

*PROJECTED TYPE BEAM DETECTOR*

MODEL AL-SPB-24

INSTALLATION INSTRUCTION

REVISED  
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## 1. OVERVIEW

### 1.1. GENERAL DESCRIPTION :

The photoelectric beam detector consists of an Emitter and a Receiver which face each other at a distance of between 32.8 to 328 feet (10 to 100 meters). In the event of a fire, the smoke generated will decrease the amount of near infrared beams on the Receiver. This decrease is electronically interpreted to identify the occurrence of a 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 switch selectable in 3 settings of 25%, 50%, and 70%/span beam obscuration.

### 1.2. PRINCIPLE :

A near infra-red pulsed beam generated by the Emitter is sensed by the photo diode of the Receiver where it is converted into an electrical signal.

This signal is then amplified and applied, via an A to 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.

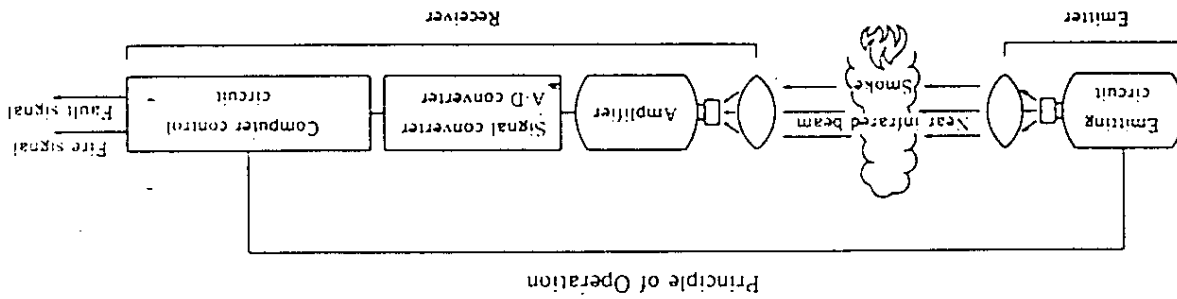
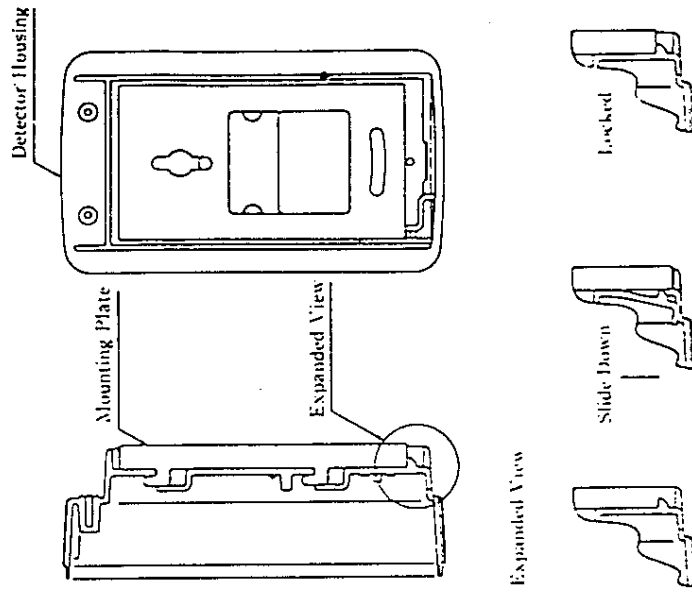
When there is a difference between actual beam strength and stored reference data that indicates the occurrence of a fire, then a fire signal is produced. A trouble signal is generated if the axis of the beam signal is completely obstructed (as opposed to partially obscured by smoke).

The microprocessor also provides compensation for a change in the received signal value caused by contamination of the optics. Since a change occurs with time, a slow change in the beam signal takes place. The microprocessor compensates in such a manner that the signal moves closer to the reference data at a rate of approximately 1% per hour. When the limit of compensation is reached, the microprocessor automatically generates a trouble signal.

## 2. MOUNTING THE SPIB-24

Select a suitable position for the installation of the Emitter and Receiver so there are no visible obstructions between them. There SHOULD always be a clear line of sight between the Emitter and Receiver. The location should also be chosen where no moving objects will obscure the beam.

Screw the detector mounting plate firm to the wall or other suitable mounting point. Hook the back of the detector body to the 4 prongs of the mounting plate and slide it down firmly to fix. The detector body should lock into place by the locking mechanism on the bottom corner of the backside of the detector body. Open the detector cover (see Section 4) and place the locking screw as shown.



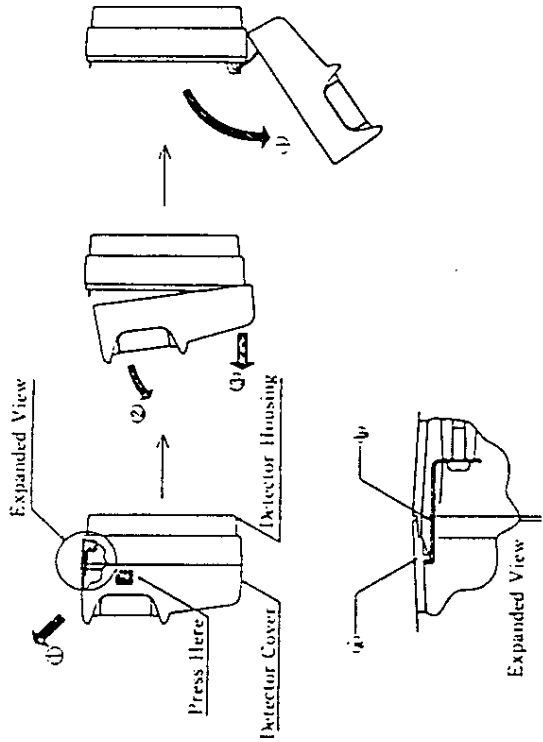
### 3. REMOVING THE SPB-24

Open the detector cover (see Section 4) and remove the locking screw from the detector housing. The detector can be removed from the mounting plate by pressing the locking mechanism located on the bottom, left-hand side of the detector housing. Looking at the detector housing from the back, use a narrow rod or screw driver to push the locking mechanism in. Pull the detector upwards until it disengages from the mounting plate.

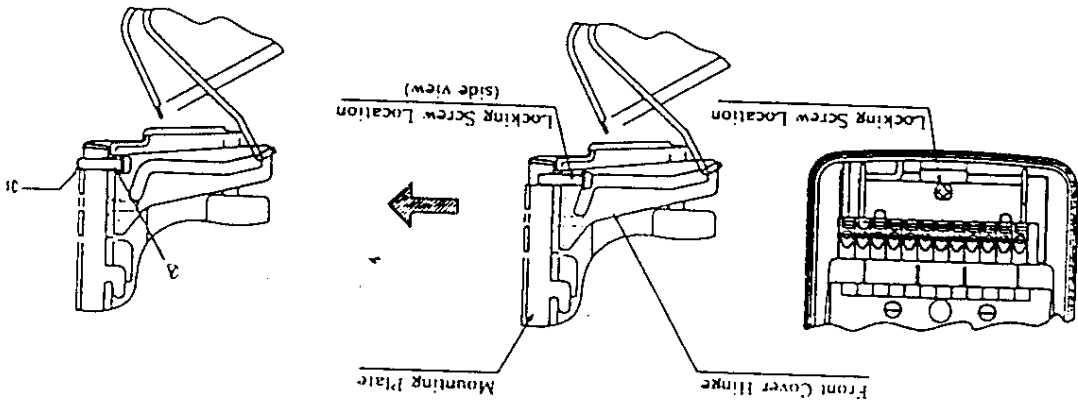
### 4. OPENING THE SPB-24 COVER

Hold the cover between the thumb and fingers near the top of the cover (positioning close to where the cover meets the detector housing). Press the detector firmly on both sides. The top of the cover should expand slightly so it can be pulled away from the detector housing. This should be done while pulling away at an upward 45° angle. Now, hold the cover firmly at the bottom and carefully pull away from the detector housing until a click is heard. The cover will now drop down. Rest the cover on the retaining clips allowing access to the inside of the detector housing.

This procedure pertains to both Emitter and Receiver.

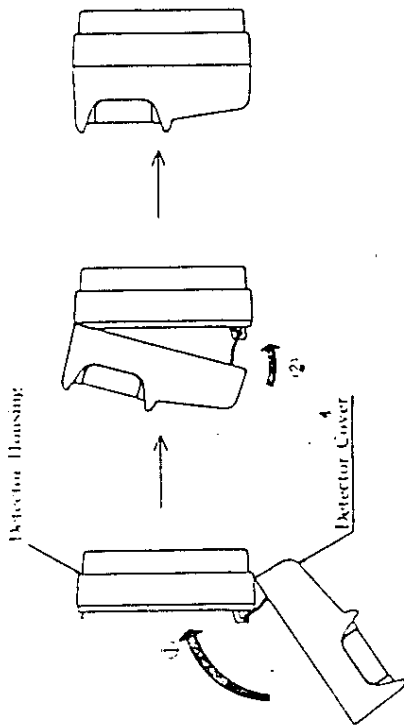


- Ⓐ After mounting the detector to the mounting plate, install the locking screw
- Ⓑ Prevents removal of the detector from the mounting plate



### 5. CLOSING THE SPB COVER

Move the cover upwards so the top of the cover engages with the top of the detector housing. Hook the top of the cover over the metal clip protruding out from the top of the detector housing. Pull down the top of the cover ensuring it is flush with the detector housing top. Push the cover at the bottom firmly toward the detector housing until it locks back into place.



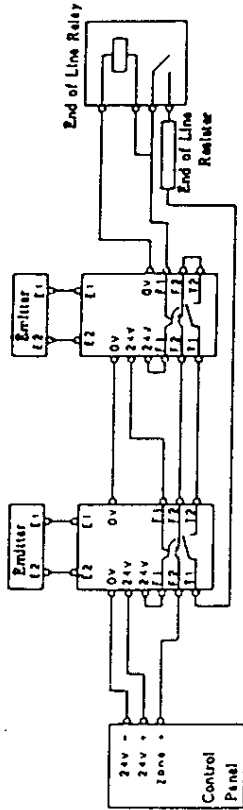
### 6. WIRING THE SPB-24

The beam detector consists of two parts: the Emitter and the Receiver. The Emitter is connected by a pair of wires to the Receiver. These two wires provide power and a synchronized signal. This enables the Emitter to transmit a light beam in sync with the Receiver. This synchronization ensures that the Receiver is looking for a signal from the Emitter at a precise time period which increases the reliability of the signal.

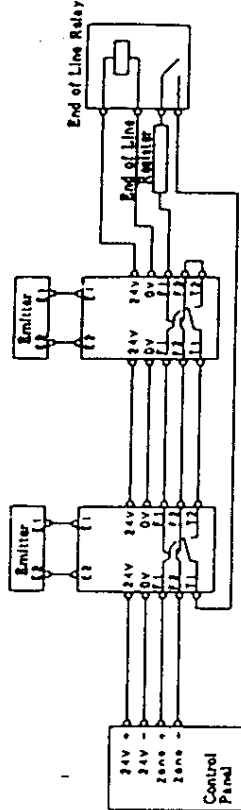
The SPB-24 can be wired using either a 3 or 4 wire configuration. If more than 1 SPB-24 is to be connected in any zone, refer to the appropriate wiring diagram to ensure proper wire supervision. The Receiver connections are:

- E1, E2 ..... Emitter power and control terminals
- 24V, 0V ..... Receiver power supply terminals at 24VDC
- F1, F2 ..... fire output contacts that are normally open relay contacts
- T1, T2 ..... trouble output contacts that are normally closed relay contacts

### 6.1 THREE CONNECTION TO THE CONTROL PANEL :

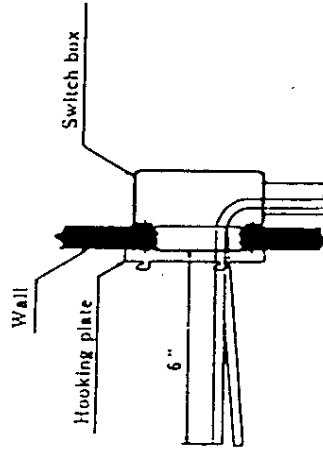


### 6.2 FOUR WIRE CONNECTION TO THE CONTROL PANEL :

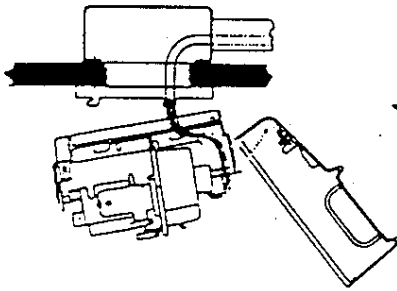


### 6.3 SPB WIRING METHOD :

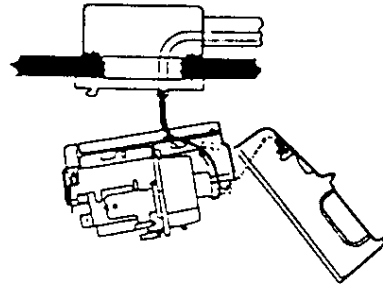
Pull the cable out about 6 inches from the wall and strip 5 inches of the outer insulation jacket.



Push cable wires through the hole in the back side of the SPB-24. Open the detector cover and connect the wires to the terminals on the terminal block inside the detector.

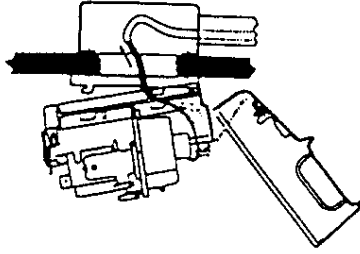


After wiring, pull the cable tight to take up the slack. Push any excess wire lengths toward the back of the detector. Be careful not to catch the wires on the detector cover.



Finally, push any excess wire lengths into the electrical box and mount the detector onto the mounting plates.

The SPB-24 will accept wire sizes ranging from 14 to 20AWG.



NOTE: REFER TO NEC 760 FOR PROPER WIRE GAUGE INFORMATION

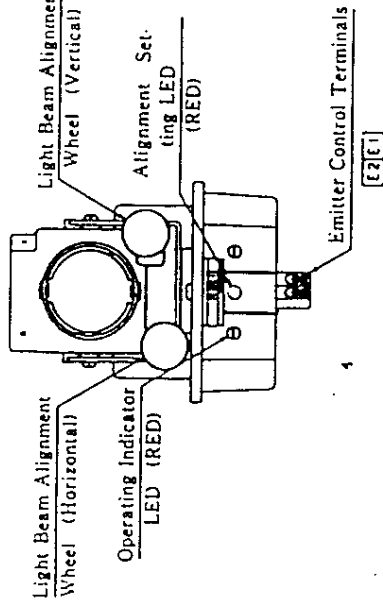
WARNING:

*If the wiring to a SPB-24 is to be tested for insulation resistance using a high voltage tester such as a megger, WIRING TO THE SPB-24 MUST BE DISCONNECTED. Otherwise, permanent damage to the detector may result.*

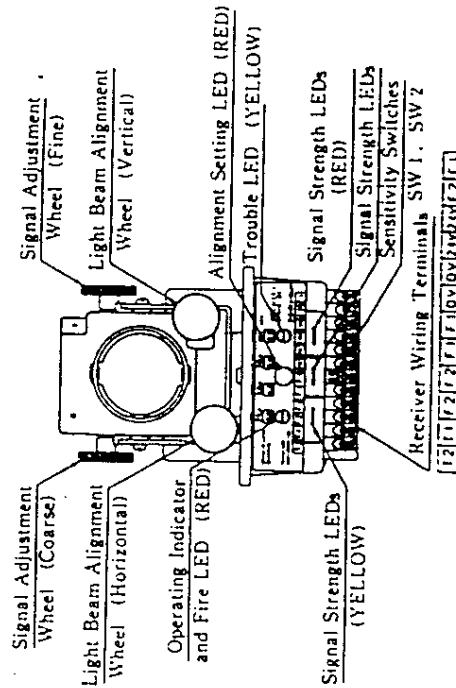
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## 7. TERMINAL LAYOUT AND PART DESIGNATION

### 7.1 EMITTER :



### 7.2 RECEIVER :



## 8. ADJUSTMENT PROCEDURE

The adjustment procedure is carried out by first using the sight holes and alignment adjustment wheels. Following this, the signal strength is adjusted by using the signal adjustment wheels and signal strength LEDs.

### 8.1 ALIGNMENT USING SIGHT HOLES :

Open the covers of the Emitter and Receiver as previously described. On the Receiver confirm that both sensitivity setting switches SW 1 and SW 2 are set to "OFF" (sensitivity off). Power up both units and wait two minutes for the SPB-24 to stabilize. Once stabilized, the red operation LED will flash in sync with the red alignment setting LED once every second. On the Receiver, one of the 6 small LEDs located between the terminals and the normal monitor LEDs will be flashing. The LED flashing will indicate the amount of light reaching the Receiver. Turn the alignment adjustment wheels located on the Emitter. Look through the sight hole on the Emitter until the Receiver can be seen in the center of the sight hole.

**NOTE:** When installing the units in a dimly lit area it may be difficult to see the Receiver and Emitter. Alignment can be accomplished by turning the adjustment wheels until the alignment setting LED is in the center of the sight hole.

Close the cover of the Emitter and repeat the procedure for the Receiver.

### 8.2 SIGNAL STRENGTH ADJUSTMENT :

First, turn the adjustment wheel (coarse adjustment) until the further most right hand side red signal strength LED is flashing. This indicates that the signal will be at maximum. The two yellow LEDs indicate that the signal strength is too small and the two red LEDs indicate the signal is too large. When either of the green LEDs flash, the signal strength is within the correct range.

Adjust either of the signal adjustment wheels until one of the green signal strength LEDs flash. If it is not possible to adjust either wheel to cause one of the green LEDs to flash, it will be necessary to recheck the optical alignment.

## 10. SPB-24 MAINTENANCE PROCEDURE

### 10.1 GENERAL :

The SPB-24 contains an automatic compensation function which allows the detector to operate correctly when the amount of signal reaching the Receiver has changed (up to 1%/hour). Minor changes due to contamination and beam alignment will not effect the sensitivity of the detector. To maintain optimum performance, the SPB-24 should be checked every six months.

### 10.2 VISUAL CHECK :

Check the condition of both the Emitter and Receiver for any visible damage or any other condition which may impair proper operation. If necessary, clean the lens cover with a soft, damp cloth.

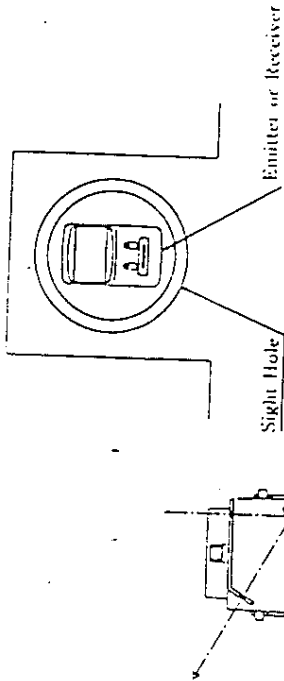
### 10.3 OPERATION CHECK :

#### 10.3.1 OPERATION CHECK :

The red alarm LED should light and an alarm signal should be transmitted to the control panel within 30 seconds after placing the appropriate filter in the path of the Emitter and Receiver beam. The choice of filter depends on the sensitivity setting selected for the SPB-24. Refer to the test filter usage table in Section 10.3.2.

#### 10.3.2 NON-OPERATION CHECK :

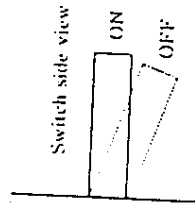
The SPB-24 should not operate within 30 seconds after placing the appropriate filter in the path of the Emitter and Receiver beam. The choice of filter depends on the sensitivity setting selected for the SPB-24. Refer to the table below:



## 9. SETTING THE SENSITIVITY

Set the sensitivity to the correct value using switches SW 1 and SW 2. The sensitivity settings for the positions SW 1 and SW 2 are shown below together with a side view of the positions of OFF and ON for these switches.

SW 1	SW 2 POSITION	PERCENTAGE OBSCURATION
OFF	OFF	—
ON	OFF	25%
OFF	ON	50%
ON	ON	70%



After setting the sensitivity, close the cover of the Receiver. The initial values of the detector setting will be stored within 10 seconds.

With the cover closed, confirm that the flash interval of the operation LED is approximately once every 3 seconds. If the flash rate is still 1 second, then the detector has not been properly initialized. In this instance, the detector will not move to the supervisory status and will not be functioning correctly. Repeat the alignment and signal strength adjustments until the condition is corrected.



Sensitivity Setting	Type of Test	Filter Value	Filter Number	
			TSK B100	SPB 24
25%	Operation	40%	No. 1	00
	Non-Operation	15%	No. 2	00
50%	Operation	65%	No. 5	00
	Non-Operation	40%	No. 1	00
70%	Operation	85%	No. 6	00
	Non-Operation	40%	No. 4	00

NOTE: Two test filter kits are available for the testing of the SPB-24. The filter numbers correspond to the filters provided in the TSK B100 filter kit. The letters in parenthesis (A,B,C,D) refer to the SPB-24 Sensitivity Test Filter. Refer to the instruction manual for these test filter kits before testing the SPB-24 Projected Beam Smoke Detector.

## 11. SUMMARY OF SPB-24 FUNCTIONS

### 11.1 ALARM SIGNAL OUTPUT AND INDICATOR LAMP :

When the beam is obscured by an amount that exceeds the preset sensitivity level, an alarm signal is produced and a red LED lights on the Receiver.

### 11.2 TROUBLE SIGNAL OUTPUT AND INDICATOR LAMP :

If the light beam is adjusted and the cover closed without setting the sensitivity setting on the SPB 24 a trouble signal will occur. The trouble output will be sent to the control and indicating equipment. The yellow LED on the Receiver will illuminate.

If the light beam is adjusted, the sensitivity is set, and the cover is closed, but the

light level is outside the allowed range (green signal strength LED is not on) then a trouble signal will occur. The trouble output will be sent to the control and indicating equipment and the yellow LED on the receiver will illuminate.

### 11.2.2 DURING NORMAL OPERATION :

If the light beam is adjusted and the sensitivity is set but the cover is not closed within approximately 5 minutes then a trouble signal will be indicated. The output trouble signal will be indicated. The trouble output will be sent to the control and indicating equipment. The yellow LED on the Receiver will illuminate.

When the amount of light received drops by 90% or more within a short period of time (quicker than the compensation rate) a trouble signal will be indicated. The trouble output will be sent to the control and indicating equipment. The yellow LED on the Receiver will illuminate.

If the Receiver is no longer able to compensate for a variation of the signal strength from the original set value a trouble signal will occur. The trouble output will be sent to the control and indicating equipment. The yellow LED on the Receiver will illuminate.

### 11.3 INDICATION OF NORMAL OPERATION :

The red indicator LEDs on both the Receiver and Emitter will flash every three seconds.

### 11.4 SENSITIVITY SETTING :

According to the required sensitivity, either as specified within a relevant national standard or specified by Hochiki America, the sensitivity must be set using SW 1 and SW 2 (Receiver) according to the distance between the Receiver and Emitter (See Section 13 for guidance).

### 11.5 AUTOMATIC COMPENSATION FOR CHANGE OF RECEIVER SIGNAL STRENGTH :

From the time the SPB-24 is initially powered-up, the signal at the Receiver is checked continuously for variation and will be altered by an amount of  $\pm 1\%$  of the initial signal value every hour. The maximum compensation will be at  $\pm 50\%$  of the initial signal value.

## 12. SPECIFICATION SHEET

### SPECIFICATION FOR SPB-24 PROJECTED BEAM DETECTOR

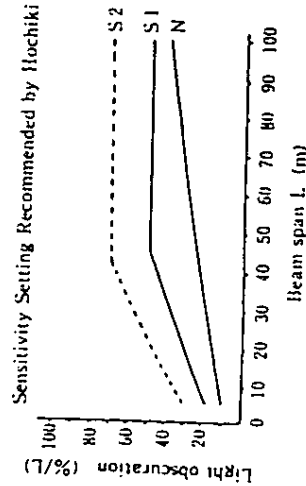
Installation Environment	Indoor use only
Principle of Operation	Light beam obscuration (near infrared)
Rated Voltage	24 VDC
Operation Voltage Range	15.0 to 33.0 VDC, Peak 42 VDC
Rated Current	20mA alarm
Supervisory Current	250 $\mu$ A (average)
Operating Temperature Range	14°F to 122°F (non-condensing)
Coverage	32.8' to 328' (10 to 100m)
Sensitivity	25%, 50%, 70%/span
Allowable-Line Resistance	500
Detector Components	Receiver Unit, Emitter Unit
Size	3.4"W x 4.0"D x 5.7"H
Color	White ivory
Housing	ACS resin
Output Contacts	Alarm signal (N/O, dry contact) Trouble signal (N/C, dry contact)
Mounting	Wall mount
Wiring	Terminal connection
Wiring Style	3 or 4 wire configuration
Wiring between Emitter and Receiver	2 wire, non-polarized

NOTE: The number of detectors connected is dependent upon the capacity of the control panel.

## 13. APPENDIX: INSTALLATION

### 13.1 SENSITIVITY SELECTION :

If requirements or standards are provided for the sensitivity of the photoelectric beam detector and a test filter, the selection of a sensitivity and its test should be performed in accordance with them. Otherwise, set the sensitivity select switch so that the sensitivity falls within the sensitivity setting range recommended by the manufacturer in accordance with the monitoring distance and ceiling height.



Ceiling Height	Recommended Sensitivity (Light Obscuration Percentage)
Less than 4.8m	Range between S1 and N
4.8m-18.3m	Range between S2 and N

### 13.2 INSTALLATION GUIDELINES :

If requirements or standards are provided for the installation of the photoelectric beam detector, it's installation should be performed in accordance with them. Otherwise, install the SPB-24 in accordance with the manufacturer's recommended installation procedure.

#### 13.2.1 LOCATION :

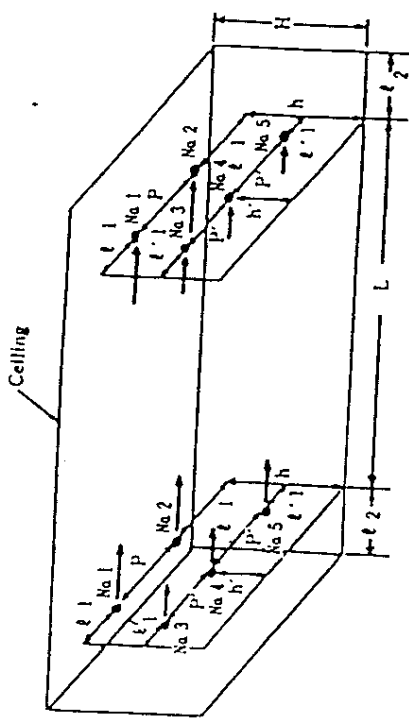
Do not install the detector in the following locations:

- (\*) The ceiling height is above 60' (see manufacturer for special applications).

- (b) A rooftop or a place where open air circulates, because the SPB-24 will not perform correctly in these conditions.
- (c) A space where the distance between the top and the bottom is below 1.6'.
- (d) Locations where large amounts of dust, fine powders, or water vapor is present.
- (e) A place (such as a kitchen) where smoke normally occurs.
- (f) Locations exposed to extreme temperatures.
- (g) Locations where adequate maintenance cannot be performed.
- (h) Locations which may be exposed to sunshine exceeding 5000 Lux.

**13.2.2 INSTALLATION PROCEDURE :**

Refer to following drawing:



Legend : H = Ceiling height  
 h = mounting height  
 l 1 = side wall distance  
 l 2 = back wall distance  
 P = distance between optical axes  
 L = distance between Emitter/Receiver

H11 ≤ 26 feet : use No.1 and No.2 locations (see drawing above)  
 H11 = 26-60 feet : Consider locations No.3, 4 and 5 when possible

No.1 and No.2  
 h = 0.811  
 l 1 = 23ft  
 l 2 = 11.5ft  
 P = 5.46ft  
 L = 32.8 - 328ft

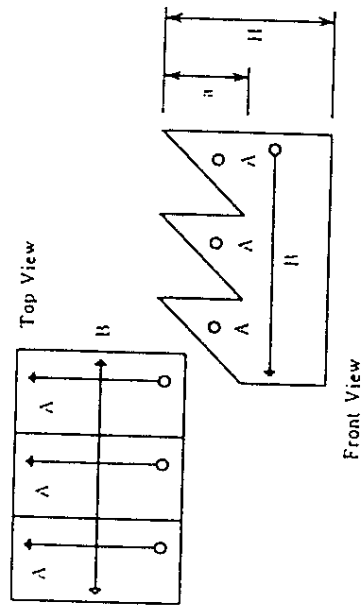
No.3, 4 and No.5  
 h' = H / 2  
 l 1 ≤ 16.4ft  
 l 2 ≤ 32.8ft

### 13.3 PRECAUTIONS :

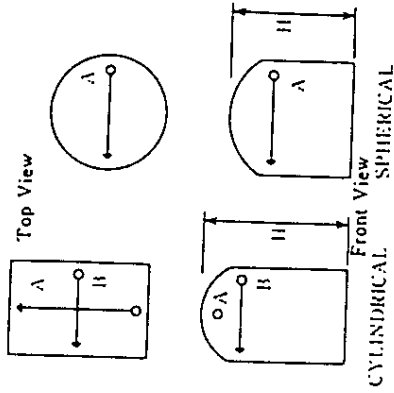
- (a) In a room where an air inlet is installed around the ceiling, place the SPB-24 near the inlet.
- (b) Select an appropriate installation place where the SPB-24 is not affected by air being drawn into a ventilated opening.
- (c) The distance between the receiving side and wall side of the detector shall be less than 11.5'.
- (d) If more than one beam detector is installed, they shall not affect each other.
- (e) The area outside the width of an open-type corridor or aisle shall be considered as another detection area.
- (f) The beam detector function shall not be affected by a shutter or hanging wall.
- (g) The monitoring distance of one set of SPB-24 shall be 32.8' to 328'.

### 13.4 INSTALLATION EXAMPLES :

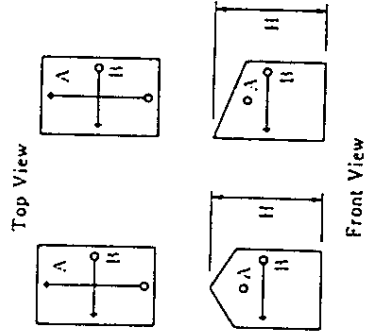
- (a) For a special ceiling: Installation in a sawtooth-like ceiling shall be installed per Line A or B. If the height of the Saw Tooth (a) is beyond 0.2H do not install per Line B.



- (b) For a circular (cylindrical, spherical) ceiling: Installation for a circular ceiling shall be installed per Line A or B.

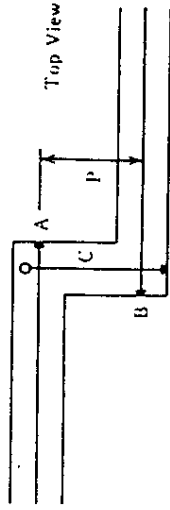


- (c) For a sloped ceiling: Installation for a sloped ceiling shall be installed per Line A or B.



- (d) For a monitor roof: Installation for a monitor roof shall be installed per Line A or B. The detector installation height shall be 0.8H or more, but if a ventilation opening is provided in the monitor roof, the beam detector shall be placed below the opening.

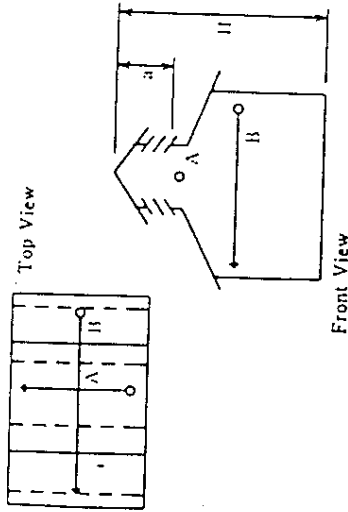
below, the detector (C) or other spot type detector shall be installed.



13.5 SMOKE PATTERNS :

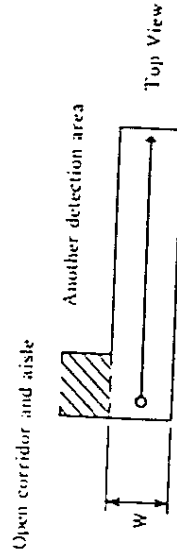
(1) Corridors and Aisles:

(1) When the beam detector is installed in a corridor with no thoroughfare and an aisle, the L distance shall be 23' or less as shown in the figure.



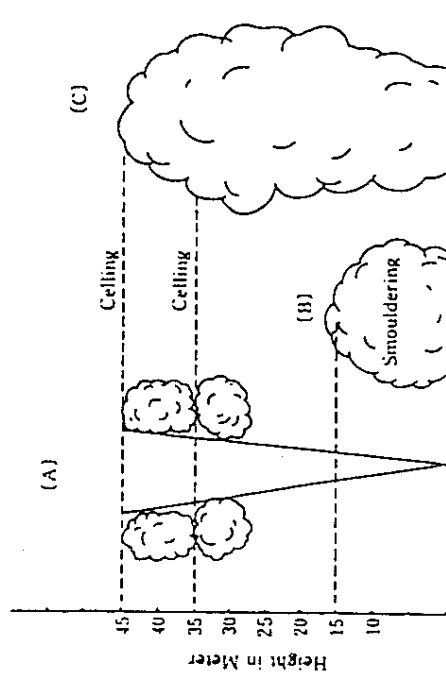
(2) For an Open Corridor and Aisle:

When the beam detector is installed in an open corridor and aisle, the area outside the width (W) of the corridor shall be treated as separate.



(3) For a Corridor with a Bend and an Aisle:

When the beam detector is installed in a corridor with a bend and an aisle, if the beam pitch (P) is 46" or more as shown in the table



- (a) This pattern is very narrow at ground level and may be easier to detect on high levels or ceilings.
- (b) This type of smoke will not rise above the 15 meters very easily.
- (c) This smoke pattern will be detected by both levels of detectors