



# Doha Metro Tunnel Fire Detection

## Doha, State of Qatar

In parallel with the launch of Doha Metro operations, AP Sensing's industry-proven Linear Heat Detection (LHD) system began monitoring Doha Metro's railway tunnels using Distributed Temperature Sensing (DTS) technology. A total of 128 km of the tunnel network is monitored by 16 multi-channel DTS units and 132 km of fiber optic sensing cable. Our system integrates seamlessly with FACP and SCADA systems such as the Train Management System, generating thousands of temperature readings with a 1 m spatial resolution.

Qatar Rail is a state-owned company responsible for rail transportation in Qatar; it's Doha Metro is a rapid transit system in Qatar's capital city that became operational in May 2019. The system is currently operating three transit lines with a fourth line planned for 2025. The automatic train operations rely on a Train Management System to ensure the safety of passengers and key infrastructure, which demand real-time fire statuses throughout the busy underground tunnel networks.



*Doha Metro map and train\**

The overall heat monitoring project is comprised of three main parts. The Red Line tunnel is 40 km long and protected with six LHD systems, the 22 km Green Line is protected with six LHD systems, and the Gold Line is 14 km long, protected by four LHD systems.

Each LHD system offers up to 256 usable alarm zones per channel and provides five dynamic criteria for setting up alarm thresholds. Additionally, each system has 44 potential free-relay contacts and a network interface for communication with SCADA via Modbus TCP/IP.

### **DTS Installation & Configuration**

Wall-mountable LHD units were placed at designated locations in the tunnels, with the fiber optic sensor cable installed along the tunnel ceiling area to detect rising hot air. Test zones were then implemented at a height for easy access in order to conduct annual functional verification. The LHD systems are connected to the metro system intranet via a LAN cable, and a field-assembled connection cable is used for interfacing potential-free relay contacts to FACP.

After field calibration, alarm zones were established with pre-determined thresholds. For the entire metro tunnel network, 4777 alarm zones were programmed with a maximum alarm threshold set at 60 °C. Alarm statuses and faults are directly transmitted to the Train Management System via Modbus coils and holding registers. For each alarm zone, coils are set up to transmit high temperature alarms, fiber break alarms, DTS measurement statuses and fault statuses. Modbus registers are configured to provide the numerical value of maximum, minimum, average and trace temperatures of all alarms zones as well as supplementary data such as timestamps and reference values.



*Tunnel along the Doha Metro line*

### **SmartVision**

Our SmartVision software enables metro operators to visualize real-time temperature distributions for all monitored tunnels. All 16 LHD units are connected to the central SmartVision server, which provides real-time asset visualization in addition to capturing, processing and storing all data. The graphical asset visualization is customized for Doha Metro's network.

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