



# FiberSystem 4000

Fiber Optic Linear  
Heat Detection  
for Special  
Hazard  
Applications



# The Protectowire Fiber Optic System

In today's complex industrial environments, the potential for down time and financial losses caused by overheat and fire can be disastrous if not detected and located quickly. That is why Protectowire Linear Heat and Fire Detection Systems are the first choice of many design professionals. With thousands of systems installed worldwide, The Protectowire Company is a leader in linear heat detection technology. Our new FiberSystem 4000 utilizes today's most advanced technology in the field of fiber optic temperature measuring techniques. The system incorporates many unique and specifiable features not available on competitive products.

## Principle

The Protectowire FiberSystem 4000 measures temperatures by means of optical fibers functioning as linear sensors. Temperatures are recorded along the sensor cable as a continuous profile. This ensures high accuracy of temperature discrimination over great distances or large surfaces, while reducing measuring times.

The system utilizes the so-called Raman effect to measure temperatures with optical fibers made of quartz glass. Thermal effects induce lattice oscillations within the solid fibers. When light falls onto these thermally

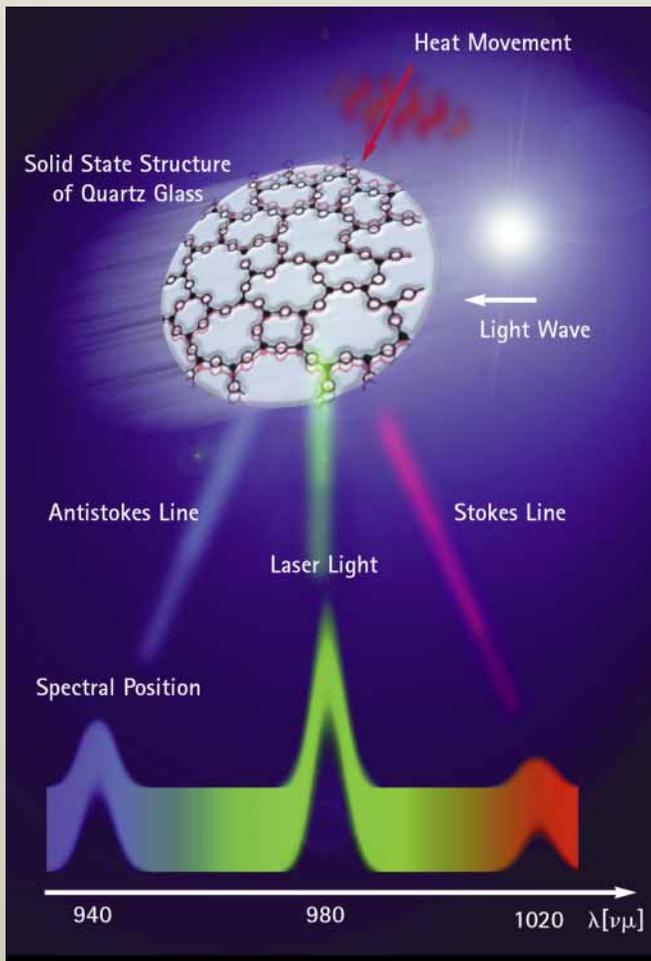
excited molecular oscillations, an interaction occurs between the light particles (photons) and electrons of the molecule. Light scatter, also known as Raman scatter, occurs in the optical fiber. Unlike incident light, this scattered light undergoes a spectral shift by an amount equivalent to the resonance frequency of the lattice oscillation.

Therefore, light scattered back from the fiber optic contains three different spectral components:

- Rayleigh scatter with the wavelength of the laser source used.
- Stokes components with the higher wavelength in which photons are generated.
- Anti-Stokes components with a lower wavelength than the Rayleigh scatter in which photons are destroyed.

The intensity of the so-called Anti-Stokes band is temperature dependent, while the Stokes band is practically independent of temperature. The local temperature of the optical fiber is derived from the ratio of the Anti-Stokes and Stokes light intensities.

Using semiconductor laser diodes and a new type of evaluation procedure, the FiberSystem 4000 Controller is capable of detecting both scatter effects (Rayleigh and Raman) in up to 2.5 miles (4 km) of optical sensor cable and reliably indicate temperature changes as small as one or two degrees centigrade per minute.



# Protectowire . . . on the cutting edge of Linear Heat Detection Technology

## Features

The Protectowire FiberSystem 4000 has been developed to satisfy the most demanding fire detection applications. By using state-of-the-art technology, we now have the capability to reduce response time, minimize false alarms, increase system reliability, and provide a new level of communication and alarm information to the system user.

The Linear Fiber Optic Sensor is capable of detecting hot gases and radiated heat and is adaptable to individual objects or hazards.

The sensor cable contains no electronics and is therefore immune to electromagnetic disturbances of any kind.

The sensor cable has been designed to provide a useful service life of approximately 30 years. It's rugged construction resists most environmental influences, such as temperature, pressure and moisture, as well as pollution and exhaust gases, which contain high amounts of corrosive materials.

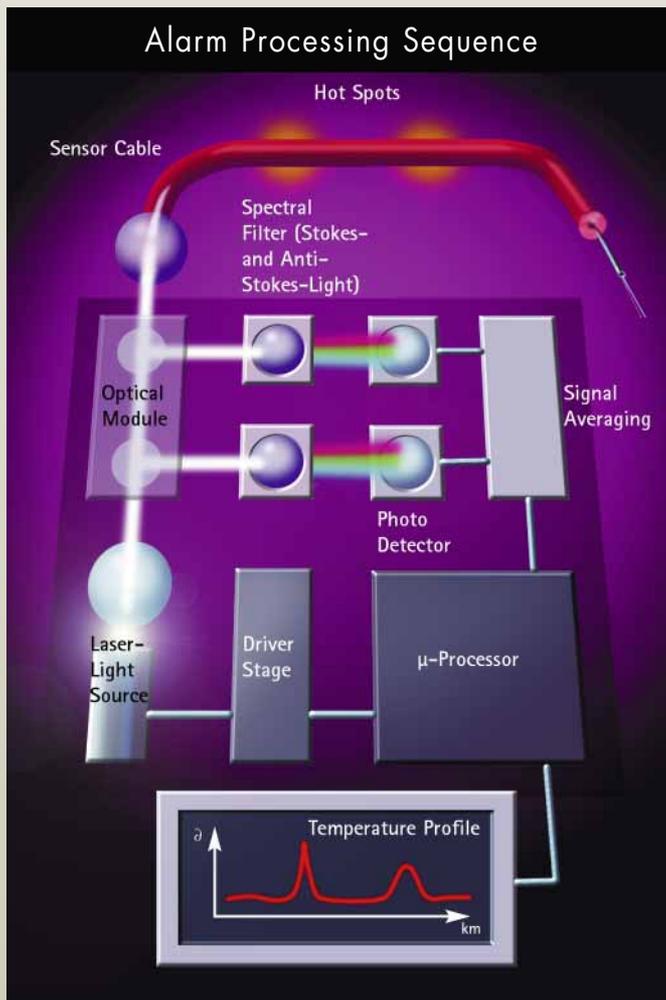
Installation and maintenance of the sensor cable is simple. A damaged section can be repaired easily by splicing in a new length of cable.

Like all Protectowire Linear Heat Detection Systems, FiberSystem 4000 will provide an exact location of the fire or hot spot anywhere along the sensor's length.

- **Unique zoning capabilities.**

A single length of sensor can be subdivided into different zones for various requirements (e.g. video, ventilation, and extinguishment zones). Zones can be defined as desired and even overlapped, increasing system control capabilities.

- **Multiple alarm initiating criteria by zone.**  
Alarm initiating may be based upon a maximum temperature per zone, temperature development per zone in terms of time (time differential), or temperature difference between a measurement location and the zone average (zone differential).
- **Capable of providing visualization of the fire size.**  
Based upon the length of sensor in alarm.
- **Capable of determining the direction of fire spread.**  
Most fires have a dominant direction of spread. Knowing this direction of spread, the intervention forces can direct their attack to the less dangerous side of the fire.
- **Available Dual Channel Operation (Option L).**  
All FiberSystem 4000 Controllers can be configured to operate in a Dual Channel Single End mode, or a Dual Channel Closed Loop Mode. In a Dual Channel Single End configuration, the Controller performs single ended measurements on two separate fibers thus providing two distinct detection "channels" or areas of coverage. In the Dual Channel Closed Loop operating mode, the sensor cable is installed in a loop, and the Controller performs measurements from both ends of the fiber. Should a break in the fiber occur, the entire sensor cable length continues to be monitored from both directions up to the point of the break.



# System Configuration

The Protectowire FiberSystem 4000 is custom configured to each customer's application requirements and is specifically designed for high risk commercial and industrial hazards that demand high reliability and customized system features. Special capabilities, such as custom operating logic, temperature monitoring, visualization of fire size and spread, outdoor installation environments, and extinguishment release activation can all be provided to meet the most demanding operating requirements. The system consists of the following major components:

**Fiber optic sensor cable.** The sensor cable consists of a stainless steel tube with an outside diameter of .05 - .07 inches (1.2 - 1.8 mm). In the tube are two independent color-coded quartz fibers. The stainless steel tube is clad with a layer of fine stainless steel wires and sheathed in a black plastic jacketing material to a diameter of .16 inches (4 mm).

**The OTS Series Controller.** Designed for 19 inch (483 mm) rack mounting, the controller

contains the system operating software, laser light generator, signal receiver module, digital module with RS 232, optional Ethernet interface, and power supply module available in 24 VDC, 115 or 230 VAC versions.

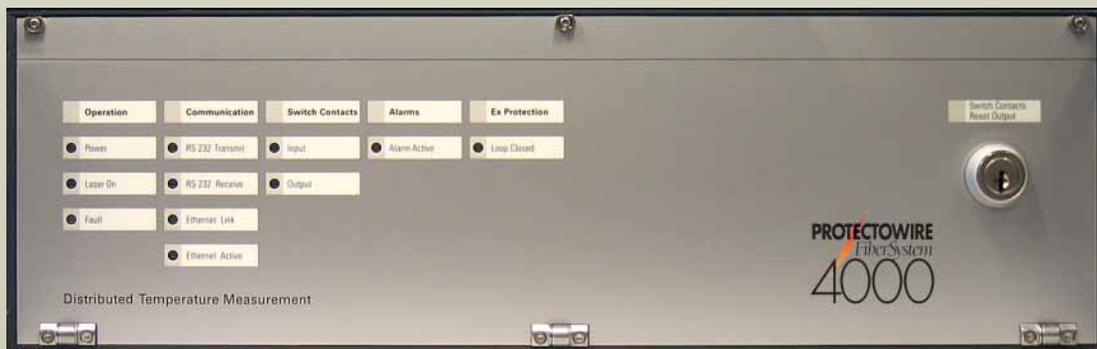
The Controller is provided with ten voltage-free outputs (nine alarm, one multifunction) for alarm and trouble reporting to a main fire alarm panel. Additional outputs for fire detection control unit interface are also optionally available to provide zone alarm, multi-input trouble, and fiber break signaling. A PC connection using an RS 232 interface is provided for setting operating parameters during initial start-up.

As an option, a PC can be connected at the interface to display zones and/or the temperature profile using the visualization software.



## Enhanced Communication

The Charon\_02 Configuration and Visualization Software is the heart of the Protectowire FiberSystem 4000. The system can be easily adapted to specific customer requirements and offers numerous options for displaying and processing the recorded alarm and temperature data.



The software makes it possible to create multiple zones along a single length of sensor cable and to configure zone related alarm generated outputs for event handling.

### **Experience Endless Visualization Possibilities:**

- In standard view, zones can be shifted or relocated using a “Drag and Drop” feature.
- Capable of providing enlarged zone views that enable zones from different controllers to be visualized on one system screen.
- Synchronized measurement browsing even with multiple control units connected.
- Simplified import and export of configuration sets, simplifying system set-up.
- The temperature history is displayed in real time.

All recorded measurement data can be conveniently managed through Measurement Explorer. In Measurement

Explorer a list of all past events (alarm, fiber break, error messages, etc.) can be displayed by time period, event, controller number or title/description.

For the connection of a Protectowire Control Panel with extinguishing release capabilities, the option to individually configure zone outputs is available.

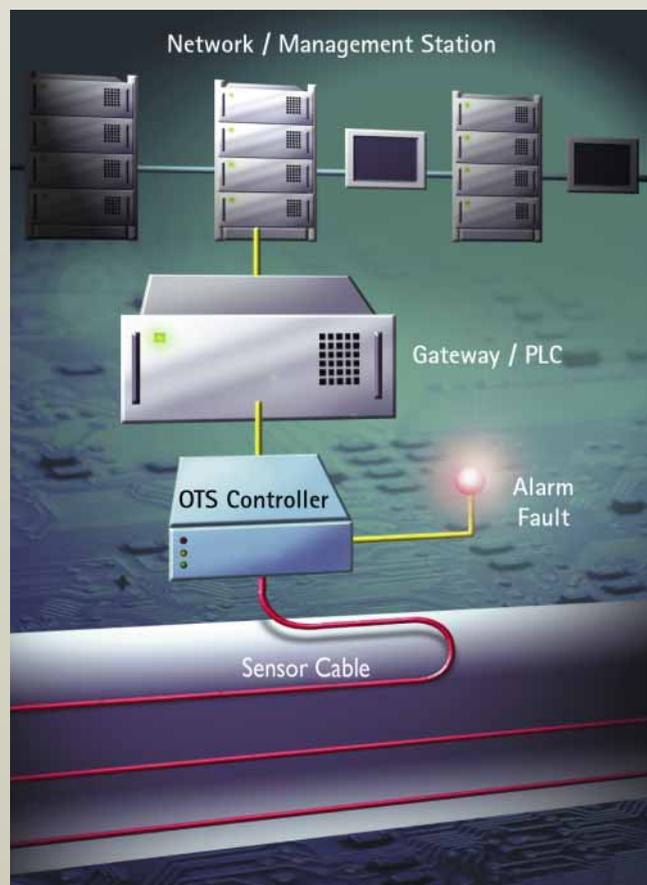
## *Passive and Maintenance-free Sensors for Every Application*

With 70 years of experience in linear heat detection technology, The Protectowire Company offers the widest range of linear heat detectors in the world. Our new fiber optic sensors are available in several different constructions designed to satisfy every application need.

The standard sensor cable consists of a stainless steel tube that accommodates two optical fibers. The coatings of the optical fibers can be altered to suit the required environmental and application temperature requirements.

Versions with an additional steel braided layer around the tube are available for fast temperature detection or if stricter requirements apply with regard to tensile strength and mechanical construction.

For applications with a high amount of electromagnetic disturbances like rail tunnels or electrical cable trays, Protectowire provides a metal-free cable to minimize the risk of induced voltages. No electronic components or devices are needed in the sensor circuit. The detection system is completely passive in the actual measuring and detection process.



# Global Leadership in Linear Heat Detection Technology

In the special hazard fire protection industry, the focus is on the protection of people's lives and property. The Protectowire Company has achieved its leadership position within the industry by continually developing and improving products designed to meet the challenges of a broad range of applications.

Our specialized engineering and design talents are focused on providing a total system approach that offers unique capabilities. Whatever the application, we can design a system to fit your needs.

The Protectowire Company and its employees are dedicated to bringing you products designed, engineered, and manufactured with the highest degree of quality and reliability.

This is demonstrated by 70 years of excellence within the fire protection community. We are an ISO 9001 Registered Company and hold other specific approvals around the world.



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**Manufacturer of  
Special Hazard  
Fire Detection Systems**