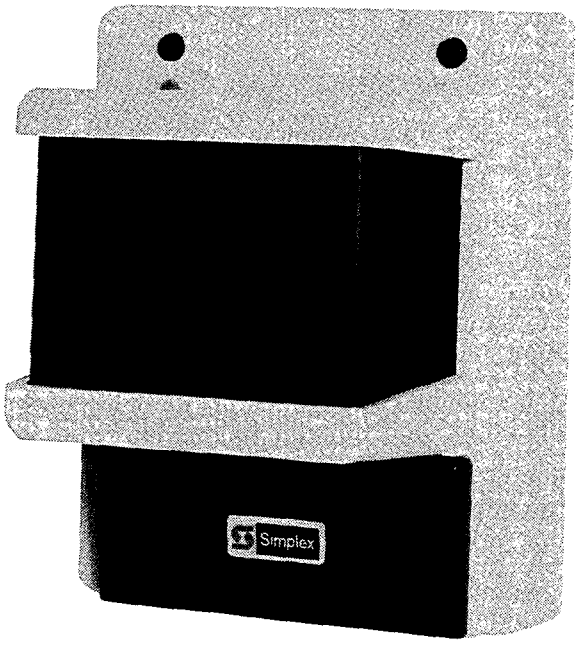
Simplex®

2098-9207 Long-Range Beam Smoke Detector

Installation Instructions



PER-21-016 (574-666)
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NOTE: This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to Part 15 of the 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 and, if not installed and used in accordance with these instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

— Reorient or relocate the receiving antenna.

— Increase the separation between the equipment and the receiver.

— Connect the equipment to a circuit different from that to which the receiver is connected.

— Consult the manufacturer or an experienced radio/TV technician for help.

GENERAL INFORMATION

The 2098-9207 is a long-range photoelectric smoke detector consisting of a separate transmitter and receiver. It protects large areas where the use of individual spot smoke detectors is impractical or uneconomical.

The transmitter's light source produces an invisible infrared beam. This beam is accurately measured by the receiver to determine obscuration by smoke. If the beam intensity falls below the threshold set for alarm, a fire alarm is initiated.

Dust build-up and other long-term effects are cancelled out and do not reduce the sensitivity of the detector. An analog output voltage can be measured remotely to help determine when cleaning is necessary. If dust builds up so that the signal is reduced by 50%, a trouble output occurs. Because this detector is a sealed unit, it requires only external cleaning. Intermittent beam blockage during cleaning is ignored. If complete beam blockage does occur, it only causes a trouble output— not an alarm.

A sync line is not required between the transmitter and the receiver. Simplified installation requires only one-time access to each unit; the transmitter is installed and aligned using internal bore sights before the receiver is in place. The receiver has microprocessor-control circuitry allowing automatic calibration at the touch of a button. The crystal-locked transmitter signature allows the receiver to distinguish the detection beam from all types of local noise sources such as fluorescent, mercury, and sodium arc lighting.

VOLTAGE RANGE: 18 to 32 VDC (maximum allowable ripple 4V p-p).

STANDBY CURRENT @ 24VDC: Receiver — 40 mA DC; Transmitter — 20 mA DC.

RECEIVER ALARM CURRENT: Trouble — 40 mA DC; Smoke detection —60 mA DC.

RANGE: 30 ft. to 350 ft. (10m - 105m).

POINTABILITY: Internally pointable optics for ± 90° horizontal, and ± 10° vertical adjustment.

SENSITIVITY: Field selectable for 20, 30, 40, 50, 60, or 70% beam obscuration.

ALARM CONTACTS: Form "A" (C, NO) with contacts rated 1 amp, 60 VDC maximum for DC resistive loads. *Do not use with capacitive or inductive loads.*

TROUBLE CONTACTS: Form "B" (C, NC) with contacts rated 1 amp, 60 VDC maximum for DC resisitive loads. *Do not use with capacitive or inductive loads.*

AUX. ALARM CONTACTS: Form "C" (NO, C, NC) with contacts rated 1 amp, 60 VDC maximum for DC resisitive loads. *Do not use with capacitive or inductive loads.*

TAMPER: **Receiver** - Access door tamper switch is in series with trouble contacts.
Transmitter - Cover tamper switch interrupts transmission upon the cover's removal.

SYSTEM SIGNALLING: Conventional 4-wire system. **Note:** Not for use with systems that incorporate an alarm verification feature.

SIGNAL DELAY: Fire = 30 ± 2 seconds; Trouble = 20 ± 2 seconds.

TEMPERATURE: The storage and operating range is -22°F to +130°F (-30°C to +54°C).

MOUNTING: The units are designed to be mounted to 4" square or octagonal electrical boxes (not supplied).

.OCATION

Proper location and spacing of detection devices are critical factors in a properly installed and operating fire alarm system. In all installations, good engineering judgement must prevail. See General Considerations below. For more detailed information, refer to the National Fire Protection Association (NFPA) Standard 72E, "Automatic Fire Detectors."

General Considerations

- Do not use mirrors. Install the 2098-9207 with a clear line-of-sight path between the transmitter and the receiver.
- Do not install the 2098-9207 where normal ambient temperatures are below -22°F (-30°C) or above +130°F (54°C).
- Do not install the 2098-9207 on a mounting surface that is likely to shift due to changes in temperature or from the operation of heavy machinery in the area.
- Do not pass the beams close to heating, ventilating, or air conditioning outlets where smoke may circulate away from the beam. Avoid other turbulent areas such as steam pipes.
- Make sure that the intended beam path is clear of moving objects.
- Set the sensitivity based on the distance between the transmitter and the receiver.
- Mount the receiver so that sunlight does not shine directly down the beam path and into the receiver.
- Avoid areas subjected to normal smoke concentrations such as kitchens and garages.
- Mount the Receiver so that interior lighting fixtures or highly reflective surfaces are not in its field of view.

Remember:

- Stratification of air in a room may hinder smoke from reaching ceiling-mounted detectors. 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. If stratification is a possibility, install extra beams at a height where stratification is expected.

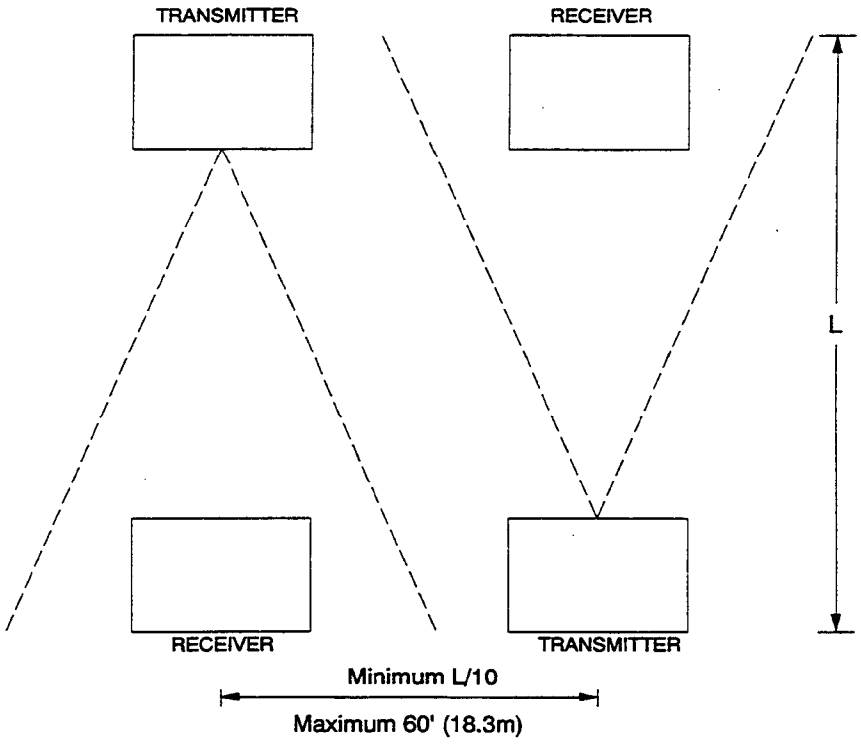
Single 2098-9207 Unit

- The 2098-9207 may be mounted either directly to the ceiling or to the side wall. Do not mount the units so that the beam path runs parallel within four (4) inches of any corner. For sloped or peaked ceilings, locate beam paths within 3' (91cm) of the ceiling's peak. Refer to the General Considerations on page 2 when selecting a mounting location.

Multiple 2098-9207 Units

- For smooth, flat ceilings, mount units so that a spacing of not more than 60' (18.3 m) exists between beam paths (with not more than one-half of that spacing between beam path and sidewall [wall parallel to beam path]). Other spacings depend on ceiling height, airflow characteristics, and response requirements. The minimum spacing between adjacent units is 1/10th of the distance between Transmitter and Receiver (If beam length is 300 feet, units should be no less than 30 feet apart).

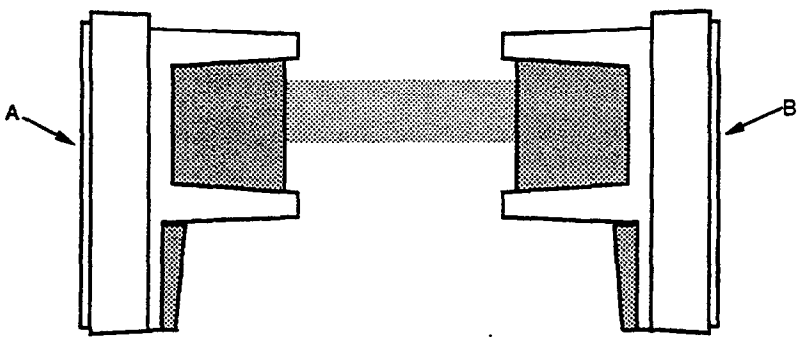
  Note: When two or more adjacent units are installed in the same area, it is required that Transmitter and Receiver locations are alternated. (see Figure 1). If not alternated, spacing must be 1/5th the distance from the Transmitter to the Receiver.



Alternating Transmitter and Receiver Locations in Multiple Unit Installations
FIGURE 1

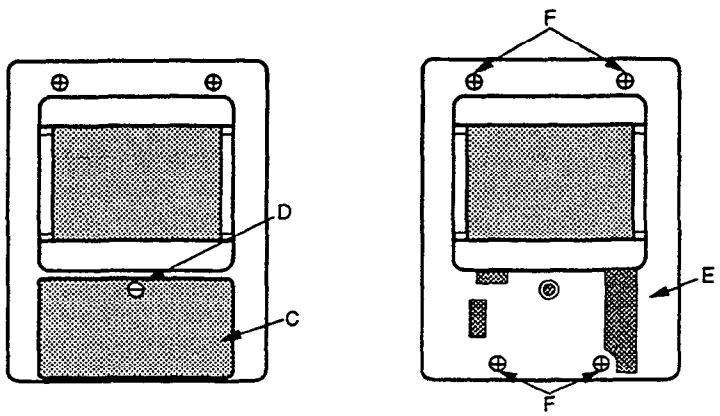
MOUNTING

1. For each receiver (A) and transmitter (B) (see Figure 2), install a 4" (10cm) square or octagonal electrical box (not supplied) to a **rigid** surface that is not subjected to movement or vibration.



2098-9207 Long-Range Beam Detector
FIGURE 2

2. Remove the access door (C) on each receiver and transmitter by removing one screw (D). The Receiver and the Transmitter may be identified by the label on the bottom of each cover. See Figures 2 and 3.



Removing Access Door and Cover
FIGURE 3

3. Remove the cover (E) on each receiver and transmitter by removing four screws (F). See Figure 3.

NOTE: For steps 4 through 7, see Figure 4.

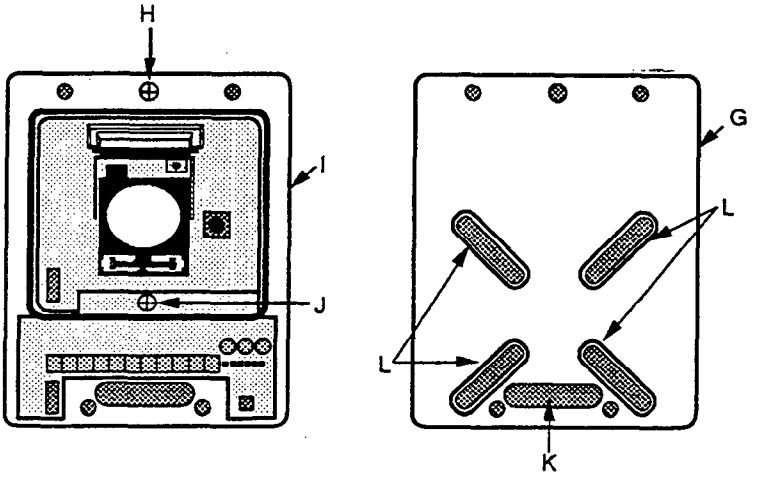
4. To expose the back mounting plate (G) on each receiver and transmitter, loosen the single captive mounting screw (H) until the Printed Circuit (PC) chassis (I) separates from the back mounting plate. (Do not remove the other visible screw [J]).

5. For each receiver and transmitter, bring wiring from the electrical box through each wiring entrance (K).

NOTE: Make sure that all wiring is unpowered.

6. Using the four mounting slots (L) and two screws if mounting to a 4" square electrical box, securely attach each back mounting plate to each electrical box.

7. Return each PC chassis (I) to its back mounting plate (G) and secure in place with each captive mounting screw (H).



Removing Back Mounting Plate
FIGURE 4

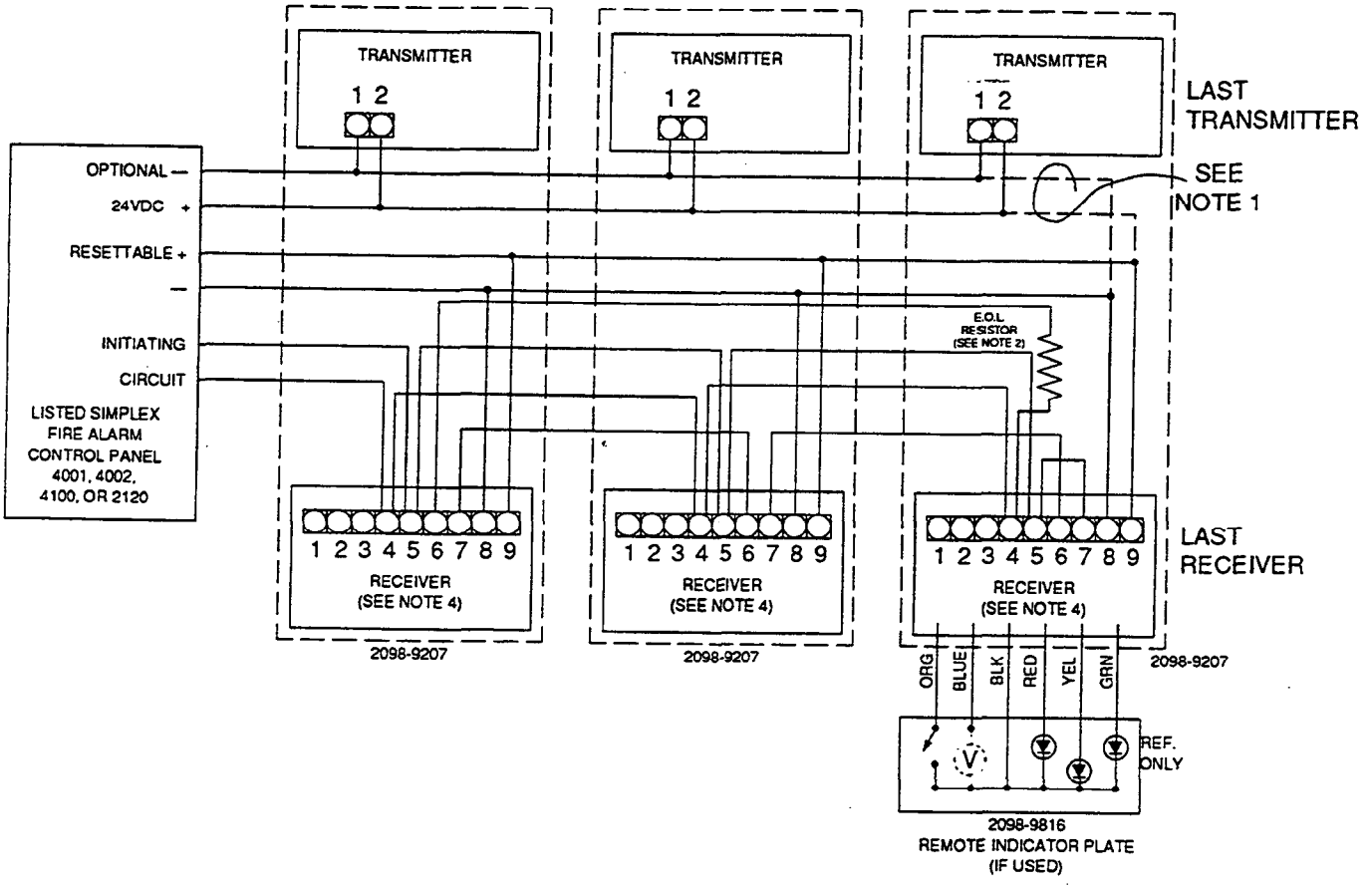
WIRING

CAUTION

1. **Do not apply power until all connections are made and inspected.**
2. **Do not coil excess wiring inside receiver or transmitter.**

8. Wire in accordance with Figure 5.

See below for a description of receiver and transmitter terminals and for detailed information on the 2098-9816 Remote Indicator Plate.

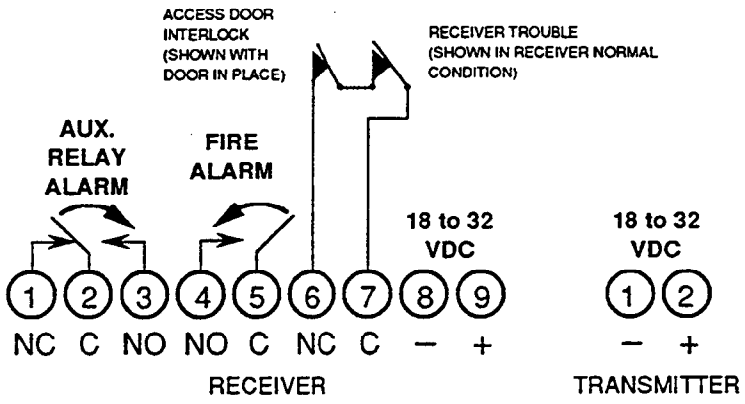


NOTES:
1. Transmitter 24VDC power can be independent of Receiver 24VDC.
2. See the 841-687 Field Wiring Diagrams supplied with each fire alarm control panel for correct resistor value and additional interconnection information.
3. Style B (formerly Class B) wiring is shown in Figure 5. For Style D (formerly Class A) wiring, do not use EOL resistor. Bring resistor connections back to initiating circuit.
4. Receiver Terminals 1 (NC), 2 (C), and 3 (NO) are for the Auxiliary Alarm Contacts rated at 1 amp, 60VDC.

Interconnection Data
FIGURE 5

Description of Transmitter Terminals (See Figure 6)

Terminals 1 and 2 – Input power terminals (resettable power not required)



Receiver and Transmitter Terminals
FIGURE 6

Description of Receiver Terminals (See Figure 6)

Terminals 1, 2, and 3 – Form "C" auxiliary relay contacts.

Terminals 1 and 2 open on fire alarm; terminals 2 and 3 close (short) on fire alarm.

Terminals 4 and 5 – Form "A" fire alarm contacts

Close (short) on fire alarm.

Terminals 6 and 7 – Form "B" trouble contacts

Open for trouble or removing of access door.

Terminals 8 and 9 – Input power terminals (resettable power required)

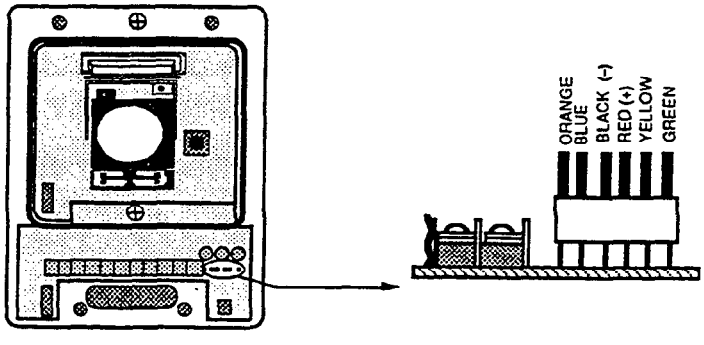
NOTE: Resetting from a fire alarm requires that power to the receiver be interrupted for at least one second.

2098-9816 Remote Indicator Plate

If a 2098-9816 Remote Indicator Plate is used, the following information applies to the 2098-9816:

- Locate the 2098-9816 Remote Indicator Plate no further than 50 feet from the 2098-9207 Receiver.
- Connect wiring to the 2098-9816 Receiver using the supplied 6-wire plug.
- For remote LEDs, connect the red, yellow, and green wires to red (alarm), yellow (trouble), and green (normal) LEDs, respectively.
- For a remote test, turn key switch to test position until alarm.
- For reference voltage measurements, connect a DC voltmeter to test point jacks marked VOLTS OUT (+) & (–).

NOTE: For mounting information on the 2098-9816 Remote Indicator Plate, see ACCESSORY MOUNTING on page 17.



2098-9207 Remote Indicator Plate Wiring
FIGURE 7

SETTING UP

9. After making sure that all connections are made and secure, apply power to both the receiver and transmitter.

10. Press the Aim Mode Button ((Z), see figure 8). This allows the transmitter to begin transmitting its signal while the cover is off. Check the transmitter's green LED indicator to make sure that it is flashing.

    • **If green LED is OFF**, recheck for presence of power and proper polarity on transmitter terminals 1 (–) and 2 (+).

    • **If green LED is ON steady**, transmitter is faulty and must be replaced.

11. Check the receiver's three LED indicators to make sure that either all three indicators are ON or the red and yellow indicators are ON and the green indicator is flashing.

    • **If all LED indicators are OFF**, recheck for presence of power and proper polarity on receiver terminals 8 (–) and 9 (+).

12. Obtain a Flasher Unit (Part No. 553-557). The Flasher Unit provides an excellent aiming light for use with the 2098-9207.

    • An aiming light may not be necessary if the distance between receiver and transmitter is 75' (23m) or less.

13. Lay the Flasher Unit (M) on top of the receiver with the lens side pointed towards the transmitter. See Figure 8.

14. Temporarily connect the flasher unit's power leads to the receiver's terminals 8 (–) and 9 (+) — black lead to 8 and red lead to 9.

PRELIMINARY ALIGNMENT

Each transmitter's optical module is equipped with two viewing ports (one on each side) for initial alignment. Use either viewing port for Step 15.

NOTE: For steps 15 through 21, see Figure 8.

15. To initially align an optical module (N), look into either mirror (Q) from a side angle at least 2 feet from the module. The optical module is pointed at objects seen in the mirror with the orange colored front bore sight even with the rear bore sights (R).

16. Rotate the optical module left or right through the detents (not shown) until you see the image of the aiming light (or image of receiver if aiming light is not used) in the mirror.

    • If you initially aimed the module too high or too low, use the vertical fine-tuning adjustment screw (S) to slightly adjust the module up or down until the proper image appears.

17. Use the vertical fine-tuning adjusment screw (S) and the horizontal fine-tuning adjustment screw (T) to fine-tune the image at the center of the mirror (in line with the front and rear bore sights [P] & [R]).

18. Make sure that the transmitter's green LED (U) is flashing.

19. Remove the Flasher Unit (M) from the receiver and lay it on top of the transmitter with the lens side pointed towards the receiver.

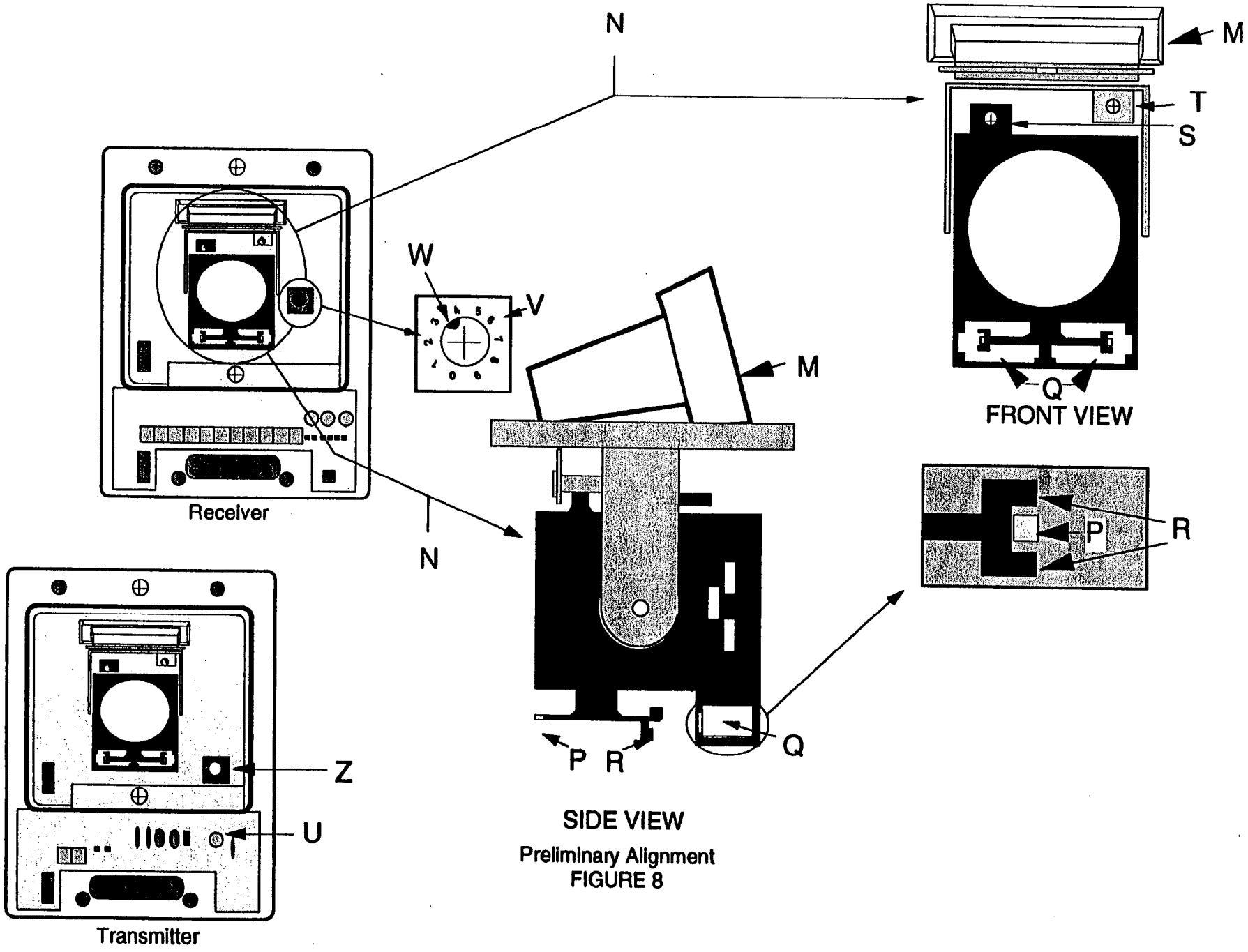
20. Temporarily connect the flasher unit's power leads to the transmitter's terminals 1 (–) and 2 (+) — black lead to 1 and red lead to 2.

21. Repeat Steps 16 and 17 to align the receiver.

    • If the receiver's green LED is flashing, remove the flasher unit from the top of the transmitter. If the green LED is not flashing, repeat Steps 15 through 21.

22. Replace the transmitter's cover using four screws (F). See Figure 3 if necessary.

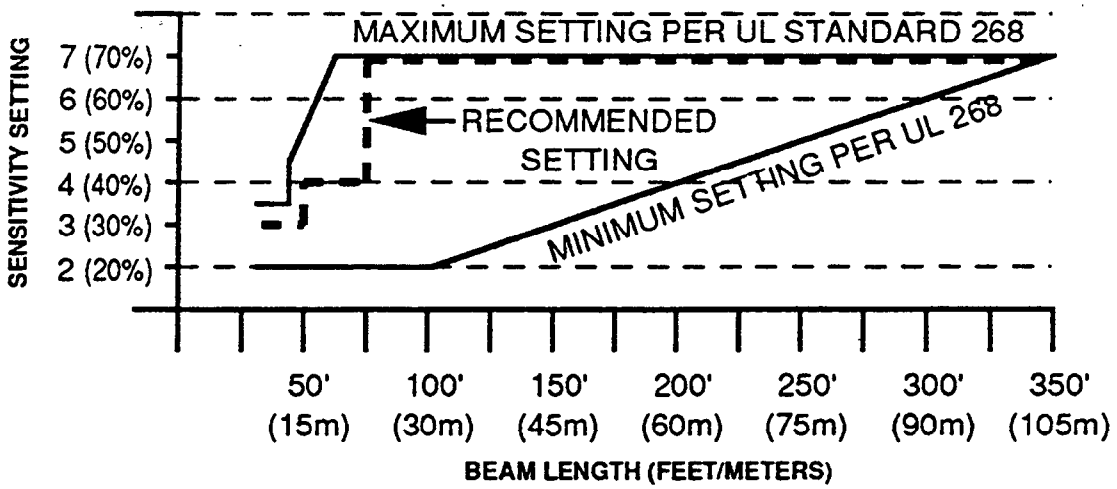
23. Replace the transmitter's access door using one screw (D). See Figure 3 if necessary.



Preliminary Alignment
FIGURE 8

SENSITIVITY ADJUSTMENT

24. Based on the distance between transmitter and receiver, select the appropriate sensitivity setting from Figure 9.



Sensitivity Setting Chart
FIGURE 9

25. Set the sensitivity pot (V) to the sensitivity setting selected in Step 24. See Figure 8 for location of sensitivity pot.

- Sensitivity pot's pointer (W) is along the side of the shaft.

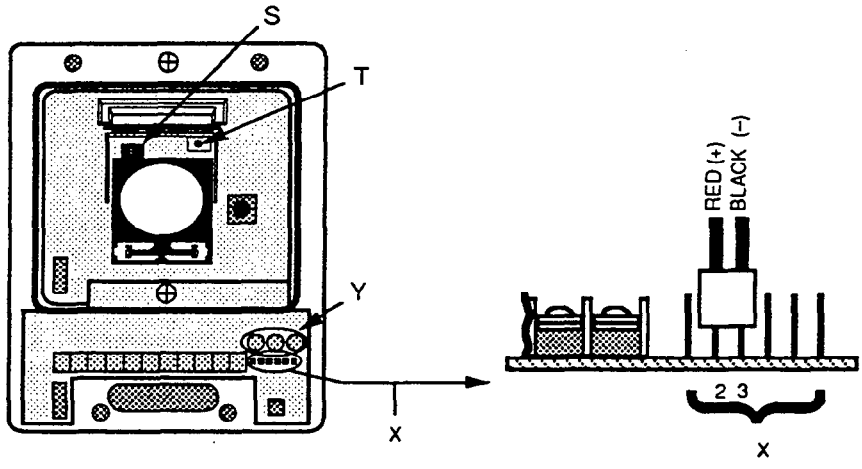
NOTES:
1. Do not use sensitivity pot positions 0, 1, 8, and 9. They are not valid positions.
2. After installing the 2098-9207 (completing Steps 1 through 35), test the detector's sensitivity using the supplied Installation Test Filters or the 553-509 Beam Detector Test Filter Kit (see Field Sensitivity Measurements under MAINTENANCE section).

FINE-TUNE ALIGNMENT

NOTE: For Steps 26 through 28, see Figure 10.

26. Connect the supplied two-wire test cable to the receiver's Pins 2 and 3 of P6 (X).

- If connected, temporarily disconnect the 2098-9816 Remote Indicator Plate connections.



Connecting Two-Wire Test Cable to Receiver
FIGURE 10

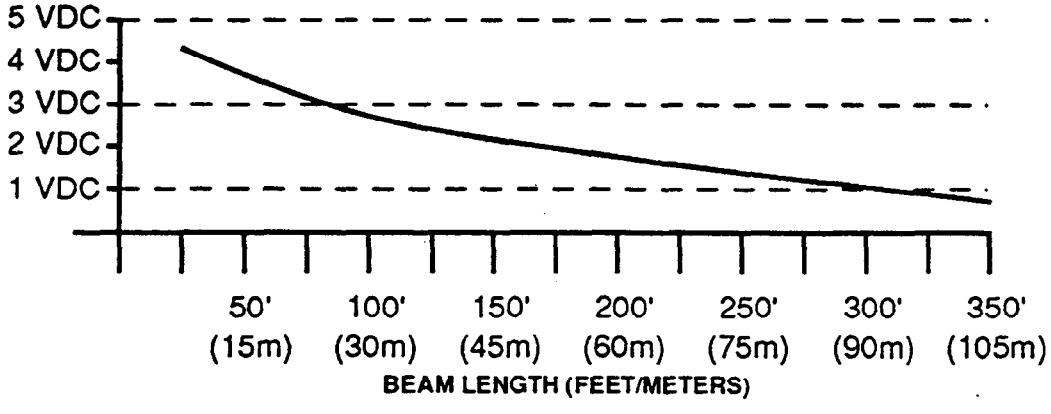
27. Connect a 20,000 ohm/volt (or greater) DC VOM to the test cable's black (common) and red (+) leads.

    - Set the VOM's scale for 0 to 5VDC readings.
    - While observing the meter readings, use the vertical fine-tuning adjustment screw (S) and the horizontal fine-tuning adjustment screw (T) to adjust for a maximum meter reading.

28. Check the receiver's three LED indicators (Y) to make sure that the beam is reaching the receiver.

    - **If the green LED is Flashing with red and yellow LEDs ON,** beam is reaching receiver. Go to Step 29.
    - **If green LED is ON steady,** beam is not reaching receiver. Repeat Steps 19 through 21 (Preliminary Alignment of Receiver).
    - **If green and yellow LED's are Flashing Alternately,** Sensitivity pot is set to an invalid setting. Repeat Step 24.

29. Since maximum meter readings vary with beam path distance, check final (maximum) reading against Figure 11. Figure 11 lists approximate voltage values for a properly aligned 2098-9207.



Voltage/Beam Path Distance Chart
FIGURE 11

NOTE: For Steps 30 through 33, see Figure 12.

30. Remove the two-wire test cable from P6 (X) and then replace the receiver's cover using four screws (F) (See Figure 3 if neccesary).

31. Make sure that the receiver's green LED (U) is still flashing.

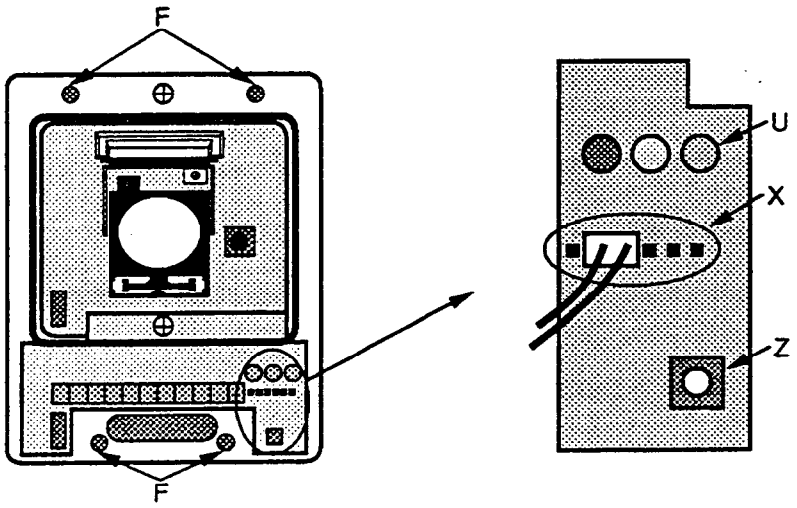
32. Reconnect the two-wire test cable to P6 (X).

33. Press the setup button (Z).

- Pressing the setup button starts an automatic setup process that results in a reference voltage for measuring beam blockages. Additionally, the red and yellow LEDs turn OFF while the green LED turns ON. After some voltage fluctuations, the meter should settle at 5VDC.

NOTE: While performing Step 33, be careful not to block the beam or move the units.

- When the setup period is over, the receiver's green LED flashes and the voltage drops to between 3.8 and 4.2 VDC. This voltage reading is a reference voltage that later readings can be compared to for determining cleaning needs (see MAINTENANCE section).
  - If the voltage is not between 3.8 and 4.2VDC, push the setup button (Z) again.



Location of Receiver's Setup Button
FIGURE 12

34. After setup is complete, remove the test cable from P6 (and reconnect the 2098-9816 Remote Indicator Plate if used).

35. Replace the receiver's access door using one screw (D). See Figure 3 if necessary.

OPERATING CONDITIONS

Normal

- Green LED flashes in both the transmitter and receiver (but not at the same rate)
- Receiver's red and yellow LEDs remain OFF.
- Receiver's reference voltage stays at about 4VDC.

Trouble

Transmitter

Green LED is OFF

- Power has been removed from transmitter. Check for presence of 18 to 32VDC at Terminals 1 (–) and 2 (+).
- Cover has been removed and the Aim Mode button has not been pressed.

Receiver

All LEDs are OFF

- Power has been removed from receiver. Check for presence of 18 to 32VDC at Terminals 8 (–) and 9 (+).

Red and Yellow LEDs are ON, Green LED is Flashing, and Open Circuit exists between Terminals 6 and 7

- Receiver's Tamper Switch (S1) is open. Receiver's cover is off or loose.

Red, Yellow, and Green LED's are ON steady

- Beam is blocked or transmitter has failed.

Red and Yellow LEDs are OFF, Green LED is Flashing, and Open Circuit exists between Terminals 6 and 7

- Receiver's Tamper Switch (S2) is open. Receiver's access door is off or loose.

Red LED is OFF, Yellow LED is ON, Green LED is Flashing, and Open Circuit exists between Terminals 6 and 7

- Beam Blockage slowly occurring over a long period of time due to a buildup of dust, dirt, and/or other materials on unit cover(s). Additional symptom is a 2VDC or less reference voltage. While cleaning covers should not cause an alarm, notify all concerned parties prior to cleaning and again after cleaning. See Cleaning under MAINTENANCE section.
- Vibrations causing receiver misalignment. If cleaning the covers does not return the reference voltage to 4VDC, perform a fine-tune alignment of the receiver. (See FINE-TUNE ALIGNMENT section). If reference voltage is still not 4VDC, press setup button (Step 33) to establish a new reference voltage level.

Red LED is OFF, Yellow LED is ON, Green LED is Flashing, Open Circuit exists between Terminals 6 and 7, and Reference Voltage is greater than 4.8VDC.

- Beam strength has increased by more than 20% of reference voltage over a long period of time. Causes include improper initial alignment or the removal of a partial beam blockage in existence at the time of alignment. Perform a fine-tune alignment of the receiver including use of setup button (Step 33). See FINE-TUNE ALIGNMENT section.

Red LED is ON, Yellow and Green LEDs are Flashing Alternately, Open Circuit exists between Terminals 6 and 7.

- Sensitivity Switch (V) is set to invalid setting (8, 9, 0, 1). Repeat Step 24.

Alarm

Red LED is ON, Yellow LED is OFF, and Green LED is Flashing

- A fire alarm has occurred or is in progress.
- To reset the receiver following a fire alarm, remove power from the receiver for one second.

NOTE: When power is removed and then re-applied to the receiver (such as in a fire alarm reset or power outage), the original reference information is lost. If the cover is on at the time of power-up, the receiver automatically restarts the setup process when power is applied. If the cover is off, you must manually depress the setup button (Step 33) after replacing the cover.

MAINTENANCE

Cleaning

At least once a year (or more often if codes require), clean the outside covers of 2098-9207 using a commonly available window cleaner and a soft, clean cloth.

Under normal conditions, cleaning does not cause a trouble as long as the beam is not continuously blocked for more than 18 seconds.

After completing the cleaning, check the receiver's reference voltage by first removing the receiver's access door (Step 2) and then connecting the test cable to the receiver's P6 connector (Steps 26 and 27). If the voltage is less than 3.8VDC or greater than 4.2VDC, calibrate the reference voltage (see Reference Voltage Calibration below).

Reference Voltage Calibration

Check the 2098-9207's reference voltage at least once a year (or more often if codes require it). CLEAN COVERS ARE NECESSARY FOR PROPER REFERENCE VOLTAGE READINGS.

To check the reference voltage, first remove the receiver's access door (Step 2) and then connect the test cable to the receiver's P6 connector (Steps 26 and 27).

- **If the voltage is less than 3.8 VDC,** perform a fine-tune alignment (see FINE-TUNE ALIGNMENT section) including use of the setup button (Step 33).
- **If the voltage is greater than 4.2VDC**, press the setup button (Step 33).

NOTE: Press the setup button only when the receiver and transmitter covers are in place.

- **If voltage is between 3.8 and 4.2VDC**, calibration is not necessary.

NOTE: The reference voltage can also be checked at the 2098-9816 Remote Indicator Plate. If the voltage is not between 3.8 and 4.2VDC, you must go to the receiver and complete Steps 2, 26, 27, and 33.

Field Sensitivity Measurements

The 2098-9207 Long-Range Beam Detector automatically compensates for the effects of component aging and dust or dirt accumulation on its covers. According to NFPA requirements (NFPA 72E, 1987, Chapter 8), you must measure the detector's sensitivity in the field within one year after initial installation and every alternate year thereafter.

To make the sensitivity measurement, use the supplied Installation Test Filters or the 553-509 Beam Detector Test Filter Kit.

Note: When using the installation test filters, check the filters for damage or scratches which may impact the accuracy of the test. If the filter is damaged, do not use.

Caution: Testing the sensitivity of the detector will cause an alarm condition. **BEFORE TESTING, DISCONNECT CITY, RELEASING DEVICES AND EXTINGUISHING SYSTEMS. NOTIFY ALL APPROPRIATE PERSONNEL OF TEST.**

By placing the appropriate filter in front of the Receiver's optical module for at least 30 seconds, you can determine the approximate sensitivity of the installed detector by the detector's response (alarm or no alarm). See Figure 13 when using the filters. See Figure 9 for UL sensitivity requirements.

SENSITIVITY CHART WHEN USING INSTALLATION FILTERS:

DETECTOR'S SENSITIVITY ADJUSTMENT SETTING	TEST FILTER	DETECTOR'S RESPONSE	
		MUST NOT ALARM	MUST ALARM
2 (20%)	No Filter	√	
	40%		√
3 (30%)	No Filter	√	
	60%		√
4 (40%)	20%	√	
	60%		√
5 (50%)	20%	√	
	80%		√
6 (60%)	40%	√	
	80%		√
7 (70%)	40%	√	
	80%		√

SENSITIVITY CHART WHEN USING 553-509 TEST FILTER KIT:

DETECTOR'S SENSITIVITY ADJUSTMENT SETTING	FILTER		DETECTOR'S RESPONSE	
	NUMBER	OBSCURATION RATING	MUST NOT ALARM	MUST ALARM
2 (20%)	1	7%	√	
	4	40%		√
3 (30%)	1	7%	√	
	5	65%		√
4 (40%)	2	15%	√	
	5	65%		√
5 (50%)	2	15%	√	
	6	85%		√
6 (60%)	4	40%	√	
	6	85%		√
7 (70%)	4	40%	√	
	6	85%		√

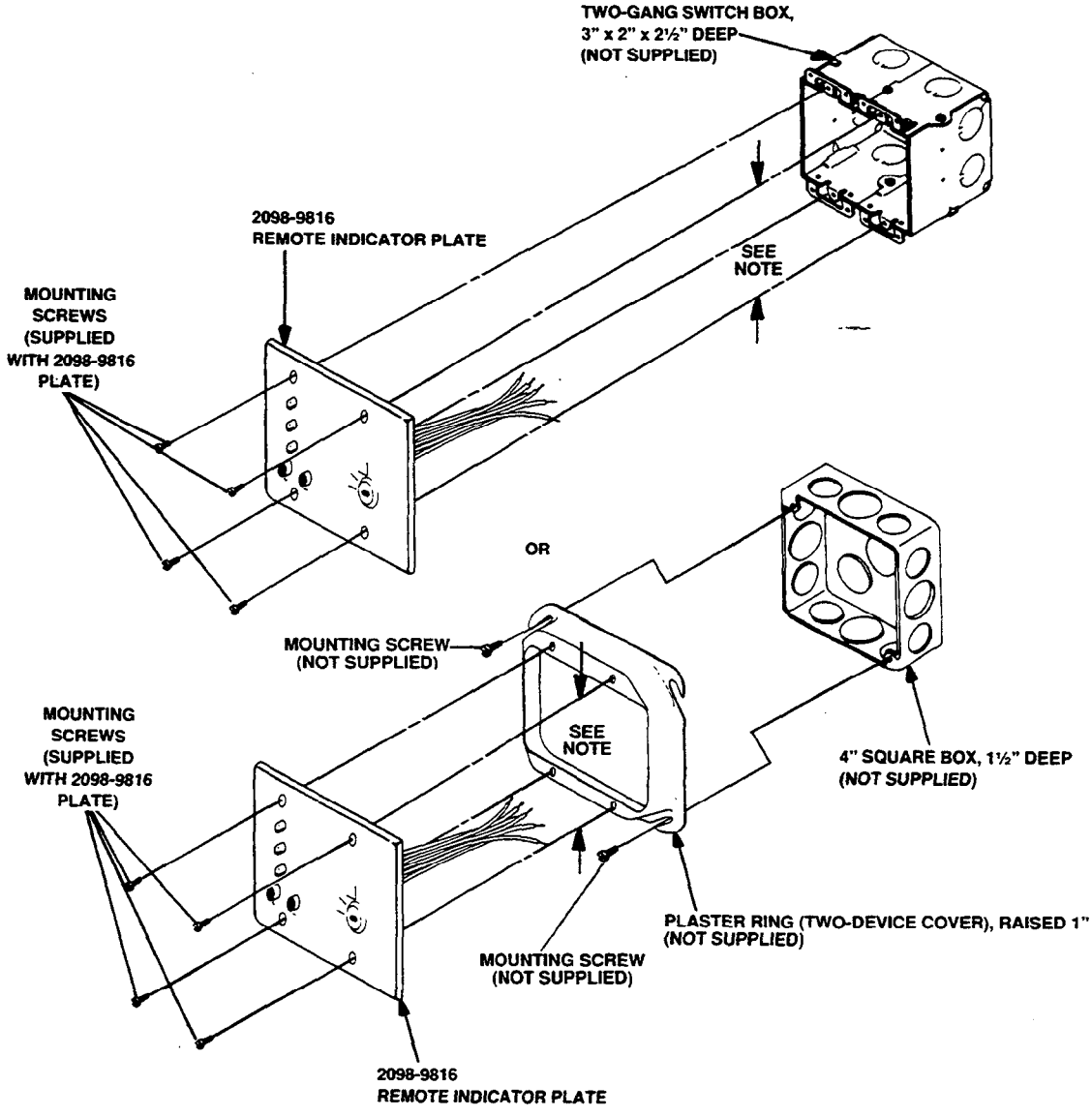
Using Filters to Determine Detector's Sensitivity
FIGURE 13

ACCESSORY MOUNTING

2098-9816 Remote Indicator Plate

Mount the 2098-9816 Remote Indicator Plate to one of the following boxes (see Figure 14):

- Standard two-gang switch box (two boxes ganged together) having a minimum depth of 2-1/2" OR
- 4" square box (1-1/2" deep) with a plaster ring (two-device cover) that is raised 1".



NOTE: DEVICE MOUNTING TABS ARE 3-9/32" APART.

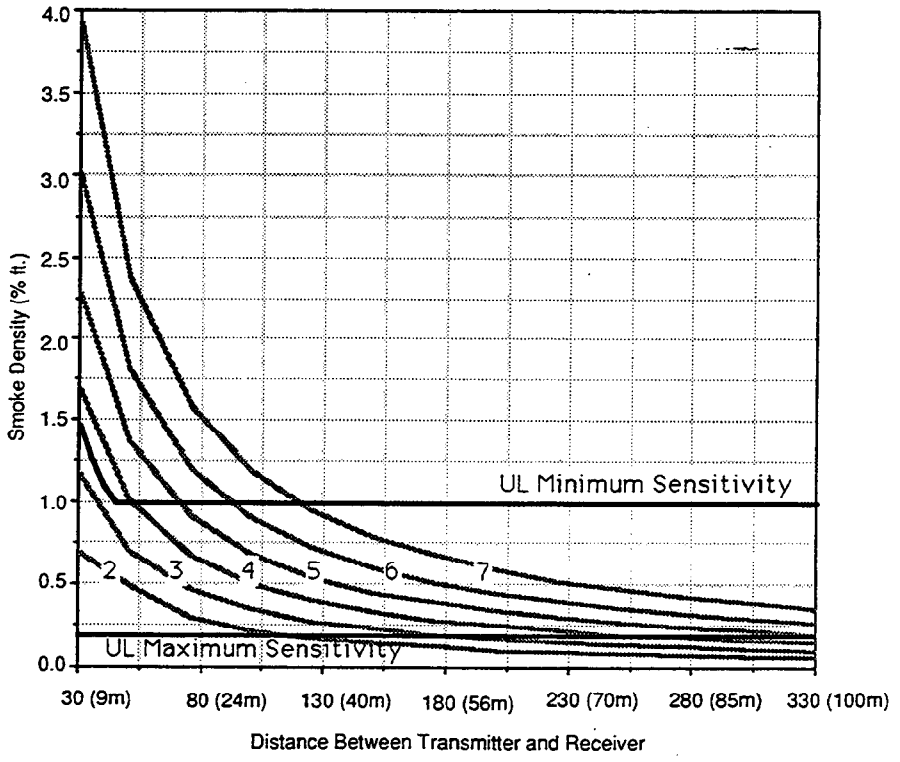
Mounting of 2098-9816 Remote Indicator Plate
FIGURE 14

SMOKE DENSITY/OBSCURATION INFORMATION

The total obscuration of the infrared beam is dependent upon the density and the width of the smoke cloud within the beam path. As the width of the smoke cloud increases, less dense smoke is required for the same total obscuration within the beam path. In practice, the smoke cloud is assumed to be the entire distance of the beam path so the total obscuration required for alarm is selected by setting the sensitivity pot as recommended in Figure 9 (Page 11).

Since the total obscuration of the beam by smoke increases with distance, the detector can be less sensitive if the distance is greater. The sensitivity of the detector should be less at greater distances because the obscuration by other contaminants such as dust increases also. The sensitivity should be set to respond to the proper smoke obscuration and also to reduce the chance of a false activation.

As shown below, if the expected smoke density is 0.5% per foot, the obscuration at 50 feet is 20% while at 250 feet it is 73%.



Sensitivity Pot Setting	Total Obscuration at Alarm
2	20%
3	30%
4	40%
5	50%
6	60%
7	70%

Smoke Density vs. Beam Length
FIGURE 15

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