DESIGN MANUAL

MODEL F110
ULTRAVIOLET FLAME DETECTOR/CONTROLLER

70047

NOTE: This manual covers the "enhanced" version of the Model F110 UV Flame Detector. The enhanced detector has three LED indicator lights (red, yellow and green) visible through the front window. Detectors manufactured prior to October 1998 do not have the enhanced features, and have only two LED's (red and green). For instructions on this earlier version, obtain a copy of the applicable manual, SST part no. 70013.

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Documentation Overview

This F110 Documentation consists of two main sections. The Model F110 Ultraviolet Flame Detector Design and Application Information section contains information for system designers. The Model F110 Ultraviolet Flame Detector Installation Instructions section provides instructions for the field installer of a Model F110 Detector.

! WARNING: The F110 requires installation by trained and qualified personnel. Improper application and or installation of the F110 may result in significant loss of property, and injury or even death to personnel. Installation personnel must be totally proficient with wiring diagrams and electrical installation. Installation personnel must be knowledgeable of all applicable codes and thoroughly familiar with this manual.

Approvals applicable to the Model F110

This device is suitable for use in both general purpose and hazardous locations. It is weatherproof and corrosion resistant. Approvals include:

Classified by Underwriters Laboratories for use in Class I, Groups B, C, and D; Class II, Groups E, F, and G Hazardous Locations. FTRV, File No. E162517(N)

Classified by Underwriters Laboratories for use in Class I, Groups B, C, and D; Class II, Groups E, F, and G Hazardous Locations per Canadian Standard C22.2 No. 30-M1986 and 25-1966. File No. E162517(N).

EEx dIIB T6 KEMA No. Ex-95.D9791 Flameproof enclosure per EN50018 for groups I, IIA and IIB and EN50014 Electrical Equipment for Potentially Explosive Atmospheres

The enclosure is rated NEMA type 4X, watertight and corrosion resistant.

Model F110 Ultraviolet Flame Detector Design and Application Information

Description

The Safety Systems Model F110 Flame Detector is a self-contained optical flame detection system that responds to the ultraviolet radiation produced by a flame. The F110 features superior sensitivity and immunity to false alarms through the use of advanced design techniques. It can operate in stand-alone mode, without the requirement for a central monitoring controller, or can easily be connected to any site specific control equipment. The F110 detects ultraviolet radiation between the wavelengths of 185 and 245 nanometers.

Internal settings control the sensor sensitivity of the detector and the latching/non-latching alarm outputs option. Three heavy-duty relays and a 0 to 20 mA control loop allow the F110 to connect to a wide variety of external equipment. The detector performs continuous self-checks and reports system level errors to external equipment. Operating personnel can tell the current operational state of the detector “at a glance” by observing the LED indicators visible from the front of the detector.

Summary of Features

- Complete sensor and controller in one integrated package.
- Stand alone local action via dry contact, high current, relay outputs. (latching or non-latching mode)
- 0 to 20 mA Current Loop output
- Selectable sensitivity modes for optimum performance in a wide variety of installations
- Built-in UV test source periodically tests sensor, window and electronics. Test Source can be remotely activated on demand
- Electronics Module plugs into rear housing after installation wiring is completed and tested — Electronics stay safe and secure during field wiring!
- Electronics Module can be removed/installed without removing system power
- Front Housing with integrated 2 pound thermal mass for additional temperature stabilization
- Field Wiring Terminal Blocks provide 2 sets of power connections for easily “daisy-chaining” multiple detectors to one power supply. The terminal blocks are located in the shallow rear housing so that all connections are easily accessible even in low light conditions and to those with large hands

Technical Specifications

Flame Sensitivity:	Reliably detects a 1 square foot gasoline fire at a distance of 70 feet in field selectable, sensitivity settings ranging from immediate (500 milliseconds) to 6 seconds of continued qualifying UV detection.
Cone of Vision:	90 degrees, minimum
Spectral Sensitivity:	185 to 245 nanometer region (ultraviolet)
Detection Modes:	Alarm — Immediate activation (500 milliseconds typical), non-latching. Delayed Alarm — 3 or 6 seconds, latching or non-latching, selected by internal jumper
Detector Self-Test:	Automatically performed every 15 seconds. Check of detector sensitivity, power supply voltage, key circuitry and optical transmission of window
Relay Outputs:	Alarm and Delayed Alarm, selectable latching or non-latching Fault Relay, non-latching Contacts Rated 6 Amps @ 28 VDC or 300 VAC, 1/8 HP @ 120/240 VAC
Analog Output:	Self powered output transmits a 0-20 mA current into a load of 100 to 800 ohms to indicate operating mode of detector. Delayed Alarm selectable for latching or non-latching. 0-2 mA = Fault 4 mA = Ready (normal operation) 12 mA = Alarm Warning (UV detected) 20 mA = Delayed Alarm
Alarm Reset:	Latched outputs are reset by activating the F110 Reset input, or by momentarily interrupting power supply
Visual Indicators:	LED's visible from front of detector display current status. Green — Detector Ready Yellow — Fault Red — Alarm or Delayed Alarm
Enclosure Ratings:	Explosion Proof; Suitable for use in Class I Division 1 Group B, C, D or Class II Groups E, F, G areas. NEMA4X watertight and corrosion resistant. EEx dIIB T6
Ambient Temperature Ratings:	Standard version -40 to +107°C, -40 to +225 °F High Temperature version -40 to +125 °C, -40 to +257 °F
Power Requirements:	20 to 35 Volts DC at 250 mA maximum, 60 mA typical, 150 mA with alarm relays energized
Dimensions:	See Figure 110-8

Principles of Operation

The Model F110 is designed to quickly and reliably detect fires from a variety of flame sources. The F110 detects flame by sensing 185 to 245 nm (ultraviolet) radiation.

In flame detection, hot objects are referred to as black bodies. A black body radiation source is, in simple terms, any object with measurable temperature (a building, person, bird, flame). Every black body emits radiation at frequencies related to its temperature. These frequencies can consist of some or all of the following: visible light, ultraviolet, infrared, microwave, x-ray, etc.

The ultraviolet emitted by a flame is detected by the F110 in a manner very similar to a Geiger counter. Each “parcel” of UV emitted by a flame that is detected by the F110 results in a pulse to the F110 control circuits. Selectable sensitivity settings enable the user to choose the minimum pulse count and time duration prior to signaling an alarm.

The F110 reports its current status and the presence of flame through the use of its 0 to 20 mA current loop and the three output relays.

Flame Response Characteristics

The primary job of a detector is to sense flame and report its presence. Acceptable response times, field of view limitations, and common false alarm sources are key considerations in the proper implementation of a fire detection system.

The ability to detect a flame is directly related to the flame source, size, distance and environmental conditions. The source of the flame determines the flame “temperature” or signature in the frequency region being observed by the detector.

To the detector, flame size and distance are approximately related by an inverse square law: when the distance is doubled, the flame size must be increased four times to provide the same radiated power to the detector.

Environmental factors have a significant influence on the performance of flame detector systems and must be seriously considered in any system design. For instance, the flame size can be greatly influenced by any local wind conditions. A one square foot gasoline fire with an 18 inch flame height can be reduced to a 5 inch height in the presence of a 10 mile per hour wind.

False Alarm Rejection

While secondary to detecting flame, the detectors ability to discriminate against false alarms, perform self tests and adequately monitor its own operation is of the utmost importance. In many installations, the ability to eliminate false alarms is as important as the ability to detect a flame. Arc welding, lightning, X-rays, gamma radiation and high electrostatic forces each emit varying levels of ultraviolet radiation. The F110 must be protected from false alarm sources such as these. The designer must choose the proper combination of placement criteria, protective requirements, response time and sensitivity for each F110 installed location.

Intended Uses

The F110 is designed to detect flames from a wide variety of fuel sources. Typical fuels include:

JP4	Methane	Wood
Diesel Fuel *	Gasoline	N-heptane
Kerosene *	Alcohol (IMS)	Ethylene glycol
Butane	Propane	LNG and SNG
Hydrogen	Munitions	

* Sensitivity of UV detectors to diesel fuel and kerosene is reduced due to precombustion smoke

Operational summary

Prior to applying power, all relay outputs are inactive. When power is applied, the Alarm and Delayed Alarm relays remain inactive, the Fault Relay is activated to acknowledge "Power On", and the 0 to 20 mA current loop is initialized to the 4 mA "Ready" state. The self-test routine is performed 15 seconds after power up, and is repeated every 15 seconds thereafter. The Model F110 Ultraviolet Flame Detector will always be in one of the following operational modes, depending on the current conditions.

Fault Mode

Fault Mode is entered upon failure of any Self Check item (dirty lens, out of range power supply, stuck Reset, etc.). The current loop output will be 2 mA when in Fault, and the Fault relay is de-energized. When in Fault Mode, the F110 will attempt continued operation. An Alarm signal received from an F110 that is in Fault Mode should be scrutinized prior to initiating extinguishant release, etc. Fault Mode indicates a serious failure and the need for immediate service prior to return to use. See the Troubleshooting section of this Installation Manual

Self Check

The Self-Check is a comprehensive test to insure proper operation of the internal circuitry. The Self-Check also includes a through the lens test of the ultraviolet sensor tube. This through the lens test insures that the lens is unobstructed and that the UV sensor is functioning. Should any portion of the Self-Check fail, the 0 to 20 mA current loop and Fault Relay are immediately placed in Fault Mode. The Self-Check is executed at Power-Up and is periodically executed from Protection Mode.

Protection Mode

During normal operation, the F110 enters Protection Mode. In Protection Mode, the F110 continually checks for a flame in its field of view. The F110 also executes a self-check regularly while in protection mode to insure key elements are operational.

Alarm Warning Mode

The Alarm Warning Mode indicates that ultraviolet radiation has been detected that has not yet met the complete criteria for flame detection (too small or still developing flame), or has been filtered out by the false alarm rejection circuitry. The current loop output is set to 12 mA during the warning condition and the Alarm relay is activated. The Alarm relay is non-latching, and will return to normal as soon as the UV radiation ceases. The Red LED is ON during the warning condition.

Delayed Alarm Mode

The Delayed Alarm indicates that the criteria for detecting a flame has existed for a user set period of at least 3 or 6 continuous seconds after the signaling of an Alarm Warning. In Delayed Alarm Mode, the Delayed Alarm relay will be active, the current loop set to 20 mA, and the Red alarm LED is ON.

When the Non-Latching Mode is selected (see Jumper pin assembly section), the Delayed Alarm will immediately reset when the flame stimulus disappears. In Latching Mode, the Delayed Alarm output will remain active until receipt of a detector Reset signal.

LED Indicators

The red, yellow and green LED's on the front of the detector allow an inspector to determine "at a glance" the current status of any F110 detector as follows:

RED	Indicates detection of any UV radiation
YELLOW	Indicates dirty window or detector fault
GREEN	Indicates Detector Power is on

Detector Reset Operation

The Model F110 "Reset" input is primarily used to remotely reset any alarms, if the detector has been set for latching alarm operation. In addition, the reset input is used to initiate self-tests in the detector. The Detector Reset input is usually controlled with a normally open pushbutton or an output from a programmable logic controller (PLC). The Detector Reset signal input on several F110's may be connected together to permit simultaneous control of several F110 detectors.

Activating the Reset signal momentarily clears all outputs, setting the current loop to 4 mA, and deenergizes the alarm and delayed alarm relays. A Reset issued while the F110 is in Fault Mode will reset all outputs, then initiate the automatic self check feature, prior to returning the detector to normal operation.

System Input Signals

The F110 UV Detector requires nominal 24 volts DC power source for operation. The Detector Reset signal is optional, but may be required if outputs are set for latching operation.

Detector Reset

The Reset input signal must be a low going signal which remains active, below 0.5 volts, for a minimum of 0.3 seconds. It is recommended that the Reset button provided to the operator be a normally open switch which goes to 0 volts (the negative side of the 24 VDC power supply, or circuit ground) when activated. A 10K pull up resistor is provided within the F110 to keep the reset signal inactive (high).

! The Reset input on the F110 is clamped at a maximum of 5.0 volts by an internal zener diode. Do not apply a voltage greater than 5 volts to this input.

+24 Volt Power

The F110 requires an external 24 volt DC power source. Any source between 20 and 35 volts is acceptable. The maximum required current is 250 mA at 35 volts or 150 mA at 24 volts. Circuitry internal to the F110 provides filtering from small power supply sags/surges. Power loss will be indicated by a change in state of the fault relay and 0 mA at the current loop output.

System Output Signals

The F110 UV Flame Detector has red, yellow and green LED's that are visible through the quartz window on the front of the detector to indicate locally the operational status. The below listed outputs are provided.

0 to 20 mA Current Loop Output

The 0 to 20 mA Current Loop (terminal 5 on the rear housing terminal connector) is "self-powered" by the F110 power supply, and can work into any load resistance between 100 and 800 ohms. Terminal 7 (0 VDC) is the return. The current loop output indicates the present operational mode of the detector as follows:

0 mA = Power fault
2 mA = Dirty window or detector fault
4 mA = Condition normal, no UV detected
12 mA = First (instantaneous) alarm warning, UV has been detected
20 mA = Delayed (final) Alarm, UV continuous for 3 or 6 seconds

The Delayed Alarm output can be configured as latching or non-latching by setting a jumper inside the detector. When set to latching, you must reset the detector to return the current loop settings to normal.

! Note that 0 mA or 2 mA is a valid output level for the current loop signal. Be sure that any external equipment, such as a PLC input or DCS system, connected to this output can sense 0 mA.

Relay Outputs

Three (3) relays are provided: Fault, Alarm, and Delayed Alarm. Normally Open and Normally Closed contacts are provided for each relay.

The Delayed Alarm relay can be set as either latching or non-latching. The Alarm and Fault Relays are always non-latching (self-clearing).

Relay Protection Circuitry

When using the F110 relays to switch external DC inductive loads, you should provide a suppression diode across the load coil as shown in figure 110-1. This will suppress the generation of large transient spikes that could burn the F110 relay contacts and cause premature failure. With AC loads, suppression is required only with very heavy loads. In that case, substitute a metal oxide varistor or other surge suppressor in place of the diode shown.

Local 24 VDC Power

When the F110 electronics module is plugged in, the two terminals identified as "local" are jumpered to the +24 VDC and 0 VDC terminals. The local power terminals are provided to allow easy "daisy chaining" of the 24 VDC power supply to any locally powered 24 volt devices or to another F110 detector.

! Note that when the F110 Electronics module is removed for inspection or service, no power will be supplied to these terminals. These outputs are NOT regulated, filtered, fused or overload protected within the F110 unit.

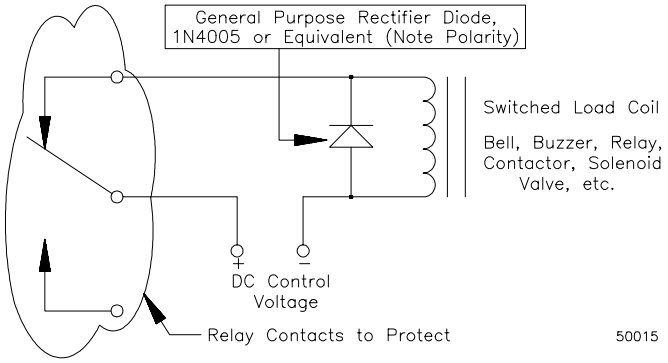

Figure 110-1 Relay Protection

Application Information

The F110 can operate as a stand alone detector or as one part of a complete, centralized detection and control system.

Stand Alone

As a stand alone device, the F110 is an integrated detector which provides complete flame detection, and output control functions at the local detector level – without the requirement for external control modules. All control features are within the F110 housing, along with 3 relay outputs to control local annunciators, warning devices or fire suppression equipment.

Centralized Control

The F110 may also communicate with a centralized detection and control system using the 0 to 20 mA current loop output. Or if the relay outputs are not being used for “stand alone” local control, they may be connected to the central control system.

Detector Sensitivity

Flame detection sensitivity adjustments require tradeoffs between response times, minimum flame size detection thresholds and false alarm rejection capabilities. Advertised detection ranges, while common in sales literature, are of secondary importance in system design. The real world provides few perfect 1 square foot gasoline fires burning under ideal conditions. While a detector capable of detecting a 1 square foot flame at 50 feet can detect a 4 square foot flame at 100 feet, few installations can provide a 100 foot unobstructed view. Likewise, large extinguishing zones are costly and often undesirable.

Systems designers can not set an arbitrary 50 foot perimeter around any detector and automatically claim complete and adequate protection. The composition and source of available combustible materials (high-pressure pipeline, ground puddle accumulation, etc.), the range and direction of ambient wind conditions, and many other local factors greatly effect the ultimate system design and detector placement criteria.

One instantaneous mode of detection and two delayed detection sensitivity settings are provided for optimum protection in a wide variety of installations. A Jumper pin assembly located on a printed circuit board inside the enclosure selects the sensitivity settings. The Normal Mode is an excellent multipurpose setting, recommended for typical installations.

Instant Mode

Instant Mode provides immediate notification of detected UV radiation. This mode is for use in protected areas, free from false alarm sources. Instant mode activates the Alarm relay, and sets the analog output to 12 mA. These outputs are non-latching. Instant mode is always available; it is not necessary to set any internal jumpers to select the instant mode.

! UV Radiation from lightning, welding, and x-rays will activate all UV flame detectors. Instant mode is not recommended where the F110 detector will be subject to these false alarm sources.

Normal Mode

Normal Mode is the suggested setting for most environments. Normal Mode requires the source of UV radiation to persist continuously for 3 seconds. The Delayed Alarm relay will be activated, and the analog output will be set to 20 mA. These alarms may be set to be latching or non-latching.

! In normal mode, the Instant Mode Alarm relay will also activate (and the analog output will go to 12 mA) during the 3 second delay. These outputs may be used as a pre-warning of a potential delayed alarm.

Reduced Mode

Installations that are challenged by potential false alarm sources can benefit from the Reduced Mode. This mode decreases sensitivity, responding to a one square foot gasoline fire in 6 seconds. The detector increases false alarm rejection by requiring the fire to be present for a longer period of time before signaling a delayed Alarm.

Setting Alarm Output Options

A 4 position jumper pin assembly inside the detector selects the desired sensitivity setting and Delayed Alarm output configuration. There are two “suitcase jumper” plugs provided which can be moved to select the desired options. The available jumper settings allow you to set the time delay for activating the Delayed Alarm to either 3 or 6 seconds, and to set this output to be either latching or non-latching. These settings affect both the relay and current loop outputs. In the latching mode, once activated, the Delayed Alarm relay outputs will remain active until receipt of a detector reset signal. In non-latching mode, the relay will remain active as long as there is a continual, uninterrupted fire presence.

The Fault and Instant Alarm outputs are always non-latching, even when latching mode is used for the delayed alarm output.

Placement

The Flame Detector must have an unobstructed view of the area it is intended to protect. When protecting an active work area (utilized by personnel or a machine) always place the detector at least 10 feet from the nearest person or active machine. This will insure that the operator does not obscure the detector's field of view.

Field of View

Flame detectors exhibit reduced sensitivity to flames that are not directly in front of them (on axis). Relative sensitivity at various off axis angles is described in the field of view diagram. It defines the detector sensitivity as a function of flame location in the field of view. For example, if the flame is located directly in front of the detector, at an angle of zero degrees (0°) the detector will respond to the standard 1 square foot gasoline fire at a distance of 70 feet. At 30° off axis, the sensor sensitivity is approximately 85% of the on-axis sensitivity; resulting in a reduction of the effective range of the detector to about 55 feet. Note that the worst case detection range for the detector will be a range of 35 feet at 45° off-axis.

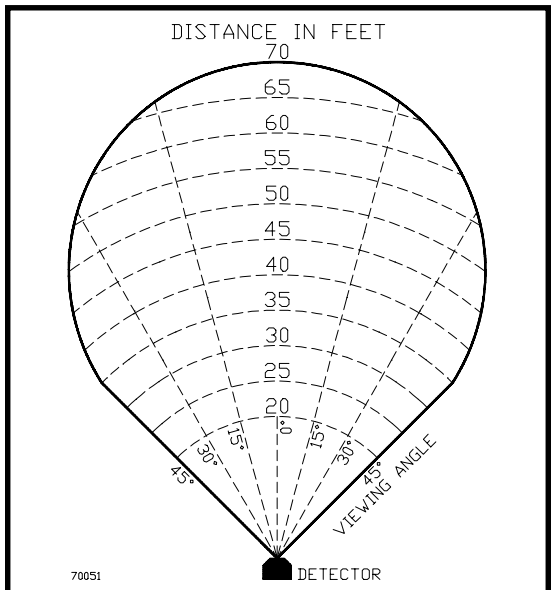

Figure 110-2 Field of View Diagram

Aiming the detector

Existing conduit will rarely provide an optimum location for the F110. A conduit union and swivel elbow is most useful for connecting the detector to existing conduit. Or a swivel mounting bracket may be used. Both of these devices are available from Safety Systems Technology. Specify 3/4 inch conduit fittings for attachment to the F110 rear housing.

Figure 110-4 shows one possible installation scheme. If the detector is located below the level of the conduit, always use a conduit seal to prevent accumulation of moisture in the conduit system from entering the detector housing. In hazardous locations, the conduit seal must always be provided in compliance with local codes.

Utilize the field of view diagram and a drawing of the area to be protected in specifying the mounting elevation and detector orientation to the field installer. Where required, additional F110 units should be utilized to insure adequate coverage.

Orientation

The F110 will operate in any orientation. Recommended orientation is above the intended protective zone to insure a clear field of view and minimal accumulation of dust and debris on the lens surface. Mount the detector at a minimum declination of 20 degrees. The F110 detector housing is marked "TOP" to identify the recommended side of the detector that should be mounted facing up. This orientation provides a slight increase in the "self cleaning" action of the housing and lens well.

Model F110 Ultraviolet Flame Detector Installation Instructions

Installation Procedure

The following steps are required for installation. Each step is explained in detail in the following pages.

1. Install Conduit Mounting
2. Chassis Grounding
3. Proper orientation of Rear Housing
4. Wiring of the Rear Housing Connectors
5. Installation of the Electronics Module
6. Installation of the Front Housing
7. Alignment of the Front Housing
8. Applying Power For the First Time
9. Test and Checkout

Prior to installation a complete drawing of the system which specifies the physical location and orientation of each detector, and all wire hook ups should be prepared by the System Designer. Your local Safety Systems Technology Distributor can assist in this process.

F110 Components

Before installing the F110 detector, you must disassemble the unit into the three components shown in figure 110-3. Use a metric hex wrench to loosen the locking screw on the rear of the detector housing. Then unscrew the front housing from the rear housing.

Removal of the Electronics Module is most easily accomplished by gently rocking the board parallel to the Rear Housing terminal blocks. Place a finger under the top PC card, place another finger under the edge of this card on the opposite side. Gently rock the board, while pulling, to disengage the module from the rear housing. *Do not allow dirt or finger marks to get onto the face of the UV sensor tube in the top of the electronics module.*

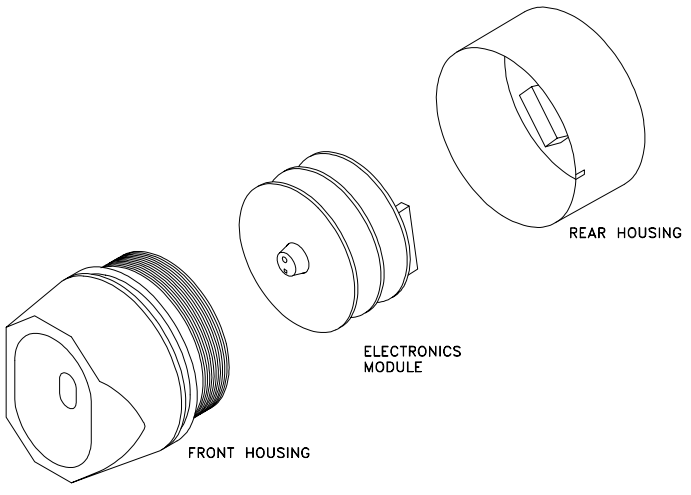

Figure 110-3 Basic Components

! The locking screw in the rear cover must never be removed. Operating the detector without the screw in place could allow moisture to enter the detector, or cause an explosion. The stainless steel cover plate over the screw prevents it from being removed.

Note that there is a small alignment notch on both the front and rear housings. You will use these notches later as a guide to indicate when the housing is properly assembled. Inside the rear housing are two terminal blocks, clearly marked with wiring information. Two chassis ground terminals are provided, one inside the housing, and the other on the back outside of the rear housing.

The threads on the housing, and the O-ring seal are lubricated to permit easy unscrewing of the front housing. Be careful not to remove this lubricant.

The Electronics Module is a set of three (3) circuit boards mounted in a rugged, compact stack. The two connectors that mate with the terminal block in the rear housing are keyed to prevent incorrect insertion of the module.

Conduit Mounting

The F110 rear housing is threaded for a standard 3/4" rigid conduit connection. In most installations, a swivel-mounting elbow is required to allow proper aiming of the Model F110 at a specific point in the protected area. See figure 110-4. It is important to follow standard procedures to insure that the conduit to F110 joint is sealed against water condensation. If the detector is located below the level of the conduit, always use a conduit seal to prevent accumulation of moisture in the conduit system from entering the detector housing. In hazardous locations, the conduit seal must always be provided in compliance with local codes.

It is also possible to mount the detector with a separate swivel-mounting bracket. In that case, a short length of flexible conduit (or flexible cable installed with an approved cable gland where regulations allow), is used between the detector and the conduit system to permit aiming of the detector.

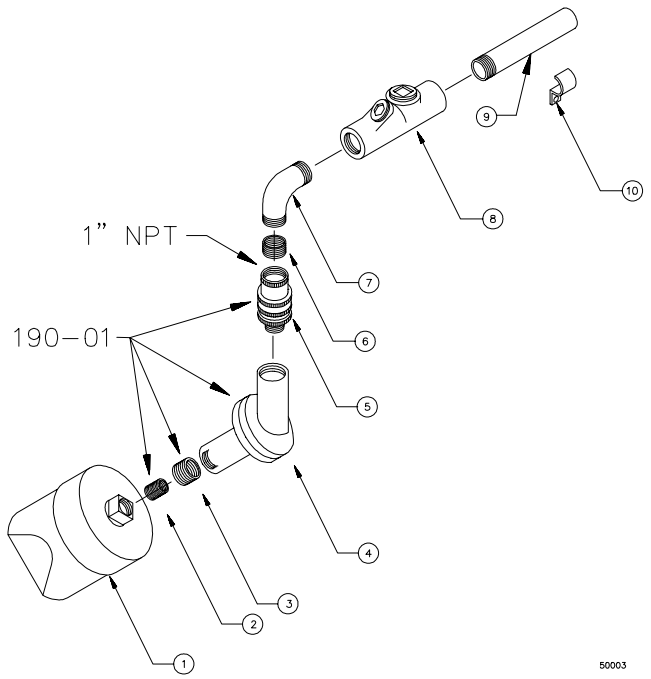

Figure 110-4 Conduit Mounting Method

Chassis Grounding

A Ground terminal is provided on both the inside and outside walls of the rear housing for use in applications where the conduit does not provide adequate grounding to the F110, or the System Designer determines that additional grounding is required. A minimum 18 gauge wire is required for the ground connection.

Circuitry that protects against damage from lightning, miscellaneous transients and power surges is internally connected to terminal #10 on the terminal block. As shipped from the factory, a jumper wire is installed between rear terminal #10 and the 0 volt terminal, thus connecting the transient protection to the grounded 0 volt power line. The 0 volt power line must always be grounded, either at the F110 or elsewhere in the system.

! In areas subject to large transients or intense lightning storms, protection can be improved by removing the factory installed jumper between terminal 10 and 0 volts, and connecting terminal 10 directly to the chassis ground screw inside the detector housing. However, this scheme can be used only if the 0 volt side of the power supply is firmly grounded. A potential difference of more that 3.0 volts DC between chassis ground and the 0 volt line will damage the F110 detector.

Rear Housing Orientation

The F110 will operate in any position. After the rear housing has been mounted on the conduit, adjust the swivel mechanism such that the detector, when installed, will be aimed at the desired protected area. If possible, now tighten the rear housing on the conduit until the metal nameplate on the outside of the housing is facing downward. This will insure that when the front housing will be in its preferred orientation when it is secured and aligned with the rear housing. The "TOP" label on the front housing will then be on top when it is installed. Mounting the detector in this orientation, provides a slight increase in the "self cleaning" action of the housing and lens well.

Field Wiring

The Rear Housing terminal blocks will accept one or two 14 AWG (2.5 mm^2) stranded wires. However, we recommend that you use 16 or 18 AWG (1.5 or 0.75 mm^2) wires whenever possible. Labels inside the Rear Housing clearly illustrate the connector assignments. These are also shown in Figure 110-5. When completed, all wiring should be tested for shorts, opens, grounds, proper voltage and polarity. Then the Electronics Module may be installed.

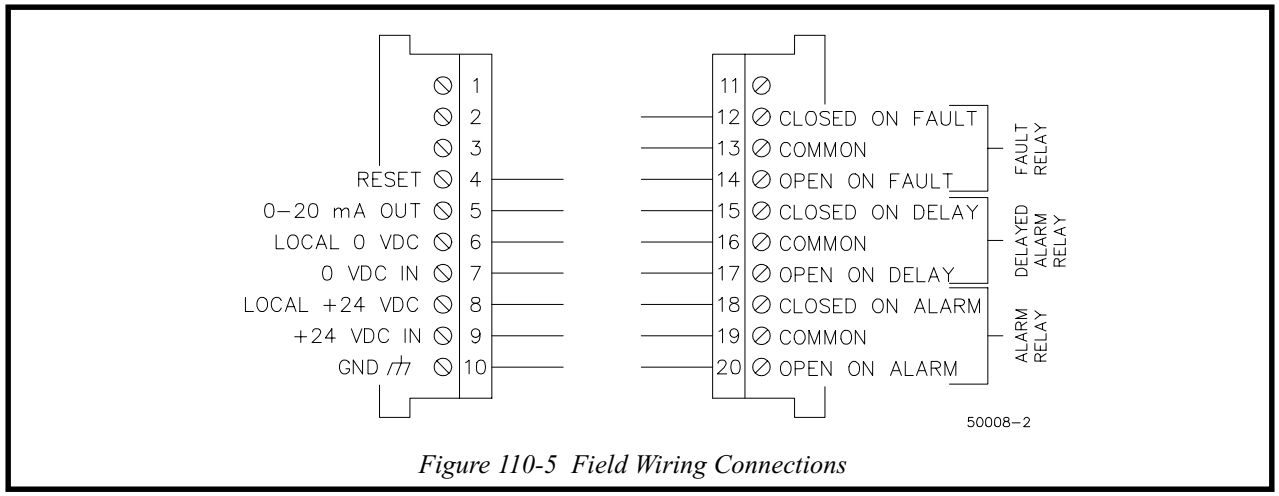

Figure 110-5 Field Wiring Connections

Installing the Electronics Module

When handling the electronics module, do not touch the front face of the UV detector tube. Finger marks or dirt here will impair the operation of the detector. The Jumper pin assembly must be set before the module is inserted into the housing.

Setting the Jumper pin assembly

Position the electronics module so that you are viewing it from the side, with the ribbon cable towards you and the detector tube pointing upward. You should now see a 4 position jumper pin assembly just to the right of the ribbon cable connector. The pins are numbered 1 - 4 from left to right.

Jumper locations 1 and 2 control the time delay for the delayed alarm output.

Placing the pin jumper on location 1 sets the delayed (final) alarm at 3 seconds.

Placing the pin jumper on location 2 sets the delayed alarm at 6 seconds.

Jumper locations 3 and 4 control the latching of the delayed alarm output.

Placing the pin jumper on location 3 sets the delayed alarm to non-latched mode. The delayed alarm contacts will reset automatically when the flame detector no longer sees UV radiation.

Placing the pin jumper on location 4 sets the delayed alarm to latched mode. In this mode you must activate the manual reset input on the detector to clear the alarm.

Note: Units are shipped set for 3-second delay non-latching.

Installing the Electronics Module into the rear housing

Dress Wires

Before installing the electronics module, make sure that all wires to the terminal blocks are properly dressed. The wires must not protrude upward, above the terminal blocks.

Connect Polarized Terminal Blocks

The mating terminal blocks of the electronics module and the rear housing each have protective (red) polarizing keys. This key is to protect against improper installation. The red key of the Electronics Module WILL NOT FIT over the red key of the rear housing connector. Orient the electronics module so that the red keys are NOT aligned.

Notice the two screw heads on the top PC Board. Place a thumb over each screw and gently push the Electronics module in place, firmly seated in the Rear Housing Terminal blocks. Once the Electronics Module is firmly in place, the Front Housing can be installed.

Installation of the Front Housing

The Front and Rear Housing threads and O-Ring are shipped prelubricated. This lubrication is required. It insures the ease of assembly and future disassembly. It also increases the water resistance of the unit. Should the lubrication become inadvertently contaminated (dirt, etc.) or removed, the lubrication replacement procedure in the Maintenance Section must be followed.

Easy way to tighten both housings together: Engage the threads of the front and rear housings. It is often helpful to rotate the front cover backwards (counterclockwise) one to two turns. This will assist in locating the threads prior to tightening the front housing into the rear. While rotating the front housing counterclockwise and applying slight rearward pressure, a slight "click" can be heard. The "click" is a useful indication that the front and rear housings are aligned and can be tightened together. Continue to tighten, BY HAND, the Front Housing into the Rear by turning it clockwise. If necessary, the Rear Housing can be held in correct orientation by placing a 1¼ inch open end wrench over the rear mounting hex shaped conduit entrance while tightening the Front Housing BY HAND.

WARNING: Do not over tighten the front and rear housings. Do not use a wrench or other mechanical device to tighten the Front Housing. Over tightening may damage the threads and or prevent the unit from operating.

After five (5) complete turns, the O-Ring will begin to engage the Rear Housing. Take note of the alignment "V" groove (see figure 110-6) located on the Front Housing and alignment marks on both the Front and Rear Housings (figure 110-7). When the O-Ring disappears and the rear-most side of the alignment "V" groove has disappeared below the leading edge of the Rear Housing, the Front Cover is adequately engaged to insure an explosion proof and water resistant junction. It also indicates that the spring-loaded lamp contacts are engaging the top PC board. Continue to rotate the Front Housing until the alignment marks on the Front and Rear housings are aligned.

When both alignment marks are aligned, the rear housing alignment screw must be fully seated to insure a water resistant seal.

WARNING: The Alignment Screw must be fully seated to insure proper operation and flame detection protection. Neglecting to fully seat the alignment screw may cause moisture to accumulate in the F110.

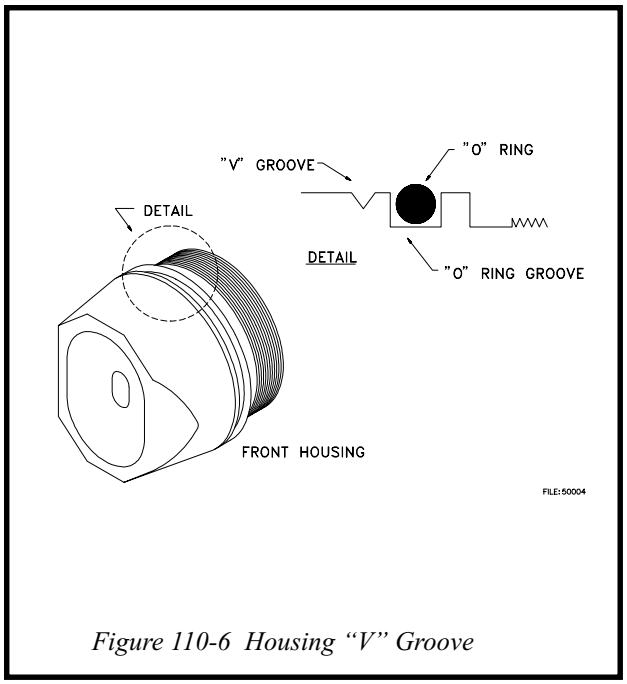

Figure 110-6 Housing "V" Groove

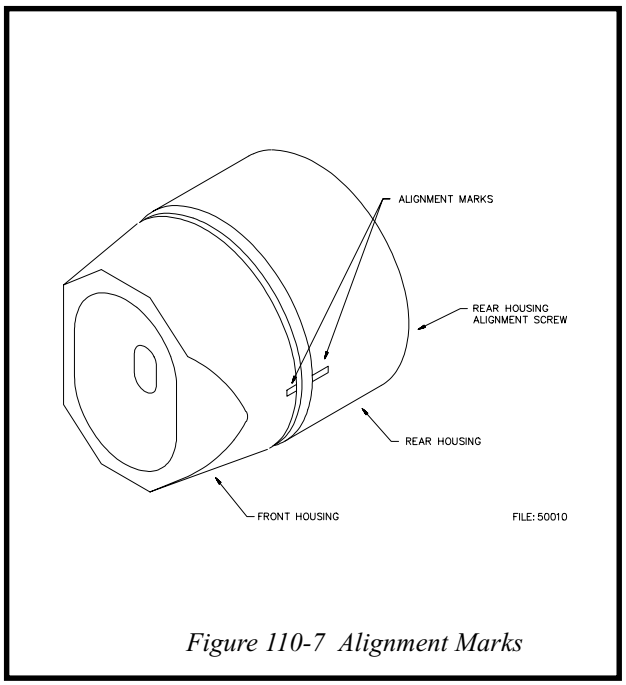

Figure 110-7 Alignment Marks

Applying power for the first time.

Power can be applied for the first time, when the Rear Housing has been properly mounted, wired and tested, the Electronics Module is in place and the Front Housing sufficiently tightened onto and aligned with the Rear Housing.

WARNING: When the unit is under power, voltages in excess of 300 volts DC are present on the electronics module. DO NOT TOUCH ANY PART OF THE MODULE when power is on.

What to expect

On power up, the current status of the F110 detector is shown by the three LED's (Red, Yellow and Green) visible from the front of the detector. A complete description of LED's can be found in the section of the Model F110 Design Manual titled "LED Indicators". At start up, only the green LED will be on.

Automatic Self Check (ASC)

Fifteen seconds after power up, the green LED will remain "ON" and the detector will enter the Automatic Self Check (ASC) mode. The test lamp is activated, and the electronic circuits are checked. A single green LED displayed at the end of the ASC indicates a "pass" condition. A yellow LED indicates a fault (malfunction) condition. If the F110 signals a malfunction, check to make sure that the Front and Rear housings are sufficiently engaged and that the aligning notches and aligning screw is in position. Additional troubleshooting instructions can be found in the Troubleshooting Section of this Manual.

Normal Operation

Upon successful completion of ASC, the F110 enters "Protection Mode" and begins normal operation. The Green LED is on.

Final Operational Check-out

Once the model F110 has entered normal operation, a final comprehensive output test of all detector inputs and outputs can be performed. The test exercises all outputs, including ALARM and DELAYED ALARM states to verify installation wiring

WARNING: Do not execute the F110 Output Test until all external equipment connected to the F110 is properly configured to receive (and possibly ignore) alarm signals from the F110. Failure to do so may result in an unnecessary release of fire extinguishant or unnecessary dispatching of emergency personnel.

You will need a source of UV radiation to activate the F110 during these tests. If the protected area is known to be non-hazardous (no flammable gasses present), you can use a cigarette lighter or other flame source. In hazardous areas, you must use a suitable UV test source. See the listing under Recommended Spare and Maintenance Parts.

Performing The Operational Test Sequence

Before starting the Test, the detector must be in normal operating mode, with no faults and no alarms. The analog output will be at 4 mA at this time. The following sequence is recommended:

Fault Test

The through-the-lens self test occurs when a source of Ultraviolet radiation inside the front cover is activated. This UV "light" shines through a tiny hole in the front cover, just in front of the quartz viewing window, and through the window onto the UV sensor tube. You can simulate a dirty lens fault by placing your finger or a piece of opaque tape over this hole. The automatic self check is performed every 15 seconds, and about 10 seconds is allowed to the detector to complete the check. So the detector will go into fault mode within 30 seconds. Results:

- Yellow Led illuminates
- 0 to 20 mA Loop output changes to 2 mA
- Fault Relay toggles "Open on Fault" and "Closed on Fault" Outputs

Instantaneous Alarm Test

Activate the detector by placing the UV test source within the field of view. The detector will go into alarm within 500 milliseconds. Results:

- Red Led illuminates
- 0 to 20 mA Loop output changes to 12 mA
- Alarm Relay toggles between "Open on Alarm" and "Closed on Alarm"

Delayed Alarm Test

Activate the detector by placing the UV test source within the field of view for at least 3 or 6 seconds, depending on time delay jumper setting in the F110. At the end of the time delay:

- Red Led remains on
- 0 to 20 mA Loop output changes to 20 mA
- Delayed Alarm Relay toggles between "Open on Alarm" and "Closed on Alarm"

Reset Test

If the delayed alarm is set for latching operation, the above conditions will remain upon completion of the Delayed Alarm Test. Activate the detector's Reset input to reset these outputs. Or you may momentarily interrupt the power to the F110 to reset. Results:

- Red Led turns off; only Green LED remains on.
- 0 to 20 mA Loop output changes to 4 mA
- Delayed Alarm Relay returns to normal

Maintenance

Periodic Maintenance

Cleaning the lens of any accumulated dust, dirt, film or debris is the only required periodic maintenance task. Use a clean rag or cloth dipped in water to wipe the lens clean. Do not allow dirt or lint to accumulate in the small hole adjacent to the lens that houses the UV test source lamp.

VERY IMPORTANT: Never clean the sensor window with Windex or other commercial glass cleaners. They often contain silicone or other UV inhibitors that will prevent the sensor from detecting a fire.

Front/Rear Housing Thread Lubrication

If contamination to the existing lubricant occurs during installation or inspection, replace with a high performance, high temperature, Molybdenum and Graphite grease. MOLYPLATE® and MOLYGRAPH® are two readily available greases that meet the requirements.

O-Ring Lubrication

The Front Housing O-ring may require additional lubrication during removal or replacement of the Front Housing. A multipurpose synthetic lubricant with Teflon, such as SUPER LUBE® by Permatex Industrial should be utilized. Petroleum jelly should not be used as a lubricant. While it will not attack the Viton O-ring, it does not provide the same lasting protection available with synthetic Teflon based lubricants.

Troubleshooting

The model F110 Self Check is a comprehensive set of tests which insures proper operation of the detector. The Self Check is automatically performed during normal operation, and is performed each time the system power is reapplied. If the detector Reset input is wired, the operator can also request the Self Check by activating the reset input of the detector.

Should any test fail, the F110 will signal a fault condition and attempt continued operation. A fault at time of initial installation is usually due to incorrect assembly of the housing or incorrect settings on the Jumper pin assembly. Fault conditions reported in normal operation usually indicate a dirty or contaminated viewing window.

If the F110 signals a Fault condition

- ❑ Check the green LED power indicator. If it is not illuminated, confirm that +24 volt DC power exists between rear terminal block pin 9 (+24v) and pin 7 (0v). If +24 VDC power is not present, troubleshoot the conduit wiring and system power supply. Replace the Electronics Module if +24 VDC is present between rear housing terminal block pins 9 and 7 and the green LED does not operate.

- ❑ Confirm Front & Rear Housings are properly aligned, using alignment marks visible on front and rear housings.

- ❑ Confirm Rear Housing alignment and lock screw is engaged.

- ❑ Check to see if the front housing cover can be engaged 1 additional turn — without excessive force.

- ❑ Confirm Jumper pin assembly jumpers are in valid positions. If in doubt, place one jumper at position number 1 and test for 3 second delayed alarm, non-latching. After changing jumper positions, remove and reapply power to the unit, causing the new setting to be read. Recheck for proper operation.

- ❑ Expose the detector to a source of UV radiation. If the F110 reports the alarm condition, then the electronics module is working; in this case, the most likely trouble is a bad UV source lamp in the detector front housing. Replace the lamp. If the detector does not alarm, either the electronics module or the sensor tube is bad, and should be returned to Safety Systems Technology for repair.

Recommended Maintenance and Spare Parts

Installations which wish to immediately return to service a F110 that has either been damaged in the field or is malfunctioning, should have on hand the following spare parts:

SST Part Number	Component
40110-22	Plug-in Electronics Module complete with UV sensor tube
20208-001	Replacement UV Sensor Tube
20206-001	Replacement UV Source Lamp
193-1	Portable UV Flame Detector Test Lamp

Tools Required for Installation/Maintenance

The following standard hand tools, not provided by SST, are recommended:

Tool	Purpose
1¼ inch Wrench	Securing Rear Housing to Conduit Swivel Elbow
4 mm Metric Hex Key	Tighten Rear Housing Alignment/Lock Screw

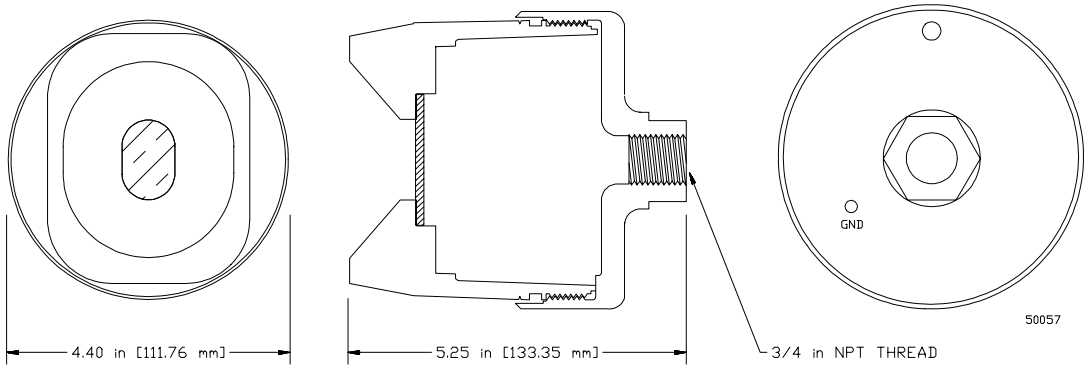

Figure 110-8 Housing Dimensions

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