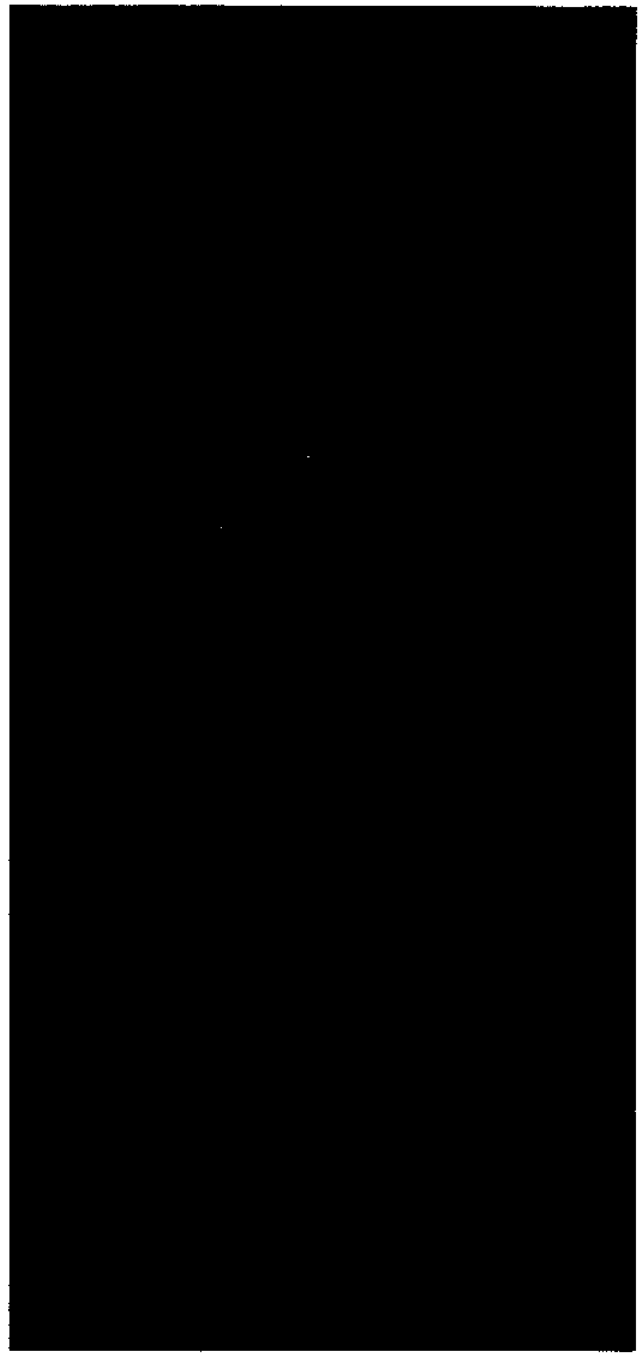
DET TRONICS



INSTRUCTIONS

Ultraviolet Fire Detection System

R7302 Controller

C7050 Detector

10/81 Form 95-8219-05

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DET TRONICS

INSTRUCTIONS

AUTOMATIC oi*

Ultraviolet Fire Detection System

R7302 Controller

C7050B Detector

SYSTEM APPLICATION

The Detector Electronics R7302 Controller and the C7050 Detector provide a system for instantaneous response to fires generating ultraviolet (UV) radiation. The system includes Automatic Optical Integrity (oi) as a standard feature, an extension and improvement of the manual oi feature originally developed by Detector Electronics. It provides continuous monitoring of optical surfaces, detector sensitivity and electronic circuitry to ensure that the fire detection system is operational and ready to respond to fire or explosion. If a fault develops in the system, the digital display on the front of the controller identifies, by code number, the nature of the fault.

The C7050 Detector, assembled in an explosion-proof, dust-tight, and watertight enclosure, is designed for use in hazardous locations. It is particularly suitable for use in outdoor applications because it is not affected by wind, rain, snow, high humidity, or extremes of temperature or pressure, and is insensitive to solar radiation. In addition, the detector is not affected by normal artificial lighting. Up to eight detectors may be connected to each controller.

Typical applications for the Det-Tronics ultraviolet 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 and SNG loading, transfer and storage facilities
—LNG marine tankers
—Hydrogen fires in ammonia production and refinery reformers.

Solid Materials
—Munitions production, illuminating flare material, TNT, black powder, other propellants
—Electrostatic powder coating booths
—Styrofoam storage.

Other Processes
—Paint spray booths
—Chemical and petrochemical production

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

*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.

FEATURES

- Instantaneous response - Typical response to an intense ultraviolet source is less than 25 milliseconds. Systems are available for application where a response time of less than 10 milliseconds is needed.
- Continuous monitoring by the automatic **Oi** feature ensures proper functioning of critical components.
- Insensitive to solar radiation and normal artificial lighting.
- Field adjustable controller sensitivity.
- Two independent relay actions. First relay responds instantly and second relay has field adjustable time delay (0.2 to 12 seconds). Both relays have N.O. and N.C. contacts (form C).
- Plug-in printed circuit boards and relays for ease of maintenance.
- Detector enclosure is available in corrosion resistant nickel-plated brass, 316 stainless steel or anodized copper-free aluminum.
- Controller mounts in standard 19-inch instrument rack.
- Sensor tube is mounted to be shock and vibration resistant inside the detector enclosure for rugged industrial applications.
- C7050B Detector meets MIL SPEC 810C shock test.
- Sensor tube module is treated to resist fungus growth.
- Low power consumption, typically 12 watts in standby.
- Terminals provided to the fault relay for external connection of visual and/or audible status indication devices.
- AC input voltages and frequencies available for applications worldwide.
- Available for 12 or 24 vdc applications.

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. An ultraviolet detector is useful in fire protection applications because it provides very fast response to ultraviolet radiation from a flame. In addition, it is not affected by environmental conditions such as wind, rain, snow or extremes of temperature and pressure. The Det-Tronics UV system is 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 an intense source of ultraviolet radiation, and care must be taken to ensure that arc welding is not performed in or near protected areas without securing the detectors. In addition, UV detectors should not be positioned so that their cone of vision coincides with the horizon. Rather, they should be directed down, over the designated hazard area to reduce the likelihood of sensing UV radiation from distant sources.

An important fact regarding radiation detectors of any type is that 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 accumulate 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 ultraviolet detectors should not be used alone.

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.

Higher 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 Det-Tronics automatic ultraviolet fire detection system consists of one to eight UV detectors housed in explosion-proof, corrosion resistant enclosures, and a remotely mounted controller which incorporates the electronic and switching components for processing signals from the detectors, and for actuating relays. The R7302 Controller is designed for use in non-hazardous areas and for mounting in a standard 19-inch rack. Figure 1 is a block diagram of the system.

C7050 Detector

The C7050 Detector (Figure 2) incorporates a Geiger-Müller type sensor tube, electronic circuitry to generate and transmit an output signal and a UV test lamp ("source tube"). When UV radiation strikes the cathode of the sensor tube,

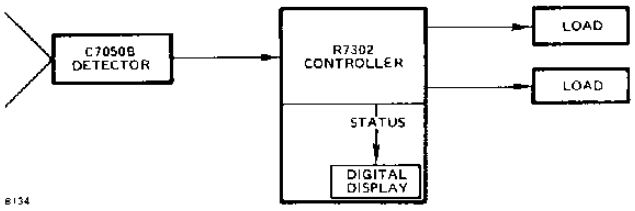


Figure 1—Block Diagram

a series of voltage pulses is sent to the controller. The frequency of the voltage pulses is proportional to the intensity of the UV.

Each detector is connected to the controller by four wires (see "Installation"). The wires are referred to as A-, B-, C- and D-leads.

1) The A-lead is connected to the +290 vdc supply.

2) The B-lead is the signal line (detector module to controller).

3) The C-lead is reference ground for the signal and +290 vdc supply.

4) The D-lead is the UV test lamp control line.

The detector is housed in an explosion-proof enclosure 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 to be used. Materials include anodized copper-free aluminum, nickel-plated brass, and 316 stainless steel. For example, anodized aluminum is often used in atmospheres containing hydrogen sulfide, nickel-plated brass is preferred for nuclear installations, and stainless steel is intended for very severe industrial atmospheres. In addition, both the aluminum and the brass housings are epoxy coated, making them suitable for use in high saline atmospheres, such as offshore platforms.

Each detector is normally mounted on an optional swivel mounting assembly (model Q9001B), which has a 240 degree sweep adjustment. Other mounting arrangements are 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.

R7302 Controller

The R7302 Controller contains the circuitry for processing signals from up to eight detectors and for actuating the instant, timed and fault relays used to control fire alarm, extinguishing and fault response equipment. It also contains the Automatic **oi** circuit, which continuously checks the optical surfaces of each detector in the system, and the automatic fault identification circuit, which responds to faults that may occur in the detector or the controller. When a fault occurs, a digital display on the front panel identifies the nature of the fault by code number (see Table 1).

Front Panel

The front panel of the R7302 (Figure 3) provides switches and indicators to enable manual **oi** and relay tests and to identify relay actuation and status occurrences.

1) The white POWER lamp is illuminated whenever power is applied to the controller.

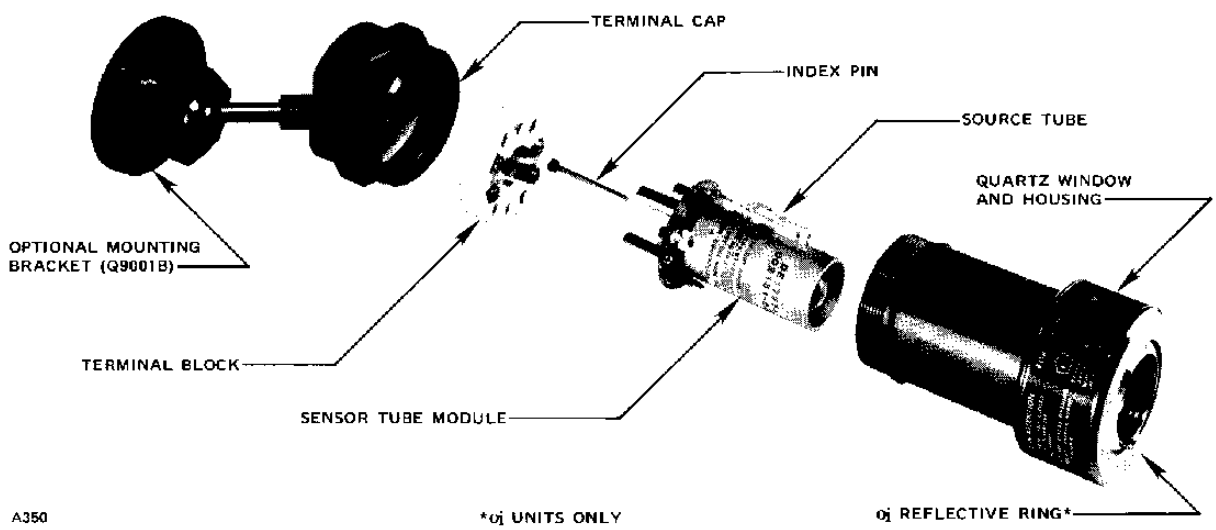


Figure 2—C7050 Detector Assembly

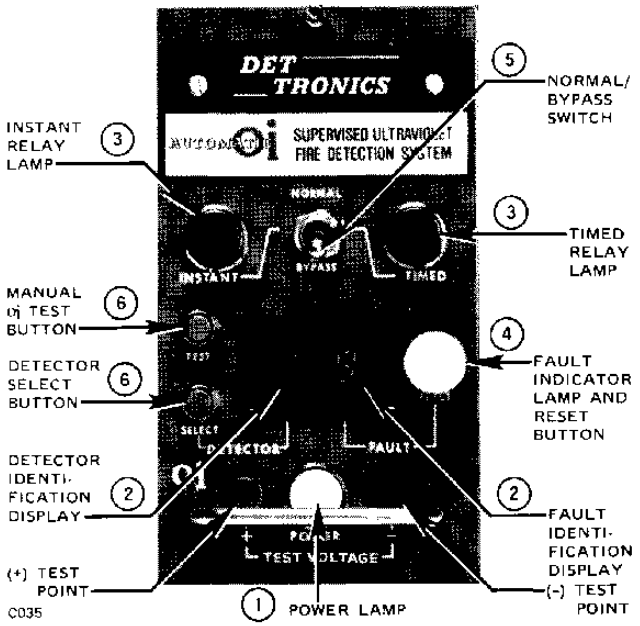


Figure 3—R7302 Controller Front Panel

2) The dual digital display identifies the fault code number on the right hand side and the number of the affected detector on the left hand side. In the test mode, the left display will indicate the number of the detector under test. Table 2, in the "Troubleshooting" section, provides a detailed explanation of the detector and fault identification codes.

3) The INSTANT and TIMED relay lamps are illuminated when their corresponding relays are energized.

4) The yellow FAULT/RESET lamp switch is illuminated when the (normally energized) Fault relay is de-energized. After the fault has been corrected, the Fault relay can be re-energized (and the lamp turned off) by pressing the lamp switch.

5) The NORMAL/BYPASS switch is used to place the system in bypass for manual checking. When in the BYPASS position, the outputs of the Instant and Timed relays are disabled, the Automatic oi test is discontinued, the FAULT/RESET lamp switch is illuminated, the digital display is activated, and the TEST and SELECT buttons are enabled.

6) The TEST and SELECT buttons are used to manually test each detector (see "Checkout Procedure" section). The SELECT button is used to sequentially select each detector in the system for test. The TEST button is used to activate the manual oi test in each detector.

Relays

The R7302 Controller contains three independent relays: the instant relay, the timed relay and the fault relay. They have form C (normally open/normally closed) contacts, and are rated for 10 amperes.

Table 1—R7302 Fault Identification

Digital Code	General Identification
0	Spurious detector discharge (low level UV)
1	DC power malfunction (standby power in ac to dc switchover models only)
2	Reduced detector sensitivity
3	Detector monitoring malfunction
4	Detector C-lead fault
5	Module missing or B-lead fault
6	Detector high voltage or A-lead fault
7	Comparator board fault
8	System in bypass or relay fault

The instant relay is energized when the controller receives a fire signal from a detector. Typical response to an intense ultraviolet source is less than 25 milliseconds.

The timed relay is energized if the signal from the detector is continuous for a preset time. The time delay is set at the factory for 5 seconds, but is field adjustable over the range of 0.2 to 12 seconds.

In many applications, the instant relay is used to sound an alarm, stop a process or cut off the source of fuel, and the timed relay is used to activate the fire extinguishing system.

The normally energized fault relay is de-energized if one or more of the following occurs:

a) Instant, timed or fault relay coils are open, or if a relay is removed.

b) Any of the printed circuit boards malfunction or are removed.

c) A detector module becomes insensitive or over-sensitive.

d) A leadwire to one of the detectors is shorted or open.

e) The system is placed in bypass.

Three optional relays are available:

- Two load monitoring relays are available to supervise the wiring connected to external loads such as alarm and extinguishing equipment. These relays continuously monitor the electrical continuity of the loads, and should an open occur in these circuits, the relays are de-ener-

gized. An external device can be connected to the load monitor relay contacts to provide indication when a load fault occurs.

- A third optional relay is available for automatically switching the controller from ac line (mains) supply to dc backup supply if a failure occurs.

Printed Circuit Boards

Relay Drive - Board No. 1—The relay drive board (Figure 4) provides the circuitry to operate the Instant, Timed and Fault relays and contains the time delay adjustment potentiometer.

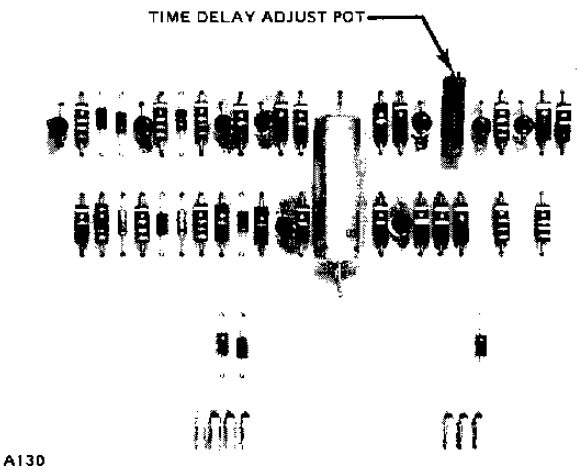


Figure 4—Relay Drive Board

Integrator and Comparator - Board No. 2—The integrator and comparator board (Figure 5) provides the circuitry to perform amplification and integration of the detector signal and contains the sensitivity selection terminal block (see "Installation" section).

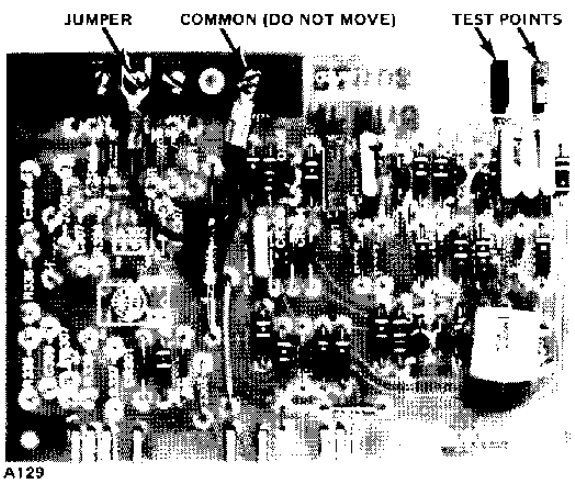


Figure 5—Integrator and Comparator Board

Detector Monitor - Board No. 3—The detector monitor board (Figure 6) contains the circuitry to continuously monitor the wiring between the detectors and the controller, to decode system faults (see Table 2), and to drive the right hand (fault identification) digital display. It also contains the detector "loop" selector terminal block (see "Installation" section).

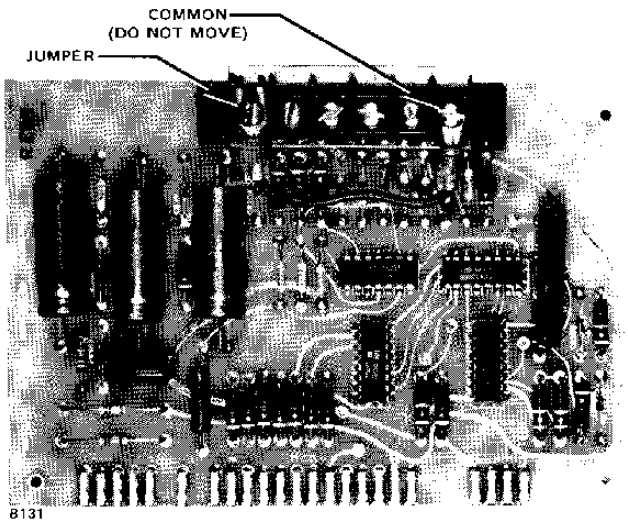


Figure 6—Detector Monitor Board

Power Supply - Board No. 4—The power supply board (Figure 7) provides regulated dc voltage for the amplifiers, relay drive voltage and +290 vdc for the detectors.

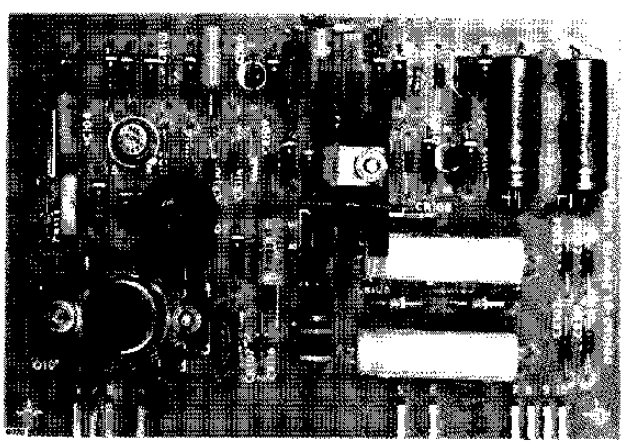


Figure 7—Power Supply Board

Automatic **oj** - Board No. 5—The Automatic **oj** board (Figure 8) provides the circuitry to sequentially test each detector, to send fault indications to the detector monitor board and to drive the left hand (detector identification) digital display. It also contains two rocker switch assemblies. The switch assembly with four rockers is used to select the number of detectors connected to the controller. Refer to the "Installation" section for switch setting instructions. The switch assembly with two rockers sets the low level (automatic **oj** threshold) sensitivity of the controller. It is set at the factory, and should not normally be reset in the field. For further information, consult Detector Electronics' Customer Service Department.

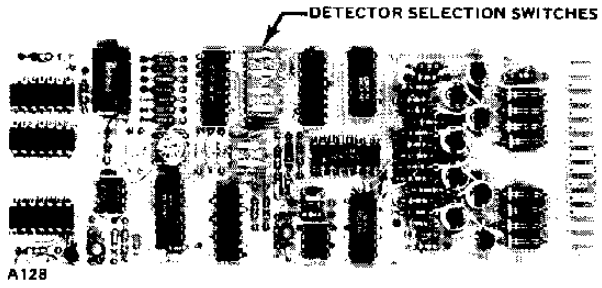


Figure 8—Automatic **oj** Board

Inverter Board—The inverter board (Figure 9) is used in controllers that are powered by a 12 vdc or 24 vdc supply (ac models have a power transformer). The controller is not field convertible from ac to dc power, but may be ordered from the factory for automatic ac to dc switchover in case of line (mains) supply failure. The automatic ac to dc switchover models use the inverter board in addition to a power transformer and related circuitry. If ac input power to the transformer fails, a switching relay will de-energize and close the contacts that connect the output of the inverter board to the controller. (A 12 vdc or 24 vdc supply must be connected to the input of the inverter board.)

The 12 vdc version of the R7302 Controller operates over the range of 10.5 to 16.0 vdc. Maximum peak repetitive voltage is 24 volts. The 24 vdc version operates over the range of 18 to 38 vdc. Maximum peak repetitive voltage is 40 volts.

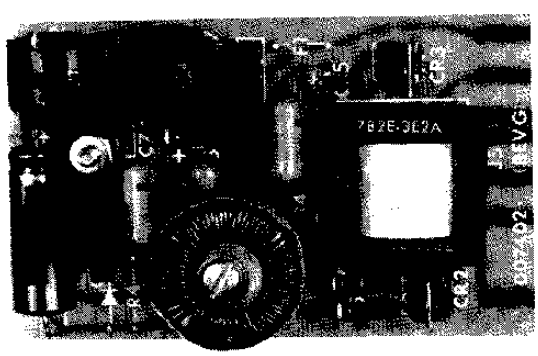


Figure 9—Inverter Board

Power Transformer—A power transformer replaces the inverter board in the controllers that are to be powered by 120 vac or 220/240 vac line (mains) voltage. Fluctuations between 85 and 110 percent of rated ac voltage have no effect on system operation.

Field Wiring Connector/Mounting Cage—The controller is furnished with a field wiring connector (Figure 10) that incorporates pressure type screw terminals for attaching wires and edge connectors for plugging in the controller. The optional Q4001 Mounting Cage holds up to four controllers and is designed to fit into a standard 19-inch instrument rack. The cage is designed to hold the field wiring connector(s) for ease in making electrical connections, installing and servicing the controller(s).

THEORY OF OPERATION

The R7302/C7050 system provides an instant and a timed relay response to flame, an automatic optical integrity (**oj**) system for determining that the electronic circuitry is operational and that the detector's optical surfaces are clean and Fault Identification circuitry to aid in troubleshooting if a fault should occur.

Fire Detection and Response Sequence

When a detector senses ultraviolet (UV) radiation, it generates a series of voltage pulses and transmits them to the integrator and comparator circuit board in the controller. (Refer to the fire circuitry block diagram - Figure 11). The pulses are amplified and used to charge an integrating capacitor. The voltage on the integrating capacitor is proportional to the frequency of the pulses, which is propor-

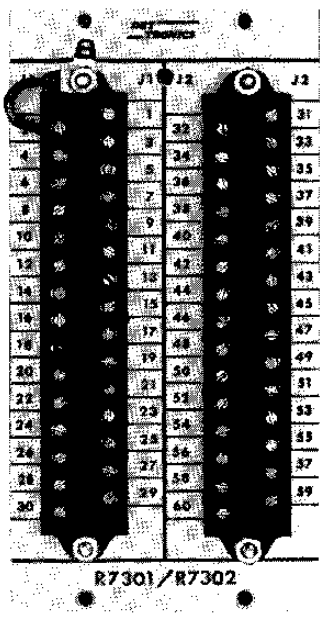


Figure 10—Field Wiring Connector

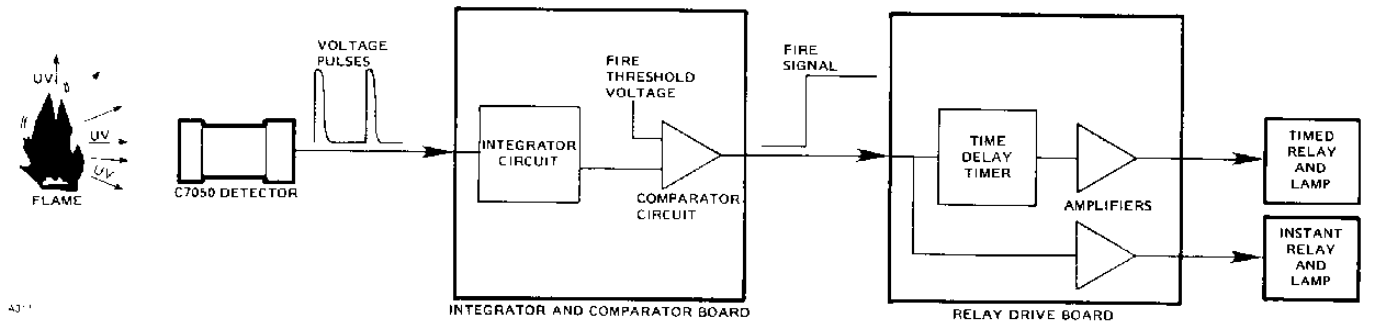


Figure 11—Fire Circuitry Block Diagram

tional to the intensity of UV sensed by the detector. A comparator circuit compares the voltage on the integrating capacitor to a preset threshold voltage. When the threshold voltage is exceeded, the comparator will send a fire signal to the relay drive circuit board.

At the relay drive board, the comparator output signal is amplified to energize the instant relay and turn on the red INSTANT lamp. It also starts a timing sequence that energizes the timed relay and turns on the red TIMED lamp if the UV fire signal is continuous for the duration of the preset time delay. If the fire signal is interrupted before the time delay is completed, the time sequence starts over when UV is again "seen."

Automatic Optical Integrity

An important consideration with any ultraviolet fire detector is that an accumulation of contaminants (oil, gasoline, dirt) on the quartz window will absorb or block ultraviolet radiation. When the accumulation becomes thick enough, the detector is "blinded." (Some UV absorbing film layers great anough to completely "blind" the detector can be virtually undetectable to the human eye.)

To ensure that the detectors are operational, the automatic **oj** circuit continuously cycles through a test of each detector and its wiring. The C7050 Detector (Figure 12) incorporates a UV sensor tube and an optically isolated UV test lamp. Actuation of the test lamp causes UV radiation to travel out through the quartz window, where it encounters a reflective **oj** ring and is directed back through the window to the sensor tube. If the window is clean, the sensor tube detects the UV from the lamp and sends a signal back to the controller to verify that the detector and its wires are

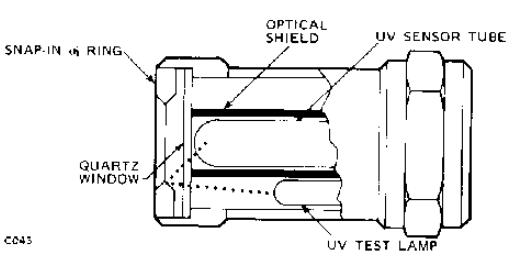


Figure 12—C7050 Detector with **oj**

functioning properly. The automatic **oj** circuit tests each detector approximately six times per minute (varies with the number of detectors connected) so that if a fault occurs, it is almost instantly detected.

The basic operation of the automatic **oj** circuit involves selecting and illuminating a detector's UV test lamp, sensing a return signal from the detector, turning off the UV test lamp, sensing the termination of the return signal and selecting and illuminating the next test lamp.

Functionally, the Automatic **oj** circuit can be divided into three sections. Refer to the automatic **oj** block diagram (Figure 13).

1. **Comparator Circuit**—The automatic **oj** comparator circuit is similar to the comparator of Board No. 2. It compares the voltage on the integrating capacitor to a preset threshold voltage. (The factory-set **oj** test threshold is much lower than the fire threshold.) When the integrating capacitor voltage is less than the **oj** threshold voltage (virtually **no** UV is being detected) the output of the comparator circuit is a logic 1. When the integrating capacitor voltage is greater than the **oj** threshold voltage (a small amount of UV is being detected), the output is a logic 0.

2. **Sensitivity Timers**—There are two sensitivity timers. The "0-fault" timer monitors the comparator and generates a fault signal if the comparator output stays at logic 0 (UV continuously being detected) for three seconds or more. The "2-fault" timer also monitors the comparator and generates a fault signal if the comparator output stays at 1 (no UV being detected) for a period determined by the **oj** threshold sensitivity setting.

3. **Test Lamp Sequencer/Driver**—The sequencer/driver circuit monitors the comparator, and sequentially selects and turns on each detector's UV test lamp. When the comparator indicates that UV is detected, the driver section turns that test lamp off and the sequencer selects the next test lamp to be driven. When the comparator indicates that no UV is being detected, the driver turns on the next test lamp.

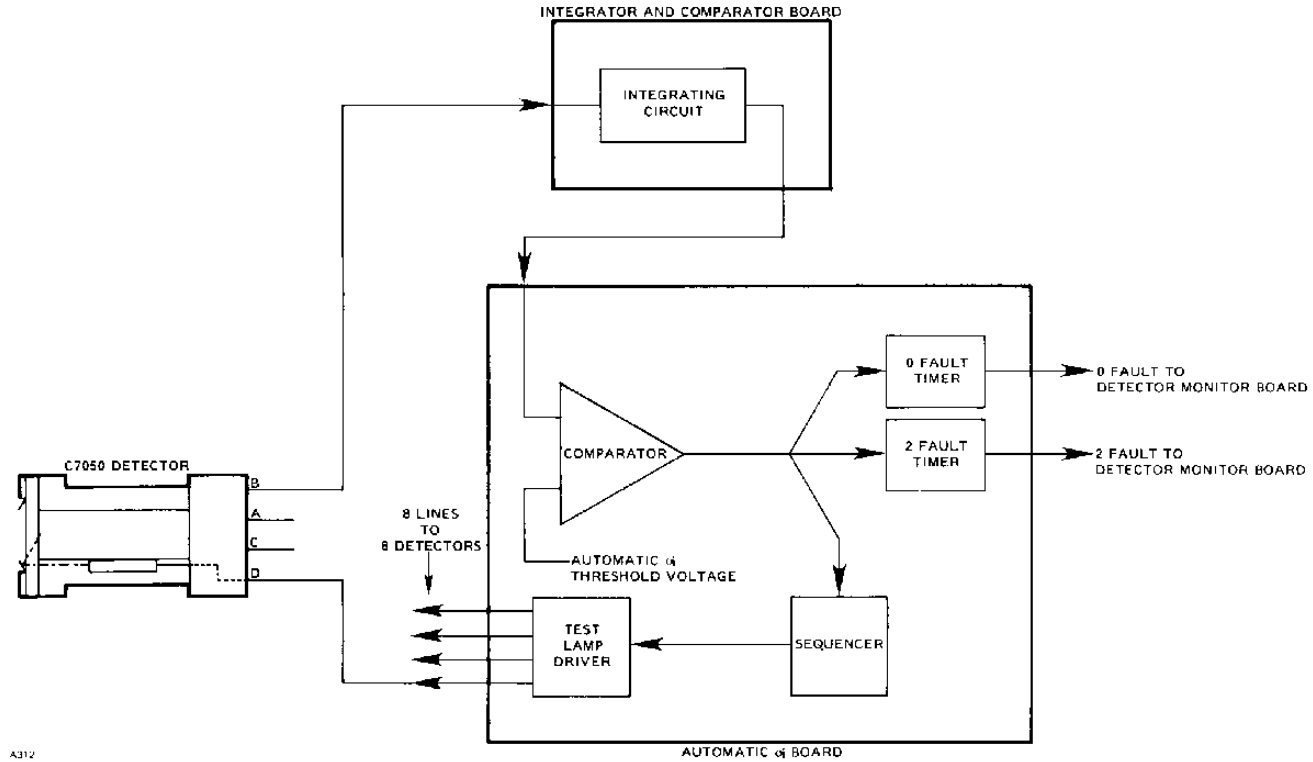


Figure 13—Automatic Oi Circuitry Block Diagram

To summarize:

a) The comparator circuit monitors the voltage on the integrating capacitor and provides a pulsing output as the voltage on the integrating capacitor rises and falls.

b) The "0-fault" timer monitors the comparator output and generates a fault signal if one or more detectors sense low level UV (below fire threshold) for over three seconds.

c) The "2-fault" timer monitors the comparator output and generates a fault signal if the detector under test does not respond to UV.

d) The sequencer/driver monitors the comparator output and turns on the UV test lamp of each detector in succession.

Fault Identification

In the event of a system malfunction, the fault identification circuitry activates the front panel digital display to identify (by code number) the nature of the fault (Table 2). When a fault occurs, the fault relay is de-energized, the FAULT indicator lamp is illuminated, and the digital display is activated. The right hand display indicates the fault code and (if there is a detector fault) the left hand display identifies the number of the affected detector.

When more than one fault occurs at the same time, a priority system of identification is automatically employed. The order of priority is:

Highest Priority	7
	6
	5
	4
	3
	2
	1
	0
Lowest Priority	8

When one fault occurs before another, the code of the first is captured and retained (latched) on the digital display until the controller is placed in the bypass mode. This ensures that identification of a transient fault will not be "lost." In the bypass mode, the number of the highest priority fault is displayed. As each fault is corrected (with the system in BYPASS), the next lower priority fault is displayed.

The fault identification circuitry is located on the detector monitor board. The circuitry that decodes the automatic Oi sequencer/driver and controls the DETECTOR digital display is on the automatic Oi board. The fault and detector identification circuitry can be divided into four sections. Refer to the fault circuitry block diagram (Figure 14).

1. **Comparators**—Four comparator circuits monitor the wires that connect the detectors to the controller, and the position of the detector loop selector (see "Installation" section).

2. **Eight Level Priority Encoder**—The priority encoder is an integrated circuit that monitors eight input lines and generates a 3-bit binary representation of the highest

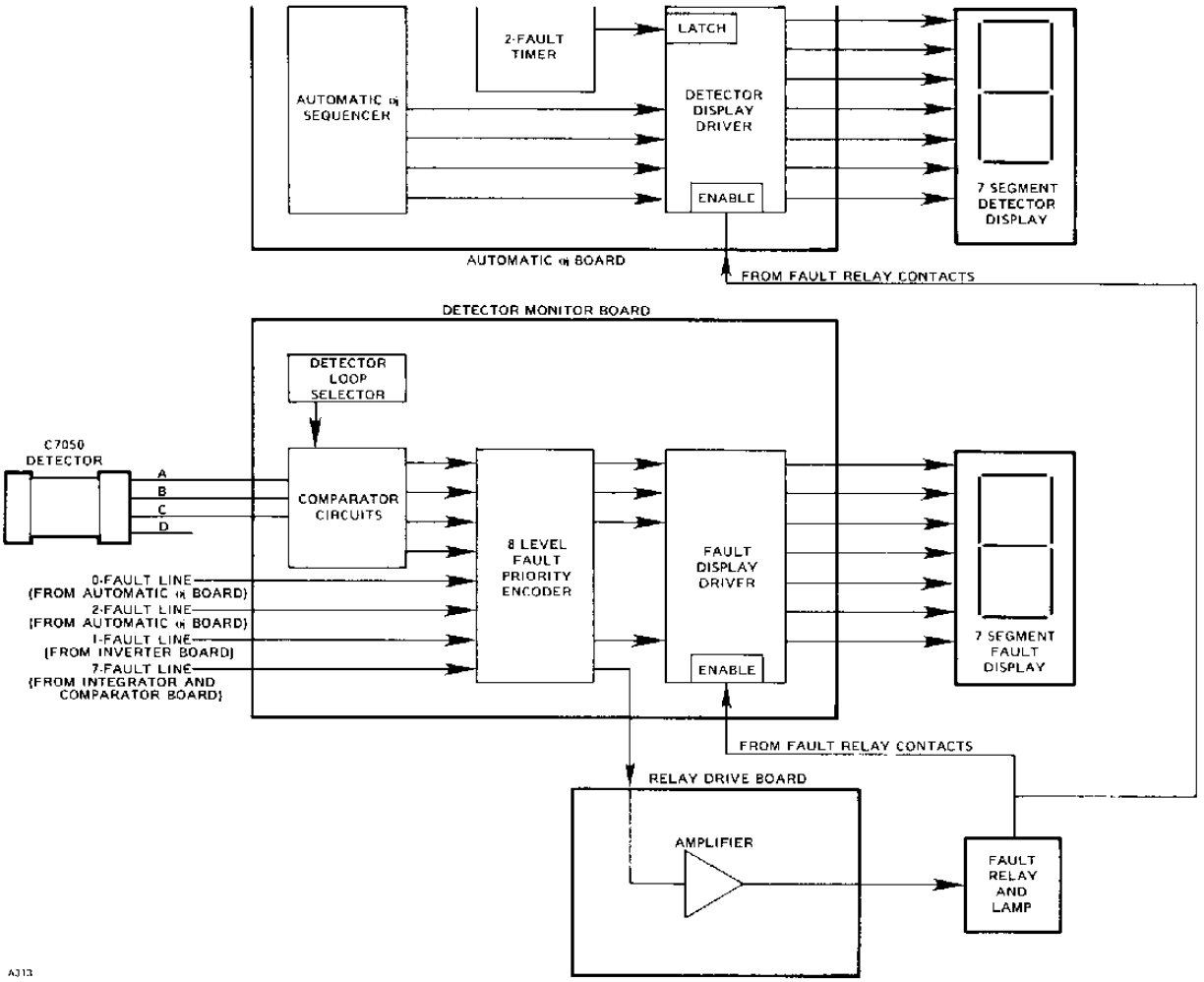


Figure 14—Fault Circuitry Block Diagram

priority, active input. Four input lines come from the four on-board comparators (mentioned above) and four come from other circuit boards in the controller. Two fault lines are connected to the sensitivity timers of the automatic **oi** board, one is connected to the integrator and comparator board and one is connected to the inverter board (ac to dc switchover models only). The outputs of the priority encoder are used to generate the fault signal that de-energizes the fault relay, and to drive the inputs of the FAULT display driver.

3. **Fault Display Driver**—The driver is an integrated circuit that decodes signals from the priority encoder and illuminates the appropriate digit in the digital FAULT display. Since the priority encoder can only generate a 3-bit binary number (0 to 7, decimal), the driver is wired to default to an output of "8" when there are no other active inputs. (This default condition gives an 8-fault the lowest priority.)

   The fault display driver is enabled only when the fault relay is de-energized. It will latch to retain an output digit and will not respond to new input information when the NORMAL/BYPASS switch is in the NORMAL position and the fault relay is de-energized.

4. **Detector Display Driver**—This driver is physically identical to the fault display driver and is located on the automatic **oi** board. It monitors the output of the sequencer circuit (mentioned above) and illuminates the number of the failing detector in the digital DETECTOR display when a 2-fault occurs. Table 2 in the "Troubleshooting" section) lists the fault and detector identification codes.

DETECTOR SENSITIVITY

The Detector Electronics ultraviolet fire detector uses a Geiger-Müller type sensor tube designed to respond to radiation over a wavelength of 1850 to 2450 Angstrom units (10,000 Angstroms = 1000 nanometers = 1 micron = 0.001 millimeter). Figure 15 illustrates the sensor tube's range of sensitivity, and compares this range to other forms of radiation. The UV radiation that reaches the earth from the sun does not extend into the detector's region of sensitivity.

In addition, radiation from normal artificial lighting, such as fluorescent, mercury-vapor and incandescent lamps does

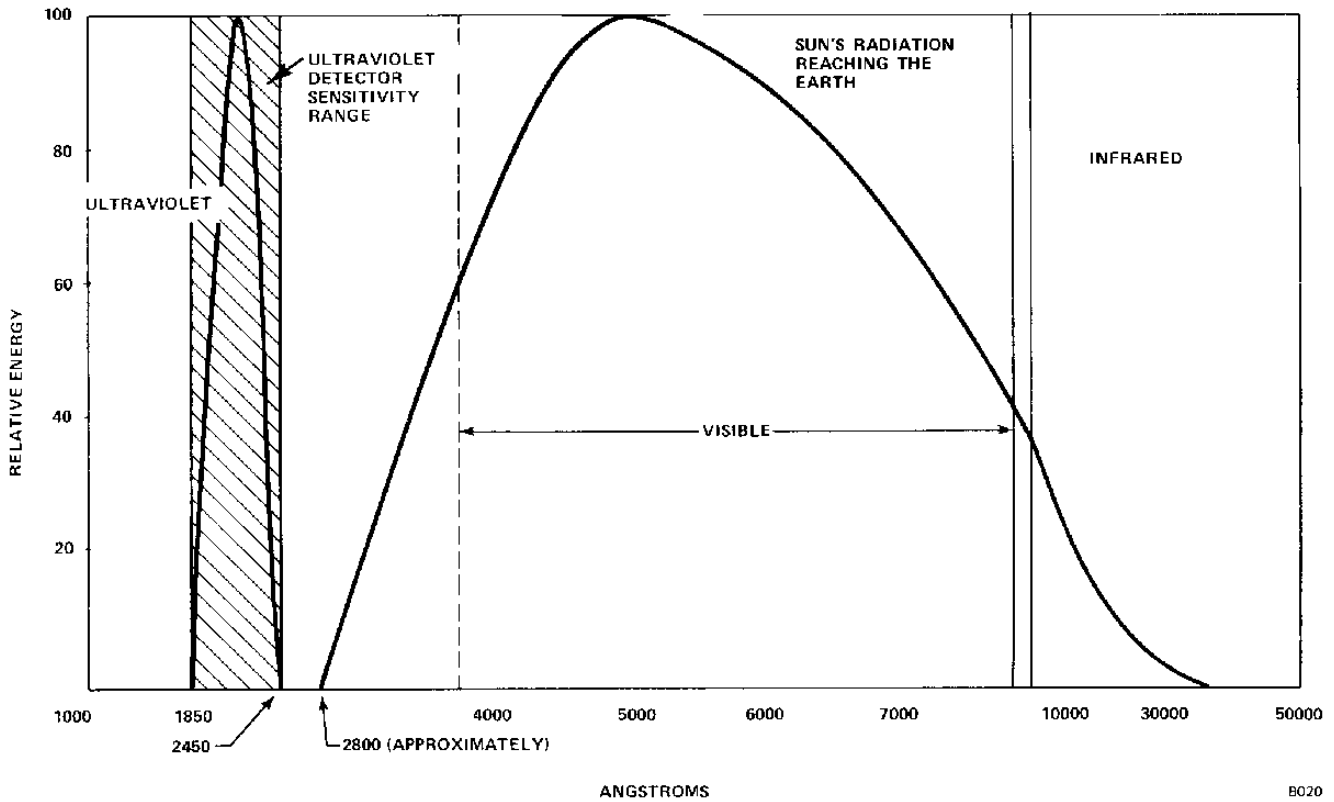


Figure 15—UV Detector's Range of Sensitivity

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. Some mercury-vapor lamps with cracked or otherwise damaged envelopes can operate for extended periods and will emit UV radiation in the frequency response range of the Det-Tronics detector. If a detector is in the vicinity, the UV radiation can result in false actuation of the system. Defective mercury-vapor lamps can also be harmful to eyes and 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 generate an output signal. 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 will 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.

SYSTEM SENSITIVITY CONSIDERATIONS

Figure 16 shows the 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) generates 100 cps, the same fire at 70 feet (21 meters) will generate about 8 cps. Because of the complexity of the combustion process, the sensor 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 sensor tube count rate is increased by approximately 60 percent.

Selection of the 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 R7302 system allows it to meet the requirements of virtually any application. For sensitivity and time delay adjustment information, see the "Installation" section. As previously stated, the 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.

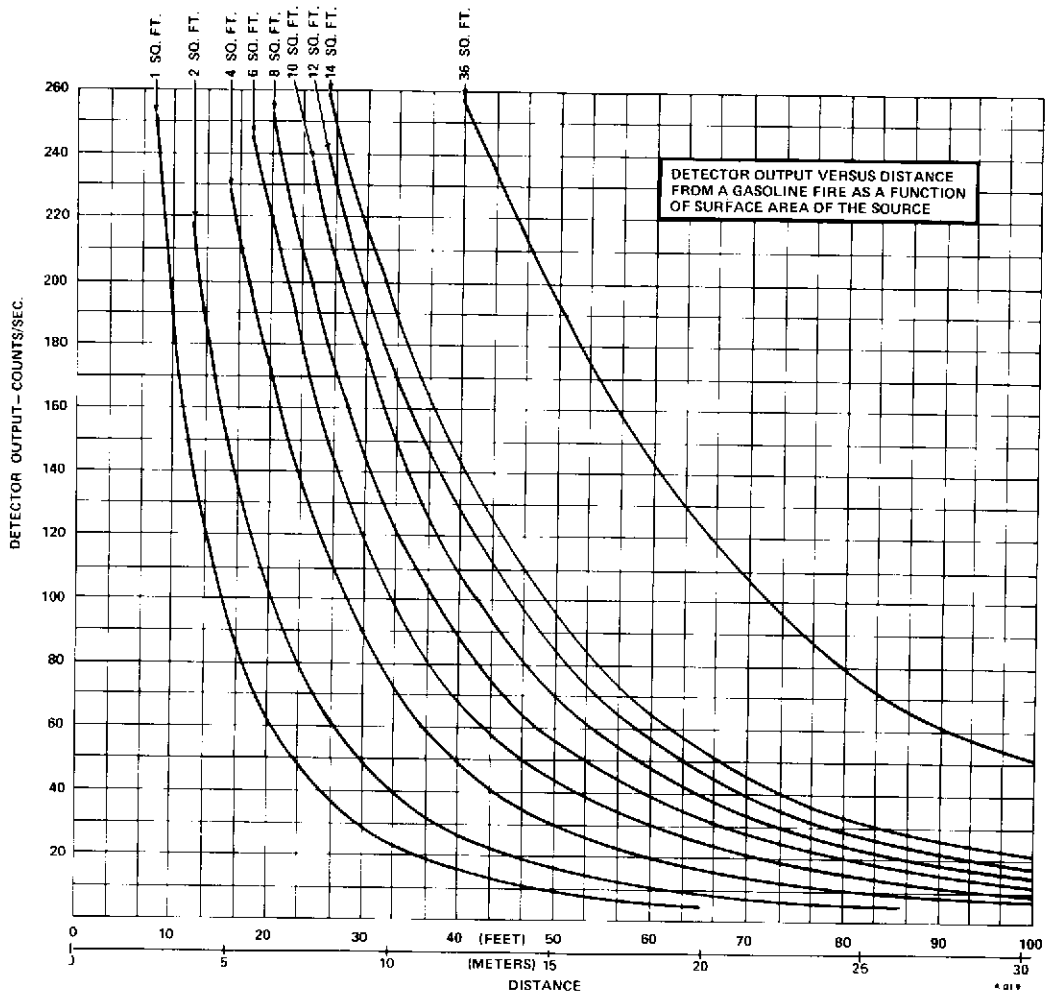


Figure 16—Sensitivity to a Gasoline Reference Fire

SPECIFICATIONS

SPECTRAL SENSITIVITY RANGE–

Det-Tronics' ultraviolet fire detectors respond to radiation over the range of 1850 to 2450 Angstroms (see Figure 15). Detectors are insensitive to direct or reflected sunlight and to normal artificial lighting.

NOTE

- *Intense levels of x rays and gamma radiation will cause the system to actuate.*
- *High electrostatic forces will affect the detectors if exposed directly at the window.*
- *Arc welding is an intense UV source and special application techniques are required to restrict this radiation from the detector's cone of vision.*

OPTICAL SENSITIVITY RANGE (Cone of Vision)–

The C7050 Detector has a nominal 80 degree cone of vision with the highest sensitivity lying along its central axis. Figure 17 shows a composite view of the cone of vision and the detector response 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). Since physical obstructions, smoke accumulation or UV absorbing chemical vapors will prevent UV from reaching the detectors, they should be mounted as close as practical to the probable hazard. Under certain controlled conditions, detectors may be used at greater distances. The chart of the gasoline reference fire (Figure 16) shows how detector response is related to distance.

CONTROLLER SENSITIVITY–

Controller sensitivity is field adjustable for 25, 50, 75 and 100 counts per second (cps). See "Theory of Operation" section for explanation of count rate. The maximum response distance is achieved at a 25 cps sensitivity setting. For an application involving high background radiation potential, the system can be desensitized by increasing the count rate required to actuate it. The 100 cps setting results in the minimum response distance.

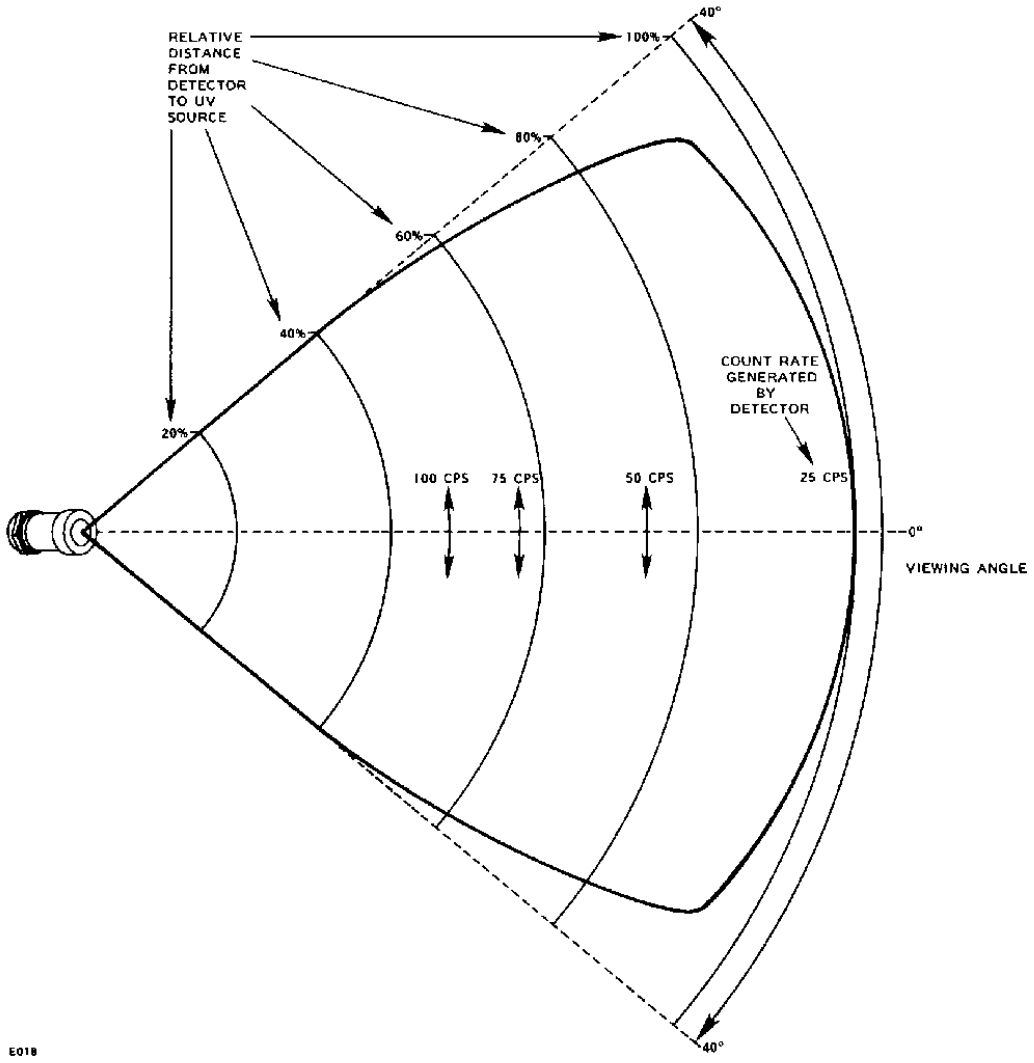


Figure 17—UV Fire Detector Cone of Vision

DIMENSIONS—

Dimensions given in Figure 18 are for the R7302 Controller only. Dimensions for the optional mounting cage (Q4001) are given in Figure 19. See Figure 20 for mounting dimensions of the C7050 Detector.

ELECTRICAL RATINGS—

Operating Voltage:

- 120 vac, 50/60 Hz
- 220/240 vac, 50/60 Hz

Fluctuations between 85 and 110 percent of rated ac voltage have no effect on detector sensitivity or system operation.

- 12 vdc - operates over the voltage range of 10.5 to 16.0 vdc.
- 24 vdc - operates over the voltage range of 18.0 to 38.0 vdc.

Relay Contact Ratings: Form C (N.O. and N.C.) 10 amperes at 250 vac resistive, 8 amperes inductive for the instant, timed, fault and (optional) load monitoring relays.

Normal/Bypass Switch Ratings: 10 amperes resistive, 8 amperes inductive.

Power Consumption (Watts):

	Typical	Maximum
Standby	12	15
Fault	13	18
Fire	20	25
Fault and fire	21	26

TEMPERATURE RATINGS—

Operating: -40 to +170°F (-40 to +77°C) for detector, -40 to +158°F (-40 to +70°C) for controller.

Storage: -67 to +170°F (-55 to +77°C) for the detector and the controller.

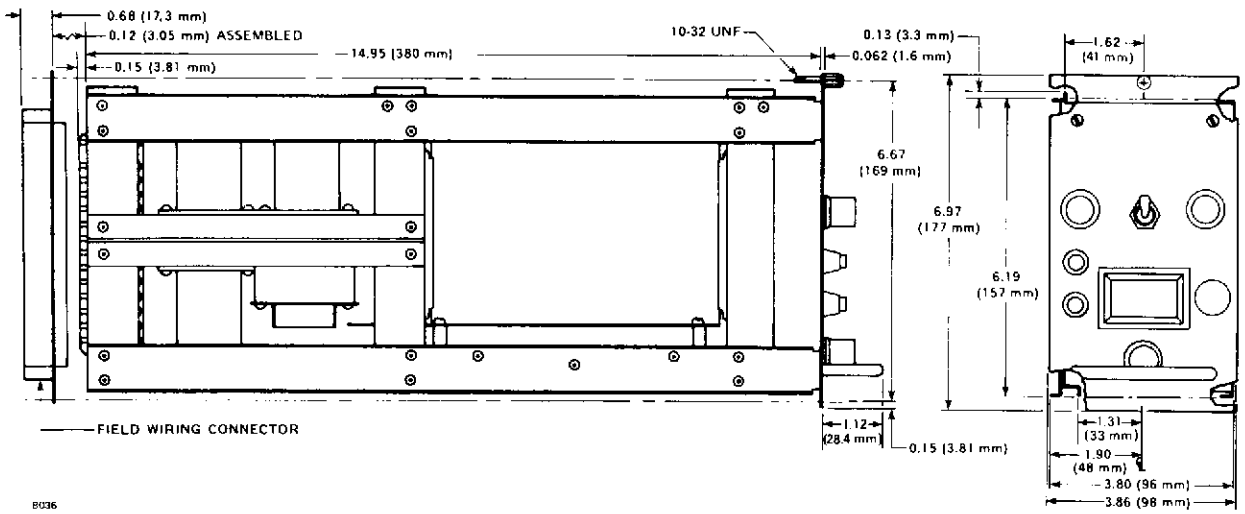


Figure 18—Dimensions of the R7302 Controller in Inches (mm)

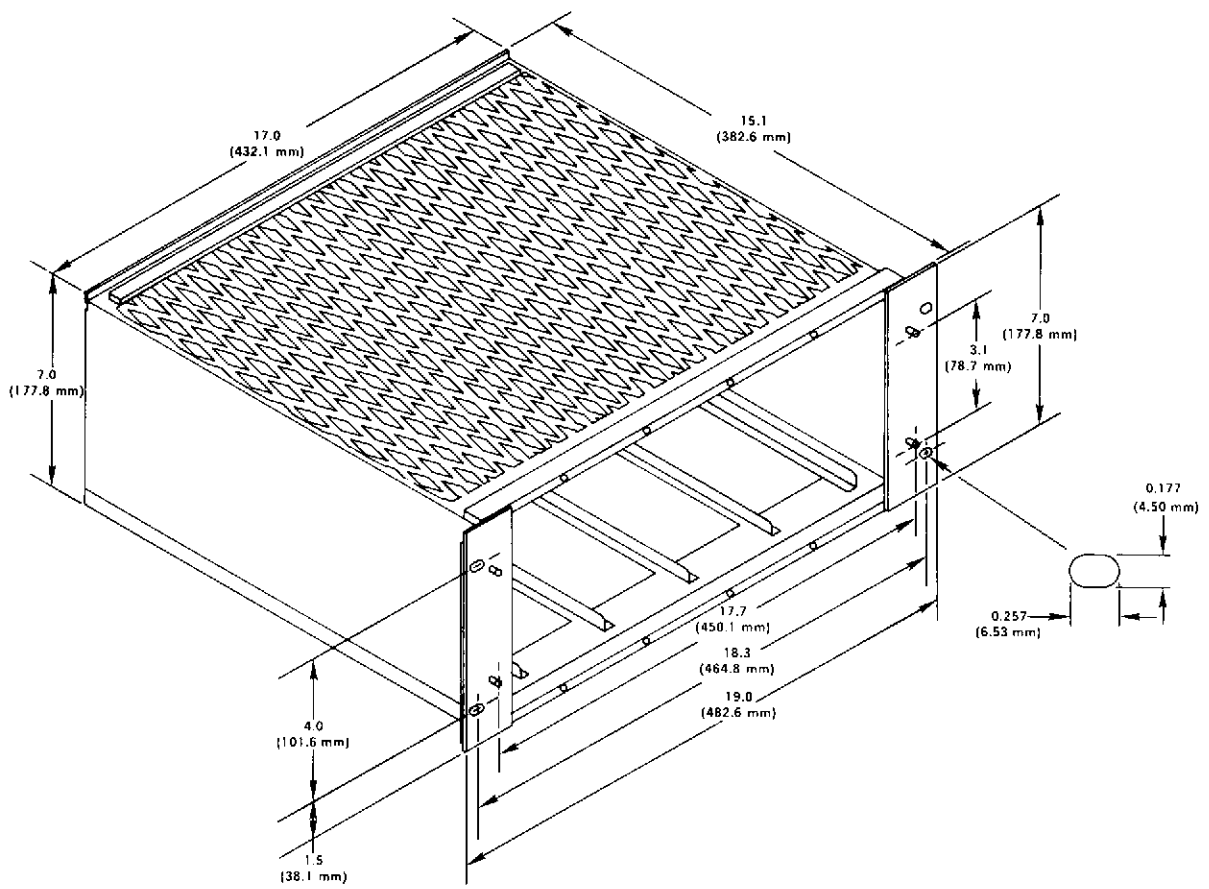


Figure 19—Dimensions of the Q4001A Mounting Cage in Inches (mm)

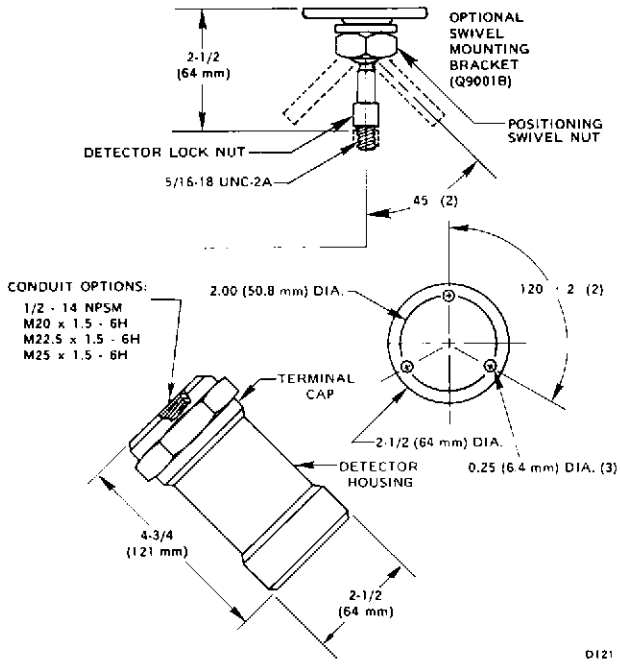


Figure 20—Dimensions of the C7050 Detector in Inches (mm)

WIRING REQUIREMENT—

A 22 gauge cable rated 300 volts rms is required for the A-, B-, C- and D-leads. The B-lead must be shielded. Each detector requires an individual wire for the D-lead, but the A-, B- and C-leads can be common to all detectors. (The R7302 Controller will accommodate up to 8 detectors.) The detectors may be located up to 1000 feet (300 meters) from the controller.

Characteristics of 22 Gauge Copper Wire

	Metric	U.S. Customary
Diameter	0.6439 mm	0.02535 in
Cross-section	0.3255 mm^2	0.0005 in^2
Resistance	33.3 ohm/km	10.15 ohm/1000 ft

DETECTOR ENCLOSURE MATERIALS—

Models available in anodized copper-free aluminum, nickel-plated brass or 316 stainless steel.

SHIPPING WEIGHT—

	Pounds	Kilograms (Approx.)
R7302 Controller	13.1	5.9
C7050B Detector - Alum.	1.25	0.56
- Brass or Stainless Steel	2.25	1.01

DETECTOR ENCLOSURE RATINGS—

Watertight, dust-tight, designed to meet NEMA standards Publication IS 1.1-1975 for Type 4 enclosures. CSA certified Enclosure 4.

Hazardous locations:

- FM approved for Class I, Groups A, B, C and D; Class II, Groups E, F and G.
- CSA certified for Class I, Groups C and D; Class II, Groups E, F and G.
- BASEEFA certified for Group Ex d IIC T6 (hydrogen).
- CENELEC certified EEx d IIB T6.
- P.T.B. certified to meet VDE 0171/1.69 specifications.

OPTIONS AVAILABLE

- **Solid State Relays**

  The R7302 Controller may be ordered with solid state relays where extermely fast (10 millisecond) reaction time is required. In most cases the dc solid state relays use the same electrical connections as the standard relays. They may be interchanged with the standard relays in either the instant relay position or the timed relay position. The ac solid state relays require a different socket and are not interchangeable. If ac solid state relays are desired, a compatible controller must be ordered from the factory. Consult Detector Electronics, Application Engineering, for details.

  If the solid state relay is intended to be used in the timed relay position, a special zero time delay board must also be ordered.

  Both the ac and the dc solid state relays have normally open (form A) "contacts" available for external connection and are limited to the two specific operating voltages of 120 volts ac or 24 volts dc. The 24 volt dc relay is rated at 1 ampere continuous and 5 amperes intermittent. The 120 volt ac relay is rated at 7 amperes.

  Refer to the "Typical System Application" section for examples of solid state relay connections.

- **Q4001A, Q4001B and Q4001D Cages**

  The Q4001A Mounting Cage is designed for holding up to four controllers in a standard 19-inch instrument rack. The Q4001B holds one controller. The Q4001D holds two controllers.

- **Automatic Switchover**

  A switchover model uses a relay to automatically switch from ac line (mains) supply to a dc backup supply if a power failure occurs.

- **Hermetically Sealed Relays**

  The R7302 Controller can be ordered with hermetically sealed instant, timed and fault relays.

- **Load Monitoring Relays**

  Two load monitoring relays are available to monitor the electrical continuity of external loads and their connecting wires. The load monitoring relays de-energize

when an open occurs in the load circuit. An external indicator is needed to show when a fault occurs.

When ordering, specify the operating voltage and the current required to energize the loads to be monitored.

- **Integrator and Comparator Board**

The integrator and comparator board is available in several options:

a) The standard version provides selectable sensitivity (25 to 100 counts per second - see "Installation" section) and non-latching output.

b) The transient arc rejection (TAR) version features protection against false actuation of extinguishing equipment due to short duration, high level UV radiation and also provides selectable sensitivity and non-latching output. This option is normally used in powder coating applications.

c) For application where the relays must remain energized after UV radiation is no longer sensed, three versions that feature latching outputs are available:

1. 10 count per second (fixed) sensitivity with latching output
2. 10 count per second (fixed) sensitivity with latching output and manual de-latching
3. 25 count per second (fixed) sensitivity with latching output and manual de-latching

- **Latching Relay Drive Board**

The relay drive board is available in a configuration that furnishes:

a) Individually selectable latching/non-latching for both instant and timed relays

b) Individually selectable time delay for relays in both the instant and timed positions (zero time delay or a range of 0.2 to 12 seconds is available).

INSTALLATION

Detector Positioning and Density

As previously stated, the Det-Tronics detector has a nominal 80° 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 from the ceiling and pointed straight down, the distance from the detector to the designated level would be 23 feet (7 meters). Because of the nominal 80° cone of vision, the detector would cover a circular area with a diameter of 39 feet (12 meters). 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. Det-Tronics systems may be adjusted to various sensitivity levels by programming the controller to respond at a predetermined detector tube count rate. This count rate is dependent upon the intensity of 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. The presence of UV absorbing vapors must be examined closely. Some chemical and petrochemical vapors have very strong UV absorption characteristics (see Appendix).

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.

Referring to Figure 16 and considering the conditions described above, the criteria for selecting a correct system sensitivity adjustment can be established. The hazard to be protected was designated to be 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 16, 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 50 cps sensitivity in order to respond to 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 the more sensitive (25 cps) setting.

NOTE

Do not mount UV detectors close to the ceiling in enclosed areas if dense smoke may 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 may be expected to accumulate prior to the presence of flame (as in an electrical fire), do not use UV detectors alone.

Mounting and Wiring the Detector

The wiring to each detector must be 22 gauge (0.643 mm diameter) minimum, with at least a 300 volt rms rating. The B-leads must be shielded to prevent interference from external sources. The detectors that are connected to one controller may share one shielded B-lead. If the B-leads are run in conduit, the conduit must not be used for wiring from other electrical equipment. The A-, C- and D-leads do not need to be shielded. Each detector may be located at a distance of up to 1000 feet (300 meters) from the controller.

If conduit is used, it is recommended that conduit sealing compound and conduit breathers be employed. In some applications, alternate changes in temperature and barometric pressure 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 to prevent this "breathing." In systems where drains and breathers are not used, moisture in the air condenses at the base of vertical conduit runs and equipment enclosures, and builds up over a period of time. This can be detrimental to electronic devices. To eliminate this condition, explosion-proof drains and breathers (such as Crouse-Hinds type ECD) should be installed to automatically bleed off accumulated water.

The following steps 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 window and reflector rings. A swivel mounting assembly (Q9001B) is available for ease of installation. For outdoor applications, the detectors should be pointed downward to prevent the cone of vision from scanning the horizon, as the detectors may 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 rings will interfere with the Automatic oi function. See Figure 20 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 using a tool as described in step 6 below, and disengage the "catch" from the terminal cap. See Figure 2 for an example of the detector assembly.

3. Install A-, B-, C- and D-leads to connections in the terminal cap. (See "Electrical Connections.") If the shielded cable is to continue to another detector, tie the shields together. Always insulate the shield from the detector housing.

4. Remove UV sensor tube module from its shipping package and install, locating the correct terminal position by observing the index pin.

5. Install four screws and tighten (some C7050 Detectors have gold-plated plug-in connections and screws are not needed).

6. Replace 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 21.) The clamp must then be fastened securely around the detector barrel by tightening the clamp with the proper tool. This locking cover feature is required for equipment approved by BASEEFA and P.T.B. The tool required

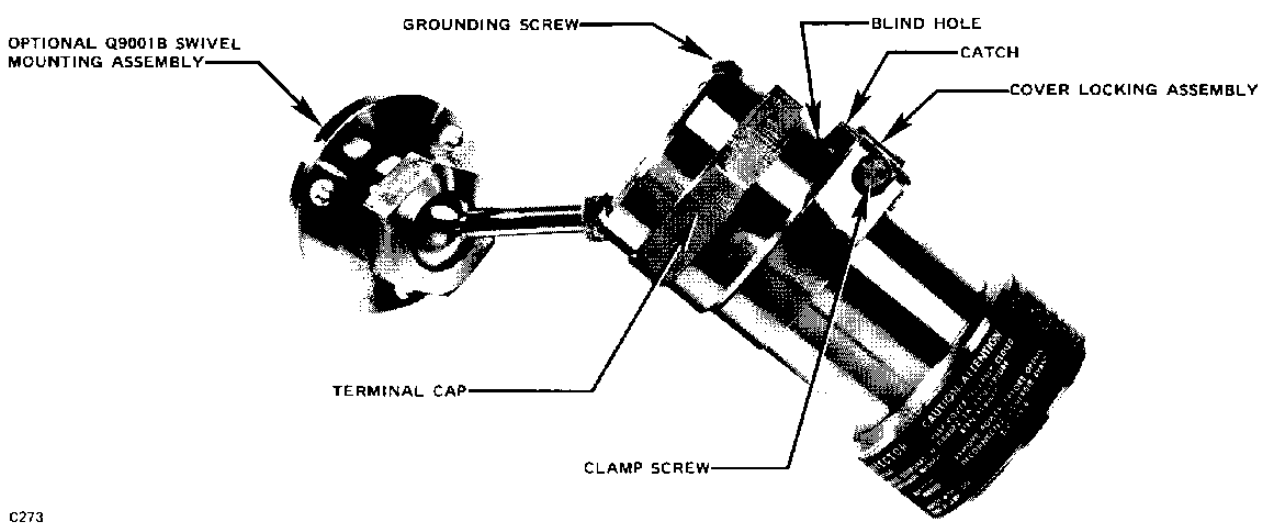


Figure 21--C7050 Detector with Cover Locking Assembly

for the BASEEFA clamp is 5/32-inch hexagonal (Allen) wrench. For the P.T.B. clamp, a triangular m4 (7 mm) wrench (DIN 22417) must be used.

7. Thoroughly clean the detector window and the reflective ring. Det-Tronics window cleaner solution (part number 001680-01) is specially designed for this application. Many of the commercial cleaners leave a residue on the surface that absorbs UV radiation. Clean the window out to the edge. After cleaning, hold the reflective ring by its tabs, being careful not to leave fingerprints on the reflective surface when re-installing.

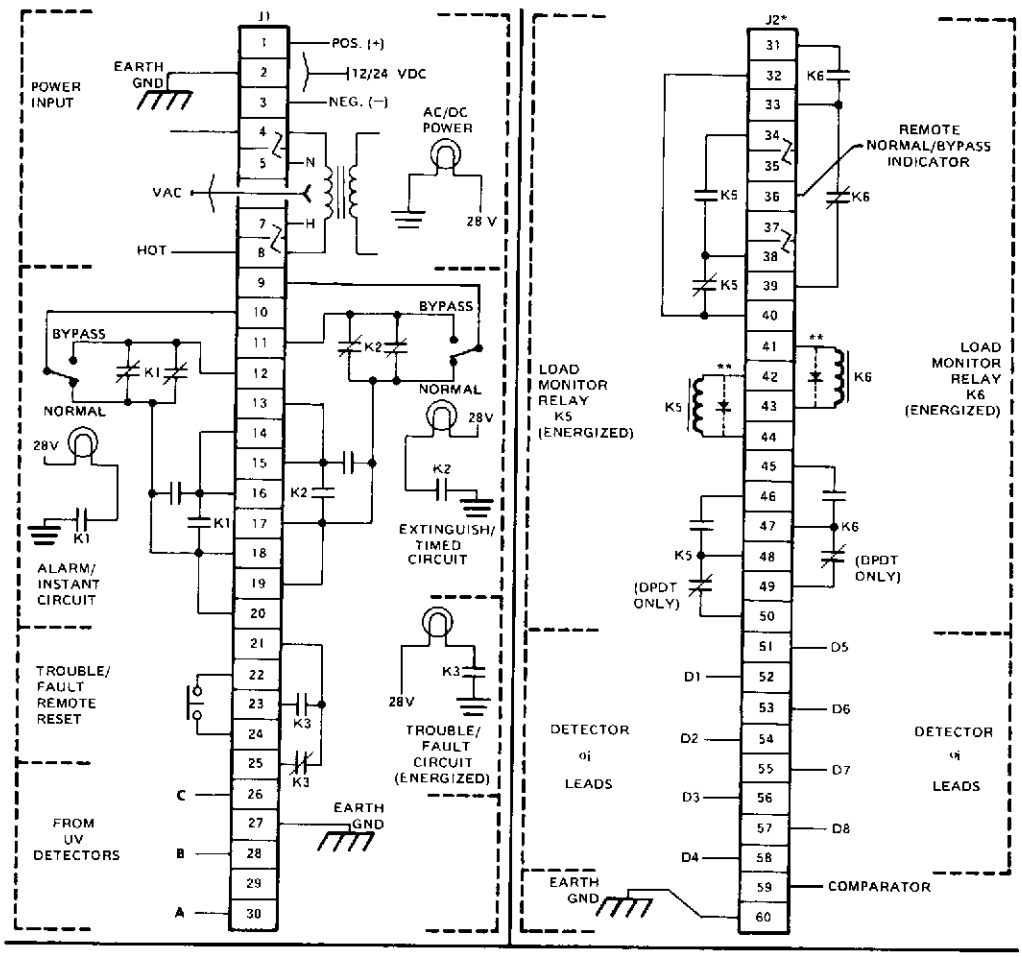
NOTE

Use a clean cloth or tissue for cleaning. DO NOT use commercial glass cleaning tissues since many of these contain a silicone substance, which remains on the cleaned surface and will absorb UV radiation.

Electrical Connections

The R7302 is designed for use with one to eight detectors. Terminals A, B and C on the detectors must be connected to the A-, B- and C-terminals on the controller. See Figure 22 for controller terminal identification.

The D-lead from each detector in the system connects directly to an individual terminal on the controller field wiring connector (terminals D1 through D8). These connections establish the detector identification number that appears on the digital display of the R7302. The detectors contain end of line (EOL) lead monitoring resistors that allow a small control current to flow through the interconnecting wires for checking their continuity. The controller monitors up to four lead monitoring "loops." A "loop" is a grouping of one or more detectors wired in parallel, with the last detector providing the EOL resistors



- K1 AND K2 RELAY CONTACTS SHOWN WITH POWER APPLIED TO CONTROLLER IN NORMAL (NO FIRE) MODE.
- K3 RELAY CONTACT SHOWN WITH RELAY IN ENERGIZED STATE (RESET ACTUATED, NO TROUBLE IN CIRCUIT).
- LOAD MONITOR RELAY CONTACTS (K5 AND K6) SHOWN WITH RELAY IN ENERGIZED STATE. LOAD MONITORING MAY BE REQUIRED ON FORM A LOADS DEPENDING ON INSTALLATION AND ELECTRICAL CODES.
- FORM A AND B LOADS CAN BE USED SIMULTANEOUSLY ON EACH RELAY.

E028 **DIODES ACROSS K5 AND K6 COILS FOR D.C. OPERATION.

Figure 22–Terminal Connection Diagram

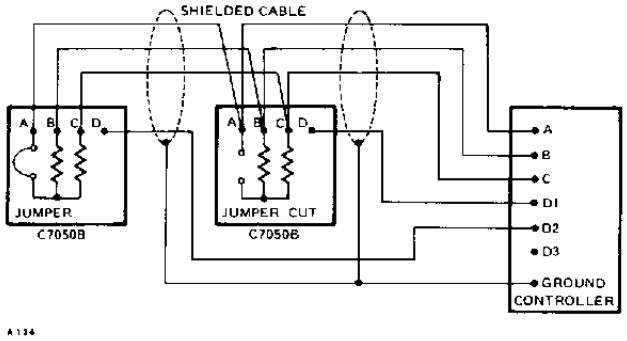


Figure 23—Wiring for Parallel Detectors

(see Figure 23). The detectors must be modified according to their electrical position in the group. The jumper "J" shown in Figure 24 must be used only in the last detector of a group of detectors wired in parallel. Jumper "J" in DE1555 and DE1666 models of the UV sensor module is a wire that is cut in all but the last detector of a group wired in parallel. Jumper "J" in models beginning with the DE1777 UV sensor module is a plug that must be installed only in the last detector of a group wired in parallel.

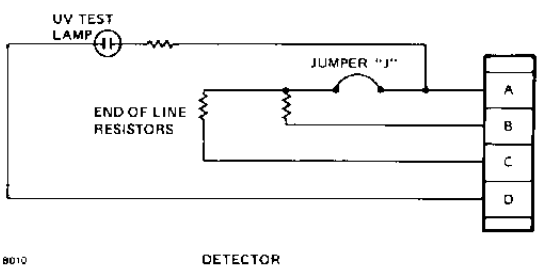


Figure 24—End Of Line (EOL) Resistors

In addition, the A-, B- and C-leads from the first detector must be connected directly to the A-, B- and C-connections in each succeeding detector of a parallel circuit. See Figure 23 for an example of a circuit wired in parallel.

The jumper wire on the detector monitor circuit board (board No. 3) in the controller, must be connected to the terminal that corresponds to the number of detectors that have their EOL resistors connected (up to four). See the "Circuit Board Setup" subsection for additional information.

Figures 26 and 27 in the "Typical System Application" section provide examples of relay load wiring.

Mounting Controller

The R7302 Controller is furnished with a field wiring connector that incorporates pressure type screw terminals for attaching wires and two edge connectors for plugging in the controller. The optional Q4001A Mounting Cage holds up to four controllers and is designed to fit into a standard 19-inch instrument rack. (The Q4001B holds one controller and the Q4001D holds two controllers.) The cage is designed to hold the field wiring connector(s) for ease in making electrical connections, installing and securing the controller(s).

NOTE

The R7302 Controller is not designed to be mounted in a hazardous location. DO NOT apply power to the controller in a hazardous area unless it is completely housed in an explosion-proof enclosure.

Circuit Board Setup

The following steps must be performed prior to applying operating power to the system:

1. **Setting detector rocker switches on the Automatic O_i Board**

   The four-rocker switch assembly on the Automatic O_i board should be set at this time. See Figure 8 for location of the switch assembly. The rocker switch assembly is set for eight detectors when shipped, and must be programmed for the number of detectors connected to the controller at the time of installation. The rocker switches are set in binary code to obtain eight different settings. The rocker switches are turned on when they are depressed toward the switch number on the assembly. See Figure 25 for an example of the switch assembly and setting of the rocker switches. The following table shows which rocker switches are to be selected for any number of detectors.

   NOTE

   If the rocker switch assembly is set for too many detectors, the controller generates a fault signal, the left digital display indicates the number of the selected, but missing detector(s) and the right digital display shows a 2. If the rocker switch assembly is set for too few detectors, the controller appears to operate normally, BUT ONLY THE NUMBER OF DETECTORS SELECTED ARE CHECKED BY THE AUTOMATIC O_i FEATURE. This condition will be found only when performing the manual O_i test procedure. See "Troubleshooting" and "Checkout Procedure" sections.

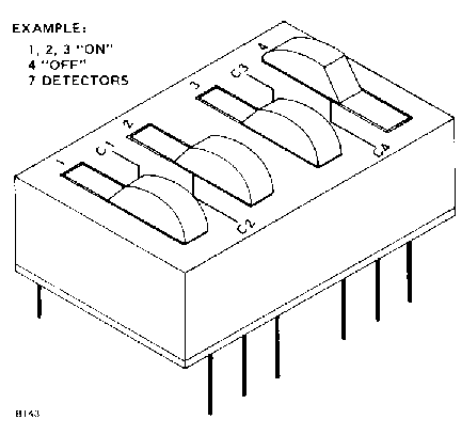


Figure 25—Rocker Switch Assembly

Number of Detectors Connected	Rocker Switch Position			
	1	2	3	4
1	on	off	off	off
2	off	on	off	off
3	on	on	off	off
4	off	off	on	off
5	on	off	on	off
6	off	on	on	off
7	on	on	on	off
8	off	off	off	on

2. Sensitivity Adjustment - Integrator and Comparator Board

The controller is shipped with the sensitivity set at 25 cps. If it is desired to change this setting, remove printed circuit board No. 2 (labeled "Integrator and Comparator"). See Figure 5. Position the wire on the terminal block to the desired sensitivity by moving the spade lug to the appropriate terminal. The numbers near each terminal indicate the sensitivity setting in counts per second (25, 50, 75 or 100). Firmly re-insert the printed circuit board.

3. End of Line Resistor ("Loop") Setting - Detector Monitor Board

The detector monitor board is programmed for one EOL resistor when shipped from the factory. If more EOL resistors are used, remove printed circuit board No. 3 (labeled "Detector Monitor"). See Figure 6. Position the spade lug of the jumper wire on the appropriate terminal for the number of detectors with EOL resistors connected. The system can include up to a maximum of eight detectors, but can have only four detectors with EOL resistors connected. To use more than four detectors, some of the detectors must be connected in parallel. When detectors are connected in parallel, only the detector that is at the "end of the line" must have its EOL resistors connected. The other detectors in the same parallel hookup (or "loop") must have their respective EOL resistors disconnected, either by cutting jumper wire "J" or by not installing jumper plug "J." Refer to Figures 23 and 24.

4. Time Delay Setting - Relay Drive Board

The time delay setting is adjusted at the factory for 5 seconds. The adjustment range is from 0.2 second to 12 seconds. If it is desired to change the time delay, place the NORMAL/BYPASS switch on the controller in the BYPASS position and turn on the input power. The FAULT lamp turns on and the digital display on the front panel of the controller turns on. The number of the detector being monitored is displayed on the left hand side and a number "8" is displayed on the right hand side.

Pushing the TEST button initiates a manual o¡ test. (See "Checkout Procedure.") A successful test causes the instant relay to energize, the INSTANT lamp to turn on and the right display to change to a "0." After the end of the time delay, the timed relay energizes and the TIMED lamp turns on. Adjust the potentiometer on the relay drive board (printed circuit board No. 1) to provide the desired time between the INSTANT and TIMED lights. See Figure 4 for location of potentiometer. Turning the potentiometer counterclockwise **increases** the time delay and turning clockwise **reduces** the delay. One turn equals approximately one second.

NOTE

UV radiation must be present continuously at the detector during the entire time delay period to actuate the timed relay. A brief interruption of the UV radiation detected by the sensor module causes the time delay period to start over again. If there is a chance of dense, heavy smoke during the initial period of combustion, a shorter time delay period may be appropriate.

TYPICAL SYSTEMS APPLICATIONS

The following are examples only and represent some typical applications. All relay contacts are shown in normal (standby) operating condition.

An external reset switch may be connected across terminals 22 and 24. (See Figure 22.) A jumper can be installed across these terminals in place of the reset switch and the FAULT lamp will stay on only while there is a fault condition and will come on momentarily when input power is applied.

Normally Energized Load - Instant Relay

Figures 26 and 27 illustrate examples of the instant relay wired to a normally energized load. Power to the external load (L1) is removed when the instant relay is energized. The bypass switches in this circuit allow checkout of the instant relay without interrupting power to the normally energized external load.

If only the normally closed contacts of the instant relay are in service and **an external bypass switch is not used**, a jumper must be connected between terminals 10 and either 18 or 20 to prevent interrupting the power to a normally energized load circuit when the internal bypass is activated (Figure 26).

NOTE

If normally open contacts are used to operate external equipment, the jumper mentioned above must not be installed. If it is, the equipment will operate normally even when the controller is in bypass.

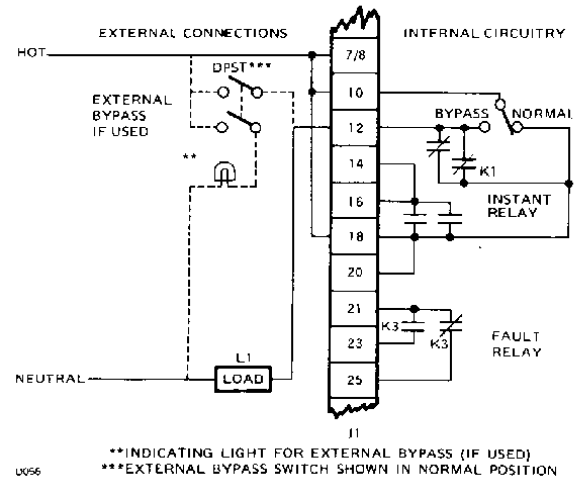
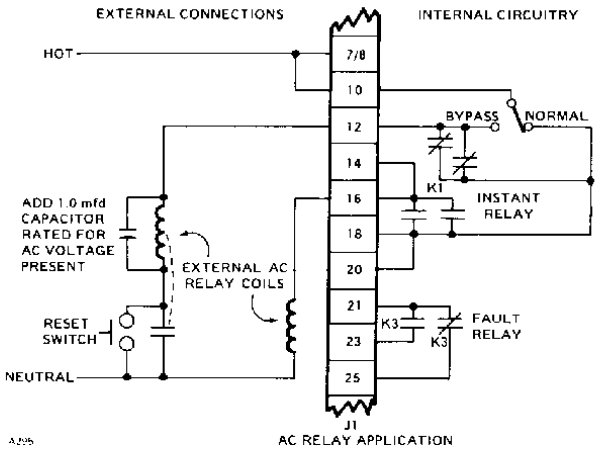


Figure 26—Normally Energized Load Circuit Connected to the Instant Relay

If both the normally open and normally closed contacts of the instant relay are in service, the load is an external, normally energized relay and **an external bypass switch is not used**, a modification as shown in Figure 27 is necessary.

Normally Energized Load - Timed Relay

Figures 28 and 29 illustrate examples of the timed relay wired to a normally energized load. Power to the external load (L2) is removed when the timed relay is energized. The bypass switches in this circuit allow checkout of the timed relay without interrupting power to the normally energized external load.



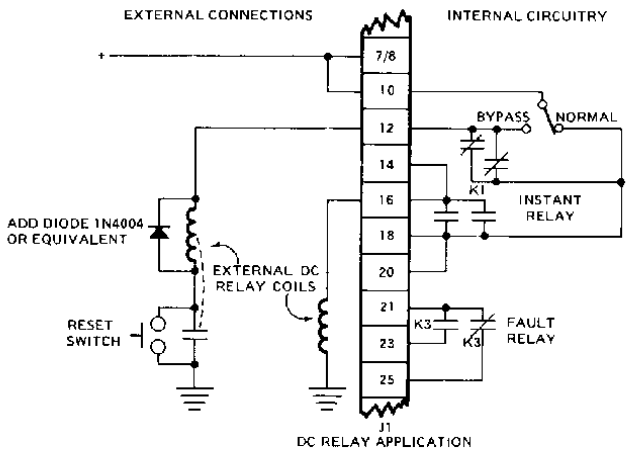


Figure 27—Normally Energized External Relay Connected to the Instant Relay

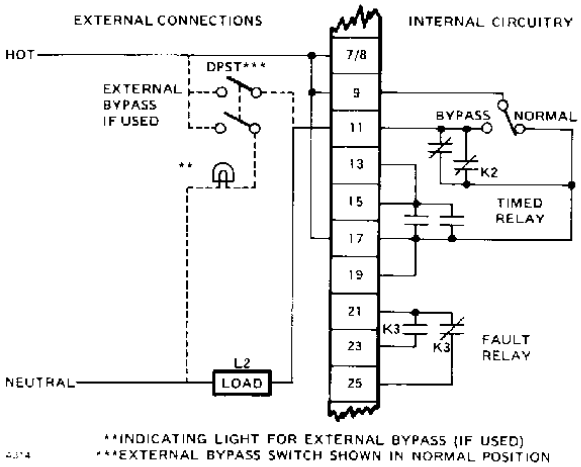


Figure 28—Normally Energized Load Circuit Connected to the Timed Relay

If only the normally closed contacts of the timed relay are in service and **an external bypass switch is not used**, a jumper must be connected between terminals 9 and either 17 or 19 to prevent interrupting the power to a normally energized load circuit when the internal bypass is activated (Figure 28).

NOTE

If normally open contacts are used to operate external equipment, the jumper mentioned above must not be installed. If it is, the equipment will operate normally even when the controller is in bypass.

If both the normally open and normally closed contacts of the timed relay are in service, the load is an external, normally energized relay and **an external bypass switch is not used**, a modification as shown in Figure 29 is necessary.

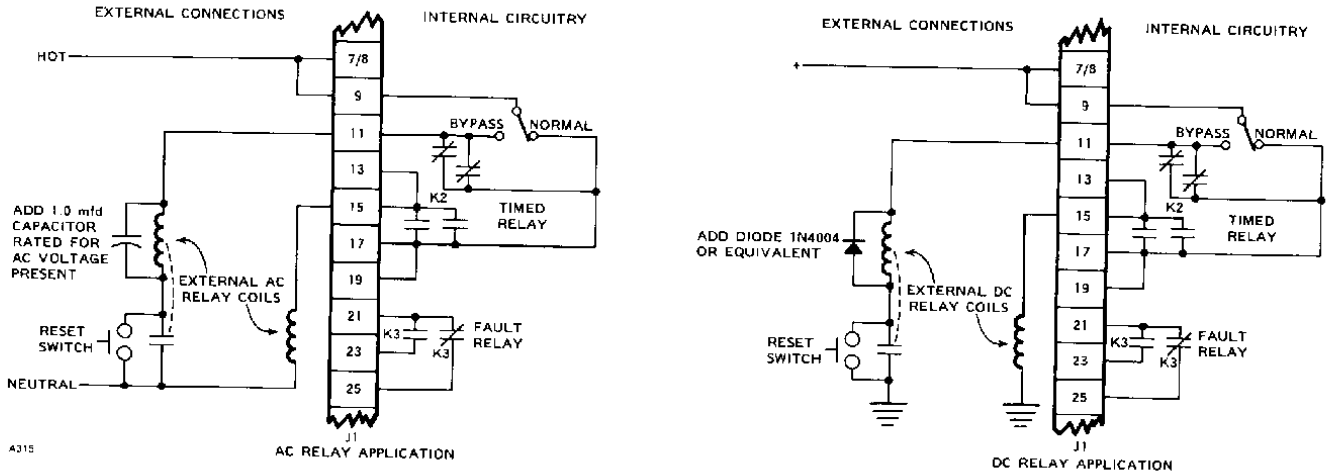


Figure 29—Normally Energized External Relay Connected to the Timed Relay

Normally De-energized Load - Instant Relay

Figure 30 illustrates an example of the instant relay wired to a normally de-energized load. Power is applied to the external load (L3) when the instant relay is energized. Actuation of either bypass switch allows checkout of the instant relay without applying power to the de-energized external load.

Normally De-energized Load - Timed Relay

Figure 31 illustrates an example of the timed relay wired to a normally de-energized load. Power is applied to the external load (L3) when the timed relay is energized. Actuation of either bypass switch allows checkout of the timed relay without applying power to the de-energized load.

Load Monitoring Relay (Optional)

Figures 32 and 33 illustrate examples of the load monitoring relay wired to a de-energized load. The fault relay contacts are shown with the fault relay energized (no trouble in circuit). The external bypass switch is shown in the normal position.

The load monitoring relays (K5 and K6) will de-energize under the following conditions:

- Open circuit in external load, external bypass switch or related wiring
- System in bypass
- Fault in controller
- Fault (short or open) in detector wiring.

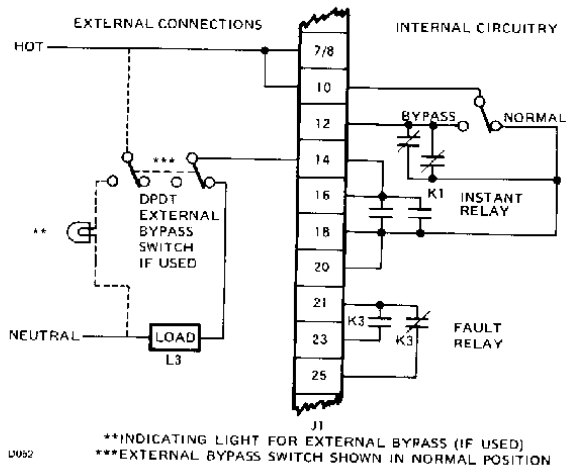


Figure 30—Normally De-energized Load Circuit Connected to the Instant Relay

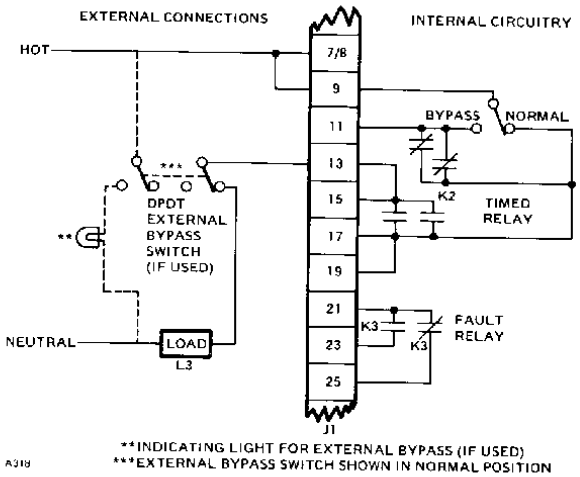


Figure 31—Normally De-energized Load Circuit Connected to the Timed Relay

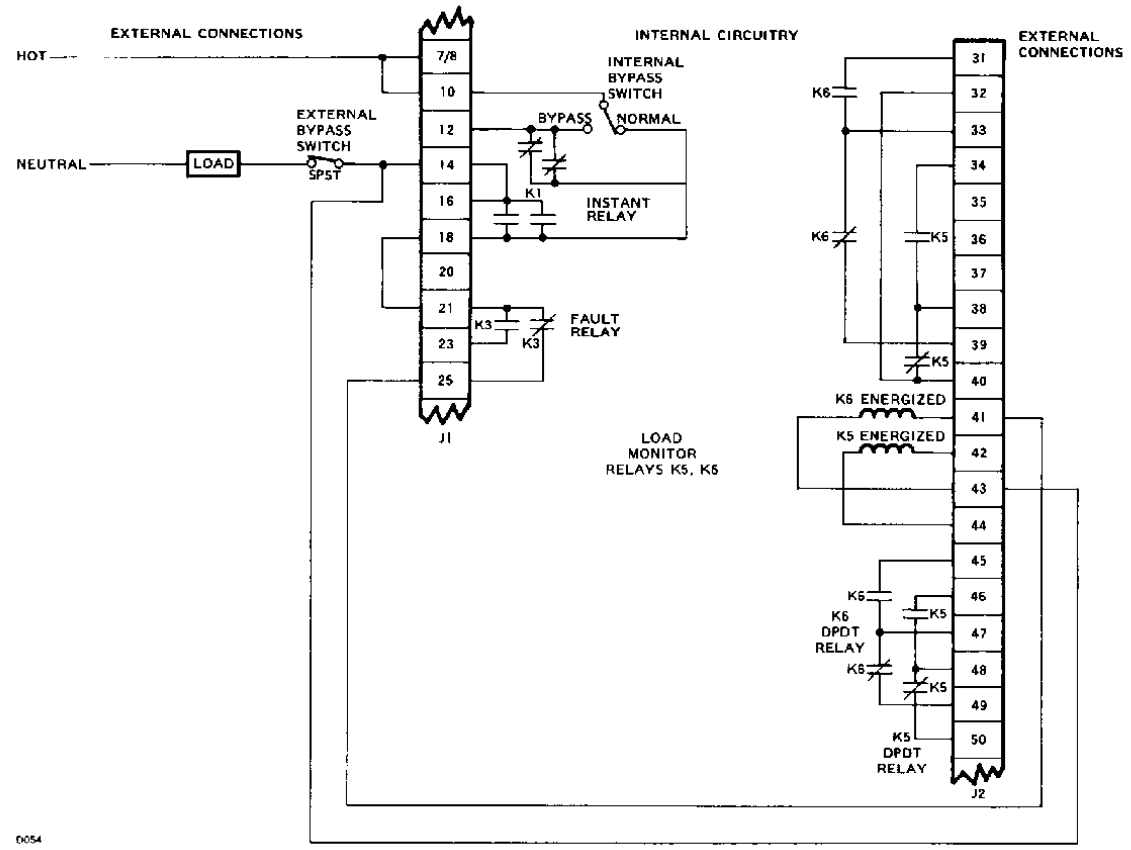


Figure 32–Normally De-energized Load Connected to the Instant (Alarm) Relay with Load Monitoring Relay

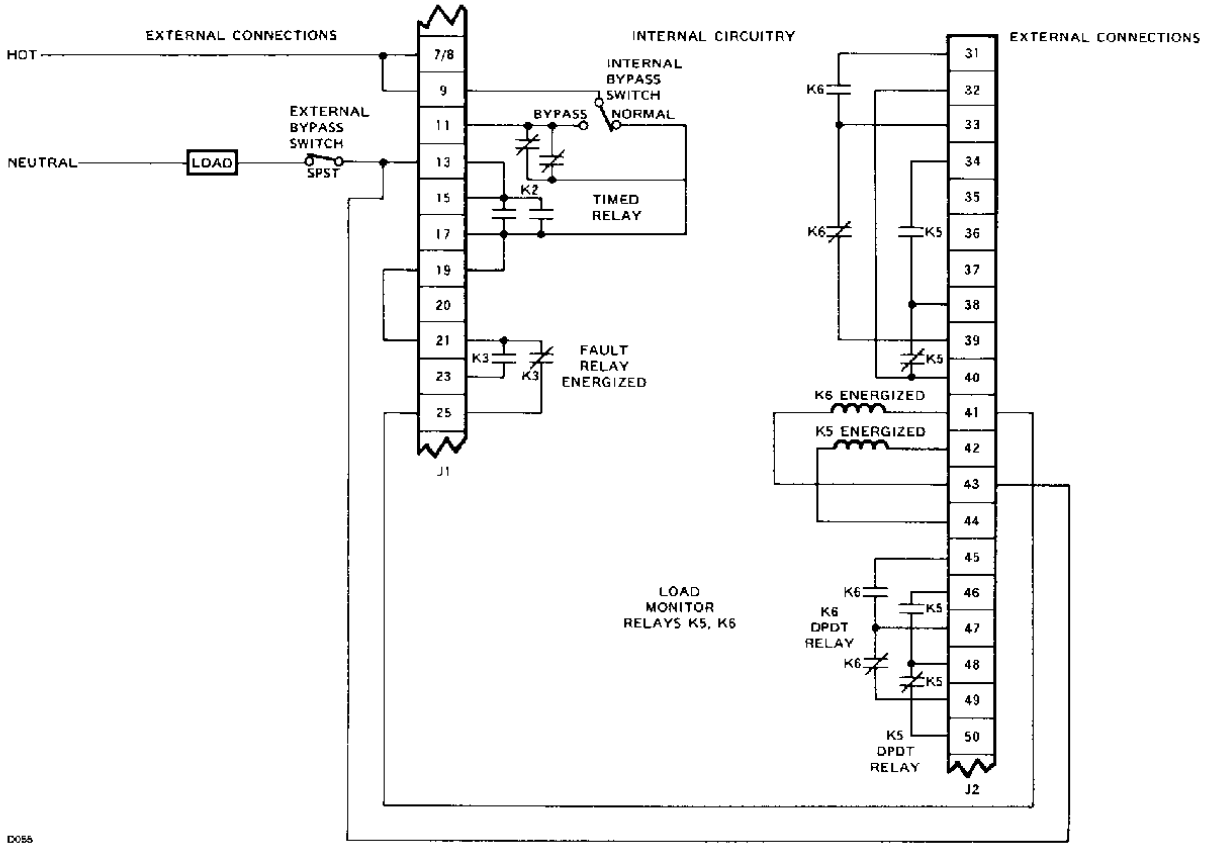


Figure 33–Normally De-energized Load Connected to the Timed (Extinguish) Relay with Load Monitoring Relay

Solid State Relays (Optional)

Figures 34 and 35 illustrate examples of wiring connections for both ac and dc solid state relays when used in the instant and timed relay positions (see "Options" section).

STARTUP CHECK

After the installation adjustments have been made, the sensitivity of the system should be checked. This requires two people, the use of a W866 Test Lamp (or an equivalent UV source), and a dc voltmeter with at least a 20,000 ohm/volt movement.

1. With the controller in bypass, turn on the W866 Test Lamp and shine it into the window of detector No. 1 from a distance of about 10 feet (3 meters).
   a. The INSTANT lamp should light immediately and the TIMED lamp should light when the time delay elapses.
2. Turn off the test lamp, move back about 5 feet (1.5 meters) and repeat the above procedure.
3. Repeat this process until the test lamp does not make the controller respond and then move closer to the window until the INSTANT lamp turns on.
4. This distance should be recorded for future reference when an overall checkup of the system is scheduled. (See recommended test form at the back of this manual.)
5. Repeat the above procedure for every detector in the system and record data.
6. Next, attach a voltmeter to the test points provided on circuit board No. 2 (the integrator and comparator board - see Figure 5 for location of test points). On newer models, the test points (labeled TEST VOLTAGE) are on the front panel.

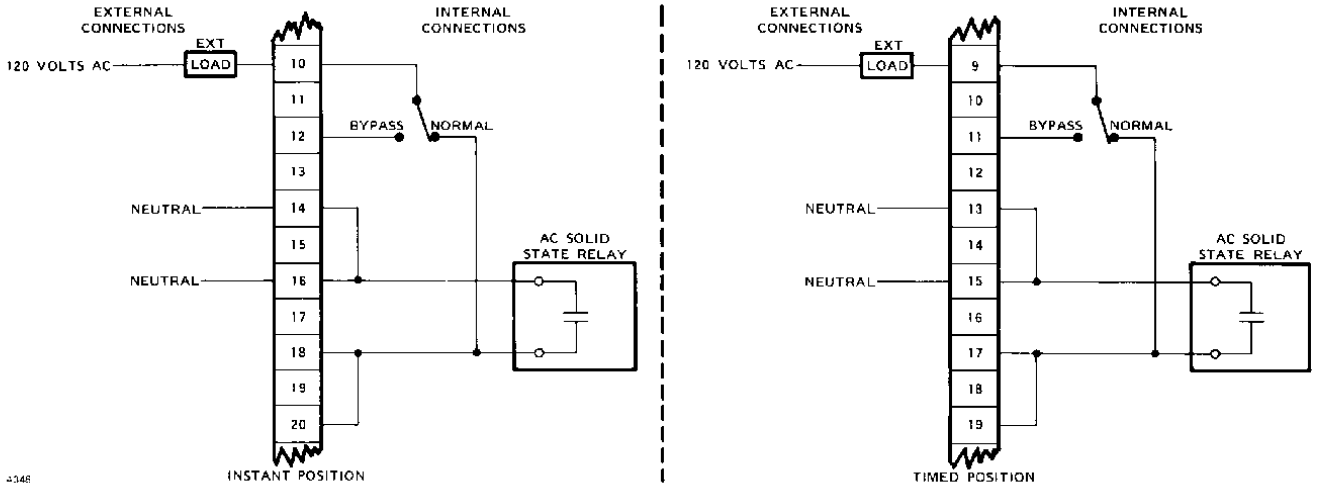


Figure 34—Typical Wiring Connections for R7302 Controllers with ac Solid State Relays

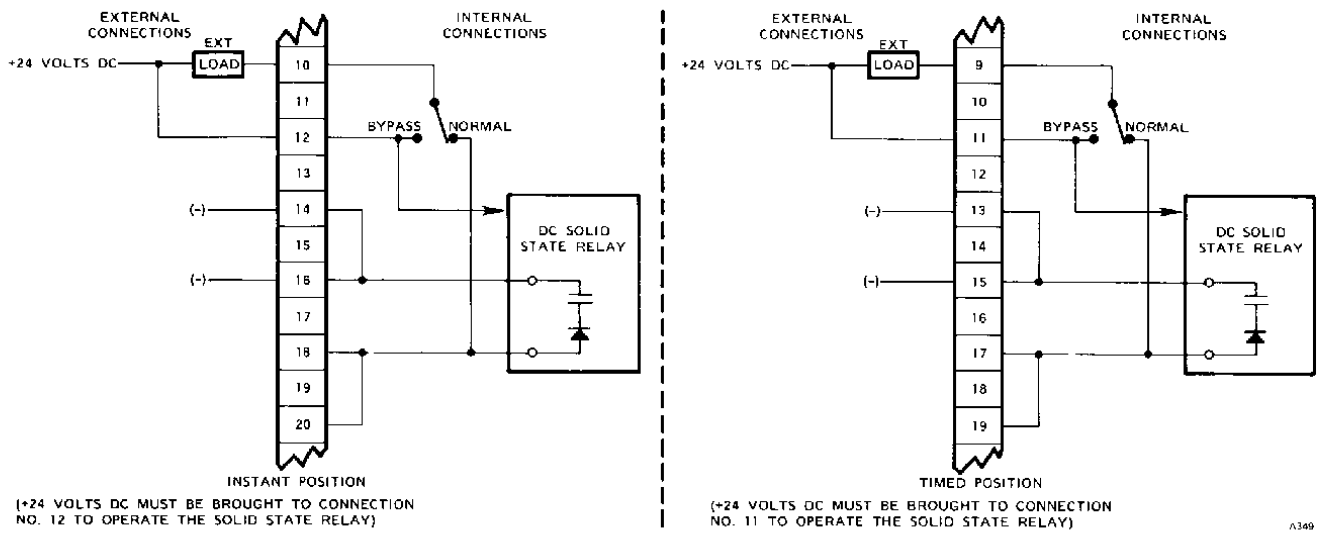


Figure 35—Typical Wiring Connections for R7302 Controllers with dc Solid State Relays

7. Set the meter on a scale where 0.2 volt dc can be read.

   a. When the detectors are not exposed to UV radiation, the voltage should be approximately 0.05 volts dc with pulses every 10 to 30 seconds up to 0.2 volts dc.

   b. If the voltage is above this level, see "Intermittent Activation of the Controller" in the "Troubleshooting" section.

CHECKOUT PROCEDURE

The Automatic **oi** system continuously monitors most of the system circuitry, however, it does not monitor the relay contact closure and some portions of the signal processing circuitry. It is important that the system be manually checked on a regular basis, using the manual **oi** checkout procedure given below. The manual **oi** test energizes the test lamp of the detector under test and (if held on) causes the instant and timed relays to energize (see "Theory of Operation" section).

NOTE

With the controller in the bypass mode, relay contact switching is electrically bypassed.

Manual oi Test

1. Place the NORMAL/BYPASS switch in the BYPASS position.

   a. The FAULT lamp turns on indicating that the controller is in BYPASS.

   b. The digital display is activated. The left display indicates which detector is selected for test. The right display indicates bypass mode (8).

2. Push and hold the TEST button. If the detector under test responds correctly:

   a. The instant relay is energized and the INSTANT lamp turns on.

   b. After three seconds, the right hand display changes from an "8" to a "0."

   c. After the preselected time delay, the timed relay is energized and the TIMED lamp turns on.

3. Release the TEST button.

   a. The INSTANT and TIMED lamps turn off.

4. Push the SELECT button.

   a. The controller selects the next detector to be tested.

5. Repeat the above sequence for each detector in the system.

If a fault is indicated by the digital display or one of the INSTANT or TIMED lamps does not light, refer to the "Troubleshooting" section. The right hand digital display changes from an "8" to a "0" approximately three seconds after the INSTANT lamp turns on. (If the transient arc rejection - TAR - option is employed, the "8" does not change to a "0.") Any other numbers that appear on the right display indicate a fault (see Table 2). Return the system to normal automatic operation by placing the NORMAL/BYPASS switch in the NORMAL position and pressing the FAULT lamp-RESET switch.

Manual System Checkout

The whole system should be periodically checked with a W866 UV Test Lamp (or equivalent UV source) to make sure that: (a) the detectors are not obstructed, (b) the viewing position of the detector has not changed, and (c) there is not a fault in the **oi** circuit.

1. Place the NORMAL/BYPASS switch in the BYPASS position.

   a. The FAULT lamp turns on to indicate that the system is in BYPASS.

   b. The digital display is activated. (Right hand display shows an "8.")

2. Move to the same distance from the detectors as recorded during the "Startup Check."

3. Turn on the W866 UV Test Lamp and shine into the detector's quartz window.

   a. The INSTANT lamp turns on.

   b. After the time delay, the TIMED lamp turns on.

4. Turn off the W866 UV Test Lamp.

   a. The INSTANT and TIMED lamps turn off.

5. Repeat the test at each detector.

If the lamps do not light, move closer to the detector until the lamps on the controller turn on. Check this distance against the original recorded distance for that detector. If there is a significant change in the distance, check the location and angle of the detector to see if it has been changed and check the quartz window on the detector to make sure it is clean. If everything is the same as it was originally and the window is clean, the sensitivity of the UV sensor tube has changed and it should be replaced. After checking all the detectors and the distances against the original recorded distances, return the system to normal operation by placing the NORMAL/BYPASS switch in the NORMAL position and pressing the RESET switch. The digital display will become blank and the FAULT lamp will turn off.

TROUBLESHOOTING

The automatic optical integrity (oi) feature automatically checks the controller and all the detectors in the system. This monitors most faults that could occur in the system, including a failure in the wiring between the detectors and the controller. If a fault occurs, the fault relay is de-energized, the FAULT lamp is illuminated and the digital display on the front of the controller is activated. The right display indicates the type of fault that has occurred. If there is a detector fault, the left display indicates which detector is affected. If a detector is not affected, the left display may be blank or a "0" or any other previously "latched in" number may be displayed. (The number has no significance when this type of fault occurs.) Table 2 lists the fault and detector identification code.

NOTE

Record all faults on Fault Record Sheet, Figure 38.

Failure of Instant or Timed Relay

When performing the "Checkout Procedure," if the INSTANT lamp does not light but the TIMED lamp lights, it indicates a burned out INSTANT lamp or a defective Instant relay. Check the lamp and replace it if it is burned out. If this does not correct the fault, replace the instant relay and repeat the "Checkout Procedure." If neither of these corrects the fault, replace circuit board No. 1.

If the INSTANT lamp lights, but the TIMED lamp does not, there are four possible reasons:

1. Check and replace the lamp if it is burned out. If this does not correct the fault -

2. Turn off input power and replace the timed relay. Turn on input power and repeat checkout procedure. If this does not correct the fault -

3. Turn off input power and replace circuit board No. 1 (relay drive board). Turn on input power and repeat "Checkout Procedure." If this does not correct the fault -

4. Turn off input power and replace circuit board No. 4 (power supply board). Turn on input power and repeat "Checkout Procedure."

CAUTION

—In a hazardous location, no input power should be connected unless the unit is in an explosion-proof enclosure.

—For safety from shock hazards, always disconnect input power before removing or replacing components or boards.

—Check the POWER lamp to see if it is "on." If not, put NORMAL/BYPASS switch in BYPASS position. The FAULT lamp should come on. If not, check for input power. If the FAULT lamp comes on, but not the POWER lamp, replace the POWER lamp.

—Remove power to the controller or place NORMAL/BYPASS switch in the BYPASS position when cleaning the detector windows. It is possible to create a static charge on the windows during cleaning that could cause the detector to respond, thus activating the controller relays.

Fault Identification

In the event of a system malfunction, the fault identification circuitry activates the front panel digital display to identify (by code number) the nature of the fault (Table 2). When a fault occurs, the fault relay is de-energized, the FAULT lamp is illuminated, and the digital display is activated. The right hand display indicates the fault code and (if there is a detector fault) the left hand display identifies the number of the affected detector.

When more than one fault occurs at the same time, a priority system of identification is automatically employed. (See "Theory of Operation" section.) When one fault occurs before another, the code of the first is captured and retained (latched) on the digital display until the controller is placed in the bypass mode. This ensures that identification of transient faults will not be "lost." In the bypass mode, the number of the highest priority fault is displayed. As each fault is repaired (with the system in bypass), the next lower priority fault is displayed.

Voltages to Aid in Troubleshooting (Measured at Controller)

A to Ground: 290 volts dc

B to Ground: 0.4 volt dc per detector with jumper "J" in place. The manual oi test (in bypass mode) causes the detector to send a series of voltage pulses to the controller. The waveform on the B-lead when a detector is being tested is illustrated in Figure 36.

C to Ground: 1.2 volts dc +0.4 volt dc per detector with jumper "J" in place.

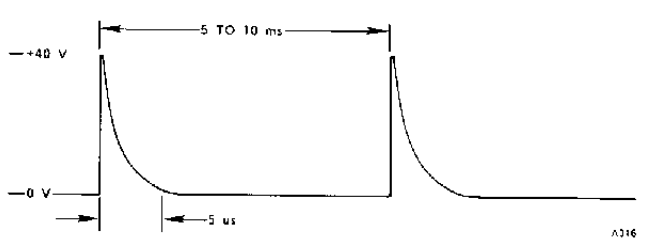


Figure 36—Detector B-lead Waveform

Table 2--Fault Identification

Display		Type of Fault
Detector (Left)	Fault (Right)	
0* or Blank	0	1. Detectors responding to a UV source which is not large enough to indicate a fire condition. 2. One or more of the detectors is becoming sun sensitive (if detector is located outdoors). 3. High multiple count rate in one or more of the sensor modules. 4. Integrator and comparator board (circuit board No. 2) malfunction. 5. The system has responded to a fire and the instant and timed relay have de-energized.
0*	1	1. Standby dc power interrupted (models with ac to dc switchover feature).
Blank	2	1. Automatic oi board (circuit board No. 5) malfunction. 2. Automatic oi board missing from circuit.
1 - 8**	2	1. Detector indicated by the left display has reduced sensitivity due to a dirty window. 2. Detector indicated by the left display has reduced sensitivity due to a failure of the UV sensor tube. 3. Integrator and comparator board (circuit board No. 2) malfunction.
0*	3	1. The detector monitor board (board No. 3) is set for **fewer** detectors with EOL resistors connected (loops) than are present in the detector circuitry. 2. High current leakage on the C-lead. 3. Malfunction of detector monitor board (board No. 3).
0*	4	1. C-lead shorted to ground. 2. C-lead is open or the C-lead is shorted to the B-lead.
0	5	1. The detector monitor board has been set for more detectors with EOL resistors connected than are present in the detector circuitry. The "0" in the left display indicates all detectors are operational **in this case only**.

Display		Type of Fault
Detector (Left)	Fault (Right)	
1 - 8** or ***	5	1. A-lead is open. 2. B-lead is open. 3. B-lead is shorted to ground. 4. UV sensor module is missing in one or more detectors.
***	6	1. The +290 volt dc supply not operating. 2. A-lead shorted to B-lead. 3. A-lead shorted to C-lead. 4. A-lead shorted to ground.
0*	7	1. +28 volt dc low voltage supply not operating. 2. Integrator and comparator board (circuit board No. 2) malfunction (or not installed).
0*	8	1. Relay drive board (circuit board No. 1) malfunction (or not installed). 2. One of the output relays missing or the coil is open (instant, timed or fault relays). 3. Controller has not been reset after the controller is placed in normal operation.
1 - 8**	8 (Blinking 2)	1. System in bypass mode. Left display indicates detector selected for manual oi test. Pushing TEST button on controller changes right display to a "0." 2. If the right display does not change to "0" when the TEST button is pushed (and circuit board No. 2 is not a TAR board) there is a fault in the Automatic oi board.
***	Blank	1. Detector monitor board (circuit board No. 3) malfunction (or not installed).
Blank	Blank	1. Normal operation. Controller in normal mode and POWER light is "on." 2. All front panel lights off indicates loss of input power. POWER lamp should be on whenever power is applied. 3. Power supply board (circuit board No. 4) malfunction.

*Indicates "0" normally, although any other number may occur. The number has no significance in this type of fault.

**Number shown on the left display indicates the affected detector.

***Display cycles through the numeral of the detectors selected on the Automatic oi board switch.

A to D: **Do not** check when controller is set for NORMAL. To check, place the controller in BYPASS. Use a meter with a movement of at least 20,000 ohms/volt.

1. Should measure less than 1 volt dc.

2. Should measure 290 vdc when the same D-lead is selected in a manual **oj** test and the TEST button is pushed.

3. Due to the meter loading factor, the voltage from the D-lead to ground measures approximately +260 vdc. When the TEST button is depressed (in bypass mode) the voltage on the D-lead of the detector under test drops to 0.5 vdc or less (see Figure 37).

Terminal 22 to terminal 2: 28 volts dc.

Test points on board No. 2 (Integrator and Comparator board and on front panel on some models:

1. 0.05 volt dc when controller is set for bypass mode and no UV is present at detectors.

2. 0.1 volt dc to 0.2 volt dc pulsing when controller is set for normal mode.

3. 2.0 volt dc to 4.9 volt dc **averaged** over 10 to 20 seconds when TEST button is pressed in bypass mode.

Intermittent Activation of the Controller

If the FAULT lamp of the controller intermittently turns on and the digital display is activated with a "0" displayed on the right side, one (or more) of the UV sensor tube modules is overly sensitive or is detecting spurious UV radiation that is not strong enough to initiate a fire response sequence. (See "Theory of Operation" section.)

To check for these conditions, perform the following steps:

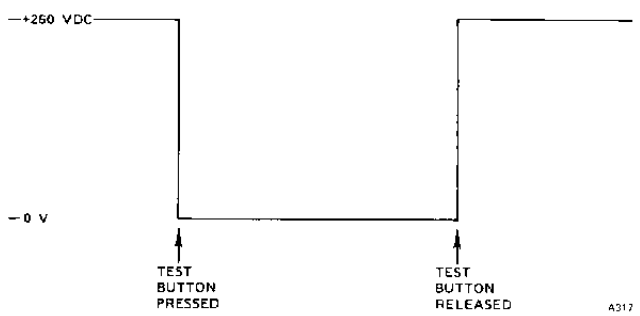


Figure 37—Detector D-lead Voltage - Manual Test

1. Place the R7302 Controller NORMAL/BYPASS switch in the BYPASS position.

   a. The FAULT lamp turns on and the digital display is activated with an "8" displayed on the right side.

2. Place a voltmeter capable of measuring 0.05 volts dc across the test points provided on top of the integrator and comparator board (see Figure 12). Red is + and black is -. (On newer controllers the test points are on the front panel.)

3. If the voltage pulses over 0.2 volts dc every two or three seconds, one (or more) UV sensor module is overly sensitive or is detecting spurious UV radiation from some other source.

NOTE

Pulses over 0.2 volts dc occurring every 10 to 30 seconds are not unusual. These are random "counts" caused by cosmic radiation.

4. Cover the window of each detector to see if the voltage returns to normal (0.05 volts) and pulses do not occur more often than every 10 to 30 seconds.

   a. If the voltage returns to normal when a detector window is covered, check for other sources of UV radiation. If no source of UV radiation (such as distant arc welding) is found, turn off power to the controller and replace the UV tube module in the detector.

DANGER

TURN OFF POWER TO CONTROLLER BEFORE OPENING DETECTOR HOUSING. Opening the detector in a hazardous area without turning off the input power to the controller may cause a fire or explosion. It also exposes the high voltage potential on the connections of the UV tube module and could cause electrical shocks.

   b. If the voltage does not return to normal when all the detector windows are covered, continue with the following steps.

5. Turn off power to the controller.

6. Starting at detector No. 1, remove the detector housing and the UV sensor tube module. Re-assemble detector housing.

7. Turn on power to the controller. If the voltage at the test points drops to normal (0.05 volts dc) and does not pulse over 0.2 volts dc more often than every 10 to 30 seconds, replace the UV sensor tube module with a new one. Be sure to **turn off** the input power before

removing detector housing to install the new tube module. If there is no change, **turn off** input power to the controller and re-install the original UV sensor tube module. Continue to each detector and repeat steps 6 and 7.

8. After any defective UV tube modules have been replaced, place the controller NORMAL/BYPASS switch in the NORMAL position. Reset the unit by depressing the FAULT lamp-RESET switch.

NOTE

It is the responsibility of the user to see that fire protection equipment controlled by the R7302 is disabled while all tests are performed and is re-enabled at the end of the testing.

After system faults have been corrected, the complete "Startup Procedure" should be performed before returning the system to normal operation.

Do not attempt to repair the UV sensor tube module or the printed circuit boards in the controller. Return all faulty items to the factory for repair.

ORDERING INFORMATION

When ordering specify the model:

- Without load monitor - R7302B

  With load monitor - R7302D (also specify operating voltage and pull-in current of the loads that are to be monitored).

  Without load monitor but with ac to dc switchover - R7302H.

  With load monitor and with ac to dc switchover - R7302F.

- Input voltage - 120 vac, 50/60 Hz
  220/240 vac, 50/60 Hz
  12 vdc
  24 vdc

- Relays - Standard relays
  Solid state relay (ac or dc)
  Hermetically sealed relays

REPLACEMENT PARTS

Model Number	Part Number	Description	Used On	Recommended Quantity
–	002519-001	Replacement oj Snap-in Ring	C7050B	†
K1002A	002507-001	Window Cleaning Kit (2 bottles of cleaner, 8 oj snap-in rings	C7050B	††
DE1666	001834-001	UV Sensor Tube Module	C7050B	1
DE1777	002181-001	UV Sensor Tube Module (replaces DE1666)	C7050B	1
**DE1049x	**002452-xxx	Relay Drive Board No. 1	R7302	1
**DE1048x	**002451-xxx	Integrator and Comparator Board No. 2	R7302	1
DE1047B	002450-002	Detector Monitor Board No. 3	R7302	1
DE1046B	002449-001	Power Supply Board No. 4	R7302	1
DE1529A	002454-001	Automatic oj Board No. 5	R7302	1
DE7403D	002453-002	Inverter Board (12 volts dc)	R7302	1
DE7403C	002453-001	Inverter Board (24 volts dc)	R7302	1
–	101164-001	Plug-in Relay (bypass, instant, timed and fault)	R7302	1
–	101295-001	Hermetically sealed 24 volt dc relay, octal base	R7302	*
–	101166-002	Load Monitor Relay (240 volt ac, 8.8 ma)	R7302	*
	101166-001	Load Monitor Relay (120 volt ac, 17 ma)	R7302	*
–	101164-001	Load Monitor Relay (24 volt dc, 51 ma)	R7302	*
–	101165-001	Load Monitor Relay (24 volt dc, 5 ma)	R7302	*
DE1112	001112-004	Solid State 24 vdc relay	R7302	*
–	101167-001	Solid State 120 vac relay	R7302	*
–	101017-004	Lamp, 28 volt	R7302	2
–	101211-001	Manual Reset Switch/Fault Lamp	R7302	1
–	101090-001	Lamp, Ultraviolet	W866	1
DE1048L	002451-004	Transient Arc Rejection Board (Takes place of standard No. 2 Board)	R7302	*

*If these optional features are part of systems, one replacement assembly is recommended.

**These boards vary according to model. Check board for dash number (example DE1048K) or part number (example 001746-003).

†One per detector. ††One per controller.

- C7050B Detector enclosure material -
  Copper-free red anodized aluminum
  Nickel-plated brass
  316 stainless steel

Accessories

W866 explosion-proof portable UV Test Lamp (see form 95-8169 for details)

R6001 Auxiliary Zone Unit (see form 90-1005 for details)

Window cleaner for detectors (part no. 001680-01).

Transient arc rejection board (see form 75-1002 for details)

Latching relay board

Load monitor relays

Automatic ac/dc switchover

Q9001B Swivel Mounting Bracket for C7050 Detectors

Q4001A Mounting Cage (see form 95-8217 for details)

Q4001B Mounting Cage (see form 95-8234 for details)

Q4001D Mounting Cage

Filler panels for Q4001A and Q4001D Mounting Cages (part no. 001397-01)

Front insertion mounts with mounting flange and quick-connect coupling for use of the C7050 in "dirty" environments (see form 95-8228 for details)

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

Detector Electronics Corporation
Sales and Application Engineering
6901 West 110th Street
Minneapolis, Minnesota 55438 U.S.A.
Telephone: (612) 941-5665
Telex: 29-0562

DEVICE REPAIR

For devices or components in need of repair, contact your local source or return to:

Detector Electronics Corporation
Return Goods Department
6901 West 110th Street
Minneapolis, Minnesota 55438 U.S.A.

Fault Record Sheet

Date	Time	Left Display	Right Display	Operator	Comments

Figure 38—Fault Record Sheet

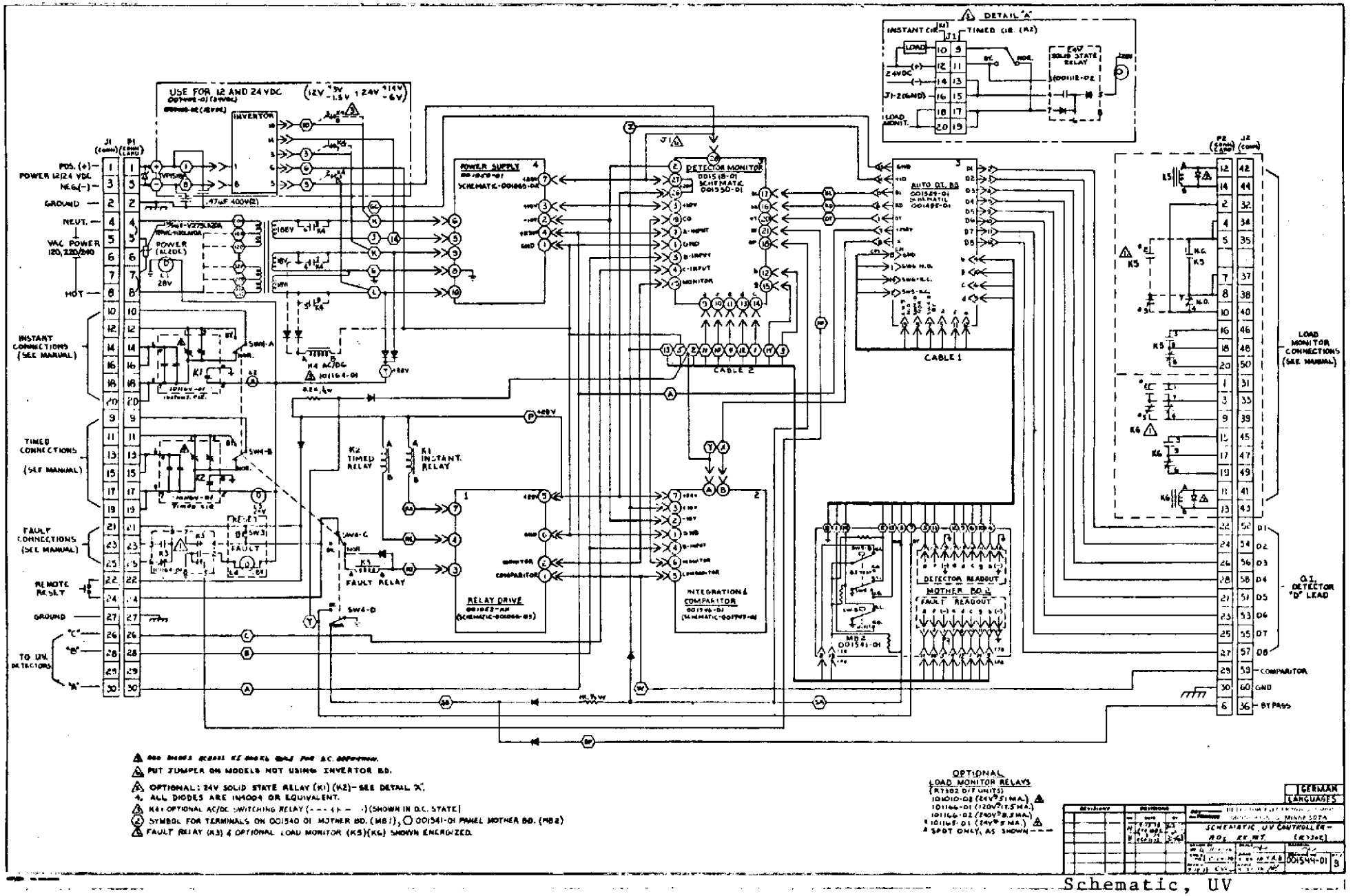
APPENDIX

UV Absorbing Gases and Vapors

The following 38 substances exhibit significant UV absorption characteristics. These are also generally hazardous vapors.

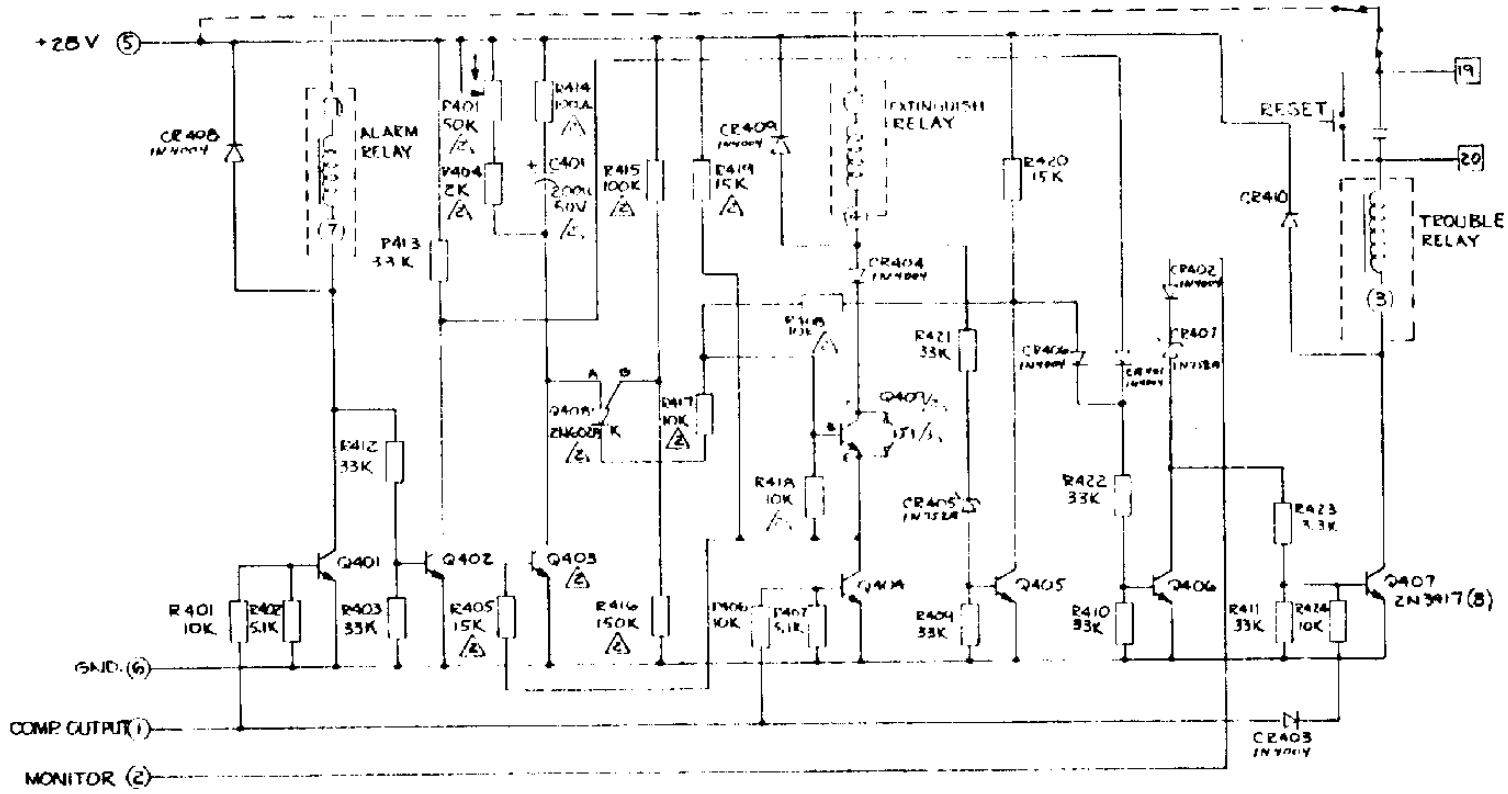
Substances such as methane, propane butane, hexane, camphor and octane, for example, are not UV absorbing.

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



Schematic, UV Controller

ASSY NO.		J1
001053-01	'A'	—
-02	'B'	X
-03	'C'	X



⚠ SEE TAB

2. COMPONENTS REMOVED ON 'B' BOARD

ALL RESISTORS ½W, ± 5% UNLESS OTHERWISE INDICATED.

REVISIONS			
NO.	DATE	BY	
A	12.03.79	D.O.	
B	6.12.79	D.O.	

DET — TRONICS MPLS, MINN.

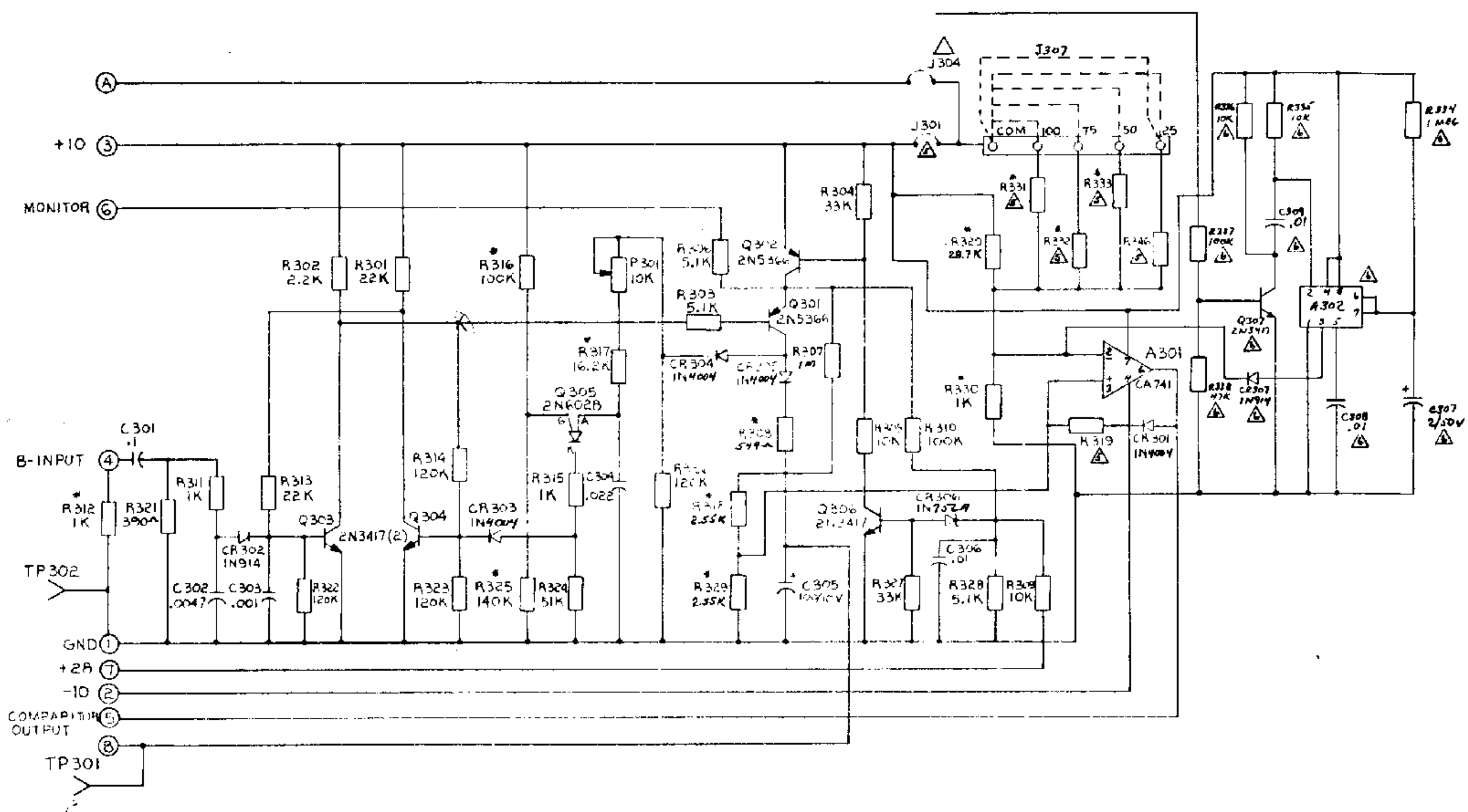
SCHEMATIC, P.C. BD. RELAY DRIVE CPT (P2300, 1, 2, 3)

DRAWN BY D.O.

DRAWING NO. 001053-05 REV C

Schematic - Relay Drive Board (SHEET ONE OF TWO SHEETS)

BOARD	R319	R331	R332	R333	R346	J301	J304	J307		COMMENTS
001746	220K	6.81K	9.09K	14.7K	51.1K	—	1	—		STD O_I B
-	220K	6.81K	9.09K	14.7K	51.1K	1	—	—		STD NON O_I
-0	56.2K	—	—	—	—	—	1	—		10CPS LATCHING
SEE NOTE 6 -04(G)	56.2K	—	—	—	—	—	1	—		10CPS LATCHING/ DELATCHING AND O_I
SEE NOTE 6 -05(P)	36.5K	—	—	—	51.1K	—	1	1		25CPS LATCHING/ DELATCHING AND O_I



J307
J304
J301
COM
100
75
50
25
+10 ③
MONITOR ⑥
B-INPUT ④
C301 .1
R312 1K
R321 390Ω
R311 1K
CR302 1N914
C302 .0047
C303 .001
R313 22K
Q303
2N3417(2)
R322 120K
Q304
R302 2.2K
R301 22K
R314 120K
CR303 1N4004
R323 120K
R325 140K
R316 100K
R315 1K
R324 51K
Q305 2N6028
R317 16.2K
P301 10K
C304 .022
R306 5.1K
R303 5.1K
Q302 2N5366
Q301 2N5366
CR304 1N4004
CR305 1N4004
R307 1M
R308 549Ω
R304 33K
R305 10K
R310 100K
Q306 2N3417
CR306 1N752A
C306 .01
C305 10/10V
R327 33K
R328 5.1K
R309 10K
R329 2.55K
R320 28.7K
R331
R332
R333
R346
R330 1K
A301 CA741
R319
CR301 1N4004
R337 100K
R318 47K
R336 10K
R335 10K
Q307 2N3417
CR307 1N914
C309 .01
A302
C308 .01
R334 1 MEG
C307 2/50V
TP302
GND ①
+28 ⑦
-10 ②
COMPARATOR ⑤ OUTPUT
⑧
TP301

⑥ ADD COMPONENTS FOR 001746-04(G) AND 001746-05(P) BOARDS

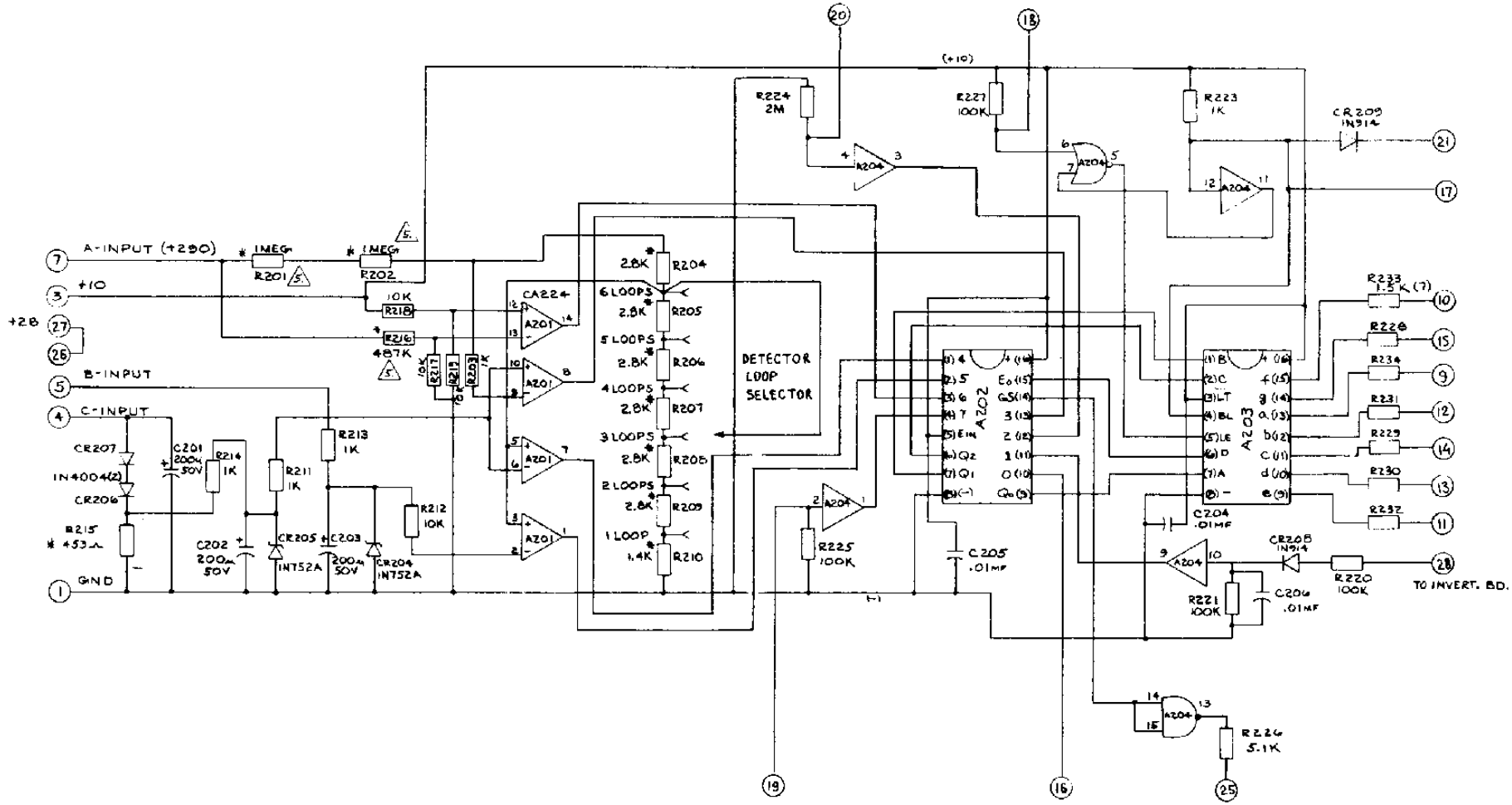
⑤ SEE TAB

4. FOR ASSY SEE 001746-XX

2. * INDICATES ± 1% TOLERANCE

1. ALL RESISTORS ½W, ± 5% UNLESS INDICATED OTHERWISE. ALL CAPACITOR VALUES ARE IN MICRO FARADS. ALL CAPACITORS ARE RATED 100VDC UNLESS INDICATED OTHERWISE.

TOLERANCES	REVISIONS			DET-TRONICS	DETECTOR ELECTRONICS CORP. MINNEAPOLIS, MINNESOTA
	NO	DATE	BY	SCHEMATIC, P.C. BD. - INTEG./COMPAR. "CB2" ([illegible], 1, 2, 3)	
DECIMAL	A	11-5-78 ECO 1098	[illegible]	DRAWN BY [illegible]	SCALE [illegible]
FRACTIONAL	B	[illegible]-8-79 ECO 1149	[illegible]	CHK'D [illegible]	MATERIAL [illegible]
ANGULAR	C	7-5-79 ECO 1193	[illegible]	[illegible] 7-7-78	DRAWING NO [illegible] REV C



△5 INDICATES 350V. RESISTOR.

4. A202(14532), A203(14511), A204(14572)

3. A201 (CA224) PIN 4 (+10), PIN 11 (GND)

2. * INDICATES ± 1% TOLERANCE

1. ALL RESISTOR ½W, ± 5% UNLESS OTHERWISE INDICATED.

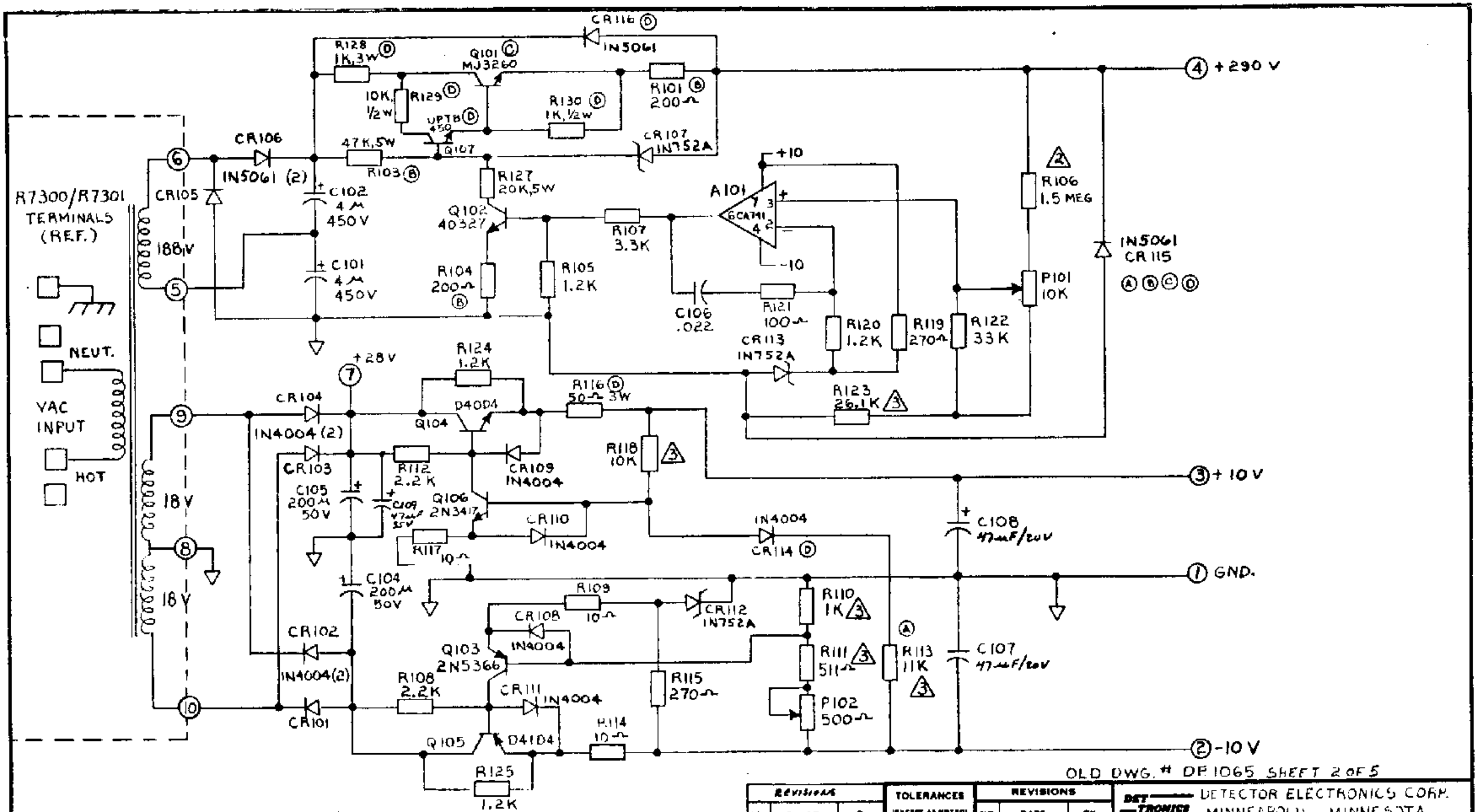
REVISIONS		
NO	DATE	BY
1		
2		
3	11-2-77	
4		
5		

DETECTOR ELECTRONICS CORP.
MPLS, MINN. 55435

SCHEMATIC
DETECTOR MONITOR - AUTO. O.I.

DRAWN BY D. ST.	SCALE	MATERIAL	
CHK'D J.G.	DATE 9-2-76	DRAWING NO 001530-01	REV. 3
TRACED	APP'D		

SCHEMATIC, DETECTOR MONITOR
(CIR.BD.3-A01) - R7302,R7303


R7300/R7301
TERMINALS
(REF.)
NEUT.
VAC
INPUT
HOT
188V
18V
18V
+290 V
+10 V
GND.
-10 V
+28V
+10
-10
CR116 (D)
IN5061
R128 (D)
1K,3W
Q101 (C)
MJ3260
R101 (B)
200Ω
10K,
1/2W
R129 (D)
UPT8 (D)
450
Q107
R130 (D)
1K,1/2W
CR107
IN752A
CR106
IN5061 (2)
47K,5W
R103 (B)
CR105
C102
4µ
450V
C101
4µ
450V
R127
20K,5W
Q102
40327
R104
200Ω
R105
1.2K
R107
3.3K
A101
6CA741
R106
1.5 MEG
IN5061
CR115
P101
10K
C106
.022
R121
100Ω
R120
1.2K
R119
270Ω
R122
33K
CR113
IN752A
R123
26.1K
R124
1.2K
D4004
Q104
R116 (D)
50Ω 3W
CR104
IN4004 (2)
CR103
R112
2.2K
CR109
IN4004
R118
10K
C105
200µ
50V
C109
47µF
35V
Q106
2N3417
CR110
IN4004
R117
10Ω
IN4004
CR114 (D)
C108
47µF/20V
C104
200µ
50V
R109
10Ω
CR112
IN752A
R110
1K
CR108
IN4004
Q103
2N5366
CR102
IN4004(2)
R111
511Ω
R113
11K
C107
47µF/20V
R108
2.2K
CR111
IN4004
R115
270Ω
P102
500Ω
CR101
Q105
D4104
R114
10Ω
R125
1.2K

OLD DWG. # DF1065 SHEET 2 OF 5

4. SYM. O = BD. CONN'S

(3) INDICATES ± 1% TOLERANCE

(2) INDICATES 350 V RESISTOR

1. ALL RESISTORS 1/2 W, ± 5% UNLESS OTHERWISE INDICATED.

REVISIONS		
No	DATE	BY
F	11-8-78 PCO 1104	

TOLERANCES (EXCEPT AS NOTED)
DECIMAL ±
FRACTIONAL ±
ANGULAR ±

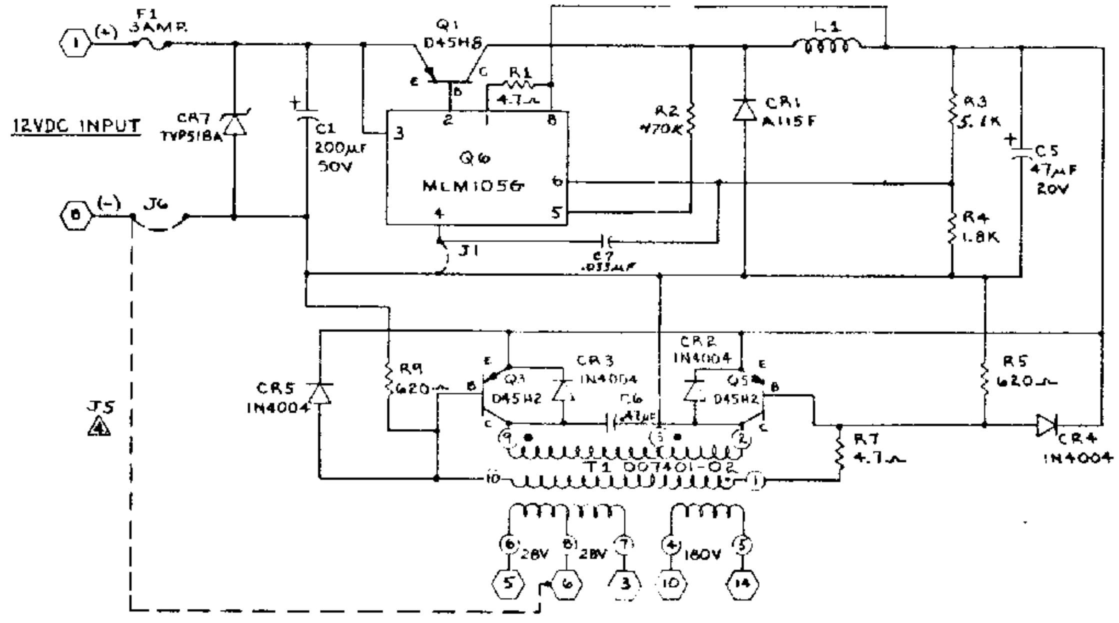
REVISIONS		
NO.	DATE	BY
A	2-25-74	L.B.
B	9-18-74	L.B.
C	1-28-76	D.G.
D	10-12-76	M.D.
E	8-1-78	

DET-TRONICS DETECTOR ELECTRONICS CORP. MINNEAPOLIS, MINNESOTA

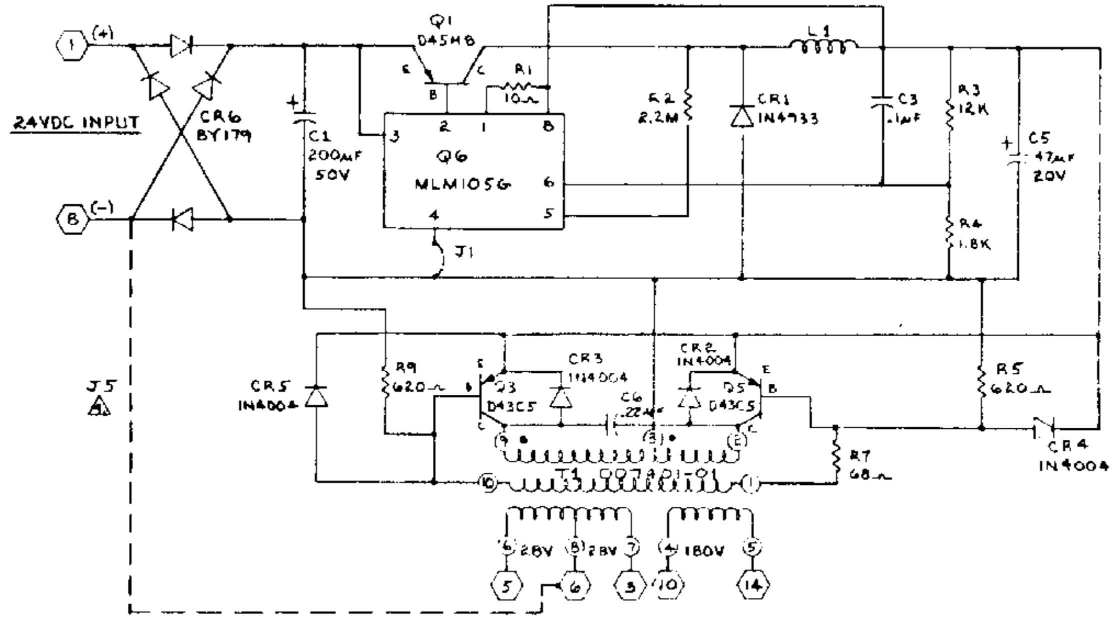
SCHEMATIC, P.C. BD - PWR SUPPLY "CBY" (R7300, 1, 2, 3)

DRAWN BY	SCALE	MATERIAL
7-16-73 R.P.		
CHK'D 11-6-78	PROD. 7-11-73 T.A.H.	DRAWING NO.
DES. 7/3/78	7-13-78	001065-02 F

Schematic, P.C. BD - PUR Supply



007409-02



007409-01

007409-XX	DEVICE NO.
(24VDC) -01	DE 7403 C
(12VDC) -02	DE 7403 D

4. ⚠ JUMPER USED ON R7300 CONTROLLER.
3. ◯ = TRANSFORMER PINS
2. ⬡ = P.C. BD. TERMINAL CONNECTIONS.
1. ALL RESISTORS ½ WATTS

REVISIONS		
NO.	DATE	BY
F	8/22/77	
F1	6-8-78	
G	10-27-78 ECO 1105	
H	2-20-79 ECO 1613	

TOLERANCES
DECIMAL ±
FRACTIONAL ±
ANGULAR ±

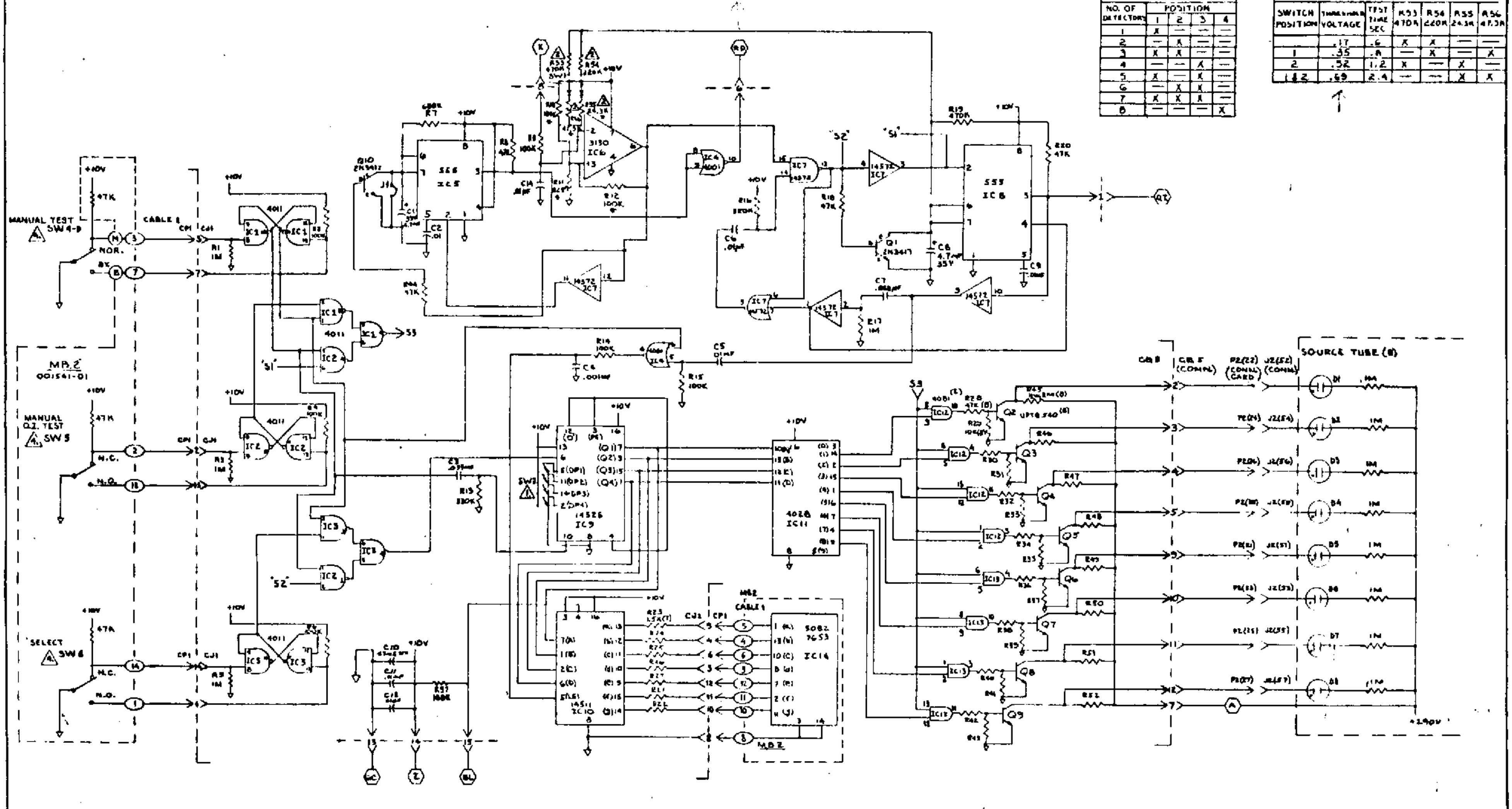
REVISIONS		
NO	DATE	BY
A	4/2/76	D.Gn.
B	4/21/76	D.Gn.
C	6/9/76	D.Gn.
D	10/6/76	D.Gn.
E	3/23/77	D.Gn.

DET-TRONICS DETECTOR ELECTRONICS CORP. MINNEAPOLIS, MINNESOTA

SCHEMATIC, P.C. BD – INVERTER, "EVF" (24 & 12 VDC)

DRAWN BY D.Gn. — SCALE — MATERIAL — DRAWING NO 007409-XX — REV. H

Schematic, P.C. BD-Inverter, "EVF" (007410-01)



SWITCH 2 POSITIONS				
NO. OF DETECTORS	POSITION			
	1	2	3	4
1	X	—	—	—
2	—	X	—	—
3	X	X	—	—
4	—	—	X	—
5	X	—	X	—
6	—	X	X	—
7	X	X	X	—
8	—	—	—	X

O.I. THRESHOLD VOLTAGE						
SWITCH POSITION	THRESHOLD VOLTAGE	TEST TIME SEC	R53 470K	R54 220K	R55 24.3K	R56 47.5K
	.17	.6	X	X	—	—
1	.35	.8	—	X	—	X
2	.52	1.2	X	—	X	—
1 & 2	.69	2.4	—	—	X	X

7. * INDICATES 1% RESISTOR.
6. ALL RESISTORS ¼W, ± 5% UNLESS OTHERWISE INDICATED.
5. SYMBOLS: P2 J2 → ≻ - RACK MOUNT CONNECTION CARD (001348-01) AND CONNECTOR (101805-01)
CJ- CP- ≻ - CABLE CONNECTIONS (CABLE PLUG)(CABLE JACK)
○ - TERMINALS ON 001540-01 (MOTHER BD)
≻ - AUTO. O.I. (CB5) CONNECTIONS /(CB5) CONNECTOR
○ - MOTHER BD. 2 (001541-01) CONNECTIONS
4. SW4-B: TOGGLE SWITCH; SW5 AND SW6: PUSH-BUTTON MOMENTARY SWITCHS.
3. ON 14 PIN DIP - PIN 7 (GND), PIN 14 (+10V); ON 16 PIN DIP - PIN 8 (GND), PIN 16 (+10V)
2. FOR O.I. THRESHOLD VOLTAGE, SEE TAB.
1. SWITCH 2 POSITIONS ARE DETERMINED BY NUMBER OF DETECTORS REQUIRED. (SEE TAB)

DETECTOR ELECTRONICS CORP
MPLS, MINN. 55435
SCHEMATIC, P.C. BD - AOI LOGIC, "CB5"
(R7302, R7503)
001435-01 A

Schematic, P.C.BD-AOi
Logic,"CB5"