Bandweaver

APPLICATION NOTE

VOID SPACES – LINEAR HEAT DETECTION USING FIBER OPTIC SENSING TECHNOLOGY

Bandweaver's FireLaser distributed temperature sensing (DTS) technology has a successful track record in providing fire safety and detection solutions as a linear heat detection system used within industrial facilities and large indoor spaces. Due to the specific need for a solution involving a low maintenance, low cost of ownership, high reliability, and effective fire detection, FireLaser DTS technology is very well suited to the specifics of monitoring large voids.

INTRODUCTION

Ceiling voids are commonly used in a number of industrial, residential, business and retail premises. Typically enclosed within suspended ceilings (or false ceilings) these voids are a space management feature which help to manage both aesthetics and environmental management.

These spaces typically contain several utility pipes and cables including electrical wiring, plumbing, heating, ventilation, and conditioning. To maximise use of spaces the building, designers will also use this framework to mount additional fixtures including lighting, security and fire detection systems. Because of this complex arrangement of mixed utilities, there are a number of potential fire risks including:

- Faulty electrical components or cable overheating, either by mechanical or caused by rodent, bird infestation
- Leaking air conditioning, heating or water pipes coming into contact with electrical equipment and causing short circuits
- Potentially dusty, dirty environments with buildup of flammable particles

According to fire regulations EN54-14, (CP10, BS5839, AS1670) ceiling voids require fire detection sensors. Some of the challenges of conventional fire detection systems include:

- Smoke detectors experience false alarms due to dust and particles
- Air conditioning and ventilation that can interfere with smoke from fire, thus delaying detection with smoke detectors
- Access issues for difficult to reach areas, for ongoing maintenance and testing of sensors
- Ineffectiveness of points sensors if source of the fire not in vicinity of point type sensor

The FireLaser fire detection system does not have any such "gaps", since the radiation heat given off by the fire is applied over the continuous length of sensing cable and is recorded and displayed accordingly.

SMART ALARMS & FULL COVERAGE

Two of the key advantages of fiber optic linear heat detection (LHD) systems are based on the smart alarming functionality and the distributed nature of the measurements. With fiber optic LHD systems based on DTS, three different types of alarms are configurable.

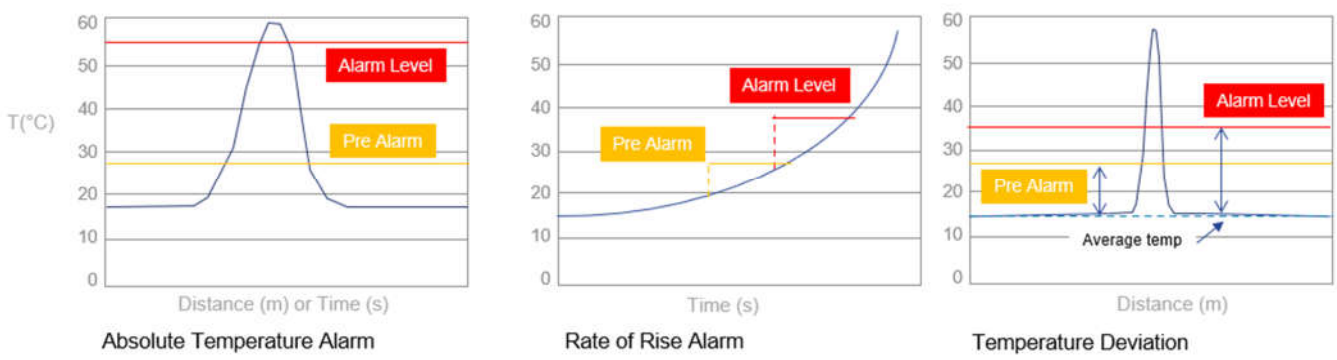


Figure 1 - Smart alarming with fiber optic linear heat detection systems

With regards to traditional fire detection, smoke detectors are highly susceptible to false alarms due to emissions. Point heat detectors are used extensively, however if the seat of the fire does not happen to be immediately under a point type sensor, the fire can no longer be detected with certainty, mainly due to detector spacing and due to the architectural structure of the ceiling such as beams, etc..

The FireLaser fire detection system takes measurement points every 0.5m along the entire length of the sensing cable and so does not have any such 'gaps'. Wherever the radiated heat is emitted, it is detected at all points along the continuous length of sensing cable and is recorded and displayed accordingly.

SYSTEM INTEGRATION

The fire detection system which incorporates a FireLaser DTS system recognizes a fire and automatically actuates the relevant, preprogrammed protective measures (alarm signals, ventilation control, fire suppression etc.). The fire alarm system needs to provide information on the exact location of the fire and key data on fire development to bring the necessary rescue or fire-fighting measures into action systematically.

The Bandweaver FireLaser DTS linear heat detection system has a centrally located sensor control unit, which can determine the temperature at any position along the length of connected sensor cable. The sensor cable is fed through the assets to be protected, which may include ceiling and floor void spaces, switch rooms transformer and generator rooms and others. The cable is divided in software into multiple fire detection zones, where each zone can have its own unique characteristic alarm thresholds assigned to it, so the system is extremely flexible in this regard.

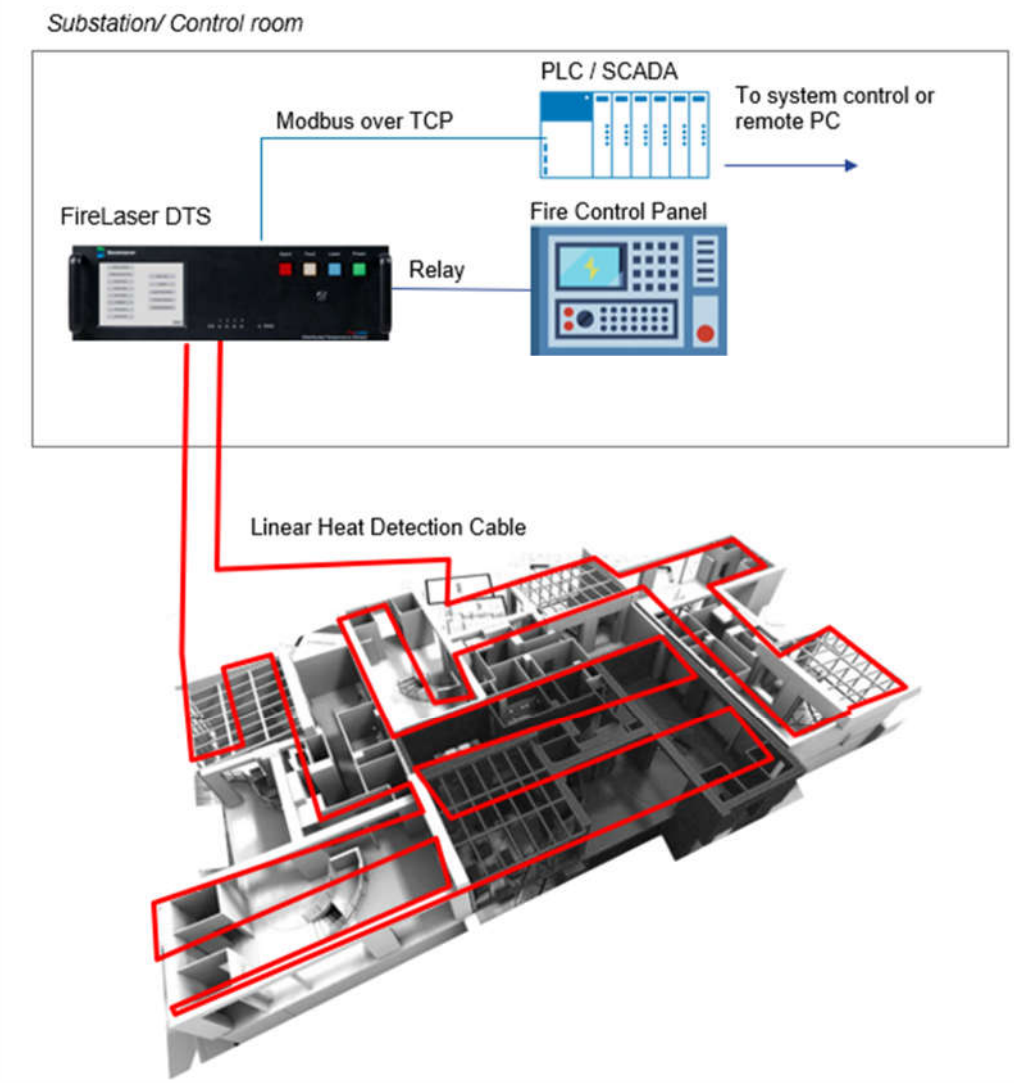


Figure 2 - Example of System Architecture

SMART ZONE CONFIGURATION

The FireLaser LHD system gives the unique capability to configure the smart alarms in conjunction with smart zones. This enables each zone to have its own specific configuration according to the specific environmental conditions or integration with other elements of the system. Examples where you may want different zone configurations include, emergency exits, ventilation zones, fire suppression.

The following table gives an example of how the smart zones integrate with the rest of the system. Because the fiber optic LHD system gives you the precise location and temperature of each event you can decide how the system will respond. In some cases, an entire zone may communicate through a relay switch (e.g. direct contact to the fire panel) and activate the fire suppression for that zone. Or in other cases the actual data can be transmitted via Modbus (or other protocol) to the system where it can decide which actions to take. The diagram below details how this may work with integration of the other sub systems.

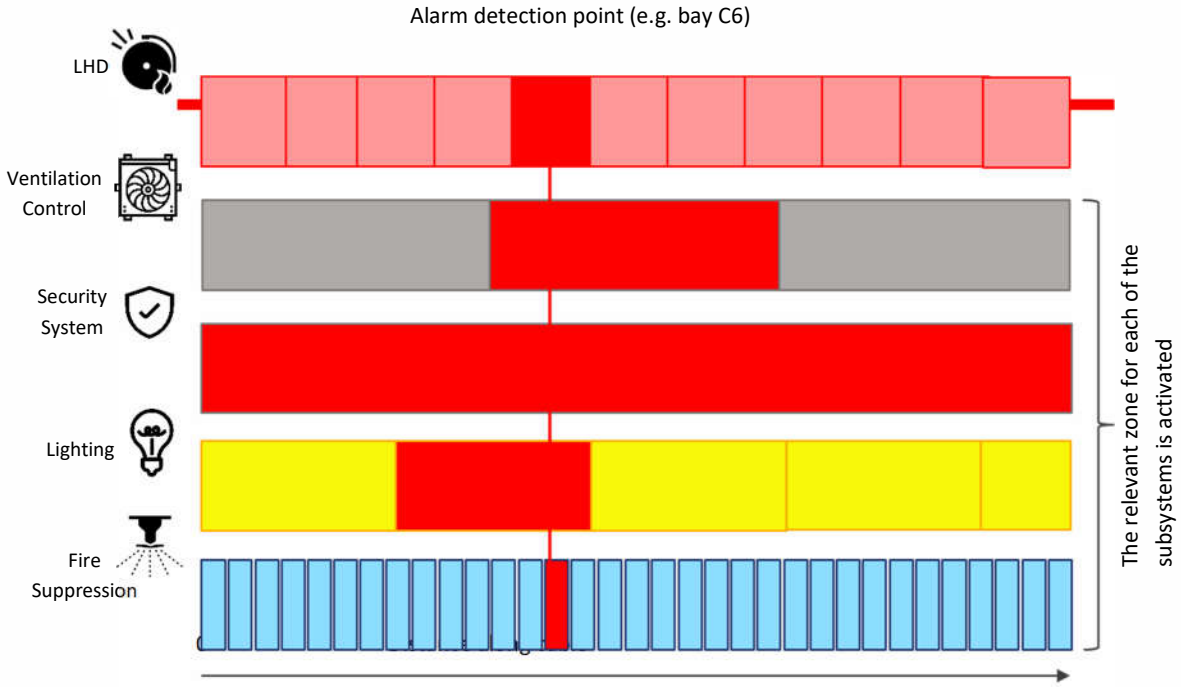


Figure 3 - Example of smart zone configuration

SENSING CABLE

The sensing cable is a completely passive element and is based on standard fiber optic telecommunications fiber. For the fire industry the standard fiber configuration has been using a 62.5/125 fiber optic due to its superior performance at distances up to 10km.

Because the sensing cable is made from fiber optic and is completely passive, it has the following benefits:

- **Continuous coverage:** No discrete sensors but continuous spatial measurements. The FireLaser provides measurement points every 50cm
- **Immune to electromagnetic interference:** Can be used in areas of high electromagnetic activity without fear of affecting or being affected by other electrical equipment
- **Corrosion and vibration resistant:** As the sensing element has no moving parts and immune to corrosion, the cable has an extremely long lifetime and can be more than 30 years

The FireFiber range of cables are designed to give maximum protection to the fiber optic while maintaining a thermal conduction which can enable the system to react very quickly. It is also very lightweight and flexible, making it easy to install.

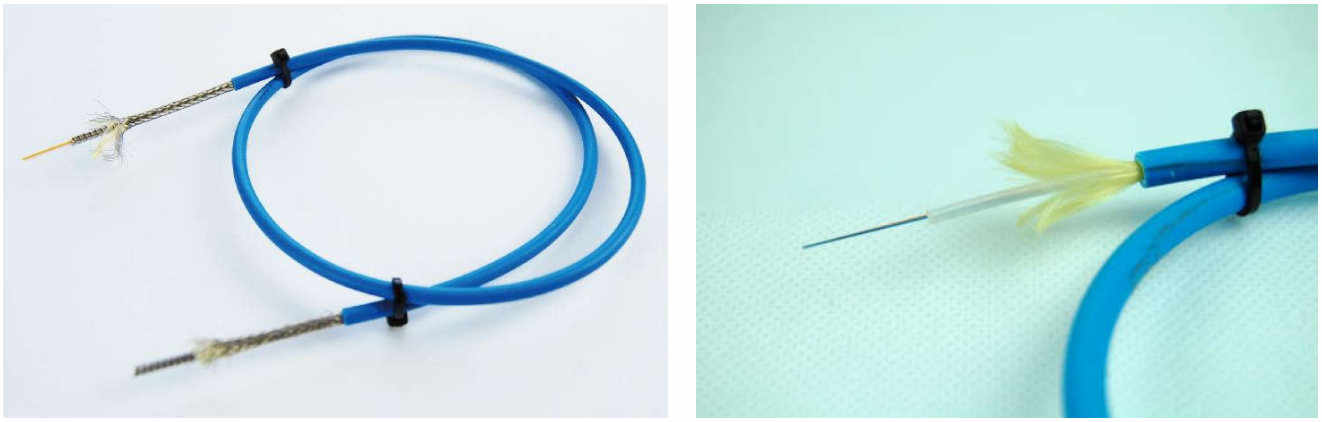
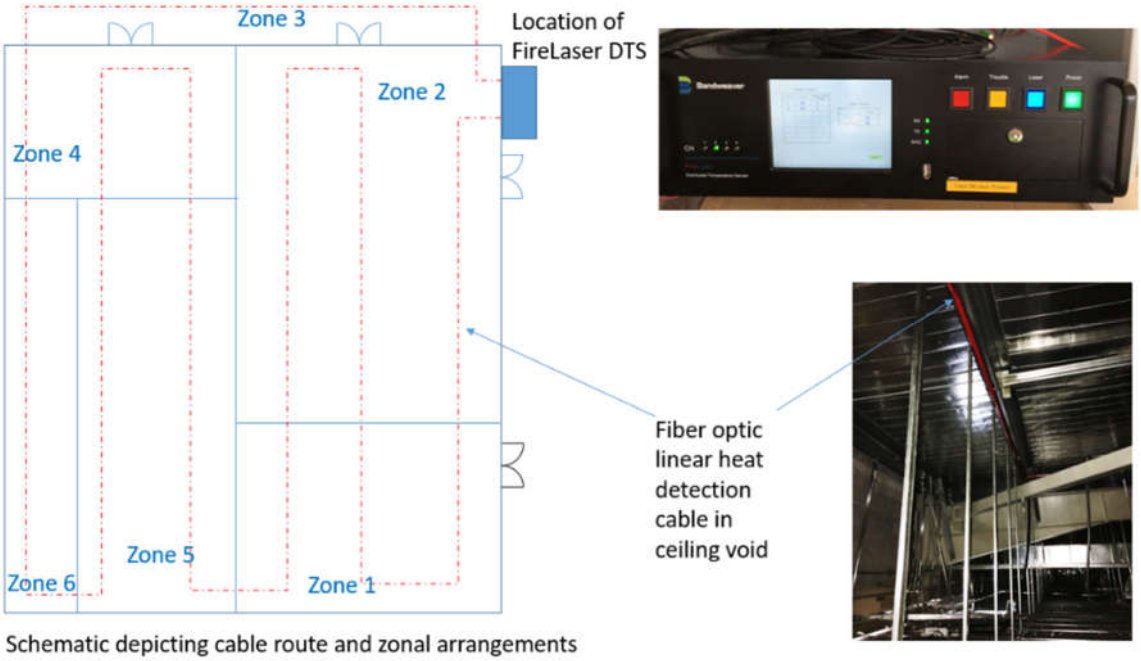


Figure 4 - Examples of FireFiber cables

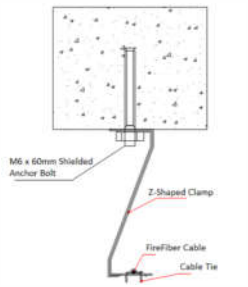
CABLE INSTALLATION AND POSITIONING

The specific cable route and zoning are very variable depending on the specific layout of the void layout and the fire zoning requirements. Below is an example of the zone layout and installation of the cable for a system in a ceiling void installed for a canteen in the ceiling void of a multinational organization.

Figure 5 - Example of cable route in ceiling void



The sensing cable is typically suspended from the ceiling by use of various fixing methods. The minimum level of protection is achieved by locating the sensing cable at the ceiling, its position defined by the structure of the ceiling, but generally under a flat ceiling, the sensor cable can be located in the center of the ceiling, at a distance of 15-50mm from the ceiling surface. A suitable cable fixing method should be adopted, using the recommended cable fixing distances, generally 1.5m apart.



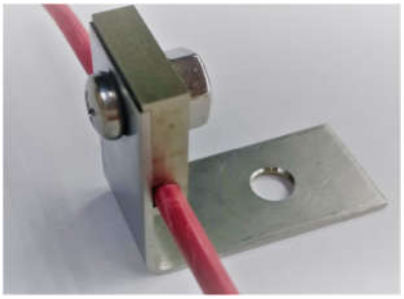


Figure 6 - Examples of cable fixtures

The location of the FireLaser controllers for an application is typically near the fire control panel. The FireLaser LHD comes with its own LCD screen and so can independently display the alarm events and also outputs to the fire alarm control panel.

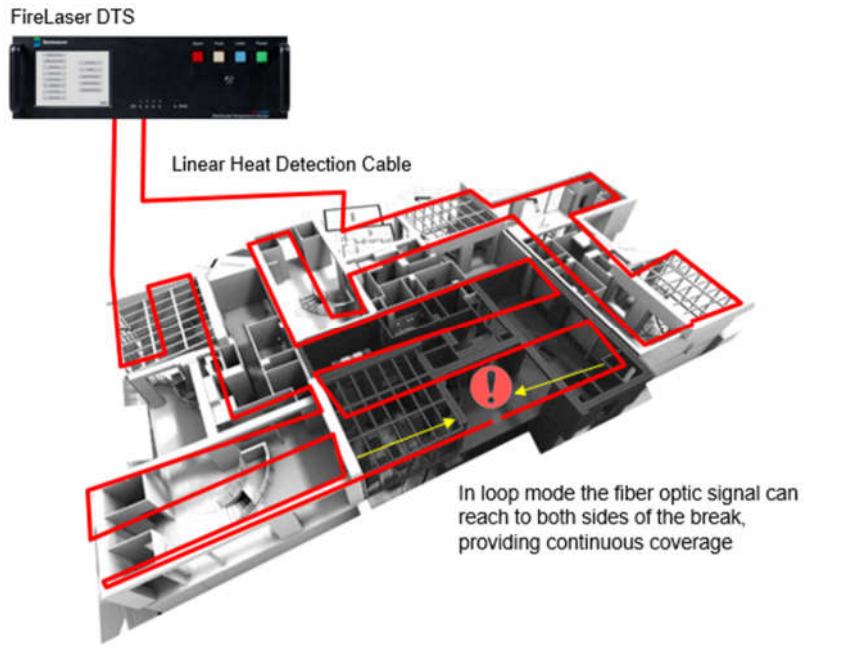


Figure 7 - Loop redundancy example

SYSTEM REDUNDANCY

Depending on the customer requirements, different levels of redundancy can be required. But essentially there are two key types of redundancy:

- **Cable Redundancy:** In the event of a cut to the cable, the system can continue to function (although a system alarm will be generated so that action for repair, analysis can be taken)
- **Controller Redundancy:** In the event of a failure to one of the fiber optic LHD controllers, the system will continue to function.

For ceiling void applications, it is unusual to have more than a single controller and so the redundancy is based around cable redundancy. The diagram left outlines the principle.

ABOUT BANDWEAVER TECHNOLOGIES

Bandweaver has been providing advanced fiber optic monitoring sensors and integrated technologies since 2002. With an installed base of over 60,000km and 8,000 systems installed, our knowledge regarding the application of distributed temperature sensing technology and linear heat detection within the fire industry is second to none. We focus on the safe integration of FireLaser DTS technologies into clients' proprietary systems and Bandweaver and our partners provide exceptional systems design support, product support during installation and provide long term maintenance packages.

For further information please contact our global team at info@bandweaver.com