



SERVICE SECTION
FOR
GE-NET 900™ GETC SHELF

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INTRODUCTION

This manual contains the information required for testing and servicing the General Electric Trunking Card (GETC) station shelf. Included are adjustment and trouble shooting procedures, GETC shelf Interconnection Diagram, Outline and Schematic Diagrams, and Parts List for the GETC logic board and the Regulator Assembly.

The adjustments cover the GETC shelf and GE-NET 900 station. Service information includes four areas of GETC test: off-site test (bench lab stand-alone test), on-site test (limited test with minimum equipment in a station), station test (test in a station), and trunking test (test with a mobile or portable acquiring the station).

INSTALLATION

The GETC is installed in a GE-NET station cabinet. A slide mount supports the GETC shelf assembly, and also allows for easy access during setup and servicing. The GETC Logic card assembly may be removed from the Shelf Assembly by disconnecting the connecting cables and removing the card assembly from the shelf slide. Installation of the GETC shelf assembly in a station is as follows:

1. Mount the GETC Shelf Assembly in the desired rack position, using the hardware provided. Extend the shelf to the servicing position.
2. Connect the harness assembly (19C320811) plug P26 to GETC Logic card connector J6.
3. Connect the harness assembly (19C320811) plug P27 to GETC Logic card connector J7.
4. Connect the harness assembly (19C320811) plug P10 to GETC Logic card connector J10.
5. Connect the harness assembly (19C320811) plug P19 to GETC Logic card connector J19.
6. Connect the harness assembly (19C336863) plug P8 to GETC Logic card connector J8.
7. Connect the harness assembly (19C336863) plug P19 to GETC Logic card connector J19.
8. Slide the GETC shelf back into the cabinet.
9. If a site controller is present, connect the Site Controller cable (from RS-232 Distribution Panel to connector J100 at the back of the GETC Shelf Assembly.

10. Connect the Backup Serial Link cable (from Failsoft Distribution Panel) to connector J102 at the back of the GETC Shelf Assembly.

STATUS INDICATION

There are seven LED indicators on the front of the GETC shelf that indicate the status of the panel. The LEDs indicate whether the repeater is operating as a control channel, idle voice channel or active voice channel. In addition, the GETC is capable of detection ROM failure, RAM failure, synthesizer lock error, or an RF power amplifier failure. If any of these faults are detected, the GETC will automatically notify the site controller (if present), take the station off-line, and begin flashing a combination of LEDs on the front panel to indicate the exact failure. The operation and description of the front panel status indicators is shown in Figure 1.

ADJUSTMENTS

Adjustments in this section are necessary when the GETC shelf is installed in a station. The adjustments properly configure the GETC (DIP switches and jumpers), balance the telephone line, and set high speed, low speed, and audio modulation.

DIP SWITCHES

There are three dual-in-line (DIP) switches on the GETC logic board that must be configured for the proper transmitter frequency, desired channel number, and default mode for trunking operation. It is also possible to invoke test mode operation with the DIP switches.

Selecting Channel Number

Switches S3-1 through S3-5 configure the GETC with the channel number. Allowable channel numbers range from 1(0001 binary) to 20 (10100 binary) for control and working channels. Channel numbers 0, 21 thru 25, and 27-30 are reserved, and channel number 31 (11111 binary) is used in the terminal test mode. Switch S3-5 is the most significant bit (MSB), and S3-1 is the least-significant bit (LSB) of the GETC channel number. Also, a logic 0 is defined as a closed (on) switch setting, and a logic 1 is defined as an open (off) switch setting. Table 1 lists the allowable channel numbers and their binary equivalents.

Selecting RF Transmit Frequency

The RF transmit frequency is set by S1-1 thru S1-7 and S2-1 thru S2-4. These eleven bits encode the transmitter and receiver frequency, in the range from 935 to 940 MHz(TX) and 896 to 901 MHz(RX), at a 12.5 kHz channel spacing. At power up, reset, or out-of-lock condition of the synthesizer, the GETC will attempt to load the transmit frequency code to the synthesizer. The allowable transmit frequencies and their corresponding switch settings are listed in Appendix A.

FRONT PANEL LED STATUS							DESCRIPTION
L1	L2	L3	L4	L5	L6	L7	
⊘	○	●	○	○	●	●	CONTROL CHANNEL
⊘	○	●	○	○	○	●	IDLE VOICE CHANNEL
⊘	○	●	○	○	●	○	ACTIVE VOICE CHANNEL
⊘	○	●	●	●	⊕	○	SYNTHESIZER FAILURE
⊘	○	●	○	○	⊕	○	SYNTHESIZER RECOVERING
⊘	○	●	○	○	⊗	○	PA FAILURE
○	○	○	○	○	⊕	⊕	POWER UP RAM/ROM FAILURE (L6, L7, BLINK TOGETHER)

● = ON
○ = OFF

⊕ = QUICK FLASHING, OFF (REPEATED)
⊗ = BLINKING ON, OFF, ON, OFF

⊘ → : L1 IS OFF IF SITE CONTROLLER IS ACTIVE.
L1 IS ON IF IN FAILSOFT MODE

Figure 1 - Front Panel Status Indicators

Selecting Default Failsoft Operation

Default failsoft operation is defined by S3-8. Setting S3 to open on a control channel will force failsoft operation at the next reset. This switch is set open only if the system is operating without a site controller.

Selecting Trunking Mode

In failsoft mode, S3-7 controls the trunking mode. Setting S3-7 open will select transmission trunked operation for all group dispatch calls. With S3-7 closed, calls are processed with a 5 second hang time on the voice channel.

Selecting Test Mode

S3-6 open selects test mode. Two test mode types are available: DIP switch mode and interactive terminal mode. All station alignment and checks can be done using DIP switch test mode. Terminal mode is selected by setting S3-1 through S3-6 all open and is used for testing the GETC board on the bench. DIP switch test mode is selected by setting S3-1 though S3-6 for the appropriate test and then resetting the GETC shelf. The DIP switch tests are used to align the station data and audio levels. The available test settings are shown in Table 4.

NOTE

A manual reset or power-up is required to insure that the DIP switch settings have been read and activated after any switch change.

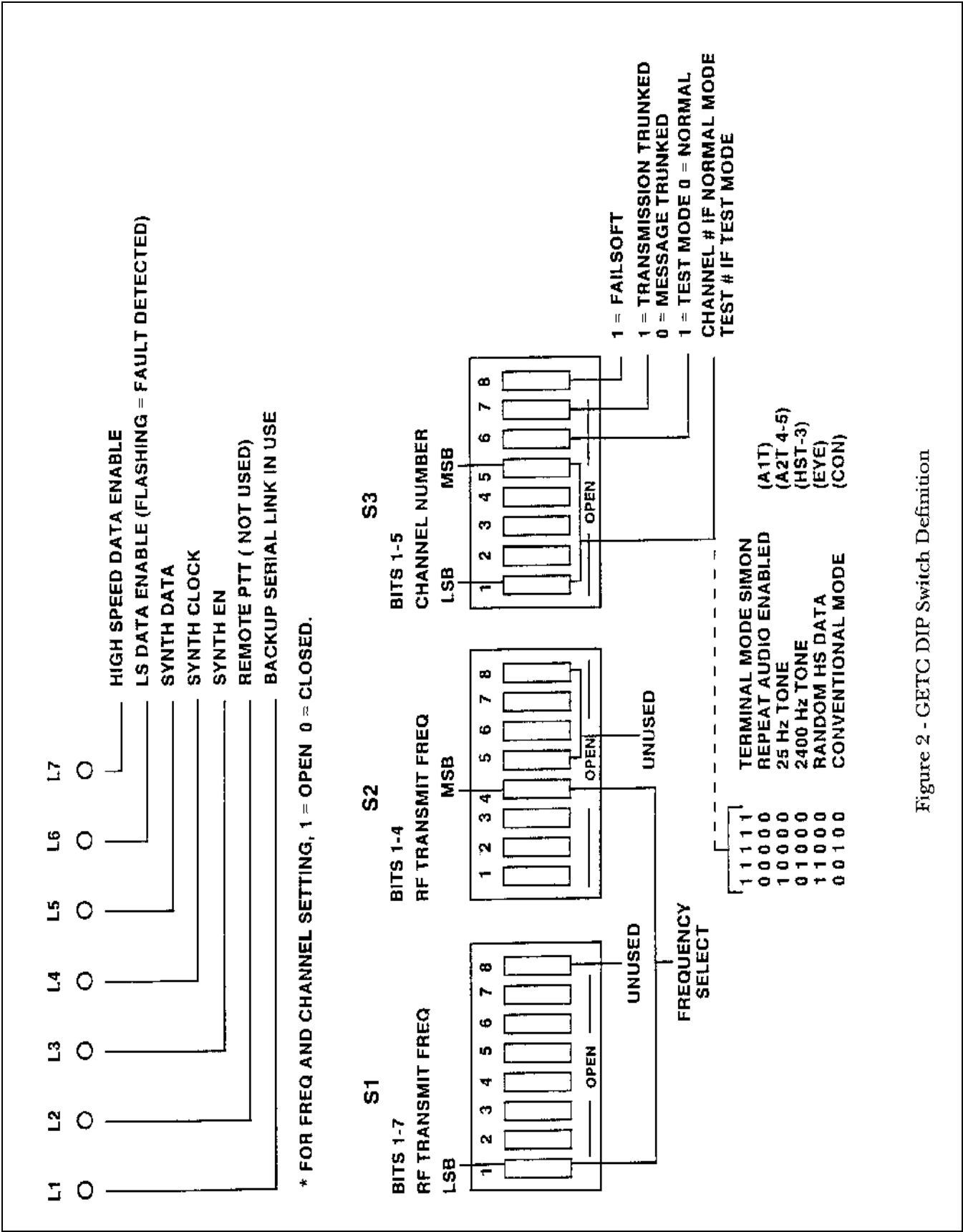
JUMPER CONFIGURATION

The jumpers on the GETC logic board are configured for GE-NET 900 applications. Table 2 describes the functions of the jumpers. Other jumper configurations enable the GETC to be used in other applications and functions.

SERVICE AND TEST

This section describes four test procedures that are used to test the GETC. These include the off site test, the on site test, the station test, and the Trunking test.

The off site test is used to test the GETC in a laboratory environment or under bench test. On site testing is used to test the GETC at the site location using a limited set of tools or equipment. Station testing is used to test the GETC in a station and to perform adjustments. The Trunking test is used to test the GETC as part of a functional system.



TERMINAL CONNECTION

An ASCII terminal or computer with terminal emulation program and RS-232 port is used to communicate with the GETC in the test mode of operation. The terminal should be configured for a 2400 baud link, odd parity, full duplex, and uppercase characters. Figure 3 shows a sample connection cable. Terminal and GETC pin assignments are listed in Table 3.

Table 1 - GETC Channel Number Settings

CHANNEL NUMBER	SWITCH SETTINGS S3-1 THRU S3-6	COMMENTS
0	000000	RESERVED
1	100000	CONTROL OR WORKING
2	010000	CONTROL OR WORKING
3	110000	CONTROL OR WORKING
4	001000	CONTROL OR WORKING
5	101000	CONTROL OR WORKING
6	011000	CONTROL OR WORKING
7	111000	CONTROL OR WORKING
8	000100	CONTROL OR WORKING
9	100100	CONTROL OR WORKING
10	010100	CONTROL OR WORKING
11	110100	CONTROL OR WORKING
12	001100	CONTROL OR WORKING
13	101100	CONTROL OR WORKING
14	011100	CONTROL OR WORKING
15	111100	CONTROL OR WORKING
16	000010	CONTROL OR WORKING
17	100010	CONTROL OR WORKING
18	010010	CONTROL OR WORKING
19	110010	CONTROL OR WORKING
20	001010	CONTROL OR WORKING
21	101010	RESERVED
22	011010	RESERVED
23	111010	RESERVED
24	000110	RESERVED
25	100110	RESERVED
26	010110	DOWNLINK
27	110110	RESERVED
28	001110	RESERVED
29	101110	RESERVED
30	011110	RESERVED
31	111111	TEST MODE (TERMINAL)

Figure 2 - GETC DIP Switch Definition

Table 2 - Jumper Setup & Functions

JUMPER	GE-NET TRUNKING	FUNCTION
P11	J11-1 & 2	Receive data from 9600 baud Modem board
P12	J12-1 & 2	Clear to send from 9600 baud Modem board
P13	J13-1 & 2	Route backup serial link tx output to backup serial link rx input
P14	J14-1 & 2	Master site controller path selection enable
P15	J15-1 & 2	Site controller path selection enable
P16	J16-1 & 2	Backup serial link selection enable
P17	J17-1 & 2	Low-speed data encode path enable
P18	J18-1 & 2	Low-speed data decode path enable
P20	J20-1 & 2	Combined ptt from station disable
P21	J21-1 & 2	High-speed, data-acquisition rate control
P22	J22-2 & 3	4800 Hz tone notch filter (disable)
P24	J24-1 & 2	Backup serial link selection enable
P25	J25-1 & 2	Low-speed data encode path enable
P26	J26-1 & 2	Lock-detect input path enable
P28	J28-1 & 2	Sync line input path enable
P29	J29-1 & 2	No function
P30	J30-2 & 3	Enable clock drive to
P30	J30-4 & 5	microcomputer for CMOS configuration
P44	J44-1 & 2	Selects A14 for 27C256 and 27C512 EPROM
P45	J45-2 & 3	Selects 6064 RAM
P46	J46-1 & 2	INTO for voter concentrator
P47	J47-1 & 2	Backup serial link select
P48	J48-1 & 2	Backup serial link select
P50	J50-1 & 2	Tone control for voted system
P51	J51-1 & 2	Morse code ID attenuator enable
P52	J52-1 & 2	TXD polarity select
P53	J53-1 & 2	RXD polarity select
52	J52-1 & 2	TXD polarity select
P53	J53-1 & 2	RXD polarity select
P54	J54-1 & 2	Enables control input to U15-A
P55	J55-1 & 2	Enables WALSH bit 1
P60	J60-1 & 2	Enables high-speed data path
P61	J61-2 & 3	Selects A15 for 27C512 EPROM U2
P62	J62-2 & 3	Selects proper clock frequency for U4 obtain 4800 Baud data rate.
P63	1 & 2	Sets TX data filter for 4800 baud
P64	1 & 2	Sets TX data filter for 4800 baud
P65	1 & 2	Sets TX data filter for 4800 baud
P66	1 & 2	Sets TX data filter for 4800 baud
P67	Omit	Receive telephone line termination (not used)
P68	J68-1 & 2	Enables delayed PTT
P69	J69-1 & 2	Enables COMB PTT IN
P70	J70-1 & 2	Enables COMB PTT IN
P71	J71-1 & 2	Configures telephone line modem RTS

Table 3 - GETC and RS-232C Pin Assignments

SIGNAL FROM GETC	GETC LOGIC BD PIN NUMBER	GETC SHELF PIN NUMBER	TERMINAL EIA RS-232C D-TYPE CONNECTOR PIN NUMBER
TXD	J8-1 (MASTER)	J100-3 (MASTER)	PIN 3
TXD	J19-1 (BACKUP)	J101-3 (BACKUP)	PIN 3
RXD	J8-2 (MASTER)	J100-2 (MASTER)	PIN 2
RXD	J19-2 (BACKUP)	J101-2 (BACKUP)	PIN 2
GND	J8-3 (MASTER)	J100-1 (MASTER)	PIN 7
GND	J19-3 (BACKUP)	J101-1 (BACKUP)	PIN 7

This connection cable may be used any time the terminal is used during a GETC test procedure. Characters that are typed from the keyboard are followed by RETURN(ENTER). A key press on the keyboard (such as ESC, TAB, or RETURN) is indicated by the key name enclosed in square brackets [KEY PRESS]. Control functions are indicated by CTRL - (CONTROL CHARACTER), such as CTRL-Z to indicate the Z is pressed while holding down the CTRL key. If variable data or commands are to be entered, they will be enclosed in angle brackets <VARIABLE DATA>. Variable data depends on your particular application or test. Type the appropriate response (do not include brackets) and follow by a return if required.

POWER SUPPLY TEST (Bench Test)

1. Connect power supply to GETC connector J10 (pin 1 is +13.8 V and pin 2 is ground).
2. Turn on the power supply and verify the current drawn does not exceed 700 mA (1.2 A with modem board installed). If current is exceeded, check power supply circuitry before proceeding.
3. Connect a frequency counter or oscilloscope to TP104 and verify the presence of the 4800 Hz clock. If the clock is missing, check modem U4 and associated circuitry.

4. Verify the presence of the following voltages:

MONITOR POINT	VOLTAGE	CHECK IF MISSING OR INCORRECT
TP110	+5.0+/-0.25	Regulator board
TP111	+5.0+/-0.25	Regulator board
TP108	-12.0 +/- 1.2	-12-volt power supply
TP109	+12.0 +/- 1.2	+12-volt power supply

MICROCOMPUTER CLOCK TEST

Equipment Required

- Frequency Counter

Test Procedure

1. Connect frequency counter to J30-3.
2. Verify the microcomputer clock frequency is 11.0592 MHz ± 500 Hz.

OFF-SITE TEST

The off site test is used to test the GETC in a laboratory environment or under bench test. This section outlines the testing of the GETC as a stand alone unit outside of the station. However, these same tests can be done with the unit installed in the station if connectors J6, J7, J8, and J19 are disconnected from the GETC board during the tests.

Equipment Required

The equipment necessary for the off site test includes:

1. HP-6286A (or equivalent) DC power supply with current limit.
2. Tektronix-468 (or equivalent) digital storage scope.
3. HP-3312A (or equivalent) Function Generator.
4. Fluke-1920A (or equivalent) Frequency Counter.

5. Data Technology Model 30 digital Multimeter or equivalent.
6. Triplet Model 630-PL Type 5 VOM or equivalent.
7. ASCII Terminal or Computer with terminal connection program.
8. HP-334A (or equivalent) Distortion Analyzer.

Preliminary Setup

1. Set switches S3-1 thru S3-6 to their off (open) positions.
2. Connect the terminal or computer to the GETC master communication link (J8). Refer to Table 3 for GETC and RS-232C pin assignments.
3. Configure jumpers as shown in Table 2 if not already set up.
4. Move jumpers from J46-1&2 to J46-2&3 and from J51-1&2 to J51-2&3.

Serial Link Test

1. Apply power to the GETC (or press RESET switch S4 if power is already applied). The terminal will display the SIMON welcome message. If the welcome message does not appear, check the following:
 - Check terminal hookup
 - Check for +5 volts at U14-4 (SITE RX EN)
 - Check reset circuitry
 - Check for serial data on the TX and RX lines
2. Execute the <BCL> command (backup communications link) on the terminal. Press [RETURN] and verify that terminal communication on the master link is inoperative.
3. Move the terminal from the master (J8) to the backup link (J19). Press [RETURN] and verify that terminal communication on the backup link is operative by executing the command.
4. Execute the <MCL> command (master communications link) on the terminal. Press [RETURN] and verify that terminal communication on the backup link is inoperative.
5. Move the terminal from the backup (J19) to the master (J8) link. Press [RETURN] and verify that terminal communication on the master link is operative by executing the command.

EPROM Test

Execute the command CHK O-FFFF. Verify the terminal response of "CHECKSUM=OO".

RAM Test

Execute the command <TMX OOO-1FFF> to check U4. Verify the terminal response of "SIX PATTERNS TO CHECK OK".

Reset Circuit Test

1. Lower the input power to 6 volts.
2. Raise the input power to 9 volts. Verify the GETC welcome message to the terminal.

Watchdog Timer Test

1. Execute the command <WAT> to verify Watchdog Timer (U4).
2. Verify the GETC response of the welcome message to the terminal after 5 seconds.

Input Buffer and Port Test

1. Move jumper P20 from J20-1&2 to J20-2&3.
2. Move jumper P26 from J26-1&2 to J26-2&3.
3. Move jumper P28 from J28-1&2 to J28-2&3.
4. Move jumper P12 from J12-1&2 to J12-2&3.
5. Connect J7-7, J7-9, J7-11, J7-13, and J3-25C to ground.
6. Execute the command <POR1>, and verify the terminal response of 10101010.
7. Execute the command <POR3>, and verify the terminal response of XX01XXXX, where X is any state.
8. Remove the ground from J7-7, J7-9, J7-11, J7-13, and J3-25C.
9. Connect J7-6, J7-8, J7-10, J7-12, and J7-14 to ground.
10. Execute the command <POR1>, and verify the terminal response of 01010101.
11. Execute the command <POR3>, and verify the terminal response of XX10XXXX, where X is any state.

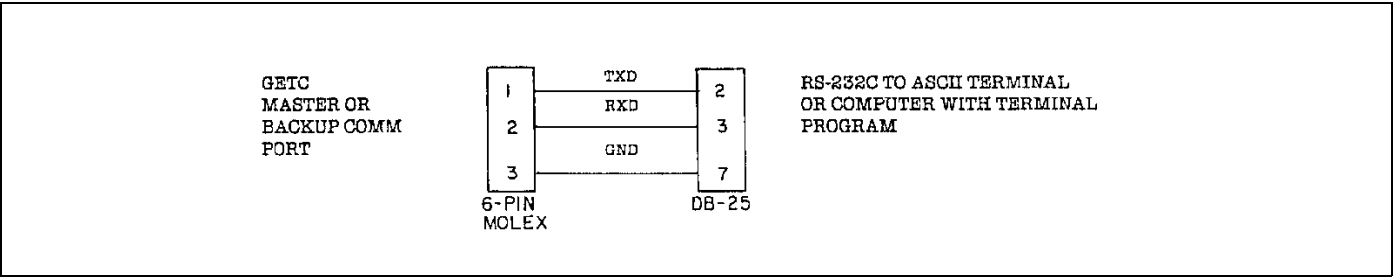


Figure 3 - Terminal-To-GETC Connection Cable

12. Remove the ground from J7-6, J7-8, J7-10, J7-12 and J7-14.

13. Move jumper P20 from J20-2&3 to J20-1&2.

14. Move jumper P26 from J26-2&3 to J26-1&2.

15. Move jumper P28 from J28-2&3 to J28-1&2.

16. Move jumper P12 from J12-2&3 to J12-1&2.

High Speed Data Test

1. Jumper J7-2 to J7-4.
2. Execute the command <MDS 0>.
3. Execute the command <BER DE-00=10>, and verify the terminal response of:

"RECEIVE ERROR COUNT=0000 RECEIVE CHECK-SUM=00188123"

which continually updates every 20 seconds.
4. Enter CTRL-Z or [ESC] to end the test. Remove the jumper from J7-2 and J7-4.

Low-Speed Data Encode/Decode Test

1. Move jumper on J15 to 2&3.
2. Place a 10K pullup on J15-1 to 5 volts.
3. Execute the command <XBY B800=B6>.
4. Monitor the following points using an oscilloscope.

MONITOR POINT	LOGIC LEVEL
U38-2	0
U38-5	1
U34-10	0
J19-6	1
J15-1	0
U38-15	1
U38-16	0
U38-19	1

5. Enter CTRL-Z or [ESC].
6. Execute the command <XBY B800=49>.

Output Latch and Buffer Test

NO.	STEP	TEST POINT	LOGIC LEVEL
1.	Move jumper P14 from J14-1&2 to J14-2&3.		
2.	Move jumper P24 from J24-1&2 to J24-2&3.		
3.	Move jumper P25 from J25-1&2 to J25-2&3.		
4.	Move jumper P20 from J20-1&2 to J20-2&3.		
5.	Install a 10K resistor from J7-14 to ground.		
6.	Install a 10K resistor from the open collector points (OC) to +13.8 volts.		
NOTE Unless otherwise specified, a logic one is defined as 13.8 ± 0.5 volts, and a logic zero is defined as 0 ± 0.5 volts.			
7.	Execute the command <XBY A800=52>.		
8.	Execute the command <XBY B000=42>.		
9.	Connect J7-6 to ground.		
		J6-1	1
		J6-2	1
		J6-3	1
		J6-4	0
		J6-5	1
		J6-10	1
		J6-11	0
		J6-12	1
		J6-13	0
		J6-14	1
		J6-15	1
		J6-16	1
		J7-14	<0.5V
		J7-15	<0.5V
		J7-16	0
		J9-1	>10V
		J3-25A	<0.5V
		J3-13C	1
		H1 (L7)	OFF
		H2 (L6)	ON
		H3 (L5)	OFF
		H4 (L4)	ON
		H5 (L3)	ON
		H6 (L2)	OFF
		H7 (L1)	OFF
NOTE Reset the GETC to terminate this test			

NO.	STEP	TEST POINT	LOGIC LEVEL
10.	Execute the command <XBY B000=B9>.		
11.	Execute the command <XBY A800=AD>.		
12.	Connect J7-6 to ground.		
		J6-1	0
		J6-2	0
		J6-3	0
		J6-4	1
		J6-5	0
		J6-10	0
		J6-11	1
		J6-12	0
		J6-13	1
		J6-14	0
		J6-15	1
		J6-16	0
		J7-14	>7V
		J7-15	>7V
		J7-16	1
		J9-1	<-10V
		J3-25A	>3.5V
		J3-13C	0
		H1 (L7)	ON
		H2 (L6)	OFF
		H3 (L5)	ON
		H4 (L4)	OFF
		H5 (L3)	OFF
		H6 (L2)	ON
		H7 (L1)	ON
13.	Execute the command <XBY A800=00>.		
14.	Execute the command <XBY B000=OC>. Do not connect J7-6 to ground.		
		J6-1	1
		J6-2	1
		J6-3	1
		J6-4	1
		J6-5	1
		J6-10	1
		J6-11	1
		J6-12	1
		J6-13	1
		J6-14	1
		J6-15	1
		J6-16	1
		J7-14	>7V
		J7-15	>0.5V
		J7-16	1
		J9-1	10V
		J3-25A	<0.5V
		J3-13C	0

NO.	STEP	TEST POINT	LOGIC LEVEL
		H1 (L7)	OFF
		H2 (L6)	OFF
		H3 (L5)	OFF
		H4 (L4)	OFF
		H5 (L3)	OFF
		H6 (L2)	OFF
		H7 (L1)	OFF
NOTE Reset the GETC to terminate this test			
15.	Execute the command <XBY B000=08>.		
16.	Execute the command <XBY A800=80>. Do not connect J7-6 to ground.		
		J6-1	1
		J6-2	0
		J6-3	1
		J6-4	1
		J6-5	1
		J6-10	1
		J6-11	1
		J6-12	1
		J6-13	1
		J6-14	1
		J6-15	1
		J6-16	1
		J7-14	>7V
		J7-15	>7V
		J7-16	1
		J9-1	>10V
		J3-25A	<0.5V
		J3-13C	0
		H1 (L7)	OFF
		H2 (L6)	OFF
		H3 (L5)	OFF
		H4 (L4)	OFF
		H5 (L3)	OFF
		H6 (L2)	OFF
		H7 (L1)	OFF
17.	Move jumper P20 from J20-2&3 to J20-1&2.		
18.	Move jumper P14 from J14-2&3 to J14-1&2.		
19.	Move jumper P24 from J24-2&3 to J24-1&2.		
20.	Move jumper P25 from J25-2&3 to J25-1&2.		

7. Monitor the following points using an oscilloscope.

MONITOR POINT	LOGIC LEVEL
U38-2	1
U38-5	0
U34-10	1
J19-6	0
J15-1	1
U38-15	0
U38-16	1
U38-19	0

8. Jumper J19-5 to J7-2.

9. Connect an oscilloscope to J19-5.

10. Execute the commands and verify the responses listed below.

COMMAND	FREQUENCY ON J19-5(HZ)	AMPLITUDE ON J19-5(VP-P) CENTERED AT	FREQUENCY OF SQUARE- WAVE ON J18-1 (HZ)
LSH 1-1	10	2.0 ± 0.25	10
LSH 1-2	100	2.0 ± 0.25	100
LSH 1-3	200	2.0 ± 0.25	200
LSH 1-4	1000	-32 dB of 2.0	UNDEFINED
LSH 2-1	10	1.0 ± 0.25	10
LSH 2-2	100	1.0 ± 0.25	100
LSH 2-3	200	1.0 ± 0.25	200
LSH 2-4	1000	-32 dB of 1.0	UNDEFINED
LSH 3-1	10	3.5 ± 0.5	10
LSH 3-2	100	3.5 ± 0.5	100
LSH 3-3	200	3.5 ± 0.5	200

11. Enter CTRL-Z or [ESC] to end the test.

12. Move jumper P15 back to J15-1&2.

DIP Switch Test

1. Execute the <DSW> command and verify the settings of DIP switches, S1, S2, and S3. The terminal display is as shown:

"-----"	-----	-----"
1 8	1 8	1 8
S1	S2	S3

An open (or OFF) on the DIP switch is displayed as a "1", while a closed (or ON) is displayed a "0".

This test continually updates the terminal display at each DIP switch setting change. Verify all switches are functional by testing both the open and closed positions.

2. Enter CTRL-Z or [ESC] to end the test. Set S3-1 thru S3-6 to open.

High Speed Data Filter Test

1. Monitor J7-4 as the output.

2. Execute the command

<FNT1>. Verify 600 Hz signal on J7-4.

3. Execute the command <FNT2>. Verify 1200 Hz signal on J7-4.

4. Execute the command <FNT3>. Verify that the generated 2400 Hz signal has approximately the same amplitude as in steps 3 and 4 and closely approximates a sinusoid. Typical output level is 1 volt RMS when R31 is adjusted for rated deviation.

Test Completion

Reposition all jumpers as shown in Table 2 before placing the GETC back in service.

ON-SITE TEST

This test is used to test the GETC at the system site location using limited tools and equipment. This procedure is a quick in-circuit functional test of the GETC in the station. DIP switch test modes are normally used to set up the station data, audio, and power levels. However, these can also be used to check basic operation of the GETC as well. Table 4 shows the available DIP switch tests.

Equipment Required

The equipment necessary for the on-site test includes:

1. Tektronix 468 (or equivalent) digital storage scope.
2. Triplett Model 630-PL Type 5 VOM or equivalent.

Preliminary Setup

1. Make sure station power is on and all jumpers are set according to Table 2.
2. Slide the GETC shelf out to gain access to the DIP switches located near the front panel.

3. Select the desired test frequency using S1 and S2. See Appendix A for frequency codes.

4. Take the station "off-line" by setting S3-1 through S3-6 to the open position and then momentarily pushing the GETC reset button.

Power Supply Test

1. Check to see that 13.8 volt power is present to the GETC on J10 (pin 1 is +13.8 V and pin 2 is ground).

2. Connect a frequency counter or oscilloscope to TP104 and verify the presence of the 4800 Hz clock. If the clock is missing, check modem U4 and associated circuitry.

3. Verify the presence of the following voltages:

MONITOR POINT	VOLTAGE	CHECK IF MISSING OR INCORRECT
TP110	+5.0+/-0.25	Regulator board
TP111	+5.0+/-0.25	Regulator board
TP108	-12.0 +/- 1.2	-12-volt power supply
TP109	+12.0 +/- 1.2	+12-volt power supply

Microcomputer & System Clock Test

1. Check for a clock frequency of 11.0592 MHz on J30-3 and J62-1.

2. Check for a 5.5296 MHz clock signal on J62-2&3.

3. Verify a 4800 Hz clock signal is present on TP104.

Low-speed Data Encode/Decode Test

1. Set up S3 for Test (B) as shown in Table 4, and reset the GETC. Make sure the receiver is squelched.

2. Check for a 25 Hz digital square wave on U38-2 and U38-5.

3. Check for a 2 volt peak-to-peak 25 Hz filtered square wave at J19-5 (Subaudible data encode port). See Figure 5 for expected output.

4. Inject an on channel RF signal into the receiver modulated with a 150 Hz tone at ± 0.2 kHz deviation.

5. Check for a 150 Hz digital square wave on J18-1&2 (Subaudible RX data).

High-speed Data Encode/Decode Test

1. Set up S3 for Test (C) as shown in Table 4, and reset the GETC.

2. Check for a 2400 Hz digital square wave on TP101 (Modem TX data).

3. Check for a 2.8 volt peak-to-peak 2400 Hz sine wave at J7-4 (Modulation port). This level may vary slightly depending on the the data deviation pot R31.

4. Inject an on channel RF signal into the receiver modulated with a 2400 Hz tone at ± 0.5 kHz deviation.

5. Check for a 2400 Hz digital square wave on TP103 (Modem RX data).

Test Completion

1. Set the GETC DIP switches back to the operational configuration for the station.

2. Reset the GETC to put the station back on line. Verify that the station comes back up as either a voice channel or a control channel.

3. Slide the GETC back into the station shelf.

STATION TEST AND ADJUSTMENT

The station test is used to test the station and to perform repeat audio, high speed data, and low speed data adjustments. This section describes the adjustments of the GETC as part of a station.

Equipment Required

The equipment necessary for the station test includes:

1. Cushman CE-51A communications monitor or equivalent.
2. Tektronix 468 (or equivalent) digital storage scope.
3. HP-3312A (or equivalent) Function Generator.
4. Fluke-1920A (or equivalent) Frequency Counter.
5. Data Technology Model 30 (or equivalent) digital Multimeter.
6. Triplett Model 630-PL Type 5 (or equivalent) VOM.
7. HP-334A (or equivalent) Distortion Analyzer

The GETC can be DIP switch programmed to enter simple test mode operation. In this mode, single test function commands can be executed without need of a video terminal. Entering any of the test functions will load the synthesizer with the channel setting from DIP switches S1, S2 and then execute a function selected with DIP switches S3-1 through S3-6. Each test function is invoked by setting DIP switches S3-1 through S3-6 to the desired test function and then resetting the GETC. Table 4 lists the available tests.

Setup

Connect the test equipment to the station unit as shown in Figure 4. Select the desired test frequency using DIP switches S1, S2 located on the GETC shelf (see Appendix A). The remaining DIP switch settings must be selected for each test. A logic '1' corresponds to an 'OPEN' switch while a logic '0' is selected by the 'CLOSED' position.

Table 4 - DIP Switch Test Configuration		
TEST	S3-1 S3-6	FUNCTIONS PERFORMED
(A)	000001	Key transmitter and enable repeat audio path.
(B)	100001	Key transmitter, enable repeat audio path and send continuous 25 Hz data.
(C)	010001	Key transmitter, enable high speed data path and send continuous 2400 Hz tone.
(D)	110001	Key transmitter, enable high speed data path and send continuous random high speed data.
(E)	001001	Conventional mode, key transmitter and enable repeat audio when carrier is present.
	101001	UNDEFINED
	011111	UNDEFINED

Low Frequency Adjustment

1. Remove all signals from the receiver input and make sure the squelch is fully muted.
2. Set up DIP switches for test "B" and reset the GETC.
3. Set R83 (TONE DATA ADJ.) on the exciter module fully clockwise for maximum subaudible data deviation.
4. Adjust R78 (DATA SYM ADJ) on the exciter module until the best square wave (25 Hz) is obtained on the service monitor. This should correspond to a minimum deviation reading. See Figure 5 for typical waveform.

5. Adjust R83 (TONE DATA ADJ) on the Exciter module for 0.5 ± 0.05 kHz deviation.

High Speed 4800 Baud Data Adjustment

1. Set up DIP switches for test "C" and reset the GETC.
2. Adjust R31 on the GETC shelf assembly to obtain 1.5 ± 0.1 kHz deviation. Verify the generated 2400 Hz tone nearly approximates a sine wave.
3. Set up DIP switches for test "D" and reset the GETC.
4. Verify the 4800 baud EYE pattern is generated and that the output is between ± 1.4 kHz and ± 1.7 kHz deviation. See Figure 6 for typical EYE pattern.

Repeat Audio Adjustment

1. Set up DIP switches for test "A" and reset the GETC.
2. Inject an on channel carrier (-50 dBm) with a 1 kHz tone @ ± 1.5 kHz deviation.
3. Check the audio level at the Volume Squelch HI signal on the audio board output located inside the receiver/exciter door. Adjust R608 on the audio board if necessary to obtain 1 volt RMS ± 50 mV at the output.
4. Adjust R60 (REPEAT AUDIO) on the control shelf assembly fully clockwise in order to overdrive the modulator and cause the exciter limiter to become active.
5. Adjust R71 (VOICE LVL ADJ) on the Exciter assembly to produce between 1.9 and 2.0 kHz deviation measured by the service monitor.
6. Readjust R60 (REPEAT AUDIO) on the control shelf to achieve ± 1.5 kHz deviation.
7. Raise the input deviation to ± 2.5 kHz. Verify the output deviation does not exceed ± 2.0 kHz.

Repeater Operation

1. Set up DIP switches for test "E" and reset the GETC.
2. Inject a 1 kHz tone at 1.5 kHz deviation into the receiver input and set the squelch for 10 dB SINAD opening level.
3. Raise the RF input level to -50 dBm and verify the repeated tone is 1000 Hz at 1.5 ± 0.1 kHz deviation at the transmitter output.
4. Remove the signal input and verify that the station unkeys. Insert the signal input and verify that the station keys.

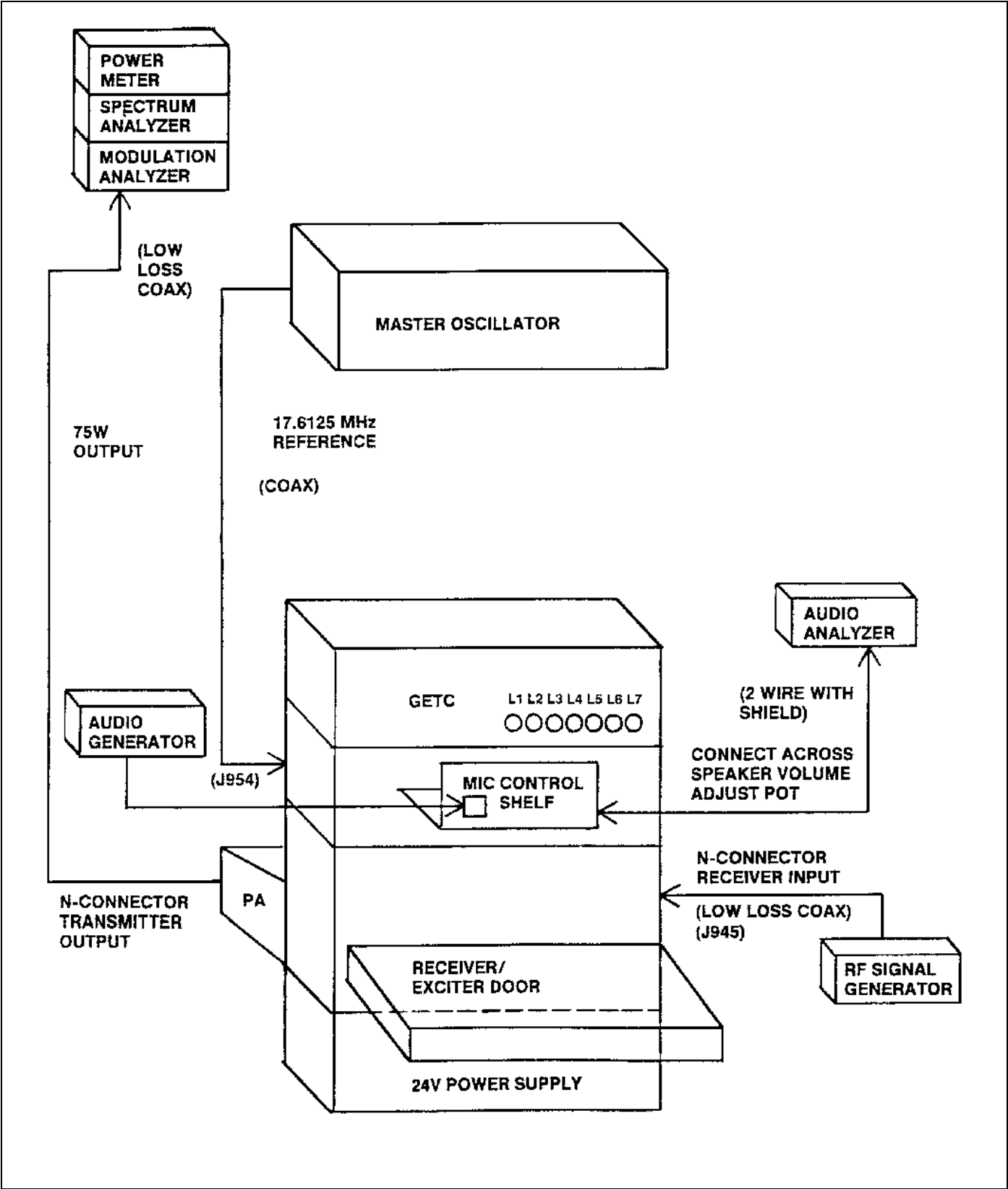


Figure 4 - Station Test Setup

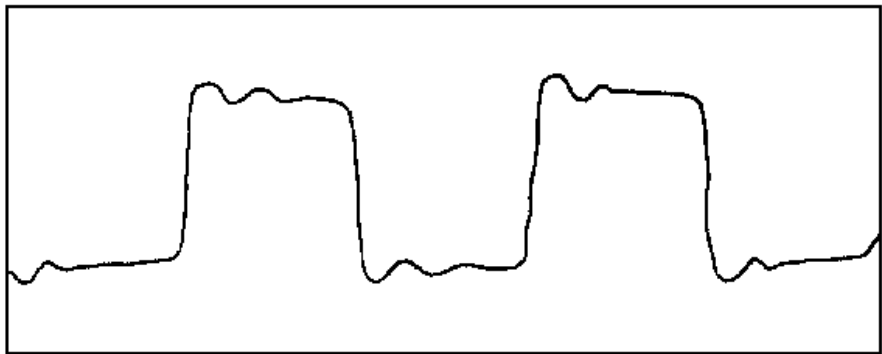


Figure 5 - 25 Hz Squarewave (Typical)

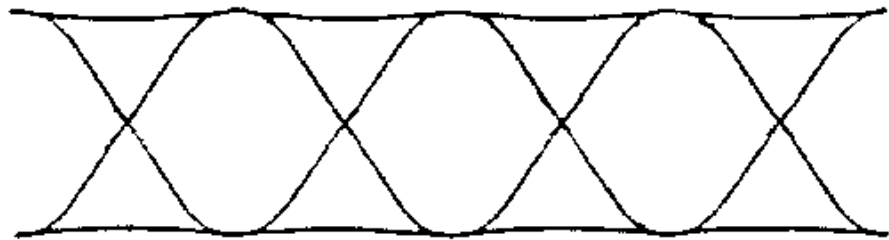


Figure 6 - Typical EYE Pattern

TRUNKING TEST

The trunking test is used to test the GETC as part of a functional system.

Equipment Required

- Single-channel trunked system (control channel and working channel).
- Trunked mobiles or portables.

Test Procedure

1. Set the mobile or portable and the site controller to the frequencies and channel numbers used for the control and working channels.
2. Configure the control and working channels for transmission trunked operation and forced select failsoft operation (S3-7 and S3-8 open).

3. Key the mobile or portable on a standard group call.
4. Verify the mobile/portable unit keys once on the control channel and then keys a second time followed by open voice communication.
5. Disconnect drive to the RF PA on the control channel. Verify L6 begins flashing and the other channel becomes control (see Figure 1).
6. Reconnect the PA drive on the station being tested. Verify L6 stops flashing within 30 seconds and the station becomes a working channel.
7. Repeat steps (4), (5), and (6).
8. Set the DIP switches as needed to achieve normal system operation before resetting the GETC to put it back in full service.

APPENDIX A

GETC FREQUENCY SELECTION SWITCH SETTINGS

TX(MHZ)	S1,1-7	S2,1-4	TX(MHZ)	S1,1-7	S2,1-4	TX(MHZ)	S1,1-7	S2,1-4
938.0125	1000111	1000	938.5125	1001100	0100	939.0125	1000001	0100
938.0250	0100111	1000	938.5250	0101100	0100	939.0250	0100001	0100
938.0375	1100111	1000	938.5375	1101100	0100	939.0375	1100001	0100
938.0500	0010111	1000	938.5500	0011100	0100	939.0500	0010001	0100
938.0625	1010111	1000	938.5625	1011100	0100	939.0625	1010001	0100
938.0750	0110111	1000	938.5750	0111100	0100	939.0750	0110001	0100
938.0875	1110111	1000	938.5875	1111100	0100	939.0875	1110001	0100
938.1000	0001111	1000	938.6000	0000010	0100	939.1000	0001001	0100
938.1125	1001111	1000	938.6125	1000010	0100	939.1125	1001001	0100
938.1250	0101111	1000	938.6250	0100010	0100	939.1250	0101001	0100
938.1375	1101111	1000	938.6375	1100010	0100	939.1375	1101001	0100
938.1500	0011111	1000	938.6500	0010010	0100	939.1500	0011001	0100
938.1625	1011111	1000	938.6625	1010010	0100	939.1625	1011001	0100
938.1750	0111111	1000	938.6750	0110010	0100	939.1750	0111001	0100
938.1875	1111111	1000	938.6875	1110010	0100	939.1875	1111001	0100
938.2000	0000000	0100	938.7000	0001010	0100	939.2000	0000101	0100
938.2125	1000000	0100	938.7125	1001010	0100	939.2125	1000101	0100
938.2250	0100000	0100	938.7250	0101010	0100	939.2250	0100101	0100
938.2375	1100000	0100	938.7375	1101010	0100	939.2375	1100101	0100
938.2500	0010000	0100	938.7500	0011010	0100	939.2500	0010101	0100
938.2625	1010000	0100	938.7625	1011010	0100	939.2625	1010101	0100
938.2750	0110000	0100	938.7750	0111010	0100	939.2750	0110101	0100
938.2875	1110000	0100	938.7875	1111010	0100	939.2875	1110101	0100
938.3000	0001000	0100	938.8000	0000110	0100	939.3000	0001101	0100
938.3125	1001000	0100	938.8125	1000110	0100	939.3125	1001101	0100
938.3250	0101000	0100	938.8250	0100110	0100	939.3250	0101101	0100
938.3375	1101000	0100	938.8375	1100110	0100	939.3375	1101101	0100
938.3500	0011000	0100	938.8500	0010110	0100	939.3500	0011101	0100
938.3625	1011000	0100	938.8625	1010110	0100	939.3625	1011101	0100
938.3750	0111000	0100	938.8750	0110110	0100	939.3750	0111101	0100
938.3875	1111000	0100	938.8875	1110110	0100	939.3875	1111101	0100
938.4000	0000100	0100	938.9000	0001110	0100	939.4000	0000011	0100
938.4125	1000100	0100	938.9125	1001110	0100	939.4125	1000011	0100
938.4250	0100100	0100	938.9250	0101110	0100	939.4250	0100011	0100
938.4375	1100100	0100	938.9375	1101110	0100	939.4375	1100011	0100
938.4500	0010100	0100	938.9500	0011110	0100	939.4500	0010011	0100
938.5625	1010100	0100	938.9625	1011110	0100	939.4625	1010011	0100
938.4750	0110100	0100	938.9750	0111110	0100	939.4750	0110011	0100
938.4875	1110100	0100	938.9875	1111110	0100	939.4875	1110011	0100
938.5000	0001100	0100	939.0000	0000001	0100	939.5000	0001011	0100

0 = CLOSED or ON 1 = OPEN or OFF

TX(MHZ)	S1,1-7	S2,1-4	TX(MHZ)	S1,1-7	S2,1-4	TX(MHZ)	S1,1-7	S2,1-4
939.5125	1001011	0100	939.6750	0110111	0100	939.8375	1100000	1100
939.5250	0101011	0100	939.6875	1110111	0100	939.8500	0010000	1100
939.5375	1101011	0100	939.7000	0001111	0100	939.8625	1010000	1100
939.5500	0011011	0100	939.7125	1001111	0100	939.8750	0110000	1100
939.5625	1011011	0100	939.7250	0101111	0100	939.8875	1110000	1100
939.5750	0111011	0100	939.7375	1101111	0100	939.9000	0001000	1100
939.5875	1111011	0100	939.7500	0011111	0100	939.9125	1001000	1100
939.6000	0000111	0100	939.7625	1011111	0100	939.9250	0101000	1100
939.6125	1000111	0100	939.7750	0111111	0100	939.9375	1101000	1100
939.6250	0100111	0100	939.7875	1111111	0100	939.9500	0011000	1100
939.6375	1100111	0100	939.8000	0000000	1100	939.9625	1011000	1100
939.6500	0010111	0100	939.8125	1000000	1100	939.9750	0111000	1100
939.6625	1010111	0100	939.8250	0100000	1100	939.9875	1111000	1100

0 = CLOSED or ON 1 = OPEN or OFF

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APPENDIX B
PARTS LIST
OUTLINE & SCHEMATIC DIAGRAMS
ADJUSTMENT AND TEST POINTS

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QETC BRKLP ASSEMBLY
19090196893
(GE-NET 900 APPLICATIONS)
ISSUE 1

SYMBOL	GE PART NO.	DESCRIPTION
QETC LOGIC BOARD 19090210461		
----- CAPACITORS -----		
C1 and C2	19A701624P118	Ceramic: 27 pF $\pm 5\%$, 500 VDCW, temp coef N80 ± 30 PPM/°C.
C3	19A702250P111	Polyester: .047 uF $\pm 10\%$, 50 VDCW.
C5	19A701534P3	Tantalum: 0.47 uF $\pm 20\%$, 35 VDCW.
C6	T644ACP247J	Polyester: .0047 uF $\pm 5\%$, 50 VDCW.
C7	T644ACP310J	Polyester: .010 uF $\pm 5\%$, 50 VDCW.
C8	T644ACP210J	Polyester: .0010 uF $\pm 5\%$, 50 VDCW.
C9	T644ACP310J	Polyester: .010 uF $\pm 5\%$, 50 VDCW.
C10	19A701534P19	Tantalum: 47 uF $\pm 20\%$, 16 VDCW.
C11 thru C13	19A701534P8	Tantalum: 22 uF $\pm 20\%$, 16 VDCW.
C14 thru C26	T644ACP310K	Polyester: .010 uF $\pm 10\%$, 50 VDCW.
C29	19A701534P7	Tantalum: 10 uF $\pm 20\%$, 16 VDCW.
C30 thru C34	T644ACP310J	Polyester: .010 uF $\pm 5\%$, 50 VDCW.
C35	19A701534P7	Tantalum: 10 uF $\pm 20\%$, 16 VDCW.
C36	19A701534P9	Tantalum: 47 uF $\pm 20\%$, 6.3 VDCW.
C37 thru C41	T644ACP310J	Polyester: .010 uF $\pm 5\%$, 50 VDCW.
C43 thru C46	T644ACP247J	Polyester: .0047 uF $\pm 5\%$, 50 VDCW.
C47	19A701534P7	Tantalum: 10 uF $\pm 20\%$, 16 VDCW.
C48	T644ACP310K	Polyester: .010 uF $\pm 10\%$, 50 VDCW.
C49	19A701534P7	Tantalum: 10 uF $\pm 20\%$, 16 VDCW.
C51	19A701534P7	Tantalum: 10 uF $\pm 20\%$, 16 VDCW.
C52	T644ACP310K	Polyester: .010 uF $\pm 10\%$, 50 VDCW.
C53	19A701534P7	Tantalum: 10 uF $\pm 20\%$, 16 VDCW.
C54 *	5496267P16	Tantalum: 100 uF $\pm 20\%$, 20 VDCW; sim to Sprague Type 150D.
C55	19A701534P2	Tantalum: 0.22 uF $\pm 20\%$, 35 VDCW.
C56	19A701534P4	Tantalum: 1 uF $\pm 20\%$, 35 VDCW.
C57	19A701534P8	Tantalum: 22 uF $\pm 20\%$, 16 VDCW.
C58	19A701534P6	Tantalum: 4.7 uF $\pm 20\%$, 35 VDCW.
C59	19A701534P8	Tantalum: 22 uF $\pm 20\%$, 16 VDCW.
C60	19A701534P6	Tantalum: 4.7 uF $\pm 20\%$, 35 VDCW.
C61 and C62	19A701534P8	Tantalum: 22 uF $\pm 20\%$, 16 VDCW.
C63	19A701534P6	Tantalum: 4.7 uF $\pm 20\%$, 35 VDCW.
C64	19A701534P8	Tantalum: 22 uF $\pm 20\%$, 16 VDCW.
C65 *	5496267P16	Tantalum: 100 uF $\pm 20\%$, 20 VDCW; sim to Sprague Type 150D.
C66 thru C69	19A703314P4	Electrolytic: 47 uF $\pm 10+50\%$, 16 VDCW; sim to Panasonic LB Series.
C70 thru C93	T644ACP310K	Polyester: .010 uF $\pm 10\%$, 50 VDCW.
C94	T644ACP247J	Polyester: .0047 uF $\pm 5\%$, 50 VDCW.
C95	T644ACP310J	Polyester: .010 uF $\pm 5\%$, 50 VDCW.
C96	T644ACP210J	Polyester: .0010 uF $\pm 5\%$, 50 VDCW.

*COMPONENTS ADDED, DELETED OR CHANGED BY PRODUCTION CHANGES

SYMBOL	GE PART NO.	DESCRIPTION
C97	T644ACP310J	Polyester: .010 uF $\pm 5\%$, 50 VDCW.
C98	19A701534P19	Tantalum: 47 uF $\pm 20\%$, 16 VDCW.
C99 *	19A701534P7	Tantalum: 10 uF $\pm 20\%$, 16 VDCW.
C100 * thru C101 *	T644ACP310K	Polyester: .010 uF $\pm 10\%$, 50 VDCW.
----- DIODES -----		
D3 thru D8	19A700028P1	Silicon: 75 mA, 75 PIV; sim to 1N4148.
D9	19A700025P2	Silicon, Zener: 400 mW max; sim to BZX55-C247.
D10 thru D13	19A700030P2	Silicon: sim to 1N4735A.
D14 thru D17	19A700028P1	Silicon: 75 mA, 75 PIV; sim to 1N4148.
D19 thru D21	19A700028P1	Silicon: 75 mA, 75 PIV; sim to 1N4148.
D22 and D23	T374ADP1041	Silicon: General Purpose Rectifier; sim to 1N4004.
D24 thru D28	19A700028P1	Silicon: 75 mA, 75 PIV; sim to 1N4148.
D29 thru D35	T324ADP1041	Silicon: General Purpose Rectifier; sim to 1N4004.
D36	19A700028P1	Silicon: 75 mA, 75 PIV; sim to 1N4148.
D37 *	19A700025P7	Silicon, Zener: 400 mW max; sim to BZX55-C5V6.
D38 *	19A700028P1	Silicon: 75 mA, 75 PIV; sim to 1N4148.
----- LDRS -----		
L1 thru L7	162B3011P0002	Light Emitting Diode: Red; sim to GE 22L-2.
----- JACKS -----		
J3 *	19A705181P1	Connector: 64 contacts; sim to Burndy Cat. RP19B32P100791.
J6 and J7	19A704852P146	Connector, printed wire, two part: 16 contacts; sim to Dupont Berg 22-12-2164.
J8 and J9	19A704852P136	Connector, printed wire, two part: 6 contacts; sim to Dupont Berg 22-12-2064.
J10	19A116659P173	Printed wire, two part: 4 contacts, sim to Molex 09-75-1041.
J11 thru J16	19A703248P12	Post: Gold Plated, 13 mm length.
J19	19A704852P136	Connector, printed wire, two part: 6 contacts; sim to Dupont Berg 22-12-2064.
J20 thru J23	19A703248P12	Post: Gold Plated, 13 mm length.
J24 thru J26	19A703248P12	Post: Gold Plated, 13 mm length.
J27	19A704852P136	Connector, printed wire, two part: 6 contacts; sim to Dupont Berg 22-12-2064.
J28 and J29	19A703248P12	Post: Gold Plated, 13 mm length.
J40	19A703248P12	Post: Gold Plated, 13 mm length.
J44	19A703248P12	Post: Gold Plated, 13 mm length.
J45 * thru J48	19A703248P17	Post: Gold Plated, 13 mm length.
J49	19A704779P59	Connector, printed wiring: 10 contacts; sim to Molex 22-16-2103.
J50 thru J55	19A703248P12	Post: Gold Plated, 13 mm length.
J60 *	19A703248P12	Post: Gold Plated, 13 mm length.

SYMBOL	GE PART NO.	DESCRIPTION
----- TRANSISTORS -----		
Q2 thru Q6	19A700023P2	Silicon, NPN: sim to 2N3904.
Q7	19A702503P2	Silicon, NPN.
Q8 thru Q10	19A700023P2	Silicon, NPN: sim to 2N3904.
Q11	19A700022P2	Silicon, NPN: sim to 2N3906.
Q12	19A116375P1	Silicon, PNP.
Q13	19A700054P1	Silicon, NPN: sim to BD-201.
Q14 and Q15	19A700023P2	Silicon, NPN: sim to 2N3904.
Q16	19A702503P2	Silicon, NPN.
Q17	19A700027P2	Silicon, PNP: sim to 2N3906.
Q18	19A700023P2	Silicon, NPN: sim to 2N3904.
----- RESISTORS -----		
R1	19B800784P106	Variable: 5K ohms $\pm 20\%$, 1/2 W.
R2	19B800784P105	Variable: 1K ohms $\pm 20\%$, .5 W.
R6 and R7	H212CRP310C	Deposited carbon: 10K ohms $\pm 5\%$, 1/4 W.
R8 and R9	19A701630P2	Network: 9 resistors rated 10K ohms $\pm 5\%$, 50 VDCW; sim to Bourne 4310R-101-103.
R10	H212CRP510C	Deposited carbon: 1M ohms $\pm 5\%$, 1/4 W.
R12	19A701637P1	Composition: 10M ohms $\pm 5\%$, 1/4 W.
R13	19A701250P446	Metal film: 294K ohms $\pm 1\%$, 1/4 W.
R14	H212CRP310C	Deposited carbon: 22K ohms $\pm 5\%$, 1/4 W.
R15	19A701637P1	Composition: 10M ohms $\pm 5\%$, 1/4 W.
R16	H212CRP310C	Deposited carbon: 10K ohms $\pm 5\%$, 1/4 W.
R17	19A701250P273	Metal film: 5.6K ohms $\pm 1\%$, 1/4 W.
R18	H212CRP147C	Deposited carbon: 470 ohms $\pm 5\%$, 1/4 W.
R19	19A701250P301	Metal film: 10K ohms $\pm 1\%$, 1/4 W.
R20 and R21	H212CRP310C	Deposited carbon: 10K ohms $\pm 5\%$, 1/4 W.
R22	19A701637P1	Composition: 10M ohms $\pm 5\%$, 1/4 W.
R25 and R26	H212CRP347C	Deposited carbon: 47K ohms $\pm 5\%$, 1/4 W.
R27	19A701250P269	Metal film: 5.11K ohms $\pm 1\%$, 1/4 W.
R28	19A701250P201	Metal film: 1K ohms $\pm 1\%$, 1/4 W.
R29	19A701250P327	Metal film: 16.5K ohms $\pm 1\%$, 1/4 W.
R30	19A701250P210	Metal film: 1240 ohms $\pm 1\%$, 1/4 W.
R31	19B235029P8	Variable: 10K ohms, $\pm 10\%$, 1/2 W.
R32	H212CRP510C	Deposited carbon: 1M ohms $\pm 5\%$, 1/4 W.
R33	H212CRP239C	Deposited carbon: 3.9K ohms $\pm 5\%$, 1/4 W.
R36	19A701250P176	Metal film: 604 ohms $\pm 1\%$, 1/4 W.
R38	H212CRP122C	Deposited carbon: 220 ohms $\pm 5\%$, 1/4 W.
R39 and R40	19A701630P2	Network: 9 resistors rated 10K ohms $\pm 5\%$, 50 VDCW; sim to Bourne 4310R-101-103.
R41	H212CRP310C	Deposited carbon: 1K ohms $\pm 5\%$, 1/4 W.
R42	H212CRP222C	Deposited carbon: 2.2K ohms $\pm 5\%$, 1/4 W.
R43	H212CRP210C	Deposited carbon: 1K ohms $\pm 5\%$, 1/4 W.
R44 thru R53	H212CRP310C	Deposited carbon: 10K ohms $\pm 5\%$, 1/4 W.
R54 thru R59	H212CRP156C	Deposited carbon: 560 ohms $\pm 5\%$, 1/4 W.
R60 *	H212CRP312C	Deposited carbon: 12K ohms $\pm 5\%$, 1/4 W.
R61	H212CRP310C	Deposited carbon: 10K ohms $\pm 5\%$, 1/4 W.
R62 *	H212CRP147C	Deposited carbon: 470 ohms $\pm 5\%$, 1/4 W.
R63	H212CRP310C	Deposited carbon: 10K ohms $\pm 5\%$, 1/4 W.

SYMBOL	GE PART NO.	DESCRIPTION
R64 *	H212CRP210C	Deposited carbon: 1K ohms $\pm 5\%$, 1/4 W.
R67	H212CRP247C	Deposited carbon: 4.7K ohms $\pm 5\%$, 1/4 W.
R68	H212CRP318C	Deposited carbon: 18K ohms $\pm 5\%$, 1/4 W.
R69	19A701250P388	Metal film: 80.6K ohms $\pm 1\%$, 1/4 W.
R70	19A701250P358	Metal film: 2.7 ohms $\pm 5\%$, 1/4 W.
R71	19A701250P383	Metal film: 71.5K ohms $\pm 1\%$, 1/4 W.
R72	19A701250P384	Metal film: 73.2K ohms $\pm 1\%$, 1/4 W.
R73	19A701250P383	Metal film: 71.5K ohms $\pm 1\%$, 1/4 W.
R74	19A701250P391	Metal film: 86.6K ohms $\pm 1\%$, 1/4 W.
R75	19A701250P325	Metal film: 17.8K ohms $\pm 1\%$, 1/4 W.
R76	19A701250P393	Metal film: 71.5K ohms $\pm 1\%$, 1/4 W.
R77	19A701250P382	Metal film: 69.8K ohms $\pm 1\%$, 1/4 W.
R78	19A701250P383	Metal film: 71.5K ohms $\pm 1\%$, 1/4 W.
R79	19A701250P350	Metal film: 32.4K ohms $\pm 1\%$, 1/4 W.
R80 thru R83	H212CRP310C	Deposited carbon: 10K ohms $\pm 5\%$, 1/4 W.
R84	H212CRP382C	Deposited carbon: 82K ohms $\pm 5\%$, 1/4 W.
R85	H212CRP318C	Deposited carbon: 18K ohms $\pm 5\%$, 1/4 W.
R86	19A701250P388	Metal film: 80.6K ohms $\pm 1\%$, 1/4 W.
R87	19A701250P358	Metal film: 2.7 ohms $\pm 5\%$, 1/4 W.
R88	19A701250P383	Metal film: 71.5K ohms $\pm 1\%$, 1/4 W.
R89	19A701250P384	Metal film: 73.2K ohms $\pm 1\%$, 1/4 W.
R90	19A701250P383	Metal film: 71.5K ohms $\pm 1\%$, 1/4 W.
R91	19A701250P391	Metal film: 86.6K ohms $\pm 1\%$, 1/4 W.
R92	19A701250P325	Metal film: 17.8K ohms $\pm 1\%$, 1/4 W.
R93	19A701250P383	Metal film: 71.5K ohms $\pm 1\%$, 1/4 W.
R94	19A701250P382	Metal film: 69.8K ohms $\pm 1\%$, 1/4 W.
R95	19A701250P383	Metal film: 71.5K ohms $\pm 1\%$, 1/4 W.
R96	19A701250P350	Metal film: 32.4K ohms $\pm 1\%$, 1/4 W.
R97 and R98	H212CRP310C	Deposited carbon: ohms $\pm 5\%$, 1/4 W.
R99	H212CRP347C	Deposited carbon: 47K ohms $\pm 5\%$, 1/4 W.
R100	H212CRP410C	Deposited carbon: 100K ohms $\pm 5\%$, 1/4 W.
R101	H212CRP368C	Deposited carbon: 68K ohms $\pm 5\%$, 1/4 W.
R103 thru R105	H212CRP310C	Deposited carbon: 10K ohms $\pm 5\%$, 1/4 W.
R106	19A701250P224	Metal film: 1740 ohms $\pm 1\%$, 1/4 W.
R107	19A701250P312	Metal film: 13K ohms $\pm 1\%$, 1/4 W.
R108	19A701250P401	Metal film: 100K ohms $\pm 1\%$, 1/4 W.
R109	19A701250P341	Metal film: 26.1K ohms $\pm 1\%$, 1/4 W.
R110	19B800784P106	Variable: 5K ohms $\pm 20\%$, 1/2 W.
R111	19A701250P274	Metal film: 1740 ohms $\pm 1\%$, 1/4 W.
R112	19A701250P312	Metal film: 13K ohms $\pm 1\%$, 1/4 W.
R113	19A701250P401	Metal film: 100K ohms $\pm 1\%$, 1/4 W.
R114	19A701250P341	Metal film: 26.1K ohms $\pm 1\%$, 1/4 W.
R115	19B800784P106	Variable: 5K ohms $\pm 20\%$, 1/2 W.
R116	19A701250P201	Metal film: 1K ohms $\pm 1\%$, 1/4 W.
R117 and R118	H212CRP310C	Deposited carbon: 10K ohms $\pm 5\%$, 1/4 W.
R119	H212CRP210C	Deposited carbon: 1K ohms $\pm 5\%$, 1/4 W.
R120	H212CRP133C	Deposited carbon: 330 ohms $\pm 5\%$, 1/4 W.
R121	19A701630P2	Network: 9 resistors rated 10K ohms $\pm 5\%$, 50 VDCW; sim to Bourne 4310R-101-103.
R123 thru R175	H212CRP310C	Deposited carbon: 1K ohms $\pm 5\%$, 1/4 W.
R176	19A700113P63	Composition: 1K ohms $\pm 5\%$, 1/2 W.
R177	3R77P511J	Composition: 510 ohms $\pm 5\%$, 1/2 W.
R128	19A700113P19	Composition: 15 ohms $\pm 5\%$, 1/2 W.

SYMBOL	GE PART NO.	DESCRIPTION
R129	19A701250P434	Metal film: 221K ohms $\pm 1\%$, 1/4 w.
R130	19A700050P313	Wirewound: 1 ohm $\pm 10\%$, 2 w.
R131	19A701250P301	Metal film: 10K ohms $\pm 1\%$, 1/4 w.
R132	19A701250P266	Metal film: 4.75K ohms $\pm 1\%$, 1/4 w.
R133	H212CRP310C	Deposited carbon: 10K ohms $\pm 5\%$, 1/4 w.
R134	H212CRP239C	Deposited carbon: 3.9K ohms $\pm 5\%$, 1/4 w.
R135	H212CRP310C	Deposited carbon: 10K ohms $\pm 5\%$, 1/4 w.
R136	5493033P2	Wirewound: 1 ohm $\pm 5\%$, 5 w.
R137	H212CRP310C	Deposited carbon: 10K ohms $\pm 5\%$, 1/4 w.
R138	H212CRP315C	Deposited carbon: 15K ohms $\pm 5\%$, 1/4 w.
R139 and R140	H212CRP310C	Deposited carbon: 10K ohms $\pm 5\%$, 1/4 w.
R141	19B800784P108	Variable: 10K ohms $\pm 20\%$, 1/2 w.
R142	H212CRP322C	Deposited carbon: 22K ohms $\pm 5\%$, 1/4 w.
R143	19A701537P1	Composition: 10M ohms $\pm 5\%$, 1/4 w.
R144	H212CRP347C	Deposited carbon: 47K ohms $\pm 5\%$, 1/4 w.
R145	H212CRP310C	Deposited carbon: 10K ohms $\pm 5\%$, 1/4 w.
R146	H212CRP212C	Deposited carbon: 2.2K ohms $\pm 5\%$, 1/4 w.
R147	H212CRP368C	Deposited carbon: 68K ohms $\pm 5\%$, 1/4 w.
R148 *	H212CRP310C	Deposited carbon: 10K ohms $\pm 5\%$, 1/4 w.
R149	19A7000184P1	Jumper.
R150 * thru R152 *	H212CRP317C	Deposited carbon: 12K ohms $\pm 5\%$, 1/4 w.
R153 *	H212CRP239C	Deposited carbon: 3.9K ohms $\pm 5\%$, 1/4 w.
		- - - - - (SWITCHES) - - - - -
S1 thru S3	19B800010P2	Dual-Inline-Package: 8 Circuits; sim to QTS 706-B.
S4	19A701324P1	Pushbutton: sim to IEE/Schedown 210091.
		- - - - - TRANSFORMERS - - - - -
T1 and T2	19A703656P1	Audio Frequency: sim to Nova Magnetics 5877-06-0001.
		- - - - - INTEGRATED CIRCUITS - - - - -
U1	19A705557P1	Digital: Microcomputer; sim to P80C32.
U2	19A705559G6	Digital: 64K EPROM; sim to 27C512. (Programmed).
U3	19A705558P1	Digital: 8K x 8 RAM; sim to HCM6064P-12.
U4	19A704727P2	Digital: CMOS Modem.
U5	19A703471P2	Digital: Octal Data Latch; sim to 74HC073.
U6	19A703471P8	Digital: Octal Tri-State Transceiver; sim to 74HC245.
U7 thru U9	19A703471P1	Digital: Octal Tri-State Buffer; sim to 74HC244.
U10	19A700037P363	Digital: Dual 2 line to 1 line Decoder/Demultiplexer; sim to 74LS155.
U11 thru U13	19A700176P1	Digital: CMOS Hex Inverting Buffer/Converter; sim to 40490B.
U14	19A116704P1	Digital: Quad Line Driver; sim to 1488.
U15	19A700029P38	Digital: CMOS Triple 2 Channel Multiplexer.
U16	19A704883P1	Linear: Quad Op Amp; sim to MC3303P.
U17	19A134764P2	Linear: Dual Voltage Comparator; sim to LM393N.
U18	19A700086P4	Linear: Dual Op Amp; sim to 4558.
U19	19A704727P2	Digital: CMOS Modem.
U20 and U21	19A704380P11	Digital: Octal Data Flip-Flop; sim to 74HC273.
U22	19A703483P1	Digital: CMOS Quad 2-Input NOR Gate; sim to 74HC07.
U23 thru U26	19A116180P75	Digital: Hex Open Collector Inverter; sim to 7406.
U27	19A116704P2	Digital: Quad Line Receiver; sim to 1489.

SYMBOL	GE PART NO.	DESCRIPTION
U28	19A116704P1	Digital: Quad Line Driver; sim to 1488.
U29	19A700176P1	Digital: CMOS Hex Inverting Buffer/Converter; sim to 40490B.
U30	19A704883P1	Linear: Quad Op Amp; sim to MC3303P.
U31	19A134764P2	Linear: Dual Voltage Comparator; sim to LM393N.
U32 and U33	19A704883P1	Linear: Quad Op Amp; sim to MC3303P.
U34	19A700029P38	Digital: CMOS Triple 2 Channel Multiplexer.
U37	19A704883P1	Linear: Quad Op Amp; sim to MC3303P.
U38	19A704380P11	Digital: Octal Data Flip-Flop; sim to 74HC273.
U39	19A134718P2	Linear: -12 Volt Regulator; sim to uA7917U.
U40	19A134717P2	Linear: 12 Volt Regulator; sim to MC7817CT.
U41	19A700037P335	Digital: Dual Data Flip-Flop; sim to 74LS74A.
		- - - - - SOCKETS - - - - -
X01	19A700156P5	Integrated circuit: 40 contacts; sim to August 340-3630D.
X02 thru X04	19A700156P3	Integrated circuit: 28 contacts; sim to AMP 640362P3.
X019	19A700156P3	Integrated circuit: 28 contacts; sim to AMP 640362P3.
X035	19A700156P15	Integrated circuit: 8 positions; sim to Mundy 011B 8P-108.
		- - - - - CRYSTALS - - - - -
Y1	19A702511G15	Quartz: 11.059200 MHz.
		- - - - - LOGIC BOARD MISCELLANEOUS - - - - -
		U39 and U40 Mounting Hardware:
5	H402P35B6	Washer: Flat.
7	H80P9005B6	Machine screw: pan head, steel.
8	H404P11B6	Lockwasher; internal: No. 4.
9	7141225P2	Hex nut: No. 4-40.
13	19A702917P7	Heat Sink.
6	19A703248P12	Post: Gold Plated, 13 mm length.
11	19A134521P1	Lens, red. (Used with R1 - R7).
12	19A134521P6	Support. (Used with H1 - R7).
14	19B232901P2	Support/Heat Sink. (Used with Q12 and Q13).
		- - - - - REGULATOR ASSEMBLY 19C33681602 - - - - -
		- - - - - RESISTORS - - - - -
R1 and R2	5493033P1	Wirewound: 5 ohms $\pm 5\%$, 5 watt; sim to Hamilton Mall Type HK-5W.
		- - - - - TERMINAL BOARDS - - - - -
TR1 and TR2	7775500P11	Phen: 5 Terminals.
		- - - - - INTEGRATED CIRCUITS - - - - -
U1 and U2	19A114777P9	Linear: 5 Volt Regulator; sim to MC7805CT.
		- - - - - CABLES - - - - -
W1	19B234688G2	Cable Assembly. (Includes P1).
		- - - - - REGULATOR ASSEMBLY MISCELLANEOUS - - - - -
2	19B234903G1	Heat Sink Assembly.
3	4038930P1	Clip. (Secures R1, R2).
7	7141225P2	Hex nut: No. 4-40.
8	H404P11B6	Lockwasher; internal: No. 4.
9	H80P9005B6	Machine screw: pan head, steel.

SYMBOL	GE PART NO.	DESCRIPTION
		- - - - - SHEET ASSEMBLY MISCELLANEOUS - - - - -
	19C851553G1	Tray Assembly.
	19C851587G1	Shelf.
	19A115594P2	Grommet.
	19A115204P1	Gusset.
	19B235048P1	Ground Cable.

PRODUCTION CHANGES

Changes in the equipment to improve performance or to simplify circuits are identified by a "Revision Letter", which is stamped after the model number of the unit. The revision identified on the unit includes all previous revisions. Refer to the Parts List for the descriptions of parts affected by these revisions.

REV. A - GETC LOGIC BOARD 19D902104G1
To update board for PST and simulcast operation, made the following changes near Q16: Added D37, 5.6 volt zener diode, added R148 and changed R67 from 820 to 470 ohms. Also added various interconnections to the board needed for PST and simulcast operation.

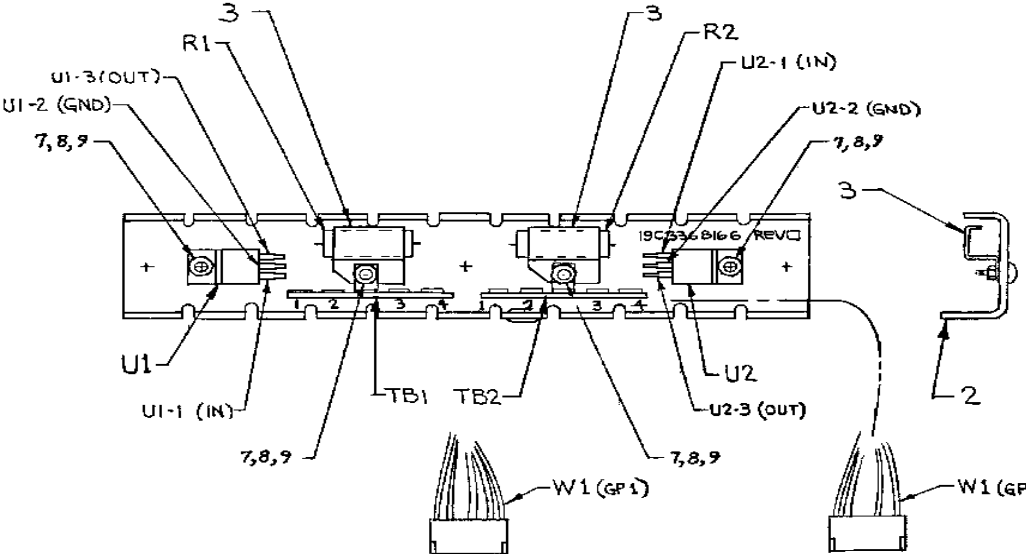
REV. B - GETC LOGIC BOARD 19D902104G1
To improve reset operation, added C99 in parallel with S4 RESET switch and R19. Also updated VG Voting Tone Board interconnections on schematic.

REV. C - GETC LOGIC BOARD 19D902104G1
Added pull-up R151 to the Reset line from J7 pin 3 to the 13.8 supply. Also added U37-C buffer to the Volume/Squelch High input at J7 pin 2.

REV. D - GETC LOGIC BOARD 19D902104G1
To update board for simulcast operation, eliminate RFL in Inverter Supply circuit, and improve BSL waveform, made the following changes: Added J72 and J73; deleted pin 3 of J3, J45 and J68; changed R64 to 1K ohms; changed C54 and C65 to 100 uF; added R150, R152 and R153; and added D38.

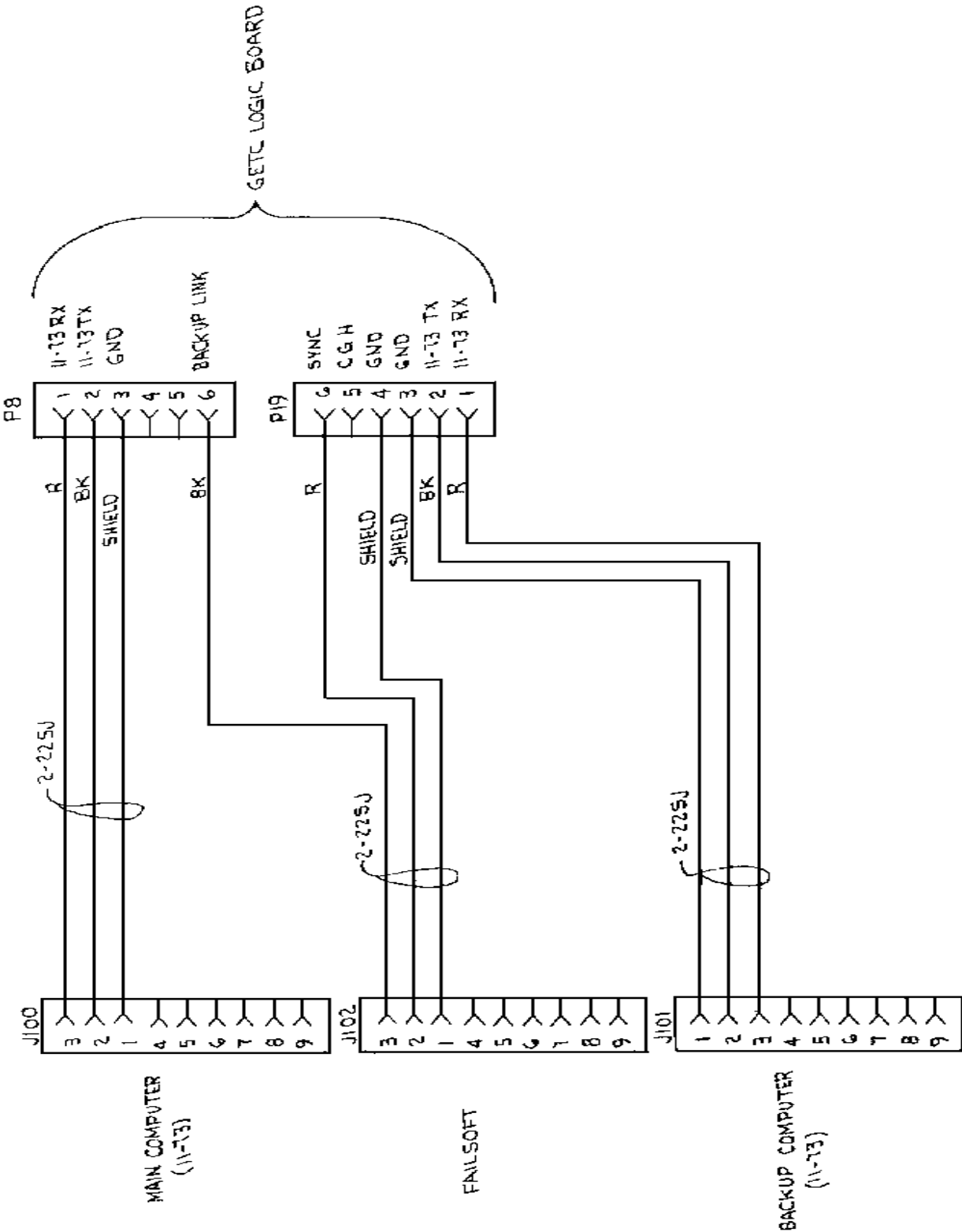
REV. E - LOGIC BOARD 19D902104G1
To stabilize low speed data encode and decode filters, added C100 and C101 (.01 uF capacitors) at U30-C and U33-D respectively.

REV. F - LOGIC BOARD 19D902104G1
To improve inbound data signalling changed R60 at U15 pin 5 from 1.5K ohms (H212CRP215C) to 12K ohms (H212CRP312C).

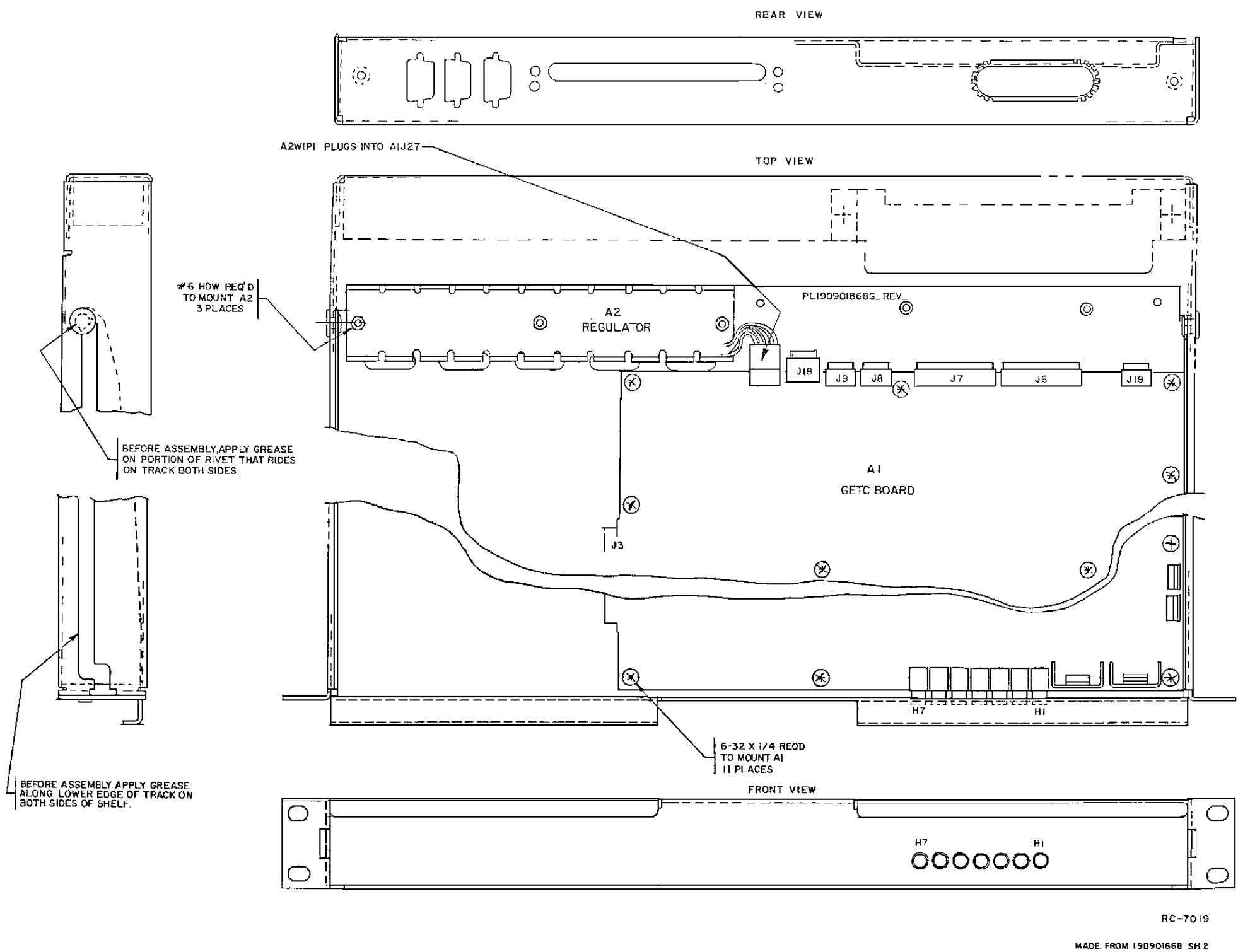


WIRING CHART			
WIRE	FROM	TO	REMARKS
ST22-W	U1-1	TB1-1	+5V R.M. INPUT
R1	TB1-1	TB2-1	
W1-W	W1P1-2	TB1-1	+5V R.M. INPUT
ST22-BK	U1-2	TB1-2	GND
ST22-BK	TB1-2	TB2-2	
ST22-BK	U2-2	TB2-2	
W1-BK	W1P1-3	TB1-2	
ST22-R	U1-3	TB1-3	+5V R.M.
W1-R	W1P1-1	TB1-3	
ST22-W	U2-1	TB2-4	+5V INPUT
R2	TB2-1	TB2-4	
W1-W	W1P1-5	TB2-4	+5V INPUT
ST22-BR	U2-3	TB1-3	+5V
W1-BR	W1P1-6	TB1-3	
W1-D	W1P1-4	TB2-1	+13.8V

REGULATOR ASSEMBLY 19C336816G2
(19C336816, Sh. 1, Rev. 6)



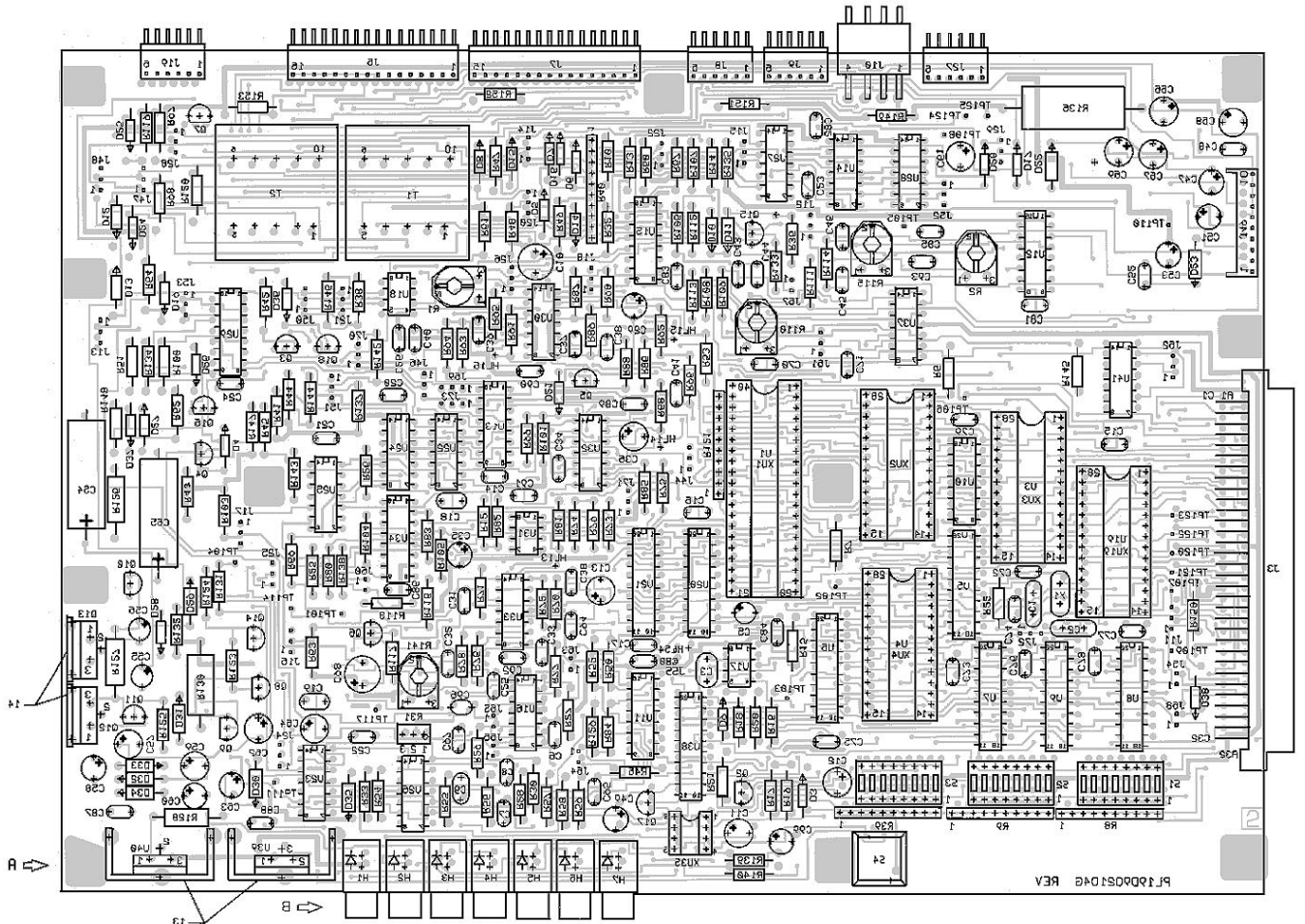
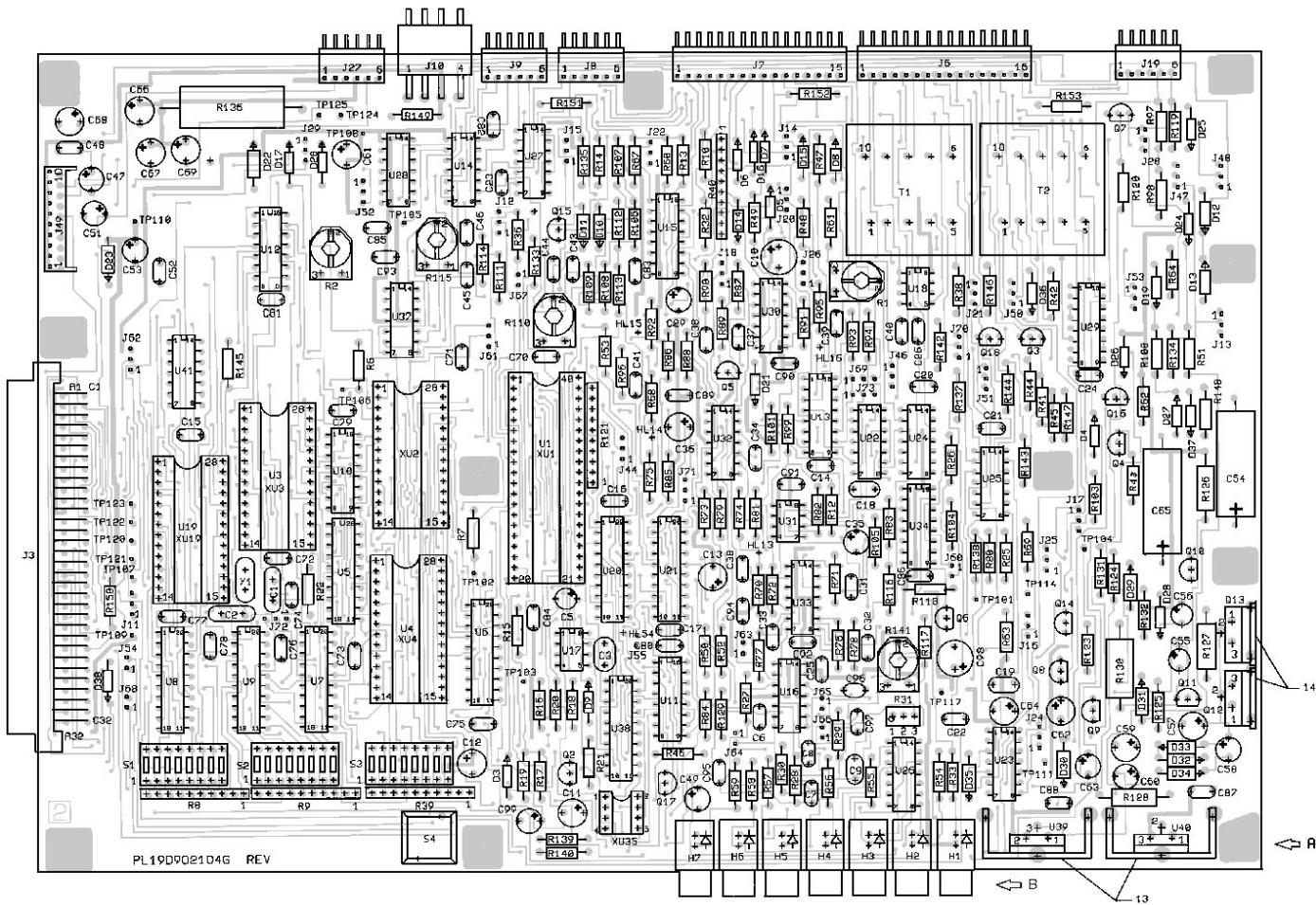
CABLE ASSEMBLY 19C336863G1
(19C336866, Sh. 1, Rev. 0)



GETCSHELF 19D901868G3

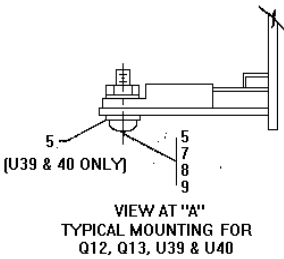
COMPONENT SIDE

SOLDER SIDE

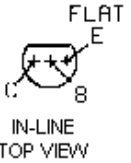


(19D902106, Rev. 4)
(19A705536, Sh. 2, Rev. 2)

(19D902106, Rev. 4)
(19A705536, Sh. 3, Rev. 2)



LEAD IDENTIFICATION
FOR Q2 - Q11 AND Q14 - Q18



NOTE: CASE SHAPE IS DETERMINING
FACTOR FOR LEAD IDENTIFICATION

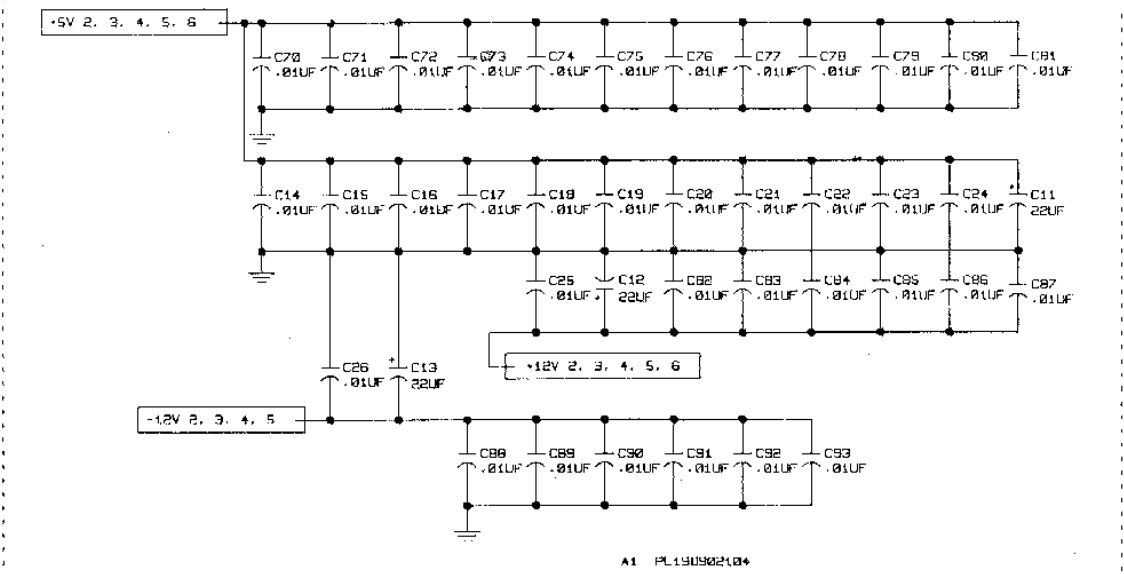


CAUTION
OBSERVE PRECAUTIONS
FOR HANDLING
ELECTROSTATIC
SENSITIVE
DEVICES

GETC BOARD 19D902104G1

VG E/D, VG REM, VG RPT, VG REM/RPT, VG SAT RX, VG VOTED REM/RPT											
JUMPER	VG VOTER SELECTOR	VG VOTER RX	PST TS(N, PST DOWNLINK, PST CD/NC	PST VOTER SELECTOR	PST VOTER DIG RX	PST SAT RX	PST SIMULCAST REMOTE	PST SIMULCAST CONTROL	900 MHZ TRUNKED		
P11	1&2	1&2	1&2	1&2	1&2	1&2	1&2	1&2	1&2	1&2	1&2
P12	1&2	1&2	1&2	1&2	1&2	1&2	1&2	1&2	1&2	1&2	1&2
P13	2&3	2&3	2&3	1&2	2&3	2&3	1&2	1&2	1&2	1&2	1&2
P14	2&3	2&3	2&3	1&2	1&2	1&2	1&2	1&2	1&2	1&2	1&2
P15	2&3	2&3	2&3	1&2	1&2	1&2	1&2	1&2	1&2	1&2	1&2
P16	1&2	1&2	2&3	1&2	2&3	2&3	1&2	1&2	1&2	1&2	1&2
P17	2&3	2&3	2&3	1&2	1&2	1&2	2&3	1&2	1&2	1&2	1&2
P18	2&3	2&3	2&3	1&2	2&3	1&2	1&2	1&2	1&2	1&2	1&2
P20	2&3	2&3	2&3	1&2	1&2	1&2	OMIT	OMIT	1&2	1&2	1&2
P21	2&3	2&3	2&3	1&2	1&2	1&2	1&2	1&2	1&2	1&2	1&2
P22	2&3	2&3	2&3	1&2	1&2	1&2	1&2	1&2	1&2	2&3	2&3
P24	2&3	2&3	2&3	1&2	1&2	1&2	1&2	1&2	1&2	1&2	1&2
P25	2&3	2&3	2&3	1&2	1&2	1&2	1&2	1&2	1&2	1&2	1&2
P26	2&3	2&3	2&3	1&2	1&2	1&2	1&2	1&2	1&2	1&2	1&2
P28	2&3	2&3	2&3	1&2	1&2	1&2	1&2	1&2	1&2	1&2	1&2
P29	1&2	OMIT	1&2	1&2	OMIT	OMIT	OMIT	1&2	1&2	1&2	1&2
P44	2&3	2&3	2&3	1&2	1&2	1&2	1&2	1&2	1&2	1&2	1&2
P46	1&2	1&2	1&2	1&2	1&2	2&3	1&2	1&2	1&2	1&2	1&2
P47	1&2	1&2	2&3	1&2	1&2	1&2	1&2	1&2	1&2	1&2	1&2
P48	1&2	2&3	1&2	1&2	1&2	1&2	1&2	1&2	1&2	1&2	1&2
P50	1&2	2&3	1&2	1&2	1&2	1&2	1&2	1&2	1&2	1&2	1&2
P51	2&3	2&3	2&3	2&3	2&3	2&3	1&2	2&3	2&3	1&2	1&2
P52	2&3	2&3	2&3	1&2	1&2	1&2	1&2	1&2	1&2	1&2	1&2
P53	2&3	2&3	2&3	1&2	1&2	1&2	1&2	1&2	1&2	1&2	1&2
P54	1&2	1&2	1&2	1&2	1&2	1&2	OMIT	OMIT	1&2	1&2	1&2
P55	OMIT	OMIT	OMIT	OMIT	OMIT	OMIT	OMIT	OMIT	1&2	OMIT	OMIT
P60	1&2	1&2	1&2	1&2	1&2	1&2	OMIT	OMIT	1&2	1&2	1&2
P61	1&2	1&2	1&2	2&3	1&2	1&2	2&3	2&3	2&3	2&3	2&3
P62	1&2	1&2	1&2	1&2	1&2	1&2	1&2	OMIT	OMIT	2&3	2&3
P63	OMIT	OMIT	OMIT	OMIT	OMIT	OMIT	OMIT	OMIT	1&2	1&2	1&2
P64	OMIT	OMIT	OMIT	OMIT	OMIT	OMIT	OMIT	OMIT	1&2	1&2	1&2
P65	OMIT	OMIT	OMIT	OMIT	OMIT	OMIT	OMIT	OMIT	1&2	1&2	1&2
P66	OMIT	OMIT	OMIT	OMIT	OMIT	OMIT	OMIT	OMIT	1&2	1&2	1&2
P67	OMIT	OMIT	OMIT	1&2	1&2	1&2	1&2	1&2	1&2	OMIT	OMIT
P68	1&2	1&2	1&2	1&2	1&2	1&2	OMIT	1&2	1&2	1&2	1&2
P69	1&2	1&2	1&2	1&2	1&2	1&2	1&2	1&2	1&2	1&2	1&2
P70	1&2	1&2	1&2	1&2	1&2	1&2	1&2	1&2	1&2	1&2	1&2
P71	1&2	1&2	1&2	1&2	1&2	1&2	1&2	2&3	2&3	1&2	1&2
P72	1&2	1&2	1&2	1&2	1&2	1&2	1&2	2&3	1&2	1&2	1&2
P73	1&2	1&2	1&2	1&2	1&2	1&2	2&3	2&3	1&2	1&2	1&2

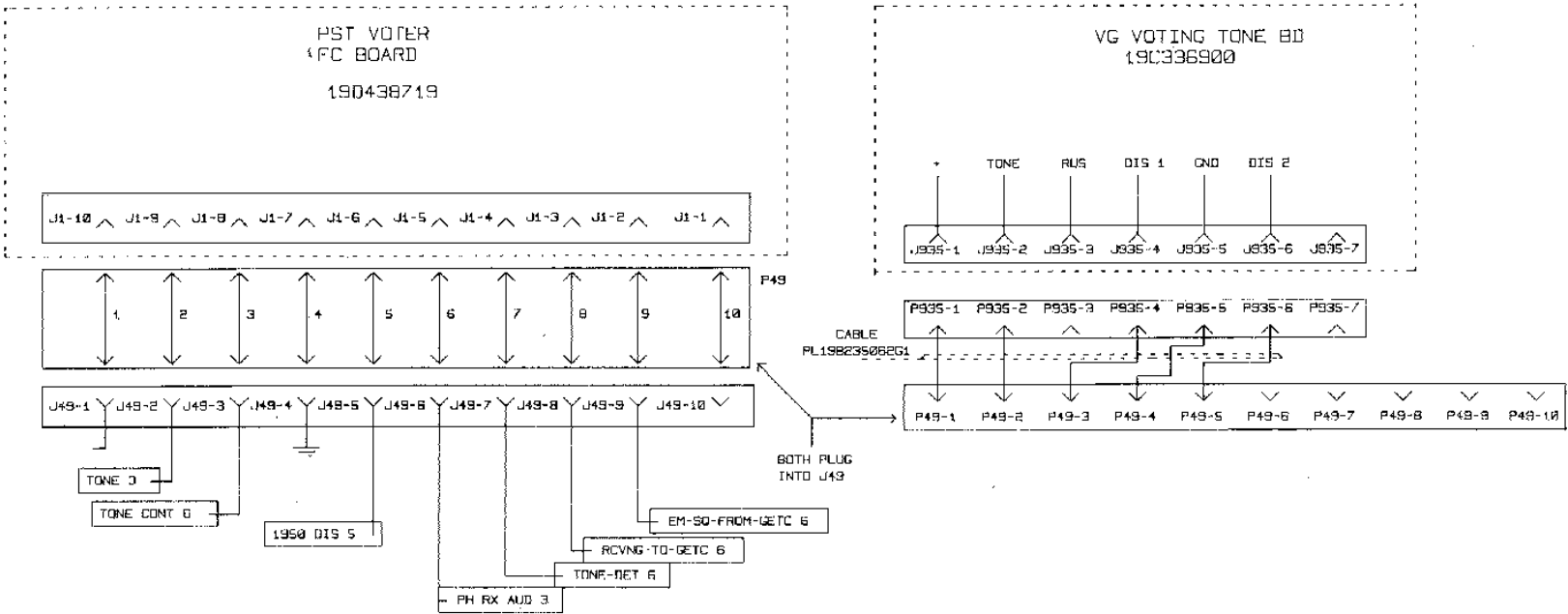
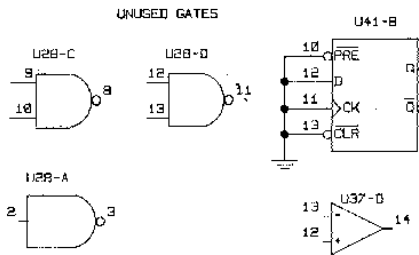
MODEL NO.	REV LETTER
PL19D502104G1	F

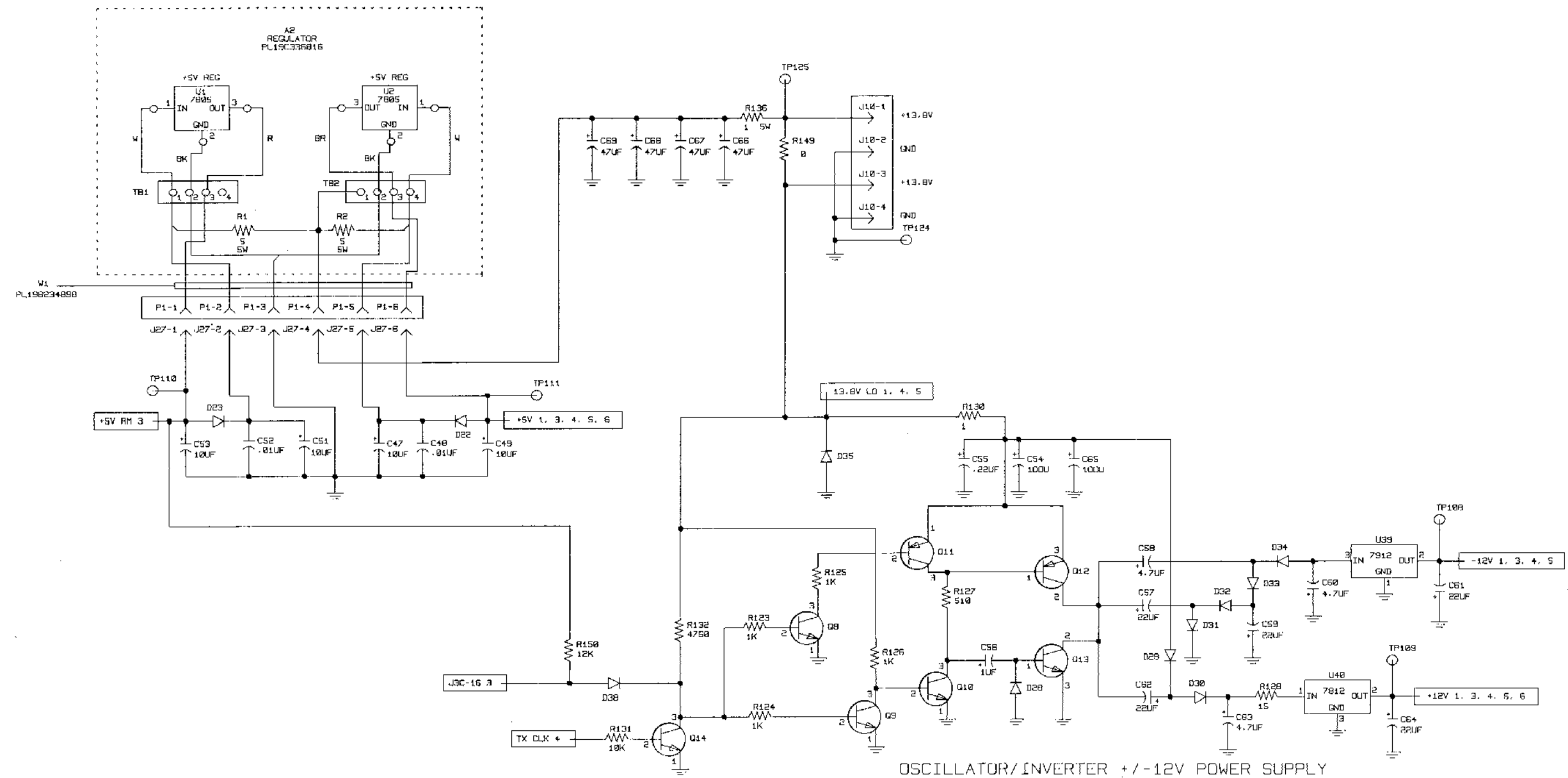


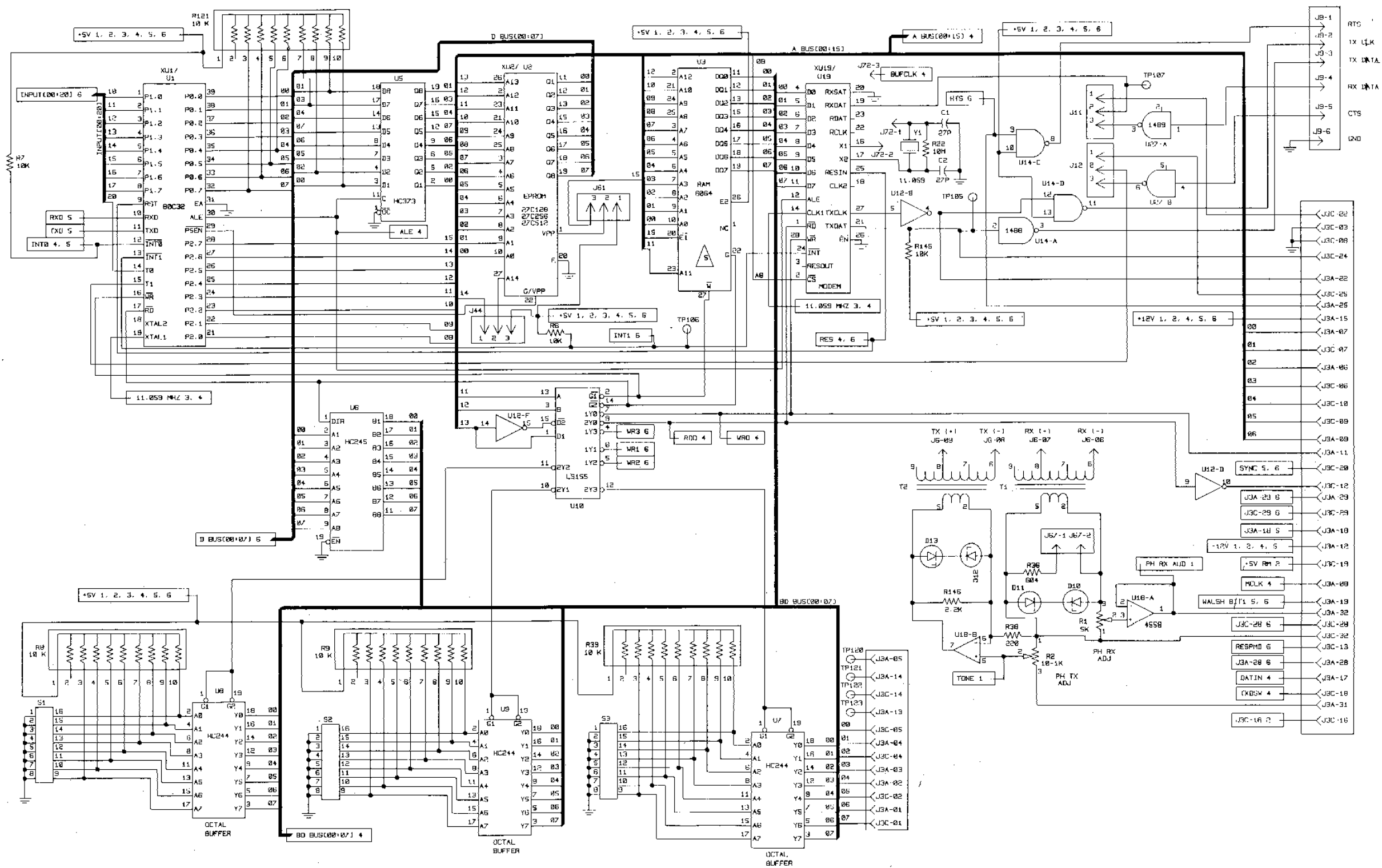
ALL RESISTORS ARE 1/4 WATT UNLESS OTHERWISE SPECIFIED.
RESISTOR VALUES IN OHMS UNLESS FOLLOWED BY MULTIPLIER K OR M.
CAPACITOR VALUES IN F UNLESS FOLLOWED BY MULTIPLIER U, N OR P.
INDUCTANCE VALUES IN H UNLESS FOLLOWED BY MULTIPLIER M OR U.

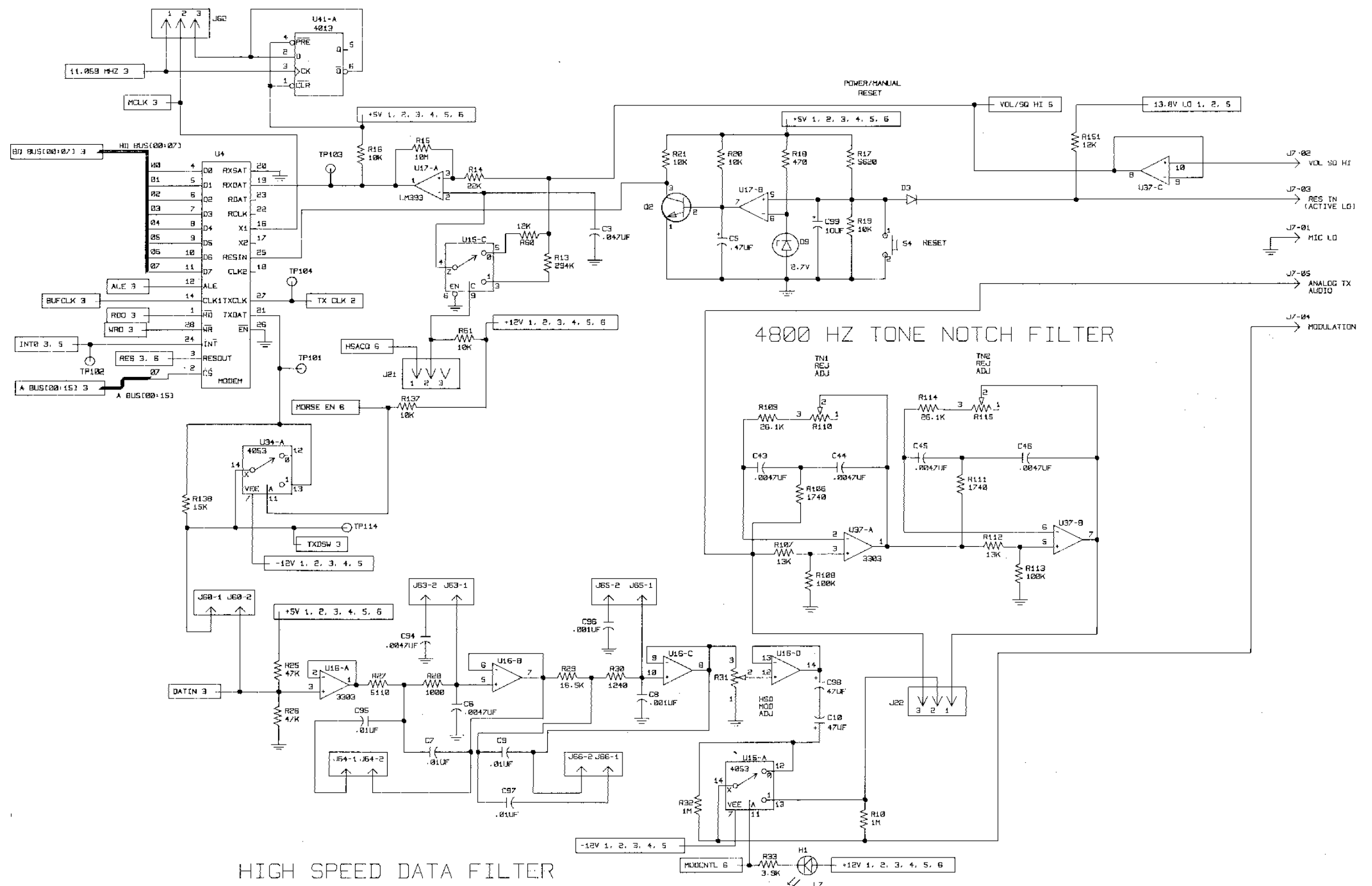
- NOTES:
- FOR JUMPER PLACEMENT, SEE JUMPER CHART.
 - FOR A 6116 RAM (24 PINS), OFFSET DOWNWARD IN THE 28 PIN SOCKET.
 - U35 NOT PRESENT. FOR FUTURE USE.
 - CONNECTIONS SHOWN FOR ROCKWELL MODEM COMMUNICATION. FOR RS232C COMMUNICATION, CONNECT J11&J12 TO P11&P12-2&3.

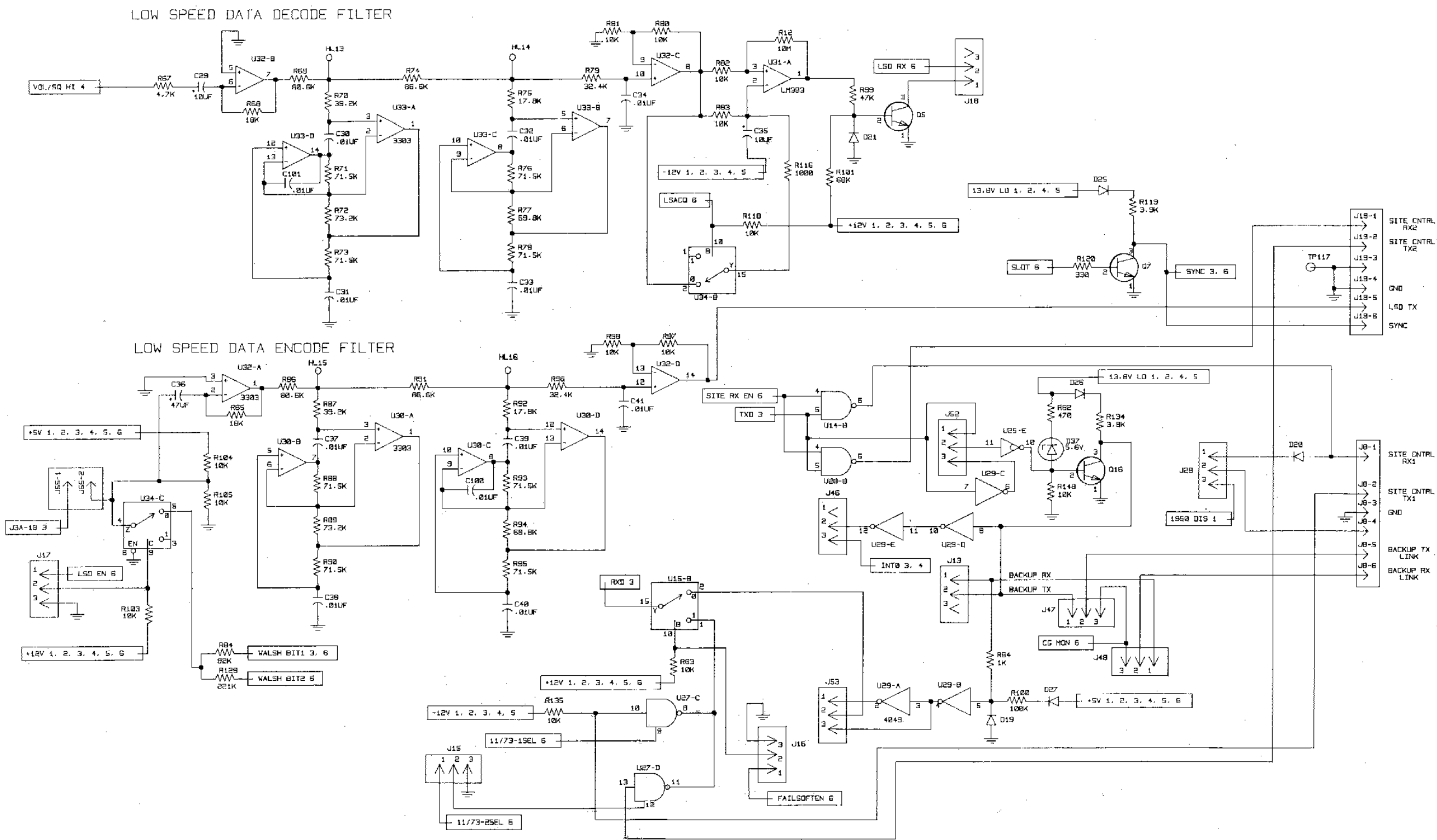
DEVICE	QND PIN NO	+5V PIN NO	+12 PIN NO	-12 PIN NO
U1	20	40		
U2	14	28		
U3	14	26, 28		
U4	13	15		
U5	10	20		
U6	10	20		
U7	10	20		
U8	10	20		
U9	10	20		
U10	8	16		
U11	8	1		
U12	8	1		
U13	8	1		
U14	7	14	1	
U15	6, 8	16	7	
U16		4	11	
U17	4	8		
U18		8	4	
U19	13	15		
U20	10	20		
U21	10	20		
U22	7	14		
U23	7	14		
U24	7	14		
U25	7	14		
U26	7	14		
U27	7	14		
U28	7	14		
U29	8	1	14	1
U30			4	11
U31			8	4
U32	3, 5		4	11
U33			4	11
U34	6, 8		16	7
U35	4			
U37			4	11
U38	10	20		
U41	7	14		















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