SharpEye™

Model 20/20MPI

Mini Triple IR (IR3) Flame Detector

User and Maintenance Manual

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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 Detector is 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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Release History

Rev	Date	Revision History	Prepared by	Approved by
C	June 2013	Third Revision	Ian Buchanan	Eric Zinn
D	September 2013	Fourth Revision	Ian Buchanan	Eric Zinn
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About this Guide

This guide describes the SharpEye Model 20/20MPI Mini Triple IR (IR3) Flame Detector and its features and provides instructions on how to install, operate and maintain the detector.

This guide includes the following chapters and appendixes:

- **Chapter 1**, **Introduction**, provides a general introduction and overview of the product.
- **Chapter 2**, **Technical Description**, describes the detector's features and principles of operation.
- **Chapter 3**, **Performance**, describes the detector's detection sensitivity and capabilities.
- **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**, describes preparations for installation, wiring and mode settings.
- **Chapter 7**, **Operating Instructions**, show how to power-up and test the detector.
- **Chapter 8**, **Maintenance and troubleshooting**, describes basic maintenance procedures, and support procedures.
- **Appendix A**, **Typical Wiring Configurations**, lists the wiring instructions for connecting the detector and provides examples of typical wiring configurations.
- **Appendix B, Long Range IR3 Fire Simulator**, describes the fire simulator that can be specifically used with SharpEye IR3 flame detectors.

Abbreviations and Acronyms

Abbreviation	Meaning
ATEX	Atmosphere Explosives
AWG	American Wire Gauge
BIT	Built In Test
EMC	Electromagnetic Compatibility
EOL	End of Line
FOV	Field of View
IAD	Immune at Any Distance
IECEx	International Electrotechnical Commission Explosion
IPA	Isopropyl Alcohol
IR	Infrared
JP5	Jet Fuel
Latching	Refers to relays remaining in the ON state even after the ON condition has been removed
LED	Light Emitting Diode
LPG	Liquefied Petroleum Gas
mA	MilliAmps (0.001 amps)
MODBUS	Master-slave messaging structure
N.C.	Normally Closed
N.O.	Normally Open
N/A	Not Applicable
NFPA	National Fire Protection Association
NPT	National Pipe Thread
VAC	Volts Alternating Current

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1 Introduction

➢ **In this chapter…**

1.1 Product Overview

The Spectrex Model 20/20MPI is a new version of the triple IR spectrum flame detector designed to provide maximum fire protection. It uses innovative technology of advanced digital signal processing to analyze the dynamic characteristics of fire. Three sensitive IR channels process the signals. 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, which provides excellent detection sensitivity with extreme immunity to false alarm.

To use the HOST software and to change the required functions, refer to manual TM768050 for instructions.

2 Technical Description

➢ **In this chapter...**

2.1 Features

The SharpEye Model 20/20MPI Mini Triple IR (IR3) Flame Detector includes the following features:

- **Detection Range**: up to 140 ft. (43m) for a 1 ft^2 (0.1m^2) n-heptane pan fire
- **Ultra High Immunity to False Alarms** (see False Alarms Prevention on page 10)
- **Advanced Digital Processing of the Dynamic Characteristics of Fire**: Flickering, Threshold correlation and Ratio
- **Three Separate IR Channels**: Between 3-5 microns
- **Field Programmable Sensitivity**: four ranges
- **Two Response Levels**: Warning and Detection
- **Solar Blind**
- **Microprocessor Based**: Digital signal processing
- **Built In Test (BIT)**: Manual and Automatic
- **Two Options of Electrical Interface:**
  - 20/20MPI-R: Dry contact relays
  - 20/20MPI-M: 0-20 mA output (stepped)
- **Functional Approvals**:
  - EN54-10 pending per VdS
  - FM approved per FM3260

2.2 Principles of Operation

2.2.1 Hydrocarbon Fire Detection

The triple IR flame detector detects all conceivable types of hydrocarbon fires, i.e. any fire, which emits CO2.

2.2.2 Identifying the CO2 Peak

The hydrocarbon fire is characterized by a typical radiation emission. The CO2 peak emits intense radiation in the spectral band between 4.2 µ - 4.5 µ and weaker radiation intensity outside this spectral band.

2.2.3 Limitations of IR-IR Flame Detectors

CO2 in the atmosphere attenuates the radiation in this spectral band. (Absorption and emission of radiation always occur in the same band.) As a result, the greater the distance between the detector and the fire, the weaker the intensity of the radiation reaching the detector (the CO2 attenuation increases). This phenomenon explains the limitations of the existing IR-IR flame detectors in the market:

- Detection distance is restricted to 33 ft. (10 m) only.
- Their immunity to false alarm sources is limited.

2.2.4 Advantages of IR3 Technology

To overcome these limitations, Spectrex Inc. devised an innovative concept of utilizing an additional detection channel. Three channels collect more data from the environment, permitting more accurate analysis and better performance.

After careful investigation, three channels were selected which, when operating jointly, provide optimal fire detection characteristics:

- **Channel 1**: 4.2 µ - 4.6 µ

  Fire - the CO2 peak

- **Channel 2**: 4.0 µ - 4.2 µ

  Eliminates false alarms from high temperature sources.

- **Channel 3**: 4.8 µ - 5.2 µ

  Eliminates false alarms from flickering of background radiation.

Most IR sources, which create misleading IR alarm stimuli, including the sun, incandescent and halogen lamps, electric arc discharges, electrical heaters, etc., do not possess this unique spectral signature of fire.

The IR sensors of the detector respond only to flickering of radiation signals. The signals are compared to a predetermined threshold. Processing of the results from the three IR channels is performed by the board microprocessor. The result is a much greater detection distance and a highly increased ability to distinguish between fire and false alarms.

This sophisticated technology surpasses all other existing flame detection techniques on the market today.

Note: This unique flame analysis capability (patent pending) has been incorporated into the Triple-IR fire detector manufactured by Spectrex, Inc. The result is a unique flame detector, which does not produce false alarms and provides detection over greatly increased distances at the same time.

2.2.5 Modbus RS-485

For more advanced communication, 20/20MPI has a RS485 Modbus compatible output that provides data communication from a network (up to 247 detectors) to a host computer on universal controller, for central monitoring. This feature enables easy maintenance local and remote diagnostic tools.

2.2.6 Types and Models

The 20/20MPI has two models:

- 20/20MPI-R: Relay output
- 20/20MPI-M: 0-20 mA output (stepped)

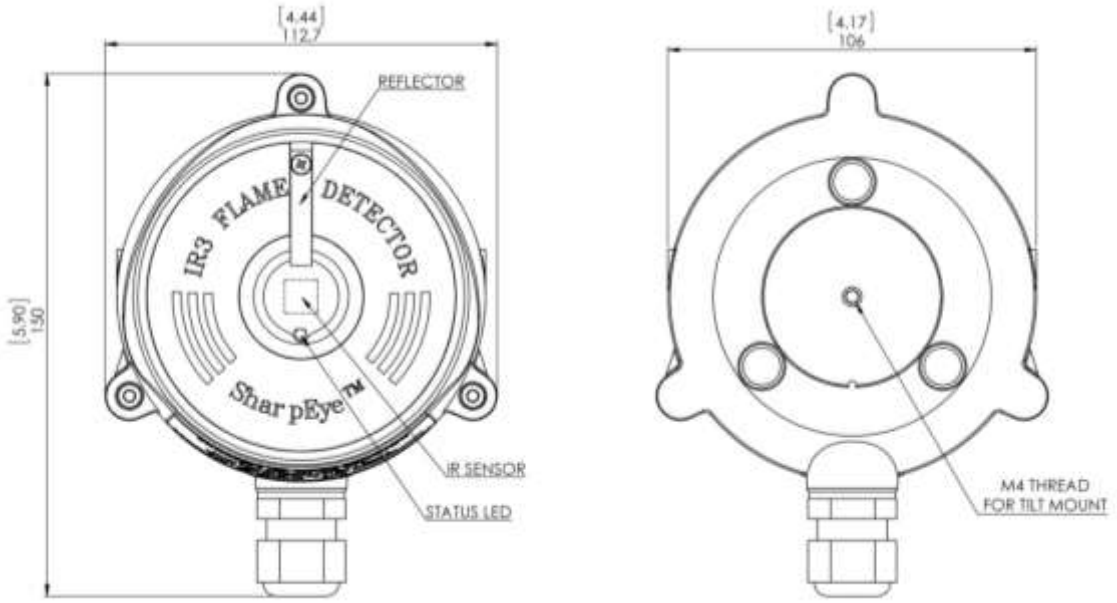

Figure 1: Flame Detector Assembly - Outline Drawing

3 Performance

➢ **In this chapter…**

3.1 Detection Sensitivity

Detection sensitivity is the maximum distance at which the detector will reliably detect a specific size of fire and typical type of fuel (standard fire).

3.1.1 Standard Fire:

A *standard fire* is defined as a 1 ft^2 ($0.1m^2$) gasoline pan fire with maximum wind speed of 6.5 ft./sec (2m/sec).

3.1.2 Sensitivity Ranges:

The detector has four user selectable sensitivity ranges. For each range there are two response levels.

- WARNING (Pre-alarm)
- ALARM

The detection distance, for the WARNING level, is approximately 10% higher than the ALARM distance. Alarm response times for a *standard fire* at a specified range are shown in *Table 1*.

Table 1: Alarm Response Time versus Range

	10	**20**	**30**	**40**
Sensitivity Range – ft. (m)	33 (10)	65 (20)	100 (30)	140 (43)
Response Time (sec)	5	8	10	10

For some typical ambient conditions the Zeta parameter, as defined in NFPA 72 for the detector, is 0.005 (1/meter).

Note: Zeta parameters may vary significantly with changes in temperature, air pressure, humidity, visibility conditions, etc.

3.1.3 Other Fuels

The detector reacts to other types of fires as shown in *Table 2*:

Table 2: Response Sensitivity Ranges

Type Of Fuel	20/20MPI-R	Type Of Fuel
Gasoline	140 ft. (43m)	100%
N-Heptane	140 ft. (43m)	100%
Alcohol 95%	100 ft. (30m)	70%
JP5	100 ft. (30m)	70%
Kerosene	100 ft. (30m)	70%
Diesel Fuel	100 ft. (30m)	70%
Methane*	39 ft. (12m)	28%
IPA	115 ft. (35m)	80%
Methanol	98 ft. (30m)	70%
LPG*	39 ft. (12m)	28%
Polypropylene	49 ft. (15m)	35%
Paper	49 ft. (15m)	35%

* 0.5m plume fire

Pan Fire Size: 1 ft^2 (0.1m2)

Maximum Wind Speed: 6.5 ft./sec (2 m/sec)

Maximum Response Time: 10 sec

3.2 Cone of Vision

- **Horizontal: 100°**
- **Vertical: 90°**

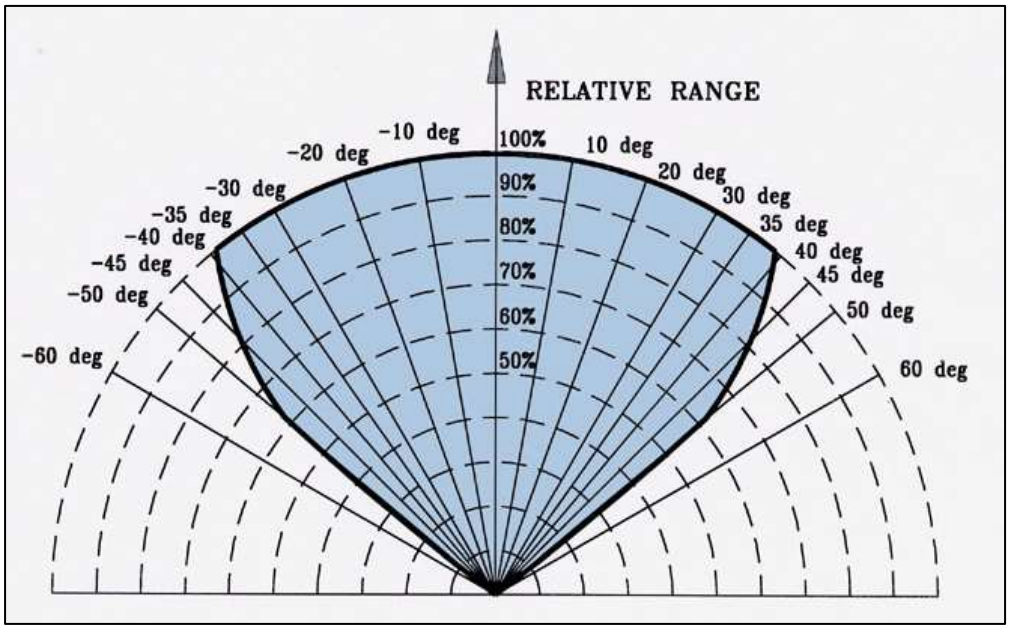

Figure 2: Horizontal and Vertical Fields of View

Note: Due to the reflector, there is a reduction in the cone of vision of 10° in the area of 5° around the reflector.

3.3 False Alarms Prevention

The detector does not provide an alarm or a warning signal as a reaction to the radiation sources specified in *Table 3*.

Table 3: Immunity to False Alarm Sources

Radiation Source	Immunity Distance ft.(m)
Sunlight	IAD
Indirect or reflected sunlight	IAD
Incandescent frosted glass light, 100 W	IAD
Incandescent clear glass light, rough service, 100 W	IAD
Fluorescent light with white enamel reflector, standard office or shop, 40 W (or two 20 W)	IAD
Electric arc [12mm (15/32 in) gap at 4000 V alternating current, 60 Hz]	IAD
Arc welding [4 mm (5/32 in) rod; 240 A]	See Table *4*
Ambient light extremes (darkness to bright light with snow, water, rain, desert glare and fog)	IAD
Bright colored clothing, including red and safety orange.	IAD
Electronic flash (180 watt-seconds minimum output)	IAD
Movie light, 625 W quartz DWY lamp (Sylvania S.G.-55 or equivalent)	6.5 (2)
Flashlight (MX 991/U)	IAD
Radiation heater, 1500 W	IAD
Radiation heater, 1000 W with fan	IAD
Quartz lamp (1000 W)	10 (3)
Mercury vapor lamp	IAD
Grinding metal	IAD
Lit cigar	1 (0.3)
Lit cigarette	1 (0.3)
Match, wood, stick including flare up	10 (3)
Grinding metal	IAD

Notes:

- IAD = Immune at Any Distance.
- All sources are chopped from 0 to 20Hz.

Table 4: Welding Immunity Distance

Sensitivity	Detection Range	Immunity Distance
10	33 ft. (10m)	>10 ft. (3m)
20	65 ft. (20m)	>15 ft. (5m)
30	100 ft. (30m)	>20 ft. (7m)
40	140 ft. (43m)	>33 ft. (10m)

4 Operation

➢ **In this chapter…**

4.1 Visual Indications

One 3-color LED-indicator is located in the detector front window.

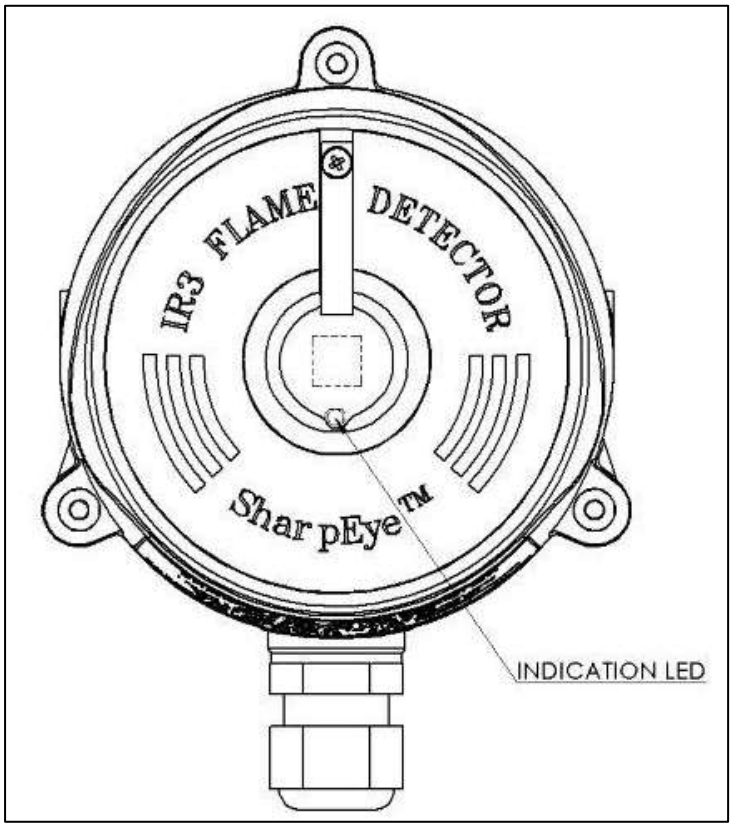

Figure 3: Indication LEDs

The LEDs are described in *Table 5*.

Table 5: 20/20MPI Status

Detector Status	LED color	LED mode
Fault, BIT Fault	Yellow	4 Hz flashing
Normal	Green	1 Hz flashing
Warning	Red	2 Hz flashing
Alarm	Red	Constant

4.2 Output Signals

The detector controls the following outputs:

- Model 20/20MPI-R:
  - Alarm Relay
  - Fault Relay
  - RS485
- Model 20/20MPI-M:
  - 0-20 mA Stepped Source Configuration
  - RS485

The detector can be in one of the following states.

Table 6: 20/20MPI Output Signals

Detector Status	Description
Normal	The detector is functioning normally.
BIT	The detector performs a Built-In Test.
Warning	Fire detected – warming alarm (pre-alarm) state
Alarm	Fire detected – fire alarm state
Latched Alarm (Optional)	The alarm outputs are latched due to the detection of a fire that has already been extinguished.
BIT Fault	A fault is detected during BIT sequence. The detector will continue to detect fire if the alarm conditions occur.
Fault	A fault is detected when the power supply is too low or during a software fault.

In each state, the detector activates different outputs, as specified in *Table* 7.

Table 7: Detector State with Output Signals

Detector State	Color LED	Flashing LED	Alarm Relay [1]	Fault Relay [1]	0-20 mA Output [2]
Normal	Green	1 Hz	Off	On	4 mA
Warning	Red	2 Hz	Off	On	16 mA
Alarm [3]	Red	Constant	On	On	20 mA
Latch [4]	Red	Constant	On	On	20 mA
BIT Fault [5]	Yellow	4 Hz	Off	Off	2 mA
Warning at BIT Fault	Red	2 Hz	Off	Off	16 mA
Alarm at BIT Fault	Red	Constant	On	Off	20 mA
Fault	Yellow	4 Hz	Off	Off	0 mA

Notes:

1 Alarm and Fault Relay refer to model 20/20MPI-R.

2 0-20 mA Output refers to model 20/20MPI-M.

3 The alarm outputs are activated as long as the alarm conditions are present

4 The alarm state can be latched (optional) according to a programmable function

5 The detector is in its BIT FAULT state until it has passed a successful BIT, and stops approximately 3 seconds after the fire is no longer detected.

4.2.1 Optional Latching

The detector has an optional latched alarm output capability, which operates according to the programmable function. If selected, upon detection of a fire, the detection signal is latched until manually reset (disconnecting the power supply). Latching affects the ALARM RELAY, 0-20 mA output, and the ALARM LED.

4.2.2 Built-In-Test

When the programmable function **Alarm BIT** at **YES** is successful, the 0-20 mA output provides 20 mA for 3 sec.

4.3 Detector Mode Setup

4.3.1 Detector Setting

Refer to *Detector Default Setup* on page 18 for default factory settings.

The detector incorporates several functions that can be set by the customer using Spectrex Host software, which is supplied for each detector shipment, (refer to manual TM768050 for programming instructions). The Host software enables you to change functions as described in *Detector* on page 16.

4.3.2 Detector Functions

4.3.2.1 Sensitivity Ranges

The detector offers four (4) sensitivity settings. The settings refer to the gasoline fire of 1 ft^2 from 33 ft. (10 m) to 140 ft. (43m). Detection distances for other fuels vary.

4.3.2.2 Alarm Delay

The detector is equipped with an Alarm Delay option, which provides programmable time delays of 0 to 30 seconds with eight (8) fixed settings:

- 0 seconds
- Anti-flare
- 3 seconds
- 5 seconds
- 10 seconds
- 15 seconds
- 20 seconds
- 30 seconds

When an Alarm (Detection) level condition is encountered, the detector delays the execution of the Alarm output's relay by the specified period of time. The detector then evaluates the condition for 3 seconds. If the Alarm level is still present, the Alarm outputs are activated. If this condition no longer exists, the detector returns to its standby state. The Alarm delay option affects the alarm relay and the 0-20 mA output. The LED indicates warning level during the delay time only if the fire condition exists.

Anti-Flare

Anti-Flare mode is selected to prevent false alarm in locations where fast flares may be present. The Time delay for fire alarm in this mode is from 2.5 to 15 seconds (mostly less than 10 seconds).

Table 8: Time Delay

Delay (seconds)
0
A – anti-flare
3 (default)
5
10
15
20
30

Note: The FM approval does not allow use of 20, and 30 second setting delay.

4.3.2.3 Function Setup

You can select the desired mode of operation by means of the host.

Table 9: Function Setup

	Name	Yes	No
1	Alarm Latch	Alarm latching enable	Alarm latching disable (default)
2	Automatic BIT	Automatic BIT (default)	No BIT

4.3.2.4 Addresses Setup

Refer to TM 768050 for instructions for defining the addresses of the detectors.

The detector provides up to 247 addresses (from 1 to 247) that can be used with RS-485 communication link.

4.3.3 Detector Default Setup

The detector has five (5) functions that can be programmed according to customer requirement at factory or at customer facility using software Host. *Table 10* lists the standard setup (default) that the detector is programmed to if there are no specific requirements.

Table 10: Default function set up

Detector Default Setup:	20/20MPI-R	20/20MPI-M
Sensitivity	20	20
Delay	3	3
Alarm Latch	NO	NO
Automatic BIT	YES	YES
Alarm BIT	NO	NO

4.4 Built-In Test

4.4.1 General

The detectors' Built-In Test (BIT) checks the following:

- Electronics circuitry
- Sensors
- Window cleanliness

The detector can be set to perform the BIT as:

- Automatically or no BIT

4.4.2 Principles

If the result of a BIT is the same as the current status of the detector (NORMAL or BIT FAULT), the detector's status is unchanged. If the result of a BIT differs from the current status of the detector, the detector's status is changed (from NORMAL to BIT FAULT or from BIT FAULT to NORMAL).

Note: In BIT FAULT status, the detector can continue to detect a fire.

4.4.3 Automatic BIT

4.4.3.1 Automatic BIT

The detector automatically performs a BIT every 15 minutes.

A successful BIT does not activate any indicator.

- The FAULT relay remains CLOSED (NORMAL) in model 20/20MPI-R.
- The LED continues to flash (1 Hz) at green.
- The 0-20mA output continues to indicate 5 mA in model 20/20MPI-M.

An unsuccessful BIT sequence activates the following:

- The FAULT relay opens in model 20/20MPI-R.
- 0-20 mA output indicates BIT FAULT (2 mA) in model 20/20MPI-M.
- The LED flashes (4 Hz) at yellow.
- BIT procedure is performed every 1 minute.

5 Technical Specifications

➢ **In this chapter…**

5.1 Electrical Specifications

- **Operating Voltage**: 18-32 VDC
- **Power Consumption**:
  - Max. 16 mA in Stand-by
  - Max. 40 mA in Alarm
- **Electrical outputs**
  - Dry Contact Relays:

Table 11: Contact Ratings

Relay Name	Type	Normal position	Maximum Ratings
Alarm	SPST	N.O.	2A at 30 VDC
Fault *	SPST	N.C.	2A at 30 VDC

* The FAULT relay is normally energized and the contact is closed during normal operation of the detector. The contact is open at Fault condition or low voltage.

- 0-20 mA Current Output:
  - The 0-20 mA is source option only.
  - The maximum permitted load resistor is 600 ohm.

Table 12: 0-20 Current Output

STATE	Output
FAULT	0 + 0.5 mA
BIT FAULT	2 mA±10%
NORMAL	4 mA±10%
WARNING	16 mA±5%
ALARM	20 mA±5%

- **Communication Network**:

  The detector is equipped with an RS-485 communication link that can be used in installations with computerized controllers. The communications protocol is Modbus compatible.

  - This protocol is a standard and widely used.
  - It enables continuous communication between a single standard Modbus controller (Master device) and a serial Network of up to 247 detectors.
  - It enables connection between different types of Spectrex detectors or other Modbus devices to the same Network.

5.2 Approvals

Functional approvals:

- EN54-10, page 22
- FM, page 22

5.2.1 EN54-10

The 20/20MPI Flame Detector is certified to EN54-10 and CPD.

The detector has been tested and approved per EN54-10 by VdS. This test includes functional test, environmental test, EMI/EMC test and software check. For more details see VdS Report No. BMA 13107 and BMA 13108.

5.2.2 FM

The 20/20MPI Flame Detector is certified to FM Functionality per FM3260

Fuel Test Response including: Gasoline, N-Heptane, Diesel, JP5, Kerosene, Ethyl, Alcohol 95%, IPA, Methanol, Methane, LPG, Polypropylene, and Paper. For more details see FM Report Project ID# 3047835.

5.3 Mechanical Specifications

- **Enclosure**: Polycarbonate
- **Functional Test:** FM functional test per FM3260
- **Water and dust tight**: IP55 per EN 60529
- **Electronic Modules**: Conformal coated.
- **Electrical connection**: M20 Gland Connection
- **Dimensions**: 4.7″ diameter x 2.9″ (119 mm x 74 mm)
- **Weight*:***
  - Detector: 10.6 oz. (300g)
  - Tilt Mount: 2.5 oz. (70g)

5.4 Environmental Specifications

Electromagnetic Compatibility (EMC)

This product is in conformance with EMC directive 89/336/EC.

- Radiated Emission EN61000-6-3
- Conducted Emission EN61000-6-3
- Radiated Immunity EN50130-4
- Conducted Immunity EN50130-4
- ESD EN50130-4
- Burst EN50130-4
- Surge EN50130-4

6 Installation Instructions

➢ **In this chapter…**

6.1 Scope

The SharpEye Model 20/20MPI is a self-contained Optical Flame Detector designed to operate as a standalone unit directly connected to alarm systems or automatic fire extinguishing systems. The detector can be a part of a more complex system where many detectors and other devices are integrated through a common control unit. 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. Wherever applicable, special safety precautions are stressed.

6.2 General Considerations

Very Important: The detector should be aimed toward the center of the detection zone and have 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 location have been taken into account.

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

- Sensitivity

  To determine the level of sensitivity, the following issues should be considered:

  - Size of fire at determined distance to be detected.
  - Type of flammable materials.

- Spacing and Location

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

  - Size of the protected area
  - Sensitivity of the detectors
  - Obstructed lines of sight
  - Cone of view of the detectors
- Environment
  - Dust, snow or rain can reduce the detectors sensitivity and require more maintenance activities.
  - The presence of high intensity flickering of IR sources may affect sensitivity.

6.3 Preparations for Installation

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

1 The detector package includes Detector assembly, Tilt Mount P/N 768004, Protective Cover P/N 768005 and 3 mm Hex Key.

Since this detector is for indoor applications only, do not assemble the Protective Cover unless it is necessary.

2 Verify the appropriate Purchase Order. Record the Part No. and the Serial No. of the detectors and the installation date in the appropriate Log-book.

3 Open the container package prior to detector installation and visually inspect the detector.

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

5 For wiring, use color-coded conductors or suitable wire markings or labels.

16 to 22 AWG (0.4 mm^2 to 1.4 mm^2) wires 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.

6.4 Detector and Tilt Installation

Refer to *Figure 4* and *Figure 5*.

1 Unpack the detector. The package includes:

- Detector Assembly P/N 768001 - 20/20MPI-R or 20/20MPI-M.
- Tilt Mount P/N 768004 including screw M4 X 12inch for installation of the detector
- Protective Cover P/N 768005 (optional use where needed)
- 3 mm Hex Key

2 Place the tilt mount (item 2) in its designated location and secure it with three (3) fasteners through three (3) holes dia. 5.4mm (*Figure 4*).

Note: Skip this step if the Tilt Mount is already installed. Also, detector removal for maintenance purpose does not require Tilt Mount removal.

3 Place the detector, with its gland pointing down, on the holding plate of the tilt mount (item 3). Secure the detector by one holding screw M4 x 12″ to the Tilt Mount. Use 3 mm Hex Key for M4 screw (see item 4 on *Figure 5*).

4 Release the locking screws (items 5 and 6 in *Figure 5*) in such a way that allows rotating the detector. Point the detector towards the protected area and make certain that the view of the area is unobstructed. Secure the detector in that position by tightening the locking screws (items 5 and 6) on the tilt mount. (Make sure the detector is in the right position.)

The detector is now correctly located, aligned and ready to be connected to the system.

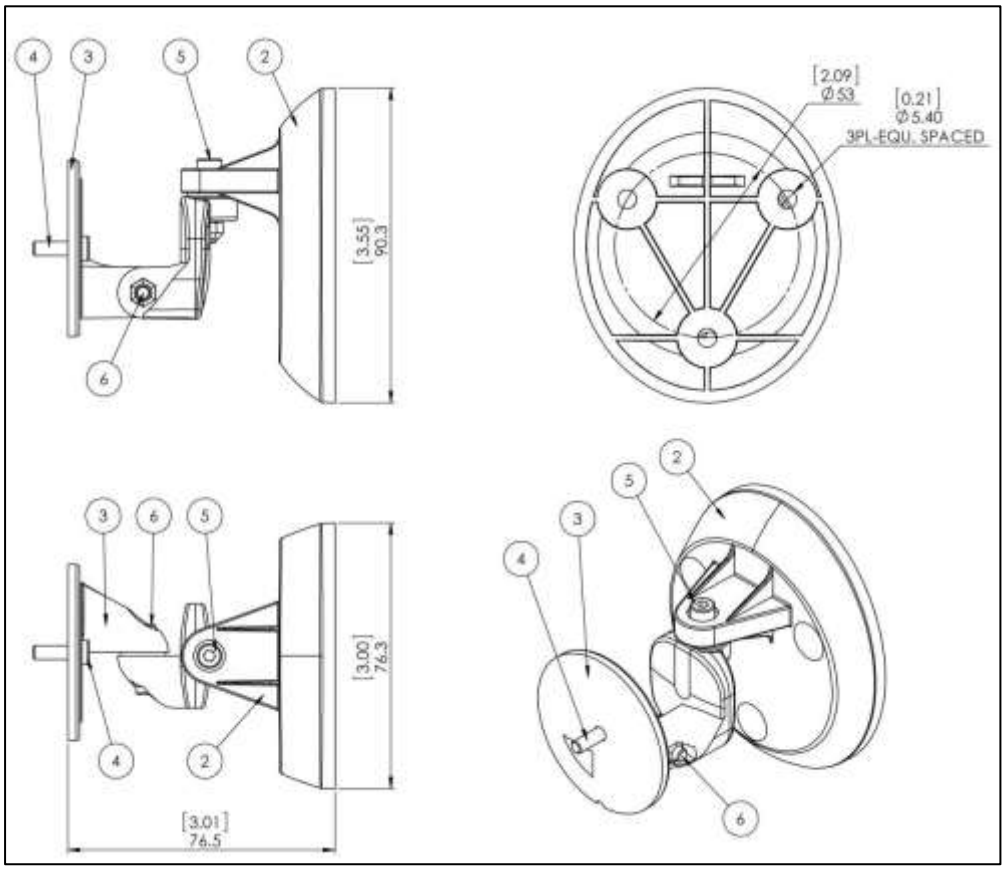

Figure 4: Tilt Mount Assembly - Outline Drawing

Number	Description
1	Mounting Plate
2	Holding Plate
3	Holding Screw
4	Alignment Screw
5	Alignment Screw

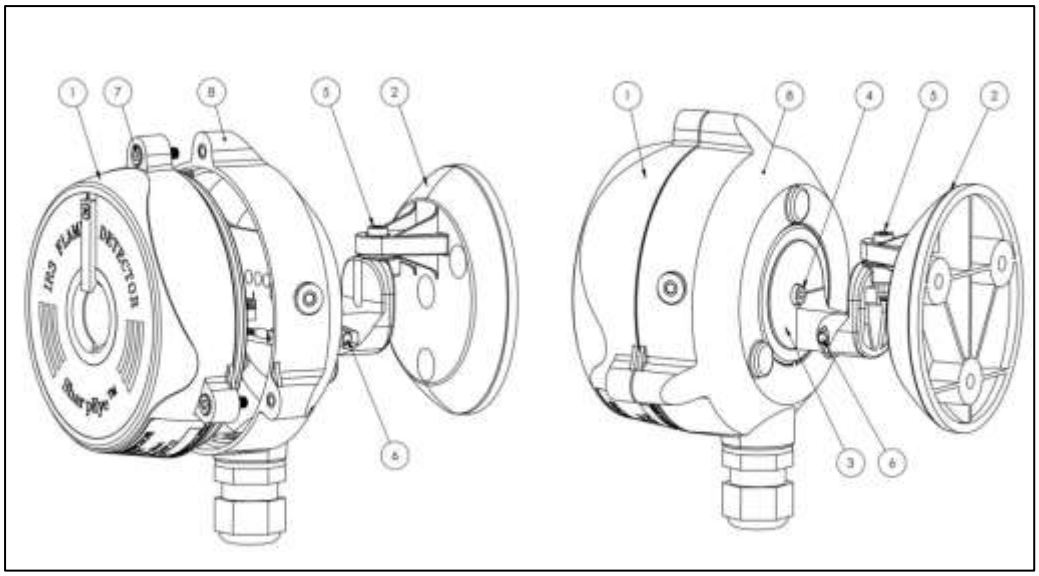

Figure 5: IR3 Detector and Tilt Mount Assembly

Number	Description
1	Detector Housing
2	Mounting Plate
3	Holding Plate
4	M4 X 12 Hex Screw
5	M4 x 20 Hex Screw
6	M4 x 16 Hex Screw
7	M4 x 13 Hex Captive Socket Head Screw
8	Connection Box Assembly

6.5 Detector Wiring

1. Choose the wiring configuration according to *Typical Wiring Configurations* on page 43.
2. Connect the wire to the required terminal according to your wiring.
   - **a** Remove the three (3) socket-head captive screw M4-13 that secure the detector housing (item 1 on *Figure* 5) to its back cover (item 8) using the 3 mm Hex Key. Pull the detector housing from its connection box.
   - **b** Make sure that the cover remains attached to the detector swivel mount.
   - **c** Pull the cable through the cable gland.
   - **d** Connect the wires to the required terminals according to the wiring diagram (see *Typical Wiring Configurations* on page 43).
   - **e** Verify that the wiring is wired according to the wiring diagram. Improper connection may damage the detector.
   - **f** Check the wiring for secure mechanical connection and press the wires neatly against the terminal board to prevent them from interfering while closing the detector's housing.
   - **g** Return the detector housing to the connection box and secure it with the three (3) socket-head screws.

6.6 Wiring Function

Refer to *Figure 6* and *Figure 7*.

The following describes the function of each electrical wire of the detector:

- Power Supply
  - Terminal # 1 or red wire - used for Input Power
  - Terminal # 2 or black wire - used for Return
- Fault Relay for Model 20/20MPI-R

  The Fault output is a N.C. SPST contact relay:
  - Terminal # 7 or brown wire
  - Terminal # 8 or light blue wire

  The contact is normally energized closed when the detector is in its normal operational condition.
- Alarm Relay for Model 20/20MPI-R

  The Alarm output is a N.O. SPST contact relay.
  - Terminal # 5 or orange wire
  - Terminal # 6 or violet wire

- 0-20 mA Output for Model 20/20MPI-M

  This output is used for stepped 0-20 mA current output:

  Terminal # 8 output (+) refers to terminal 2 RTN. See *Typical Wiring Configurations* on page 43 for more details.

- RS-485

  This output is used for communication network as specified in *Typical Wiring Configurations* on page 43.

  - Terminal # 3 RS485 (+)
  - Terminal # 4 RS485 (-)

6.7 Protective Cover Installation

The Protective Cover need only be used if required at a specific location, such as protection from water drips, high dust etc.

After wiring the detector, place the Protective Cover as in *Figure 6*. Screw the Hex screw using the 3 mm Hex Key.

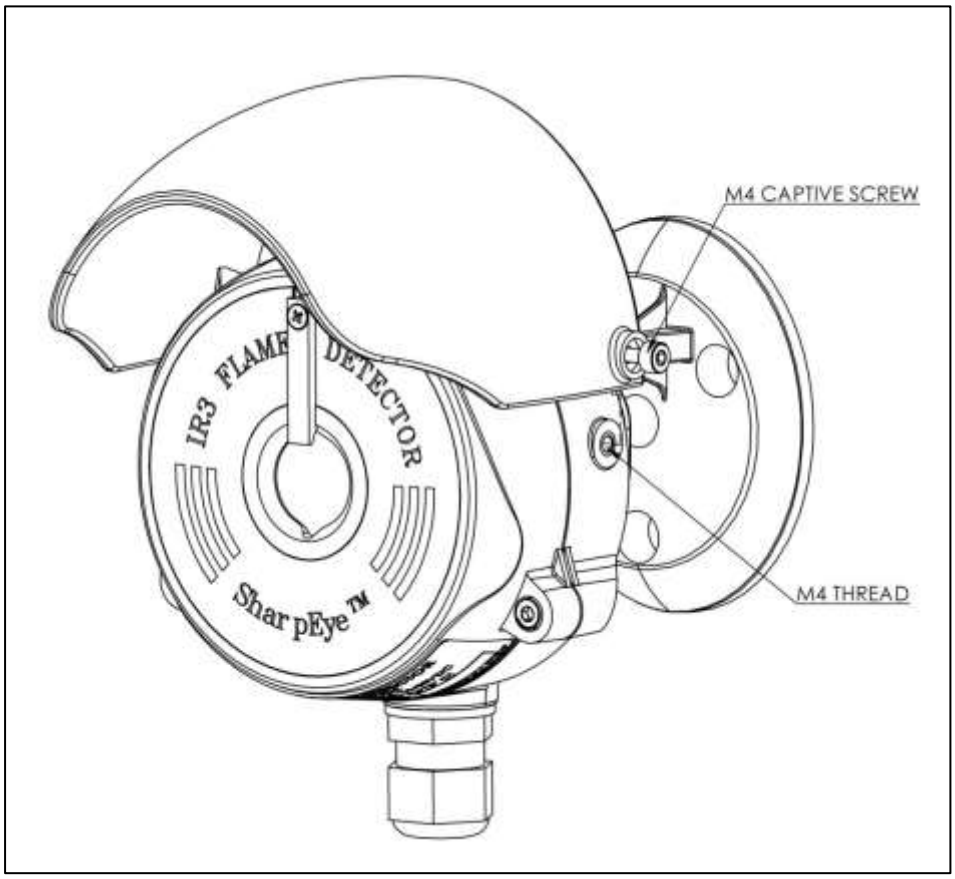

Figure 6: Protective Cover

6.8 Operation Mode

The detector is supplied with a default function setup as follows:

Table 13: Detector Default Setup

Function	20/20MPI-R	20/20MPI-M
Sensitivity	20	20
Delay	3	3
Alarm Latch	NO	NO
Automatic BIT	YES	YES

You can reprogram the function setup through RS-485 using a PC with a Spectrex Host, or using a handheld unit. Refer to TM 768050for instructions.

6.8.1 Programmable Function

Modes of operation are programmable with a PC or Handheld unit according to the selection table in *Detector Functions* on page 16.

6.8.2 Address

The detector is capable of acting as an addressable device.

The detector provides 247 (1-247) addresses, which can be used by the RS-485 communications link.

6.8.3 Alarm Delay

An Alarm Delay may be required for certain applications. The detector has an Alarm Delay that permits time delays from 0, anti-flare, 3, 5, 10, 15, 20 and 30 seconds respectively. The delay can be defined by the RS-485.

Refer to TM 768050.

7 Operating Instructions

➢ **In this chapter…**

This chapter describes how to power up and test the detector. It also includes some very important safety checks that you should make before operating the detector.

7.1 Power-Up

➢ **To power up the detector:**

1. Apply power and wait approximately 60 seconds for the automatic self-test of the detector.

   Note: Applying power initiates the following sequence:

   - 4 Hz LED flashes yellow and the BIT is executed
   - If successful, the 1 Hz LED flashes green, and the FAULT relay contacts close.

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

   The detector is in FAULT state when the supply voltage drops under 16.5V. The detector status returns to NORMAL, when the supply voltage is above 17.5V.

3. **Detector Inspection**: Visually inspect the viewing window of the detector. It should be clean and clear. Verify the following:

   - 1 Hz LED flashes green
   - ALARM relays is N.O
   - FAULT relay is N.C
   - 0-20 mA Output is 4 mA

4. If any of the outputs or indications is different from the description in step 3, see *Troubleshooting* on page 38.

The Flame Detector is now ready for Functional Testing.

7.2 Reset

Note: This is available only when the optional *latching* alarm has been selected.

To RESET a detector when in its ALARM state, disconnect power.

7.3 Functional Testing

The detector can be tested for proper functioning using the *Fire Simulator Model 20/20-310*.

7.3.1 Testing with Fire Simulator Model 20/20-310

Refer to *Long Range IR3 Fire Simulator* on page 47.

This test simulates an exposure of the detector to a real fire condition. The detector is exposed to radiation at the required detection level. As a result, the detector must generate a Fire Alarm signal.

Important Note: If the detector is exposed to a fire simulator, the Alarm Relay and 0-20 mA will be activated during the simulation. Therefore, automatic extinguishing systems or any external devices, which may be activated during this process, must be disconnected.

➢ **To test with Fire Simulator Model 20/20-310**

1 (If the detector is ON, skip this step.)

Apply power to the system and wait up to 60 seconds for the detector to turn to the normal state.

The 1 Hz LED flashes green.

2 Aim the Spectrex Fire Simulator Model 20/20-310 at the target point of the detector (see Figure 12), in such a way that the radiation emitted by it is facing directly towards the detector. (See *Long Range IR3 Fire Simulator* on page 47.)

3 Press the operation button once. After few seconds, the following occurs:

- The LED lights up red constantly for a few seconds.
- The 0-20 mA output turns to 20 mA for a few seconds and then returns to 4 mA.
- The Alarm Relay also turns on.

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

7.4 Safety Precautions

After power-up, the detector requires almost no attention in order to function properly, but the following should be noted:

- Follow the instructions in the manual and refer to the drawings and specifications issued by the manufacturer.
- Do not expose the detector to radiation of any kind unless required for testing purposes.
- Do not open the detector housing while power is supplied.
- Do not touch internal parts other than the three functional switches. Interference with internal circuits may impair detector performance and will invalidate manufacturer's Warranty.
- Disconnect external devices, such as automatic extinguishing systems, before carrying out any maintenance.

8 Maintenance Instructions

➢ **In this chapter…**

This Section deals with preventive maintenance,

This section describes the basic maintenance steps that should be taken to keep the detector in good working. In addition, it describes possible faults in detector operation and indicates corrective measures.

Ignoring these instructions may cause problems with the detector and may invalidate the warranty. Whenever a unit requires service, please contact the manufacturer or its authorized distributor for assistance.

8.1 Maintenance Instrumentation and Personnel

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

8.2 Preventive Maintenance Procedures

The detector must be kept as clean as possible. The viewing window and the reflector 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.

➢ **To clean the detector:**

1 Disconnect power to the detector before beginning any maintenance including lens cleaning.

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

Where dust, dirt or moisture accumulates on the window, first clean with a soft optical cloth and detergent, and then rinse with clean water.

8.3 Periodic Maintenance Procedures

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

8.3.1 Power-Up Procedure

Perform Power-Up procedure every time power is restored to the system. Follow the instructions in *Power-Up* on page 33.

8.3.2 Functional Test Procedure

Perform a functional test of the detector as described in *Functional Testing* on page 34.

8.4 Maintenance Records

It is recommended that maintenance operations performed on a detector are recorded in a Log-book. The record should include the following:

- Installation date, and contractor
- Serial and tag no.
- Entries for every maintenance operation performed, including the description of the operation, date and personnel ID.

If a unit is sent to Spectrex or a distributor for service, a copy of the maintenance records should accompany it.

8.5 Troubleshooting

8.5.1 Fault Indication

➢ **To identify the fault indication:**

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 paragraph 8.3 and repeat the test.

3 Disconnect the power supply to the system and check the detector's internal wiring.

4 Reconnect the power supply and wait approximately 60 seconds. Repeat the test. If the 4 Hz LED still flashes in yellow, the unit requires service.

8.5.2 False Alarm or Warning Indication

➢ **To identify the false alarm or warning indication:**

1 Disconnect the power supply from the system and check the internal wiring.

2 Reconnect the power supply and wait approximately 60 seconds. If indication remains, the unit requires service.

Appendices

A Typical Wiring Configurations

➢ **In this appendix...**

A.1 Wiring Terminal 20/20MPI-R

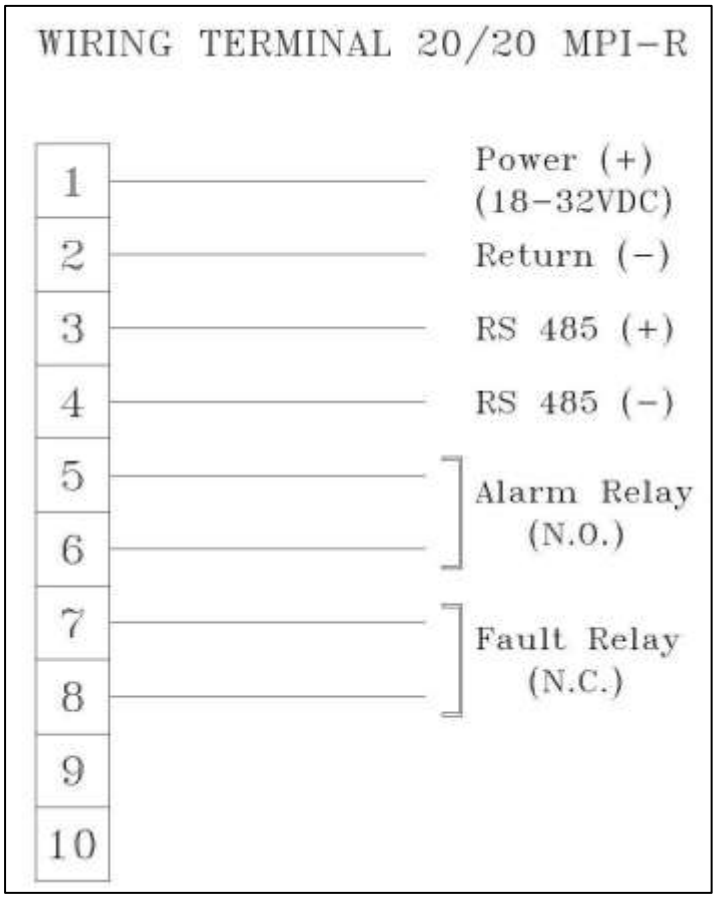

Figure 7: Wiring Terminal 20/20MPI-R

A.2 Wiring Terminal 20/20MPI-M

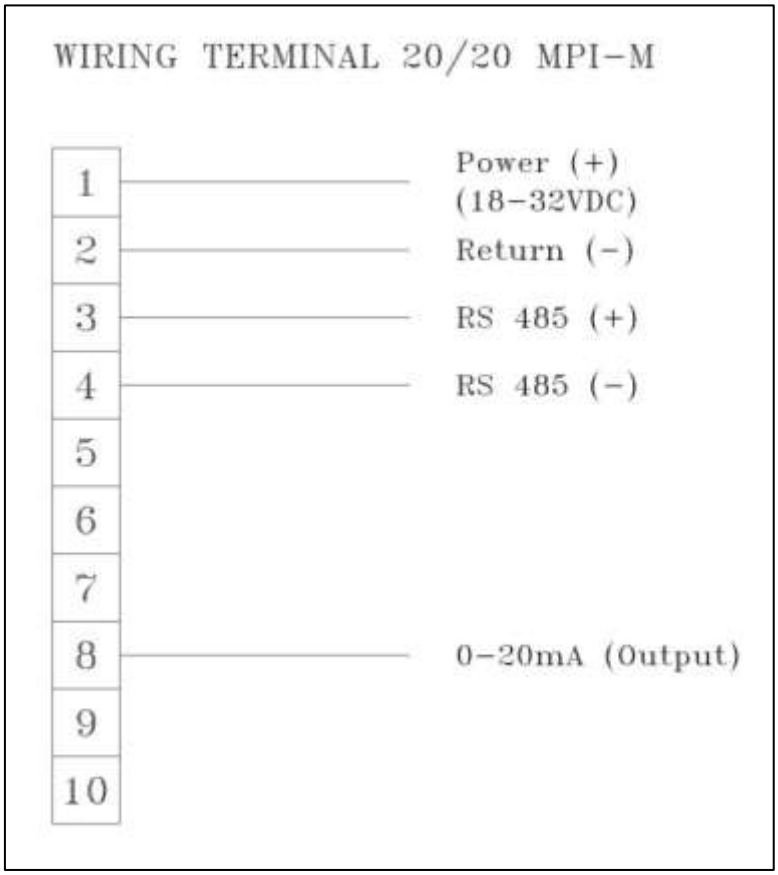

Figure 8: Wiring Terminal 20/20MPI-M

8.5.3 RS-485 Communication Network

Using the RS-485 network capability of the IR3 detector and control software you can connect up to 32 detectors in an addressable system with only 4 wires (2 for power and 2 for communication). Using repeaters, the number of detectors can be much larger (32 detectors for each repeater) up to 247 on the same 4 wires. When using the RS-485 network, you can read each detector status (FAULT, WARNING, ALARM) and to initiate a BIT to each detector individually.

For more details, consult the factory.

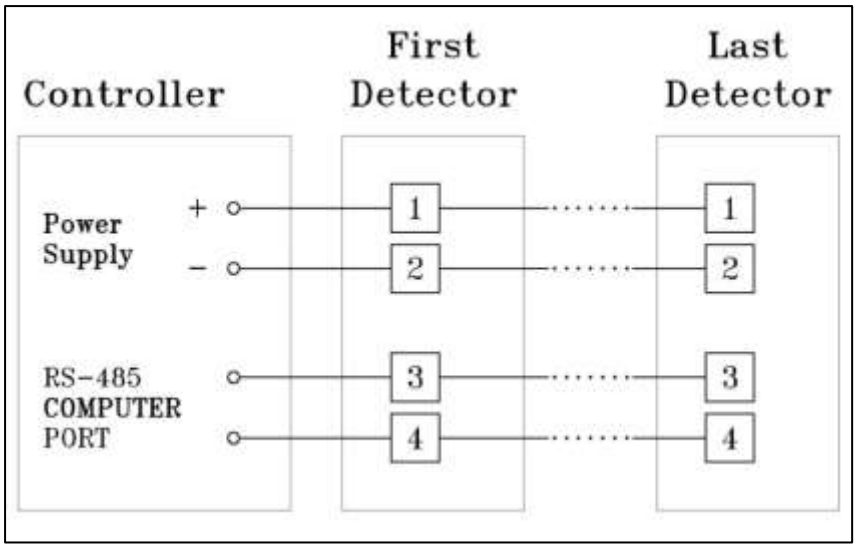

Figure 9: RS-485 Networking

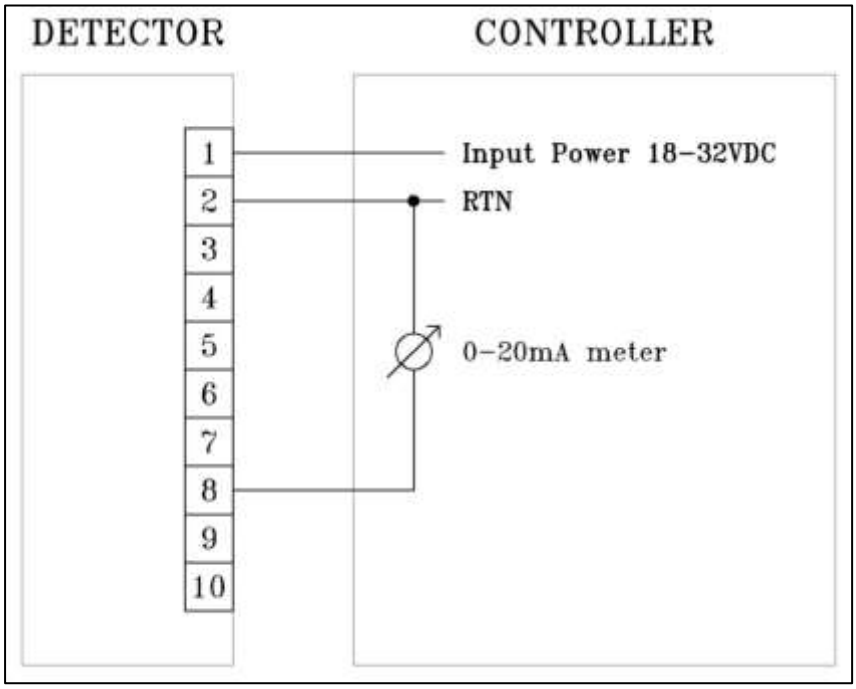

Figure 10: 0-20mA Source (3-Wire) - model 20/20MPI-M

Note: The detectors are 0-20mA source only configuration.

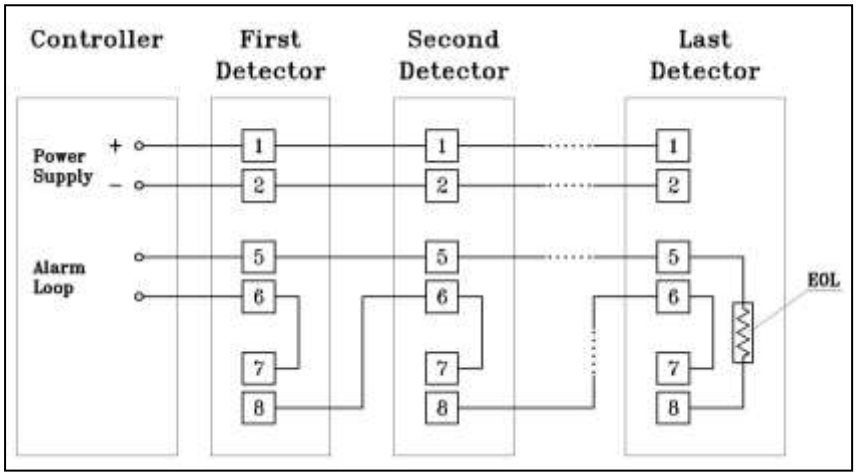

Figure 11: Typical Wiring for 4 Wire Controllers – model 20/20MPI-R

B Long Range IR3 Fire Simulator

➢ **In this appendix…**

B.1 Description

The SharpEye IR3 Long Range Fire simulator 20/20-310 is designed specifically for use with SharpEye IR3 flame detectors. The Fire Simulator emits IR radiation in a unique sequential pattern corresponding to and recognizable by the IR3 detector as fire. This allows the IR3 detectors to be tested under simulated fire conditions without the associated risks of an open flame.

There is a specially designed beam collimator model number 20/20-190 used for extended operating range.

Figure 12: Fire Simulator

B.2 Unpacking

When unpacking the fire simulator, check that the following items are included:

- Fire Simulator with built-in batteries
- Delivery form
- Battery charger
- Optional Beam Collimator
- Storage Case

B.3 Operating Instructions

Warning: Do not open the Fire Simulator to charge the batteries or for any other reason in a hazardous area.

CAUTION: The following test will simulate a real fire condition and may activate the extinguishing system or other alarms. If this is not desired, disconnect/inhibit them before the test and reconnect after the simulation.

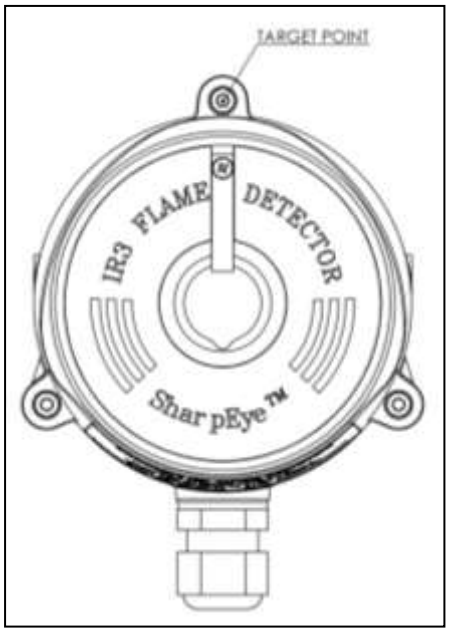

Figure 13: Mini IR3 Detector Target Point

➢ **To simulate a fire:**

1 Aim the Fire Simulator towards the detector's *Target Point*.

2. For testing purposes, keep a distance of at least 50 cm (20 inches) from the detector.
3. Press the operation button once. Fire simulation lasts for 20 seconds. The detector sends an alarm signal (solid red LED).
4. To perform another fire simulation, wait 20 seconds before performing the next test.
5. Make sure the optical window is clean and keep the Fire Simulator in a safe place when not in use.

B.4 Battery Charging

The Fire Simulator uses NiCad batteries as a rechargeable power source. When the batteries are fully charged it operates for at least 60 times without recharging. An internal buzzer is sounded when the voltage from the batteries is lower than the required operational level.

➢ **To charge the battery:**

1. Place the Fire Simulator on a table in a safe area.
2. Turn the sealed plug (next to the operation button) counter-clockwise with a suitable wrench.
3. Connect the battery charger.
4. Charge for a maximum of 14 hours.
5. Disconnect the charger.
6. Tighten the sealed plug clockwise.

B.5 Specifications

Mechanical

- Explosion Proof Enclosure:
- NFPA (designed to meet)
- Class I, Division 1 & 2 Groups B, C and D
- Class II, Division 1 & 2 Groups E, F, and G
- ATEX EX II 2G NEMKO 02ATEX255
- Exd IIB T5 50°C, per EN 50-014 & EN50-018

Electrical

- Power: 8 VDC Max.

  6 x Rechargeable 1.2 VDC NiCad Batteries
- Current: 2.5A Avg.
- Charge: 400mA for 14 Hours

Environmental

- Temperature Range: -4º F (-20º C) to 122º F (50º C)
- Vibration Protection: 1g (10 — 50 Hz)
- Water and Dust: IP 67 per EN 60529

Physical

- Dimension: 11.5 x 10.1 x 3.9 in (292 x 258 x 100 mm)
- Weight: 7.5 lb. (3.4 Kg)

Range*

Sensitivity	Range	Extended Range
33 ft. (10m)	2.3 ft. (0.7 m)	-
65 ft. (20m)	4 ft. (1.2 m)	8.2 ft. (2.5 m)
100 ft. (30m)	6.6 ft. (2 m)	13.2 ft. (4 m)
132 ft. (40m)	10 ft. (3 m)	20 ft. (6 m)

***** At extreme temperatures - 15% Max. Reduction in range

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