Installation & Maintenance Instructions

MAGNETROL ECHOTEL

SIL Safety Manual for Echotel® Model 961/962

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ECHOTEL®

SIL Safety Manual for Echotel® Model 961/962

Ultrasonic Level Switches

Model 961

Model 962

This manual complements and is intended to be used with the *Magnetrol Echotel® Model 961/962 Ultrasonic Single and Dual Point Level Switches Installation and Operating Manual* (Bulletin 51-646).

Application

Echotel® Model 961/962 ultrasonic level switches utilize pulsed signal technology to detect high, low, or dual-point level in a broad range of liquid media applications. The advanced self-test technology provides reliability and continuous testing of electronics, transducer, piezoelectric crystals, and electromagnetic noise.

Benefits

The Echotel Model 961/962 ultrasonic level switches provide the following benefits:

- Single- or dual-point liquid level measurement
- Adjustable time-delay for turbulent aerated liquids
- Reliable liquid level measurement independent of changes in media density, conductivity, or temperature
- Two-wire mA current shift and relay output options
- Relay output or mA current shift with separate malfunction indication
- Integral or remote mount electronics
- Pulsed signal technology
- Extensive hazardous location certifications
- Suitable for Safety Integrity Level (SIL) 2 loops

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Echotel® Model 961/962 Ultrasonic Level Switches

Table of Contents

1.0 Introduction

1.1 Product Description

Echotel® Model 961 and 962 ultrasonic level switches utilize pulsed signal technology to detect high, low, or dual point level in a broad range of liquid media applications.

Model 961 is a single-point level switch. Model 962 is a dual-point switch used as a level controller or to control pumps in an auto-fill or auto-empty mode.

Both Model 961 and 962 switches are suitable for use in Safety Integrity Level (SIL) 2 loops.

1.2 Theory of Operation

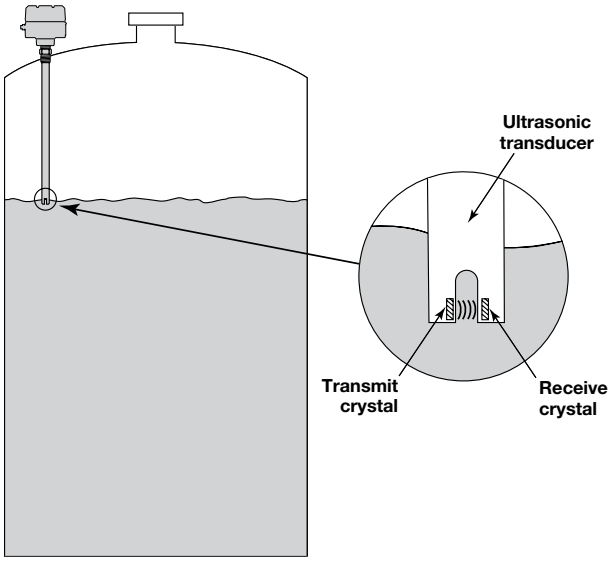

Figure 1
Ultrasonic Signal Transmission Across Transducer Gap

Model 961/962 switches utilize ultrasonic energy to detect the presence or absence of liquid in a single or dual point transducer. Ultrasonic contact level technology uses high-frequency sound waves that are easily transmitted across a transducer gap (see Figure 1) in the presence of a liquid media, but are attenuated when the gap is dry. Model 961/962 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.

1.2.1 Transducer Design

Magnetrol's advanced transducer design performs in difficult process conditions. Model 961 has a tip-sensitive transducer with an arched gap increasing its performance in aerated or foamy liquids. Model 962 has a tip-sensitive lower gap and flow-through upper gap permitting separations of 125 inches (318 cm).

1.2.2 Transducer Materials

A broad selection of transducer materials is available for the Model 961/962. Metallic transducers include 316 SS, Hastelloy® C, and Monel®. The 316 SS transducer has a NACE construction option for sour gas service, and can also be built per ASME B31.1 and B31.3 piping codes. Thermoplastic transducers include Kynar® and CPVC. These corrosion resistant plastic transducers feature a stiffening tube that runs the length of the transducer for extra rigidity. Kynar-faced 316 SS flange options are offered with the Kynar transducers.

1.3 Determining Safety Integrity Level (SIL)

The FMEDA report provides the failure rates and information for the PFDavg and Architecture Constraint.

The architecture constraint was determined using the 2H approach according to 7.4.4.3 of IEC 61508-2, 2010 edition. The Model 961/962 meets the hardware architecture constraints for up to SIL 2 at HFT=0 (or SIL 3 at HFT=1) when the failure rates listed in the FMEDA report are used.

Table 1
SIL vs. PFDavg

Safety Integrity Level (SIL)	Target Average Probability of Failure on Demand (PFDavg)
4	$\geq 10^{-5}$ to $<10^{-4}$
3	$\geq 10^{-4}$ to $<10^{-3}$
2	$\geq 10^{-3}$ to $<10^{-2}$
1	$\geq 10^{-2}$ to $<10^{-1}$

2.0 Applicable Models

This manual is applicable to the following models of the Echotel ultrasonic level switches with current shift output:

- Model 961 Single-Point Level Switches
- Model 962 Dual-Point Level Switches

3.0 Mean Time To Repair (MTTR)

SIL determinations are based on a number of factors including the Mean Time To Repair (MTTR). The analysis for the Echotel Model 961/962 ultrasonic level switch is based on a MTTR that is dependent on the end-user practices.

4.0 Supplementary Documentation

Refer to the following documents as supplements to this Echotel Model 961/962 SIL Safety Manual:

- *Echotel Model 961/962 Ultrasonic Level Switches Installation and Operating Manual* (Bulletin 51-646)
- Failure Modes, Effects and Diagnostics Analysis (FMEDA)
  exida Report No.: MAG 17/10-006 R001
  Version V2, Revision R0, August 17, 2018

NOTE: The Failure Modes, Effects, and Diagnostic Analysis (FMEDA) report can be found in the Downloads tab of the Echotel 961/962 site page on ametek-measurement.com.

5.0 Instructions

5.1 Systematic Limitations

The following application and environmental limitations must be observed to avoid systematic failures.

5.1.1 Application Locations

The Model 961/962 ultrasonic level switch should be located for easy access for service, configuration, and monitoring. There should be sufficient headroom to allow installation and removal of the unit. Special precautions should be made to prevent exposure to corrosive atmosphere, excessive vibration, shock, or physical damage.

5.1.2 Operating Temperature

The ambient temperature range for the 961/962 electronics is -40 to +160 °F (-40 to + 70 °C). The operating temperature for the transducer is dependent on transducer material.

Table 2
9A1/9M1 Transducer Operating Temperatures

316 Stainless Steel, Hastelloy C, and Monel	-40 to +325 °F (-40 to +163 °C)
Kynar	-40 to +250 °F (-40 to +121 °C)
CPVC	-40 to +180 °F (-40 to +82 °C)

5.1.3 Operating Pressure

Maximum operating pressures are dependent on the transducer material. Refer to Section 3.4 in the *Echotel Model 961/962 Ultrasonic Level Switches Installation and Operating Manual* (Bulletin 51-646).

5.2 Skill Level of Personnel

Personnel following the procedures of this safety manual should have technical expertise equal to or greater than that of a qualified instrument technician.

5.3 Necessary Tools

No special equipment or tools are required to install Echotel Model 961/962 ultrasonic level switch. The following items are recommended:

- Wrenches, flange gaskets, and flange bolting appropriate for process connection(s)
- Screwdrivers and assorted tools for making conduit and electrical connections
- Digital multimeter or DVM for troubleshooting

5.4 Installation

The Model 961 single point switch may be used for high or low level alarm, overfill protection, or seal pot level and pump protection. Model 961 can be mounted vertically or horizontally in vessels, bridles, or pipes.

The Model 962 dual point switch may be used to measure high/low, high/high, or low/low levels. It can be used as a level controller or to control pumps in an auto-fill or auto-empty mode. Model 962 must be top mounted.

Refer Figures 2–5 to the *Echotel Model 961/962 Ultrasonic Switches Installation and Operating Manual* (Bulletin 51.646) for the proper installation instructions.

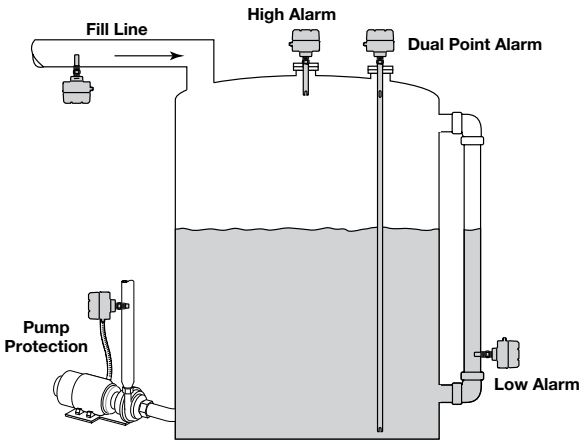

Figure 2
Typical Mounting Orientations

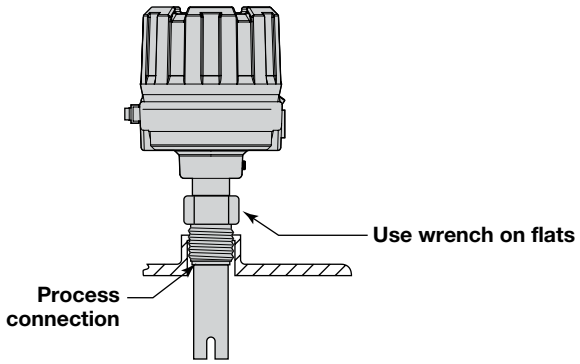

Figure 3
Typical Mounting Orientations

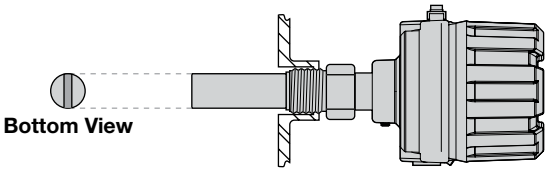

Figure 4
Horizontal Mounting

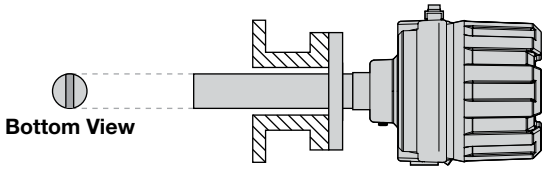

Figure 5
Nozzle Mounting

5.5 Configuration

Refer to Section 2.5 in the *Echotel Model 961/962 Ultrasonic Level Switches Installation and Operating Manual* (Bulletin 51-646) for complete configuration instructions.

5.5.1 Time-Delay Potentiometer

The time-delay potentiometer is used in applications where turbulence or splashing may cause false level alarm. The response time can be adjusted from factory-set standard of 0.5 seconds to a maximum of 10 seconds. The time-delay potentiometer is an option for both Model 961 and Model 962. The safety function must be designed so that it will operate correctly with the 961/962 set to maximum delay.

5.5.2 Level Test Push Button

The level test push button is used to manually test the DPDT process level relay and whatever is connected to the relay. Pressing this push button reverses the state of the DPDT relay from engaged to disengaged, or vise-versa. The level test push button is an option for both Model 961 and Model 962 in line-powered configuration only.

5.5.3 Malfunction Test Push Button

The malfunction test push button is used to manually test the SPDT malfunction relay and whatever is connected to the relay. Pressing and holding this push button for 2 seconds causes the SPDT relay to de-engage, indicating a fault condition. The malfunction test push button is an option for both the Model 961 and Model 962 in line-powered configuration only.

5.5.4 High/Low DIP Switch

The Hi/Lo DIP switch is used to select whether the switch is used as a high-level fail-safe or a low-level fail-safe switch. See Section 2.5 of the *Echotel Model 961/962 Ultrasonic Level Switches Installation and Operating Manual* (Bulletin 51-646) for high/low DIP switch configuration tables.

5.5.5 Independent/Joint DIP Switch

The I/J DIP switch is used to configure the SPDT malfunction relay to act independently or jointly with the DPDT process-level relay. In the factory-set I position, the SPDT and DPDT relays act independent of each other. In the J position, both the SPDT and DPDT relays will de-engage when a fault is detected. The I/J DIP switch is an option for the Model 961 in line-powered configuration only.

5.5.6 Loop Test Push Button

The loop test push button is used to manually test the loop current output. For Model 961, pressing the loop test push button reverses the output from 8 mA to 16 mA or from 16 mA to 8 mA. For Model 962, pressing the loop test push button changes the output from 8 mA to 12 mA, 12 mA to 16 mA, or 16 mA to 8 mA.

5.5.7 Fault Test Push Button

The fault test push button is used to manually change the mA values to that selected at the 22/3.6 DIP switch. Pressing this push button for two seconds simulates a circuit test failure. The output goes to the selected fault current of either 22 or 3.6 mA, and all three LEDs go dark. The fault test push button is an option on both Model 961 and Model 962.

5.5.8 22/3.6 DIP Switch

The 22/3.6 switch is used to produce a 22 mA or 3.6 mA output when the unit detects a fault. The 22/3.6 switch is on both the Model 961 and Model 962.

5.6 Site Acceptance Testing

Complete a site acceptance test to ensure proper operation after installation and configuration. Results of site acceptance testing must be recorded for future reference.

5.7 Maintenance

5.7.1 Diagnostics

Table 3
Diagnostic Push Buttons and LED Indications

Electronics Version	Push Button	LED
961 with 5 amp relays	LEVEL TEST	FAULT
961 with current shift	LOOP TEST	FAULT
962 with 5 amp relays	LEVEL TEST	FAULT
962 with current shift	LOOP TEST	16 mA

Worst-case internal fault detection time is 10 seconds.

5.7.2 Troubleshooting

Report all failures to the AMETEK LMS Technical Support Department.

Refer to the Echotel Model 961/962 Ultrasonic Level Switches Installation and Operating Manual (Bulletin 51-646) for troubleshooting device errors.

- As there are no moving parts in this device, the only maintenance required is the SIL Proof Test.
- Firmware can only be upgraded by factory personnel.

Table 4
Troubleshooting Faults and Corrective Actions

Flashes	Fault	Action
1 flash	Indicates a problem with either the transducer, piezoelectric crystals, or the interconnection wiring.	Check wiring inside the housing to make sure that all wires are secure in their respective terminal blocks. Make sure that all the terminal block screws are fully tightened. If all wires are secure then contact the factory. Replace transducer if needed. Refer to Section 3.8 of the *Installation and Operating Manual* for proper replacement part numbers.
2 flashes	Indicates a problem with one of the electronics boards.	Contact the factory for a replacement electronics module. Refer Section 3.8 of the *Installation and Operating Manual* for spare electronics modules part numbers.
3 flashes	Indicates excessive levels of environmental noise.	Check if any source may be causing the interference, such as VFD (variable frequency drive), radiated electrical interference (two-way radio transceiver) or mechanical vibration from nearby source.

6.0 Recurrent Function Tests

6.1 Proof Testing

6.1.1 Introduction

Following are the procedures utilized to detect Dangerous Undetected (DU) failures.

6.1.2 Interval

To maintain the appropriate Safety Integrity Level of a Safety Instrumented System, it is imperative that the entire system be tested at regular time intervals (shown as TI in the appropriate standards). The necessary time interval is determined by what is required to achieve the appropriate SIL level for PFDavg.

NOTE: It is the responsibility of the owner/operator to select the type of inspection and the time period for these tests.

6.1.3 Recording Results

Results of the Proof Test should be recorded for future reference.

6.1.4 Suggested Proof Test

Suggested proof tests are provided for the relay and loop versions of the 961/962.

Step	Proof Test – Echotel Model 961 Loop
Refer to the Model 961 installation and operation manual and the SIL Safety Manual (note the chart in section 2.5.2.4 of the I & O Manual).	
1	Bypass the PLC or take other action to avoid a false trip.
2	Inspect the Unit in detail outside and inside for physical damage or evidence of environmental or process leaks a.) Inspect the exterior of the Unit housing. If there is any evidence of physical damage that may impact the integrity of the housing and the environmental protection, the unit should be repaired or replaced. b.) Inspect the interior of the Unit. Any evidence of moisture, from process or environment, is an indication of housing damage, and the unit should be repaired or replaced.
3	Observe and record the settings of the HI/LOW and 22/3.6 DIP switches, the LED indicators, Loop Current and Sensor GAP condition (WET or DRY). If the FAULT LED is lighted, diagnose the fault and repair or replace the unit. Confirm proper operation of the unit: WET/DRY GAP condition; 8mA LED or 16mA LED is lighted; Loop current = 8mA ±1mA or 16mA ±1 mA. a.) Press LOOP TEST push button and confirm change; 8mA >> 16mA or 16mA >> 8mA. Release the button and unit returns to proper operation. b.) Change HI/LOW DIP switch position. Confirm both LED & Loop Current change state; 8mA >> 16mA or 16mA >> 8mA. Observe the time delay from change of DIP switch until LED and Loop current change. Delay is set by Time Delay Pot, so delay may be as long as 15 seconds. Change HI/LOW DIP switch back to original setting and confirm proper operation, after the delay. c.) Press FAULT TEST push button and confirm: FAULT LED lights; Loop current ≥22mA or ≤3.6mA based on 22/3.6 switch. Release button. d.) Change the 22/3.6 DIP switch position. Press FAULT TEST push button and confirm: FAULT LED lights; Loop current ≥22mA or ≤3.6mA as expected. Release push button. Return 22/3.6 switch to original setting e.) Adjust the Time Delay Pot to maximum delay, fully clock-wise up to 20 turns. Change HI/LOW DIP switch position and observe the time delay from change of DIP switch until LED and Loop current change. Confirm delay ≥10 seconds. Change HI/LOW DIP switch back to original setting and confirm ≥10 seconds delay. Adjust the Time Delay Pot to minimum delay, fully counter-clock-wise ~20 turns. Change HI/LOW DIP switch position and observe the time delay. Confirm delay ≤1 seconds. Change HI/LOW DIP switch back to original setting and confirm minimum delay.
4	When possible moving the process level will provide a more complete proof test. Confirm proper operation of the unit: WET/DRY GAP condition; 8mA LED or 16mA LED is lighted; Loop current = 8mA ±1mA or 16mA ±1 mA. a.) Move the process level and confirm the GAP condition has changed. Confirm proper operation of the unit: WET/DRY GAP condition; 8mA LED or 16mA LED is lighted; Loop current = 8mA ±1mA or 16mA ±1 mA. b.) Move the process level and confirm the GAP condition has returned to orginal state. Confirm proper operation of the unit: WET/DRY GAP condition; 8mA LED or 16mA LED is lighted; Loop current = 8mA ±1mA or 16mA ±1 mA. c.) If unit fails the tests of steps 4a or 4b proceed to step 5. d.) Adjust the Time Delay Pot to the original setting. Use HI/LOW DIP switch (as described in step 2e) to confirm that delay is returned to original setting. e.) Proceed to step 6.

continued on next page

Step	Proof Test – Echotel Model 961 Loop (continued)
5	If the unit under test fails to respond to process level changes remove the unit from the process and bench test. a.) Remove the unit from the process. Inspect the ultrasound transducer for evidence of damage or coating buildup. Fouling on the transducer surface may interfere with normal operation. If heavy fouling is evident, it is suggested to service the transducer more frequently. b.) Clean the ultrasonic transducer, especially in the area of the sensor GAP. c.) Perform a bench test per the steps of section 4. When possible it is best to use the actual process material, because materal properties affect the ultrasonic performance. Confirm proper unit operation: WET/DRY GAP condition; 8mA LED or 16mA LED is lighted; Loop current = 8mA ±1mA or 16mA ±1mA d.) If unit passes the tests of steps 5c, return to the process installation and repeat the tests of step 4. e.) If the unit fails re-test in the process, it must be replaced.
6	Proof test is complete. Restore loop to full operation.

Step	Proof Test – Echotel Model 961 Relay
Refer to the Model 961 installation and operation manual and the SIL Safety Manual (note the charts in section 2.5.1 of the I & O Manual).	
1	Bypass the PLC or take other action to avoid a false trip.
2	Inspect the Unit in detail outside and inside for physical damage or evidence of environmental or process leaks. a.) Inspect the exterior of the Unit housing. If there is any evidence of physical damage that may impact the integrity of the housing and the environmental protection, the unit should be repaired or replaced. b.) Inspect the interior of the Unit. Any evidence of moisture, from process or environment, is an indication of housing damage, and the unit should be repaired or replaced.
3	Observe and record the settings of the HI/LOW and INDEPENDENT/JOINT (I/J) DIP switches, the LED indicators, Relay contact conditions and Sensor GAP condition (WET or DRY). If the FAULT LED is lighted or the MALF LED is OFF, diagnose the fault and repair or replace the unit. Confirm proper operation of the unit: WET/DRY GAP condition and WET LED; LEVEL LED and relay operation. a.) Press LEVEL TEST push button and confirm Relay Contacts and LEVEL LED change state. Release the button and unit returns to proper operation based on the GAP condition and switch settings. b.) Change HI/LOW DIP switch position. Confirm LED & Relay change state. Observe the time delay from change of DIP switch until LED and Relay contacts change. Delay is set by Time Delay Pot, so delay may be as long as 10 seconds. Change HI/LOW DIP switch back to original setting and confirm proper operation, after the delay. c.) Press MALF TEST push button and confirm: FAULT LED lights, MALF and WET LEDs goes OFF and MALF Relay contacts go to the de-energized state. Release button. Confirm unit returns to normal operation d.) Adjust the Time Delay Pot to maximum delay, fully clock-wise up to 20 turns. Change HI/LOW DIP switch position and observe the time delay from change of DIP switch until LED and Relays change. Confirm delay ≥10 seconds. Change HI/LOW DIP switch back to original setting and confirm ≥10 seconds delay. Adjust the Time Delay Pot to minimum delay, fully counter-clockwise ~20 turns. Change HI/LOW DIP switch position and observe the time delay. Confirm delay ≤1 seconds. Change HI/LOW DIP switch back to original setting and confirm minimum delay.
4	When possible moving the process level will provide a more complete proof test. Confirm proper operation of the unit: WET/DRY GAP condition, WET LED and relay operation. a.) Move the process level and confirm the GAP condition has changed. Confirm proper operation of the unit: WET/DRY GAP condition and corresponding LED and Relay contacts state. b.) Return process level to original state. Confirm proper operation of the unit: WET/DRY GAP condition and corresponding LED and Relay contacts state. c.) If unit fails the tests of steps 4a or 4b proceed to step 5. d.) Adjust the Time Delay Pot to the original setting. Use HI/LOW DIP switch (as described in step 3b) to confirm that delay is returned to original setting. e.) Proceed to step 6.

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Step	Proof Test – Echotel Model 961 Relay (continued)
5	If the unit under test fails to respond to process level changes remove the unit from the process and bench test. a.) Remove the unit from the process. Inspect the ultrasound transducer for evidence of damage or coating buildup. Fouling on the transducer surface may interfere with normal operation. If heavy fouling is evident, it is suggested to service the transducer more frequently. b.) Clean the ultrasonic transducer, especially in the area of the sensor GAP. c.) Perform a bench test per the steps of section 4. When possible it is best to use the actual process material, because materal properties affect the ultrasonic performance. Confirm proper unit operation: WET/DRY GAP condition; LEDs and Relay contacts state. d.) If unit passes the tests of steps 5c, return to the process installation and repeat the tests of step 4. e.) If the unit fails re-test in the process, it must be replaced.
6	Proof test is complete. Restore loop to full operation.

Step	Proof Test – Echotel Model 962 Loop
Refer to the Model 962 installation and operation manual and the SIL Safety Manual (note the chart in section 2.5.4.4 of the I & O Manual).	
1	Bypass the PLC or take other action to avoid a false trip.
2	Inspect the Unit in detail outside and inside for physical damage or evidence of environmental or process leaks. a.) Inspect the exterior of the Unit housing. If there is any evidence of physical damage that may impact the integrity of the housing and the environmental protection, the unit should be repaired or replaced. b.) Inspect the interior of the Unit. Any evidence of moisture, from process or environment, is an indication of housing damage, and the unit should be repaired or replaced.
3	Observe and record the settings of the HI/LOW and 22/3.6 DIP switches, the LED indicators, Loop Current and Sensor GAP conditions (WET or DRY). If the FAULT condition is indicated by loop current and LED indicators all OFF, diagnose the fault and repair or replace the unit. Confirm proper operation of the unit: WET/DRY GAP conditions; 8mA LED, 12mA or 16mA LED is lighted; Loop current = 8mA ±1mA, 12mA ±1mA or 16mA ±1 mA. a.) Press LOOP TEST push button and confirm change; 8mA >> 12mA, 12mA >> 16mA or 16mA >> 8mA. Release the button and unit returns to proper operation. b.) Change HI/LOW DIP switch position. Confirm both LED & Loop Current change state; 8mA >> 16mA or 16mA >> 8mA. Note that 12mA will stay at 12mA with the switch change. Observe the time delay from change of DIP switch until LED and Loop current change. Delay is set by Time Delay Pot, so delay may be as long as 12 seconds. Press LOOP TEST push button and confirm change; 8mA >> 12mA, 12mA >> 16mA or 16mA >> 8mA. Release the button and unit returns to proper operation. Change HI/LOW DIP switch back to original setting and confirm proper operation, after the delay. c.) Press FAULT TEST push button and confirm: all LEDs go OFF; Loop current ≥22mA or ≤3.6mA based on 22/3.6 switch. Release button. d.) Change the 22/3.6 DIP switch position. Press FAULT TEST push button and confirm: all LEDs go OFF; Loop current ≥22mA or ≤3.6mA as expected. Release push button. Return 22/3.6 switch to original setting. e.) Adjust the Time Delay Pot to maximum delay, fully clock-wise up to 20 turns. Change HI/LOW DIP switch position and observe the time delay from change of DIP switch until LED and Loop current change. Confirm delay ≥10 seconds. Change HI/LOW DIP switch back to original setting and confirm ≥10 seconds delay. Adjust the Time Delay Pot to minimum delay, fully counter-clock-wise ~20 turns. Change HI/LOW DIP switch position and observe the time delay. Confirm delay ≤1 seconds. Change HI/LOW DIP switch back to original setting and confirm minimum delay.

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Step	Proof Test – Echotel Model 962 Loop (continued)
4	Move the process level to achieve three possible states: 1. both GAPs DRY, 2. one GAP DRY & one GAP WET, 3. Both GAPs WET. This test confirms operation with all GAP states. Confirm proper operation of the unit: WET/DRY GAP conditions; 8mA LED, 12mA or 16mA LED is lighted; Loop current = 8mA ±1mA, 12mA ±1mA or 16mA ±1mA. a.) Move the process level to achieve state 1. Both GAPS DRY. Confirm proper operation of the unit: WET/DRY GAP conditions; 8mA LED or 16mA LED is lighted; Loop current = 8mA ±1mA or 16mA ±1 mA. b.) Move the process level to achieve state 2. one GAP DRY and one GAP WET. Confirm proper operation of the unit: WET/DRY GAP conditions; 12mA LED is lighted; Loop current = 12mA ±1mA. c.) Move the process level to achieve state 3. Both GAPS WET. Confirm proper operation of the unit: WET/DRY GAP conditions; 8mA LED or 16mA LED is lighted; Loop current = 8mA ±1mA or 16mA ±1 mA. d.) If unit fails the tests of steps 4a 4b or 4c proceed to step 5. e.) Adjust the Time Delay Pot to the original setting. Use HI/LOW DIP switch (as described in step 2e) to confirm that delay is returned to original setting. f.) Proceed to step 6.
5	If the unit under test fails to respond to process level changes remove the unit from the process and bench test. a.) If the unit under test fails to respond to process level changes remove the unit from the process and bench test. b.) Clean the ultrasonic transducer, especially in the area of the sensor GAPs. c.) Perform a bench test per the steps of section 4. When possible it is best to use the actual process material, because materal properties affect the ultrasonic performance. Confirm proper unit operation: WET/DRY GAP conditions; 8mA LED, 12mA LED or 16mA LED is lighted; Loop current = 8mA ±1mA, 12ma ±1mA or 16mA ±1mA. d.) If unit passes the tests of steps 5c, return to the process installation and repeat the tests of step 4. e.) If the unit fails re-test in the process, it must be replaced.
6	Proof test is complete. Restore loop to full operation.

Step	Proof Test – Echotel Model 962 Relay
Refer to the Model 962 installation and operation manual and the SIL Safety Manual (note the charts in section 2.5.3 of the I & O Manual).	
1	Bypass the PLC or take other action to avoid a false trip.
2	Inspect the Unit in detail outside and inside for physical damage or evidence of environmental or process leaks. a.) Inspect the exterior of the Unit housing. If there is any evidence of physical damage that may impact the integrity of the housing and the environmental protection, the unit should be repaired or replaced. b.) Inspect the interior of the Unit. Any evidence of moisture, from process or environment, is an indication of housing damage, and the unit should be repaired or replaced.
3	Observe and record the settings of the HI/LOW and PUMP CONTROL/LEVEL CONTROL (PC/LC) DIP switches, the LED indicators, Relay contact conditions and Sensor GAP condition (WET or DRY). If the FAULT LED is lighted or the MALF LED is OFF, diagnose the fault and repair or replace the unit. Confirm proper operation of the unit: WET/DRY GAP condition for each GAP; UPPER LED and relay operation; and LOWER LED and relay operation. a.) Press LEVEL TEST push button and confirm both UPPER and LOWER Relay Contacts change state, and LEDs also change. Release the button and unit returns to proper operation based on the GAP condition and switch settings. b.) Change HI/LOW DIP switch position. Confirm LEDs & Relays change state. Observe the time delay from change of DIP switch until LEDs and Relay contacts change. Delay is set by Time Delay Pot, so delay may be as long as 10 seconds. Change HI/LOW DIP switch back to original setting and confirm proper operation, after the delay. c.) Press MALF TEST push button and confirm: FAULT LED lights, All other LEDs goes OFF, and all Relay contacts go to the de-energized state. Release button. Confirm unit returns to normal operation. d.) Adjust the Time Delay Pot to maximum delay, fully clock-wise up to 20 turns. Change HI/LOW DIP switch position and observe the time delay from change of DIP switch until LED and Relays change. Confirm delay ≥10 seconds. Change HI/LOW DIP switch back to original setting and confirm ≥10 seconds delay. Adjust the Time Delay Pot to minimum delay, fully counter-clock-wise ~20 turns. Change HI/LOW DIP switch position and observe the time delay. Confirm delay 1 seconds. Change HI/LOW DIP switch back to original setting and confirm minimum delay.
4	When possible moving the process level will provide a more complete proof test. Confirm proper operation of the unit: WET/DRY GAP condition for each GAP; UPPER LED and relay operation; and LOWER LED and relay operation. a.) Move the process level and confirm the GAP condition has changed. Confirm proper operation of the unit: WET/DRY GAP condition and corresponding LED and Relay contacts state. Continue to move process level in order to test three possible states; 1. Both GAPS DRY 2. One GAP WET 3. BOTH GAPS WET. b.) Change the PUMP CONTROL / LEVEL CONTROL (PC/LC) DIP switch position. Repeat the test of step 4a to test all three possible GAP states and confirm expected operation. Return the PC/LC DIP to the original position. c.) If unit fails the tests of steps 4a or 4b proceed to step 5. d.) Adjust the Time Delay Pot to the original setting. Use HI/LOW DIP switch (as described in step 2e) to confirm that delay is returned to original setting. e.) Proceed to step 6.

continued on next page

Step	Proof Test – Echotel Model 962 Relay (continued)
5	If the unit under test fails to respond to process level changes remove the unit from the process and bench test. a.) Remove the unit from the process. Inspect the ultrasound transducer for evidence of damage or coating buildup. Fouling on the transducer surface may interfere with normal operation. If heavy fouling is evident, it is suggested to service the transducer more frequently. b.) Clean the ultrasonic transducer, especially in the area of the sensor GAP. c.) Perform a bench test per the steps of section 4. When possible it is best to use the actual process material, because materal properties affect the ultrasonic performance. Confirm proper unit operation: WET/DRY GAP condition; LEDs and Relay contacts state. d.) If unit passes the tests of steps 5c, return to the process installation and repeat the tests of step 4. e.) If the unit fails re-test in the process, it must be replaced
6	Proof test is complete. Restore loop to full operation.

6.1.5 Proof Test Coverage

The Proof Test Coverages for the various product configurations is given in Table 5 and Table 6.

Table 5
Proof Test Coverage
961/962 Line Powered – Relay Output Version

Device	λ_{DU}PT (FIT)[6]	Proof Test Coverage
961 Dry is Safe Redundant	30	87%
961 Wet is Safe Redundant	50	78%
961 Dry is Safe Non-Redundant	55	93%
961 Wet is Safe Non-Redundant	76	84%
962 Dry is Safe	60	75%
962 Wet is Safe	96	72%

Table 6
Proof Test Coverage
961/962 Loop Powered – Current Shift Version

Device	λ_{DU}PT (FIT)[6]	Proof Test Coverage
961 Dry is Safe	10	20%
961 Wet is Safe	27	63%
962 Dry is Safe	10	70%
962 Wet is Safe	47	87%

7.0 Appendices

7.1 SIL Summary

The Echotel® Model 961/962 random capability information is summarized in Tables 6 and 7. FIT = Failure in Time (1×10E-9 failures per hour).

Table 7
Relay Output Version

Product	Model 961 Dry is Safe Non-redundant	Model 961 Wet is Safe Non-redundant	Model 961 Dry is Safe Redundant	Model 961 Wet is Safe Redundant	Model 962 Dry is Safe	Model 962 Wet is Safe
SIL Architechture Constraint (2H)	SIL 2 @ HFT=0 SIL 3 @ HFT=1	SIL 2 @ HFT=0 SIL 3 @ HFT=1	SIL 2 @ HFT=0 SIL 3 @ HFT=1	SIL 2 @ HFT=0 SIL 3 @ HFT=1	SIL 2 @ HFT=0 SIL 3 @ HFT=1	SIL 2 @ HFT=0 SIL 3 @ HFT=1
Device Type	B	B	B	B	B	B
λ_{sd}	263 FITS	15 FITS	263 FITS	15 FITS	451 FITS	24 FITS
λ_{su}	199 FITS	178 FITS	186 FITS	165 FITS	226 FITS	186 FITS
λ_{dd}	28 FITS	275 FITS	28 FITS	275 FITS	39 FITS	466 FITS
λ_{du}	55 FITS	76 FITS	30 FITS	50 FITS	60 FITS	96 FITS

Table 8
Loop Version

Product	Model 961 Dry is Safe	Model 961 Wet is Safe	Model 962 Dry is Safe	Model 962 Wet is Safe
SIL Architechture Constraint (2H)	SIL 2 @ HFT=0 SIL 3 @ HFT=1	SIL 2 @ HFT=0 SIL 3 @ HFT=1	SIL 2 @ HFT=0 SIL 3 @ HFT=1	SIL 2 @ HFT=0 SIL 3 @ HFT=1
Device Type	B	B	B	B
λ_{sd}	0 FITS	0 FITS	0 FITS	0 FITS
λ_{su}	38 FITS	20 FITS	64 FITS	26 FITS
λ_{dd}	234 FITS	234 FITS	426 FITS	426 FITS
λ_{du}	10 FITS	27 FITS	10 FITS	47 FITS

7.2 FMEDA Report

Failure Modes, Effects and Diagnostic Analysis

Project:
ECHOTEL 961/962 Ultrasonic Single and Dual Point Level Switches

Company:
Magnetrol International, Inc.
Aurora, IL
USA

Contract Number: Q17/10-006
Report No.: MAG 17/10-006 R001
Version V2, Revision R0, August 17, 2018
Rudolf Chalupa

Management Summary

This report summarizes the results of the hardware assessment in the form of a Failure Modes, Effects, and Diagnostic Analysis (FMEDA) of the ECHOTEL 961/962 Ultrasonic Single and Dual Point Level Switches, hardware and software revision per Section 2.5.1. A Failure Modes, Effects, and Diagnostic Analysis is one of the steps to be taken to achieve functional safety certification per IEC 61508 of a device. From the FMEDA, failure rates are determined. The FMEDA that is described in this report concerns only the hardware of the 961/962. For full functional safety certification purposes, all requirements of IEC 61508 must be considered.

ECHOTEL 961/962 Ultrasonic Single and Dual Point Level Switches utilize pulsed signal technology to detect high, low, or dual point level in a broad range of liquid media applications. Model 961 is a single point level switch. Model 962 is a dual point switch used as a level controller or to control pumps in an auto-fill or auto-empty mode.

Table 1 and Table 2 are an overview of the different versions that were considered in the FMEDA of the 961/962.

Table 1 Line Powered, Relay Output Version Overview

961 Dry Is Safe Redundant	961-2 or 961-7 Single Point Level Switch, Reported Dry Condition Is Safe, Redundant Relay Contacts
961 Wet Is Safe Redundant	961-2 or 961-7 Single Point Level Switch, Reported Wet Condition Is Safe, Redundant Relay Contacts
961 Dry Is Safe Non-redundant	961-2 or 961-7 Single Point Level Switch, Reported Dry Condition Is Safe, Non-redundant Relay Contacts
961 Wet Is Safe Non-redundant	961-2 or 961-7 Single Point Level Switch, Reported Wet Condition Is Safe, Non-redundant Relay Contacts
962 Dry Is Safe	962-2 or 962-7 Dual Point Level Switch, Reported Dry Condition Is Safe
962 Wet Is Safe	962-2 or 962-7 Dual Point Level Switch, Reported Wet Condition Is Safe

Table 2 Loop Powered, Current Shift Version Overview

961 Dry Is Safe	961-5 Single Point Level Switch, Reported Dry Condition Is Safe
961 Wet Is Safe	961-5 Single Point Level Switch, Reported Wet Condition Is Safe
962 Dry Is Safe	962-5 Dual Point Level Switch, Reported Dry Condition Is Safe
962 Wet Is Safe	962-5 Dual Point Level Switch, Reported Wet Condition Is Safe

The 961/962 is classified as a Type B[1] element according to IEC 61508, having a hardware fault tolerance of 0.

[1] Type B element: “Complex” element (using micro controllers or programmable logic); for details see 7.4.4.1.3 of IEC 61508-2, ed2, 2010.

The failure rate data used for this analysis meet the *exida* criteria for Route 2_H which is more stringent than IEC 61508. Therefore, the 961/962 meets the hardware architectural constraints for up to SIL 2 at HFT=0 (or SIL 3 @ HFT=1) when the listed failure rates are used.

Based on the assumptions listed in 4.3, the failure rates for the 961/962 are listed in section 4.4.

These failure rates are valid for the useful lifetime of the product, see Appendix A.

The failure rates listed in this report are based on over 250 billion-unit operating hours of process industry field failure data. The failure rate predictions reflect realistic failures and include site specific failures due to human events for the specified Site Safety Index (SSI), see section 4.2.2.

A user of the 961/962 can utilize these failure rates in a probabilistic model of a safety instrumented function (SIF) to determine suitability in part for safety instrumented system (SIS) usage in a particular safety integrity level (SIL).

7.3 Lifetime of Critical Components

According to Section 7.4.9.5 of IEC 61508-2, a useful lifetime, based on experience, should be determined and used to replace equipment before the end of useful life.

Although a constant failure rate is assumed by the exida FMEDA prediction method, this only applies provided that the useful lifetime* of components is not exceeded. Beyond their useful lifetime, the result of the probabilistic calculation method is likely optimistic, as the probability of failure significantly increases with time. The useful lifetime is highly dependent on the subsystem itself and its operating conditions.

Table 8 shows which components are contributing to the dangerous undetected failure rate and, therefore, to the PFDavg calculation and what their estimated useful lifetime is.

Table 9
Useful lifetime of components contributing to dangerous undetected failure rate

Component	Useful Life
Capacitor (electrolytic) — Aluminum electrolytic, non-solid electrolyte	Approximately 90,000 hours

It is the responsibility of the end user to maintain and operate the 961/962 per manufacturer's instructions. Furthermore, regular inspection should show that all components are clean and free from damage.

The limiting factors with regard to the useful lifetime of the system are the aluminum electrolytic capacitors. Therefore, the useful is predicted to be 10 years.

For high demand mode applications, the useful lifetime of the relays is limited by the number of cycles. The useful lifetime of the relay is > 100,000 full scale cycles or 8 to 10 years, whichever results in the shortest lifetime.

When plant/site experience indicates a shorter useful lifetime than indicated in this appendix, the number based on plant/site experience should be used.

* *Useful lifetime is a reliability engineering term that describes the operational time interval where the failure rate of a device is relatively constant. It is not a term which covers product obsolescence, warranty, or other commercial issues.*

References

- IEC 61508 Edition 2.0.2010 “Functional Safety of Electrical/Electronic/Programmable Electronic Safety Related Systems”
- ANSI/ISA-84.00.01-2004 Part 1 (IEC 61511-1Mod) “Functional Safety: Safety Instrumented Systems for the Process Industry Sector–Part 1 Hardware and Software Requirements”
- ANSI/ISA-84.00.01-2004 Part 2 (IEC 61511-2Mod) “Functional Safety: Safety Instrumented Systems for the Process Industry Sector–Part 2 Guidelines for the Application of ANSI/ISA84.00.01-2004 Part 1 (IEC 61511-1 Mod)–Informative”
- ANSI/ISA-84.00.01-2004 Part 3 (IEC 61511-3Mod) “Functional Safety: Safety Instrumented Systems for the Process Industry Sector–Part 3 Guidance for the Determination of the Required Safety Integrity Levels– Informative”
- ANSI/ISA-TR84.00.04 Part 1 (IEC 61511 Mod) “Guideline on the Implementation of ANSI/ISA-84.00.01-2004”

ASSURED QUALITY & SERVICE COST LESS

Service Policy

Owners of Magnetrol controls may request the return of a control or any part of a control for complete rebuilding or replacement. They will be rebuilt or replaced promptly. Controls returned under our service policy must be returned by Prepaid transportation. Magnetrol will repair or replace the control at no cost to the purchaser (or owner) other than transportation if:

1. Returned within the warranty period; and
2. The factory inspection finds the cause of the claim to be covered under the warranty.

If the trouble is the result of conditions beyond our control; or, is NOT covered by the warranty, there will be charges for labor and the parts required to rebuild or replace the equipment.

In some cases it may be expedient to ship replacement parts; or, in extreme cases a complete new control, to replace the original equipment before it is returned. If this is desired, notify the factory of both the model and serial numbers of the control to be replaced. In such cases, credit for the materials returned will be determined on the basis of the applicability of our warranty.

No claims for misapplication, labor, direct or consequential damage will be allowed.

Return Material Procedure

So that we may efficiently process any materials that are returned, it is essential that a “Return Material Authorization” (RMA) number be obtained from the factory, prior to the material’s return. This is available through a Magnetrol local representative or by contacting the factory. Please provide the following information:

1. Company Name
2. Description of Material
3. Serial Number
4. Reason for Return
5. Application

Any unit that was used in a process must be properly cleaned in accordance with OSHA standards, before it is returned to the factory.

A Material Safety Data Sheet (MSDS) must accompany material that was used in any media.

All shipments returned to the factory must be by prepaid transportation.

All replacements will be shipped F.O.B. factory.

MAGNETROL® / AMETEK®

705 Enterprise Street • Aurora, Illinois 60504-8149 USA
630.969.4000 • info.magnetrol@ametek.com • ametek-measurement.com

BULLETIN: 51-650.3
EFFECTIVE: March 2024
SUPERSEDES: February 2019

Installation & Maintenance Instructions

MAGNETROL ECHOTEL

Line Powered Model 961/962

Supplied by

247able.com

Call us on +44 (0)118 916 9420 | Email info@247able.com

ECHOTEL® 961/962
LINE POWERED

Installation and Operating Manual

Ultrasonic

Single and

Dual Point

Level Switches

Model 961

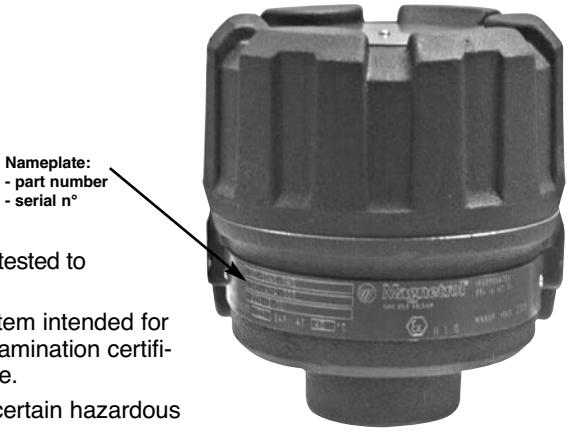
Model 962

MAGNETROL®

AMETEK®

UNPACKING

Unpack the instrument carefully. Make sure all components have been removed from the foam protection. Inspect all components for damage. Report any concealed damage to the carrier within 24 hours. Check the contents of the carton/crates against the packing slip and report any discrepancies to Magnetrol. Check the nameplate model number to be sure it agrees with the packing slip and purchase order. Check and record the serial number for future reference when ordering parts.



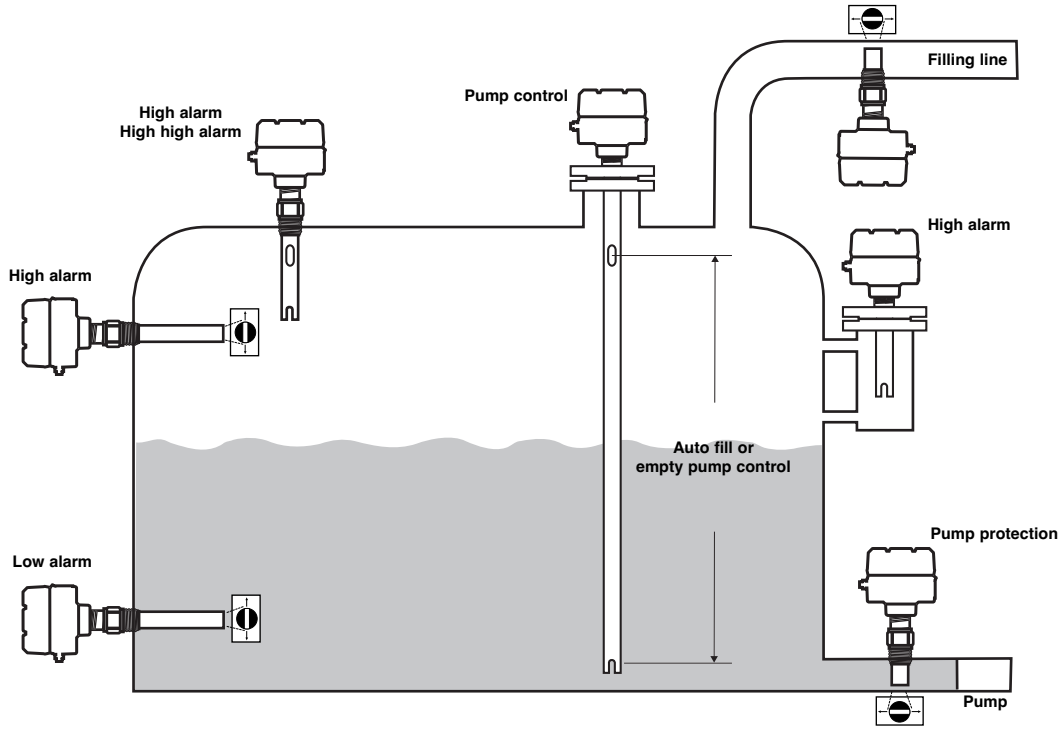
These units are in compliance with:

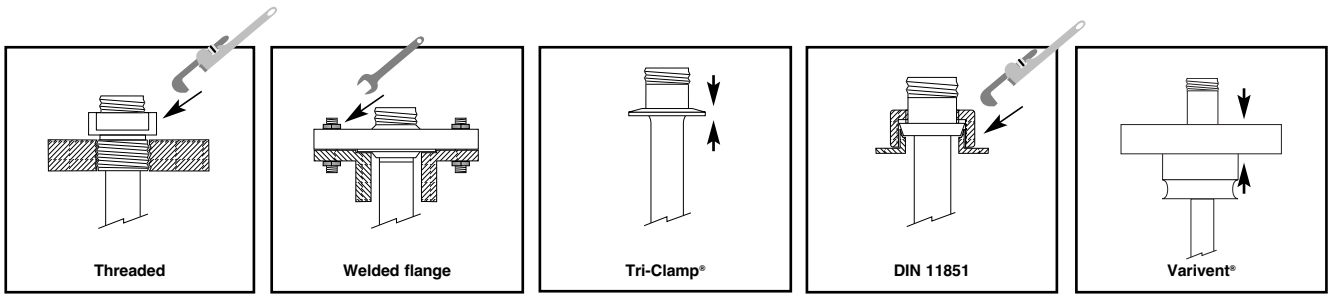
1. The EMC directive 2014/30/EU. The units have been tested to EN 61326: 1997 + A1 + A2.
2. Directive 2014/34/EU for equipment or protective system intended for use in potentially explosive atmospheres. EC-type examination certificate number FM19ATEX0204X - flameproof enclosure.
3. RoHS directive 2011/65/EU (restriction of the use of certain hazardous substances in electrical and electronic equipment).

SPECIAL CONDITIONS FOR ATEX USE

1. The enclosure contains aluminum and is considered to present a potential risk of ignition by impact or friction. Care must be taken during installation and use to prevent impact or friction.
2. To maintain the T6 temperature code care shall be taken to ensure the “Enclosure Temperature” does not exceed 70 °C.
3. The risk of electrostatic discharge shall be minimized at installation, clean non-conductive surfaces with moist cloth only.
4. Contact the original manufacturer for information in the dimensions of flameproof joints.
5. For installation with ambient temperature of 70 °C, refer to the manufacturer’s instructions for guidance on proper selection of conductors.
6. The ultrasonic probe is only for use with the Echotel ultrasonic switch.

MOUNTING

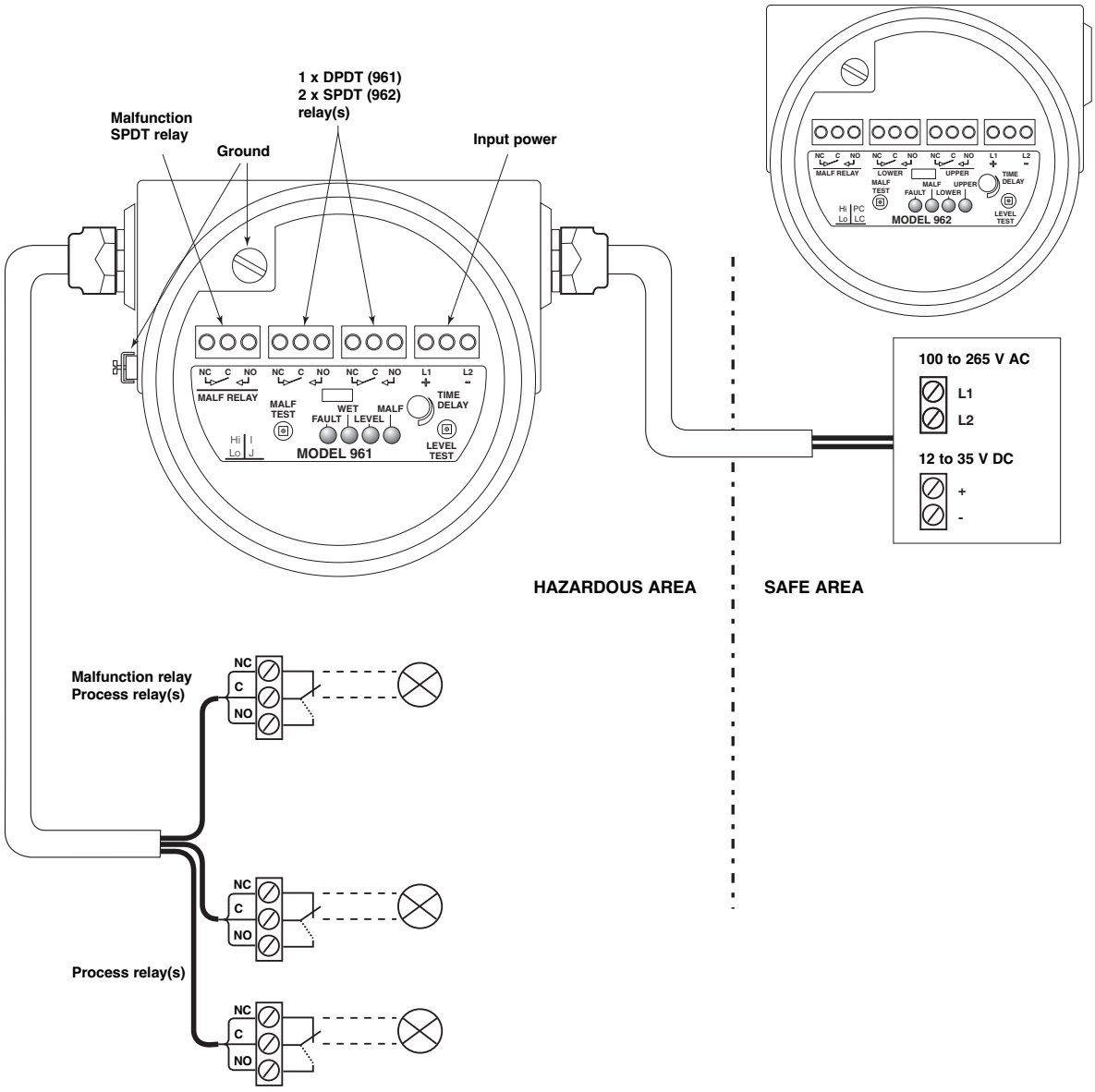




WIRING

Echotel® 961 electronics

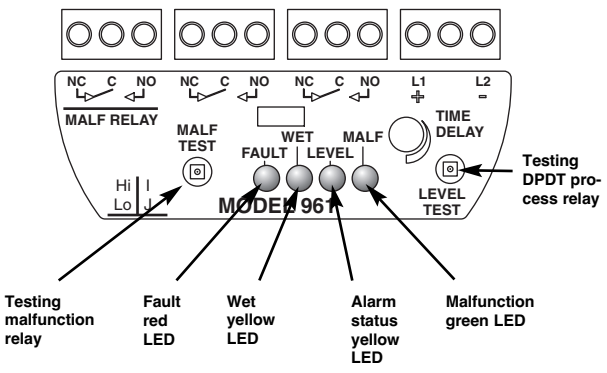
Echotel® 962 electronics



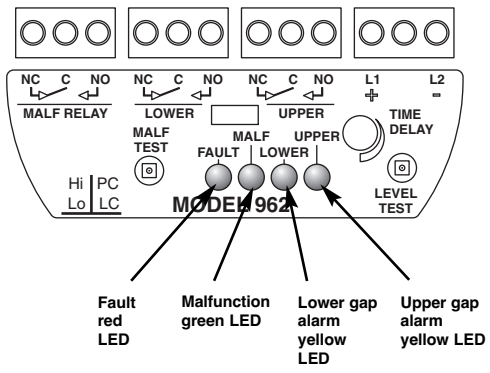
Important: Connect the unit to the ground for avoiding earth potential drifts. Use the green internal grounding screw

USER INTERFACE

Echotel® 961



Echotel® 962



Note: in normal operation «`Fault`» is OFF / «`MALF`» is ON
in malfunction condition: «`Fault`» is ON / «`MALF`» is OFF

SET UP AND FUNCTIONS

Set up

High – Low Level Failsafe selection:
In «Hi» position, the process relay will de-energize (report alarm) when the transducer is **wet.**
In «Lo» position, the process relay will de-energize (report alarm) when the transducer is **dry.**

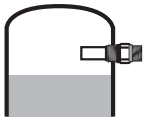
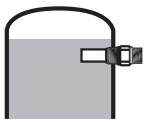
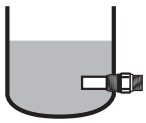
Fault selection:
The echotel 961 is equipped with a malfunction relay separate from the 5A DPDT process relay. The separate or joined operation of both relays can be selected :
I = in case of a malfunction, only the malfunction relay will de-energize. The process relay will only de-energize in case of a process alarm
J = in case of a malfunction, both the malfunction relay and the process relay will de-energize

The Echotel 962 is equipped with a malfunction relay separate from the two 5A SPDT process relays. In case of a malfunction, both the malfunction relay and the process relays will de-energize. The operation of the two process relays can be selected:
LC (level control) = the two relays operate independent and will be de-energized when the corresponding tranducer gap is immerged/dry (following Hi/Lo setting)
PC (pump control) = the two relays operate in a latched mode, allowing to perform an automatic fill or drain pump control function in between the 2 transducer gaps. Consult below tables for proper indication and function.

Time delay setting:
Turning the potentiometer clockwise will increase the time delay from 0,5 s to 10 s. Time delay is typically used where turbulence, boiling or splashing can cause false level alarms.

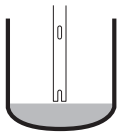
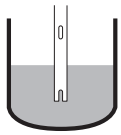
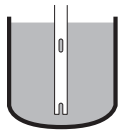
961 - Relay/ LED Indication:
When «WET» (wet LED): OFF = transducer gap is dry / ON = transducer gap is immerged
When «LEVEL» (level LED): ON = relay is energized / OFF = relay de-energized

Echotel 961: Relay/LED indication

Mode	Level	Process relay	« LEVEL» LED (relay - yellow)	« WET» LED (gap - yellow)	Error LED indication	
					Fault (red)	Malfunction (green)
«Hi» High level failsafe		Energized	ON	OFF	OFF = Normal operation ON = Malfunction See troubleshooting for malfunction identification	ON = Normal operation OFF = Malfunction See troubleshooting for malfunction identification
		De-energized	OFF	ON		
«Lo» Low level failsafe		Energized	ON	ON		
		De-energized	OFF	OFF		

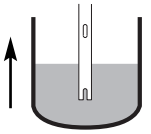
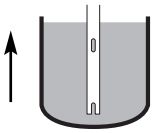
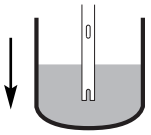
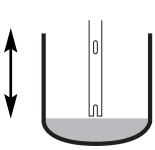
Echotel 962 as level control «LC»: Relay/LED indication

Relay # 1 = lower gap – Relay # 2 = upper gap

Level	Mode	Process relay	Lower LED	Upper LED	Error LED indication	
					Fault (red)	Malfunction (green)
	«Hi» High level failsafe	# 1 & 2: Energized	ON	ON	OFF = Normal operation ON = Malfunction See troubleshooting for malfunction identification	ON = Normal operation OFF = Malfunction See troubleshooting for malfunction identification
	«Lo» Low level failsafe	# 1 & 2: De-energized	OFF	OFF		
	«Hi» High level failsafe	# 1: De-energized # 2: Energized	OFF	ON		
	«Lo» Low level failsafe	# 1: Energized # 2: De-energized	ON	OFF		
	«Hi» High level failsafe	De-energized	OFF	OFF		
	«Lo» Low level failsafe	Energized	ON	ON		

Echotel 962 pump control «PC»: Relay/LED indication

High Level Failsafe (Hi) = auto empty mode
Low Level Failsafe (Lo) = auto fill mode

Level	Mode	Process relay	Lower LED	Upper LED	Error LED indication	
					Fault (red)	Malfunction (green)
	«Hi» High level failsafe	Energized	ON	ON	OFF = Normal operation ON = Malfunction See troubleshooting for malfunction identification	ON = Normal operation OFF = Malfunction See troubleshooting for malfunction identification
	«Lo» Low level failsafe	De-energized	OFF	OFF		
	«Hi» High level failsafe	De-energized	OFF	OFF		
	«Lo» Low level failsafe	Energized	ON	ON		
	«Hi» High level failsafe	De-energized	OFF	OFF		
	«Lo» Low level failsafe	Energized	ON	ON		
	«Hi» High level failsafe	Energized	ON	ON		
	«Lo» Low level failsafe	De-energized	OFF	OFF		

MAINTENANCE

Manual Testing

Level Test: (process relay(s)):
Pressing the “Level Test” pushbutton, will manually test the process relays and connected actuators/indicators. The level test forces the relay(s) to change from a de-energized to an energized status and vice versa. The LED’s will be ON/OFF corresponding (see tables in the configuration section). The time delay setting is not active during testing.

Malfunction Test (malfunction relay):
Pressing the “Malfunction Test” pushbutton for min 2 s, will manually test the malfunction relay and connected actuators/indicators. The malfunction test simulates a circuit failure and forces all relays to de-energize. The «MALF» LED will turn OFF and the «FAULT» LED ON. The time delay setting is not active during testing.

Troubleshooting

Problem	Action/Indication	Solution
No output signal	No LED’s are ON	Check wiring / input power Check for malfunction (962). See below
No change in output between wet gap / dry gap	Gap may be plugged by solids / dense foam	Clean the transducer
	Gap is out of reach of liquid	Check mounting section and relocate the unit or check blocking valves.
Chattering output	Excessive aeration / Turbulence	Introduce a time delay Check input power Relocate the switch If installed horizontally, make sure the 961 transducer gap is oriented in a vertical position as shown in the mounting section. This allows proper drainage from the gap, and prevents air bubbles from accumulating in the gap.
Fault LED is ON	A system fault has been detected	Check input power Check wiring between transducer and electronics or replace transducer.
	Press «LEVEL TEST» test pushbutton to identify the problem:	
	* --- * : 1 flash	Check wiring between transducer and electronics or replace transducer.
	** --- ** : 2 flashes	Replace electronics
	*** --- *** : 3 flashes	The unit senses excessive noise interference. Check shield connection or eliminate interference from a walkie-talkie, radio or other nearby source

REPLACEMENT PARTS

Replacing electronics/transducer

Echotel electronics can be removed in the field under process conditions. Follow below steps to exchange electronics/transducer:

Note: Adjust set up of the replacing electronics following the settings of the old electronics (see configuration section)

1. Disconnect power before removing the housing cover
2. Remove power/output wires (a)
3. (Skip step 3 if hygienic housing.) Click out the protection cap of the electronics (b)
4. Remove the 2 bracket screws and slide out electronics (c)
5. Remove the transducer wires (see Wiring section) (d)
6. Re-assemble following the same procedure in opposite way. Make sure that the tip on the bracket of the electronic block is seated properly in the corresponding recess in the housing base - (e)

Replacement parts

Partn°: ☐☐☐–☐☐☐☐–☐☐☐

Digit in partn°: X | 1 | 2 | 3 – 4 | 5 | 6 | 7 – 8 | 9 | 10

X = product with a specific customer requirement

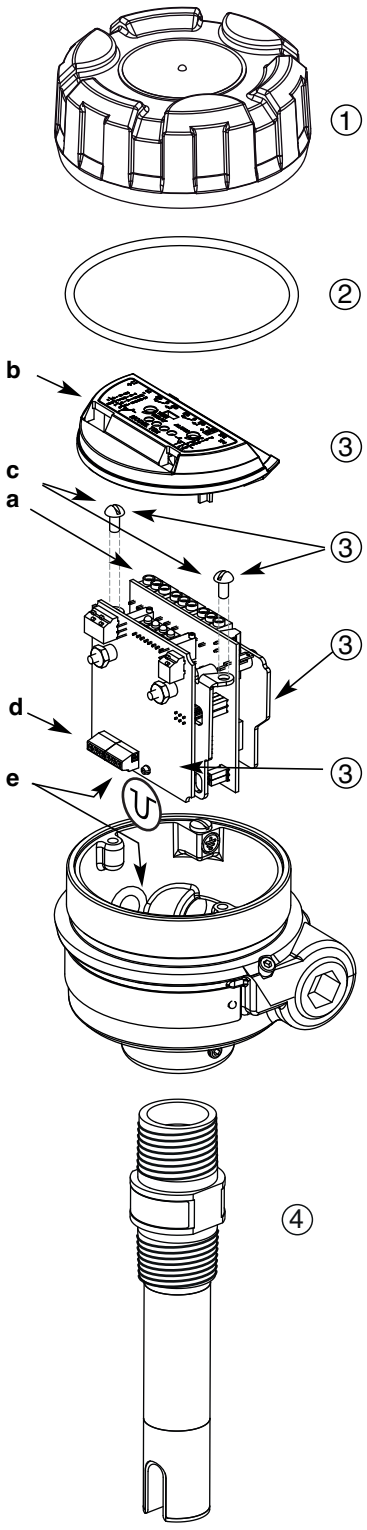
Serial n°: ☐☐☐☐☐☐–☐☐–☐☐☐

See nameplate, always provide complete partn° and serial n° when ordering spares.

EXPEDITE SHIP PLAN (ESP)

Several parts are available for quick shipment, within max. 1 week after factory receipt of purchase order, through the Expedite Ship Plan (ESP).
Parts covered by ESP service are conveniently grey coded in the selection tables.

No.	*Description*	*Part Number*
1	Cast aluminium cover (digit 10 = 0 or 1)	
	Blind	004-9192-009
	With window	036-4410-010
	Cast stainless steel cover (digit 10 = 2 or 3)	
	Blind	004-9224-014
	Deep drawn stainless steel cover (digit 10 = 4 or 5)	
	Blind	032-3934-001
	With window	036-5702-002
2	"O"-Ring	
	digit 10 = 0, 1, 2 or 3	012-2201-237
	digit 10 = 4 or 5	012-2201-155
3	Electronic module for industrial housing (digit 10 = 0, 1, 2 or 3)	
	961 – AC power	089-7259-001
	961 – DC power	089-7259-002
	962 – AC power	089-7258-001
	962 – DC power	089-7258-002
	Electronic module for hygienic housing (digit 10 = 4 or 5)	
	961 – AC power	089-7256-001
	961 – DC power	089-7256-002
	962 – AC power	089-7257-001
	962 – DC power	089-7257-002
4	Transducer	consult factory



MODEL IDENTIFICATION

A complete measuring system consists of:

1. Echotel® electronics
2. Echotel® transducer

1. Code for Echotel® electronics

1 2 3 | BASIC MODEL NUMBER

9 6 1	Echotel 961 electronics for single setpoint 9M1 transducers
9 6 2	Echotel 962 electronics for dual setpoint 9M2 transducers

4 5 6 | INPUT POWER

2 D A	12 - 35 V DC line powered electronics with 5 A gold flash relay(s) output
7 D A	100 - 265 V AC line powered electronics with 5 A gold flash relay(s) output

7 | ACCESSORIES

0	Blind housing cover
1	Housing cover with glass window (not for cast stainless steel housings)

8 | MOUNTING

0	Integral mount electronics

9 | APPROVALS

C	ATEX II 1/2 G / IEC Ex db IIC T6 Ga/Gb, flameproof enclosure	- except deep drawn SST housing
3	Weatherproof	- except deep drawn SST housing
7	Weatherproof	- deep drawn SST housing

10 | HOUSING / CABLE ENTRY

1	Cast aluminium housing with M20 x 1,5 cable entry (2 entries – one plugged)
0	Cast aluminium housing with 3/4" NPT cable entry (2 entries – one plugged)
3	Cast stainless steel with M20 x 1,5 cable entry (2 entries – one plugged)
2	Cast stainless steel with 3/4" NPT cable entry (2 entries – one plugged)
5	Deep drawn 304 stainless steel with M20 x 1,5 cable entry (2 entries – one plugged)
4	Deep drawn 304 stainless steel with 1/2" NPT cable entry (1 entry)

	9	6			D	A		0		
	1	2	3	4	5	6	7	8	9	10

complete code for Echotel® electronics

→ X = product with a specific customer requirement

2. Code for Echotel® transducer

1 2 3 | BASIC MODEL NUMBER

9 M 1	Echotel® 961 transducer with single setpoint
9 M 2	Echotel® 962 transducer with dual setpoints

4 | TRANSDUCER MATERIALS (use only metal transducers for hazardous area)

A	316/316L (1.4401/1.4404) stainless steel
B	Hastelloy® C (2.4819) – only available with 9M1
C	Monel® (2.4360) – only available with 9M1
N	316/316L (1.4401/1.4404) stainless steel & NACE MR0175/MR0103
P	CPVC
R	Kynar® (PVDF) – only available with 9M1
S	316/316L (1.4401/1.4404) stainless steel with 0,5 μm Ra (20 Ra) surface finish

SEE NEXT PAGE

	9	M								
	1	2	3	4	5	6	7	8	9	10

complete code for Echotel® transducer

→ X = product with a specific customer requirement

2. Code for Echotel® transducer

SEE PREVIOUS PAGE

5 6 | PROCESS CONNECTION

Threaded (plastic transducers are only available with 3/4" NPT connection)

1 1	3/4" NPT
2 1	1" NPT
1 2	3/4" BSP (G 3/4")
2 2	1" BSP (G 1")

ASME Flanges for metal transducers

2 3	1"	150 lbs	ASME RF
2 4	1"	300 lbs	ASME RF
2 5	1"	600 lbs	ASME RF
3 3	1 1/2"	150 lbs	ASME RF
3 4	1 1/2"	300 lbs	ASME RF
3 5	1 1/2"	600 lbs	ASME RF
4 3	2"	150 lbs	ASME RF
4 4	2"	300 lbs	ASME RF
4 5	2"	600 lbs	ASME RF
5 3	3"	150 lbs	ASME RF
5 4	3"	300 lbs	ASME RF
5 5	3"	600 lbs	ASME RF
6 3	4"	150 lbs	ASME RF
6 4	4"	300 lbs	ASME RF
6 5	4"	600 lbs	ASME RF

EN Flanges for metal transducers

B B	DN 25	PN 16/25/40	EN 1092-1 Type A
B C	DN 25	PN 63/100	EN 1092-1 Type B2
C B	DN 40	PN 16/25/40	EN 1092-1 Type A
C C	DN 40	PN 63/100	EN 1092-1 Type B2
D A	DN 50	PN 16	EN 1092-1 Type A
D B	DN 50	PN 25/40	EN 1092-1 Type A
D D	DN 50	PN 63	EN 1092-1 Type B2
D E	DN 50	PN 100	EN 1092-1 Type B2
E A	DN 80	PN 16	EN 1092-1 Type A
E B	DN 80	PN 25/40	EN 1092-1 Type A
E D	DN 80	PN 63	EN 1092-1 Type B2
E E	DN 80	PN 100	EN 1092-1 Type B2
F A	DN 100	PN 16	EN 1092-1 Type A
F B	DN 100	PN 25/40	EN 1092-1 Type A
F D	DN 100	PN 63	EN 1092-1 Type B2
F E	DN 100	PN 100	EN 1092-1 Type B2

ASME Flanges for plastic transducers①

2 3	1"	150 lbs	ASME RF②
3 3	1 1/2"	150 lbs	ASME RF②
4 3	2"	150 lbs	ASME RF②

EN Flanges for plastic transducers①

B A	DN 25	PN 16	EN 1092-1 Type A
C A	DN 40	PN 16	EN 1092-1 Type A
D A	DN 50	PN 16	EN 1092-1 Type A

① CPVC flanges for CPVC transducers, Kynar® cladded SST flanges for Kynar® transducers
② FF (flat face) flanges for CPVC transducers

Hygienic

3 T	1 1/2" Tri-clamp®
4 T	2" Tri-clamp®
V V	DN 65 Varivent® type N
B S	DN 25 DIN 11851
C S	DN 40 DIN 11851
D S	DN 50 DIN 11851

7 | SENSOR TYPE

A	Standard sensor: min -40 °C / max +165 °C (-40 °F / +325 °F)
C	Low temperature sensor: min -80 °C / max +120 °C (-110 °F / +250 °F) – only available with 9M1-A

8 9 10 | ACTUATION LENGTH – specify per cm (0.39") increment
Total insertion length = actuation length + 6 mm (0.25")

9M1 transducers

0 0 3	Minimum 3 cm (1.2") – for metal transducers with NPT connections only
0 0 5	Minimum 5 cm (2") – for all other connections
3 0 4	Maximum 304 cm (120") – for Kynar® (PVDF) material
3 3 0	Maximum 330 cm (130") – for all other materials

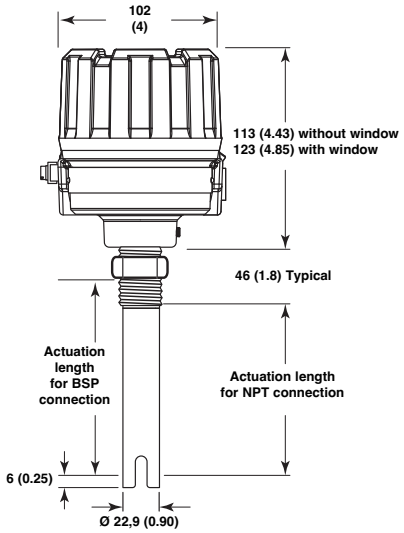
9M2 transducers "A" length
specify "B" length separately (see drawing and note shown in the dimensions section)

0 1 3	Minimum 13 cm (5.1") – for metal transducers with NPT connections only
0 1 5	Mininimum 15 cm (5.9") – for all other connections
3 3 0	Maximum 330 cm (130")

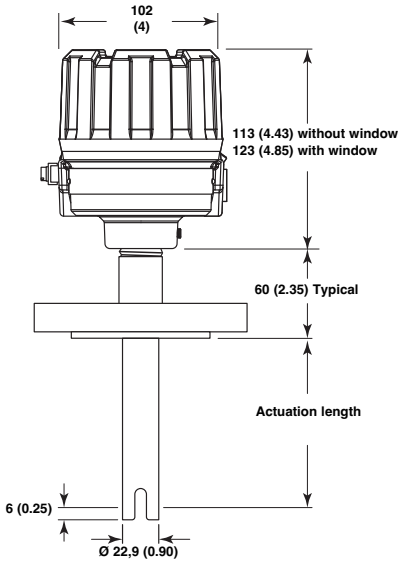
	9	M								
1	2	3	4	5	6	7	8	9	10	**complete code for Echotel® transducer**

→ X = product with a specific customer requirement

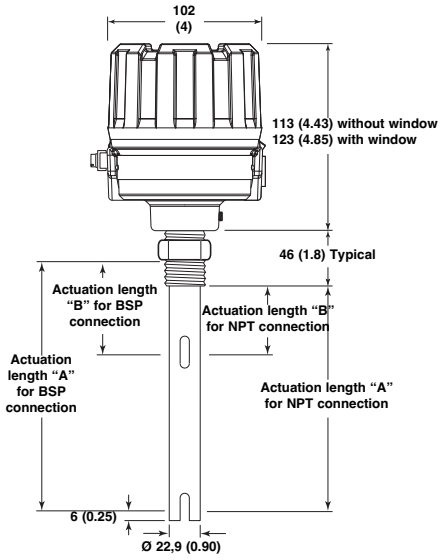
DIMENSIONS IN mm (inches)



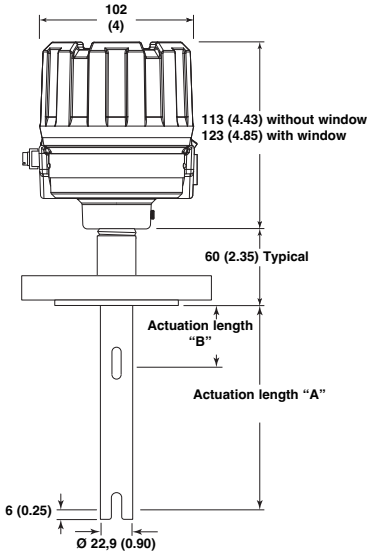
961 - Threaded connection



961 - Flanged connection



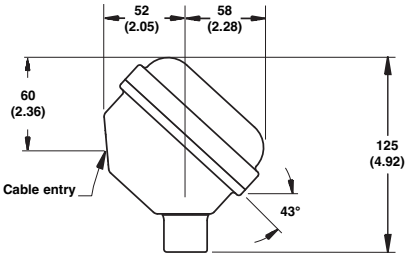
962 - Threaded connection

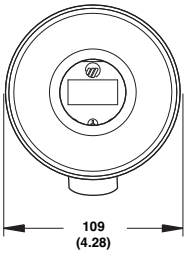


962 - Flanged connection

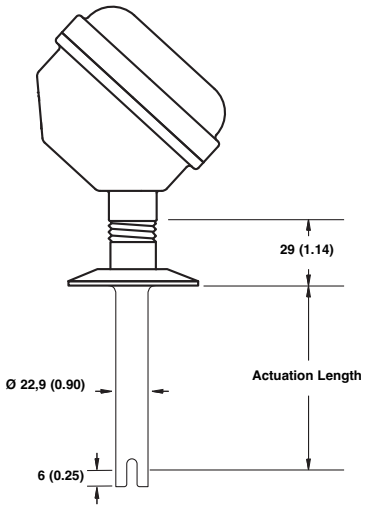
Note: - Difference between actuation lengths "A" and "B" must be min. 8 cm.
- Max. length for dimension "B" is 322 cm.

DIMENSIONS IN mm (inches)

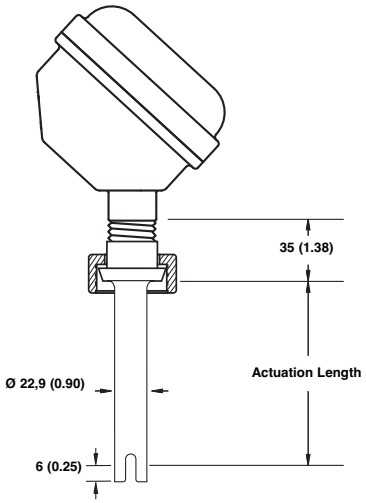




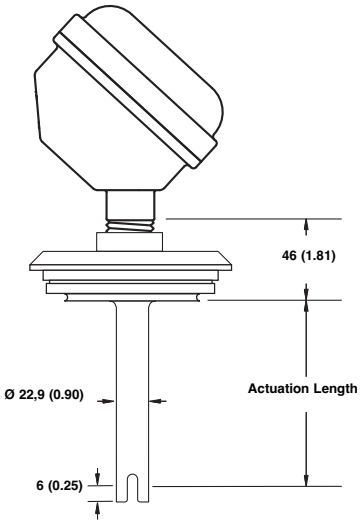
43° View



Tri-Clamp®



DIN 11851



Varivent®

SPECIFICATIONS

Electronics specifications

Description		Specification
Input Voltage		100 - 265 V AC 50/60 Hz or 12 - 35 V DC
Power Consumption		< 3 Watt
Output		**961**: one 5 A DPDT relay, **962**: two 5 A SPDT relays **961/962**: one 5 A SPDT malfunction relay
Time delay		0,5 to 10 s adjustable (in addition to transducer response time)
Indication		LED's for process alarm status, malfunction (error of transducer, electronics or electrical noise interference) and wet/dry status of transducer (961 only)
Selftest	Automatic	Continuously verifies electronics, transducer and noise interference
	Manual	Via pushbutton for checking alarm output(s) and error output/function.
Housing material		IP66, cast aluminium, cast stainless steel or deep drawn 304 stainless steel (IP 67)
Approvals ①		ATEX II 1/2 G Ex db IIC T6 Ga/Gb flameproof enclosure IEC Ex db IIC T6 Ga/Gb Overfill prevention TÜV - WHG § 63 / VLAREM II 5.17.7 Other approvals are available, consult factory for more details
SIL (Safety Integrity Level)		Functional safety to SIL 2 in accordance to IEC 61508 – SFF > 90 %. Full FMEDA report and declaration sheets available at request.
Shock/Vibration		ANSI/ISA-S71.03 Class SA1 (shock), ANSI/ISA-S71.03 Class VC2 (vibration)
Net weight		Aluminium / Deep drawn 304 SST: 1 kg (2.2 lbs) – electronics only Cast SST: 2,5 kg (5.5 lbs) – electronics only

① Only available with cast aluminium or cast stainless steel housings.

Performance

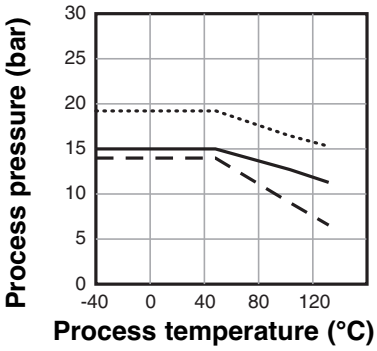
Description	Specification
Response time	0,5 s typical
Repeatability	± 2 mm (0.078")
Ambient Temperature	-40 °C to +70 °C (-40 °F to +160 °F)
Humidity	0-99 %, non-condensing
Electromagnetic Compatibility	Meets CE requirements (EN 61326: 1997 + A1 + A2) and NAMUR NE 21

Transducer specification

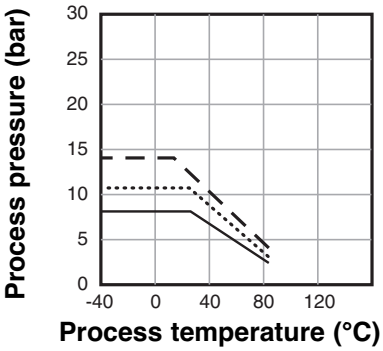
Description	Plastic transducers	Metal transducers
Material	CPVC Kynar® (PVDF)	316/316L SST (1.4401/1.4404) Hastelloy® C (2.4819) Monel® (2.4360)
Mounting	Threaded (NPT/BSP) – Flanged (ASME - EN) – Hygienic	
Actuation length	From 5 cm up to 304 cm (2" up to 120") – PVDF From 5 cm up to 330 cm (2" up to 130") – CPVC	From 3 cm up to 330 cm (1.2" up to 130")
Process temp. (consult temp/ press. graphs)	-40 °C to +120 °C (-40 °F to +250 °F) – PVDF -40 °C to +80 °C (-40 °F to +180 °F) – CPVC	-40 °C to +165 °C (-40 °F to +325 °F) – standard -80 °C to +120 °C (-110 °F to +250 °F) – low temperature version in 316/316L SST
Max pressure (consult temp/ press. graphs)	13,8 bar @ +40 °C (200 psi @ +100 °F) for NPT threaded units	82,8 bar (1200 psi) for Monel transducers Consult temp/press. graphs for other materials
	Flanged models are downrated to the design pressure of the selected flange	

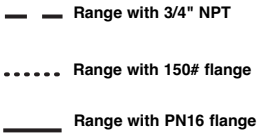
PRESSURE / TEMPERATURE RATINGS

Kynar® Transducer Ratings

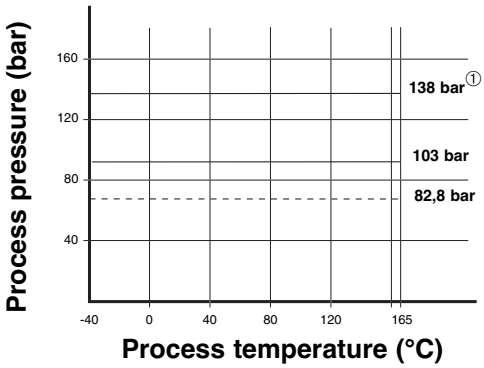


CPVC Transducer Ratings





Metal Transducer Ratings



316/316L (1.4401/1.4404)②
Hastelloy® C (2.4819)

Monel® (2.4360)

① Only applicable to NPT-connections with actuation length = 3 cm and BSP/ASME/EN-connections with actuation length = 5 cm

② For low temperature sensor: from -80 °C up to +120 °C

Notes

Notes

IMPORTANT

SERVICE POLICY

Owners of Magnetrol products may request the return of a control; or, any part of a control for complete rebuilding or replacement. They will be rebuilt or replaced promptly. Magnetrol International will repair or replace the control, at no cost to the purchaser, (or owner) ***other than transportation cost*** if:

a. Returned within the warranty period; and,
b. The factory inspection finds the cause of the malfunction to be defective material or workmanship.

If the trouble is the result of conditions beyond our control; or, is **NOT** covered by the warranty, there will be charges for labour and the parts required to rebuild or replace the equipment.
In some cases, it may be expedient to ship replacement parts; or, in extreme cases a complete new control, to replace the original equipment before it is returned. If this is desired, notify the factory of both the model and serial numbers of the control to be replaced. In such cases, credit for the materials returned, will be determined on the basis of the applicability of our warranty.
No claims for misapplication, labour, direct or consequential damage will be allowed.

RETURNED MATERIAL PROCEDURE

So that we may efficiently process any materials that are returned, it is essential that a “Return Material Authorisation” (RMA) form will be obtained from the factory. It is mandatory that this form will be attached to each material returned. This form is available through Magnetrol’s local representative or by contacting the factory. Please supply the following information:

1. Purchaser Name
2. Description of Material
3. Serial Number and Ref Number
4. Desired Action
5. Reason for Return
6. Process details

Any unit that was used in a process must be properly cleaned in accordance with the proper health and safety standards applicable by the owner, before it is returned to the factory.
A material Safety Data Sheet (MSDS) must be attached at the outside of the transport crate or box.
All shipments returned to the factory must be by prepaid transportation. Magnetrol ***will not accept*** collect shipments.
All replacements will be shipped Ex Works.

BULLETIN N°: BE 51-645.12
EFFECTIVE: JULY 2021
SUPERSEDES: August 2017

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MAGNETROL®

AMETEK®

Installation & Maintenance Instructions

MAGNETROL ECHOTEL

Loop Powered Model 961/962

Supplied by

247able.com

Call us on +44 (0)118 916 9420 | Email info@247able.com

ECHOTEL® 961/962
Loop Powered

Installation and Operating Manual

Ultrasonic

Single and

Dual Point

Level Switches

Model 961

Model 962

MAGNETROL®

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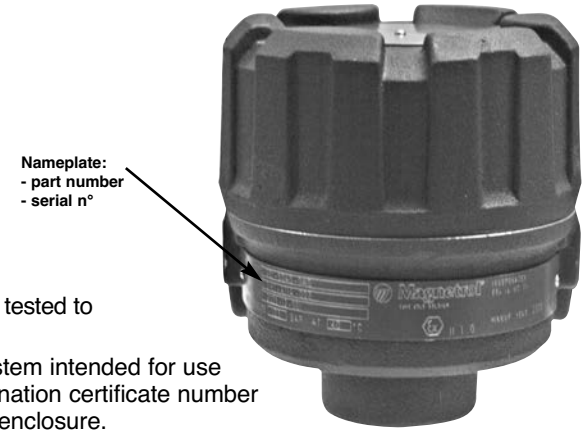
UNPACKING

Unpack the instrument carefully. Make sure all components have been removed from the foam protection. Inspect all components for damage. Report any concealed damage to the carrier within 24 hours. Check the contents of the carton/crates against the packing slip and report any discrepancies to Magnetrol. Check the nameplate model number to be sure it agrees with the packing slip and purchase order. Check and record the serial number for future reference when ordering parts.



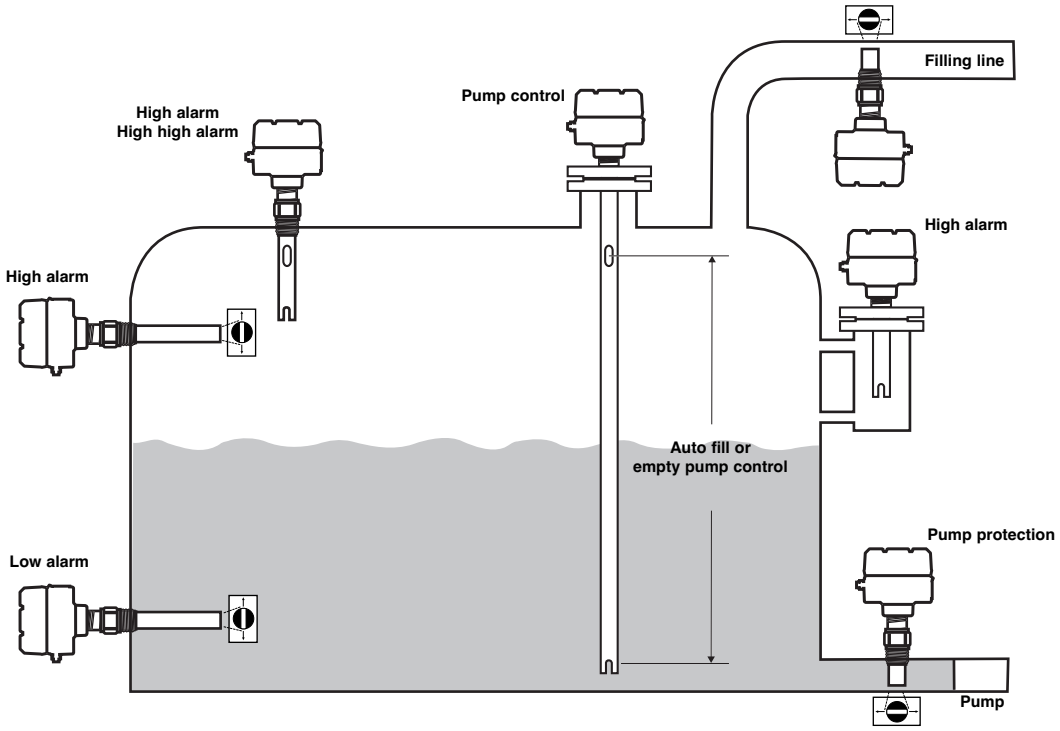
These units are in compliance with:

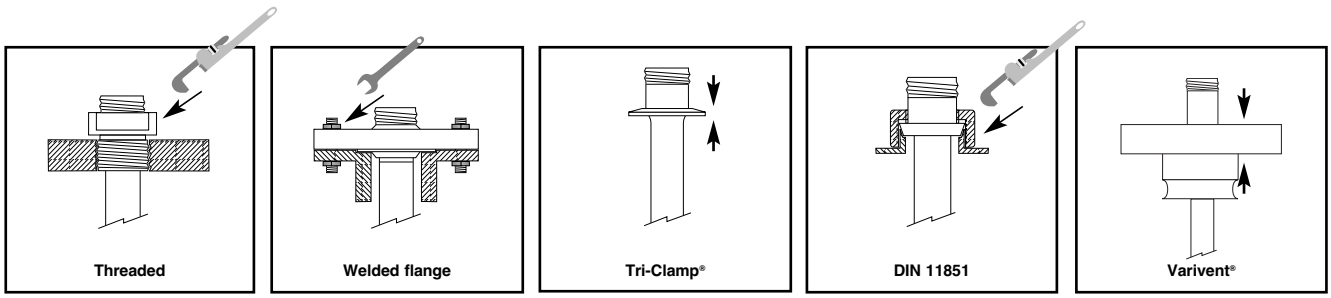
1. The EMC directive 2014/30/EU. The units have been tested to EN 61326: 1997 + A1 + A2.
2. Directive 2014/34/EU for equipment or protective system intended for use in potentially explosive atmospheres. EC-type examination certificate number FM19ATEX0204X - intrinsically safe and flameproof enclosure.
3. RoHS directive 2011/65/EU (restriction of the use of certain hazardous substances in electrical and electronic equipment).

SPECIAL CONDITIONS FOR ATEX USE

1. The enclosure contains aluminum and is considered to present a potential risk of ignition by impact or friction. Care must be taken during installation and use to prevent impact or friction.
2. To maintain the T6 and/or T4 temperature code care shall be taken to ensure the “Enclosure Temperature” does not exceed 70 °C.
3. The risk of electrostatic discharge shall be minimized at installation, clean non-conductive surfaces with moist cloth only.
4. Contact the original manufacturer for information in the dimensions of flameproof joints.
5. For installation with ambient temperature of 70 °C, refer to the manufacturer’s instructions for guidance on proper selection of conductors.
6. The ultrasonic probe is only for use with the Echotel ultrasonic switch.

MOUNTING

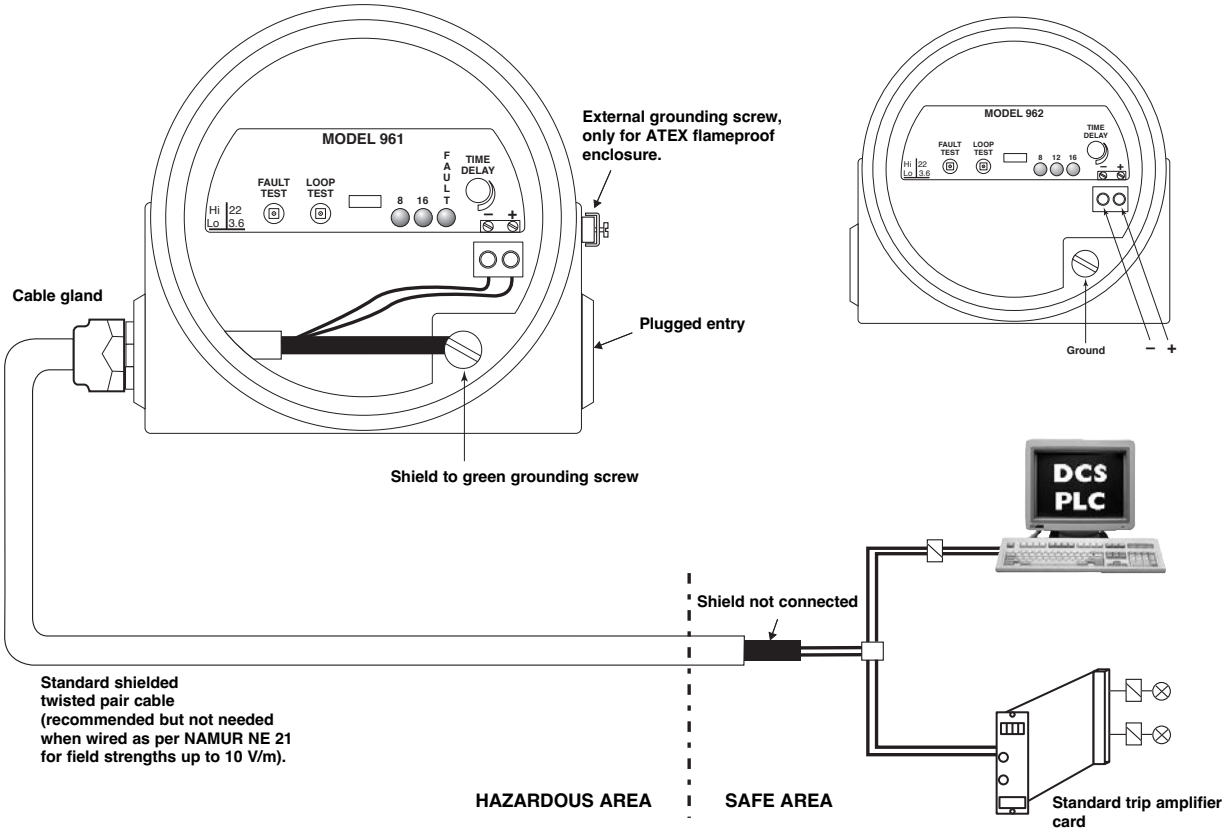




WIRING

Echotel® 961 electronics

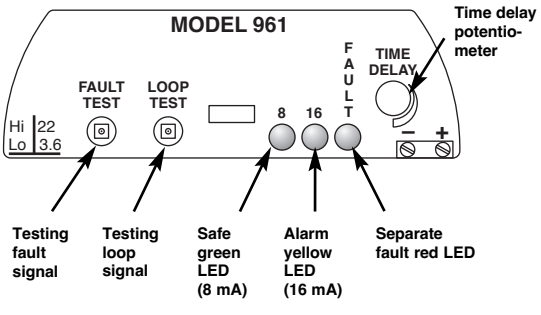
Echotel® 962 electronics



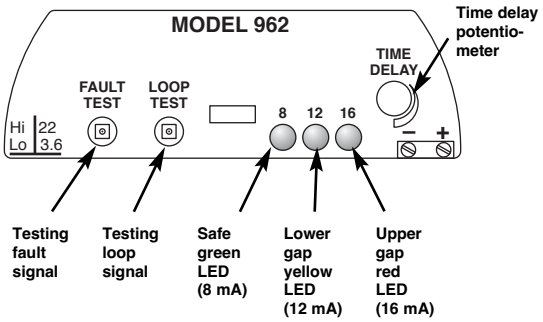
Important: Connect the unit to the ground for avoiding earth potential drifts.

USER INTERFACE

Echotel® 961



Echotel® 962



SET UP AND FUNCTIONS

Set up

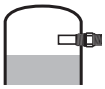
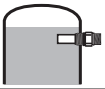
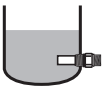
High – Low Level Failsafe selection:[1]
In «Hi» position, the current will shift to 12/16 mA (report alarm) when the transducer is **wet**.
In «Lo» position, the current will shift to 12/16 mA (report alarm) when the transducer is **dry**.
In both positions, the current will stay at 8 mA to report a safe condition.

Fault selection:
Select for which signal the unit should report a malfunction ≥ 22 mA or ≤ 3,6 mA

Time delay setting:
Turning the potentiometer clockwise will increase the time delay from 0,5 s to 10 s. Time delay is typically used where turbulence, boiling or splashing can cause false level alarms.

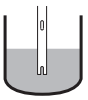
Indication

Echotel 961

Failsafe[1] mode	Level	Output signal	8 mA green LED	16 mA yellow LED	Fault red LED
«Hi» High Level Failsafe		8 mA (± 1 mA)	ON	OFF	OFF
		16 mA (± 1 mA)	OFF	ON	OFF
«Lo» Low Level Failsafe		8 mA (± 1 mA)	ON	OFF	OFF
		16 mA (± 1 mA)	OFF	ON	OFF

Fault LED is ON = Fault indication

Echotel 962

Failsafe mode	Level	Output signal	8 mA green LED	12 mA yellow LED	16 mA red LED
«Hi» High Level Failsafe		8 mA (± 1 mA)	ON	OFF	OFF
		12 mA (± 1 mA)	OFF	ON	OFF
		16 mA (± 1 mA)	OFF	OFF	ON
«Lo» Low Level Failsafe		8 mA (± 1 mA)	ON	OFF	OFF
		12 mA (± 1 mA)	OFF	ON	OFF
		16 mA (± 1 mA)	OFF	OFF	ON

All LED's OFF = Fault indication

[1] **Use the following settings to replace Echotel 915 series with the new Echotel 961 series:**
For High Level Failsafe, use «Lo» setting = low current draw (from 16 mA (safe) to 8 mA (alarm))
For Low Level Failsafe, use «Hi» setting = high current draw (from 8 mA (safe) to 16 mA (alarm))

MAINTENANCE

Manual Testing

Loop Test: (8 mA / 12mA / 16mA):
Pressing the “Loop Test” pushbutton, will manually test the loop and connected actuators/indicators. The loop test forces the output and corresponding LED’s to shift from 8 mA to 12 mA (only 962) to 16 mA back to 8 mA. The time delay setting is not active during testing.

Fault Test (3.6 mA /22 mA):
Pressing the “Fault Test” pushbutton for min 2 s, will manually test the fault output and connected actuators/indicators. The fault test simulates a circuit failure and forces the output to either ≤ 3.6 mA or ≥ 22 mA. The time delay setting is not active during testing.

Troubleshooting

Problem	Action/Indication	Solution
No loop signal	No LED’s are ON	Check wiring / input power Check for malfunction (962). See below
No change in output between wet gap / dry gap	Gap may be plugged by solids / dense foam	Clean the transducer
	Gap is out of reach of liquid	Check mounting section and relocate the unit or check blocking valves.
Chattering output	Excessive aeration / Turbulence	Introduce a time delay Check input power Relocate the switch If installed horizontally, make sure the 961 transducer gap is oriented in a vertical position as shown in the mounting section. This allows proper drainage from the gap, and prevents air bubbles from accumulating in the gap.
Fault LED is ON (961) All LED’s OFF (962)	A system fault has been detected	Check input power
	Press «Loop Test» pushbutton to identify the problem:	
	* --- * : 1 flash (red LED)	Check wiring between transducer and electronics or replace transducer.
	** --- ** : 2 flashes (red LED)	Replace electronics
	*** --- *** : 3 flashes (red LED)	The unit senses excessive noise interference. Check shield connection or eliminate interference from a walkie-talkie, radio or other nearby source

REPLACEMENT PARTS

Replacing electronics/transducer

Echotel electronics can be removed in the field under process conditions. Follow below steps to exchange electronics/transducer:

Note: Adjust set up of the replacing electronics following the settings of the old electronics (see configuration section)

1. Disconnect power before removing the housing cover
2. Remove power/output wires (a)
3. (Skip step 3 if hygienic housing.) Click out the protection cap of the electronics (b)
4. Remove the 2 bracket screws and slide out electronics (c)
5. Remove the transducer wires (see Wiring section) (d)
6. Re-assemble following the same procedure in opposite way. Make sure that the tip on the bracket of the electronic block is seated properly in the corresponding recess in the housing base - (e)

Replacement parts

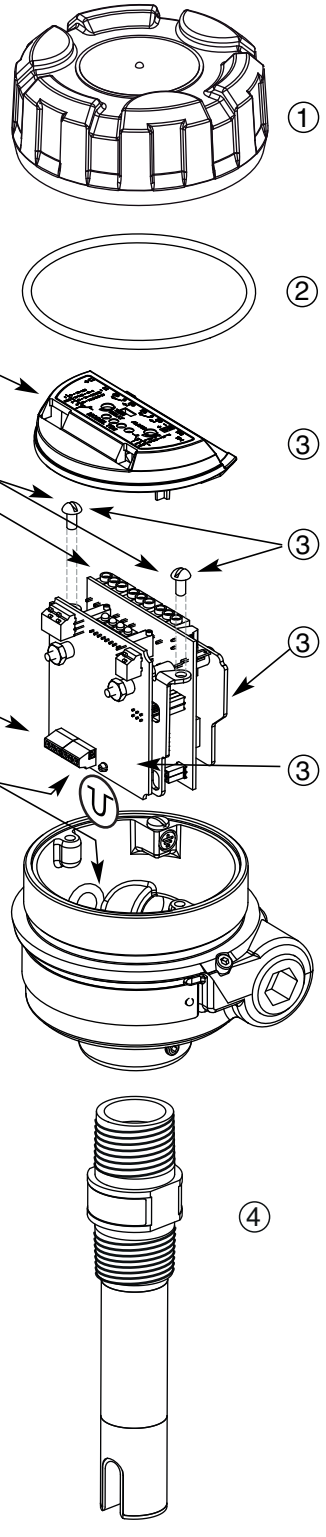
Partn°: ☐☐☐–☐☐☐☐–☐☐☐

Digit in partn°: X | 1 | 2 | 3 – 4 | 5 | 6 | 7 – 8 | 9 | 10

X = product with a specific customer requirement

Serial n°: ☐☐☐☐☐☐–☐☐–☐☐☐

See nameplate, always provide complete partn° and serial n° when ordering spares.



EXPEDITE SHIP PLAN (ESP)

Several parts are available for quick shipment, within max. 1 week after factory receipt of purchase order, through the Expedite Ship Plan (ESP).
Parts covered by ESP service are conveniently grey coded in the selection tables.

No.	*Description*	*Part Number*
1	Cast aluminium cover (digit 10 = 0 or 1)	
	Blind	004-9192-009
	With window	036-4410-010
	Cast stainless steel cover (digit 10 = 2 or 3)	
	Blind	004-9224-014
	Deep drawn stainless steel cover (digit 10 = 4 or 5)	
	Blind	032-3934-001
	With window	036-5702-002
2	"O"-Ring	
	digit 10 = 0, 1, 2 or 3	012-2201-237
	digit 10 = 4 or 5	012-2201-155
3	Electronic module for industrial housing (digit 10 = 0, 1, 2 or 3)	
	961	089-7259-005
	962	089-7258-003
	Electronic module for hygienic housing (digit 10 = 4 or 5)	
	961	089-7256-003
	962	089-7257-003
4	Transducer	consult factory

MODEL IDENTIFICATION

A complete measuring system consists of:

1. Echotel® electronics
2. Echotel® transducer

1. Code for Echotel® electronics

1 2 3 | BASIC MODEL NUMBER

9 6 1	Echotel® 961 electronics for single setpoint 9M1 transducers
9 6 2	Echotel® 962 electronics for dual setpoint 9M2 transducers

4 5 6 | INPUT POWER

5 0 A	12 - 35 V DC 2-wire loop powered electronics with current shift output

7 | ACCESSORIES

0	Blind housing cover
1	Housing cover with glass window (not for cast stainless steel housings)

8 | MOUNTING

0	Integral mount electronics

9 | APPROVALS

A	ATEX II 1 G Ex ia IIC T4 Ga, intrinsically safe	- except deep drawn SST housing
C	ATEX II 1/2 G / IEC Ex db IIC T6 Ga/Gb, flameproof enclosure	- except deep drawn SST housing
1	Weatherproof	- except deep drawn SST housing
7	Weatherproof	- deep drawn SST housing

10 | HOUSING / CABLE ENTRY

1	Cast aluminium housing with M20 x 1,5 cable entry (2 entries – one plugged)
0	Cast aluminium housing with 3/4" NPT cable entry (2 entries – one plugged)
3	Cast stainless steel with M20 x 1,5 cable entry (2 entries – one plugged)
2	Cast stainless steel with 3/4" NPT cable entry (2 entries – one plugged)
5	Deep drawn 304 stainless steel with M20 x 1,5 cable entry (2 entries – one plugged)
4	Deep drawn 304 stainless steel with 1/2"NPT cable entry (1 entry)

	9	6		5	0	A		0			**complete code for Echotel® electronics**
	1	2	3	4	5	6	7	8	9	10	

→ X = product with a specific customer requirement

2. Code for Echotel® transducer

1 2 3 | BASIC MODEL NUMBER

9 M 1	Echotel® 961 transducer with single setpoint
9 M 2	Echotel® 962 transducer with dual setpoints

4 | TRANSDUCER MATERIALS (use only metal transducers for hazardous area)

A	316/316L (1.4401/1.4404) stainless steel
B	Hastelloy® C (2.4819) – only available with 9M1
C	Monel® (2.4360) – only available with 9M1
N	316/316L (1.4401/1.4404) stainless steel & NACE MR0175/MR0103
P	CPVC
R	Kynar® (PVDF) – only available with 9M1
S	316/316L (1.4401/1.4404) stainless steel with 0,5 μm Ra (20 Ra) surface finish

SEE NEXT PAGE

	9	M									**complete code for Echotel® transducer**
	1	2	3	4	5	6	7	8	9	10	

→ X = product with a specific customer requirement

2. Code for Echotel® transducer

SEE PREVIOUS PAGE

5 6 | PROCESS CONNECTION

Threaded (plastic transducers are only available with 3/4" NPT connection)

1 1	3/4" NPT
2 1	1" NPT

1 2	3/4" BSP (G 3/4")
2 2	1" BSP (G 1")

ASME Flanges for metal transducers

2 3	1" 150 lbs ASME RF
2 4	1" 300 lbs ASME RF
2 5	1" 600 lbs ASME RF
3 3	1 1/2" 150 lbs ASME RF
3 4	1 1/2" 300 lbs ASME RF
3 5	1 1/2" 600 lbs ASME RF
4 3	2" 150 lbs ASME RF
4 4	2" 300 lbs ASME RF
4 5	2" 600 lbs ASME RF
5 3	3" 150 lbs ASME RF
5 4	3" 300 lbs ASME RF
5 5	3" 600 lbs ASME RF
6 3	4" 150 lbs ASME RF
6 4	4" 300 lbs ASME RF
6 5	4" 600 lbs ASME RF

EN Flanges for metal transducers

B B	DN 25 PN 16/25/40 EN 1092-1 Type A
B C	DN 25 PN 63/100 EN 1092-1 Type B2
C B	DN 40 PN 16/25/40 EN 1092-1 Type A
C C	DN 40 PN 63/100 EN 1092-1 Type B2
D A	DN 50 PN 16 EN 1092-1 Type A
D B	DN 50 PN 25/40 EN 1092-1 Type A
D D	DN 50 PN 63 EN 1092-1 Type B2
D E	DN 50 PN 100 EN 1092-1 Type B2
E A	DN 80 PN 16 EN 1092-1 Type A
E B	DN 80 PN 25/40 EN 1092-1 Type A
E D	DN 80 PN 63 EN 1092-1 Type B2
E E	DN 80 PN 100 EN 1092-1 Type B2
F A	DN 100 PN 16 EN 1092-1 Type A
F B	DN 100 PN 25/40 EN 1092-1 Type A
F D	DN 100 PN 63 EN 1092-1 Type B2
F E	DN 100 PN 100 EN 1092-1 Type B2

ASME Flanges for plastic transducers①

2 3	1" 150 lbs ASME RF②
3 3	1 1/2" 150 lbs ASME RF②
4 3	2" 150 lbs ASME RF②

EN Flanges for plastic transducers①

B A	DN 25 PN 16 EN 1092-1 Type A
C A	DN 40 PN 16 EN 1092-1 Type A
D A	DN 50 PN 16 EN 1092-1 Type A

① CPVC flanges for CPVC transducers, Kynar® cladded SST flanges for Kynar® transducers
② FF (flat face) flanges for CPVC transducers

Hygienic

3 T	1 1/2" Tri-clamp®
4 T	2" Tri-clamp®
V V	DN 65 Varivent® type N

B S	DN 25 DIN 11851
C S	DN 40 DIN 11851
D S	DN 50 DIN 11851

7 | SENSOR TYPE

A	Standard sensor: min -40 °C / max +165 °C (-40 °F / +325 °F)
C	Low temperature sensor: min -80 °C / max +120 °C (-110 °F / +250 °F) – only available with 9M1-A

8 9 10 | ACTUATION LENGTH – specify per cm (0.39") increment

Total insertion length = actuation length + 6 mm (0.25")

9M1 transducers

0 0 3	Minimum 3 cm (1.2") – for metal transducers with NPT connections only
0 0 5	Minimum 5 cm (2") – for all other connections
3 0 4	Maximum 304 cm (120") – for Kynar® (PVDF) material
3 3 0	Maximum 330 cm (130") – for all other materials

9M2 transducers "A" length
specify "B" length separately (see drawing and note shown in the dimensions section)

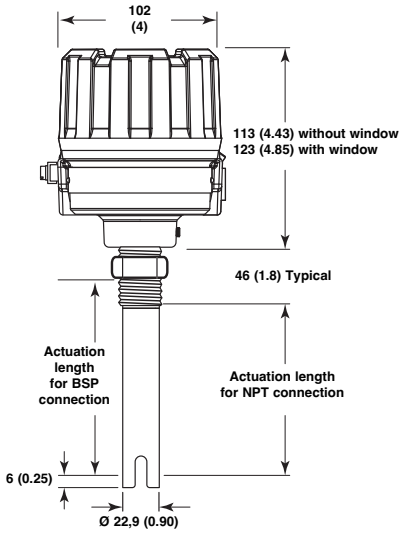
0 1 3	Minimum 13 cm (5.1") – for metal transducers with NPT connections only
0 1 5	Mininimum 15 cm (5.9") – for all other connections
3 3 0	Maximum 330 cm (130")

	9	M								
1	2	3	4	5	6	7	8	9	10	

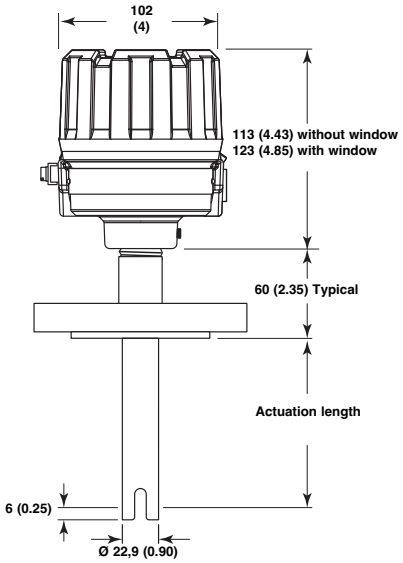
complete code for Echotel® transducer

→ X = product with a specific customer requirement

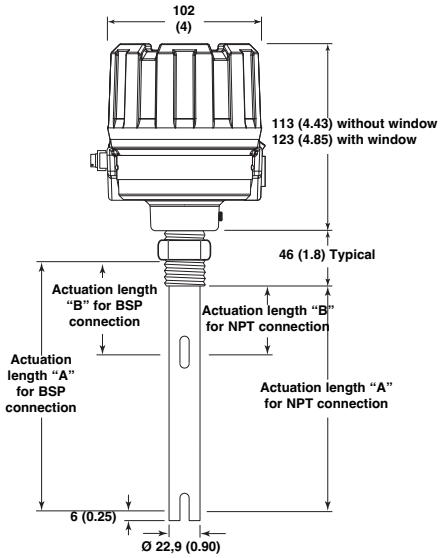
DIMENSIONS IN mm (inches)



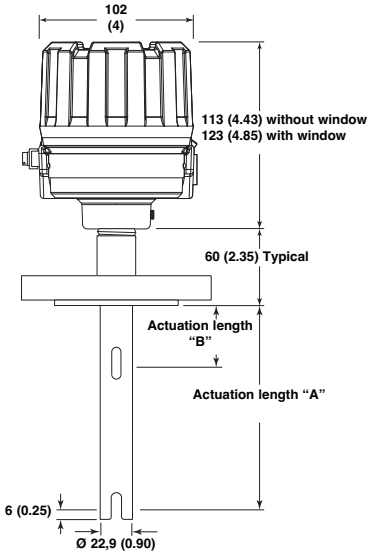
961 - Threaded connection



961 - Flanged connection



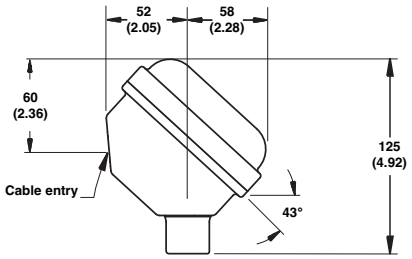
962 - Threaded connection

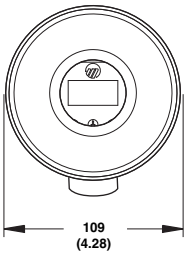


962 - Flanged connection

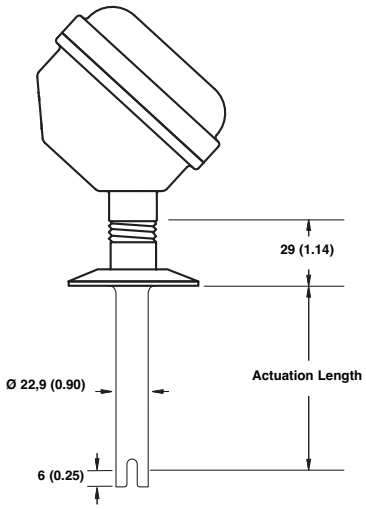
Note: - Difference between actuation lengths "A" and "B" must be min. 8 cm.
- Max. length for dimension "B" is 322 cm.

DIMENSIONS IN mm (inches)

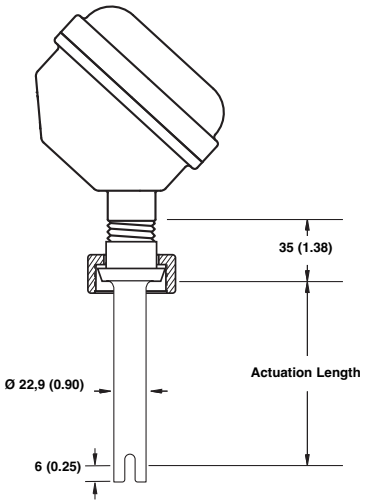




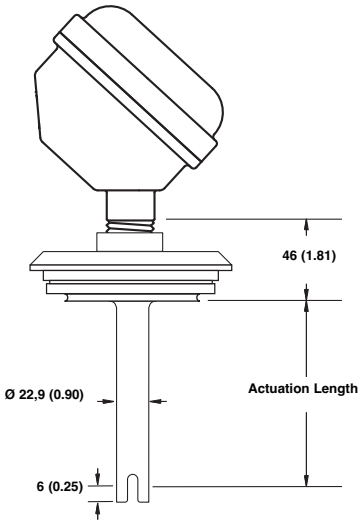
43° View



Tri-Clamp®



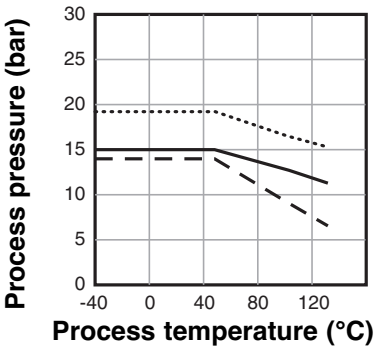
DIN 11851



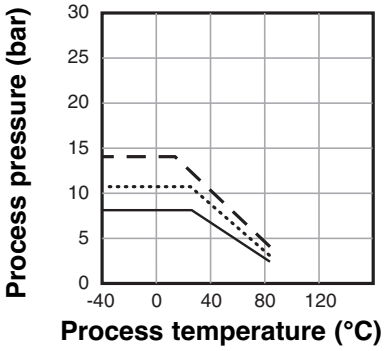
Varivent®

PRESSURE / TEMPERATURE RATINGS

Kynar® Transducer Ratings



CPVC Transducer Ratings

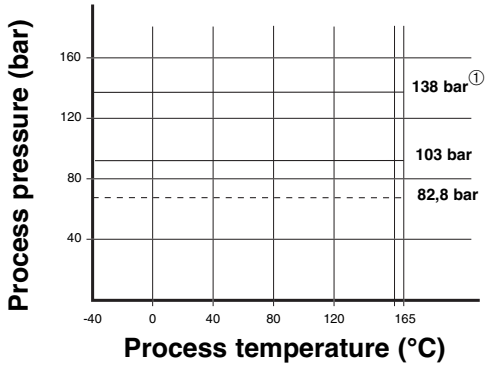


Range with 3/4" NPT

Range with 150# flange

Range with PN16 flange

Metal Transducer Ratings



316/316L (1.4401/1.4404)②
Hastelloy® C (2.4819)

Monel® (2.4360)

① Only applicable to NPT-connections with actuation length = 3 cm and BSP/ASME/EN-connections with actuation length = 5 cm

② For low temperature sensor: from -80 °C up to +120 °C

SPECIFICATIONS

Electronics specifications

Description		Specification
Input Voltage		2 wire loop powered, 12 - 35 V DC
Power Consumption		< 1 Watt
Output		**961**: 8 mA (safe), 16 mA (alarm) ± 1 mA **962**: 8 mA (safe), 12 mA (lower gap alarm), 16 mA (upper gap alarm) ± 1 mA **961/962**: ≤ 3,6 or ≥ 22 mA error signal
Time delay		0,5 to 10 s adjustable (in addition to transducer response time)
Indication		LED's for process alarm status, malfunction (error of transducer, electronics or electrical noise interference)
Selftest	Automatic	Continuously verifies electronics, transducer and noise interference
	Manual	Via pushbutton for checking alarm output(s) and error output/function.
Housing material		IP66, cast aluminium, cast stainless steel or deep drawn 304 stainless steel (IP 67)
Approvals ①		ATEX II 1 G Ex ia IIC T4 Ga, intrinsically safe ATEX II 1/2 G Ex db IIC T6 Ga/Gb, flameproof enclosure IEC Ex d IIC T6 Ga/Gb + Ex ia IIC T4 Ga Overfill prevention TÜV - WHG § 63 / VLAREM II 5.17.7 Other approvals are available, consult factory for more details
SIL (Safety Integrity Level)		Functional safety to SIL 2 in accordance to IEC 61508 – SFF > 90 % Full FMEDA report and declaration sheets available at request
Electrical data		Ui = 28,4 V, Ii = 94 mA, Pi = 0,67 W
Equivalent data		Ci = 10,4 nF, Li = 3 μH
Shock/Vibration		ANSI/ISA-S71.03 Class SA1 (shock), ANSI/ISA-S71.03 Class VC2 (vibration)
Net weight		Aluminium / Deep drawn 304 SST: 1 kg (2.2 lbs) – electronics only Cast SST: 2,5 kg (5.5 lbs) – electronics only

① Only available with cast aluminium or cast stainless steel housings

Performance

Description	Specification
Response time	0,5 s typical
Repeatability	± 2 mm (0.078")
Ambient Temperature	-40 °C to +70 °C (-40 °F to +160 °F)
Humidity	0-99 %, non-condensing
Electromagnetic Compatibility	Meets CE requirements (EN 61326: 1997 + A1 + A2) and NAMUR NE 21

Transducer specifications

Description	Plastic transducers	Metal transducers
Material	CPVC Kynar® (PVDF)	316/316L SST (1.4401/1.4404) Hastelloy® C (2.4819) Monel® (2.4360)
Mounting	Threaded (NPT/BSP) – Flanged (ASME - EN) – Hygienic	
Actuation length	From 5 cm up to 304 cm (2" up to 120") – PVDF From 5 cm up to 330 cm (2" up to 130") – CPVC	From 3 cm up to 330 cm (1.2" up to 130")
Process temp. (consult temp/ press. graphs)	-40 °C to +120 °C (-40 °F to +250 °F) – PVDF -40 °C to +80 °C (-40 °F to +180 °F) – CPVC	-40 °C to +165 °C (-40 °F to +325 °F) – standard -80 °C to +120 °C (-110 °F to +250 °F) – low temperature version in 316/316L SST
Max pressure (consult temp/ press. graphs)	13,8 bar @ +40 °C (200 psi @ +100 °F) for NPT threaded units	82,8 bar (1200 psi) for Monel transducers Consult temp/press. graphs for other materials
	Flanged models are downrated to the design pressure of the selected flange	

IMPORTANT

SERVICE POLICY

Owners of Magnetrol products may request the return of a control; or, any part of a control for complete rebuilding or replacement. They will be rebuilt or replaced promptly. Magnetrol International will repair or replace the control, at no cost to the purchaser, (or owner) ***other than transportation cost*** if:

a. Returned within the warranty period; and,
b. The factory inspection finds the cause of the malfunction to be defective material or workmanship.

If the trouble is the result of conditions beyond our control; or, is **NOT** covered by the warranty, there will be charges for labour and the parts required to rebuild or replace the equipment.
In some cases, it may be expedient to ship replacement parts; or, in extreme cases a complete new control, to replace the original equipment before it is returned. If this is desired, notify the factory of both the model and serial numbers of the control to be replaced. In such cases, credit for the materials returned, will be determined on the basis of the applicability of our warranty.
No claims for misapplication, labour, direct or consequential damage will be allowed.

RETURNED MATERIAL PROCEDURE

So that we may efficiently process any materials that are returned, it is essential that a “Return Material Authorisation” (RMA) form will be obtained from the factory. It is mandatory that this form will be attached to each material returned. This form is available through Magnetrol’s local representative or by contacting the factory. Please supply the following information:

1. Purchaser Name
2. Description of Material
3. Serial Number and Ref Number
4. Desired Action
5. Reason for Return
6. Process details

Any unit that was used in a process must be properly cleaned in accordance with the proper health and safety standards applicable by the owner, before it is returned to the factory.
A material Safety Data Sheet (MSDS) must be attached at the outside of the transport crate or box.
All shipments returned to the factory must be by prepaid transportation. Magnetrol ***will not accept*** collect shipments.
All replacements will be shipped Ex Works.

BULLETIN N°: BE 51-646.12
EFFECTIVE: JULY 2021
SUPERSEDES: August 2017

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