard in the process control industry. This interface provides the following benefits: remote configuration, remote diagnostic monitoring and on-line testing using available hand held configurators.

MODBUS

The Modbus local network protocol (ASCII or RTU) is included. The use of Modbus is extremely useful, as most features may be accessed, including configuration upload, download, etc.

ORDERING INFORMATION

Table 1 lists the Parent Number of the standard models, size, sensor type and flow area. **Table 2** lists the standard full-scale flow range for each Model Number for most Industrial Gases. **Table 3** lists the pressure drop at the listed full-scale flow rate range for most Industrial Gases.

TABLE 1: SERIES 504FTB IN-LINE MASS FLOW TRANSMITTERS

Model Number	Parent Number	Sensor Type	Schedule 40 Pipe Size and Length	A* Flow Area (FT²)
504FTB-6A	755960	MD	3/8" x 7"	0.00044
504FTB-6	755961	MD	3/8" x 7"	0.00107
504FTB-8	755962	MD	1/2" x 8"	0.00179
504FTB-12	755963	MD	3/4" x 10"	0.00328
504FTB-16	755964	MD	1" x 12"	0.00546
504FTB-24	755965	MD	1 1/2" x 18"	0.01337
504FTB-32	755966	MD	2" x 24"	0.02253
504FTB-40	755967	FD2	2 1/2" x 24"	0.03248
504FTB-48	755968	FD2	3" x 24"	0.05057
504FTB-64	755969	FD2	4" x 24"	0.08763

FD2 Sensor Models use an all-welded construction with a compression fitting for mounting the sensor support. Please see the outline drawings.

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TABLE 2: STANDARD FULL SCALE FLOW RANGES (Q _{MAX})						
Model Number	Q _{MAX} Flow in SCFM (NCMH), Note 1					
	Gas Category and Gas Type					
	1 Air, N ₂ , O ₂ , Ar, CO ₂ , Dry Cl ₂	2 Methane Digester Gas, Dry Ammonia	3 Ethylene	4 Ethane	5 Helium, Propane Butane	6 Hydrogen
504FTB-06A	2 (3.1)	1.8 (2.8)	1.7 (2.6)	1.5 (2.3)	1 (1.56)	1 (1.56)
504FTB-06	10 (15.6)	9.5 (14.8)	8 (12.5)	7 (11)	5 (7.8)	3 (4.7)
504FTB-08	20 (31)	19 (29.6)	16 (25)	14 (22)	10 (15.5)	5 (7.8)
504FTB-12	40 (62)	38 (59)	33 (51.5)	28 (44)	20 (31)	15 (23.4)
504FTB-16	75 (117)	71 (111)	62 (97)	55 (86)	40 (62)	30 (46.8)
504FTB-24	150 (234)	140 (218)	125 (195)	110 (172)	100 (156)	75 (117)
504FTB-32	300 (468)	285 (445)	250 (390)	220 (344)	150 (234)	100 (156)
504FTB-40	400 (624)	380 (593)	333 (520)	296 (462)	200 (312)	150 (234)
504FTB-48	600 (936)	570 (889)	500 (780)	445 (694)	300 (468)	200 (312)
504FTB-64	1000 (1560)	950 (1482)	833 (1300)	740 (1154)	600 (936)	400 (624)

Note 1: SCFM: Standard Cubic Feet-Per-Minute (Ref.: 77°F, 14.69 PSIA).
 NCMH: Normal Cubic Meters-Per-Hour (Ref.: 0°C, 760 mmHg).
 NCMH = 1.56 x SFPM (Approximate).

TABLE 3: ESTIMATED PRESSURE DROP (DP _S) (Note 1)	
Gas	Pressure Drop inches water (mm water)
Air	30 (762)
Argon	40 (1016)
Butane	18 (457)
Carbon Dioxide	45 (1143)
Dry Ammonia	18 (457)
Dry Chlorine	51 (1295)
Ethane	18 (457)
Ethylene	20 (508)
Helium	2 (51)
Hydrogen	1 (25)
Methane	15 (381)
Digester Gas: 50% CH ₄ , 50% CO ₂	28 (711)
Digester Gas: 60% CH ₄ , 40% CO ₂	25 (635)
Digester Gas: 70% CH ₄ , 30% CO ₂	23 (584)
Nitrogen	29 (737)
Oxygen	33 (838)
Propane	14 (356)
Special Gases – Consult Kurz	

Note 1: The Estimated Standard Drop (DP_S) is the End-to-End pressure drop at Standard Conditions at the Standard Full Scale Flow Rate (Q_{max}) listed in Table 2.

NOMENCLATURE:

SENSOR TYPE	
Identifier	Description
MD	"Mini-Dual" MetalClad™ all-welded sensor, .074" diameter elements.
FD2	"Fast-Dual" MetalClad™ all-welded sensor, 0.105" diameter elements.

END CONNECTION TYPES		
Identifier	Description	Pressure Rating (PSIG)
MNPT	Male Pipe Threads (USA)	150
CL150	Class 150 ANSI B1.6.5 Raised Face Flanges	150
CL300	Class 300 ANSI B1.6.5 Raised Face Flanges	300

FLOW AREA	
Identifier	Description
A*	Area (FT ²) of effective flow area at the sensor location.

DEFINITIONS FOR THE USE OF TABLES 1, 2, 3:

$$\text{Equation 1: } DR_p = \frac{P_p}{P_s} \times \frac{T_s}{T_p}$$

$$\text{Equation 2: } DP_p = \frac{1}{DR_p} \times \left(\frac{Q_p}{Q_{MAX}} \right)^2 \times DP_s$$

Q_p = Process Flow Rate (SCFM for English Units, NCMH for Metric Units).

Q_{MAX} = Maximum flow rate for a specific gas type and model number (Table 2).

T_s = Standard Process Absolute Temperature: 537°R (77°F + 460) for English Units or 273°K (0°C) for Metric Units.

T_p = Process Absolute Temperature: °R (T°F + 460) for English Units or T°K (T°C + 273°C) for Metric Units.

P_s = Standard Absolute Pressure (14.69 PSIA for English Units or 760 mm Hg for Metric Units).

P_p = Process Absolute Gas Pressure (PSIA for English Units and mm Hg for Metric Units).

DR_p = Process Gas Density Ratio.

DP_p = Estimated Pressure Drop at Process conditions (inches water or millimeters of water).

DP_s = Standard Pressure Drop (See Table 3, use either inches of water for English Units or millimeters of water for Metric Units).

PART NUMBER GENERATION PROCEDURE

Select the Model 504FTB that meets the full scale flow rate, pressure drop and pipe or flange size. With the selected Parent Number, specify the entire Part Number by selecting an Option for each Feature as shown in the Part Number example below.

755964 **A** **32** **B** **I** **F** **01** **A** **015** **B** **537**
 Parent Number F1 F2 F3 F4 F5 F6 F7 F8 F9 F10

SUMMARY OF FEATURES	
Feature	Feature Description
1	Electronics Enclosure Configuration/Input Power, LCD/Keypad
2	Sensor Material/Flow Body and Flange Material
3	Flow Body Connection Type
4	Process Temperature Compensation
5	Gas Flow Rate Calibration Data Range
6	Specialty Gas Flow Rate Calibration
7	Safety Approval
8	Process Pressure
9	Analog & Digital Inputs/Outputs
10	Process Temperature

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FEATURE 1: ELECTRONICS ENCLOSURE CONFIGURATION AND INPUT POWER (See Note 1, 2)	
Option	Description
A	Directly Attached Dual-Chamber Electronics Enclosure, AC-Power, LCD/Keypad.
B	Directly Attached Dual-Chamber Electronics Enclosure, AC-Power, without LCD/Keypad.
C	Directly Attached Dual-Chamber Electronics Enclosure rotated 180° for viewing, AC Power, LCD/Keypad.
D	Remote Dual-Chamber Electronics Enclosure, AC-Power, LCD/Keypad.
E	Remote Dual-Chamber Electronics Enclosure, AC-Power, without LCD/Keypad.
F	Directly Attached Dual-Chamber Electronics Enclosure, 24VDC-Power, LCD Keypad.
G	Directly Attached Dual-Chamber Electronics Enclosure rotated 180° for viewing, 24VDC-Power, LCD/Keypad.
H	Directly Attached Single-Chamber Electronics Enclosure, 24VDC-Power, without LCD/Keypad.
I	Remote Dual-Chamber Electronics Enclosure, 24VDC-Power, LCD/Keypad.
J	Remote Single-Chamber Electronics Enclosure, 24VDC-Power, without LCD/Keypad.

Note 1: If the process gas temperature or the ambient temperature is greater than 65°C, then the remote electronics enclosure must be used (options D, E, I, J).

Note 2: The conduit or cable seal must be installed by an experienced and careful installer to prevent water intrusion into the enclosure and to maintain the enclosure rating. Failure to properly install the conduit seals may void the Kurz Warranty and may compromise the safety approval rating.

FIRST DIGIT OF FEATURE 2: SENSOR MATERIAL	
Option	Description
3	Alloy C-276

SECOND DIGIT OF FEATURE 2: FLOW BODY AND FLANGE MATERIAL	
Option	Description
2	316L Stainless Steel

FEATURE 3: FLOW BODY CONNECTION TYPE		
Option	Description	Pressure Rating(PSIG)
A	Male NPT Pipe Ends (MNPT)	150
B	Class 150 ANSI B16.5 Flanges (CL150)	150
C	Class 300 ANSI B16.5 Flanges (CL300)	300

FEATURE 4: PROCESS TEMPERATURE COMPENSATION	
Option	Description
I	Standard Temperature Compensation over process temperature range of -40°C to +125°C for all gases. Uncertainty: ± 3% of Reading + (A*)/(75 SFPM) above or below 25°C (note 1). A* is the flow area of the 504FTB, see Table 1. This accuracy specification assumes an upstream, unobstructed L/D of 30:1 and a downstream, unobstructed L/D of 10:1

Note 1: An uncertainty specification of $\pm 0.025\%/^{\circ}\text{C} + (A^*)/(0.25 \text{ SFPM}/^{\circ}\text{C})$ should be added for temperatures above or below standard.

FEATURE 5: GAS FLOW RATE CALIBRATION DATA RANGE (NOTE 1)			
Option	Description	Option	Description
A	100% of Q_{MAX}	I	60% of Q_{MAX}
B	95% of Q_{MAX}	J	55% of Q_{MAX}
C	90% of Q_{MAX}	K	50% of Q_{MAX}
D	85% of Q_{MAX}	L	45% of Q_{MAX}
E	80% of Q_{MAX}	M	40% of Q_{MAX}
F	75% of Q_{MAX}	N	35% of Q_{MAX}
G	70% of Q_{MAX}	P	30% of Q_{MAX}
H	65% of Q_{MAX}	Q	25% of Q_{MAX}

Note 1: See Table 2

FEATURE 6: SPECIALTY GAS FLOW CALIBRATION	
There are two gas flow calibration methods available:	
1. Laboratory Gas Flow Calibration	
2. Correlation Gas Flow Calibration in which the In-Line Mass Flow Transmitter is calibrated in air and experimentally derived correlation factors are used to obtain calibration data for the required gas type.	

FEATURE 6: SPECIALTY GAS VELOCITY CALIBRATION (Note 1)		
Laboratory Calibration Option	Gas Type	Correlation Calibration Option
01	Air	–
07	Compressed Air	–
–	Dry Ammonia	56
08	Argon	58
–	Butane	60
14	Carbon Dioxide	64
–	Dry Chlorine	68
20	Ethane	70
22	Ethylene	72
26	Helium	76
28	Hydrogen	78
32	Methane	82
35	“Digester Gas” 50% CH ₄ , 50% CO ₂	85
36	“Digester Gas” 60% CH ₄ , 40% CO ₂	86
37	“Digester Gas” 70% CH ₄ , 30% CO ₂	87
40	Nitrogen	90
44	Oxygen (Note 2)	94
46	Propane	96

Note 1: Laboratory Gas calibrations are performed with gases of high purity and are NIST Traceable. Customer must specify calibration pressure (Feature 8). Propane to 50 PSIA, all other gases to 150 PSIA. Correlation calibrations are based on experimental data correlated to an air calibration at ambient pressure and temperature. The user's flow element is calibrated in air, and an additional calibration data sheet is made for the specialty gas based upon the correlation factors. Add ±5% of Reading to the accuracy specifications when using a gas correlation calibration. All correlations include VTM.

Note 2: It is the customer's responsibility to insure that the Mass Flow Element is clean of Hydrocarbons and is safe for oxygen use. (See Accessories in Section C-I for Cleaning and Bagging).

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FEATURE 9: SAFETY APPROVALS (Note 1)	
Option	Description
A	Non-Incendive (NI), CSA, ATEX and IECEx Ex nA II, T6, T5, T4 or T150°C (electronics enclosure) Ex nA II, T5 or T3 (sensing element)
B	Explosion-Proof/Flame-Proof, CSA, ATEX and IECEx Ex d IIB + H2, T6, T4, T110°C or T150°C (electronics enclosure) Ex d IIB + H2, T4 or T3 (sensing element)

Note 1: See Specifications, Page 5.

FEATURE 8: PROCESS PRESSURE
Enter the Absolute Pressure (PSIA), rounded off to 3 digits. Example: For a Process Absolute Pressure of 14.7 PSIA, enter 015; for 150 PSIA, enter 150.

FEATURE 9: ANALOG AND DIGITAL INPUTS/COMMUNICATIONS							
Option	Analog & Digital Inputs				Communication Protocols		
	No. of Alarm Relay Outputs (DO)	No. of 4-20mA Outputs (AO)	No. of Digital Inputs (DI)	No. of 4-20mA Inputs (AI)	USB	Modbus RS-485 RTU or ASC II	HART (FSK 7.0)
B ¹	0	2	0	0	Yes	Yes	No
C ²	2	2	2	1	Yes	Yes	No
E ³	2	1	2	1	Yes	Yes	Yes

¹Option B provides:

- Two 4-20 mA outputs for Flow Rate and/or Temperature, NAMUR NE-43 compliance.
- USB, Modbus and RS-485 communication protocols.

²Option C provides:

- Two 4-20 mA outputs for: Flow Rate, Temperature, EPA Zero-MidSpan-Span Drift check^{III} or PID Flow Control^{I,II}, NAMUR NE-43 compliance.
- Two alarm relays for: Flow Rate, Temperature or Pulsed Flow Totalizer. External 4-20 mA input.
- DI for EPA Zero-MidSpan-Span Drift Check initiation.
- USB, Modbus and RS-485 communication protocols.

³Option E provides:

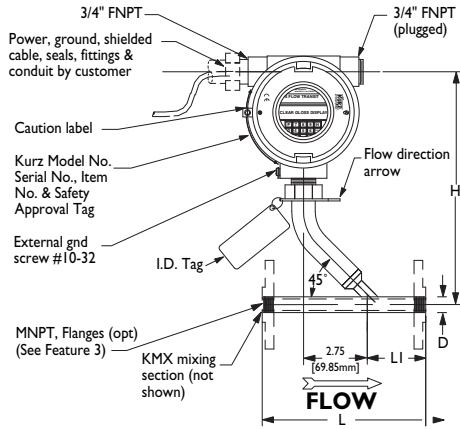
- One 4-20 mA output for: Flow Rate, Temperature, EPA Zero-Mid-Span Drift check^{III} or PID Flow Control^{I,II}, NAMUR NE-43 compliance.
- Two alarm relays for: Flow Rate, Temperature or Pulsed Flow Totalizer. External 4-20 mA input.
- DI for EPA Zero-MidSpan-Span Drift Check initiation.
- HART Communication Interface, USB, Modbus and RS-485 communication protocols.

Notes:

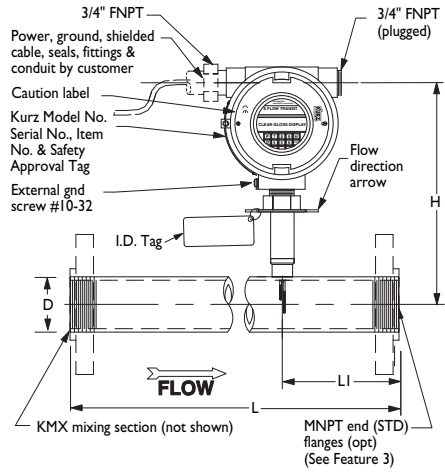
- I. The PID Flow Controller uses one 4-20 mA output for the flow controller.
- II. The External Input PID Controller requires a 4-20 mA flow reference input.
- III. EPA Zero-MidSpan-Span Drift check normally requires a contact closure to verify that the Drift Check has been truly indicated. The contact closure is generated by the Continuous Emissions Monitor Computer at a specific time every day to indicate the Daily Drift Check. Both 4-20mA outputs are used during the Drift Check Calibration procedure.

FEATURE 10: PROCESS TEMPERATURE
Enter the Absolute Process Temperature (°Rankin = °F + 460) rounded off to 3 digits. Example: For a Process Temperature of 77°F, enter 537.

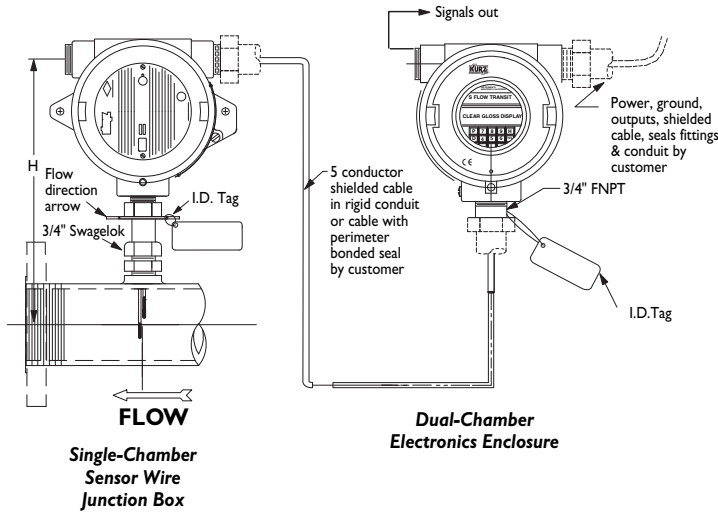
SERIES 504FTB OUTLINE DRAWINGS



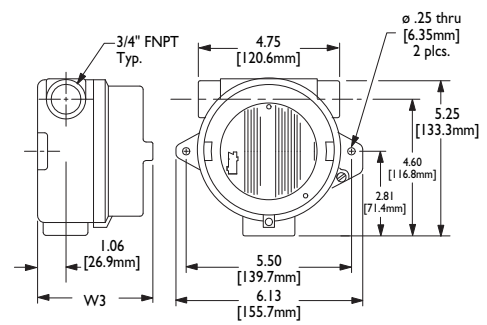
Models 504FTB-6A, -6, -8, -12, -16
Shown Directly Attached with Standard Display Orientation



Models 504FTB-24, -32
Shown Directly Attached with Standard Display Orientation



Models 504FTB-40, -48, -64
Shown with Enclosure Remotely Attached

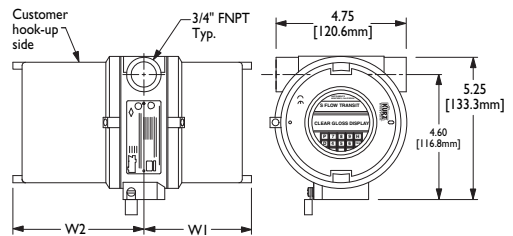


Enclosure Type	W ₃
Junction Box	3.88 [99mm]
Electronic Enclosure	5.94 [151mm]

TABLE 3: SERIES 504FTB IN-LINE MASS FLOW TRANSMITTERS DIMENSIONS

Model Number	D (in)	Flange Size (in)	L (in)	LI (in)	H (in)	Net Wt. Lbs. (See Note 1)	
						Threaded	Flanged
504FTB-6A	.675	1/2	7	2.5	9.94	6.5	9.0
504FTB-6	.675	1/2	7	2.5	9.94	6.5	9.0
504FTB-8	.840	1/2	8	3	10.02	6.5	9.0
504FTB-12	1.050	3/4	10	3	10.13	7.0	10.0
504FTB-16	1.315	1	12	3.5	10.25	7.5	11.5
504FTB-24	1.90	1 1/2	18	4	9.20	10.0	18.0
504FTB-32	2.375	2	24	5	9.38	13.0	26.0
504FTB-40	2.875	2 1/2	24	5	11.5	NA	36.5
504FTB-48	3.500	3	24	5	11.5	NA	46.0
504FTB-64	4.500	4	24	5	11.5	NA	61.5

Note 1: Add 3.3 lbs for AC Option. Add 4 lbs for Remote Option.



Input Power	Display/Keypad	W ₁	W ₂
AC	Yes	3.41" (87mm)	4.69" [119mm]
AC	No	2.75" [70mm]	4.69" [119mm]
24VDC	Yes	3.41" [87mm]	4.69" [119mm]

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Technology for Process and
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