UE UCA586 ULTRASONIC CONDITION ANALYZER

Instruction Manual

OVERVIEW

The UE UCA586 is an Ultrasonic Detection unit that is targeted for continuous monitoring. The unit offers an overall dynamic range of roughly 100 decibels, and is configured for structure borne ultrasonic detection.

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 UCA586 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.

Mechanical Monitoring Concepts

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.

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 restriction on a fluid, the 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.

4. Orifice Shape
   Under the same environmental conditions, a smooth orifice will not produce as much turbulence as a jagged edge orifice.

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 preset baseline and will be detected. This may be set up to produce an alarm.

UE UCA586 INSTALLATION & OPERATION

POWER REQUIREMENTS

The UE UCA586 requires a 24 Volt, DC power source @ 200 milliamperes total. The power connections are to be made to the I/O cable. Refer to the Pin Out/Description Diagram for the connections.

SENSITIVITY CONTROL

In order to accommodate the entire 100 decibel dynamic range, some adjustment in the field is required. This is set by the 20 turn potentiometer located inside the unit. It is accessed through the front panel behind the hex head screw next to the DB9 connector. The sensitivity is preset at the factory to maximum or fully clockwise. If this is too sensitive, turn the potentiometer counterclockwise to decrease the sensitivity.

THRESHOLD CONTROL

The threshold adjustment is available if an alarm output is required. This is the adjustment used to get a simple output signal change when the ultrasonic input has either exceeded or gone below a set point. There is a Alarm Threshold Sense output at pin 8 on the DB9 connector or on the Blue colored I/O Cable wire. This can be detected as a voltage from 0-10 VDC which is where the threshold or set point is currently adjusted to. To raise the level, turn the potentiometer clockwise and to lower the level turn the potentiometer counterclockwise.

VOLTAGE AND CURRENT OUTPUTS

The sensor provides voltage, and current outputs. The voltage and current outputs are continuous analog signals that are proportional to the ultrasonic activity sensed.

The voltage output has a range of 0 to 10 volts DC full scale. A 2.5 volt change in output voltage corresponds to a 10dB change in ultrasonic input signal. Therefore, the entire 10 volt range represents a 40 dB change in ultrasonic input level.

The current output has a range of 4 mA to 20 mA DC. Therefore, the full 4 mA to 20 mA range represents an ultrasonic level change of 40dB. The output can be connected to a 250 OHM resistor from current output to current output return and fed to a 5V A to D converter if digital monitoring is required. Refer to the diagram for connections. Note: Current output is 4-20 mA output (pin 2) and current output return is pin 3 .

ALARM OUTPUT

The sensor provides an alarm output which is an open collector transistor. The open collector can switch 24 volts DC @10 mA maximum. The alarm is preset at the Factory to transition at 50% of full scale. There are no “dead bands”. The alarm output stops conducting when the input or ultrasonic signal level exceeds the threshold level or set point.

HETERODYNED AUDIO OUTPUT

The sensor provides an audio output for use with a speaker or a pair of headphones. The signal can also be fed into a spectrum analyzer for waveform analysis. The output level is preset at the Factory @ 90 dBA for the full scale output.

SYSTEM SETUP

Once the system is connected and functioning properly, the sensor should be exposed to the user’s steady state source of ultrasound (bearing, leak, etc.) this ultrasonic source should represent a normally functioning valve, bearing, etc. During exposure, the user should monitor the current or voltage output. The sensitivity should be adjusted so that this steady state ultrasonic level is converted to an output that is located somewhere in the lower portion of the applicable range (4.3 to 5.0 mA on the current output or .5 to 1.0 volt on the voltage output).

The unit will now sense the increases in ultrasonic activity above the ambient condition.

DECREASES OF ULTRASOUND LEVELS

If the application requires the sensing of ultrasonic decreases, the sensitivity of the unit should be adjusted (with ambient ultrasound sensed) so that the current output and or the voltage output is in high portion of the applicable range.

UE UCA586 PIN OUT/DESCRIPTION DIAGRAM

PIN#	I/O CABLE COLOR	DESCRIPTION
1	Orange	0-10 VDC Output
2	Red	4-20 mA Output
3	Green	4-20 mA Return
4	White	Heterodyned (Audio) Output
5	Black	Ground
6	Yellow	Open Collector Alarm Output (rated at 24VDC @10 mA maximun)
7	Black	Ground
8	Blue	Alarm Threshold (Set Point) Sense
9	Brown	Power Supply Voltage Input. 20 to 30 VDC, nominal 24VDC @200 mA maximum.

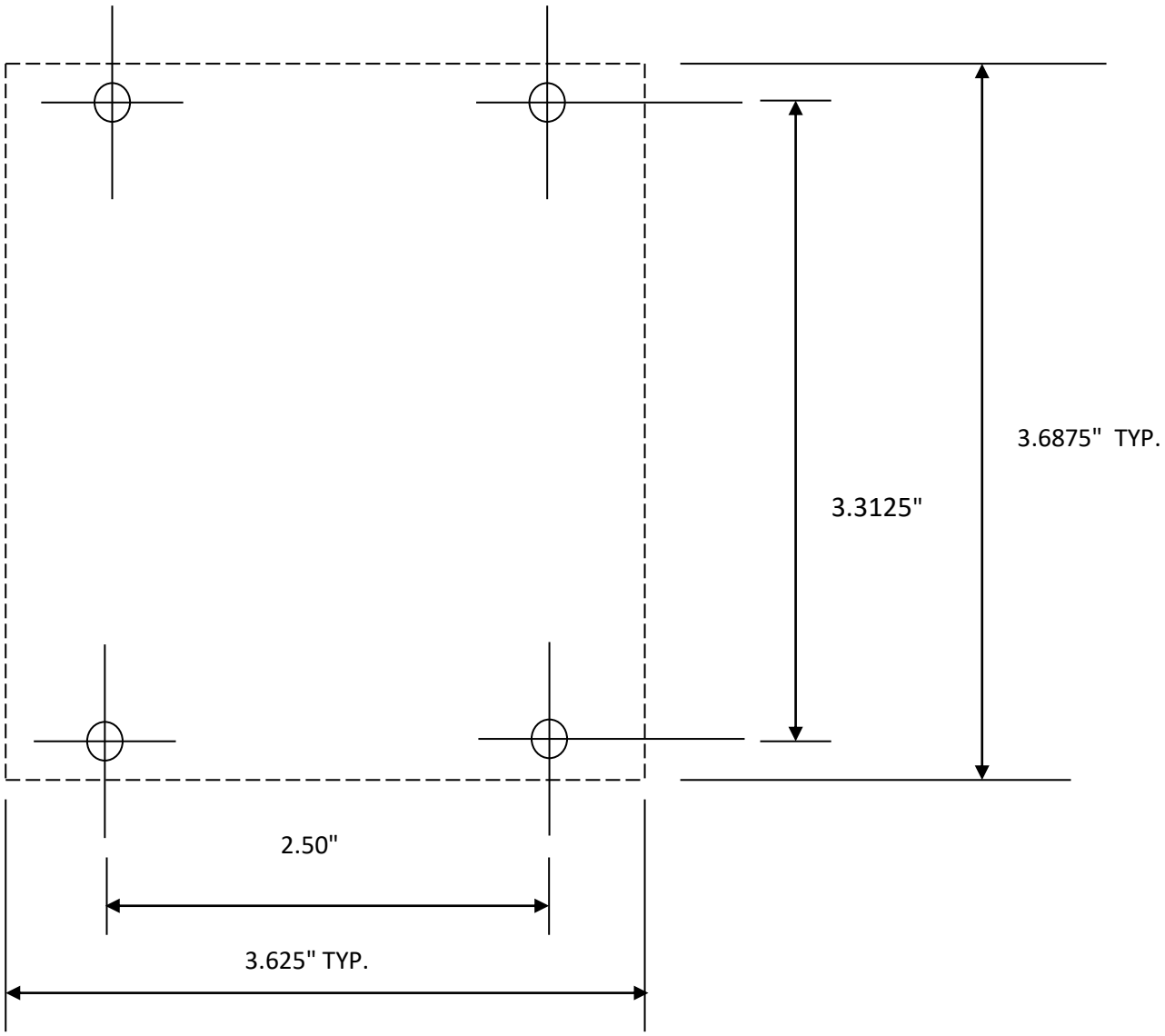
PANEL INDICATORS:

LED	FUNCTION
Blue	UCA586 Powered Up & Ok to Monitor
Red	LED ON = Alarm Condition

PANEL Adjustments:

Sensitivity Adjust
Threshold Adjust

The Sensitivity and Threshold adjustments are internal and are located behind the black Button Head Screws on the front panel. Turn clockwise to increase and counterclockwise to decrease.



(4) HOLES .1875" DIA

HEIGHT = 1.90"

Specifications

Frequency Range:	25-50 kHz
Outputs:	4-20 mA DC Linear Output Transfer Function: dB/mA DC Scale: 1 mA DC = 2.5 dB input Level Dynamic Measurement Range: 40 dB (set anywhere along the 100 dB input range) 0-10 DC V Linear Output Transfer Function: dB/VDC Scale: 1 VDC = 4 dB input level Dynamic Measurement Range: 40 dB(set anywhere along the 100 dB input range)
Alarm:	Open collector rated @ 24 VDC, 10 mA Threshold Level: Adjustable over the output range. Alarm output stops conducting when input level exceeds the threshold level (set point)
Heterodyned (Audio) Output:	90 dBA at full scale output into 16 ohms 3 dB bandwidth approx. 6 kHz
Threshold Setting:	Low impedance output which senses the threshold setpoint (set point)
Dynamic Input Range:	Approx. 100 dB
I/O Cable:	RF shielded. Length: 6 ft. (1.82 m)
I/O Connector:	DB9
Transducer Input Connector:	BNC
Panel Adjustments:	Sensitivity and threshold
Power Indicator:	Blue LED
Alarm Indicator:	(local) Red LED

Need further support?

Want information regarding products or training?

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