DTSX Application Note

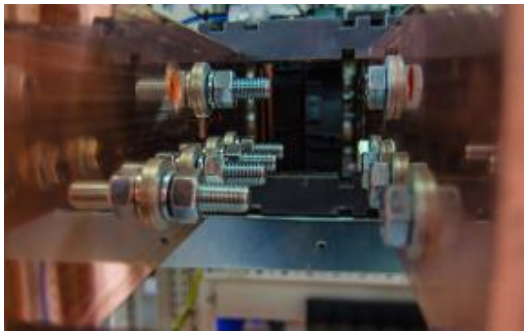
Improved Detection of Bus Bar Overheating

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

Customer Concerns

Bus bars for high current power distribution

Bus bars are uninsulated strips of a highly conductive metal such as copper or aluminum. As they have lower electrical resistance than insulated power cables, they can carry large electrical currents and are thus suitable for use in power distributions systems in power plants, substations, factories, and data centers. Bus bars are also used in power distribution boards. Bus bars offer great flexibility as they are made of highly malleable metals that can be easily shaped to suit any number of facility layouts.



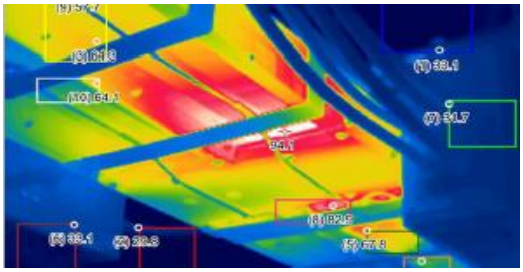
Bus bars

Abnormal overheating of bus bars

Bus bars are bolted, clamped, or welded to each other and to other apparatuses. If a bolt or clamp comes lose or a welded joint fails, abnormal heating may occur at that location due to an increase in the electrical resistance. The overheating further increases the electrical resistance and can lead to a burnout or even a fire.

In order to prevent overheating at any of the bus connections, the connections should be inspected on a regular basis. However, as the bus bars are often inside plastic or metal bus ducts and covers, and are often in difficult to access locations, visual inspection can be difficult.

The burning out of a power supply bus bar is a threat to plant safety and can lead to an unplanned shutdown of plant operations. To eliminate such risks and avoid the huge costs of lost production, it is vital to quickly detect and immediately respond to any indication of overheating in a power bus bar.



Abnormal overheating of bus duct

The Solutions and the Benefits

24/7/365 temperature monitoring to detect overheating

Burnouts in a power bus bar can be prevented by quickly and accurately detecting abnormal rises in temperature and locating the hot spots. As bus bars are surrounded by strong electric fields, conventional electric sensors such as thermocouple thermometers are not suitable for this purpose. Bus bars also sometimes follow complicated paths through plant structures and other types of buildings and may have a number of blind spots that cannot be readily imaged using thermal imaging cameras.

The Yokogawa DTSX is a unique and innovative temperature monitoring solution that uses an optical fiber cable as a temperature sensor. Since the sensor is not affected by electromagnetic noise, the DTSX is able to monitor distribution of temperature in units of 1 meter accuracy under a strong electric field. By quickly detecting overheating and pinpointing the location of a hotspot, the DTSX ensures that any problem can be responded to immediately, before it leads to a costly and expensive plant shutdown.
The optical fiber cable can be installed directly on a bus bar and on the surface of a bus duct or cover.

Efficient inspection inside bus ducts

Thanks to its ability to continuously detect abnormal rises in temperature and pinpoint hot spots even when a bus bar is located inside a bus duct, the DTSX is also useful in maintenance applications such as locating bolts that need to be tightened.

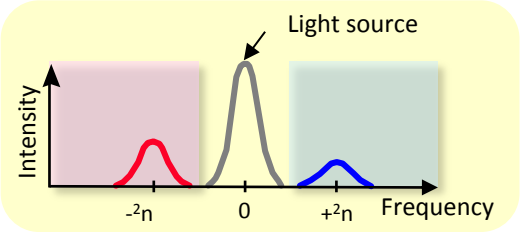
Cable laying example for bus duct

The benefits

- Accurate temperature monitoring under a strong electric field
- Flexible sensor cable for complex extended structure
- Quick detection with abnormal location to prevent burnout
- Condition based inspection work by temperature changes

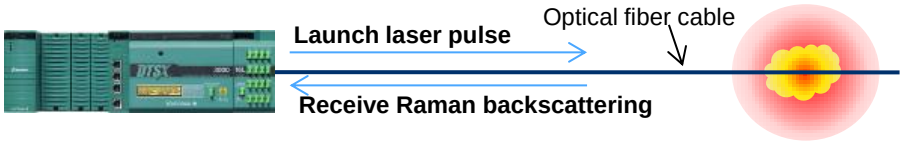
How DTSX Works

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.



Raman backscattering

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.

✓ **Abnormal heat detection in power distribution**
Ageing power transmission cables can fail, resulting in power outages and even fires, and bringing life to a standstill. To detect and locate problems before they can escalate, an optical fiber sensor cable can be laid together with the power cable in a conduit.

✓ **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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