GENERAL MONITORS

Model DC110

Combustible Gas Smart Sensor Multi-channel Readout/Relay Module

Instruction Manual **11/89**

Part No. **MANDC110**
Revision **11/89**

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GENERAL MONITORS

MODEL DC110

COMBUSTIBLE GAS SMART SENSOR MULTICHANNEL READOUT/RELAY MODULE

I. INTRODUCTION

A. NOTICE

All information contained in this instruction manual may be used only to install and operate the Model DC110 Readout/Relay Module provided by GENERAL MONITORS, INC. (GMI). The sale of the instrument does not license the user to reproduce GENERAL MONITORS' drawings or to utilize proprietary circuitry or information without prior written permission.

The Model DC110 Readout/Relay Module is as easy to install and operate as any gas monitor available. However, this manual should be read in full, and the information contained herein understood before attempting to install or operate the system.

B. GENERAL

The Model DC110 is an eight channel readout/relay module designed to be used with the Model SC100 Smart Sensor. This system will continuously monitor most combustible gases and vapors in the 0-100% Lower Explosive Limit (LEL) range. Normally only a periodic system calibration check is needed to assure dependable performance. There are relatively few combustible gases which should not be monitored by the system; however as a precaution GMI should always be consulted to verify the feasibility of monitoring any gas or vapor other than those specified at the time of purchase.

The microprocessor based DC110 may be rack, panel, or wall mounted in a non-hazardous area. Weatherproof enclosures are available for outdoor installations and Explosion Proof enclosures for hazardous installations.

NOTE: Weatherproof and explosion proof enclosures are not included in the Factory Mutual performance approval of this system.

The DC110 has a digital display (0-99% LEL) and visual status indicators as follows:

CONDITION	INDICATOR
Normal operation.	Digital display indicates "0".
Low gas alarm.	WARN (flashing amber).
High gas alarm.	ALARM (flashing red).
Malfunction.	MAL (flashing amber).
Calibration.	CAL (steady amber).
Channel being indicated.	PEAK CH (steady green).
Reset of latching alarm.	RESET (steady red).
Alarm inhibit.	AL (red indication appears to right of digital display).

B. GENERAL (cont'd)

Eight LED indications numbered from 1 to 8 are also included around each of the status indicators to identify the channel or channels associated with the condition being displayed. Output from the DC110 is in the form of open collectors which will "sink" a maximum of 100 mA when active. These open collector outputs are referenced to system ground (common).

Three relay outputs are also provided. The ALARM and WARN relays are DPDT and the MALfunction relay is SPDT. Various options for the operation of the Alarm and Warn relays are switch selectable and will be described later in this manual.

C. OPERATION

This discussion covers the general operations and functions of the Model DC110 Readout/Relay module; those which are readily apparent to the operator in day to day usage. In addition to their primary functions, several of the switches perform other sub-functions and these will be discussed in Section III.

The Model DC110 furnishes the 24 VDC power to the SC100 Smart Sensors as well as receiving the 4 to 20 mA output signal from the SC100's. The digital display of the DC110 shows the gas concentration level up to 99% LEL. Higher concentration levels will cause the display to blink the 99 reading. Should a malfunction occur in the SC100 Smart Sensor, the DC110 will display a flashing "MAL" on the front panel. During calibration, the DC110 will display the word "CAL" on the front panel. The channel LED's will also be illuminated to identify the affected channel (s).

The Model DC110 is designed to provide operational status of any and all active channels. For example, if a MALfunction should occur in channel 2, the MALfunction status indicator will illuminate and the associated channel LED indicator "2" will be shown. The remaining active channels will continue to indicate their normal functions.

If fewer than eight channels are connected to the Model DC110, the unused channels will cause a MALfunction indication to appear on the front panel. To prevent this, a CHANNEL DISABLE switch is provided on the main P.C. board. This switch (S1) consists of 8 two-position switches (see figure 3). Each switch is associated with the individual channels (1 to 8) to permit disabling those not currently in use. The DISABLE switches may also be used if a channel is to be taken out of service for any reason.

In normal operation either a "0" or a % LEL reading will appear on the Digital Display. If any channel detects a gas buildup above the 2% LEL level, the value will be displayed on the Digital Display and a PEAK CH indication along with the associated channel number will appear on the front panel.

C. OPERATION (cont'd)

The standard configuration provides for latching ALARM and non-latching WARN relays; however, any combination of latching or non-latching alarms may be selected by the customer through the use of switch S8.

If a gas concentration exceeding the WARN or ALARM setpoint is detected, its value will be indicated by the DC110. When latching alarms are used and the gas concentration has dropped below the preset ALARM level, the word RESET will be illuminated to indicate that the ALARM may be reset. The RESET switch (S2) is located adjacent to the illuminated RESET. The WARN indication will remain on until the gas concentration falls below the WARN preset level when the word RESET will again illuminate to indicate to the operator that the WARN may be reset. The alarms may be remotely reset by using a momentary contact pushbutton connected to the terminals labeled P3z-28 and P3z-30 on the rear terminal connector (See Fig. 2).

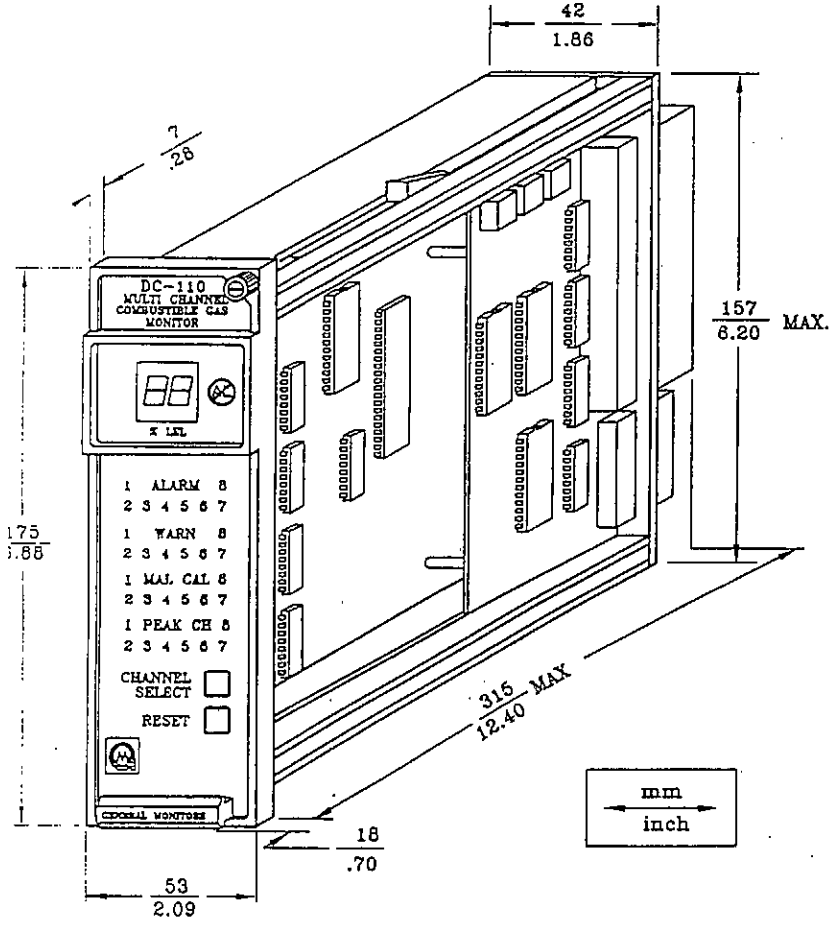
D. VOTING OPTION

The Model DC110 can be supplied with a special voting option when specified on the original order for the equipment. A system supplied with this option will require that two channels reach the ALARM setpoint before the ALARM relay will actuate. All other functions of the Model DC110 system will be the same as for the non-voting system.

Since all other outputs from the Model DC110 are the same in the voting and non-voting versions, a special open collector output is provided for the customer who wishes to use the open collectors in a voting mode. Terminal P3z2 (ALARM VOTING OUT) and P3d2 (COMMON) are used for this purpose (See Fig. 2).

THE VOTING OPTION IS NOT INCLUDED IN THE FACTORY MUTUAL APPROVAL OF THIS EQUIPMENT.

Note: Factory Mutual requires that any combustible gas controller alarm be of the latching type and not capable of being set above 60% LEL. If the Model DC110 has been ordered with non-latching relays it should be connected to an auxiliary system that accomplishes the latching function.



(Reference 30126)

Figure 1

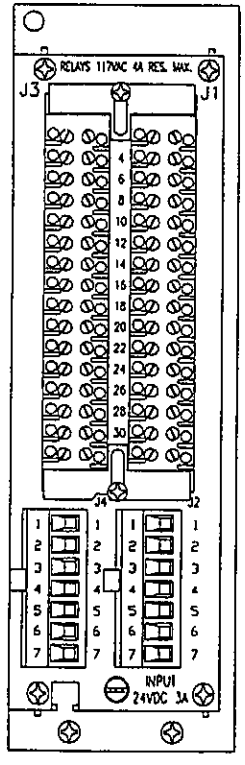
P3

	d	z	
COMMON	2	2	ALARM VOTING OUT
MALF OC 2	4	4	MALF OC 1
MALF OC 4	6	6	MALF OC 3
MALF OC 6	8	8	MALF OC 5
MALF OC 8	10	10	MALF OC 7
WARN OC 2	12	12	WARN OC 1
WARN OC 4	14	14	WARN OC 3
WARN OC 6	16	16	WARN OC 5
WARN OC 8	18	18	WARN OC 7
COMMON	20	20	ALARM OC 1
ALARM OC 2	22	22	ALARM OC 3
ALARM OC 4	24	24	ALARM OC 5
ALARM OC 6	26	26	ALARM OC 7
ALARM OC 8	28	28	RESET
COMMON	30	30	COMMON
COMMON	32	32	CH SELECT

P4

KEY	1	
K3 - NC	2	MALF
K3 - C	3	MALF
K3 - NO	4	MALF
NC	5	
NC	6	
NC	7	

MALF relay is shown as normally energized with power applied.



REAR VIEW

P1

	d	z	
CH1 4-20mA	2	2	COMMON
CH1 24V	4	4	COMMON
CH2 4-20mA	6	6	COMMON
CH2 24V	8	8	COMMON
CH3 4-20mA	10	10	COMMON
CH3 24V	12	12	COMMON
CH4 4-20mA	14	14	COMMON
CH4 24V	15	16	COMMON
NO - K1 - 1	18	18	CH5 4-20mA
C - K1 - 1	20	20	CH5 24V
NC - K1 - 1	22	22	CH6 4-20mA
NO - K1 - 2	24	24	CH6 24V
C - K1 - 2	26	26	CH7 4-20mA
NC - K1 - 2	28	28	CH7 24V
NO - K2 - 1	30	30	CH8 4-20mA
C - K2 - 1	32	32	CH8 24V

WARN

ALARM

P2

NC - K2 - 1	1	
NO - K2 - 2	2	
C - K2 - 2	3	
NC - K2 - 2	4	
24VDC IN	5	
24V COM	6	
KEY	7	

WARN & ALARM relays are shown as normally de-energized with power applied.

OUTLINE & REAR TERMINAL CONNECTIONS - MODEL DC110

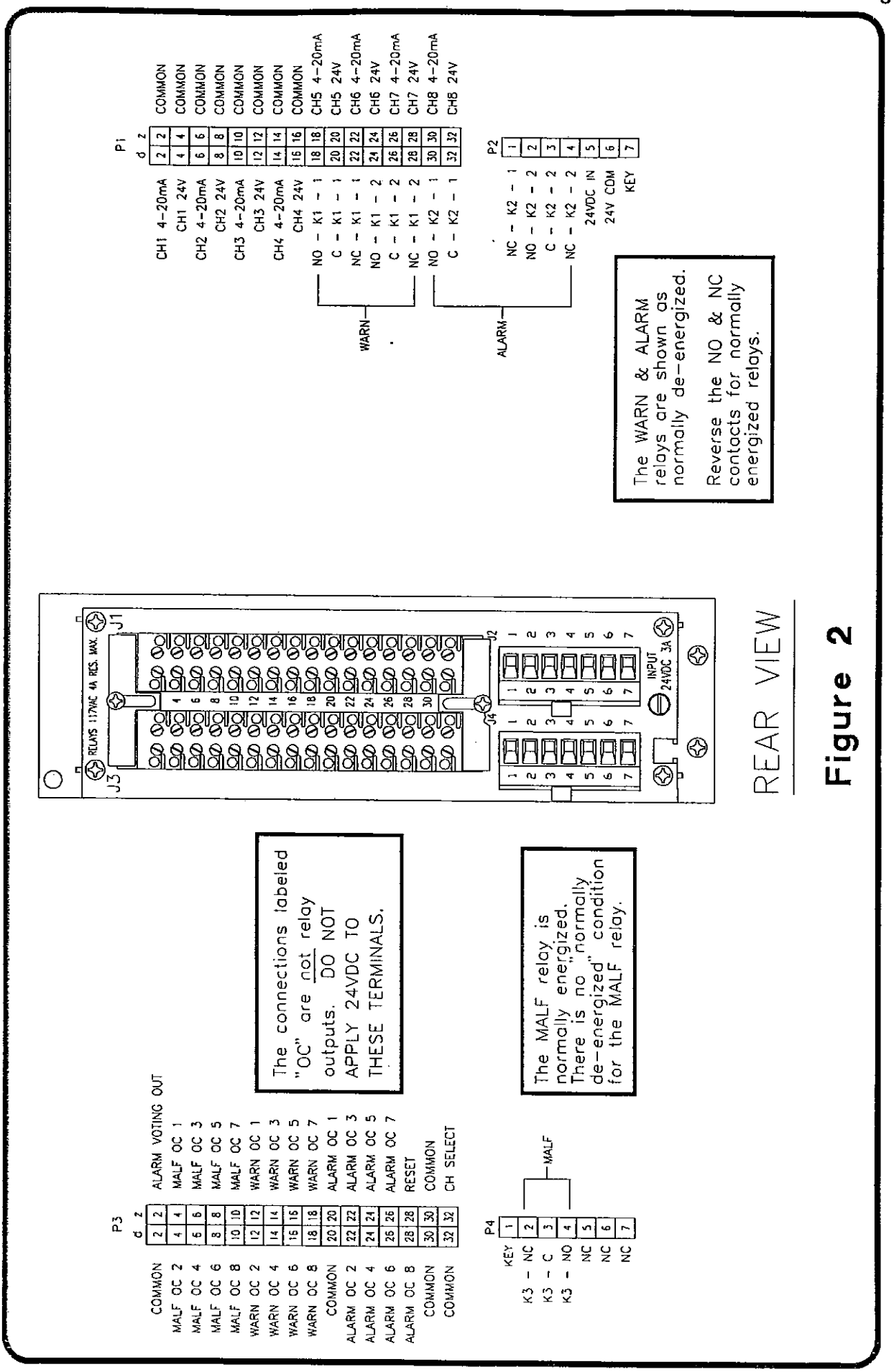
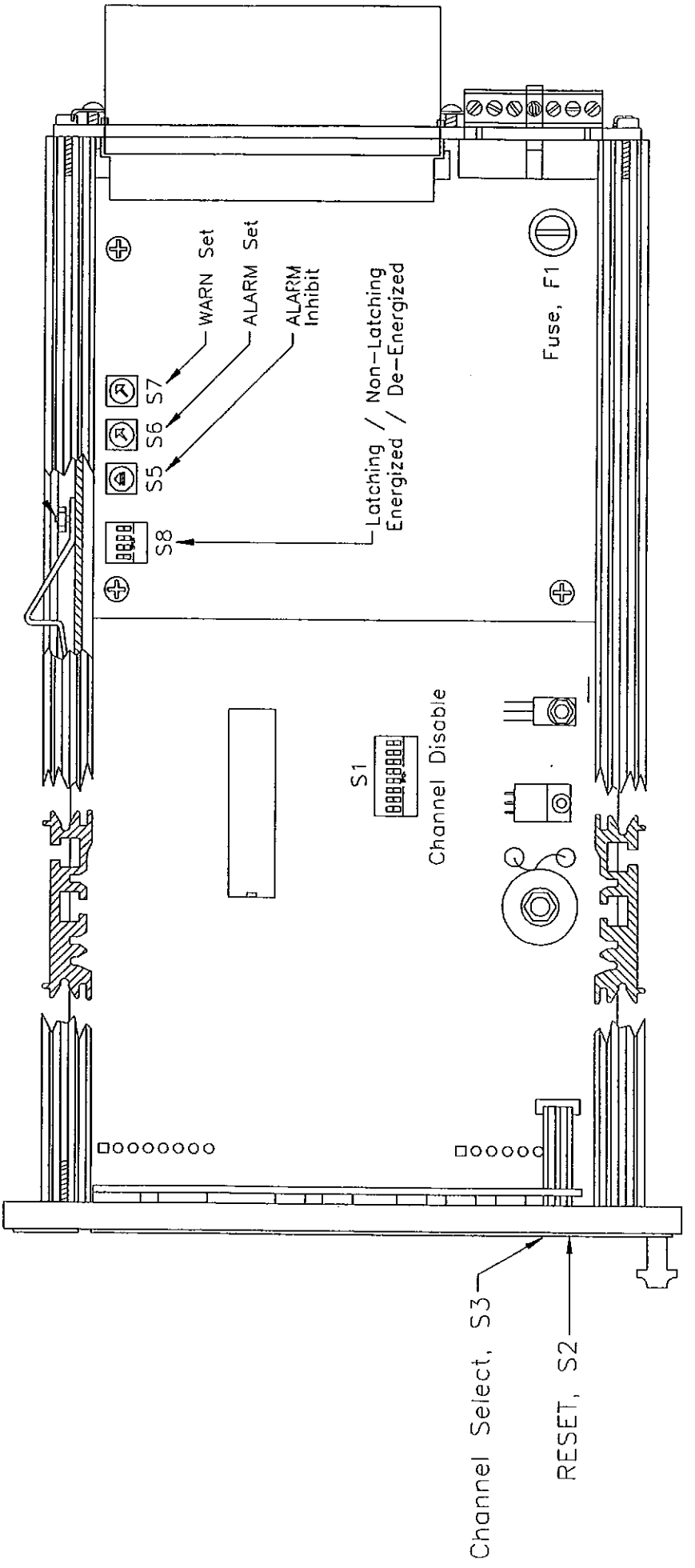

P1
CH1 4-20mA
CH1 24V
CH2 4-20mA
CH2 24V
CH3 4-20mA
CH3 24V
CH4 4-20mA
CH4 24V
NO - K1 - 1
C - K1 - 1
NC - K1 - 1
NO - K1 - 2
C - K1 - 2
NC - K1 - 2
NO - K2 - 1
C - K2 - 1
CH5 4-20mA
CH5 24V
CH6 4-20mA
CH6 24V
CH7 4-20mA
CH7 24V
CH8 4-20mA
CH8 24V
COMMON
WARN
ALARM
P2
NC - K2 - 1
NO - K2 - 2
C - K2 - 2
NC - K2 - 2
24VDC IN
24V COM
KEY
The WARN & ALARM relays are shown as normally de-energized.
Reverse the NO & NC contacts for normally energized relays.
J1
J2
J3
J4
RELAYS 117VAC 4A RES. MAX.
INPUT 24VDC 3A
REAR VIEW
P3
ALARM VOTING OUT
MALF OC 1
MALF OC 3
MALF OC 5
MALF OC 7
WARN OC 1
WARN OC 3
WARN OC 5
WARN OC 7
ALARM OC 1
ALARM OC 3
ALARM OC 5
ALARM OC 7
RESET
COMMON
CH SELECT
COMMON
MALF OC 2
MALF OC 4
MALF OC 6
MALF OC 8
WARN OC 2
WARN OC 4
WARN OC 6
WARN OC 8
COMMON
ALARM OC 2
ALARM OC 4
ALARM OC 6
ALARM OC 8
COMMON
COMMON
The connections labeled "OC" are not relay outputs. DO NOT APPLY 24VDC TO THESE TERMINALS.
P4
KEY
K3 - NC
K3 - C
K3 - NO
NC
NC
NC
MALF
The MALF relay is normally energized. There is no "normally de-energized" condition for the MALF relay.

Figure 2



CONTROL ELECTRONICS
MODEL DC110

FIGURE 3

E. REAR CONNECTOR IDENTIFICATION

Please refer to Figures 1 and 2. Figure 1 is the outline dimensional drawing which also shows the rear connector view. This view shows the nomenclature which is silk-screened on the rear panel and associated with the Jacks J1, J2, J3 & J4.

Figure 2 gives a detailed description of the 78 connections on the rear panel.

The plugs associated with the connections are identified as P1, P2, P3 & P4. P1 & P3 contain two vertical rows of sixteen terminations each and each row is identified as row "d" or row "z". Additionally the rows are identified in pairs using even numbers from 2 through 32. For example termination P1z-2 is the top right hand terminal of plug P1 and termination P1d-32 is the lower left hand termination of plug P1.

P2 and P4 each contain a single row of seven terminations. By similar example, termination P2-1 is the top terminal of plug P2 and P2-7 is the bottom.

All 4 of the plugs are keyed to only fit in their proper locations.

With reference to Figure 2, the location of specific terminations is as follows:

Plug P1

Row d, terminals 2 through 16 and Row z terminals 18 through 32 are the +24 VDC power to the eight SC100 Smart Sensors and the 4-20 mA signals from the SC100's. The common terminations associated with these connections are located on Row z terminals 2 through 16.

Row d terminals 18 through 28 are the output connections from the WARNing relay contacts.

Row d terminals 30 & 32 are two of the contacts of the ALARM relay. (See Plug P2).

Plug P2

Terminals 1 through 4 are the remaining four connections for the ALARM relay contacts. (See Plug P1).

Terminals 5 and 6 are the +24 VDC input and 24 VDC common input respectively to the Model DC110.

Terminal 7 serves as the key.

E. REAR CONNECTOR IDENTIFICATION (cont'd)

Plug P3

Plug P3 primarily provides the open collector output signals for the MALfunction, WARNing and ALARM conditions. Terminals d4 through 10 and z4 through 10 are the MALfunction output signals from the eight Smart Sensors.

Terminals d12 through 18 and z12 through 18 are the eight WARNing output signals. Terminals d22 through 28 and z20 through 26 are the eight ALARM output signals.

Terminals d2, d20, d30, d32 and z30 are Common terminals.

Terminal z2 is the open collector output signal to be used when in the ALARM voting mode.

Terminal z28 will permit a remote reset switch to be used to reset the alarms when the latching mode is in use.

Terminal z32 permits a remote channel select switch to be used.

Plug P4

Terminal 1 serves as the key.

Terminals 2,3 & 4 are the output connections from MALfunction relay contacts.

Terminals 5,6 & 7 are not used.

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II. INSTALLATION INSTRUCTIONS

A. LOCATION OF THE READOUT/RELAY MODULE

The Model DC110 Readout/Relay Module should be mounted in a non-hazardous area. It should also be mounted in a weather-protected location unless installed in a weatherproof enclosure. The following mounting hardware is available to facilitate installations.

1.	Panel Mount Frame (one unit), 49 mm (2") wide	P/N 10201-1
2.	Panel Mount Frame (two units), 98 mm (4") wide	P/N 10199-1
3.	Rack Frame (up to 8 units), 483 mm (19") wide	P/N 10200-1
	Blank Panel (for unused position)	P/N 10187
4.	Wall Mount Bracket (one unit)	P/N 10195-1
5.	Wall Mount Bracket (two units)	P/N 10202-1
6.	Weatherproof Enclosure (one or two units)	P/N 10259-1
7.	NEMA 7 Explosion Proof Enclosure (one or two units).	P/N 10099
8.	Desk Top Cabinet (up to 8 units)	P/N 914-006

NOTE: Mounting Hardware is not included in the Factory Mutual approval of this equipment.

The mounting should be as free from shock and vibration as possible. Care should be taken to mount the Module away from radio transmitters or similar equipment, even though it is RFI/EMI resistant. Provide a wiring service loop (Module to field wiring) to facilitate access to the adjustments located on the PC Board. This service loop will also provide easy removal and disconnect from the front of the panel. Care should be taken to assure adequate ventilation. Do not mount the DC110 in a manner which will restrict the natural convection air flow from normal ambient air. The operating range is 0°C to 60°C (32°F to 140°F).

B. POWER CONNECTIONS

The DC110 will operate on nominal line power of 22 - 30 VDC. There is no power on-off switch, so power must remain disconnected until all other wiring connections are made. A power on-off switch is not included to prevent accidental system shut down, since the system is designed for continuous use to maximize protection from combustible gas buildup.

Primary DC power may be provided by any nominal 24V direct current supply. Appropriate cables should be used to prevent excessive voltage drop, and the cable run should be as short as possible. Connect the positive supply to +24V In (connector P2-5) and the common to 24V COM-In (connector P2-6). An internal diode protects the system in the event of inadvertent supply reversal.

C. POWER INTERCONNECTION TO THE MODEL SC100 SMART SENSOR

The Model DC110 is designed to supply the 24VDC power required by the General Monitors' Model SC100 Smart Sensor. To power the SC100, the DC110 must be located within a maximum distance of 1000 meters (3000 ft.) from the Model SC100 Smart Sensor and the maximum permissible loop resistance is 20 ohms at 24 VDC using 16 AWG cable. The interconnection is made from the P1 rear connector block terminations of the Model DC110 identified as CH "(X)" + 24V ("X" stands for the appropriate channel number 1 to 8), and common. The +24V terminal should be connected to the TB1 connection point 7 identified as +24 VDC RED in the Model SC100. See Figure 1 in the Model SC100 manual for the Terminal Block identification of the Model SC100. The common terminal point is connected to the TB1 connection point 6 in the Model SC100 identified as "COM-BLK" (TB1-6). Each of the P1 terminations also identifies the SC100 with which it is associated. For instance, the connections to SC100 number 1 are P1d4 and P1z2.

D. ANALOG INTERCONNECTION TO MODEL SC100 SMART SENSOR

The 4-20 mA output signal from the Model SC100 Smart Sensor is interconnected with the Model DC110 Readout/Relay Module to provide (1) indication in a control room or other location remote to the Model SC100 of the operation and alarm conditions of the Model SC100, (2) to provide alarm relays for audible or visual indications or other relay type of functions desired by the user, and (3) to provide the open collector output signals.

To interconnect the DC110 with the SC100, make the following interconnections:

DC110		SC100	Note:
CH "(X)" 4-20 mA	to	CURRENT OUT (WHT)	("X" stands for for the appropriate channel no's. 1 to 8).

E. ALARM WIRING CONNECTIONS

Alarm wiring connections are also made at designated connectors located on the rear panel of the DC110. The ALARM and WARN gas alarm relay contacts (dry) are DPDT and rated 4 amps at 117 VAC, resistive. They may be latching (manual reset) or non-latching (automatic reset), and normally energized or normally de-energized (with power applied to the controller). Each of these operations can be selected by DIP switches in the DC110. The MALfunction alarm relay contacts (dry) are SPDT and rated 4 Amps at 117 VAC resistive. The MALfunction relay is always provided as non-latching and normally energized (with power applied to the controller).

The number designations on the alarm connection terminals (rear panel) are in accordance with the following (See Figure 2):

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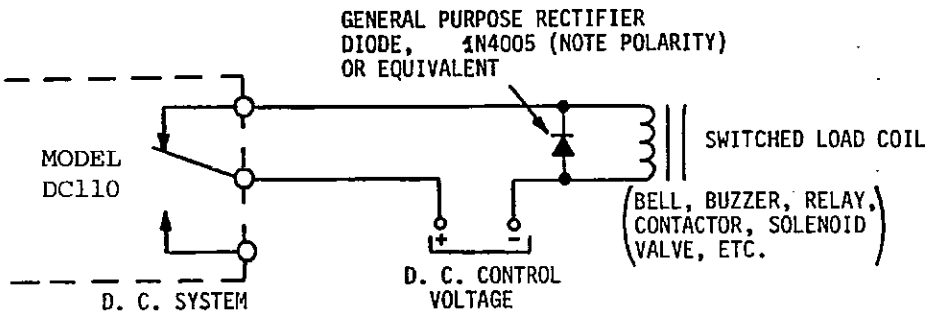
E. ALARM WIRING CONNECTIONS (cont'd)

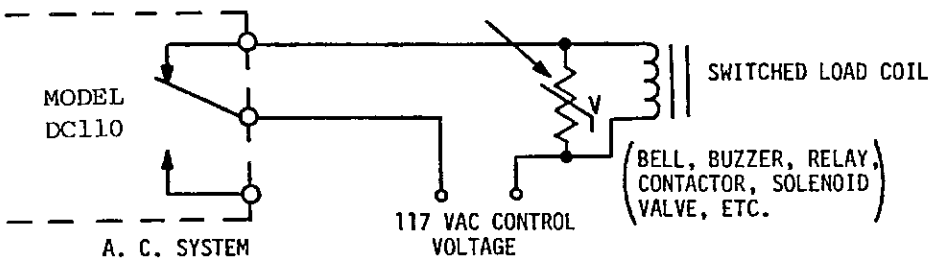
MALfunction alarm (with power applied)		P4-3 = Common P4-4 = Open P4-2 = Closed	
WARN alarms normally energized (with power applied)	P1d-20, P1d-22, P1d-18,	P1d-26 = Common P1d-28 = Open P1d-24 = Closed	Note: Corresponding terminations for one set of contacts are identified vertically for each pole of the WARN and ALARM relays.
WARN alarms normally de-energized (with power applied)	P1d-20, P1d-18, P1d-22,	P1d-26 = Common P1d-24 = Open P1d-28 = Closed	
ALARM alarms normally energized (with power applied)	P1d-32 P2-1, P1d-30,	P2-3 = Common P2-4 = Open P2-2 = Closed	
ALARM alarms normally de-energized (with power applied)	P1d-32, P1d-30, P2-1,	P2-3 = Common P2-2 = Open P2-4 = Closed	

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 one of 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.



METAL OXIDE VARISTOR RATED FOR 150 VRMS
GENERAL ELECTRIC V150LA20A OR EQUIVALENT

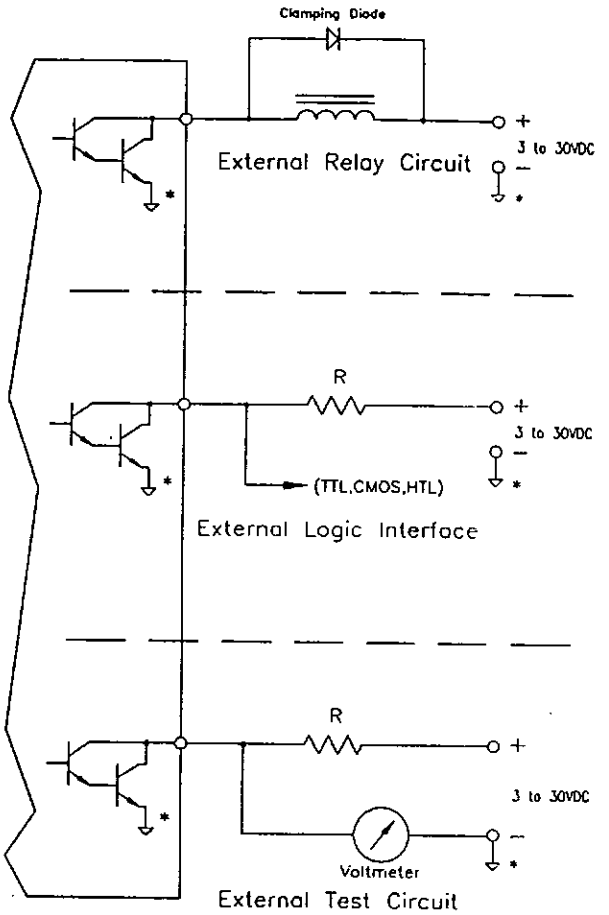


F. OPEN COLLECTOR OUTPUTS

An open collector output can simply be thought of as a SPST switch connected such that one terminal is connected to the system common, and the other terminal is the output. The load to be driven is connected between the open collector output and a supply voltage that is positive with respect to the system common. When the output is not activated, like a normally de-energized relay, there is no current flow (the switch is open). For an active output the switch is closed permitting current to flow. It is very important that the load is selected such that the maximum current flow is less than the rated value. This is especially true for loads with high surge currents such as incandescent lamps.

The ALARM and WARNing open collector can be nornally energized (sink current) or normally de-energized (not sinking current). They can also be latching or non-latching. These settings are DIP switch selectable. The MALFunction open collector is always normally energized (sinking current) and non-latching.

The open collectors are rated at 100mA at 30 VDC max. The maximum output leakage current is 50 uA. To connect to an open collector see Figure AA.



* Note: All system commons (⏚) must be tied together.

Figure AA Typical Open Collector External Circuits

CAUTION

If any open collector output is connected to an external device which is not powered by the same power supply that is powering the Model DC110, jumper W2 must be removed. See figure 7; sheet 1 for jumper location.

G. APPLYING POWER

Before applying power to the system for the first time, all wiring connections should be double-checked for correctness.

The Model SC100 has a time delay (during which time a constant 4mA signal is supplied by the unit) for approximately 45 seconds after DC power is applied. The purpose of this feature is to eliminate false alarms which might otherwise result while the system is stabilizing. The time delay is also initiated when the SC100 Smart Sensor returns to normal operation from the MALfunction mode.

> IMPORTANT
>
> During the time out period for a Smart Sensor, no indication will be given of this condition by the DC110 All other channels will function normally.

H. ALARM SET POINT ADJUSTMENTS

(1) WARNing setting.

The WARNing setpoint level may be adjusted in 5% steps between the values of 10 and 60% LEL. This is accomplished by rotary switch S7 shown on figure 3. Switch S7 is a 16 position switch with the positions marked from 0 through 9 and A through F. Position 0 corresponds with 10%.

(2) ALARM setting.

The ALARM setpoint level adjustment is identical to that for WARN signal given above. For the ALARM setting use rotary switch S6 shown on figure 3.

To check that the desired values have been set for the WARN and ALARM signals depress the RESET switch on the front panel and hold it in. The digital display will show the percent LEL at which the WARN relay and open collector signals will actuate.

Release the RESET switch and immediately depress it and hold it in again. The percent LEL on the digital display will switch to show the setpoint for the ALARM level.

When the RESET switch is released, the Model DC110 will return to its normal function and the peak channel will again be indicated.

III. INDICATORS, SWITCHES AND FUNCTIONS

A. % LEL DISPLAY

The digital display is scaled from 0 to 99% LEL for the gas/vapor for which the system will be calibrated.

CAUTION: READINGS OF 99% LEL OR HIGH OFFSCALE READINGS (FLASHING "99") INDICATES AN EXPLOSIVE GAS CONCENTRATION IS PRESENT AND IMMEDIATELY ACTION SHOULD BE TAKEN.

B. PEAK CHANNEL DISPLAY

The Model DC110 will continuously display the value of the highest reading channel on the digital readout. Simultaneously the PEAK CH LED will be illuminated along with the channel number (1 through 8).

A special feature allows the user to view the level of each of the other active channels by depressing the CHANNEL SELECT Switch (S3) on the front panel and holding it in for approximately 2 seconds. When it is released the display will cycle through all channels that have not been disabled beginning with channel 8 and ending with channel 1 after which it will return to the PEAK CH indication. During the cycle, each channel will be displayed approximately 2 seconds.

A slower cycle may be obtained by holding the CHANNEL SELECT switch in rather than releasing it after 2 seconds. This allows the user to view channel 8 for as long as the switch is held depressed. To move to channel 7, release the switch and immediately depress and hold it in again. Continue releasing and depressing the switch to cycle through the remaining channels.

C. GAS ALARM INDICATORS

The red "ALARM" LED and amber "WARN" LED indicators illuminate whenever the gas concentration at any sensor exceeds the concentration at which the respective alarm circuits were pre-set. The activating of the LED's will be accompanied by the activation of the associated relay contacts and the open collector output signals.

D. MALFUNCTION INDICATOR

Normally off, this amber indicator flashes any time there is a fault in the system. Gas alarm indications by relays, open collector output signals and the front panel indicators for that channel are bypassed during a malfunction; the MALfunction relay de-energizes and the green flashing "MAL" alarm LED accompanied by a flashing amber channel indicator (1 through 8) illuminate on the front panel, telling the operator which channel is in MALfunction. If more than one channel is in MALfunction, all channel numbers that are in MALfunction will be displayed.

E. CALIBRATION INDICATOR

When any channel is placed into the calibration mode an amber "CAL" indicator will appear on the front panel accompanied by the channel indicator number (1 through 8). Both of these indications will be steady. When a channel is in the "CAL" mode the ALARM and WARN relays and the open collector output associated with that particular channel will not operate. The MALfunction outputs will be operative in the "CAL" mode, however.

F. RESET SWITCH

Any alarm relay and open collector output which is set for LATCHING operation, and its associated alarm indicator, will stay in the alarm condition even if the gas concentration at the sensor drops below the set point. When the "RESET" indication appears on the front panel of the Model DC110, the alarm condition can be cancelled by depressing the momentary-action RESET SWITCH, S2 located on front panel adjacent to the "RESET" indication. (See figure 3). Depressing the switch has no effect if the gas concentration is still above the set point levels.

The RESET SWITCH serves the additional function of an LED check and the setpoint level check for the WARN and ALARM signals.

By depressing the switch and holding it for 2 to 3 seconds the WARN indicator will begin to flash and its associated channel indicators (1 through 8) will be illuminated (steady). The digital display will show the setpoint for the WARN alarm. After 4 to 5 seconds the indication will switch to the ALARM indicator where the information for the ALARM condition will be shown in a similar manner. After displaying the ALARM condition for approximately 4 seconds the system will automatically return to its operating condition.

G. ALARM OUTPUT INHIBIT

Alarm circuits can be inhibited to prevent activation of the WARN & ALARM relays and the associated channel open collector outputs when testing the complete SC100 - DC110 system. To do so, slide the DC110 forward and activate the internal ALARM INHIBIT Rotary Switch (S5) located on the printed circuit board (see figure 3). When in this mode the symbol (AL) will appear just to the right of the digital display on the front panel. Switch S5 has 10 positions. Positions 0 and 9 are not active and the switch should be in one of these positions for all channel alarms to be active. Positions 1 through 8 will inhibit each of the associated channels.

NOTE: Inhibiting a channel will have no effect on any other channel

H. CHANNEL DISABLE

The function and use of this switch (S1) was described under section I, C earlier in this manual. It has no secondary functions.

I. RELAY OPERATION SELECTION

The Model DC110 provides optional relay operation for the WARN and ALARM relays. These various operations are switch selectable by the customer through the use of switch S8 (see figure 2). S8 is a four section, two position DIP switch mounted on the main P.C. board. Sections 1 & 2 control whether the relays will be energized or de-energized during normal operation and sections 3 & 4 determine if they will be latching or non-latching. Switch settings are shown in the table below. To simplify the instructions the terms IN and OUT are used for the switch positions. These terms have reference to the top of each switch section when looking into the P.C. board from the right side. The sections of the switch are numbered 1 through 4 from left to right. "IN" means that the top section of the switch is depressed. "OUT" is accomplished by depressing the bottom of the switch to move the top of the switch "OUT".

DE-ENERGIZED	Section	Relay	Switch Position
	1	ALARM	IN
	2	WARN	IN

In this position the relays will be de-energized during normal operation of the system with power applied.

ENERGIZED	Section	Relay	Switch Position
	1	ALARM	OUT
	2	WARN	OUT

In this position the relays will be energized during normal operation of the system with power applied and will drop out upon loss of primary system power.

LATCHING	Section	Relay	Switch Position
	3	ALARM	IN
	4	WARN	IN

In this position the relays will latch upon reaching an alarm condition and will require manual reset when the alarm condition is removed.

NOTE: For an FM approved installation, the latching mode must be used.

I. RELAY OPERATION SELECTION (cont'd)

NON-LATCHING	Section	Relay	Switch Position
	3	ALARM	OUT
	4	WARN	OUT

In this position the relays will automatically reset after an alarm condition when the gas concentration falls below the pre-set alarm set-point.

J. CHANNEL SELECT SWITCH FUNCTIONS

As mentioned earlier the Model DC110 will show the condition of all active channels. This is accomplished through use of the CHANNEL SELECT Switch (S3) as described in Section III, B above and by watching the digital display reading for each channel. The following indications may be observed.

Condition	Observation
All channels operational and functioning normally.	During the cycle from channel to channel any gas concentration above 2% LEL will be shown on the digital display.
One or more channels disabled; others functioning normally.	The LED channel number indicators associated with the disabled channels will not appear during the scan cycle and the digital display will function as above for all active channels.
One or more channels in MALfunction; others functioning normally.	The digital display will show an "Er" for any channel in MALfunction. All other indications will show the gas concentration (above 2% LEL) for operating channels.
One or more channels in CALibrate, others functioning normally.	The digital display will show a "CA" for any channel in CALibration. All other indications will show the gas concentration (above 2% LEL) for operating channels.

Note: CHANNEL SELECT may also be accomplished remotely by connecting a momentary contact pushbutton between the CH SELECT terminal Z32 and common d30 on Plug P3 on the rear of the module (See figure 2).

K. OTHER DIAGNOSTIC INFORMATION

Additional diagnostic capability has been incorporated into the Model DC110 that does not require the use of any of the switches. This information will be displayed by the front panel LED's and the digital display when it occurs.

Condition	Observation
All active channels (those not disabled) in MALfunction.	The digital display will show an "Er". The MAL LED and associated channel number LED's will flash. Numbers for the disabled channels will be missing.
All active channels (those not disabled) in CALibrate.	The digital display will show a "CA". The CAL LED and associated channel number LED's will be on steady. Numbers for the disabled channels will be missing.

If all active channels are in the CAL mode and a MALfunction occurs on one channel, the MAL LED will turn on and begin to flash. The associated channel number LED will also change from steady to flashing and the MALfunction circuit will actuate. The digital display, however, will continue to display a "CA" until the calibration of one sensor is completed and it is returned to service. At this time the display will switch to read the gas concentration of that channel.

IV. OPERATIONAL ADJUSTMENTS AND PROCEDURES

A. INITIAL START-UP

Each Model DC110 is ccmpletely checked at the factory for proper operation. However, a complete checkout is a necessity upon placing the system in operation to assure system integrity. This includes verify- the digital indicator zero, checking and adjusting alarm set points, and performing a complete calibration procedure for each associated Model SC100.

B. MODEL SC100/DC110 CALIBRATION

Calibration of the Model SC100 Smart Sensor is covered in Section IV, B in the SC100 instruction manual.

The Model DC110 provides the customer with an alternate method of returning a Model SC100 to operation without performing a calibration to that of reapplying the magnetic screwdriver to the calibration switch as described in the SC100 instruction manual.

To assist the customer in a situation where the wrong channel is inadvertently placed into calibration, momentary contact switch S4 at the rear of the P.C. Board (see Figure 3) may be pressed to cancel the calibration mode by momentarily removing the 24VDC power.

> CAUTION
>
> It should be remembered that removing the 24VDC power to a Model SC100 will automatically cause it to go into a time out mode for 45 seconds when power is restored. This will also be true for ALL other channels associated with this particular DC110 since actuation of switch S4 will remove power from all the Model SC100 units.

During a normal calibration of a Smart Sensor the output current is held at a constant 1.5 mA so that it is not necessary to inhibit the channel under calibration to prevent relay operation.

If other tests are to be conducted with gas applied to the Smart Sensor, the alarm circuits can be disabled to prevent activation of the relay contacts. To do so, rotate switch S5 (see figure 3) to the channel number (1 through 8) to be tested.

The red (AL) indication will appear on the front panel next to the digital display to remind the operator that a channel alarm has been inhibited.

B. MODEL SC100/DC110 CALIBRATION (cont'd)

Be sure to return the channel to operation when testing is complete.

C. ALARM SET POINT CHECK

To check the alarm set points, depress RESET switch S2 and hold it in to check the WARN set point. Release and immediately depress S2 again and hold it in to check the ALARM set point.

V. SYSTEM PROBLEMS AND TROUBLESHOOTING

A. MAINTENANCE

Once installed, the Model SC100/DC110 systems require little or no routine maintenance other than periodic calibration checks. GMI recommends that a calibration schedule be established and adhered to. GMI also recommends that a log book be kept showing calibration dates and dates of sensor replacement.

B. TROUBLESHOOTING TABLE

The information presented in the following table is designed to correct the more common problems which appear during system startup and operation. Should the various actions suggested in the table fail to restore normal operation, we recommend that the factory be consulted and, if necessary, that the module be returned to the factory for repair.

V. MODEL DC110 TROUBLE SHOOTING

INTRODUCTION

This section is intended to be a guide in correcting problems which may arise in the field. This section is not all-inclusive, and General Monitors should be contacted for assistance if the corrective actions listed do not eliminate the problem. If equipment or qualified personnel required for various tests is not available it is recommended that the defective unit be returned to General Monitors for repair. A complete written description of the problem should be included.

Be sure to place instrument in Alarm Inhibit mode or disconnect external alarm wiring before making any check which might send the unit into alarm, if an alarm condition will create problems.

NOTE: If the equipment is under warranty, any repairs performed by persons other than General Monitors' authorized personnel may void the warranty. Please read the warranty statement carefully.

PROBLEM	POSSIBLE CAUSE	CORRECTIVE ACTION
1. % LEL display does not turn on after application of DC power.	1. No input power. 2. 3 amp DC fuse (F1) is defective. 3. Input power leads reversed.	1. Insure proper power supply to controller 2. Replace F1. 3. Verify connections to +24VDC-IN and 24V COM IN are correct.
2. The MAL LED is flashing.	1. The SC100 is in the MALfunction mode.	1. Check the SC100 unit for proper operation.
3. The MAL LED is on steady but appears to be dim.	1. Low input voltage.	1. Insure proper voltage (22-30 VDC) to the Readout/Relay Module.
4. The MAL LED is flashing alternately bright and dim.	1. Problems 2 and 3 above both exist.	1. Check for proper operation of SC100 unit and insure proper voltage to the DC110.
5. WARN and/or ALARM LED's do not turn "ON" when % LEL readout exceeds desired alarm set point.	1. Alarm set points not properly adjusted.	1. Perform ALARM and WARN alarm set point adjustment.

VI. DC110 SPECIFICATIONS

Dimension:	Approx. 2.1" x 6.9"H x 11.5"D (53mm x 175mm x 294mm
Weight:	Approx. 3.8 lbs. (1.8kg.)
Mounting Configurations:	Rack, Panel, Wall, Weatherproof Enclosure
Temperature Range:	(32°F to 140°F) 0°C to 60°C
Storage Temperature:	-28°F to + 130°F
Power:	22-30 VDC, 8 Watts DC-110 plus 6 watts for each Model SC100
Power Supply:	Minimum - 4 Amp. Unregulated 7.5 Amp. Regulated
Humidity:	15 to 95% Non-condensing
Display Range:	0 to 99% Lower Explosive Level (% LEL) Blinking '99' for Over-range Indication
Accuracy:	± 3% LEL or ± 10% of applied gas, whichever is greater
Status Indicators:	ALARM, WARNing, MALfunction, CALibrate, PEAK CHannel, RESET, (AL)
Channel Indicators:	1 through 8 associated with status indicators ALARM, WARN, MAL, CAL, PEAK CH
Front Panel Switches:	Channel Select Reset
Alarm & Warn LED Test:	Incorporated with Reset switch (hold for over one second)
Alarm Disable:	9 position rotary switch
ALARM Setting:	16 position rotary switch (5% steps between 10 and 60 percent LEL)
WARNing Setting:	16 position rotary switch (5% steps between 10 and 60 percent LEL)

GENERAL MONITORS

DC110 SPECIFICATION (cont'd)

Energized-De-energize Option:	ALARM & WARN Set by DIP Switch
Latching-Non-latching Option:	ALARM & WARN Set by DIP Switch
CHANNEL enable:	Set by DIP Switch for each channel
Voting:	Jumper selectable - one or two channels ALARM only
Calibration Reset:	One momentary pushbutton switch - PC board mounted
Channel Input Resistance:	125 ohms maximum
Outputs:	Open collector: One ALARM per channel One WARNing per channel One MALfunction per channel Relay: ALARM - DPDT contacts at 4 AMP 117 VAC resistive WARNing- DPDT contacts at 4 AMP 117 VAC resistive MALfunction - SPDT contacts at 4 AMP 117 VAC resistive
Output Power to Smart Sensor:	24 VDC nominal at 0.25 AMP to the SC100 Smart Sensors
Remote Reset:	Yes
Electrical Classification:	General purpose for mounting in a non-hazardous area
Input:	0-20 MA from the SC100 Smart Sensor
Warranty:	Two years
Cable:	3 wire shielded maximum cable length allowable between Display Module and Sensor Assembly with one way resistance of 10 ohms (total 20 ohm loop) (power for smart sensor supplied by module)

AWG	METERS	FEET
18	600	1800
16	1000	3000
14	1500	4500

VII. RECOMMENDED SPARE PARTS

One Model DC110

For up to Two Years Operation

ITEM	DESCRIPTION	PART NUMBER	QTY.
1.	Fuse, 3 amp, 250 VAC, Slo-Blo	951-208	2

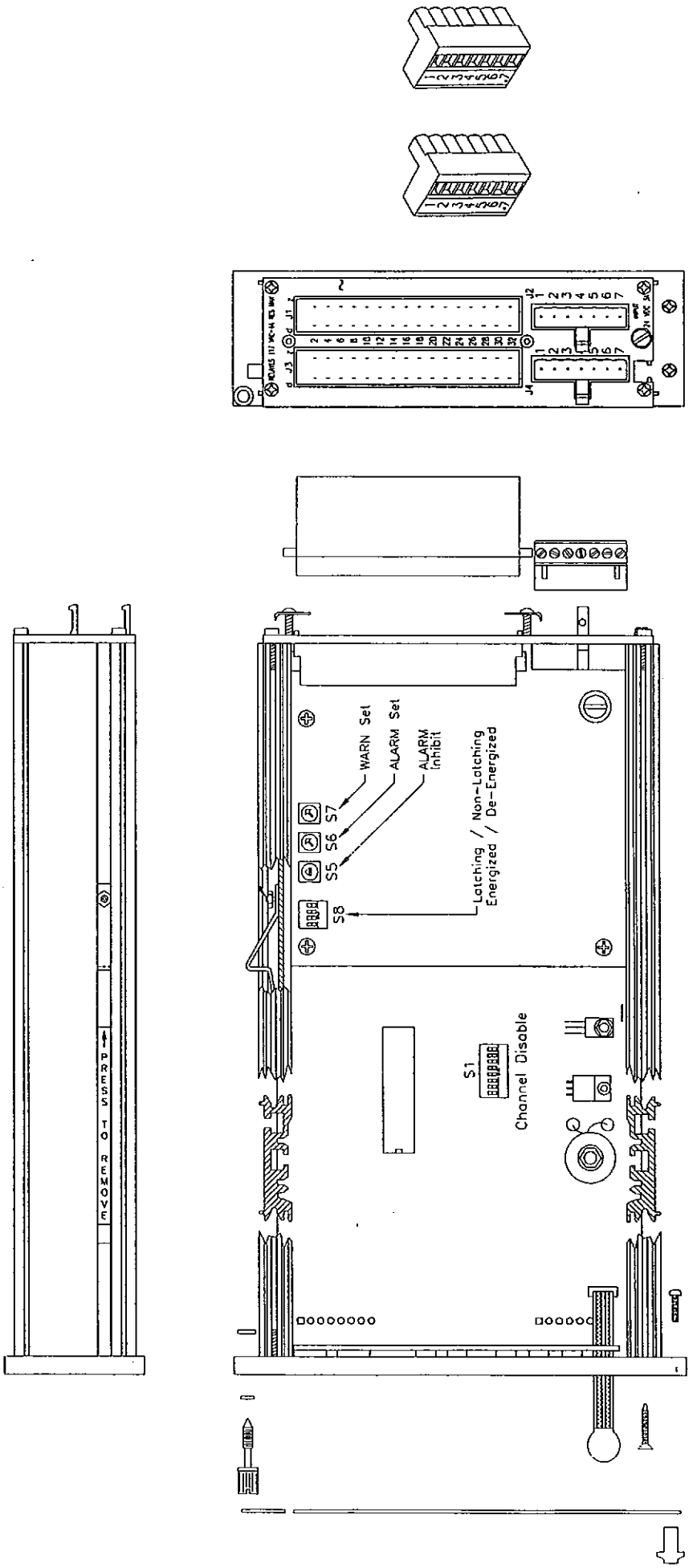
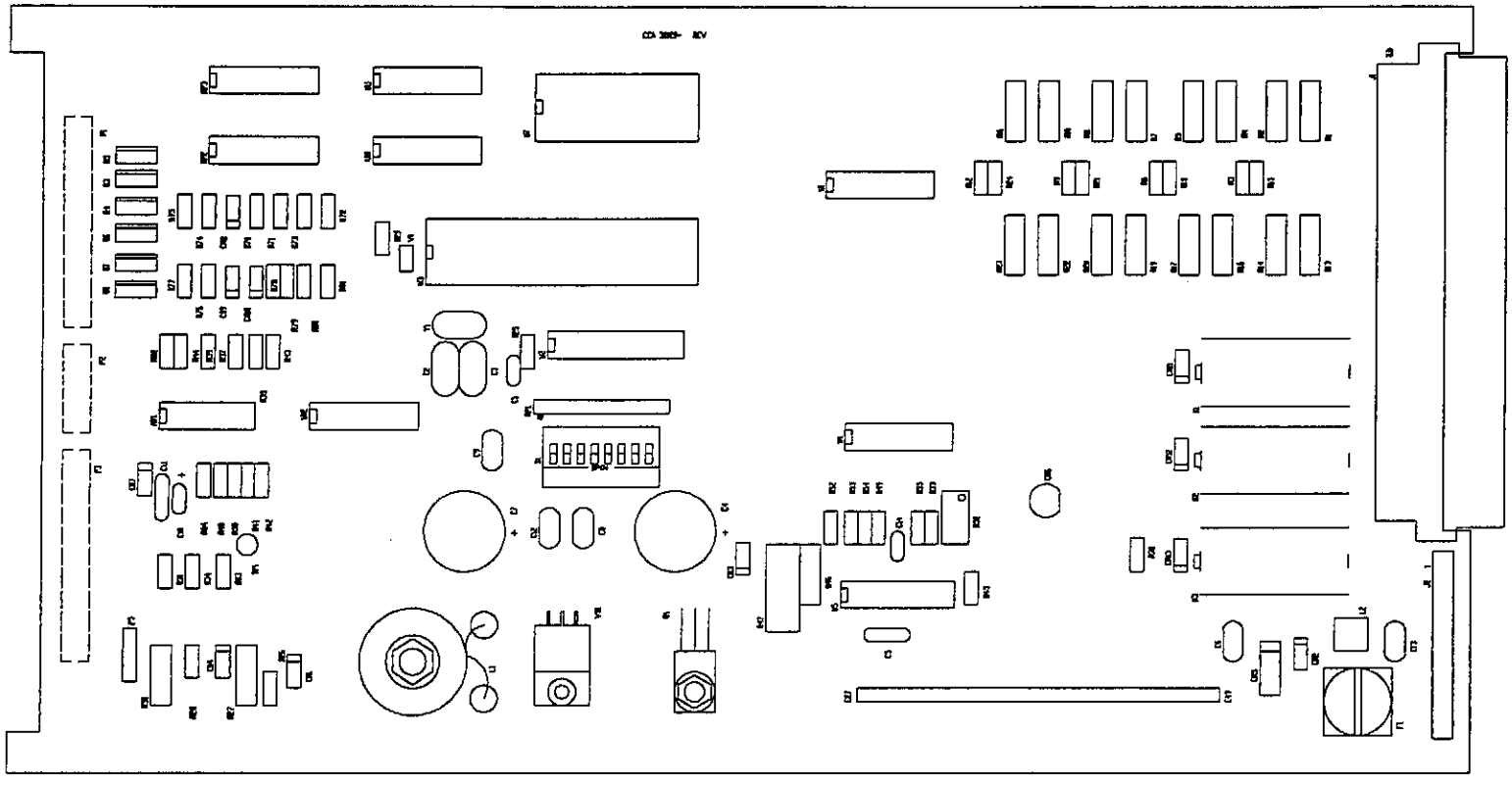
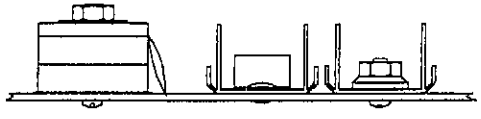


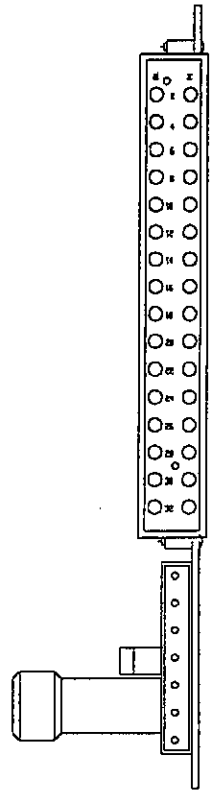
FIGURE 4

FINAL ASSEMBLY
MODEL DC110

(Reference 30125)





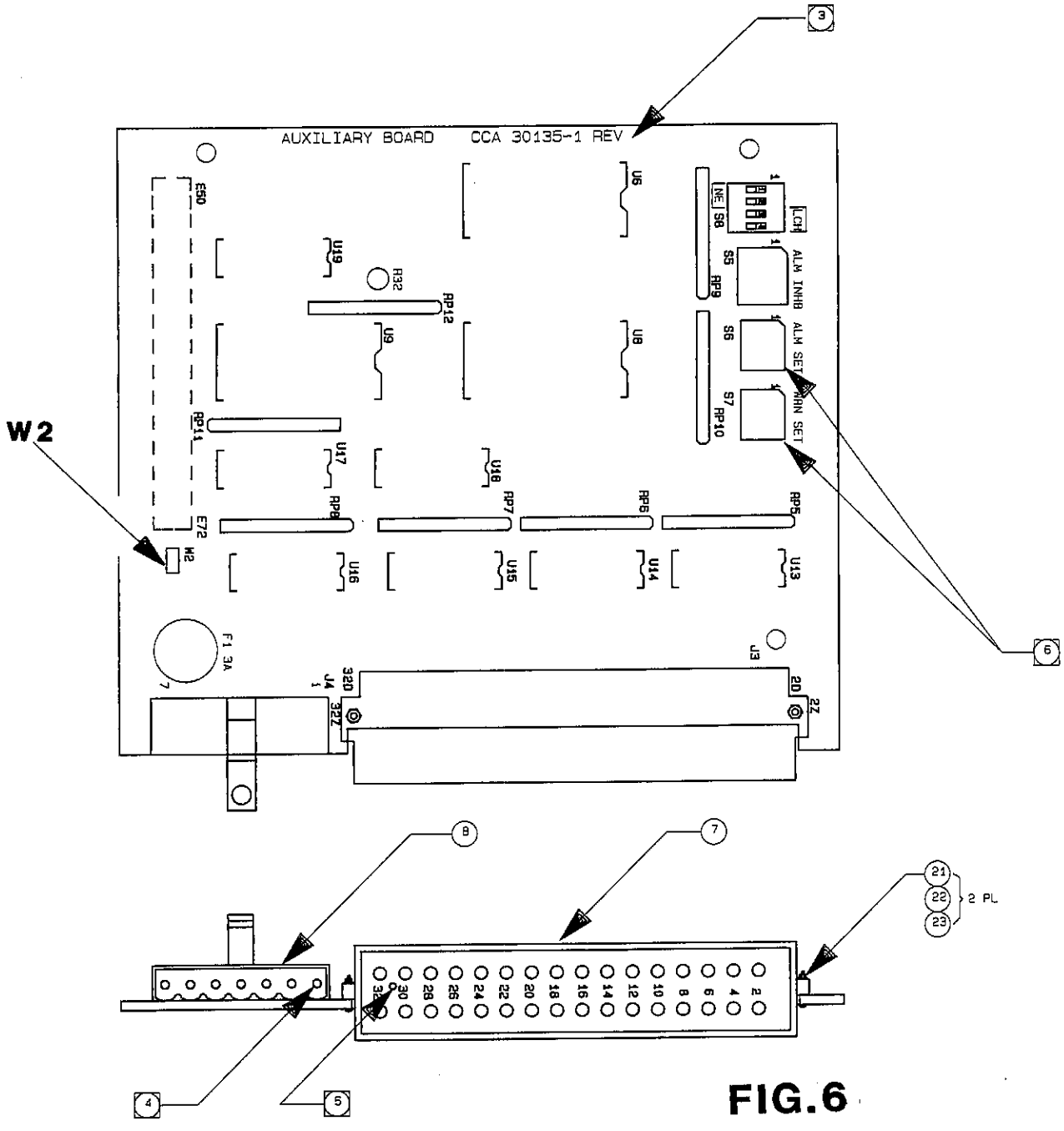


CAUTION
SENSITIVE ELECTRONIC DEVICES

CCA - CONTROL ELECTRONICS

(REF 30129K) FIGURE 5

Model DC110



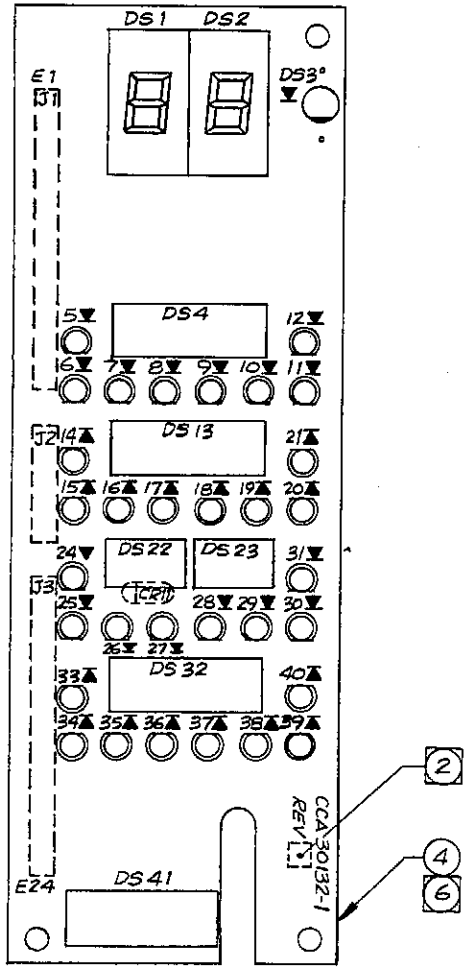
(REF 30135F)

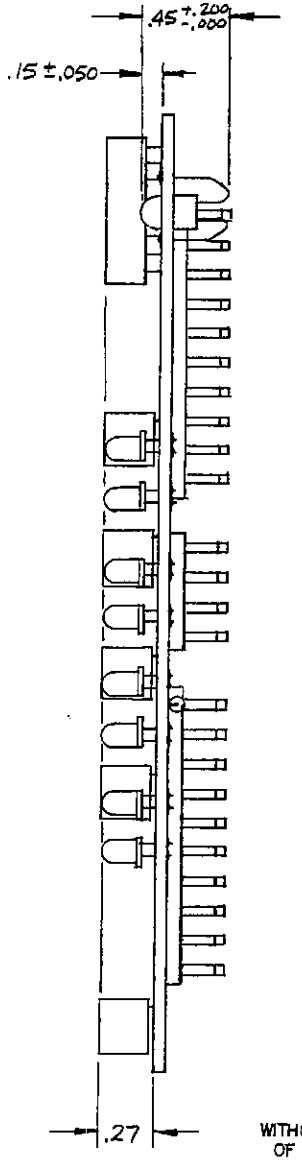
FIG.6

NO CHANGES
WITHOUT AUTHORIZATION
OF FACTORY MUTUAL

FOR PARTS LIST SEE COMPUTER BOM 30135-

CCA - AUXILIARY BOARD MODEL DC 110





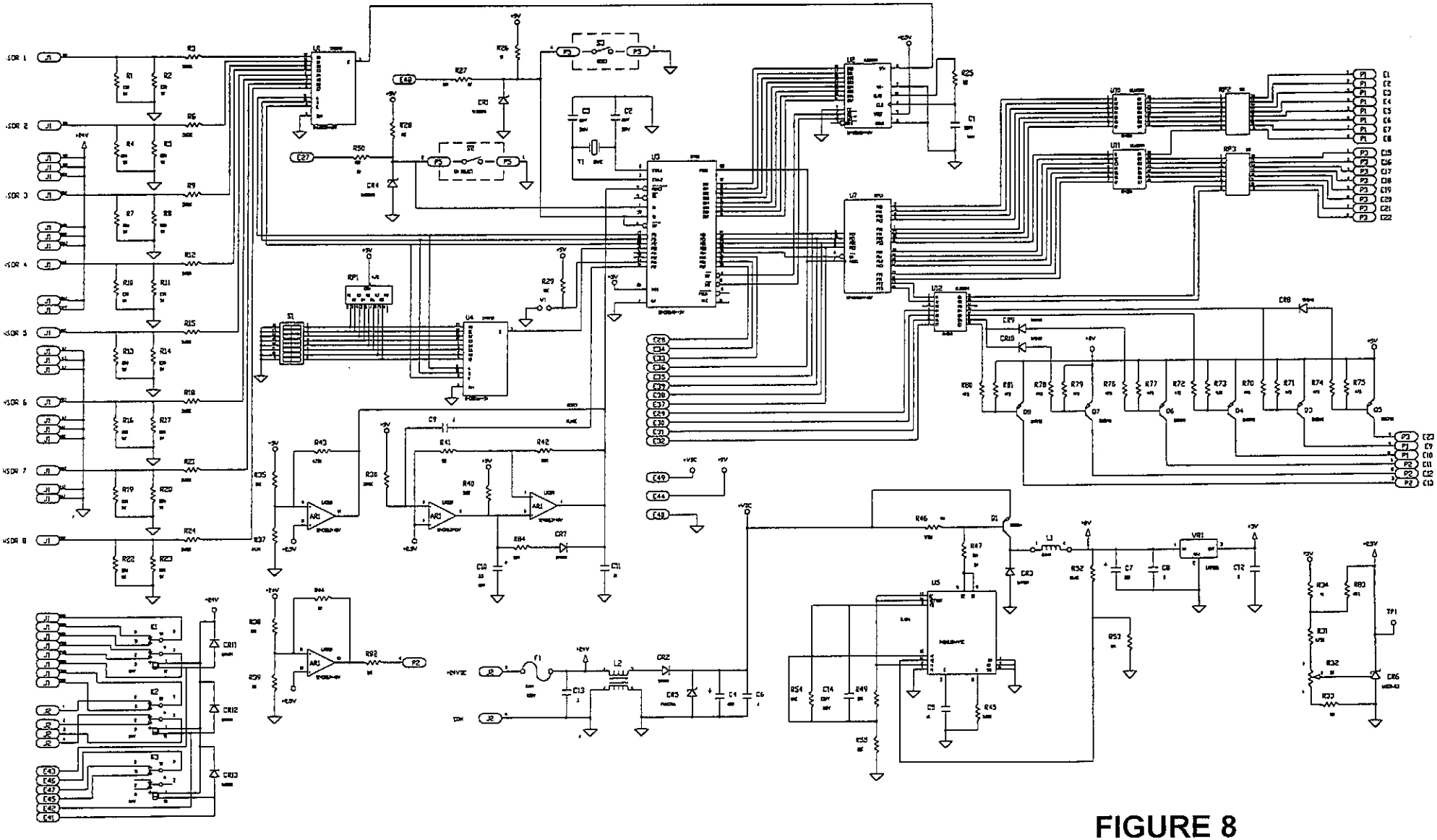
	QTY.	PART NO.	DESCRIPTION		ITEM
	AR	932-002	CONFORMAL COATING		23
	1	948-342	LED, RED	DS 3	22
5 4	8	948-347	LED, YELLOW .118 DIA	DS 24,25,26,27,28,29,30,31	21
5 4	8	948-346	LED, GREEN .118 DIA	DS 33,34,35,36,37,38,39,40	20
5 4	8	948-345	LED, AMBER .118 DIA	DS 14,15,16,17,18,19,20,21	19
5 4	8	948-344	LED, RED .118 DIA	DS 5,6,7,8,9,10,11,12	18
					17
	1	948-349	LIGHT BAR MODULE - ORANGE	DS 22	16
	1	948-348	LIGHT BAR MODULE - YELLOW	DS 23	15
	2	948-340	LIGHT BAR MODULE - RED	DS 4, 41	14
	1	948-339	LIGHT BAR MODULE - GREEN	DS 32	13
	1	948-338	LIGHT BAR MODULE - ORANGE	DS 13	12
	2	948-334	LED 7 SEGMENT DISPLAY	DS 1, 2	11
					10
3	1	948-104	DIODE, SIGNAL IN4148	CR 11	9
					8
3	2	921-707	CONNECTOR, 10 POS	J1, 3	7
3	1	921-751	CONNECTOR, 4 POS	J2	6
					5
	1	30133-1	CCD, DISPLAY BD.		4
	INFO	30127	SCHEMATIC DIAGRAM		3
					2
	-	-1	CCA, DISPLAY BD.		1

REF 30135

FIG. 7

CCA DISPLAY BOARD
MODEL DC 110

SCHEMATIC DIAGRAM
MODEL DC110



(Reference 30127 rev. K)

FIGURE 8
SHEET 1

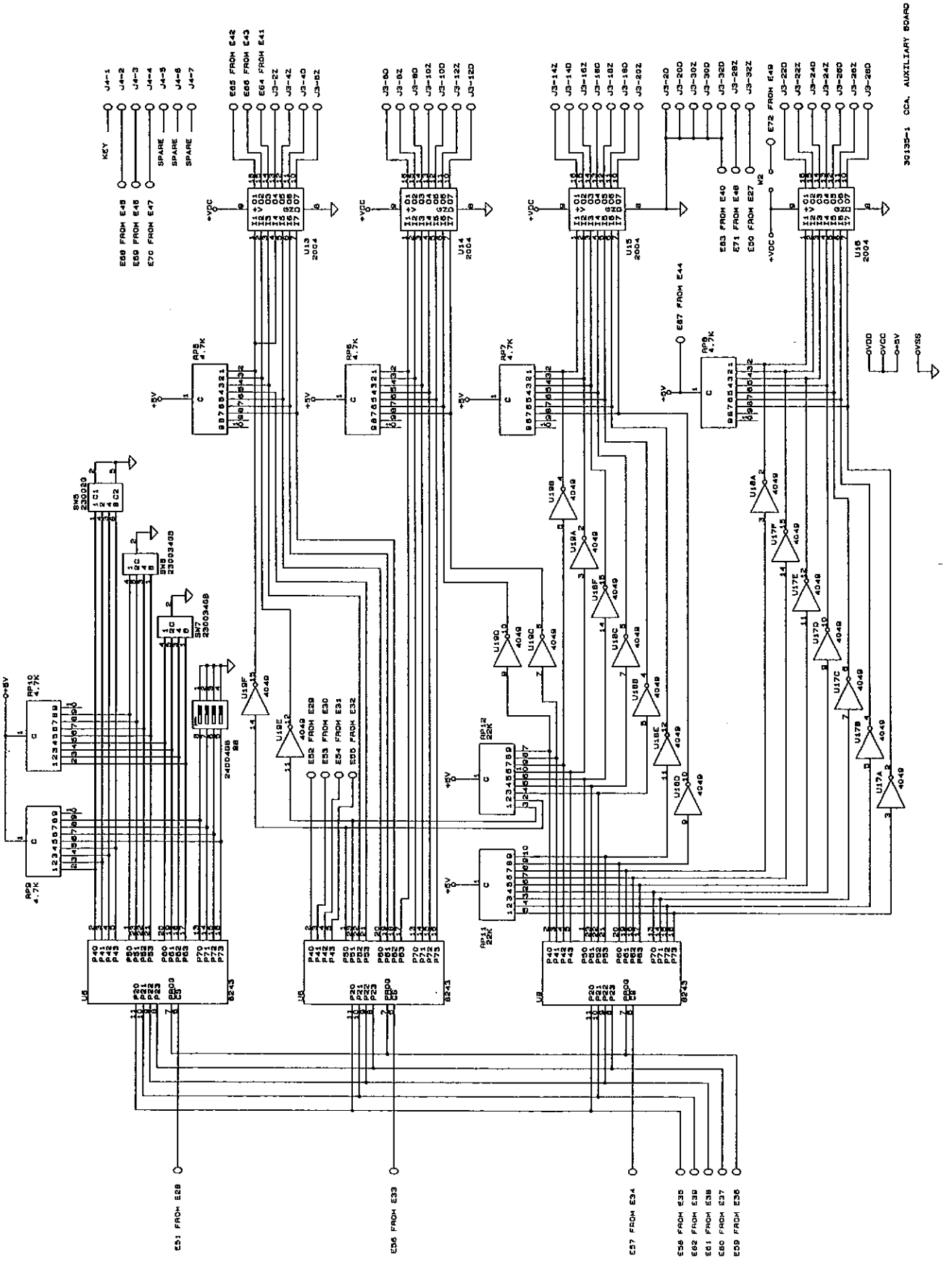
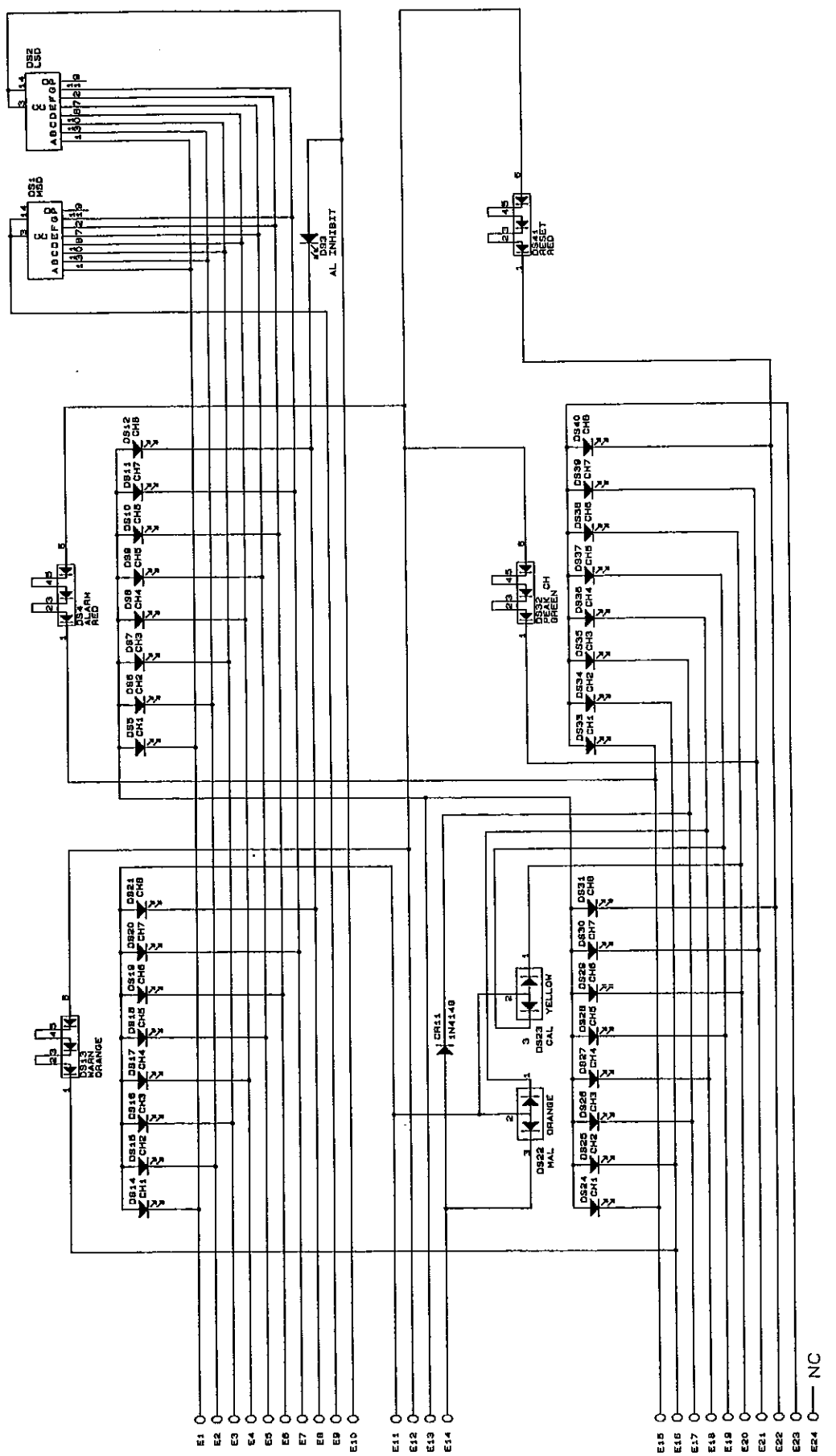


FIGURE 8
Sheet 2

SCHEMATIC DIAGRAM
MODEL DC110

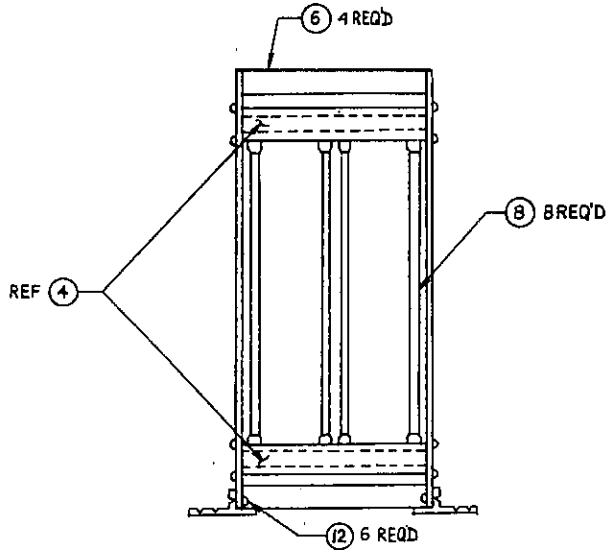
(Reference 30135)

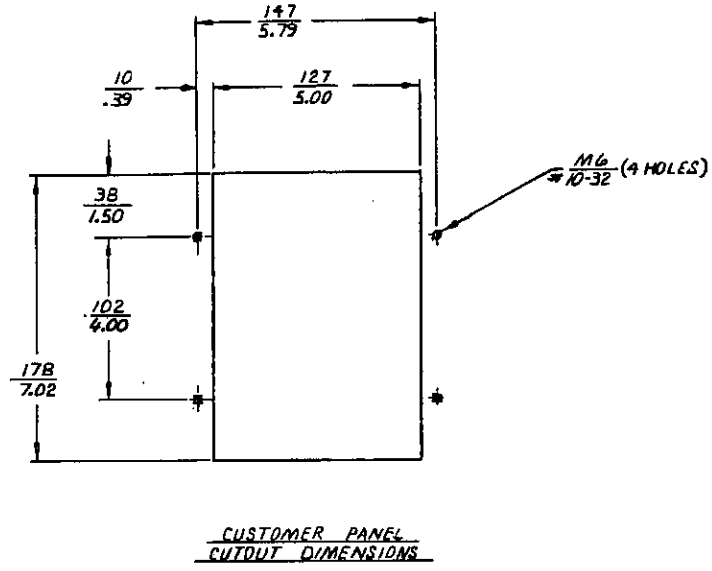


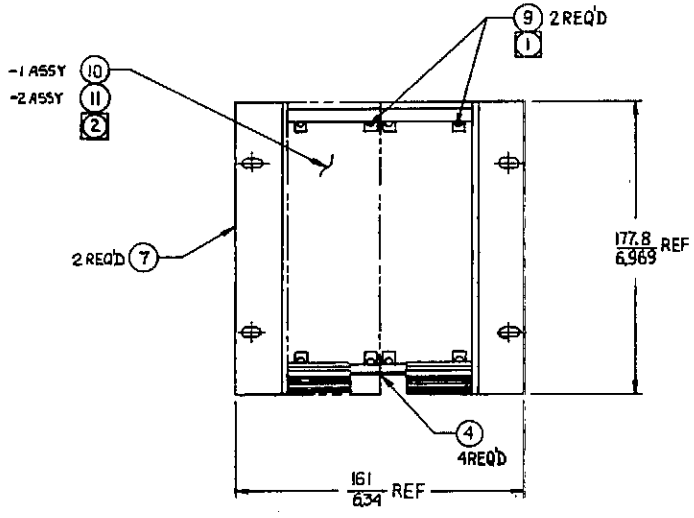
SCHEMATIC DIAGRAM
MODEL DC110

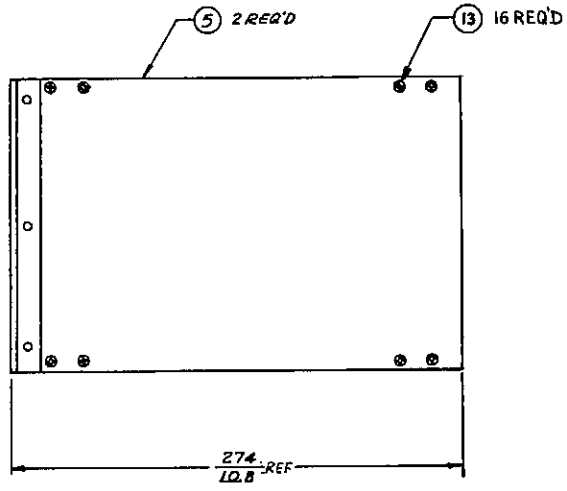
FIGURE 8
Sheet 3

(Reference 30132)





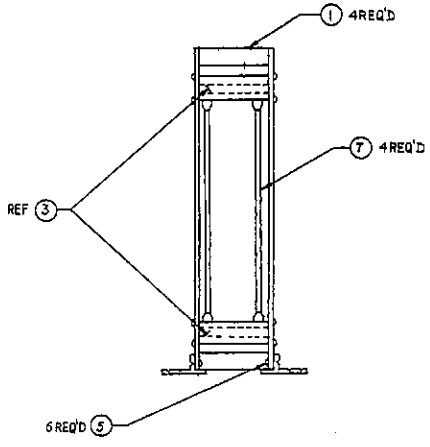


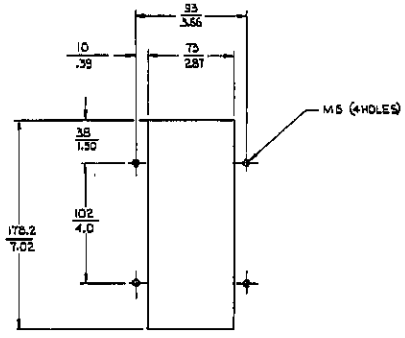


(REF 10199C)

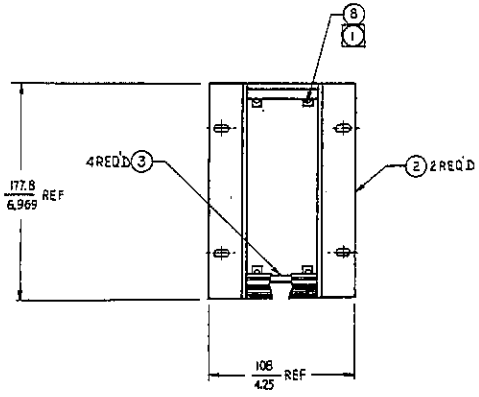
FIG.9

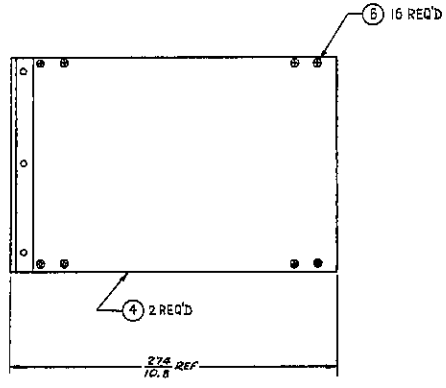
RACK ASSEMBLY, PANEL MOUNT - 98
P/N 10199-1





CUSTOMER PANEL
CUTOUT DIMENSIONS





QTY-2	ITEM	PART NO.	DESCRIPTION
	1	①	NUT, SQUARE M4x0.7 STL-CAD-PLT
	4	921-209	GUIDE, SNAP-IN
	16		SCR, THD. FORMING, M3x0.5x12 P-PH-ST-ZI
	6	DIN 7985	SCR, MACH - M3x0.5x6, P-PHIL-SST
	2	10197-2	SIDE PANEL, *PANEL MOUNTING*
	4	10185-1	STRIP, LOCATING
	2	10196	MOUNTING BRACKET, FRONT VERTICAL
	4	10198-1	HORIZONTAL MEMBER

(REF 10201B)

FIG.10

RACK ASSEMBLY , PANEL MOUNT - 49
P/N 10201-1

4-20ma CONVERSION CHART

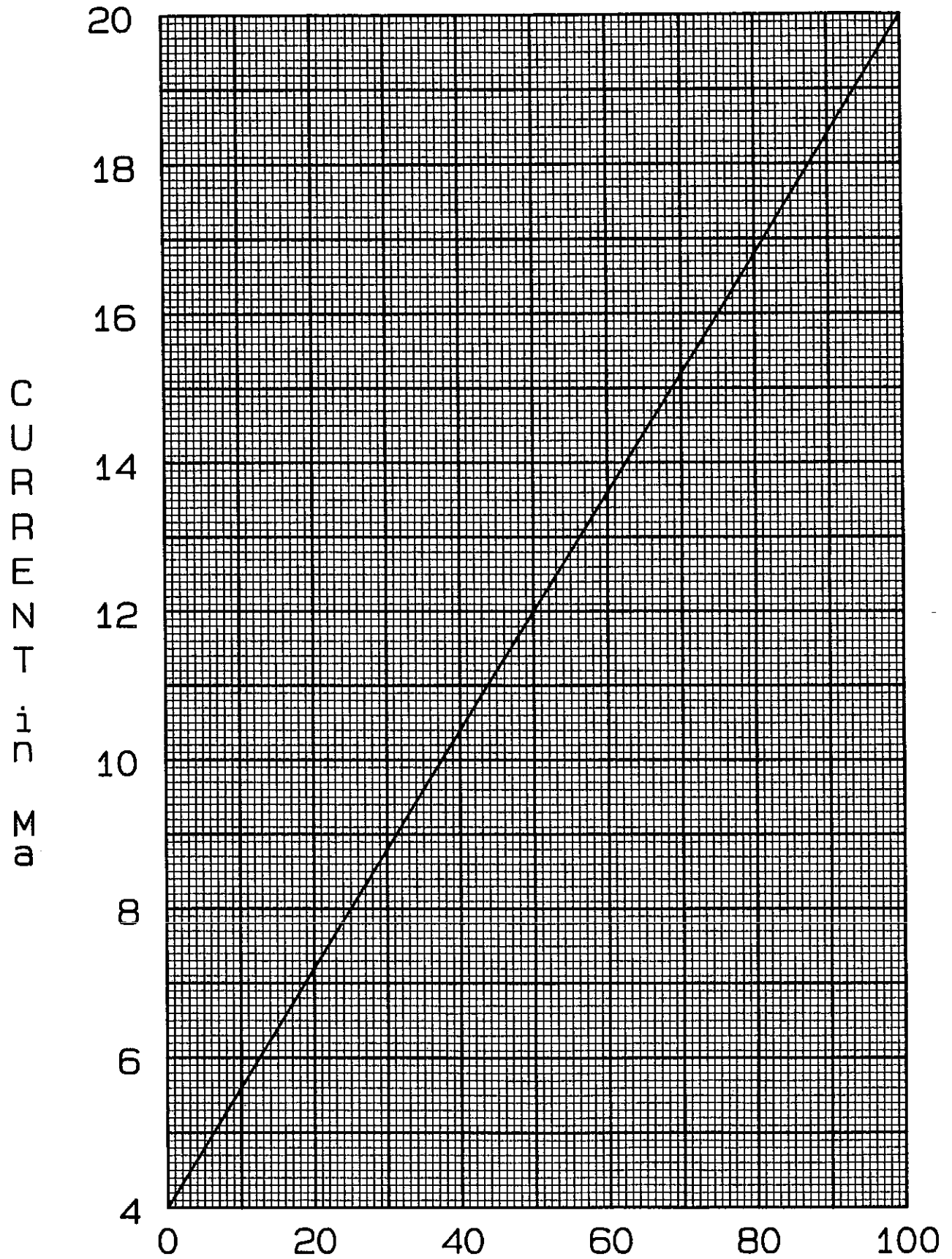


FIG. 11

ADDENDUM
Product Disposal Considerations

This product may contain hazardous and/or toxic substances.

EU Member states shall dispose according to WEEE regulations. For further General Monitors' product WEEE disposal information please visit:
www.generalmonitors.com/customer_support/faq_general.html

All other countries or states: please dispose of in accordance with existing federal, state and local environmental control regulations.