

MODEL 3100-XX
FLAME DETECTOR



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MODEL 3100-XX

Flame Detector

APPLICABILITY & EFFECTIVITY

This manual provides instructions for the following Sierra Monitor products:

| <u>Model</u> | <u>Description</u> |
|--------------|--|
| 3100-01 | Flame Detector - Standard |
| 3100-02 | Flame Detector - Enhanced Relay |
| 3100-03 | Flame Detector - Enhanced Relay |
| 3100-04 | Flame Detector - Enhanced Relay |
| 3100-05 | Flame Detector - Enhanced Relay |
| 3100-06 | Flame Detector - Flame Detector - 4-20mA |

The instructions are effective for the above models as of March 1, 1997

Instruction Manual Part Number: T15007
Rev. C2

Applicability & Effectivity

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1. PRODUCT DESCRIPTION

1.1 Introduction

All versions of the Model 3100 Flame Detector Series utilize Ultraviolet, Infrared and Visible spectrum to provide continuous and reliable flame detection. The microprocessor in the Model 3100 is configured with state-of-the-art fire algorithms and continuously analyzes the data from the sensor array for individual intensity values, change of intensity values, relationship of intensity values and frequency signature correlations. Each algorithm is designed to recognize a different type of flame signature from the detectors while rejecting common false sources. When the conditions of any one of the several fire algorithms are met the Model 3100 declares a fire.

1.2 Fault Diagnostics

The micro-processor is also continuously performing system tests looking for any faults which would impair its ability to accurately detect a flame and declare an alarm. The systems being tested include: input power, sensor circuits, relay circuits, and several other internal systems. The Model 3100 Flame Detector also performs a through the lens test of the sensor and lens systems. All faults are recorded in non-volatile memory and may be retrieved by a trained technician.

1.3 Configuration

The Model 3100-01 has a Fire Relay and a Fault Relay which may be connected as normally open or normally closed contacts. Models 3100-02, -03, -04, and -05 have in addition to the Fire and Faults relays a Fire Verify system and an Auxiliary Fault system. The Fire Verify system adds a “field adjustable” level of certainty to the declaration of a verified fire. The Auxiliary Fault system will activate the Aux. Relay for the Lens Test fault. This allows a separate indication for the most common fault (a dirty lens). A technician can know immediately what is wrong and how to fix it (i.e. wipe the lens) without reading codes, consulting manuals, or wading through a process of complex diagnostics. The 3100-06 has an industry standard 4-20 mA output and no relays.

The Model 3100 detector is mounted in a NEMA 4X explosion proof housing, rated for Class I Division 1 & 2 Groups B, C, D, Class II Division 1 & 2 Groups E, F, G, and Class III locations. The electronics are mounted inside an aluminum cup to protect the electronics during installation. All switch settings and indicators are located on the front of the Model 3100 detector module allowing field adjustments to be made without removing the detector module from the housing.

Each Model 3100 detector is calibrated and tested to respond to a 1 square foot Kerosene fire at 80 feet with a Field-of-View of 120°. The Model 3100 detector has four sensitivity settings and six verify levels.

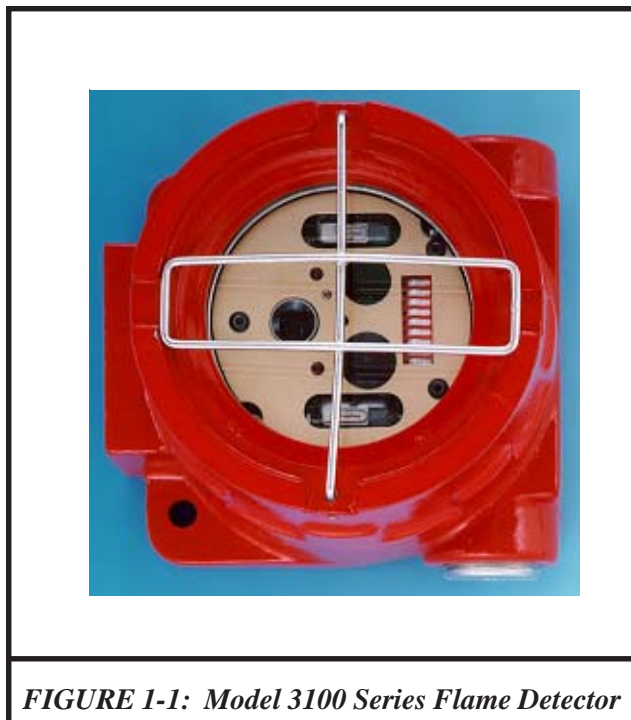


FIGURE 1-1: Model 3100 Series Flame Detector

| Model | Fire Relay | Fault Relay | Verify Relay | Aux. Relay |
|----------------------|---------------------|-------------|--------------|------------|
| 3100-01 | X | X | None | None |
| 3100-02 | X | X | N/O | N/C |
| 3100-03 | X | X | N/C | N/O |
| 3100-04 | X | X | N/O | N/O |
| 3100-05 | X | X | N/C | N/C |
| 3100-06 | 4-20 mA signal only | | | |
| Models and Functions | | | | |

2. OPERATION

2.1 General

When the Model 3100 Flame Detector is powered up, the microprocessor checks the configuration switch settings and configures the detector. The microprocessor then runs a full series of self tests. After the self test process is complete and all tests are passed, the detector is ready to detect a fire.

All modes of operation are indicated by two LEDs located on the front of the detector. Normal Mode is indicated by a brief flash of the LEDs every 8 seconds. With the device in Normal Mode it is constantly monitoring the environment and ready to detect a fire.

When a fire is detected the flame detector will activate the Fire Relay and turn on both LEDs. If the device is configured for "Latching" Mode the device will remain in Alarm Mode until power is removed. In "Fire Following" Mode the Fire Relay will reset when the Fire Probability Algorithm determines there is no longer a fire.

The self test system is continuously monitoring the internal systems. When a fault is detected the Fault Relay is de-energized. In Fault Mode the LEDs

will flash a code indicating the type of fault. A fault indication may mean the device is unable to detect a fire or that a device has become unreliable. (i.e. a "Voltage Low" fault) For most faults the detector will return to Normal Mode when the fault condition is corrected.

The Model 3100 Series comes in several versions. The basic version 3100-01 does not have the Verify or the Auxiliary Relay systems. The enhanced Models 3100-02, -03, -04 and -05 have the Verify and Auxiliary Relay systems. These versions represent the different configurations (Normally Open or Closed contacts) of the Verify and Auxiliary Relays. The Auxiliary Relay provides a separate relay output for the Lens Test Fault. The Verify system is activated when a fire is declared. A Verified Fire is declared when the conditions of the Verify Fire Algorithm are met. All other functions are the same as the basic Model 3100-01.

The 3100-06 does not have relay outputs. It uses a 4-20 mA current circuit. The detector's status determines the amount of current flow through the circuit.

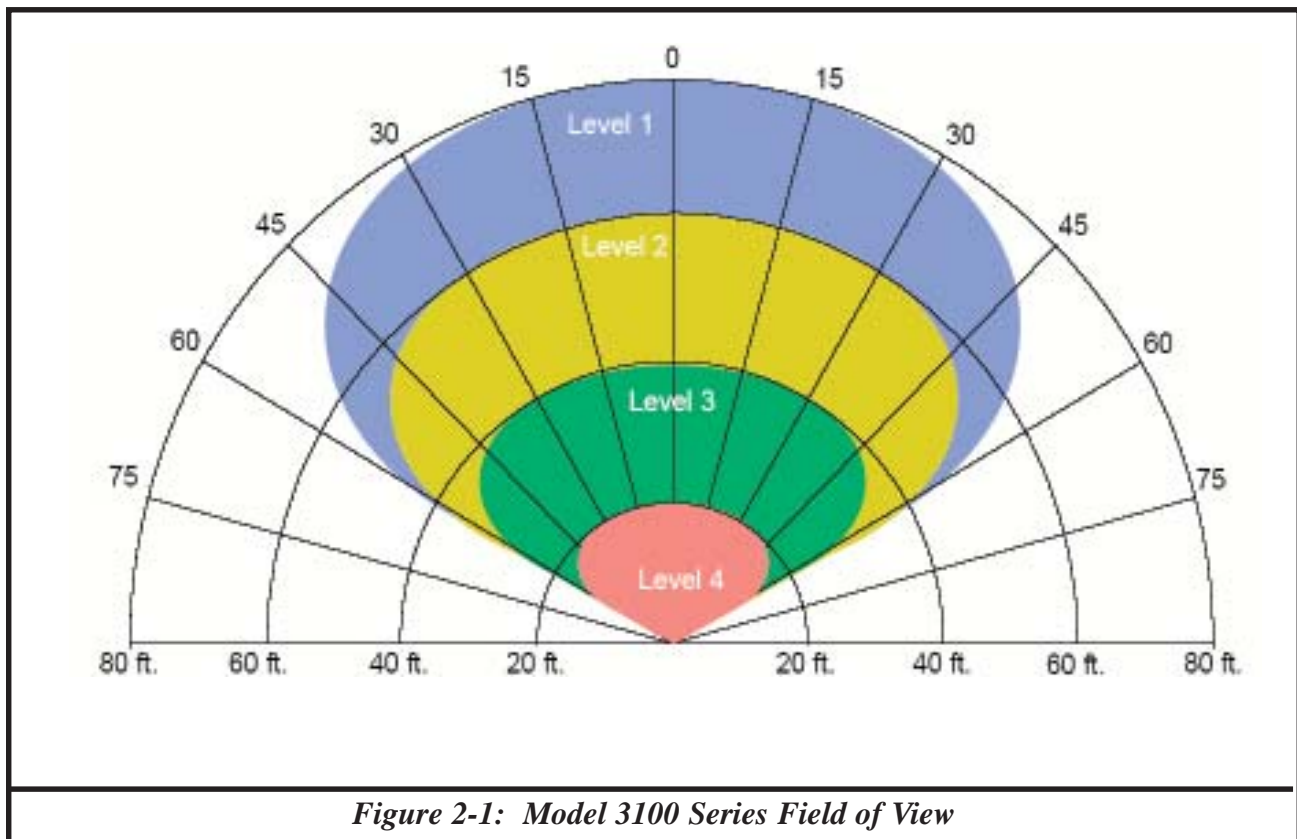


Figure 2-1: Model 3100 Series Field of View

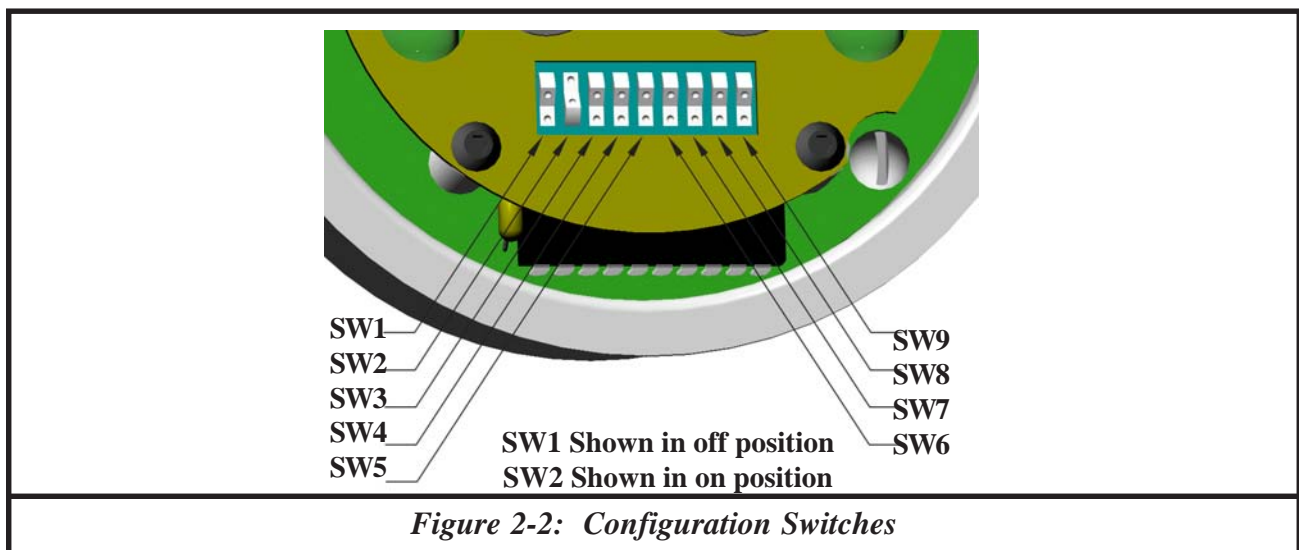


Figure 2-2: Configuration Switches

2.2 Field-of-View (See Figure 2-1)

Optical Flame Detectors must be able to “see” the fire to declare an alarm. Any obstruction between the detector and the threat area will impair the detectors ability to cover the threat area. An obstruction is anything that is not transparent to the sensor elements of the detector. UV sensors and some types of IR sensors cannot see through glass or plastics. The 3100 series of Flame Detectors has a 120° Field of View.

When covering a large area the detectors should be located to provide overlapping fields of view to insure complete coverage.

2.3 Range

The size of fire and type of materials which constitute the threat will affect the detector’s range. Different materials produce different amounts of the radiant energy used by the detector to “see” the fire. Also, the range of the detector is a function of the fire size. Using the square of the distance rule, if the device will detect a one sq. ft. fire at 60 feet, to detect a 1/4 size fire (aprox. 6 sq. in.) the devices must be within 30 feet. The Model 3100 Detector is optimized to a 1 sq. ft. Kerosene fire at 80 feet with the sensitivity settings set to maximum sensitivity.

2.4 Environment

All optical flame detectors sense radiant energy at some frequency or frequencies within their Field-of-View. Any source which radiates energy at the same frequency or frequencies used by the detector

to sense a fire may impact the detector’s ability to “see” the fire. Care should be taken to minimize radiant energy sources within the detectors Field-of-View. Because of the variety of environments and conditions, a factory trained technician or qualified P.E. should be consulted before deciding on the location of devices. The Model 3100 Detector uses an Ultraviolet sensor (180 - 260 nanometers), an Infrared sensor (.715 - 3.5 microns), and a Visible sensor (480 - 560 nanometers).

2.5 Configuration (See Figure 2-2)

All of the 3100 Series models have field adjustable configuration switches located on the front face of the detector. The factory settings are shown in *italic* text. The enhanced models have additional configuration options for the Verified Fire.

2.5.1 Sensitivity

All versions have several sensitivity settings available. The sensitivity settings are 20, 40, 60, and 80 feet. Each setting is optimized to alarm on a 1 sq. ft. Kerosene fire within 5 seconds. Switches 1 and 2 control the sensitivity. *The factory default is 80 feet. (SW1 and SW2 are off.)*

Note: Different fuels emit energy at different rates. For example; a fire involving fuel oil does not emit energy at the same rate as gasoline. Consequently, the Model 3100 will be able to respond to a gasoline fire at a little greater distance than it will to a fuel oil fire. Similarly, a fire involving acetone will be seen at a greater distance than one involving gasoline.

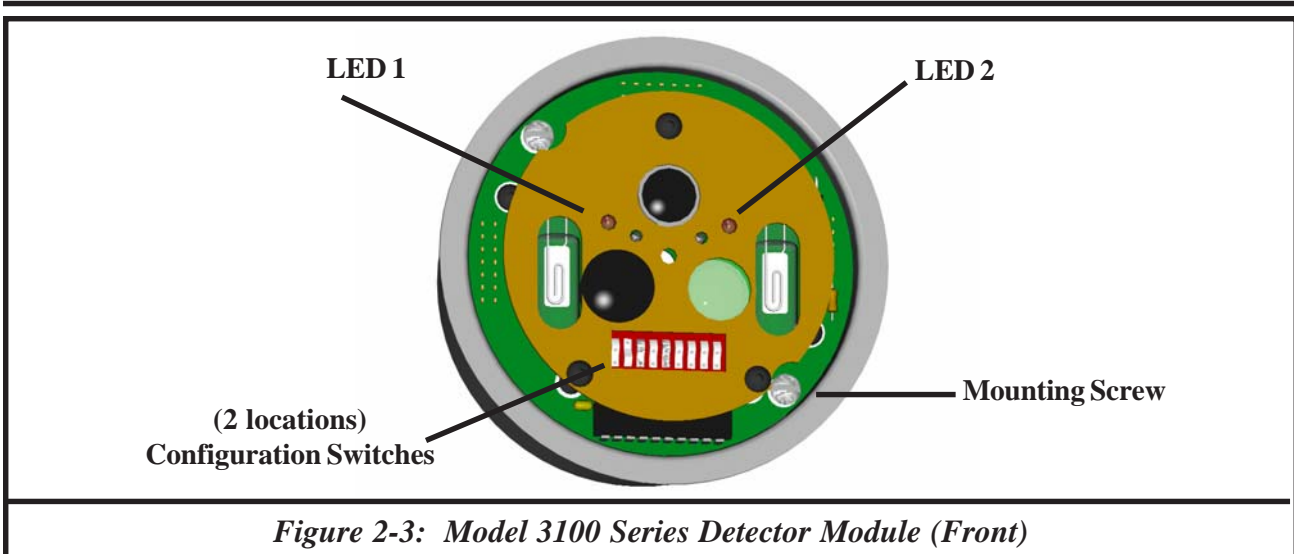


Figure 2-3: Model 3100 Series Detector Module (Front)

2.5.2 Verify Control

The Enhanced Model 3100-02, -03, -04, -05 and -06 have the Verified Fire function. The Verify Control switches allow the user to select the verify level, disable the verify function, or make the Verify Relay operate in parallel with the Fire Relay. The verify function is enabled when the detector declares an alarm. The verify level sets the degree of certainty required to declare a verified fire. The lowest level (1) is the lowest certainty (fastest) and the highest level (6) is the greatest certainty (slowest) of a fire. The verify function enables an algorithm which evaluates the fire signature over time to determine the degree of certainty. When the degree of certainty exceeds the level set by the configuration switches a Verified Fire is declared and the Verify Relay is energized. Switches 3, 4, and 5 control the verify function. *The factory default is verify disabled and set to level 0. (SW3, SW4 and SW5 are off.)*

2.5.3 Latching Control

The latching controls allow the detector or individual relay outputs to be set to "Latching" or "Fire Following". "Latching" causes the relay to stay energized until power is removed from the detector. "Non-latching" allows the relay to reset (de-energize) when a flame is not present for a short period of time.

For the detector to be set to "Non-latching" both Fire Output and Verify Output must be set to "Non-latching". If either the fire out-

put or the verify output is set to "Latching" then the detector will be set to "Latching".

When the detector is set to "Latching" the LED's will indicate an alarm until the device is reset regardless of the fire or verify relay output settings.

The Verify Relay is automatically configured as "Latching" if the Fire Relay is set to "Latching". SW6 sets the Fire Relay Output, SW7 sets the Verify Relay Output and SW8 sets the Detector Mode. To set the detector to "Non-latching", SW6, SW7 and SW8 must be set to "Non-latching". *The factory defaults are "Latching" (SW6 and SW7 are off.)*

2.5.4 Other Configuration Switches

The last configuration switch (SW9) must be in the off position. *The factory default setting is off.*

2.6 LED operation (See Figure 2-3)

The status of all versions of the flame detectors can be determined from the LEDs located behind the lens on the front of the detector. The LEDs will flash at intervals or remain on to indicate the detectors status. (Fault Mode, Normal Mode, Alarm Mode, Verified Fire Mode, and on power up the Configuration Settings).

2.6.1 Power Up

At power up all versions of the flame detector will begin flashing the LEDs. The LEDs will flash 8 consecutive patterns which indicates the positions of the configuration switches. Each pattern indicates the position

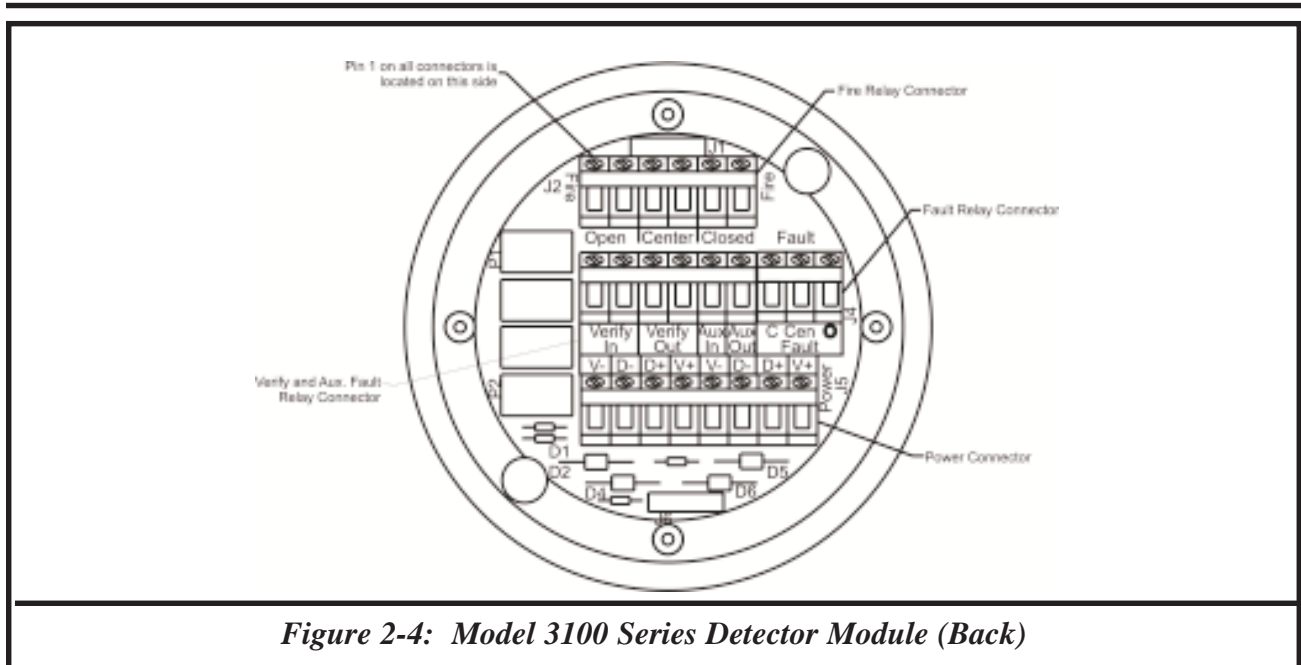


Figure 2-4: Model 3100 Series Detector Module (Back)

“on” or “off”) of a switch (SW1-SW8). The first flash pattern indicates the position of the first switch (SW1), with each consecutive flash indicating the position of the next switch in order. The flash pattern is as follows: only one LED “on” indicates a switch in the “off” position, both LEDs “on” indicates a switch in the “on” position. The position of SW9 is not indicated. If SW9 is in the “on” position the detector will power up in fault mode.

2.6.2 Normal

In Normal Mode the LEDs will flash briefly every 8 seconds. Whenever the device is in any other mode the “flash every 8 seconds” is suspended until the detector returns to Normal Mode.

2.6.3 Fire

When any version of the Model 3100 declares a fire, both LEDs will come “on” and stay “on”. If the detector is set to “Latching” the LED's will remain “on” and stay “on” until the detector is powered down. If the detector is set to “Non-latching” the LED's will reset to “Normal Mode” when the fire is no longer being detected. If the Verified Fire is declared (Verify Fire is only on the Enhanced Models) the LEDs will blink “off” briefly every second. If the detector is set to “Latching” the LED's will remain in this state until the detector is powered down.

2.6.4 Fault

When the detector has power and is in Fault Mode LED1 (the left LED when facing the detector with the configuration switches below the LEDs) will be on for 5 seconds while the LED2 (the right LED) will be off see Table B.4 on page 12. The LED will turn “off” and LED 2 will begin flashing 1/2 seconds “on” and 1/2 second “off” a number of times. The number of times LED2 flashes indicates the type of fault. This cycle is repeated until the fault is corrected. Only the highest number fault is indicated. Once a fault is corrected the next highest level fault will be indicated until all faults are cured. Except for fault level 2 and 3, a fire indication will override a fault indication. The detector is disabled if a fault 2 or 3 is indicated.

2.7 Relay operation (See Figure 2-4)

The Model 3100-01 has two relays, the enhanced Models 3100-02, -03, -04 and -05 have four relays. The function of the Fire and Fault Relays is the same on all models. The Verify Relay and Aux. Relay is only available on the enhanced models. All relay connections are made at the connectors located on the back of the flame detector module.

2.7.1 Fire Relay

The Fire Relay will energize whenever the detector declares a fire. Depending on the configuration setting, the relay will: “Latch-

ing” - remain energized until power is removed, “Fire Following” - de-energize a short time after the fire is no longer detected. The “J2” connector provides connections for both normally open contacts and normally closed contacts on the Fire Relay.

2.7.2 Fault Relay

The Fault Relay is a normally energized relay. It will de-energize when a Fault occurs. This means the detectors Fault Relay is in the “Fault” state when the detector has no power, and remains in the “Fault” state until the detector is powered up and operating normally. The “J4” connector provides both normally open contacts and normally closed contact on the Fault Relay.

2.7.3 Verify Relay

The Verify Relay will energize when a “Verified Fire” is declared. Depending on the configuration the relay will: “Latching” - remain energized until power is removed, “Fire Following” - de-energize a short time after the fire is no longer detected. Further, the “Verify Control” configured to Level 0 will disable the Verify Relay, and Level 7 causes the Verify Relay to operate in parallel with the Fire Relay. The connector labeled “Verify In” and “Verify Out” provides connections for normally open contacts on the 3100-02 and 3100-04 or normally closed contacts on the 3100-03 and 3100-05. The configuration of Normally Open or Normally Closed contacts is fixed and can only be changed by the factory.

2.7.4 Auxiliary Fault

The Aux. Relay is energized whenever the detector fails the “Lens Check” test. This fault indicates the detectors inability to “see” a fire. Normally, cleaning the lens will clear this fault. Because a dirty lens is the most common type of fault, a separate indicator connected to this relay will simplify maintenance. The connector labeled “Aux In” and “Aux Out” provides connections for Normally Open contacts on the 3100-03 and 3100-04 models or Normally Closed contacts on the

3100-02 and 3100-05 models. The configuration of Normally Open or Normally Closed contacts is fixed and can only be changed by the factory.

2.7.5 4-20 mA Operation

The 3100-06 uses a 4 to 20 mA current draw circuit to indicate Fault, Fire, Verify Fire and Normal Mode. The current draws are as follows:

| | |
|--------------|-------|
| Fault Mode: | 0 mA |
| Normal Mode: | 4 mA |
| Alarm Mode: | 12 mA |
| Verify Mode: | 20 mA |

The 4-20 circuit is connected across the J2 connector at contact 6 and 7 where connection 6 is the negative side and connection 7 is the positive side. Additionally, a jumper between contacts 7 and 8 must be made.

3.0 INSTALLATION

3.1 General Precautions

All wiring and installation must be done in accordance with the NFPA 70 and 72 standards and must comply with any codes specific to the application or location. Contact the local authority having jurisdiction and the company safety engineer for information on codes which may apply.

3.2 Housing and Conduit

3.2.1 Mounting the Housing

The housing is mounted by using the two 0.3" diameter holes located in ears on the back of the housing. The two conduit holes located on the side of the housing are not to be used for mounting. The detector should be mounted securely to a flat surface. The mounting location must be strong enough to support the detectors 3 lb. weight. Although the detector is not vibration sensitive the detector should not be exposed to excessive vibration. "(The detector has been tested to meet the vibration standard set in FM's Approval Standard Class 3820, Sept. 1979. (.022" displacement, 10 Hz to 30 Hz sweep cycled at 2 cpm for 4 hours)"

3.2.2 Installing the Conduit and Wiring

Mount a "Seal Off" at the housing into the 3/4" NPT conduit(s) located on either side of the housing. Connect the conduit to the "Seal Off". If one of the conduit openings is not used insert a sealing plug into the unused opening. Run the wires through the conduit, "Seal Off", and into the housing. The ends of the wire should extend several inches (at least 2" to 4") beyond the front of the housing base.

3.3 Connection (See Appendix C for information regarding connection to various systems)

All connections are made on the back of the Model 3100 Flame Detector Module. Remove the housing cover from the housing base. Loosen the two slotted head captive screws located on the top of the PC board. Lift the Detector Module out of the housing base. Strip and connect the wires to the connectors located on the back of the Detector Module.

3.3.1 Power

Power for the 3100-01, -02, -03, -04 and -05 flame detector is connected to the J5 connector labeled "Power". Connect the negative wire to PIN 1. Connect the positive (24 VDC) wire to PIN 4.

Power for the 3100-06 detector connected to the J2 connector. Connect positive wire at 4. Connect negative wire at pin 1. Pins 2 and 3 should be left open.

3.3.2 Fire Relay

The Fire Relay has two internal connection points. Either or both may be used. The Fire Relay connector, labeled "FIRE", has connection points for Normally Open, Normally Closed, and Common. The Normally Open connections are labeled "Open", the Common contacts are labeled "Com", and the Normally Closed contacts are labeled "Closed".

3.3.3 Verify Relay

The Verify Relay has two internal connection points. Either or both may be used. The Verify Relay connector is located between the Power and Fire relay connectors. The connection points are labeled "Verify In" and "Verify Out". The Verify relay is configured for Normally Open (3100-02 and 3100-04), or Normally Closed (3100-03 and 3100-05) operation at the factory.

3.3.4 Fault Relay

The Fault Relay connector is labeled "Fault". The Normally Open connection is labeled "O", the Common connection is labeled "Com", and the Normally Closed connection is labeled "C". The Fault Relay is a normally energized relay. When the detector has no power the Normally Open contact is closed and the Normally Closed contact is open.

3.3.5 Auxiliary Relay

The Auxiliary Relay connector is located between the Power and Fire Relay connectors. The connection points are labeled "Aux In" and "Aux Out". The Aux. Relay is configured for Normally Open (3100-03 and 3100-04), or Normally Closed (3100-02 and 3100-05) operation at the factory.

3.3.6 4-20 mA Connections

The 4-20 mA connections are connected at the J2 connections. The positive side of the 4-20 mA circuit is connected to Pin 7 and negative side to Pin 6.

3.4 Testing

The Model 3100 Flame Detector uses ongoing self-test functions which will indicate a fault if any of the functions fail to pass. If an end to end test is required, a 1 sq. ft. pan with 1 inch of water and 1/8 inch of kerosene set at the max. distance set by the sensitivity settings may also be used. The detector should alarm within 5 seconds of ignition of the fire.

The Model 3140 Flame Tester is also available. It simulates a UV/IR flame signature by emitting a steady state UV signal and modulated IR signal at a flicker frequency of 5 to 10 Hz.

NOTE: Because of the danger involved with fire testing all safety precautions must be observed.

4.0 MAINTENANCE

The self-test functions eliminate the need for most regular maintenance procedures. If a detector indicates a fault, use the troubleshooting section of this document to correct the fault. Contact the local "authority having jurisdiction" or consult the local codes for any maintenance they may require for the type of system installed.

4.1 Lens Cleaning

The most common fault is a Lens Test Fault. Regular cleaning of the Lens will eliminate this type of fault. The frequency will depend on the cleanliness of the area where the detector is installed and how the detector is mounted. A detector which is pointed down should require less cleaning than one that is pointed up. An area which has lots of oil particulates or dust will require more frequent cleaning than one that is oil and dust free. The frequency of the Lens Test Fault will indicate how often cleaning is necessary. If the device is failing the "Lens test" too often it may be necessary to install a dust shroud, realign the detector, or change the detectors mounting location.

To clean the lens: Wipe the lens surface and grill with a clean lint free cloth. If more extensive cleaning is required use denatured or Isopropyl alcohol and a clean lint free cloth. **Do not use any silica based solvents. (Most common glass cleaners are silica based and should not be used to clean the lens.)**

5.0 TROUBLESHOOTING

The flame detector has several built-in self test mechanisms which verify function and calibration. The following procedure covers most faults and problems which may occur during installation or during the course of normal operation.

5.1 No LED blink or erratic LED blink

With power connected to the detector the LEDs on the front of the detector module should begin blinking and blink about every 8 seconds. If they do not blink or blink in an abnormal fashion.

1. Remove the detector module from the housing.
2. Check voltage at power connector (J5, Pin 1 and Pin 4) Pin 1 should be connected to negative, and Pin 4 should be positive. Voltage should be between 15 and 32 volts DC.
3. If Main power is correct and the detector is not indicating a fault. The detector module should be returned to the factory.

5.2 Detector Indicates Fault

Use the fault table (Table B.4, page 17) to determine what type of fault is occurring and see appropriate section below to correct. If the corrective actions listed below do not correct the fault, contact the factory for further diagnostic instructions or instructions on returning the detector for servicing. (Ref. 2.6.4) or repeat.

5.2.1 Fault Type 1 - "Lens Test Fault"

Clean lens and grill per section 4.1. Reset the detector (remove and replace power). If the fault persists it may indicate a bad UV tube or UV source tube, factory service is required.

5.2.2 Fault Type 2 - "Configuration Fault"

Dip Switch SW9 is "ON". SW9 should be set to off for normal operation. Change SW9 to "OFF" and reset detector.

5.2.3 Fault Type 3 - "Calibration Fault"

Calibration constants have been corrupted. Factory service is required.

5.2.4 Fault Type 4 - "Voltage Low Fault"

The input voltage is below 15 VDC. Remove the Detector Module from the housing. With the detector connected to power, measure the voltage between Pin 1 and Pin 4 on the Power connector (J5). The voltage should be between 15 - 32 VDC. If the voltage is out of range check external wiring and power supply. There should not be more than 1 volt of AC ripple at 24 VDC. If the measured voltage is in range and there is no AC ripple, contact the factory for return and service information.

5.2.5 Fault Type 5 - "Photo Sensor Fault"

One of the Photo Sensors (Visible or IR) did not pass the internal self test. If both sensors are clean. The fault may be in the sensors or the self test circuit. Contact the factory for further diagnostic information.

5.2.6 Fault Type 6 - "Relay Fault"

One of the Relay's coil circuits is open. There is no corrective action. Contact the factory for return and service information.

5.2.7 Fault Type 7 - "Voltage High"

The Detector was exposed to an input voltage above 32 Volts. There is no corrective action. Contact the factory for return and service information.

5.2.8 Fault Type 8 - "Temperature Out of Range"

The internal measured temperature was below -40° C or above 85° C. There is no corrective action. Contact the factory for return and service information.

5.3 Device appears to operate normally but will not alarm to a fire.

When the detector declares an alarm two things should happen. One, both the LEDs on the front of the detector should come on. Two, the fire relay should energize. Check the dip switch settings. (SW1, SW2, SW8, and SW9 should be off SW3 - SW7 have no impact.) Connect an ohm meter across the Fire relay connections at the "Fire" connector (Pin 1 and Pin 3 of J2). Run a fire test per section 3.4.

1. If the relay closes (0 ohms on the meter) and the LEDs come “on” the detector is operating normally. Check external alarm initiating circuit wiring.
2. If the relay closes and the LEDs remain off, or the relay remains open and the LEDs come on, the detector needs factory service.
3. If the relay remains open and the LEDs remain off, contact the factory for further diagnostic information.

6.0 SPECIFICATIONS

| | |
|---|--|
| Sensitivity: | 1 ft. sq. Pan fire on axis @ 80 feet within 5 seconds (using standard fuel) Switch selectable form 20 to 80 feet to a 1 sq. ft. kerosene fire |
| Field of View: | 120 degree cone |
| Responsivity: | UV - 185 to 260 nm, IR - 0.715 to 3.5 microns, Visible - 480 to 560 nm |
| Input voltage: | 15 to 32 volts, typically 24 volts |
| Current Draw: | @24 Volts DC: 72 mA normal mode, 82 mA alarm mode |
| Temperature Range: | |
| Operating: | -40°F to 185°F (-40°C to 85°C) |
| Storage: | -67°F to 230°F(-55°C to 110°C) |
| LEDs: | Display switch settings, fault type, fire and verified fire information |
| Relays: | |
| Model 3100-01: | Fire and Fault Relays 120 VAC, 1.0 amp @ 24 VDC resistive, normally open and normally closed contacts, latching or fire-following modes |
| 3100-02, -03, -04, -05 Enhanced Relay | Fire, Fault, Verify and Aux Relays |
| Models: | 0.5 amp @ 120 VAC, 1.0 amp @ 24 VDC resistive, normally open and normally closed contacts are available. |
| 4-20 mA Outputs | |
| 3100-06: | 0 mA - Fault, 4 - mA - Normal Mode, 12 mA - Alarm, 20 mA - Verified Fire |
| Connections: | Screw terminals, 14 - 22 AGW wire size |
| Enclosure: | Copper-free Cast Aluminum with epoxy finish, Conduits: Two 3/4 inch NPT feed- through hubs |
| Hazardous area classification: | NEMA 4X, Explosion Proof Class I, Div. 1 and 2, Groups B, C, D, Class II and III, Div. 1 and 2, Groups E, F, G |
| Dimensions: | 5.4 x 4.8 x 3.7 inches (13.7 x 12.2 x 9.4 cm) |
| Weight: | 3 lbs (1.3 Kg) |

7.0 LIMITED WARRANTY

SIERRA MONITOR CORPORATION warrants its products to be free from defects in workmanship or material under normal use and service for two years after date of shipment. SMC will repair or replace without charge any equipment found to be defective during the warranty period. Final determination of the nature and responsibility for defective or damaged equipment will be made by SMC personnel.

All warranties hereunder are contingent upon proper use in the application for which the product was intended and do not cover products which have been modified or repaired without SMC approval or which have been subjected to accident, improper maintenance, installation or application, or on which original identification marks have been removed or altered. This Limited Warranty also will not apply to interconnecting cables or wires, consumables (ie. calibration gases, batteries, sensors),

nor to any damage resulting from battery leakage.

In all cases SMC's responsibility and liability under this warranty shall be limited to the cost of the equipment. The purchaser must obtain shipping instructions for the prepaid return of any item under this warranty provision and compliance with such instruction shall be a condition of this warranty.

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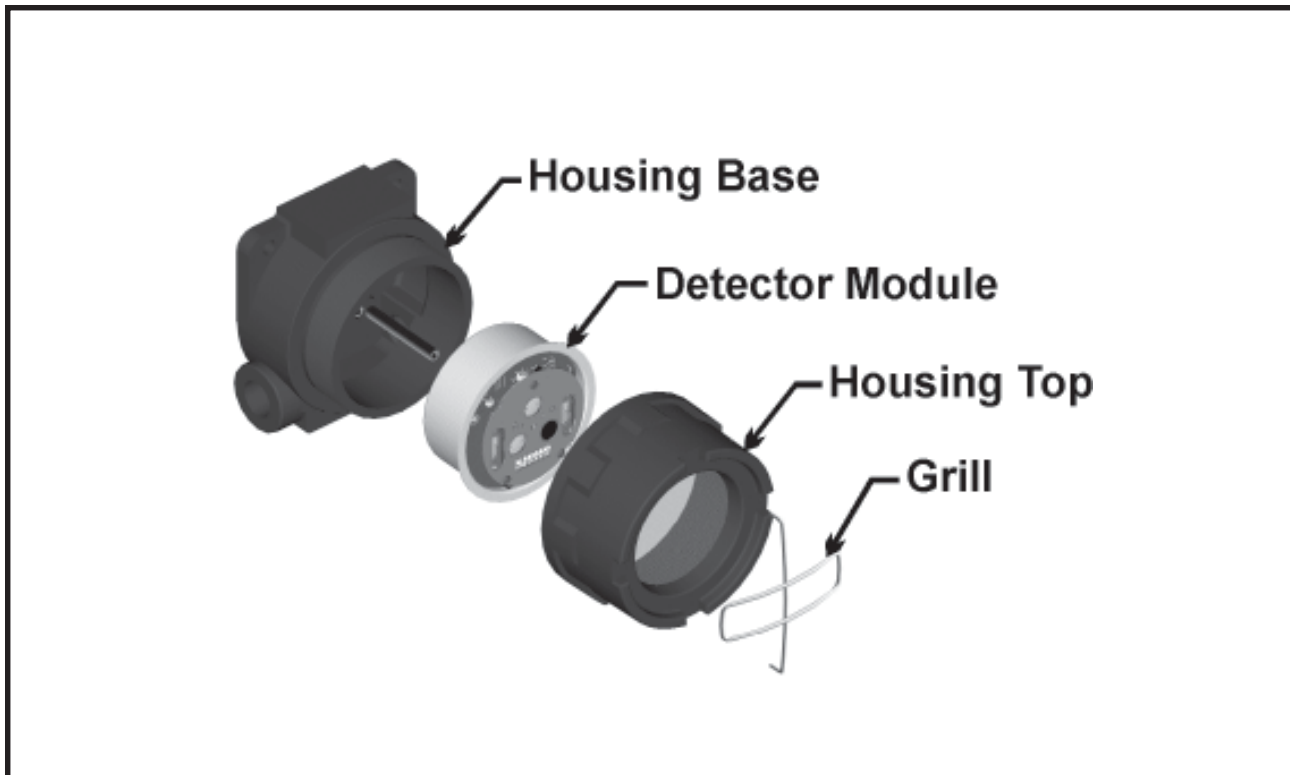


Figure A-1: Model 3100 Series Exploded View

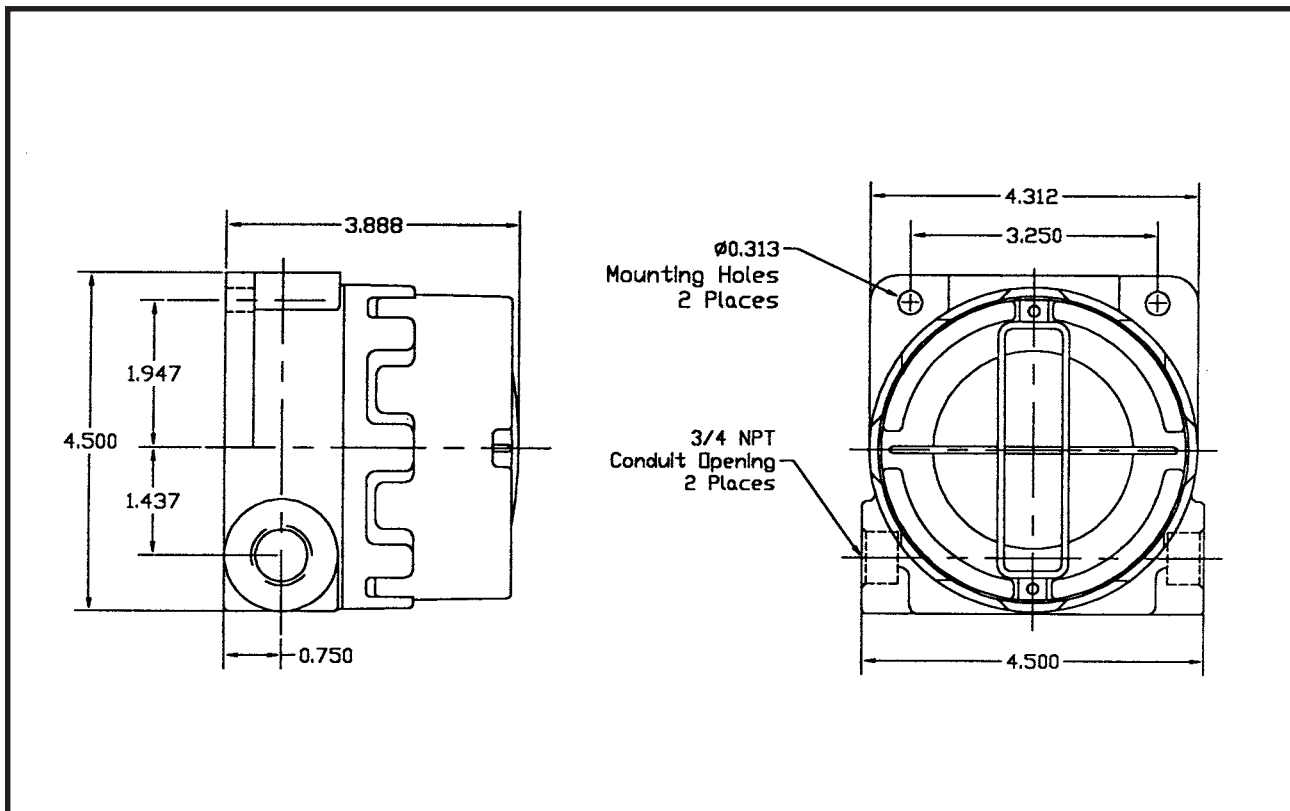


Figure A-2: Model 3100 Series Dimensions

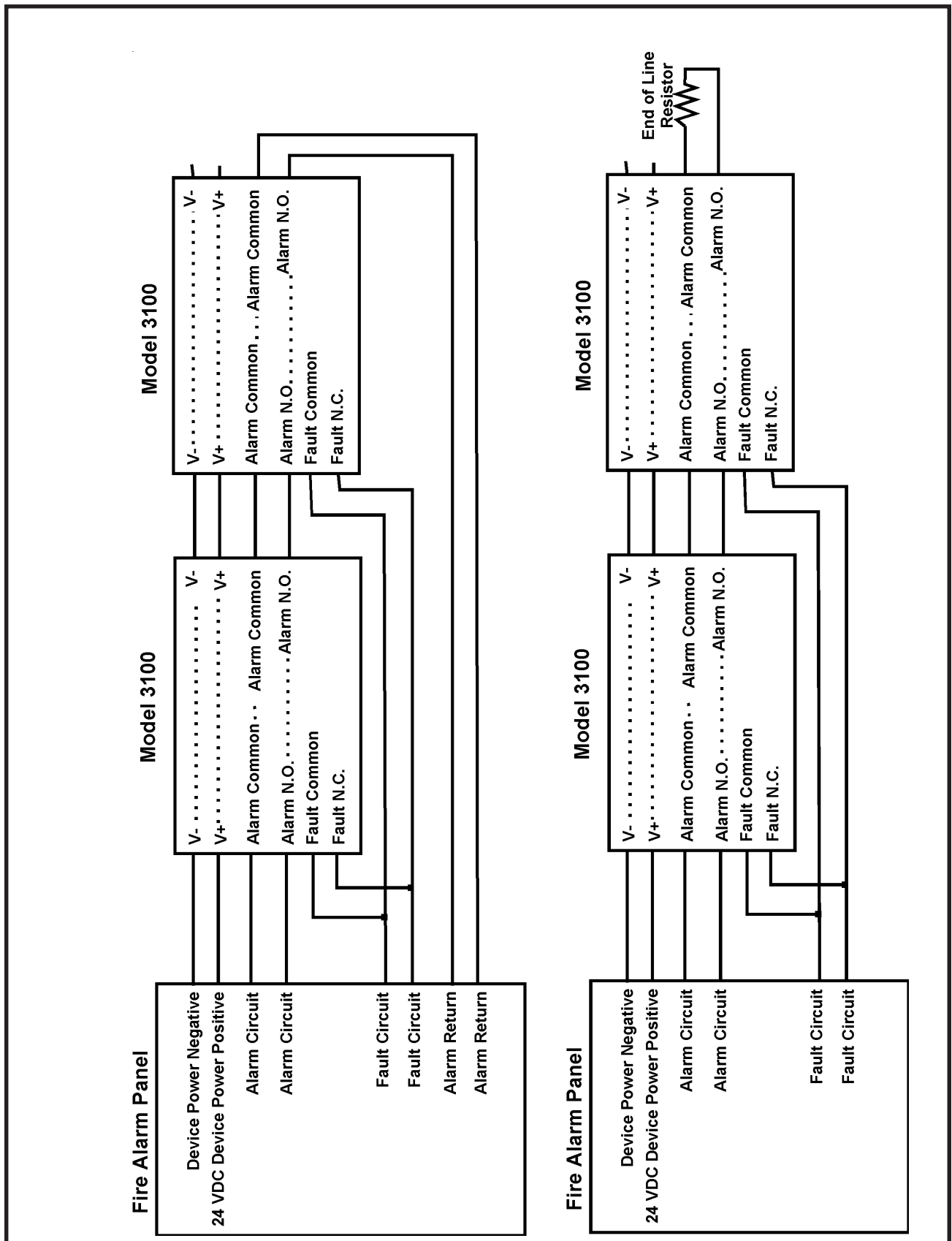


Figure A-3: Model 3100 Series Common Wiring Connections

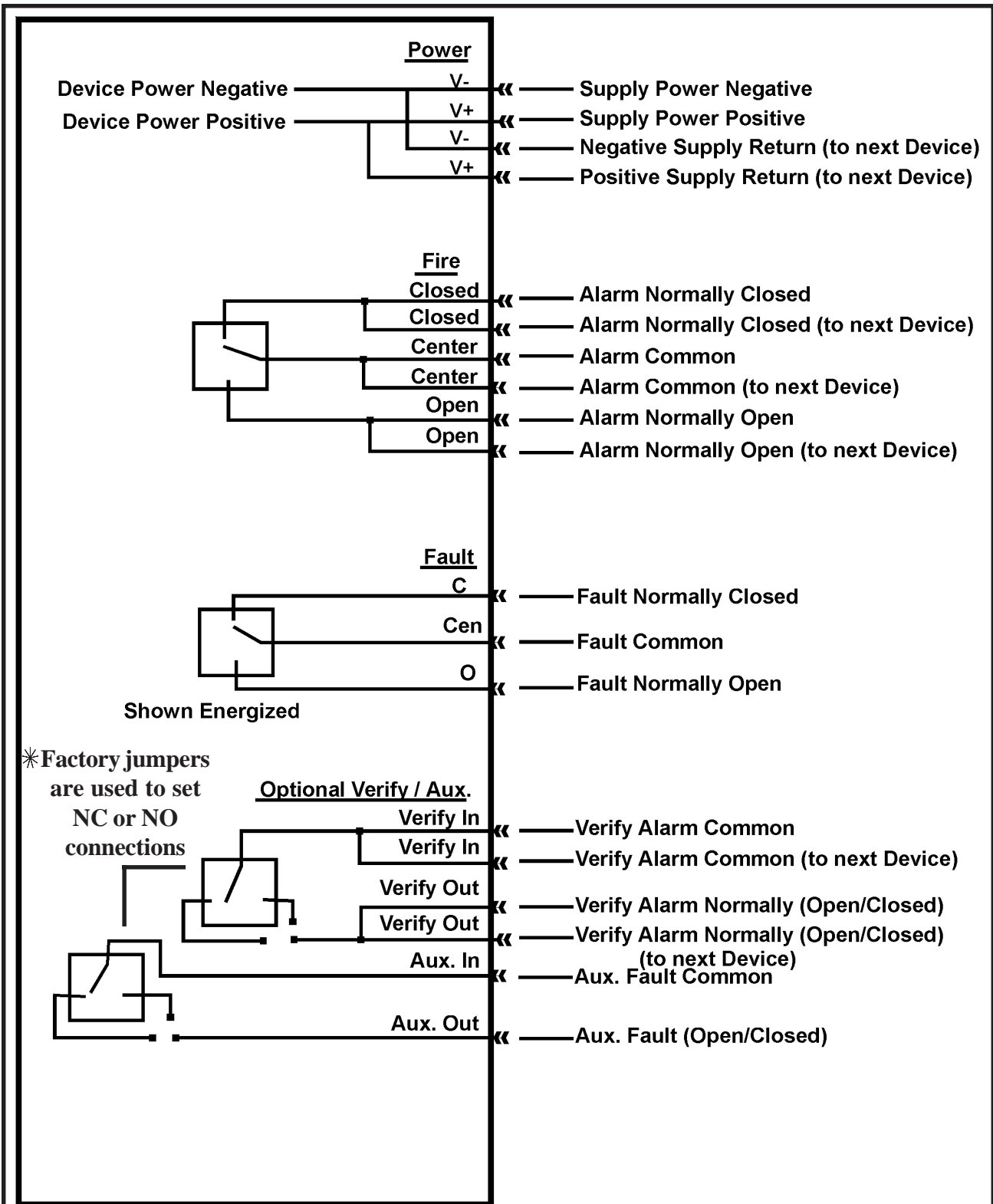


Figure A-4: Model 3100 Series (Enhanced) Wiring Connections

APPENDIX B

TABLES

B.1 Dip Switch Settings

B.1.1 Sensitivity

| Sensitivity | SW1 | SW2 | Level |
|-------------|-----|-----|-------|
| 20 Foot | ON | ON | 4 |
| 40 Foot | OFF | ON | 3 |
| 60 Foot | ON | OFF | 2 |
| 80 Foot | OFF | OFF | 1 |

B.1.2 Verify Control (3100-02, -03, -04 and -05 Models only)

| Verify | Description | SW3 | SW4 | SW5 |
|---------|-----------------------|-----|-----|-----|
| Level 0 | Verify = Fire | OFF | OFF | OFF |
| Level 1 | Min. Verify (shorter) | ON | OFF | OFF |
| Level 2 | Min. Verify (shorter) | OFF | ON | OFF |
| Level 3 | Min. Verify (shorter) | ON | ON | OFF |
| Level 4 | Min. Verify (shorter) | OFF | OFF | ON |
| Level 5 | Min. Verify (shorter) | ON | OFF | ON |
| Level 6 | Max. Verify (longer) | OFF | ON | ON |
| Level 7 | Verify Disabled | ON | ON | ON |

B.1.3 Fire Output“Latching” Control

| Fire Output | Description | SW6 |
|-------------|-------------------------------------|-----|
| Latching | Alarm until Power down Reset | OFF |
| Following | Alarm until no fire (.5 to 10 sec.) | ON |

B.1.4 Verify Relay “Latching” Control (3100-02, -03, -04 and -05 Models only)

| Verify Relay | Description | SW7 |
|--------------|-------------------------------------|-----|
| Latching | Alarm until Power down Reset | OFF |
| Following | Alarm until no fire (.5 to 10 sec.) | ON |

B.1.5 Detector "Non-Latching" Control

SW6, SW7 and SW8 must be on for the detector to be "Non-Latching".

B.1.6 Factory Use Only

SW8 and SW9 must be in the **OFF** position for normal operation. They are used for factory calibration and testing.

B.2 Connectors

B.2.1 Fire Relay Connector

| (J2) Fire Relay | Description |
|----------------------------|--------------------------------|
| Pin 1 (Left Most) & Pin 2 | Normally Open Side of Relay |
| Pin 3 & Pin 4 (Middle) | Common or Center Side of Relay |
| Pin 5 & Pin 6 (Right Most) | Normally Closed Side of Relay |

B.2.2 Verify and Aux. Fault Connector

| (J3) Verify/Aux. | Description |
|---------------------------|---|
| Pin 1 (Left Most) & Pin 2 | Verify Relay Common Side of Relay |
| Pin 3 & Pin 4 | Verify Relay NO or NC Side of Relay |
| Pin 5 | Aux. Fault Relay Common Side of Relay |
| Pin 6 (Right Most) | Aux. Fault Relay NO or NC Side of Relay |

B.2.3 Fault Connector

| (J4) Fault Relay | Description (Normally Energized State) |
|--------------------|--|
| Pin 1 (Left Most) | Normally Closed Side of Relay |
| Pin 2 (Middle) | Common Side of Relay |
| Pin 3 (Right Most) | Normally Open Side of Relay |

B.2.4 Power/Communications Connector

| (J5) Power/Comm. | Description |
|----------------------------|--------------------------|
| Pin 1 (Left Most) & Pin 5 | Power (DC -) |
| Pin 2 & Pin 6 | Communication RS 485 (-) |
| Pin 3 & Pin 7 | Communication RS 485 (+) |
| Pin 4 & Pin 8 (Right Most) | Power (DC +) |

B.2.5 3100-06 Connectors

| (J2) Connector | Description |
|------------------------------------|--------------------------|
| Pin 1 (Left Most) | Power (DC -) |
| Pin 2 | Communication RS 485 (-) |
| Pin 3 | Communication RS 485 (+) |
| Pin 4 | Power (DC +) |
| Pin 5 | 4-20mA Negative |
| Pin 6 | 4-20mA Positive |
| Pin 7 to Pin 8 Jumper (Right Most) | Enables 4-20 mA |

B.3 Verify/Aux. Relay Configurations

| Model # | Verify Relay | Aux. Relay |
|---------|-----------------|-----------------|
| 3100-02 | Open Contacts | Closed Contacts |
| 3100-03 | Closed Contacts | Open Contacts |
| 3100-04 | Open Contacts | Open Contacts |
| 3100-05 | Closed Contact | Closed Contacts |

B.4 Fault Table

| Fault # | Fault Label | Description |
|---------|---------------------|---|
| 1 | Lens Test Fault | UV sensors didn't detect enough UV from the internal UV source. |
| 2 | Configuration Fault | SW9 is "ON" or a failed program |
| 3 | Calibration Fault | Device is out of calibration |
| 4 | Volt. Low | Input Voltage is below 15 VDC |
| 5 | Photo. Sensor Fault | IR or Visible sensor failed to detect internal test source. |
| 6 | Relay Fault | Relay coil circuit is open. |
| 7 | Volt. High | Input Voltage was above 32 VDC |
| 8 | Temp. Out of Range | Internal device temperature went below -40° C or above 85° C. |

B.5 False Alarm Stimuli Table

FALSE ALARM RESPONSE

This table shows the detectors ability to tolerate both modulated and unmodulated false alarm stimuli.

| False Alarms Source | Distance | Unmodulated | Modulated |
|--------------------------------------|------------------|-------------|-------------|
| Resistive Electric Heater 1320 Watt | 6 Feet | No Response | No Response |
| Fluorescent Lights (2) 40 Watt Bulbs | 6 Feet | No Response | No Response |
| Halogen Light 500 Watt | 10 Feet | No Response | No Response |
| Incandescent Light 100 Watt | 6 Feet | No Response | No Response |
| Arc Welder 50 Watt | 25 Feet | No Response | No Response |
| Direct Sunlight | 93 million miles | No Response | No Response |

B.6 Fire and False Alarm Stimuli Table

Model 3100 detector response to a fire while exposed to a variety of radiant energy sources.

| False Alarms Source | Distance to False Alarm Source | Distance to Fire | Response Time to Fire |
|-------------------------------------|--------------------------------|------------------|-----------------------|
| Resistive Electric Heater 1320 Watt | 6 Feet | 6 Feet | Less than 5 sec. |
| Florescent Lights (2) 40 Watt Bulbs | 6 Feet | 6 Feet | Less than 5 sec. |
| Halogen Light 500 Watt | 10 Feet | 6 Feet | Less than 5 sec. |
| Incandescent Light 100 Watt | 6 Feet | 6 Feet | Less than 5 sec. |
| Arc Welder 50 Watt | 25 Feet | 6 Feet | Less than 5 sec. |
| Direct Sunlight | 93 million miles | 6 Feet | Less than 5 sec. |

| B.7 Detector Response to Fuels Table | | | |
|---|----------|---------------|------------------|
| Fuel | Distance | Fire Size | Response Time |
| Heptane | 80 Feet | 1 Square Foot | Less than 3 sec. |
| Silane | 50 Feet | 18 inch jet | Less than 3 sec. |
| Hydrogen | 15 Feet | 18 inch jet | Less than 5 sec. |
| Kerosene | 75 Feet | 1 Square Foot | Less than 5 sec. |

APPENDIX C -- WIRING CONNECTIONS

MODEL 3100

Connector Legend

| # | Marking | Function |
|----|----------------|--------------------------|
| 1 | J2 Open Fire | Fire Normally Open |
| 2 | J2 Open Fire | Fire Normally Open |
| 3 | J2 Com Fire | Fire Fire Common |
| 4 | J2 Com Fire | Fire Common |
| 5 | J2 Closed Fire | Fire Normally Closed |
| 6 | J2 Closed Fire | Fire Normally Closed |
| 7 | J3 Verify In | } |
| 8 | J3 Verify In | |
| 9 | J3 Verify Out | |
| 10 | J3 Verify Out | |
| 11 | J3 Aux In | |
| 12 | J3 Aux Out | |
| 13 | J4 C Fault | Fault Closed |
| 14 | J4 Com Fault | Fault Common |
| 15 | J4 O Fault | Fault Open |
| 16 | J5 1 Power | Power (DC -) |
| 17 | J5 2 Power | Communication RS 485 (-) |
| 18 | J5 3 Power | Communication RS 485 (+) |
| 19 | J5 4 Power | Power (DC +) |
| 20 | J5 5 Power | Power (DC -) |
| 21 | J5 6 Power | Communication RS 485 (-) |
| 22 | J5 7 Power | Communication RS 485 (+) |
| 23 | J5 8 Power | Power (DC +) |

Table for relay contact configuration

| RELAY CONTACT CONFIGURATION | | |
|-----------------------------|-----------------|-----------------|
| Model # | Verify Relays | Aux. Relay |
| 3100-01 | None | None |
| 3100-02 | Open Contacts | Closed Contacts |
| 3100-03 | Closed Contacts | Open Contacts |
| 3100-04 | Open Contacts | Open Contacts |
| 3100-05 | Closed Contacts | Closed Contacts |

By Factory
 Field Wiring

SIIC *sierra monitor corporation*
(408) 262-6611

**MODEL 3100-XX
FLAME DETECTOR**

TYPICAL WIRING CONNECTIONS

| | |
|-----------------------|---------------|
| BASE NAME: M3100A.VSD | DATE: 6/04/99 |
| FILE NAME: M3100A.VSD | BY: MN |

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