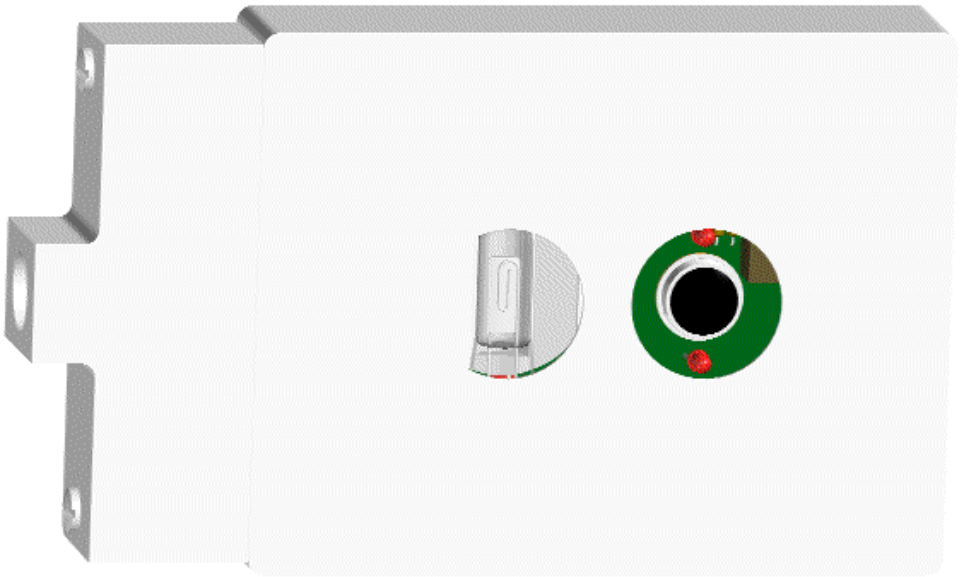
Sierra Safety Technology Inc.

CFD1

Models CFD1-S, T, and E



TECHNICAL SUPPORT and INSTALLATION MANUAL

Sierra Safety Technology, Inc.

Installer's Manual

1. Overview

The CFD1 is designed to provide reliable flame detection for indoor applications that are not classified as hazardous. The CFD1 is ideal for commercial occupancies where flammable liquids are stored or used. All versions of the CFD1 Flame Detector use UV and IR sensors to look for flaming combustion. The CFD1 Flame Detector is a microprocessor-controlled device programmed with state-of -the-art fire algorithms. Each algorithm is designed to recognize a different type of flame signature while rejecting common false sources. When the conditions of the fire algorithms are met the CFD1 Detector declares a fire. See tables 7.3 and 7.4 for detectors ability to reject false alarm stimuli and its response to various fuels.

The microprocessor is also continuously performing system tests looking for faults that would impair its ability to detect a flame and declare an alarm. These tests include: input power, sensor circuits, relay circuits, as well as other internal systems. The CFD1 has both a Fire Relay and a Fault Relay.

The CFD1 detector has a polypropylene housing and uses a terminal strip in a separate compartment for the user connections, thus protecting the electronics and optics from damage during installation.

2. Basic Operation

2.1 General

When the CFD1 Detector is powered up, the microprocessor checks the detector with a series of self-tests. After the self-test process is complete and all tests are passed, the detector is ready to detect a fire. The power-up and test process may take up to 10 seconds.

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

When a fire is detected the CFD1 will activate the Fire Relay and turn on both LEDs. The detector then stores the pre-fire spectral data in memory. This is the Alarm Mode and the device will remain in this mode until power is removed.

The self-test system is continuously monitoring the internal systems. If a fault is detected the Fault Relay is de-energized. When the detector is in a Fault Mode the LEDs will flash a code indicating the type of fault. A fault indication may mean the device is being operated in an unsafe manner, unable to detect a fire or that a device has become unreliable (i.e. a "Voltage Low" fault). For most faults the detector will return to Normal Mode when the fault condition is corrected.

2.2 Field-of-View

Optical Flame Detectors must be able to "see" the fire to declare an alarm. Any obstruction between the detector and the threat area will impair the detector's ability to cover the threat area. An obstruction is anything that is not transparent to the sensor elements of the detector. This would include glass or plastics. The CFD1 series of Flame Detectors has a 120° Field of View.

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

2.3 Range

The fuel and ambient conditions may affect the sensitivity of a detector. The CFD1 was tested to a 1 square foot heptane fire at a distance of 40 feet and an isopropyl alcohol fire at a distance of 10 feet. Using the inverse square of the distance rule, if the device will detect a 4-inch isopropyl fire at 10 feet, then to detect a 1/4-size fire (approximately 2-inch) the devices must be within 5 feet. The typical speed of response is 3 seconds.

2.4 Environment

The CFD1 Detector uses an Ultraviolet sensor (185-260 nanometers) and an Infrared sensor (.715-3.5 microns). This detector senses all radiant energy at these frequencies within their Field-of-View. Any source, which radiates energy at these same frequencies, may impact the detector's ability to discriminate against false alarms. Care should be taken to minimize such radiant energy sources within the detectors Field-of-View. Because of the variety of environments and conditions, a factory trained technician or qualified Professional Engineer should be consulted before deciding on the location of devices.

2.5 Configuration

All models of the CFD1 detector are configured at the factory. There are no user adjustable settings in the CFD1 detector housing.

The CFD1 comes in three models. The "S" or standard model is designed for simple and reliable operation at the least expense. The

"T" or self-test model has a built in self-test circuit for the sensors. This added self-test improves reliability and reduces regular maintenance. Chart 1 below shows the features of each model. In addition to the features of the "T" model the "E" model includes the ability to communicate with an external computer. This permits the downloading of a DataScan™ or FireScape™ from the detector.

Model	Built in Sensor Self-test	RS485 comm. port	Blinks
CFD1-S	NO	YES	1
CFD1-T	YES	YES	2
CFD1-E	YES	YES	3

Chart 1
CFD1 models

2.6 LED operation

The status of all versions of the CFD1 detectors can be determined from the LEDs located behind the lens on the front of the detector. The LEDs will flash at intervals or remain on to indicate the detector's status. (Fault Mode, Normal Mode, Alarm Mode)

2.6.1 Power Up

At power up all versions of the CFD1 detector will begin by flashing the LEDs in a pattern indicating the model and configuration. The first LED will turn on while the second LED blinks a number of times. The number of times the second LED blinks defines the model of the CFD1 (see Chart 1). Both LEDs will then turn off. Then the First LED will turn on again while the second LED blinks a number.

After blinking the configuration pattern the LEDs will flash once every 8 seconds while in normal mode. If the detector is powered up and a fault is detected the LEDs will flash in a pattern indicating the type of fault.

2.6.2 Normal

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

2.6.3 Fire

When the CFD1 declares a fire both LEDs will come "on" and the Fire Relay will energize. The detector will stay in alarm mode until power is removed.

2.6.4 Fault

When the detector has power and is in Fault Mode LED1 (the left LED when facing the detector with the cable below the LEDs) will be "off" while the LED2 (the right LED) will begin flashing, 1/2 second "on" and 1/2 second "off", a number of times. The number of times LED2 flashes indicates the level of fault. LED2 will stop flashing and LED1 will turn "on". This cycle is repeated until the fault is corrected. See Fault table 7.2 for fault types. Only the lowest level fault is indicated. Once a fault is corrected the next level fault will be indicated until all faults are cured. Except for fault level 2 or 3, a fire indication will override a fault indication.

2.7 Relay operation

All Models of the CFD1 have two relays. One Fire Relay for indicating fire conditions and one Fault Relay for indicating detector fault conditions.

2.7.1 Fire Relay

The Fire Relay will energize whenever the detector declares a fire. The Fire Relay will remain energized until power is removed from the CFD1.

2.7.2 Fault Relay

The Fault Relay is a normally energized relay. It will de-energize when a Fault occurs. This means the detectors Fault Relay is in the "Fault" state when the detector has no power, and remains in the "Fault" state until the detector is powered up and operating normally.

3. Installation

3.1 Housing

3.1.1 Mounting the Housing

The housing is mounted by using the bracket located on the back of the housing. The detector should be mounted securely to a flat surface. The preferable orientation of the detector is for the cable to exit from the bottom. Remove the bracket from the housing by sliding the bracket down. The bracket may be welded (plastic weld) or screwed to the mounting surface. The mounting location must be strong enough to allow the detector to be snapped into place. Although the detector is not vibration sensitive the detector should not be exposed to excessive vibration. The detector meets the vibration standard set in FM's Approval Standard Class 3820, Sept.

1979. (.022" displacement, 10 Hz to 30 Hz sweep cycled at 2 cpm for 4 hours)

3.1.2 Wiring

The wiring termination for the CFD1 detector is located inside the connection box. The terminal blocked located under the connection box cover will handle 14 to 24 gauge wire.

3.2 Connection

All connections are made inside the connection box. Remove the two connection box screws and the connection box cover. Run the wires through the conduit opening in the connection box cover. Connect the wires to the terminal strip. Replace the connection box cover and the two screws. Connect the wiring to the appropriate connection points in the controller or junction box. See table 7.1 for wiring information.

3.2.1 Power

Supply power must be "OFF" before connecting the CFD1 Detector. D.C. power for the CFD1 detector is connected to Terminal 1 and 2 of the terminal block. Connect the negative or groundside of the power supply to Terminal 1. Connect the positive side (24VDC) of the power supply to Terminal 2. Check the controller manufacturer's manual for proper connection points.

3.2.2 Fire Relay

The Fire Relay is connected using Terminals 3, 4, 5, 6, and 7. The Fire Relays are not polarized and are isolated from the rest of the detectors circuitry.

For Normally Open Operation: Connect one side of the Fire Signal Circuit to terminals 3 or 4. Connect the other side of the Fire Signal Circuit to terminals 5 or 6. Terminals 3 and 4 are connected internally to the Normally Open side of the Fire Relay, and Terminals 5 and 6 are connected internally to the Common of the Fire Relay. If multiple detectors are being used on a single Fire Signal Circuit or an EOL (End of Line) resistor is used, connect the unused terminal of 3, 4 and 5, 6 to the Fire Relay of the next detector.

For Normally Closed Operation: Connect one side of the Fire Signal Circuit to terminals 5 or 6. Connect the other side of the Fire Signal Circuit to terminal 7.

Refer to the controller manufacturer's manual for proper connection points and value of EOL resistor.

3.2.3 Fault Relay

The Fault Relay is connected using Terminals 8, 9, and 10. The Fault Relays are not polarized and are isolated from the rest of the detectors circuitry.

For Normally Closed Operation: Connect one side of the Fault Circuit to terminal 8 and the other side to terminal 9.

For Normally Open Operation: Connect the Fault Circuit to terminal 9 and the other side to terminal 10.

Refer to the controller manufacturer's manual for proper connection points.

3.3 Testing

The CFD1 detector uses ongoing self-test functions, which will indicate a fault if any of the functions fail to pass. If an end-to-end test is required the detector may be put into alarm with a small butane-lighter (Bic) with a flame approximately 1 inch high. Hold the lighter about 2 feet directly in front of detector's face. Light the lighter and wiggle it about 1/2 inch at about 2 - 4 Hz. The detector should alarm within 3 seconds. A 4-in. diameter pan with isopropyl alcohol set 10 feet may also be used. If you choose to use this method, the detector field of view should be blocked until the fire has achieved its maximum size. Remove the shield. The detector should alarm within 3 seconds. Again the detector should alarm within 3 seconds. The CFD1 may also be tested using a factory-approved hand held tester.

NOTE: Because of the danger involved with fire testing, please exercise CAUTION and observe All safety procedures. If an extinguishing system is present, make sure to disable the outputs to the extinguishing system prior to testing. After testing, re-enable the extinguishing system outputs.

4. Maintenance

If a detector indicates a fault, use the troubleshooting section of this document to correct the fault. Contact the local "authority having jurisdiction" or consult the local codes for any maintenance they may require for the type of system installed. The detector should be tested quarterly or more frequently as required by local codes.

4.1 Lens Cleaning

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

5. General Specifications

Input voltage: 12 to 32 Volts DC, typically 24 Volts DC

Current draw: @ 24 Volts DC: 28 ma normal mode 54 ma alarm mode

Temperature Range: -40° to 85° Celsius

Relay contacts: 1.0 Amp @ 30 VDC resistive

Connections: 14 - 24 gauge wire recommended

Weight: Approximately 1 pound

Housing:

Dimensions: 3.4" x 5.6" x 1"

Material: FR Polypropylene (UL 94 flammability rating V0)

Sensitivity:

Spectral Responsivity: UV - 185 to 260 nanometers
IR - 715 to 3500 nanometers

Range[1]: within 3 seconds to a 4-in. diameter isopropyl alcohol fire at 10 feet.

within, 3 seconds to a 1 sq. ft. gasoline (heptane) fire at 40 feet.

Field-of-View: 120° full-cone

1) See tables 7.3 and 7.4 for detectors ability to reject false alarm stimuli and its response to various fuels.

6. Figures

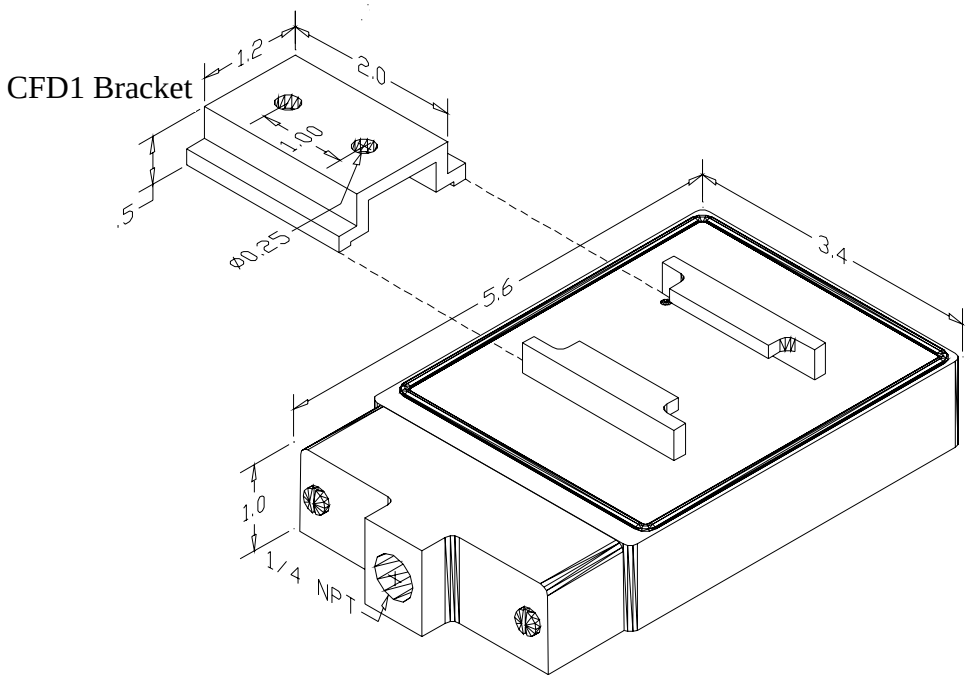


Figure 1
CFD1 Housing Dimensions

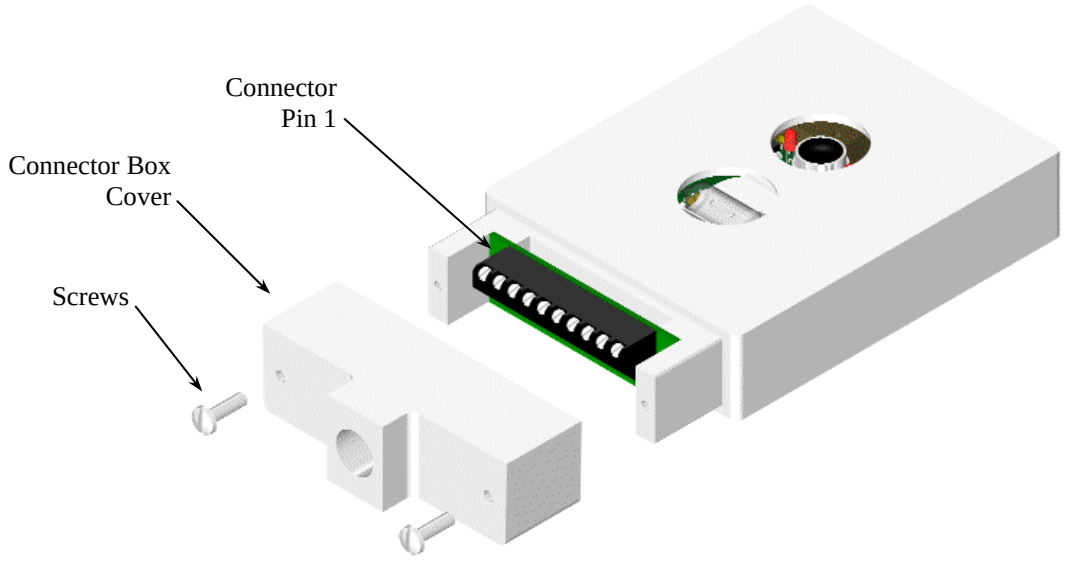


Figure 2
CFD1 Connector Box

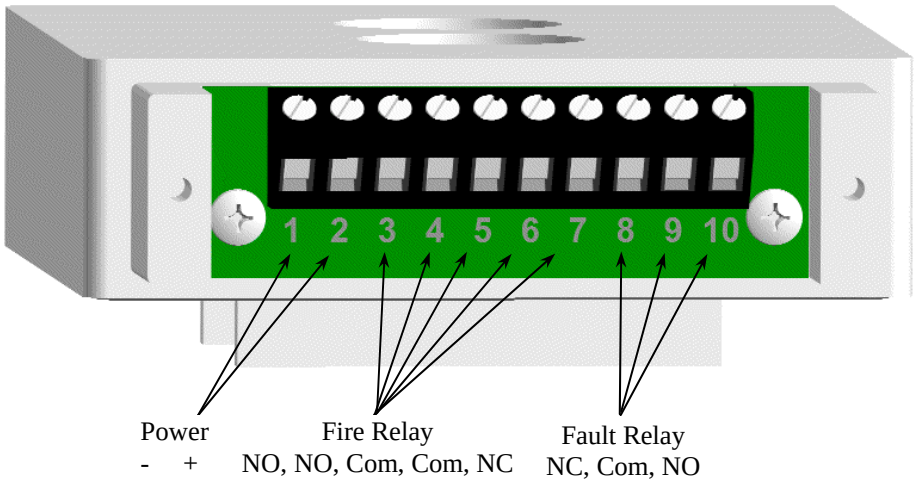


Figure 3
CFD1 Wiring

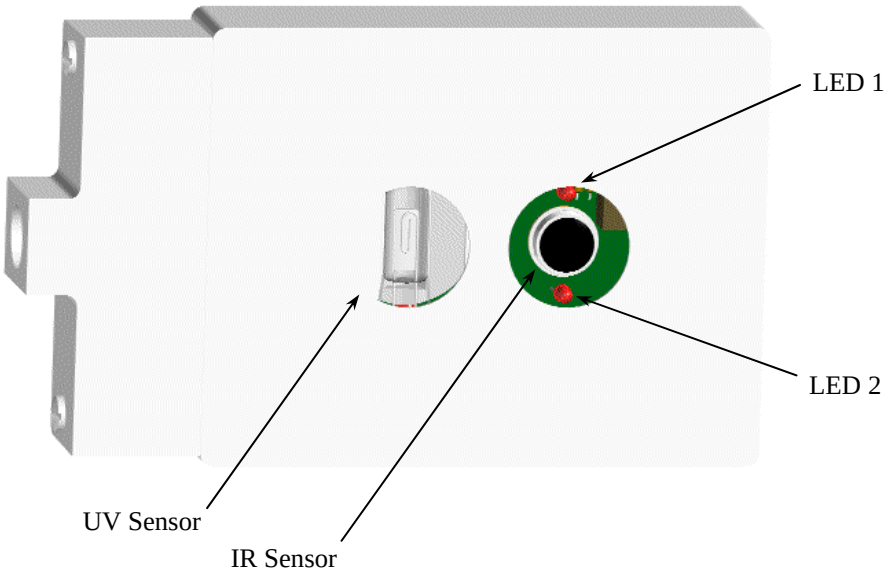


Figure 4
CFD1 Layout (Sensor & LEDs)

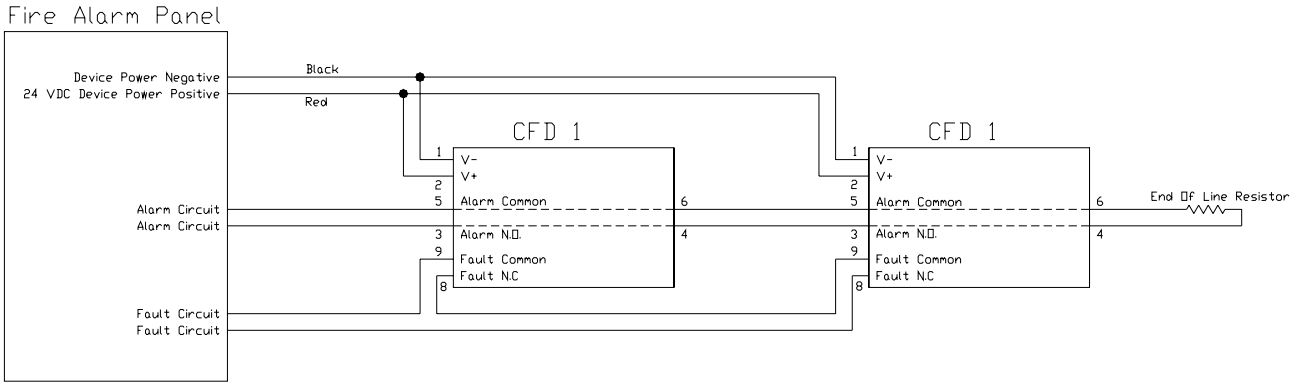


Figure 4
CFD1 Wiring

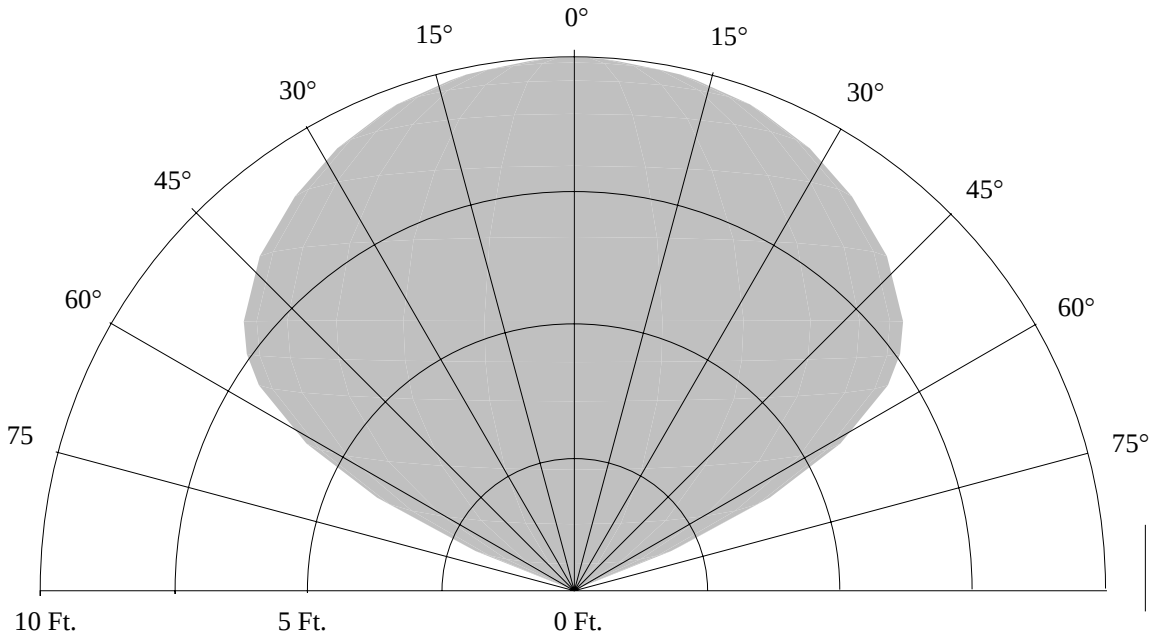


Figure 5
CFD1 Field-of-View

7. Tables

7.1 Wiring

Term. #	Description	Internal Connection
1	Negative side of power	-
2	Positive power 12 to 30 VDC	+
3	Fire Relay Normally Open In	Fire relay N.O.
4	Fire Relay Normally Open Out	Fire relay N.O.
5	Fire Relay Common In	Fire relay Common
6	Fire Relay Common Out	Fire relay Common
7	Fire Relay Normally Closed	Fire relay N.C.
8	Fault Relay Normally Closed*	Fault relay N.C.
9	Fault Relay Common*	Fault relay Common
10	Fault Relay Normally Open*	Fault relay N.O.

* Fault relay is a normally energized relay. When there is no power the Normally Closed contact is open and the Normally Open contact is closed. Normal means that the device has power and there is no fire and no fault.

7.2 Fault Table

Fault #	Fault Label	Description
1	UV Test Fault (CFD1-T or -E)	UV sensors didn't detect enough UV from the internal UV source
2	Program Failure	The program sum check is in error
3	Calibration Fault	Device is out of calibration
4	Volt. Low	Input Voltage is below 12 VDC
5	Photo. Sensor Fault	IR sensor failed to detect internal test source.
6	Relay Fault	Relay coil circuit is open.
7	Volt. High	Input Voltage was above 32 VDC
8	Temp. Out of Range	Internal device temperature went below -40° C or above 85° C.

The fault number is shown by the number of times LED2 blinks while in fault mode. See section 2.6.4 for further explanation.

7.3 False Alarm Stimuli Table

This table shows the detectors ability to reject 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

7.4 Fire Response Table (to Various Fuels)

CFD1 Fire Response Times vs. Fuels			
Fuel	**Distance**	**Fire Size**	**Response Time**
Polypropylene	8 feet	4 inch diameter	Less than 3 Seconds
Isopropyl Alcohol (IPA)	10 feet	4 inch diameter	Less than 3 Seconds
Heptane	40 feet	1 square foot	Less than 3 Seconds
MEK	15 Feet	4 inch diameter	Less than 3 Seconds
Silane	30 feet	18 inch jet	Less than 3 Seconds
Hydrogen	15 Feet	18 inch jet	Less than 3 Seconds

8. Troubleshooting

The CFD1 detector has several built-in self-test mechanisms that verify function and calibration. The following procedure covers most faults and problems, which may occur during installation or during the course of normal operation.

8.1 No LED blink or erratic LED blink

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

1. Check voltage at power connections. Terminal 1 should be positive; Terminal 2 should be negative. There should be between 12 and 32 volts DC across Terminals 1 and 2 of the detector.
2. If main power is correct and the detector does not indicate a fault then the detector should be returned to the factory.

8.2 Detector Indicates Fault

Use the fault table to determine what type of fault is occurring and see appropriate section below to correct. If the corrective actions listed below do not correct the fault, contact the factory for further diagnostic instructions or instructions on returning the detector for servicing.

8.2.1 Fault Type 1 - "UV Test Fault" (One blink of LED2)

During the UV self-test there the UV sensor didn't see enough UV from the UV source. This test is available on the -T and –E versions. Factory service is required.

8.2.2 Fault Type 2 - "Program Failure Fault" (Two blinks of LED2)

The program has been damaged.
Factory service is required.

8.2.3 Fault Type 3 - "Calibration Fault" (Three blinks of LED2)

Calibration constants have been corrupted.
Factory service is required.

8.2.4 Fault Type 4 - "Voltage Low Fault" (Four blinks of LED2)

The input voltage is below 12 VDC. With the detector connected to power, measure the voltage between Terminal 1 and Terminal 2 at the detector. The voltage should be between 12 - 32 VDC. If the voltage is out of range check external wiring and power supply. There should not be more than 1 volt of AC ripple at 24 VDC. If the measured voltage is in range and there is no AC ripple. Contact the factory for return and service information.

8.2.5 Fault Type 5 - "Photo Sensor Fault" (Five blinks of LED2)

The IR Sensor did not pass the internal self-test. If the lens is clean. The fault may be in the sensors or the self-test circuit. This test is available on the –T and –E versions. Contact the factory for further diagnostic information.

8.2.6 Fault Type 6 - "Relay Fault" (Six blinks of LED2)

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

8.2.7 Fault Type 7 - "Voltage High" (Seven blinks of LED2)

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

8.2.8 Fault Type 8 - "Temperature Out of Range" (Eight blinks of LED2)

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

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

When the detector declares an alarm two things should happen. One, both the LEDs on the front of the detector should come on. Two, the fire relay should energize. Connect an ohmmeter across the Fire relay Common and N.O. terminals. Run a fire test per section 3.3.

1. If the relay closes (0 ohms on the meter) and the LEDs come on the detector is operating normally. Check external alarm initiating circuit wiring.

2. If the relay closes and the LEDs remain off, or the relay remains open and the LEDs come on, the detector needs factory service.

3. If the relay remains open and the LEDs remain off, contact the factory for further diagnostic information.

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