Analog Voter System

tyco Electronics

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NOTICE!

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SPECIFICATIONS*

INPUT POWER (Maximum) 19D413917G3 19D413917G4	 80 Watts @ 120 VAC ±10%. 80 Watts @ 27.5 Vdc ±5%.
INPUT IMPEDANCE	600 Ohms
Input Level (Minimum)	-30 dBm
INITIAL RESPONSE TIME	Less than 50 milliseconds from unsqulech to select.
AUDIO OUTPUT	2 Watts with less than 5% distortion into 3.2 ohms.
600 Ohm OUTPUT LEVEL	Adjustable to +11 dBm.
FREQUENCY RESPONSE	±1 dB from 300 Hz to 3 kHz except around notching frequency.
NOTCH FREQUENCY	1950 Hz ±10 Hz
NOTCH DEPTH	More than 40 dB.
UNSQUELCHED CHANNEL REJECTION	40 dB
RESET TIME	50 milliseconds after receipt of tone from all receivers.
LINE FAILURE LOCKOUT TIME (Steady Line Level)	20 seconds nominal.
TELEPHONE LINE REQUIREMENTS (AC or DC)	Input at 1950 Hz must not be attentuated below -30 dBm.
DIMENSIONS (HxWxD) - cm. (in.)	17.78 x 48.26 x 24.13 (7 x 19 x 9.5)
TEMPERATURE RANGE	0°C to +60°C (+32°F to +140°F): System may operate from -30°C with some degradation in performance.

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

WARNING

No one should be permitted to handle any portion of the equipment that is supplied with high voltage or to connect any external apparatus to the units while the units are supplied with power. KEEP AWAY FROM LIVE CIRCUITS!

DESCRIPTION

The Voting Selector is used with satellite receivers to form a receiver voting system *(Figure 1).*

The satellite receivers are located so that one or more of the receivers will receive a good quality signal from a Personal or Mobile two-way radio transmitting from anywhere in a specified operating area. Each receiver output is connected to a centrally located Voting Selector by an RF link, an AC or a DC line, or an E&M pair.

The Voting Selector provides continuous voting for the satellite receivers and selects the receiver with the best audio quality. The selected audio is amplified and applied to the selector speaker. In remote control applications, the selected audio is applied to the remote control unit from the Selector 600-ohm output.

In applications where continuous voting is not desired, the Audio Module in the Voting Selector can be strapped for two alternate selection hold modes of operation. In one mode of operation, the Selector locks on the first voted signal for a time period that can be set for 5 to 30 seconds. At the end of the time period, the Selector votes again for approximately 1/2-second and again locks on the signal for the pre-set period. In the other mode of operation, the Selector locks on the first voted signal for the duration of the message.

Strapping instructions for the two alternate modes of operation are contained in the Adjustment Procedures as listed in the Table of Contents.

The selector panel normally mounts in a station cabinet and provides voting for up to six satellite receivers. A second Selector panel can be added in parallel for controlling up to 12 receivers.

In paralleled applications, the Selector panels should be mounted in the same cabinet *(or rack),* and interconnected by harness 19A128199G4. The Selector panel is available without the cabinet for mounting in a 19-inch rack *(four rack units),* or on a table or desk.

All connections to the Selector Panel are made to terminals on the back of the Selector panel.

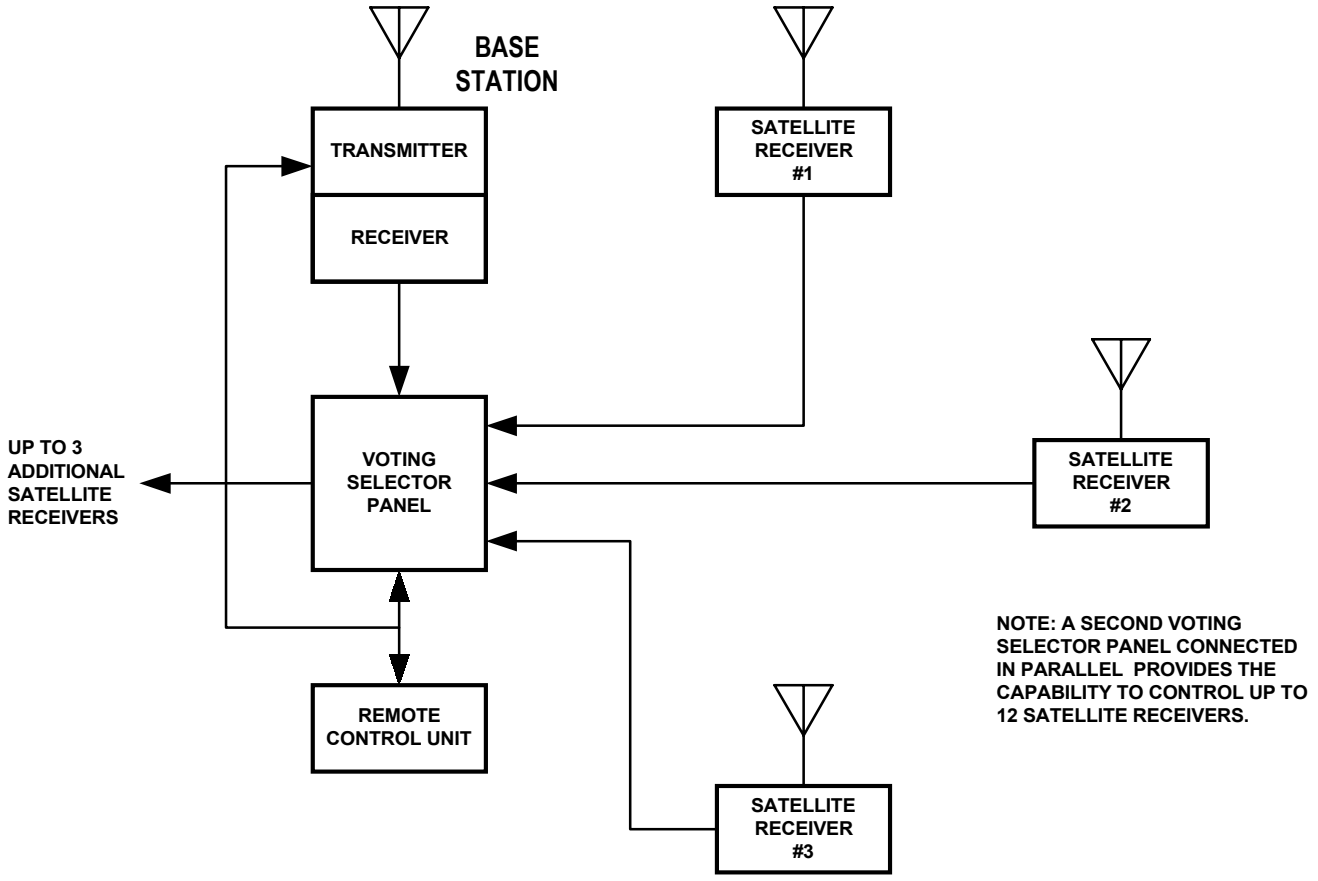

Figure 1 - Typical Receiver Voting System

CONTROLS AND INDICATORS

RECEIVER MODULE

Each Receiver Module has a three-position switch and three indicator lights mounted on the front of the module *(Figure 2)*.

Toggle Switch

The three toggle switch positions are marked SELECT, NORMAL and DISABLE. Placing the toggle switch in the NORMAL position enables the Receiver Module so that the Voting Selector operates normally.

Moving the switch to the SELECT position manually selects that receiver, and disables the selector voting circuitry. One or more of the receivers can be selected at the same time.

Placing the switch in the DISABLE position removes the associated receiver from the voting process. One or more receivers can be rejected at any time. The receivers remain rejected until the switch is returned to the NORMAL position.

Indicator Lights

The three indicator lights are marked VOTED, RCVNG, and FAILED. Whenever a satellite receiver is selected, the Green VOTED light of the associated Receiver Module turns on.

When any of the satellite receivers unsquelch, the Yellow RCVNG light turns on. Normally, several of the RCVNG lights will be turned on during each call.

A telephone line failure or a receiver malfunction that turns off the 1950 Hz squelch tone will turn on the Red FAILED light. This removes the failed receiver from the voting process. As soon as the fault is corrected, the FAILED light turns off and the receiver is restored to the voting process. The Alarm output (TB8-11) provides a connection point to the FAILED circuit for activating an external alarm. This connection will sink about 15 mA below 0.5 volts. Whenever the FAILED light turns on, the alarm connection drops to near ground potential.

AUDIO MODULE

The Audio Module has the VOLUME control mounted on the front. This controls the two-watt (3.2 ohm) output to the local speaker in the Power Supply Module.

POWER SUPPLY MODULE

The Power Supply has an OFF-ON switch mounted on the front panel for control of the input power source.

The Local/Remote switch and 20 volt adjust are located on the rear panel. The Local/Remote switch selects between local or remote lights. The 20 volt adjust (R7) provides adjustment of the +20 Vdc regulated output.

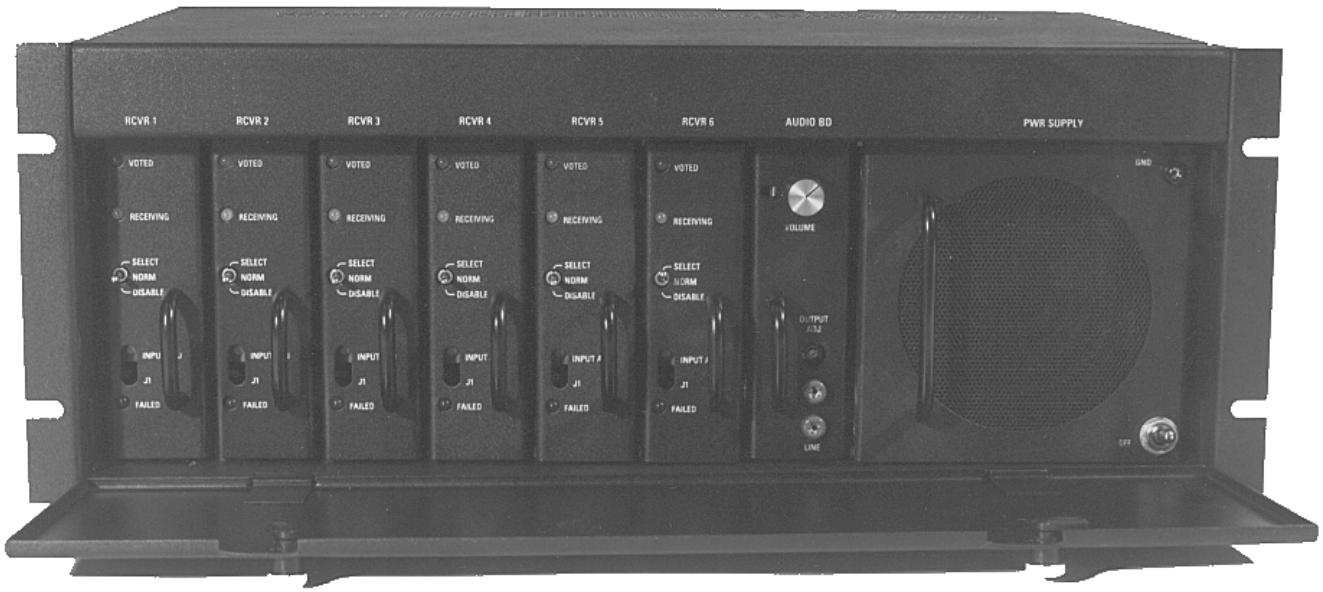

Figure 2 - Typical Voting Selector Panel

TELEPHONE LINES

A key link in receiver voting systems is the audio path. A standard voting system may require up to 12 audio pairs to connect all of the satellite receivers to the Voting Selector.

Two problems encountered in multiple-line systems that affect system performance are:

- Noisy lines
- Lines with different frequency responses

NOISY LINES

The Voting Selector picks the best quality audio signal applied to the Selector. However, noisy telephone lines can degrade the signal arriving at the Selector. Comparison readings for determining the worst lines can be obtained by measuring the idle line noise *(no tone or audio applied)* with a Wideband Audio Voltmeter. It may be possible to compensate for the noisy lines by improving the RF system performance. This can be accomplished by reducing the range between the Personal or Mobile units and the satellite receiver, or installing additional satellite receivers, Another possibility is to contact the telephone company about obtaining quieter lines.

FREQUENCY RESPONSE

The frequency response of different telephone lines can vary greatly. This can cause annoying changes in pitch between words or even syllables as the Voting Selector changes receivers. It is recommended that the frequency response of each telephone pair to be measured and the difference between the lines observed. Telephone line Evaluation forms are available to aid in making the measurements. A sample of this form is located at the end of this book *(ECP-774)*.

After the frequency responses have been measured, the lines should be equalized by a service technician or telephone company as required.

E&M SIGNALING

E&M signaling is a method of transmitting a contact closure, usually to ground, from end-to-end of a telephone line link or a customer owned microwave mux link. The signal may be transmitted by tone or radio thus it is not a metallic link.

The squelch signal, normally transmitted by inband 1950 Hz tone, may be transmitted using E&M signaling.

Normally, a **C**arrier **O**perated **R**elay (**C.O.R.**) option is applied to the satellite receiver. This relay provides the contact closure to the M lead. Although usually connected to ground, some telephone or mux systems require switching to +24 Vdc or +48 Vdc. Connect the leads to the C.O.R. so that closure occurs when the receiver unsquelches.

At the voter end, connect the N.O. contacts (E lead) between ground and TB1-5 (for RX #1) or TB2-5, TB3-5, TB4-5, TB5-5, or TB6-5 for the other receivers. A pullup resistor (1K) is required from each TBx-5 to 17 Vdc (Pin 14 of each receiver module connector). When the contact closes to ground, the input to the receiver module will be pulled to ground putting the module in receive condition.

The old modules (19D413994G1) would accept 5 V to 20 V for the E&M input. The new module (19D903175G1) requires 12 V to 17 V.

INSTALLATION

SELECTOR CABINET

Install the Voting Selector cabinet within 6 feet of a 120-VAC, 50/60 Hz power source, and as close to the telephone line termination block as possible. Be sure to leave sufficient room on each side of the cabinet so that both of the cabinet side panels can be removed for servicing.

A separate 15-ampere, 120 VAC circuit should be provided for the Voting Selector. A separate line will prevent an interruption of communication if a failure occurs in other building circuits. The power supply is available in two versions: Group 3 and Group 4. The Group 3 supply is a 120 VAC 50/60 Hz to DC converter and regulator.

The Group 4 supply accepts a nominal 27.5 Vdc input and provides regulated DC output power. The Group 4 Power Supply would typically gets power from the Power Converter Panel 19C320687, which accepts a nominal 13.8 Vdc and generates 27.5 Vdc. The power converter panel would receive power from the cabinet power supply, such as a 19A149978G2 Rev. D. This supply accepts 230 VAC @ 50 Hz and provides up to 33 amperes of output current at a nominal 13.2 Vdc. Refer to the following instruction manuals:

- **LBI-4583** - Power Converter Panel 19C320687G1&G2
- **LBI-38550** - Cabinet Power Supply 19A149978G1 &G2 120/240V, 50/60 Hz
- **LBI-39177** - Battery Standby

In either case, the AC supply power cable is supplied with a three-prong plug.

One prong grounds the equipment to protect personnel. The attached ground wire must be connected to building ground. Make a continuity check between the Selector rack and a known ground point to make sure that a good ground connection has been made.

NOTE

A practice of bonding and grounding cabinets, racks, and equipment to a site common ground system as a preventative measure against lighting damage should ***not*** be overlooked.

The most effective protection from lightning will be from well-grounded telephone line and power line surge protectors located external to, and away from, the Voting Selector equipment.

Check the electrical code to assure compliance with local ordinances.

SELECTOR PANEL

The Voting Selector Panel may be ordered without the station cabinet for installation in a 19-inch rack. In this case connect the power supply cable to a grounded three-prong 120-Volt, 50/60 Hz outlet (Group 3). For Group 4 supplies, the power connection is made to the selector panel via the standby power input on the interconnection board.

AUDIO CONNECTIONS

All audio inputs from the satellite receivers are connected to terminal boards mounted on the back of the Interconnection Board. A #22 AWG twisted pair is recommended for the audio leads. Spade terminals 19B209260P108 are recommended. To gain access to the input terminals, remove the cabinet side panels and then remove the back plate on the Selector panel. Connect the audio pairs to the line input terminals as shown in the following table:

Table 1 - Audio Connections for a Single Selector Panel

AUDIO FOR RECEIVER MODULE:	CONNECT AUDIO PAIR TO:
1	TB9-17* and TB9-20*
2	TB9-12 and TB9-15
3	TB9-7 and TB9-10
4	TB9-2 and TB9-5
5	TB8-17 and TB8-20
6	TB8-12 and TB8-15

***NOTE**

[1]In remote control applications where the base station receiver is used in the voting system, ***do not*** make the audio connections at TB9-17 and TB9-20 (Receiver Module 1).

When two Selector panels are connected in parallel, connect the audio pairs to the line input terminals on the second Selector as shown in the following table:

Table 2 - Audio Connection for Two Selector Panels

AUDIO FOR RECEIVER MODULE:	CONNECT AUDIO PAIR TO:
7	TB9-17 and TB9-20
8	TB9-12 and TB9-15
9	TB9-7 and TB9-10
10	TB9-2 and TB9-5
11	TB8-17 and TB8-20
12	TB8-12 and TB8-15

REMOTE CONNECTIONS

In remote control applications, audio and control connections are required from the remote control unit and the remote base station to the Voting Selector. A nylon or rayon jacketed #20 AWG stranded wire is recommended for the ground and keying lines. A #20 AWG twisted pair is recommended for the audio/control lines. All connections, using solderless terminals 19B209260P108, are made to terminals on the Interconnection Board at the Selector.

ADJUSTMENT PROCEDURE

Before adjusting the Voting Selector, make sure that all AC power lines, telephone lines and ground connections have been completed to the Selector. Make sure the satellite receivers are set on frequency.

POWER SUPPLY

1. Turn the OFF-ON switch to the ON position.
2. Measure for 20 Volts DC at any Red jack to any Black jack (Ground) on the Interconnection Panel. If the reading is not 20 Volts DC, adjust R7 on back of power supply for 20 Volts DC.

[1] This note applies to earlier MASTR II, and MASTR IIe applications. It does not apply to MASTR III and later applications. For further assistance call the number listed on the back of this manual.

RECEIVER MODULE

There are two methods for adjusting the input levels to the Receiver Module. The preferred method requires a technician at the Satellite Receiver and another technician at the Voting Selector. The preferred method must be used in E&M systems. The alternate method requires only one technician at the Voting Selector, and also requires that the tone and noise outputs have been pre-set to equal levels arriving at the Voting Selector.

Equipment Required

- Wideband Audio Voltmeter or Distortion Analyzer: Similar to Simpson 715, HP400 series or HP331A.
- RF Signal Generator: Similar to HP8640.

Preferred Method

1. At the Satellite Receiver, connect a Wideband Audio Voltmeter across the telephone line.
2. Apply a 1000 microvolt signal modulated by 1000 Hz with ±3.0 kHz deviation (standard signal) to the receiver antenna jack.
3. Set the Audio Line Level as follows:
   a. If the line loss is less than 10 dB, set the Audio Line Level for the maximum level allowed by the telephone company, but no greater than 0 dBm.
   b. If the line loss is greater than 10 dB, set the Audio Line Level for the maximum level allowed.
4. Remove the signal generator and unsquelch the receiver.
5. At the Voting Selector, connect a Wideband Audio Voltmeter to X1, accessible through the hole on the front of the associated Receiver Module, and to the Ground jack on the front of the power supply module.
6. With receiver noise on the line, adjust the Input level control R2 on the front of the Receiver Module for -20 dBm.
7. At the Satellite Receiver, readjust the SQUELCH control on the receiver for the desired setting.
8. At the satellite receiver, adjust the 1950 Hz Tone Board for a reading of -20 dBm at X1 on the Voting Selector. Do not adjust R2 at the Receiver Module.
9. Repeat Steps 1 through 8 for each Satellite Receiver Module.

Alternate Method

1. At the Satellite Receiver, connect a Wideband Audio Voltmeter across the phone line.
2. Apply a 1000 microvolt signal modulated by 1000 Hz with ±3.0 kHz deviation to the receiver antenna jack.
3. Set the Audio Line Level Adjust as follows:
   a. If the line loss is less than 10 dB, set the Audio Line Level for the maximum level allowed by the telephone company, but no greater than 0 dBm.
   b. If the line loss is greater than 10 dB, set the Audio Line Level for the maximum level allowed.
4. Remove the signal generator and squelch the receiver.
5. With a Wideband Audio Voltmeter, measure the difference in receiver output on a standard signal versus unsquelched noise. The standard output will generally be about 3 dB higher than the unsquelched noise. With the receiver squelched, adjust the 1950 Hz tone level to the standard output level minus the difference measured above.
6. At the Voting Selector, adjust Input Level control R2 on the front of the Receiver Module for a reading of -20 dBm at X1 on the 1950 Hz tone.
7. Repeat Steps 1 through 7 for each Satellite Receiver Module.

Fine Tuning

After following the above preferred or alternative method of level adjustment, levels may be fine tuned to eliminate changes in voted audio levels as different receivers are selected.

1. Connect a Wideband Audio Voltmeter to the two jacks, J1 & J2, on the front of the audio module.
2. On the rear of the voting selector, connect temporary jumpers to disable the fail circuits: J-17 to J-22 (receivers #1 to #6 respectively) to ground (TB7-1).
3. Generate a strong signal (such as from a mobile transmitter) capable of producing a full quieting signal into each satellite receiver in the system.

4. Modulate the signal with a 1000 Hz tone at 3.0 kHz deviation (encode channel guard if required).
5. Manually select each receiver, one at a time, recording the audio levels. Select/calculate the average reading obtained.
6. Again, manually select each receiver and adjust the Input level control R2 for the average reading determined above.

When finished the audio level should not change as each receiver is selected while receiving the "same" signal into all receivers.

AUDIO BOARD

Audio Line Output

In remote control applications where the audio is applied to telephone lines, the line output should be adjusted to the maximum level allowed by the telephone company.

1. Connect a Wideband Audio Voltmeter to the two jacks on the front of the Audio Module.
2. Adjust R10 for the desired audio output level.

Selection Hold Adjustment

The Voting Selector is normally shipped from the factory strapped for continuous voting. The Audio Module can be strapped to lock on the first voted message from 5 to 25 seconds, or to lock on the first voted message for the duration of the call. Refer to the Audio Module Outline Diagram for the location of components mentioned in the following procedure.

To lock on for 5 to 25 seconds:

1. Turn the power OFF and remove the Audio Module from the Shelf assembly.
2. Remove the jumper connection from J5 to J6. Then adjust R47 for the desired hold time. The hold period is adjustable from less than 5 seconds with R47 fully counterclockwise to more than 25 seconds with R47 fully clockwise.
3. Replace the Audio Module and turn the power ON.

To lock on for the duration of the message:

1. Turn the power OFF and remove the Audio Module from the shelf assembly.
2. Remove the jumpers connected from J5 to J6 and from J3 to J4.
3. Replace the Audio Module and turn the power ON.

Voting selection may be stopped or frozen by applying between +12 and +17 volts to TB7-10.

MAINTENANCE

The Voting Selector assembly was designed for ease of servicing and minimum maintenance. All of the Selector modules plug into card-edge connectors on the Interconnection Board, and can be easily unplugged for routine inspection and maintenance. The Interconnection Board also has jacks for the major metering points. A decal mounted inside of the Selector back panel identifies all of the metering points and terminals.

An Extender Board and Test Assembly is supplied with the Selector panel for servicing any of the Modules out of the panel. The Extender Board plugs into the Selector, and the Test Assembly or Module plugs into the jack on the Extender Board Cable. The Test Assembly has duplicate metering jacks so that all measurements can be made with the Test Assembly lying on a bench.

NOTE

Turn the power OFF before removing and replacing any of the modules.

LINE LEVEL CHECKS

The line levels at X1 should be checked periodically to see if the line levels need readjusting.

TROUBLESHOOTING

A Troubleshooting Procedure is provided to assist the service technician in maintaining the Voting Selector *(see Table of Contents)*. The procedure contains **Quick Checks** for quickly isolating the problems, and DC voltage readings for the Power Supply, Audio and Receiver Modules.

CIRCUIT ANALYSIS

The basic Voting Selector consists of an Interconnection Board, a 120–Volt Power Supply Module, an Audio Module, and up to six Voting Receiver Modules *(one for each satellite receiver).*

Two Selector panels can be connected in parallel to provide voting for up to 12 receivers operating on the same frequency.

Reference to symbol numbers mentioned in the following text may be found on the applicable Schematic Diagram, Outline Diagram, and Parts List *(see Table of Contents).* A Block Diagram of the Voting Selector is shown in Figure 3.

INTERCONNECTION BOARD

The Interconnection Board mounts on the rear of the Selector panel and contains Carrier Operated Relay Board A2. The Interconnection board provides all connections between the Selector Modules.

Carrier Operated Relay Board A2 provides two Form "C" relay contacts for controlling external functions. When any satellite receiver is receiving, TB7-6 (RCVNG) goes to +16 volts. This signal is applied through P3 to the base of emitter-follower transistor Q1. Conduction of Q1 turns on transistor Q2 which, in turn, connects ground through P2 to operate relay K1. Contacts of K1 operate the external functions.

The Interconnection Board is equipped with terminal strips for connections from the satellite receivers, remote control unit and remote base station. In addition, the terminal boards contain logic and control tie points that may be used in both standard and special applications. The description and function of the tie-points is shown in Table 1.

Metering jacks are also provided on the Interconnection Board for critical metering voltages. A +20 Volts jack and a ground jack are available for metering each module. The following jacks are provided for servicing the Voting Receiver Module:

- **Failure disable**: Ground to disable the failure circuit.
- **Envelope detector**: For servicing signal quality circuit.
- **Valley detector**: For servicing signal quality circuit.

POWER SUPPLY (Group 3)

The Power Supply Module consists of a 20-Volt and a 25-Volt regulator circuit, a remote line switching relay and a 2-Watt Speaker.

Turning OFF-ON switch S2 to the ON position applies 120 Volts AC to the primaries of step-down transformers T1 and T2. The primaries are fused by fuse F1. Thyrector CR13 protects the regulator circuits against line surges.

25-Volt Regulator

The voltage across the secondary of T1 is applied to full-wave bridge rectifier diodes CR6 through CR9. The rectified output is filtered by capacitor C1. Fuse F2 protects the transformer secondary and rectifiers.

Applying voltage to the circuit turns on regulator transistors Q5 and Q4. A pair of 13 volt zener diodes CR11 and CR12 keep the base of Q5 at 26 Volts, which holds the base bias on Q4 constant. This clamps the output voltage at the emitter of Q4 at approximately 25 Volts. Capacitor C4 provides additional filtering.

A continuous 25 Volts is applied to remote line relay K1, to the audio PA circuit on the Audio Module, and to the lights on the Voting Receiver Module.

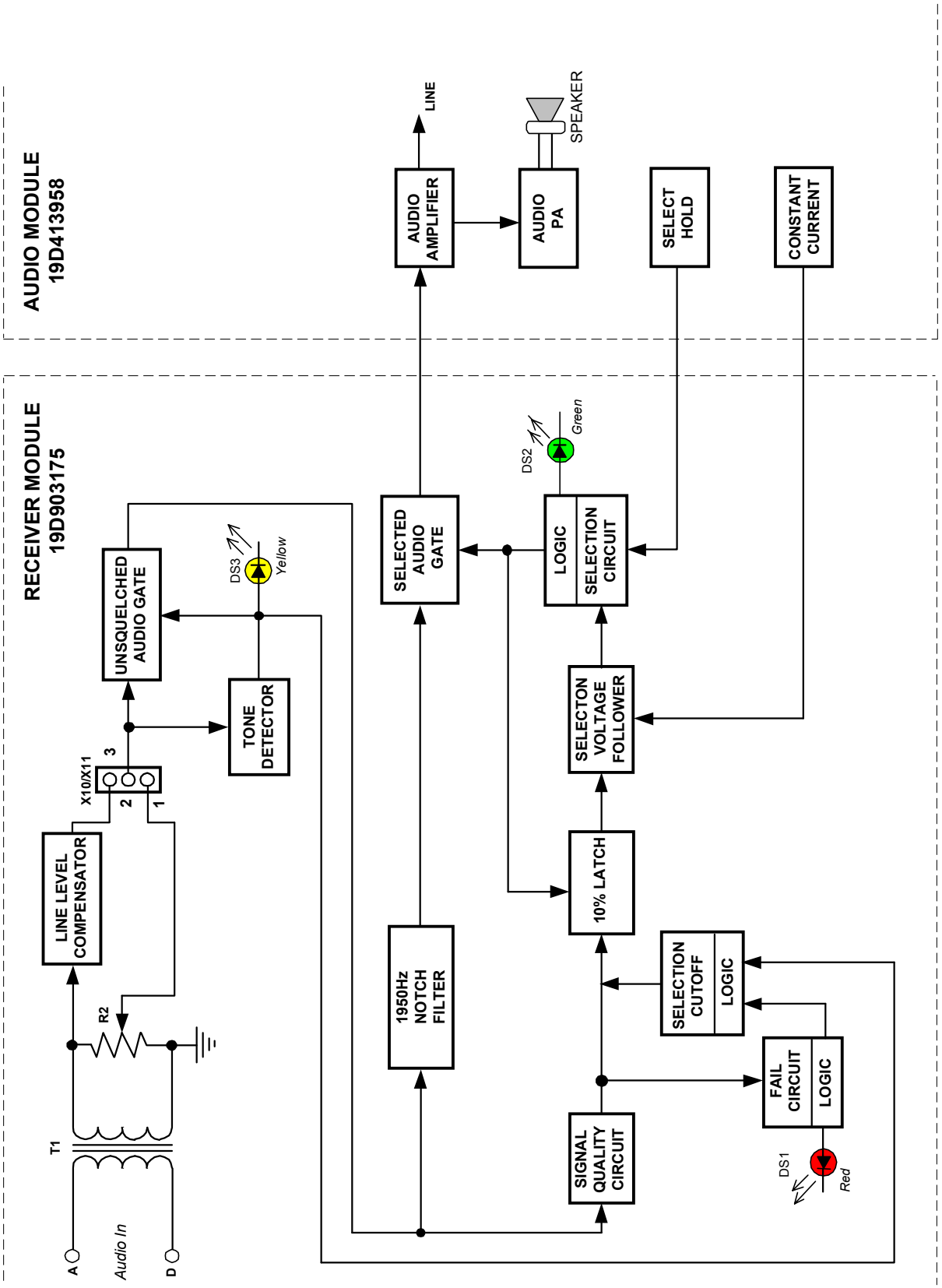

Figure 3 - Volting Selector Block Diagram

Table 3 - Interconnection Board Tie Points

TIE-POINT FUNCTION	PIN NUMBER	DESCRIPTION
Selected (for each Receiver Module)	TB1-4 thru TB6-4	Ground indicates receiver selection.
Unsquelched (for each Receiver Module)	TB1-6 thru TB6-6	Ground indicates receiver unsquelched.
Select Switch (for each Receiver Module)	TB1-2 thru TB6-2	Ground to select.
Reject Switch (for each Receiver Module)	TB1-1 thru TB6-1	Ground to reject.
Audio (for each Receiver Module)	TB1-3 thru TB6-3	
E&M Squelch (for each Receiver Module)	TB1-5 thru TB6-5	+12 to +17 Vdc for squelch; ground or open for unsquelch.
Selected Audio	TB7-5	Audio from selected receiver.
Mute	TB7-8	Ground to mute the 600-ohm output and the selected audio (not used in standard systems).
Selector Lock	TB7-10	+12 to +17 Vdc locks selection.
Receiving	TB7-6	+16 Volts when any receiver unsquelches. Used to key repeaters.
Alarm	TB8-11	Provides diode path to ground when any line fails (20 mA, 25 Volts max.).
Standby Power - Power Selector in absence of AC Power	TB7-2	Nominal 24 Volts, 1-ampere standby power connector.
Constant Current	TB7-7	For parallel Selectors.
Speaker High	TB7-9	For remote speaker.
Ground	TB7-1	
Pulse Unlock	TB7-4	Ground defeats the selection lock timer circuit. A positive pulse causes revoting and locking on signal (not used in standard systems).
PTT	TB8-2	Ground keys K1 in power supply switching audio path for station receiver and disabling voting.
+25 Volts	TB8-16	Available for external leads up to 200 mA.

20-Volt Regulator

The voltage across the secondary of transformer T2 is applied to full-wave bridge rectifier diodes CR1 through CR4. The rectified output is filtered by capacitor C2 and by capacitors C5, C6, and C7. Fuse F3 protects the transformer secondary and rectifiers.

Applying voltage to the circuit turns on regulator transistors Q1 and Q2, applying a continuous +20 Volts to the Audio and Voting Receiver Modules.

When the output voltage at the emitter of Q1 starts to increase, the voltage at the base of transistor Q3 increases. This causes Q3 to conduct harder, reducing the base bias of Q2. Reducing the base bias on Q2 causes it to conduct less. This increases the voltage drop across Q1, keeping the output constant.

When the output voltage starts to drop, Q3 conducts less. This allows Q2 and Q1 to conduct harder, reducing the voltage drop across Q1 and keeping the output constant.

Potentiometer R7 is used for setting the regulator for the desired 20-Volt output. Diode CR10 provides a constant reference voltage for the emitter of Q3. The +20 Volts can be metered at any Red Jack on the Interconnection Board.

Remote Line Relay

In remote control applications, the PTT lead and relay contacts brought out at TB8 are connected to the remote control unit and remote base station. Keying the remote microphone energizes relay K1, switching the Audio/Control lines from receive to transmit. Energizing the relay also opens a ground path to the constant current switch on the Audio Module through normally-closed contacts K1-11 and -12. Opening the ground path disables the constant current circuit, and prevents the Selector from voting during the transmit mode.

POWER SUPPLY (Group 4)

The Power Supply Module consists of the 20-Volt and 25-Volt regulator circuits, the remote line switching relay, and the 2-Watt speaker.

Turning OFF-ON switch S2 to the ON position applies 27.5 Vdc to the inputs of each regulator through fuses F2 and F3.

25-Volt Regulator

The DC input to the 25–Volt Regulator circuit is filtered by capacitor C1. Applying voltage to this circiut turns on regulator transistors Q5 and Q4. A pair of 13 Volt zener diodes CR11 and CR12 keep the base of Q5 at 26 Volts, which holds the base bias on Q4 constant. This clamps the output voltage on the emitter of Q4 at approximately 25 Volts. Capacitor C4 provides additional filtering.

A continuous 25 Volts is applied to remote line relay K1, to the audio PA circuit on the Audio Module, and to the lights on the Voting Receiver Module.

20-Volt Regulator

The DC input to the 20–Volt Regulator circuit is filtered by capacitor C2. Applying voltage to this circuit turns on regulator transistors Q1 and Q2, applying a continuous +20 Volts to the Audio and Voting Receiver Modules.

When the output voltage at the emitter of Q1 starts to increase, the voltage at the base of Q3 increases. This causes Q3 to conduct harder, reducing the base bias of Q2. Reducing the base bias on Q2 causes it to conduct less. This increases the voltage drop across Q1, keeping the output constant.

When the output voltage starts to drop, Q3 conducts less. This allows Q2 and Q1 to conduct harder, reducing the voltage drop across Q1 and keeping the output constant.

Potentiometer R7 is used for setting the regulator for the desired 20-Volt output. Diode CR10 provides a constant reference voltage for the emitter of Q3. The +20 Volts can be metered at any Red Jack on the Interconnection Board.

AUDIO MODULE

In earlier models of the voting selector, audio modules 19D413958G1 revisions A thru F and 19D413958G3 through revision A were used. Refer to LBI-4292 for maintenance information on these models.

The Audio Module consists of Audio Amplifiers, Audio Gate and Line Driver circuitry, as well as the Audio PA, Constant Current Source and the Selection Hold Timer Circuits.

Amplifiers, Gate & Line Driver

Selected audio from the voted receiver module is applied through pin 11/M to amplifier transistor Q27. The output of Q27 is applied to an attenuation filter composed of inductors L2 & L3 and capacitors C32-C34. This filter attenuates the second harmonic (3900 Hertz) of the 1950 Hertz tone from the satellite receiver. The voted audio is then applied to amplifier transistor Q28.

The output of Q28 is applied to a 20 dB notch filter consisting of inductor L1 and capacitor C14. This notch filter, the attenuation filter and a notch filter on the Voting Receiver Module provides approximately 40 dB attenuation of any 1950 Hertz tone from the satellite receiver before the tone detector is activated.

The Audio Gate consists of transistors Q14, Q2, Q30 and Q31. Transistor Q31 is a **F**ield **E**ffect **T**ransistor (**FET**). When tone is applied to the Selector (receiver squelched), Q14 is off and Q2 is on. Conduction of Q2 turns Q30 on. Conduction of Q30 turns FET Q31 off, preventing the output of the notch filter from passing. When the tone is removed from the Selector (receiver unsquelched) a positive voltage from the Receive Module is applied to the base of Q14 through pins 12/N. This turns Q14 and Q2 off. Q30 is turned off, allowing Q31 to conduct and pass the audio to emitter-follower transistor Q29.

A second connection to the base of Q14 permits audio muting from a remote source. Applying a ground to the base of Q14 allows Q2 to conduct, opening the audio path. The muting connection is made through pins 14/R to TB7 on the Interconnection Board.

The output of Q29 is connected through VOLUME control R27 to the audio PA circuit and through LINE LEVEL control R10 to the base of amplifier transistor Q13. The output of line driver transistor Q15 is coupled through 600-ohm line transformer T1 to terminals on TB8 on the Interconnection Board. The 600-ohm audio output may be connected from TB8 to telephone lines in remote installations.

Audio PA

The Audio PA circuit consists of transistors Q4, Q6, and Q7 mounted on the Audio Board and power transistors Q8 and Q32 mounted on a separate heatsink. Audio from the VOLUME control arm is applied to the base of buffer amplifier Q4. The buffer amplifier output is connected to the base of driver transistors Q6 and Q7. Following the drivers, a complimentary push-pull power amplifier (Q8 and Q32) drives the speaker in the Power Supply.

For E&M signaling applications, refer to the E&M signaling section as listed in the Table of Contents.

Constant Current

The Constant Current source consists of transistor switch Q16 and Current Source transistors Q10 and Q11. The emitter of Q16 is connected to ground through relay K1 on the Power Supply, causing the transistor to conduct. Turning on Q16 causes its collector to drop to ground potential, turning on Q10 and Q11. When Q11 conducts, a current of approximately one milliampere is available at the emitter of each voltage follower stage (Q26[2]) on the Voting Receiver Boards. As all of the followers are powered from Q11, the current available is sufficient to turn on only one stage. Therefore, only one channel may be selected at a time.

In remote control applications, keying the remote microphone opens the emitter lead of Q16. This turns off Q16, Q10 and Q11 and disables the selection circuit. When the remote microphone is unkeyed, capacitor C20 holds Q16 off for approximately 150 milliseconds to eliminate squelch burst.

Selection Hold Timer

The Selection Hold Timer circuit consists of an astable multivibrator transistors Q17 and Q18, and switching transistors Q19 through Q26. The timer circuit is normally shipped from the factory with jumpers connected from J3 to J4, and from J5 to J6. The jumper connected from J5 to J6 disables the multivibrator so that the Selector provides continuous voting. However, the timer circuit can be strapped for the following alternate modes of operation:

- **Adjustable hold**: the Selector locks on the first voted receiver for a preset period of from 5 to 30 seconds.
- **Call duration hold**: the Selector locks on the first voted receiver for the duration of the call.

Adjustable Hold

For this mode of operation, the jumper from J5 to J6 is removed to enable the multivibrator circuit. When one of the satellite receivers unsquelches, +20 Volts from the associated Voting Receiver Module is connected through Pins 12/N to the base of Q22, turning it on. This turns on transistors Q23, Q26 and Q21.

Transistor Q17 in the multivibrator circuit also turns on for 1/2 second, allowing a receiver to be selected. When Q17 turns off, transistors Q18, Q19 and Q20 turn on and remain on from 5 to 30 seconds as determined by the setting of potentiometer R47. Turning on Q19 applies +20 Volts through Pins 15/S to the selection circuit on the Voting Receiver Module. The +20 Volts causes the selection circuitry to lock on the voted receiver for the preset time. At the end of the preset time, Q17 switches on *(Q18 switches off)* for 1/2 second to allow the Selector to vote again before locking on the selected receiver.

[2] This is Voltage Follower transistor V19 on the new ROA 117 2355/1 Voting Receiver Board.

Call Duration Hold

For this mode of operation, the jumpers from J3 to J4 and from J5 to J6 are removed. When a receiver unsquelches, Q22, Q23, Q26 and Q21 turn on. Transistor Q18 in the multivibrator circuit turns on and remains on for the duration of the call. This keeps Q20 and Q19 on, locking the initial selection on until the receiver squelches.

Transistors Q24 and Q25 are provided to permit a negative pulse *(or ground)* at Pins 10/L. this unlocks the timing circuit if desired. The circuit is not used in standard applications.

ANALOG VOTER RECEIVER

Voter receiver module 19D903175G1 with printed wire board 19D903174G1 replaced the original modules (19D413994G1 & G3) which were a combination of Resistor Transistor Logic (RTL) and Diode Transistor Logic (DTL) circuits. The older modules were powered by a 20 volt supply. To make the updated module compatible with the old, it uses CMOS logic driven at 18 V. Several op-amps were introduced into the circuit, mainly as buffers. Discrete transistors are still used in a few places for compatibility with the old module. The audio transformer no longer has a split winding.

Newer Voter Receiver module 19D903175 uses printed wire board ROA 117 2355/1. This printed wire board is similar to 19D903174G1 with differences noted below. Some reference designators are changed and all parts have M/A-COM numbers.

Regulators

Voltage regulator N18 regulates the 20 V input to 5 V for the circuitry in the line level compensator. Voltage regulator N13 regulates the 20 volts to 18 volts to meet CMOS logic power requirements. The LEDs are powered directly from 25 volts provided by the voter power supply.

Several zero ohm resistors are inserted in the power leads to sections of circuitry to assist in troubleshooting. By removing one of these resistors, power can be removed to a section of circuitry to help isolate shorts. The circuits associated with each resistor are listed as:

R109 Signal Quality circuit including D2

R110 Log Amp

R111 D2 alone (R111 is a 10 ohm decoupling resistor)

R112 Notch Filter

R113 Logic

Audio Path

When jumper X10 is in positions 1 and 2, potentiometer R2 allows adjustment of the gain between the phone lines and jack X1. Placing the jumper in positions 2 and 3 enables the Line Level Compensator. The parallel combination resistors of R1 and R2 form a 600 ohm load to match the impedance of the line.

Operational amplifier $D1_{(Pins\ 1,2\ \&\ 3)}$ *(refer to IC DATA)* amplifies the incoming signal and drives the tone detector. Levels as low as -30 dBm may be adjusted for -20 dBm at X1. When the detector does not receive the 1950 Hz tone, Gate $D3_{(Pins\ 1,\ 2\ \&\ 13)}$ *(Refer to IC DATA)* opens and the audio passes to the notch filter. The filter attenuates 1950 Hz tone that squelches the module at the end of every call. Operational amplifier $D1_{(Pins\ 5,\ 6\ \&\ 7)}$ buffers the notch filter output. When the module is selected, Gate $D3_{(Pins\ 3,4\ \&\ 5)}$ opens and the audio passes to the Audio Module.[3]

1950 Hz Notch Filter

The Operational Amplifiers of D14 *(refer to IC DATA)* and the surrounding resistors and capacitors form the 1950 Hz notch filter. The notch is more than 20 dB deep and less than 150 Hz wide. Potentiometer R72 adjusts the center frequency. The notch filter will work in systems employing 2175 Hz by soldering jumpers across X3-X4 and X5-X6 without readjusting R72.

Line Level Compensator

The Line Level Compensator (LLC) compensates for changes in the phone line levels from the satellite receivers. It uses a feedback circuit that sets the audio gain based on the received 1950 Hz tone level. The circuit holds the audio gain constant during a call.

Digital Potentiometer D16 is a 10k ohm, 99-step digital potentiometer with the resistance stepped up or down by 555 timer D17, depending on the output of comparator $D15_{(Pins\ 12,\ 13\ \&\ 14)}$. This changes the gain of the amplifier $D15_{(Pins\ 5,\ 6\ \&\ 7)}$. Timer D17 is a 555 timer configured as an oscillator with a frequency of approximately 10 Hz. The output of D17 drives the increment input of the digital potentiometer D16. The oscillator is stopped by grounding D17, Pin 4, (RESET). This is done by transistor V30 when the module is unsquelched. Therefore, the value of the digital potentiometer will not be adjusted when audio is on the line.

[3] This new arrangement eliminates loading of the Audio Module input, which before reduced the audio level a small amount for each Receiver Module connected. Now, only the select module is connected.

The feedback network is made up of a comparator and peak detector. The comparator $D15_{(Pins\ 12,\ 13\ \&\ 14)}$ gets its input from the amplifier and peak detector formed by $D15_{(Pins\ 8,\ 9\ \&\ 10)}$, resistors R95, R96, and R97, diode V12, and capacitor C47. This level is compared to a reference voltage that is set with potentiometer R98. The reference voltage is set at the factory to cause the comparator to switch when a level of -20 dBm appears at X1. The LLC is activated by placing jumper X11 across X10-2 & 3. The LLC should only be used in situations where line variations are a problem.

Tone Detector

When there is no activity on a channel, a 1950 Hz tone is applied to the phone line by the satellite receiver to squelch the module. When the receiver module detects this tone, it squelches.

The tone detector consists of D6 and associated circuitry. This phase locked loop based device has a center frequency of 1950 Hz and a bandwidth of approximately 30 Hz[4]. Potentiometer R38 adjusts the center frequency. The output D6, Pin 5 is an open-collector and requires pull-up resistor, R51. The tone detector will detect at 2175 Hz instead of 1950 Hz without retuning if a jumper is soldered between holes X11 and X2.

Signal Quality Circuit

The signal quality circuit consists of a Logarithmic Amplifier, Rectifier, Envelope Detector, Valley Detector, 10% Latchup, and Selection Voltage Follower. Several logic signals also force or prohibit the audio from being selected.

The Envelope Detector has a time constant such that it follows the envelope of the logarithmic amplification of the input audio signal. The valley detector has a much longer time constant and detects the lowest levels between syllables. The module that has the lowest voltage at the Valley Detector is selected and sends its audio to the output. Once a module is selected, the 10% Latchup gives it a slight advantage so that the audio will not be rapidly switched between two or more Voting Receiver Modules.

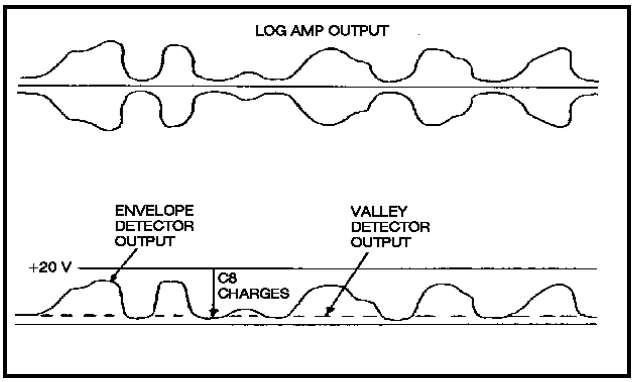

Figure 4 - Signal Quality Waveforms

Logarithmic Amplifier

Operational Amplifier N11 has a piecewise linear feedback loop. For small signals, the gain is approximately 75 dB, but it drops to only a few decibels for very large signals. This makes the amplifier most sensitive at low signal levels, thus converting the logarithmic variations in instantaneous speech level to a linear voltage change. Thus, variations in voltage represent decibel differences in audio level. The value is roughly 3 dB per volt but is not constant over the 40 dB dynamic range of the voter. Capacitor C17 eliminates noise that is not in the audio band.

Rectifier

Operational Amplifier N19 buffers the output from the Logarithmic Amplifier. Transistor V20 acts as a class B amplifier. The upper half of the logarithmic signal is disregarded and the lower half is inverted and amplified.

Envelope Detector

The Envelope Detector consists of Analog Switch $D2_{(Pins\ 1,\ 2\ \&\ 13)}$, diode V13, capacitors C7 and C58, and resistors R120 and R26. This circuit is a peak rectifier with a discharge time constant of 27 ms. This time constant allows the detector to follow the envelope of the signal.

Valley Detector

The Valley Detector consists of Analog Switch $D2_{(Pins\ 3,\ 4\ \&\ 5)}$, diode V14, capacitor C8, and resistors R122 and R27. It works much like the envelope detector, but it has a discharge time constant of 2.7 seconds. Capacitor C8 charges down to the lowest signal level detected by the Envelope Detector. This is determined by the noise in the signal.

[4] The Bandwidth has been narrowed in the ROA 117 2355 module to reduce talk off.

Selection Voltage Follower

The Selection Voltage Follower circuit consist of transistors V19 and V40, and resistors R125 and R32. The emitters of V19 in all receiver modules are tied together and fed by a constant current source that supplies 1 mA. The module that presents the lowest voltage to the base of the associated V19 will cause that V19 to conduct the entire 1mA, leaving no current for the other modules, since they will be back biased. The 1 mA, is detected by comparator D5 due to the voltage across R32/R125. Comparator D5 is adjusted so it will detect 1 mA, but if the current were to divide between 2 or more modules, only one module can be selected at one time.

A change is incorporated in the ROA 117 2355/1 board, which reduces a tendency to split the current so evenly that no module is selected. Transistor V40, a high beta NPN, is added to increase the gain of the voltage follower so that a tiny difference in voltage between two circuits will result in only one circuit conducting and the others remaining off. When V19 conducts the constant current, $D5_{(Pins\ 1,\ 2\ \&\ 13)}$ turns on, selecting the module. The audio of the selected module will be allowed to pass to the audio module.

Solid State relay K1 is added in the constant current path. This relay is of advanced design capable of switching very heavy loads and has a power FET output that ensures low ON resistance, no offset voltage and low leakage current. This device is optically coupled for greater isolation. Relay K1 is ON when this Voting Receiver Module is powered up and unsquelched. This allows the constant current to flow to the voltage follower, thus the module can participate in the vote. If power is not applied, perhaps the module is in a second shelf, the constant current is not connected thus does not affect voting in modules which do have power. Relay K1 is also off if this module is squelched (1950 Hz or E&M present). This reduces leakage on the constant current. Only those modules which have valid signals can vote.

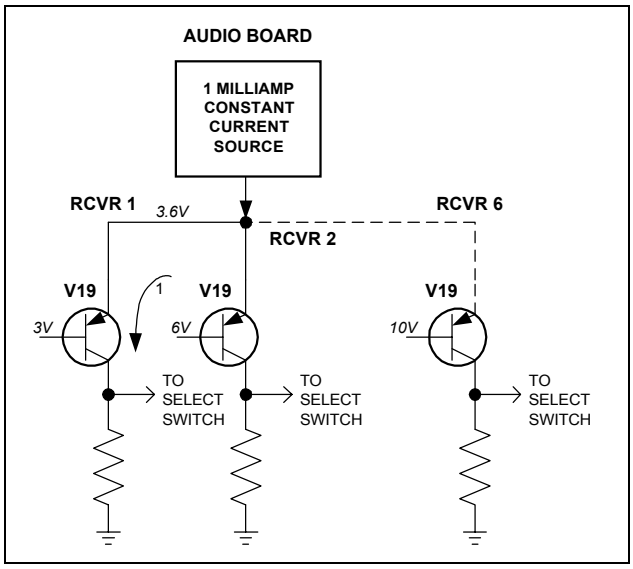

Figure 5 - Selection Voltage Circuit

10% Latchup

When the module is selected, Analog Switch $D4_{(Pins\ 3,4\ \&\ 5)}$ will be on. This connects resistor R31 to ground forming a voltage divider with resistor R30, which reduces the valley voltage by 10%, giving the selected module a slight advantage. This prevents two modules that are receiving audio of equal quality from switching back and forth repeatedly during a call.

Fail Detection Circuit

This circuit takes its input from the Envelope Detector through voltage follower $D1_{(Pins\ 8,\ 9\ \&10)}$. When the module is unsquelched, transmission Gate $D4_{(Pins\ 3,\ 4\ \&\ 5)}$ is closed and the node at the positive terminal of the comparator will slowly rise from the 0 V initial condition to one diode drop above the lowest value attained by the Envelope Detector within the past several seconds. Similarly, C4 will discharge to one diode drop below the highest value attained by the Envelope Detector. When voice is passed through the module, the positive input of the comparator will be at a lower voltage than the inverting terminal. However, if the Envelope Detector stops fluctuating, the positive terminal will eventually become two diode drops higher than the inverting terminal. This will change the state of the comparator, indicating a failure.

In the new module ROA 117 2355/1, the fail condition is latched on until either 1950 Hz squelch tone reappears or E&M squelch is applied. When the fail condition is first detected, D22, Pin 3 is set HI which forces D22, Pin 4 LO latching the RS latch and the fail state. When squelch, either tone or E&M, reappears, the other side of the latch, D22, Pin 4 is set HI, forcing D22, Pin 3 LO, clearing the fail

state. This means that at power up, the fail flip flop can come up in either state until squelch is applied.

Logic And Inputs

The output of the tone detector, D6, Pin 5, directly affects the operation of all parts of the module. The output is connected to one input of NAND Gate D12, Pin 5. The other input of D12, Pin 6 is the inverted E&M SQUELCH input. Applying 18 volts to the E&M SQUELCH input simulates having 1950 Hz tone on the line. This input is used instead of 1950 Hz tone in some systems.

The output of D12, Pin 4 is then combined with the input from edge connector X20, Pin 22, FLTR_TUNE*. Grounding Pin 22 overrides the tone detector output and E&M SQUELCH input to simulate the no tone condition even when 1950 Hz is present. This is used only in testing and calibrating the module. It sets up the audio paths so the 1950 Hz notch filter can be nulled at the factory. FLTR_TUNE*[5] also masks the tone detector action so that R38 (tone detector setting) cannot be adjusted while FLTR_TUNE* is applied.

The output of the failure detection circuit D5-1 is ANDed through $D12_{(Pins\ 11,12\ \&\ 13)}$ with the FAIL DISABLE* coming onto the board via edge connector X20, Pin 4. Failures are disabled by applying a ground to this input. This is normally done only when testing the module. A failure also disables the RCVNG output, X20-12/N.

When the module is squelched (UNSQ is low), the following conditions are set on the board:

1. Analog Switch $D3_{(Pins\ 1,\ 2,\ \&\ 13)}$ is open (OFF). This keeps the 1950 Hz tone from reaching the notch filter, log amp, and audio output.
2. Analog Switch $D3_{(Pins\ 8,\ 9,\ \&\ 6)}$ is open (OFF) and $D3_{,\ Pins\ 10,\ 11\ \&\ 12}$ is closed (ON). This pulls all voltages in the Signal Quality Circuit high.
3. Analog Switch $D4_{(Pins\ 1,\ 2,\ \&\ 13)}$ is closed (ON). This pulls down one side of the Failure Detection Circuit. The other side is near 18 volts because the input to the circuit is pulled high by $D3_{(Pins\ 6,\ 8\ \&\ 9)}$ and $D3_{(Pins\ 10,\ 11,\ \&\ 12)}$. These two levels initialize the failure circuit.
4. The yellow light is off.
5. The oscillator in the Line Level Compensator is enabled.

The two positions of the switch, SWSEL* and DISABLE*, have corresponding inputs, SEL INP* and REJ_SW*. Grounding one of these inputs has the same effect as setting the switch to the corresponding position. These inputs may be used for testing or as remote enable and disable inputs.

Analog Switch $D3_{(Pins\ 3,\ 4,\ \&\ 5)}$ will allow audio to pass to the audio module if DISABLE* is not low and either the selection circuit draws the 1 mA constant current or SWSEL* is low (switch in "select" position). This signal also turns on the green light.

If the analog switch is set to the "select" position, or if the module is locked, AND Gate $D8_{(Pins\ 1,\ 2,\ \&\ 3)}$ turns on analog switch $D4_{(Pins\ 6,\ 8\ \&\ 9)}$ to draw the 1 mA away from all of the other modules so that no others will be selected.

When the ANY_SEL and UNSQ lines are high, AND Gate $D10_{(Pins\ 11,\ 12\ \&\ 13)}$ turns on analog switch $D4_{(Pins\ 3,\ 4\ \&\ 5)}$ (.10_LATCH). This drops the DC level at the base of transistor V19 by 10% to give the selected module a slight advantage.

Selection Lock

If X20-15/S is pulled high by the audio module selection lock circuit, the module which is presently selected will remain selected while the voltage is on Pin X20-15/S even though other modules have better signal quality. The ***"lock"*** is broken if the module squelches or is manually disabled.

Action of the select switches is somewhat different in new modules than the old modules when locked. If two or more new modules are together in a system and one is locked, if one or more other modules are selected with the select switch, all will remain selected until the last switch is returned to NORMAL. As the last module is returned to NORMAL, a revote occurs and the best module will be selected and locked.

When new modules are used in combination with old modules, if the old module is locked, selecting a new module with the select switch will steal the vote from the old module. Conversely, if the new module is locked, and the old module is selected, the old module will select but the new module will remain selected.

In the preceding discussion ***"old"*** refers to Voting Receiver Module 19D413994G1. Modules refered to as ***"new"*** refer to all versions of Voting Receiver Module 19D903175G1.

[5] * Indicates active low condition, i.e. $\overline{\text{FILTER\_TUNE}}$

TROUBLE SHOOTING PROCEDURE

QUICK CHECKS

RECEIVER BOARD	
SYMPTOM	**PROCEDURE**
I. With the receiver squelched (1950 Hz input to the Voting Selector), all lights should be off. A. If the Yellow light is on:	1. Check for 1950 Hz input. 2. Check for -20 dBm input at X1. 3. Check for a reading of less than 0.5 Volts at D6, Pin 5. a) If D6, Pin 5 is correct, check logic and light driver circuitry. b) If D6, Pin 5 is ***not*** correct, check the tone detector circuitry.
B. If the Red light is on and the Yellow light is off:	1. Check for a reading of less than 0.5 Volts at D5, Pin 1. a) If D5, Pin 1 is correct, check $D12_{(Pins\ 11,\ 12\ \&\ 13)}$ and the Fail Light Driver. b) If D5, Pin 1 is ***not*** correct, check the Fail Detect Circuit.
C. If the Green light is on:	1. Make sure switch S1 is in the NORMAL position. 2. Check the selection circuitry. 3. Check Selection Cutoff $D4_{(Pins\ 6,\ 8\ \&\ 9)}$. 4. Check the signal quality circuitry.
D. Place S1 in the SELECT position. If the Green light does not come on:	Check the selection logic.
II. With the input to the selector removed *(no 1950 Hz tone applied),* the Green and Yellow light should turn on immediately. The Red light should turn on in less than 30 seconds. A. If the Red light doesn't come on in less than 30 seconds:	Check the failure circuitry. **NOTE:** To complete steps B, C & D, it may be necessary to disable the failure circuit by grounding the appropriate violet jack on the Interconnection Board.
B. If the Green light does not turn on:	1. Check to see if one of the other receiver modules is selected. If so disable the module. 2. Check the selection circuitry, Tone Detector and Logic.
C. If the Green light does not turn off:	Place S1 in the DISABLE position. If the Green light does not go out, check the Logic.
D. If the Yellow light does not turn on:	1. Check the Tone Detector circuitry. 2. Check light driver V35 and associated circuitry.
III. If none of the lights can be turned on:	1. Check to see if the power is turned on. 2. Check to see if the Local/Remote switch on the back of the power supply is in the Local Position. 3. Check the 25 Volt fuse (F2) and the power supply.
IV. If No audio can be heard:	1. Check the VOLUME CONTROL setting. 2. Check to see if a receiver has been selected. 3. Check for audio at X1. 4. Check to see if all of the Modules are plugged in. 5. Check the audio circuitry in the Receiver module and the Audio Module.

POWER SUPPLY

DC Voltages readings are measured with a DC Voltmeter, and with the Audio and Receiver modules in the Selector Panel.

Measuring Point	DC Voltage
Q2-Base	+20.9 Vdc
Q2-Collector	+26.7 Vdc
Q3-Emitter	+6.3 Vdc
Q3-Collector	+17.5 Vdc
Q4-Collector	+26.8 Vdc
Q5-Base	+26.0 Vdc
R7-Arm	+7.0 Vdc

AUDIO MODULE

AC Voltage Readings

AC reading are taken with a Wideband Audio Voltmeter with 1000 Hz applied and set to -20 dBm at J1 and Fail circuit disabled. Readings pertain to Audio Module 19D413958G3, Rev. B and later.

Transistor	AC Voltage
Q4-Base	22 mV
Q4-Collector	4.5 V
Q6-Emitter	4.5 V
Q6-Base	4.5 V
Q7-Emitter	4.5 V
Q7-Base	4.5 V
Q13-Ease	0.7 V
Q15-Collector	2.7 V
Q27-Collector	0.4 V
Q28-Collector	1.9 V
Q29-Emitter	1.8 V

DC Voltages Readings

All DC voltage readings are taken with a DC Voltmeter and measured from a transistor pin to ground. Readings pertain to Audio Module 19D413958G3, Rev. B and later.

Transistor	Emitter	Base	Collector
Q2	0	0	1.85
Q4	0.3	1.0	8.9
Q6	11.5	12.1	25.0
Q7	9.6	8.9	0
Q8	10.9	11.5	25.0
Q10	16.2	16.0	2.8
Q11	17.0	16.2	17.0
Q13	5.4	6.0	19.5
Q15	4.8	5.4	19.5
Q16	0	0.61	16.0
Q17	0.6	1.22	0.65
Q18	0	0	20.0
Q19	20.0	20.0	20.0
Q20	0	0	20.0
Q21	0	0.78	0
Q22	0.68	1.28	0.76
Q23	0	0.68	0
Q24	0	0	0
Q25	0	0.68	0
Q26	0.92	1.05	20.0
Q27	0	0.63	10.5
Q28	0	0.61	12.4
Q29	5.	6.1	20.0
Q30	20	*	*
Q32	11.1	11.7	0
	SOURCE	**GATE**	**DRAIN**
Q31	0	*	**0**

*** DO NOT MEASURE.**

RECEIVER BOARD

All voltages except X1 are DC voltage readings taken with a DC voltmeter with an 11 megohm impedance, and with the Failure circuit disabled (Violet jack on the Interconnection Board Grounded) except "FAILED" column. Voltages are measured with respect to ground. An oscilloscope is needed to see pulses, audio, and tone. Refer to figures 6, 7 and 8 for wave forms.

PIN	SQUELCHED	UNSQUELCHED -20dBm, 1000 Hz @ X1	UNSQUELCHED -40 dBm, 1000 Hz @ X1	SELECTED	FAILED
N18, Pin 8	20 V				
N18, Pin 1	5 V				
N13, Pin 8	20 V				
N13, Pin 1	17.50 V				
D6, Pin 5	HI	LO			
D1, Pin 8	HI		8.1 V		HI
D5, Pin 1	LO				
D17, Pin 4	5 V	0.2 V			
D17, Pin 3	PULSES	NO PULSES			
D15, Pin 1	2.50 V	2.5 V+AUD			
D15, Pin 7	2.50 V	2.5 V+AUD			
D15, Pin 8	2.50 V	2.5 V+AUD			
D15, Pin 12	2.30 V				
D15, Pin 13	2.26 V				
D15, Pin 14	0 V *or* 5V*	0 V *or* 5V			
X1	-20 dBm	-20 dBm	-40 dBm		
D1, Pin 1	8.75 V**	8.75 V+AUD			
N13, Pin 13	LO	HI	HI	HI	
D14(Pins 1,7 & 8)	8.75 V				
D14, Pin 14	8.75 V	8.75 V+AUD	8.75 V+AUD		
D3, Pin 5	LO			HI	
D1, Pin 7	8.75 V	8.75 V		8.75 V+AUD	
N11, Pin 6	8.75 V	8.75 V *(Figure 6)*	8.75 *(Figure 7)*		
N19, Pin 6	8.75 V	8.75 V *(Figure 6)*	8.75 *(Figure 7)*		
V20-Base	19.16 V	19.36 V	19.19 V		
V20-Emitter	19.78 V	18.59 V	19.37 V		
V20-Collector	1.09 V	PULSES *(Figure 8)*			
D3, Pin 6	LO	HI			
D3, Pin 12	HI	LO			
D2, Pin 3	17.50 V	6.48 V	2.94 V		
D2, Pin 1	17.50 V	6.40 V	2.94 V		
D2, Pin 5	17.00 V	15.50 V	7.87 V		
D2, Pin 7	17.00 V	15.50 V	7.88 V		
D2, Pin 10	17.23 V	15.94 V	8.60 V		
D2, Pin 8	17.23 V	15.94 V	8.62 V		
D2, Pin 12	17.10 V	15.35 V	8.00 V		
D2, Pin 14	17.10 V	15.35 V	8.00 V		
V19-Emitter	17.50 V	15/20 V	8.00 V		
V40-Emitter	0 V			1.30 V	

Continued

Continued

PIN	SQUELCHED	UNSQUELCHED -20dBm, 1000 Hz @ X1	UNSQUELCHED -40 dBm, 1000 Hz @ X1	SELECTED	FAILED
D4, Pin 12	LO	LO	LO	HI !!	
D5, Pin 7	17.50 V			LO	
V35-Collector	25 V	0.2 V			
V33-Collector	25 V			0.20 V	
V37-Collector	25 V	25 V			0.20 V
D10, Pin 11	HI			LO	
X20, Pin 12/N	0 V	16.20 V			
D4, Pin 6	HI	LO	LO	LO	HI

***** **SWITCHING**
****** **+1950 Hz**
! **NO OTHER MODULES ACTIVE**
!! **WHEN SELECTED BY S1 OR WHEN LOCKED**
LO=<0.5 V; HI=>17 V

VALLEY DETECTOR

DC readings are taken with 1000 Hz applied and measured from the Blue jack to ground.

Level @ X1	Reading @ Blue Jack
-20 dBm	15.5 V
-25 dBm	14.0 V
-30 dBm	12.3 V
-40 dBm	8.6 V
-50 dBm	4.9 V
-55 dBm	3.3 V
-60 dBm	2.4 V

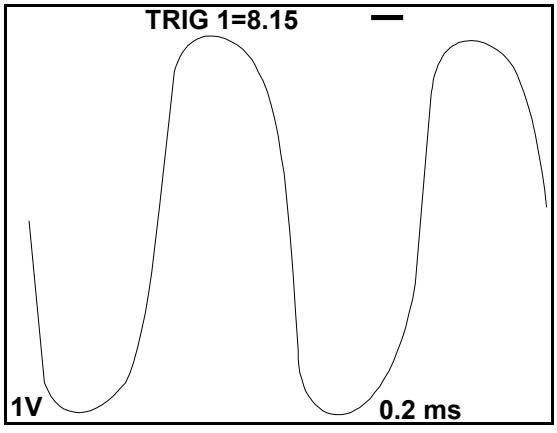

Figure 6 - WAVE1

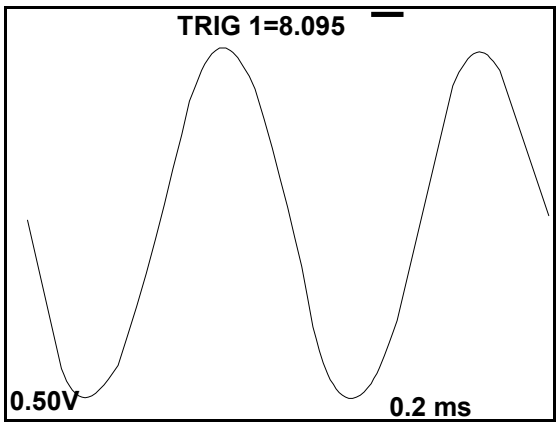

Figure 7 - WAVE2

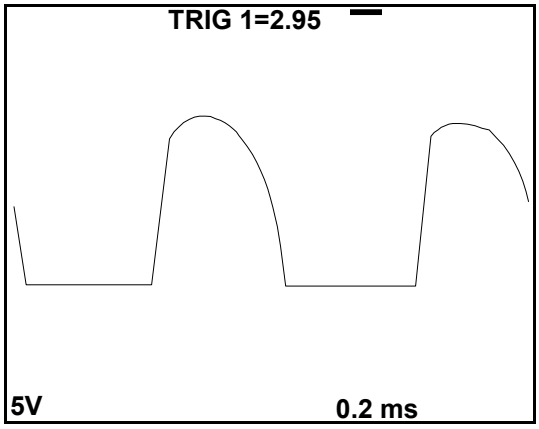

Figure 8 - WAVE3

VOTING SELECTOR SHELF
19E500936G2

ISSUE 2

SYMBOL	PART NUMBER	DESCRIPTION
A1		INTERCONNECTION BOARD 19D413916G1
		- - - - JACKS - - - -
J1 thru J2	19A116505P4	Connector, printed wiring, one-part:: 44 contacts; sim. to Elco 00-6007-044-981-002.
J11 thru J16	19A116066P3	Jack, tip:: dark green nylon; sim. to EF Johnson Type 105.
J17 thru J22	19A116066P9	Jack, tip: violet nylon; sim. to EF Johnson Tyhpe 105.
J23 thru J28	19A116066P2	Jack, tip: black nylon; sim. to EP Johnson Type 105.
J29 thru J34	19A116066P1	Jack, tip: red nylon; sim. to EP Johnson Type 105.
J35 thru J40	19A116066P8	Jack, tip: white nylon; sim. to EP Johnson Type 105.
J41 thru J46	19A116066P5	Jack, tip: yellow nylon; sim. to EP Johnson Type 105.
J47 thru J52	19A116066P7	Jack, tip: blue nylon; sim. to EP Johnson Type 105.
		- - - - RESISTORS - - - -
R1 thru R18	19A116310P5	Composition: 22 Ohms ±5%, 1 watt. Sim. to Allen-Bradley type GB.
		- - - TERMINAL BOARDS - - - -
TB1 thru TB6	19A116005P5	6 terminals rated 5 amps @ 350 Vrms; sim. to Kulka 410Y6.
TB7	19A116005P4	10 terminals rated 5 amps @ 350 Vrms; sim. to Kulka 410Y10.
TB8 and TB9	19A116005P3	20 terminals rated 5 amps @ 350 Vrms; sim. to Kulka 410Y20.
A2		C.O.R. BOARD 19B219964G1
		- - - - DIODES - - - -
CR1 and CR2	T324ADP1041	Silicon: Rectifier; sim. to IN4004.
		- - - - RELAY - - -
K1	19c307010P8	Enclosed: 24 Vdc nominal, 1.5 watt max, 700 Ohms ±10%, 2 form C contacts; sim. to Allied Control T163X-18.

*COMPONENTS ADDED, DELETED, OR CHANGED BY PRODUCTIONS CHANGES

SYMBOL	PART NUMBER	DESCRIPTION
		- - - - TRANSISTORS - - - -
Q1	19A700023P1	Silicon, NPN: Sim. to 2N3904.
Q2	19A115300P2	Silicon, NPN: Sim. to 2N3053.
		- - - - RESISTORS - - - -
R1 and R2	19A700113P103	Composition: 47k Ohms ±5%, 1/2 watt.
R3	19A700113P87	Composition: 10k Ohms ±5%, 1/2 watt.
		- - - - SOCKETS - - - -
XK1	5491595P6	Relay: 10 contacts; sim. to Allied Control 30054-3.
	5491595P8	Retainer, spring; sim. to Allied Control 30040-1.
		- - - - MISCELLANEOUS - - - -
4	19B209209P304	Tap screw, Phillips POZIDRIV: No. 6-32 x 1/4.
6	19B209209P304	Tap screw, Phillips POZIDRIV: No. 6-32 x 1/4.
10	19B209209P208	Tap screw, Phillips POZIDRIVE: No. 4-40 X 1/2.
12	19A701863P17	Clip loop
16	N80P9004B6	Machine screw: No. 4-40 x 1/4.
17	N402P5B6	Washer: narrow, steel.
18	19C317745G3	Shelf.
19	19C317738P2	Plate.
20	19C317854G2	Plate.
21	19B219220G3	Cover.

POWER SUPPLY
19D413917G3, G4

ISSUE 2

SYMBOL	PART NUMBER	DESCRIPTION
A1		COMPONENT BOARD 19D413908G1
		- - - - CAPACITORS - - - -
C3 and C4	5496267P20	Tantalum: 47 µF ±20%, 35 VDCW; sim. to Spraque Type 150D.
C5 thru C7	344A4195P101500	Electrolytic: 100 µF +150, -10%, 50 VDCW; sim. to Mallory type TTX.
		- - - - DIODES - - - -
CR5	T324ADP1041	Silicon: Rectifier; sim. to IN4004.
CR10	4036887P6	Zener: 500 mW, 6.5 V nominal.
CR11 and CR12	4036887P10	Zener: 500 mW, 13.5 V nominal.
CR14	19A115250P1	Silicon, fast recovery, 225 mA, 50 PIV.
CR15 and CR16	T324ADP1041	Silicon: Rectifier; sim. to IN4004.
		- - - - RELAY - - - -
K1	19B209375P7	Enclosed: 915 Ohms ±10% coil; resistance, 24 Vdc nominal, 6 form C contacts; sim. to CP Clare LB0060K00.
		- - - - TRANSISTORS - - - -
Q2	19A115300P2	Silicon, NPN: sim. to Type 2N3053.
Q3	19A700023P1	Silicon, NPN: sim. to 2N3904.
Q5	19A115300P2	Silicon, NPN: sim. to Type 2N3053.
		- - - - RESISTORS - - - -
R1	19A700113P59	Composition: 680 Ohms ±5%, 1/2 Watt.
R2	19A700113P63	Composition: 1k Ohms ±5%, 1/2 Watt.
R3	3R77P911J	Composition: 910 Ohms ±5%, 1/2 Watt.
R4	3R77P204J	Composition: 200k Ohms ±5%, 1/2 Watt.
R5	19A700113P87	Composition: 10k Ohms ±5%, 1/2 Watt.
R6	3R77P432J	Composition: 4.3k Ohms ±5%, 1/2 Watt.
R8	3R77P202J	Composition: 2k Ohms ±5%, 1/2 Watt.
R9	19A700113P59	Composition: 680 Ohms ±5%, 1/2 Watt.

*COMPONENTS ADDED, DELETED, OR CHANGED BY PRODUCTION CHANGES

SYMBOL	PART NUMBER	DESCRIPTION
		- - - - SOCKET - - - -
XK1	19B209375P2	Socket *(For printed wire board mounting)* and clip; sim. to CP Clare RP15450G6.
		- - - - MISCELLANEOUS - - - - *(Components not part of component board A1)*
	19A701332P4	Insulator, washer: nylon *(Used with Q2 and Q5)*.
		- - - - CAPACITORS - - - -
C1 and C2	7476442P23	Electrolytic, twist prong: 2000µF -10 +250%, 50 VDCW *(Used in G3).*
C3	19A116080P111	Polyester: 0.47µF ±10%, 50 VDCW *(Used in G4).*
		- - - - DIODES - - - -
CR1 thru CR4	T324ADP1041	Silicon: Rectifier; sim. to IN4004 *(Used in G3).*
CR6 thru CR9	T324ADP1041	Silicon: Rectifier; sim. to IN4004 *(Used in G3).*
		- - - - FUSES - - - -
F1	7487942P5	Cartridge, slow blow: 1 amp @ 250 V; sim. to Bussmann MDL 1 *(Used in G3).*
F2	1R16P4	Quick blow: 1-1/2 amp @ 250 V; sim to Littelfuse 31201.5, or Bussmann AGC-1-1/2 *(Used in G3).*
F2	19A1349 42P18	Cartridge: 1/2 amp @ 250 V; sim. to Bussmann CMA 1-1/2 *(Used in G4).*
F3	IR164P4	Quick blow: 1-1/2 amp @ 250 V; sim to Littelfuse 31201.5, or Bussmann AGC-1-1/2 *(Used in G3).*
F3	19A1349 42P18	Cartridge: 1/2 amp @ 250 V; sim. to Bussmann CMA 1-1/2 *(Used in G4).*
		- - - - JACK - - - -
J1	715076P1	Jack, tip, stake-in: block nylon body, sim. to Alden Products 110BC1.
		- - - - LOUDSPEAKER - - -
LS1	5491260P7	Permanent magnet, 5-inch: 3.2 Ohms ±10% voice coil impedance, 15 watt max operating, 390 Hz ±15% resonance, paper dust cap; sim. to Jensen Model P5-VA.
		- - - - TRANSISTORS - - - -
Q1	19A116203P2	Silicon, NPN.
Q4	19A116203P2	Silicon, NPN.
		- - - - RESISTORS - - - -
R7	19B209368P6	Variable, carbon film: 1k Ohms ±20%, 350 VDCW; sim. to CTS Type 200.

SYMBOL	PART NUMBER	DESCRIPTION
R10	19A700113P29	Composition: 39 Ohms ±5%, 1/2 Watt.
		- - - - VARISTOR - - - -
RV15	19A134142P1	Electrical surge arrestor, (Varistor): sim. to GE SPD #V130LAX576 *(Used n G3).*
		- - - - SWITCHES - - - -
S1	19B209040P4	Slide: SPDT, 0.5 amp @ 125 V; sim. to Continental-Wirt Type 126.
S2	5491899P3	Toggle: SPST rated 3 amps @ 250 V., sim. to Cutler-Hammer 8383K3.
		- - - - TRANSFORMERS - - - -
T1 and T2	19B209188P1	Power, step-down: Pri: 120 V, 50/60 Hz, Sec: 25.2 V 1 amp *(Used in G3).*
		- - - - CABLE - - - -
W1	19A134567P1	Power, 3- wire, 13 amps @ 125 VAC, approximately 6 Ft. long *(Used in G3).*
		- - - - FUSE SOCKETS - - - -
XF1 and XF2	19B209005P1	Fuseholder: 15 amps @ 250 V; sim. to Littelfuse 342012 *(Used in G3).*
XF2 and XF3		Includes items 52-54 *(Used in G4).*
XF3	19B209005P1	Fuseholder: 15 amps @ 250 V; sim. to Littelfuse 342012 *(Used in G3).*
		- - - - MISCELLANEOUS - - - *(Mechanical Parts)*
3	19B219206P1	Heat sink.
5	19A127949P1	Handle.
7	7115195P2	Hex nut: 15/32.
8	7115130P11	Lockwasher: 15/32; sim. to Shakeproof 1222-1.
9	7127662P2	Flatwasher: 5/8 OD.
10	19B203848P1	Heat sink.
11	77 75500P18	Phen: 8 terminals *(Used in G3).*
12	19A702464P4	Bushing, strain relief (Used in G3).
13	5490407P83	Grommet, rubber.
14	19B201074P304	Tap screw, Phillips POZIDRIV: N0. 6-32 x 1/4.
15	19A705469P1	Insulator Plate, T0-220.
16	19A116022P1	Insulator, bushing.
17	19B201074P206	Tap screw, Phillips POZIDRIV: No. 4-40 x 3/8.
21	19A115332P2	Tap Screw.
24	N681P13006B6	Screw.
25	N330P5305P22	Eyelet, metalic.
26	N402P3B13	Washer, plain.
28	19A116888P11	Wire, Stranded.
31	19A116888P12	Wire, Stranded.
33	19A116888P11	Wire, Stranded.

SYMBOL	PART NUMBER	DESCRIPTION
34	19D413917G2	Wiring Harness *(Used in G3).*
35	19B209260P107	Terminal, solderless: wire No. 22-16 AWG; sim. to AMP 34107 *(Used in G3).*
36	N403P13B6	Lockwasher: No. 6 *(Used in G3).*
37	N404B13B6	Lockwasher, internal tooth, No. 6 *(Used in G3).*
38	7141225P2	Nut, Hex: No. 6-32.
39	N404P11B6	Lockwasher, internal tooth, No. 4 *(Used in G3).*
40	7141225P2	Nut, Hex: 4-40 *(Used in G3).*
41	N404P8B6	Lockwasher.
42	N80P5005B6	Machine screw.
43	N80P13008B6	Machine screw, panhead: No. 6-32 x 1/2.
44	N210P5B6	Machine nut.
45	N414P25B6	Lockwasher.
47	19C317728G2	Support.
49	19B219205P2	Grille.
52	19A134796P1	Fuseholder: sim. to Schurter 031.1657 (Used in G4).
53	19A134796P4	Fuseholder: sim. to Schurter 031.1663 *(Used in G4).*
54	19A134796P5	Nut: sim. to Schurter 583.0016 *(Used in G4).*

AUDIO MODULE
19D413958G5

ISSUE 2

SYMBOL	PART NUMBER	DESCRIPTION
A2		COMPONENT BOARD 19D413955G2
		- - - - CAPACITORS - - - -
C4	549626P13	Tantalum: 2.2 µF ±20%, 20 VDCW; sim. to Spraque Type 150D.
C5	459626P18	Tantalum: 6.8 µF ±20%, 35 VDCW; sim. to Spraque Type 150D.
C6	344A4195 P101500	Electrolytic: 100 µF +150, -10%, 50 VDCW; sim. to Mallory type TTX
C8	5494481P111	Ceramic disc: 1000pF 2 µF ±20%, 1000 VDCW; sim. to Mallory Type TTX.
C9	5496267P2	Tantalum: 47 µF ±20%, 6 VDCW; sim. to Spraque Type 150D.
C10	19A115680P10	Electrolytic: 200 µF +150 -10%, 18 VDCW; sim. to Mallory Type TTX.
C11	7489162P43	Silver mica: 470 pF ±5%, 500 VDCW; sim. to Spraque Type 118.
C12	748445P1	Electrolytic, non-polarized: 4 µF -10 +1--%, 150 VDCW.
C14	19C307114P250 2G	Polystyrene: 25,000 pF ±2%, 100 VDCW, temp. coef. -120+30 PPM/°C.
C15	19A700105P46	Mica: 270 pF ±5%, 500 VDCW.
C16	5494481P29	Ceramic disc: 3900 pF ±20%, 1000 VDCW; sim. to RMC type JF Discap.
C17	19A700064P3	Electrolytic: 47µF ±10%, 25 VDCW.
C19	5496267P15	Tantalum: 47µF ±20%, 20 VDCW; sim. to Spraque Type 150D.
C20	5496267P19	Tantalum: 22µF ±20%, 35 VDCW; sim. to Spraque Type 150D.
C21	5496267P17	Tantalum: 1.0µF ±20%, 35 VDCW; sim. to Spraque Type 150D.
C22 and C23	5496267P15	Tantalum: 47µF ±20%, 20 VDCW; sim. to Spraque Type 150D.
C25	19A700105P34	Mica: 100 pF ±5%, 500 VDCW.
C26 and C27	19A116080P107	Polyester:0.1µF ±10%, 50 VDCW.
C28	7491827P2	Ceramic: 0.01µF -30 +80%, 50 VDCW, sim. to Spraque 19C180.
C29 thru C31	5496267P17	Tantalum: 1.0µF ±20%, 35 VDCW; sim. to Spraque Type 150D.
C32	19C300075 P22001G	Polyester: .022µF ±2%, 100 VDCW, sim. to GE Type 61F.
C33 and C34	19C300075 P12001G	Polyester: .012 0µF ±2%, 100 VDCW, sim. to GE Type 61F.
C1735		Added when mod kit 19A130751G1 is installed.
		- - - - DIODES - - - -
CR1 and CR2	19A115250P1	Silicon, fast recovery, 225 mA, 50 PIV.
CR3 and CR4	19A116325P6	Zener: 5 watt, 20 V.
CR5 thru CR11	19A115250P1	Silicon, fast recovery, 225 mA, 50 PIV.
CR12 and CR13	T324ADP1041	Silicon: Rectifier; sim. to IN4004.
		- - - - JACKS - - - -
J3 thru J6	4033513P4	Contact, electrical: sim. to Bead Chain L93-3.
		- - - - INDUCTORS - - - -
L1	19b205354G2	Coil.
L2	19B221434G4	Coi.
L3	19B221434G5	Coil.
L1704		Used when mid kit 19A130751G1 is installed.
		- - - - PLUGS - - - -
P1 thru P4	19A702402P2	Contact, electrical; sim. to AMP 42827-2.
		- - - - TRANSISTORS - - - -
Q2	19A700023P1	Silicon, NPN: sim. to 2N3904.
Q4	19A700023P1	Silicon, NPN: sim. to 2N3904.
Q6	19A700023P1	Silicon, NPN: sim. to 2N3904.
Q7	19A700022P1	Silicon, PNP: sim. to 2N3906.
Q10 and Q11	19A115768P1	Silicon, PNP: sim. to 2N3702
Q13 and Q14	19A700023P1	Silicon, NPN: sim. to 2N3904.
Q15	19A115300P2	Silicon, NPN; sim. to Type 2N3053.
Q16	19A116774P1	Silicon NPN: sim. to Type 2N5210.
Q17 and Q18	19A700023P1	Silicon, NPN: sim. to 2N3904.
Q19	19A115768P1	Silicon, PNP: sim. to 2N3702
Q20 thru Q26	19A700023P1	Silicon, NPN: sim. to 2N3904.

* COMPONENTS ADDED, DELETED, OR CHANGED BY PRODUCTON CHANGES

SYMBOL	PART NUMBER	DESCRIPTION
Q27 thru Q29	19A116774P1	Silicon, PN; sim. to Type 2N5210.
Q30	19A700022P1	Silicon, PNP: sim. to 2N3906.
Q31	19A134226P1	P Type, field effect; sim to Type 2N3993.
		- - - - RESISTORS - - - -
R5	3R77P513J	Composition: 51k Ohms ±5%, 1/2 watt.
R6	19A700113P111	Composition: 100k Ohms ±5%, 1/2 watt.
R7	3R77P202J	Composition: 2k Ohms ±5%, 1/2 watt.
R11	3R77P622J	Composition: 6.2k Ohms ±5%, 1/2 watt.
R12	19A700113P111	Composition: 100k Ohms ±5%, 1/2 watt.
R13	3R77P131J	Composition: 130 Ohms ±5%, 1/2 watt.
R14	3R77P622J	Composition:6.2k Ohms ±5%, 1/2 watt.
R15	19A700113P45	Composition:180 Ohms ±5%, 1/2 watt.
R17	19B209022P89	Wirewound: 0.1 Ohm, ±5%, 2 watt; sim. to IRC Type BWH.
R18	19A700113P83	Composition: 6.8k Ohms ±5%, 1/2 watt.
R19	19A700113P107	Composition:68k Ohms ±5%, 1/2 watt.
R20	19A700113P77	Composition: 3.9k Ohms ±5%, 1/2 watt.
R21	3R77P622J	Composition: 6.2k Ohms ±5%, 1/2 watt.
R22	19A700113P95	Composition: 22k Ohms ±5%, 1/2 watt.
R23	19A700113P75	Composition: 3.3k Ohms ±5%, 1/2 watt.
R24	19A700113P63	Composition: 1k Ohms ±5%, 1/2 watt.
R25	19A700113P75	Composition: 3.3k Ohms ±5%, 1/2 watt.
R26	19A700113P99	Composition: 33k Ohms ±5%, 1/2 watt.
R28	19A700113P87	Composition:10k Ohms ±5%, 1/2 watt.
R29	19A700113P95	Composition: 22k Ohms ±5%, 1/2 watt.
R33	19A700113P43	Composition: 150 Ohms ±5%, 1/2 watt.
R34	19A700113P63	Composition:1k Ohms ±5%, 1/2 watt.
R35	19A700113P55	Composition:470 Ohms ±5%, 1/2 watt.
R36	19A700113P95	Composition: 22k Ohms ±5%, 1/2 watt.
R37	3R77P244J	Composition: 240k Ohms ±5%, 1/2 watt.
R38	19A700113P87	Composition: 10k Ohms ±5%, 1/2 watt.
R39	19A700113P111	Composition: 100k Ohms ±5%, 1/2 watt.
R40	19A700113P95	Composition: 22k Ohms ±5%, 1/2 watt.
R41 and R42	19A700113P87	Composition: 10k Ohms ±5%, 1/2 watt.
R43	19A700113P111	Composition: 100k Ohms ±5%, 1/2 watt.
R44	3R77P224J	Composition: 220k Ohms ±5%, 1/2 watt.
R45	19A700113P79	Composition: 4.7k Ohms ±5%, 1/2 watt.
R46	3R77P684J	Composition: 680k Ohms ±5%, 1/2 watt.
R47	19B209358P112	Variable, carbon film: approximately 2000 to 1 megohm ±20%, 1/4 watt; sim. to CTS Type X-201.
R48	19A700113P111	Composition: 100k Ohms ±5%, 1/2 watt.
R49 and R50	19A700113P95	Composition: 22k Ohms ±5%, 1/2 watt.
R51	19A700113P75	Composition: 3.3k Ohms ±5%, 1/2 watt.
R52 thru R54	19A700113P87	Composition: 10k Ohms ±5%, 1/2 watt.
R55	19A700113P111	Composition: 100k Ohms ±5%, 1/2 watt.
R56	19A700113P57	Composition: 560 Ohms ±5%, 1/2 watt.
R57 and R58	19A700113P39	Composition: 100 Ohms ±5%, 1/2 watt.
R59 and R60	3R77P200J	Composition: 20 Ohms ±5%, 1/2 watt.
R61	3R77P433J	Composition: 43k Ohms ±5%, 1/2 watt.
R62	19A700113P93	Composition: 18k Ohms ±5%, 1/2 watt.
R63	19A700113P81	Composition: 5.6k Ohms ±5%, 1/2 watt.
R64	19A700113P107	Composition:68k Ohms ±5%, 1/2 watt.
R65	19A700113P79	Composition: 4.7k Ohms ±5%, 1/2 watt.
R66	19A700113P107	Composition: 68k Ohms ±5%, 1/2 watt.
R67	19A700113P79	Composition: 4.7k Ohms ±5%, 1/2 watt.
R68	19A700113P83	Composition: 6.8k Ohms ±5%, 1/2 watt.
R70	19A700113P81	Composition: 5.6k Ohms ±5%, 1/2 watt.
R71	3R77P684J	Composition: 680k Ohms ±5%, 1/2 watt.

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SYMBOL	PART NUMBER	DESCRIPTION
R72 and R73	3R77P224J	Composition: 220k Ohms ±5%, 1/2 watt.
R74	3R77P203J	Composition: 20k Ohms ±5%, 1/2 watt.
R75	3R77P202J	Composition: 2k Ohms ±5%, 1/2 watt.
R76	19A700113P87	Composition: 10k Ohms ±5%, 1/2 watt.
R1769		Used when mod kit 19A130751G1 is installed
		- - - - TRANSFORMERS - - - -
T1	19A115731P1	Audio: 300-6000 Hz; Pri (1-4): 22 Ohms ±15% DC res, Pri (2-3): 12.5 Ohms ±15% DC res, Sec 1:13 Ohms ±15%.
		- - - - JACKS - - - -
J1 and J2	7150763P4	Jack, tip, stake-in: green nylon body, sim. to Alden Products 110BC1.
		- - - - TRANSISTORS - - - -
Q8	19A116742P1	Silicon, NPN; sim. to Type 2N6103.
Q32	19A21166375P1	Silicon, PNP.
		- - - - MISCELLANEOUS - - - - *(Mechanical Parts)*
4	19B216210P2	Heat sink *(Used with Q8 and Q32).*
5	19A122682G2	Handle.
6	19A116296P2	Knob, push-0n *(Used with R27).*
7	19A121882P1	Washer, shield *(Used with Q8 and Q32).*
8	19A705469P1	Insulator Plate, T0-220 *(Used with Q8 and Q32).*
10	7893938P1	Hex nut: No. 8032.
11	7115130P9	Lockwasher, internal tooth: No. 3/8.
13	19B201974P304	Tap screw, Phillips POZIDRIV: No. 6-32 x 1/4.
18	N681P13005C1	Screw.
20	7160861P1	Nut, sheet spring: sim. to Tinnerman C1996-632-157.
21	19A115139P26	Sleeve.
29	19C317781G2	Support.
	7118719P4	Clip, spring tension: sim/ to Prestole E-50005-003 *(Used with C12).*
	N80P13005B6	Machine screw, panhead: No. 6-32 x 5/16 *(Secures T1).*
	19A701332P4	Insulator, washer: nylon *(Used with Q15).*
	19A1212075P11	Insulator *(Used with C14).*

ANALOG VOTING RECEIVER MODULE 19D903175G1

ISSUE 2

SYMBOL	PART NUMBER	DESCRIPTION
		ANALOG VOTING RECEIVER BOARD ROA 120 2355/1
		- - - - CAPACITORS - - - -
C1	RJC 464 3066/1	Ceramic: 100nF-10%, 50 VDCW.
C2	RJE 584 3167/1	Electrolytic, Tantalum: 1µF, 16 VDCW.
C3 and C4	RJE 584 3258/1	Electrolytic, Tantalum: 10µF, 25 VDCW.
C5	RJC 464 3066/1	Ceramic: 100nF-10%, 50 VDCW.
C6	RJE 584 3356/33	Electrolytic, Tantalum: 0.33µF, 35 VDCW.
C7	RJC 464 3076/22	Ceramic: 220nF -10%, 50 VDCW.
C8	RJE 584 3208/22	Electrolytic: 22µF…20 VDCW.
C9	RJC 464 3066/1	Ceramic: 100nF-10%, 50 VDCW.
C10	RJC 529 5875/15	Ceramic: 15000pF 2%, VDCW.
C11 and C12	RJC 464 3066/1	Ceramic: 100nF-10%, 50 VDCW.
C13	RJC 464 2044/15	Ceramic: 1.5nF ±5%, 50 VDCW.
C14	RJE 584 3167/1	Electrolytic, Tantalum: 1µF, 16 VDCW.
C17	RJC 463 4043/68	Ceramic: 680pF ±5%, 50 VDCW.
C18 and C19	RJC 463 4074/22	Ceramic: 2.2nF ±5%, 50 VDCW.
C20	RJC 464 3066/1	Ceramic: 100nF-10%, 50 VDCW.
C21	RJE 584 3208/22	Electrolytic: 22µF ± %, 20 VDCW.
C22 thru C35	RJC 464 3045/1	Ceramic: 10nF ±10%, 50 VDCW.
C36	RJE 584 3208/22	Electrolytic: 22µF ± %, 20 VDCW.
C37	RJE 584 3167/1	Electrolytic, Tantalum: 1µF, 16 VDCW.
C38	RJC 464 3045/1	Ceramic: 10nF ±10%, 50 VDCW.
C40	RJE 584 3167/1	Electrolytic, Tantalum: 1µF, 16 VDCW.
C41 thru C43	RJC 464 3045/1	Ceramic: 10nF ±10%, 50 VDCW.
C44	RJE 584 3258/1	Electrolytic, tantalum: 10µF %, 25 VDCW.
C45	RJE 584 3208/22	Electrolytic: 22µF %, 20 VDCW.
C46 and C47	RJE 584 3167/1	Electrolytic, Tantalum: 1µF, 16 VDCW.
C48	RJC 464 3045/1	Ceramic: 10nF ±10%, 50 VDCW.
C49	RJC 464 3076/22	Ceramic: 220nF -10%, 50 VDCW.
C50	RJC 464 3066/1	Ceramic: 100nF -10%, 50 VDCW.
C51	RJE 584 3258/1	Electrolytic, tantalum: 10µF %, 25 VDCW.
C53	RJC 464 3065/47	Ceramic: 47nF -10%, 50 VDCW.
C54	RJC 464 3066/1	Ceramic: 100nF -10%, 50 VDCW.
C55	RJC 463 4064/22	Ceramic: 2.2nF ±5%, 50 VDCW.
C56	RJC 463 4043/68	Ceramic: 680pF ±5%, 50 VDCW.
C57	RJC 464 3066/1	Ceramic: 100nF -10%, 50 VDCW.
C58	RJC 464 3076/22	Ceramic: 220nF -10%, 50 VDCW.
C59	RJE 584 3167/1	Electrolytic, tantalum: 1µF %, 16 VDCW.
C60	RJC 464 3066/1	Ceramic: 100nf -10%, 50 VDCW.
C61	RJC 464 2044/15	Ceramic: 1.5nF ±5%, 50 VDCW.
		- - INTEGRATED CIRCUITS - -
D1	RYT 101 6055/2C	Quad, Low Power Operational Amplifier; sim to MC3303.
D2	RYT 101 030/C	Quad Operation Amplifier, sim to LM324A.
D3 and D4	RYT 301 1006/3C	Quad, Analog Switch; sim to 4066B.
D5	RYT 101 034/C	Dual Voltage Comparator; sim to LM2903.
D6	RYT 101 256/C	Demodulator/Tone Decoder: sim to 2211.
D7 and D8	RYTUA 106 6011/C	Quad, 2-input NAND Gate; sim to MC14011.
D9	RYTUA 106 6049/C	CMOS HEX Inverter; sim to MC14049.
D10	RYTUA 106 6081/C	Quad 2-ijnput AND Gate; sim to MC14081.
D12	RYT 106 6011/C	Quad, 2-input NAND Gate; sim to MC14011.
D14 and D15	RYT 101 6055/2C	Quad, Low Power Operational Amplifier; sim to MC3303.
D16	RYT 115 6009/1	Digital Potentiometer; sim to X9C103.
D17	RYT 108 6003/C	Timer; sim to TLC555ID.
D20	RYTUA 106 6012/C	Dual, 4-input NAND Gate; sim to MC14012.
D22	RYTUA 106 6011/C	Quad, 2-input NAND Gate; sim to MC14011.
		- - - - DIODES - - - -
H1	RZK 433 650/1	LED: Right angle,Yellow; sim to
H2	RZK 433 624/1	LED: Red; sim to 550-5107.
H3	RKZ 433 624/2	LED: Green; sim. to 550-5607.
		- - - - RELAY - - - -
K1	RAV 947 17/1	Solid State, Bi-Directional; sim to
		- - - - OP-AMPL - - - -
N11	RYT 101 405/C	JFET Input Single Operational Amplifier with low offset and low bias currents; sim to MC34081.

NOTE: COMPONENTS ARE ADDED, DELETED, OR CHANGED BY PRODUCTIONS CHANGES

Continued

Continued

SYMBOL	PART NUMBER	DESCRIPTION
		- - VOLTAGE REGULATORS - -
N13	RYT 113 070/C	Low Drop Regulator; sim to LM2931.
N18	RYT 113 6018/1C	Regulator; sim to 78/L05.
		- - - - OP-AMPL - - - -
N19	RYT 101 405/C	JFET Input Single Operational Amplifier with low offset and low bias currents; sim to MC34081.
		- - - - RESISTORS - - - -
R1	REP 615 623/681	Carbon: 681 Ohms ±1%, ±100 PPM.
R2	REL 316 4204/5	Potentiometer: 5k Ohms, side adjust thru-hole.
R3	REP 615 625/1	Carbon: 10k Ohms ±1%, ±100 PPM.
R4	REP 615 625/383	Carbon: 38.3k Ohms ±1%, ±100 PPM.
R5	REP 615 625/1	Carbon: 10k Ohms ±1%, ±100 PPM.
R6	REP 615 624/392	Carbon:3.92k Ohms ±1%, ±100 PPM.
R7 and R8	REP 615 627/1	Carbon: 1meg Ohm ±1%, ±100 PPM.
R9 thru R11	REP 615 625/1	Carbon: 10k Ohms ±1%, ±100 PPM.
R12	REP 615 624/1	Carbon: 1k Ohms ±1%, ±100 PPM.
R13	REP 615 624/464	Carbon: 4.64k Ohms ±1%, ±100 PPM.
R14	REP 615 625/1	Carbon: 10k Ohms ±1%, ±100 PPM.
R15	REP 615 622/2	Carbon: 20k Ohms ±1%, ±100 PPM.
R16	REP 615 625/392	Carbon: 39.2 Ohms ±1%, ±100 PPM.
R17	REP 615 625/365	Carbon: 36.5k Ohms ±1%, ±100 PPM.
R18	REP 615 626/133	Carbon: 133k Ohms ±1%, ±100 PPM.
R19	REP 615 626/332	Carbon: 332k Ohms ±1%, ±100 PPM.
R20	REP 615 626/681	Carbon: 681 Ohms ±1%, ±100 PPM.
R21	REP 615 625/147	Carbon: 14.7k Ohms ±1%, ±100 PPM.
R22	REP 615 626/221	Carbon: 221k Ohms ±1%, ±100 PPM.
R23	REP 615 624/1	Carbon: 1k Ohms ±1%, ±100 PPM.
R24	REP 615 624/43	Carbon: 4.3k Ohms ±1%, ±100 PPM.
R25	REP 615 625/1	Carbon: 10k Ohms ±1%, ±100 PPM.
R26	REP 615 625/511	Carbon: 51.1k Ohms ±1%, ±100 PPM.
R27	REP 615 626/115	Carbon: 115k Ohms ±1%, ±100 PPM.
R29R31	REP 615 625/1	Carbon: 10k Ohms ±1%, ±100 PPM.
R30	REP 616 624/169	Carbon: 1k Ohms ±1%, ±100 PPM.
R31	REP 615 625/1	Carbon: 10k Ohms ±1%, ±100 PPM.
R32	REP 615 624/169	Carbon: 1.69k Ohms ±1%, ±100 PPM.
R33	REP 615 625/976	Carbon: 97.6k Ohms ±1%, ±100 PPM.
R34	REP 615 624/365	Carbon: 3.65k Ohms ±1%, ±100 PPM.
R35	REP 615 626/43	Carbon: 430k Ohms ±1%, ±100 PPM.
R36	REP 615 627/33	Carbon: 3.3 Megohms ±1%, ±100 PPM.
R37	REP 615 625/316	Carbon: 31.6k Ohms ±1%, ±100 PPM.
R38	REL 316 114/5	Potentiometer: 5k Ohms, Trimmer; sim to Gullwing.
R39 thru R41	REP 615 626/1	Carbon: 100 Ohms ±1%, ±100 PPM.
R42	REP 615 624/562	Carbon: 5.62k Ohms ±1%, ±100 PPM.
R43 and R44	REP 615 626/1	Carbon:100 Ohms ±1%, ±100 PPM.
R45	REP 615 624/562	Carbon: 5.62k Ohms ±1%, ±100 PPM.
R46 and R47	REP 615 626/1	Carbon: 100 Ohms ±1%, ±100 PPM.
R48	REP 615 624/562	Carbon: 5.62k Ohms ±1%, ±100 PPM.
R49 thru R57	REP 615 625/1	Carbon:10k Ohms ±1%, ±100 PPM.
R58 and R59	REP 615 626/1	Carbon: 100 Ohms ±1%, ±100 PPM.
R61	REP 615 625/2	Carbon:20k Ohms ±1%, ±100 PPM.
R62 and R63	REP 615 625/1	Carbon:10k Ohms ±1%, ±100 PPM.
R64	REP 615 626/301	Carbon: 301k Ohms ±1%, ±100 PPM.
R65	REP 615 623/1	Carbon: 100 Ohms ±1%, ±100 PPM.
R66	REP 615 625/1	Carbon: 10k Ohms ±1%, ±100 PPM.
R67	REP 615 625/187	Carbon: 18.7k Ohms ±1%, ±100 PPM.

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SYMBOL	PART NUMBER	DESCRIPTION
R68	REP 615 625/2	Carbon: 20k Ohms ±1%, ±100 PPM.
R69 thru R71	REP 615 625/1	Carbon: 10k Ohms ±1%, ±100 PPM.
R72	REL 316 115/1	Potentiometer: 10K Ohms, Trimmer; sim to Gullwing.
R73	REP 615 625/1	Carbon: 10k Ohms ±1%, ±100 PPM.
R74	REP 615 624/909	Carbon: 9.09k Ohms ±1%, ±100 PPM.
R75	REP 615 625/1	Carbon: 10k Ohms ±1%, ±100 PPM.
R76	REP 615 626/332	Carbon: 332k Ohms ±1%, ±100 PPM.
R77	REP 615 625/2	Carbon: 20k Ohms ±1%, ±100 PPM.
R78	REP 615 625/110	Carbon: 11k Ohms ±1%, ±100 PPM.
R79	REP 615 623/1	Carbon:100 Ohms ±1%, ±100 PPM.
R80	REP 615 624/392	Carbon: 3.92k Ohms ±1%, ±100 PPM.
R81 thru RR86	REP 615 624/562	Carbon: 5.62k Ohms ±1%, ±100 PPM.
R87 thru R89	REP 615 625/1	Carbon: 10k Ohms ±1%, ±100 PPM.
R90	REP 615 626/1	Carbon: 100k Ohms ±1%, ±100 PPM.
R91	REP 615 624/511	Carbon: 5.11k Ohms ±1%, ±100 PPM.
R92 and R93	REP 615 625/2	Carbon: 20k Ohms ±1%, ±100 PPM.
R94	REP 615 624/274	Carbon: 2.74k Ohms ±1%, ±100 PPM.
R95	REP 615 624/2	Carbon: 2k Ohms ±1%, ±100 PPM.
R96	REP 615 625/383	Carbon: 38.3k Ohms ±1%, ±100 PPM.
R97	REP 615 626/562	Carbon: 562k Ohms ±1%, ±100 PPM.
R98	REL 316 115/1	Potentiometer: 10k Ohms, trimmer: sim. To Gullwing.
R99	REP 615 624/464	Carbon:4.64k Ohms ±1%, ±100 PPM.
R100 and R101	REP 615 625/1	Carbon 10k Ohms ±1%, ±100 PPM.
R102	REP 615 626/562	Carbon: 562k Ohms ±1%, ±100 PPM.
R103	REP 615 625/511	Carbon: 51.1k Ohms ±1%, ±100 PPM.
R104	REP 615 626/1	Carbon: 100k Ohms ±1%, ±100 PPM.
R105	REP 615 62625/1	Carbon: 10k Ohms ±1%, ±100 PPM.
R106	REP 615 626/15	Carbon: 51.1k Ohms ±1%, ±100 PPM.
R107	REL 316 115/1	Potentiometer: 10k Ohms, Trimmer; sim to Gullwing.
R108	REP 615 627/1	Carbon: 1 Megohm ±1%, ±100 PPM.
R109 and R110	REP 615 001/0	Carbon: 0 Ohms, +50 Milliohms.
R111	REP 615 622/1	Carbon: 10 Ohms ±1%, ±100 PPM.
R112 and R113	REP 615 001/0	Carbon: 0 Ohms, +50 Milliohm.
R114	REP 615 625/1	Carbon: 10k Ohms ±1%, ±100 PPM.
R115	REP 615 626/1	Carbon: 100k Ohms ±1%, ±100 PPM.
R116	REP 615 624/1	Carbon: 1k Ohms ±1%, ±100 PPM.
R120 and R118	REP 615 625/1	Carbon: 10k Ohms ±1%, ±100 PPM.
R119	REP 615 624/511	Carbon: 5.11k Ohms ±1%, ±100 PPM.
R120	REP 615 625/1	Carbon: 10k Ohms ±1%, ±100 PPM.
R121	REP 615 625/178	Carbon: 17.8k Ohms ±1%, ±100 PPM.
R122	REP 615 625/110	Carbon: 11k Ohms ±1%, ±100 PPM.
R123	REP 615 625/383	Carbon: 38.3k Ohms ±1%, ±100 PPM.
R124	REP 615 625/187	Carbon: 18.7 Ohms ±1%, ±100 PPM.
R125	REP 615 624/523	Carbon: 5.23k Ohms ±1%, ±100 PPM.
R126	REP 615 625/187	Carbon: 18.7k Ohms ±1%, ±100 PPM.
R127 and R128	REP 615 626/332	Carbon: 332k Ohms ±1%, ±100 PPM.
R129	REP 615 626/287	Carbon: 287k Ohms ±1%, ±100 PPM.
R130 and R131	REP 615 625/1	Carbon: 10k Ohms ±1%, ±100 PPM.
R132	REL 316 116/1	Potentiometer: 100k Ohms, Trimmer; sim to Gullwing.
R133	REP 615 626/1	Carbon: 100k Ohms ±1%, ±100 PPM.
R134	REP 615 624/34	Carbon: 3.4k Ohms ±1%, ±100 PPM.
R135 and R136	REP 615 627/1	Carbon:1 Megohm ±1%, ±100 PPM.
R137	REP 615 626/221	Carbon: 221k Ohms ±1%, ±100 PPM.

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SYMBOL	PART NUMBER	DESCRIPTION
		- - - - VARISTORS - - - -
RV1 and RV2	REY 203 02/2	Varistor/26 V.
		- - - - SWITCH - - - -
S1	RMF 356 201/1	Toggle: 2/SPDT, 3-Position.
		- - - - TRANSFORMER - - - -
T1	REG 135 69/1	Audio Frequency.
		- - - SWITCHING DIODES - - -
V1 thru V7	RKZ 123 634/2	Dual Switching, In Series.
V8 & v9	RKZ 123 03/1	Dual Switching, In Series.
V12 thru V15	RKZ 123 03/1	Dual Switching, In Series.
		- - - - TRANSISTORS - - - -
V19	RYT 120 634/1	PNP: Audio Frequency, High Beta, SOT23; sim to
V20	RYN 120 619/1	General Purpose PNP; Sim to MMBT3006
V21 and V22	RKZ 123 03/1	Dual Switching, In Series.
V23 thru V28	RYZ 123 602	Diode: SOT-23; sim to BAS70-04.
V30 thru V40	RYT 121 675/1	General Purpose NPN; Sim to MMBT3904
		- - - - CONNECTORS - - - -
X1	RPV 403 813/01	PIN: Unit.Connector, Test.
X10	RPV 380 10/03	PIN: Strip
X11	RNV 207 03/1	U-LINK
X100	RPV 403 813/01	PIN: Connector Unit/Connector, Test.
		- - - - MISCELLANEOUS - - - - *(Mechanical Parts - refer to Assembly Drawing for Analog Receiver Module 19D903175G1)*
3	19D903172G1	Support.
4	N84P13005B6	Machine Screw.
5	7160861P1	Nut, sheet spring: sim. To Tinnerman C1996-632-157.
6	19A122682G2	Handle
7	N80P13005B6	Machine Screw, panhead: No. 6-32 x 5/16.
8	N404P13B6	Lockwasher, internal tooth: No. 6.
9	N80P13004B6	Machine Screw: No. 6-32 x 1/4.

PRODUCTION CHANGES

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

VOTING SELECTOR SHELF 19E500936G2

REV. A - SELECTOR SHELF 19E500936G2
Previously incorporated *(See LBI-4292).*

POWER SUPPLY 19D413917G1

REV. A&B - POWER SUPPLY 19D413917G1
Previously incorporated *(See LBI-4292).*

REV. C - POWER SUPPLY 19D413917G1
To make compatible with Canadian standards.

Electrically reversed location of power switch S1 and fuse F1.

REV. D - POWER SUPPLY 19D413917G3
REV. B - POWER SUPPLY 19D413917G4
To replace capacitors no longer available.

Changed capacitors C1 and C2. Capacitors C1and C2 were 7476442P20, 1600µF. Added C1 (-) from ground to XF2-1. Added C2 (-) from ground to XF3-1.

REV. E - POWER SUPPLY 19D413917G3
REV. C - POWER SUPPLY 19D413917G4
To replace electrolytic capacitor no longer available.

Changed electrolytic capacitors C5 thru C7 on Component Board A1. Electrolytic capacitors C5 thru C7 were 19A115680P6, 50 µF.

AUDIO MODULE 19D413958G3/G5[6]

REV. A - AUDIO MODULE 19D413958G5
Incorporated in initial shipment as 19D413958G3 (See LBI-4292).

REV.B - AUDIO MODULE 19D413958G5
To reduce level of audio chirp heard when satellite receiver squelches.

Deleted transistors Q1, Q3 and Q12.
Deleted resistors R1, R2, R30, R31 and R32.
Added transistors Q27 thru Q31.
Added resistors R63 thru R67.

REV. C - AUDIO MODULE 19D413958G5
To ensure saturation of transistor Q16.

Changed transistor Q16. Transistor Q16 was ????

Changed resistors R22 and R37. Resistors R22 and R37 were ????

REV. D - AUDIO MODULE 19D413958G5
To increase the voltage rating of capacitor C17 and improve safety margin.

Changed capacitor C17. Capacitor C17 was 549626P15, Tantalum: 47µF ±20%, 20 VDCW.

REV. E - AUDIO MODULE 19D413958G3/G5
No Change.

REV. F - AUDIO MODULE 19D413958G3/G5
To change Audio Module line impedance to 600 ohms and to replace an electrolytic capacitor no longer available. Also, to change the number in the Revision Letter Block of Schematic Diagram 19D423508 from G3 to G5 and delete reference to PL19A130751G1.

Changed capacitor C6. Capacitor C6 was 19A115680P6, 50 µF.

Changed resistor R5. Resistor R5 was 3R77P513J, 51k Ohms, ±5%, 1/2 Watt.

Changed Resistor R33. Resistor R33 was 19A700113P43, 150 Ohms, ±5%, 1/2 Watt.

Changed resistor R35. Resistor R35 was 19A700113P55, 450 Ohms, ±5%, 1/2 Watt.

Changed resistor R50. Resistor R50 was 19A700113P95, 22k, ±5%, 1/2 Watt.

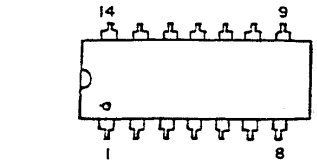
ANALOG VOTER RECEIVER MODULE 19D903175G1

To improve voter operation. Changed the Analog Voter Receiver Module to new Voter Receiver Module ROA 117 2355/1, according to AN21016 *(8/11/98).*

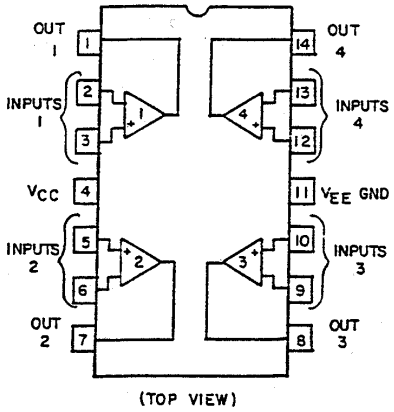
[6] Revision F changed the Revision Letter Block on Schematic Diagram 19D423508 from 19D413917G3 to 19D413917G5. PL19A130751G1 was deleted from the Revision Letter Block.

IC DATA
(Receiver Module)

D1, D14, & D15
QUAD LOW-POWER OPERATIONAL AMPLIFIER
RYT 101 6055/2C ***(MC3303)***

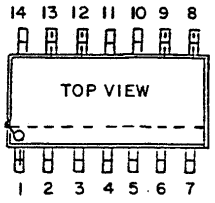


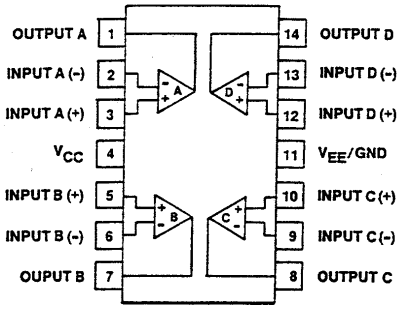
PIN CONNECTIONS



(TOP VIEW)

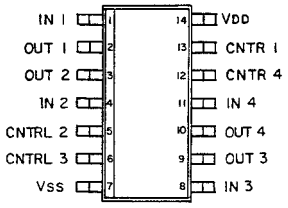
D2
QUAD OPERATIONAL AMPLIFIER
RYT 101 030/C ***(LM324A)***



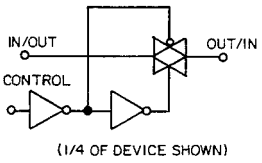


D3 & D4
QUAD ANALOG SWITCH
RYT 301 1006/3C ***(4066B)***

PIN CONFIGURATION



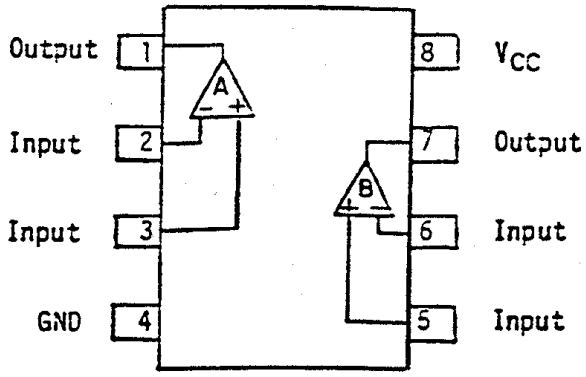
LOGIC DIAGRAM



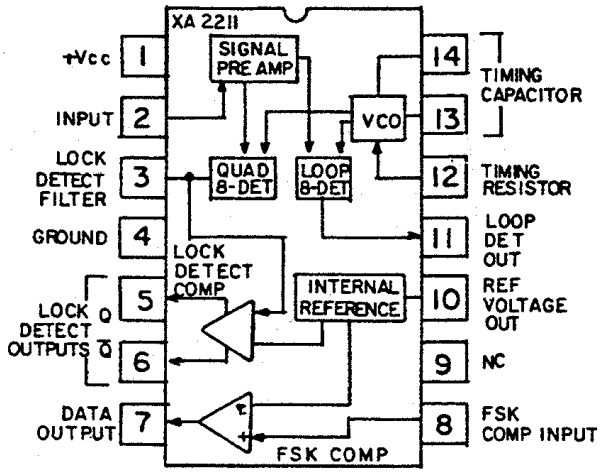
(1/4 OF DEVICE SHOWN)

CONTROL	SWITCH
0	OFF
1	ON

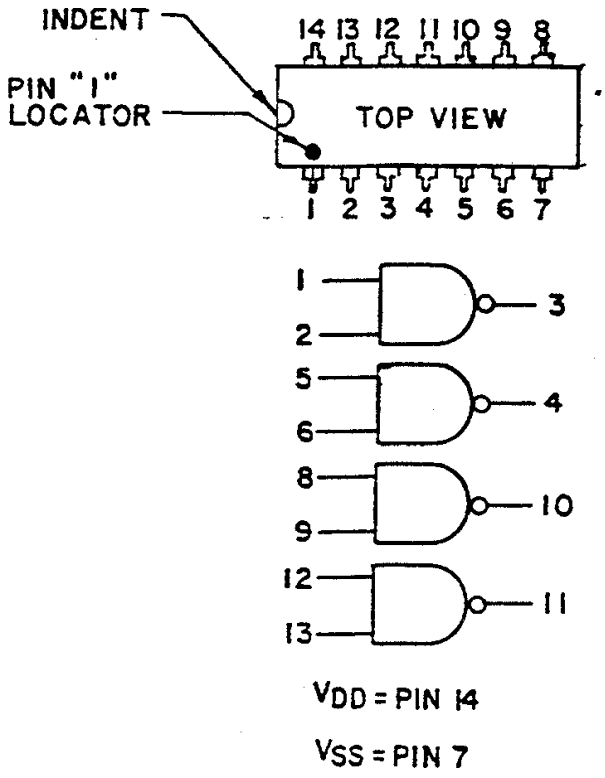
D5
DUAL VOLTAGE COMPARATOR
RYT 101 034/C ***(LM2903)***



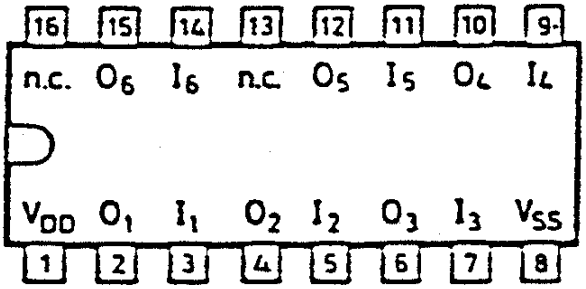
D6
FSK DEMODULATOR/TONE DECODER
RYT 101 256/C *(2211)*



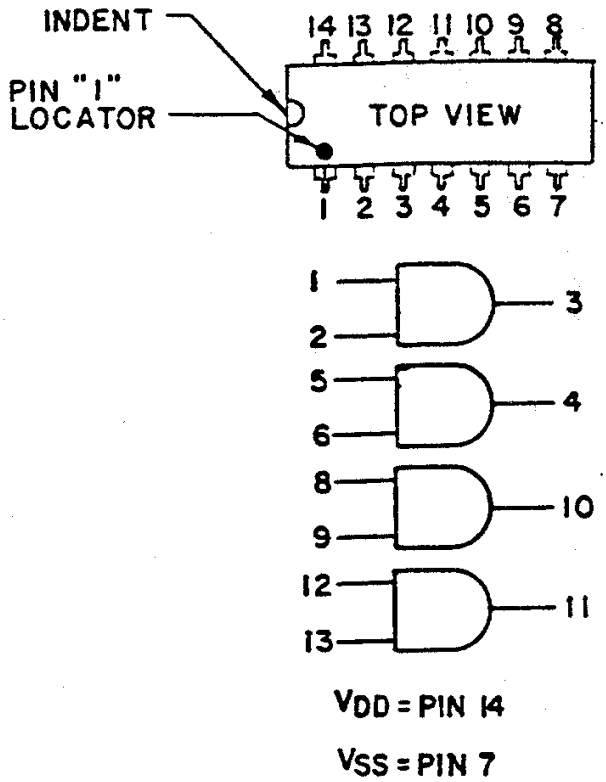
D7, D8, D12, & D22
QUAD 2-INPUT NAND GATE
RYTUA 106 6011/C *(MC14011)*



D9
CMOS HEX INVERTER
RYTUA 106 6049/C *(MC14049)*

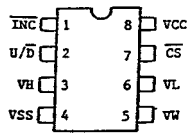


D10
QUAD 2-INPUT AND GATE
RYTUA 106 6081/C *(MC14081)*



D16
DIGITAL POTENTIOMETER
RYT 115 6009/1 ***(X9C103)***

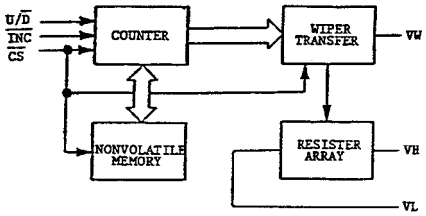
PIN CONFIGURATION



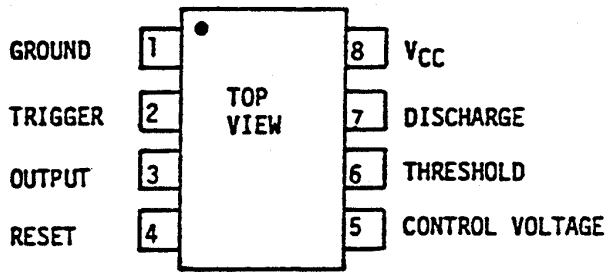
PIN NAME

VH	HIGH TERMINAL OF POT
VW	WIPER TERMINAL OF POT
VL	LOW TERMINAL OF POT
VSS	GROUND
VCC	SYSTEM POWER
U/D	UP / DOWN CONTROL
INC	WIPER MOVEMENT CONTROL
CS	CHIP SELECT

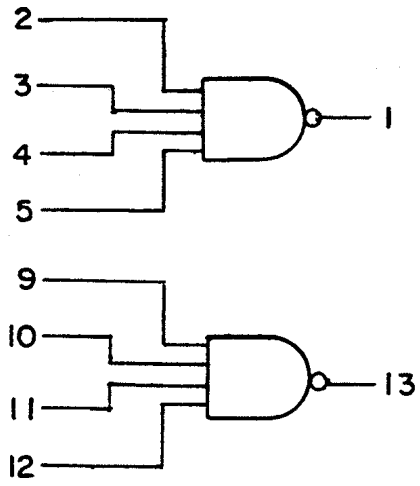
FUNCTIONAL DIAGRAM



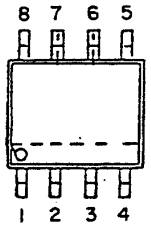
D17
555 TIMER
RYT 108 6003/C (TLC555ID)

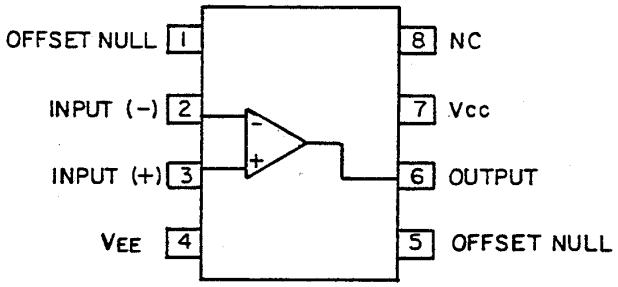


D20
QUAD 4-INPUT NAND GATE
RYTUA 106 6012/C ***(MC14012)***

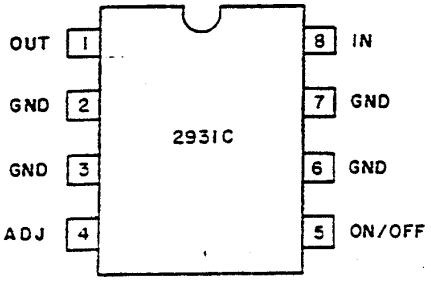


N11 & N19
OPERATIONAL AMPLIFIER
RYT 101 405/C ***(MC34081)***

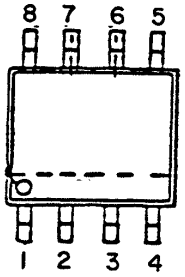




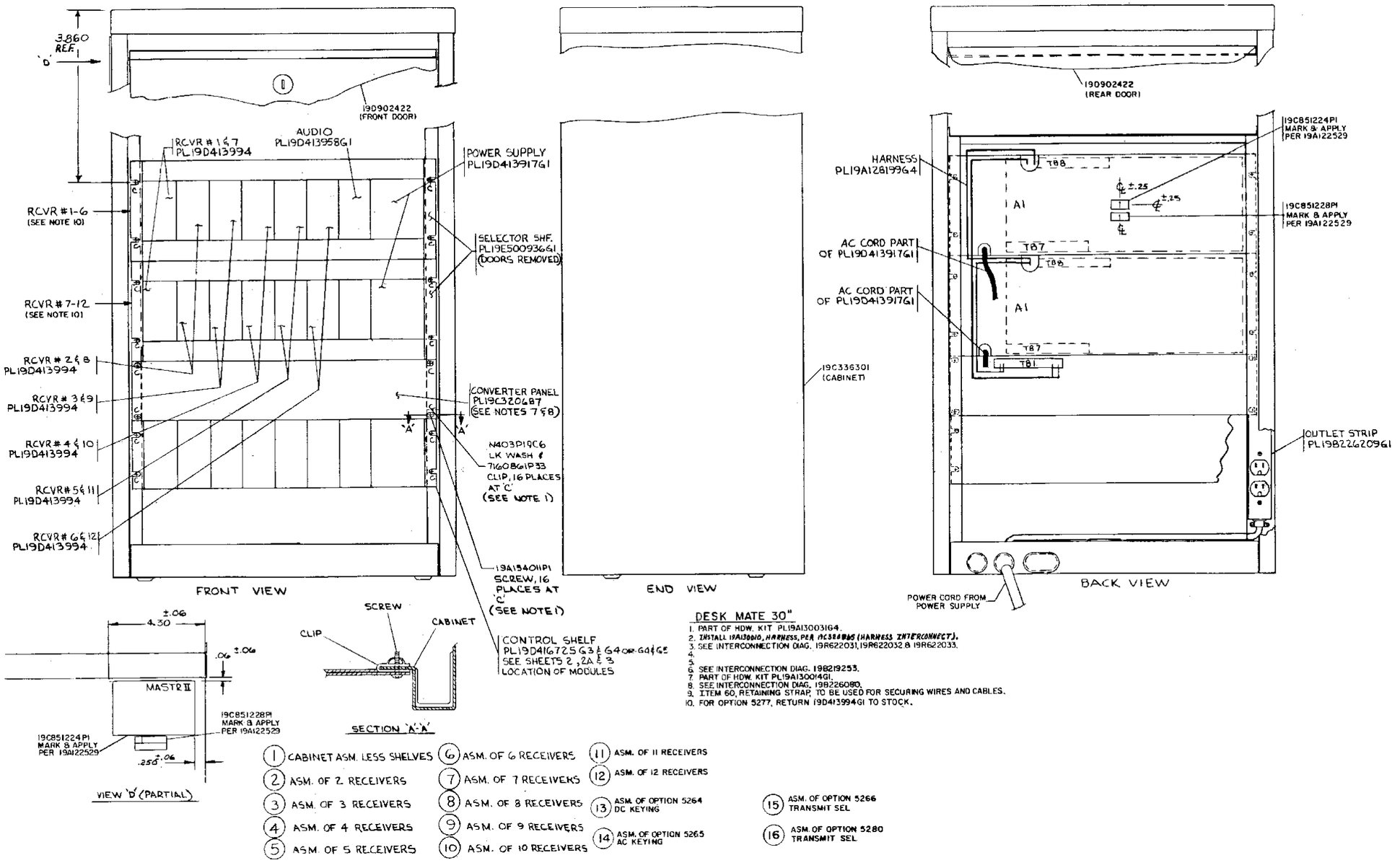
N13
LOW DROP REGULATOR
RYT 113 070/C ***(LMC2931)***



N18
VOLTAGE REGULATOR
RYT 113 6018/C ***(78L05)***



PIN	FUNCTION
1	Vout
2	GROUND
3	GROUND
4	N.C.
5	N.C.
6	GROUND
7	GROUND
8	Vin



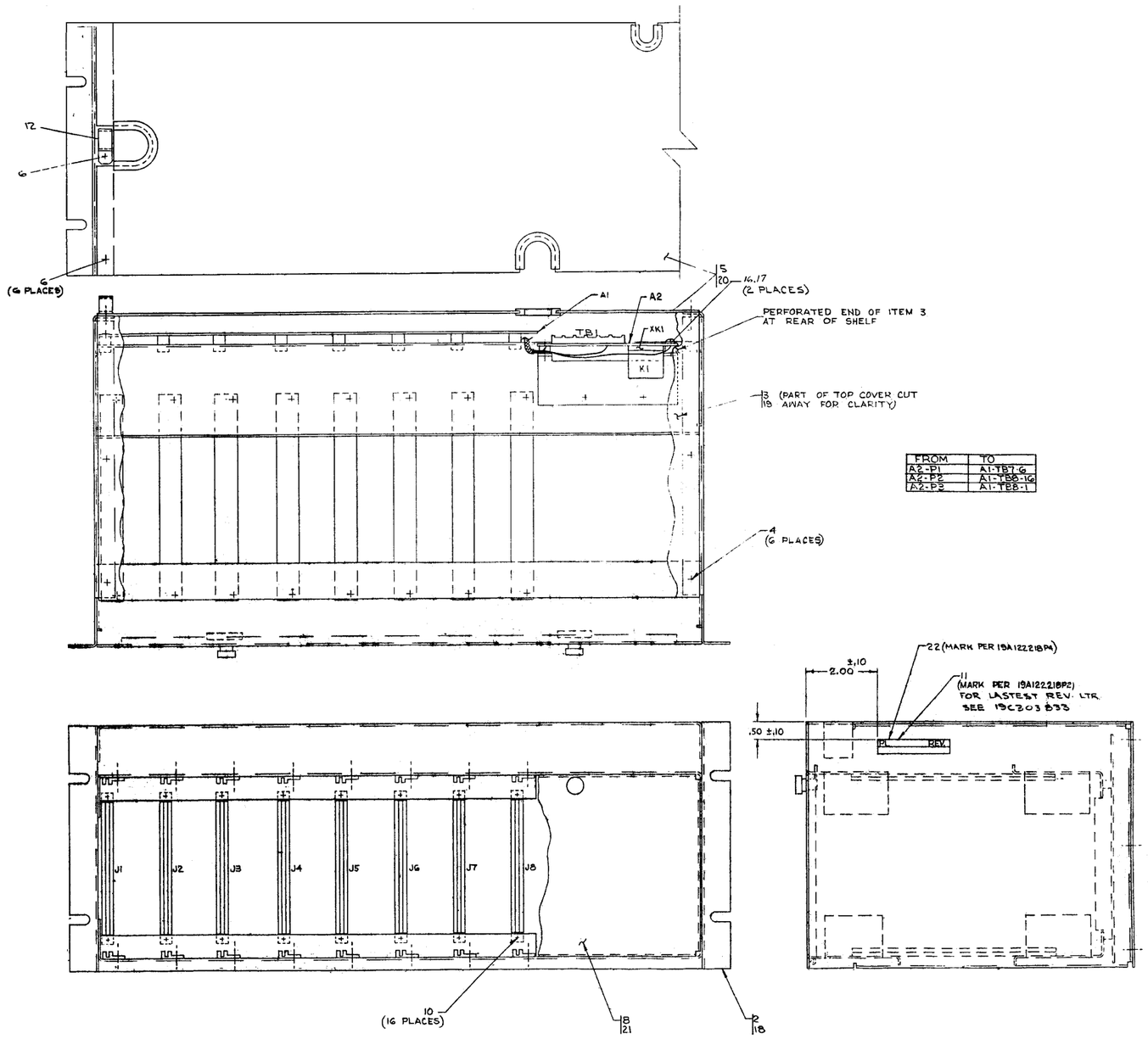
DESK MATE 30"

1. PART OF HDW. KIT PL19A130031G4.
2. INSTALL 19A139010, HARNESS, PER 19C332185 (HARNESS INTERCONNECT).
3. SEE INTERCONNECTION DIAG. 19R622031, 19R622032 & 19R622033.
4.
5.
6. SEE INTERCONNECTION DIAG. 19B219253.
7. PART OF HDW. KIT PL19A130014G1.
8. SEE INTERCONNECTION DIAG. 19B226080.
9. ITEM 60, RETAINING STRAP, TO BE USED FOR SECURING WIRES AND CABLES.
10. FOR OPTION 5277, RETURN 19D413994G1 TO STOCK.

(1) CABINET ASM. LESS SHELVES
(2) ASM. OF 2 RECEIVERS
(3) ASM. OF 3 RECEIVERS
(4) ASM. OF 4 RECEIVERS
(5) ASM. OF 5 RECEIVERS
(6) ASM. OF 6 RECEIVERS
(7) ASM. OF 7 RECEIVERS
(8) ASM. OF 8 RECEIVERS
(9) ASM. OF 9 RECEIVERS
(10) ASM. OF 10 RECEIVERS
(11) ASM. OF 11 RECEIVERS
(12) ASM. OF 12 RECEIVERS
(13) ASM. OF OPTION 5264 DC KEYING
(14) ASM. OF OPTION 5265 AC KEYING
(15) ASM. OF OPTION 5266 TRANSMIT SEL
(16) ASM. OF OPTION 5280 TRANSMIT SEL

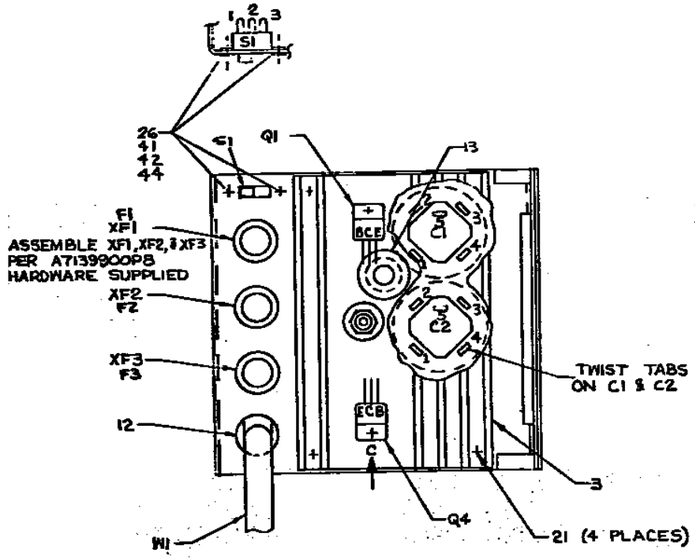
STATION CABINET

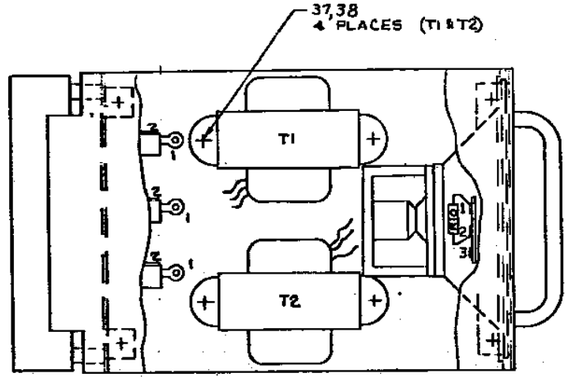
(19D429593, Sh. 1, Rev. 6)

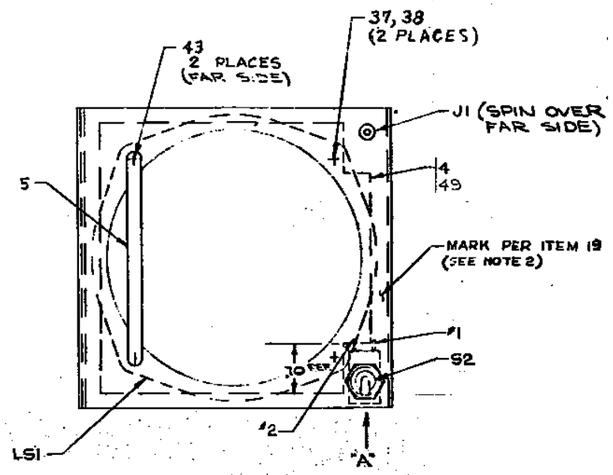


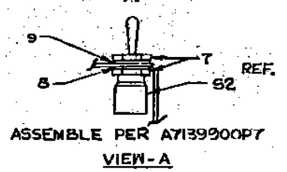
SELECTOR SHELF
19E500936G2

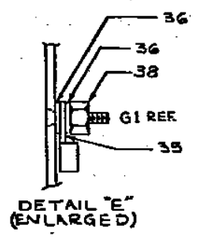
(19E500936, Sh. 1, Rev. 11)

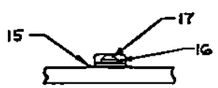


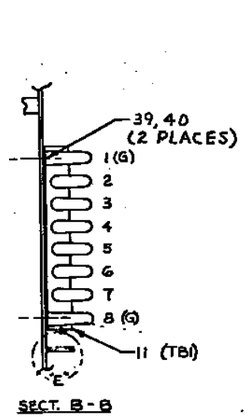








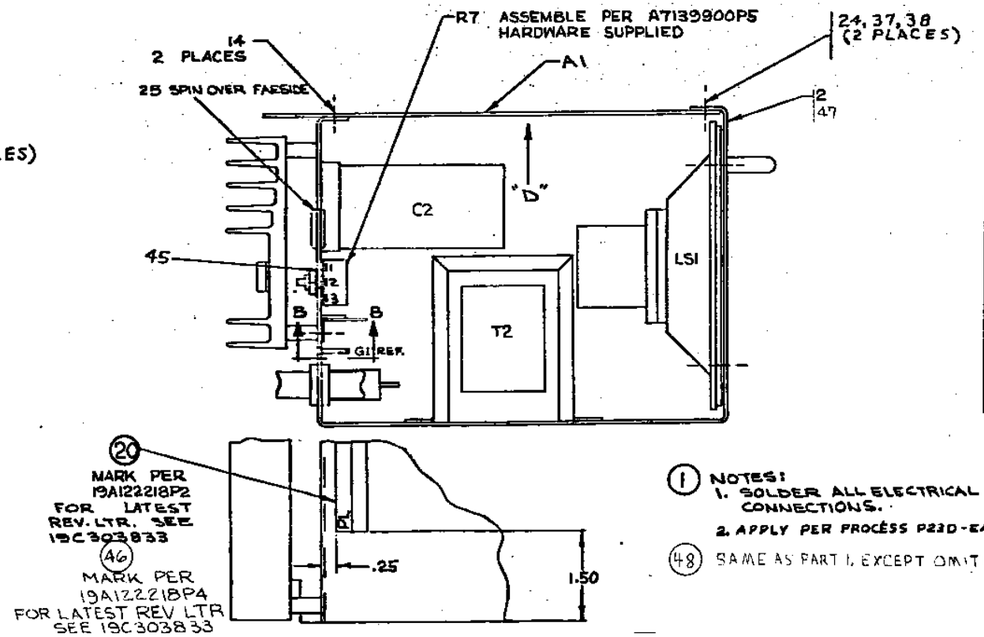


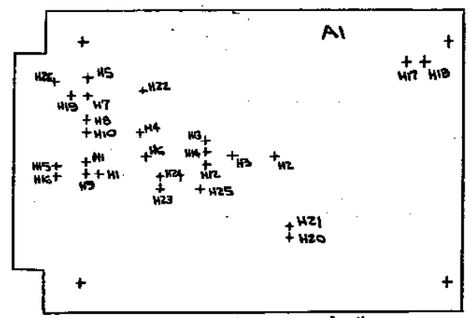


SECT. B-B

VIEW C
(MTG. FOR Q1 & Q4)

REFER TO WIRING DIAGRAM 19D413361 FOR THE FOLLOWING CONNECTIONS		
WIRE CHART		
FROM	TO	REMARKS
W1-6	G1	ITEM 35





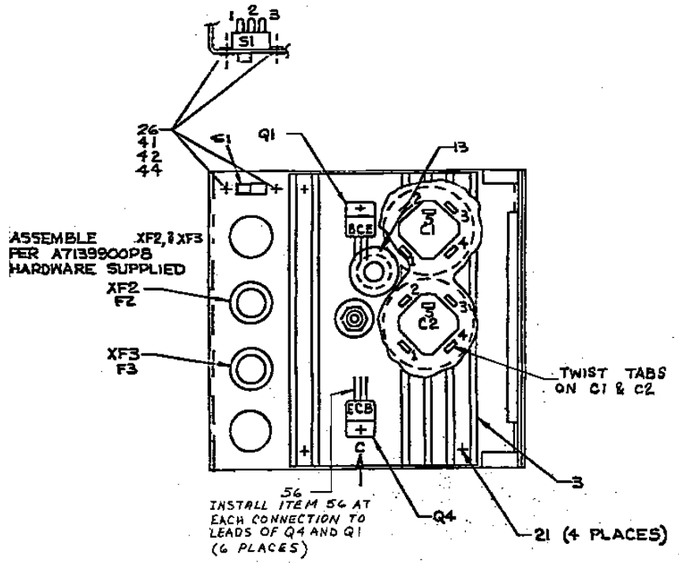
VIEW AT "D"

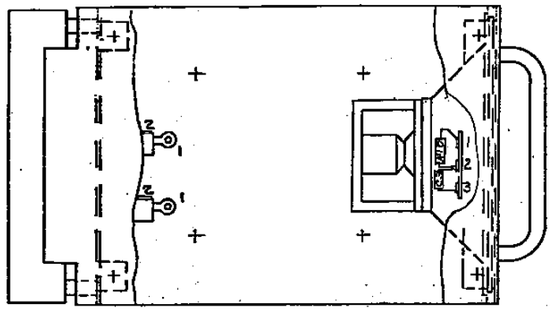
(1) NOTES:
1. SOLDER ALL ELECTRICAL CONNECTIONS.
2. APPLY PER PROCESS P23D-EA100P1.

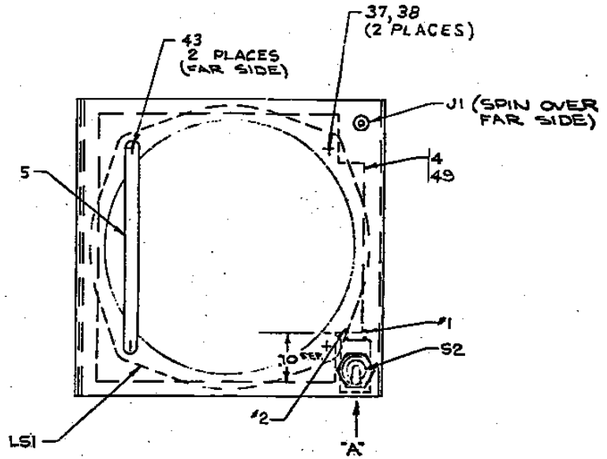
(48) SAME AS PART 1, EXCEPT OMIT NOTE 2.

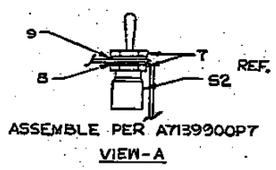
POWER SUPPLY
19D413917G3

(19D413917, Sh. 1, Rev. 19)

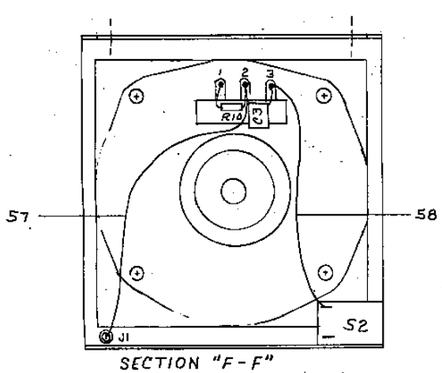




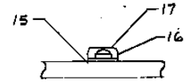




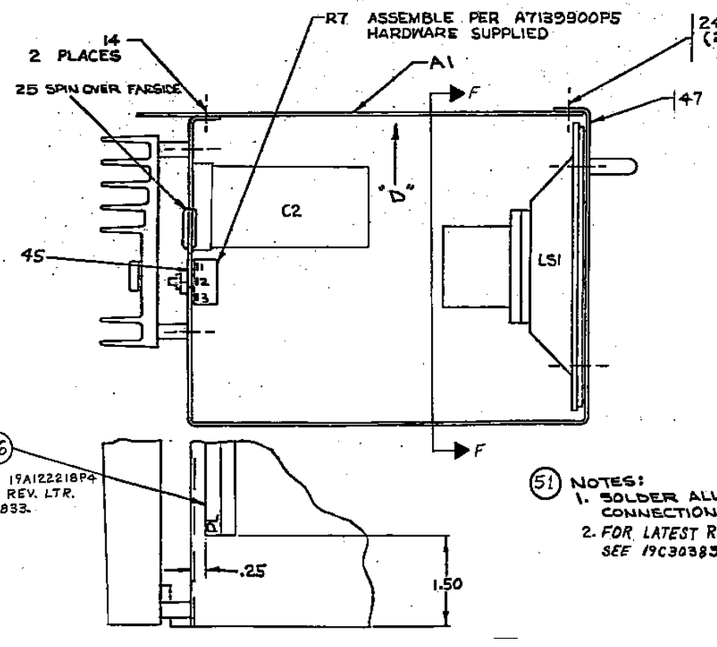
ASSEMBLE PER A7139900P7
VIEW-A

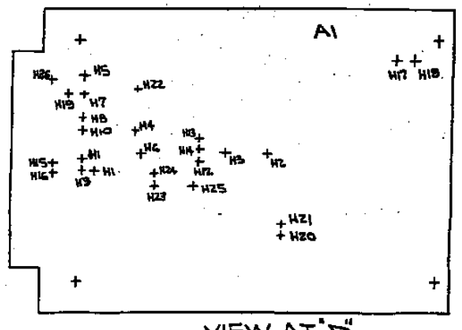


SECTION "F-F"



VIEW "C"
(MTG. FOR Q1 & Q4)



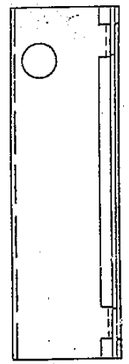


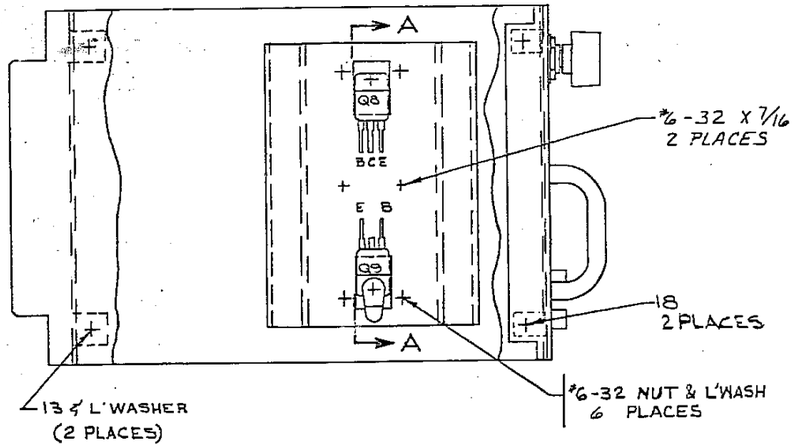
VIEW AT "D"

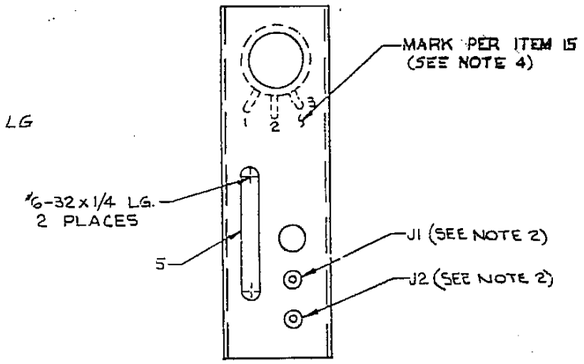
(51) NOTES:
1. SOLDER ALL ELECTRICAL CONNECTIONS.
2. FOR LATEST REV. LTR. SEE 19C303833 SH. 1E

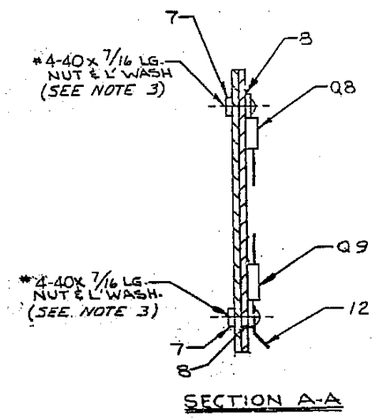
POWER SUPPLY
19D413917G4

(19D413917, Sh. 2, Rev. 19)

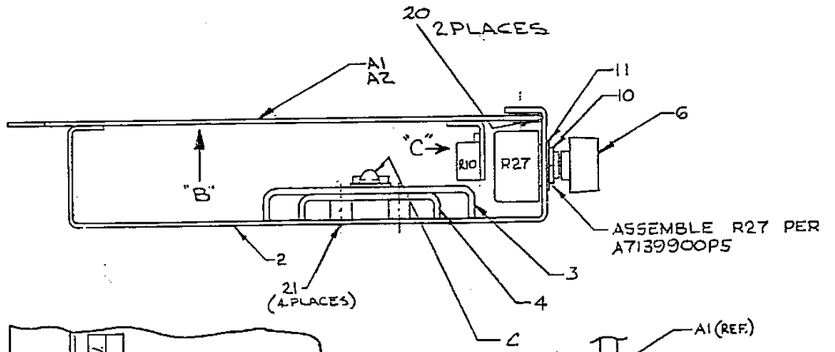


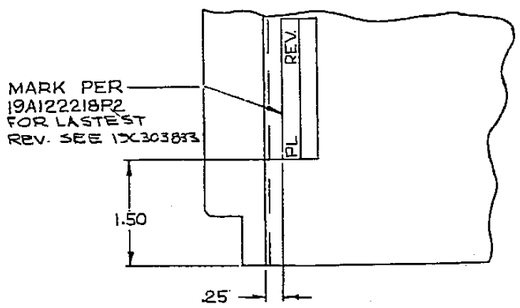


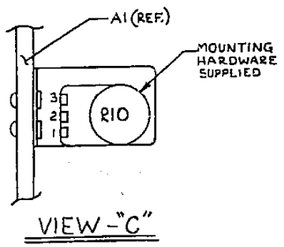




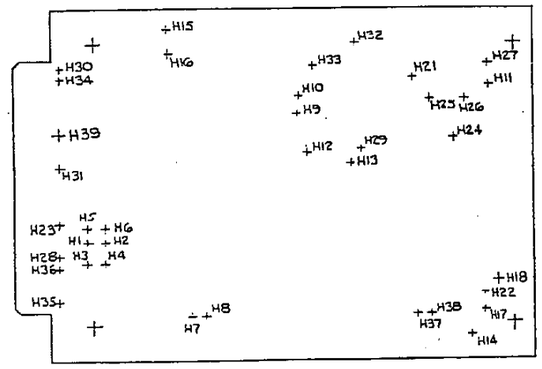
SECTION A-A







VIEW -"C"

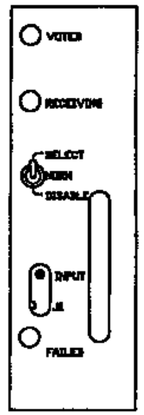


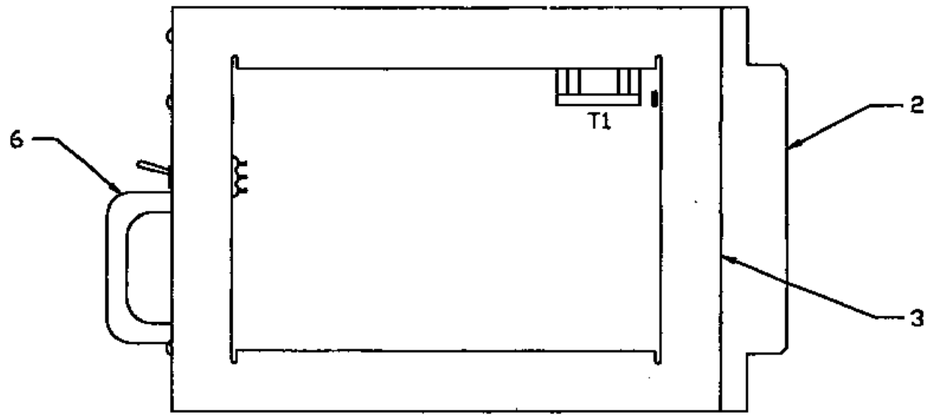
VIEW AT "B"

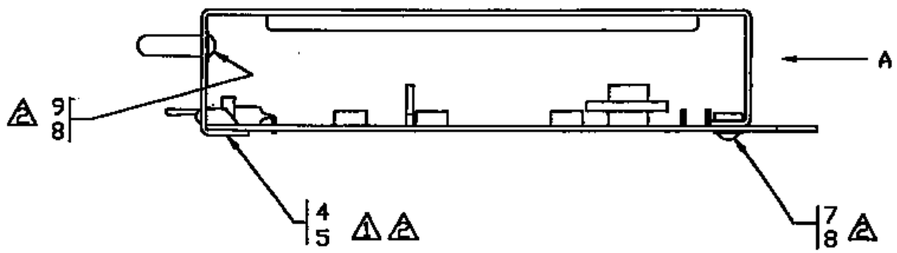
(1) NOTES:
1. SOLDER ALL ELECTRICAL CONNECTIONS
2. SPIN J1 & J2 OVER FAR SIDE.
3. LENGTH IS CRITICAL, LENGTH SPECIFIED TO BE MAX.
4. APPLY PER PROCESS P23D-EA100P1.

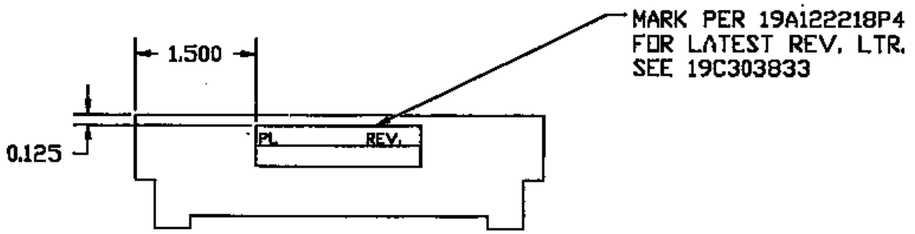
AUDIO MODULE
19D413958G5

(19D413958, Sh. 1, Rev. 16)







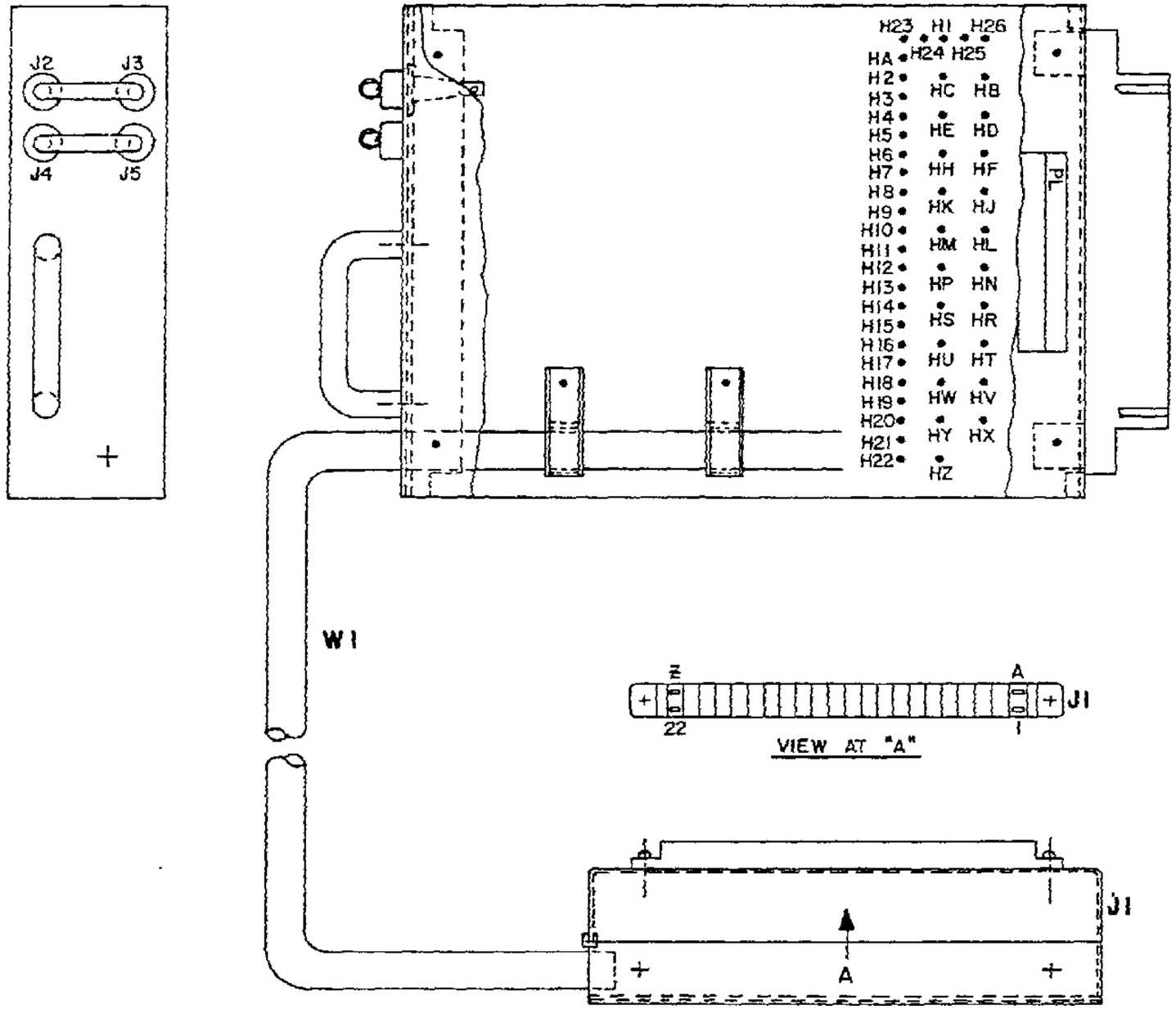


VIEW "A"
PARTIAL END VIEW

(1) NOTES:
1. TIGHTEN SCREWS, ITEM 4, BEFORE ITEM 7.
2. TIGHTEN ALL SCREWS TO 7 IN LBS ± 1 IN LB.

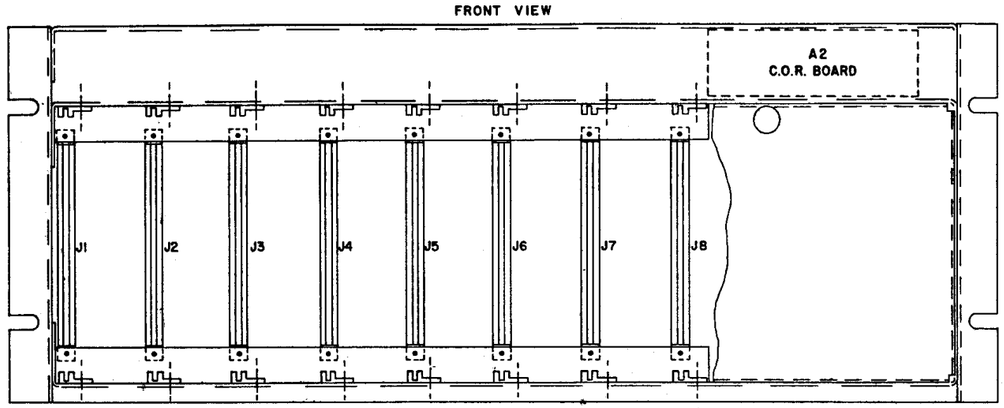
VOTER RECEIVER MODULE
19D903175G1

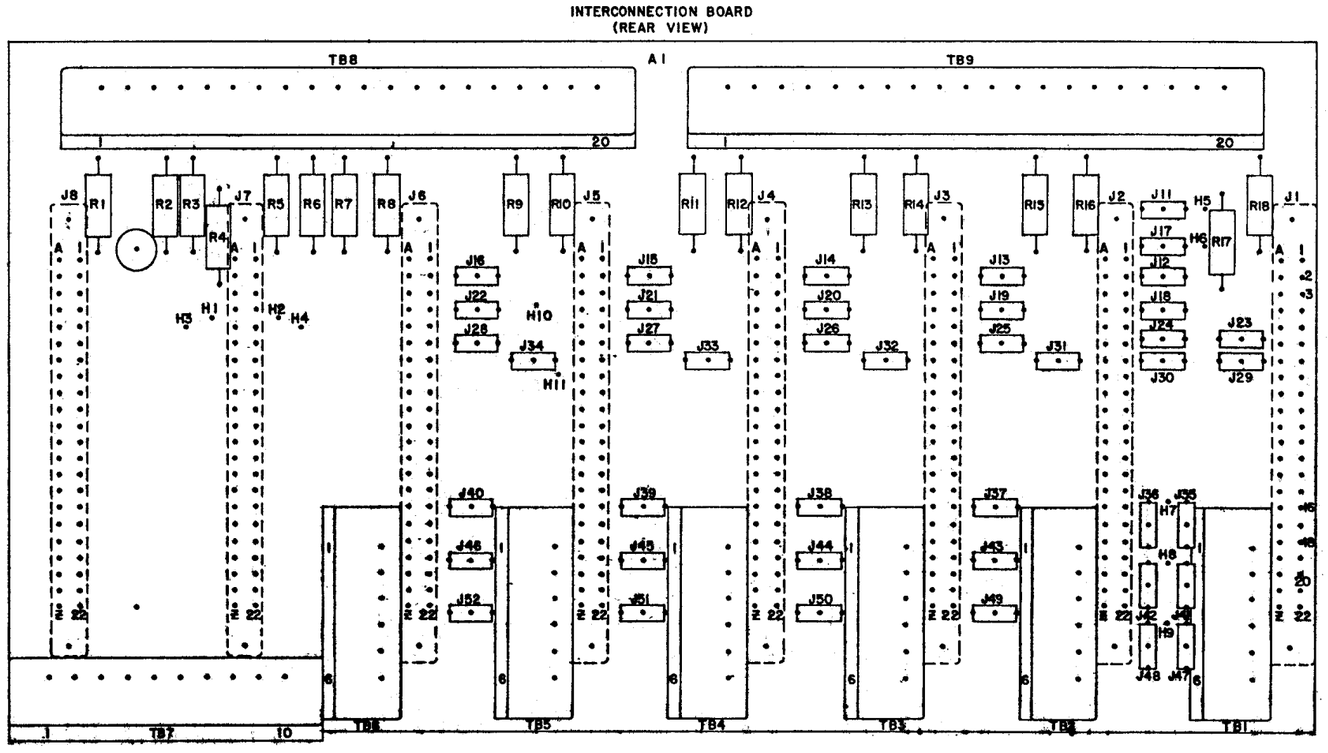
(19D903175, Sh. 1, Rev. 1)



EXTENDER BOARD
19C317762G2

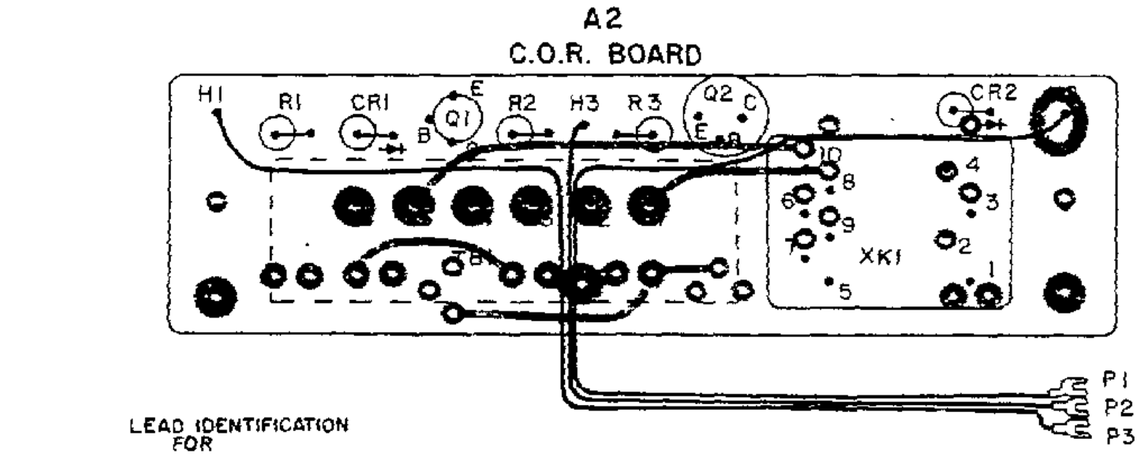
(19C320041, Rev. 0)



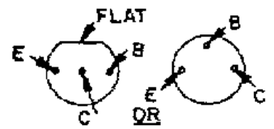


INTERCONNECTION BOARD
19E500936G2

(19E500974, Rev 3)



LEAD IDENTIFICATION FOR

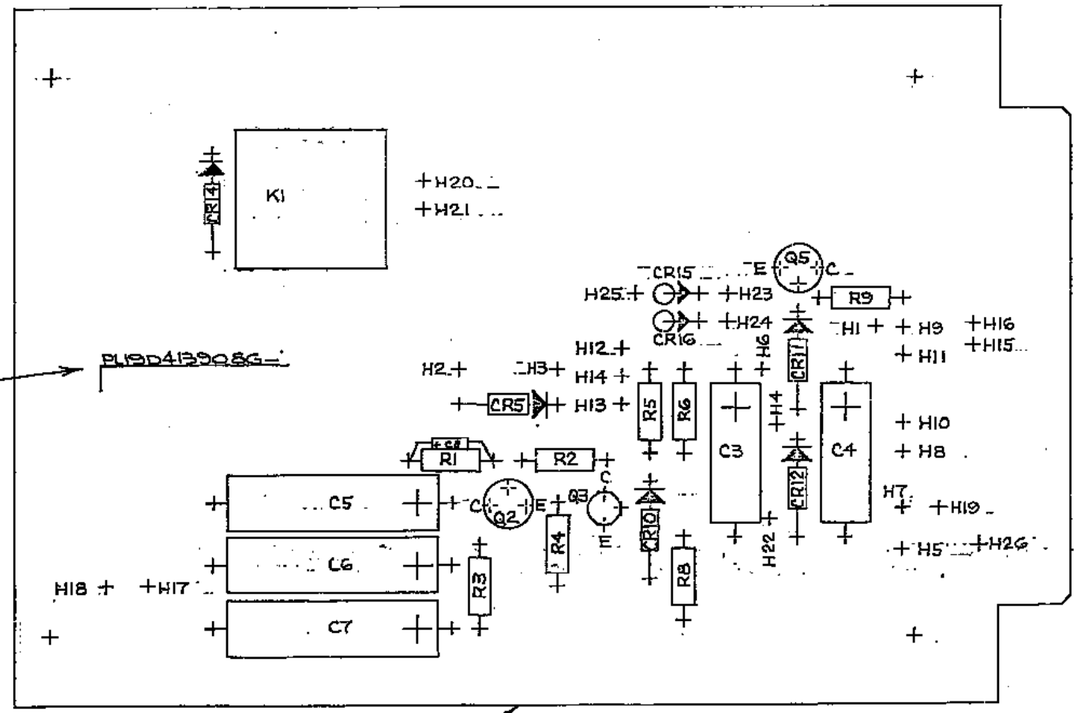


IN-LINE TRIANGULAR
VIEW FROM LEAD END

NOTE: LEAD ARRANGEMENT, AND NOT CASE SHAPE, IS DETERMINING FACTOR FOR LEAD IDENTIFICATION.

C.O.R. BOARD A2
19E500936G2

(19E500974, Rev. 3)



4 MARK AS SHOWN WITH APPLICABLE GR. NO.
CHARACTERS .25 HIGH
COLOR BLACK
PER 19A115744P1
APPLICATION TOL. ±.03

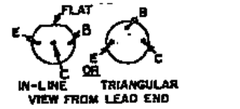
CONNECTION CHART FOR P1

FROM	TO	WIRE
H25	H26	SN22 BR
H19	H20	SN22 BK
H21	H22	SN22 W

6 SAME AS PART 1. EXCEPT USE CONNECTION CHART BELOW

FROM	TO	WIRE
H19	H20	SN22 BK
H21	H22	SN22 W
H15	H16	DB

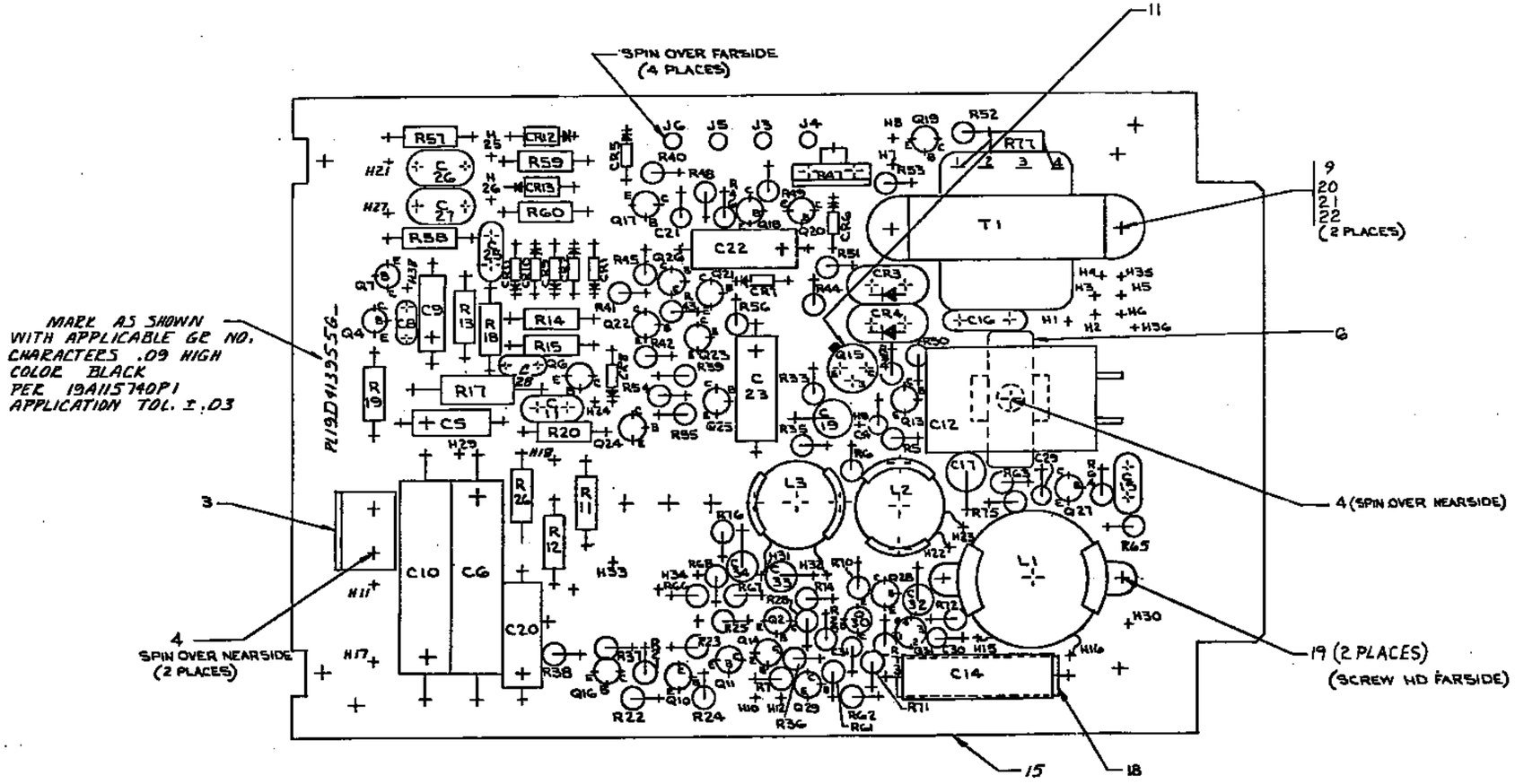
1 NOTES:
1. SOLDER ALL MICROELECTRONIC COMPONENTS.
2. LEAD FORM ALL COMPONENTS AS REQUIRED TO MEET QUALITY STANDARDS, (SEE 19B204900).
3. COMPONENT LEADS TO PROTRUDE .09 MAX. BELOW PT.2.
4. ASM ITEM 3 UNDER Q2 & Q5



NOTE: LEAD ARRANGEMENT, AND NOT CASE SHAPE, IS DETERMINING FACTOR FOR LEAD IDENTIFICATION.

POWER SUPPLY
19D413917G3

19D413908, Rev., Rev. 3)



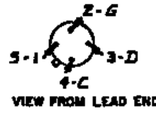
REFER TO WIRING DIAGRAM FOR THE FOLLOWING CONNECTIONS		
FROM	TO	WIRE
T1-1	H7	SF24-BL
T1-4	H8	SF24-O
T1-BK	H4	
T1-O	H3	
T1-BR	H1	
T1-Y	H2	
L1-Y	H16	
L1-BK	H15	
L2-Y	H22	
L2-BK	H23	
L3-Y	H31	
L3-BL	H32	
H33	H34	DA
C12-1	H5	DA
C12-2	H6	DA
R10-1	H11	PART OF 19D413968 ASSEMBLY
R10-2	H9	
R10-3	H10	
H30	H29	SF24-W
J3	J4	SF24-R*
J5	J6	SF24-O*
H21	LET HANG	SF24-WOG
H17		SF24-WBRR
H18		SF24-WOBR
H10		SF24-WOBL
H27		SF24-WBR
H38		SF24-WOBK
H26		SF24-R
H24		SF24-WOR
H25		SF24-WO
H36		SF24-WYR
H35	LET HANG	SF24-WYO

*TERMINATE WITH ITEMS P1 THROUGH P4

(14) NOTES:

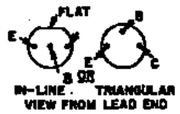
1. SOLDER ALL ELECTRICAL CONNECTIONS.
2. COMPONENT LEADS TO PROTRUDE .09 MAX., BELOW ITEM 2.

LEAD IDENTIFICATION FOR Q34



VIEW FROM LEAD END

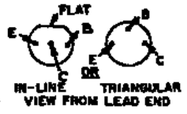
LEAD IDENTIFICATION FOR Q4, Q6, Q7, Q21-Q30



IN-LINE TRIANGULAR
VIEW FROM LEAD END

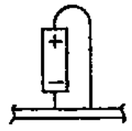
NOTE: LEAD ARRANGEMENT, AND NOT CASE SHAPE, IS DETERMINING FACTOR FOR LEAD IDENTIFICATION.

LEAD IDENTIFICATION FOR Q1, Q10, Q11, Q13-Q26



IN-LINE TRIANGULAR
VIEW FROM LEAD END

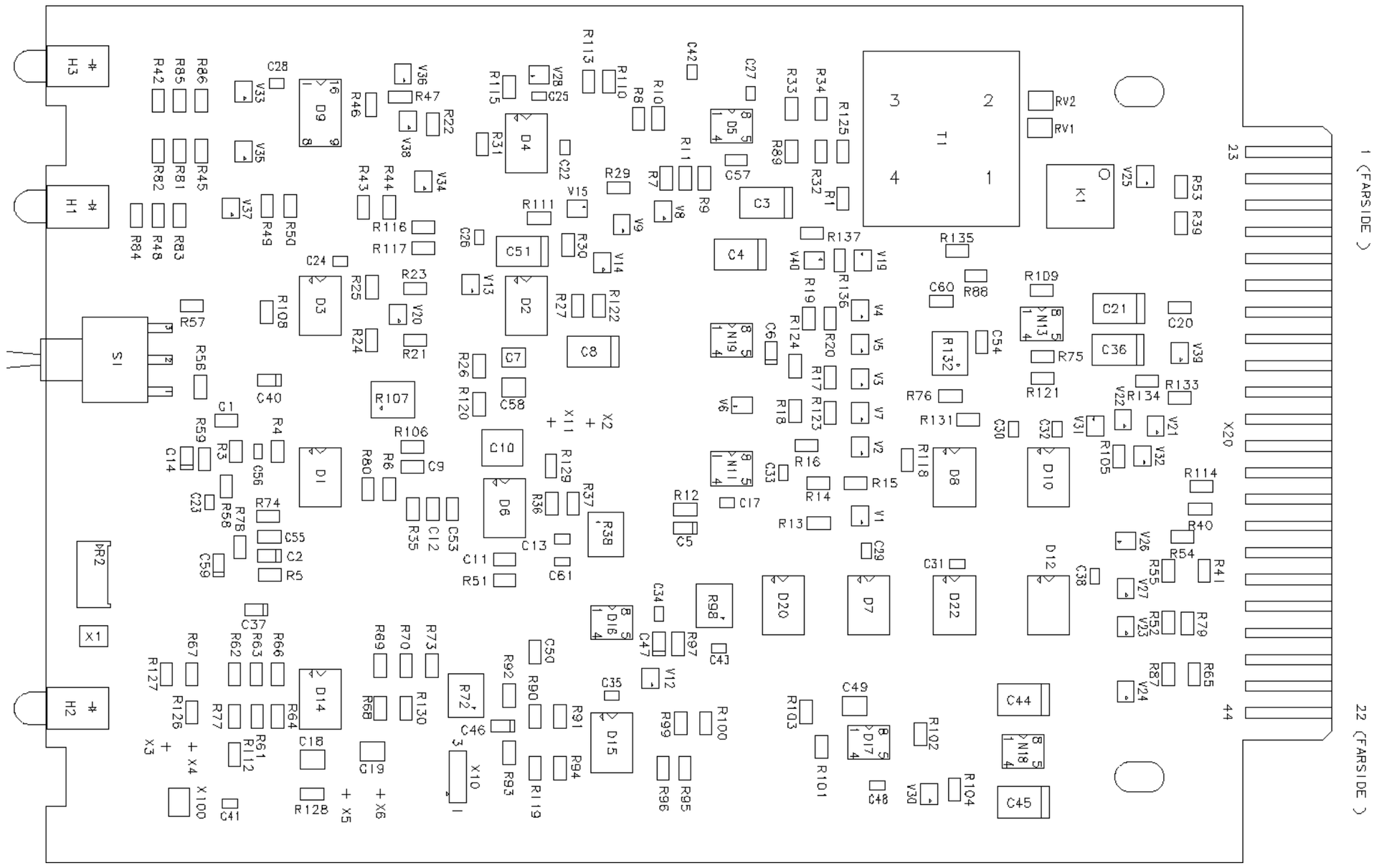
NOTE: LEAD ARRANGEMENT, AND NOT CASE SHAPE, IS DETERMINING FACTOR FOR LEAD IDENTIFICATION.



POLARITY FOR ALL STANDUP CAPICATORS

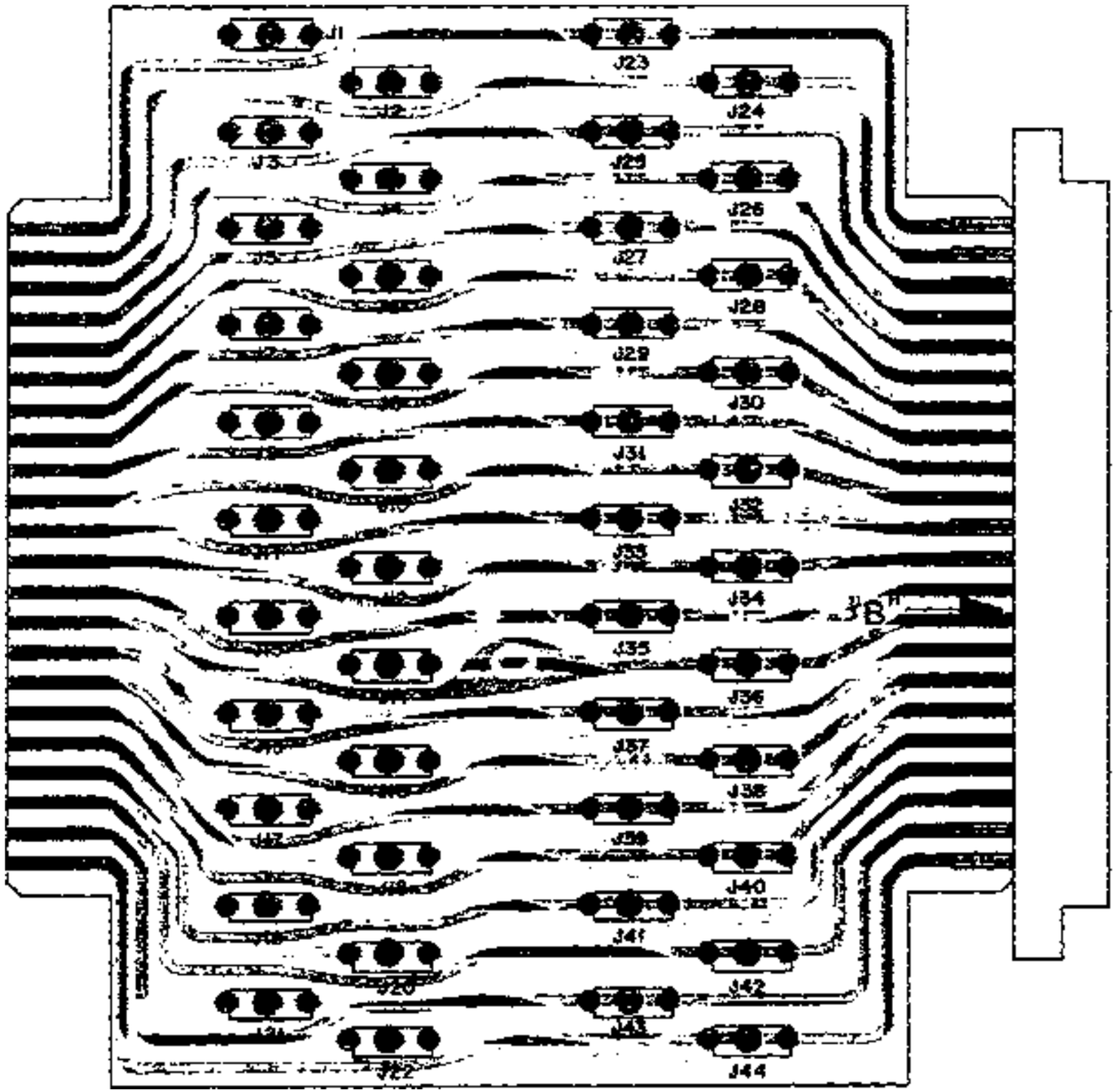
AUDIO MODULE
19D413958G5

(19D413955, Sh.. 2, Rev. 14)



VOTING RECEIVER BOARD
ROA 120 2355/1

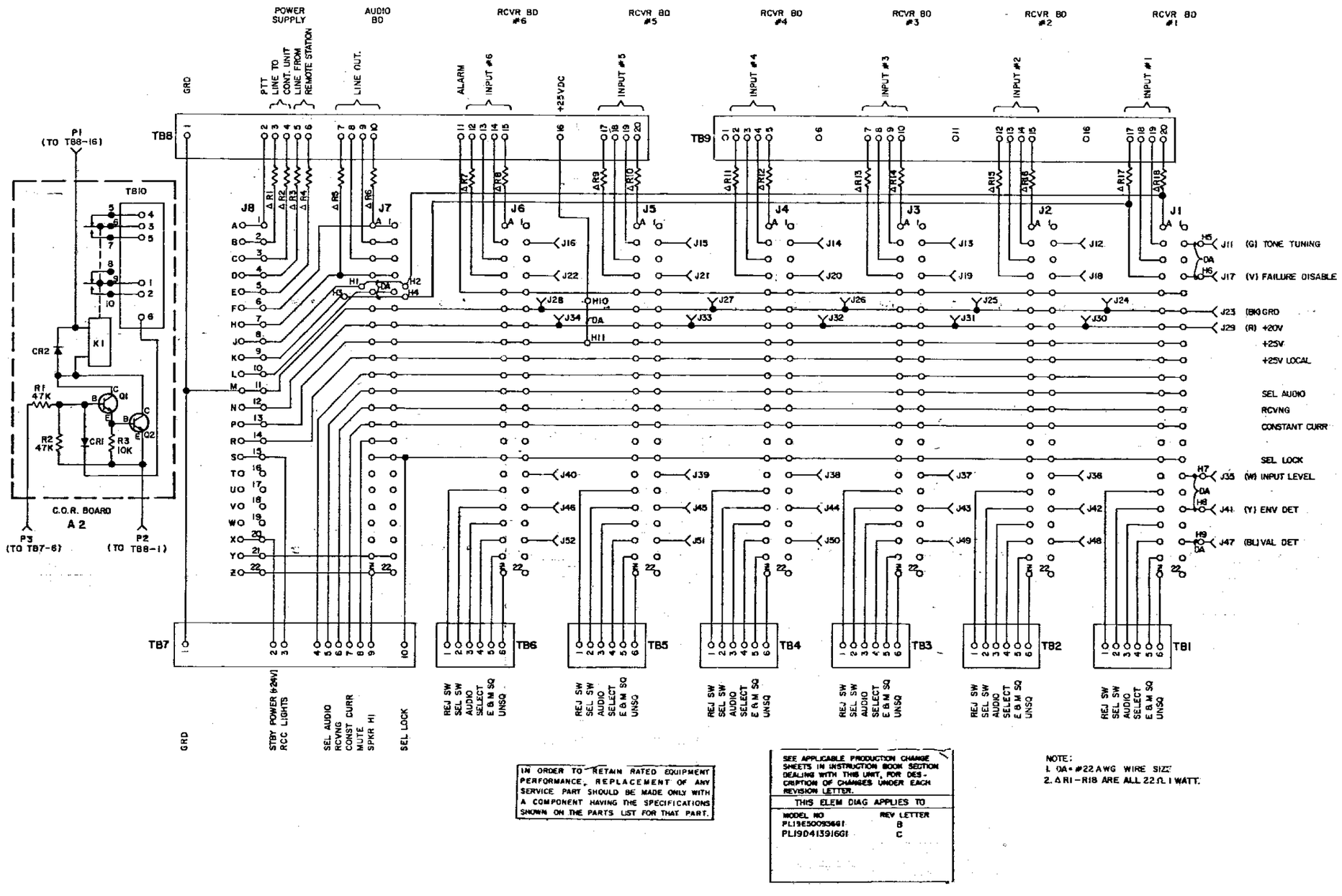
(1078 ROA 120 2355, Sh. 1, Rev. 0)



VIEW AT "B" (REDUCED)

TEST ASSEMBLY
19D416003G1

(19C320040, Rev. 0)



IN ORDER TO RETAIN RATED EQUIPMENT PERFORMANCE, REPLACEMENT OF ANY SERVICE PART SHOULD BE MADE ONLY WITH A COMPONENT HAVING THE SPECIFICATIONS SHOWN ON THE PARTS LIST FOR THAT PART.

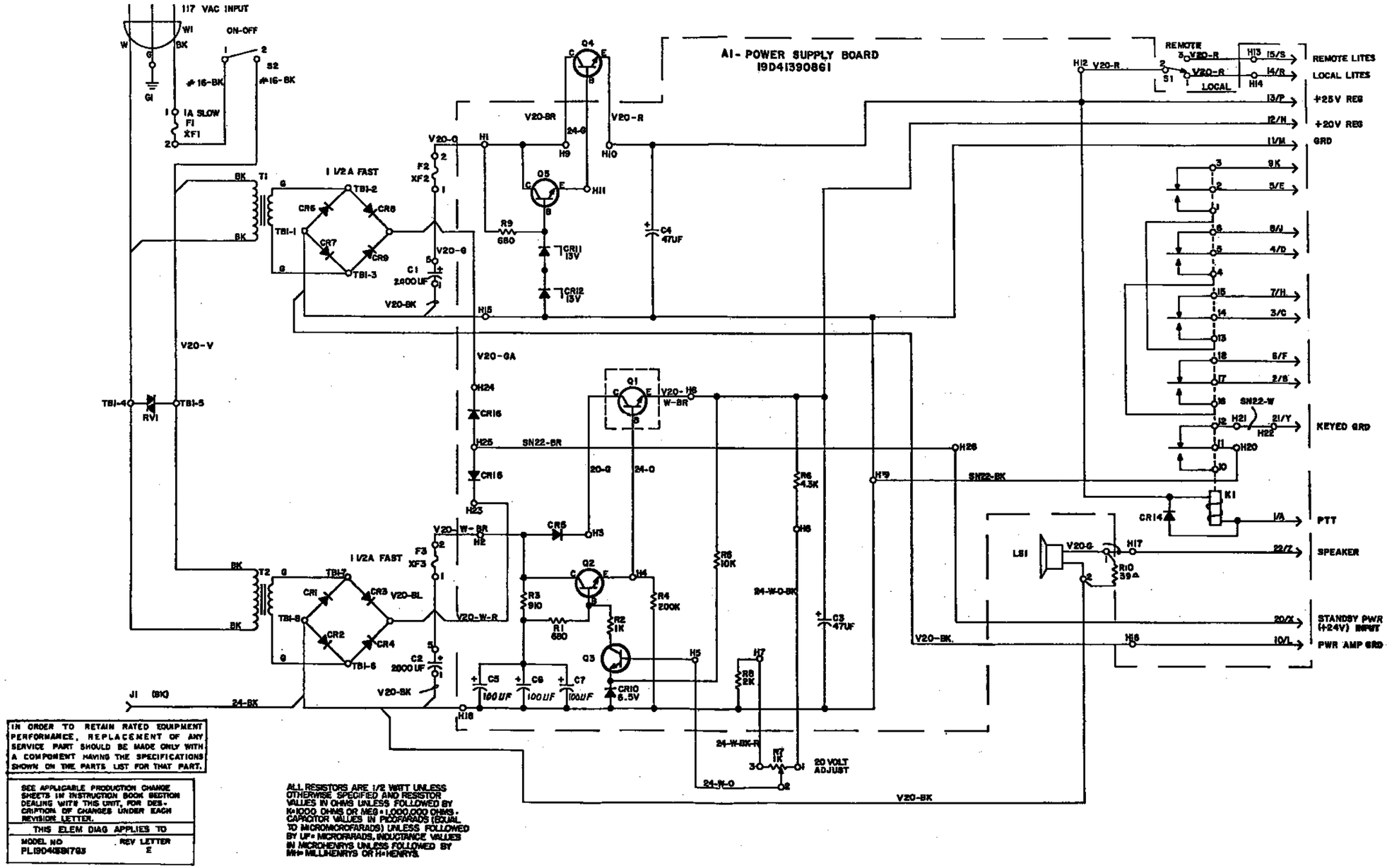
SEE APPLICABLE PRODUCTION CHANGE SHEETS IN INSTRUCTION BOOK SECTION DEALING WITH THIS UNIT, FOR DESCRIPTION OF CHANGES UNDER EACH REVISION LETTER.

THIS ELEM DIAG APPLIES TO	
MODEL NO	REV LETTER
PLI9E500936G1	B
PLI9D413916G1	C

NOTE:
1. 0A = #22 AWG WIRE SIZE.
2. ΔR1–R18 ARE ALL 22Ω 1 WATT.

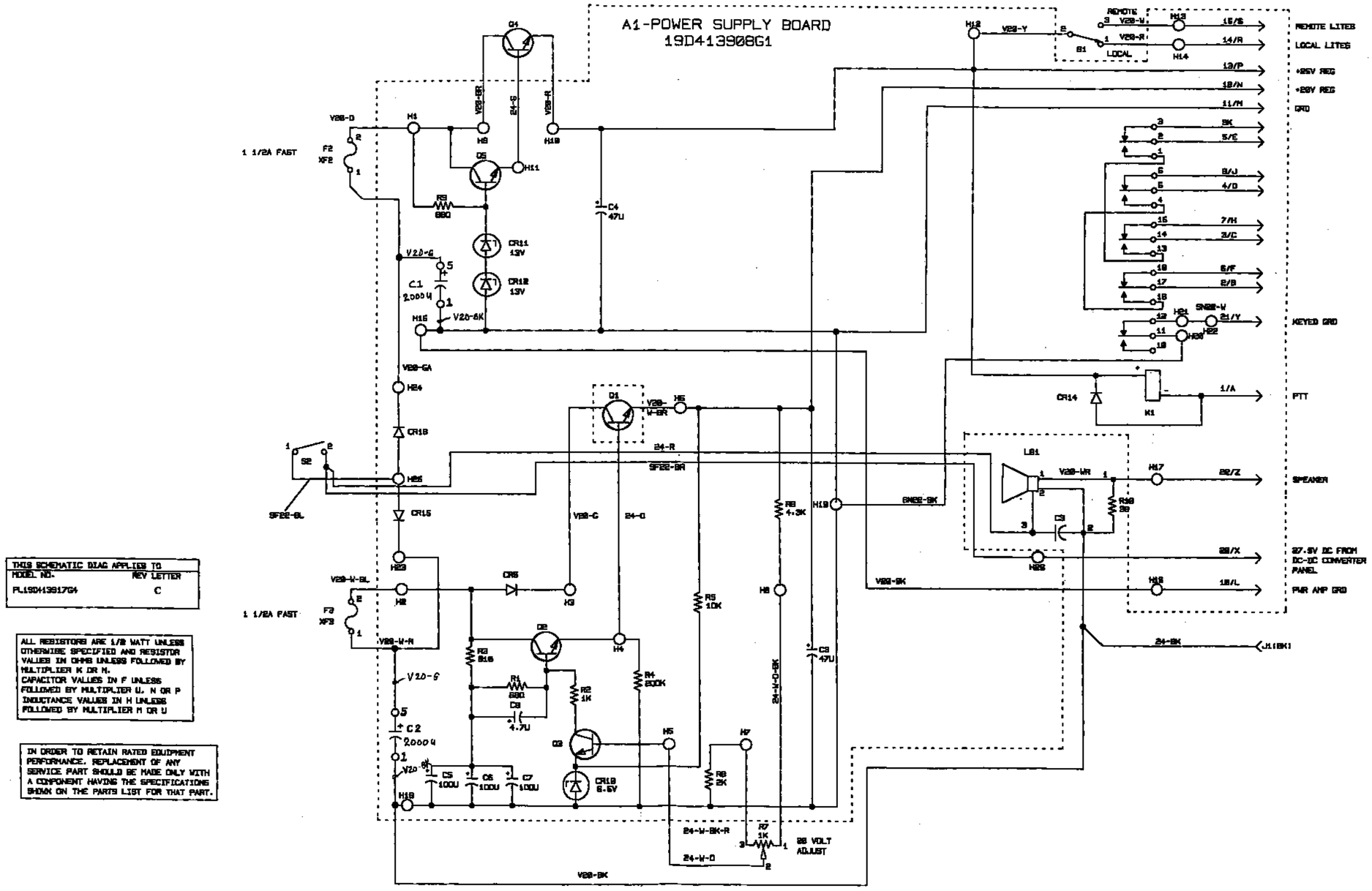
INTERCONNECTION BOARD 19E500936G2

(19D413988, Sh. 1, Rev. 8)



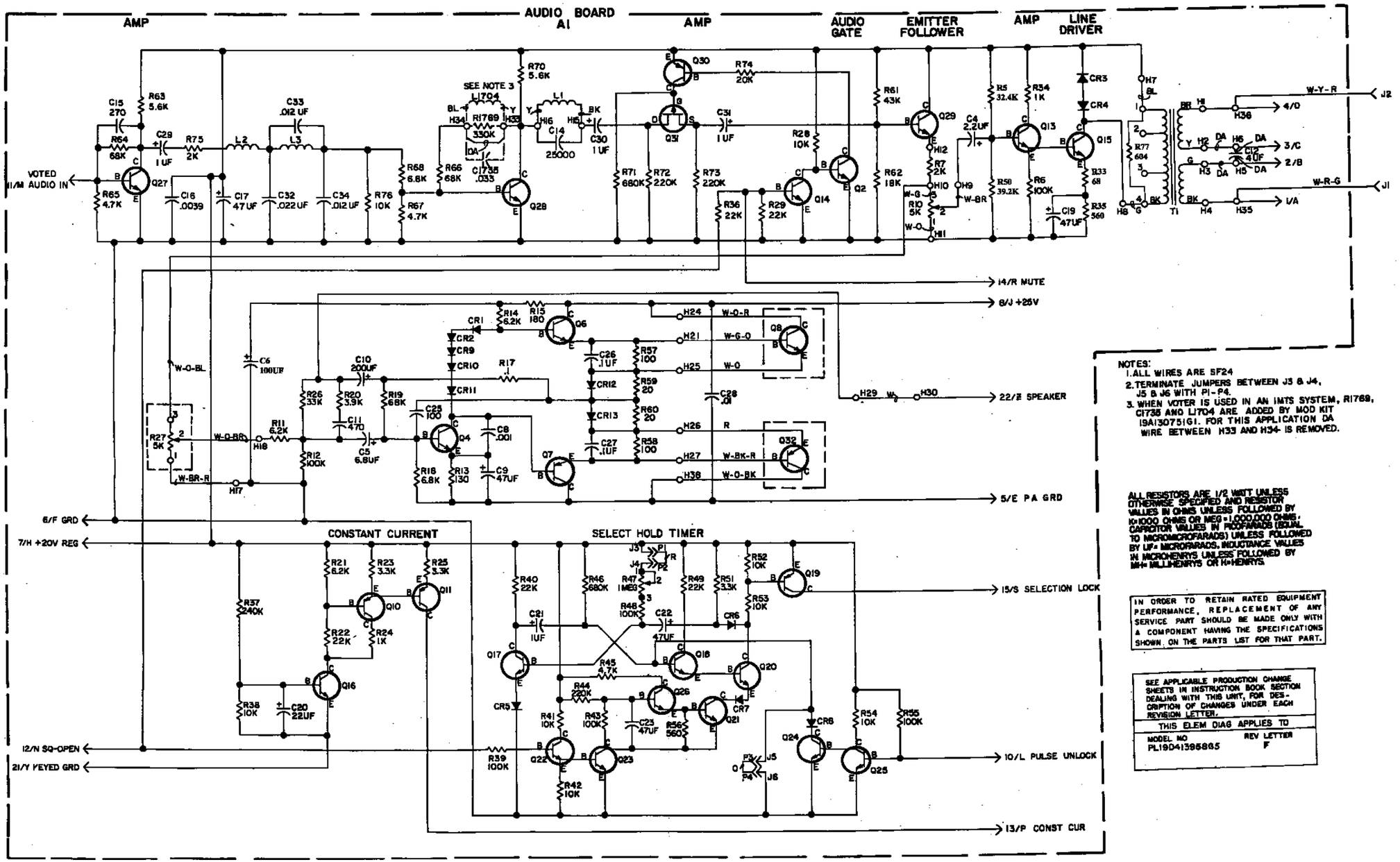
POWER SUPPLY
19D413917G3

(19D413961, Sh. 1, Rev. 11)



POWER SUPPLY
19D413917G4

(19D904125, Sh. 1, Rev. 6)



NOTES:
1. ALL WIRES ARE SF24
2. TERMINATE JUMPERS BETWEEN J3 & J4, J5 & J6 WITH P1-P4.
3. WHEN VOTER IS USED IN AN IMTS SYSTEM, R1789, C1738 AND L1704 ARE ADDED BY MOD KIT 19A130751G1. FOR THIS APPLICATION DA WIRE BETWEEN H33 AND H34 IS REMOVED.

ALL RESISTORS ARE 1/2 WATT UNLESS OTHERWISE SPECIFIED AND RESISTOR VALUES IN OHMS UNLESS FOLLOWED BY K=1000 OHMS OR MEG=1,000,000 OHMS. CAPACITOR VALUES IN MICROFARADS (EQUAL TO MICROMICROFARADS) UNLESS FOLLOWED BY UF= MICROFARADS. INDUCTANCE VALUES IN MICROHENRYS UNLESS FOLLOWED BY MH= MILLIHENRYS OR H=HENRYS.

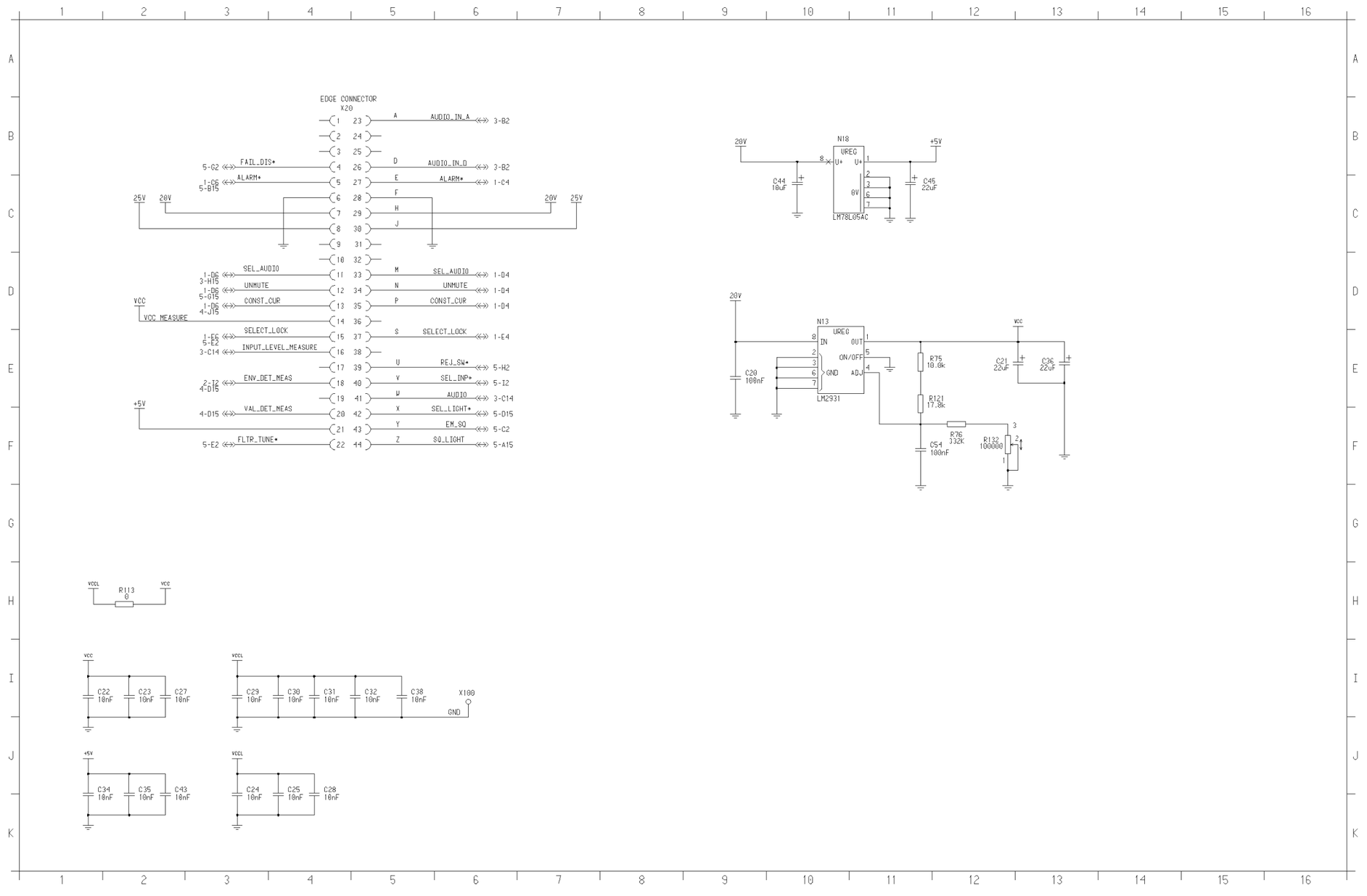
IN ORDER TO RETAIN RATED EQUIPMENT PERFORMANCE, REPLACEMENT OF ANY SERVICE PART SHOULD BE MADE ONLY WITH A COMPONENT HAVING THE SPECIFICATIONS SHOWN ON THE PARTS LIST FOR THAT PART.

SEE APPLICABLE PRODUCTION CHANGE SHEETS IN INSTRUCTION BOOK SECTION DEALING WITH THIS UNIT, FOR DESCRIPTION OF CHANGES UNDER EACH REVISION LETTER.

THIS ELEM DIAG APPLIES TO	
MODEL NO	REV LETTER
PL19D413958G5	F

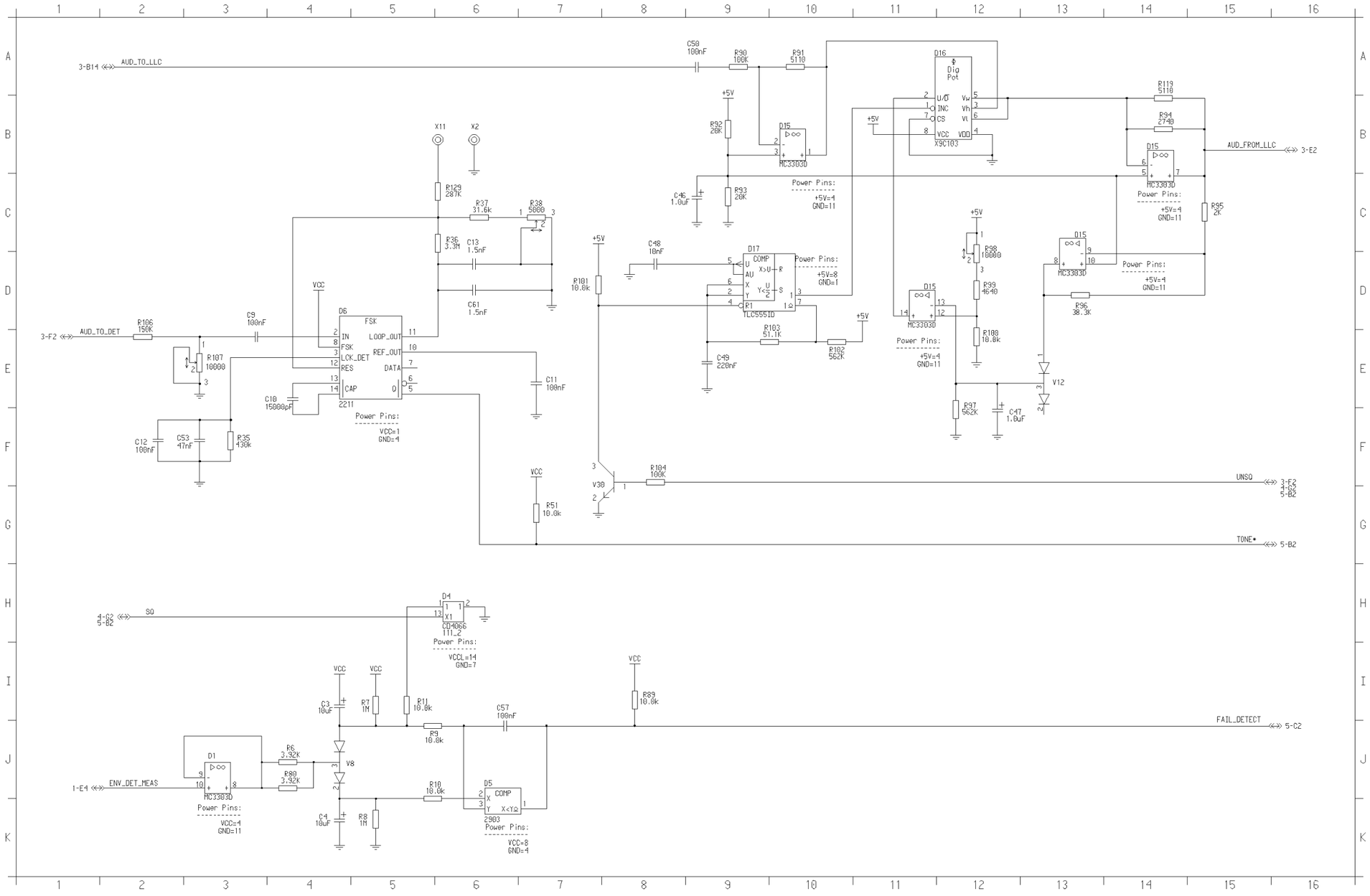
AUDIO MODULE
19D413958G5

(19D423508, Sh. 1, Rev. 7)



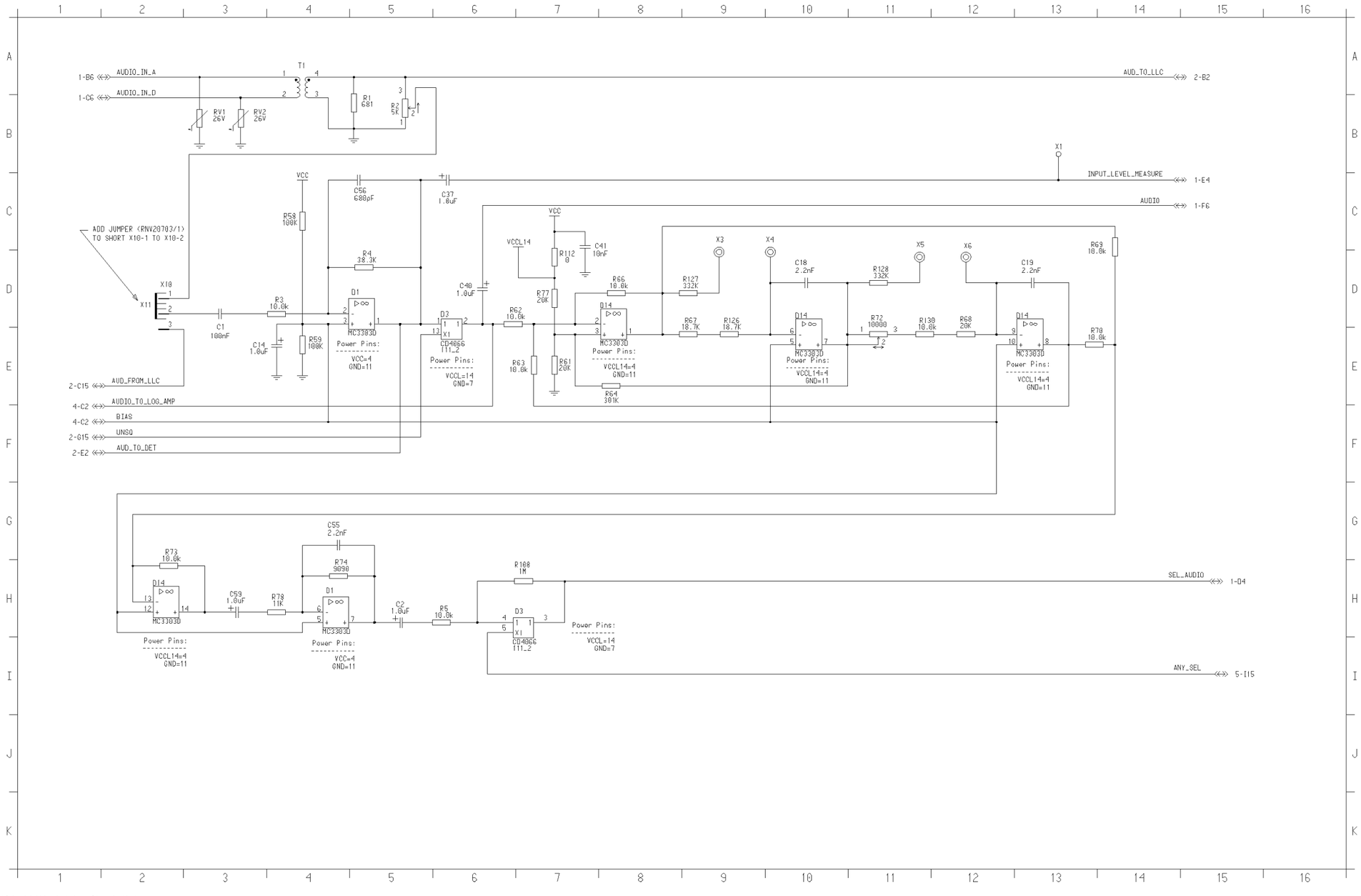
VOTING RECEIVER BOARD
ROA 120 2355/1

(1911-ROA 120 2355, Sh. 1, Rev. A)



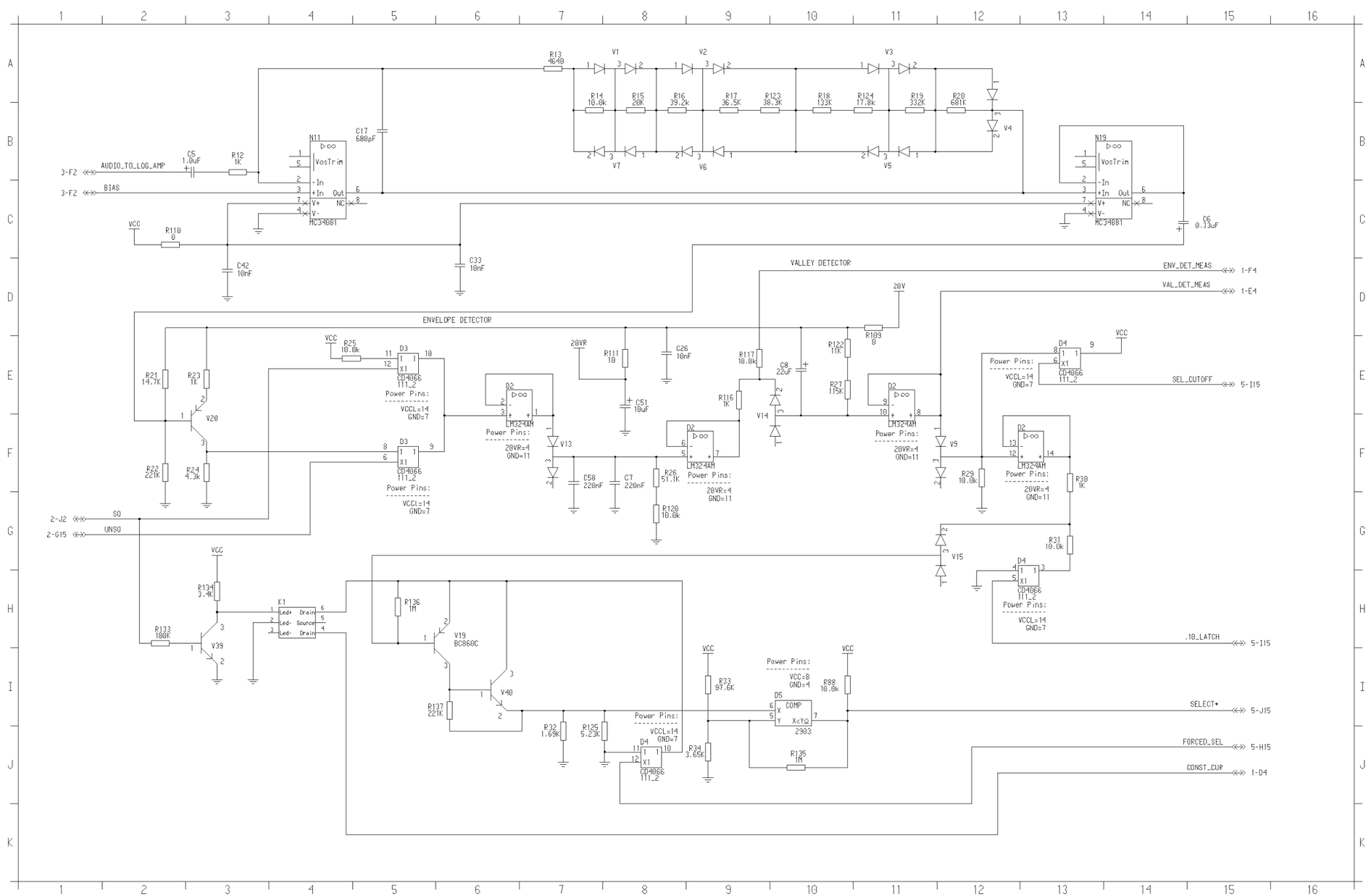
VOTING RECEIVER BOARD
ROA 120 2355/1

(1911-ROA 120 2355, Sh. 2, Rev. A)



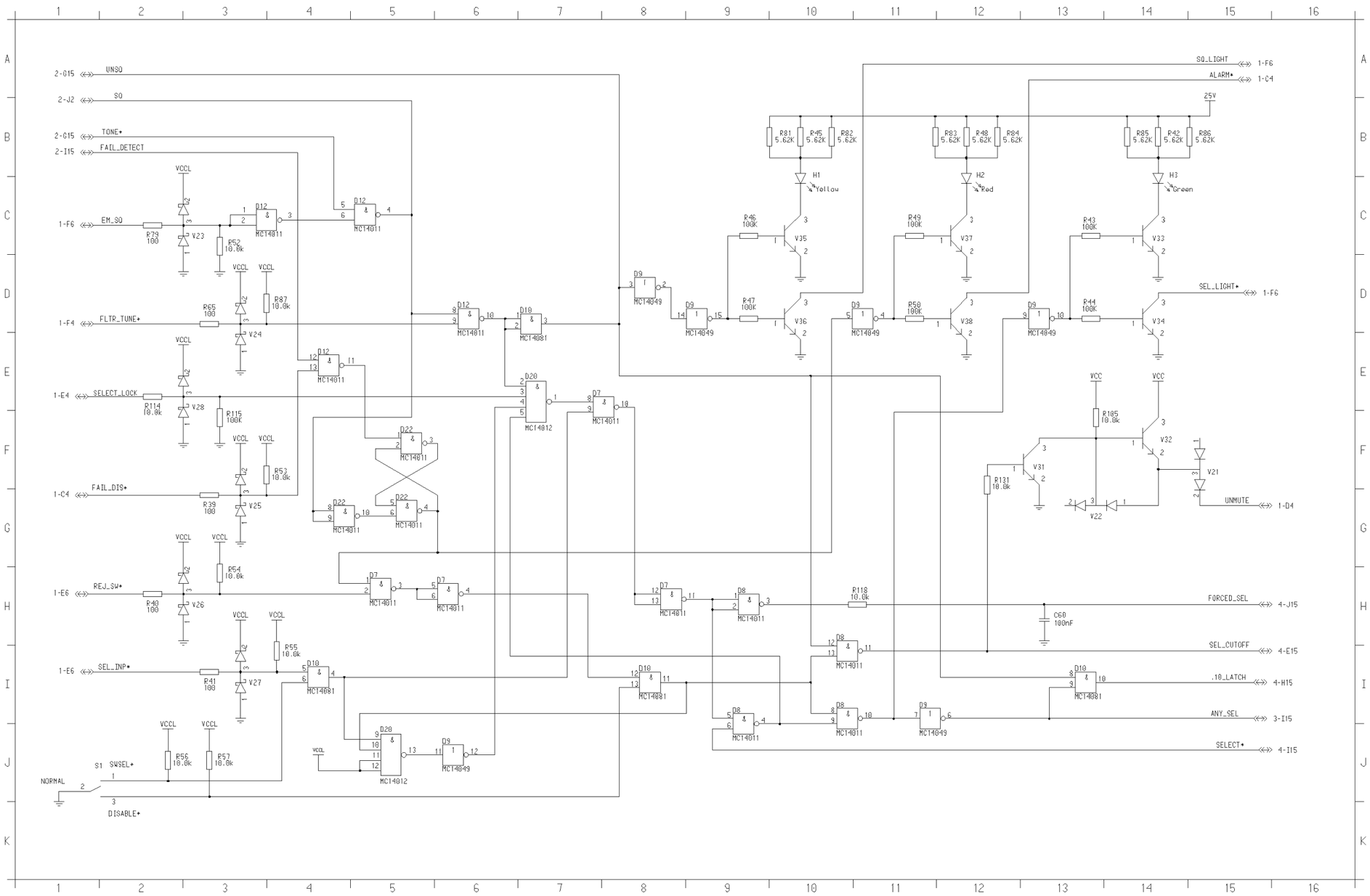
VOTING RECEIVER BOARD
ROA 120 2355/1

(1911-ROA 120 2355, Sh. 3, Rev. A)



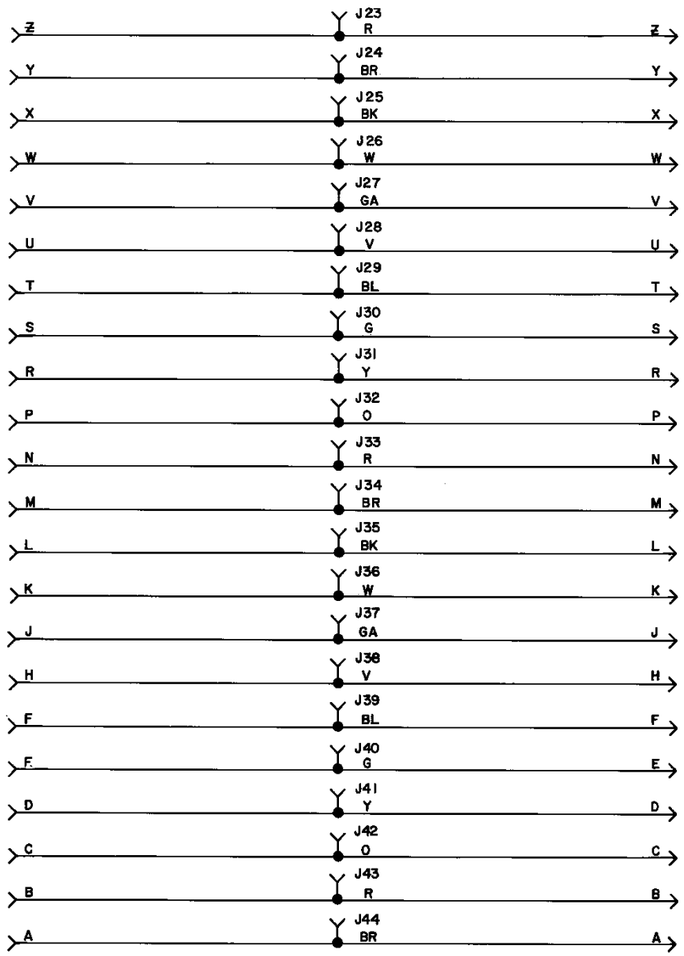
VOTING RECEIVER BOARD
ROA 120 2355/1

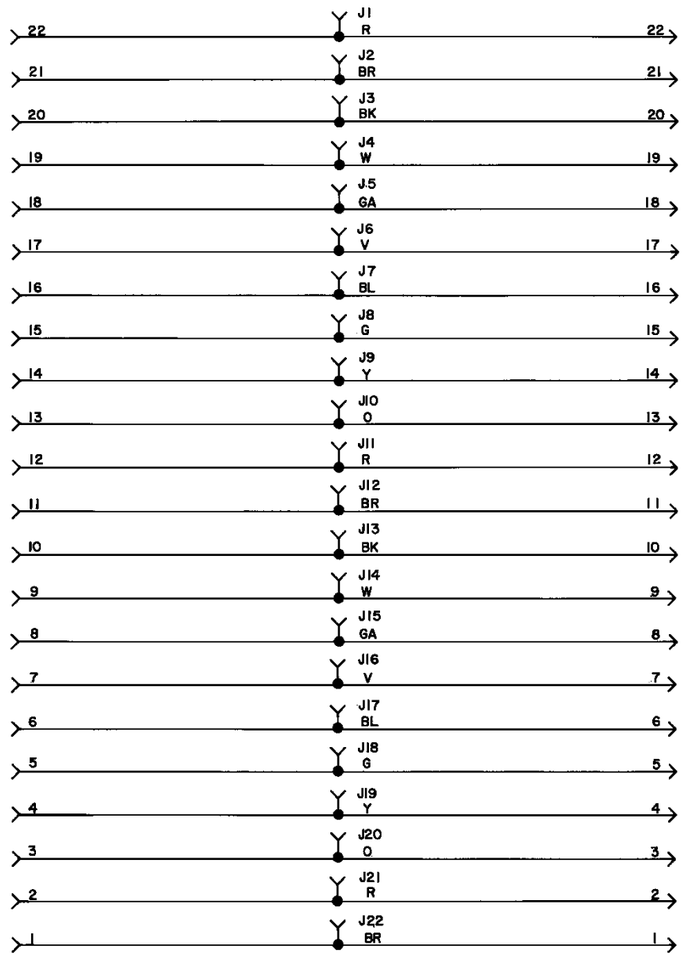
(1911-ROA 120 2355, Sh. 4, Rev. A)



VOTING RECEIVER BOARD
ROA 120 2355/1

(1911-ROA 120 2355, Sh. 5, Rev. A)





IN ORDER TO RETAIN RATED EQUIPMENT PERFORMANCE, REPLACEMENT OF ANY SERVICE PART SHOULD BE MADE ONLY WITH A COMPONENT HAVING THE SPECIFICATIONS SHOWN ON THE PARTS LIST FOR THAT PART.

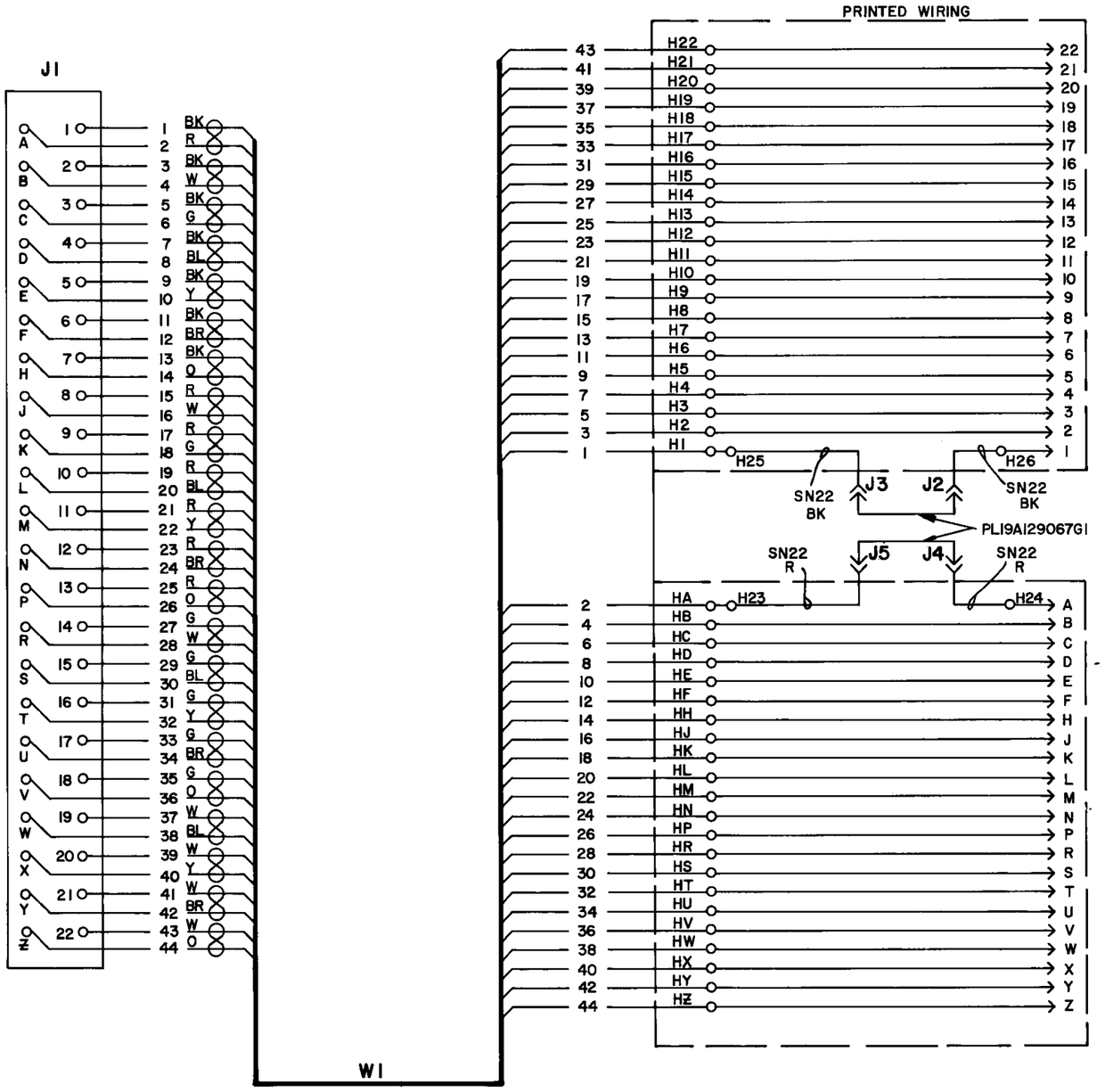
SEE APPLICABLE PRODUCTION CHANGE SHEETS IN INSTRUCTION BOOK SECTION DEALING WITH THIS UNIT, FOR DESCRIPTION OF CHANGES UNDER EACH REVISION LETTER.

THIS ELEM DIAG APPLIES TO

MODEL NO	REV LETTER
PLI9D416003G1	

TEST ASSEMBLY
19D416003G1

19D416011, Sh. 1, Rev. 1)



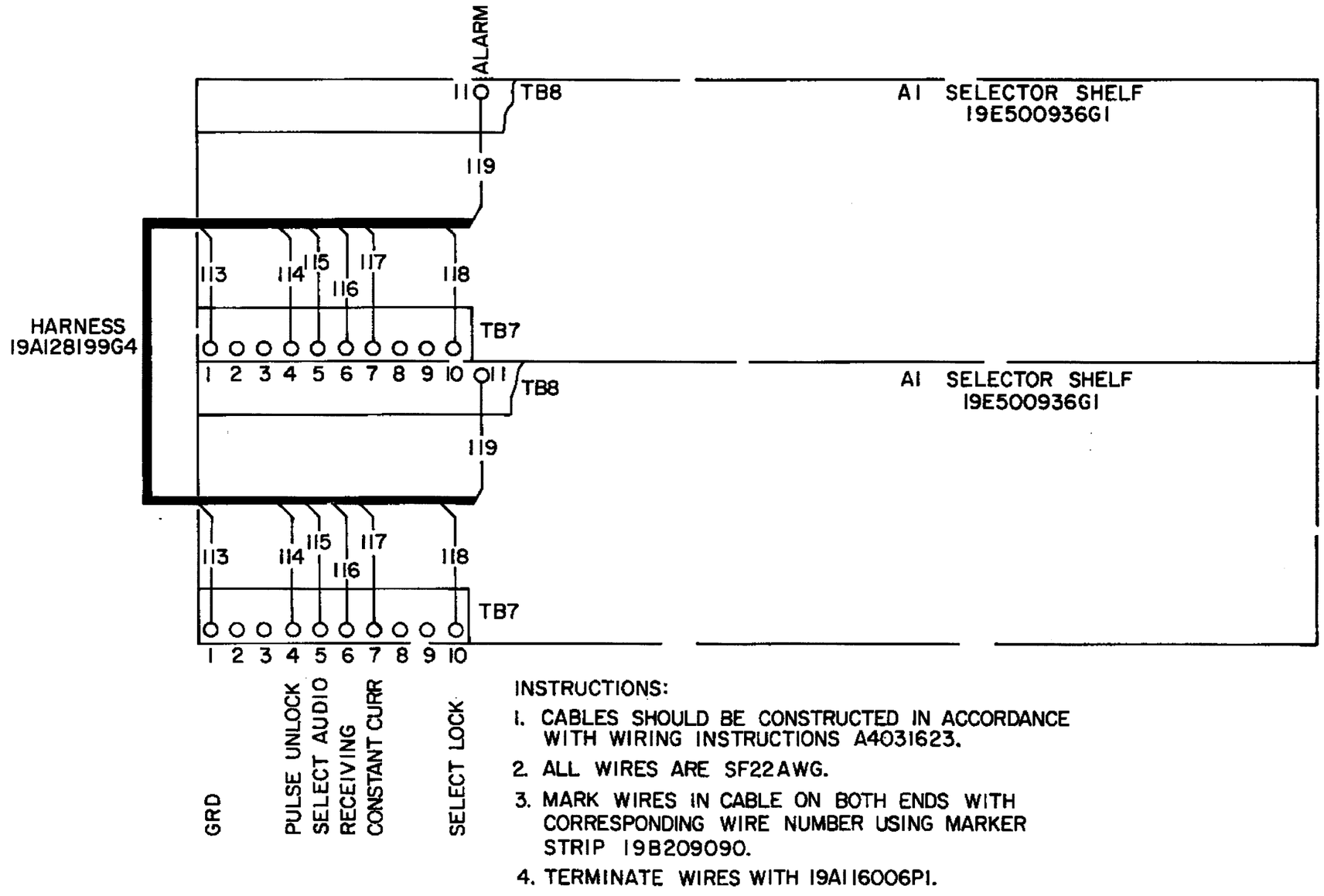
SEE APPLICABLE PRODUCTION CHANGE SHEETS IN INSTRUCTION BOOK SECTION DEALING WITH THIS UNIT, FOR DESCRIPTION OF CHANGES UNDER EACH REVISION LETTER.

THIS ELEM DIAG APPLIES TO

MODEL NO	REV LETTER
PLI9C3I7762GI	

EXTENDER BOARD ASSEMBLY
19C317762G2

(19C317760, Sh. 1, Rev. 1)



INSTRUCTIONS:

1. CABLES SHOULD BE CONSTRUCTED IN ACCORDANCE WITH WIRING INSTRUCTIONS A4031623.
2. ALL WIRES ARE SF22AWG.
3. MARK WIRES IN CABLE ON BOTH ENDS WITH CORRESPONDING WIRE NUMBER USING MARKER STRIP 19B209090.
4. TERMINATE WIRES WITH 19A116006P1.

PARALLELED VOTING SELECTORS

(19B219253, Sh. 1, Rev. 1)

RECEIVER MODULE (EARLIER VERSION) 19D903175G1 ISSUE 1

SYMBOL	PART NO.	DESCRIPTION
		COMPONENT BOARD 19D903174G1
		- - - - - - - - - - CAPACITORS - - - - - - - - -
C1	19A702052P26	Ceramic: 0.1 uF ±10%, 50 VDCW.
C2	19A705205P2	Tantalum: 1 uF, 16 VDCW; sim to Sprague 293D.
C3 and C4	19A705205P7	Tantalum: 10 uF, 25 VDCW; sim to Sprague 293D.
C5	19A705205P2	Tantalum: 1 uF, 16 VDCW; sim to Sprague 293D.
C6	19A705205P12	Tantalum: .33 uF, 16 VDCW; sim to Sprague 293D.
C7	19A702052P32	Ceramic: 0.220 uF ±10%, 50 VDCW.
C8	19A705205P121	Tantalum: 22 uF ±10%, 20 VDCW; sim to Sprague 293D.
C9	19A702052P26	Ceramic: 0.1 uF ±10%, 50 VDCW.
C10	19A703675P3	Ceramic, temperature compensating: 0.015 uF ±2%, 100 VDCW.
C11 and C12	19A702052P26	Ceramic: 0.1 uF ±10%, 50 VDCW.
C13	19A702061P89	Ceramic: 1500 pF ±5%, 50 VDCW, temp coef 0 ±30 PPM.
C14	19A705205P2	Tantalum: 1 uF, 16 VDCW; sim to Sprague 293D.
C17	19A702052P4	Ceramic: 680 pF ±10%, 50 VDCW.
C18 and C19	19A702061P93	Ceramic: 2200 pF ±5%, 50 VDCW, temp coef 0 ±30 PPM.
C20	19A702052P26	Ceramic: 0.1 uF ±10%, 50 VDCW.
C21	19A705205P121	Tantalum: 22 uF ±10%, 20 VDCW; sim to Sprague 293D.
C22 thru C35	19A702052P14	Ceramic: 0.01 uF ±10%, 50 VDCW.
C36	19A705205P121	Tantalum: 22 uF ±10%, 20 VDCW; sim to Sprague 293D.
C37	19A705205P2	Tantalum: 1 uF, 16 VDCW; sim to Sprague 293D.
C40	19A705205P2	Tantalum: 1 uF, 16 VDCW; sim to Sprague 293D.
C41 thru C43	19A702052P14	Ceramic: 0.01 uF ±10%, 50 VDCW.
C44	19A705205P7	Tantalum: 10 uF, 25 VDCW; sim to Sprague 293D.
C45	19A705205P121	Tantalum: 22 uF ±10%, 20 VDCW; sim to Sprague 293D.
C46 and C47	19A705205P2	Tantalum: 1 uF, 16 VDCW; sim to Sprague 293D.
C48	19A702052P14	Ceramic: 0.01 uF ±10%, 50 VDCW.
C49	19A702052P32	Ceramic: 0.220 uF ±10%, 50 VDCW.
C50	19A702052P26	Ceramic: 0.1 uF ±10%, 50 VDCW.
C51	19A705205P7	Tantalum: 10 uF, 25 VDCW; sim to Sprague 293D.
C53	19A702052P22	Ceramic: 0.047 uF ±10%, 50 VDCW.
C54	19A702052P26	Ceramic: 0.1 uF ±10%, 50 VDCW.
C55	19A702052P7	Ceramic: 2200 pF ±10%, 50 VDCW.
C56	19A702052P4	Ceramic: 680 pF ±10%, 50 VDCW.
C57	19A702052P26	Ceramic: 0.1 uF ±10%, 50 VDCW.
C58	19A702052P32	Ceramic: 0.220 uF ±10%, 50 VDCW.
C59	19A705205P2	Tantalum: 1 uF, 16 VDCW; sim to Sprague 293D.
C60	19A702052P26	Ceramic: 0.1 uF ±10%, 50 VDCW.
C61	19A702061P89	Ceramic: 1500 pF ±5%, 50 VDCW, temp coef 0 ±30 PPM.
D1 thru D9	19A700053P2	- - - - - - - - - - DIODES - - - - - - - - - - Silicon: 2 Diodes in Series; sim to BAV99.
D13 thru D15	19A700053P2	Silicon: 2 Diodes in Series; sim to BAV99.
D21 and D22	19A700053P2	Silicon: 2 Diodes in Series; sim to BAV99.
D23 thru D28	19A705377P4	Silicon, Hot Carrier: sim to HSMS-2802.
DS1	19A149932P2	- - - - - - - - INDICATING DEVICES - - - - - - - - LED: RED, right angle viewing; sim to Dialight 550-5106.
DS2	19A149932P3	LED: GREEN, right angle viewing; sim to Dialight 550-5206.
DS3	19A149932P4	LED: YELLOW, right angle viewing; sim to Dialight 550-5306.
J1	344A3367P1	- - - - - - - - - - JACKS - - - - - - - - - - Test point with orange insulator; sim to Components Corp. TP104-01-03.
J2		Part of printed wiring board.
J3	344A3367P1	Test point with orange insulator; sim to Components Corp. TP104-01-03.
J4	19A704852P2	Connector: 3 Pin Male Header.
P4	19A702104P2	- - - - - - - - - - PLUGS - - - - - - - - - - Connector: Shorting Jumper, Gold Plated. (Housing Color: White).
Q1 and Q2	19A700059P2	- - - - - - - - - - TRANSISTORS - - - - - - - - - Silicon, PNP: sim to MMBT3906, low profile.
Q3 thru Q11	19A700076P2	Silicon, NPN: sim to MMBT3904, low profile.
R1	19B800607P681	- - - - - - - - - - RESISTORS - - - - - - - - - - Metal film: 680 ohms ±5%, 1/8 w.
R2	19A134594P6	Variable: 5K ohms.
R3	19A702931P301	Metal film: 10K ohms ±1%, 200 VDCW, 1/8 w.
R4	19A702931P357	Metal film: 38.3K ohms ±1%, 200 VDCW, 1/8 w.
R5	19A702931P301	Metal film: 10K ohms ±1%, 200 VDCW, 1/8 w.
R6	19B800607P392	Metal film: 3.9K ohms ±5%, 1/8 w.
R7 and R8	19B800607P105	Metal film: 1M ohms ±5%, 1/8 w.
R9 thru R11	19B800607P103	Metal film: 10K ohms ±5%, 1/8 w.
R12	19A702931P201	Metal film: 1000 ohms ±1%, 200 VDCW, 1/8 w.
R13	19A702931P265	Metal film: 4640 ohms ±1%, 200 VDCW, 1/8 w.
R14	19A702931P301	Metal film: 10K ohms ±1%, 200 VDCW, 1/8 w.
R15	19A702931P330	Metal film: 20K ohms ±1%, 200 VDCW, 1/8 w.
R16	19A702931P358	Metal film: 39.2K ohms ±1%, 200 VDCW, 1/8 w.
R17	19A702931P355	Metal film: 36.5K ohms ±1%, 200 VDCW, 1/8 w.
R18	19A702931P413	Metal film: 133K ohms ±1%, 200 VDCW, 1/8 w.
R19	19A702931P451	Metal film: 332K ohms ±1%, 200 VDCW, 1/8 w.
R20	19A702931P481	Metal film: 681K ohms ±1%, 200 VDCW, 1/8 w.
R21	19A702931P317	Metal film: 14.7K ohms ±1%, 200 VDCW, 1/8 w.
R22	19A702931P451	Metal film: 332K ohms ±1%, 200 VDCW, 1/8 w.
R23	19A702931P201	Metal film: 1000 ohms ±1%, 200 VDCW, 1/8 w.
R24	19A702931P265	Metal film: 4640 ohms ±1%, 200 VDCW, 1/8 w.
R25	19B800607P103	Metal film: 10K ohms ±5%, 1/8 w.
R26	19A702931P369	Metal film: 51.1K ohms ±1%, 200 VDCW, 1/8 w.
R27	19A702931P406	Metal film: 113K ohms ±1%, 200 VDCW, 1/8 w.
R29	19A702931P301	Metal film: 10K ohms ±1%, 200 VDCW, 1/8 w.
R30	19A702931P201	Metal film: 1000 ohms ±1%, 200 VDCW, 1/8 w.
R31	19A702931P301	Metal film: 10K ohms ±1%, 200 VDCW, 1/8 w.
R32	19A702931P222	Metal film: 1650 ohms ±1%, 200 VDCW, 1/8 w.
R33	19A702931P394	Metal film: 93.1K ohms ±1%, 200 VDCW, 1/8 w.
R34	19A702931P253	Metal film: 3480 ohms ±1%, 200 VDCW, 1/8 w.
R35	19A702931P462	Metal film: 432K ohms ±1%, 200 VDCW, 1/8 w.
R36	19B800607P335	Metal film: 3.3M ohms ±5%, 1/8 w.
R37	19A702931P350	Metal film: 32.4K ohms ±1%, 200 VDCW, 1/8 w.
R38	19A116559P102	Variable cermet: 5000 ohms ±20%, 1/2 w; sim to CTS Series 360.
R39 thru R41	19B800607P101	Metal film: 100 ohms ±5%, 1/8 w.
R42	19B800607P562	Metal film: 5.6K ohms ±5%, 1/8 w.
R43 and R44	19B800607P104	Metal film: 100K ohms ±5%, 1/8 w.
R45	19B800607P562	Metal film: 5.6K ohms ±5%, 1/8 w.
R46 and R47	19B800607P104	Metal film: 100K ohms ±5%, 1/8 w.
R48	19B800607P562	Metal film: 5.6K ohms ±5%, 1/8 w.
R49 and R50	19B800607P104	Metal film: 100K ohms ±5%, 1/8 w.
R51 thru R57	19B800607P103	Metal film: 10K ohms ±5%, 1/8 w.
R58 and R59	19A702931P401	Metal film: 100K ohms ±1%, 200 VDCW, 1/8 w.
R61	19A702931P330	Metal film: 20K ohms ±1%, 200 VDCW, 1/8 w.
R62 and R63	19A702931P301	Metal film: 10K ohms ±1%, 200 VDCW, 1/8 w.
R64	19A702931P447	Metal film: 301K ohms ±1%, 200 VDCW, 1/8 w.
R65	19B800607P101	Metal film: 100 ohms ±5%, 1/8 w.
R66	19A702931P301	Metal film: 10K ohms ±1%, 200 VDCW, 1/8 w.
R67	19A702931P327	Metal film: 18.7K ohms ±1%, 200 VDCW, 1/8 w.
R68	19A702931P330	Metal film: 20K ohms ±1%, 200 VDCW, 1/8 w.
R69 and R70	19A702931P301	Metal film: 10K ohms ±1%, 200 VDCW, 1/8 w.
R72	19A116559P102	Variable cermet: 5000 ohms ±20%, 1/2 w; sim to CTS Series 360.
R73	19A702931P301	Metal film: 10K ohms ±1%, 200 VDCW, 1/8 w.
R74	19A702931P293	Metal film: 9090 ohms ±1%, 200 VDCW, 1/8 w.
R75	19A702931P301	Metal film: 10K ohms ±1%, 200 VDCW, 1/8 w.
R76	19A702931P457	Metal film: 383K ohms ±1%, 200 VDCW, 1/8 w.
R77	19A702931P330	Metal film: 20K ohms ±1%, 200 VDCW, 1/8 w.
R78	19A702931P305	Metal film: 11K ohms ±1%, 200 VDCW, 1/8 w.
R79	19B800607P101	Metal film: 100 ohms ±5%, 1/8 w.
R80	19B800607P392	Metal film: 3.9K ohms ±5%, 1/8 w.
R81 thru R86	19B800607P562	Metal film: 5.6K ohms ±5%, 1/8 w.
R87 thru R89	19B800607P103	Metal film: 10K ohms ±5%, 1/8 w.
R90	19A702931P401	Metal film: 100K ohms ±1%, 200 VDCW, 1/8 w.
R91	19A702931P269	Metal film: 5110 ohms ±1%, 200 VDCW, 1/8 w.
R92 and R93	19A702931P330	Metal film: 20K ohms ±1%, 200 VDCW, 1/8 w.
R94	19A702931P243	Metal film: 2740 ohms ±1%, 200 VDCW, 1/8 w.
R95	19A702931P301	Metal film: 10K ohms ±1%, 200 VDCW, 1/8 w.
R96	19A702931P357	Metal film: 38.3K ohms ±1%, 200 VDCW, 1/8 w.
R97	19A702931P473	Metal film: 562K ohms ±1%, 200 VDCW, 1/8 w.
R98	19A116559P102	Variable cermet: 5000 ohms ±20%, 1/2 w; sim to CTS Series 360.
R99 thru R101	19B800607P103	Metal film: 10K ohms ±5%, 1/8 w.
R102	19A702931P473	Metal film: 562K ohms ±1%, 200 VDCW, 1/8 w.
R103	19A702931P369	Metal film: 51.1K ohms ±1%, 200 VDCW, 1/8 w.
R104	19B800607P104	Metal film: 100K ohms ±5%, 1/8 w.
R105	19B800607P103	Metal film: 10K ohms ±5%, 1/8 w.
R106	19A702931P330	Metal film: 20K ohms ±1%, 200 VDCW, 1/8 w.
R107	19A702931P249	Metal film: 3160 ohms ±1%, 200 VDCW, 1/8 w.
R108	19B800607P105	Metal film: 1M ohms ±5%, 1/8 w.
R109 and R110	19B800607P1	Metal film: Jumper.
R111	19B800607P100	Metal film: 10 ohms ±5%, 1/8 w.
R112 and R113	19B800607P1	Metal film: Jumper.
R114	19B800607P103	Metal film: 10K ohms ±5%, 1/8 w.
R115	19B800607P104	Metal film: 100K ohms ±5%, 1/8 w.
R116	19B800607P102	Metal film: 1K ohms ±5%, 1/8 w.
R117 and R118	19B800607P103	Metal film: 10K ohms ±5%, 1/8 w.
R119	19A702931P269	Metal film: 5110 ohms ±1%, 200 VDCW, 1/8 w.
R120	19A702931P301	Metal film: 10K ohms ±1%, 200 VDCW, 1/8 w.
R121	19A702931P325	Metal film: 17.8K ohms ±1%, 200 VDCW, 1/8 w.
R122	19A702931P305	Metal film: 11K ohms ±1%, 200 VDCW, 1/8 w.
R123	19A702931P357	Metal film: 38.3K ohms ±1%, 200 VDCW, 1/8 w.
R124	19A702931P325	Metal film: 17.8K ohms ±1%, 200 VDCW, 1/8 w.
R125	19A702931P273	Metal film: 5620 ohms ±1%, 200 VDCW, 1/8 w.
R126	19A702931P327	Metal film: 18.7K ohms ±1%, 200 VDCW, 1/8 w.
R127 and R128	19A702931P450	Metal film: 324K ohms ±1%, 200 VDCW, 1/8 w.
R129	19A702931P445	Metal film: 287K ohms ±1%, 200 VDCW, 1/8 w.
R130	19A702931P317	Metal film: 14.7K ohms ±1%, 200 VDCW, 1/8 w.
R131	19B800607P103	Metal film: 10K ohms ±5%, 1/8 w.
RV1 and RV2	19A705677P3	- - - - - - - - - - Varistors - - - - - - - - - - Arrester, electrical surge (MOV): sim to Harris V39ZT1.
S1	19A702103P10	- - - - - - - - - - SWITCHES - - - - - - - - - - Toggle switch.
T1	344A3106P1	- - - - - - - - - - TRANSFORMERS - - - - - - - - AF transformer.
U1	19A704883P2	- - - - - - - - INTEGRATED CIRCUITS - - - - - - - Linear: Quad Op Amp; sim to MC3303D.
U2	19A702293P1	Linear: Quad Op Amp; sim to LM324D.
U3 and U4	19A702705P4	Digital: Quad Analog Switch/Multiplexer; sim to 4066BM.
U5	19A704125P3	Linear: Dual Comparator; sim to LM2903D.
U6	344A3302P101	FSK Demodulator/Tone Decoder; sim to EXAR XR-2211.
U7 and U8	19A700029P507	Digital: Quad-2 input NAND gate; sim to 4011BCM.
U9	19A700176P101	Digital: Hex Inverting Buffer/Converter; sim to 4049UBD.
U10	19A700029P547	Digital: Quad-2 input AND gate; sim to 4081BCM.
U11	19A705037P302	Linear: Op Amp; sim to MC34081.
U12	19A700029P507	Digital: Quad-2 input NAND gate; sim to CD4011BCM.

*COMPONENTS ADDED. DELETED OR CHANGED BY PRODUCTION CHANGES

SYMBOL	PART NO.	DESCRIPTION
U13	19A702536P3	Linear: Positive voltage regulator.] sim to LM2931CM.
U14 and U15	19A704883P2	Linear: Quad Op Amp; sim to MC3303D.
U16	19A705180P102	Digitally Controlled Potentiometer: 40 - 10K ohms; sim to X9103S.
U17	19A701865P101	Linear: 555 Timer; sim to NE555D.
U18	19A704971P9	Voltage Regulator: +5 volts; sim to MC78L05ACD.
U19	19A705037P302	Linear: Op Amp; sim to MC34081.
U20	19A700029P508	Digital: Dual-4 input NAND gate; sim to 4012BCM.
		- - - - - - - - - MISCELLANEOUS - - - - - - - - -
3	19D903172G1	Support.
4	N84P13005B6	Machine Screw.
5	7160861P1	Nut, sheet spring: sim to Tinnerman C1996-632-157.
6	19A122682G2	Handle.
7	N80P13005B6	Machine screw, panhead: No. 6-32 x 5/16.
8	N404P13B6	Lockwasher, internal tooth: No. 6.
9	N80P13004B6	Machine screw: No. 6-32 x 1/4.

PRODUCTION CHANGES

REV. A - H RECEIVER MODULE, 19D413994G1
Previously incorporated. (See LBI-4292.)

REV. J RECEIVER MODULE, 19D413994G1
To reduce level of Audio chirp heard when satellite receiver squelches. Changed C17, R8, R9, R85, R89, and Q35. Added R128 and R129. Deleted CR31, CR33, and R84.

REV. K RECEIVER MODULE, 19D413994G1
To improve operation. Added R1, R130, R131, and CR49 through CR54. Changed R12 and R116.

REV. L RECEIVER MODULE, 19D413994G1
To eliminate residual current in off condition of the Select and Receive indicator lights. Relocated R122 from collector of Q30 to anode of CR39 and R123 from collector of Q41 to anode of CR38.

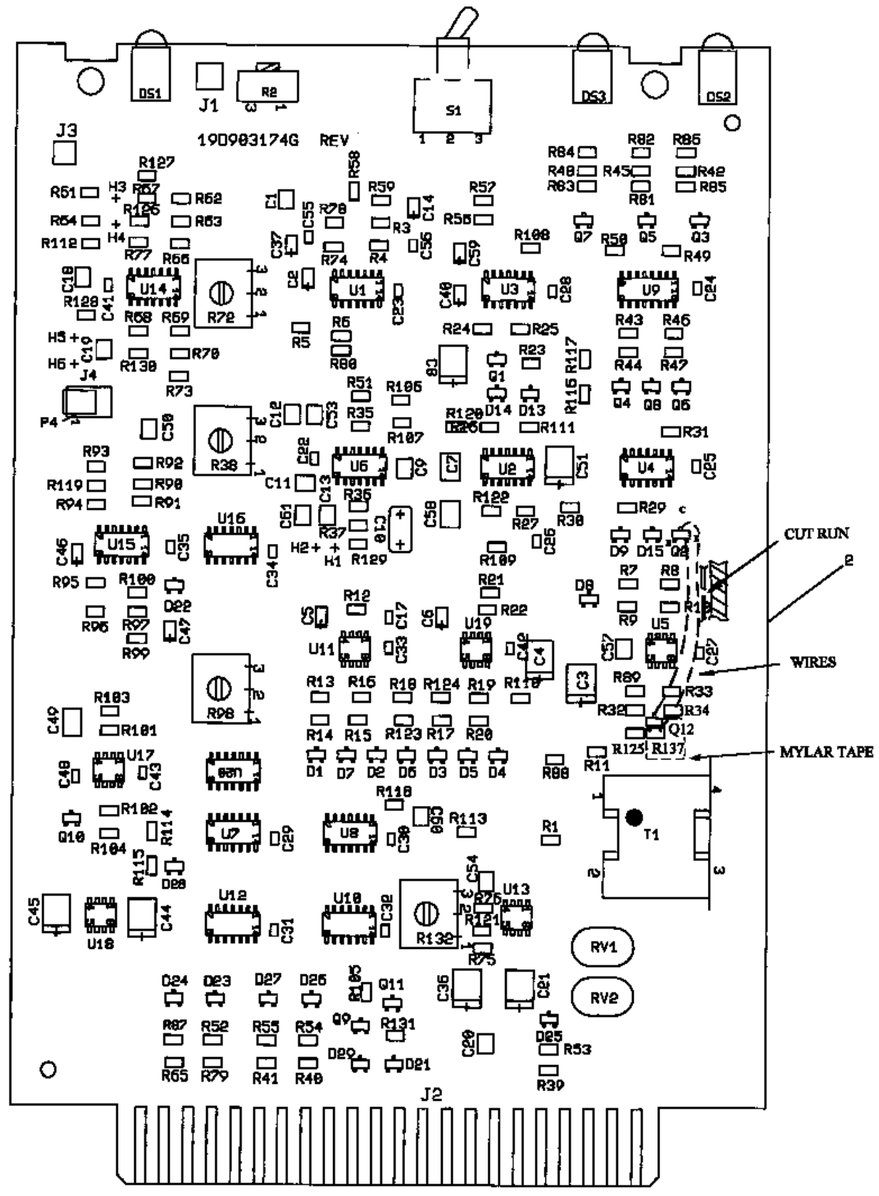
REV. M RECEIVER MODULE, 19D413994G1
To reduce noise occuring on audio line when receiver votes. Changed Q3.

REV. N RECEIVER MODULE, 19D413994G1
Increase voltage rating of C25 to improve safety margin. C25 was 5496267P26; polyester: 0.1 uF ±10%, 50 VDCW.

REV. P RECEIVER MODULE, 19D413994G1
To improve reliability of voter operation. Changed R64 and R119. R64 was: 3R77132J, Composition, 1300 ohms, ±5%, 1/2W.
R119 was: 3R77P511J; Composition, 510 ohms ±5%, 1/2W.

REV. Q RECEIVER MODULE, 19D413994G1
To provide a high frequency roll off to prevent log amp oscillation due to use of higher gain transistors. Added C35.

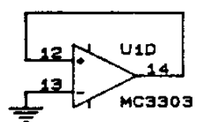
REV. R RECEIVER MODULE, 19D413994G1
To prevent a "no vote" condition when several modules have a good signal and to eliminate oscillation problems. Deleted R131 and C35. Changed R39, R64, and R111. Also added C36 from XDS3-1 and XDS3-2.
C35 was: 19A116192P13 - Ceramic: 1000pF ±10%, 50 VDCW.
R39 was: 19A700113P91 - Composition: 15K ohms ±5%, 1/2 W.
R64 was: 19A700113P71 - Composition: 2.2K ohms ±5%, 1/2 W.
R111 was: 3R77P474J - Composition: 470K ohms ±5%, 1/2 W.
R131 was: 3R152P224J - Composition: 220K ohms ±5%, 1/4 W.



RECEIVER MODULE (Earlier Version)
19D903175G1

(19D903174, Sh. 1, Rev. 5)

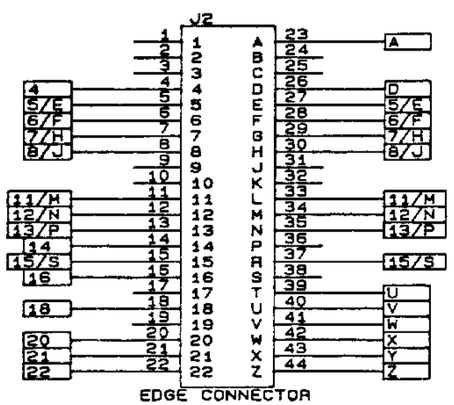
UNUSED GATE



IC	VCC	GND
U1	4	11
U5	8	4
U6	1	4

IC	5V	GND
U15	4	11
U16	13	6
U17	8	1

IC	VCCL	GND
U3	14	7
U4	14	7
U7	14	7
U8	14	7
U9	1	8
U10	14	7
U12	14	7
U20	14	7



MODEL NO.	REV. LETTER
PL19D903175G1	B

NOTES:

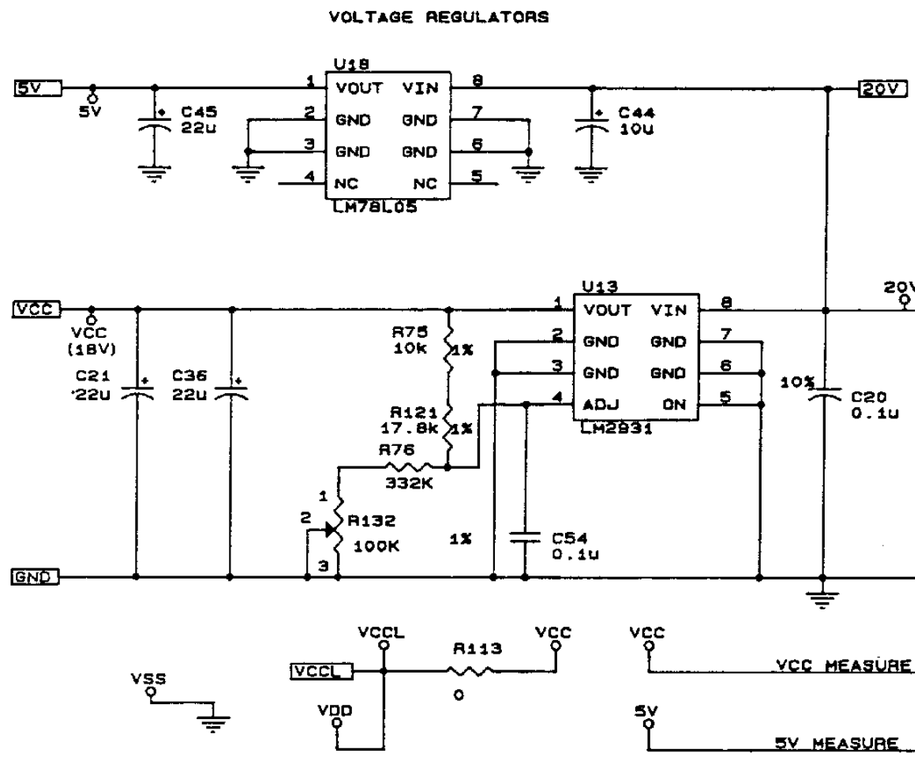
(1.) ALL RESISTORS ARE 1/10 WATT UNLESS OTHERWISE SPECIFIED.

(2.) UNMARKED RESISTORS ARE 5%.
UNMARKED CAPACITORS ARE 20%.

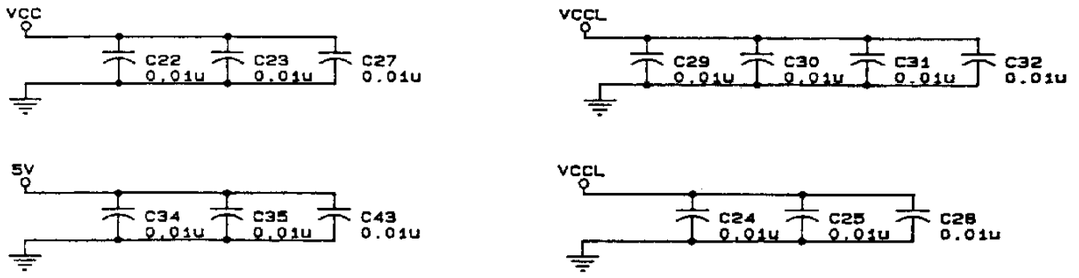
(3.) TO ENABLE LINE LEVEL COMPENSATOR,
CONNECT P4 BETWEEN J4, PINS 2 & 3.
TO DISABLE LINE LEVEL COMPENSATOR,
CONNECT P4 BETWEEN J4 PINS 1 & 2.

(4) TO USE BOARD WITH 2175HZ TONE,
SOLDER WIRE JUMPER BETWEEN H1-H2, H3-H4, H5-H6.

VOLTAGE REGULATORS

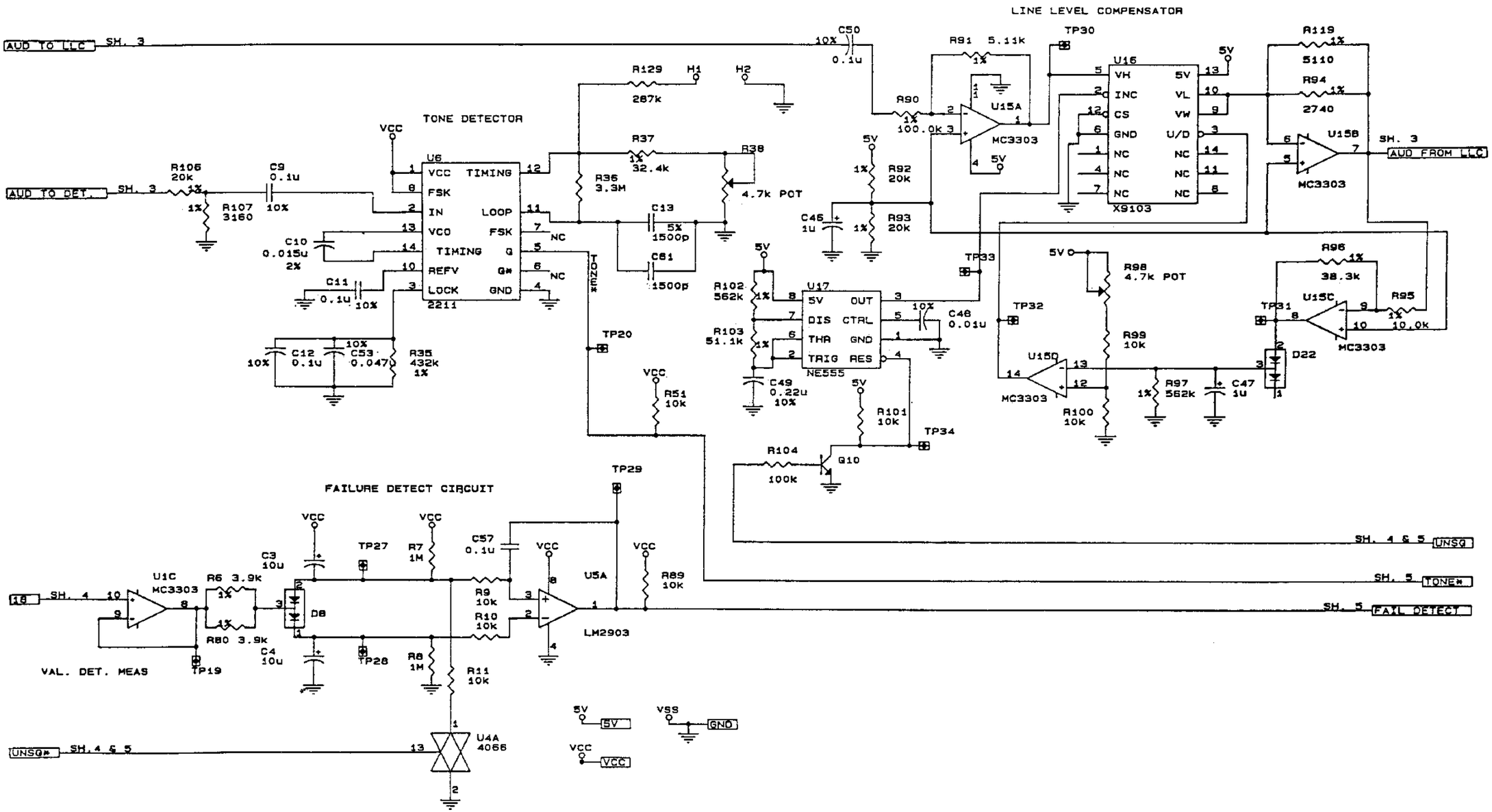


All of these capacitors have a 10% tolerance.



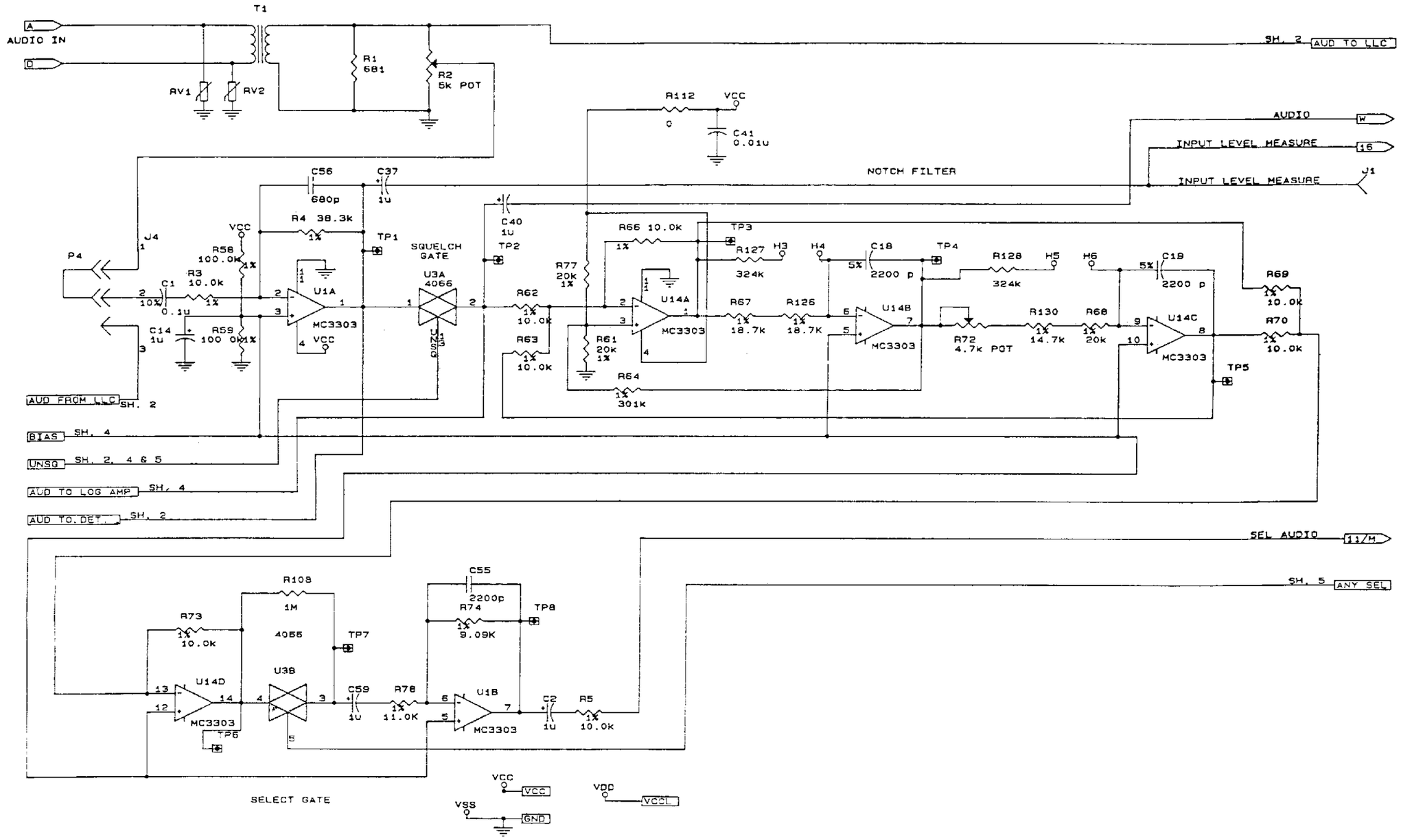
RECEIVER MODULE (Earlier Version)
19D903175G1

(19B235898, Sh. 1, Rev. 2)



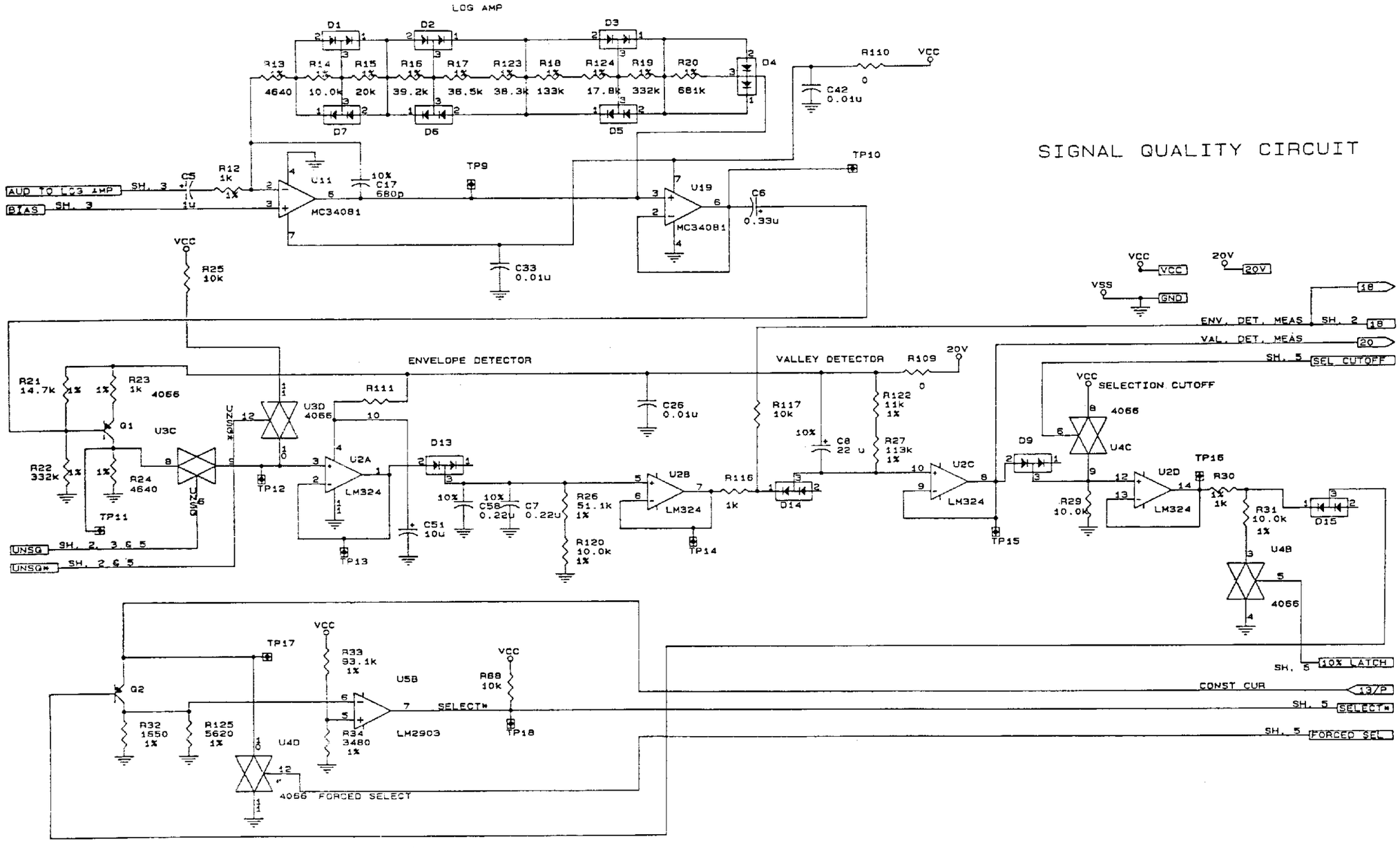
RECEIVER MODULE (Earlier Version)
19D903175G1

(19B235898, Sh. 2, Rev. 0)



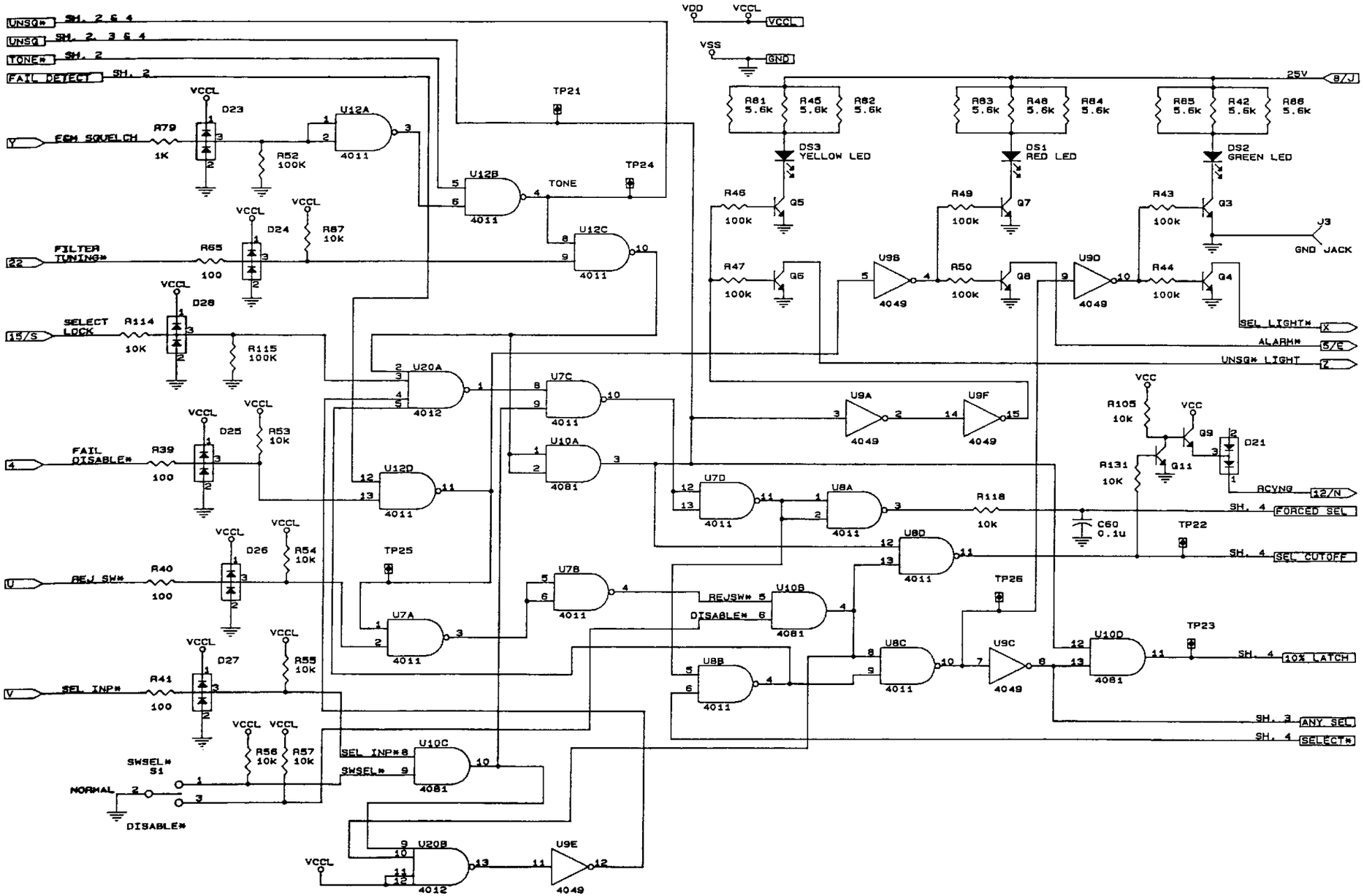
RECEIVER MODULE (Earlier Version)
19D903175G1

(19B235898, Sh. 3, Rev. 0)



RECEIVER MODULE (Earlier Version)
19D903175G1

(19B235898, Sh. 4, Rev. 0)



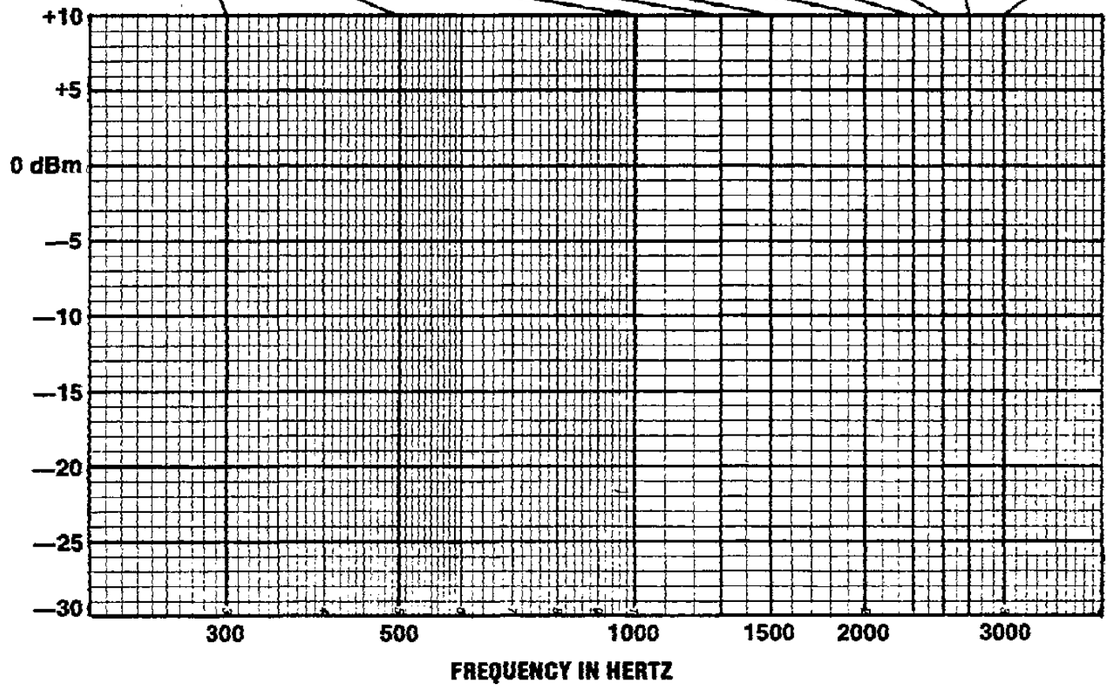
RECEIVER MODULE (Earlier Version)
19D903175G1

(19B235898, Sh. 5, Rev. 2)

TELEPHONE LINE EVALUATION

USER	DATE
TELEPHONE CIRCUIT NO.	TIME
SENDING POINT	SENDING LEVEL dBm
MEASUREMENTS TAKEN AT	BY
NOISE LEVEL dBrnC dBm (FLAT)	TERMINATION IMPEDANCE ohms

FREQ. Hz	300	500	1000	1300	1500	2000	2300	2500	2700	3000
REC'V'D LEVEL dBm										



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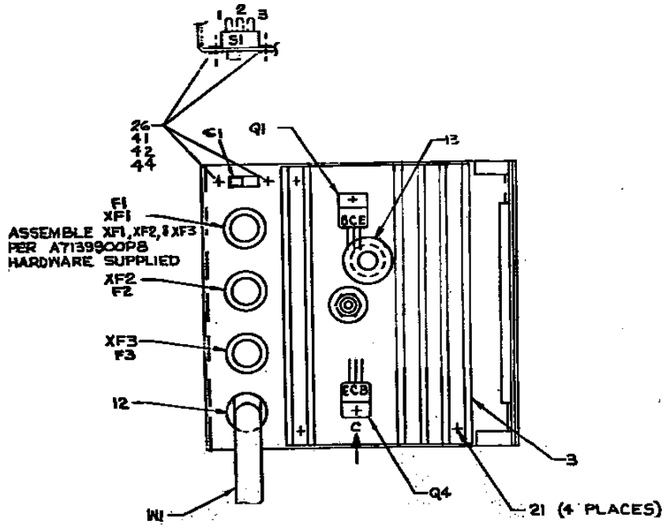
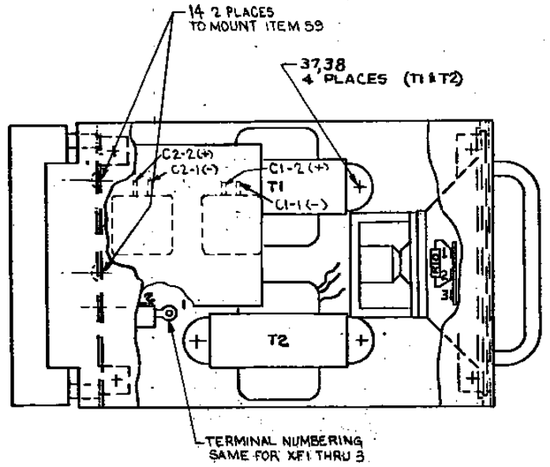
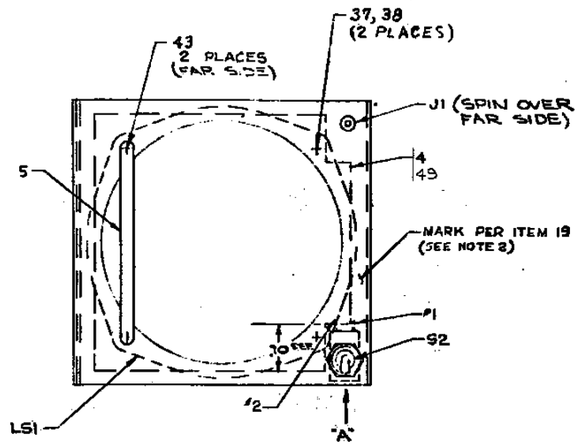
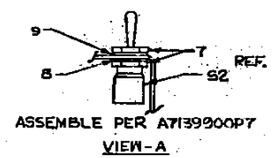
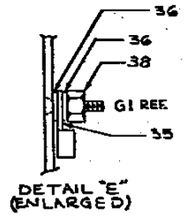
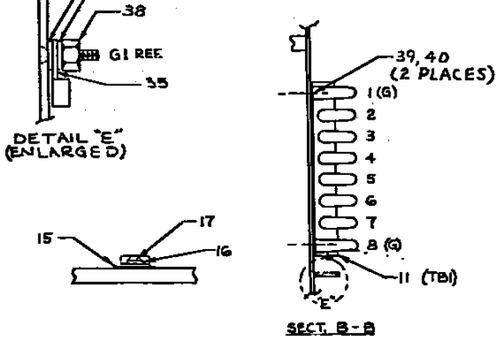






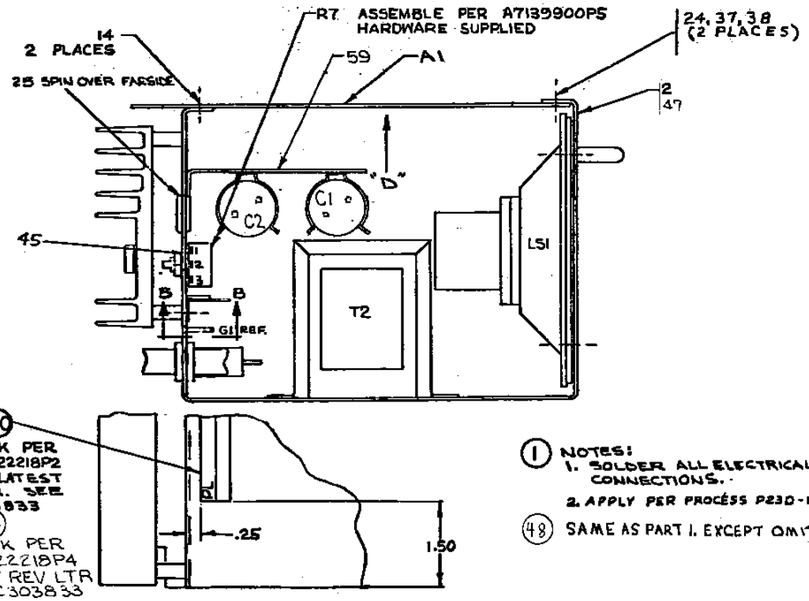


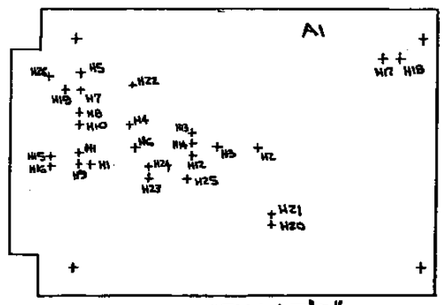




VIEW C
(MTG. FOR Q1 & Q4)

REFER TO WIRING DIAGRAM 19D413561 FOR THE FOLLOWING CONNECTIONS		
WIRE CHART		
FROM	TO	REMARKS
W1-6	J1	ITEM 35





(1) NOTES:
1. SOLDER ALL ELECTRICAL CONNECTIONS.
2. APPLY PER PROCESS P23D-EA100P1.

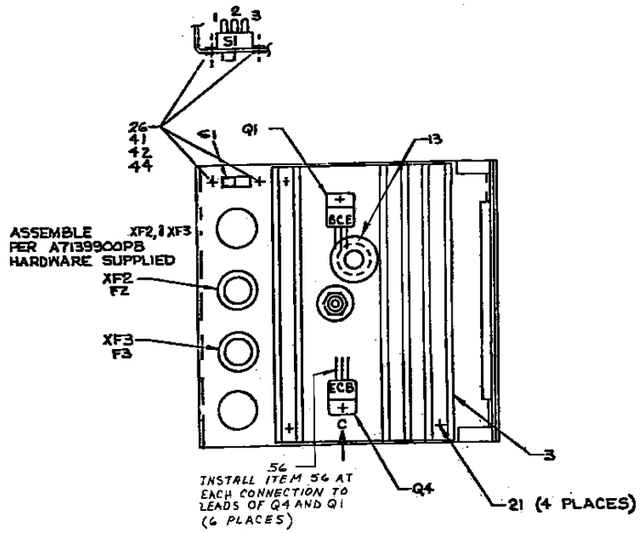
(48) SAME AS PART 1. EXCEPT OMIT NOTE 2.

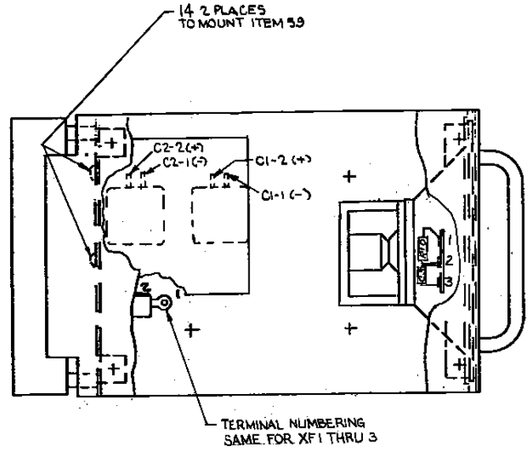
Assembly Diagram

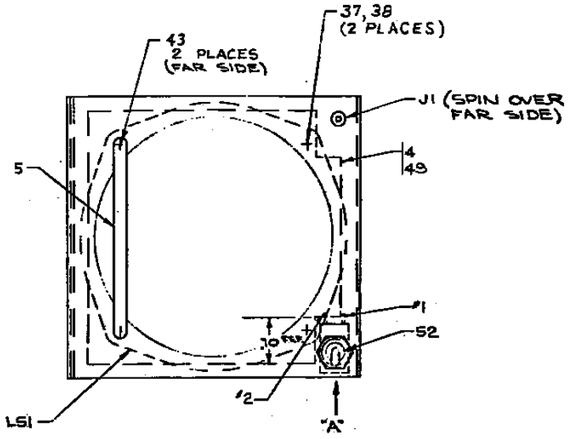
Voter Power Supply
19D413917G3

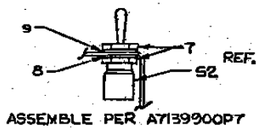
(19D413917, Sheet 1, Rev. 20)

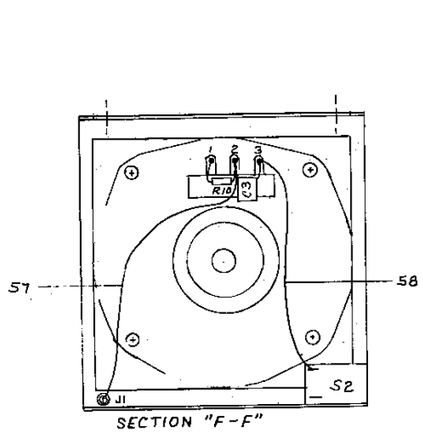
ADDEMDUM NO. 1 TO LBI-38676C
PCVR

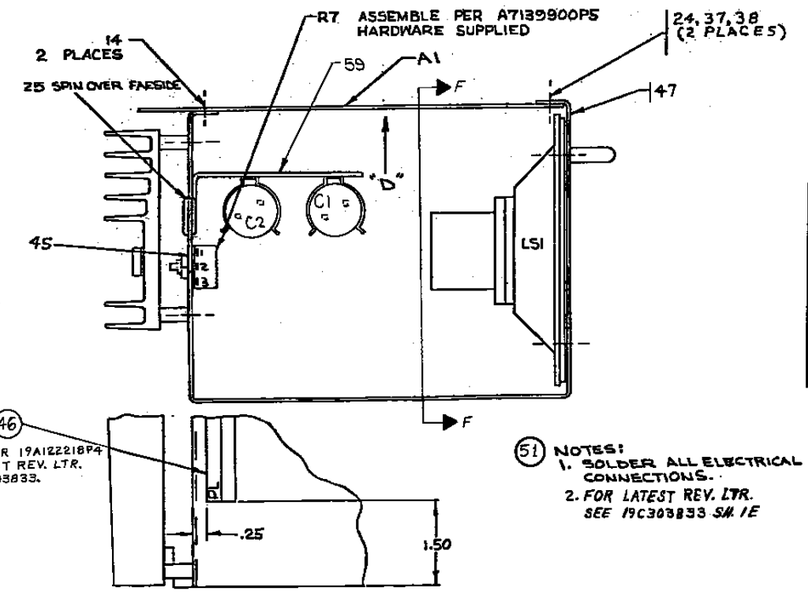


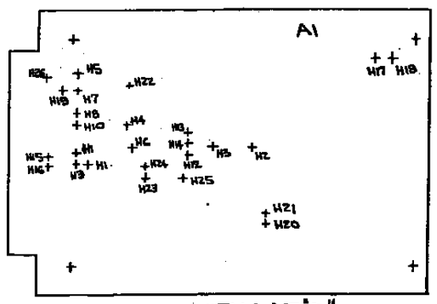


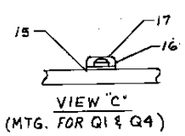












NOTES:
1. SOLDER ALL ELECTRICAL CONNECTIONS.
2. FOR LATEST REV. LTR. SEE 19C303833 SH 1E

Assembly Diagram

Voter Power Supply
19D413917G4

(19D413917, Sheet 2, Rev. 20)