

Optical Fiber DTS for Manufacturing and Industrial Facilities

Manufacturing and industrial facilities operate complex processes involving high temperatures, heavy electrical loads, combustible materials, moving equipment, and continuous production operations. In these environments, early fire detection and thermal monitoring are critical for protecting personnel, infrastructure, production assets, and operational continuity.

Conventional fire detection technologies may struggle to provide sufficient coverage across large industrial spaces or harsh operating environments. Dust, vibration, humidity, airborne contaminants, and extreme temperatures can reduce detector performance and increase maintenance requirements.



Optical Fiber Distributed Temperature Sensing (DTS) provides continuous, real-time thermal monitoring over long distances using standard optical fiber cables as linear heat sensors.

DTS technology enables industrial operators to identify abnormal temperature conditions, developing fires, overheating equipment, and process anomalies at an early stage – helping reduce downtime, improve safety, and protect critical assets.

Key Challenges

Industrial and manufacturing environments contain numerous ignition sources and thermal hazards.

Common risks include:

- Electrical faults
- Overheated machinery
- Conveyor friction
- Motor failures
- Bearing overheating
- Combustible dust ignition
- Hydraulic fluid leaks
- Hot work activities
- Process equipment failures
- Cable overheating
- Furnace and kiln incidents
- Chemical reactions

Many facilities also operate continuously, increasing the importance of rapid incident detection and minimising unplanned shutdowns.

Challenges - Fire and Thermal Risks in Industrial Facilities

Manufacturing Plants

Production facilities often contain:

- Automated machinery
- High-current electrical systems
- Process heating equipment
- Dense cable infrastructure
- Robotic systems
- Continuous production lines

Unexpected thermal events can rapidly disrupt operations and damage high-value equipment.



Heavy Industrial Facilities

Facilities such as steel plants, cement plants, paper mills, and refineries operate in harsh environments with:

- High ambient temperatures
- Dust contamination
- Mechanical vibration
- Corrosive atmospheres
- Long process routes

These conditions can challenge conventional fire detection technologies.



Electrical and Utility Infrastructure

Industrial sites contain extensive electrical distribution systems including:

- Cable trays
- Switchgear rooms
- MCC rooms
- Transformers
- Busbars
- UPS systems
- Battery rooms

Electrical overheating remains one of the most common industrial fire causes.



Challenges with Conventional Fire Detection

Traditional point-based detection systems can face significant limitations in industrial applications.

Large Area Coverage

Manufacturing facilities often span large areas with:

- High ceilings
- Complex layouts
- Multiple process zones
- Long conveyor systems

Point detectors may leave gaps in coverage or require large numbers of devices.

Airflow and Ventilation Effects

Strong ventilation or process airflow may dilute or redirect smoke, delaying activation of conventional smoke detectors.

Harsh Operating Conditions

Industrial environments may expose detectors to:

- Dust
- Oil mist
- Steam
- Vibration
- Humidity
- Temperature fluctuations
- Corrosive chemicals

These conditions can increase nuisance alarms or reduce detector lifespan.

Accessibility and Maintenance

Detectors installed in difficult-to-access areas can increase maintenance complexity and operational disruption.

DTS Technology Overview

Distributed Temperature Sensing systems use optical fiber cables as continuous linear heat detectors. The DTS controller analyses temperature changes along the entire fiber length in real time. Unlike point detectors, DTS provides uninterrupted thermal monitoring across the entire protected asset or route.

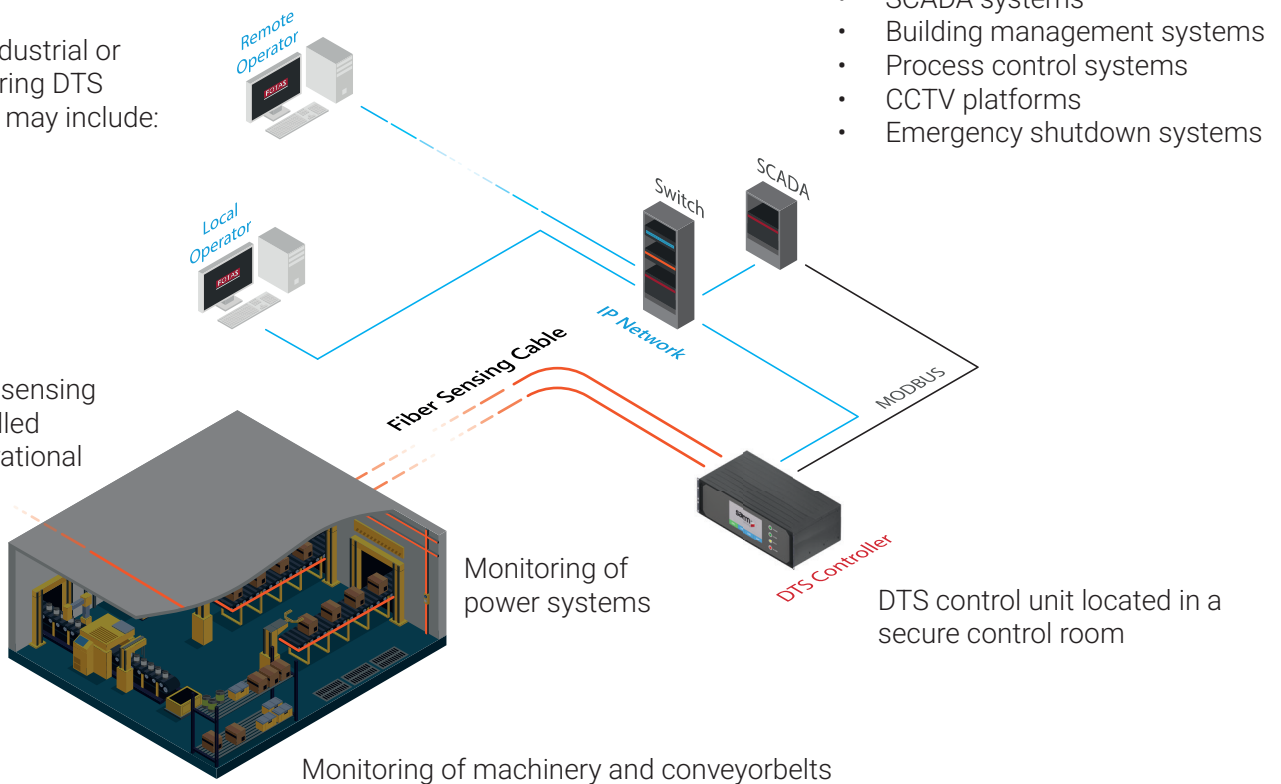
Key Benefits

- Continuous temperature monitoring
- Precise alarm location
- Real-time thermal trending
- Long-distance coverage
- Immunity to electromagnetic interference
- Reliable operation in harsh environments

System Architecture

A typical industrial or manufacturing DTS installation may include:

Fiber optic sensing cable installed above operational areas



Key Factors for Successful Deployment



Fiber Placement

Fiber routing should maximise thermal exposure while protecting cables from:

- Mechanical damage
- Excessive vibration
- Chemical exposure
- Crushing or abrasion



Environmental Protection

Cable selection should match environmental conditions, for example:

- Armoured/UV resistant cable construction
- Chemical-resistant
- High-temperature rated
- Low smoke zero halogen (LSZH) materials



Alarm Strategy

Should align with process conditions and ambient temperatures. Industrial DTS systems may use:

- Fixed temperature alarms
- Rate-of-rise detection
- Multi-stage alarm thresholds
- Zone-based logic

Key Applications

Conveyor Belt Monitoring

Conveyor systems are common ignition sources. DTS cables installed along conveyor routes provide continuous thermal monitoring and early fault detection.

- Roller failures
- Belt friction
- Misalignment
- Bearing overheating
- Material accumulation

Machinery and Process Equipment Monitoring

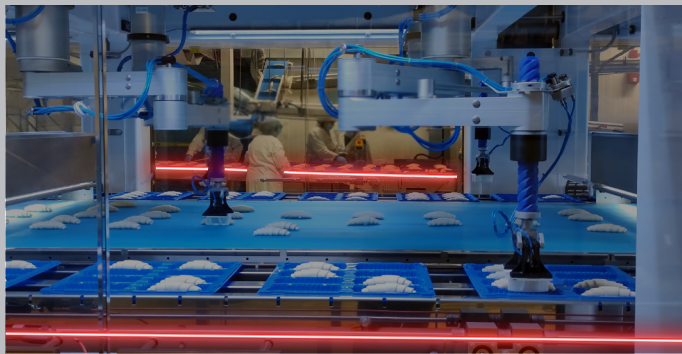
Optical fiber supports both fire detection and predictive maintenance strategies. can be installed around:

- Motors and turbines
- Compressors
- Bearings
- Hydraulic systems
- Production equipment

Storage Area Monitoring

Continuous linear detection is particularly beneficial in large storage areas to protect:

- Warehouses
- High-rack storage
- Raw material areas
- Hazardous material storage
- Packaging zones



Cable Tray and Power Distribution Protection

Industrial facilities contain extensive electrical infrastructure. Continuous monitoring helps identify abnormal heating before electrical failure or fire develops. DTS can monitor:

- Cable trays
- Busbars
- Switchgear
- MCC rooms
- Transformer connections
- UPS systems

Tunnel and Utility Corridor Protection

Industrial sites often contain areas that can be difficult to access and monitor using conventional systems.

- Utility tunnels
- Service corridors
- Pipe racks
- Cable tunnels

Battery and Energy Storage Monitoring

DTS can provide early detection of thermal anomalies associated with battery systems. Modern industrial sites increasingly use:

- Battery energy storage systems (BESS)
- UPS battery rooms
- EV fleet charging infrastructure



Supporting Operational Continuity

In manufacturing environments, fire incidents can lead to:

- Production downtime
- Supply chain disruption
- Equipment damage
- Safety incidents
- Financial losses

Early thermal detection helps operators:

- Respond more quickly
- Minimise operational disruption
- Protect critical infrastructure
- Improve overall plant resilience

DTS technology also supports modern industrial strategies focused on:

- Predictive maintenance
- Asset health monitoring
- Industrial automation
- Smart factory operations

Key Benefits

Early Detection of Thermal Abnormalities:

DTS identifies abnormal heat development before flames or significant smoke occur to support faster intervention, reduced equipment damage and improved operational continuity

Continuous Linear Coverage: Optical fiber provides uninterrupted monitoring along the entire protected area. This reduces blind spots compared with point-based systems.

Support for Predictive Maintenance:

Continuous temperature trending allows operators to identify gradual equipment degradation, abnormal operating conditions and developing mechanical failures. This can reduce unplanned downtime and maintenance costs.

Precise Alarm Localisation: DTS systems pinpoint the exact location of overheating or fire events, improving response efficiency.

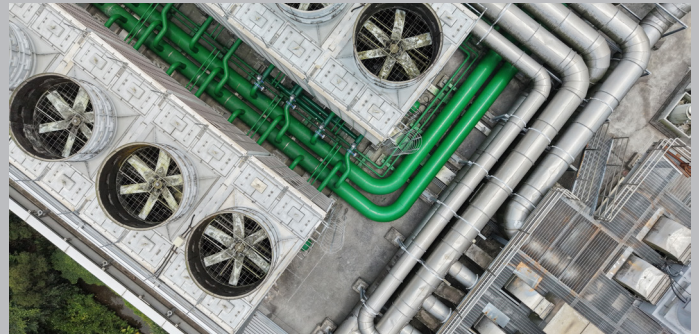
Reliable Operation in Harsh Environments: Fiber optic sensing cables are resistant to electromagnetic interference, moisture, corrosion and dust contamination. This makes DTS particularly suitable for industrial environments.

Reduced Maintenance Requirements: DTS systems contain no electrical sensing elements distributed in the field. This reduces maintenance demands and improves long-term reliability.

Scalability: DTS systems can support large industrial sites, long process routes, multi-building facilities and future facility expansion.

Key Advantages of Optical Fiber DTS in Industrial Facilities

- Continuous linear heat detection
- Early detection of overheating equipment
- Conveyor and cable tray monitoring
- Precise alarm location identification
- Reliable operation in harsh industrial environments
- Immunity to electromagnetic interference
- Reduced maintenance requirements
- Integration with fire and industrial control systems
- Support for predictive maintenance strategies
- Scalable protection for large facilities



Conclusion

Manufacturing and industrial sites have demanding fire detection and thermal monitoring challenges due to large areas, harsh environments, critical processes, and complex infrastructure. Optical Fiber Distributed Temperature Sensing provides a robust solution for continuous, real-time thermal monitoring across industrial operations.

By delivering early detection, precise event localization, and reliable performance in difficult environments, DTS technology helps industrial operators improve safety, reduce downtime, protect assets, and support long-term operational continuity.