880

Combustible Gas Detection System

Operation Manual

DET TRONICS

FORMERLY REXNORD

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Catalog No. 225479-03
Edition H
September 1986
Printed in USA

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SECTION 1
GENERAL INFORMATION

1.1 INTRODUCTION

This manual contains all information required to install, operate, calibrate, and service the Model 880 Gas Detection System, a patented 8-channel, three-wire system (Figure 1-1). The various sections of the manual provide information as follows:

a. SECTION 2 INSTALLATION. Provides information relative to power and mounting of the system.

b. SECTION 3 OPERATION. Provides information relative to operating the system.

c. SECTION 4 THEORY OF OPERATION AND MAINTENANCE. Provides information on the functional operations, calibration, checkout, and troubleshooting of the system.

d. SECTION 5 RECOMMENDED SPARES. Provides a list of suggested spare parts and recommended quantities to maintain the system.

e. SECTION 6 OPTIONS AND ACCESSORIES. Provides information relative to options and accessories available for use with the system.

f. SECTION 7 CAUSES OF SIGNAL LOSS IN CATALYTIC TYPE COMBUSTIBLE GAS SENSORS.

1.2 GENERAL DESCRIPTION

The Model 880 Gas Detection System consists of one 8-channel controller, and from one to eight transmitter assemblies as shown in Figure 1-1. A transmitter assembly consists of a conduit box, transmitter, and sensor. The conduit box contains a printed wiring assembly (PWA) which provides interface connectors for the sensor, transmitter, and external controller wire connections.

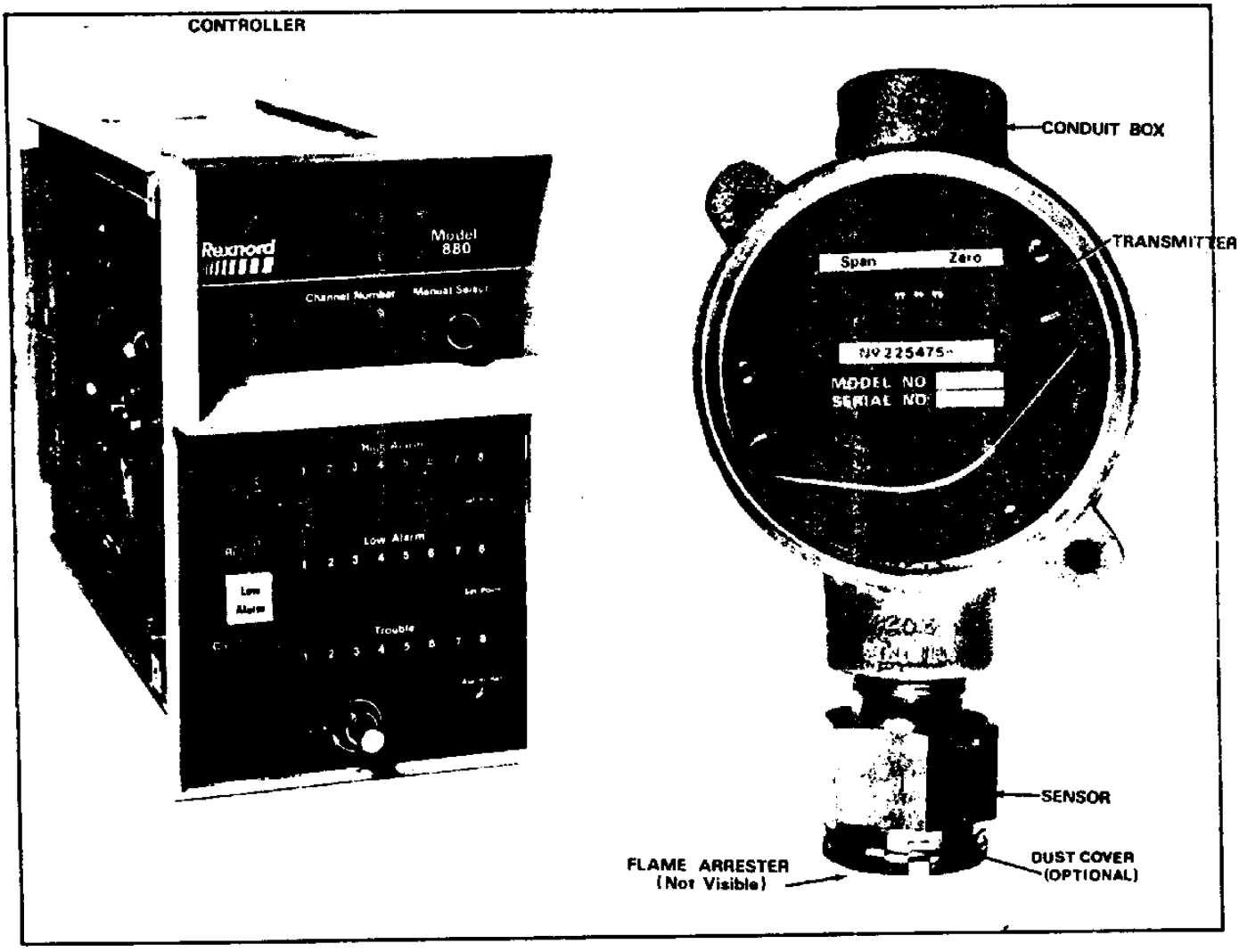


Figure 1-1. Major Components

SECTION 2
INSTALLATION

2.1 INSTALLING THE SENSOR CONDUIT BOXES

To obtain the proper desired controller operation and optional features, read this manual prior to plugging the controller into the rack and applying ac and/or dc power.

WARNING

Installation and maintenance of the Model 880 Gas Detection System should be performed only by technically-qualified persons.

The explosion-proof sensor conduit box houses the transmitter and the connections for the sensor that detects the presence of a combustible gas. The two most important factors that determine where the sensor conduit boxes are to be situated are the expected flow pattern of the gases (which is a function of the molecular weights of the gases and the ventilation system) and the most probable location of gas leakage. If the gases are lighter than air, the conduit boxes should be placed above the points where the leaks are most likely to occur; if the gases are heavier than air, the conduit boxes should be placed below the points where the leaks are most likely to occur.

As a rule, the sensor is screwed into a 3/4-inch NPT threaded opening on one side of the conduit box, and the conduit is screwed into a second 3/4-inch NPT threaded opening on the opposite side of the conduit box. The conduit boxes can be bolted to a wall or a post, or they can be suspended by the conduit. See Figure 2-1 for various typical installation configurations.

WARNING

Regardless of the method used to install the conduit box, it *must* be oriented with the sensor down as shown in Figure 2-1. If it is not, erroneous readings will result and the sensor could be damaged. Make certain there is enough space around the sensor to allow the calibration cup or other calibration assemblies to be properly connected.

When installing the conduit boxes, make sure that all local electrical codes are observed.

2.2 POWER REQUIREMENTS

The Model 880 operates on 117 Vac 60 Hz; 234 Vac 50 Hz available on request. The unit also operates from a +24 ± 4 Vdc battery or other dc source. The +24 Vdc battery system can be connected simultaneously with ac power for continuous system operation in the event of ac power loss.

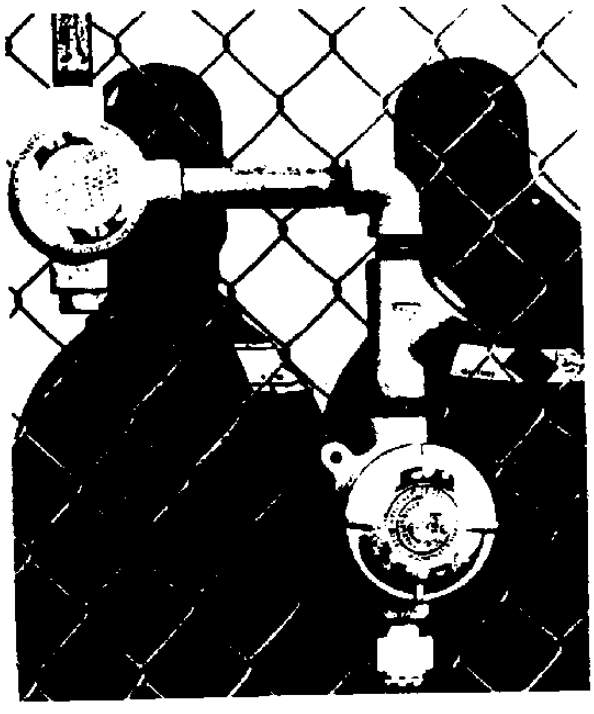


Figure 2-1. Normal Installations for the Model 880 Conduit Box

2.3 CONTROLLER ENCLOSURES AND EXTERNAL CONNECTIONS

There are four standard controller enclosures as follows:

a. 19-inch 4-unit rack (Panel Mount Available)

b. Single unit panel mount

c. Weather-proof wall mount (NEMA 3) Single or Multiple Unit

d. Single unit explosion-proof (NEMA 7)

All configurations have screw type terminals for external connections and are as follows:

a. Full sets (NO-COMMON-NC) of low, high, and trouble relay contacts.

b. A.C. and/or D.C. power

c. Sensor-transmitter conduit box

d. Upon special order – IAO (INDIVIDUAL ALARM OPTION) low and/or high alarm NO or NC relay contact or logic outputs for each channel. (Application Note available.)

Terminal strip wiring diagrams accompany each enclosure concept and are discussed in sections 2.3.1 through 2.3.4.

2.3.1 19-Inch Rack or Panel Mount for One to Four Controller Units

This configuration accepts as many as four 880 or 740 (refer to the 740 manual for terminal connections) units in any combination. Each controller has its own separate screw-terminal strip connections. Figure 2-2 shows the terminal strip connections for each controller. J1 is the 44-pin connector which mates the control unit to the external screw-terminals motherboard.

2.3.2 Single Unit Panel Mount

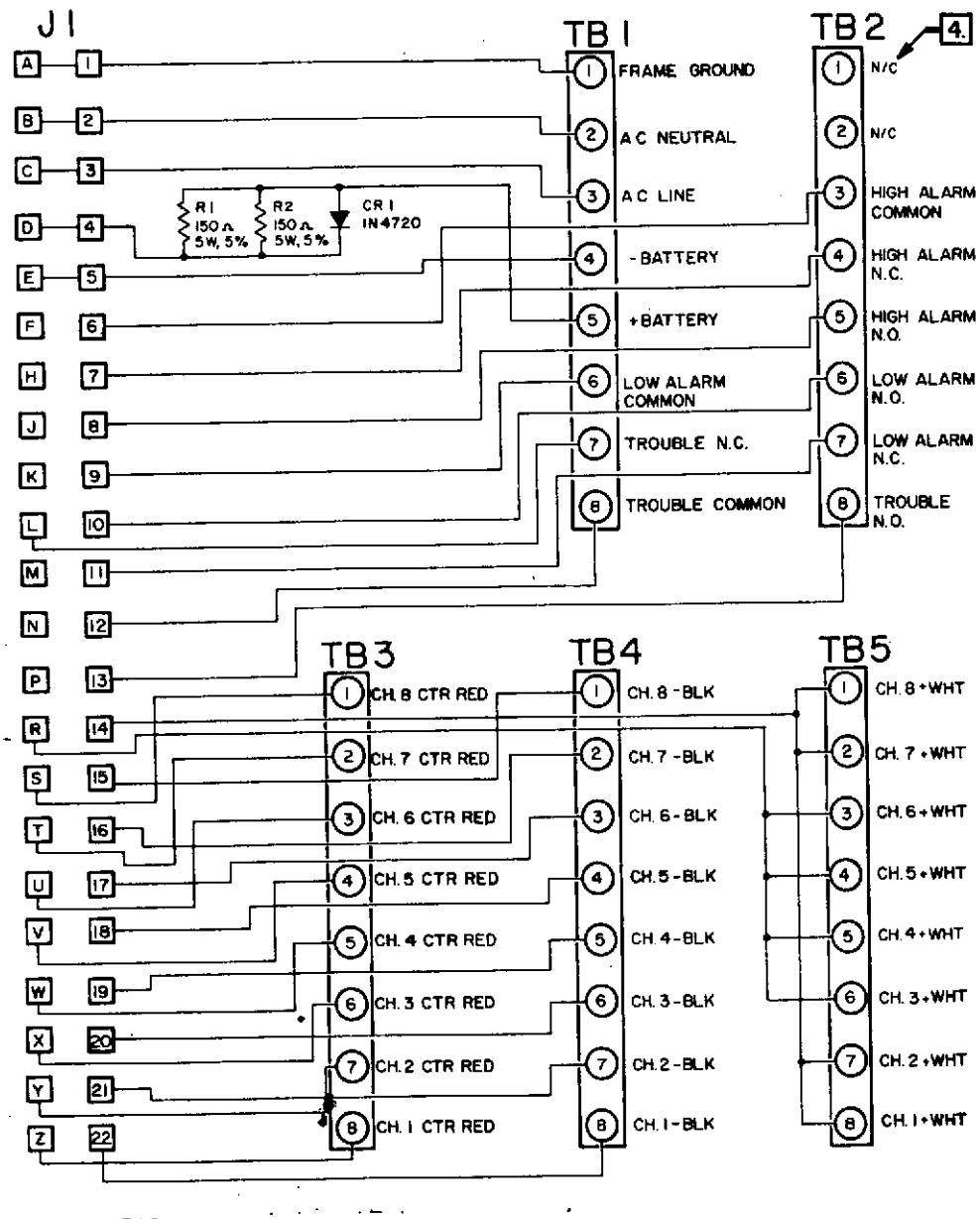
This enclosure accepts a single 880 controller. The same terminal strip wiring diagram applies as for the 19-inch rack and is shown in Figure 2-2.

2.3.3 Weather-Proof Wall Mount (NEMA 3), Single or Multiple Unit

The terminal block interconnect diagram for this enclosure is shown in Figure 2-3. An extra set of relay contacts are shown at TB3-7 through TB3-13. Connector J3 connects the 880 front panel switches to terminal strip TB3 (terminals 4, 15 and 16). These terminals are in turn connected to switches accessible on the outside of the housing. Figure 2-4 shows the interconnect diagram between the controller connectors J1 and J2 (see Figure 2-3). Although this is a single unit enclosure there is a 4 or 8-unit weatherproof housing available. Figure 2-2 should be consulted if you have a 4-unit housing.

2.3.4 Single Unit Explosion-Proof Housing

The terminal block interconnect diagram shown in Figure 2-5 is for a single unit in this type of housing. J1 is the controller connector. The switches on the housing cover duplicate the switches on the 880 front panel. The IAO option is **not available** with this enclosure.



NOTES:

1. DIAGRAM SHOWS CONNECTIONS AS VIEWED FROM REAR OF RACK
2. TB1-5 NOMENCLATURE DESIGNATES CUSTOMER EXTERNAL CONNECTIONS
3. P.W.B REORDER NUMBER IS: 226178 (SINGLE UNIT PANEL MOUNT) AND 225476 (19" RACK).

4. N/C DENOTES "NO CONNECTION" FOR 740 APPLICATIONS DO NOT CONNECT.

Figure 2-2. Single or 19" Rack Terminal and Interconnect Diagram

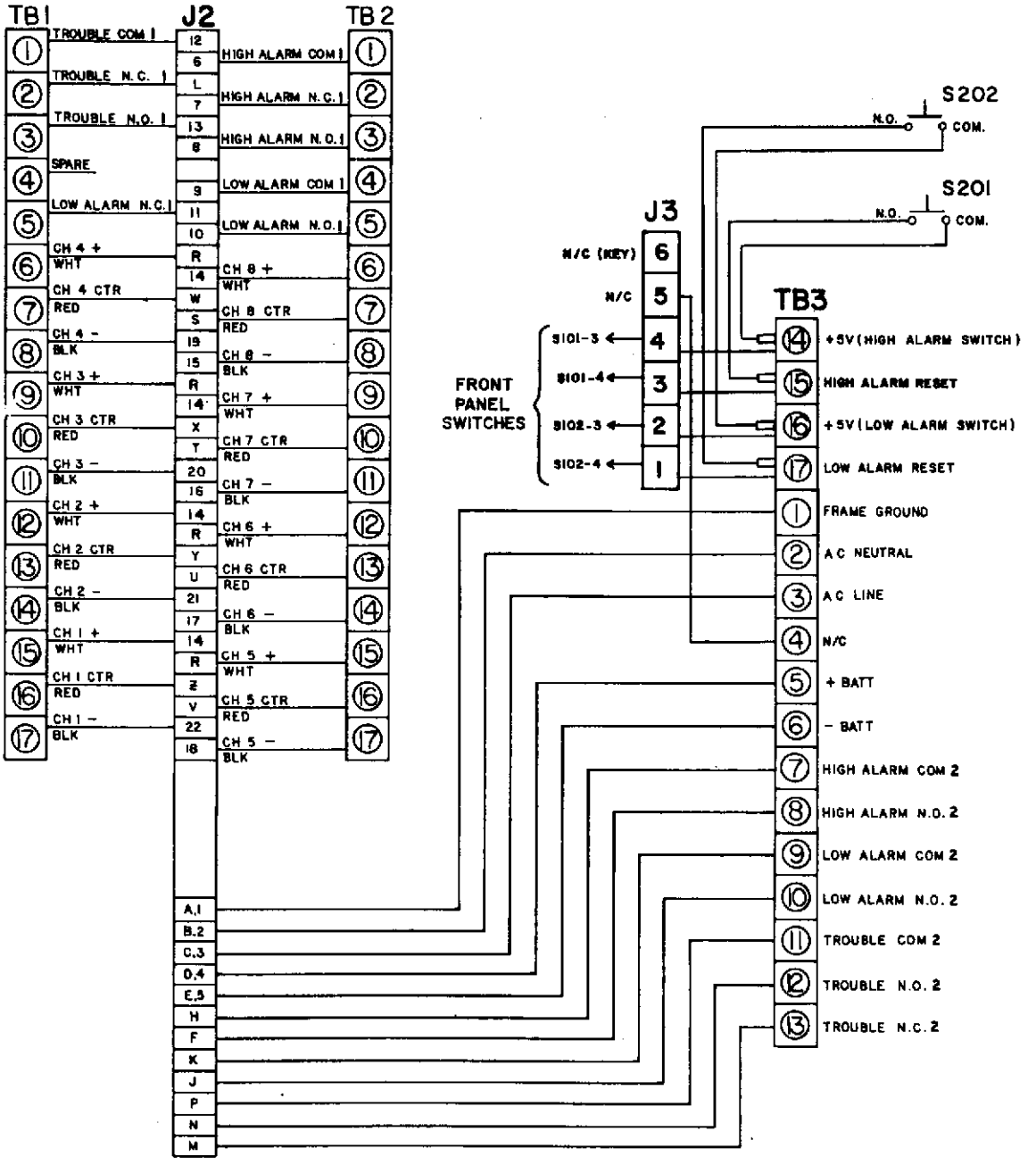


Figure 2-3. NEMA 3 Terminal and Interconnect Diagram

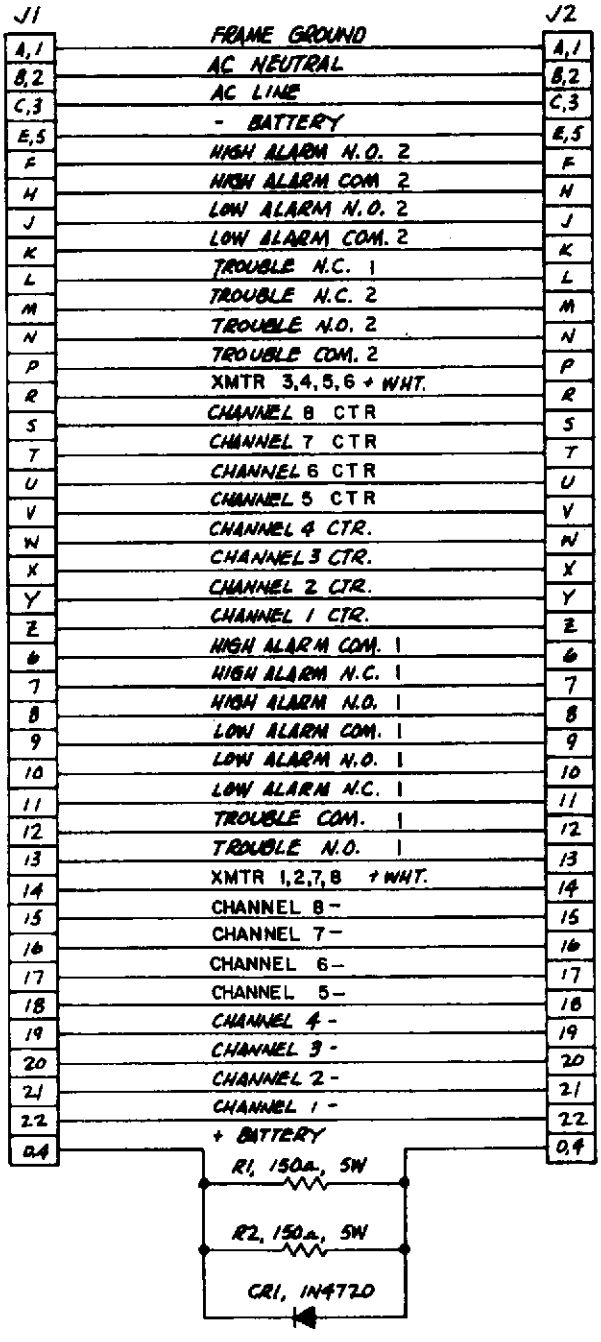
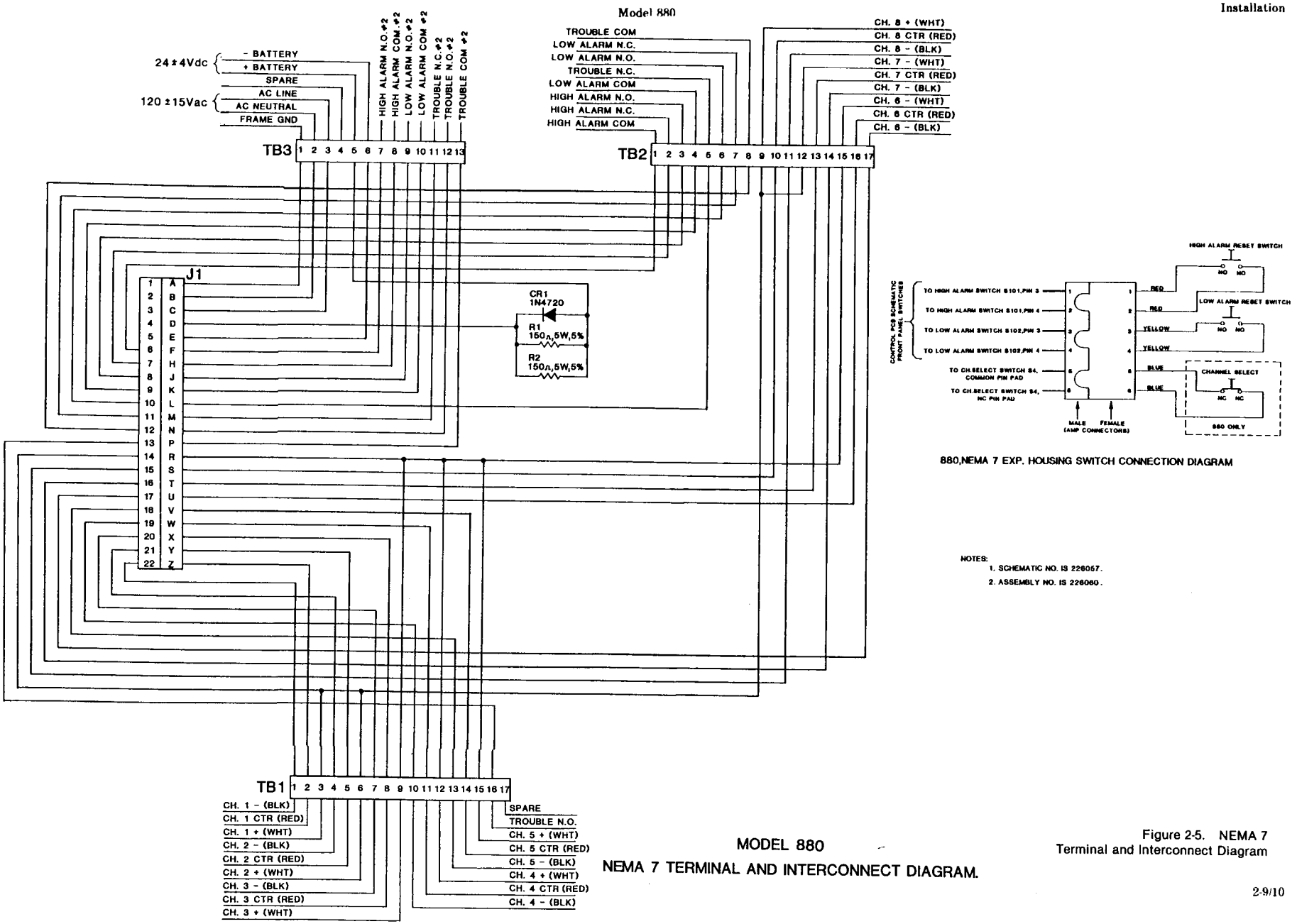


Figure 2-4. NEMA 3 Mother Board Interconnect Diagram



MODEL 880

NEMA 7 TERMINAL AND INTERCONNECT DIAGRAM.

880,NEMA 7 EXP. HOUSING SWITCH CONNECTION DIAGRAM

NOTES:

1. SCHEMATIC NO. IS 226057.
2. ASSEMBLY NO. IS 226060.

Figure 2-5. NEMA 7
Terminal and Interconnect Diagram

2.4 WIRE SIZE TABLE

The transmitter requires three wires for operation. Two of the wires are used to supply electrical power from the controller to the transmitter and the third wire is used to send the signal from the transmitter to the controller. The two electrical power wires must be chosen from the wire size table (Table 2-1). The third wire can be any wire that is 24 gage or larger for all applications. Figure 2-6 shows a block diagram of the transmitter and controller and identifies the wire connecting them.

Table 2-1 shows the maximum distance that a transmitter may be located from the controller for several wire sizes. This wire size table takes into account only the two electrical power wires between the controller and transmitter.

To demonstrate the use of the wire size table, the following example is given.

Example:

A transmitter is to be located 700 feet from its controller. What is the smallest wire size that can safely be used? Number 20 wire or larger must be used since the next smaller wire size shown in the table can only be used for a transmitter located not more than 600 feet from its controller.

The resistance of pure annealed copper wire changes considerably with changes in its temperature. The wire size table takes this into consideration. The maximum distances between a transmitter and its controller for a given wire size are valid over the entire operating temperature range of the system. The system has been designed so that changes in the resistance of the copper wire will have no significant effect on the system's operation.

Table 2-1. Wire Size Versus Distance

Wire Size		Maximum Distance Transmitter May Be Located From Controller	
AWG No.	Diameter (millimeters)	(feet)	(meters)
24	0.511	400	121.92
22	0.644	600	182.88
20	0.812	1000	304.80
18	1.024	1500	457.20
16	1.291	2400	731.52
14	1.628	4000	1219.20
12	2.053	6400	1950.72
10	2.588	10000	3048.01
8	3.264	16000	4876.81

*conversion = 3.280833333 feet/meter
or 0.3048006096 meters/feet

2.5 INSTALLING THE SENSOR

a. Remove the cover of the sensor conduit box. Check to see that there are three wires coming out of the conduit and that these are connected to points labeled *White*, *Black* and *Red* on the barrier strip inside the box.

b. Screw the sensor into the 3/4-inch NPT threaded opening at the bottom of the conduit box and tighten the sensor securely with a wrench. Connect the plug from the sensor to the receptacle on the motherboard (see Figure 2-7). Install the optional dust cover over the sensor if the area is dusty. If desired, a section of conduit up to 50 feet long can be used between the sensor and the conduit box if no. 18 AWG wire is used.

c. Install the transmitter PWA (see Figure 2-8) by inserting the connector pins on the bottom of the PWA into the mating receptacle in the conduit box. Verify the connector is fully engaged. The system is now ready for calibration.

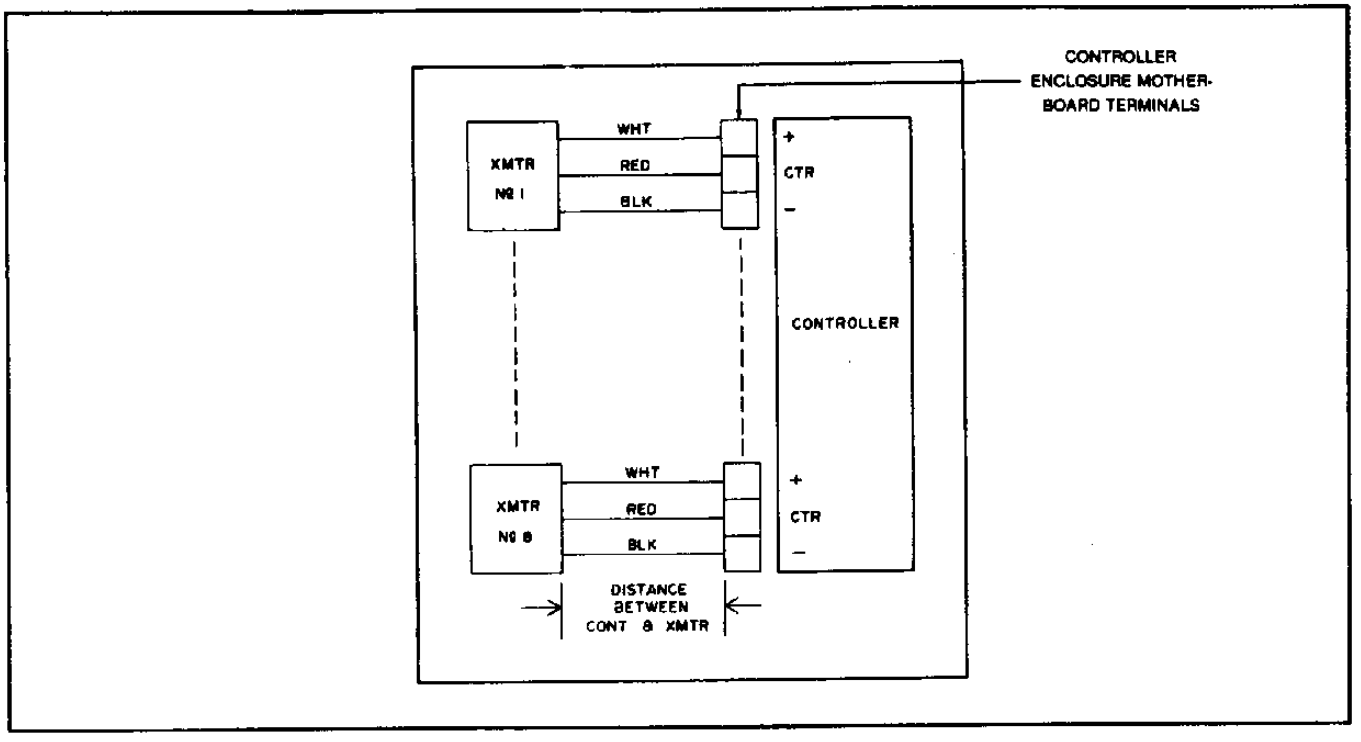


Figure 2-6. Interconnection Wiring Between Transmitters and Controller

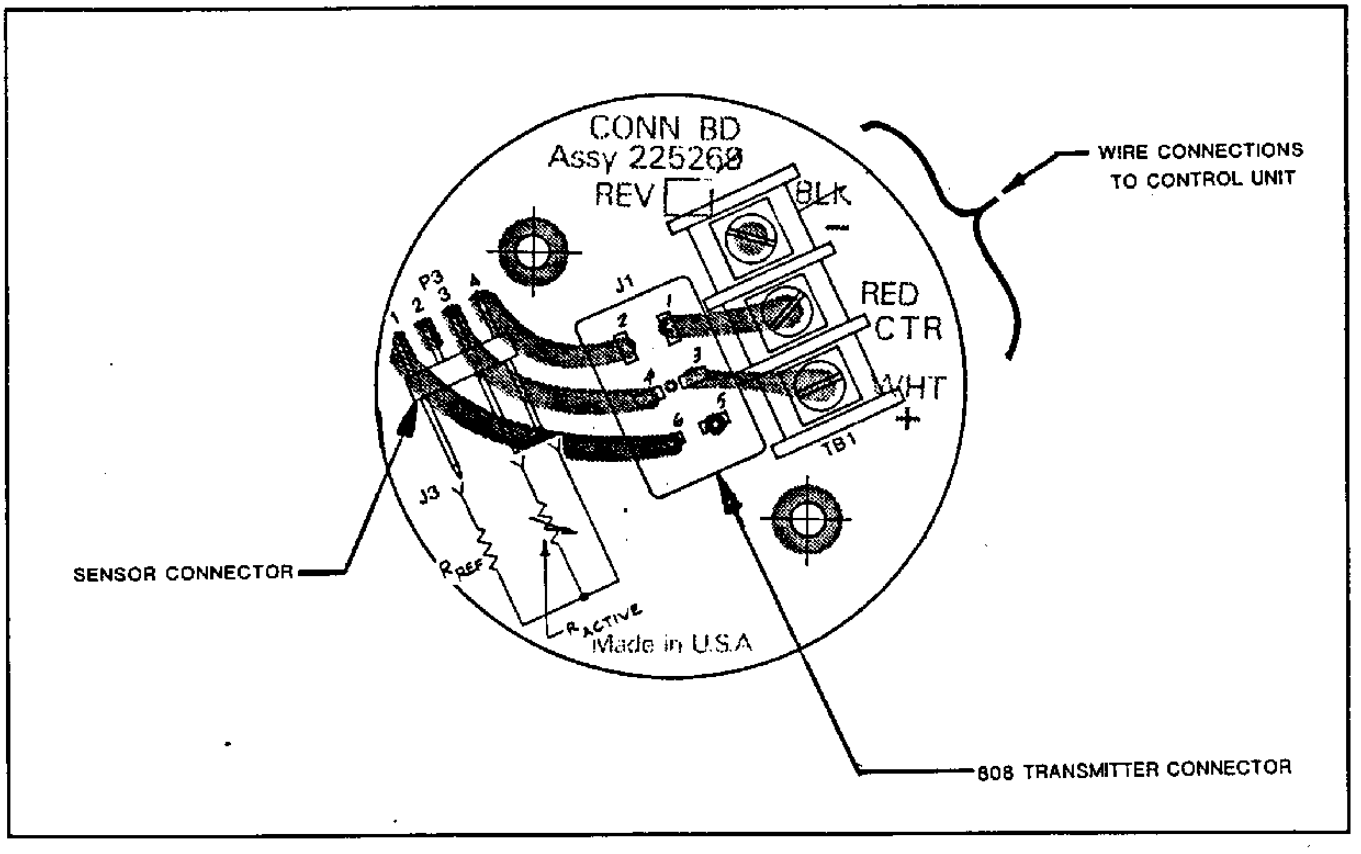


Figure 2-7. Transmitter and Sensor Connector PWA

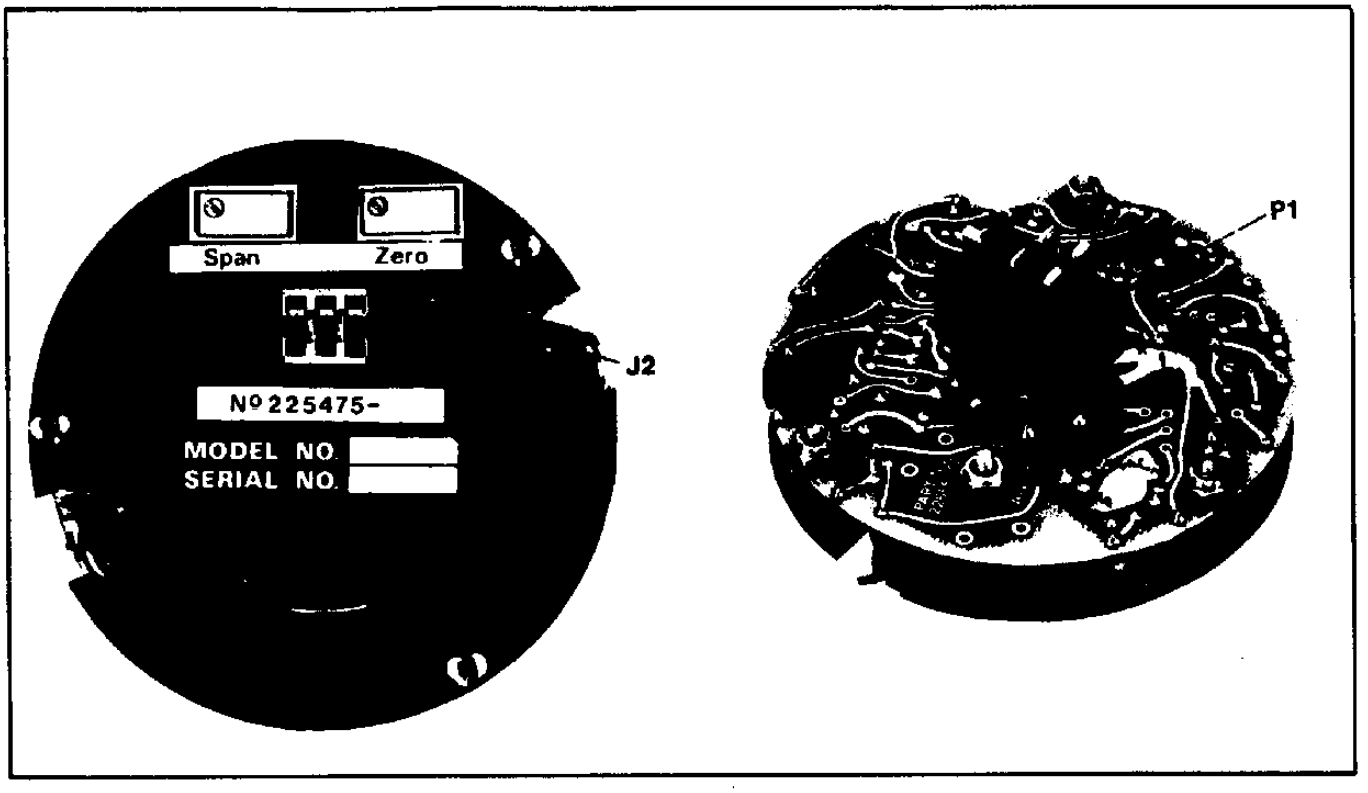


Figure 2-8. Transmitter PWA, Top and Bottom Views

WARNING

A sintered-metal cover which acts as a flame arrester is an integral part of the Model 880 Gas Detection System combustible gas sensor. Do NOT operate the system if the sintered-metal is damaged.

2.6 INSTALLING THE CONTROLLER

To install the controller, slide the controller PWA (Figure 2-9) into the rack card guides until the PWA fingers come in contact with the connector; then push the PWA in as far as it will go (approximately 0.25 inch). If the connector in the rack is connected to the line voltage, and is properly wired, the TROUBLE lamp will light. A timing circuit keeps the TROUBLE lamp lit and the alarm relays disabled for a period of 18 – 44 seconds to ensure proper sensor warmup and stability. If the TROUBLE lamp remains on after a maximum of 44 seconds, REFER TO Section 3.2.5 for possible causes.

Prior to installation of the controller, all programming switches, channel sweep select switch, and jumpers should be investigated to ensure desired controller operation. Section 3 discusses switch positioning and jumper orientation.

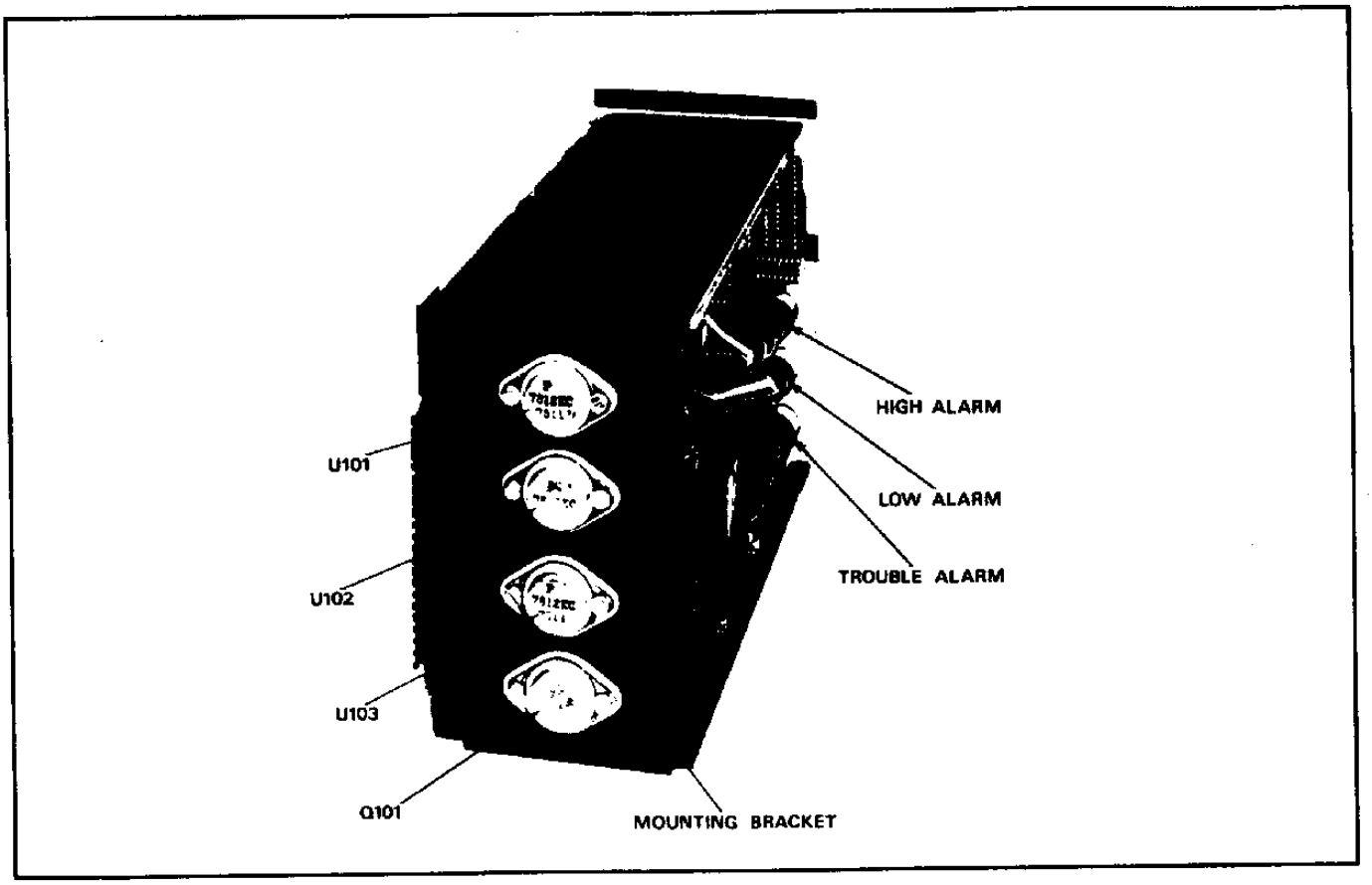


Figure 2-9. Controller, Rear View

2.7 CALIBRATION

Each system shipped from the factory has been calibrated for the gas specified.

Immediately upon installation, the unit should be recalibrated in accordance with the routine calibration procedures to verify that the installation or shipment has not damaged the system component parts.

The system also has to be calibrated regularly (about once every 60 to 90 days) and must be recalibrated whenever the sensor is replaced. Routine calibration is described in Subsection 4.2; recalibration upon sensor and/or transmitter removal or replacement is described in Subsection 4.3.

SECTION 3
OPERATION

3.1 GENERAL

Operating controls on the 880 Controller are located on the front panel (see Figure 3-1). Additional operating control switches and/or jumpers are located on the controller main control PWA and the plug-in logic PWA (see Figure 3-2).

3.2 CONTROLS AND INDICATORS

The front panel contains the following indicators:

- Two-digit % LFL display
- Single digit channel number
- LOW ALARM lamp (yellow)
- Eight low alarm individual channel LEDs
- HIGH ALARM lamp (red)
- Eight high alarm individual channel LEDs
- TROUBLE ALARM lamp (blue)
- Eight trouble alarm individual channel LEDs

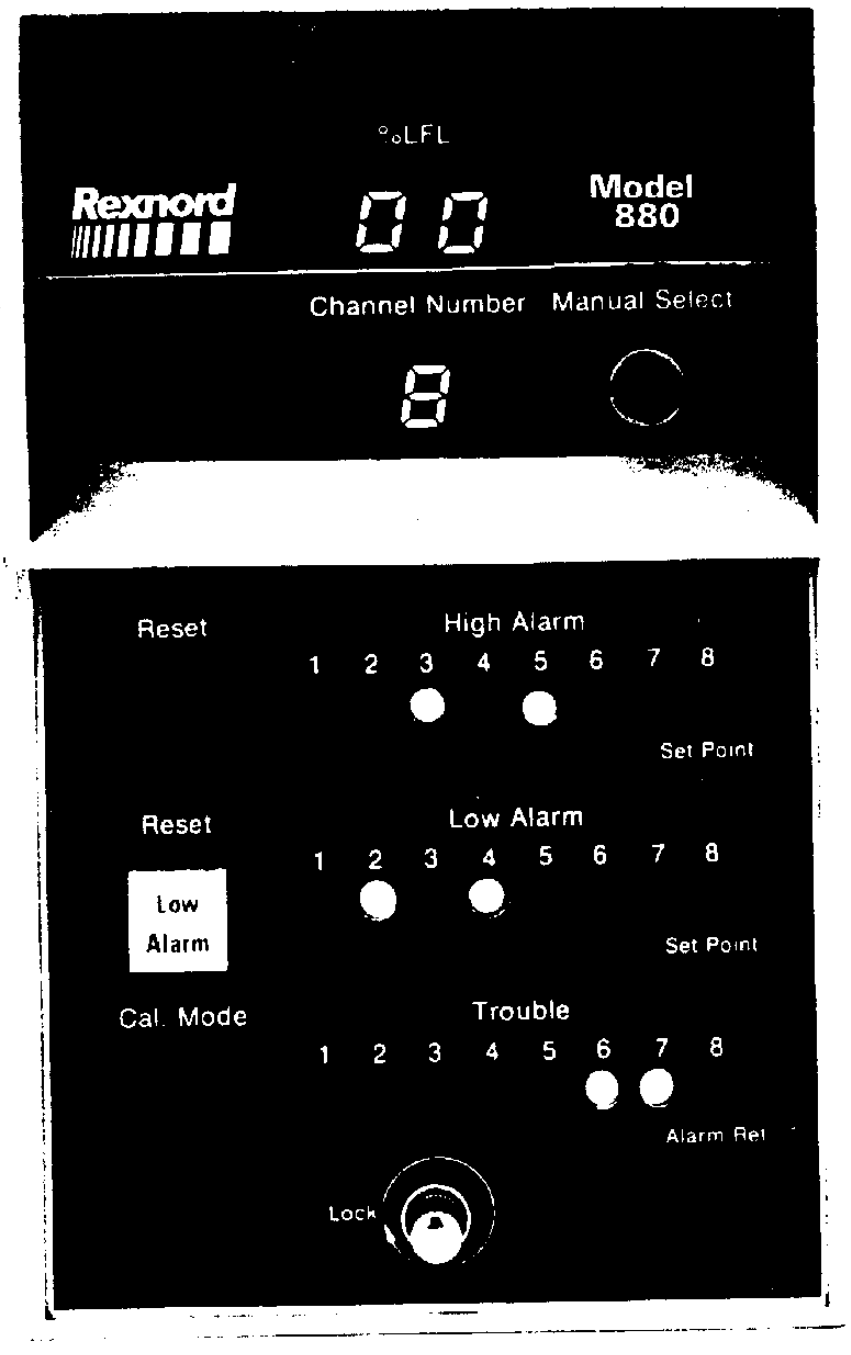


Figure 3-1. Controls and Indicators

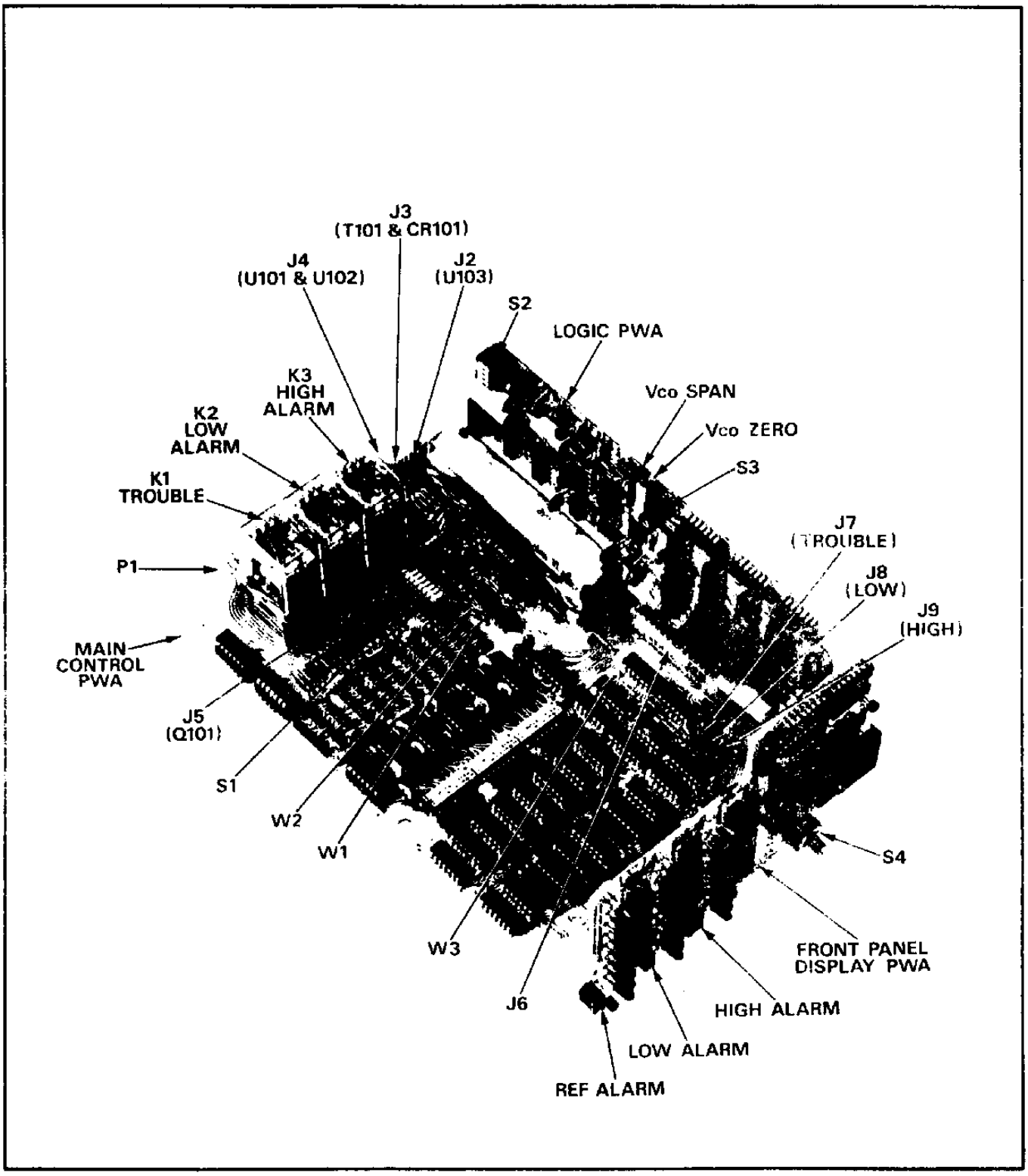


Figure 3-2. Controller Printed Wiring Assemblies

The front panel has the following control functions:

- Channel MANUAL SELECT display pushbutton
- Momentary HIGH ALARM reset pushbutton
- Momentary LOW ALARM reset pushbutton
- Momentary CAL. MODE (trouble) adjust pushbutton
- HIGH ALARM screwdriver pot adjustment
- LOW ALARM screwdriver pot adjustment
- ALARM REF. screwdriver pot adjustment

The main control PWA switch and jumper functions:

- Unused channel transmitter disable rocker switch (S1-1 through S1-8)
- Jumpers W1 and W2 for "−4" front panel trouble lamp indication (W1) and/or trouble relay (W2) drop out capability
- Jumper W3 to keep low alarm relay energized during high alarm condition (refer to Section 3.2.3 for details).

The plug-in logic PWA switch functions are:

- Channel 1-8 sweep select (S3)
- Active-passive alarm test rocker switch (S2-1)
- Low alarm acknowledge relay drop out rocker switch (S2-2) (refer to Section 3.2.3 for details).

3.2.1 % LFL and Channel Number Displays

The % LFL two-digit and channel number single digit display indicates the gas concentration present as a percentage of the lower flammable limit (% LFL) of a particular gas, on the channel being indicated for the three-second time span. Each channel number and the simultaneous % LFL reading are displayed every 3.2 seconds i.e., display on for three seconds and off for 0.2 seconds. The total time for all eight channels to be displayed is thus 8 × 3.2 seconds or 25.6 seconds. If, however, the channel sweep select switch (S3) is set to 6, only channels 1 through 6 will be displayed and require 19.2 seconds for a complete sweep cycle.

The % LFL and channel number displays serve as the power-on indication since there is no separate power-on lamp when alarms do not exist.

A negative (−0 to −9) % LFL is provided to allow more precise adjustments of the transmitter around "00" % LFL. It is also an excellent indicator of transmitter misalignment (not an unlikely event since an electromechanical pin type meter is used to set the transmitters), sensor drift, or an open connection between the transmitter and controller. Two additional features are provided for customer use, in that when a particular channel reaches a "−4" or more negative display, the TROUBLE lamp can be turned on when jumper W1 is open (offset so that female jumper does not short out the 2-male pins) and/or the trouble relay can be de-energized when the jumper W2 is open.

When any particular channel reaches "99" % LFL or higher, the display is automatically inhibited and flashes at a 5 Hz rate. It is intended as an additional visual second alarm warning above the normal high alarm indication.

3.2.2 Channel Manual Select Pushbutton

A MANUAL SELECT channel pushbutton switch is provided so that one may select any channel to read out. If the button is held depressed, the selected channel will repeatedly display the % LFL information present until the button is released. When the button is released the display will continue its normal scan sequence.

NOTE

The upper half of the front panel display has no effect on the lower half, i.e., no matter what channel is being displayed or selected by means of the MANUAL SELECT button, the lower half will display—and particular relays activate—the instant alarm data is detected.

3.2.3 Low Alarm Lamp—Reset Pushbutton and Relay

When the % LFL exceeds the previously adjusted low alarm "set point" value on any channel, the low alarm relays (K2) energizes, the lamp flashes at a rate of 5 Hz, and the particular channel alarm LED will light. Acknowledgment of the low alarm condition by depressing the lamp RESET pushbutton causes the lamp to glow steady and the channel LED will remain on as long as the low alarm condition continues to exist. The low alarm relay condition following low alarm "reset" is dependent on the position of switch S2-2 on the logic board. While the low alarm condition only exists and S2-2 is on (closed), the low alarm relay will remain energized. If S2-2 is off (open) during a low alarm condition only the relay can be dropped out (de-energized) when the low alarm lamp button is depressed.

When other conditions occur, such as high alarm, the states of the Low Alarm lamp and relay can be altered when the Low Alarm button is depressed. The operation sequence of the Low Alarm lamp and relay as a function of the states of switch S2-2 (on logic board) and jumper W3 (on main control board between ICs U20 and U21) are shown in Table 3-1. The customer should refer to this table to observe the sequence of events he desires. If the customer chooses columns II or III from this table, offset the jumper female connector so that the 2-male pins (W3) are open.

3.2.4 High Alarm Lamp—Reset Pushbutton and Relay

When the % LFL exceeds the previously adjusted high alarm "set point" value on any channel, the high alarm relay (K3) energizes, the lamp flashes at a 5 Hz rate, and the particular channel alarm LED lights.

Acknowledgment of the high alarm condition by depressing the lamp RESET pushbutton causes the lamp to glow steady. The relay will remain energized and particular channel LED will stay on as long as the high alarm condition exists. Table 3-1 shows the states for a typical sequence of events. Also note that the condition of S2-2 and jumper W3 have *no effect* on the high alarm lamp or relay states, but was included to demonstrate their sequence in tabular form. When the high alarm condition is corrected i.e., goes away or to low alarm state, the particular high alarm channel LED will go out. The lamp can be extinguished, and relay dropped out, only when the high alarm condition is corrected and the lamp pushbutton depressed to reset circuit logic states.

Table 3-1. Low and High Alarm Lamp Reset and Relay Operating Sequence as a Function of S2-2 and W3

Sequence of Events		I S2-2 On (Closed) and W3 Installed				II S2-2 On (Closed) and W3 Cut (Open)				III S2-2 Off (Open) and W3 Cut (Open)				IV S2-2 Off (Open) and W3 Installed			
Sequence No.	Event	Low Alarm		High Alarm		Low Alarm		High Alarm		Low Alarm		High Alarm		Low Alarm		High Alarm	
		Lamp	Relay	Lamp	Relay	Lamp	Relay	Lamp	Relay	Lamp	Relay	Lamp	Relay	Lamp	Relay	Lamp	Relay
1	No Alarm	Off ***	Off	Off	Off	Off	Off	Off	Off	Off	Off	Off	Off	Off	Off	Off	Off
2	Low Alarm Occurs	Flash *	On	Off	Off	Flash	On	Off	Off	Flash	On	Off	Off	Flash	On	Off	Off
3	Low Alarm Reset (Acknowledge)	On **	On	Off	Off	On	On	Off	Off	On	Off	Off	Off	On	Off	Off	Off
4	High Alarm Occurs	On	On	Flash	On	On	On	Flash	On	On	Off	Flash	On	On	Off	Flash	On
5	Low Alarm Reset (Acknowledge)	Off	Off	Flash	On	On	On	Flash	On	On	Off	Flash	On	Off	Off	Flash	On
6	High Alarm Reset (Acknowledge)	Off	Off	On **	On	On	On	On	On	On	Off	On	On	Off	Off	On	On
7	Return To Low Alarm From High Alarm	Flash	On	On or Flash	On	Flash	On	On or Flash	On	Flash	On	On or Flash	On	Flash	On	On or Flash	On
8	Low Alarm Reset (Acknowledge)	On	On	On or Flash	On	On	On	On or Flash	On	On	Off	On or Flash	On	On	Off	On or Flash	On
9	High Alarm Reset (Acknowledge)	On	On	Off	Off	On	On	Off	Off	On	Off	Off	Off	On	Off	Off	Off
10	Return To No Alarm	On or Flash	On	Off	Off	On or Flash	On	Off	Off	On or Flash	Off	Off	Off	On or Flash	Off	Off	Off
11	Low Alarm Reset (Acknowledge)	Off	Off	Off	Off	Off	Off	Off	Off	Off	Off	Off	Off	Off	Off	Off	Off

*Flash = Low or high alarm lamp flashes at 1 Hz rate.

**On = Lamp is glowing continuously. In the case of a relay it means it is energized.

***Off = Lamp is extinguished or relay is de-energized.

3.2.5 Trouble Alarm Lamp— CAL MODE Pushbutton and Relay

The TROUBLE alarm lamp, its associated CAL. MODE pushbutton, and relay serve many duties in the 880. Below are listed all the possible duties:

a. TROUBLE lamp on, and relay is de-energized

1. When power has been interrupted to any transmitter i.e., + or − wires from controller are open or a sensor failure (open) occurs. This is the primary duty of the trouble circuit portion of the system.

2. When both jumpers W1 and W2 on main control board are cut (open) and any channel reaches −4 or less. This is indicative of sensor failure or excessive negative drift, open signal (CTR) wire, or transmitter drift or failure. The CAL MODE trouble pushbutton must be depressed to reset circuit when this failure condition is corrected, unless any channel to follow is above approximately 5% LFL in which case automatic reset occurs.

b. TROUBLE lamp on, low and high alarm relays inhibited for 15-44 seconds under the following conditions.

1. When ac or dc input power is initially applied to the controller.

2. When any transmitter is removed from its socket, power is interrupted to that sensor. Upon replacement of the transmitter (with sensor properly connected and the appropriate channel disable switch, S1-3 for example, in the "off" or open position) the trouble relay will energize, but the trouble light will remain lit and the alarm relays will be inhibited until timeout has expired.

3. When ac power line voltage drops below approximately 85-100 Vrms or a momentary interruption in ac power occurs, unless battery power keeps controller on line.

c. TROUBLE lamp on only.

1. When jumper W1 is open and any channel reaches −4 or less (also refer to paragraph 3.2.5, step a.2). The CAL. MODE pushbutton must be depressed to reset the circuitry and extinguish the lamp, unless a following % LFL displayed channel is ≃5% LFL or higher, in which case the lamp resets automatically.

2. When the CAL. MODE pushbutton is depressed, e.g., to check alarm set point levels.

d. Trouble relay de-energized only.

1. When jumper W2 is open and any channel reaches −4 or less (also refer to paragraph 3.2.5, step a.2). The CAL. MODE pushbutton must be depressed to reset the circuitry and energize the relay, unless a following % LFL displayed channel is approximately 5% LFL or higher, in which case the relay energizes automatically.

3.2.6 Low and High Alarm Set Point Calibration

To adjust the LOW and HIGH ALARM lamp, and relay trip points, the TROUBLE/CAL. MODE pushbutton lamp/switch is utilized in conjunction with channel 1 alarm LED. When the CAL. MODE pushbutton is depressed the unit is forced to read an ALARM REF. potentiometer value on the % LFL display which is equivalent to a transmitter input (CTR) signal. The reference input is applied to the input low and high alarm comparators while the real input from channel 1 transmitter is blocked. As long as this pushbutton is depressed the unit is forced to read the % LFL and alarm LED indications on channel 1 only.

CAUTION

The rocker programming switch, S2-1, on the logic board is the active-passive alarm test and should be set prior to initial application of controller ac power for desired mode of operation. Read section 3.2.7 for detailed information on the setting of this switch as it applies to the CAL MODE pushbutton and ALARM REF functions.

The LOW ALARM lamp, relay, and channel LED trip point adjustment is as follows:

a. Depress and hold down CAL. MODE pushbutton.

b. Insert pot screwdriver into the Alarm Ref. hole on the front panel and turn pot to the desired % LFL reading for the low alarm level (clockwise increases % LFL reading).

c. Insert pot screwdriver into low alarm "set point" hole (middle pot adjust hole) and turn clockwise until channel 1 low alarm LED goes out. Then slowly turn counterclockwise until the same LED lights. The low alarm trip point is set.

The HIGH ALARM lamp, relay, and channel LED trip point adjustment is as follows:

a. While still holding down the CAL. MODE pushbutton as noted in (a) above for low alarm set point adjustment,

b. Increase (clockwise) the ALARM REF. potentiometer % LFL reading to the desired indication for the high alarm trip point.

c. Insert pot screwdriver into high alarm "set point" hole (right uppermost pot adjust hole) and turn clockwise until the channel 1 HIGH ALARM LED goes out. Then slowly turn the pot counterclockwise until the channel 1 HIGH ALARM LED lights. This sets the high alarm trip point.

If the low alarm set point is adjusted to trip at a lower % LFL value than the high alarm set point, as it is in most cases, the lamps, relays, and channel LEDs will activate in the sequence listed in Table 3-1.

An exception to the above is that the complete low alarm section can be disabled i.e., lamp, relay, and channel LEDs, if the low alarm set point is adjusted to a higher % LFL value than the high alarm set point. This can be accomplished as follows:

1. Depress and hold down the CAL. MODE pushbutton.

2. Adjust ALARM REF. pot setting to the desired % LFL high alarm trip point.

3. Adjust high alarm "set point" until the channel 1 LED lights i.e., turn counterclockwise until LED comes back on.

4. Decrease (ccw) ALARM REF. setting 1 or 2% LFL until channel 1 low alarm LED lights.

5. Increase (cw) low alarm "set point" until high alarm LED lights and LOW ALARM LED extinguishes. Turn low alarm "set point" *another turn or two* to ensure it is well above the high alarm setting.

The system is now set to operate the HIGH ALARM lamp, relay, and channel LEDs only. The low alarm portion of the system is totally deactivated.

NOTE

The low alarm deactivation procedure just described above is a feature not normally used but is a benefit of priority logic systems. The low alarm system is normally used as a pre-warning alert and its adjusted trip point is generally set at a lower % LFL level than the high alarm set point.

3.2.7 Active and Passive Alarm Test

As mentioned previously at the beginning of Section 3.2.6, the programming switch S2-1 for this feature should be set prior to initial application of ac or dc power to the controller. The passive alarm test feature can be obtained by setting programming switch S2-1 (on the logic board) to the "on" (closed) position. This allows the CAL. MODE pushbutton to be depressed with the ALARM REF. level set at, or above, the low and/or high alarm adjusted set points without energizing alarm lamps or relays.

The active alarm test feature can be obtained by setting switch S2-1 to the "off" (open) position. This allows the CAL. MODE pushbutton to be depressed with the ALARM REF. level set at, or above, the low and/or high alarm adjusted set points and the alarm lamp and relay will be activated. Thus the operator actively tests any external components or systems that are connected to the controller alarm relay contacts. The extender card shown in Figure 6-1 can be used to disengage relay contacts from external connections. Jumper posts on this extender card are provided to maintain NC contacts to external connections.

3.3 DISABLING UNUSED CHANNELS

If any channel is not being utilized, a simple two-step process is required to disable the controller input signal to those channels only. Switch S1-1 through S1-8, for channels 1 through 8 respectively, on the main control board and jumpers from appropriate channel "CTR" to "−BATT" terminals on the rear of the mounting rack are required to disable the controller channel desired. For example:

a. On the panel mount rack to disable channel 8 place a jumper from adjacent terminals TB3-1 (Ch 8 CTR) to TB1-4 (−BATT). Then place switch S1-8 on the main control board on the "on" (closed) position. Channel 8 is now disabled.

b. On the 19-inch rack to disable channel 6 on controller number 4, place an insulated wire jumper from TB3-3 (Ch 6 CTR) to TB1-4 (−BATT).

NOTE

Insulated wire must be used so that no other terminal points can be shorted accidentally.

Then on controller number 4, place switch S1-6 on the main control PWA to the "on" (closed) position. Channel 6 of controller number 4 is now disabled.

No further action is necessary to disable an unused channel.

SECTION 4
THEORY OF OPERATION AND MAINTENANCE

4.1 General Information and Basic Definitions

A combustible gas is one that will burn when mixed with air (or oxygen) and ignited.

The lower explosive limit (LEL) or lower flammable limit (LFL) of a combustible gas is defined as the smallest amount of the gas that will support a self-propagating flame when mixed with air (or oxygen) and ignited. In gas-detection systems, the amount of gas present is specified in terms of % LFL; 0% LFL being a gas-free atmosphere and 100% LFL being an atmosphere in which the gas is at its lower flammable limit. The relationship between % LFL and % by volume differs from gas to gas. The following data is from NFPA 5th Edition 325M.

	@ 100% LFL
Hydrogen(H_2)	= 4.0% by volume in air
Methane(CH_4)	= 5.0% by volume in air
Ethane(C_2H_6)	= 3.0% by volume in air
Ethylene(C_2H_4)	= 2.7% by volume in air
Pentane(C_5H_{12})	= 1.5% by volume in air
Propane(C_3H_8)	= 2.2% by volume in air

For data on other gases, refer to NFPA 5th Edition 325M. Typical settings for the alarm circuit are 20% for the low alarm and 40% for the high alarm.

The LFL of a gas is affected by the temperature and pressure: As the temperature increases, the LFL decreases and hence the explosion hazard increases; the relationship between LFL and pressure is fairly complex, but at approximately one atmosphere a pressure increase usually lowers the LFL. The LFL of a gas is not significantly affected by the humidity fluctuations normally encountered in the operation of a gas-detecting system.

WARNING

Maintenance should NOT be performed with power on if there is any indication of combustible gas at the sensors.

Each unit shipped from the factory has been calibrated for the gas specified on the inside of the front cover of this manual. Immediately upon installation, the unit should be recalibrated in accordance with the routine calibration procedures to verify that the installation or shipment has not damaged any components function.

The system will also have to be calibrated regularly (about once every 60 to 90 days) and will have to be recalibrated whenever the sensor and/or transmitter is replaced. Routine calibration is described in Section 4.2. Recalibration is described in Section 4.3.

The following equipment is needed for a routine calibration of the system: an adapter fitting for applying the test gas and a Rexnord calibration kit (or equivalent). The Rexnord calibration gas kit (Figure 6-1) and meter (Figure 6-3) are optional accessories. The adapter fitting on the end of the hose (Figure 6-3) is contained in the calibration kit.

1. When using the Rexnord calibration gas kit, check to make sure that the gas gauge indicates that there is gas in the sphere. If you are using other than Rexnord calibration equipment, make sure that the flow rate of the test gas is always between 1.5 and 2.0 cu ft/hr (42.5 to 56.7 liters/hr).

2. The area should be declassified as non-hazardous prior to calibration.

4.1.1 Sensors

Each sensor has somewhat different characteristics. When no gas is present, the zero offset voltage varies slightly from sensor to sensor. When the sensors are exposed to a specific concentration of gas, the signal voltage varies somewhat from sensor to sensor. The ZERO and SPAN potentiometers associated with the amplifier circuit (see Figure 4-3) are used to compensate for the variables in the sensors.

4.2 REMOTE TRANSMITTER ROUTINE CALIBRATION

The calibration procedure for remote calibration is detailed below. Figure 4-1 shows the steps required when using the Rexnord calibration gas kit. The photographs are numbered in the same sequence as the procedural steps.

4.2.1 Calibration Procedure Using the Rexnord Calibration Gas Kit

1. Make sure gas gauge indicates there is gas in the container.

2. Use a portable gas detector to verify no combustible gas is present at sensor location

3. Remove cover from conduit box.

WARNING

This location must be declassified as non-hazardous prior to calibration.

NOTE

When the calibration meter is plugged into the PWA the two Shunt terminals are shorted. This prevents the transmitter from sending signals back to the controller (thereby causing accidental alarm conditions). If the Shunt terminals were not shorted, the alarm signals at the controller would not be deactivated and false alarms are possible. DO NOT unplug the meter until the reading is below the low alarm set point.

4. Plug the calibration meter into the four terminals labeled SHUNT and CAL METER on Remote Calibration Assembly.

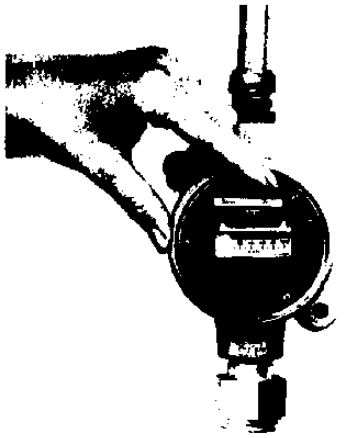
5. If a dust cover is used, remove it from the end of sensor.

WARNING

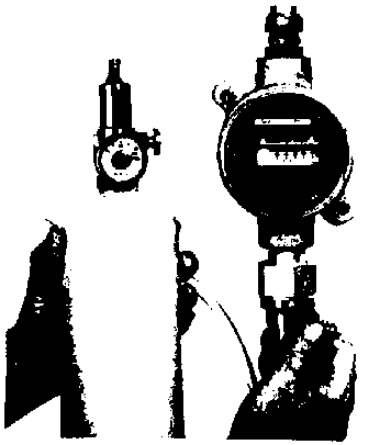
Check that the small hole in the side of the Rexnord calibration gas kit adapter fitting is clear. If the hole is obstructed, a calibration error can result.

Step 1

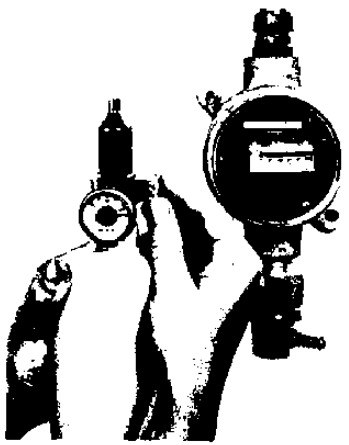
Steps 2 3 & 4



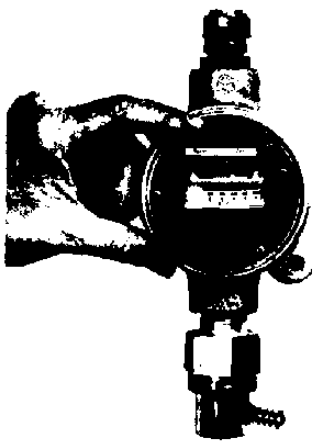
Step 5



Step 6

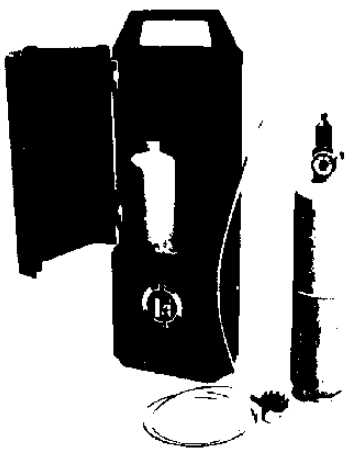


Step 7



Step 8

Step 9



Rexnord Calibration Gas Kit

Figure 4-1. Remote Calibration Procedure

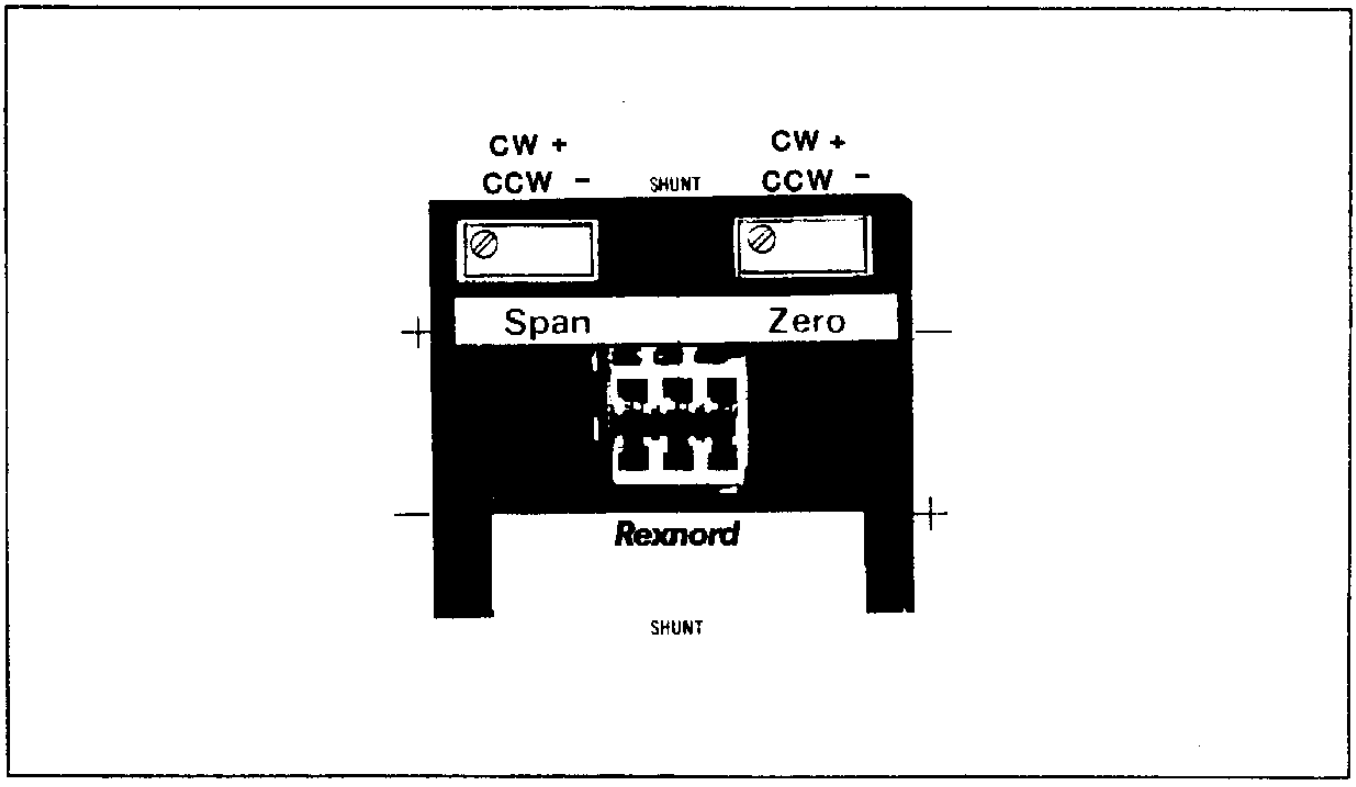


Figure 4-2. Edge Connector on Remote Calibration Unit

6. Re-zero Meter with ZERO pot on assembly.

WARNING

If the sintered disc is not in place in the adapter fitting, a 10 to 15% calibration error can result.

7. Snap on adapter fitting over sensor.

NOTE

It is recommended that all calibration be performed with the gas that the sensor is intended to monitor.

8. Attach hose to hose barb fitting on regulator.

9. Screw regulator down on container until it is firmly secured. To flow the calibration gas, push in and apply a 1/4-turn to the valve located on the side of the regulator. The calibration gas will flow at the rate of 2.0 ± 0.1 cubic feet per hour.

10. Adjust the SPAN control on the assembly until the meter indicates the same % LFL as indicated on the container.

WARNING

Wait until the meter reading drops below the alarm trip point before removing the meter as indicated in Step 13.

11. To stop the gas flow, turn the valve until it pops out.

12. Remove the adapter fitting from the sensor, and reinstall the dust cover on the sensor (if a dust cover is used).

13. Remove the meter and **reinstall cover on conduit box.**

The SPAN control setting (i.e., the gain) will have to be changed (increased) over the life of the sensor since the catalyst is slowly consumed during the course of system operation. Under normal circumstances, the sensor will last several years.

If, at any given calibration, it is necessary to change the SPAN control setting by more than 15% LFL but less than 25% LFL, the system should be recalibrated in the manner described in Section 4.3. If, at any given calibration, it is necessary to change the SPAN adjustment by more than 25% LFL, the sensor should be replaced, and the system should be recalibrated (refer to Section 4.3).

Check the condition of the dust cover, and if necessary, clean the dust cover prior to replacing it. Refer to Section 4.4.1 for a description of how to clean the dust cover.

4.2.2 Calibration Procedure Using Other Than Rexnord Calibration Gas Kit

1. If using other than Rexnord calibration equipment, make sure the flow rate of the test gas is always between 1.5 and 2.0 cu ft/hr (42.5 to 56.7 liters/hr).

WARNING

This location must be declassified as non-hazardous prior to calibration.

2. Plug the calibration meter into the card edge connector shown in Figure 4-2 (refer to Section 4.2.1.3).

3. Remove the dust cover from the end of the sensor.

4. Re-Zero Meter with ZERO pot on the PWA.

5. Snap the adapter fitting over the sensor in place of the dust cover.

WARNING

If the sintered disc is not in place in the adapter fitting, a 10% to 15% calibration error can result.

6. Attach one end of a length of hose to the adapter fitting and the other end to the source of calibration gas.

7. Adjust the flow rate of the gas to 1.5 to 2.0 cu ft/hr (42.5 to 56.7 liters/hr).

NOTE

It is recommended that all calibration be performed with the gas that the sensor is intended to monitor

8. Adjust the SPAN control of the PWA until the indication by the meter is the same as the percentage LFL of the test gas.

9. Turn off the valve on the calibration container.

10. Remove the adapter fitting from the sensor and reinstall the dust cover on the sensor.

WARNING

Wait until the meter reading drops below the low alarm set point before removing the meter.

The SPAN control setting (i.e., the gain) will have to be changed (increased) over the life of the sensor since the catalyst is slowly consumed during the course of operation of the system. Under normal circumstances, the sensor will last several years.

If, at any given calibration, it is necessary to change the SPAN control setting by more than 15% LFL but less than 25% LFL, the system should be recalibrated in the manner described in Section 4.3. If, at any given calibration, it is necessary to change the SPAN adjustment by more than 25% LFL, the sensor should be replaced, and the system should be recalibrated (refer to Section 4.3).

Check the condition of the dust cover, and if necessary, clean the dust cover prior to replacing it. Refer to Section 4.4.1 for a description of how to clean the dust cover.

4.3 RECALIBRATION AFTER CHANGING THE SENSOR

The calibration procedure is identical to the routine calibration discussed in Section 4.2, except that step 5 is replaced with the following:

5. Adjust the ZERO pot on the remote calibration PWA until the meter reads +3 to +4% LFL, and turn the SPAN pot in the increasing direction until the meter reading does not change with SPAN adjustment. Then adjust the ZERO pot until the meter reads 0% LFL.

4.4 TRANSMITTER ASSEMBLY ROUTINE MAINTENANCE AND TROUBLESHOOTING

4.4.1 Dust Covers

The optional dust cover is recommended for sensors used in dirty areas. The dust cover prevents the sensor flame arresters from becoming clogged. These dust covers must be cleaned periodically—the dirtier the environment, the more often they need to be cleaned. Clean the dust covers as follows:

a. Snap off the dust cover by grasping the outer ring and pulling.

b. If there is a light accumulation of dust, it can be removed by tapping the dust cover against a hard surface.

If there is a heavy accumulation of dust, the dust cover should be soaked in a non-flammable solvent, such as trichloroethylene, and then blown out with compressed air. Should this procedure fail to result in a clean dust cover, the cover must be replaced.

4.4.2 Schematic Diagram

The transmitter electronic schematic diagram is shown in Figure 4-3. This is provided for convenience in the event the customer wishes to make his own repairs; however, it is recommended that the local Rexnord representative or the factory be consulted before doing so. Warranties may still be in effect and local repair could void this guarrantee.

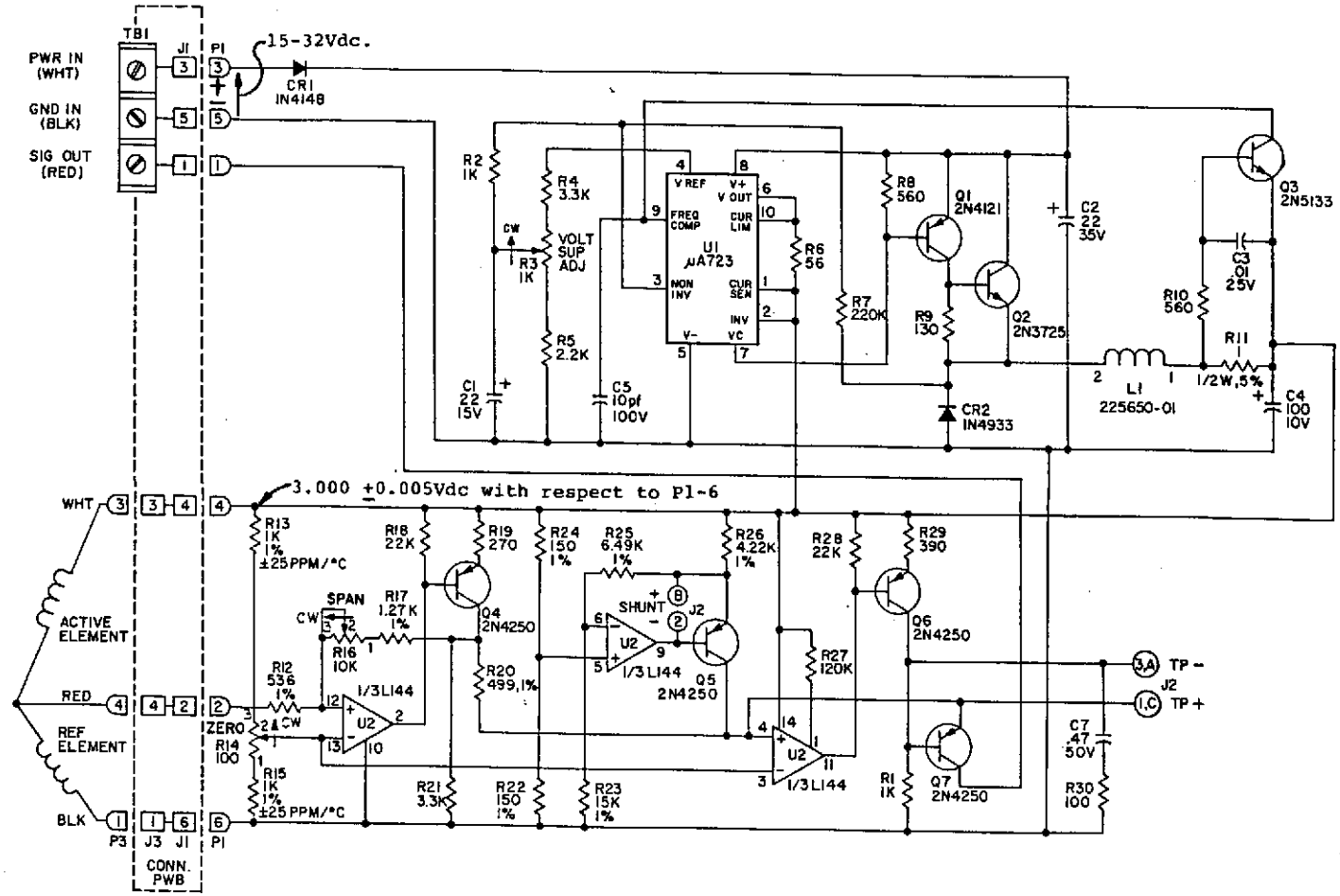
4.4.3 Connectors

CONNECTORS are a typical source of transmitter problems. There are four connectors to each assembly. All connectors are gold plated, but continual transmitter and sensor removal and replacement could be a problem aided by a HOSTILE ENVIRONMENT. Any unusual drift or meter pegging is an indication that the base PWA (see Figure 2-7) may need repair or replacement because of a defective connector.

4.5 CONTROLLER—GENERAL

The 880 controller was produced with the latest electronic and mechanical design techniques. The unit can be completely disassembled, by removing 14 screws and the front panel bezel nut, and still be tested electronically (with the spectra-strip connectors and rear panel PWA in place). Three separate PWAs (Figure 3-2), front panel (Figure 3-1), and the wrap-around assemblies (Figure 2-9) are necessary for electrical operation. However, it is not recommended that this unit be repaired because of its layout complexity and warranty considerations. Rexnord and its local representatives, when contacted, can provide quick turnaround of the controller, if repair is necessary. Expert Rexnord personnel can diagnose, repair, and return the repaired unit on a 2-6 week basis with a repair report.

REF DESIGNATION	
USED	NOT USED
R30	
C7	C6
CR2	
Q7	
U2	
L1	
J6	
P6	
TB1	



NOTES: UNLESS OTHERWISE SPECIFIED

1. ALL RESISTORS ARE 1/4 W, 5% .
2. ALL RESISTANCE VALUES ARE IN OHMS.
3. ALL CAPACITANCE VALUES ARE IN MICROFARADS.
4. ALL 1% RESISTORS ARE ± 100 PPM /°C, 1/8 W .

SCHEMATIC NO.225553,REV.C

Figure 4-3. Transmitter, Schematic Diagram

CAUTION

All PWA boards are coated with a protective film (Humi-Seal type 1A27, Humiseal Division of Columbia Technical Corporation, Woodside, New York) to prevent PC trace and lead corrosion (except socket plug-in devices). Any part replacement that requires soldering will destroy this protective coating thus opening the area to a contaminating atmosphere. Tiny solder or wire slivers are a common cause of operational malfunctions; therefore, any PC board corrections involving soldering should be thoroughly cleaned, blown dry with clean compressed air, and re-coated with protective film as noted above or its equivalent.

Again, if repair is deemed necessary, it is suggested:

a. Call the local Rexnord representative or our plant (see front title page for telephone or TELEX number) as soon as possible for work scheduling purposes, and

b. Send unit (see front page for address) by most convenient and expedient means.

NOTE

Please read thoroughly Sections 3 and 4 as they will provide simpler diagnostic directions for correcting indications of malfunctions.

4.5.1 Controller Schematics and Layouts

The controller contains five electrical assemblies as listed in Table 4-1 and the 808 transmitter.

The schematics and layouts are provided for convenience in the event the customer wishes to make his own repairs. However, as previously stated, it is recommended that the local Rexnord representatives or the factory be consulted before doing so. Warranties may still be in effect and local repair could void this guarantee.

Table 4-1. 880 Assemblies, Schematics

ITEM	PART	ASSEMBLY FIG. NO.	SCHEMATIC/PWB LAYOUT FIG. NO.
1	Front panel w/switches and lamps only		
	a. Connectors J2, J3 and J4	3-2	
	b. Front view	3-1	4-7/—
	c. Rear view	2-9	
2	Front panel PWA		
	a. Front view in panel	3-1	4-4/4-11
	b. PWA view	3-2	
3	Logic PWA	3-2	4-5/4-10
4	Main control PWA	3-2	4-7/4-9
5	Wraparound		
	a. Rear view	2-9	4-7/—
	b. Connectors J5, J6, J7 and J8	3-2	
6	808 Transmitter	2-8	4-3/4-8

4.5.2 Power Supplies and Regulators

The Model 880 contains five regulated voltage supplies as shown in Table 4-2. All supplies are short-circuit protected except the −9V supply; however, this supply operates from the +12 Vdc regulated source which has short circuit protection. The +5V(R), +5V, +12V, and −9 Vdc supplies are used by the controller internal circuitry. Both the battery trickle charge (+Batt and −Batt) and the transmitter (CH N+ and CH N−, where N = 1 to 8) supply terminals are short-circuit protected. The battery output terminals are current-limited through two 150Ω, 5W resistors located on the panel mount or 19-inch rack rear mother board. This short circuit current is 339 ±111 mAdc. The transmitter (XMTR + and XMTR −) is current-limited by a circuit on the main control board (R15 and Q9) to 1.376 ±0.519 Adc.

CAUTION

If the controller connections to external components are not made by using Rexnord panel mount or 19-inch rack rear terminals, the customer must provide external resistor and diode connections (see Figure 2-3 or 2-5 for part descriptions and connection diagram), the battery terminals will not have short circuit protection, and improper system operation could result.

Table 4-2. Power Supplies

POWER SUPPLY	LOCATION
A precision 5Vdc supply (+5V (R) on schematic) for an accurate reference voltage	Main control PWA—U30, R42, R43, R44, R45, C37, C35, and C40.
A regulated 5 Vdc (+5V on schematic) as an IC and LED supply source.	Wrap-around—U101, U102, C101, and C102. Main Control PWA—R41, C38, C39, and C34.
A regulated +12 Vdc (+12V on schematic) for relay, lamp, and −9V supply source.	Wrap-around—U103 Main Control PWA—R13, C41, C42, and C43.
A −9 Vdc (−9V on schematic) for operational amplifier negative source,	Logic PWA—U21, R27, C5, C9, C10, CR4, and CR5.
An unregulated +18 Vdc to +32 Vdc supply for transmitter sources (+XMTR to −XMTR).	Wrap-around—Q101 Main Control PWA—R16, R17, R14, R15, C31 C32, and Q9.

In any event, the transmitter supply voltage (XMTR+ to XMTR−) on any channel should be greater than +18 Vdc under normal operating conditions i.e., no short circuit, ac line voltage not less than 105 Vrms, or some other system failure mode. Under normal operating conditions (no alarms or short circuits) the transmitter supply voltage will be approximately 24 Vdc.

4.5.3 Front Panel Display Board Including Alarm Lamp-Switches

The schematic diagram is shown in Figure 4-4. The gated VCO % LFL pulses present at pin A31 are applied directly to U3 (1/2 MC14518, BCD up counter) and the BCD output code applied to U8 (MC14511, BCD to 7-segment decoder). The U8 outputs then drive DS27 (LSD). The A31 % LFL pulses also are applied to U1 (MC14017, decode counter/divider) which divides input pulses by 10. These ÷10 pulses are then decoded by the other half of U3 and U7 to drive the MSD 7-segment display DS26. The reset, blanking, and latch enable states from the logic board appear on B30, B27/A28, and A27, respectively.

The channel number BCD code to U6 comes directly from the logic PWA through pins B21 through B24. The U6 outputs drive DS25. All alarm LEDs and their associated transistor stages are driven from the main control PWA CMOS priority logic outputs. A logic 1 (≙ +5V) turns on the appropriate LED; logic 0 (0 Vdc) holds the LED off. One-half of U4 and U5 are NAND gates used to detect the "99" BCD code so that % LFL digits can be flashed. Output U4-13 (IC U4-Pin 13) is used to cut off the logic board VCO through pin A22. The other 1/2-U4 is the timeout circuit first gain stage. R1, R5-1/2 U2, and R3-1/2 U2 are the alarm reference voltage circuits for the system that are accessible through the front panel (see Figure 3-1). Q4 is the minus sign drive transistor and is on when pin B29 is low (≙ 0 Vdc).

4.5.4 Plug-In Logic PWA

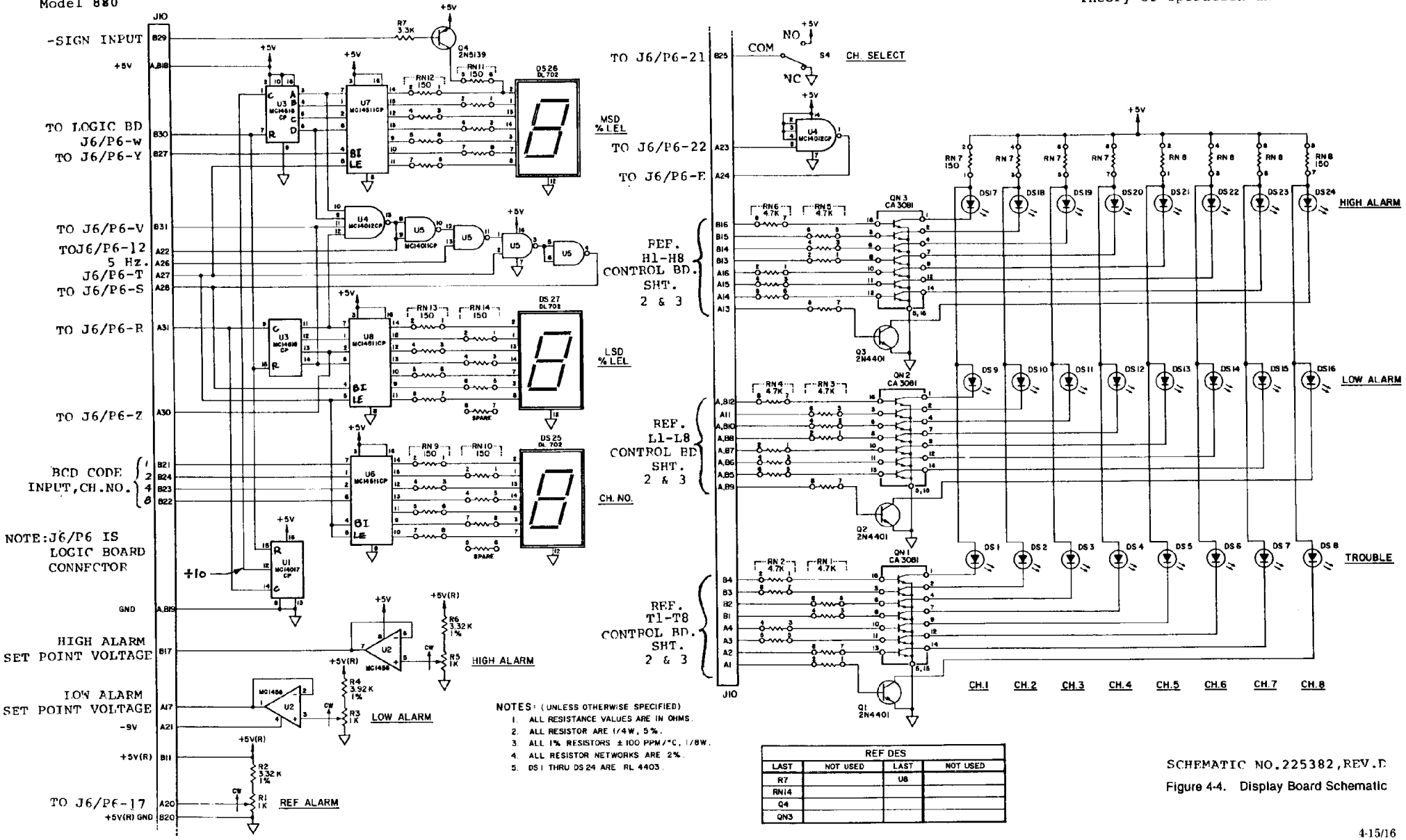
The logic PWA (Figure 4-5) contains the base frequency oscillator, −9V power supply for operational amplifiers, division and decoding logic, 18-44 second timing circuit, channel advance logic, minus signal logic, dc amplifier−VCO logic, and the channel dc input signal multiplexing gates.

a. Base Oscillator. U15 is a NE555 or CP376 (Signetics) timer-oscillator.

b. Negative 9V Supply. The −9V supply consists of U21, C5, C9, C10, CR4, CR5, and R27. The typical voltage is about −8.7 Vdc and supplies the negative reference to three operational amplifiers; MC1458C−U5 and U6 on the logic PWA and U2 on the front panel display PWA (refer to Section 4.5.2).

c. Division and Decoding Logic. The base oscillator frequency division and decoding circuitry consists of U10, U11, U2, U20, U8, U3, and U9. Figure 4-6 is a timing diagram showing the important inputs and outputs that may be observed on an oscilloscope.

d. 18-44 Second Timing Circuit. The timing circuit components are CR6, R31, R32, C12, Q6, R14, C11, R29, and 1/4 of U18. The components associated with 1/4 of U18 (pins 6, 8, and 9) discharge C12 in the event of significant ac-power drop and transmitter replacement (refer to 3.2.5 b-1, −2, and −3). A 20-Hz signal from U10 pin 6 charges C12 through CR6, R31, and R32 plus a small amount of leakage current through Q6 base-emitter.



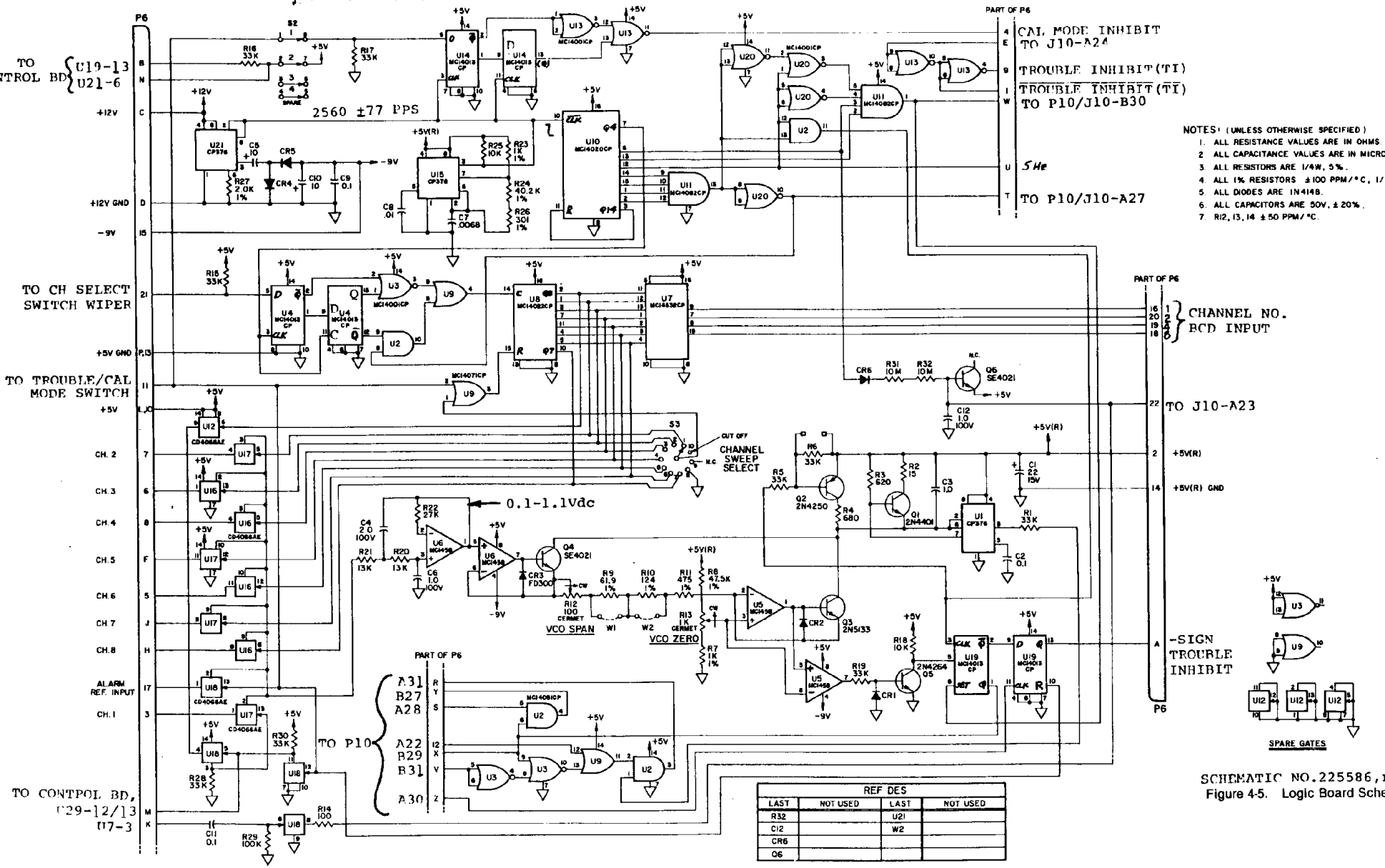
NOTES: (UNLESS OTHERWISE SPECIFIED)

1. ALL RESISTANCE VALUES ARE IN OHMS.
2. ALL RESISTOR ARE 1/4W, 5%.
3. ALL 1% RESISTORS ± 100 PPM/°C, 1/8W.
4. ALL RESISTOR NETWORKS ARE 2%.
5. DS1 THRU DS24 ARE RL 4403.

REF DES			
LAST	NOT USED	LAST	NOT USED
R7		U8	
RN14			
Q4			
QN3			

SCHEMATIC NO. 225382, REV. D

Figure 4-4. Display Board Schematic



REF DES			
LAST	NOT USED	LAST	NOT USED
R32		U21	
C12		W2	
CR6			
Q6			

SCHEMATIC NO.225586,rev.A

Figure 4-5. Logic Board Schematic

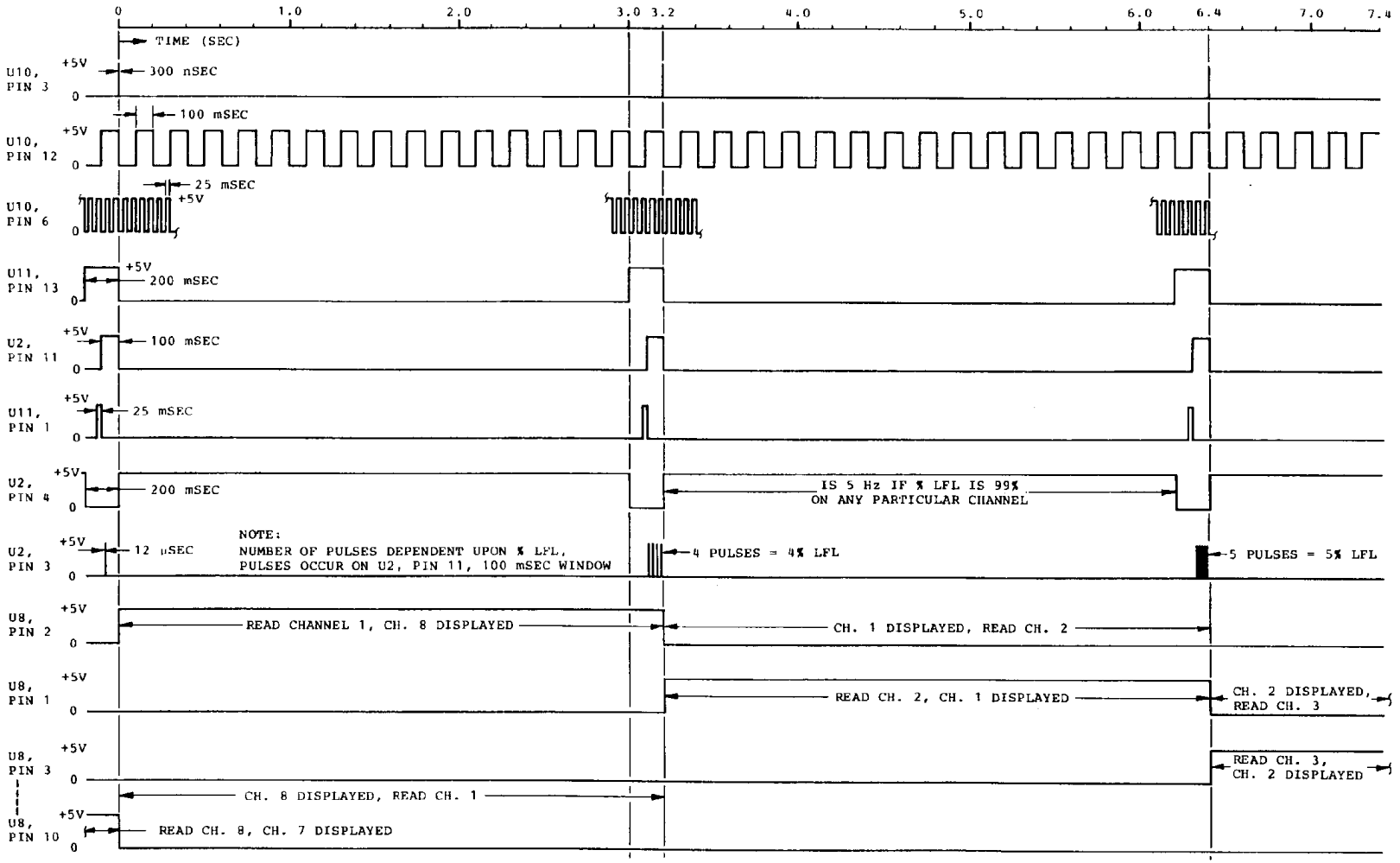


Figure 4-6. Logic PWA IC Timing Diagram

NOTE

Do not connect a scope or other voltage measurement instrument across C12 in an attempt to measure the timeout period. C12 will discharge slowly through any low resistance and the timeout circuit will activate; thus disabling the alarm relays.

e. Channel Advance Logic. The automatic or manual channel advance circuitry components are R15, U4, U2, U3, U9, and S3. Pressing the front panel MANUAL SELECT pushbutton disables the normal system advance pulse input by turning off gate U2 (pin 10). Manual select pulses are applied through flip-flop U4 and gates U3-U9 (refer to Section 3.2.2).

f. Minus Sign Logic. The minus sign logic components are 1/2 of U5, R18, R19, Q5, and U19. When the dc input on any channel drops below $\triangleq$75 mVdc, U5 switches from $\triangleq -7.0$ Vdc to $\triangleq +4.1$ Vdc turning on Q5, thus U19 input (pin 5, U19-D1) and output (pin 2, U19-Q1) are low.

g. DC Amplifier and VCO Logic. The DC amplifier and VCO logic consists of integrated circuits U1, U5, U6 and associated components. The VCO zero (R13, 1K ohms Cermet, $\leq$ 100 ppm/ C) and span (R12, 100 ohms Cermet, $\leq$ 100 ppm/ C) adjustment potentiometers are associated with this part of the system. These pots are factory adjustments and should not be altered. Glyptol is used to keep the screw heads fastened to the pot case. In the unlikely event that they are brioken loose, the following adjustment procedure must be adhered to for correct operation of the % LFL vs transmitter CTR DC input:

1. Remove the Controller and place the CHANNEL SELECT switch (S3) to position 1 with the pot screwdriver.

2. Disconnect transmitter channel 1 CTR wire from TB3-8 and bend it back so that it cannot short to any other terminal. Terminal designations referred to in this section "g" are those shown on page 2-4, Figure 2-2, Single Panel Mount or 4-unit 19-inch rack terminal designation and interconnect diagram.

3. Connect a precision DC voltage source between TB3-8 (+ voltage source lead, Ch. 1 CTR.,red) and TB1-4 (– voltage source lead, –Batt). *DO NOT TURN ON THIS SUPPLY* until it is certain that it is adjusted to about 200 mVdc. This power supply should be adjustable from 0 Vdc to 1.200 Vdc (adjustable to ± 1 mVdc, and stable to better than ± 0.5 mVdc over the area temperature variations). Turn on the power supply.

4. Replace the controller, using the extender card, into the powered rack or panel mount housing and wait until the 18-44 second time-out period has expired, i.e., TROUBLE lamp goes out.

NOTE

Refer to Section 3.2.5, c.1 if TROUBLE lamp does not go out.

5. Using a frequency counter (HP5300A or equivalent) monitor the frequency at U15-3 with respect to ground (U15-1) on the logic PWA. It must be 2560 ±10 pps. Remove frequency counter.

6. With an accurate digital voltmeter connected across R18 (Control PWA), adjust the precision voltage source previously referred to in step 3 above to 100 ±2 mVdc. Adjust R13 (1K ohms,VCO zero) on the Logic PWA to read 00% LFL on the front panel display. A 00% LFL will appear for 1 to 1-1/2 turns of R13; thus, the best setting is the midpoint between the extremes where the adjustments just indicate –0 and 01% LFL.

7. Adjust the precision DC voltage source to read 1.080 ±.002 Vdc across R18 on the Control PWA. Adjust R12 (100 ohms, VCO span) on the Logic PWA to read 98% LFL on the front panel display. Again, a 98% LFL will appear for 1 to 1-1/2 turns of R12; thus, the best setting is the midpoint between the extremes where the adjustments just indicate 97 and a flashing 99% LFL.

Remove all test equipment. Remove the controller and extender card from the housing and replace the lead removed in step 2 to TB3-8. The Controller is now calibrated and can be installed in the housing for normal operation.

A simple VCO calibration procedure can be accomplished without the use of any external test equipment. All that is required is the calibration meter, controller extender card, and the pot screwdriver. This method is as follows:

1. Remove the Controller and using the pot screwdriver set the channel select switch (S3) on the Logic PWA to position 1.

2. Replace the Controller with its extender card and wait for the warm-up time-out period to expire i.e., TROUBLE light goes out.

3. Place the Calibration meter into Channel 1 transmitter connector J2 (see Figure 4-1 or Figure 4-2). Adjust transmitter zero adjustment pot wheel to read 00% LFL on the meter.

4. Remove calibration meter and adjust the VCO zero pot (R13, 1K ohms on Logic PWA) to read 00% LFL on the display. Adjust the pot at its midpoint i.e., as discussed in last sentence of step 6 on page 4-21.

5. Replace calibration meter and set zero pot to read 98% LFL.

CAUTION

Ensure that Controller relay output contacts will not cause some undesirable control function to occur; e.g., turn on deluge water system, etc. Your extender card is specifically designed to negate any unwanted relay contact open or closure by proper placement of jumpers. Sheet 3 of 3 of control board schematic shows the P1 relay output connections.

If care has been taken so that no unwanted contact output closure can cause a problem then remove the calibration meter. Set the VCO span pot R12, 100 ohms, on the Logic PWA) until the front panel display read 98% LFL. Repeat the last sentence of Step 7 (page 4-21) to set the midpoint between 97 and the flashing 99% LFL. If during this step you had to change the transmitter span pot to reach 98% LFL on the calibration meter, it will be necessary to apply calibration gas to readjust this transmitter. Simply, insert the calibration meter, and readjust zero and span pots to read 0% LFL. Then apply calibration gas and set the span pot to read the calibration gas level desired after a stable meter reading occurs.

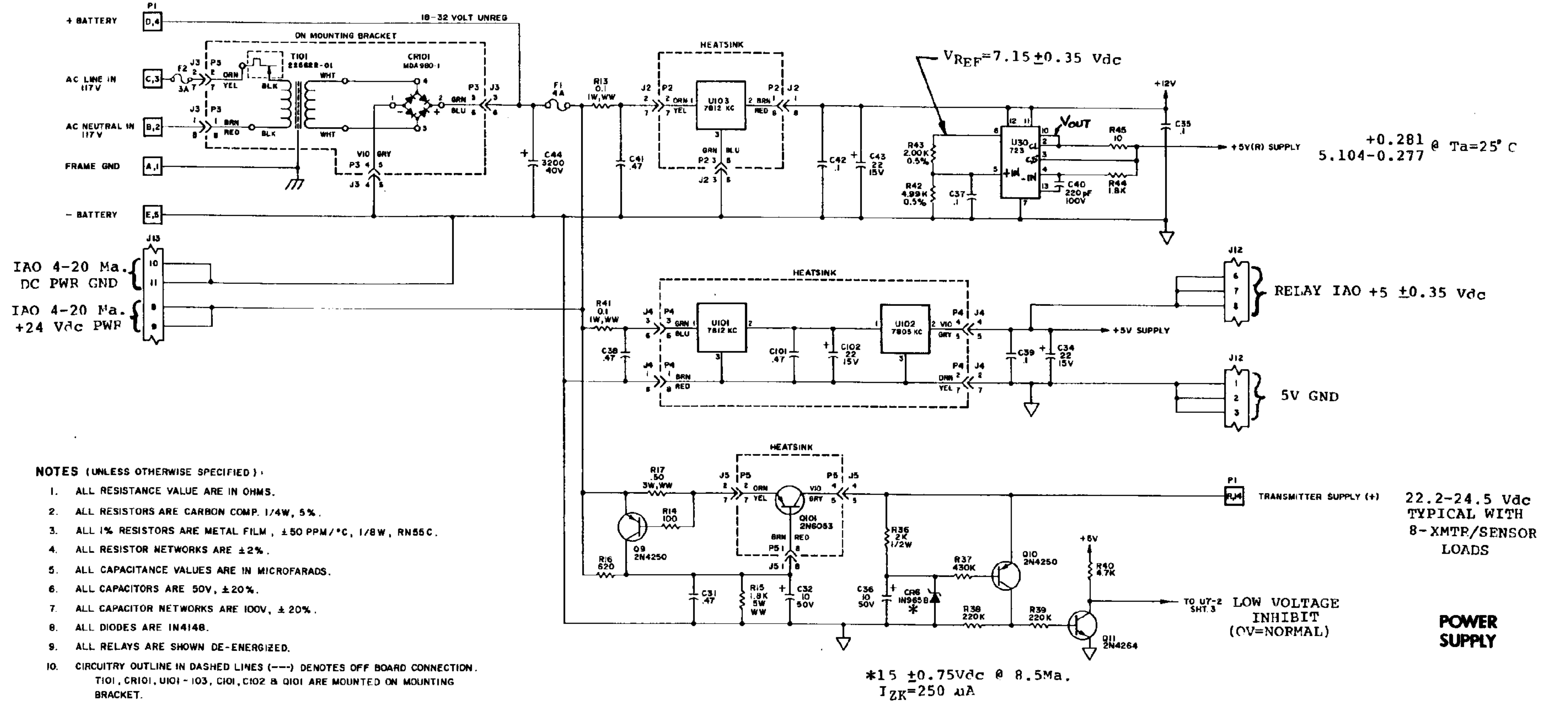
Keep in mind that this simpler calibration method is subject to errors of the meter (including eyeball error) and the transmitter meter circuit. It is not as accurate as a precision voltage reference, but you should be able to keep the errors to within +2-5% LFL of your zero and span settings. If you have a reasonably accurate DVM, you can set the zero and span points more accurately by monitoring across R18 on the Control PWA while you are calibrating.

4.5.5 Main Control PWA

The main Control PWA is illustrated in Figure 4-7.

a. U22 through U27 are the alarm comparator ICs. U8 through U15 are the priority logic ICs connected to the comparator outputs. The typical operation described for channel 2 is the same for the other 7 channels. An open-circuit in channel 2 transmitter + or − wires or sensor failure causes U22-6 (IC U22, pin 6) to go to +5V (logic 1). Gate U8 output goes high, turning on front panel DS-2 drive transistor (QN1-2 = 0 Vdc). The logic 1 on U22-6 causes U9-10 and U8-10 to be low (= 0 Vdc) no matter what the U22-8 or U23-8 outputs may be. This condition would be a trouble alarm on channel 2.

APPLICATION		REVISIONS			
NEXT ASSY	MODEL	ISSUE	DESCRIPTION	SIGNATURE	DATE
225582	880	A	PROD REL		
		B	ECN 3033		
		C	ECN 4102		
		D	ECN 4173		3 21 81
		E	ECN 4195		
		F	ECN 4217	J.E 8 24 82	



NOTES (UNLESS OTHERWISE SPECIFIED):

1. ALL RESISTANCE VALUE ARE IN OHMS.
2. ALL RESISTORS ARE CARBON COMP. 1/4W, 5%.
3. ALL 1% RESISTORS ARE METAL FILM, ±50 PPM/°C, 1/8W, RN55C.
4. ALL RESISTOR NETWORKS ARE ±2%.
5. ALL CAPACITANCE VALUES ARE IN MICROFARADS.
6. ALL CAPACITORS ARE 50V, ±20%.
7. ALL CAPACITOR NETWORKS ARE 100V, ±20%.
8. ALL DIODES ARE 1N4148.
9. ALL RELAYS ARE SHOWN DE-ENERGIZED.
10. CIRCUITRY OUTLINE IN DASHED LINES (---) DENOTES OFF BOARD CONNECTION. T101, CR101, U101 - 103, C101, C102 & Q101 ARE MOUNTED ON MOUNTING BRACKET.

REF DES			
LAST	NOT USED	LAST	NOT USED
C46		U30	
CN2		K3	
CR6		S1	
CRN1		F1	
R44		W5	
RN28	RN6, 7, 9, 10, 12, 13	J13	
Q11			

Figure 4-7. Control Board Schematic Diagram (1 of 3)

MATERIAL	DRAWN / CHECKED / APPROVED / APPROVED	Rexnord Gas Detection Products
FINISH	UNLESS OTHERWISE SPECIFIED: DIMENSIONS ARE IN INCHES. TOLERANCES: XX±, XXX±, ANGLES±	TITLE: SCHEMATIC, CONTROL BOARD, 880
		SCALE / SIZE D / DRAWING NO. 225579 / SHEET 1 OF 3

APPLICATION		REVISIONS			
NEXT ASSY	MODEL	ISSUE	DESCRIPTION	SIGNATURE	DATE
225582	880		SEE SHEET 1		

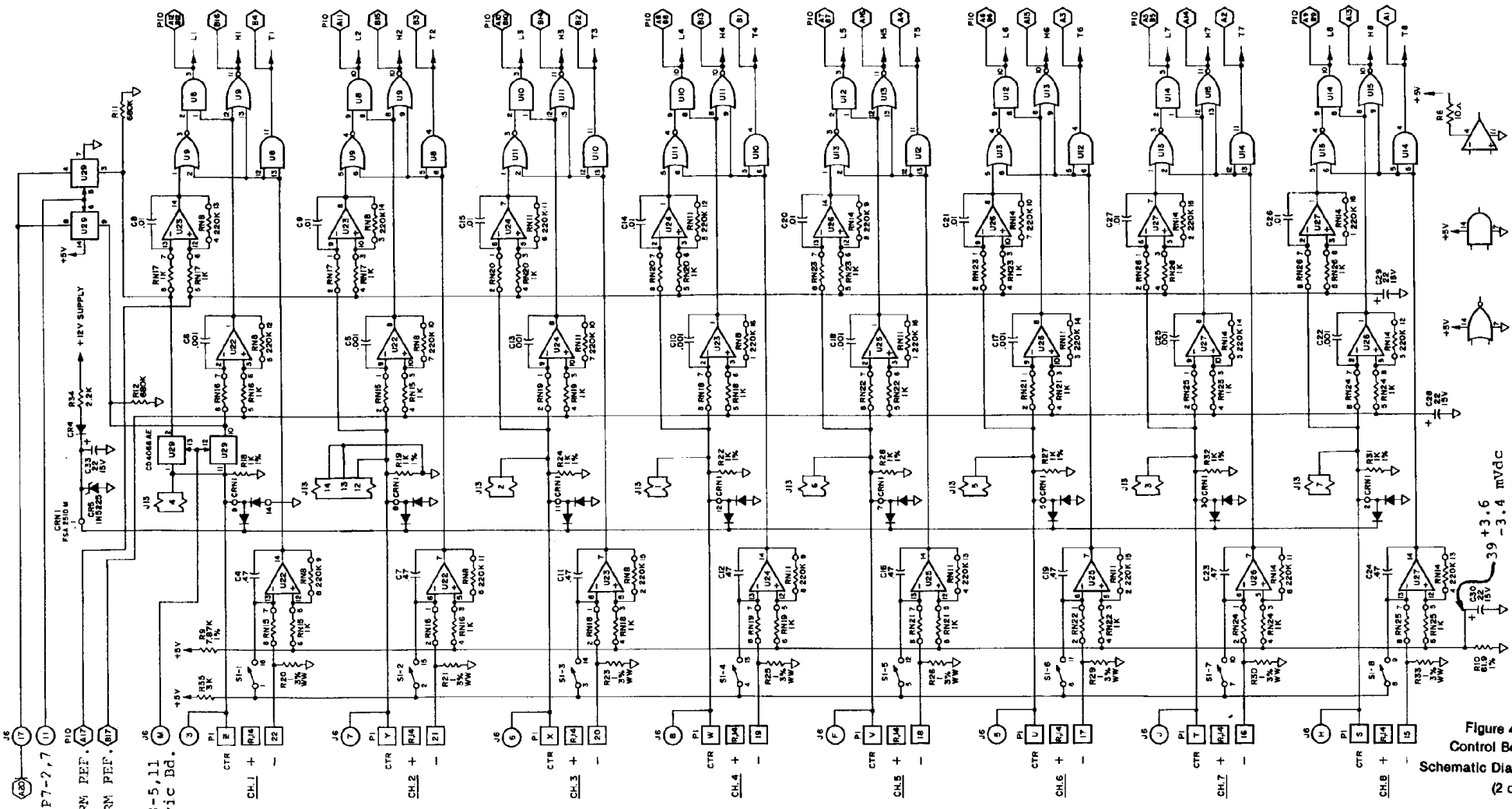
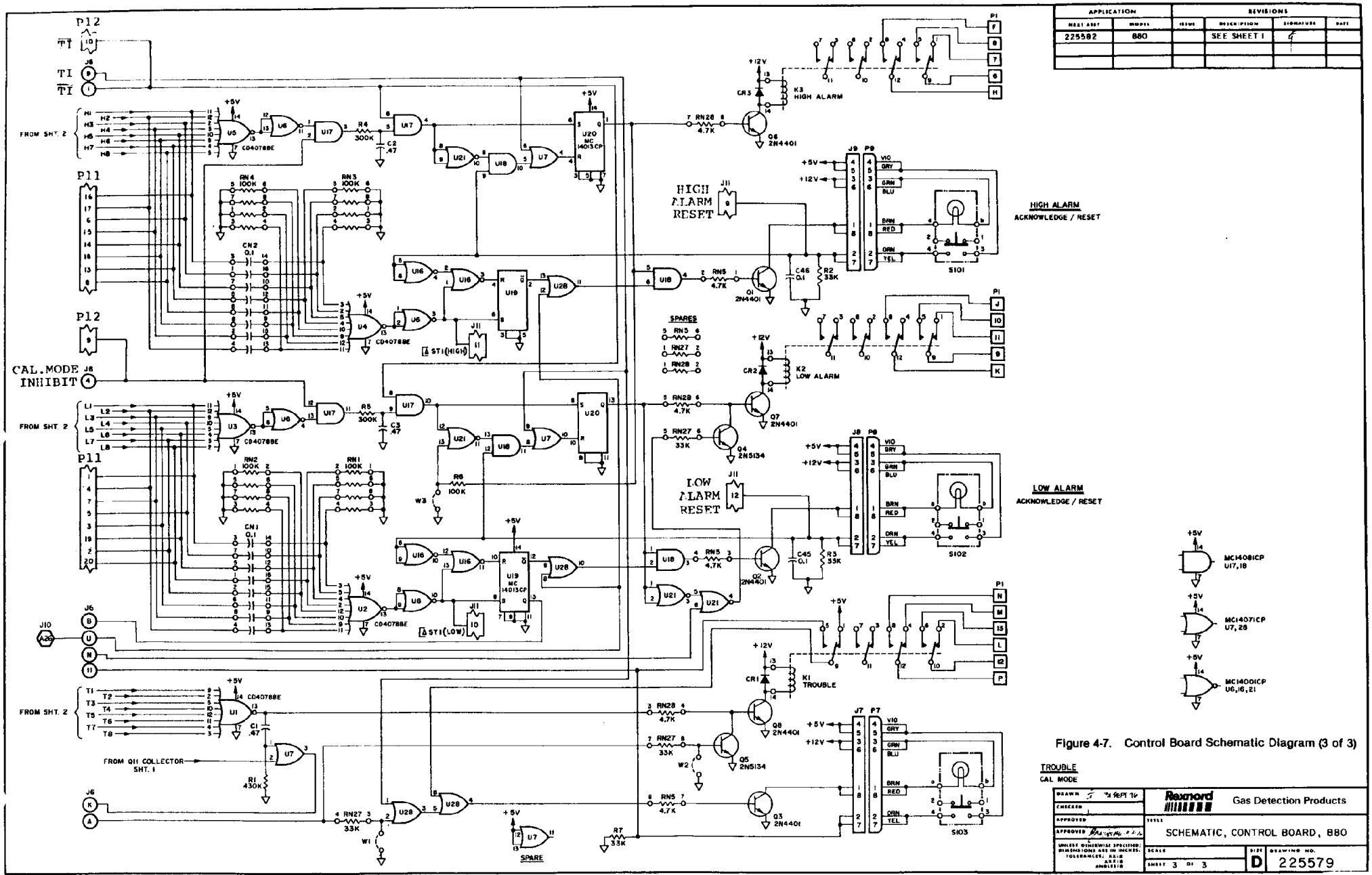


Figure 4-7. Control Board Schematic Diagram (2 of 3)

MATERIAL	DRAWN	Rexnord	Gas Detection Products
	CHECKED		
	APPROVED	TITLE	SCHEMATIC, CONTROL BOARD, 880
FINISH	APPROVED		
	UNLESS OTHERWISE SPECIFIED: DIMENSIONS ARE IN INCHES. TOLERANCES: .XX ± .XXX ± ANGLES ±	SCALE	SIZE D DRAWING NO 225579
		SHEET 2 OF 3	



APPLICATION		REVISIONS			
PART ASSY	MODEL	ISSUE	DESCRIPTION	SIGNATURE	DATE
225582	880		SEE SHEET 1		

Figure 4-7. Control Board Schematic Diagram (3 of 3)

DRAWN	9 Sept 76	Rexnord Gas Detection Products
CHECKED		
APPROVED		TITLE: SCHEMATIC, CONTROL BOARD, 880
APPROVED		
UNLESS OTHERWISE SPECIFIED: DIMENSIONS ARE IN INCHES. TOLERANCES: XX=± .XX=± ANGLES=±	SCALE	SIZE D — DRAWING NO. 225579
	SHEET 3 OF 3	

b. If U22-6 remains at logic 0 (0 Vdc) and U22-8 goes low (high alarm condition), then U9-10 goes high energizing the high alarm condition), then U9-10 goes high energizing the high alarm circuitry. As long as U22-8 is low, the state of U23-8 is insignificant as gate U8-10 output is held at logic 0.

c. If U22-6 = logic 0 and U22-8 = logic 1, a logic 0 on U23-8 (low alarm condition), allows U9-4 to go high; thus, U8-10 goes high energizing the low alarm circuitry. The priority logic circuitry sequence for any channel is that trouble overrides high and low alarms, high alarm overrides the low alarm, and low alarm overrides neither of the other two alarm conditions.

d. If any trouble alarm comparator output goes high, the buffered AND gate outputs apply a high to the 8-input NOR gate U1. Any high input causes U1-13 output to go low, turning off Q8 and de-energizing K1 (trouble relay).

e. If any alarm comparator output goes low, the low alarm 8-input NOR gate U3-3 output goes low, and U6-4 output goes high. U17-11, thus U17-10, go high, setting U20-13 (D flip-flop) output high, turning on Q7, and energizing low alarm relay K2. In the same manner, the same U3 inputs are applied to capacitor package CN1 (0.1 uF).

A logic 0 spike on U2-13 is inverted at U6-10 and sets U19-12 to a low state. U28-10 output is a 5-Hz pulse that causes lamp flashing. This pulse and a high at U20-13 output (U18-1 input) are gated by U18 which turns on Q2, thus, the LOW ALARM flashes. As long as the alarm exists and U20-13 is high, pressing the low alarm RESET pushbutton resets U19-12 to a high state, thus, U28-10 and U18-3 are high continuously (lamp on steady). When the low alarm goes away, U20-13 can be reset to a low state, dropping out the relay and turning off the lamp.

The only exceptions to the case just described are dependent upon the states of S2-2 (logic PWA) and W3 (main control PWA). These states are described in 3.2.3

f. The high alarm section works identically to that described for the low alarm in step e. above except for the second paragraph. The high alarm lamp or relay cannot be turned off unless the alarm condition goes away on any one or all channels.

g. The alarm reference, low alarm and high alarm set point voltages originate on the front panel (pin A20-R1 wiper, pin A17-U2-1, and pin B17-U2-7, respectively). These voltages appear at the appropriate device inputs shown on the schematic diagram. The trouble alarm comparators obtain their reference voltage from voltage divider network R9 and R10. The channel disable switch, S1, connects a reference current input to any unused channel comparator through R35. The quad switch gates, U29, cut off channel 1 input signal and connect the alarm reference signal to the low and high alarm comparators when the trouble alarm pushbutton is depressed.

h. The power supply regulator components on the main control PWA are described in Section 4.5.2.

i. Fuse F1 blows. This 4-ampere picofuse is conservatively rated for the system; thus, if it opens (with no externally induced aid), a catastropic failure has occurred, and the unit should be returned to the factory for detailed examination.

4.6 GENERAL INFORMATION

Any of the failures noted above should result in checking of components tied to the ICs in question and/or replacement of the IC. Every practical effort has been made to protect internal controller circuitry short of protection against high voltage spikes such as lightning strikes, etc. If the unit is installed in such a hazardous environment, where induced high voltages or lightning strikes are common, a form of line voltage protection networks should be considered. Consult Rexnord or the local representative for some suggestions in this area.

Operation of this equipment in close proximity to Medium RF, High RF, VHF, UHF, or microwave frequency powered equipment could result in error or system malfunction. In normal installations, proper chassis and power grounds are adequate, but nearby high frequency electromagnetic fields will cause any low frequency or dc system to malfunction. Any such equipment (such as walkie-talkies, transmitters, generators in the aforementioned frequency bands) should be positioned away from low frequency electronics instruments. The separation distance is a function of the frequency-power spectrum output.

4.7 PWA COMPONENT LAYOUTS

The Printed Wiring Assembly (PWA) layouts for the 808 transmitter, control, logic, and front panel component layouts are shown on Figures 4-8 through 4-11. Please read 4.5.1 on page 4-10.

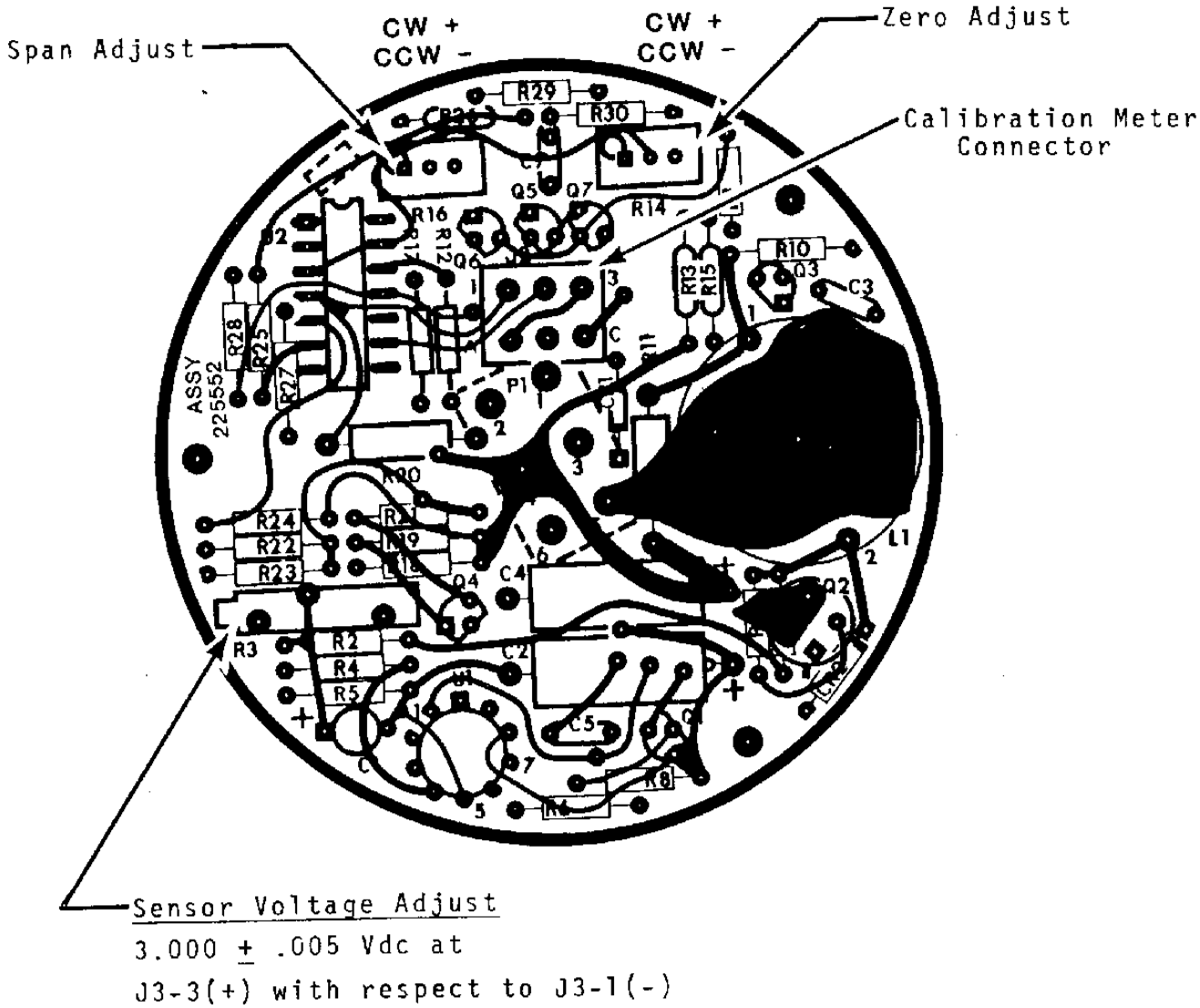
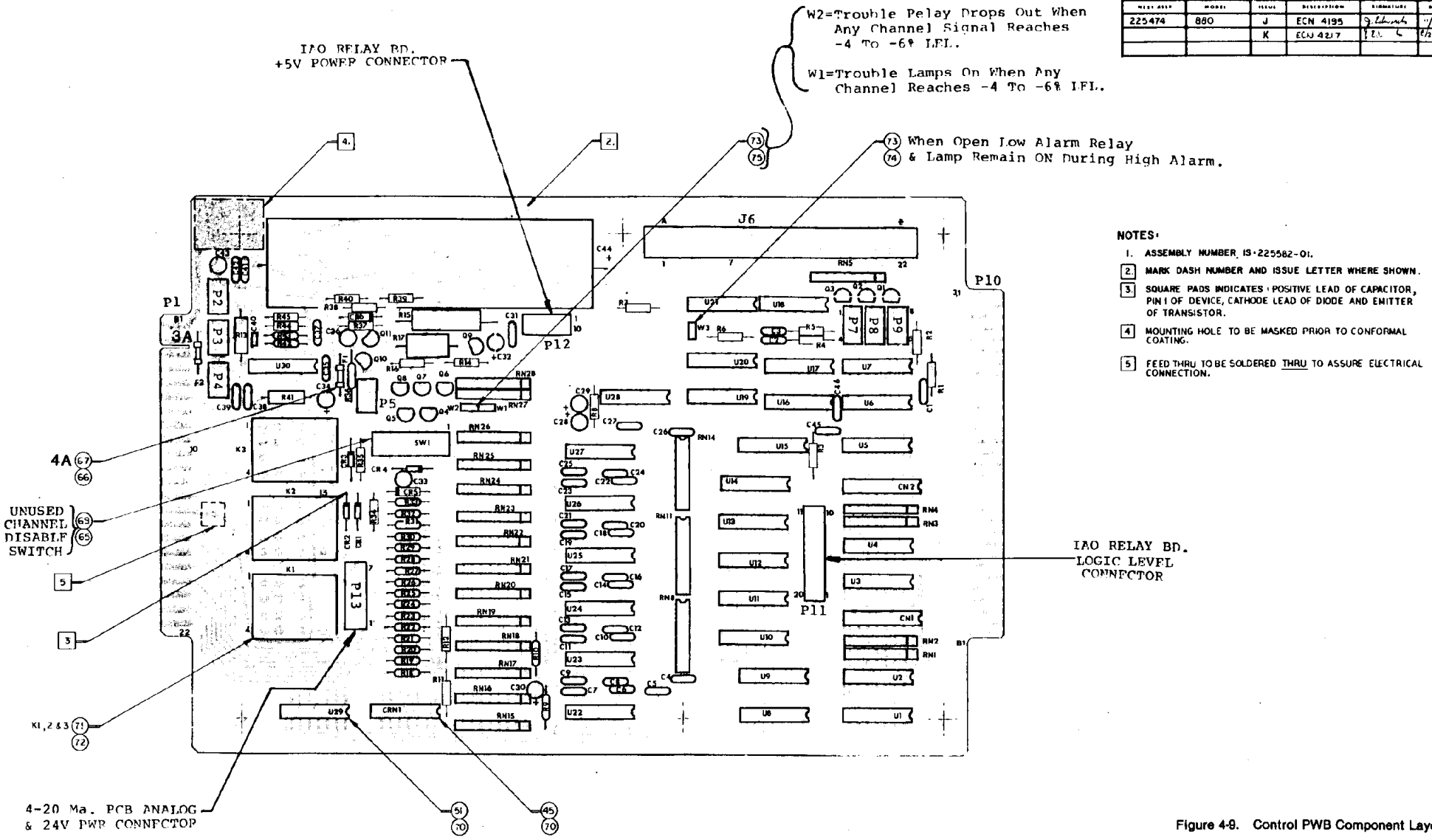


Figure 4-8. Transmitter, Model 808, PWA Layout

APPLICATION		REVISIONS			
NEXT ASSY	MODEL	ISSUE	DESCRIPTION	SIGNATURE	DATE
225474	880	J	ECN 4195	S. Edwards	1/25/91
		K	ECN 4217	T.L. C	6/25/91

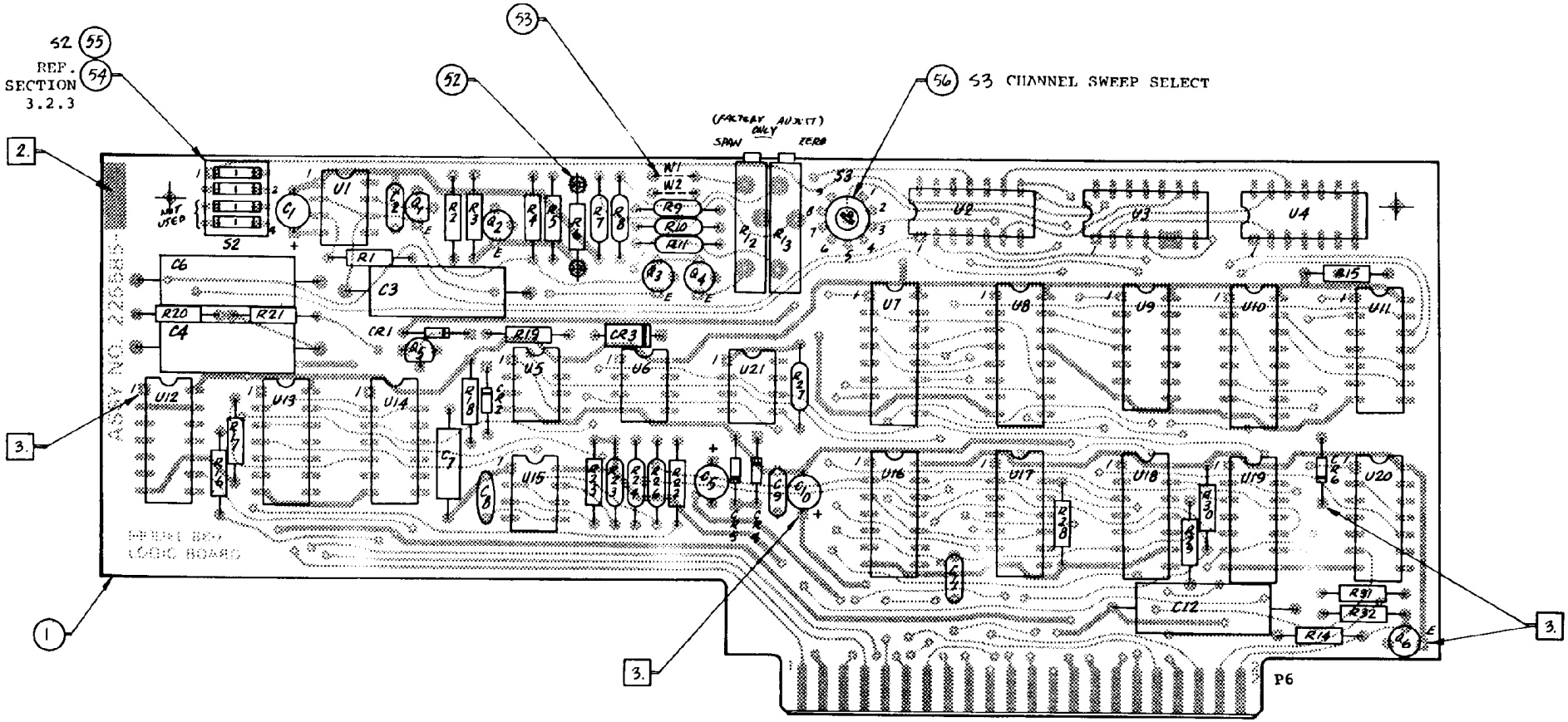


NOTES:

1. ASSEMBLY NUMBER IS 225582-01.
2. MARK DASH NUMBER AND ISSUE LETTER WHERE SHOWN.
3. SQUARE PADS INDICATES POSITIVE LEAD OF CAPACITOR, PIN 1 OF DEVICE, CATHODE LEAD OF DIODE AND EMITTER OF TRANSISTOR.
4. MOUNTING HOLE TO BE MASKED PRIOR TO CONFORMAL COATING.
5. FEED THRU TO BE SOLDERED THRU TO ASSURE ELECTRICAL CONNECTION.

Figure 4-8. Control PWB Component Layout

DRAWN 9. Edwards 1/25/91	Rexnord	Gas Detection Products
CHECKED 1-30-91	TITLE	ASSEMBLY – PRINTED WIRING BOARD, CONTROL BOARD, 880
APPROVED 1/24/91	SIZE D	DRAWING NO. 225582
APPROVED	SCALE 2 : 1	SHEET 1 OF 1



NOTES:

[3] SQUARE PADS INDICATE: PIN 1 OF IC's, POSITIVE LEAD OF CAPACITORS, CATHODE LEAD OF DIODES.

Figure 4-10. Logic PWA Layout

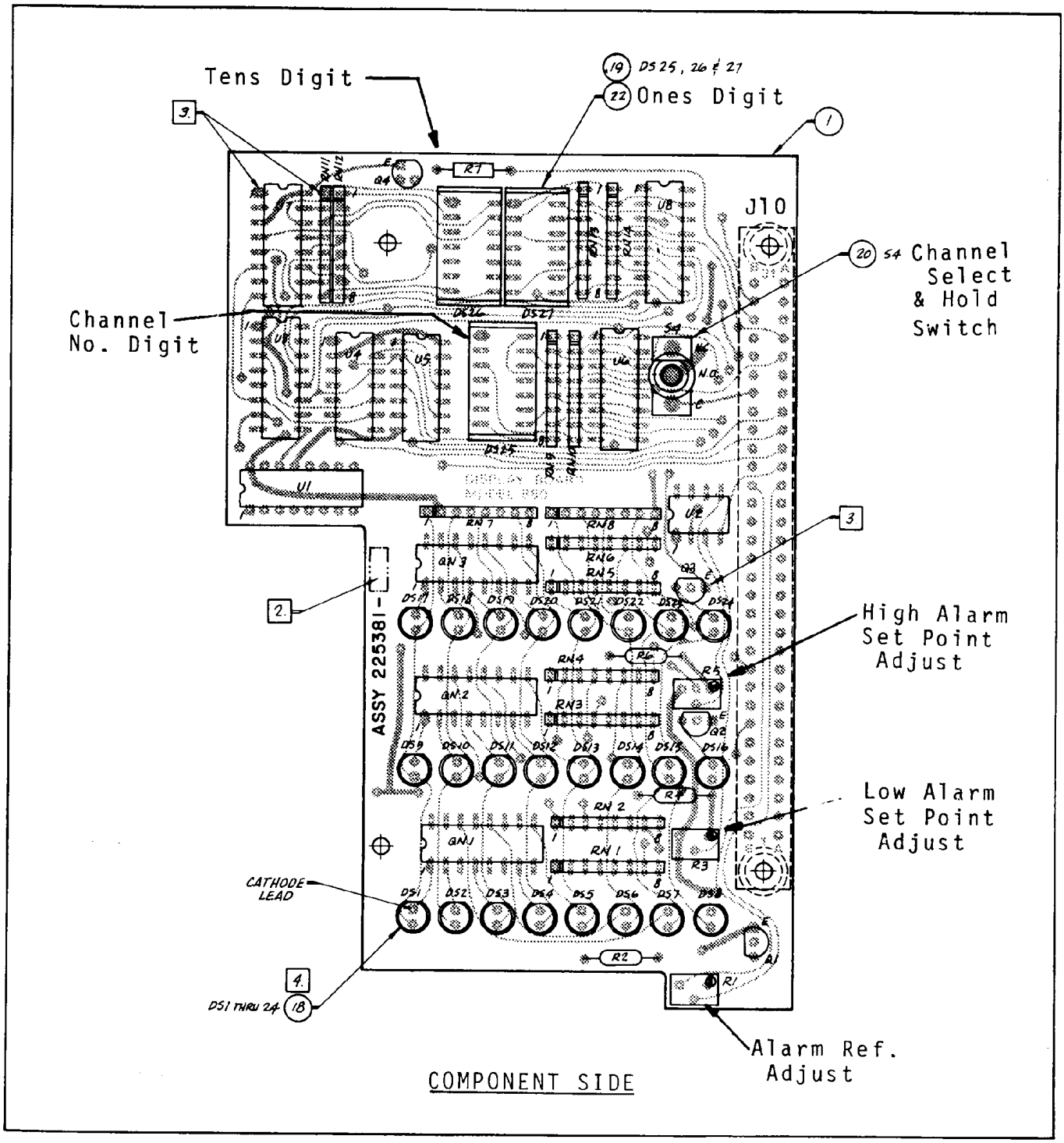


Figure 4-11. Display Board PWA Assembly

SECTION 5
RECOMMENDED SPARES

The recommended quantity and type of suggested spare parts depends upon the total number of instruments used in the system. The minimum spare parts recommended are listed in Table 5-1 together with their part numbers

Table 5-1. Recommended Spares

ITEM	PART NUMBER	MANU-FACTURER PART NUMBER	MANU-FACTURER CODE	MINIMUM QUANTITY
880 Controller	225474			1 per 12 Controllers
808 Remote Calibration Unit	225475			1 per 20 Remote Calibration
Lamp, Indicator	162345	7382AS-25	05464	1 per Controller
Sensor	225006			1 per 5 Sensors
Relay	156077	67R4-12DC	78277	1 per 10 Controllers
Dust Cover	225312			1 per 5 Sensors
Remote Calibration Meter	225198			

Table 5-2. Manufacturers Code Numbers and Addresses

CODE	MANUFACTURER	ADDRESS
05464	Industrial Electronic Engineers, Inc.	Van Nuys, Calif.
78277	Sigma Instruments, Inc.	Braintree, Mass.

CAUTION

The power supply transformer is specifically designed for use with the 880 Controller. If a transformer must be replaced order P/N 225622 from the factory.

SECTION 6
OPTIONS AND ACCESSORIES

6.1 GENERAL

This section describes the options and accessories available for use with the Rexnord gas detection systems.

6.2 PWA EXTENDER CARD

The PWA extender card (Figure 6-1) is required to provide access to internal 880 circuitry or functions described in Sections 3 and 4.

6.3 CALIBRATION GAS KIT

The Rexnord calibration gas kit (Figure 6-2) provides a convenient and reliable method of calibrating the gas detection system. The kit consists of a sphere of the specified type of gas, a gauge which indicates the quantity of gas in the sphere, an adapter, and a carrying case.

6.4 CALIBRATION METER

The calibration meter (Figure 6-3) is used with the calibration gas kit for system calibration.

6.5 DUST COVER

The dust cover is available as an option to prevent the sensor flame arrester from becoming clogged when operated in dusty or dirty areas.

6.6 INDIVIDUAL ALARM OPTION

Provides low and/or high alarm NO or NC contact or open collector transistor sink outputs for each channel.

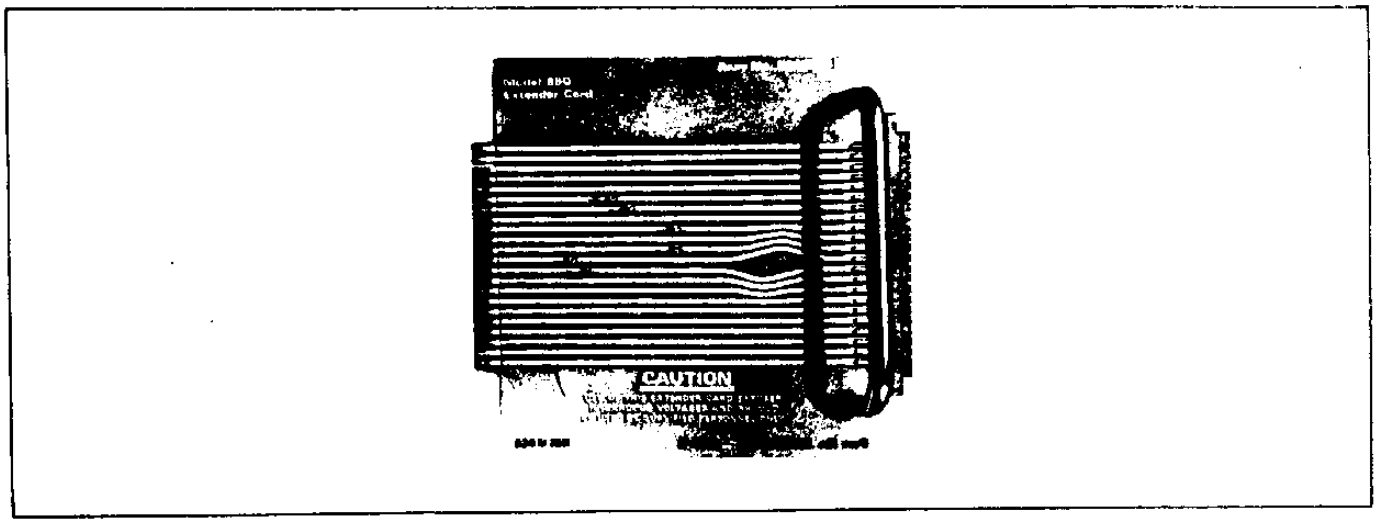


Figure 6-1. PWA Extender Card

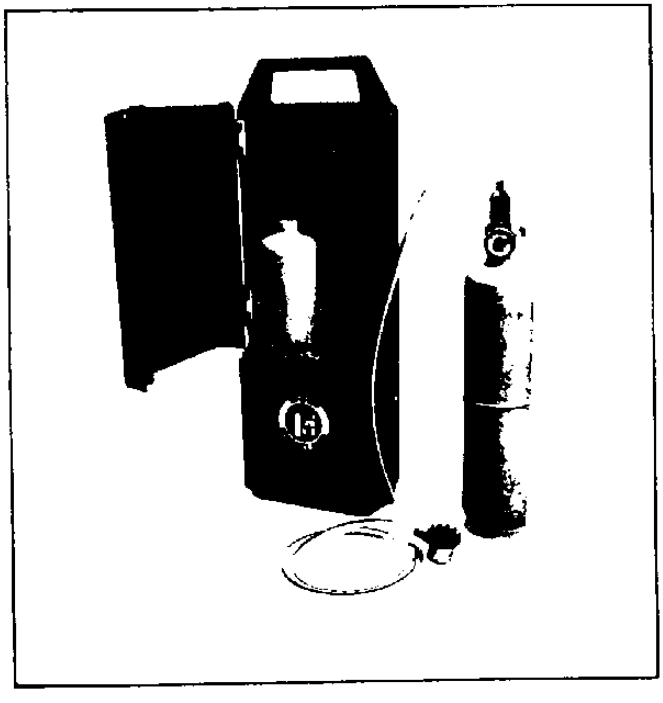


Figure 6-2. Calibration Gas Kit

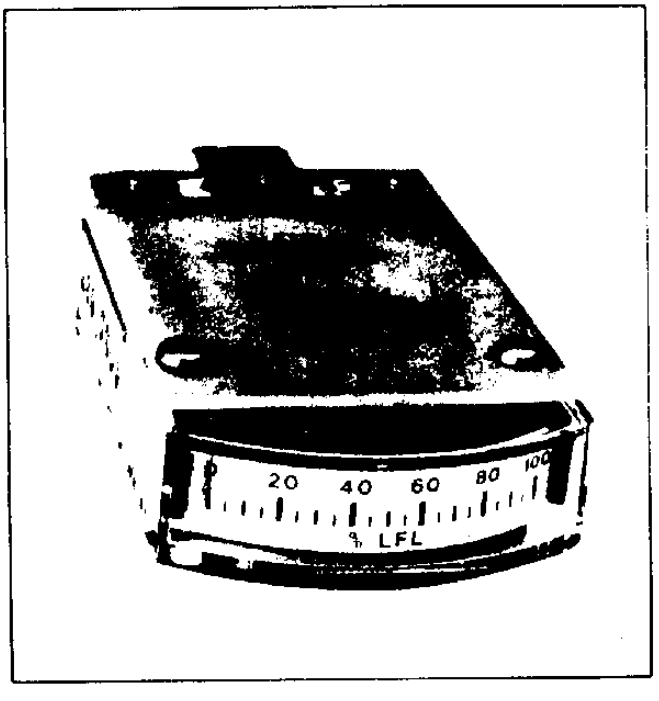
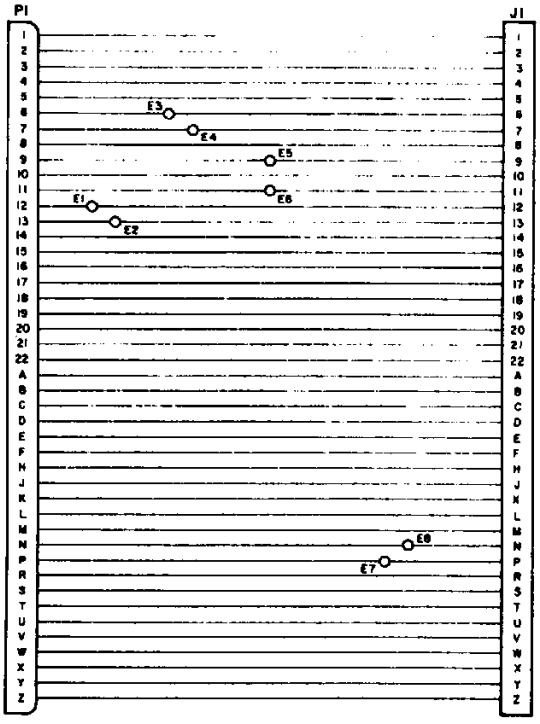


Figure 6-3. Calibration Meter



NOTES:

1. TO MAINTAIN N.C. CONTACTS TO EXTERNAL EQUIPMENT DURING REPEATED CONTROLLER REMOVAL AND REPLACEMENT OR ACTIVE ALARM TESTING, THE JUMPERS CAN BE INSTALLED AS SHOWN IN THE TABLE BELOW.

JUMPER BETWEEN	N.C. CONTACT CLOSURE MAINTAINED
E3 TO E4	HIGH ALARM N.C.
E5 TO E6	LOW ALARM N.C.
E1 TO E2	ONE SET TROUBLE ALARM N.O. (N.C. DURING POWER ON)
E7 TO E8	SECOND SET TROUBLE ALARM N.O. (N.C. DURING POWER ON)

BEFORE INSTALLING THE JUMPERS NOTED IN THE TABLE, BE SURE THAT EXTERNAL CONNECTIONS UPON ALARM CONTACT CLOSURE WILL NOT CAUSE EXTERNAL SYSTEM FAULT OR MALFUNCTION.

225671A

Figure 6-4. Extender Card Schematic

MODEL 880 SYSTEM SPECIFICATIONS

AS VERIFIED BY FACTORY MUTUAL

RANGE:	0-99% LFL (LEL)
POWER:	105-130 VAC, 60 Hz; 18-30 VDC (Standard) 215-245 VAC, 50 Hz; 18-30 VDC (Standard)
SYSTEM RESPONSE TIME:	90% Reading of maximum indicated gas concentration in less than 30 seconds.
OPERATING TEMPERATURE:	CONTROLLER - 0° to 50°C (32° to 122°F) SENSOR/TRANSMITTER - 40° to 75°C (-40° to 167°F)
STORAGE TEMPERATURE:	-35° to 55°C (-31°C to 131°F)
RELATIVE HUMIDITY:	10% to 90% (Sensor Assembly)
MAXIMUM RESISTANCE:	20 OHMS Closed Loop
ALARM RELAYS:	ONE SET SPDT 3A, 115 VAC resistive relay for each alarm function (LOW, HIGH, TROUBLE).

SECTION 7
CAUSES OF SIGNAL LOSS IN CATALYTIC TYPE COMBUSTIBLE GAS SENSORS

Interfering or contamination gases or substances which may adversely affect proper operation of the instrument are as follows:

A. Materials that may clog the pores of the flame arrestor thereby reducing the gas diffusion rate into the sensor are:

1) Dirt and Oil

a. A dust cover should be installed to protect the flame arrestor whenever these conditions exit.

b. The dust cover can be cleaned as part of routine maintenance. Clean in an organic solvent using an ultrasonic bath.

2) Corrosion Products

a. This occurs when Cl_2 (chlorine) or HCl are present. A dust cover provides some protection.

b. Replace the dust cover as part of routine maintenance.

3) Flame arrestor clogged during painting and house cleaning.

a. The sensor should be covered by a plastic bag. Remove the bag as soon as possible. Make this a check point in your maintenance procedures.

4) Polymer formation in the flame arrestor

a. This sometimes occurs where monomer vapors such as 1, 3 butadiene, styrene, isoprene, etc., are present.

B. Substances that cover or tie up the active sites on the catalytic surface of the sensor's active element.

This occurs in the presence of volatile metal organics, gases, or vapors of hydrides, and volatile compounds containing phosphorous, boron, silicon, etc.

EXAMPLES:

lead tetraethyl
phosphine
diborane
silane
trimethyl chlorsilane
hydrogen fluoride
boron trifluoride
phosphate esters
silicone oils and greases
RTV silicone sealants

C. The catalytic metals are removed from the sensor's active elements.

1) Some substances react with the catalytic metal forming a volatile compound. This erodes the metal from the surface and, given sufficient exposure to these types of material, all or most of the metal catalyst can be removed from the surface of the sensor's active element.

2) Halogens and halogen containing compounds are materials of this nature.

EXAMPLES:

Chlorine
Bromine
Iodine
Hydrogen chloride, bromide or iodide
Organic halides
Trichloroethylene
dichlorobenzene
vinyl chloride
freons
Halon 1301
(Bromotrifluoromethane)

3) A brief exposure to one of these materials may increase the sensitivity of the sensor. This is usually a temporary effect as a result of etching the catalytic surface.

This is sometimes used as a means to activate a sensor that has a degraded signal. *THIS IS A PRACTICE THAT IS UNRELIABLE AND MAY GIVE A FALSE SENSE OF SECURITY.*

D. Extended exposure to high concentrations of combustible gases and air.

1) Extended exposure of a detector element to certain concentrations of combustible gases and/or air can introduce stress to the element that may seriously affect its performance, and therefore re-calibration should be carried out or the sensor replaced, or both, after an alarm due to an indication of a high concentration.

E. The degree of damage to a sensor is a combination of the type of contaminant, its concentration in the ambient atmosphere and the length of time the sensor is exposed.

1) The loss of sensitivity is generally discovered when the sensor is calibrated. When this occurs, first ascertain whether the calibration has been correctly carried out, the calibration system is functioning properly, and the correct gas mixture is being used.

2) The calibration schedule should reflect the probable exposure of the sensor to known conditions that affect the quality of sensor signal.

3) When it is known that the sensor has been exposed to high concentrations of a poison, extended exposure to high concentrations of combustible gas/air mixtures, or other unusual conditions, it should be recalibrated at that time and a few days later to look for a significant shift in its sensitivity.

APPENDIX A
THE 880 INDIVIDUAL ALARM OPTION-II (IAO-II) AND 4-20 mA CURRENT LOOP OUTPUT AUXILIARY PCBs AND ITS OPERATION

A.1 PURPOSE

The purpose of the 880 Individual Alarm Option-II Board (hereafter called the "IAO-II" board) is three fold. First it provides the user with the options of selecting normally open or normally closed, normally de-energized or normally energized alarm relay contact outputs on all eight low and high alarm channels.

Secondly, a transistor open collector current sink output option can be used to drive external interface circuitry such as; control relays, TTL inputs, optoisolators, etc.

Lastly, it provides both mechanical and electrical support for the 4-20 mA current loop output (hereafter called the 4-20 mA board). In addition, external user supplied reset switches can be connected at a remote site to parallel the functions of the front panel reset switches.

A.2 OUTPUT OPTIONS

A. Relay contacts

1) Normally open, normally de-energized, both high and low alarm. (P/N 226408-03)
2) Normally closed, normally de-energized, both high and low alarm. (P/N 226408-06)
3) Normally open, normally energized, both high and low alarm. (P/N 226408-103)
4) Normally closed, normally energized, both high and low alarm. (P/N 226408-106)

B. Transistor open collector outputs

1) Normally off, both high and low alarm (P/N 226408-18)
2) Normally on, both high and low alarm (P/N 226408-118)

C. 4-20 mA current loop output board

1) 4-20 mA option PCB with one of the required options shown in A. or B. above, P/N 226425-01
2) 4-20 mA option only, no IAO-II function (P/N 226420-01) Includes a 4-20 mA board, blank IAO-II board, and connectors.

D. IAO-II terminal motherboard

1) Rack mount-19" rack (P/N 226457-01)
2) Single unit panel mount (P/N 226461-01)

A.3 TECHNICAL SPECIFICATIONS

A. IAO-II Board

1) Relay contact maximum rating @ T_{air} = 0 °C to 70 °C

Current carrying capacity (under resistive load):
3A @ 30V DC or 3A@ 120V AC

Initial contact resistance ≤ 0.1Ω

Life expectancy (under full load)
≤ 100,000 operations

Bounce time ≤ 1 millisecond

2) Transistor open collector output* at the maximum recommended values:

Power dissipation (Pd) per device
0.625W @ 25 °C,
0.265W @ 70 °C

V_{ceo} ≤ 32Vdc

I_c ≤ 425mAdc @ T_{air} = 25 °C to a minimum of 140mAdc @ T_{air} = 70 °C

V_{ce} – (sat) ≤ 0.5Vdc @ T_{air} = 25 °C and I_c = 100mAdc.

*For more detailed information, please consult device manufacturer's data sheet, your local Rexnord representative, or factory in Sunnyvale, California.

B. 4-20 mA current loop output board @ T_{air} = 0 °C to 70 °C

Minimum controller ac line voltage = 100 V

Load resistance range** = 200Ω to 650Ω

**Even though resistance under specified range will not cause any harm to the circuit, it is not recommended.

Output current range
minimum is 4 mA d.c.
maximum is 19.84 mA (current limited at 35mA d.c. maximum)

Accuracy (assuming both the transmitter and controller have been correctly adjusted),
±4% over temperature range
±3% @ 25 °C

Output current range
minimum is 1.5 mA d.c.
maximum is 35 mA d.c.

Maximum ripple and noise current
0.1 mA peak to peak

A.4 OUTPUT CONNECTIONS

A. Relay contact output

Shown in Figure A-1 is the terminal block output connection for the IAO-II mother board. The terminal block will accept wire size as large as 14 AWG. The outputs are grouped in numerical order to facilitate installation.

B. Transistor open collector output

For the transistor open collector output, "POWER GROUND" terminals should be used for grounding. The user has to provide external power supply not exceeding the device's power rating. Figure A-2 shows some typical applications.

CAUTION

When sinking an inductive load, a free-wheeling diode must be installed on the inductor to prevent the transistor from being damaged by back EMF.

WARNING

The "ANALOG GROUND" is for testing purposes only. Do not connect any wire to this terminal.

C. 4-20 mA current loop output

A true-differential (as opposed to common ground) input amplifier should be used to interface the output in order to avoid any ground-loop hazzard. A buffer amplifier should be added if a true-differential input amplifier is not available. Even though the 4-20 mA current loop circuit will not be damaged by using loads that are outside the 200Ω to 650Ω range, pro-longed operation under these loads can decrease the circuit's reliability and accuracy.

Since the output of the current-loop is directly proportional to the sensing resistor, it is imperative that only high quality low tolerance, low temperature coefficient resistors be used.

CAUTION

Keep in mind the power dissipation of the sensing resistor should be enough to handle worst case conditions. For example: using a 250Ω sensing resistor and assuming out of calibration worst case current is 35 mA, power dissipation is 250Ω × (0.035 A)² = 0.3W dc. Thus a 3W or higher power resistor should be used.

The controller itself has to be calibrated carefully because any error in the controller will be reflected in the current-loop output. Calibration of individual channels should be done by referring to the output of the 4-20 mA rather than to the front panel display. The connection between the current loop output and the sensing resistor should be made by using twin center lead shielded wire, with the shield tied to ground or guard point of the receiving device to minimize Radio Frequency Interference (RFI). Figure A-3 shows some typical applications of the current loop output.

CAUTION

When using shielded wire, connect the shield only at the receiver's end. DO NOT CONNECT at the controller earth ground terminal.

WARNING

The channel (+) outputs for all the eight current loop outputs is directly connected to +24V supply. Shorting this side to the chassis, analog ground or power ground will blow a fuse (F1) located on the 4-20 mA board.

A.5 PROGRAMMING JUMPERS FOR RESET AND CALIBRATION MODE OPERATION

There are two major modes of alarm relay reset operation in the 880 IAO-II board. They are selected by putting in the appropriate jumpers. The setting of programming jumpers on the IAO-II board will have absolutely no effect on the controller's front panel switches. A front view of the programming jumper positions is shown in Figure A-4.

A. Automatic reset mode

In the automatic reset mode, the alarm will be reset as soon as the gas concentration goes below the alarm set point. The user has the option of selecting high, low or both alarms to operate in this mode. However, *individual channel selection is not available.*

To set the IAO-II board into the automatic reset mode:

High Alarm
1) Short TB5-8 to TB5-9
2) Select jumpers W19, W21, W23, W25, W27, W29, W31 and W33

Low Alarm
1) Short TB6-8 to TB6-9
2) Select jumper W1, W3, W5, W7, W9, W11, W13 and W15

B. Manual reset mode

In the manual reset mode, each channel can be set independently.

1) Reset if and only if gas is below alarm set point. In this mode, the reset function on the external user supply switch will be disabled if the gas is at or above the alarm set point.

2) Reset even if gas is at or above alarm set point. In this mode, reset is possible with the external switch no matter what the gas level is. (Note that if gas is at or above alarm set point, the alarm will come on if the no alarm-alarm cycle occurs again).

C. Calibration mode (Cal-mode) operation

Alarm relay outputs can be programmed to be active (energized) or passive (inhibited) upon alarm during calibration if the controller Cal-mode Inhibit is correctly programmed (refer to section 3.2.7, page 3-9). This function applies to both high and low alarm on all eight channels. See Figure A-4 for jumper settings.

CAUTION

If the alarm test switch on the controller logic board is set to be active (S2-1 off or open), then both Channel 1 high and low alarm on the IAO-II board will be latched whenever the CAL-MODE pushbutton is depressed. However, this situation will not occur if passive alarm test is selected (S2-1 on or closed). The controller is shipped with this switch set to the passive position; it is recommended that this switch remain in this position to prevent false alarms.

D. Trouble inhibit

The alarm relay output will be inhibited when a trouble condition is sensed by the controller. This can happen when the line voltage is below 90V or when opens in transmitter power lead wiring is sensed.

WARNING

The trouble condition will also reset all the alarms that were latched.

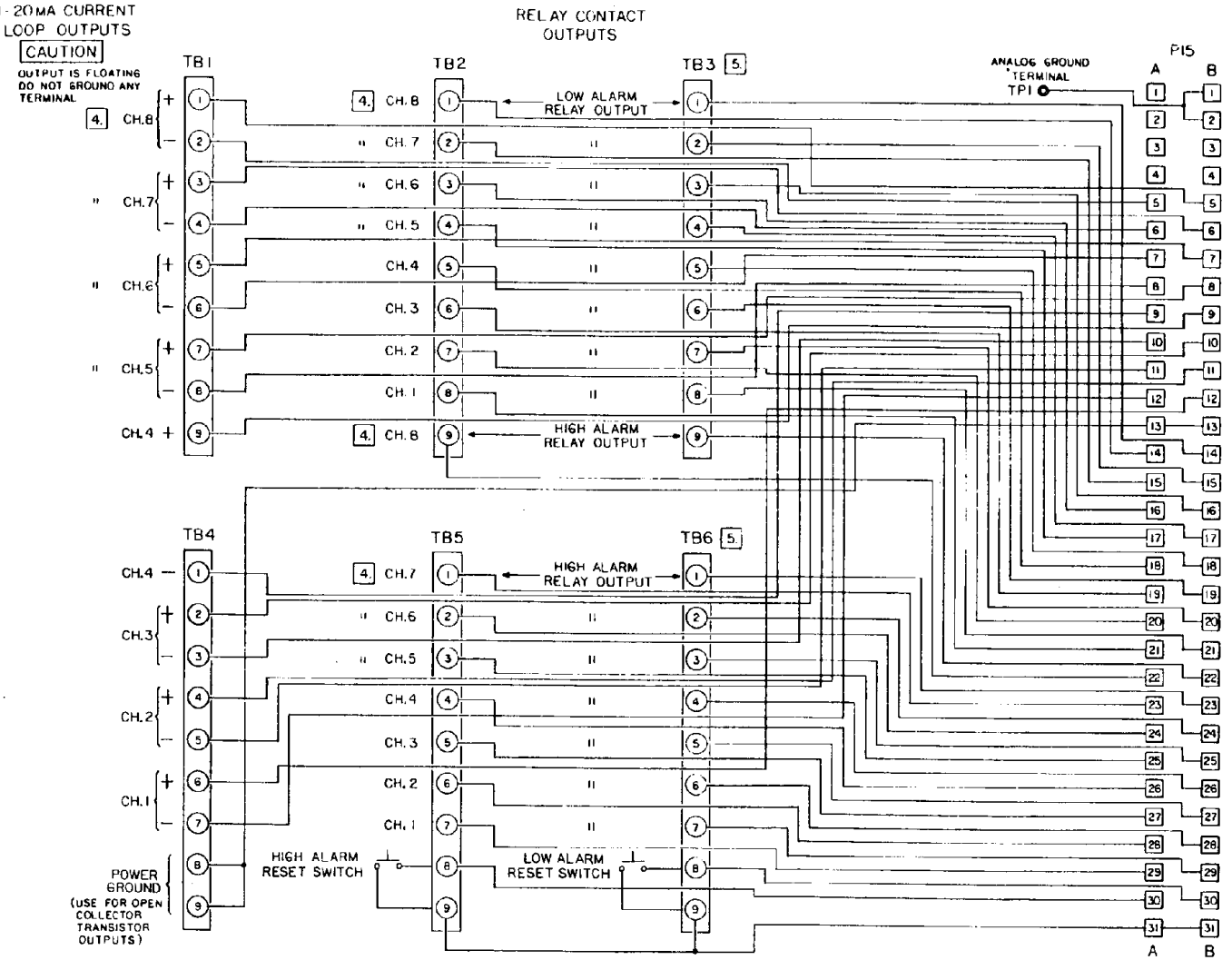
E. What is inhibit as it appears to relay options?

Inhibit means that relay is **not energized** for both normally de-energized or normally energized option. In normally open contact the contact will be open. In normally closed contact, the contact will be closed.

A.6 COOLING REQUIREMENT FOR THE 880 WITH IAO'S

When the IAO board is installed on the 880 controller, air flow through the unit is restricted. It is vital that air holes in or any passages around the controller are free of any obstructions, especially when more than one rack is stacked together. A cooling fan inside the rack cabinet is recommended.

A cooling fan is **mandatory** when the normally energized relay option is chosen. The increase in temperature inside the controller is caused by the energized relay coils (8 watts typical) and the higher transformer load (thus increased case temperature). It is imperative that a more efficient heat transfer cooling fan be used to prevent excessive temperature buildup or possible system failure.



NOTES:

1. DIAGRAM SHOWS CONNECTIONS AS VIEWED FROM REAR OF RACK.
2. TB1-6 NOMENCLATURE DESIGNATES CUSTOMER EXTERNAL CONNECTIONS.
3. P.W.B. REORDER NUMBER IS: 226461-01 (SINGLE UNIT PANEL MOUNT) AND 226457-01 (19" RACK).
4. NO CONNECTION TO CHANNELS 5-8 FOR 740 APPLICATIONS.
5. WHEN OPTION 226408-18 OR -118 (TRANSISTOR OPEN COLLECTOR OUTPUT) ARE USED TB3 & 6 ARE THE TRANSISTOR COLLECTOR SIDES.

(REF. 226454, Issue A)

Figure A-1. IAO-II Motherboard Interconnect Diagram

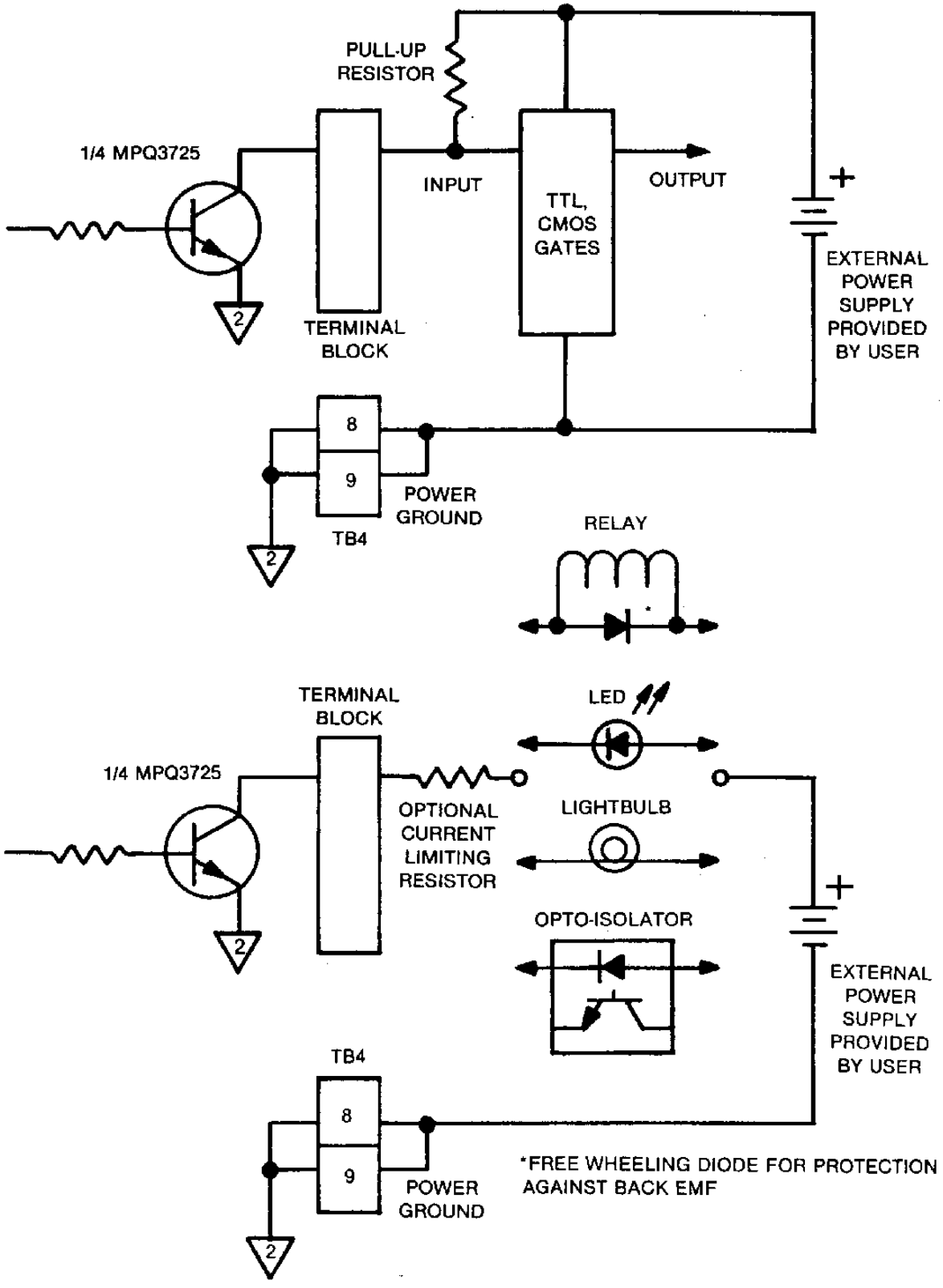


Figure A-2. Transistor open collector output applications

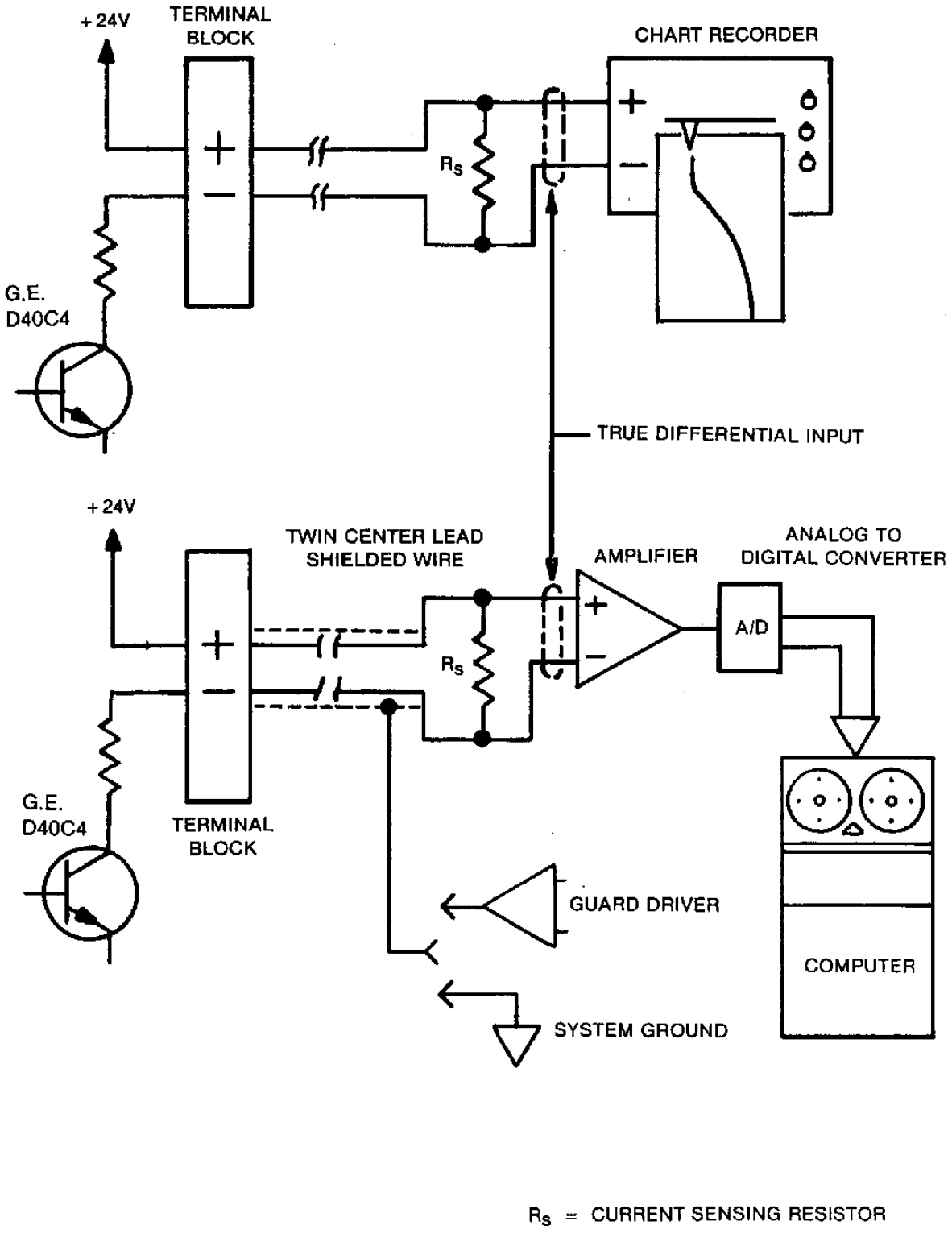
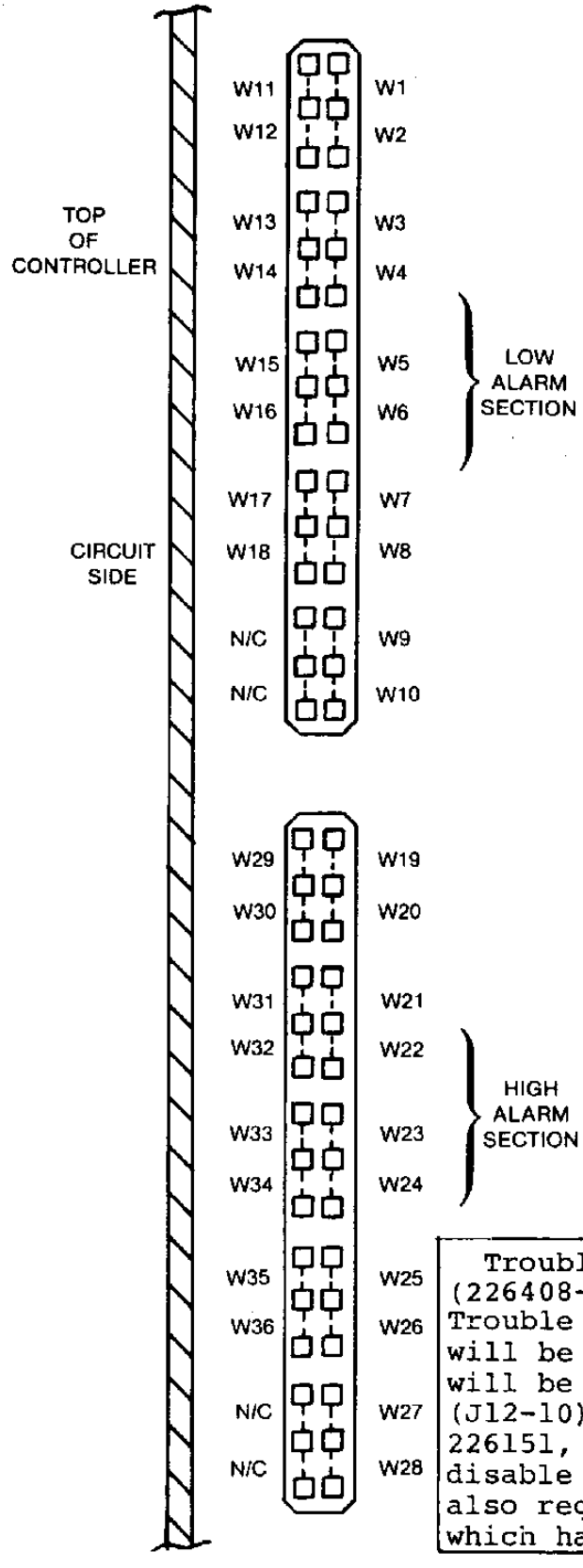


Figure A-3. 4-20 mA current loop output applications



ALARM RELAY RESET OPTIONS

ALARM SECTION	CHANNEL	RESET IF AND ONLY IF GAS IS BELOW ALARM SET POINT. * (ALSO FOR AUTOMATIC RESET MODE)	RESET EVEN GAS IS AT OR ABOVE ALARM SET POINT.
LOW	1	W1	W2
	2	W3	W4
	3	W5	W6
	4	W7	W8
	5	W9	W10
	6	W11	W12
	7	W13	W14
	8	W15	W16
HIGH	1	W19	W20
	2	W21	W22
	3	W23	W24
	4	W25	W26
	5	W27	W28
	6	W29	W30
	7	W31	W32
	8	W33	W34

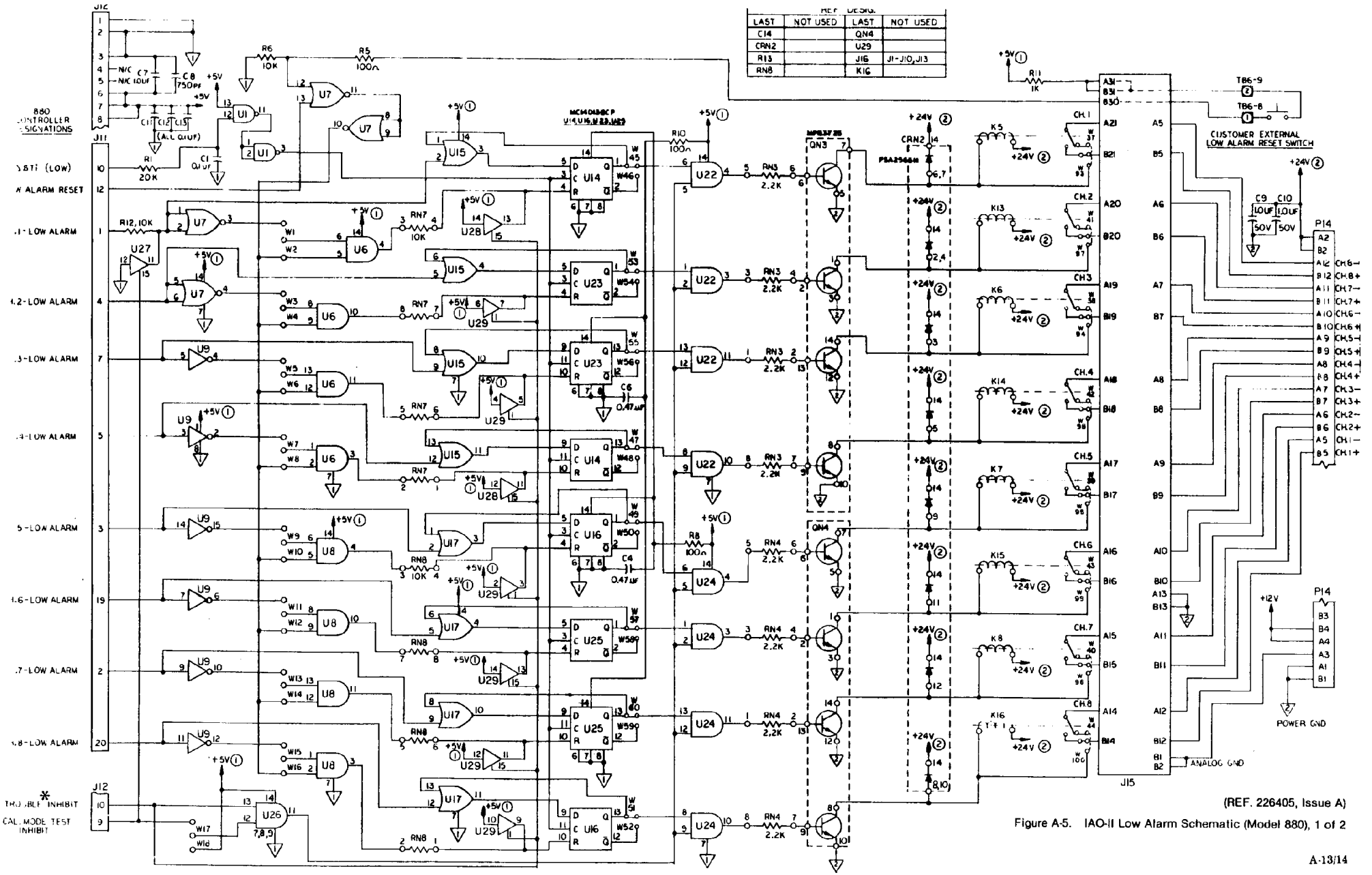
*For automatic reset—Install jumpers (odd numbered) noted in table above, then short terminals TB5-8 to TB5-9 (High Alarm) and/or terminals TB6-8 to TB6-9 (Low Alarm). Also see Figure A-1, page A-7/8.

CAL MODE OPERATION

ALARM (ALL 8 CHANNELS)	ACTIVE-ENABLE DURING CALIBRATION	PASSIVE-INHIBITED DURING CALIBRATION
LOW	W18	W17
HIGH	W36	W35

CAUTION

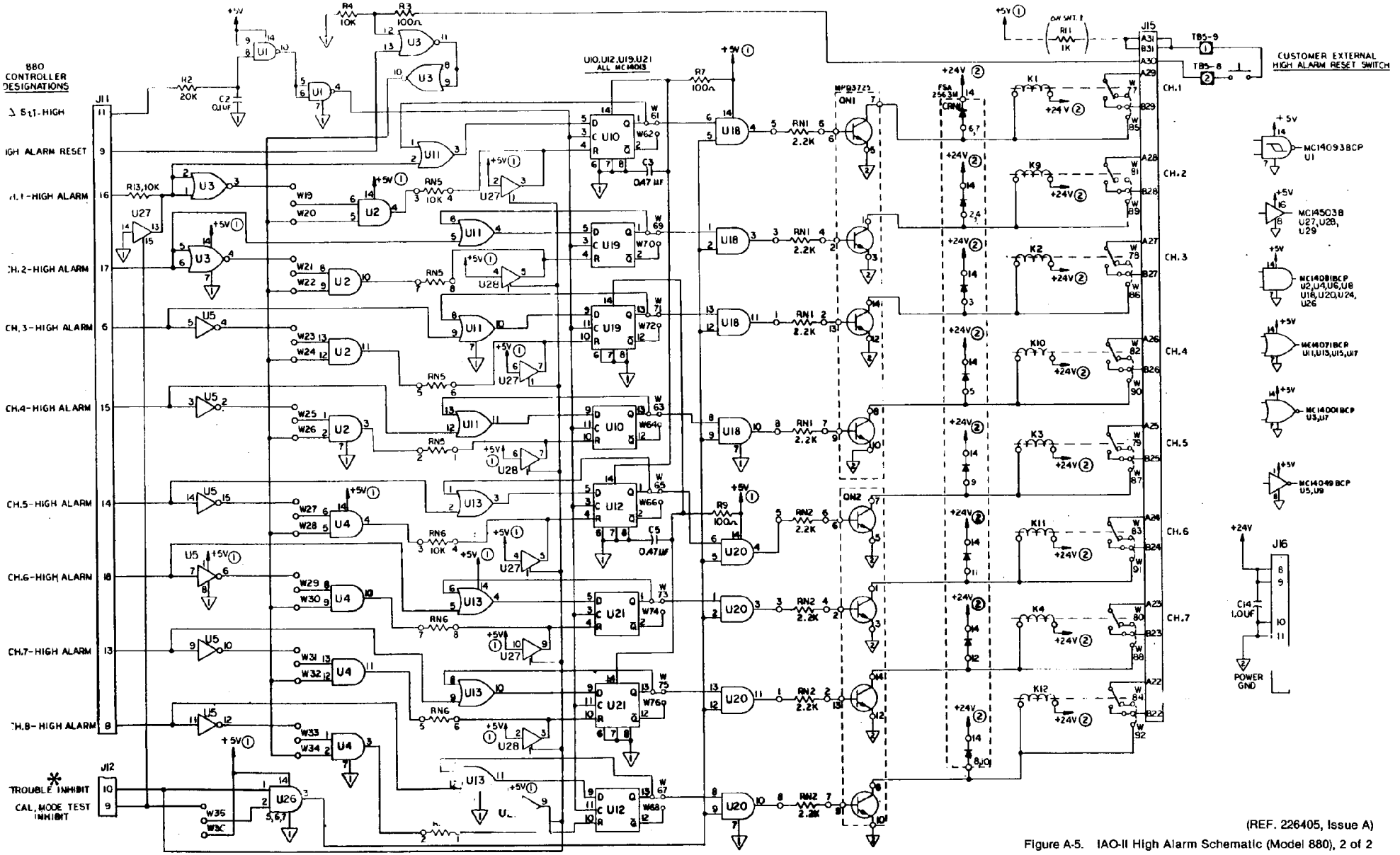
Trouble Inhibit and normally "energized" relays (226408-103/106) or "ON" transistor (226408-118): Trouble Inhibit cannot be disabled, thus all relays will be de-energized or open collector transistors will be turned "off" when the Trouble Inhibit signal (J12-10) is low indicating a trouble condition. Board 226151, Rev E, must be purchased (has 10W relays) to disable the Trouble Inhibit function. This option also requires a different motherboard (226156, Rev B) which has a 44-pin connector.



(REF. 226405, Issue A)

Figure A-5. IAO-II Low Alarm Schematic (Model 880), 1 of 2

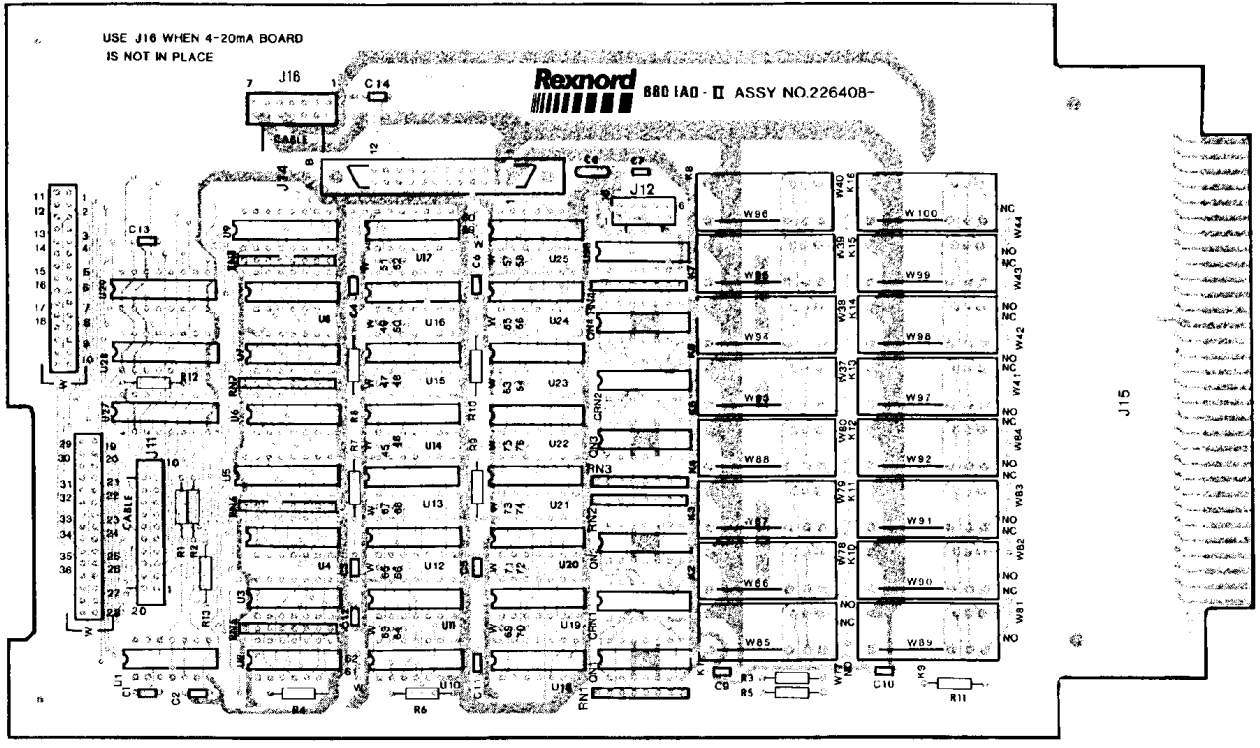
*WARNING: TROUBLE INHIBIT MUST BE DISABLED(J12-PIN 10 REMOVED & U26-13 CONNECTED TO +5V) FOR NORMALLY ENERGIZED RELAYS OR FALSE ALARMS COULD RESULTS.(SEE CAUTION NOTE,PAGE A-11)



(REF. 226405, Issue A)

Figure A-5. IAO-II High Alarm Schematic (Model 880), 2 of 2

*WARNING: TROUBLE INHIBIT MUST BE DISBALED (J12-Pin 10 REMOVED & U26-1 CONNECTED TO +5V) FOR NORMALLY ENERGIZED RELAYS OR FALSE ALARM COULD RESULT. (SEE CAUTION NOTE, PAGE A-11)



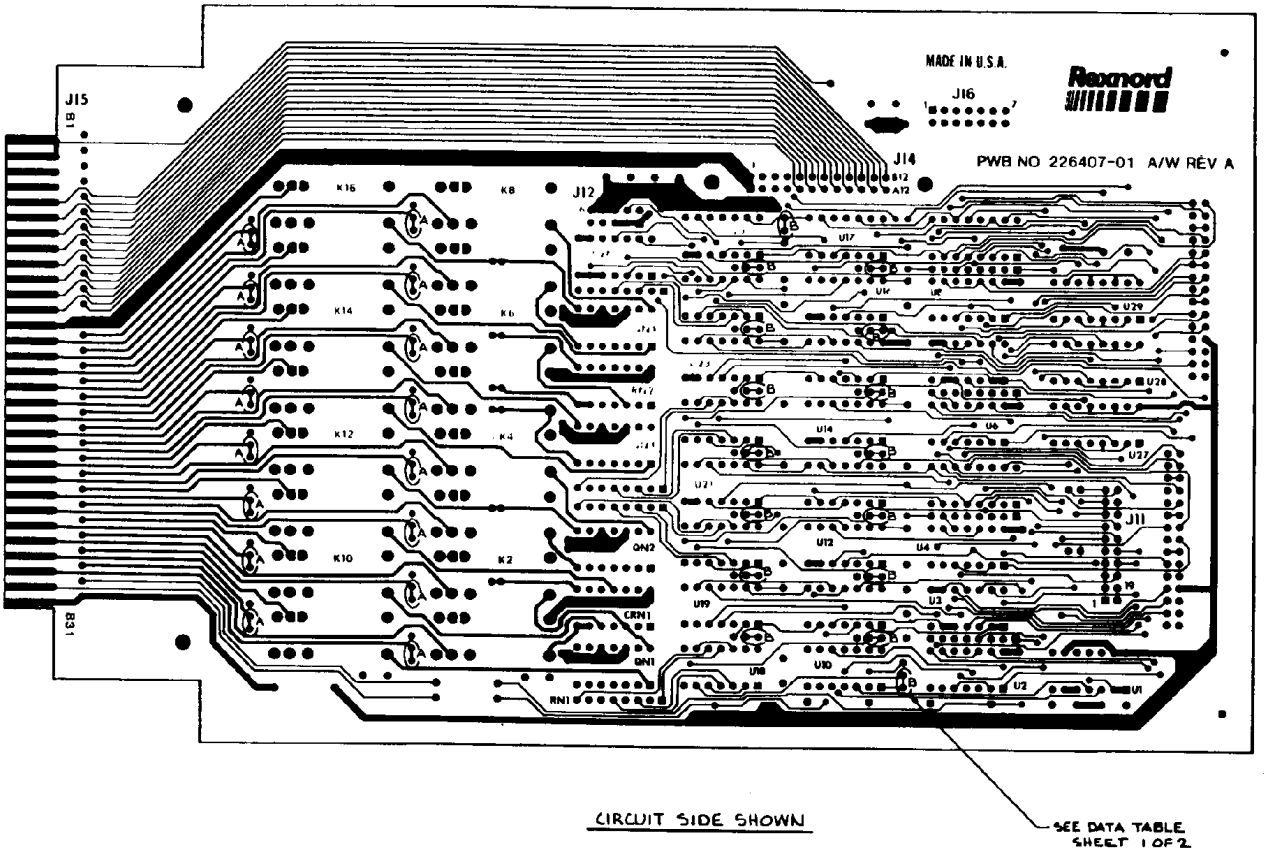
NOTES:

1. ASSEMBLY NUMBER IS:226406-xx(SEE DATA TABLE).
2. MARK DASH NUMBER AND ISSUE LETTER WHERE SHOWN.
3. SQUARE PADS INDICATES:POSITIVE LEAD OF CAPACITOR. PIN 1 OF DEVICE,CATHODE LEAD OF DIODE AND EMITTER OF TRANSISTOR.

DATA TABLE		MODIFICATIONS TO BE MADE	
VERSION	DESCRIPTION	TRACES TO BE CUT (CIRCUIT SIDE)	JUMPERS TO BE INSTALLED
-03	LOW & HIGH ALARM,NORMALLY OPEN,NORMALLY DE-ENERGIZED		
-06	LOW & HIGH ALARM,NORMALLY CLOSED,NORMALLY DE-ENERGIZED	TRACES LABELED "A"	W37-44 & W77-84
-103	LOW & HIGH ALARM,NORMALLY OPEN,NORMALLY ENERGIZED	TRACES LABELED "B"	W46,48,50,52,54,56,58,60,62,64,66,68,70,72,74 & 76
-106	LOW & HIGH ALARM,NORMALLY CLOSED,NORMALLY ENERGIZED	TRACES LABELED "A & B"	W46,48,50,52,54,56,58,60,62,64,66,68,70,72,74,76 & W37-44,W77-84
-18	LOW & HIGH ALARM,TRANSISTOR OPEN COLLECTOR OUTPUT NORMALLY OFF		W85-100
-118	LOW & HIGH ALARM,TRANSISTOR OPEN COLLECTOR OUTPUT NORMALLY ON	TRACES LABELED "B"	W46,48,50,52,54,56,58,60,62,64,66,68,70,72,74,76 & W85-100

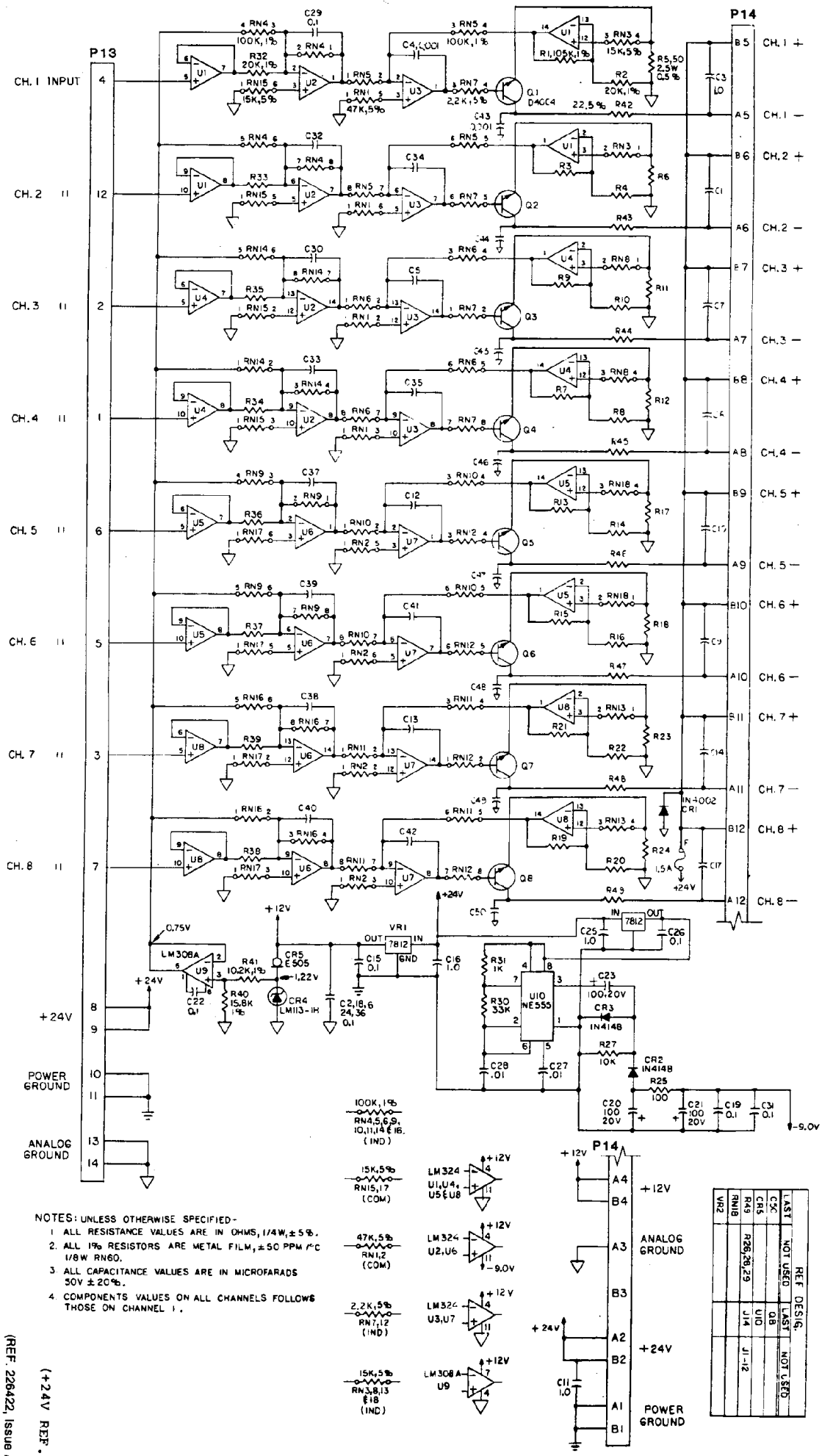
(REF. 226408, Issue A)

Figure A-6. IAO-II Printed Wiring Board (Model 880), 1 of 2



(REF. 226408, Issue A)

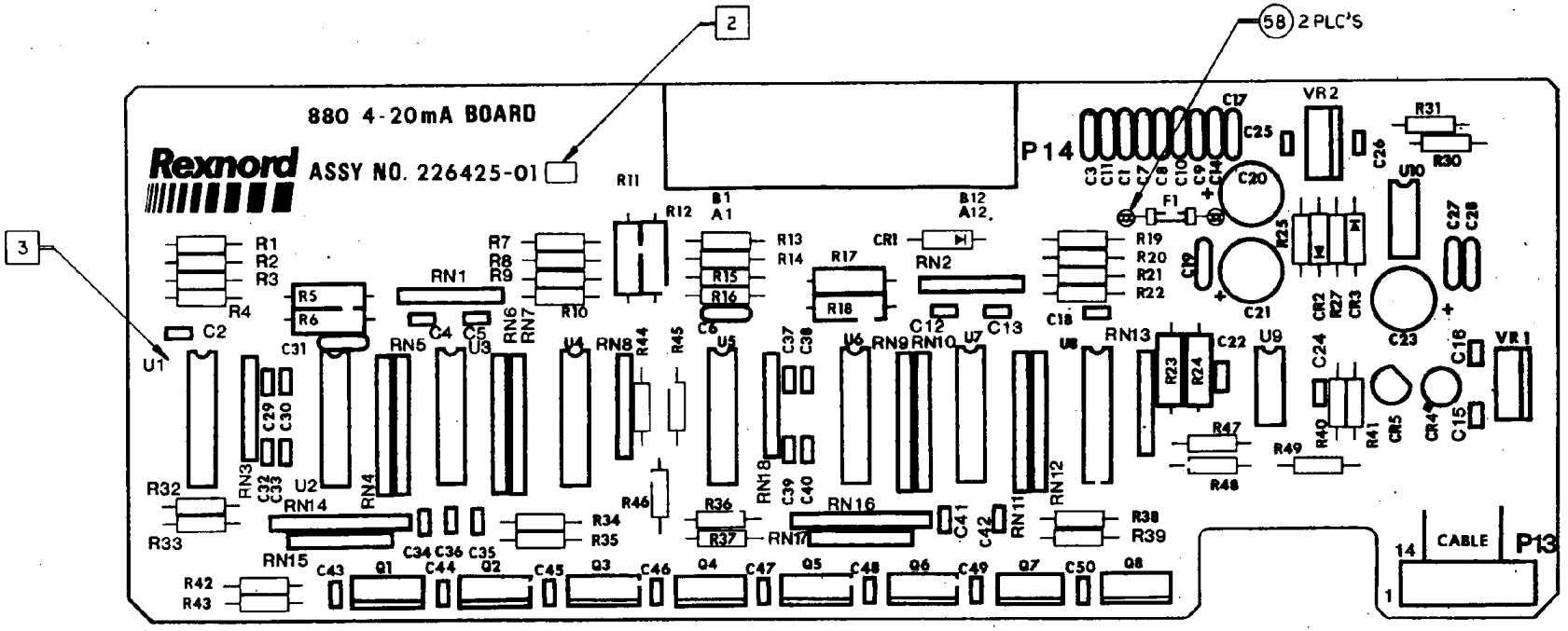
Figure A-6. IAO-II Printed Wiring Board (Model 880), 2 of 2



NOTES: UNLESS OTHERWISE SPECIFIED-

1. ALL RESISTANCE VALUES ARE IN OHMS, 1/4W, ± 5%.
2. ALL 1% RESISTORS ARE METAL FILM, ± 50 PPM /°C 1/8W RN60.
3. ALL CAPACITANCE VALUES ARE IN MICROFARADS 50V ± 20%.
4. COMPONENTS VALUES ON ALL CHANNELS FOLLOWS THOSE ON CHANNEL 1.

Figure A-7. 4-20 mA Board Schematic (Model 880) (REF. 226422, Issue A)



COMPONENT SIDE

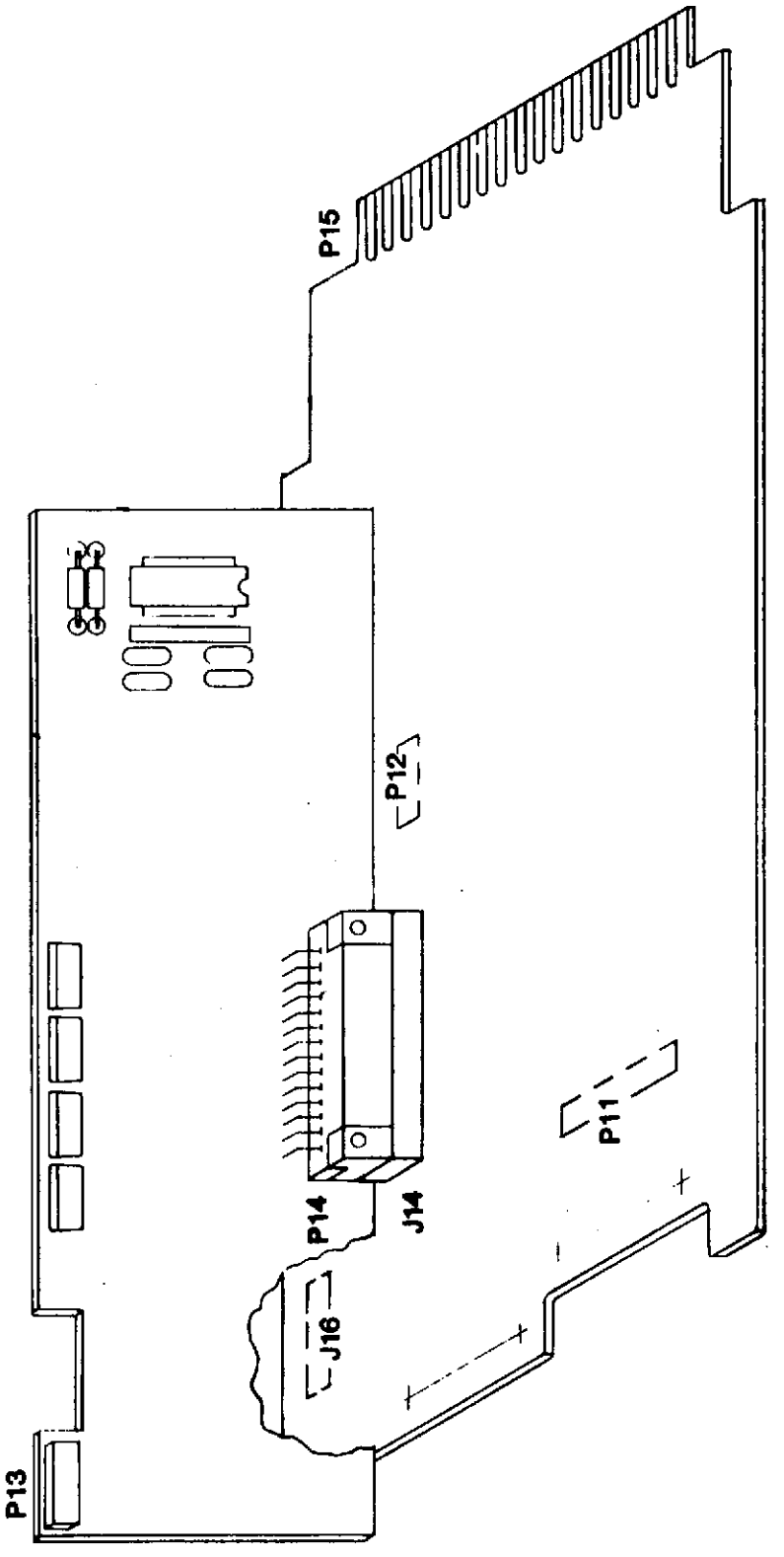
NOTES:

1. ASSEMBLY NUMBER IS : 226425— 01, Issue A

2. **MARK DASH NUMBER AND ISSUE LETTER WHERE SHOWN.**

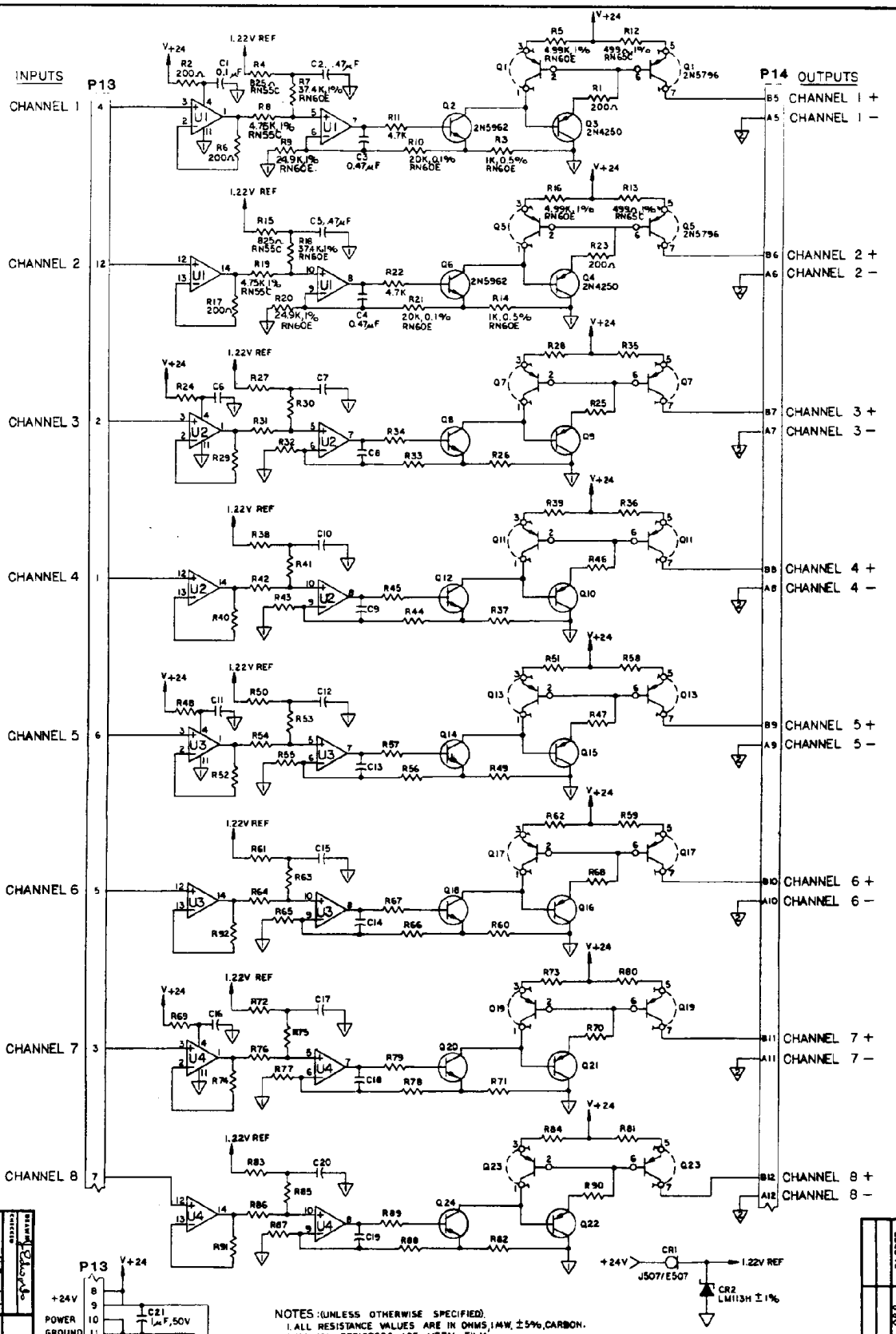
3. **SQUARE PADS INDICATES : POSITIVE LEAD OF CAPACITOR, PIN 1 OF DEVICE, CATHODE LEAD OF DIODE AND EMITTER OF TRANSISTOR.**

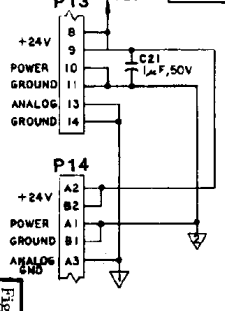
4. METHOD OF INSTALLATION WITH IAO BOARD REF(TEMPORARLY MOUNT ITEMS (49) & (50) TO CONNECTOR FOR LATER EASE OF ASSY).



NOTES:
1. ASSEMBLY NO. IS: 226420-01. (REF. 226420, Issue A)

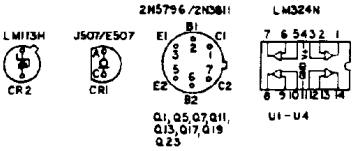
Figure A-9. 4-20 mA Option Only





NOTES: (UNLESS OTHERWISE SPECIFIED).
1. ALL RESISTANCE VALUES ARE IN OHMS, 1/4W, ±5%, CARBON.
2. ALL 1% RESISTORS ARE METAL FILM.
3. ALL CAPACITANCE VALUES ARE IN MICROFARADS 50V ±20%.
4. COMPONENTS CONNECTIONS AND PART VALUES ON CHANNEL PAIRS: "3 E 4", "5 E 6", E "7 E 8" ARE THE SAME AS ON CHANNELS "1 E 2".

REF DESIG.			
LAST	NOT USED	LAST	NOT USED
C21		Q24	
CR2		U4	
R92		J14	J1-J12

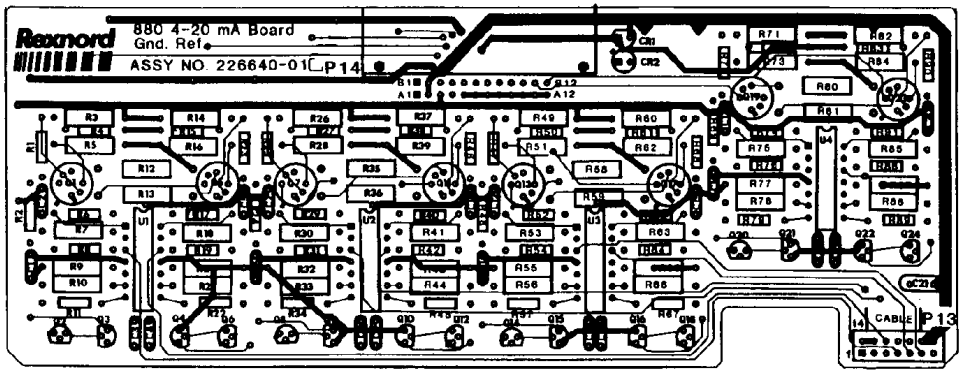


APPLICATION					
226640	B80	A	PROD REL		

REVISIONS			
DESCRIPTION			DATE
			12-22-88

SCHEMATIC
4-20MA, GND REF, 880
Rosemount Gas Detection Products
D 226641
Figure A-10
A-25/26
226641

APPLICATION		REVISIONS			
NEXT ASSY	MODEL	ISSUE	DESCRIPTION	SIGNATURES	DATE
225420	880/8000	A	PROD REL	[illegible]	12/18/82



COMPONENT SIDE

NOTES:

1. ASSEMBLY NUMBER IS 226640-01.
2. MARK DASH NUMBER AND ISSUE LETTER WHERE SHOWN.
3. SQUARE PADS INDICATES POSITIVE LEAD OF CAPACITOR, PIN 1 OF DEVICE, CATHODE LEAD OF DIODE AND EMITTER OF TRANSISTOR.
4. METHOD OF INSTALLATION WITH IAO BOARD REF (TEMPORARILY MOUNT ITEMS (33) & (34) TO CONNECTOR FOR LATER EASE OF ASSY).

Figure A-11

DRAWN	Rexnord	Gas Detection Products
CHECKED		
APPROVED	TITLE	ASSEMBLY - PRINTED WIRING BOARD, 880 4-20mA BD, GND REF
APPROVED	SCALE 2 : 1	SIZE D
	SHEET 1 OF 1	DRAWING NO 226640

OPTION A OR B: 226408-03,-06,-103,-106 OR 226408-18,-118 ONLY

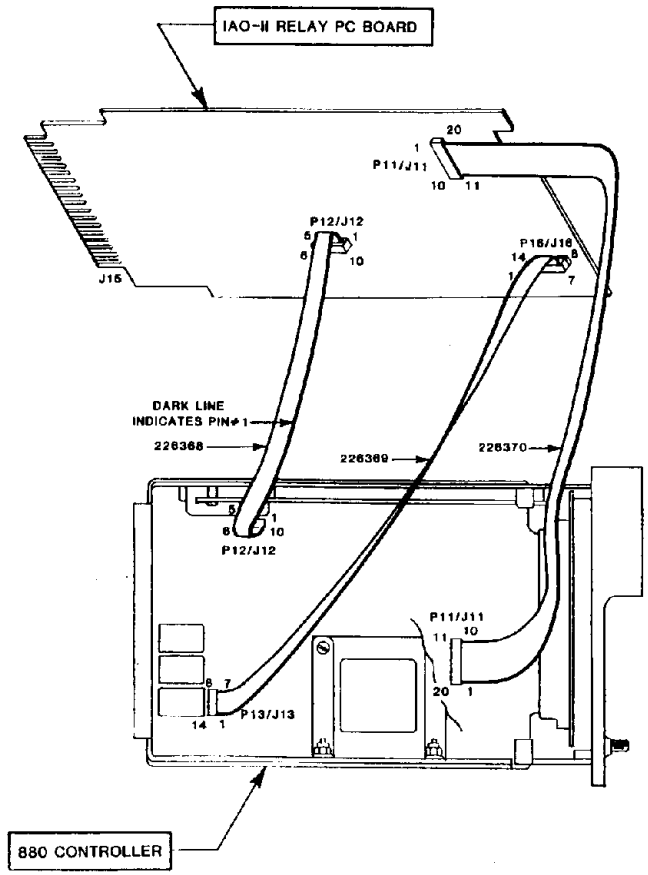


FIGURE A - 880 SYSTEM CABLE CONNECTIONS FOR THE IAO-II RELAY PC BOARD ONLY.

OPTION A OR B AND C-1: 226408-03,-06,-103,-106 OR 226408-18,-118 AND 226425-01

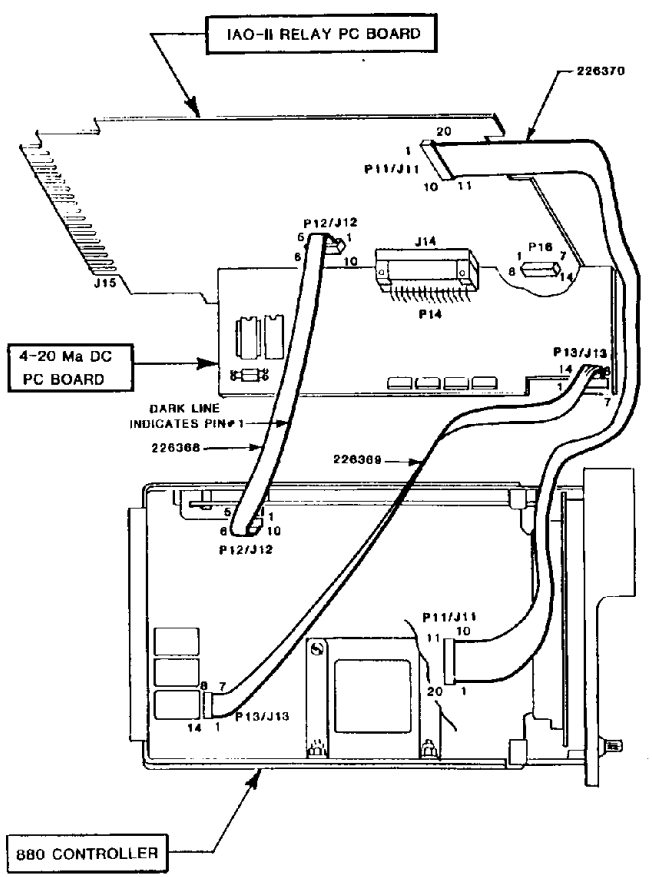


FIGURE B - 880 SYSTEM CABLE CONNECTIONS FOR BOTH IAO-II RELAY & 4-20 Ma DC PC BOARDS.

OPTION C-2 ONLY: 226420-01

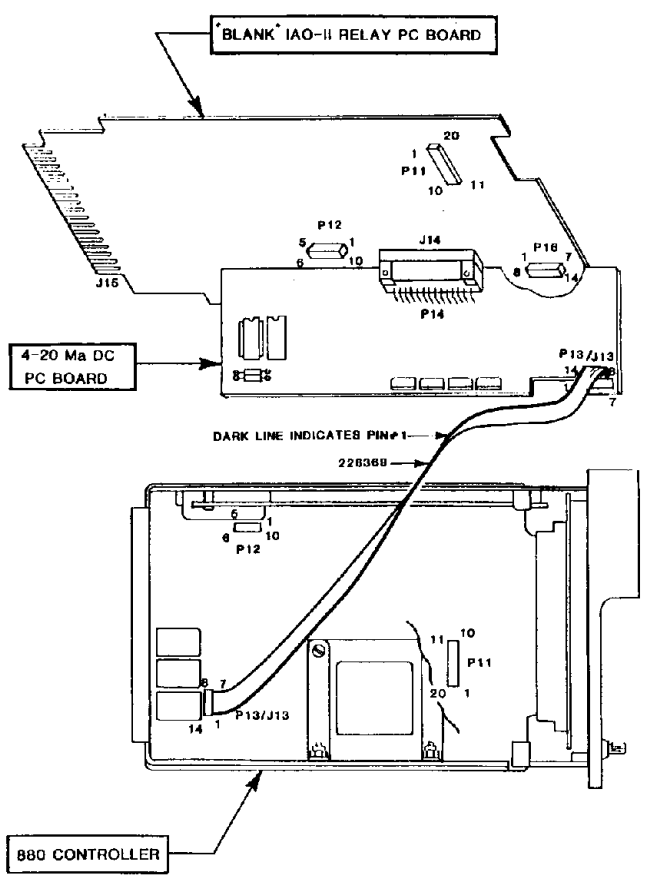


FIGURE C -880 SYSTEM CABLE CONNECTIONS FOR THE 4-20 Ma DC & "BLANK" RELAY IAO-II PC BOARDS.