Model FL3100/FL3101

UV/IR and UV only
Flame Detectors

Instruction Manual **07-05**

Part No. **MANFL3100/3101**
Revision **H/07-05**

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Quick Start Guide

Mount and Wire the Detector

Pay special attention to the conduit seal entry (Canadian Electrical Code Handbook Part 1, Section 18-154). Also, lithium based grease is applied to the O-ring seal between the back-plate and housing, as additional protection to avoid water ingression into the housing. Mount detector using swivel mount or mounting bracket hardware.

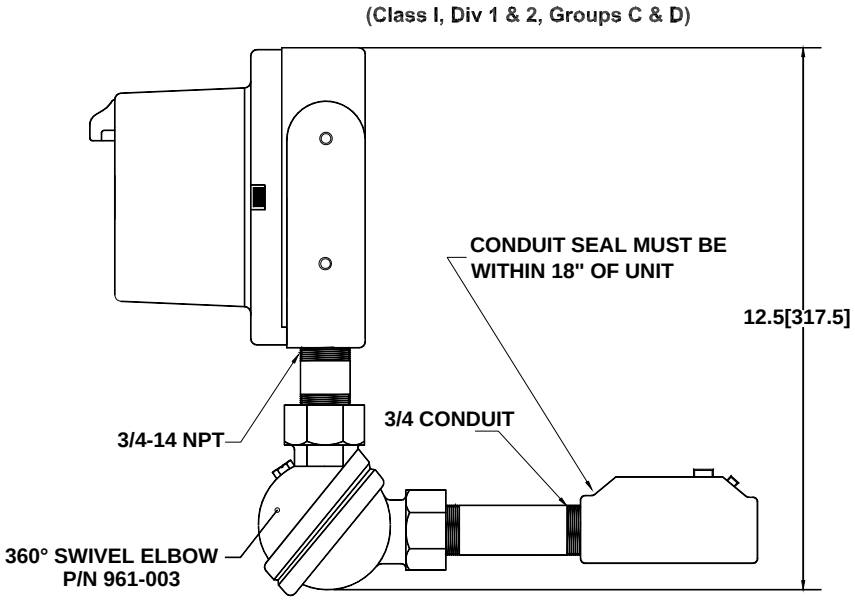


Figure 1: 961-004 Union Swivel Mounting Hardware

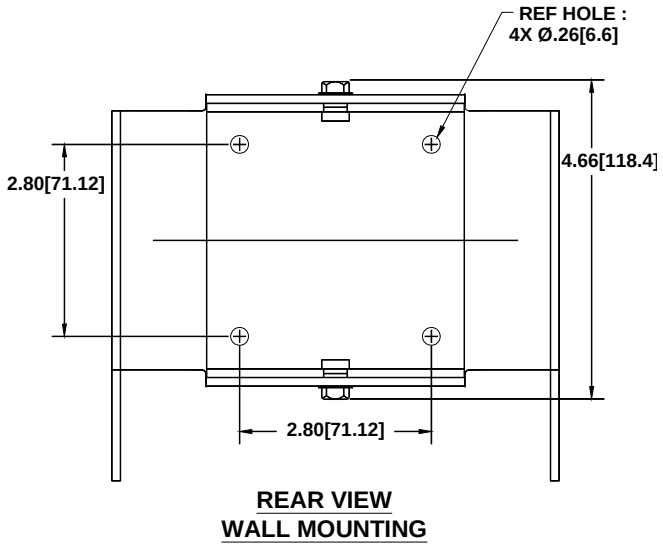


Figure 2: 71172 Rear View Wall Mounting Assembly

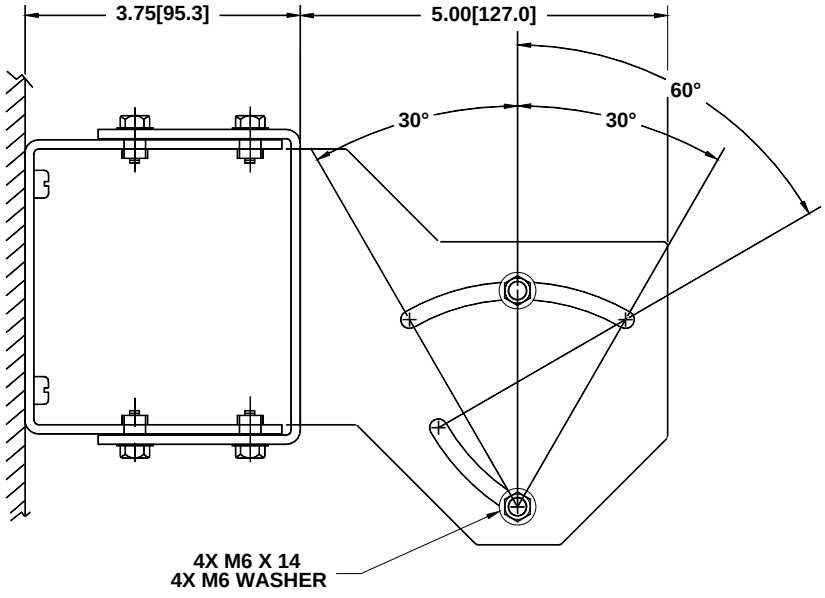


Figure 3: 71172 Rear View Bracket Assembly

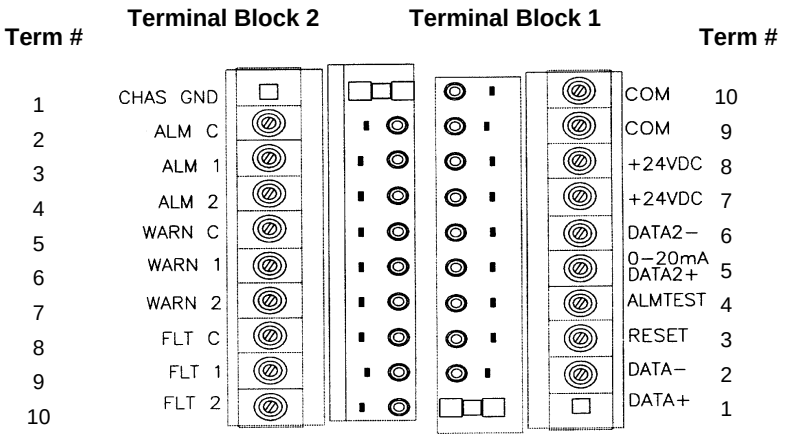


Figure 4: Field Terminations

Apply Power to the Detector

Two light emitting diodes (LED's) are visible through the UV window (the larger window on UV/IR units). Immediately upon powering up the detector, both LED's will start blinking alternately for 10 seconds. The unit will then enter the "Ready" mode. During the "Ready" mode, the green LED will flash off 1 second, every 10 seconds.

Test the Detector Using the TL100 (UV only) or TL103 (UV/IR)

Test the integrity of your system by using either the TL100 UV test lamp (part# TL100-000-000-020) or the TL103 UV/IR test lamp (part# TL103-000-000-130). The original configuration (i.e. sensitivity and relay options) can be changed by using the "Switch Selectable Options" (Figure 7) and then changing the dipswitch settings located on the bottom of the power board (SW1).

The instrument is now ready to operate. Please consult the manual for more information on the instrument's many features.

NOTE: If you have any problems in the set-up or testing of the detector, please refer to the "Trouble Shooting Section", or call the factory direct.

Worldwide service is available by calling:

Lake Forest, California (24 hr. service)	Toll Free: +1-800-446-4872 Phone: +1-949-581-4464 Fax: +1-949-581-1151
Houston, Texas	Phone: +1-281-855-6000 Fax: +1-281-855-3290
Ireland	Phone: +353-91-751175 Fax: +353-91-751317
Singapore	Phone: +65-6748-3488 Fax: +65-6748-1911
United Arab Emirates	Phone: +971-4-8815751 Fax: +971-4-8817927
United Kingdom	Phone: +44-1625-619583 Fax: +44-1625-619098

1.0 Introduction

1.1 Protection for Life

General Monitors' mission is to benefit society by providing solutions through industry leading safety products, services, and systems that save lives and protect capital resources from the dangers of hazardous flames, gases, and vapors.

This manual provides instruction for installing and operating General Monitors' Models FL3100 and FL3101 for UV/IR and UV Only Flame Detection. While the FL3100/3101 is easy to install and operate, this manual should be read in full and the information contained herein understood before attempting to place the system in service.

The safety products you have purchased should be handled carefully and installed, calibrated, and maintained in accordance with the respective product instruction manual. Remember these products are for your safety.

1.2 Special Warnings

Through engineering design, testing, manufacturing techniques, and rigid quality control, General Monitors supplies the finest flame detection systems available. The user must recognize his responsibility for maintaining the flame detection system in operational condition.

Installation and Maintenance must be carried out by suitably skilled and competent personnel only.

The Model FL3100/FL3101 UV/IR and UV only Flame Detectors contain components, which can be damaged by static electricity. Special care must be taken when wiring the system, to ensure that only the connection points are touched.

1.3 System Integrity Verification

General Monitors mission is to benefit society by providing solutions through industry leading safety products, services and systems that save lives and protect capital resources from the dangers of hazardous flames, gases and vapors.

The safety products you have purchased should be handled carefully and installed, calibrated and maintained in accordance with the respective product instruction manual. Remember these products are for your safety. To ensure operation at optimum performance, General Monitors recommends that certain maintenance items be performed.

Commissioning Safety Systems

Before power up, verify wiring, terminal connections and stability of mounting for all integral safety equipment including, but not limited to:

- Power supplies
- Control modules
- Field detection devices

- Signaling / output devices
- Accessories connected to field and signaling devices

After the initial application of power (and any factory specified warm-up period) to the safety system, verify that all signal outputs, to and from devices and modules, are within the manufacturers' specifications. Initial testing should be performed per the manufacturers' recommendations and instructions.

Proper system operation should be verified by performing a full, functional test of all component devices of the safety system, ensuring that the proper levels of alarming occur. Fault/Malfunction circuit operation should be verified.

Periodic Testing of Field Devices

Periodic testing/calibrating should be performed per the manufacturers' recommendations and instructions. Testing/Calibrating procedures should include, but not be limited to:

- Verify integrity of all optical surfaces and devices
- For flame detectors, use the appropriate test lamp

When testing produces results outside of the manufacturers' specifications, replacement of the suspect device(s) should be performed as necessary. Maintenance intervals should be independently established through a documented procedure, including a Maintenance log maintained by plant personnel or third party testing services.

Periodic System Verification

The following system verifications should be performed at least annually:

Verify wiring, terminal connections and stability of mounting for all integral safety equipment including, but not limited to:

- Power supplies
- Control modules
- Field detection devices
- Signaling / output devices
- Accessories connected to field and signaling devices

Proper system operation should be verified by performing a full, functional test of all component devices of the detection system, ensuring that the proper levels of alarming occur.

Fault/Malfunction circuit operation should be verified.

Maintenance intervals should be independently established through a documented procedure, including a maintenance log maintained by plant personnel or third party testing services.

2.0 Product Description

2.1 General Description

Fire is usually manifested in heat (IR), smoke, light (visible), and flame (UV). Flame is the gaseous region of a fire where vigorous combustion chain reactions take place. These reactions emit radiation covering the Infrared, Ultraviolet and the Visible Spectral Regions.

The General Monitors' Model FL3100 is an Ultraviolet/Infrared (UV/IR) Flame Detector (Figure 5). It detects the Ultraviolet and Infrared spectral regions of flame to produce a system which is highly immune to false alarms caused by lightning, arc-welding, hot objects, and other sources of radiation. The Model FL3101 is an Ultraviolet (UV) flame detector (Figure 6). It only responds to UV and has been optimized for speed of response.

Both units may be used with the General Monitors TA40X Modules, FL802 controller, or with other equipment, which accepts the 4 to 20mA output. They may also be interfaced directly with alarm/suppression devices or with switched input modules using integral relays.

NOTE: Model FL802 is not CE Marked and, therefore, cannot be supplied to the EU.

The Models FL3100 and FL3101 features include:

- Compact unitized design
- Continuous optical path monitoring (COPM)
- 4-20mA, alarm relays and MODBUS RTU RS-485 standard (Dual MODBUS optional)
- Wide field of view
- High false alarm immunity & Visual indicators

Figure 5: Model FL3100

Figure 6: Model FL3101

3.0 Installation

WARNING: Suitably skilled and competent personnel must carry out installation and maintenance.

3.1 Tools Required

- "T" Allen head wrench to remove detector head from detector base (included with flame detector).
- Flat head screwdriver maximum 3/16in (5 mm) width for terminal block connections.
- Adjustable wrench for conduit, or cable gland connections.

3.2 Choosing Product Locations

Several variables are involved in selecting the locations to install detectors to ensure proper flame detection. There are no hard and fast rules defining the optimum location.

Following are some general suggestions that should be considered in regard to particular conditions at the site where the unit(s) are being installed:

3.2.1 Detector Field of View

The Models FL3100 and FL3101 Flame Detectors have a maximum cone of vision of 120° and 140° maximum respectively. This cone has its vertex at the center of the detector (Figure 7 & Figure 8).

3.2.2 Optical Sensitivity Range

The distance at which the detector will respond to a flame is a function of the intensity of that flame.

The maximum distance is 50ft (15.2m) for a gasoline fire with a surface area of $1ft^2$ ($0.093m^2$).

3.2.3 Environmental Factors

Mounting should be as free from shock and vibration as possible and convenient for visual inspection and cleaning.

Detectors mounted in dirty atmospheric conditions will require frequent inspection, cleaning, and sensitivity checking. Make sure the field-of-view of the detector is not obstructed by the cover or nearby objects.

Observe the ambient temperature range for the specific model (Section 9.3.4). For outdoor installations or other areas exposed to intense, direct solar radiation, the detector may reach temperatures well above specifications. For these installations, a shade or cover may be required to keep the detector temperature within specifications.

Avoid conditions that would allow ice build-up on the optical detector windows. Complete icing over of the detector window(s) can result in fault conditions. Mount away from sources of electrical noise where possible. A constant UV source detected by the unit will cause the

detector to go into FAULT after 9 – 10 minutes of exposure. Source must be removed or detector repositioned. (UV detectors can pick-up arc welding up to 2–3 miles away).

Users should be aware that any UV detector may be triggered by other sources of EMI, for instance X-rays, sunlight, reflected sunlight, Gamma rays, lightning, arc welding, industrial lighting, fluorescent lighting, etc., and due regard should be paid to the possible presence of such radiation.

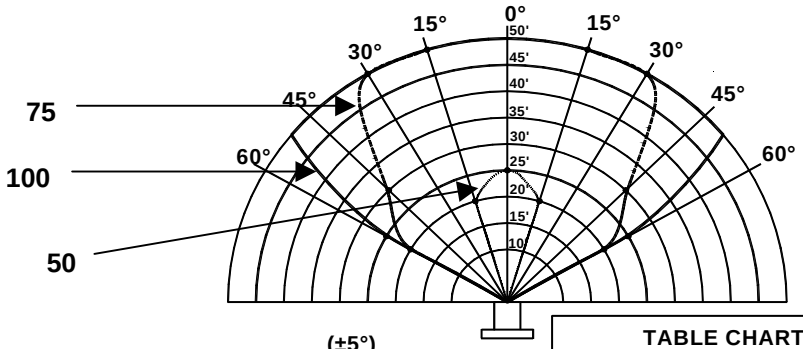


TABLE CHART			
HORIZONTAL	100%	75%	50%
0°	50'	50'	25'
±15°	50'	50'	15'
±30°	50'	50'	<5'
±45°	50'	30'	<5'
±60°	25'	<20'	<5'

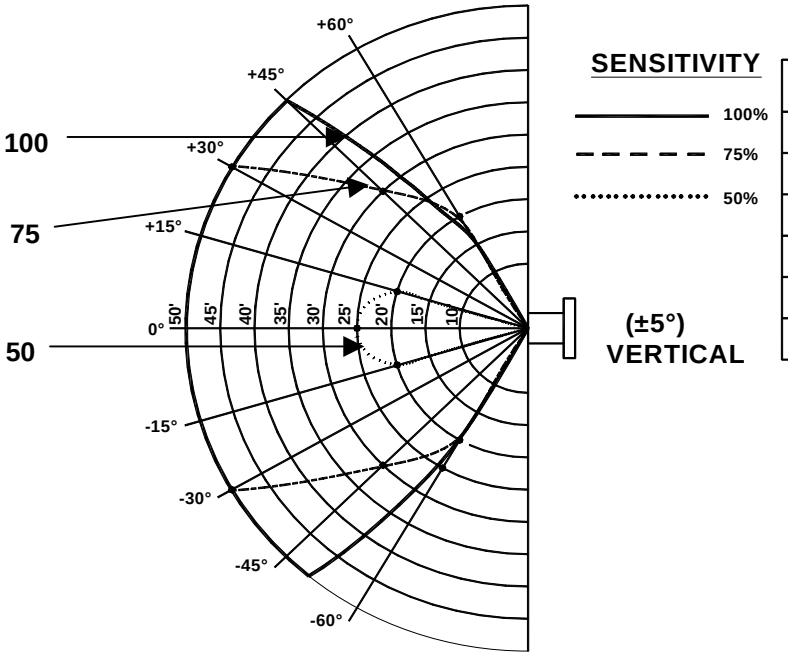
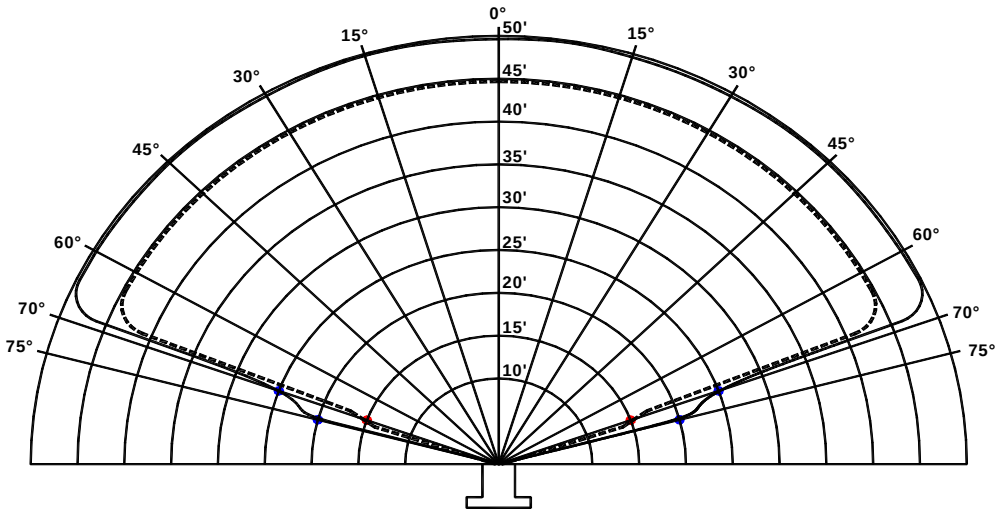


TABLE CHART			
VERTICAL	100%	75%	50%
0°	50'	50'	25'
±15°	50'	50'	25'
±30°	50'	50'	25'
±45°	50'	30'	<20'
±60°	20'	<20'	<20'

Figure 7: FL3100 (UV/IR) Field of View



(±5°)

HORIZONTAL

SENSITIVITY

100%

75%, 50%

TABLE CHART			
HORIZONTAL	100%	75%	50%
0°	50'	45'	45'
± 15°	50'	45'	45'
± 30°	50'	45'	45'
± 45°	50'	45'	45'
± 60°	50'	45'	45'
± 70°	25'	<15'	<15'
± 75°	20'	<15'	<15'

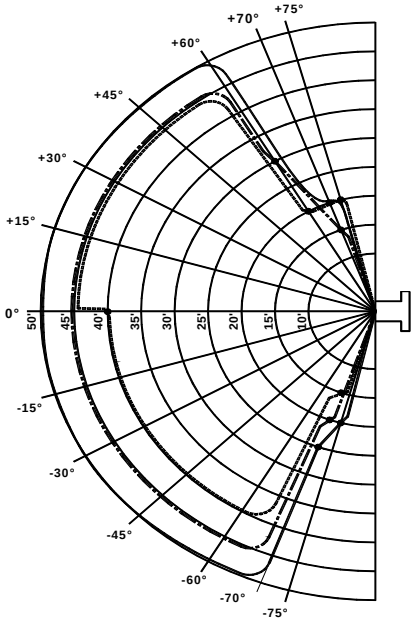


TABLE CHART							
VERTICAL	100%	75%	50%	VERTICAL	100%	75%	50%
0°	50'	45'	40'	0°	50'	45'	45'
- 15°	50'	45'	40'	+ 15°	50'	45'	45'
- 30°	50'	45'	40'	+ 30°	50'	45'	45'
- 45°	50'	45'	40'	+ 45°	50'	45'	45'
- 60°	50'	45'	40'	+ 60°	50'	30'	20'
- 70°	25'	<20'	<15'	+ 70°	20'	<15'	<20'
- 75°	<20'	<20'	<15'	+ 75°	<20'	<15'	<20'

(±5°)

VERTICAL

SENSITIVITY

100%

75%

50%

Figure 8: FL3101 (UV) Field of View

3.3 Mounting and Wiring

WARNING: The conduit entries should be sealed per the Canadian Electrical Code Handbook (Part 1, Section 18-154) or NEC 500-3d. An additional benefit of conduit seals is the prevention of water entering the housing through the conduit entry.

WARNING: Unused cable entry holes must be sealed with an approved stopping plug. Red caps supplied by GM are for dust protection only and must not be left on unit when installed.

The Model FL3100/FL3101 Flame Detector should be mounted pointing downward so that dust/moisture will not accumulate on the optical window(s). The detector(s) should be mounted in locations, which will inhibit people or objects from obscuring the detector's cone of vision.

Detectors should be mounted such that the conduit or cable gland entries are pointed downward. See above warning for conduit entries. For cable glands and stopping plugs, the threads should be sealed with Castrol EP and boots fitted over the cable gland to prevent water ingress at the cable-to-gland junction.

Mounting hardware should be used as shown in Figure 9, Figure 10, & Figure 11. The overall dimensions of the detector and mounting hardware are shown in Figure 12 & Figure 13.

NOTE: General Monitors does not recommend the use of cable shoes or crimps on any junction box or housing wiring terminals. Poor crimping can cause a bad connection when the unit experiences temperature variations.

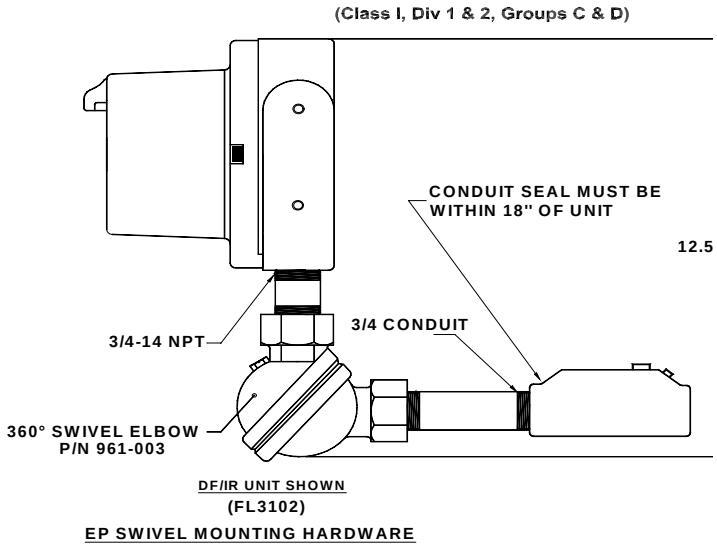
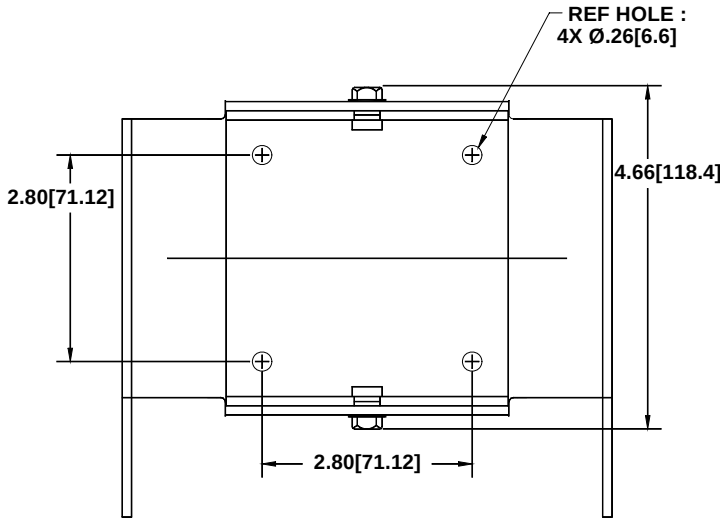
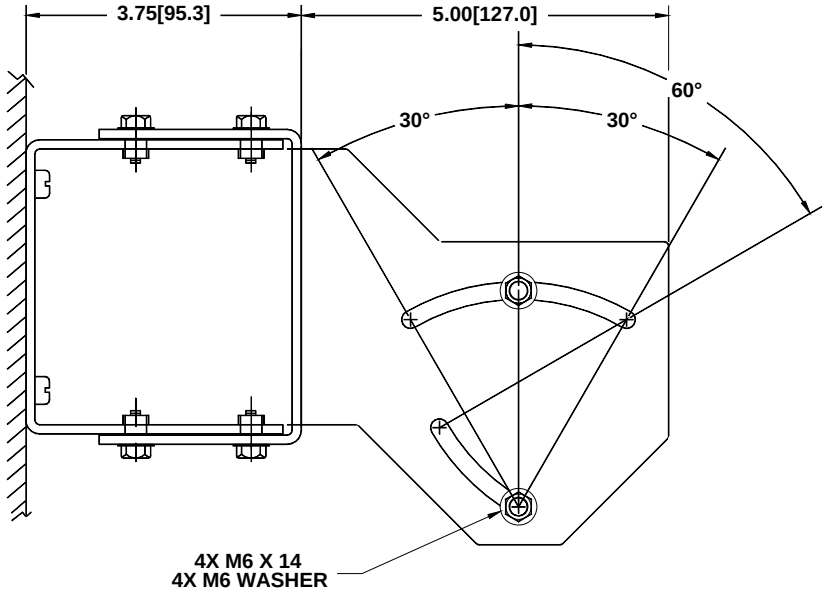


Figure 9: 961-004 Swivel Elbow Drawing (Class I, Div 1 & 2, Groups C & D)



REAR VIEW
WALL MOUNTING

Figure 10: 71072 Mounting Bracket Drawing (Class I, Div 1 & 2, Groups B, C & D or Zone 1 and 2)



BRACKET ASSEMBLY

Figure 11: 71072 Mounting Bracket Drawing (Class I, Div 1 & 2, Groups B, C & D or Zone 1 and 2)

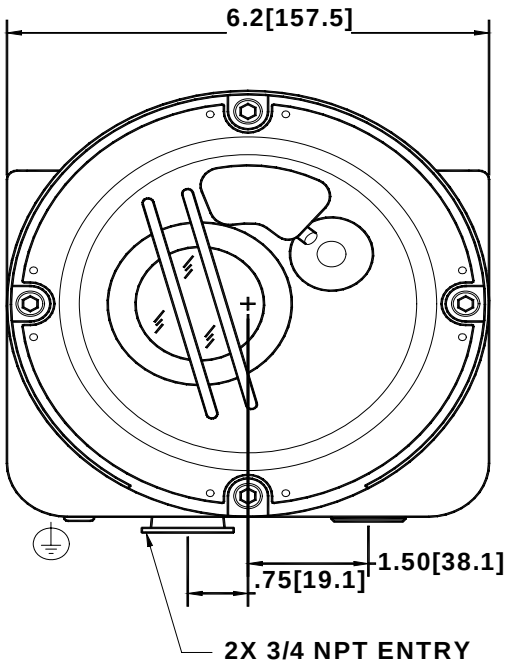


Figure 12: FL3100 & FL3101 Outline Drawing

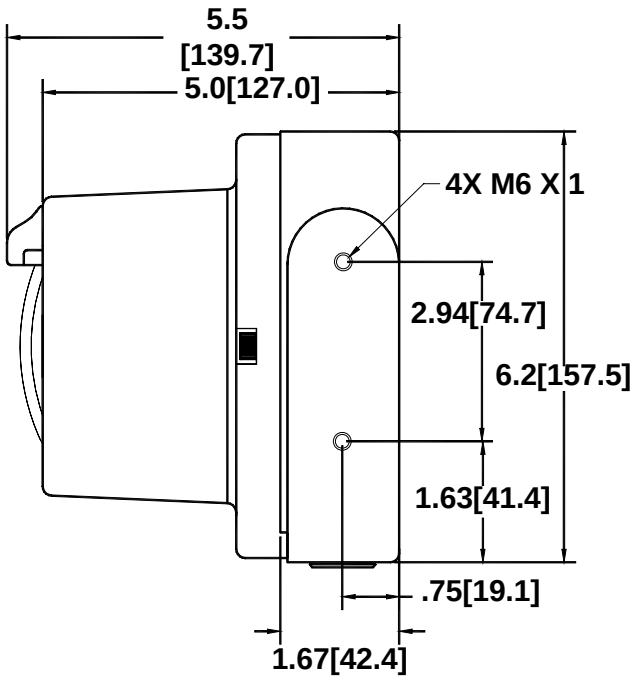


Figure 13: FL3100 & FL3101 Outline Drawing

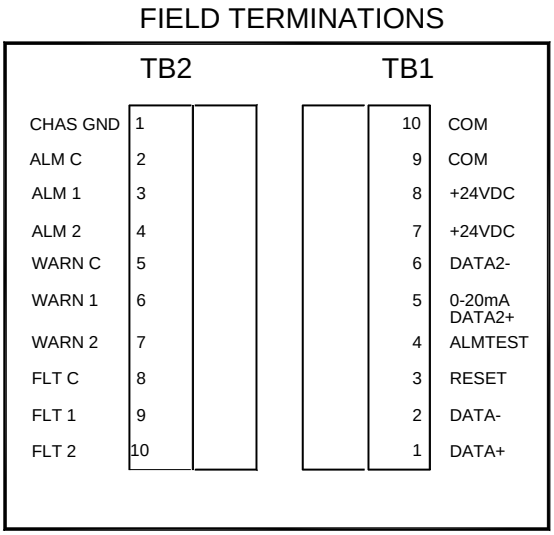


Figure 14: FL3100 & FL3101 Field Terminations

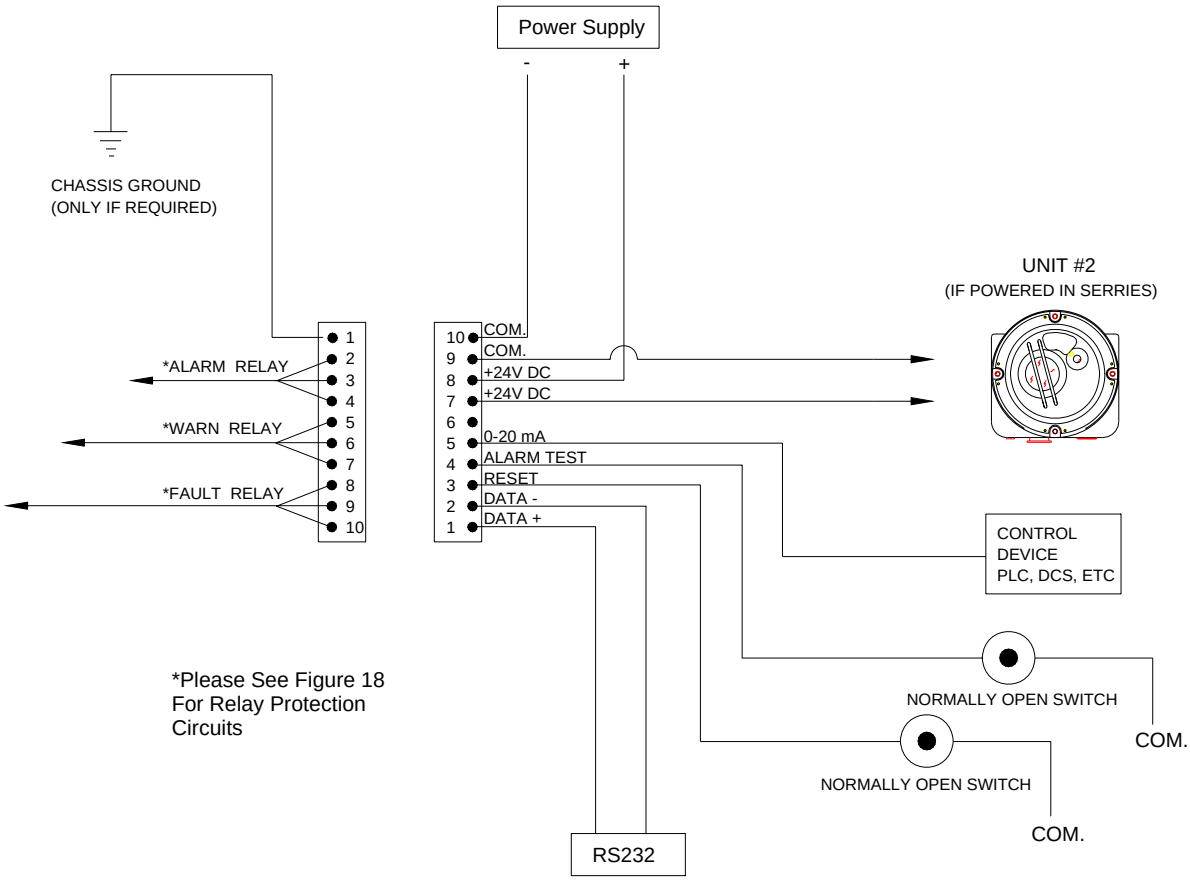


Figure 15: Terminal Designations

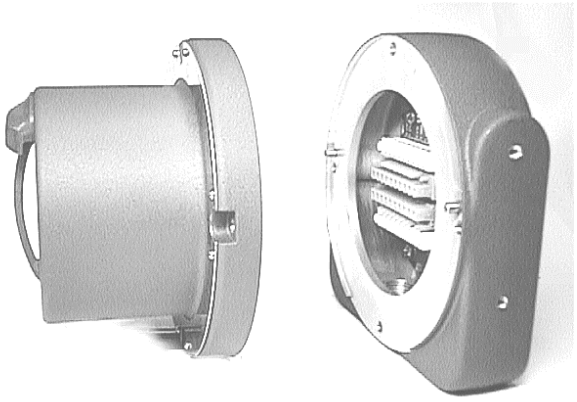


Figure 16: Detector Housing and Base

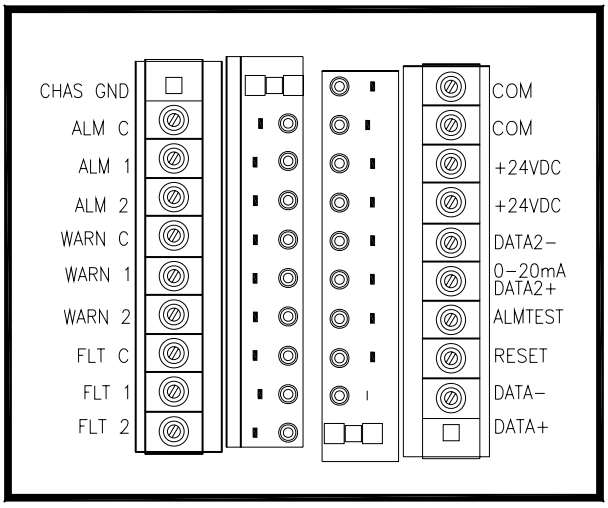


Figure 17: Terminal Block Operation

3.3.1 Terminal Connections

All wire connections are made through the base entries to the terminal block (Figure 17). The terminal block accepts 14 AWG to 22 AWG (2.1 to 0.3mm^2) stranded or solid core wire. Each wire should be stripped to .25in (.64cm). To connect the wire to the terminal block, insert the conductor into the connection space as shown in Figure 17 and tighten the corresponding screw terminal. There are twenty terminal connections. The following pages contain descriptions and specifications for each connection.

WARNING: Relay contacts must be protected against transient and over-voltage conditions (Figure 18).

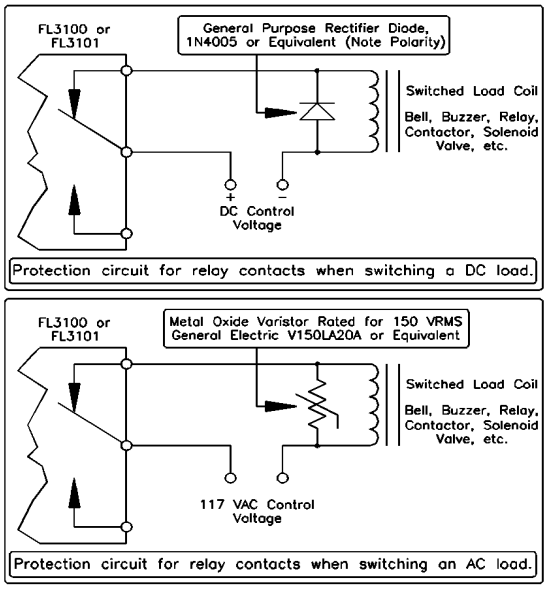


Figure 18: Protection Circuits for Relay Contacts

3.3.2 Terminal Block TB2 – Alarm Relay Connections

TB2 Position	Alarm Relays	Relay Contact (De-Energized)	Relay Contact (Energized)
2	C	Common	Common
3	1	Normally Closed	Normally Open
4	2	Normally Open	Normally Closed

Table 1: TB2 Alarm Relay Connections

These connections are for the SPDT ALARM relay. The ALARM output is time delayed for 2, 4, 8 or 10 seconds. This time delay can be set by RS-485 or by DIPswitch.

The ALARM output can be normally energized or normally de-energized, latching or non-latching, and these options are also set via RS-485 or by DIPswitch (Section 4.4).

For all relay connections see Figure 18.

North American Approved Applications: The ALARM relay contact ratings are 8A @ 250 VAC and 8A @ 30 VDC resistive max.

European Union (EU) Approved Applications: The ALARM relay contact ratings are 8A, 30 V RMS/42.4 V peak or 8A @ 30 VDC resistive max.

3.3.3 Terminal Block TB-2 Warning Relay Connections

TB2 Position	Warn Relays	Relay Contacts (De-Energized)	Relay Contacts (Energized)
5	C	Common	Common
6	1	Normally Closed	Normally Open
7	2	Normally Open	Normally Closed

Table 2: TB2 Warning Relay Connections

These connections are for the SPDT WARN relay. The WARN output is immediate on Models, FL3100/FL3101. The WARN output can be normally energized or normally de-energized, latching or non-latching, and these options are also set via RS-485 or by a DIPswitch (Section 4.4).

The **WARN** relay contact ratings are 8A @ 250VAC and 8A @ 24VDC.

CAUTION: Inductive loads (bells, buzzers, relays, etc.) on dry relay contacts must be clamped down as shown in Figure 2-J. Unclamped inductive loads can generate voltage spikes in excess of 1000 Volts. Spikes of this magnitude may cause false alarms and contact damage.

North American Approved Applications: The ALARM relay contact ratings are 8A @ 250 VAC and 8A @ 30 VDC resistive max.

European Union (EU) Approved Applications: The ALARM relay contact ratings are 8A, 30 V RMS/42.4 V peak or 8A @ 30 VDC resistive max.

3.3.4 Fault Relay

These connections are for the SPDT FAULT relay. The FAULT output configuration is normally energized and non-latching. This is the standard configuration and it cannot be changed. The FAULT circuit will be activated during the time-out function, a low power or loss of power condition, and during a failed COPM check. During these conditions the FAULT relays will de-energize and the analog output signal will drop to 0mA (2mA for COPM Faults) for the duration of the FAULT.

TB2 Position	Fault Relays	Relay Contacts (De-Energized)	Relay Contacts (Energized)
8	C	C	C
9	1	Normally Closed	Normally Open
10	2	Normally Open	Normally Closed

Table 3: Fault Relay Connections

North American Approved Applications: The ALARM relay contact ratings are 8A @ 250 VAC and 8A @ 30 VDC.

European Union (EU) Approved Applications: The ALARM relay contact ratings are 8A, 30 V RMS/42.4 V peak or 8A @ 30 VDC resistive max.

3.3.5 Alarm Reset Terminal

The RESET, when activated, returns a latched ALARM and/or WARN output, that is no longer valid, to its original state. For this RESET function, place one contact of a normally open momentary switch to TB1 Terminal 3 and the other contact to DC COM (the detector's common). To activate, just press and release the switch.

TB1 Position	Relays
3	RESET
4	TEST
5	0-20mA

Table 4: Alarm Reset Terminal Connections

By connecting one contact of a normally open, momentary switch, to TB1 Terminal 4 and the other contact to TB1 Terminals 9 and 10 (DC COM), the user can test the alarm outputs of the Flame Detector by activating this switch for one to eight seconds depending on the alarm time delay setting. The Alarm Test will activate the WARN and ALARM relay outputs as well as the appropriate analog output. The Flame Detector will remain in this state until the switch is released.

NOTE: The latching WARN and/or ALARM will have to be RESET manually. The Alarm Test feature **cannot** be daisy chained between two or more FL3100/FL3101 Flame Detectors.

3.3.6 Analog Output

The 0 to 20mA output is a current signal that corresponds to the following signals:

FAULT:	0 to 0.2mA
COPM Fault:	2.0 ± 0.2mA
Ready:	4.0 ± 0.2mA
IR (FL3100 only):	8.0 ± 0.2mA
UV (FL3100 only):	12.0 ± 0.2mA
WARN:	16.0 ± 0.2mA
ALARM:	20.0 ± 0.2mA

NOTE: The maximum analog output load is 600 ohms, including wiring.

3.3.7 Cable Requirements

For interfacing with 250 ohm input impedance devices, the following maximum cable lengths apply (maximum 50-ohm loop):

Cable AWG	Run Feet	Cable mm^2	Run Meters
14	9000	2.50	2750
16	5800	1.50	1770
18	3800	1.00	1160
20	2400	0.75	730
22	1700	0.50	520

Table 5: Maximum Cable Requirements

3.3.8 Power

These are the power connections. The supply voltage range is 20 to 36VDC at the detector (low voltage is detected at approximately 18.5 VDC).

TB1 Position	Connection
7	+24VDC
8	+24VDC
9	COM
10	COM

Table 6: Power Connections

The following maximum cable lengths apply for a +24VDC supply (maximum 20-ohm loop):

Cable AWG	Run Feet	Cable mm^2	Run Meters
14	1370	2.5	4500
16	715	1.5	2340
18	470	1.00	1540
20	300	0.75	970
22	205	0.50	670

Table 7: Maximum Cable Lengths for +24 VDC Supply

3.3.9 MODBUS Interface

These are the connections for the MODBUS interface. It is used to either query the unit's status or to configure the unit. See Section 5.0, for detailed information on MODBUS RTU Protocol.

TB1 Position	Connection
1	DATA +
2	DATA -

Table 8: Connections for the MODBUS Interface

NOTE: If Dual MODBUS output is ordered, then the 0-20mA output is not available and the wiring terminals for the second MODBUS channels are:

TB1 Position	Connection
5	DATA2 +
6	DATA2 -

Table 9: Connections for the Second MODBUS Interface

3.3.10 Chassis Ground

This connection is available for use in wiring that requires a connection to chassis ground.

TB2 Position	Connection
1	CHAS GND

Table 10: Chassis Ground Connection

3.3.11 Connection to Fire Cards/Panels

For special applications where the detectors are to be wired together for monitoring via standard fire cards, GM will factory-fit EOL and alarm resistors. If this special option is required, please specify at time of order and provide the following information:

- Specify one or two resistors (i.e. Alarm only, or alarm resistor and EOL).
- Specify value of resistors.

Where detectors are used in conjunction with a GM Model IN042 card, values would be 470-ohm Alarm resistor and 5.6K EOL. The EOL resistors are onboard the IN042, selectable by DIP-switches.

NOTE: Contact General Monitors or an authorized representative for further details.

European Union (EU) Approved Applications: Interconnecting cables must have an overall screen or screen and armor. Cables BS5308 Part 2, Type 2, or equivalent are suitable. Note that the terms 'screen' and 'shield' are equivalent for the purpose of this manual. The cable armor must be terminated in a suitable cable gland at the detector to ensure a positive electrical connection.

3.3.12 Cable Termination in the Non-Hazardous Area

- The cable **armor** must be connected to **safety earth** in the safe area.
- The cable **screen** (drain wire) must be connected to an **instrument earth** in the safe area.
- The power supply **OV return** must be connected to an **instrument earth** in the safe area.
- The interconnecting cables should be segregated from power and other noisy cables. Avoid proximity to cables associated with radio transmitters, welders, switch mode power supplies, inverters, battery chargers, ignition systems, generators, switch gear, arc lights and other high frequency or high power switching process equipment. In general, maintain separation of at least 1m between instrument and other cables. Greater separations are required where long parallel cable runs are unavoidable. Avoid running instrument cable trenches close to lightning conductor earthing pits.
- Complete all cable insulation testing before connecting the cable at either end.

WARNING: Under no circumstances should equipment be connected or disconnected when under power. This is contrary to hazardous area regulations and may lead to serious damage to the equipment. Equipment damaged in this manner is not covered under warranty.

4.0 Operation

4.1 Checklist

Prior to starting the system verify the following:

- Inhibit any external devices, such as automatic extinguishing fire suppression systems or others, which you do not want activated.
- Verify that the DIP-switch settings are set for the desired configuration.
- Verify that the unit is properly mounted. Ensure the conduit/cable gland entries are pointed downward.
- Verify the field of view for each detector covers the area intended for flame detection.
- Verify that the wiring is correct.
- Verify that the power supply is connected properly. The detector is powered by +24VDC (20 to 36 VDC voltage range). The detector will output a low voltage fault at 18.5 VDC or below.

4.2 Start Up

To start up the system, apply power to the flame detectors. Each detector will begin its self-test start up sequence. For the first 10 seconds, the unit will output 0mA, the fault relay stays de-energized, and the green and red LED will flash alternately for 1.0 second, each, or .05 seconds, each.

After this 10-second period, the unit will output 4mA, the fault relay will energize, the red LED will turn off, and the green LED will turn on constant and briefly flash off every 10 seconds.

4.3 System Test

To test the system, use the General Monitors Test Lamp Model TL103 for the FL3100 Flame Detector or the Model TL100 for the FL3101 Detector (Section 6.3).

4.4 User Selectable Options/Factory Defaults

All settings on the Models FL3100 and FL3101 are done via a DIPswitch on the Power/Relay Board or via MODBUS (overrides switch settings). To set these options, remove the detector head from the Base Assembly and locate the DIPswitch (Figure 19 & Figure 20). On the DIPswitch, ON/CLOSED means the switch is pushed in on the side labeled ON or CLOSED (opposite the OPEN side). OFF/OPEN means the switch is pushed in on the side with the number corresponding to the switch position or the side labeled OPEN. Refer to Table 11 for the switch assignments. The settings for the WARN and ALARM outputs have been covered in Section 3.3. The time delay specifies the amount of time a WARN condition persists before an ALARM condition will occur.

Option	Off	On
1. 100% Sens – 1 sqft @ 50 ft	1&2	
2. 75% Sens – 1 sqft @ 35 ft	2	1
3. 50% Sens – 1 sqft @ 25 ft	1	2
4. 2 Second ALARM Time Delay	3	4
5. 4 Second ALARM Time Delay	3&4	
6. 8 Second ALARM Time Delay	4	3
7. 10 Second ALARM Time Delay		3&4
8. ALARM non-latching	5	
9. ALARM latching		5
10. WARN non-latching	6	
11. WARN latching		6
12. ALARM normally energized		7
13. ALARM normally de-energized	7	
14. WARN normally energized		8
15. WARN normally de-energized	8	

Table 11: DIP Switch Options

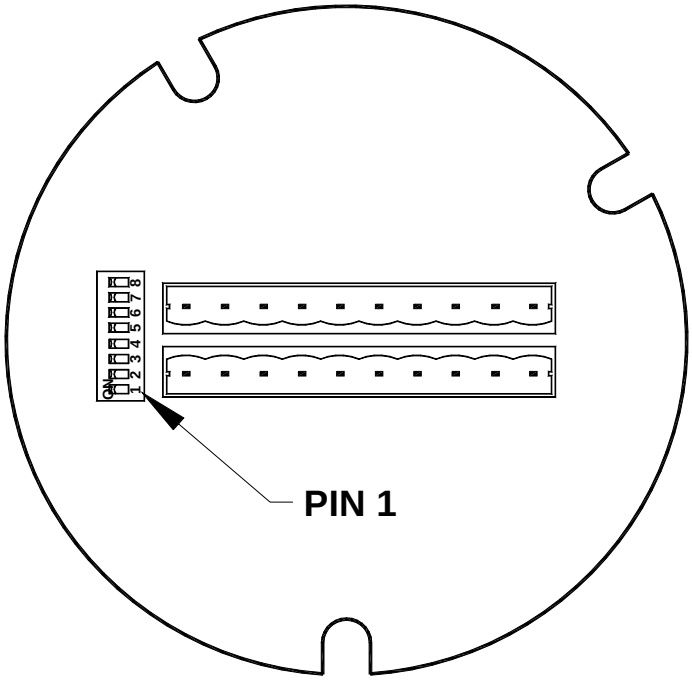


Figure 19: DIPswitch Location

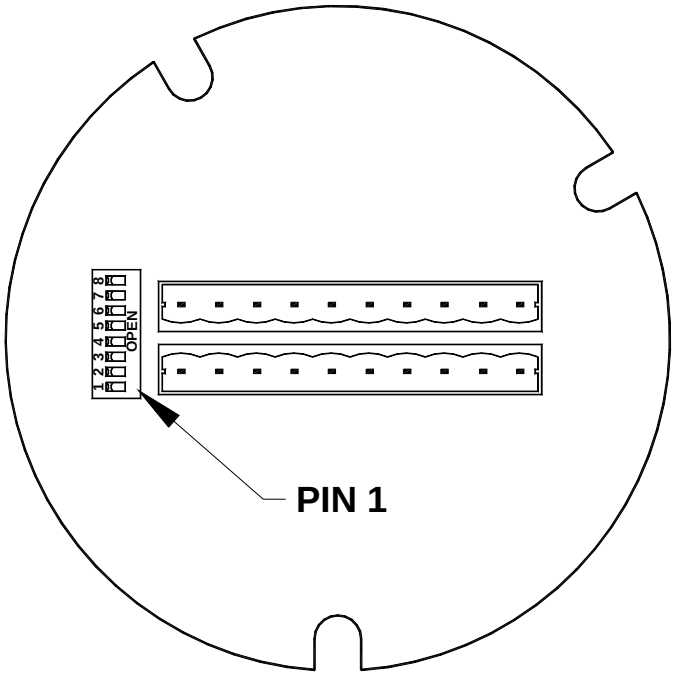


Figure 20: DIPswitch Location

5.0 MODBUS Interface

Standard Model FL3100 or FL3101 Flame Detectors include a Single MODBUS Communications Board that is referenced as Comm 1. A Dual MODBUS feature is optional, which includes two independent communications channels referenced as Comm 1 and Comm 2.

NOTE: Comm 2 is utilized as a backup communications channel, therefore it is not recommended to have both Comm 1 and Comm 2 channels active simultaneously. If the dual Comm option is ordered, the Analog output will not be available.

5.1 Baud Rate

The Baud Rate is a selectable setting via the MODBUS Communications Interface. The selectable baud rates are 19.2K, 9600, 4800, or 2400 bits per second.

5.2 Data Format

The Data Format is a selectable setting via the MODBUS Communications Interface. The selectable data formats are as follows:

Data Bits	Parity	Stop Bit	Format
8	None	1	8-N-1
8	Even	1	8-E-1
8	Odd	1	8-O-1
8	None	2	8-N-2

Table 12: Data Format

5.3 MODBUS Read Status Protocol (Query/Response)

5.3.1 MODBUS Read Query Message

Byte	MODBUS	Range	Referenced to FL3100, FL3101
1st	Slave Address	1-247 *	FL3100, FL3101 ID (Address) (X = 0 or 1 Model Type)
2nd	Function Code	03	Read Holding Registers
3rd	Starting Address Hi**	00	Not Used by FL3100, FL3101
4th	Starting Address Lo**	00-FF (Hex)	FL3100, FL3101 Commands
5th	No. of Registers Hi	00	Not Used by FL3100, FL3101
6th	No. of Registers Lo	01	No. of 16 Bit Registers
7th	CRC Lo	00-FF (Hex)	CRC Lo Byte
8th	CRC Hi	00-FF (Hex)	CRC Hi Byte

Table 13: MODBUS Query Messages

NOTE*: Address 0 is reserved for broadcast mode and will not be supported at this time.

NOTE:** Start Address can be a maximum of 9999 Address Locations (0000-270E)

5.3.2 MODBUS Read Response Message

Byte	MODBUS	Range	Referenced to FL3100, FL31001
1st	Slave Address	1-247* (Decimal)	FL3100, FL3101 ID (Address)
2nd	Function Code	03	Read Holding Registers
3rd	Byte Count	02	No. of Data Bytes
4th	Data Hi	00-FF (Hex)	FL3100, FL3101 Hi Byte Status Data
5th	Data Lo	00-FF (Hex)	FL3100, FL3101 Lo Byte Status Data
6th	CRC Lo	00-FF (Hex)	CRC Lo Byte
7th	CRC Hi	00-FF (Hex)	CRC Hi Byte

Table 14: MODBUS Read Response Messages

NOTE: Address 0 is reserved for broadcast mode and will not be supported at this time.

5.4 MODBUS Write Command Protocol (Query/Response)

5.4.1 MODBUS Write Query Message

Byte	MODBUS	Range	Referenced to FL3100, FL3101
1st	Slave Address	1-247* (Decimal)	FL3100, FL3101 ID (Address)
2nd	Function Code	06	Preset Single Register
3rd	Register Address Hi**	00	Not used by FL3100, FL3101
4th	Register Address Lo**	00-FF (Hex)	FL3100, FL3101 Commands
5th	Preset Data Hi	00-FF (Hex)	FL3100, FL3101 Hi Byte Command Data
6th	Preset Data Lo	00-FF (Hex)	FL3100, FL3101 Lo Byte Command Data
7th	CRC Lo	00-FF (Hex)	CRC Lo Byte
8th	CRC Hi	00-FF (Hex)	CRC Hi Byte

Table 15: MODBUS Write Query Message

NOTE*: Address 0 is reserved for broadcast mode and will not be supported at this time.

NOTE:** Register Address can be a maximum of 9999 Address Locations (0000-270E)

5.4.2 MODBUS Write Response Message

Byte	MODBUS	Range	Referenced to FL3100, FL3101
1st	Slave Address	1-247* (Decimal)	FL3100, FL3101 ID (Address)
2nd	Function Code	06	Preset Single Register
3rd	Register Address Hi**	00	Not used by FL3100, FL3101
4th	Register Address Lo**	00-FF (Hex)	FL3100, FL3101 Commands
5th	Preset Data Hi	00-FF (Hex)	FL3100, FL3101 Hi Byte Command Data
6th	Preset Data Lo	00-FF (Hex)	FL3100, FL3101 Lo Byte Command Data
7th	CRC Lo	00-FF (Hex)	CRC Lo Byte
8th	CRC Hi	00-FF (Hex)	CRC Hi Byte

Table 16: MODBUS Write Response Message

NOTE*: Address 0 is reserved for broadcast mode and is not supported at this time.

NOTE**: Register Address can be a maximum of 9999 Address Locations (0000-270E)

5.4.3 Function Codes Supported

Function Code 03 (Read Holding Registers) is used to read status from the slave unit. Function Code 06 (Preset Single Register) is used to write a command to the slave unit.

5.5 Exception Responses and Exception Codes

In a normal exchange, the master device sends a query to the FL3100, FL3101. The FL3100, FL3101 receives the query and returns a normal response to the master. If a normal communications error occurs, there are 4 possible responses from the FL3100, FL3101:

1. If the FL3100, FL3101 does not recognize the query due to a communications error, then no response is returned from the FL3100, FL3101 and the master device will eventually process a timeout condition for the query.

2. If the FL3100, FL3101 receives the query, but detects a communication error (CRC, etc.), then no response is returned from the FL3100, FL3101 and the master device will eventually process a timeout condition for the query.

3. If the FL3100, FL3101 receives the query without a communications error, but cannot process the response to the master within the master's timeout setting, then no response is returned from the FL3100, FL3101 and the master device will eventually process a timeout condition for the query.

In order to prevent this condition from occurring, the typical response times for the FL3100, FL3101 are listed below:

Baud Rate (bps)	Query From Master (msec)	Unit Response Delay Time to Query (msec)	Response From Unit (msec)	Master Response Delay Time Between End of Unit Response and Next Master Query (msec)	Total Response Time (msec)
19.2K	4	4	4	100 - 120*	112 – 132
9600	8	5	8	100 - 120*	121 – 141
4800	16	6	16	100 - 120*	138 – 158
2400	32	8	32	100 - 120*	172 – 192

Table 17: Typical Response Times for FL3100/FL3101

NOTE*: Master Response Delay Time is dependent on the speed of response for the Master (DCS, PLC, etc.) Cycle Time can be significantly reduced with a faster Master. The 100ms Delay Time was taken from a typical Master, using a PC with Intellution Industrial Control Software, which was set at the minimum poll time.

If the FL3100, FL3101 receives the query without a communications error, but cannot process it due to reading or writing to a non-existent or illegal FL3100, FL3101 Function Code, Illegal Command Starting Address or Register Address, or Illegal Data Value, then the FL3100, FL3101 will return an exception response message informing the master of the error.

The exception response message has two fields that differentiate it from a normal response, which is explained in Section 5.5.1.

5.5.1 Exception Responses

Byte	MODBUS	Range	Referenced to FL3100, FL3101
1st	Slave Address	1-247* (Decimal)	FL3100, FL3101 ID (Address)
2nd	Function Code	83 or 86 (Hex)	MSB is set with Function Code
3rd	Exception Code	01 - 06 (Hex)	Appropriate Exception Code (See below)
4th	CRC Lo	00-FF (Hex)	CRC Lo Byte
5th	CRC Hi	00-FF (Hex)	CRC Hi Byte

Table 18: Exception responses

5.5.1.1 Function Code Field

In a normal response, the FL3100, FL3101 echoes the function code of the original query in the function code field of the response. All the Function Codes have a most-significant bit (MSB). In an exception response, the FL3100, FL3101 sets the MSB of the function code to a one (1). With the function code's MSB set, the master can recognize the exception response and can process the data field for the exception code from the FL3100, FL3101 response message.

5.5.1.2 Exception Code Field

In a normal response, the FL3100, FL3101 returns data and status in the data field, which was requested in the query from the master. In an exception response, the FL3100, FL3101 returns an exception code in the data field, which describes the FL3100, FL3101 condition that caused the exception. Below is a list of exception codes that are supported by the FL3100, FL3101:

Code	Name	Description
01	Illegal Function	The function code received in the query is not an allowable action for the FL3100, FL3101.
02	Illegal Data Address	The data address received in the query is not an allowable address for the FL3100, FL3101.
03	Illegal Data Value	A value contained in the query data field is not an allowable value for the FL3100, FL3101.
04	Slave Device Failure	An unrecoverable error occurred while the FL3100, FL3101 was attempting to perform the requested action.
05	Acknowledge	The FL3100, FL3101 has accepted the request and is processing it, but a long duration of time will be required to do so. This response is returned to prevent a timeout error from occurring in the master.
06	Device Busy	The FL3100, FL3101 is engaged in processing a long-duration program command. The master should retransmit the message later when the slave is free.

Table 19: Exception Code Field

5.6 Command Register Locations

5.6.1 Operational Mode Commands

See section number listed below and reference Section 5.7 for details of each register.

R - indicates Read Only Access **R/W - indicates Read/Write Access**

Parameter	Function	Type	Scale	Access	REG Addr	Master I/O Addr	Refer to Section
Analog	0-20mA Current Output	Value	16-Bit	R	0000	40001	7.7.1
Mode	Indicates Fire Status Mode	Value	(0-11)	R	0001	40002	7.7.2
Status/Error	Indicates Error	Bit	8-Bit	R	0002	40003	7.7.3
UV/IR Only	Indicates Detection of UV Only or IR Only (FL3100 only)	Bit	2-Bit	R	0003	40004	7.7.4
Model Type	Identifies the Model FL3100, FL3101 (X=0 or 1 to indicate Model)	Decimal	310X	R	0004	40005	7.7.5
Software Rev	Indicates the Software Revision	ASCII	2-Char	R	0005	40006	7.7.6
COPM Fault	UV/IR COPM Fault	Bit	2-Bit	R	0006	40007	7.7.7

EEPROM Override	Set Bit for EEPROM to Override DIPswitch Settings	Bit	1-Bit	R/W	0007	40008	7.7.8
Options	Indicates Unit Options	Bit	8-Bit	R/W	0008	40009	7.7.9
Comm 1 Address	Unit Address (Comm 1)	Decimal Hex	(1-247) (01-F7)	R/W	0009	40010	7.7.10
Not Used					000A	40011	
Comm 1 Baud Rate	Indicates present Baud Rate (Comm 1) (2400, 4800, 9600,19.2K)	Value	(0-3)	R/W	000B	40012	7.7.11
Comm 1 Data Format	Indicates present Data Format (Comm 1) (8N-1, 8E-1, 8O-1, 8N-2)	Value	(0 - 3)	R/W	000C	4013	7.7.12
UV Sig Count	Indicates No. of UV Signal Pulses within 500 ms	Value	8-Bit	R	000D	4014	7.7.13
IR Sig Count	Indicates No. of IR Signal Pulses within 500 ms	Value	8-Bit	R	000E	4015	7.7.14
UV Fault Total	Indicates Total No. of UV COPM Faults	Value	8-Bit	R	000F	40416	7.7.15
IR Fault Total	Indicates Total No. of IR COPM Faults	Value	8-Bit	R	1010	4017	7.7.16
Remote Reset	Remotely Resets the Alarm & Warn Relays	Bit	1-Bit	R/W	0011	4018	7.7.17
Remote Alarm Test	Remotely Activates Alarm Test	Bit	1-Bit	R/W	0012	40419	7.7.18
Clear COPM Faults	Clears UV/IR COPM Fault Counters	Bit	1-Bit	R/W	0013	40020	7.7.19
Comm 1 & 2 Total Receive Errors	Total # of Receive Errors (Comm 1 & 2)	Value	8-Bit	R	0020	40033	7.7.20
Comm 1 or 2 Bus Activity Rate %	Bus Activity Rate in % Of this Addressed Node vs. Other Addressed Nodes (Comm 1 or 2)	Decimal Hex	(0-100%) (0-64)	R	0021	40034	7.7.21
Comm 1 & 2 Function Code Errors	Total # of Function Code Errors (Comm 1 & 2)	Value	8-Bit	R	0022	40035	7.7.22
Comm 1 & 2 Starting Address Errors	Total # of Starting Addresses Errors (Comm 1 & 2)	Value	8-Bit	R	0023	40036	7.7.23
Comm 1 Only Total Receive Errors	Total # of Comm 1 Only Receive Errors	Value	8-Bit	R	0024	40037	7.7.24

Comm 1 & 2 RXD CRC Lo Errors	Total # of RXD CRC Lo Errors (Comm 1 & 2)	Value	8-Bit	R	0025	40038	7.7.25
Comm 1 & 2 RXD CRC Hi Errors	Total # of RXD CRC Hi Errors (Comm 1 & 2)	Value	8-Bit	R	0026	40039	7.7.26
Comm 1 Only Overrun Errors	Total # of Overrun Errors (Comm 1 Only)	Value	8-Bit	R	1027	40040	7.7.27
Comm 1 Only Noise Flag Errors	Total # of Noise Flags Errors (Comm 1 Only)	Value	8-Bit	R	0028	40041	7.7.28
Comm 1 & 2 Framing Errors	Total # of Framing Errors (Comm 1 & 2)	Value	8-Bit	R	0029	40042	7.7.29
Comm 1 or 2 Message Interval	Indicates Comm 1 or 2 Message Interval in Milli-seconds	Value	8-Bit	R	002A	40043	7.7.30
Comm 2 Only Total Receive Errors	Total # of Comm 2 Only Receive Errors	Value	8-Bit	R	002B	40044	7.7.31
Comm 1 Only SCI Interrupt Errors	Total # of Serial Comm Interface Errors (Comm 1 Only)	Value	8-Bit	R	002C	40045	7.7.32
Comm 1 & 2 Errors	Clear All Comm 1 & 2 Errors	Bit	1-Bit	R/W	002D	40046	7.7.33
Not Used					002E	40047	
Comm 2 Address	Unit Address (Comm 2)	Decimal Hex	(1-247) (01-F7)	R/W	002F	40048	7.7.34
Comm 2 Baud Rate	Indicates present Baud Rate (Comm 2) (2400, 4800, 9600, 19.2K)	Value	(0-3)	R/W	0030	40049	7.7.35
Comm 2 Data Format	Indicates present Data Format (Comm 2) (8N-1, 8E-1, 8O-1, 8N-2)	Value	(0-3)	R/W	0031	40050	7.7.36

Table 20: Operational Mode Commands

5.7 FL3100, FL3101 Operational Mode Command Register Details

5.7.1 Analog

A read returns a value, which is proportional to the 0-20mA output current. The current is based on a 16-bit value. The master scaling is 0-65535 decimal, which corresponds to the FL3100, FL3101 scaling which is 0-20mA.

5.7.2 Mode

A read returns the fire status mode of the FL3100, FL3101.

Mode	Decimal Value
Power-up Delay	1
Warn Non-latching Only	2
Warn & Alarm Non-Latching	3
Warn Latching Only	4
Alarm Latching Only	5
Warn & Alarm Latching	6
Ready State (No Fire)	7
UV Only Fire (FL3100 Model Only)	8
IR Only Fire (FL3100 Model Only)	9
Alarm Test	10
COPM Fault Detected	11

Table 21: Mode

5.7.3 Status/Error

A read returns the errors that are occurring now, which are indicated by bit position.

Byte	Function Bit	Position
Low	EPROM Checksum	8
	EEPROM Checksum	7
	RAM Test	6
	Low Line Voltage Check	5
	UV COPM	4
	IR COPM	3
	Not Used	2
	Not Used	1
High	Reset Line Shorted	8
	UV 10 Minute	7
	Not Used	6-1

Table 22: Status/Error

5.7.4 UV/IR Only

A read indicates the detection of UV Only or IR Only when using the UV/IR Model FL3100.

UV Only Detected = 01 (Lo Data Byte)

IR Only Detected = 02 (Lo Data Byte)

High Data Byte Not Used.

5.7.5 Model Type

A read returns the Decimal Value 3100 or 3101, which identifies each particular type of unit by model number.

Model	Version	Decimal Value
FL3100	UV/IR	3100
FL3101	UV Only	3101

Table 23: Model Type

5.7.6 Software Revision

A read returns the software revision of the FL3100, FL3101 in 2 ASCII characters. (Usually a blank and then a letter revision ex. A, B, C, etc).

5.7.7 COPM Fault

A read returns the type of Continuous Optical Path Monitoring (COPM) Fault, which is an UV COPM Fault or an IR COPM Fault, or both. The UV COPM and/or the IR COPM Fault indicates that the UV and/or IR windows are dirty and need to be cleaned, or that there is a hardware problem with the UV and/or IR detection circuitry.

UV COPM Fault= 01 (Lo Data Byte)

IR COPM Fault = 02 (Lo Data Byte)

High Data Byte Not Used.

5.7.8 EEPROM Override

A read indicates the status of the EEPROM Override bit. A write command changes the state of the EEPROM Override bit. When the EEPROM Override bit is enabled, the options for the Detector Sensitivity, Relay Delay, Relay Latching/Non-Latching and Relay Energized/Non-Energized features are now controlled by the data stored in the EEPROM and are no longer controlled by the 8-position DIPswitch located on the bottom of the Power/Relay Board. When the EEPROM Override bit is disabled the options are under the control of the 8-position DIPswitch. The EEPROM Override bit is located in the LSB of the Low Data Byte and the High Data Byte is not used.

Function	Bit (LSB)	Access
Enable	1	Read/Write
Disable	0	Read/Write

Table 24: EEPROM Override

EXCEPTION - If an EEPROM error occurs, then the Exception Code 04 (Slave Device Failure) is returned.

NOTE: By grounding the ALARM TEST input during power-up cycle (approximately 10 seconds), the FL3100, FL3101 will disable the EEPROM Override and set the Bit = 0, thus enabling the 8-position DIPswitch.

5.7.9 Options

A read returns the status of the settings for the Detector Sensitivity, Relay Delay, Relay Latching/Non-Latching and Relay Energized/Non-Energized features either from the Options DIPswitch or the EEPROM depending on the setting of the EEPROM Override bit listed above. A write command changes the settings for the EEPROM only when the EEPROM Override bit is set.

EXCEPTION - If an attempt to change the EEPROM Options is made while the EEPROM Override bit is not set, then the unit shall return an Exception Code 01 (Illegal Function).

These functions are indicated on the Low Data Byte and the High Data Byte is not used.

Function	Bit Position	Conditions				Access
Warn Energized	8 (MSB)	1 = Energized 0= Non-Energized				Read/Write
Alarm Energized	7	1 = Energized 0= Non-Energized				Read/Write
Warn Latched	6	1 = Latched 0 = Non-Latched				Read/Write
Alarm Latched	5	1 = Latched 0 = Non-Latched				Read/Write
		10	8	4	2	Time Delay in Seconds
Alarm Time Delay 2	4	0	0	1	1	Read/Write
Alarm Time Delay 1	3	0	1	0	1	Read/Write
		100	75	50		% Sensitivity
Sensitivity 2	2	0	0	1		Read/Write
Sensitivity 1	1 (LSB)	0	1	0		Read/Write

Table 25: Options

5.7.10 Comm 1 Address

A read returns the Comm 1 address of the FL3100, FL3101. A write changes the address to the requested address. The range of the address is 1 to 247 (01 to F7 Hex). After the address has been changed to the slave unit, the MODBUS communications will cease because the address has changed; therefore the master will have to change its query address to the slave's new address in order to restart the communications.

EXCEPTION - If the EEPROM write error occurs, then the Exception Code 04 (Slave Device Failure) is returned.

NOTE: By grounding the RESET input during power-up cycle (approximately 10 seconds), the FL3100, FL3101 Address will default to 1.

5.7.11 Comm 1 Baud Rate

A read returns the Comm 1 baud rate of the FL3100, FL3101. A write changes the baud rate to the requested baud rate. After the baud rate has been changed to the addressed unit, the MODBUS communications will cease because the baud rate has changed; therefore the master will have to change its baud rate to the slave's new baud rate in order to restart the communications.

Baud Rate	Low Data Byte	Access
19.2K	03	Read/Write
9600	02	Read/Write
4800	01	Read/Write
2400	00	Read/Write

Table 26: Comm 1 Baud Rate

This function is indicated on the Low Data Byte and the High Data Byte is not used.

EXCEPTION - If an illegal data value is entered which is not listed above, then the Exception Code 03 (Illegal Data Value) is returned.

EXCEPTION - If an EEPROM write occurs, then the Exception Code 04 (Slave Device Failure) is returned.

NOTE: By grounding the RESET input during power-up cycle (approximately 10 seconds), the FL3100, FL3101 Baud Rate will default to 19.2K.

5.7.12 Comm 1 Data Format

A read returns the Comm 1 data format of the FL3100, FL3101. A write changes the data format to the requested data format. After the data format has been changed to the addressed unit, the MODBUS communications may cease or start producing Comm errors because the data format has changed; therefore the master will have to change its data format to the slave's new data format in order to restart or provide proper communications.

Data	Parity	Stop	Format	Low Data Byte	Access
8	None	1	8-N-1	00	Read/Write
8	Even	1	8-E-1	01	Read/Write
8	Odd	1	8-O-1	02	Read/Write
8	None	2	8-N-2	03	Read/Write

Table 27: Comm 1 Data Format

This function is indicated on the Low Data Byte and the High Data Byte is not used.

NOTE: By grounding the RESET input during power-up cycle (approximately 10 seconds), the FL3100, FL3101 Data Format will default to 8-N-1.

5.7.13 UV Signal Count

A read indicates the number of UV Signal Counts that have occurred within 500 ms, which is the time duration that is required to detect a fire in the UV spectrum.

5.7.14 IR Signal Count

A read indicates the number of IR Signal Counts that have occurred within 500 ms which is the time duration that is required to detect a fire in the IR spectrum.

5.7.15 UV Fault Total

A read indicates total number of UV COPM Faults for an indefinite period of time until the Clear COPM Fault command is activated. The maximum count is 255 and then the counter will rollover to zero and begin counting again.

5.7.16 IR Fault Total

A read indicates total number of IR COPM Faults for an indefinite period of time until the Clear COPM Fault command is activated. The maximum count is 255 and then the counter rolls back to zero and begins counting again.

5.7.17 Remote Reset

Writing a 1 to the bit activates the Remote Reset function that resets the Alarm and Warn Relays. The function is active momentarily and will reset automatically after being used.

Function	Bit (LSB)	Access
Enable	1	Read/Write
Disable	0	Read/Write

Table 28: Remote Reset

5.7.18 Remote Alarm Test

Writing a 1 to the bit activates the Remote Alarm Test function, which activates the Warn and Alarm relay turn-on along with the Analog current status. Once the Alarm Test is complete, the Remote Alarm Test function should be disabled by writing a zero to the Remote Alarm Test and then resetting the Alarm and Warn relays by writing a one to the Remote Reset (referenced above).

Function	Bit (LSB)	Access
Enable	1	Read/Write
Disable	0	Read/Write

Table 29: Remote Alarm Test

5.7.19 Clear COPM Faults

Writing a 1 to the bit activates the Clear COPM Faults function that resets both the UV and IR COPM faults. The function is active momentarily and will reset automatically after being used.

Function	Bit (LSB)	Access
Enable	1	Read/Write
Disable	0	Read/Write

Table 30: Clear COPM Faults Function

5.7.20 Comm 1 & 2 Total Receive Errors

A read indicates the total MODBUS Comm 1 & 2 Receive Errors that occurred in the slave device. The maximum count is 255 and then the counter will rollover to zero and begin counting again. The total errors are an accumulation of the individual Comm errors listed below:

5.7.21 Comm 1 or 2 Bus Activity Rate %

A read indicates the Comm 1 or 2 Bus Activity Rate in percent of this Slave's addressed node versus other addressed nodes. Range of this value is in hex (0-64), which translates to decimal (0-100%).

5.7.22 Comm 1 & 2 Function Code Errors

A read indicates the number of Comm 1 & 2 Function Code Errors that occurred in the slave device. The maximum count is 255 and then the counter will rollover to zero and begin counting again.

5.7.23 Comm 1 & 2 Starting Address Errors

A read indicates the number of Comm 1 & 2 Starting Address Errors that occurred in the slave device. The maximum count is 255 and then the counter will rollover to zero and begin counting again.

5.7.24 Comm 1 Only Total Receive Errors

A read indicates the total MODBUS Comm 1 Only Receive Errors that occurred in the slave device. The maximum count is 255 and then the counter will rollover to zero and begin counting again.

5.7.25 Comm 1 & 2 RXD CRC Lo Errors

A read indicates the number of Comm 1 & 2 RXD CRC Lo Byte Errors that occurred in the slave device. The maximum count is 255 and then the counter will rollover to zero and begin counting again.

5.7.26 Comm 1 & 2 RXD CRC Hi Errors

A read indicates the number of Comm 1 & 2 RXD CRC Hi Byte Errors that occurred in the slave device. The maximum count is 255 and then the counter will rollover to zero and begin counting again.

5.7.27 Comm 1 Only Overrun Errors

A read indicates the number of Comm 1 Only Overrun Errors that occurred in the slave device. The maximum count is 255 and then the counter will rollover to zero and begin counting again.

NOTE: An overrun error occurs when the next received byte of data tries to overwrite an existing received data byte, which has not been processed. Therefore, the next received byte of data is lost. This can be controlled by implementing the proper DCS or PLC Error Handling Timing Setting (ex. Reply Timeout Setting, Delay Time, and Number of Retries) and proper Baud Rate Setting.

5.7.28 Comm 1 Only Noise Flag Errors

A read indicates the number of Comm 1 Only Noise Flag Errors that occurred in the slave device. The maximum count is 255 and then the counter will rollover to zero and begin counting again.

5.7.29 Comm 1 & 2 Framing Errors

A read indicates the number of Comm 1 & 2 Framing Errors that occurred in the slave device. The maximum count is 255 and then the counter will rollover to zero and begin counting again.

5.7.30 Comm 1 or 2 Message Interval

A read indicates the time interval in milliseconds between Comm 1 or 2 Message Intervals. The maximum time interval indicated is 255.

5.7.31 Comm 2 Only Total Receive Errors

A read indicates the total MODBUS Comm 1 Only Receive Errors that occurred in the slave device. The maximum count is 255 and then the counter will rollover to zero and begin counting again.

5.7.32 Comm 1 Only SCI Errors

A read indicates the number of Comm 1 Only SCI (Serial Communications Interface) Errors that occurred in the slave device. The maximum count is 255 and then the counter will rollover to zero and begin counting again.

5.7.33 Clear Comm 1 & 2 Errors

Writing a 1 to the bit activates the Clear Comm 1 & 2 Errors function, which resets all of the MODBUS Comm Error counters to zero. The function is active momentarily and will reset automatically after being used.

Function	Bit (LSB)	Access
Enable	1	Read/Write
Disable	0	Read/Write

Table 31: Comm 1 & 2 Errors

5.7.34 Comm 2 Address

A read returns the Comm 2 address of the FL3100, FL3101. A write changes the address to the requested address. The range of the address is 1 to 247 (01 to F7 Hex). After the address has been changed to the slave unit, the MODBUS communications will cease because the address has changed. Therefore, the master will have to change its query address to the slave's new address in order to restart the communications.

EXCEPTION - If the EEPROM write error occurs, then the Exception Code 04 (Slave Device Failure) is returned.

NOTE: By grounding the RESET input during power-up cycle (approximately 10 seconds), the FL3100, FL3101 Address will default to 1.

5.7.35 Comm 2 Baud Rate

A read returns the Comm 2 baud rate of the FL3100, FL3101. A write changes the baud rate to the requested baud rate. After the baud rate has been changed to the addressed unit, the MODBUS communications will cease because the baud rate has changed. Therefore, the master will have to change its baud rate to the slave's new baud rate in order to restart the communications.

Baud Rate	Low Data Byte	Access
19.2K	03	Read/Write
9600	02	Read/Write
4800	01	Read/Write
2400	00	Read/Write

Table 32: Comm 2 Baud Rate

This function is indicated on the Low Data Byte and the High Data Byte is not used.

EXCEPTION - If an illegal data value is entered which is not listed above, then the Exception Code 03 (Illegal Data Value) is returned.

EXCEPTION - If an EEPROM write occurs, then the Exception Code 04 (Slave Device Failure) is returned.

NOTE: By grounding the RESET input during power-up cycle (approximately 10 seconds), the FL3100, FL3101 Baud Rate will default to 19.2K.

5.7.36 Comm 2 Data Format

A read returns the Comm 2 data format of the FL3100, FL3101. A write changes the data format to the requested data format. After the data format has been changed to the addressed unit, the MODBUS communications may cease or start producing Comm errors because the data format has changed. Therefore, the master will have to change its data format to the slave's new data format in order to restart or provide proper communications.

Data	Parity	Stop	Format	Low Data Byte	Access
8	None	1	8-N-1	00	Read/Write
8	Even	1	8-E-1	01	Read/Write
8	Odd	1	8-O-1	02	Read/Write
8	None	2	8-N-2	03	Read/Write

Table 33: Comm 2 Data Format

This function is indicated on the Low Data Byte and the High Data Byte is not used.

NOTE: By grounding the RESET input during power-up cycle (approximately 10 seconds), the FL3100, FL3101 Data Format will default to 8-N-1.

6.0 Maintenance

6.1 General Maintenance

Once correctly installed, the unit requires very little maintenance other than regular sensitivity checks and cleaning of the lenses. General Monitors recommends that a schedule be established and followed.

WARNING: Disconnect or inhibit external devices, such as automatic extinguishing or fire suppression systems before performing any maintenance.

NOTE: The removal of particulate matter and any film buildup on the windows and light rods is necessary to ensure proper sensitivity of the system. It is recommended that the window and light rods be cleaned at least every 30 days or more often if the detector is located in a particularly dirty environment.

During routine maintenance of the equipment, if the base plate is removed, the flame path should be replenished with grease compound.

European Union (EU) Approved Applications: The following grease compound is recommended for use: PBC Plybutylcuprysil, (or equivalent), which has BASEEFA Health & Safety Executive component approval No. 1051U for use as a jointing compound on flameproof electrical enclosures. This is available from General Monitors.

The neoprene rubber gasket should also be lubricated with Type P80 lubricant available from General Monitors (P/N 610-010) should it be found to be dry.

The removal of dust and film build-up on the windows is necessary to ensure proper sensitivity of the system. Windows may be cleaned periodically, to avoid a COPM fault being triggered by build-up, dirt or debris.

For use in environments where windows are likely to become blocked regularly, an optical air guard is recommended.

6.2 Cleaning the Lenses/Light Rods

NOTE: DO NOT USE A COMMERCIAL GLASS CLEANER OTHER THAN "INDUSTRIAL STRENGTH WINDEX® with Ammonia D". The lenses are not glass. The UV lens material is quartz and the IR lens material is sapphire. The cleaning solution should be General Monitors' P/N 10272-1 ("Industrial Strength Windex® with Ammonia D").

A clean, soft, lint-free cloth, tissue or cotton swab should be used to apply the cleaning solution. Do not touch the lenses or light rods with fingers.

1. Wet the window with the cleaning solution.
2. Rub with a dry, unsoiled cloth until the window is clean.
3. Let the window dry completely.

4. Repeat steps 1, 2 and 3 for the light rods (Figure 21). Take care only to clean the non-coated (non - aluminum) areas of the light rods.

NOTE: The removal of particulate matter and any film buildup on the lenses and light rods is necessary to ensure proper sensitivity of the system. It is recommended that the window and light rods be cleaned at least every 30 days or more often if the detector is located in a particularly dirty environment.

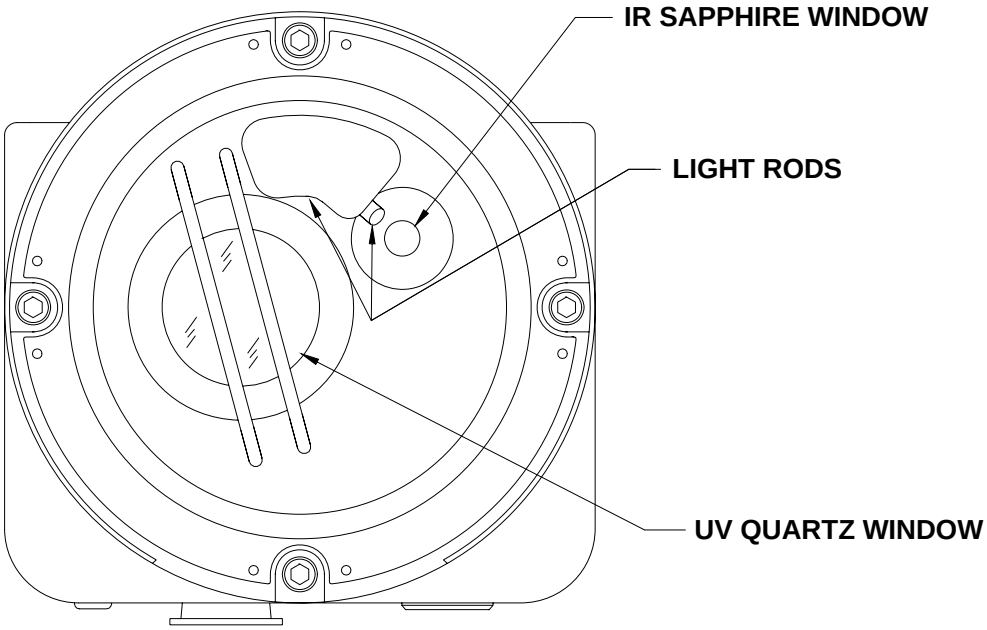


Figure 21: UV and IR Windows

6.3 Sensitivity Check

To verify that each detector is functioning correctly, a General Monitors Test Lamp and/or the ALARM TEST function should be used. For the Model FL3100 (UV/IR) the General Monitors Model TL103 Test Lamp is recommended. For the Model FL3101 (UV only) the General Monitors Model TL100 Test Lamp is recommended.

6.3.1 Alarm Test

The Models FL3100 and FL3101 Flame Detectors have a built-in Alarm Test feature. By connecting one contact of a SPST momentary switch to TB1 position 4 and the other contact to DC COM TB1, position 9 and 10 (Section 3.3.1), the user can test the alarm outputs of the Flame Detector by activating this switch for one to eight seconds depending on the Alarm Time Delay Setting.

If the Flame Detector detects these sources, it will immediately go into WARN and then into the time delayed ALARM. After one to eight seconds the Flame Detector will reset the non-latching WARN and/or ALARM. A latching WARN and/or ALARM will remain latched until manually

reset. If the Flame Detector does not respond to the sources, it will output a FAULT condition and will retest every ten seconds, as in the COPM FAULT case.

6.3.2 TL100 UV Test Lamp

The General Monitors TL100 Test Lamp is a portable, rechargeable source of ultra-violet radiation, specifically designed for use in testing UV flame detection systems. It emits a wide band of radiation and specifically covers the 185 to 260-nanometer region, which corresponds with the response of most ultraviolet flame detectors.

The Test Lamp is CSA certified intrinsically safe for Class I, Division 1, Groups C and D and therefore does not require an explosion-proof housing.

To avoid damaging exposure to ultraviolet radiation, the TL100 provides a Power On indicator so that direct viewing is not necessary. Insert the charging plug into the receptacle. Complete recharging takes a minimum of fourteen hours.

6.3.3 TL100 Operating Instructions

The TL100 has two intensity levels, LO and HI as indicated on the rocker switch label. With the switch in the HI position, the Test Lamp is capable of activating General Monitors' UV flame detection systems at distances up to 40 feet (12 meters) from the detector. The LO switch will activate the system at distances up to 20 feet (6 meters).

To operate the Test Lamp switch, aim it directly at the detector to be tested and activate the desired intensity level. The ON LED (green) should light, indicating Power On and the Low Battery LED (red) should remain off, indicating a sufficient charge for normal operation. The response of the system will depend on the distance from the detector, as well as the sensitivity and/or time-delay settings at the control module. If the system is operating normally, it will respond immediately upon activating the TL100. If the TL100 remains ON for the time period set by the Time Delay adjustment, the flame detector and the control module will go into ALARM.

If the low battery LED (red) is illuminated, the batteries are nearing discharge; however, there is a built-in battery reserve of approximately 15 minutes. It is recommended that the batteries be recharged as soon as possible after this period. Do not allow the unit to remain in a discharged state.

NOTE: Recharging the TL100 must be done in a non-hazardous area. Recharging the batteries is required whenever the Low Battery LED (red) is illuminated. Plug the charger into a suitable outlet and insert the charging plug into the charging receptacle located on the back end of the Test Lamp. Fourteen to sixteen hours are required for a complete charge. Although overcharging for up to twenty-four hours is tolerable, it will reduce battery life and is not recommended. If the TL100 is not used for an extended period of time, it is recommended that it be charged bimonthly to prevent excessive discharge. Batteries may be recharged on an average 500 times.

6.3.4 TL103 UV/IR Test Lamp

The General Monitors TL103 Test Lamp is a battery operated, rechargeable, test source specifically designed to test General Monitors' UV, UV/IR, and Digital Frequency IR Flame Detection Systems.

It consists of a high-energy broadband radiation source, which emits sufficient energy in both the Ultraviolet and Infrared spectra to activate UV and/or IR detectors. To simulate a fire, the test lamp automatically flashes at one of three DIPswitch selectable rates.

The Model TL103, rated explosion-proof, is CSA certified for use in Class I, Division 1, Groups C and D areas.

The test lamp operates on internal lead-acid batteries which, when fully charged, will operate continuously for 25 to 30 minutes. An internal circuit will prevent operation when the batteries are low.

6.3.5 TL103 Operating Instructions

It is always important to start a series of TL103 checks with a fully charged unit. Stand within 20 feet (FL3100) or within 35 feet (FL3101) of the unit to be tested and aim the TL103 squarely into the detector face. Shaking the lamp from side to side or up and down will increase the simulation of flame flicker, and improve the response of the flame detector to the lamp.

If the system is operating normally, the detector will go into a WARNING condition after a few flashes of the Test Lamp. If the lamp remains ON for the time-delayed period of the DIPswitch setting, the detector will go into ALARM.

To conserve charge, do not operate the Test Lamp longer than is necessary to test each detector. When the battery level drops below the level required maintaining the proper intensity of the lamp, an internal low voltage circuit will shut the lamp off until the batteries have been recharged.

6.3.6 TL103 Recharging Instructions

Insert the charging plug into the receptacle. Complete recharging takes a minimum of fourteen hours. A schedule should be established and followed.

WARNING: Replace the knurled plug after charging is complete. Charging must be carried out in a non-hazardous area. The charging receptacle is located inside the housing adjacent to the ON button. To gain access, it is necessary to unscrew the gnarled plug from the body of the unit. The plug is secured to the ON button by a safety strap to keep it from being lost. It is recommended that the TL103 be kept on charge when not in use to prevent excessive battery discharge. The batteries may be charged an average of 500 times and the battery pack is replaceable.

6.4 Storage

General Monitors Flame Detectors should be stored in a clean, dry area and within the temperature and humidity ranges quoted in the Appendix, under Environmental Specifications.

When prolonged storage is anticipated, detectors should be sealed together with a desiccant into plastic bags and double wrapped for protection. They should not be subjected to shock or vibration as this may cause damage. Ideally, the detectors should remain packed in the molds as shipped by General Monitors. Insert red dust caps into vacant cable entry holes.

7.0 Trouble Shooting

7.1 Trouble Shooting

CAUTION: Component level repair must be undertaken either by General Monitors' personnel or by competent authorized service engineers. SMT PCB repair shall only be performed at a GM facility.

7.1.1 Introduction

Included in this section is a trouble-shooting table. The information included is designed to cope with the more common faults, which occur during commissioning and operation and which are repairable by a competent operator.

Should the various actions suggested in the table fail to restore normal operation, the unit should be returned to General Monitors for repair. A complete written description of the problem should be included.

Be sure to inhibit or disconnect external alarm wiring before making any check that might send the unit into alarm, if an alarm condition will cause a problem.

NOTE: On no account should repair of the electronic circuit be undertaken by anyone other than General Monitors' personnel or authorized representative. Failure to comply with this requirement will invalidate the warranty.

PROBLEM	POSSIBLE CAUSE	CORRECTIVE ACTION
No output signal and green LED in UV window is off.	No DC Power to the Unit	Be sure the +24 VDC is applied with the correct polarity.
No output signal and green LED in UV window is rapidly blinking.	Low voltage FAULT (voltage at unit less than +18VDC).	Be sure that the unit is powered with at least +20VDC under load.
2mA signal and green LED in UV window is slowly blinking.	COPM FAULT, dirty or obscured optical path (UV or IR window)	Clean UV and IR window and associated source light rods.
Constant 8mA signal with no known radiation to detector (FL3100 only).	Background IR radiation at detector.	Cover IR portion of FL3100 for ten seconds to determine if there is background IR. If there is, remove IR Radiation source or change FL3100 location. If there is no background IR, replace IR detector in FL3100.
Constant 12mA signal with no known radiation to detector (FL3100 only).	Background UV radiation at detector.	Cover UV portion of FL3100 for ten seconds to determine if there is background UV. If there is, remove UV radiation source or change FL3100 location. If there is no background UV, replace UV

		detector tube in FL3100.
Constant 16mA or 20mA signal (WARN or ALARM) with no known radiation at detector (FL3101 only).	Background UV radiation at detector.	Cover UV portion of FL3101 for ten seconds to determine if there is background UV. If there is, remove UV radiation source or change FL3101 location. If there is no background UV, replace UV detector tube in FL3101.

Table 34: Trouble Shooting Table

8.0 Customer Support

8.1 General Monitors' Offices

Area	Phone/Fax/Email
UNITED STATES	
	Toll Free: +1-800-446-4872
Corporate Office: 26776 Simpatica Circle Lake Forest, CA 92630	Phone: +1-949-581-4464 Fax: +1-949-581-1151 Email: info@generalmonitors.com
9776 Whithorn Drive Houston, TX 77095	Phone: +1-281-855-6000 Fax: +1-281-855-3290 Email: gmhou@generalmonitors.com
UNITED KINGDOM	
Heather Close Lyme Green Business Park Macclesfield, Cheshire, United Kingdom, SK11 0LR	Phone: +44-1625-619-583 Fax: +44-1625-619-098 Email: info@generalmonitors.co.uk
IRELAND	
Ballybrit Business Park Galway, Republic of Ireland	Phone: +353-91-751175 Fax: +353-91-751317 Email: info@gmil.ie
SINGAPORE	
No. 2 Kallang Pudding Rd. #09-16 Mactech Building Singapore 349307	Phone: +65-6-748-3488 Fax: +65-6-748-1911 Email: genmon@gmpacifica.com.sg
MIDDLE EAST	
LOB12, #G20 P.O. Box 61209 Jebel Ali, Dubai United Arab Emirates	Phone: +971-4-8815751 Fax: +971-4-8817927 Email: gmme@emirates.net.ae

Table 35: GM Locations

8.2 Other Sources of Help

General Monitors provides extensive documentation, white papers, and product literature for the company's complete line of safety products, many of which can be used in combination with the FL4000. Many of these documents are available online at the General Monitors website at http://www.generalmonitors.com.

9.0 Appendix

9.1 Warranty

General Monitors warrants the Models FL3100 and FL3101 to be free from defects in workmanship or material under normal use and service within two years from the date of shipment.

General Monitors will repair or replace without charge any such equipment found to be defective during the warranty period. Full determination of the nature of, and responsibility for, defective or damaged equipment will be made by General Monitors' personnel.

Defective or damaged equipment must be shipped to General Monitors' plant or representative from which the original shipment was made. In all cases this warranty is limited to the cost of the equipment supplied by General Monitors. The customer will assume all liability for the misuse of this equipment by its employees or other personnel.

All warranties are contingent upon proper use in the application for which the product was intended and does not cover products which have been modified or repaired without General Monitors' approval, or which have been subjected to neglect, accident, improper installation or application, or on which the original identification marks have been removed or altered.

Except for the express warranty stated above, General Monitors disclaims all warranties with regard to the products sold, including all implied warranties of merchantability and fitness and the express warranties stated herein are in lieu of all obligations or liabilities on the part of General Monitors for damages including, but not limited to, consequential damages arising out of, or in connection with, the performance of the product.

9.2 Principle of Operation

9.2.1 UV Detector - FL3100 & FL3101

The Model FL3101 is a Flame Detector, which contains an ultraviolet phototube that responds to Ultra-Violet (UV) radiation in the 185 to 260 nanometer region (Figure 22). When radiation from a flame reaches the cathode plate within the UV detector tube, electrons are ejected from the cathode plate. These electrons are accelerated towards the positively charged anode of the tube. They collide with molecules of an ionizable gas, with which the tube is filled. This emits more electrons and produces an avalanche condition. More electrons are released which creates a momentary electron flow from the cathode to the anode. This momentary current (pulse) recurs at a rate proportional to the intensity of the UV radiation.

The Model FL3101 UV Flame Detector processes these UV pulses with a microcomputer and produces the following outputs:

- 4 to 20 Milliampere (mA) signal
- Immediate WARN relay contacts
- Time delayed ALARM relay contacts
- FAULT relay contacts

- RS-485 MODBUS RTU output
- Optional: Redundant RS-485 MODBUS RTU output

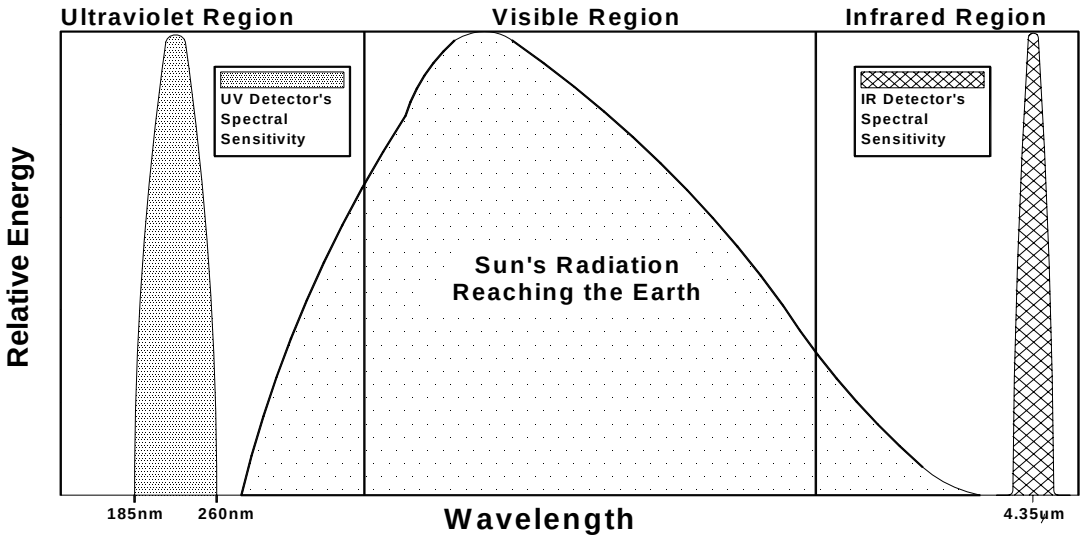


Figure 22: Spectral Response of UV and IR Detectors

(See Sections 3.0 and 5.2 for more information on detector outputs.)

9.1.2 UV/IR Flame Detector - FL3100

The Model FL3100 is a discriminating UV/IR Detector, which makes use of an ultraviolet radiation sensitive phototube in addition to an infrared detector. This combination provides a flame detection system, which is highly immune to false alarms.

The UV portion of the detector, as described in UV Detector, is combined with an infrared detector, which responds to changes in the intensity of infrared radiation. By sensing very specific wavelengths in both the UV and IR spectra (Figure 22) and then processing these signals with a microcomputer, a very high degree of discrimination is achieved.

Incorporated in the IR circuitry is a flicker discrimination circuit. This permits the detector to ignore steady IR sources such as hot objects. The inherent flickering of a flame provides the necessary modulation to activate the IR circuit.

Since a flame is a copious source of both ultraviolet and infrared radiation, discrimination is provided when both UV and IR emissions are detected. If only UV is detected, as in the case of arc welding, no alarm is given. If only IR is detected, such as a large modulating hot object, no alarm is given. However, if both conditions are met in the correct combination and intensity, as determined by an algorithm in the microcomputer, a fire is identified and the alarm outputs are activated.

9.1.3 COPM Circuitry

A self-testing feature called Continuous Optical Path Monitoring (COPM) checks the optical path, the detector(s), and the related electronic circuitry once every minute. If foreign material

impairs the optical path of the UV detector tube (both Models FL3100 and FL3101) or the infrared detector (Model FL3100 only) for two consecutive checks, the unit will indicate FAULT. The optical FAULT outputs are a 2.0mA signal, de-energizing of the FAULT relay, and RS-485 output signal (Section 3.3.1). After a COPM FAULT, a COPM check is performed every 7 - 8 seconds until the fault condition is removed. Then the COPM check will resume a once per minute check.

WARNING: Dirty or partially blocked windows can significantly reduce the detector's field of view and detection distance.

NOTE: Since the optical path is checked once per minute and it requires two check failures to produce a FAULT, it may take up to two minutes for the unit to detect an obstruction.

9.1.4 Alarm Test

The Models FL3100 and FL3101 Flame Detectors have a built-in Alarm Test feature. By connecting one contact of a SPDT momentary switch to TB1 position 4 and the other contact to DC COM TB1, position 9 and 10 (Section 3.3.1), the user can test the alarm outputs of the Flame Detector by activating this switch for one to eight seconds depending on the Alarm Time Delay Setting.

If the Flame Detector detects these sources, it will immediately go into WARN and then into the time delayed ALARM. After one to eight seconds the Flame Detector will reset the non-latching WARN and/or ALARM. A latching WARN and/or ALARM will remain latched until manually reset. If the Flame Detector does not respond to the sources, it will output a FAULT condition and will retest every ten seconds, as in the COPM FAULT case.

9.1.5 Visual Indicators

Two light emitting diodes (LED's) are visible through the UV window (the larger window). LED's are provided for a visual indication that corresponds with the detectors outputs. The following blinking sequence indicates the operation condition:

- Timeout (10 seconds when the unit is first powered) - Green and red LED's blinking alternately
- Ready - Green LED that flashes off 1 second, every 10 seconds
- WARNING - Slow blinking red LED with green LED on steady
- ALARM - Fast blinking red LED with green LED on steady
- COPM FAULT - Slow blinking green LED
- Low Voltage FAULT/Shorted Reset Switch - Fast blinking green LED

9.3 Specifications

9.3.1 System Specifications

Application:	FL3100	UV/IR Flame Detection
	FL3101	UV Flame Detection
Detector Location:	Class I, Division 1 & 2, Groups B, C & D;	
(FL3100/FL3101)	Class II, Groups E, F & G; Class III	
	EExd, IIB, T6	
Waterproof:	Type 4x, IP66/7	
UV Detector Pass Band:	(Figure 22) 185 to 260 nanometers	
IR Detector center wavelength:	(Figure 22) 4.35 microns	
Typical Alarm Activation	FL3100	< 3 sec. @ 50 ft. (15.2m)
Response Times*:	FL3101	< 1 sec. @ 50 ft. (15.2m)
Minimum Detector Response	FL3100	< 500 ms.
Times:	FL3101	< 100 ms.
Zeta Value:	Zeta = -0.001(The margin of error in the range measurement is estimated at +/- 5 feet due to wind conditions and flame turbulence	
Field of View*:	(Figure 3-A)	
	FL3100	120° maximum conical
	FL3101	140° maximum conical

NOTE*: Response Times and Field of View data have been derived by testing the Models FL3100/FL3101 Flame Detectors with a 1 square foot gasoline fire. One cup of unleaded gasoline on top of a one-inch layer of water was ignited for each test. These are typical values and different results may occur depending on the variation of each fire.

Sensitivity:	50 feet (15.2m); Maximum distance for a 1 square foot (.093m^2) gasoline fire to be reliably detected. (For settings see Section 4.4 User Selectable Options/Factory Defaults). If need to detect fires at distances over 50 feet, contact General Monitors directly for more information.
Maximum Cable Parameters:	**Output Signal:** 9000 feet (2750m), maximum 50 Ohms loop, with maximum 250 Ohms input impedance of readout unit. **Remote power supply:** 3000 feet (930 m), maximum 20 Ohms loop and 24VDC minimum. (See Section 3.3 Terminal Connections)
Warranty:	Two Years

9.3.2 Mechanical Specifications

Enclosure Material:	Aluminum (AL) A-356, Stainless Steel (SS): Natural 316
Color:	Aluminum Red
Finish:	Aluminum: Chemical Film per MIL-C-5541, Epoxy Powder Coated
Height:	6.0 in (15.2cm)

Width:	6.0 in	(15.2cm)
Depth:	5.5 in	(14.0cm)
Weight:	5 lbs	(2.3 kg) AL
	16 lbs	(7.3 kg) SS

Cable Entry: 2 x 25mm ISO or 2 x PG 13.5 or 2 x 20mm ISO or 2 x ¾" NPT.
Each unit has an Exd approved stopping plug installed, plus Red Dust cap. Dust caps must be replaced by Exd IIB Approved cable glands and **must not** be left on the unit when powered up.

Cable Requirements: Screened or Screened and armored to BS5308 Part 2, Type 2 or equivalent. Note that terms Screen and Shield are identical in this case.

9.3.3 Electrical Specifications

European Union (EU) Approved Applications: PSU noise and ripple voltage 1.0Vpp max. The customer supplied PSU must comply with IEC 1010-1, limiting current to 8A under Fault conditions, in order to comply with CE Marking requirements.

Nominal supply voltage:	24VDC
Supply voltage range:	20 to 36VDC
Maximum supply current:	150mA
Maximum output signal load:	600 Ohms
Output signal range:	0 to 20mA
FAULT signal:	0 to 0.2mA
COPM fault signal:	2.0 ± 0.2mA
Ready signal:	4.0 ± 0.2mA
IR only signal (FL3100 only):	8.0 ± 0.2mA
UV only signal (FL3100 only):	12.0 ± 0.2mA
WARN signal:	16.0 ± 0.2mA
ALARM signal:	20.0 ± 0.2mA
Relay Contact Ratings:	*North American Approved Applications:* SPDT, 8A, @ 250VAC, or 8A @ 30 VDC resistive max. *European Union (EU) Approved Applications:* SPDT, 8A 30V RMS/42.4V Peak, 8A @ 30 VDC, resistive max.
RS-485 Output:	MODBUS RTU 128 units in series max. (247 units with repeaters) Baud Rate: 2400, 4800, 9600 or 19200 BPS Optional: Dual MODBUS RTU Communications available (See Section 3.3 Terminal Connections, for Alarm Output Connections)
RFI/EMI Protection:	Complies with EN50081-2, EN50082-2
Status Indicator:	Two LEDs indicate status, fault and alarm conditions

9.3.4 Environmental Specifications

Operating temperature range:	-40°F to 184°F (-40°C to 85°C)
Storage temperature range:	-40°F to 184°F (-40°C to 85°C)
Humidity range:	0 to 100% RH non-condensing
MODBUS RTU Protocol:	For detailed information on addressing, baud rate, data format, read commands, write commands, register details, register locations, refer to the Appendix.

9.4 Approvals

CSA, FM, ATEX & CE Marking.

9.5 Accessories

9.5.1 Mounting Swivel/Union

A mounting swivel and union are available to connect ¾" conduit into the base of the Model FL3100/FL3101. The swivel design allows for optical alignment adjustments for the Models FL3100 and FL3101 when using rigid conduit.

NOTE: Swivel is only rated for Class I, Division 1 and 2, Group C & D areas. For Group B areas, use mounting bracket. Swivel is not approved for CENELEC requirements.

9.5.2 Mounting Bracket

A mounting bracket is available to mount the FL3100/FL3101 to a wall, pole, etc. The mounting bracket design allows for optical alignment adjustments for the Models FL3100 and FL3101 when installed to a fixed installation.

9.5.3 Optical Air Guard

An optical air guard is available for applications such as paint spray booths, which require a method to keep detector optics clean. The air guard mounts at the front of the FL3100/FL3101 and has a connection for shop air. The air, when turned on, creates an air wall to keep optics clean.

9.6 Storage

The Flame Detectors should be stored in a clean, dry area and within the temperature and humidity ranges quoted in Section 9.3.4.

9.7 Final Assembly

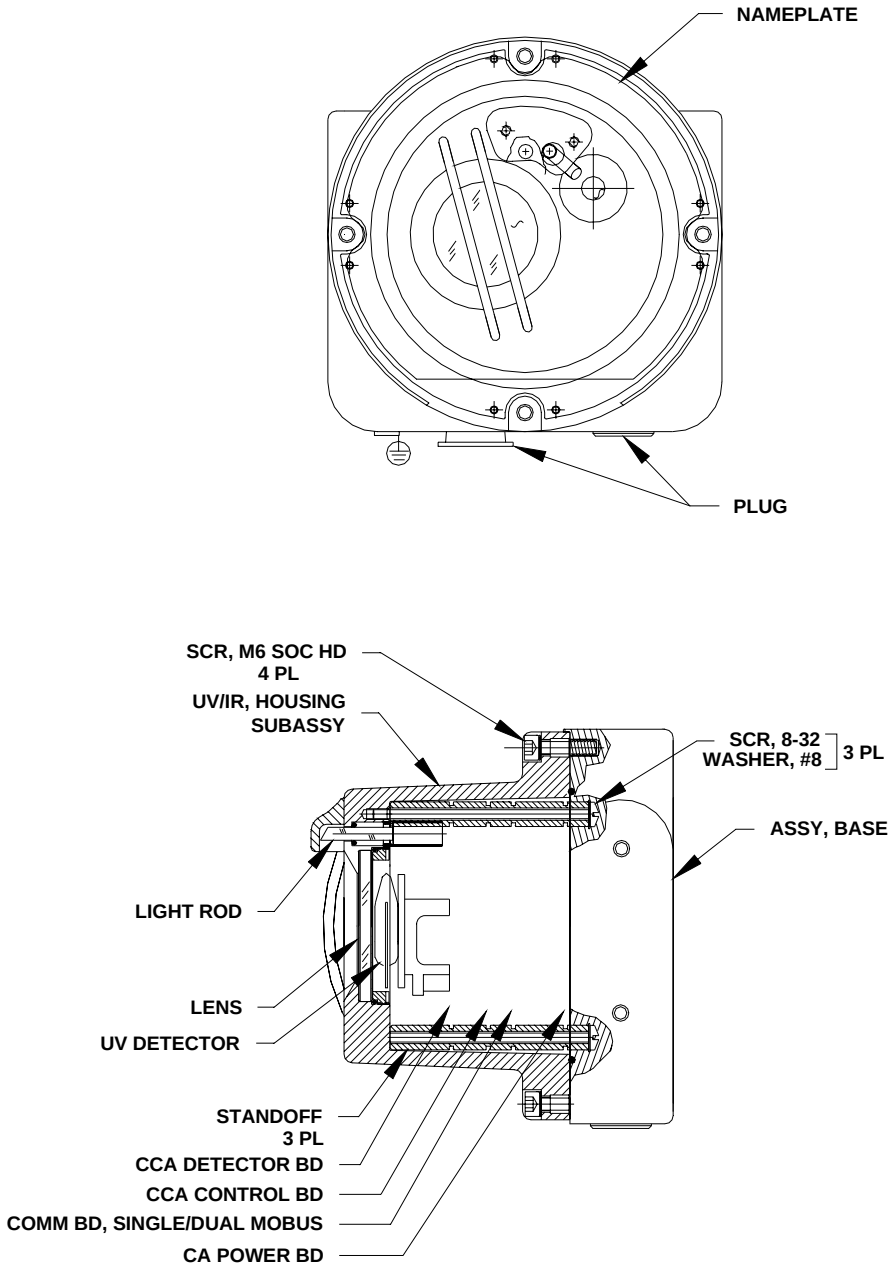


Figure 23: 71100 FL3100 (UV/IR), Final Assembly

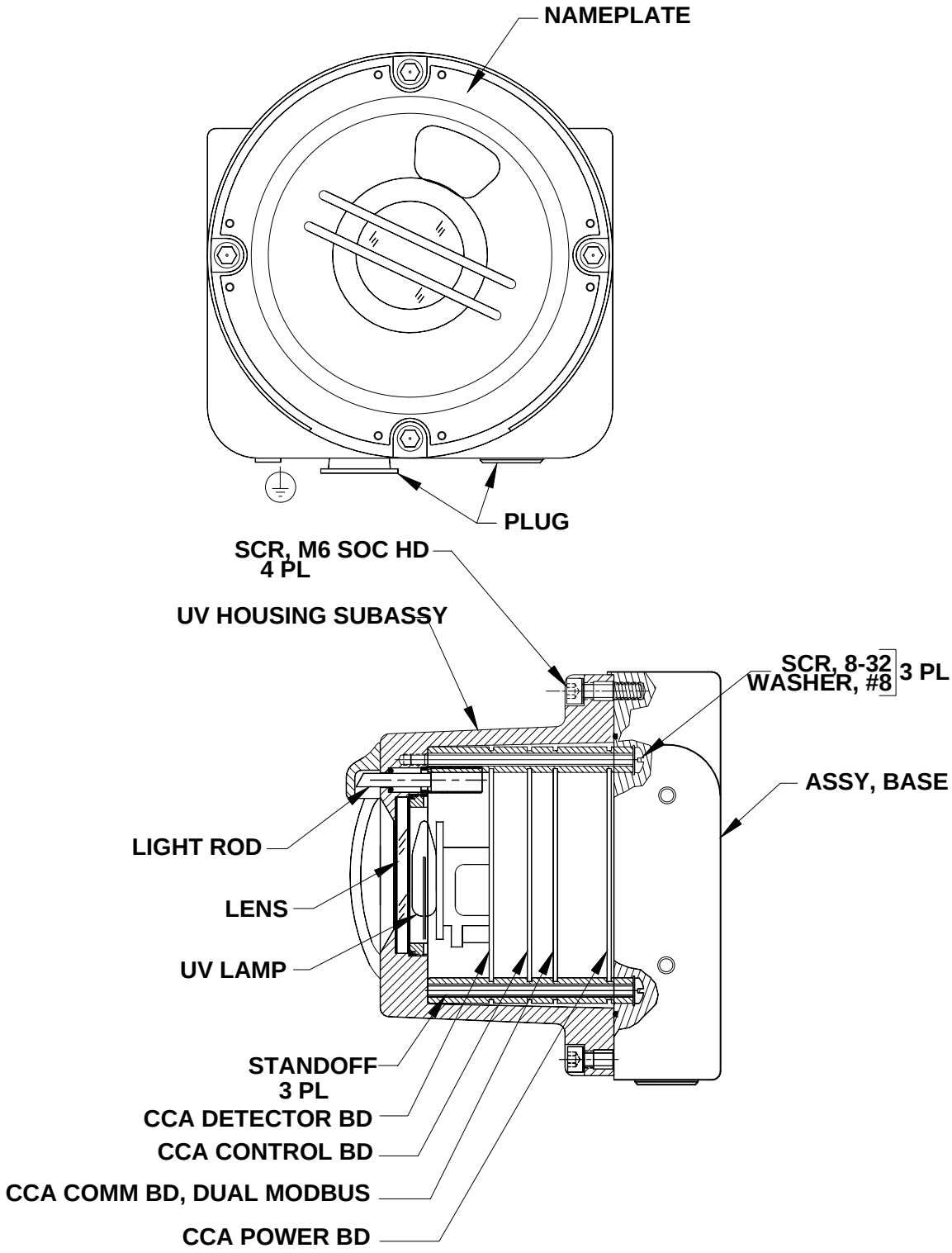


Figure 24: 71125 FL3101 (UV), Final Assembly

ADDENDUM

Product Disposal Considerations

This product may contain hazardous and/or toxic substances.

EU Member states shall dispose according to WEEE regulations. For further General Monitors' product WEEE disposal information please visit:
www.generalmonitors.com/customer_support/faq_general.html

All other countries or states: please dispose of in accordance with existing federal, state and local environmental control regulations.

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