GENERAL MONITORS

Protection for life.

MODEL 2250

Multi-Channel
Hydrogen Sulfide Gas Monitor

INSTRUCTION MANUAL 11/89

Part No. MAN2250
Revision 11/89

GENERAL MONITORS

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MODEL 2250

MULTICHANNEL HYDROGEN SULFIDE MONITOR

I. INTRODUCTION

A. NOTICE

The Model 2250 System is easy to install, calibrate, and operate when the procedures described in this manual are followed. General Monitors urges that the entire manual be carefully read before attempting to place the system in service, and that all "CAUTIONS" and "WARNINGS" stated in this manual be observed.

B. GENERAL

The General Monitors (GMI) Model 2250 System has evolved from earlier GMI systems which have been used world-wide for many years. GMI systems have an unsurpassed reputation for reliability. By carefully following the instructions in this manual you will be assured of continuous and dependable protection against hazardous accumulations of hydrogen sulfide gas.

Model 2250 is a multichannel system for continuous, independent monitoring of 2, 3, or 4 locations. The system consists of a general purpose controller plus 2, 3, or 4 explosion proof sensor assemblies (depending on how many active channels were ordered). The system contains two independent gas alarm circuits (designated LOW and HIGH) to warn of dangerous accumulations of gas at any sensor location.

The controller is a general purpose solid-state electronic instrument featuring recent advances in electronic circuitry and packaging techniques. It is designed for wall, rack or panel mounting. The sensor assemblies are explosion proof, for remote mounting in the areas where hydrogen sulfide may be present.

External controller connections are made to positive pressure terminals on rear-mounted terminal blocks. Primary power requirements are 117VAC @ 50-60Hz, or 24VDC. If desired the DC input terminals may be used for "battery back-up" connections, to provide continuous operation during commercial power outages. (See Battery Backup Section, Page 13 for details.) Power consumption is 12 watts (nominal) for the common alarm version, or 16 watts when the controller is supplied with the discrete channel alarm option.

Front panel indicators include a meter, plus discrete status indicating LED's per channel to indicate low gas alarm, high gas alarm, malfunction, and channel idenification. The meter is linear and is scaled from either 0-20 ppm, 0-50 ppm, or 0-100 ppm H_2S, depending which range was specified on the purchase order.

A "Peak Picking" circuit constantly monitors the sensor input from all channels and sends the highest channel signal to the meter for visual display. The highest reading channel is identified by the "HI CHAN" LED for that channel. The discrete status indicators operate independently of the "Peak-Picking" circuit, and provide continuous visual indication of the status of all channels.

A 4-20 ma analog output signal (optionally available) tracks the meter reading. When this option is supplied, a second output signal (1, 2, 3, or 4 V) is also provided for channel identification purposes.

In addition to the discrete alarm LED's, relay contacts common* to all channels are provided for the low, high, and malfunction alarm circuits. Several relay options are available, as covered in the "Controller Features" Section of this manual.

If either or both gas alarms are ordered in latching configuration (requiring manual reset), they are reset by the pushbutton on the upper right of the front panel. The alarms will only reset after the gas concentration falls below the set point level.

The discrete channel alarm LED's operate independently of the HI CHAN selection circuit. In other words, on any channel where the H_2S concentration exceeds the alarm set point, its discrete channel alarm LED will illuminate regardless of whether that channel is the highest reading channel.

C. SENSOR OPERATING PRINCIPLE

GMI's sensor is a solid state, continuous diffusion type element. H_2S will adsorb onto different metal oxide semiconductors, and change their electrical resistance. GMI has developed a proprietary metal oxide semiconductor which is extremely selective in "permitting" only H_2S to adsorb onto it. That is, very few other compounds found in practical applications will affect this metal oxide.

The semiconductor is located in the system circuit, acting as a resistor. When air which contains H_2S diffuses into the sensor through the flame arrestor, the adsorption of the H_2S onto the semiconductor causes its electrical resistance to decrease. The sensor is temperature controlled to prevent adsorption rate variations from ambient temperature changes. The decrease in resistance is extremely repeatable over a range of 0-100 ppm H_2S. The resistance change produces an analog signal proportional to the H_2S concentration. This signal is processed and displayed on the controller meter in ppm H_2S. The controller analog output signal (if optionally selected) accurately tracks the H_2S reading as well.

*Discrete gas alarm relay contacts per channel are optionally available.

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C. SENSOR OPERATING PRINCIPLE (Cont'd)

The adsorption process is reversible, so that when air which is free of H_2S subsequently diffuses into the sensor, the H_2S gas desorbs. The semiconductor then resumes its original "clean air" resistance value.

II. CONTROLLER FEATURES

A. "CALIBRATION" TOGGLE SWITCH

This three-position switch is located on the upper left hand side of the front panel. The three positions are:

1. "N" (Normal Operation). This is the position for everyday operation.
2. "C" (System Calibration). This position is for use whenever a system calibration is performed (see the CALIBRATION SECTION of this manual). With the switch in this position the low and high gas alarm relays are disabled to prevent false alarms.
3. "A" (Alarm Set). The controller must be switched to this position when ever the alarm set points or the analog output signal are being adjusted (see the INSTALLATION INSTRUCTIONS SECTION). In this position all gas alarm relays are disabled to prevent false alarms.

NOTE: In the "C" and "A" positions, all discrete channel Malfunction LED's will flash on/off indicating "not normal operation". This safety feature will remind the operator to return the Calibration Toggle Switch to the Normal Operation ("N") position.

B. METER

The linear meter provides a direct readout in a range of either 0-20, 0-50, or 0-100ppm, depending on which range was ordered.

C. DISCRETE CHANNEL STATUS INDICATORS

Each active channel has four status indicators (LED's). They are:

1. Malfunction (MALF). An internal electronic circuit monitors each active channel for certain problem conditions (power outage or low line power, severed sensor cable, and improper sensor heater functioning). Any channel in malfunction at any given time will have its yellow MALF LED illuminated.

IMPORTANT NOTE: If your system was ordered with more active channels than you intend to utilize initially, a dummy sensor (CMI P/N 50460 3) must be connected to each channel not being used; otherwise those channels will constantly be in malfunction. The dummy sensors will have been provided with the system if less than a 4 channel unit was ordered.

2. High Channel ("HI CHAN"). The channel which is producing the highest H_2S reading at any given time will have its green HI CHAN LED illuminated. The highest reading channel will always be the channel which is automatically displayed on the meter.

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C. DISCRETE CHANNEL STATUS INDICATORS (Cont'd)

3. Low Gas Alarm ("LOW"). An internal circuit monitors each channel for a pre-set low alarm ppm level. The set point level is fully adjustable over the meter range. If one or more sensors are exposed to an H_2S concentration which reaches or exceeds the set point level, the yellow "LOW" LED for each channel in low alarm will illuminate.

4. High Gas Alarm ("HIGH"). The high alarm circuit operates the same as the low alarm circuit, but is independent from it.

NOTE: On the standard Model 2250 the low and high alarm circuits operate normally de-energized, and the malfunction circuit normally energized, with power applied. By special order the low and high alarm circuits can be provided to operate normally energized.

D. MANUAL OVERRIDE SWITCH

This pushbutton switch enables the operator to check the meter reading for any channel. It overrides the automatic display of the highest reading channel. The switch for each channel is located immediately below the MALF LED for that channel.

E. ALARM RESET SWITCH

This pushbutton switch must be depressed in order to de-activate any existing gas alarm condition if either gas alarm circuit was provided in latching configuration. The alarm will reset only if the H_2S concentration for each channel in alarm has fallen below the pre-set alarm level. If either or both gas alarm circuits were ordered in non-latching configuration, the alarm condition will automatically reset once the H_2S concentration falls below the pre-set level.

NOTE:

Latching high alarm, non-latching low alarm is standard on the Model 2250. Your system will differ only if specified at the time of order. The malfunction alarm is always non-latching.

F. ALARM RELAY CONTACTS

Your Model 2250 was provided with a DPDT contact for each of the three alarm circuits. Each circuit and its relay is common to all active channels in the standard Model 2250. These contacts are rated at 3 amps at 117VAC, resistive. See Section III. E. for information on inductive loads, and for wiring connection instructions in general.

G. ALARM RELAY CONTACT OPTION

If your order specified, your system will have been provided with sealed DPDT relays. These relays are encased in a nitrogen atmosphere. The sealed relay contacts are rated 3 amps at 117 VAC, resistive.

H. ANALOG OUTPUT OPTION

If specially ordered, your system will have been provided with a 4-20 milliampere analog output signal, common to all channels, which tracks the meter reading both in automatic or manual override mode. A second output signal provides channel identification by means of a voltage offset signal. When the peak-picking circuit selects the highest channel, the corresponding I.D. signal levels are: Channel #1, 1 volt; #2, 2 volts; #3; 3 volts; and #4, 4 volts.

I. DISCRETE ALARM RELAY OPTION

This "special order" option provides independent low and high alarm relay contacts for each active channel. The malfunction relay operation remains the same (one relay, common to all channels). The option consists of a special controller plus an auxiliary relay module. The special controller contains the common malfunction relay plus the gas alarm relays for Channel #1. The auxiliary module contains the independent gas alarm relays for the other channels. See the Installation Section of this manual for further details. CAUTION: unless the relay module is interconnected to the controller, the controller will alarm on Channel 1 only.

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III. INSTALLATION

A. CHOOSING SENSOR LOCATIONS

There are no hard and fast rules governing the selection of optimum sensor locations. The customer must evaluate conditions at his own facility to make this determination. The following are the major factors to be considered:

1. LIKELY SOURCES OF ESCAPING H_2S

In general at least one sensor should be located in close proximity to each point where H_2S is most likely to escape into the air. Consideration should also be given to placing sensors at locations where the H_2S may be carried by local air currents, ventilation equipment, etc.

2. ENVIRONMENTAL FACTORS

Avoid installing sensors where they will be unnecessarily exposed to wind, dust, water, shock, or vibration. Observe the temperature range limitations of sensors, covered in the specification section of this manual.

3. "POISONS" AND "CONTAMINANTS"

Sensors may be adversely affected by prolonged exposure to certain materials. Loss of sensitivity, or corrosion, may be gradual if such materials are present in low concentrations, or it may be rapid at higher concentrations. The more important materials adversely affecting sensors are:

- Halides (compounds containing chlorine, fluorine, bromine, or iodine).
- Silicones (often contained in greases and aerosols). Silicones do not chemically attack the sensor. They instead coat it and therefore reduce or stop its response to H_2S.
- Acid vapors.
- Caustic liquids or vapors.

The presence of such materials in an area does not necessarily preclude the use of a sensor. The feasibility of using a sensor in such areas must be determined by an analysis of the specific factors in each application. However, sensors used in such areas usually require calibration checks on a more frequent basis than normal, and typically have a shorter life than normal. In many such applications the normal two year warranty would not apply.

B. SENSOR ASSEMBLY INSTALLATION

******CAUTION-VERY IMPORTANT******

You will note that each sensor is shipped from the factory with a red plastic cap fitted over the sensing head. Inside the cap is a desiccant. DO NOT remove this cap until you are ready to power the system. SAVE the cap and RE-CAP the sensor at any time in the future when the system's power is off for an extended period of time. The desiccant pack may be discarded. When installing sensors be sure to leave enough clearance from the ground, walls, etc. to be able to fit the calibration bottles supplied with the system onto the sensor head. Each sensor is matched with a specific channel at the factory, and is tagged accordingly. Check and match each sensor to the proper channel before installing it.

The standard sensor assembly consists of a sensor housing (GMI P/N 10252) and sensor (P/N 50445-1, -5, or -9) (see Figure 1). The dash (-) numbers correspond to full scale ranges of 0-100, 0-50, or 0-20 ppm respectively. The sensor assembly is recognized as safe for U.S. National Electric Code (NEC) Class 1, Groups B, C and D hazardous areas, and is approved by the Canadian Standards Association (CSA).

Sensors should ALWAYS be mounted pointing DOWNWARD to prevent the collection of moisture or contaminants. Several sensor covers are available, which will have been supplied with the system if ordered. These include P/N 1800822 sintered stainless steel dust cap, P/N 10395-1 splash guard, and P/N 10110 dust guard. All of these accessories are designed to provide extra protection in problem environments.

The sensor is connected to a numbered terminal strip within the sensor housing, as follows (Terminal #5 is not used):

SENSOR HOUSING TERMINAL NUMBER	SENSOR WIRE COLOR
1	White
2	Black
3	Red
4	Green

The Sensor Assembly should be installed with conduit in hazardous areas. The sensor cable should be shielded, especially when run near high power electrical circuits or R-F equipment. Shielded cable should be grounded only at the controller, using the ground terminals provided. Care should be taken to insure that the outer braid does not contact the conduit or junction boxes.

B. SENSOR ASSEMBLY INSTALLATION (Cont'd)

General Monitors' cable is color coded, and should be connected to Rear Terminal Board, at "CH 1 SNSR", "CH 2 SNSR", etc., as shown in the following table.

CHANNEL (1,2,3, or 4) TERMINAL BOARD	Sensor Cable Color
W1	White
B2	Black
R3	Red
G4	Green

General Monitors cable must be specified on the purchase order, otherwise GMI assumes that the cable will be supplied by others.

Splices in the sensor cable should be avoided where possible. If required, they must be of high quality and must be soldered. Soldered connections in the sensor cable run will insure trouble-free operation of the low level sensor signals.

C. CONTROLLER LOCATION

The controller is not explosion proof or weatherproof. It must be installed in a non-hazardous, weather protected area. The following mounting hardware items are available:

P/N 10199-1	98 mm Panel Mount Frame
P/N 10203-1	98 mm Wall Mount Bracket
P/N 10200-1	19" Rack Frame (up to 4 controllers)
P/N 10191	Blank Panel (one per unused position in P/N 10200-1 Frame)

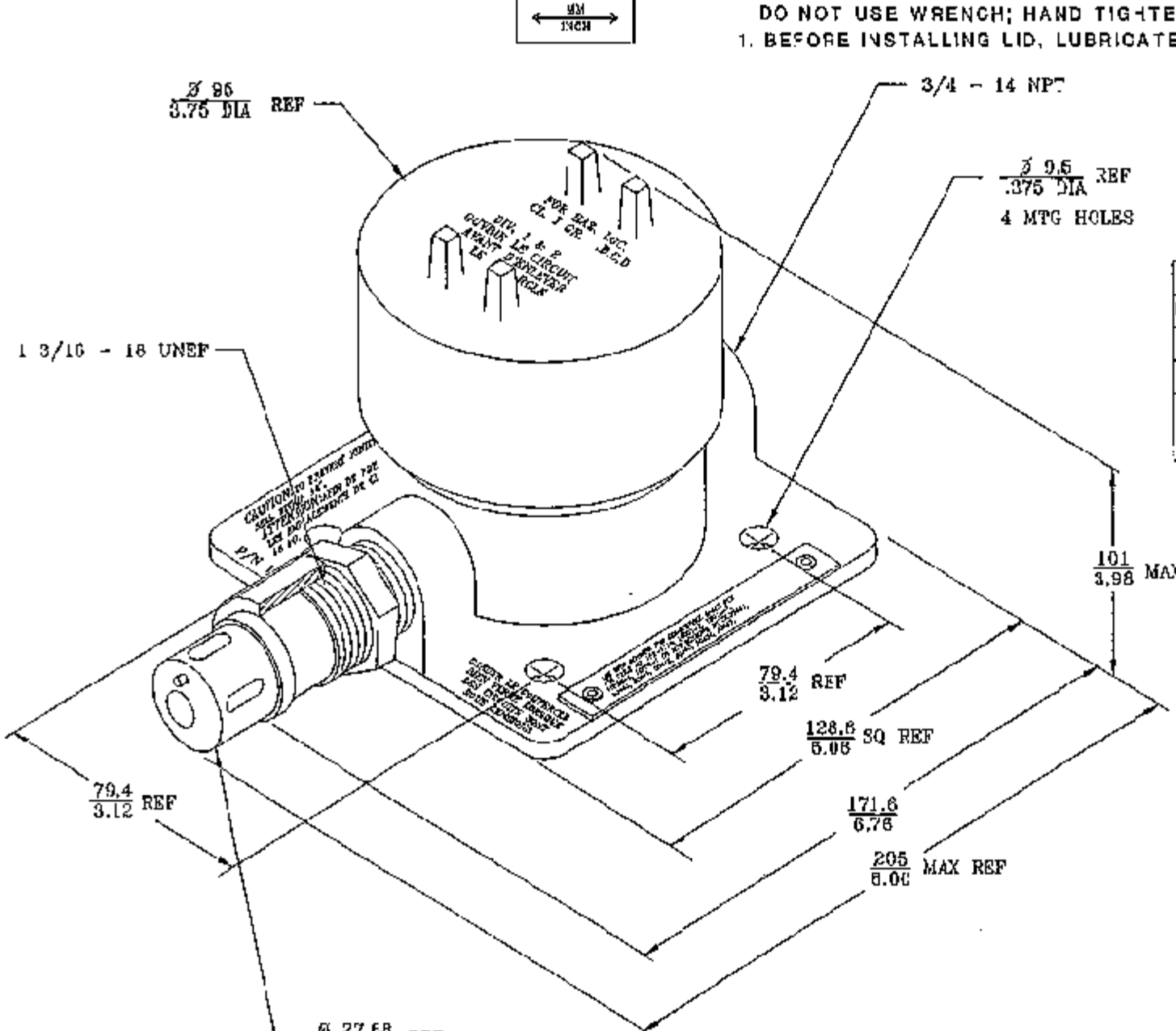
Controller mounting should always be as free from shock and vibration as possible. A wiring service loop is recommended to facilitate access to the rear panel and alarm set pots.

******CAUTION:******

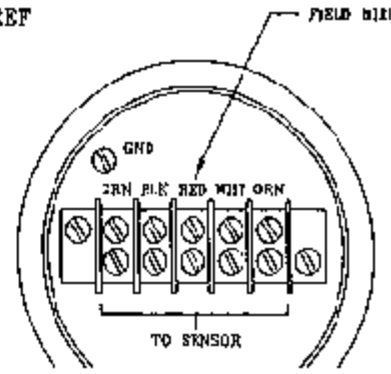
The controller terminals will not accept cable larger than AWG #14. If the discrete alarm relay option has been provided, refer to Section E.

DIMENSIONS
MM
INCH

3. JUNCTION BOX ASSY (WITHOUT SENSOR) PN 10252.
2. SENSOR INSTALLATION - LUBRICATE THREADS AND DO NOT USE WRENCH; HAND TIGHTEN ONLY.
1. BEFORE INSTALLING LID, LUBRICATE THREAD STACK.



SENSOR GUARDS	
PART NUMBER	DESCRIPTION
1800822	DUST GUARD
10395	SPLASH GUARD
10110	DUST GUARD WITH DISPOSABLE SCREEN



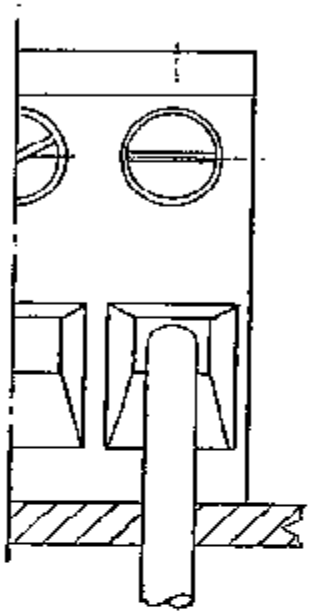
WIRING DETAIL
(COVER REMOVED)

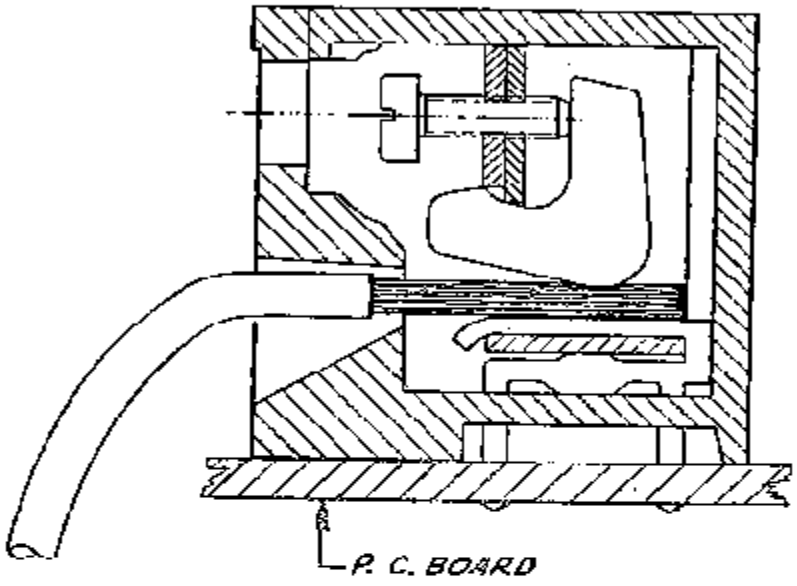
(REF 10266D)

FIG. 1

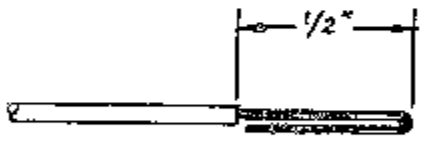
JUNCTION BOX ASSY-
SENSOR

WIRE INSERTION INSTRUCTIONS
FOR WEIDMÜLLER TYPE "TOP" TERMINAL BLOCKS





WIRES 14 TO 18 AWG



WIRES 20 OR 22 AWG

NOTES:

1. STRANDED WIRE IS PERMISSIBLE, BUT SOLID WIRE IS PREFERRED.
2. WIRE MUST BE STRIPPED, AS SHOWN, AND FULLY INSERTED.
3. LEADS MUST NOT BE TINNED.
4. THE USE OF ANY SCREWDRIVER OTHER THAN THE PROVIDED "GENERAL MONITORS" MODEL OR ANY STRAIGHT SHANK (CABINET) 1/8" MIN. BLADE MAY CAUSE INCORRECT TIGHTENING, BREAK THE SCREW HEAD OR OTHERWISE DAMAGE THE TERMINAL BLOCK AND ITS CONNECTION.

OCTOBER 1984

D. POWER CONNECTIONS

(See Figure 2). The controller can be factory ordered to operate from either 117VAC or 220VAC (not both), 50/60 Hz. Connections are made to the AC Terminal Board (Line, Neutral, Ground), using accepted commercial wiring practices. Since no ON-OFF Switch is provided in the instrument, power should not be connected to the Primary Power until all remaining connections are made. GMI does not supply an ON-OFF switch in order to eliminate the risk of accidental shutdown.

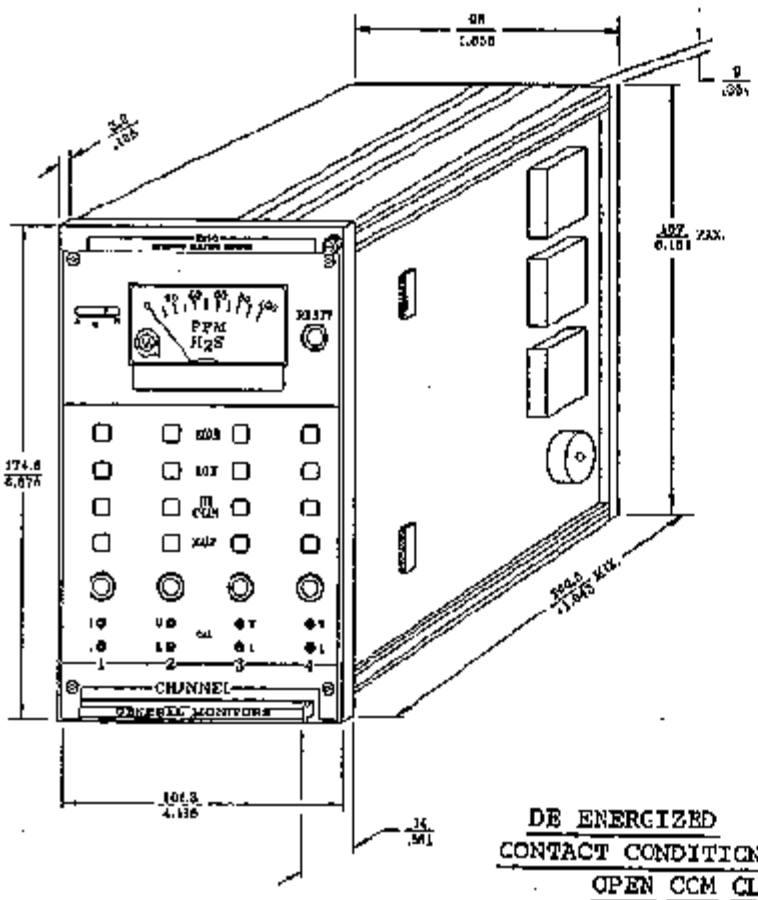
The system may also be powered from a 24VDC source with a minimum capacity of 2 amperes. Primary DC Power connections (or Battery Back-up) are made to Controller Terminal Blocks "DC" (+ and -). (See Figure 2).

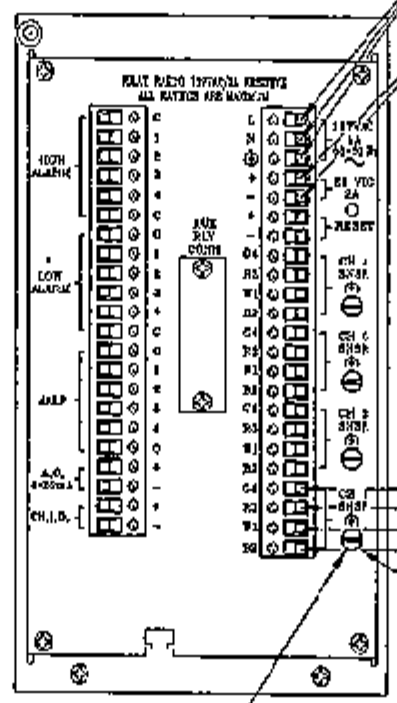
E. ALARM, ANALOG OUTPUT, AND REMOTE RESET CONNECTIONS

Alarm contacts for customer use are brought out to the Alarm Terminal Blocks at the rear of the controller. These three individual DPDT contacts are rated 3A at 117VAC, resistive.

*****CAUTION:*****

Inductive loads (bells, buzzers, relays, contactors, solenoid valves, etc.) connected to the high alarm, low alarm, and malfunction alarm relays must be clamped as shown in the following diagrams. Unclamped inductive loads can generate voltage spikes in excess of 1000 volts. Spikes of this magnitude will cause false alarms and possible damage.





PRIMARY INPUT POWER
117 VAC 50–60 Hz

BACKUP/ALTERNATE INPUT
POWER 24 VDC
(CUSTOMER SUPPLIED OPTION)

CONDUIT

FIELD TERMINATION LUGS TO BE CRIMPED AND SOLDERED.

DRN
NOT USED

TO SENSOR

SENSOR

CABLE:
4 CONDUCTOR SHIELDED CABLE. DO NOT SPLICE CABLE UNLESS NECESSARY. SPLICES, INCLUDING SHIELD, MUST BE TIGHT AND SOLDERED. (ALL ACTIVE CHANNELS)

REAR VIEW

DE ENERGIZED
CONTACT CONDITION

	OPEN	COM	CLOSED
LOW ALARM	2,3	C	1,4
HIGH ALARM	2,3	C	1,4

ENERGIZED
CONTACT CONDITION

	OPEN	COM	CLOSED
MALFUNCTION	1,4	C	2,3
LOW ALARM	1,4	C	2,3
HIGH ALARM	1,4	C	2,3

NOTE:
TIE SHIELD AT REAR OF CONTROLLER ONLY. IT MUST NOT TOUCH SENSOR HOUSING, CONDUIT, OR ANY OTHER GROUND POINT.

JUNCTION BOX WIRING DETAIL
(COVER REMOVED)

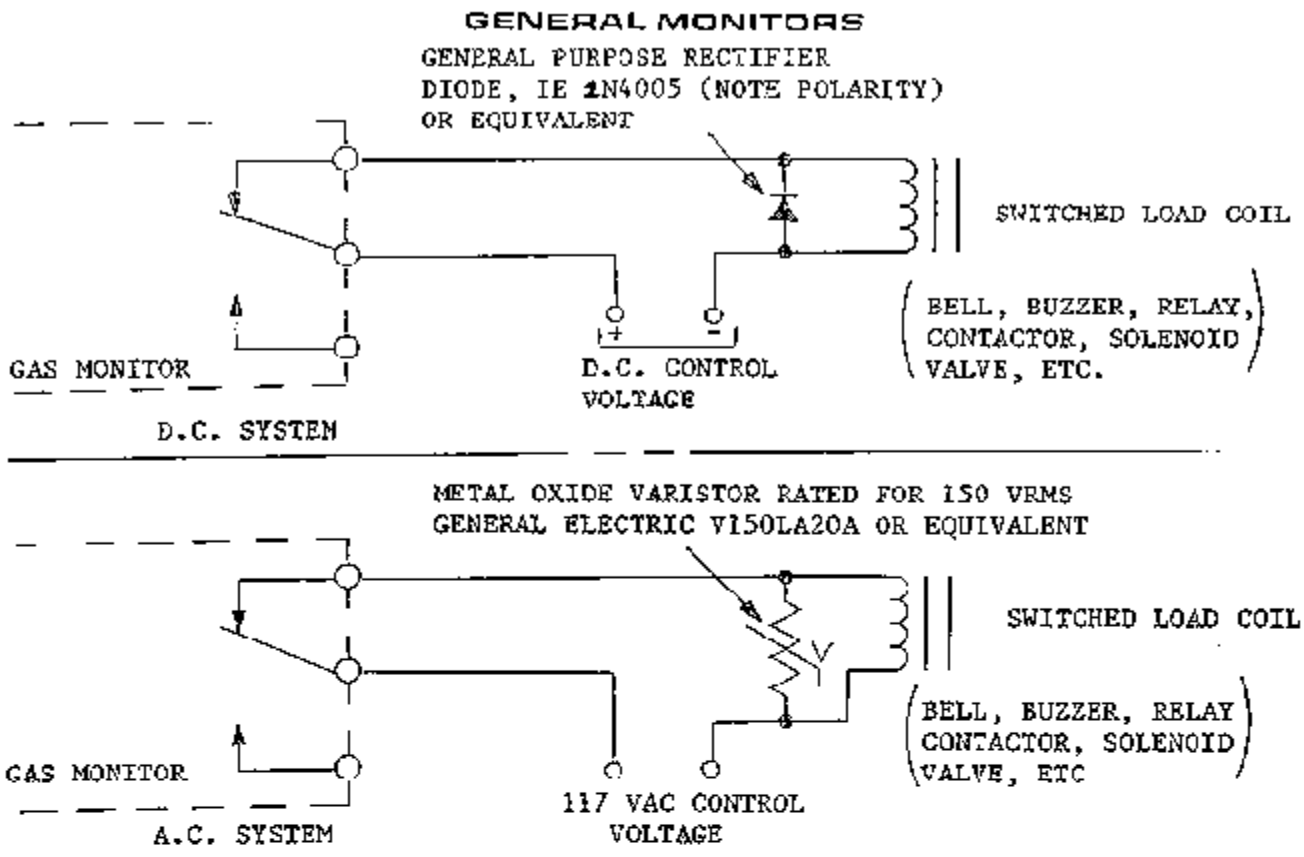
DIMENSIONS
mm
inch

OUTLINE DRAWING AND REAR TERMINAL CONNECTIONS

Mi FI 2250

(REF 50691D)

FIG.2

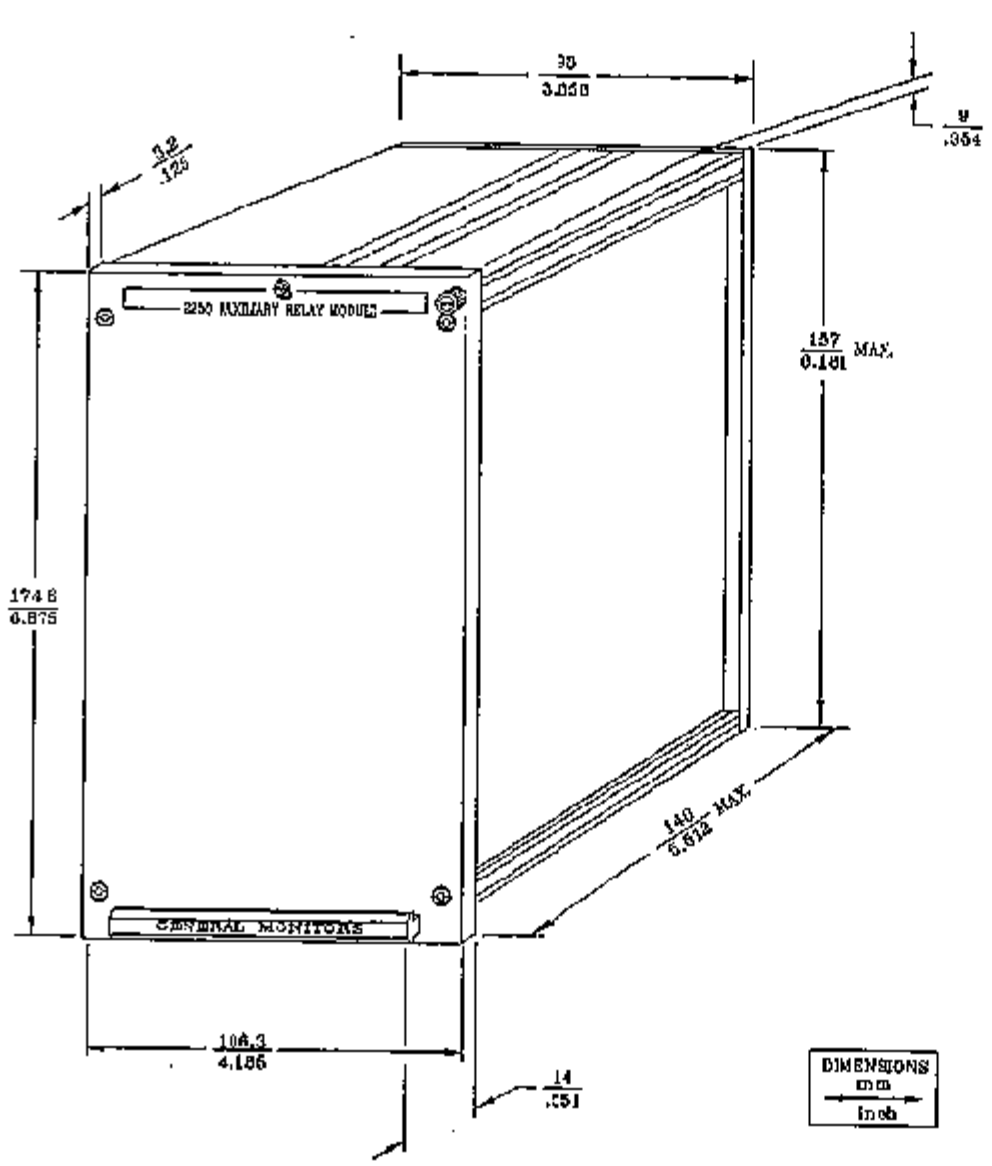


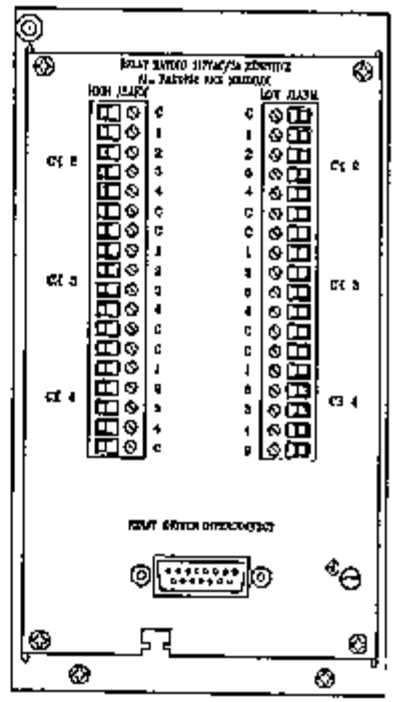
The relay contacts may be used to operate customer auxiliary alarms, shut down or start up equipment, etc. The malfunction relay is normally energized with power applied. The gas alarm relays (HIGH and LOW) are normally de-energized (normally energized operation of these relays is available on special order).

If GMI's Discrete Alarm Relay Option was ordered, the following information is applicable. An auxiliary relay module will have been provided, in addition to a special Model 2250 Controller (see Figure 3). The module has the same front panel dimensions as the controller, but is only half as long. All mounting hardware accessories for the controller may be used for the auxiliary module as well. The module can be mounted immediately beside the controller, or behind it on a shelf, in a rack or panel mounted configuration. The controller contains the malfunction relay (common to all channels), plus the low and high alarm relays for Channel #1. The auxiliary module contains the low and high alarm relays for the other active channels. The module is connected to the controller by 12 conductor cable. External alarm connections are made at the appropriate terminal blocks on the controller and auxiliary module.

The 4-20 milliampere analog output signal is only provided if specially ordered. Connections are made to the terminal blocks labeled A.O. (+ and −). Channel I.D. connections (CH. I.D. + and −) are located just below the analog output. (Channel #1, 1 volt; Channel #2, 2 volts; Channel #3, 3 volts and Channel #4, 4 volts) (see Figure 2).

Remote manual reset of latching gas alarm relays (if any) may be utilized. Connections are made to the terminal block labeled "RESET". The remote reset switch must be a normally open type.





REAR VIEW

1. FOR OUTLINE DRAWING & REAR TERMINAL CONNECTIONS, MODEL 225C CONTROL INSTRUMENT, SEE DWG 50691.

(REF 50731C)

FIG.3

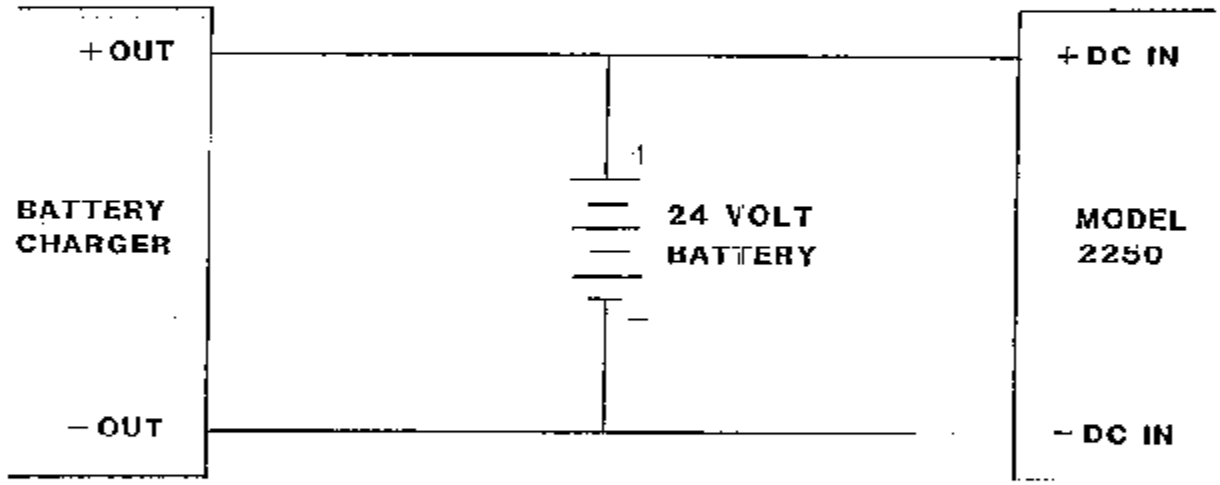
OUTLINE DRAWING & REAR TERMINAL CONNECTIONS MODEL 2250AUX RELAY MODULE

F. BATTERY BACKUP

Battery backup may be employed if desired. The customer furnished battery may be connected as shown. No manual or relay switching is required. A customer furnished battery charger should be used to keep the battery charged to battery manufacturer's recommended level. The cable length (battery to controller) should be as short as possible. Should an AC power failure occur, the 24 Volt battery supplies current through the diode to the controller circuitry DO NOT USE MORE THAN A 24 VOLT BATTERY.

The battery rating (ampere-hour capacity) is dictated by the length of time you expect power outages to last. A complete 4-channel Model 2250 requires approximately 1 ampere (peak) at 24 Volts DC. General Monitors recommends that a Lead-Acid type battery be used. This type battery can be expected to last for several years with minimum maintenance.

NOTE: The schematic is complete for a total of one Model 2250 Controller. A separate battery is recommended for EACH controller.



IV. OPERATING ADJUSTMENTS

A. GENERAL

Review the previous section on installation instructions and double-check all cable and power connections for proper installation.

B. APPLICATION OF POWER

Apply power to the controller. One of the discrete channel HI CHAN" LED's will turn on immediately. "HI CHAN" LED's may switch from one channel to another during the initial warm-up period. Should a malfunction condition be displayed, check the sensor cable for that channel for proper connections at the controller and sensor housing, and for cable splices. If this check does not locate the problem, check for proper Primary Voltages (AC or DC), then for proper sensor operating voltages.

REAR PANEL SENSOR TERMINAL	OPERATING VOLTAGE*
*W (WHITE)	+ 18 to 19VDC
*R (RED)	+ 15 VDC

* Use the (-) DC terminal on the Rear Panel as "common" for these measurements.

C. ALARM ADJUSTMENTS

Alarm adjustment pots are accessible from the right hand side of the controller (when facing it). To gain access, slide the controller forward a few inches from its mounted position.

TO ADJUST THE LOW ALARM: (see Figure 4).

1. Set the Toggle Switch (upper left corner of the controller front panel) to position "A". This position permits adjustment and disables external alarm circuitry. With the toggle switch in this position, all malfunction LED's will flash, indicating the controller is "out of normal operating mode".

2. Turn Cal. Pot R131 (on the left side of unit) (see Figure 5) clockwise and observe the meter needle deflection. Adjust the pot to move the needle to the desired low alarm set point.

C. ALARM ADJUSTMENT (Cont'd)

3. With the meter at the desired level, adjust the LO Pot R118 (on the right side of unit) counter clockwise (CCW) until the Low Alarm LED (Channel 1 only) just starts flashing. If this Low Alarm LED is flashing initially, turn the pot clockwise (CW) until the LED goes off, then adjust CCW until the LED flashes.

4. To check the alarm setpoint, adjust the meter down scale using the CAL pot then slowly adjust the meter upscale, noting the concentration on the meter at which the Low Alarm LED (Channel 1) flashes. Repeat steps 2 and 3 if the Low Alarm LED does not start to flash at the desired concentration.

5. Return the toggle switch to position "N". All Malfunction lights will stop flashing and turn "OFF".

The procedure for adjusting the High Alarm is similar to the Low Alarm adjustment procedure.

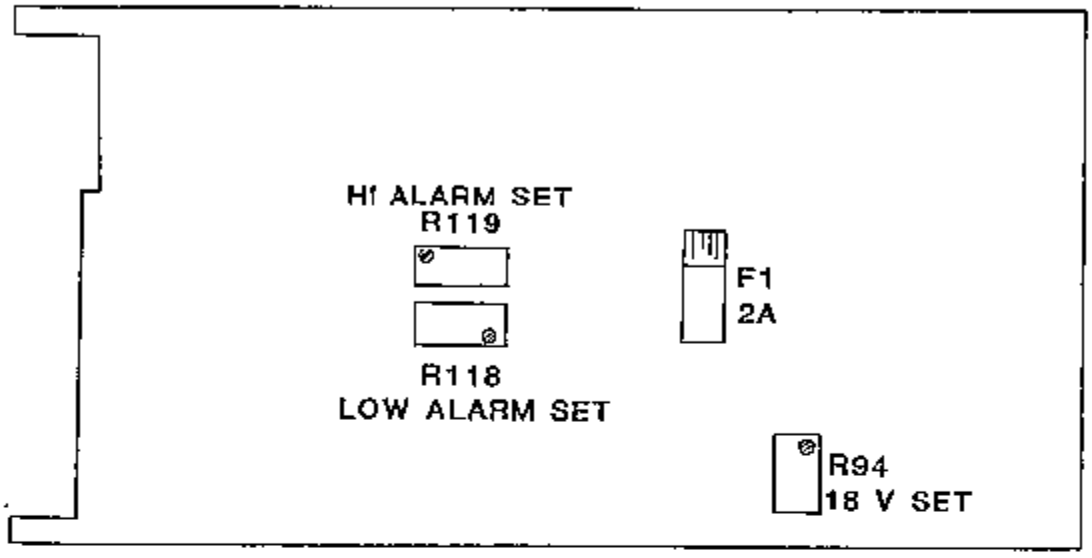
1. Set the Toggle Switch to Position A. Malfunction lights will start flashing.

2. Using CAL pot R131, adjust the meter to the desired high alarm set point.

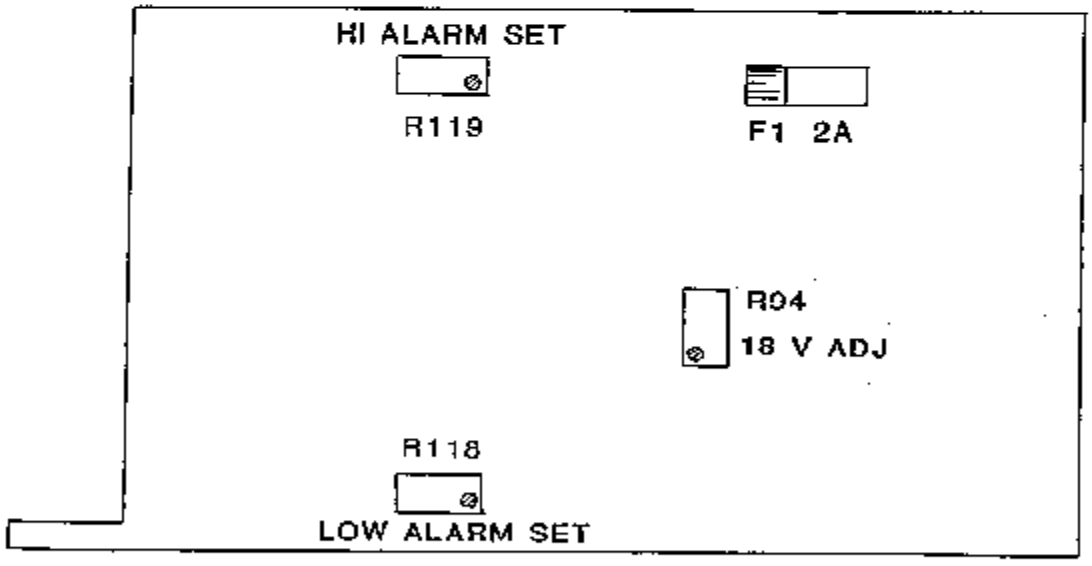
3. If the High Alarm LED (Channel 1) is off, adjust HI pot R119 CCW until the High Alarm LED just starts flashing. If the High Alarm light is flashing adjust HI pot R119 CW until it goes out, then CCW until it starts flashing. (Hold Reset Switch in for Automatic Reset).

4. To check the High Alarm set point adjust the meter downscale, then slowly adjust it upscale, noting the point at which the High Alarm LED (Channel 1) starts flashing. If the set point is not adjusted properly, repeat Steps 2 and 3. The high alarm is now set.

5. Return the toggle switch to position "N" for normal operation. Malfunction lights will stop flashing and turn "OFF".



POWER SUPPLY CARD ENERGIZED



POWER SUPPLY CARD DE-ENERGIZED

FIG.4

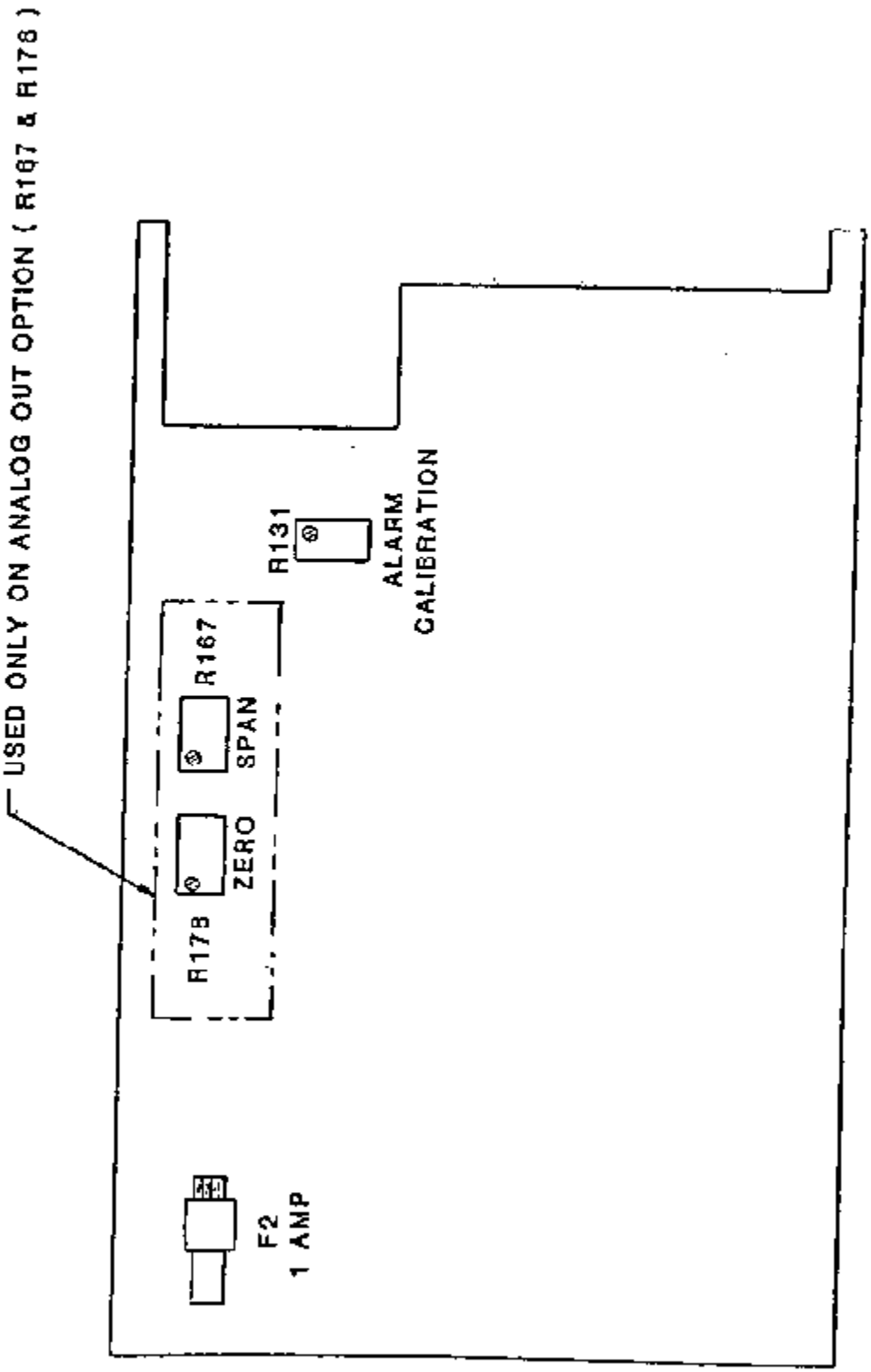

USED ONLY ON ANALOG OUT OPTION (R167 & R178)
R178
ZERO
R167
SPAN
R131
ALARM
CALIBRATION
F2
1 AMP
CONTROL
ELECTRONICS

FIG. 5

D. ANALOG OUTPUT ADJUSTMENT/CHECK

A 4-20 milliampere analog output signal is optional, and this section is applicable only if it was specially ordered.

Adjustment for the low end of the range (4ma) is controlled by Recorder Zero (RZ) Pot R178 (see Figure 5). The high end of the range is controlled by Recorder Span (RS) Pot R167. RZ and RS are located on the left hand side when facing the controller.

To adjust or check the output, move Toggle Switch SW1 to the Alarm Set Position "A". All discrete malfunction lights on the front panel will start flashing, indicating "out of normal operation". The meter deflection is now controlled by Cal Pot R131. Adjust R131 so the meter needle is at zero. The analog output should now be at 4ma. Measure it at the A.O. Terminals on the rear panel. If adjustment is necessary, adjust RZ Pot R178. Now move the front panel meter to full scale by adjusting Cal Pot R131. This will activate the front panel low and high alarm lights. Again measure the output at the A.O. Terminals. It should be 20 ma. If adjustment is necessary, adjust it using RS Pot R167. The output signal is now checked or adjusted. The Cal Pot R131 must now be adjusted so that the meter deflection is below the low alarm set point. Push the front panel Alarm Reset switch to reset any latching alarms. Return the toggle switch to the "N" (Normal) position. All malfunction lights will turn off unless a true Malfunction condition exists.

VI. TROUBLESHOOTING PROCEDURES

PROBLEM	POSSIBLE CAUSE	CORRECTIVE ACTION
1. Front Panel "Hi-Chan" LED doesn't light on application of primary power to controller.	1. Primary Power (AC or DC) fuse blown. 2. No Primary Power. 3. Channel "L" span Pot turned down.	1. Replace blown fuses. 2. Check primary power. 3. Rotate "L" span Pot CW until "Hi Chan" LED lights.
2. Front Panel Alarm Light (discrete) is on all the time.	1. Gas at Sensor. 2. Sensor leads (Red & Green) are shorted.	1. Check for gas at the sensor. 2. Check sensor cable & connections for shorts.
3. Front Panel Reset Switch doesn't "Reset" the alarm LED's.	1. Gas at Sensor. 2. Sensor leads (Red & Green) are shorted.	1. Check for gas at the sensor. 2. Check sensor cable & connections for shorts.
4. Alarm circuits (Low and/or High) do not turn on when gas is at the sensor.	1. No 15 VDC power to the Sensor. 2. Problem in the Controller alarm circuits.	1. Verify 15 VDC power to sensor. (Red sensor lead to -DC terminal). Controller should be returned to the factory for repair if power to sensor is not 15 VDC. 2. Short red to green wire. This will cause false high alarm if controller is working O.K. If controller is O.K., problem is in sensor or sensor cable.
5. All front panel Malfunction Lights are flashing on/off. 6. All front panel lights are on (not flashing).	1. Toggle switch SW1 in C or A position. 1. Low primary power. 2. All sensors in malfunction.	1. Be sure Toggle Switch is in the N (Normal operation) position. 1. Verify proper primary power. 2. Check 18 & 15 VDC sensor operating voltages.
7. Malfunction light is flashing on/off after initial application of power during installation.	1. Sensor cable not connected properly at sensor or controller. 2. Low primary power (AC or DC) to controller. 3. Blown fuse in individual channel 18 VDC power circuit.	1. Verify sensor cable connection correct at sensor and controller. 2. Verify proper primary voltage at controller. 3. Check for voltage (18 to 19 VDC between sensor White and Black leads. If low, adjust 18 Volt control on controller right hand side (R94)(see Figure 4).

If the problem appears to be beyond the scope of the above procedures, please consult the factory. Repair effort beyond replacement of recommended spare parts by other than factory personnel may void the warranty.

VII. SPECIAL WARNING

Through engineering design, testing, manufacturing techniques, and rigid quality control, General Monitors delivers the finest gas detection systems available. The user must recognize his responsibility for maintaining the gas detection system in operational condition.

(1) GENERAL MONITORS recommends a calibration check on a regular schedule. The calibration check should be conducted at least every ninety (90) days. This is the only method of insuring proper system operation and response to H_2S. More frequent calibration checks are encouraged, to spot problems such as mud collecting on the sensor heads, accidental painting over of sensors, etc. A calibration check is defined as the procedure of applying a known concentration of gas to the system sensors while observing the controller. The visual display will indicate the gas concentration and activate alarm indicators/circuits in direct relationship to gas concentration. Calibration adjustments must be made if results are at variance (See CALIBRATION section of this manual).

(2) GENERAL MONITORS cautions, as with all equipment of this type, that high levels or long exposure to certain atmospheres will "poison" the sensor and eventually affect sensitivity. See Section III.A (3) for specific information. Use in such atmospheres requires calibration checks on a more frequent schedule than normal. General Monitors should be consulted for application feasibility determination before installing a system in such atmospheres.

(3) GENERAL MONITORS' sensors and sensor housings are designed and tested for use in certain classes of hazardous atmospheres. Explosion-proof integrity cannot be maintained if sensors and sensor housings are operated in other than the "as designed" condition. Terminal access covers of sensor housings must be on. Sensor housing must be installed in accordance with National Electrical Code acceptable practices for the class of hazardous atmosphere.

(4) Sensors are designed with sintered metal or screen covers which act as flame arrestors. Do not operate sensors without screen or sintered metal parts in place.

(5) GENERAL MONITORS' gas detection systems are primarily SAFETY devices for the protection of personnel and facilities, and must be "always ready". With proper installation, calibration, and maintenance, the system will provide continuous monitoring of hazardous areas. The user must assume all liability for misuse of GENERAL MONITORS' gas detection systems.

(6) The system's full two year warranty will be voided if customer personnel or third parties damage the system during repair attempts.

V. CALIBRATION

A. GENERAL

Considering the toxicity of hydrogen sulfide, General Monitors strongly recommends the period between calibrations should never exceed 90 days.

It is very important that the owner/operator of this equipment determine the correct calibration schedule for their particular environment. Frequently because of environmental contaminants and conditions the frequency of calibration may be substantially shorter than 90 days. This calibration frequency must be determined empirically by following a regular calibration routine and procedure.

A sample calibration schedule and checklist have been provided in the appendix of the manual. Please refer to it in establishing the required calibration program.

There are two calibration routines for the Model 2180 H_2S monitoring system which will required periodically. They are described in detail below.

1. Calibration Check

   This procedure is used to periodically and routinely check the response of an installed system to a known concentration of H_2S (see Part C below).

2. System Calibration

   This procedure is used for the initial installation/start-up of the system. This procedure is also used to re-calibrate the system if a controller or sensor is replaced/exchanged (see Part D below).

B. PRE-CALIBRATION INSTRUCTIONS

Before a full calibration or a calibration check is begun, assure that the sensing assembly is in "clean air". If the atmosphere at the sensor contains a low background of H_2S observe the following procedure:

1. Obtain a GMI field calibrator plastic bottle (P/N 50000). Assure that it contains no H_2S by flushing it with clean air. Place your hand or a cover over the bottle's open end take it to the sensor.
2. Place the bottle over the sensor.
3. Wait a few minutes for the sensor to become permeated with clean air. The meter will be in the wide black zone on the meter face.
4. Remove the sensor from the bottle.

After each use of the field calibrator plastic bottle, it is necessary to clear the bottle of residual H_2S gas. This may be done by flushing the plastic bottle with clean air or by human breath.

C. CALIBRATION CHECK

Using field calibrator plastic bottle (P/N 50000), obtain a GMI glass ampoule which has the same ppm H_2S concentration as the 50% of full scale marking on controller. For example, for a 100 ppm full scale range, use a 50 ppm ampoule. Check the date code on the ampoule. Ampoules may start to lose concentration after a specified period. The ampoule label will state: "EXP (date)". Please adhere to this cut-off date. Place the ampoule in the holder inside the bottle and place the bottle over the sensor to be calibrated. Crush the ampoule by turning the screw assembly, which serves as a vise. Wait for the meter to stabilize.

After stabilizing, the meter should read [50$\pm$10 (e.g.,$\pm$20%) ppm]. If so, the CALIBRATION CHECK is completed. If the meter does not read within above noted tolerances, it will be necessary to calibrate per Section D, which follows.

D. SYSTEM CALIBRATION

1. Controller and sensors are factory matched and should be installed as a matched set in order to preserve factory-set adjustment points. The correct sensor serial number to be used with each channel, along with alarm set points, are found on the white label on the top plate of the controller. Be sure each controller/sensor has been in operation for 24 hours prior to calibration to assure its stability.

2. Assure that the sensor is in "clean air" per Section B above. Select an H_2S calibration ampoule that represents the full scale reading on the meter. Place the ampoule in the calibration bottle (P/N 50000). Place the bottle over the sensor, and crush the ampoule as described in Section C. above. Make sure that there is a tight seal between the sensor and the bottle. Approximately 5 minutes should be allowed to assure a stabilized reading. After it stabilizes, adjust the front panel "D" Span Pot for that channel, to obtain a full scale reading. Remove the calibration bottle from the sensor and empty of broken glass. Clear the bottle of residual H_2S gas before exposure to the "low calibration ampoule".

3. Select an H_2S calibration ampoule that represents 20% of the full scale meter range. Place the ampoule in the field calibration bottle and repeat the procedure per Step 2 above to expose the sensor to H_2S gas for 5 minutes. Then adjust the "L" Span Pot to move the meter needle to 20% of full scale. Remove the calibration bottle from the sensor and empty the broken glass.

4. Next, perform the procedure given in Part C above at 50% of full scale. This will verify the accuracy of calibration.

5. When a new sensor is installed in an existing system, recalibrate using each step of Section D.

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VIII. WARRANTY

GMI warrants all of its products to be free from defects in workmanship or material under normal use and service within two (2) years (Gas Detection) and (1) year (Flame Detection) from date of shipment. GMI will repair or replace without charge any equipment found to be defective during the warranty period. Final determination of the nature and responsibility for defective or damaged equipment will be made by GMI personnel. Gas detection elements which have been poisoned by contaminants are not included in this warranty. In all cases this warranty is limited to the cost of the equipment. All warranties hereunder are contingent upon proper use in the application for which the product was intended and do not cover products which have been modified or repaired without GMI approval or which have been subjected to neglect, accident, improper installation or application, or on which the original identification marks have been removed or altered. GMI's responsibility under the above warranty shall be limited to the repair or replacement at GMI's option at no cost to the purchaser for parts or labor, of any component which fails during the warranty period provided that the purchaser has promptly reported such failure to GMI in writing and GMI, upon inspection, found such component to be defective. The purchaser must obtain shipping instructions for the return of any item under this warranty provision and compliance with such instruction shall be a condition of this warranty.

EXCEPT FOR THE EXPRESS WARRANTY STATED ABOVE, GMI DISCLAIMS ALL WARRANTIES WITH REGARD TO THE PRODUCTS SOLD HEREUNDER INCLUDING ALL IMPLIED WARRANTIES OF MERCHANTABILITY AND FITNESS AND THE EXPRESS WARRANTIES STATED HEREIN ARE IN LIEU OF ALL OBLIGATIONS OR LIABILITIES ON THE PART OF GMI FOR DAMAGES INCLUDING, BUT NOT LIMITED TO CONSEQUENTIAL DAMAGES ARISING OUT OF/OR IN CONNECTION WITH THE USE OR PERFORMANCE OF THE PRODUCT.

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SAMPLE CALIBRATION SCHEDULE AND CHECKLIST

Sensor Serial Number _____ Location _____

1) Installation and Preliminary Calibration (Record date after preliminary calibration in done) Date: _____

2) 24 hour calibraton (Record date after 24 hour calibration is done) Date: _____

3) 7 day calibration check (Record date and reading of calibration check. Repeat after 7 days if reading deviates more than +/- 20% or 2 ppm, whichever is greater. Otherwise go to step 4)

Date/Reading		Date/Reading		Date/Reading	

4) 14 day calibration check (Record date and reading of calibration check. Repeat after 14 days if reading deviates more than +/- 20% or 2 ppm, whichever is greater. Otherwise go to step 5)

5) 1 month calibration check (Record date and reading of calibration check. Repeat after 1 month if reading deviates more than +/- 20% or 2 ppm, whichever is greater. Otherwise go to step 6)

6) 2 months calibration check (Record date and reading of calibration check. Repeat after 2 months if reading deviates more than +/- 20% or 2 ppm, whichever is greater. Otherwise go to step 7)

7) 90 day calibration check

IX. MODEL 2250 SPECIFICATIONS

CONTROLLER

Mounting Options:	Rack, panel or wall.
Dimensions:	106 mm x 175 mm x 298 mm (4"W x 7"H x 11-1/2"D).
Weight:	3.6 kg (8 lbs.)
Temperature Range:	-18°C to + 66°C (0°F to + 150°F).
Power:	22-30 VDC; 105 130 VAC, or 200-240 VAC, 50-60 Hz; 12 watts (nominal (16 watts for discrete alarm option).
Meter Range:	0-100ppm H_2S (standard). Others available are 0-20, 0-50ppm.
Repeatability:	± 1% of input.
Number of channels:	4 (maximum).
Alarm Circuits (standard):	Three: High, Low and Malfunction, common to all channels. Non latching malfunction and low alarm, and latching high alarm. DPDT contacts rated at 3A @ 117 VAC, resistive.
Status Indicators:	One meter common to all channels. Individual LED's to indicate high alarm, low alarm, and malfunction conditions, as well as peak channel identification.
Electrical Classification:	General purpose.
Options:	4-20 ma analog output, plus channel identification mark for peak channel. Normally energized low and high alarms. Latching or non-latching low and high alarms (any combination). Discrete HIGH and LOW relay contacts per channel. Sealed relays.
Warranty:	Two years.

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SENSOR

Type:	Continuous diffusion, adsorption type.
Temperature Range:	-40°C to + 90°C, (-40°F to + 195°F).
Response Time:	Meter display reads 25% full scale within 20 seconds, 50% within 60 seconds, when exposed to H_2S in a concentration equal to full scale.
Drift:	5% per year.
Repeatability:	2 ppm or $\pm$ 10% of applied gas, whichever is greater.
Electrical Classification:	Class I, Division 1, Group B, C, and D (U.S. NEC). Approved by the Canadian Standards Association (CSA).
Specificity:	H_2S specific.
Warranty:	Two years.
Cable:	Four conductor cable. Maximum length of cable between controller and sensor assembly with loop resistance of 20 ohms.

Wire Size	Length:	
AWG	(Meters)	(Feet)
14	1,029	3,375
16	686	2,250
18	411	1,350
20	274	900

NOTE: Shielded cable is recommended.

X. RECOMMENDED SPARE PARTS

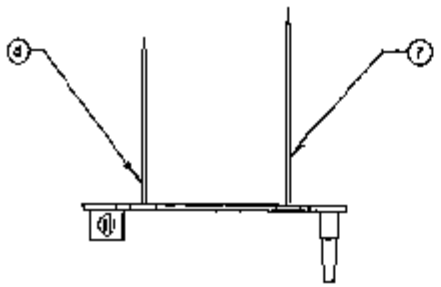
Up to Two Years Operation

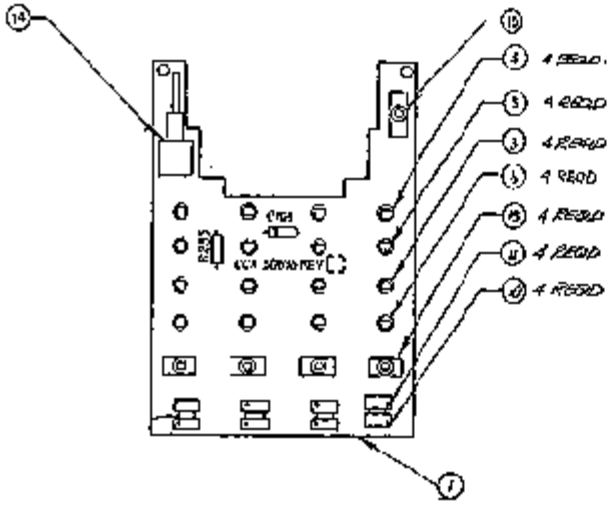
ITEM	QTY.	P/N	DESCRIPTION
1.	1	939-048	Lens - Amber
2.	1	939-049	Lens - Red
3.	1	939-047	Lens - Green
4.	1	951-201	Fuse, 2 amp
5.	1	951-013	Fuse, 1 amp
6.	4	951-104	Fuse, 3/4 amp
7.	1	50445-X	Sensor (specify range)
8.	A/R	50009-X	Calibration Kit (specify meter range)
9.	A/R	50008-X	Calibration Ampoules (box of 12) (specify meter range)

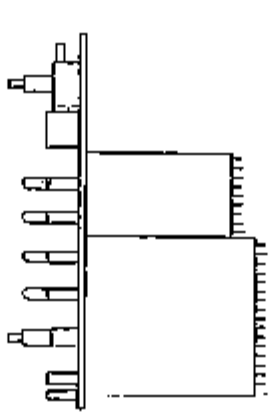
NOTES:

1. If more than one Model 2250 is purchased we recommend that one spare sensor be purchased for every controller, and quantities shown above for all other items be purchased for every two controllers.

2. When ordering please identify the range of any item with "-X" in P/N.





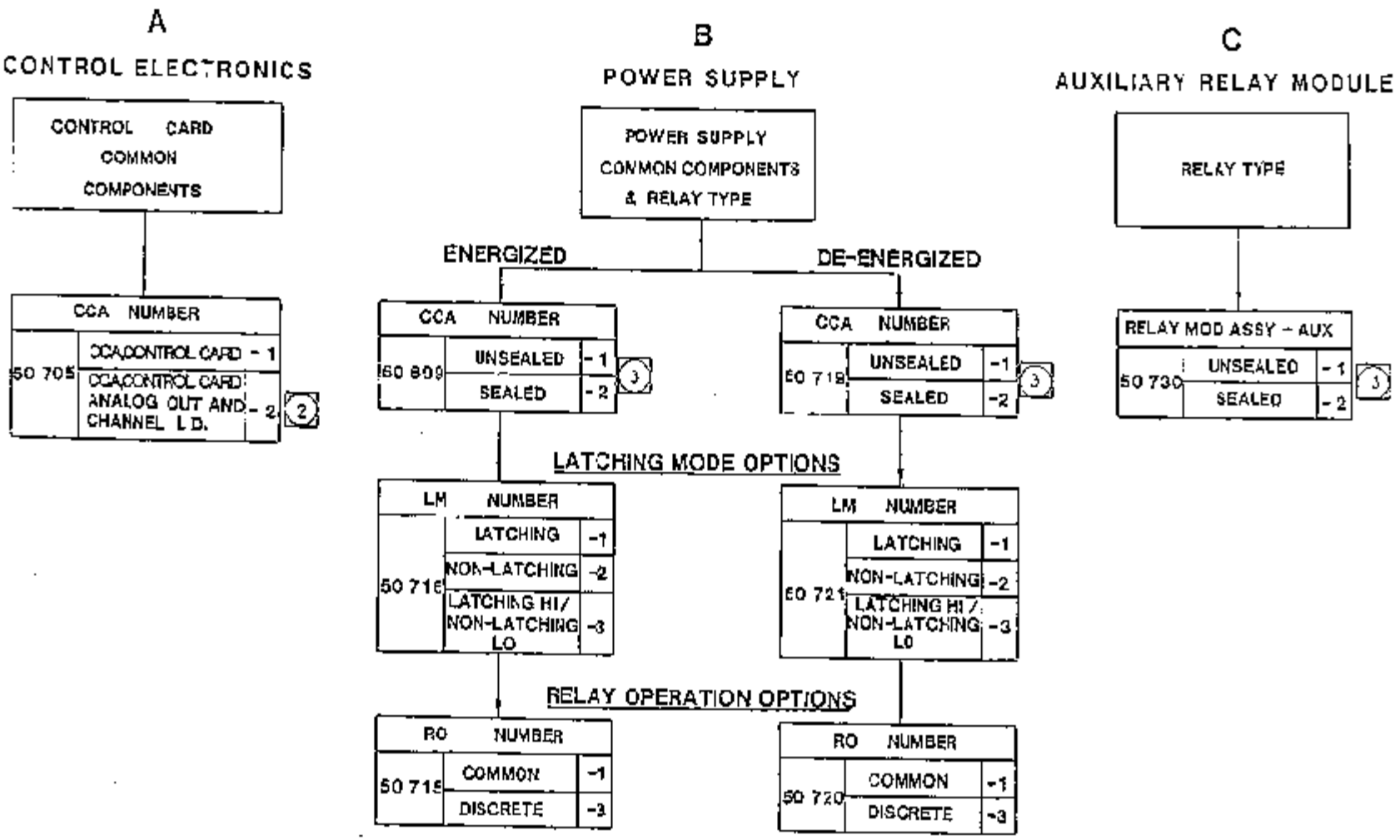


A/R	932-002	CONFORMAL COATING		15
1	951-340	SWITCH TOGGLE (DPDT)	SZ	14
5	951-417	SWITCH, PUSH (SPDT)	SZ THRU 5	13
4	911-036	RESISTOR, 10K, 1/4W, 1%	R 9 THRU 12	12
4	947-543	POT 10K	RV57, 171, 332, 251	11
1	947-552	POT 1K	RV8, 138, 219, 228	10
1	918-102	DIODE, IN4002	CR 114	9
1	10207-6	JUMPER, FLEXSTRIP 36-0		8
1	10207-1	JUMPER, FLEXSTRIP (1-CKT)		7
				6
8	948-329	LED LIGHT, AMBER	LED5-8, 13-16	5
4	948-327	LED LIGHT, RED	LED1-4	4
4	948-328	LED LIGHT, GREEN	LED9-12	3
				2
1	50 096	CCA, INTERFACE BOARD		1
QTY	PART NO.	DESCRIPTION		ITEM

(REF 50696-B)

FIG.6

CCA, INTERFACE BOARD



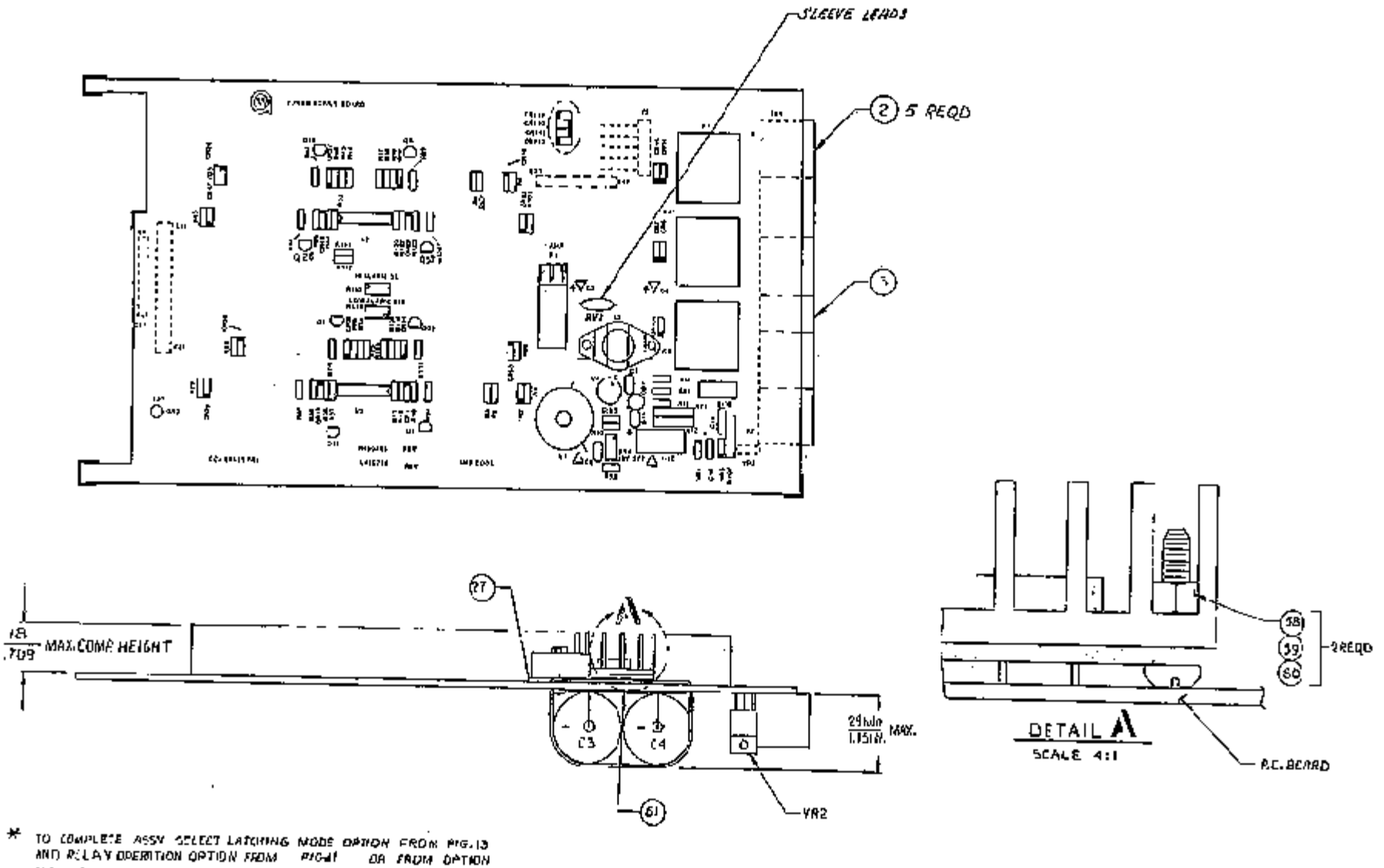
(3) COORDINATE UNSEALED OR SEALED OPTIONS.

(2) ANALOG OUT & CHANNEL I.D. OPTION ARE ALWAYS TO BE SPECIFIED IN CONJUNCTION WITH EACH OTHER.

(REF 50693 E)

FIG.7

OPTION TABULATION, CONTROL ELECTRONICS AND POWER SUPPLY



* TO COMPLETE ASSY SELECT LATCHING MODE OPTION FROM FIG.13 AND RELAY OPERATION OPTION FROM FIG.11 OR FROM OPTION VARIATION FIG.7 PER CUSTOMER REQUIREMENT.

(REF 50699 E)

FIG.8 SHT 1

CCA, POWER SUPPLY - COMMON COMPONENTS (ENERGIZED)

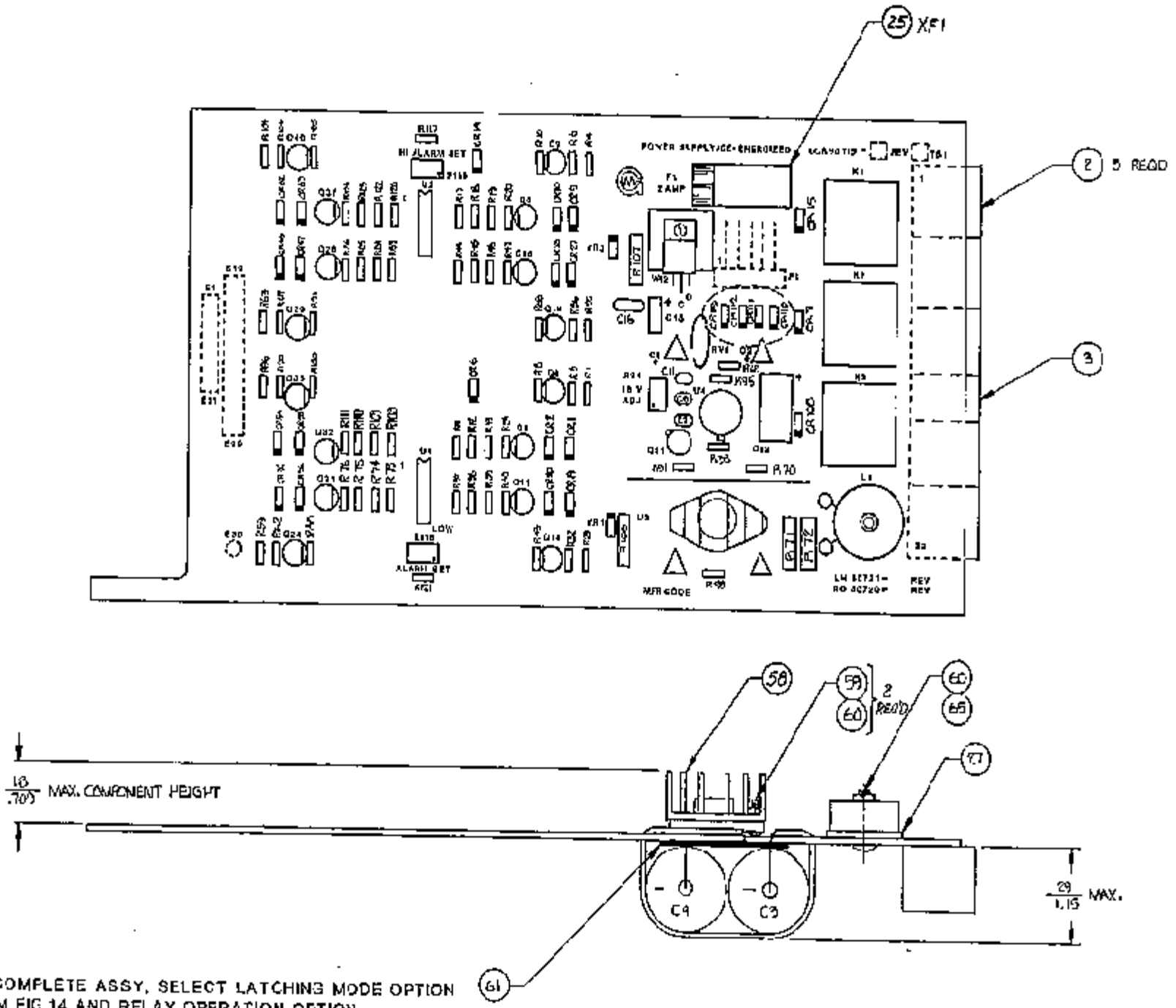
QTY 2	QTY 1	PART NO.	DESCRIPTION	REMARKS	ITEM
2	2	947-042	RESISTOR 33K, 1/4W ± 5%	R8, 10	42
3	3	947-032	RESISTOR 4.7K, 1/4W ± 5%	R3, 6, 58	41
8	8	947-024	RESISTOR, 1K, 1/4 W ± 5%	R1, 2, 26, 53, 59, 63, 95, 110	40
					39
2	2	947-576	POT, 10K	R118, 119	38
1	1	947-526	POT, 200	R94	37
					36
3	-	945-030	RELAY, 24V (SEALED)	K1, K2, K3	35
-	3	945-027	RELAY, 24V (UNSEALED)	K1, K2, K3	34
1	1	931-307	VOLT. REG. 305	U4	33
1	1	931-337	TRANS. SWITCH. REG. PIC600	U3	32
2	2	931-316	QUAD OP AMP 324	U1, U2	31
1	1	931-310	VOLT REG 5V 7815	VR2	30
					29
1	1	50560	INDUCTOR, 300UH	L1	28
1	1	93-040	INSULATOR PAD		27
					26
1	1	921-607	HOLDER, FUSE	XF1	25
					24
1	1	95-015	FUSE, MINIATURE 2AMP	F1	23
					22
1	1	931-360	VARISTOR, V47ZA7	AV1	2
1	1	948-030	DIODE, ZENER 1N4733A	VR3	20
1	1	948-017	ZENER 1N4744A	VR1	19
4	4	948-115	1N5416	CR80, 81, 82, 113	18
13	13	948-102	1N4002	CR2, 6, 7, 10, 14, 15, 20, 25, 26, 27, 31, 69, 100, 78, 79, 83, 84	17
8	8	948-104	DIODE, 1N4148	CR1, 3, 5, 9, 11, 33, 34, 64, 68	16
					15
					14
1	1	915-125	CAPACITOR .33 UF, 35 V	C15	13
1	1	915-110	1000 UF, 30 V	C12	12
1	1	915-035	.0047 UF, 50V	C11	11
1	1	915-032	.022 UF, 50V	C8	10
1	1	915-030	330 PF, 100V	C7	9
2	2	915-127	16000 UF, 40V	C3, 4	8
1	1	915-033	CAPACITOR, .1 UF, 50V	C16	7
					6
1	1	921-170	CONNECTOR, RT. ANGLE	P1	5
					4
1	1	921-337	BLOCK, TERMINAL (2 POS)	TB1	3
5	5	921-335	BLOCK, TERMINAL (4 POS)	TB1	2
1	1	50698	CCD. POWER SUPPLY		1

(REF 50699 E)

QTY 2	QTY 1	PART NO.	DESCRIPTION	REMARKS	ITEM
					63
					62
1	1		FISH PAPER 25MIL (50 mm/2IN X 56mm/2.2IN.)		61
2	2		NUT, HEX M3x0.5 (NYLON)		60
2	2		SCREW MACH M3x0.5x12mm PAN-NY-SL		59
1	1	948-412	HEAT SINK, TO-66		58
1	1	948-223	TRANSISTOR 2N2222A	Q31	57
8	8	948-226	TRANSISTOR, U2TA506	Q1, 6, 7, 16, 21, 26, 32, 37	56
1	1	947-001	RESISTOR 3.9, 1/4W, 5%	R69	55
1	1	947-216	47, 1W, 5%	R106	54
1	1	947-365	3.32K, 1% RN55D	R121	53
1	1	947-376	14K, 1% RN55D	R117	52
1	1	947-209	300, 1W, 5%	R107	51
1	1	947-318	1.5K, 1% RN55	R95	50
1	1	947-343	15.8K, 1% RN55	R93	49
2	2	947-416	1.0, 1W, 1%	R71, R72	48
1	1	947-012	100, 1/4W, ± 5%	R70	47
1	1	947-004	15, 1/4W ± 5%	R51	46
8	8	947-038	15K, 1/4W, ± 5%	R13, 19, 24, 46, 75, 85, 100, 124	45
8	8	947-071	2.7M, 1/4W, ± 5%	R15, 18, 23, 43, 74, 84, 104, 124	44
16	16	947-036	RESISTOR 10K, 1/4W, ± 5%	R11, 17, 20, 28, 32, 48, 67, 72, 73, 82, 83, 105, 110, 120, 124	43
QTY 2	QTY 1	PART NO.	DESCRIPTION	REMARKS	ITEM

FIG.8 SHT 2

CCA, POWER SUPPLY - COMMON COMPONENTS (ENERGIZED)



NOTE: TO COMPLETE ASSY, SELECT LATCHING MODE OPTION FROM FIG.14 AND RELAY OPERATION OPTION FROM FIG.12 OR FROM OPTION TABULATION FIG.7 PER CUSTOMER REQUIREMENTS.

(RE '0719C)

FIG. 9 SHT 1

CCA, POWER SUPPLY - COMMON COMPONENTS (DE-ENERGI D)

2	2	947-376	POTENTIOMETER, 10 K	R 10, 19	36
1	1	947-526	POTENTIOMETER, 500	R 94	37
					36
3	—	945-090	RELAY, 24 V SEALED	K1, 2, 3	35
—	3	945-027	RELAY, 24 V (UNSEALED)	K1, 2, 3	34
1	1	931-307	VOLTAGE REGULATOR 505	U4	33
1	1	931-337	TRANS. SWITCH REG. PIC 600	U5	32
2	2	931-316	QUAD, OP AMP 324	U1, 2	31
1	1	931-310	VOLTAGE REGULATOR, 15 V 7815	VR 2	30
1	1	931-360	VARISTOR, V47ZA1	RV1	29
1	1	50 660	INDUCTOR, 300 UH	L1	28
1	1	931-040	INSULATOR PAD		27
					26
1	1	921-607	HOLDER, FUSE	XF1	25
					24
1	1	931-035	FUSE, MINIATURE 2 AMP	F1	23
					22
					21
1	1	948-050	DIODE, ZENER IN4735A	VR 5	20
1	1	948-017	ZENER IN4744A	VR 1	19
4	4	948-115	IN 5416	DR 10, 11, 12, 13	18
15	16	948-102	IN4002	DR 1, 2, 3, 4, 5, 6, 7, 8, 9, 20, 21, 22, 23, 24, 25, 26, 27, 28, 29, 30, 31, 32, 33, 34, 35, 36, 37, 38, 39, 40, 41, 42, 43, 44, 45, 46, 47, 48, 49, 50, 51, 52, 53, 54, 55, 56, 57, 58, 59, 60, 61, 62, 63, 64, 65, 66, 67, 68, 69, 70, 71, 72, 73, 74, 75, 76, 77, 78, 79, 80, 81, 82, 83, 84, 85, 86, 87, 88, 89, 90, 91, 92, 93, 94, 95, 96, 97, 98, 99, 100, 101, 102, 103, 104, 105, 106, 107, 108, 109, 110, 111, 112, 113, 114, 115, 116, 117, 118, 119, 120, 121, 122, 123, 124, 125, 126, 127, 128, 129, 130, 131, 132, 133, 134, 135, 136, 137, 138, 139, 140, 141, 142, 143, 144, 145, 146, 147, 148, 149, 150, 151, 152, 153, 154, 155, 156, 157, 158, 159, 160, 161, 162, 163, 164, 165, 166, 167, 168, 169, 170, 171, 172, 173, 174, 175, 176, 177, 178, 179, 180, 181, 182, 183, 184, 185, 186, 187, 188, 189, 190, 191, 192, 193, 194, 195, 196, 197, 198, 199, 200, 201, 202, 203, 204, 205, 206, 207, 208, 209, 210, 211, 212, 213, 214, 215, 216, 217, 218, 219, 220, 221, 222, 223, 224, 225, 226, 227, 228, 229, 230, 231, 232, 233, 234, 235, 236, 237, 238, 239, 240, 241, 242, 243, 244, 245, 246, 247, 248, 249, 250, 251, 252, 253, 254, 255, 256, 257, 258, 259, 260, 261, 262, 263, 264, 265, 266, 267, 268, 269, 270, 271, 272, 273, 274, 275, 276, 277, 278, 279, 280, 281, 282, 283, 284, 285, 286, 287, 288, 289, 290, 291, 292, 293, 294, 295, 296, 297, 298, 299, 300, 301, 302, 303, 304, 305, 306, 307, 308, 309, 310, 311, 312, 313, 314, 315, 316, 317, 318, 319, 320, 321, 322, 323, 324, 325, 326, 327, 328, 329, 330, 331, 332, 333, 334, 335, 336, 337, 338, 339, 340, 341, 342, 343, 344, 345, 346, 347, 348, 349, 350, 351, 352, 353, 354, 355, 356, 357, 358, 359, 360, 361, 362, 363, 364, 365, 366, 367, 368, 369, 370, 371, 372, 373, 374, 375, 376, 377, 378, 379, 380, 381, 382, 383, 384, 385, 386, 387, 388, 389, 390, 391, 392, 393, 394, 395, 396, 397, 398, 399, 400, 401, 402, 403, 404, 405, 406, 407, 408, 409, 410, 411, 412, 413, 414, 415, 416, 417, 418, 419, 420, 421, 422, 423, 424, 425, 426, 427, 428, 429, 430, 431, 432, 433, 434, 435, 436, 437, 438, 439, 440, 441, 442, 443, 444, 445, 446, 447, 448, 449, 450, 451, 452, 453, 454, 455, 456, 457, 458, 459, 460, 461, 462, 463, 464, 465, 466, 467, 468, 469, 470, 471, 472, 473, 474, 475, 476, 477, 478, 479, 480, 481, 482, 483, 484, 485, 486, 487, 488, 489, 490, 491, 492, 493, 494, 495, 496, 497, 498, 499, 500, 501, 502, 503, 504, 505, 506, 507, 508, 509, 510, 511, 512, 513, 514, 515, 516, 517, 518, 519, 520, 521, 522, 523, 524, 525, 526, 527, 528, 529, 530, 531, 532, 533, 534, 535, 536, 537, 538, 539, 540, 541, 542, 543, 544, 545, 546, 547, 548, 549, 550, 551, 552, 553, 554, 555, 556, 557, 558, 559, 560, 561, 562, 563, 564, 565, 566, 567, 568, 569, 570, 571, 572, 573, 574, 575, 576, 577, 578, 579, 580, 581, 582, 583, 584, 585, 586, 587, 588, 589, 590, 591, 592, 593, 594, 595, 596, 597, 598, 599, 600, 601, 602, 603, 604, 605, 606, 607, 608, 609, 610, 611, 612, 613, 614, 615, 616, 617, 618, 619, 620, 621, 622, 623, 624, 625, 626, 627, 628, 629, 630, 631, 632, 633, 634, 635, 636, 637, 638, 639, 640, 641, 642, 643, 644, 645, 646, 647, 648, 649, 650, 651, 652, 653, 654, 655, 656, 657, 658, 659, 660, 661, 662, 663, 664, 665, 666, 667, 668, 669, 670, 671, 672, 673, 674, 675, 676, 677, 678, 679, 680, 681, 682, 683, 684, 685, 686, 687, 688, 689, 690, 691, 692, 693, 694, 695, 696, 697, 698, 699, 700, 701, 702, 703, 704, 705, 706, 707, 708, 709, 710, 711, 712, 713, 714, 715, 716, 717, 718, 719, 720, 721, 722, 723, 724, 725, 726, 727, 728, 729, 730, 731, 732, 733, 734, 735, 736, 737, 738, 739, 740, 741, 742, 743, 744, 745, 746, 747, 748, 749, 750, 751, 752, 753, 754, 755, 756, 757, 758, 759, 760, 761, 762, 763, 764, 765, 766, 767, 768, 769, 770, 771, 772, 773, 774, 775, 776, 777, 778, 779, 780, 781, 782, 783, 784, 785, 786, 787, 788, 789, 790, 791, 792, 793, 794, 795, 796, 797, 798, 799, 800, 801, 802, 803, 804, 805, 806, 807, 808, 809, 810, 811, 812, 813, 814, 815, 816, 817, 818, 819, 820, 821, 822, 823, 824, 825, 826, 827, 828, 829, 830, 831, 832, 833, 834, 835, 836, 837, 838, 839, 840, 841, 842, 843, 844, 845, 846, 847, 848, 849, 850, 851, 852, 853, 854, 855, 856, 857, 858, 859, 860, 861, 862, 863, 864, 865, 866, 867, 868, 869, 870, 871, 872, 873, 874, 875, 876, 877, 878, 879, 880, 881, 882, 883, 884, 885, 886, 887, 888, 889, 890, 891, 892, 893, 894, 895, 896, 897, 898, 899, 900, 901, 902, 903, 904, 905, 906, 907, 908, 909, 910, 911, 912, 913, 914, 915, 916, 917, 918, 919, 920, 921, 922, 923, 924, 925, 926, 927, 928, 929, 930, 931, 932, 933, 934, 935, 936, 937, 938, 939, 940, 941, 942, 943, 944, 945, 946, 947, 948, 949, 950, 951, 952, 953, 954, 955, 956, 957, 958, 959, 960, 961, 962, 963, 964, 965, 966, 967, 968, 969, 970, 971, 972, 973, 974, 975, 976, 977, 978, 979, 980, 981, 982, 983, 984, 985, 986, 987, 988, 989, 990, 991, 992, 993, 994, 995, 996, 997, 998, 999, 1000	16
8	8	948-104	DIODE, IN4148	DR 1, 14, 15, 21, 22, 23, 24, 25, 26, 27, 28, 29, 30, 31, 32, 33, 34, 35, 36, 37, 38, 39, 40, 41, 42, 43, 44, 45, 46, 47, 48, 49, 50, 51, 52, 53, 54, 55, 56, 57, 58, 59, 60, 61, 62, 63, 64, 65, 66, 67, 68, 69, 70, 71, 72, 73, 74, 75, 76, 77, 78, 79, 80, 81, 82, 83, 84, 85, 86, 87, 88, 89, 90, 91, 92, 93, 94, 95, 96, 97, 98, 99, 100, 101, 102, 103, 104, 105, 106, 107, 108, 109, 110, 111, 112, 113, 114, 115, 116, 117, 118, 119, 120, 121, 122, 123, 124, 125, 126, 127, 128, 129, 130, 131, 132, 133, 134, 135, 136, 137, 138, 139, 140, 141, 142, 143, 144, 145, 146, 147, 148, 149, 150, 151, 152, 153, 154, 155, 156, 157, 158, 159, 160, 161, 162, 163, 164, 165, 166, 167, 168, 169, 170, 171, 172, 173, 174, 175, 176, 177, 178, 179, 180, 181, 182, 183, 184, 185, 186, 187, 188, 189, 190, 191, 192, 193, 194, 195, 196, 197, 198, 199, 200, 201, 202, 203, 204, 205, 206, 207, 208, 209, 210, 211, 212, 213, 214, 215, 216, 217, 218, 219, 220, 221, 222, 223, 224, 225, 226, 227, 228, 229, 230, 231, 232, 233, 234, 235, 236, 237, 238, 239, 240, 241, 242, 243, 244, 245, 246, 247, 248, 249, 250, 251, 252, 253, 254, 255, 256, 257, 258, 259, 260, 261, 262, 263, 264, 265, 266, 267, 268, 269, 270, 271, 272, 273, 274, 275, 276, 277, 278, 279, 280, 281, 282, 283, 284, 285, 286, 287, 288, 289, 290, 291, 292, 293, 294, 295, 296, 297, 298, 299, 300, 301, 302, 303, 304, 305, 306, 307, 308, 309, 310, 311, 312, 313, 314, 315, 316, 317, 318, 319, 320, 321, 322, 323, 324, 325, 326, 327, 328, 329, 330, 331, 332, 333, 334, 335, 336, 337, 338, 339, 340, 341, 342, 343, 344, 345, 346, 347, 348, 349, 350, 351, 352, 353, 354, 355, 356, 357, 358, 359, 360, 361, 362, 363, 364, 365, 366, 367, 368, 369, 370, 371, 372, 373, 374, 375, 376, 377, 378, 379, 380, 381, 382, 383, 384, 385, 386, 387, 388, 389, 390, 391, 392, 393, 394, 395, 396, 397, 398, 399, 400, 401, 402, 403, 404, 405, 406, 407, 408, 409, 410, 411, 412, 413, 414, 415, 416, 417, 418, 419, 420, 421, 422, 423, 424, 425, 426, 427, 428, 429, 430, 431, 432, 433, 434, 435, 436, 437, 438, 439, 440, 441, 442, 443, 444, 445, 446, 447, 448, 449, 450, 451, 452, 453, 454, 455, 456, 457, 458, 459, 460, 461, 462, 463, 464, 465, 466, 467, 468, 469, 470, 471, 472, 473, 474, 475, 476, 477, 478, 479, 480, 481, 482, 483, 484, 485, 486, 487, 488, 489, 490, 491, 492, 493, 494, 495, 496, 497, 498, 499, 500, 501, 502, 503, 504, 505, 506, 507, 508, 509, 510, 511, 512, 513, 514, 515, 516, 517, 518, 519, 520, 521, 522, 523, 524, 525, 526, 527, 528, 529, 530, 531, 532, 533, 534, 535, 536, 537, 538, 539, 540, 541, 542, 543, 544, 545, 546, 547, 548, 549, 550, 551, 552, 553, 554, 555, 556, 557, 558, 559, 560, 561, 562, 563, 564, 565, 566, 567, 568, 569, 570, 571, 572, 573, 574, 575, 576, 577, 578, 579, 580, 581, 582, 583, 584, 585, 586, 587, 588, 589, 590, 591, 592, 593, 594, 595, 596, 597, 598, 599, 600, 601, 602, 603, 604, 605, 606, 607, 608, 609, 610, 611, 612, 613, 614, 615, 616, 617, 618, 619, 620, 621, 622, 623, 624, 625, 626, 627, 628, 629, 630, 631, 632, 633, 634, 635, 636, 637, 638, 639, 640, 641, 642, 643, 644, 645, 646, 647, 648, 649, 650, 651, 652, 653, 654, 655, 656, 657, 658, 659, 660, 661, 662, 663, 664, 665, 666, 667, 668, 669, 670, 671, 672, 673, 674, 675, 676, 677, 678, 679, 680, 681, 682, 683, 684, 685, 686, 687, 688, 689, 690, 691, 692, 693, 694, 695, 696, 697, 698, 699, 700, 701, 702, 703, 704, 705, 706, 707, 708, 709, 710, 711, 712, 713, 714, 715, 716, 717, 718, 719, 720, 721, 722, 723, 724, 725, 726, 727, 728, 729, 730, 731, 732, 733, 734, 735, 736, 737, 738, 739, 740, 741, 742, 743, 744, 745, 746, 747, 748, 749, 750, 751, 752, 753, 754, 755, 756, 757, 758, 759, 760, 761, 762, 763, 764, 765, 766, 767, 768, 769, 770, 771, 772, 773, 774, 775, 776, 777, 778, 779, 780, 781, 782, 783, 784, 785, 786, 787, 788, 789, 790, 791, 792, 793, 794, 795, 796, 797, 798, 799, 800, 801, 802, 803, 804, 805, 806, 807, 808, 809, 810, 811, 812, 813, 814, 815, 816, 817, 818, 819, 820, 821, 822, 823, 824, 825, 826, 827, 828, 829, 830, 831, 832, 833, 834, 835, 836, 837, 838, 839, 840, 841, 842, 843, 844, 845, 846, 847, 848, 849, 850, 851, 852, 853, 854, 855, 856, 857, 858, 859, 860, 861, 862, 863, 864, 865, 866, 867, 868, 869, 870, 871, 872, 873, 874, 875, 876, 877, 878, 879, 880, 881, 882, 883, 884, 885, 886, 887, 888, 889, 890, 891, 892, 893, 894, 895, 896, 897, 898, 899, 900, 901, 902, 903, 904, 905, 906, 907, 908, 909, 910, 911, 912, 913, 914, 915, 916, 917, 918, 919, 920, 921, 922, 923, 924, 925, 926, 927, 928, 929, 930, 931, 932, 933, 934, 935, 936, 937, 938, 939, 940, 941, 942, 943, 944, 945, 946, 947, 948, 949, 950, 951, 952, 953, 954, 955, 956, 957, 958, 959, 960, 961, 962, 963, 964, 965, 966, 967, 968, 969, 970, 971, 972, 973, 974, 975, 976, 977, 978, 979, 980, 981, 982, 983, 984, 985, 986, 987, 988, 989, 990, 991, 992, 993, 994, 995, 996, 997, 998, 999, 1000	15
					14
1	1	915-125	CAPACITOR .33 UF, 35 V	C 15	13
1	1	915-118	10 UF, 50 V	C 12	12
1	1	915-035	.0047 UF, 50 V	C11	11
1	1	915-092	.022 UF, 50 V	C6	10
1	1	915-050	150 PF, 100 V	C7	9
2	2	915-127	1000 UF, 40 V	C3, 4	8
1	1	915-055	CAPACITOR, 1 UF, 50 V	C16	7
					6
1	1	921-170	CONNECTOR, RIGHT ANGLE	P1	5
					4
1	1	921-997	BLOCK, TERMINAL (2 POS)	TB1	3
5	5	921-995	BLOCK, TERMINAL (4 POS)	TB1	2
1	1	50 122	C.C. FILLER SUPPLY (DE-ENERGIZES)		1
QTY-2	QTY-1	PART NUMBER	DESCRIPTION		ITEM

4	4	DIN 985	NUT, LOCK N3, NYLON INS, ST-ZN-PLT		57
1	1	DIN 125	WASHER, FLAT M3 ST - CAD		56
1	1	DIN 85	SCREW, MACH M3 X 10	PAN HEAD-SLOTTED-NYL	55
1	1	DIN 7985	SCREW, MACH M3 X 8	PAN - 3ST - PHIL	54
1	1	948-410	HEAT SNK		53
1	1	931-056	INSULATOR, SIL-PAD		52
1	1		FISHPAPER, 25 MIL (50 mm/2 IN. X 38mm/1.5 IN.)		51
3	3	DIN 934	NUT, HEX M3 (NYLON)		50
2	2	DIN 85	SCREW, MACH M3 X 12	PAN HEAD-SLOTTED-NYLON	49
1	1	948-412	HEAT SNK, TO-66		48
1	1	948-229	TRANSISTOR, 2N2222 A	Q21	47
8	8	948-226	TRANSISTOR, 2 TA 506	Q1, 6, 11, 15, 21, 26, 32, 37	46
8	8	948-240	TRANSISTOR, MPS-A56	Q2, 4, 7, 12, 16, 17, 27, 35, 40	45
1	1	947-365	RESISTOR, 3.32K, 1% RN55D	R 28	44
1	1	947-376	RESISTOR, MX, 1% RN60D	R 67	43
1	1	947-216	RESISTOR, 47, 1W, ±5%	R 106	42
1	1	947-209	RESISTOR, 300, 1W, 5%	R 107	41
1	1	947-438	1.5 K, 1%, RN55	R 95	40
1	1	947-349	15.8K, 1%, RN55	R 96	39
2	2	947-416	1.0 - 1W, 1%	R 71, 72	38
1	1	947-012	100, 1/4 W, ±5%	R 70	37
1	1	947-004	15, 1/4 W, ±5%	R 51	36
8	8	947-036	15 K, 1/4 W, ±5%	R 13, 31, 41, 75, 85, 100, 125	35
8	8	947-071	2.7 M, 1/4 W, ±5%	R 12, 18, 26, 45, 74, 89, 109, 114	34
16	16	947-096	10 K, 1/4 W, ±5%	R 11, 17, 25, 44, 73, 88, 108, 113, 123, 124, 126, 127	33
8	8	947-042	93 K, 1/4 W, ±5%	R 9, 16, 43, 86, 90, 91, 102, 122	32
9	9	947-032	47 K, 1/4 W, ±5%	R 2, 8, 38, 50, 54, 65, 92, 104	31
1	1	947-001	3.9 - 1/4 W, ±5%	R 69	30
8	8	947-024	RESISTOR, 1M, 1/4 W, ±5%	R 21, 33, 39, 78, 83, 96, 101	29
QTY-2	QTY-1	PART NUMBER	DESCRIPTION		ITEM

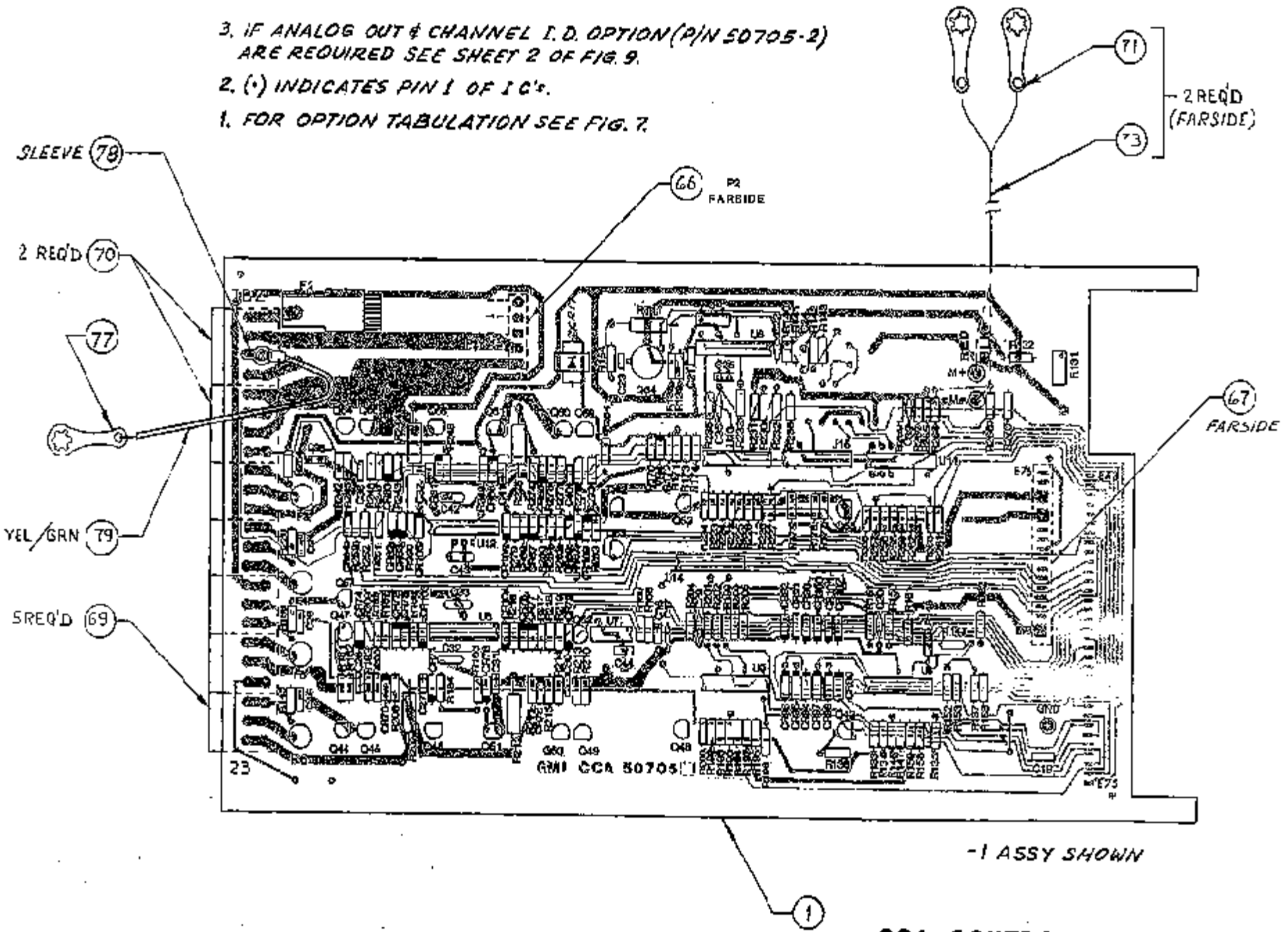
FIG 2

CCA, POWER SUPPLY - COMMON COMPONENTS

3. IF ANALOG OUT & CHANNEL I.D. OPTION (P/N 50705-2) ARE REQUIRED SEE SHEET 2 OF FIG. 9.

2. (•) INDICATES PIN 1 OF I C's.

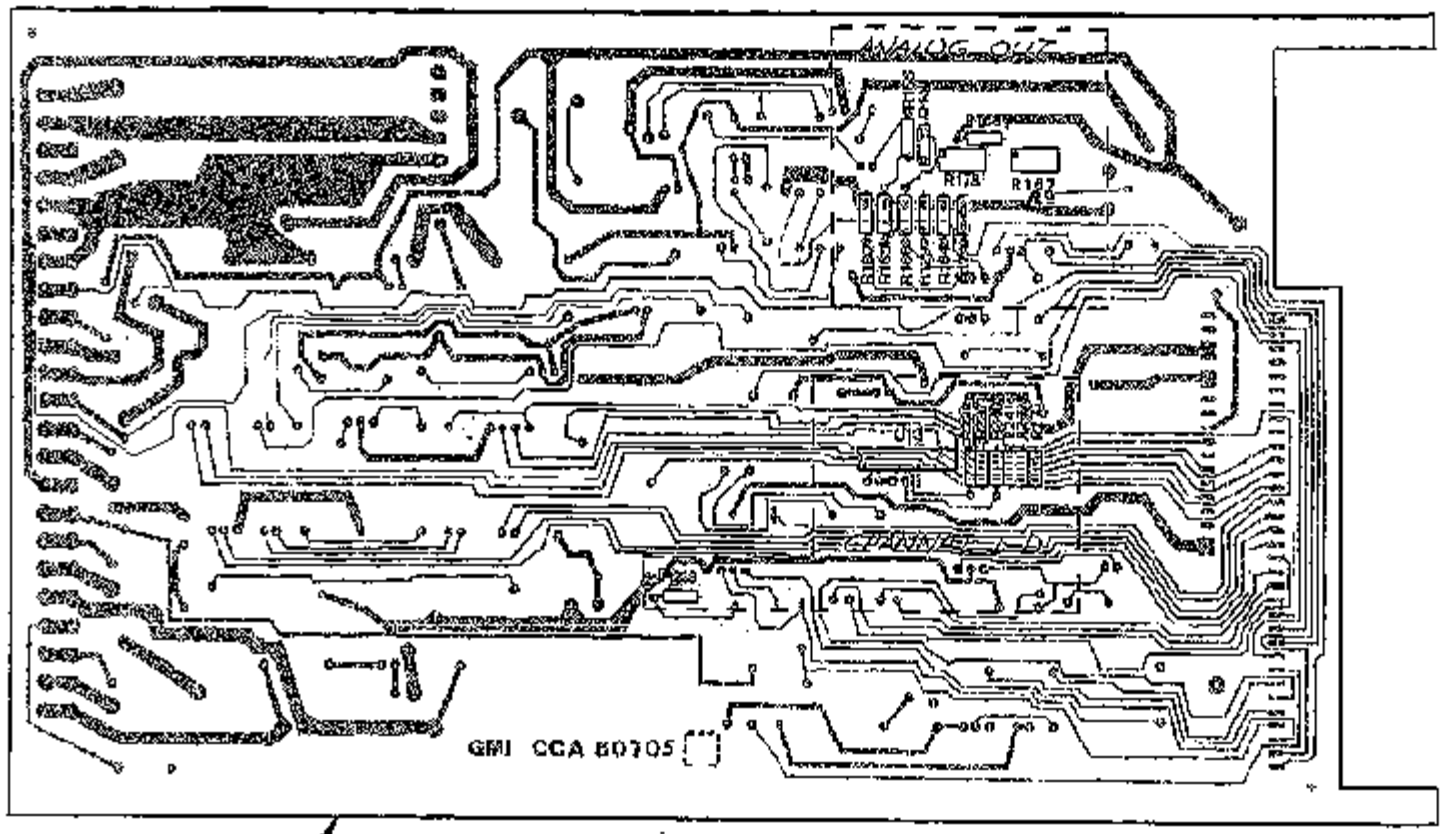
1. FOR OPTION TABULATION SEE FIG. 7.



(REF 50705 C)

FIG. 10 SHT 1

CCA, CONTROL ELECTRONICS, ANALOG OUT/CHANNEL I.D. - COMMON COMPONENTS



-2 ASSY COMMON COMPONENTS REMOVED FOR CLARITY

(REF 50705 C)

FIG.10 SHT 2

CCA, CONTROL ELECTRONICS, ANALOG OUT/CHANNEL I.D. - COMMON COMPONENTS

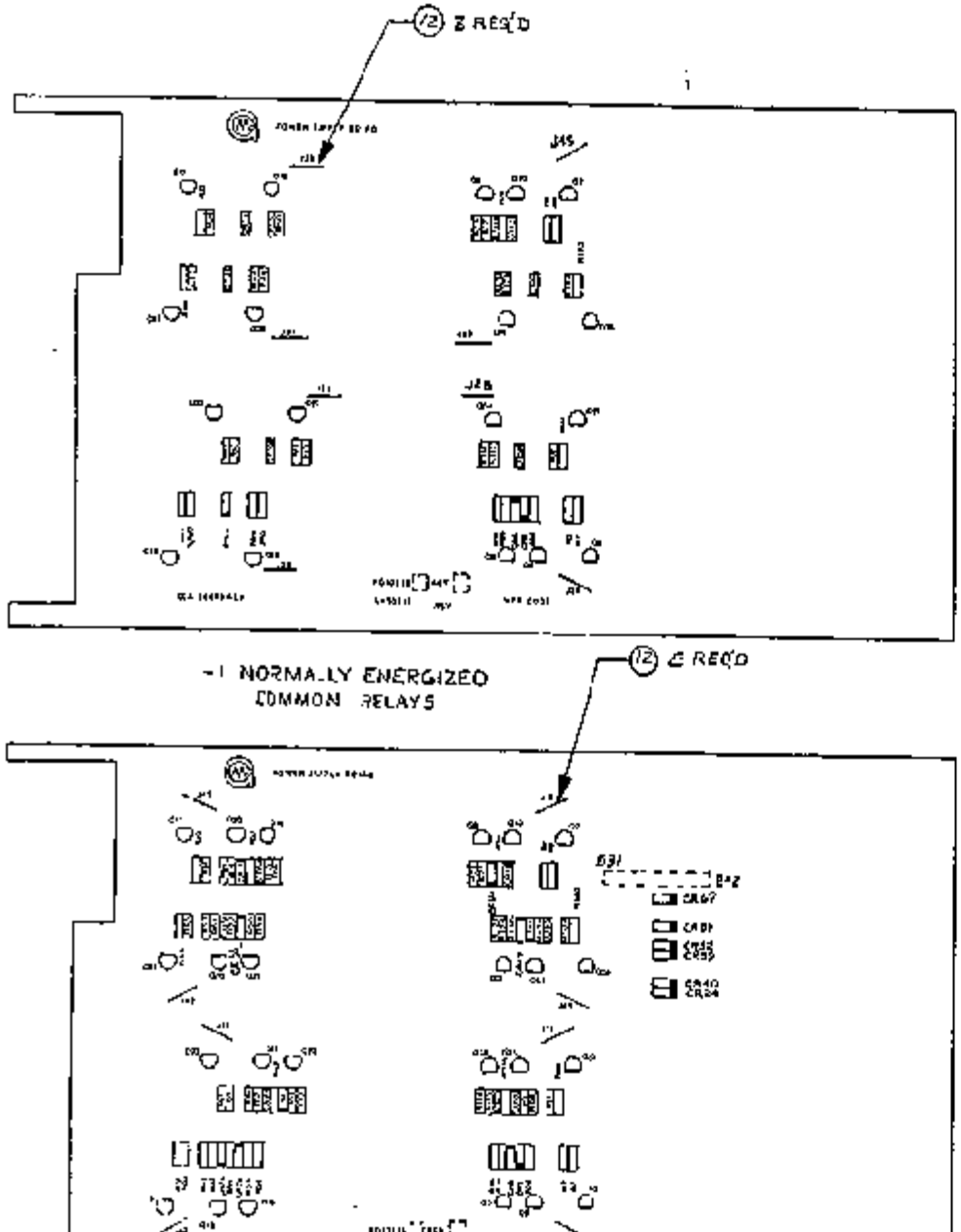
QTY-2	QTY-1	PART NO.	DESCRIPTION		ITEM
10	10	947-325	RESISTOR 20K, 1%, RN55D	[illegible]	45
4	4	947-374	121Ω, 1%, RN55D	R145, 189, 220, 251	44
5	5	947-379	5.11K, 1%, RN55D	R153, 171, 192, 223, 257	43
5	-	947-328	1K, 1%, RN55D	R238, 240, 241, 271, 272	42
2	2	947-337	7.87K, 1%, RN55D	R171, 72	41
1	1	947-027	2K, 1/4W, 5%	R140	40
1	1	947-049	120K, 1/4W, 5%	R174	39
1	1	947-031	3.9K, 1/4W, 5%	R132	38
5	4	947-024	1K, 1/4W, 5%	R209, 211, 253, 258, 239	37
2	2	947-048	100K, 1/4W, 5%	R156, 169	36
4	4	947-092	680Ω, 1/4W, 5%	R162, 205, 236, 270	35
4	4	947-020	470Ω, 1/4W, 5%	R150, 201, 233, 247	34
7	6	947-036	10K, 1/4W, 5%	[illegible]	33
9	9	947-046	20K, 1/4W, 5%	[illegible]	32
4	4	947-059	3M, 1/4W, 5%	R184, 185, 248, 249	31
14	13	947-032	4.7K, 1/4W, 5%	[illegible]	30
8	8	947-038	RESISTOR, 15K, 1/4W, 5%	[illegible]	29
1	-	947-575	POT 20K, 20 TURNS	R178	28
1	1	947-537	POT, 10K, 20 TURNS	R131	27
1	-	947-547	POT, 100Ω, 20 TURNS	R167	26
1	1	931-306	TIMER 555	U7	25
2	2	931-356	I.C., UA3045DM	U11, 15	24
1	1	931-386	DUAL PREC OP-AMP 2301	U6	23
4	4	931-316	QUAD OP AMP 324	U5, 9, 10, 11	22
2	2	931-335	DUAL TIMER, ANALOG 556	U8, 12	21
4	4	921-605	HOLDER, MICROFUSE P.C. MTD	XF3, 4, 5, 6	20
1	1	921-607	HOLDER, FUSE, P.C. MTD	XF2	19
4	4	951-104	MICROFUSE, 3/4 AMP	F3, 4, 5, 6	18
1	1	951-013	FUSE, MINIATURE 1 AMP	F2	17
1	-	931-416	I.C. AMP. MC14C16CP	U15	16
					15
1	1	948-126	DIODE, RECTIFIER MR751	CR17	14
1	1	948-014	DIODE, ZENER IN4746A	VR4	13
5	5	948-102	DIODE, RECTIFIER IN4002	CR74, 79, 84, 89, 109	12
33	33	948-104	DIODE, SIGNAL IN4148	[illegible]	11
4	4	915-166	CAPACITOR, 3.3UF, 25V	C27, 31, 37, 41	10
1	1	915-041	CAPACITOR, 4.7PF, 100V	C24	9
9	9	915-011	.01UF, 50V	[illegible]	8
2	2	915-102	1UF, 35V	C18, 45	7
2	2	915-040	150PF, 100V	C21, 25	6
1	1	915-024	20PF, 1KV	C22	5
11	11	915-033	CAPACITOR, .1UF, 50V	[illegible]	4
					3
					2
1	1	50 704	CCD, CONTROL ELECTRONICS		1

(REF 50705C)

QTY-2	QTY-1	PART NO.	DESCRIPTION		ITEM
1	1		WIRE, PVC INS, 20 AWG, YEL/GRN (50mm/2IN LENGTH)		79
1	1	921-511	LUG, CONNECTOR		78
1	1	921-503	TERMINAL, LOCKWASHER		77
					76
1	1	947-310	RESISTOR, 1.10K, 1%, RN55D	R176	75
4	4	947-379	RESISTOR, 4.75K, 1%, RN55D	R158, 195, 226, 260	74
2	2		WIRE, PVC INS., 22 AWG (152mm/6IN. LENGTHS)		73
A/R	A/R	932-002	COATING, CONFORMAL		72
2	2	921-512	TERMINAL, LOCKWASHER		71
2	2	921-335	BLOCK, TERMINAL, 4 POS.		70
5	5	921-326	BLOCK, TERMINAL, 3 POS.		69
					68
1	1	10207-5	FLEXSTRIP, 18 COND		67
1	1	921-170	CONNECTOR, 5 PIN	P2	66
					65
1	1	948-226	TRANSISTOR, L2TA306	Q63	64
1	1	948-234	2N2920	Q64	63
12	12	948-240	MPS-A56	[illegible]	62
8	8	948-243	TRANSISTOR, MPS-A06	[illegible]	61
1	-	948-213	TRANSISTOR, 2N5193	Q43	60
					59
1	1	953-010	SENSISTOR, 1K, 1%	RT1	58
4	4	947-424	RESISTOR 4Ω, 3W, 5%	R207, 212, 241, 275	57
23	19	947-301	RESISTOR, 10K, 1%, RN55D	[illegible]	56
1	1	947-378	243Ω, 1%, RN55D	R175	55
1	1	947-351	30.1K, 1%, RN55D	R137	54
1	1	947-307	953Ω, 1%, RN55D	R143	53
1	1	947-349	15.8K, 1%, RN55D	R154	52
2	2	947-316	100K, 1%, RN55D	R138, 139	51
4	4	947-327	2K, 1%, RN55D	R146, 193, 221, 255	50
1	-	947-318	1.5K, 1% RN55D	R179	49
1	-	947-314	49.9Ω, 1% RN55D	R168	48
4	4	947-339	35K, 1%, RN55D	R161, 204, 235, 269	47
9	8	947-345	RESISTOR, 15K, 1%, RN55D	[illegible]	46

FIG.10 SHT 3

CCA, CONTROL ELECTRONICS, ANALOG OUT/CHANNEL I.D. - COMMON COMPONENTS



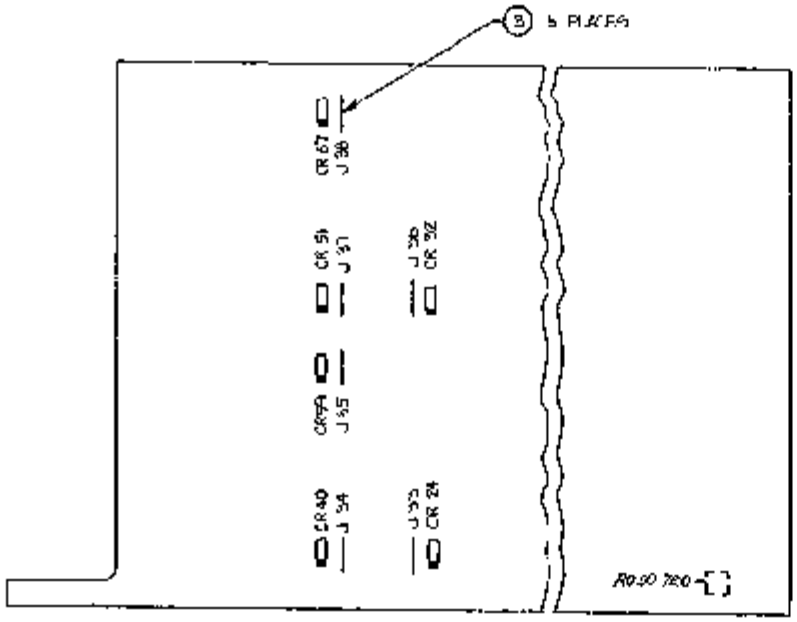
NOTE: FOR OPTION TABULATION SEE FIG.7.

AR	AR	932-002	COATING, CONFORMAL		13
AR	AR		WIRE, PVC - STD SLV, SOLID 22 AWG		12
					11
8	2	948-226	TRANSISTOR, U2TA50L	Q5,12,15,20,25,30,34,42	10
8	8	948-243	TRANSISTOR, MPS-A06	Q3,8,17,18,23,26,34,39	9
8	8	948-290	TRANSISTOR, MPS-A56	Q1,4,7,9,(2),(8),(11),19,22,24,27,29,32,35,38,40	8
22	10	948-102	DIODE, IN4002	CR5,8,14,16,21,26,31,34,37,39,40,43,50,51,53,58,63,64,67,69	7
					6
8	8	947-068	RESISTOR, 75K, 1/4W, 5%	R2,21,30,33,75,99,114,127	5
8	8	947-066	RESISTOR, 20K, 1/4W, 5%	R25,27,34,36,81,90,115,118	4
8	2	947-086	RESISTOR, 1CK, 1/4W, 5%	R35,38,56,57,82,91,116,126	3
14	8	947-042	RESISTOR, 33K, 1/4W, 5%	R7,9,11,13,43,66,68,80,91,98,100,103,107	2
14	8	947-032	RESISTOR, 4.7K, 1/4W, 5%	R1,3,10,12,19,20,60,62,65,67,81,99,102,104	1
QTY-3	QTY-1	PART NO.	DESCRIPTION		ITEM

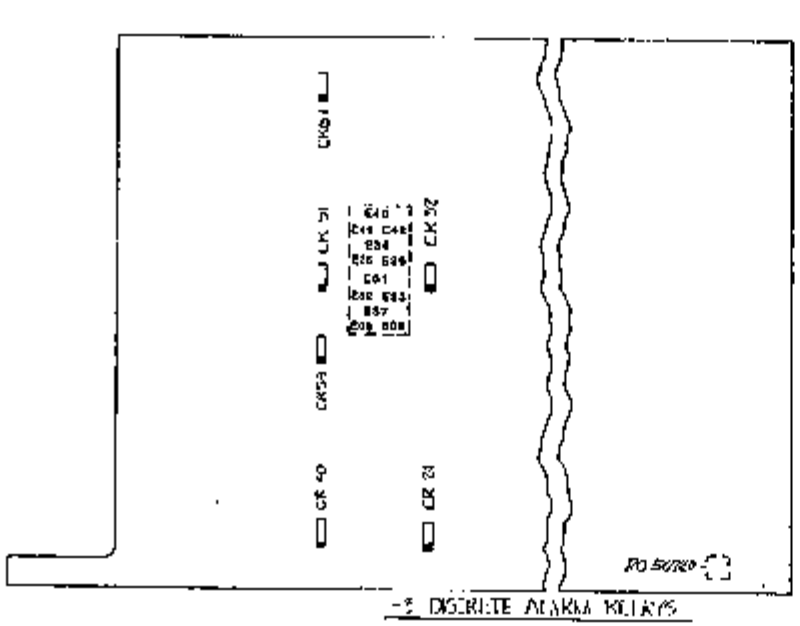
(REF 50716F)

FIG. 11

CCA, POWER SUPPLY - RELAY OPERATION
(NORMALLY ENERGIZED)



-1 COMMON RELAYS



-2 DISCRETE ALARM RELAYS

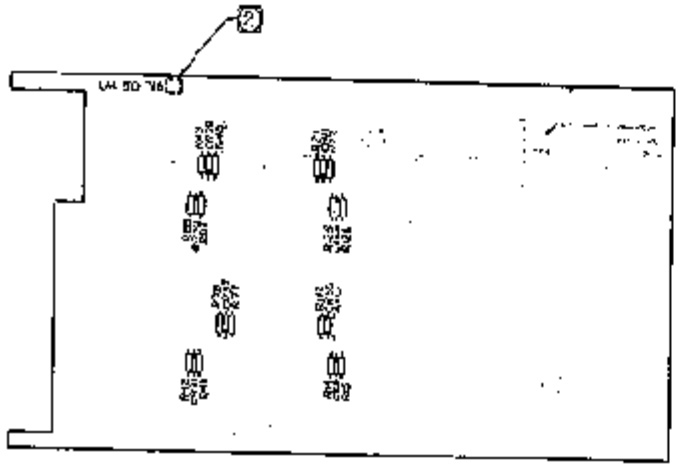
NOTE: FOR OPTION TABULATION SEE FIG.7

A/R	A/R	992-002	COATING, CONFORMAL		5
					4
—	A/R		WIRE, #26, TYC 26/7, 27 AWG	J 93-94-95-96-97-98	3
					2
6	6	948-102	DIODE, 1N4002	CR 24-40-51-52-53-54-67	1
ATC-3	ATC-1	PART NO.	DESCRIPTION	USED ON	ITEM

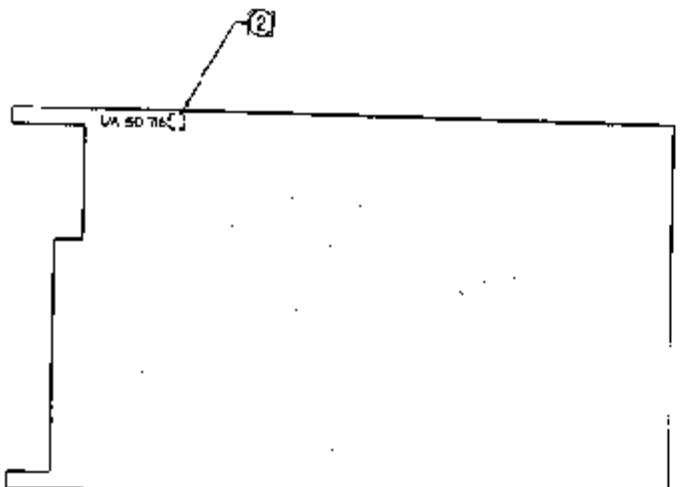
(REF 50720 A)

FIG.12

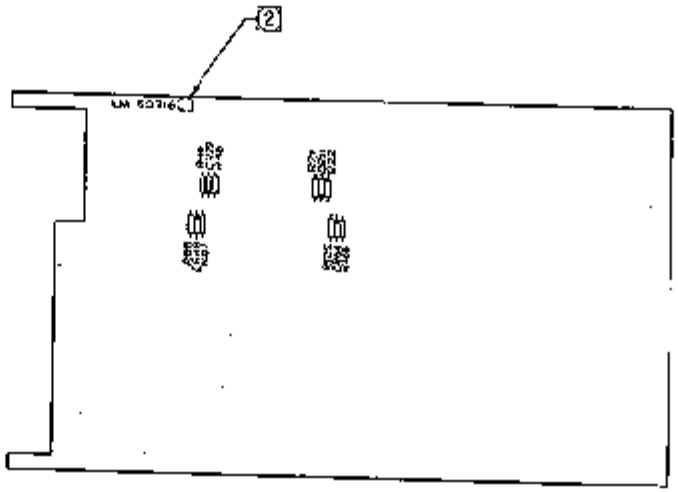
CCA, POWER SUPPLY - RELAY OPERATION
(DE-ENERGIZED)



-1 LATCHING



-2 NON-LATCHING



-3 LATCHING SET/NON-LATCHING LOW

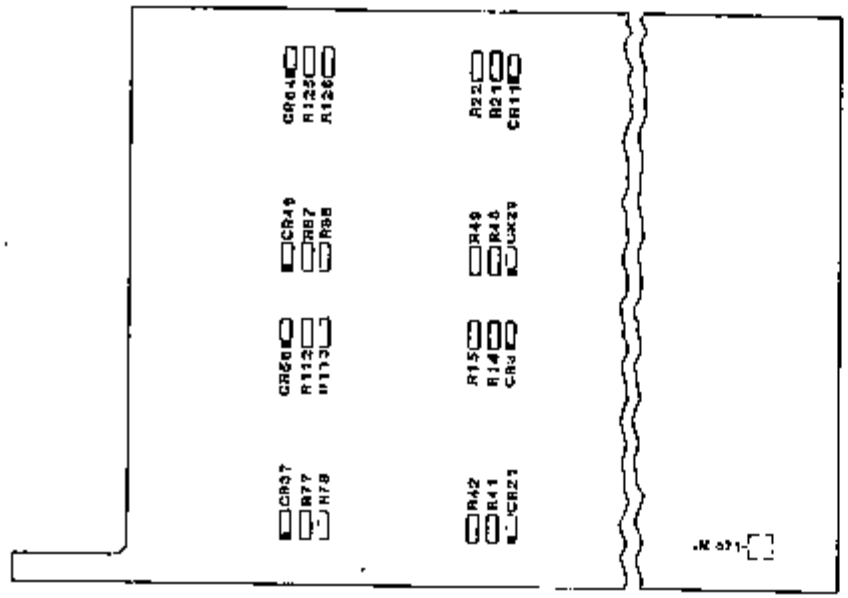
TO COMPLETE ASSY, SELECT RELAY OPERATION DASH (-) FROM OPTION TABULATION (FIG. 1), PER CUSTOMER REQUIREMENTS.

					6
					5
4	—	B	947-036	RESISTOR, 10K, 1/4W, 5%	4
1	—	B	947-038	RESISTOR, 15K, 1/4W, 5%	3
					2
4	—	B	948-104	DIODE, IN4148	1
QTY-1	QTY-2	QTY-3			REF

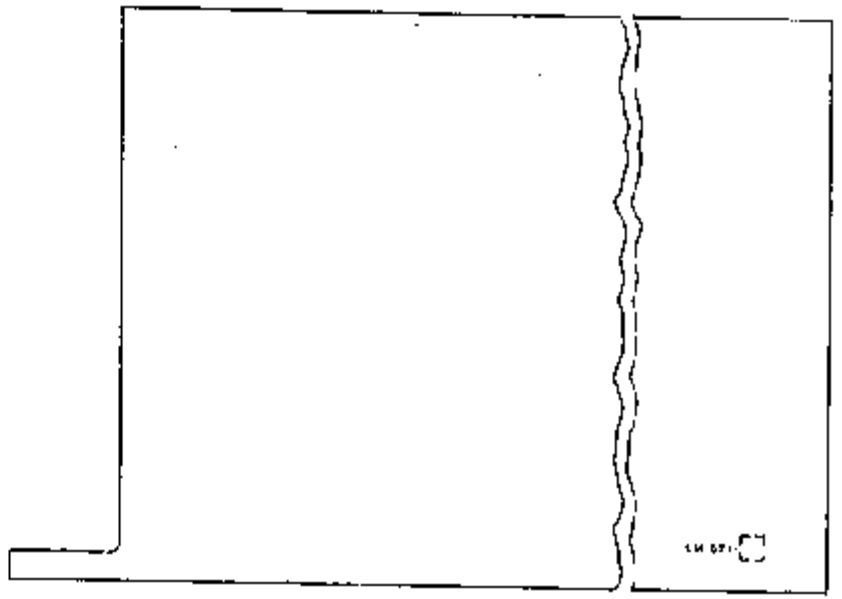
(REF 50716 A)

FIG. 13

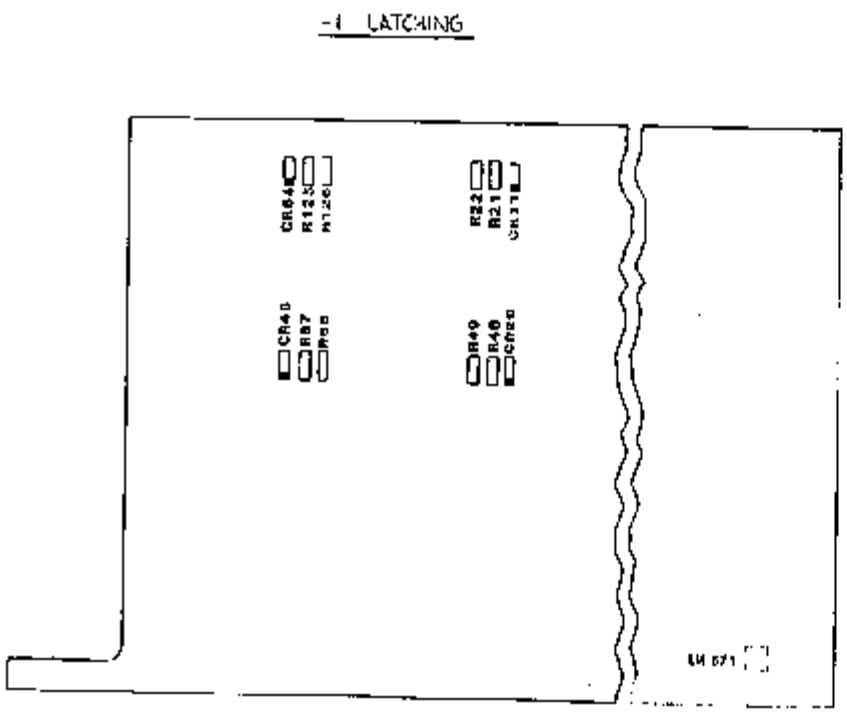
CCA, POWER SUPPLY - LATCHING MODES (ENERGIZED)



-1 LATCHING



-2 NON-LATCHING



-3 LATCHING HI/NON-LATCHING LOW

NOTE: TO COMPLETE ASSY, SELECT RELAY OPERATION DASH NO. FROM OPTION TABULATION FIG.7 PER CUSTOMER REQUIREMENTS.

4	—	8	947-046	RESISTOR - 10 K - 1/4 W, 5 %	R15,R2,R3,R4,R5,R6,R7,R8	5
4	—	8	947-038	RESISTOR - 1.5 K - 1/4 W, 5 %	R9,R10,R11,R12,R13,R14,R15,R16	3
						2
4	—	8	948-104	DIODE - 1N4148	CR1,R2,R3,R4,R5,R6,R7,R8	1
QTY-1	QTY-2	QTY-3	PART NO.	DESCRIPTION	REFERENCE DESIGNATION	ITEM

(REF 5[illegible]21 A)

FIG.14

CCA, POWER SUPPLY - LATCHING MODES (DE-ENERGIZED)