Instructions 95-8408-03

Unitized Single Frequency IR Flame Detector/Controller
U7698E

DET-TRONICS
Detector Electronics Corporation
6901 West 110th Street • Minneapolis, Minnesota 55438 USA
Tel: 952.941.5665 or 800.765.3473 • Fax: 952.829.8750

11/01 95-8408-03

Table of Contents

List of Illustrations

List of Tables

DET-TRONICS®

INSTRUCTIONS

AUTOMATIC oi*

Unitized Single Frequency IR Flame Detector/Controller U7698E

IMPORTANT

Be sure to read and understand the entire instruction manual before installing or operating the flame detection system.

WARNING

Do not open the detector assembly in a hazardous area when power is applied.

CAUTION

The wiring procedures in this manual are intended to ensure proper functioning of the device under normal conditions. However, because of the many variations in wiring codes and regulations, total compliance to these ordinances cannot be guaranteed. Be certain that all wiring complies with local installation practices and with the local authority having jurisdiction. If in doubt, consult a qualified official before wiring the system. Installation must be done by a properly trained person.

CAUTION

To prevent unwanted actuation, alarm and extinguishing devices must be disconnected prior to performing detection system tests.

ATTENTION

Observe precautions for handling electrostatic sensitive devices.

DESCRIPTION

The U7698E is a unitized single frequency infrared (IR) flame detector, containing an IR sensor module and control circuitry in a single explosion-proof/flame-proof enclosure. The detector is equipped with both automatic and manual optical integrity (oi) testing capability. Field selectable options include latching/non-latching relays, field adjustable sensitivity, time delay, and signal processing methods. Fire and fault relay outputs are standard, and an optional 4 to 20 ma output is available. The U7698E provides LEDs in the sensor window for indicating normal operation, fire, and fault conditions.

Table 1 indicates the condition of the Fire relay, Fault relay, optional 4 to 20 ma output and LEDs for each detector status.

*oi is Detector Electronics' Trademark for its patented Optical Integrity Systems, U.S. Patent 3,952,196, United Kingdom Patent 1,534,969, Canada Patent 1,059,598.

Table 1—U7698E Status/Indications

Status	LEDs	Optional 4 to 20 ma Output	Fire Relay	Fault Relay
Normal with automatic **oi** selected	Blink every 5 seconds	4 ma	De-energized	Energized
Normal with manual **oi** selected	Blink every 10 seconds	4 ma	De-energized	Energized
Fault (General)	Off	0 ma	De-energized	De-energized
oi Fault	Off	2 ma	De-energized	De-energized
Instant Alarm (standard mode only—IR present, time delay not yet satisfied)	LEDs continue blinking according to **oi** setting (see above)	16 ma	De-energized	Energized
Fire	On	20 ma	Energized	Energized

SIGNAL PROCESSING

The U7698E features three field selectable signal processing methods to customize the U7698E to the application.

Time Domain Signal Analysis (TDSA)

The TDSA signal processing technique analyzes the input signal in real time, requiring the IR signal to flicker randomly in order to recognize it as a fire condition. This method effectively ignores regularly chopped IR signals that could cause an alarm using the Standard signal processing method.

NOTE

TDSA is the recommended signal processing method.

Standard

Standard signal processing uses a threshold and flicker filter to test the signal, rejecting any signal that does not meet the requirements. This method ignores steady state IR emissions from uninterrupted blackbody sources.

Massive Channel (High Speed)

The Massive Channel (High Speed) feature can be used in conjunction with the Standard or TDSA signal processing method. This method overrides time delay requirements in the event of an intense signal. When the Massive Channel is activated, the detector is capable of responding to an intense fire signal in less than 50 milliseconds (0.050 seconds). Using the Massive Channel feature in conjunction with TDSA signal processing allows the detector to provide a high speed response to a large, non-flickering fire (such as in high pressure gas applications) while maintaining an ability to respond to smaller fires.

RESPONSE CHARACTERISTICS

Table 2 lists the typical distances of the U7698E to various flammable materials. Fuel for the fire is approximately one pint of liquid and is burned in a 1

Table 2—U7698E Typical Response Distances to Burning Fuels

Fuel	Response Distance Based on Signal Processing and Sensitivity Settings (Feet)*							
	Standard Signal Processing**				TDSA Signal Processing***			
	Very High Sensitivity	High Sensitivity	Medium Sensitivity	Low Sensitivity	Very High Sensitivity	High Sensitivity	Medium Sensitivity	Low Sensitivity
Methanol	50	40	20	10	50	40	20	10
Methane	45	35	15	10	45	35	15	10
Gasoline	85	65	35	20	85	65	35	20

* Actual distances may be shorter if longer processing time is selected. Typical response time is less than 10 seconds. Response time is a function of fuel, fire size, distance, detector adjustments and orientation of the fire source.

** Distances based on 3 second time delay in Standard Signal Processing Mode.

*** Distances based on 4 second processing time in TDSA Signal Processing Mode.

foot by 1 foot steel pan. The methane gas fire test is performed to standard FM 3260, with the flame approximately 30 inches high and 6 to 8 inches in diameter. The detector was sighted to observe the fire at center axis ±10 degrees.

Response is dependent on the type of fuel, the temperature of the fuel, and the time required for the fire to build. As with all fire tests, results must be interpreted according to an individual application.

DATA LOGGER

The optional data logger provides status recording capability for the detector. Important status data such as power-up/down, faults and alarms are date and time stamped as they occur and stored in non-volatile memory. Up to 510 events can be recorded — up to 63 fire alarm events and up to 447 non-fire events. This data is later uploaded to a personal computer (PC) where it can be displayed, saved and/or printed.

The Data Logger system consists of a special electronic module (located inside the detector enclosure) and a W6300 Detector Inspector™, which provides the interface between the electronic module and the PC.

The W6300 Detector Inspector is furnished with an RS-232 serial port for connection to the serial port of the PC. Communication between the data logger module and the PC uses the Modbus RTU protocol, with the data logger module configured as a Modbus slave.

The Inspector software (included) can operate on most Intel® Pentium® based computers running Microsoft Windows 95/98.

The real time clock in the module is furnished with battery back-up to ensure correct operation in the event of a power failure. The clock provides second, minute, hour, day, month and year data.

The detector's relays and LEDs function exactly the same as the standard detector; however, the 4 to 20 ma output is not available.

IMPORTANT APPLICATION CONSIDERATIONS

In applying any type of sensing device as a fire detector, it is important to know of any conditions that can prevent the device from responding to fire, and also to know what other sources besides fire can cause the device to respond.

Arc Welding

Arc welding should not be performed within 10 feet of the detector when sensitivity is set at Low, Medium or High. Arc welding should not be performed within 15 feet of the detector when sensitivity is set at Very High. Although only a low level of radiation in the 4.45 micron range is emitted by the welding, the heated metal can become a black body source.

Artificial Lighting

The U7698E should not be located within 3 feet of artificial lights.

EMI/RFI Interference

The U7698E is resistant to interference by EMI and RFI. It will not respond to a 5 watt walkie-talkie at a distance of greater than 1 foot.

Non-Carbon Fires

The U7698E is a single frequency IR device with detection limited to the hot CO_2 emission peak, therefore, it should not be used to detect fires that do not contain carbon, such as hydrogen, sulfur and burning metals without thorough verification testing.

Blackbody Sources

WITH TDSA SIGNAL PROCESSING SELECTED

When TDSA signal processing is selected (Programming Switch 1 open), the U7698E will ignore regularly chopped blackbody sources alone (occurring in areas where moving conveyors and hot objects in proximity to one another result in a regularly chopped IR signal) because it looks for a less uniform signal. However, in the presence of a regularly chopped signal, the unit is more susceptible to false alarms due to sporadic IR that functions as a trigger when occurring in conjunction with the regularly chopped signal.

INSTALLATION

DETECTOR POSITIONING

Detectors should be positioned to provide the best unobstructed view of the area to be protected. The following factors should also be taken into consideration:

- Identify all high risk fire ignition sources.
- Be sure that enough detectors are used to adequately cover the hazardous area.
- Locate and position the detector so that the fire hazard(s) are within both the field of view and detection range of the device. Refer to Appendix A for specific information.
- Be sure that the unit is easily accessible for cleaning and other periodic servicing.
- Particular attention should be paid to potential false alarm sources in the area, such as the rotating blades of a fan or surface vibration of an IR source, since these could allow a flickering IR signal to reach the detector that can cause an alarm signal if standard signal processing is selected.
- For outdoor applications, the detector should be aimed downward at least 10 to 20 degrees to prevent it from scanning the horizon. This minimizes response to distant IR sources outside the protected area. See Figure 1.
- Dense fog, rain or ice can absorb IR radiation and reduce the sensitivity of the detector.
- Although the IR detector is less affected by smoke than UV detectors, the U7698E should not be placed where rising CO_2 and particulates can obscure its vision. If smoke is expected before fire, smoke or other alternative detectors should be used in conjunction with the U7698E.
- For indoor applications, if dense smoke is expected to accumulate at the onset of a fire, mounting the detector on a side wall a few feet (1 meter) down from the ceiling will normally allow enough time for the unit to respond before it is affected by rising smoke.

If possible, fire tests should be conducted to verify correct detector positioning and coverage.

WIRING REQUIREMENTS

Wire Size and Type

The system should be wired using a 14 to 22 gauge (1.3 to 0.5 mm^2) cable. The wire size selected should be based on the number of detectors connected, the supply voltage and the cable length. A minimum input voltage of 18 vdc must be present at the U7698E.

The use of shielded cable is required to protect against interference caused by EMI and RFI.

In applications where the wiring cable is installed in conduit, the conduit should not be used for wiring to other electrical equipment.

Protection Against Moisture Damage

It is important to take proper precautions during installation to ensure that moisture will not come in contact with the electrical connections or components of the system.

Conduit drains must be installed at water collection points to automatically drain accumulated moisture. Conduit breathers should be installed at upper locations to provide ventilation and allow water vapor to escape. At least one breather should be used with each drain.

Conduit raceways should be inclined so that water will flow to low points for drainage and will not collect inside enclosures or on conduit seals. If this is not possible,

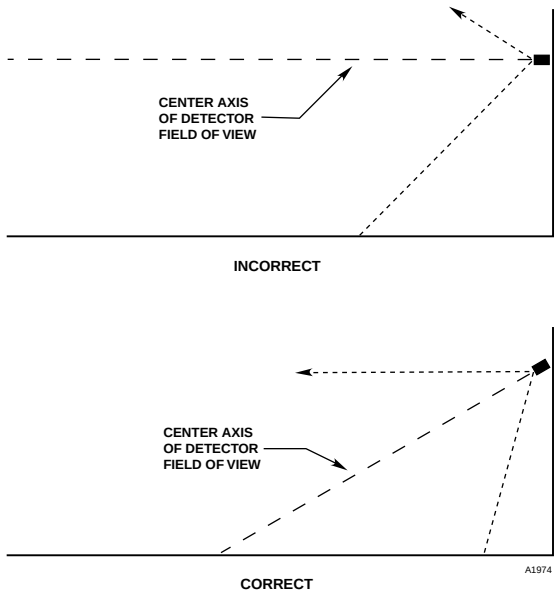


Figure 1—Detector Orientation Relative to Horizon

install conduit drains above the seals to prevent the collection of water or install a drain loop below the detector with a conduit drain at the lowest point of the loop.

Explosion-proof conduit seals should be installed within 18 inches (46 cm) of the detector. Conduit seals prevent the passage of vapors or flames through the conduit. Seals are recommended even if they are not required by local wiring codes.

4 to 20 ma Current Output

The 4 to 20 ma current output requires a minimum of 6.5 vdc across its "+" and "–" terminals (terminals 3 and 4) in order to operate properly. For example: If an external 24 vdc supply is used to power the isolated 4 to 20 ma loop, the external load resistance (including field wiring) can be from 0 to 875 ohms.

24.0 vdc – 6.5 vdc = 17.5 vdc

17.5 vdc ÷ 20 ma = 875 ohms.

The 4 to 20 ma dc output can be wired for current sinking or current sourcing, isolated or non-isolated operation. Figures 2A and 2B show the detector in a non-isolated configuration. Non-isolated current sourcing operation requires installation of a jumper wire between terminal 3 and either terminal 1 or 13 (Figure 2A). Non-isolated current sinking requires installation of a jumper between terminal 4 and either terminal 2 or 14 (Figure 2B). (Terminals 1 and 2 are directly connected to the power supply. Terminals 13 and 14 provide a diode isolated power source for non-isolated current output applications.)

Figures 3A and 3B show the detector in an isolated circuit. Note that isolated operation requires the use of a separate power supply.

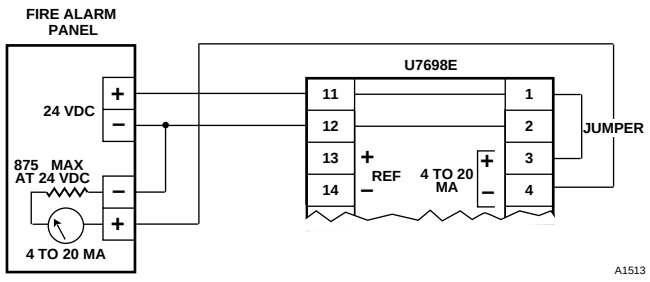


Figure 2A—U7698E Wired for Non-Isolated 4 to 20 ma Current Output (Sourcing)

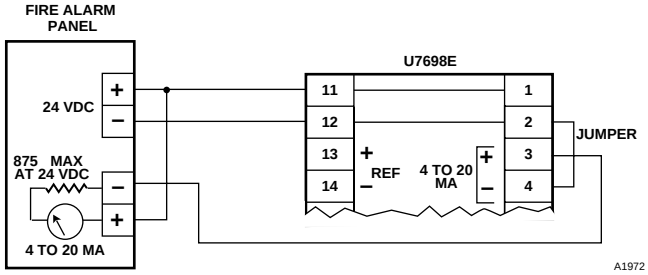


Figure 2B—U7698E Wired for Non-Isolated 4 to 20 ma Current Output (Sinking)

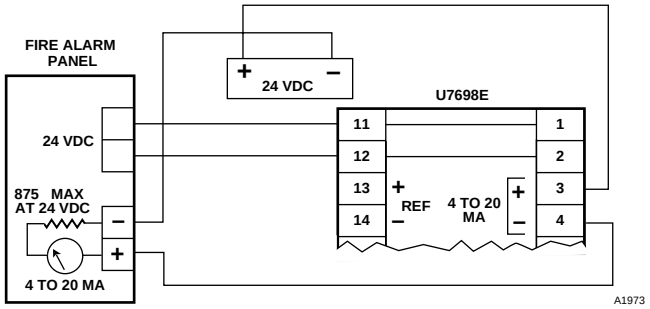


Figure 3A—U7698E Wired for Isolated 4 to 20 ma Current Output (Sourcing)

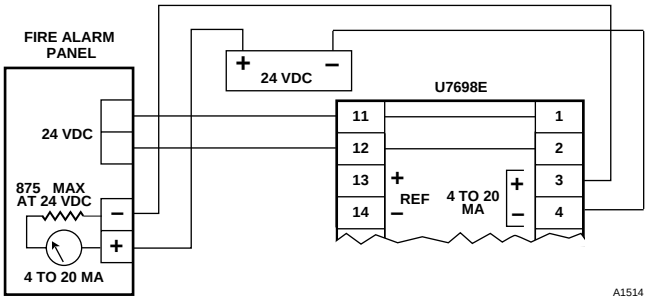


Figure 3B—U7698E Wired for Isolated 4 to 20 ma Current Output (Sinking)

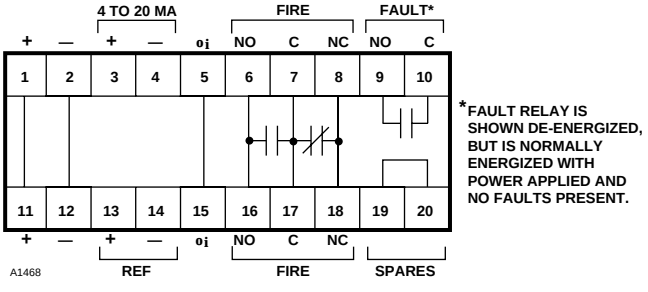


Figure 4—U7698E Terminal Configuration

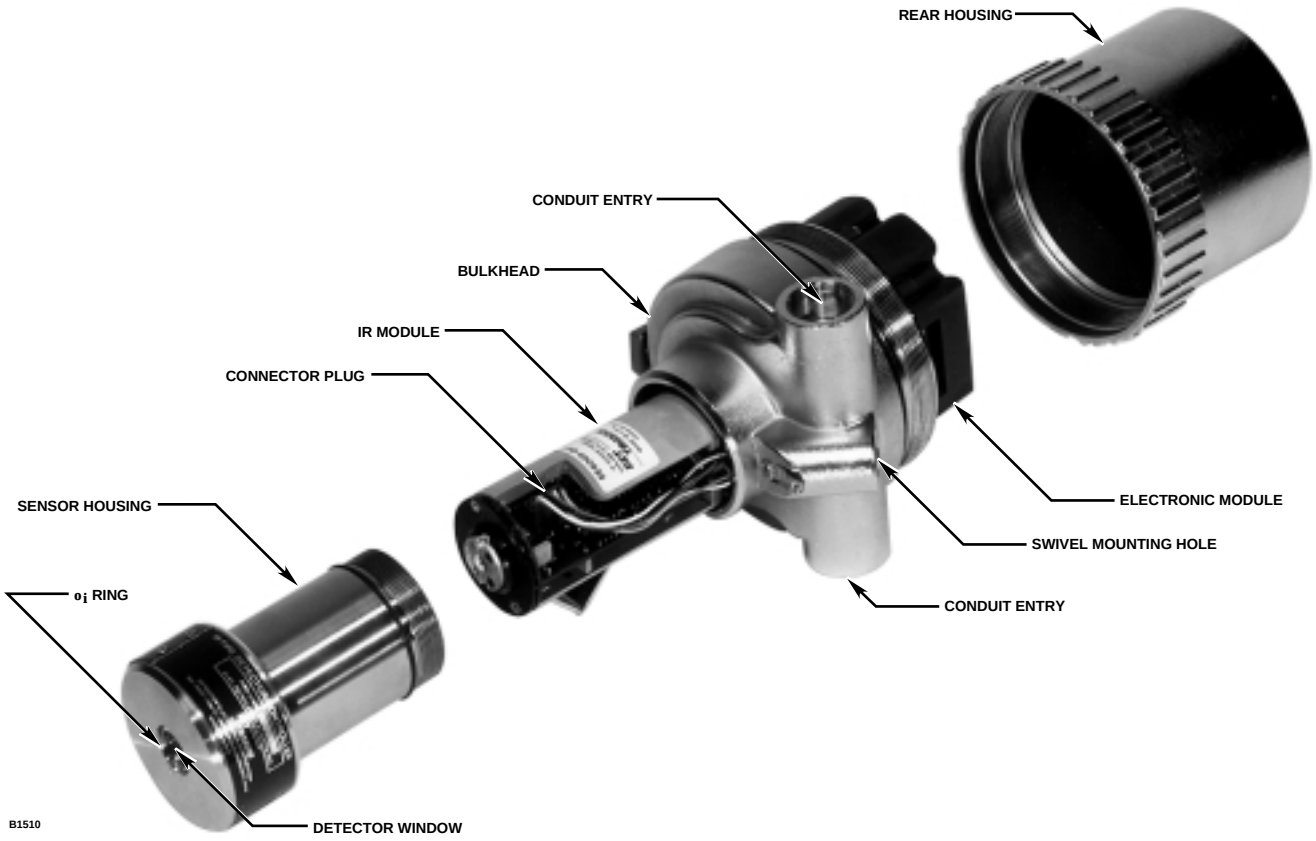


Figure 5—U7698E Detector/Controller Assembly

WIRING PROCEDURE

The following procedure should be used for mounting and wiring the U7698E. Refer to Figure 4 for terminal configuration, Figure 5 for parts identification, Figure 6 for location of the terminals and Figure 7 for typical system wiring.

1. Install the swivel mounting bracket assembly on the wall or ceiling. The installation surface should be free of vibration and suitable to receive 1/4 inch (M6) screws with a length of at least 1 inch (25 mm).

2. Attach the detector/controller to the swivel mounting bracket and tighten the 3/4 inch nut to secure it in place. Refer to Figure 8.

3. Remove the rear housing from the bulkhead by turning it counterclockwise (see Figure 5). If the detector is equipped with a locking cover device, this must be loosened in order to remove the rear housing (see Figure 9).

4. Route the field wiring through the detector conduit entry.

5. Attach the field wiring following local ordinances and guidelines in this manual.

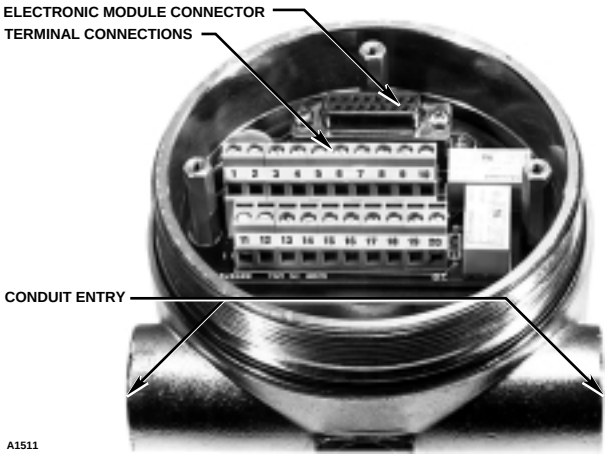


Figure 6—Terminal Location Inside Bulkhead

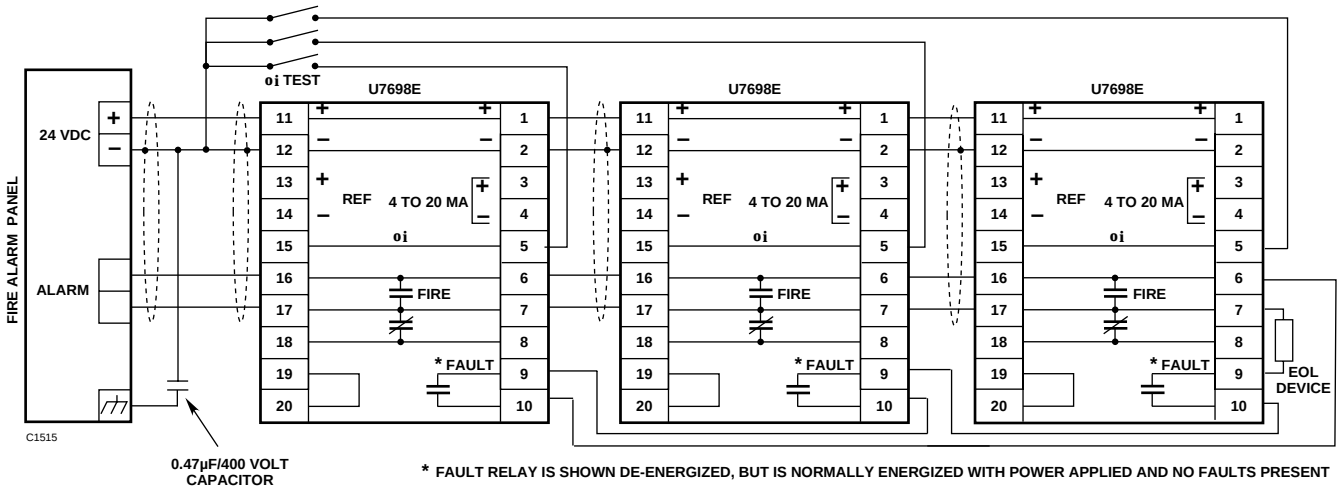


Figure 7—A Typical System

NOTE

Connect the shield to power supply minus (circuit ground) at the detector end. At the fire panel end, connect the shield and power supply minus to chassis ground through a 0.47 µF 400 Volt non-polarized capacitor (not supplied).

6. To wire the **oi** test switch (for manual **oi**), connect a normally open switch (capable of switching 1 ma at 5 vdc and with resistance no more than 25 ohms) between the negative (–) side of the dc power source and one of the terminals marked "5" or "15" on the detector terminal block. Each detector should have its own **oi** test switch. The manual **oi** function can also be used when automatic **oi** testing has been selected to test the operation of the Fire relay, LEDs and field wiring.

7. Check all field wiring to be sure that the proper connections have been made.

8. Set the programming switches on the electronic module. Refer to the "Switch Setting Procedure" below.

NOTE

When installing the U7698E with an Apollo module, refer to Appendix B for a wiring diagram and switch setting information.

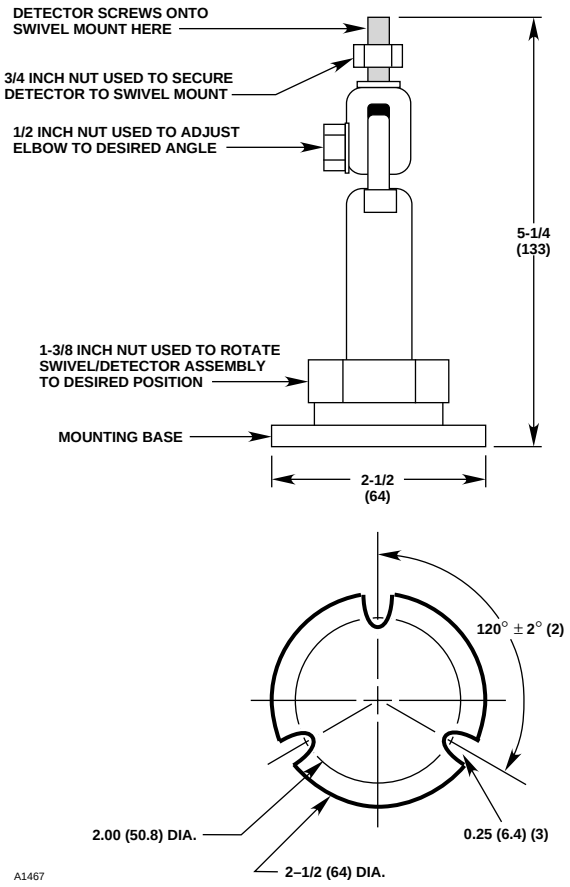
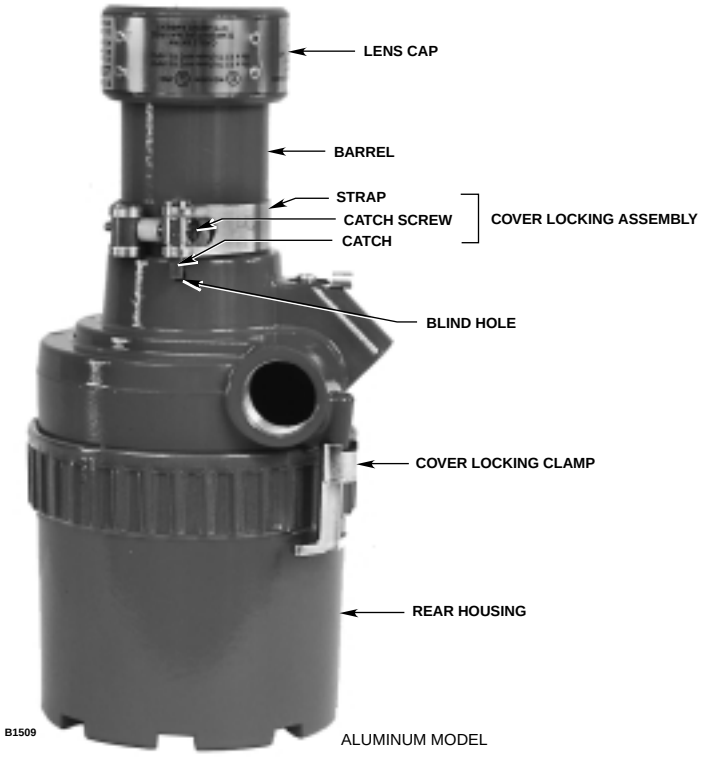


Figure 8—Swivel Mounting Bracket Dimensions in Inches (mm)



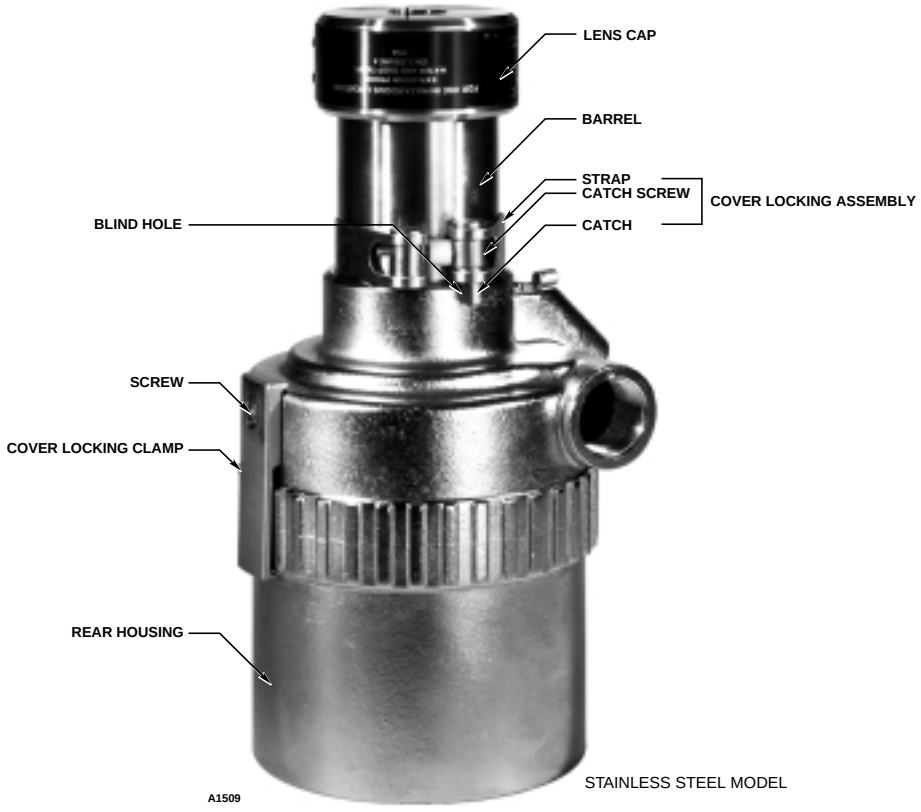


Figure 9—Cover Locking Devices (Optional)

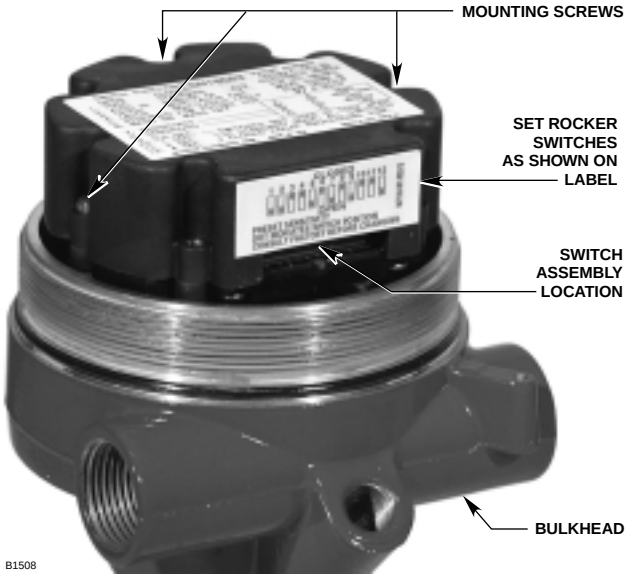


Figure 10—Electronic Module Mounted on Bulkhead

SWITCH SETTING PROCEDURE

Remove the electronic module from its shipping package. Refer to the switch descriptions in this section for a functional description of each switch. The location of the programming switches is shown in Figure 10. Switches are "Open" when pressed in the direction of the word "OPEN" and "Closed" when pressed in the opposite direction.

For most applications the following switch settings are factory recommended:

- TDSA signal processing
- Automatic **oi**
- Non-latching fire relay
- Non-latching fault relay
- Massive channel (high speed) off
- High sensitivity.

If further adjustments are necessary, refer to the descriptions below.

NOTE

Switches are "OFF" in the Open position and "ON" in the Closed position.

NOTE

Any time that the switch settings are changed, power to the unit must be recycled before those changes will register.

Switch 1 - Signal Processing

Refer to the "Description" section for an introduction to the Standard and TDSA signal processing features. For most applications, TDSA Signal Processing is recommended. Consult the factory before using Standard Signal Processing. Instructions for fine-tuning the unit for a particular application are provided in the "Startup Procedure" later in this manual.

Open–	TDSA signal processing selected (used when regularly chopped blackbody sources are present, in high pressure gas applications).

Closed– Standard signal processing selected

Switch 2 - Optical Integrity (oi)

Open–	Automatic oi (optical surfaces and electronic circuitry tested automatically approximately once each minute). Successful Automatic oi test does not result in fire alarm relay activation.

Closed– Manual **oi** (optical surfaces and electronic circuitry test must be manually initiated by closing an external switch that is electrically connected between **oi** (terminal 5 or 15) and circuit ground (terminal 2, 12 or 14) on the U7698E. Caution: Successful Manual **oi** test results in fire alarm relay activation.

Switch 3 - Fire Relay Latching/Non-Latching

Open– Latching (relay remains in "Fire" condition after fire has been detected until U7698E is reset).

Closed–	Non-latching (relay remains in "Fire" condition only as long as a fire is being detected).

Switch 4 - Fault Relay Latching/Non-Latching

Open– Latching (relay remains in "Fault" condition after fault has been cleared until the U7698E power is cycled).

Closed– Non-latching (relay remains in "Fault" condition only as long as a fault is being detected).

Switch 5 - Reserved for future use.

Switch 6 - Massive Channel (high speed channel)

Open– Massive channel (high speed) on (overrides time delay and signal processing time settings in the event of an intense fire signal).

Closed– Massive channel (high speed) off (time delay and signal processing time criteria must be met regardless of the intensity of the incoming fire signal).

Switches 7 and 8 - Sensitivity

The U7698E can be set for either Very High Sensitivity, High Sensitivity, Medium Sensitivity or Low Sensitivity using these two switches. (High sensitivity is the recommended setting).

Switch 7	Switch 8	Sensitivity Level
Open	Open	Very High
Open	**Closed**	**High**
Closed	Open	Medium
Closed	Closed	Low

Switch 9 to 12 - Standard Signal Processing

These switches are used to set the time delay when standard signal processing is selected (see switch 1). Each switch has a time value assigned. The total time delay is the added value of all switches that are set in the closed position. A time delay of 3 seconds minimum is required to avoid false alarms.

Switch 9: Closed = 0.5 second
Switch 10: Closed = 1.0 second
Switch 11: Closed = 2.0 seconds
Switch 12: Closed = 4.0 seconds

Default – With all switches open, the unit defaults to a 0.5 second time delay (not recommended).

ELECTRONIC MODULE INSTALLATION

1. Ensure that the switch settings on the module are correct and that the wiring to the terminals in the detector are correct.

2. Install the electronic module, ensuring that the connector is aligned correctly. Tighten the three captive screws that hold the electronic module in place. See Figure 10.

3. Replace the rear housing and hand tighten to ensure proper sealing.

4. If the detector is equipped with a cover locking device, tighten it so that it clamps the rear housing to the bulkhead.

oi RING/TEST LAMP ORIENTATION

NOTE

The U7698E is normally provided with the IR sensor module already installed. If the IR module is not installed, refer to the Sensor Module Replacement section before proceeding.

Check the viewing window surface (Figure 11) and ensure:

- That the two **oi** lamps on the IR sensor are located at the top of the detector (when viewed from the front)
- The opening on the **oi** ring is positioned at the bottom.

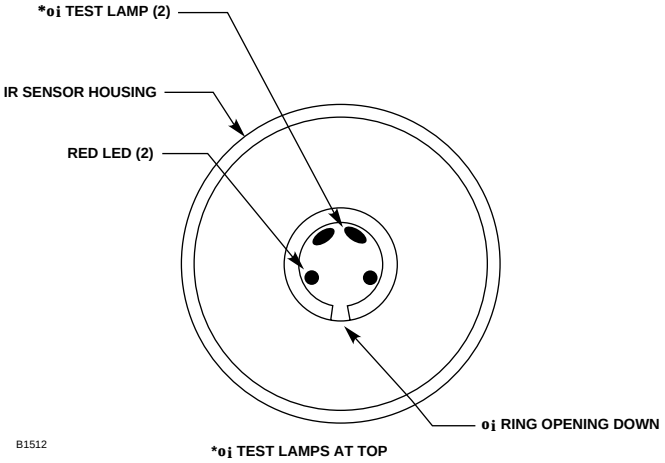


Figure 11—Front View of the U7698E Detector

This will ensure proper operation of the oi system and will also minimize the accumulation of moisture and contaminants between the oi ring and the viewing window. (The oi lamps on the IR sensor are identified as oblong in shape and clear in color. The status indicating LEDs are red in color.)

STARTUP PROCEDURE

When the installation of the equipment is complete, perform the "Fire Alarm Test" and "False Alarm Test" below.

FIRE ALARM TEST

1. Disable all extinguishing and alarm equipment that is connected to the system.

2. Apply input power to the system. Allow a 20 second power-on delay.

   NOTE

   The Fault Relay does not energize until after the power-on delay is complete.

3. Hold a flickering IR source (such as the Det-Tronics model W867 Test Lamp or W8067 Test Lamp) close to the detector or press the oi test button for 5 to 15 seconds, or until unit alarms. The alarm relay will energize and the LEDs will be illuminated when the device goes into an alarm condition.

   NOTE

   Because the TDSA mode requires a randomized signal, this test using the W867 or W8067 Test Lamp works best when the lamp is wobbled slightly while turned on and pointed directly at the detector being tested. The W867 Test Lamp must be at very close range: 1 foot from detector when low sensitivity is selected, 4 feet for medium sensitivity, 7 feet for high sensitivity, and 9 feet for very high sensitivity. The W8067 Test Lamp may be located at a greater distance: 10 feet from the detector when medium sensitivity is selected, 20 feet for high sensitivity, and 30 feet for very high sensitivity.

4. To test the massive channel (high speed), first ensure that the massive channel feature is activated (switch 6 open). Hold the IR source (such as the W867 Test Lamp) 6 inches away from the detector viewing window. The unit should immediately go into an alarm, regardless of the time delay (processing time) settings.

5. Remove the IR source (or release the oi test button). If the unit is programmed for non-latching operation, the alarm relay will become de-energized and the LEDs will turn off when the IR source is removed. If the unit is programmed for latching operation, it can be reset by removing input power (0.1 second minimum).

6. Repeat this test for all detectors in the system. If a unit fails the test, refer to the "Troubleshooting" section.

7. Verify that all detectors in the system are properly aimed at the area to be protected.

8. Enable extinguishing equipment when the test is complete.

FALSE ALARM TEST

1. Disable all extinguishing and alarm response equipment that is connected to the system.

2. Allow the system to monitor the area for a period of time in which all the operations that take place in the area are represented to ensure that the sensitivity setting and the time delay/processing time are set correctly for the application. If the unit responds during this test period (indicating a fire when no fire occurred), check the area to see if IR sources are present. If possible, remove the sources, or reposition the detectors so that the sources fall outside of the detector's cone of vision. If problems still occur, the sensitivity should be adjusted. Reduce the sensitivity setting to the next lower increment and verify that the detector is set for the TDSA mode.

3. Recycle power and test again as described above.

4. Once the correct sensitivity setting is obtained, turn on all alarm and extinguishing equipment that is connected to the system. Record all switch settings for later reference.

TROUBLESHOOTING

1. Before disassembling or removing the unit, perform the following steps.

2. Disable all alarm and extinguishing equipment that is connected to the unit.

3. Inspect the viewing window for contamination. The IR detector is relatively insensitive to airborne contaminants, however, thick deposits of ice, dirt, or oil will reduce sensitivity. To clean the window, use Det-Tronics window cleaner (part number 001680-001) and a soft cloth or tissue. (Refer to the "Maintenance" section for complete information regarding cleaning of the detector viewing window.)

4. Check input power to the unit.

5. Hold a flickering IR source close to the detector or press the **oi** test button for five to fifteen seconds. The alarm relay will energize and the LEDs will turn on. The **oi** test lamps will automatically turn off as soon as the alarm is indicated.

NOTE

When TDSA signal processing is selected, the instant alarm (16 ma) is not available and 20 ma is indicated immediately. When Standard signal processing is selected, the time delay must be satisfied before an alarm is indicated.

6. Remove the IR source (or release the **oi** test button). The alarm relay will become de-energized and the LEDs will turn off if non-latching operation is selected.

7. If the device did not respond properly, check the **oi** lamps to be sure that they blink during the manual **oi** test and also check the **oi** ring for proper alignment. Turn off the input power to the system and check all wiring for continuity.

8. If the wiring checks out, replace the IR module.

9. If all wiring checks out and replacement of the IR sensor did not correct the fault condition, replace the electronic module.

PERIODIC CHECKOUT PROCEDURE

A checkout of the system using the **oi** feature, a flame, or other flickering IR source should be performed on a regularly scheduled basis to ensure that the system is operating properly, especially if the automatic **oi** feature is not activated. To test the system, perform the "Fire Alarm Test" as described in the "Startup Procedure" section of this manual.

MAINTENANCE

The detector requires no periodic calibration. However, to maintain maximum sensitivity, the viewing window must be kept clean at all times.

To clean the optical surfaces, remove the **oi** ring from the detector by gently squeezing the tabs together and then pulling out. Clean the viewing window thoroughly using a clean cloth or tissue and Det-Tronics window cleaning solution. Also clean the back side of the **oi** ring, holding it by its tabs to avoid leaving fingerprints on the reflective surface. Re-install the ring so that the opening is positioned downward to prevent a buildup of contaminants.

NOTE

If corrosive contaminants in the atmosphere cause the reflective rings to deteriorate to the extent that it is no longer possible to restore them to their original condition, they must be replaced.

To ensure the watertight integrity of the detector housing, the O-rings must be in good condition. Periodically, the housing should be opened and the O-rings inspected for breaks, cracks, or dryness. To test the O-rings, remove them from the detector housing and stretch them slightly. If cracks are visible, they should be replaced. If they feel dry to the touch, a thin coating of lubricant should be applied. When re-installing the O-rings, be sure that they are properly seated in the groove on the housing.

Before re-assembling the detector, apply a thin coating of silicone-free grease to the threads on the detector enclosure. This will both lubricate the threads and help to prevent moisture from entering the detector housing.

REPLACING A SENSOR MODULE

1. Remove power from the detector and relay contacts.

2. If the sensor housing is equipped with a cover locking clamp, loosen it and move the clamp "catches" out of the blind holes located in the bulkhead. See Figure 9.

3. Remove the sensor housing (see Figure 5). Unplug the connector from the top of the IR module (Figure 12) and pull the sensor module away from the bulkhead.

4. Determine the proper orientation for the new sensor module (with the **oi** test lamps positioned at the top of the detector). See Figure 11. Thread the wire leads and keyed connector plug through the slotted opening on the IR module. Plug the IR module into the two banana plugs in the bulkhead.

5. Connect the keyed connector plug to the connector on the top of the IR module.

6. Check the O-rings, then replace the sensor housing.

7. If the unit is equipped with cover locking clamps, loosen the clamps sufficiently so that the clamp catches can be seated in the blind holes on the bulkhead. See Figure 9. Fasten the clamps securely.

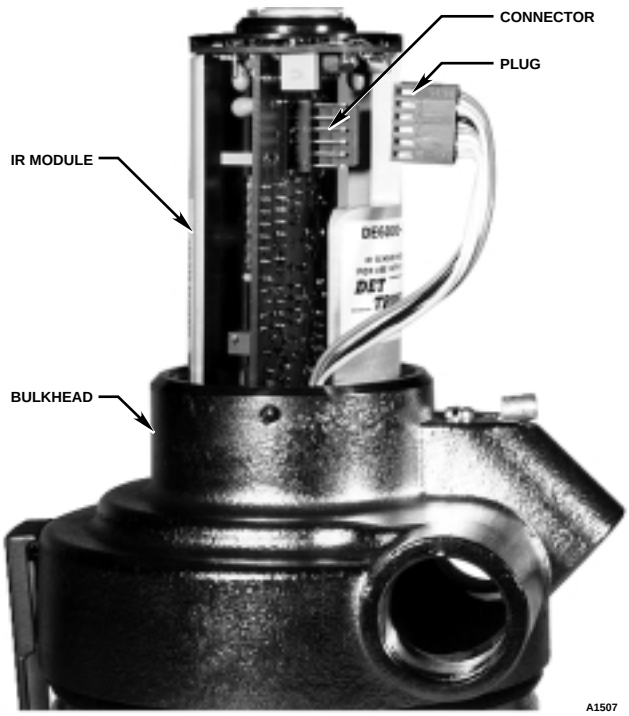


Figure 12—IR Module with Connector (Shown Disconnected)

8. Inspect the viewing windows and **oi** rings and clean if necessary.

NOTE

The two **oi** *lamps should be at the top of the detector (when viewed from the front) and the opening on the* **oi** *ring should be positioned at the bottom. This will ensure proper operation of the* **oi** *system and also minimize the accumulation of moisture and contaminants between the* **oi** *ring and the viewing window. The IR module can be rotated 180° and plugged into the banana plugs to ensure proper orientation.*

9. Perform the "Startup Procedure" as described in this manual before returning the system to normal operation.

REPLACING THE ELECTRONIC MODULE

1. Remove power from the detector and relay contacts.

2. Remove the rear housing of the U7698E (see Figure 9). If the detector is equipped with a cover locking device, loosen it so that it does not clamp the rear housing to the bulkhead, then remove the rear housing.

3. Loosen the three captive screws that hold the electronic module in place, then unplug the module from the U7698E bulkhead.

4. Remove the replacement electronic module from the shipping package.

5. Note the switch settings of all switches on the electronic module, then duplicate those settings on the replacement electronic module.

6. Replace the electronic module, ensuring that the connector is aligned correctly. Tighten the three captive screws that hold the electronic module in place. Replace the rear housing and the cover locking device.

7. Perform the "Startup Procedure" as described before returning the system to normal operation.

FEATURES

- Long detection range for hydrocarbon fires.
- Selectable automatic or manual **oi**.
- Fire and fault relays standard.
- Optional 4 to 20 ma output with separate **oi** fault indication.
- Easily visible LEDs indicate normal operation, fire and fault conditions.
- Adjustable sensitivity.
- Selectable latching or non-latching for fire and fault outputs.
- High-speed capability.
- Time Domain Signal Analysis (TDSA).
- Modular design, microprocessor based circuitry.
- Ignores false alarm sources such as arc welding, lightning, chopped sunlight and x-rays.
- Optional swivel mounting bracket for ease of installation and positioning.
- Optional data logger.
- Operates under adverse weather conditions and in dirty environments.
- Explosion-proof/flame-proof detector housing. Meets FM, CSA, CENELEC and Russian certification requirements.
- Designed for future expansion allowing integration with addressable system.

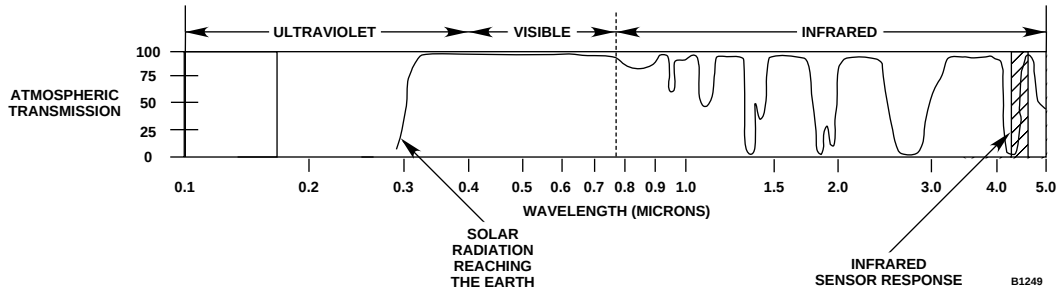


Figure 13—Atmospheric Transmission of the Sun's Radiation

SPECIFICATIONS

OPERATING VOLTAGE—
24 vdc nominal (18 vdc minimum, 32 vdc maximum).

POWER CONSUMPTION—
2.0 watts typical, 4.5 watts maximum (during oi test) at 24 vdc. Detector rated for use with end of line components consuming up to 2.5 additional watts.

OUTPUT RELAYS—
Fire Alarm relay, Form C (N.O. and N.C. contacts available), 5 amperes at 30 vdc: The Fire Alarm relay is a timed relay that is normally de-energized and is field programmable for either latching or non-latching operation.

Fault relay, 5 amperes at 30 vdc: The Fault relay is normally energized (no faults indicated) and is field programmable for latching or non-latching operation. The Fault relay contacts are normally closed when power is applied and no faults are present.

CURRENT OUTPUT—
An optional 4 to 20 ma output is available that can be wired for current sinking or current sourcing, isolated or non-isolated operation. The output requires a minimum of 6.5 vdc across its terminals to operate properly. The output is capable of driving an 875 ohm load when at 24 vdc.

0 ma indicates a fault

2 ma indicates an oi fault

4 ma indicates a normal condition

16 ma indicates instant alarm condition (occurs only when standard signal processing mode and a time delay are selected)

20 ma indicates a fire condition after time delay (standard mode) or processing time (TDSA mode) requirements are met.

TEMPERATURE RANGE—
Operating: –40°F to +167°F (–40°C to +75°C).
Storage: –40°F to +185°F (–40°C to +85°C).

HUMIDITY RANGE—
0 to 95% relative humidity, can withstand 100% condensing humidity for short periods of time.

SPECTRAL SENSITIVITY RANGE—
4.45 microns. See Figure 13.

CONE OF VISION—
See Figure 14. 80 degree cone of vision using methane fuel (30 inch).

FLAME SENSITIVITY—
The detector has 4 field adjustable sensitivity settings. The detector will respond to a 1 square foot gasoline fire at 85, 65, 35 and 20 feet when the sensitivity settings are very high, high, medium and low respectively. High sensitivity with TDSA is the recommended setting. Refer to Table 2.

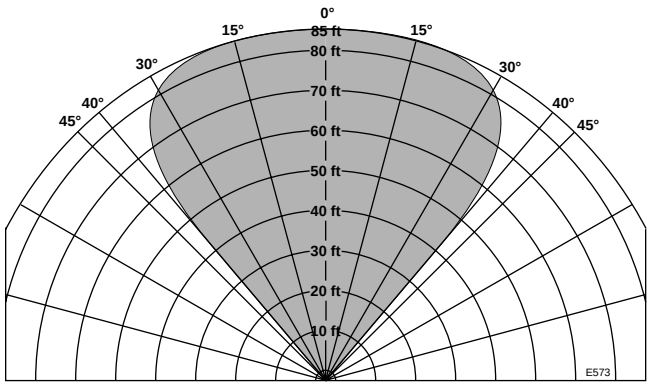


Figure 14—Cone of Vision

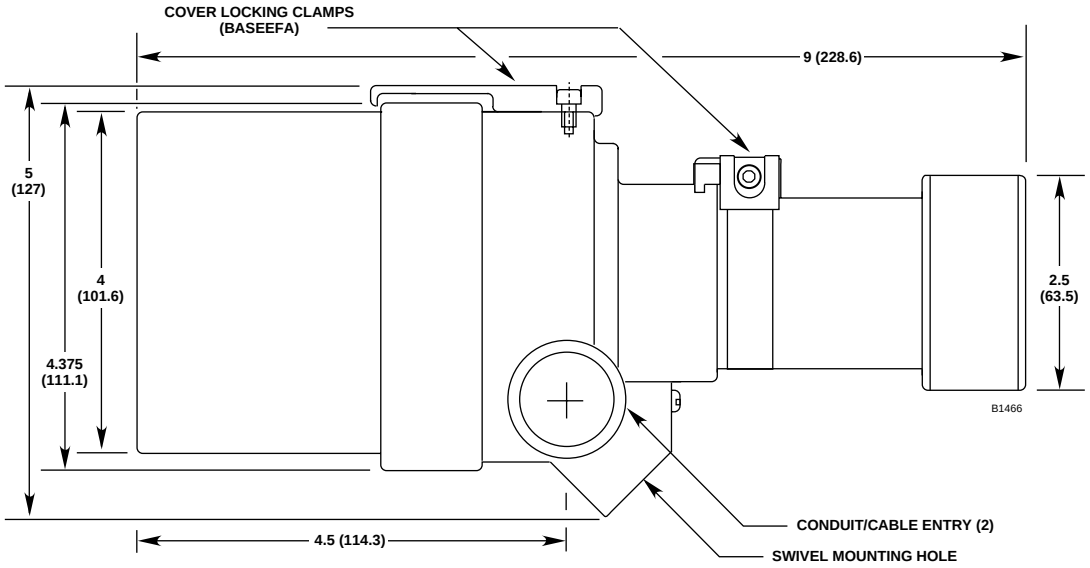


Figure 15—U7698E Dimensions in Inches (MM)

RESPONSE TIME—
The TDSA signal processing mode offers a typical response time of 1 to 10 seconds. The detector is capable of responding to fire within 30 milliseconds when the Massive Channel (high speed) is selected. Response time is a function of fuel, fire size, distance, detector adjustments and orientation of the fire source.

POWER ON DELAY—
0.5 second.

ENCLOSURE MATERIAL—
Copper-free aluminum or 316 stainless steel. Optional stainless steel mounting bracket used with both housings.

CERTIFICATION—

FMR: Reference Appendix A.

CSA: Class I, Div. 1, Groups B, C & D.
Class I, Div. 2, Groups A, B, C & D (T4).
Class II/III, Div. 1, Groups E, F, & G.
Class II/III, Div. 2, Groups F & G (T4).
Enclosure Type 4X.

CENELEC: EExd IIC T6 (T_{amb} = –40°C to +70°C)
EExd IIC T5 (T_{amb} = –40°C to +75°C)
EExd IIC T4 (T_{amb} = –55°C to +125°C)
IP66

Gosstandart: 1 Ex d IIC T6 (T_{amb} = –40°C to +70°C)
1 Ex d IIC T5 (T_{amb} = –40°C to +75°C)
1 Ex d IIC T4 (T_{amb} = –55°C to +125°C)
Flame Characteristics Verified

INGRESS PROTECTION—
IP66, NEMA/Type 4X (indoor and outdoor use).

VIBRATION—
The U7698E meets MIL-STD-810C vibration requirements.

DIMENSIONS—
See Figures 8 and 15.

TERMINAL CONFIGURATION—
See Figure 4.

WIRING—
14 AWG (1.5 mm^2) to 22 AWG (0.3 mm^2) shielded cable is recommended.

CONDUIT ENTRIES—
Two conduit/cable entries per detector. Two sizes available: 3/4 inch NPT or 25 mm.

SHIPPING WEIGHT (Approximate)—
Aluminum: 4.75 pounds (2.14 kilograms).
Stainless Steel: 10.0 pounds (4.54 kilograms).

REPLACEMENT PARTS

The electronic module is not designed to be repaired in the field. If a problem should develop, first carefully check for proper wiring and switch setting. If it is determined that the problem is caused by an electronic defect, the device must be returned to the factory for repair.

NOTE

When replacing an electronic module, be sure that the rocker switches of the replacement are set the same as the original. Remove power before removing the housing cover from the detector or plugging in the replacement module.

DEVICE REPAIR AND RETURN

Prior to returning devices or components, contact the nearest local Detector Electronics office so that a Service Order number can be assigned. A written statement describing the malfunction must accompany the returned device or component to expedite finding the cause of the failure.

Pack the unit or component properly. Use sufficient packing material in addition to an anti-static bag or aluminum-backed cardboard as protection from electrostatic discharge.

Return all equipment transportation prepaid to the factory in Minneapolis.

ORDERING INFORMATION

When ordering, specify model and options.
U7698E Unitized IR Detector

4 to 20 ma output:
—Yes
—No

Enclosure material:
—Copper-free aluminum
—316 Stainless steel

Conduit entry:
—3/4 inch NPT
—25 mm

ACCESSORIES

Q9001L Swivel Mount Assembly is recommended for mounting the detector.

Q1113 Air Shield Assembly is intended for use in locations with high levels of airborne contaminants.

W867 or **W8067 Test Lamp** for testing the detector.

Q1201 Laser Holder and Laser for determining the cone of vision.

REPLACEMENT PARTS

Part Number	Description
DE5994-003	Electronic module without 4 to 20 ma output
DE5994-004	Electronic module with 4 to 20 ma output
DE6000-001	IR sensor module
001680-001	Window cleaner squeeze bottle (package of six bottles)
003525-001	Stainless steel snap-in oi ring
107427-004	Small O-ring
107427-040	Large O-ring
005143-001	Silicone-free grease

For assistance in ordering a system to fit your application, please contact:

Detector Electronics Corporation
6901 West 110th Street
Minneapolis, Minnesota 55438 USA
Telephone (612) 941-5665 or (800) 765-FIRE
Fax: (612) 829-8750
Web site: www.detronics.com
E-mail: detronics@detronics.com

APPENDIX A – FACTORY MUTUAL RESEARCH (FMR) APPROVAL DESCRIPTION

(THE FOLLOWING ITEMS, FUNCTIONS AND OPTIONS DESCRIBE THE FMR APPROVAL)

- Explosion-proof for Class I, Div. 1, Groups B, C and D Hazardous (Classified) Locations per FM 3615.
- Non-incendive for Class I, Div. 2, Groups A, B, C and D (T4); Class II/III, Div. 2, Groups F & G (T4) Hazardous (Classified) Locations per FM 3611.
- Dust-ignition proof for Class II/III, Div. 1, Groups E, F and G Hazardous (Classified) Locations per FM 3615.
- Enclosure rating NEMA Type 4X per NEMA 250.
- Ambient Temperature Limits: –40°F to +167°F (–40°C to +75°C).
- Automatic Fire Alarm Signaling Performance verified per FM 3260.

RESPONSE CHARACTERISTICS – Time Domain Signal Analysis (TDSA)

Sensitivity	Fuel	Size	Distance	Avg. Response Time
Very High	Gasoline	1 square foot (0.09 square meter)	85 feet (25.5 meters)	7 seconds
High			65 feet (19.5 meters)	7 seconds
Medium			35 feet (10.5 meters)	4 seconds
Low			20 feet (6 meters)	4 seconds
Very High	Methanol	1 square foot (0.09 square meter)	50 feet (15 meters)	5 seconds
High			40 feet (12 meters)	9 seconds
Medium			20 feet (6 meters)	4 seconds
Low			10 feet (3 meters)	3 seconds
Very High	Methane Gas Flame	30 inch flame (0.8 meter)	45 feet (13.5 meters)	8 seconds
High			35 feet (10.5 meters)	4 seconds
Medium			15 feet (4.5 meters)	5 seconds
Low			10 feet (3 meters)	4 seconds
Very High	Heptane	1 square foot (0.09 square meter)	60 feet (18 meters)	6 seconds
High			50 feet (15 meters)	6 seconds
Medium			40 feet (12 meters)	7 seconds
Low			15 feet (5 meters)	4 seconds

NOTE: All fuels at 20°C ±2°C with response timed from fuel ignition.

Sensitivity	Fuel	Size	Distance	Avg. Response Time
Very High	Gasoline	1 square foot (0.09 square meter)	85 feet (25.5 meters)	7 seconds
High			65 feet (19.5 meters)	5 seconds
Medium			35 feet (10.5 meters)	4 seconds
Low			20 feet (6 meters)	6 seconds
Very High	Methanol	1 square foot (0.09 square meter)	50 feet (15 meters)	4 seconds
High			40 feet (12 meters)	4 seconds
Medium			20 feet (6 meters)	4 seconds
Low			10 feet (3 meters)	4 seconds
Very High	Methane Gas Flame	30 inch flame (0.8 meter)	45 feet (13.5 meters)	4 seconds
High			35 feet (10.5 meters)	4 seconds
Medium			15 feet (4.5 meters)	4 seconds
Low			10 feet (3 meters)	4 seconds
Very High	Heptane	1 square foot (0.09 square meter)	65 feet (19.5 meters)	5 seconds
High			50 feet (15 meters)	9 seconds
Medium			20 feet (6 meters)	8 seconds
Low			15 feet (5 meters)	4 seconds

NOTE: All fuels at 20°C ±2°C with response timed from fuel ignition.

RESPONSE CHARACTERISTICS — TDSA MODE, MASSIVE CHANNEL

Atomized fuel fires of methanol, isopropanol, acetone and heptane are detectable within 100 milliseconds at a distance of 25 feet (7.5 m). Fuel flow rate equals 10 cc per second.

The operation of the U7698E was tested to verify alarm indication in less than 30 milliseconds when exposed to an intense fire. The large signal produced by ignition of 20 grams (0.7 ounce) of black powder bypassed the TDSA, delay and sensitivity settings. Operation was satisfactory.

ANGLE OF VIEW—
–38 to +38 degrees off centerline in vertical and horizontal planes.

MOUNTING—
Q9001L swivel mount.

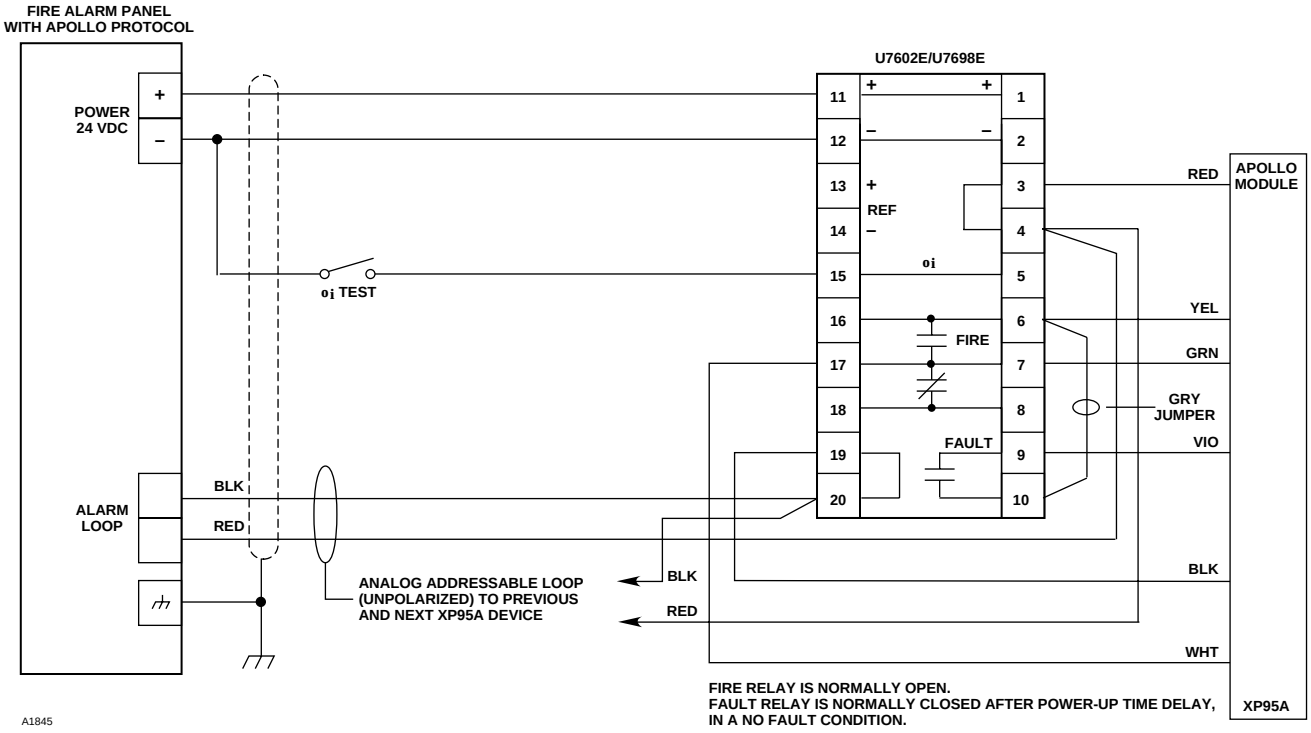
FALSE ALARM IMMUNITY—
- Direct sunlight.
- Indirect (reflected) sunlight.
- A 100 watt incandescent light at 3 feet (0.9 meter).
- Four 34 watt fluorescent lights at 3 feet (0.9 meter).
- A 1500 watt electric heater at 3 feet (0.9 meter).
- Arc welding at 55 ampere setting standard, high sensitivity at 10 feet (3.meters); standard, very high sensitivity at 15 feet (4.5 meters); TDSA, high sensitivity at 10 feet (3 meters); TDSA, very high sensitivity at 15 feet (4.5 meters).

- Vibration immunity for vertical displacement of 0.02 inch (0.5 millimeter) as a frequency of 10 to 30 hertz for 4 hours.
- Radio frequency interference (RFI) immunity at 12 inches to 155 megahertz and 450 megahertz with radiation power levels of 5.0 watts.
- TDSA Mode, High Sensitivity Setting: A modulated infrared (IR) signal produced by a 6 kilowatt (342 BTU/minute) infrared electric heater equipped with a revolving set of blades. Even when a person walked between the detector and heater, there was no alarm. While the modulated IR from the heater was present, the detector went into alarm from a one square foot (0.09 square meter) heptane fire ignited 25 feet (7.6 meters) from the detector.

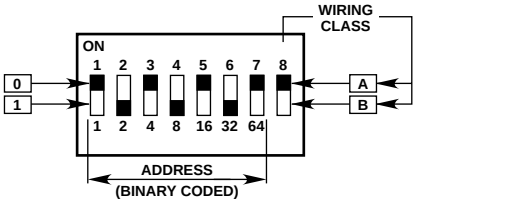
OPTIONS

- Aluminum or Stainless Steel Explosion-proof Enclosure Material.
- 3/4 inch NPT or 25 mm Explosion-proof Enclosure Conduit Entry Thread Types. (Metric straight thread types are for use in non-North American applications.)

APPENDIX B – U7698E WITH THE APOLLO MODULE



U7602E/U7698E Detector/Apollo Module Style D (Class “A”) Wiring Diagram



SWITCH DIAGRAM ABOVE SHOWS AN ADDRESS
OF 0101010 = 42 CLASS "A" WIRING

A1846

SWITCH SETTING: THE ADDRESS NUMBER IS BINARY ENCODED
WITH ROCKER SWITCH NO. 1 BEING THE LEAST SIGNIFICANT BIT.
EACH ROCKER SWITCH HAS A SPECIFIC BINARY VALUE.
THE ADDRESS IS EQUAL TO THE ADDED VALUE OF ALL CLOSED ROCKER SWITCHES.
ALL OPEN SWITCHES ARE IGNORED.
SWITCH NO. 8 SELECTS CLASS A OR B WIRING.

NOTES

1. REFERENCE SPECIFIC EQUIPMENT INSTRUCTION MANUALS
   FOR PRODUCT OPERATION AND OTHER INSTALLATION INFORMATION.

2. WIRING SHOWN IS STYLE D, CLASS A.
   STYLE B, CLASS B NOT SHOWN AND NOT RECOMMENDED.

3. FOLLOW LOCAL ELECTRICAL CODE WHEN INSTALLING EQUIPMENT.

Apollo Module DIP Switch Setting