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MEASUREMENT AND CONTROL

2700 Series Ultrasonic Level Switches



2700 Single Point with "U" gap style sensor

The 2700 Series Ultrasonic Level Switches

are a cost-effective solution for your applications. It is a single or dual point device designed for the economical detection of clean liquids. The 2700 is available as either integral or remote mounted. A field selectable failsafe, adjustable time delay and self-test function come standard with all units. All units ordered with dual point configuration can be used either as independent alarm points or in tandem providing pump control logic at no additional cost.

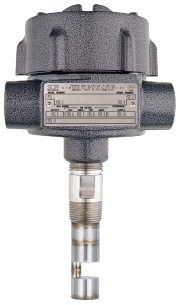
Installation requires mounting the sensor (threaded or flanged) to the vessel, connecting the power and control wires, and applying power. There is no additional set-up or calibration required. Since it is an electronic instrument with no moving parts, preventive maintenance is limited to an annual visual inspection.



2700 Dual Point Flange with "N" notch style sensor

Features

- No calibration required
- 10A SPDT relay output
- FM Approved for hazardous locations
- Field-selectable failsafe
- 30 second adjustable time delay
- Self-test function



2700 Single Point with "N" notch style sensor

Product Specifications

Input Power	
Line	120/240 VAC, 50/60 Hz 24 VDC
Output Type	
Single Point - Standard	10A SPDT, 250VAC 10A SPDT, 24VDC DC rating shown for resistive loads
Single Point - HR/RG Accessory	2A SPDT, 250VAC 2A SPDT, 24VDC DC rating shown for resistive loads
Dual Point - Standard	(2) 10A SPDT, 250VAC (2) 10A SPDT, 24VDC DC rating shown for resistive loads
Dual Point - HR/RG Accessory	(2) 2A SPDT, 250VAC (2) 2A SPDT, 24VDC DC rating shown for resistive loads
Repeatability	0.078" (2mm)
Maximum Current Draw	
24 VDC	70mA
120 VAC	40mA
240 VAC	20mA

Response Time	
On	250 ms
Off	250 ms
Failsafe	Field-selectable
Time Delay	0-30 s (Adjustable)
Enclosure Environmental Rating	NEMA 4X; IP65
Conduit Connection	3/4" NPT
Maximum Remote Distance from Sensor	50 ft. (15.2 m)
Ambient Temperature Range	-40 to 160°F (-40 to 71°C)
Process Temperature Range	-40 to 250°F (-40 to 121°C)
Maximum Process Pressure	2000 psig (138 bar)
Weight*	3 lbs. (1.4 kg)
Warranty	3 years

*See page 16 for sensor weights.

Design and specifications are subject to change without notice. For latest revision, see SORInc.com

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Ultrasonic switches are simple to apply and use. There are only a few limitations to their use:

- The media must be liquid
- Process temperature between -40 and 250°F (-40 to 121°C)
- The media must have less than 5% suspended solids
- No aeration in fluids with a viscosity of 100cP (30W motor oil) or greater

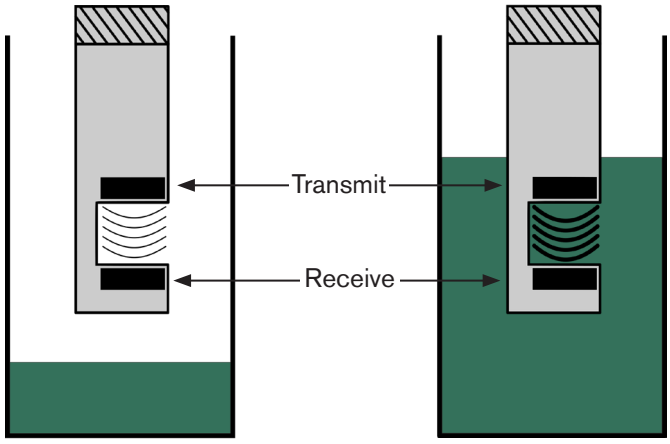
An ultrasonic switch is a device that uses inaudible high-frequency sound (ultrasound) to detect the presence or absence of a liquid at a designated point. The device consists of an electronic control unit and a sensor.

Ultrasonic level switches use the properties of sound transmission in vapor and liquids to detect liquid level. When sound travels in air, it loses a great deal of signal strength. When traveling in liquid, sound retains almost all of its signal strength.

To detect liquid level, we must determine if there is a liquid or gas (air) in the gap. Since liquids have a higher density than gasses, it is easier to transmit sound through them. One side of the sensor gap transmits sound, the other side detects it. When liquid is present, a high amount of sound is received at the detection side. When gas (air) is present, a small amount of sound is received. The electronics detect this difference and switch a relay accordingly.

Ultrasonic switch sensors contain two piezoelectric crystals, one transmits sound and one receives sound. Each crystal is mounted on one side of a gap in the metal sensor. The transmit crystal generates high frequency sound (1MHz to 3 MHz) that is directed across the gap to the receiver crystal. The receiver crystal converts the sound energy received into an electric signal, which is processed by the electronics to determine if the gap has liquid or air in it.

The drawing below shows the basic construction of an ultrasonic level switch sensor. An electrical signal is sent to the “transmit” crystal, which causes it to vibrate and produce high frequency sound. The “receive” crystal converts the high frequency sound that strikes it to another electrical signal, which is sent back to the electronics for processing. The sound energy that makes it across the sensor gap is very weak in air, and becomes very strong in liquid.



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Ultrasonic Level Switches

Application Conditions

Ultrasonic level switches can be used in a wide variety of applications without any calibration or setup. However, there are limitations to the types of process they will work in. The factors below must be taken into consideration before selecting an ultrasonic level switch for your application.

- Liquids only - the process media must be a liquid. The ultrasonic level switch cannot detect the difference between two gases or a gas and a solid. The even density of a liquid is required for proper detection.

- Clean liquids only - a liquid that has too high a percentage of solids will not transmit sound well enough to allow detection. Typically 5% suspended solids are the maximum amount allowed.

- The liquid must flow - an application where the liquid cannot drain out of the sensor gap will cause false alarms. If a liquid is too viscous to flow out of a 3/4" gap then the unit will not operate properly. Sometimes this can be solved by different mounting, but some liquids are just too viscous.

- No (or few) bubbles - especially in fluids with a viscosity higher than 100cP (30W motor oil). Large bubbles in thick fluids will block the sound signal from crossing the gap. Low viscosity fluids can have a fairly large amounts of bubbles as they tend to be very small (Alka-Seltzer in water).

If these guidelines are properly observed, the ultrasonic level switches will provide trouble-free operation without any calibration or periodic adjustment.

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Ultrasonic Level Switches

How to Order

The 2700 Ultrasonic Level Switch is comprised of two parts.

- The first is the electronics which is selected from the model tree below.
- The second is the sensor which is on page 8 and 9.
- The housing dimensions can be seen on page 7.
- Orders must have complete model numbers, i.e., each component must have a designator.

Note: For units requiring remote mounting capability, refer to the Remote Mounting Accessory section on page 6.

1 Model

Ulrasonic Level Switch	2700

2 Electrical Housing

Integral	K1

3 Power Supply

Alternating Current	AC
Direct Current	DC

4 Agency Approval

No Agency Approval	00
FM Explosion-Proof Approval [1]	FM

5 Sensor Type

Single Point	01
Dual Point	02

6 Accessories

BK	Flat surface mounting bracket (remote mount only) *See details on page 6.*
GW	Glass window on housing
HR	Hermetically-sealed relay
PK	Pipe mounting kit (remote mount only) [2] *See details on page 6.*
PP	Fiber tag with customer specified tag information
RG	Gold-contact relay
RR	316SS nameplate wired to the unit with customer specified tag information
TT	316SS nameplate permanently affixed to the housing with customer specified tag information
VV	Fungicidal varnish applied to housing exterior

7 Certificates

C1	Calibration
C3	Inspection Report
C4	Compliance/Conformance
C6	Insulation Resistance
D1	Certificate of Origin
D2	Manufacturer's Certification

2700	-	K1	-		-		-		-		

2700-K1-AC-FM-01-RR C1 Example Model No.

[1] Match sensor approvals to electronics approvals to maintain the agency listing integrity.

[2] Requires BK accessory.

Agency Approval

Agency	Safety Method	Approval	Model(s)
FM	Explosion Proof	Class I, Groups C, D; Class II, Groups E, F, G; Class III, Division 1	2700-K1-xx-FM-xx

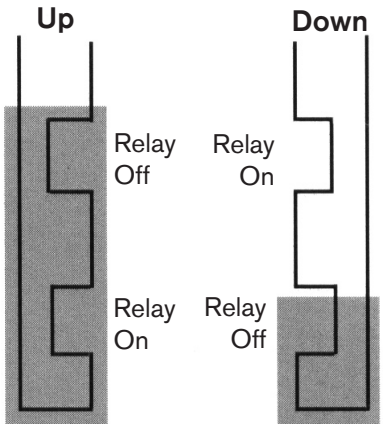
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Pump Logic

As a standard feature, all dual point ultrasonic level switches are capable of pump control.

By default, pump logic is disabled. Pump logic can be field wet to pump up (left diagram) or pump down (right diagram).



Time Delay & Failsafe

All ultrasonic level switches include a time delay and failsafe.

- The time delay is an adjustable dial and can be set from 0 to 30 seconds.
- The failsafe is field-selectable and can be set to either high or low level.

Self-Test

A Self Test button comes standard on all units. The Self Test button can be used to manually change the state of the relays to check that the 2700 Ultrasonic Level Switch is properly connected to the control system. The Self Test button also performs a check for continuity between the Electronics and Sensor and verifies the transmit and receive crystals are operating correctly.

Remote Mounting Accessory

The standard ultrasonic level switch is integrally mounted but remote mounting capability can be added. This is accomplished using remote cable which connects the electronics and sensor allowing them to be mounted in separate locations.

To order a remote mount unit, add designator RM to the accessory section of the sensor's model number. At the time of order, you must also specify the remote cable length, which is available in whole foot lengths from 1 to 50 feet.

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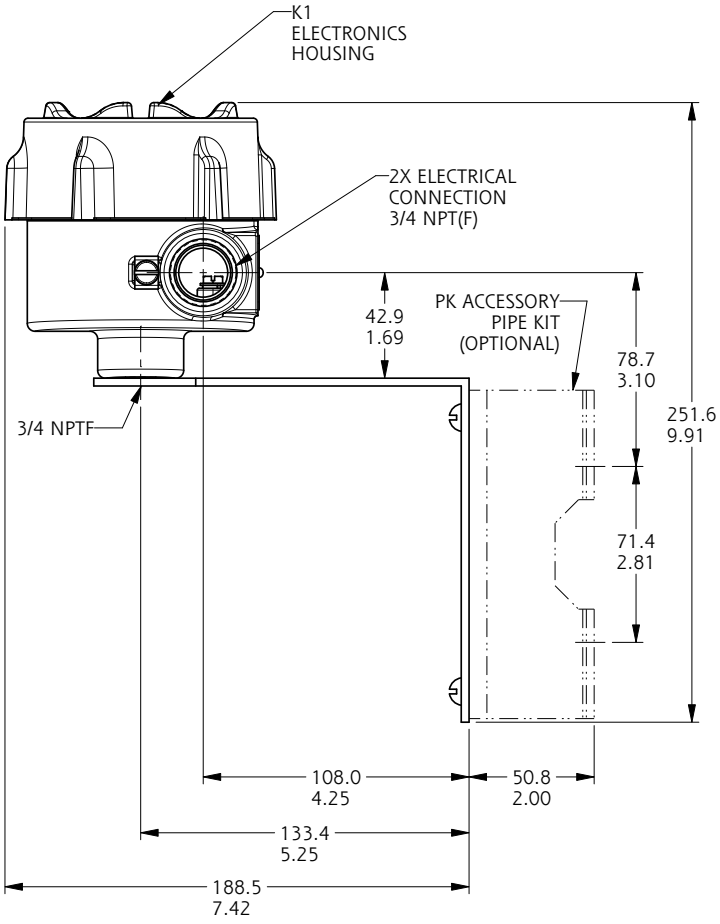
All ultrasonic level switch electronic housings are supplied with line mounting as a standard. Optional brackets are available for flat surface (BK) or pipe (PK) mounting.

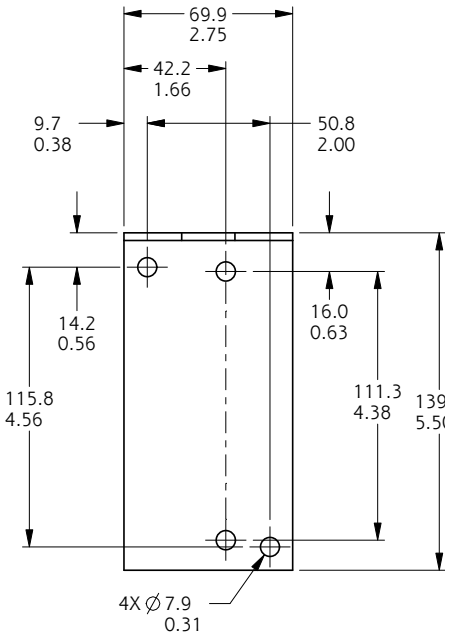
For the basic flat surface mounting bracket, add designator BK to the accessory section of the electronics' model number.

The basic BK bracket can be adapted for mounting onto 1-1/2" to 2" pipe or stanchion by adding accessory designator PK after BK.

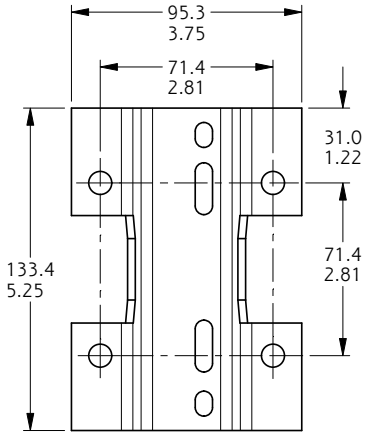
Dimensions are expressed as millimeter over inches (Linear = mm/in.).

Drawing 0390084





BK ACCESSORY
MOUNTING BRACKET
HOLE PATTERN



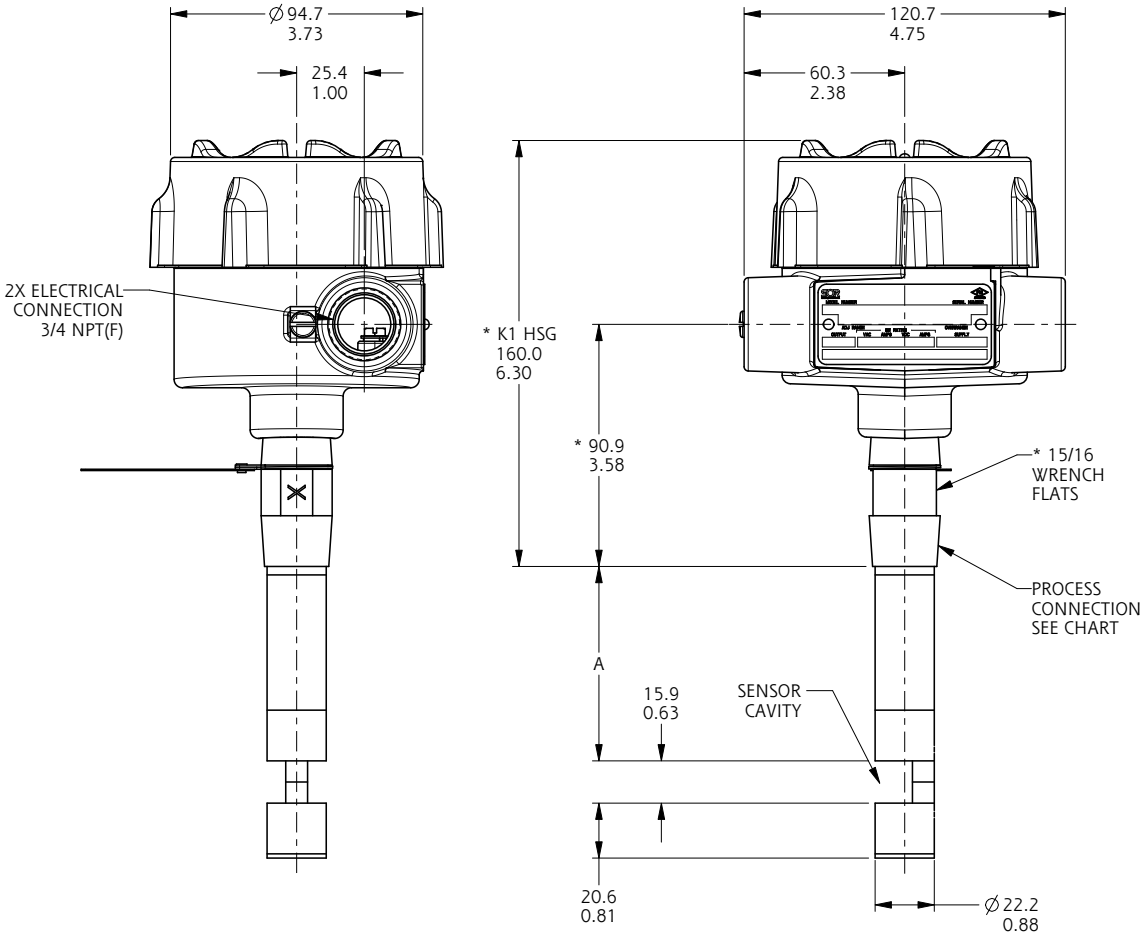
PIPE KIT
MOUNTING BRACKET
HOLE PATTERN

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Drawing 0390070



PROCESS CONN SIZE	* LENGTH	* WRENCH FLATS
3/4 NPTM	SHOWN	SHOWN
1 NPTM	ADD 8.0 0.31	1-3/16
1-1/2 NPTM	ADD 9.5 0.38	1-3/4
2 NPTM	ADD 9.5 0.38	2-1/4

PROBE LENGTH A	

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The 371 sensor is designed for use with all single-point ultrasonic electronic units.

1 Model

Single Point — 371

2 Sensor Type

Vertical Gap	U
Horizontal (Notch) Gap	N

3 Insertion Length

Enter the required probe length, "A", in inches (as a decimal, up to five characters including the decimal, leading zeroes not required. Max. two digits after decimal point).

Probe Length in Decimal Form

Probe Description	Allowable Lengths
"U" Sensor (Vertical Gap 701)	1.2", 1.7"-180" (30, 43-4572mm)
"U" Sensor with Flanged Connection (Vertical Gap 701)	3"-180" (77-4572mm)
"N" Sensor with "A", "L", "J" or "C" Material (Horizontal Gap 711, 721)	2"-180" (77-4572mm)

4 Sensor Material

316SS (standard)	C
Monel (N type sensor)	A
Carpenter 20 (N type sensor)	L
Hastelloy C (N type sensor)	J

5 Process Connection

3A	3/4" NPT
4A	1" NPT
5A	1-1/2" NPT
6A	2" NPT
3D	1" 150# ANSI RF Flange
3E	1-1/2" 150# ANSI RF Flange
3F	2" 150# ANSI RF Flange
3G	3" 150# ANSI RF Flange
3H	4" 150# ANSI RF Flange
3K	1" 300# ANSI RF Flange
3L	1-1/2" 300# ANSI RF Flange
3M	2" 300# ANSI RF Flange
3N	3" 300# ANSI RF Flange
3P	4" 300# ANSI RF Flange

6 Accessories

C2	Hydrostatic Pressure Test
CV	Canadian Registration Number (CRN) Process ratings may be affected. Consult the factory for details
FM	FM Approved Explosion Proof*
PP	Fiber tag with customer specified tag information
RM	Remotely mounted, refer to page 5 for ordering instructions.
RR	316SS nameplate wired to the unit with customer specified tag information
TT	316SS nameplate permanently affixed to housing with customer specified tag information

371 - [ ] [ ] - [ ] [ ] - [ ]

371- U 2 - C 3A - RR Example Model No.

See page 16 for sensor & flange weights.

*Match sensor approvals to electronics approvals to maintain the agency listing integrity.

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The 372 sensor is designed for use with all dual-point ultrasonic electronic units.

Model 1

Dual Point

371	
372	

Sensor Type 2

Horizontal (Notch) Gap

N	

Insertion Length A 3

Enter the required probe length, "A", in inches (as a decimal, up to five characters including the decimal; leading zeros not required). Maximum two digits after decimal point, minimum 3" maximum 180".

Probe Length in Decimal Form

Insertion Length B 4

Enter the required probe length, "B" in inches (as a decimal, up to five characters including the decimal, leading zeroes not required.) Maximum two digits after decimal point. Minimum 3". Maximum 48".

Probe Length in Decimal Form

Sensor Material 5

316SS (standard)	C
Monel	A
Carpenter 20	L
Hastelloy C	J

6 Process Connection

3A	3/4" NPT
4A	1" NPT
5A	1-1/2" NPT
6A	2" NPT
3D	1" 150# ANSI RF Flange
3E	1-1/2" 150# ANSI RF Flange
3F	2" 150# ANSI RF Flange
3G	3" 150# ANSI RF Flange
3H	4" 150# ANSI RF Flange
3K	1" 300# ANSI RF Flange
3L	1-1/2" 300# ANSI RF Flange
3M	2" 300# ANSI RF Flange
3N	3" 300# ANSI RF Flange
3P	4" 300# ANSI RF Flange

7 Accessories

C2	Hydrostatic Pressure Test
CV	Canadian Registration Number (CRN) Process ratings may be affected. Consult the factory for details
FM	FM Approved Explosion Proof*
PP	Fiber tag with customer specified tag information
RM	Remotely mounted, refer to page 5 for ordering instructions.
RR	316SS nameplate wired to the unit with customer specified tag information
TT	316SS nameplate permanently affixed to housing with customer specified tag information

372 - N 3 - 6 - C 3A - RR Example Model No.

See page 16 for sensor & flange weights.

*Match sensor approvals to electronics approvals to maintain the agency listing integrity.

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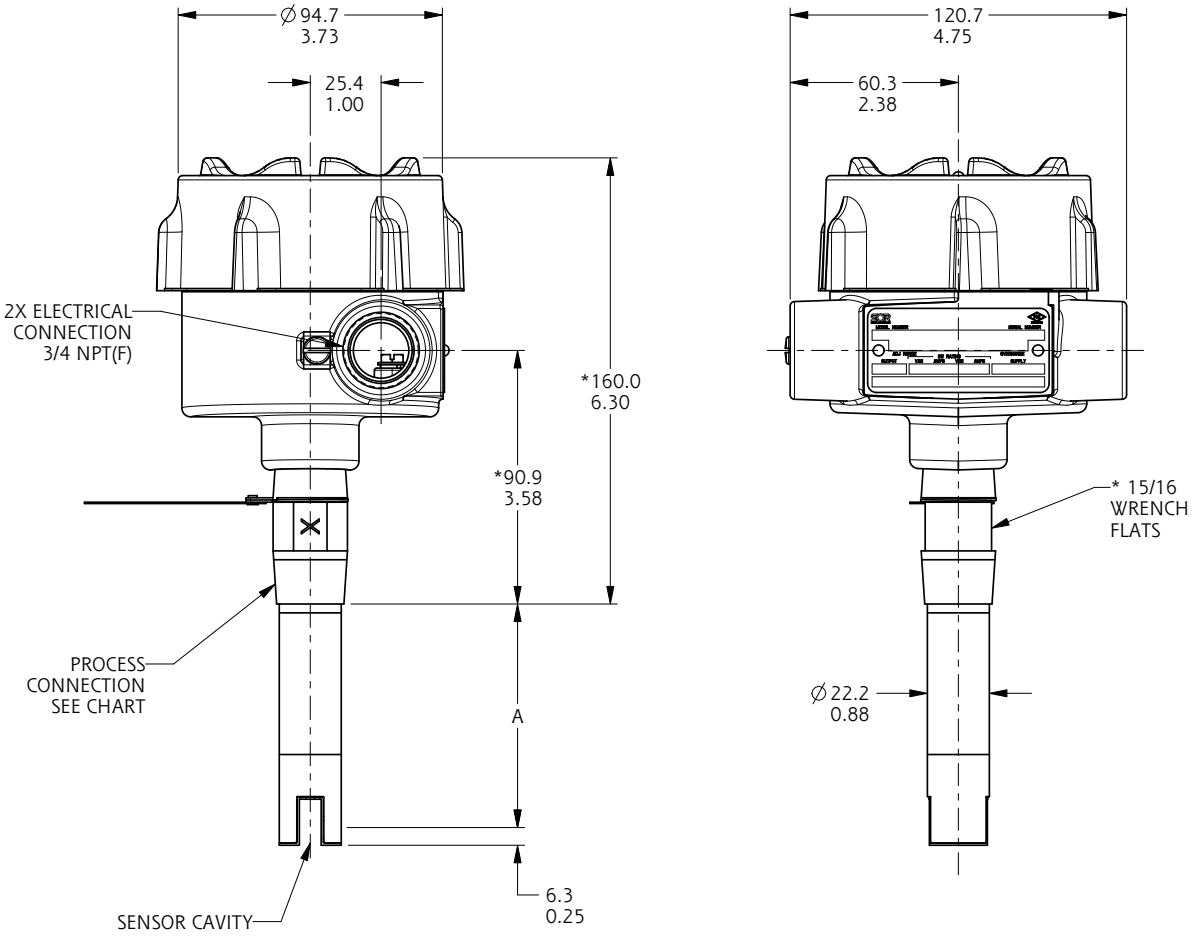
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Contact the factory for certified dimension drawings.
Linear = mm/in.

Process Connection	*Add to Length	*Wrench Flats
3/4" NPT(M)	Shown	Shown
1" NPT(M)	Add 8.0 .313	1-3/16
1-1/2" NPT(M)	Add 9.5 .375	1-3/4
2" NPT(M)		2-1/4

Type U Single Point (Threaded)

Drawing 0390072



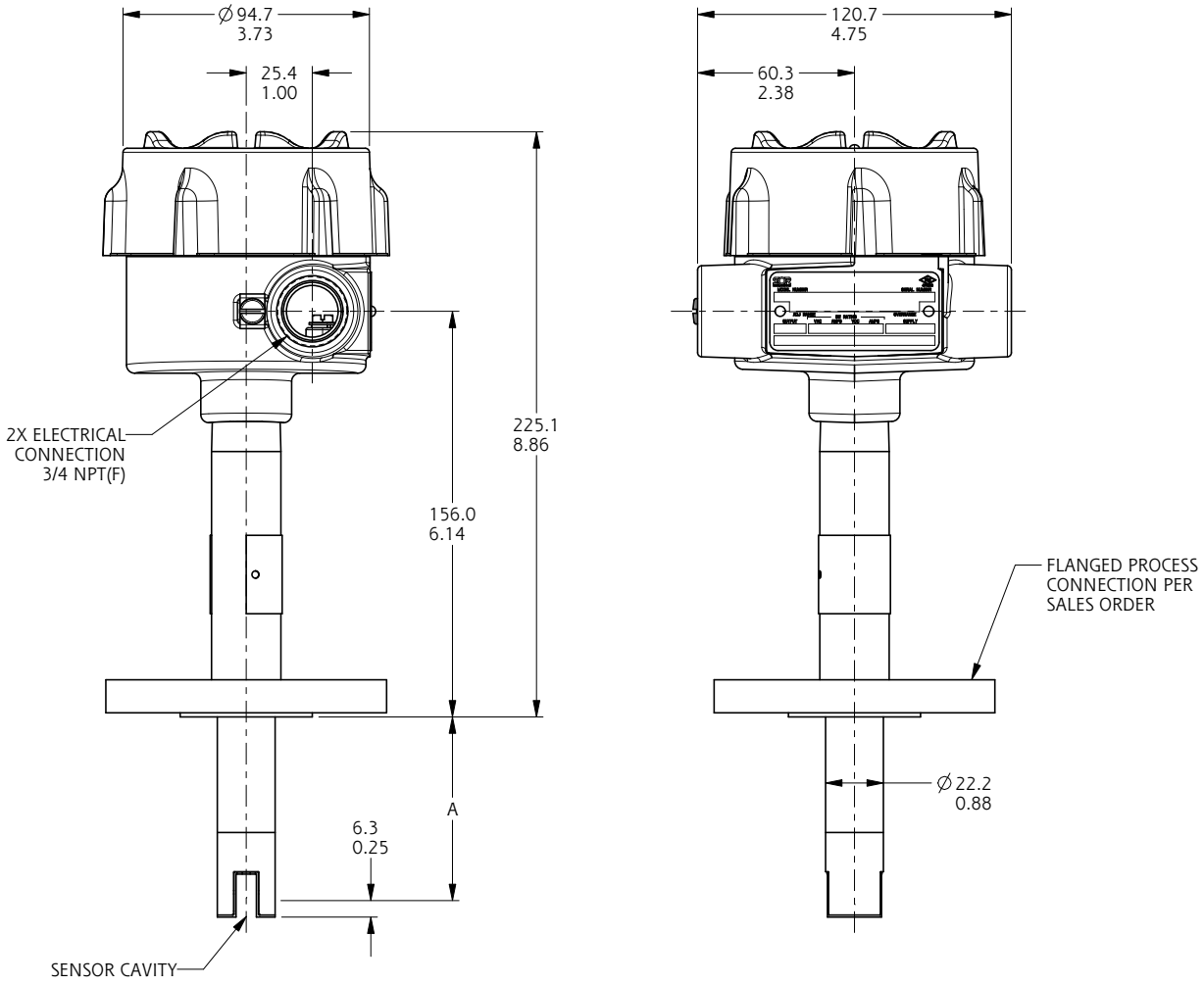
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Type U Single Point (Flanged)

Drawing 0390073



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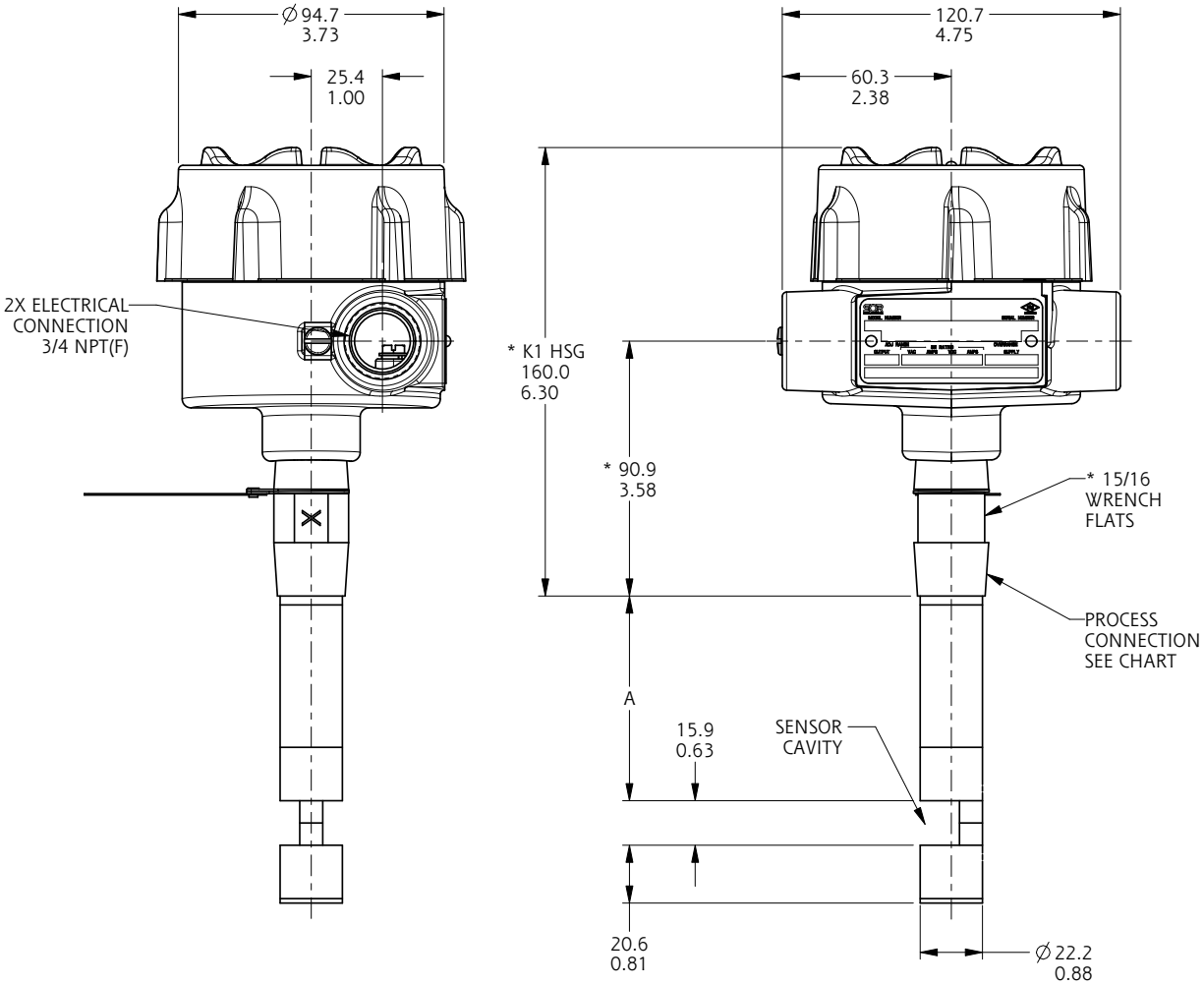
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Contact the factory for certified dimension drawings.
Linear = mm/in.

Process Connection	*Add to Length	*Wrench Flats
3/4" NPT(M)	Shown	Shown
1" NPT(M)	Add 8.0 .313	1-3/16
1-1/2" NPT(M)	Add 9.5 .375	1-3/4
2" NPT(M)		2-1/4

Type N Single Point (Threaded)

Drawing 0390070



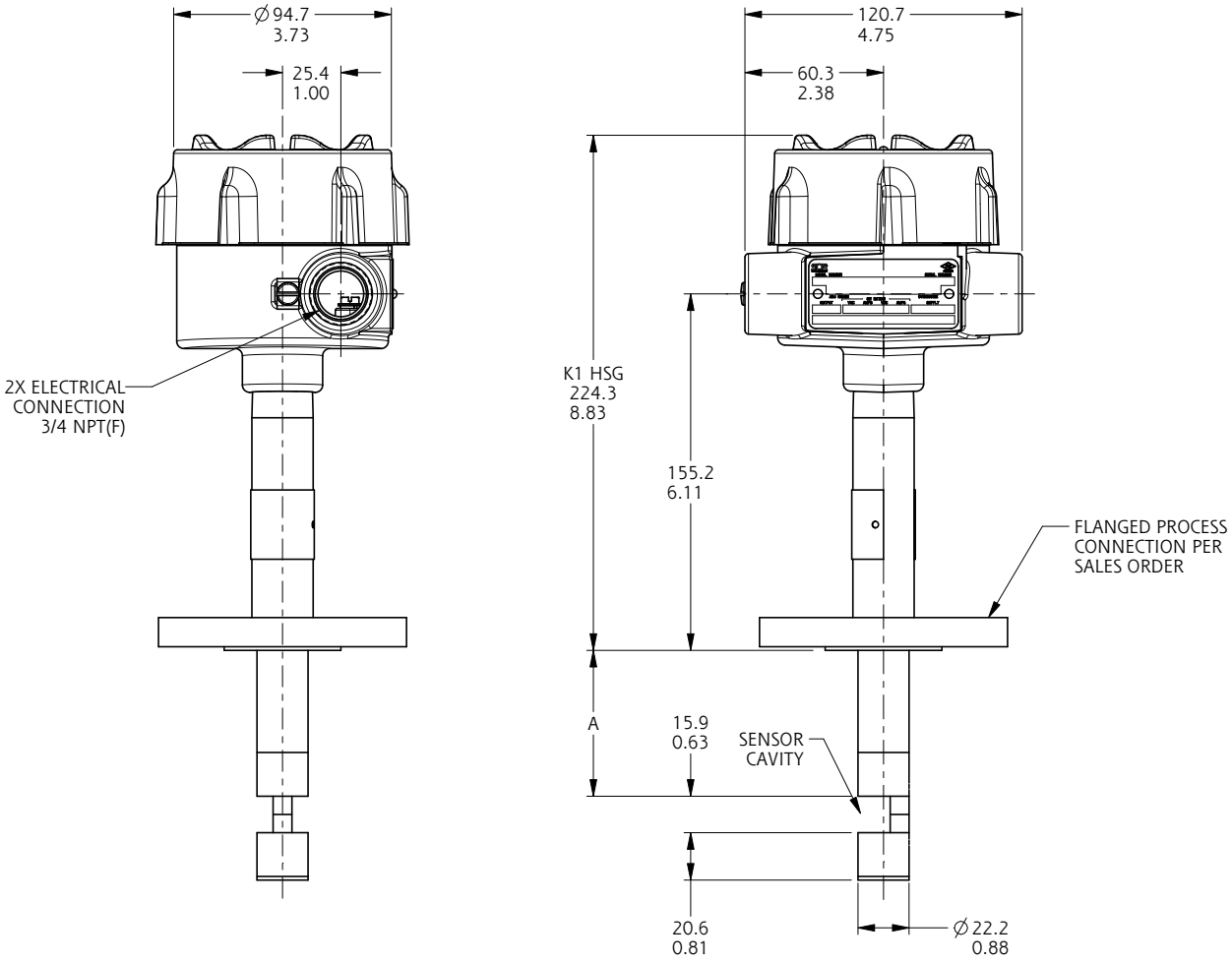
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Type N Single Point (Flanged)

Drawing 0390071



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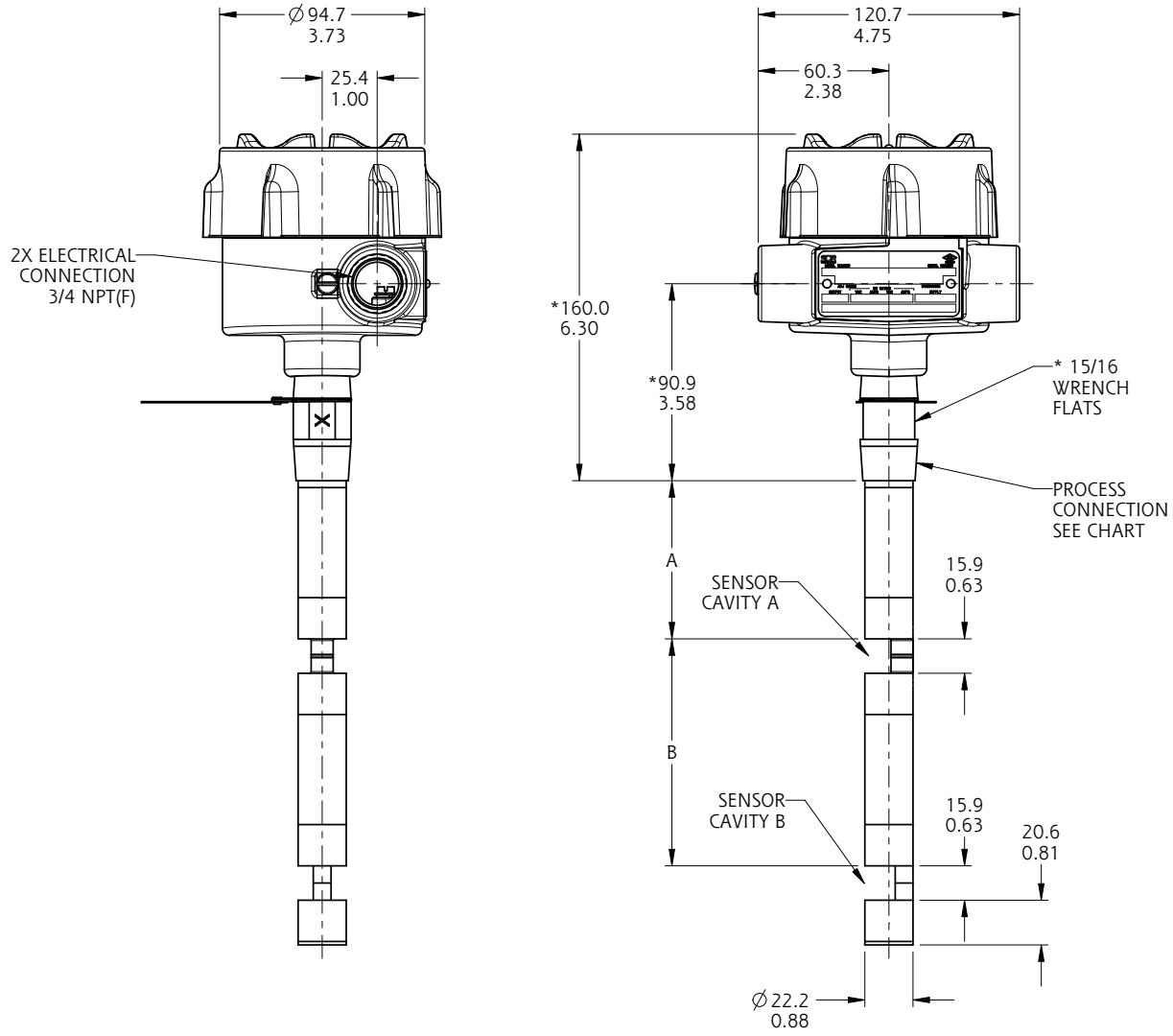
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Process Connection	*Add to Length	*Wrench Flats
3/4" NPT(M)	Shown	Shown
1" NPT(M)	Add 8.0 .313	1-3/16
1-1/2" NPT(M)	Add 9.5 .375	1-3/4
2" NPT(M)		2-1/4

Type N Dual Point (Threaded)

Drawing 0390074



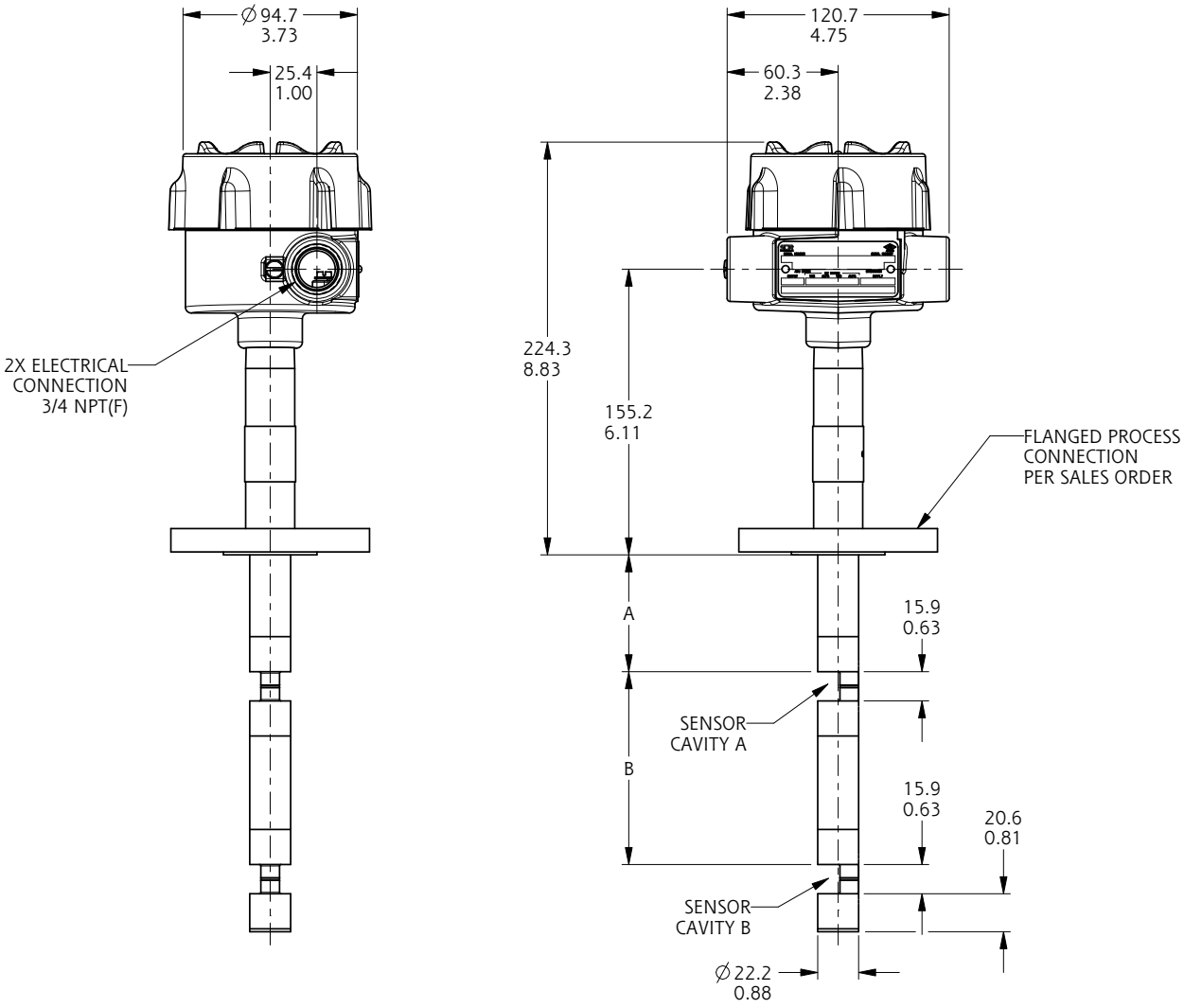
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Type N Dual Point (Flanged)

Drawing 0390075



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Sensor Weight

0.5 lbs. for first 6”
1 lb. (0.5 kg) for each additional 12”

Flange Weight and Pressure Rating

Process Connection	Add to Weight		Maximum Pressure Rating
	lbs.	kg	
3D	2	1.0	275 psig (19 bar)
3E	4	1.8	
3F	5	2.3	
3G	9	4	
3H	17	8	
3K	3	1.5	720 psig (50 bar)
3L	6	2.7	
3M	8	3.6	
3N	16	7.5	
3P	27	12.5	

MEASUREMENT AND CONTROL

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