Bandweaver

CASE STUDY

MARINA BAY METRO PROTECTION
Fiber Optic Linear Heat Detection (LHD)

THE SCENARIO

Marina Bay MRT station is an underground Mass Rapid Transit (MRT) interchange station on the North South line (NSL) and Circle line (CCL), operated by SMRT Trains. The station is located on the boundary of the Downtown Core and Straits View planning areas in Singapore and was built alongside Bayfront Avenue. As the name suggests, it is located near Marina Bay.

CLIENT REQUIREMENTS

The client already had a fiber optic linear heat detection (LHD) system installed but for operational reasons they wanted to upgrade to the latest technology. The tunnel length was approximately 1km in length and the customer specified cut redundancy as an additional requirement. This means that in the event of a cut to the cable, the system can continue to function. They also required a system with smart zones and smart alarms, with the capability for rapid detection using rate of rise and deviation alarms. The system was also required to have EN54 part 22 certifications.

Monitored | Secured | Safe

Figure 1 Inside of Marina Bay Station

WHAT DID WE DO?

System Design

Innovative Energy worked with the customer to design, supply, and install a fiber optic linear heat detection system based on Bandweaver's FireLaser DTS solution. One of the key decision-making factors was the cut redundancy and how to address this in the most cost-effective manner. Innovative Energy's design was based on a single LHD system utilising the 2km, 2-channel FireLaser DTS unit.

The system utilised a loop design with each channel having a dedicated fiber returning to the unit (see diagram below). Because the FireFiber AT cable had 2 fibers, this can be achieved with a single fiber cable, helping to minimise costs whilst still maintaining full functionality.

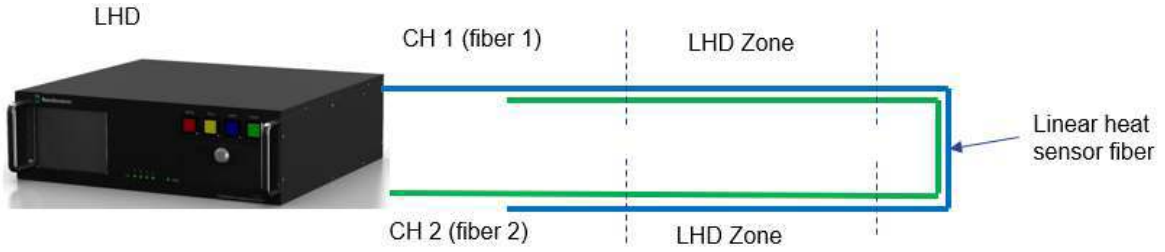


Figure 2 Schematic depicting loop redundancy configuration

The system was deployed in both the tunnel (1250m) and the station itself (450m) and a total of 15 zones were created. Because of the different thermal environments in the station and the tunnel, different alarm temperature thresholds were applied to take this into account.

When the FireLaser LHD system detects the fire, it triggers the respective programmable dry contact outputs for the specific zone in which the fire occurs. For this scenario, in addition to the power connection from the fire panel, Innovative Energy also designed in an Uninterruptable Power Supply (UPS) into the system cabinet for added redundancy.

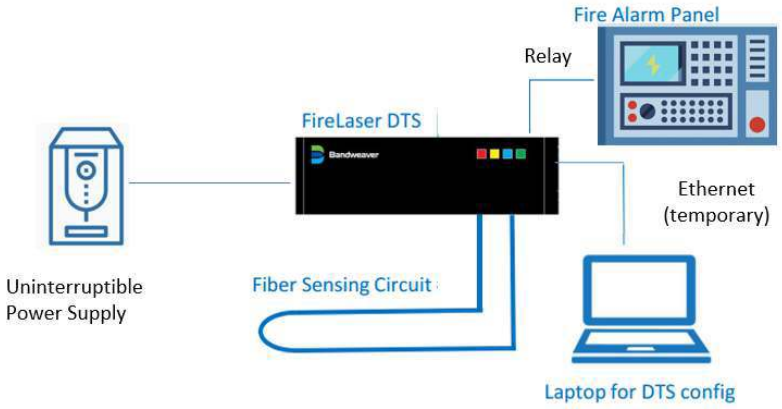


Figure 3 Example of system architecture

Installation and Commissioning

The system was installed in a wall mounted unit which included both the LHD system and the uninterruptable power supply (UPS).

Figure 4 LHD panel and Fire Alarm Control Panel (FACP)

The system testing and commissioning were very comprehensive, and all the system functionality and associated relay signals were tested. The FireLaser LHD reserves the first 7 relays for system fault diagnosis and this also is communicated to the relevant channel on the FACP.

In the example below, you can see the laser switch (typically enclosed under a locked panel during normal operations) has been turned off to simulate the laser fault. The appropriate dry relay contact has been triggered and the FACP displays the appropriate alarm.

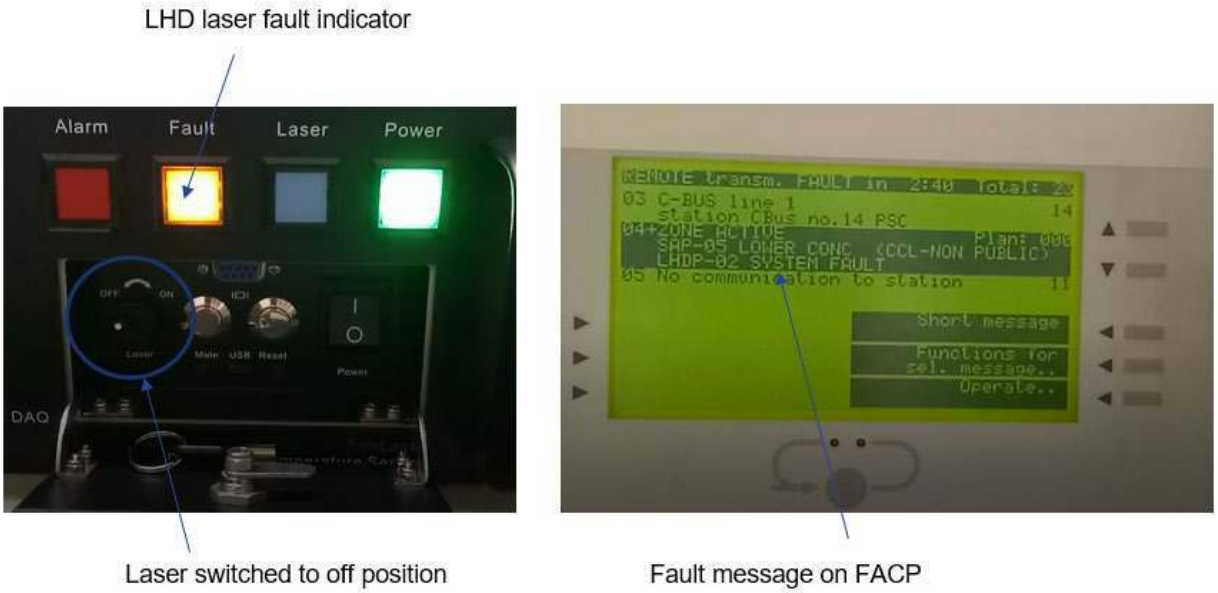


Figure 5 - Laser fault simulation at testing stage

Similarly, the fiber break alarm is also demonstrated by removing the fiber connector at the rear of the unit:

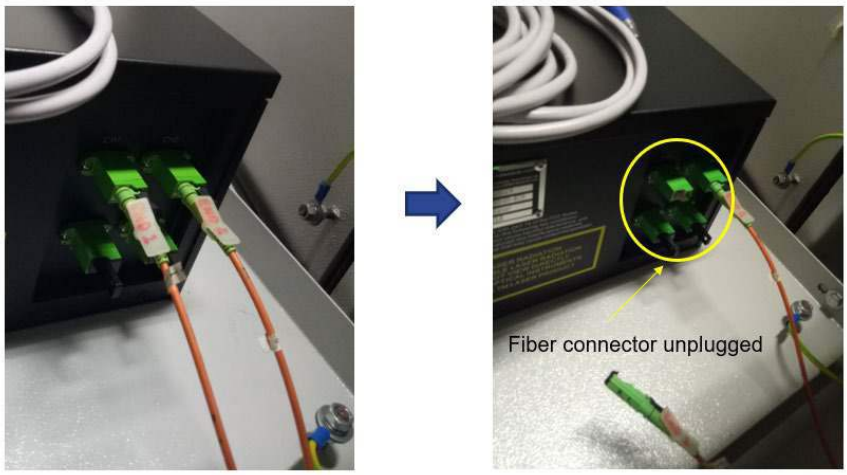
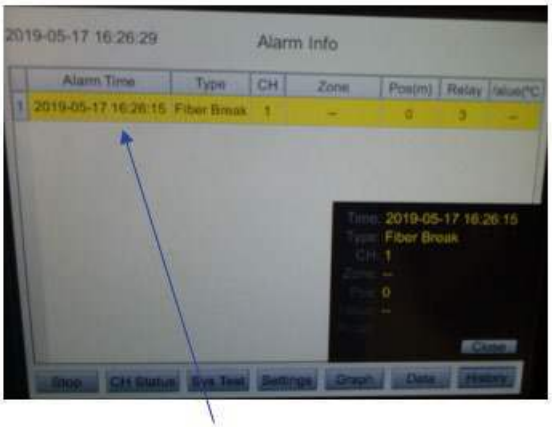


Figure 6 Fiber break simulation at testing stage

The pictures below show the alarm signals both on the LCD screen on the LHD and on the FACP. It is important to note that the LHD gives an alarm when there is a fiber break but continues to measure up to the point of the break in the cable. Because of the loop configuration, the system continues to operate without interruption.



Fiber break alarm message on LCD of LHD system

Corresponding system fault message on FACP

For the fire detection alarms, a pole mounted heat source was used to simulate and trigger each of the individual alarm points. Due to the fully distributed nature of the fiber optic linear heat detection system, the alarm location can be detected to within 1m and is sensitive along the entire length, so there are no blind spots.

The operator decided on a quarterly maintenance programme, which utilises these tests to evaluate and confirm system performance and integrity.

Figure 7 Testing the temperature alarms

BENEFITS TO THE CLIENT

When evaluating the system, the client reviewed several factors in making the choice to optimise cost and performance throughout the lifetime of the project. Below are the following benefits which helped persuade the client the fiber optic LHD systems were a superior choice to other technologies:

- **Low Cost of Ownership:** Fiber optic sensors are completely passive and are immune to EMC interference, not affected by dust or other environmental factors and are completely non-corrosive. Therefore, the lifetime of a fiber optic cable can be greater than 30 years, without any maintenance required.
- **High Reliability:** Another benefit of the passive, inert nature of fiber optics is that they are very reliable and so there is no downtime. In addition to the lower maintenance costs, they also provide a higher level of coverage which lowers the overall risk and improves protection levels.
- **Fully Certified to Internationally recognised standards**: The Bandweaver FireLaser DTS together with the sensing cable has been certified to EN54 part 22. This gives the customer the knowledge and security that the system has been designed and tested to the highest standards in the fire detection industry.
- **Complete Coverage:** Because the sensing cable was installed along the entire length of the tunnel, it means you have complete coverage. With the fiber optic LHD, measurements can be taken every 50cm, meaning there are no gaps between sensing points.
- **Early detection with Smart Alarms:** The smart alarms be configured to enable the system to detect much earlier than with conventional LHD systems thus minimising any damage to the assets.

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