Echotel® Model 960 AS-Interface® Ultrasonic Level Switches

DESCRIPTION

Echotel Model 960 Ultrasonic Level Switches use pulsed signal technology for superior performance in difficult process conditions, and to provide excellent immunity from sources of electrical noise interference. Extensive self-testing of the electronics and transducer make this advanced switch suitable for a wide variety of critical level applications.

Model 960 Switches use Actuator-Sensor-Interface (AS-i) bus digital communications for high or low single point liquid level measurement. AS-i is a versatile, low cost cabling solution that is a digital replacement for traditional hard wiring of field devices. The AS-i bus system provides a digital serial interface with a single unshielded two-wire cable for power and data transfer.

The industrial version of the Model 960 has a cast aluminum electronics housing and a wide variety of threaded or flanged versions of the ultrasonic transducer. The sanitary version is offered in a deep drawn 304 stainless steel housing and transducers with a 20 R_a surface finish.

FEATURES

- Patent pending technology provides unsurpassed reliability and testing of electronics, transducer, piezoelectric crystals, and electromagnetic noise
- Adjustable time delay for turbulent aerated liquids
- Tip-sensitive transducer measures level within ¼" of the vessel bottom
- Pulsed signal technology provides superior performance in difficult process conditions
- AS-i output reduces cabling costs and simplifies installation

Model 960
(Industrial Design)

Model 960
(Sanitary Design)

APPLICATIONS

- High level alarm
- Overfill protection
- Low level alarm
- Pump protection
- Seal pot level
- Leak detection
- Compressor skids

INDUSTRIES

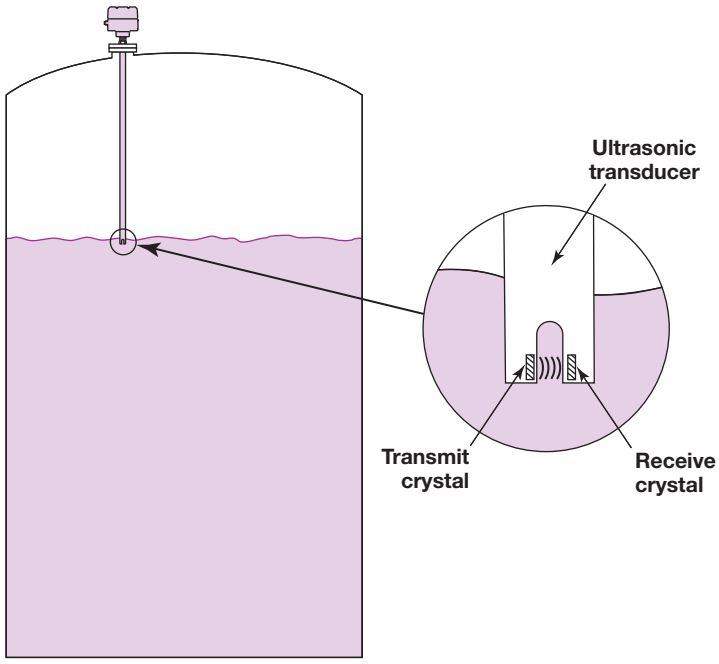
- Power
- Chemical
- Petrochemical
- Refining
- Food and beverage
- Pharmaceutical

TECHNOLOGY

BASIC OPERATION

Model 960 switches utilize ultrasonic energy to detect the presence or absence of liquid in a single point transducer. Ultrasonic contact level technology uses high-frequency sound waves that are easily transmitted across a transducer gap in the presence of a liquid media, but are attenuated when the gap is dry. Model 960 switches use 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 that vibrates at a given frequency when subjected to an applied voltage. The transmit crystal converts the applied voltage from the electronics into an ultrasonic signal. When liquid is present in the gap, the receive crystal senses the ultrasonic signal from the transmit crystal and converts 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 is not detected by the receive crystal.



Ultrasonic signal transmission across transducer gap

PULSED SIGNAL TECHNOLOGY

Challenging process conditions such as aeration, suspended solids, and high viscosities are easily handled with the pulsed signal technology utilized in the 960 switches. Pulsed signal circuitry drives the transmit piezoelectric crystal to produce powerful pulses of high-frequency ultrasonic energy. These ultrasonic pulses are readily transmitted through liquids, but are attenuated when the transducer gap is dry. This technology also provides excellent immunity from electromagnetic noise interference.

Pulsed signal technology makes the 960 units more reliable than older continuous wave ultrasonic switches. Unlike many tuning forks, pulsed signal ultrasonic switches do not need to be configured for different media densities, making these units the most universally applied level switches on the market today.

ADJUSTABLE TIME DELAY

Turbulence and splashing can cause some fixed time response switches to produce false level alarms. Model 960 switches overcome this difficulty with an adjustable time delay feature.

A potentiometer allows a ½ to 45-second delay to be set to disregard waves or splashes, and reliably detect the true liquid level.

ADVANCED SELF-TEST

Ultrasonic switches are often used as the last means of detecting whether a process vessel will overflow and cause a spill of potentially hazardous liquids, or empty out and possibly cavitate the pumps. In these critical applications it is desirable to have a method of periodically testing the ultrasonic switch.

Model 960 switches feature an advanced patent pending technology that not only tests the electronics, transducer, and piezoelectric crystals, but also tests for the presence of industrial sources of environmental noise. Should the switch detect any problems a malfunction output is generated to alarm the user, and a red LED is lit to indicate an alarm condition.

Self-test is performed automatically and continuously several times per second to verify proper operation of the ultrasonic switch. In addition, a push button is provided to initiate a manual self-test mode. Pressing this test button stops all transmit pulses, which simulates an electronics failure.

Taking diagnostics one step further is the unique noise self-test mode feature that is standard in all 960 switches. This tests for electromagnetic and acoustical noise that can influence many instrumentation technologies. If high levels of environmental noise are detected, the electronics reports a fault condition to alert the user of potential instrumentation reliability concerns.

AGENCY APPROVALS

AGENCY	APPROVED MODELS	PROTECTION METHOD	AREA CLASSIFICATION
FM FM APPROVED	960-58AX-030 or 960-58AX-031 with transducers 9X1-XXXA-XXX	Explosion Proof	Class I, Div. 1,Groups B,C, & D Class II, Div. 1, Groups E,F, & G Class III, Type 4X, IP 66, T6
	960-58AX-07X or 960-58AX-03X with transducers 9X1-XXXA-XXX	Non-Incendive	Class I, Div. 2,Groups A,B,C, & D Class II, Div. 2, Groups F & G Class III, Type 4X, IP 66, T4 IP67 for 304 Stainless Steel Housing
CSA	960-58AX-030 or 960-58AX-031 with transducers 9X1-XXXA-XXX	Explosion Proof	Class I, Div. 1,Groups B,C, & D Class II, Div. 1, Groups E,F, & G Class III, Type 4X, IP 66, T6
PENDING FEBRUARY 2007	960-58AX-07X or 960-58AX-03X with transducers 9X1-XXXA-XXX	Non-Incendive	Class I, Div. 2,Groups A,B,C, & D Class II, Div. 2, Groups E,F, & G Class III, Type 4X, IP 66, T4 IP67 for 304 Stainless Steel Housing
ATEX	960-58AX-0C0 or 960-58AX-0C1 with all metallic transducers*	Flame Proof	Ⓔx II 1/2 G, EEx d IIC T6
	960-58AX-0EX with all metallic transducers*	Non-Sparking	Ⓔx II 3 G, EEx n II T6
AS-i	These units have been tested to AS-Interface Specification **EN50295** and **IEC 62026-2**, and have met the demands of the AS-Interface Test Requirements. AS-Interface certificate **#76401**		

***Consult factory for model numbers**

CE These units have been tested to EN 61326 and are in compliance with the EMC Directive 89/336/EEC.

ELECTRONICS SPECIFICATIONS

MODEL 960 WITH AS-Interface

Supply Voltage		21 to 31 VDC
AS-i Version		V 3.0
AS-i Slave Type		A/B (Maximum of 62 nodes)
AS-i Slave Profile		S-0.A.E
AS-i Data Bits	Gap Condition:	D2 = 1 with a wet gap
		D2 = 0 with a dry gap
	Malfunction Status:	D3 = 1 during malfunction
		D3 = 0 in normal state
Connectable Load		EN50295 and IEC 62026-2
Power Consumption		Less than 1 watt

ENVIRONMENTAL SPECIFICATIONS

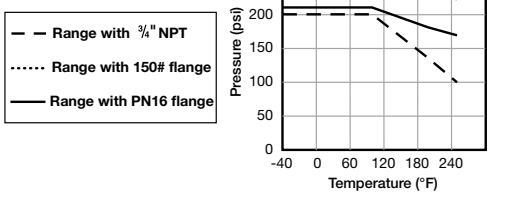
Ambient Temperature	Electronics:	-13° to +160° F (-25° to +71° C)
Storage Temperature	Electronics:	-40° to +160° F (-40° to +71° C)
Process Temperature	Transducer:	-40° to +325° F (-40° to +163° C)
Humidity		0-99%, Non-condensing

TRANSDUCER SPECIFICATIONS

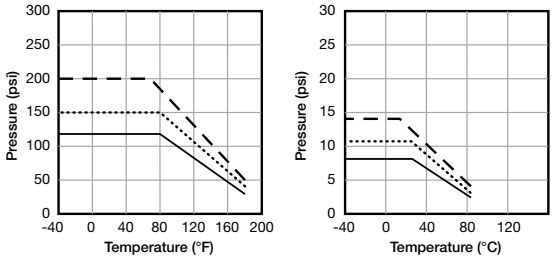
MODEL 9A1 SINGLE POINT

Transducer Material	Material Code (page 10)	Operating Temperature Range	Maximum Pressure	Actuation Length
316 Stainless Steel	A, S, N, K	-40° to +325° F (-40° to +163° C)	2000 psi (138 bar)	1" and 2" (3 and 5 cm)
316 Stainless Steel	A, S, N, K	-40° to +325° F (-40° to +163° C)	1500 psi (103 bar)	3" to 130" (6 to 330 cm)
Hastelloy® C-276	B	-40° to +325° F (-40° to +163° C)	2000 psi (138 bar)	1" and 2" (3 and 5 cm)
Hastelloy® C-276	B	-40° to +325° F (-40° to +163° C)	1500 psi (103 bar)	3" to 130" (6 to 330 cm)
Monel®	C	-40° to +325° F (-40° to +163° C)	1200 psi (83 bar)	1" to 130" (3 to 330 cm)
Kynar®	R	-40° to +250° F (-40° to +121° C)	see graph below	2" to 130" (5 to 330 cm)
CPVC	P	-40° to +180° F (-40° to +82° C)	see graph below	2" to 130" (5 to 330 cm)

Kynar Transducer Ratings



CPVC Transducer Ratings



PERFORMANCE SPECIFICATIONS

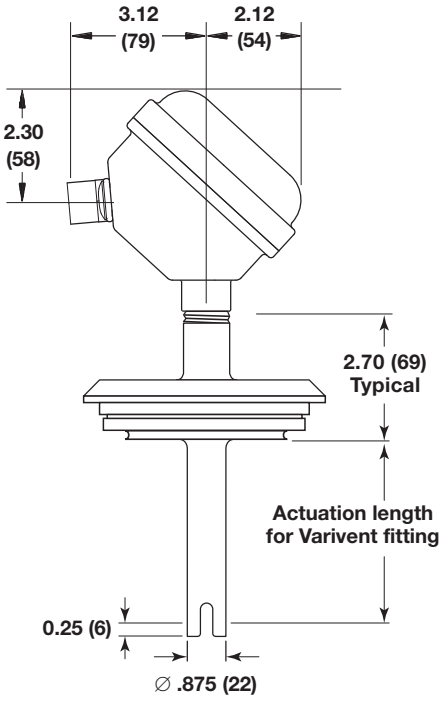
Repeatability		± 0.078" (± 2 mm)
Response Time		½ second typical
Time Delay		Variable 0.5 – 45 seconds on rising and falling levels
Self-Test	Automatic:	Continuously verifies operation of electronics, transducer,
		piezoelectric crystals, and electrical noise
	Manual:	Push button verifies operation of electronics, transducer,
		and piezoelectric crystals
Shock Class		ANSI/ISA-S71.03 Class SA1
Vibration Class		ANSI/ISA-S71.03 Class VC2
Electromagnetic Compatibility		Meets CE requirements EN 61326

PHYSICAL SPECIFICATIONS

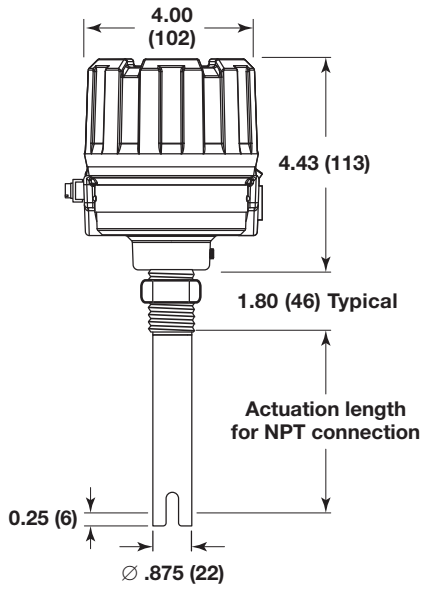
Housing Material		Cast aluminum A356-T6, or deep drawn 304 stainless steel
Cable Entry	Cast Aluminum:	Dual ¾" NPT, or M20
	304 Stainless Steel:	Dual ½" NPT, or M20

DIMENSIONAL SPECIFICATIONS

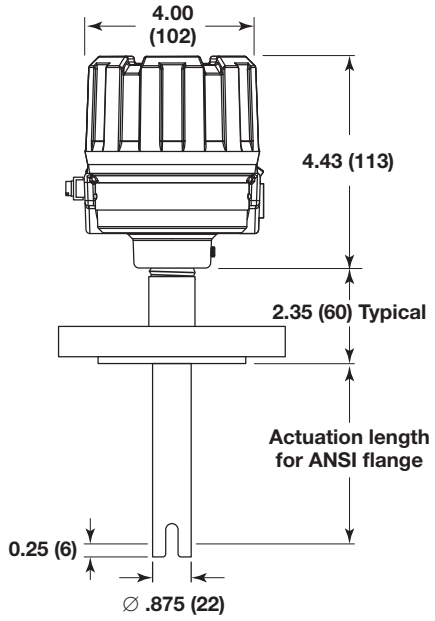
INCHES (mm)



Model 960
with DN65 Varivent® Flange



Model 960
with NPT Connection



Model 960
with ANSI Flange

MODEL NUMBER

960 ELECTRONICS

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

960	Integral mount ultrasonic level switch

INPUT POWER

5	24 VDC loop powered

OUTPUT SIGNAL

8	Actuator-Sensor-Interface (AS-Interface)

SELF-TEST

A	Automatic & manual via push button

OPTIONS

0	None
1	Glass window in housing cover

MOUNTING

0	Integral

AGENCY APPROVAL

3	FM/CSA Explosion proof & Non-incendive (Available with 10th digit = 0 or 1)
7	FM/CSA Non-incendive & General Purpose (Available with 10th digit = 4 or 5)
C	ATEX II 1/2 G EEx d II C T6 Flame Proof (Available with 10th digit = 0 or 1)
E	ATEX EEx n II T6, Non-sparking (Available with 10th digit = 4 or 5)

HOUSING & CONDUIT CONNECTION

0	Cast aluminum with ¾" NPT dual conduit entries
1	Cast aluminum with M20 dual conduit entries
4	Deep drawn 304 stainless steel w/ ½" NPT dual conduit entries
5	Deep drawn 304 stainless steel w/M20 dual conduit entries

9	6	0	—	5	8	A		—	0		

MODEL NUMBER

960 SINGLE POINT TRANSDUCER

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

TRANSDUCER UNIT OF LENGTH

A	English (length in inches)
M	Metric (length in centimeters)

MATERIALS OF CONSTRUCTION

A	316/316L stainless steel
S	316/316L with 20 Ra sanitary finish (use only with Process Connection codes 3T, 4T, or VV)
B	Hastelloy C-276
C	Monel
R	Kynar (use only with Process Connection codes 11, 23, 33, 43, BA, CA, DA)
P	CPVC (use only with Process Connection codes 11, 23, 33, 43, BA, CA, DA)
N	316/316L stainless steel, NACE construction
K	316/316L stainless steel, ASME B31.1 &B31.3 construction

PROCESS CONNECTIONS

THREADED CONNECTIONS

11	¾" NPT
21	1" NPT
22	1" BSP (G1)

SANITARY CONNECTIONS

3T	1"/1½" Tri-Clamp® 16 AMP fitting
4T	2" Tri-Clamp® 16 AMP fitting
VV	DN65 – Varivent

ANSI RAISED FACE FLANGES

23	1" 150# ANSI RF flange
24	1" 300# ANSI RF flange
25	1" 600# ANSI RF flange
33	1½" 150# ANSI RF flange
34	1½" 300# ANSI RF flange
35	1½" 600# ANSI RF flange
43	2" 150# ANSI RF flange
44	2" 300# ANSI RF flange
45	2" 600# ANSI RF flange

EN/DIN FLANGES

BA	DN 25 PN 16 EN 1092-1 Type A
BB	DN 25 PN 25/40 EN 1092-1 Type A
BC	DN 25 PN 63/100 EN 1092-1 Type B2
CA	DN 40 PN 16 EN 1092-1 Type A
CB	DN 40 PN 25/40 EN 1092-1 Type A
CC	DN 40 PN 63/100 EN 1092-1 Type B2
DA	DN 50 PN 16 EN 1092-1 Type A
DB	DN 50 PN 25/40 EN 1092-1 Type A
DD	DN 50 PN 63 EN 1092-1 Type B2
DE	DN 50 PN 100 EN 1092-1 Type B2

ACTUATION LENGTH (unit of length specified in second digit)

1" to 130" in 1" increments
1" minimum for NPT process connections
2" minimum for BSP, sanitary, and flanged process connections
Example: 4 inches = 004

Available English ESP lengths: 1", 2", 4", 6", 8", 12"

3 cm to 330 cm in 1 cm increments
3 cm minimum for NPT process connections
5 cm minimum for BSP, sanitary, and flanged process connections
Example: 6 centimeters = 006

Available metric ESP lengths: 3, 5, 10, 30 cm

9		1				A			

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 Model 960 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 51-632.

Magnetrol®

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