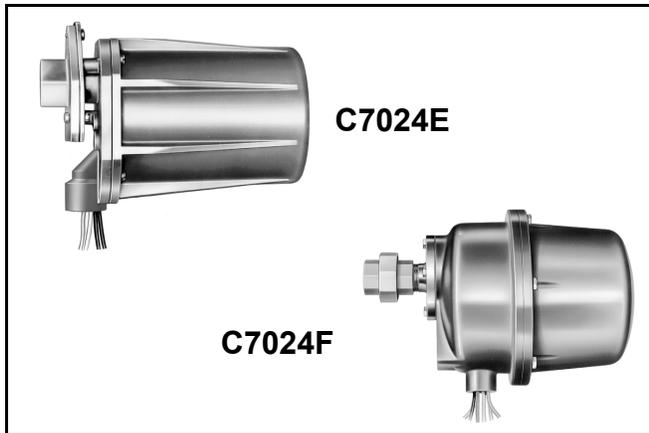


## C7024E,F 24 Vdc Solid State Purple Peeper® Ultraviolet Flame Detectors

### PRODUCT DATA



### APPLICATION

The C7024E,F 24 Vdc Flame Detectors are solid-state electronic devices for sensing the ultraviolet radiation emitted by the combustion of most carbon containing fuels such as natural gas, LP gases, and oil.

### FEATURES

#### C7024E,F:

- Solid-state electronic circuitry provides low power consumption and high reliability.
- Detectors can be mounted horizontally, vertically or at any angle in between. The self-checking models require faceplate alignment and have integral locating reference points to assure proper operation of the shutter mechanism.

- Ultraviolet radiation sensing tube and quartz viewing window are field replaceable.
- Threaded conduit fitting and color-coded lead-wires allow rapid electrical installation.
- Two flame detectors can be wired in parallel to reduce nuisance shutdowns in difficult flame sighting applications.
- A swivel mount is available to facilitate flame sighting.
- -40° F (-40° C) rating.
- Incorporates UV sensor tube checking feature used with Honeywell dynamic self-check R7824C Flame Signal Amplifiers.
- Oscillating shutter interrupts ultraviolet radiation reaching UV sensor 12 times per minute to provide the UV sensor checking function. Amplifier circuitry components are checked from the microprocessor in the RM7824.

#### C7024E:

- Housing meets NEMA 4 enclosure standards (indoor, outdoor protection: rain-tight, dust-tight, hose directed water).
- Protective heat block built into the mounting flange.
- High pressure (50 psi [345 kPa]) quartz viewing window, focusing lens and antivibration mounting accessories available.

#### C7024F:

- Housing designed to be explosion-proof and Underwriters Laboratories Inc. Component Recognized for use in hazardous locations: Class 1, groups C and D, and Class 2, groups E, F and G.
- Viewing window rated for 100 psi (690 kPa).

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## SPECIFICATIONS

### IMPORTANT:

*The specifications in this publication do not include normal manufacturing tolerances. Therefore, this unit may not exactly match the listed specifications. This product is tested and calibrated under closely controlled conditions, and minor differences in performance can be expected if these conditions are changed.*

### Models:

C7024E Self-Checking Solid State Purple Peeper Ultraviolet Flame Detector: For use with R7824C Dynamic Self-Check Amplifiers.

C7024F Self-Checking Solid State Purple Peeper Ultraviolet Flame Detector: Same as C7024E except with explosion-proof housing for use in hazardous locations.

### Electrical Ratings:

Voltage: 24 Vdc.

Power Consumption: 7.8 watts maximum.

### Ambient Temperature Ratings (outside the case):

C7024E,F: -20° F to +175° F (-29° C to +79° C).

**Storage Temperature Ratings:** -60° F to +175° F (-51° C to +79° C).

### Housing:

C7024E: Violet, cast aluminum cover; mounting flange with heat block and faceplate are separate to provide heat insulation and sealoff. Meets NEMA 4 enclosure requirements (indoor, outdoor protection; rain-tight, dust-tight, hose-directed water). Optional water jacket available for the C7024E.

C7024F: Explosion-proof, two-piece, violet, cast aluminum.

### Pressure Rating of Quartz Viewing Window:

C7024E: 20 psi (138 kPa). Focusing lens (20 psi [138 kPa] rating) or high pressure viewing window (50 psi [345 kPa] rating) available; see Accessories.

C7024F: 100 psi (690 kPa).

**Mounting:** C7024E: Mounting flange with 3/4 inch NPT internal threads for attachment to sight pipe.

### Wiring Connections:

NEC Class 1 color-coded lead-wires, 8 feet (2.4 meters) long.

Number of Leadwires: Six.

Threaded Leadwire Opening in Faceplate:

C7024E: 1/2-14 NPSM or 7/8-20 UNSM internal threads for attaching conduit.

C7024F: 1/2-14 NPT internal threads for attaching pipe.

**Dimensions:** See Figs. 1 and 2.

### Weight:

C7024E: Approximately 4.25 pounds (1.9 kg).

C7024F: Approximately 14.5 pounds (6.6 kg).

**Serviceability C7024E and F:** Field replaceable viewing windows and ultraviolet sensing tube, self-checking coil and shutter assembly.

### Approvals:

Underwriters Laboratories Inc. Component Recognized:

C7024E: File no. MP268.

C7024F: For use in hazardous locations; Class 1, Groups C and D; Class 2, Groups E, F and G; File no. E34649.

Canadian Standards Association Certified: File no. LR95329-3.

### Replacement Parts:

C7024E,F:

191286 Ultraviolet Sensing Tube for -40° F (-40° C) operation.

190971G Coil and Shutter Assembly, 24 Vdc.

C7024E:

114372 Quartz Viewing Window; rated for 20 psi (138 kPa).

114465 Gasket, silicone rubber; for installing viewing window (three required).

120739 Gasket, fiber-neoprene; heat insulation and sealoff for mounting flange.

C7024F:

122037 Quartz Viewing Window, rated for 100 psi (690 kPa).

### Accessories:

C7024E,F:

W136A Test Meter (includes 196146 Meter Connector Plug).

118367A Swivel Mount.

C7024E:

122748 Quartz Viewing Window, rated for 50 psi (345 kPa).

## ORDERING INFORMATION

When purchasing replacement and modernization products from your TRADELINE® wholesaler or distributor, refer to the TRADELINE® Catalog or price sheets for complete ordering number.

If you have additional questions, need further information, or would like to comment on our products or services, please write or phone:

1. Your local Honeywell Automation and Control Products Sales Office (check white pages of your phone directory).
2. Honeywell Customer Care  
1885 Douglas Drive North  
Minneapolis, Minnesota 55422-4386

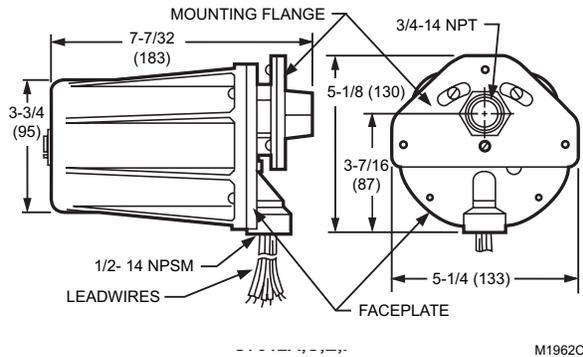
In Canada—Honeywell Limited/Honeywell Limitée, 35 Dynamic Drive, Scarborough, Ontario M1V 4Z9.

International Sales and Service Offices in all principal cities of the world. Manufacturing in Australia, Canada, Finland, France, Germany, Japan, Mexico, Netherlands, Spain, Taiwan, United Kingdom, U.S.A.

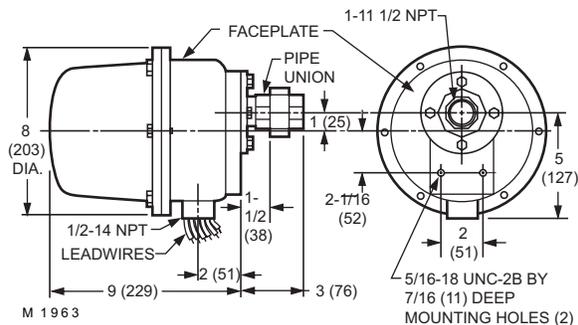
- 124204 Quartz Focusing Lens, rated for 20 psi (138 kPa); for increasing the ultraviolet radiation sensed by the detector.
- 120934 Mounting Flange, aluminum, with 3/4 inch NPT internal threads for attaching to sight pipe.
- 123539 Antivibration Mount.
- 190105 Water Jacket.

**C7024F:**

- 118369 Bushing: Galvanized iron, with 3/4 inch NPT internal threads on one end and 1 inch NPT external threads on the other. For adapting a detector with 1 inch NPT internal threads (for mounting) to a 3/4 inch sight pipe, or to the pipe nipple and tee for connecting an air supply.



**Fig. 1. Dimensions of C7024E in in. (mm).**



**Fig. 2. Dimensions of C7024F in in. (mm).**

**⚠ CAUTION**

**Equipment Damage Hazard.**  
**Failure of sensing tube can cause improper operation.**

Ultraviolet sensing tubes have a life expectancy of 40,000 hours of continuous use within ambient temperature and voltage ratings. Worn-out ultraviolet sensing tubes result in failure of the sensing tube to properly discriminate between flame conditions.

Appliances with burners that remain on continuously for 24 hours or longer should use the C7024E,F Flame Detectors and the R7824C Amplifier with their associated controls.

**⚠ WARNING**

**Electrical Shock Hazard.**  
**Can cause severe injury, death or property damage.**

1. Disconnect power supply before beginning installation to prevent electrical shock and equipment damage. More than one disconnect may be involved.
2. Do not connect detectors to non-Honeywell manufactured controls (primaries, programmers, multiburner systems, and burner management systems). Unsafe conditions could result.
3. All wiring must be NEC Class 1 (Line Voltage).
4. Assure voltage of the power supply connected to this detector agrees with the values marked on the detector.
5. Sight the detector so it will not respond to the ignition spark.
6. On multiburner installations, assure each detector responds only to the flame produced by the burner it is supervising.

**IMPORTANT:**

*Do not connect more than two C7024 Flame Detectors in parallel.*

Proper flame detector installation is the basis of a safe and reliable flame safeguard installation. Refer to the burner manufacturer instructions and to those included here. Carefully follow instructions to make the best possible flame detection application.

**INSTALLATION**

**When Installing This Product...**

1. Read these instructions carefully. Failure to follow them could damage the product or cause a hazardous condition.
2. Check the ratings given in the instructions and on the product to make sure the product is suitable for your application.
3. Installer must be a trained, experienced flame safeguard service technician.
4. After installation is complete, check out product operation as provided in these instructions.

**Basic Requirements**

The combustion flames of most carbon-based fuels emit sufficient ultraviolet radiation to enable the C7024 Solid State Purple Peeper Ultraviolet Flame Detector to prove flame presence in a combustion chamber. The detector is mounted outside the combustion chamber. Its mounting flange or union is threaded to one end of a sight pipe inserted through the wall of the combustion chamber. The ultraviolet sensing tube in the flame detector sights the flame through the pipe.

When a flame is present, the UV tube in the C7024 senses the ultraviolet radiation emitted. The C7024 produces a signal that is sent to the amplifier in the flame safeguard control. The amplified signal pulls in the flame relay in the control to allow proper operation of the system.

Because it is necessary for the UV sensing tube to actually see the flame, it is best to locate the detector as close to the flame as physical arrangement, temperature, and other restrictions permit. These restrictions are described in detail in the following paragraphs.

## Determine the Location

Before beginning the actual installation, determine the best location for mounting the detector. Carefully consider the factors discussed in this section before deciding on the location.

## Temperature

Install the C7024 where the ambient temperature (outside the case) will stay within the ambient operating temperature ratings.

To keep the C7024 below its maximum rating, it may be necessary to add additional insulation between the wall of the combustion chamber and the flame detector. A shield or screen can be added to reflect radiated heat away from the detector. If the detector continues to get too hot, cooling is necessary. Refer to the Sight Pipe Ventilation section. Part number 190105 Water Jacket is also available for cooling the C7024E Flame Detector.

## Vibration

If the C7024 is subject to excessive vibration, a special antivibration mount, part number 123539, can be used for the C7024E. If you use this mount, install it before positioning and sighting the detector.

## Clearance

Make sure there is enough room to easily mount the sight pipe, detector, and all the required fittings, and to remove the detector for troubleshooting and service.

## Radiation Sources (Other Than Flame)

Examples of radiation sources (other than flame) that could actuate the detection system:

1. **Ultraviolet sources:**
  - a. Hot refractory above 2300° F (1260° C).
  - b. Spark:
    - (1) Ignition transformers.
    - (2) Welding arcs.
    - (3) Lightning.
  - c. Welding flames.
  - d. Bright incandescent or fluorescent artificial light.
  - e. Solar radiation.
  - f. Gas lasers.
  - g. Sun lamps.
  - h. Germicidal lamps.
  - i. Bright flashlight held close to the sensing tube.
2. **Gamma ray and X-ray sources:**
  - a. Diffraction analyzers.
  - b. Electron microscopes.
  - c. Radiographic X-ray machines.
  - d. High voltage vacuum switches.
  - e. High voltage condensers.
  - f. High voltage coronas.

g. Radioisotopes.

Except under unusual circumstances, none of these sources (except hot refractory and ignition spark) would be present in or near the combustion chamber.

The detector may respond to hot refractory above 2300° F (1260° C) if the refractory surface represents a significant percentage of the detector field of view. If the temperature of the hot refractory causes the flame relay (in the flame safeguard control) to pull in, re-aim the sight pipe so the detector views a cooler area of the refractory.

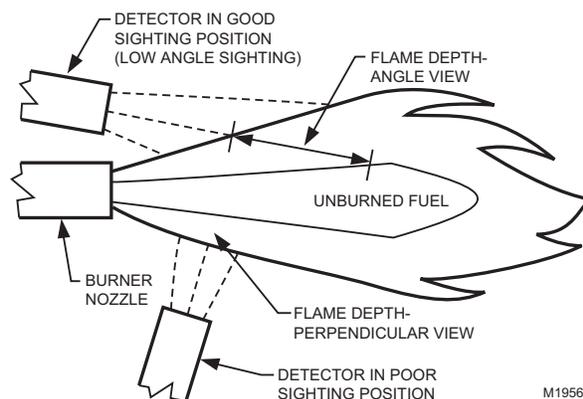
Ignition spark is an intense source of ultraviolet radiation. When installing the detector, make sure it does not respond to ignition spark.

## Single Burner Requirements

The detector must have an unobstructed view of a steady part of the flame it is supervising. This requires a proper sighting angle and minimized ultraviolet radiation attenuation effects. When supervising only one burner, sighting requirements are simplified.

## Sighting Angle (See Fig. 3)

The first 30 percent of a flame nearest the burner nozzle (flame root) emits the most ultraviolet energy. Also, if the detector sights the flame at an angle instead of perpendicularly, it views more flame depth. Therefore, the best sighting angle is nearly parallel to the axis of the flame, permitting the detector to view a large portion of the first 30 percent of the flame nearest to the burner nozzle, as illustrated in Fig. 3.



**Fig. 3. Detector sighting angle.**

Low angle sighting permits the detector to view a greater depth of flame, thus reducing the effects of instabilities in the flame pattern. Also, the environment near the burner nozzle is usually cleaner than at any other part of the combustion chamber. This provides a clearer line of sight and may keep the viewing window cleaner, reducing the maintenance required.

**NOTE:** When possible, it is desirable to tilt *downward* the detector and sighting pipe to prevent buildup of soot in the pipe or on the viewing window.

In most installations, the detector will need to respond to pilot flame alone, then the pilot and main burner flame together, and finally the main burner flame alone. The detector must meet all sighting requirements that apply:

Pilot flame alone—the smallest pilot flame that can be detected must be capable of reliably igniting the main burner.

Pilot and main burner flame together—the detector must sight the junction of both flames.

Main burner flame alone—the detector must sight the most stable part of the flame for all firing rates.

## Parallel Flame Detectors

Shifting flame patterns, commonly encountered on burners with high turndown ratios, may require two parallel detectors to prove the flame at the highest and lowest firing rates and for the modulation in between. In this case, one detector supervises the pilot (interrupted) and both detectors supervise the main burner flame. During the main burner run period, either detector is capable of maintaining system operation. A maximum of two C7024 Detectors can be connected in parallel.

In addition to assuring more reliable flame detection, parallel detectors facilitate maintenance during burner operation. Each detector can be removed, in turn, without shutting down the supervised burner. However, a flame simulating failure occurring in the flame signal amplifier or in either detector will cause a shutdown.

## Screening Effects

Smoke, oil, mist, dirt and dust are masking agents that attenuate the ultraviolet radiation emitted by the flame. If they absorb too much radiation, the amount of ultraviolet radiation reaching the detector is reduced. The flame signal then can become too low to hold in the flame relay, resulting in burner shutdown.

The problem can be eliminated by diluting the contaminants. A strong flow of air through the sight pipe will clear a viewing path through the attenuating material. Refer to Sight Pipe Ventilation section.

It is also desirable to sight the detector at an area containing fewer masking agents such as near the burner nozzle or near the entrance of the combustion air. Increasing the viewing area of the detector by shortening the sight pipe or by increasing the diameter of the sight pipe also reduces the attenuating effects of masking agents.

## Multiburner Requirements (Flame Discrimination)

In addition to meeting the requirements for a single burner, a multiburner installation requires discrimination between flames. *Flame discrimination* can be defined as locating all flame detectors so that each detector responds only to the flame produced by the burner it is supervising.

In multiple burner systems, not every detector can be positioned so its line-of-sight does not intercept flames from other burners. For example, this situation occurs in front-fired boiler-furnaces having more than one row of burners, or in multilevel opposed-fired furnaces where the burners face each other.

When planning such an installation, locate each flame detector so that it has the best possible view of the first 30 percent nearest the burner nozzle (flame root) it is supervising, and the worst possible view of all other flames.

Fig. 4 illustrates a critical detector application problem that requires flame discrimination. Flame discrimination is accomplished for Detector A by repositioning it until the flame relay (in the flame safeguard control) does not respond to Flame B. Note that Detector A is aimed at the first 30 percent of Flame A where the ultraviolet radiation is most intense. It sights the tip of Flame B, but is not aimed at the first 30 percent of Flame B where UV is intense. Detector A is repositioned to assure maximum response to Flame A while rejecting Flame B. Similarly, Detector B is positioned to assure maximum response to Flame B while rejecting Flame A.

If you reposition a detector and still cannot achieve flame discrimination, try reducing the viewing area by increasing the length or decreasing the diameter of the sight pipe, or adding an orifice plate.

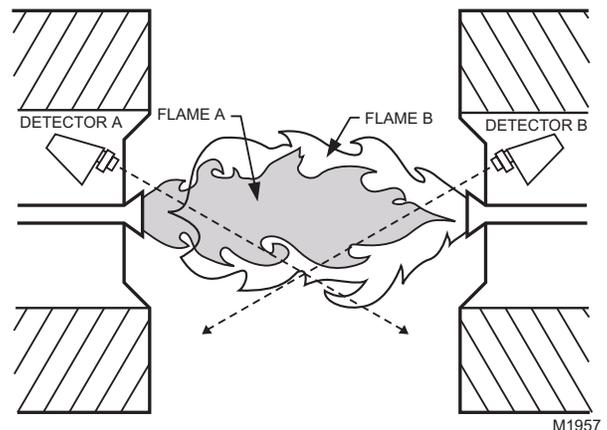


Fig. 4. Example of flame discrimination problem (opposed burners).

## Install the Sight Pipe (See Fig. 5)

After you have determined the location and sighting angle, select the sight pipe. A black iron pipe with a minimum diameter of 1-1/2 in. [38.1 mm] is recommended. Do not use stainless steel or galvanized pipe because they reflect ultraviolet radiation internally and complicate aiming the pipe.