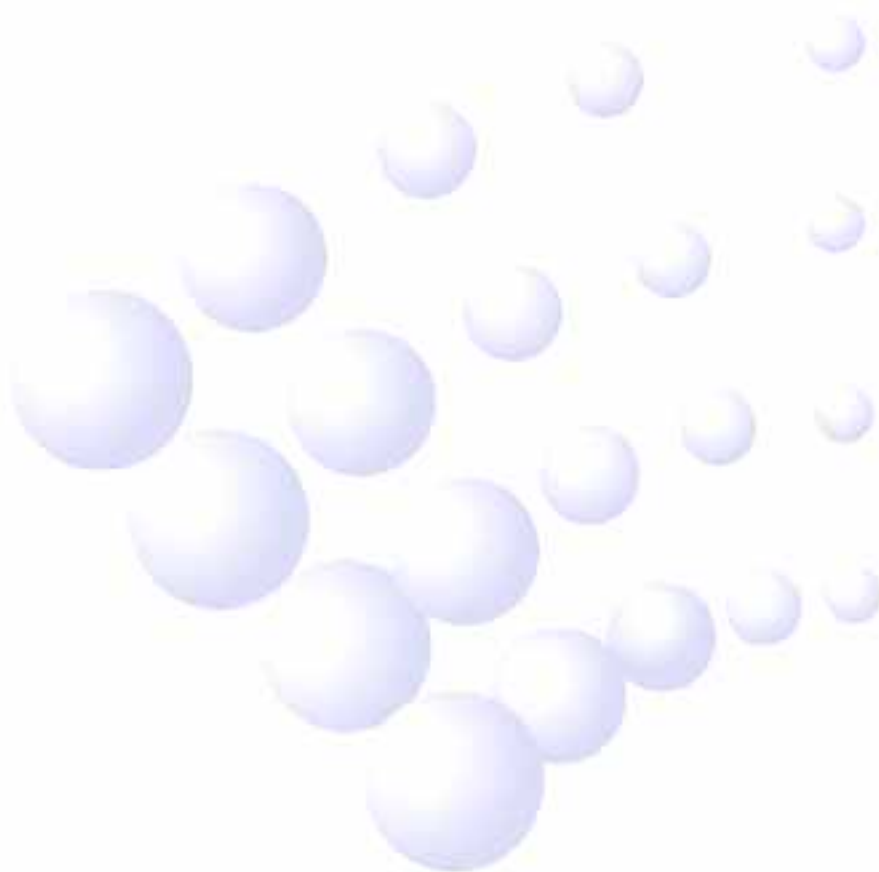


C-9105R
Conventional Reflective Beam Detector
Installation and Operation Manual
(Issue 2.01, February 2006)



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I General

C-9105R Conventional Reflective Beam Detector (hereinafter called the detector) is a non-addressable reflective infrared beam smoke detector, which must be used together with a reflector. The number of reflector(s) to be used (one or four) depends on the distance from the detector.

With excellent built-in microprocessor, the detector has strong ability of analysis and judgment. The detector can automatically carry out system adjustment, compensation of variation of ambient data, and judgment of fire and fault through fixed algorithm, and indicate these states by LED and signal output terminals. With new and reasonable design, attractive appearance, flexible adjustment and alignment method it's easy to install and adjust. The sensitivity of the detector can be set through hand held programmer in field, decreasing the demand for cleanliness of field conditions, and enlarging application areas. The detector is applicable to historical buildings, warehouses, large storages, shopping malls, leisure centers, exhibition halls, hotel lobbies, printing houses, clothing factories, museums and prisons etc, as well as places where slight smoke particles exist.

II Features

- (1) Wide operating voltage range, big monitoring areas.
- (2) Combination of the emitting and receiving part makes mounting easy and optical pathway accurate.
- (3) Built-in microprocessor enables intelligent judgment of fire alarm and fault.
- (4) The detector can calibrate automatically, which ensures that one person complete adjustment in short time. It's also convenient to operate.
- (5) Self-diagnosis function can monitor the inner fault.
- (6) Automatic compensation for factors weakening received signals, such as dust contamination, positional excursion and ageing transmitter.
- (7) It has passive output contacts for fire alarm and fault.
- (8) Two sensitivity levels can be set in field.
- (9) The detector's optical pathway is designed with strong anti-interference ability.
- (10) SMT processing technology.
- (11) Attractive and decent appearance.

III Technical Specifications

- (1) Power Voltage: 15VDC ~ 28VDC
- (2) Power Current: Commission current 20mA
Standby current 12mA
Alarm current 22mA
- (3) Fire Alarm and Fault Contact Output:
Fire Alarm Relay: Contact capacity 28V/2A, which is normally open in normal state

and closed in fire alarm state.

Fault Relay: Contact capacity 28V/2A, which is normally open in normal state and closed in fault state.

- (4) Angle of Adjusting: $-6^{\circ} \sim +6^{\circ}$
- (5) Dependency Angle of Optical Pathway Orientation: $\pm 0.5^{\circ}$
- (6) Sensitivity Level:
 - Level 1: High sensitivity.
 - Level 2: Medium sensitivity.
- (7) Indication of Detector State:

Commission: Green LED and Yellow LED are lit or flash in a certain way. See details in Section VI *Commission*.

Normal monitoring state: Red LED flashes periodically.

Fire: Red LED constantly illuminates, and Yellow LED turns off. Fire alarm should be cleared through powering up again.

Fault: Yellow LED constantly illuminates. The detector clears the fault signal automatically if the condition causing the fault disappears.

Optical pathway obscured totally: the detector first gives fault signal and turns on Yellow LED. 20s later, it alarms fire, illuminates Red LED and turns off Yellow LED. **Note: In this case, it does not mean there is a fire. After the obscuration is removed, the detector clears fault signal automatically. Fire signal has to be cleared by powering up the detector again.**
- (8) Operating Environment:

Temperature: $-10^{\circ}\text{C} \sim +50^{\circ}\text{C}$
Relative Humidity 95%, non condensing
- (9) Monitoring Area: Maximum monitoring area: $14 \times 100 = 1400\text{m}^2$
Maximum width: 14m
- (10) Length of Optical Pathway: 8m ~ 100m
- (11) Protection Level:

Under common environment, ingress protection rating is IP20.
Under special environment, ingress protection rating is IP66 through glue-seal treatment.
- (12) Dimension: length: 206mm width: 95mm thickness: 95mm
- (13) Material and Color of Enclosure: ABS, gray
- (14) Weight: 450g
- (15) Mounting Hole Spacing: Spacing for embedding: 158mm
Spacings for surface mounting: 79mm x 96mm

IV Structure and Operation Principle

- (1) Appearance of the detector is shown in Fig. 1.



Fig. 1 Appearance

(2) Internal devices of the detector and positions to be glued are shown in Fig. 2.

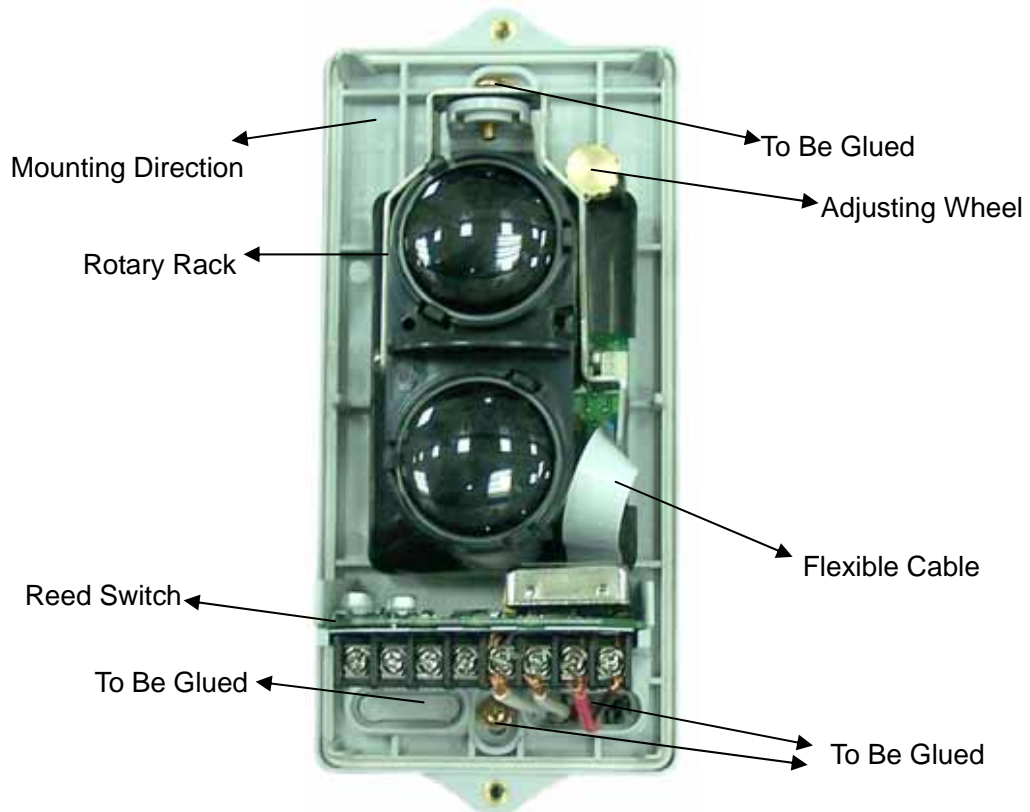


Fig. 2 Internal Devices and Positions to Be Glued

(3) Operation Principle

The detector and reflector are placed oppositely. The detector includes emitting part and receiving part. Infrared beam of certain intensity sent out from the emitting part is reflected by the right-angle prisms of the reflector, and then received by the receiving part of the detector. The receiving part simultaneously collects and amplifies the returned infrared beam, analyzes and judges the collected signals through its microprocessor. When the detector is in normal monitoring state, the intensity of infrared beam received by the receiving part is steady at a certain level. When smoke particles enter the detecting area, the intensity of infrared light received by the receiving part falls owing to light scattering. When the smoke particles reach a certain density, and the intensity of infrared light received by the receiving part is reduced below the preset threshold value, the detector alarms fire, illuminates Red LED, and closes passive fire output contact. Operation principle is shown in Fig. 3.

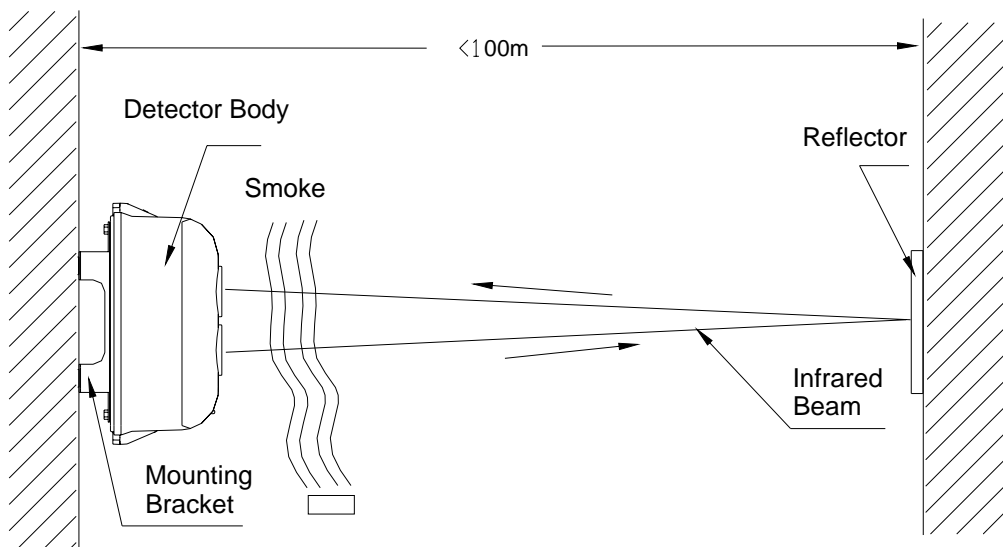


Fig. 3 Operation Principle

V Mounting and Wiring

(1) Ambient Conditions for Installation

The detector works on light obscuration principle. Avoid any fixed or moving obscuration in its optical pathway when installing.

The wall for mounting either the detector or the reflector should be firm and smooth. The detector is mounted vertical to the wall. The wall may seem to be smooth, but corrugated or uneven, or may be changed by the environment (in rainy season or in winter) and the installer should ensure the detector not affected by these factors. If the detector is installed on sustaining rack similar to metal tube, make sure the sustaining rack fixed firmly.

Not Fit for Locations where:

- Space height is over 40m.
- It is not roofed.

- Space height is less than 1.5m.
- There are a lot of dust, powder or vapor.
- It is clean normally, but can be dusty in some special cases.
- Where temperature is high. **Note: Temperature at top part of a workshop with transparent roof may be over 50 when there is sunshine.**
- There is no access to maintenance.
- The mounting wall or fitting is greatly affected by mechanical vibration.
- There are fixed or moving objects within 1m from the detector's optical pathway.
- There is strong magnetic field.

(2) Mounting Height and Position

The mounting height of the detector and reflector should be most accessible by smoke into beam zone. The following recommendations are for reference.

- a) When space height is not over 5m, the detector and reflector should be mounted on the two facing walls 0.5m from the ceiling, see Fig. 4.

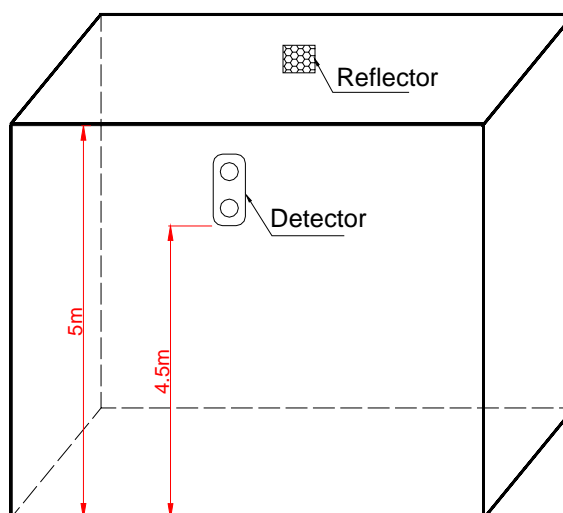


Fig. 4 Mounting

- b) When space height is between 5m and 8m, the detector and reflector should be mounted on the two facing walls 0.5m to 1m from the ceiling, see Fig. 5.

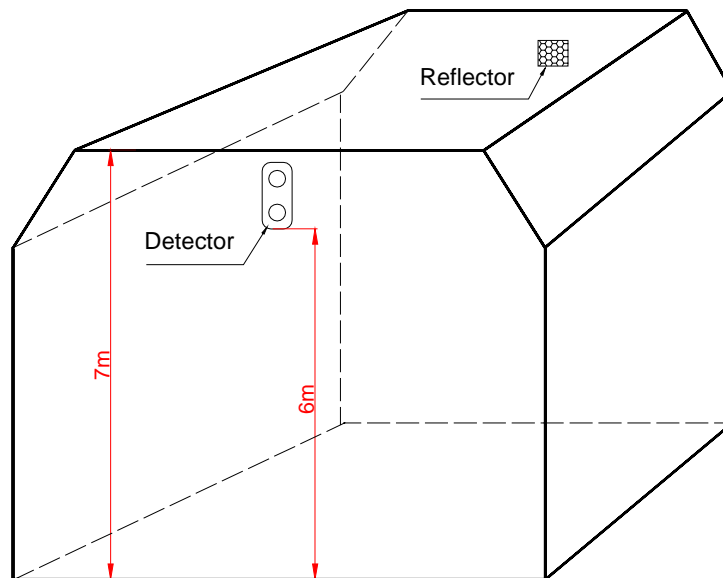


Fig. 5 Mounting

- c) When space height is more than 8m, the roof is normally gabled without ceiling, the detector and reflector should be mounted on the two facing walls about 8m from the floor, ensuring that the vertical distance between the detector/reflector and top of the building is more than 0.5m, see Fig. 6. The distance should be 7m from the detector to the floor.

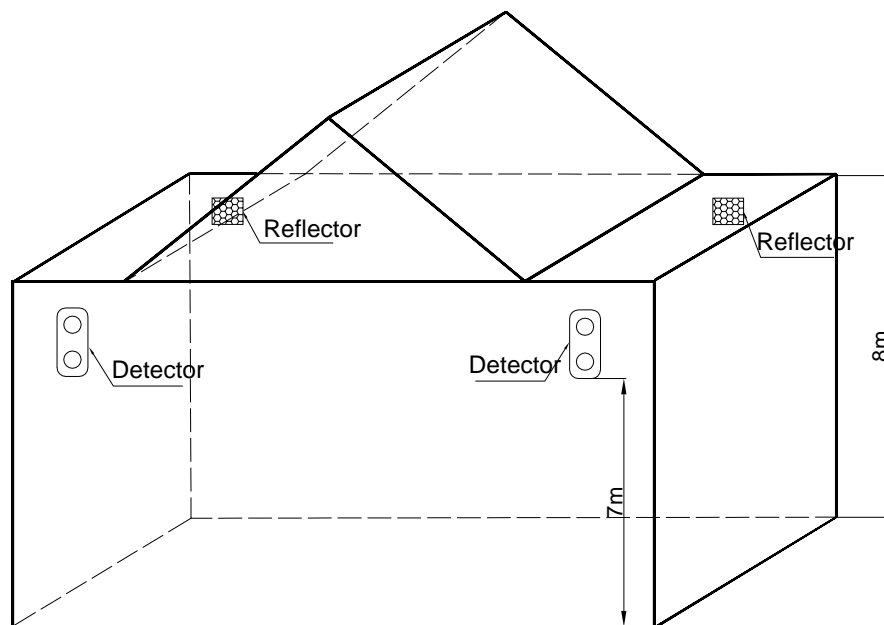


Fig. 6 Mounting

- d) For gable structure with space height about 8m, the detector and reflector should be mounted on the two facing walls 1.5m from the gabled girder, see Fig. 7.

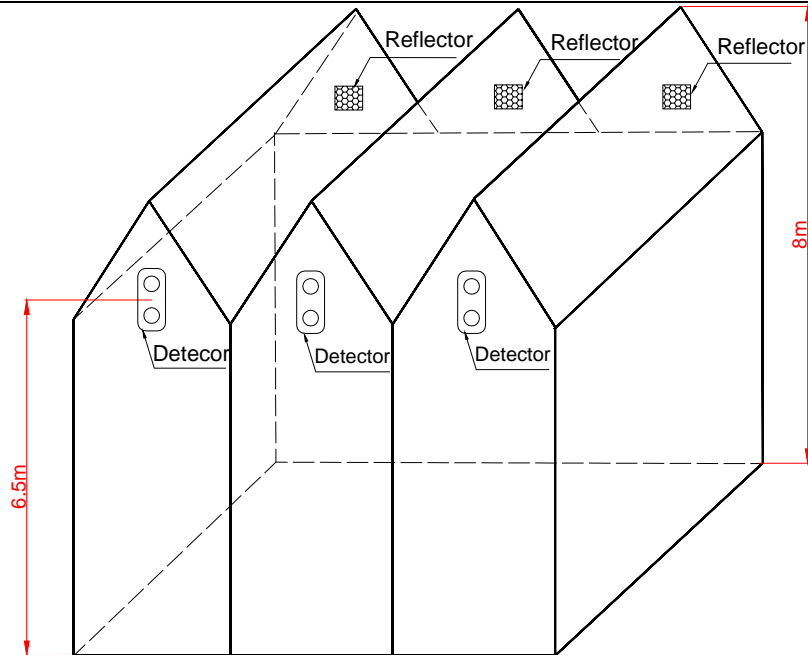


Fig. 7 Mounting

- e) If the surroundings are glass or transparent plastic, please place the detector on the south wall in a building. If the detector cannot be mounted northward, then place the detector on the west wall. For applications where sunlight can reach the detector after reflected, please consider mounting a sunshade over the detector's optical pathway or contact our field engineer for a solution.

(3) Mounting

1) Setting Length of Optical Pathway

Before installation, you need to set the length of optical pathway first by setting device type of the detector. The detector can work at two levels of length. When mounting distance between the detector and the reflector is not less than 40m (but no more than 100m), the detector type should be set at "54" (factory default). When the mounting distance between the detector and the reflector is less than 40m (but more than 8m), the detector type should be set at "53". See Section VIII Operation for detailed setting methods.

2) Mounting the Detector

Align the detector and the reflector horizontally on the two facing walls in monitoring area. See Fig. 8.

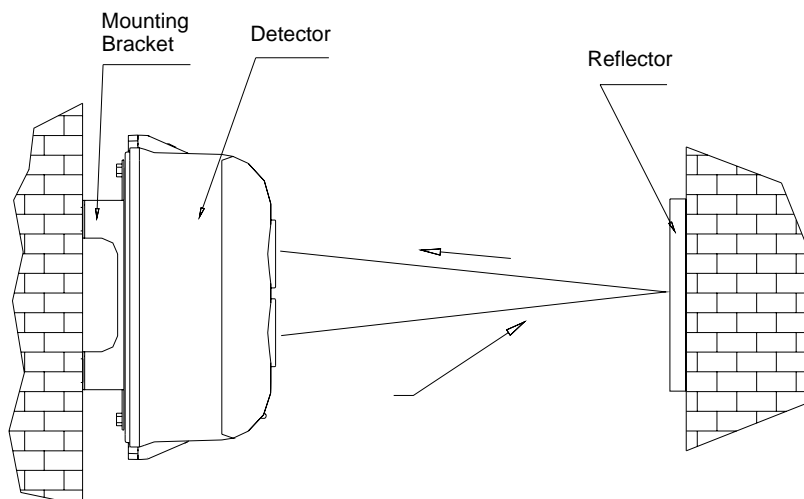


Fig. 8 Mounting

The detector can be surface-mounted in two ways: with wiring tube embedded or wiring tube surface-mounted.

Note: Before installing, knock off the “Knock-off Hole” (see Fig. 1) on the base of the detector.

- (1) Embedding wiring tube
 - a. Remove the detector's top cover.
 - b. Align the base of the detector over the embedded box and mark the positions of mounting holes on the wall.
 - c. Drill two holes at the marked positions, and push two $\varnothing 6$ plastic expansion bolts in.
 - d. Thread the wires through wire-in hole and knock-off hole, ensuring the length of wires inside convenient for connection.
 - e. Fix the detector base on the wall with two $\varnothing 6$ plastic expansion bolts and flat washers.

Mounting method is shown in Fig. 9.

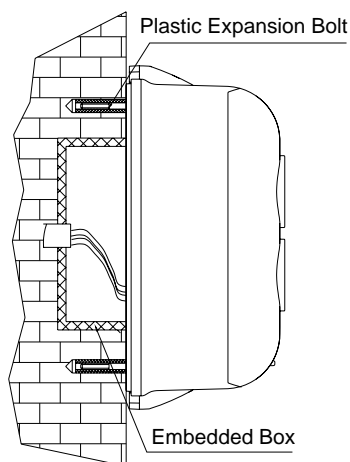


Fig. 9 Wiring Tube Embedded

- (2) Wiring tube surface mounting
 - a. Put the mounting bracket at position intended to install the detector; mark

the locations of the four holes of mounting bracket on the wall.

- b. Drill the holes on marked positions, and push $\varnothing 6$ plastic expansion bolts in.
- c. Fix the mounting bracket on the wall with four $\varnothing 6$ plastic expansion bolts and flat washers.
- d. Remove the detector's top cover; thread the wires through the wire-in hole and the knock-off hole, ensuring the length of wires inside convenient for connection.
- e. Fix the detector base onto the bracket with two M4 \times 10 bolts and flat washers.

Mounting method is shown in Fig.10.

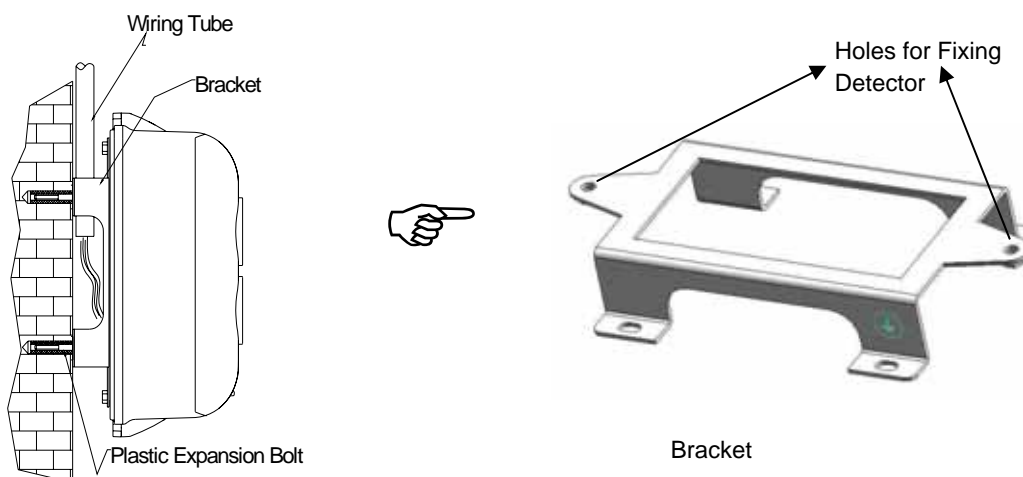


Fig. 10 Wiring Tube Surface Mounted

(3) Mounting the reflector

The reflector is mounted opposite the detector but in line with it. When the distance between the detector and the reflector is more than 8m (less than or equal to 40m), one reflector is enough. When the distance is more than 40m (less than or equal to 100m), four reflectors are needed. Two $\varnothing 6$ plastic expansion bolts are needed to fix single reflector. Mounting size is shown in Fig.11a. If four reflectors are needed, place them seamlessly as shown in Fig. 11b.

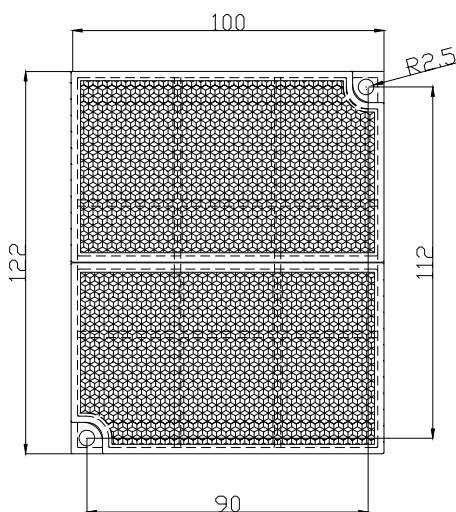


Fig. 11a Single Reflector

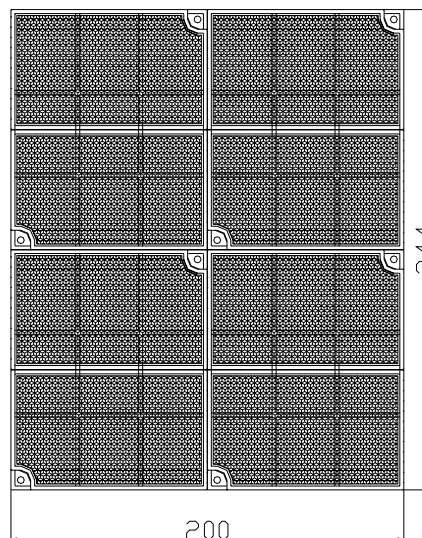


Fig. 11b Four Reflectors (not to scale)

(4) Wiring

Connect 24VDC power wire (without polarity) to terminal D1 and D2 of the detector in field. Terminal K11 and K12 are fire passive output contacts, and K21 and K22 are fault passive output contacts. The reflector needs not to connect with wires. Terminals are shown in Fig. 12.

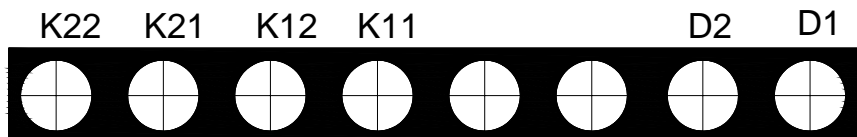


Fig. 12 Terminals

Wiring: Twisted pair with cross section not less than 1.0mm^2 for signal wires connecting with K11, K12, K21 and K22. 227 IEC 01 cable with cross section not less than 1.5mm^2 for power cable connecting with D1 and D2.

Note: If the detector is mounted in special environment where there are slight dust or where it's damp, seal the four positions shown in Fig. 2 (two mounting holes and two wire-in holes) with glass glue or 703 silica gel after the detector is fixed and wiring is finished to ensure the detector work stably.

VI Commission

1. Steps:

- 1) Take off the protective membrane carefully on the surface of the reflector and of the detector cover. Do not scratch or contaminate their surfaces.
- 2) Remove the detector's top cover, and power up the detector with 24VDC. Two minutes later, put the magnet of commission tool close to the reed switch (around the red LED) of detector's interface board. There may be two cases with the LEDs:
 - a. Green LED flashes.

- b. Green LED illuminates continuously.
Take away the commission tool.
- 3) If Green LED flashes, it means the received light is quite weak (the slower the flashing frequency, the weaker the received light signal is). Tune the adjusting wheel and rotary rack on the detector to align the light beam until Green LED is lit continuously, showing that the light received by the detector is strong. Then stop regulating and enter step 4). If Green LED illuminates continuously, it means the received light is quite strong, you can go straight to step 4).

Note: Observe the detector's optical pathway carefully to ensure that the received light signal is reflected by the reflector rather than by obstructions like wall, ceiling or pillar. If uncertain, verify by covering the reflector with opaque objects.

- 4) Put on the top cover gently; screw the two bolts on the cover.
- 5) The green LED illuminates continuously. Put the magnet of commission tool close to the zone where marked (M) until Yellow LED illuminates continuously, then remove the commission tool quickly and make sure there is no obstruction on the optical pathway. About 5 seconds later, the detector begins to adjust automatically. Yellow LED flashing means weak light, Green LED flashing means strong light. Ten seconds later, If Red LED, Yellow LED and Green LED flash alternately, this means the detector failed to adjust automatically and cannot enter normal monitoring state. Please open the detector's top cover and do adjustment again from step 2). If Yellow LED and Green LED illuminate no more, and Red LED flashes periodically, this means the detector is at the best position and has entered normal monitoring state. The commission is finished.

2. Fire Alarm Test

After the detector has been in normal monitoring state for 20s, cover the receiving window and emitting window with the IR Light Filter (please use the part for fire alarm test), the detector should alarm fire in 30s and Red LED should turn on. Fire passive contact is closed. Removing the filter, the detector should enter normal monitoring state directly without alarming fire or fault.

3. Fault Test

Cover the receiving or emitting window of the detector quickly with the IR Light Filter (the part for commission) to obscure the optical pathway, and Yellow LED of the detector should be on. Remove the filter immediately, and Yellow LED should be off.

4. Failed Detectors

During testing, repair the failing detectors according to directions in Section IX *Troubleshooting* and *X Maintenance*, and test again. If they fail again, return them to factory for repair.

VII Cautions

- (1) Power up only after all devices are well connected.
- (2) Adjustment should be made to the detector after installation and maintenance.

- (3) Don't move the detector while the receiving window and emitting window are covered with the IR Light Filter.
- (4) During adjustment, the detector may give fault signal (fault passive output contact is closed), but this will not affect adjustment.
- (5) The detector base should be fixed directly on solid wall or frame that will not be deformed by vibration. Any deformable material such as paperboard, plastic board, foam board or thin wood board should not be placed between the base and the wall or the bracket.

VIII Operation

Device type and sensitivity level of the detector can be set with P-9910B Hand Held Programmer. Open the detector's top cover, connect I²C cable of hand held programmer (PS/2 cable) with XT3 of the detector. Turn on the power of hand held programmer, input 2, 5, 9 and *Function* key to enter I²C programming mode, the screen shows a "0". After carrying out operations needed, input 2, 5, 9 and *Function* key to exit I²C programming mode and return to power-on state.

1. Reading Information

The handheld programmer can conveniently get original information like sensitivity level and device type. See details below:

- ✧ Enter I²C programming mode, the screen shows a "0".
- ✧ Press *Test*, the screen shows the address code of the detector (factory-set number, meaningless for actual use).
- ✧ Press *Up*, the screen shows the sensitivity level and device type in sequence.
- ✧ Press *Down*, the screen shows the above contents in opposite way.

2. Setting Sensitivity Level

Handheld programmer can set two sensitivity levels to the detector. 2 is sensitivity level one. 3 is sensitivity level two. See the details below:

- ✧ Enter I²C programming mode of handheld programmer, the screen shows a "0".
- ✧ Input unlock password and press *Clear* key, the lock is opened.
- ✧ Press *Function*, and then the figure "3", the screen shows a " - ".
- ✧ Input sensitivity level to be set, and press *Program* to begin programming. The screen will show a "P" if programming is successful, otherwise it will show an "E".
- ✧ Press *Clear* key, the screen shows a "0", and you can go on with further operations.

3. Setting Device Type

You can also set device type of the detector by hand held programmer. See detailed operation below:

- ✧ Enter I²C mode of the programmer, the screen shows a "0".
- ✧ Input unlock password and press *Clear*, the lock is opened.
- ✧ Press *Function* and then figure "4", the screen shows a " - ".
- ✧ Input the device type, press *Program* to start programming, "P" will be shown when successful, otherwise an "E" will be shown.
- ✧ Press *Clear* the screen will show a "0". You can continue with further operation.

4. Other Functions

1) Automatic Compensation of Light

When dust exists in the working environment of the detector for some time, the emitting window, receiving window and reflector will be covered with dust, which will affect normal operation. In order to solve the problem, we designed the function of automatic compensation of light. When there is dust on windows, the detector can judge the amount of dust, and compensate the received signal through internal program and circuit to ensure the detector can continue to work normally. The detector gives fault signal through output contact and indicator when dust on the lens and reflector surface reaches a certain level and the light compensation reaches the limit for the detector to work normally.

2) Self-diagnosis on Optical Signal

The detector has functions of checking emitting, receiving and amplifying circuit. When there is fault on these three parts of circuit during operation, the detector will generate fault information.

IX Troubleshooting

Common problems and repair methods are as follows:

Table 1

Problems	Reasons	Repair Methods
Working indicators not lit after power on	a) 24V power off. b) Working indicators damaged. c) Transient suppressor VD12 damaged. d) Diode VD1, VD2, VD10, VD11 breakdown resulting in short circuit with ground. e) N1, N2 damaged. f) The flexible cable inside was not connected or not connected correctly.	If the problems are mentioned in a) ~ e) , replace the component with problem. If in f), connect again in right way.
Fault indicator constantly illuminates after power on	Wrong device type.	Set the device type 53 or 54 again according to Section VIII <i>Operation</i> .
Green LED constantly flashes after power on	a) Emitting diode or circuit damaged. b) Photodiode or amplifying circuit damaged.	Replace the component with problem.
Gives fault signal after a period of normal operation	The detector cannot work normally.	Commission once more.
Reports fire alarm after a period of operation, alarms detector fault after restart	The detector has deviated due to external vibration.	Commission once more.
Fire signal cannot be cleared	a) There are obstruction on the optical pathway between the detector and the reflector. b) The angle of optical pathway has changed and need to be aligned again. c) The emitting diode or circuit damaged. d) The photodiode or amplifying circuit damaged. e) Relay or control circuit damaged.	If the problems are mentioned in a), b), commission once again. If in c), d), e) replace the component with problem.

X Maintenance

- (1) If the detector gives fault signal after working for a long time, first check whether the detector is damaged or not, and make sure that it is fixed to the wall or other fixity. Then check whether it is the accumulating dust and positional excursion, causing compensation fault, then consider other types of fault.
- (2) If emitting window, receiving window and reflector surface are found contaminated, clean them with soft cloth and alcohol (avoid scraping). Never use water or other

- chemicals. Commission the detector again after cleaning.
- (3) The detector is fire protection product, whose operation must be well recorded by the personnel on duty and shift.
 - (4) Personnel on duty should be familiar with the functions and operation process of the device in order to avoid mis-operation.
 - (5) Test alarm function once half a year.

XI Accessories

Accessories provided with the detector are as follows.

Four Ø6 plastic expansion bolts.

One bracket.

One IR Light Filter.

Two M4 × 10 cross recessed pan head screws.

Six Ø4 flat washers.

One commission tool.

Appendix 1 Warnings

Limitations of Smoke Detector

The smoke detector is designed for triggering and initiating emergency fire equipments, but it only functions when matching with other equipments. Installation of this smoke detector must conform to electrical codes and standards in your country.

The smoke detector cannot work without power. It cannot work if power is cut off for any reason.

The smoke detector may not sense fire that starts where smoke cannot reach it, such as in chimneys, in walls, on roofs, or on the other side of closed doors.

The detector also may not sense a fire on another level of a building. Therefore, detectors should be placed on every level of a building.

All types of smoke detector have limitations. Because fires develop in different ways and are often unpredictable in their growth, it is impossible to predict which type of detector will provide the earliest warning. No types of smoke detector can sense every kind of fire every time. Generally speaking, detectors may not warn you about fires caused by insufficient safety measures, violent explosions, leaking gas, improper storage of flammable materials like diluents and other safety hazards, arson or children playing with fire. The alarm of a smoke detector used in high velocity environment will be delayed due to dilution of smoke by frequent and fast airflow. What's more, the smoke detector has to be maintained frequently because there will be more dust contamination.

The smoke detector cannot last forever. In order to keep the detector working in good condition, please maintain the equipment continuously according to recommendations from manufacturer and relative nation codes and laws. Take specific maintenance measures on the basis of different environments. The smoke detector contains electronic parts. Even though it's made to last for a long period of time, any of these parts could fail at any time. Therefore, test your smoke detector at least every half-year according to national codes or laws. Any smoke detectors, fire alarm devices or any other components of the system must be repaired or replaced as long as they fail.

Appendix 2 Warranty

Our company warrants that the detector will be free from defects in design, materials and workmanship. The warranty is valid for a period of 2 years from time of dispatch. This warranty shall not apply to any product that is found to have been damaged, improperly installed or used in any way not in accordance with the instructions supplied with the product. Anybody, including the agents, distributors or employees, is not in the position to amend the contents of this warranty. Products not covered by this warranty shall also be returned for repair. Please return the products together with a description of fault and possible reason to the company.



GST China

Gulf Security Technology Co., Ltd.
No. 80, Changjiang East Road, QETDZ, Qinhuangdao, Hebei,
P. R. China 066004
Tel: +86 (0) 335 8502528
Fax: +86 (0) 335 8508942
Email: sales@gst.com.cn
www.gst.com.cn

GST UK

Global System Technology PLC
Enterprise Glade, Bath Lane, Moira, South Derbyshire,
England. DE12 6BD
Tel: + 44 (0) 1283 225 478
Fax: + 44 (0) 1283 220 690

Regional Office

PO Box 17998 Unit ZA04 JEBEL ALI Free Zone,
Dubai, UAE
Tel: +971 (0) 4 8833050
Fax: +971 (0) 4 8833053
Email: tech.support@gst.uk.com
www.gst.uk.com