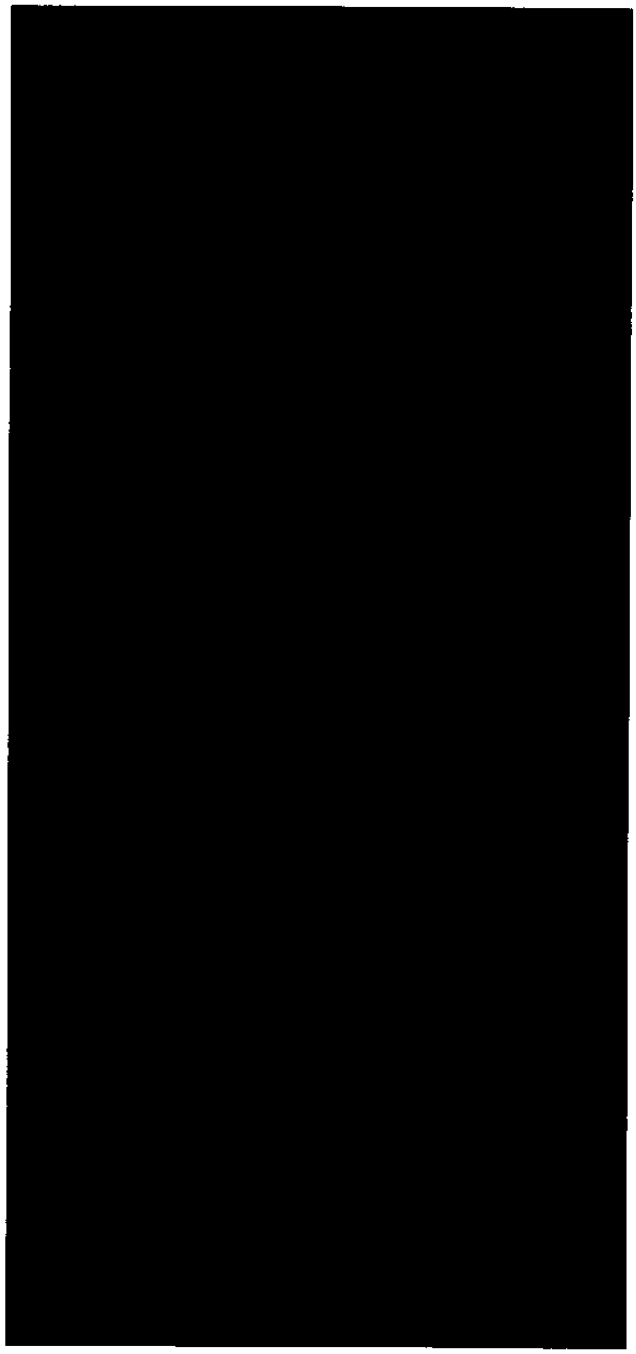
DET TRONICS



INSTRUCTIONS

Combustible Gas Detection System

C7061C Detector

R8460 Controller

9/85

Form 95-8253-02

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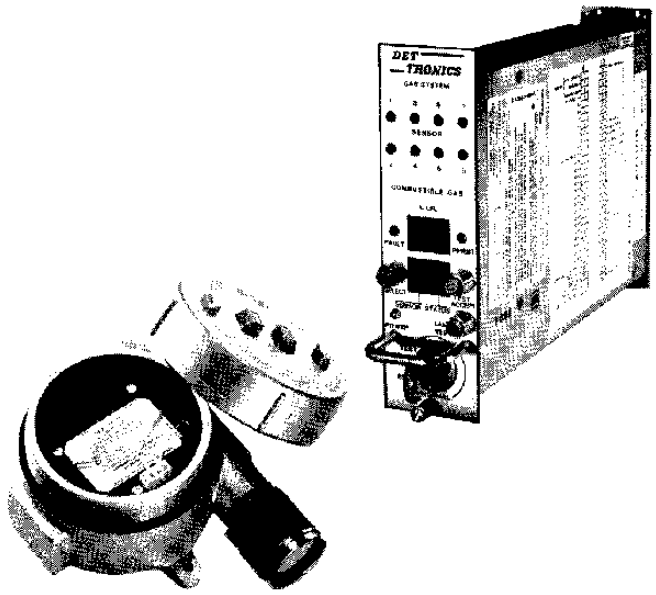


SYSTEM APPLICATION

Since the accumulation of a combustible gas is a major cause of fires and explosions, an effective gas detection system has an essential place in the overall fire protection system. Advance warning given by a gas detection system usually allows ample time for necessary action to be taken before the danger becomes acute, significantly reducing the potential for catastrophe. With any combustible gas detection system, the emphasis is placed on prevention. The Det-Tronics gas detection system can be used wherever any of the following is a consideration:

- Highly explosive or flammable gases are involved.
- Immediate response to a hazardous situation is required.
- Continuous and fully automated protection is needed.
- A large capital investment must be protected.
- Human life and well-being are at stake.
- Gas can accumulate in an inaccessible area.
- Gas can accumulate in an area too hazardous for safe entry.

The combustible gas detection system broadens the capabilities and increases the versatility of fire protection systems. Microprocessor based circuitry in the R8460 Controller provides operational flexibility, while utilizing many important features and design innovations used in other Det-Tronics products. These include automatic diagnostic tests that continuously check detector output, relay coil continuity, and the electronic circuitry of the system. Also included is automatic fault identification, which uses a numerical code to identify system status on a digital display. Other features also common to Det-Tronics flame detection equipment include individual detector identification, "voting" capability, and manual system testing.

FEATURES

- Continuous monitoring of up to eight combustible gas detectors.
- Two independently adjustable alarm threshold levels for each channel.
- Two solid state alarm outputs for each channel.
- Four voting outputs - solid state or optional relay contacts.
- Fault output - solid state or optional relay contacts.
- Pulsating SENSOR LEDs provide visual indication of an alarm condition.
- Digital display shows the LEL (lower explosive limit) percentage at the detector with the highest concentration of combustible gas.
- Microprocessor control provides continuous diagnostics and automatic fault identification.
- A readout of the actual LEL percentage being detected by any individual detector can be obtained in the Test mode.
- A negative zero drift condition can be indicated on the digital display in the Test mode.
- The alarm thresholds that are programmed for each channel can be read on the digital display when in the Test mode.
- Microprocessor based controller features pushbutton calibration, or a plug-in calibration meter can be used for calibration of the detector by one individual.
- The system can be calibrated using any gas concentration up to 60% LEL.

- Calibration of an individual detector can be accomplished without disturbing the normal operation of the other detectors in the system.

- Electronic circuitry of the detector is mounted in a junction box for easy accessibility of calibration adjustments.

- Frequency transmission permits longer sensor wiring distances with no effect on calibration.

SYSTEM DESCRIPTION

The Det-Tronics eight channel combustible gas detection system consists of an R8460 Controller and up to eight C7061C Detectors.

DETECTOR

The C7061C uses a catalytic gas sensor (pellistor) to detect the presence of combustible gases and vapors. The detector consists of a matched pair of elements. One is an active catalytic sensing element, and the other functions as a temperature compensating reference element. In the presence of a combustible gas, catalytic reaction causes the resistance of the active element to increase relative to the resistance of the reference element. The difference in the resistance between the two elements increases in proportion to the concentration of gas at the detector.

The C7061C Detector is connected to the input of an electronic transmitter module, which is mounted in an explosion proof aluminum junction box. This transmitter module contains the electronic circuitry that generates the output signal, which is sent to the controller for processing. When no gas is being detected, the output of the transmitter is a continuous series of voltage pulses at a nominal frequency of 100 Hz. This frequency is directly controlled by the resistance of the sensing elements in the C7061C. When the resistance of the active sensing element increases as the result of exposure to combustible gas, the frequency of the transmitter also increases in proportion to the concentration of gas at the detector. This process is also reversible, causing the detector output to return to 100 Hz when the level of gas returns to 0% LEL. This exclusive frequency transmission technique permits the detector to be located relatively long distances from the controller without affecting the calibration or performance of the detector.

The C7061C has been designed for use with methane gas, but with proper calibration it can be used to detect nearly any combustible gas. Contact the Field Support Group at Detector Electronics for assistance in adapting the detector to a specific application.

R8460 CONTROLLER

The microprocessor based R8460 Controller continuously monitors the output signals from the detectors and uses the frequency to determine the level of gas present. If the frequency indicates that an alarm threshold has been exceeded, the appropriate output is energized. The microprocessor also monitors the circuitry of the detectors and controller as well as the interconnecting wiring to assure proper system operation. Front panel LEDs and digital displays provide a visual indication of system status.

Alarm Thresholds

The controller has eight independent channels, each having both a low and a high alarm threshold (setpoint). The microprocessor compares the level of gas at the detector to these threshold levels to determine when an alarm output is generated. The alarm thresholds are individually programmed for each channel and are adjustable between 10 and 40% LEL in increments of 2 for the low alarm, and from 20 to 60% LEL in increments of 5 for the high alarm. Threshold levels are programmed by setting rocker switches that are located on the controller.

Solid State Alarm Outputs

The R8460 provides two solid state alarm outputs for each of the eight channels. The low alarm output is actuated in response to a signal that exceeds the low threshold, and the high alarm output is actuated when the high threshold is exceeded. All alarm outputs remain latched on until the controller is reset.

Voting Outputs

In addition to the alarm outputs, four voting outputs are provided for enhancing the flexibility of the gas detection system. The voting circuitry of the R8460 allows the eight channels to be grouped in either of two ways. Two groups of four channels each can "vote" independently of each other, or all eight can vote as a single group. See Table 1.

If the controller is programmed for two separate voting groups, channels one to four make up the first group and channels five to eight make up the second. Each voting group has two outputs. The low output responds to signals that exceed the low alarm thresholds and the high output responds to signals that exceed the high thresholds. The controller is programmed to energize a voting output when either one or two of the four channels detect a threshold-exceeding level of gas.

Alternatively, the controller can be programmed for all eight channels to vote as a single group. The controller is then programmed to actuate a voting output when

Table 1—Voting Options

		Detectors Responding to Gas			
		1 or 2 of Detectors 1 to 4	1 or 2 of Detectors 5 to 8		1, 2, 3, or 4 of Detectors 1 to 8
Level of Gas Required	Low Threshold Exceeded	A Low	B Low	OR	A and B Low
	High Threshold Exceeded	A High	B High		A and B High
		Voting Outputs Energized			

alarm thresholds are exceeded simultaneously at one, two, three or four detectors. The two "low" voting outputs are energized simultaneously when the appropriate number of low alarm thresholds is exceeded, and the two "high" voting outputs are energized when the appropriate number of high alarm thresholds is exceeded.

Rocker switches on the controller are used to select the voting arrangement to be implemented. Voting outputs remain latched on until the controller is reset.

Alarm Indicators

Individual SENSOR LEDs are provided for indicating an alarm condition at any of the eight detectors. A slow rate of blinking (twice per second) indicates that the low threshold for the responding detector has been exceeded. A faster rate (four times per second) indicates that the high threshold has also been exceeded. Until the controller is manually reset, the LEDs continue to blink after an alarm output has been generated, even if the level of gas at the detector no longer exceeds either threshold.

Digital Displays

In the Normal operating mode, the % LEL display indicates the level of gas at the detector with the highest level of gas present. In the Test mode, the % LEL display can indicate:

1) the level of gas present at the selected detector

2) the low alarm threshold for the selected detector

3) the high alarm threshold for the selected detector

4) negative zero drift of the detector.

See the "Test Mode" section for more information.

NOTE

In the Normal mode, the % LEL display is activated when the concentration of gas being detected reaches 7% LEL, regardless of where the alarm thresholds are set.

In the Normal mode, the SENSOR display indicates the number of the detector that senses the highest level of gas. In the Test mode, it displays the number of the detector that has been selected for test or calibration.

The STATUS display uses a numerical code to indicate the current status of the system. See Table 2.

High Levels of Gas

Inaccurate readings in gas concentrations beyond 100% LEL are an inherent problem with catalytic type sensing devices. For this reason, the R8460 does not indicate gas concentrations in excess of 99% LEL. When the level of gas being detected reaches 100% LEL, the % LEL display reads "99" and the STATUS display shows "7". Exposure to a high level of gas can have an adverse effect on the sensitivity of the sensing element. After this condition has occurred, all affected detectors should be tested and recalibrated or replaced as required.

Automatic Diagnostics and Fault Identification

Microprocessor controlled diagnostics and fault identification features, which have been developed through several generations of Det-Tronics equipment, are incorporated in the R8460 Combustible Gas Controller. When power is applied to the controller or when it is manually reset, the microprocessor program automatically tests memory

Table 2—System Status Codes

Status Display	Condition
0	Reset mode
1	Test mode
2	Not Used
3	Low count rate - detector circuit failure (broken wire)
4	High count rate - detector output exceeds operating parameters - outputs (for affected detectors) locked out
5	Low Alarm - low threshold exceeded
6	High Alarm - high threshold exceeded
7	Level of gas at detector has reached 100% LEL (% LEL display reads "99")
8	Controller calibration mode
9	Memory/relay failure
Blank	FAULT LED on - microprocessor failure

and pulses relay coils (if used) to test their continuity. In normal operation, the controller continuously monitors the input signals from the detectors to ensure that the count rates are within specified limits. (This assures that the detectors are functioning properly.) The controller continuously cycles through the relay continuity test and maintains a "watchdog" timer to ensure that the program is running correctly. Should a failure ever occur in the system, the FAULT LED is illuminated, the normally energized fault output is de-energized, and the digital STATUS display is activated to identify the nature of the fault using a numerical code. The FAULT LED remains on and the fault output remains de-energized until the fault is corrected and the controller is manually reset.

Outputs

The controller provides 16 solid state alarm outputs (open collector transistor), a solid state fault output, and 4 solid state voting outputs. If relay contacts are required, optional form C (normally open/normally closed) relays can be ordered for the voting and fault outputs. If relays are required for the alarm outputs, an R6007B Auxiliary Relay Output Assembly or an R6006 Relay Output Module can be used in conjunction with the R8460 Controller. (See "Options" section.)

Reset Mode

When the keylock switch is placed in the RESET position, all outputs are delatched and inhibited, and the FAULT and INHIBIT LEDs are illuminated. If no previous status condition was displayed, the STATUS display shows a "0" status. If a previous status condition exists, its status code will be displayed. Pressing the LAMP TEST button while in the Reset mode resets the operating program to its startup position. Depressing the SELECT button while in the Reset mode causes the selected calibration gas concentration to be indicated on the % LEL display.

Test Mode

The R8460/C7061C system can be tested manually to verify that the controller and detectors are operational or to check the system for proper calibration. When the keylock switch is turned to the TEST position, the SENSOR display shows the number of the detector under test (starting with the highest numbered detector). The % LEL display indicates the actual level of gas at the selected detector. The system can then be tested by applying a controlled concentration of gas to the detector under test and observing the response of the controller. To check for negative drift of the detector, observe the % LEL display with clean air present at the detector. The controller indicates a negative zero drift condition by blanking the left hand digit of the % LEL display and reading the amplitude of drift on the right hand digit up to -9%. (All outputs are inhibited in the Test mode to prevent actuation.)

Pressing the TEST/ACCEPT button once causes the % LEL display to show the low alarm threshold that has been programmed for the detector under test. The corresponding SENSOR LED blinks slowly.

Pressing the TEST/ACCEPT button a second time causes the % LEL display to show the high threshold setting for the detector under test. The corresponding SENSOR LED blinks at a faster rate.

When the TEST/ACCEPT button is pressed a third time, the test is cycled back to its initial position, with the % LEL display again showing the actual level of gas present at the detector under test.

Pressing the SELECT button (at this position in the program only) causes the next lower numbered detector to be selected for test.

Calibration Options

The R8460/C7061C System can be calibrated by either of two methods. One method, which normally requires two people, can be accomplished without opening the junction box, allowing calibration to be performed without securing the area. One person uses a calibration kit to apply the gas/air calibration mixture to the detector being calibrated, and the second person presses the ap-

propriate buttons on the controller. The microprocessor based controller responds by automatically making the necessary adjustments.

The alternate calibration procedure can be performed by one person. This method involves the use of a plug-in frequency counter to monitor the output frequency of the transmitter module. Two potentiometers that are located on the transmitter assembly inside the junction box are then adjusted to obtain the correct detector output. This method of calibration can be performed with the controller in the Normal operating mode, allowing the seven remaining detectors to function normally as each individual detector is being calibrated. See the "Calibration" section for complete information regarding system calibration.

Programming Switches

The R8460 is furnished with 12 rocker switch assemblies. These switches are used to identify the channels that have detectors connected, to select alarm threshold levels and concentration of calibration gas, and to select various options. Switch assemblies are accessible at the side, top and bottom of the controller.

Field Wiring Connector and Mounting Cage

The R8460 Controller is furnished with a field wiring connector that incorporates pressure type screw terminals for connecting the external wiring and two circuit board edge connectors for connecting to the controller. This allows the controller to be removed from the mounting cage without disturbing the wiring. The controller is designed for use in a non-hazardous area. It fits into a 19 inch instrument rack and is fully compatible with other equipment in the Det-Tronics "Micro-Module" line.

Controller Front Panel

The front panel of the R8460 Controller provides a keylock switch for selecting the mode of operation, pushbutton switches for initiating test functions, and LEDs and digital displays for reporting system status information. Figure 1 illustrates the R8460 front panel.

1. SENSOR LEDs

Normal: Off with no gas present.
Blinking indicates an alarm condition, rate of blinking indicates whether low or high threshold has been exceeded.

Test: Rate of blinking indicates whether the low or high threshold is shown on the % LEL display.

Calibrate: LEDs blink slowly when zero value is programmed and faster when span value is programmed. Steady light indicates calibration fault.

2. % LEL DISPLAY

Normal: Off with no gas present.
Turns on at 7% LEL to indicate level of gas at detector that senses the highest concentration of gas.

Test: Indicates 1) level of gas at selected detector,
2) low threshold,
3) high threshold.

Blank left hand digit indicates a negative value.

Example: [0][5] = 5% [ ][5] = −5%

Reset: Displays calibration gas concentration when SELECT button is pressed.

Calibrate: Indicates LEL percentage of test gas being applied to detector when TEST/ACCEPT button is pressed.

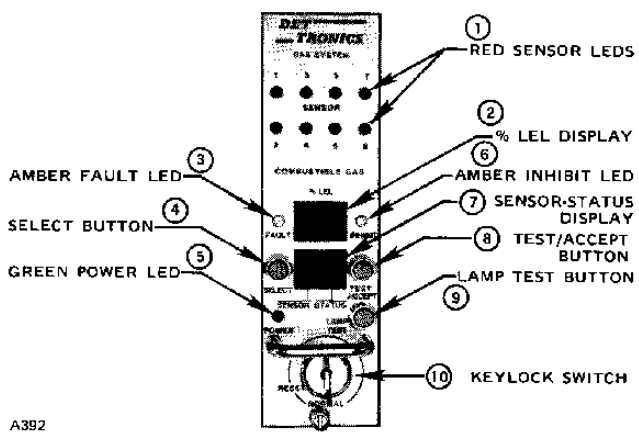
3. FAULT LED

Normal: Illumination indicates a fault condition.

Test: Illuminated.

Reset: Illuminated.

Power-up: Illuminated during two minute warmup.



4. SELECT BUTTON

Test: Selects detector to be tested or calibrated.

Reset: Causes % LEL display to indicate selected calibration gas concentration.

5. POWER LED

Illuminated when power is applied to the system.

6. INHIBIT LED

Indicates that outputs are inhibited.

Normal: Illuminated if external inhibit switch is actuated.

Test: Illuminated.

Reset: Illuminated.

7. SENSOR DISPLAY

Normal: Identifies detector with highest level of gas present, or detector affected by status change.

Test: Identifies detector selected for test or calibration.

STATUS DISPLAY

Indicates current system status using numerical code.

8. TEST/ACCEPT BUTTON

Test: Selects display of alarm threshold levels. When depressed simultaneously with SELECT button, controller enters Calibration mode.

Calibrate: Programs zero and span values.

9. LAMP TEST

Illuminates LEDs and all segments of digital displays.

Reset: Resets operating program to startup position.

10. KEYLOCK SWITCH

Selects Normal, Reset, or Test mode.

SPECIFICATIONS

OPERATING POWER—
R8460 Controller: Operates from any voltage in the range of 10 to 38 vdc. C7061C Detector/Transmitter: Operates from any voltage in the range of 20 to 32 vdc, with peak voltages not to exceed 35 volts. Startup current - 150 milliamperes maximum at 24 vdc. Operating current - 100 milliamperes maximum at 24 vdc.

POWER CONSUMPTION—
Controller, operating condition: 2.6 watts typical. Controller, alarm condition: 6.0 watts maximum. Detector: 2.4 watts maximum at 24 vdc.

OUTPUT CIRCUIT RATINGS—
Open collector transistor output is rated 100 milliamperes dc. Lead monitoring is provided by an internal 100 kilohm resistor from output to ground. The output transistors are rated at 60 vdc. Form C relay contacts (optional) are rated for 3 amperes at up to 30 vdc or 250 vac.

DETECTOR ENCLOSURE MATERIAL—
Anodized aluminum or 316 stainless steel.

SHIPPING WEIGHT (Approximate)—

	Pounds	Kilograms
R8460 Controller	4.4	2.0
C7061 Detector (aluminum)	0.5	0.2
(stainless steel)	1.0	0.4
Transmitter Assembly	3.7	1.7

DIMENSIONS—
The dimensions of the R8460 Controller are shown in Figure 2. See Figure 3 for dimensions of the C7061C Detector and Figure 4 for the junction box.

DETECTOR ENCLOSURE RATINGS—
Hazardous locations - designed to meet FM and CSA requirements for Class I, Groups B, C and D; Class II, Groups E and G. Designed to meet BASEEFA requirements for Class II B T6.

CONTROLLER TEMPERATURE RANGE—
Operating: −40°F to +158°F (−40°C to +70°C)
Storage: −67°F to +170°F (−55°C to +77°C)

DETECTOR TEMPERATURE RANGE—
Operating: −40°F to +167°F (−40°C to +75°C)
Storage: −67°F to +185°F (−55°C to +85°C)

OXYGEN EFFECTS—
The detector will operate with the oxygen level in the atmosphere down to about 10 percent. Under oxygen enriched conditions the detector will respond, but the user should beware of an increase in the explosive hazard.

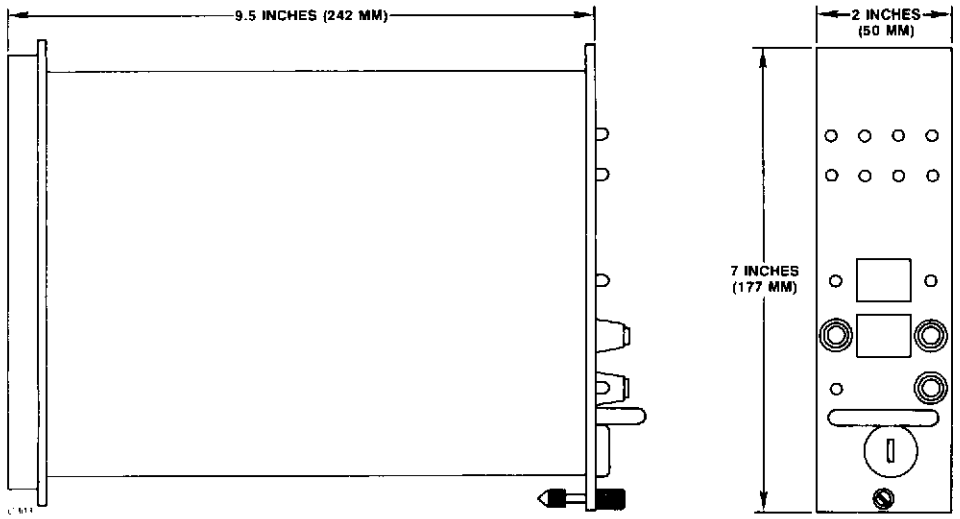


Figure 2—R8460 Dimensions in Inches (Millimeters)

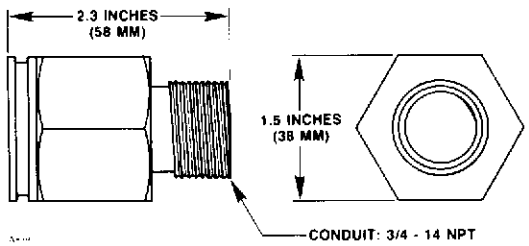


Figure 3—C7061C Dimensions in Inches (Millimeters)

SENSOR WIRING—

22 gauge, three wire shielded cable, up to 1500 feet (450 meters). Larger diameter wire can increase the distance.

REPEATABILITY—

±5 percent, full scale.

LINEARITY—

±3 percent full scale, up to 2.5% methane gas by volume in air. ±5 percent full scale, up to 5% methane gas by volume in air.

RESPONSE TIME—

10 seconds to reach 50 percent of value of applied gas.

SENSOR LIFE EXPECTANCY—

Up to 3 years in normal service, dependent on environment.

WARRANTY

Detector Electronics warrants its catalytic sensing elements to be free of defects in materials or workmanship and will repair or replace without charge any sen-

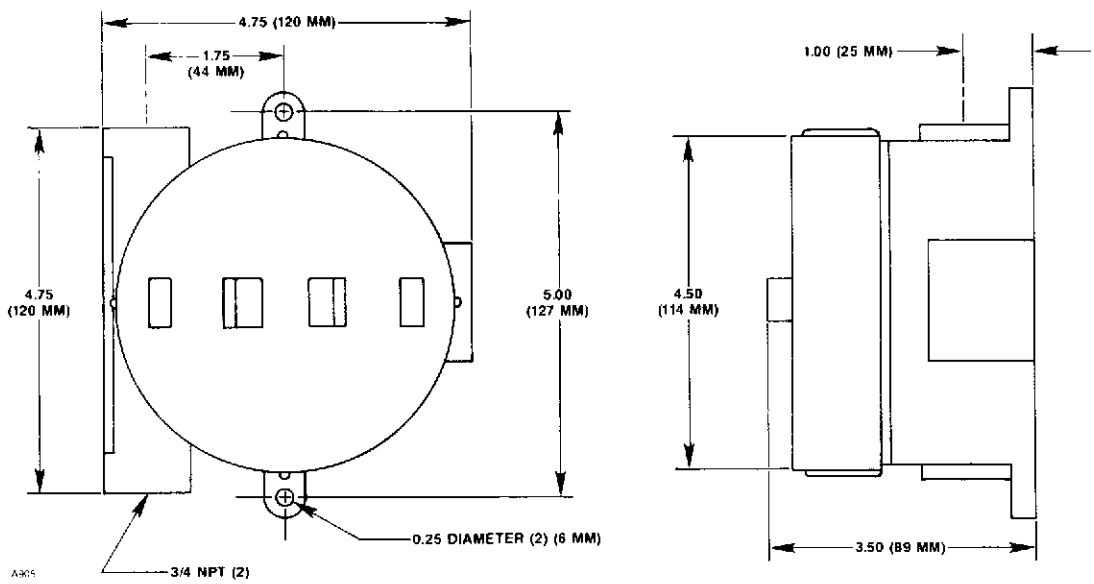


Figure 4—Junction Box Dimensions in Inches (Millimeters)

sing element that is found to be defective for two years after the date of purchase. Gas detection elements that are damaged by exposure to poisoning contaminants or to a high level of combustible gas are not covered by this warranty. Det-Tronics reserves the right to make the final determination of the nature of and responsibility for defective or damaged equipment. Equipment that has been repaired or modified by the user, damaged as the result of an accident, incorrectly installed, or used in an environment or application for which it was not intended is not included in this warranty. Det-Tronics' responsibility under this warranty shall be limited to the repair or replacement of the defective equipment at their option when it is returned to the factory transportation prepaid. The defective unit will be repaired or replaced free of charge to the customer and returned transportation prepaid. In all cases this warranty is limited to the cost of the equipment.

POISONOUS MATERIALS

The following is intended to aid the user of the gas detection system in identifying those substances that will poison or inhibit the gas sensing element. By no means should this be considered a complete list. Substances that may act as poison (permanent loss of sensitivity) on the catalytic gas sensing element include silicone compounds often found in oils, greases, and resins. Other known poisons include antiknock compounds such as tetra ethyl lead and tetra methyl lead, phosphate esters, as well as hydrogen sulfide and other sulfur based compounds.

Inhibition (temporary loss of sensitivity) of the sensing element can be caused by volatile halogenated compounds, tetrachlorethylene, HCL, fluorinated hydrocarbons, antiseptics, and hot P.V.C.

A special contamination resistant sensing element is available from Det-Tronics to provide extended service life in the presence of poisonous substances.

OPTIONS AVAILABLE

- The R8460 Controller is shipped from the factory equipped with solid state (open collector transistor) outputs. Optional form C (normally open/normally closed) relay contacts are available for the voting and fault outputs.

- The C7061C housing is available in anodized aluminum or 316 stainless steel.

ACCESSORIES

- The Q4004 Mounting Cage, designed for holding up to eight modules in a standard 19 inch instrument rack, is recommended for ease of installation and service, (see form 95-8241). Mounting cages that hold fewer modules are also available.

- The R6006 Relay Output Module is used in conjunction with the R8460 Controller when supervised relay outputs are required. The R6006 Relay Output Module provides eight relays and offers optional load monitoring. The relays are energized by the solid state output signals generated by the R8460 Controller. The relays in the R6006 have form C contacts (normally open/normally closed) that are capable of operating devices requiring up to 3 amperes at up to 30 vdc or 250 vac. See form 90-1016.

- The R6007B Auxiliary Relay Output Assembly provides form C relay contacts for use with those circuits that are normally furnished with solid state outputs. The assembly has a fault relay and can be ordered with 4, 8, 12, or 16 alarm relays. The R6007B also includes a prewired connector backplate, which eliminates the need for external wiring between the controller and relay assembly. See form 90-1029.

- The Q8000C Calibration/Test Kit is available for assuring accurate system calibration.

- Filters or baffles as required for a specific application are available upon request.

- Locking devices are available to comply with applicable regulations.

- Filler panels (part number 002188-001) are available to cover unused sections of the mounting cage.

INSTALLATION

WIRING REQUIREMENTS

The wiring to each detector is a three conductor shielded cable, which must be at least 22 gauge (0.643 mm diameter). This will allow the detector to be located up to 1500 feet (450 meters) from the controller. The use of larger diameter wire increases this distance. Contact the Field Support Group at Detector Electronics for details. If the cable is run in conduit, the conduit should not be used for wiring to other electrical equipment.

In applications where conduit is used for wiring the detector, the use of conduit seals is required to prevent moisture from entering the junction box. These seals must be installed even if they are not required by local wiring codes. A seal must be located as close to the detector as possible. In no case should this seal be located more than 18 inches (457 mm) from the junction box. When local codes require an explosion-proof installation, an additional seal is also required at any point where the conduit enters a

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

Since moisture can be detrimental to electronic devices, it is essential that moisture not be allowed to come in contact with the electrical connections of the detector. Moisture in the air can be trapped within sections of conduit and can condense and accumulate at the base of vertical conduit runs. To eliminate this condition, explosion-proof drains and breathers (such as Crouse-Hinds type ECD) should be installed to automatically bleed off accumulated water.

NOTE

Be certain that all wiring complies with applicable electrical wiring regulations that relate to the installation of electrical equipment in a hazardous area.

DETECTOR POSITIONING

If the gas detection system is to provide maximum protection, it is essential that the detectors be properly positioned. Unfortunately, there is no fool-proof formula for determining the most effective number and placement of detectors. No two installations will be exactly alike. Therefore, the individual who is responsible for the installation must rely on experience and common sense to determine the best detector locations for the area to be protected.

Several factors should be considered for every installation:

1. What kind of gas is to be detected? If it is lighter than air, place the detectors close to the ceiling. Place them close to the floor for gases having a density greater than the surrounding air or for vapors resulting from flammable liquid spills.

2. How rapidly will the gas diffuse into the air? Select a location for the detectors as close as practical to the anticipated source of a gas leak.

3. Ventilation characteristics of the immediate area must also be considered. Movement of air will cause gas to accumulate more heavily in one area than another. The detectors should be placed in the areas where the most concentrated accumulation of gas is anticipated. Also take into consideration the fact that many ventilation systems do not operate continuously.

4. Water, dirt, or other non-gaseous materials must not be permitted to accumulate on the sintered metal screen that covers the gas inlet and prevent gas from reaching the sensing element.

5. The detectors must be accessible for testing and calibration.

6. The detector should be located in an area where it is safe from potential sources of contamination that can poison the sensing element.

Remember, the finest gas detection system is of little value if the gas can not readily come into contact with the detectors.

DETECTOR WIRING

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

1. Detectors should be installed in the locations that are best suited for covering the area to be protected, following the previously discussed guidelines. Whenever practical, they should be placed where they will be easily accessible for calibration.

2. Remove the junction box cover by turning it counterclockwise.

3. Connect the junction box to the conduit so that the wires from the controller can be installed and trimmed.

4. Connect the leadwires to the screw connectors on the terminal block inside the junction box. (See Figure 5). Connect the positive lead to "+", the negative lead to "−", and the signal lead to "signal". **Do not** ground the shield at the detector. Always insulate the shield from the junction box and ground the shield at the controller **only** (terminal 2).

5. Check all field wiring to ensure that the proper connections have been made, then pour the conduit seals and allow them to dry (if conduit is being used).

6. Attach the detector to the junction box as shown in Figure 5 and connect the plug. The plug is keyed to aid in correct installation.

7. Line up the connectors on the transmitter module

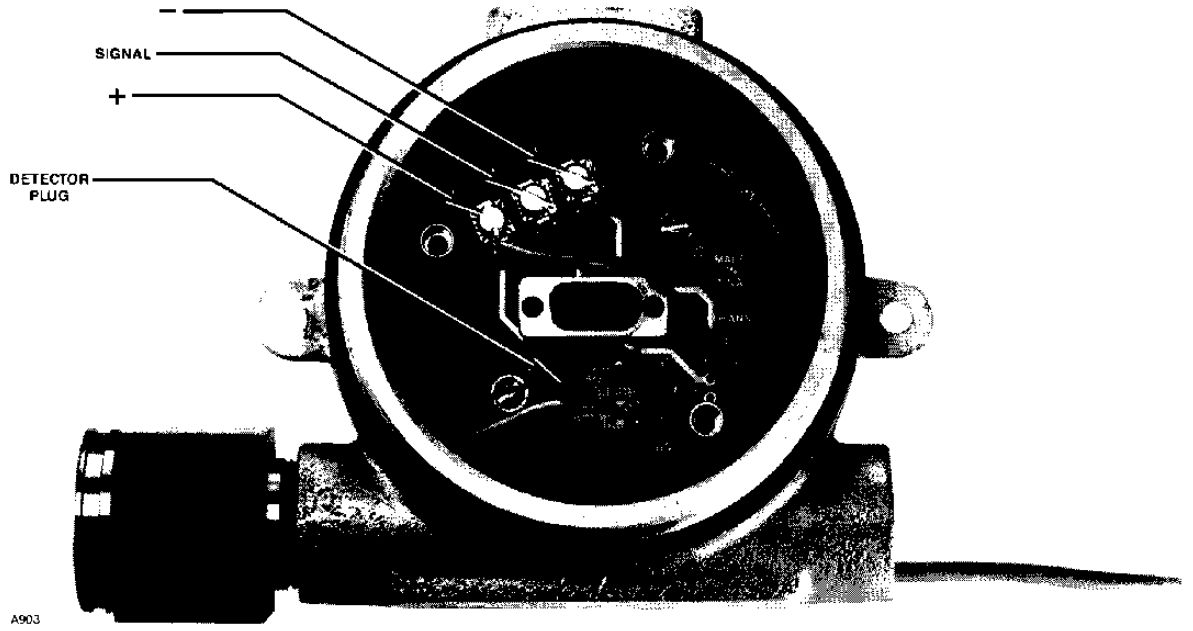


Figure 5—Junction Box

with those on the printed circuit board inside the junction box and press the module into position in the junction box.

8. Be sure the jumper plug is properly installed on the transmitter module.

9. Place the cover back on the junction box.

CONTROLLER LOCATION

The R8460 Controller must be mounted in a non-hazardous area. It is furnished with a field wiring connector that incorporates pressure type screw terminals for attaching wires and two circuit board edge connectors for plugging in the controller.

NOTE

Be sure to install the caution label that is supplied with the controller, which states that only qualified personnel are to operate or service the controller. This label should be located as close to the controller as possible and must be clearly visible.

The optional Q4004 Mounting Cage is designed to hold up to eight modules in a 19 inch instrument rack. This mounting cage can also house relay output modules, voltage converters, UV controllers, or H_2S controllers, which can be used in conjunction with the R8460 Controller as part of the total detection system. The cage is designed to hold the field wiring connectors for ease in making electrical connections, installation, servicing, and replacing the modules. See Figure 6 for illustrations and dimensions.

ELECTRICAL CONNECTIONS

All electrical connections are made to the field wiring connector that is furnished with the controller. Figure 7 shows the terminal configuration for the R8460 Controller.

Power for the R8460 Controller may be furnished by external 12 or 24 volt batteries, a regulated dc power supply, or optional Det-Tronics voltage converters. The detectors require a 24 volt dc power supply. (See the "Specifications" section for current rating.) If separate power sources are used for detectors and controller, they must use a common ground (terminal 2 on controller).

Terminal 1— Connected to the positive terminal of an external power supply.

Terminal 2— Circuit ground. This terminal is connected to the negative terminal of all power supplies used in the system. It is also used to ground the shield of detector wiring cables. If local wiring codes do not permit the shields to be grounded at terminal 2, connect them to terminal 64 (earth ground), and also connect a 1 microfarad 250 vdc capacitor between terminal 2 and terminal 64.

Terminal 3— Spare

Terminals 4 to 11— These controller inputs are connected to the output leads of the detectors. Inputs No. 1 through No.

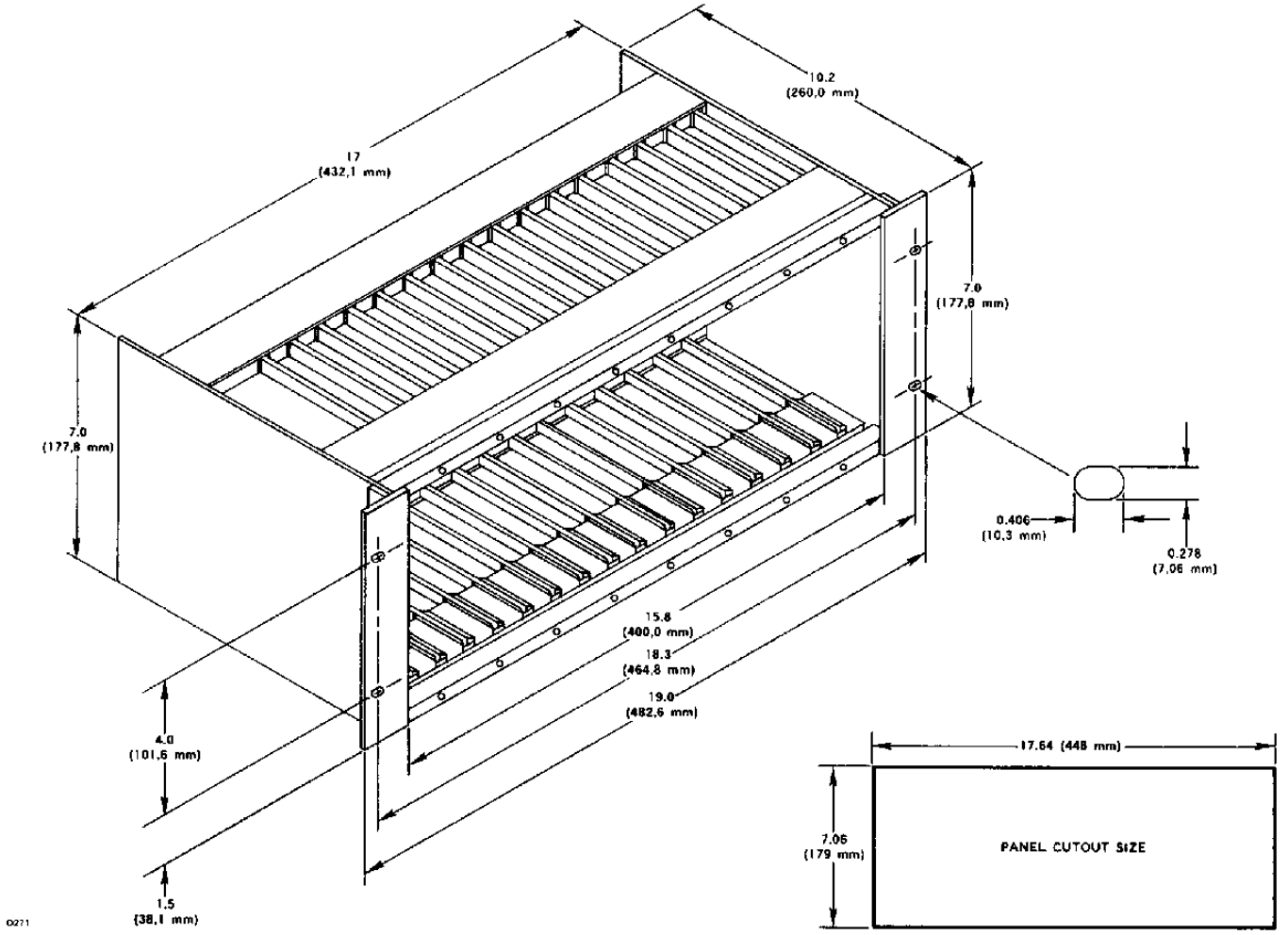


Figure 6—Dimensions of Q4004 Mounting Cage in Inches (Millimeters)

8 correspond to channels 1 through 8, respectively.

Terminals 12 to 23—Solid state (or optional relay) outputs of the voting circuitry.

Terminals 24 to 26—The solid state (or optional relay) fault output is de-energized in the event of a system failure.

Terminals 27 to 32—No external equipment should be connected to these terminals.

Terminals 33 to 40—The solid state output is actuated when the count rate of the detector exceeds the low alarm threshold.

Terminals 41 to 48—The solid state output is actuated when the count rate of the detector exceeds the high alarm threshold.

Terminal 49— External Inhibit/Reset is a means of remotely inhibiting the outputs by placing the controller in the Reset mode, and may be performed by an external switch or an interface that drives the input to less than 0.5 vdc.

Terminal 50— Make no connections to this terminal.

Terminal 51— Outputs Inhibited is an output that is driven low when the outputs of the controller are inhibited (keylock switch in TEST or RESET position.)

Terminals 52 to 63—No external equipment should be connected to these terminals.

Terminal 64— Chassis (earth) ground.

If the controller is supplied with optional relays in place of solid state outputs for the fault and voting outputs, the terminal configuration for terminals 12 through 26 will be different. Refer to Figure 8 for an illustration of this terminal configuration. The optional relays have form C (normally open/normally closed) contacts.

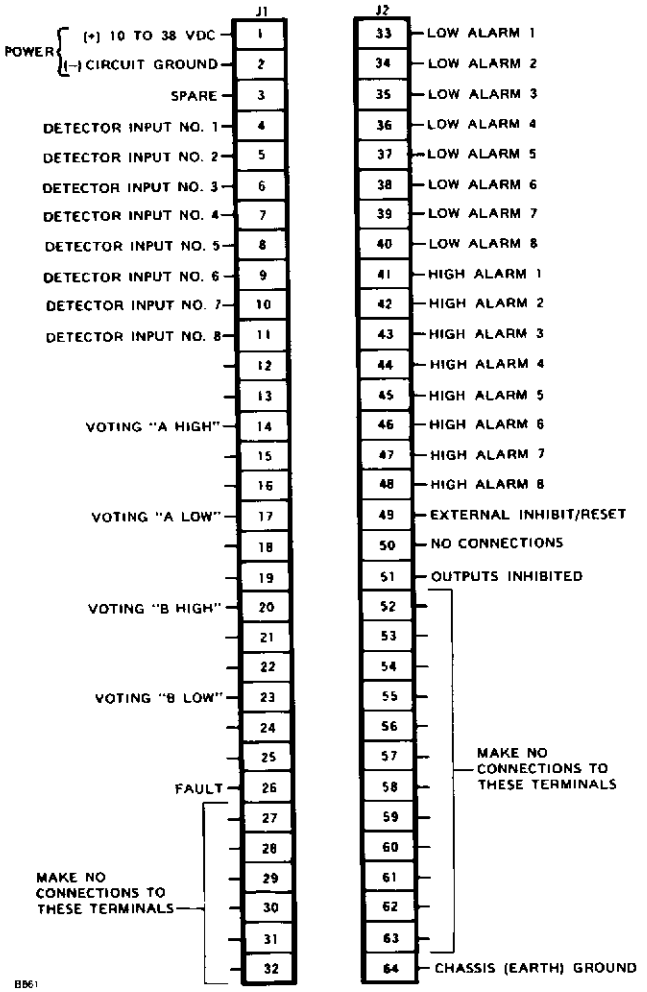


Figure 7—R8460 Terminal Configuration

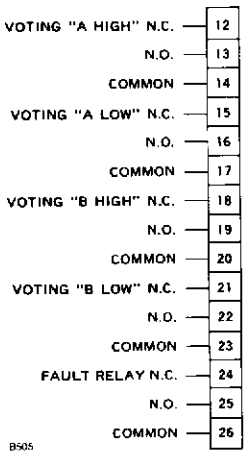


Figure 8—Terminal Configuration for Optional Relays

NOTE

External equipment that may generate transients when switching (such as relays) should have a transient suppression device connected across the coil at the time of installation. This will safeguard the output transistors of the R8460 against possible damage. Figure 9 illustrates an ac device with a Metal Oxide Varistor (MOV) across the coil and a dc device with a diode used for transient suppression.

PROGRAMMING THE CONTROLLER

The R8460 Controller must be programmed for use in each individual installation. This is accomplished by setting rocker switches that are located on either of the two printed circuit boards. The board on the left hand side (when viewed from the front with the controller in its normal upright position) is referred to as the microprocessor board and contains four rocker switch assemblies. (See Figure 10.) The board on the right hand side of the controller is referred to as the power supply board and contains eight rocker switch assemblies, four on the top edge and four on the bottom edge of the board.

The individual rocker switches are identified by numbers 1-1, 1-2, 1-3, etc. in this manual. The number preceding the dash indicates the number of the switch assembly. The number following the dash identifies the specific rocker on the switch assembly.

Each rocker switch assembly contains eight separate rocker switches. The rockers are identified by the numbers one through eight on one side of the assembly. The word "open" can be seen on the opposite side. (See Figure 11.) The switch is open when depressed in the direction of the word "open" and closed when depressed in the direction of the numbers. All even numbered rockers of the assembly shown in Figure 11 are open.

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

NOTE

The R8460 Controller contains several semiconductor devices that are susceptible to damage by electrostatic discharge. An electrostatic charge can build up on the skin and discharge when an

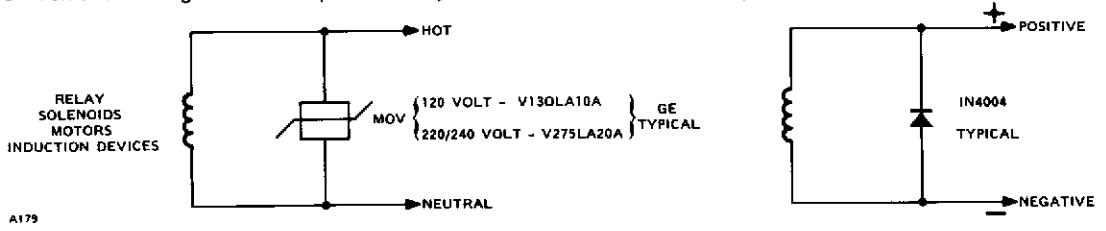


Figure 9—Transient Suppression Devices

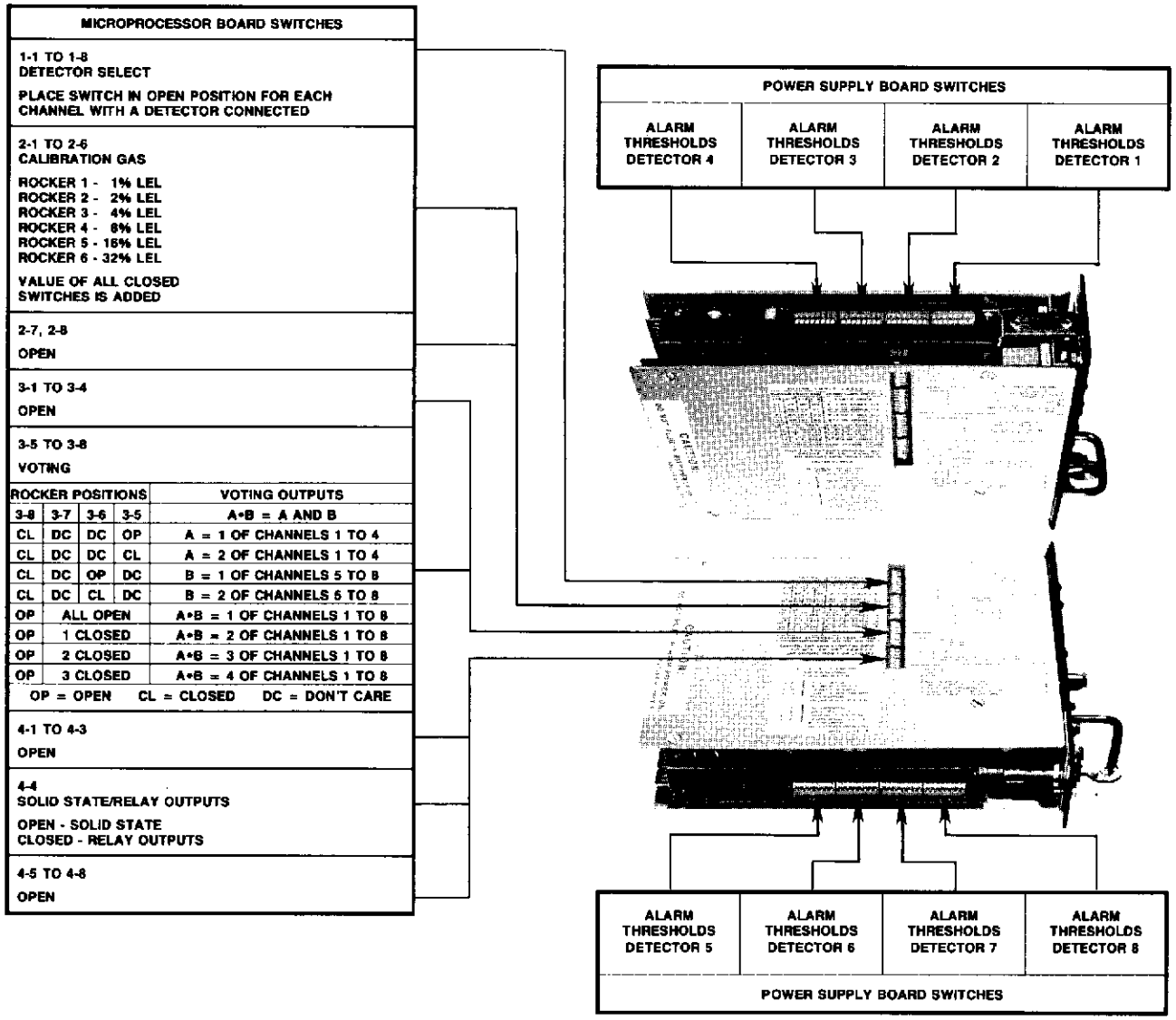


Figure 10—R8460 Rocker Switches

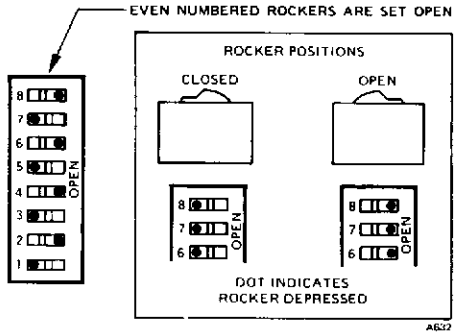


Figure 11—Rocker Positions

object is touched. Therefore, the controller should be carefully handled by the outside shields, taking care not to touch the terminals or electronic components. If it is possible to do so, take the controller to a static safeguarded work area when setting the rocker switches. For more information on proper handling of the controller, a Service Memo (form 75-1005) has been included with the controller.

System Layout

A layout of the total system should be made to provide the information that is needed to program the controller. Before this can be done, a number of decisions must be made.

1. How many detectors will be used?

2. The alarm threshold levels for each channel must be determined. The low threshold is adjustable between 10% and 40% LEL, in increments of 2. The high threshold is adjustable in increments of 5 from 20% to 60% LEL.

3. The voting criteria to be satisfied before the voting outputs are actuated must be determined. Refer to the "System Description" section for information on voting options.

4. A rocker switch must be set to inform the microprocesssor whether the controller is equipped with solid state or relay outputs for the voting and fault circuity.

5. The LEL percentage of the calibration gas must be determined.

CAUTION

Use care when setting the rocker switches on the controller. An incorrectly set rocker switch can result in an obvious controller malfunction, or the controller could appear to be functioning normally, but not produce the desired output in response to the input conditions. (Some of the switches on the R8460 are not used. These switches should be left open.)

Switch Setting Procedure

The microprocessor board, located on the left hand side of the controller, contains four rocker switch assemblies. See Figure 10 for identification of the switch assemblies. Identification labels have been placed on the side shields of the controller to further assist in switch identification.

Detector Select - Switches 1-1 to 1-8

The number after the dash corresponds to the number of each channel. Open the switch for each channel that has a detector connected to it. For example, if the system consists of five detectors, switches 1-1 through 1-5 will be open and 1-6 through 1-8 will be closed. See Figure 12. If a rocker is set open, but no detector is connected, the controller will indicate a "3" fault on the STATUS display. If a rocker is closed when a detector is connected, the diagnostic and fault identification circuitry will bypass that channel, and it will never be checked for proper functioning. Therefore, it is important that these switches be properly set.

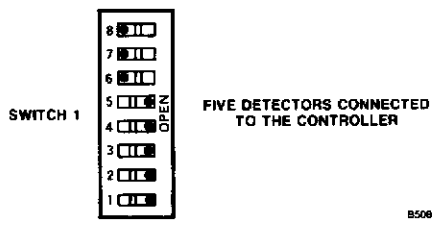


Figure 12—Detector Select

Calibration Gas Concentration - Switches 2-1 to 2-6

The system can be field calibrated using any concentration up to 60% LEL of the gas that is intended to be detected. Gas/air mixtures **greater than 30% LEL** are recommended for greatest accuracy. The controller is programmed by closing the appropriate combination of switches, the added value of which equals the LEL percentage of the calibration gas.

Switch 2-1 equals	1% LEL
Switch 2-2 equals	2% LEL
Switch 2-3 equals	4% LEL
Switch 2-4 equals	8% LEL
Switch 2-5 equals	16% LEL
Switch 2-6 equals	32% LEL

For example, when a 50% LEL gas/air mixture is used, close switches 2-2, 2-5, and 2-6. See Figure 13.

NOTE

The calibration gas concentration must NEVER be set to 0% LEL (all switches open). The controller will not operate properly if a calibration gas level has not been programmed.

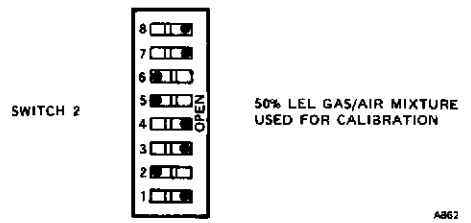


Figure 13—Calibration Gas

Switches 2-7 and 2-8

Leave these switches open.

Switches 3-1 to 3-4

Leave these switches open.

Voting - Switches 3-5 to 3-8

Rocker switches 3-5 to 3-8 are used to program the controller for the particular arrangement to be employed by the voting circuitry. (Refer to the "System Description" section of this manual for a description of the options available with the voting feature.) Then refer to the Voting Selection Table (Table 3) to determine the correct positions for switches 3-5 to 3-8.

Separate

For two separate voting groups:
3-8 is closed.
3-7 is not used in this voting arrangement.

Table 3—Voting Selection

Rocker Positions				Voting Outputs
3-8	3-7	3-6	3-5	A • B = A and B
CL	DC	DC	OP	A = 1 of Channels 1-4
CL	DC	DC	CL	A = 2 of Channels 1-4
CL	DC	OP	DC	B = 1 of Channels 5-8
CL	DC	CL	DC	B = 2 of Channels 5-8
OP	All Open			A • B = 1 of Channels 1-8
OP	1 Closed			A • B = 2 of Channels 1-8
OP	2 Closed			A • B = 3 of Channels 1-8
OP	3 Closed			A • B = 4 of Channels 1-8

OP = Open, CL = Closed, DC = Don't Care

3-6 programs voting output B (channels 5, 6, 7, 8)
— open, one of four
— closed, two of four
3-5 programs voting output A (channels 1, 2, 3, 4)
—open, one of four
—closed, two of four

Common
All eight channels voting:
3-8 is open.
3-5, 3-6, 3-7 — All open = one of eight
any one closed = two of eight
any two closed = three of eight
all three closed = four of eight

The example illustrated in Figure 14 has two separate voting groups. "A" requires one of four and "B" requires two of four channels to detect gas before a voting output is energized.

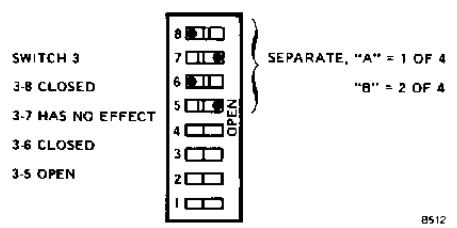


Figure 14—Voting Selection - Separate

Figure 15 shows the correct switch positions for an application with three of eight channels voting.

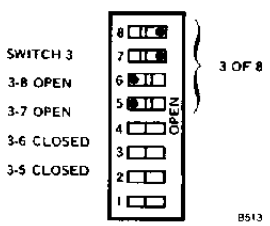


Figure 15—Voting Selection - Combined

Switches 4-1 to 4-3

Leave these switches open.

Solid State/Relay Outputs - Switch 4-4

This switch is set open if the controller is equipped with solid state outputs. If optional relays are used, the switch must be closed.

NOTE

The microprocessor in the R8460 Controller continuously pulses the optional voting relay coils to check them for continuity. If this switch is closed in a controller equipped with solid state voting outputs, these test pulses will cause unwanted activation of the voting outputs. The STATUS display could also show "9", indicating a relay problem. (See Table 2.) To assure proper operation of the system, it is essential that this switch be properly set.

Switches 4-5 to 4-8

Leave these switches open.

When the proper position for each of the switches on the microprocessor board has been determined, record this information carefully in the space provided on Figure 16. This chart is intended as an aid in system layout, to provide a means of double checking switch positions before power is applied to the controller, and to provide a record of switch positions for future reference.

Low/High Alarm Thresholds

Each channel must be programmed for its own individual low and high alarm thresholds. The low threshold is adjustable from 10 to 40% LEL in increments of 2. The high threshold is adjustable between 20 and 60% LEL in increments of 5. The switch assemblies used to make the settings are located on the power supply board and are accessible from the top and bottom of the controller. (See Figure 10.) The switch assembly number (the number before the dash) corresponds to the number of the channel. Rocker numbers one to four are used to set the low threshold, and rockers five to eight are used to set the high threshold.

NOTE

The rocker switch assemblies used on the power supply board are slightly different than those used on the microprocessor board. See Figure 17. The switch is open when the rocker is depressed toward the word "open" on the switch assembly. It is closed when the rocker is depressed toward the numbers. In the example illustrated in Figure 17, rocker No. 1 is open and all other switches are closed.

To set the alarm threshold levels for each channel:

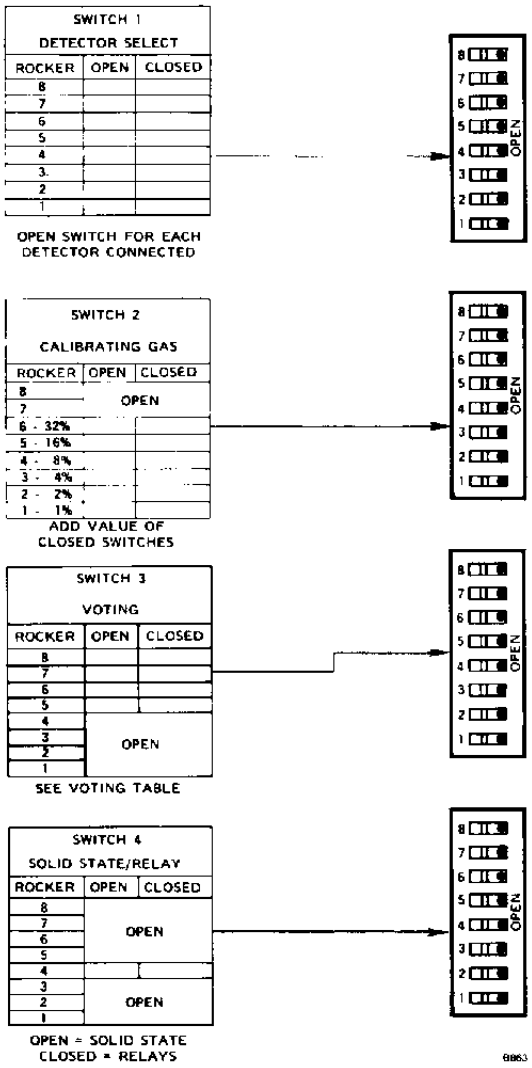


Figure 16—System Layout Chart (Microprocessor Board)

Figure 17—Rocker Switch Assembly

Table 4—Alarm Threshold Switch Settings

Low % LEL	No. 1	No. 2	No. 3	No. 4
10	op	op	op	op
12	cl	op	op	op
14	op	cl	op	op
16	cl	cl	op	op
18	op	op	cl	op
20	cl	op	cl	op
22	op	cl	cl	op
24	cl	cl	cl	op
26	op	op	op	cl
28	cl	op	op	cl
30	op	cl	op	cl
32	cl	cl	op	cl
34	op	op	cl	cl
36	cl	op	cl	cl
38	op	cl	cl	cl
40	cl	cl	cl	cl
High % LEL	**No. 5**	**No. 6**	**No. 7**	**No. 8**
20	op	op	op	op
25	cl	op	op	op
30	op	cl	op	op
35	cl	cl	op	op
40	op	op	cl	op
45	cl	op	cl	op
50	op	cl	cl	op
55	cl	cl	cl	op
60	op	op	op	cl
60	cl	op	op	cl
60	op	cl	op	cl
60	cl	cl	op	cl
60	op	op	cl	cl
60	cl	op	cl	cl
60	op	cl	cl	cl
60	cl	cl	cl	cl

op = open cl = closed

Figure 18—Alarm Threshold Setting

1. Determine the alarm threshold levels to be programmed.
2. Find the correct switch settings using Table 4.
3. Carefully set all eight rockers of the switch assembly.
4. Repeat steps 1 to 3 for each channel having a detector connected.

For example, if a low threshold of 30% and a high threshold of 50% LEL are required, the switch assembly rockers would be set as follows (see Figure 18):

	1	= open
Low	2	= closed
	3	= open
	4	= closed
	5	= open
High	6	= closed
	7	= closed
	8	= open

Figure 19 provides a system layout chart for the power supply board and should be used in conjunction with the microprocessor board chart (Figure 16) to aid in switch

setting and provide a permanent record of all original switch settings. An additional copy of each chart is included in the back of this manual.

SUGGESTION

Filling out the two system layout charts first, and then using the charts to set the rocker switches can result in greater convenience and reduce the chance for error when setting the rocker switches.

TYPICAL SYSTEM APPLICATION

The following typical application is an example only. For assistance in adapting a system to your individual requirements, contact the Field Support Group at Detector Electronics.

The system illustrated in Figure 20 has eight gas detectors connected to an R8460 Controller. Sixteen solid state alarm outputs are furnished, two for each detector (terminals 33 through 48). Four voting outputs (with optional relay contacts) are also available (terminals 12 to 23). The conditions necessary for an output at any of the four voting outputs depends upon the specific voting arrangement pre-programmed by the rocker switches on the microprocessor board. External Inhibit/Reset (terminal 49) is used as a means of remotely inhibiting the output circuits and resetting the controller from a remote location. When the keylock switch on the controller is placed in TEST or RESET, the solid state Outputs Inhibited output (terminal 51) is driven low. The fault relay is de-energized in the event of a system failure.

Power is supplied to the system by external power supplies. The detectors require a 24 volt supply, while the controller can operate from any regulated dc source supplying an output voltage between 10 and 38 volts dc. If separate supplies are used, as shown in this example, their negative terminals must be common. (The use of a well regulated power supply is recommended to en-

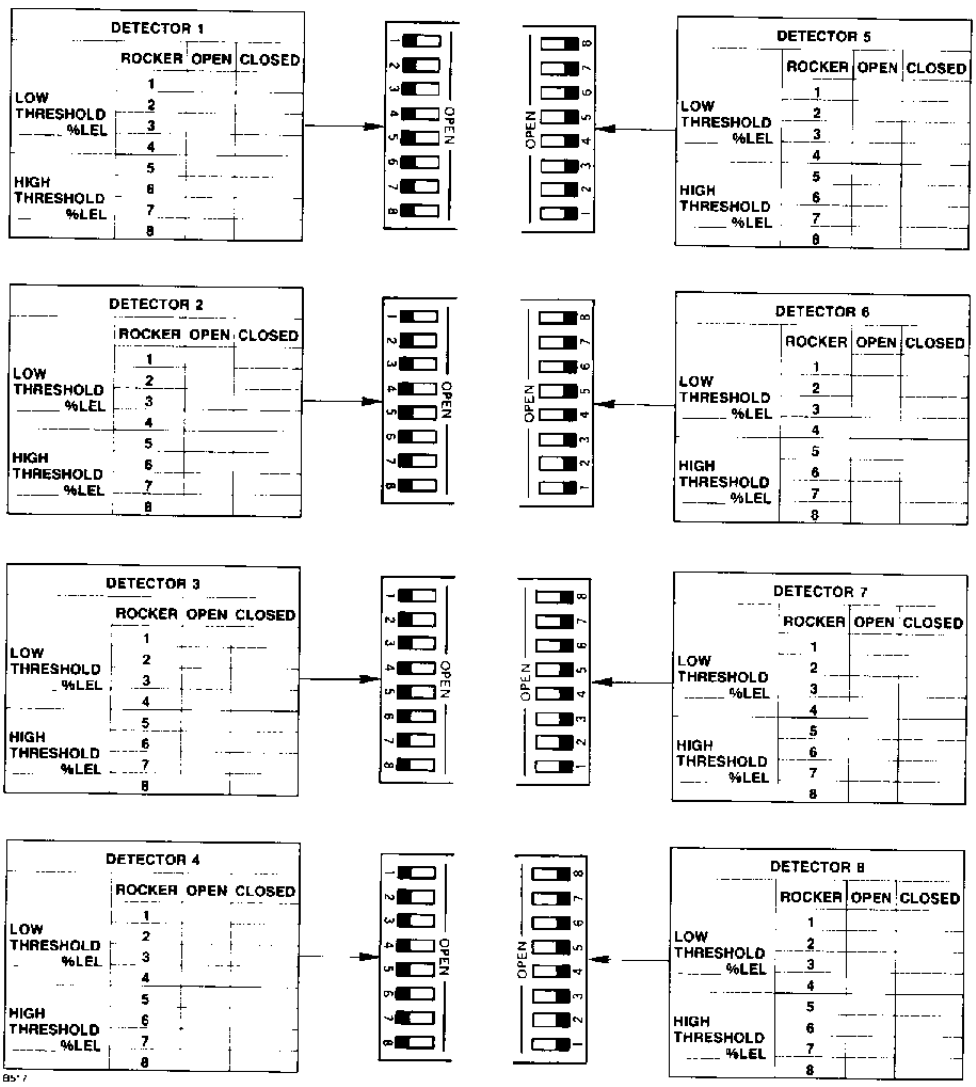


Figure 19—System Layout Chart (Power Supply Board)

sure proper operation of the system. Contact Detector Electronics for information regarding the use of power supplies.) The shields of the detector wiring cables are connected to terminal 2 of the controller.

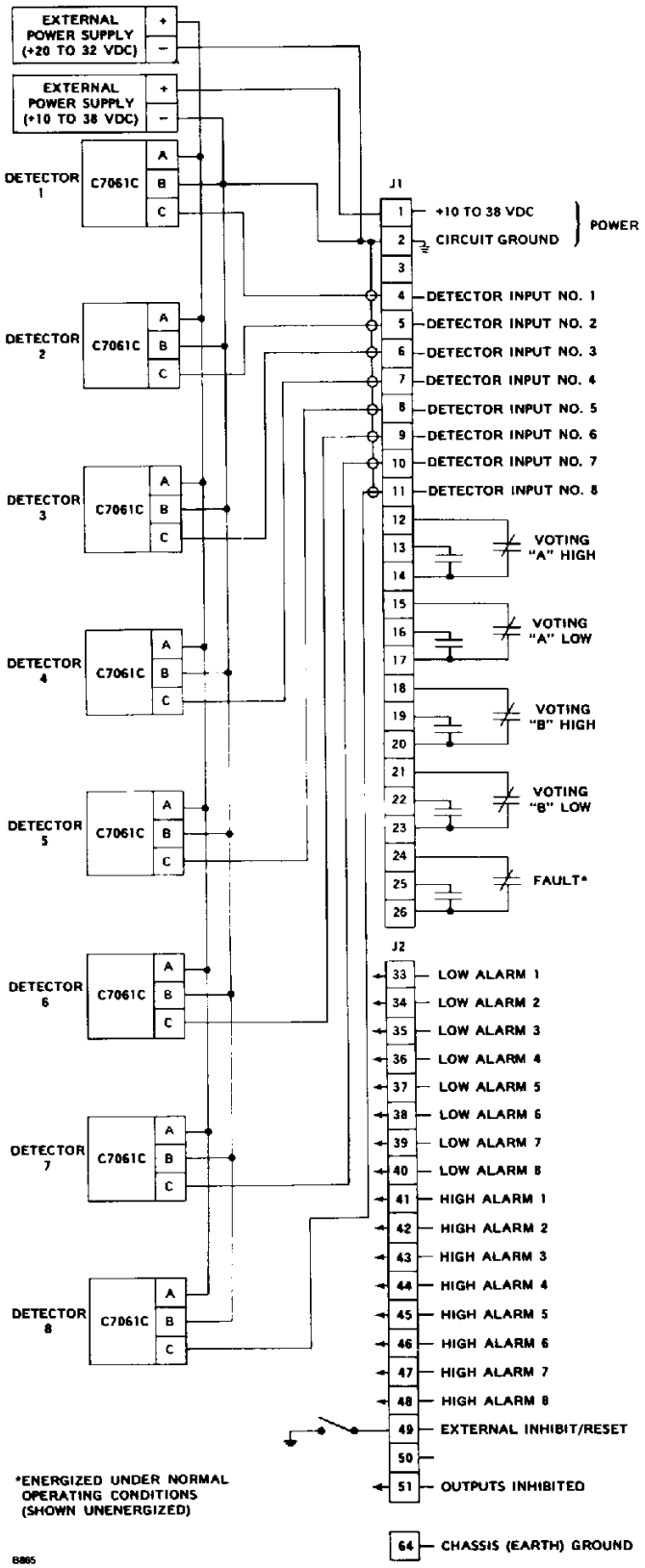


Figure 20—Typical System

STARTUP PROCEDURE

1. In a new installation where power has never been applied to the controller, the system has not yet been "proven" and unpredictable results are possible. Therefore, it is advisable to secure all output loads (remove power from all output devices) that would normally be actuated by the gas detection system to prevent an undesired activation of any of the output devices.

2. After the electrical connections are completed and all rocker switches are properly set, plug the controller into the connector.

3. Apply power to the controller.

4. Perform the Checkout and Calibration procedures.

5. If the controller appears to be operating normally, remove mechanical blocking devices (if used) and restore power to the output loads.

NOTE

The catalytic sensing element in the detector must be operating within a specific temperature range to produce the proper output when exposed to combustible gas. The microprocessor has been programmed to "wait" for two minutes before beginning normal operation when power is applied to the system. During this time, all outputs are inhibited and the FAULT and INHIBIT LEDs are on. This allows adequate time for the detector to properly "warm up" before beginning normal operation. (This warmup feature can be bypassed by applying power to the system with the keylock switch in the RESET position.)

CHECKOUT PROCEDURE

THRESHOLD SETTING TEST

1. Place the keylock switch in the TEST position.

2. Apply power to the controller.

   —The digital displays are blank.
   —The FAULT and INHIBIT LEDs are on.

3. Allow the two minute warmup time to elapse.

   —The controller automatically enters the Test mode. (STATUS display shows "1").
   —The SENSOR display shows the highest numbered detector in the system and the corresponding SENSOR LED is on.
   —The % LEL display indicates the actual LEL percentage of gas being detected at the selected

detector.

4. Press the TEST/ACCEPT button once.

   —The % LEL display shows the low alarm threshold that has been programmed for the channel indicated on the SENSOR display.

   —The corresponding SENSOR LED blinks slowly.

NOTE

The microprocessor requires a finite amount of time to recognize the closure of any of the controller's pushbutton switches. If a button is depressed by a sudden snap of the finger, it is possible for the switch to remain closed for too short a period of time for the microprocessor to recognize a valid switch closure. The controller will then appear to be malfunctioning. Always press the buttons slowly and firmly, while at the same time observing the appropriate displays on the controller. The button(s) can be released as soon as the proper controller response is observed (less than one second).

5. Press the TEST/ACCEPT button a second time.

   —The % LEL display now indicates the high threshold that has been programmed for the selected channel.
   —The SENSOR LED blinks at about twice the previous rate.

6. Depress the TEST/ACCEPT button a third time to cycle the test back to its original position, again displaying the amount of combustible gas actually being detected.

7. Press the SELECT button to select the next lower numbered detector for test. (This is the only position in the program where another channel can be selected for test.)

8. Repeat steps 4 through 7 until all channels in the system have been checked.

NOTE

If this test indicates that an error has been made when programming any of the alarm thresholds, it is necessary to:

—Remove power from the system.
—Remove the controller from the mounting cage.
—Reset the appropriate rocker switches on the power supply board (see "Installation" section).
—Re-install the controller in the mounting cage.
—Apply power to the system.
—After the necessary warmup time has elapsed, retest all channels in the system for proper threshold levels.

MANUAL CHECK OF OUTPUT DEVICES

Automatic diagnostic circuitry in the R8460 Gas Controller continuously monitors the operation of the controller, detectors, and all interconnecting wiring. It does not, however, monitor external relays or equipment activated by the controller output signals. It is important that these devices be checked initially when the system is installed, as well as periodically during the ongoing maintenance program.

CHECKOUT IN TEST MODE

The system can be checked by exposing the detectors, one at a time, to a known level of combustible gas. The gas/air mixture used for system calibration can be used for this purpose. When the detector is exposed to a gas/air mixture when the controller is in the Test mode, the % LEL display indicates the actual LEL percentage that is being detected. If it does not read within 10 percent of the actual value of the test gas (or as defined by the requirements of the particular installation), re-calibration is needed.

CHECKOUT IN NORMAL MODE

The entire system should be periodically checked in the Normal mode to ensure that gas at any detector can cause the controller to produce an output.

CAUTION

Be sure to secure all output devices that are actuated by the controller to prevent unwanted activation of this equipment.

CALIBRATION

Different factors affect the time interval between periodic recalibrations. Certain contaminants in the air, exposure to a high concentration of gas, or even an extended period of normal operation can cause changes in the sensitivity of the sensing element. Since each application is different, the appropriate time interval between regularly scheduled recalibrations must be determined for each individual installation. It is recommended that calibration be checked every 30 days.

Calibration should always be performed using a gas/air mixture of the gas that is intended to be detected. LEL percentages betweeen 30 and 60% are recommended for greatest accuracy.

NOTE

Prolonged exposure to combustible gases may cause the sensitivity of the catalytic sensing element to increase. This shift in sensitivity is not per-

manent, and after operating in clean air for 24 hours, the sensitivity of the detector will return to near its original level. The detector should NOT be calibrated during a time when it is in a state of "increased sensitivity". An unsafe condition could result when it returns to its "normal sensitivity". The R8460 Controller has been designed so that a "4" fault appears when field calibration is attempted on a detector that has been conditioned into a state of "increased sensitivity". Should this occur, allow the detector to operate in clean air for 24 hours before the next calibration is attempted.

To check the system for proper calibration:

—Place the keylock switch on the controller in the TEST position. The % LEL display shows the level of combustible gas currently being detected by the detector that is indicated on the SENSOR display.

—The % LEL display should read zero with no gas (clean air) at the detector.

—Use the calibration kit to apply the gas/air mixture to the detector under test. Allow ample time for the reading on the % LEL display to stabilize (2 to 3 minutes). The reading on the % LEL display should equal the value of the test gas (±10% or as required for the particular installation).

—Press the SELECT button to select the next lower numbered detector for test.

—Repeat the test for all channels in the system.

—Return the keylock switch on the controller to the NORMAL position after the last detector has been tested.

TWO PERSON FIELD CALIBRATION

Since the controller and detectors are normally located a significant distance from each other, two people are needed to perform this calibration procedure. One person uses the calibration kit to apply the calibration mixture to the detector, while the second person operates the switches on the controller.

Each detector is calibrated individually, beginning with the highest numbered detector and proceeding to the lowest numbered detector.

Calibrate each detector in the system as follows:

1. Place the keylock switch on the controller in the RESET position and depress the SELECT button. The % LEL display indicates the gas concentration that the controller is programmed to use for calibration. If a different value is intended to be used, remove power from the system and reprogram the controller as described in the "Installation" section.

2. Place the keylock switch on the controller in the TEST position.

   —The SENSOR window displays the number of the selected detector and the corresponding SENSOR LED is illuminated.
   —A "1" (Test mode) appears in the STATUS window.
   —The FAULT and INHIBIT LEDs are illuminated.
   —The % LEL display indicates the actual LEL percentage of gas at the selected detector.

3. Simultaneously depress the SELECT and TEST/ACCEPT buttons.

   Release the buttons after observing:

   —The SENSOR LED goes out.
   —The % LEL display goes blank.
   —The "1" in the STATUS window changes to "8" (Calibrate mode).

4. The person at the controller presses the TEST/ACCEPT button with clean air (0% LEL) present at the detector. Four seconds later the SENSOR LED blinks slowly (twice per second) and the % LEL display shows "0 0".

5. The person at the detector uses the calibration kit to apply the gas/air mixture to the detector.

6. After the detector has had adequate time to respond to the presence of gas and produce a stable output (approximately 2 minutes), the person at the controller again presses the TEST/ACCEPT button. The SENSOR LED blinks at a faster rate (four times per second) and the % LEL display shows the LEL percentage of the calibration gas.

NOTE

If the SENSOR LED fails to blink (is on steady) after steps 4 or 6, and the STATUS display shows a "3" (count rate too low) or a "4" (count rate too high), it indicates that the sensitivity of the detector is too far out of tolerance for the controller to be able to compensate. The LED for this channel will remain on while the other channels in the system are being calibrated. This must be corrected in either of two ways:

— The detector can be calibrated by the one person calibration method.

— If the sensitivity is reduced to the extent that the detector can no longer be calibrated, the C7061C Detector must be replaced. If the

C7061C is replaced, the one person calibration method should be used.

7. To select the next detector for calibration, the controller must be switched from the Calibrate mode back to the Test mode. (The STATUS display must show "1".) To do this:

   —Simultaneously depress the SELECT and TEST/ACCEPT buttons until a "1" appears in the STATUS window.

   —Press the SELECT button to select the next lower numbered detector.

   (At this point the controller is in the same position in the program as in step 2 above.)

8. Repeat steps 3 through 7 until all detectors in the system have been calibrated.

IMPORTANT

After the entire calibration procedure has been completed, the keylock switch must be placed in RESET. At this time:

—The SENSOR and STATUS displays both show "0". (The SENSOR and STATUS displays MUST both show "0" in the Reset mode before the controller is returned to the Normal mode.)

—The new calibration data computed by the microprocessor is now transferred to the non-volatile memory.

9. Place the keylock switch in NORMAL and the calibration is complete.

NOTE

During the time that the system is being calibrated, the microprocessor stores the pertinent information in a volatile memory. Should power ever be lost during this time, the data will be lost and the procedure must be repeated. After the calibration procedure is completed, the keylock switch must be placed in the RESET position. This transfers the information from the volatile memory to the non-volatile memory. All information in the non-volatile memory is retained if power is ever removed from the controller. If it is necessary to interrupt the calibration procedure, complete the calibration procedure for the channel under test, then place the keylock switch in the RESET position to store the information in the non-volatile memory. The calibration procedure can be continued at a later time at the point where it was interrupted.

ONE PERSON CALIBRATION

The alternate method of calibration requires the use of a calibration kit and a Q8025A Calibration Meter, and can be accomplished by one person. In addition, it can be performed with the controller in the Normal mode. This allows the remaining detectors to function normally as each detector is calibrated.

If the system has previously been calibrated using the two person calibration method, the controller **must** first be programmed to implement the "one person calibration" program. (This is required only if the new system has not yet been calibrated or when going from the two person calibration method to the one person method.) Once the controller has been programmed, future recalibrations using the one person calibration method can be performed without reprogramming the controller.

To program the controller for operation using detectors calibrated by the one person calibration method:

1. Place the keylock switch in the TEST position.

   —The SENSOR display shows the number of the selected channel (starting with the highest numbered channel) and the corresponding SENSOR LED is illuminated.

   —The STATUS display shows "1" (Test mode).

2. Simultaneously depress the SELECT and TEST/ACCEPT buttons until the "1" on the STATUS display changes to "8".

3. Depress the SELECT button until the STATUS display again reads "1". When the SELECT button is depressed in the Calibrate mode, the microprocessor is instructed to implement the "one person calibration program" and to automatically switch out of the Calibrate mode back to the Test mode.

4. Depress the SELECT button to select the next lower numbered channel. The next channel can be selected only in the Test (not Calibrate) mode. Repeat steps 2 through 4 for all channels in the system.

IMPORTANT

After the entire procedure has been completed, the keylock switch MUST be placed in the RESET position. At this time the SENSOR and STATUS displays both show "0". The controller can now be switched back to the Normal operating mode.

Calibrate each detector as follows:

1. Verify that no hazardous levels of combustible gas exist in the area of the detector.

2. Remove the cover from the junction box by turning counterclockwise.

3. Remove the jumper plug from the transmitter module.

4. Plug the calibration meter into the transmitter module. (See Figure 21.)

5. Adjust the ZERO potentiometer for a reading of 100 Hz with clean air (0% LEL) at the detector.

6. Apply the calibration gas to the detector. When the reading stabilizes (about two minutes), adjust the SPAN potentiometer for the required output frequency as calculated below:

   To calculate the SPAN frequency -
   multiply the LEL percentage of the calibration gas by 5, then add 100
   Frequency= (% LEL x 5) + 100

   For example, if a 50% LEL calibration gas is used, the SPAN potentiometer would be set for a reading of 350 Hz on the calibration meter.

7. Remove the calibration gas, then allow 2 to 3 minutes for the reading to return to near 100 Hz. (This will prevent unwanted actuation of alarm outputs when the jumper plug is re-installed.)

8. Remove the calibration meter from the transmitter module and re-install the jumper plug.

9. Place the cover back on the junction box. Be sure that it is tight.

10. Calibrate the remaining detectors in the same manner.

NOTE

Removing the jumper plug will cause the controller

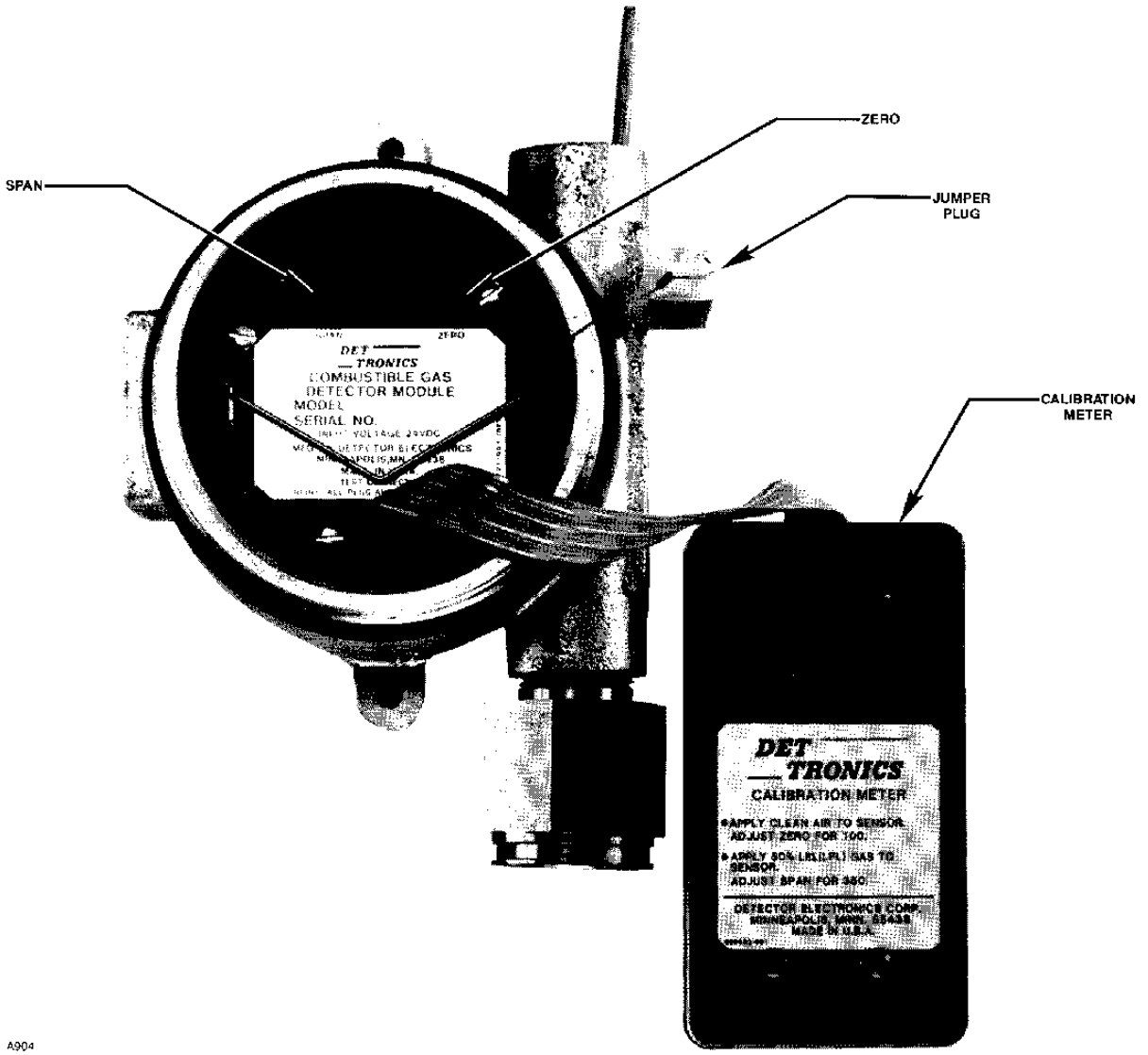


Figure 21—Transmitter Module

to indicate a "3" fault. After the calibration procedure is completed, place the keylock switch on the controller in the RESET position, then return it to NORMAL. If a "3" is still displayed on the STATUS display, check the detector that is indicated on the SENSOR display to be sure that the jumper plug is properly installed.

MAINTENANCE

The gas detection system requires virtually no routine maintenance, except for periodic checks to assure proper system function and calibration. The frequency of these checks is determined by the requirements of the particular installation. In most installations, calibration should be checked every 30 days.

When the detector loses sensitivity to the point that it can no longer be calibrated, it must be replaced. Frequency of replacement will be determined by the amount and type of contamination present at the particular installation.

At least one spare C7061C should be kept on hand for each detector in the system. For maximum protection against contamination and deterioration of the element, it should not be removed from the original protective packaging until immediately before installation. This protective packaging is designed to protect it from contamination for an indefinite period of time.

A test form is supplied with this manual for recording maintenance performed on the system.

TROUBLESHOOTING

NEW INSTALLATION

If a new system malfunctions as soon as power is applied, the problem can usually be attributed to one of three causes:

1. Calibration Required

2. Rocker Switches

   If an error is made in setting the rocker switches on the controller, in some cases the FAULT LED and STATUS display will not be activated. The controller will operate normally, however, it will not respond as desired for the particular application. If this appears to be the problem, double check the rocker switch settings on the controller, carefully following the procedure described in the "Installation" section.

3. Wiring Error

   Broken, missing, or incorrectly installed field wiring can cause malfunctions too numerous to list. Most will be indicated on the STATUS display.

PREVIOUS INSTALLATION

If a system that has functioned normally in the past suddenly develops a malfunction, it is logical to eliminate the possibility of incorrectly set rocker switches or wiring errors. The most likely sources of trouble are:

—Calibration
—Broken or loose wires
—Sensing element contaminated or in need of replacement.

The STATUS display and Table 5 in this manual are intended to serve as an aid in locating the cause of a problem.

The R8460 Controller is not designed to be user serviceable. If a problem develops, first carefully check the calibration, programming, and wiring of the system. If it is determined that the problem is with the controller, it should be returned to the factory for service.

NOTE

Record all faults on the Fault Record Sheet supplied with this manual.

DEVICE REPAIR AND RETURN

Prior to returning devices or components, contact the nearest local Detector Electronics office so that an RMI (Return Material Identification) number can be assigned. A written statement describing the malfunction must accompany the returned device or component to expedite finding the cause of the failure, thereby reducing the time and cost of the repair to the customer.

Return equipment transportation prepaid to the Minneapolis location.

Office locations:

Detector Electronics Corporation
6901 West 110th Street
Minneapolis, Minnesota 55438 USA
Telephone (612) 941-5665
Telex 29-0562 DETRONICS BLTN or 6879043 DETEL UW
Cable Detronics

Detector Electronics Corporation
3000 Wilcrest
Suite 145
Houston, Texas 77042 USA
Telephone (713) 782-2172

Table 5—System Status Identification

Status Display	Condition
0	Keylock switch in RESET position, or the External Inhibit/Reset is being used. Outputs are inhibited.
1	Keylock switch is in TEST position. Outputs are inhibited.
2	Not used.
3	The count rate produced by the detector is lower than what the controller will accept. Possible cause: defective detector, calibration needed, broken detector wire.
4	Count rate is higher than what is accepted by the controller. Output of affected channel is inhibited. Possible cause: detector lead wire is open.
5	Level of gas at the affected detector exceeds the low alarm threshold.
6	Level of gas at the affected detector exceeds the high alarm threshold. As soon as the high threshold is exceeded, the "5" changes to a "6". The "6" continues to be displayed until reset, even if the level of gas drops below the threshold.
7	The concentration of gas being detected has reached 100% LEL. The % LEL display indicates "99".
8	Controller is in the Calibrate mode.
9	The controller memory test, which is automatically initiated upon power-up, has revealed a fault in the controller's memory. If a "9" appears after the controller has been operating normally for a time, the problem could be caused by a defective Voting relay.
Blank	FAULT LED on. The 2 minute warm-up time has not yet elapsed. If the FAULT LED remains on after the warm-up time, place the keylock switch in RESET and press the LAMP TEST button. If the FAULT LED is still on, be sure that the calibration gas is not programmed for 0% LEL (switches 2-1 to 2-6 on the microprocessor board are open). If the FAULT LED is still on, there is a problem in the microprocessor circuitry. It is necessary to repair the controller. Be sure the new controller is programmed exactly the same as the original.

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Detronics A/S
Spireaveien 6
0580 Oslo
NORWAY
Telephone 2651 000
Telex 76082

ORDERING INFORMATION

When ordering, specify model, options and shipping mode.

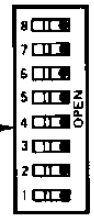
For assistance in ordering a system to fit your application, please contact:

Detector Electronics Corporation
Field Support Group
6901 West 110th Street
Minneapolis, Minnesota 55438 USA
Telephone (612) 941-5665
Telex 29-0562 DETRONICS BLTN or 6879043 DETEL UW
Cable Detronics

SWITCH 1
DETECTOR SELECT

ROCKER	OPEN	CLOSED
8		
7		
6		
5		
4		
3		
2		
1		

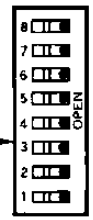
OPEN SWITCH FOR EACH DETECTOR CONNECTED



SWITCH 2
CALIBRATING GAS

ROCKER	OPEN	CLOSED
8	OPEN	
7		
6 - 32%		
5 - 16%		
4 - 8%		
3 - 4%		
2 - 2%		
1 - 1%		

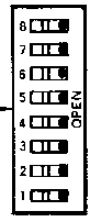
ADD VALUE OF CLOSED SWITCHES



SWITCH 3
VOTING

ROCKER	OPEN	CLOSED
8		
7		
6		
5		
4	OPEN	
3		
2		
1		

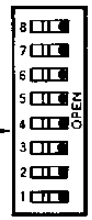
SEE VOTING TABLE



SWITCH 4
SOLID STATE/RELAY

ROCKER	OPEN	CLOSED
8	OPEN	
7		
6		
5		
4		
3	OPEN	
2		
1		

OPEN = SOLID STATE
CLOSED = RELAYS



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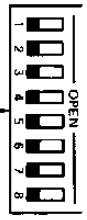
DETECTOR 1

	ROCKER	OPEN	CLOSED
LOW THRESHOLD ____ %LEL	1		
	2		
	3		
	4		
HIGH THRESHOLD ____ %LEL	5		
	6		
	7		
	8		

DETECTOR 2

	ROCKER	OPEN	CLOSED
LOW THRESHOLD ____ %LEL	1		
	2		
	3		
	4		
HIGH THRESHOLD ____ %LEL	5		
	6		
	7		
	8		

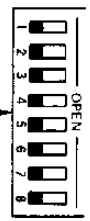


DETECTOR 3

	ROCKER	OPEN	CLOSED
LOW THRESHOLD ____ %LEL	1		
	2		
	3		
	4		
HIGH THRESHOLD ____ %LEL	5		
	6		
	7		
	8		

DETECTOR 4

	ROCKER	OPEN	CLOSED
LOW THRESHOLD ____ %LEL	1		
	2		
	3		
	4		
HIGH THRESHOLD ____ %LEL	5		
	6		
	7		
	8		



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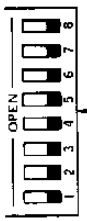
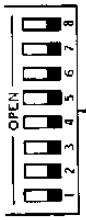
DETECTOR 5

	ROCKER	OPEN	CLOSED
LOW THRESHOLD ____ %LEL	1		
	2		
	3		
	4		
HIGH THRESHOLD ____ %LEL	5		
	6		
	7		
	8		



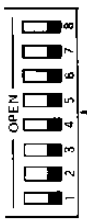
DETECTOR 6

	ROCKER	OPEN	CLOSED
LOW THRESHOLD ____ %LEL	1		
	2		
	3		
	4		
HIGH THRESHOLD ____ %LEL	5		
	6		
	7		
	8		



DETECTOR 7

	ROCKER	OPEN	CLOSED
LOW THRESHOLD ____ %LEL	1		
	2		
	3		
	4		
HIGH THRESHOLD ____ %LEL	5		
	6		
	7		
	8		



DETECTOR 8

	ROCKER	OPEN	CLOSED
LOW THRESHOLD ____ %LEL	1		
	2		
	3		
	4		
HIGH THRESHOLD ____ %LEL	5		
	6		
	7		
	8