Echotel® Trident® 91S/92S Ultrasonic Level Switches

DESCRIPTION

The Trident® 91S/92S detects single or dual point level in a wide variety of liquid applications. It is available with either a mA current shift, or a 10 amp relay output. Trident switches incorporate a unique, continuous self-testing feature which automatically verifies the integrity of the entire unit, including the crystal bond.

The relay version has a 10 amp DPDT process relay(s) and a dedicated 10 amp SPDT malfunction relay. The single point unit has one process relay and one dedicated malfunction or self-test relay. The dual point relay unit has two process relays and one dedicated malfunction relay.

The current shift version is a 24 VDC switch that produces discrete mA values for specific gap conditions. When liquid is in the gap, the unit will produce a 16 mA output, while a dry gap condition produces an 8 mA signal. The current shift version also has a field selectable 5 mA or 19 mA signal should a malfunction condition occur.

FEATURES

- Adjustable time delay on rising and/or falling level
- Single or dual point
- Advanced, continuous self-test checks crystal bond, transducer, and electronics integrity with or without liquid in the gap
- Relay output or current shift with separate malfunction indication
- Surface mount conformal coated electronics
- Electronic windowing (pulsed) signal technique
- Extensive FM, CSA, and CENELEC approvals
- No calibration required
- Integral or remote mount electronics

Model 91S with Tip Style Stainless Steel Sensor

Model 92S with Gap Style Sensor

APPLICATIONS

- High level alarm
- Low level alarm
- Overfill protection
- Pump protection
- Seal pot level
- Pump control

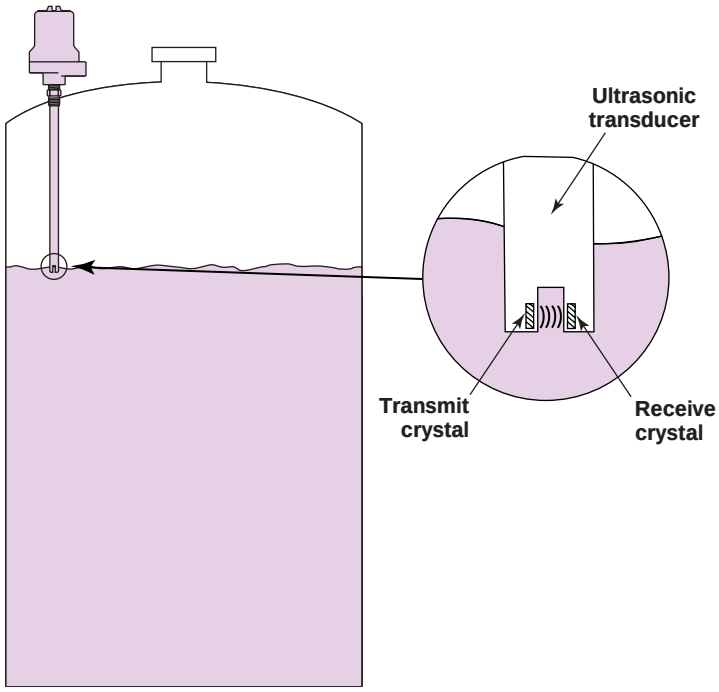
INDUSTRIES

- Chemical
- Petrochemical
- Pulp and paper
- Food and pharmaceutical
- Power
- Water and wastewater

TECHNOLOGY

Trident 91S/92S utilizes ultrasonic energy to detect the presence or absence of liquid in a tip sensitive or side gap transducer. The principle behind ultrasonic contact technology is that high-frequency sound waves are easily transmitted across a transducer gap in the presence of a liquid medium, but are attenuated when the gap is dry. The Trident 91S/92S uses an ultrasonic frequency of 2 MHz to perform this liquid level measurement in a wide variety of process media and application conditions.

The transducer uses a pair of piezoelectric crystals that are encapsulated in epoxy at the tip of the transducer. The crystals are made of a ceramic material, such as lead zirconate. The transmit crystal converts an electrical signal from the Trident 91S/92S circuitry into an ultrasonic signal. When liquid is present in the gap, the receive crystal is able to sense the ultrasonic signal from the transmit crystal and convert it back to an electrical signal. This signal is sent to the electronics to indicate the presence of liquid in the transducer gap. When there is no liquid present, the ultrasonic signal is attenuated, and the receive crystal is not able to sense the sound waves from the transmit crystal.

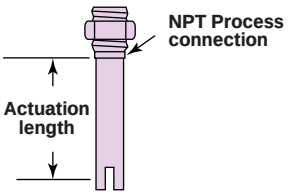


Ultrasonic signal transmission across transducer gap

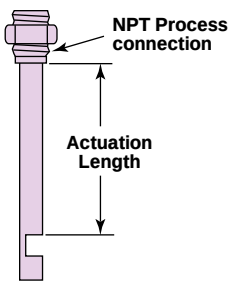
TRANSDUCER GAP STYLE

Two different transducer gap styles are used with the Trident Level Switches. The 91S Single Point Level Switch uses a tip sensitive gap style for 316 stainless steel transducers, and a side gap for Hastelloy C and Monel transducers.

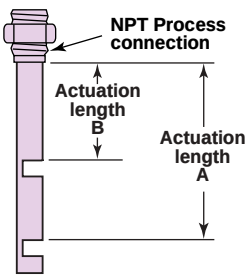
The 92S Dual Point Level Switch uses two side gaps for all materials.



Trident 91S with tip sensitive 316 stainless steel transducer



Trident 91S with side gap Monel or Hastelloy C transducer

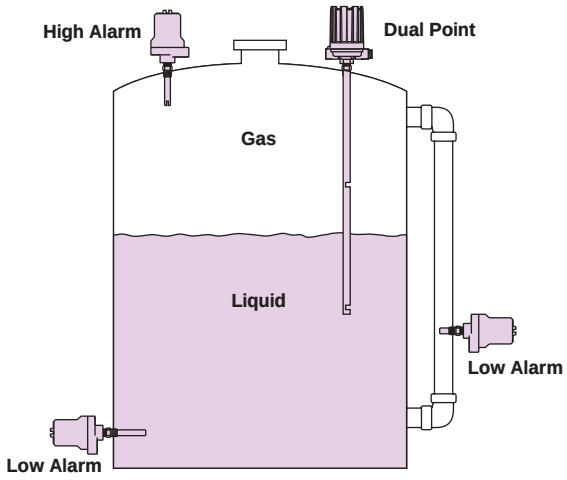


Trident 92S dual gap all materials

TYPICAL APPLICATIONS

Trident switches may be used for high or low level alarm, as well as for pump protection. The 92S dual gap unit can also be set up to control pumps in an auto fill or auto empty mode.

The single point 91S can be mounted vertically or horizontally in vessels, bridles, or pipes. The dual gap 92S is always top mounted.



SELF-TEST CAPABILITIES

Ultrasonic gap switches are commonly used as high or high-high and low or low-low point liquid level devices. Many times the device is used as the last means of detecting whether the vessel will overflow and cause a spill, or empty out and possibly cavitate the pumps.

Since reliable level measurement is critical, it is desirable to have a method of periodically testing the level switch to ensure that it is functioning properly. The Trident 91S/92SS utilizes an advanced method of self-testing.

Self-testing on the Trident 91S/92S is performed both automatically and manually to provide the ultimate in reliability. The unique self-test includes verifying proper operation of the electronics and sensor and the bonding of the piezoelectric crystal to the sensor gap. This is accomplished without the use of an additional set of self-test crystals or electronics in the transducer. On four-wire units, malfunctions are indicated by a dedicated 10 amp SPDT relay. On two-wire units malfunctions are indicated by a field selectable 5 mA or 19 mA signal.

The automatic self-test is performed continuously, several times per second, and verifies proper operation of the entire switch, including the crystal bonds. The manual self-test may be accomplished by using a pushbutton on the PC board or, remotely, by wiring an external pushbutton to a terminal block provided on the unit.

The Trident 91S/92S is the only ultrasonic gap switch on the market that provides both continuous, automatic self-test, and remote manual self-test capabilities.

ADJUSTABLE TIME DELAY

The Trident 91S/92S has a time delay feature to compensate for splashing or turbulence of the process fluid. The delay is adjustable from .5 to 30 seconds to accommodate a wide variety of liquid level application conditions. This delay is field selectable to occur on rising and/or falling liquid level conditions. This provides more flexibility to deal with agitation and turbulence than any other ultrasonic gap switch.

TRIDENT 92S DUAL GAP SYNCHRONIZATION

The 92S Dual Point Level Switch has an ultrasonic pulse synchronization feature. This eliminates signal cross talk between the upper and lower transducer gaps, and provides a more reliable level measurement.

ELECTRICAL SPECIFICATIONS

MODEL 91S/92S WITH CURRENT SHIFT OUTPUT

Supply voltage		10-35 VDC
Current loop loads		650 ohms with 24 VDC power source
		1200 ohms with 35 VDC power source
Analog output	Process:	8 mA (dry) or 16 mA (wet)
	Malfunction:	5 mA or 19 mA for fault conditions
Self-test	Continuous:	Verifies operation of electronics, transducer, and crystal bonding
	Manual:	Local pushbutton to force a malfunction condition
Time delay		Variable 0.5–30 seconds on rising and/or falling level
Fail-safe		Field selectable for high or low level
Repeatability		±0.078" (1.98 mm)
Power consumption		1 watt maximum
Electronics temperature		-40° to +160° F (-40° to +71° C)
Transducer temperature		-40° to +325° F (-40° to +163° C)
Pressure (operational)		1500 psig @ -40° to +325° F
		(103 bar @ -40° to +163° C)

ELECTRICAL SPECIFICATIONS

MODEL 91S/92S WITH RELAY OUTPUT

Supply voltage		12, 24, or 48 VDC (±10%)
		120 or 240 VAC (+10%/-15%), 50/60 Hz
Relay Outputs	91S:	One process relay and one malfunction relay
	92S:	Two process relays and one malfunction relay
Relay Ratings	Process:	DPDT with gold flash contacts, 10 amps @ 120 VAC, 240 VAC, 10 amps @ 28 VDC
	Malfunction:	SPDT with gold flash contacts, 10 amps @ 120 VAC, 240 VAC, 10 amps @ 30 VDC
Self-test	Continuous:	Verifies operation of electronics, transducer, and crystal bonding
	Manual:	Local or remote pushbutton to force a malfunction condition
Time delay		Variable 0.5–30 seconds on rising and/or falling level
Fail safe		Field selectable for high or low level
Repeatability		±0.078" (1.98 mm)
Power consumption		2.50 VA nominal
Electronics temp.		-40° to +160° F (-40° to +71° C)
Transducer temp.		-40° to +325° F (-40° to +163° C)
Pressure (operational)		1500 psig @ -40° to +325° F
		(103 bar @ -40° to -163° C)

AGENCY APPROVALS

AGENCY	MODEL APPROVED	APPROVAL CATEGORY	APPROVAL CLASSES
FM	9XS-X1XX-E1X 9XS-X1XX-F1X 9XS-X1XX-Y1X with transducer 9XX-XXX1-XXX	Explosion Proof	Class I, II, III, Div. 1; Groups C, D, E, F, & G NEMA 4X, IP65
	9XS-X1XX-71X with transducer 9XX-XXX1-XXX	Explosion Proof	Class I, II, III, Div. 1; Groups B, C, D, E, F, & G NEMA 4X, IP65
	9XS-X1XX-E1X 9XS-X1XX-F1X 9XS-X1XX-Y1X 9XS-X1XX-71X with transducer 9XX-XXX1-XXX	Non-Incendive	Class I, II, III, Div. 2; Groups A, B, C, D, F, & G NEMA 4X, IP65
CSA	9XS-X1XX-E1X 9XS-X1XX-F1X 9XS-X1XX-Y1X 9XS-X1XX-711 with transducer 9XX-XXX1-XXX	Explosion Proof	Class I, II, III, Div. 1; Groups C, D, E, F, & G Type 4X
	9XS-X1XX-710 with transducer 9XX-XXX1-XXX	Explosion Proof	Class I, II, III, Div. 1; Groups B, C, D, E, F, & G Type 4X
	9XS-X1XX-E1X 9XS-X1XX-F1X 9XS-X1XX-Y1X 9XS-X1XX-71X with transducer 9XX-XXX1-XXX	Non-Incendive	Class I, II, III, Div. 2; Groups A, B, C, D, F, & G Type 4X
CENELEC	91S-X1XX-V1X 91S-X1XX-W1X with transducer 9X1-XXX1-XXX and 92S-X1XX-B1X 92S-X1XX-N1X with transducer 9X2-XXX1-XXX	Flame Proof	EEx d II C T6

CE These units have been tested to EN 50081-2 and EN 50082-2 and are in compliance with the EMC Directive 89/336/EEC.

MODEL NUMBER

Models available for quick shipment, usually within one week after factory receipt of a purchase order, through the Expedite Ship Plan (ESP)

BASIC MODEL NUMBER

91S	Single point electronics

OUTPUT VOLTAGE

A1A	10 amp DPDT relay (available with Housing code F, 7, V, or W)
T1W	8 or 16 mA current shift (available with Input Power code 2 and Housing code E, Y, or 7)

INPUT POWER

0	120 VAC
1	240 VAC
2	24 VDC
3	12 VDC
5	48 VDC

HOUSING

F	FM and CSA, aluminum, ¾" NPT dual conduit
E	FM and CSA, aluminum, ¾" NPT single conduit
Y	FM and CSA, 316 stainless steel, ¾" NPT single conduit
7	FM and CSA, aluminum, 1" NPT dual conduit
V	CENELEC, aluminum, ¾" NPT dual conduit
W	CENELEC, aluminum, M20 x 1.5 dual conduit

MOUNTING

0	Integral
1	Remote (connecting cable required refer to page 10)

9	1	S	—					—		1	

91S TRANSDUCER

MODEL NUMBER

MATERIAL OF CONSTRUCTION & UNIT OF MEASURE ①

B	316 stainless steel, length in inches
D	316 stainless steel, length in centimeters
E	Monel or Hastelloy C, length in inches
F	Monel or Hastelloy C, length in centimeters

① 316 stainless steel transducers have tip sensitive gaps as shown on page 2.
Monel and Hastelloy C transducers have side gaps as shown on page 2.

PROCESS CONNECTION

1	¾" NPT
2	1" NPT
3	1½" sanitary flange (316 stainless steel only)
4	2" sanitary flange (316 stainless steel only)
B	1" 150 lb. flange
C	1½" 150 lb. flange
D	2" 150 lb. flange
E	1" 300 lb. flange
F	1½" 300 lb. flange
G	2" 300 lb. flange
H	1" 600 lb. flange
J	2" 600 lb. flange

TRANSDUCER MATERIAL

22	316 stainless steel
HC	Hastelloy C
MM	Monel

ACTUATION LENGTH (unit of measure specified in second digit)

1" to 130" in 1" increments 1" minimum for NPT process connections 2" minimum for flanged process connections Example: 4 inches = 004
Available English ESP lengths: 1", 2", 4", 6", 12"
2.5 cm to 330 cm in 1 cm increments 2.5 cm minimum for NPT process connections 5 cm minimum for flanged process connections Example: 6 centimeters = 006
Available metric ESP lengths: 3, 5, 10, 30 cm

9		1	—				1	—			

MODEL NUMBER

BASIC MODEL NUMBER

92S	Dual point electronics

OUTPUT VOLTAGE

A1A	10 amp DPDT relay (available with Housing code 7, B, or N)
T1W	8 or 16 mA current shift (available with Input Power code 2 and Housing code E, Y, 7, B, or N)

INPUT POWER

0	120 VAC
1	240 VAC
2	24 VDC
3	12 VDC
5	48 VDC

HOUSING

7	FM and CSA, Group B, aluminum, 1" NPT dual conduit
E	FM and CSA, aluminum, ¾" NPT single conduit
Y	FM and CSA, 316 stainless steel, ¾" NPT single conduit
B	CENELEC, aluminum, M20 x 1.5 dual conduit
N	CENELEC, aluminum, 1" NPT dual conduit

MOUNTING

0	Integral
1	Remote (connecting cable required refer to page 10)

9	2	S	—					—		1	

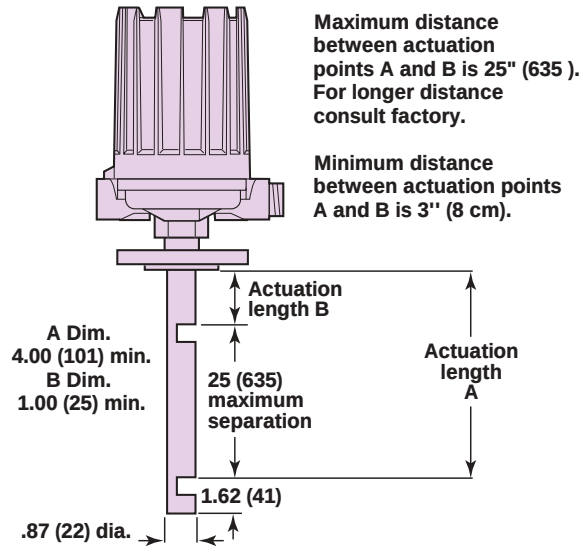


Figure 1

MODEL NUMBER

UNIT OF MEASURE ①

B	Length in inches
D	Length in centimeters

① All transducers have dual side gaps as shown on page 2.

PROCESS CONNECTION

1	¾" NPT
2	1" NPT
B	1" 150 lb. flange
C	1 ½" 150 lb. flange
D	2" 150 lb. flange
E	1" 300 lb. flange
F	1 ½" 300 lb. flange
G	2" 300 lb. flange
H	1" 600 lb. flange
J	2" 600 lb. flange

TRANSDUCER MATERIAL

22	316 stainless steel
HC	Hastelloy C
MM	Monel

Important: Use the "A" dimension from Figure 1 on page 8 as the actuation length code. The "B" dimension from Figure 1 must also be specified.

Example: For a 92S with an "A" dimension of 18" and a "B" dimension of 7", specify actuation length code 018. If the gaps are more than 25" apart and/or fractional in length, consult factory.

For a 92S with an "A" dimension of 30 cm and a "B" dimension of 15 cm, specify actuation length code 030. If the gaps are more than 64 cm apart and/or fractional in length, consult factory.

ACTUATION LENGTH (unit of measure specified in second digit)

4" to 130" in 1" increments 4" minimum for NPT process connections 5" minimum for flanged process connections Example: 4 inches = 004
10 cm to 330 cm in 1 cm increments 13 cm minimum for NPT process connections 14 cm minimum for flanged process connections Example: 10 centimeters = 010

9		2	—				1	—			

CONNECTING CABLE

MODEL NUMBER

CABLE TYPE

A1	RG 178 for one (1) set point, 1 to 50 feet (0.3 to 15 meters)
B1	RG 58 for one (1) set point, 51 to 300 feet (15 to 90 meters)
A2	RG 178 for two (2) set points, 1 to 50 feet (0.3 to 15 meters)
B2	RG 58 for two (2) set points, 51 to 300 feet (15 to 90 meters)

CABLE LENGTH

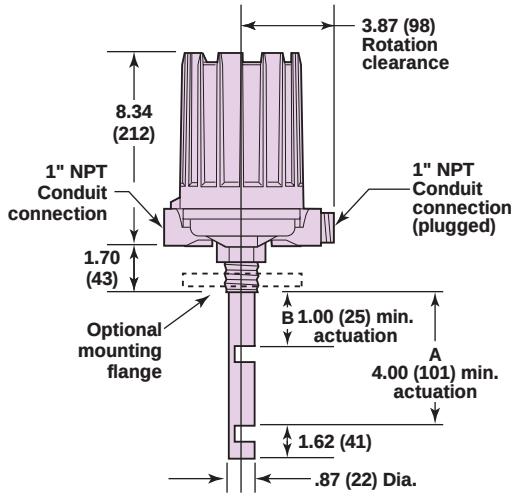
Length of cable from remote electronics to transducer in feet, maximum length 300 feet (90 meters)

Example: 12 feet = 012

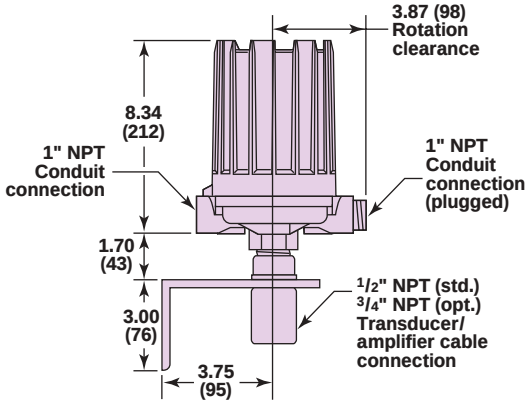
3	7	0	—	0	0			—			

DIMENSIONAL SPECIFICATIONS

INCHES (mm)



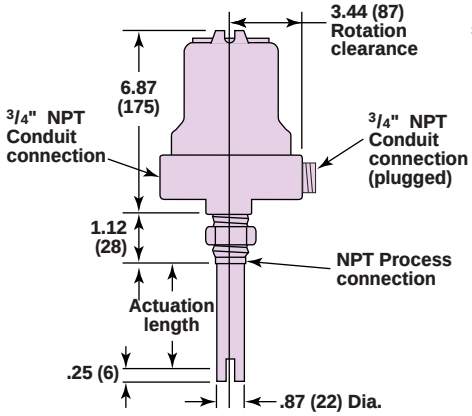
Integral Group B NEMA 4X/7/9 Housing (Models 9XS-XXXX-710, 9XS-XXXX-B10, and 9XS-XXXX-N10)



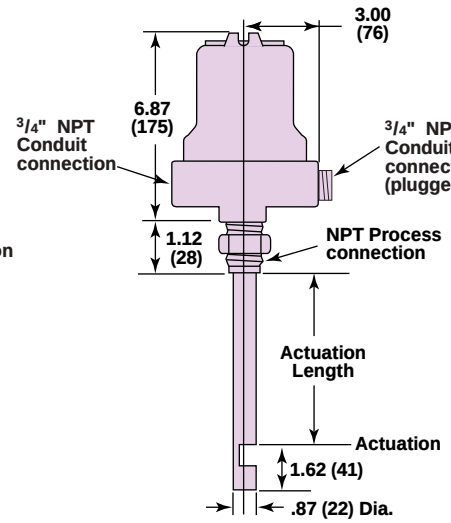
Remote Group B, NEMA 4X/7/9 Housing (Models 9XS-XXXX-711, 9XS-XXXX-B11, and 9XS-XXXX-N11)

DIMENSIONAL SPECIFICATIONS

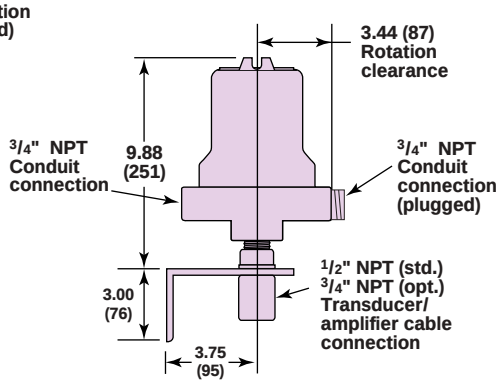
INCHES (mm)



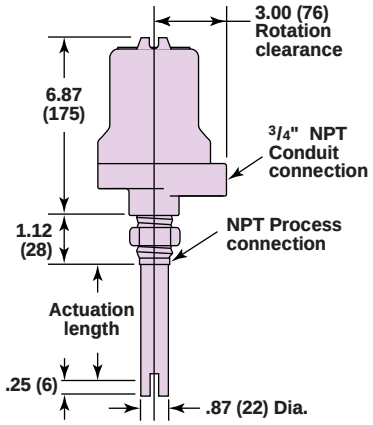
Integral NEMA 4X/7/9 Housing
(Model 91S-XXXX-F10
with tip sensitive 316 SS transducer)



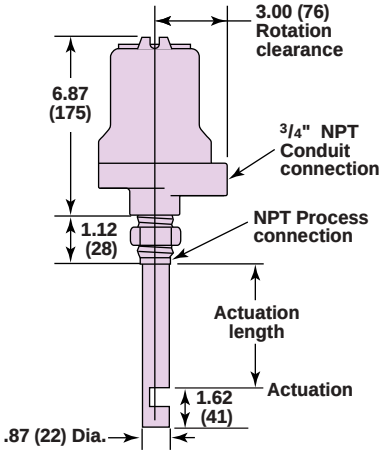
Integral NEMA 4X/7/9 Housing
(Model 91S-XXXX-F10 with side gap
Monel or Hastelloy C transducers)



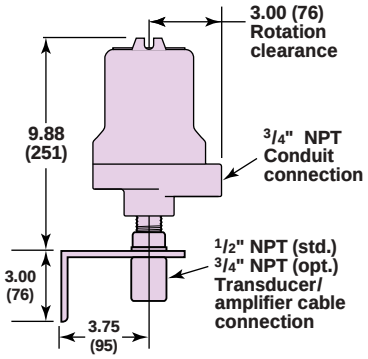
Remote NEMA 4X/7/9 Housing
(Model 91S-XXXX-F11)



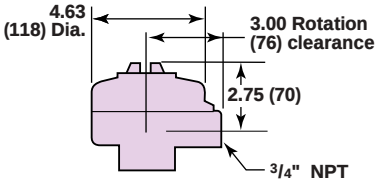
Integral NEMA 4X/7/9 Housing
(Model 91S-XXXX-E10
with tip sensitive 316 SS transducer)



Integral NEMA 4X/7/9 Housing
(Model 91S-XXXX-E10 with side
gap
Monel or Hastelloy C transducers)



Remote NEMA 4X/7/9 Housing
(Model 91S-XXXX-E11)



Remote Transducer Housing

QUALITY

MAGNETROL
REGISTERED TO
ISO 9001
Your Assurance of
Quality and Service

The quality assurance system in place at Magnetrol guarantees the highest level of quality throughout the company. Magnetrol is committed to providing full customer satisfaction both in quality products and quality service.

Magnetrol's quality assurance system is registered to ISO 9001 affirming its commitment to known international quality standards providing the strongest assurance of product and service quality available.

ESP

Expedite
Ship
Plan

Several Echotel Trident 91S units are available for quick shipment, usually within one week after factory receipt of a purchase order, through the Expedite Ship Plan (ESP).

To take advantage of ESP, simply match the color coded model number codes (standard dimensions apply).

ESP service may not apply to orders of ten units or more. Contact your local representative for lead times on larger volume orders, as well as other products and options.

WARRANTY

All Magnetrol electronic level and flow controls are warranted free of defects in materials or workmanship for one full year from the date of original factory shipment.

If returned within the warranty period; and, upon factory inspection of the control, the cause of the claim is determined to be covered under the warranty; then, Magnetrol will repair or replace the control at no cost to the purchaser (or owner) other than transportation.

Magnetrol shall not be liable for misapplication, labor claims, direct or consequential damage or expense arising from the installation or use of equipment. There are no other warranties expressed or implied, except special written warranties covering some Magnetrol products.

For additional information, see Instruction Manual 51-623.

Magnetrol

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