

7000 SERIES FLAME DETECTORS

Type 7011 Infra-red Long Range Monitor with Air Purging.



The Patol 7011 Long Range Flame Detector is specifically designed for the protection of large enclosed or open spaces where other forms of monitoring are inadequate or impractical. The unit is particularly suited when there is a potential hazard due to volatile materials such as PRB coal.

The type 7011 detector employs enhanced infra-red monitoring technology that analyses the levels of IR emission in specific bands. The unique "signature" of a flame condition can be recognised whilst "background" and "transient" IR spectra are discriminated. If non-flame IR conditions prevail at sufficient level and duration to effectively "blind" the flame detection function then a fault warning is signalled.

The unit incorporates an air cleansing scheme which permits operation in dusty environments such as coal fired power stations.

There are many other uses within sectors such as Aircraft Hangars, Petro-chemical, Process Plant, Waste Disposal, Road Tunnels and Rail Networks. The 7011 unit has been specifically designed to both meet the rigors of all of these environments and to provide the reliability demanded by these industries.

- ◆ **Detection of flame at distances in excess of 100m.**
- ◆ **Resilient to optical background interference - High false alarm immunity.**
- ◆ **Sixteen high integrity detectors - Eight channels of discrete viewed field processing - Enhanced optical and spectral analysis.**
- ◆ **Unique multi-axis reflective cone lensing system with solid state controlled focal adjustment - Zoom feature analogous to photographic cameras.**
- ◆ **Four sensitivity level settings - each with the focal axis zoom option.**
- ◆ **Volt free contact outputs for Fire and Fault signalling.**
- ◆ **Tuned response - Solar blind - Static anomaly and transient immune.**
- ◆ **Air purging scheme for use in dusty environments.**
- ◆ **Specifically designed for high EMC compliance.**

7011 AIR PURGED LONG RANGE INFRA-RED FLAME DETECTOR

Principles

Infra-red (IR) emissions are dependant on the material of origination, its temperature and its physical state or (chemical) process.

Figure 1 shows 'black body' IR emissions for passive material at various temperatures.

Superimposed is the IR peak emission at 4.3um occurring on CO₂ formation during the combustion of hydrocarbons.

Other conditions, such as arc welding, provide different spectra, however, only flame provides significant IR energy over a narrow band centred on 4.3um, with virtually zero accumulative energy occurring in the long pass band above 5um.

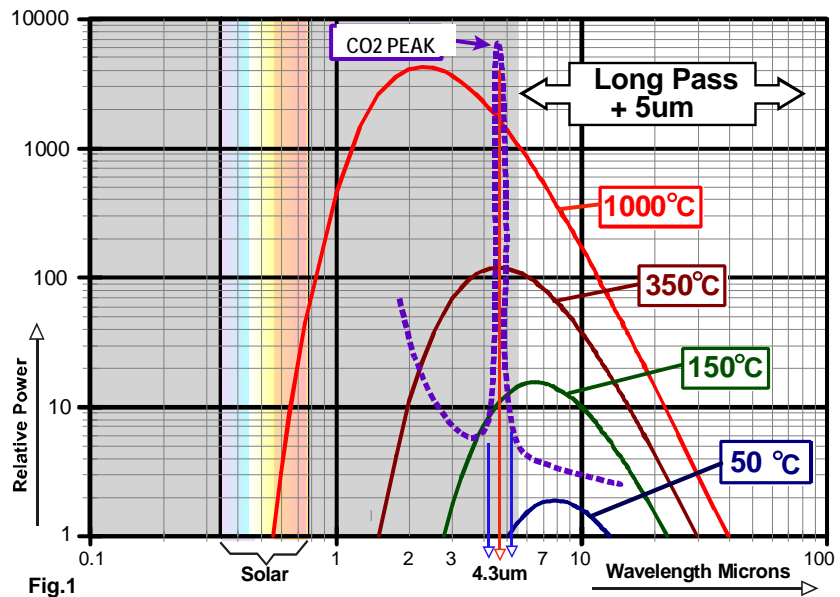


Fig.1

The unit has sensors, configured in pairs as channels, which generally respond to modulated infra-red in the range 1Hz to 10Hz, as is produced by flame flicker. Static background black body emissions are automatically rejected. The unit's narrow band (4.2-4.7um) and wide band (>5um) filters, together with electronic analysis in relation to the various energy level parameters, enable the discrete channels to reject spurious and transient emissions from the local environment. The 7011 does not react to visible light from the sun or local luminaires.

It is possible for certain conditions to 'dazzle' any particular detector channel. For example hot machinery rotating at 300 rpm could produce 5Hz IR modulation at 4.3um. Whilst the channel's analytical circuit associated with the long pass detector will identify this as an erroneous signal and override an Alarm being raised, that channel is in effect blind for the duration of the condition.

The 7011 Detector incorporates timer functions that check the ability of the unit to be able to detect flame by all channels for at least a proportion of a defined monitoring period. If the local environment has prevailing IR conditions at sufficient level to effectively "blind" any one channel's flame detection function over all of this period then a fault warning is signalled. The monitoring period is nominally set at 10s but can be adjusted to suit particular site conditions. The 7011 unit continuously checks itself. It will always provide a response to a flame condition, unless the site has problematical ambient conditions in which case an advanced fault warning will be registered.

The 7011 has eight pairs of detectors, each pair operating as a discrete channel (alarm path). With this arrangement the overall field of view is sub-divided such as to more readily analyse & compute background emissions. The optical viewing field of each detector pair is 30° x 90°. The overall arrangement is such that the eight channels are mounted on a 22.5° rotational pattern which provides a 360° coverage.

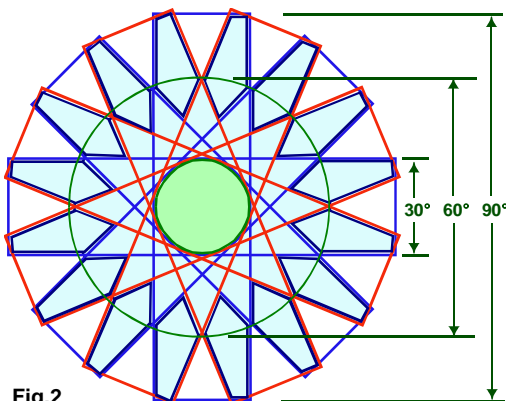


Fig.2

Referring to Figure 2 :-

- All eight channels have a 30° field of view (+/-15° off the optical axis) Green Area.
- Within a 60° window (+/- 30° off axis) a minimum of two channels will register.
- The blue shaded pattern indicates the field of view for at least two channels.
- A target within 90° (+/- 45° off axis) will be in the view field of one channel as a minimum.

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Application

The 7011 Unit is designed to monitor large spaces for flame conditions. The unit is most applicable to situations where conventional building fire protection monitors can not be practically employed. With both open air sites and large enclosed areas, such as aircraft hangars, the normal rules regarding heat convection patterns, smoke stratification, and collection profiles at the ceiling are not applicable. This makes point heat and smoke detectors ineffective. Sites where there is a potential hazard due to volatile materials such as aviation fuel are particularly suitable for protection by Patol's Type 7011 Flame Detectors.

- ◆ Turbine Halls
- ◆ Boiler Fronts
- ◆ Coal Stacks
- ◆ Aircraft Hangars
- ◆ Engine Test Bays
- ◆ Oil Refineries
- ◆ Recycling Plants
- ◆ Waste Handling & Tips
- ◆ Paint Spraying Areas
- ◆ Fuel Distribution Sites

The detector has four basic sensitivity settings. Each of these levels has a 'zoom' option. Euro-Standard EN54-10 employs a 330 x 330 mm pan of ignited n-heptane for range classification. Based on this, table 1 shows the typical range along the optical axis. Figure 3 charts the field of view.

Sensitivity	Axial Range - m	
	Zoom Off	Zoom On
A - Least		
D - Most		
A	20	25
B	45	60
C	70	90
D	80	105

Table 1

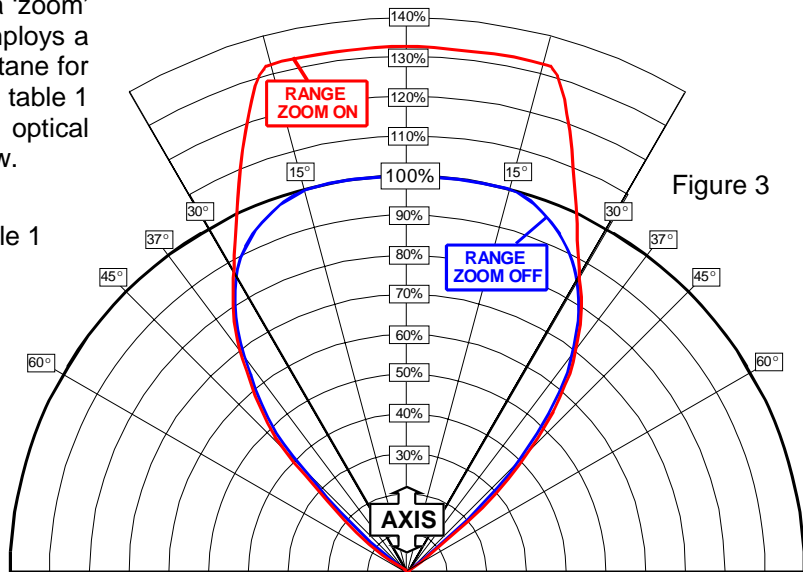


Figure 3

Figure 4

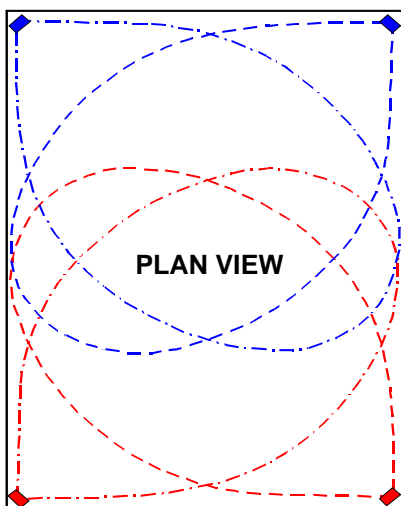
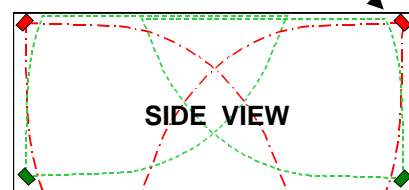


Figure 5



The exact location of the flame monitors, in order to adequately protect any particular site, is dependant on:- the space's dimensions, the flame hazard (potential flame type/size), and the performance characteristics of the type 7011 flame detector (table 1 & figure 3).

The 7011 units should be directed toward the centre of the protected area and ideally have a completely unobstructed view of all hazards. This would be an un-usual site coverage for a single detector.

The exact position and orientation of units must take into account obstructions to the field of view. Most applications will require two or more detectors for full coverage, even though some sub-areas will then be monitored by multiple devices.

Figures 4 & 5 show a typical arrangement for protection of a large space such as a power station turbine hall or boiler area. The example shows detector placement at both high and low level to obviate obscuration by mezzanine floors and machinery

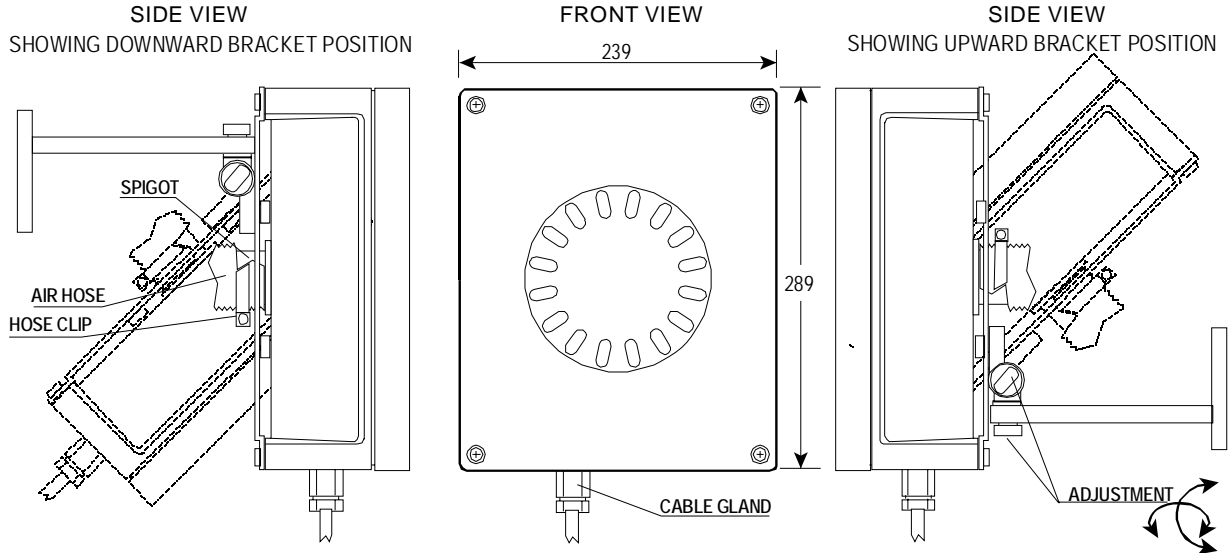
If fire extinguishing media is to be automatically activated, all associated sub-areas should have duplex coverage such that a "double knock" regime for "release" can be implemented.

When the protected area is very large, as would be for multi-unit power stations, the overall space must be sub-divided into zones - each zone similar to that indicated in figures 4 & 5. A degree of overlap of zone boundaries should be employed to ensure effective coverage.

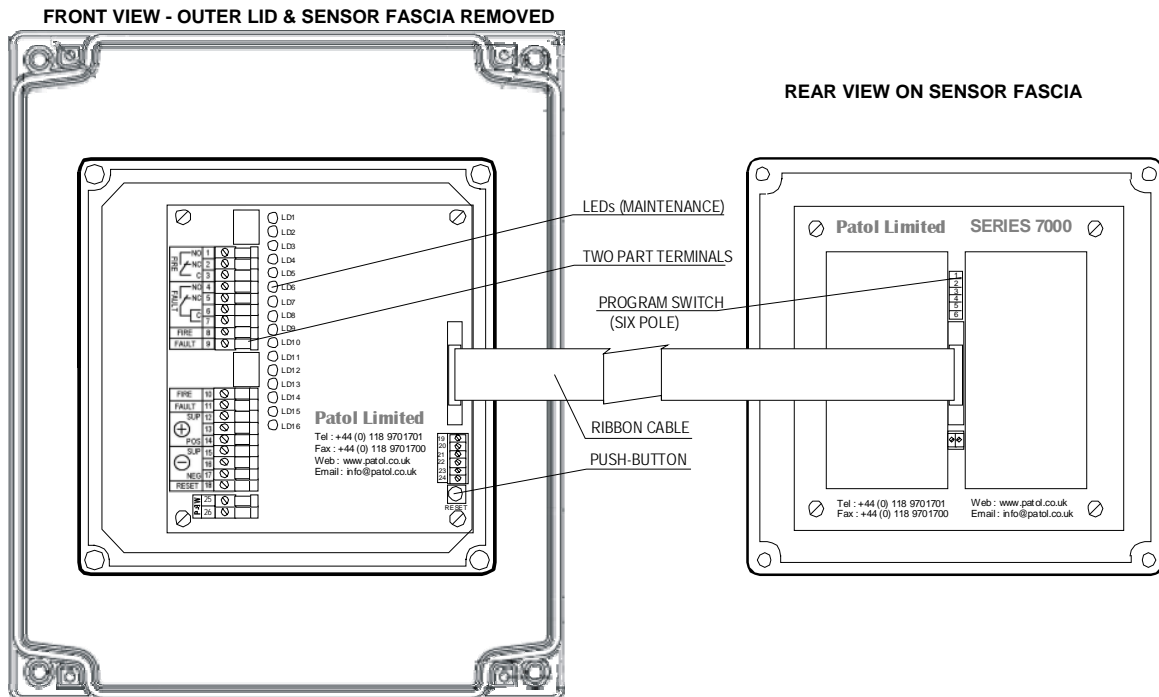
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Detector Unit

The Type 7011 flame detector comprises an inner polycarbonate enclosure located within an outer housing which is connected to an air blower such as to keep a positive air pressure around the unit's sensor windows. An adjustable bracket permits alignment in both vertical and horizontal planes. The inner module's windows and lid are sealed to provide a high environmental rating.



A pressure switch monitors the cleansing air supply, with a Fault being signalled on failure. Removing the outer lid and inner fascia gives access to the unit's maintenance features. The unit provides volt free relay change over contacts for both Fire and Fault signalling. Cable connections for the input supply and signal outputs are made at rising clamp screw terminals. These blocks are two part plug-in types permitting PCB module removal without wiring disconnection. Sixteen LEDs can be enabled during commissioning and maintenance for indication of the dynamic status of the eight flame detection channels. Located at the rear of the fascia unit is a six pole SIL program switch for setting the sensitivity level and optical axis focal 'zoom' characteristics of the device.



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Connections

The unit's primary connections are at two nine way terminal blocks. These blocks are of the two part type permitting site cabling to be un-plugged without disconnecting wires at individual terminals.

The unit has Fire and Fault outputs at terminals 10 & 11. These are solid state 'open collector' type switching to the Common/0V rail. The fire signal is normally off - connecting to 0V on alarm. The fault signal is switched to 0V in normal conditions and 'open circuits' on trouble.

These outputs may be used for direct signalling purpose; in which case the unit operates with its widest supply voltage range and lowest current.

Alternatively, the outputs may be connected to terminals 8 & 9 thus utilising the unit's integral relays. This requires a higher voltage supply to be maintained and the quiescent current is increased by the load of the Fault relay coil, which is normally energised.

Reset from a remote location is achieved by momentary supply interruption. An option for connection of a normally open push-button (or similar signal) is provided at terminal 18.

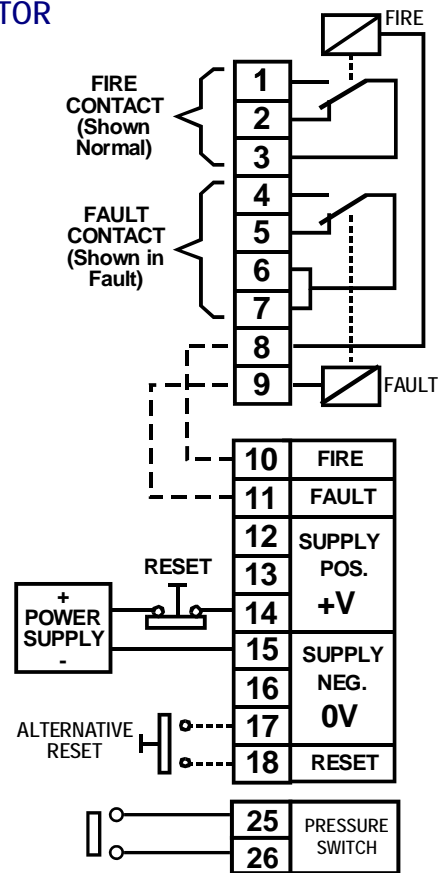
A small 6 way TB (19 to 24) is also located within the unit. This is for factory test and special applications.

General Specification

Supply Voltage:-	With relays : 20 - 30 Vdc No relays : 10 - 30 Vdc	Detectors:-	Band Pass 4.2 to 4.7 um - 8 off Long Pass 5.0 to 15.0 um - 8 off Greater than 100m - see table 1
Supply Current:-	With relays : 12 mA Stand by* No relays : 2 mA Stand by* *Maintenance LEDs disabled 40 mA Max / Full Alarm** **Maintenance LEDs enabled	Range:- Angle of view:- Indications:-	+/- 45° - see figure 3 Internal - Channel Flame - Red LED - 8 off Ambient - Yellow LEDs - 8off Reset PB Program SIL switch. (Sensitivity / Zoom)
Temperature :-	-20°C to +70°C	Controls:-	Timer period - 2 bit jumper.
Enclosure:-	Material - Polycarbonate Size - 239 x 289 x 114 mm Colour - Grey RAL 7032	Outputs:-	Alarm Contact - 1 pole C/O Fault Contact - 1 pole C/O Rating - 30 Vdc - 500 mA
Weight:-	<2.0 kg (Including bracket)		
Termination:-	Screwed Rising Clamp Max Wire size - 4.0 mm ²		

Special Options

The flame detector housing can be fitted with daylight visible LED indicators illuminating on Fire and/or Fault conditions.



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