Temperature Monitoring Solution for Maximum VSD Operating Efficiency

Distributed Temperature Sensor

The DTSX is a unique and innovative temperature monitoring system that uses a high-bandwidth optical fiber cable as a temperature sensor.

Customer Concerns

The importance of VSDs in industrial operations

Variable speed drives (VSD) are used in a wide range of industries to control the speed of machinery such as compressors and pumps. The advantage of VSDs is that they are more energy efficient than conventional fixed-speed drives (gas turbines and the like), and it allows motors to run over speed through the use of frequency control (Hertz).

Overheating of high voltage power transmission cables

When a VSD outputs a high voltage, however, its high voltage power cable can overheat and this can lead to problems such as voltage drops, equipment malfunctions, and fires. The major cause of cable overheating is harmonic distortion.

In many cases, users just select an output voltage based on prior experience, without having accurate information on cable temperature. As a result, they are unable to get optimum performance from their compressors and pumps.
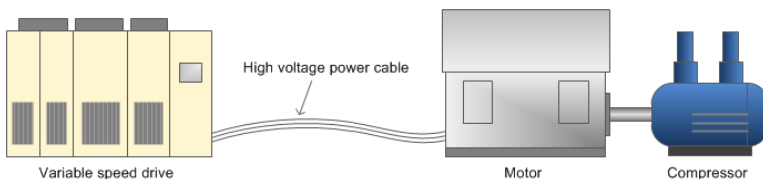
The Solutions and the Benefits

Maximizing VSD efficiency by monitoring cable temperature

With its optical fiber sensor cable, the Yokogawa DTSX distributed temperature sensor is able to monitor the temperature of a high voltage power cable accurately and in real time. This solution allows users to dynamically control the VSD voltage output level (Frequency). While maintaining a safe state, productivity can be dramatically improved.

For instance, a Yokogawa customer has set an alarm to sound when the cable temperature reaches 85 degrees Celsius, and has set a maximum VSD operating limit of 90 degrees Celsius. By continually monitoring temperature in real time, this customer has been able to increase natural gas production by up to $120,000 per day per unit.

Optic fiber sensor cable

Power cable

Even in harsh environments where a power cable is exposed to higher temperatures, the DTSX can provide the information needed to safely and efficiently operate a VSD.

Hot spot monitoring: Early detection of abnormal overheating

The DTSX can accurately monitor the temperature of long optical fiber sensor cables continuously, and with one meter resolution can pinpoint the location of hot spots due to excessive loading. Quick detection helps to prevent fires and unplanned plant shutdowns.

Equipment trend monitoring for efficient maintenance

With its ability to monitor temperatures 24/7/365, the DTSX generates the data needed to visualize normal state power transmission cable operating conditions. By comparing this historical data with data that is collected in real time, it is possible to identify when an older power cable no longer is able to perform as specified. This enables not only fire prevention but proactive, condition-based maintenance.

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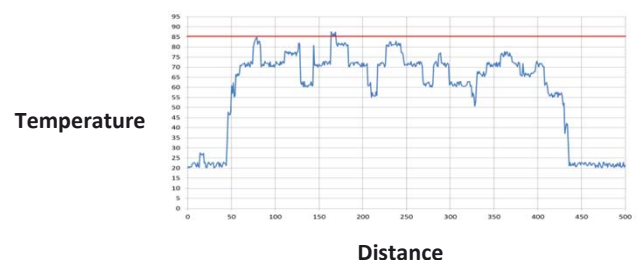
How DTSX Works

Measuring the intensity of Raman scattered light

Using pulses of laser light beamed through an optical fiber cable, the DTSX is able to detect temperature-dependent variations in signal frequency that are the result of a phenomenon known as Raman scattering that occurs along the entire length of the optical fiber cable, and it also can determine the locations of those temperature readings using light that is bounced back (backscattering) to the source.

Example: Along a 6,000 meter optical fiber cable, nearly 6,000 measurement points

By measuring how long it takes light to make a round trip back to the source (backscattering), the DTSX is able to calculate the location for each temperature reading. Abnormalities can be located with a spatial resolution of just one meter.
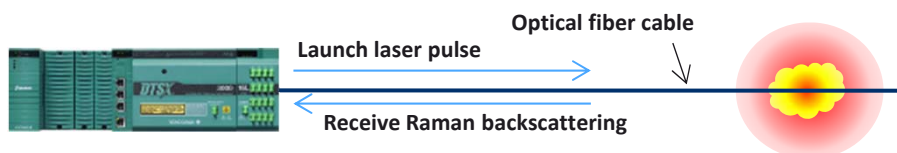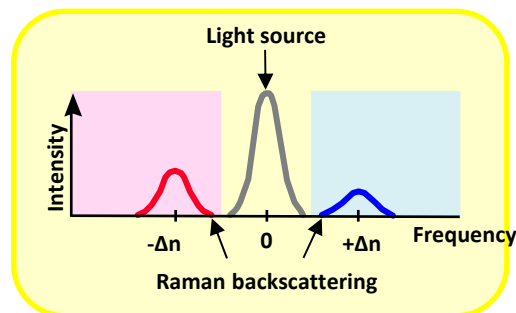
Advantages of the DTSX

Long distance, wide area coverage

Temperature can be monitored anywhere along a single optical fiber sensor cable that is kilometers in length. No longer is it necessary to install numerous temperature sensors for a specific application. A single DTSX can monitor variations in surface temperature at any point on the outer wall of a large reactor vessel or furnace.

Temperature monitoring in difficult to access locations

The DTSX can monitor the temperature in locations (underground, etc.) that cannot be easily accessed by maintenance personnel. Abnormal temperatures can be detected quickly and automatically.

Flexible installation

The DTSX only needs to be wrapped around objects or affixed to surfaces to measure temperature in specific locations. As such, the DTSX can flexibly accommodate the needs of all kinds of facilities, both greenfield and brownfield.

Integration with host control systems

Fully compatible with DCS, SCADA, and process automation and control (PAC) systems, the DTSX is well suited for use in integrated temperature monitoring systems.

Related Applications

In a wide range of applications, the DTSX is able to quickly detect temperature changes that are the result of equipment failures and other abnormal situations.

✓ LNG tank leak detection

Leaking natural gas can catch fire or explode. If cold (-162 degrees Celsius) liquefied natural gas (LNG) starts to leak from a tank, the temperature in the area immediately surrounding the leak will fall. A DTSX optical fiber sensor cable placed around the tank will detect that temperature change so that emergency corrective measures can be immediately taken.

✓ Reactor / Furnace wall health monitoring

Hot spots on the outer surface of a reactor or furnace occur wherever there are breaks in the refractory brick lining. With the DTSX's ability to monitor surface temperature, condition-based maintenance can be performed at proper time.

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