

## 7000 SERIES FLAME DETECTORS

### Type 7010 Infra-red Long Range Monitor



The Patol 7010 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 aviation fuel.

The type 7010 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 system's primary designed application is the protection of Aircraft Hangars, especially the monolithic structures employed for the servicing of today's super-jumbos such as the A380.

There are many other uses within sectors such as Power Generation, Petro-chemical, Process Plant, Waste Disposal, Road Tunnels and Rail Networks. The 7010 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.**
- ◆ **Specifically designed for high EMC compliance.**
- ◆ **Air purged version available - Type 7011**
- ◆ **Patent Pending GB1013271.0**

7010 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 CO<sub>2</sub> 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.

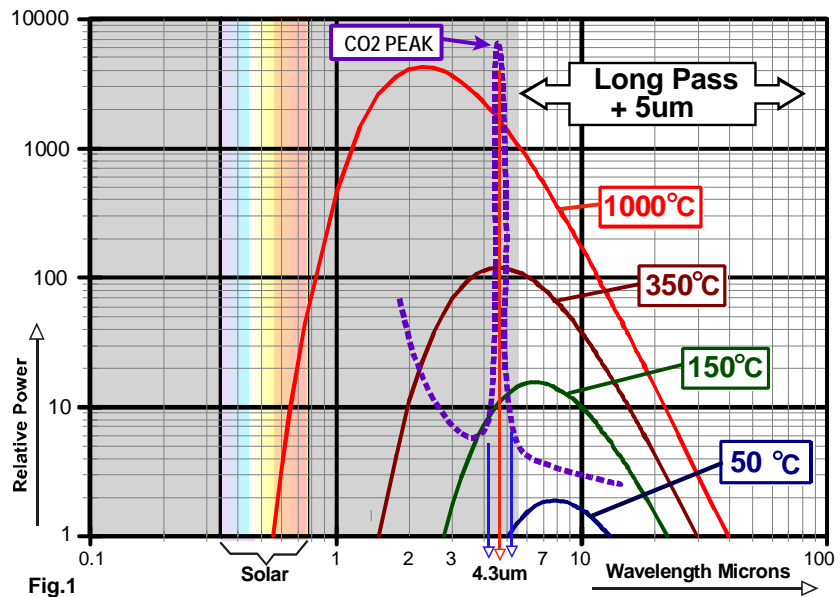


Fig.1

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 7010 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 7010 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 7010 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 7010 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.

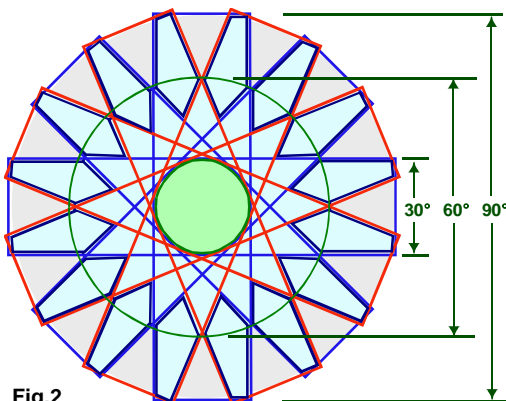


Fig.2

Referring to Figure 2 :-

- All eight channels have a 30° field of view (+/-15° of 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 +/- 45° from the axis (90° overall) will be in the view field of one channel as a minimum.

**7010 LONG RANGE INFRA-RED FLAME DETECTOR**

*Application*

The 7010 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 7010 Flame Detectors.

- ◆ Aircraft Hangars
- ◆ Engine Test Bays
- ◆ Oil Refineries
- ◆ Turbine Halls
- ◆ Boiler Fronts
- ◆ Coal Stacks
- ◆ 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

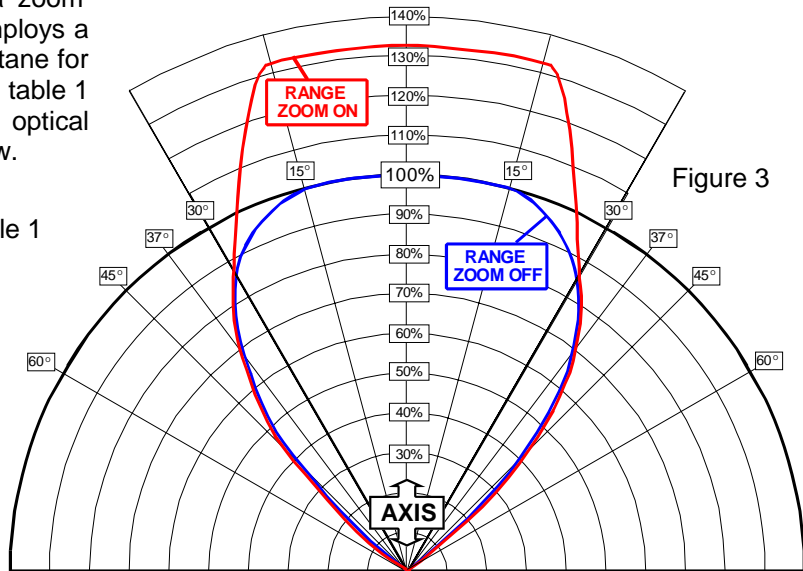
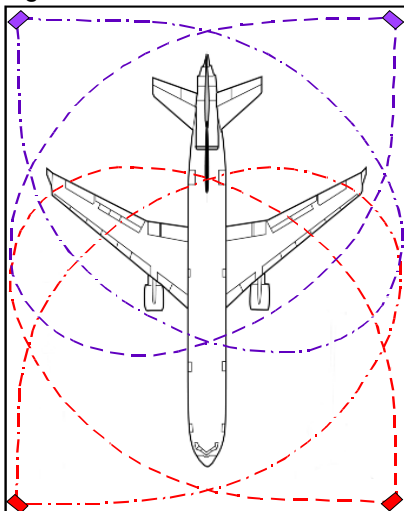


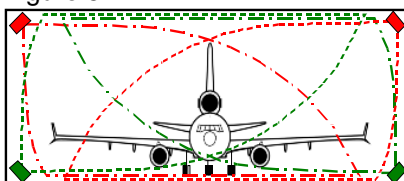
Figure 3

Figure 4



7010 Detectors

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 7010 flame detector (table 1 & figure 3).

The 7000 units should be directed toward the centre of the protected area and ideally have a completely unobstructed view of all hazards. This is 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, and 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 an aircraft hangar. The area under the aircraft is a particular hazard. Thus the example shows detector placement at both high and low level to obviate obscuration by aircraft wings and body.

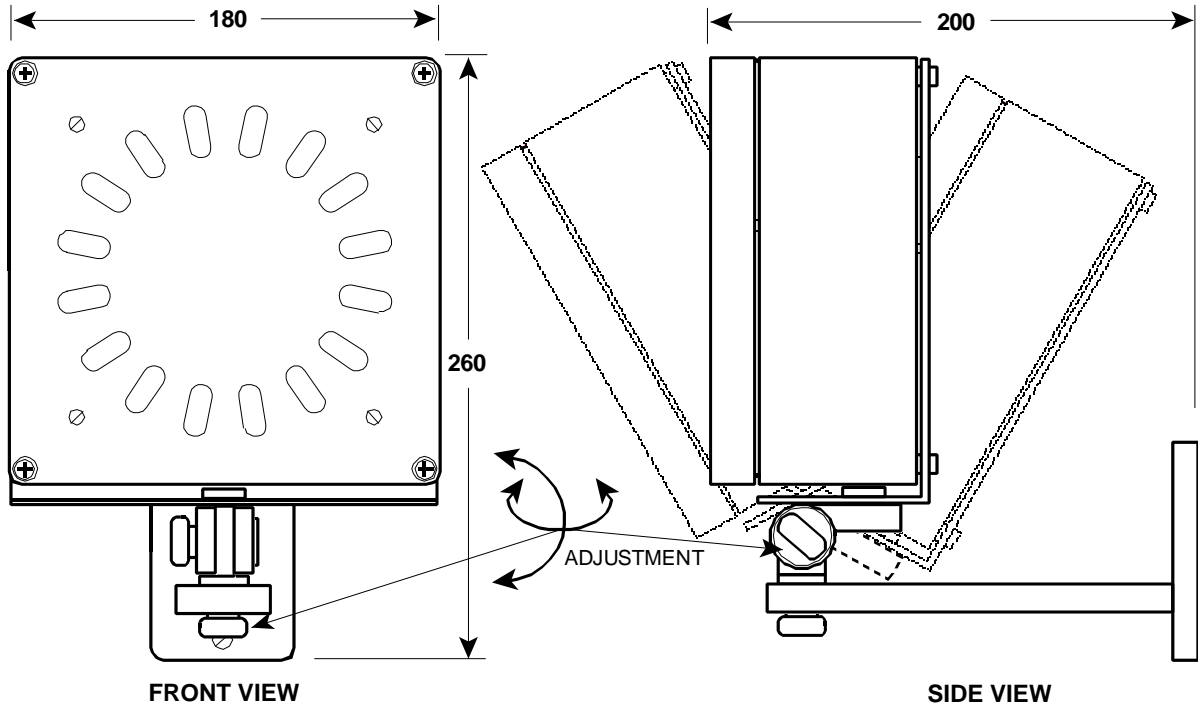
If fire extinguishing media is to be automatically activated, all associated sub-areas should have duplex coverage such that a "double knock" regime for "release" can be implemented.

When the protected area is very large, as would be for multi-bay aircraft service facilities, the overall space must be subdivided 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.

**7010 LONG RANGE INFRA-RED FLAME DETECTOR**

*Detector Unit*

The Type 7010 flame detector comprises a polycarbonate enclosure which is mounted by means of an adjustable bracket permitting alignment in both vertical and horizontal planes. The housing fascia and back-box are fitted with high integrity seals and cable glands, and thus the unit has an excellent environmental rating.



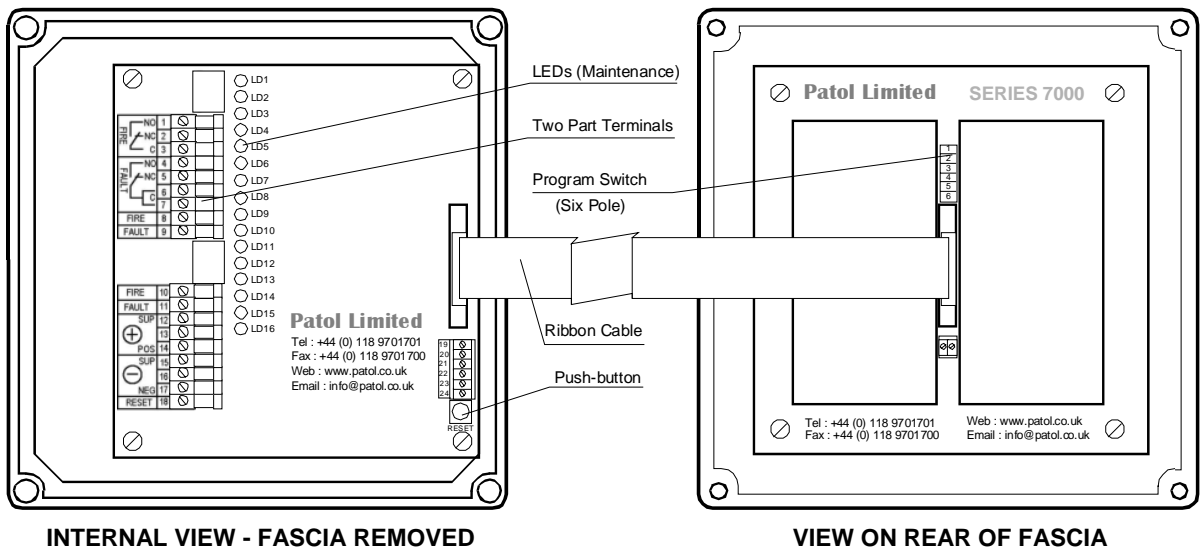
Removing the 7010 detector's fascia gives access to the unit's installation and maintenance features.

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 provide indication of the dynamic status of the eight flame detection channels. These are principally used as commissioning and maintenance aids. During normal operation, in order to minimise supply current, the indicators are usually disabled by means of PCB jumpers.

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.



**7010 LONG RANGE INFRA-RED FLAME DETECTOR**

*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.

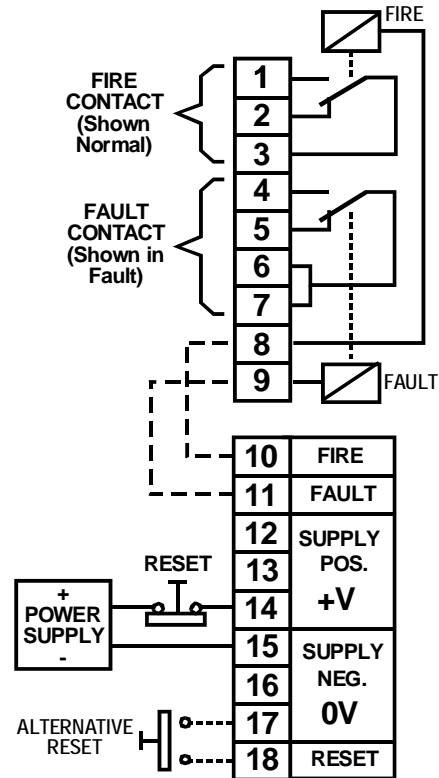
The unit has Fire and Fault outputs at terminals 10 & 11. These are solid state 'open collector' type switching to the Common/0V rail. The fire signal is normally off - connecting to 0V on alarm. The fault signal is switched to 0V in normal conditions and 'open circuits' on trouble.

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 : 13 - 30 Vdc	Detectors:-	Band Pass 4.2 to 4.7 um - 8 off Long Pass 5.0 to 15.0 um - 8 off
Supply Current:-	With relays : <30 mA Stand by* No relays : <20 mA* *Maintenance LEDs disabled 50 mA Max / Full Alarm** **Relays and LEDs enabled	Range:-	Greater than 100m - see table 1
Temperature :-	-20°C to +70°C	Angle of view:-	+/- 45° - see figure 3
Enclosure:-	Material - Polycarbonate Size - 180 x 182 x 90 mm Colour - Grey RAL 7032	Indications:-	Internal - Channel Flame - Red LED - 8 off Ambient - Yellow LEDs - 8off
Weight:-	<1.5 kg (Including bracket)	Controls:-	Reset PB Program SIL switch. (Sensitivity / Zoom)
Termination:-	Screwed Rising Clamp Max Wire size - 4.0 mm <sup>2</sup>	Outputs:-	Timer periods - 2 bit jumpers. Alarm Contact - 1 pole C/O Fault Contact - 1 pole C/O Rating - 30 Vdc - 500 mA

*Special Options*

The flame detector can be fitted with a screened flexible cable connecting to a separate junction box for the termination of rigid site cables. In addition to containing connection terminals, this JB unit can be provided with daylight visible LED indicators illuminating on Fire and/or Fault conditions.

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