



D-9105RExd Digital Flame Proof Reflective Beam Detector



Installation and Operation Manual

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I Overview

D-9105RExd Digital Flame Proof Reflective Beam Detector is able to output signal in two ways: loop output and contact output. When the detector is connected with GST fire alarm control panel, information between the detector and the control panel is transmitted through the detection loop. The detector address can be programmed ranging from 1 to 242 using GST programmer. When the detector is not connected with the control panel, fire and fault information can be transmitted through contacts.

The detector 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 carry out system commission, compensation of environmental variation, and judgment of fire and fault through fixed algorithm. Digital bus technology ensures quick and complete information transmission. With new and reasonable design, flexible judgment and precise alignment, it's aesthetically pleasing and easy to install and adjust. Its sensitivity can be set with hand held programmer in field, decreasing the demand for cleanliness of field conditions, and enlarging application areas.

The detector is applicable to either commercial areas or hazardous industrial areas, such as Zone 1 and 2 of explosive gas areas and Zone 21 and 22 of combustible dust areas.

II Features

1. Wide operating voltage range, large monitoring areas.
2. Combination of transmitter and receiver ensures easy installation and accurate optical pathway.

3. Built-in microprocessor enables intelligent judgment of fire alarm and fault.
4. The detector can calibrate automatically, which ensures one person to complete adjustment in short time. It's also convenient to operate.
5. Self-diagnosis function can monitor fault with itself.
6. Automatic compensation for factors weakening received signals, such as a certain amount of dust contamination, positional excursion and ageing transmitter.
7. Compatible to digital bus protocol, easy to control and operate.
8. Electronically addressed. The address can be programmed in field.
9. Two sensitivity levels can be set in field.
10. The detector's optical pathway is designed with strong anti-interference ability.
11. SMT processing technology.
12. Attractive and decent appearance.

III Technical Specifications

1. Operating Voltage: Power supply voltage 15VDC~28VDC
Loop voltage 15V~28V
2. Operating Current:
Power current: Commission current $\leq 20\text{mA}$
Standby current $\leq 12\text{mA}$
Alarm current $\leq 22\text{mA}$
Loop current $\leq 2\text{mA}$
3. Fire, fault contact output:
Fire relay: contact capacity is 28V/2A. Normally open in normal state, closed in fire condition.
Fault relay: contact capacity is 28V/2A. Normally open in normal state, and closed in fault condition.

4. Adjustment Angle: Vertical ± 30 degrees, horizontal ± 45 degrees

5. Maximum angular misalignment: $\pm 0.5^\circ$

6. Sensitivity Level:

Level 1: high sensitivity

Level 2: low sensitivity

7. Indication of Detector State:

Commission: Green LED and yellow LED illuminates or flashes in a certain way. Refer to Section *VI Commission* for details.

Normal monitoring state: Red LED flashes periodically.

Fire: Red LED illuminates and fire output contact is closed when the detector reports fire alarm. The fire signal can be transmitted to the control panel through loop and has to be cleared by the control panel. If it's not connected with GST fire alarm control panel, the fire signal has to be cleared by rebooting.

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

Optical pathway is obscured totally: the detector first gives fault signal, turns on yellow LED and closes fault relay. 20 seconds later, it reports fire alarm, turns on red LED and closes fire relay. Yellow LED is turned off, fault relay is disconnected. **Note: In this case, it does not necessarily mean there is a fire. After the obscuration is removed, the detector clears the fault signal automatically.**

8. Operating Environment:

Temperature: $-20^\circ\text{C} \sim +40^\circ\text{C}$

Relative Humidity $\leq 95\%$, non condensing

9. Monitoring Area: Maximum monitoring area: $14 \times 100 = 1400\text{m}^2$

Maximum width: 14m

10. Length of Optical Pathway: $8\text{m} \sim 100\text{m}$

11. Ingress Protection Rating: IP66

12. Dimensions:

Length: 344mm

Width: 240mm

Depth : 212mm(with adjustment frame)

13. Material and Color of Enclosure: Stainless steel, metallic gray

14. Weight: Detector: 6kg Adjustment frame: 3.8kg

15. Mounting Hole Spacing:

Spacing for embedding: 70mm x 50mm

16. Explosion-proof mark: ExdIICT6/DIP A21 TA,T6

IV Structure and Operation Principle

1. Appearance of the detector is shown in Fig. 1.

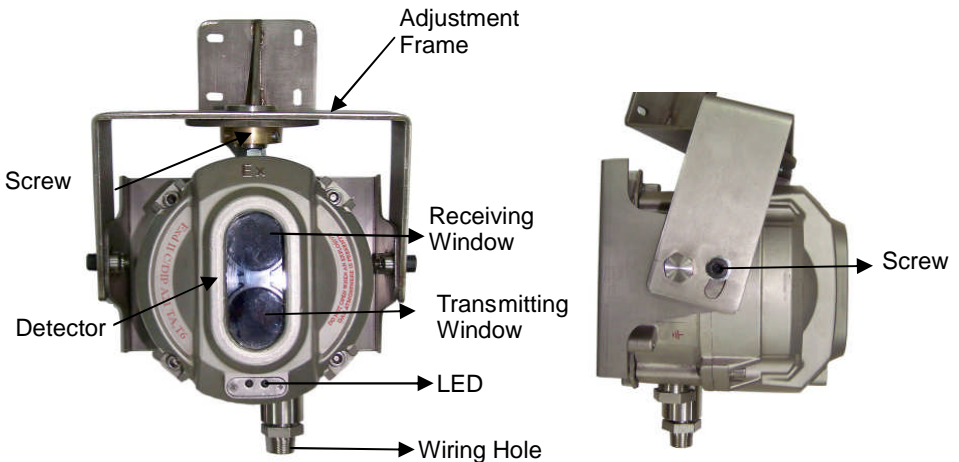


Fig. 1

2. Operation Principle

The detector and reflector are placed oppositely. The detector includes a transmitter and a receiver. Infrared beam of certain intensity sent out from the transmitter is reflected by the right-angle prisms of the reflector, and then received by the receiver. The receiver simultaneously collects and amplifies the returned infrared beam, analyze and judge the

collected signals through its microprocessor. When the detector is in normal monitoring state, the intensity of infrared beam received by the receiver is steady at a certain level. When smoke particles enter the detecting area, the intensity of infrared light reaching the receiver falls owing to light scattering. When the smoke particles reach a certain density, and the intensity of infrared light received is reduced below the preset threshold value, the detector alarms fire and illuminates red LED. The fire signal will be transmitted to fire alarm control panel connected with the detector. Operation principle is shown in Fig. 2.

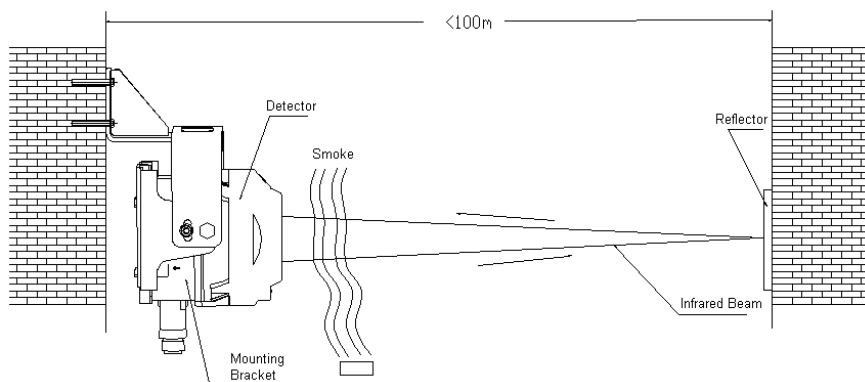


Fig. 2

V Mounting and Wiring

1. Ambient Conditions for Installation

The detector works on light obscuration principle, so any fixed or moving obscuration in its optical pathway must be avoided when locating it.

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 is installed firmly.

Not Fit For Locations where:

- The height of the roof is over 40m.
- There is no roof at all.
- The space is lower than 1.5m.
- There are a lot of dust, powder or vapor.
- It is clean normally, but can be dusty in some special cases.
- Temperature is high. **Note: Temperature at top part of a workshop with transparent roof may be over 50°C when there is sunshine.**
- There is no access for 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:

- (1) When space height is not over 5m, the detector and reflector should be mounted on the two facing walls 0.5m from the ceiling, as shown in Fig. 3.

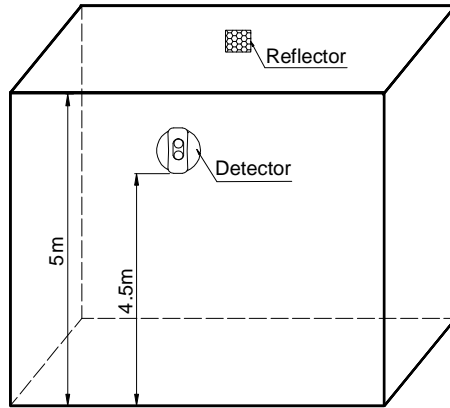


Fig. 3

(2) 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, as shown in Fig. 4.

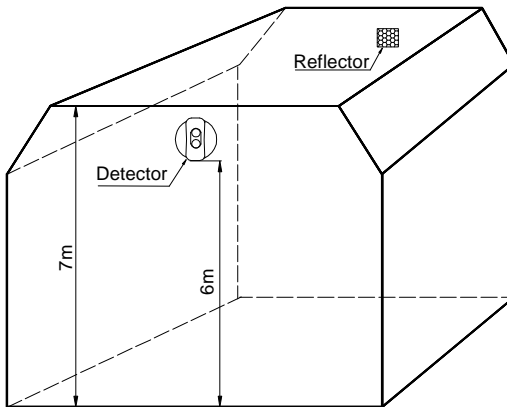


Fig. 4

(3) 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 not less than 0.5m, as shown in Fig. 5.

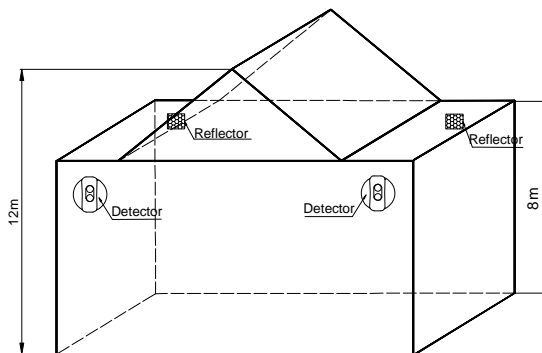


Fig. 5

(4) 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, as shown in Fig. 6.

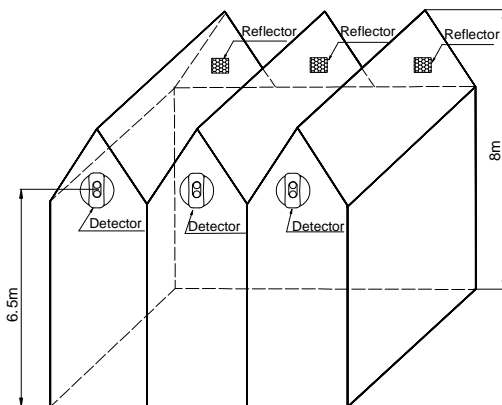


Fig. 6

(5) 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 application 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 length ranges. When mounting distance between the detector and the reflector is not less than 40m (but not more than 100m), the detector type should be set at "52" (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 "51". Refer to Section *VII Operation* for detailed setting methods.

(2) Mounting the detector

Align the detector and the reflector horizontally on the two facing walls of the monitoring area, as shown in Fig. 2.

The detector is wall-mounted. First mount the adjustment frame on the wall, then hang the detector on it, and finally secure them to the wall. The steps are as follows:

- a. Installing the adjustment frame

Secure the adjustment frame on the wall using an M6 expansion bolt, as shown in Fig. 7.

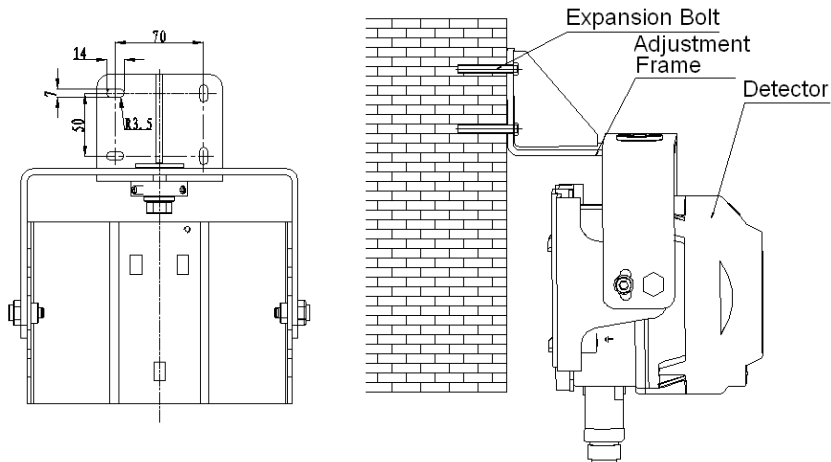


Fig. 7

b. Installing and adjusting the detector

Hang the detector with the lining board onto the adjusting frame and secure them using M5 screw (Fig. 8).

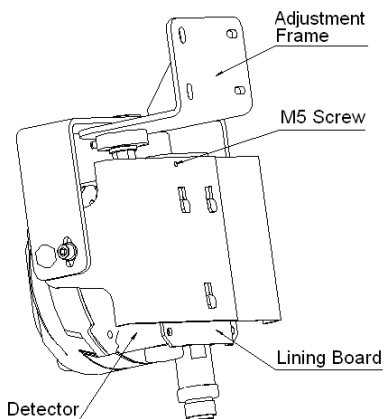


Fig. 8

c. Installing 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 a single reflector. Mounting size is shown in Fig.9a. If four reflectors are needed, place them seamlessly as shown in Fig. 9b.

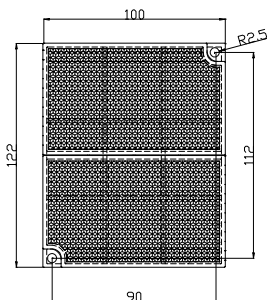


Fig. 9a

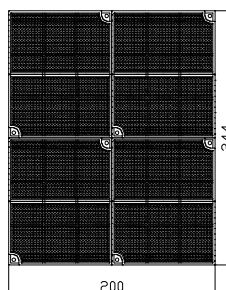


Fig. 9b (Not to Scale)

4. Wiring

- (1) It is recommended to use multi-core copper cable with core cross section $\geq 1.0\text{mm}^2$, and external diameter $\varnothing 8\text{mm} \sim \varnothing 10\text{mm}$ in Zone 1 and 2. The cable shall meet field requirements on resistance to heat, corrosion and fire. If there's no special requirement, $\varnothing 10$ screened cable can be used. Connect the screen layer to the safety earth position inside the housing. Cable layout shall also meet requirement in explosive environment. It's prohibited for the cable to have joints in explosive environment. If a joint is necessary under special condition, it's only allowed in Zone 2 with the joint protected with explosion-proof junction box.
- (2) Connect 24VDC power cable (without polarity) to terminal D1 and D2 of the detector. K11, K12 are volt-free fire output contacts. K21 and K22 are volt-free fault output contacts. No cable connection is necessary for the reflectors. Terminals are shown in Fig. 12. Z1 and Z2 are for polarity-insensitive connection with FACP loop. Refer to

Fig. 10 for terminals.

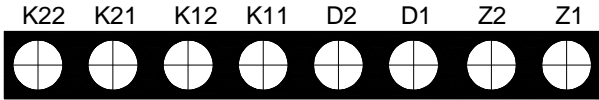


Fig. 10

If the detector does not connected with GST fire alarm control panel, D1 and D2 are to be connected with 24VDC power cable polarity-insensitively, K11 and K12 are used as volt-free fire alarm output contact, and K21 and K22 volt-free fault output contact, as in Fig. 11.

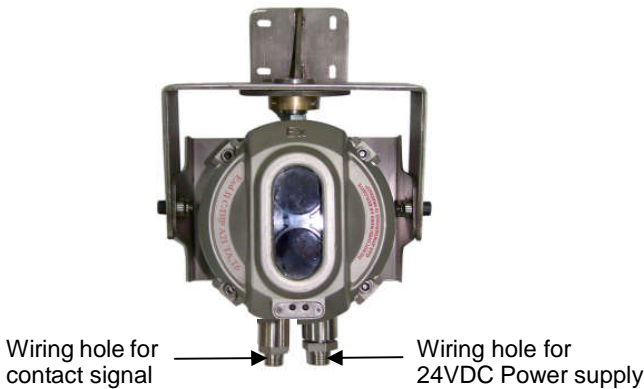


Fig. 11

- (3) Connect the earth cable to the earth point on the housing.
- (4) Connect the ribbon cable of the detector body to XT4 on the interface board on the base, and then install the detector body onto the base. Make sure the location element on the base in align with the U-shaped groove on the detector body.
- (5) Secure the body with the base with the 4 Allen screws.
- (6) After installation, double-check the following: If there is cracks or holes on the surface of the housing; if the base and detector body


are securely installed; if there is scratches or cracks in the glass detector window; if there is sealing ring at the wiring hole; if the sealing ring matches the cable gauge; if the locking nut at the wiring hole is locked; if there is earth cable at earth mark position.

Note:

- (1) If the detector connects with GST fire alarm control panel, only one wiring hole is needed. The other one should be stopped with an end cap, as shown in Fig. 1.
- (2) If the detector does not connected with GST fire alarm control panel, the two wiring holes are both needed, as shown in Fig. 11.

VI Commission

1. Steps

- a) Take off the protective membrane carefully on the surface of the reflector and the detector. Do not scratch or contaminate their surfaces.
- b) Power up the control panel and detector. Put the commission area of the commission tool close to the part of detector with a mark . There may be two cases with the LEDs:
 - (1) Green LED flashes.
 - (2) Green LED illuminates continuously.Then take away the commission tool.
- c) 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 d).

If green LED illuminates continuously, it means the received light is

quite strong, you can go straight to step d).

Note: Observe the detector's optical pathway carefully to ensure that the received light signal is reflected by the reflector rather than by obscurations like wall, ceiling, or pillar. If uncertain, verify by covering the reflector with opaque objects. If the green LED flashes, it means the light is from the reflector. If the green LED constantly lights, then the light is not from the reflector. The optical pathway should be adjusted again.

d) Gently tighten the screws at the top middle and on the two sides of the adjusting frame.

e) Put the magnet of commission tool close to the area marked with

Ⓜ until yellow LED illuminates constantly, then remove the

commission tool quickly and make sure there is no obscuration 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. 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 from step b). 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 20 seconds, cover the receiving window and transmitting window with the IR Light Filter (please use the part for fire alarm test), the detector should report fire alarm in 30 seconds and red LED should turn on. Remove the filter and clear the fire alarm from the FACP, the red LED should go out, and the detector should resume normal standby state.

3. Fault test

Cover the receiving or transmitting window of the detector quickly with the IR Light Filter to obscure the optical pathway. Yellow LED of the detector should be turned on. Taking off the filter immediately, yellow LED of the detector should be turned off.

4. Defect Detectors

For detectors failing in testing, please repair them following the instructions in the sections of *Troubleshooting* and *Maintenance*, and re-test them. If they fail again, return them to factory for repair.

VII Operation

The detector address, device type and sensitivity level can be simply programmed by P-9910B hand held programmer. Open the detector's top cover, connect the ribbon cable from the detector body to XT2 of the small connector board coming with the detector, and then connect the I²C cable of hand held programmer (PS/2 cable) with XT1 of the connector board (or directly connect the ribbon cable of the detector body with the connector on the base, and the I²C cable to XT3 of the interface board). Turn on the power of hand held programmer, input 2, 5, 9 and *Function* to enter I²C programming mode, the screen shows a "0". After programming, input 2, 5, 9 and *Function* again to exit I²C programming mode and return to power-on state.

1. Reading Information

Using the hand held programmer, you can easily get original information of the detector, such as the address. Refer to details below:

- (1) Enter I²C programming mode, the screen shows a "0".
- (2) Press *Test*, the screen shows the address code of the detector.
- (3) Press *Up*, the screen shows sensitivity level and device type in sequence.
- (4) Press *Down*, the screen shows above contents in opposite way

2. Setting Address Code

The detector offers address code programming for field application. Refer to operation below:

- (1) Enter I²C programming code, and the screen is a "0".
- (2) Input address code for programming (1~242).
- (3) Press *Program* to start programming. "P" will be shown when successful, otherwise an "E" will be shown.
- (4) If programming is successful, press *Clear*, the screen will show a "0", and you can go on with further operations.
- (5) If programming fails, press *Clear*, the screen will show a "0", input address code once again.

3. Setting Sensitivity Level

The hand held programmer can set two sensitivity levels to the detector. 2 is sensitivity one, and 3 is sensitivity two, as detailed below:

- (1) Enter I²C programming mode of hand held programmer, and the screen shows a "0".
- (2) Input unlock password, press *Clear*, and open the lock.
- (3) Press *Function* then the figure "3", the screen shows a "-".
- (4) 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".
- (5) *Clear* pressed, the screen shows "0", and you can go on with further operations.

4. Setting the Device Type

You can also set the device type of the detector through a programmer, as detailed below:

- (1) Enter I²C mode of the programmer, and the screen shows "0".
- (2) Input unlock password, press *Clear*, and open the lock.

- (3) Press *Function* and then figure “4”, the screen shows “—”.
- (4) Input the device type to be set, press *Program* to begin programming. “P” will be shown when successful, otherwise “E” will be shown.
- (5) Pressing *Clear* shows “0” on the screen, and you can go on with further operations.

5. Other Functions

(1) Automatic Compensation of Light

When dust exists in the working environment of the detector, the transmitting window, receiving window and reflector may be covered with dust, which will affect normal operation. In order to solve the problem, the detector is designed with 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 working normally. The detector gives fault signal when dust on the lens and reflector surface reaches a certain level and light compensation reaches the limit for the detector to work normally.

(2) Self-diagnosis on Optical Signal

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

VIII Troubleshooting

- ✧ If the detector reports fault after long time running, please first check if it's damaged. Make sure it's securely installed on the wall or other fixed supporters. Then check the dust accumulation level and position deviation to see if these has resulted in fault in automatic compensation, and then consider other types of fault.
- ✧ If the surface of the transmitting/receiving window or the reflector is

found to be contaminated, please clean it with soft cloth and alcohol. Avoid scratching the surface. Do not clean the surface using water or other chemicals. After cleaning, please commission the detector again to make it work in normal standby state.

Common problems and repair methods are as shown in Table 1.

Table 1

Problems	Reasons	Repair Methods
Working LEDs not lit after power up.	a) 24V power off b) Working LEDs 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 LED constantly illuminates after power up	a) Device type read by programmer is not 51 or 52. b) The optical pathway is not well aligned.	a) Correct the device type. b) Commission the detector again. If commissioning fails for 3 time, please return the detector for repair.
Reports loop fault after power-up	a) Diode VZ1, VZ2, VD3 or VD4 is broken, and is shorted to earth. b) TVS diode VC13 is damaged.	Commission once more.
FACP reports detector fault after registration.	The detector does not enter normal operation state.	Re-commission the detector.
The FACP does not register the detector after power-up	a) Loose connection with FACP loop. b) 24V power is not applied. c) N3 or N4 is damaged. d) The flexible cable inside the detector is not connected or not connected well. e) N1 or N2 is damaged.	Replace the faulty component, re-connect the flexible cable or re-register the detector.
Green LED flashes after power-up despite adjustment	a) Transmitting diode or circuit is damaged. b) Receiving diode or amplifying circuit is damaged.	Replace the faulty component.

Reports fault after a period of normal operation	The detector cannot work normally.	Commission once more
Reports fire after operation for some time, and reports fault after restarted	The detector has deviated due to external vibration.	Commission once more
Fire signal cannot be cleared	a) There is obscuration 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 transmitting diode or circuit damaged. d) The photodiode or amplifying circuit damaged.	For a) and b), commission once again. For c) and d), replace the faulty component.
The control panel can't receive fire or fault signals.	No registration.	Register again.

IX Maintenance

- ✧ The detector is fire protection product, operation of which must be well recorded by the personnel on duty and shift.
- ✧ Personnel on duty should be familiar with the functions and operation process of the device to avoid mis-operation.
- ✧ Test alarm function once every 6 months.

X Caution

- ✧ Protect the detector from damage in maintenance.
- ✧ Install and maintain the detector in strict compliance with safety regulations for explosive and hazardous areas.
- ✧ Never open the housing with power on.
- ✧ The detector housing should be earthed.

- ✧ Power up only after all devices are connected.
- ✧ Commission the detector after installation and maintenance.
- ✧ During commissioning, the FACP may report detector fault which does not affect commissioning.
- ✧ 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.

XI Accessories

Accessories provided with the detector are as follows:

- Four M6 x 60 expansion bolts.
- Four M5 cross recessed pan head screws.
- One adjustment bracket.
- One IR Light Filter.
- One Commission Tool.
- One Allen key M8.
- One connector board.



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