

Distributed Temperature and Acoustic Sensing (DTS & DAS) for Data Centres and Telecommunications Infrastructure

Data centres and telecommunications infrastructure are foundational to digital economies, supporting cloud services, hyperscale computing, telecom networks, edge facilities, and critical communications systems. As these facilities become larger, denser, and more mission-critical, the demands for uptime, resilience, and operational visibility continue to increase.

Thermal events, infrastructure failures, cable incidents, cooling inefficiencies, and physical security threats can all impact service continuity and asset protection.

Fiber optic sensing technologies provide a powerful monitoring approach for these challenges.



Distributed Temperature Sensing (DTS) provides continuous thermal monitoring for fire detection, cable monitoring, and cooling optimisation.

Distributed Acoustic Sensing (DAS) provides distributed vibration and acoustic monitoring for physical security, cable route protection, and infrastructure event detection.

Together, DTS and DAS provide continuous, real-time monitoring for both operational integrity and infrastructure security.

Key Challenges

- High uptime requirements with near-zero tolerance for downtime
- Increasing rack power densities and thermal loads
- Fire risks associated with electrical infrastructure and batteries
- Extensive power and fiber cable networks
- Cooling system efficiency and resilience challenges
- Physical security concerns across buildings and external cable routes
- Distributed infrastructure spanning central facilities, edge sites, and long-haul networks

Technology Overview

Distributed Temperature Sensing (DTS)

DTS uses optical fibers as continuous linear temperature sensors, providing real-time temperature profiles along the monitored asset.

DTS supports:

- Continuous thermal monitoring
- Fire and hot spot detection
- Cable and power infrastructure monitoring
- Cooling performance optimisation

Distributed Acoustic Sensing (DAS)

DAS transforms optical fiber into a distributed acoustic and vibration sensor capable of detecting and classifying disturbances along facilities and cable routes.

DAS supports:

- Physical intrusion detection
- Cable route security monitoring
- Vibration and infrastructure event detection
- Distributed perimeter monitoring

Key Benefits of Fiber Optics

- Provides continuous real time temperature data and early indications of a fire or other critical failure (DTS)
- Monitors both the physical building and cable routes with a single controller (DAS)
- Immunity to electromagnetic interference (EMI/FRI)
- Passive sensing element (no power required in the field)
- Sensing cable with a design life of 25+ years
- Minimal maintenance requirements

System Architecture

A typical integrated DTS/DAS for data centre monitoring systems include:

Analytics and alarm management platform

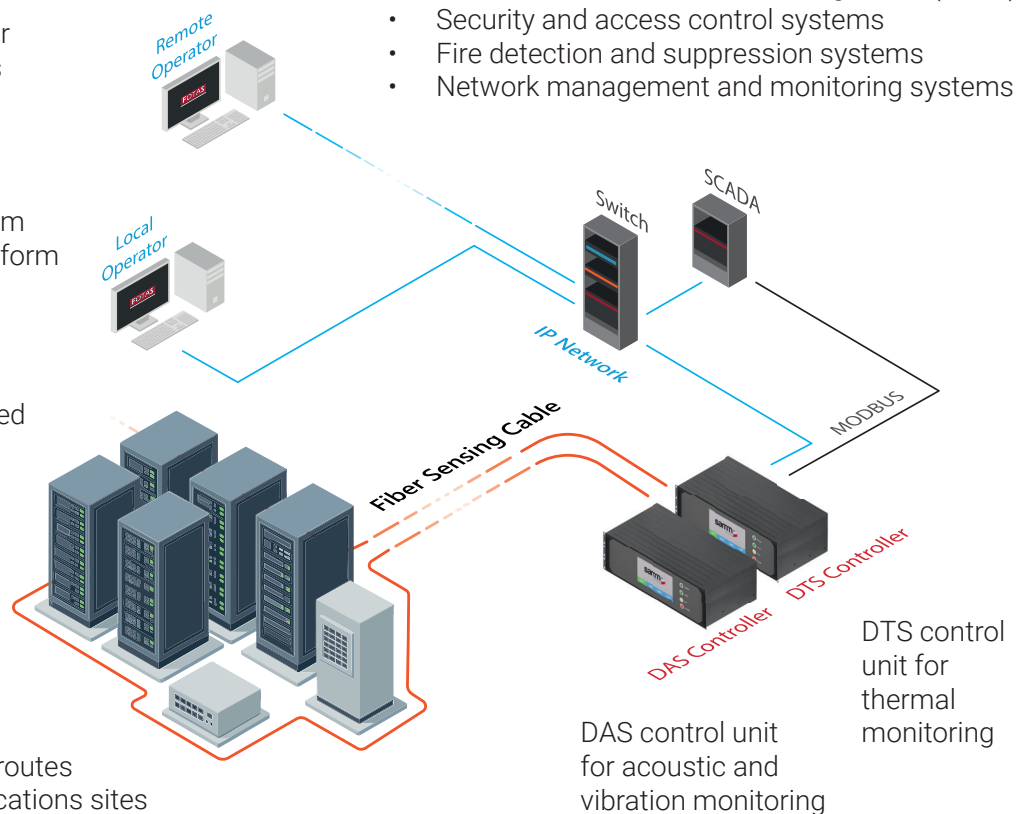
Fiber optic sensing cable installed in facilities, cable routes or site perimeters

Deployment configurations:

- Hyperscale data centres
- Enterprise data centres
- Co-location facilities
- Telecom central offices
- Fiber backbones and cable routes
- Edge and remote communications sites

Integrated DTS/DAS systems can interface with:

- Building Management Systems (BMS)
- Data Center Infrastructure Management (DCIM)
- Security and access control systems
- Fire detection and suppression systems
- Network management and monitoring systems



Key Factors for Successful Deployment



Fiber Deployment

- Cable trays and power pathways
- Site perimeters and secure boundaries
- Telecom ducts and route corridors
- Integration with existing fiber infrastructure



Cable Selection

- Fire-rated or ruggedised sensing cable as required
- Mechanical protection appropriate to environment
- Design compatible with both DTS and DAS objectives



System Design

- Alarm zoning and event classification strategy
- Integration with existing operational and security systems
- Redundancy for high-availability applications

DTS FOR THERMAL MONITORING

DTS Applications in Data Centre:

Cooling System Optimisation

Thermal performance is central to data centre efficiency. DTS supports:

- Monitoring of cooling distribution performance
- Identification of localised hot zones
- Cooling imbalance detection
- Support for airflow and thermal optimisation

Power Cable and Busway Monitoring

Electrical distribution is a critical risk area. DTS enables monitoring of power cables, bus ducts and busway, terminations and connection points and high-load distribution pathways. Benefits include:

- Hot spot detection
- Early warning of connection faults
- Improved electrical reliability

Battery and Energy Storage Monitoring

Many facilities include UPS batteries or on-site energy storage. DTS supports:

- Monitoring battery rooms and enclosures
- Early detection of abnormal heating
- Support for thermal runaway mitigation strategies

Linear Heat and Fire Detection

DTS provides continuous linear heat detection across critical infrastructure. Applications include, cable trays and power distribution routes, underfloor or overhead cable pathways, battery rooms and UPS areas and generator and fuel support systems. Benefits include:

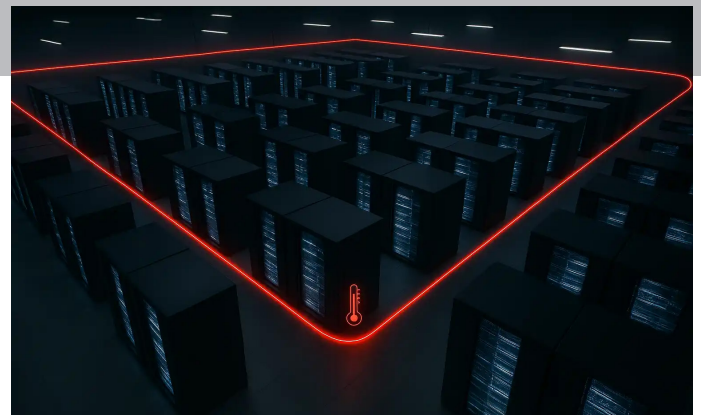
- Early detection of thermal anomalies
- Precise event localisation
- Enhanced fire protection coverage

DTS Applications in Telecoms

Fiber Route and Cable Infrastructure Monitoring

DTS can support monitoring of critical telecom cable routes, cable vaults and underground ducts, remote shelters and equipment rooms, landing stations and critical network nodes. Applications include:

- Fire detection
- Hot spot monitoring
- Environmental and equipment thermal monitoring



Key Benefits

- Continuous thermal visibility
- Early fault and fire detection
- Improved uptime protection
- Cooling optimisation support
- Enhanced electrical asset protection
- Reduced maintenance risk

DAS FOR SECURITY AND INFRASTRUCTURE PROTECTION

DAS Applications in Data Centres

Perimeter Intrusion Detection

DAS can support distributed perimeter security around sites and facilities. Detectable events may include:

- Perimeter fence breaches (cuts, climbing, lifting, digging)
- Unauthorised access attempts
- Vehicle activity near critical zones
- Ground disturbance near secure areas

Critical Infrastructure Protection

DAS can monitor vibration signatures associated with:

- Tampering or intrusion attempts
- Mechanical disturbances near critical assets
- Unauthorised activity around protected zones

DAS Applications in Telecoms

Fiber Route Protection

Telecom fiber routes are vulnerable to accidental and intentional damage. DAS enables:

- Excavation detection near cable routes
- Third-party intrusion monitoring
- Construction activity detection
- Protection of long-haul and metro fiber routes

Subsea and Landing Station Security (where applicable)

For critical communications infrastructure:

Monitoring of landing station approaches
Detection of disturbances near protected assets
Enhanced situational awareness around critical network entry points

Key Benefits

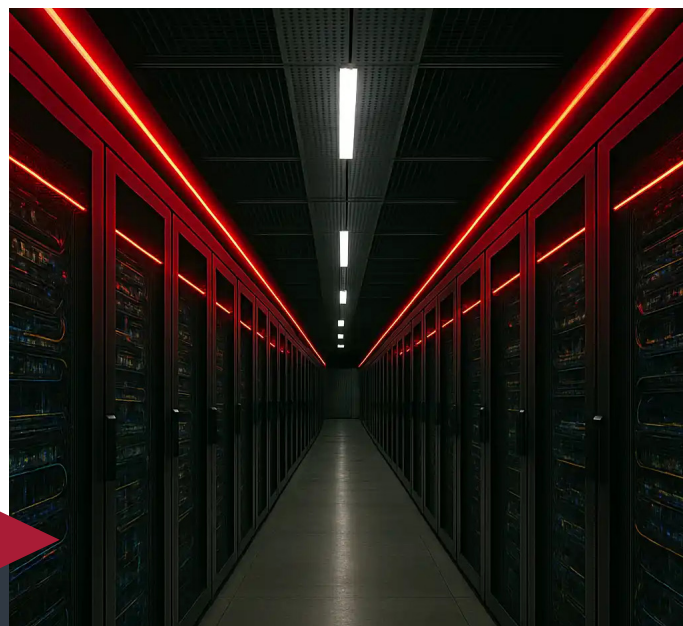
- Continuous distributed security monitoring
- Real-time disturbance detection and localisation
- Reduced risk of cable damage and outages
- Enhanced perimeter and route protection
- Faster incident response
- Lower dependence on manual patrols or point sensors

INTEGRATED DTS + DAS SOLUTION

Using DTS and DAS together provides both infrastructure health monitoring and distributed security.

Integrated monitoring can support:

- Fire and hot spot detection
- Power and cooling monitoring
- Cable route protection
- Intrusion detection
- Distributed infrastructure visibility



Combined Benefits

- Single fiber supporting multiple sensing functions
- Unified monitoring platform
- Reduced infrastructure complexity
- Improved resilience and situational awareness
- Comprehensive protection strategy