APPLICATION NOTE

Distributed Temperature Sensing (DTS) for Conveyor Belts

Conveyor belt systems are widely used across industries such as mining, bulk material handling, power generation, manufacturing, and logistics. These systems often operate continuously over long distances and in harsh environments, making reliability and safety both critical.

One of the primary risks associated with conveyor systems is overheating due to mechanical faults, friction, material buildup, or component failure. This can lead to flammable commodities on the belt being transported. All of these can lead to belt damage, unplanned downtime, or fire incidents.

Distributed Temperature Sensing (DTS) using fiber optic technology provides continuous, real-time thermal monitoring along the entire length of the conveyor system. This enables early detection of abnormal conditions, helping operators prevent failures and improve operational efficiency.

Key Challenges

- **Long distances:** Conveyors can extend up to 10 kilometres for a single belt, often across complex terrain
- **Harsh environments:** Dust, dirt, moisture, vibration, and extreme temperatures
- **Fire risk:** Combustible materials and friction-related heating increase ignition risk
- **Difficult access:** Remote or elevated installations complicate inspection and maintenance
- **Continuous operation:** Downtime is costly and disruptive
- **Mechanical wear:** Rollers, bearings, and belts are subject to ongoing degradation

DTS Technology Overview

Distributed Temperature Sensing (DTS) systems use optical fibers as continuous linear temperature sensors. A DTS control unit sends laser pulses through the fiber and analyses backscattered light (typically Raman scattering) to determine temperature along the fiber.

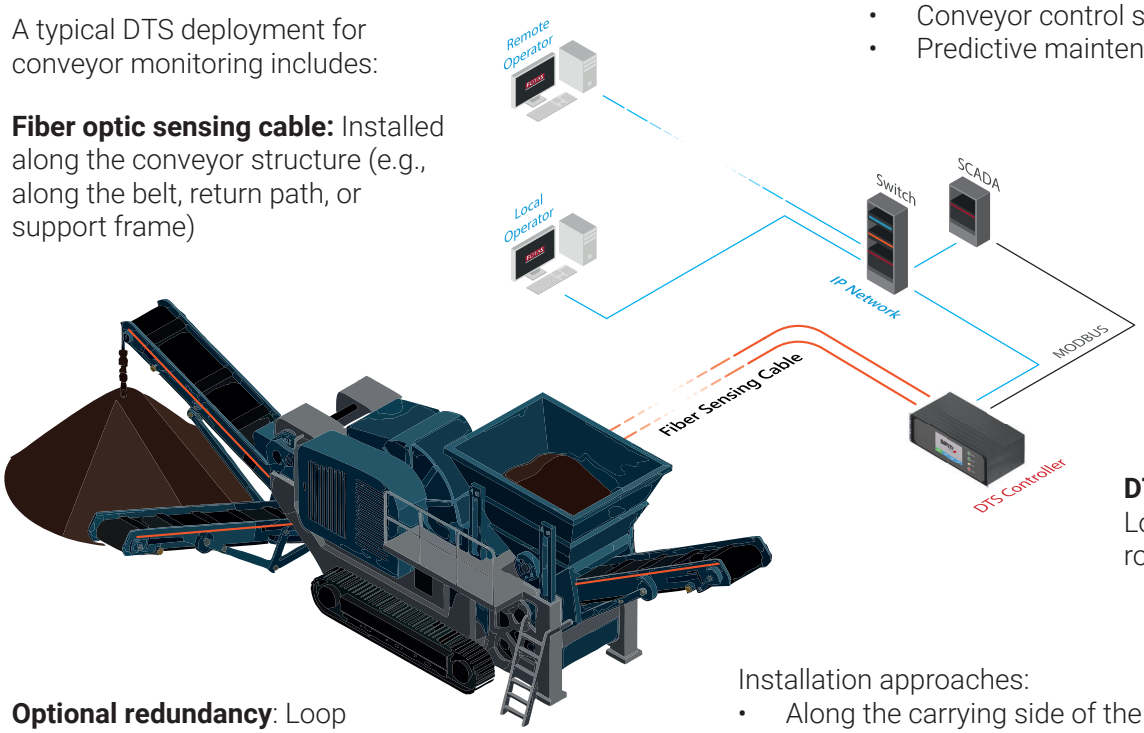
Key Benefits

- Continuous temperature monitoring along the length of the conveyor
- Spatial resolution typically 1 metre
- Real-time data with rapid response
- Passive sensing element with no power required along the conveyor
- Immune to electromagnetic interference

System Architecture

A typical DTS deployment for conveyor monitoring includes:

Fiber optic sensing cable: Installed along the conveyor structure (e.g., along the belt, return path, or support frame)



Communication interface - integration with:

- SCADA or DCS platforms
- Fire detection and alarm systems
- Conveyor control systems
- Predictive maintenance platforms

This enables automated responses such as system shutdown, alarm triggering, or activation of fire suppression systems.

DTS control unit: Located in a control room or field enclosure.

Optional redundancy: Loop configurations for critical or high-risk conveyors

Installation approaches:

- Along the carrying side of the belt for fire detection
- Along the return side for full coverage
- Close to rollers, idlers, and drive stations for component monitoring

Key Factors for Successful Deployment

- **Cable placement:** Close proximity to heat sources (belt, rollers, structure)
- **Mechanical protection:** Use of armoured or ruggedised fiber cables
- **Environmental suitability:** Resistant to dust, moisture, and temperature extremes
- **Zoning strategy:** Logical segmentation for alarm management
- **Redundancy:** Loop configurations for critical applications

Key Applications

Fire Detection Along Conveyor Belts
This is especially critical in industries such as mining and power generation, where combustible materials are transported. DTS provides continuous linear heat detection along the conveyor:
- Early detection of overheating material/belt friction.
- Rapid identification of fire risks along the full conveyor length .
- Accurate localisation for fast emergency response.

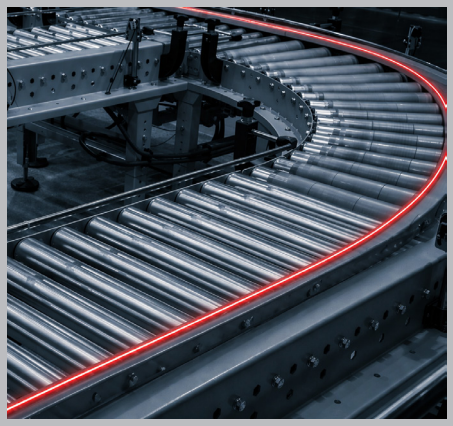
Belt Misalignment and Friction Detection
Misaligned belts can cause friction against the conveyor structure, leading to excessive heat generation, accelerated belt wear and increased fire risk.
- DTS detects abnormal temperature increases associated with these conditions, enabling corrective action.

Material Build-Up and Blockage Detection
Accumulated material can create friction points or restrict movement. DTS helps identify:
- Hot spots caused by trapped material.
- Areas prone to blockages.
- Conditions that may lead to belt damage or fire.

Drive Station and Pulley Monitoring
Critical components such as motors, gearboxes, and pulleys can be monitored for:
- Overheating due to overload or mechanical faults.
- Lubrication issues .
- Cooling system failures.
- Temperature trends provide early warning of developing issues.

Idler and Roller Bearing Monitoring
Faulty or seized rollers are a common source of overheating. DTS provides ability to:
- Detect hot spots caused by failing bearings.
- Identify maintenance needs before catastrophic failures occur.
- Reduce belt damage caused by seized components.

Tunnel and Enclosed Conveyor Monitoring
In enclosed or underground conveyors, fire detection is critical due to limited ventilation. DTS provides:
- Continuous monitoring in restricted areas.
- Integration with ventilation and fire suppression systems.



Key Benefits

- **Continuous coverage:** Full-length monitoring of conveyor systems
- **Early fault detection:** Identification of issues before failure or fire
- **Improved safety:** Reduced risk of fire and equipment damage
- **Reduced downtime:** Faster fault localisation and maintenance response
- **Low maintenance:** Passive fiber with long service life
- **High reliability:** Performs well in harsh industrial environments
- **Scalable solution:** Suitable for short conveyors and multi-kilometre systems