

# ULTRA-TRAK 750

## Safety advisory

### Please read before using your instrument.

#### Warning

Improper use of your ultrasonic detector may result in death or serious injury. Observe all safety precautions. Do not attempt to make any repairs or adjustments while the equipment is operating. Be sure to turn off and LOCK OUT all electrical and mechanical sources before performing any corrective maintenance. Always refer to local guidelines for appropriate lockout and maintenance procedures.

**SAFETY PRECAUTION:** Although your ultrasonic instrument is intended to be used while equipment is operating, the close proximity of hot piping, electrical equipment and rotating parts are all potentially hazardous to the user. Be sure to use extreme caution when using your instrument around energized equipment. Avoid direct contact with hot pipes or parts, any moving parts or electrical connections. Do not attempt to check findings by touching the equipment with your hands or fingers. Be sure to use appropriate lockout procedures when attempting repairs.

Be careful with loose hanging parts such as the wrist strap or headphone cord when inspecting near moving mechanical devices since they may get caught. Don't touch moving parts with the contact probe. This may not only damage the part, but cause personal injury as well.

When inspecting electrical equipment, use caution. High voltage equipment can cause death or severe injury. Do not touch live electrical equipment with your instrument. Use the rubber focusing probe with the scanning module. Consult with your safety director before entering the area and follow all safety procedures. In high voltage areas, keep the instrument close to your body by keeping your elbows bent. Use recommended protective clothing. Do not get close to equipment. Your detector will locate problems at a distance.

When working around high temperature piping, use caution. Use protective clothing and do not attempt to touch any piping or equipment while it is hot. Consult with your safety director before entering the area.

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## Overview

The UE Ultra-Trak 750 is an Ultrasonic Sensor that is targeted for continuous monitoring of changes in ultrasonic amplitude. The unit offers an overall dynamic range of roughly 100 decibels, and is configured for structure borne ultrasonic detection.

## UE Ultra-trak 750 installation & operation

### Power requirements

The UE Ultra-Trak 750 requires a 18 to 30 Volt, DC power source @ 30 milliamperes total. The power connections are to be made via the cable connections on the sensor (refer to the connection diagram below). NOTE: The sensor requires +18 VDC Minimum at the sensor after any voltage drops in the power supply loop.

### CABLE CONNECTIONS:

wire color	function
black	ground
red	power supply (vsupply) 18 to 30 vdc
yellow	audio *
blue	sensitivity mode +10 to +30 vdc = max sensitivity ground = adjustable sensitivity
orange	Sensitivity adjustment normally open - momentary contact closure to ground
green	sensitivity adjustment ttl signal, 5hz max
brown	0 to 30 ma output maximum connect to ground for loop powered operation

## Sensitivity control

The UE Ultra-Trak 750 features two modes of sensitivity control.

1. Maximum / Fixed Sensitivity Mode
2. Adjustable Sensitivity Mode
  - a. Maximum / Fixed Sensitivity Mode:

To Set the Ultra-Trak 750 to Fixed Maximum Sensitivity Mode by connecting the Blue wire to the Supply Voltage (18 to 30 VDC) or to an external voltage referenced to power supply ground = 10 to 30 VDC. In this mode the Ultra-Trak 750's sensitivity cannot be adjusted and the dynamic range is fixed at approx. 60 dB. In this mode the Ultra-Trak 750's sensitivity is about +10 dB greater than the maximum sensitivity of the adjustable sensitivity mode.

- b. Adjustable Sensitivity Mode:

To Set the Ultra-Trak 750 to Adjustable Sensitivity Mode by connecting the Blue wire to power supply ground. The sensitivity can be adjusted by momentarily connecting the Orange wire to ground via a normally open momentary switch or normally open momentary relay contact closure. Every time the orange wire is toggled to ground the sensitivity adjustment is incremented. Successively toggling or holding the Orange wire to ground will sequentially increase or decrease the sensitivity. To reverse the direction of sensitivity adjustment pause from toggling the Orange wire to ground for several seconds, then resume toggling the Orange wire to ground and the direction of sensitivity adjustment will be reversed. The sensitivity adjustment is non-volatile. Once the sensitivity is set, if power is lost, wait several seconds before power up and the sensitivity setting will be restored. Failure to wait several seconds before re-powering up the Ultra-Trak 750 may result in the loss of the sensitivity setting. If this occurs re-set the sensitivity as described above. The sensitivity can also be adjusted by connecting a TTL signal to the Green wire. The frequency of the TTL signal should be set between 1 and 5 Hz. When adjusting the sensitivity in this way, the Orange wire is disabled. The TTL signal sweeps the sensitivity adjustment up and down at a rate proportional to the TTL signal frequency. To set sensitivity levels automatically, monitor the Ultra-Trak 750's output level while applying the TTL signal to the Green wire. When the desired output level is measured remove the TTL signal.

## Loop powered operation & power supply current draw

The Ultra-Trak 750's power supply current draw is proportional to the ultrasonic activity sensed. For loop powered operation tie the current output (Brown Wire) to ground (Black Wire). With no Ultrasonic signal at the input, the sensor only draws 4 mA. At the maximum ultrasonic input, the sensor draws approx. 25mA maximum. The full 4 mA to 20 mA range is proportional to an ultrasonic level change of approx. 40dB. The positive power input to the sensor can be connected to a 249 OHM resistor from the positive supply voltage. Monitoring the voltage across the 249 OHM resistor will provide a 1 to 5 VDC signal that is proportional to the received Ultrasound. This voltage signal can be fed into a 5V A to D converter if digital monitoring is required. Refer to Diagram 1 for the connections.

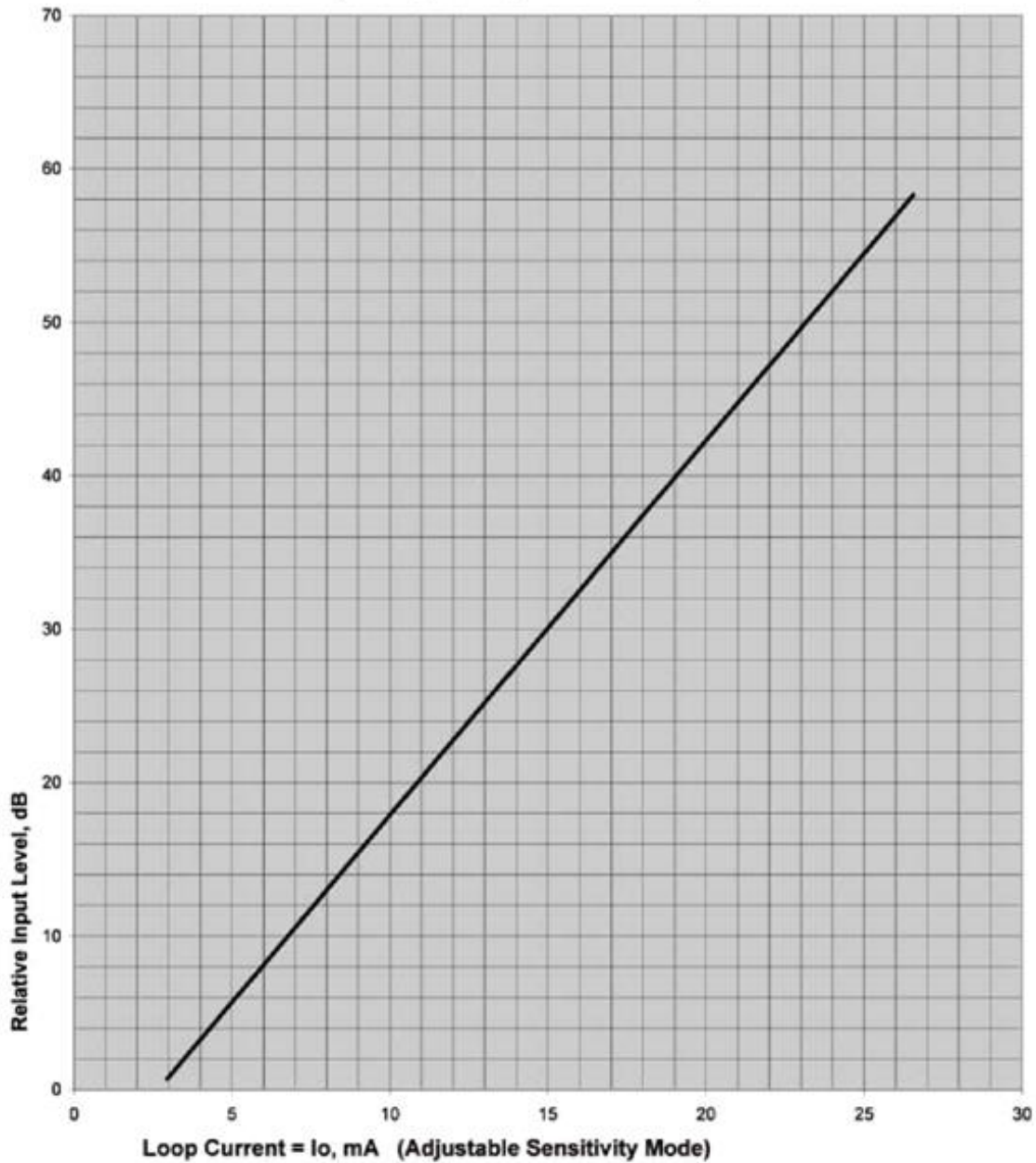
## Audio output

The Ultra-Trak 750 is equipped with an Audio Output. This output is heterodyned and is proportional to the ultrasound detected. The sensor's peak frequency response is approx. 40 KHZ  $\pm$  2 KHZ. The Bandwidth of the audio output is approx. 2KHZ. This output is a low level signal approx. 100 mVrms full scale with an output impedance of approx. 100 ohms.

### Current Output

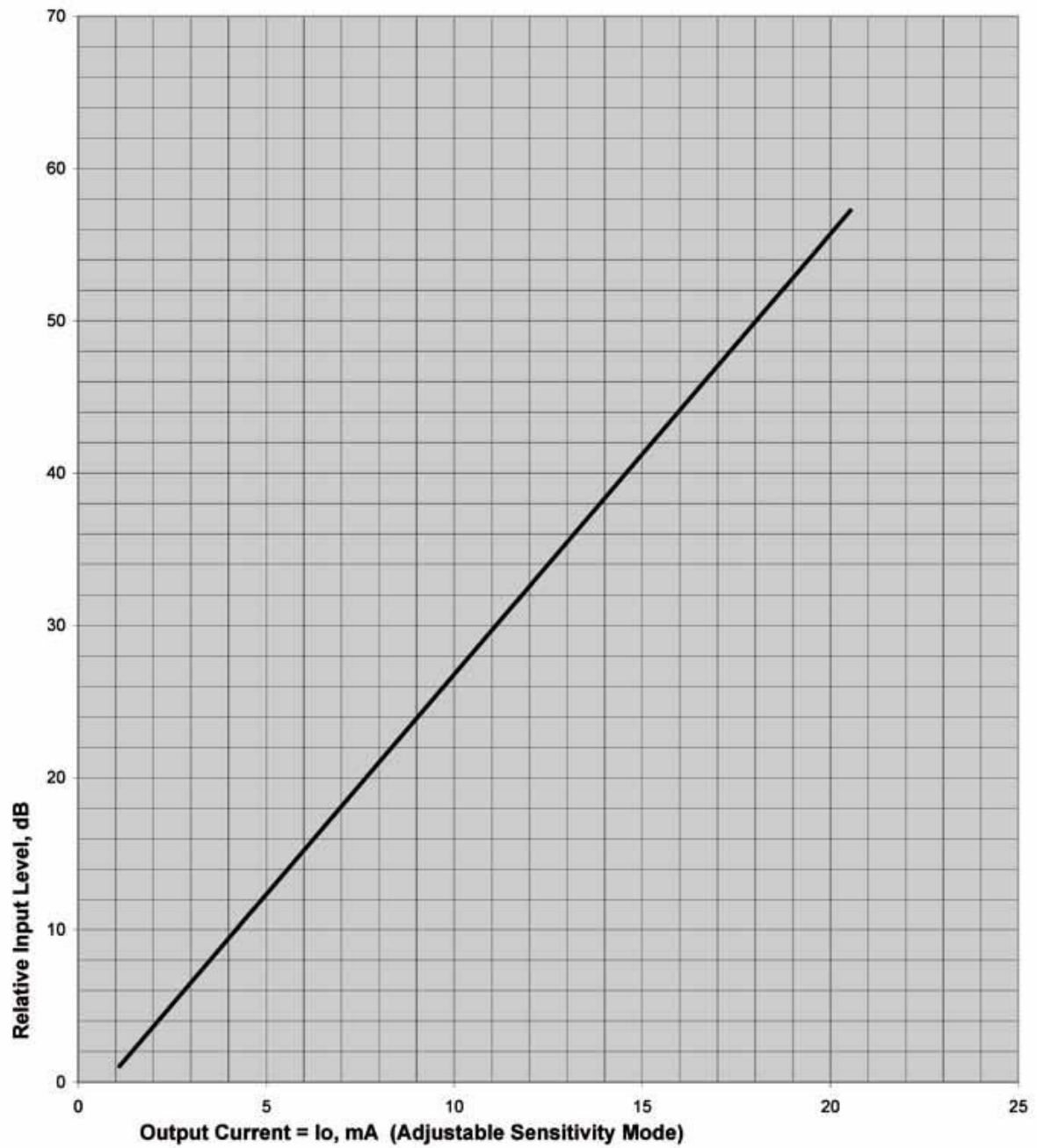
The Ultra-Trak 750 is equipped with a ( 0 to 30 mA max, 0 to 25 mA typical) DC Current Source Output. The output current is proportional to an ultrasonic level change of approx. 60dB.

**UltraTrak 750 Loop Current Typical Transfer Curve**  
(Linearity Error approx. + or - 3 dB)



Transfer function:  $dB = 2.4403 * I_o - 6.5144$   
Specifications subject to change without notice.

### UltraTrak 750 Current Source Typical Transfer Curve (Linearity Error approx. + or - 3 dB)



Transfer Function:  $\text{dB} = 2.8914 \cdot I_o - 2.1311$

Specifications subject to change without notice

## System setup

Once the system is connected and functioning properly, the Ultra-Trak 750 should be exposed to the user's steady state source (ambient condition) of ultrasound (bearing, leak, etc.). This ultrasonic source should represent a normally functioning bearing, valve, etc. During exposure, the user must monitor the power supply current or the current output.

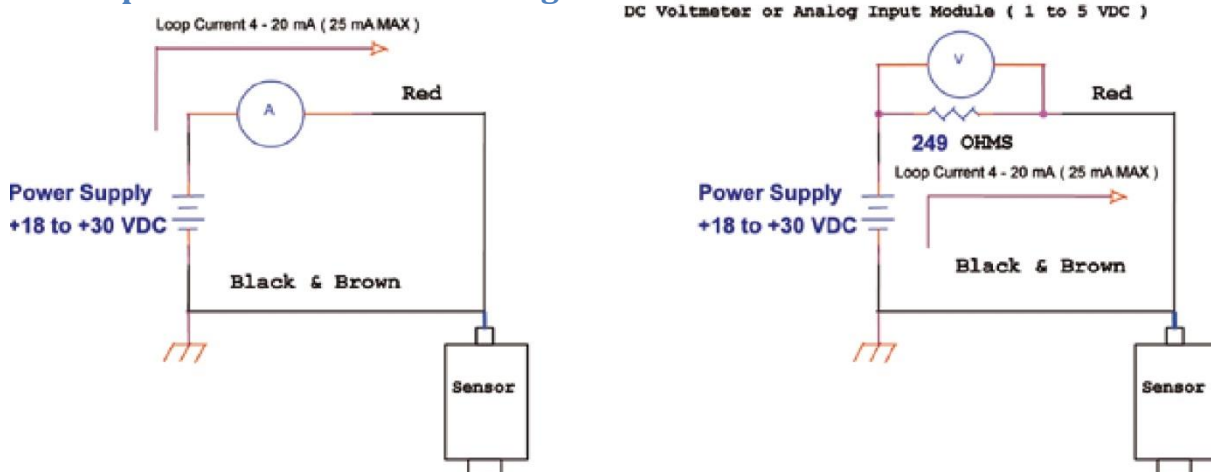
### Sensing Ultrasound Above a Set Threshold:

The Ultra-Trak 750 sensor's sensitivity must be adjusted so that the output level of the sensor is located somewhere in the lower portion of the applicable range (4.3 to 5.0 mA on the Power Supply Current draw or 1 to 2 mA on the Current Source Output). This is now the threshold setting of the sensor. If the ultrasonic amplitude increases above the ambient condition the sensor's output will increase. The sensor will now sense the increases in ultrasonic activity above the threshold (ambient condition).

### Sensing Ultrasound Below a Set Threshold:

The Ultra-Trak 750 sensor's sensitivity must be adjusted so that the output level of the sensor is located somewhere in the upper portion of the applicable range (19 to 20 mA on the Power Supply Current draw or on the Current Source Output). This is now the threshold setting of the sensor. If the ultrasonic amplitude decreases below the ambient condition the sensor's output will decrease. The sensor will now sense the decreases in ultrasonic below the threshold (ambient condition).

### Loop Powered Connection Diagram:



**Note:** The 249 ohm resistor is not required if using the Current Source Output

There are ultrasonic components in practically all forms of friction. As an example, if one were to rub the sensor probe with a finger, an ultrasonic signal will be generated. Although there might be some audible components to this friction, the sensor will only sense the ultrasonic components which, in this example, will be considered a gross signal that is also amplified. In fact, due to the comparative low amplitude nature of ultrasound, amplification is a very important feature. Although there are obvious audible sounds emitted by most operating equipment, is the ultrasonic elements of the acoustic emissions that are generally the most important. Ultrasound offers a predictable diagnostic capacity. When changes begin to occur in the ultrasonic range, there is still time to plan appropriate maintenance. According to NASA research, when a bearing enters the beginning stages of failure, there is an amplitude increase of from 12 to 50 times over a set baseline. Not only can the early stage of bearing failure be monitored and detected, other warning signs can also be noted such as: lack of lubrication, advanced failure and catastrophic failure.

The levels of change are as follows:

lubrication failure:	8 db
beginning stages of failure:	16 db
catastrophic failure:	35 to 50 db



## Cavitation

As air enters a valve or pump, the dynamics of the pressure within can create cavitation: the forming and explosion of bubbles. Although cavitation may be present, it does not necessarily create a problem. It becomes a maintenance problem only when the process increases to produce conditions that will cause internal damage. By setting a baseline, the increase in cavitation activity can be monitored to a point where an alarm can be set and preventive measures can be taken.

## Monitoring: flow/no flow and leakage

Valves control fluid flow. Whether the valve's function is to provide a simple flow/ no flow operation (on/off) or to regulate the amount of flow, a malfunction can be critical. Changes in amplitude related to these conditions can be monitored and alarm levels may be set to note or control these changes.

When leak occurs, the fluid will move from high pressure (upstream), through the valve seat, to the low pressure (downstream) side. As it reaches the low pressure side, it expands briefly, producing a turbulent flow. This turbulence has strong ultrasound components. The amplitude of the turbulence is related to a few basics:

1. Fluid Viscosity  
Under identical environments, pressures, leak size, etc.; a lighter fluid, such as air will produce more turbulence than a heavier fluid, such as oil.
2. Orifice Size  
The more the restriction of a fluid, less amplitude generated. A smaller diameter hole will not produce as much sound as a larger hole under similar flow conditions.
3. Pressure Differential  
Given identical leak sizes, when there is a greater pressure difference between the upstream and downstream sides, the leak with the greater difference will produce a louder signal.

## Solid Flow: Powders, Metal Filings, Etc.

As solid moves through a carrier, such as piping, the particles will produce friction which may be monitored. Any flow disruption will display a drop in amplitude over a pre-set baseline and will be detected. This may be set up to produce an alarm.

## Ultrasound technology

The Ultrasound Technology utilized by this system is generally referred to as “Airborne Ultrasound”. Airborne Ultrasound is concerned with the transmission and reception of ultrasound through the atmosphere without the need of sound conductive (interface) gels. It incorporates methods of receiving signals generated through one or more media via wave signals. When it is used to detect/monitor problems within a specific media, the technology may be referred to as Airborne/ Structure borne Ultrasound (A/B Ultrasound).

A/B Ultrasound is concerned with sound waves that occur above human perception. The normal “audible” environment in which the human ear is capable of sensing is 20 Hertz to 20 kHz (1,000 Hertz is 1 kiloHertz or 1 kHz). The average threshold of human perception is 16,500 Hertz or 16.5 kiloHertz. These audible wavelengths range in size from as small as 3/4 inch (1.9 cm) to as large as 56 feet (17 m). The frequencies sensed by airborne ultrasound instruments such as the UE XS are above 20 kHz to 100 kHz. The wavelengths are magnitudes smaller than the audible, ranging from 1/8 inch (0.3 cm) to 5.8 inch (1.6 cm). The short wave nature of the ultrasonic signal provides many advantages over lower frequencies.

1. High frequency amplitudes drop off quickly as they move from the source of emission.
2. The signals tend to radiate in straight paths providing relative ease of detection.
3. Since the signal strength diminishes rapidly, the sound source is easily separated from background noise.
4. Subtle changes are detected before a major failure occurs.

## Ultra-Trak 750™ Specifications

	<b>Loop Powered</b>	<b>Current Output</b>
<b>Power Supply</b>	18-30 V (30 mA max)	18-30 V
<b>Current Draw</b>	4-20 mA (25 mA max)proportional to ultrasound signal detection	30 mA max
<b>Output</b>	Demodulated/heterodyned	Demodulated/heterodyned 4-20 mA proportional to ultra sound signal detected
<b>Ambient Temperature Range</b>	0 °C - 50 °C (32 °F - 122 °F)	
<b>Detection Frequency</b>	40 kHz (± 2 kHz)	
<b>Non-Volatile Sensitivity Adjustment</b>	Pushbutton contact closure or TTL control signal	
<b>Cable</b>	RF Shielded 3 m (10")	
<b>Transducer</b>	piezoelectric	
<b>Method of Attachment</b>	10/32 female thread mounting	
<b>Housing</b>	Stainless steel: water resistant and dustproof, meets NEMA 4X requirements. Exceeds IP 64 ratings	

Need further support?

Want information regarding products or training?

Contact :

UE Systems Europe, Windmolen 20, 7609 NN Almelo (NL)

e: [info@uesystems.eu](mailto:info@uesystems.eu) w: [www.uesystems.eu](http://www.uesystems.eu)

t: +31 (0)546 725 125 f: +31 (0)546 725 126

[www.uesystems.eu](http://www.uesystems.eu)