Bandweaver

APPLICATION NOTE

WAREHOUSES AND HANGERS – 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 (LHD) 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 spaces such as warehouses and hangers.

INTRODUCTION

Warehouses and hangers have unique challenges when it comes to fire safety. These spaces can be highly populated and highly trafficked areas with potentially flammable goods with fire loading hazards. Some of the typical challenges include:

- High ceilings with irregular building, shelving space, atriums and other difficult to reach areas.
- Point smoke and heat detectors are expensive to install and maintain and can be at a considerable distance from the smoke/heat source.
- Potentially dusty, dirty environments. This has a double impact with buildup of potentially highly flammable particles, which is a fire hazard in itself. In addition, these particles can cause false alarms for both beam and aspiration detectors.
- Air conditioning and ventilation can interfere with smoke from fire, thus delaying detection with smoke detectors
- Ongoing maintenance and testing of sensors can be difficult to reach due to access issues.

SYSTEM INSTALLATION WITHIN WAREHOUSES

Within high density warehouses, even relatively small fires can spread very quickly both along the racks and vertically. This can rapidly cause softening of the steelwork leading to collapse of the racking, which makes it even more challenging for both fire suppression systems and firefighting departments.

With fiber optic LHD systems, the cable can be installed within the racking itself and so is always close to the fire. Therefore, overheating can be detected early on, leading to a much higher probability of controlling and containing the fire.

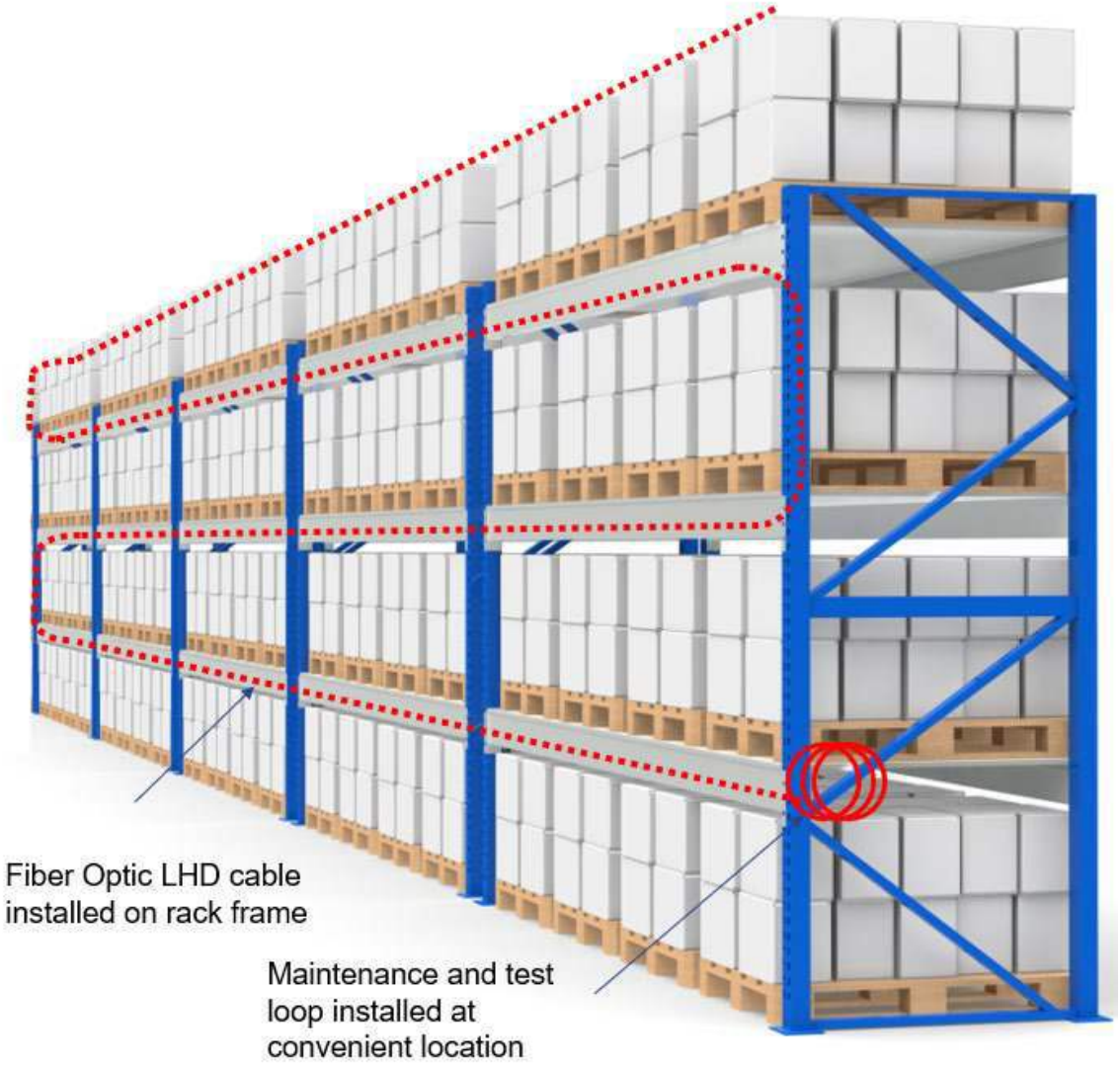


Figure 1 - 3D isometric view of cable installed on racking

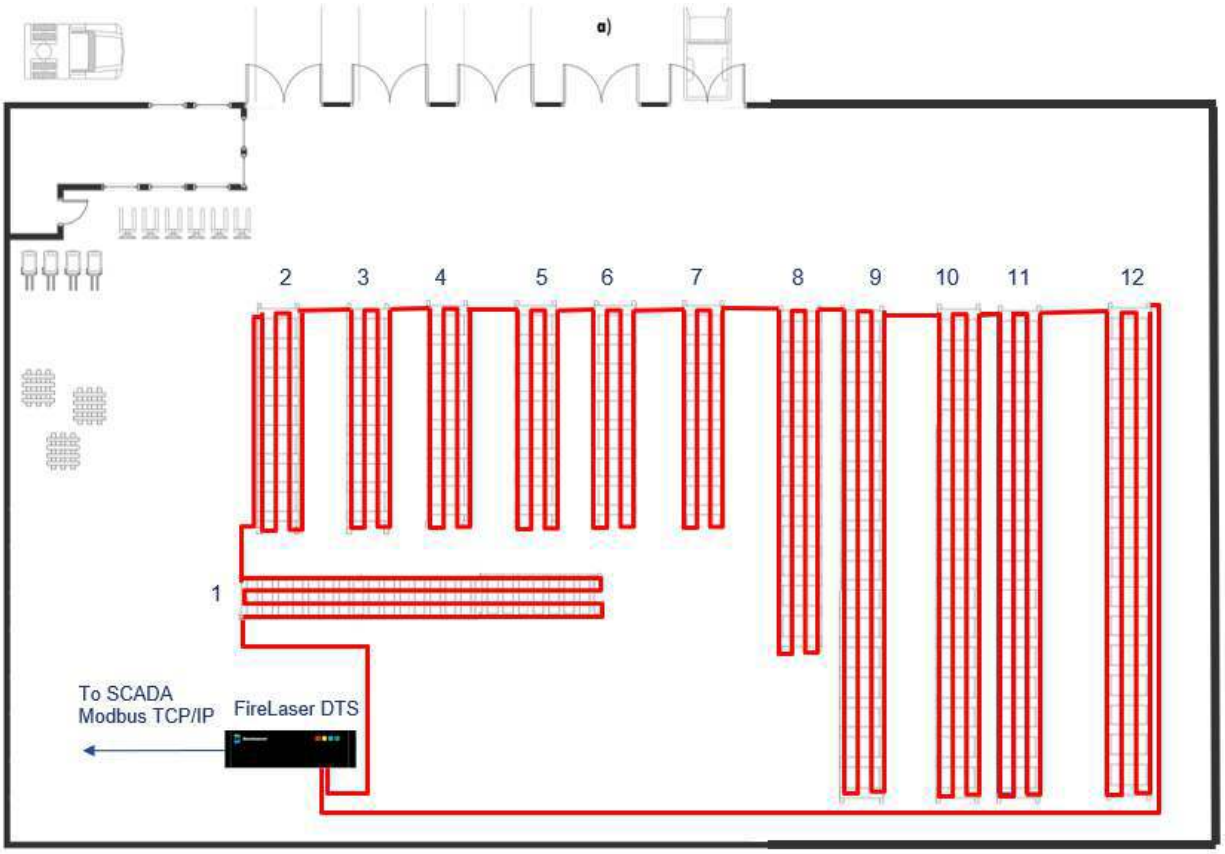


Figure 2 - 2D plan view of cable route within warehouse

The location of the FireLaser controllers for this type of 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 as well as output to the fire alarm control panel.

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. 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.

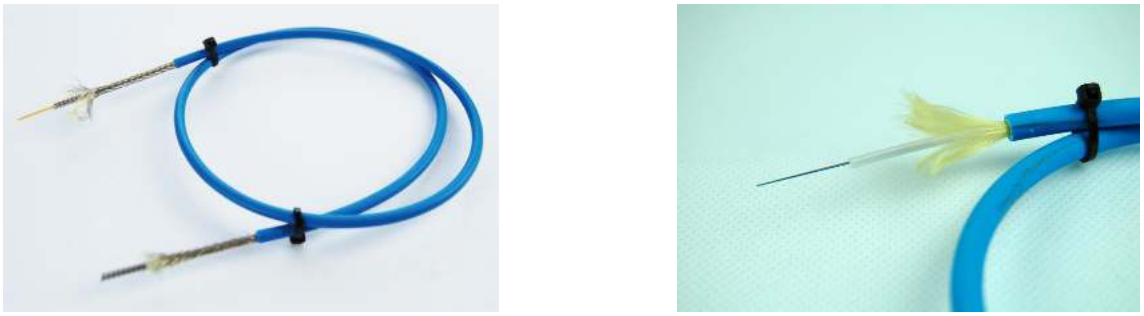


Figure 3 - Examples of FireFiber cables

CABLE INSTALLATION AND POSITIONING

The sensing cable is typically either suspended from the ceiling or attached to the racks by use of various fixing methods. The minimum level of protection is achieved by locating the sensing cable at the ceiling height. A suitable cable fixing method should be adopted, using the recommended cable fixing distances, generally 1.5m apart. Below are some samples of different fixture types.

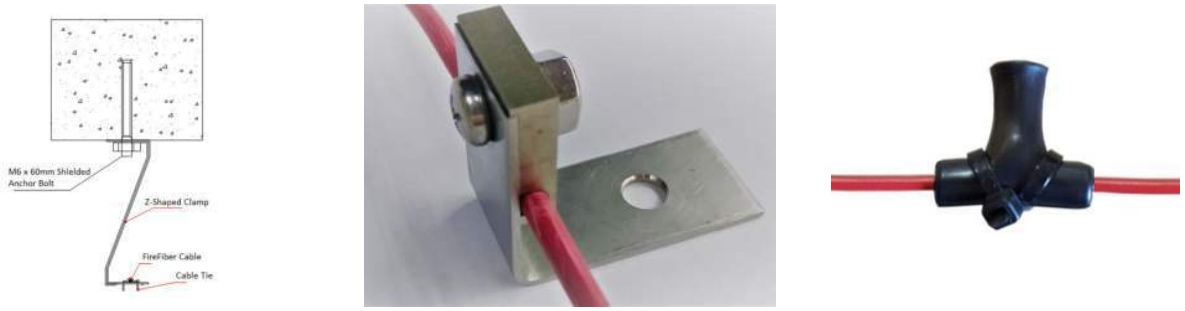


Figure 4 - Examples of cable fixtures

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.

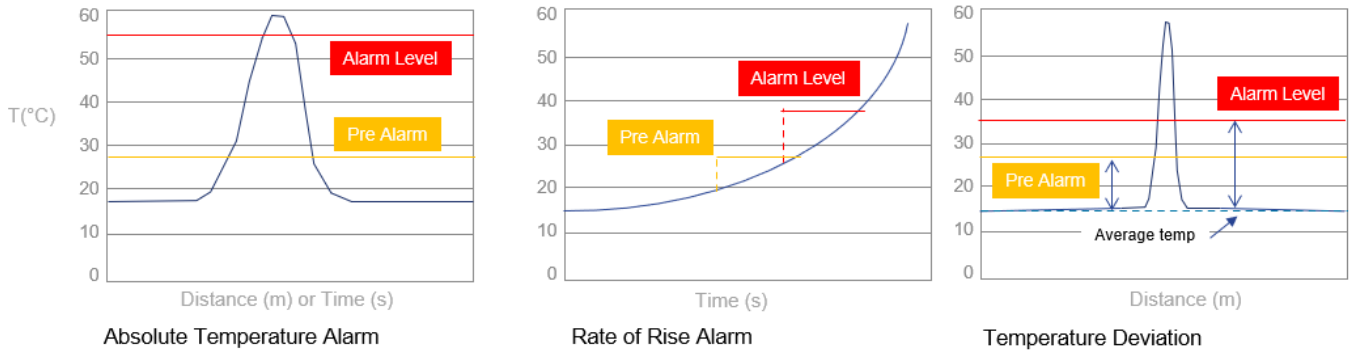


Figure 5 - Smart alarming with fiber optic linear heat detection systems

As can be seen from the figure above, by using smart alarms, fires can be detected much earlier and again significantly lowering risk. 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.

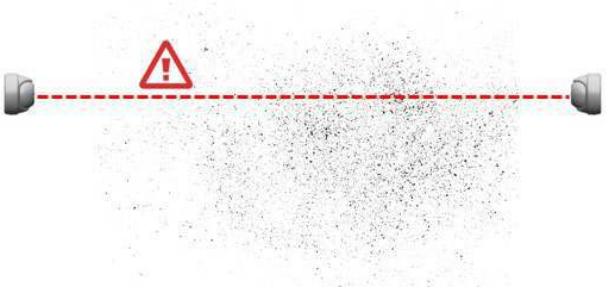
The FireLaser fire detection system takes measurement points every 0.5m along the entire length of the sensing cable and so does not have any such 'gaps'. Wherever the radiated heat is emitted, it is detected at all points along the continuous length of sensing cable and is recorded and displayed accordingly.

ADVANTAGES OVER OTHER DETECTION TECHNOLOGIES

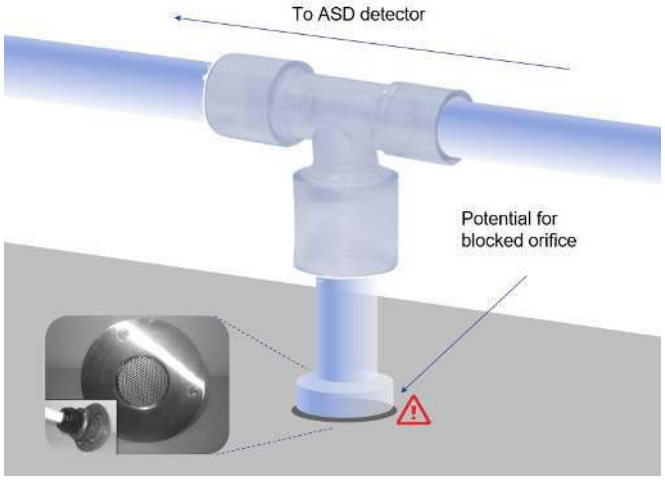
With the smart alarms and continuous coverage, fiber optic LHD systems offer a number of advantages over existing technologies.

Some of the key issues for existing technologies are caused by dust and particles in the environment. They can cause false alarms and also can become blocked.

Beam detectors blocked by objects



Beam detector - false alarms due to dust and particles



ASD pipeline vent blockage

Difficult to maintain and test

Figure 6 - Examples of issues with conventional detection technologies

Below is a summary table demonstrating the key areas for comparison between the technologies:

	Fiber Optic LHD	Analogue LHD	Aspirated Smoke Detector	Beam Detector	Point heat detector	Point smoke detector
Method of detection	Heat	Heat	Smoke	Smoke	Heat	Smoke
Resistant to building movement	Yes	Yes	Yes	No	Yes	Yes
Resistant to dust/particles	Yes	Yes	No	No	Yes	No
Affected by lighting or sunlight	No	No	No	Yes	No	No
Obstructed by foreign objects	No	No	No	Yes	No	No
Full ceiling coverage	Yes	Yes	Yes	Yes	No	No
Full rack coverage	Yes	Yes	No	No	No	No
Early detection smart alarms	Yes	No	N/A	N/A	Some	N/A
Maintenance costs	Low	Low	Med	High	High	High
Immune to RFI/corrosion	Yes	No	Yes	No	No	No

Figure 7 - Comparison of fiber optic LHD vs other technologies

SYSTEM INTEGRATION

The fire detection system which incorporates a FireLaser DTS system recognises 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 etc. 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.

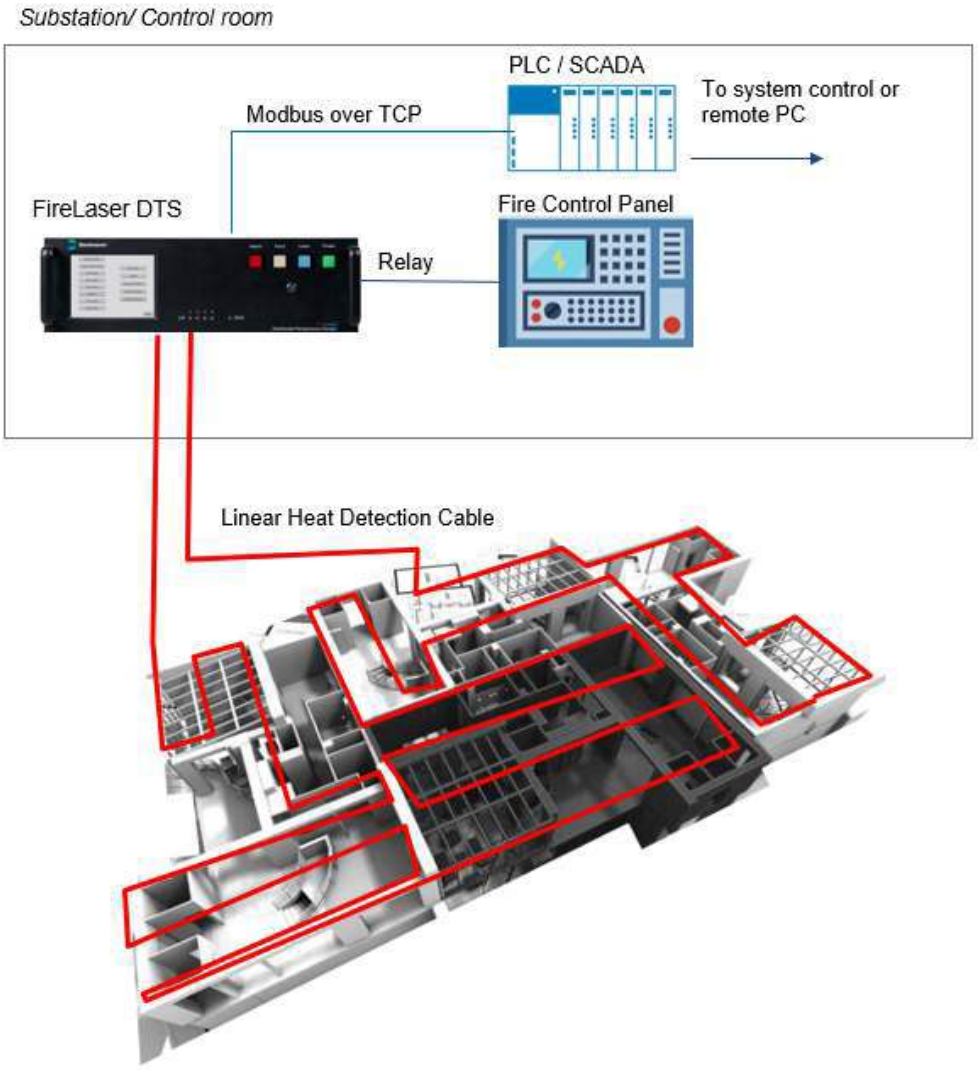


Figure 8 - Example of System Architecture

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 diagram 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. 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.

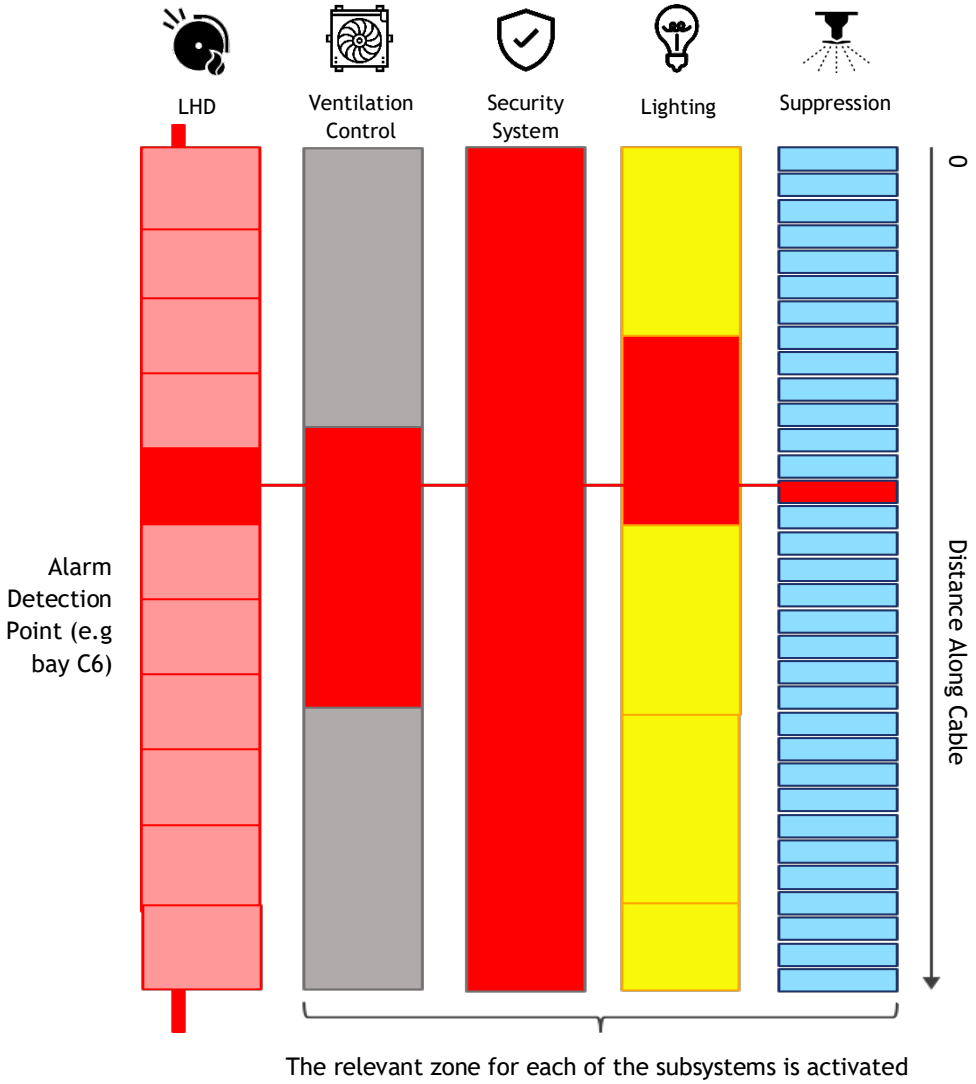


Figure 9 - Example of smart zone configuration

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 below outlines the principle.

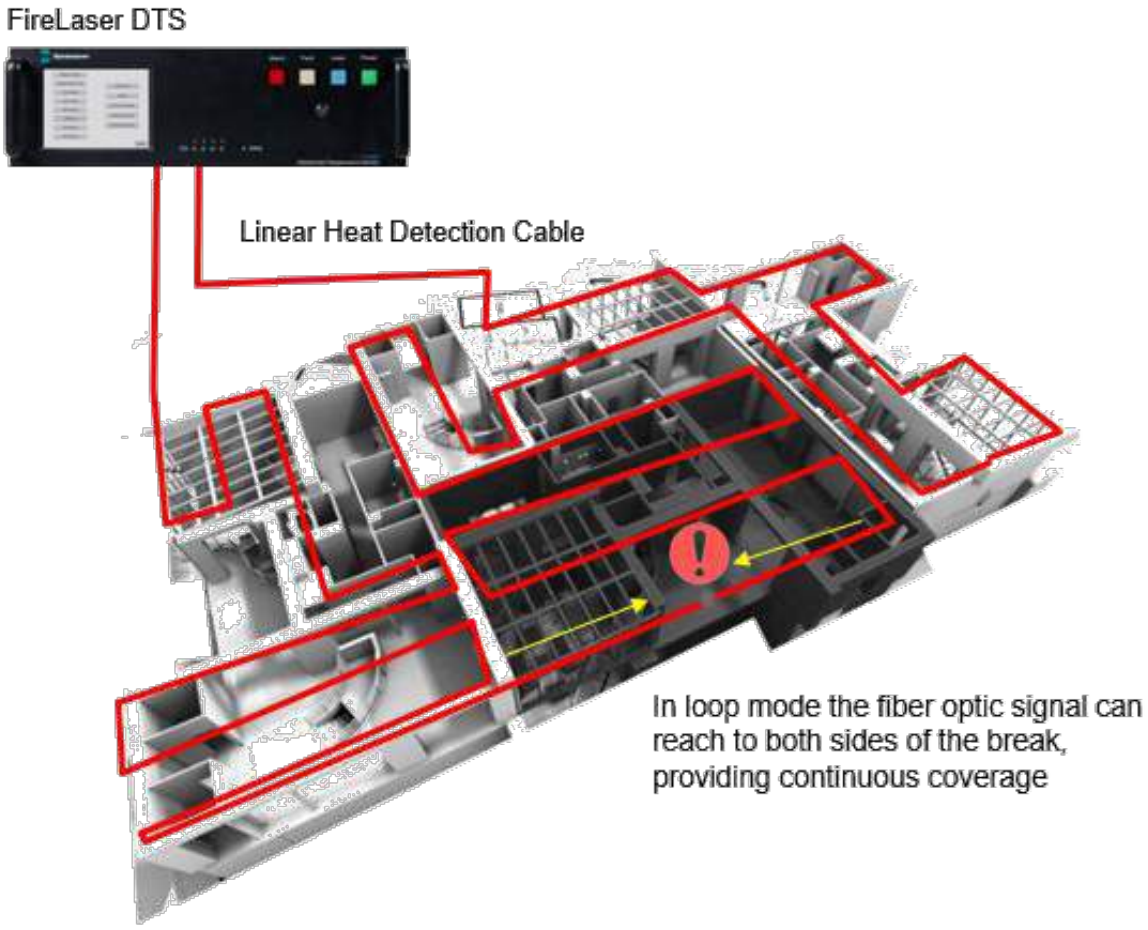


Figure 10 - Loop redundancy example

ADVANCED VISUALISATION SOFTWARE

Bandweaver's MaxView provides an additional level of visualisation. With more complex installations with multiple zones, the asset owner will benefit from additional visualisation. This enables the operator in the control room to intuitively and rapidly locate the potential event. This is particularly relevant for pre-alarms or early detection which occurs prior to the activation of the fire suppression system.

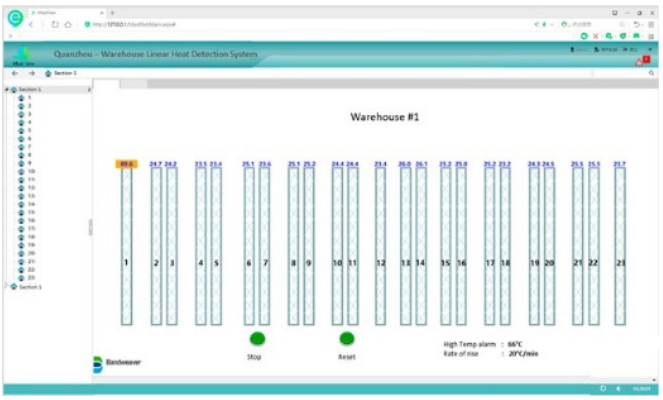


Figure 11 – Screenshot Plan view of warehouse floor layout

Figure 12 - Screenshot profile view of rack 1 within warehouse

The above examples detail a warehouse in which 11 FireLaser systems were utilised across 46 warehouse racks split across 2 zones (23 sets of shelves for each zone). Each rack comprises 8 levels and with MaxView the precise location can be detailed to within the nearest 1m on each of the specific shelves.

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