

Smart Grid Application  
Ecology & Environment  
Fire Detection

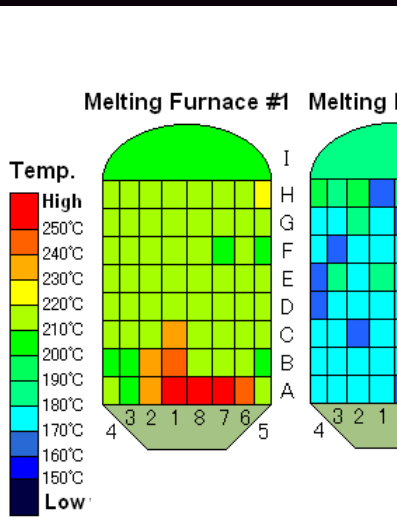
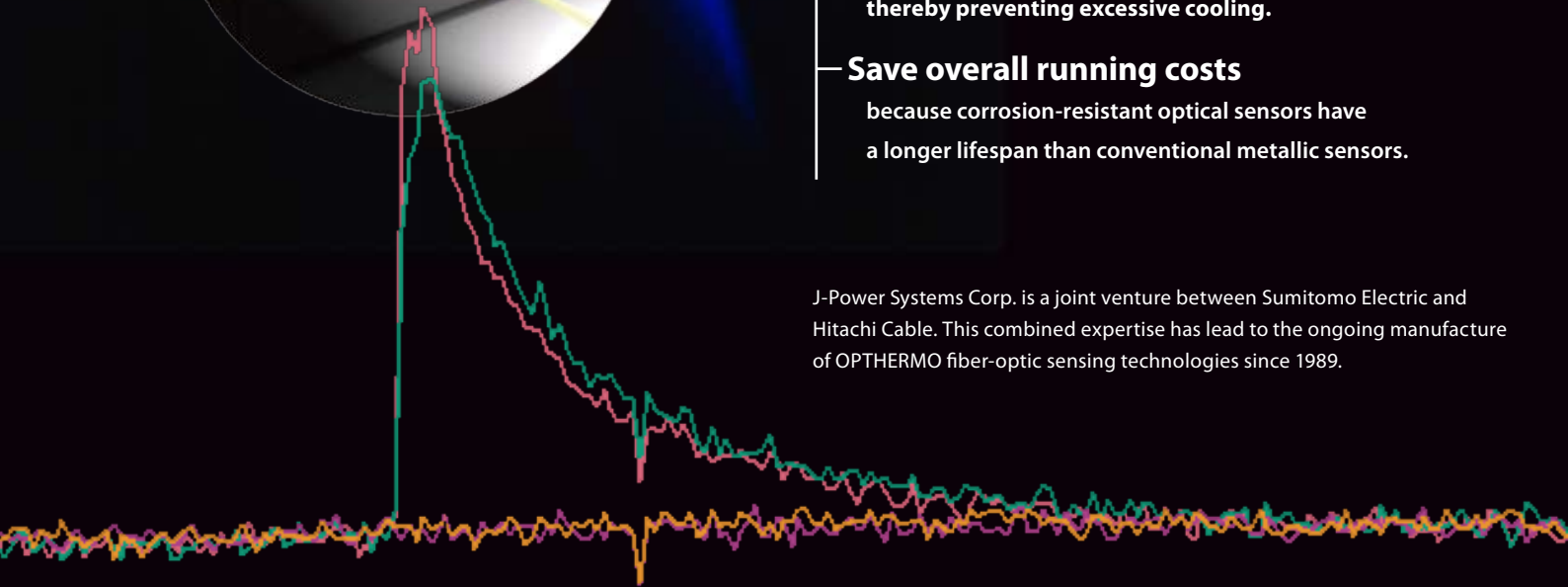
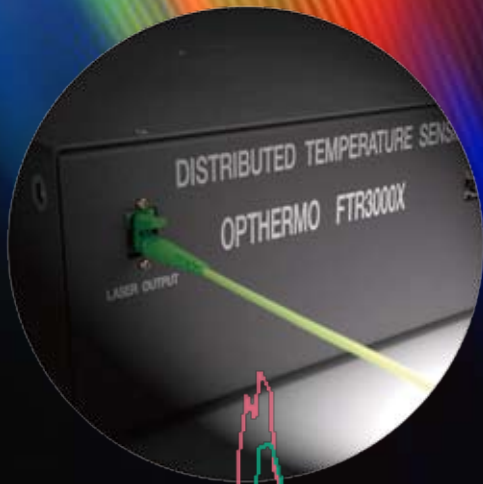
Fiber-Optic Distributed Temperature Sensing System

# OPTHERMO®

Benefits of using OPTHERMO fiber-optic temperature measurement;

- **Display temperature profiles at a glance**  
helps you localize an abnormal hot spot within a large/long facility with high spatial resolution.
- **Detect fires in advance**  
within your facility using fast identification of abnormal rises in temperature.
- **Save energy**  
using temperature profiles to control air conditioning, thereby preventing excessive cooling.
- **Save overall running costs**  
because corrosion-resistant optical sensors have a longer lifespan than conventional metallic sensors.

J-Power Systems Corp. is a joint venture between Sumitomo Electric and Hitachi Cable. This combined expertise has led to the ongoing manufacture of OPTHERMO fiber-optic sensing technologies since 1989.

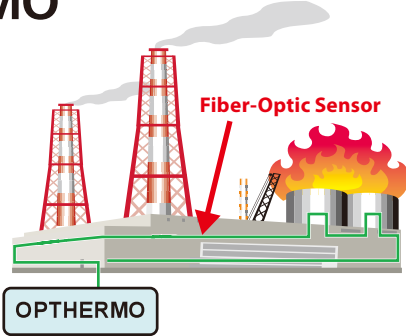


J-Power Systems Corporation

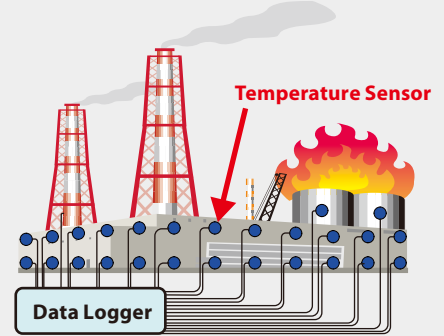
[www.jpowers.co.jp/opthermo/](http://www.jpowers.co.jp/opthermo/)

## Features

### OPTHERMO®



### Conventional Temperature Sensor



#### Simple

By laying one optical fiber provides, a 30km temperature profile can be measured at 1m intervals. System configuration is simpler than conventional styles.

← Every temperature sensor must be wired to data logger. Therefore, system configuration is complicated in case of multi-monitoring.

#### Low Cost

Initial cost and maintenance costs are lower (in case of multi-monitoring).

← Initial cost and maintenance costs are high (in case of multi-monitoring).

#### Seamless

Available for seamless temperature monitoring. (No blank area)

← Discrete Monitoring

#### Long Lifetime

Sensor Lifetime > 30 years (\*)  
(\*) under normal temperature conditions.

← Sensor Lifetime: 10 to 15 years

#### Withstands Harsh Environments

Applicable in explosive environments and within strong electromagnetic fields.

← Not applicable under strong electromagnetic fields. Expensive box required in explosive areas.

#### Easy Installation

Install just one light weight sensor cable.

← Wiring work is necessary for each sensor installed.

## System Components

#### Control Unit

By collecting temperature data, recording and alarm detection process are performed.

#### OPTHERMO®

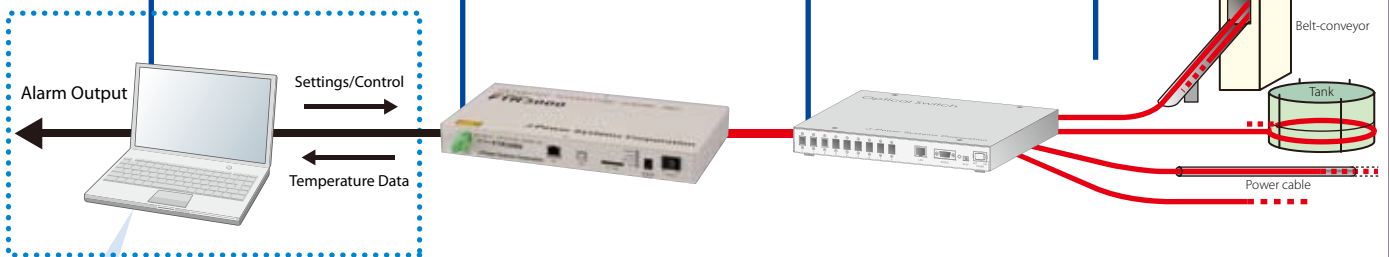
Injects a light pulse in the optical fiber and detects the intensity of Raman Scattering. The results are converted to temperature data.

#### Optical Switch (Option)

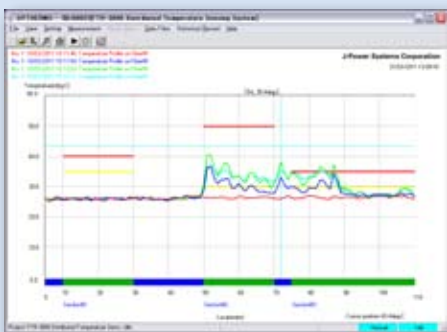
The switch is used when measuring multiple optical fibers in sequence. (64 channels max.)

#### Fiber-Optic Sensor

The optical fiber is the sensor. Temperature profile along the fiber is measured in real time.



Control unit is applied in case temperature display is required.



#### Standard Software Functions

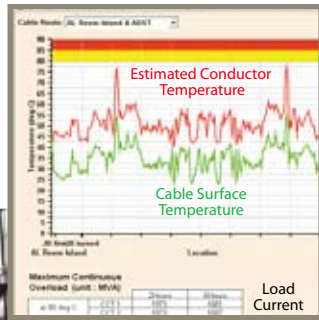
- Display/recording of temperature data (English/Japanese/Chinese)
- Display of temperature trend of each point.
- Alarm settings for maximum of 400 zones (absolute or differential temperature judgement)
- Contact signal output (64 points max.)
- Statistical analysis (max./min./average)
- Excel format (CSV) conversion
- Communication (TCP/IP and Modbus) of measurement data
- Self-diagnosis (fiber breaks, light source status, watchdog timer)



# Application

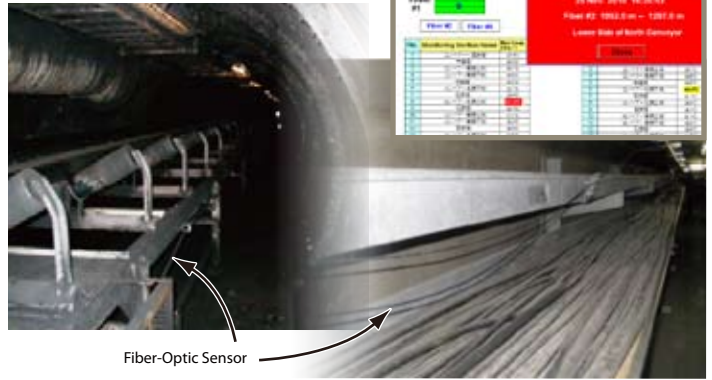
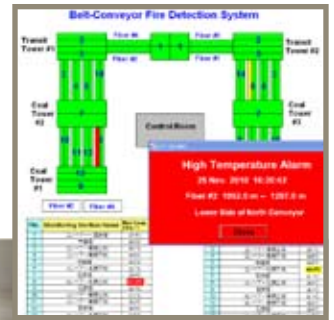
## Power Cable / Power Facilities

- ▶ Power cable temperature monitoring
- ▶ Tunnel/conduit for power cable monitoring
- ▶ Dynamic Cable Rating System (DRS) to estimate conductor temperature for management of transmission capacity



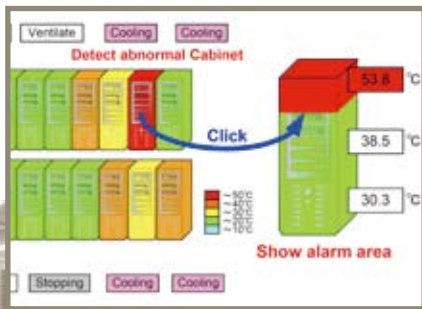
## Fire Detection / Disaster Measures

- ▶ Common Utility Tunnel management
- ▶ Coal Belt-conveyor temperature management and fire detection
- ▶ Cable tray or pit temperature management



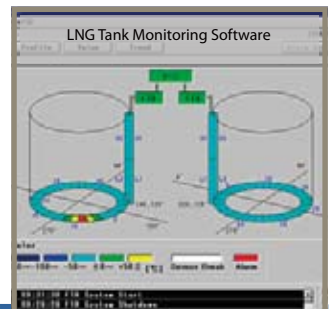
## Data Center / Server Room

- ▶ Server room temperature monitoring to prevent excess cooling
- ▶ Air conditioning system monitoring using temperature feedback control



## Plant Facilities Management

- ▶ LNG Tank leak detection/heat control system
- ▶ Steel plant facilities (smelting furnace, steam pipeline) monitoring
- ▶ Bus duct temperature monitoring to detect contact errors



## Other Applications

OPTHERMO is used for various field shown as followings

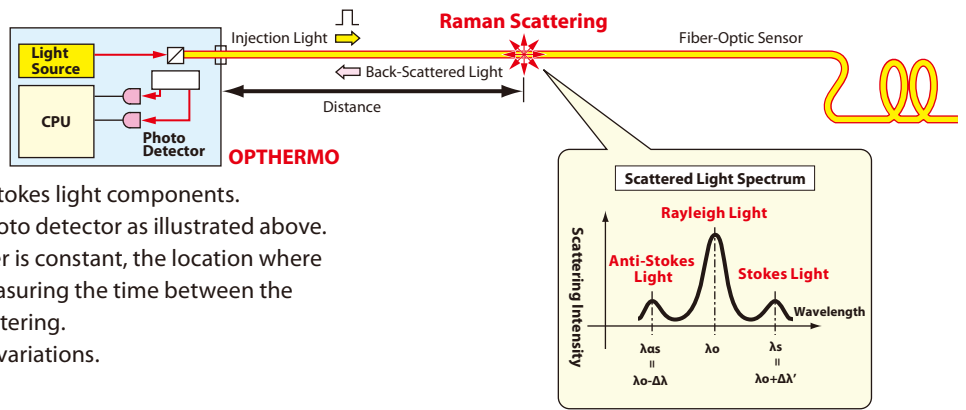
- ▶ Pharmaceutical/Food freezer temperature monitoring
- ▶ Oil/Gas/Geothermal well temperature monitoring
- ▶ Marine/Atmosphere temperature monitoring
- ▶ Sulfur pipeline flow management
- ▶ Dam structural concrete hardening monitoring
- ▶ Freeze detection system on road surface
- ▶ Transformer panel temperature monitoring



# Measurement Principle

A light pulse injected at one end of an optical fiber is subjected to scattering due to temperature gradients as it travels along the fiber.

Raman scattering describes the light scattering phenomenon, and consists of Stokes and Anti-stokes light components. The Raman scattered light is reflected to the photo detector as illustrated above. Since the speed of pulse propagation in the fiber is constant, the location where the scattering occurs can be determined by measuring the time between the pulse injection and the detection of Raman scattering. This provides precise detection of temperature variations.



## Specification

Items	FTR3000	FTR3000X	Remarks Column
Max. measuring length	2km	5km, 10km, 15km, 30km	
Sampling Resolution	1 m	0.25m/0.5m/1m (selectable)	
Temperature Resolution (*1)	<1°C		
Measuring Time (*2)	8 sec. to 10 min.	10sec. to 15 hours	
Spatial Resolution	2m	1.2m @ 10km	10-90%
Optical Fiber Type	Multi-mode (GI 50/125)(*3)		
Compatible Connector	E2000 (APC) connector		
Interface	LAN/USB		
Storage Media	SD Card		
Operating Temperature	0~40°C		
Size	300(W) × 160(D) × 37(H) mm	400(W) × 200(D) × 88(H) mm	
Weight	3kg	6kg	
Power Consumption	<15W	<30W	unit temp : 20°C

\*1 : Temperature resolution values are representative data using J-Power Systems' recommended optical fiber with a few splices.

\*2 : Measuring time is selectable by software. When longer measuring times are selected, better resolution is acquired.

\*3 : When SM Fiber is required, please contact our sales staff.

## Fiber-Optic Sensor Specifications (JPS's standard)

Type	Non-metallic	Built-in stainless steel tube	Built-in stainless steel tube w / PE Sheath	Protection steel tube w / PVC Sheath
Structure				
Temperature Range	-20~70°C (continuous) 150°C or less (for short time)	-20~75°C (standard) / -200~60°C (for low-temp.) / -20~300°C (for high-temp.)	-20~75°C (standard)	-20~75°C (standard)
Applications	<ul style="list-style-type: none"> <li>Power cable temperature monitoring</li> <li>Tunnel fire monitoring</li> <li>Factory equipment temperature monitoring etc.</li> </ul>	<ul style="list-style-type: none"> <li>LNG plant LNG leakage</li> <li>Sulfur piping temperature monitoring</li> <li>Dam structural concrete temperature monitoring etc.</li> </ul>	<ul style="list-style-type: none"> <li>Power cable temperature monitoring (buried cable)</li> <li>Cable rack temperature monitoring</li> <li>Tunnel fire monitoring etc.</li> </ul>	<ul style="list-style-type: none"> <li>Cable rack temperature monitoring</li> <li>Coal conveyer fire detection etc.</li> </ul>
Dimension	2×4mm	1.4~3.2mm dia.	3~5mm dia.	2.5mm dia.
Allowable Bending radius	70mm or larger	70mm or larger (standard)	70mm or larger (standard)	60mm or larger
Allowable tensile	100N or smaller	300N or smaller (standard)	300N or smaller (standard)	200N or smaller

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