

S E R I E S
454FT
INSERTION
MASS FLOW
TRANSMITTERS



SERIES 454FT INSERTION MASS FLOW TRANSMITTERS

DESCRIPTION

The Series 454FT Insertion Mass Flow Transmitters raise the standard for mass flow measurements of air and industrial gases. The 454FT incorporates the rugged Kurz all-welded thermal sensor having a miniature, powerful "in-the-head" microprocessor having a large, lighted LCD/Keypad, with easy-to-use set-up and configuration menus. The 454FT uses only two all-welded RTD sensors to provide fast measurements of the velocity and process temperature. The optional temperature ratings are 200°C and 500°C. Kurz uniquely offers an automatic, Hot-Air Purge Sensor Cleaning System for use with the Model 454PFT. The LCD/Keypad can be rotated in 90° increments to provide a convenient orientation for all applications. English or Metric Units are selected by the user. The 454FT includes up to two optically isolated 4-20 mA outputs and alarms, a RS-232 port for use with a PC to download, upload, record and "ECHO" the display. A flash EEPROM Program Memory allows the user to upgrade the firmware in the field. A RS 485/Modbus local area network protocol is optional. The 454FT includes the most advanced temperature compensation, microprocessor technology and the highest repeatability, accuracy, and reliability available. The 454FT has CE Compliance, hazardous gas safety approvals and a Canadian Registration Number for most applications. Kurz has world-class calibration facilities, and is ISO 9001:2000 certified.

KEY FEATURES

- Easy-to-use menu for display and set-up with HELP screens.
- Two-line 16 character, back-lit LCD with twenty button keypad (optional).
- User selectable scrolling display.
- Adjustable LCD/Keypad orientation allowing ease of reading the display for horizontal or vertical installations.
- Twenty-four hour clock/calendar.
- Two optically isolated loop-powered 4-20 mA outputs, one for mass flow rate, one for process temperature (optional).
- 4-20 mA outputs meet NAMUR NE43 recommendations.
- Two optically isolated solid-state alarm/relays (optional).
- Pulsed output for use as a remote flow totalizer (optional).
- User selected English or Metric units (SFPM, SCFM, SCFH, PPM, PPH, °F; SMPS, SLPM, SCM, KGM, KGH, °C).
- Multi-Point calibration correction factors for Flow and Temperature.
- User-entered METER ID Number.
- User-entered flow area.
- Programmable sensor out-of-tolerance indication and alarm functions.
- User may change STP reference condition.
- User-selectable digital filtering for each METER.
- Built-in flow totalizers and elapsed time.
- User Access Code.
- Selectable RS-232C or RS-485 Serial port for terminal operation.
- Modbus ASCII or RTU communications
- NEMA 4X/7 dual chamber epoxy painted electronics enclosure.
- CE Compliance, including the current EMC, ATEX, LVD and PED Directives.
- Configuration upload/download software using a PC.
- Velocity/Temperature/Mapping (VTM) for wide ranging velocity and temperature.
- Input power options of 115VAC or 230 VAC 50/60 Hz or 24 VDC.
- Flash EEPROM program memory for user firmware upgrades.
- Remote Electronics Enclosure option.
- Velocity range of 0-24,000 SFPM.
- Optional Hot-Air Purge Sensor Cleaning System

- Process Temperature Rating of -40°C to 200°C (MT) or -40°C to +500°C (HHT).
- Process Pressure Rating of 150 PSIG for MT temperature range and Class 150 mounting flanges; 300 PSIG for MT and HHT temperature ranges for no flange connection and Class 300 flanges.
- Electronics operating temperature range of -25°C to +65°C, non-condensing, and -40°C to +65°C without the LCD/Keypad option.
- All-welded sensor construction.
- Fastest response to temperature and velocity changes in the industry.
- Attitude insensitive.
- Sensor lead length independent circuitry.
- Non-Incendive, Flameproof/Explosion-Proof Safety Approvals (ATEX, CSA).
- All components pass an extensive burn-in test for high reliability.
- Optional Modbus local area network with a read-only control set (Trademark of Square D Company).
- Canadian Registration Number (CRN) available for all listed gases, except Chlorine, and all Models except 454PFT-HHT.

APPLICATIONS

- Industrial and process gas mass flows
- Combustion air flow measurements
- EPA Flow Monitors
- Flare stack metering
- Aeration air flow and digester off-gas flow
- Landfill vapor recovery
- Incinerator stack mass flow
- Solvent recovery system mass flow
- VOC mass flow
- Cement plants
- Coal-fired boiler combustion air
- Compressed air
- Natural gas
- Semi-conductor processing gas metering
- O.E.M. applications

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.

SERIES 454FT INSERTION MASS FLOW TRANSMITTERS

PRINCIPLE OF OPERATION

The Series 454FT uses the well-recognized Kurz thermal convection mass flow measurement method by detecting the heat transfer from the heated RTD sensor (Rp) referenced to the temperature of the ambient gas stream RTD sensor (Rt). A constant temperature difference between the heated sensor and the temperature sensor is maintained by a modified 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 454FT to fit all flow requirements. Display screens are easy-to-use and provide all the flow and 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", by contacting the Kurz Factory, or by visiting our web site.



Figure 1—Series 454FT LCD/Keypad with Lid Removed.



Figure 2—Fast Dual (FD) Sensor.

CALIBRATION CURVE

Figure 3—The flow 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.

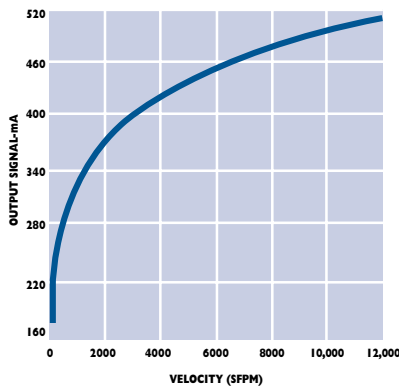


Figure 3—Calibration Curve.

TIME RESPONSE TO FLOW AND TEMPERATURE CHANGES

Figure 4—Shows the response of a Kurz Fast Dual (FD) MetalClad™ sensor to a step change in velocity. Kurz manufactures the fastest industrial quality sensors available.

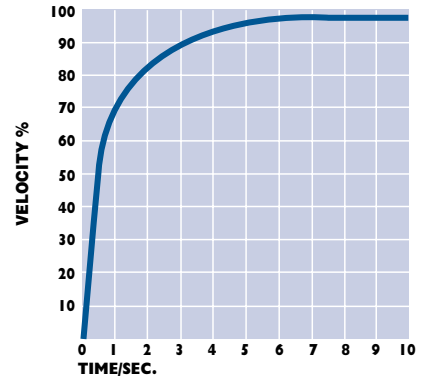


Figure 4—Sensor Flow Response.

Figure 5—Shows a typical response to a step change in temperature for a Kurz Fast Dual (FD) MetalClad™ sensor. It is exceptional and allows use of the sensor for combustion air flow measurements in boilers that mix hot and cold air for temperature control in coal pulverizers, for example.

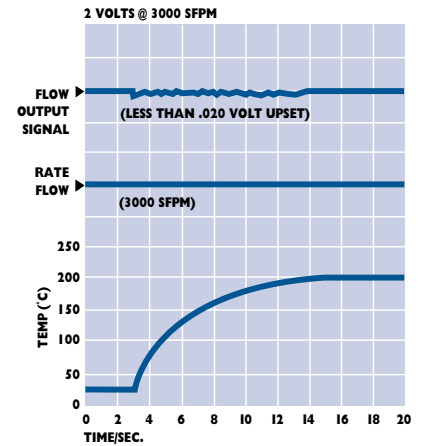


Figure 5—Sensor Temperature Response.

ORIENTATION EFFECTS

Figure 6—Shows a typical output response to changes in the incoming velocity direction. Data is shown for rotation and yaw, as defined by Figure 7. Note that the effect is small for angles up to ± 20 degrees. This is extremely important for flow applications having severe turbulence and a non-axial velocity direction.

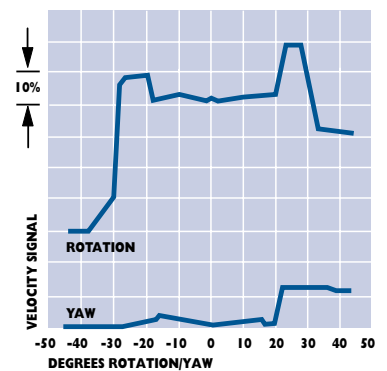


Figure 6—Sensor Measurement Error Versus Rotation/Yaw Angles.

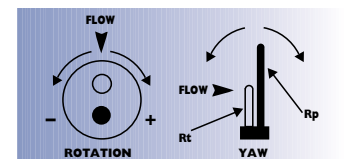


Figure 7—Sensor Rotation and Yaw Description.

SERIES 454FT INSERTION MASS FLOW TRANSMITTERS

SPECIFICATIONS

Process Temperature and Pressure Rating:

MT(-40°C to 200°C):
150 PSIG Class 150 Flange
300 PSIG no Flange
& Class 300 Flange
HHT(-40°C to 500°C):
300 PSIG no Flange
& Class 300 Flange

Sensor Material:

Alloy C-276; optional abrasion-resistant Chromium Nitride coating on Alloy C-276 sensor materials, PTFE coating for chemical resistance on Alloy C-276 sensor and sensor support, HHT sensors, 260°C max.

Sensor Support Material:

316L Stainless Steel, optional Alloy C-276.

Repeatability: 0.25%

Velocity Time Constant:

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

Process Temperature Time Constant:

8 seconds at a velocity of 6000 SFPM.

Velocity Accuracy:

See Feature 8 for overall accuracy including the effects of process temperature.

Temperature Accuracy:

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

Power: +24 VDC ±10%, 115/230 VAC ±10% 50/60 Hz; 15 watts max.

Enclosure

Temperature Rating:

-25°C to +65°C
with LCD/Keypad option;
-40°C to +65°C without
LCD/Keypad option.

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

Solid-State Relays:

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 18 VDC, 800Ω at 24 VDC, 1400Ω at 36 VDC; meets NAMUR NE43 recommendations.

Continued on facing page

TECHNICAL DESCRIPTION

SENSOR DESIGN

Series 454FT Insertion Mass Flow Transmitters use the Kurz MetalClad™ FD all-welded Alloy C276 sensor. 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 fast response to process temperature changes.

SENSOR MATERIALS AND CONSTRUCTION

The standard sensor material for all Kurz metal sensors is Alloy C-276. This material is far superior to 316 Stainless Steel in high temperature and corrosive applications. Kurz offers Chromium Nitride coating for abrasive, dirty applications, such as in boiler coal pulverizers. Kurz exclusively uses Inconel sheathed mineral-insulated cable (MI cable) for temperatures above 200°C.

PROCESS TEMPERATURE RATING

Kurz offers sensor process temperature ratings of 200°C and 500°C. Field data verifies that the lifetime at 500°C is at least five years and the lifetime at 200°C is many decades.

TRANSMITTER CONFIGURATIONS

Two configurations are available; Directly Attached Electronics Enclosure (TA) and Remotely Attached Electronic Enclosure (TS).

PROCESS TEMPERATURE COMPENSATION

The influence of temperature on the thermal properties of gases requires temperature compensation for repeatable and accurate measurements. Standard Temperature Compensation (STC) is used for applications in which the process temperature is below 125°C over a moderate velocity range or below 200°C over more limited velocity range. If the process temperature and gas velocity vary widely, Velocity/Temperature/Mapping (VTM) is recommended. VTM includes taking velocity calibrations at two or three process temperatures and using the microprocessor to calculate the velocity based on the built-in process temperature measurement.

GAS CALIBRATION

The customer has a choice of a laboratory calibration or a gas correlation calibration. Air calibrations are performed in the Kurz Model 400D NIST traceable wind tunnel.

SENSOR PROTECTION

The 454FT circuitry includes circuitry to prevent an over-temperature condition caused by a sensor, wiring or component failure. Our sensors will not overheat at zero flow, unlike most competitive devices because of our constant temperature sensor control method and the power limiting design.

HOT-AIR PURGE SENSOR CLEANING SYSTEM

The Model 454PFT-16-HHT has a special nozzle in the sensor window for use with the Model 146 or 148 Hot-Air Purge Sensor Cleaning System. The sensor cleaning is accomplished by a short, high pressure blast of hot air (sonic velocity) directed at the velocity and temperature sensors. Kurz offers a programmable timer, air heaters, solenoid valves and air blow-down tanks to allow periodic or on-demand cleaning. The air blow-down tank uses customer supplied compressed air (instrument quality) at 60 to 125PSIG. The average cleaning air consumption is less than 0.125 SCFM. The Model 454PFT is designed to measure air flow only at ambient pressure. Canadian Registration (CRN) is not available for the Model 454PFT. The primary application is for extremely dirty stacks and ducts having dry particulate matter that may build up on the sensor. Applications include fossil-fueled power boilers, municipal waste incinerators and combustion air flow situations in which fly ash is entrained.

SENSOR ELECTRONICS

The Series 454FT has several innovations which improve performance, reduce cost and provide extraordinary flexibility. A new constant temperature bridge circuit includes an efficient switching power supply and allows the microprocessor to calculate the process gas temperature directly using the temperature compensation sensor. The 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.

ANALOG-TO-DIGITAL CONVERTER

A serial 16-bit ADC provides excellent resolution and noise rejection. To minimize noise the user can select the ADC sample rate for 50 Hz or 60 Hz to provide the best noise rejection.

SPECIFICATIONS *Cont'd.*

Meter Filter Time Constant:
Selectable 0 to 600 seconds.

Safety Approvals:
ATEX and CSA Non-Incendive (NI) and Flame-Proof/Explosion-Proof (FP/XP) in gas and dust environments. See Feature 11 for details.

CE Directives:
EMC, ATEX, LVD and PED. Consult Kurz for details.

Canadian Registration Number (CRN):
All models except the Model 454PFT and Models for use with dry Chlorine gas have Canadian Registration (CRN). Series 454FT Accessories do not have Canadian Registration at this time.

Serial Port Baud Rate:
User selectable: 1200, 2400, 4800, 9600, 14,400, 19,200, 38,400.

Digital Outputs:
RS-232 Port for Upload, Download, Record, Echo using user's PC; RS-485 communication port, with Modbus ASCII or RTU Mode.

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/Shipping Weight:
DC Version: 4lbs/5lbs;
AC Version: 8lbs/10lbs,
add 4lbs/5lbs for remote option.

TECHNICAL DESCRIPTION *Cont'd.*

FIRMWARE

The Display, Executive and Programming menus are very easy-to-use and are largely self-explanatory. The functions and instructions for the Series 454FT are nearly the same as those used for the Series 155 Mass Flow Computers, which are widely accepted. The flow and temperature data may be scrolled so it can be seen through the window in the cover. The user may press "D" and see the flow and temperature data, as well as the raw flow data. Pressing "H" holds the display screen (but not the readings). A user access code is required for programming, seeing data and entering configuration and other user data.

HELP SCREENS

By pressing "HH" the user can obtain important information on the use of the Series 454FT, including the firmware version, Kurz telephone and fax numbers and the web site address, etc.

FLASH EEPROM PROGRAM MEMORY

The program may be updated in the field by the user using the RS-232 port. This new feature will allow our customers to upgrade to the latest firmware.

SELF-DIAGNOSTICS

The 454FT performs an extensive check-out upon power-up, and continuously monitors the sensor inputs/outputs and verifies the integrity of the sensor wiring and the measurements. The Sensor Kick-Out feature is used to set the fault limits.

PROGRAMMABLE CORRECTION FACTORS

A multi-point Variable Correction Factor (VCF) may be used to correct the flow calibration data to meet in-situ flow tests over the entire velocity range such as done for EPA Stack Flow Monitors. If VCF is not used, a Sensor Blockage Correction Factor (SBCF) can be used to correct for the area reduction caused by the sensor support. The user enters the area of the flow passage and the sensor center line distance from the inside of the flow passage and the Series 454FT automatically calculates the SBCF.

METER FILTER TIME CONSTANT

A digital filter time constant may be set for each METER which affects the display readings and the 4-20 mA outputs. The time constant maybe set from 0 to 600 seconds.

COMPATIBILITY WITH SERIES 155 MASS FLOW COMPUTERS

A "Blind" Series 454FT (ordered with the two 4-20 mA Outputs and the +24VDC power supply; but without the LCD/Keypad and Alarm/Relay/Pulsed Outputs) is fully compatible with the inputs and features of the Series 155 Mass Flow Computers. Thus, the user may obtain the advantages of flow and temperature measurements, Velocity/Temperature/Mapping (VTM), with a rugged, remote, easy-to-use electronics enclosure with LCD/Keypad, power supply, and all of the other features of the Series 155 Mass Flow Computer. (Please see the Series 155 brochure).

SELECTABLE STP CONDITIONS

The mass flow calibration data is referenced to the Kurz laboratory standard of 77° F/14.69 PSIA (25° C/760 mmHg). The user may change the STP conditions to suit his requirement.

4-20 mA OUTPUTS

These loop-powered outputs are optically isolated, and include the NAMUR NE43 recommendation regarding fault detection. The fault conditions are set at the Kurz Factory, but may be set by the user. The user may easily calibrate the 4-20 mA outputs by entering the Output Calibration menu, measuring the output and adjusting it using the LCD/Keypad.

NAMUR NE43 COMPLIANCE

Kurz meets the NAMUR NE43 recommendation for the 4-20 mA outputs, under a fault defined by the sensor Kick-Out menu. A low flow or temperature condition will be transmitted as a 3.6 mA or less signal; a high flow or high temperature condition will be transmitted as a 21.0 mA or greater signal. This feature also frees up the alarm/relays so that the user can set-up the flow and temperature alarms for other needs.

ALARM/RELAYS/PULSED

TOTALIZER OUTPUT

The customer may order 0 or 2 solid-state optically isolated relays. If no relays are ordered, the alarm functions are displayed on the LCD. Both relays may be used for alarms (LO, HI and HOL) or for the Sensor Kick-Out feature; or one relay may be used for an alarm function and one may be used as a pulsed output for use as a remote flow totalizer, or both relays may be used as pulsed outputs. Totalizers may be automatically reset at a specific total quantity (i.e., 10,000 SCF).

SERIES 454FT INSERTION MASS FLOW TRANSMITTERS

ORDERING INFORMATION

SERIES 454FT SELECTION TABLE					
Model Number	Parent Number	Sensor Support Dia.	Process Temp. Rating	Air Purge	Safety Approvals (Note 1)
454FT-08-MT	756001	½"	MT	No	NI, FP/XP, CRN
454FT-08-HHT	756002	½"	HHT	No	NI, CRN
454FT-12-MT	756003	¾"	MT	No	NI, FP/XP, CRN
454FT-12-HHT	756004	¾"	HHT	No	NI, CRN
454FT-16-MT	756005	1"	MT	No	NI, FP/XP, CRN
454FT-16-HHT	756006	1"	HHT	No	NI, CRN
454PFT-16-HHT	756007	1"	HHT	Yes	NI

Note 1: CRN Registration for all listed gases except Chlorine, and all Models except the Model 454PFT-16-HHT

NOMENCLATURE:

PROCESS TEMPERATURE RATING		
Identifier	Description	Range
MT	Medium Temperature	-40°F to 392°F (-40°C to 200°C)
HHT	Very High Temperature	-40°F to 932°F (-40°C to 500°C)

SAFETY APPROVALS	
Identifier	Description
NI	Non-Incendive, ATEX and CSA Approvals
FP/XP	Flame-Proof/Explosion-Proof, ATEX and CSA Approvals
CRN	Canadian Registration Number

RECOMMENDED MAXIMUM GAS VELOCITY	
Gas Type	Velocity
	SFPM (SMPS)
Air, Argon, Nitrogen, Oxygen	24,000 (120)
Methane, Natural Gas, Digester Gas, Dry Ammonia, Carbon Dioxide	18,000 (90)
Dry Chlorine, Ethylene	15,000 (75)
Ethane	13,300 (66.5)
Helium, Propane	10,000 (50)
Hydrogen	6,000 (30)

PART NUMBER GENERATION PROCEDURE

With the selected Parent Number, specify the entire Part Number by selecting an Option for each Feature as shown in the example below. Feature options in Bold type are more readily available.

756004 — **13** — **20** — **11** — **0520** — **21** — **14** — **01** — **28** — **21** — **11** — **12**
 Parent No. F1 F2 F3 F4 F5 F6 F7 F8 F9 F10 F11

SUMMARY OF FEATURES	
Feature	Description
1	Sensor Type/Sensor Material
2	Sensor Support Material/Length
3	Optional Flange Connection Size and Rating
4	Optional Flange U Dimension
5	Electronics Enclosure Configuration/Input Power
6	Gas Velocity Calibration Data Range
7	Specialty Gas Velocity Calibration
8	Process Temperature Compensation
9	4-20 mA Outputs/LCD/Keypad

SUMMARY OF FEATURES (Continued)	
Feature	Description
10	Alarms, Relays, Pulsed Outputs/Terminal Communication & Data Ports
11	Safety Approvals

FIRST DIGIT OF FEATURE 1: SENSOR TYPE	
Option	Description
1	FD Sensor, Fast Dual MetalClad™ Sensor

SECOND DIGIT OF FEATURE 1: SENSOR MATERIAL	
Option	Description
3	Alloy C276
7	Alloy-C276 with Abrasion-Resistant Chromium Nitride Coating (CrN)

FIRST DIGIT OF FEATURE 2: SENSOR SUPPORT MATERIAL			
Option	Description	Option	Description
2	316L Stainless Steel	3	Alloy C276
8	Alloy-C276 with PTFE Teflon Coating cured for chemical resistance. Includes support, sensor and flange; FD-HHT sensors only, 260°C Max.		

SECOND DIGIT OF FEATURE 2: SENSOR SUPPORT LENGTH L					
Option	Support	Length L	Option	Support	Length L
0	All	18"	5	¾", 1"	36"
1	½", ¾"	9" (MT Only)	6	1"	48"
2	½", ¾"	6" (MT Only)	7	1"	60"
3	All	12"	8	¾", 1"	30"
4	All	24"	9	Special	Special.

FEATURE 3: OPTIONAL FLANGE CONNECTION				
Option	Description	Option	Description	Notes
00	No flange	02	½" Class 300	Process Pressure Rating of 150 PSIG for MT temperature range and Class 150 mounting flanges; 300 PSIG for MT and HHT temperature ranges for no flange connection and Class 300 flanges. Flange and sensor materials must match. Flange mounting dimensions conform to ANSI B16.5
01	½" Class 150	12	¾", Class 300	
11	¾", Class 150	22	1", Class 300	
21	1", Class 150	26	1¼", Class 300	
25	1¼", Class 150	32	1½", Class 300	
31	1½", Class 150	42	2" Class 300	
41	2" Class 150	62	3" Class 300	
61	3" Class 150			

Note: Flange material must match sensor support material (Feature 2).

FEATURE 4: OPTIONAL FLANGE U DIMENSION	
Directions	
Enter U dimension length to the nearest hundredth of an inch (0.01). Enter four digits, U minimum = 4", Enter 0000 if a flange is not used. Example: U = 5.20"; Enter 0520	

FIRST DIGIT OF FEATURE 5: ELECTRONICS ENCLOSURE CONFIGURATION	
Option	Description
1	Electronics Enclosure Directly Attached to Sensor Support, with one I.D. Tag.
2	Electronics Enclosure Remotely Attached to Sensor Support, with two I.D. Tags.

SECOND DIGIT OF FEATURE 5: INPUT POWER			
Option	Description	Option	Description
1	115 VAC, 50/60 Hz	3	+24VDC
2	230 VAC, 50/60 Hz		

SERIES 454FT INSERTION MASS FLOW TRANSMITTERS

FEATURE 6: GAS VELOCITY CALIBRATION DATA RANGE			
Option	SFPM (SMPS)	Option	SFPM (SMPS)
02	300 (1.5)	14	6,000 (30)
04	600 (3)	16	9,000 (45)
06	1,000 (5)	18	12,000 (60)
08	2,000 (10)	20	15,000 (75)
10	3,000 (15)	22	18,000 (90)
12	4,000 (20)	24	24,000 (120)

FEATURE 7: SPECIALTY GAS CALIBRATION (Note 1)		
Laboratory Calibration	Gas Type	Correlation Calibration
01	Air at 0 PSIG	—
07	Air to 150 PSIA	—
—	Dry Ammonia	56
08	Argon to 100 PSIA	58
14	Carbon Dioxide to 50 PSIA	64
—	Dry Chlorine (Note 2)	68
20	Ethane to 100 PSIA	70
22	Ethylene to 100 PSIA	72
26	Helium to 100 PSIA	76
28	Hydrogen to 100 PSIA	78
32	Methane to 100 PSIA	82
34	Natural Gas (Simulated with Methane) to 100 PSIA	84
35	"Digester Gas" 50% CH ₄ , 50% CO ₂ to 50 PSIA	85
36	"Digester Gas" 60% CH ₄ , 40% CO ₂ to 50 PSIA	87
37	"Digester Gas" 70% CH ₄ , 30% CO ₂ to 50 PSIA	87
40	Nitrogen to 100 PSIA	90
44	Oxygen to 100 PSIA	94
46	Propane to 50 PSIA	96
99	Special Gas calibration (including mixed gases)—Specify	

Note 1: Laboratory calibrations can be ordered between 0 PSIG and the pressures noted. Correlated calibrations are performed at 0 PSIG. The customer is responsible for cleaning oxygen flow elements. Add ± 5% of reading at correlated calibrations. The cost of calibrations is dependent on the types of gas and the velocity range. Contact Kurz for details.

Note 2: CRN Not available

FEATURE 8: PROCESS TEMPERATURE COMPENSATION	
Option	Description
01	Standard Temperature Compensation (STC) over process temperature range of -40°C to +125°C. Accuracy: ± [(1% + .025%/°C) reading + (20 SFPM + .25 SFPM/°C)] Above or below 25°C, all gases.
13	Standard Temperature Compensation (STC) over process temperature range of 0°C to 200°C. Accuracy: ± [(2% + .025%/°C) reading + (20 SFPM + .25 SFPM/°C)] Above or below 100°C; Air, O ₂ and N ₂ only.
23	Velocity/Temperature/Mapping (VTM) with three calibration data sets over process temperature range of 0°C up to 200°C. Accuracy: ±(2% reading + 20 SFPM), Specify Process Temperature Range, Air, O ₂ and N ₂ only.

FEATURE 8: PROCESS TEMPERATURE COMPENSATION (Continued)	
Option	Description
28	Velocity/Temperature/Mapping (VTM) with four calibration data sets over process temperature range of 0°C up to 500°C. Accuracy: ±(3% reading + 30 SFPM), Specify Process Temperature Range, Air, O ₂ and N ₂ only. HHT models only.

FIRST DIGIT OF FEATURE 9: 4-20 mA OUTPUTS	
Option	Description
0	No 4-20 mA Outputs.
2	Two 4-20 mA outputs, loop-powered, optically isolated.

SECOND DIGIT OF FEATURE 9: LCD/KEYPAD	
Option	Description
0	No LCD/Keypad and enclosure lid without window.
1	Includes back-lit LCD with 20-button keypad and enclosure lid with window.

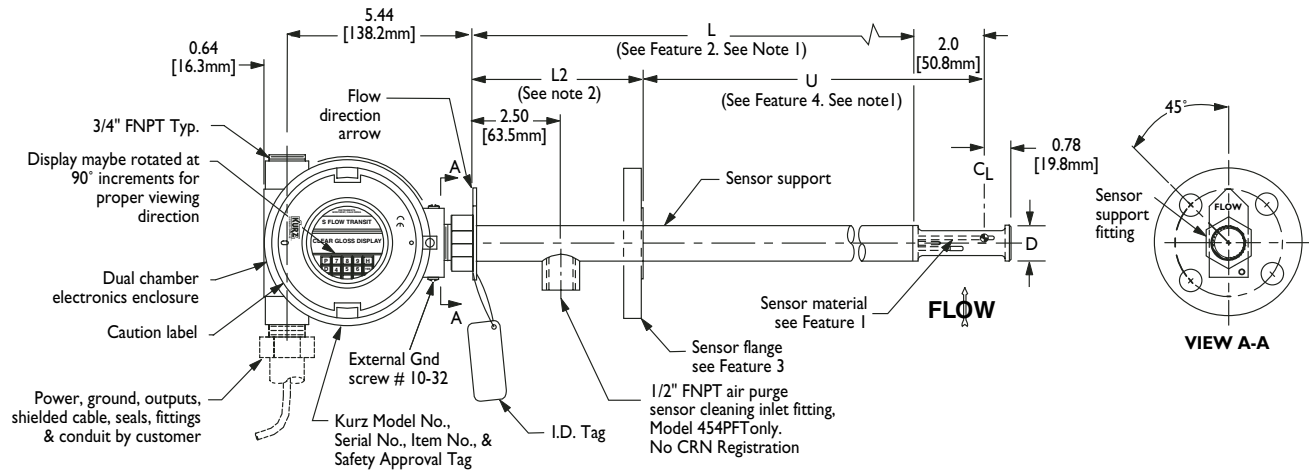
FIRST DIGIT OF FEATURE 10: ALARMS, RELAYS, PULSED OUTPUTS	
Option	Description
0	No Solid-State Relay or Pulsed outputs, alarm functions displayed on LCD.
1	Two Optically Isolated Solid-State Alarm Relays
2	Two Optically Isolated Solid-State pulsed outputs for remote flow totalizers.
3	One Optically Isolated Solid-State Alarm Relay and one pulsed output for a remote flow totalizer.

SECOND DIGIT OF FEATURE 10: TERMINAL COMMUNICATION AND DATA PORTS	
Option	Description
1	RS-232C or RS-485 (Jumper Selected) serial port; echoes the display and permits remote keypad entry for use with a PC running a terminal emulator program, supports configuration Upload/Download.
2	Option 1 plus a read-only command set for all METERS, including the log (L) or summary command.
3	Option 1 with RS-485 Multi-Point Modbus ASCII or RTU protocol with read-only control.

FEATURE 11: SAFETY APPROVALS	
Option	Description
12	Non-Incendive (NI), MT and HHT Models: 24VDC 0.6 A, -20°C to 60°C ambient, IP66/NEMA4X/7: ATEX: Ⓢ II 3 GD, EEx nA II T5 CSA: Class I, Div. 2, GPS. ABCD, T5 115/230 VAC, 15 W, 50/60 Hz PH I, -20°C to 60°C ambient, IP66/NEMA4X/7: ATEX: Ⓢ II 3 GD, EEx nA II T4 CSA: Class I, Div. 2, GPS. ABCD, T4
24	Flame-Proof (FP)/Explosion-Proof (XP) MT Models only: 24VDC 0.6 A or 115/230 VAC, 15 W, 50/60 Hz PH I, -20°C to 60°C ambient, T195°C, IP66/NEMA4X/7: ATEX: Ⓢ II 2 GD, EEx d IIB + H ₂ T3 CSA: Class I, Div. 1, GPS. ABCD T3, Class II, Div. 1, GPS. EF&G
32*	Non-Incendive (NI), MT and HHT Models: Includes CRN otherwise same as Option 12
44*	Flame-Proof (FP) Explosion-Proof (XP) MT Models only: Includes CRN otherwise same as Option 24

* CRN not available for Model 454PFT nor any Model for use with Chlorine.

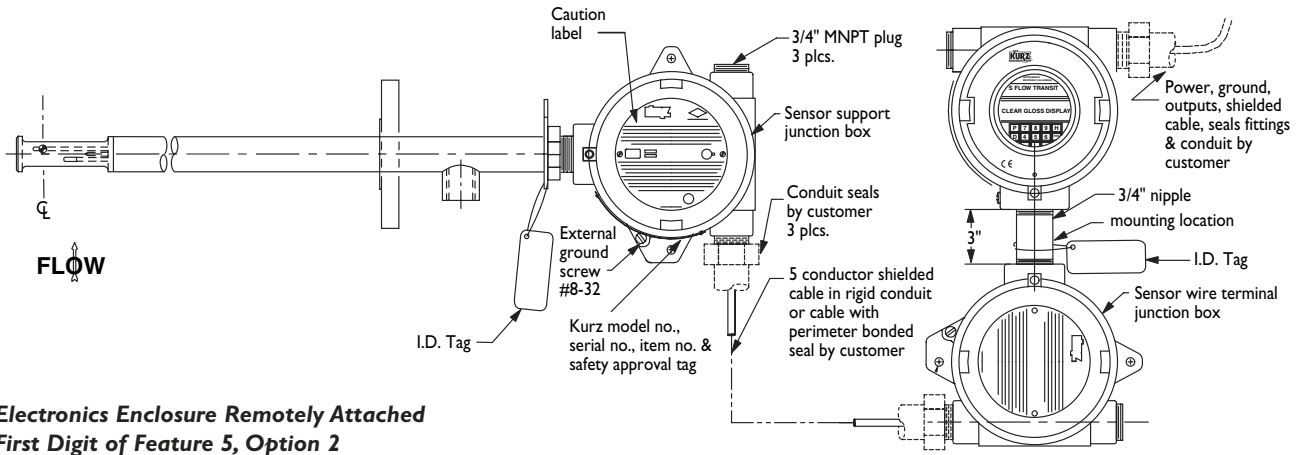
SERIES 454FT OUTLINE DRAWINGS



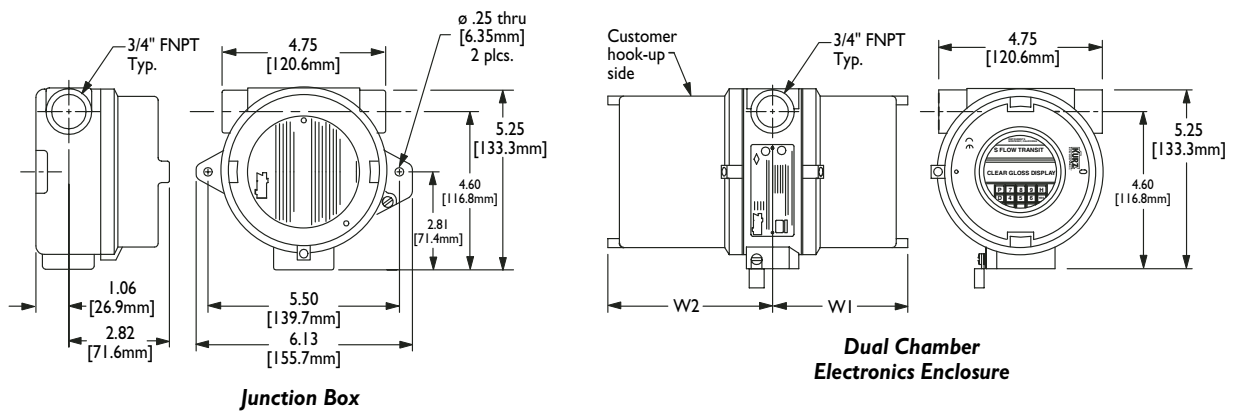
Electronics Enclosure Directly Attached
First Digit of Feature 5, Option 1

Note 1: $L = U + L2 - 2.00''$, (min) $U=4''$

Note 2: $L2$ (min) = 4" for MT Models and 8" for HHT Models



Electronics Enclosure Remotely Attached
First Digit of Feature 5, Option 2



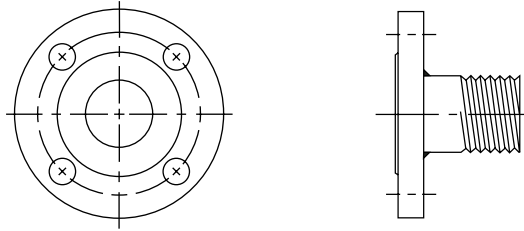
Input Power	Display/Keypad	W1	W2
AC	Yes	3.50" (88.9mm)	6.60" [167.6mm]
AC	No	2.82" [71.6mm]	6.60" [167.6mm]
24 VDC	Yes	3.50" [88.9mm]	2.82" [71.6mm]
24 VDC	No	2.82" [71.6mm]	2.82" [71.6mm]

Model Number	D
454FT-08	1/2" [12.7mm]
454FT-12	3/4" [19.1mm]
454FT-16	1" [25.4mm]

SERIES 454FT ACCESSORIES (Note 1)

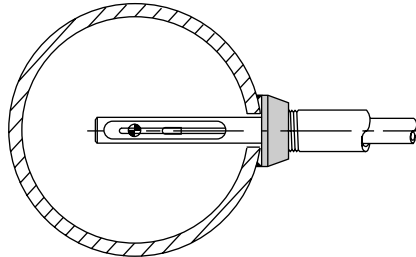
MOUNTING FLANGE ASSEMBLIES

Class 150 and 300 ANSI B16.5 flanges with 3" overall length, 1/2", 3/4", 1", 1 1/4", 1 1/2" sizes, threaded or unthreaded pipe sleeves, carbon steel, 316 SS, Alloy C276. Refer to Part No. 759032.



BRANCH FITTINGS (Thredolets® and Sockolets®)

Convenient for attaching mounting hardware to process piping. Sizes 1/2", 3/4", 1", 1 1/4", 1 1/2" for pipe sizes above 2 1/2". Carbon Steel, 316 SS, Alloy C-276. Refer to Part No. 759033 for Thredolets. Refer to Part No. 759034 for Sockolets.



Thredolet and Sockolet are registered trademarks of Bonney Forge.

BALL VALVES

Sizes of 3/4", 1", 1 1/4", 1 1/2" are available in 316SS, Alloy C-276 and Monel. Refer to Part No. 754060.

PACKING GLANDS

Models PG-08, PG12 and PG-16 fit the 1/2", 3/4", and 1" sensor supports respectively. Optional body materials are 316SS, Alloy C-276 and Monel. The standard packing material is Gortex Expanded PTFE. Refer to Part No. 759050.

RETRACTOR/RESTRAINTS

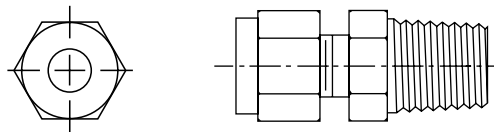
Model RR-08, RR-12 and RR-16 clamp to the packing gland and sensor support. It has a worm-gear crank mechanism and adjustable stops. Refer to Part No. 759040.

PIPE NIPPLES

These schedule 40 pipe nipples are used with ball valves, retractor/restraints, packing glands and pipe mounting fittings. Pipe sizes of 1/2", 3/4", 1", 1 1/4", 1 1/2" in length from 2" to 12" are available in Carbon Steel, 316SS, Alloy C-276 and Monel. Refer to Part No. 759070.

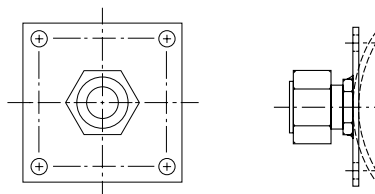
MALE COMPRESSION FITTINGS

Bored-thru 1/2", 3/4" and 1" tube fittings for use with Thredolets or customer's fittings with 1/2", 3/4", 1", 1 1/4" and 1 1/2" male IPS threads, 316 SS Body, 316 SS, Nylon or Teflon ferrules. Refer to Part No. 759031.



DUCT MOUNTING BRACKETS

These convenient brackets are used to mount the 1/2", 3/4" or 1" diameter sensor support on flat or curved ducts. 316 Stainless Steel bracket and compression fitting, Teflon, Nylon or 316 SS ferrules. Refer to Part No. 759030.



IDENTIFICATION TAGS

Part Number I70098, 1.25" x 3", 316 SS, maximum of 4 lines, 32 characters per line.

HOT-AIR PURGE SENSOR CLEANING SYSTEMS

Models I46 or I48 includes timer, flash air heater, valves and continuous air bleed system. Consult Kurz for details.

Note 1: Series 454FT Accessories do not have CRN.

**The leader in Mass Flow
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