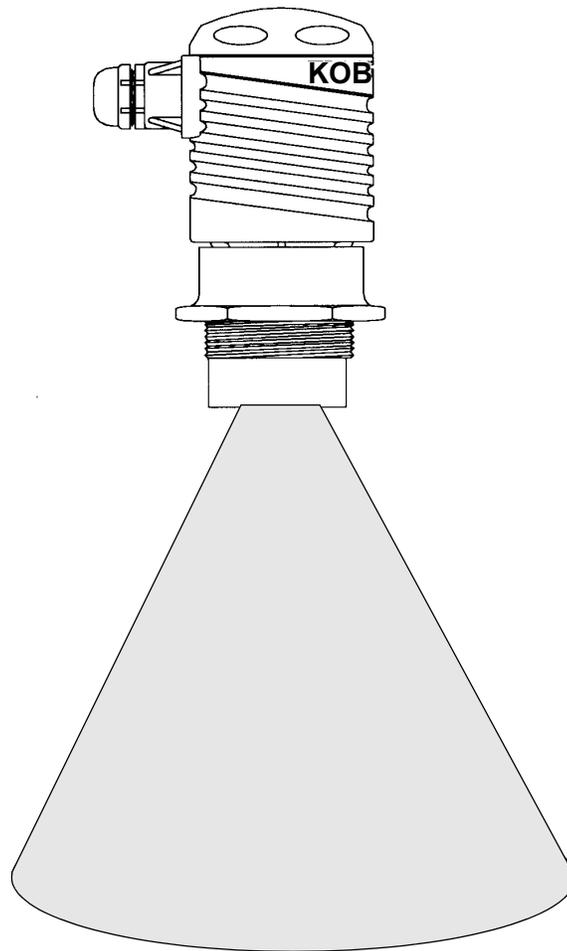


# KOBOLD EchoKing NEO-5003 Series

## Ultrasonic Level Transmitter

### User Instructions

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Manual-NEO\_5003-4\_9-97

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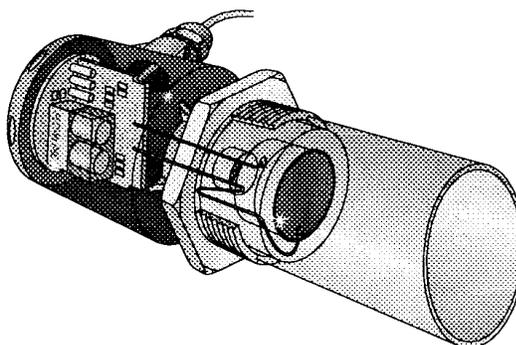
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**CAUTION: For safety reasons, please read the precautionary information Located at the end of this manual, before attempting installation**

## 1.0 General

The KOBOLD EchoKing™ level transmitter operates on the ultrasonic principle. An ultrasonic sound wave is pulsed eight times per second from the base of the transducer. The sound wave reflects against the process medium below and returns to the transducer. The microprocessor based electronics measure the time of flight between the sound generation and receipt, and translates this figure into the distance between the transmitter and process medium below. This design results in a high degree of accuracy with no requirement for contact with the fluid.

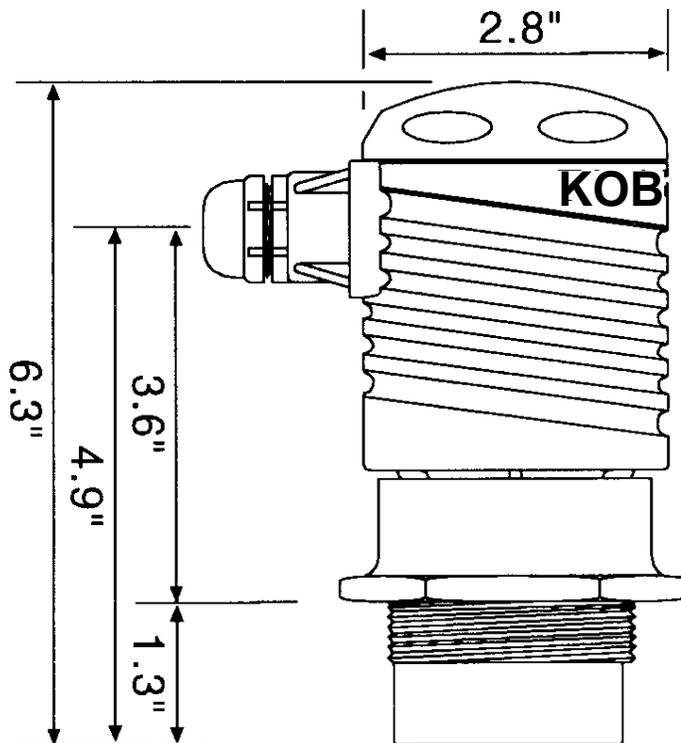


## 2.0 Specifications

Range:	0.5 to 24.5 feet
Accuracy:	± 0.25% of span (air)
Resolution:	0.125" (3 mm)
Pulse Frequency:	50 kHz
Pulse Rate:	8 pulses per second
Dead Band:	6" from transducer face minimum
Display Type:	4 segment LED
Display Units:	Selectable Inch or cm
Calibration/programming:	Push button
Fail-safe diagnostics:	Relay reverts to safe position
Temperature rating:	-4° to 140° F; (-20° to 60° C)
Temp. compensation:	Automatic over entire range
Pressure rating:	30 psi @ 25 °C., de-rated @ 1.667 psi per °C above 25°C.
Fitting Size:	2" NPT
Transducer material:	Polyvinylidene Fluoride (PVDF)

**Electrical Ratings:**

Enclosure rating:	NEMA 4X / IP65
Enclosure material:	Polypropylene
Supply voltage:	14-36 VDC
Current Consumption:	200 mA
Signal output:	Sourcing or sinking 4-20 mA
Output relay:	Programmable for level alarm, pump-up/ pump-down or loss of signal alarm
Output relay ratings:	250 VAC, 10 amp, 1/2 hp, SPDT

Diagram 2.1 Dimensions

### 3.0 Installation

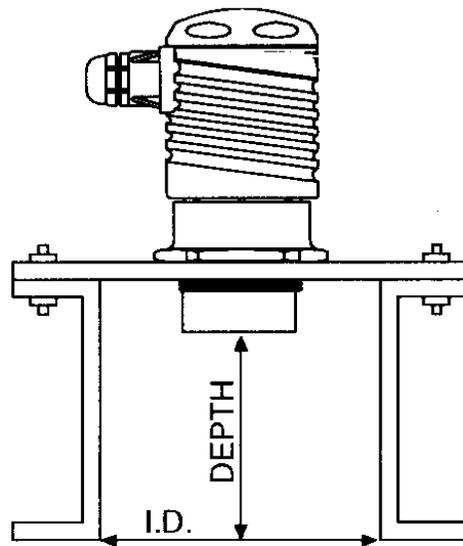
#### 3.1 Mechanical Installation

Mounting the NEO properly is critical to operation. To install the NEO ultrasonic level transmitter in a system proceed as follows:

- 3.1.1 If the NEO is installed such that the transducer face is recessed in a fitting or flange rather than flush with the tank lid, follow the criteria listed in **Diagram 3.1** below. For a recess I.D. less than 3", do not recess the NEO more than 1" for best results.

Diagram 3.1 Recess installation

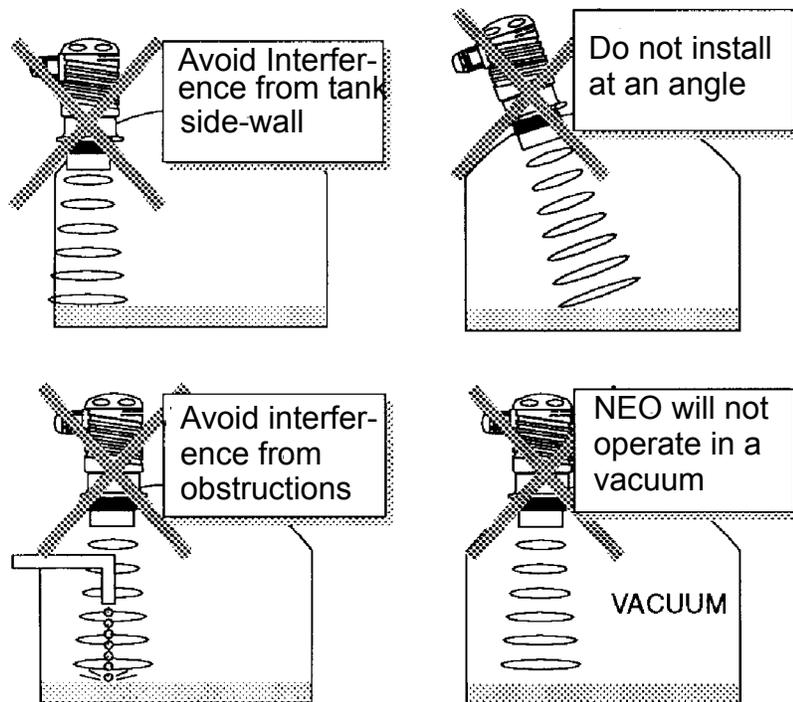
Recess I.D. (inches)	Max. Depth (inches)
3	3
4	7
5	11
6	15
7	19
8	26



3.1.2 The NEO level transmitter must be installed to avoid interference of the ultrasonic beam cone from the tank side wall. It must be installed such that the beam cone is not interfered by obstructions in the tank such as pipes, nozzles, ladders etc. The transmitter cannot be mounted at an angle (i.e. must be mounted perpendicular to the fluid surface). The NEO will not function in a vacuum.

**Diagram 3.2** illustrates these mounting precautions. **Diagram 6.2 on page 11** gives the beam cone radius for various distances from the transducer face.

Diagram 3.2 Installation Precautions



### 3.2 Special Instructions for Mounting near Tank Sidewall, Obstructions, and Turbulent Tanks

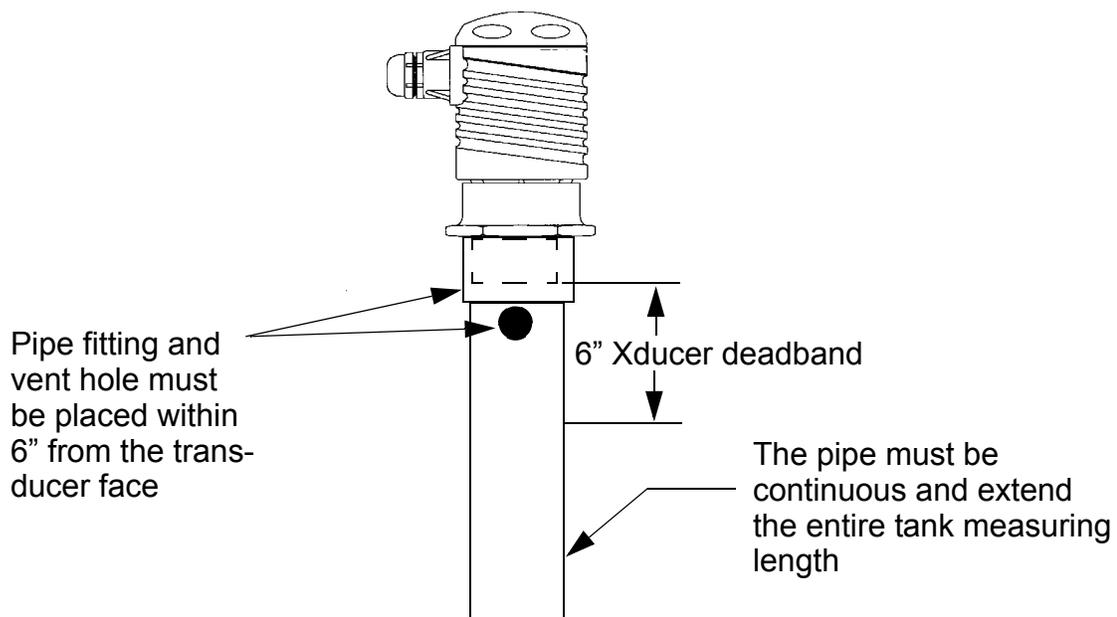
When installing the NEO EchoKing level transmitter, every effort should be made to install the unit adhering to the precautions detailed in section 3.1.2, on page 4. In some installations where it is impossible to install away from the tank sidewall, away from obstructions or where the tank has a turbulent fluid surface it still may be possible to use the NEO level transmitter by attaching a two inch nominal I.D. pipe to the NEO transducer. The ultrasonic beam is then directed down the length of the pipe to the fluid surface and back to the transducer face.

For this type of installation to work successfully, the following specific installation requirements must be met:

- The fluid cannot be a coating type media which will coat the inside of the pipe. If this occurs, the ultrasonic signal will be dispersed and the signal reflected off the fluid surface will not be strong enough to be detected by the NEO.
- The pipe used must be a single, continuous, straight length with no fittings, couplings or discontinuities except for the fitting which attaches the pipe to the 2 inch NPT fitting on the NEO transducer face.
- The pipe must extend into the tank the entire desired measuring length.
- A vent hole must be placed in the pipe. Both the vent hole and the two inch NPT fitting which attaches the pipe to the NEO must be placed within the six inch deadband which extends from the transducer face. If they extend beyond this deadband, they will interfere with the transmitted signal.

**Diagram 3.3** Illustrates this special installation.

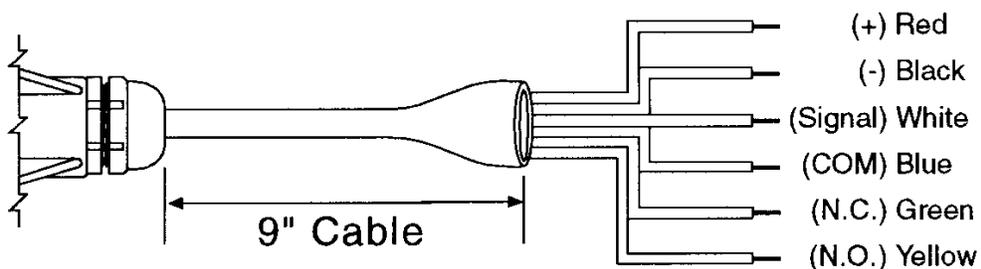
Diagram 3.3.Special NEO EchoKing Installation



#### 4.0 Electrical Connections

The NEO-5000 series level transmitter has both a 4-20 mA continuous level transmitter and SPDT relay. The SPDT relay can be programmed as a level alarm, as a pump-up/pump-down control, to alarm when the transmitted ultrasonic signal return is lost, or to alarm when the 4-20 mA signal is lost. **Diagram 4.1** shows the wiring color coding for the NEO. **The NEO requires a 14-36 VDC power with at least a 200 mA supply.**

Diagram 4.1 NEO-5000 Wiring



#### 4.1 4-20 mA Transmitter Wiring

The NEO-5000 Series level transmitter has two different types of 4-20 mA transmitters. The Model NEO-5003 is a current sourcing 4-20 mA transmitter. This means that it has an internal power source for the 4-20 mA loop and requires no external D.C. power for the 4-20 mA current loop. It is for use with un-powered 4-20 mA loops and with PLCs which have no power source at their current inputs (current sinking inputs). The Model NEO-5004 is a current sinking 4-20 mA transmitter which requires an external power source in its 4-20 mA loop. It is for use with 4-20 mA loops in which has a power source in the loop and with PLCs which have a power source at their current inputs (current sourcing inputs). **Diagram 4.2** shows wiring to a 4-20 mA loop. **Diagram 4.3** shows wiring to PLCs.

Diagram 4.2 Wiring the NEO to a 4-20 mA Control Loop

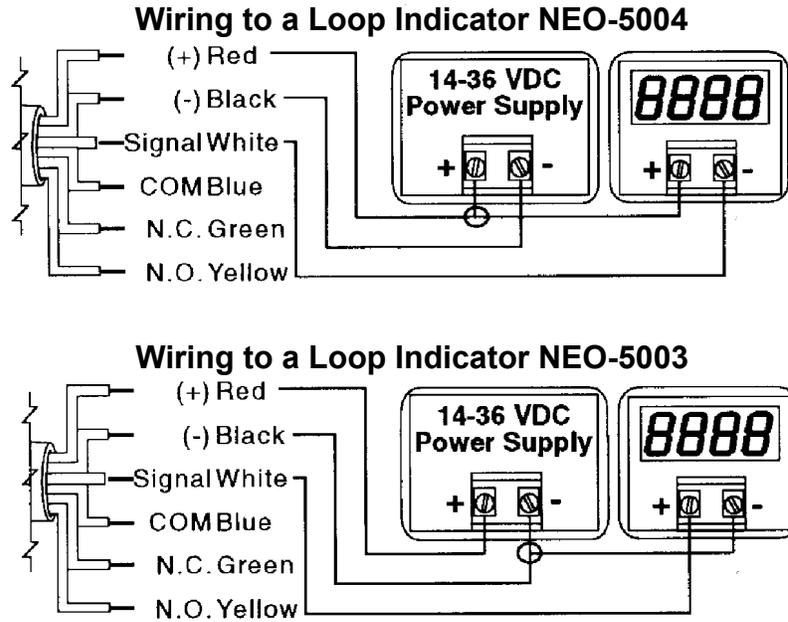
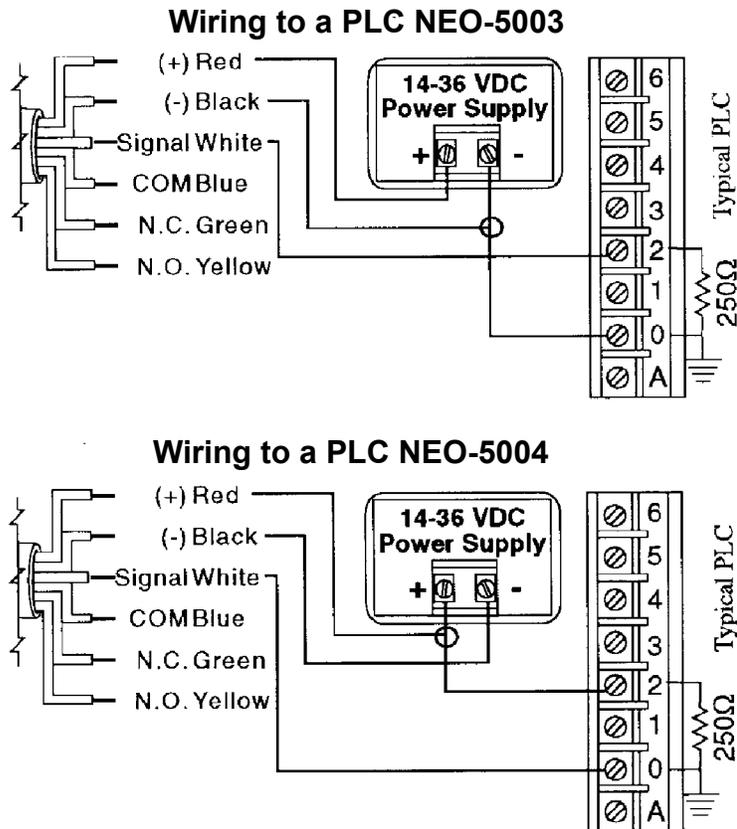
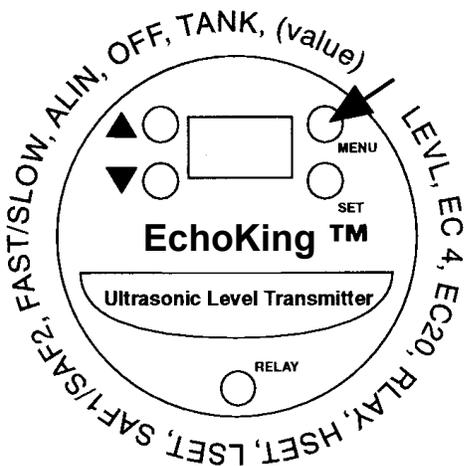


Diagram 4.3 Wiring the NEO to a PLC



## 5.0 Programming/Calibration



Holding down the “MENU” key will scroll the display through its programming sequence. The display is lit only during the programming mode. It will automatically extinguish when programming is completed and the push-buttons are idle for 30 seconds.

The following is a description of each item in the programming sequence:

**Program current settings:** First determine the 4mA and 20 mA distances for the NEO. The 4mA setting is labeled EC4 and the 20 mA setting is labeled EC20. These settings represent the distance from the 4mA and 20 mA level to the bottom of the sensor. The EC4 value will be larger than the EC20 value.

**EC4:** Hold the [MENU] key until EC4 appears in the display. Release the key and wait until a value appears. This value is the level that the NEO currently senses. If this is an acceptable 4 mA tank level, press [SET] to lock the value as the new EC4. If not, press either the [▲] or [▼] keys and the old setting for the EC4 will appear. From here, use the [▲] or [▼] keys to raise or lower the value to the correct measurement. Press the [SET] key to lock this value as the new EC4 value.

**EC20:** Hold the [MENU] key until EC20 appears in the display. Release the key and wait until a value appears. This value is the level that the NEO currently senses. If this is an acceptable 20 mA tank level, press [SET] to lock the value as the new EC20. If not, press either the [▲] or [▼] keys and the old setting for the EC20 will appear. From here, use the [▲] or [of] keys to raise or lower the value to the correct measurement. Press the [SET] key to lock this value as the new EC20 value.

**RLAY:** Only an indicator for the next two modes. The 10 amp relay is latched between the HSET and LSET points (for pump-up/pump-down as an example). To simply energize or de-energize the relay at a single level (as for a level alarm), HSET and LSET should be set to the same value.

**HSET & LSET:** Sets the high point and low point for relay activation. Press [MENU] key until either HSET or LSET appears. Wait for the display to change to the current value and press either [▲] or [▼] to change the numeric value. The [SET] key does not need to be pressed to lock in the value. Repeat process for the other setting.

**SAF1/SAF2:** The 10 amp relay inside the NEO can be used in a fail-safe design for your system. When [SAF1] is set, the relay will **de-energize** when the acoustic return signal is LOST. When [SAF2] is set, the relay will **energize** when the 4-20 mA signal is LOST. Response times will vary according to the setting of the NEO ([FAST] or [SLOW] modes).

**FAST/SLOW:** [FAST] is the standard in which the NEO operates. [SLOW] is designed to dampen out turbulence in tanks. In the [FAST] mode, the NEO will average 8 responses per second and update every second. In the [SLOW] mode, the NEO will average over the preceding 10 seconds. When used with [SAF1] or [SAF2], the time for the relay to switch over is 30 seconds for the [FAST] mode, and 2.5 minutes for the [SLOW] mode.

**ALIN:** Indicates that the unit is in the Alignment Mode. Display will show the return signal strength in dB's. Used as an indicator for mechanical alignment of the NEO and/or to indicate signal attenuation. Typical readings range between 0 and 50 dB's. For optimum alignment, first energize the unit and receive a valid return signal. Then select the ALIN mode and adjust the NEO until the display is maximized.

**ON/OFF:** Used to toggle alignment [ON] or [OFF] with the [Set] key. The ALIN mode must be turned [OFF] when alignment is completed. This mode will not automatically default back to [LEVL].

**TANK:** Used as an indication for [TANK]. TANK sets the maximum tank depth that the NEO will recognize. It will filter out any returns greater than the tank value. This feature is useful for eliminating false readings in tanks which have irregular shaped bottoms or obstructions near the bottom of the tank. When the signal does exceed the tank value, the tank value will be displayed and transmitted. Use the next setting to change the TANK value.

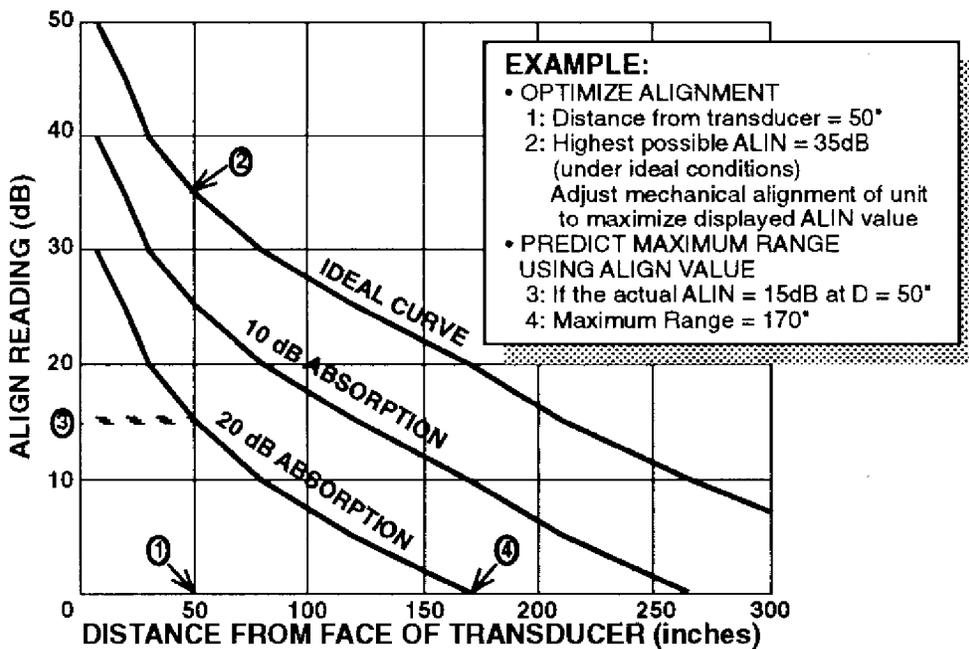
**(value):** Use the [▲] and [▼] buttons to change the current TANK value and press [SET] to enter the value. The NEO will limit the displayed and transmitted level to this distance. The maximum distance is 300 inches.

## 6.0 Troubleshooting

### 6.1 Maximum Application Range for the NEO Level Transmitter

The maximum range of the NEO is 24.5 feet at 110 dB. Yet a number of factors can reduce the overall quality of signal return and shorten the accurate range of the transmitter. To determine the maximum application range of the product, follow the example signal return formula against the echo attenuation graph below.

Diagram 6.1 Echo Attenuation Graph



## 6.2 Loss of Acoustic Return Signal

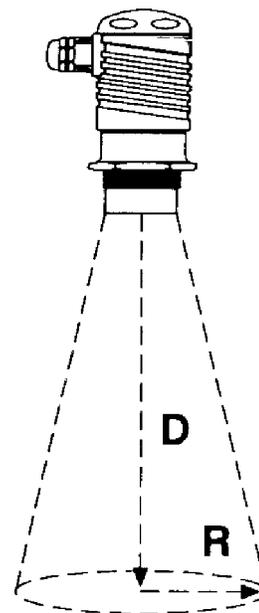
A reading of **LOST** in the display of the NEO indicates the NEO is not receiving a valid return signal. In addition to a **LOST** appearing on the NEO display, the transmitter output will freeze at the last value where a valid acoustic return was received regardless of changes in tank level. If **LOST** appears, please check for:

- Interference such as the side wall, ladders, seams, rungs or pipes within the NEO's beam cone. The beam cone data is listed in **Diagram 6.2** below.
- Proper installation such that the NEO is installed level and free from interference from the installation fitting.
- Sufficient power being supplied to the NEO. The NEO requires 14 to 36 VDC power with a minimum supply of 200 mA.
- Proper programming of the TANK function. For best results, set the TANK function as the distance from the bottom of the tank to the transmitter.

When the acoustic return is again recognized by the NEO. The **LOST** display will clear and the transmitter will resume normal function.

Diagram 6.2      NEO Beam Cone Data

Range (feet)	Radius (inches)	Range (feet)	Radius (inches)
1	2.6	13	21.5
2	4.2	14	23.1
3	5.7	15	24.7
4	7.3	16	26.3
5	8.9	17	27.8
6	10.5	18	29.4
7	12.1	19	31.0
8	13.6	20	32.6
9	15.2	21	34.2
10	16.8	22	35.7
11	18.4	23	37.3
12	20.0	24	38.8
		25	40.5



### 6.3 Factory Settings

The NEO sensor is preset at the factory. When powering up the sensor the first time, the factory settings will be active. If at any time in you need to return to these settings, remove power from the sensor and wait 10 seconds. Press the [Set] and [Menu] buttons simultaneously while powering up the sensor.

Table 6.1 Factory Calibration Default Values

LEVL	Inches	SAF1/2	SAF1
EC 4	8"	F/S	FAST
EC 20	288"	ALIN	N/A
RLAY	N/A	OFF	OFF
HSET	5"	TANK	N/A
LSET	288"	value	288"

### 6.4 Changing the Display Units

The NEO comes preset to measure in inches. To change the unit to display centimeters, remove power to the unit and wait 10 seconds. Press [▲] and [Set] simultaneously while powering up the sensor. The NEO will now read in centimeters. To return to inches, remove power and wait 10 seconds. Press [▼] and [Set] simultaneously while powering up the sensor.

### 6.5 If the Transmitter Output Current is Always 4 mA or 20 mA

If the output of the NEO is always reading 4mA or 20 mA, check the EC 4 and EC 20 input values for the NEO. The display of the NEO reads to the 1/10 of an inch or cm. A display of 1234 is "123.4" and not "1234".

## 7.0 Maintenance

The Series NEO level transmitter is an electronic device with no moving parts. It has a totally digital electronic design which means that there is minimal calibration drift. These features make the NEO virtually maintenance free. If a coating of process media should form on the sensor face the unit should be removed from the system and the sensor face cleaned.

## 8.0 Arrival of Damaged Equipment

Your instrument was inspected prior to shipment and found to be defect-free. If damage is visible on the unit, we advise that you carefully inspect the packing in which it was delivered. If damage is visible, notify your local carrier at once. The carrier is liable for a replacement under these circumstances. If your claim is refused, please contact KOBOLD Instruments.

**CAUTION**

PLEASE READ THE FOLLOWING WARNINGS BEFORE ATTEMPTING  
INSTALLATION OF YOUR NEW DEVICE. FAILURE TO HEED THE  
INFORMATION HEREIN MAY RESULT IN EQUIPMENT FAILURE AND  
POSSIBLE SUBSEQUENT PERSONAL INJURY.

- **User's Responsibility for Safety:** KOBOLD manufactures a wide range of process sensors and technologies. While each of these technologies are designed to operate in a wide variety of applications, it is the user's responsibility to select a technology that is appropriate for the application, to install it properly, to perform tests of the installed system, and to maintain all components. The failure to do so could result in property damage or serious injury.
- **Proper Installation and Handling:** Use a proper sealant with all installations. Never overtighten the transmitter within the fitting. Always check for leaks prior to system start-up.
- **Wiring and Electrical:** A supply voltage of 14-36 VDC is used to power the NEO transmitter. The sensor systems should never exceed a maximum of 36 VDC. Electrical wiring of the sensor should be performed in accordance with all applicable national, state, and local codes.
- **Temperature and Pressure:** The NEO is designed for use in application temperatures from -20 °C (-4 °F) to 60 °C (140 °F), and for use at pressures up to 30 psi @ 25 °C, de-rated @ 1.667 psi per °C above 25 °C. Operation outside these limitations will cause damage to the unit.
- **Material Compatibility:** The NEO is made of two materials. The enclosure is of Polypropylene (PP) and the transducer is made of Polyvinylidene Fluoride (PVDF). Make sure that the model which you have selected is chemically compatible with the application liquids. While the transmitter housing is liquid resistant when installed properly, it is not designed to be immersed. It should be mounted in such a way that it does not normally come into contact with fluid.
- **Flammable, Explosive and Hazardous Applications:** The NEO level transmitter system is not an explosion-proof design. It should not be used in applications where an explosion-proof design is required.
- **Make a Fail-Safe System:** Design a fail-safe system that accommodates the possibility of transmitter or power failure. In critical applications, KOBOLD recommends the use of redundant backup systems and alarms in addition to the primary system.

## WARRANTY, SERVICE & REPAIR

If for some reason your product must be returned for factory service, contact KOBOLD, or your KOBOLD distributor to receive a material return authorization number first, and provide them with the following information:

1. Part number, serial number
2. Name and telephone number of a person who can answer questions related to the product and its application
3. Return shipping address
4. Brief description of the symptom
5. Brief description of the application

A KOBOLD customer service representative will issue a return authorization. Once you have received a return authorization, ship the product prepaid in its original packing to:

KOBOLD INSTRUMENTS INC.  
1801 Parkway View Drive  
Pittsburgh, PA 15205

Please include any related symptom and application information with your product. This information enables our service technicians to process your repair order as quickly as possible.

# KOBOLD

## Ultrasonic Level Transmitter

### Model NEO-5001

### Owner's Manual



Version 2.0.1

Part # LU900005

7/98

This warranty may not be extended, altered or varied except by a written instrument signed by a duly-authorized officer of KOBOLD, Inc. If KOBOLD level transmitters or switches are used for process control where failure of the transmitter or switch could result in personal injury or property damage, an independent means such as a redundant KOBOLD point level switch should be used. Where KOBOLD level transmitters or switches are used as a part of a pressure vessel or pipe, care should be taken to independently protect against personal injury or property damage should the KOBOLD sensor fail or be mishandled. Contact KOBOLD or your local distributor for additional information.

THESE ARE NO WARRANTIES WHICH EXTEND BEYOND THE DESCRIPTION ON THE FACE OF THIS WARRANTY. THIS WARRANTY AND THE OBLIGATIONS AND LIABILITIES OF KOBOLD UNDER IT ARE EXCLUSIVE AND INSTEAD OF, AND THE ORIGINAL PURCHASER HEREBY WAIVES, ALL OTHER REMEDIES, WARRANTIES, GUARANTEES OR LIABILITIES, EXPRESS OR IMPLIED, INCLUDED FROM THIS WARRANTY IS THE IMPLIED WARRANTY OF FITNESS OF THE PRODUCTS FOR A PARTICULAR PURPOSE OR USE AND THE IMPLIED WARRANTY OF MERCHANT ABILITY OF THE PRODUCTS.

Products which are thought to be defective must be shipped prepaid and insured to KOBOLD's factory or a designated service center (the identity and address of which will be provided upon request) within 30 days of the discovery of the defect. Such defective products must be accompanied by proof of the date of purchase.

This warranty does not apply to products which have been subject to electrical or chemical damage due to improper use, accident, negligence, abuse or misuse. Abuse shall be assumed when indicated by electrical damage to relays, feed switches or other components. The warranty does not apply to products which are damaged during shipment back to KOBOLD's factory or designated service center or are returned without the original casing on the products. Moreover, this warranty becomes immediately null and void if anyone other than service personnel authorized by KOBOLD attempts to repair the defective products.

KOBOLD'S obligation under this warranty is solely and exclusively limited to the repair or replacement, at KOBOLD'S option, of the products (or components thereof) which KOBOLD'S examination proves to its satisfaction to be defective. KOBOLD SHALL HAVE NO OBLIGATION FOR CONSEQUENTIAL DAMAGES TO PERSONAL OR REAL PROPERTY, OR FOR INJURY TO ANY PERSON.

This warranty covers only those components of the products which are non-moving and not subject to normal wear. Moreover, products which are modified or altered, and electrical cables which are cut to length during installation are not covered by this warranty.

KOBOLD warrants to the original purchaser of its products that such products will be free from defects in material and in workmanship under normal use and service for a period which is equal to the shorter of one year from the date of purchase of such products.

## SAFETY PRECAUTIONS

### Step Two

**⚠ About this Manual:** PLEASE READ THE ENTIRE MANUAL PRIOR TO INSTALLING OR USING THIS PRODUCT. This manual includes information on all versions of the continuous ultrasonic level transmitter from KOBOLD; model NEO-50\_1 and NEO-50\_1-IS. Please refer to the part number located on the sensor label to verify the exact model which you have purchased.

**⚠ User's Responsibility for Safety:** KOBOLD manufactures a wide range of liquid level sensors and technologies. While each of these technologies are designed to operate in a wide variety of applications, it is the user's responsibility to select a technology that is appropriate for the application, install it properly, perform tests of the installed system, and maintain all components. The failure to do so could result in property damage or serious injury.

**⚠ Proper Installation and Handling:** Use a proper sealant with all installations. Never overtighten the transmitter within the fitting. Always check for leaks prior to system start-up.

**⚠ Wiring and Electrical:** A supply voltage of 12-36 VDC is used to power the NEO-50\_1 transmitter and a supply voltage of 12-32 VDC is used to power the NEO-50\_1-IS. The sensor systems should never exceed a maximum of 36 VDC for the NEO-50\_1 and 32 VDC for the NEO-50\_1-IS. Electrical wiring of the sensor should be performed in accordance with all applicable national, state, and local codes.

**⚠ Temperature and Pressure:** The NEO-50\_1 is designed for use in application temperatures from -40 °C (-40 °F) to 60 °C (140 °F), and for use at pressures up to 30 psi @ 25 °C, derated @ 1.667 psi per °C above 25 °C.

**⚠ Material Compatibility:** The continuous ultrasonic level transmitter, NEO-50\_1, is made of two materials. The enclosure is of Polypropylene (PP) and the transducer is made of Polyvinylidene Fluoride (PVDF). Make sure that the model which you have selected is chemically compatible with the application liquids. While the transmitter housing is liquid-resistant when installed properly, it is not designed to be immersed. It should be mounted in such a way that it does not normally come into contact with fluid.

**⚠ Flammable, Explosive and Hazardous Applications:** Only the NEO-50\_1-IS is rated for use in hazardous locations. Refer to the Certificate of Compliance for all applicable intrinsically safe ratings and entity parameters for the NEO-50\_1-IS. Refer to the National Electric Code (NEC) for all applicable installation requirements in hazardous locations. **DO NOT USE THE NEO-50\_1 GENERAL PURPOSE TRANSMITTER IN HAZARDOUS LOCATIONS.**

**⚠ Make a Fail-Safe System:** Design a fail-safe system that accommodates the possibility of transmitter or power failure. In critical applications, KOBOLD recommends the use of redundant backup systems and alarms in addition to the primary system.

### ⚠ Warning ⚠

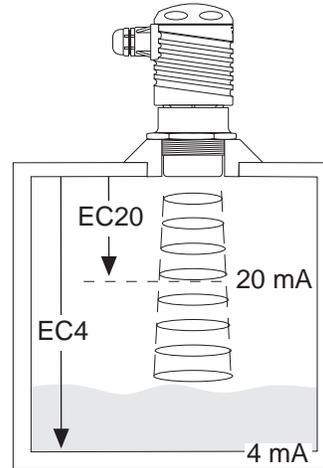
**The NEO-50\_1 is a loop powered device. The load should never exceed 900 Ohms.**

**NEO-50\_1-IS must be installed in accordance with drawing LU20CD rev B (see steps) for safe operation in a hazardous area.**

**When installing the NEO-50\_1, never tighten the transmitter from the body. Always use the wrench flat located above the threads.**

## DEFINITION

### Step Three



**EC4:** The 4 mA setting for the NEO-50\_1. The EC4 is the distance from the bottom of the NEO-50\_1 to the 4 mA set point. This setting is measured in either inches or centimeters on the display. The EC4 setting is typically greater than the EC20 setting.

**EC20:** The 20 mA setting for the NEO-50\_1. The EC20 is the distance from the bottom of the NEO-50\_1 to the 20 mA set point. This setting is measured in either inches or centimeters on the display.

**SAF1/SAF2/SAF3:** Fail-Safe setting for the NEO-50\_1. Use the SAF\_ settings to determine a fail-safe mode for the current signal. When [SAF1] is set, the current will increase to 22 mA if the signal becomes LOST. When [SAF2] is set, the current will decrease to 4 mA if the signal becomes LOST. When [SAF3] is set, the current will remain constant if the signal becomes LOST.

**FAST/SLOW:** Setting for echo averaging on the NEO-50\_1. [FAST] is the typical setting for the NEO-50\_1 to operate. [SLOW] is designed to help dampen out effects caused by severe turbulence. In the [FAST] mode, the NEO-50\_1 will average 2 signal responses per second and update every second. In the [SLOW] mode, the NEO-50\_1 will average signal returns over the preceding 10 seconds. When used with [SAF 1/2/3], the time for the current to default is 30 seconds for [FAST] mode and 2.5 minutes for [SLOW] mode.

**ALIN:** Indicates that the unit is in the Alignment mode. Display will show the return signal strength in dB's. Used as an indicator for mechanical alignment of the NEO-50\_1 and/or signal attenuation. Typical readings range between 2 and 60 dB's. For optimum alignment, first energize the unit and receive a valid return signal. Then select the ALIN mode and adjust the NEO-50\_1 until the display value is maximized.

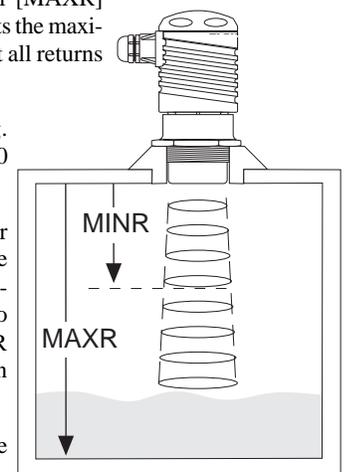
**ON/OFF:** Actual setting for ALIN mode. The ALIN mode must be turned [OFF] when alignment is completed. This mode will not automatically default back to [LEVL].

**MAXR:** Used as an indication for [MAXR] or maximum range. The MAXR sets the maximum tank height and will filter out all returns greater than this value.

**(value):** Actual MAXR setting. The maximum distance is 216.0 inches.

**MINR:** Used as an indication for [MINR] or the minimum range. The MINR value is the deadband closest to the transducer face where no signal will be generated. The MINR sets the minimum distance between the liquid and the transducer.

**(value):** Actual MINR setting. The minimum distance is 6.0 inches.



# PROGRAMMING

## Step Four

### EC4:

1. Hold [MENU] key until EC4 appears in display.
2. Release [MENU] key and wait until a value appears. This value is the current measured level value.
3. If this is acceptable, press [SET] to lock the value as the new EC4 set point. If not, press either the [▲] or [▼] keys once and the old setting for the EC4 will appear.
4. From here, use the [▲] or [▼] keys to raise or lower the value to the desired value.
5. Press the [SET] key to enter this value as the new EC4 set point.

### EC20:

1. Hold [MENU] key until EC20 appears in display.
2. Release [MENU] key and wait until a value appears. This value is the current measured level value.
3. If this is acceptable, press [SET] to lock the value as the new EC20 set point. If not, press either the [▲] or [▼] keys once and the old setting for the EC4 will appear.
4. From here, use the [▲] or [▼] keys to raise or lower the value to the desired value.
5. Press the [SET] key to enter this value as the new EC20 set point.

### SAF1/SAF2/SAF3:

1. Hold [MENU] key until SAF1, SAF2 or SAF3 appears in the display.
2. Release [MENU] key and hold [SET] key to toggle between SAF1, SAF2 and SAF3.
3. When desired setting is reached, release [SET] key. The last displayed setting will be locked into memory. To change, start again at step 1.

### FAST/SLOW:

1. Hold [MENU] key until FAST or SLOW appears in the display.
2. Release [MENU] key and hold [SET] key to toggle between FAST and SLOW.
3. When desired setting is reached, release [SET] key. The last displayed setting will be locked into memory. To change, start again at step 1.

### ALIN:

1. Hold [MENU] key until ALIN appears in the display.
2. Continue to hold [MENU] key until OFF appears in the display.
3. Release [MENU] key and hold [SET] key to toggle from OFF to ON.
4. Release [SET] key. The NEO-50\_1 is now in ALIN mode.
5. To exit ALIN mode, repeat steps 1-4 changing from ON to OFF.

### MAXR:

1. Hold [MENU] key until MAXR appears in the display.
2. Continue to hold [MENU] key until a value appears in the display. This value is the current MAXR setting.
3. If this is acceptable, press [SET] to lock the value as the MAXR setting. If not, use the [▲] or [▼] keys to raise or lower the value to the desired setting.
4. Press the [SET] key to enter this value as the new MAXR setting.

### MINR:

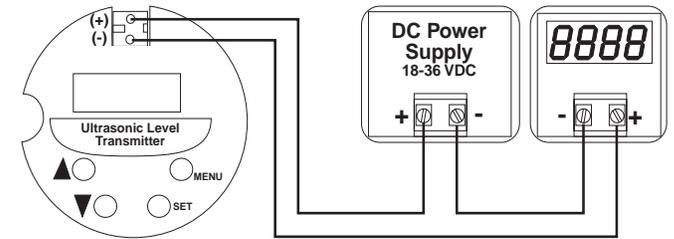
1. Hold [MENU] key until MINR appears in the display.
2. Continue to hold [MENU] key until a value appears in the display. This value is the current MINR setting.
3. If this is acceptable, press [SET] to lock the value as the MINR setting. If not, use the [▲] or [▼] keys to raise or lower the value to the desired value.
4. Press the [SET] key to enter this value as the new MINR setting.

# WIRING

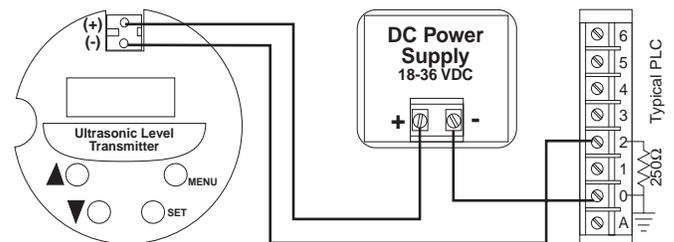
## Step Five

The NEO-50\_1 requires 12-36 VDC power with at least 25 mA supply in order to operate.

### 1. Wiring to a Two-Wire Loop Indicator (Model NEO-50\_1):



### 2. Wiring to a PLC (NEO-50\_1):

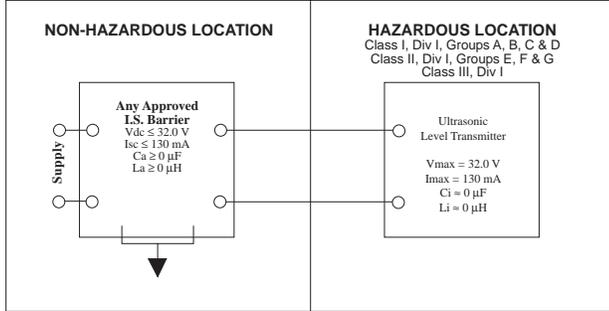


# WIRING II

## Step Six

The NEO-50\_1-IS requires 12-32 VDC power with at least 25 mA supply in order to operate. The follow provides an overview of wiring the NEO-50\_1-IS to various devices. Please note that a barrier must be installed between the NEO-50\_1-IS and the device and the barrier must be located within the nonhazardous location.

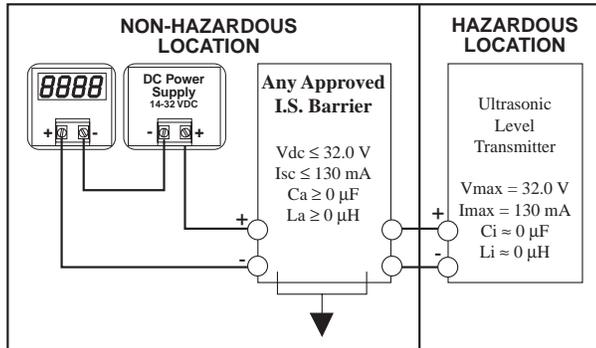
### 1. Hazardous System Diagram



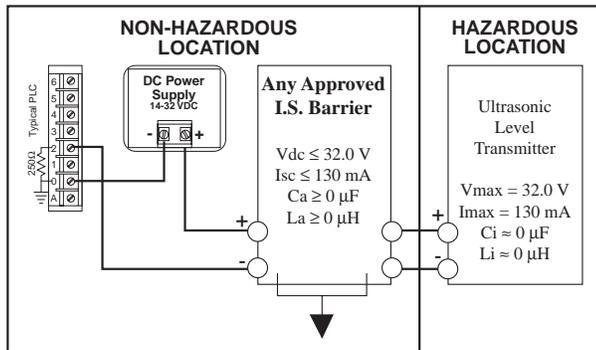
Control drawing for the NEO-50\_1-IS ultrasonic level transmitter approved under the entity concept as an I.S. apparatus

Control Drawing: LU20CD  
Rev. B\* 8-15-97

### 2. Wiring to a Two-Wire Loop Indicator



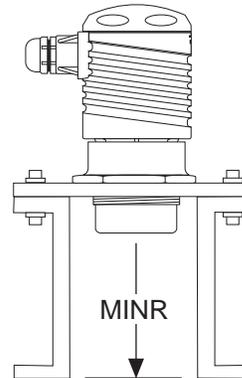
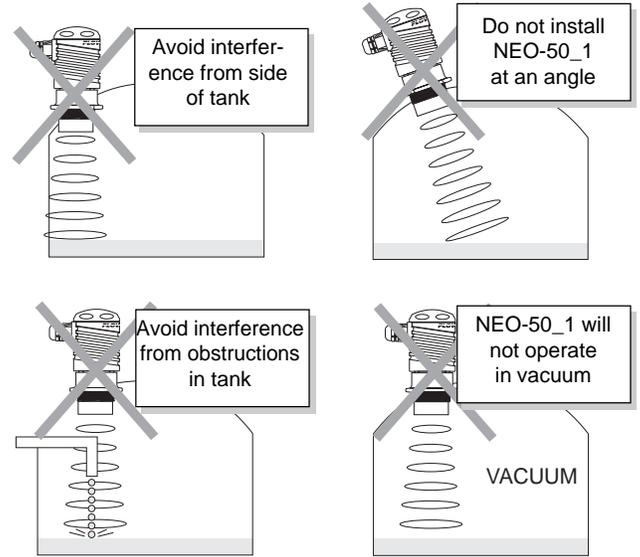
### 3. Wiring to a PLC



# INSTALLATION

## Step Seven

Mounting the NEO-50\_1 is critical to the successful operation of the transmitter. Avoid the following parameters:



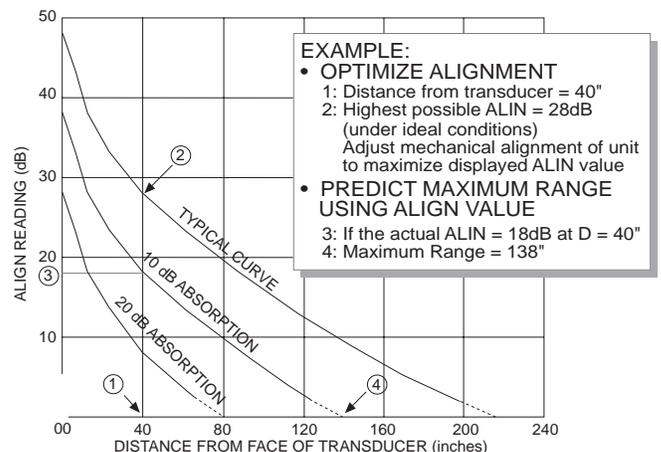
### Minimum Range (MINR) Setting

If installing the NEO-50\_1 in a flange or any device which recesses the bottom of the transmitter, use the MINR setting. The minimum value for the MINR setting is the distance from the bottom of the transmitter to the end of the flange. Never set MINR to less than 6.0 inches.

### Maximum Application Range

The maximum range of NEO-50\_1 is 18 feet at 110 dB. Under less than ideal conditions, a number of factors can reduce the overall quality of signal return and shorten the accurate range of the transmitter. To determine the maximum application range of the product, follow the signal return formula against the echo attenuation graph below.

### Echo Attenuation Graph



## INSTALLATION II

### Step Eight

**Factory Settings:** The NEO-50\_1 is preset at the factory. When powering up the transmitter the first time, the factory settings will be active. If at any time in you need to return to these settings, remove power from the NEO-50\_1 and wait 10 seconds. Press the [Set] and [Menu] buttons simultaneously while powering up the transmitter.

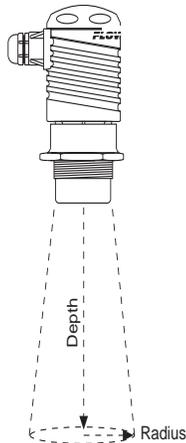
#### Factory Calibration

EC 4	216" (548.4 cm)	OFF	OFF
EC20	8" (20.3 cm)	MAXR	N/A
SAF1/2/3	SAF1	value	216" (548.4 cm)
Fast/Slow	FAST	MINR	N/A
ALIN	N/A	value	6" (15.2 cm)

**Changing Display Units:** The NEO-50\_1 comes preset to measure in inches. To change the unit to display centimeters, remove power to the NEO-50\_1 and wait 10 seconds. Press [▲] and [Set] simultaneously while powering up the transmitter. The NEO-50\_1 will now read in centimeters. To return to inches, remove power and wait 10 seconds. Press [▼] and [Set] simultaneously while powering up the transmitter.

#### Beam Cone Data

Range (Feet)	Radius (Inches)	Range (Feet)	Radius (Inches)
1'	2.6"	10'	16.8"
2'	4.2"	11'	18.4"
3'	5.7"	12'	20.0"
4'	7.3"	13'	21.5"
5'	8.9"	14'	23.1"
6'	10.5"	15'	24.7"
7'	12.1"	16'	26.3"
8'	13.6"	17'	27.8"
9'	15.2"	18'	29.4"



## TROUBLESHOOTING

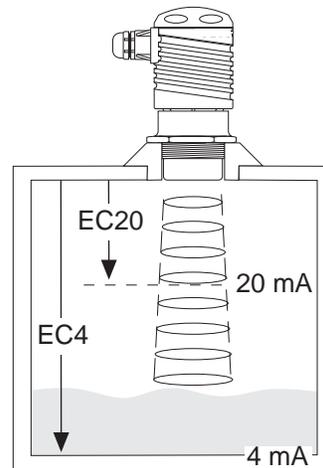
### Step Nine

**LOST Signal:** A reading of LOST in the display of the NEO-50\_1 indicates the transmitter is not receiving a valid return signal. If LOST appears, please check the following troubleshooting items:

1. Beam cone interference such as the side wall, ladders, seams, rungs or pipes within the NEO-50\_1's beam cone.
2. Proper installation such that the NEO-50\_1 is installed level and free from interference from the installation fitting or flange.
3. Sufficient power being supplied to the NEO-50\_1. The NEO-50\_1 requires 12-36 VDC power with a minimum supply of 25 mA. The NEO-50\_1-IS requires 12-32 VDC power with a minimum supply of 25 mA.
4. Proper programming of the MAXR or MINR function. For best results, set the MAXR function as the distance from the bottom of the tank to the bottom of the transmitter. Also set the MINR distance above the highest level in the tank. Do not set the MINR to less than 6 inches.
5. Make sure that the transmitter is not installed at an angle. Even a 5 degree offset can reduce the signal return strength greatly.

#### Other Hints:

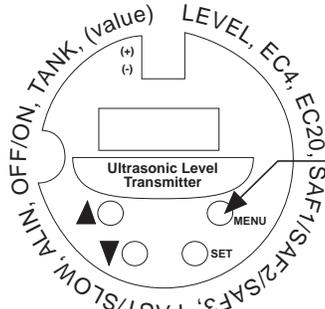
Current must change with changes in level. Example: For the illustration below, as level increases, the current output will increase and as the level decreases, the current output will decrease. If the output of the NEO-50\_1 is always reading 4 mA or 20 mA, check the input values for the NEO-50\_1.



# SPECIFICATIONS

## Step One

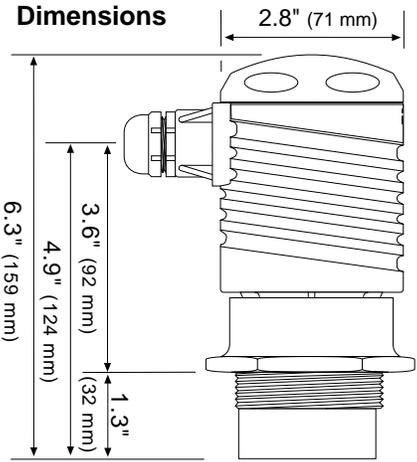
Range:	0.5 to 18 feet (15 cm to 5.4 m)
Accuracy:	± 0.25% of span in air
Resolution:	0.125" (3 mm)
Frequency:	50 kHz
Pulse rate:	2 pulses per second
Beam width:	8° conical
Deadband:	0.5' (15 cm) minimum
Blocking distance:	0.5 to 18 feet (15 cm to 5.4 m)
Display type:	4 segment LCD
Display units:	Inch (cm)
Memory:	Non-volatile
Supply voltage:	GP: 12-36 VDC IS: 12-32 VDC
Max loop resistance:	GP: 900 Ohms @ 36 VDC (see below) IS: 900 Ohms @ 32 VDC (see below)
Signal output:	GP: 4-20 mA, 12-36 VDC (see below) IS: 4-20 mA, 12-32 VDC (see below)
Signal invert:	4-20 mA / 20-4 mA
Calibration:	Push button
Fail-safe diagnostics:	Reverts to 4 mA, 22 mA or remains constant
Temperature rating:	F: -40° to 140° C: -40° to 60° (see below)
Temp. compensation:	Automatic over entire range
Pressure rating:	30 psi (2 bar) @ 25 °C., derated @ 1.667 psi (.113 bar) per °C. above 25 °C. (see below)
Enclosure rating:	NEMA 4X (IP65)
Enclosure material:	Polypropylene (PP), U.L. 94VO
Transducer material:	Polyvinylidene Fluoride (PVDF)
Mounting threads:	2" NPT (2" G)
Mounting gasket:	Viton (2") metric only
Conduit connection:	1/2" NPT (1/2" BSP)
CE Compliance:	EN 50082-2 immunity EN 55011 emission
CSA Certificate:	LR702516
*GP = General Purpose IS = Intrinsically Safe	



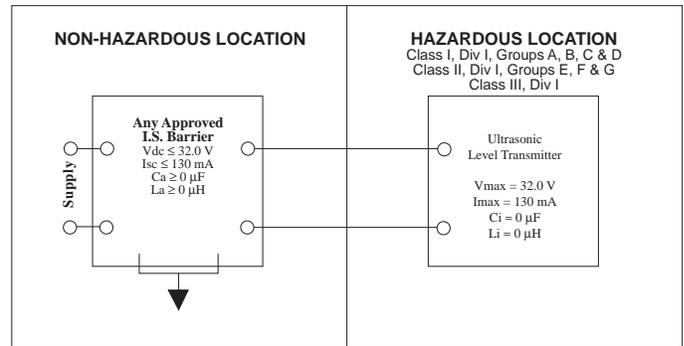
Holding down the [MENU] key will scroll the display in the following sequence.

## Technology

An ultrasonic sound wave is pulsed two times per second from the base of the transducer. The sound wave reflects against the process medium below and returns to the transducer. The microprocessor based electronics measure the time of flight between the sound generation and receipt, and translates this figure into the distance between the transmitter and process medium below.

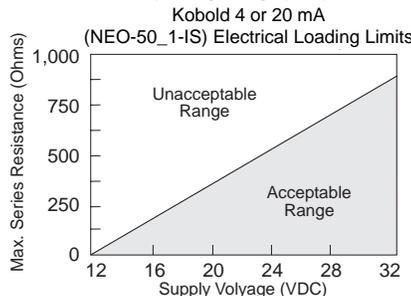
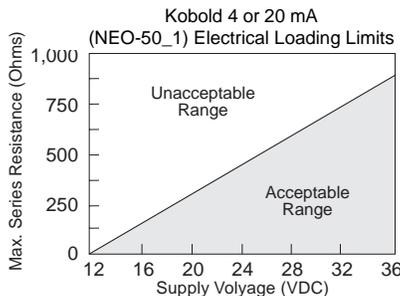
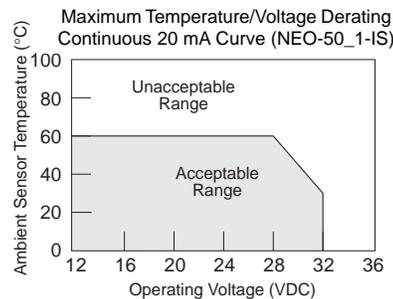
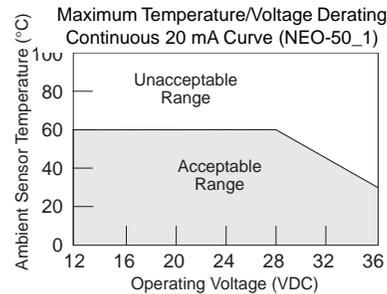
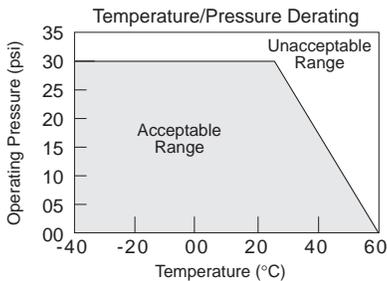


## Intrinsically Safe Control Drawing LU20CD



Control drawing for the NEO-50\_1-IS ultrasonic level transmitter approved under the entity concept as an I.S. apparatus

Control Drawing: LU20CD  
Rev. B\* 8-15-97



**SP** LR 702516

**NRTL/C**  
Intrinsically Safe/  
Securite Intrinseque

Exia

For use in  
**Hazardous Locations:**  
Class I, Groups A, B, C & D  
Class II, Groups E, F & G  
Class III  
Temperature Code: T3C

**Intrinsically Safe when used with an approved I.S. barrier. Entity Parameters**

V<sub>max</sub> = 32.0 VDC  
I<sub>max</sub> = 130 mA  
C<sub>1</sub> = 0 μF  
L<sub>1</sub> = 0 μH

Warning: Suitable for Class I, Groups A, B, C & D; Class II, Groups E, F & G; Class III, T3C; when used with an approved I.S. barrier. Substitution of components may impair intrinsic safety NEO-50\_1-IS requirements for Intrinsically Safe operation.

Part #	Description	Thread
NEO-5001	General Purpose	2" NPT
NEO-5061	General Purpose	2" G
NEO-5001-IS	Intrinsically Safe	2" NPT
NEO-5061-IS	Intrinsically Safe	2" G