PROTECTOWIRE®
FiberSystems

Protectowire FiberSystem 8000 PTS Series Controllers

Features

- Unique zoning capabilities. A single length of sensor can contain up to 256 zones.

- Multiple alarm initiating criteria by zone.

- Available with 1, 2 or 4 channels.

- Capable of continuous temperature monitoring in ranges up to 10km (32,800 ft.).

- Graphic display of temperature profile, fire size, and spread using computer interface.

- LAN Interface (TCP/IP) enables remote access from multiple locations.

Description

The Protectowire FiberSystem 8000 has been designed for use as a linear heat detection system using state-of-the-art fiber optic sensing technology. The system consists of Type PFS Fiber Optic Sensor Cable and the PTS Controllers with related software. The PTS Series Controllers can be configured for various alarm criteria and can be connected to an approved fire alarm control panel using relay inputs and outputs. The system is specifically designed for high risk commercial and industrial hazards that demand high reliability and customized system features.

Protectowire's distributed temperature measurement is based on the proven Raman-Optical Time-Domain-Reflectometry (OTDR) technique. An optical laser pulse propagating through the sensor fiber gets scattered light back to the transmitting end, where it is analyzed using a patented code sequence measurement concept.

The backscattered light is spread across a range of wavelengths. Some of these wavelengths are affected by temperature changes while others are immune. The intensity of the Raman signals is a measure of the temperature along the fiber. By very accurately measuring the difference in the signal intensity of the backscattered light an accurate temperature measurement can be made.

The local position of an alarm temperature is determined by measuring the arrival time of the returning light pulse similar to a radar echo showing the distance of a car or plane. This enables the FiberSystem PTS Controller to provide an exact location of a fire or hot spot anywhere along the sensor's length. Temperatures are recorded as a continuous profile. The system is also capable of providing graphical representation of the fire size and direction of fire spread based upon the length of sensor in alarm.

System Design Features

Each PTS Controller is provided with four (4) programmable optically decoupled inputs, and forty four (44) programmable voltage free outputs (one trouble relay output and forty three alarm relay outputs) for reporting to a main fire alarm panel. The trouble relay is normally closed and the alarm relays are normally open. Reverse logic can also be programmed. The resulting ability to switch between these two states provides several options for the user. For example, the output can be used to operate external audible signals or warning lamps.

The system can be integrated easily into your management platform (e.g. SCADA systems) by either directly communicating over Ethernet (TCP/IP) using SCPI (Standard Commands for Programmable Interface), or Modbus RS232, RS422, RS485 and TCP/IP. Also optionally available is a relay extension module that can trigger up to 256 relays per channel. The relay extension module is used to extend the forty four (44) standard embedded relay outputs provided in the PTS Controller.

System Architecture

Controller: The PTS Controller is housed in a NEMA 1(IP20) type enclosure. The Controller contains the system operating software, transmitter, receiver, and digital processor.

- Transmitter: This unit contains the laser and its control. Its function is to generate the laser light by means of a semiconductor laser diode, and to control its overall operation.

- Receiver: This unit contains the entire optical design including coupler and optical receiver. Its function is to couple the laser light generated in the transmitter module to the sensor cable fiber. Additionally, the back-scattered light returned from the sensor fiber is distributed to the individual measurement channels, converted optically/electrically and amplified.

- Digital Processor: The digital processor controls the overall operation of the Controller and the temperature measurement process. Based upon the data it receives, the unit calculates the temperature profile along the sensor cable, controls alarm processing based upon stored zone definitions, manages the integrated four (4) inputs and multiple outputs, and communicates over the serial interface or via Ethernet.

The Controller is provided with active system status indicators, color display, one (1) power disconnect switch, and one (1) reset switch mounted inside the enclosure. The LED visual indicators are grouped into four functional categories and signal the following information:

- TX/RX - Indicates communication activity between the PTS and controlling computer.

- FAULT - Indicates the PTS has an error or "trouble" condition.

- RDY - Switches on after booting as readiness indicator.

- ALARM - On when the temperature value measured on the corresponding measuring channel exceeds the predefined alarm limits.

Fiber Optic Sensor Cable:
Protectowire PFS Series Fiber Optic Sensor Cable has unique advantages over other types of detectors, especially when difficult installation factors or severe environmental conditions are present. When used with a Protectowire FiberSystem 8000 PTS Controller, temperature measurement on the Sensor Cable takes place at periodic intervals to provide a continuous temperature profile.

The sensor cable consists of a non-metallic or stainless steel tube with an outside diameter of 1.2 - 1.8 mm (.05 - .07 inches). In the
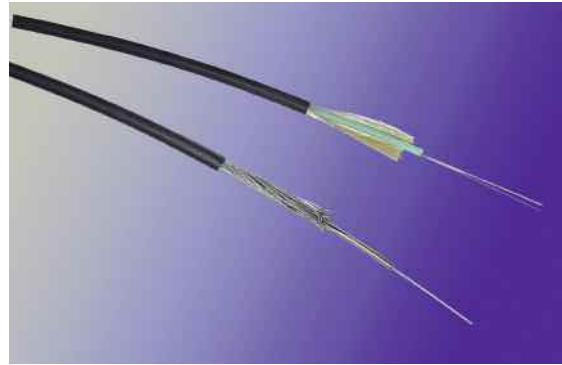
tube are two independent color-coded quartz fibers. Depending upon the model selected, the tube is clad with a layer of stainless steel wire or Aramid yarns. The sensor's core is then sheathed in a flame retardant jacketing material to a diameter of 4 mm (.16 inches).

System Configuration:
- Power supply and a power source in compliance with UL requirements (10 to 30 VDC).

- The fiber optic sensor cable with PTS Controller shall be connected to a listed or approved fire alarm control panel through up to forty four (44) potential free contact outputs. Alarm and trouble conditions are conveyed by this means (43 alarm, 1 common trouble).

- Alarm confirmation of the fire alarm control panel occurs by means of up to four (4) opto-decoupled Controller inputs. Alternatively, this can also take place by means of a computer (if connected).

- The Controller can be connected to a PC by USB or LAN. This allows system parameterization to be carried out and measurement information to be read and displayed.

Functions

Operating Modes: Standard PTS Controllers are configured to operate as a Single Channel Single End device. In this configuration, if a fiber break caused by fire or mechanical damage should occur, the monitored area after the fiber break would be lost, and would no longer be capable of initiating an alarm.

When a Multi-Channel Controller is utilized, it incorporates additional optical connectors. These connectors allow the device to operate in a Multi-Channel Single End mode, or a Multi-Channel Closed Loop mode.

In a Multi-Channel Single End configuration, the Controller performs single ended measurements on two or four separate fibers thus providing distinct detection "channels." In the Multi-Channel Closed Loop operating mode, the sensor cable is installed in a loop, and the Controller performs measurements from both ends of the fiber. If a break should occur in the fiber, the entire sensor cable length continues to be monitored from both directions thus ensuring detection over the entire length of the sensor cable up to the point of the break.

Zones: A single length of sensor cable can be partitioned into different "zones" for various requirements (e.g. equipment shutdown, ventilation, and extinguishment release). Zones can be defined as desired and even overlapped, increasing system control capabilities. All FiberSystem 8000 PTS Controllers provide up to 256 alarm zones per channel. Individual alarm parameters and outputs can be assigned to each zone. The PTS Controllers also provide the ability to localize fire location with great accuracy. This ability is particularly useful for connecting the Controller to a control panel with extinguishing release capabilities.
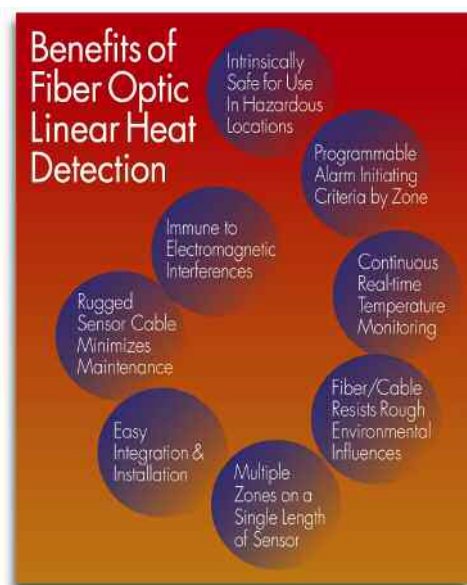
Alarm Initiation: Temperature measurement on the sensor cable by the PTS Controller takes place at periodic intervals known as the measurement cycle time. An alarm is triggered at the end of the measurement cycle if any one of the following alarm criteria is exceeded in a zone:

• Maximum temperature per zone.

• Temperature difference between a measurement location and the zone average (zone differential).

• Temperature development per zone in terms of time (time differential / rate-of-rise).

Unlike conventional systems, these freely programmable alarm settings are user selectable and can be adapted individually by zone depending upon the specific requirements of the application. Different alarm sensitivities on the same sensor cable run allow precise and selective initiation of counter measures.

Fire Size: The PTS Controllers have the unique ability to provide information on the size of the fire by displaying relevant information in the visualization software. Fire size parameters can be individually set for five different sizes during parameterization. Default values are: Size 1 = < 5m (16 ft.); Size 2 = 5 to 10m

(16 - 33 ft.); Size 3 = 10 to 50m (33 - 164 ft.); Size 4 = 50 to 100m (164 - 328 ft.); Size 5 = 100 to 500m (328 - 1640 ft.).

Direction of Fire Spread: Most fires have a dominant direction of spread caused by such factors as air current, construction, or combustibles. By knowing this propagation direction, the counter action of the emergency services can be directed to the less hazardous side of the fire. The visualization software provides three different options for determining the direction of fire spread.

• No direction - localized.

• Toward the PTS Controller (beginning of the sensor cable run).

• In the direction away from the PTS Controller (toward the end of the sensor cable run).

In the case of a sensor cable closed loop set-up, the "Point of Return" needs to be set to ensure that the propagation direction is displayed correctly.

Alarm Resetting: Resetting an alarm condition on the PTS Controller is done by using one of the four input contacts, the internally mounted reset button, or via the PTS Configuration software.

Communication

Configuration Software is provided with each FiberSystem 8000 Controller. This software 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, select multiple alarm initiating criteria, provide unique alarm visualization graphics, and to configure zone related alarm generated outputs for event handling.

Interface Solutions

The FiberSystem 8000 can easily be integrated into SCADA Systems, direct process control or external connections to fire alarm control panels. The following special order accessory products can be used to extend the standard PTS interfaces:

Interface Box for Modbus: This device provides access via the Modbus protocol over RS232, RS422, or RS485, as well as over TCP/IP. The Modbus protocol offers, complete temperature trace data, each alarm parameter per zone, and several status conditions like fiber break.

Through a virtual host concept, the data is available for each sensor (channel) as a Modbus unit. This means that only one unit is required even for multiple channel operation. Ten thousand register holdings and three thousand register coil definitions can be flexibly assigned for each Modbus unit.

Relay Control: When the application requires the use of more than the forty four (44) embedded relay outputs of the PTS Controller, a Relay Controller Set should be used. In combination with the Relay Extension Set it is capable of controlling up to 256 relay outputs per channel. Each relay output can be flexibly assigned to any defined alarm condition.

The Relay Controller Set includes:
• Pre-programmed Relay Controller
• One (1) digital output module, one (1) end module
• Eight (8) relays

The Relay Extension Set adds another Digital Output Module and eight (8) relays. As an example, to offer forty-eight relays, one Relay Controller Set and five Relay Extension Sets would be needed.

FiberSystem 8000 PTS Specifications

Power Input:
DC Power Supply, 10 to 30 VDC

Power Consumption: 17 W typical @ 20°C (68°F). Maximum power is < 40 W (under all operating conditions). UL listed systems require the use of an auxiliary 24 VDC power source capable of providing a minimum of 24 hours of standby emergency power with 10 minutes of alarm.

Relay Controller Set & External Relays: RCS-1 = 24 VDC @ 300mA plus 105mA per every RES-2 extender block.

Environmental Conditions:
Operating Temperature Range: -10°C to 60°C (14°F to 140°F)

Storage Temperature Range: -40°C to +80°C (-40°F to 176°F)

Operating Humidity Range: 0% to 95% non-condensing

Housing:
PTS Controller is mounted in a NEMA 1 (IP20) type enclosure with a textured red finish.

Size: 20in. W x 30in. H x 7in. D (51cm x 76cm x 18cm)

Interfaces:
Optical Connector: E2000; 8 degree angled
Number of Channels: 1, 2 or 4 depending on model
Computer Interface: USB, LAN
Relay Board: 4 inputs / 44 outputs (voltage free contacts)

Ordering Information

1. FiberSystem 8000 PTS Series Controllers - Select the model number of the basic system control unit from the chart below. All Controllers are mounted in a NEMA 1 (IP20) enclosure and contain 4 input and 44 output relay contacts, ethernet/USB interface and configuration software.

Range	One (1) Channel	Two (2) Channels	Four (4) Channels
1 kilometer (3,280 ft.)	PTS-8101	PTS-8201	PTS-8401
2 kilometer (6,560 ft.)	PTS-8102	PTS-8202	PTS-8402
4 kilometer (13,120 ft.)	PTS-8104	PTS-8204	PTS-8404
6 kilometer (19,680 ft.)	PTS-8106	PTS-8206	PTS-8406
8 kilometer (26,240 ft.)	PTS-8108	PTS-8208	N/A
10 kilometer (32,800 ft.)	PTS-8110	N/A	N/A

2. PTS Controller Options - Add option code letter to basic PTS model number when ordering.

Option Code	Description
A	Integrated Modbus TCP/IP Interface

Accessories

Protectowire Model No.	Description
RCS-1	Relay Controller Set (includes power supply, relay controller, output/end modules, and eight (8) relays).
RES-2	Relay Extension Set (includes digital output module and eight (8) relays).
PWC-2000	E-2000 APC 8° Angled Connector with 16 ft. (5m) Pigtail.
PWC-2000A	E-2000 Adapter; Connects two E-2000 Connectors.
MIB-8000	Interface Box for Modbus.
JB-2S	Joint Box w/Integral Strain Relief & Splice Tray (NEMA 1/IP20).

PROTECTOWIRE®
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Protectowire FiberSystem 8000
PFS Series Fiber Optic Sensor Cable

Features

- Two models available.
- Immune to electromagnetic interferences.
- Withstands severe environmental conditions.
- Little or no maintenance required.
- Halogen free, flame retardant jacket.
- Programmable alarm temperature.

Description

Protectowire's PFS Series Fiber Optic Sensor Cable measures temperatures by means of optical fibers functioning as linear sensors. Temperatures are monitored along the sensor cable as a continuous profile. This ensures highly accurate temperature discrimination over great distances or large surface areas. The cable is capable of detecting hot gases as well as radiated heat and is adaptable to individual objects or hazards. The sensor cable contains no electronics and is therefore immune to electromagnetic disturbances of all kinds.

The sensor cable is available in two models suitable for the broadest range of application requirements and has been designed to provide years of useful service. Its rugged construction and halogen free flame retardant jacket resists most environmental influences, such as temperature, pressure and moisture changes.

Applications

- Tunnels
- Cable trays
- Conveyors
- Power distribution apparatus: switchgear, transformers, motor control centers, power cables
- Cooling towers
- Mines
- Pipelines
- Bridges, piers, marine vessels
- Aircraft hangars

Today, fiber optic temperature sensors are used in a variety of special applications. Their unique characteristics make them adaptable for such varied uses as monitoring the curing of concrete, detecting road icing and leaks in pipelines, and monitoring power cables for overloads.

In the area of fire detection, fiber optic technology is ideally suited to industrial high-risk hazards as well as many types of commercial applications. Protectowire PFS Series Fiber Optic Sensor Cable has unique advantages over other types of detectors, especially when difficult installation factors or severe environmental conditions are present. When used with a Protectowire FiberSystem 8000 PTS Controller, temperature measurement on the Sensor Cable takes place at periodic intervals to provide a continuous temperature profile.

Features & Benefits

• Identifies and displays the alarm location anywhere along its length when used with the unique visualization software and PTS Controller.

• Unique zoning capabilities. A single length of sensor can be divided into 256 zones for various requirements (e.g. video, ventilation, and extinguishment zones).

• 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 (rate-of-rise), or temperature difference between a measurement location and the zone average (zone differential).

• Reinforced stainless steel inner core (Type FR) and rugged flame retardant outer jacket provide resistance to mechanical damage.

• Simple to install. Can be field spliced with appropriate fusion splicing tools.

Specifications

The PFS Series product range consists of two distinct types of Sensor Cable. Each type has a unique construction that has been designed to accommodate the widest range of installation requirements and environments. All product specifications are subject to change without notice.

PFS-554-FR - Type FR Sensor Cable consists of a stainless steel core tube that contains two independent color-coded quartz fibers each with an outside diameter of .25 mm (.01 inches). The tube cavity is gel-free and is longitudinally and laterally watertight. The outside of the core tube is wrapped with a layer of fine stainless steel wires that add to the mechanical and tensile strength of the cable. The sensor cable is then sheathed with a halogen free, flame retardant FRNC thermoplastic jacket suitable for a wide range of applications and environments.

PFS-654-MF - Type MF Sensor Cable is a metal free Sensor and has been specifically designed for use in applications where a high amount of electromagnetic disturbances are expected like tunnels, high voltage cable trays and transformers. To minimize the risk of induced voltages, the construction of the metal free Sensor Cable substitutes a core reinforced with Aramid yarn in place of the stainless steel tube and wire used in the FR type Sensor. The outer jacket consists of the same halogen free, flame retardant FRNC thermoplastic used throughout the product line. This series is best described as multi-purpose, and is well suited to a wide range of both commercial and industrial applications.

Installation Accessories

A comprehensive range of mounting and installation accessories are available for the installation of Protectowire Type FR and MF Fiber Optic Sensor Cables. These include several types of clips, straps, drive rings, beam clamps, cable standoffs, connectors and zone boxes. Their proper use assures a neat and reliable installation. Only installation hardware supplied or approved by The Protectowire Company should be used.

Cable Type	PFS-554-FR	PFS-654-MF
Number of fibers	2	2
Cable Diameter	4 mm (.16 inches)	3.8 mm (.15 inches)
Min. bend radius	60 mm (2.4 inches)	60 mm (2.4 inches)
Max. Ambient Temperature Range	-40° to 85° C (-40° to 185° F)	-40° to 85° C (-40° to 185° F)
Cable Weight	44 kg/km (30 lbs./1,000 ft.)	18 kg/km (12 lbs./1,000 ft.)
Max. UL Listed Spacing	15.2 m (50 ft.)	15.2 m (50 ft.)
UL Listed Alarm Operating Temperature Range	Both Models Programmable from 57° C (135°F) to 113° C (235° F).	

Only Protectowire PFS Fiber Optic Sensor Cables comply with the manufacturer's requirements for calibration and compatibility with FiberSystem 8000 PTS Controllers. The use of any other fiber optic cable or sensor on this system is considered a misapplication of the product and will void all warranties either expressed or implied.

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