

GE MOBILE RADIO

MAINTENANCE MANUAL

S-950 CONTROL UNIT

(19B234583P1)



SPECIFICATIONS *

Controls

Power
 Squelch (✓✓)
 Volume (✓✓)
 Mode (✓✓)
 Channel (✓✓)
 Scan
 Add
 Delete

Indicators

Power (Display)
 Mode (Display)
 Channel (Display)
 Scan (Display)
 Transmit
 Busy
 Scan ON
 Priority-1
 Priority-2

*These specifications are intended primarily for the use of the serviceman. Refer to the appropriate Specification Sheet for the complete specifications.

GENERAL  ELECTRIC

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GENERAL ELECTRIC COMPANY • MOBILE COMMUNICATIONS DIVISION
WORLD HEADQUARTERS • LYNCHBURG, VIRGINIA 24502 U.S.A.



COMBINATION NOMENCLATURE

DIGITS 1 & 2	DIGIT 3	DIGIT 4
Product Code	Control Unit Application	Configuration
S9	5 Delta-S/SX	0 Standard

STRUCTURED OPTIONS

Digit A	Digit B	Digit C	Digit E	Digit G	Digit J	Digit K	Digit M	Digit R	Digit S	Digit T
Programming	Tone Connector Cable	Option	Auxiliary Switch	Dual Priority Scan	Carrier Control Timer	Modes Channels	Microphone	Accessories	Speaker	Ignition Cable
0 Test Program Only No Download	0 None	0 None	0 Standard Aux	0 Standard Front Programmable	0 None	0 Standard 8 Modes/ 16 Channels (128)	0 Std Delta w/HKSW	0 w/Pwr Cntrl Cable & Accessories 6 Mtr. Short Ground	0 Delta Standard 3 x 5	0 W/O Ign Standby
1 Custom Program No Download	A Decoder Cable	A T90 Encode (HKSW/1st PTT) or T99 Encode (HKSW/1st PTT) or GE-Star ID Encode (Each PTT)	A Encode T90/T99/GE-Star	1 Priority 1 on Ch. 1, Priority 2 & Non-Priority are Programmable	1 1 Minute	A 4 Modes/32 Channels (128)	1 MASTR II w/HKSW	1 3 Mtr. Cable Short Ground	1 Delta 3 x 5 Window	1 With Ign Standby
2 Custom Program Download Narrowband	B Encoder Cable	B Encoder Cable	B Home (Chan. 1) each Mode	2 Priority 1 follows Ch. Selected, Priority 2 & Non-Priority Are Programmable			2 Noise Canc. w/HKSW.	2 9 Mtr. Cable Short Ground	2 MASTR II Style	2 No Cable
3 Custom Program Download Wideband	C Decoder and Encoder Cables	C Decoder and Encoder Cables	C Home w/Encode T90/T99/GE-Star	3 Non-Priority Scan			3 Handset w/HKSW.	3 6 Mtr. Cable Long Ground	3 MASTR II Window	3 With Ign Standby & Relay
				4 No Scan			4 None	4 3 Mtr. Cable Long Ground	5 Ext. Spkr. 4 Ohm	
								5 9 Mtr. Cable Long Ground	6 No Speaker	
								N w/Out Pwr Cntrl Cable, Microphone, & Ming Hdwr		
								C No Cables		

DESCRIPTION

The S-950 Control Unit is an attractively styled, highly functional unit. It is enclosed in a two-piece molded ABS resin housing for durability and ease of disassembly. The control unit can be mounted to the dash, hump or overhead using a multi-position metal bracket.

The control unit contains four four-layer printed circuit boards; one for the Display/Control board, one for the Input/Output (I/O) board, one for Microcomputer board and one for the Backplane Connector board. All external interconnecting jacks are at the rear of the unit.

The Display/Control board and the Input/Output board are electrically and mechanically (soldered) connected to form one composite assembly. Likewise, the Microcomputer board and the Backplane Connector board are similarly assembled in a Tee-shaped configuration. The two assemblies are connected electrically by four circuit board plugs and jacks. There are no interconnecting wires in the control unit, other than to the power switch.

All controls are front mounted, push-button type and all indicators are Light Emitting Diodes or Seven Segment Displays, providing long life, low power consumption and high reliability.

FUNCTIONS

The S-950 Control Unit is a highly versatile, software-controlled unit providing numerous functions and options including:

- Dual Priority Scan
- Digital Volume Control
- Digital Squelch Control
- Type 90 or 99 Encode Tones
- GE-STAR Identification
- 128 Channels in -
 - 8 Modes of 16 Channels each
 - or
 - 4 Modes of 32 Channels each
- Carrier Control Timer (per mode basis)
- Channel Guard - Tone or Digital*
- Channel Frequencies
- Home Channel Revert
- Auxiliary Relay Control

* These functions are actually performed in the radio. If you have downloaded, the data is held in the control unit.

PROGRAMMING

The various functions and options must be programmed into the S-950 Control Unit. The TQ2310 Universal Radio Programmer equipped for the S-950 Control Unit is required. The S-950 PROM is identified as TQ2329 [includes both Control and I/O PROMs (19A148766G3)] and the programmer cable is TQ2322 (19B234413G15). Plug P2 of the programming cable connects to J2 on top of the Data I/O Module in the TQ2310 programmer and plug P7 connects to J6 on the back of the control unit. Refer to the S-950 Control Unit Programming Instructions LBI31380 for detailed procedures.

Custom Programming

- A0 - The control unit is shipped with the test program and requires field programming. If attached to the radio it will operate as a normal control unit and does not download any channel information.
- A1 - The control unit is programmed for options as ordered, such as Scan or encode tones. The control unit operates the radio using the radio's internal channel programming (does not download channel information). Channel control is set up for one mode of 16 channels unless option KA is ordered then it will be one mode of 32 channels. Dual Priority Scan is set for Priority 1 to be front panel programmable unless a "G" option is ordered. No tone or GE-STAR is provided unless 'CA' is ordered. The auxiliary button will activate a field installed relay. If an 'E' option is ordered the auxiliary button will perform the required function and activate the relay, if installed. Variable squelch is standard.
- A2 - The control unit is programmed for options and channel information. The number of modes and channels is set by channel information on the worksheet. The radio is reprogrammed by the S-950 each time a new mode is selected (does download). Dual Priority Scan is set for Priority 1 to be front panel programmable unless a "G" option is ordered. No tone or GE-STAR is provided unless 'CA' is ordered. The auxiliary button will activate a field installed relay. If an 'E' option is ordered the auxiliary button will perform the required function and activate the relay if installed.

Variable squelch is standard. Option A2 is used for DELTA-S radios.

- A3 - This is the same as A2, except that A3 is used for DELTA-SX wideband radios.

INSTALLATION

Refer to the System Interconnection Diagram 19D901581 for the proper connections of the mobile combination. Connections to the radio, the microphone hookswitch, speaker and external functions and options are shown.

For external tone, cables must be connected internally to J5 (decoder) or to J12 (encoder) and routed out through the Backplane Connector board. See Option Application Diagram 19D901492.

OPERATION

(Refer to Operator's Manual LBI31377)

Power to the S-950 Control Unit and to the radio is controlled by the power (PWR) on/off switch. In is ON - out is OFF. The radio and the control unit are operated by the front panel push-button controls.

TO RECEIVE A MESSAGE

1. Turn the radio and control unit on by pressing the power switch. This lights the CHANNEL and MODE indicators.
2. Set squelch by coming off hook with the microphone and pressing SQUELCH down switch until noise is heard. Then press SQUELCH up switch until noise disappears.

NOTE

If Fixed Squelch has been programmed, you cannot set the squelch level. To check the squelch level, first push the A "up" button then the V "down" button.

3. Set the desired volume level by pressing VOLUME up or down switches. A tone BEEP will be heard that is proportional to the audio level.
4. If more than one frequency is available, select the proper channel by pressing the MODE up or down switch and then the CHANNEL up or down switch.

5. The radio is now ready to receive messages from other radios in the system. If the channel digit fails to light, the radio failed to download.

TO TRANSMIT A MESSAGE

1. If more than one frequency is available, select the proper channel as in step 4 above.
2. Check the CHANNEL BUSY indicator to make sure the channel is not being used.
3. Pick up microphone and press Push-To-Talk (PTT) switch. the red Transmit light will turn on. Speak across the microphone in a normal voice. Always release PTT switch when message is completed and listen for an answer.

MAINTENANCE

DISASSEMBLY

1. To gain access to the inside of the control unit, remove the two screws, lock washers and nuts holding the top and bottom covers together. Remove the covers and remove the mounting screw nuts from the cover cavities to prevent loss.

NOTE

It may save time later if you mark the top and bottom covers on the inside. Use an indelible marking pen. The adjustment holes prevent the covers from being interchangeable.

2. Remove the single screw (center of board) holding the I/O Board and Microcomputer Board together.
3. Carefully separate the I/O and Microcomputer boards.
4. To gain access to the Display/Control board, remove the four screws and carefully remove the front panel.
5. Note that the I/O and Display boards are soldered together in a Tee configuration. The same is true for the Microcomputer and Back Connector board. Do not exert undue stress on these electrical circuit connections.

REASSEMBLY

1. After servicing the boards, carefully connect the I/O and Microcomputer boards together. Pay careful attention to the alignment of the connector pins and sockets. Do not force the connectors together.
2. Lock the assembly together with the single screw and lockwasher (located in the approximate center of the boards).
3. Place the assembled boards in the bottom cover. Be sure adjustment hole provides access to the variable resistor underneath. Be certain the front and back boards are in the cover slots.
4. Place the two mounting screw nuts in the cover cavities.
5. Carefully fit the top cover on. When properly aligned, fasten with the two screws and nuts.

REPLACING CHIP COMPONENTS

Replacement of chip capacitors should always be done with a temperature-controlled soldering iron, using a controlled temperature of 700°F (371°C). However, do NOT touch black metal film of the resistors or the ceramic body of capacitors with the soldering iron.

NOTE

The metalized end terminations of the parts may be touched with the soldering iron without causing damage.

REMOVING CHIP COMPONENTS

1. Grip the component with tweezers or needle nose pliers.
2. Alternately heat each end of the chip in rapid succession until solder flows, and then remove and discard the chip.
3. Remove excess solder with a vacuum solder extractor or Solder-wick®.
4. Carefully remove the epoxy adhesive and excess flux to prevent damage to the printed board.

TO REPLACE CHIP COMPONENTS

1. Using as little solder as possible, "tin" one end of the component and one of the pads on the printed wiring board.

2. Place the "tinned" end of the component on the "tinned" pad on the board and simultaneously touch the component and the pad with a well "tinned" soldering iron while pressing the component down on the board.
3. Place the "tinned" soldering iron on the other end of the component and the pad simultaneously. Apply solder to the top of the end of the component until the solder starts to flow. Use as little solder as possible while getting a good joint.
4. After the component has cooled, remove all flux from the component and printed wiring board area with alcohol.

REMOVING IC'S

Removing IC's (and all other soldered-in components) can be easily accomplished by using a de-soldering tool such as a SOLDAoPULLT® or equivalent. To remove an IC, heat each lead separately on the solder side and remove the old solder with the de-soldering tool.

CAUTION

The CMOS Integrated Circuit devices used in this equipment can be destroyed by static discharges. Before handling one of these devices, the serviceman should discharge himself by touching the case of a bench test instrument that has a 3-prong power cord connected to an outlet with a known good earth ground. When soldering or de-soldering a CMOS device, the soldering iron should also have a 3-prong power cord connected to an outlet with a known good earth ground. A battery-operated soldering iron may be used in place of the regular soldering iron.

TROUBLESHOOTING

Introduction

Some DELTA-S (narrowband) radios formerly in use with other control units must have some modifications made before they can be used with the S-950 Control Unit that has downloading capabilities. No modifications to the cable are required if downloading is not used.

1. The STORE and RESET leads in the control cable must be connected. Refer to the Interconnection Diagram 19D433081, Sheet 1 in this manual. (These leads are already connected in the new 19D900447G16, 18 and 20 cables.)
2. A 68 nf capacitor C726 (19A702052P24) must be connected from the STORE circuit to ground in the radio as shown in the partial schematic below. Connect between J604-4 and J604-14. This is REV. G to T/R/S board 19D900840G1, 2. This is also REV. H to T/R/S Board 19D900775G1 thru G4.

(19D900837, Sh. 2, REV.3)

3. The RESET circuit must be present in the radio as shown on Schematic Diagram 19D9000837, Sheet 2 (in radio manual) and for UHF on Schematic Diagram 19D900902, Sheet 2.
4. A Schottky diode D720 (19A700047P2) from AR to RESET lead must be in the radio. Connect between U703-5 (cathode) and U706-10 (anode) as shown on Schematic Diagram 19D900837, Sheet 3. This is REV. H to T/R/S board 19D900840G1, 2. This is also REV. J to T/R/S Board 19D900775G1 thru G4.
5. The second EEPROM (19C851006G1 Not Programmed) for 32 channels must be present if the DELTA-S, SX radio is more than 16 channels.
6. Jumper connector P610 must be connected in the radio to allow the Alert Tone to pass through to the speaker.
7. When all the above conditions are met, the Delta-S radio and the S-950 Control Unit should function together as a system.

SELF TEST

The tests described in this section are designed to check out all S-950 functions. If this series of tests is passed and the radio is operating in a normal manner, the control unit may be assumed to perform its normal functions. The tests should be of special value in locating failures and as an aid in troubleshooting.

Test Requirements

These tests require the following conditions to be met before starting:

1. The control unit should be correctly connected to a working radio.
2. The control unit/radio are connected to a 13.8 volt supply capable of powering the transmitter.
3. All normal microphone, speaker and hookswitch connections have been made.
4. A voltmeter/scope is available to monitor control lines and circuit leads.
5. A 10,000 ohm pull up resistor to 13.8 volts has been connected to External Relay output J2-8.
6. Control unit is initially turned OFF.

Enter Self Test

1. The control unit must be OFF.
2. The microphone must be ON HOOK.
3. Press SCAN/ADD/DELETE buttons simultaneously.
4. Turn the control unit ON. The control unit is now in the Self Test mode.

RAM/ROM/EEPROM Test

All displays will be momentarily blank while the computer checks RAM/ROM/EEPROM.

1. If ROM failed the display will show 1.
2. If RAM failed the display will show 2.
3. If EEPROM failed the display will show 3.
4. If all tests pass the display will show 0 and an alert tone will sound for 5 seconds.

FUNCTIONAL PROBLEMS

CHECKS

UNIT ON - NO DISPLAYS	1. Power source, cables and connections. 2. 5-Volt and 8-volt regulators and circuits. Check power on the I/O Board. 3. Microcomputer clock - 6 MHz at U1-18, 19. 4. Program Memory EPROM U2, Personality Memory EEPROM U4, I/O Expanders U101 and U102. 5. Enter Self Test routine for RAM, ROM and EEPROM functional check. This does not check EEPROM Program. Look for a ZERO in the mode display. (See Self Test).																																																																	
INCORRECT DISPLAYS No display change or incorrect display when buttons are pushed.	1. Stuck buttons (feel). 2. Display drivers - shorted or shorted lines. U101-13, 14, 15, 16 are multiplexed outputs. 3. Multiplexers. 4. LED's - shorted or open. 5. Enter Self Test routine and run Button test. (See Self Test).																																																																	
SOME DISPLAYS NOT LIGHTED All tens or ones do not light. (6 instead of 16) No LED's	1. Display drivers U105-U106. 2. Display Switches Q101-Q104. Mode - Q101 Channel - Q102 Search - Q103 LED's - Q104																																																																	
SQUELCH LEVELS	<table><tr><th>LEVEL</th><th colspan="3">BINARY INPUTS</th><th></th></tr><tr><td></td><td>P5.0</td><td>P5.1</td><td>P5.2</td><td></td></tr><tr><td></td><td>Pin 1</td><td>23</td><td>22</td><td>(U102 Output)</td></tr><tr><td>1</td><td>0</td><td>0</td><td>0</td><td>(MIN SQ)</td></tr><tr><td>2</td><td>0</td><td>0</td><td>1</td><td></td></tr><tr><td>3</td><td>0</td><td>1</td><td>0</td><td></td></tr><tr><td>4</td><td>0</td><td>1</td><td>1</td><td></td></tr><tr><td>5</td><td>1</td><td>0</td><td>0</td><td></td></tr><tr><td>6</td><td>1</td><td>0</td><td>1</td><td></td></tr><tr><td>7</td><td>1</td><td>1</td><td>0</td><td></td></tr><tr><td>8</td><td>1</td><td>1</td><td>1</td><td>(MAX SQ)</td></tr><tr><td></td><td>Pin 9</td><td>10</td><td>11</td><td>(U108 Input)</td></tr><tr><td></td><td colspan="3">(Will be inverted)</td><td></td></tr></table> J16 in B position	LEVEL	BINARY INPUTS					P5.0	P5.1	P5.2			Pin 1	23	22	(U102 Output)	1	0	0	0	(MIN SQ)	2	0	0	1		3	0	1	0		4	0	1	1		5	1	0	0		6	1	0	1		7	1	1	0		8	1	1	1	(MAX SQ)		Pin 9	10	11	(U108 Input)		(Will be inverted)			
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RADIO WILL NOT UNSQUELCH ON SOME CHANNELS	1. On Open channel? Squelched. 2. Locked Synthesizer. 3. Radio problem?																																																																	

FUNCTIONAL PROBLEMS

CHECKS

RADIO STAYS KEYED	1. PTT shorted - U11-9, 10 short to A-. 2. Input Multiplexer U12. 3. Radio PTT J10-1 from U102 LO = TX, HI = RX																																																																																																																																																			
BUTTONS DON'T WORK or strange things happen	1. Stuck buttons (feel). 2. Input Multiplexer U12 - button scanning defective. 3. I/O Expander U101-13, 14, 15, 16 defective. U101 through switches through J9-2, 3, 4 to input. Multiplexer U12-13, 14, 15. Keyboard A reads S103, S106, S109, S112. Keyboard B reads S102, S105, S108, S111. Keyboard C reads S101, S104, S107, S110. 4. Tee joint connections.																																																																																																																																																			
NO RECEIVE AUDIO	1. PA KEY shorted to A-. If AA KEY is grounded, a bilateral switch in the radio is turned off preventing VOL ARM audio from going through. Check PA KEY circuit. 2. VOL/SQ HI open or shorted. Check VOL/SQ HI from radio through bilateral switch U113, resistor network, multiplexer U107 to I/O Expander U102. Also check VOL ARM circuit. 3. Multiplexer U107 defective. See Volume Level. 4. U112 OPAMP defective. Check U112-5 bias for 4 volts.																																																																																																																																																			
VOLUME LEVELS	<table><tr><th colspan="2">LEVEL</th><th colspan="4">BINARY INPUTS</th><th></th></tr><tr><th></th><th></th><th>P4.0</th><th>P4.1</th><th>P4.2</th><th>P4.3</th><th></th></tr><tr><td></td><td>Pin</td><td>2</td><td>3</td><td>4</td><td>5</td><td>(U102 Output)</td></tr><tr><td>1</td><td></td><td>1</td><td>1</td><td>1</td><td>1</td><td>(MIN LEVEL)</td></tr><tr><td>2</td><td></td><td>1</td><td>1</td><td>1</td><td>0</td><td></td></tr><tr><td>3</td><td></td><td>1</td><td>1</td><td>0</td><td>1</td><td></td></tr><tr><td>4</td><td></td><td>1</td><td>1</td><td>0</td><td>0</td><td></td></tr><tr><td>5</td><td></td><td>1</td><td>0</td><td>1</td><td>1</td><td></td></tr><tr><td>6</td><td></td><td>1</td><td>0</td><td>1</td><td>0</td><td></td></tr><tr><td>7</td><td></td><td>1</td><td>0</td><td>0</td><td>1</td><td></td></tr><tr><td>8</td><td></td><td>1</td><td>0</td><td>0</td><td>0</td><td></td></tr><tr><td>9</td><td></td><td>0</td><td>1</td><td>1</td><td>1</td><td></td></tr><tr><td>10</td><td></td><td>0</td><td>1</td><td>1</td><td>0</td><td></td></tr><tr><td>11</td><td></td><td>0</td><td>1</td><td>0</td><td>1</td><td></td></tr><tr><td>12</td><td></td><td>0</td><td>1</td><td>0</td><td>0</td><td></td></tr><tr><td>13</td><td></td><td>0</td><td>0</td><td>1</td><td>1</td><td></td></tr><tr><td>14</td><td></td><td>0</td><td>0</td><td>1</td><td>0</td><td></td></tr><tr><td>15</td><td></td><td>0</td><td>0</td><td>0</td><td>1</td><td></td></tr><tr><td>16</td><td></td><td>0</td><td>0</td><td>0</td><td>0</td><td>(MAX LEVEL)</td></tr><tr><td></td><td>Pin</td><td>9</td><td>10</td><td>11</td><td></td><td>(U107 Input)</td></tr><tr><td></td><td></td><td colspan="4">(Will be inverted)</td><td></td></tr></table>	LEVEL		BINARY INPUTS							P4.0	P4.1	P4.2	P4.3			Pin	2	3	4	5	(U102 Output)	1		1	1	1	1	(MIN LEVEL)	2		1	1	1	0		3		1	1	0	1		4		1	1	0	0		5		1	0	1	1		6		1	0	1	0		7		1	0	0	1		8		1	0	0	0		9		0	1	1	1		10		0	1	1	0		11		0	1	0	1		12		0	1	0	0		13		0	0	1	1		14		0	0	1	0		15		0	0	0	1		16		0	0	0	0	(MAX LEVEL)		Pin	9	10	11		(U107 Input)			(Will be inverted)				
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FUNCTIONAL PROBLEMS

CHECKS

POWER DOWN MEMORY FAILURE Radio turned on/off/on should retain Mode, Channel, Volume and Squelch Data.	1. Defective EEPROM U4- Enter Self Test (See Self Test) A3 indicates a PROM write failure. 2. Defective Vcc Switch Q4 - Enter Self Test. Check Vcc control from U102-18 through U111 buffer to Vcc switch Q4. Change channel and monitor U4-24 with scope. Short Q4C-E. 3. Write line U1-16 to U4-21 problem check circuit. Pin U11-14 should be HI in static condition. If LO, channel memory will not work. 4. Address decoder U13-U7) or lines defective. Use TQ2310 Programmer and try to download. If successful, check for defective address decoder U13. If unsuccessful, U4 is probably defective.
TONE FAILURE - T90/T99/GE-STAR	1. U4 EEPROM may be incorrectly programmed. Use the TQ2310 Programmer to read EEPROM and get printout. 2. Transmit Deviation level may be incorrect. Check setting of R165 on I/O board. 3. Defective bilateral tone switch U7. Control is from U102-17 to J9-5/P9-5 to U7-12. TX Tone goes to U7-11 and on to MIC HI. U7 is switched by +5 V. 4. Walsh Function - Check U1-14 and 15 and summing resistors to P8-2/J8-2. Monitor U112-1 and operate Tone Button (S101). If tones appear, they are getting through OPAMP U112.
INCORRECT CHANNEL FREQUENCY	1. U4 EEPROM may be incorrectly programmed. Read the EEPROM with the TQ2310 Programmer and get a printout. 2. If downloading is programmed, check FB1-FB5 lines for open or short. FB1-FB4 are from I/O expander U102-13, 14, 15 and 16. Also check diodes CR112-CR119. FB5 is from U1-10 and should be HI for Channel 1-16 and LO for Channel 17-32. 3. Check radio for necessary PROMS.
SCAN NOT WORKING Most Scan problems are related to Personality PROM data. Check control unit programming before beginning equipment tests.	1. Check hookswitch. No scan or OFF HOOK if unit is so programmed. 2. Operate SCAN button. See that Scan Indicator turns on and off. 3. Check with a scope for Advance Change pulse at U1-11. Also check Fast Squelch at U12-5.

FUNCTIONAL PROBLEMS

CHECKS

SCAN NOT WORKING (CON'T)	4. Check Channel Guard operation. CG input is the RX Mute line through U11-45 to U12-2. RX Mute LO indicates incorrect tone. RX Mute HI indicates correct tone or not programmed for tone. 5. Check to see that the radio synthesizer is locked. 6. Check to be sure channels are not blank or open channels.
LOUD NOISE WHEN COMING OFF PRIORITY (squelch noise)	1. Check VOL/SQ HI circuit with scope. If voice is observed after Advance Change pulse, the radio is not returning to channel fast enough. 2. Check for Advance Change pulse from U1-11 to the radio (P1-32). 3. Check radio for defective squelch.
ID ERROR when downloading from programmer	1. Check that power is on and mic/handset is on hook. (Gives ID: 0,0). Check that all cables are properly connected. The following lines are used in programming: LATCH (CG DIS. INPUT) (U12-4) DATA (FB5) (U1-10) CU STORE (U11-11) A- CU RESET (U1-9) CLOCK (ADV. CHNG) (U1-11) ID 255, 255
READ BUT NO WRITE with programmer If programmer can read control that indicates serial loading routine is working.	1. Check that control unit is hooked to radio and that J2-2 is grounded. If radio is not connected, J2-2 must be jumpered to unit, A- (battery negative). 2. Check CU STORE through circuit to U7-13. Th programmer grounds CU STORE and puts a HI on pin 13. U7 is turned on and connects Write line (U1-16) to the EEPROM (U4-21). If the circuit is open, write failure will occur.
RADIO DOWNLOAD FAILURE Incorrect programming Channel capacity exceeded faulty circuits or cables. Indicated by channel display going blank and staying blank after power on or mode change. To make control unit active after a download failure, depress the HOME button.	1. Check radio and control unit programming compatibility - NB or WB. 2. If more than 16 channels are being programmed, the second EEPROM must be present in the radio for downloading. 3. Check radio with TQ2310 Programmer to be certain it can be programmed. 4. If radio is good, check cables, cable modifications and all programming circuits in the control unit.

The test will stop after any failed condition.

Upon completion of the alert tone the tests will automatically resume.

Display Test

All seven segment-displays will light with 8. All individual LED's will light.

Tone Test/Deviation Set

Press the AUX button to enter this test.

Press SCAN/ADD/DELETE to skip this test and proceed.

This test places the radio in a normal operating mode in all respects except Tone/GE-STAR encoding.

After entering this mode, go to the channel/mode on which you want to set deviation. Initiate a signalling sequence using the method the radio is programmed or use (PTT, hookswitch, or AUX). The radio will transmit the first tone in the sequence or a 1600 Hz tone if GE-STAR and hold that tone. Pressing the AUX button advances to the second tone in the sequence or, if T-99 or GE-STAR is present, removes the modulation. If T-99 is present pressing the AUX button a second time removes modulation and returns the radio to the mode allowing you to select a channel.

Once this test mode has been selected, the control unit must be turned off and back on to resume normal operation.

Switch Tests

All displays will be off except the channel display which will indicate the button depressed. If a button is stuck closed or pressed for over 5 seconds an alert tone will sound.

BUTTON PRESSED	CHAN. DISPLAY	OTHER ACTION
AUX	1	Ext Relay out low
VOL UP	2	Alert tone/mid volume
VOL DN	3	Alert tone/low volume
SQ UP	4	Ramp SQ. UP
SQ DN	5	Decrement Squelch Level
MODE UP	6	
MODE DN	7	
CHN UP	8	
CHN DN	9	
SCAN	10	
ADD	11	
DELETE	12	

Press SCAN/ADD/DELETE simultaneously to advance to the next test.

External Inputs

The channel display should show 00

BUTTON	CH DISPLAY	ACTION
PTT	77	TX LED on, Radio Keyed, MIC audio on
CG DISABLE	66	CG DIS to radio low
PTT+CG DIS	55	TX LED on, Radio Keyed, CG DIS low. Alert tone to mic high
GE-STAR	44	Radio reset low
CAS HIGH	33	CAS Light on
FAST SQ HIGH	22	
CAS/FAST SQ HI	32	33/22 are not useful while connected to a radio. CAS light will be on.
RX MUTE HIGH	11	

Fast Squelch may be taken high by feeding a carrier into the radio. If more than one action is taken the highest numbered function will be performed. The radio reverts to the idle state after each input is completed.

Press SCAN/ADD/DELETE to continue.

Radio Test

(To exit turn power off).

Displays are all off. Checks radio ID.

ID Failed displays	1
ID Passed, but wrong radio	2
ID Passed, display	0

Press SCAN/ADD/DELETE to continue.

CAUTION

THIS TEST MAY DESTROY THE EEPROM CONTENTS IF A FAILURE OCCURS DURING THIS TEST.

Displays are all off. Write a 00 then FF to PROM location 00. Then restore PROM to original contents.

0 Passed

1 Failed

Press SCAN/ADD/DELETE a second time to continue.

This completes the self test diagnostics. The radio will exit self test and "hang" until the watchdog timer causes a reset to the operating mode.

Operate the radio on channel 1, 2, 4, 8 and ensure it receives on the appropriate frequency.

The control unit is now completely tested.

CIRCUIT DESCRIPTION

Refer to the control unit Block Diagram RC4956 and to the 19D901448 Schematic Diagrams for identification of the various circuits and functions as described in this section.

Shielding is used on PWB to eliminate RF Interference.

POWER CIRCUITS

External Battery A+ (13.8 VDC nominal) is applied to Backplane connector J1-11. A- is applied through J1-1. DC power is controlled by Power Switch S113 as shown on Schematic Diagram 19D901448, Sh. 3. When S113 is closed, switched A+ is applied back through the internal power cable to the Backplane Connector board and to Tee junction M to the Microcomputer Board. The +13.8 volts is applied to 8-volt linear regulator U10 and through P10-15/J10-15 to the I/O Board.

+5 Volts

The 5-volt linear voltage regulator U9 and 5-watt dropping resistor R52 (on Backplane Connector board) provide +5 VDC for main Microcomputer power and for memory and digital logic circuit power.

The +5 VDC (Vcc) goes through Tee junction 15 to the Microcomputer board. It is applied through P11-3/J11-3 to the I/O board. Computer controlled (U102) switched Vcc is applied through J11-1/P11-1 to switch Q4. This is used to energize EEPROM U4 and is a power conservation device.

+8 Volts

The 8-volt linear voltage regulator U10 and filter capacitors C14, C16 (on Microcomputer board) provide +8 VDC for the analogue circuits on the I/O board. The 8 volts allows sufficient voltage swing to prevent audio clipping. The +8 VDC is applied through P10-16/J10-16 to the I/O board.

MICROCOMPUTER

The U1 microcomputer is an 8031 device having no real internal memory

capacity for specific data. Instead a program memory EPROM U2 and a personality memory EEPROM U4 are used. The EEPROM contains all of the personality and variable data.

An input multiplexer U12 is used to provide additional input capacity to U1. Fast Squelch, CAS, RX Mute, PTT, CG Disable and the keyboard outputs are brought into the microcomputer through this multiplexing gate. U1-1, -2 and -3 are the control lines for U12. Input data is from U12-3 to U1-8.

FAST SQUELCH

OPAMP U6 and associated components make up the Fast Squelch circuit. The circuit filters receiver noise and removes the low frequency components and rectifies the resultant signal. If the noise level drops below the level set by R16 and R17, the circuit indicates a carrier is present by grounding Q1 base. The circuit is designed to detect carrier presence within a milliseconds after the carrier appears. Resistor R25 is used to set the Fast Squelch response level and is normally set to operate squelch on a -15 dBm or stronger signal.

I/O EXPANDERS

The U101 and U102 I/O Expanders assist the microcomputer in maintaining functional control and display. U101 multiplexes the keyboard and the displays and controls the U105 and U106 display drivers and Q101-Q104 display switches. The microcomputer controls U101 and U102 through chip select signals CS1 and CS2.

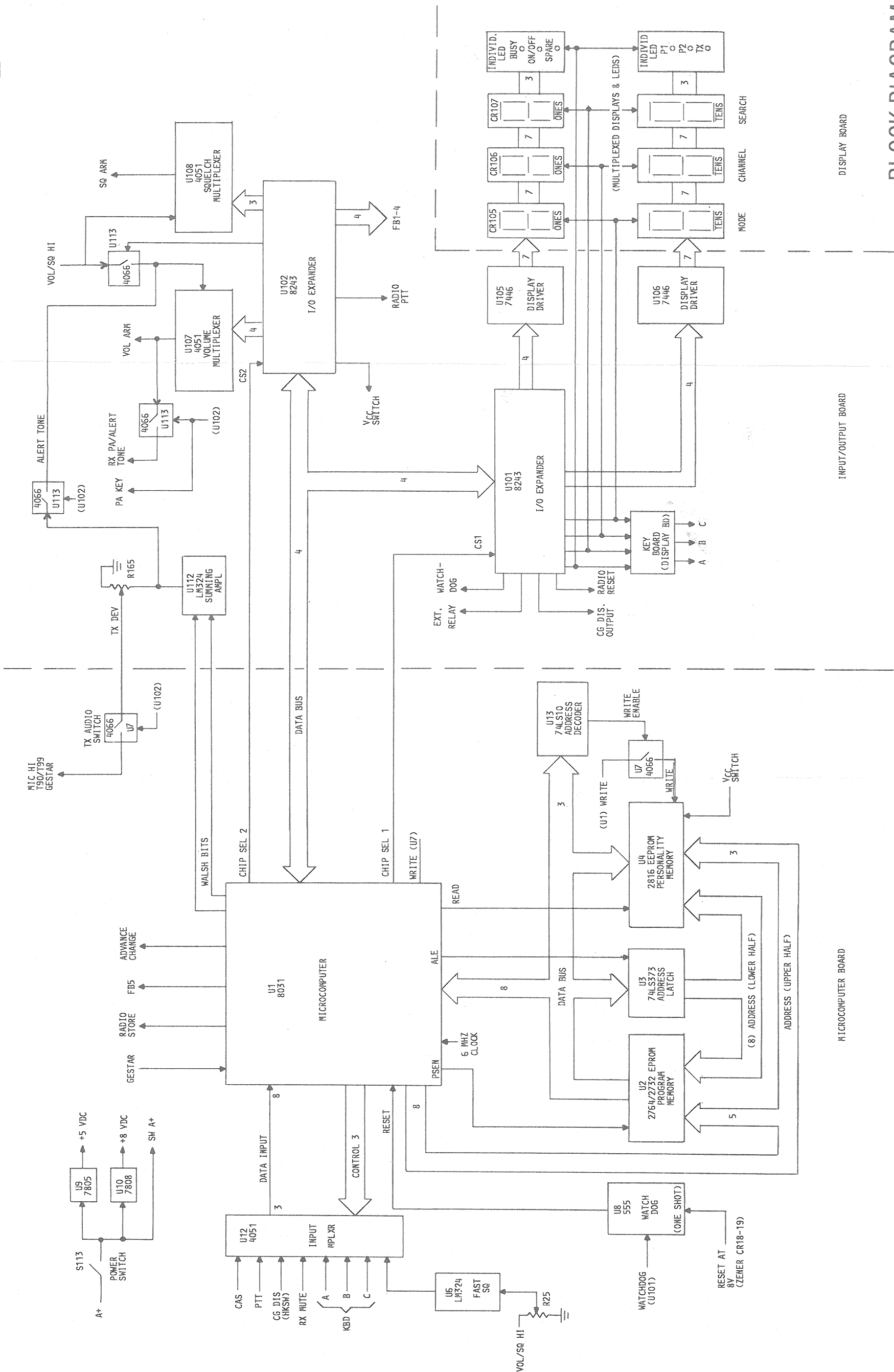
I/O Expander U102 controls the Vcc Switch used to energize EEPROM U4. Volume level control is provided by Volume Multiplexer U107 and the associated network resistors. The volume control provides 16 steps of 3 dB each via U113 and R155. The Squelch Multiplexer U107 is driven by U102. U107 and the associated network resistors provide 8 steps of squelch level.

AUDIO GATES & BUFFERS

Bilateral switch U113 and buffer U112 provide gating and buffering of alert and signalling tones. One section of U112 provides a low noise bias output (U112-14) of 4 volts for the other amplifiers and audio circuits.

TONES

Tones are generated inside the microcomputer as square waves or as 2-bit Walsh function (depending on frequency). They are applied through U1-14 and -15 and scaling resistors R24 and R26 to summing amplifier U112. The transmit deviation level is set by resistor R165.



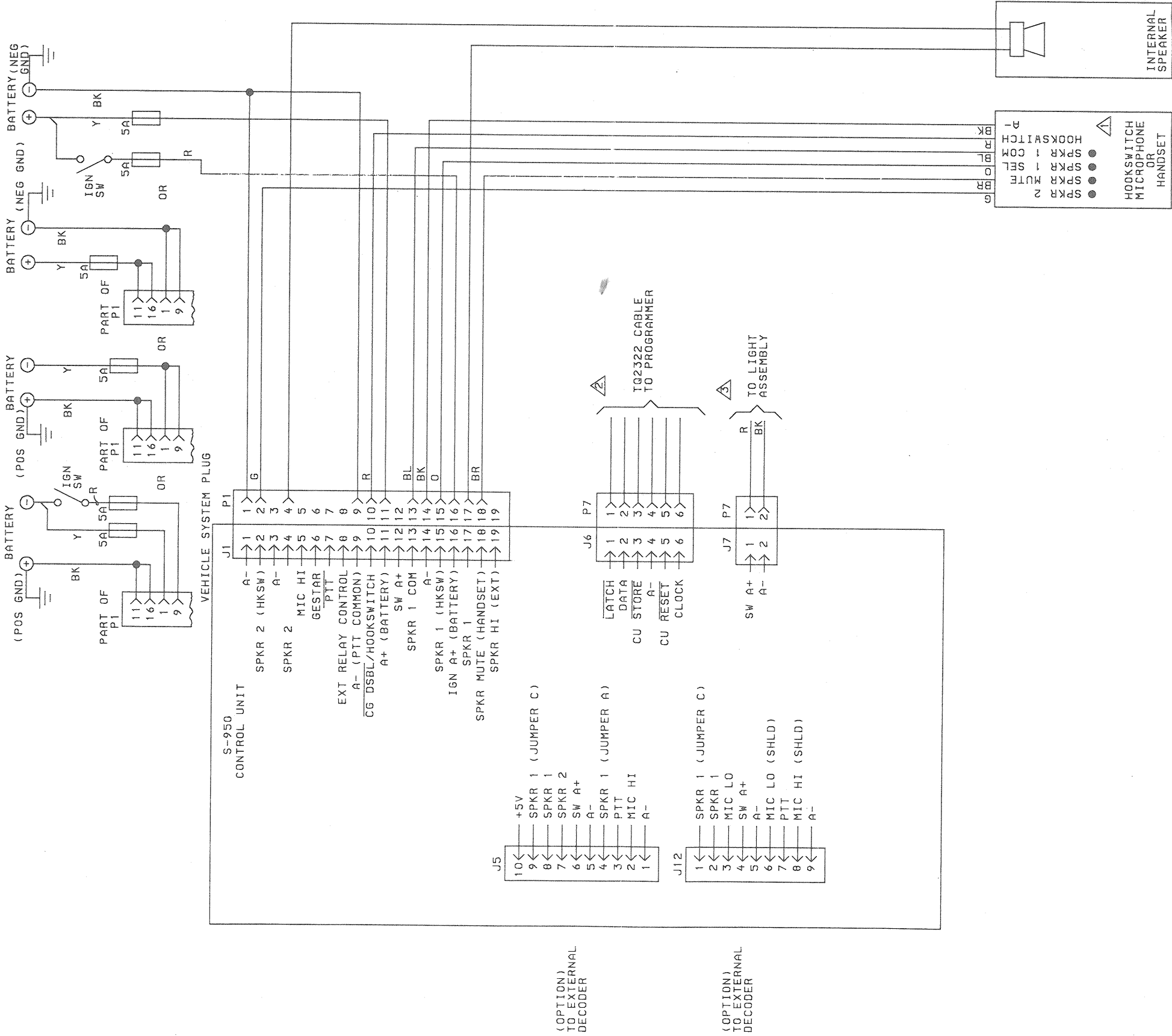
RC4956

BLOCK DIAGRAM

S-950 CONTROL UNIT

Issue 1

11

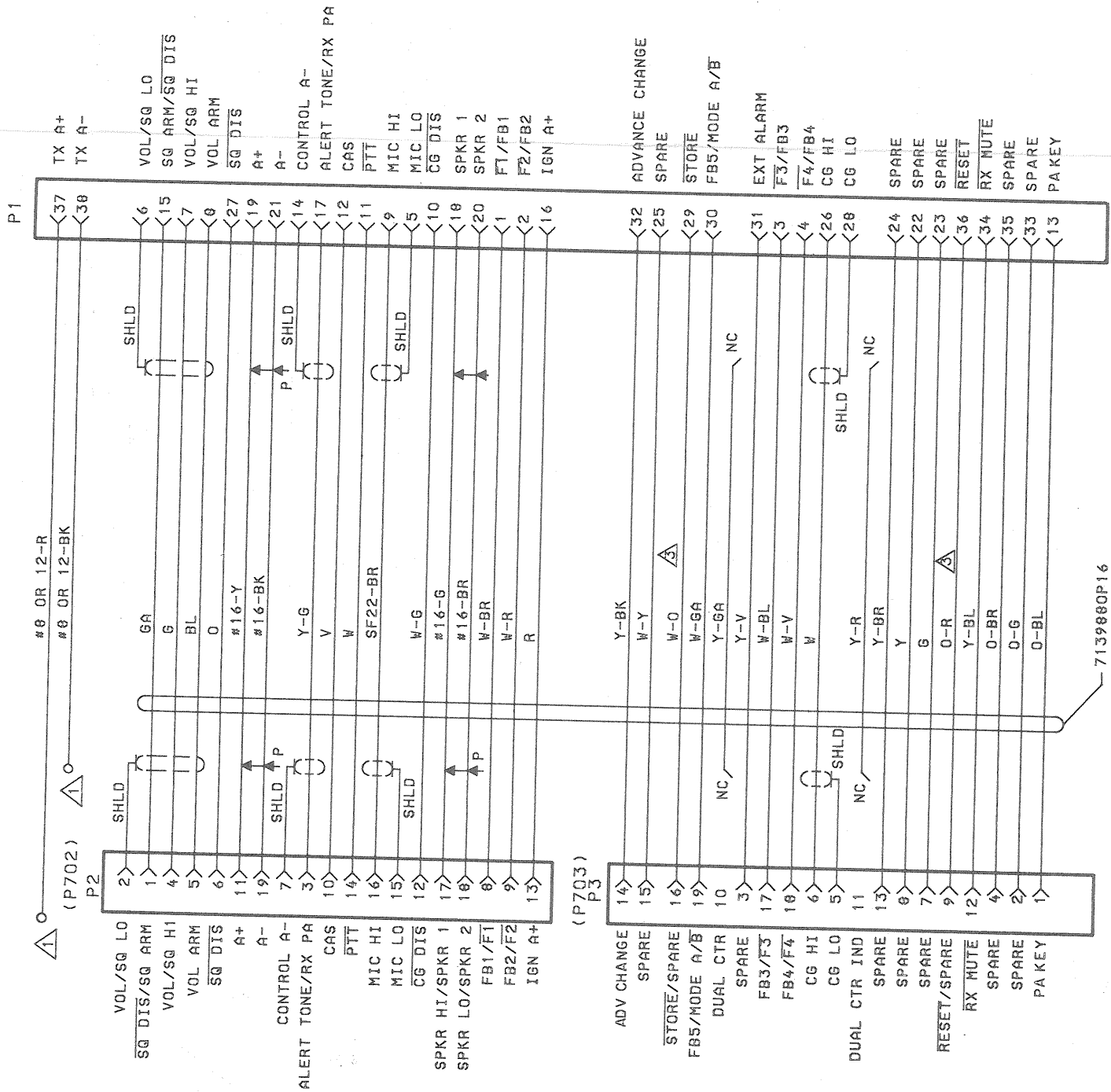


- ▲ PRESENT IN HANDSET HOOKSWITCH ONLY.
- ▲ PART OF PROGRAMMING EQUIPMENT.
- ▲ PART OF LIGHT ASSEMBLY 19C851339.
- 4. SEE SHEET 1 FOR RADIO CONNECTIONS.

INTERCONNECTION DIAGRAM

S-950 CONTROL UNIT

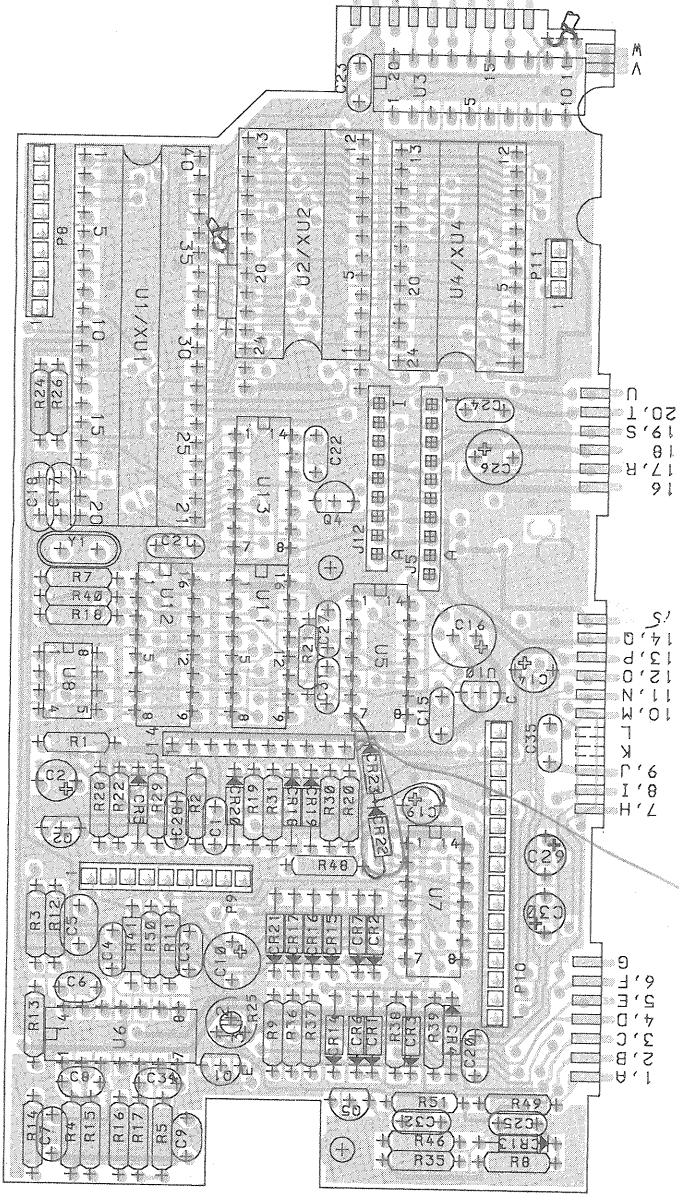
Issue 1



- 1 ELECTRICALLY UNCONNECTED UNTIL INSTALLED BUT TERMINATED PER ASM 19D900447.
2. ALL WIRES ARE #SF24 AWG UNLESS OTHERWISE SPECIFIED.
- 3 FOR GROUPS 1-6, W-O AND O-R WIRES ARE NOT CONNECTED AT EITHER END.

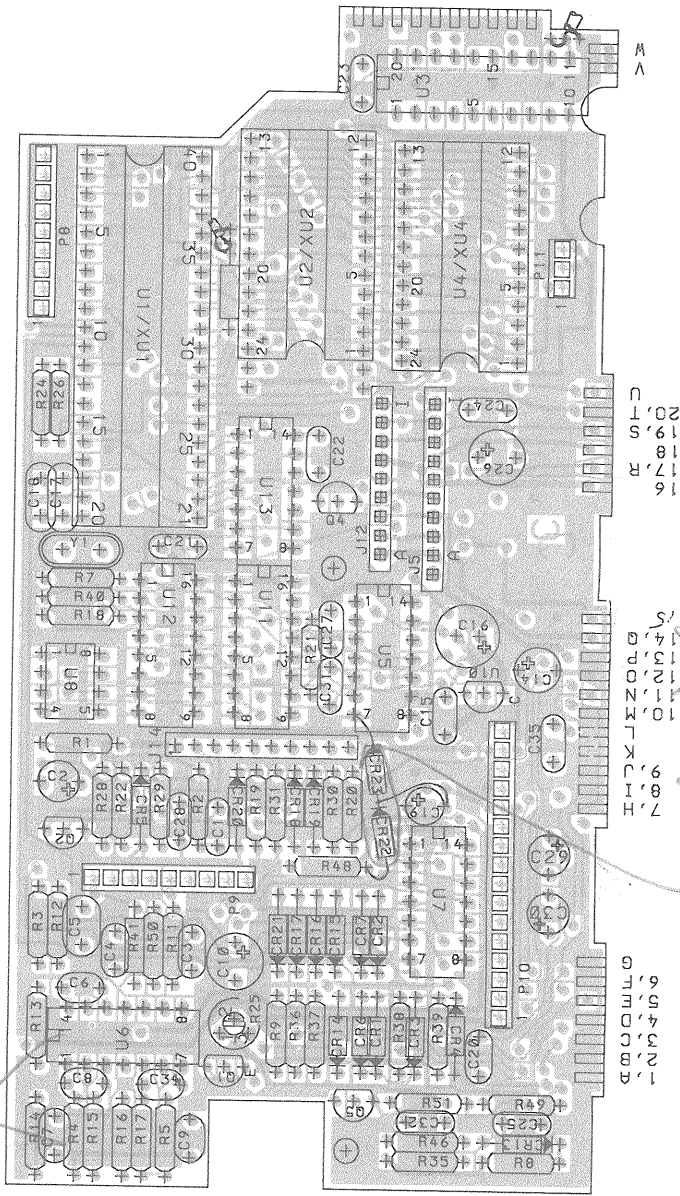
WIRING DIAGRAM

POWER/CONTROL CABLE
(19D900447G16, 18 & 20)



B310
MICRO-COMPUTER

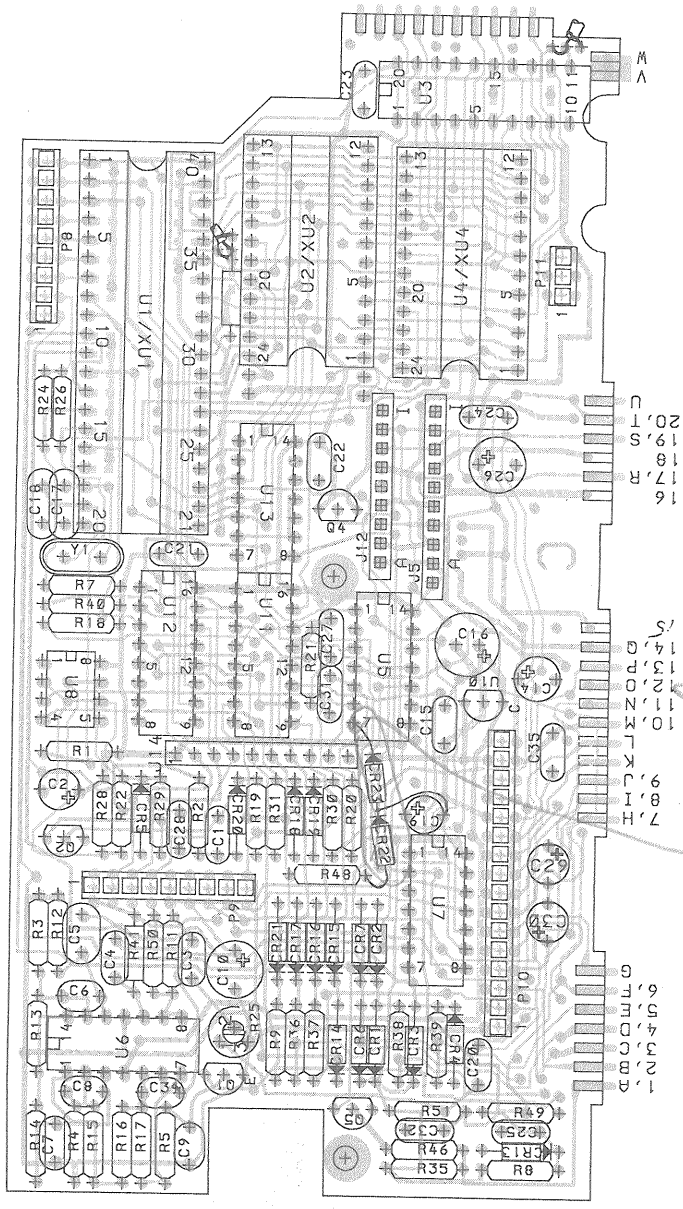
(B310)
Layer One (B310)
Layer Two (B310)



B310
MICRO-COMPUTER

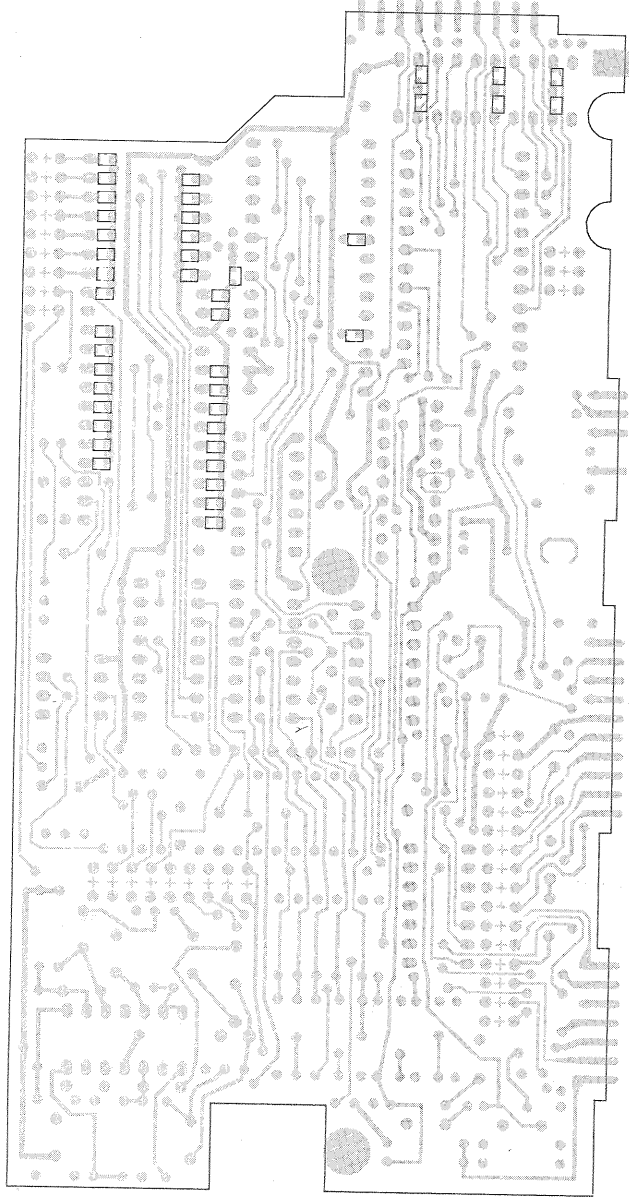
(B310)
Layer Two (B310)
Layer Three (B310)

OUTLINE DIAGRAMS MICROCOMPUTER BOARD

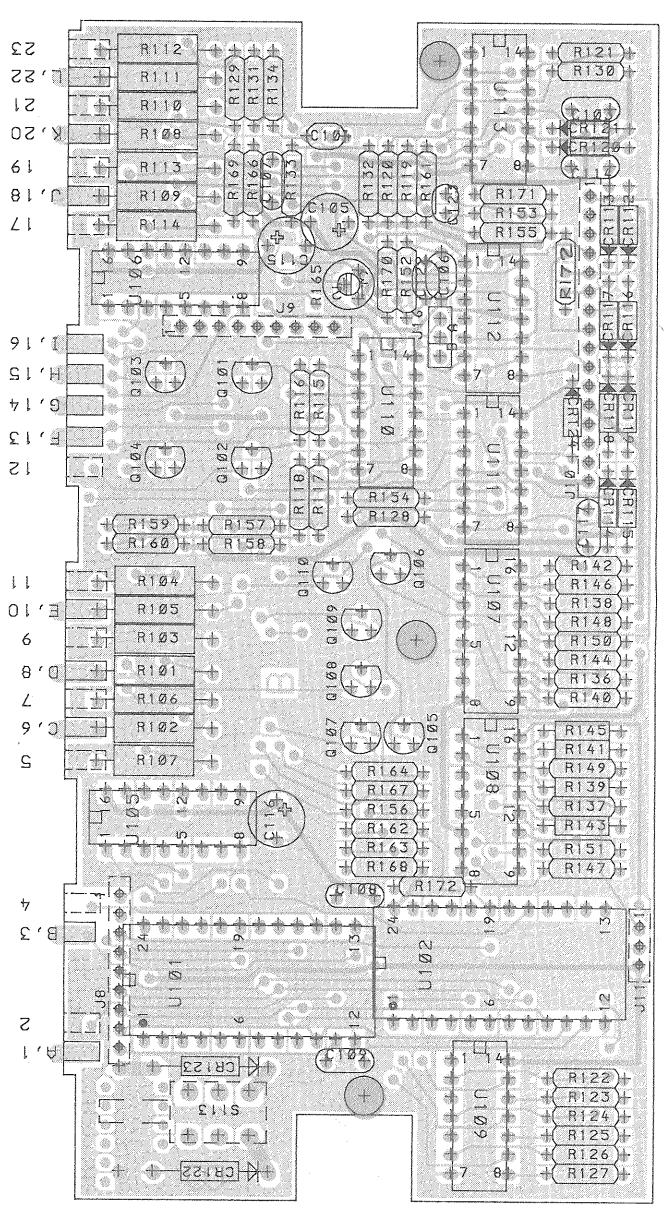


B310
MICRO-COMPUTER

(B310)
Layer Two (B310)
Layer Four (B310)



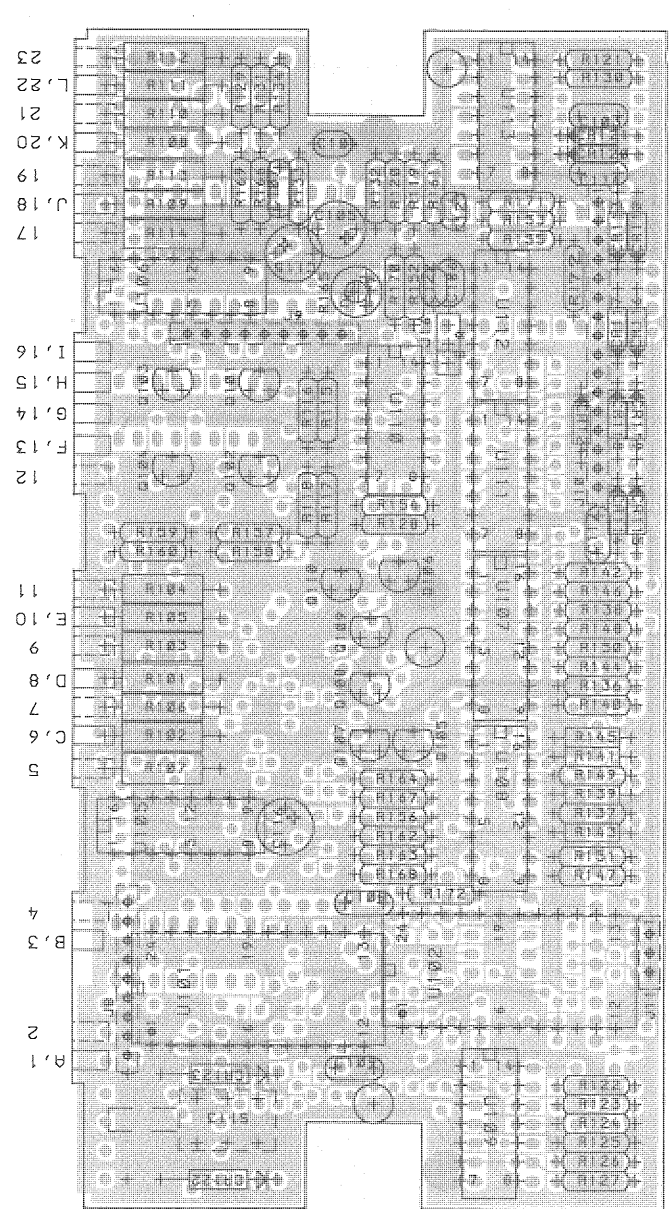
(B310)
Layer Four (B310)



B313 I/O BOARD

(B313)
Layer One (B313)
Layer Two (B313)

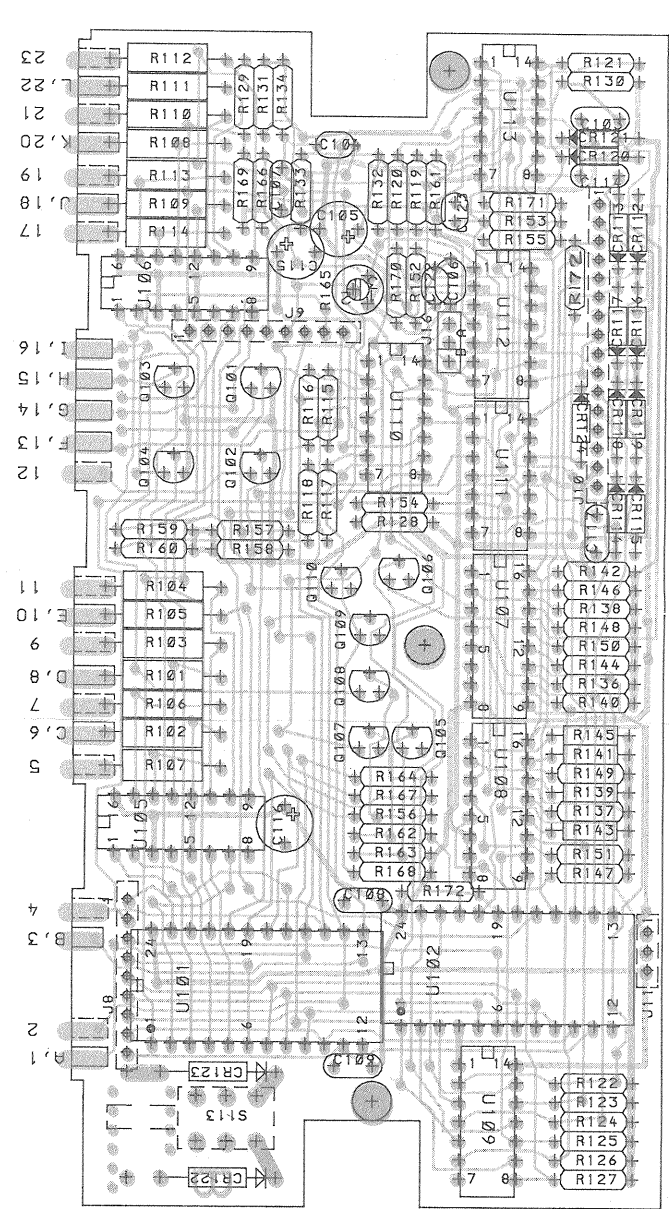
RUNS ON LAYER ONE
RUNS ON BOTH LAYERS
RUNS ON LAYER TWO



B313 I/O BOARD

(B313)
Layer Two (B313)
Layer Three (B313)

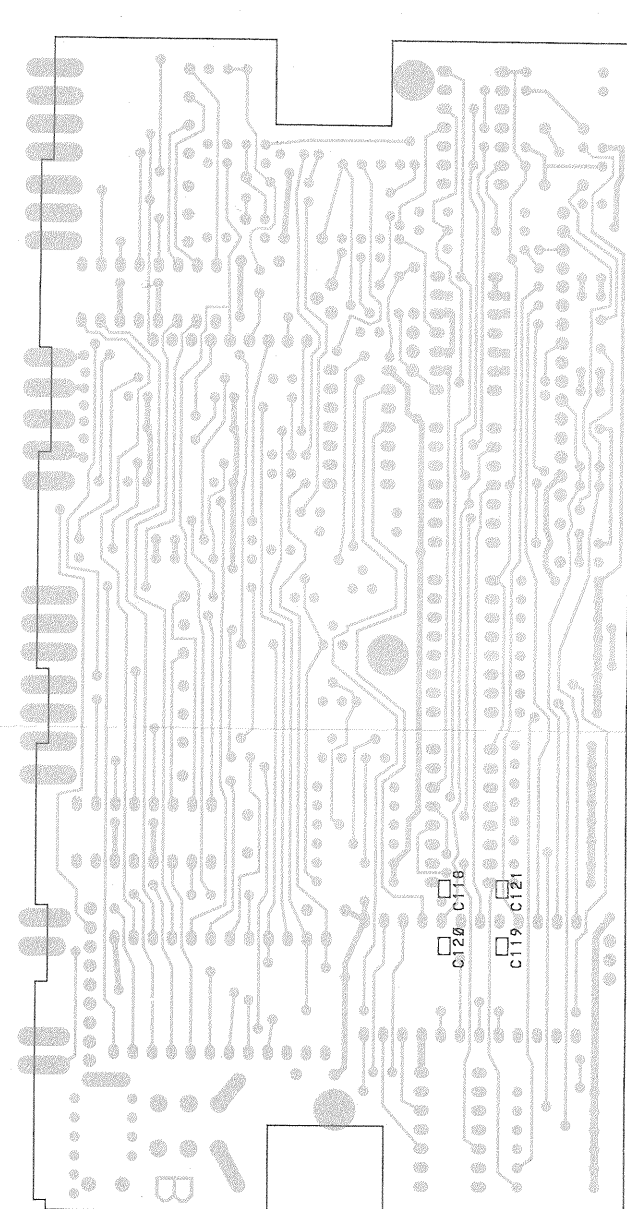
RUNS ON LAYER TWO
RUNS ON BOTH LAYERS
RUNS ON LAYER THREE



B313 I/O BOARD

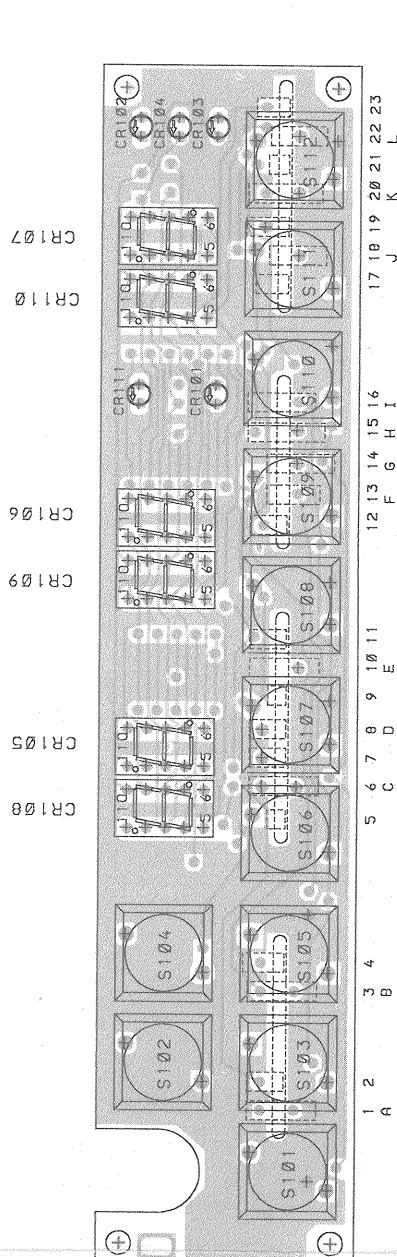
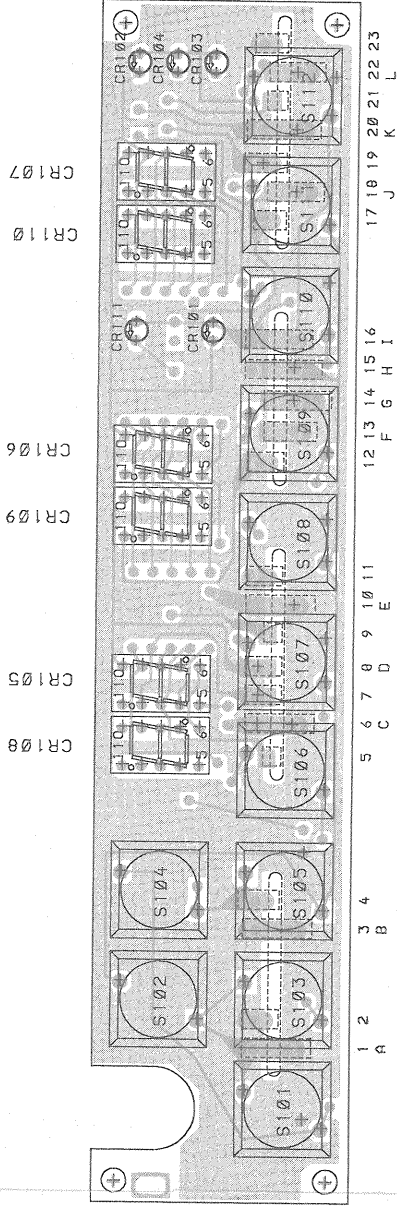
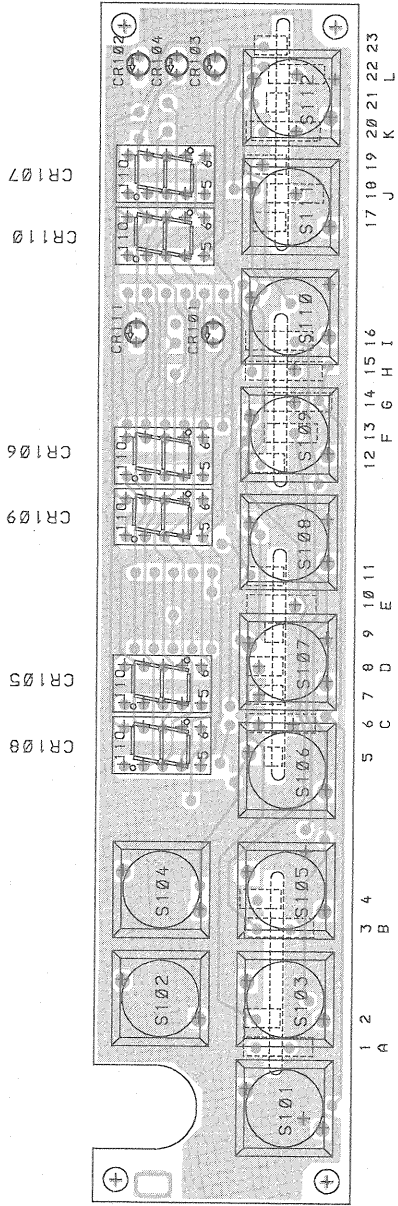
(B313)
Layer Two (B313)
Layer Four (B313)

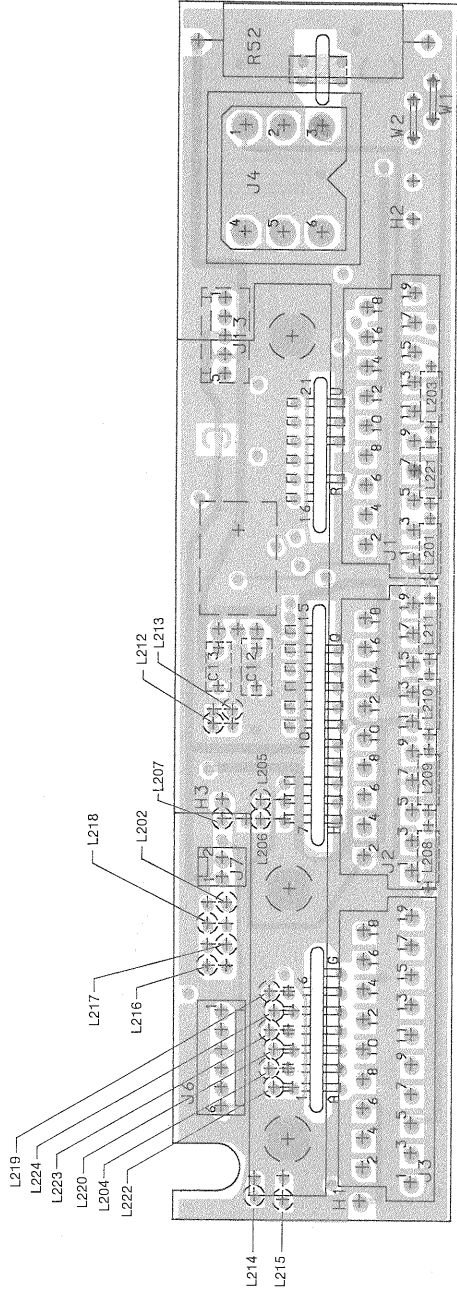
RUNS ON LAYER TWO
RUNS ON BOTH LAYERS
RUNS ON LAYER FOUR



(B313)
Layer Four (B313)

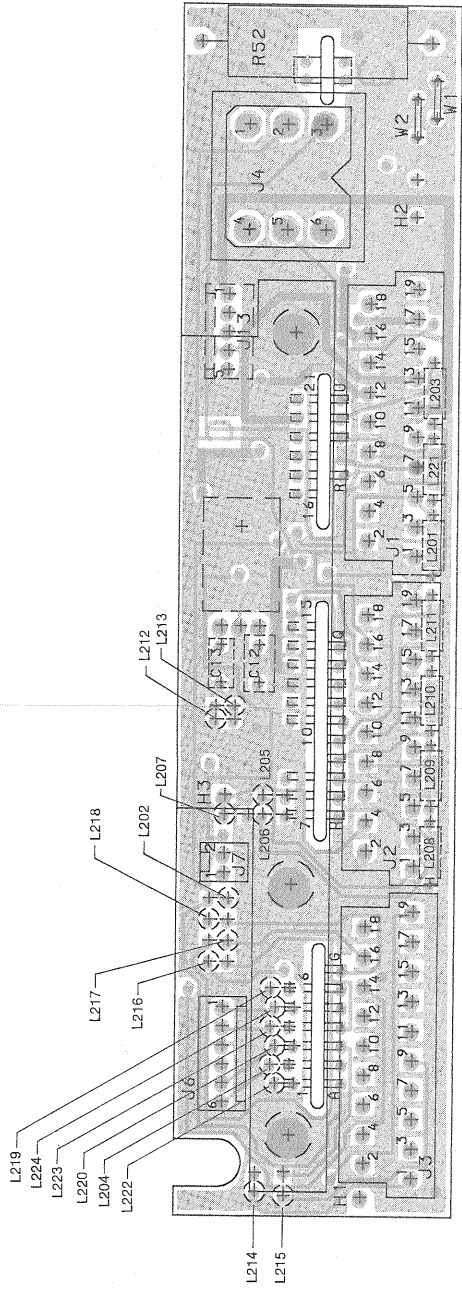
REAR VIEW





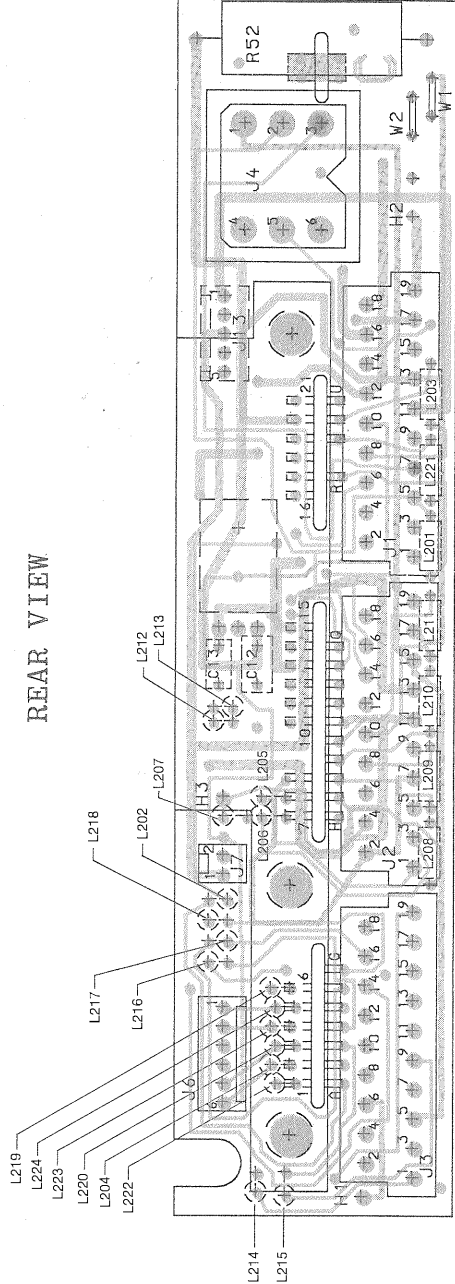
(B318)
Layer One (B318)
Layer Two (B318)

RUNS ON LAYER ONE
RUNS ON BOTH LAYERS
RUNS ON LAYER TWO



(B318)
Layer Two (B318)
Layer Three (B318)

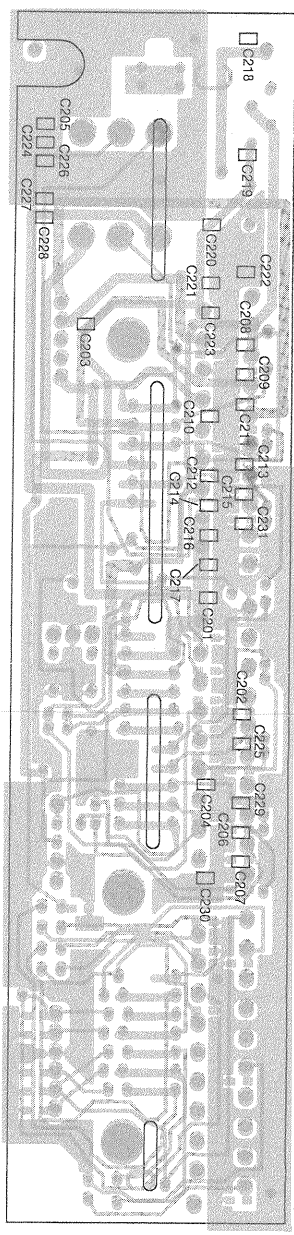
RUNS ON LAYER TWO
RUNS ON BOTH LAYERS
RUNS ON LAYER THREE



REAR VIEW

(B318)
Layer One (B318)
Layer Three (B318)

RUNS ON LAYER ONE
RUNS ON BOTH LAYERS
RUNS ON LAYER THREE

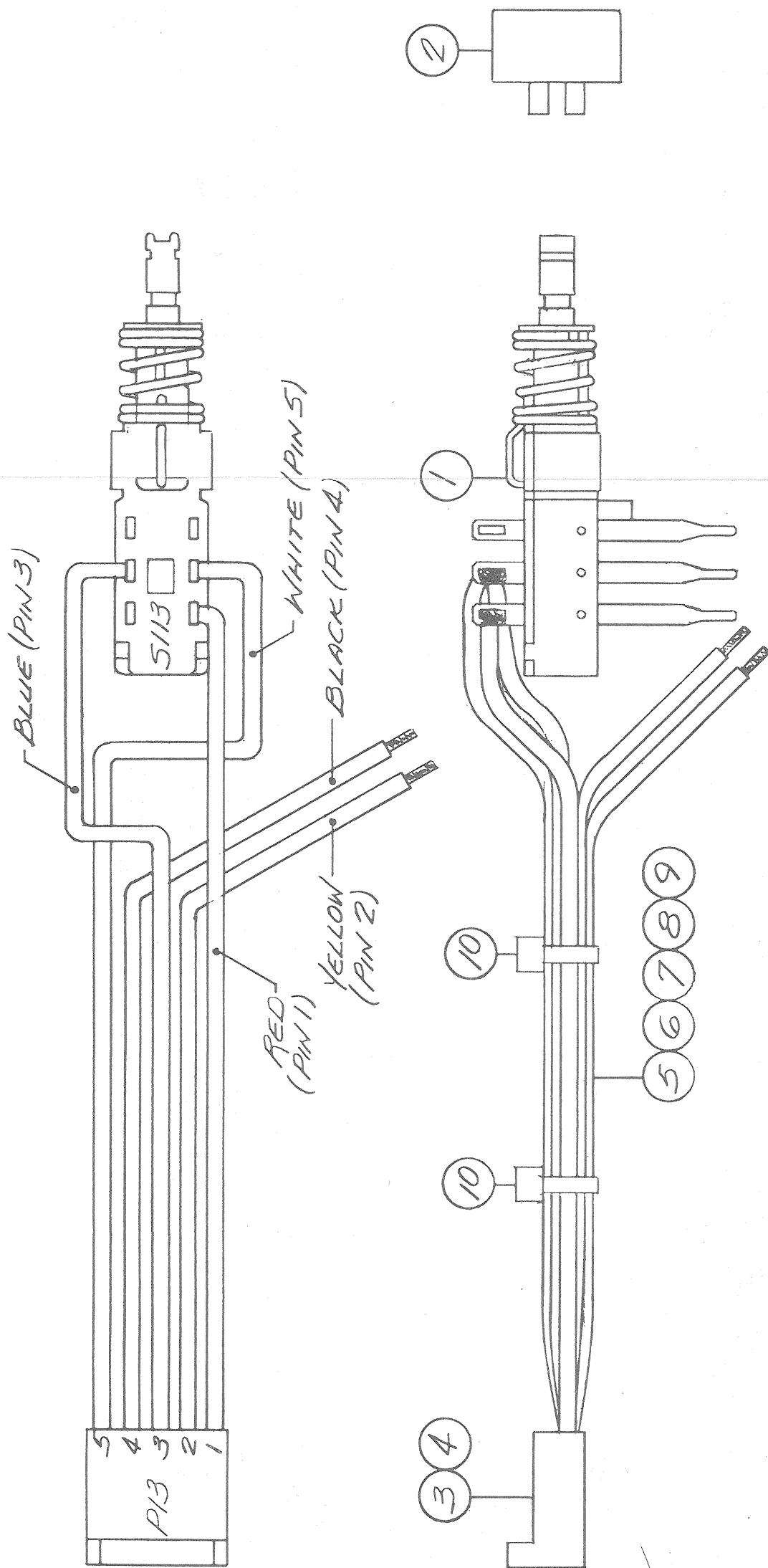


(B318)
Layer Three (B318)
Layer Four (B318)

RUNS ON LAYER THREE
RUNS ON BOTH LAYERS
RUNS ON LAYER FOUR

OUTLINE DIAGRAM

BACKPLANE BOARD

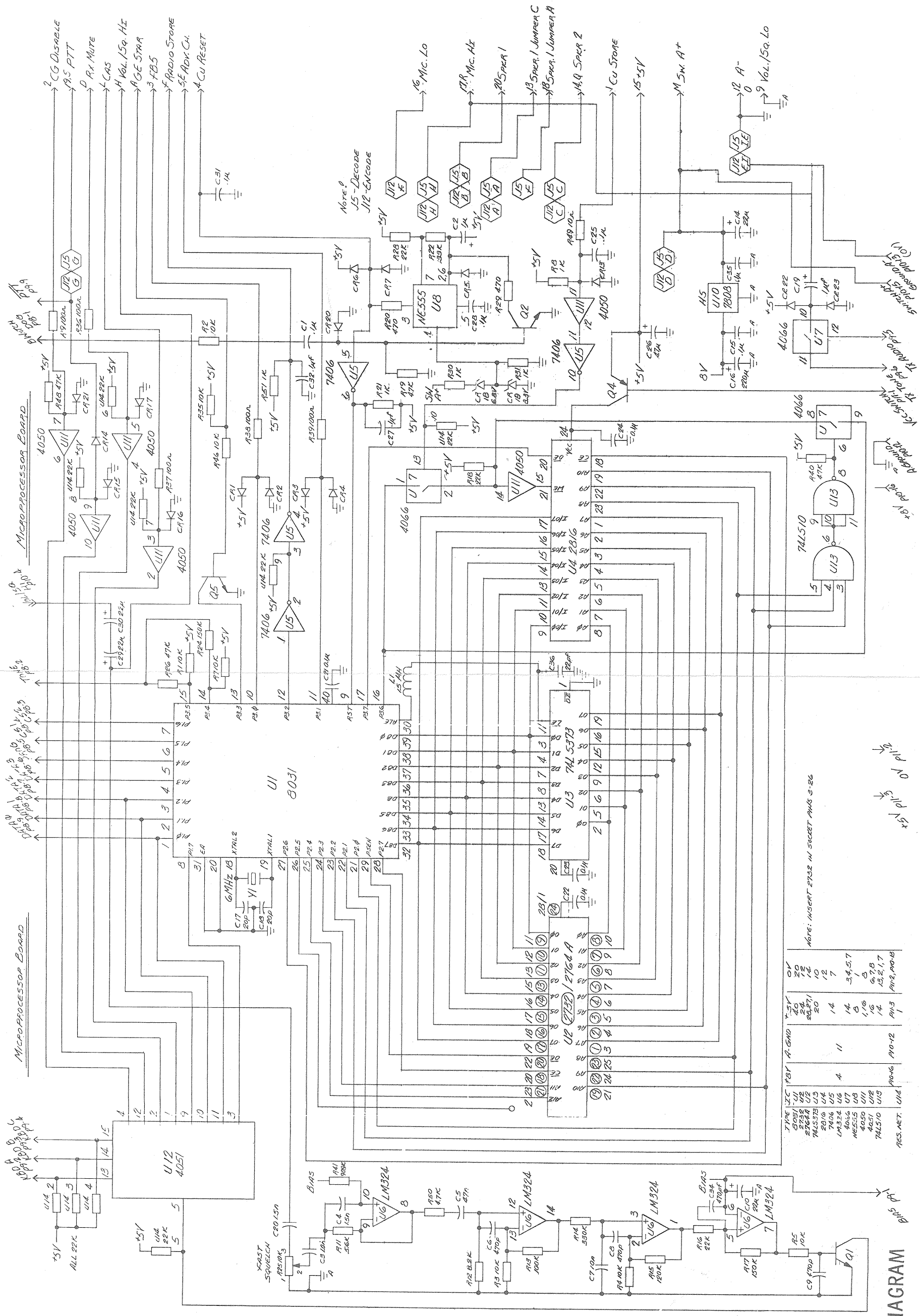


(E200041)

OUTLINE DIAGRAM

POWER SWITCH ASSEMBLY

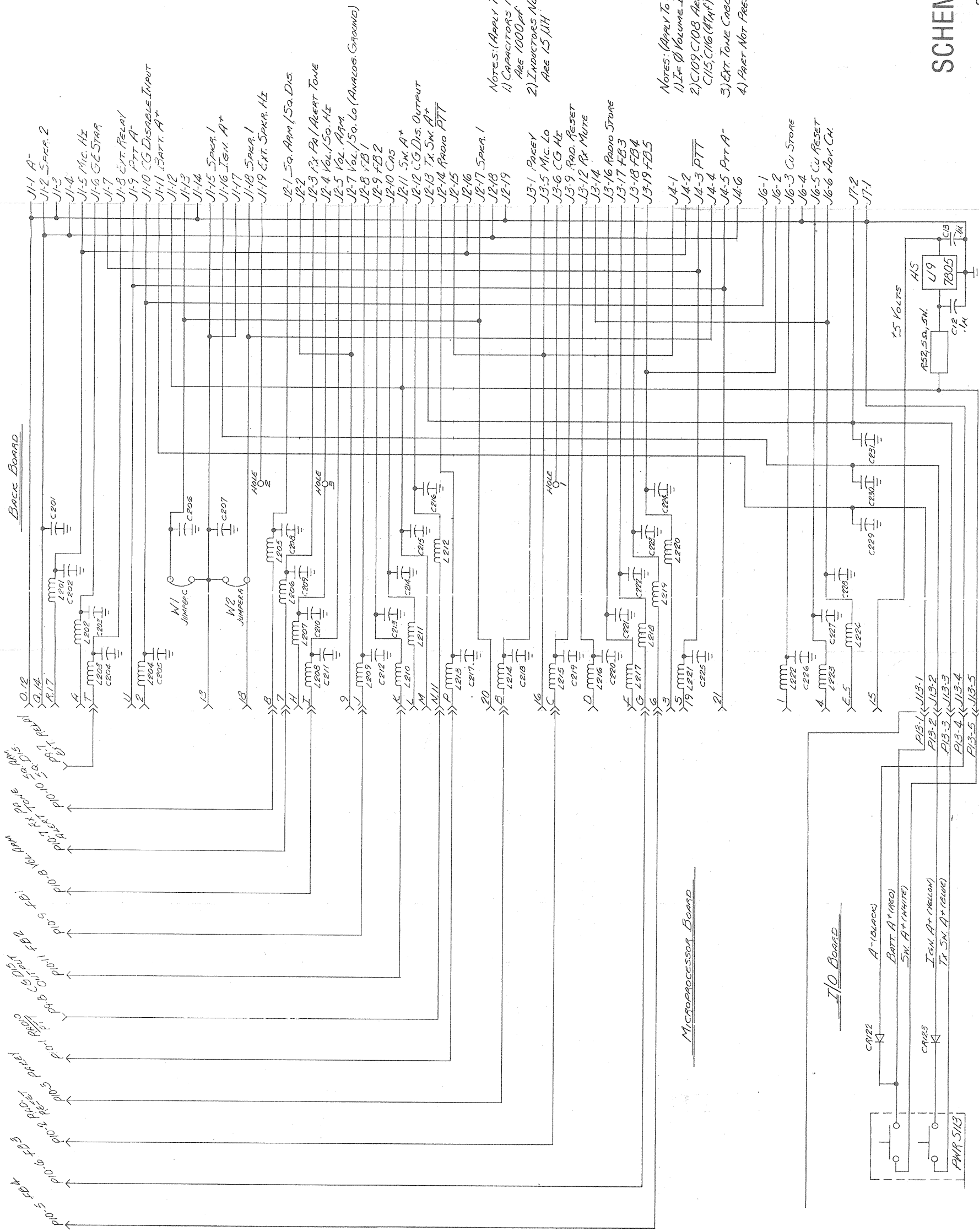
20 Issue 1



SCHEMATIC DIAGRAM

S-950 CONTROL UNIT

Back Board

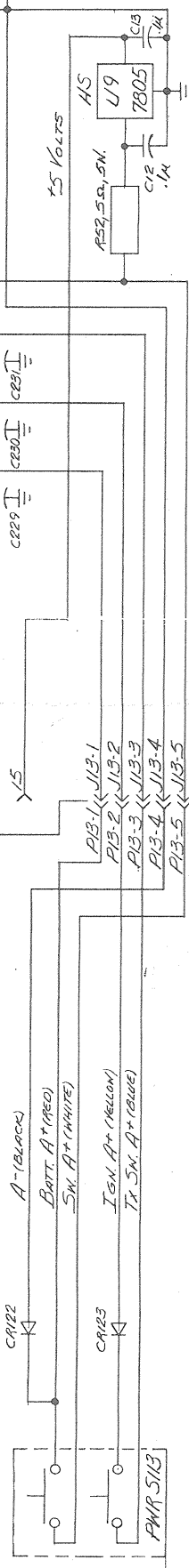


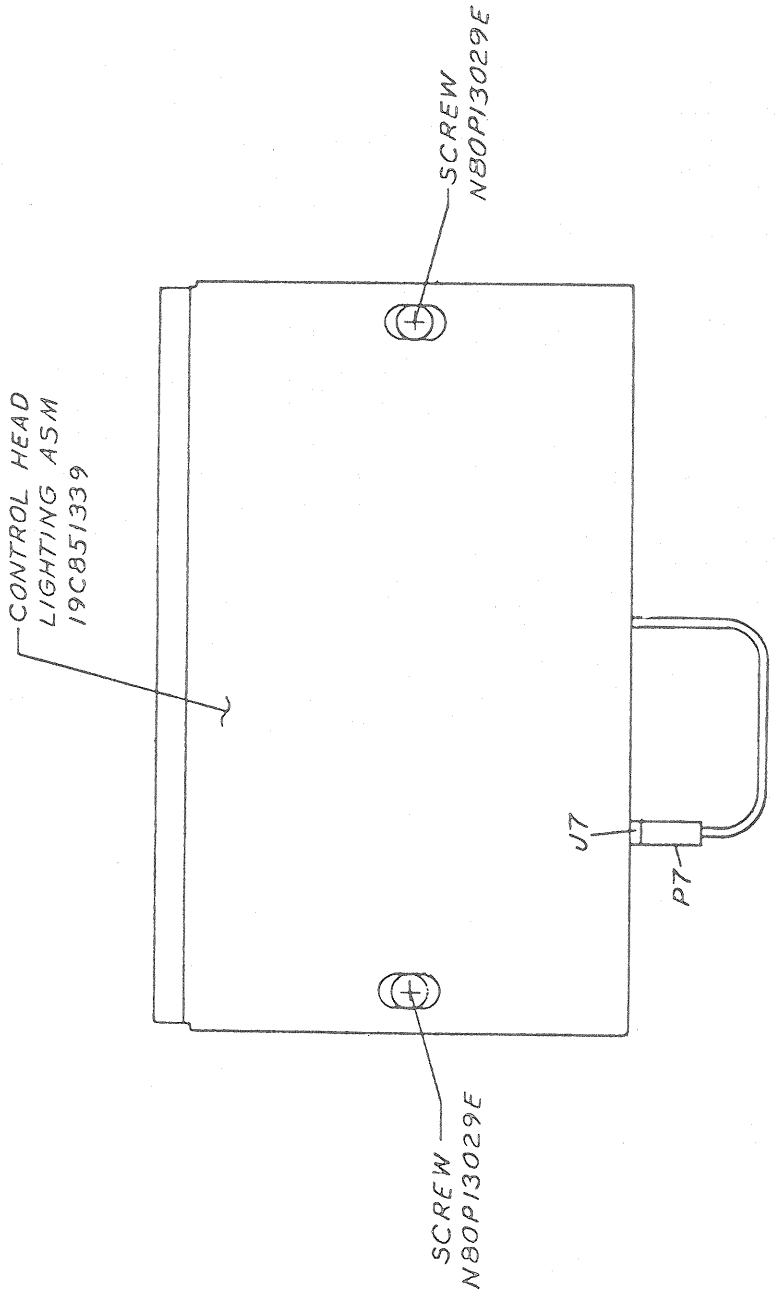
Notes: (Apply To Micro Board)
1) Capacitors Numbered C201 Thru C231
Are 1000pf
2) Inductors Numbered L201 Thru L224
Are 15 uH

Notes: (Apply To Micro Board)
1) If 0 Volume Is Desired, Remove R150
2) C109, C108 Are Near U101, U102 Across +5V & 0V
C115, C116 (RTN) Are Near U105, U106 Across +5V & 0V
3) EXT. TONE CABLE TUNE DECODES ONLY
4) Paper Not Present

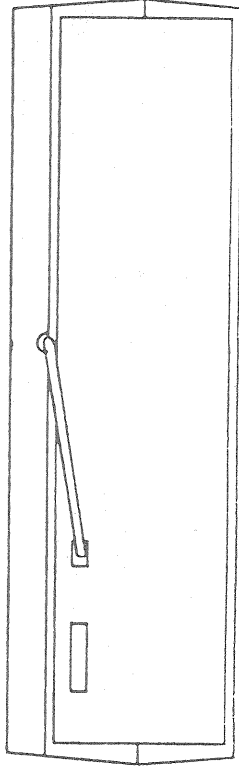
Microprocessor Board

I/O Board





1. REMOVE EXISTING SCREWS WHICH HOLD CONTROL HEAD TOGETHER AND DISCARD.
2. ASSEMBLE CONTROL HEAD LIGHTING ASM IN POSITION SHOWN AND SECURE TO S950 CONTROL HEAD USING SCREWS N80P13029E.
3. PLUG P7 INTO J7.



(19C851340, Rev. 0)

INSTALLATION INSTRUCTIONS

LIGHT ASSEMBLY

1 S950 CONTROL UNIT 19B234583P1

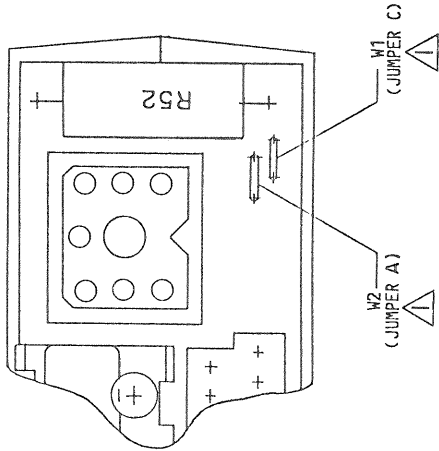
NOTES:

- 1. MARK AND APPLY PER 19A122529
- 2. STAMP LATEST REVISION LETTER SAME AS THE LETTER STAMPED ON HEATSINK BY VENDOR.

3 HANDSET HOOKSWITCH

NOTES:

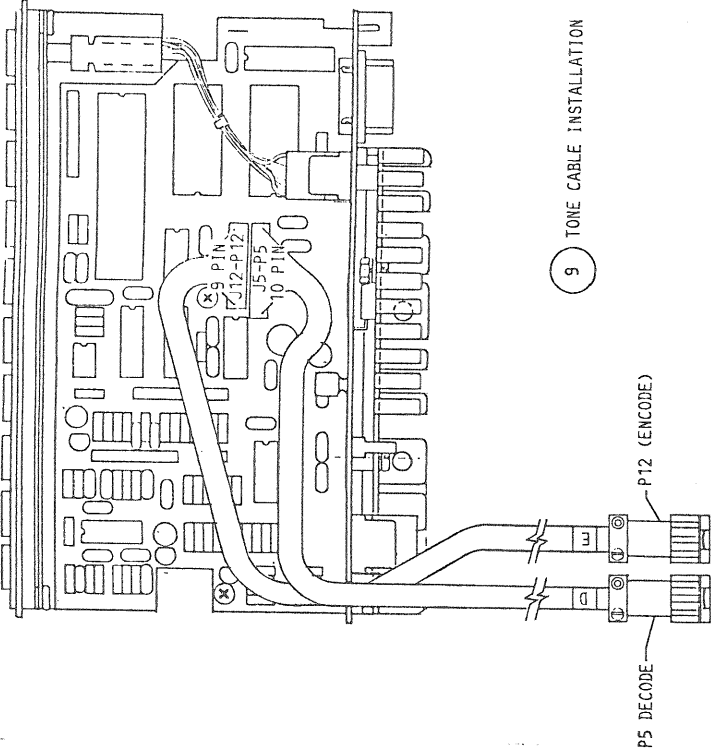
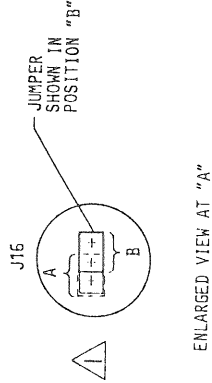
- 1. REMOVE JUMPERS "A" (W2) AND "C" (W1)



2 FIXED SQUELCH

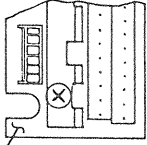
NOTES:

- 1. MOVE JUMPER FROM POSITION "B" TO POSITION "A"

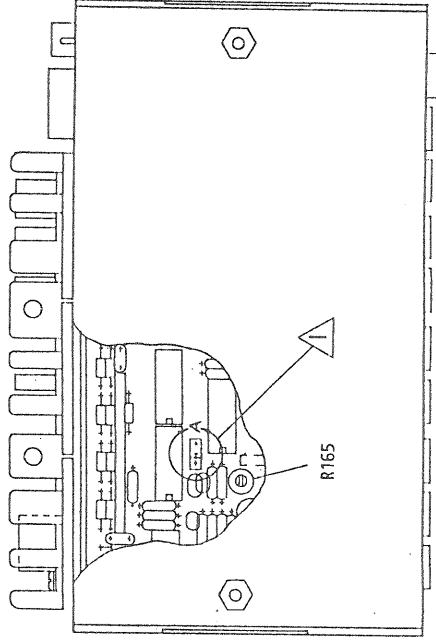
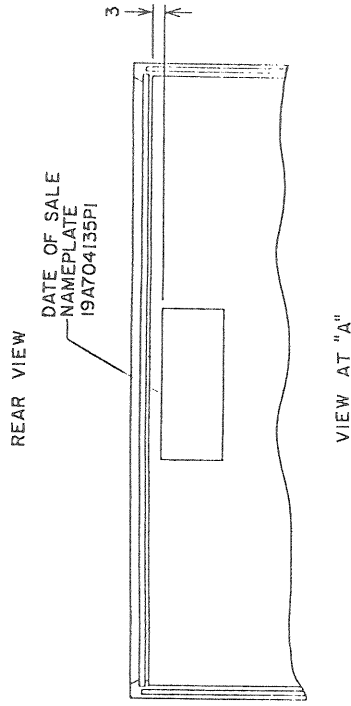
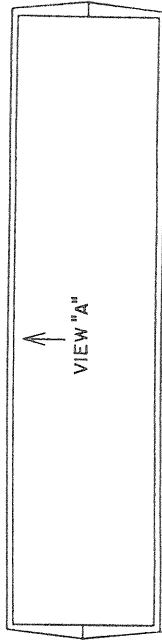


9 TONE CABLE INSTALLATION

IF BOTH TONE CABLES ARE USED REMOVE THIS TAB



4 DEALER PACKAGE



BOTTOM VIEW

OPTION APPLICATION

PARTS LIST

S-950 CONTROL UNIT
 19B23486P1
 ISSUE 1

SYMBOL	GE PART NO.	DESCRIPTION
A1		MICROPROCESSOR/BACK BOARD
		Microprocessor. R300061.
C1	19A116192P14	Ceramic: 0.1 uF ±20%, 50 VDCW; sim to Erie USCC CW20C104-M2.
C2	19A703314P6	Electrolytic: 1 uF -10+0% tol, 50 VDCW; sim to Panasonic LS Series.
C3	19A700234P1	Polyester: 1000 pF ±10%, 50 VDCW.
C4	19A700234P2	Polyester: 1500 pF ±10%, 50 VDCW.
C5	19A702250P111	Polyester: 047 uF ±10%, 50 VDCW.
C6	19A700233P5	Ceramic: 470 pF ±20%, 50 VDCW.
C7	19A700234P7	Polyester: 0.01 uF ±10%, 50 VDCW.
C8 and C9	19A700233P5	Ceramic: 470 pF ±20%, 50 VDCW.
C10	19A701534P8	Tantalum: 0.47 uF ±20%, 35 VDCW.
C14	19A703314P5	Electrolytic: 22 uF ±10+50% tol, 25 VDCW; sim to Panasonic LS Series.
C15	19A116192P14	Ceramic: 0.1 uF ±20%, 50 VDCW; sim to Erie USCC CW20C104-M2.
C16	19A703314P2	Electrolytic: 220 uF -10 + 50%, 10 VDCW.
C17 and C18	19A701624P15	Ceramic, disc: 20 pF ±%, 500 VDCW, temp coef 0 PPM ±30.
C19	19A701534P4	Tantalum: 1 uF ±20%, 35 VDCW.
C20	19A700234P2	Polyester: 1500 pF ±10%, 50 VDCW.
C21 thru C25	19A116192P14	Ceramic: 0.1 uF ±20%, 50 VDCW; sim to Erie USCC CW20C104-M2.
C26	19A701534P9	Tantalum: 47 uF ±20%, 6.3 VDCW.
C27 and C28	19A116192P14	Ceramic: 0.1 uF ±20%, 50 VDCW; sim to Erie USCC CW20C104-M2.
C29 and C30	19A700003P5	Tantalum: 2.2 uF ±20%, 35 VDCW.
C31 and C32	19A116192P14	Ceramic: 0.1 uF ±20%, 50 VDCW; sim to Erie USCC CW20C104-M2.
C34	19A700233P5	Ceramic: 470 pF ±20%, 50 VDCW.
C35	19A116192P14	Ceramic: 0.1 uF ±20%, 50 VDCW; sim to Erie USCC CW20C104-M2.
C36	19A700007P29	Ceramic: 22 pF ±5%, temp coef 0 ±30 PPM.
CR1 thru CR7	19A700028P1	----- DIODES ----- Silicon, fast recovery: fwd current 75 ma, 75 PIV; sim to Type 1N4146.
CR13 thru CR17	19A700028P1	Silicon, fast recovery: fwd current 75 ma, 75 PIV; sim to Type 1N4146.
CR18	19A700025P8	Silicon, zener: 400 mW max; sim to BZX55-C6V8.
CR19	19A700025P3	Silicon, zener: 400 mW max; sim to BZX55-C3V3.
CR20 and CR21	19A700028P1	Silicon, fast recovery: fwd current 75 ma, 75 PIV; sim to Type 1N4146.
CR22 and CR23	19A134134P2	Rectifier, silicon; sim to Motorola 1N5818.

SYMBOL	GE PART NO.	DESCRIPTION
J5	19A700072P208	----- JACKS ----- Printed wire: 10 contacts rated at 2.5 amps; sim to Berg 65500-410.
J12	19A700072P208	Printed wire: 10 contacts rated at 2.5 amps; sim to Berg 65500-410.
L1	19A700024P27	----- COILS ----- Coil, RF: 15 uH ±10%.
P8 and P9		----- PLUGS ----- Receptacle: Bottom entry, 9 pin; sim to AMP P5210-532-6.
P10		Receptacle: Bottom entry, 16 pin; sim to AMP P5210-532-23.
P11		Receptacle: Bottom entry, 3 pin; sim to AMP P5210-532-22.
Q1 and Q2	19A700023P1	----- TRANSISTORS ----- Silicon, NPN; sim to Type 2N3904.
Q4	19A134960P1	Silicon, PNP; sim to Type 2N4403.
Q5	19A700023P1	Silicon, NPN; sim to Type 2N3904.
R1 thru R5	19A700019P49	----- RESISTORS ----- Deposited carbon: 10K ohms ±5%, 1/4 w.
R7	19A700019P49	Deposited carbon: 10K ohms ±5%, 1/4 w.
R8	19A700019P37	Deposited carbon: 100 ohms ±5%, 1/4 w.
R9	19A700019P25	Deposited carbon: 5.6K ohms ±5%, 1/4 w.
R11	19A700019P46	Deposited carbon: 8.2K ohms ±5%, 1/4 w.
R12	19A700019P48	Deposited carbon: 0.1M ohms ±5%, 1/4 w.
R13	19A700019P61	Deposited carbon: 0.33M ohms ±5%, 1/4 w.
R14	19A700019P67	Deposited carbon: 0.12K ohms ±5%, 1/4 w.
R15	19A700019P62	Deposited carbon: 22K ohms ±5%, 1/4 w.
R16	19A700019P53	Deposited carbon: 0.15M ohms ±5%, 1/4 w.
R17	19A700019P63	Deposited carbon: 22K ohms ±5%, 1/4 w.
R18	19A700019P53	Deposited carbon: 47K ohms ±5%, 1/4 w.
R19	19A700019P57	Deposited carbon: 470 ohms ±5%, 1/4 w.
R20	19A700019P33	Deposited carbon: 1K ohms ±5%, 1/4 w.
R21	19A700019P37	Deposited carbon: 33K ohms ±5%, 1/4 w.
R22	19A700019P55	Deposited carbon: 0.15M ohms ±5%, 1/4 w.
R24	19A700019P63	Variable, cermet: 10K ohms ±10%, 1/2 w; sim to Bourne 3329H-1-103.
R25	19A700019P74	Deposited carbon: 47K ohms ±5%, 1/4 w.
R26	19A700019P57	Deposited carbon: 22K ohms ±5%, 1/4 w.
R28	19A700019P53	Deposited carbon: 22K ohms ±5%, 1/4 w.
R29	19A700019P33	Deposited carbon: 1K ohms ±5%, 1/4 w.
R30 and R31	19A700019P37	Deposited carbon: 10K ohms ±5%, 1/4 w.
R35	19A700019P49	Deposited carbon: 100 ohms ±5%, 1/4 w.
R36 thru R39	19A700019P25	Deposited carbon: 47K ohms ±5%, 1/4 w.
R40	19A700019P57	Metal film: 90.9K ohms ±1%, 250 VDCW, 1/4 w.
R41	19A701250P393	Deposited carbon: 10K ohms ±5%, 1/4 w.
R46	19A700019P49	Deposited carbon: 47K ohms ±5%, 1/4 w.
R48	19A700019P57	

SYMBOL	GE PART NO.	DESCRIPTION
R49	19A700019P13	Deposited carbon: 10 ohms ±5%, 1/4 w.
R50	19A700019P45	Deposited carbon: 4.7K ohms ±5%, 1/4 w.
R51	19A700019P37	Deposited carbon: 1K ohms ±5%, 1/4 w.
U1	19A703104P1	----- INTEGRATED CIRCUITS ----- Microcomputer. 8031.
U2	19A703482P1	Programmable Read Only Memory (64K Ultraviolet Erasable).
U3	19A700037P415	Digital: 74LS373.
U4	19A703952P1	Digital: 2KX8 EPROM 2816 (P10002).
U5	19A116180P75	Digital: 7406.
U6	19A701789P1	Linear: LM324.
U7	19A700029P44	Digital: 4066.
U8	19A701865P1	Linear: 555.
U10	19A704073P1	Linear: 8V Regulator.
U11	19A700029P35	Digital: 4050.
U12	19A700029P36	Digital: 4051.
U13	19A700037P309	Digital: 74LS10.
U14	19A701630P8	Resistor Network. 22K.
XU1	19A700156P5	----- SOCKETS ----- IC: 40 pin.
XU2	19A700156P3	IC: 28 pin.
XU4	19A700156P3	IC: 28 pin.
Y1	19A702511G3	----- CRYSTALS ----- Crystal Unit, 6 MHz.
	19A701516P1	----- MISCELLANEOUS ----- Insulator. (Located between Y1 and printed board).
A2		Backboard. A-SYSTEMS R200032.
C12	19A700234P7	Polyester: 0.01 uF ±10%, 50 VDCW.
C13	19A116192P14	Ceramic: 0.1 uF ±20%, 50 VDCW; sim to Erie USCC CW20C104-M2.
C201 thru C231	19A702032P5	Ceramic: 1000 pF ±10%, 50 VDCW.
J1 thru J3	19A116659P35	----- JACKS ----- Connector, printed wiring: 11 contacts rated at 5 amps; sim to Molex 09-64-2113.
J4	19B219627G1	Connector: 6 contacts.
J6	19A700072P32	Printed wire: 6 contacts rated at 2.5 amps; sim to Molex 22-27-2001.
J7	19A700072P28	Printed wire: 2 contacts rated @ 2.5 amps; sim to Molex 22-27-2021.
J31	19A700072P31	Printed wire: 5 contacts rated at 2.5 amps; sim to Molex 22-27-2001.
L201 thru L224	19A700024P27	----- COILS ----- Coil, RF: 15 uH ±10%, 150 mA; sim to Jeffers Cat. No. 1316-2K.
R52	5493035P1	----- RESISTORS ----- Wirewound: 5 ohms ±5%, 5 watt; sim to Hamilton Hall Type RH-5W.
U9	19A134117P1	----- INTEGRATED CIRCUITS ----- Linear: 5 Volt Regulator.

SYMBOL	GE PART NO.	DESCRIPTION
W1 and W2	19A702028P1	----- CABLES ----- Jumper.
		----- MISCELLANEOUS ----- Spacer: Threaded No. 6-32 Metallic Swage Type. Heat sink angle bracket. A-SYSTEMS R200035.
	N80P13006C6	Screw: Phillips panhead, No. 6-32 x 3/8. (Secures heat sink).
	N80P9004C6	Screw: Phillips, panhead, No. 4-40 x 1/4. (Secures U9 to heat sink).
	7141225P2	Lockwasher: Split, No. 6. (Secures heat sink).
		Lockwasher: Split, No. 4. (Secures U9 to heat sink).
		Hexnut: No. 4-40. (Secures U9 to heat sink).
A3		INPUT-OUTPUT/FRONT BOARD R300064
		Input-Output Assembly. R300080.
C103	19A116192P14	Ceramic: 0.1 uF ±20%, 50 VDCW; sim to Erie USCC CW20C104-M2.
C104	19A116192P12	Ceramic: 4700 pF ±10%, 50 VDCW; sim to Erie 8121-M050-W5R-472K.
C105	19A701534P9	Tantalum: 47 uF ±20%, 6.3 VDCW.
C106	19A700233P5	Ceramic: 470 pF ±20%, 50 VDCW.
C107 thru C109	19A116192P14	Ceramic: 0.1 uF ±20%, 50 VDCW; sim to Erie USCC CW20C104-M2.
C114	19A116192P14	Ceramic: 0.1 uF ±20%, 50 VDCW; sim to Erie USCC CW20C104-M2.
C115 and C116	19A701534P9	Tantalum: 47 uF ±20%, 6.3 VDCW.
C117	19A116192P14	Ceramic: 0.1 uF ±20%, 50 VDCW; sim to Erie USCC CW20C104-M2.
C118	19A700058P3	Ceramic: 470 pF ±10%, 50 VDCW; sim to IEC Type 2C1.
C121		Ceramic: 3900 pF ±10%, 50 VDCW; sim to Erie 8121-M050-W5R-392K.
C122 and C123		----- DIODES ----- Silicon, fast recovery: fwd current 75 ma, 75 PIV; sim to Type 1N4146.
CR112 thru CR121	19J706100P1	Rectifier, silicon; sim to 1N4001.
CR122 and CR123	19A700028P1	Silicon, 100 mW, continuous dissipation; sim to DO-15.
CR124	19A700047P2	Silicon, fast recovery: fwd current 75 ma, 75 PIV; sim to Type 1N4146.
CR125		----- JACKS ----- Header: 9 pin. CASPSP100-430T-730.
J8 and J9		Header: 16 pin. CASP16P100-430T-730.
J10		Header: 3 pin. CAS3SP100-430T-730.
J11	19A700072P208	Header: 10 pin.
J16		----- TRANSISTORS ----- Silicon, PNP; sim to Type 2N4403.
Q101 thru Q104	19A134960P1	

*COMPONENTS ADDED, DELETED OR CHANGED BY PRODUCTION CHANGES

SYMBOL	GE PART NO.	DESCRIPTION
W1 and W2	19A702028P1	----- CABLES ----- Jumper.
	19A143578P210	----- MISCELLANEOUS ----- Spacer: Threaded No. 6-32 Metallic Swage Type. Heat sink angle bracket. A-SYSTEMS R200035. Screw: Phillips panhead, No. 6-32 x 3/8. (Secures heat sink). Screw: Phillips, panhead, No. 4-40 x 1/4. (Secures U9 to heat sink). Lockwasher: Split, No. 6. (Secures heat sink). Lockwasher: Split, No. 4. (Secures U9 to heat sink). Hexnut: No. 4-40. (Secures U9 to heat sink).
A3	N80P13006C6	INPUT-OUTPUT/FRONT BOARD R300084
	N80P9004C6	Input-Output Assembly. R300090.
C103	19A116192P14	----- CAPACITORS ----- Ceramic: 0.1 uF ±20%, 50 VDCW; sim to Erie USCC CW20C104-M2.
	19A116192P212	Ceramic: 4700 pF ±10%, 50 VDCW; sim to Erie S121-M050-W5R-472K.
C105	19A701534P9	Tantalum: 47 uF ±20%, 6.3 VDCW.
C106	19A700023P5	Ceramic: 470 pF ±20%, 50 VDCW.
C107	19A116192P14	Ceramic: 0.1 uF ±20%, 50 VDCW; sim to Erie USCC CW20C104-M2.
C109		
C114	19A116192P14	Ceramic: 0.1 uF ±20%, 50 VDCW; sim to Erie USCC CW20C104-M2.
C115 and C116	19A701534P9	Tantalum: 47 uF ±20%, 6.3 VDCW.
C117	19A116192P14	Ceramic: 0.1 uF ±20%, 50 VDCW; sim to Erie USCC CW20C104-M2.
C118 thru C121	19A700058P3	Ceramic: 470 pF ±10%, 50 VDCW; sim to IEC Type ZC1.
C122 and C123	19A116192P5	Ceramic: 3900 pF ±10%, 50 VDCW; sim to Erie 8121-M050-W5R-392K.
CR112 thru CR121	19A700028P1	----- DIODES ----- Silicon, fast recovery: fwd current 75 mA, 75 PIV; sim to Type 1N4148.
	19J706100P1	Rectifier, silicon; sim to 1N4001.
CR124	19A700047P2	Silicon, 100 mW, continuous dissipation; sim to DO-15.
CR125	19A700028P1	Silicon, fast recovery: fwd current 75 mA, 75 PIV; sim to Type 1N4148.
J8 and J9		----- JACKS ----- Header: 9 pin. CASP9SF100-430T-730.
J10		Header: 16 pin. CASP16P100-430T-730.
J11		Header: 3 pin. CASSP100-430T-730.
J16	19A700072P208	Header: 10 pin.
Q101 thru Q104	19A134860P1	----- TRANSISTORS ----- Silicon, PNP; sim to Type 2N4403.

SYMBOL	GE PART NO.	DESCRIPTION
Q105	19A700023P1	Silicon, NPN; sim to Type 2N3904.
Q106	19A134859P1	Silicon, NPN; sim to Type 2N4401.
Q107 thru Q110	19A700023P1	Silicon, NPN; sim to Type 2N3904.
R101 thru R114	19A700113P55	----- RESISTORS ----- Composition: 470 ohms ±5%, 1/2 w.
	19A700019P33	Deposited carbon: 470 ohms ±5%, 1/4 w.
R115 thru R118	19A700019P57	Deposited carbon: 47K ohms ±5%, 1/4 w.
R119 thru R128	19A700019P61	Deposited carbon: 0.1M ohms ±5%, 1/4 w.
R129	19A700019P61	Deposited carbon: 0.1M ohms ±5%, 1/4 w.
R130	19A700019P37	Deposited carbon: 1.0K ohms ±5%, 1/4 w.
R131	19A700019P45	Deposited carbon: 4.7K ohms ±5%, 1/4 w.
R132 and R133	19A700019P61	Deposited carbon: 0.1M ohms ±5%, 1/4 w.
R134	19A700019P49	Deposited carbon: 10K ohms ±5%, 1/4 w.
R136	19A700019P43	Deposited carbon: 3.3K ohms ±5%, 1/4 w.
R137	19A700019P42	Deposited carbon: 2.7K ohms ±5%, 1/4 w.
R138	19A700019P47	Deposited carbon: 6.8K ohms ±5%, 1/4 w.
R139	19A701250P253	Metal film: 3.48K ohms ±1%, 1/4 w.
R140	19A700019P50	Deposited carbon: 12K ohms ±5%, 1/4 w.
R141	19A701250P261	Metal film: 4.22K ohms ±1%, 1/4 w.
R142	19A700019P54	Deposited carbon: 27K ohms ±5%, 1/4 w.
R143	19A701250P269	Metal film: 5.11K ohms ±1%, 1/4 w.
R144	19A700019P58	Deposited carbon: 56K ohms ±5%, 1/4 w.
R145	19A701250P277	Metal film: 6.19K ohms ±1%, 1/4 w.
R146	19A700019P61	Deposited carbon: 0.1M ohms ±5%, 1/4 w.
R147	19A701250P285	Metal film: 7.5K ohms ±1%, 250 VDCW, 1/4 w.
R148	19A700019P65	Deposited carbon: 0.22M ohms ±5%, 1/4 w.
R149	19A701250P305	Metal film: 11K ohms ±1%, 250 VDCW, 1/4 w.
R150	19A700019P69	Deposited carbon: 0.47M ohms ±5%, 1/4 w.
R151	19A700019P70	Deposited carbon: 0.56M ohms ±5%, 1/4 w.
R152 and R153	19A700019P43	Deposited carbon: 3.3K ohms ±5%, 1/4 w.
R154	19A700019P33	Deposited carbon: 470 ohms ±5%, 1/4 w.
R155	19A700019P48	Deposited carbon: 8.2K ohms ±5%, 1/4 w.
R156 thru R160	19A700019P49	Deposited carbon: 10K ohms ±5%, 1/4 w.
R161	19A700019P57	Deposited carbon: 47K ohms ±5%, 1/4 w.
R162	19A700019P53	Deposited carbon: 22K ohms ±5%, 1/4 w.
R163	19A700019P37	Deposited carbon: 1K ohms ±5%, 1/4 w.
R164	19A700019P57	Deposited carbon: 47K ohms ±5%, 1/4 w.
R165	19A700019P4	Variable, cermet: 10K ohms ±10%, 1/2 w; sim to Bourns 3328H-1-103.
R166	19A700019P37	Deposited carbon: 47K ohms ±5%, 1/4 w.
R167	19A700019P49	Deposited carbon: 10K ohms ±5%, 1/4 w.
R168	19A700019P37	Deposited carbon: 1K ohms ±5%, 1/4 w.
R169	19A700019P43	Deposited carbon: 3.3K ohms ±5%, 1/4 w.
R170 thru R171	19A700019P37	Deposited carbon: 1K ohms ±5%, 1/4 w.
R172	19A700019P66	Deposited carbon: 0.27M ohms ±5%, 1/4 w.
R173	19A700019P25	Deposited carbon: 100 ohms ±5%, 1/4 w.

SYMBOL	GE PART NO.	DESCRIPTION
S113	19A700041P31	----- SWITCHES ----- Switch, push. R200041.
	19A700041P25	----- PLUGS ----- Connector. Includes: Shell.
P13	19A701699P21	Contact. (Quantity 5).
	19A701699P20	----- MISCELLANEOUS ----- Switch, push: 1 station, DPDT, 100 DC mA at 28 Volts; sim to IEEE/SCHADOW F2UEE. (Part of S113).
U101 and U102	19B800563P7	Pushbutton. (Part of S113).
	19C850640P1	----- INTEGRATED CIRCUITS ----- Digital. 8243.
U105 and U106	19A7006028P1	Digital. 7446.
U107 and U108	19A116180P60	Digital. 4051.
U109	19A700029P36	Digital. 4051.
U110	19A116180P75	Digital. 7406.
U111	19A116180P56	Digital. 7407.
U112	19A116180P75	Digital. 7406.
U113	19A701789P1	Linear. LM324.
A4	19A700029P44	Digital: BILATERAL SWITCH.
		Front Board. R200034.
CR101	19A703595P3	----- DIODES ----- Optoelectronic: green; sim to Hewlett Packard HLMF-1540.
	19A703595P4	Optoelectronic: red; sim to Hewlett Packard HLMF-1301.
CR103	19A703595P6	Optoelectronic: green; sim to Hewlett Packard HLMF-1303.
CR104	19A703595P3	Optoelectronic: green; sim to Hewlett Packard HLMF-1540.
CR105 thru CR110	19A703607P5	Optoelectronic: green; sim to Hewlett Packard HJSP-7801.
CR111	19A703595P4	Optoelectronic: red; sim to Hewlett Packard HLMF-1301.
S101 thru S112	19A701324P2	----- SWITCHES ----- Push: sim to IEE/Schadow Series WDP Module.
		----- MISCELLANEOUS ----- Pushbutton. (Used with S101-S112).
N80P9003C6	19C850665P1	Spacer, threaded: No. 4-40, metallic swage Type. (Located in center of Input-Output/Front Board).
	19A143578P58	Spacer, Insulated-threaded: No. 4-40 x 3/16; nylon.
N80P9003C6		Screw, Phillips panhead: No. 4-40 x 3/16. (Secures Input-Output/Front Board).
		Lockwasher, split: No. 4. (Secures Input-Output/Front Board).
19A700041P32		Front Panel. (T30784 Olive gray). R300091.
		Equipment Enclosure Half. (T30784 Olive gray). R300085.
		Connector cover, 6 pin. (Used with J6).

SYMBOL	GE PART NO.	DESCRIPTION
P16	19A700041P28	Connector cover, 2 pin. (Used with J7).
	19A700041P25	Contact. (Used with J6 & J7 connector covers).
N80P13024C6	19B801231P1	Nameplate. (GE).
	19A701699P5	Nameplate button. (∧).
7141225P3	19A701699P18	Nameplate button. (VOL ∧).
	19A701699P19	Nameplate button. (VOL ∨).
N210P15C6	19A701699P20	Nameplate button. (SQ ∧).
	19A701699P21	Nameplate button. (SQ ∨).
	19A701699P22	Nameplate button. (Blank).
	19A701699P23	Nameplate button. (PWR).
	19A701699P24	Nameplate button. (ADD).
	19A701699P25	Nameplate button. (DEL).
	19A701699P26	Nameplate button. (SCAN).
	N80P9003P6	Screw: Phillips, panhead, No. 4-40 x 3/16. (Secures Microprocessor/Back Board to Input-Output/Front Board).
		Lockwasher, split: No. 4. (Secures Microprocessor/Back Board to Input-Output/Front Board).
		Jumper. AMP 531220-1. (P16).
		Screw: Phillips, panhead, No. 4 x 1/4 Type 25. (Secures Front Panel to Input-Output/Front Board).
		Screw: Phillips, panhead, No. 6-32 x 1 1/2. (Secures Equipment Enclosure halves to Front Panel).
		Lockwasher, split: No. 6. (Secures Equipment Enclosure halves to Front Panel).
		Hexnut: No. 6-32. (Secures Equipment Enclosure halves to Front Panel).
		Hexnut: No. 8-32. (Used with mounting bracket).

PARTS LIST

POWER/CONTROL CABLES
30 CONDUCTOR SHORT GRD.
19D900447G16 3 METER
19D900447G18 6 METER
19D900447G20 9 METER

ISSUE 1

SYMBOL	GE PART NO.	DESCRIPTION
P1		----- PLUGS ----- Connector. Includes: Shell. Housing. Cover. Contact, electrical rated @ 4 amps; sim to AMP 350657-1. (P1 - 1 thru 17, 22 thru 36). Contact, electrical rated @ 35 amps; sim to AMP 350655-1. (P1 - 37, 38). Contact, electrical rated @ 4 amps; sim to AMP 350656-1. (P1 - 18 thru 21). Thumbscrew: thd. size M4 x 0.7. (Secures P1 to radio). Flatwasher: 1.7 - 1.85 ID. (Used with thumbscrew). Retaining ring. (Contains thumbscrew). Gasket. (Used with P1 cable clamp). Cable clamp. Machine screw, No. M3-0.5 x 25. (Secures P1 cable clamp). Nut, hex: No. M3 x 0.5MM. (Secures P1 cable clamp). Lockwasher, internal tooth: No. 3MM. (Secures P1 cable clamp).
P2		Connector. Includes: Shell. Contact, electrical: wire range No. 18-24 AWG; sim to Molex 08-50-0106. (P2 - 11, 17 thru 19). Contact, electrical: wire range No. 22-26 AWG; sim to Molex 08-50-0108. (P2 - 1 thru 5, 6 thru 10, 12 thru 16).
P3		Connector. Includes: Shell. Contact, electrical: wire range No. 22-26 AWG; sim to Molex 08-50-0108. (P3 - 1 thru 9, 12 thru 19). ----- MISCELLANEOUS ----- Cable, red; sim to GE S1-57528. Cable, black. Solderless terminal. (Located on black ground wire). Solderless terminal. (Located on red + wire). Screw, thd forming: M3.5-1.27 x 9.60. (Secures J1 cover to housing). Screw, thd. forming: No. 3.5-1.27 x 12.7. (Secures J1 connector to housing). GROUND CABLE KIT (5-1/2 TO 33 FT MOD) 19A136690G1 Cable, black. (Approx 33 feet). Contact, electrical rated @ 35 amps; sim to AMP 350655-1. Solderless terminal. Solderless terminal. (Optional terminal for cable).

*COMPONENTS ADDED, DELETED OR CHANGED BY PRODUCTION CHANGES.

PARTS LIST

LIGHT ASSEMBLY
19C851339G1

ISSUE 1

SYMBOL	GE PART NO.	DESCRIPTION
A1		LIGHT PANEL 19C851337G1 ----- DIODES ----- Optoelectronic: green; sim to Hewlett Packard HLMP-1540. ----- PLUGS ----- Connector. Includes: Shell. Contact; sim to molex 08-50-0114. (Quantity 2). ----- RESISTORS ----- Composition: 330 ohms $\pm 5\%$, 1/4 w. Composition: 470 ohms $\pm 5\%$, 1/4 w. ----- MISCELLANEOUS ----- Top cover. Light diffuser. Pad. (Used with P7 cable). Drive screw, pan head: 0-40 x 5/32. (Secures light diffuser and A1).
H1 thru H5	19A703595P3	
P7	19A700041P28 19A700041P25	
R1	19A700106P51	
R2	19A700106P55	
	19D901357P1 19B801244G1 19B232682P4 19A134588P1	

*COMPONENTS ADDED, DELETED OR CHANGED BY PRODUCTION CHANGES.