Long-range Beam Smoke Detectors

D296/D297

BOSCH

en Installation Instructions

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1 Notices

Before installing the module, become familiar with the *Installation and Operation Guide* for the control panel you are using.

Caution!
When power is removed and reapplied to the receiver, such as in a power outage and restoral or an alarm reset, an internal setup procedure is initiated and can last from 1 min to 2 min. During this period, the detector is not able to initiate signals. Avoid connecting these detectors to circuits, such as those programmed for alarm verification, that remove and reapply power.

1.1 Regulatory

FCC compliance
This equipment was tested and complies with the limits for a Class B digital device, pursuant to Part 15 of the Federal Communications Commission (FCC) Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses, and can radiate radio frequency energy. When this equipment is not installed and used according to the instructions, it might cause harmful interference to radio communications. There is no guarantee that interference will not occur in a particular installation.
If this equipment causes harmful interference to radio or television reception that can be determined by turning the equipment off and on, correct the interference by:
– Reorienting or relocating the receiving antenna.
– Increasing the separation between the equipment and the receiver.
– Connecting the equipment to an outlet on a circuit different from the circuit to which receiver is connected.
– Consulting the dealer or an experienced radio or TV technician for help.

Codes and standards
Install, test and maintain the module according to these instructions, NFPA codes, local codes, and the authority having jurisdiction (AHJ). Failure to follow these instructions can result in failure of a detector to initiate an alarm event. Bosch Security Systems, Inc. is not responsible for improperly installed, tested or maintained devices.

1.2 Trademarks

All hardware and software product names used in this document are likely to be registered trademarks and must be treated accordingly.

2 System overview

2.1 Description

The D296 (24 VDC) and D297 (12 VDC) Long-range Beam Smoke Detectors have a separate transmitter and receiver. Internal pointability provides coverage flexibility without brackets. Automatic signal synchronization and range adjustment reduce installation costs. Selectable sensitivity and alarm response time provide installation flexibility.
Available accessories:

- A D306 Remote Indicator Plate, a D1005 Test Cable, and a set of four plastic sensitivity test filters are included with each detector.
- A D307 Remote Test and Indicator Plate (not supplied) is required for remote alarm testing.
- A D308 Test Kit (not supplied) is needed for field testing.
- A D309 Alignment Light is also available to aid in transmitter/receiver alignment.

2.2 Operation

Each transmitter sends an invisible infrared beam of a specific frequency and intensity. Each receiver detects and measures the beam's intensity (see the following figure).

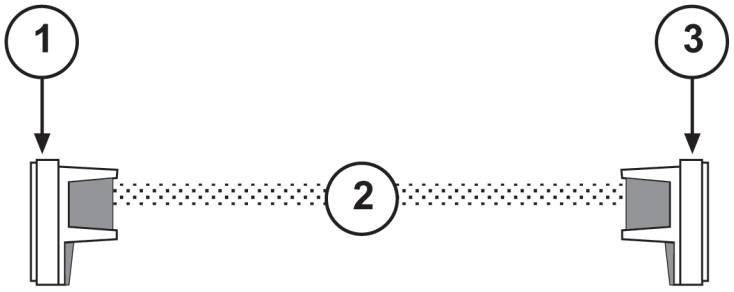

Figure 2.1: Infrared Transmission

1	Transmitter	3	Receiver
2	Beam		

As smoke obscures the beam, the receiver senses a decrease in the signal strength and measures that decrease. The receiver compares the signal level with two preset thresholds: an alarm threshold that is set using the sensitivity switch and a trouble threshold that is preset at approximately 10%. If the signal falls below the alarm threshold for the programmed alarm period, the receiver signals an alarm (see the following figure).

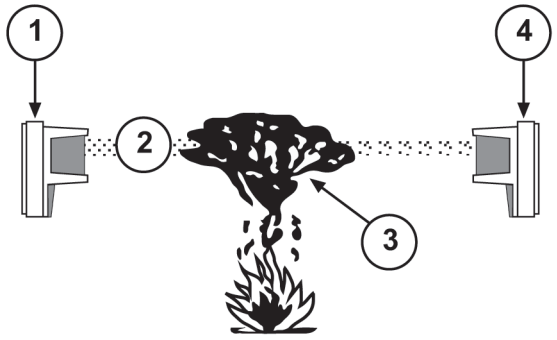

Figure 2.2: Beam Obscuration

1	Transmitter	3	Obscuring matter
2	Beam	4	Receiver

If the signal falls below the trouble threshold for more than 20 sec (caused by an object blocking the beam for example), the receiver signals a trouble condition (see the following figure).

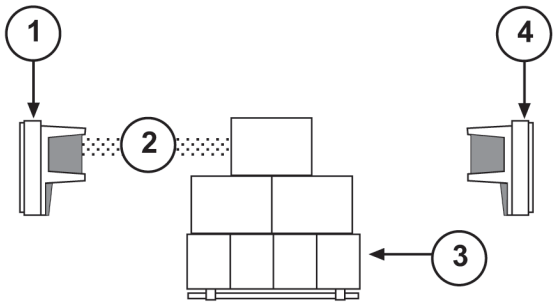

Figure 2.3: Beam Blockage

1	Transmitter	3	Blocking object
2	Beam	4	Receiver

The receiver automatically compensates for the gradual signal loss because of dust and dirt buildup on the cover. After a signal loss of 50%, the receiver indicates a trouble. When the built-up dust and dirt are cleaned or the blockage is removed, the detector automatically returns to its normal operation level.
The receiver indicates a trouble if the beam strength increases by more than 20% for longer than 20 sec. A trouble can be caused by an initial misalignment or the removal of a partial beam blockage during alignment. Perform a fine-tune alignment.
For alignment details, see *Setup, page 17*.

3 Installation considerations

Correct smoke detector location and spacing is critical in a properly installed and operating fire alarm system. For best results, place and space the detectors according to the National Fire Protection Association (NFPA) Standard 72, The National Fire Code.
In all installations, good engineering judgment must prevail.

- Do not use mirrors. Install detectors with a clear line-of-sight between the transmitter and receiver.
- Clear the beam path of moving objects.
- Avoid areas with normal smoke concentrations, such as kitchens and garages.
- Do not install detectors where the normal ambient temperatures are below -22°F (-30°C) or above +130°F (+54°C).
- Set sensitivity based on the distance between the transmitter and receiver. For information on selecting and setting sensitivity, see *Design for the expected fire load, page 8* and *Sensitivity setting, page 11*.

3.1 Avoid air movement sources

- Place the transmitters/receivers where the beam path does not pass near heating and cooling outlets. Do not mount where hot or cold air blows directly into the beam path. Heating, ventilating, and air conditioning (HVAC) systems can blow smoke away from the beam path. Smoke must accumulate in the beam path to be detected.
- Do not mount heaters close to the beam path. Heat can distort the beam.
- Test for beam distortion by monitoring the signal voltage. After setup, the detector's signal voltage must read between 3.8 VDC and 4.2 VDC. Monitor the voltage and turn on all heating and cooling devices in the area. The signal voltage must not fluctuate more than 0.20 VDC. If it does, relocate the detector to avoid these disturbances.

3.2 Avoid bright light sources

Bright light can cause stray signals. Do not point the receiver toward any of the following sources.

Sunlight: Do not point the receiver directly at the rising or setting sun. If installing the receiver where sunlight cannot be avoided, mount it slightly higher than the transmitter and aim it down toward the transmitter. This causes the receiver to look below the horizon.

Bright Lights: Do not mount the receiver where it looks at exposed bulbs of high-pressure sodium, mercury vapor, and metal halide lights. For an illustration of areas in which to avoid exposed lights, see the following figure.

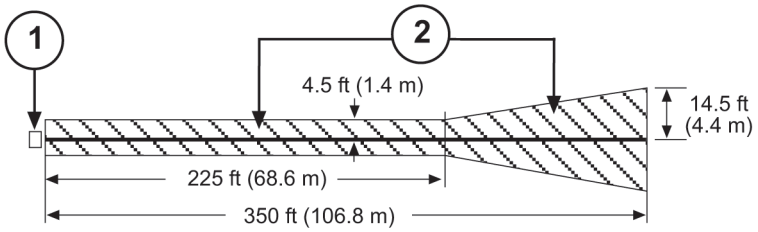

Figure 3.1: Avoiding Exposed Lights

1	Receiver	2	Do **not** place bright lights in this area.

Bare fluorescent lights can also create a problem, especially in long hallways where a series of lights are perpendicular to the beam. Incandescent lights are not a problem as long as they are not directly in the beam path.

3.3 Use correct wire gauge and length

Beam smoke detectors are often used to protect large areas, requiring long wire runs to power the detectors and signal alarm conditions. The voltage available at the end of long wire runs might not be sufficient to power the detector, especially when the system is running on backup battery power. Use the correct wire gauge when installing detectors.

For the proper number of transmitter and receiver pairs depending on wire size and length, see the following table.

Wire Length	Wire Size		
	14 AWG (ISO 2.5 mm²)	**16 AWG (ISO 1.5 mm²)**	**14 AWG (ISO 0.75 mm²)**
500 ft (152 m)	20 pairs	13 pairs	8 pairs
1000 ft (304 m)	10 pairs	6 pairs	4 pairs
2500 ft (762 m)	4 pairs	3 pairs	2 pairs
5000 ft (1524 m)	2 pairs	1 pair	1 pair

Table 3.1: Wire Gauge and Length

3.4 Provide a stable mounting surface

Beam smoke detectors depend on the projected beam measurement to sense smoke. Trouble or alarm conditions can be caused by shifts in beam alignment when the transmitter or receiver moves.

Never mount a detector to a suspended support, such as a pipe or length of wood that is supported at only one end. This type of mounting can create a pendulum effect that greatly multiplies even very small movements at one end of the support. For example, a 2 in. (5.1 cm) movement translates into a beam misalignment of more than 20 ft at 350 ft (6 m at 107 m). Support mounting surfaces at opposite corners to reduce the pendulum effect.
Always select surfaces that are not subject to building movement. The automatic compensation circuits eliminate most problems created by normal building expansions and contractions. In some unusual circumstances, the walls and support structure might be subject to more significant movement because of heavy equipment operation, such as cranes anchored to the top of the walls.
When you are uncertain about mounting surface stability, measure the detector's signal voltage. This voltage must be between 3.8 VDC and 4.2 VDC. Beam misalignment can cause this voltage to increase or decrease. The detector indicates a trouble condition when the voltage increases to greater than ~4.8 VDC or decreases to less than ~2 VDC over a long period. A trouble condition also occurs when voltage decreases to ~0.4 VDC for more than 20 sec. For how to take a voltage reading, see *Reference voltage adjustment, page 24***.**
If you expect the mounting surface to move, relocate the detector to a stable surface or add supports to the mounting surface to prevent movement.
Mounting the detector to a square or octagonal electrical mounting box of 4 in. (10 cm) can bow the mounting plate. Bowing can occur because the mounting box screw tabs are below flush with the top edges of the mounting box. Over tightening the mounting screws bows the mounting plate inward at the bottom, causing the optics to aim low.
Irregularities in the flatness of the mounting box edge surfaces or at the screw tabs worsens this condition. Only use mounting boxes with flat, regular surfaces and properly formed screw tabs. Tightening the mounting screws to secure the mounting plate to 2 in. (5 cm) or 2 lb (0.9 k) torque minimizes misalignment caused by mounting plate bowing.

3.5 Plan for the effects of stratification in cold environments

Air stratification might prevent smoke from reaching detectors mounted close to the ceiling. Stratification occurs when smoke, rising because it is warmer than the surrounding air, reaches a level where it is the same temperature as the surrounding air and does not rise to the ceiling. In extremely cold environments such as unheated warehouses, smoke cools very quickly and is less likely to rise to the ceiling. Add more detectors at lower mounting heights to compensate.

3.6 Design for the expected fire load

When designing a fire alarm system, set detector sensitivity to respond to the proper smoke obscuration and to reduce the chance of a false activation within the application. The total obscuration of the infrared beam depends on the density of the smoke and width of the smoke cloud along the beam path as illustrated in the following figure.

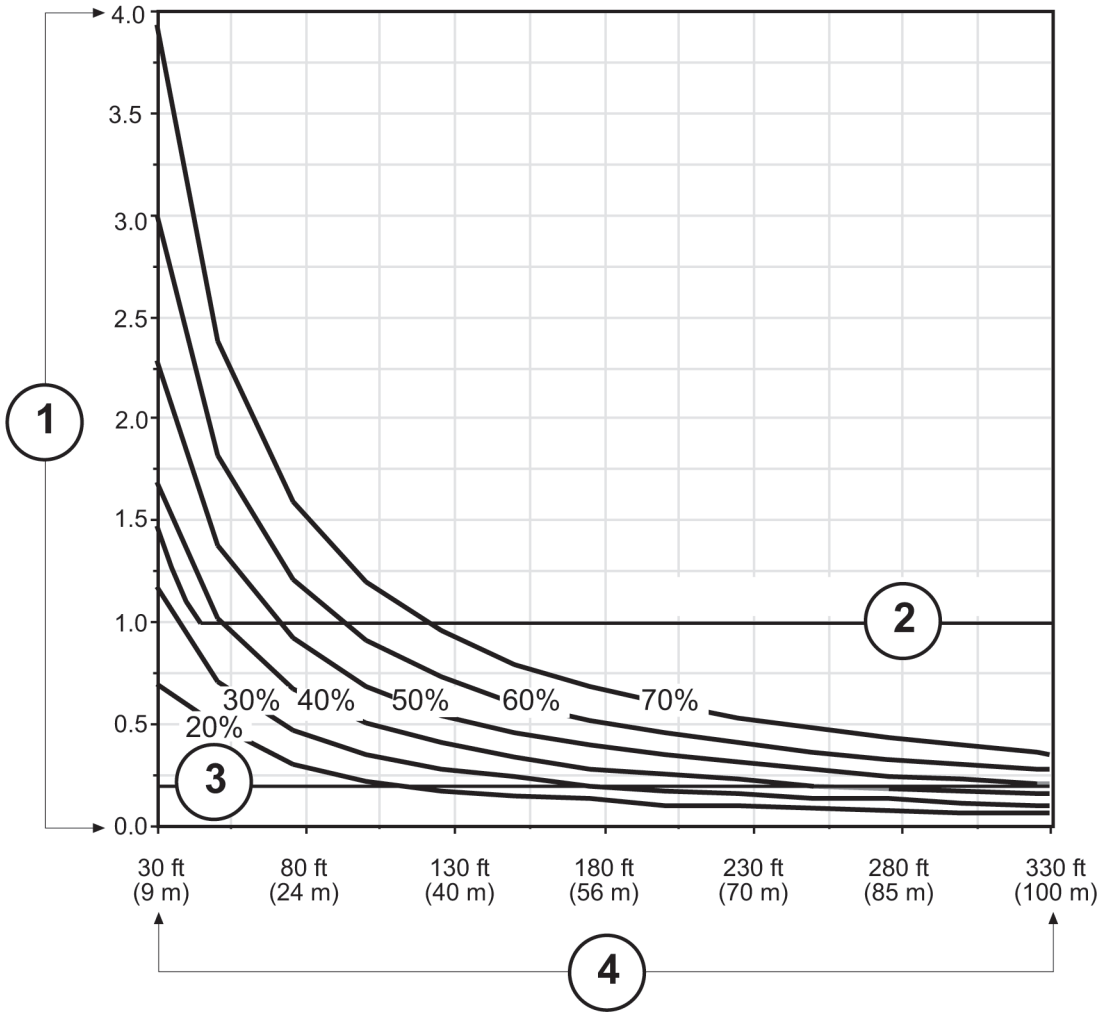

Figure 3.2: Smoke Densty and Obscuration Graph

1	Smoke density	3	UL maximum sensitiivity
2	UL minimum sensitivity	4	Distance between transmitter and receiver

Determine the total obscuration needed for an alarm and select the sensitivity setting needed according to the following table.

Total Obscuration at Alarm	**Sensitivity Switch Setting**
20%	2
30%	0 or 3
40%	4
50%	5
60%	1 or 6
70%	7

The D296 and D297 can be set for quick response (5 sec) or normal response (30 sec). Some burning materials release hazardous gases along with the smoke and should be set for a shorter response times to minimize exposure to the dangerous vapors. Denser smokes, if allowed to collect for too long (obscuration time set too long), can produce near total obscuration of the detector resulting in a trouble signal before an alarm is generated. For example, fires caused by the ignition of flammable petroleum-based liquids generally lead to a rapid buildup of heavy smoke. When this type of fire is probable, use sensitivity settings 0 or 1 for a 5-sec response time.
For instructions on setting the sensitivity, see *Sensitivity setting, page 11*.

4 Mounting

Notice!
Use this product in indoor, dry applications only.

1. Install a 4-in. square or octagonal electrical box (or equivalent) to a rigid surface that is not subject to movement or vibrations.
2. Remove the screw on the receiver's access door. Then remove the cover’s four screws indicated in the following figure.

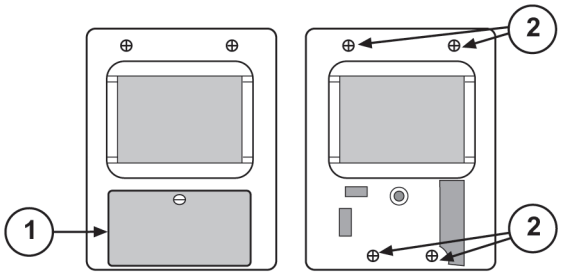

Figure 4.1: Access Door and Cover

1	Access door	2	Cover mounting screws (4)

3. Remove the receiver back plate by unscrewing the single mounting screw from the top of the circuit board carrier plate and separating the two plates as indicated in the following figure.

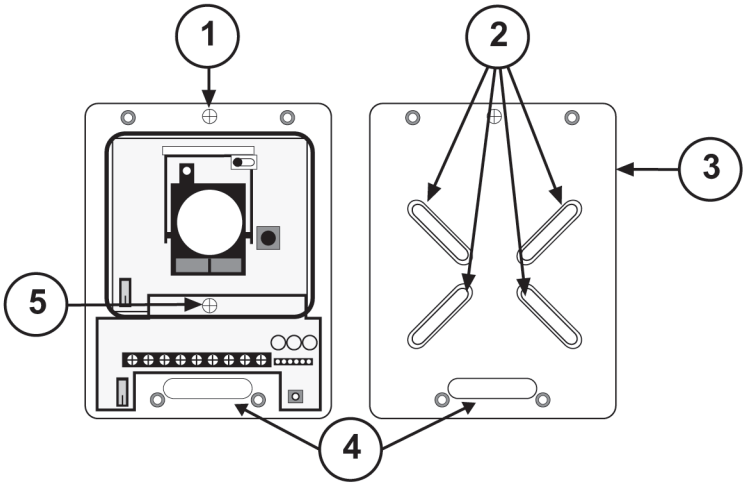

Figure 4.2: Removing the Back Plate

1	Remove screw to expose back plate	4	Wiring entrance
2	Mounting slots (4)	5	Do **not** remove
3	Back Plate		

Warning!
Remove power to all wiring before proceeding.

4. Route the wiring from the electrical box through the wire entrance. If you are going to connect a D306 or D307, route that wiring also.
5. Mount the back plate to the electrical box.
6. Attach the circuit carrier plate to the back plate using a single mounting screw.
7. Repeat Steps 1 through 6 to mount the transmitter.

4.1 Sensitivity setting

1. Select the appropriate sensitivity setting based on the distance between the transmitter and receiver. For a list of distances including some settings that overlap, see the following table. Select a lower setting for a more sensitive detection or select a higher setting for better immunity to false alarms.

Switch Setting	Sensitivity	Alarm Response	Beam Length
0	30%	5 sec	30 ft to 100 ft (9 m to 31 m)
1	60%	5 sec	100 ft to 350 ft (31 m to 107 m)
2	20%	30 sec	30 ft to 50 ft (9 m to 15 m)
3	30%	30 sec	45 ft to 75 ft (14 m to 23 m)
4	40%	30 sec	70 ft to 100 ft (21 m to 31 m)
5	50%	30 sec	90 ft to 140 ft (27 m to 43 m)
6	60%	30 sec	120 ft to 180 ft (37 m to 55 m)
7	70%	30 sec	160 ft to 350 ft (49 m to 107 m)

Switch Setting	Sensitivity	Alarm Response	Beam Length
8*	Not used		
9*	Not used		
* Do not use positions 8 and 9. They are not valid.			

2. Set the receiver’s sensitivity switch to your selected setting. The sensitivity switch is located to the right of the optical module. The indicator, or pointer marking, runs along the side of the switches' shaft as indicated in the following figure.

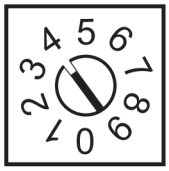

Figure 4.3: Sensitivity Switch

4.2 Quick start installation flowchart

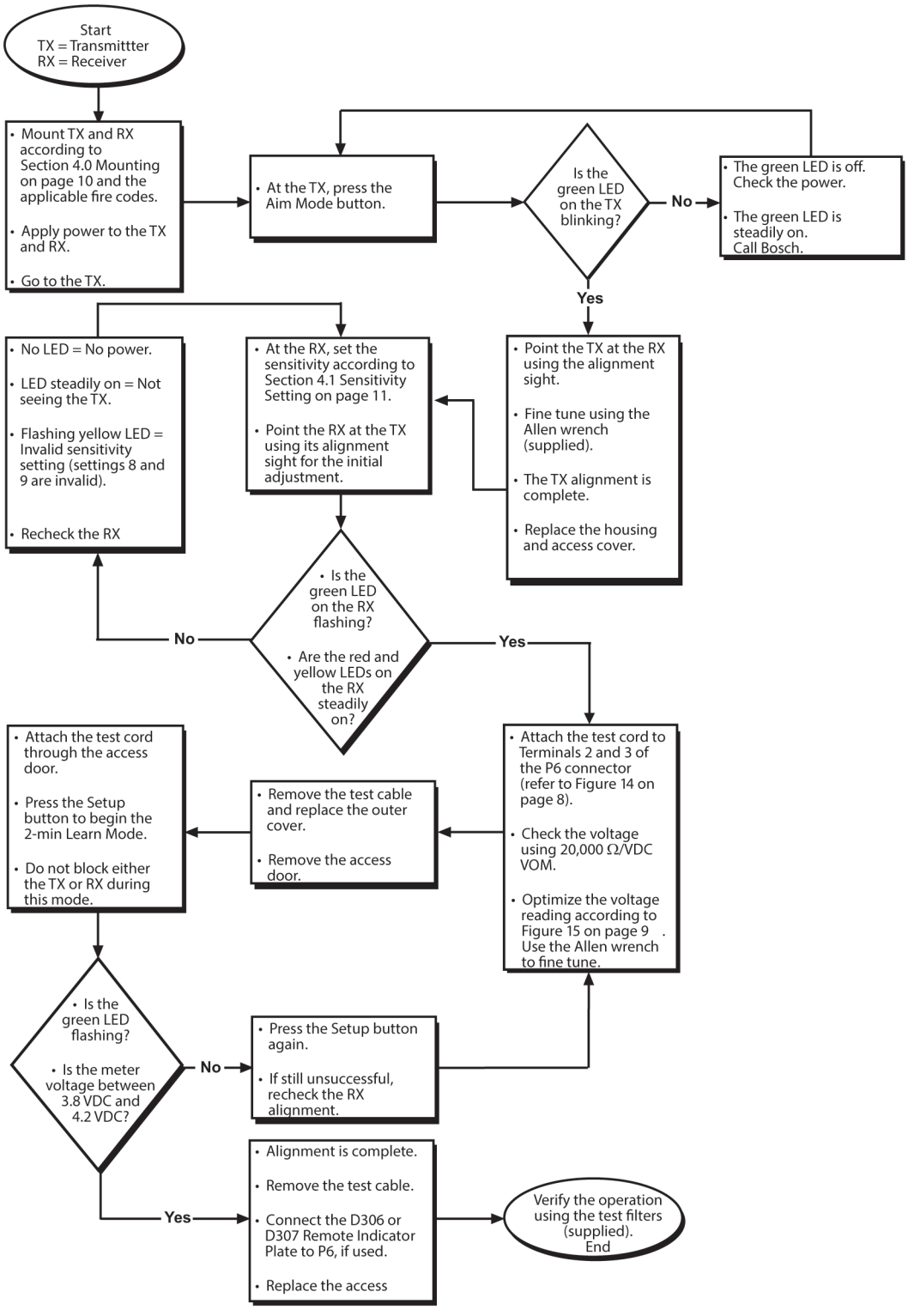

Figure 4.4: Installation Flowchart

5 Wiring

Warning!
Only apply power after all connections are made and inspected.

Notice!
Do not install on fire circuits programmed for alarm verification.

Notice!
Do not coil excess wiring inside the units.

5.1 Wiring a single detector

When wiring the transmitter and receiver terminals, see the following figure and table.

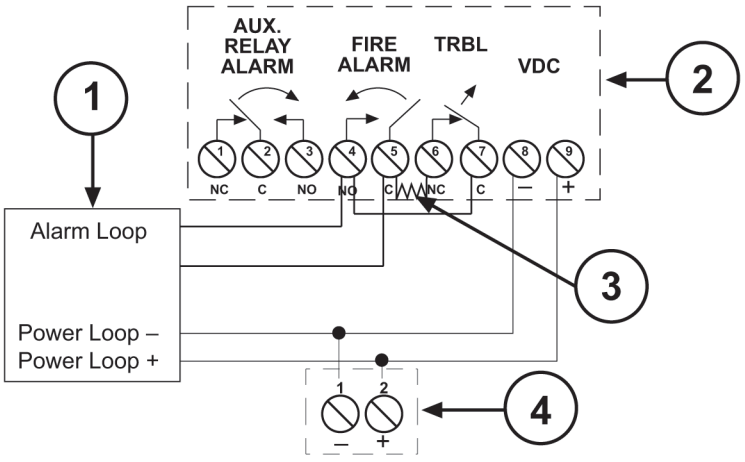

Figure 5.1: Wiring a single detector

1	Fire alarm control panel (FACP)	3	End-of-line (EOL) resistor
2	Receiver	4	Transmitter

Type	Terminal	Description
Transmitter terminals	1 and 2	Input power terminals. for operating voltages, see *Specifications, page 26*.
Receiver terminals	1, 2, and 3	Form C auxiliary relay contacts. On fire alarm, Terminals 1 and 2 open; Terminals 2 and 3 close (short).

Type	Terminal	Description
Receiver terminals	4 and 5	On fire alarm, normally open (NO) fire alarm contacts close (short).
Receiver terminals	6 and 7	On trouble, normally closed (NC) trouble contacts open.
Receiver terminals	8 and 9	Input power terminals. For operating voltages, see *Specifications, page 26*.

Table 5.1: Transmitter and Receiver Terminals

Notice!
To reset after a fire alarm, interrupt power to the receiver for a minimum of 1 sec. If the fire panel does not allow you to reset, install a switch in series with Terminal 8.

5.2 Wiring a remote indicator

A D306 Remote Indicator Plate is shipped with the D296 as a standard accessory. The D306 has three LEDs to indicate the detector's condition and status and test points for measuring the sensitivity voltage. Although the D306 is not required, the manufacturer recommends its installation to check the detector's condition from ground level. If using D306 Remote Indicator Plate, install the remote indicator connector to the receiver as indicated in the following figure.

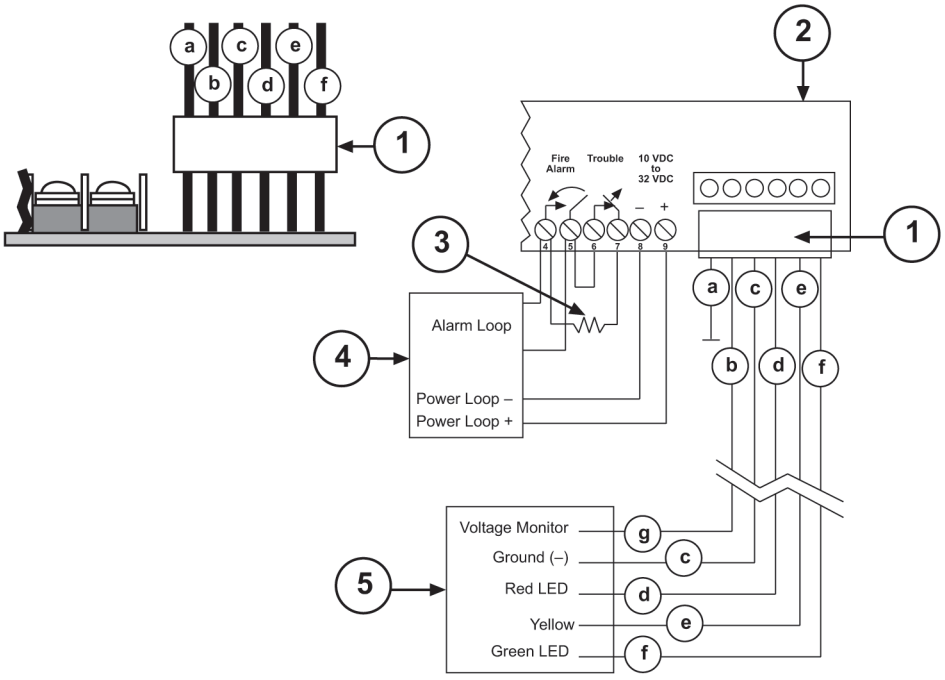

Figure 5.2: Connecting a D306 Remote Indicator Plate

1	D306 Remote Indicator Plate Connector	4	FACP
2	D296/D297 Receiver	5	D306 Remote Indicator Plate
3	EOL resistor	6	Wiring: a=orange, b=blue, c=black, d=red, e=yellow, f=green, g=violet

You can wire the D306 a maximum of 500 ft (152 m) from the receiver.
A D307 Remote Test and Indicator Plate can be used in place of the D306 and should be connected if remote alarm testing is desired. To connect a D307, follow the instructions in the *D307 Installation Instructions*.

5.3 Wiring multiple detectors

For smooth, flat ceilings, mount the detectors so there is spacing of no more than 60 ft (18.3 m) between beam paths (with no more than half of this spacing between the beam path and side wall, the wall parallel to the beam path). Other spacings depend on ceiling height, air flow characteristics, and response requirements. The minimum spacing between alternated adjacent detectors is 1/10th the distance between the transmitter and receiver. For example, if the beam length is 300 ft (91 m), place the detectors a minimum of 30 ft (9.1 m) apart. For layout placement, see the following figure.

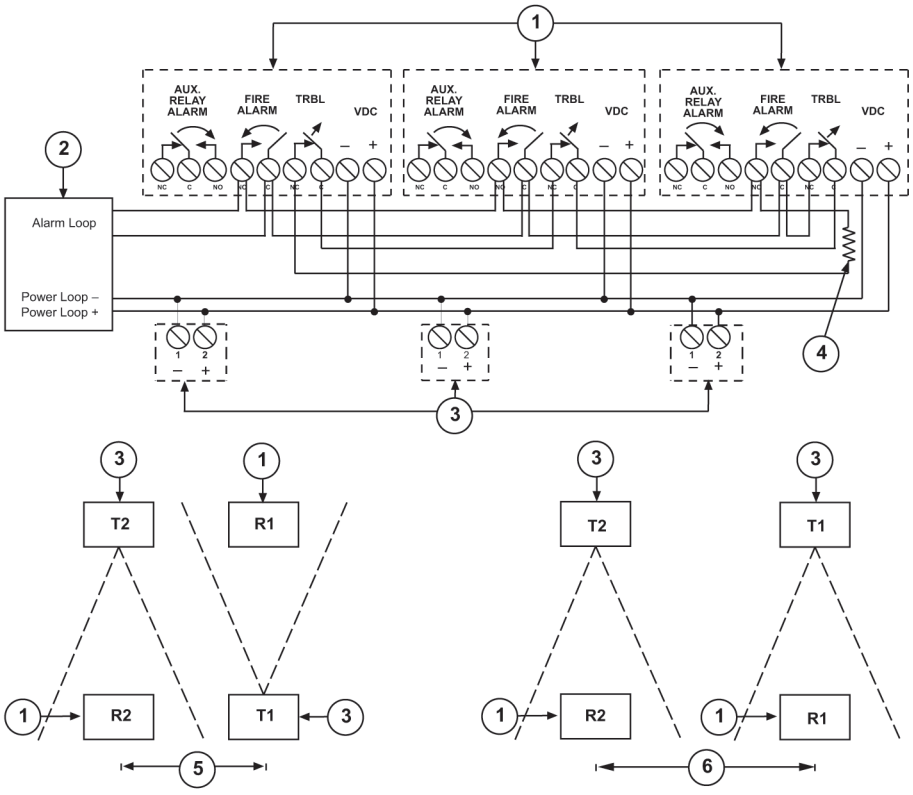

Figure 5.3: Transmitter and Receiver Placement

1	Receiver	4	EOL resistor
2	FACP	5	Minimum spacing = 1/10 x distance
3	Transmitter	6	Minimum spacing = 1/5 x distance
* maximum spacing between adjacent systems is 60 ft (16.3 m)			

Notice!

When two or more adjacent detectors are installed in the same area, alternate the transmitter and receiver locations. If the transmitter and receiver are not alternated, ensure the spacing between the detectors is 1/5th the distance from the transmitter to the receiver.

6 Setup

Before performing a setup, ensure all connections are made and secure. Then, apply power to the transmitter and receiver.

1. To allow the transmitter to power up while the cover is off, press the transmitter's Aim Mode button located above the green LED as indicated in the following figure.

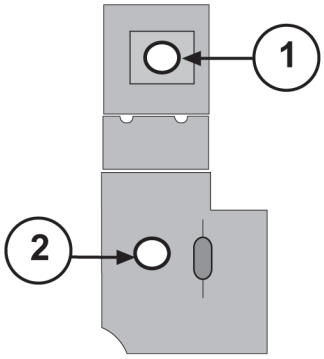

Figure 6.1: Transmitter Circuit Board Showing Aim Mode Button

1	Aim Mode button	2	Green LED

2. Ensure the green LED flashes on and off. If this LED is off, check for power and proper polarity on Terminals 1 (–) and 2 (+). If the green LED is steadily lit, you have a faulty transmitter. To begin the process of obtaining a replacement, call the Bosch National Repair Center at (800) 366-2283 or send an e-mail to repair@us.bosch.com.
3. Check the three receiver LEDs indicated in the following figure. It is normal for all three LEDs to be on at this time, with the green LED either flashing or steadily on. If all LEDs are off, check for power and proper polarity on Terminals 8 (–) and 9 (+).

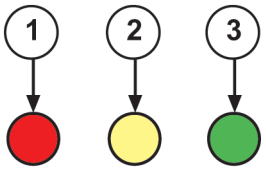

Figure 6.2: Receiver LEDs

1	Alarm LED (red)	3	Normal LED (green)
2	Trouble LED (yellow)		

4. Depending on your application, an aid to alignment might be necessary. If so, mount an aiming light, D309 or equivalent, as close to the receiver as possible, preferably on top of the receiver.
5. Point the aiming light at the transmitter using it as your aiming guide.

6.1 Preliminary alignment

Each optical module has two alignment mirrors, one on each side, for preliminary alignment as indicated in the following figure.

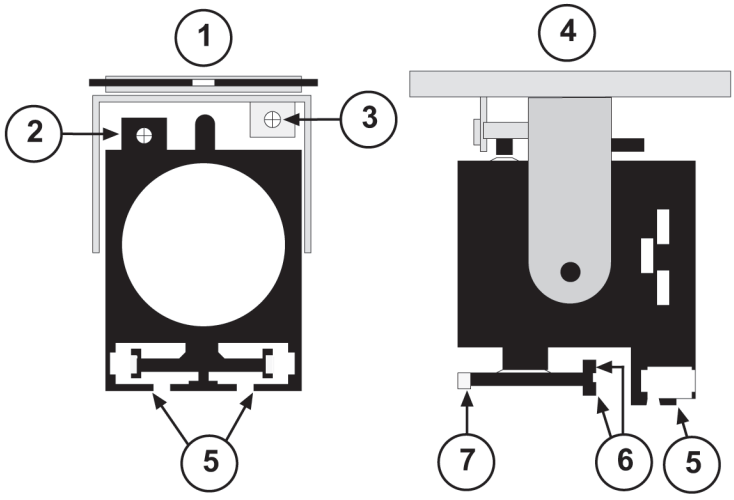

Figure 6.3: Optical Module

1	Front view	5	Alignment mirrors (3)
2	Vertical fine tune	6	Rear bore sights (2)
3	Horizontal fine tune	7	Front bore sight
4	Side view		

1. Look into either mirror from a side angle at a minimum of 2 ft (61 cm) from the module.
2. Use the rear and front sights in the same way as you use sights when aiming a gun.
3. Rotate the transmitter's optical module left or right until you see the aiming light image (or receiver’s image, if aiming light is not used) in the mirror. The optical module points at objects seen in the mirror when the front bore sight is in the center of the rear bore sights as indicated in the following figure.

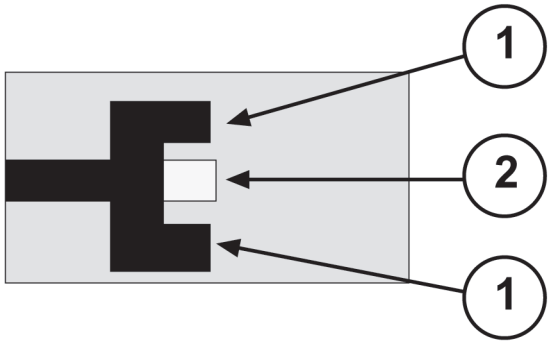

Figure 6.4: Alignment Mirror

1	Rear bore sights (2)	2	Front bore sight

4. If the optical module is initially aimed too high or too low, adjust the Vertical Fine Tuning adjustment Allen screw (with the supplied Allen wrench) slightly up or down until you see the image.

5. Use the Vertical Fine Tuning adjustment screw and the Horizontal Fine Tuning adjustment screw to fine tune the image to the center of the mirror (aligned with the front and rear bore sights).
6. Replace and secure the transmitter's cover.
7. Ensure the transmitter's green LED is flashing.
8. Replace and secure the transmitter's access door.
9. Align the receiver to the transmitter image following Steps 1 through 7.
10. Ensure the receiver's green LED is flashing, indicating the preliminary alignment is complete.
11. If the receiver’s green LED is not flashing, repeat Steps 1 through 9 for the receiver.

6.2 Fine-Tune alignment

1. Connect the D1005 Test Cable (supplied) to Pins 1, 2, and 3 of P6. These pins are located to the right of the receiver’s terminal strip as indicated in the following figure.

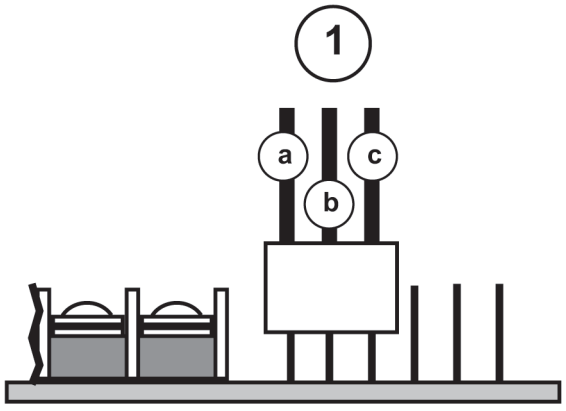

Figure 6.5: D1005 Connection

1	Connector wires: a = white, b = red [+], c = black [-]

Notice!
If the Remote Indicator Plate connector is installed, temporarily disconnect it.

2. Connect a 20,000 Ω/VDC VOM (or greater) to the D1005’s black (–) and red (+) leads. Set the meter scale so you see the readings ranging from 0 VDC to 5 VDC.
3. Check the three receiver LEDs on the receiver.

– If the receiver gets the beam, the green LED flashes and the red and yellow LEDs are steadily on.
– If the green LED is steadily on, the beam is not reaching the receiver. Realign according to the procedure described in *Preliminary alignment, page 18*.

4. Observe the meter readings. Adjust the receiver’s optical module using the horizontal and vertical fine-tuning adjustment screws for a maximum meter reading.

Notice!
This is the most critical alignment process. For the most effective system operation, ensure you have peak voltage during the fine-tune alignment.

Notice!
When performing fine-tune alignment, keep your arms and hands away from the front of the receiver and out of the beam path.

- The maximum voltage peak reading varies, depending on the distance between the transmitter and receiver. The acceptable peak voltage range is from 0.50 V to 5.00 V. The voltage at the receiver is greater at shorter distances.
- Make a note of the alignment voltage. It might be helpful if you need to troubleshoot at another time.

Notice!
Peak the voltage to ensure a stable and trouble-free detector.

5. After completing the fine-tune alignment, remove the test cable.
6. Replace and secure the receiver's cover.
7. Check the status of the receiver's green LED to ensure it is still flashing.
8. With the meter still connected to the test cable, reinstall this cable to P6. Route the test cable through the opening in the cover (white lead towards center of the receiver).
9. At this point, you can perform an Alarm Test. Connect the D1005's white and black wires. Reset the receiver by temporarily removing power.
10. Press the receiver's Setup button, located below the P6 and test cable connection as indicated in the following figure.

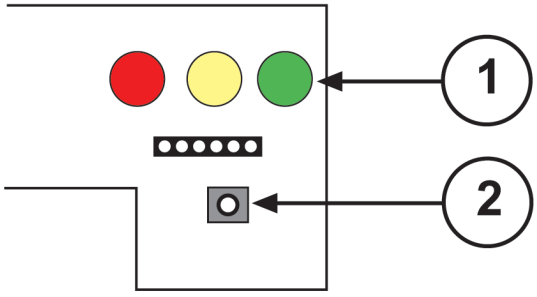

Figure 6.6: Receiver Setup Button

1	LEDs	2	Setup button

Notice!
Only press the Setup button if the covers are on both the transmitter and receiver.

- A 1-min to 2-min automatic internal setup process begins. This setup ends in a reference voltage that is used to measure beam blockages.
- The red and yellow LEDs turn off and the green LED turns steadily on. After some voltage fluctuations, the meter sets to 5.0 VDC.

Notice!
During this time, do not block the beam or move the units.

11. At the end of the setup, the receiver's green LED flashes and the voltage decreases to a range from 3.8 VDC to 4.2 VDC. Use this voltage as a reference when you compare later readings to determine the need for cleaning. If the voltage is not within this range, press the Setup button.
12. After setup, remove the test cable.
13. Reconnect the D306 or D307 connector if used.
14. Replace and secure the access door.

7 Troubleshooting

7.1 Transmitter

LED	Condition	Solution
Flashing	Normal	
Off	1. There is no power at the transmitter. 2. The Aim Mode button not pressed. 3. The transmitter is faulty.	1. Restore power to Terminals 1 and 2. 2. Press the Aim Mode button. 3. Replace the transmitter.

7.2 Receiver - Aim Mode (cover off)

Red LED	Yellow LED	Green LED	Terminals 4 and 5	Terminals 6 and 7	Condition	Solution
On	On	Flashing	Open	Open	The alignment is acceptable.	
On	On	On	Open	Open	The beam is blocked or the receiver is misaligned.	Clear the beam path or realign the receiver.
On	Flashing	Flashing	Open	Open	The sensitivity setting is invalid.	Set the receiver to the proper setting.
On	Off	Off	Open	Open	There is no power.	Check for power at Terminals 8 and 9.

7.3 Receiver - Normal Mode (cover on)

Red LED	Yellow LED	Green LED	Terminals 4 and 5	Terminals 6 and 7	Condition	Solution
Off	Off	On	Open	Closed	The receiver is initializing. It stabilizes in 60 sec to 120 sec.	
Off	Off	On	Open	Open	The receiver is initializing. The access door is missing or loose.	Replace the access door.
Off	Off	Flashing	Open	Closed	Normal	
Off	Off	Flashing	Open	Open	The access door is missing or loose.	Replace the access door.
Off	On	On	Open	Open	Trouble. Beam is blocked or misaligned.	Clear the beam path or realign the receiver.
Off	On	Flashing	Open	Open	Trouble. If the reference voltage is less than ~2 VDC, dust on the lens reduced the signal strength or vibration misaligned the receiver.	Clean the transmitter and receiver covers. If the reference voltage does not return to 3.8 VDC to 4.2 VDC, realign the receiver and press the Setup switch.
Off	On	Flashing	Open	Open	If the reference voltage is greater than ~4.2 VDC, the beam strength increased because an initial beam misaligned or a partial blockage was removed at setup.	Perform a fine-tune alignment of the receiver and use the Setup button.
On	Off	Flashing	Closed	Closed	Alarm	Determine the cause of the alarm and reset the receiver.

Red LED	Yellow LED	Green LED	Terminals 4 and 5	Terminals 6 and 7	Condition	Solution
On	Off	Flashing	Closed	Open	Alarm. The access door is missing or loose.	Determine the cause of the alarm and reset the receiver. Replace the access door.
On	On	On	Closed	Open	Alarm and Trouble. An alarm occurred, then the beam was blocked.	Determine the cause of the alarm and reset the receiver. Clear the beam path.

8 Maintenance and Testing

8.1 Fire alarm reset

Reset the receiver after a fire alarm by removing power from the receiver for at least 1 sec., then reapply power.
For additional information, see *Power outage, page 24*.

8.2 Reference voltage adjustment

Notice!
Clean covers are necessary for proper reference voltage readings. For cleaning procedures, see *Cleaning, page 24*.

Check the detector's reference voltage a minimum of once each year. Check the voltage more often if required by local regulations or AHJs.
To check the reference voltage, connect a VOM to the voltage monitor contacts on the D306 or D307 if used. If you do not have a D306 or D307 connected to the detector, remove the receiver access door and measure the reference voltage using the supplied test cable. For cable connection, see *Fine-Tune alignment, page 20*.
If the voltage is less than 3.8 VDC or greater than 4.2 VDC, remove the access cover and press the setup button to initiate a reset of the reference voltage. The reset can take 1 min to 2 min.

8.3 Cleaning

Clean the outside of the covers a minimum of once each year. Use a common window cleaner and a soft, clean cloth. Under normal conditions, there is no trouble alarm if the beam is not continuously blocked for longer than 18 sec. After cleaning, recheck the reference voltage. If voltage is less than 3.8 VDC or greater than 4.2 VDC, reset the reference voltage using the procedure in *Reference voltage adjustment, page 24*.

8.4 Power outage

When power is removed and reapplied to the receiver, such as in a power outage or alarm reset, the original reference voltage information is lost.

– If the cover is on during power-up, the receiver automatically restarts the internal setup process for a new reference voltage when power is applied.

– If the cover is off, reattach it and press the setup button.

8.5 Remote test

Notice!
A D307 is required for the remote alarm test.

Notice!
Clean covers are necessary for proper reference voltage readings. For cleaning procedures, see *Cleaning, page 24*. For aiming procedures, see *Preliminary alignment, page 18* and *Fine-Tune alignment, page 20*.

With a D307 connected to the receiver, use the following procedure to perform a remote test.

1. Insert the operating key and turn the switch to the TEST position for a minimum of 5 sec.
– The red LED lights steadily and the system sounds an alarm.
2. Turn the switch to RESET for a minimum of 1 sec.
– The red LED turns off and the green LED lights steadily for approximately 60 sec to 120 sec.
– The receiver proceeds with its Setup Mode. When the setup is completed, the green LED begins flashing.
3. Connect a standard volt-ohm meter (VOM) to the voltage monitor plugs. The voltage reading must range between 3.8 VDC and 4.2 VDC when clean and properly aimed.

Notice!
You can also use the voltage monitor to check the sensitivity level of the detector. As the signal level decreases because of dust or dirt buildup on the lenses or system misalignment, the voltage reading also decreases.

8.6 Field sensitivity measurements

Notice!
Testing these detectors activates a fire alarm. Inform all concerned personnel before performing a test.

The detectors automatically compensate for the effects of dust and dirt accumulation on their covers. They also compensate for component aging.

Notice!
NFPA 72 requires the detector sensitivity be measured in the field within one year after its initial installation and every alternate year thereafter.

Use the Sensitivity Test Kit supplied with the detector to check detector sensitivity only during installation. For field testing, order and use a D308 Test Kit.
Each filter decreases the detector's signal by a specific amount. When you place a filter in front of the receiver's optical module for a minimum of 30 sec (5 sec for position 0 or 1), you can determine the approximate sensitivity setting of the installed detector by its response as shown in the following table.

Sensitivity Setting	Must Not Alarm	Must Alarm
2	0% (no filter)	40% filter
0 or 3	0% (no filter)	60% filter
4	20% (filter)	60% filter
5	20% (filter)	80% filter
1 or 6	40% (filter)	80% filter
7	40% (filter)	80% filter

Table 8.1: Sensitivity and Response

9 Specifications

Electrical

Alarm Current (Receiver)	D296: 70 mA maximum at 24 VDC D297: 75 mA at 12 VDC
Standby Current	D296 Receiver: 45 mA at 24 VDC D296 Transmitter: 20 mA at 24 VDC D297 Receiver: 50 mA at 12 VDC D297 Transmitter: 20 mA at 12 VDC
Operating Voltage	D296: 18.0 VDC to 32.0 VDC D297: 10.2 VDC to 15.0 VDC
Alarm contacts	Normally Open (N/O) contacts rated 1 A, 60 VDC maximum for DC resistive loads; do **not** use with capacitive or inductive loads
Auxiliary alarm contacts	Normally Open (N/O) contacts rated 1 A, 60 VDC maximum for DC resistive loads; do **not** use with capacitive or inductive loads
Trouble contacts	Normally Closed (N/C) contacts rated 1 A, 60 VDC maximum for DC resistive loads; do **not** use with capacitive or inductive loads

Environmental

Environment	Indoor, dry
Relative humidity	0% to 95%, non-condensing
Temperature (storage and operating)	-22°F to +130°F (-30°C to +54°C) *For UL Listed installations, the range is +32°F to +130°F (0°C to +54°C)*

Mechanical

Dimensions	7 in. x 5.5 in. x 5.5 in. (17.8 cm x 14 cm x 14 cm)
Mounting	mount to 3.5 in. or 4-in. square or octagonal electrical boxes or European Beza boxes
Pointability	Internally pointable optics for ±90° horizontal, and ±10° vertical adjustment
Sensitivity	Field selectable for 20%, 30%, 40%, 50%, 60%, or 70% beam obscuration
System Signaling	Conventional four-wire system; do **not** use with systems incorporating an alarm verification feature
Signal Delay	Fire: Selectable 30 sec or 5 sec Trouble: 20 ± 2 sec
Spacing (distance between systems)	60 ft (18 m) maximum; spacing confirmed by Underwriters Laboratories (UL) testing
Transmission range	30 ft (9 m) to 350 ft (107 m)
Tamper	Receiver: Access door tamper switch in series with trouble contacts. Transmitter: When the cover is removed, the cover tamper switch interrupts transmission

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