

Increasing Tunnel Safety with High Performance Fire Detection

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.

Introduction

Fire detection in a tunnel is critical in preventing catastrophic damage to infrastructure, injury, death, and severe economic consequences. Therefore, it is essential to detect fires and their locations as soon as they break out. Additionally, detection systems have to be able to work in harsh conditions of dirt, smog, corrosion, and high humidity. The capability to monitor a fire's vector is also needed for effective firefighting action. Those capabilities ensure safety and the optimal fire mitigation in a tunnel. The DTSX is an optical fiber distributed temperature monitoring solution from Yokogawa that is able to accurately measure and locate any occurrence of damaging heat over the length of the fiber (up to 50 km). With a minimum sampling resolution of 1 m or less, it monitors with no blind spots along the tunnel while giving near real-time information. The DTSX is a reliable and robust tool for fire detection over long distances and large areas. Among DTSX, DTSX 1 Fiber Optic Heat detector, which has the functions for fire detection in one box and is certified by EN 54 22 certified, is a suitable solution.

* Fire detection standard (EN 54 22 certificated VdS approval No G 220001)



DTSX1 Fiber Optic Heat Detector



The Solutions and the Benefits

Tunnel safety monitoring 24 hours a day, 365 days a year

The DTSX system acquires temperature from a fiber optic cable installed along the tunnel length within seconds. Its robust and compact industrial design allows it to monitor in harsh conditions with no blind spots. Since only one DTSX and its software application is needed to cover a tunnel length of up to 50 km, you can centralize the monitoring of the entire tunnel. In addition, one DTSX can monitor several fiber optic cables. Therefore, a variety of semi-redundant and completely redundant solutions can be offered.

Identifies trouble spots in 1 m increments which gives you the opportunity to pinpoint the exact fire position within seconds.

For tunnel safety, it is essential not only to detect the outbreak of a fire, but also to pinpoint its exact location. Detection and locating have to be done quickly to minimize danger, and at the same time the system must provide critical information to emergency personnel such as the rate and direction of fire build-up. This blind-spot-free detection capability cannot be achieved by using discrete sensors or IR cameras.

Mitigating risk while keeping running costs down

The optical fiber cable installation along the tunnel requires no power, except for the DTSX unit which is usually installed in a control room. Also, the cable requires almost no maintenance, and can detect any damage to itself. Thus, the DTSX system increases tunnel safety and minimizes operational costs.

System Configuration



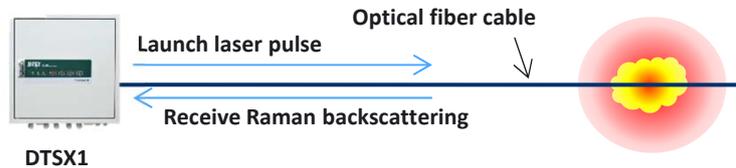
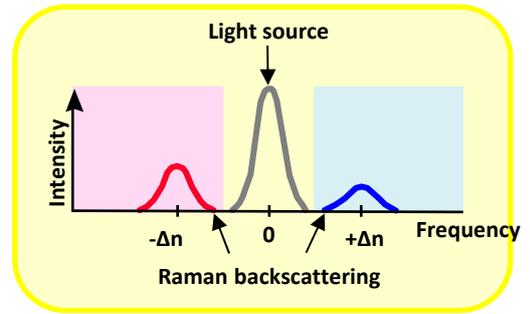
How DTSX Works

Measuring the intensity of Raman scattered light

Using pulses of laser light transmitted through an optical fiber cable, the DTSX can determine temperature by intensity variations of Raman-scattering that phenomenon 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 16,000 meter optical fiber cable, nearly 16,000 measurement points

By measuring how long it takes for 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 DTSX1 Fiber Optic Heat detector

Cost-effective and easy-to-install all-in-one solution

All DTSX1 components, including an easy-to-read display, relay output circuits, alarm circuits, and other hardware required for heat detection, are housed in a single enclosure measuring 50 cm (W) × 50 cm (H) × 25 cm (D). This small footprint is wall-mountable. The DTSX1 is easy to install, takes less time to install*1, and costs less than a general-purpose fiber optic temperature sensor.

Able to measure temperature profile every 1 m from 4 cables up to 16 km in length

Along the length of the fiber optic sensor cable up to 1,000 alarm zones can be defined. In total, you can connect 4 fiber optic sensor cables with a length of up to 16km*2 each. The high-performance DTSX1 has a measurement period of only 5 seconds for each fiber.

Easily integration with fire management systems

Easily integrate with fire management systems by relay outputs and with SCADA systems for e.g. monitoring and logging of events and alarms. Also ready-to-use Yokogawa's GA10 PC-based data logging software templates have been created that facilitate the display of DTSX1 data. Monitoring windows for each type of application enable the quick detection and location of failures.

*1 The overall installation time from the start of installation to the completion of setting has been reduced by approximately 30%.

*2 Certified by EN 54-22 up to 10 km.

Related Applications for the DTSX1

In a wide range of applications, the DTSX1 is able to quickly detect heating temperature changes that are the result of equipment failures and other abnormal situations.

✓ Warehouse fire detection

Although it is desirable to efficiently store flammability products such as batteries and spray cans in a 3D automatic warehouse, the risk of fire increases because it is difficult to monitor from top to bottom. With existing spot-type temperature sensors and fire detectors, it is impossible to monitor all shelves in a three-dimensional automatic warehouse. However, DTSX contribute to safer operation by monitoring temperature of the shelves continuously by laying optical fibers on the shelves.

✓ Detection of abnormal overheating inside bus ducts

Unlike conventional electric sensors, which do not perform well in bus ducts due to the intense electric field, the DTSX's optical fiber sensor is able to accurately monitor temperature in such locations.

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