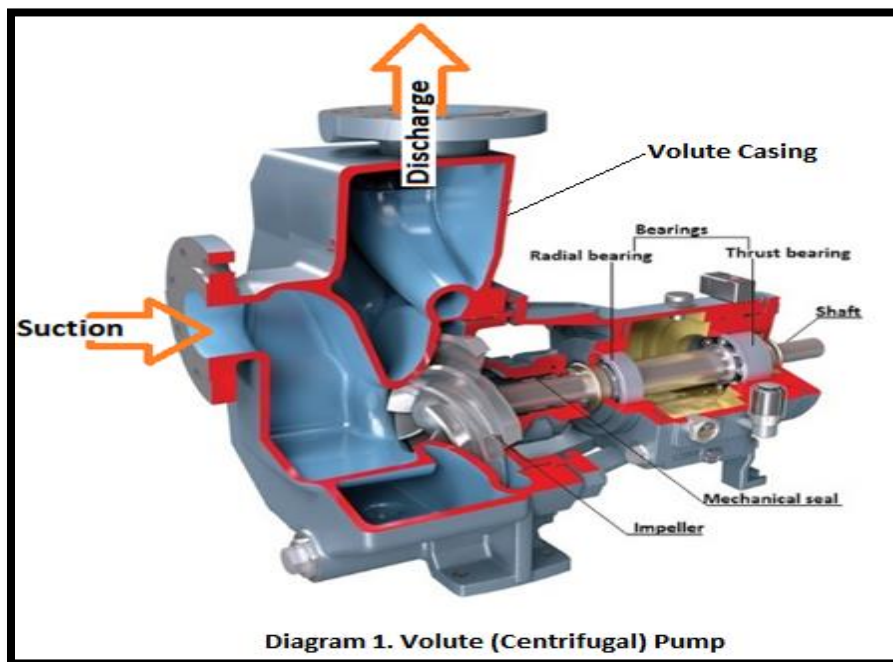


VTB-RS485 – A Low Cost and Reliable Alternative to Minimize Operation Downtime on Centrifugal Pumps

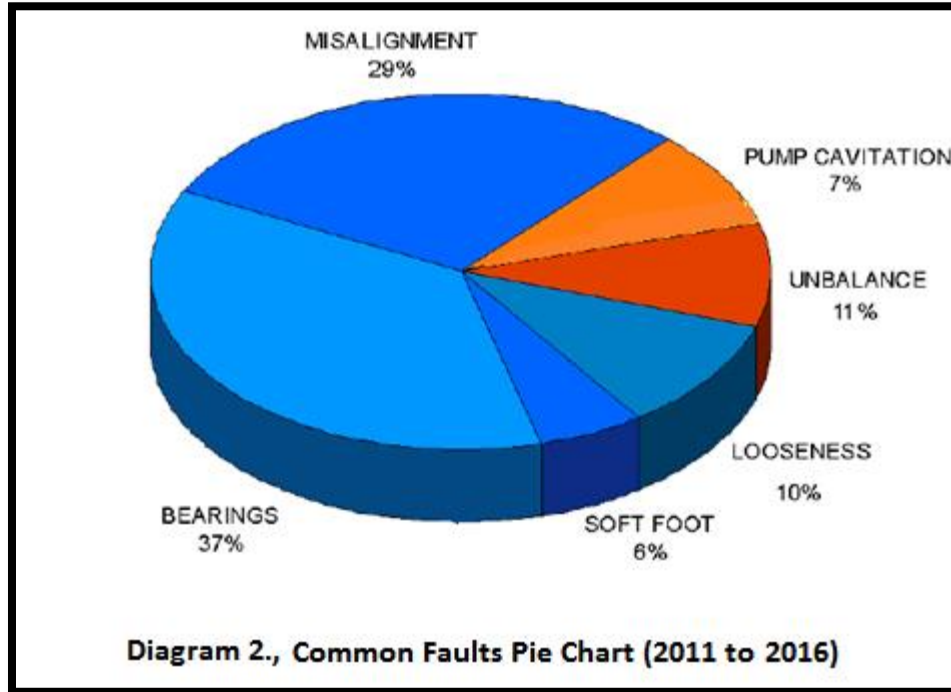


The centrifugal pump is one of the most versatile types of process equipment for all industries. Compared with reciprocating and rotary pumps, the centrifugal pump is smaller, lighter, and operates at high speeds. The majority of these pumps are direct-coupled to an AC motor.

In a centrifugal pump, the liquid is forced by atmospheric pressure (or other types of pressure) into a set of rotating vanes – an impeller – that discharges the liquid at a high velocity. This velocity is converted to pressure energy by means of a volute. The diagram below indicates the major components of a small centrifugal pump.



The diagram below indicates the common faults that will ultimately lead to process equipment downtime.



The vibration comes from a number of sources that include:

Pump Vibrating or Overheating

- Engine speed too high
- Base pedestal is too light (base mass should be three to five times heavier than the pump and motor)
- Obstruction in pump casing/impeller damaged
- Cavitation due to excessive suction lift
- Suction or discharge re-circulation of fluid within the pump
- Impeller out of balance or clogged
- Diameter of the impeller is too large
- Thick film has developed on the volute or diffuser inner casing
- Shaft bent
- Shaft running improperly because of worn bearings or misalignment
- Misalignment
- Pump not primed
- Pump or suction pipe not completely filled with water
- Inlet of suction pipe insufficiently submerged
- Excessive thrust caused by mechanical failure inside pump
- Bearings worn

- Rolling Element Bearings are not designed to run greater than 4000 RPM
- Lack of bearing lubrication
- Incorrect assembly of stacked bearings (ex. angular contact ball bearings fitted front-to-front instead of back-to-back)
- Dirt in bearings
- Rusting of bearings from water in housing

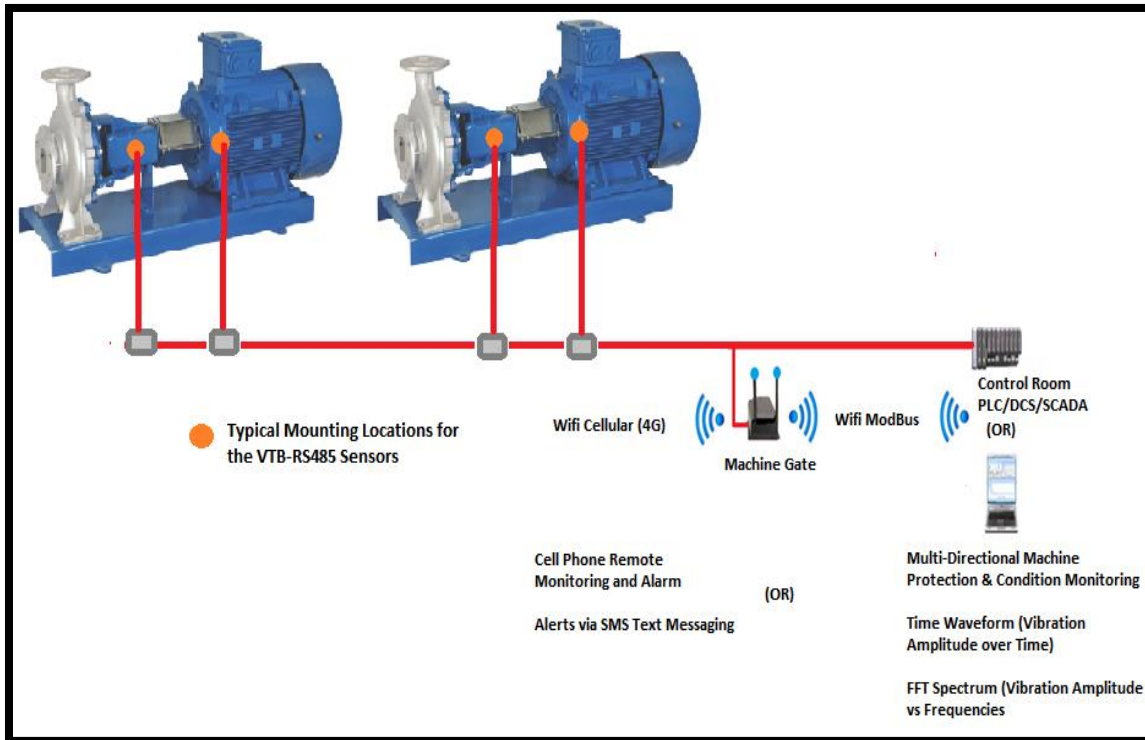
Shorter Pump Bearing Life

- Obstruction in pump casing/impeller
- Impeller out of balance
- Shaft bent
- Shaft running improperly because of worn bearings or misalignment
- Misalignment
- Bearings worn
- Excessive thrust caused by mechanical failure inside pump
- Lack of bearing lubrication
- Incorrect assembly of stacked bearings (ie angular contact ball bearings fitted front-to-front instead of back-to-back)
- Dirt in bearings
- Rusting of bearings from water in housing

Pump Using Excessive Power

- Engine speed too high
- Obstruction between impeller and wear plates
- Viscosity and/or slug of liquid being pumped too high
- Incorrect direction of rotation
- Misalignment
- Shaft bent

Mounting a Machine Saver Sensor



Key Benefits and Flexibility of the VTB-RS485 Sensor

The VTB-RS485 Sensor is used to monitor and detect vibration levels found in the common right angle gear drive or in the direct drive permanent magnet motors. By measuring vibration continuously, machine degradation and impending failures can be prevented, and unscheduled shutdowns can be avoided.

Dynamic vibration data can be obtained online at any time from any location, allowing plant personnel to make decisions that best minimize machine shutdown time. Trended overall vibration levels can be kept on a virtual server for analysis and future reference. Early alarm thresholds can be set, which can provide sufficient time for management to purchase parts and plan around unused machines, and minimize cooling process downtime.

Additionally, Machine Saver Sensors:

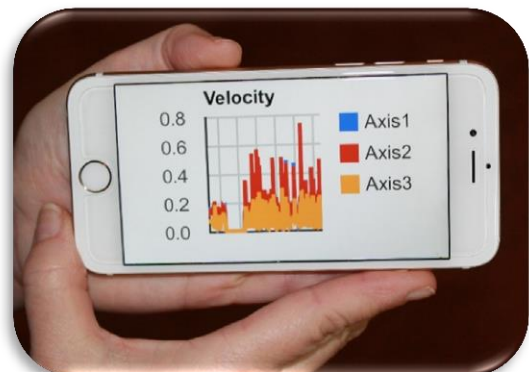
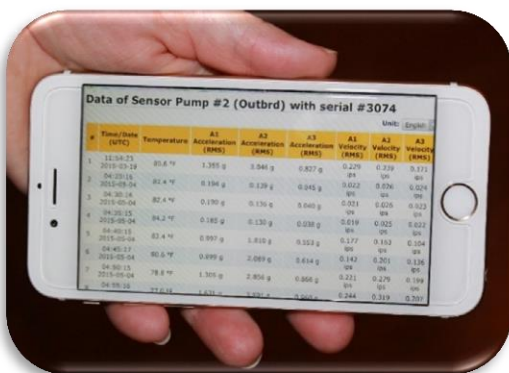
- Are permanently installed and can be universally mounted in any direction. This allows for safe access to cooling tower components located in remote, hazardous, and dirty environments.
- Use a low power sensor that detects and measures both vibration and temperature parameters.

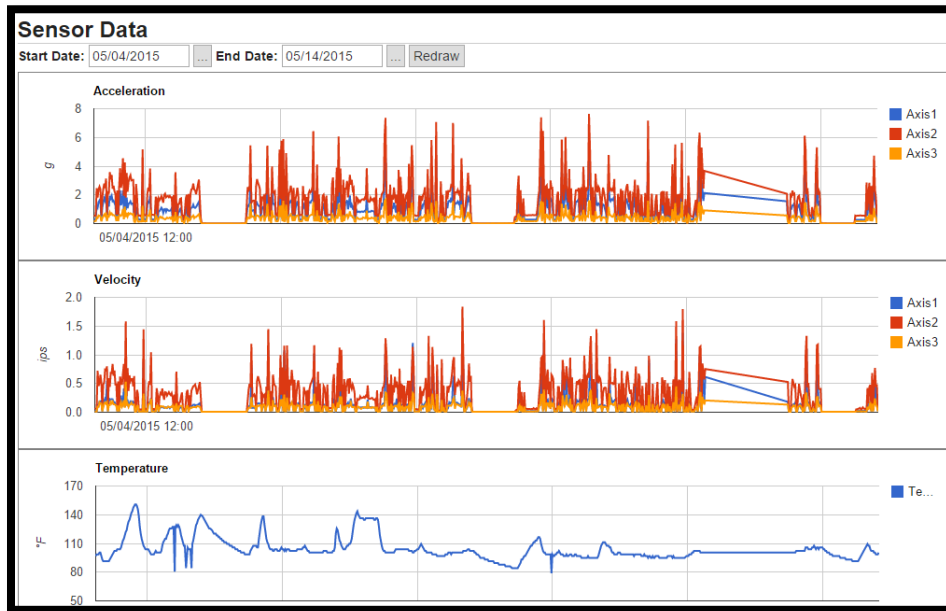
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- Can communicate overlong distances using reliable Modbus RS485 RTU digital communications protocol.
- Utilize special algorithms that provide improved resolution at lower and higher frequencies.
- Transmit overall vibration and temperature levels to a PLC, DCS, or SCADA control system for 24/7 machine protection
- Are simple to install: 250 sensors can be daisy chained together, or a Wi-Fi system via ethernet Modbus or cellular gateway can be utilized
- Provides unique machine vibration signature that can be compared to similarly located group of machines for baseline levels
- Reduces unplanned shutdowns and minimizes cooling process downtime
- Provides 24/7 overall vibration and temperature levels to a remote portal

Remote Monitoring Portal

The system operates as a fully customizable portal that enables users of the VTB-RS485 system to remotely monitor overall machine vibration and temperature. The data can be viewed remotely from a smartphone, tablet, or laptop.





Remote Monitoring Portal Details

Our technology allows users to remotely monitor and observe trends of overall vibration and temperature data (acceleration, velocity, and displacement). This dynamic data is stored on a virtual server, which allows for vibration analysts or reliability engineers to review. Email and text alerts will notify appropriate personnel when problems are detected. **Vibration and temperature data can be easily exported, and time waveform and spectrum data is available with third party condition monitoring software.**

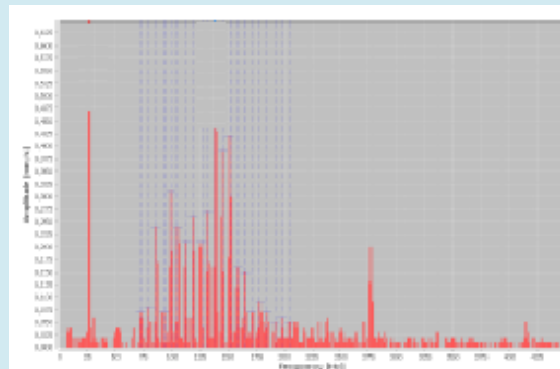
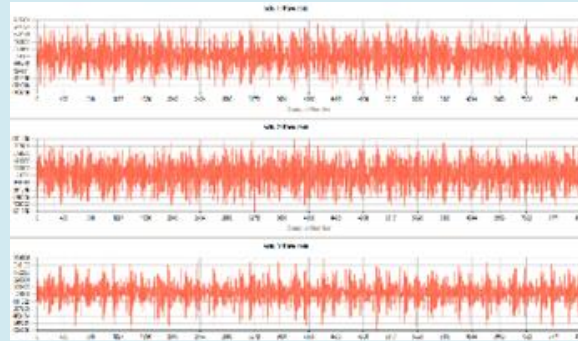
Summary of Traditional Vibration Devices vs . VTB –RS485 Sensor

Mechanical Vibration Switches	PROS <ul style="list-style-type: none"> • Basic, extremely simple switch • Does not require special work permits • Hazardous area certified • Inexpensive
	CONS <ul style="list-style-type: none"> • Sensitive to only one axis • Limited frequency response (typically 0 to 100 Hz) • Sensitive only to sudden and severe changes in acceleration (Gs). (acceleration is not best vibration detection measurand for the low RPMs encountered on large cooling fans) • No trending or analysis capabilities • Poor performance in detecting malfunctions on low frequency machines (ex. fans) • No self-calibration capabilities
2-Wire Loop Powered Vibration Transmitters	PROS <ul style="list-style-type: none"> • Durable – industrial grade steel casing with electronics potted with epoxy • High signal strength of 4-20mA allows for long distance locations with minimal signal losses (compared to voltage-type signals) • Less wire required for installation (only two wires per sensor required to function) • Decent frequency response (typically 2 Hz-1500 Hz for velocity, and 10 Hz-1500 Hz for acceleration) • Optional built-in temperature sensors
	CONS <ul style="list-style-type: none"> • Sensitive to one axis only • 4-20mA signal highly susceptible to direct and indirect two-way radio interference • No field accessible calibration potentiometers to adjust – is a pass/fail, disposable unit • No fault protocols for problematic transmitters • Once installed, device performance verifiable with a cumbersome, portable vibration shaker system
VTB-RS485 Sensor	PROS and CAPABILITIES <ul style="list-style-type: none"> • Proven dual three-axis vibration and temperature sensor; DSP for calculations • Smart, addressable microcontroller for onboard signal conditioning • 24/7 protection and condition machine monitoring • Reliable Modbus RS485 RTU digital communications protocol • Universal and permanent installation, and able to be oriented in any direction • CSA and class I division 2, groups A, B, C, D certification • Acceleration, velocity vibration measurand • Band-pass filters, configurable using provided vibration software • Programmable start-up and trip delay • Automatic sensor self-test diagnostics and dual sensor verification • Multi-color and SMART LED status

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**Multi-Directional
Machine Monitoring
(Time Waveforms)****FFT**

Real-time dynamic data output of vibration is viewable from any computer, smartphone, or tablet with an internet connection:

**Conclusion**

This technical brief has practical suggestions to assist you in your motor and pump vibration monitoring application. We want to support you with a reliable vibration and temperature sensor that consistently detects, monitors, and protects your equipment. Our team can provide vibration monitoring solutions for all balance of plant equipment used. Let us know about your application by contacting Machine Saver (832) 581-9908, or visiting us online at www.machinesaver.com.