Use of the UltraTEV™ Family of Products to Detect Physical Phenomena

Date: May 2016

Version History

Date	Version	Author(s)	Notes
May 2016	1	W. Higinbotham	

Final Approval

Approval Type	Date	Version	EA Technology Issue Authority
Unrestricted	TBD	1	

EA Technology LLC, Denville NJ USA
http://www.eatechnologyusa.com

Executive Summary

The UltraTEV™ family of products is designed for the use of detection partial discharge in medium and high voltage electrical apparatus. One technology it employs is a highly sensitive ultrasonic sensing system. This sensing system can be used for a variety of other applications such as vacuum and pressure leak detection, bad bearing detection, and vibration source location.

While these are not the primary uses of the equipment, these abilities add a level of usefulness to the product. This document explains how the UltraTEV can be used for detecting physical phenomena.

Contents

1. Forward

The UltraTEV[tm] family of products is designed for the use of detection partial discharge in medium and high voltage electrical apparatus. One technology it employs is a highly sensitive ultrasonic sensing system. This sensing system can be used for a variety of other applications such as vacuum and pressure leak detection, bad bearing detection, and vibration source location.

While these are not the primary uses of the equipment, these abilities add a level of usefulness to the product. The examples given below are not the only areas where ultrasonic detection can be of value. Many physical operations involve the generation of audio and ultrasonic energy which may be used to detect abnormal conditions.

2. Introduction to Ultrasonic Detection

The UltraTEV family of products all include an ultrasonic sensing function. The products come with several narrow band ultrasonic sensors. With the UltraTEV Plus for example, the user has a choice of the built in sensor, the flexible probe sensor, the parabolic dish, and the contact sensor.

All of these sensors go to a measuring circuit which provides a quantitative measurement of the energy in a 2 KHz band centered at 40 KHz. Additional circuitry then heterodynes the signal down to be centered at 1.6 KHz without changing its nature. This is available via the headphone jack on the unit. A volume control and mute function is provided. When connected to a set of high quality headphones, this output allows the user to hear what is normally above the range of human hearing.

The built in sensor and flexible sensors are designed for short distance detection through air. They should not be expected to work well beyond 10 feet.

The parabolic dish focusses sound and is designed to work at a much longer range. The parabolic dish can give a gain of 20 dB (100 times more sensitive on axis) over the other sensors. A laser pointer is included to help identify the source of the sound.

The contact sensor can be used to detect ultrasonic vibrations in machinery or to detect airborne ultrasonic energy on the far side of a thin metal panel such as a cabinet door.

3. Use of the UltraTEV Plus for Ultrasonic detection of Mechanical Phenomena

3.1 Vacuum leaks

Small vacuum leaks are extremely difficult to locate by their very nature. There is no outgoing substance (air, hydraulic fluid, product, etc.) to be seen. In addition, any noise is going to be very low in amplitude because the vacuum reduces the sound energy escaping the leak area. However, small vacuum leaks to create turbulent air and turbulent air creates a high level of ultrasonic energy.

A sensitive instrument like the UltraTEV Plus can detect this energy. Extreme sensitivity is the key. The UltraTEV plus is capable of measuring Ultrasonic levels as low as -7 dBuV. By comparison, the ultrasound given off by a human eye blink at 1 foot is about +8 dBuV. This can easily be detected and heard through the UltraTEV Plus.

3.2 Pressure leaks

Pressure leaks are also detected via the turbulence created in the air surrounding the leaks. They are often easier to detect because they give off significant audio noise as well. Pressure leaks can be difficult to locate because the sound reflects off hard surfaces and it may not be feasible to get close enough to the equipment when operating.

Using the flexible sensor or parabolic dish will allow the user to remain clear of the equipment when searching for the leak. The level measurement can also be of value because as one gets closer to the source, the values should increase. This is difficult to quantify without the readout.

3.3 Mechanical Vibrations

Mechanical vibrations are typically heavily dominated by both the frequency of the source (i.e an 1800 RPM motor with a bearing that makes noise in one spot is going to have a lot of 30 Hz energy) and the natural resonant frequency of the mechanism. In addition, mechanisms will give harmonically related (i.e 2x, 4x, 8x, etc) vibrations and this can generate significant ultrasonic energy. Lastly, the ultrasonic energy may be in bursts related to the dominant frequency. In any event, these patterns are distinct and detectable. This energy can be airborne but is usually better detected with the contact sensor.

The sensor should be applied to the surface and unless the surface is very smooth, it helps if there is something to provide good contact. The voids between the sensor and the mechanism can limit the sensitivity. A small amount of modelling clay, ultrasonic gel, or even bearing grease is recommended for all but the smoothest of surfaces.

As all mechanical devices are going to emit some ultrasonic energy, the best method for determining concerning emissions is by comparison. Comparing the levels from two identical motors will give an indication of the bearing health. In addition, baseline testing of motors in their current state and periodically checking them for significant changes in level can provide valuable information

4. Disclaimer

These notes are provided for technical guidance only. It is the responsibility of the operator to perform any safety/risk assessments necessary to perform the measurements in keeping with their Company policy and the operational conditions prevailing at the time. The photographs provided in this document are for illustrative purposes only and are not to be taken as a guide to appropriate PPE usage.

5. Further Assistance

Should you require further advice or technical assistance in using the UltraTEV Plus+™ or other instruments, please contact Product Support at EA Technology:

Product Support

Email: product-support@eatechnology.com (Copy sales@eatechnologyusa.com)

Tel: (862) 261-2759 (North America)

Tel: +44 (0)151 347 2293 (UK)

6. Contact Us

For non-technical enquiries, please use the following contact details:

EA Technology LLC

400 Morris Avenue, Suite 240

Denville, NJ 07834

USA

www.eatechnologyusa.com

Email: sales@eatechnologyusa.com

(862) 261-2759

www.eatechnologyusa.com
Australia | China | Singapore | UAE | Europe | USA

Main Telephone (862) 261-2759
EA Technology LLC 400 Morris Ave, Suite 240
Denville NJ 07834 USA

Global Footprint

We provide products, services and support for customers in 90 countries, through our offices in Australia, China, Europe, Singapore, UAE and USA, together with more than 40 distribution partners.

Our Expertise

We provide world-leading asset management solutions for power plant and networks.

Our customers include electricity generation, transmission and distribution companies, together with major power plant operators in the private and public sectors.

- Our products, services, management systems and knowledge enable customers to:
- Prevent outages
- Assess the condition of assets
- Understand why assets fail
- Optimise network operations
- Make smarter investment decisions
- Build smarter grids
- Achieve the latest standards
- Develop their power skills

Main Telephone (862) 261-2759
EA Technology LLC 400 Morris Ave, Suite 240
Denville NJ 07834 USA