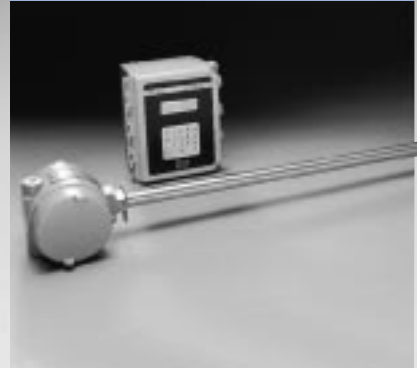


SERIES

452

INSERTION
MASS FLOW
ELEMENTS



CE

FM
APPROVED



KURZ
INSTRUMENTS INC.™

DESCRIPTION

The Series 452 represents the Kurz family of heavy-duty industrial, single-point Insertion Mass Flow Elements for industrial gases.

The Series 452 meets the CE compliance requirements for EMI emissions and immunity and have optional Non-Incendive and Explosion-Proof approvals.

The Series 452 Insertion Mass Flow Elements are operated by the Series 155 Mass Flow Computers and are normally used with pipes or ducts having an internal diameter of about 2½" or larger. For small pipes or ducts, low mass flow rates, or when improved accuracy is required, the Series 502 In-Line Mass Flow Elements is recommended.

Kurz offers the broadest line of thermal mass flow meters and accessories to meet nearly all requirements. The Series 452 meets the highest standards for safety, reliability, repeatability, ease-of-use and the fastest response to velocity and temperature changes available.

Kurz Instruments' "Smart" Mass Flow Meters are the most versatile and technologically advanced thermal mass flow meters and can solve the toughest mass flow applications.

PRINCIPLE OF OPERATION

Series 452 uses the well recognized Kurz thermal convective mass flow measurement technology, using constant temperature anemometry.

Kurz Mass Flow Elements feature the unique "MetalClad™" "FD" and "FDT" Dual-Sting, thermal mass flow sensors. Kurz sensors provide the fastest velocity and temperature response available (see Fig. 1 and Fig. 2). Kurz Dual-Sting sensors can withstand yaw and rotational deviations of ±20 degrees with less than a 2% error (see Fig. 3).

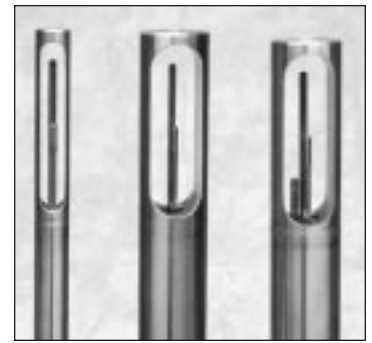
APPLICATIONS

- ▶ Industrial and process gas mass flow
- ▶ Combustion air flow
- ▶ EPA Clean Air Act stack flow monitor
- ▶ Flare gas metering
- ▶ Aeration flow and digester off-gas flow
- ▶ Landfill vapor recovery
- ▶ Incinerator stack mass flow
- ▶ Coal pulverizer inlet air flow
- ▶ Solvent recovery system mass flow
- ▶ VOC stack mass flow
- ▶ Cement plants

KEY FEATURES

- ▶ Exceptional accuracy and repeatability (.25%)
- ▶ 0 to 18,000 SFPM
- ▶ High temperature (to +500°C)
- ▶ Pressure to 300 PSIG
- ▶ Dirty and corrosive gases
- ▶ All-welded construction
- ▶ Pressure and temperature compensated
- ▶ Optional air purge sensor cleaning system
- ▶ Simple, low cost installation
- ▶ Alloy C276 sensor material
- ▶ Fast response to velocity and temperature changes
- ▶ Attitude insensitive
- ▶ Lead length independent sensor electronics
- ▶ Specified accuracy over a 500°C temperature range
- ▶ CE compliance for EMI emissions and immunity with surge protection
- ▶ Non-Incendive and Explosion-Proof Approvals (FM, CSA, CENELEC)

Left—Fast Dual Sensor with ½" sensor support. **Center**—Fast Dual Sensor with 1" sensor support. **Right**—Fast Triple Sting Sensor with 1" sensor support.



452PT with Air Purge Sensor Cleaning System.



Fig. 1 Sensor Response to a change in Velocity at 6000 SFPM.

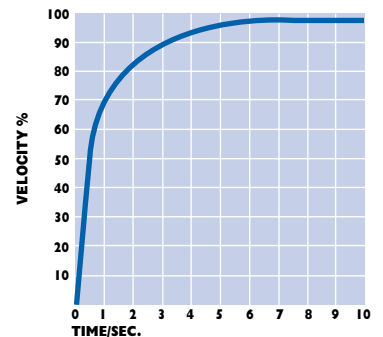


Fig. 2 Sensor Response to a change in Temperature at Constant Velocity.

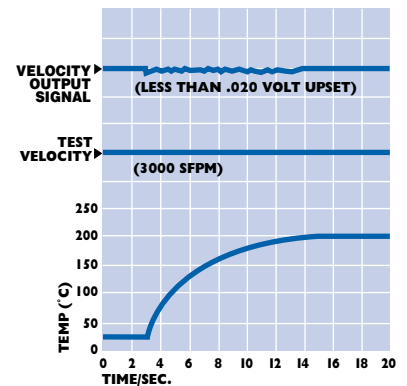
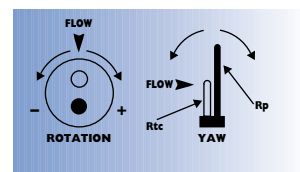
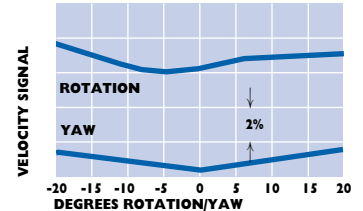


Fig. 3 Sensor Rotation/Yaw Measurement Error.



SPECIFICATIONS

- Process Velocity Range:**
0-18,000 SFPM
- Process Temperature Rating:**
MT: -40°C to 200°C
HHT: -40°C to 500°C
- Pressure Rating:** 300 PSIG
- Sensor Material:**
Alloy C276 Stings with
Carpenter 20Cb-3 Sensor
Base; Titanium Nitride
Coating Optional
(350°C max.).
- Sensor Support Material:**
316L Stainless Steel,
Alloy C276 Optional.
- Repeatability:** 0.25%
- Response Time (One TC):**
Velocity: 1 Second
Temperature: 3 Seconds
Separate Temperature: 8
Seconds.
- Accuracy:**
Velocity: See Feature 7 for
overall calibration accuracy
at temperatures to 500°C
Temp.: ± (1% reading + 1°C.)
- Power:** 24VDC, loop-powered
from a Series 155 Mass Flow
Computer
- Current:** 500 mA max. for
velocity, 4-20 mA for tempera-
ture on FDT sensor.
- Field Wiring:** Models 452, 452P:
1 pair of twisted shielded wire;
Models 452T, 452PT: 2 pair of
twisted shielded wires; Wire
Size: 18 GA typical (4 ohms
maximum loop resistance).
- Electrical Enclosure:**
Epoxy-painted aluminum,
NEMA 4X/7.
- Safety Approvals:**
Non-Incendive Class I, Div. 2,
GPS.A, B, C, D, T5; FM, CSA
Explosion-Proof Class I,
Div. 1, GPS. B, C, D, T1; FM
Explosion-Proof Class I,
Div. 1, GPS. A, B, C, D, T3; CSA
Explosion-proof EEx d I I CT3,
CENELEC.
- EMI Approvals:** CE compliance:
light industrial (EN 50081-1)
for emissions, heavy industrial
(EN 50082-2) for immunity,
plus (EN 61000-4-5) for surges.
- Enclosure Temperature:**
-40°C to 60°C, non-
condensing.
- Weight Net/Shipping:**
4.0 lbs./5.0 lbs. (Typical).

TECHNICAL DESCRIPTION

Series 452 Insertion Mass Flow Elements use the Kurz “MetalClad”™ “FD” and “FDT” all-welded Alloy C276 sensors with an all-welded sensor support. Since the introduction of the original Kurz “MetalClad” sensor in 1984, Kurz has pioneered thermal sensor research and development. In this design, the temperature sensor and mass velocity sensor are mounted in separate tubes (or “stings”), providing much improved thermal isolation from the sensor support structure and exceptional time response to process temperature changes. The 452T and 452PT use the new “Fast Triple-Sting” (FDT) sensor, which incorporates a separate temperature sensor. This sensor is used to provide a process temperature signal that can be used for “VTM” (Velocity/ Temperature Mapping). VTM greatly improves temperature compensation over a wide range of process temperature and mass velocity. The HHT and air purge models use mineral-insulated Inconel sheathed cable, a unique Kurz innovation that provides unsurpassed reliability.

The Models 452P and 452PT have an integral Air Purge Sensor Cleaning System for automatically cleaning the sensor. The cleaning is accomplished by a short, high pressure blast of air (sonic velocity) directed at the velocity and temperature sensors. Kurz offers a programmable timer, solenoid valve and air blow-down tank to allow periodic or on-demand cleaning. The air blow-down tank uses customer supplied compressed air (instrument quality) at 60 to 125 PSIG. The average cleaning air consumption is less than 0.005 SCFM. The 452P and 452PT are designed to measure non-combustible gases. The purge cleaning system requires that the process pressure be less than 35% of the absolute pressure of the compressed air for effective cleaning. The primary application is for extremely dirty stacks and ducts having dry particulate matter that may build up on the sensor. It is not expected to solve problems with wet, sticky materials or chemicals that may solidify on the sensor. Applications include fossil-fueled power boilers, municipal waste incinerators and combustion air flow situations in which fly ash is entrained.

Another new Kurz innovation is a Correlation Gas Velocity Calibration Option for most industrial gases. Correlation Gas Velocity Calibrations are based on an air calibration and eliminate the need for a laboratory gas velocity calibration in many applications.

All Series 452's include a unique sensor lead resistance-independent bridge circuit that eliminates output change due to temperature variations. The new bridge

circuit also allows the sensor cable to be shortened or lengthened without affecting the calibration. This is especially useful for sensors having remote sensor electronics. The newly designed 452's include our next generation sensor bridge circuit that has many features that will allow Kurz to continue to lead in thermal mass flow technology.

There are two Series 452 Sensor Electronics Enclosure Configurations available to accommodate a wide range of temperature, space, and wiring requirements. The sensor support is ½" or 1" diameter tubing that allows convenient mounting with compression fittings. A welded flange connection is an option. Installation hardware options include duct mounting brackets with compression fittings, Thredolets®, Sockolets®, standard pipe flanges, and ball valve retractor/restraints and packing glands.

SENSOR PLACEMENT CRITERIA

- a) For pipes having an inside diameter of 2.5 to 3.0", place the center line of the sensor at 1.5" from the inner wall of the pipe.
- b) For pipes having an I.D. of 3.0" to 12", place the center line of the sensor 1.8" from the inner wall of the pipe.
- c) For pipes having an I.D. greater than 12", place the center line of the sensor 15% of the pipe I.D. from the inner wall of the pipe.
- d) Use a sufficiently long sensor support to ensure that the surface temperature of the Sensor Electronics Enclosure does not exceed 60°C for TA mounting, and 85°C for TS mounting.
- e) Refer to Kurz technical note DCN 364002 to obtain the appropriate sensor blockage correction factor (SBCF) to be entered into the Series 155 Mass Flow computer, if required.

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 452 INSERTION MASS FLOW ELEMENTS

ORDERING INFORMATION

The table on the right lists the major features of the Series 452 Insertion Mass Flow Elements and their Parent Numbers. All models meet current CE compliance and may be ordered with directly attached (TA) or remotely attached sensor electronics enclosures (TS).

Model Number	Parent Number	Sensor Support Diameter	Sensor Type	Process Temperature Rating	Built-In Temperature Sensor	Air Purge Sensor Cleaning System	Optional Safety Approvals
452-08-MT	752731	½"	FD	MT	No	No	NI, XP
452-08-HHT	752733	½"	FD	HHT	No	No	NI
452-16-MT	752741	1"	FD	MT	No	No	NI, XP
452-16-HHT	752743	1"	FD	HHT	No	No	NI
452T-16-MT	752791	1"	FDT	MT	Yes	No	NI, XP
452T-16-HHT	752795	1"	FDT	HHT	Yes	No	NI
452P-16-HHT	752771	1"	FD	HHT	No	Yes	NI
452PT-16-HHT	752772	1"	FDT	HHT	Yes	Yes	NI

SENSOR TYPE			
Identifier	Description	Time Response (Note 1)	Application
FD	Fast Dual MetalClad Velocity Sensor, all-welded construction. Maximum current of 500 mA. Requires one Series 155 Mass Flow Computer input channel.	Velocity: 1 Sec. Temp.: 3 Sec.	Dirty Air, Fast Changing Gas Velocity and Temperature, Pipe I.D. ≥ 2.5".
FDT	Fast Dual MetalClad Velocity Sensor with separate MetalClad Temperature Sensor, all-welded construction. Maximum current of 520 mA. Requires two Series 155 Mass Flow Computer input channels.	Velocity: 1 Sec. Temp.: 3 Sec. Separate Temp. Sensor: 8 Sec.	Dirty Air, Fast Changing Gas Velocity and Temperature, Simultaneous Temperature and Velocity Sensing, Pipe I.D. ≥ 2.5", Velocity/Temp. Mapping (VTM).

Note 1: Time response is the time required to attain 63% (1 time constant) of the original reading after a step change in process temperature at constant velocity, or a step change in velocity at constant process temperature, at an initial mass velocity of 6000 SFPM.

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 APPROVAL	
Identifier	Description
NI	Non-Incendive
XP	Explosion-Proof

RECOMMENDED MAXIMUM GAS VELOCITY		
Gas Type	Gas Velocity	
	SFPM	SMPS
Air, Argon, Carbon Dioxide, Dry Chlorine, Nitrogen, Oxygen	18,000	90
Butane, Ethane, Ethylene, Methane, Natural Gas, Digester Gas, Dry Ammonia	15,000	75
Helium	7,000	35
Hydrogen	4,000	20

SUMMARY OF FEATURES	
Feature	Description
1	Sensor Material
2	Sensor Support Material/Length
3	Gas Velocity Calibration Data Range
4	Sensor Electronics Enclosure Configuration
5	Optional Flange Connection Size and Rating
6	Specialty Gas Velocity Calibration
7	Process Temperature Compensation
8	Optional Flange U Dimension
9	Safety Approval

PART NUMBER GENERATION PROCEDURE

With the selected Parent Number, specify the entire Part Number by selecting an Option for each Feature. The Part Number is the Parent Number followed by an Option Number for each Feature as shown in the example below:

752795	0	3	2	0	1	4	0	2	2	1	0	1	2	8	0774	11
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Parent Number F1 F2 F3 F4 F5 F6 F7 F8 F9

FEATURE 1: SENSOR MATERIAL	
Option	Description
03	Alloy C276 Sensor Stings with Carpenter 20Cb-3 Flanged Sensor. Base
07	Titanium Nitride Sensor Coating on Option 03 material.

FIRST DIGIT OF FEATURE 2: SENSOR SUPPORT MATERIAL	
Option	Description
2	316L Stainless Steel
3	Alloy C276

SECOND DIGIT OF FEATURE 2: SENSOR SUPPORT LENGTH			
Option	Length	Option	Length
0	18"	5	36"
1	3" (½" dia. only)	6	48" (1" dia. only)
2	6"	7	60" (1" dia. only)
3	12"	8	30"
4	24"	9	Special

SERIES 452 INSERTION MASS FLOW ELEMENTS

FEATURE 3: GAS VELOCITY CALIBRATION DATA RANGE			
Option	SFPM	Option	SMPS
02	300	52	1.5
04	600	54	3
06	1,000	56	5
08	2,000	58	10
10	3,000	60	15
12	4,000	62	20
14	6,000	64	30
16	9,000	66	40
18	12,000	68	60
20	15,000	70	75
22	18,000	72	90
99	Special	99	Special

FEATURE 4: SENSOR ELECTRONICS ENCLOSURE CONFIGURATION	
Option	Description
01	Sensor Electronics Enclosure directly attached to sensor support (TA).
02	Sensor Electronics Enclosure Remotely Attached (TS).

FEATURE 5: OPTIONAL FLANGE CONNECTION			
Option	Description	Option	Description
88	No flange	99	Special, consult Kurz
01	½", Class 150	02	½", Class 300
11	¾", Class 150	12	¾", Class 300
21	1", Class 150	22	1", Class 300
31	1½", Class 150	32	1½", Class 300
41	2", Class 150	42	2", Class 300
51	3", Class 150	52	3", Class 300
61	4", Class 150	62	4", Class 300

Note: Flange material must match sensor support material (Feature 2). Flanges are ANSI B16.5.

FEATURE 6: SPECIALTY GAS CALIBRATION (Note 1)		
Laboratory Calibration	Gas Type	Correlation Calibration
01	Air	—
—	Dry Ammonia	56
08	Argon	58
10	Butane (Simulated with Propane)	60
14	Carbon Dioxide	64
—	Dry Chlorine	68
20	Ethane	70
22	Ethylene	72
26	Helium	76
28	Hydrogen	78
32	Methane	82
34	Natural Gas (Simulated with Methane)	84
35	"Digester Gas" 50% CH ₄ , 50% CO ₂	85
37	"Digester Gas" 70% CH ₄ , 30% CO ₂	87
40	Nitrogen	90

FEATURE 6: SPECIALTY GAS CALIBRATION (Continued)		
Laboratory Calibration	Gas Type	Correlation Calibration
44	Oxygen	94
46	Propane	96
99	Special Gas calibration (Including mixed gases)— Specify	

Note 1: All calibrations are NIST traceable and taken at room pressure. This procedure is valid because the pressure effect is small up to 150 PSIG. For maximum accuracy the user should obtain the zero flow output data at pressure and enter it into the Series 155 Mass Flow Computer. The customer is responsible for cleaning hydrocarbons from oxygen mass flow elements. The mass flow reference standard is 77°F, 14.69 PSIA for English units and 0°C, 760 mmHg for metric units. Data for velocities above 12,000 SFPM is obtained using the Kurz correlation method. Add [5% reading + 30 SFPM] to the accuracy specification when using a gas correlation calibration.

FEATURE 7: 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 + (20SFPM + .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 + (20SFPM + .25 SFPM/°C)] Above or below 100°C; Air and N ₂ only.
15	Standard Temperature Compensation (STC) over process temperature range of 250°C ± 50°C. HHT sensors only. Accuracy: ± [(2% + .025%/°C) reading + (20 SFPM + .25 SFPM/°C)], Air and N ₂ only.
17	Standard Temperature Compensation (STC) over process temperature range of 350°C ± 50°C. HHT sensors only. Accuracy: ± [(2% + .025%/°C) reading + (20 SFPM + .25 SFPM/°C)], Air and N ₂ only.
19	Standard Temperature Compensation (STC) over process temperature range of 450°C ± 50°C. HHT sensors only. Accuracy: ± [(2% + .025%/°C) reading + (20 SFPM + .25 SFPM/°C)], Air and N ₂ only.
23	Velocity/Temperature Mapping (VTM) with two calibration data sets over process temperature range of 0°C up to 200°C. Accuracy: ±(2% reading + 20 SFPM), Air and N ₂ only.
28	Velocity/Temperature Mapping (VTM) with three calibration data sets over process temperature range of 0°C up to 500°C. Accuracy: ±(3% reading + 30 SFPM), Air and N ₂ only.

FEATURE 8: OPTIONAL FLANGE U DIMENSION	
Directions	
Enter U dimension length to the nearest hundredth of an inch (0.01), Enter 4 digits, U minimum = 4", Enter 0000 if a flange is not used. Example: U = 7.74"; Enter 0774	

FEATURE 9: SAFETY APPROVAL (Note 1)	
Option	Description
11	Non-Incendive (NI): Class I, Div. 2, GPS.A, B, C, D, T5; FM
12	Non-Incendive (NI): Class I, Div. 2, GPS.A, B, C, D, T5; CSA
21	Explosion-Proof (XP): Class I, Div. 1, GPS. B, C, D, T1; FM
22	Explosion-Proof (XP): Class I, Div. 1, GPS.A, B, C, D, T3; CSA
23	Explosion-Proof (XP): EEx d I I C T3; CENELEC

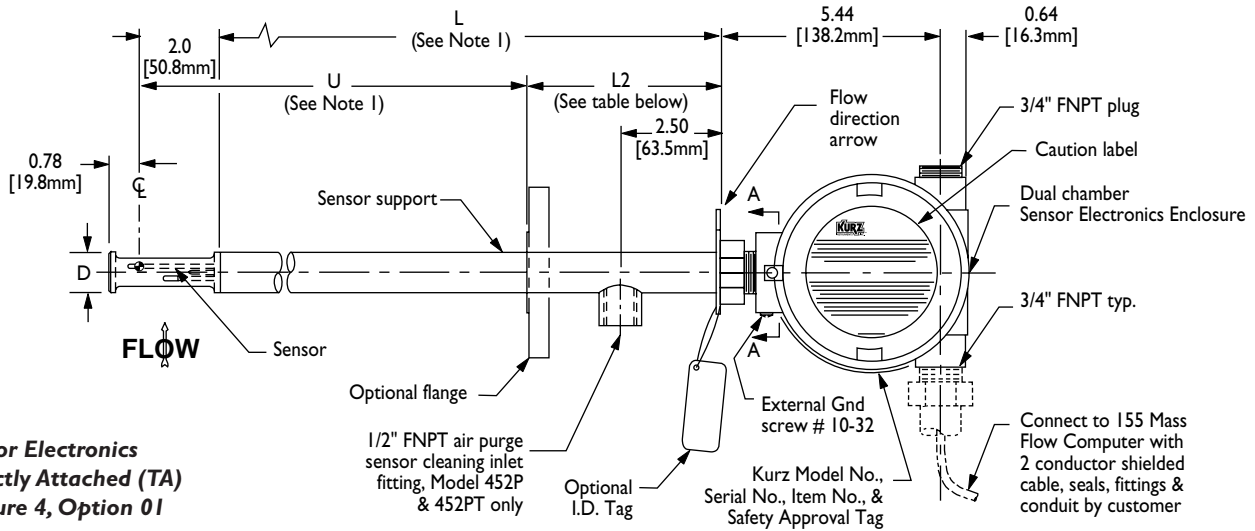
Note 1: The enclosure temperature range for the approvals is -40°C to +60°C.

ORDERING INFORMATION

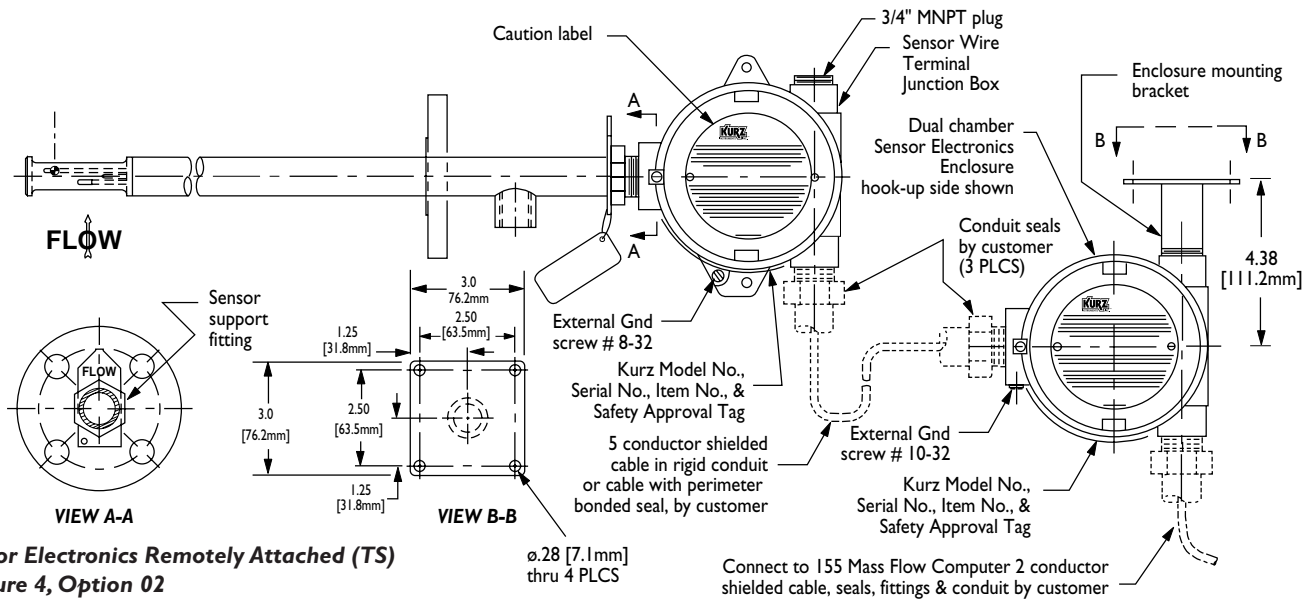
Using the Single-Point Insertion Mass Flow Elements Part Number/Order Sheet:

- A** Complete the application information section.
- B** Enter the complete Series 452 Part Number.
- C** Enter the Series 452 mounting hardware and accessory Part Numbers.
- D** Contact the Kurz Representative or the Kurz factory to place the order or to obtain additional information.

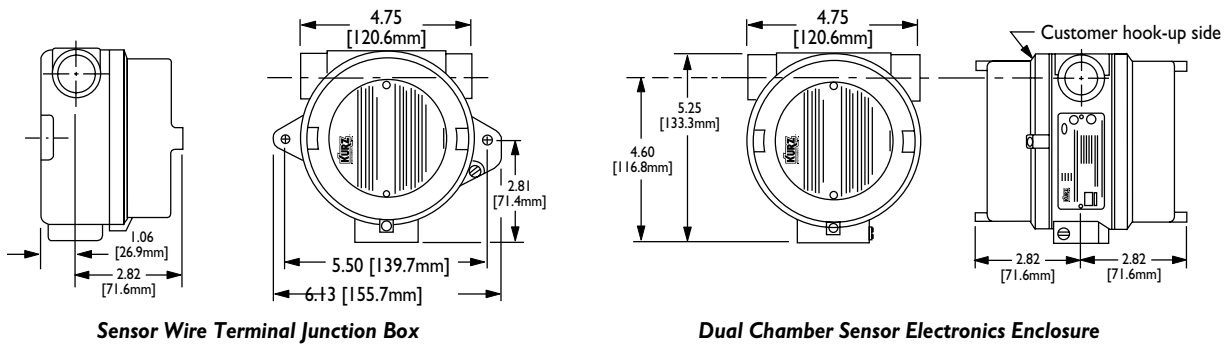
SERIES 452 OUTLINE DRAWINGS



**Sensor Electronics Directly Attached (TA)
Feature 4, Option 01**



**Sensor Electronics Remotely Attached (TS)
Feature 4, Option 02**



Sensor Wire Terminal Junction Box

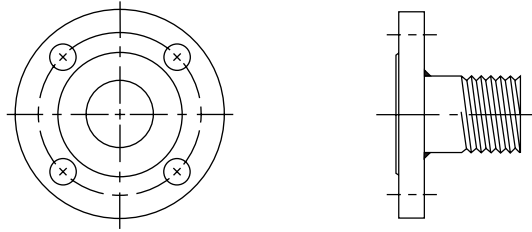
Dual Chamber Sensor Electronics Enclosure

Model Number	D	L2 (Min) (Note 2)
452-08-MT	1/2"	4"
452-08-HHT	1/2"	8"
452-16-MT, 452T-16-MT	1"	4"
452-16-HHT, 452T-16-HHT	1"	8"
452P-16-HHT, 452PT-16-HHT	1"	8"

Note 1: $L = U + L2 - 2.00"$, $U_{MIN} = 4"$
Note 2: L2 (min) should be longer if the temperature at the flow arrow could be greater than 60°C when using the TA option or greater than 85°C when using the TS option.

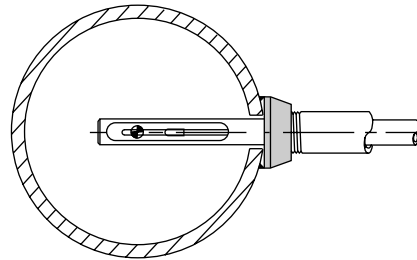
MOUNTING FLANGE ASSEMBLIES

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 452 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. 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 1/2", 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 and PG-16 fit the 1/2" 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

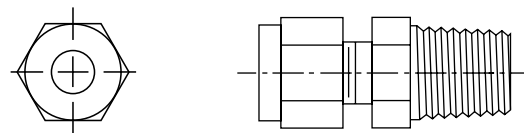
Models RR-08 (1/2") and RR-16 (1") clamp to the packing gland and sensor support. It has a worm-gear crank mechanism and adjustable stops. Refer to Part No. 759040.

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.

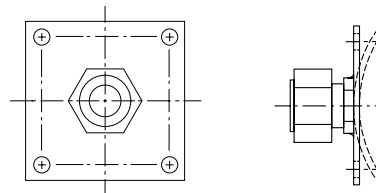
MALE COMPRESSION FITTINGS

Bored-thru 1/2" and 1" fittings for use with Thredolets or customer's fittings. 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" and 1" diameter sensor supports on flat or curved ducts. 316 Stainless Steel bracket and compression fitting, Teflon, Nylon or 316 SS ferrules. Refer to Part No. 759030.



MODEL 145 AIR PURGE SENSOR CLEANING SYSTEM

For Models 452P and 452PT, includes compressed air blow-down tank (ASME code listed), air solenoid valves, Model PCT-8 purge control timer, 115 or 230 VAC, 50/60Hz. Refer to Part No. 759037.

IDENTIFICATION TAGS

Part Number 170098, 1.25" x 3", 316 SS, maximum of 4 lines, 32 characters per line.

**The leader in Mass Flow
Technology for Process and
Environmental Measurements**



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