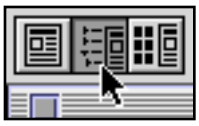
To navigate through this document, click on the “Bookmarks and Page” button → and use the bookmarks to access information.



DET TRONICS

INSTRUCTIONS

Ultraviolet Flame Detection System

R7404 Controller

C7050 Detector

7/97 **Form 95-8242-04**

Table of Contents

DET TRONICS

INSTRUCTIONS

AUTOMATIC oi*

Ultraviolet Flame Detection System
R7404 Controller
C7050 Detector

SYSTEM APPLICATION

The Det-Tronics model R7404 Controller and C7050 Detector provide fast, reliable flame detection in a wide variety of applications. The microprocessor based controller simultaneously monitors up to 16 C7050 ultraviolet (UV) detectors in up to 8 different zones. The system uses the Automatic Optical Integrity (**oi**) feature, which provides a continuous check of detector optical surfaces, detector sensitivity, and electronic circuitry of the detector/controller system. Also included is automatic fault identification, which monitors the system for proper operation, and provides a digital display of system status using a numerical code. Other features include individual zone identification and "voting" capability, as well as manual **oi** testing.

The C7050 Detector responds instantly to the ultraviolet radiation that is emitted by a flame. It is designed for use in hazardous locations and is particularly suitable for use in outdoor applications because it is not affected by wind or rain, and is insensitive to solar radiation. In addition, the detector does not respond to normal artificial light.

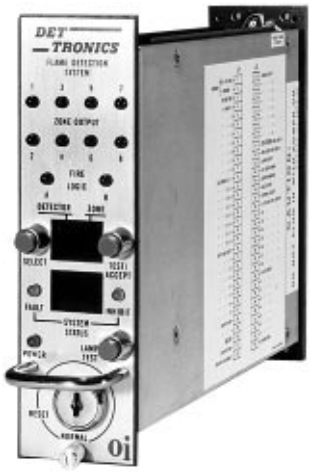
Typical applications for Det-Tronics UV detection systems are:

— Wherever highly combustible materials are involved

— Where there is a need for instantaneous response to flame

— Wherever unsupervised areas require automated fire protection

— Where there is a large capital investment to be protected.



Examples of actual installations using the Det-Tronics UV detector in automated fire protection systems include:

Petroleum Products
— Gasoline transport loading terminals
— Offshore drilling and production platforms
— Pipeline pumping stations
— Tank farms
— Refineries
— Marine engine rooms
— Jet engine test cells

Gaseous Fuels
— Butane and propane loading and storage
— Pipeline compressor stations
— Gas gathering facilities
— Pipelines in highly populated areas
— LNG loading, transfer and storage facilities
— Hydrogen and ammonia production and refinery reformers
— Gas turbines

*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.

Solid Materials
— Munitions production such as illuminating flare material, TNT, and other propellants
— Powder coating booths

Other Processes
— Paint Spray booths
— Chemical and Petrochemical production

Information on these and a wide variety of applications is available from Detector Electronics.

FEATURES

- Instantaneous response to ultraviolet radiation.
- Detectors operate under adverse weather conditions such as wind, rain, snow, high humidity, and extremes of temperature or pressure.
- Automatic Optical Integrity.
- Adjustable sensitivity and time delay.
- All automatic test functions performed with the system on line.
- Manual **oi** test capability (in addition to Automatic **oi** capability).
- Automatic fault identification.
- Individual zone identification with eight voting options.
- Microprocessor control.
- Latching ZONE LEDs identify the zone responding to fire.
- Output circuits can be made latching or non-latching through field adjustment.
- Individual detector output (count rate) can be measured and observed on the digital display.
- Digital display of background UV signals in Test mode.
- Digital display signal output available at field wiring terminals for interfacing with computers or other equipment.
- Detector is Factory Mutual (FM) approved, Canadian Standards Association (CSA) certified, and BASEEFA/CENELEC certified.

GENERAL APPLICATION INFORMATION

In applying any type of sensing device as a fire detector, it is important to know of any conditions that may prevent the device from responding to a fire, and also to know what other sources besides fire will cause the device to respond. A UV detector is useful in fire protection applications because it will provide very fast response to the presence of ultraviolet radiation emitted by a flame. In addition, it is not affected by environmental conditions such as wind, rain, or extremes of temperature and pressure. The Det-Tronics UV system is also insensitive to the ultraviolet component of solar radiation.

Considering the above, it can be seen that there are fire detection applications where only ultraviolet sensors are suitable. However, success in using an ultraviolet detector is dependent not only on knowing its advantages, but also its limitations. It is important to note that electric arc welding is a source of intense ultraviolet radiation, and care must be taken to ensure that arc welding is not performed in protected areas without securing the system. In addition, UV detectors should not be positioned so that their cone of vision can scan the horizon. Rather, they should be directed down over the designated hazardous area to reduce the likelihood of picking up UV radiation from distant sources.

An important fact regarding radiation detectors of any type is that the radiation must reach the detectors in order for them to respond. Care must be taken to keep obstructions out of the line of view. For an ultraviolet detector, this means that ultraviolet absorbing gases or vapors as well as physical obstructions must not be allowed to come between the detector and the protected hazard. Smoke will absorb ultraviolet radiation, and if accumulations of dense smoke can be expected to precede the presence of flame, then UV detectors that are used in enclosed areas should be mounted on the wall approximately 3 feet (1 meter) from the ceiling where the accumulation of smoke is reduced. Glass and plexiglass windows also significantly attenuate UV radiation and must not be located between the detector and a potential flame source. If the window cannot be eliminated or the detector location changed, contact Detector Electronics for recommendations regarding window materials that will not attenuate UV radiation.

It must be noted that malfunctions can occur in any type of equipment, and although Det-Tronics systems are subjected to rigorous tests before shipment, no way has yet been found to guarantee that every device will always operate perfectly. The highest reliability with regard to response to a fire is achieved when a hazardous area is supervised by more than one detector, and when each detector can independently register an alarm.

SYSTEM DESCRIPTION

The R7404/C7050 UV detection system consists of an R7404 Controller and up to 16 C7050 Detectors.

DETECTOR

The C7050 Detector responds to UV radiation over the range of 1850 to 2450 angstroms. It is insensitive to direct or reflected sunlight and to normal artificial lighting.

The output of the detector consists of a series of voltage pulses or “counts.” The frequency of these pulses is directly proportional to the intensity of the radiation being detected and is measured in counts per second (cps).

oi

The detector is equipped with the Automatic **oi** feature (Figure 1). A UV test lamp is mounted in the same enclosure with the UV sensor tube, but they are optically isolated from each other by a cylindrical shield. When the test lamp is actuated by a signal from the controller, it generates a UV test signal that travels out through the viewing window, where it encounters the reflective **oi** ring and is directed back through the window to the sensor. The controller evaluates the strength of the return signal to determine the relative condition of the detector and its optical surfaces. Since this UV test signal must pass through the same portion of the viewing window as UV radiation generated by a flame, a reliable test of the ability of the detector to “see” a fire is achieved.

The controller continuously executes the automatic **oi** test, sequentially testing each detector connected to it. If a fault should occur in the system, it is quickly detected and registered on the digital display on the front panel of the controller and the Fault output is de-energized.

Internal Reflection oi

The use of an Internal Reflection **oi** detector is recommended in applications where corrosive or oily contaminants are present in the atmosphere. This type of environment can cause rapid deterioration of the reflectivity of externally mounted **oi** rings, resulting in the need for frequent detector maintenance. Since the Internal Reflection detector checks the cleanliness of the viewing window without the use of an external reflective **oi** ring, faults caused by corrosion or contamination of the ring are eliminated. A fault will be indicated only if the viewing window is actually dirty. It is important to note that the internal reflection system is effective only with oily substances that wet the surface of the window. It does not detect dry contaminants and, therefore, is not practical for powder coating booths or similar applications where various dry contaminants can obscure the vision of the detector.

UV detectors that are currently using the external reflection **oi** system can easily be converted to Internal Reflection in the field by simply replacing the existing sensor tube module with a DE1888V Internal Reflection **oi** Tube Module. No calibration or other adjustments are required, and no modifications to the detector enclosure are needed.

Detector Enclosure

The detector is housed in an explosion-proof enclosure that is designed to meet most national and international standards. It is available in various materials to meet the requirements of the environment in which it is used. Materials include anodized aluminum, nickel-plated brass and 316 stainless steel. The aluminum and the nickel-plated brass housings are epoxy coated, making them suitable for use in high saline atmospheres, such as offshore platforms.

The detector is typically mounted on an optional swivel mounting assembly (Model Q9001), which is recommended for ease in installation. Other mounting arrangements are also available, such as a quick-connect front mount for applications involving paint spray or powder coating booths, or for looking inside mixers, kettles, conveyors and other inaccessible areas.

CONTROLLER

The R7404 is designed for use with 24 volt dc power supplies, but will operate from any direct current supply between 10 and 38 volts. The unit will tolerate transients such as those that can occur when fully discharged batteries are placed on charge. When power is present at the R7404 Controller, it is indicated by a continuously energized green LED. All other lights and displays on the R7404 panel are normally off, but may be periodically checked for operation by pressing the LAMP TEST button located directly opposite the POWER light as illustrated in Figure 2. It is not necessary for the controller to be in the TEST mode when this check is performed.

The R7404 Controller incorporates a microprocessor and a programmable-read-only-memory (PROM) to store and implement the permanent program for operating the sys-

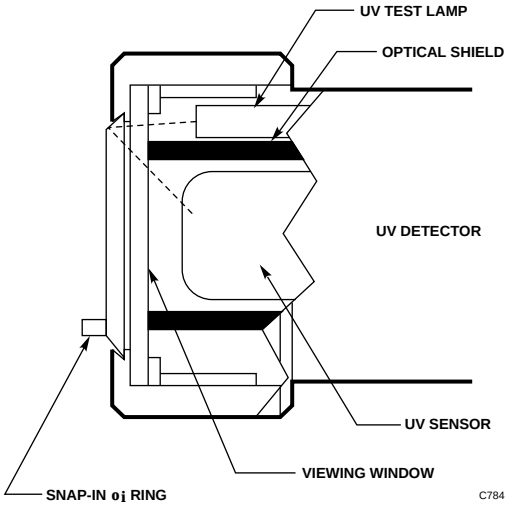


Figure 1—Detector with **oi**

tem. The main loop of the operating program continuously cycles through the Automatic Optical Integrity test, checking each detector and its wiring. At the same time, the microprocessor can be interrupted by any one of several status changes, such as a fault, a "fire" signal from one of the detection zones, or a change in the setting of the keylock switch. In the event of a status change, the microprocessor will take the appropriate action.

NOTE

The R7404 is available with various optional operating programs (STAR Logic, Remote Surveillance, etc.). This manual covers the operation of the R7404 with the standard program. Always refer to the manual supplied with any special purpose controllers when operating or installing the equipment.

Fire Response

When the controller receives a "fire" signal from any detector in the system, it is compared to the stored information of the program. If the signal frequency is lower than the programmed setting for sensitivity, the lower display on the front panel of the controller responds with a "3" and the upper display identifies the first zone affected. If the signal frequency is greater than the programmed sensitivity setting for a period greater than the preset time delay, the following actions take place:

1. The appropriate solid state zone output(s) is energized. One zone output is available for each of the eight zones.

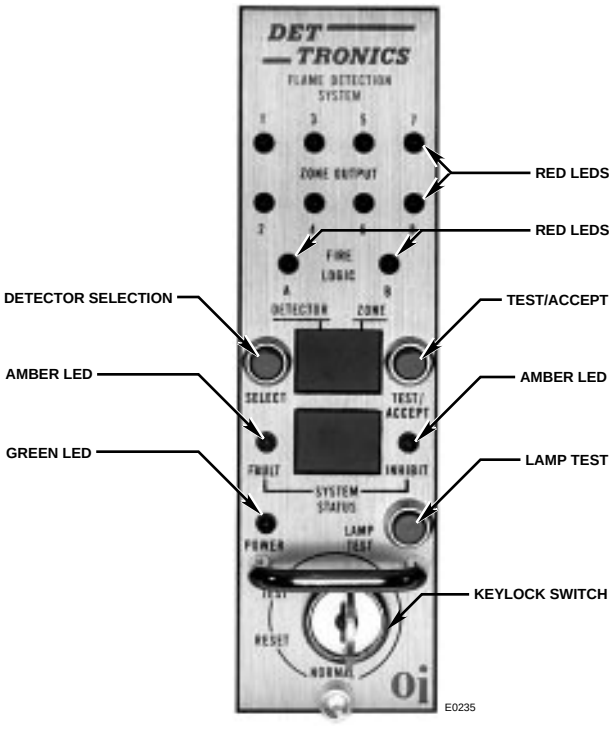


Figure 2—Front Panel of R7404

2. The solid state alarm output is energized. The alarm output is activated when any zone detects a fire.
3. The ZONE display identifies the first responding zone. The DETECTOR display is blank.
4. The SYSTEM STATUS display shows a "6", indicating fire.
5. One or more ZONE LEDs turn on (blinking), indicating the zone(s) detecting UV radiation.
6. If the selected "voting" criteria has been satisfied, the appropriate Fire Logic output is energized, and the corresponding LED is on.

NOTE

When a fire signal is no longer present, the ZONE LED(s) and the display indication will latch until manually reset (ZONE LED emits steady light). The display latch feature is useful in post-fire analysis as a means of determining fire origin.

The Alarm output is typically used to actuate an external audible alarm when a fire signal is received from one or more detectors. Since these alarms can be disruptive to personnel who are responding to the fire emergency, a means for alarm silencing has been provided. The R7404 is equipped with a TEST/ACCEPT button, which will de-activate the alarm circuit without interrupting the Zone and Fire Logic outputs. The alarm can also be silenced by an optional external silence switch (see "Typical Applications" section).

NOTE

If the system is going to be put out of service for periods of time, use the Test/accept to bypass the alarm contacts instead of shutting down the system. This will provide optimum performance when reconnected.

Digital Displays

The upper digital display on the R7404 panel identifies both the detector and zone involved in any "System Status" occurrence. For example, with the keylock switch in the TEST position, and a "1" digit showing on the lower display, the upper display shows which detector and zone is electrically positioned for a manual **oi** test.

Voting Logic

The R7404 permits two groups of four zones each to "vote" separately, or eight zones to "vote" together. This means that the controller can be programmed to require more than one detector to be actuated before the Fire Logic A and/or B outputs are energized. The Det-Tronics "voting" principle allows combinations of detec-

tors to fulfill voting requirements, and represents the best balance between reliability of fire detection and freedom from false actuation due to individual detector malfunction.

Fault Identification

The automatic fault identification feature of the R7404 operates much the same as on other Det-Tronics equipment, but has expanded capability. The lower display on the controller panel identifies the probable source or type of fault using a numerical code. A summary of the R7404 system status code is shown in Table 1.

System Reset

The reset function is incorporated in a rotary keylock switch, which has three positions: (1) NORMAL, (2) RESET and (3) TEST. The switch sequence is such that a return to NORMAL from the TEST position can be achieved only by passing through the RESET mode (Figure 2). The reset function may also be performed by an optional external reset switch. Whenever the keylock switch is placed in the RESET or TEST position, the FAULT and INHIBIT LEDs will turn on, and all Zone, Fire Logic, and Alarm outputs will be disabled.

Programming Switches

The circuit board on the left side of the R7404 Controller contains switches for selection of:

1. Detectors connected to the controller
2. System sensitivity
3. Time delay
4. Fire logic and latching/non-latching options.

See “Switch Setting Procedure” in the “Installation” section for a detailed description.

Table 1—System Status Codes

0 —	Keylock switch in RESET position, or external Inhibit/Reset is activated.
1 —	Keylock switch in TEST position.
2 —	Reduced detector sensitivity (**oi** fault) or faulty wiring.
3 —	Spurious UV detection or over sensitive detector.
4 —	Low +290 vdc (+290 volt detector supply wire may be shorted).
5 —	High +290 vdc (voltage regulation failure in the 290 volt supply).
6 —	Fire.
7 —	Not used.
8 —	Controller in count test mode.

SPECIFICATIONS

SPECTRAL SENSITIVITY RANGE—
The detector responds to UV radiation over the range of 185 to 245 nanometers (1850 to 2450 angstroms).

SYSTEM SENSITIVITY—
Sensitivity for the standard R7404 Controller is field adjustable over a range of 8 through 120 counts per second (cps) in increments of 8 cps. The maximum response distance is achieved at an 8 cps sensitivity setting. For applications involving high background radiation potential, the system can be desensitized by increasing the count rate required to actuate it. The 120 cps setting results in the minimum response distance.

INPUT VOLTAGE—
The R7404 can operate from any voltage in the range of 18 to 38 volts dc.

TEMPERATURE RATING—
Operating:
Standard detector: –40°F to +167°F (–40°C to +75°C).
Controller: –40°F to +167°F (–40°C to +75°C).
Detectors with higher temperature ratings are available.

Storage:
Detector and controller:
–67°F to +167°F (–55°C to +75°C).

HUMIDITY—
0 to 95% RH, non-condensing.

RESPONSE TIME—
Response to a saturating (high intensity) UV source is typically 10 milliseconds for the zone and alarm outputs and 150 milliseconds for the fire logic outputs when sensitivity is set for 8 cps and time delay is set for 0 seconds.

OUTPUT CIRCUIT RATINGS—
Open collector solid state output is rated 100 milliamperes dc at 60 volts dc. Lead monitoring is provided by an internal 100 kilohm resistor from output to ground. External equipment that can generate transients when switching (such as relays) must have a transient suppression device (diode) connected across the coil at the time of installation to safeguard the output transistors against possible damage. See the “Installation” section for details.

POWER CONSUMPTION (Controller and 16 Detectors)—
Standby: 1.5 watts typical, 1.7 watts maximum.
Fire: 15 watts typical, 16.5 watts maximum.

WIRING REQUIREMENTS—
The detector wiring must be a minimum of 22 gauge with a minimum voltage rating of 600 volts rms. (22 gauge copper wire has a diameter of 0.6439 mm or 0.02535 inch. Its cross section is 0.3255 mm^2 or 0.0005 in^2. Its

resistance is 16.14 ohm/1000 ft. or 53.0 ohm/km.) The R7404 Controller will accommodate up to 16 detectors. The detectors can be located up to 2000 feet (600 meters) from the controller. Shielded cable is required for the “B” (signal) leadwires. As with any field device, shielded cable on all wires provides maximum protection from RFI/EMI sources.

SHIPPING WEIGHT (Approximate)—

	Pounds	Kilograms
Controller	2.5	1.12
Detector (aluminum)	1.25	0.56
(stainless steel or brass)	2.25	1.0

DIMENSIONS—
Refer to Figure 3 for dimensions of the controller and Figure 4 for the detector and swivel mounting brackets. Figure 5 shows the dimensions of the Q4004 Mounting Cage. Cages that hold fewer devices are also available.

CONE OF VISION—
The C7050 Detector has a nominal 90 degree cone of vision with the highest sensitivity along its central axis. See Figure 7.

DETECTOR ENCLOSURE MATERIALS—
Models are available in anodized copper-free aluminum, nickel-plated brass, or 316 stainless steel.

CERTIFICATIONS—

FMRC: See Appendix A for details.

CSA: Explosion-proof for Class I, Division 1, Groups C and D.
Dust ignition-proof for Class II, Division 1, Groups E, F, and G.
Enclosure Type 4 (Indoor and Outdoor Use)

CSFM: Explosion-proof for Class I, Division 1, Groups B, C and D.
Dust ignition-proof for Class II, Division 1, Groups E, F, and G.

CENELEC: EEx d IIB+H_2 T6 (T_{amb} = –40°C to +77°C)
EEx d IIB+H_2 T4 (T_{amb} = –40°C to +125°C)
IP66

Special Conditions for Safe Use “X”:
The fused silica window is liable to be damaged by impact. The detector should be installed in such a manner as to prevent the window from receiving mechanical damage.

Russian Certification: Performance Verified from –55°C to +75°C
1Ex d IIB T6X (T_{amb} = –40°C to +77°C)
1Ex d IIB T4/H_2 X (T_{amb} = –40°C to +125°C)
IP66

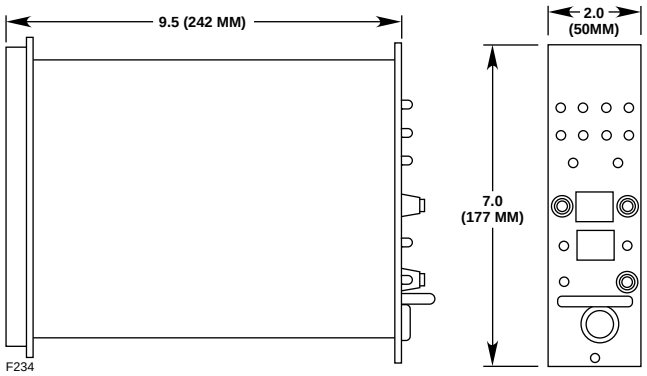
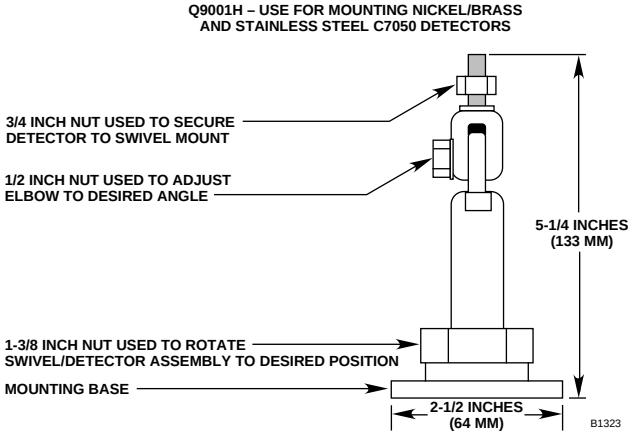


Figure 3—Controller Dimensions in Inches (Millimeters)



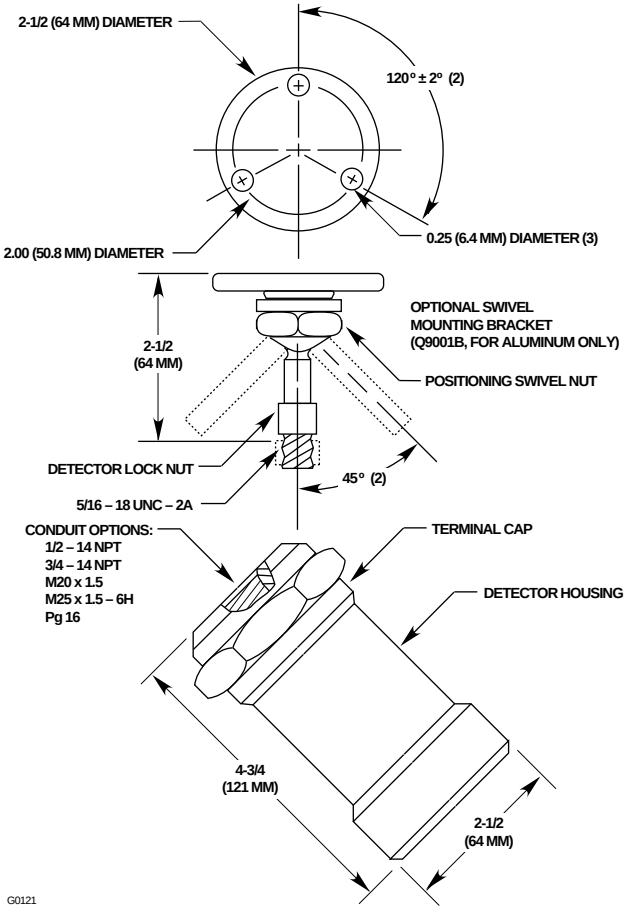


Figure 4—Detector Dimensions in Inches (Millimeters)

PART NUMBER 005269-XXX	CONTROLLER POSITIONS FOR:		HT:	DIM. (A)		DIM. (B)		DIM. (C)		DIM. (D)		DIM. (E)		WEIGHT	
	FIRE	GAS		INCH	MM	INCH	MM	INCH	MM	INCH	MM	INCH	MM	LB	KG
–001	8	16	4U	19.00	482.6	18.30	464.8	17.36	440.9	4.00	101.6	6.97	177.1	9.3	4.2
–002	6	12	4U	15.06	382.6	14.36	364.7	13.42	340.9					7.6	3.5
–003	4	8	4U	11.13	282.6	10.43	264.9	9.49	241.1					5.9	2.7
–004	3	6	4U	9.16	232.7	8.46	214.9	7.52	191.0					5.1	2.3
–005	2	4	4U	7.19	182.7	6.49	164.9	5.55	141.0					4.2	1.9
–006	1	2	4U	5.22	132.6	4.52	114.8	3.58	90.9					3.1	1.4

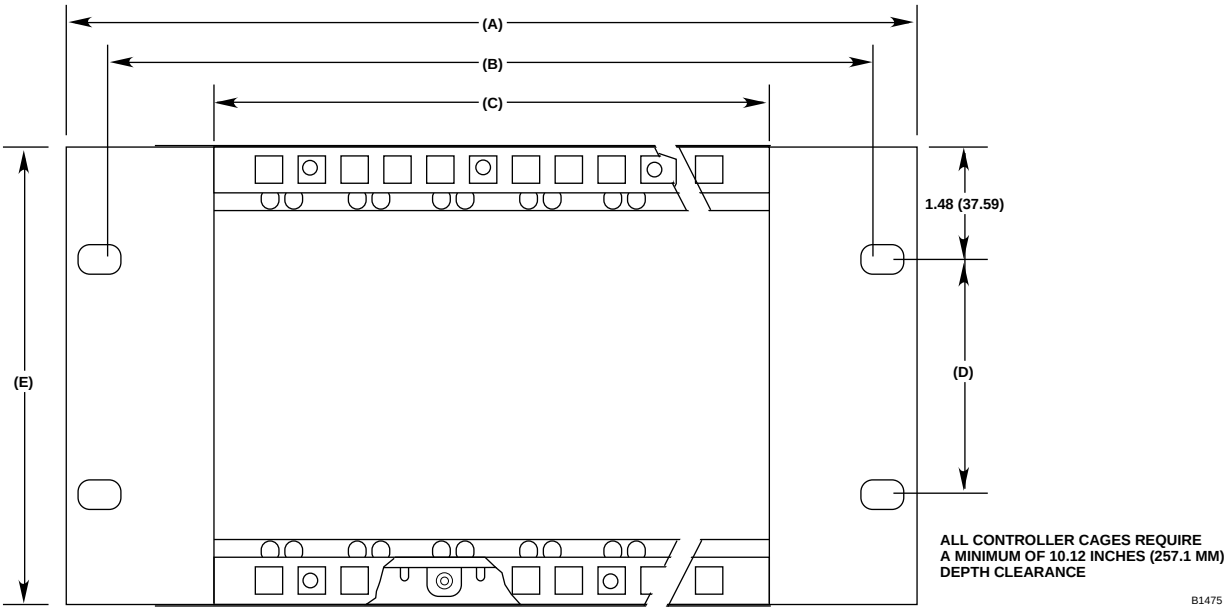


Figure 5—Q4004 Mounting Cage Dimensions in Inches (Millimeters)

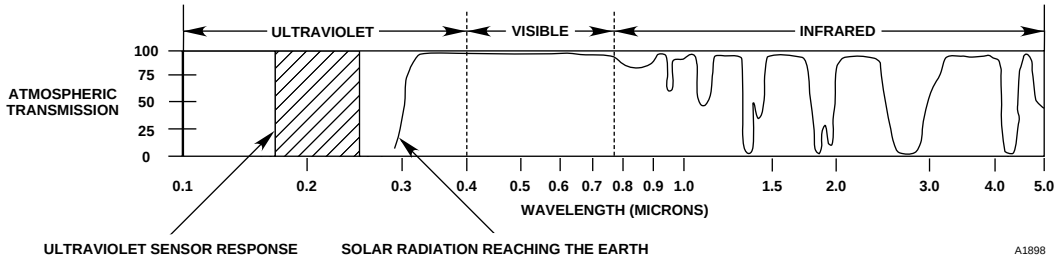


Figure 6—Detector Range of Sensitivity

DETECTOR SENSITIVITY

The UV flame detector responds to radiation over wavelengths of 185 to 245 nanometers (1850 to 2450 angstroms). Figure 6 illustrates the range of sensitivity, and compares this range to other forms of radiation. Note that UV radiation reaching the earth from the sun does not extend into the region of sensitivity of the detector. In addition, radiation from normal artificial lighting, such as fluorescent, mercury vapor, and incandescent lamps does not extend into the detector's spectral range. As a result, the detector is insensitive to these forms of radiation and may be used outdoors or indoors.

NOTE

Some mercury vapor lamps can operate for extended periods with cracked or otherwise damaged envelopes, and will then emit UV radiation in the frequency response range of the detector. Defective mercury vapor lamps should be immediately removed from service.

The UV sensor responds to any radiation that can penetrate its glass envelope and create ion pairs. The glass envelope absorbs most alpha or beta particles, but it permits both gamma and x-rays to pass through. If these rays create ion pairs between the electrodes near the cathode, the normal discharge process will occur and the detector will

produce a count. If the x- or gamma ray flux is sufficient to produce a count rate higher than the system sensitivity setting, an undesired response of the system can occur.

Data on sensitivity of the C7050 Detector to various x-ray and gamma radiation intensities is impossible to relate to a typical detector exposure. The normal precaution against false actuation due to x-rays or gamma radiation is to turn off the detection system when sources of high level radiation are being used in the immediate area. **Caution must be exercised** if the detection system is turned off, since the hazardous area will not be protected. If the application requires continuous supervision by the detection system, a "Nuclear Surveillance" system is needed. Refer to form number 95-8256 or contact Det-Tronics for complete information.

NOTE

Ultraviolet detectors are very sensitive to arc welding, and if this type of radiation can be expected, it must be controlled through proper application. Successful application techniques include careful positioning and shielding of the detectors. Some applications can require a "Remote Surveillance" or UV/IR system. Contact the Field Support Group at Detector Electronics for complete information.

Figure 7 shows a composite view of the cone of vision and the response of a typical detector to a constant UV source at various relative distances. Depending upon the intensity of the ultraviolet radiation source, the C7050 can be considered to have a practical application distance of up to about 50 feet (15 meters). Under certain controlled conditions, detectors can be used at greater distances.

SYSTEM SENSITIVITY CONSIDERATIONS

Figure 8 shows the approximate relation between counts per second (cps) and distance. From this curve it can be seen, for example, that a 4 ft^2 (0.37 m^2) gasoline fire at 60 feet (18 meters) will normally cause the detector to generate 20 cps. The same fire at 40 feet (12 meters) will generate about 50 cps. If a 2 ft^2 (0.18 m^2) fire at 20 feet (6 meters) will generate about 100 cps, the same fire at 70 feet (21 meters) will generate about 8 cps. Because of the complexity of the combustion process, the UV tube count rate generated by different size fires viewed from the same distance is difficult to predict with a high degree of precision. In general, however, if a fire doubles in size, the tube count rate is increased by approximately 60 percent.

NOTE

The count rate of any given detector will depend upon the sensitivity of the sensor tube, the type and amount of fuel, the distance between the detector and the fire, as well as various other factors. Figure 8 illustrates the relative response of a "typical" C7050 to various size gasoline fires based on minimum sensitivity standards for DE1888 UV sensor modules. Sensor modules with higher sensitivity are available. Consult the Field Support Group at Det-Tronics for information or assistance concerning a specific detector tube type or a specific combustible material.

Selection of controller sensitivity and time delay to be used in a given application is dependent on the level of hazard present and the action to be taken in the event of fire. The adjustable sensitivity and time delay of the R7404 allows it to meet the requirements of virtually any application.

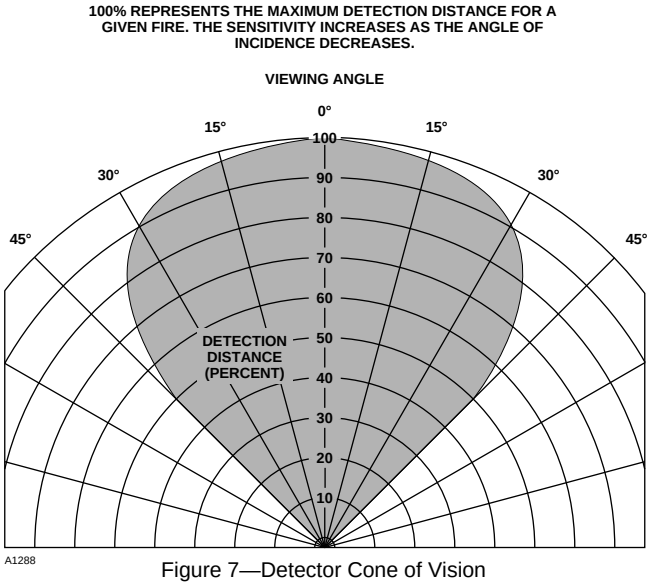


Figure 7—Detector Cone of Vision

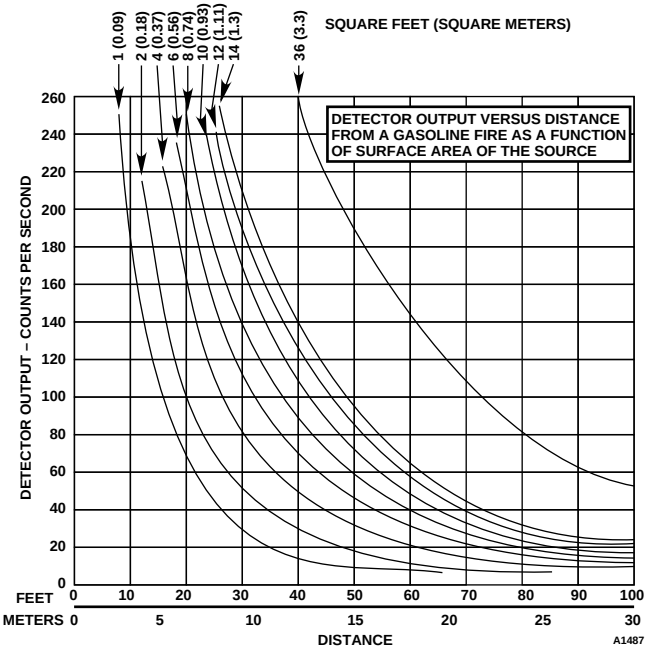


Figure 8—Sensitivity of a Typical Detector to a Gasoline Reference Fire

The system can be adjusted to various sensitivity levels by programming the controller to respond at a pre-determined detector tube count rate. This count rate is dependent upon the intensity of the ultraviolet radiation reaching the detector, which is a function of fuel, flame size, distance from the detector, and the amount of UV absorbing vapors that may be present.

Programming the controller to respond to a low count rate results in high system sensitivity. Conversely, programming the controller to require a high count rate results in low system sensitivity. The presence of UV absorbing vapors must be examined closely. Some chemical and petrochemical vapors have very strong UV absorption characteristics. See Table 2.

Referring to Figure 8 and considering the conditions described above, the criteria for selecting a correct system sensitivity adjustment can be established. For example, assume that the hazard to be protected is at a distance of 23 feet (7 meters) from the detector. Assume that the hazard is gasoline and that it is desired to produce an alarm signal when a fire with a surface area of 1 square foot (0.09 m^2) develops. Reading on the horizontal "Distance" axis of Figure 8, locate the vertical line at approximately 23 feet (7 meters). Follow this line until it intersects the "1 square foot" curve. Note that this occurs at the horizontal line of about 50 counts per second on the vertical "Detector Output" axis. This means that the controller should be adjusted to 48 cps sensitivity in order to detect this size fire from 23 feet (7 meters). If the detectors were located 30 feet from the hazard, it can be seen that it would be necessary to use a more sensitive (lower cps) setting.

Table 2—UV Absorbing Gases and Vapors

The following 38 substances exhibit significant UV absorption characteristics. These are also generally hazardous vapors. While generally of little consequence in small amounts, these gases can restrict UV detection if they are in the atmosphere in heavy concentrations. It should also be determined whether or not large amounts of these gases may be released as a result of a fire-causing occurrence.

Acetaldehyde	Methyl Methacrylate
Acetone	Alpha-Methylstyrene
Acrylonitrile	Naphthalene
Ethyl Acrylate	Nitroethane
Methyl Acrylate	Nitrobenzene
Ethanol	Nitromethane
Ammonia	1-Nitropropane
Aniline	2-Nitropropane
Benzene	2-Pentanone
1,3 Butadiene	Phenol
2—Butanone	Phenyl Clycide Ether
Butylamine	Pyridine
Chlorobenzene	Hydrogen Sulfide
1-Chloro-1-Nitropropane	Styrene
Chloroprene	Tetrachloroethylene
Cumene	Toluene
Cyclopentadiene	Trichloroethylene
O-Dichlorobenzene	Vinyl Toluene
P-Dichlorobenzene	Xylene

If UV-absorbing gases may be a factor in a given application, precautionary measures should be taken. Detectors can be placed closer to the potential hazard area, and/or the sensitivity of the detection system can be increased. Contact the factory for further details.

Substances such as methane, propane, butane, hexane, camphor and octane are not UV absorbing.

INSTALLATION

IMPORTANT

The installation procedure described in this manual is intended for wiring and programming the standard R7404 Controller used with the C7050B Detector. It is important to note that the R7404 Controller is available with various operating programs (EPROMs). This can affect the system programming and/or terminal configuration of the controller. Since the installation procedure and application instructions vary with each model, specific information is supplied in a separate manual that is specific to the equipment being installed. When installing any "special purpose" version of the R7404 Controller, always use the manual that is supplied with the controller in conjunction with this manual. If a conflict arises, follow the procedure in the manual for the specific equipment involved.

Device	***Manual Form Number***
R7404 with STAR Logic	*95-8294*
R7404 for Remote Surveillance System	*95-8249*
R7404 for Nuclear Surveillance System	*95-8256*

WIRING REQUIREMENTS

The wiring to the detector must be a shielded cable 22 gauge (0.643 mm diameter) minimum, with at least a 600 volt rms rating. If there are two detectors in a zone, they may share a cable. If the detector leads are run in conduit, the conduit must not be used for wiring from other electrical equipment. Detectors can be located up to 2000 feet (600 meters) from the controller.

Shielded cable is required for the "B" (signal) leadwires. As with any field device, shielded cable for all wires provides maximum protection from RFI/EMI sources. In applications where the wiring cable is installed in conduit, the conduit must not be used for wiring to other electrical equipment.

Since moisture can be detrimental to electronic devices, it is important that moisture not be allowed to come in contact with the electrical connections of the system. Moisture in the air can be trapped within sections of conduit, therefore the use of conduit seals is required to prevent damage to electrical connections caused by condensation within the conduit. These seals must be watertight and explosion-proof and are to be installed even if they are not required by local wiring codes. A seal must be located as close to the detector as possible. In no case should this seal be located more than 18 inches (46 cm) from the detector. If a conduit swivel is used, a seal **must** be located between the detector and the swivel. When local codes require an explosion-proof installation, an additional seal is also required at any point where the conduit enters a non-hazardous area.

When pouring a seal, the use of a fiberdam is required to assure proper formation of the seal. The seals should never be poured in temperatures that are below freezing, since the water in the sealing compound will freeze and the compound will not dry properly. Contamination problems can then result when temperatures rise above the freezing point and the compound thaws. The shielding of the cable should be stripped back to permit the seal to form around the individual leads, rather than around the outside of the shield. This will prevent any siphoning action that might occur through the inside of the shield.

It is recommended that conduit breathers also be used. In some applications, alternate changes in temperature and barometric pressure can cause "breathing," which allows the entry and circulation of moist air throughout the detector and connected conduit. Joints in the conduit system and its components are seldom tight enough the prevent this "breathing." Moisture in the air can condense at the base of vertical conduit runs and equipment enclosures, and can build up over a period of time. This can be detrimental to electronic devices. To eliminate this condition, explosion-proof drains and breathers should be installed to automatically bleed off accumulated water.

Cable made specifically for harsh, salt-water environments must be used in areas where high humidity or salt water is a problem. In all cases, typical cable insulation resistance should measure 100 megohms or more, using a high voltage insulation tester (megohmmeter). If cable resistance drops below 10 megohms, it should be replaced immediately to avoid shorting.

IMPORTANT

Disconnect the detectors and controller before applying a megohmmeter to the cable.

When using steel wire armored or mineral-insulated copper-sheathed cables, select an approved gland with a watertight compression stage and an overall gland shroud for outdoor applications. A sealing washer must be fitted between the gland and the conduit entry to ensure IP66 rating.

NOTE

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 applicable regulations that relate to the installation of electrical equipment in a hazardous area. If in doubt, consult a qualified official before wiring the system.

DETECTOR POSITIONING AND DENSITY

The detector has a nominal 90° cone of vision. What this means in practical terms can be understood by reference to a typical installation. Consider an application such as a loading rack with a ceiling height of 25 feet (7.5 meters), and assume it is desired to have complete detector coverage at floor level. If a detector is mounted 2 feet (0.6 meter) from the ceiling and pointed straight down, the distance from the detector to the designated level would be 23 feet (7 meters). Because of its 90° cone of vision, the detector would cover a circular area with a diameter of 46 feet (14 meters) at the designated level. A simple layout of the area to be covered will easily reveal the number of detectors required to completely supervise the designated area. In general, detectors should be placed as close as practical to the probable hazard.

NOTE

Do not mount UV detectors close to the ceiling in enclosed areas if dense smoke can be expected to accumulate at the onset of a fire. Mounting the detector on side walls a few feet (or about 1 meter) down from the ceiling will normally allow time for the detectors to respond before they are affected by smoke rising to the ceiling. It is also advisable to shorten any time delay settings for applications where smoke may accumulate during a fire. If dense smoke can be expected to accumulate prior to the presence of flame (as in an electrical fire), do not use UV detectors alone.

MOUNTING THE DETECTOR

The following procedure should be used for mounting and wiring the detectors.

1. Detectors should be located for the best unobstructed view of the area to be protected. Detectors must be accessible for cleaning the viewing window and reflector rings. Care must be taken so that dirt or other foreign material will not accumulate and obscure the detector viewing window. For outdoor applications, the detectors should be pointed down-

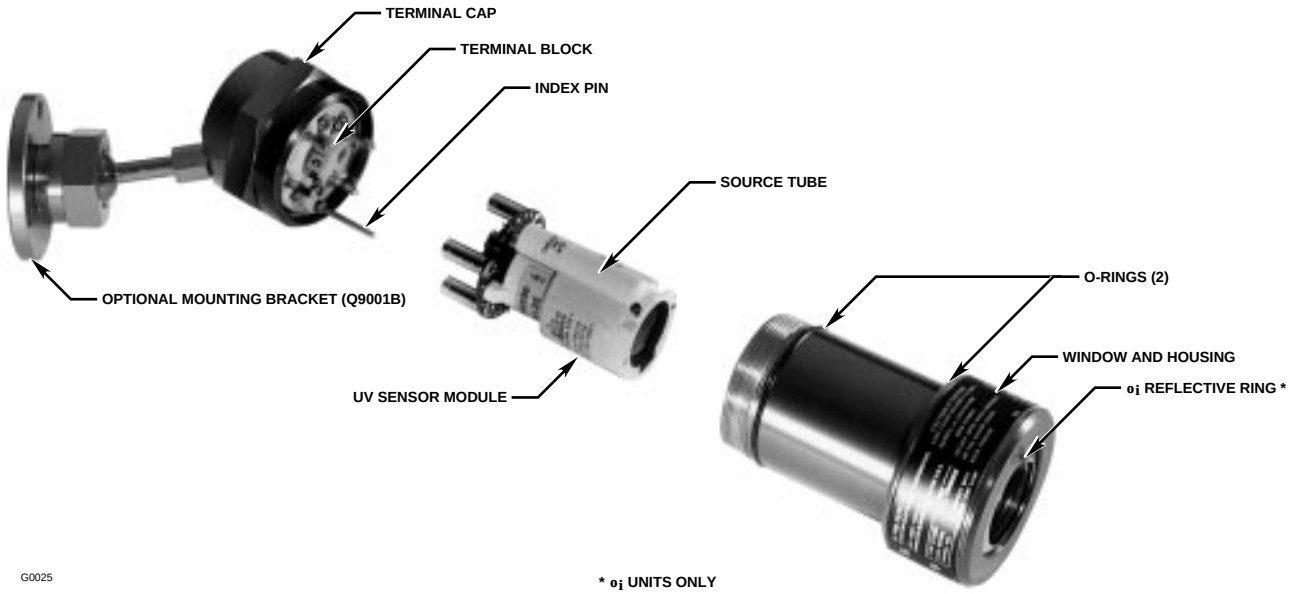


Figure 9—C7050 Detector

ward to prevent the cone of vision from scanning the horizon, since the detectors can be affected by long duration lightning flashes or distant arc welding. When practical, mount the detectors so that the UV test lamp is on top, since dirt accumulation between the window and the reflector ring can interfere with the Automatic **oi** function. See Figure 4 for mounting dimensions.

2. Disassemble the detector enclosure by turning the housing cover counterclockwise. If the detector is equipped with a cover locking device, loosen the clamp and disengage the "catch" from the terminal cap. See Figure 9 for an illustration of the detector assembly and Figure 10 for the optional cover locking assembly. The tool required for the BASEEFA clamp is a 5/32 inch hexagonal (Allen) wrench. For the P.T.B. clamp, a triangular m4 (7 mm) wrench (Din 22417) must be used.

NOTE

Power must not be applied to the system while opening the detector housings, or while plugging in or removing the sensor tube modules.

3. Install the A-, B-, C-, and D-leads to the connections on the terminal block. See Figure 11. Do not ground the shield to the detector housing.

NOTE

Many wiring codes prohibit the connection of a shield to the negative terminal of a power source (terminal 2 of the controller). If such a connection is permitted, the detectors can be wired using a 3 wire shielded cable. The shield is connected to the "C" terminal of the detector in place of a separate C-lead. (See Figure 23).

4. Remove the UV sensor tube module from its shipping package. When handling the sensor tube module, be careful not to touch the sensor tube, since oil from the skin can attenuate UV radiation, reducing the sensitivity of the tube.

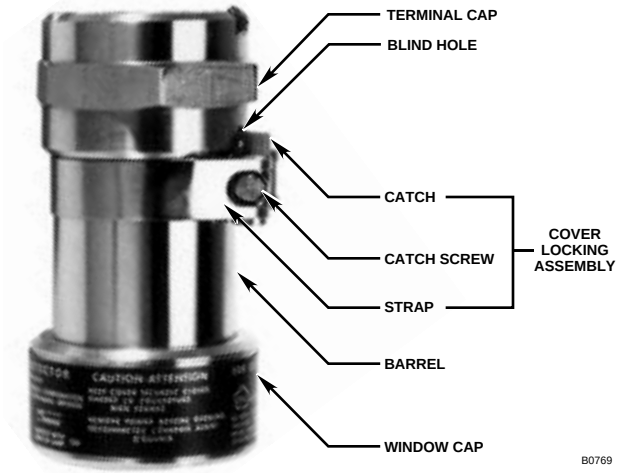


Figure 10—Detector with Cover Locking Assembly

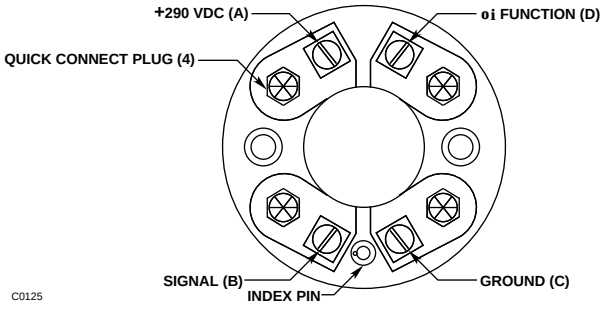


Figure 11—Detector Terminal Block

IMPORTANT

Use only DE1888 sensor modules with the C7050 Detector. The jumper plug must not be installed on the UV sensor module used with the R7404 Controller (see Figure 12). The jumper plug is supplied for detectors that are used with other controller models.

5. Using the index pin as a guide, install the sensor module on the detector terminal block.

6. Re-assemble the detector housing. If the detectors are equipped with cover locking devices, loosen the clamp sufficiently so that the "catch" can be seated in the blind hole provided on the terminal cap. (See Figure 10.) The clamp must then be fastened securely around the detector barrel by tightening with the proper tool.

NOTE

If the wires from individual detectors are connected to the R7404 Controller using a multiple conductor cable with a single outer shield and without twisted pairs, careful placement of the individual detector leads is necessary to prevent "cross-talk" between zones. The individual B-leads should be arranged around the outside of the cable with a ground lead between. The inner layer of conductors should be the D-leads and the common A-lead should be in the center.

When using multiconductor cable with twisted pairs, only one leadwire of each twisted pair can be connected to the B-terminal in the detector. The other leadwire must be used as a shield by connecting it to the C-terminal in the detector and to ground terminal 2 on the R7404. When several detectors are connected to one controller using twisted pairs of leadwires, a junction box is required to connect the many ground leads together so that only one ground leadwire need be run to the controller. (Keep this common ground leadwire as short as possible.) Ground all unused leads at the controller. For additional information refer to Service Memo 75-1003, "Multiconductor Cable Wiring."

Figure 12—Jumper Plug

CONTROLLER

The controller is furnished with a field wiring connector that incorporates pressure type screw terminals for attaching wires and two circuit board edge connectors for plugging in the controller.

The controller must be located in a non-hazardous area.

The use of a mounting cage is recommended for mounting the controller. The cage is designed to hold the field wiring connectors for ease in making electrical connections and installing, servicing, or replacing the modules. The Q4004 Mounting Cage is designed to hold up to 8 modules in a 19 inch instrument rack (See Figure 5). This mounting cage can also house voltage converters or other equipment that is used in conjunction with the R7404 as part of the total detection system. Cages that hold fewer modules are also available. Optional filler panels (part number 002188-001) are available for covering unused sections of the mounting cage.

NOTE

The R7404 Controller contains several semiconductor devices that are susceptible to damage by electrostatic discharge. An electrostatic charge can build up on the skin and discharge when an object is touched. Therefore, the controller should be handled carefully, taking care not to touch the terminals or electronic components. For more information on proper handling of the controller, refer to the Service Memo (form 75-1005)

Switch Setting Procedure

It is essential that the controller be properly programmed before applying power to the system. There are four rocker switch assemblies on the left side of the controller. Each switch assembly has eight rockers, which are opened or closed to select zone and detector combinations, controller sensitivity, fire logic, output latching, and time delay. Figure 13 illustrates the left side of the R7404 and contains a short explanation of rocker switch usage.

CAUTION

Use care when setting the rocker switches on the controller. An incorrectly set rocker switch can result in an obvious controller malfunction, or in some cases the controller can appear to be func-

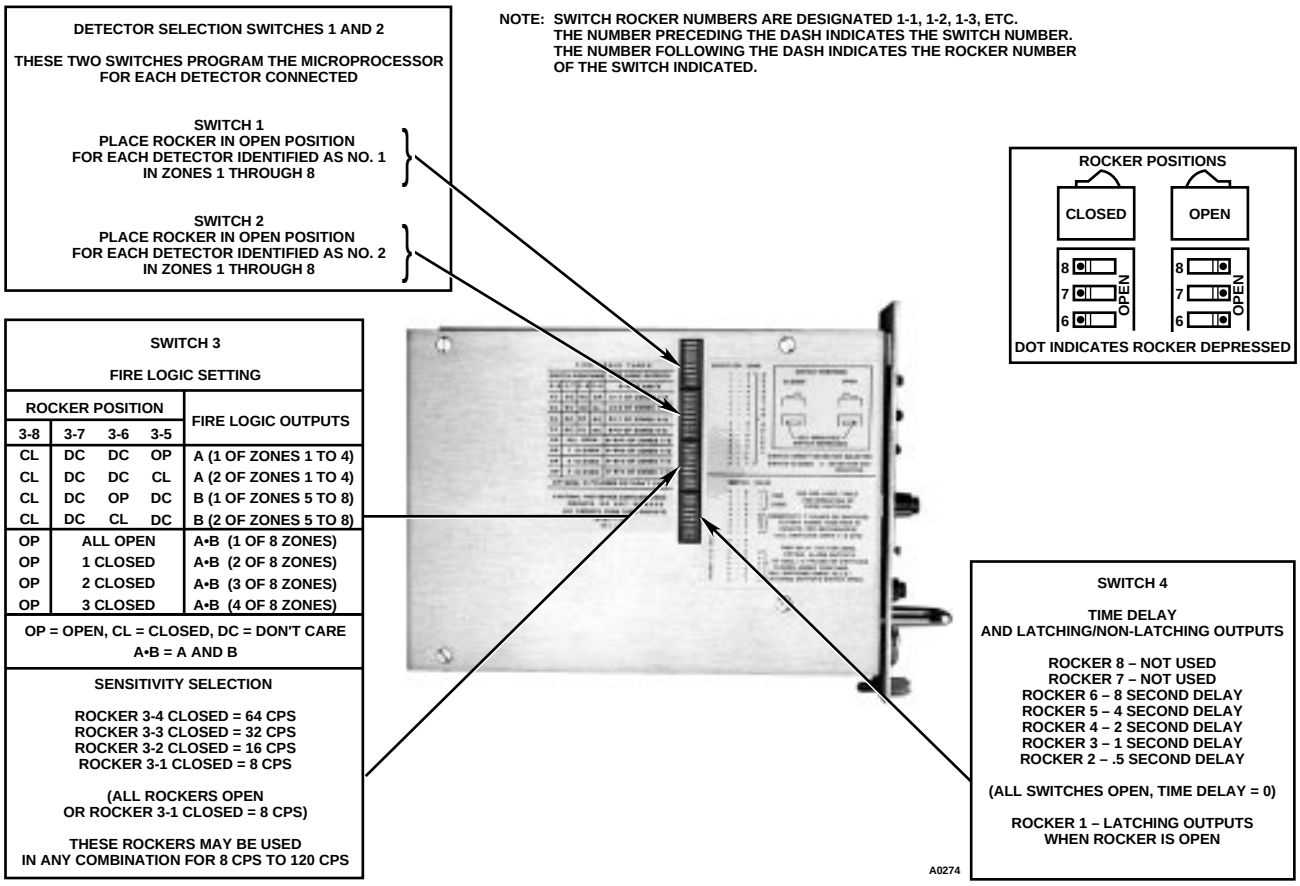


Figure 13—Rocker Switches

tioning normally, but will not produce the desired output in response to the input conditions. (Some of the switches are not used and should be left in the open position.)

The rocker switches must be set **before** power is applied to the system. **Do not plug the controller in or remove it from the mounting rack while power is turned on.**

1. Zone and Detector Selection — Switch Assemblies 1-1 to 1-8, and 2-1 to 2-8

Each zone can have either one or two detectors for a maximum of 16 detectors in 8 zones connected to one controller. Rockers 1-1 through 1-8 are used to enable the detectors connected to position No. 1 of each zone. Rockers 2-1 through 2-8 enable position No. 2 of each zone. The appropriate rocker must be set to the "Open" position for each detector connected. Care must be taken when setting these rockers. If a rocker is set open, but no detector is connected in the location, the controller will show a "2" fault on the lower digital display and the detector display will show either a "1" or "2", depending on which detector is not connected in the zone. The zone display will show the incorrectly set zone. If a rocker is set closed, but a detector **is** connected, the controller performs normally, but that detector is eliminated from the Automatic **oi** test sequence, and any faults that may occur in its circuit would not be automatically identified. This condition can be found only when performing the manual **oi** test procedure.

See Figure 14 for an example of selection switch setting for a system using 12 detectors in 8 zones.

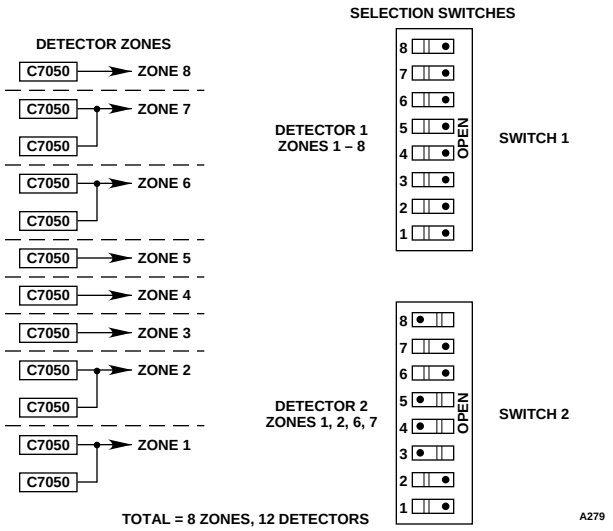


Figure 14—Detector and Zone Selection

2. Controller Sensitivity — Rockers 3-1 to 3-4

Rockers 3-1 to 3-4 are used to program controller sensitivity in 8 cps increments.

3-1 closed — 8 cps
3-2 closed — 16 cps
3-3 closed — 32 cps
3-4 closed — 64 cps

The values of the closed rockers are added together. The rockers can be set in any combination to give the sensitivity setting selected for the application, up to 120 cps.

NOTE

If no rockers are closed, or if only rocker 3-1 is closed, the controller responds to an 8 cps signal from the detector.

Refer to Figure 15 for an example of a 24 cps setting.

Figure 15—Controller Sensitivity Setting

3. Fire Logic (Voting) — Rockers 3-5 to 3-8

Rockers 3-5 to 3-8 select the voting requirements, which can be Fire Logic A and B common (8 zones voting) or Fire Logic A (4 zones voting) separate from Fire Logic B (4 zones voting). When separate, Fire Logic A consists of zones 1 to 4, and Fire Logic B consists of zones 5 to 8. See Figure 16.

NOTE

When the outputs are set for non-latching operation, the voting process will actuate the Fire Logic output(s) only if the pre-selected number of voting zones "see" fire at the same time. When the outputs are set for latching operation, the voting process will actuate the Fire Logic output(s) when voting criteria have been met, even if fire is not being seen by each voting zone at the same time.

Separate - Rocker 3-8 closed

Rocker 3-5 programs Fire Logic A (zones 1 to 4)
__ when open, votes one of four zones
— when closed, votes two of four zones.

Rocker 3-6 programs Fire Logic B (zones 5 to 8)
— when open, votes one of four zones
— when closed, votes two of four zones

Fire Logic A and B Common — Rocker 3-8 open

3-5, 3-6, 3-7 open — votes one of eight zones
3-5 closed; 3-6 and 3-7 open — votes two of eight zones
3-5 and 3-6 closed; 3-7 open — votes three of eight zones
3-5, 3-6, 3-7 closed — votes four of eight zones

In the example illustrated in Figure 17, the setting is for 3 of 8 zones voting.

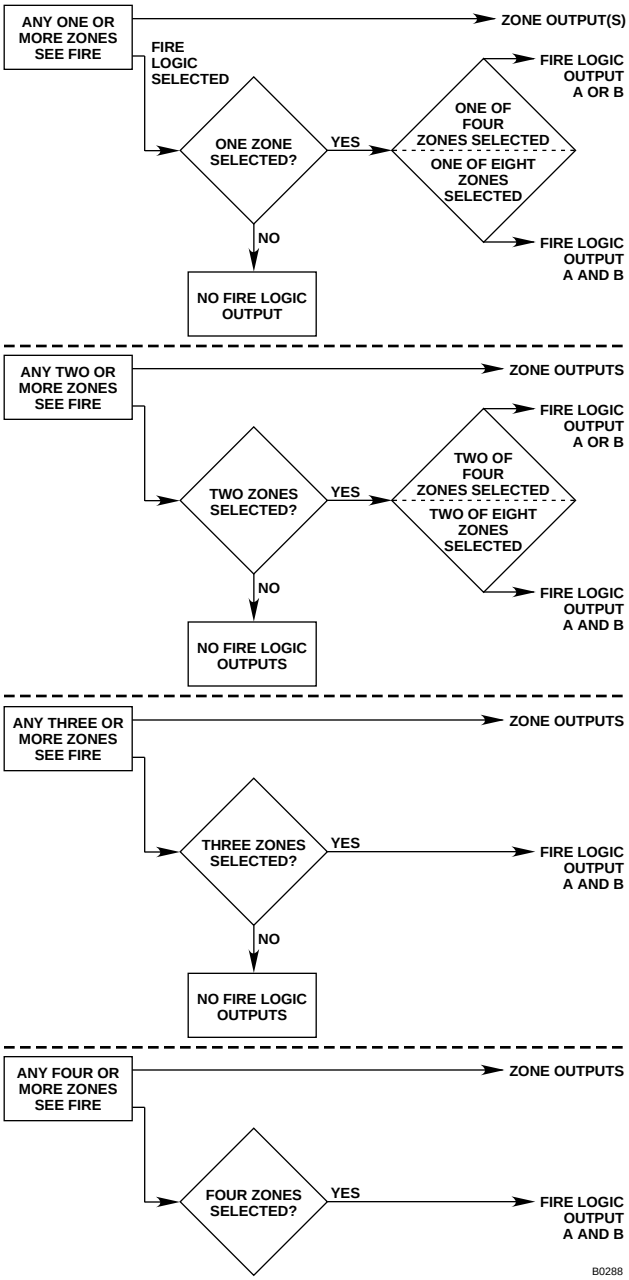


Figure 16—Fire Logic Flow Chart

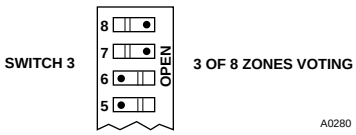


Figure 17—Fire Logic Setting

4. Output Latching/Non-latching — Rocker 4-1

closed — non-latching
open — latching

NOTE

The zone and fire logic outputs will latch when turned on if rocker 4-1 is set open. The outputs are de-latched by placing the keylock switch in the RESET position.

5. Time Delay — Rockers 4-2 to 4-6

The output signals can be delayed as follows:

4-2 closed — 0.5 second
4-3 closed — 1 second
4-4 closed — 2 seconds
4-5 closed — 4 seconds
4-6 closed — 8 seconds

The total time delay is the added value of all closed rockers. Rockers can be closed in any combination for a time delay from 0 to 15.5 seconds in half second increments. For no time delay, all rockers must remain open.

Figure 18 shows the switch setting for a time delay of 6 seconds.

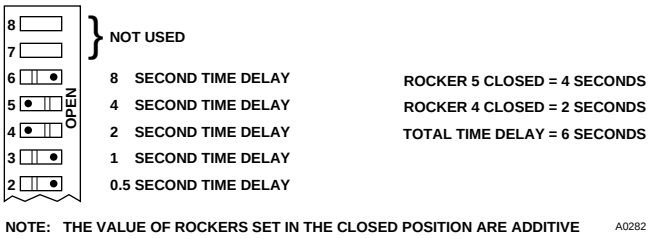


Figure 18—Time Delay Setting

System Layout

When the proper position for each of the rocker switches has been determined, record this information carefully in the space provided on the System Layout Chart (Figure 19). This chart is intended as an aid in system layout, and also provides both a means of double checking rocker switch positions before power is applied to the controller and a record of rocker switch positions for future reference.

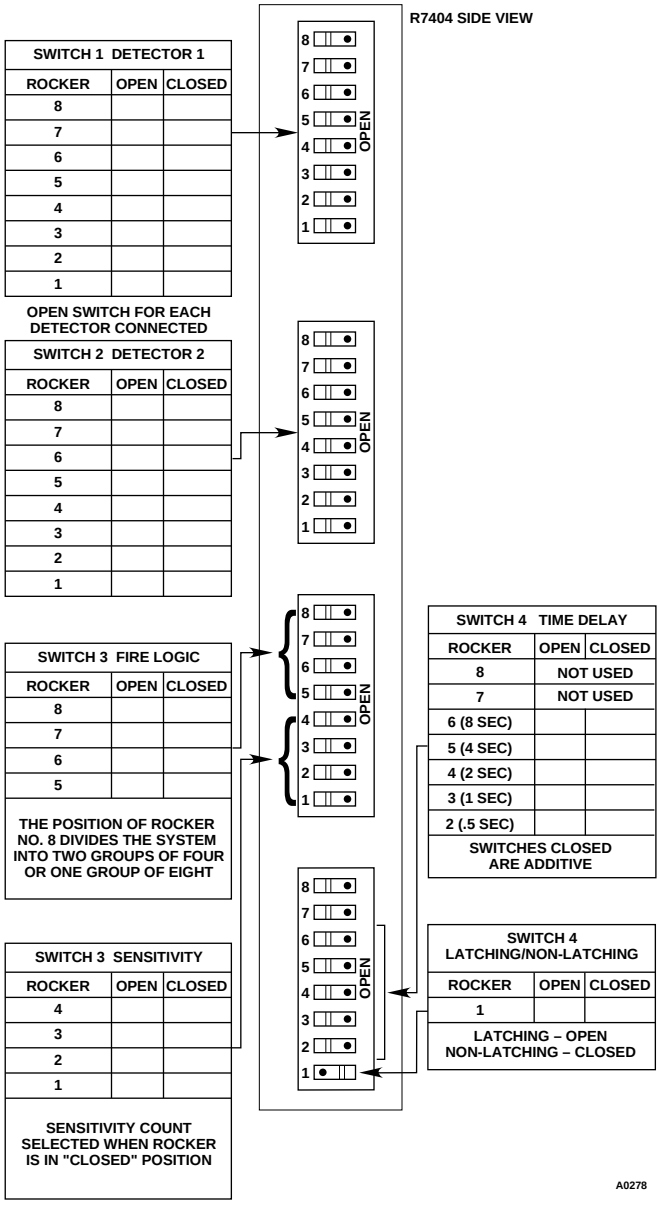


Figure 19—System Layout Chart

Electrical Connections

All electrical connections are made to the field wiring connector that is furnished with the controller. Figure 20 shows the terminal configuration for the controller.

Up to 16 detectors in 8 separate zones can be connected to the controller. Terminals A, B, and D on the detectors must connect to the appropriate A, B, and D terminals at the controller. Connect terminal C on the detector to power supply negative (terminal 2) at the controller. Connect the shields to terminal 64 (chassis ground) of the controller. The shields should not be connected to the detectors at any point. Connect a non-polarized 0.47 microfarad 250 vdc capacitor from terminal 64 to terminal 2. This places the controller chassis and the power supply negative at the same ac potential, minimizing the induction of noise into the system through the detector wiring.

NOTE

*External equipment that can generate transients when switching (such as relays) **must have a transient suppression device** (diode) connected across the coil at the time of installation. This will safeguard the output transistors of the controller against possible damage. Figure 21 illustrates an inductive load with a diode used for transient suppression.*

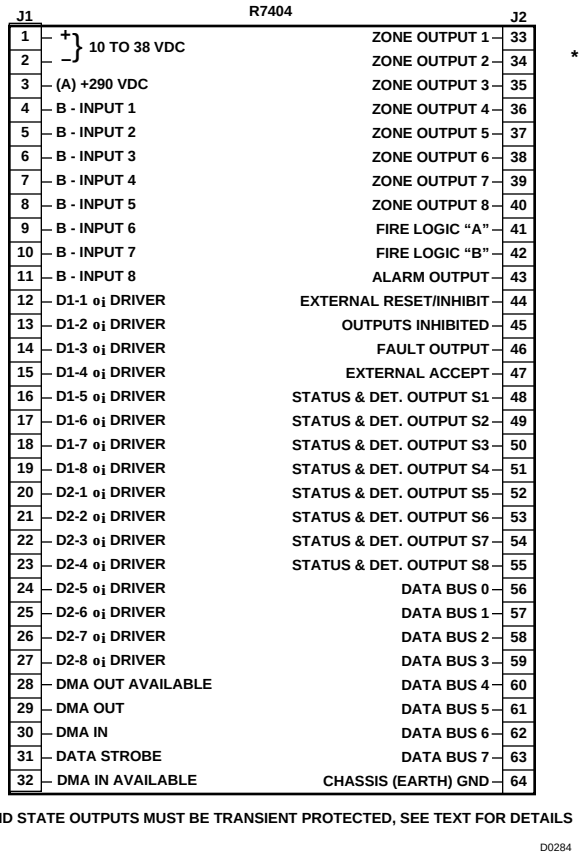


Figure 20—R7404 Terminal Configuration (Standard Model)

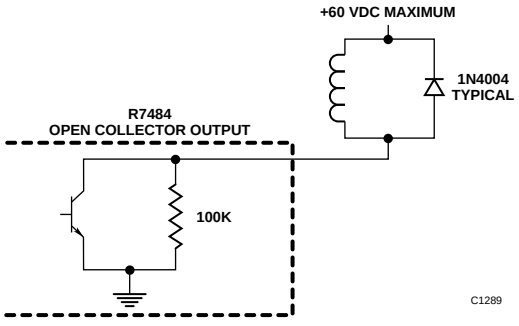


Figure 21—Transient Suppression Device

TYPICAL SYSTEM APPLICATIONS

The following typical applications are examples only. See Figures 22, 23 and 24. For assistance in adapting a system to your individual requirements, contact the Field Support Group at Detector Electronics.

The system illustrated in Figure 22 furnishes solid state output signals from zones 1 to 5, Fire Logic A and B, and the Alarm output. External Inhibit and External Accept are shown connected for use in locations remote from the controller. Other connections are not used in this configuration.

External Inhibit/Reset (terminal 44) is a means of remotely inhibiting the output circuits and resetting the controller. External Accept (terminal 47) is a means of remotely turning off the alarm output. These functions can be performed by a computer interface, external switches, or any interface that drives the input to less than 0.5 vdc. Outputs Inhibited (terminal 45) is an output that is driven low when the controller is in the Outputs Inhibited mode (keylock switch in TEST or RESET position or External Inhibit/Reset switch closed).

The system illustrated in Figure 23 furnishes solid state output signals from zones 1 to 3, Fire Logic A and B, and the Alarm output. External Inhibit and External Accept are shown connected for use in locations remote from the controller. Other connections are not used in this configuration. In this illustration the detectors are connected using a 3 wire shielded cable, with the shield functioning as the C-lead.

NOTE

Wiring codes in many areas do not permit the detectors to be wired using the method shown in Figure 23. Therefore, this should be considered an alternate method for use only where codes allow.

The system illustrated in Figure 24 furnishes solid state output signals from zones 1 through 8, Fire Logic A and B, and the Alarm output. External Accept and External Inhibit are shown connected for use in locations remote from the controller. Other connections are not used in this configuration.

Status and detector output terminals 48 to 55 provide binary output representations of the front panel digital displays for zone, detector, and system status. Tables 3 and 4 list the identification codes and the logic states of the "Fault" and "Outputs Inhibited" bits for the various status conditions.

Under "normal" (no fault) conditions, the Fault output is energized (logic 1).

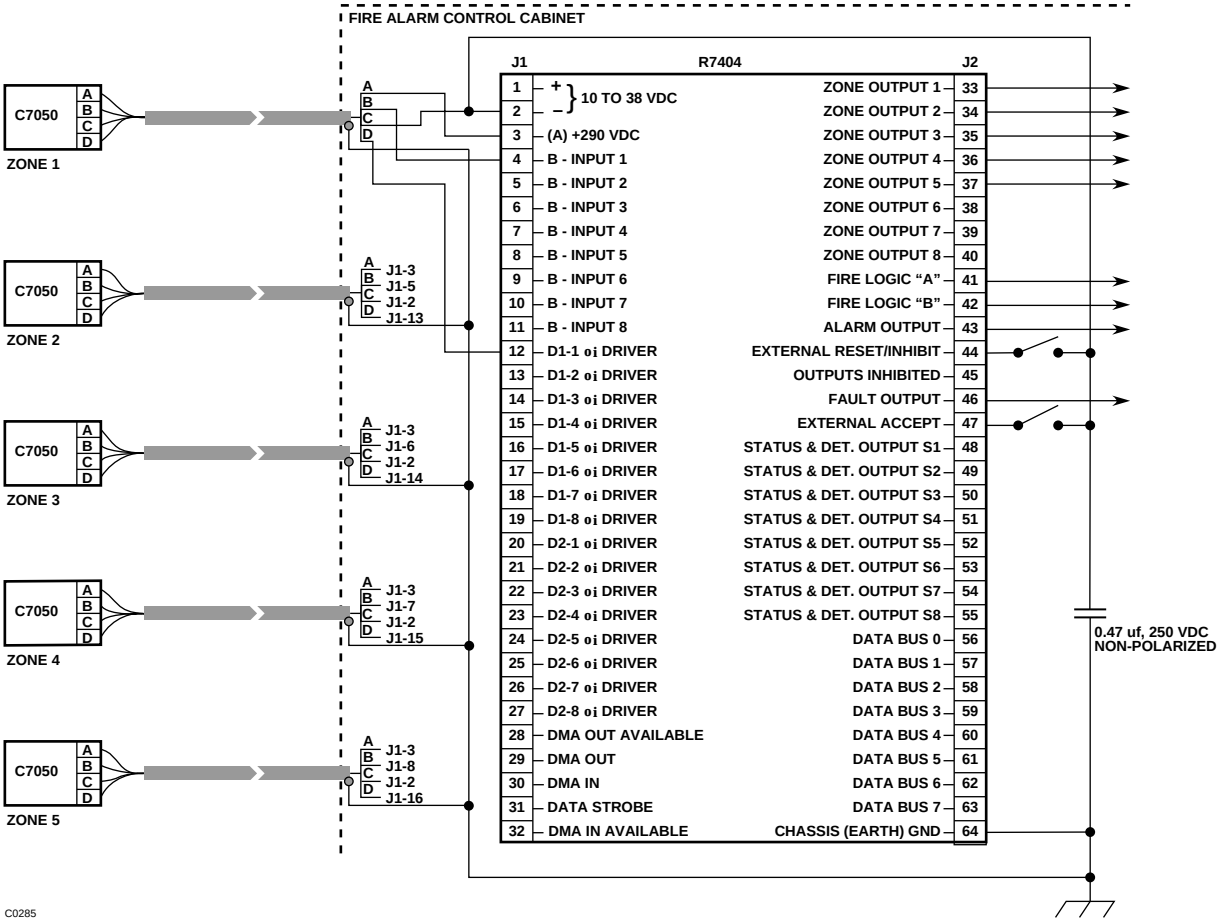


Figure 22—Typical System - Five Detectors in Five Zones

Table 3—Relationship of Zone and Detector Displays to the Status Outputs

Front Panel Display		Status Outputs				
Zone	Detector	S1	S2	S3	S4	S5
1	1	1	0	0	0	0
1	2	1	0	0	0	1
2	1	0	1	0	0	0
2	2	0	1	0	0	1
3	1	1	1	0	0	0
3	2	1	1	0	0	1
4	1	0	0	1	0	0
4	2	0	0	1	0	1
5	1	1	0	1	0	0
5	2	1	0	1	0	1
6	1	0	1	1	0	0
6	2	0	1	1	0	1
7	1	1	1	1	0	0
7	2	1	1	1	0	1
8	1	0	0	0	1	0
8	2	0	0	0	1	1

Table 4—Relationship of SYSTEM STATUS Display to Status Outputs

Front Panel Display	Status Outputs				
System Status	S6	S7	S8	Fault	Outputs Inhibited
0	0	0	0	0	1
1	1	0	0	0	1
2	0	1	0	0	0
3	1	1	0	1	0
4	0	0	1	0	0
5	1	0	1	0	0
6	0	1	1	1	0
7	1	1	1	0	1
8	0	0	0	0	1
Blank and No Fault	0	0	0	1	0
Status Outputs S1 – S8, Fault Outputs Inhibited	Logic 0 = 100 kilohms to 0 volts Logic 1 = Less than 25 ohms to 0 volts				

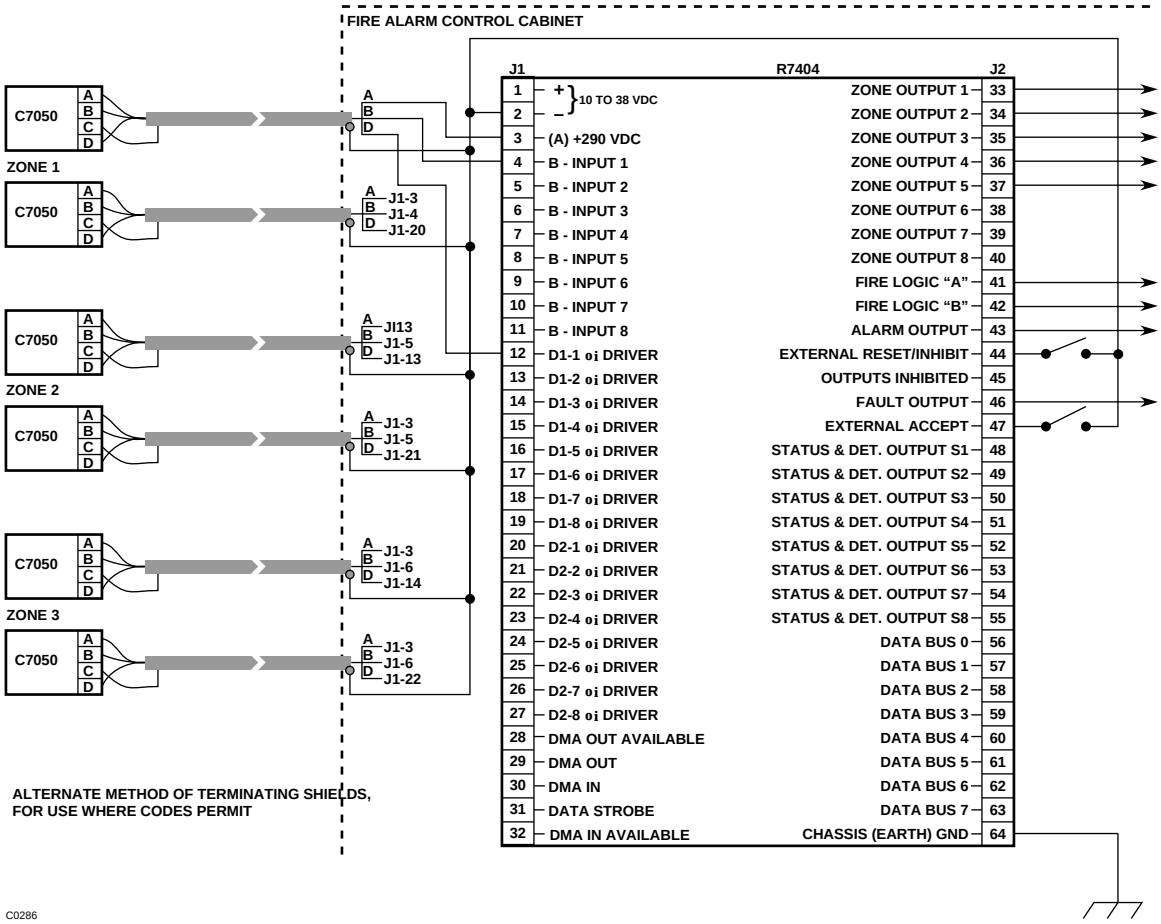


Figure 23—Typical System - Six Detectors in Three Zones

The Data Bus terminals (56 to 63) and the DMA (direct memory access) and Data Strobe terminals (28 to 32) provide external access to the microprocessor, which permits inter-controller communication. For further information, contact the Field Support Group at Detector Electronics. (This feature is not available on all R7404 models.)

STARTUP PROCEDURE

CAUTION

Placing the controller in the Test mode inhibits its outputs, rendering the system incapable of actuating any extinguishing or alarm circuits that are connected to it. For maximum safety, however, secure output loads (remove power from any devices that would normally be actuated by the system) before manually testing the system. Remember to place this same equipment back into service when the test is complete.

1. After setting the selection switches and making all electrical connections, plug the controller into the connector.

2. Turn on power and perform Checkout Procedure.

3. If the controller appears to be operating normally, remove mechanical blocking devices and restore power to the extinguishing loads.

NOTE

Be sure that the detector is correctly aimed at the potential hazard and that no obstructions interfere with its line of vision. In addition, UV absorbing gases should not exist between the detector and the potential hazard.

CHECKOUT PROCEDURE

CAUTION

When testing the system, be sure to secure all output devices to prevent unwanted activation of this equipment, and remember to place these same devices back into service when the checkout is complete.

MANUAL oi CHECK

1. Place the keylock switch in the TEST position.

   — The FAULT and INHIBIT LEDs turn on
   — Upper right display indicates the zone selected. Upper left display identifies the detector of the displayed zone.

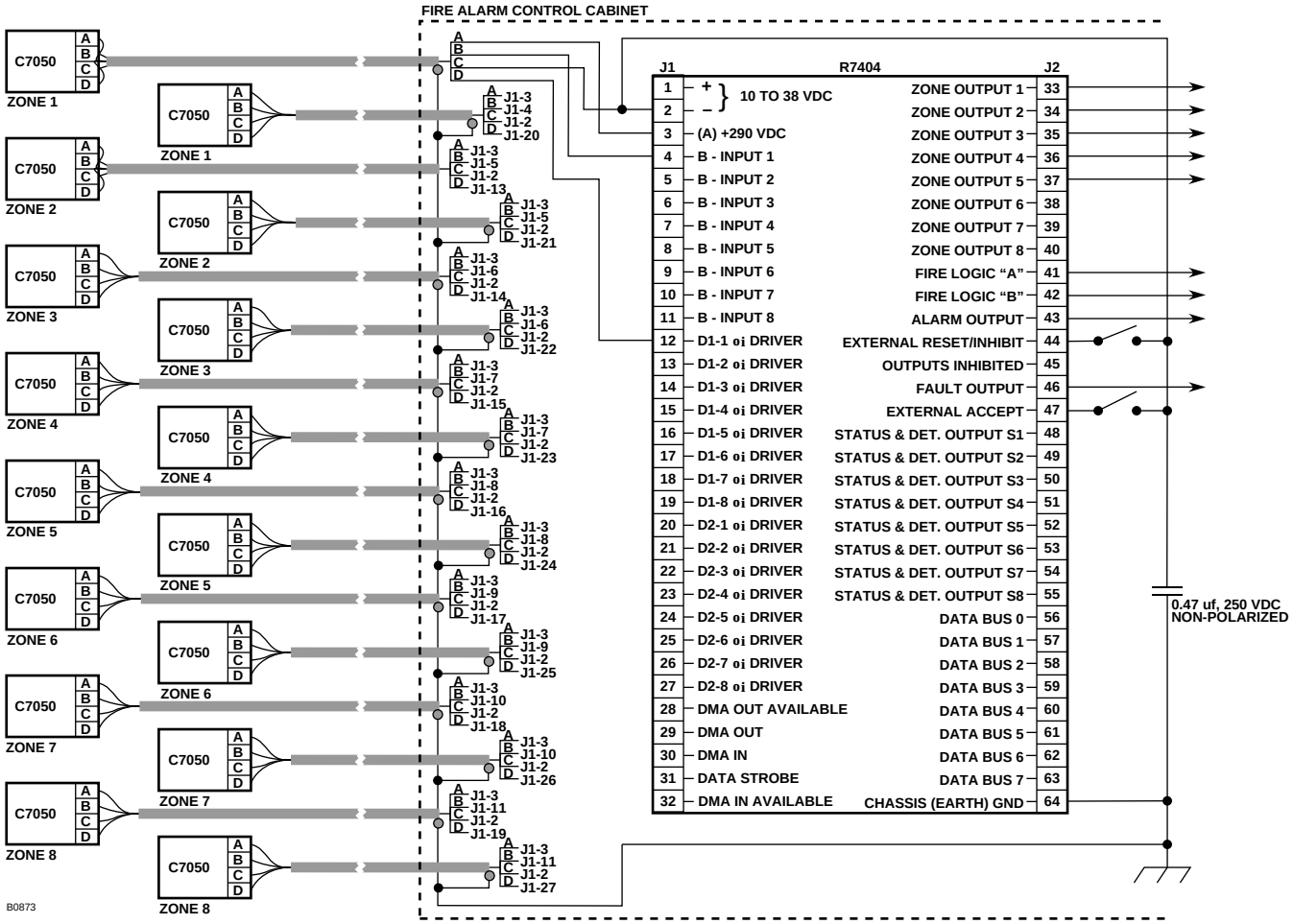


Figure 24—A Typical System – 16 Detectors in 8 Zones

— Lower display indicates a "1." (If any other number appears, refer to the "Troubleshooting" section of this manual.)

2. Push and hold the TEST/ACCEPT button.

— A ZONE OUTPUT LED flashes to indicate the zone of the detector being tested.
— Upper left display goes blank.
— Lower display changes to "6" to indicate that the fire threshold has been exceeded due to the radiation received from the UV source in the detector. (See Table 1 for System Status Codes.)

3. Release the TEST/ACCEPT button.

— The ZONE OUTPUT LED remains on steady.
— The upper left display again shows the detector being checked. The lower display changes back to a "1."

4. Push the SELECT button. The controller sequences to the next lower numbered zone.

NOTE

*The **oi** test will check the detectors connected to the No. 2 position of each zone first. The upper display will indicate 2-8, 2-7, etc., and then cycle to 1-8, 1-7, etc., until all (switch selected) detectors are checked.*

5. Repeat the test until all detectors have been checked.

6. Return the system to the normal operating mode after the test is complete.

NOTE

*The Automatic **oi** system continuously monitors the operation of the R7404 but **does not** monitor external relays or equipment that may be operated from the fire signal output, the alarm signal output, or the fault signal output. It is important that the system be manually checked using the NORMAL mode checkout procedure on a regular basis. The whole system (including external equipment) should be checked periodically using a UV Test Lamp to simulate a fire.*

DETECTOR COUNT TEST

1. Place the keylock switch in the TEST position.

   — The SYSTEM STATUS display shows the number "1."
   — The upper displays show the detector and zone that are electrically positioned for test. If the desired detector and zone are not displayed, press the SELECT button until the appropriate numerals appear on the upper display.

2. Press and release the SELECT and TEST/ACCEPT buttons at exactly the same time.

   — SYSTEM STATUS display changes to an "8."
   — Upper display does not change.

3. Press and hold the TEST/ACCEPT button.

   — The UV source tube in the detector under test turns on.
   — The upper displays indicate the discharge rate of the UV sensor under test. If the FIRE LOGIC LEDs turn on, multiply the displayed count by 10. If the count rate does not fall within the 50 to 300 range, clean the detector viewing window and the **oi** reflector ring, then test again. If cleaning does not solve the problem, replace the **oi** reflector ring. Make sure that the slot is positioned at the bottom of the detector and away from the source tube.

   NOTE

   During normal operation, tube modules should be replaced only if a "2" fault occurs and cannot be remedied following the above procedure.

4. Release the TEST/ACCEPT button. The upper displays now indicate the quiescent state of the detector tube. The count should be between 0 and 5. If higher, place an obstruction (cardboard or similar material) over the detector window. If the count rate returns to the 0 to 5 range, the detector has been responding to external radiation. Check the area for the external source of UV radiation, and either remove it or shield the detector from it. If the high count rate continues after the detector window is covered, this indicates a faulty module, and it must be replaced. If other detectors in the vicinity exhibit similar symptoms, the presence of x-rays or gamma radiation is indicated.

   NOTE

   If a zone has two detectors, the sum of the two is displayed.

5. Press the SELECT button to position the next zone for test.

   — The DETECTOR display remains the same until the ZONE display changes from the lowest to the highest zone. The DETECTOR display then cycles from "2" to "1" or "1" to "2."

6. Repeat the test until all detectors have been checked. At the completion of the sequence, each detector will have been tested for the following conditions:

   — Influence of background radiation
   — Capability of optical surfaces to transmit UV radiation
   — Calibration of UV source/UV detector (these elements are factory adjusted, but are subject to influences that may affect the calibration).
   — If the system is to be tested for response to an actual fire, the exact response of each detector can be measured. If any improvements in system layout are needed, it will be revealed in this way.

7. After completing the test, return the keylock switch to the NORMAL position. All LEDs are reset and the digital displays should become blank.

MANUAL CHECK IN NORMAL MODE

The whole system should be checked periodically with a UV test lamp (such as the Det-Tronics model W8066) to make sure that the detectors are not obstructed, that the area "seen" by the detector has not changed, and that there is no fault in the **oi** circuit.

CAUTION

Secure all output loads connected to the controller outputs to prevent unwanted activation.

1. Place the keylock switch in the NORMAL position.

2. Shine the UV test light into a detector viewing window.

   — The corresponding ZONE LED turns on and flashes, indicating the zone in which the detector is located. The upper display shows the first zone activated. The lower display shows a "6."
   — The appropriate FIRE LOGIC LED(s) turns on if voting requirements are met.

3. Turn off the UV source.

   — FIRE LOGIC LED(s) stays on (if illuminated).
   — ZONE LED stays on but stops flashing. The numeral indicating the first zone to respond to the UV signal is shown in the upper display, and the numeral "6" remains in the lower display.

4. Repeat the test for all detectors in the system.

5. After all detectors have been checked, reset the system by turning the keylock switch to the RESET position, then turn it to the NORMAL position.

6. Restore power to output loads or remove any mechanical blocking devices.

MAINTENANCE

The detector requires no periodic calibration. However, to maintain maximum sensitivity, the viewing windows should be cleaned on a regular basis. The length of time between periodic cleanings will be determined by the nature and amount of contaminants present in the environment.

Remove the **oi** ring from the detector and clean the viewing window thoroughly, all the way to the edge. Also clean the **oi** ring. When re-installing the reflective ring, hold it by its tabs to avoid leaving fingerprints on the reflective surface. Re-install the rings so that the split is 180 degrees from the **oi** test lamp on the UV detector (opening down to prevent water buildup). 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.

Use a clean cloth or tissue to clean the window and **oi** ring. DO NOT use commercial glass cleaning tissues. Many of these contain a silicone substance that remains on the cleaned surface and will absorb radiation.

Det-Tronics window cleaning solution (part number 001680-001) is designed specifically for cleaning the optical surfaces of the detector. Avoid the use of commercial cleaners, since many of them can leave a UV absorbing residue on the surface.

NOTE

Remove power to the controller or switch the unit to the Test mode when cleaning the detector windows to avoid the possibility of false actuation.

Rubber O-rings are used on the detector housings to ensure the watertight integrity of the detector. The housings should be opened periodically and the O-rings inspected for breaks, cracks, or dryness. To test them, remove the O-rings from the detector housing and stretch them slightly. If cracks are visible, the O-ring 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.

It is imperative that these O-rings be properly installed and in good condition. Failure to properly maintain these rings can allow water to enter the detector and cause premature failure. The life expectancy of rubber O-rings can vary considerably, depending on the amount and nature of contaminants that are present in the environment. The person responsible for maintenance of the system must rely on experience and common sense to determine how frequently the rings should be inspected. A coating of lubricant should also be applied to the threads on the detector enclosure before reassembling the detector. This will both lubricate the threads and help to prevent moisture from entering the detector housing.

CAUTION

The O-ring should be lubricated with polyalphaolefin grease, such as GRS-450 made by CPI Engineering. ***Silicone*** *based lubricants should* ***never*** *be used if catalytic type combustible gas sensors are being used in conjunction with the UV detectors, since inadvertent use of a silicone lubricant on or near the combustible gas sensor will cause irreversible damage to the sensing element.*

A test form is supplied at the rear of this manual for recording maintenance performed on the system.

TROUBLESHOOTING

The Automatic **oi** feature continuously checks the system for various faults that can occur. If a fault should be detected, the FAULT LED will turn on. If the fault is in the detector or wiring, the upper displays will indicate which zone and detector is affected. The lower display will indicate by code number the type of fault. If the fault is in the microprocessor circuitry, the FAULT LED will turn on, but the displays will remain blank. See Table 5 for a detailed explanation of the status/fault code numbers on the lower digital display, and the corresponding detector identification numbers on the upper digital display.

The R7404 is not designed to be repaired by the customer in the field. If a problem should develop, first carefully check for proper wiring and programming. If it is determined that the problem is caused by an electrical malfunction, the unit must be returned to the factory for repair.

Record all faults on the Fault Record Sheet at the back of this manual.

Table 5—Troubleshooting Chart

Upper Displays		Lower Display	Status
Detector	Zone		
0	0	0	Keylock switch is in RESET position, or the external inhibit is being used. (Outputs inhibited, except Status outputs.)
1 or 2	1 - 8	1	Keylock switch is in TEST position. (Outputs inhibited except Status outputs.)
1 or 2	1 - 8	2	**oi** fault - either the **oi** ring and/or the window of the detector indicated in the upper left display is dirty, or the detector module has lost sensitivity, or there is an open wire between the detector and the controller. The upper right display indicates the zone affected.
Blank	1 - 8	3	One or more detectors are responding to a UV source that is not large enough to reach the fire threshold programmed into the controller. One or more detectors may be sun sensitive (if located outside). Alternatively, there may be a high multiple count rate in one of the modules (this can be checked by using the count mode test of the controller as described in the “Checkout” section). FAULT LED is not turned on. Normally energized fault output remains energized.
0	0	4	Low +290 vdc caused by a shorted “A” lead or controller malfunction.
0	0	5	High +290 vdc caused by a failure in the regulating network in the controller.
Blank	1 - 8	6	Fire Output signal - blinking ZONE OUTPUT LED indicates fire location. Steady ZONE OUTPUT LED indicates that the detectors in that zone have responded to a UV signal, but are no longer responding.
		7	Not used.
1 or 2	1 - 8	8	Controller has been placed in “count” mode (see “Checkout” section). Pushing and releasing both SELECT and TEST/ACCEPT buttons at the same time while the keylock switch is in the TEST position changes the lower display to a numeral “8” - the count mode for checking the count rate of each zone.
Blank	Blank	Blank	FAULT LED on. There is a problem in the R7404 microprocessor circuitry. Place keylock switch in RESET, push and release LAMP TEST pushbutton. If operation does not return to normal, replace the entire R7404. Make sure the new R7404 is programmed the same as the R7404 being replaced.
Blank	Blank	Blank	No LEDs on or displays on. Check input power to controller or blown fuse in controller. See separate figure for location.

DEVICE REPAIR AND RETURN

Prior to returning devices or components, contact the nearest local Detector Electronics office so that an RMI (Return Material Identification) 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, thereby reducing the time and cost of the repair to the customer.

Return all equipment transportation prepaid to the Minneapolis location.

OFFICE LOCATIONS

6901 West 110th Street
Minneapolis, Minnesota 55438 USA
Telephone (612) 941-5665 or (800) 765-FIRE
Facsimile (612) 829-8750
www.detronics.com
E-mail: detronics@detronics.com
Cable Detronics
Telex 6879043 DETEL UW

Detector Electronics Corporation
13949 Williams Road
P. O. Box 1329
Glen Ellen, California 95442 USA
Telephone (707) 996-0196
Facsimile (707) 996-0197
Voice Mail Box Number 930

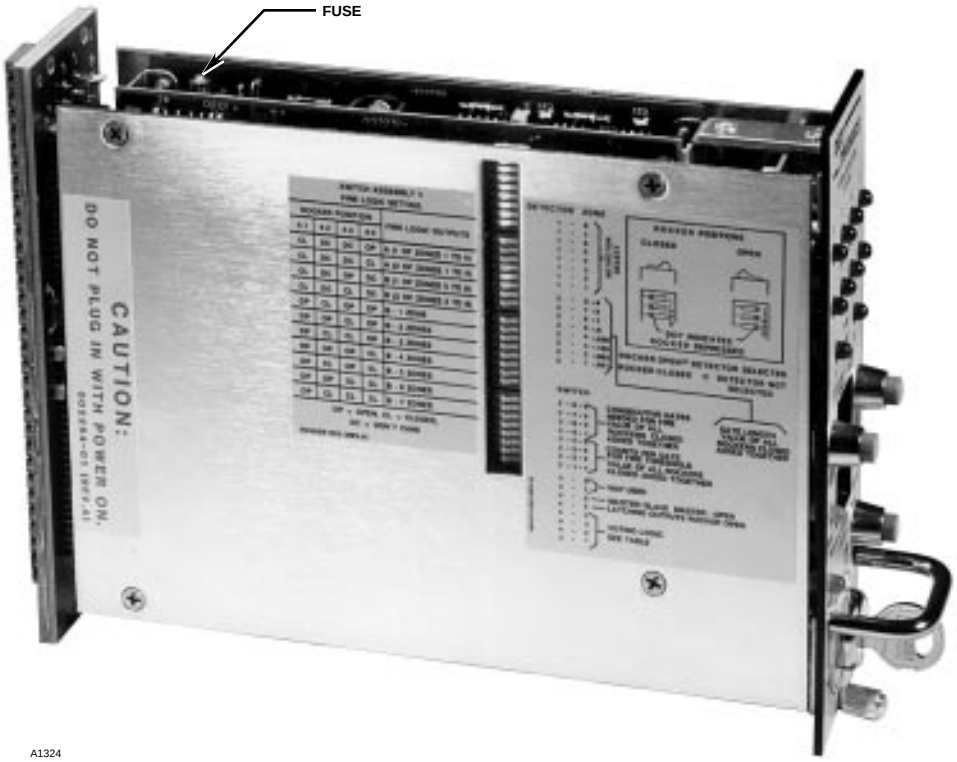


Figure 25—Fuse Location

Detector Electronics Corporation
466 Conchester Highway
Aston, Pennsylvania 19014 USA
Telephone (610) 497-5593
Facsimile (610) 485-2078

Detector Electronics Corporation
11210 Steeplecrest Drive
Suite 104
Houston, Texas 77065 USA
Telephone (713) 970-2646
Facsimile (713) 970-2667

Detector Electronics (UK) Limited
Riverside Park, Poyle Road
Colnbrook
Slough, Berkshire
SL3 OHB
ENGLAND
Telephone 01753 683059
Telex 848124 GRAVIN G
Facsimile 01753 684540

Automatismes Sicli
Departement Det-Tronics
1, rue Yvan-Pavlov
93152 Le Blanc-Mesnil Cedex
FRANCE
Telephone 33 1 49 39 41 58
Facsimile 33 1 49 39 43 15

Det-Tronics Deutschland
Kidde Deugra GmbH
Postfach 1457
Harkortstrasse 3
D-4030 Ratingen 1
GERMANY
Telephone 49 2102 4050
Direct 49 2102 405152
Facsimile 49 2102 405151
Telex 8589029

Detector Electronics Italy
Fenwal Italia S.p.A.
Viale De Gasperi, 44
20010 Bareggio (Mi)
ITALY
Telephone (39) 2 90 36 16 20
Facsimile (39) 2 90 36 16 27

Detector Electronics
108, Sai Prasad Complex
Opp. Khar Railway Station
Khar (W)
Bombay 400 052
INDIA
Telephone (91) 22 604 6142
Facsimile (91) 22 649 7775

Det-Tronics Benelux
Costerweg 5
NL-6702 AA Wageningen
THE NETHERLANDS
Telephone 31 (0)317 497625
Facsimile 31 (0)317 427308

117333 Moscow
Gubkina St, d.3
Gipronii Ran
Kidde Graviner
RUSSIA
Telephone 7 (095) 135 5389
Facsimile 7 (502) 222 1276

Det-Tronics Scandinavia AB
Box 81
S-260 83 Vejbystrand
SWEDEN
Telephone 431-53002/53240
Facsimile 431-52236

Detector Electronics Corporation
C/O Kidde International Protection Systems
143 Cecil Street
#15-01 G. B. Building
SINGAPORE 0106
Telephone (65) 220-1355
Facsimile (65) 226-6305

Detector Electronics Middle East
C/O Kidde International
P O Box 30791
BUAMEEM II Building
Umm Hureir Road
Dubai, U.A.E.
Telephone 971 4 372498
Facsimile 971 4 375088

Det-Tronics South America.
Calle 72 con Avenida 3H
Centro Comercial “Las Tinajitas”
Local No. 18
2do. Nivel
Maracaibo, VENEZUELA
Telephone 58-61-926885
Facsimile 58-61-926525

Detector do Brasil
Avenida Geremario Dantas 493
Rio de Janeiro 22740-011
BRAZIL
Telephone (55) 21 392 9633
Facsimile (55) 21 392 5568

ORDERING INFORMATION

When ordering specify:
— R7404 Controller
— C7050 Detector
— Detector housing material
  Aluminum
  Nickel-plated brass
  316 stainless steel
— Cover locking assembly (if required to comply with local regulations)

Special Purpose C7050 Detectors:

— **Nuclear Surveillance Detector** for applications involving x-rays or gamma radiation.

— **Internal Reflection oi** can extend detector maintenance intervals in applications involving oily contaminants.

Special Purpose R7404 Controllers:

— **STAR (Selectable Transient Arc Rejection) Logic Controller** is recommended for applications where transient electric arcs, such as those produced in electrostatic power coating or paint spraying booths, can cause false actuation of a standard UV system.

— **High Speed Suppression Controller** is designed for use with the R1425 Detonator Module for protecting installations where extremely fast system response times are required.

— **Remote Surveillance Controller** significantly reduces false alarms caused by UV interference that is generated by sources outside the protected area.

— **Nuclear Surveillance Controller** is designed for use with the nuclear surveillance detector in applications involving interference from x-rays and gamma radiation.

OPTIONS

— **Q4004 Mounting Cage**, which accommodates up to eight modules, is designed to fit a standard 19 inch instrument rack and is recommended for ease of installation and service. Cages that hold fewer modules are also available.

— **Filler Panels** for empty spaces in the optional mounting cages.

— **Voltage Converters** are available for providing system power from ac line (mains) voltage.

— **Air Shields** provide a continuous flow of clean air across the viewing window of the detector to reduce the accumulation of certain types of airborne contaminants.

— **Q9001 Swivel Mounting Assembly** for mounting the C7050 Detector. Use the Q9001B for C7050 Detectors with aluminum housings and the Q9001H for C7050 Detectors with nickel/brass and stainless steel housings.

— **R6006 Relay Output Module** is used in conjunction with the R7404 when supervised relay outputs are required. The relays are energized by the solid state output signals generated by the controller. The R6006 provides eight relays and offers optional load monitoring. The relays have form C contacts (normally open/normally closed) and are rated up to 3 amperes at up to 30 vdc or 250 vac.

— **R6007 Auxiliary Relay Output Assembly** provides the user's choice of either 4, 8, 12, or 16 form C relay contacts. A pre-wired connector backplate eliminates the need for external wiring between the controller and the relay assembly.

— **R1425 Detonator Module** provides input and output monitoring and is used in applications where the fastest possible system response is required.

RECOMMENDED SPARE PARTS

— 2 ampere micro fuse for R7404 (part number 101363-001).

— **oi** ring for UV detector (part number 003088-001).

— O-rings for UV detector (part number 107427-004).

— UV tube module (part number DE1888).

— Window Cleaner squeeze bottle, package of six (part number 001680-001).

— Window Maintenance Kit, includes 2 bottles of cleaner and 8 **oi** rings (part number 002507-001).

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

6901 West 110th Street
Minneapolis, Minnesota 55438 USA
Telephone (612) 941-5665 or (800) 765-FIRE
Facsimile (612) 829-8750
www.detronics.com
E-mail: detronics@detronics.com
Cable Detronics
Telex 6879043 DETEL UW

APPENDIX [Factory Mutual Research Corporation (FMRC) Approval Description]

R7404 CONTROLLER AND C7050 UV FLAME DETECTOR

- Automatic Fire Alarm Signaling Performance verified per FM3260.
- Performance verified Optical Integrity (oi).
- The following performance criteria was verified by FMRC:

Response Characteristics

Refer to Table A1.

Table A1—C7050/R7404 Flame Detector Response Characteristics

Counts Per Second (cps)	Fuel	Size	Distance
10	n-heptane	1 ft x 1 ft (0.3 m x 0.3 m)	100 ft (30 m)
25	n-heptane	1 ft x 1 ft (0.3 m x 0.3 m)	40 ft (12 m)
100	n-heptane	1 ft x 1 ft (0.3 m x 0.3 m)	25 ft (8 m)

Angle of View

–45 to +45 off centerline in vertical and horizontal planes.

False Alarm Immunity

- Direct Sunlight
- Artificial light
- Vibration immunity for vertical displacement of 0.02 inches (0.5 mm) at a frequency of 10 to 30 Hz for 4 hours.
- Radio frequency interference (RFI) immunity at 12 inches to 155 MHz and 450 MHz with radiation power levels of 5.0 watts.

C7050 UV FLAME DETECTOR ONLY

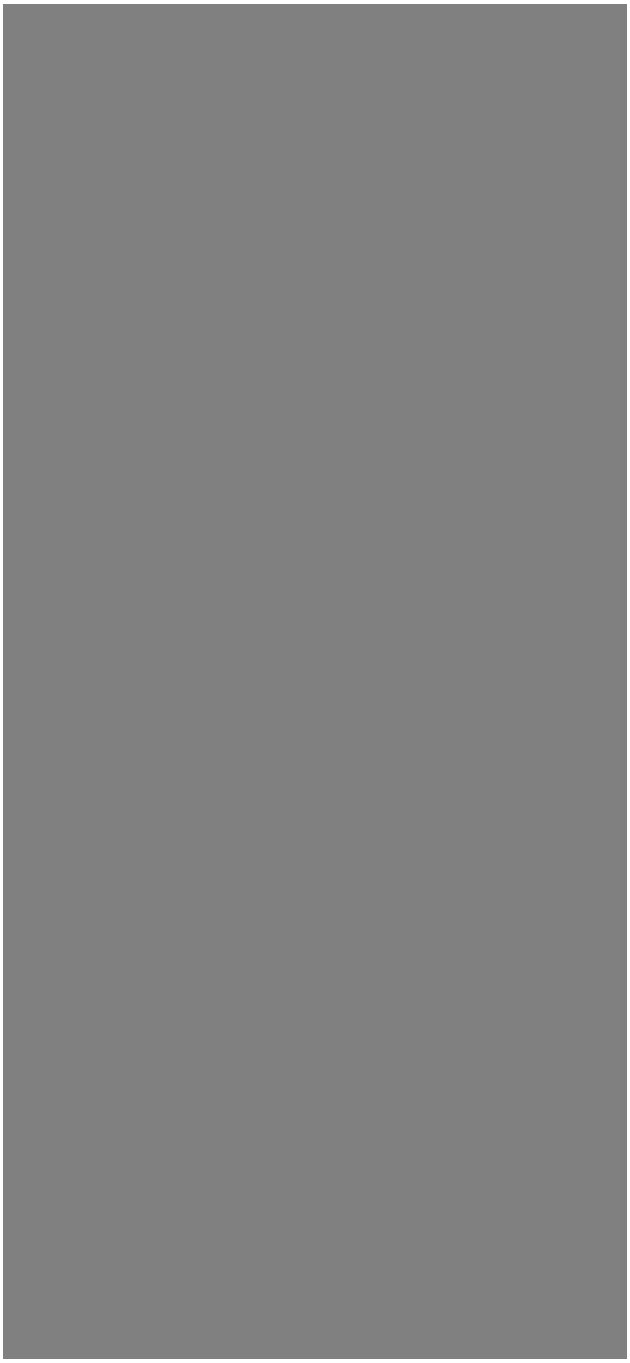
Models C7050 with aluminum or stainless steel enclosure and 1/2-inch or 3/4-inch NPT conduit entries (M20, M25 or Pg 16 conduit entries can be used in non-North American applications). For 18 to 32 vdc operation through an approved control panel that provides separate circuits for power and alarm initiation.

- Explosion-proof for Class I, Division 1, Groups B, C and D Hazardous (Classified) Locations per FM 3615.
- Dust ignition-proof for Class II/III, Division 1, Groups E, F, and G Hazardous (Classified) Locations per FM 3615.
- Ambient Temperature Limits –40°C to +75°C.
- Enclosure Rating NEMA Type 4 (Indoor and Outdoor Locations) per NEMA 250.

Options

Model Q9001B Aluminum Swivel Mounting Assembly
Model Q9001H Stainless Steel Swivel Mounting Assembly

DET TRONICS



INSTRUCTIONS

Ultraviolet Flame Detection System

R7404 Controller

C7050 Detector

7/97 **Form 95-8242-04**