

Minerva

FIRELINE

Applications

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Power Stations

MoD Property

Road and Rail Tunnels

Mass Transit Railway Systems

Petrochemical and Oil Terminals

Airport Terminals and Hangars

Process Plants, Distilleries, Escalators

Roof Tanks, Warehouses and Cold Stores

Cable and Utility Tunnels

Data Processing Centres

Parking Garages

Conveyer Belts

Offshore

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MXF100 Optical Fibre Temperature Sensing Technology



The Minerva Fireline MFX100 is a revolutionary laser and fibre optic based Linear Heat Detection system providing a fast, flexible and highly resilient means of detecting fires and protecting both people and plants in a wide variety of risks. The technology is well proven and has already been specified and successfully installed in many different applications.

Introduction

The Minerva Fireline MXF100 uses a combination of powerful laser technology and computer processing to provide fast and accurate temperature measurement along a 2 Km loop of fibre optic cable. Precise fire and sensor cable break detection can be determined within an accuracy of 1.25m. The MXF100 provides a flexible programmable platform to suit many different risks and can be easily integrated into the overall fire protection system.

Main Features

- Automatic detection and full recovery from sensor cable break
- Safe (Class 1) laser operation
- Continuous 'live' assessment of the development of fires
- Wide range of programmable temperature operating modes and alarm thresholds
- Up to 200 programmable alarm zones
- High Immunity to Electromagnetic Interference (EMI)
- Suitable for use in designated Hazardous Areas
- Unrivalled speed of response - 15 second update for 2km length

MXF100 Control Unit

Alarm information is obtained quickly from the powerful and intelligent MXF100 processor. The control unit uses a laser light source to launch light signals into the optical fibre (Fig. 1). As pulses travel down the fibre, energy is lost through scattering. A fraction of the scattered signal is retained within the fibre. A portion of this is directed back along the fibre towards the laser source - this signal is called back-scatter. Part of the back-scatter signal (Raman Scattering) is used to provide accurate remote temperature measurements at hundreds of points along the fibre.

The MXF100 control unit is a wall mounted cabinet. It is available in a style and livery matching that of the latest range of Minerva MX control panels. It is designed to receive the MXF100 optics unit and provides local alarm and fault indications, a PSM800 4A power supply module, field terminals for connection to signalling relays and a termination box for the fibre optic splice joints to the sensing cable.

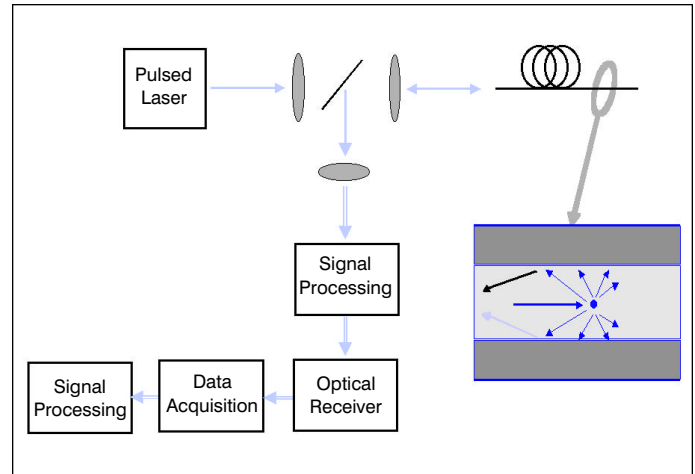


Fig. 1 MXF100 Operating Principle

System Architecture

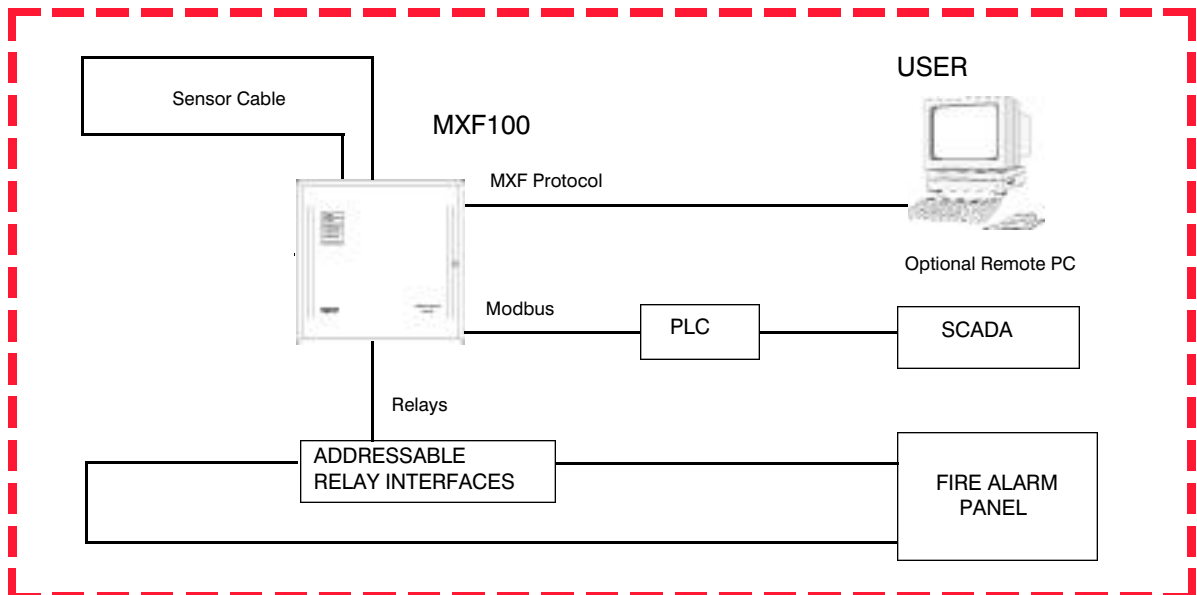


Fig. 2 Minerva Fireline MXF100 Typical System Layout

FEATURES

BENEFITS

CONTINUOUS TEMPERATURE PROFILES

By connecting a PC, it is possible to monitor the entire sensing cable length to view the current status of the alarm system which assists in easily determining the proximity to an alarm state.

VARIABLE RATE OF RISE AND FIXED TEMPERATURE FUNCTION

Variable rate of rise and fixed temperature alarm levels, ensure a flexible heat detector sensitivity which can be tailor made to give an early warning signal, dependant on the fire risk.

PROGRAMMABLE NUMBER AND LENGTH OF FIRE DETECTION ZONES

A single cable length can be divided into multiple fire detection zones thereby giving increased system flexibility whilst keeping cable lengths to a minimum.

MULTIPLE & PROGRAMMABLE ALARM LEVELS PER FIRE DETECTION ZONE

Pre-alarm warnings can be given, prior to a full alarm condition, thus helping to ensure minimal plant downtime.

UNRIVALLED RESPONSE TIME

The sensing element is designed to respond very quickly to changes in ambient temperature thus ensuring an early warning heat detection system.

DIRECT PC CONNECTION

This enables a user to view the temperature profile for the risk. It also provides an interface to allow adjustment of the alarm trip levels - this is access level protected.

The MXF100 provides several output options, which operate concurrently to give system design flexibility. 30 programmable relays can be used to map out alarm zones and signal into a fire panel, either directly or via addressable interface modules such as the MX CIM800. Protocol definition data is provided to enable the MXF100 to be connected via a PLC to a centralised control and monitor information centre, e.g. SCADA. Definition for a bespoke MXF protocol is also available to enable the development of alternative graphics display interfaces. The full 200-zone capability of the system can be exploited using either the Modbus and MXF protocols. Figure 2 shows typical system architecture.

MXF Manager Software

The MXF Manager software is used as an interface to the MXF100 control unit. By using this software, it is possible to configure the MXF100 unit to suit the particular fire risk. The system is password protected and can be set up to provide a continuous display of system status on a dedicated PC. Useful tool for commissioning and technical support.

Figure 3. Temperature Profile & Alarm Display



Figure 3 Illustrates the temperature profile display for the entire fibre length and also a numerical display for individual zonal temperatures.

The Optical Fibre Sensor

The MXF100 uses standard communications grade optical fibre of the 62.5/125 graded index multimode type. The temperature range is predominantly a function of the coating used to protect the optical fibre as the fibre itself is well behaved over a wide temperature range. Special coatings have been tested down to -190°C and up to 460°C (metallic - available upon request) performance of the standard type is detailed overleaf. Optical fibre itself offers several advantages as a sensing medium. The signals are immune to electromagnetic interference thereby ensuring integrity of readings from electrically noisy areas. As no electrical current is used in the sensing fibre and the fibre is a relatively inert and dielectric (non-conducting) medium, it is safe technology to use in hazardous environments.

FEATURES

BENEFITS

HIGH SYSTEM INTEGRITY - LOOP BREAK RECOVERY

The system can be set to operate in either single ended or loop mode without any additional costly hardware. The system continuously monitors the integrity of the loop and continues to operate in the event of a cable fault. The system is designed with an automatic loop break recovery operation.

FIBRE OPTIC SENSOR LOOP UP TO 2Km

Very long distance (large areas) can be monitored using a single length of heat sensing cable. The hot spot identification on a 2 Km length of fibre optic sensing cable, is to within 1.25metres.

PROGRAMMABLE RELAY CONTACTS

30 zonal relays ensure that the system can provide sufficient alarm notifications – typically directly to any Fire Alarm Control Panel. 2 relay contacts are reserved for system and sensor fault.

MODBUS OUTPUT PORT

Permits connection of the system to any PLC (programmable logic controller) or DCS (distributed control system) using industry standard communications, thereby providing a very flexible system topology.

AUTOMATIC FAILURE MODE ANALYSIS

Cable faults are detected to an accuracy of $\pm 1.25m$. The control system is continuously monitoring and a full syntax of fault information is provided with the system.

SAFE LASER SOURCE

In the event of a cable failure, where the laser light source may be exposed, the laser light is determined a safe source in accordance with IEC825.

DIAGNOSTIC CAPABILITY

Enables interrogation of the system to determine system status.

MODEM INTERFACE

By using a remote PC with a dial up connection to the host PC on site, it is possible for system to be accessed from a remote location to help assist with on-line technical support.

Summary of Cable Features



- Low thermal mass for rapid response to temperature
- Low smoke halogen free jacket, with excellent flame retardancy. Suitable for all indoor applications
- Stainless steel clad fibre optic cable suitable for all harsh area applications
- Strong, lightweight and flexible
- Designed for ease of installation

MXF100 Cable Options

The fibre used in this system is based upon standard 62.5/125 fibre optic cable. The cable has been further modified by adding a choice of two external sheaths which provide additional mechanical strength to the fibre. Gel filled loose tube technology protects the fibre from mechanical and environmental damage, whilst maintaining a low thermal mass for rapid response to temperature changes. This temperature sensor cable is jacketed with a special flame retardant halogen free coating.

Two new types of fibre optic sensor cables are available for use with MXF100. MXF-SL, SensorLine, is a thermoplastic LSOH cable. It is available under Stock Code number 516.016.112 for a 1km reel. MXF-SS, SensorTube, is an acrylate-coated fibre supplied in a 3.2mm OD stainless steel tube. It is available under Stock Code number 516.016.113 for a 1km reel.

Both SensorLine and SensorTube cables have been specified to achieve optimum heat sensing performance with the MXF100 controller. A range of installation accessories are available for mounting the cable in various locations.

MXF-SL cable is specifically designed for indoor applications. It will withstand occasional contacts with hydrocarbons such as kerosene, but long term exposure should be avoided. It should not be directly buried in the ground or installed in ducts that are susceptible to flooding. Long term exposure to water should be avoided. Where mechanical damage is likely or for increased mechanical strength, the MXF-SS cable should be used. The MXF-SS is particularly suitable for harsh industrial environments. The fibre optic cable is supplied encased in a stainless steel capillary tube. This sensor cable is designed for use in heavy industrial, offshore and petrochemical applications.

FEATURES	BENEFITS
INSENSITIVE TO EMI	<i>This allows the sensing cable to be installed in areas with high levels of electrical and magnetic fields without any risk of unwanted alarms due to interference from EMI.</i>
INTRINSICALLY SAFE SENSOR	<i>The sensing element is suitable for hazardous area applications.</i>
USES STANDARD GRADE COMMUNICATION FIBRE	<i>Some application areas may require relatively long transit cable runs. These transit cables can be any suitable and appropriate communications grade optical fibre (62.5/125). Additionally, existing fibres have a quoted lifetime of 30 years, and no associated maintenance.</i>
CHOICE OF CABLE CONSTRUCTION	<i>The sensing cable comes in a variety of different forms to provide a cost effective solution for the fire risk.</i>

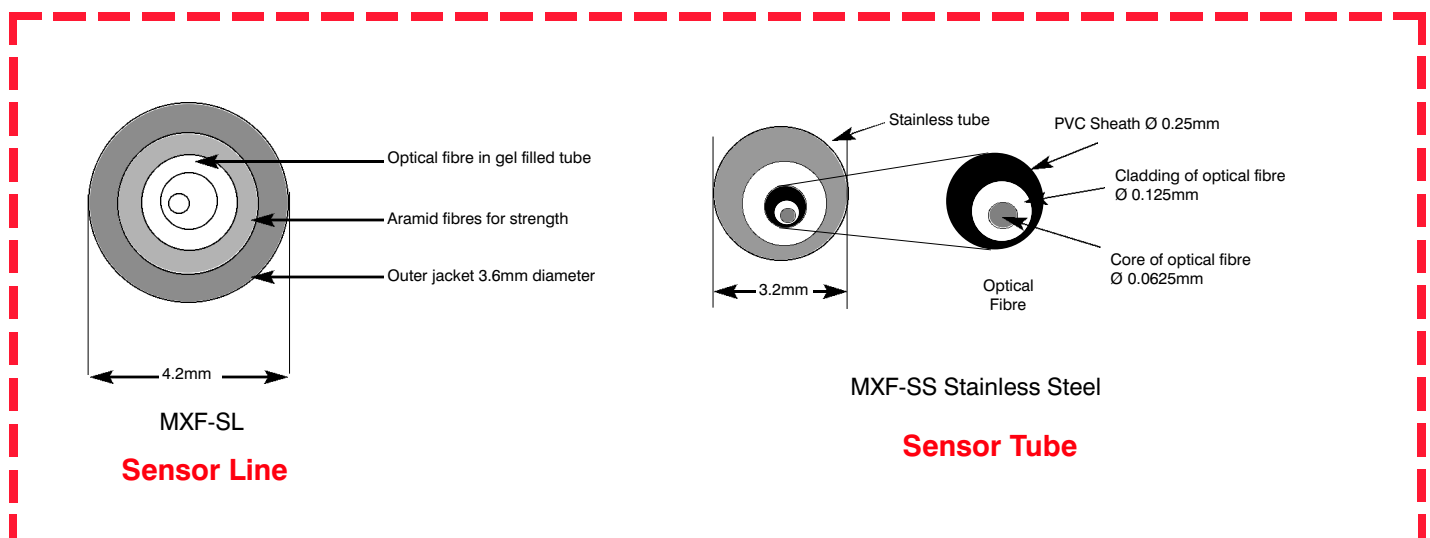


Figure 4. Cable Options

Standards and Approvals

LPCB/Vds to EN54/5 (submitted)
KFEIC (Korea): Cert. No. 01/14 & 01/30

The MXF100 system complies with:

- EMC Directive 89/336/EEC
- Low Voltage Directive 72/2/EEC

The MXF100 contains a Class 1 Laser product and complies with:

- International Electrotechnical Commission Standard 825 (1990)

Technical Information

MXF100 Control Unit		Product Code
		516.016.111
Mechanical		
Dimensions(mm)	559(W) x 588(H) x 120(D)	
Weight		
Electrical		
Supply Voltage	Nom.230 Volt 60hz/18-32 Vdc. derived for analyser	
Power Consumption (Analyser)	25W max	
Supply Current (Analyser)	<1A @ 24Vd.c.	
Fuse Rating	<2A (anti-surge)	
Interface Options		
2 off RS232 Ports		
Port 1: Direct PC Connection for continuous temperature profile displays (MXF protocol)		
Port 2: Modbus master port		
Relay Outputs		
30 Programmable outputs - SPDT 1A @24V dc		
Environmental		
Temperature		
Operating:	0°C to 40°C	(Note*)
Storage	-40°C to 65°C	
Humidity	0 to 95% RH (non condensing)	
Electromagnetic Compatibility (EMC)		
Assessed for Immunity to: BS EN 50082-2 and BS EN 50130-4		
Assessed for Emissions to: BS EN 50081-2		
Fibre Optic Cable	Product Code	Operating Temperature
Supplied as 1km reel		
MXF- SL Standard	516.016.112	-20°C to 70°C
MXF- SS Stainless Steel	516.016.113	-40°C to 90°C
MXF 100 Control Unit		516.016.111

Comprising: - analyser, PSU, splice box, terminals, 3 tier housing.

* Note: Can be operated outside this temperature range using IP66 enclosure with thermal management unit.

For more information on this product please refer to the following manuals:

User Manual 120-415-55

The right is reserved to modify or withdraw any product or service without notice