

5000 SERIES INFRA-RED FIRE & HEAT DETECTORS Conveyor & Transport System Monitoring

Technical Specification

Overview

The Patol 5000 Series of equipment is specifically designed for the detection of fire hazards whilst materials are being moved such as on conveyor belt systems. The equipment is particularly suited to coal handling plants.

The 5000 system employs enhanced Infra-red monitoring technology that enables the detection of both small glowing embers within direct sight of the sensor, and high energy sources buried within the transported material that would not be registered by other types of flame, spark or ember detector.

By the use of both optical filtering and electronic analysis of the various parameters the system is blind to visible light from the sun or local luminaires, whilst being able to detect relatively low temperature material moving through the field of view.

Features

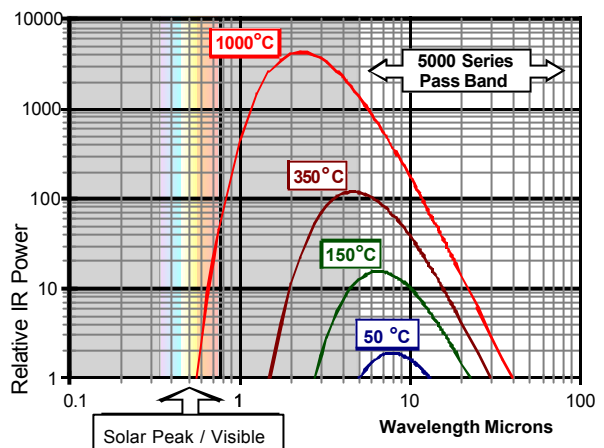
- ◆ Detection of hazards at temperatures below flame point including both embers and buried hot spots.
- ◆ Air purged system for *Dusty* environments with air pressure monitoring.
- ◆ Four high integrity detector channels for maximum reliability
- ◆ Multi-facet lensing provides wide uniform coverage superior to some ember/spark detectors.
- ◆ Coincidence - *Double Knock* - voting option for unit detectors as standard.
- ◆ Timed auto reset / coincidence analyser circuit.
- ◆ Latching & Non-latching signal modes.
- ◆ Tuned response - solar blind.
- ◆ Adjustable sensitivity
- ◆ Specifically designed for high EMC compliance - **CE** marked.

Principle

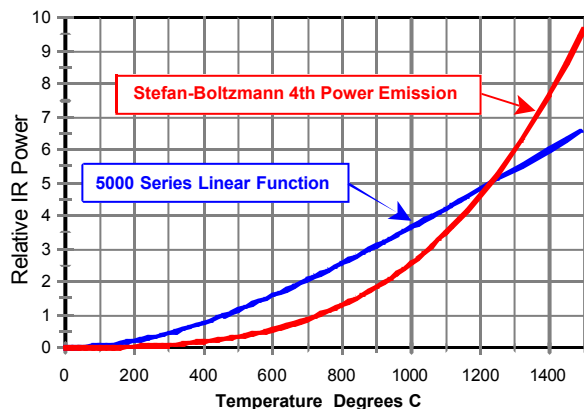
Infra-red emissions occur for all materials.

The wave length spectrum and intensity of this IR depends on the material's temperature, and for solid bodies such as coal is determined by the **Laws of Physics** formulated by Planck, Stefan, Boltzmann & Wien.

Planck's Law defines the spectrum and level of IR emissions at any given temperature.



The Stefan-Boltzmann Law is that IR Power emitted is proportional to the fourth power of the Absolute Temperature (Deg.K). The Patol 5000 Series optical filter system both linearises this natural curve and rejects shorter wavelengths, including solar emissions and those in the visible light band.



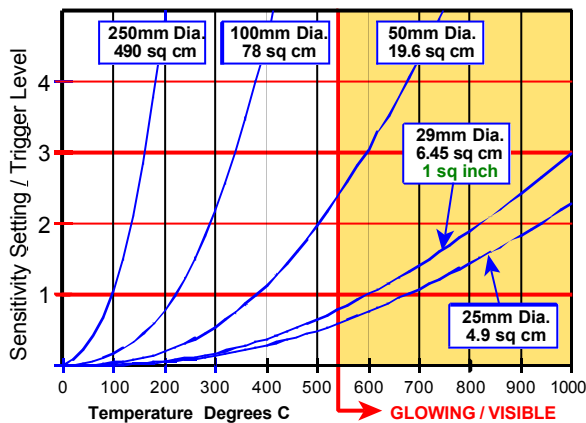
Wien's Law correlates the wavelength of peak IR emissions to any specific temperature.

Performance

The sensor monitors materials moving through its field of view, and responds to abnormal increases in Infra-red emissions. The monitored IR levels are dependant on the materials temperature and wavelength filters (page 1), together with the size of the IR radiator / target.

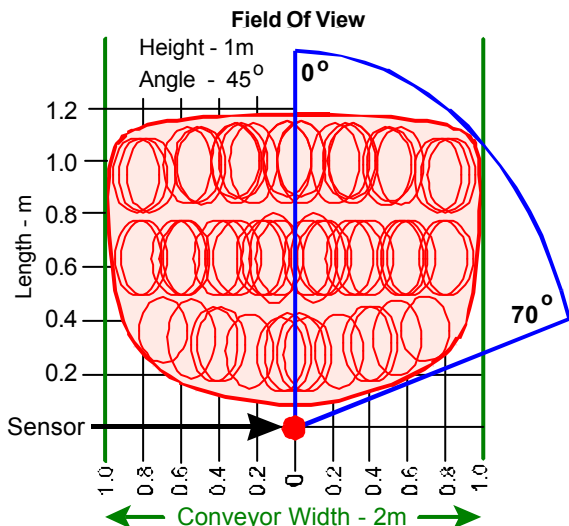
The Series 5000 sensor is designed to detect both small glowing "coals" of 25mm dia. and larger areas of material at abnormal pre-ignition temperatures as may occur when a burning coal is buried below the surface of the material.

The system has four settable levels of 10 to 40 micro-watt sensitivity to accommodate various applications and installation differences.

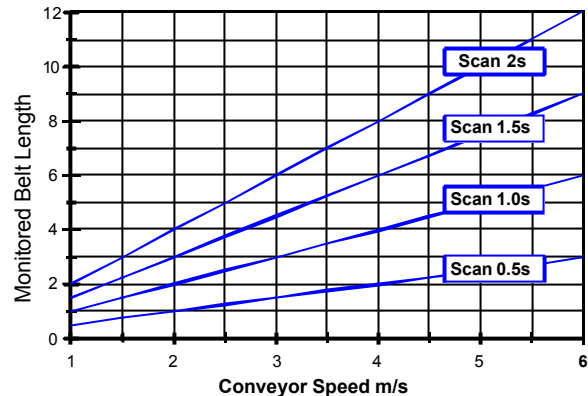


In practice small "embers" will impart energy to surrounding material which increases response. e.g. a 30mm "coal" at the edge of visibility (500 to 600 deg C) will produce a level 3 trigger.

The sensor has eight detectors configured as four channels and employs a multi-faceted lens system such that a large number of focal points are spread across the field of view in three rows. This arrangement achieves a much more uniform spread of sensitivity than single lens/detector systems and provides a voting (double-knock) option feature.



The detector response speed is such that the Series 5000 sensor may be used to monitor conveyors with speeds between 1 & 6 m/s. in both sunlight and night time ambient conditions. Some materials, especially coal, will normally have a degree of hot elements present. In addition to the primary sensitivity setting the voting feature provides the ability to discriminate against unwanted trips by looking for a burst (more than one) of marginal targets within a length of belt. This feature is adjusted by setting the scan time (auto reset period after first detection).

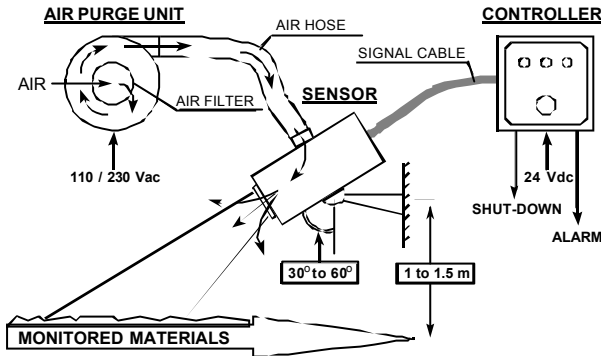


- Detectors:- 8 off (4 off Channels)
- Sensitivity:- 10 to 40 μ W adjustable
- Spectral Filter:- 5 - 14 μ m (5-6 μ m @ 50%)
- Transit speed:- 1 to 6 m/s
- Supply Voltage:- 20 - 30 Vdc
- Supply Current:- 35 mA Stand by
70 mA Max / Full Alarm
- Indications:- Detectors - 4 off - Red LEDs
Alarm - Red LED
Trip (S/D) - Red LED
Fault - 3 off - Yellow LEDs (Air / Sensor / Auxiliary)
Supply On - Green LED
- Outputs:- Alarm Contact - 1 pole C/O
Trip Contact - 1 pole C/O
Fault Contact - 1 pole C/O
Rating - 30 Vdc - 500 mA
- Controls:- Sensor Head Test PB
Reset PB
Lamp Test PB
Program DIL switch.
- Auxiliary input:- PSU / Charger etc.
- DIL Switch :- Sensitivity - 4 level
Latching / Auto Reset
Alarm - One Shot / Voting
Trip - One Shot / Voting
Auto Reset / Scan - 4 settings

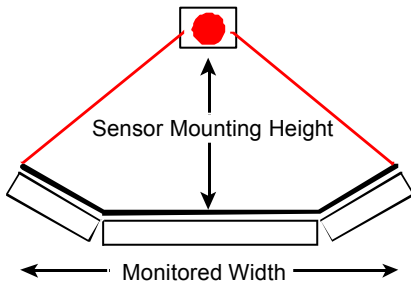
For full electro-mechanical information refer to Series 5000 Data Sheet.

Location & Installation

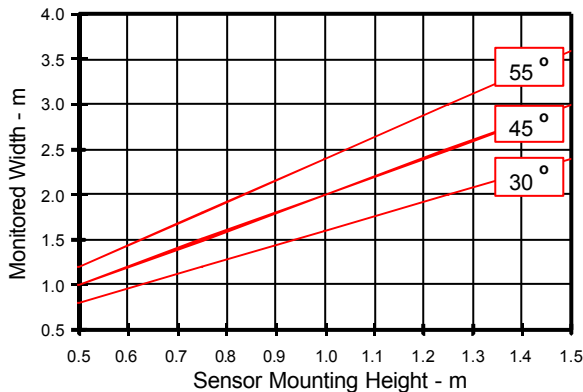
The octal detector quad channel sensor module is mounted by means of an adjustable bracket permitting alignment in both vertical and horizontal planes. The housing is equipped with an air hose spigot, and is designed to be continuously air purged such that a positive pressure is maintained at the Sensor Head. This arrangement ensures integrity of the optical system. The Series 5000 sensor is extremely tolerant of external dust laden atmospheres.



In the case of conveyors, the optimum mounting arrangement is for the sensor to be mounted 1m above the belt. With the unit set at an angle of 45 deg. to the perpendicular from the conveyor plane, the monitored belt width is 2m.



Differing mounting heights and monitored path widths are accommodated by adjustment of the set angle.



Comparison of detector types

A great variety of "infra-red" detectors are available for fire protection. However, whilst all monitor for *infra-red* emissions they have very different uses and operational performances. They fall into three principal categories :-

Spark Detectors

These are designed to detect sparks and very small visibly glowing embers. These types monitor for short IR wave lengths that are at or near the solar band and are mainly intended for installation in ducts where there is a very low to zero level of ambient lighting. These types are not solar blind and the IR filters (e.g. 0.4 to 1.6 microns) do not permit detection of IR emissions from relatively low temperature abnormalities such as pre-ignited coal.

Flame Detectors

Many of these types monitor for the peak IR emissions, associated with specific gases, that occur during combustion. These emission spectra are not the same as for "black body" radiators as defined by Planck. e.g. for CO₂ formation a peak occurs at 4.3 microns which may be compared with specific narrow bands where little emission occurs. Other types filter shorter wavelengths, similar to spark detectors (e.g. 0.7 to 2.7 microns), and apply analysis to detect "flame flicker".

These techniques monitor for volatile fluids and gases after "flash point" and are not suited for close range monitoring of moving bulk materials such as coal when on conveyor belts.

Heat Energy Detectors

These employ IR filters that select longer wavelengths and are "blind" to the visible spectrum. They can detect both the high energy emissions from very hot / burning materials, and abnormal but relatively low temperatures. The Series 5000 system is within this category.

The graph shows relative transmission power for various filter paths :-

