Technical Support & Installation Manual

MODEL RED1

FLAME DETECTORS

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APPLICABILITY & EFFECTIVITY

This manual provides instruction for the follow products:

Highlights

RED1-ST: Fire & Fault Relay Outputs (N.O. and N.C.) with Optical Self-Test
RED1-NT: Same as RED1-ST without Optical Self-Test
RED1-E1: Same as RED1-ST with N.O. Verify & N.C. Aux Relays Outputs
RED1-E2: Same as RED1-ST with N.C. Verify & N.O. Aux Relays Outputs
RED1-E3: Same as RED1-ST with N.O. Verify & N.O. Aux Relays Outputs
RED1-E4: Same as RED1-ST with N.C. Verify & N.C. Aux Relays Outputs
RED1-420: 4-20mA Output with no Relay Outputs

N.O. = Normally Open Contacts N.C. = Normally Closed Contacts

This manual is effective for the above models as of September 01, 2017

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1 PRODUCT DESCRIPTION

1.1 Introduction

RED1 flame detectors use a multiple spectrum sensor array to sense temperature, ultraviolet (UV), infrared (IR) and visible energy. The internal microprocessor, using state-of-the-art fire algorithms, evaluates these sensor inputs with flame signature analysis. This is performed by algorithms which evaluate spectrum signatures. These signatures correlate the intensity values, change of intensity values, relationship of intensity values, and frequency distribution of the sensor inputs. Most common false sources (spurious energy emissions) are filtered out by these algorithms. Providing continuous and reliable flame detection, the RED1 declares an alarm event when the conditions of a fire algorithm are met.

Figure 1-1 RED1 Flame Detectors

1.2 Configuration

Table 1-1 Model Configurations

Model	Fire/Fault Relays	Verify Fire Relay	Aux. Relay	Optical Self-Test
RED1-ST	N.O. and N.C.	-	-	Yes
RED1-NT	N.O. and N.C.	-	-	No
RED1-E1	N.O. and N.C.	N.O.	N.C.	Yes
RED1-E2	N.O. and N.C.	N.C.	N.O.	Yes
RED1-E3	N.O. and N.C.	N.O.	N.O.	Yes
RED1-E4	N.O. and N.C.	N.C.	N.C.	Yes
RED1-420	4-20 mA Output: 0 mA Fault, 4 mA Normal, 12 mA Fire, 20 mA Verified Fire (there are no relay outputs)			Yes

On all relay models, the Fire Relay and Fault Relay can be connected as either normally open (N.O.) or normally closed (N.C.)

For enhanced models, the Verify Fire Relay and Auxiliary Fault Relay are factory configured to either N.O. or N.C.

The RED1-420 model has an industry standard 4 to 20 mA current draw interface to indicate Normal, Fire, Verify Fire and Fault modes. The RED1-420 does not have relay outputs.

1.3 Description

RED1 detectors are calibrated to respond to a 1 square foot Heptane fire at 80 feet on axis. In addition, all RED1 models have four selectable sensitivity settings sensitivity with a 120° Conical Field-of-View.

All RED1 models have a NEMA 4X explosion proof housing, FM rated for Class I Division I & II Groups B, C, D, Class II Division I & II Groups E, F, G, and Class III locations. Furthermore, the electronics are mounted inside an aluminum cup to help protect the electronics during installation. All dip switch settings and LED indicators are located on the face of the RED1 detector module. This allows for field adjustments to be made and verified without removing the detector module from the housing enclosure.

The RED1 detector is field programmed for latching or non-latching operation of the Detector, Fire and or Verify Fire outputs.

The Verify Fire system adds a “field adjustable” level of certainty to the declaration of a verified fire. The Auxiliary Fault system activates the Aux Fault Relay when the integrity of the UV Sensor System has been compromised thereby allowing a separate indication for one of the most common faults, which is a lens that is soiled by contaminates that absorb UV. The Verify output can be disabled or set for one of seven levels on those versions of the RED1 which have either a Verify Fire Relay or 4-20 mA output.

Using a factory approved interface box and software (see “Accessories” document) the detector may be connected to an external computer. This allows a trained technician to view the real time spectral data being sensed by a RED1 detector and to verify that the detector is properly configured and set to the correct sensitivity setting for the installation.

A FireScape™ is recorded when the RED1 enters Fire Mode. The pre-fire spectral data is stored in the detector’s nonvolatile memory so it can be retrieved for later evaluation and analysis. It is important to note that the internal software trigger for the FireScape™ function is initialized during Power Up Mode. This is true for devices set to either a latching or non-latching configuration. As a result, the FireScape™ data is captured and stored for the first fire event that put the detector into Fire Mode. Once a detector is reset by cycling power, the FireScape™ data will be overwritten the next time the detector enters Fire Mode.

1.4 Fault Diagnostics

The microprocessor in the RED1 looks for fault conditions that could impair the detector’s ability to accurately detect a flame and declare an alarm. By continuously monitoring many of the detector’s key metrics and systems (i.e. input voltage, sensor circuits, relay circuits, internal temperature, defined calibration constants, etc.) the RED1 can detect the occurrence of fault conditions. Also, most RED1 models have an integrated Optical System Self-Test feature to periodically check the integrity of the optical system.

2 OPERATION

2.1 General

When power is applied to a RED1, the onboard microprocessor begins by checking the configuration switch settings before initializing the detector and then running a series of self-tests to ensure the detector is functioning properly. Upon successful completion the detector's Power Up Mode, the RED1 will go into Normal Mode, which means it is ready to detect a fire.

2.2 Field-of-View

All RED1 detectors have a 120° Field-of-View. In order to declare an alarm, a RED1 must be able to "see" a fire. Any obstruction between the detector and the threat area will impair the detector's ability to cover the threat area effectively. An obstruction is considered as anything that is not transparent to the energy being detected. Objects within the detector's Field-of-View, for example scaffolds and ladders, will impact the detector's response.

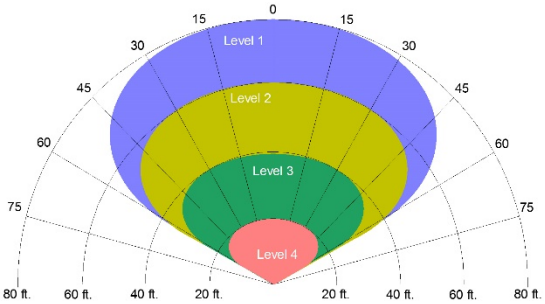


Figure 2-1 Field-of-View

Note: The RED1's sensors are not able to detect the spectral energy produced by a fire through most types of glass or plastic. This includes glass or plastic that is visually transparent.

To provide coverage to a large area, multiple RED1 detectors should be used with overlapping Field-of-Views (FOV). Flame detectors should never be located so that they are looking down from a ceiling of large enclosed spaces as the products of combustion may stratify in the enclosed volume. Such stratification may severely impact the detector's ability to respond to a fire.

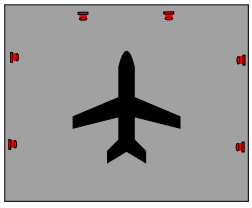


Figure 2-2 Overlap FOV

2.3 Range

The RED1 detector has four sensitivity settings, which specify the distance at which a standard fire may be detected. The DIP switches located on the face of the detector allow the sensitivity setting to be changed when necessary (see ***SECTION 2.5.1***).

The range of the RED1 is a function of the sensitivity setting, degree of obstruction, presence of spurious energy sources, type of fire, position of the fire, fire size and rate of fire growth. As illustrated in ***FIGURE 2-1,*** the response of each setting is affected by the angle at which the fire is located from the face of the detector. For example, at a Level 1 sensitivity setting, a 1 square foot Heptane fire on axis can be detected at 80 feet, whereas the same fire located 60° off axis will be detected at approximately 40 feet. If the size of the fire is reduced to ¼ of the size, hence using an approximate 6 inch square fire, the detection distance would be reduced to 40 feet on axis. The type of materials that constitute the threat will also affect the detector's range. Different materials and environmental conditions produce different amounts of the radiant energy, which is used by the detector to "see" the fire.

2.4 Environment

All optical flame detectors sense radiant energy at some frequency or frequencies within their Field-of-View. Any source that 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. The RED1 Flame Detector uses a UV sensor (180 – 260 nm), a IR sensor (.715 to 3.5 microns), and a Visible sensor (480 – 460 nm). Care should be taken to minimize radiant energy sources within the detector's Field-of-View. Because of the variety of environments and conditions, a trained technician or qualified P.E. may need to be consulted before deciding on the location of the devices.

If there is a question as to spurious energy sources in an application, a factory approved interface box and software (see "Accessories" document) may be used by a technician to view the real time radiant energy data to determine the appropriate sensitivity setting to be used.

2.5 Configuration Settings

DIP switches located on the face of the RED1 detector allow for configuration settings adjustments. By changing the position of each switch, the following settings may be modified:

Figure 2-3 DIP Switch

2.5.1 Sensitivity

All models of the RED1 detector have four sensitivity settings to set the distance at which a fire can be detected. The sensitivity settings are 20, 40, 60 and 80 feet. It is important to note that different fuels emit energy at different rates. The four sensitivity settings were calibrated to alarm on a 1 square foot Heptane fire within a few seconds. Different fuels and or environmental conditions can impact those distances.

Switches SW1 and SW1 control the sensitivity (see ***TABLE 8-1***). The factory default is 80 feet.

2.5.2 Verify Fire Control (Enhanced and 4-20 mA Models Only)

Models RED1-E1 to -E4 and the RED1-420 each have a Verify Fire function. This function allows the degree of certainty associated with the verify response to be set by the user. The Verify Fire Control switches (SW3, SW4 and SW5) allow users to either select a verify level, disable the Verify Fire Control, or to make the Verify Fire Mode trigger when the detector enters Fire Mode.

Once the detector enters Fire Mode, the Verify Fire Control uses an algorithm to determine the degree of certainty of the fire signature over time. When the degree of certainty exceeds the level set by the configuration switches, the detector enters Verified Fire Mode. Each verify level (see ***TABLE 8-2***) adds approximately 5 seconds of delay to the verify response time. Therefore, when a detector is set to the Level 1, the lowest level of certainty, the Verify Fire Mode would trigger approximately 5 seconds after the Fire Mode triggers.

Accordingly, when set to Level 6, the highest level of certainty, the detector's Verify Fire Mode would trigger approximately 30 seconds after the Fire Mode triggers. Factory default is Level 0, which means Verify Fire Mode triggers in parallel with Fire Mode.

2.5.3 Latching Controls

The Latching Controls switches (SW6, SW7 and SW8) allow a detector or individual output to be set to either "Latching" or "Non-Latching" operation. The terms "Non-Latching" and "Fire Following" are interchangeable in some manuals. Latching means the detector and its outputs will remain in the triggered state after entering Fire Mode until the detector is reset by cycling power. When set to non-latching, the detector and its outputs will reset after a period of time once a flame is no longer detected. The FireScape™ trigger will only reset once power has been cycled to the device. This allows for the detector to store the FireScape™ data for the first fire event that occurred, which means any subsequent fire events will not overwrite that data until the detector's power is cycled. Each of the 3 configuration switches affects a different Latching Control (see ***TABLE 2-1***).

Table 2-1 Latching Controls

Switch			Latching Configuration		
6	**7**	**8**	**Fire Output**	**Verify Output**	**Detector**
ON	ON	ON	Non-Latching	Non-Latching	Non-Latching
ON	ON	OFF	Non-Latching	Non-Latching	Latching
ON	OFF	X	Non-Latching	Latching	Latching
OFF	X	X	Latching	Latching	Latching

X - Switch Condition Does Not Matter

Switch SW6 is used to control the Fire Output Latching Control. When set to Latching (factory default), the Fire Output will stay active once a fire is declared and stay on until the detector is reset by removing power. When set to Non-Latching, the Fire Output will reset automatically once a flame is no longer detected for a period of time.

Switch SW7 is used to control the Verify Fire Output on equipped models. The detector's Verify Fire Output can be set to latching (factory default) or to non-latching. However, for the Verify Fire Output to be set to non-latching, both SW6 and SW7 must be set to ON.

Switch SW8 is used to set the Detector's Latching Control. When set to latching (factory default) both the detector and its LEDs will remain in either Fire Mode or Verify Fire Mode until the detector is reset by removing power. In non-latching operation, the detector and its LEDs will go back to Normal Mode but the FireScape™ trigger will not re-initialize until power is cycled to the detector. For a detector to be in non-latching operation, switches SW6, SW7 and SW8 must all be set to ON.

Note: In non-latching operation for the Fire and Verify Fire outputs, the period of time it takes for the detector to reset is user programmable. The time may be set from .5 seconds to 10 seconds using a factory approved interface box and software (see "Accessories" document). The factory default time is approximately 3 seconds before resetting. Both the Fire Output and Verify Fire Output can be adjusted by the user. The detector's non-latched status however, has no such delay.

2.5.4 Factory Switch

Configuration switch SW9 is reserved for factory use only and must be in the “OFF” position. When SW9 is set to “ON” during normal operation, the detector will immediately go into a Configuration Fault (see ***TABLE 10-1***) upon startup.

2.6 LED Operation, Detector Modes & FireScape™ Function

The status of a RED1 can be determined from the two LEDs located on the face of the detector. All RED1 devices have four standard modes: Power Up, Normal, Fault and Fire. There is also a Verify Fire Mode for the enhanced relay and RED1-420 models.

The LEDs will either flash at intervals or remain lit to indicate the detector’s status.

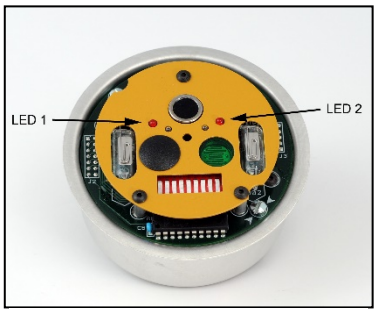


Figure 2-4 LEDs

2.6.1 Power Up Mode (Detector Reset)

A RED1 detector is reset once it enters Power Up Mode. Power must be cycled to a device for it to enter Power Up Mode. Upon entering Power Up Mode, all internal flags and triggers are re-initialized and self-tests are initiated to ensure the proper operation of the detector’s systems. In addition, both red LEDs located under the detector’s faceplate (see ***FIGURE 2-4***) will begin flashing 8 consecutive patterns, thereby providing a quick visual representation of each DIP switch’s position.

The first flash pattern indicates the position of SW1 and each subsequent flash pattern indicates the position of the next switch in order. If a switch is in the OFF position, only one LED will flash on. If both LEDs flash on then the corresponding switch is in the ON position. Once Power Up Mode has successfully completed, the RED1 should go into Normal Mode to indicate that the detector is ready to detect a fire.

Note: The position switch SW9 is not indicated during the Power Up Mode LED flash sequence as it is only used by the factory. If SW9 is in the ON position the detector will trigger a Configuration Fault after the power up sequence completes. The factor default position of all DIP switches is OFF.

2.6.2 Normal Mode

In Normal Mode, the LEDs will briefly flash every 8 seconds. When a detector is in Normal Mode it is constantly monitoring the environment and ready to detect a fire. If a detector goes into a different mode, the appropriate output is triggered and the “flash every 8 seconds” LED indication is suspended until the detector returns to Normal Mode.

2.6.3 Fire Mode

When a RED1 declares a fire, the Fire Output triggers and both red LEDs on the face of the detector (see ***FIGURE 2-4***) come on and stay lit.

If SW6 is set to Latching (OFF), and a fire is declared, the detector will remain in Fire Mode until the detector enters Verify Fire Mode or is reset by cycling power.

When SW6, SW7 and SW8 are set to Non-Latching (ON), and the fire falls below the acceptable threshold, the detector returns to Normal Mode without reinitiating Power Up Mode.

If SW6 is set to Non-Latching (ON) and SW7 or SW8 is set to Latching (OFF), the Fire Output will reset automatically once a flame is no longer detected for a period of time and the LEDs will remain lit until the detector is reset (see ***TABLE 2-1***).

2.6.4 Fault Mode

The RED1, when powered on, continuously monitors several of its internal systems to ensure proper functionality is maintained. When a fault is detected, the device immediately enters Fault Mode and triggers the Fault Output. In addition, the two LEDs on the face of the detector (see ***FIGURE 2-4***) provide a visual indication to help identify the type of fault being reported (see ***TROUBLESHOOTING***). Only the highest number of fault is indicated on the LEDs. If the fault condition can be corrected by the user, the next highest fault will be indicated until all faults are cured. Although both Fire Mode and Verify Fire Mode are designed to override a fault indication, some faults, such as "Configuration Fault" and "Calibration Fault" may prevent the reporting of a fire.

Note: The RED1 may be able to indicate a fire while in Fault Mode.

2.6.5 Verify Fire Mode

When a RED1 enters Verified Fire Mode, the Verify Fire Output (on equipped models) triggers and both red LEDs on the face of the detector (see ***FIGURE 2-4***) begin flashing simultaneously approximately every half second.

When SW6, SW7 and SW8 are set to Non-Latching (ON), the Verify Fire Output will reset automatically once a flame is no longer detected for a period of time and the detector will return to Normal Mode without reinitiating Power Up Mode.

If SW6 and SW7 are set to Non-Latching (ON) and SW8 is set to Latching (OFF), the Verify Fire Output will reset automatically once a flame is no longer detected for a period of time, however, the LEDs will continue to blink until the detector is reset (see ***TABLE 2-1***).

If SW6 or SW7 is set to Latching (OFF), the Verify Fire Output will stay triggered and the LEDs will continue flashing approximately every half second until the detector is reset by cycling power.

2.6.6 FireScape™ Function

When a RED1 enters Fire Mode, the pre-fire spectral data is stored in nonvolatile memory so it can be retrieved for evaluation and analysis. To retrieve the data, a trained technician must use a factory approved interface box and software (see "Accessories" document), in conjunction with a computer, to communicate with the detector. It should be noted that the internal software trigger for FireScape™ is initialized during Power Up Mode and, once a FireScape™ has been triggered by a device that has gone into Fire Mode, it cannot be retriggered until the device is reset by cycling power. This is true for

devices set to either latching or non-latching and allows the FireScape™ data to be captured and stored for the first fire event that put the detector into Fire Mode. Once a detector has been reset by cycling power, the previous FireScape™ data will be overwritten if the detector enters Fire Mode.

Note: Extreme care must be taken to ensure power is cycled after conducting any test which may put the detector into Fire Mode. Failure to do so will result in any subsequent fire event not being recorded.

2.7 Outputs

The RED1 is available with either relay outputs or an industry standard 4-20 mA current output. For detectors with relay outputs, all models are equipped with both a Fire Relay and Fault Relay. For enhanced models such as the RED1-E1, -E2, -E3, and -E4, two additional relays, as well as additional connectors, are added for Verify Fire and Auxiliary Fault. All connections are made on the back of the flame detector module (see ***SECTION 3.2.4***).

2.7.1 Fire Relay

The RED1 provides connections for both the Normally Open and Normally Closed contacts of the Fire Relay. When a fire is declared, the Fire Relay will energize. Depending on the configuration setting (see ***SECTION 2.5.3***), the relay will either stay energized when configured for latching operation or, for non-latching operation, it will energize while a fire is being detected and then de-energize after a set amount of time. There are 2 screw terminals for each contact to allow for the Daisy-Chaining of multiple RED1 detectors.

2.7.2 Fault Relay

When a RED1 is powered on, the Fault Relay is normally energized. When a fault occurs, the Fault Relay will de-energize. This means the Fault Relay reports a fault state if the detector loses power. The RED1 provides connections for both Normally Open and Normally Closed contacts for the Fault Relay.

2.7.3 Verify Fire Relay (Enhanced Models Only)

The Verify Fire Relay energizes when a verified fired is declared and the detector goes into Verify Fire Mode. Depending on the configuration setting (see ***SECTION 2.5***), the Verify Fire Relay will either stay energized when configured for latching operation or, for non-latching operation, it will energize while a fire is being detected and then de-energize after a set amount of time. If the Verify Control (see ***SECTION 2.5.2***) is configured to Level 0 then the Verify Fire Relay will operate in parallel with the Fire Relay. If the Verify Control is configured to Level 7, then the Verify Fire Relay is disabled. The connectors for “Verify In” and “Verify Out” provide connections for Normally Open Contacts on the RED1-E1 and RED1-E3 models and Normally Closed Contacts for the RED1-E2 and RED1-E4 models. There are 2 screw terminals for each contact to allow for the Daisy-Chaining of multiple detectors.

2.7.4 Auxiliary Fault Relay (Enhanced Models Only)

The Aux Fault Relay energizes when the integrity of the UV Sensor system has been compromised. This allows a separate indication for one of the most common faults, which is a lens soiled by contaminated known to absorb UV, such as oil. It should be noted that if a UV Self-Test Fault should occur, the Fault Relay will de-energize in addition to energizing the Aux Fault Relay. The connectors provide connections for Normally Open Contacts on the RED1-E2 and RED1-E3 models and Normally Closed Contacts for the RED1-E1 and RED1-E4 models.

2.7.5 4-20 mA Operation

The RED1-420 model uses an industry standard 4 to 20 mA current draw circuit to indicate Normal, Fire, Verify Fire and Fault modes. The RED1-420 has no relay outputs. The current draws are as follows:

Fault Mode:	0 mA
Normal Mode:	4 mA
Fire Mode:	12 mA
Verify Fire Mode:	20 mA

3 INSTALLATION

3.1 General Precautions

All wiring and installation should 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, if applicable, the company safety engineer, for information on codes which may apply.

3.2 Housing and Conduit

All RED1 housings consist of a housing base, housing top and a protective grill (see ***FIGURE 7-1***). All housings contain two ¾ inch NPT feed-through hubs and are constructed of copper-free aluminum that is powder coated with either a red or gloss white epoxy finish. Each RED1 housing is rated by FM as: NEMA 4X, Explosion Proof, Class I Divisions 1 & 2 Groups B, C, D Class II Divisions 1 & 2 Groups E, F, G Class III.

3.2.1 Mounting the Housing

The housing should be mounted by using the two 0.3 inch diameter holes located in the ears on the back of the housing (see ***FIGURE 7-2***). 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 and the mounting location must be strong enough to support the weight of the detector. For applications which require the detector to be pointed at a specific area, an optional swivel mount assembly can be used (see “Accessories” document).

Although the RED1 is not overly sensitive, it should not be exposed to excessive vibration as it may damage its components and will void factory warranty. The detector has been tested to 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" into the ¾ inch NPT conduit(s) located on either side of the housing. If only one conduit opening is being used, insert a sealing plug into the unused opening. Connect the conduit to the "Seal Off" and run the wires through the conduit and "Seal Off" into the housing. The ends of the wires should extend at least 2 to 4 inches beyond the front of the housing base. Contact the local authority having jurisdiction and, if applicable, the company safety engineer, for information on codes which may apply.

3.2.3 Housing Top

To maintain a weathertight seal and hazardous location rating, the housing top must be fully tightened after installation. Some housing tops are equipped with a tightening screw that must also be tightened once the housing cover is fully engaged to secure the cover into place (see ***FIGURE 7-3***).

3.2.4 Removing Detector Module

To access the detector module, remove the housing top from the housing base and loosen the two captive mounting screws located on the top of the detector module. Care must be taken to ensure that the screw driver blade does not damage or touch the UV Sensor tubes mounted under the faceplate (see ***FIGURE 3-1***). Lift the detector module out of the housing base.

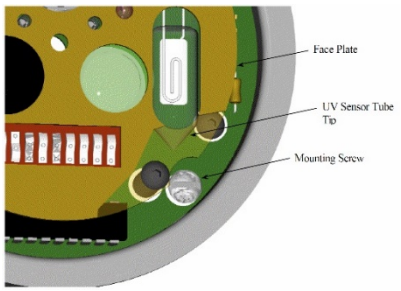


Figure 3-1 RED1 Module

3.3 Wiring Connections

All wiring connections are made on the back of the detector module once it is removed from the housing base. Strip all wires to an appropriate length and connect them to the proper terminals (see ***FIGURE 9-1***). The left most connection terminal of each connector is considered Pin 1.

Warning: Power should not be turned on until all wiring connections have been connected and verified to be correct.

Note: Care must be taken to ensure that wire clippings and other debris are not allowed to fall into the detector module as this may cause damage within the detector module and will void the factory warranty.

It is imperative to make sure extreme care is taken to ensure all wiring is properly connected to the correct terminals before powering the device on. Using the device in excess of its specifications or miswiring the device could result in serious damage to the device and/or control panel and will void the factory warranty.

RELAY OUTPUT MODELS

3.3.1 Fire Relay

The Fire Relay connector (see ***TABLE 9-1***) has two terminals for each connection. Multiple terminals are provided to allow for devices to be Daisy-Chained. The Fire Relay connector has terminals for Normally Open (Pins 1 & 2), Normally Closed (Pins 5 & 6), and Common (Pins 3 & 4).

Note: On the back of the detector, the Normally Open terminals are labeled “Open”, the Common terminals are labeled “Center”, and the Normally Closed terminals are labeled “Closed”.

3.3.2 Verify Fire Relay

The Verify Fire Relay connector (see ***TABLE 9-2***) has two terminals for each connection. Multiple terminals are provided to allow for devices to be Daisy-Chained. Pins 1 & 2 are for Verify In and Pins 3 & 4 are for Verify Out.

Note: On the back of the detector, the connections are labeled as “Verify In” and “Verify Out”. The Verify Fire Relay is factory configured for Normally Open on RED1-E1 and -E3 models and Normally Closed on RED1-E2 and -E4 models.

3.3.3 Auxiliary Fault Rely

The Aux. Fault Relay connector (see ***TABLE 9-2***) has one terminal for each connection. Pin 5 is for Aux In and Pin 6 is for Aux Out.

Note: On the back of the detector, the connections are labeled as “Aux In” and “Aux Out”. The Aux. Relay is factory configured for Normally Open on the RED1-E2 and -E3 models and Normally Closed on the RED1-E1 and -E4 models.

3.3.4 Fault Relay

The Fault Relay connector (see ***TABLE 9-3***) has one terminal for each connection. Pin 1 is for the Normally Closed side of the relay, Pin 3 is for the Normally Open side of the relay and Pin 2 is for Common.

The Fault Relay is a normally energized relay, which means when the detector is not receiving power the Normally Open terminal is closed and the Normally Closed terminal is open. This means the control panel will report a fault condition if the detector loses power.

Note: On the back of the detector, the Normally Closed terminal is labeled “C”, the Common terminal is labeled “Cen”, and the Normally Open terminal is labeled “O”.

3.3.5 Power

Power is supplied via the terminals on the back of the detector module (see ***TABLE 9-4***). Connect the negative wire to Pin 1 and the positive wire (typically 24 VDC) to Pin 4. Multiple connections are provided to allow for devices to be Daisy-Chained. To pass power to another device, connect a negative wire to Pin 5 and a positive wire to Pin 8 of the first detector and connect them to Pins 1 and 4 of the second detector.

Note: Exceeding the specified input voltage rating for the detector will result in a High Voltage fault. This type of fault is a permanent condition and the detector must be sent back to the factory for evaluation. The evaluation, as well as any resulting damage to the detector, is not covered under factory warranty.

3.3.6 Communications

A RED1 may communicate with a computer using the detector's RS485 port. RS485 communication requires a factory approved interface box and software (see "Accessories" document).

The RS485 terminals (see ***TABLE 9-4***) provide connection points that are labeled "D-" (Pins 2 and 6) and "D+" (Pins 3 and 7) for RS485 B and RS485 A, respectively.

Note: Extreme care must be taken to ensure the detector's input voltage wires are not connected to the communication terminals by mistake. Miswiring a device could result in serious damage to the detector and/or control panel and will void the factory warranty.

4-20 mA MODEL

3.3.7 Power

Connect the negative wire to Pin 1 and the positive wire (typically 24 VDC) to Pin 4 (see ***TABLE 9-6***).

Note: Exceeding the specified input voltage rating for the detector will result in a High Voltage fault. This type of fault is a permanent condition and the detector must be sent back to the factory for evaluation. The evaluation, as well as any resulting damage to the detector, is not covered under factory warranty.

3.3.8 4-20 mA Output

The RED1-420 model uses an industry standard 4 to 20 mA current draw circuit to indicate Normal, Fire, Verify Fire and Fault modes (see ***TABLE 9-6***). There are two standard connection methods for measuring the 4-20 mA output.

The typical method jumpers Pins 7 and 8 together and measures the current flow from Pin 6 to Pin 5. Pin 5 is the Negative side of the circuit and Pin 6 is the positive side of the circuit.

An alternative hookup method jumpers Pins 5 and 6 together and measures the current flow from Pin 8 to Pin 7. Pin 7 is the Negative side of the circuit and Pin 8 is the positive side of the circuit.

3.3.9 Communications

A RED1 may communicate with a computer using the detector's RS485 port. RS485 communication requires a factory approved interface box and software (see "Accessories" document).

The communications terminals (see ***TABLE 9-6***) provide connection points for both the RS485 B (Pin 2) and RS485 A (Pin 3) communication signals.

Note: Extreme care must be taken to ensure the detector's input voltage wires are not connected to the communication terminals by mistake. Miswiring a device could result in serious damage to the detector and/or control panel and will void the factory warranty.

3.4 Testing

The RED1 installation should be inspected and tested in accordance with NFPA 72 standards and or any codes specific to the application or location. Contact the local authority having jurisdiction and, if applicable, the company safety engineer, for information on specific testing requirements and recommended frequency.

Functional testing a RED1 will cause the detector to enter Alarm Mode and or Verified Alarm Mode. Therefore, if the detector is connected to an extinguishing system, the outputs to the system should be disconnected prior to testing to avoid accidental discharge.

The RED1 can be tested with either fire or a factory approved handheld test source (see "Accessories" document). Either a pan fire or butane lighter may be used to test with fire.

To test for sensitivity with a pan fire, use a 1 sq. ft. pan with 1 inch of water and 1/8 inch of Heptane set at distance specified by the sensitivity settings. The detector should alarm within a few seconds of the fire becoming fully involved.

For end-to-end functional testing, use a butane lighter with approximately a 1 inch high flame. Start by holding the lighter approximately 2 feet directly in front of the detector's face and wiggle it slightly (about 2 – 4 Hz). The detector should alarm within a few seconds.

Note: Because of the dangers involved with fire testing, the use of a factory approved handheld test source (see "Accessories" document) is strongly recommended.

Prior to using a factory approved handheld test source, it is important to check that the battery is installed correctly and producing enough power to ensure proper operation and maximum performance. In addition, a factory approved handheld UV detector (see "Accessories" document) may be used to verify proper operation of the handheld test source. To test a RED1 using a handheld test source, hold the tester directly in front of the detector's face at the distance specified on the tester and activate the device. The RED1 should alarm within a few seconds.

It is recommended to periodically use a factory approved handheld UV detector (see "Accessories" document) to verify the UV sensors are not self-exciting due to blunt force, excessive vibration or other damage.

After placing a detector into alarm with a handheld test source, cover the face of the RED1 and turn the handheld UV detector on to verify there are no other sources of UV in the immediate area. Next, unblock the face of the RED1 and point the handheld UV detector directly at the face of the RED1, holding it a few inches away, and turn the handheld UV detector on. If the handheld UV detector detects UV, it is recommended that further testing be conducted to verify the RED1 UV sensors are operating properly.

4 MAINTENANCE

In addition to periodic testing, it is recommended to occasionally clean the lens of the RED1 to remove any grease, dust or other particulates that may hinder the detector's ability to operate correctly.

4.1 Lens Cleaning

Regular cleaning of the RED1 lens is strongly recommended. The frequency of cleaning depends on the cleanliness of the area where the detector is installed and mounted. An area which has a lot of dust or oil particulates will require more frequent cleanings than an area with a clean environment.

To clean the lens and grill, wipe the surfaces with a clean lint free cloth. If more extensive cleaning is required, denatured or Isopropyl alcohol may be used with a clean lint free cloth. Do not use any silica-based solvents, which can commonly be found in most glass cleaners, as this may damage the lenses. Scratched and or damaged lenses are not covered under factory warranty.

5 TROUBLESHOOTING

If a problem is detected during installation or if the RED1 enters Fault Mod (see section 2.6.4), the following procedures are recommended. If the actions listed below do not correct the problem, contact your distributor for further diagnostic instructions or to obtain an authorization to return the detector for evaluation. For issues which fall outside the scope of the factory warranty, fees will apply.

To perform a more extensive diagnostic check, a factory approved interface box and software (see "Accessories" document) can be used. Contact a Fire Protection Distributor for information on purchasing this accessory.

5.1 No LED blink or erratic LED blink

Once power is turned on and the detector is in Normal Mode, the two red LEDs on the front of the detector module (see ***FIGURE 5-1***) should blink simultaneously every 8 seconds. If they do not blink or if they should begin blinking in an abnormal fashion, remove the detector module from the housing and check the power connections to ensure Pin 1 is connected to negative and Pin 4 is connected to positive. The voltage between Pins 1 and 4 should be within the input voltage specifications (see ***SECTION*** 6). Providing the detector is not indicating a fault condition and the input voltage is correct, the detector should be returned to the factory for evaluation if the problem persists.

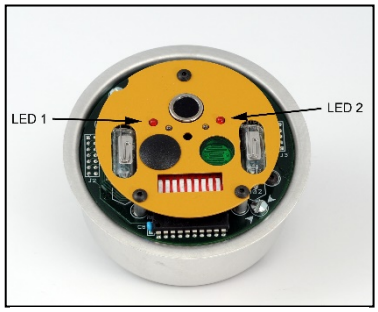


Figure 5-1 LEDs

5.2 Detector Indicates Fault

The RED1, when powered on, continuously monitors several of its internal systems. When a fault is detected, the device immediately enters Fault Mode and triggers the Fault Output. In addition, the two LEDs on the face of the detector (see ***FIGURE 5-1***) provide a visual indication to help identify the type of fault being reported.

To determine the fault type, LED 1 will illuminate briefly and then turn off. LED 2 will then begin blinking. The number of times LED 2 blinks will indicate the Fault Type number. Once the fault

type is indicated, LED 2 will turn off and LED 1 will illuminate again. This cycle will continue until the fault condition has been cured.

If multiple fault conditions are detected, only the highest numbered fault will be indicated on the LED 2. If the fault condition can be corrected by the user, the next highest fault will be indicated, if one exists. Once all faults have been cured, the RED1 should enter Normal Mode.

To determine the best course of action to resolve a fault condition, use the Fault Type number to reference the appropriate section below.

5.2.1 Fault Type 1 – "UV Self-Test Fault"

Clean lens and grill per section 4.1. Reset the detector by cycling power. If the fault persists it may indicate a bad UV sensor or source which will require factory service.

5.2.2 Fault Type 2 – "Configuration Fault"

Dip Switch SW9 (see ***SECTION 2.5.4***) is set to ON or the program's sum check is invalid. If SW9 is in the ON position, switch it to the OFF position and cycle power to the detector. If setting SW9 to OFF and cycling power to the device does not clear the fault, factory service is required.

5.2.3 Fault Type 3 – "Calibration Fault"

Calibration settings are corrupted. There is no corrective action. Factory service is required.

5.2.4 Fault Type 4 – "Low Voltage Fault"

The input voltage does not meet the minimum device specification. Remove the detector module from the housing. With the detector connected to power, measure the voltage between Pins 1 and 4 and Pins 5 and 8 on the Power connector. Both sets of pins should be report the same voltage and be within the input voltage specifications (see ***SECTION*** 6). If the voltage does not meet specifications, check the external wiring and power supply. There should not be more than 1 Volt of AC ripple at 24 VDC. If the measured voltage is within specification and there is no AC ripple, then factory service may be required.

5.2.5 Fault Type 5 – "Sensor Fault"

Either the visible or infrared sensor did not pass an internal self-test. Ensure the lens is clean by following the instructions provided in section 4.1. In addition, use a dry, lint free cloth to gently clean the sensors on the face of the detector. Reset the device by cycling power. If the fault persists, factory service is required.

5.2.6 Fault Type 6 – "Relay Fault"

One or more of the relay coils are not functioning correctly. There is no corrective action. Factory service is required.

5.2.7 Fault Type 7 – "High Voltage Fault"

The detector was exposed to a voltage that exceeded its listed specifications (see ***SECTION*** 6). There is no corrective action. Factory service is required.

5.2.8 Fault Type 8 – "Temperature Out-of-Range Fault"

The internal measured temperature exceeded listed specifications (see *SECTION* 6). There is no corrective action. Factory service is required.

Note: Any damage caused to a detector resulting from abuse or improper use, or from exceeding its specifications, is not covered under factory warranty.

5.3 Detector Goes into Alarm but No Fire Appears to be Present

After a detector goes into alarm, the FireScape™ data should be retrieved and evaluated to determine if the spectral data that was recorded for the event correlates with an actual fire signature (see *SECTION 2.6.6*). In addition, a factory approved handheld UV detector (see "Accessories" document) may be used to determine if there are any spurious UV sources in the environment, which may have contributed to the alarm event. For further diagnostics and information, contact your distributor.

5.4 Detector Appears to Operate Normally but Will Not Alarm to a Fire or Test Source

Both the LEDs on the front of the detector illuminate and the Fire Output triggers when the detector enters Fire Mode (see *SECTION 2.6.3*.). To determine if the detector is operating normally, the configuration settings should be checked to ensure they are correct (see *SECTION 2.5*).

Follow the appropriate procedure below for the type of RED1 model being tested.

RELAY OUTPUT MODELS

If all of the configuration settings are correct, connect an ohmmeter across Pins 2 and 3 of the Fire Relay connector (see *FIGURE 9-1*) and perform a fire test per section 3.4.

- If the relay closes (0 ohms on the meter) and the LEDs come on, then the detector is operating normally. Check external alarm initiating circuit wiring.
- If the relay closes and the LEDs remain off, or the relay remains open and the LEDs come on, factory service is required.
- If the relay remains open and the LEDs remain off, factory service is required.

4-20 mA MODEL

If all of the configuration settings are correct, jumper Pins 7 and 8 of the RED1-420 connector and connect a current meter between Pins 5 and 6 (see *FIGURE 9-2*). Perform a fire test per section 3.4.

- If the current draw reads 12 mA or 20 mA and the LEDs come on, then the detector is operating normally. Check external alarm initiating circuit wiring.
- If the current draw reads 12 mA or 20 mA and the LEDs remain off, or the current draw is not 12 mA or 20 mA and the LEDs come on, factory service is required.
- If the current draw is not 12 mA or 20 mA and the LEDs remain off, factory service is required.

6 SPECIFICATIONS

Sensitivity at 80 Feet on Axis to a 1 sq. ft. Heptane Fire:	2.75 Seconds Average During FM Testing Note: Sensitivity is Field Selectable for a 20, 40, 60 or 80 Foot Range to a Standard (Heptane Fuel) Fire
Field-of-View:	120° Full Cone
Sensor Responsivity:	Ultraviolet: 185 to 260 nm Infrared: 0.715 to 3.5 µm Visible: 480 to 560 nm
Input Voltage:	15 to 32 VDC, Typically 24 VDC
Current Draw:	40 to 100 mA Nominal Depending on Model, Mode of Operation and Device Status
Relay Outputs:	0.5 A @ 120 VAC, 1.0 A @ 24 VDC Resistive
4 to 20 mA Outputs:	0 mA Fault Mode, 4 mA Normal Mode, 12 mA Fire Mode, 20 mA Verified Fire Mode
Temperature Range:	Operating (Tamb): -40° C to 85° C Storage: -55° C to 110° C
LEDs:	2 Red LEDs Display Switch Settings, Fault Types, Fire and Verify Fire Information
Connections:	Screw Terminals, 14 – 22 AGW Wire Size
Enclosure:	Copper Free Cast Aluminum with Red (Standard) or Gloss White Epoxy Finish Conduits: Two ¾ inch NPT Feed-through Hubs
Hazardous Area Classification:	NEMA 4X, Explosion Proof, Class I Divisions 1 & 2 Groups B, C, D Class II Divisions 1 & 2 Groups E, F, G Class III
Dimensions:	5.4 x 4.8 x 3.7 inches (13.7 x 12.2 x 9.4 cm)
Weight:	Approximately 3 lbs. (1.3 Kg)
Approvals:	FM 3260 CE (EMC 2014/30/EU) Conforms to EN 50130-4:2011

7 APPENDIX A - DRAWINGS

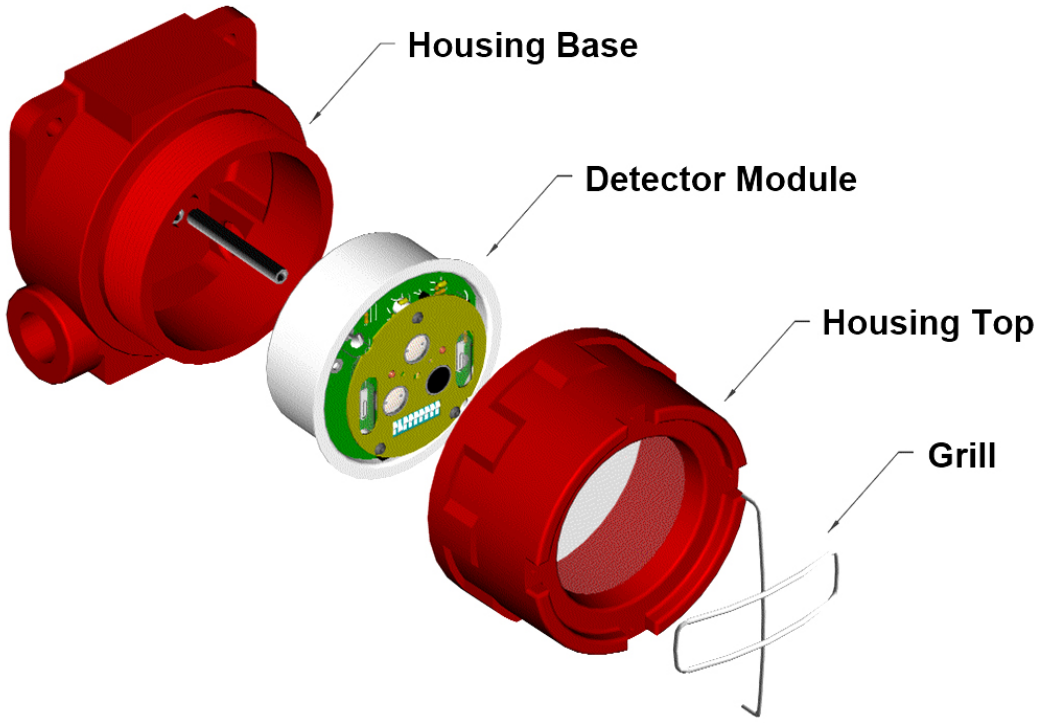


Figure 7-1 RED1 Exploded View

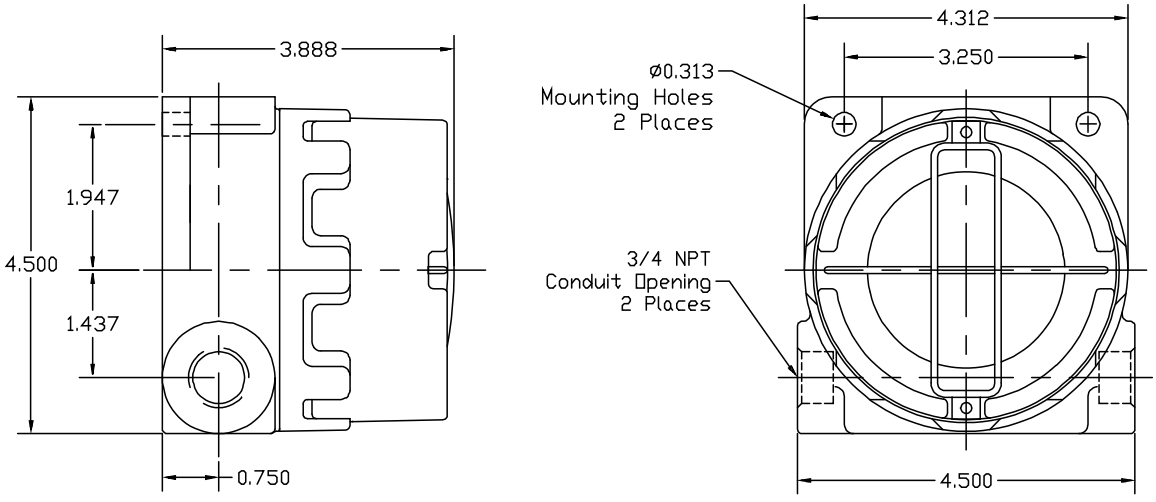


Figure 7-2 Housing Dimensions

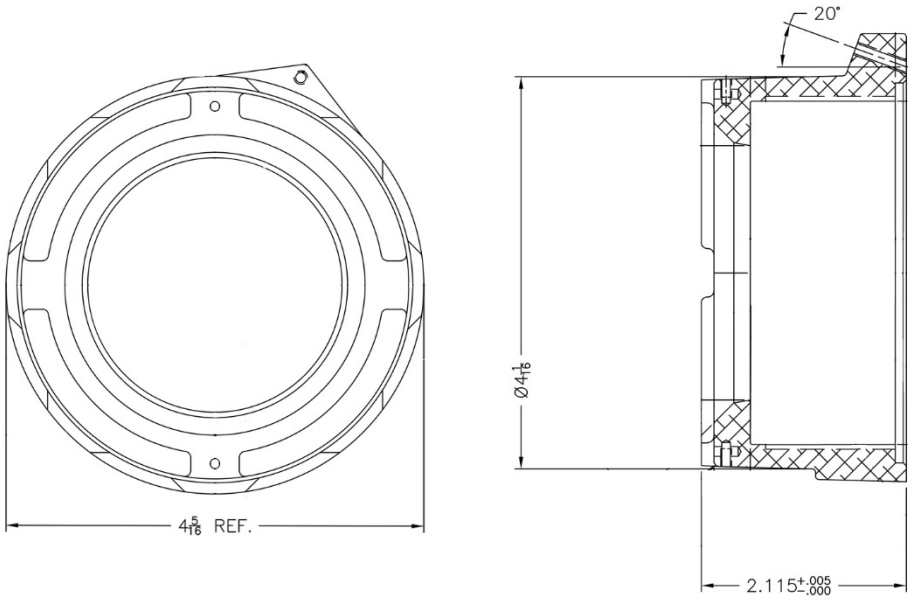
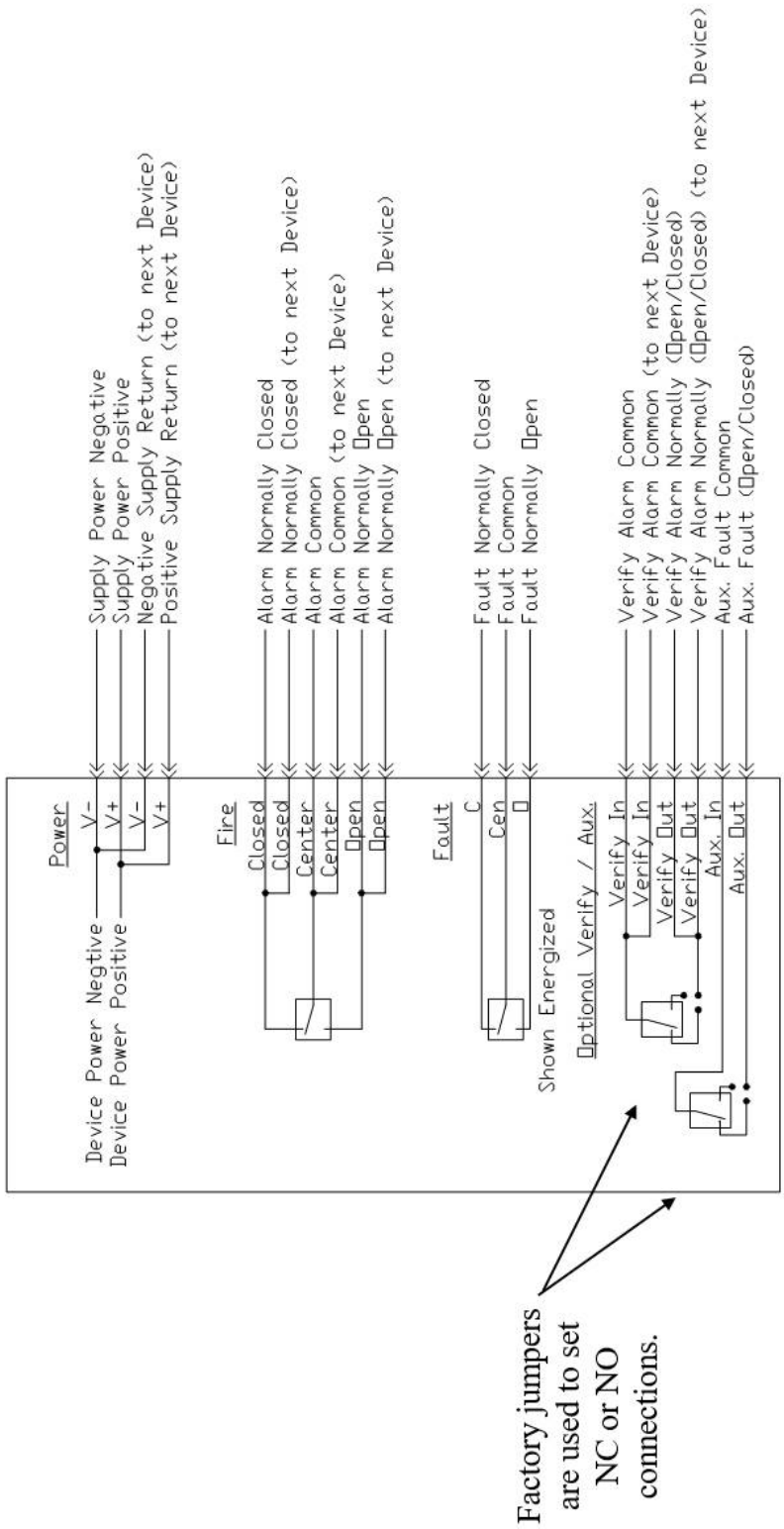
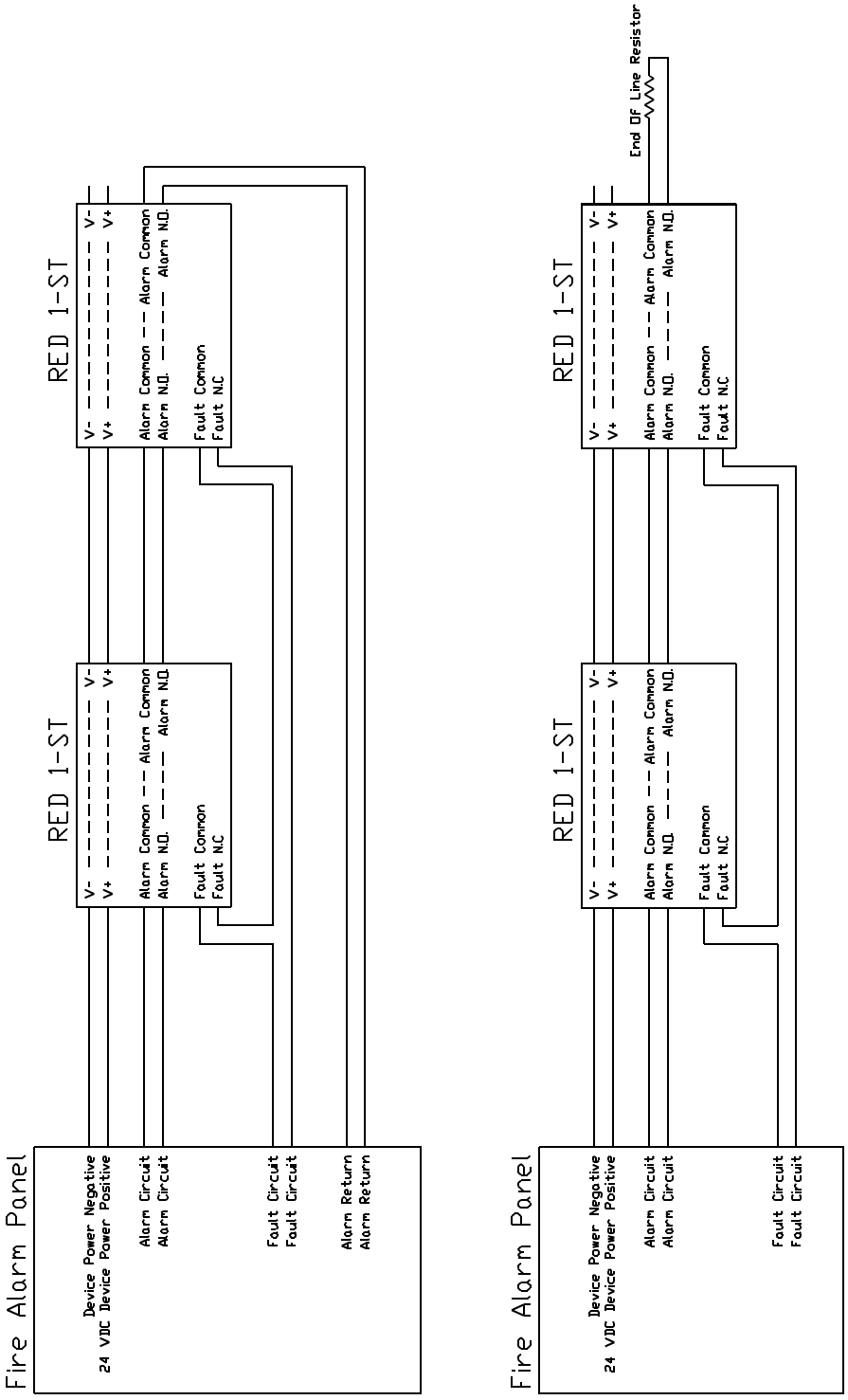


Figure 7-3 Housing Top with Tightening Screw


Power
V-
V+
V-
V+
Device Power Negtive
Device Power Positive
Supply Power Negative
Supply Power Positive
Negative Supply Return (to next Device)
Positive Supply Return (to next Device)
Fire
Closed
Closed
Center
Center
Open
Open
Alarm Normally Closed
Alarm Normally Closed (to next Device)
Alarm Common
Alarm Common (to next Device)
Alarm Normally Open
Alarm Normally Open (to next Device)
Fault
C
Cen
O
Fault Normally Closed
Fault Common
Fault Normally Open
Shown Energized
Optional Verify / Aux.
Verify In
Verify In
Verify Out
Verify Out
Aux. In
Aux. Out
Verify Alarm Common
Verify Alarm Common (to next Device)
Verify Alarm Normally (Open/Closed)
Verify Alarm Normally (Open/Closed) (to next Device)
Aux. Fault Common
Aux. Fault (Open/Closed)
Factory jumpers are used to set NC or NO connections.


RED 1-ST
V-
V+
Alarm Common
Alarm N.O.
Fault Common
Fault N.C
RED 1-ST
V-
V+
Alarm Common
Alarm N.O.
Fault Common
Fault N.C
End Of Line Resistor
Fire Alarm Panel
Device Power Negative
24 VDC Device Power Positive
Alarm Circuit
Alarm Circuit
Fault Circuit
Fault Circuit
Alarm Return
Alarm Return
Fire Alarm Panel
Device Power Negative
24 VDC Device Power Positive
Alarm Circuit
Alarm Circuit
Fault Circuit
Fault Circuit

8 APPENDIX B - DIP SWITCH SETTINGS

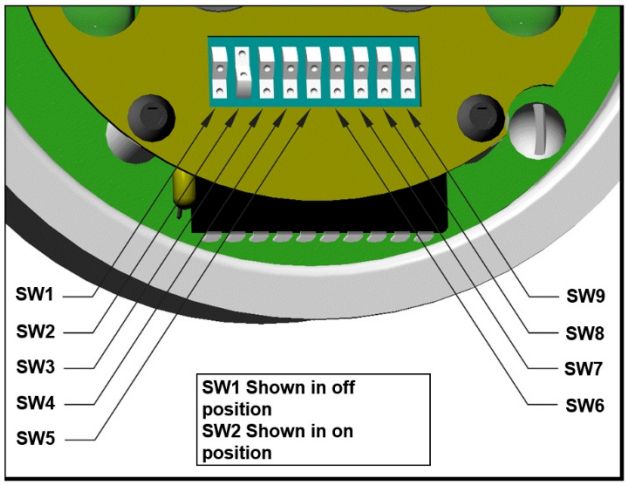


Figure 8-1 DIP Switch Example

Table 8-1 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**

Table 8-2 Verify Fire Control (Enhanced and 4-20 mA Models Only)

Verify	Description	SW3	SW4	SW5
Level 0	**Verify Fire = Fire**	**OFF**	**OFF**	**OFF**
Level 1	Minimum Verify (shorter)	ON	OFF	OFF
Level 2	↓	OFF	ON	OFF
Level 3	↓	ON	ON	OFF
Level 4	↓	OFF	OFF	ON
Level 5	↓	ON	OFF	ON
Level 6	Maximum Verify (longer)	OFF	ON	ON
Level 7	Verify Fire Disabled	ON	ON	ON

Table 8-3 Fire Output Latching Control (All Models)

Fire Output	Description	SW6
Latching	**Alarm Until Power Cycled**	**OFF**
Non-Latching	Alarm Until No Fire (0.5 to 10 sec.)	ON

Table 8-4 Verify Fire Output Latching Control (RED1-E1 to -E4 Models Only)

Verify Fire Output	Description	SW7
Latching	**Alarm Until Power Cycled**	**OFF**
Non-Latching	Alarm Until No Fire (0.5 to 10 sec.)	ON

Note: SW6 and SW7 must be **ON** for the Verify Fire Relay to be Non-Latching.

Table 8-5 Detector's Latching Control

Detector Output	Description	SW8
Latching	**Alarm Until Power Cycled**	**OFF**
Non-Latching	Alarm Until No Fire	ON

Note: SW6, SW7, and SW8 must be **ON** for the detector to be Non-Latching. In this mode the detector's LEDs will follow the fire.

SW9 - Factory Use Only

SW9 is used for factory calibration and testing and **must** be in the **OFF** position for normal operation. Turning this switch ON will result in a Configuration Fault during Power Up Mode.

NOTE: FACTORY DEFAULTS shown in bold

9 APPENDIX C - CONNECTIONS

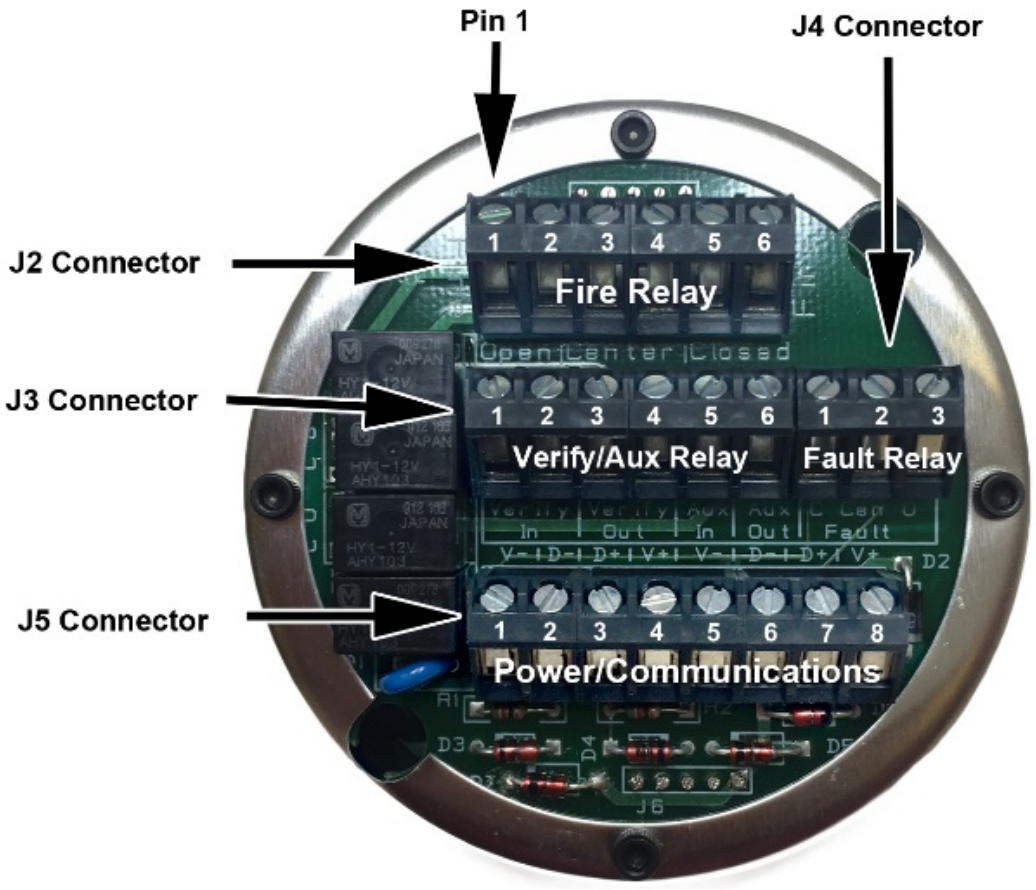


Figure 9-1 RED1 Connections

Note: J3 Only Available on Enhanced Models

Table 9-1 Fire Relay Connector – J2

J2 Fire Relay	Description
Pin 1 & Pin 2	Normally Open Side of Relay (Open)
Pin 3 & Pin	Relay Common (Center)
Pin 5 & Pin 6	Normally Closed Side of Relay (Closed)

Table 9-2 Verify Fire and Aux. Fault Connector – J3

J3 Verify/Aux.	Description
Pin 1 & Pin 2	Verify In
Pin 3 & Pin 4	Verify Out
Pin 5	Aux. In
Pin 6	Aux. Out

Table 9-3 Fault Connector – J4

J4 Fault Relay	Description (Normally Energized State)
Pin 1	Normally Closed Side of Relay (C)
Pin 2	Relay Common (Cen)
Pin 3	Normally Open Side of Relay (O)

Table 9-4 Power/Communications Connector – J5

J5 Power/Communications	Description
Pin 1 & Pin 5	Power (V -)
Pin 2 & Pin 6	RS485 B (D-)
Pin 3 & Pin 7	RS485 A (D+)
Pin 4 & Pin 8	Power (V +)

Table 9-5 Verify Fire and Auxiliary Relay Configurations

Model	Verify Fire Relay	Auxiliary Relay
RED1-E1	Open Contacts	Closed Contacts
RED1-E2	Closed Contacts	Open Contacts
RED1-E3	Open Contacts	Open Contacts
RED1-E4	Closed Contact	Closed Contacts

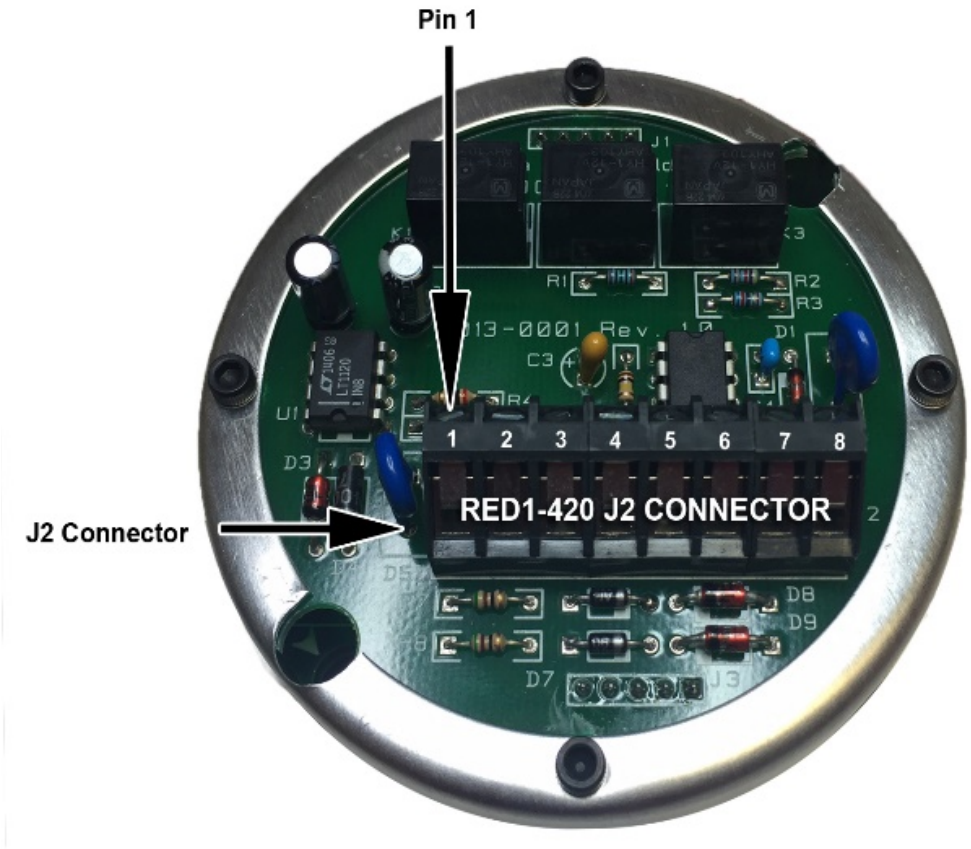


Figure 9-2 RED1-420 Connections

Table 9-6 RED1-420 Connector – J2

Typical Connections

J2 Connector	Description
Pin 1	Power (V -)
Pin 2	RS485 B (D-)
Pin 3	RS485 A (D+)
Pin 4	Power (V +)
Pin 5	4-20 mA Negative
Pin 6	4-20 mA Positive
Pin 7 & Pin 8	Jumper Together

Alternative Connections

J2 Connector	Description
Pin 1	Power (V -)
Pin 2	RS485 B (D-)
Pin 3	RS485 A (D+)
Pin 4	Power (V +)
Pin 5 & 6	Jumper Together
Pin 7	4-20 mA Negative
Pin 8	4-20 mA Positive

10 APPENDIX D - MISC. TABLES

Table 10-1 Faults

Fault #	Fault Type	Description
1	UV Self-Test Fault	UV Sensors Did Not Detect Enough UV from the Internal Source
2	Configuration Fault	SW9 is “ON” or Internal Program Failure
3	Calibration Fault	Device Calibration Corrupted
4	Low Voltage Fault	Insufficient Input Voltage
5	Sensor Fault	IR or Visible Sensor Did Not Pass Internal Self-test
6	Relay Fault	Relay Coil Circuit is Open
7	High Voltage Fault	Input Voltage Exceeded Specifications
8	Temperature Out of Range Fault	Internal Device Temperature Went Outside Specifications

Table 10-2 False Alarm Stimuli

FALSE ALARM RESPONSE This Table Shows the Detector’s Ability to Tolerate Both Modulated and Unmodulated False Alarm Stimuli			
False Alarm 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

Table 10-3 Detector Response to Fuels

Detector Response To Various Fuels (On Axis with Sensitivity Set to Level 1)			
Fuel	**Distance**	**Fire Size**	**Average Response Time**
Heptane	80 Feet	1 Square Foot	2.75 Seconds
Silane (5 psig)	50 Feet	18 Inch Jet	3.42 Seconds
Hydrogen	15 Feet	18 Inch Jet	3.28 Seconds
Kerosene	75 Feet	1 Square Foot	2.85 Seconds

Table 10-4 Fire Response with False Alarm Stimuli

RED1 detector response to a fire while exposed to radiant energy sources.			
False Alarm 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 Seconds
Fluorescent Lights 2-40 Watt Bulbs	6 Feet	6 Feet	Less than 5 Seconds
Halogen Light 500 Watt Bulb	10 Feet	6 Feet	Less than 5 Seconds
Incandescent Light 100 Watt Bulb	6 Feet	6 Feet	Less than 5 Seconds
Arc Welder 50 Watt	25 Feet	6 Feet	Less than 5 Seconds
Direct Sunlight	93 Million Miles	6 Feet	Less than 5 Seconds