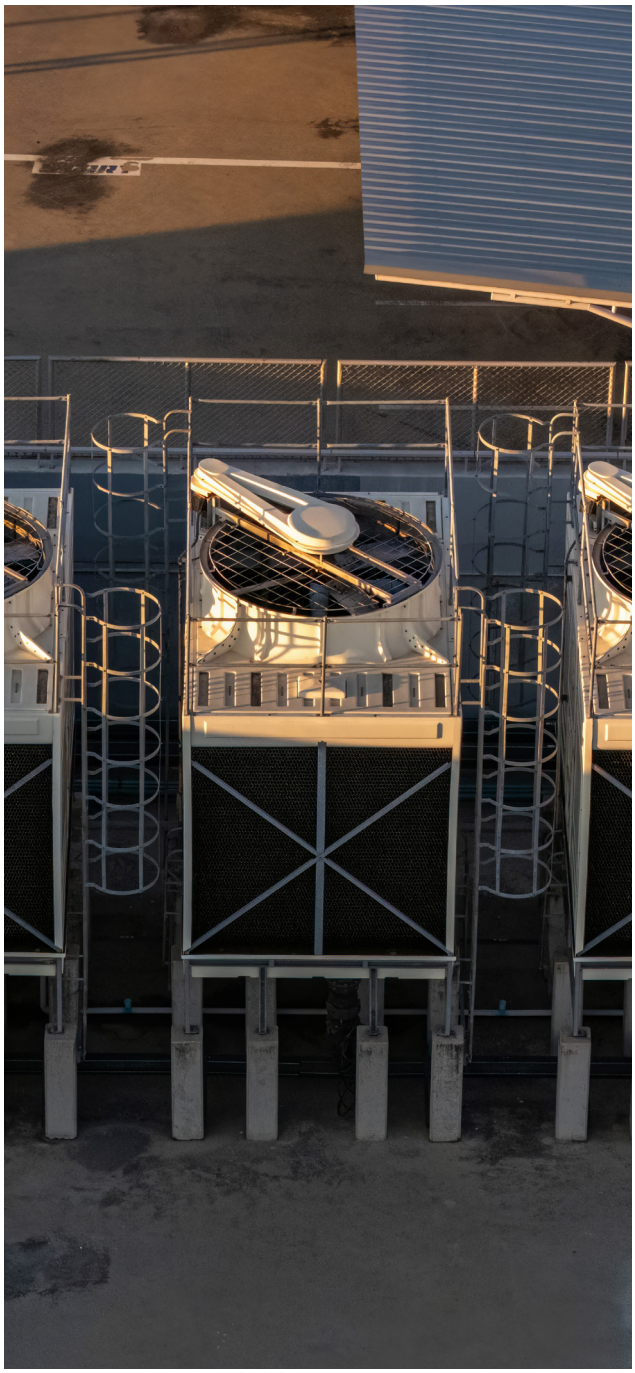
VIBRATION MONITORING FOR

DATA CENTER HVAC UNITS

WHEN RELIABILITY MATTERS CONNECT TO CONFIDENCE

CTC
CONNECTION TECHNOLOGY CENTER, INC.

Monitoring the health of HVAC units within data centers presents a critical challenge for predictive maintenance strategies. These units are responsible for maintaining precise temperature and humidity levels to ensure the optimal performance and longevity of sensitive IT equipment. Even minor fluctuations in environmental conditions can lead to equipment malfunctions, reduced efficiency, or costly downtime. As a result, traditional maintenance approaches that require direct access to system components for vibration monitoring or visual inspection are often impractical due to the risk of disrupting airflow and introducing contaminants.



Common faults with HVAC units include:

- Unbalance
- Misalignment of shafts and couplings
- Looseness in mounting hardware or structural components
- Belt wear, slippage, or resonance defects
- Bearing wear, pitting, or lubrication failure
- Fan blade damage or imbalance
- Motor issues including rotor bar faults

Vibration Monitoring can be used on HVAC units to:

- Reduce or eliminate exposure to safety hazards
- Reduce data collection time while increasing repeatability and data accuracy
- Collect data on previously inaccessible fan components
- Prevent high-cost failures
- Help ensure consistent environmental conditions

The first consideration is whether or not process monitoring or dynamic vibration analysis is right for your condition monitoring program. Due to access concerns, permanent monitoring is the preferred method for repeatability, human safety, and operational effectiveness.

Process monitoring requires 4-20 mA loop power sensors, which will provide the overall vibration level of the machine so that it can be trended and alarmed using the plant's DCS, PLC, or SCADA system. Process monitoring will require permanently-mounted loop power sensors that output a 4-20 mA signal proportional to velocity or acceleration. Process monitoring will provide an allover understanding of machine health, but cannot provide the same level of detailed diagnostic data as dynamic vibration analysis.

Dynamic vibration analysis allows for trended data and machine health diagnostics. However, dynamic vibration sensors can be paired with CTC's SC300 Series signal conditioners to create a hybrid approach for both process monitoring and dynamic analysis. A signal conditioner converts the signal from a dynamic sensor into a 4-20 mA output, so it can be trended and alarmed using the plant DCS, PLC, or SCADA system, and may also be used for more in-depth predictive maintenance.

Regardless of whether or not a signal conditioner is the right choice for your program, CTC has a variety of accelerometers for use HVAC unit monitoring within data centers.

Connect Wireless Solutions

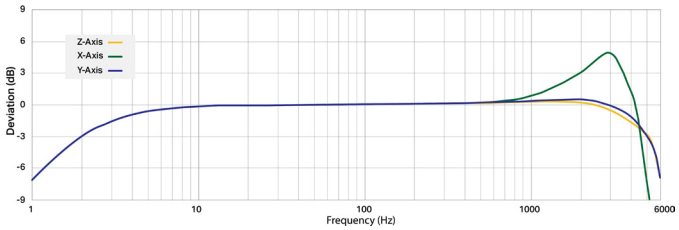
The CTC Connect ecosystem offers you the highest quality wireless hardware system on the market, with industry-leading sensor line-of-sight range, and is designed for integration into 3rd-party vibration analysis software. Our complimentary ConnectView™ Web Application comes preloaded on the ConnectBridge™ Gateway and provides basic vibration monitoring management tools and device management options like sensor configuration, battery level information, and more. When used with 3rd-party vibration analysis software, our wireless sensors and gateway can be harnessed for advanced data analysis that meets your specific needs.

Wireless Process Control Monitoring

Overall vibration sensor with temperature output that advertises periodic overall vibration levels (RMS, Peak, or Pk-Pk) over **Bluetooth®** Low Energy 5.2 which can be picked up by a ConnectBridge Gateway:

WS100 Series

ConnectSens Wireless Sensor - Triaxial Overall Vibration Signal with Temperature Output



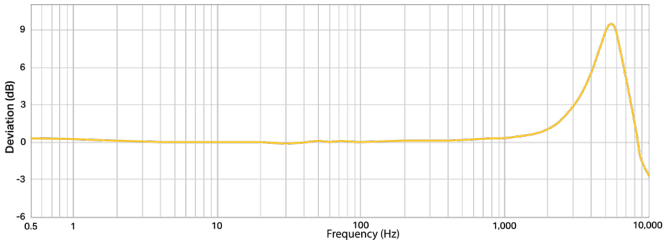
High frequency 2 Hz - 5 kHz only; not reflective of results on other frequency ranges

Wireless Dynamic Data Capture

All-in-one wireless vibration sensors with built-in temperature outputs:

WS200 Series

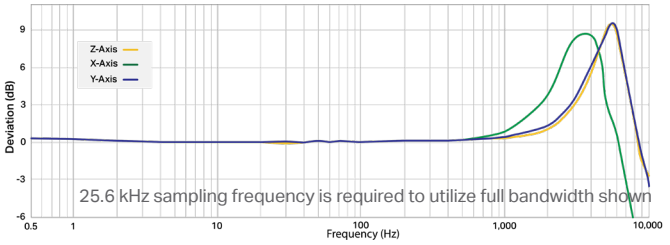
ConnectSens Wireless Sensor - Single Axis Dynamic Vibration Signal Capture with Temperature Output



25.6 kHz sampling frequency is required to utilize full bandwidth shown

WS300 Series

ConnectSens Wireless Sensor - Triaxial Dynamic Vibration Signal Capture with Temperature Output



25.6 kHz sampling frequency is required to utilize full bandwidth shown

Loop Power Sensor Offerings for Process Monitoring:

4-20 mA monitoring will provide a cost effective, online process monitoring solution. Our standard LP200 and LP300 Series can be permanently mounted for a 4-20 mA output proportional to vibration in velocity or acceleration respectively.

LP200 SERIES

4-20 mA Output Proportional to Vibration in Velocity

LP300 SERIES

4-20 mA Output Proportional to Vibration in Acceleration

CTC's Loop Power Sensors can be paired with our PMX enclosure to display overall vibration levels with additional capabilities to alarm and shutdown.

Relay and Display Equipment for Use with Loop Power Sensors:

CTC's PMX Series Enclosure is a stainless steel, 1-4 channel process control enclosure with display and relay. These enclosures are designed for loop power sensor input, and the relays can trigger alarm or shutdown. Optional stack light and horn alarm is available.

General Purpose Accelerometers:
General Purpose Accelerometers typically meet the needs of air handling units. In limited access areas, like near belt guards, side exit connector accelerometers are typically suggested. CTC's Dynamic Vibration IEPE Ultrasound Sensors also provide an excellent solution for general purpose monitoring with the ability for high frequency fault detection.

CTC offers a wide variety of General Purpose Accelerometers in top and side exit configurations, including:

AC102 & AC104

Multipurpose Accelerometer,
2 Pin Connector,
100 mV/g,
±10%
±80 g, Dynamic Range

AC292 & AC294

Premium Compact
Accelerometer,
2 Pin Connector,
100 mV/g,
±5%
±80 g, Dynamic Range

UEB332 & UEA332

Dynamic Vibration IEPE
Ultrasound Sensor,
1/4-28 Mounting,
2 Pin mini-MIL Connector,
100 mV/g,
±10%
±80 g, Peak

Cables and Connectors:
Due to the environment within the air handling unit, the cable connecting the accelerometer to the switch box needs to be robust, chemically resistant, moisture resistant, as well as reliable in a caustic environment, such as CTC's Premium V Series Viton™ Boots or A Series Standard MIL-Style Connectors.

Our Viton™ Boot Series (V Series) Connectors are a premium offering for the best chemical resistance and an IP69 rating for moisture concerns.

Our A Series Connectors are a general purpose offering that work in a variety of environments. The A Series comes with a stainless steel locking ring and variety of material options, including Polycarbonate, PPS, and Nylon.

Junction Boxes:

Junction Boxes can be used for local measurements or the transmission of data to online vibration monitoring systems. Junction Boxes can also be used for cable reduction purposes or for switched outputs during manual route data collection of the vibration signals. Depending on the environment in which your junction box is mounted, CTC offers the majority of our offerings in either fiberglass or stainless steel options.

	MINI-MAXX BOXES *Mini enclosed BNC connection boxes*	**MAXX BOXES** *Enclosed BNC connection boxes*	**SB BOXES** *Legacy switch box series*	**JB BOXES** *Premium switch box series*
				
Provides connection for remotely installed sensors to portable data collectors	✓	✓	✓	✓
Optional cord grip or conduit inputs provide quick & secure cable entry to closure	✓	✓	✓	✓
Withstands harsh factory & outdoor environments	✓ NEMA 4X / IP66 rated	✓ NEMA 4X / IP66 rated	✓ NEMA 4X / IP66 rated	✓ NEMA 4X / IP66 rated
Covered BNCs	✓	✓	✓	✓
Quick release terminal blocks		✓	✓	✓
Fiberglass & stainless steel options available		✓	✓	✓
Sloped top & modular box options available		✓	✓	✓
Optional continuous outputs			✓	✓
Minimum channel count	**1**	**1**	**4**	**4**
Max channel count	**4**	**12**	**48**	**48**
Fold-forward panel for easy wiring				✓
IEPE bias indicator light				✓
Cost rating (1-4)	**1** lowest cost option for harsh factory environments	**2** low cost option for higher channel counts in harsh environments	**3** high-end offering for ease of data collection & ability for online expansion	**4** premium offering with the most benefits & features in one NEMA 4X enclosure