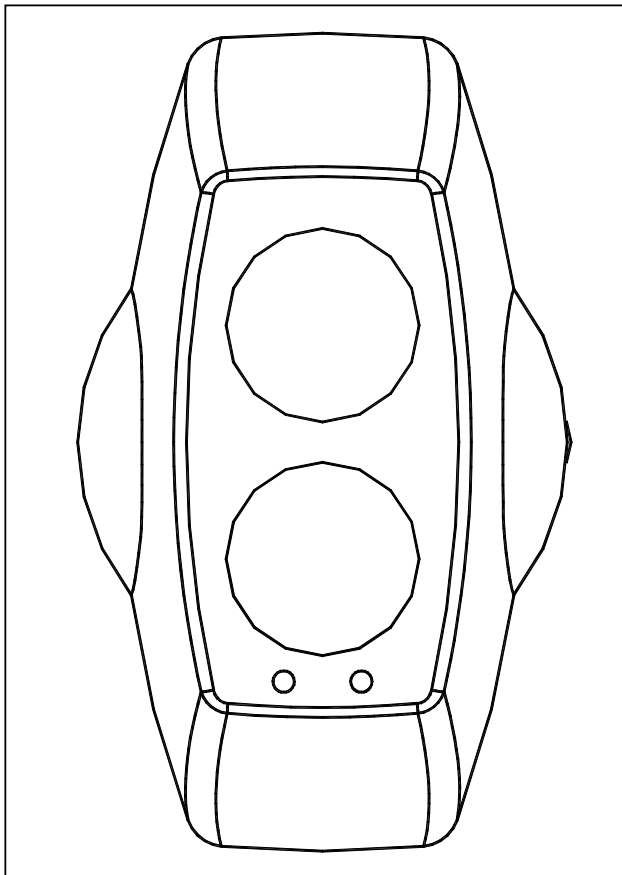


# 50RV and 100RV Optical Beam Smoke Detector



## FEATURES

- **Microprocessor controlled**
- **Model 50RV**  
**Range 5 – 50 Metres**
- **Model 100RV**  
**Range 50 – 100 Metres**
- **Unique simple alignment**
- **12Vdc to 24Vdc operating voltage**
- **Selectable alarm thresholds**
- **Low current consumption**
- **Automatic reset**
- **Automatic contamination compensation**
- **Low Level Control tester option**

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## 1. System Description.

The Detector comprises a Transmitter and Receiver contained within one enclosure.

The Transmitter emits an invisible infrared light beam that is reflected via a prism(s) mounted directly opposite and with a clear line of sight. The reflected infrared light is detected by the Receiver and analysed.

The Detector has a maximum lateral detection defined by the local National Standard. As a guide a common lateral distance of 7.5m will be used in this guide. Use the latest beam detector standards EN54 part 12, VdS 2095 or BS5839 part 1 for further guidance.

The optimal beam distance from the ceiling will be between 500mm and 600mm, again the Local National Standard will give guidance.

## 2. System Operation.

Smoke in the beam path will reduce the received infrared light proportionally to the density of the smoke. The Detector analyses this attenuation, or obscuration of light, and acts accordingly.

Alarm thresholds of 12%, 25%, 35%, and 50% can be selected to suit the environment, where 50% is the least sensitive. If the received infrared signal reduces to below the selected threshold and is present for approximately 10 seconds, the Alarm relay is activated, and the Alarm Led illuminates.

There are two modes to the operation of the Alarm relay : Auto Reset and Alarm Latching. Auto reset mode will reset the Alarm relay, and Alarm LED, 5 seconds after the received infrared signal has recovered to a level above the alarm threshold. Latching mode holds the Alarm relay, and Alarm LED, active indefinitely after an alarm condition has occurred. There are two methods to clear the latched mode.

- 1) Place the beam into Prism Targeting or Alignment Mode, and then go back to Run Mode.
- 2) Remove power to the beam. Power must be removed from the Detector for **10 seconds**.

If the infrared beam is obscured rapidly to a level of 93%, or greater, for approximately 10 seconds the Fault relay is activated. The Fault LED will also illuminate. This condition can be entered in a number of ways, for example, an object being placed in the beam path, transmitter failure, loss of the prism(s), sudden misalignment of the Detector, or the received signal becomes too high. The Fault relay will reset within 5 seconds of the condition being rectified.

The Detector monitors long term degradation of signal strength caused by component ageing or build up of dirt on optical surfaces. This operates by comparing the received infrared signal against a reference signal every 15 minutes; differences of less than 4.7%/Hour are corrected automatically. When the detector is showing AGC fault (Fault LED flashing once in every two seconds), the detector will still operate correctly indicating Alarm conditions as normal. Realignment of the beam may be necessary if AGC fault occurs.

## 3. Detector Positioning.

It is important that the Detector is positioned correctly to minimise the detection time.

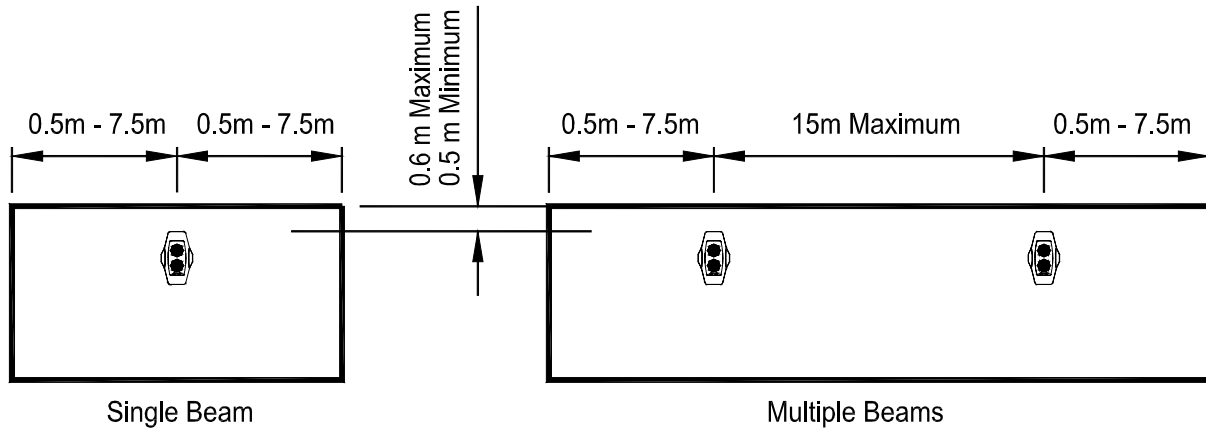
Experiments have shown that smoke from a fire does not rise directly upwards, but fans out or mushrooms due to air currents and heat layering effects. The time to signal a fire condition depends on the location of the Detector within the premises, the volume and density of smoke produced, construction of the roof, ventilation arrangements and airflow within the detection area.

Smoke layering, where smoke does not reach the ceiling level due to layers of static hot air, is overcome by mounting the Detector/Prism(s) at the recommended height below the ceiling (see section 1). This brings the infrared beam below the heat layer and into the smoke layer. However, if there are objects below the ceiling that could obscure the beam path, the detector/prism(s) positioning may need to be adjusted.

**It is recommended that a beam path clearance radius of 0.5 metres be employed.**

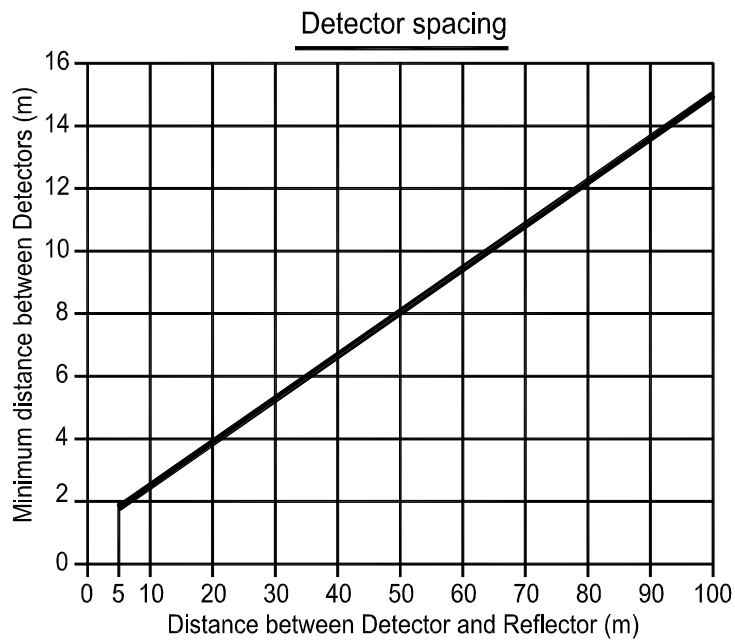
Refer to the Detector minimum spacing graph on page 3 for detection under flat ceilings.

3.1. Detector Positioning Under Flat Ceilings.



Typical installation

(Refer to graph for minimum Detector spacing)

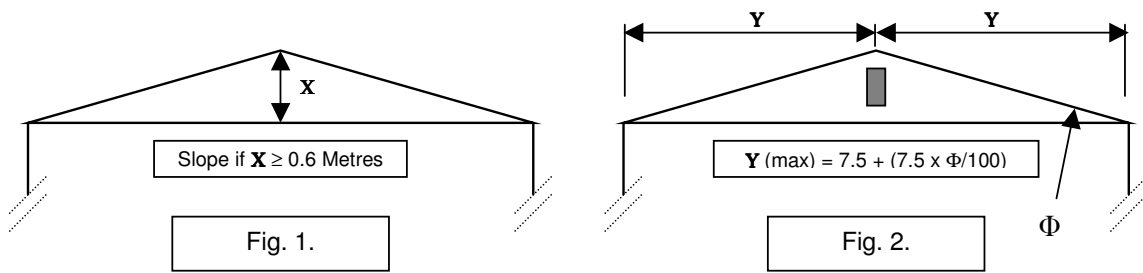


In all installations the latest National Fire Standards **must** be consulted.  
If there is any doubt on the correct mounting height, positioning may be determined by smoke tests.



3.2. Detector Positioning In Apex Of Sloping Ceiling.

A ceiling is defined as sloping if the distance from the top of the apex to the intersection of the ceiling and adjacent wall is greater than 0.6 metres. See Fig. 1.



When a Detector is positioned in the apex of a ceiling (See Fig. 2), the lateral beam distance covered (Y) can be increased in relation to the angle of the pitch ( $\Phi$ ), to a maximum pitch of 25°.

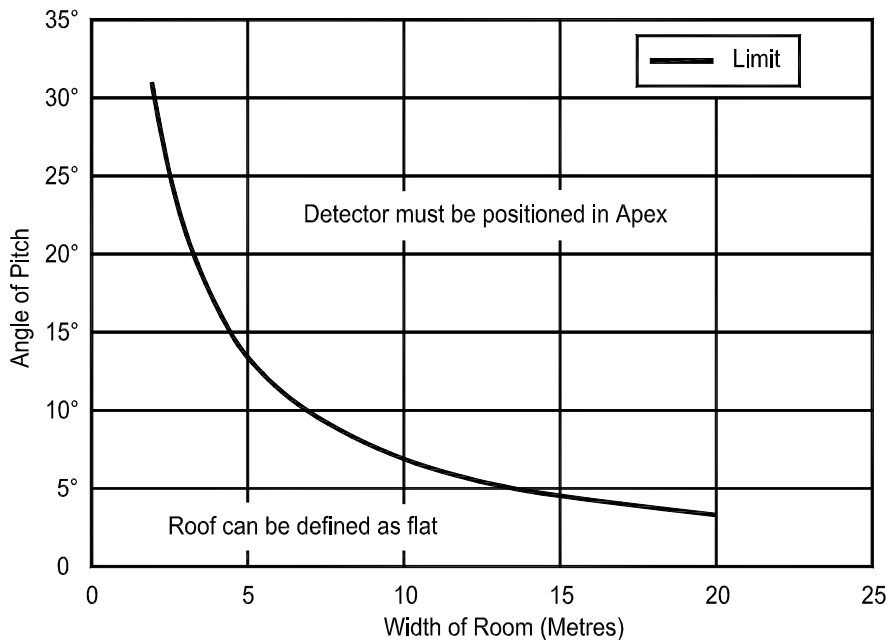
For Example:

If the pitch angle is 20 degrees, the lateral coverage can be increased from 7.5 metres either side of the beam (Y) to:

$$Y = 7.5 + (7.5 \times 20/100) \text{ metres}$$

$$Y = 9 \text{ metres}$$

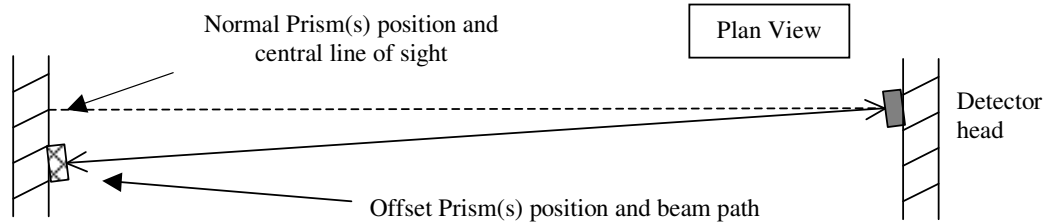
Therefore, with a roof pitch of 20 degrees the lateral coverage can be increased from 7.5 metres either side of the beam to 9 metres either side of the beam, but only for the beam positioned in the apex. All other calculations remain the same.



Limit to when a Detector must be positioned in a Roof Apex

### 3.3. Detector Positioning In Atrium.

If the detector is to be placed in an atrium, or near glass/polished surfaces, the prism(s) should be offset from the central line of sight (approximately 300mm), and angled back to the beam detector. This can be either on the vertical or horizontal axis. This will reduce the amount of spurious returned signal from the glass/polished surfaces. The reflected signal from the prism(s) will be returned to the detector in the normal way.



## 4. Installation.

Pre-installation at Ground Level.

Confirm that all parts have been supplied as listed in the parts list. See page 12.

Select the required alarm threshold using switches 3 and 4 (See fig. 4 page 11 for switch configuration settings). The factory default setting is 35% this should be adequate for most environments, if the Detector is to be installed into an exceptionally dirty environment change the threshold to 50%.

Switch 1 selects latching or auto reset for the alarm relay. Auto reset is the factory default setting. See Fig.4 for setting options.

Using the mode switch at the back of the unit, (See fig. 4 page 11) select Prism Targeting Mode (Switch will be in its upper position).

The Detector Head Assembly is now ready for installation. If switches 1 to 4 require resetting after installation, a power down reset is required (entering into Prism Targeting/Alignment Mode can also be used as a reset).

### 4.1. Detector Head Assembly Installation.

Remove the outer cover before installation; this is only to prevent the cover becoming dislodged during handling.

**Do not mount on plasterboard, cladded walls, wood or similar materials, as these surfaces do, and will move.**

Determine the position of the Head Assembly, which must be mounted on a **solid structure**. Ensure that there is a **clear line of sight** (0.5 metres radius around the beam) to the proposed position of the prism(s), which is to be mounted on a solid structure between 5 and 100 metres directly opposite the Detector (range and number of prisms dependent on model).

Using the template provided, mark and install all 4 fixing points to the structure. The rear mounting plate of the Detector Head Assembly is provided with 4 keyhole slotted apertures to allow for easy installation onto the 4 fixing points.

Replace the outer cover.

Terminate the field wiring. See section 8.

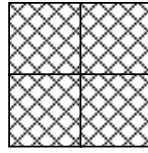
### 4.2. Prism(s) Installation.

Mount the Prism(s) on a **solid structure**, 90° to the beam path, between 5 to 50 metres (for the 50 metre Detector), and 50 to 100 metres (for the 100 metre Detector) directly opposite the Detector.

**If the detector is to be placed in an atrium, or near glass/polished surfaces, the prism(s) should be offset from the central line of sight (Refer to Section 3.2).**



1 Reflective Prism for  
the 50 metre Detector



4 Reflective Prisms for  
the 100 metre Detector

Ensure that there is a clear line of sight to the Detector, taking care that no moving objects i.e. doors, mechanical lifting equipment etc, will interfere with the beam path between the Detector and Prism(s).

*Note: On ranges of  $\geq 5$  metres and  $\leq 50$  metres use a 50 metre Detector.  
On ranges of  $\geq 50$  metres and  $\leq 100$  metres use a 100 metre Detector.*

## 5. Prism Targeting Mode.

Apply power to the Detector. There is a 5 seconds pre-charge delay after power is applied to allow the internal circuits to stabilise correctly. After this period the RED indicator will flash once to indicate that the model is a 50 metre Detector or will flash twice to indicate a 100 metre Detector.

### **Do not remove the detector from the wall during this action.**

Mechanical alignment is provided by two adjustment thumb wheels on two sides of the Detector, positioned just behind the Detector Head cover. Adjustment is achievable in both vertical and horizontal axis. Find the prism(s) by adjusting the horizontal and vertical thumbwheels until the FAULT indicator is continuously ON. The FAULT indicator will be OFF when no signal is being received. It will then flash at an incrementing rate to determine the target position. The faster the flash rate (the stronger the signal), the nearer you are to the target (prism). As the beam is moved across the prism the flash rate will increase, go solid and then go back to a flash rate. A continuous LED indicates that the prism has been detected. Find the halfway point for each axis, by counting the amount of turns of the thumbwheel it takes for the LED to go from just flashing to on, to on to just flashing. At this point reverse the direction of rotation, and turn the thumbwheel half the amount of turns counted.

### **It is essential to test that the prism(s), and not another surface, is reflecting the signal back to the detector.**

This can easily be confirmed by covering the prism(s), with a non-reflecting surface, and confirm that the FAULT indicator changes state, either the FAULT indicator is OFF or flashing very slowly.

If an area has a large amount of reflective surface along the beam path, do not at first fit the reflector(s). When in targeting mode ensure that the AMBER LED does not flash. Then fit the reflector(s) in a position that turns the AMBER LED constantly on.

## 6. Alignment Mode.

### 6.1. Enabling Alignment Mode.

### **Do not remove the detector from the wall during this action.**

Using the mode switch (See fig. 4, page 11) select Alignment Mode (Move switch to the middle position).

### 6.2. Adjustment in Alignment Mode.

The Detector will automatically adjust its infrared beam power and receiver sensitivity to give an optimum receiver signal strength (100%).

The alignment progress is indicated by the colour and state of the indicator lamp on the front of the Detector.

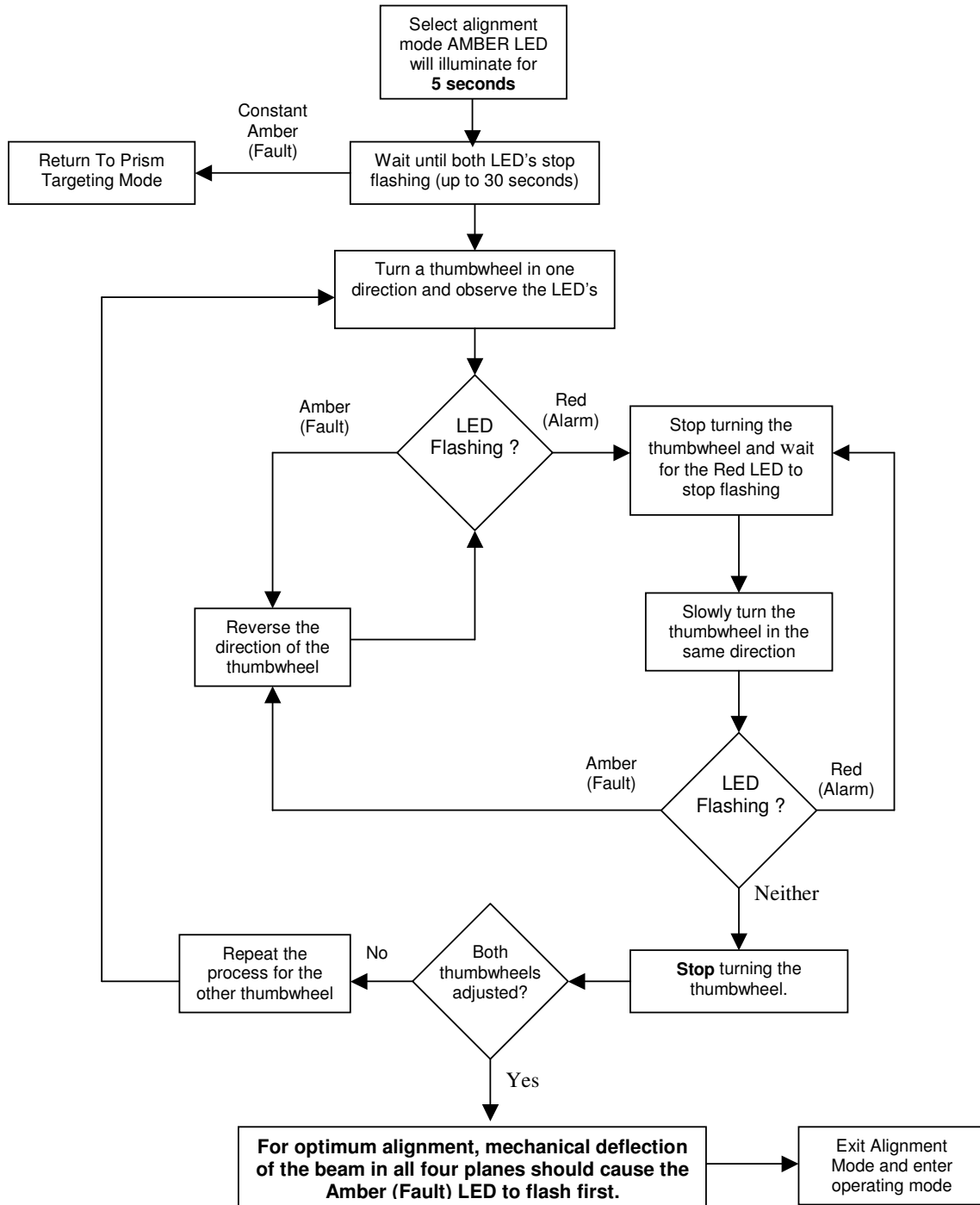
- **FLASHING ALARM (Red LED)**  
The Detector is receiving a **high** signal ( $>100\%$ ) and is attempting to reduce the infrared power output to compensate.
- **CONTINUOUS FAULT (After a 5 minute period of Amber LED flashing)**  
The Detector is not receiving a signal (0%). **Go back to Prism Targeting Mode.**



- **FLASHING FAULT (Amber LED)**  
The Detector is receiving a **low** signal (<100%) and is attempting to increase the infrared power output.
- **OFF**  
The Detector has optimised the infrared power and receiver gain for the current orientation of the Detector and Prism(s). **This does not mean that the Detector to Prism(s) alignment is at its optimum**, i.e. if the power is too high, a misaligned Detector may be receiving a fringe reflection from another object.
- **ALTERNATING ALARM/FAULT (Flickering Red/Amber LED)**  
This state can sometimes occur. It means that the infrared power is stepping between optimum settings (treat this state as **OFF**).

Continue to flow diagram for procedure.

6.3. Alignment Process Flow Diagram.



## 6.4. Exiting Alignment Mode.

### **Do not remove the detector from the wall during this action.**

Using the mode switch (See fig. 4 page 11) select Operating Mode (Switch will be in its lower position).

On exiting alignment mode the Detector will perform an internal calibration check. The Amber (Fault) LED will flash once a second, for up to sixty seconds, and then go out. If this fails, which would be due to bad alignment or either electrical/optical noise, the detector will indicate a Fault condition. In this case the alignment procedure must be repeated.

If the internal calibration check completes satisfactory, the FAULT LED indicator will turn OFF and the fault relay will clear. The Detector is now in normal operating mode.

**Note: On the 50 metre and 100 metre Detectors, the Amber LED will flash once every 10 seconds to indicate the beam is operational.**

## 7. System Testing.

After successful installation and alignment the System will require testing for both alarm and fault conditions.

### 7.1. Fault Test.

Using a non-reflective object, quickly cover the entire prism(s).

The Detector will indicate a fault within 10 seconds by activating the FAULT LED and operating the Fault Relay.

The fault condition will automatically reset after a period not greater than 2 seconds when the obstruction is removed.

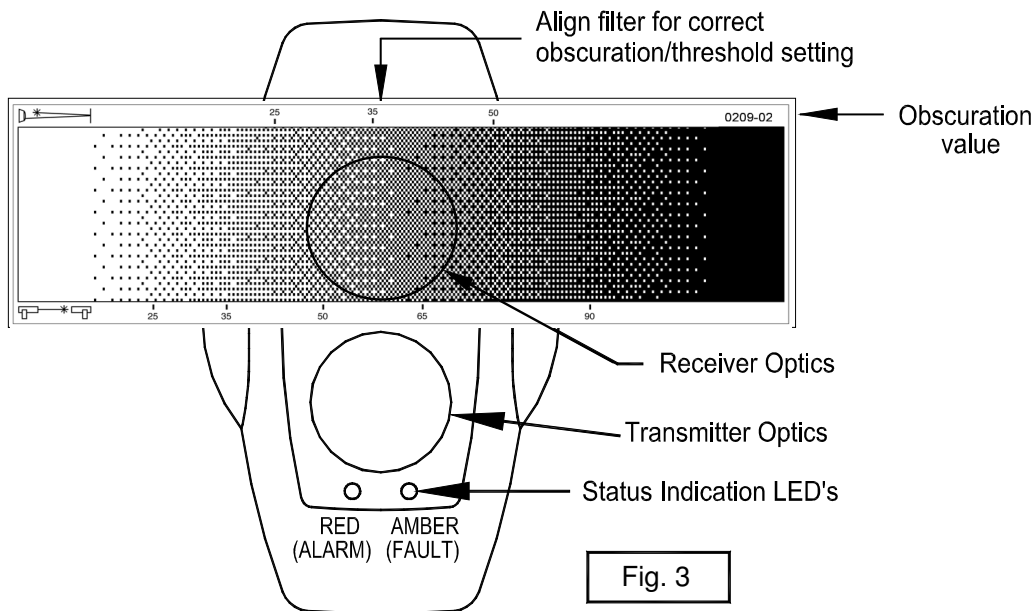
### 7.2. Alarm (smoke) Test.

Select obscuration mark on the filter to correspond with the Detector alarm threshold (see fig. 3 below).

Place the filter over the receiver optics (Top of Detector Head – opposite end to the status indication LED's) at the correct obscuration value determined by the threshold selected, i.e. if a threshold of 35% has been selected, position the filter just past the 35% obscuration value on the filter (see fig 3 below).

Take care not to cover the transmitter optics.

The Detector will indicate a fire within 10 seconds by activating the ALARM LED and operating the Fire Relay.



## 8. Connection and Configuration Settings.

### 8.1. Field Wiring.

The field wiring interface is accessed through the back plate of the Detector Head (See Fig 4). The small 2-pin connector on the left is the port for the optional Low Level Control tester. The 8-pin connector is the interface to the *field wiring* and is numbered left to right. Each unit is fitted with a 'flying' lead, with an 8-pin connector fitted. Relay states are shown in powered, no alarm, no fault condition. **See table below :**

Pin Number	Wire Colour	Signal Description
1 *)	BROWN	Fire relay normally closed (NC) connection
2	BLUE	Fire relay common (COM) connection
3	YELLOW	Fire relay normally open (NO) connection
4	RED	Positive Supply +10.2 to +30 Vdc
5	BLACK	Negative Supply
6	GREEN	Fault relay normally closed (NC) connection
7	WHITE	Fault relay common connection (COM) connection
8 *)	ORANGE	Fault relay normally open (NO) connection

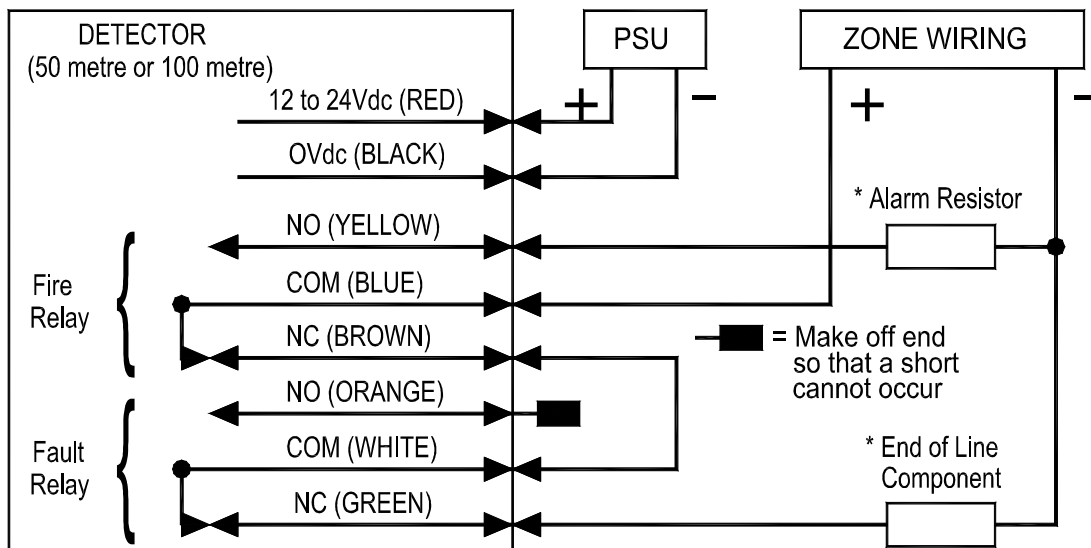
\*) = Not available with 6-wire cables.

### 8.2. DIP Switch Settings.

Access to the configuration settings is through the back plate of the Detector Head (See Fig 4 page 10). Factory default configuration settings are marked ←.

Function	Dip switch				
	1	2	3	4	
Auto Reset Fire Relay (5 seconds)	ON				←
Latching Fire Relay	OFF				
Fire Relay Enable, On Compensation Limit		OFF			
Fire Relay Disable, On Compensation Limit		ON			←
25% Threshold			OFF	OFF	
35% Threshold			OFF	ON	←
50% Threshold			ON	OFF	
12% Threshold (Use for extreme sensitivity requirements)			ON	ON	

### 9.1 Typical single zone wiring diagram.

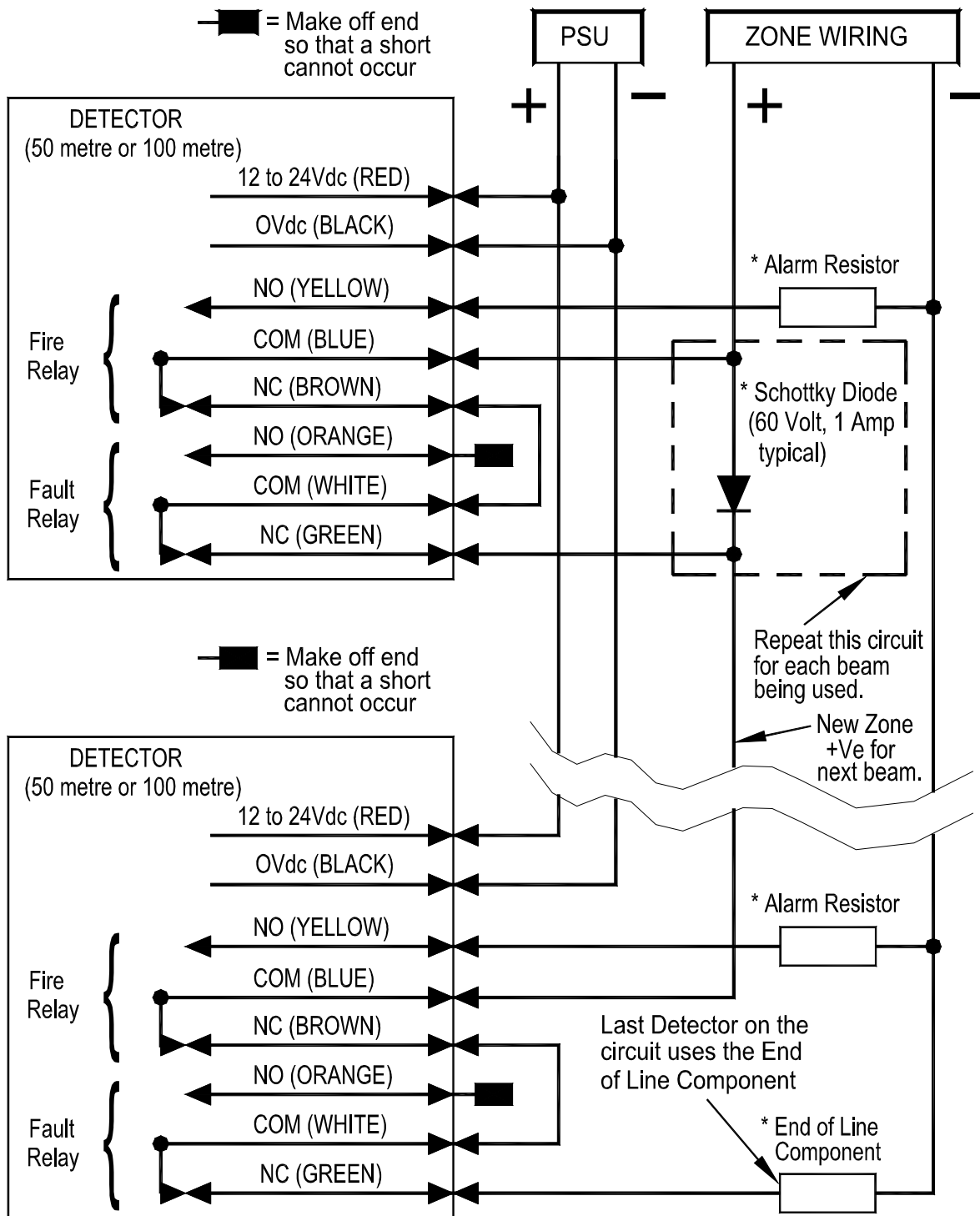


This diagram is an example for a single Detector being the only device on a zone. The operation for Fire and Fault, should always be checked for correct connection to the panel. Relays are shown in quiescent condition.

**Contact fire panel manufacturer for values of 'Alarm Resistor' and 'End of Line Component'.**

**\* These parts are not supplied with the beam.**

**9.2 Typical multiple-beam zone wiring diagram.**



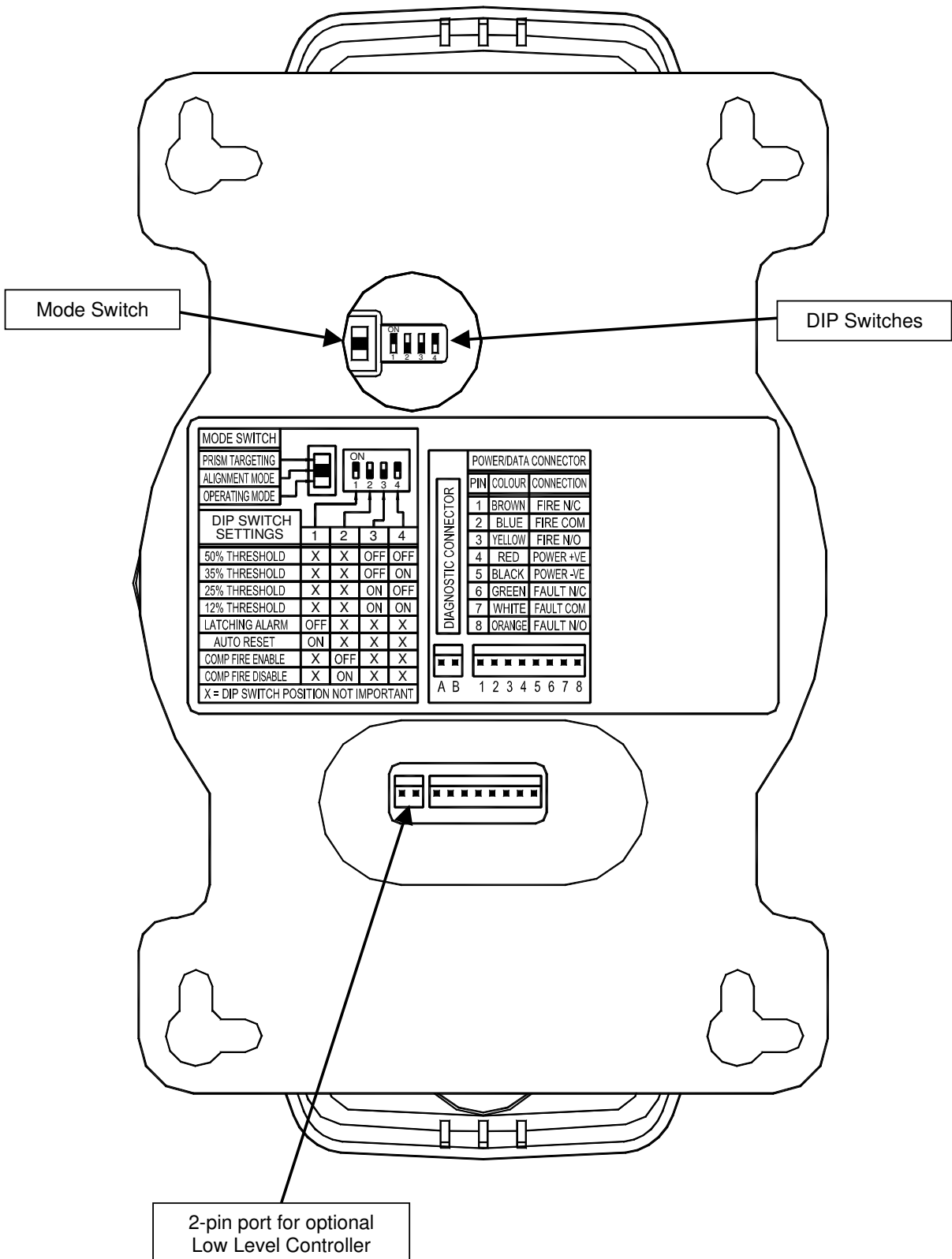
This diagram is an example for multiple Detectors on a zone. The operation for Alarm and Fault should always be checked for correct connection to the panel. Relays are shown in quiescent condition.

**Contact fire panel manufacturer for values of 'Alarm Resistor' and 'End of Line Component'.**

**\* These parts are not supplied with the beam.**

# 10. Detector Interface Assembly Configuration Settings.

Fig. 4



## 11. Technical Data.

- Operating Range (50 metre Detector) 5 to 50 metres
- Operating Range (100 metre Detector) 50 to 100 metres
- Supply Voltage limits 10.2Vdc to 30Vdc
- Quiescent Current (no LED's illuminated) <4mA
- Alarm/Fault Current <15 mA
- Power Down Reset Time 10 seconds
- Operating Temperature -30°C to 55°C
- Relative Humidity 0% to 90% (non-condensing)
- Tolerance to Beam Misalignment at 35% Detector  $\pm 0.5^\circ$ , Prism  $\pm 5.0^\circ$
- Fire Alarm Thresholds 2.50dB (25%), 3.74dB (35%), 6.02dB (50%)
- Optical Wavelength Infrared spectrum (880nm typical)
- Head Maximum Size Width 130mm, Height 210mm, Depth 120mm
- Weight 770 gms
- IP rating IP50
- VdS Approval No. : G 203070
- CPD Approval No. : 0786-CPD-20045

## 12. Service / Application Notes.

- Red LED indicates FIRE.
- Continuous Amber LED indicates FAULT.
- Amber LED flashing once every 10 seconds indicates normal operating mode.
- Amber LED flashing once every 2 seconds indicates that the contamination/compensation function has reached its limit (Fault condition).
- Alarm condition indicated by fire relay closing (relay contact is normally open).
- Fault condition indicated by fault relay opening (relay contact is normally closed).
- Alarm may be latching or non-latching (default).

## 13. Parts List.

- 1 qty. Detector Head Assembly
- 1 qty. Reflective Prism for the 50 metre Detector, **OR** 4 qty. Reflective Prisms for the 100 metre Detector
- 1 qty. Test Filter
- 1 qty. Cable Interface Assembly (fitted to the back of the Detector)

## 14. Optional Product Parts List.

- Low Level Controller (Optional product, part No. 0400-02-xx, where xx is the latest issue). This product enables the remote testing of the Detector from a distance of up to 100 metres.