



Form 1035

### SOR® ultrasonic transmitters

are a proven solution offering more flexibility and reliability than similar products. With unique features such as state-of-the-art programming, adaptive gain and a very powerful transmit pulse, they provide consistent operation under conditions where other ultrasonics fail.

**Features and Benefits**

- Powerful transmitted pulse for greater flexibility
- Low frequency sound for superior penetration in tough conditions
- Automatic adaptive gain continually adjusts to process conditions
- Superior application flexibility – automatic compensation for dust, foam, steam, fog and condensation



### Technology Comparison

echOsonix are unmatched in tough conditions where level measurement is critical. The following chart shows how echOsonix match up against other level transmitters.

	echOsonix	Other Ultrasonics	Radar	RF Capacitance	Differential Pressure	Laser
Easily selected for liquids, slurries or solids	A	B	B	C	X	A
Changing dielectric constant	A	A	B	X	A	A
Changing specific gravity	A	A	A	A	X	A
Dusty atmospheres	A	C	C	A	X	C
Water vapor (steam, fog, condensation, etc.)	A	C	C	A	A	X
Long measuring ranges (over 100 feet)	A	B	B	C	C	A
Poor surface conditions (foam, etc.)	A	C	A	B	B	X
High turbulence	A	B	B	C	A	B
Vessel intrusions	A	B	B	B	A	A

A = Excellent    B = Average    C = Poor    X = Not Recommended

**Theory of Operation**

echOsonix use pulses of sound to determine the distance to a target. They measure the time for the sound pulse to travel to the target and return as an echo. The distance can be calculated using the measured time and speed of sound in the atmosphere of the vessel.

Any condition that affects the size of echo, creates false echoes or alters the speed of sound can cause problems with this process. In industrial applications there are many of these situations. The following pages show how echOsonix handle these issues, where they can be used successfully and what to avoid.

**Features of echOsonix**

There are three main features of echOsonix that allow them to outperform other level transmitters – high power signal, low frequency sound and adaptive gain control.

**High Power**

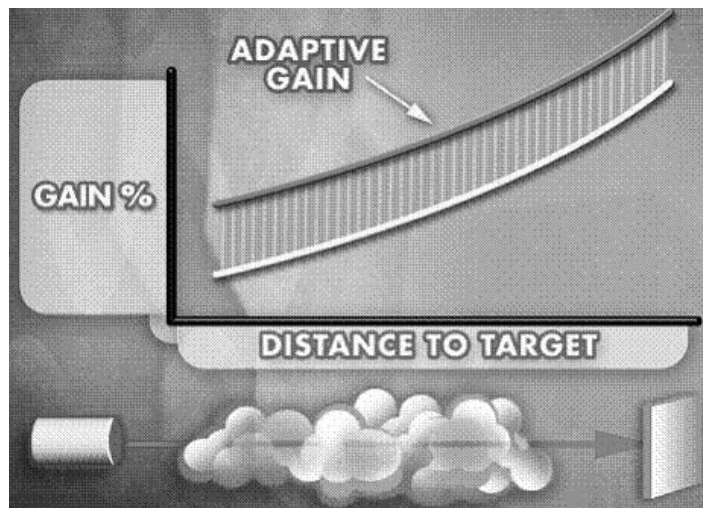
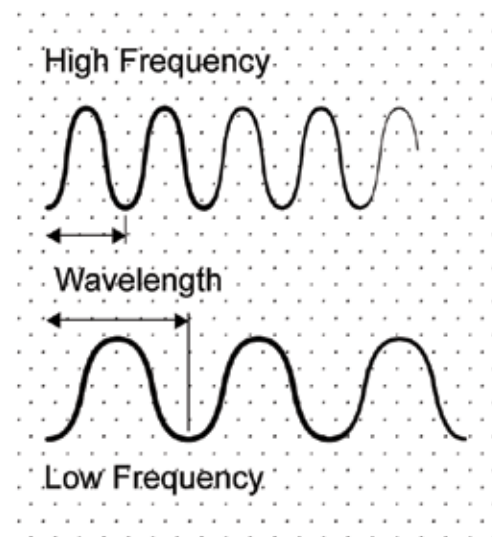
echOsonix produce the most intense sound pulse of all ultrasonic transmitters available. When conditions like dust or foam absorb sound, it makes sense to use as much energy as possible. This is a “bigger hammer” approach – when trying to get through a tough barrier, hit it with a bigger hammer!

**Low Frequency**

Airborne particles absorb sound. High frequency sound has a shorter wavelength, and must travel farther to go the same linear distance. Therefore it hits more particles and loses more energy in a given distance.

This example shows high and low frequency sound traveling through dust. High frequency hits more dust particles and loses energy more quickly. This is why foghorns on ships have such low frequency, so the sound will travel farther through the water particles in fog. echOsonix uses lower frequency sound to provide better penetration through dust, steam and fog.

Sound Source	Energy
Space Shuttle Launch	180 dB
Jet Engine at Takeoff	140
echOsonix Transmitter	138
Jackhammer	105
Normal Conversation	60



**Adaptive Gain Control**

High power and low frequency may not be enough to ensure proper level detection in tough processes. If a device is not sensitive enough, it will not detect the returned echo, and if it is too sensitive, problems can occur when conditions improve.

The sensitivity of sound detection is called gain. echOsonix monitor application conditions through the size of echo received. If the echo gets too small, echOsonix increases the gain. If the echo gets too large, it decreases the gain.

**Applications to Look For**

echOsonix are suitable for many industrial applications. Its features allow this product to perform in many difficult applications. Some samples of applications where echOsonix excel are given here.

**Powder and Bulk Solids**

echOsonix are successful in a variety of bulk solids applications. They are routinely used to measure dusty and clean solids, large and small particle sizes, and extremely long ranges. Some common solids echOsonix applications are:

- Power – fly ash, coal, limestone
- Food – whole kernel grains, various meals, flour, sugar, etc.
- Cement – powdered cement, fly ash, limestone, clinkers
- Manufacturing – soda ash, sand, carbon black, bauxite, etc.
- Pulp & Paper – bentonite, wood chips, fines, etc.



**Liquids/Slurries**

Many industrial liquids applications have steam, fog and/or condensation present. echOsonix perform excellently in liquid applications where the atmosphere gases will not be changing in composition (see below for details). Some typical applications where echOsonix offer unique advantages are:

- Power – cooling towers, sump pits, lime slurries, etc.
- Food – alcohol storage, waste oil pits, batching slurries, etc.
- Manufacturing – liquid latex, effluent, machine coolant, etc.
- Oil and Gas – crude oil sumps, water reclamation tanks, fuel oil storage, etc.
- Water/Wastewater – chemical storage, digesters, sediment ponds, etc.



If you want to know if echOsonix can handle your application, fill out the worksheet on page 14 of this catalog and forward it to either your local SOR representative or the factory.

**Applications to Avoid**

As with any technology, echOsonix are not a perfect fit for all applications. Below are some types of applications where ultrasonic transmitters, including echOsonix, may not be a good fit:

- Sealed tanks where the atmospheric gases are either layered or changing in composition – the speed of sound in the tank is not constant and will cause erroneous readings.
- Very high pressure and/or temperature – these have a pronounced effect on sound waves. The listed specifications for echOsonix should always be observed.
- Solids applications where the angle of repose (angle of the side of the pile of material) is greater than 45° and particle size is less than 1" (25mm). The sound is actually reflected away from the instrument.

The transducers produce the transmit pulse and detect returning echoes. They have a fixed frequency that determines the measured distance and what effects process conditions will have. echOsonix transducers are selected based on the range to be measured, the media type and the expected vessel conditions.

### Transducer Selection for Liquids and Slurries

**Typical Blanking** – a dead zone where the transmitter cannot detect the process.

**Foam/Condensate Range** – some conditions, like foam, steam, fog and condensate, reduce the effective range of echOsonix. Use this value to determine the estimated effective range of the transducer when any of these conditions are present.

**Ideal Conditions Range** – ideal conditions for liquids and slurries are little or no foam, steam, fog or condensate. Use this maximum range to select a transducer for these conditions.

Transducer Frequency	Typical Blanking	Foam / Condensate Range	Ideal Conditions Liquid & Slurries Range
30 kHz	18" (45cm)	6 ft. (1.8m)	33 ft. (10m)
20 kHz	24" (60cm)	33 ft. (10m)	65 ft. (20m)
15 kHz	24" (60cm)	50 ft. (15m)	100 ft. (30m)
10 kHz	48" (1.2m)	150 ft. (45m)	260 ft. (80m)
5 kHz	60" (1.5m)	260 ft. (80m)	260 ft. (80m)

### Transducer Selection for Solids

**Typical Blanking** – a dead zone where the transmitter cannot detect the process.

**Heavy Dust/Small Particle Range** – solids with heavy dust (visibility of 3 ft., 1m or less) and/or small particles (less than 1/16", 1mm) reduce the effective range of echOsonix.

**Ideal Conditions Range** – ideal conditions for solids are when little or no dust is present and particle sizes are above 1/16", 1mm. Use this maximum range to select a transducer for these conditions.

Transducer Frequency	Typical Blanking	Heavy Dust / Small Particle Range	Ideal Conditions Solids Range
30 kHz	18" (45cm)	3 ft. (1m)	10 ft. (3m)
20 kHz	24" (60cm)	20 ft. (6m)	33 ft. (10m)
15 kHz	24" (60cm)	33 ft. (10m)	65 ft. (20m)
10 kHz	48" (1.2m)	65 ft. (20m)	100 ft. (30m)
5 kHz	60" (1.5m)	130 ft. (40m)	260 ft. (80m)

### Product Specifications

<b>Operating Voltage</b>	
110 VAC Version	22-27 VDC and/or 100-126 VAC
220 VAC Version	22-27 VDC and/or 205 - 250 VAC
<b>Power Consumptions</b>	
24 VDC Power Supply	10 W maximum
110/220 VAC Power Supply	10 VA maximum
<b>Relay Output</b>	
Integral Version	2 Form 'C' (SPDT) contacts rated 10A @ 240 VAC
Remote Version	4 Form 'C' (SPDT) contacts rated 10A @ 240 VAC
All relays have independently adjustable deadbands.	
<b>Analog Output</b>	Isolated 4-20 mA or 20-4 mA (700 ohm)
<b>Digital Output</b>	Modbus Communications
<b>Electronic Accuracy</b>	±0.25% of maximum range
<b>Remote Cable Length</b>	<100m (330 feet)
<b>Remote Cable Type</b>	TYCAB DMC 71402 or Carol Cable C0784 7-conductor, 22 Ga. shielded cable
<b>Memory</b>	Non-volatile with >10 years retention
<b>Electrical Connections</b>	2x3/4" NPT(F) on integral units Customer supplied on remote units
<b>Operating Pressure</b>	20" HgV to 15 psig
<b>Operating Temperature</b>	-40°F (-40°C) to 140°F (60°C)

### Agency Approvals

CSA

*Integral*

Class I, Groups B, C, and D;  
Class II, Groups E, F, and G;  
Class III  
Divisions 1 & 2

*Remote*

Class I, Groups A, B, C, and D;  
Class II, Groups E, F, and G;  
Class III  
Division 2  
Provides Non-Incendive Outputs

FM (Pending)

ATEX (Pending)

### Product Specifications

Transducer Model (Frequency)	Maximum Blanking Distance	Maximum Liquid / Slurry Range	Maximum Solid / Powder Range	SPL at 3 ft. (1m) in front of transducer	SPL at 3 ft. (1m) to side of unit
A (5 kHz)	60 in. (1.52m)	260 ft. (80m)	260 ft. (80m)	137 dB	113 dB
B (10 kHz)	48 in. (1.22m)	260 ft. (80m)	100 ft.(30m)	138 dB	105 dB
K (15 kHz)	24 in. (0.61m)	100 ft. (30m)	65 ft. (20m)	135 dB	107 dB
C (20 kHz)	24 in. (0.61m)	65 ft. (20m)	33 ft. (10m)	132 dB	108 dB
D (30 kHz)	18 in. (0.46m)	33 ft. (10m)	10 ft. (3m)	129 dB	102 dB

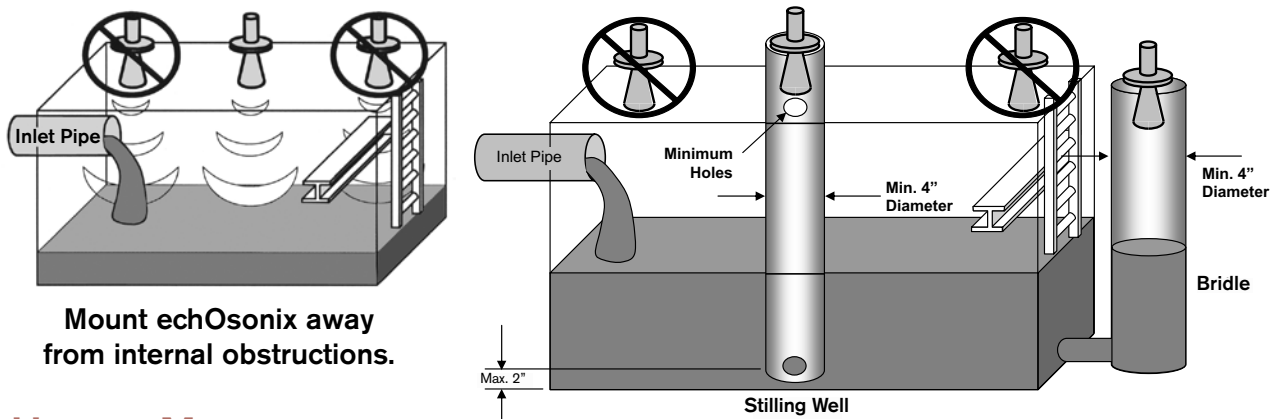
Design and specifications are subject to change without notice. For latest revision, see [www.sorinc.com](http://www.sorinc.com).

### Installation Notes

echOsonix can be adversely affected by improper installation. The sound waves used by any ultrasonic transmitter have some specific properties that can make certain installations very difficult to deal with. Many headaches can be avoided by following some simple installation guidelines. The figures below show some things to avoid and how to correct other situations. Following these recommendations will greatly increase the chance of a successful application and reduce frustration in trying to get the product to work in an installation where there are physical problems.

### Location

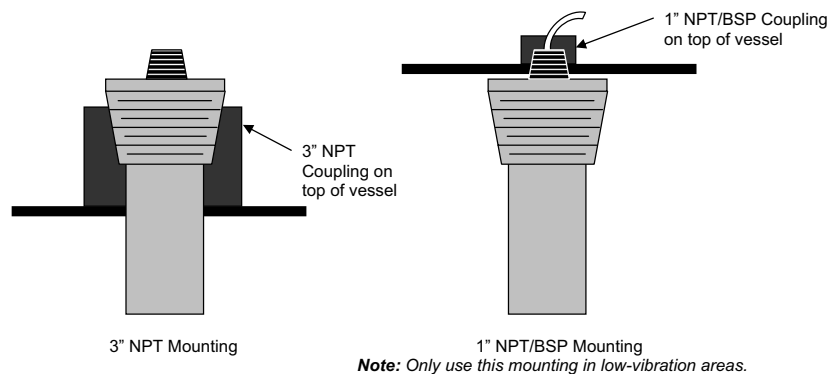
Where echOsonix are mounted is the first critical item to address. The sound waves come out in a cone-shaped beam. This beam should not intersect any physical obstructions such as inlet pipes, ladders or I-beams. A stilling well or bridle can be used for very tight or difficult installations.



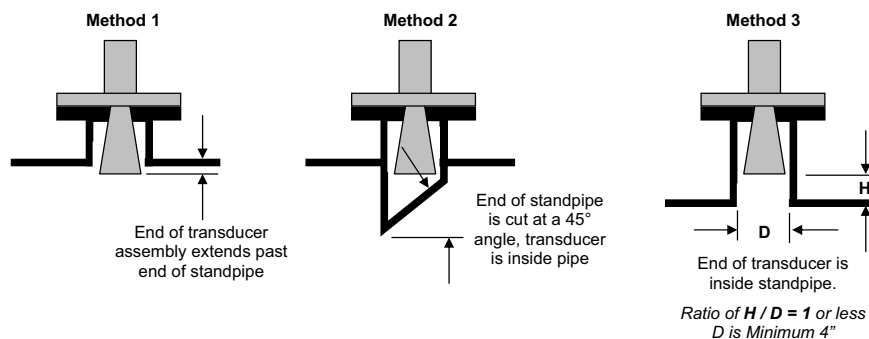
### How to Mount

The most common mounting for echOsonix transducers is on a flange. Some can be mounted on a threaded connection, but most are flange mounted. The key issue to be careful of when mounting on threads or a flange is to make sure the pulses of sound are not inhibited. Some common mounting problems are shown below along with the SOR recommendations to fix these situations.

### Threaded Mounting



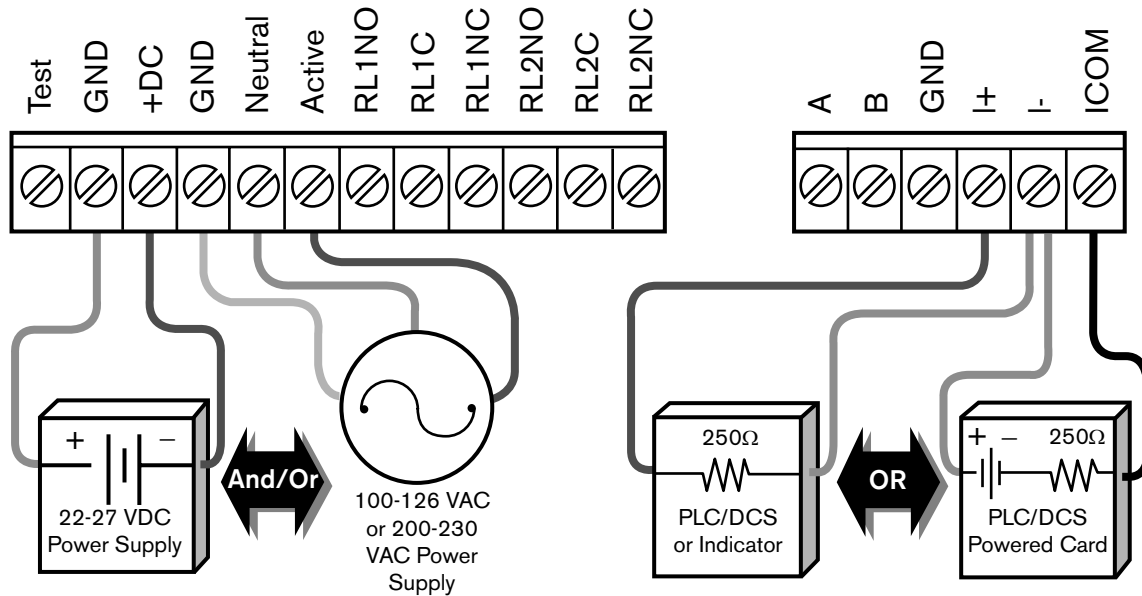
### Flanged Mounting



### Wiring Diagrams

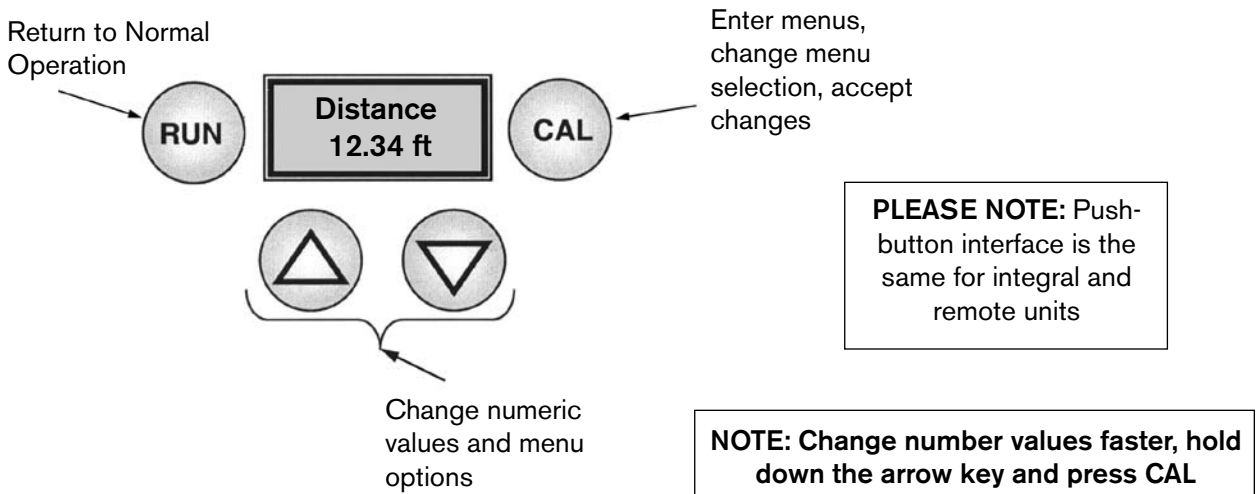
echOsonix come standard with a universal input power supply (AC and DC) and an isolated 4-20 mA output. Unit power can be connected to either AC or DC, or can be connected to both at the same time. This provides the capability to use AC main power and DC battery backup as well as the flexibility to use either AC or DC for main power.

The isolated 4-20 mA output can be either powered internally by echOsonix to run a separate meter or straight input, or it can be externally powered through an I/O card. This circuit is compatible with all input/output devices and provides the flexibility to fit all user needs.



### Programming Basics

echOsonix are programmed through a 4-button interface following on-screen directions. The diagram below shows the basic user interface and function of the four buttons. Menus are designed to be intuitive and easy to set up. Refer to the General Instructions form #1034 for menu specifics.

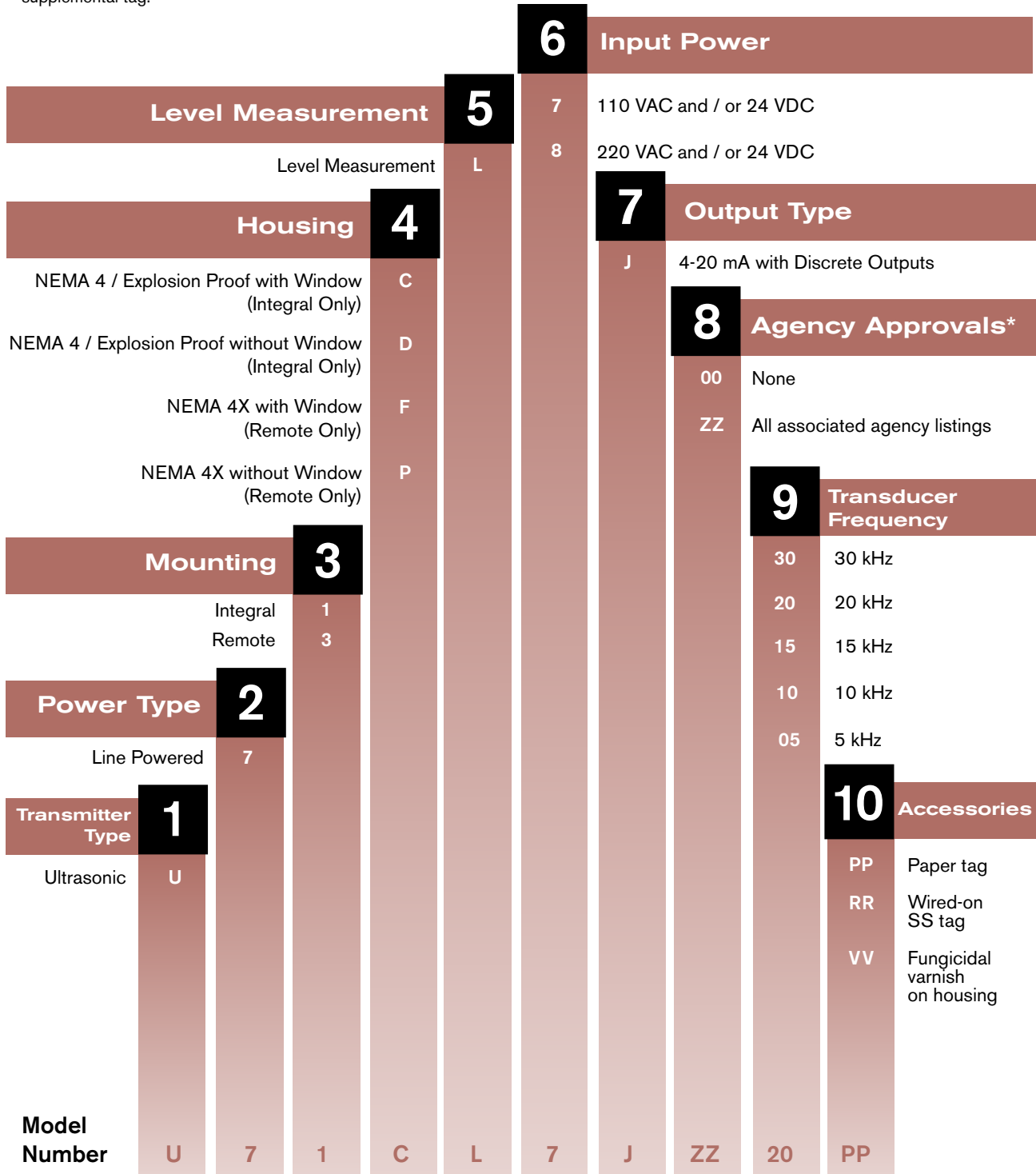


echoOsonix are selected as two separate model numbers - one for the electronics package and one for the transducer.

**Model Number System**

**U71 - CL7J - ZZ - 20 - PP**

echOsonix Level Transmitter; line-powered integral unit; weathertight and explosion-proof housing with window; 110 VAC and/or 24 VDC power supply with 4-20 mA and two discrete outputs, 20 kHz sensor range; all associated agency listings and a paper supplemental tag.

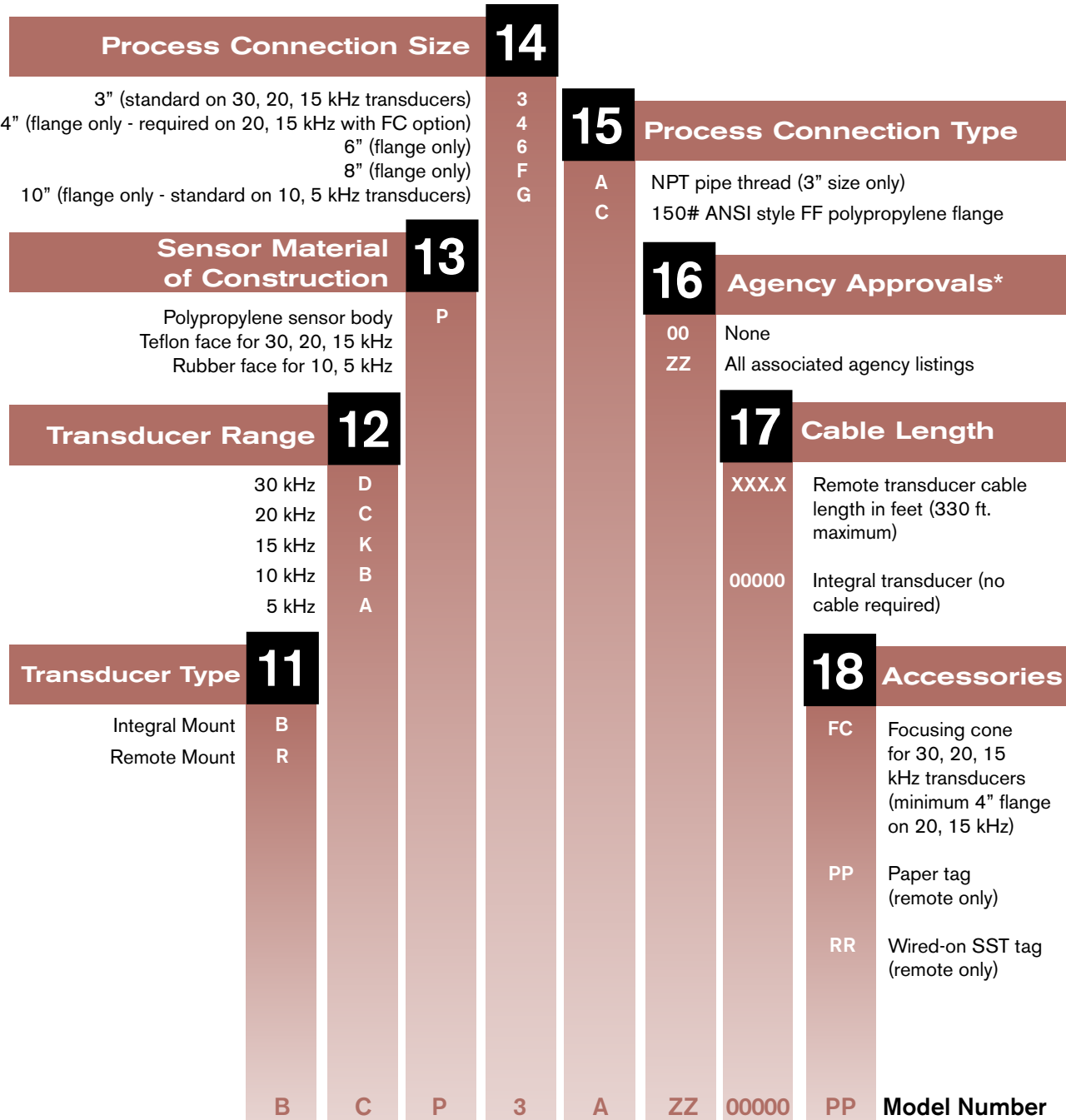


\*Match electronics and transducer approvals to maintain the agency listing integrity.

**Model Number System**

**BCP - 3A - ZZ - 00000**

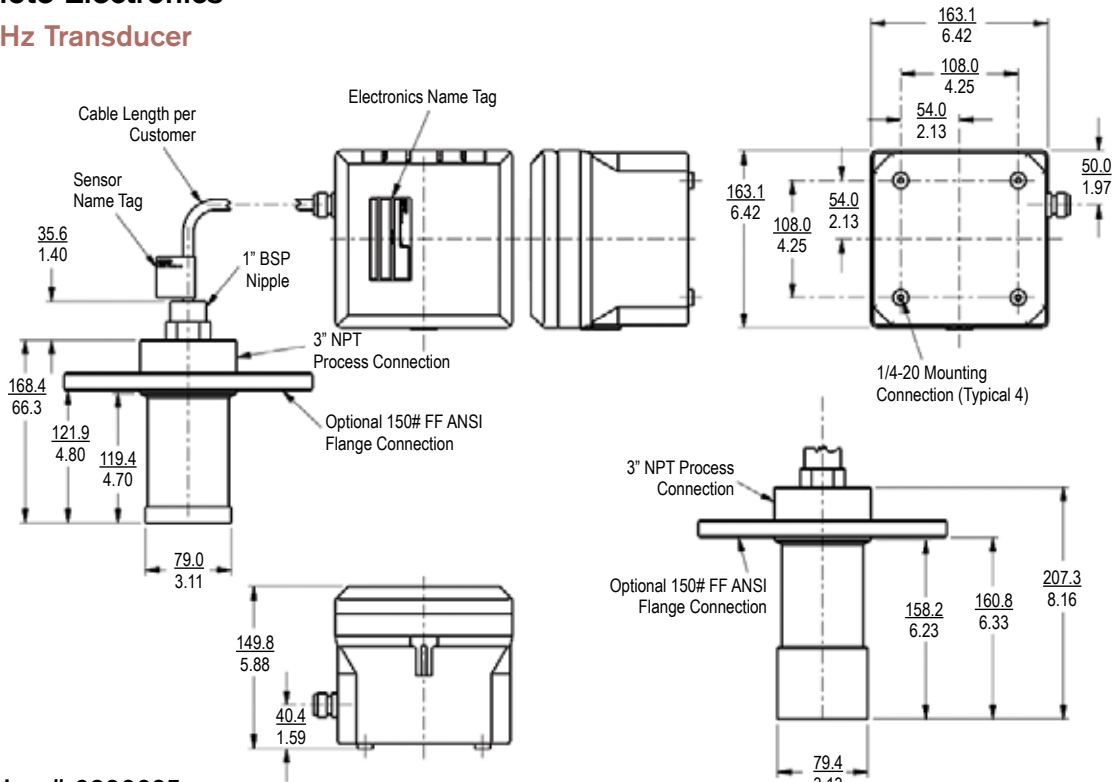
Integral-mount transducer; 20kHz; polypropylene sensor; 3" NPT(M) Process Connection; all associated agency listings; no transducer cable and no accessories.



\*Match electronics and transducer approvals to maintain the agency listing integrity.

Remote Electronics

30 kHz Transducer



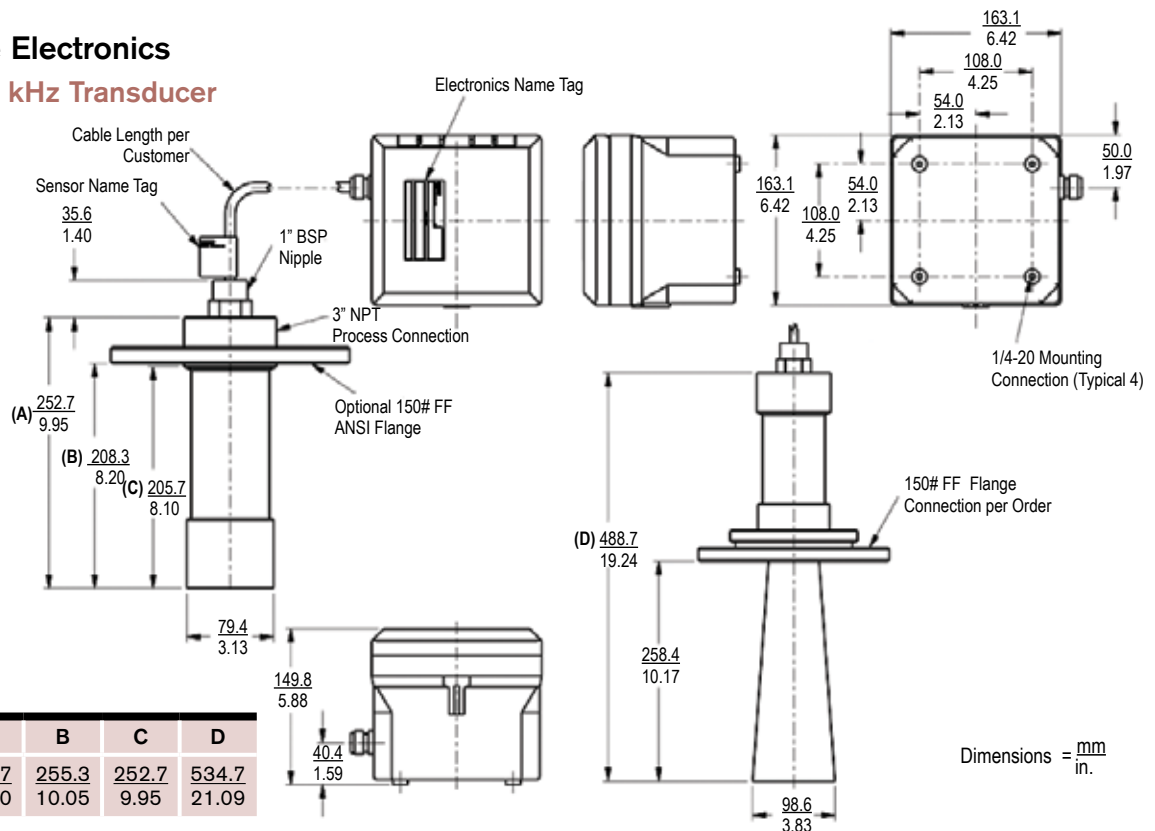
Drawing # 0390625

FC Option

Dimensions =  $\frac{\text{mm}}{\text{in.}}$

Remote Electronics

15 or 20 kHz Transducer



	A	B	C	D
15 kHz	299.7 11.80	255.3 10.05	252.7 9.95	534.7 21.09

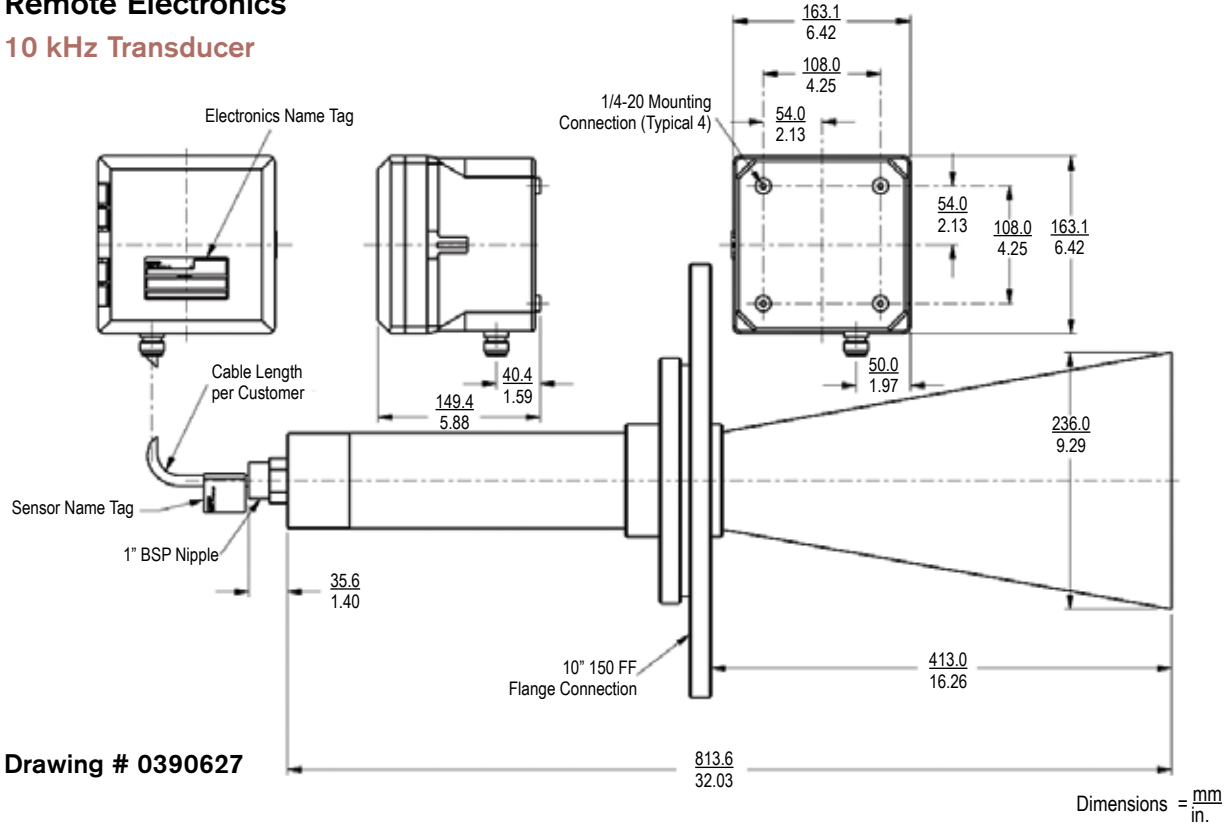
Drawing # 0390626

FC Option

Dimensions =  $\frac{\text{mm}}{\text{in.}}$

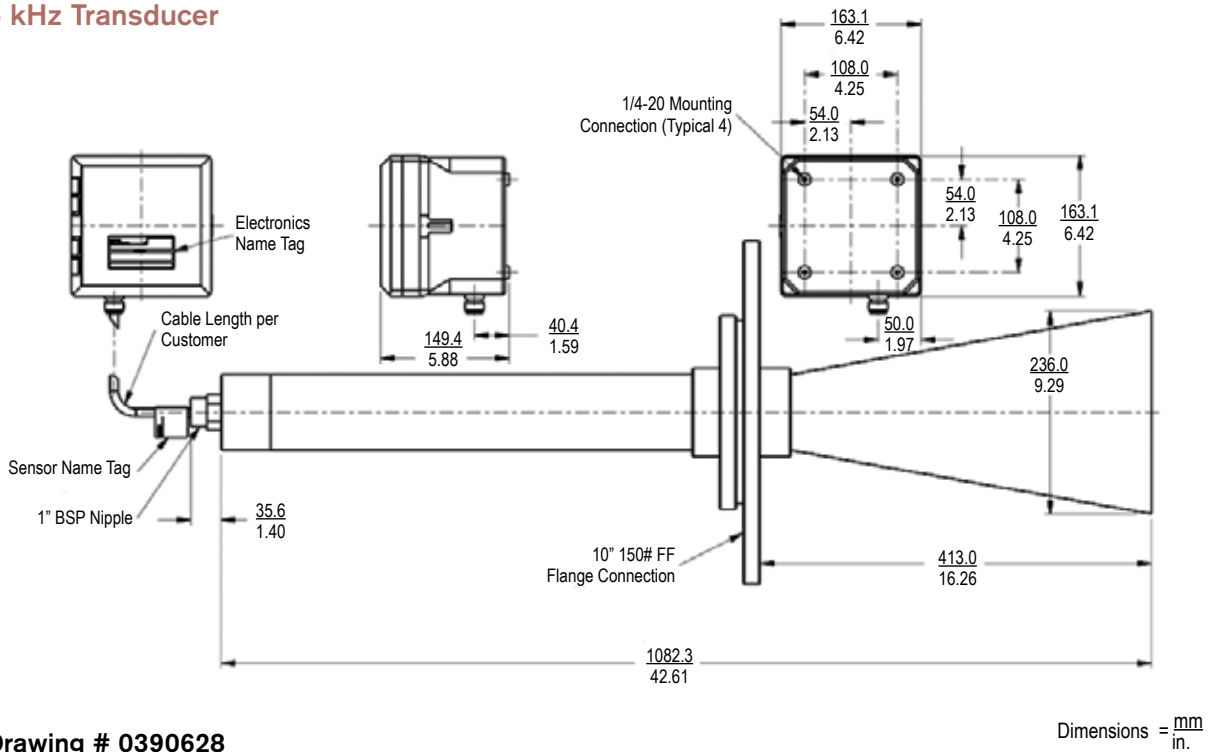
Remote Electronics

10 kHz Transducer

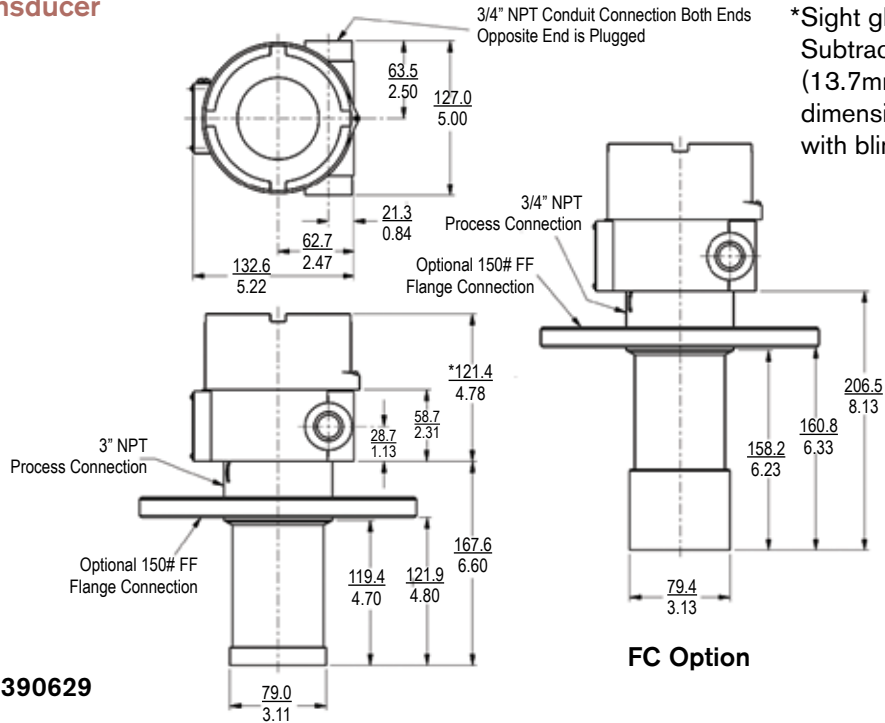


Remote Electronics

5 kHz Transducer



**Integral Electronics**  
**30 kHz Transducer**



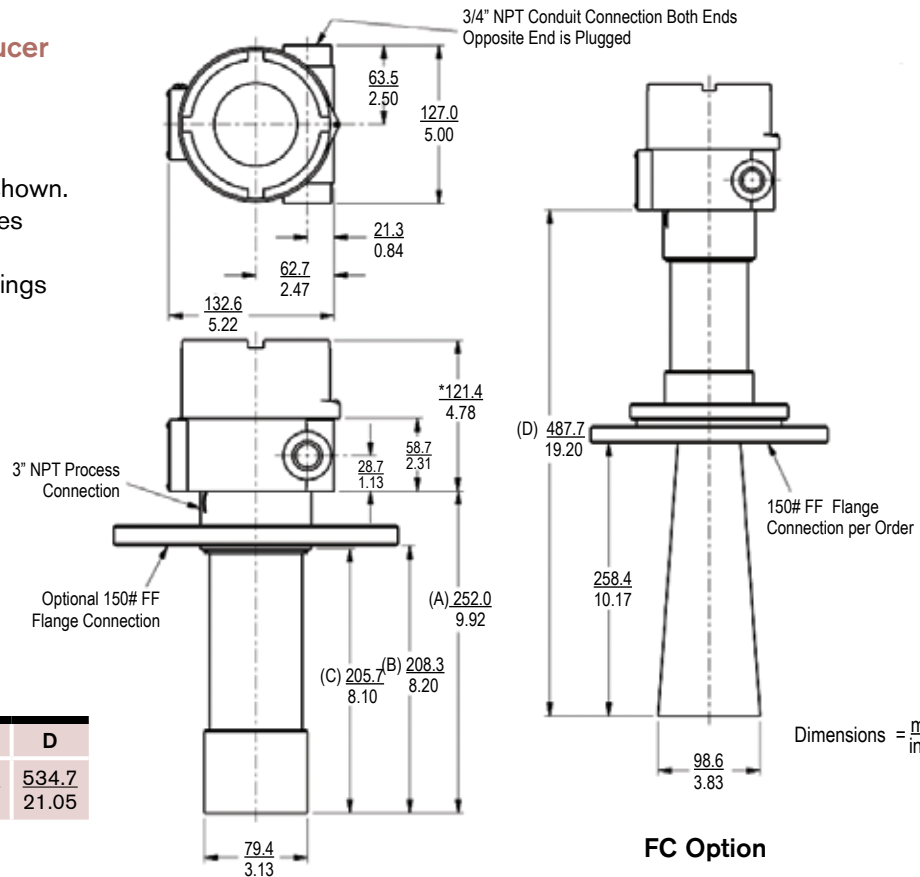
\*Sight glass cover shown.  
Subtract 0.52 inches  
(13.7mm) from this  
dimension for housings  
with blind covers.

Dimensions =  $\frac{\text{mm}}{\text{in.}}$

**Drawing # 0390629**

**Integral Electronics**  
**15 or 20 kHz Transducer**

\*Sight glass cover shown.  
Subtract 0.52 inches  
(13.7mm) from this  
dimension for housings  
with blind covers.

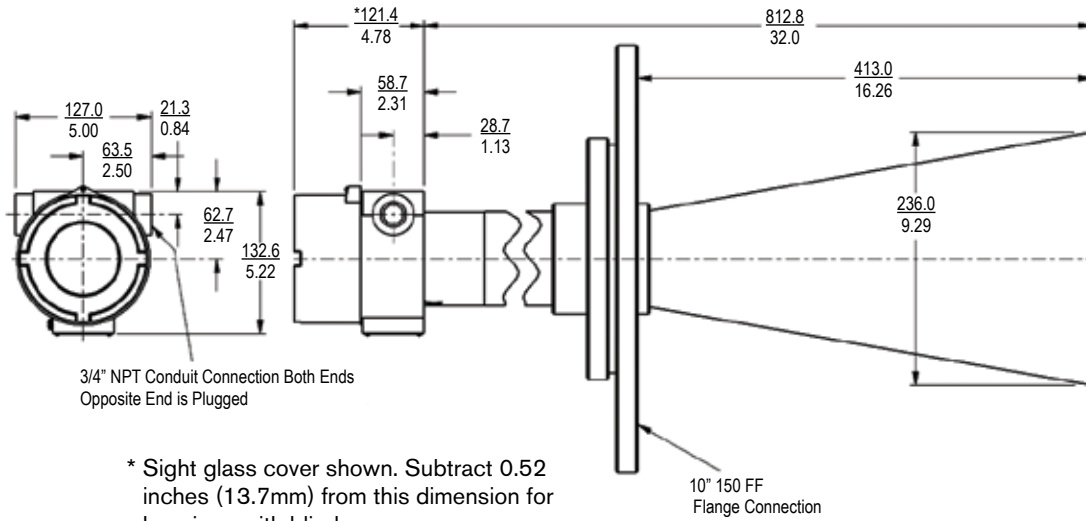


Dimensions =  $\frac{\text{mm}}{\text{in.}}$

**Drawing # 0390630**

15 kHz	A	B	C	D
289.9	255.3	252.7	534.7	
11.77	10.05	9.95	21.05	

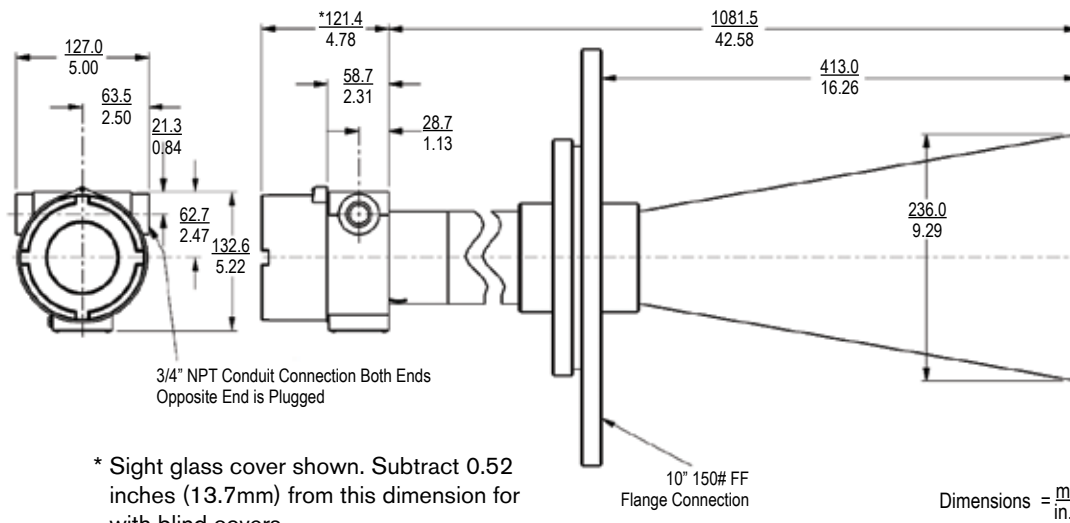
**Integral Electronics**  
**10 kHz Transducer**



Dimensions =  $\frac{\text{mm}}{\text{in.}}$

Drawing # 0390627

**Integral Electronics**  
**5 kHz Transducer**



Dimensions =  $\frac{\text{mm}}{\text{in.}}$

Drawing # 0390628

### Customer Information

Customer Name \_\_\_\_\_  
 Industry \_\_\_\_\_  
 Location \_\_\_\_\_

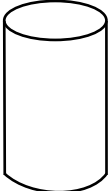
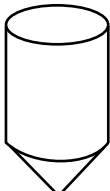
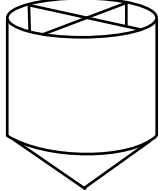

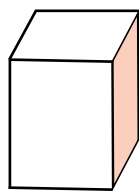
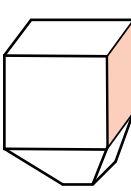
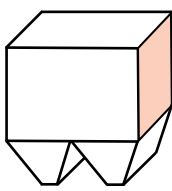
Contact \_\_\_\_\_  
 Phone \_\_\_\_\_  
 FAX \_\_\_\_\_  
 E-mail \_\_\_\_\_

### Process Information

Process Name \_\_\_\_\_ Solid  Liquid  Slurry   
 Tag No. \_\_\_\_\_ Dust: Heavy  Medium  Light   
 Temperature \_\_\_\_\_ Foam: Thickness \_\_\_\_\_ Dense  Light   
 Pressure \_\_\_\_\_ Condensation? Y  N  Agitation? Y  N   
 Atmosphere: Air  Other? \_\_\_\_\_ Homogenous? Y  N

### Installation Information

Vessel Shape (check the one that applies, or sketch vessel below)

Cylinder	Cone-bottom Cylinder	Section Cylinder	"Bullet" Tank	Box	Cone-bottom Box	Dual-outlet Box
						
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Vessel Height: \_\_\_\_\_ Measured Range: \_\_\_\_\_ Vessel Diameter: \_\_\_\_\_  
 Vessel Material: SS  Other Metal  Concrete  Other? \_\_\_\_\_  
 Mounting: Stand Pipe  Coupling  Bracket  Other? \_\_\_\_\_  
 Connection Size / Type: \_\_\_\_\_ Stand Pipe Diameter / Length: \_\_\_\_\_

### Instrument Requirements

Input Power: 110VAC  220VAC   
 24 VDC Line Power   
 24 VDC Loop Power   
 Output Type: 4-20 mA  Relay   
 # of Relays: \_\_\_\_\_ Modbus   
 Remote Electronics:  Distance \_\_\_\_\_  
 Integral Electronics:   
 Area  NEMA 4X  
 Classification:  Classes I, II & III; Div. 2  
 Classes I, II & III; Div. 1 & 2  
 \_\_\_\_\_  
 Sight Window? Y  N

### Application Notes and Sketch

**Please submit your completed worksheet via fax to the number listed below.**

Range	Electronics Package	Unit Weight*		Electronics		Cable (per 50 ft)		Packaging		Estimated Shipping Weight	
		lbs	kg	lbs	kg	lbs	kg	lbs	kg	lbs	kg
5 kHz	Integral	24.5	11	-	-	-	-	14	6.5	38.5	17.5
5 kHz	Remote	20	9	4	1.75	2.25	1	14	6.5	40.25	18.25
10 kHz	Integral	14.5	6.4	-	-	-	-	7	3	21.5	9.4
10 kHz	Remote	10	4.5	4	1.75	2.25	1	7	3	23.25	10
15 kHz	Integral	10	4.5	-	-	-	-	7	3	17	7.5
15 kHz	Remote	5.5	2.5	4	1.75	2.25	1	7	3	18.75	8.25
20 kHz	Integral	9	4	-	-	-	-	4	2	13	6
20 kHz	Remote	4.5	2	4	1.75	2.25	1	4	2	14.75	6.75
30 kHz	Integral	8	3.5	-	-	-	-	4	2	11.2	5.5
30 kHz	Remote	3.5	1.5	4	1.75	2.25	1	4	2	13.75	6.25

\*Equipment mounted on top of vessel.

*SOR® offers a full line of commercial-grade process instruments.*

**echOsonix®  
Level Transmitters**

**Level Switches**

**Temperature Switches**

**Flow Switches**

**Pressure Switches**

**Level**

**Temperature**

**Pressure**

**Flow**



**Process Instrumentation**

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