Flame Vision™

UV FLAME DETECTOR

MODELS FV-10-1 / & 10-2

Technical Manual

FlameVision Rev B, February 1997

Scott / Bacharach
Gas Detection Products

251 Welsh Pool Rd, Exton, PA 19341
610-363-5450 • service@scottbacharach.com

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Warning:

This manual should be carefully read by all individuals who have or will have responsibility for using, maintaining or servicing the product.

The Source and Detector are not field-repairable due to the meticulous alignment and calibration of the sensors and the respective circuits. Do not attempt to modify or repair the internal circuits or change their settings, as this will impair the system's performance and void the Spectrex, Inc. Product warranty.

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1. SCOPE

1.1. PRODUCT OVERVIEW

The Scott/Bacharach Model FV-10 is a UV Flame Detector. It is designed to sense the occurrence of fire and flames and subsequently activate an alarm or an extinguishing system directly or through a control circuit for maximum fire protection. It uses innovative technology of advanced digital signal processing to analyze the dynamic characteristics of fire.

The Model FV-10-2 includes a Built In Test (BIT) function while the Model FV-10-1 does not include the BIT.

Detection performance is controlled by a microprocessor and easily adapted to all environments, applications and requirements. The result is a unique and superior flame detector that provides excellent detection sensitivity with extreme immunity to false alarm.

1.2. DOCUMENT OVERVIEW

This manual describes the detector and its features. It describes instructions on the installation, operation and maintenance.
This manual is divided into several parts. Each part is contained in a separate chapter as follows:

Chapter 1. **Scope**. A general introduction and overview of the product and the Manual and provides a brief description of its content.

Chapter 2. **Technical Features** presents the detector features and capabilities.

Chapter 3. **Performance** describes the detector's theory of operation.

Chapter 4. **Operation** describes the detector's operation modes, user interface and indications.

Chapter 5. **Technical Specifications** lists the Detector's electrical, mechanical and environmental specifications.

Chapter 6. **Installation Instructions** addresses the detector's proper installation, including wiring and mode setting.

Chapter 7. **Operating Instructions** addresses operation instructions and power-up procedures.

Chapter 8. **Maintenance Instructions** addresses maintenance instructions and support procedures.

Appendix A. **Wiring Selection Tables** contains tables for electrical wire selection according to installation configuration.

Appendix B. **Typical Wiring Configurations** provides wiring diagrams for installation.

2. TECHNICAL FEATURES

- **DETECTION RANGE:** Up to 15m (50 ft) for a 0.3m x 0.3m (1ft x 1ft) Gasoline fire.
- **HIGH IMMUNITY TO FALSE ALARM** (see section. 3.3.).
- **ADVANCED DIGITAL PROCESSING OF THE DYNAMIC CHARACTERISTICS OF FIRE**
- **SINGLE SPECTRUM:** UV radiation
- **MULTIPLE DETECTION LEVELS:** Warning, alarm and saturated signal
- **SOLAR BLIND**
- **MICROPROCESSOR BASED:** Microcontroller performs signal processing
- **BUILT IN TEST:** Manual and automatic BIT for FV-10-2 only (see section 4.5)
- **ELECTRICAL INTERFACE:**
  - Dry contact RELAYS.
  - 4-20mA outputs.

2.1. PRINCIPLES OF OPERATION

The Model FV-10 Radiation Flame Detector is an electronic device designed to sense the occurrence of fire and flames and subsequently activate an alarm or an extinguishing system directly or through a control circuit.

The UV Flame Detector is a single spectrum optical detector sensitive to the UV radiation spectrum, which present in fires. The detector monitors the protected volume, by measuring the radiation intensity in it, the frequency range of the electromagnetic spectrum, namely the UV.

The detector senses one channel in which appropriate detection pulses are registered and further analyzed for frequency, intensity and duration.

2.2. THE SENSING ELEMENT

The UV sensor is sensitive to radiation over the range of 0.185-0.260 micron. The UV channel incorporates a special logic circuit that eliminates false alarms caused by solar radiation and other non-fire UV sources. Further more; the UV channel sensitivity is stabilized over the working temperature range.

2.3. DETECTION LEVELS

Detection of radiation in the UV channel having an intensity which exceeds detector's preset Warning level will result in a Warning signal.

Detection of radiation in the UV channel having an intensity which exceeds detector's preset Alarm level will result in an Alarm signal.

Detection of radiation in both the UV channel having an intensity which exceeds detector's preset Flash-Fire Detection level will result in an immediate Alarm signal, regardless of the detector mode setting selected.

2.4. ALARM SIGNAL DELAY

The detector is adapted with an Alarm Signal delay selector, providing a user to set a different delay between 0 to 30 seconds, mandatory for several specific applications.

When Alarm level detection conditions are met, an internal time delay is initiated as preset on the selector. Once the preset time delay has elapsed, detection conditions are evaluated for 3 seconds. If during that evaluation period Alarm level detection conditions persist, the Alarm signal is triggered. If no Alarm level detection conditions endure, the Alarm signal Delay is reset.

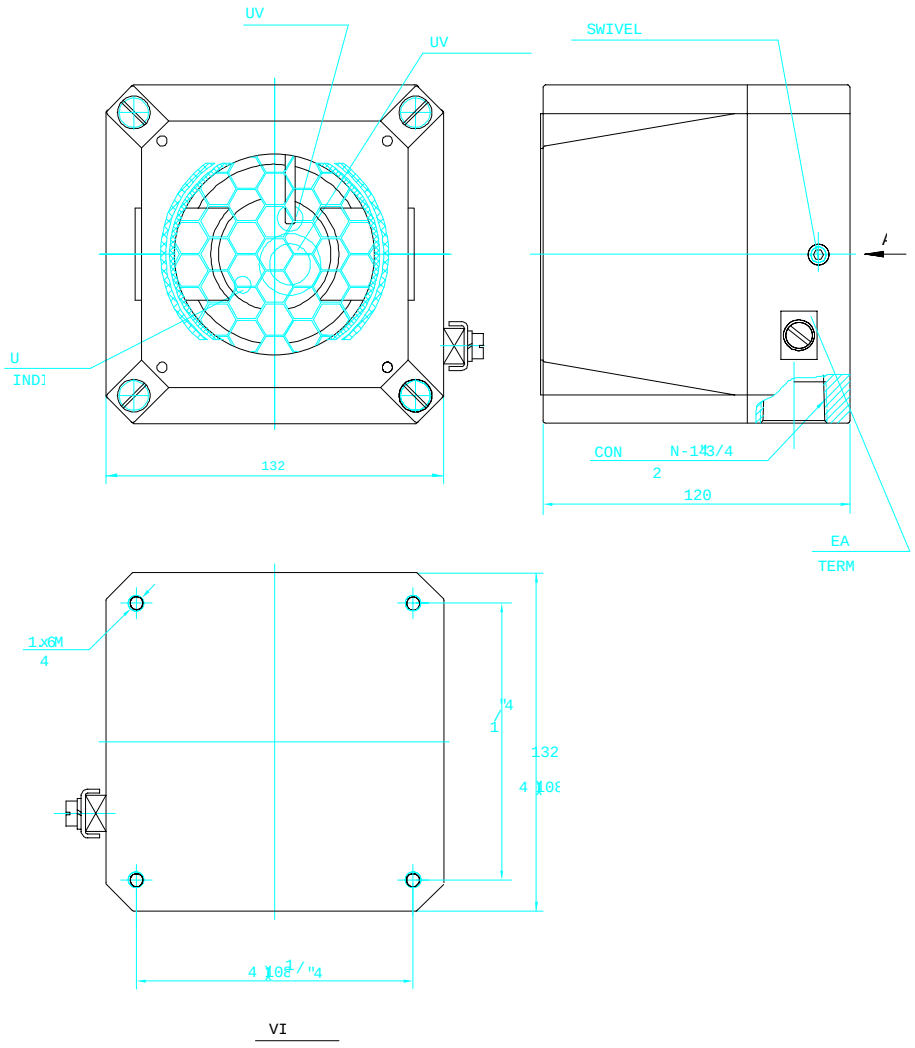
2.5. BUILT-IN-TEST(BIT) CAPABILITIES

The detector is adapted with BIT (Built-In-Test only in FV-10-2) capabilities. The BIT is continuously performs at predetermined time intervals averaging 60 minutes. It performs automatic full-featured test of the detector's internal electric circuits, and checks the radiation sensors and the detector window cleanliness.

The BIT circuits will generate response signals to indicate adequate operation of the detector or a fault should it be detected during a BIT sequence. The BIT sequence can also be initiated manually by the user at his preference, upon a remote operation from a control unit.

2.6. DETECTOR STRUCTURE

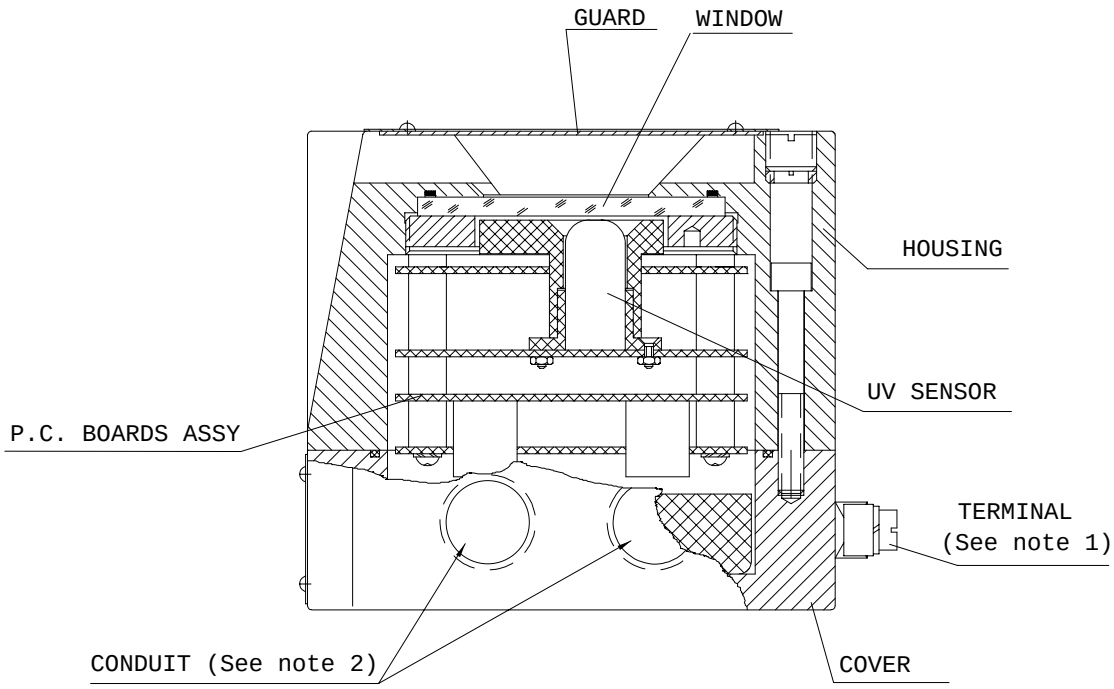
Regarding detector's structural design and configuration, Figure 1 presents an outline drawing of the Flame Detector Assembly. Figure 2 presents a schematic section of the internal Flame Detector, and describes its main components.



Note 1: This figure describes the Detector that includes Ground Terminal for CENELEC installation. For FM installation device, which includes 1/4" thread for external grounding screw mounting.

Note 2: Conduit standard size is 3/4"-14NPT. M25 optional.

Figure 1. Flame Detector Assembly - Outline Drawing



Note 1: This figure describes the Detector which includes Ground Terminal for CENELEC installation. For FM installation device, which includes 1/4" thread for external grounding screw mounting.

Note 2: Conduit standard size is 3/4"-14NPT. M25 optional.

Figure 2. Flame Detector Assembly - Schematic Section

2.7. SYSTEM CONFIGURATION

The Scott/Bacharachmodel FV-10 is a self-contained Optical Flame Detector that can function as a stand alone unit directly connected to external devices as alarm systems or automatic fire extinguishing systems. The same detector can form part of a more complex system where a plurality of detectors and other devices are integrated through a dedicated control unit.

2.8. DETECTOR TYPES

This manual covers two types of detectors. The Model FV-10-2 (w/ BIT) and the Model FV-10-1 (no BIT)

The two Models are available in Aluminium (Al.) housing, or Stainless Steel (St.St.) housing. They also include an option for higher ambient temperature (+85°C) upon requirement.

3. PERFORMANCE

3.1. DETECTION SENSITIVITY

Detection sensitivity of a fire detector is defined as the detection distance for a specified size of fire and a specified type of fuel ("Standard Fire") within a given time.

Standard Fire:
Standard fire is defined as a 0.3m x 0.3m (1ft x 1ft) Gasoline pan fire with max. Wind speed of 2m/sec (6.5ft/sec).

Sensitivity Ranges:
The detector has two response levels:

1. Warning (Pre-alarm)
2. Alarm

Response Time:
The typical response time of the detector is 3 seconds. for 1 sq. ft. gasoline fire, and 20 ms for saturated signal which is defined as a 5" diameter Gasoline fire from a distance of 12".

Other Fuels:
The Detector will react to other fuels in standard fire conditions at maximum response time of 5 seconds.
The sensitivity range of other fuels varies according to the fuel type. The percentage of the range for a fuel type that is relative to gasoline standard fire source is given at Table 1 below.

The response sensitivity ranges is given at Table 1 below.

Table 1. Response Sensitivity Ranges

TYPE OF FUEL	% OF MAX. DISTANCE AT EACH SENSITIVITY RANGE
GASOLINE	100%
N-HEPTANE	100%
ALCOHOL 95%	75%
JP4	100%
KEROSENE	75%
DIESEL FUEL	75%

3.2. CONE OF VISION

The cone of vision of the detector is as follows:
Horizontal: 90°
Vertical: 90°

Figure 3 illustrates the relative range as a function of the incidence angle.

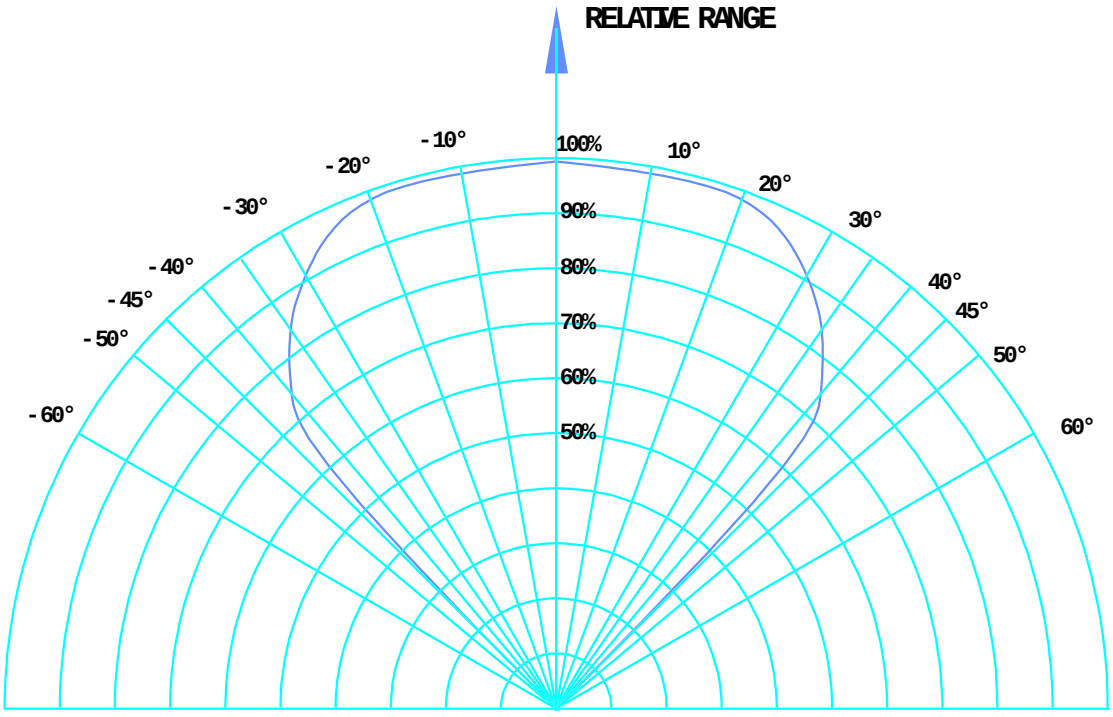


Figure 3. Horizontal and Vertical Fields of View

3.3. FALSE ALARMS

The detector does not provide an alarm or a warning signal as a reaction to the radiation sources specified at Table 2 below.

Notes:

IAD = Immune at any distance.
All sources are chopped from 0 to 20 Hz.

Table 2. Immunity to False Alarm Faults

RADIATION SOURCE	IMMUNITY DISTANCE m (ft.)
Sunlight	IAD
Indirect or reflected sunlight	IAD
Vehicle headlights (low beam) conforming to MS53023-1	IAD
Incandescent frosted glass light, 100W	IAD
Incandescent clear glass light, rough service, 100W	IAD
Fluorescent light with white enamel reflector, standard office or shop, 40W (or two 20W)	IAD
Bright colored clothing, including red and safety orange.	IAD
Red dome light conforming to M251073-1	IAD
Blue-green dome light conforming to M251073-1	IAD
Flashlight (Mx 991/U)	IAD
Radiation heater, 1500W	IAD
Radiation heater, 1000W with fan	IAD
Lit cigar or cigarette	1.5m (5ft.)
Match, wood, stick including flare up	4.0m (13.3ft.)

4. OPERATION

4.1. VISUAL INDICATIONS

One indication LED is located in the detector's front window.

Yellow LED - provides indication of the UV channel.

The LED indications within different Detector states are as follows:

Normal - the LED blinks at 0.5Hz rate.
Fault - the LED blinks at 4Hz rate.
Warning - the LED blinks at 0.5Hz rate (same as at Normal)
Alarm -the LED is on at constant illumination.

4.2. OUTPUT SIGNALS

The detector includes the following control outputs:

- Alarm Relay
- Accessory Relay
- Fault Relay
- 4-20mA Current Source Output

4.3. MODE SELECTION

The detector has 2 DIP switches which enables the user to adapt the detector's operation to specific applications:

- Function switch (SW1)
- Alarm Delay Switch (SW2)

4.3.1. Function switch (SW1)

The user can select the desired mode of operation by means of this switch according to Table 3.

Table 3. Function Switch SW1

SWITCH NO.	ON POSITION	OFF POSITION
1	Alarm Signal Latching enabled. Reset of the Alarm signal is performed by momentary disconnection of power supply or manual BIT activation.	Alarm Signal Latching disabled.
2	Automatic & Manual BIT can be performed.	Only Manual BIT can be performed.
3	Not Used	
4	Accessory Relay used by the Warning level.	Accessory Relay used in parallel to the Alarm Relay.
5	Not used	
6	Following a successful Manual BIT sequence: Alarm Relay is activated and the 4-20mA output turns to 20mA for approximately 3 seconds.	Following a successful Manual BIT sequence **(1),(2)**: Alarm Relay is not activated
7	Following a successful Manual BIT sequence **(2)**: Accessory Relay is activated and the 4-20mA output turns to 16mA for approximately 3 seconds **(3)**.	Following a successful Manual BIT sequence **(2)**: Accessory Relay is not activated.
8	Accessory Relay used as EOL relay.	Accessory Relay function in accordance with the position of SW1-4.

Notes:

(1) The BIT sequence may last up to 7 seconds. Verify that all eight (8) switches are in the appropriate setting (ON/OFF), to achieve the required functional mode of operation.

(2) SW1-2, SW1-6, SW1-7 are function only for models FV-10-2. Model FV-10-1 does include BIT.

(3) If both SW1-6 and SW1-7 are at on position the 4-20mA output is 20mA (Alarm Level) after successful manual BIT.

Optional Latching:

The detector includes a latched alarm output capability which operates according to the DIP-switch SW1-1 position. Upon the detection of a fire, the detection signal is latched until manually reset (disconnecting the power supply or upon performing a manual BIT).Latching affects the Alarm Relay only.

Built-in-Test Options:

Successful Manual BIT activates the following outputs according to SW1 switches.

SW1-6 ON:	The Alarm relay will be activated for 3 seconds. The 4-20mA output will provide 20mA for 3 seconds.
SW1-7 ON & SW1-6 ON:	The Accessory & Alarm relays will be activated for 3 seconds. The 4-20mA output will provide 20mA for 3 seconds.
SW1-7 ON & SW1-6 OFF:	The Accessory Relay will be activated for 3 seconds. The 4-20mA output will provide 16mA for 3 seconds.
ACCESSORY RELAY AS EOL:	If SW1-8 is ON then the Accessory Relay is used as End of Line (EOL) relay. In this case the accessory relay is always active as long as the detector is powered.

4.3.2. Alarm Delay Switch (SW2)

The detector is equipped with different Alarm Delay options. It provides programmable time delays of 0 to 30 seconds with eight (8) fixed settings at: 0, 3, 5, 10, 15, 20, 25 and 30 seconds, using SW2 switches 1-3. See Table 4.

When an Alarm (Detection) level condition is encountered, the detector delays execution of the Alarm Relay and the 4-20mA output by the specified period of time. The detector will then evaluate the condition for required delay period. If the Alarm level is still present, the Alarm indications return to its standby state.

The Alarm delay option will affect the output relay and the 4-20mA output but not the LED status.

Table 4. SW2 Alarm Delay Setting

DELAY	SW2 switches			
(seconds)	4	3	2	1
0	N/A	off	off	off
3	N/A	off	off	on
5	N/A	off	on	off
10	N/A	off	on	on
15	N/A	on	off	off
20	N/A	on	off	on
25	N/A	on	on	off
30	N/A	on	on	on

4.4. DETECTOR STATES

The detector can be in one of the following states:

Normal: The detector is functioning.
BIT: The detector performs a BIT.
Warning: The detector detects a fire and changes into its warning-pre-alarm state.
Alarm: The detector detects a fire and changes into fire alarm state.
Latched Alarm: The alarm outputs are latched after Alarm state due to the detection of a fire even when the fire has already been extinguished.
Fault: A fault is indicated during a BIT sequence, or if the power supply voltage is too low.

In each state the detector will activate different outputs as specified in Table 5.

Table 5. Output Signals Versus Detector State

DETECTOR STATE	SW1 SWITCHES	INDICATION LEDs	ALARM RELAY	ACCESSORY RELAY	FAULT RELAY	4-20 mA OUTPUT
Fault		Blink 4Hz	off	off	off	0mA
Normal		Blink ½ Hz	off	off	on	4mA
Warning	SW1-4 on	Blink ½ Hz	off	on	on	16mA
Alarm	SW1-1 off	on	on		on	20mA
Latch	SW1-1 on	on	on		on	20mA

The detector remains in Fault state until it passed a successful BIT.

When SW1-4 is OFF, warning state is the same as the Alarm state.

The alarm outputs are activated as long as the alarm conditions are present and stop approximately five seconds after the fire is no longer detected.

4.5. BUILT IN TEST

a. General

The detector's Built In Test (BIT) checks the following:

- Electric circuitry
- Sensor
- Window cleanness

The detector can be set to perform the BIT automatically and manually (SW1-2= on) or manually only (SW1-2= off).

b. Principles:

If the BIT passes the detector's status turns to Normal.

If the BIT fails, a second BIT is executed after a delay of 6 seconds.

If the second BIT passes, the detector's status turns to Normal, otherwise the status is turned to Fault.

c. Manual BIT only (SW1-2= off):

The BIT is initiated manually by momentarily connecting terminal No. 3 with terminal No. 2.

A successful manual BIT activates the following:

- Fault Relay is closed.
- Alarm Relay is activated for 3 seconds (only if SW1-6 = on).
- Accessory Relay is activated for 3 sec (only if SW1-7 = on).
- 4-20mA Output current will be 20mA (only if SW1-6 = on) or 16mA (only if SW1 -7 = on and SW1-6 = off).

Unsuccessful BIT activates the following:

- Fault Relay is released.
- 4-20mA output indicates Fault condition (0mA).
- The LED blinks (at 4Hz rate).

IMPORTANT NOTE !

*If SW1 switches 7 or 6 are in their "ON" position the Alarm and Accessory Relays will be activated during a MANUAL BIT, therefore, automatic extinguishing systems or any external devices that may be activated during BIT **must** be disconnected.*

d. Automatic & Manual BIT (only when SW1-2 = ON):

Manual BIT:

Functions as described in section 4.5.c.

In the case of an unsuccessful BIT all outputs will function as described in section. 4.5.c., however, automatic BIT will be automatically executed every 1 minute.
This mode of operation continues until successful BIT have been encountered. As such result, the detector resumes its normal operation.

The Manual BIT performance initiates the DIP switches configuration reading of the detector. This function is performed at any switch configuration even if manual BIT is disabled. This initiation is also performed at the FV-10-1 model, even though BIT does not exist.

Automatic BIT:

The detector automatically performs a BIT every 60 minutes.

A successful BIT does not activate any indication and the detector indicates normal as follows:

The Fault Relay contacts are closed.
The LED blinks at 0.5Hz rate.

An unsuccessful BIT sequence the detector turns to Fault and activates the indications as follows:

The Fault Relay contact are opened.
4-20mA output indicates Fault (0mA).
The LED blinks at 4Hz rate.
BIT procedure is performed every one minute.

5. TECHNICAL SPECIFICATIONS

5.1. ELECTRICAL SPECIFICATIONS

a. Operating Voltage:

18-32 VDC

b. Power Consumption:

Max. 80 mA in Stand-by
Max. 120 mA in Alarm

c. Electric input protection:

The input circuit is protected against voltage reversed polarity voltage transients, surges and spikes according to MIL-STD-1275.

d. Electrical Interface:

Terminals	Function
1 2	POWER SUPPLY IN(+) RTN
3	MANUAL BIT
4 5 6	ALARM RELAY(NO) ALARM RELAY (COMMON.) ALARM RELAY(NC)
7 8	FAULT RELAY (NO) FAULT RELAY (COMMON.)
9 10	ACCESSORY RELAY (NO) ACCESSORY RELAY (COMMON)
11 12	4-20mA(-) 4-20mA(+)

e. Electrical outputs:

Dry Contacts Relays Ratings:

Relay Name	Type	Normal position	Maximum Ratings
Alarm Relay	DPDT	NO, NC	2A at 30 VDC or 0.5A at 250 VAC.
Accessory Relay	SPST	NO	5A at 30VDC or 250VAC.
Fault Relay	SPST	NC	5A at 30VDC or 250 VAC

4-20mA Current Output Levels at different detector states (on terminals 11 and 12):

Fault:	0mA	+0.5mA
Normal:	4mA	±5%
Warning:	16mA	±5%
Alarm:	20mA	±5%

- The 4-20mA output is a current source type. The signal is driven via terminal 12 through the load to terminal 11 that should be at RTN level. (when connected to terminal 2.)
- Maximum load permitted resistance for the 4-20mA is 600 ohm.

5.2. MECHANICAL SPECIFICATIONS

a. Enclosure:

Aluminum enclosure or St.St. 316.
Chromate coating and Epoxy enamel finish for Al..
Electrochemical and pasivation coating for St.St. 316.

b. Explosion Proof

Designed to meet FM requirements:
Class I Div. 1 Group B, C and D.
Class II Div. 1 Groups E, F and G.

CENELEC approved (SCS No. Ex95D1159).
EExd IIB T5 (70°) and T4 (85°) per En 50014 & En 50018

One. Electrical Modules:

Conformal coating.

d. Electrical connection:

Standard: Two 3/4” - 14NPT conduits.
Optional: Two M25 x 1.5 conduits

e. Dimensions:

Base: 132cm x 132cm (5.2 x 5.2 in)
Height: 120cm (4.7in)

f. Weight:

3.7kg (8.1 lb.) - Al. enclosure
6.5kg (14.3 lb) - St.St. enclosure

5.3. ENVIRONMENTAL SPECIFICATIONS

a. High Temperature:

Design to MIL-STD-810C, method 501.1 procedure II
Operating temperature: +85 degrees C (+185 degrees. F)
Storage temperature: +85 degrees C (+185 degrees. F)

b. Low Temperature:

Design to MIL-STD-810C, method 502.1, procedure I
Operating temperature: -40 degrees C (-40 degrees. F)
Storage temperature: -55 degrees C (-65 degrees F)

c. Humidity:

Designed to meet MIL-STD-810C, method 507.1, procedure IV
Relative humidity of up to 95% for the operational temperature range.

d. Salt and Fog:

Designed to meet MIL-STD-810C, method 509.1 procedure I.
Exposure to a 5% salt solution for 48 hours.

e. Water and Dust:

IP67 per En60529
IP66 per En60529
Dust: Totally protected against dust.
Liquids: Protected against immersion between 15cm and 1m in depth. Protected against all water jets from all directions.

Designed to meet NEMA 250 6P.

f. Shock and Vibration:

Vibration: Designed to meet MIL-STD-810C, method 514.2, procedure VIII.
Mechanical Shock: Designed to meet MIL-STD-810C, method 516.1, procedure I.

g. Electromagnetic Compatibility (EMC):

The detector is design and approved according to the following EMC requirements:

Electrostatic Discharge(ESD):	IEC801-2:1984.
Conducted emission:	EN55022, Class A.
Radiated emission:	EN55022, Class A.
Radiated immunity:	IEC801-3: 1984.
EFT/B:	IEC801-4: 1988.

6. INSTALLATION INSTRUCTIONS

6.1. INTRODUCTION

This chapter does not attempt to cover all of the standard practices and codes of installation. Rather, it emphasizes specific points of consideration and provides some general rules for qualified personnel. Special safety precautions are stressed wherever applicable.

6.2. GENERAL CONSIDERATIONS

Very Important!

The detector should be aimed towards the center of the detection zone and has a completely unobstructed view of the protected area.

Whenever possible, the detector face should be tilted down at a slight angle to prevent the accumulation of dust and dirt.

Do not start an installation unless all conceivable considerations regarding detector locations have been taken into account.

To ensure optimal performance and an efficient installation, the following guidelines should be considered.

a. Spacing and Location

The number of detectors and their locations in the protected area are affected by the following:

- Size of the protected area.
- Sensitivity of the detectors.
- Obstructed lines of sight.
- Cone of view of the detectors.

b. Environment

Dust, snow, rain and oil can reduce the detector's sensitivity and require more maintenance activities.

6.3. PREPARATIONS FOR INSTALLATION

Installation should comply with NFPA 72E, as applicable to flame detectors.
The detectors can be installed with the use of general purpose common tools and equipment.

1. Verify the appropriate Purchase Order. Record the part number and Serial number of the detectors and the installation date in the appropriate Log-book.
2. Open the container package immediately prior to detector installation and visually inspect the detector.

3. Verify that all components required for the detector installation are readily available before commencing the installation. In case that the installation is not completed in a single session, secure and seal detectors and conduits.

4. For wiring, use color coded conductors or suitable wire markings or labels. Wire diameter among 12 to 20 AWG may be used for site wiring. The selection of wire gauge should be based on the number of detectors used on the same line and the distance from the control unit, in compliance with specifications (see Appendix A)

6.4. CONDUIT INSTALLATION

1. To avoid water condensation in the detector, it should be installed with the conduits placed downward, and should include drain holes.

2. When using the optional swivel mount, use flexible conduits for the last portion connecting to the detector.

3. For installations in atmospheres as defined in Group B of the NFPA, conduit inlets should be sealed.

4. When pulling the cables through the conduits, ensure that they are not tangled or stressed. Extend the cables about 30 cm. (12 in.) beyond the detector location to accommodate wiring after installation.

5. After the conductor cables have been pulled through the conduits, perform a continuity test.

6.5. DETECTOR MOUNTING

The detector may be mounted on a simple fabricated bracket, or preferably the optional Swivel Mount, Model No. 20/20-003. The Swivel Mount enables the detector to be rotated up to 40 degrees in all directions.

In addition, there are different Swivel Mounts as per special customer's specifications.

6.5.1 Swivel Mount Kit

Mounting according to FM requirements:

ITEM	QTY	TYPE /MODEL	LOCATION
Swivel Mount	1	20/20-003	
Screw	4	1/4" -20UNC	Detector - Holding plate
1/4" Spring Washer	4	1/4"	Detector - Holding plate

Mounting according to CENELEC requirements:

ITEM	QTY	TYPE /MODEL	LOCATION
Swivel Mount	1	20/20-003-1	
Screw	4	M6 x 1P	Detector - Holding plate
Spring Washer	4	M6	Detector - Holding plate

6.5.2 Swivel installation (Figure 4a and 4b)

1. Place the swivel mount (6) in its designated location and secure it with four M6 or 1/4” screws (10), placed 76.2 mm. (3.0 in.) apart.

   Note:

   Skip this step if the Swivel Mount is already installed. Also detector removal for maintenance purpose does not require Swivel Mount removal.

2. Unpack the detector carefully

3. Place the detector with its conduit inlets pointing down on the holding plate of the Swivel Mount (7). Secure the detector to the Swivel Mount by four 1/4”-20UNC screws or M6 x 1P (9) with 1/4” spring washers enclosed with the Swivel Mount Kit.

Use 3/16 Hex Key for 1/4” screws and No. 5 Hex Key for M6 screws.

4. Tighten the three locking 3/8”-24UNF screws (8) of the swivel mount ring until the friction in the ball joint holds the detector in its position. Yet, still permits it to be moved by hand-applied force (use 3/16 Hex Key).

5. Point the detector towards the protected area and make certain that the view of the area is not obstructed. Secure the detector in that position by tightening the locking screws of the swivel mount ring.

The detector is now correctly located and aligned, and ready for connecting to the system.

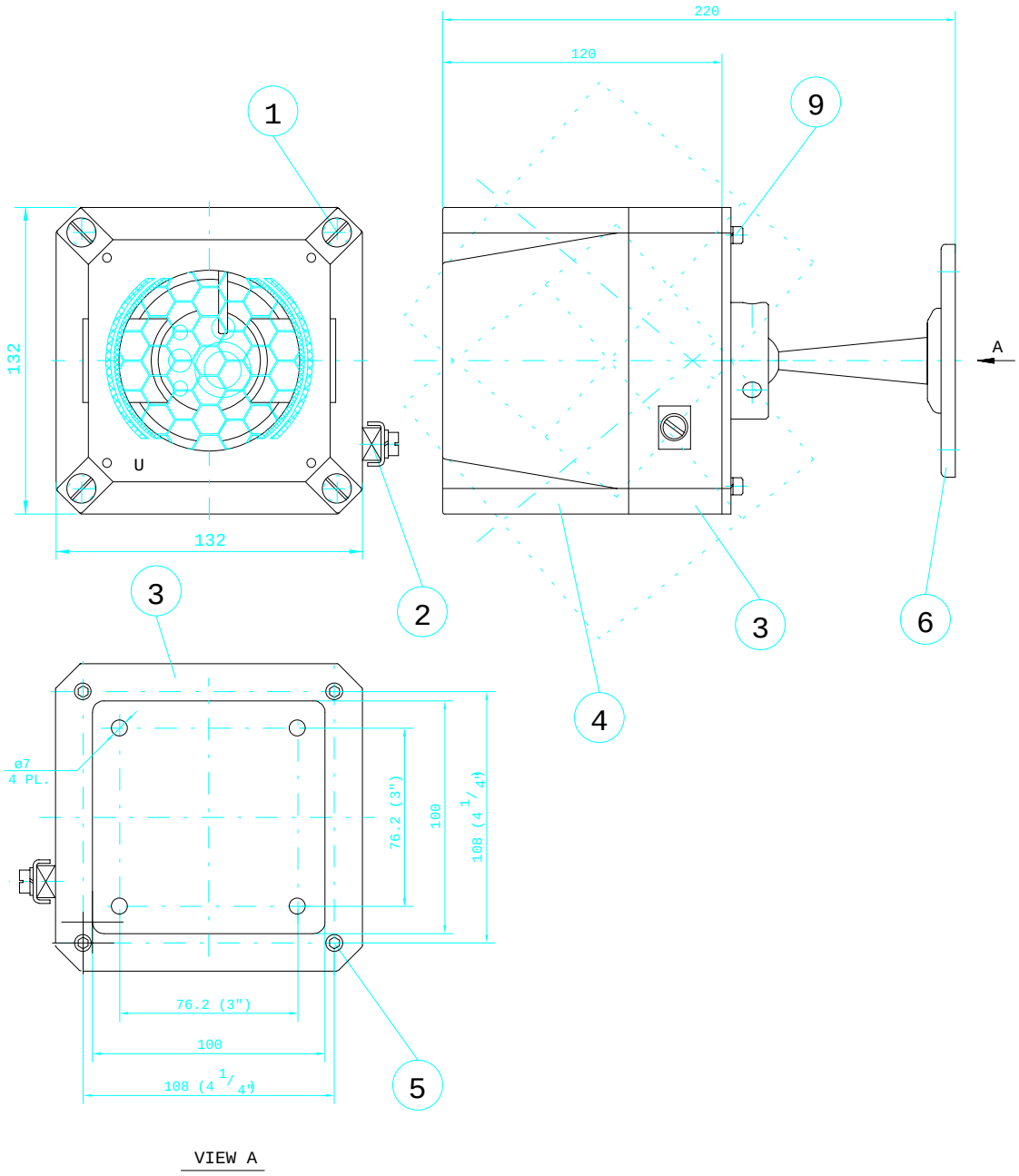
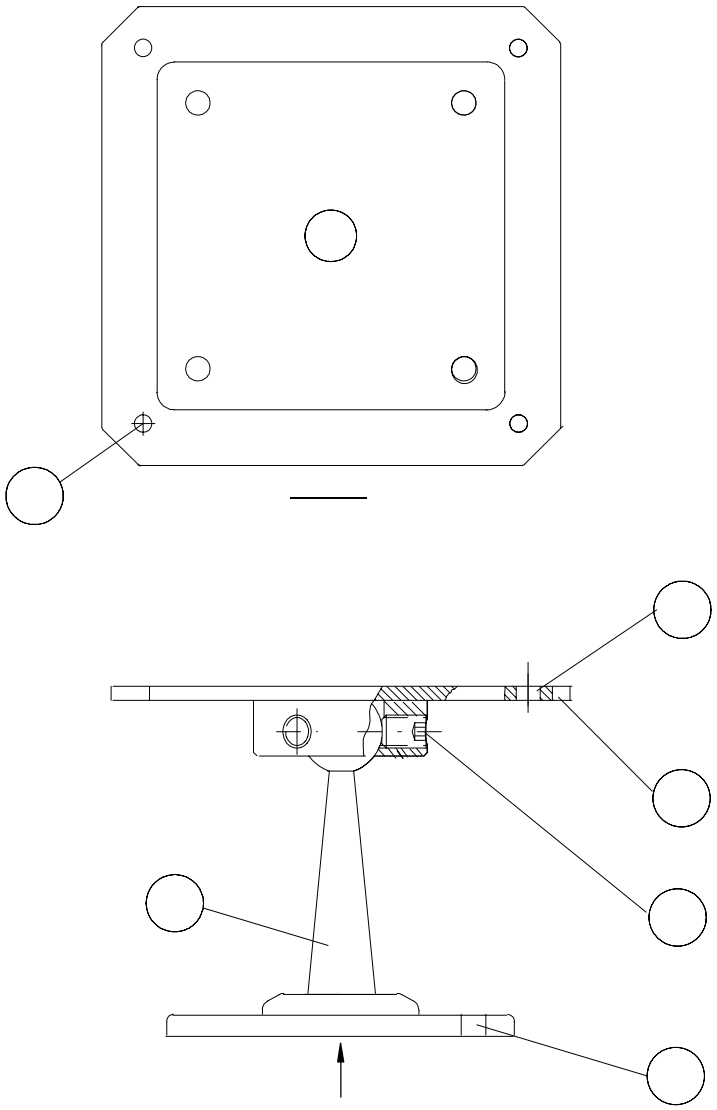


Figure 4.a. UV Detector and Swivel Mount Assembly
Detector Assembly



LEGEND (for Figure 4.a and 4.b):

1. Protective Set Screws
2. Ground Terminal (for CENELEC) or Ground Thread (for FM)
3. Back Cover
4. Housing
5. Swivel Mount Screw Hole
6. Swivel Mount
7. Holding Plate
8. Locking Screws
9. Securing Screws (4)
10. Swivel Mount Plate Securing Screws Hole(4)

Figure 4.b. UV Detector and Swivel Mount Assembly
Swivel Mount Assembly

6.6. HARNESS CONNECTION (Figure 5)

1. Disconnect power.

2. Remove the four protective set-screws (Fig 4, item 1) from detector front.

3. Refer to Figure 5. Release the four socket-head screws that secure the detector housing (6) to its back cover (3) using No. 5 Hex Key for M6 screw. Hold the housing during the removal of the screws. With the screws removed, pull the detector housing from its cover. The cover remains attached to the detector swivel mount. The housing slides under the cover and remains attached to it by a securing cable(8). The terminal board (7) inside the detector cover is now revealed.

4. Remove the protective plug mounted on the detector conduit inlet (10). Pull the wires through the detector cover (3) and secure them firmly to the cover using the cable-tie (11) attached to it. Use a 3/4”-14NPT or M25 x 1.5P explosion-proof conduit connection (M25 optional) to assemble the conduit to the detector.

5. Connect the wires to the required terminals (7) according to the wiring diagram. See section 6.7 and figures 5 and 6.

6. Connect a Grounding Cable to the Ground Terminal (4) outside the detector cover(3). For FM installation connect the Grounding Cable to the Ground Thread (4) using appropriate screw. The detector must be well grounded to Earth Ground for proper operation.

7. Verify the wiring. Improper wiring may damage the detector.

8. Check the wires for secure mechanical connection and press them neatly against the Terminal Board (7) to prevent them from interfering while closing the detector’s housing.

6.7. TERMINAL WIRING (Figures 6,7)

The detector contains a terminal board consisting of two terminal blocks. The left terminal block is labeled 1 to 6; the right terminal block is labeled 7 to 12. See Figure 6. The following describes the function of each electrical terminal of the detector.

Power Supply: (Terminals 1, 2)

Input power is supplied to terminal No. 1.
The RETURN is connected to terminal No.2.

Manual Bit Activation: (Terminal 3)

Terminal No. 3 is used for the manual BIT activation. The manual BIT is initiated by a momentary connection of terminal No. 3 to the power supply return line.

Alarm Relay: (Terminals 4, 5, 6)

The Alarm output is a change over contact relay (SPDT).
Terminal no. 4 is the NO. relay contact.
Terminal no. 5 is the COMMON relate contact.
Terminal no. 6 is the NC relay contact.

Fault Relay: (Terminals 7, 8)

The Fault output in NO SPST relay at terminals no. 7 and 8. The contacts are closed when the detector is in its normal operational condition.

Accessory Relay: (Terminals 9, 10)

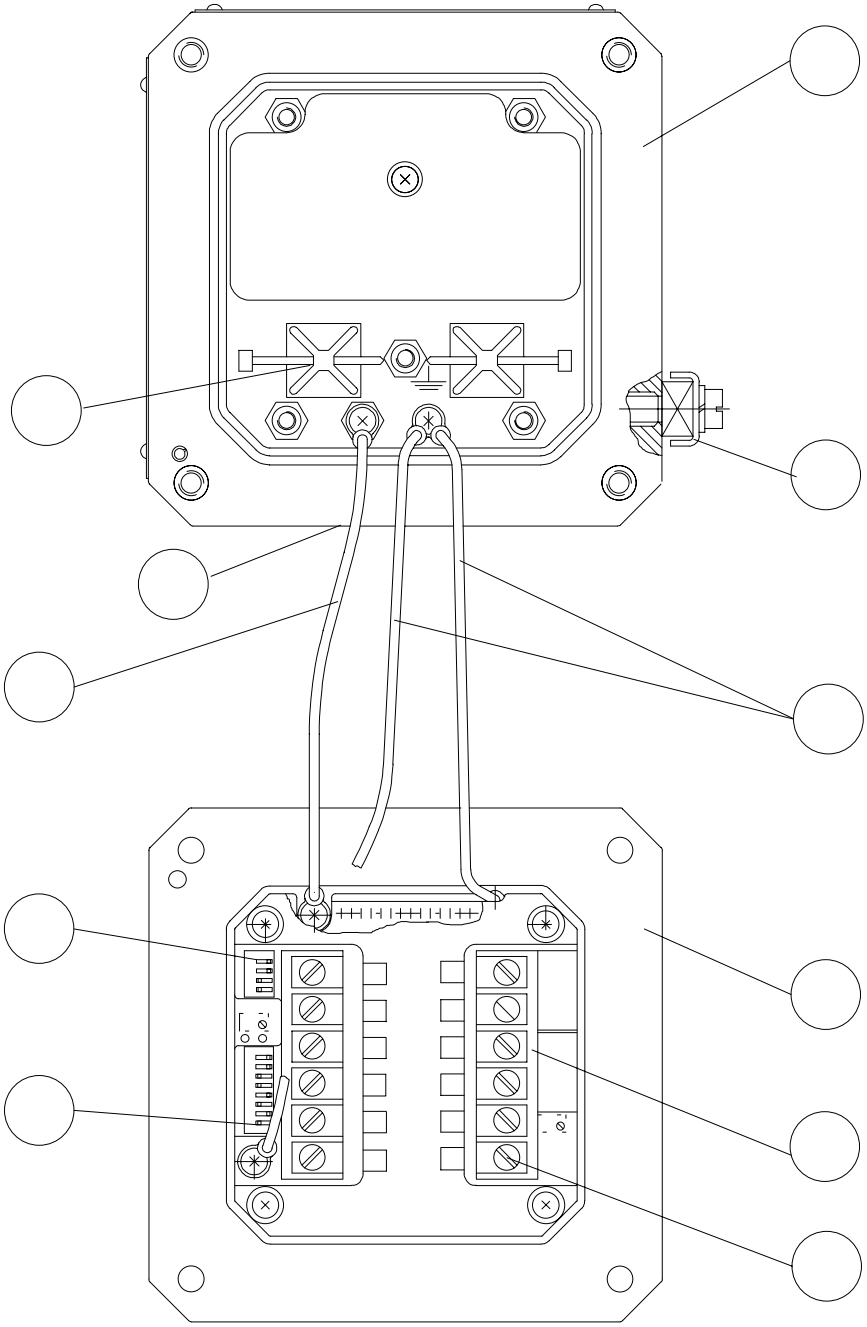
The Accessory output is N.O. SPST relay at terminals no. 9 and 10. The Accessory relay may act in parallel with the Alarm relay to activate another external device or it may provide a warning signal, depending on the position of SW1-4.

NOTE:

To protect the dry contacts from voltage surges when connected to reactive loads (electric motors, sirens, etc.) connect an appropriate varistor over these contacts.

4-20mA Output: (Terminals11, 12)

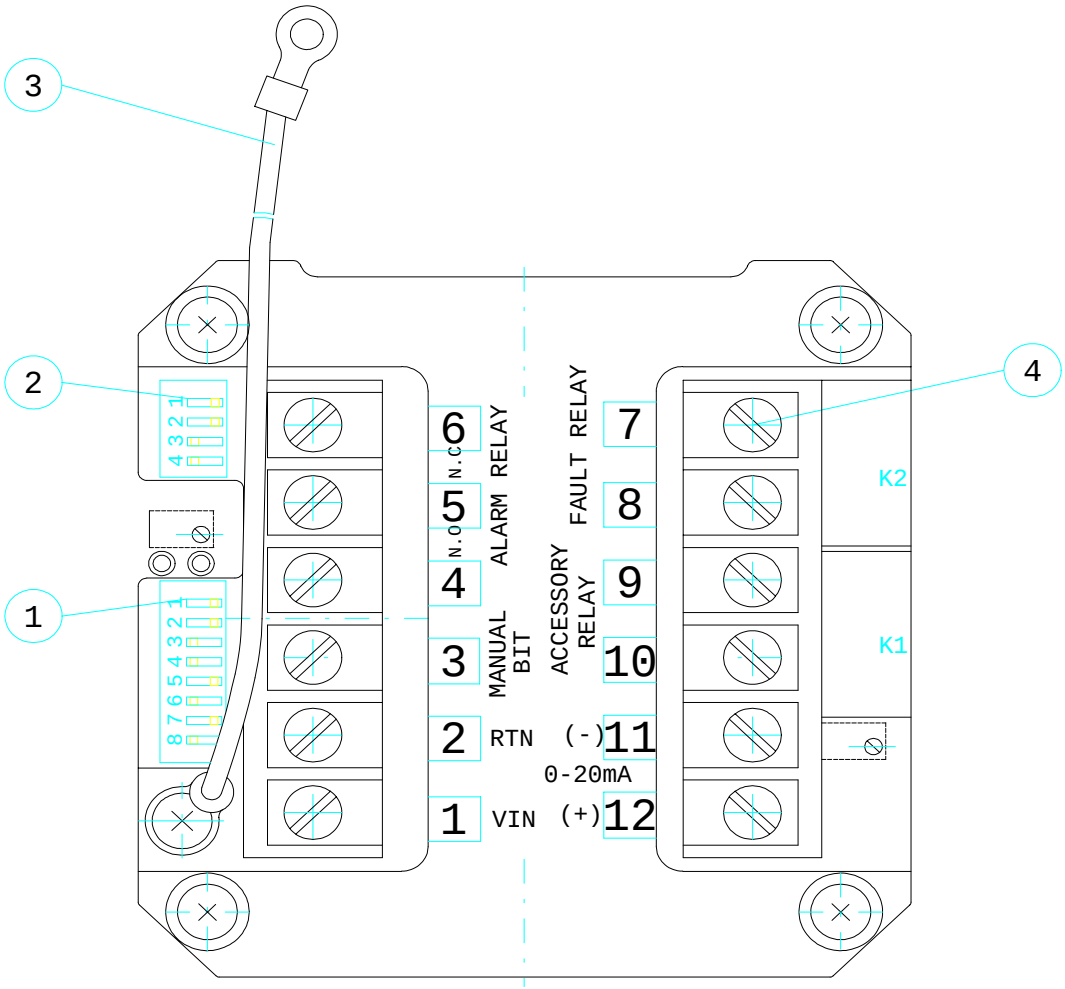
Terminals 11 and 12 are used for 4-20mA current output as specified in section 5.1.e.
Terminal 11 is used as output terminal (-) (RTN)
Terminal 12 is used as input terminal (+)
See appendix B for more details.



LEGEND:

1. Alarm Delay Switch (SW2)
2. Function Switch (SW1)
3. Cover
4. Earth (Ground)Terminal (for CENELEC) or Earth Thread (for FM)
5. Grounding Wires
6. Housing
7. Terminal Board
8. Securing Cable
9. Terminal Screws
10. Conduit Inlet
11. Cable Tie

Figure 5. UV Flame Detector with Cover Removed



LEGEND:
1. Function Switch (SW1)
2. Alarm Delay Switch (SW2)
3. Ground Cable
4. Terminal Screws

Figure 6. Terminal Board Configuration

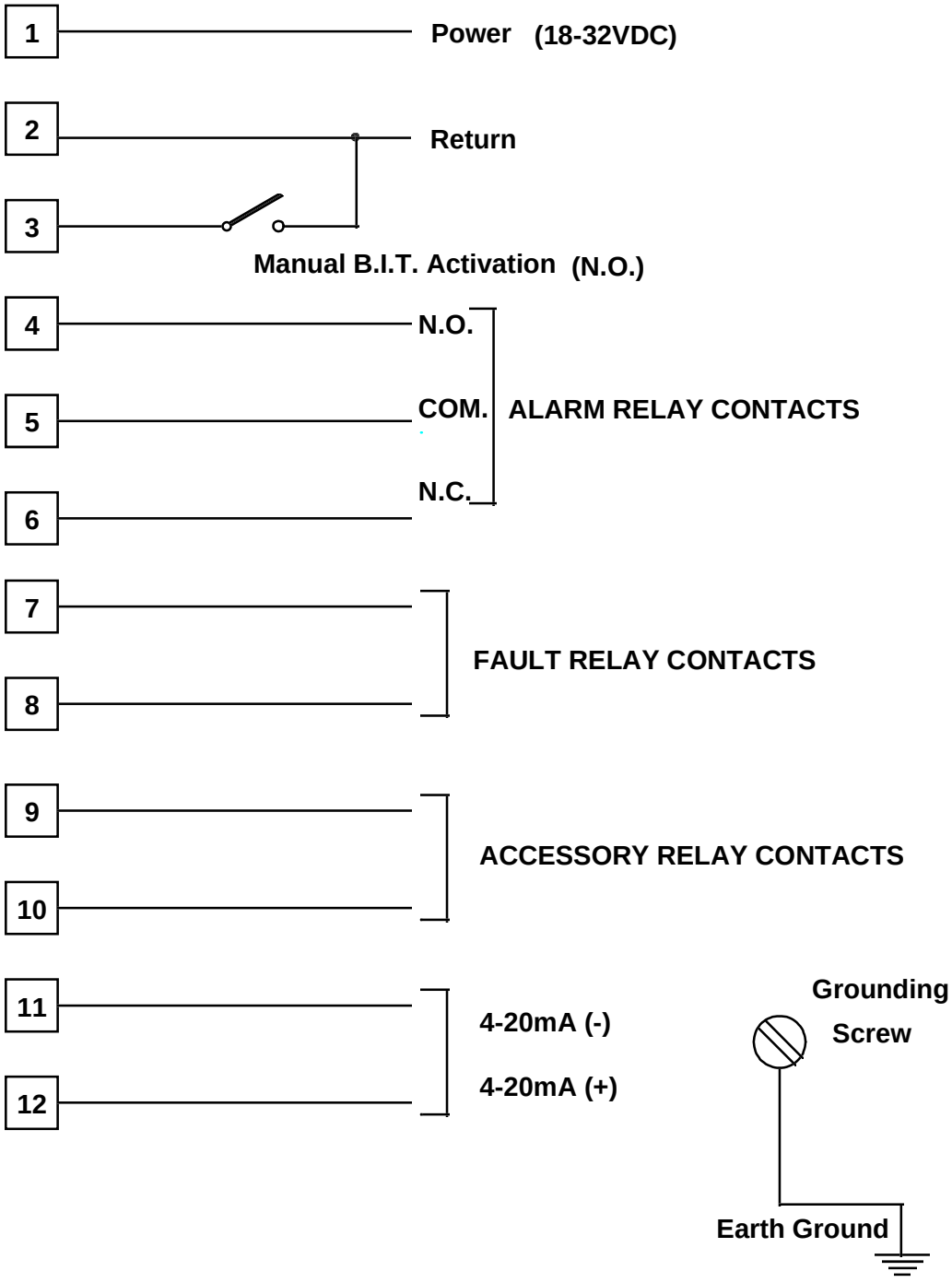


Figure 7. Flame Detector Assembly - Wiring Diagram

6.8. SELECTION OF OPERATING MODES

When wiring is completed the operational mode can be selected.

Mode selection is achieved by means of two DIP switches listed below:

SW1 - Function switch
SW2 - Alarm Delay switch

Function switch (SW1)
Modes of operation are selected by DIP switch (SW2) according to the selection table (Table 3 at section 4.3).

Alarm Delay Switch (SW2)
An Alarm Delay may be required for certain applications. The detector has an Alarm Delay switch (SW2), permitting time delays from 0, 3, 5, 10, 15, 20, 25 and 30 seconds respectively (see table 4).

1. Setting Function Switch (SW1):

Set all eight (8) switches of SW1 to their appropriate settings (ON/OFF), to achieve the required functional mode. See Table 3 at section 4.3.

2. Setting Alarm Signal Delay switch (SW2):

Set SW2 to the appropriate position to achieve the required time delay. See Table 4 at section 4.3.

3. Close the detector; Connect the housing to the cover using the alignment open on the back cover. Tighten the Four (4) socket-head screws to secure the detector housing to its back cover.

4. Install the four (4) set-screws that protect the socket-head screws.

The Detector is now wired, assembled as its operational mode properly set.

7. OPERATING INSTRUCTIONS

7.1. SCOPE

The following instructions are designed to obtain optimal performance from the detector over its life-cycle.

7.2. POWER-UP

1. Apply power and wait up to 40 seconds for the automatic self-test of the detector.
   Note:
   Applying power initiates the following sequence:
   The LED blinks (4 Hz)
   BIT is executed. If successful then:
   The LED blinks (0.5Hz)
   Fault Relay contacts close

2. Wiring inspection If a short-circuit or line discontinuity exists, indications will appear on the control unit display panel. Review your wiring.

3. The detector goes into its FAULT state when supply voltage drops under 16.5V. The detector status goes back to NORMAL when the supply voltage is above 17.5V.

4. Detector inspection: Visually inspect the viewing window of the detector. It should be clean and clear. The LED should blink (0.5 Hz) and the Alarm and Accessory Relays should be off and the Fault Relay should be on.

5. If any of the outputs or indications are different from the description in step 3, see section 8.6. for troubleshooting.

The Flame Detector is now ready for Functional Testing.

7.3. RESET

To reset a detector when its Alarm Latch state, disconnect power (terminal No. 1 or terminal No. 2), or initiate a manual BIT.

7.4. FUNCTIONAL TESTING

Following is a testing procedure for proper wiring and functioning of the detector.

IMPORTANT NOTE !

If SW1 switches 7 or 6 are in their "ON" position the Alarm and Accessory Relays will be activated during a MANUAL BIT, therefore, automatic extinguishing systems or any external devices that may be activated during BIT must be disconnected.

1. Verify that the detector is operated properly.
2. Initiate manual BIT.
   Verify the appropriate SW1 setting. After a few seconds the following occurs:
   Alarm Relay will be activated for 3 seconds (Only if SW1-6 is ON).
   Accessory Relay will be activated for 3 seconds (Only if SW1-7 is ON).
   The two LEDs should blink at 0.5Hz rate.
   Fault Relay will stay active during the test.

This completes the installation procedure. The detector and system are now ready for operation.

7.5. TESTING WITH FIRE SIMULATOR

This test is produced by simulating an exposure of the detector to a real fire. The detector is exposed to the radiation in the specified detection level. As a result a Fire Alarm signal must be generated by the detector.

IMPORTANT NOTE !

*If the detector is exposed to a fire simulator and SW1 switches 7 or 6 are in their "ON" position the Alarm and Accessory Relays will be activated during the simulation. Therefore, automatic extinguishing systems or any external devices that may be activated during this process **must** be disconnected.*

1. Apply power to the system and wait up to 40 seconds for turning of the detector to normal state. The LED should blink at 0.5 Hz rate.

2. Aim the Spectrex Fire Simulator Model 20/20-311 against the front of the viewing window of the detector, in a way that the radiation emitted by it is facing directly towards the detector.

3. Activate the Fire Simulator, in this position for about three (3) seconds, then slide the Fire Simulator to a side to reveal the detector viewing window. The LED should be on and remain so for approximately four (4) seconds. After this period the LED should return to blink at 0.5Hz rate. The 4-20mA output should turn to 20mA for approximately four (4) seconds and then to return to 4mA. The Alarm Relay should also turn on to this period. The Accessory Relay should respond in parallel to the Alarm Relay if SW1-4 is off.

7.6. SAFETY PRECAUTIONS

After powering-up, the detector requires minimal attention in order to function properly, but the following should be noted

One. Follow the instructions in the manual and refer to the drawings and specifications issued by the manufacturer.

Two. Do not expose the detector to radiation of any kind unless required for testing purposes.

Three. Do not open the detector housing, while power is supplied.

Four. Do not touch internal parts other than the two functional switches. Interference with internal circuits may impair detector performance and will invalidate manufacturers warranty.

Five. Disconnect external devices, such as automatic extinguishing systems before carrying our any maintenance task.

8. MAINTENANCE INSTRUCTIONS

8.1. SCOPE

This chapter deals with preventive maintenance, describes possible faults in detector operation and indicates corrective measures. Ignoring these instructions may cause problems with the detector and any invalidate the warranty.

Whenever a unit requires service, please contact the manufacturer or its authorized distributor for assistance.

8.2. MAINTENANCE INSTRUMENTATION AND PERSONNEL

The detector's maintenance requires ordinary tools and qualified personnel, which should be familiar with local codes and practices

8.3. PREVENTIVE MAINTENANCE PROCEDURES

The detector must be kept as clean as possible. The viewing window and the reflector of the model FV-10-1, FV-10-2 Flame Detector must be cleaned on a periodic basis. The frequency of cleaning operations depends upon the environmental conditions and specific applications. The fire detection system designer will give his recommendations.

1. Disconnect power to the detector before proceeding with any maintenance.

2. To clean the detector viewing window and reflector use water and detergent, then rinse with clean water.

3. Where dust, dirt or moisture accumulates on the window, first clean with a small soft brush under the window guard, then clean with a soft optical cloth and detergent and finally rinse with clean water. Do not attempt to open the window guard since it should not be removed.

8.4. PERIODIC MAINTENANCE PROCEDURES

In addition to preventive cleaning and maintenance, the detector should be functionally tested every six months. The test should also be carried out for any reason the detector has been opened.

8.4.1 Power Up Procedure

Perform Power-Up procedure every time power is restored to the system. Follow the instructions in section 7.2. above.

8.4.2 Functional Test Procedure

Perform a functional test of the detector as described in section 7.4 and 7.5 above.

8.5. MAINTENANCE RECORDS

It is recommended to record maintenance operations performed on a detector in the System Log Book. The record should include information which identifies the unit, installation date, contractor, and entries for every maintenance operation performed including the description of the operation, date and personnel ID.
If a unit is sent to the manufacturer or distributor for service, a copy of the Maintenance records should accompany it.

8.6. TROUBLESHOOTING

8.6.1 Fault Indication

The following subsections describe possible faults and suggestion for immediate solutions.

1	Check power supply for correct voltage, polarity and wiring.
2	Check detector window and reflector for cleanness. If necessary clean the window as indicated in section 8.3. above and repeat the test.
3	Disconnect the power supply from the system and check the detectors' internal wiring.
4	Re-connect power supply and wait approximately one minute. Repeat the test. If any indication LED is still blinking at 4Hz rate, the unit is faulty and requires to be removed and to be submitted for repair.

8.6.2 False Alarm or Warning Indication

1	Check detector window and reflector for cleanness. If necessary clean the window as indicated in section 8.3 above and repeat the test.
2	Disconnect the power supply from the system and check the detector's internal wiring.
3	Re-connect power supply and wait approximately one minute. Repeat the test. If the indication LED is still blinking at 4Hz rate, the unit is faulty and requires to be removed and to be submitted for repair.

APPENDIX A - WIRE SELECTION TABLES

GENERAL INSTRUCTION FOR ELECTRICAL WIRING

1. Refer to Table A-1 to determine the required wire gauge for general wiring, such as relay wiring. Calculate the permitted voltage fall with respect to loads current, wire gauge, length of wires.

2. Refer to Table A-2 to select wire gauge for detectors power supply wires. DO NOT connect any device or load to detectors supply inputs.

Table A-1. Maximum DC resistance at 68°F for copper wire

AWG	mm^2	Ohm per 100 ft.	Ohm per 100 meter
26	0.12 - 0.15	4.32	14.15
24	0.16 - 0.24	3.42	11.22
22	0.30 - 0.38	1.71	5.60
20	0.51 - 0.61	1.07	3.50
18	0.81 - 0.96	0.67	2.20
16	1.22 - 1.43	0.43	1.40
14	1.94 - 2.28	0.27	0.88
12	3.09 - 3.40	0.17	0.55
10	4.56 - 6.64	0.11	0.35
10	4.56 - 6.64	0.11	0.35

Wiring gauge

One) Select “No. of detectors” connected on one circuit.
Two) Select “wiring length” per your installation requirements.
Three) Refer to “Power Supply Range” for voltage extreme applied.

Table A-2. Wiring length in meters (ft)

No. of Detectors	**Recommended Wire Diameter in AWG.**					**Power Supply Range (VDC)**
24	18	16	14	-	-	22-32
20	18	16	14	-	-	22-32
16	20	18	16	14	-	22-32
12	20	18	16	14	-	20-32
8	20	18	16	14	-	20-32
4 and less	20	18	16	16	14	18-32
meter (feet)	0 (164)	100 (328)	150 (492)	200 (656)	250 (820)	
	Max. Lengh from Power Supply to Last Detector					

APPENDIX B - TYPICAL WIRING CONFIGURATIONS

Wiring for Four Wire Controllers:

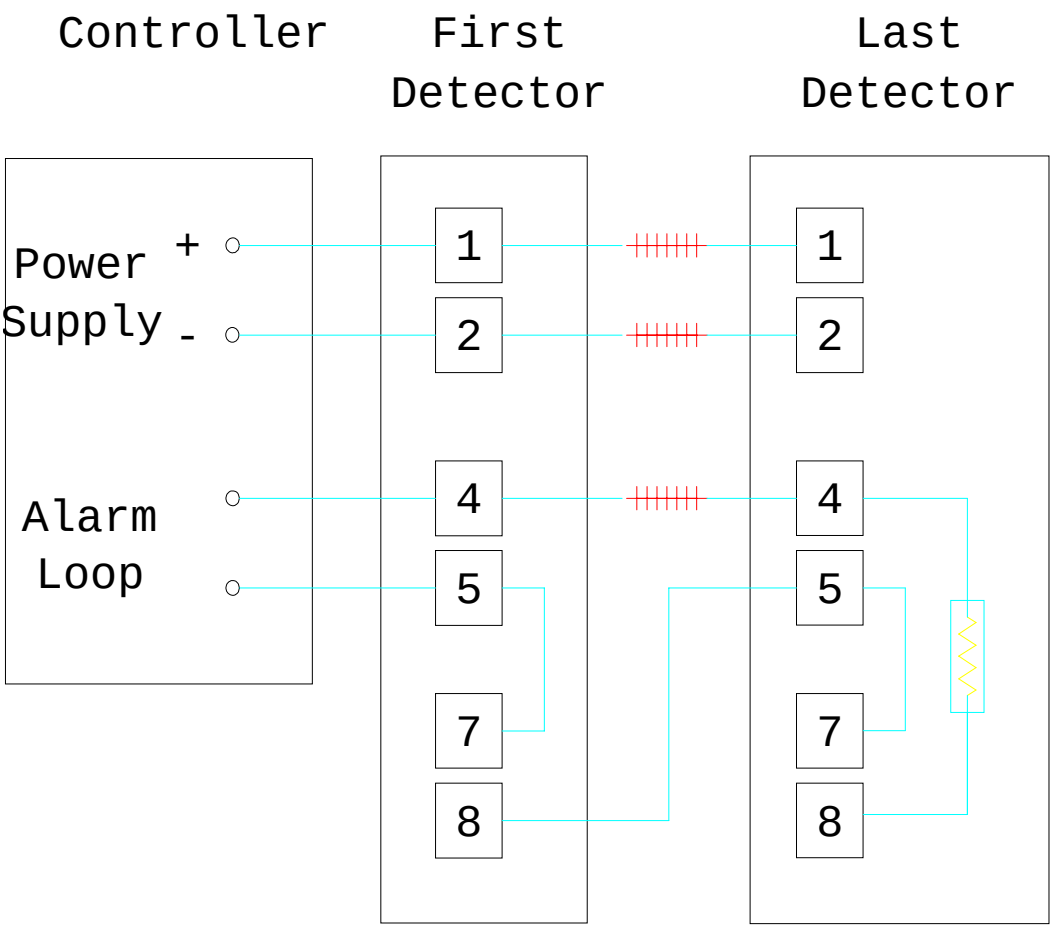


Figure B-1. Typical Wiring Diagram for Four Wire Controller

4-20 mA Interface Wiring:

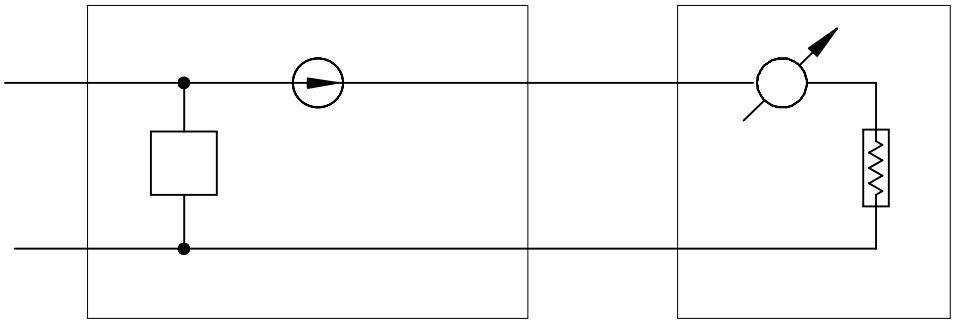


Figure B-2. Wiring Diagram for 4-20mA

For further details or assistance , contact:

SPECTREX INC.
Peckman Industrial Park, 218 Little Falls Road
Cedar Grove, New Jersey 07009, USA
Tel: (201) 239-8398; Fax: (201) 239-7614

Your Local Authorized Distributor: