

PHOTOELECTRIC REFLECTIVE BEAM DETECTOR

MODEL SRA-ET

Installation Instructions



World Class Leaders in Fire Detection
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1. Overview

1.1. General Description

The Photoelectric reflective beam detector consists of the SRA-ET unit and a reflector, which face each other at a distance of between 5 and 30 metres. In the event of fire the smoke generated will decrease the amount of near infrared light incident on the SRA-ET, this decrease is electronically interpreted to identify the occurrence of fire. An important feature of the detector is that it monitors the protected space linearly. This enables the detector to identify a fire before it spreads, even when the smoke is scattered over a large area.

The fire detection sensitivity is factory set at 30% beam obscuration and cannot be altered.

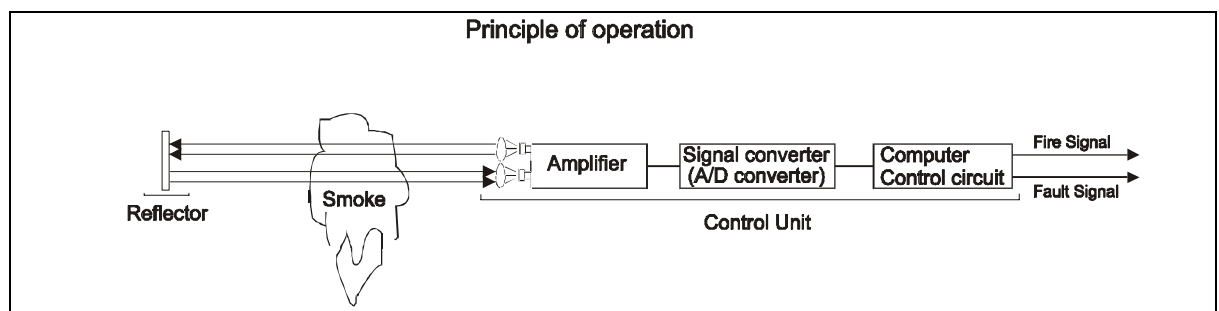
1.2. Detection principle

A near infrared-pulsed beam generated by the SRA-ET and is reflected back to the unit, where it is converted into an electrical signal. This signal is then amplified and applied via an A/D converter to a microprocessor. The normal state signal (the initial beam data) once stored in the microprocessor is used as a reference for comparison with subsequent beam signals.

When there is sufficient difference between actual beam strength and stored reference data to indicate the occurrence of a fire, then a fire signal is produced.

The microprocessor also provides compensation for a change in received signal value with time, caused by contamination of the optics or slight alignment changes. The processed signal is adjusted at a rate of $\pm 1\%$ towards the reference data every 20 minutes. When the limit of compensation is reached the microprocessor will automatically produce a fault signal.

Note: To meet with current standards if the SRA-ET is totally obscured then a fire condition will be generated.



2. Installing the detector

2.1. Siting

Select a suitable position for the installation of both SRA-ET and reflector, such that there are no visible obstructions between them. Remember that the beam detector works on the principle of reduction of light between the SRA-ET and reflector. If there is any possibility of an object remaining within the beam for a few seconds then the siting of the detector is unsuitable.

For mounting either the SRA-ET or reflector it is important to establish that the mounting place such as the wall is solid and that the beam detector alignment will be rigid. The wall may appear to be solid, but may be subject to twisting or other changes when the temperature outside the building varies greatly during one day, for instance on cold, frosty days. The installer must ensure that the beam will not be subject to misalignment due to changes in the building itself.

The spacing and siting in specific types of locations is covered in section 7.

The beam detector must not be installed in the following locations:

- ▶ Where the ceiling height is greater than 40m
- ▶ A roof top or place where open air circulates
- ▶ Where the distance between top and bottom of the space is less than 0.5m
- ▶ Where objects such as ceiling beams or girders are within 75cm of the beam axis
- ▶ In locations where a large amount of dust, fine powder or water vapour is present
- ▶ In locations such as kitchens where smoke occurs normally
- ▶ In locations which are exposed to extremely high temperatures
- ▶ Where access to the beam detector is impossible for maintenance purposes
- ▶ Where the rigid fixing of either the SRA-ET or reflector is impossible
- ▶ Where access to the beam detector to align and set is impossible
- ▶ Where there is not a clear line of site between the Receiver and Reflector/Emitter

Warning: The SRA-ET is not solar blind, therefore the SRA-ET or reflector should not be installed where they can be subjected to direct or reflected sunlight, i.e. via adjacent walls and reflective surfaces. It is recommended that in these locations or where the beam detector may be surrounded by glass, the SPB-ET Beam Detector should be fitted.

2.2. Installation

Please check that the beam detector contains the following components so installation can be carried out.

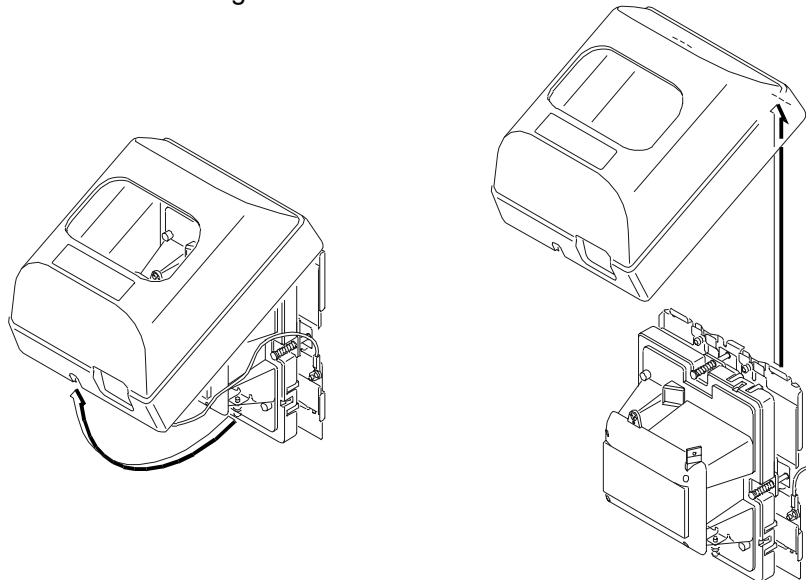
- ▶ 1 SRA-ET
- ▶ 1 Reflector (**enclosed in packaging**)
- ▶ 1 Mask
- ▶ 1 Installation manual
- ▶ 2 Fixing screws
- ▶ 1 SRA-ET mounting plate (termination module PCB on the back)

The termination module is designed to facilitate the installation of the SRA-ET beam detector to fire cables using a standard surface/flush dual gang installation box or the Hochiki SRA-ET Back Box. The module also provides three types of fault monitoring configurations, simple beam reset and remote fire indication.

2.3. Opening the detector cover

Removal of the detector can be achieved by unscrewing the outer cover locking screw and pulling the cover forward and then lifting the cover off of the locating slots at the top of the fixing plate, the cover is then retained by a anti-drop cable. The fixing plate screws should then be loosened (Figure 4-1 & Figure 4-3) and the beam assembly can then be removed.

Figure 1 - opening the detector housing



2.4. Field wiring & line continuity

The connection of this unit requires the use of a dual gang installation box, either flush mount or surface mount or the Hochiki SRA-ET Back Box. Suggested types are MK897 ALM surface mount, MK862 ZIC flush mount, but any equivalent type is usable providing that it has a minimum depth of 25mm. This item should be firmly fixed to the wall or other suitable mounting point first. With reference to the wiring diagram Figure 2 & Figure 3 ensure that the field wiring is terminated into the dual gang installation box.

The Termination Module can be configured to provide correct operation for three different types of zone fault indication, which provide the same fault detection functions as Hochiki's conventional detector bases when the detector heads are removed. The configuration is achieved using jumpers at the top of the termination PCB (refer to figure 3) and the selection should be made according to the type of fire alarm control panel being used. If the SRA-ET is being used with the CHQ-MZ/Z then the jumpers need to be set to the normal mode.

Normal:- No line continuity option (zone is open circuit during fault).
Jumpers LK1, LK4 & LK6 ARE MADE, all other jumpers are removed.

Zener:- Line continuity using a Zener clamp (produces detector removal fault at the control panel).
Jumpers LK2 & LK5 ARE MADE, all other jumpers are removed.

Schottky:- Line continuity using a Schottky diode (produces detector removal fault at the control panel).
Jumpers LK1, LK3, LK4 & LK6 ARE MADE, all other jumpers are removed.

Note: The Termination Module is factory configured for Schottky diode line continuity. If in doubt check the correct line continuity for the control panel.

Warning: When the Zener option is used it must be connected to a control panel, which is able to use this type of option. If connected either to an unsuitable panel or a 24V-power supply the interface could be damaged due to over-current.

Figure 2 - Termination module wiring diagram

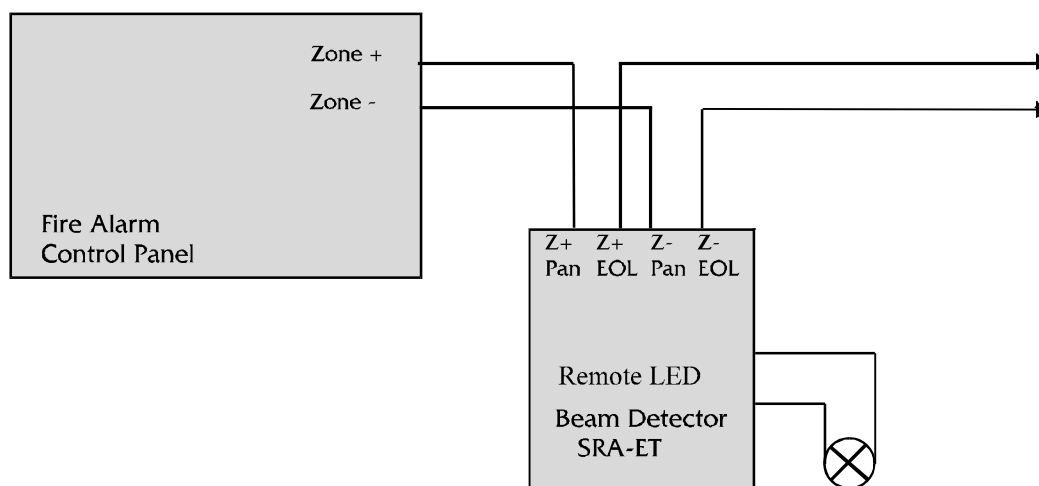
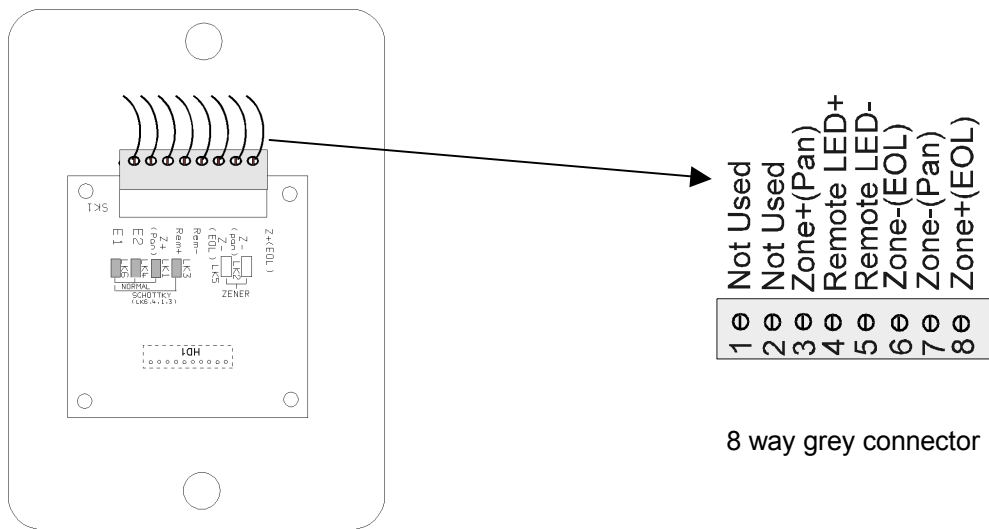


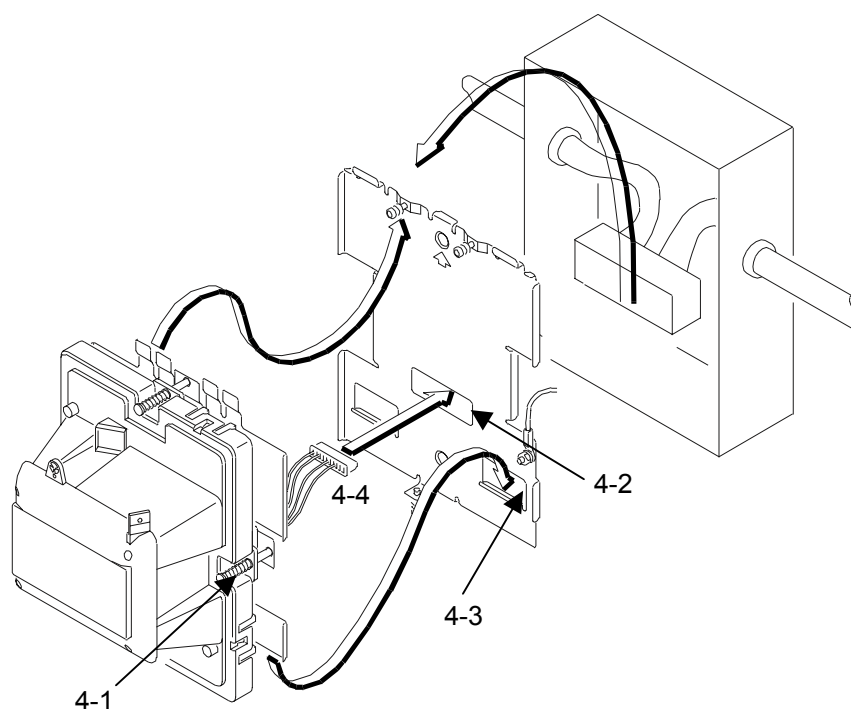
Figure 3 – Cable Termination



Unplug the 8 way grey connector from the end of the Termination PCB (Figure 4-4). Install the wires into the correct position and secure by the terminal screw (Figure 3). Ensure the grey connector is facing upwards and that the cables are insulated and neatly located into the base of the installation box. Plug the grey connector back into the PCB then connect the pre-wired ribbon cable assembly to the socket on the back plate (Figure 4-2), the back plate should then be screwed to the back box.

Fix the beam assembly to this by fitting the locating slots under the fixing screws (4-1) and pushing the beam up until the locating tabs can be dropped into the back plate (4-3). The top fixing screws should then be tightened, and the cover fitted to the beam detector once the adjustment and calibration procedure has been completed (see section 2.6).

Figure 4 Termination module assembly



2.5. Reflector - Installation Procedure

Reflector to wall mounting:

The reflector should be mounted using the 5mm fixing holes onto a flat surface with suitable screws, care should be taken not to over tighten these screws as this could damage or distort the reflector.

Figure 5 – Reflector with mask

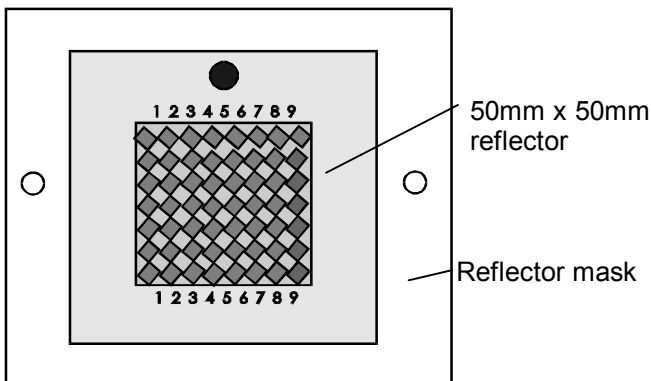
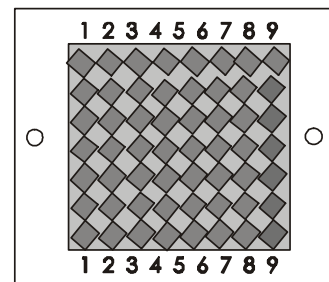


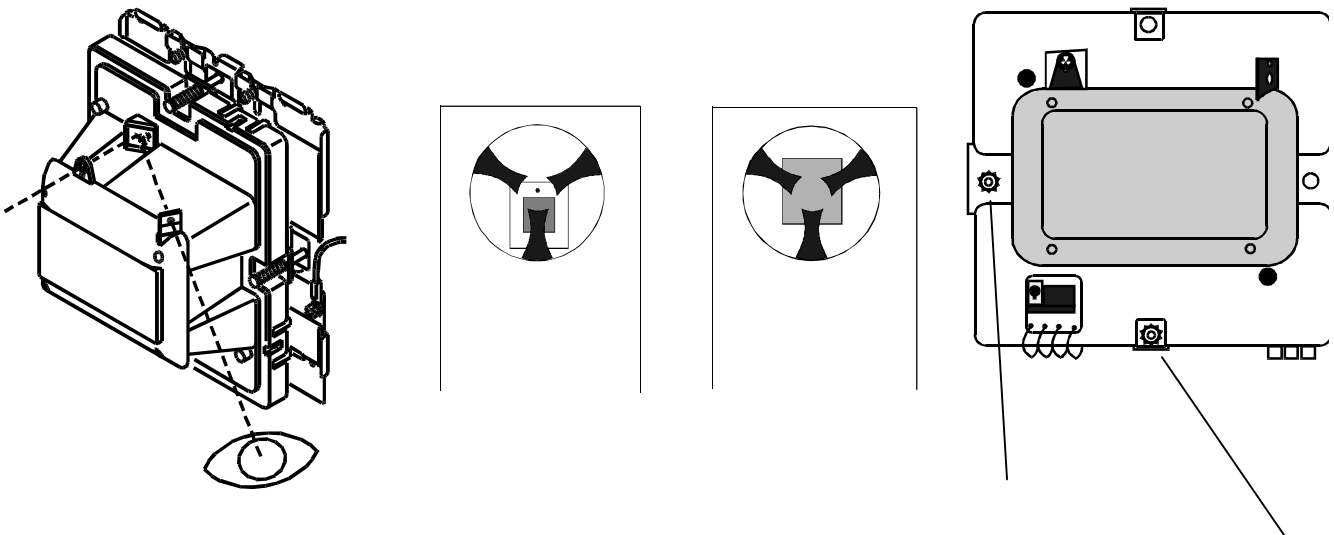
Figure 6 – Reflector without mask



If the SRA-ET is being used over a distance of 5m-15m then the mask should be fitted to the reflector (Figure 5). From distances of 15m-30m then the mask must not be fitted to the reflector (Figure 6).

2.6. Adjustment & Calibration procedure

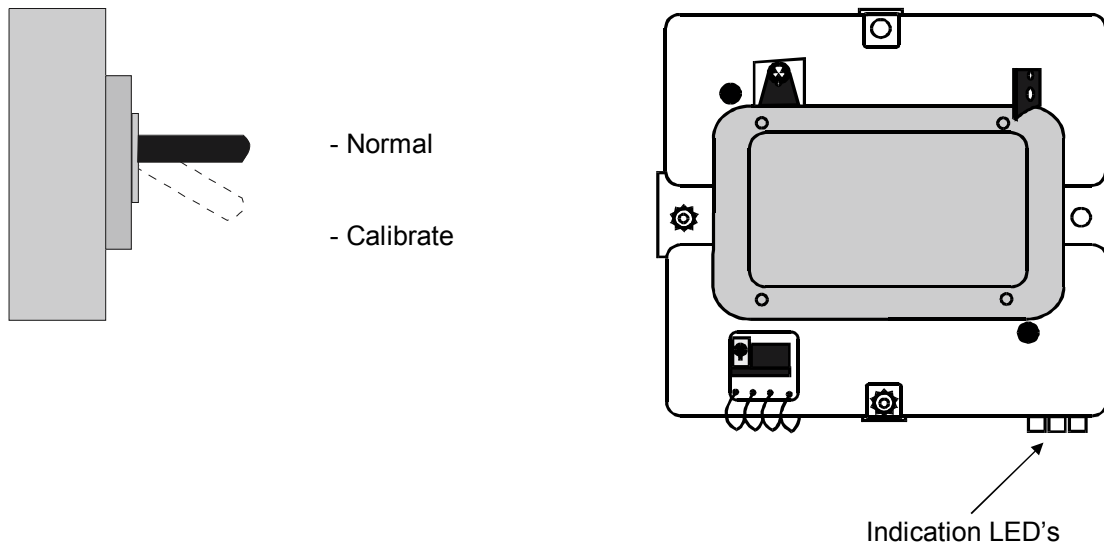
The adjustment procedure should be carried out by powering up the SRA-ET and setting the switch to calibrate; at this time the yellow LED will start to flash. Then, using the sight holes and alignment adjustment screws, the detector should be adjusted so the reflector can be seen in the centre of the sight hole. If the reflector is being used with the mask then the detector must be adjusted until the black dot on the reflector is in the centre of the site hole.



Alignment with mask Alignment without mask Horizontal adjustment

Vertical adjustment

When setting the SRA-ET up the set up switch must be set to calibrate, once alignment is completed as above then the switch must be returned to the normal position.



The set up switch should now be set to the normal position, at this time the yellow and green operating LED's will be flashing this should last for one minute as the detector automatically adjusts. When this has been completed the yellow LED will extinguish and the green LED will continue to flash. If the adjustment isn't completed satisfactorily then the yellow LED will flash on its own. The cover should now be fitted and operation tests should now be carried out as described in section 2.7.

The SRA-ET has three LED's mounted underneath the unit, these are yellow, green and red and are illuminated depending on the current state of the SRA-ET. Please find below a table showing the various states of the SRA-ET and which LED's will be illuminated.

	LED 1	LED 2	LED 3
SRA-ET state	Green	Yellow	Red
Beam in set up mode	⊗	⊗	
Operating satisfactorily	⊗		
Beam in fault or calibration		⊗	
Beam in Fire	⊗ See Note 1	⊗ See Note 1	●

⊗ - LED Flashing (once every 3 secs)

● - LED illuminated

Note 1: The Green and Yellow LED may flash depending on the zone voltage in alarm.

2.7 Testing the SRA-ET

The reflector is marked with graduations between 1 and 9, which equates from 10% through to 90%. The SRA-ET can be tested by obscuring 60% of the reflector (Figure 7) with a material that is non reflective and impervious to infra red light, it will then take 11 to 16 seconds for the beam detector to go into a fire condition. A non-operation test can be carried out by obscuring 40% of the reflector (Figure 8).

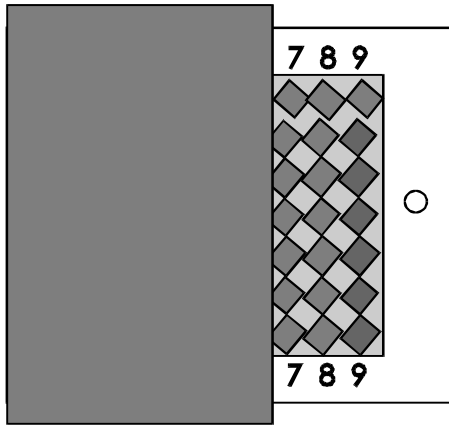


Figure 7 ~ Operation test

Note: - As shown above, up to graduation number 6 is obscured

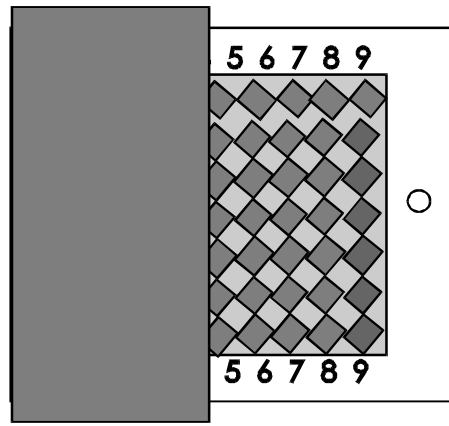


Figure 8 ~ Non-operation test

Note: - As shown above, up to graduation number 4 is obscured

3. Maintenance

3.1. General

The detector contains an automatic compensation function, which allows the detector to operate correctly even when the amount of signal reaching the SRA-ET has changed (the compensation rate is $\pm 1\%/20$ mins). This means that minor changes due to contamination and beam alignment will not affect the sensitivity of the detector. There is of course a limit that the detector can compensate for and this is -50% and $+50\%$ of the initial setting. In order to maintain proper performance the detector should be checked every six months.

3.2. Visual check

Check the condition of both the reflector and SRA-ET for physical damage or any other condition that might impair proper operation. Ensure that both the SRA-ET and reflector are still firmly secured to the wall or other fixing point.

If necessary clean the lens cover or reflector with a damp soft cloth. Washing liquid, alcohol or detergent must not be used.

3.3. Operation checks

Perform the sensitivity check function as defined in section 2.7.

3.4. Precautions for insulation resistance checking

If the wiring to a beam detector is to be tested for insulation resistance using a high voltage tester such as a "Megger", the wiring to the beam detector must be disconnected from the detector by disconnecting the white terminal connector from the PCB.

3.5. Re-initialisation after cleaning or re-adjustment

Because the beam detector contains sophisticated processing algorithms to take account of fluctuations in the beam intensity and alignment, if during routine maintenance the beam detector lenses have been cleaned or re-aligned then it will be necessary to make the detector read and store its initial value. This can be achieved by moving the set up switch to the calibration position for 10 seconds and then moving it back to the normal position.

4. Summary of the SRA-ET's functions

4.1. Alarm signal output and indicator lamp

When the beam is obscured by an amount that exceeds the sensitivity setting of the detector then a fire signal is produced lighting the red LED on the SRA-ET. It should be noted that the SRA-ET has a sophisticated processing and analysing circuit and therefore a fire will not occur immediately the obscuration exceeds the sensitivity value, but will take typically 11 to 16 seconds to produce the fire signal. The fire decision is based on an averaging technique and therefore the time to fire alarm will vary depending on the level of obscuration and the sensitivity setting.

4.2. Fault signal output and indicator lamp

4.2.1. General

The beam detector may produce a fault condition for one of many different reasons, which will depend on whether the detector has just been set up or is in normal operation, when this occurs the yellow fault LED on the SRA-ET will be illuminated and flash.

4.2.2. After adjustment/re-initialisation

The beam detector will produce a fault after or during adjustment for one of the following reasons:

- ▶ The set up switch was left in the calibrate position
- ▶ The signal strength is too high or too low.

4.2.3. During normal operation

The beam detector will produce a fault during normal operation for one of the following reasons:

- ▶ The limit of contamination has been reached. The detector is only able to compensate for contamination or alignment change up to a certain point

4.3. Indication of normal operation

When the SRA-ET has been set up correctly then the green LED mounted underneath the case will flash every 3 seconds to confirm that the detector is operating satisfactorily.

4.4. Total obscuration of the beam

If the beam detector is totally obscured, the green LED will continue flash and the red fire LED will illuminate, a fire signal will then be produced at the fire alarm panel.

4.5. Automatic compensation for change of SRA-ET's signal strength

From the time that the beam detector is initialised, the signal at the SRA-ET is checked every 20 minutes for variation and will be altered by $\pm 1\%$ back towards the original stored value. The beam detector will store the initialisation value, when the set up switch is moved from calibrate to normal.

5. Specification

Installation Environment	Indoor use only
Principle of Operation	Light beam obscuration (near infra-red)
Rated voltage	24V (nominal)
Operating voltage range	15.0 ~ 30V dc
Peak surge voltage	42V
Current in alarm	50mA
Quiescent current	350 μ A
Compensation method	1% every 20 mins. towards initial value
Compensation limits	+50% to -50% of the initial value
Fire condition	Red fire LED on SRA-ET illuminated & 470 ohm across zone
Fault condition	Yellow fire LED on SRA-ET flashes
Monitor condition	Set up condition: Both green and yellow LED's flash Normal operation: Green LED flashes
Monitor condition flash repetition time	1 per 3 seconds
Minimum time needed to reset from fire	100msec
Minimum time needed before beam can reset after fire produced	3 seconds
Operating temperature range	-10°C to 50°C
Maximum humidity	95% R.H. non-condensing
Beam length	5m to 30m
Sensitivity	30% obscuration
Size	Reflector: 190mm x 190mm x 3mm SRA-ET: 152mm x 122mm x 80mm
Weight (without termination module)	Reflector: 50g. SRA-ET: 700g
Colour	White Ivory (Black lens)
Housing material	ABS resin
Reflector material	Expanded Polyvinyl Chloride
Reflector sheet	Aluminium metallic acrylic film
Mounting	Wall mounting
Reflector mounting angle	+/- 10°
Connection method	Termination module: screw terminals
Wiring method	Termination module: 2 wires for zone
Approval Body	LPCB

6. Troubleshooting

The following conditions relate to the SRA-ET itself.

6.1. Monitor LED fails to flash

The monitor LED should flash every 3 seconds. If it does not the reason may be as follows:

- ▶ Zone voltage to the SRA-ET less than 15V
- ▶ SRA-ET is damaged
- ▶ Ensure that the SRA-ET has been powered for more than 60 seconds and that the power at the SRA-ET is greater than 15V.

6.2. Fire signal continues after reset

When a fire has occurred there may be certain circumstances that will prevent the beam detector from resetting. These are:

- ▶ There is an obstruction of the optical path between reflector and SRA-ET. Ensure there is no obstruction.
- ▶ The optical axis has been altered suddenly. The beam will need re-alignment.
- ▶ Insufficient time between fire and reset. At least 3 seconds are required before resetting the beam after the fire signal has occurred.

6.3. Fault signal cannot be reset

6.3.1. Fault only

If a fault has been generated without any obvious reason, it has occurred due to one of the following reasons:

- ▶ Contamination limit has been exceeded (light received has changed by more than 50%)
- ▶ Beam detector is defective or removed from interface PCB

6.4. Beam detector generates a fire but panel does not register the condition

- ▶ The zone is incorrectly wired to the beam detector. The wiring must be done in accordance with the relevant wiring diagram
- ▶ The control panel is incompatible with the interface PCB
- ▶ The interface PCB is defective
- ▶ The interface fault monitoring jumpers have been incorrectly set. Verify the fault monitoring function of the control panel
- ▶ Panel does not use 470 ohms to detect a fire condition

6.5. Beam detector generates a fault but panel does not register the condition

- ▶ The zone is incorrectly wired to the beam detector. The wiring must be done in accordance with the relevant wiring diagram.

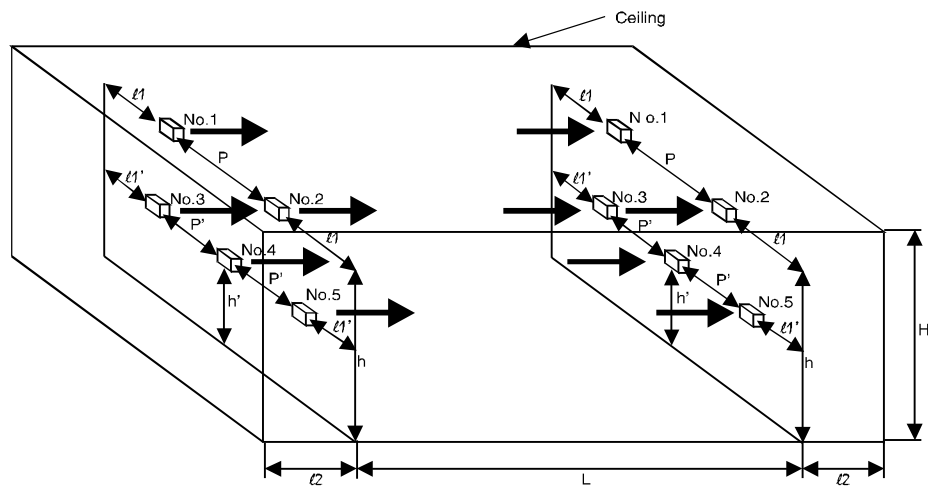
7. Installation guide lines

The Hochiki SRA-ET beam detector must be installed according to the requirements laid out in National or local standards. The following guidelines for installation are provided to give information in certain installation conditions where no advice or regulations are provided by the relevant standard.

7.1. General installation conditions

The diagram in Figure 9 relates to the typical installation condition i.e. in a long straight area and details the siting positions of the beam detector:

Figure 9 General installation conditions.



H=ceiling height

h=mounting height

l1=side wall distance

l2=back wall distance

P=distance between optical axes

L=distance between Reflector/SRA-ET

If $H \leq 15\text{m}$ then use beam detectors at locations 1 and 2

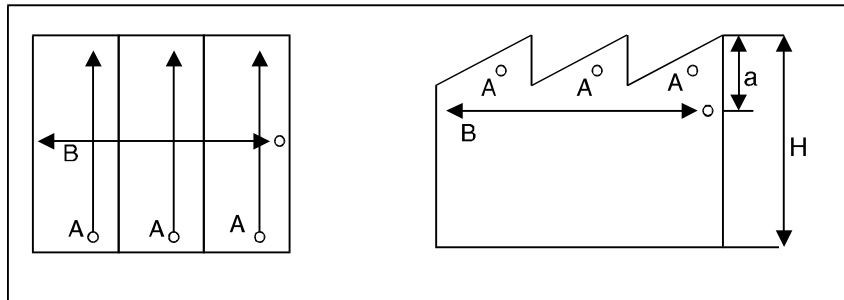
If $H > 15\text{m}$ then beam detectors should be mounted at locations 1, 2, 3, 4 and 5

For Detectors at 1 and 2	For detectors at 3, 4 and 5
$h \leq 0.8H$	$h' = H/2$
$l1 \leq 7\text{m}$	$l1 \leq 5\text{m}$
$l2 \leq 1\text{m}$	
$P \leq 14\text{m}$	$P' \leq 5\text{m}$
$L = 5\text{m to } 30\text{m}$	$L = 5\text{m to } 30\text{m}$

7.2. Installation in Saw-tooth type ceilings

In installations where there is a saw-tooth shape to the ceiling the detectors should be mounted with the axis either in condition A or condition B according to Figure 10. If the height of the ceiling 'a' is greater than 0.2'H' do not install with the axis according to line B.

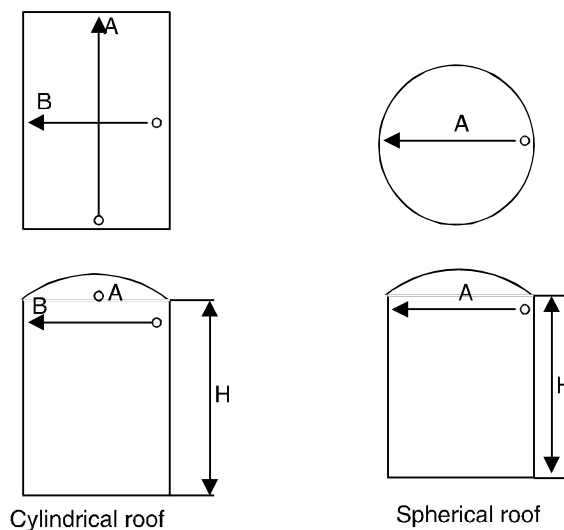
Figure 10 Installation in saw-tooth shaped roofs



7.3. Installation in circular type ceilings

The installation in a cylindrical or circular roofed building should be in accordance with Figure 11. In the case of the cylindrical roof position A or B for the detector's axis is acceptable.

Figure 11 Installation in circular shaped ceilings



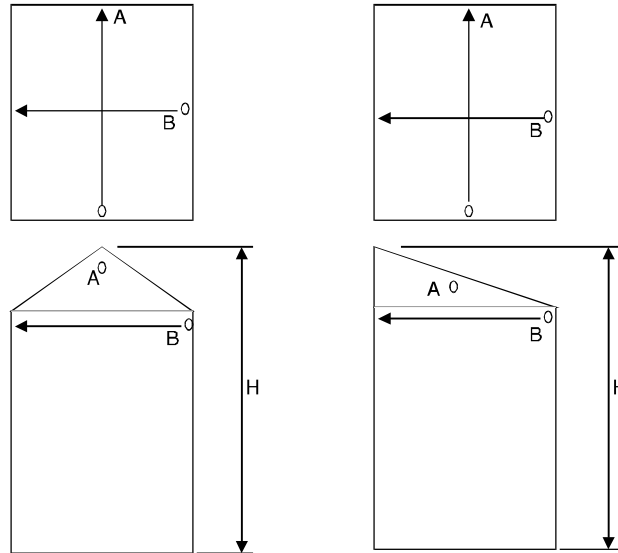
Cylindrical roof

Spherical roof

7.4. Installation in sloped ceilings

The installation for a sloped type roof or ceiling will be as shown in Figure 12. Either position A or B is acceptable for installation of the SRA-ET.

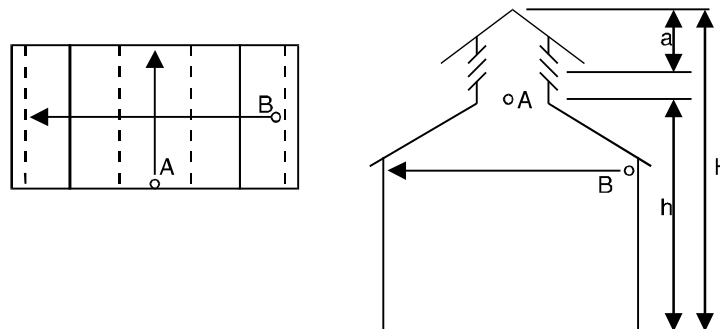
Figure 12 Installation under a sloped ceiling



7.5. Installation in a monitor roof

The installation for a monitor roof should be performed as in Figure 13. The detector's installation height should be 0.8H or higher. If there is ventilation in the top part of the roof then the detector must be placed below the opening. The detector should be installed in accordance with the following height restriction:

Figure 13 Installation in a monitor roof



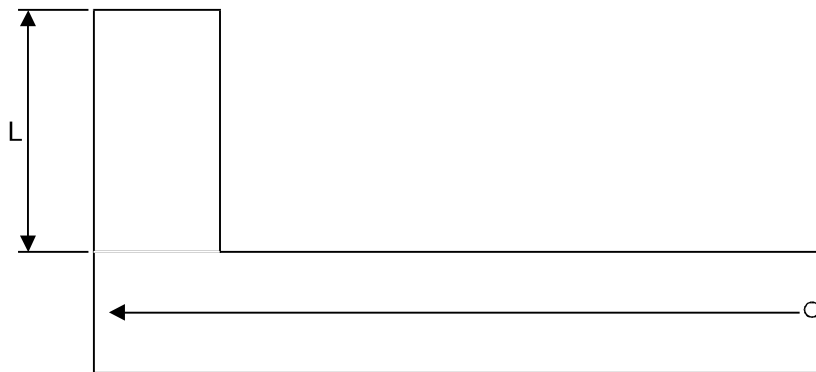
$$H - a > h \geq 0.8H$$

7.6. Installation in corridors or aisles

7.6.1. Closed corridor

When the detector is installed in a corridor with a closed corner it is possible to use just one detector as shown in Figure 14 providing that the distance L is less than 7.5m.

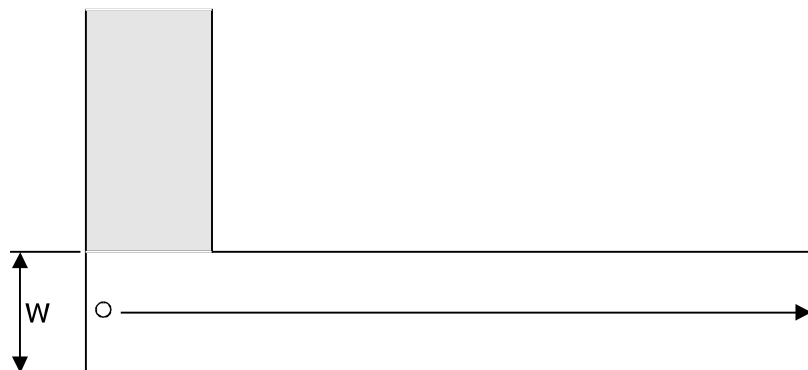
Figure 14 Installation in a closed corridor



7.6.2. Corridor with open adjoining aisle

When the detector is installed in a corridor with an area adjoining which is open as shown in Figure 15, it is necessary to consider the adjoining area as a separate detection area.

Figure 15 Installation in an open corridor



7.6.3. Corridor with corners

When the detector is installed in a corridor with a bend and an aisle as shown in Figure 16 it will be necessary to use at least 2 beam detectors to cover the corridors. If the distance P is greater than 15m then another beam detector will need to be installed at point C.

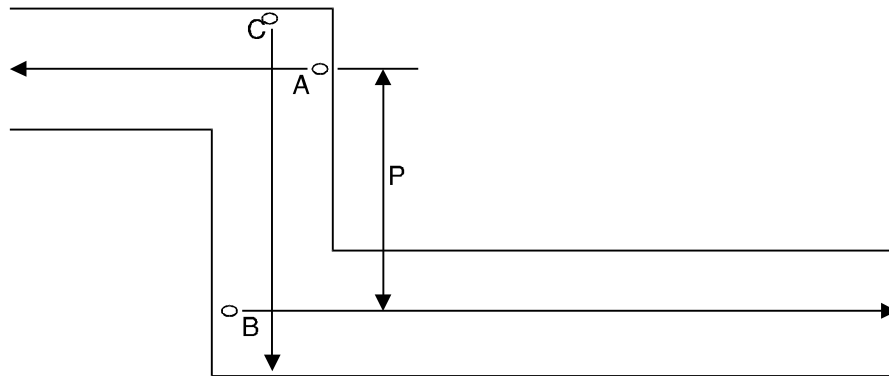


Figure 16 Installation in a corridor with corners

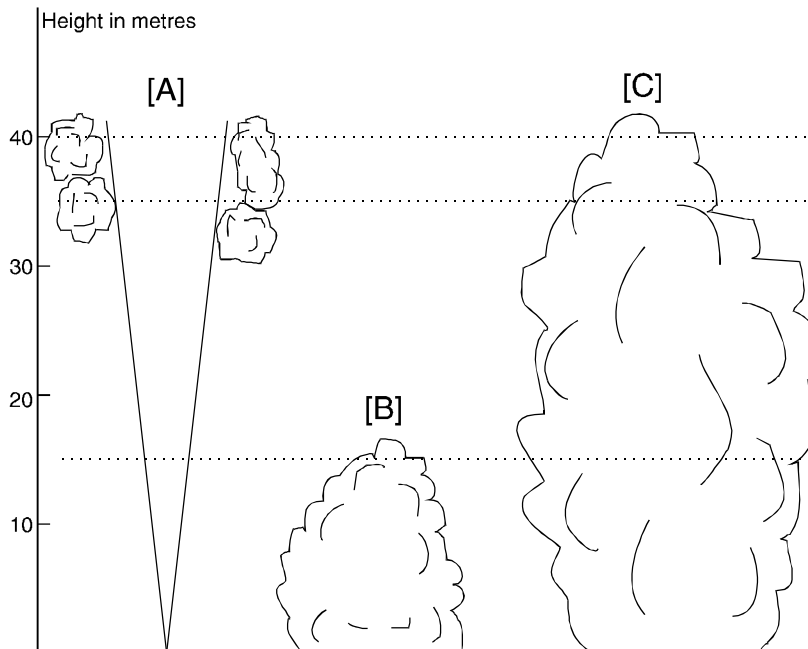
7.7. Installation precautions

The following precautions are necessary when installing beam detectors: -

- ▶ In a room where an air inlet is positioned in the ceiling the beam detector should be placed near to the air inlet.
- ▶ Select an appropriate installation place where the detector is unaffected by air being drawn into a ventilated opening.
- ▶ The distance between the SRA-ET and the wall immediately behind the SRA-ET should be less than 7.5m.
- ▶ If more than one detector is installed they must be positioned in such a manner that they cannot affect each other's operation.
- ▶ The detector should be positioned such that a shutter or hanging wall will not affect it.
- ▶ The detector should be positioned such that it will be unaffected by moving objects.
- ▶ The detector should not be installed in a rooftop or place where open air circulates.
- ▶ The detector should be installed where the distance between top and bottom of the space is greater than 0.5m.
- ▶ The monitoring distance between the reflector and SRA-ET is 5m to 30m and the maximum distance of coverage between the line of the beam is 7.5m.
- ▶ If there is a probability of people walking in the area of the beam then the beam detector should be installed at least 2.7m from the floor.
- ▶ The beam detector should not be installed at a height greater than 25m unless the fire detection system is connected directly to the fire brigade or via a central station and rapid

attendance by the fire brigade is possible. In any case the maximum installation height is 40m.

7.8. Smoke patterns appropriate to the consideration of beam detector installation



[A] This pattern is produced by hotter burning fires and is very narrow at ground level. Therefore it may be easier to detect at a higher level or at the ceiling

[B] This type of smoke produced by a smouldering fire will not rise above 15m and therefore to cover this type of risk it is necessary to install the detector below 15m

[C] This smoke pattern will be detected by detectors installed at any height

Figure 17 Typical smoke patterns



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