(609) 728-2020

QEI CORPORATION
ONE AIRPORT DRIVE, P. O. BOX D • WILLIAMSTOWN, N. J. 08094

FM MODULATION MONITOR/TEST SET

MODEL 691

INSTRUCTION MANUAL

#330 LAMPS

INFORMATION FOR OPTION -02, DUAL 67 & 92 KHz SCA,

IS LOCATED IN THE APPENDIX OF THIS MANUAL.

SECTION 1

GENERAL INFORMATION

1-1 DESCRIPTION

The QEI Model 691 Modulation Monitor/Test Set (FCC Type Approval Number 3-244) is an all solid state Modulation Monitor designed to meet or exceed the Federal Communication Commission requirements for measuring the modulation characteristics of FM transmitters having a frequency range of 88.1MHz to 107.9MHz both at the transmitter and off-air.

The 691 is manufactured in a 10½" X 19" rack mount. All operator controls are located on the front panel. AC Power, RF Inputs and Monitor Outputs are located on the rear panel.

1-2 ELECTRICAL SPECIFICATIONS

RF Frequency Range..... 88.1 - 107.9MHz
(Thumbwheel selected)

RF Input (to guarantee 66dB S/N in a 30KHz Bandwidth)
- Antenna ..... 3mv to 200mv
- Signal ..... 2mw to 50W (depending on external load)

Total Modulation Display

Modulation Meter

- Accuracy..... +2% entire range
- Frequency Response..... 0.2dB 30Hz - 75KHz
- Range..... 0-133% (-20dB to +2dB)
- Ballistics..... per FCC regulations

Peak Indicators

- Range..... 0-199% in 1% increments
- Accuracy..... ± 1%

Peak Counter

- Set Point..... 100% ± 1%
- Time..... 1 minute ± 1 sec.

Distortion..... 0.05% THD or IMD

S/N..... better than 75dB (with 75usec de-emp)
better than 66dB in a 30KHz Bandwidth

Test Displays (2)

- Meter Accuracy ..... ± 2% entire range
- Peak Indicator Accuracy..... ± 1%
- Meter Range..... 133% to -75dB (autoranging)
- Pilot & SCA Injection Accuracy... ± 0.5% (6% to 12%)

Separation

L into R or R into L.	55db

Crosstalk

Main into Sub	65db
Sub into Main	65db
SCA into Sub or Main.	70 db
Pilot into Sub or Main.	70 db

Monitoring Modes

1)	Left	Right
2)	Main	Sub
3)	Pilot Level	Phase Cal.
4)	38KHz	Gen. Phase
5)	FM/S/N	AM S/N
6)	SCA Inj. narrow	Main
7)	SCA Inj. wide	SCA Mod.

Distortion (Left or Right)

THD	0.05%
IMD	0.1% (SMPTE)
SCA (4KHz dev.)	1% (50Hz to 5KHz) (150us de-emp)

Outputs

Left.	+10 dbm bal. and Hi-z
Right	+10 dbm bal. and Hi-z
Scope	1Vpp
Frequency	X.O, I.F. Pilot, SCA (TTL)

Spectrum Analyzer Output

X Horizontal.	4Vpp
Y Vertical.	0.5V/10db

1-3 MECHANICAL SPECIFICATIONS

Dimensions.	(10½"H) x (19"W) x (12"D) (26.68cm) x (48.29cm) x (30.5cm)
Weight.	16 lbs.
Ambient Operating Temp.	32°F to 122°F 0°C to 60°C

1-4 INSTRUMENT IDENTIFICATION

This unit is identified by a Model and Serial Number located on the rear panel. All correspondence to your sales representative or the factory in regard to the unit should reference the complete Model and Serial Numbers.

1-5 OPTIONS

(01) SCA Monitor option (67KHz) consists of the plug in board assembly A6

(02) SCA Monitor option (special frequency) (not FCC Type Approved)

(03) CCIR Specifications (not FCC Type Approved)

SECTION 2

INSTALLATION

2-1 INITIAL INSPECTION

Check the shipping carton for external damage. If the carton exhibits evidence of abuse in handling (holes, broken corners, etc.) ask the carrier agent to be present when the unit is unpacked. Carefully unpack the unit and inspect all equipment for physical damage. Immediately after unpacking any bent or broken parts, or scratches should be noted. Keep all packing material for proof of damage claim or for possible future use.

2-2 PREPARATION FOR USE

The unit is designed to be mounted in a standard 19" rack. Air space should be provided above and below the unit so that heat generated by the circuitry may be dissipated. Additional cooling may be required if the unit is placed above high heat generating equipment in order to keep the ambient temperature below the maximum specified ($50^{o}C$).

Mount the unit to the rack using #10 countersink screws and finishing washers.

The unit requires a 105-125V single phase, 50/60Hz power source or a 220-250V single phase, 50/60Hz power source. The identification plate on the back panel shows for which power source the unit is wired. See Section 5-7 for information on changing taps.

2-3 MONITOR CONNECTIONS

1. Connect the antenna supplied to monitor ANT connector J11 if off air operation is desired.

2. Connect a dummy load large enough to handle the RF input to DUMMY LOAD connector J9. A ½ watt termination is supplied. The input signal sampler will handle up to 50 watts with an adequate external dummy load, thus allowing direct measurement of exciters and low power transmitters. DO NOT OPERATE THIS EQUIPMENT WITHOUT AN ADEQUATE DUMMY LOAD INSTALLED.

3. Connect the RF sample to RF IN connector J10.

4. TB1-4 and TB1-5 are 600 ohm balanced left audio output.

5. TB1-6 and TB1-7 are 600 ohm balanced right audio output.

6. TB1-8 is 600 ohm unbalanced SCA audio (ref. to gnd.)

2-4 REPACKING FOR SHIPMENT

NOTE: WARRANTY MAY BE VOID IF UNIT IS NOT RETURNED IN ORIGINAL PACKING.

NOTE: Before returning a unit for repair or calibration, contact the factory or your authorized representative for Return Authorization. Attach a tag showing owner's name and address. A description of the service required should also be included. Unit must be shipped prepaid and insured for full value. USE THE ORIGINAL SHIPPING CARTON AND PACKING MATERIAL FOR RE-SHIPMENT.

SECTION 3

OPERATION

3-1 OPERATOR CONTROLS AND INDICATORS (FRONT PANEL)

1. POWER Switch and led A1S1 and A1CR1 apply line power to unit.

2. CARRIER FREQUENCY thumbwheel A1S2 sets unit on desired frequency.

3. L.O. UNLOCK led A1CR2
   Led lights if local oscillator is unlocked or reference is lost.

4. RF LEVEL leds A1CR3 (Hi), A1CR4 (LO), A1CR5 (OK)

a. A1CR5 (OK) will light and A1CR4 (LO) will go out when there is sufficient RF input to allow accurate modulation and signal to noise measurements. This level will normally be obtained with the antenna supplied within the 70dBu contour.

b. A1CR3 (Hi) will light if an excessive RF sample is applied. Reduce the RF LEVEL pot on rear panel until A1CR3 extinguishes. A1CR5 (OK) will remain lit with Hi RF level since all required monitor functions will be in specification. However, AM Signal to Noise will not be accurate because of saturation of the IF amplifier. In addition, when A1CR3 (Hi) is lit, the input mixer is being protected by an input clipper.

5. MUTE Switch A1S3

a. With MUTE switch in ON position unit will mute all signals below RF LEVEL OK threshold.

6. COMP Jack A1J1 provides a $6V_{pp}$ wideband composite signal.

7. DE-EMP AUDIO Jack A1J2 provides a $6V_{pp}$ @ 400Hz signal with 75usec de-emphasis. NOTE: This signal is NOT filtered to remove 19KHz.

8. TOTAL MODULATION Displays (Yellow)

a. Meter A1M1 in conjunction with MOD METER switch A1S4A provides total modulation (main, sub and SCA) indication with FCC semi-peak ballistics switchable to POS or NEG.

b. PEAK MOD thumbwheel A1S5 and lamp A1DS1 provide a total modulation peak indicator independent of polarity and settable in 1% increments from 0 to 199%. This flasher will light from 2 to 4 seconds each time a peak is detected.

c. 100% PEAKS PER MINUTE Display A1DS2 and RESET/OFF Switch A1S6 provide a count of 5ms 100% peaks. The display flashes at a count of 10, has a maximum count of 19 and resets automatically each minute. RESET overrides the automatic reset function and OFF extinguishes the display. This indication is intended to monitor modulation peaks for Automatic Transmitter Systems (ATS) as defined by the FCC in the ATS rules.

d. CAL pushbutton A1S7 provides a total modulation calibrate signal. The frequency of this signal is 32KHz. See Section 5 for further information. NOTE: LO UNLOCK led must light when CAL is depressed.

9. SCOPE Display (Vector and Spectrum Analyzer)

NOTE: To use these features of the 691 requires an oscilloscope with X and Y DC Coupled inputs. The bandwidth of the scope need only be a few hundred kilohertz but it must be DC Coupled on both X and Y inputs.

a. Connect VERT (A1J3) to Scope Y input. Connect HORIZ (A1J4) to Scope X input. Set both inputs to DC coupled, 0.5 volts/div.

b. To view Stereo Vector pattern, depress VECTOR button on A1S4B. Mono modulation will give a vertical line. Any deviation from vertical indicates that the station mono balance is incorrect.

c. To use Spectrum Analyzer feature, depress NARROW pushbutton on A1S4B. Adjust scope horiz. (X) gain to get full width baseline. Adjust scope vert (Y) gain to 0.5/div. Display will be centered on frequency determined by CARRIER FREQUENCY switch and will be approximately ±120KHz and 10dB/div. Depressing WIDE pushbutton will change dispersion to approximately ±350KHz. NOTE: WIDE position will cause TOTAL MODULATION display to pin meter and peak flasher if MUTE is OFF.

10. PILOT PRESENT indicator A1DS3 and ØADJ A1R1 indicate the presence of the 19KHz pilot tone and provide monitor phase calibration in conjunction with Ø CAL position of CHANNEL B DISPLAY SELECT. Pilot Ø ADJ A1R1 is set for a null on CHANNEL B meter. This adjustment is accurate even with modulation applied.

11. SCA PRESENT indicator A1DS4 indicates the presence of SCA. The DEV switch A1S9 may be set to cause CHANNEL B SCA MOD display to indicate 100% at either 4KHz or 6KHz deviation.

12. FREQ Jack A1J5 and switch A1S8 provide a convenient output for an external counter to read station frequency, pilot frequency or SCA frequency. To read station frequency requires a counter capable of 10.7MHz. First connect the counter to the XO jack on the rear panel. If the X.O. is not exactly 8.000000MHz, adjust the piston trimmer on the monitor A2 assembly until it does. See Section 5 for details. Now connect the counter to A1J5 and place A1S8 to IF position. The counter should read 10.7MHz. If it reads lower, the station frequency is higher by the same number of hertz. Conversely, if it reads higher, the station frequency is lower. NOTE: Be sure of the accuracy of the counter. Also, remove modulation from the carrier when making this measurement. To measure pilot frequency, place A1S8 in PILOT position. Frequency read on counter will be 10 times the actual pilot. This allows a counter with only a one second gate time to read to .1Hz accuracy. To measure SCA frequency, place A1S8 in SCA position. NOTE: Remove modulation from SCA when making this measurement.

13. OUTPUT SELECT Switch A1S10, AUDIO Jack A1J6 and SCOPE Jack A1J7 provide distortion measuring outputs and scope observation output. Switch A1S10 in LEFT/CHAN A position provides left deemphasized audio with a cutoff frequency of 15KHz for stereo distortion measurements at A1J6 and whatever is displayed on the CHANNEL A meter at A1J7 for scope observation. When A1S10 is in RIGHT/CHAN B position, right audio is provided at A1J6 and Channel B signal appears at A1J7.

14. SCA Audio Jack A1J8 provides 150usec deemphasized 5KHz bandwidth SCA audio for distortion measurements.

15. TEST DISPLAYS (CHANNEL A - green) (CHANNEL B - blue) and DISPLAY SELECT switch A1S11

a. DISPLAY SELECT switch controls the signal components to be displayed.

b. Meters A1M2A and A1M2B in conjunction with +/- switches A1S13A and A1S13B, MOD; HOLD: AUTO switches A1S14A and A1S14B and RANGE (-dB) readouts A1DS5A and A1DS5B provide two metering displays with a range of 0 to 133% with FCC ballistics (MOD position) or -70dB to +3dB with semi VU ballistics (AUTO or HOLD position). These displays may be switched to + or - indications and may be deemphasized by pushbuttons A2S15A or A1S15B. NOTE: FM and AM S/N are automatically deemphasized.

c. PEAK thumbwheels A1S12A and A1S12B and leds A1CR6A and A1CR6B provide a peak indication of the corresponding meter display settable in 1% increments from 0 to 199%.

3-2 OPERATOR CONTROL AND CONNECTIONS (REAR PANEL)

1. DUMMY LOAD Jack A1J9 - A DUMMY LOAD ADEQUATE FOR THE RF INPUT SUPPLIED MUST BE INSTALLED AT THIS JACK. A ½ watt load is supplied with the unit.

2. RF INPUT Jack A1J10 - Transmitter RF sample connects to this jack.

3. CARRIER LEVEL Control A1R2 - This control is used to reduce RF Input below RF HI threshold.

4. ANT Jack A1J11 - 75 ohm FM Antenna connects to this jack.

5. X.O. OUT Jack A1J12 - 8MHz sample from crystal reference oscillator is available at this jack for measurement purposes.

6. S.A. CENTER Control A1R3 - Control used to center Spectrum Analyzer display.

7. COMPOSITE EXT INPUT A1J13 - This input allows a composite signal to be applied directly to the Stereo and SCA circuits of the monitor bypassing the RF demodulator.

8. COMPOSITE EXT LEVEL Control A1R4 - Sets external composite signal level.

9. COMPOSITE Switch A1S16 - This switch must be in INT position to use RF demodulator. In EXT position signal applied to COMPOSITE EXT INPUT A1J13 is fed to stereo and SCA circuits.

3-3 MONAURAL MEASUREMENTS

1. Total Modulation

Set the CARRIER FREQUENCY thumbwheel to the desired frequency and MUTE switch to ON. Verify that L.O. UNLOCK led is out and that RF LEVEL OK led is lit. Allow a few seconds for the monitor to stabilize on the frequency selected. Adjust the PEAK MOD thumbwheel to the desired level. The amber PEAK MOD lamp will flash for 2 to 4 seconds each time the modulation exceeds the preset PEAK MOD level in either a positive or negative direction. The TOTAL MODULATION meter responds to total modulation with FCC specified ballistics and may be switched to read either positive or negative modulation with the MOD METER POS or NEG pushbuttons.

NOTE

> The Total Peak Mod Flasher and Total Modulation Meter will only agree if the transmitter is modulated by a low distortion sine wave. Any distortion will cause positive to negative assymmetry approximately double the amount of the distortion in percent. Remember that the flasher reads the highest polarity and that the meter reads the selected polarity. The difference in readings with program material is due to many factors such as the amount of audio dynamic range compression, transmitter overshoot, program assymmetry, etc.

The 100% PEAKS PER MINUTE readout counts the number of positive or negative 100% peaks occuring within one minute. This counter was designed to show compliance with FCC ATS rules. Therefore, it counts 5 millisecond peaks as per FCC rules 73.342(b)3. However, the required PEAK MOD flasher must remain lit for 2 to 4 seconds each time it triggers per FCC rules 73.332(D)4i. This means that it is possible to get many ATS 5 millisecond peaks during one flash of the PEAK MOD flasher. Since the ATS rules allow 10 (ten) 100% 5 millisecond peaks per minute, the readout flashes at 10 and has a maximum count of 19. It automatically resets at one minute intervals and may be manually reset or turned off with its associated switch.

2. Mono Distortion

Approximately $6V_{pp}$ @ 100% @ 400Hz is available for connection to a high Z distortion meter at the DE EMP AUDIO jack. This output is deemphasized 75usec and is NOT filtered to remove 19KHz.

3. FM Signal to Noise / AM Signal to Noise

Remove modulation from the transmitter. Depress FM S/N - AM S/N DISPLAY SELECT pushbutton. Place CHANNEL A and CHANNEL B METER MOD/HOLD/AUTO switches in AUTO. FM Signal to Noise will be displayed on CHANNEL A meter and AM Signal to Noise will be displayed on CHANNEL B meter. The reading will be the algebraic sum of the METER RANGE (-dB) readout and the associated meter. Note that FM S/N is automatically measured with 75usec deemp in a 50Hz to 15KHz bandwidth. If it is desired to check for FM noise below 50Hz, e.g. blower vibration, depress DISPLAY SELECT MAIN-SUB and read CHANNEL A while holding CHANNEL A METER DE EMP - FLAT pushbutton depressed. Any difference in the noise readings indicates noise with a frequency component below 50Hz. AM S/N is automatically measured with 75usec deemp and is accurate as long as the RF LEVEL HI led is out and RF LEVEL OK led is lit. The residual noise may be observed with a scope connected to SCOPE jack. The OUTPUT SELECT switch is then used to route either Channel A or Channel B to the scope.

3-4 STEREO MEASUREMENTS

1. Left and Right Channel Modulation

Depress DISPLAY SELECT LEFT-RIGHT pushbutton and place METER MOD/HOLD/AUTO switches in MOD position. CHANNEL A meter will indicate left channel modulation and CHANNEL B meter will indicate right channel modulation with FCC specified semi-peak ballistics.

A fully modulated left or right stereo signal will indicate 90%. If pilot is removed, both meters will indicate the same as the TOTAL MODULATION meter.

If MOD/HOLD/AUTO switches are placed in HOLD position, the ballistics change to semi-VU and the RANGE (-dB) readouts will illuminate. If the METER DE EMP pushbutton is then depressed, the meter will give an approximate indication of the loudness perceived at the output of a receiver.

2. Separation

Depress DISPLAY SELECT LEFT-RIGHT pushbutton and place METER MOD/HOLD/AUTO switches in AUTO position. Apply a fully modulated left or right signal to the transmitter. The fully modulated channel should read 90% (-1dB). The unmodulated channel will autorange to give the separation reading. (Algebraic sum of the METER RANGE (-dB) and its associated meter -1dB.) NOTE: Be sure of monitor Ø calibration before attempting separation measurements. See 3.4.7.

3. Left and Right Signal to Noise

Depress DISPLAY SELECT LEFT-RIGHT pushbutton and place METER MOD/HOLD/AUTO switches in AUTO position. Remove left and right modulation from transmitter but do not remove pilot. Depress METER DE EMP pushbuttons. Meters will autorange to give signal to noise readings.

4. Left and Right Distortion

High impedance deemphasized audio is available at the LEFT/RIGHT AUDIO jack for connection to a distortion test set. The signal is switched between left and right by the OUTPUT SELECT switch.

5. Main Channel (L=+R) and Subchannel (L=-R) Modulation

Depress DISPLAY SELECT MAIN-SUB pushbutton and place METER MOD/HOLD/AUTO switches in MOD position. A fully modulated L=+R signal will read 90% on CHANNEL A meter and 0 on CHANNEL B meter. A fully modulated L=-R signal will read 90% on CHANNEL B meter and 0 on CHANNEL A meter.

6. Crosstalk (Main into Sub and Sub into Main)

Depress DISPLAY SELECT MAIN-SUB pushbutton and place METER MOD/HOLD/AUTO switches in AUTO position. A fully modulated L=+R or L=-R signal will indicate 90% (-1dB) on its respective meter. The other meter will autorange to give the crosstalk reading. (Algebraic sum of METER RANGE (-dB) and its associated meter -1dB.)

7. Pilot Injection and Monitor Phase Calibration

Depress DISPLAY SELECT PILOT - Ø CAL pushbutton and place METER MOD/HOLD/AUTO switches in MOD position. Pilot injection is then read on the PILOT scale of CHANNEL A meter. PILOT PRESENT lamp will light at approximately 3% pilot injection. Monitor Phase Calibration is accomplished by setting PILOTØ CAL control for a null on CHANNEL B meter. Phase Calibration may be accomplished accurately while transmitter is being modulated.

8. 38KHz Suppression

Depress DISPLAY SELECT 38KHz - GEN Ø pushbutton and place METER MOD/HOLD/AUTO switches in AUTO position. Modulate the transmitter with a L=-R signal between 5KHz and 15KHz. CHANNEL A meter will autorange to give 38KHz suppression reading.

9. Stereo Generator Pilot Phase

Check monitor phase calibration according to 3.4.7. Set monitor and modulation as in 3-4-8 above. Adjust stereo generator phase control for minimum indication on CHANNEL B meter. This feature allows setting generator phase without an oscilloscope.

3-5 SCA MEASUREMENTS

NOTE
This monitor is designed and approved only for use with a 67KHz SCA and 10% SCA injection as used with stereo.

1. SCA Injection (Unmodulated)

Depress DISPLAY SELECT SCA INJ NARROW-MAIN pushbutton and place METER MOD/HOLD/AUTO switches in MOD position. CHANNEL A meter will read SCA injection on the PILOT scale through an FCC specified narrow filter. The SCA must be unmodulated for an accurate reading. The SCA PRESENT lamp will light at approximately 3% injection. Main channel 0 - 15KHz modulation will be displayed on the CHANNEL B meter.

2. SCA Injection (Modulated)

Depress DISPLAY SELECT SCA INJ WIDE-SCA MOD pushbutton and place METER MOD/HOLD/AUTO switches in MOD position. CHANNEL A meter will read SCA Injection on the PILOT scale through a wide filter. This filter allows injection to be monitored while modulating the SCA.

3. SCA Modulation

Set monitor up as in 3-5-2 above. Place SCA DEV switch in 4KHz or 6KHz position as desired. This sets the deviation for 100%. CHANNEL B meter will indicate SCA Modulation with FCC semi-peak ballistics.

4. SCA Distortion

High impedance 150usec deemphasized SCA audio is available at the SCA AUDIO jack for connection to a distortion test set.

5. SCA Signal to Noise

Depress DISPLAY SELECT SCA INJ WIDE-SCA MOD pushbutton and place CHANNEL B METER MOD/HOLD/AUTO switch in AUTO position. Modulated the transmitter with a unmodulated SCA. Depress CHANNEL B METER DE EMP pushbutton. Meter will autorange to give noise reading. Reading will be made with 150usec deemphasis.

SECTION 4

THEORY OF OPERATION

4-1 GENERAL

The monitor is basically a specialized FM superhet receiver. It has been specifically designed to operate in a high RF environment and as such does not have an RF preamplifier. It has also been designed with a wide IF filter in order to meet FCC requirements for FM modulation monitors. Because of these restraints it is neither as sensitive nor as selective as a normal FM receiver. However, it will operate in close proximity to antenna farms and master antennas without the intermodulation and overload problems normally encountered in these areas.

Unlike other monitors/RF amplifier systems, the signal path in the 691 is the same whether the monitor is driven from the transmitter or off-air. The only difference is a -40dB signal sampler when driven from the transmitter input (RF IN) port. This means that there is no signal degradation when used off-air above the mute level. This level is set for use within the 70dBu contour with the antenna provided.

Refer to Block Diagram 6912001. RF signal is fed to either the Antenna or RF inputs. The signal then passes through the voltage tuned image rejection board (A13) then to the A4 receiver assembly. The output of the phase locked 1st Local Oscillator is also fed to the A4 assembly producing a 10.7MHz IF. The L.O. phase lock loop circuitry is located on the A2 assembly. The 10.7MHz IF is filtered, demodulated, and the resulting composite signal is amplified and fed to the various filtering, stereo and SCA demodulation and metering circuitry required. A portion of the 10.7MHz IF is also fed to a mixer along with a swept 2nd L.O. operating at 10.255MHz + 120KHz. The resulting 455KHz + 120KHz is filtered by a ceramic filter, fed to a logarithmic amplifier, demodulated and used to provide a spectrum analyzer presentation on an X-Y oscilloscope.

4-2 DETAIL CIRCUIT DESCRIPTION

1. A1 (Chassis) Assembly

The chassis assembly contains the power supplies (+12V, -12V, +5V), filter, 1st L.O., meters, indicators and controls. The power supplies are regulated by three terminal regulators.

2. A2 (PLL and Total Meter Driver) Assembly

The output of a high stability crystal reference oscillator (Y1, Q10, Q11) is divided down to 5KHz. A sample of the 1st L.O. is fed to Q9 and then to a programmmable divider. The CARRIER FREQUENCY thumbwheel programs the divider so that when the L.O. is 10.7MHz above the thumbwheel setting, the divider output is 5KHz. The reference signal and the programmable signal are compared in phase and the resultant error voltage is filtered by active filter U15 and U16 and then fed to the AFC port of the 1st L.O. U12 is used to light the L.O. UNLOCK led if lock or reference is lost. U11 is used to generate the 32KHz pulse for the calibrate function.

U17 and U18 and the Total PEAK MOD thumbwheel form a precision positive and negative reference for the modulation peak comparators U20. R83 and R86 provide reference for the 100% PEAKS PER MINUTE comparators. Composite signal from the A4 assembly is also fed to these comparators.

The outputs of these comparators are fed to one shots of 2 to 4 seconds in the case of PEAK MOD and 5 milliseconds in the case of the 100% PEAKS PER MINUTE. The 100% PPM one shot drives a counter made up of U22, U23 and U24. This counter is reset every minute by a pulse derived from the A3 assembly.

Composite signal is also fed through the TOTAL METER POS and NEG switches to the total meter driver circuit, U13, U14 and associated circuitry.

3. A3 (Dual Average Voltmeter) Assembly

This board contains two identical voltmeter circuits, one for Channel A Display, one for Channel B Display plus the reset generator (U10) and decoder driver (U11, U12, U13) for the 100% PEAKS PER MINUTE display.

Channel A designators are in units; Channel B designators are in hundreds. A1 and U1 along with their associated PEAK thumbwheel are used to drive the TEST DISPLAY PEAK led. Signal components selected by the DISPLAY SELECT push-buttons and the METER +/- switch are amplified or inverted by U2 and fed to a combination attenuator-amplifier. This combination provides gain in 10dB steps from 0 dB to 50 dB. The action is as follows:

RANGE	ATTEN	AMP
0dB	-30dB	+30dB
-10dB	-20dB	+30dB
-20dB	-10dB	+30dB
-30dB	0dB	+30dB
-40dB	-10dB	+50dB
-50dB	0dB	+50dB

The range changes are accomplished by the outputs of up-down counter U6 being used to clamp the appropriate resistors to ground through U3. A sample of the attenuator-amplifier output is fed to comparator U8. The output of U8 in conjunction with gates U5, U6, and U7 then drives U6 up or down to the required range.

The output of the attenuator-amplifier is then peak detected by Q7 and fed to meter driver U9. Q9 is used to change ballistics from FCC to VU as required.

4. A4 (Receiver) Assembly

Q1 and associated circuitry buffer and filter the output of the 1st L.O. (fc + 10.7MHz). This signal and the incoming RF are mixed in balanced

mixer Z1 to produce the 10.7MHz IF. This IF signal is amplified by U1, filtered and applied to U2 which is an FM IF Amplifier and Demodulator System. The demodulated composite output of U2 is amplified by Q4 and Q5 and filtered by a low overshoot, phase compensated low pass filter. Either the output of this filter or the composite input from the rear panel is supplied to composite driver amplifier Q8, Q9, Q10, Q11 and Q12. The output of this amplifier is $6V_{pp}$ @ 100% and is used to drive the stereo and SCA monitoring circuits.

Q6 and filter C54, L16 and C55 convert a 32KHz pulse from the A2 assembly to a 32KHz sine wave which is used to FM a 10.7MHz oscillator (Q7 and associated circuitry) when the CAL pushbutton is depressed. This signal is coupled to the IF amplifier and used to provide the monitor calibrate signal.

The RF signal level voltage at U2 pin 13 is fed to voltage comparator circuit U3. The outputs of this IC are used to mute the monitor and also drive the RF LEVEL L.O. and OK leds.

The 10.7MHz signal from the IF filter FL1 is also fed to mixer Z2 through buffer Q2. There it is mixed with the output of 2nd L.O. Q13 and Q14. This L.O. is frequency swept by a sawtooth generator made up of CR14, Q16 and U6. The output of the sawtooth generator is also used to sweep the 1st L.O. in SPECTRUM ANALYZER WIDE mode through Q15. The 455KHz output of mixer Z2 is fed through buffer Q17 and Q18 to the spectrum analyzer filter and logarithmic amplifier U4 and associated circuitry. The output of the log amp is AM demodulated and fed through active filter U5 to the SCOPE VERT jack and the AM Noise measurement circuit.

5. A5 (Stereo Demodulator) Assembly

Composite signal is fed to Q1 which drives the pilot filter. The filtered 19KHz is squared by U3 after passing through the phase adjust circuit composed of Q3, Q4 and the front panel PILOT Ø CAL control. The 19KHz square wave is used to lock PLL U4. The output of U4 is nominally 190KHz. This signal is divided down to provide square waves of 38KHz @ 0°, 38KHz @ 180°, 38KHz @ 90° and 19KHz @ 90°. These signals are used to demodulated left and right and also to provide GEN Ø calibration and PILOT Ø calibration signals. Stereo demodulation is accomplished by choppers Q10 and Q11 and the resulting left and right signals are amplified by Q12 through Q17. The output of these amplifiers is filtered and used to feed the DISPLAY SELECT switch and also audio output amplifiers U10, U13 and Q19 through Q22. Left and right audio is added in U11 to produce the vertical channel for the vector display and subtracted in U12 to produce the horizontal channel for the vector display.

Choppers Q7 and Q8 are fed a 19KHz square wave at 90° along with composite signal. The action of these choppers and U2 produces the PILOT Ø null indication.

Transistor Q18 is used to couple 38KHz @ 90^{0} into the Subchannel filter to produce the GEN Ø indication.

CR1, CR2, U1 and Q6 provide the Pilot Present Lamp threshold detect functions.

6. A6 (SCA) Assembly

The Composite signal is buffered by Q1 and fed to the dual 67KHz filter. One section of this filter has a bandwidth approximately 1KHz and fulfills the FCC specification for exact measurement of SCA injection. The output of this filter section is buffered by Q2 and fed to the DISPLAY SELECT switch. The other section of this filter has a wide bandwidth to allow injection measurements under modulation and also to prevent unwanted composite signal components from reaching the SCA demodulator. U2 is a phase locked loop demodulator. The audio output is buffered by Q6, filtered and amplified by U1 and U4. Q3 changes the 100% deviation point from 4KHz to 6KHz depending upon the front panel SCA DEV switch.

U3 determines SCA presence and also drives the SCA frequency output. Q7 mutes SCA audio if the SCA is lost. Q8 and Q9 drive the SCA PRESENT lamp.

7. A11 (Display Select Switch) Assembly

This seven station pushbutton selects the signal component to be displayed. U1 and associated circuitry form a high pass active filter with a low frequency cutoff of 50Hz used to feed the FM S/N position. L1 is a 19KHz filter that smoothes the PILOT Ø CAL null indication.

SECTION 5

ALIGNMENT AND TROUBLESHOOTING

5-1 EQUIPMENT REQUIRED BUT NOT SUPPLIED

1. Oscilloscope, DC coupled, triggered, dual trace, horizontal input min. 10 MHz BW.
2. Digital Voltmeter
3. Audio Generator
4. Frequency Counter
5. Stereo Generator
6. SCA Generator
7. FM Signal Generator with Calibrated RF Attenuator
8. Distortion Analyzer
9. Assorted Cables and hand tools.

NOTE: DO NOT ATTEMPT TROUBLESHOOTING AND ALIGNMENT OF THIS UNIT WITHOUT ADEQUATE TOOLS AND TEST EQUIPMENT.

Before starting alignment of this unit, verify that the three supply voltages are present and correct.

5-2 PLL AND TOTAL METER ALIGNMENT (A2 Assembly)

1. Place MOD PEAK Thumbwheel (A1S5) to 100.
2. Measure voltage at A2U17-6 (TP1), this voltage should be +3.00V $\pm$.15V
3. Measure voltage at A2U18-6 (TP2). Adjust A2R69 until this voltage has the same magnitude but opposite polarity of step 5-2 (2)
4. Measure voltage on center arm of A2R83. Adjust A2R83 until its voltage is 30mv higher than that in step 5-2 (2) (+3.03V).
5. Measure voltage on center arm of A2R86. Adjust A2R86 until its voltage is 30mv lower than that in step 5-2 (3) (-3.03V).
6. Depress NEG button on A1S4A.
7. Adjust A2R115 until TOTAL MOD meter (A1M1) is zeroed.
8. Apply a 400 Hz, 4Vp-p sine wave to COMP IN (A1J13).

9. Place INT-EXT switch (A1S16) in EXT position.

10. Adjust COMP LEVEL (A1R4) until MOD PEAK lamp (A1DS1) just lights at 100%.

11. Turn PPM readout switch (A1S6) to on. PPM readout should read "00". Set MOD PEAK thumbwheel to 101%. Increase audio slightly, PPM readout should count to "19" before MOD PEAK lamp lights at 101%.

12. Set audio level until MOD PEAK lamp just lights at 100%.

13. Adjust A2R99 until TOTAL MOD meter (A1M1) reads 100%.

14. Depress POS button on A1S4A.

15. Adjust A2R104 until TOTAL MOD meter (A1M1) reads 100%.

16. Connect a frequency counter to X.O. OUT (A1J12).

17. Adjust A2C16 until the frequency is exactly 8.000000 MHz.

    NOTE: This will set the L.O. exactly 10.7 MHz above the indication on the CARRIER FREQ. thumbwheel (A1S2).

    NOTE: The crystal used in the 691 Modulation Monitor is a high accuracy crystal with stability of 2.5 PPM from 0 - 60°C.

5-3 DUAL AVERAGE VOLTMETER ALIGNMENT (A3 Assembly)

1. Calibrate PLL and Total Meter (Section 5-2)

2. Preliminary set up:

   a. Place thumbwheels A1S12A and A1S12B to 100%.

   b. Place +,- switches (A1S13A and A1S13B) in - position.

   c. Place MOD-HOLD-AUTO switches (A1S14A and A1S14B) in MOD Position

   d. Depress MAIN, SUB button on DISPLAY SELECT switch (A1S11).

3. Remove audio input from the monitor.

4. Adjust A3R74 until CH.A meter (A1M2A) zeroes.

5. Adjust A3R174 until CH.B meter (A1M2B) zeroes.

6. Apply 400 Hz audio input until MOD PEAK lamp (A1DS1) just lights at 100%.

7. Adjust MAIN filter control (A1R15) until CH.A PEAK led just lights.

8. Adjust A3R73 until CH.A meter (A1M2A) reads 100%.

9. Place +,- switch (A1S13A) in + position.

10. Adjust A3R25 until CH.A meter (A1M2A) reads 100%.

11. Place MOD-HOLD-AUTO switch (A1S14A) in AUTO position.

12. Reduce input level until CH.A meter auto-ranges. AVM display (A1DS5A) will read 10. Increase input level until CH.A meter auto-ranges up. AVM display (A1DS5A) will read 00. Adjust A3R60 until CH.A meter (A1M2A) auto-ranges at approximately -15 dB and +1.5 dB.

13. Increase input frequency to 40 KHz. Adjust input level until MOD PEAK light (A1DS1) just lights.

14. Adjust SUB filter control (A1R13) until CH.B PEAK led just lights.

15. Adjust A3R173 until CH.B meter (A1M2B) reads 100%.

16. Place +,- switch (A1S13B) in + position.

17. Adjust A3R125 until CH.B meter (A1M2B) reads 100%.

18. Place MOD-HOLD-AUTO switch (A1S14B) in AUTO position.

19. Repeat step 12 of this section. Adjust A3R160 for auto range set point.

20. Set input frequency to exactly 38000 Hz. Adjust input level until MOD PEAK light (A1DS1) just lights.

21. Depress 38K, GENØ button on DISPLAY SELECT switch (A1S11).

22. Adjust 38K filter control (A1R14) until CH.A PEAK led just lights at 100%. CH.A meter should read 100%.

5-4 STEREO DEMODULATOR ALIGNMENT (A5 Assembly)

1. Complete alignment of A2 assembly (Section 5-2) and A3 assembly (Section 5-3).

2. Apply an input signal of 19000 Hz. Adjust input level until MOD PEAK lamp just lights at 100%.

3. Reduce input level by exactly 20 dB.

4. Depress PILOT LEVEL, Ø CAL button on DISPLAY SELECT switch (A1S11).

5. Adjust A5R4 until CH.A meter reads 100% (10% on pilot scale).

6. Connect a cable from COMP output (A1J1) to CH.1 of your oscilloscope. Using a probe, display 38 KHz square wave located at A5, CR 6 or 8 on CH.2 of your scope. Trigger scope on CH.1.

7. Adjust A5C27 until 38 KHz signal locks to 19 KHz input. CH.2 on scope will be exactly double the frequency of CH.1.

8. Reduce input level to 4%. Adjust A5R108 until PILOT lamp A5DS3 just lights at this point.

9. Remove audio from COMP IN (A1J13). Connect your Stereo Generator to COMP IN (A1J13). Adjust COMP LEVEL (A1R4) until pilot level reads 10%.

10. Phase Cal. the monitor (Section 3-4 (7)).

11. Modulate the left channel only of the stereo generator with a 400 Hz tone. Adjust this tone until the MOD PEAK lamp just lights at 100%.

    NOTE: Due to the complex waveshape of a stereo signal, the TOTAL MOD meter (A1M1) will not read 100%. With a left or right only signal, the TOTAL MOD meter will read about 96%.

12. Set up monitor for stereo separation measurements (Section 3-4 (1) and (2)).

13. Adjust LEFT filter control (A1R8) until CH.A meter (A1M2A) reads 90%.

14. Generate a signal in the right channel of the stereo generator exactly 40 dB below the signal in the left channel.

15. Adjust A5R67 until CH.B meter reads 40 dB.

16. Repeat steps 11 through 15 with a full amplitude signal in the right channel of the stereo generator. Adjust RIGHT filter control (A1R7) in step 13. Adjust A5R56 in step 15.

17. Modulate the stereo generators LEFT and RIGHT channels with 400 Hz in phase. This will produce a L + R signal.

18. Set up scope display for VECTOR operation (Section 3-1 (9)).

19. Adjust A5R101 for a straight vertical line on your scope.

20. Change the phase of one of the input of the stereo generator. This will produce an L - R signal.

21. Adjust A5R103 for a straight horizontal line on the scope.

5-5 SCA DEMODULATOR ALIGNMENT (A6 Assembly)

1. Complete alignment of A2 assembly (Section 5-2) and A3 assembly (Section 5-3).

2. Apply an input signal of 67000 Hz into the COMP IN (A1J13). Adjust input level until MOD PEAK lamp just lights at 100%.

3. Reduce input level by exactly 20 dB.

4. Depress SCA INJ. NARROW, MAIN button on DISPLAY SELECT switch (A1S11).

5. Adjust A6R9 until CH.A meter (A1M2A) reads 100%. This is equal to 10% SCA injection.

6. Depress SCA INJ. WIDE, SCA MOD button on DISPLAY SELECT switch (A1S11).

7. Adjust A6R25 until CH.A meter (A1M2A) reads 100%. This is equal to 10% SCA injection.

8. Connect a scope probe to A6U2-9. Adjust A6R33 until signal on A6U2-9 locks onto incoming 67 KHz.

9. Reduce SCA injection to 3%. Adjust A6R39 until SCA PRESENT lamp (A1DS4) just lights.

10. Connect your SCA generator to the COMP IN (A1J13). Adjust COMP LEVEL (A1R4) for 10% injection.

11. Depress SCA INJ. NARROW, MAIN button on DISPLAY SELECT switch (A1S11). Place DEV switch (A1S9) in 4 KHz position.

12. Modulate the SCA generator with a frequency of 1660 Hz. Increase the audio input until the CH.A meter (A1M2A) nulls for the first time. NOTE: This is a Bessel null function for 4KHz deviation.

13. Depress SCA INJ. WIDE, SCA MOD button on DISPLAY SELECT switch (A1S11).

14. Adjust A6R15 until CH.B meter (A1M2B) reads 100%.

5-6 RECEIVER ALIGNMENT (A4 Assembly)

1. Complete alignment of A2 assembly (Section 5-2), A3 assembly (Section 5-3), A5 assembly (Section 5-4), and A6 assembly (Section 5-5).

2. LOG AMP ALIGNMENT

   a. Put probe from DC coupled scope on A4U6-6.

b. Depress LEFT, RIGHT button on DISPLAY SELECT switch (A1S11). Depress NARROW button on switch A1S4B.

c. Adjust A4R99 until positive peak of sawtooth wave is 3 volts above ground.

d. Adjust A4R108 until negative peak of sawtooth is 3 volts below ground.

e. Touch up either A4R99 or A4R108 until the peak to peak voltage of the sawtooth wave is symetrical around ground.

f. Attach a frequency counter to the junction of A4C88 and A4Z2. Adjust A4L18 for 11.145 MHz.

g. Set CARRIER FREQUENCY thumbwheel (A1S2) to the frequency you will use with your FM Signal Generator for RF Calibration.

h. Connect 691 Monitor for Spectrum Analyzer display (Section 3-1 (9)).

i. Connect FM Signal Generator to ANT input (A1J11). Set frequency of generator to that shown on the CARRIER FREQUENCY thumbwheel (A1S2). Modulate the Signal Generator with a 120 KHz tone at approximately 75 KHz deviation.

j. Adjust A4R97 until the 120 KHz sideband appear near the edge of the scope display.

k. Adjust A4C30 to peak Spectrum Analyzer display.

l. Depress WIDE button on switch A1S4B. Increase modulating frequency to about 300 KHz. Adjust A4R114 and A4R110 (if necessary) until 300 KHz sideband appear near the edge of the scope display.

3. DEMODULATOR ALIGNMENT

a. Connect 691 Monitor for Spectrum Analyzer display (Section 3-1 (9)).

b. Connect FM Signal Generator to ANT input (A1J11). Set frequency of generator to that shown on the CARRIER FREQUENCY thumbwheel (A1S2).

c. Modulate the signal generator with an audio tone of 13586 Hz. Increase the level of the tone until the carrier nulls for the second time. At this point the signal generator is deviating exactly 75 KHz (100%).

d. Adjust A4R121 until MOD PEAK lamp lights at 100%.

e. Reduce audio tone frequency to 400 Hz. Adjust level for 100% modulation.

f. Connect your Distortion Analyzer to DE EMP output (A1J2).

g. Adjust A4C38 and A4C40 for minimum distortion.

h. Recheck steps c and d if necessary.

i. Depress CAL button A1S7. Adjust A4L17 until carrier of calibrate oscillator appears centered on the Spectrum Analyzer display.

j. Adjust A4R35 and A4L16 until the carrier is in its deepest null. This will be a modulation percentage of 102.7%.

NOTE: Due to some distortion when filtering a square wave, some positive to negative assymetry will be noted.

SECTION 6

PARTS LIST

Parts List

Chassis Assembly A1

Ref. Des.	Description	QEI Part No.
A1C1	Cap., Cer., .01uf @ 1KV	110-0103-K
A1C2	Cap., Cer., .01uf @ 1KV	110-0103-K
A1C3	Cap., Elect., 5000uf	110-3508-25
A1C4	Cap., Elect., 5000uf	110-3508-25
A1C5	Cap., Poly, .01uf	110-4103
A1C6	Cap., Poly, .01uf	110-4103
A1C7	Cap., Poly, .01uf	110-4103
A1C8	Cap., Mica, 1000pf	110-1102
* A1C9	Cap., Selected	*
* A1C10	Cap., Mica, 120pf	110-1121 *
* A1C11	Cap., Mica, 300pf	110-1301 *
A1C12	Cap., Elect., 5000uf	110-3508-25
A1C13	Cap., Elect., 5000uf	110-3508-25
A1C14	Cap., Cer., .1uf	110-0104
A1C15	Cap., Elect., 100uf	110-3107
A1CR1	Diode, LED, Green	113-3001
A1CR2	Diode, LED, Red	113-3000
A1CR3	Diode, LED, Red	113-3000
A1CR4	Diode, LED, Yellow	113-3002
A1CR5	Diode, LED, Green	113-3001
A1CR6A, A1CR6B	Diode, LED, Red	113-3000
A1CR7	Diode, Bridge Rect.	113-1960-1
A1CR8	Diode, Bridge Rect.	113-1960-1
A1DS1	Amber Lens	192-0007
A1DS2	Display, LED (Part of A9 Ass'y)	
A1DS3	Green Lens	192-0008
A1DS4	Blue Lens	192-0006
A1DS5A, A1DS5B	Display, LED (Part of A10 Ass'y)	
A1F1	Fuse, 1 Amp	120-0002
A1FL1	Filter, Left-Right	L15K1.2A/B
A1FL2	Filter, L+R, 38KHz	L15K1.2B38K6
A1FL3	Filter, L-R	B2S3K6A

* Indicates factory selected - nominal value shown

Parts List

Chassis Assembly A1 (Cont'd)

Ref. Des.	Description	QEI Part No.
A1J1	Connector, BNC	130-0001
A1J2	Connector, BNC	130-0001
A1J3	Connector, BNC	130-0001
A1J4	Connector, BNC	130-0001
A1J5	Connector, BNC	130-0001
A1J6	Connector, BNC	130-0001
A1J7	Connector, BNC	130-0001
A1J8	Connector, BNC	130-0001
A1J9	Connector, BNC	130-0001
A1J10	Connector, BNC	130-0001
A1J11	Connector, F type	130-07024
A1J12	Connector, BNC	130-0001
A1J13	Connector, BNC	130-0001
A1J14	Connector, BNC	130-0001
A1M1	Meter, Modulation	145-0002
A1M2A	Meter, Modulation/Pilot	145-0005
A1M2B	Meter, Modulation	145-0002
A1R1	Res., Var., 1K, 2W	RV4NAYSD102A
A1R2	Res., Var., 100 Ohm, 2W	RV4LAYSD101A
A1R3	Res., Var., 10K, 2W	RV4LAYSD103A
A1R4	Res., Var., 5K, 2W	RV4LAYSD502A
A1R5	Res., Carb., 4.7K, ½W, 5%	RC20GF472J
A1R6	Res., Carb., 10K, ½W, 5%	RC20GF103J
A1R7	Res., Var., 250 Ohm	167-0251
A1R8	Res., Var., 250 Ohm	167-0251
A1R9	Res., Carb., 2.2K, ½W, 5%	RC20GF222J
A1R10	Res., Carb., 2.2K, ½W, 5%	RC20GF222J
A1R11	Res., Carb., 1.2K, ½W, 5%	RC20GF122J
A1R12	Res., Carb., 620 Ohm, ½W, 5%	RC20GF621J
A1R13	Res., Var., 250 Ohm	167-0251
A1R14	Res., Var., 250 Ohm	167-0251
A1R15	Res., Var., 250 Ohm	167-0251
A1R16	Res., Carb., 390 Ohm, ½W, 5%	RC20GF391J
A1R17	Res., Carb., 390 Ohm, ½W, 5%	RC20GF391J
A1R18	Res., Carb., 330 Ohm, ½W, 5%	RC20GF331J
A1R19	Res., Neg. Temp. Coefficient	168-0001
A1R20	Res., Neg. Temp. Coefficient	168-0001
A1R21	Res., Neg. Temp. Coefficient	168-0001
A1R22	Res., Carb., 620 Ohm, ½W, 5%	RC20GF621J
A1R23	Res., Carb., 100 Ohm, ½W, 5%	RC20GF101J

Parts List

Chassis Assembly A1 (Cont'd)

Ref. Des.	Description	QEI Part No.
A1S1	Switch, SPDT	175-0012-F
A1S2	Switch, Thumbwheel	175-0010
A1S3	Switch, SPDT	175-0012-F
A1S4A, A1S4B	Switch, (Part of A12 Ass'y)	
A1S5	Switch, Thumbwheel	175-0010
A1S6	Switch, 3 pos. on-off-Momentary	175-0013-F
A1S7	Switch, P.B. Momentary	175-0009
A1S8	Switch, DPDT	175-0014-F
A1S9	Switch, SPDT	175-0012-F
A1S10	Switch, DPDT	175-0011-F
A1S11	Switch, (Part of A11 Ass'y)	
A1S12A, A1S12B	Switch, Thumbwheel	175-0010
A1S13A, A1S13B	Switch, DPDT	175-0011-F
A1S14A, A1S14B	Switch, 3 pos., on-off-on	175-0015-F
A1S15A, A1S15B	Switch, P.B. Momentary	175-0009
A1S16	Switch, SPDT	17S-0012-F
A1T1	Transformer, Power	180-3140/A
A1T2	Transformer, Audio	180-2001
A1T3	Transformer, Audio	180-2001
A1U1	IC, 5 Volt Reg.	182-323K
A1U2	IC, +12 Volt Reg.	182-340T-12
A1U3	IC, -12 Volt Reg.	182-320T
A1XDS1	Lamp Socket	192-0001
A1XDS3	Lamp Socket	192-0001
A1XDS4	Lamp Socket	192-0001
A1XF1	Fuse Holder	193-0001

Parts List

PLL and Total Meter Driver Assembly A2

Ref. Des.	Description	QEI Part No.
A2	Assembly, P.C.	691002
A2C1	Cap., Mica, 470pf	110-1471
A2C2	Cap., Cer., .01uf	110-0103
A2C3	Cap., Cer., .001uf	110-0102
A2C4	Cap., Cer., .001uf	110-0102
A2C5	Cap., Cer., .01uf	110-0103
A2C6	Cap., Cer., .05uf	110-0503
A2C7	Cap., Mica, 620pf	110-1621
A2C8	Cap., Cer., .1uf	110-0104
A2C9	Cap., Cer., .001uf	110-0102
A2C10	Cap., Tant., .22uf	110-3224
A2C11	Cap., Tant., .47uf	110-3474
A2C12	Cap., Mica, 470pf	110-1471
A2C13	Cap., Mica, 470pf	110-1471
A2C14	Cap., Mica, 1000pf	110-1102
* A2C15	Cap., Mica, 27pf	110-1270 *
A2C16	Cap., Var., 1-10pf	110-6110
A2C17	Cap., Mica, 470pf	110-1471
A2C18	Cap., Mica, 470pf	110-1471
A2C19	Cap., Cer., .1uf	110-0104
A2C10	Cap., Cer., .001uf	110-0102
A2C21	Cap., Tant., .22uf	110-3224
A2C22	Cap., Elect., 5uf	110-3505
A2C23	Cap., Elect., 100uf	110-3107
A2C24	Cap., Tant., .22uf	110-3224
A2C25	Cap., Elect., 5uf	110-3505
A2C26	Cap., Elect., 100uf	110-3107
* A2C27	Cap., Mica, 250pf	110-1251 *
* A2C28	Cap., Mica, 15pf	110-1150 *
* A2C29	Cap., Tant., .47 uf	110-3474 *
* A2C30	Cap., Tant., 2.2uf	110-3225 *
A2C31	Cap., Cer., .01uf	110-0103
A2C32	Cap., Elect., 5uf	110-3505
A2CR1	Diode, Silicon	113-04446
A2CR2	Diode, Germanium	113-0034
A2CR3	Diode, Silicon	113-04446

* Indicates factory selected - nominal value shown

Parts List

PLL and Total Meter Driver Assembly A2 (Cont'd)

	Ref. Des.	Description	QEI Part No.	
	A2Q1	Transistor, NPN	160-05179	
	A2Q2	Transistor, NPN	160-04401	
	A2Q3	Transistor, NPN	160-04401	
	A2Q4	Transistor, NPN	160-04401	
	A2Q5	Transistor, NPN	160-04401	
	A2Q6	Transistor, NPN	160-04401	
	A2Q7	Transistor, FET	160-13819	
	A2Q8	Transistor, NPN	160-04401	
	A2Q9	Transistor, NPN	160-05179	
	A2Q10	Transistor, NPN	160-04401	
	A2Q11	Transistor, NPN	160-04401	
	A2Q12	Transistor, NPN	160-04401	
	A2Q13	Transistor, NPN	160-04401	
	A2Q14	Transistor, NPN	160-04401	
	A2Q15	Transistor, NPN	160-04401	
	A1Q16	Transistor, NPN	160-04401	
	A2R1	Res., Carb., 1K, ¼W, 5%	RC07GF102J	
	A2R2	Res., Carb., 1K, ¼W, 5%	RC07GF102J	
	A2R3	Res., Carb., 1K, ¼W, 5%	RC07GF102J	
	A2R4	Res., Carb., 1K, ¼W, 5%	RC07GF102J	
	A2R5	Res., Carb., 1K, ¼W, 5%	RC07GF102J	
	A2R6	Res., Carb., 1K, ¼W, 5%	RC07GF102J	
	A2R7	Res., Carb., 1K, ¼W, 5%	RC07GF102J	
	A2R8	Res., Carb., 1K, ¼W, 5%	RC07GF102J	
	A2R9	Res., Carb., 1K, ¼W, 5%	RC07GF102J	
	A2R10	Res., Carb., 4.7K, ¼W, 5%	RC07GF472J	
	A2R11	Res., Carb., 100 Ohm, ½W, 5%	RC20GF101J	
	A2R12	Res., Carb., 3.3K, ½W, 5%	RC20GF332J	
	A2R13	Res., Carb., 330 Ohm, ½W, 5%	RC20GF331J	
	A2R14	Res., Carb., 390 Ohm, ½W, 5%	RC20GF391J	
	A2R15	Res., Carb., 270 Ohm, ½W, 5%	RC20GF271J	
	A2R16	Res., Carb., 270 Ohm, ½W, 5%	RC20GF271J	
	A2R17	Res., Carb., 620 Ohm, ½W, 5%	RC20GF621J	
	A2R18	Res., Carb., 1.5K, ½W, 5%	RC20GF152J	
	A2R19	Res., Carb., 1.5K, ½W, 5%	RC20GF152J	
	A2R20	Res., Carb., 33K, ½W, 5%	RC20GF333J	
	A2R21	Res., Carb., 33K, ½W, 5%	RC20GF333J	
*	A2R22	Res., Carb., 56K, ½W, 5%	RC20GF563J	*
*	A2R23	Res., Carb., 150K, ½W, 5%	RC20GF154J	*
	A2R24	Res., Carb., 33K, ½W, 5%	RC20GF333J	
	A2R25	Res., Carb., 33K, ½W, 5%	RC20GF333J	

* Indicates factory selected - nominal value shown

Parts List

PLL and Total Meter Driver Assembly A2 (Cont'd)

Ref. Des.	Description	QEI Part No.
A2R26	Res., Carb., 10K, ½W, 5%	RC20GF103J
A2R27	Res., Carb., 4.7K, ½W, 5%	RC07GF472J
A2R28	Res., Carb., 4.7K, ½W, 5%	RC20GF472J
A2R29	Res., Carb., 15K, ½W, 5%	RC20GF153J
A2R30	Res., Carb., 4.7K, ½W, 5%	RC20GF472J
* A2R31	Res., Carb., 100K, ½W, 5%	RC20GF104J *
A2R32	Res., Carb., 3.3K, ½W, 5%	RC20GF332J
A2R33	Res., Carb., 3.3K, ½W, 5%	RC20GF332J
A2R34	Res., Carb., 3.3K, ½W, 5%	RC20GF332J
A2R35	Res., Carb., 10K, ½W, 5%	RC20GF103J
A2R36	Res., Carb., 1.2K, ½W, 5%	RC20GF122J
A2R37	Res., Carb., 330K, ½, 5%	RC20GF334J
A2R38	Res., Carb., 33K, ½W, 5%	RC20GF333J
A2R39	Res., Carb., 4.7K, ½W, 5%	RC20GF472J
A2R40	Res., Carb., 4.7K, ½W, 5%	RC20GF472J
A2R41	Res., Carb., 1.5K, ½W, 5%	RC20GF152J
A2R42	Res., Carb., 510 Ohm, ½W, 5%	RC20GF511J
A2R43	Res., Carb., 100 Ohm, ½W, 5%	RC20GF101J
A2R44	Res., Carb., 220 Ohm, ½W, 5%	RC20GF221J
A2R45	Res., Carb., 10K, ½W, 5%	RC20GF103J
A2R46	Res., Carb., 33K, ½W, 5%	RC20GF333J
A2R47	Res., Carb., 330 Ohm, ½W, 5%	RC20GF331J
A2R48	Res., Carb., 120 Ohm, ½W, 5%	RC20GF121J
A2R49	Res., Carb., 470 Ohm, ½W, 5%	RC20GF471J
A2R50	Res., Carb., 1.5K, ½W, 5%	RC20GF152J
A2R51	Res., Carb., 4.7K, ½W, 5%	RC20GF472J
A2R52	Res., Carb., 10K, ½W, 5%	RC20GF103J
A2R53	Res., Carb., 4.7K, ½W, 5%	RC20GF472J
A2R54	Res., Carb., 15K, ½W, 5%	RC20GF153J
A2R55	Res., Carb., 33K, ½W, 5%	RC20GF333J
A2R56	Res., Carb., 4.7K, ½W, 5%	RC20GF472J
A2R57	Res., Film, 2.0 K, ¼W, 1%	165-2001
A2R58	Res., Film, 2.49K, ¼W, 1%	165-2491
A2R59	Res., Film, 4.99K, ¼W, 1%	165-4991
A2R60	Res., Film, 10.0K, ¼W, 1%	165-1002
A2R61	Res., Film, 20.0K, ¼W, 1%	165-2002
A2R62	Res., Film, 25.0K, ¼W, 1%	165-2502
A2R63	Res., Film, 49.9K, ¼W, 1%	165-4992
A2R64	Res., Film, 100.0K, ¼W, 1%	165-1003
A2R65	Res., Film, 200.0K, ¼W, 1%	165-2003
A2R66	Res., Film, 499 Ohm, ¼W, 1%	165-4990
A2R67	Res., Carb., 1K, ½W, 5%	RC20GF102J
A2R68	Res., Carb., 4.7K, ½W, 5%	RC20GF472J
A2R69	Res., Var., 10K, ½W, 5%	167-3002
A2R70	Res., Film, 5.11K, ¼W, 1%	165-5111
A2R71	Res., Film, 11K, ¼W, 1%	165-1102
A2R72	Res., Carb., 1K, ½W, 5%	RC20GF102J

* Indicates factory selected - nominal value shown

Parts List

PLL and Total Meter Driver Assembly A2 (Cont'd)

Ref. Des.	Description	QEI Part No.
A2R73	Res., Carb., 10M, ½W, 5%	RC20GF106J
A2R74	Res., Carb., 1K, ¼W, 5%	RC07GF102J
A2R75	Res., Carb., 10M, ½W, 5%	RC20GF106J
A2R76	Res., Carb., 3.3K, ½W, 5%	RC20GF332J
A2R77	Res., Carb., 3.3K, ½W, 5%	RC20GF332J
A2R78	Res., Carb., 4.7K, ¼W, 5%	RC07GF472J
A2R79	Res., Carb., 1.5K, ½W, 5%	RC20GF152J
* A2R80	Res., Carb., 33K, ½W, 5%	RC20GF333J *
A2R81	Res., Carb., 68 Ohm, 2W, 10%	RC42GF680K
A2R82	Res., Carb., 8.2K, ½W, 5%	RC20GF822J
A2R83	Res., Var., 1K	167-3102
A2R84	Res., Carb., 2.2K, ½W, 5%	RC20GF222J
A2R85	Res., Carb., 8.2K, ½W, 5%	RC20GF822J
A2R86	Res., Var., 1K	167-3001
A2R87	Res., Carb., 2.2K, ½W, 5%	RC20GF222J
A2R88	Res., Carb., 1K, ¼W, 5%	RC07GF102J
A2R89	Res., Carb., 10M, ½W, 5%	RC20GF106J
A2R90	Res., Carb., 1K, ¼W, 5%	RC07GF102J
A2R91	Res., Carb., 10M, ½W, 5%	RC20GF106J
A2R92	Res., Carb., 3.3K, ½W, 5%	RC20GF332J
A2R93	Res., Carb., 3.3K, ½W, 5%	RC20GF332J
A2R94	Res., Carb., 4.7K, ¼W, 5%	RC07GF472J
* A2R95	Res., Carb., 15K, ½W, 5%	RC20GF153J *
A2R96	Res., Carb., 1K, ½W, 5%	RC20GF102J
A2R97	Res., Carb., 7.5K, ½W, 5%	RC20GF752J
A2R98	Res., Film, 7.5K, ¼W, 1%	165-7501
A2R99	Res., Var., 1K	167-3001
A2R100	Res., Film, 1.21K, ¼W, 1%	165-1211
A2R101	Res., Carb., 10K, ½W, 5%	RC20GF103J
A2R102	Res., Carb., 8.2K, ½W, 5%	RC20GF822J
A2R103	Res., Film, 2.0 K, ¼W, 1%	165-2001
A2R104	Res., Var., 10K	167-3103
A2R105	Res., Carb., 100K, ½W, 5%	RC20GF104J
A2R106	Res., Carb., 1.5K, ½W, 5%	RC20GF152J
* A2R107	Res., Carb., 12M, ½W, 5%	RC20GF126J *
* A2R108	Res., Carb., 27K, ½W, 5%	RC20GF273J *
* A2R109	Res., Carb., 3.3K, ½W, 5%	RC20GF332J *
A2R110	Res., Var., 10K	167-3002
* A2R111	Res., Carb., 10K, ½W, 5%	RC20GF103J *
* A2R112	Res., Carb., 8.2K, ½W, 5%	RC20GF822J *
A2R113	Res., Carb., 1K, ½W, 5%	RC20GF102J
A2R114	Res., Carb., 1K, ½W, 5%	RC20GF102J
A2R115	Res., Carb., 100K, ½W, 5%	RC20GF104J
A2R116	Res., Carb., 470 Ohm, ½W, 5%	RC20GF471J
A2R117	Res., Carb., 4.7K, ½W, 5%	RC20GF472J

* Indicates factory selected - nominal value shown

Parts List

PLL and Total Meter Driver Assembly A2 (Cont'd)

Ref. Des.	Description	QEI Part No.
A2R118	Res., Carb., 4.7K, ¼W, 5%	RC07GF472J
A2R119	Res., Carb., 47K, ½W, 5%	RC20GF472J
A2R120	Res., Carb., 2.7K, ½W, 5%	RC20GF272J
A2T1	Transformer, RF	180-22137B
A2U1	IC, Full Adder	182-7483
A2U2	IC, ECL	182-10131
A2U3	IC, Counter	182-8290
A2U4	IC, Up/Down Counter	182-74192
A2U5	IC, Up/Down Counter	182-74192
A2U6	IC, Up/Down Counter	182-74192
A2U7	IC, Flip-Flop	182-7474
A2U8	IC, Decade Counter	182-7490
A2U9	IC, Decade Counter	182-7490
A2U10	IC, Binary Counter	182-7493
A2U11	IC, Decade Counter	182-7490
A2U12	IC, Retriggerable One Shot	182-74123
A2U13	IC, Op. Amp.	182-1709
A2U14	IC, Op. Amp.	182-1741
A2U15	IC, Op. Amp.	182-1741
A2U16	IC, Op. Amp.	182-1741
A2U17	IC, Op. Amp.	182-1741
A2U18	IC, Op. Amp.	182-1741
A2U19	IC, One Shot	182-74121
A2U20	IC, Quad Comparator	182-339
A2U21	IC, One Shot	182-74121
A2U22	IC, Quad NOR Gate	182-7402
A2U23	IC, Quad NAND Gate	182-7400
A2U24	IC, Decade Counter	182-7490
A2U25	IC, Quad NAND Gate	182-7400
A2U26	IC, Dual NAND Gate	182-7440
A2Y1	Crystal, 8.0 MHz	198-0800

Parts List

Dual Average Voltmeter Assembly A3

Ref. Des.	Description	QEI Part No.
A3	Assembly, P.C.	691003
A3C1, A3C101	Cap., Cer., .1uf	110-0104
A3C2, A3C102	Cap., Cer., .001uf	110-0102
A3C3, A3C103	Cap., Cer., .1uf	110-0104
A3C4, A3C104	Cap., Mica, 270pf	110-1271
* A3C5, A3C105	Cap., Mica, 10pf	110-1100*
A3C6, A3C106	Cap., Elect., 15uf	110-3156
A3C7, A3C107	Cap., Elect., 100uf	110-3107
A3C8, A3C108	NOT USED	
A3C9, A3C109	Cap., Cer., .1uf	110-0104
A3C10, A3C110	Cap., Elect., 100uf	110-3107-25
A3C11, A3C111	Cap., Elect., 100uf	110-3107-25
A3C12, A3C112	Cap., Elect., 50uf	110-3506-25
A3C13, A3C113	Cap., Elect., 15uf	110-3156
A3C14, A3C114	Cap., Elect., 15uf	110-3156
A3C15, A3C115	Cap., Elect., 50uf	110-3506
* A3C16, A3C116	Cap., Tant., 1uf	110-3105T *
* A3C17, A3C117	Cap., Tant., 2.2uf	110-3225T *
A3C18, A3C118	Cap., Tant., .47uf	110-3474T
A3C19, A3C119	Cap., Cer., .1uf	110-0104
A3C20, A3C120	Cap., Elect., 100uf	110-3107-25
A3C21	Cap., Elect., .47uf	110-3474
A3C22	Cap., Cer., .1uf	110-0104
A3C23	Cap., Cer., .05uf	110-0503
A3C24	Cap., Cer., .01uf	110-0103
* A3C25	Cap., Elect., 15uf	110-3156*
A3CR1, A3CR101	Diode, Silicon	113-04446
A3CR2, A3CR102	Diode, Silicon	113-04446
A3CR3, A3CR103	Diode, Silicon	113-04446
A3CR4, A3CR104	Diode, Silicon	113-04446
A3CR5, A3CR105	Diode, Germanium	113-0003
A3CR6, A3CR106	Diode, Silicon	113-04446
A3CR7, A3CR107	Diode, Silicon	113-04446
A3CR8, A3CR108	Diode, Silicon	113-04446
A3R1, A3R101	Res., Film, 200K, ¼W, 1%	165-2003
A3R2, A3R102	Res., Film, 100K, ⅛W, 1%	165-1003
A3R3, A3R103	Res., Film, 49.9K, ⅛W, 1%	165-4992
A3R4, A3R104	Res., Film, 25K, ¼W, 1%	165-2502
A3R5, A3R105	Res., Film, 20K, ¼W, 1%	165-2002
A3R6, A3R106	Res., Film, 10K, ⅛W, 1%	165-1002
A3R7, A3R107	Res., Film, 4.99K, ⅛W, 1%	165-4991
A3R8, A3R108	Res., Film, 2.49K, ⅛W, 1%	165-2491
A3R9, A3R109	Res., Film, 2.00K, ⅛W, 1%	165-2001

* Indicates factory selected - nominal value shown

Parts List

Dual Average Voltmeter Assembly A3 (Cont'd)

Ref. Des.	Description	QEI Part No.
A3R10, A3R110	Res., Carb., 10K, ½W, 5%	RC20GF103J
A3R11, A3R111	Res., Film, 332 Ohm, ¼W, 1%	165-3320
A3R12, A3R112	Res., Carb ., 10K, ½W, 5%	RC20GF103J
A3R13, A3R113	Res., Carb., 1.2K, ½W, 5%	RC20GF122J
A3R14, A3R114	Res., Carb., 10K, ½W, 5%	RC20GF103J
A3R15, A3R115	Res., Carb., 22K, ½W, 5%	RC20GF223J
A3R16, A3R116	Res., Carb., 1K, ½W, 5%	RC20GF102J
A3R17, A3R117	Res., Carb., 560K, ½W, 5%	RC20GF564J
A3R18, A3R118	Res., Carb., 4.7K, ½W, 5%	RC20GF472J
A3R19, A3R119	Res., Carb., 10K, ½W, 5%	RC20GF103J
A3R20, A3R120	Res., Carb., 1K, ½W, 5%	RC20GF102J
A3R21, A3R121	Res., Carb., 10K, ½W, 5%	RC20GF103J
A3R22, A3R122	Res., Carb., 10M, ½W, 5%	RC20GF106J
A3R23, A3R123	Res., Carb., 330K, ½W, 5%	RC20GF334J
* A3R24, A3R124	Res., Carb., 1.5K, ½W, 5%	RC20GF152J *
A3R25, A3R125	Res., Var., 1K	167-3102
A3R26, A3R126	Res., Carb., 12K, ½W, 5%	RC20GF123J
A3R27, A3R127	Res., Carb., 820 Ohm, ½W, 5%	RC20GF821J
A3R28, A3R128	Res., Carb., 1.5K, ½W, 5%	RC20GF821J
A3R29, A3R129	Res., Carb., 56K, ½W, 5%	RC20GF563J
A3R30, A3R130	Res., Carb., 1.5K, ½W, 5%	RC20GF152J
A3R31, A3R131	Res., Carb., 2.2K, ½W, 5%	RC20GF222J
A3R32, A3R132	Res., Film, 23.7K, ¼W, 1%	165-2372
A3R33, A3R133	Res., Carb., 10K, ½W, 5%	RC20GF103J
A3R34, A3R134	Res., Carb., 1K, ½W, 5%	RC20GF102J
A3R35, A3R135	Res., Carb., 4.7K, ¼W, 5%	RC07GF472J
A3R36, A3R136	Res., Film, 2.67K, ¼W, 1%	165-2671
A3R37, A3R137	Res., Film, 1.21K, ¼W, 1%	165-1211
A3R38, A3R138	Res., Carb., 4.7K, ¼W, 5%	RC07GF472J
A3R39, A3R139	Res., Film, 23.7K, ¼W, 1%	165-2372
A3R40, A3R140	Res., Film, 768 Ohm, ¼W, 1%	165-7680
A3R41, A3R141	Res., Film, 61.9 Ohm, ¼W, 1%	165-61R9
A3R42, A3R142	Res., Carb., 10K, ½W, 5%	RC20GF103J
A3R43, A3R143	Res., Carb., 510 Ohm, ½W, 5%	RC20GF511J
A3R44, A3R144	Res., Carb., 4.7K, ¼W, 5%	RC07GF472J
A3R45, A3R145	Res., Carb., 10K, ½W, 5%	RC20GF103J
A3R46, A3R146	Res., Carb., 4.7K, ¼W, 5%	RC07GF472J
A3R47, A3R147	Res., Carb., 5.1K, ½W, 5%	RC20GF512J
A3R48, A3R148	Res., Carb., 1.2K, ½W, 5%	RC20GF122J
A3R49, A3R149	Res., Carb., 3.3K, ½W, 5%	RC20GF332J
A3R50, A3R150	Res., Carb., 1M, ½W, 5%	RC20GF105J
A3R51, A3R151	Res., Carb., 1M, ½W, 5%	RC20GF105J
A3R52, A3R152	Res., Carb., 2.2K, ½W, 5%	RC20GF222J
A3R53, A3R153	Res., Carb., 10K, ½W, 5%	RC20GF103J
A3R54, A3R154	Res., Carb., 10K, ½W, 5%	RC20GF103J
A3R55, A3R155	Res., Carb., 2.2K, ½W, 5%	RC20GF222J
A3R56, A3R156	Res., Carb., 4.7K, ½W, 5%	RC20GF472J
A3R57, A3R157	Res., Carb., 5.6K, ½W, 5%	RC20GF562J
A3R58, A3R158	Res., Carb., 22K, ½W, 5%	RC20GF223J

* Indicates factory selected - nominal value shown

Parts List

Dual Average Voltmeter Assembly A3 (Cont'd)

Ref. Des.	Description	QEI Part No.
A3R59, A3R159	Res., Carb., 6.8K, ½, 5%	RC20GF682J
A3R60, A3R160	Res., Var., 10K	167-3103
A3R61, A3R161	Res., Carb., 4.7K, ½W, 5%	RC20GF472J
A3R62, A3R162	Res., Carb., 10K, ½W, 5%	RC20GF103J
A3R63, A3R163	Res., Carb., 4.7K, ¼W, 1%	RC07GF472J
A3R64, A3R164	Res., Carb., 4.7K, ¼W, 1%	RC07GF472J
* A3R65, A3R165	Res., Carb., 560K, ½W, 5%	RC20GF564J *
* A3R66, A3R166	Res., Carb., 3.3M, ½W, 5%	RC20GF335J *
* A3R67, A3R167	Res., Carb., 1.5M, ½W, 5%	RC20GF155J *
A3R68, A3R168	Res., Carb., 22K, ½W, 5%	RC20GF223J
* A3R69, A3R169	Res., Carb., 15 K, ½W, 5%	RC20GF153J *
A3R70, A3R170	Res., Carb., 4.7K, ½W, 5%	RC20GF472J
A3R71, A3R171	Res., Carb., 22K, ½W, 5%	RC20GF223J
* A3R72, A3R172	Res., Carb., 22K, ½W, 5%	RC20GF223J *
A3R73, A3R173	Res., Var., 10K	167-3103
A3R74, A3R174	Res., Var., 10K	167-3103
A3R75, A3R175	Res., Carb., 47K, ½W, 5%	RC20GF473J
A3R76, A3R176	Res., Carb., 820 Ohm, ½W, 5%	RC20GF821J
* A3R77, A3R177	Res., Carb., 8.2K, ½W, 5%	RC20GF822J *
* A3R78, A3R178	Res., Carb., 10K, ½W, 5%	RC20GF103J *
A3R79, A3R179	Res., Carb., 560K, ½W, 5%	RC20GF564J
A3R80, A3R180	Res., Carb., 100K, ½W, 5%	RC20GF104J
A3R81, A3R181	Res., Carb., 100K, ½W, 5%	RC20GF104J
A3R82, A3R182	Res., Carb., 100K, ½W, 5%	RC20GF104J
A3R83, A3R183	Res., Carb., 100K, ½W, 5%	RC20GF104J
A3R84, A3R184	Res., Carb., 1K, ¼W, 5%	RC07GF102J
A3R85, A3R185	Res., Carb., 270 Ohm, ¼W, 5%	RC07GF271J
A3R86, A3R186	Res., Carb., 270 Ohm, ¼W, 5%	RC07GF271J
A3R87, A3R187	Res., Carb., 270 Ohm, ¼W, 5%	RC07GF271J
A3R88, A3R188	Res., Carb., 270 Ohm, ¼W, 5%	RC07GF271J
A3R89, A3R189	Res., Carb., 270 Ohm, ¼W, 5%	RC07GF271J
A3R90, A3R190	Res., Carb., 270 Ohm, ¼W, 5%	RC07GF271J
A3R91, A3R191	Res., Carb., 270 Ohm, ¼W, 5%	RC07GF271J
A3R92, A3R192	Res., Film, 11K, ¼W, 1%	165-1102
A3R93	Res., Carb., 4.7K, ¼W, 5%	RC07GF472J
A3R94	Res., Carb., 2.2M, ½W, 5%	RC20GF225J
* A3R95	Res., Carb., 1.5M, ½W, 5%	RC20GF155J *
A3R96	Res., Carb., 220 Ohm, ½W, 5%	RC20GF221J
A3R97	Res., Carb., 47K, ½W, 5%	RC20GF473J
A3R98	Res., Carb., 470K ¼W, 5%	RC20GF474J
A3R99	Res., Carb., 4.7K, ½W, 5%	RC20GF472J
A3R100	Res., Carb., 120 Ohm, ½W, 5%	RC20GF121J
A3R193	Res., Carb., 270 Ohm, ¼W, 5%	RC07GF271J
A3R194	Res., Carb., 270 Ohm, ¼W, 5%	RC07GF271J
A3R195	Res., Carb., 270 Ohm, ¼W, 5%	RC07GF271J
A3R196	Res., Carb., 270 Ohm, ¼W, 5%	RC07GF271J

* Indicates factory selected - nominal value shown

Parts List

Dual Average Voltmeter Assembly A3 (Cont'd)

Ref. Des.	Description	QEI Part No.
A3R197	Res., Carb., 270 Ohm, ¼W, 5%	RC07GF271J
A3R198	Res., Carb., 270 Ohm, ¼W, 5%	RC07GF271J
A3R199	Res., Carb., 270 Ohm, ¼W, 5%	RC07GF271J
A3R200	Res., Carb., 1K, ½W, 5%	RC20GF102J
A3R201	Res., Carb., 5.6K, ½W, 5%	RC20GF 562J
A3R202	Res., Carb., 3.3K, ½W, 5%	RC20GF332J
A3R203	Res., Carb., 3.3K, ½W, 5%	RC20GF332J
A3R204	Res., Carb., 5.6K, ½W, 5%	RC20GF 562J
A3Q1, A3Q101	Transistor, NPN	160-4401
A3Q2, A3Q102	Transistor, NPN	160-4401
A3Q3, A3Q103	Transistor, NPN	160-4401
A3Q4, A3Q104	Transistor, NPN	160-4401
A3Q5, A3Q105	Transistor, PNP	160-4403
A3Q6, A3Q106	Transistor, NPN	160-4401
A3Q7, A3Q107	Transistor, NPN	160-4401
A3Q8, A3Q108	Transistor, NPN	160-4401
A3Q9, A3Q109	Transistor, NPN	160-4401
A3Q10, A3Q110	Transistor, NPN	160-4401
A3U1, A3U101	IC, Quad Comparator	182-0339
A3U2, A3U102	IC, Op. Amp.	182-1709
A3U3, A3U103	IC, Hex Inverter	182-7405
A3U4, A3U104	IC, Decoder Driver	182-7447
A3U5, A3U105	IC, Quad NAND Gate	182-7400
A3U6, A3U106	IC, Counter, Up/Down	182-74192
A3U7, A3U107	IC, Quad NOR Gate	182-7402
A3U8, A3U108	IC, Quad Comparator	182-0339
A3U9, A3U109	IC, Op. Amp.	182-1741
A3U10	IC, Timer	182-0555
A3U11	IC, Timer	182-0555
A3U12	IC, Dual NAND Gate	182-7440
A3U13	IC, Decoder Driver	182-7447

Parts List

Receiver Assembly A4

Ref. Des.	Description	QEI Part No.
A4	Assembly, P.C.	691004
A4C1	Cap., Mica, 1000pf, DM15	110-1102
A4C2	Cap., Mica, 1000pf, DM15	110-1102
A4C3	Cap., Mica, 1000pf, DM15	110-1102
A4C4	Cap., Mica, 1000pf, DM15	110-1102
A4C5	Cap., Mica, 27pf, DM15	110-1270
A4C6	Cap., Mica, 51pf, DM15	110-1510
A4C7	Cap., Mica, 27pf, DM15	110-1270
A4C8	Cap., Mica, 68pf, DM15	110-1680
A4C9	Cap., Mica, 470pf, DM15	110-1471
A4C10	Cap., Mica, 2-22pf var.	110-6518
A4C11	Cap., Cer., .1uf	110-0104
A4C12	Cap., Tant., 1.0uf	110-3105T
A4C13	Cap., Mica, 68pf, DM15	110-1680
A4C14	Cap., Mica, 2-22pf var.	110-6518
A4C15	Cap., Mica, 2-22pf var.	110-6518
A4C16	Cap., Cer., .1uf	110-0104
A4C17	Cap., Mica, 68pf, DM15	110-1680
A4C18	Cap., Mica, 2-22pf var.	110-6518
A4C19	Cap., Mica, 2-22pf var.	110-6518
A4C20	Cap., Mica, 68 pf, DM15	110-1680
A4C21	Cap., Mica, 2-22pf var.	110-6518
A4C22	Cap., Mica, 2-22pf var.	110-6518
A4C23	Cap., Mica, 68pf, DM15	110-1680
A4C24	Cap., Mica, 2-22pf var.	110-6518
A4C25	Cap., Mica, 2-22pf var.	110-6518
A4C26	Cap., Mica, 2-22pf var.	110-6518
A4C27	Cap., Mica, 51pf, DM15	110-1510
A4C28	Cap., Cer., .1uf	110-0104
A4C29	Cap., Mica, 5pf, DM15	110-1500
A4C30	Cap., Mica, 5-65pf var.	110-6565
*A4C31	Cap., Mica, 68pf, DM15	110-1680*
A4C32	Cap., Poly, 500 pf	110-1501
A4C33	Cap., Cer. .1uf	110-0104
A4C34	Cap., Cer., .05uf	110-0503
A4C35	Cap., Cer., .05uf	110-0503
A4C36	Cap., Cer., .1uf	110-0104
*A4C37	Cap., Mica, 68pf, DM15	110-1680*
A4C38	Cap., Mica, 2-22pf var.	110-6518
A4C39	Cap., Mica, 10 pf, DM15	110-1100
A4C40	Cap., Mica, 2-22pf var.	110-6518
A4C41	Cap., Mica, 91pf, DM15	110-1910
A4C42	Cap., Tant., 1.0uf	110-3105T
A4C43	Cap., Tant., 1.0uf	110-3105T
*A4C44	Cap., Mica, 300pf, DM15	110-1301 *
*A4C45	Cap., Mica, 10pf, DM15	110-1100 *
*A4C46	Cap., Mica, 1000pf, DM15	110-1102 *
*A4C47	Cap., Mica, 120pf, DM15	110-1121 *
*A4C48	Cap., Mica, 27pf, DM15	110-1270 *

* Indicates factory selected value - nominal shown.

Parts List

Receiver Assembly A4 (Cont'd)

Ref. Des.	Description	QEI Part No.
* A4C49	Cap., Mica, 270pf, DM15	110-1271 *
A4C50	Reserved	
* A4C51	Cap., Mica, 1000pf, DM15	110-1102 *
A4C52	Cap., Cer., .001uf	110-0102
A4C53	Cap., Cer., .1uf	110-0104
A4C54	Cap., Poly, 10,000pf	110-4103
44C55	Cap., Poly, 10,000pf	110-4103
A4C56	Cap., Mica, 120pf, DM15	110-1121
* A4C57	Cap., Mica, 68pf, DM15	110-1680 *
A4C58	Cap., Poly, 1000pf	110-4102
A4C59	Cap., Poly, 1000pf	110-4102
A4C60	Cap., Cer., .1uf	110-0104
A4C61	Cap., Cer., .001uf	110-0102
A4C62	Cap., Mica, 620pf, DM15	110-1621
A4C63	Cap., Cer., .1uf	110-0104
A4C64	Cap., Cer., .1uf	110-0104
A4C65	Cap., Tant. 1.0uf	110-3105T
A4C66	Cap., Cer., .1uf	110-0104
A4C67	Cap., Cer., .1uf	110-0104
A4C68	Cap., Cer., .1uf	110-0104
A4C69	Cap., Cer., .1uf	110-0104
A4C70	Cap., Cer., .1uf	110-0104
A4C71	Cap., Cer., .1uf	110-0104
A4C72	Cap., Mica, 27pf, DM15	110-1270
A4C73	Cap., Mica, 27pf, DM15	110-1270
A4C74	Cap., Cer., .1uf	110-0104
A4C75	Cap., Mica, 5pf, DM15	110-1500
A4C76	Cap., Cer., .1uf	110-0104
A4C77	Cap., Cer., .1uf	110-0104
A4C78	Cap., Cer., .01uf	110-0103
A4C79	Cap., Cer., .05uf	110-0503
A4C80	Cap., Mica, 620pf, DM15	110-1621
A4C81	Cap., Cer., .1uf	110-0104
A4C82	Cap., Cer., .001uf	110-0102
A4C83	Cap., Tant., 1.0uf	110-3105T
A4C84	Cap., Elect., 200uf	110-3207-15
A4C85	Cap., Cer., .1uf	110-0104
A4C86	Cap., Cer., .1uf	110-0104
A4C87	Cap., Elect., 200uf	110-3207-15
A4C88	Cap., Cer., .1uf	110-0104
A4C89	Cap., Cer., .01uf	110-0103
A4C90	Cap., Poly, 1000pf	110-4102
A4C91	Cap., Poly, 1000pf	110-4102
A4C92	Cap., Cer., .1uf	110-0104
* A4C93	Cap., Mica, 51pf, DM15	110-1510 *
A4C94	Cap., Cer., .01uf	110-0103

* Indicates factory selected value - nominal shown

Parts List

Receiver Assembly A4 (Cont'd)

Ref. Des.	Description	QEI Part No.
A4C95	Cap., Mica, 120pf, DM15	110-1121
A4C96	Cap., Elect., 100uf	110-3107-25
A4C97	Cap., Elect., 5uf	110-3505-25
A4C98	Cap., Elect., 200uf	110-3207-15
A4C99	Cap., Elect., 100uf	110-3107-25
A4C100	Cap., Cer., .1uf	110-0104
A4C101	Cap., Elect., 100uf	110-3107-25
A4C102	Cap., Cer., .1uf	110-0104
A4C103	Cap., Poly, 2200pf	110-4222
A4C104	Cap., Cer., .1uf	110-0104
A4C105	Cap., Elect. 15uf	110-3156-25
A4C106	Cap., Cer., .1uf	110-0104
A4C107	Cap., Tant., 2.2uf	110-3225T
A4CR1	Diode, Varicap	113-51650
A4CR2	Diode, Zener	113-25234
A4CR3	Diode, Zener	113-25234
A4CR4	Diode, Silicon	113-04446
A4CR5	Diode, Silicon	113-04446
A4CR6	Diode, Silicon	113-04446
A4CR7	Diode, Silicon	113-04446
A4CR8	Diode, Germanium	113-0034
A4CR9	Diode, Germanium	113-0034
A4CR10	Diode, Varicap	113-51650
A4CR11	Diode, Varicap	113-51650
A4CR12	Diode, Silicon	113-04446
A4CR13	Diode, Silicon	113-04446
A4CR14	Diode, SCR	113-45061
A4CR15	Diode, Silicon	113-04446
A4CR16	Diode, Silicon	113-04446
A4CR17	Diode, Silicon	113-04446
A4FL1	Filter, 1st IF	146-107M
A4FL2	Filter, 2nd IF	146-455KI
A4FL3	Filter, 2nd IF	146-455KD
A4L1	Inductor, RF	140-0418
A4L2	Inductor, RF	140-0418
A4L3	Inductor, RF toroid	140-256030
A4L4	Inductor, IF toroid	140-256015B
A4L5	Inductor, IF toroid	140-256030
A4L6	Inductor, IF toroid	140-256030
A4L7	Inductor, IF toroid	140-256030
A4L8	Inductor, IF toroid	140-256015B
A4L9	Inductor, IF toroid	140-256012
A4L10	Inductor, Det toroid	140-221324

Parts List

Receiver Assembly A4 (Cont'd)

Ref. Des.	Description	QEI Part No.
A4L11	Inductor, Det toroid	140-256030
A4L12	Inductor, Det toroid	140-256030
A4L13	Inductor, Audio	140-42098
A4L14	Inductor, Audio	140-42098
A4L15	Inductor, Audio	140-42124 CT
A4L16	Inductor, Audio	140-42122
A4L17	Inductor, Cal Osc	140-30030
A4L18	Inductor, 2nd LO	140-30030
A4L19	Inductor, Choke 15uh	140-2150
A4L20	Inductor, Choke 15uh	140-2150
A4L21	Inductor, Choke, Wideband	140-2008
A4Q1	Transistor, NPN	160-05179
A4Q2	Transistor, FET	160-13819
A4Q3	Transistor, NPN	160-05179
A4Q4	Transistor, NPN	160-04401
A4Q5	Transistor, PNP	160-04403
A4Q6	Transistor, NPN	160-04401
A4Q7	Transistor, NPN	160-05179
A4Q8	Transistor, NPN	160-04401
A4Q9	Transistor, NPN	160-04401
A4Q10	Transistor, PNP	160-04403
A4Q11	Transistor, NPN	160-04401
A4Q12	Transistor, PNP	160-04403
A4Q13	Transistor, NPN	160-05179
A4Q14	Transistor, NPN	160-05179
A4Q15	Transistor, FET	160-13819
A4Q16	Transistor, NPN	160-04401
A4Q17	Transistor, NPN	160-04401
A4Q18	Transistor, PNP	160-04403
A4Q19	Transistor, NPN	160-04401
A4Q20	Transistor, NPN	160-04401
A4Q21	Transistor, PNP	160-04403
A4Q22	Transistor, NPN	160-04401
A4Q23	Transistor, NPN	160-04401
A4Q24	Transistor, PNP	160-04403
A4Q25	Transistor, NPN	160-04401
A4Q26	Transistor, NPN	160-04401
A4Q27	Transistor, PNP	160-04403
A4Q28	Transistor, NPN	160-04401
A4Q29	Transistor, NPN	160-04401
A4Q30	Transistor, PNP	160-04403
A4R1	Res., Carb., 51 Ohm, ¼W, 5%	RC20GF510J
A4R2	Res., Carb., 6.8K, ¼W, 5%	RC20GF682J
A4R3	Res., Carb., 4.7K, ¼W, 5%	RC20GF472J
A4R4	Res., Carb., 620 Ohm, ¼W, 5%	RC20GF621J
A4R5	Res., Carb., 1.2K, ¼W, 5%	RC20GF122J

Parts List

Receiver Assembly A4 (Cont'd)

Ref. Des.	Description	QEI Part No.
* A4R6	Res., Carb., 750 Ohm ½W, 5%	RC20GF751J *
A4R7	Res., Carb., 1K, ½W, 5%	RC20GF102J
A4R8	Res., Carb., 220 Ohm, ½W, 5%	RC20GF221J
* A4R10	Res., Carb., 1K, ½W, 5%	RC20GF102J *
A4R11	Res., Carb., 22K, ½W, 5%	RC20GF223J
A4R12	Res., Carb., 10K, ½W, 5%	RC20GF103J
A4R13	Res., Carb., 15K, ½W, 5%	RC20GF153J
A4R14	Res., Carb., 820 Ohm ½W, 5%	RC20GF 821J
A4R15	Res., Carb., 820 Ohm ½W, 5%	RC20GF 821J
A4R16	Res., Carb., 10K, ½W, 5%	RC20GF103J
A4R17	Res., Carb., 27K, ½W, 5%	RC20GF273J
A4R18	Res., Carb., 15K, ½W, 5%	RC20GF153J
A4R19	Res., Carb., 15K, ½W, 5%	RC20GF 153J
A4R20	Res., Carb., 4.7K, ½W, 5%	RC20GF472J
*A4R21	Res., Carb., 1K, ½W, 5%	RC20GF102J*
*A4R22	Res., Carb., 1K, ½W, 5%	RC20GF102J*
A4R23	Res., Carb., 4.7K, ¼W, 5%	RC07GF472J
A4R24	Res., Carb., 180 Ohm, ½W, 5%	RC20GF181J
A4R26	Res., Carb., 3.3K, ½W, 5%	RC20GF332J
A4R27	Res., Carb., 3.3K, ½W, 5%	RC20GF332J
A4R28	Res., Carb., 2.2K, ½W, 5%	RC20GF222J
A4R29	Res., Carb., 2.2K, ½W, 5%	RC20GF222J
A4R30	Res., Carb., 2.2K, ½W, 5%	RC20GF222J
A4R31	Res., Carb., 4.7K, ½W, 5%	RC20GF472J
A4R32	Res., Carb., 4.7K, ½W, 5%	RC20GF472J
A4R33	Res., Carb., 4.7K, ½W, 5%	RC20GF472J
A4R34	Res., Carb., 3.3K, ½W, 5%	RC20GF332J
A4R35	Res., Var., 1K	167-3102
A4R36	Res., Carb., 1.2K, ½W, 5%	RC20GF122J
A4R37	Res., Carb., 33K, ½W, 5%	RC20GF333J
A4R38	Res., Film, 11K, ¼W, 1%	165-1102
A4R39	Res., Film, 11K, ¼W, 1%	165-1102
A4R40	Res., Film 768 Ohm, ¼W, 1%	165-7680
A4R41	Res., Carb., 6.8K ½W, 5%	RC20GF 682J
A4R42	Res., Carb., 1.2K, ½W, 5%	RC20GF 122J
A4R43	Res., Carb., 100 Ohm, ½W, 5%	RC20GF 101J
A4R44	Res., Carb., 82 Ohm, ½W, 5%	RC20GF 820J
A4R45	Res., Carb., 1K, ½W, 5%	RC20GF102J
A4R46	Res., Carb., 2.2K ½W, 5%	RC10GF 222J
A4R47	Res., Carb., 51 Ohm ½W, 5%	RC20GF 510J
A4R48	Res., Carb., 2.2K, ½W, 5%	RC20GF222J
A4R49	Res., Carb. 2.2K, ½W, 5%	RC20GF222J
A4R50	Res., Carb., 2.2K, ½W, 5%	RC20GF222J
A4R51	Res., Carb., 2.7K, ½W, 5%	RC20GF272J
A4R52	Res., Carb., 10K, ½W, 5%	RC20GF103J
A4R53	Res., Carb. 4.7K, ½W, 5%	RC20GF472J

* Indicates factory selected value - nominal shown

Parts List

Receiver Assembly A4 (Cont'd)

Ref. Des.	Description	QEI Part No.
A4R54	Res., Carb., 1K, ½W, 5%	RC20GF102J
A4R55	Res., Carb., 10K, ½W, 5%	RC20GF103J
A4R56	Res., Carb., 2.2K, ½W, 5%	RC20GF222J
A4R57	Res., Carb., 330 Ohm, ½W, 5%	RC20GF331J
A4R58	Res., Carb., 220 Ohm, ½W, 5%	RC20GF221J
A4R59	Res., Carb., 220 Ohm, ½W, 5%	RC20GF221J
A4R60	Res., Carb., 1K, ½W, 5%	RC20GF102J
A4R61	Res., Carb., 4.7K, ½W, 5%	RC20GF472J
A4R62	Res., Carb., 12K, ½W, 5%	RC20GF123J
A4R63	Res., Carb., 330 Ohm, ½W, 5%	RC20GF331J
A4R64	Res., Var., 1K	167-3102
A4R65	Res., Carb., 3.3K, ½W, 5%	RC20GF332J
A4R66	Res., Carb., 4.7K, ½W, 5%	RC20GF472J
A4R67	Res., Carb., 1K, ½W, 5%	RC20GF102J
A4R68	Res., Var., 1K	167-3102
A4R69	Res., Carb., 330 Ohm, ½W, 5%	RC20GF331J
A4R70	Res., Carb., 12K, ½W, 5%	RC20GF123J
A4R71	Res., Carb., 3.3K, ½W, 5%	RC20GF332J
A4R72	Res., Carb., 15K, ½W, 5%	RC20GF153J
A4R73	Res., Carb., 4.7K, ½W, 5%	RC20GF472J
A4R74	Res., Carb., 4.7K, ½W, 5%	RC20GF472J
A4R75	Res., Carb., 22K, ½W, 5%	RC20GF223J
A4R76	Res., Carb., 1K, ½W, 5%	RC20GF102J
A4R77	Res., Carb., 4.7K, ½W, 5%	RC20GF472J
A4R78	Res., Carb., 12K, ½W, 5%	RC20GF123J
A4R79	Res., Var., 10K	167-3103
A4R80	Res., Carb., 1.5K, ½W, 5%	RC20GF152J
44R81	Res., Carb., 10K, ½W, 5%	RC20GF103J
A4R82	Res., Carb., 82K, ½W, 5%	RC20GF823J
A4R83	Res., Carb., 3.3K, ½W, 5%	RC20GF332J
A4R84	Res., Carb., 3.3K, ½W, 5%	RC20GF332J
A4R85	Res., Carb., 3.3K, ½W, 5%	RC20GF332J
A4R86	Res., Carb., 10K, ½W, 5%	RC20GF103J
A4R87	Res., Carb., 4.7K, ½W, 5%	RC20GF472J
A4R88	Res., Carb., 1K, ½W, 5%	RC20GF102J
A4R89	Res., Carb., 22 Ohm, ½W, 5%	RC20GF220J
A4R90	Res., Carb., 620 Ohm, ½W, 5%	RC20GF621J
A4R91	Res., Film 768 Ohm, ¼W, 1%	165-7680
A4R92	Res., Film, 11K, ¼W, 1%	165-1102
A4R93	Res., Film, 11K, ¼W, 1%	165-1102
A4R94	Res., Carb., 100K, ½W, 5%	RC20GF104J
A4R95	Res., Carb., 4.7K, ½W, 5%	RC20GF472J
A4R96	Res., Carb., 10K, ½W, 5%	RC20GF103J
A4R97	Res., Var., 10K	167-3103
A4R98	Res., Carb., 820 Ohm, ½W, 5%	RC20GF821J
A4R99	Res., Var., 1K	167-3102

Parts List

Receiver Assembly A4 (Cont'd)

Ref. Des.	Description	QEI Part No.
A4R100	Res., Carb., 220 Ohm, ½W, 5%	RC20GF221J
A4R101	Res., Carb., 10K, ½W, 5%	RC20GF103J
*A4R102	Res., Carb., 220K, ½W, 5%	RC20GF224J *
A4R103	Res., Carb., 180K, ½W, 5%	RC20GF184J
A4R104	Res., Carb., 2.7K, ½W, 5%	RC20GF272J
A4R105	Res., Carb., 220 Ohm, ½W, 5%	RC20GF221J
A4R106	Res., Carb., 4.7K, ½W, 5%	RC20GF472J
A4R107	Res., Carb., 1K, ½W, 5%	RC20GF102J
A4R108	Res., Var., 1K	167-3102
A4R109	Res., Carb., 4.7K, ½W, 5%	RC20GF472J
A4R110	Res., Var., 10K	167-3102
A4R111	Res., Carb., 1K, ½W, 5%	RC20GF102J
A4R112	Res., Carb., 620 Ohm, ½W, 5%	RC20GF621J
A4R113	Res., Carb., 10K, ½W, 5%	RC20GF103J
A4R114	Res., Var., 10K	167-3103
A4R115	Res., Carb., 3.3K, ½W, 5%	RC20GF332J
A4R116	Res., Carb., 10K, ½W, 5%	RC20GF103J
A4R117	Res., Carb., 1K, ½W, 5%	RC20GF102J
A4R118	Res., Carb., 470 ohm, ½W, 5%	RC20GF471J
* A4R119	Res., Carb., 33K, ½W, 5%	RC20GF333J*
* A4R120	Res., Carb., 3.3K, ½W, 5%	RC20GF332J *
A4R121	Res., Var., 1K	167-3102
A4R122	Res., Carb., 51 Ohm, ½W, 5%	RC20GF510J
A4R123	Res., Carb., 100 Ohm, ½W, 5%	RC20GF101J
A4R124	Res., Carb. 4.7 Ohm, ½W, 5%	RC20GF4R7J
A4R125	Res., Carb., 4.7 Ohm, ½W, 5%	RC20GF4R7J
A4R126	Res., Carb., 1.5K, ½W, 5%	RC20GF152J
A4R127	Res., Carb., 51 Ohm, ½W, 5%	RC20GF510J
A4R128	Res., Carb., 1.5K, ½W, 5%	RC20GF152J
A4R129	Res., Carb., 220 Ohm, ½W, 5%	RC20GF221J
* A4R130	Res., Carb., 15K, ½W, 5%	RC20GF153J*
A4T1	Transformer, RF	180-22137B
A4T2	Transformer, RF	180-256030B
A4U1	IC, RF Amp	182-1703
A4U2	IC, FM IF/Det	182-1235
A4U3	IC, Comparator	182-0339
A4U4	IC, Log Amp	182-0441
A4U5	IC, Op Amp	182-1741
A4U6	IC, Op Amp	182-1741
A4Z1	Mixer, Balanced	179-0021
A4Z2	Mixer, Balanced	179-0021

* Indicates factory selected value - nominal shown

Parts List

Stereo Demodulator Assembly A5

Ref. Des.	Description	QEI Part No.
A5	Assembly, P.C.	691005
A5C1	Cap., Elect. 5uf	110-3505
A5C2	Cap., Poly, 10,000pf	110-4103
A5C3	Cap., Poly, 510pf	110-4511
A5C4	Cap., Poly, 10,000pf	110-4103
A5C5	Cap., Poly, 510pf	110-4511
A5C6	Cap., Poly, 10,000pf	110-4103
A5C7	Cap., Tant., .22uf	110-3224T
A5C8	Cap., Poly, 3000pf	110-4302
A5C9	Cap., Cer., .1uf	110-0104
A5C10	Cap., Cer., .01uf	110-0103
A5C11	Cap., Mica, 120pf, DM15	110-1121
A5C12	Cap., Mica, 120 pf, DM15	110-1121
A5C13	Cap., Tant., 1.0uf	110-3105T
A5C14	Cap., Cer., .1uf	110-0104
A5C15	Cap., Elect., 5uf	110-3505
* A5C16/C16A	Cap., Selected, approx. 1200pf	*
A5C17	Cap., Elect., 100uf	110-3107
A5C18	Cap., Cer., .1uf	110-0104
A5C19	Cap., Cer., .1uf	110-0104
A5C20	Cap., Cer., .001uf	110-0102
A5C21	Cap., Cer., .1uf	110-0104
A5C22	Cap., Mica, 120pf, DM15	110-1121
A5C23	Cap., Mica, 120pf, DM15	110-1121
A5C24	Cap., Cer., .01uf	110-0103
A5C25	Cap., Mica, 470pf, DM15	110-1471
* A5C26	Cap., Mica, 91uf DM15.	110- 1910
A5C27	Cap., Var., 5-65pf	110-6565
A5C28	Cap., Cer., .1uf	110-0104
A5C29	Cap., Elect., 5uf	110-3505
A5C30	Cap., Var., 5-65pf	110-6565
A5C31	Cap., Var., 5-65pf	110-6565
A5C32	Cap., Elect., 200uf	110-3207
A5C33	Cap., Elect., 200uf	110-3207
A5C34	Cap., Cer., .1uf	110-0104
A5C35	Cap., Cer., .1uf	110-0104
A5C36	Cap., Cer., .1uf	110-0104
A5C37	Cap., Cer., .1uf	110-0104
A5C38	Cap., Elect., 100uf	110-3507
A5C39	Cap., Elect., 15uf	110-3156
* A5C40	Cap., Mica, 250pf, DM15	110-1251 *
* A5C41	Cap., Mica, 10pf, DM15	110-1100 *
A5C42	Cap., Cer., .1uf	110-0104
A5C43	Cap., Cer., .1uf	110-0104
A5C44	Cap., Cer., .05uf	110-0503
A5C45	Cap., Tant., 1.0uf	110-3105T

* Indicates factory selected - nominal value shown

Parts List

Stereo Demodulator Assembly A5 (Cont'd)

Ref. Des.	Description	QEI Part No.
A5C46	Cap., Cer., .1uf	110-0104
A5C47	Cap., Elect., 15uf	110-3156
* A5C48	Cap., Mica, 250pf, DM15	110-1251 *
* A5C49	Cap., Mica, 10pf, DM15	110-1100 *
A5C50	Cap., Cer., .05uf	110-0503
A5C51	Cap., Cer., .1uf	110-0104
A5C52	Cap., Cer., .1uf	110-0104
A5C53	Cap., Elect., 5uf	110-3505
* A5C54	Cap., Mica, 22pf, DM15	110-1220 *
* A5C55	Cap., Mica, 22pf, DM15	110-1220 *
A5CR1	Diode, Silicon	113-04446
A5CR2	Diode, Silicon	113-04446
A5CR3	Diode, Zener	113-25234
A5CR4	Diode, Silicon	113-04446
A5CR5	Diode, Silicon	113-04446
A5CR6	Diode, Silicon	113-04446
A5CR7	Diode, Silicon	113-04446
A5CR8	Diode, Silicon	113-04446
A5CR9	Diode, Silicon	113-04446
A5CR10	Diode, Silicon	113-04446
A5CR11	Diode, Silicon	113-04446
A5CR12	Diode, Silicon	113-04446
A5CR13	Diode, Silicon	113-04446
A5L1	Inductor, Pilot Filter	140-42160
A5L2	Inductor, Pilot Filter	140-42155
A5L3	Inductor, Pilot Filter	140-42160
A5Q1	Transistor, NPN	160-04401
A5Q2	Transistor, NPN	160-04401
A5Q3	Transistor, FET	160-13819
A5Q4	Transistor, FET	160-13819
A5Q5	Transistor, NPN	160-04401
A5Q6	Transistor, NPN	160-04401
A5Q7	Transistor, PNP	160-04403
A5Q8	Transistor, PNP	160-04403
A5Q9	Transistor, NPN	160-05179
A5Q10	Transistor, PNP	160-04403
A5Q11	Transistor, PNP	160-04403
A5Q12	Transistor, NPN	160-04401
A5Q13	Transistor, NPN	160-04401
A5Q14	Transistor, PNP	160-04403
A5Q15	Transistor, NPN	160-04401
A5Q16	Transistor, NPN	160-04401
A5Q17	Transistor, PNP	160-04403
A5Q18	Transistor, PNP	160-04403

* Indicates factory selected - nominal value shown

Parts List

Stereo Demodulator Assembly A5 (Cont'd)

Ref. Des.	Description	QEI Part No.
A5Q19	Transistor, PNP	160-4403
A5Q20	Transistor, NPN	160-4401
A5Q21	Transistor, PNP	160-4403
A5Q22	Transistor, NPN	160-4401
A5R1	Res., Carb., 15K, ½W, 5%	RC20GF153J
A5R2	Res., Carb., 470 Ohm, ½W, 5%	RC20GF471J
A5R3	Res., Carb., 10K, ½W, 5%	RC20GF103J
A5R4	Res., Var., 1K	167- 3102
A5R5	Res., Carb., 680 Ohm, ½W, 5%	RC20GF681J
A5R6	Res., Carb., 270 Ohm, ½W, 5%	RC20GF271J
A5R7	Res., Carb., 15K, ½W, 5%	RC20GF153J
A5R8	Res., Carb., 1K, ½W, 5%	RC20GF102J
A5R9	Res., Carb., 1K, ½W, 5%	RC20GF102J
A5R10	Res., Carb., 1K, ½W, 5%	RC20GF102J
A5R11	Res., Carb., 3.3K, ½W, 5%	RC20GF332J
A5R12	Res., Carb., 3.3K, ½W, 5%	RC20GF332J
A5R13	Res., Carb., 3.3K, ½W, 5%	RC20GF332J
A5R14	Res., Carb., 4.7K, ½W, 5%	RC20GF472J
A5R15	Res., Carb., 2.7K, ½W, 5%	RC20GF272J
A5R16	Res., Carb., 1.5K, ½W, 5%	RC20GF152J
A5R17	Res., Carb., 10K, ½W, 5%	RC20GF103J
A5R18	Res., Carb., 100 Ohm, ½W, 5%	RC20GF101J
A5R19	Res., Carb., 1.5K, ½W, 5%	RC20GF152J
A5R20	Res., Carb., 68 Ohm, 2W, 10%	RC42GF680K
A5R21	Res., Carb., 330 Ohm, ½W, 5%	RC20GF331J
A5R22	Res., Carb., 1K, ½W, 5%	RC20GF102J
A5R23	Res., Carb., 1K, ½W, 5%	RC20GF102J
A5R24	Res., Carb., 10K, ½W, 5%	RC20GF103J
A5R25	Res., Carb., 10K, ½W, 5%	RC20GF103J
A5R26	Res., Carb., 10K, ½W, 5%	RC20GF103J
A5R27	Res., Carb., 150K, ½W, 5%	RC20GF154J
A5R28	Res., Carb., 1.5K, ½W, 5%	RC20GF152J
A5R29	Res., Carb., 1K, ½W, 5%	RC20GF102J
A5R30	Res., Carb., 10K, ½W, 5%	RC20GF103J
A5R31	Res., Carb., 6.8K, ½W, 5%	RC20GF682J
A5R32	Res., Carb., 100 Ohm, ½W, 5%	RC20GF101J
A5R33	Res., Carb., 1M, ½W, 5%	RC20GF105J
A5R34	Res., Carb., 1.2K, ½W, 5%	RC20GF122J
A5R35	Res., Film, 11K, ¼W, 1%	165-1102
A5R36	Res., Film, 11K, ¼W, 1%	165-1102
A5R37	Res., Carb., 12K, ½W, 5%	RC20GF123J
A5R38	Res., Carb., 2.2K, ½W, 5%	RC20GF222J
A5R39	Res., Carb., 10K, ½W, 5%	RC20GF103J
A5R40	Res., Carb., 4.7K, ½W, 5%	RC20GF472J
A5R41	Res., Carb., 2.2K, ½W, 5%	RC20GF222J

Parts List

Stereo Demodulator Assembly A5 (Cont'd)

Ref. Des.	Description	QEI Part No.
A5R42	Res., Carb., 1K, ½W, 5%	RC20GF102J
A5R43	Res., Carb., 1K, ¼W, 5%	RC20GF102J
A5R44	Res., Carb., 1K, ¼W, 5%	RC20GF102J
A5R45	Res., Carb., 1K, ¼W, 5%	RC20GF102J
A5R46	Res., Carb., 4.7K, ¼W, 5%	RC20GF472J
A5R47	Res., Carb., 10K, ½W, 5%	RC20GF103J
A5R48	Res., Carb., 15K, ½W, 5%	RC20GF153J
A5R49	Res., Carb., 4.7K, ½W, 5%	RC20GF472J
A5R50	Res., Carb., 8.2K, ½W, 5%	RC20GF822J
A5R51	Res., Carb., 1K, ½W, 5%	RC20GF102J
A5R52	Res., Carb., 1.2K, ½W, 5%	RC20GF122J
* A5R53	Res., Carb., 10K, ½W, 5%	RC20GF103J *
* A5R54	Res., Carb., 6.8 K, ½W, 5%	RC20GF682J *
A5R55	Res., Carb., 33 K, ½W, 5%	RC20GF333J
A5R56	Res., Var., 25K	167-3253
A5R57	Res., Carb., 1.2K, ½W, 5%	RC20GF122J
A5R58	Res., Carb., 8.2K, ½W, 5%	RC20GF822J
A5R59	Res., Carb., 15K, ½W, 5%	RC20GF153J
A5R60	Res., Carb., 4.7K, ½W, 5%	RC20GF472J
A5R61	Res., Carb., 1K, ½W, 5%	RC20GF102J
A5R62	Res., Carb., 1.2K, ½W, 5%	RC20GF122J
A5R63	Res., Carb., 1.2K, ½W, 5%	RC20GF122J
* A5R64	Res., Carb., 10 K, ½W, 5%	RC20GF103J *
* A5R65	Res., Carb., 6.8K, ½W, 5%	RC20GF682J *
A5R66	Res., Carb., 33K, ½W, 5%	RC20GF333J
A5R67	Res., Var., 25K	167-3253
A5R68	Res., Carb., 270 Ohm, ¼W, 5%	RC07GF271J
A5R69	Res., Carb., 10K, ½W, 5%	RC20GF103J
A5R70	Res., Carb., 120K, ½W, 5%	RC20GF124J
A5R71	Res., Carb., 1.5K, ½W, 5%	RC20GF152J
A5R72	Res., Carb., 6.8K, ½W, 5%	RC20GF682J
A5R73	Res., Carb., 1.5K, ½W, 5%	RC20GF152J
A5R74	Res., Carb., 7.5K, ½W, 5%	RC20GF752J
A5R75	Res., Carb., 10K, ½W, 5%	RC20GF103J
A5R76	Res., Carb., 6.8K, ½W, 5%	RC20GF682J
A5R77	Res., Carb., 470 Ohm, ½W, 5%	RC20GF471J
A5R78	Res., Carb., 4.7 Ohm, ½W, 5%	RC20GF4R7J
A5R79	Res., Carb., 4.7 Ohm, ½W, 5%	RC20GF4R7J
A5R80	Res., Carb., 470 Ohm, ½W, 5%	RC20GF471J
A5R81	Res., Carb., 620 Ohm, ½W, 5%	RC20GF681J
A5R82	Res., Carb., 10K, ½W, 5%	RC20GF103J
A5R83	Res., Carb., 10K, ½W, 5%	RC20GF103J
A5R84	Res., Carb., 1.5K, ½W, 5%	RC20GF152J
A5R85	Res., Carb., 120K, ½W, 5%	RC20GF124J
A5R86	Res., Carb., 7.5K, ½W, 5%	RC20GF752J
A5R87	Res., Carb., 1.5K, ½W, 5%	RC20GF152J

* Indicates factory selected - nominal value shown

Parts List

Stereo Demodulator Assembly A5 (Cont'd)

Ref. Des.	Description	QEI Part No.
A5R88	Res., Carb., 6.8K, ½W, 5%	RC20GF682J
A5R89	Res., Carb., 6.8K, ½W, 5%	RC20GF682J
A5R90	Res., Carb., 470 Ohm, ½W, 5%	RC20GF471J
A5R91	Res., Carb., 4.7 Ohm, ½W, 5%	RC20GF4R7J
A5R92	Res., Carb., 4.7 Ohm, ½W, 5%	RC20GF4R7J
A5R93	Res., Carb., 470 Ohm, ½W, 5%	RC20GF471J
A5R94	Res., Carb., 620 Ohm, ½W, 5%	RC20GF621J
A5R95	Res., Carb., 33K, ½W, 5%	RC20GF333J
A5R96	Res., Carb., 10K, ½W, 5%	RC20GF103J
A5R97	Res., Carb., 33K, ½W, 5%	RC20GF333J
A5R98	Res., Carb., 10K, ½W, 5%	RC20GF103J
A5R99	Res., Carb., 33K, ½W, 5%	RC20GF333J
A5R100	Res., Carb., 4.7K, ½W, 5%	RC20GF472J
A5R101	Res., Var., 10K	167-3103
A5R102	Res., Carb., 27K, ½W, 5%	RC20GF273J
A5R103	Res., Var., 10K	167-3103
A5R104	Res., Carb., 33K, ½W, 5%	RC20GF333J
A5R105	Res., Carb., 10K, ½W, 5%	RC20GF103J
A5R106	Res., Carb., 10K, ½W, 5%	RC20GF103J
A5R107	Res., Carb., 33K, ½W, 5%	RC20GF333J
A5R108	Res., Var., 10K	167-3103
A5U1	IC, Comparator	182-1710
A5U2	IC, Op Amp	182-1741
A5U3	IC, Comparator	182-1710
A5U4	IC, PLL	182-14046
A5U5	IC, Decade Counter	182-7490
A5U6	IC, D Flip-Flop	182-7474
A5U7	IC, Quad NAND Gates	182-7400
A5U8	IC, Quad NAND Gates	182-7400
A5U9	IC, D Flip-Flop	182-7474
A5U10	IC, Op Amp	182-1709
A5U11	IC, Op Amp	182-1741
A5U12	IC, Op Amp	182-1741
A5U13	IC, Op Amp	182-1709
A5U14	IC, Quad NAND Gates	182-7400
A5U15	IC, Quad NOR Gates	182-7402

Parts List

SCA Assembly A6

Ref. Des.	Description	QEI Part No.
A6	Assembly, P.C.	691006
A6C1	Cap., Cer., .1uf	110-0104
A6C2	Cap., Tant., 1.0uf	110-3105T
A6C3	Cap., Cer., .1uf	110-0104
A6C4	Cap., Cer., .1uf	110-0104
A6C5	Cap., Tant., 1.0uf	110-3105T
A6C6	Cap., Tant., 1.0uf	110-3105T
A6C7	Cap., Elect., 15uf	110-3156
A6C8	Cap., Cer., .1uf	110-0104
A6C9	Cap., Tant., 1.0uf	110-3105T
A6C10	Cap., Tant., 1.0uf	110-3105T
A6C11	Cap., Cer., .001uf	110-0102
A6C12	Cap., Cer., .001uf	110-0102
A6C13	Cap., Cer., .01uf	110-0103
A6C14	Cap., Elect., 50uf	110-3506
A6C15	Cap., Cer., .01uf	110-0103
A6C16	Cap., Mica, 300pf, DM15	110-1301
A6C17	Cap., Cer., .01uf	110-0103
A6C18	Cap., Cer., .01uf	110-0103
A6C19	Cap., Mica, 820pf, DM15	110-1821
A6C20	Cap., Cer., .01uf	110-0103
A6C21	Cap., Elect., 5uf	110-3505
A6C22	Cap., Cer., .1uf	110-0104
A6C23	Cap., Tant., 1.0uf	110-3105T
A6C24	Cap., Cer., .1uf	110-0104
A6C25	Cap., Poly, 10,000pf	110-4103
A6CR1	Diode, Silicon	113-04446
A6CR2	Diode, Silicon	113-04446
A6CR3	Diode, Silicon	113-04446
A6FL1	Filter, SCA	B67KN10W2
A6J1	Connector, PC Board	130-0019
A6L1	Inductor, Audio	140-84350
A6L2	Inductor, Audio	140-84350
A6Q1	Transistor, NPN	160-4401
A6Q2	Transistor, NPN	160-4401
A6Q3	Transistor, NPN	160-4401
A6Q4	Transistor, NPN	160-4401
A6Q5	Transistor, PNP	160-4403
A6Q6	Transistor, NPN	160-4401
A6Q7	Transistor, NPN	160-4401
A6Q8	Transistor, NPN	160-4401
A6Q9	Transistor, NPN	160-4401

Parts List

SCA Assembly A6 (Cont'd)

Ref. Des.	Description	QEI Part No.
A6R1	Res., Carb., 10K, ½W, 5%	RC20GF103J
A6R2	Res., Carb., 2.2K, ½W, 5%	RC20GF222J
A6R3	Res., Carb., 10K, ½W, 5%	RC20GF103J
A6R4	Res., Carb., 2.2K, ½W, 5%	RC20GF222J
A6R5	Res., Carb., 22K, ½W, 5%	RC20GF223J
A6R6	Res., Carb., 22K, ½W, 5%	RC20GF223J
A6R7	Res., Carb., 2.7K, ½W, 5%	RC20GF272J
A6R8	Res., Carb., 220 Ohm, ½W, 5%	RC20GF221J
A6R9	Res., Var., 1K	167-3102
A6R10	Res., Carb., 10K, ½W, 5%	RC20GF103J
* A6R11	Res., Carb., 56K,, ½W, 5%	RC20GF563J *
A6R12	Res., Carb., 10K, ½W, 5%	RC20GF103J
A6R13	Res., Carb., 220 Ohm, ½W, 5%	RC20GF221J
A6R14	Res., Carb., 2.2K, ½W, 5%	RC20GF222J
A6R15	Res., Var., 10K	167-3103
* A6R16	Res., Carb., 4.7K, ½W, 5%	RC20GF472J *
A6R17	Res., Carb., 10K, ½W, 5%	RC20GF103J
A6R18	Res., Carb., 22K, ½W, 5%	RC20GF223J
A6R19	Res., Carb., 22K, ½W, 5%	RC20GF223J
A6R20	Res., Carb., 10K, ½W, 5%	RC20GF102J
A6R21	Res., Carb., 10K, ½W, 5%	RC20GF103J
* A6R22	Res., Carb., 2.2K, ½W, 5%	RC20GF222J *
A6R23	Res., Carb., 100 Ohm, ½W, 5%	RC20GF101J
A6R24	Res., Carb., 1K, ½W, 5%	RC20GF102J
A6R25	Res., Var., 1K	167-3102
A6R26	Res., Carb., 10K, ½W, 5%	RC20GF103J
A6R27	Res., Carb., 10K, ½W, 5%	RC20GF103J
A6R28	Res., Carb., 4.7K, ½W, 5%	RC20GF472J
A6R29	Res., Carb., 4.7K, ½W, 5%	RC20GF472J
A6R30	Res., Carb., 4.7K, ½W, 5%	RC20GF472J
A6R31	Res., Carb., 620 Ohm, ½W, 5%	RC20GF621J
A6R32	Res., Carb., 2.7K, ½W, 5%	RC20GF272J
A6R33	Res., Var., 10K	167-3103
A6R34	Res., Carb., 2.2K, ½W, 5%	RC20GF222J
A6R35	Res., Carb., 2.2K, ½W, 5%	RC20GF222J
A6R36	Res., Carb., 10K, ½W, 5%	RC20GF103J
A6R37	Res., Carb., 56K, ½W, 5%	RC20GF563J
A6R38	Res., Carb., 10K, ½W, 5%	RC20GF103J
A6R39	Res., Var., 10K	167-3103
A6R40	Res., Carb., 10K, ½W, 5%	RC20GF103J
A6R41	Res., Carb., 6.8K, ½W, 5%	RC20GF682J
A6R42	Res., Carb., 8.2K, ½W, 5%	RC20GF822J
A6R43	Res., Carb., 15K, ½W, 5%	RC20GF153J
A6R44	Res., Carb., 10K, ½W, 5%	RC20GF103J
A6R45	Res., Carb., 68 Ohm, 2W, 10%	RC42GF680K

* Indicates factory selected - nominal value shown

Parts List

SCA Assembly A6 (Cont'd)

	Ref. Des.	Description	QEI Part No.
	A6R46	Res., Carb., 4.7K, ½W, 5%	RC20GF472J
	A6R47	Res., Carb., 620 Ohm, ½W, 5%	RC20GF621J
	A6R48	Res., Carb., 56K, ½W, 5%	RC20GF563J
	A6R49	Res., Carb., 22K, ½W, 5%	RC20GF223J
	A6R50	Res., Carb., 2.7K, ½W, 5%	RC20GF272J
*	A6R51	Res., Carb., 330K, ½W, 5%	RC20GF334J *
	A6U1	IC, Op Amp	182-1741
	A6U2	IC, Demod	182-0565
	A6U3	IC, Comparator	182-0339
	A6U4	IC, Op Amp	182-1741

* Indicates factory selected - nominal value shown

Parts List

Local Oscillator Assembly A7

Ref. Des.	Description	QEI Part No.
A7C1	Cap., Feed-Thru, 1000pf	110-7102
A7C2	Cap., Feed-thru, 1000pf	110-7102
A7C3	Cap., Feed-thru, 1000pf	110-7102
A7C4	Cap., Feed-thru, 1000pf	110-7102
A7C5	Cap., Elect., 15uf	110-3156
A7C6	Cap., Mica, 470pf	110-1471
A7C7	Cap., Var., 1-10pf	110-6110
A7C8	Cap., Mica, 1000pf	110-1102
A7C9	Cap., Cer., 3.3pf	110-03R3
A7C10	Cap., Mica, 1000pf	110-1102
A7C11	Cap., Mica, 1000pf	110-1102
A7C12	Cap., Cer., .05uf	110-0503
A7C13	Cap., Elect., 15uf	110-3156
A7C14	Cap., Mica, 1000pf	110-1102
A7CR1	Diode, Varicap	113-52001
A7CR2	Diode, Zener	113-2056
A7L1	Inductor, RF	140-2008
A7L2	Inductor, RF	140-2000
A7Q1	Transistor, PNP	160-04403
A7Q2	Transistor, FET	160-13819
A7Q3	Transistor, NPN	160-04401
A7R1	Res., Carb., 4.7K, ½W, 5%	RC20GF472J
A7R2	Res., Carb., 620 Ohm, ½W, 5%	RC20GF621J
A7R3	Res., Carb., 62 Ohm, ½W, 5%	RC20GF620J
A7R4	Res., Film, 649 Ohm, ¼W, 1%	165-6490
A7R5	Res., Carb., 10K, ½W, 5%	RC20GF103J
A7R6	Res., Carb., 6.8K, ½W, 5%	RC20GF682J
A7R7	Res., Carb., 680 Ohm, ½W, 5%	RC20GF681J
A7R8	Res., Carb., 51 Ohm, ½W, 5%	RC20GF510J
A7T1	Transformer, RF	180-22137B

Parts List

SCA Assembly A6 (Cont'd)

	Ref. Des.	Description	QEI Part No.
	A6R46	Res., Carb., 4.7K, ½W, 5%	RC20GF472J
	A6R47	Res., Carb., 620 Ohm, ½W, 5%	RC20GF621J
	A6R48	Res., Carb., 56K, ½W, 5%	RC20GF563J
	A6R49	Res., Carb., 22K, ½W, 5%	RC20GF223J
	A6R50	Res., Carb., 2.7K, ½W, 5%	RC20GF272J
*	A6R51	Res., Carb., 330K, ½W, 5%	RC20GF334J *
	A6U1	IC, Op Amp	182-1741
	A6U2	IC, Demod	182-0565
	A6U3	IC, Comparator	182-0339
	A6U4	IC, Op Amp	182-1741

* Indicates factory selected - nominal value shown

Parts List

Local Oscillator Assembly A7

Ref. Des.	Description	QEI Part No.
A7C1	Cap., Feed-Thru, 1000pf	110-7102
A7C2	Cap., Feed-thru, 1000pf	110-7102
A7C3	Cap., Feed-thru, 1000pf	110-7102
A7C4	Cap., Feed-thru, 1000pf	110-7102
A7C5	Cap., Elect., 15uf	110-3156
A7C6	Cap., Mica, 470pf	110-1471
A7C7	Cap., Var., 1-10pf	110-6110
A7C8	Cap., Mica, 1000pf	110-1102
A7C9	Cap., Cer., 3.3pf	110-03R3
A7C10	Cap., Mica, 1000pf	110-1102
A7C11	Cap., Mica, 1000pf	110-1102
A7C12	Cap., Cer., .05uf	110-0503
A7C13	Cap., Elect., 15uf	110-3156
A7C14	Cap., Mica, 1000pf	110-1102
A7CR1	Diode, Varicap	113-52001
A7CR2	Diode, Zener	113-2056
A7L1	Inductor, RF	140-2008
A7L2	Inductor, RF	140-2000
A7Q1	Transistor, PNP	160-04403
A7Q2	Transistor, FET	160-13819
A7Q3	Transistor, NPN	160-04401
A7R1	Res., Carb., 4.7K, ½W, 5%	RC20GF472J
A7R2	Res., Carb., 620 Ohm, ½W, 5%	RC20GF621J
A7R3	Res., Carb., 62 Ohm, ½W, 5%	RC20GF620J
A7R4	Res., Film, 649 Ohm, ¼W, 1%	165-6490
A7R5	Res., Carb., 10K, ½W, 5%	RC20GF103J
A7R6	Res., Carb., 6.8K, ½W, 5%	RC20GF682J
A7R7	Res., Carb., 680 Ohm, ½W, 5%	RC20GF681J
A7R8	Res., Carb., 51 Ohm, ½W, 5%	RC20GF510J
A7T1	Transformer, RF	180-22137B

Parts List

Image Board A8 Assembly

	Ref. Des.	Description	QEI Part No.
	A8	Assembly, P.C.	
	A8C1	Cap., Cer., .001uf	110-0102
	A8C2	Cap., Cer., 3.3pf	110-03R3
*	A8C3	Cap., Mica, 120pf	110-1121 *
	A8CR1	Diode, Silicon	113-04446
	A8CR2	Diode, Varicap	113-52001
	A8CR3	Diode, Varicap	113-52001
	A8CR4	Diode, Varicap	113-5650
	A8CR5	Diode, Varicap	113-5650
	A8Q1	Transistor, NPN	160-04401
	A8R1	Res., Carb., 620 Ohm, ½W, 5%	RC20GF621J
	A8R2	Res., Carb., 51 Ohm, ½W, 5%	RC20GF510J
	A8R3	Res., Carb., 47K, ½W, 5%	RC20GF473J
*	A8R4	Res., Carb., 82K, ½W, 5%	RC20GF823J *
	A8T1	Transformer, RF	180-22137A
	A8T2	Transformer, RF	180-22137A

* Indicates factory selected - nominal value shown

Parts List

Peaks Per Minute Readout

Ref. Des.	Description	QEI Part No.
A9	Assembly, P.C.	691-PPM
A9CR1	Diode, Silicon	113-04446
A9CR2	Diode, Silicon	113-04446
A9DS1	Display, LED	192-16710
A9Q1	Transistor, PNP	160-04403
A9R1	Res., Carb., 120 Ohm, ½W, 5%	RC20GF121J
A9R2	Res., Carb., 390 Ohm, ½W, 5%	RC20GF391J

Average Voltmeter Readout

Ref. Des.	Description	QEI Part No.
A10A, A10B	Assembly, P.C.	691-AVM
A10ADS1, A10BDS1	Display, LED	192-16710
A10AQ1, A10BQ1	Transistor, PNP	160-04403
A10AQ2, A10BQ2	Transistor, PNP	160-04403
A10AR1, A10BR1	Res., Carb., 390 Ohm, ½W, 5%	RC20GF391J
A10AR2, A10BR2	Res., Carb., 51 Ohm, ½W, 5%	RC20GF510J

Parts List

Switch Assembly A11

Ref. Des.	Description	QEI Part No
A11	Assembly, Switch	6910011
A11C1	Cap., Tant., .22uf	110-3224T
A11C2	Cap., Tant., .22uf	110-3224T
A11C3	Cap., Tant., .22uf	110-3224T
A11C4	Cap., Cer., .1uf	110-0104
A11C5	Cap., Elect., 50uf	110-3506
A11C6	Cap., Elect., 5uf	110-3505
A11C7	Cap., Cer., .1uf	110-0104
A11C8	Cap., Elect., 50uf	110-3506
A11L1	Inductor	140-42053
A11R1	Res., Carb., 620 Ohm, ½W, 5%	RC10GF621J
A11R2	Res., Carb., 10K, ½W, 5%	RC20GF103J
A11R3	Res., Carb., 3.3K, ½W, 5%	RC20GF332J
A11R4	Res., Carb., 120K, ½W, 5%	RC20GF124J
A11R5	Res., Carb., 120K, ½W, 5%	RC20GF124J
A11R6	Res., Carb., 1K, ½W, 5%	RC20GF102J
A11R7	Res., Carb., 2.2K, ½W, 5%	RC20GF222J
A11R8	Res., Var., 10K	167-3002
A11R9	Res., Carb., 3.3K, ½W, 5%	RC20GF332J
A11R10	Res., Carb., 2.2K, ½W, 5%	RC20GF222J
A11R11	Res., Carb., 2.2K, ½W, 5%	RC20GF222J
A11R12	Res., Carb., 2.2K, ½W, 5%	RC20GF222J
A11S1	Switch	175-0013
A11U1	IC, Op Amp	182-1741

Parts List

Switch Assembly A12

Ref. Des.	Description	QEI Part No.
A12	Assembly, P.C.	6910012
A12S1	Assembly, Switch	175-0012
A12R1	Res., Carb., 2.2K, ½W, 5%	RC20GF222J
* A12R2	Res., Carb., 3.3K, ½W, 5%	RC20GF332J *

* Indicates factory selected - nominal value shown

SECTION 7

INTERCONNECTION TABLES

Interconnection Table

PLL and Total Meter Driver A2

A2E1 to +5
A2E2 to A1S2 - .8C
A2E3 to A1S2 - .4C
A2E4 to A1S2 - .2C
A2E5 to A1S2 - .1C
A2E6 to A1S2 - 8C
A2E7 to A1S2 - 4C
A2E8 to A1S2 - 2C
A2E9 to A1S2 - 1C
A2E10 to A1S2 - 10C
A2E11 to A1S2 - 80C
A2E12 to A8E1
A2E13 No Conn.
A2E14 to A7C4
A2E15 to A7J2
A2E16 to A1J12
A2E17 to A4E2
A2E18 to A1S7-3, A4E1
A2E19 to A1CR2
A2E20 to A1S5 - 100T
A2E21 to A1S5 - 80T
A2E22 to A1S5 - 40T
A2E23 to A1S5 - 20T
A2E24 to A2S5 - 10T
A2E25 to A1S5 - 8T
A2E26 to A1S5 - 4T
A2E27 to A2S5 - 2T
A2E28 to A2S5 - 1T
A2E29 to +12V
A2E30 to -12V
A2E31 to A4E8, A5E2, A1J14-1
A2E32 to A1S5 - Common
A2E33 to GND.
A2E34 to A1DS1
A2E35 to A1TB1-2
A2E36 to A1J1
A2E37 to A1J2
A2E38 to A12E2
A2E39 to A12E3
A2E40 to A12E4
A2E41 to A12E1
A2E42 to A1TB1-1
A2E43 to A1M1
A2E44 to A3E59
A2E45 to A3E56
A2E46 to A3E57
A2E47 to A3E58
A2E48 to A3E69, A1S6-1, A9E9
A2E49 to A3E68
A2E50 to A4E24

Interconnection Table

Dual Average Voltmeter Assembly A3

A3E1 to A1S13A - 1
A3E2 to A1S13A - 1
A3E3 to A1S13A - 5
A3E4 to A1S12A - 1T
A3E5 to A1S12A - 2T
A3E6 to A1S12A - 4T
A3E7 to A1S12A - 8T
A3E8 to A1S12A - 10T
A3E9 to A1S12A - 20T
A3E10 to A1S12A - 40T
A3E11 to A1S12A - 80T
A3E12 to A1S12A - 100T
A3E13 to A1S12A - Common
A3E14 to A1S12B - 1T
A3E15 to A1S12B - 2T
A3E16 to A1S12B - 4T
A3E17 to A1S12B - 8T
A3E18 to A1S12B - 10T
A3E19 to A1S12B - 20T
A3E20 to A1S12B - 40T
A3E21 to A1S12B - 80T
A3E22 to A1S12B - 100T
A3E23 to A1S12B - Common
A3E24 to A1S15A-1
A3E25 to A1CR6A
A3E26 to A1S10-1
A3E27 to A11E6
A3E28 to A10A-E1
A3E29 to A1M2A
A3E30 to A1TB1-10
A3E31 to A1S14A-6
A3E32 to A10A-E2
A3E33 to A10A-E3
A3E34 to A10A-E4
A3E35 to A10A-E5
A3E36 to A10A-E6
A3E37 to A10A-E7
A3E38 to A10A-E8
A3E39 to A1S13B-4
A3E40 to A1S13B-1
A3E41 to A1S13B-5
A3E42 to A1S15B, A11E2
A3E43 to A1CR6B
A3E44 to A1S10-3
A3E45 to A10B-E1
A3E46 to A1M2B
A3E47 to A1TB1-12
A3E48 to A1S14B-6
A3E49 to A10B-E2
A3E50 to A10B-E3
A3E51 to A10B-E4
A3E52 to A10B-E5
A3E53 to A10B-E6
A3E54 to A10B-E7
A3E55 to A10B-E8
A3E56 to A2E45
A3E57 to A2E46
A3E58 to A2E47
A3E59 to A2E44
A3E60 to A9-E1
A3E61 to A9-E2
A3E62 to A9-E3
A3E63 to A9-E4
A3E64 to A9-E5
A3E65 to A9-E6
A3E66 to A9-E7
A3E67 to A9-E8
A3E68 to A2E49
A3E69 to A2E48, A1S6-1, A9E9
A3E70 to +12V
A3E71 to -12V
A3E72 to +5V
A3E73 to A1S14A-4
A3E74 to A1S14B-4

Interconnection Table

Receiver Assembly A4

A4E1 to A1S7-3, A2E18
A4E2 to A2E17
A4E3 to A2S7-1, A7C3
A4E4 to A7J1
A4E5 to A8E
A4E6 to A1S16-1
A4E7 to A1S16-2
A4E8 to A2E31, A5E2, A1J14-1
A4E9 to A12E5
A4E10 to -12V
A4E11 to +12V
A4E12 to A11E11
A4E13 to A12E19
A4E14 to A11E7
A4E15 to A1R3
A4E16 to A12E8, A11E8
A4E17 to A12E18, A7C1
A4E18 to A7C2
A420 to A1S8-3
A4E21 to A1S3
A4E22 to A1CR4
A4E23 to A1CR5
A4E24 to A2E50
A4E25 to A12E11, A11E10
A4E26 to A11E24
A4E27 to A12E15
A4E28 to A12E17
A4E29 to A11E25
A4E30 to A12E14
A4E31 to A11E22
A4E32 to A12E20
A4E33 to +18V

Interconnection Table

Stereo Demodulator Assembly A5

A5E1 to +12V
A5E2 to A2E31, A4E8, A1J14-1
A5E3 to -12V
A5E4 to +5V
A5E5 to +18V
A5E6 to -18V
A5E7 to A1T2
A5E8 to A1T3
A5E9 to A12E12
A5E10 to A12E7
A5E11 to A11E17
A5E12 to A1DS3
A5E13
A5E14 to A1J14-16
A5E15 to A11E13
A5E16 to A1S8-5
A5E17 to A1S8-1
A5E18 to A1R11
A5E19 to A1FL1-1
A5E20 to A1FL1-2
A5E21 to A1R8, A11E21
A5E22 to A1R7, A11E20
A5E23 to A1S10-4
A5E24 to A1S10-6
A5E25 to A11E16

Interconnection Table

Local Oscillator Assembly A7

A7C1 to A4E17, A12E18
A7C2 to A4E18
A7C3 to A1S7-1, A4E3
A7C4 to A2E14
A7J1 to A4E4
A7J2 to A2E15

Interconnection Table

Image Board A8 Assembly

A8E1 to A2E12
A8E2 to A1J11
A8E3 to A1R2
A8E4 to A1CR3
A8E5 to A4E5

Interconnection Table

Peaks Per Minute Readout Assembly A9

A9E1 to A3E60
A9E2 to A3E61
A9E3 to A3E62
A9E4 to A3E63
A9E5 to A3E64
A9E6 to A3E65
A9E7 to A3E66
A9E8 to A3E67
A9E9 to A2E48, A1S6-1, A3E69

Interconnection Table

Average Voltmeter Readout Assemblys A10A & A10B

A10AE1 to A3E28	A10BE1 to A3E45
A10AE2 to A3E32	A10BE2 to A3E49
A10AE3 to A3E33	A10BE3 to A3E50
A10AE4 to A3E34	A10BE4 to A3E51
A10AE5 to A3E35	A10BE5 to A3E52
A10AE6 to A3E36	A10BE6 to A3E53
A10AE7 to A3E37	A10BE7 to A3E54
A10AE8 to A3E38	A10BE8 to A3E55
A10AE9 to A1S14A-1	A10BE9 to A1S14B-1

Interconnection Table

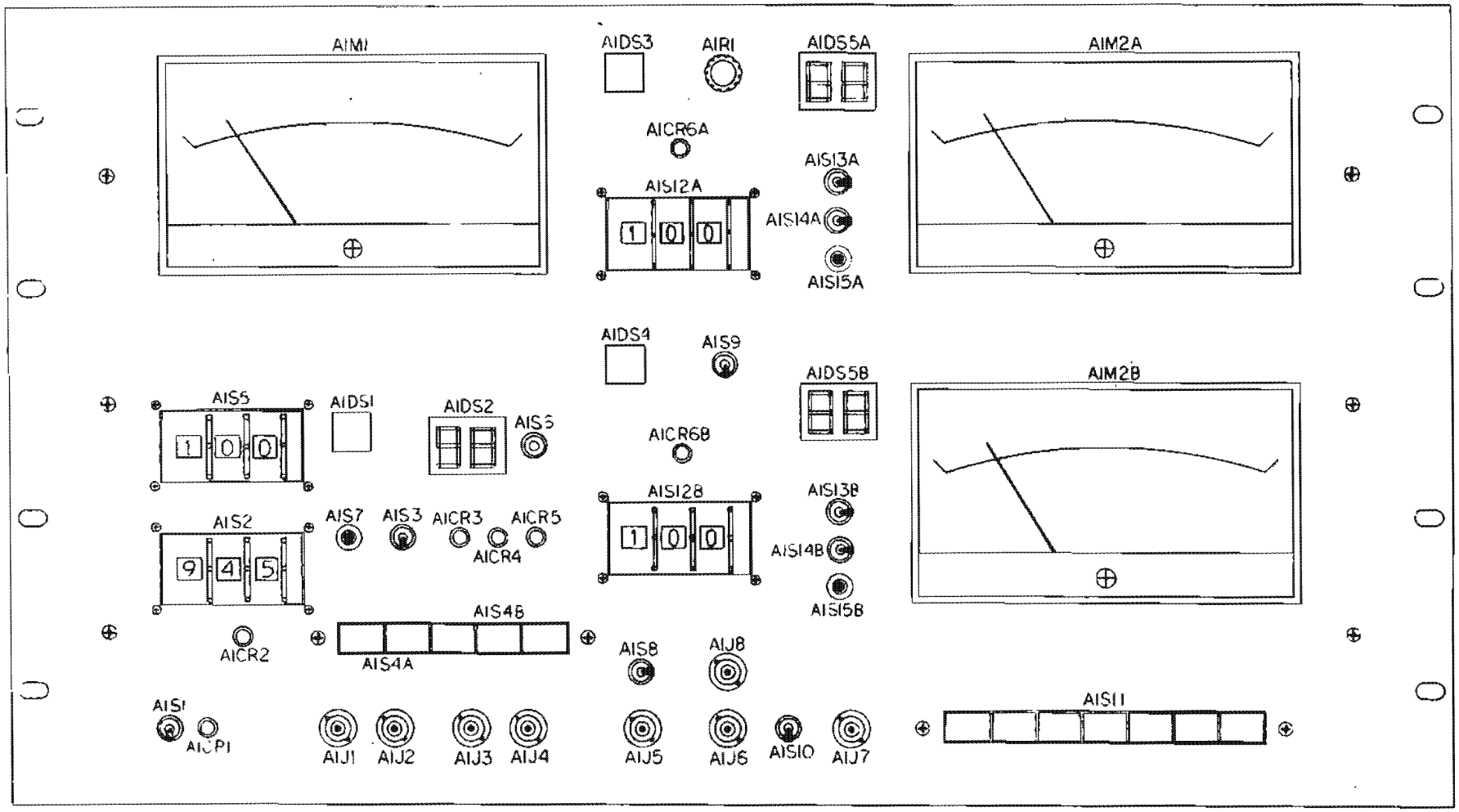
Switch Assembly A11

A11E1 to A1S13A-2
A11E2 to A1S15B, A3E42
A11E3 to A1J14-8
A11E4 to A1J14-21
A11E5 to A1J14-4
A11E6 to A3E27
A11E7 to A4E14
A11E8 to A4E16, A12E8
A11E9 to A1S13B-2
A11E10 to A4E25, A12E11
A11E11 to A4E12
A11E12 to A1R14
A11E13 to A5E15
A11E14 to -12V
A11E15 to +12V
A11E16 to A5E25
A11E17 to A5E11
A11E18 to A1R15
A11E19 to A1R13
A11E20 to A1R7, A5E22
A11E21 to A1R8, A5E21
A11E22 to A4E31
A11E23 to A12E16
A11E24 to A4E26
A11E25 to A4E29

Interconnection Table

Switch Assembly A12

A12E1 to A2E41
A12E2 to A2E38
A12E3 to A2E39
A12E4 to A2E40
A12E5 to A4E9
A12E6 to A1J4
A12E7 to A5E10
A12E8 to A4E16, A11E8
A12E9 to -12V
A12E10 to +12V
A12E11 to A4E25, A11E10
A12E12 to A5E9
A12E13 to A1J3
A12E14 to A4E30
A12E15 to A4E27
A12E16 to A11E23
A12E17 to A4E28
A12E18 to A4E17, A7C1
A12E19 to A4E13
A12E20 to A4E32



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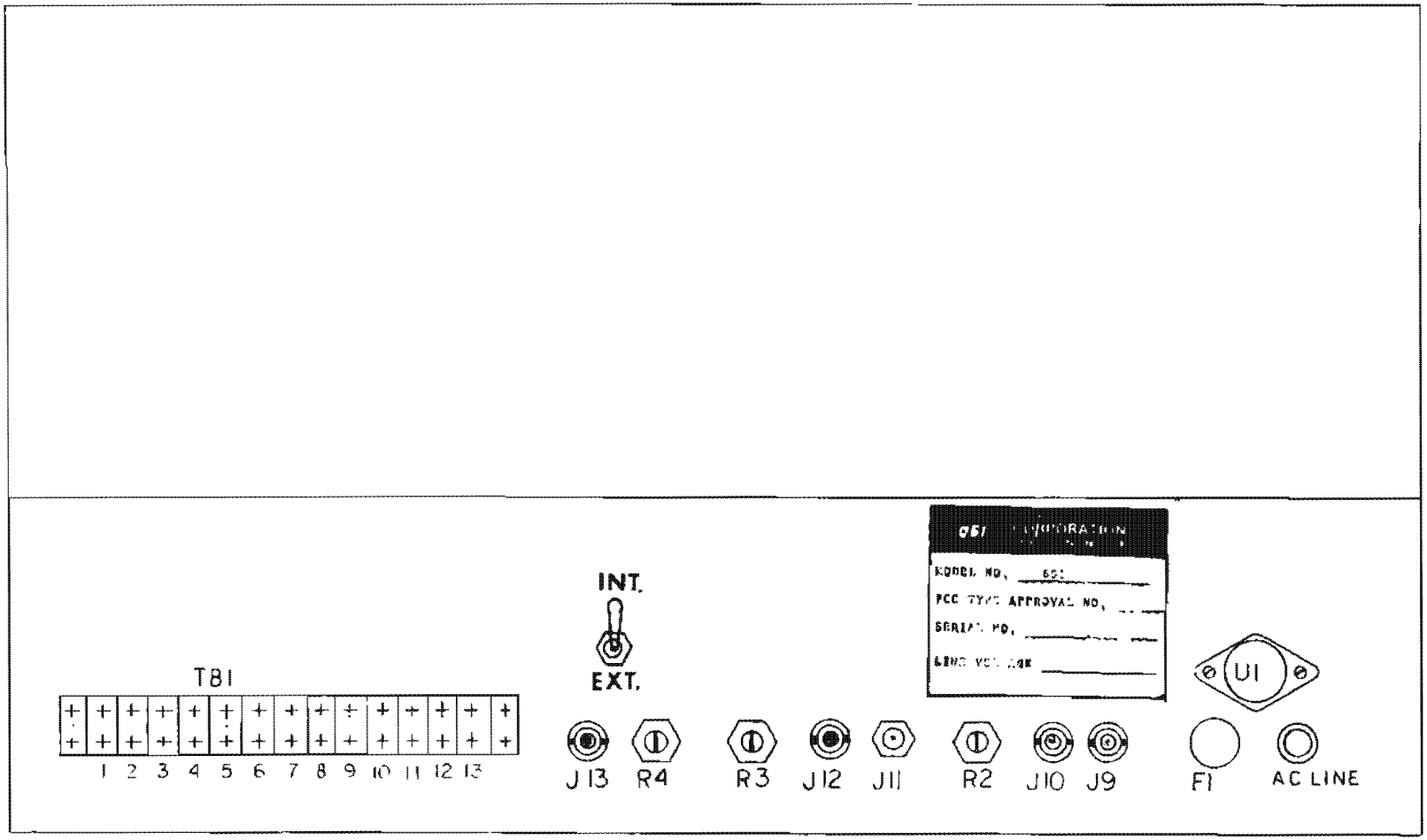
DECIMAL	NO	DATE	BY	
FRACTIONAL				FRONT PANEL LAYOUT
ANGULAR	DRAWN BY Tobin	SCALE 1/1	MATERIAL	
	CHK'D	DATE 9/80	DRAWING NO.	
	TRACED	APP'D		



TOLERANCES	REVISIONS			OEI CORPORATION
DECIMAL	NO	DATE	BY	REAR PANEL LAYOUT
FRACTIONAL				
ANGULAR				DRAWN BY TEF
				CHK'D
				TRACED
				SCALE 1/1
				DATE 3/80
				MATERIAL
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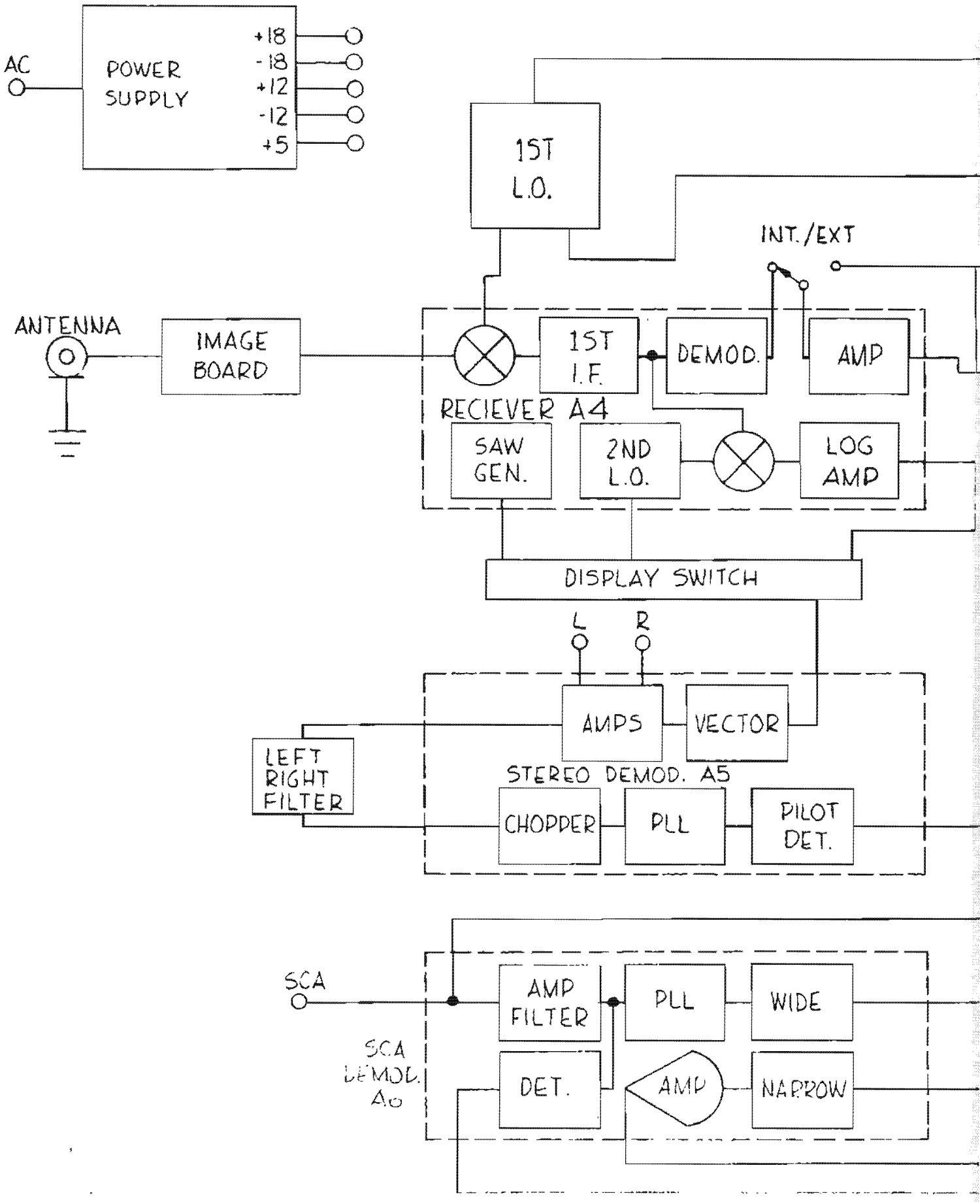
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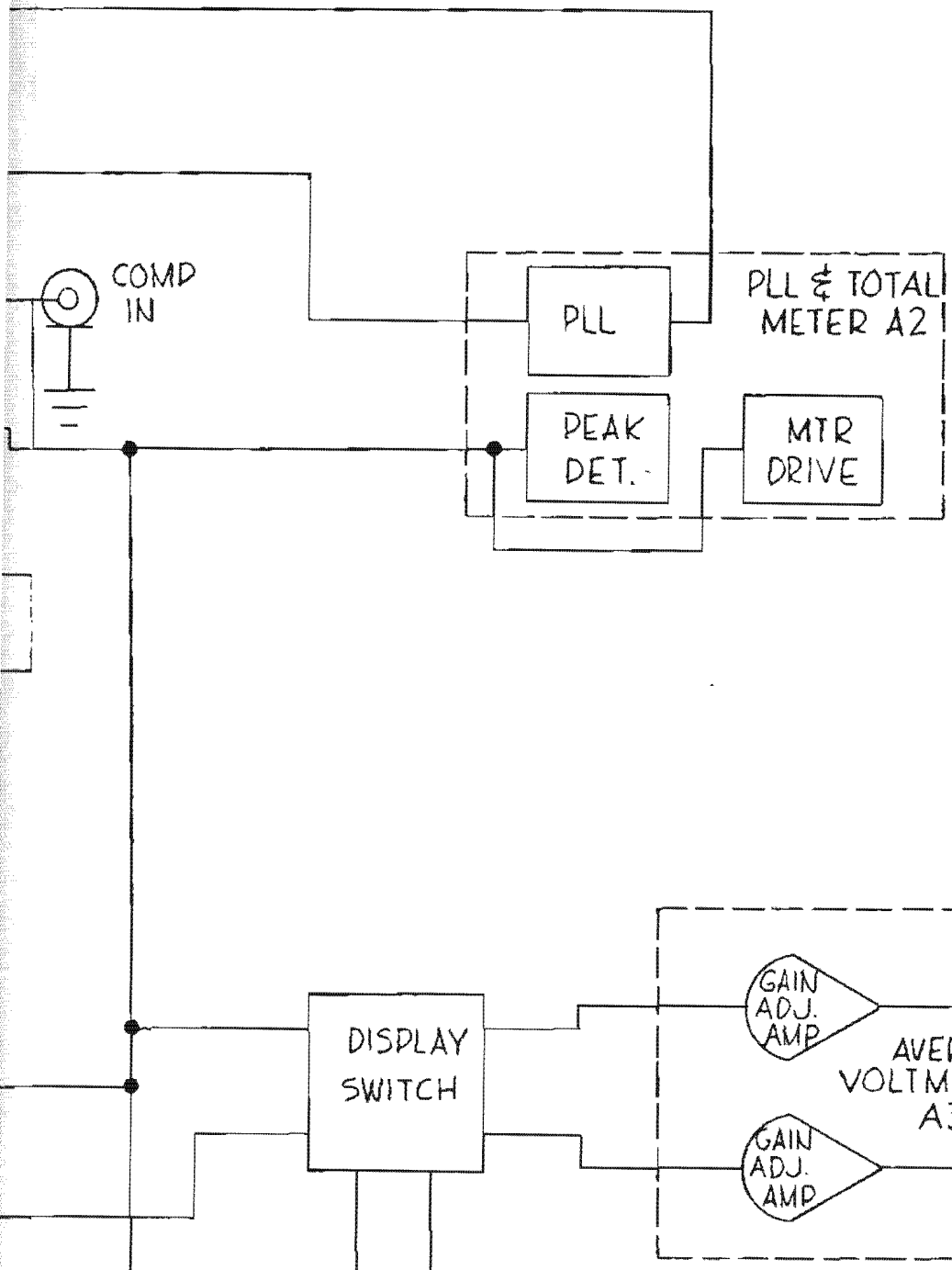
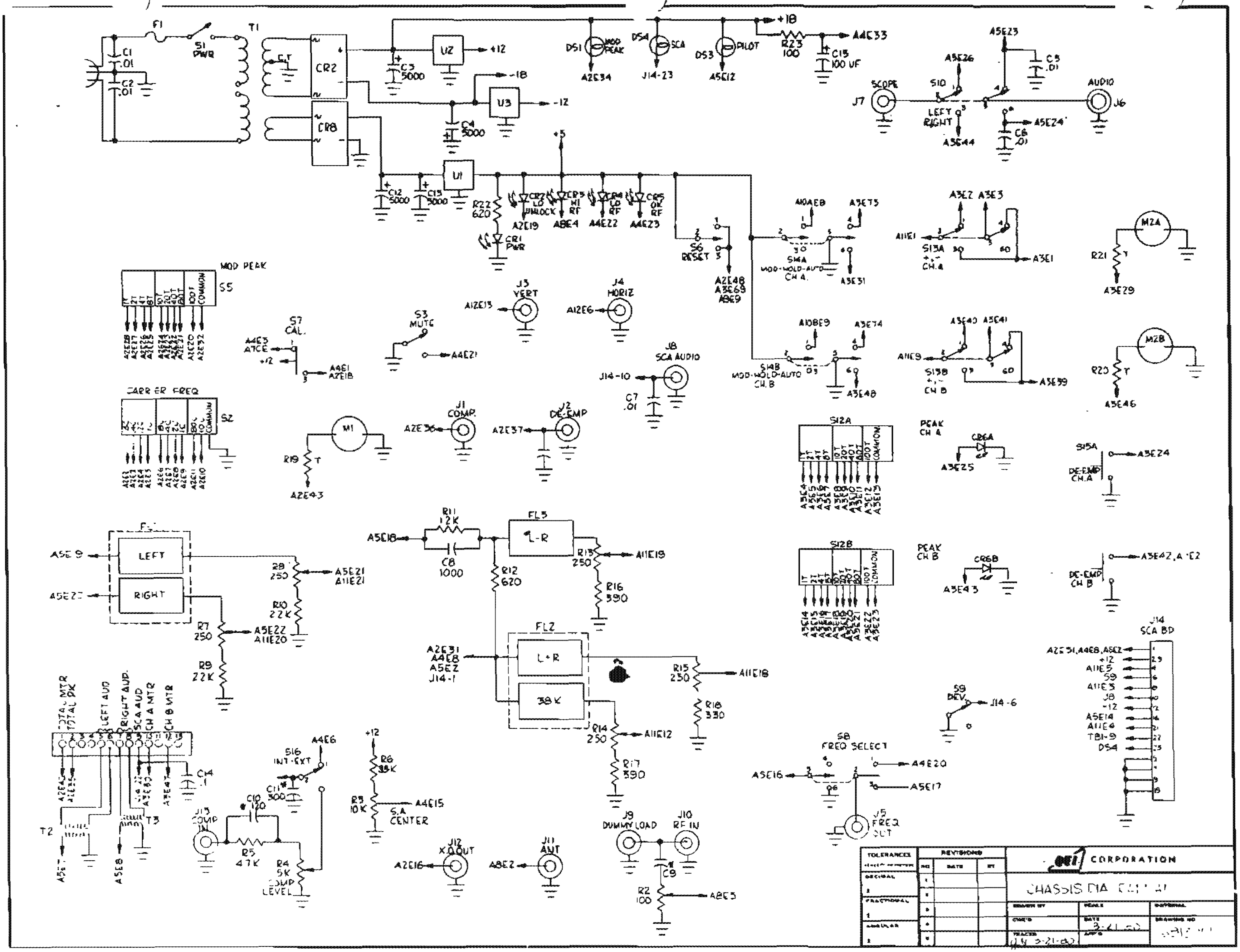
POWER SUPPLY
+18
-18
+12
-12
+5
1ST L.O.
INT./EXT
ANTENNA
IMAGE BOARD
1ST I.F.
DEMOD.
AMP
RECIEVER A4
SAW GEN.
2ND L.O.
LOG AMP
DISPLAY SWITCH
L
R
AMPS
VECTOR
LEFT RIGHT FILTER
STEREO DEMOD. A5
CHOPPER
PLL
PILOT DET.
SCA
AMP FILTER
PLL
WIDE
SCA DEMOD. A6
DET.
AMP
NARROW

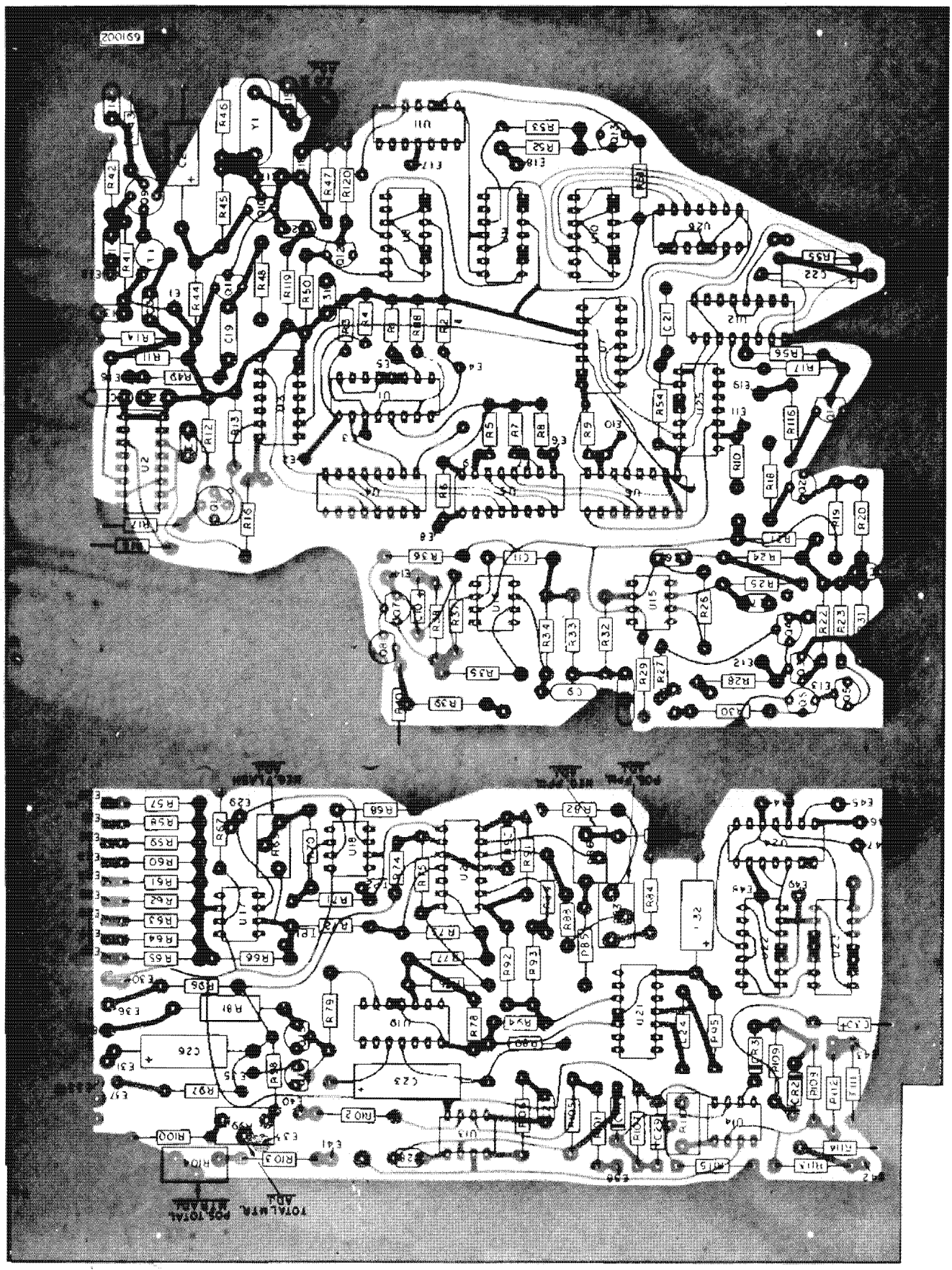


REVISIONS		
NO.	DATE	BY
1		
2		
3		
4		
5		

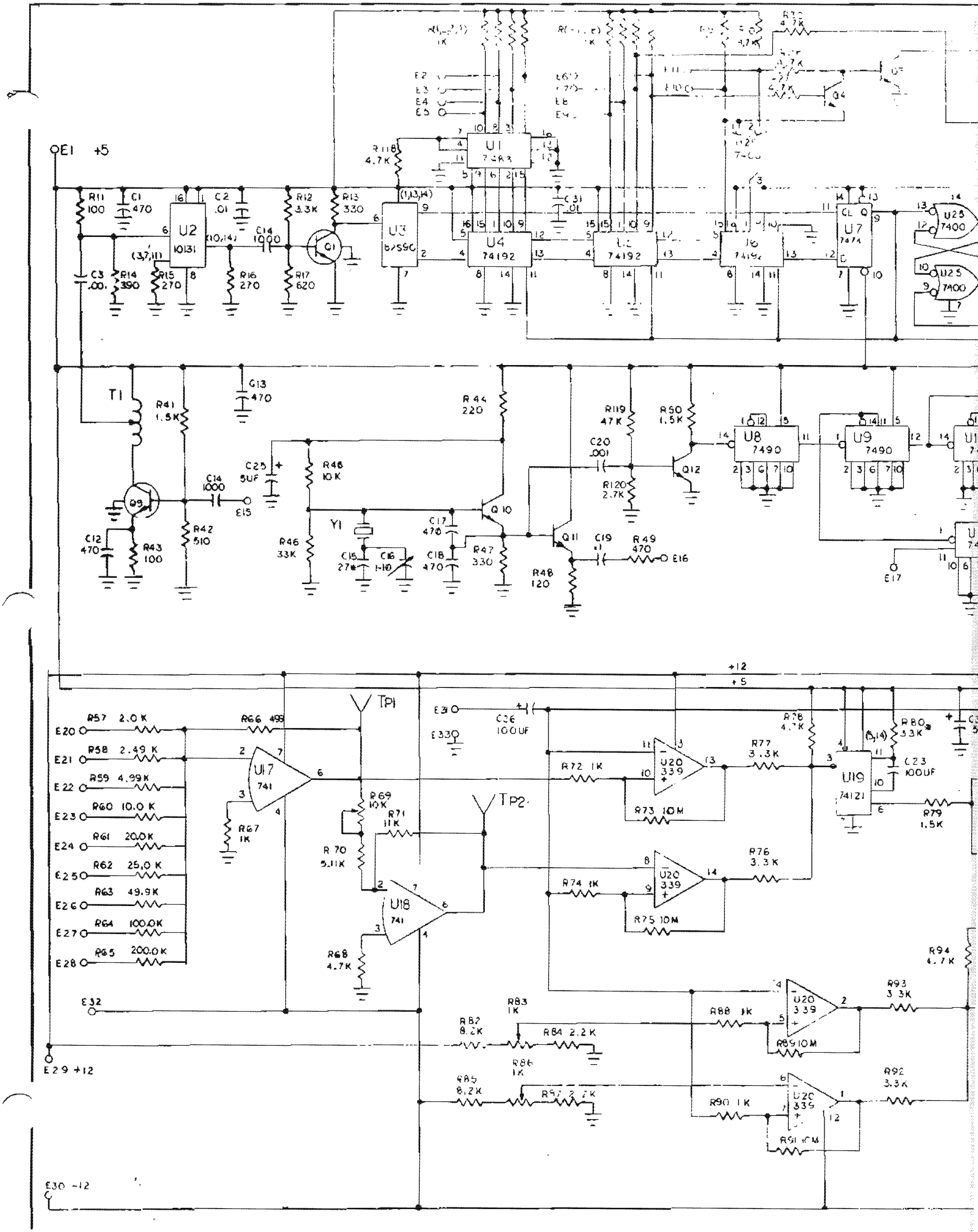
691 MON. BLOCK DIAGRAM

DRAWN BY J.N	SCALE NONE	MATERIAL
CHK'D	DATE 4-7-50	DRAWING NO 6912001
TRACED	APP'D	

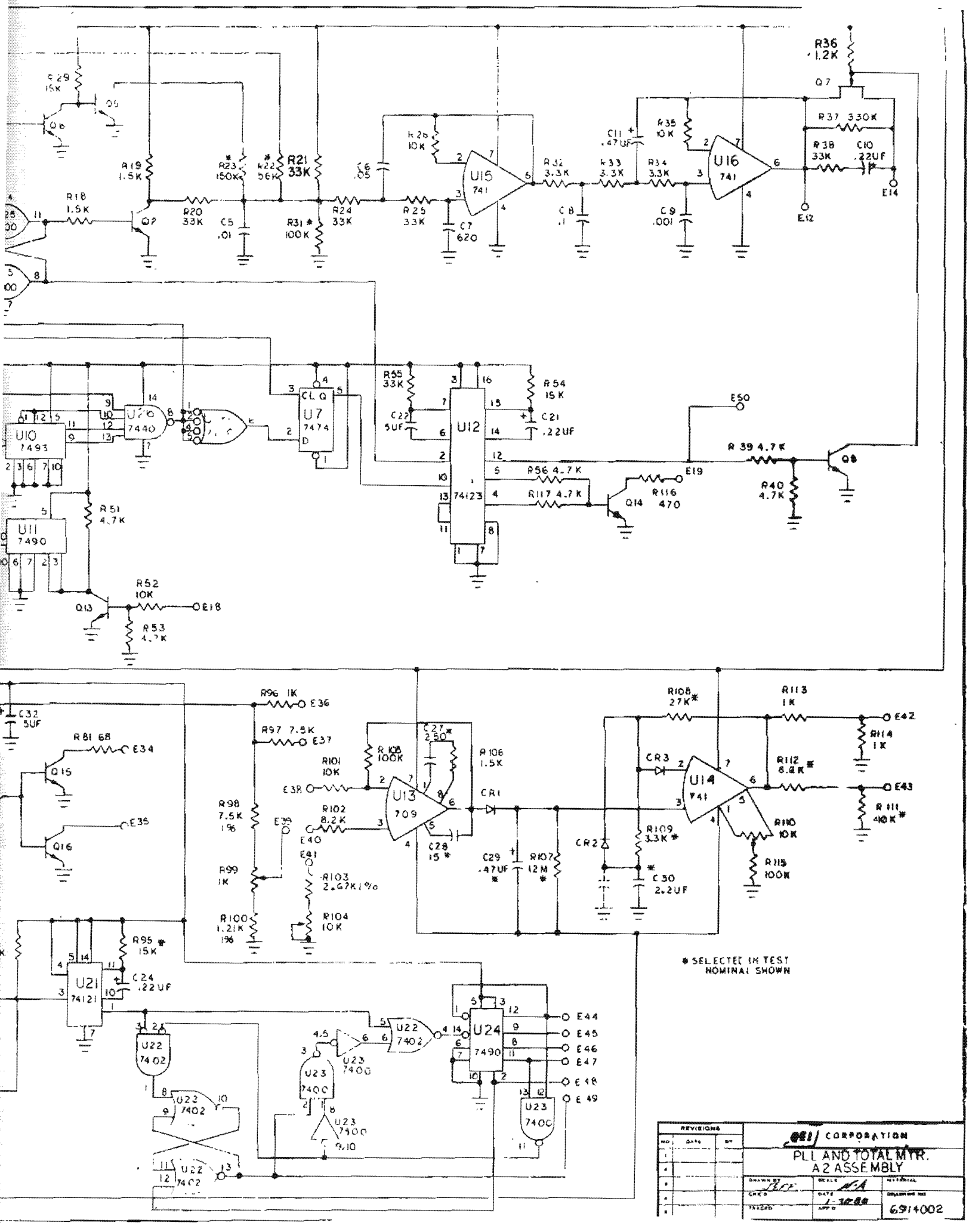

CORPORATION
F1
S1 PWR
T1
CR2
CR8
C1 .01
C2 .01
C3 5000
C4 5000
C12 5000
C13 5000
U1
U2
U3
+12
-18
-12
+5
+18
DS1 MOD PEAK
DS4 SCA
DS3 PILOT
R23 100
C15 100 UF
A4E33
A2E34
J14-23
A5E12
J7 SCOPE
J6 AUDIO
S10
LEFT RIGHT
C5 .01
C6 .01
R22 620
CR1 PWR
CR2 LO UNLOCK
CR3 HI RF
CR4 LO RF
CR5 OK RF
S6 RESET
S14A MOD-HOLD-AUTO CH A.
S14B MOD-HOLD-AUTO CH B
S13A CH A
S13B CH B
M2A
M2B
R21
R20
S5
MOD PEAK
S7 CAL.
S3 MUTE
J3 VERT
J4 HORIZ
J8 SCA AUDIO
C7 .01
CARRIER FREQ
S2
M1
R19
J1 COMP.
J2 DE-EMP
S12A
S12B
PEAK CH A
PEAK CH B
CR6A
CR6B
S15A
DE-EMP CH.A
DE-EMP CH B
LEFT
RIGHT
R8 250
R10 22K
R7 250
R9 22K
R11 12K
C8 1000
FL3
L-R
R12 620
R13 250
R16 390
FL2
L+R
38K
R15 250
R18 330
R14 250
R17 390
S9 DEV.
J14 SCA BD
TOTAL MTR
TOTAL PK
LEFT AUD
RIGHT AUD.
SCA AUD
CH A MTR
CH B MTR
C14 .1
T2
T3
S16 INT-EXT
C11 300
C10 120
J13 COMP IN
R5 47K
R4 5K COMP LEVEL
R6 33K
R3 10K
S.A CENTER
J12 XO OUT
J11 ANT
J9 DUMMY LOAD
J10 RF IN
C9
R2 100
S8 FREQ SELECT
J5 FREQ OUT
TOLERANCES
REVISIONS



VIEW COMPONENT SIDE



E1 +5
R11 100
C1 470
U2 10131
C2 .01
C14 1000
R12 3.3K
R13 330
Q1
U3 82S90
R118 4.7K
U1 74H83
E2
E3
E4
E5
U4 74192
U5 74192
U6 74192
C31 .01
U7 7474
U25 7400
C3 .001
R14 390
R15 270
R16 270
R17 620
T1
R41 1.5K
C13 470
R44 220
R119 47K
R50 1.5K
U8 7490
U9 7490
C20 .001
R120 2.7K
Q12
C25 5UF
R45 10K
Q10
Q9
C14 1000
E15
R42 510
C12 470
R43 100
R46 33K
Y1
C15 27
C16 1-10
C17 470
C18 470
R47 330
Q11
C19 .1
R49 470
E16
R48 120
E17
+12
+5
TP1
TP2
E31
C26 100UF
E33
R57 2.0 K
R58 2.49 K
R59 4.99K
R60 10.0 K
R61 20.0K
R62 25.0 K
R63 49.9K
R64 100.0K
R65 200.0K
E20
E21
E22
E23
E24
E25
E26
E27
E28
R66 499
U17 741
R67 1K
R69 10K
R70 5.11K
R71 11K
U18 741
R68 4.7K
R72 1K
R73 10M
U20 339
R74 1K
R75 10M
R77 3.3K
R76 3.3K
R78 4.7K
U19 74121
R80 33K
C23 100UF
R79 1.5K
R94 4.7K
R93 3.3K
R92 3.3K
R88 1K
R89 10M
R90 1K
R91 10M
E32
R82 8.2K
R83 1K
R84 2.2K
R85 8.2K
R86 1K
R87 2.2K
E29 +12
E30 -12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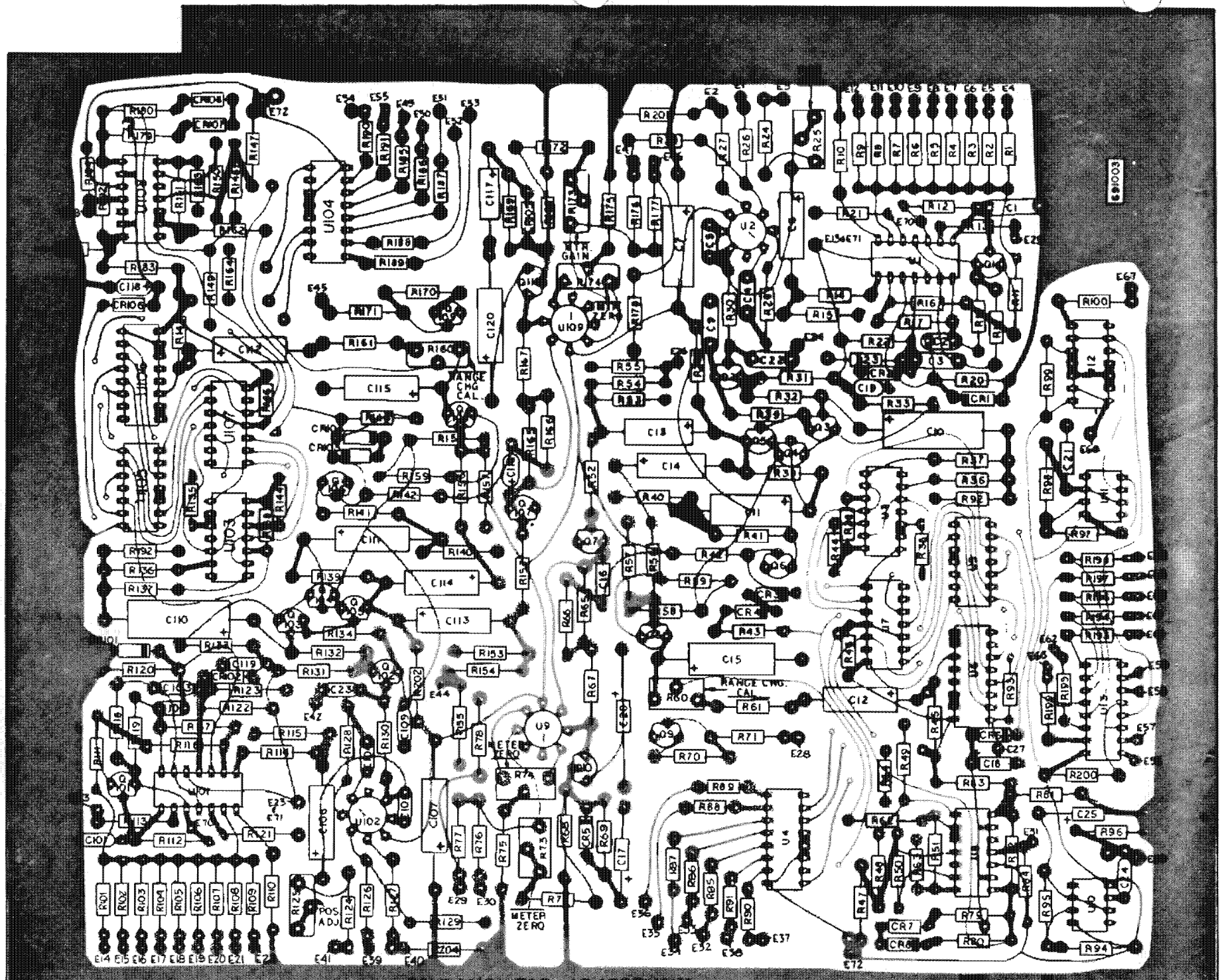
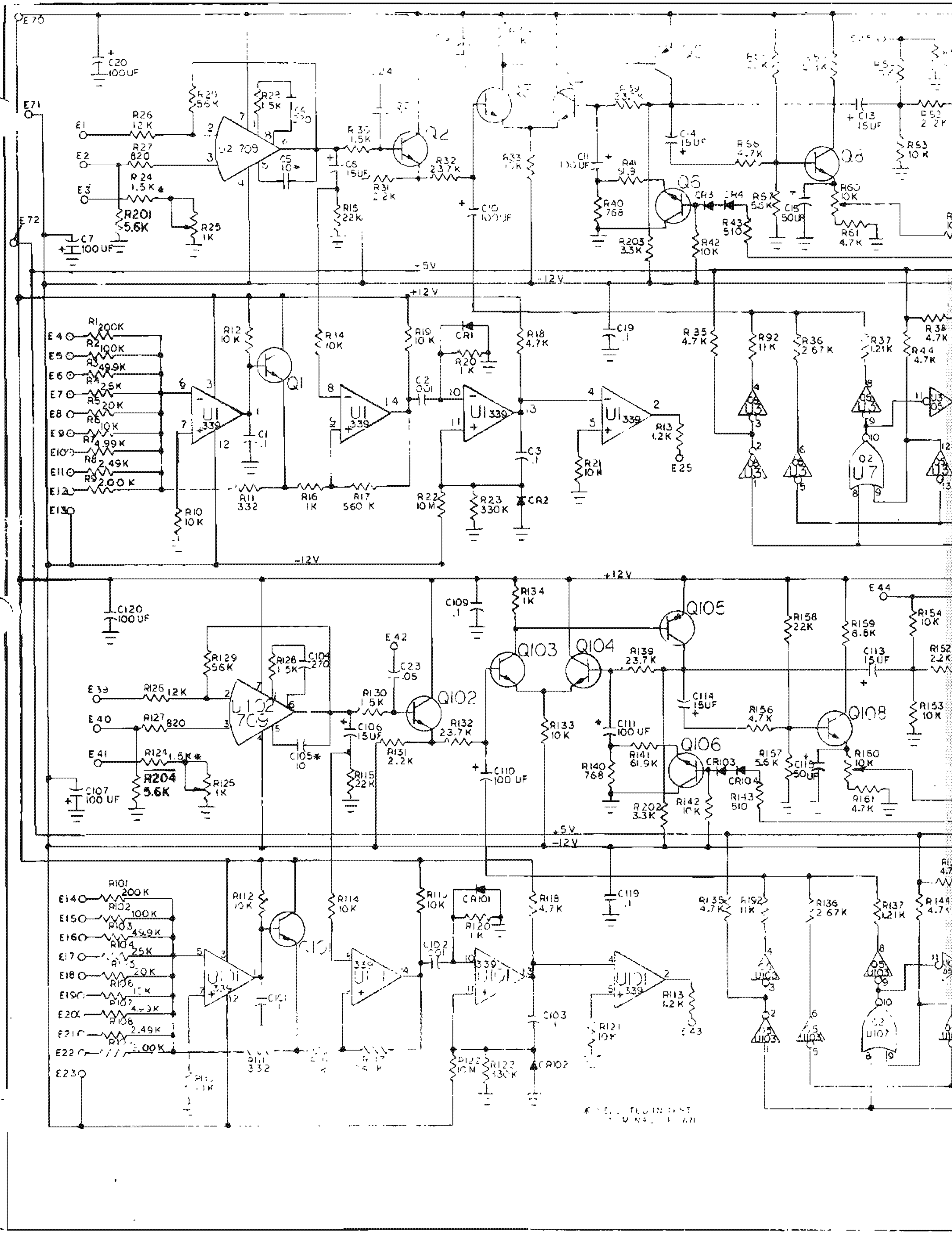
Q6
Q5
R19 1.5K
R23* 150K
R22* 56K
R21 33K
C6 .05
R26 10K
U15 741
R32 3.3K
R33 3.3K
R34 3.3K
C11 .47UF
R35 10K
U16 741
R36 1.2K
Q7
R37 330K
R38 33K
C10 .22UF*
E14
E12
R18 1.5K
Q7
R20 33K
C5 .01
R31* 100K
R24 33K
R25 33K
C7 620
C8 .1
C9 .001
U10 7493
U20 7440
U7 7474
CL Q D
R55 33K
C22 5UF
U12
R54 15K
C21 .22UF
E50
R39 4.7K
Q8
R40 4.7K
E19
R56 4.7K
R117 4.7K
Q14
R116 470
74123
U11 7490
R51 4.7K
R52 10K
Q13
E18
R53 4.7K
C32 5UF
R81 68
E34
Q15
E35
Q16
R96 1K
E36
R97 7.5K
E37
R101 10K
E38
R98 7.5K 1%
R99 1K
R100 1.21K 1%
E39
E40
E41
R102 8.2K
R103 2.67K 1%
R104 10K
R108 100K
C27 250*
U13 709
R106 1.5K
CR1
C28 15*
C29 .47UF*
R107 12M*
R108 27K*
R113 1K
E42
R114 1K
CR3
U14 741
R112 8.2K*
E43
R111 410K*
R110 10K
R115 100K
CR2
R109 3.3K*
C30 2.2UF
* SELECTED IN TEST NOMINAL SHOWN
R95* 15K
U21 74121
C24 .22UF
U22 7402
U23 7400
U24 7490
E44
E45
E46
E47
E48
E49
REVISIONS
NO. DATE BY
GE CORPORATION
PLL AND TOTAL MTR. A2 ASSEMBLY
DRAWN BY
CHK'D
TRACED
SCALE N/A
DATE 1-30-80
APP'D
MATERIAL
DRAWING NO. 6914002



GSI FM MONITOR A3 ASSEMBLY VIEW COMPONENT SIDE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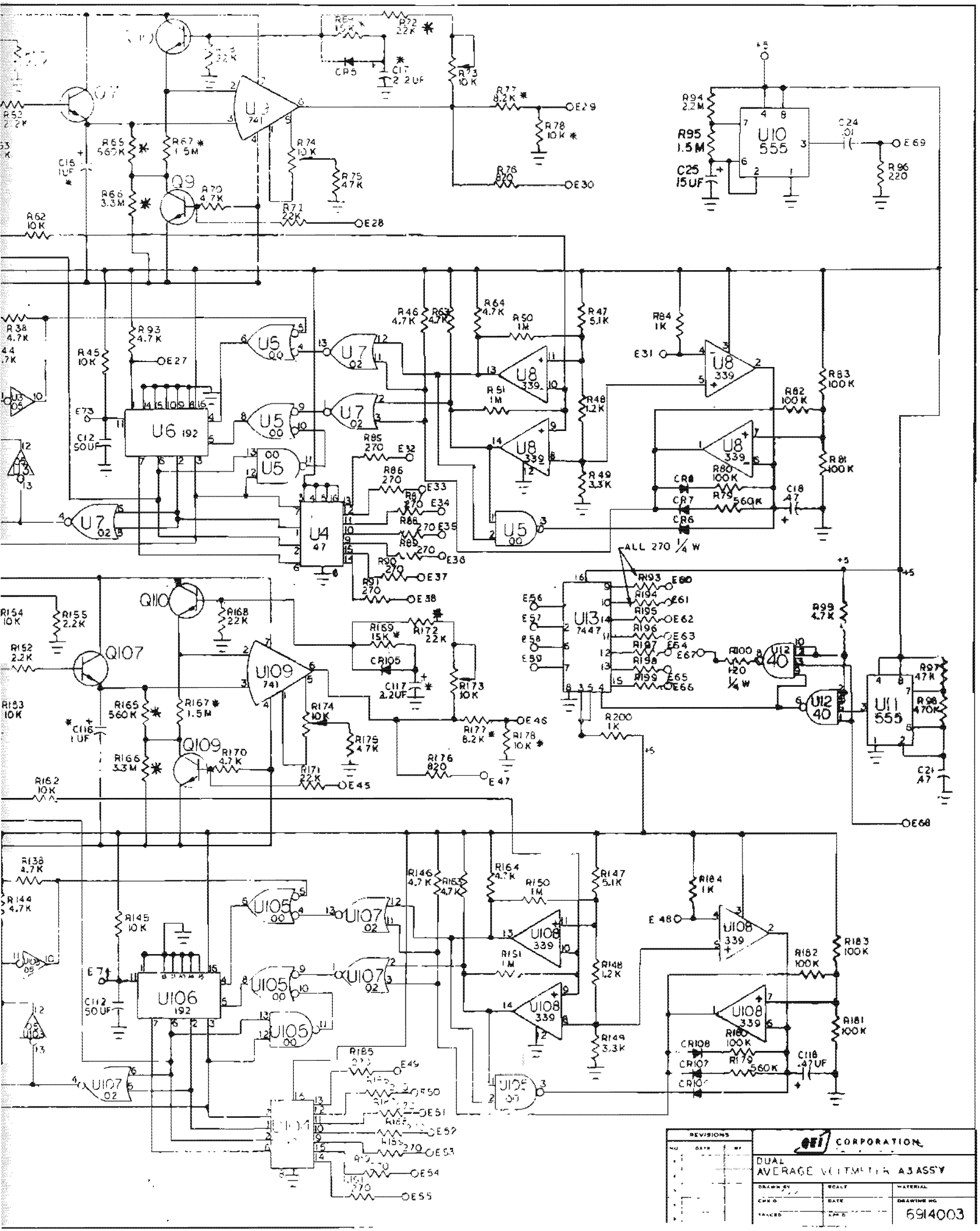
C20 100 UF
E71
E1
E2
E3
R26 12 K
R27 820
R24 1.5 K *
R201 5.6K
R25 1K
R29 56K
R28 1.5K
U2 709
C5 10
C6 15UF
R15 22K
R30 1.5K
R31 2.2K
R32 23.7K
Q2
R33 10K
C10 100 UF
R39 23.7K
C11 100 UF
R41 61.9
R40 768
Q5
CR3
CR4
R203 3.3K
R42 10K
R43 510
R57 5.6K
C15 50UF
C14 15UF
R56 4.7K
Q8
C13 15UF
R52 2.2K
R53 10K
R60 10K
R61 4.7K
E72
C7 100 UF
+5V
-12V
+12V
R1 200K
R2 100K
R3 49.9K
R4 25K
R5 20K
R6 10K
R7 4.99K
R8 2.49K
R9 2.00K
E4
E5
E6
E7
E8
E9
E10
E11
E12
E13
U1 339
R10 10K
R12 10K
Q1
C1 .1
R11 332
R16 1K
R17 560K
R14 10K
R19 10K
C2 .001
CR1
R20 1K
R18 4.7K
C3 .1
CR2
R22 10M
R23 330K
R21 10K
R13 1.2K
E25
C19 .1
R35 4.7K
R92 11K
R36 2.67K
R37 1.21K
R38 4.7K
R44 4.7K
U3
U7
C120 100 UF
E39
E40
E41
R125 12K
R127 820
R124 1.5K *
R204 5.6K
R125 1K
R129 56K
R128 1.5K
C104 270
U102 709
C105 * 10
C107 100 UF
E42
C23 .05
R130 1.5K
C106 15UF
R115 22K
Q102
R131 2.2K
R132 23.7K
C109 .1
R134 1K
Q103
Q104
Q105
R133 10K
C110 100 UF
R139 23.7K
C111 100 UF
R141 61.9K
R140 768
Q106
CR103
CR104
R202 3.3K
R142 10K
R143 510
C114 15UF
R158 22K
R156 4.7K
R157 5.6K
C115 50UF
Q108
R159 8.8K
C113 15UF
R160 10K
R161 4.7K
E44
R154 10K
R152 2.2K
R153 10K
R101 200K
R102 100K
R103 49.9K
R104 25K
R105 20K
R106 10K
R107 4.99K
R108 2.49K
E14
E15
E16
E17
E18
E19
E20
E21
E22
E23
U101 339
R112 10K
C101
R111 332
R114 10K
R119 10K
CR101
R120 1K
C102 .001
R118 4.7K
C103
CR102
R122 10M
R123 330K
R121 10K
R113 1.2K
E43
C119 .1
R135 4.7K
R192 11K
R136 2.67K
R137 1.21K
R144 4.7K
U103
U107

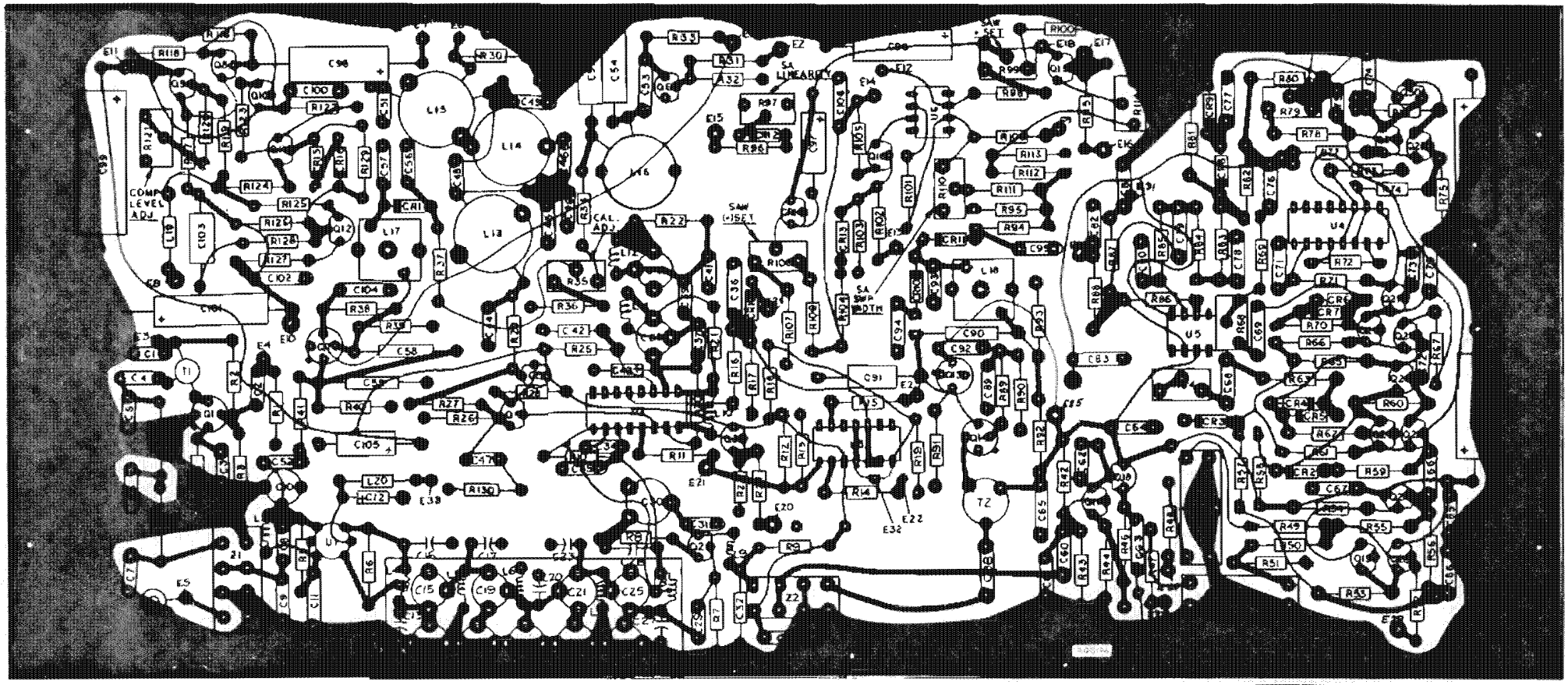


OEI CORPORATION

REVISIONS

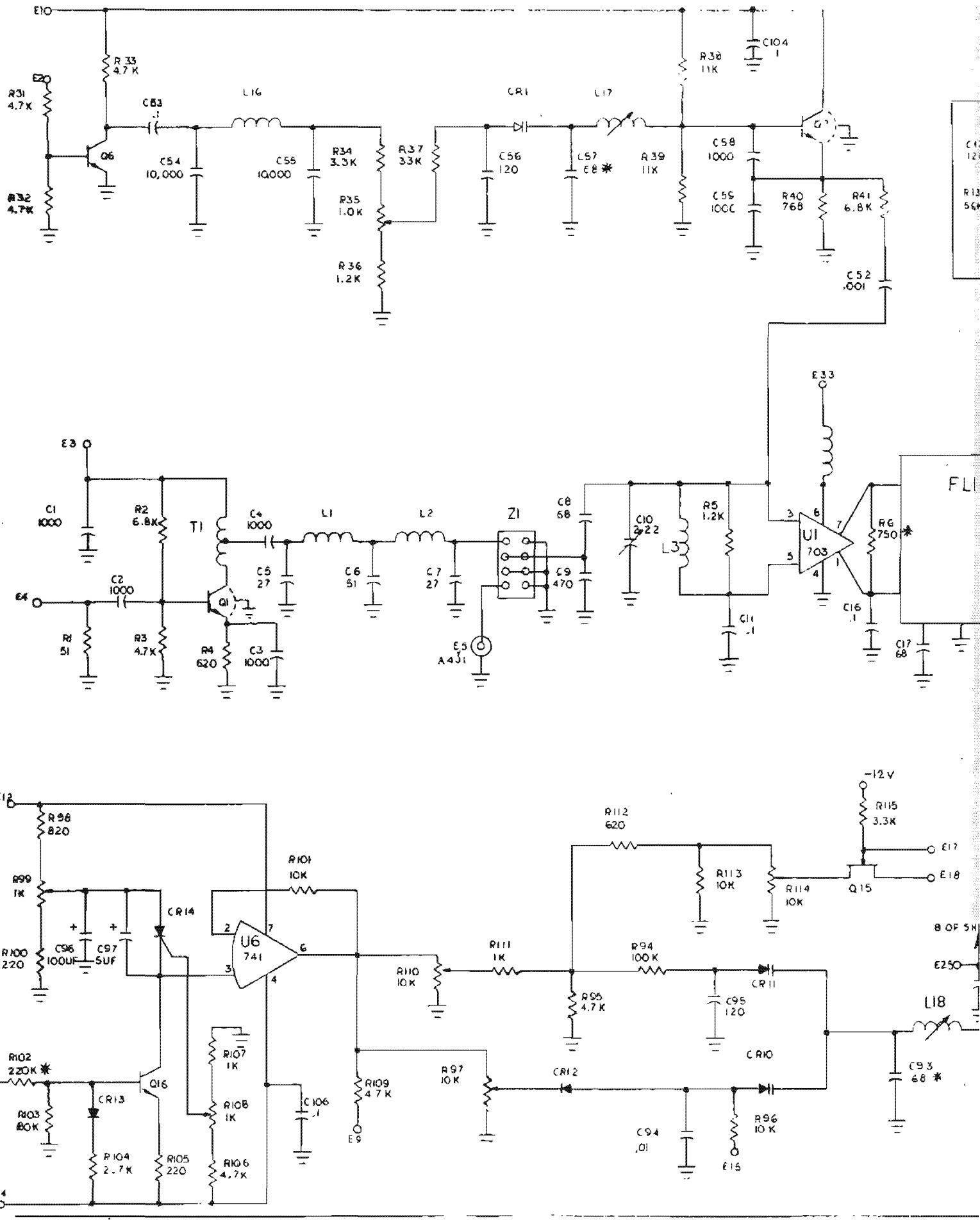
DUAL AVERAGE VOLTMETER A3 ASS'Y

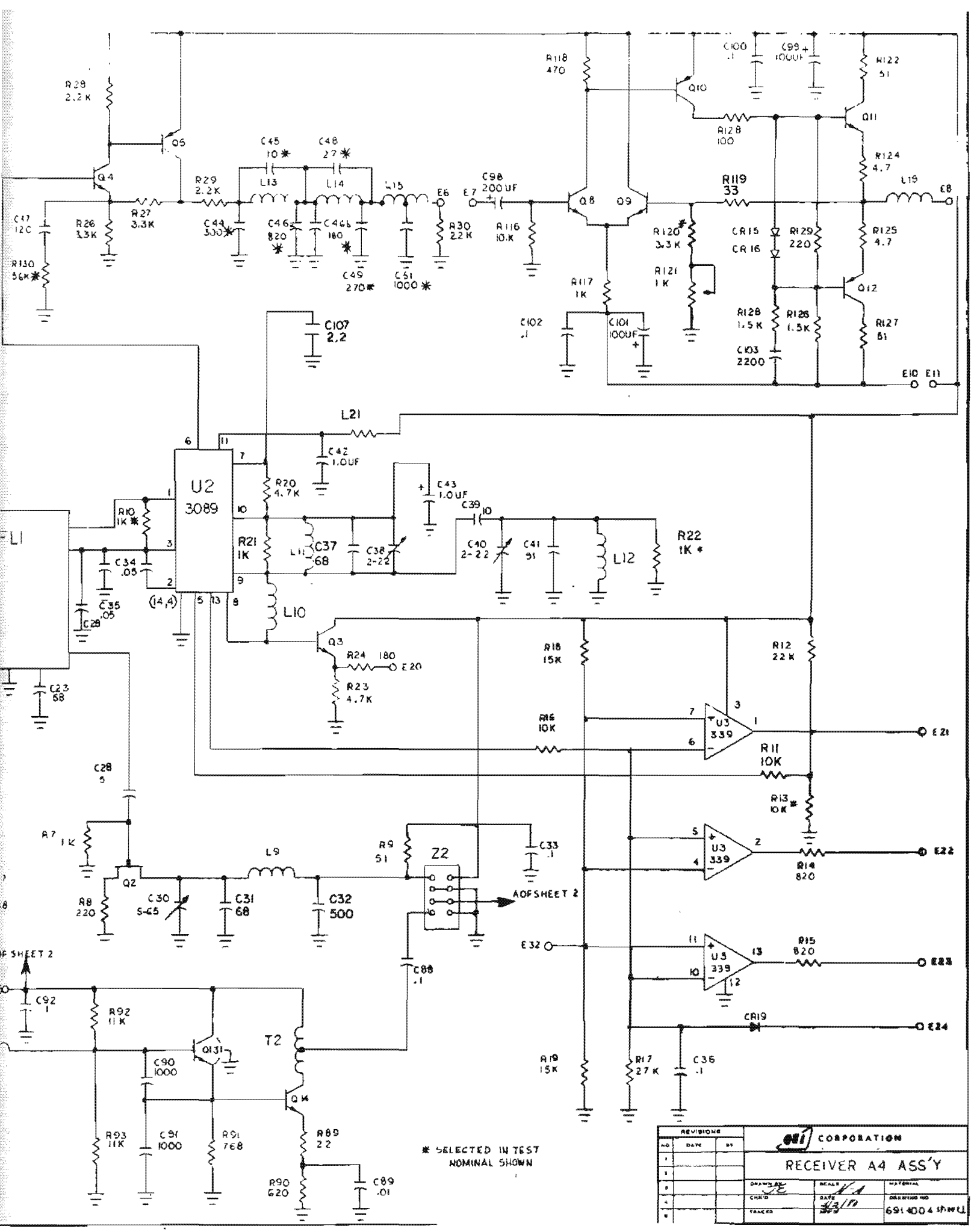
DRAWN BY | SCALE | MATERIAL
CHK'D | DATE | DRAWING NO.
TRACED | APP'D | 6914003

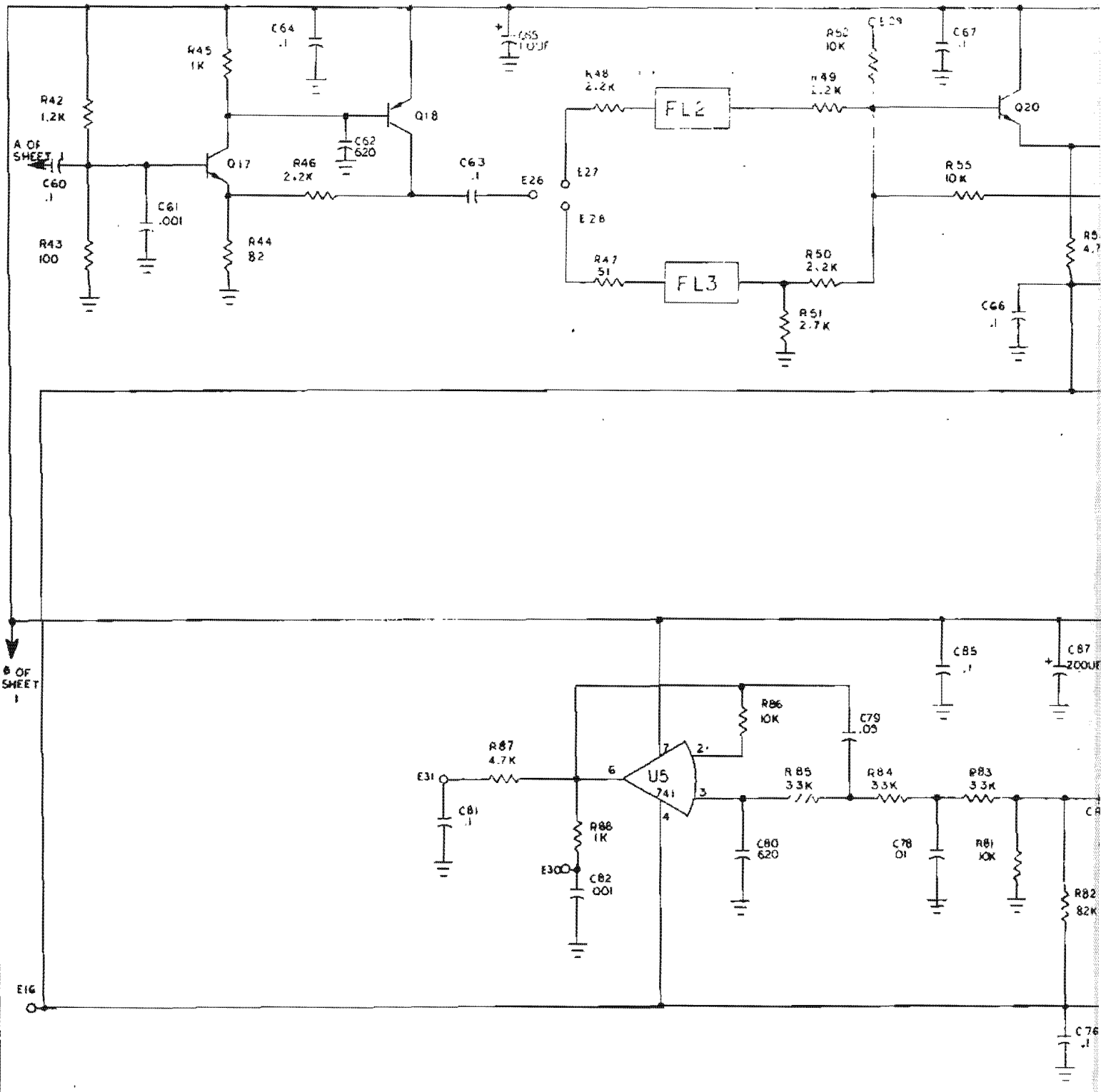


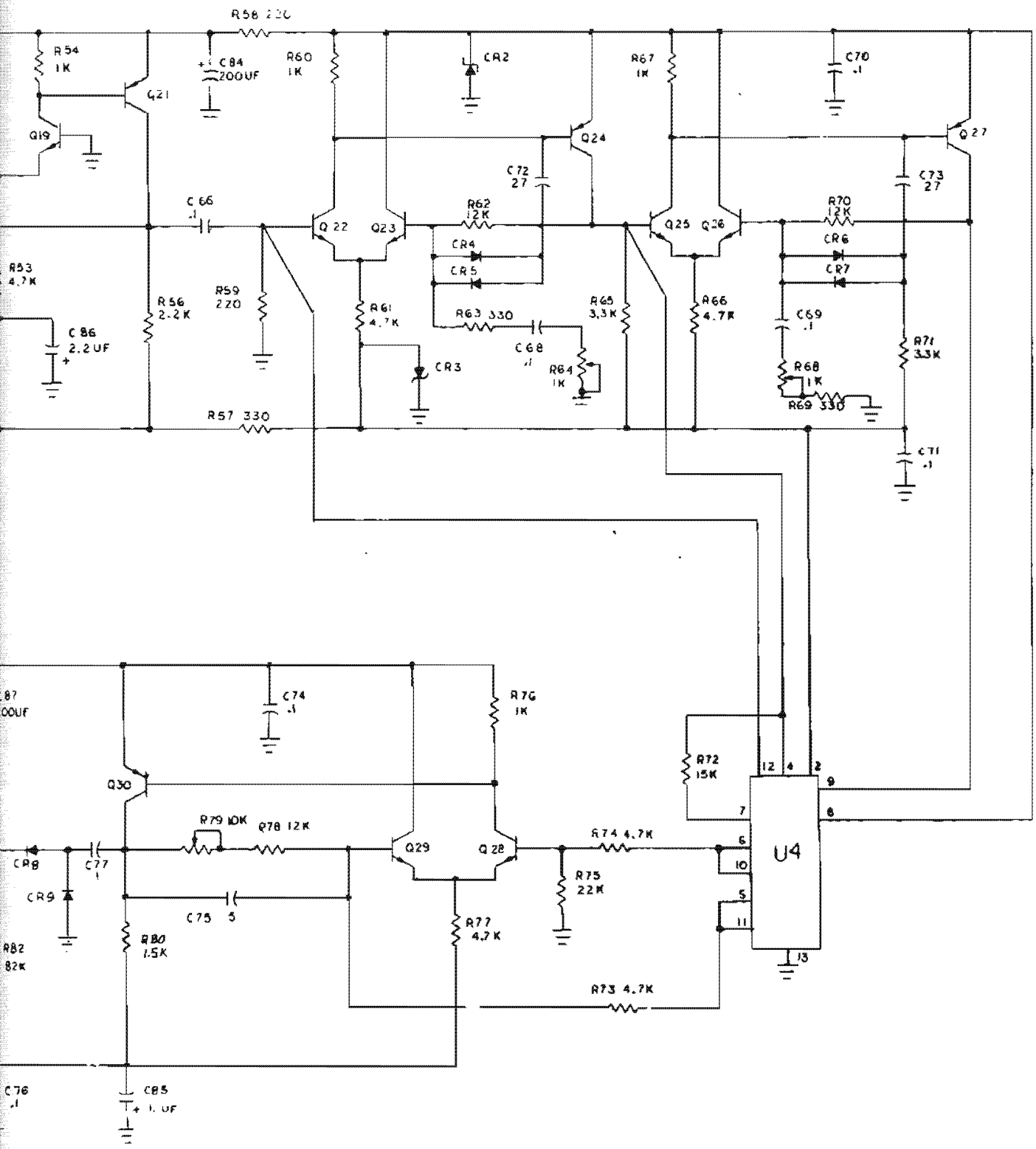
VIEW COMPONENT SIDE

REVISIONS			gei CORPORATION
			RECIEVER A4 ASSEMBLY
			SCALE N/A


E10
R33 4.7K
E20
R31 4.7K
Q6
R32 4.7K
C83
L16
C54 10,000
C55 10000
R34 3.3K
R35 1.0K
R36 1.2K
R37 33K
CR1
C56 120
L17
C57 68 *
R38 11K
A39 11K
C104 1
C58 1000
C59 1000
Q7
R40 768
R41 6.8K
C52 .001
E33
E3
C1 1000
R2 6.8K
T1
C4 1000
L1
L2
Z1
C8 68
C10 2-22
L3
R5 1.2K
U1 703
R6 750 *
C16 .1
C17 68
E4
C2 1000
Q1
R1 51
R3 4.7K
R4 620
C3 1000
C5 27
C6 51
C7 27
C9 470
E5 A431
C11 .1
E12
R98 820
R99 1K
R100 220
C96 100UF
C97 5UF
CR14
R101 10K
U6 741
R102 220K *
Q16
CR13
R103 80K
R104 2.7K
R105 220
R106 4.7K
R107 1K
R108 1K
C106 .1
R109 4.7K
E9
E14
R110 10K
R111 1K
R112 620
R113 10K
R114 10K
Q15
-12V
R115 3.3K
E17
E18
R94 100K
R95 4.7K
C95 120
CR11
CR10
CR12
R97 10K
C94 .01
R96 10K
E15
L18
C93 68 *
E25


R29 2.2K
Q5
Q4
R29 2.2K
C45 10*
C48 27*
L13
L14
L15
E6
R26 3.3K
R27 3.3K
C44 300*
C46 820*
C46A 180*
C49 270*
C51 1000*
R30 2.2K
C47 120
R130 56K*
C98 200UF
E7
R116 10K
Q8
Q9
R118 470
Q10
C100 .1
C99 1000UF
R122 51
Q11
R128 100
R124 4.7
L19
E8
R119 33
R120 3.3K
R121 1K
CR15
CR16
R129 220
R125 4.7
Q12
R117 1K
C102 .1
C101 100UF
R128 1.5K
R126 1.5K
R127 51
C103 2200
E10
E11
C107 2.2
L21
C42 1.0UF
C43 1.0UF
C39 10
U2 3089
R20 4.7K
R10 1K*
R21 1K
L11
C37 68
C38 2-22
C40 2-22
C41 51
L12
R22 1K*
C34 .05
C35 .05
C28
(14,4)
L10
Q3
R24 180
E20
R23 4.7K
C23 68
R18 15K
R12 22K
R16 10K
U3 339
E21
R11 10K
C28 5
R13 10K*
R7 1K
L9
R9 51
Z2
C33 .1
U3 339
E22
R14 820
Q2
R8 220
C30 5-65
C31 68
C32 500
AOFSHEET 2
E32
R15 820
U3 339
E23
CR19
E24
C88 .1
R19 15K
R17 27K
C36 .1
C92 1
R92 11K
Q131
T2
C90 1000
Q14
R93 11K
C91 1000
R91 768
R89 22
R90 620
C89 .01
* SELECTED IN TEST
NOMINAL SHOWN
REVISIONS
NO
DATE
BY
CORPORATION
RECEIVER A4 ASS'Y
DRAWN
CHKD
TRACED
SCALE
DATE
691-4004 SHEET 1


R42
1.2K
R45
1K
C64
.1
C65
100UF
R52
10K
C67
.1
R48
2.2K
FL2
R49
2.2K
Q20
A OF SHEET 1
C60
.1
Q17
R46
2.2K
C62
620
Q18
C63
.1
E26
E27
E28
R55
10K
C61
.001
R43
100
R44
82
R47
51
FL3
R50
2.2K
R51
2.7K
C66
.1
B OF SHEET 1
C85
.1
C87
200UF
R86
10K
C79
.05
R87
4.7K
E31
U5
741
R85
3.3K
R84
3.3K
R83
3.3K
C81
.1
R88
1K
E30
C82
001
C80
620
C78
01
R81
10K
R82
82K
E16
C76
.1



REVISIONS			
NO	DATE	BY	
1			
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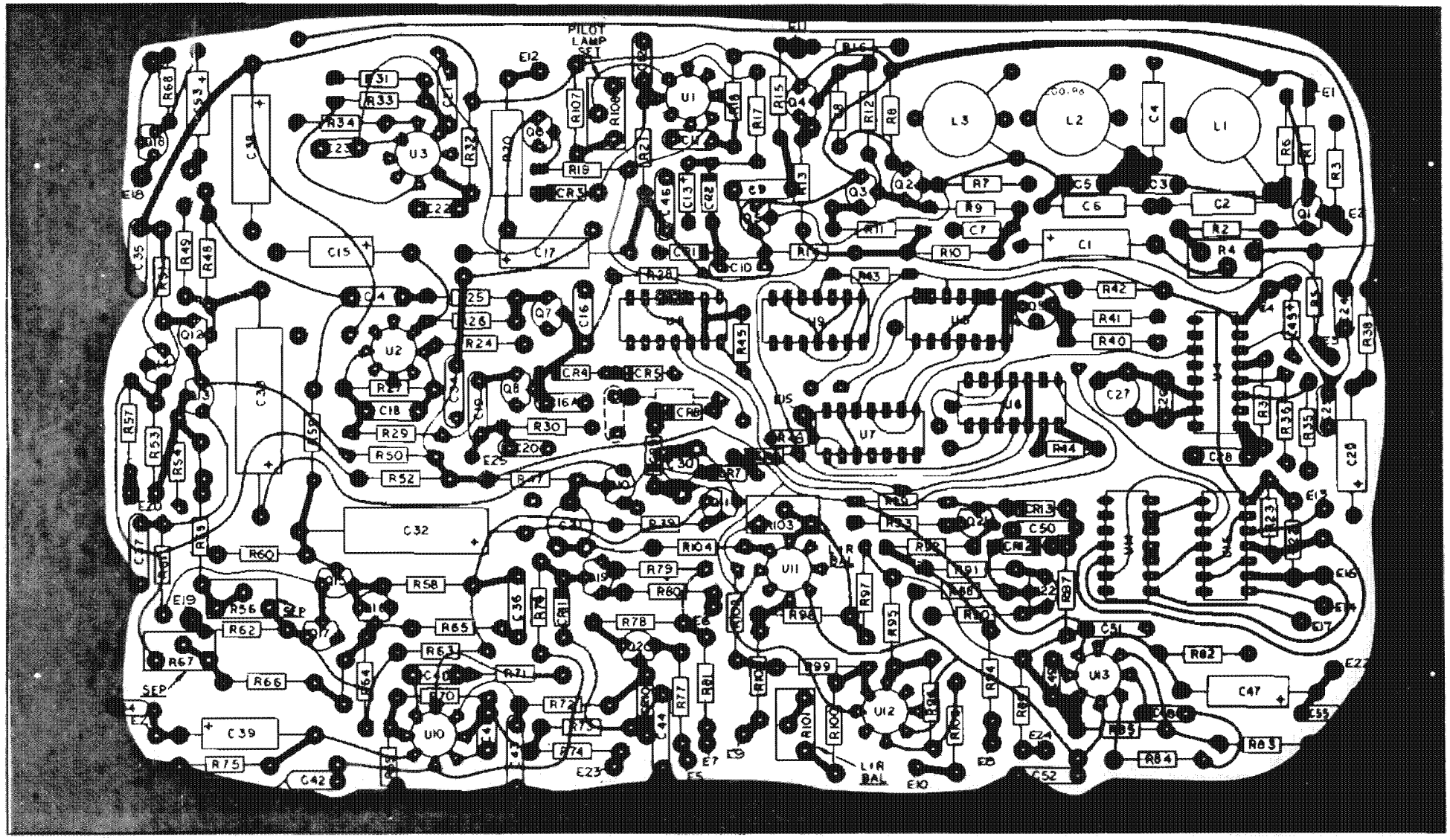
CORPORATION

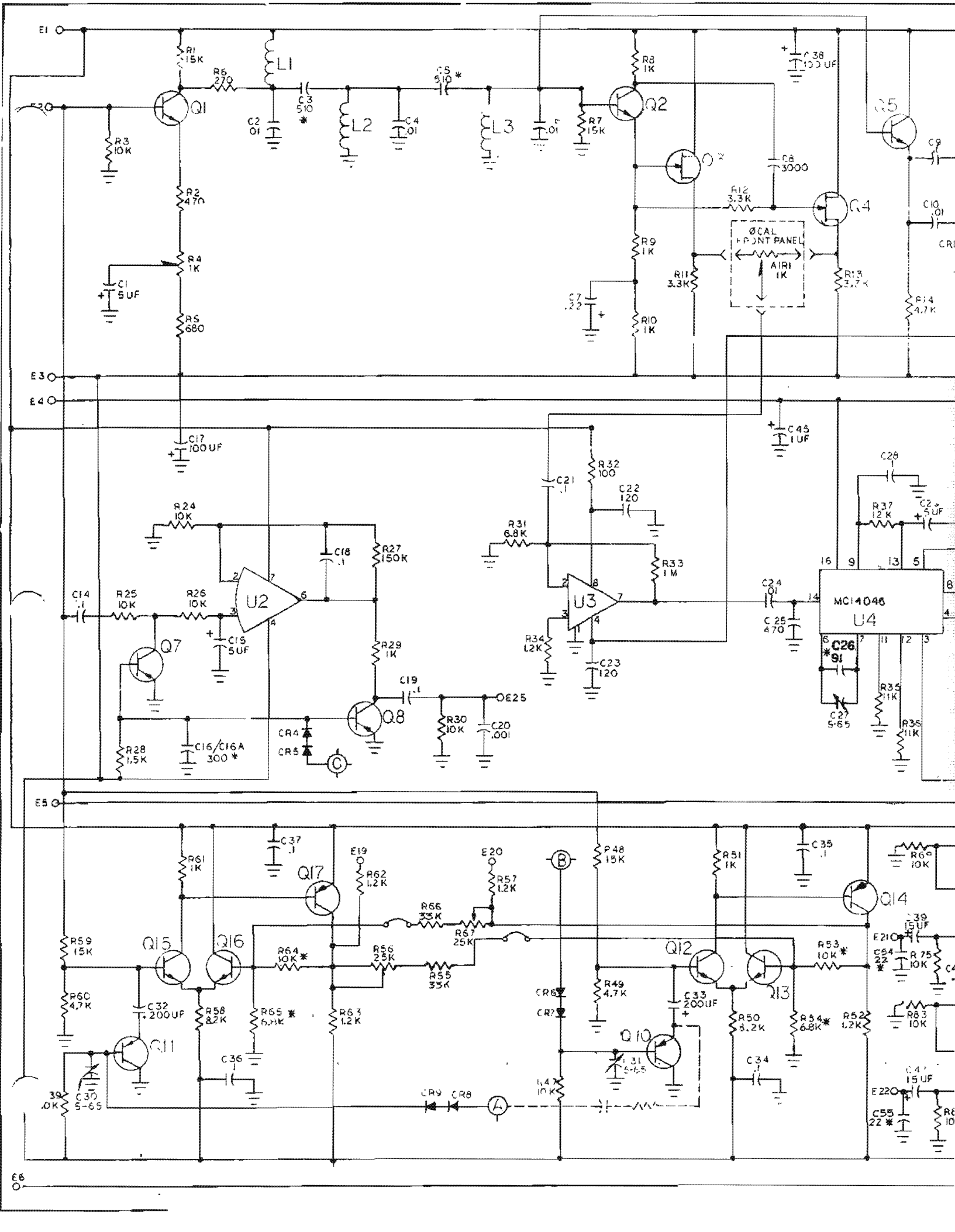
RECEIVER A4 ASSY

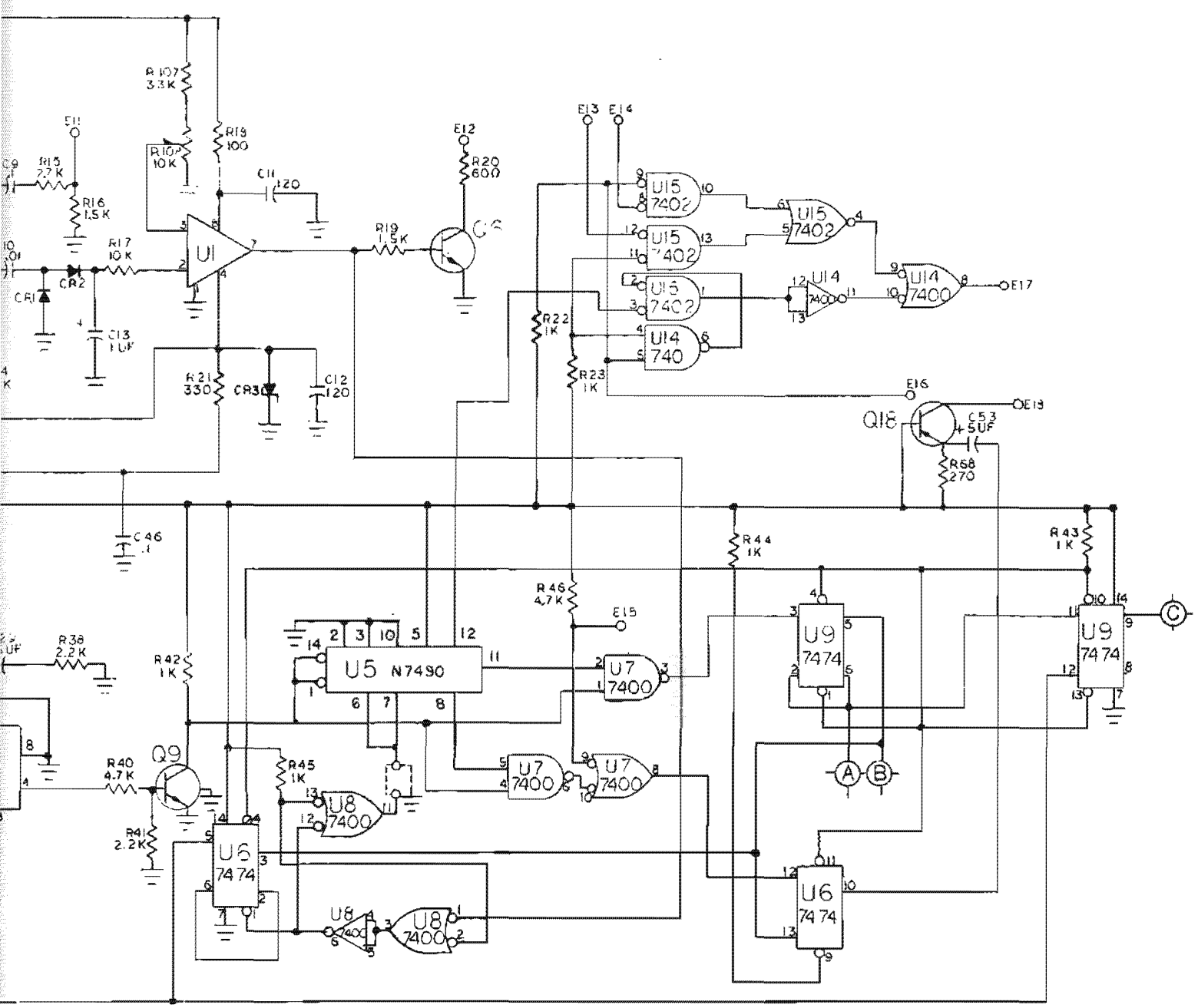
DRAWN
CHK'D
TRACED
SCALE 4-1
DATE 4/80
MATERIAL
DRAWING NO 6914004

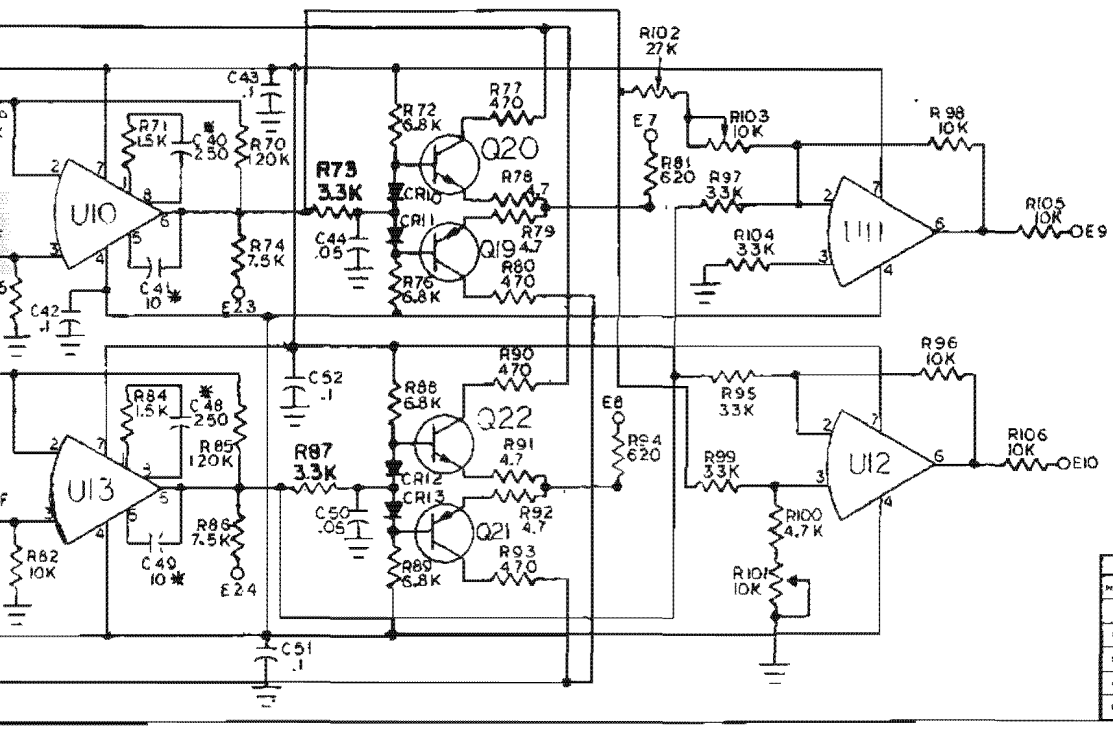


VIEW COMPONENT SIDE

REVISIONS			EI CORPORATION
NO.	DATE	BY	
1			STEREO DEMODULATOR
2			AS ASSEMBLY
3			DRAWN BY: SCALE: N/A MATERIAL:
4			CHK'D: DATE: DRAWING NO.
5			TRACED: APP'D:
6			


E1
E2
E3
E4
E5
E6
R1 15K
R2 470
R3 10K
R4 1K
R5 680
R6 270
C1 5UF
C2 .01
C3 510 *
C4 .01
C5 510 *
L1
L2
L3
Q1
Q2
R7 15K
R8 1K
R9 1K
R10 1K
C7 .22
R11 3.3K
R12 3.3K
R13 3.7K
ØCAL FRONT PANEL
AIR1 1K
Q3
Q4
Q5
C8 3000
C9
C10 .01
R14 4.7K
C38 100 UF
C17 100 UF
C45 1 UF
R24 10K
C18 .1
R27 150K
C14 .1
R25 10K
R26 10K
U2
C15 5UF
Q7
R29 1K
C19 .1
Q8
R30 10K
C20 .001
E25
CR4
CR5
R28 1.5K
C16/C16A 300 *
C21 .1
R32 100
C22 120
R31 6.8K
R33 1M
U3
R34 1.2K
C23 120
C24 .01
C25 470
MC14046
U4
C26 91 *
C27 5-65
R35 11K
R36 11K
C28
R37 12K
C29 5 UF
C37 .1
R61 1K
E19
E20
Q17
R62 1.2K
R57 1.2K
R56 33K
R67 25K
R55 33K
R64 10K *
R66 25K
R59 15K
Q15
Q16
R60 4.7K
C32 200 UF
R58 8.2K
R65 6.2K *
R63 1.2K
C36 .1
Q11
C30 5-65
39 .0K
CR9
CR8
A
B
R48 15K
R49 4.7K
CR6
CR7
C33 200UF
Q10
1.31 5-65
1.4K 10K
R51 1K
C35 .1
Q14
Q12
Q13
R53 10K *
R50 8.2K
R54 6.8K *
R52 1.2K
C34 .1
R6 10K
C39 15UF
E21
C54 22 *
R75 10K
R63 10K
C41 15UF
E22
C55 22 *
R6 10


R107 3.3K
R19 100
R10 10K
E11
E12
R20 600
C11 120
R15 2.7K
R16 1.5K
R17 10K
U1
R19 1.5K
C8
CR2
CR1
C13 1 UF
R21 330
CR3
C12 120
E13 E14
U15 7402
U15 7402
U15 7402
U14 740
U14 7400
E17
R22 1K
R23 1K
E16
Q18
C53 5UF
E18
R68 270
C46 .1
R44 1K
R43 1K
R46 4.7K
E15
U5 N7490
U7 7400
U9 7474
U9 7474
C
R38 2.2K
R42 1K
R40 4.7K
Q9
R45 1K
U8 7400
U7 7400
U7 7400
A
B
R41 2.2K
U6 7474
U8 7400
U8 7400
U6 7474



* SELECTED IN TEST
NOMINAL SHOWN

REVISIONS			
NO	DATE	BY	
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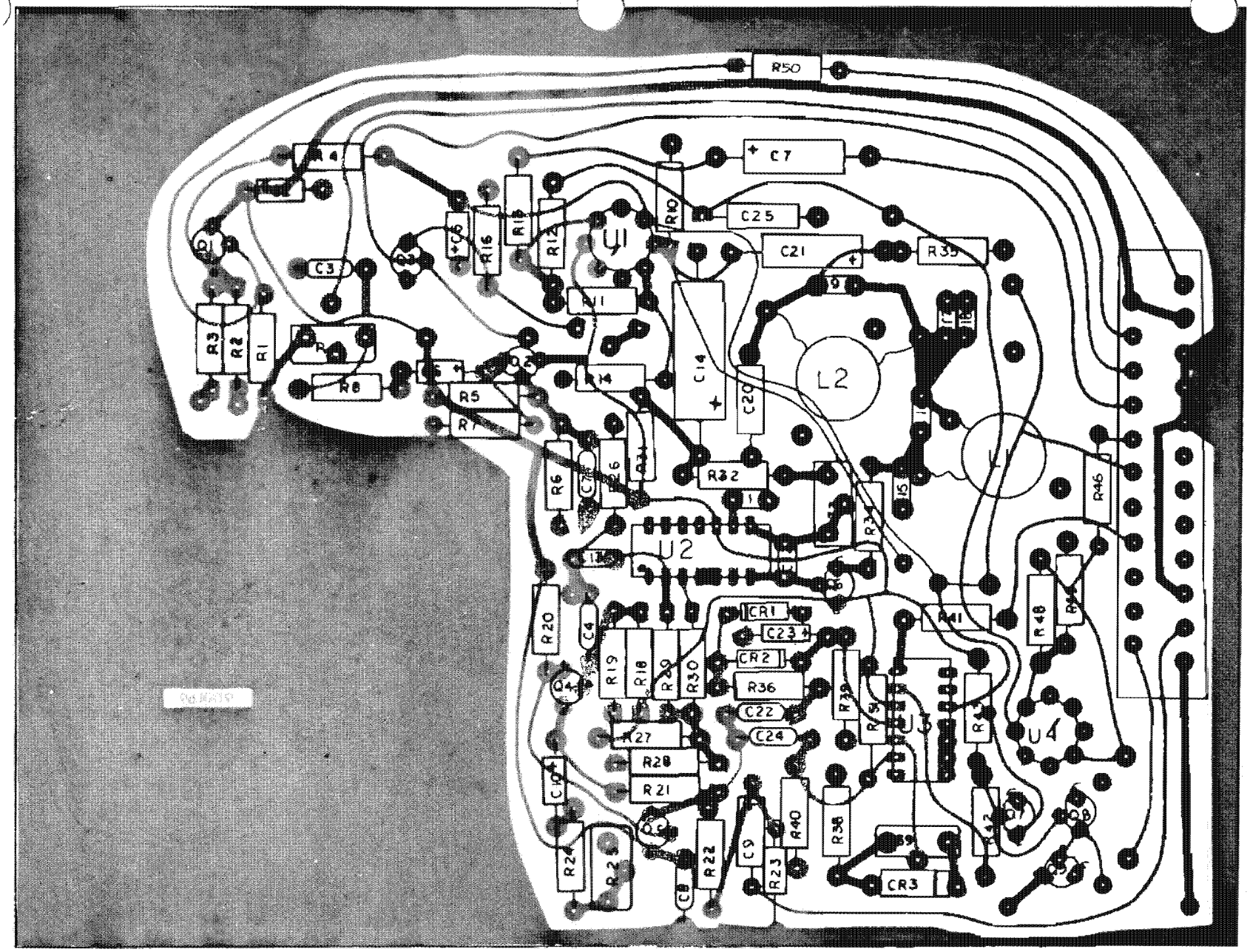
DEI CORPORATION

STEREO DEMODULATOR
A5 ASSEMBLY

DRAWN BY	SCALE	MATERIAL
CHK'D	DATE 10-29	DRAWING NO 6914005
TRACED	APP'D	

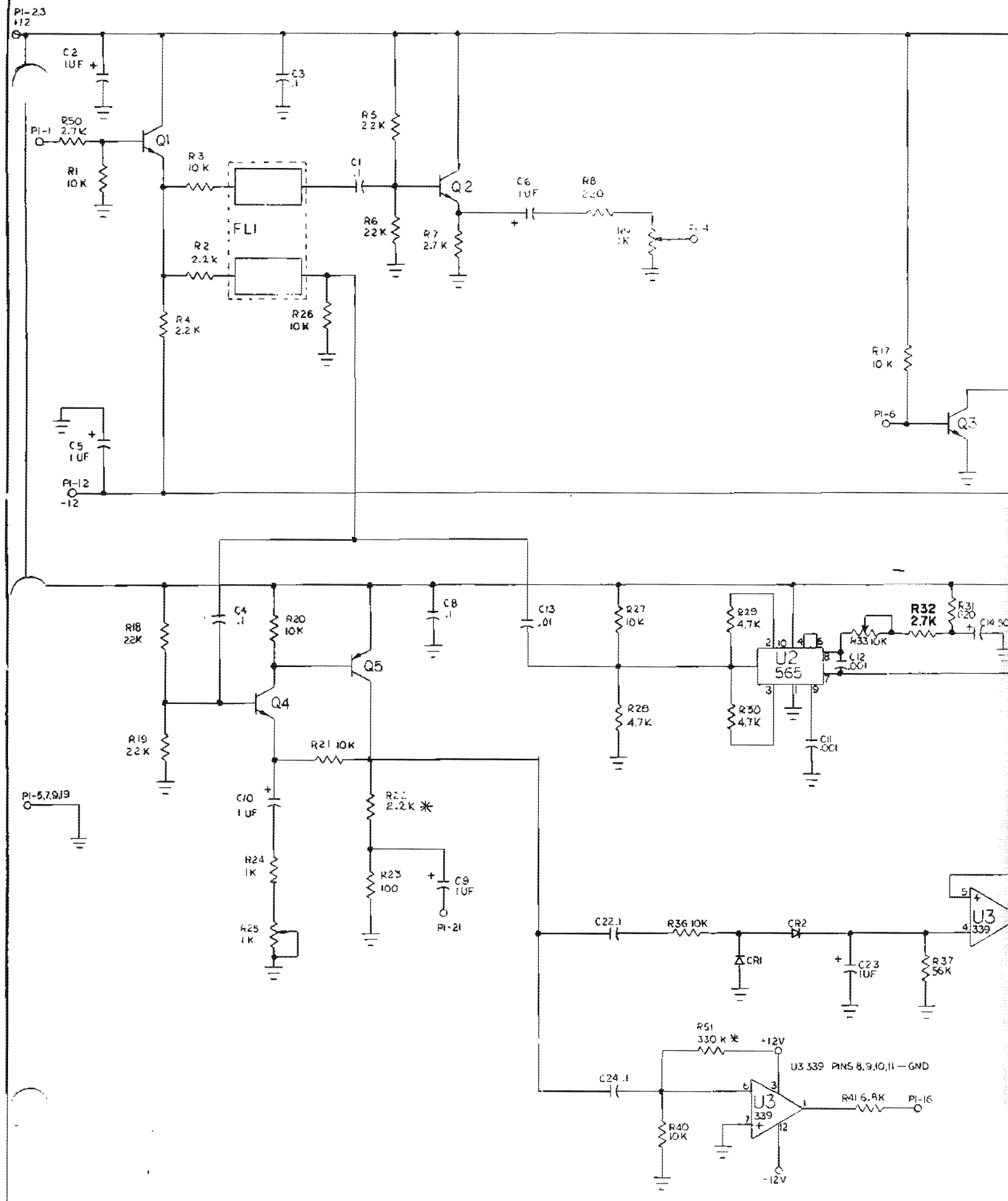


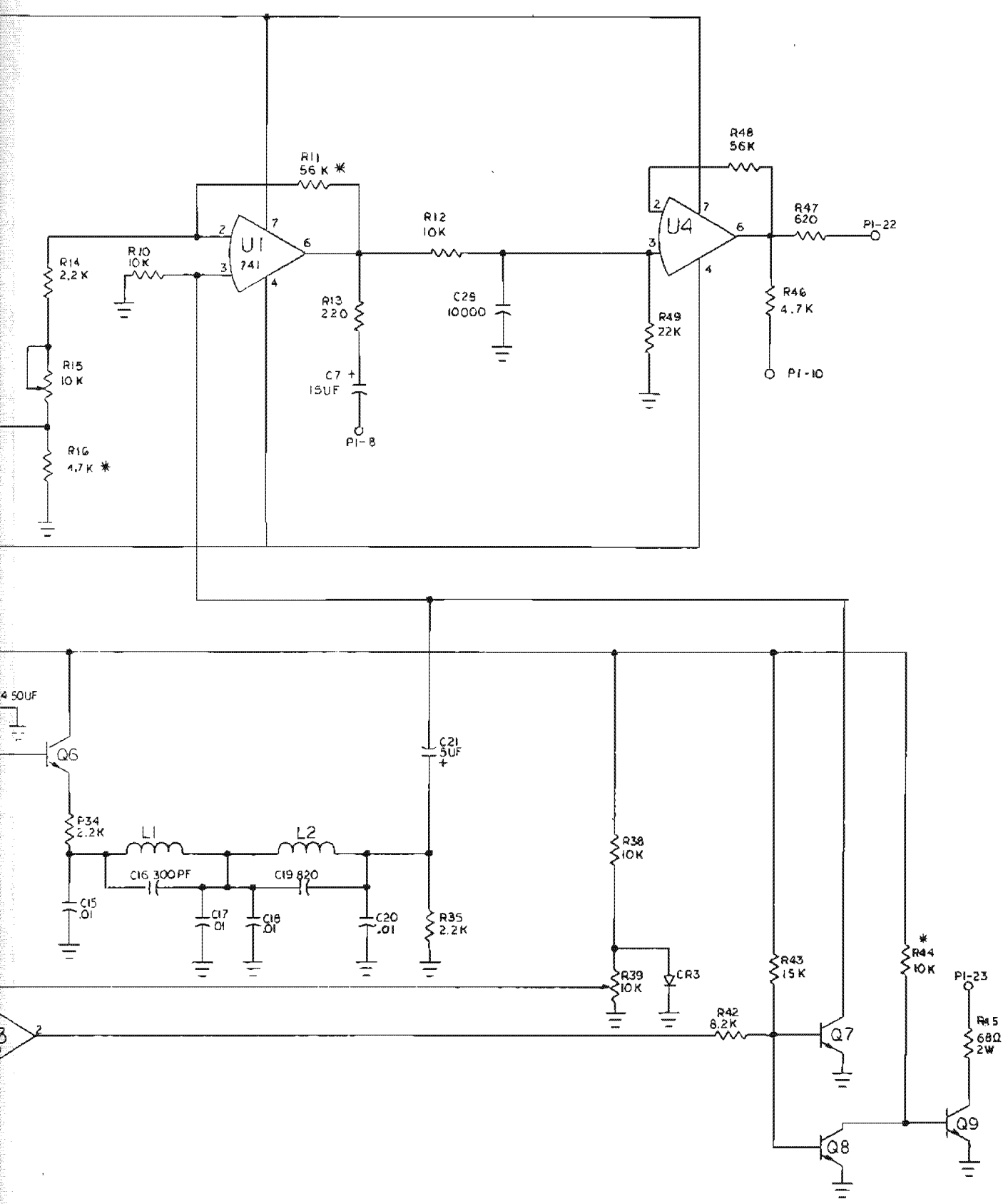
VIEW COMPONENT SIDE

REVISIONS			OEI CORPORATION	
NO	DATE	BY		
			SCA DEMODULATOR	
			A6 ASSEMBLY	
			DRAWN BY kbw	SCALE N/A
			CHK'D	DATE
			TRACED	APP'D

MATERIAL

DRAWING NO.


P1-23
+12
C2
1UF
C3
.1
R50
2.7K
P1-1
Q1
R1
10K
R3
10K
FLI
R2
2.2K
R4
2.2K
R26
10K
R5
2.2K
C1
.1
Q2
R6
22K
R7
2.7K
C6
1UF
R8
220
P1-4
C5
1 UF
P1-12
-12
R17
10 K
P1-6
Q3
R18
22K
C4
.1
R20
10K
C8
.1
C13
.01
R27
10K
R28
4.7K
R29
4.7K
R30
4.7K
U2
565
R33 10K
R32
2.7K
R31
C20
C14
C12
.001
C11
.001
Q5
Q4
R19
22K
R21 10K
P1-5,7,9,19
C10
1 UF
R24
1K
R25
1K
R22
2.2K *
R23
100
C9
1UF
P1-21
C22 .1
R36 10K
CR1
CR2
C23
1UF
R37
56K
U3
339
R51
330 K *
+12V
U3 339 PINS 8,9,10,11 — GND
C24 .1
R40
10K
R41 6.8K
P1-16
-12V



NOTE:

* VALUE SELECTED IN TEST

·.P1 CONNECTED TO AIJ14

REVISIONS			
NO.	DATE	BY	
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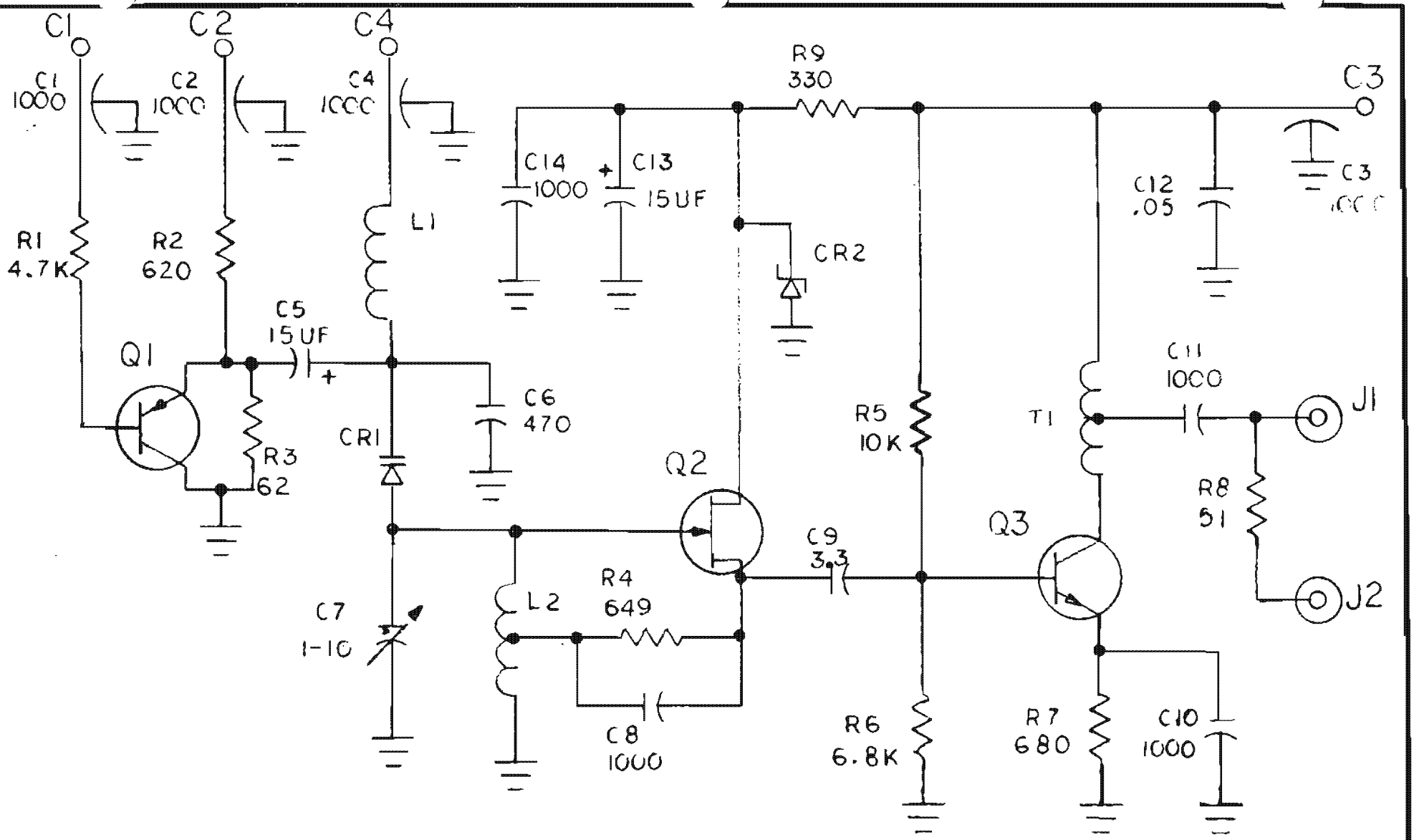
CORPORATION

A6 SCA DEMODULATOR

DRAWN BY JE	SCALE NA	MATERIAL
CHK'D	DATE 4/80	DRAWING NO 6914006
TRACED	APP'D	



REVISIONS		
NO	DATE	BY
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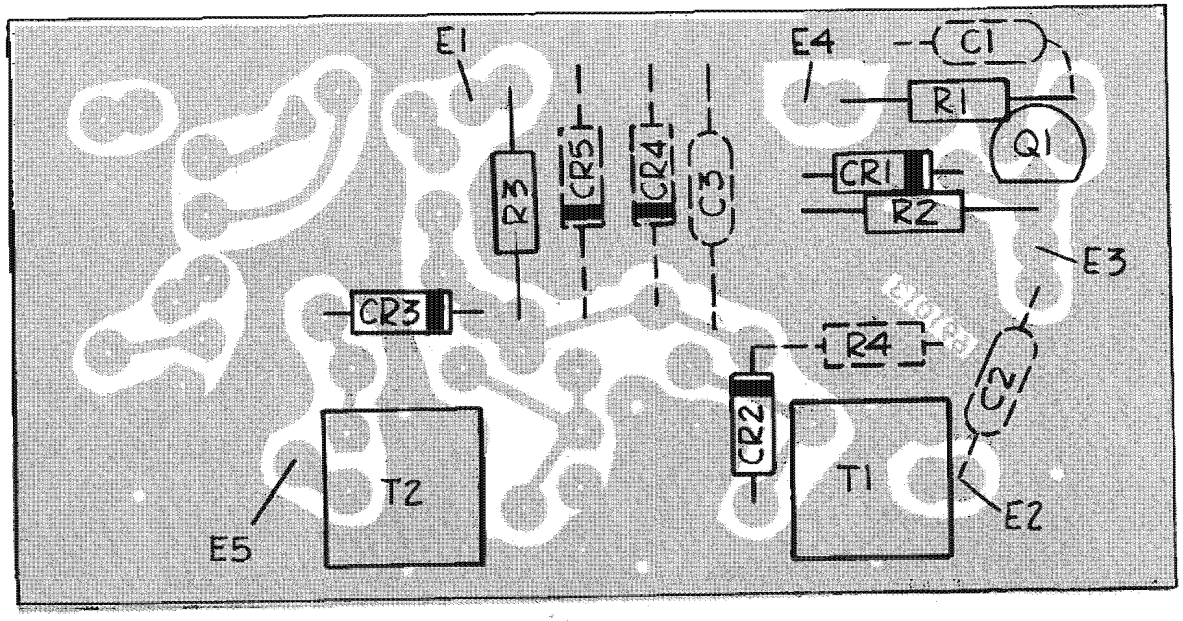
CORPORATION

LOCAL OSCILATOR A7ASSY

DRAWN BY JE	SCALE N/A	MATERIAL
CHK'D	DATE 3/80	DRAWING NO. 6911007
TRACED	APP'D	

TELEDYNE POST 18AE-01E—8½X11



VIEW COMPONENT SIDE

REVISIONS		
NO.	DATE	BY
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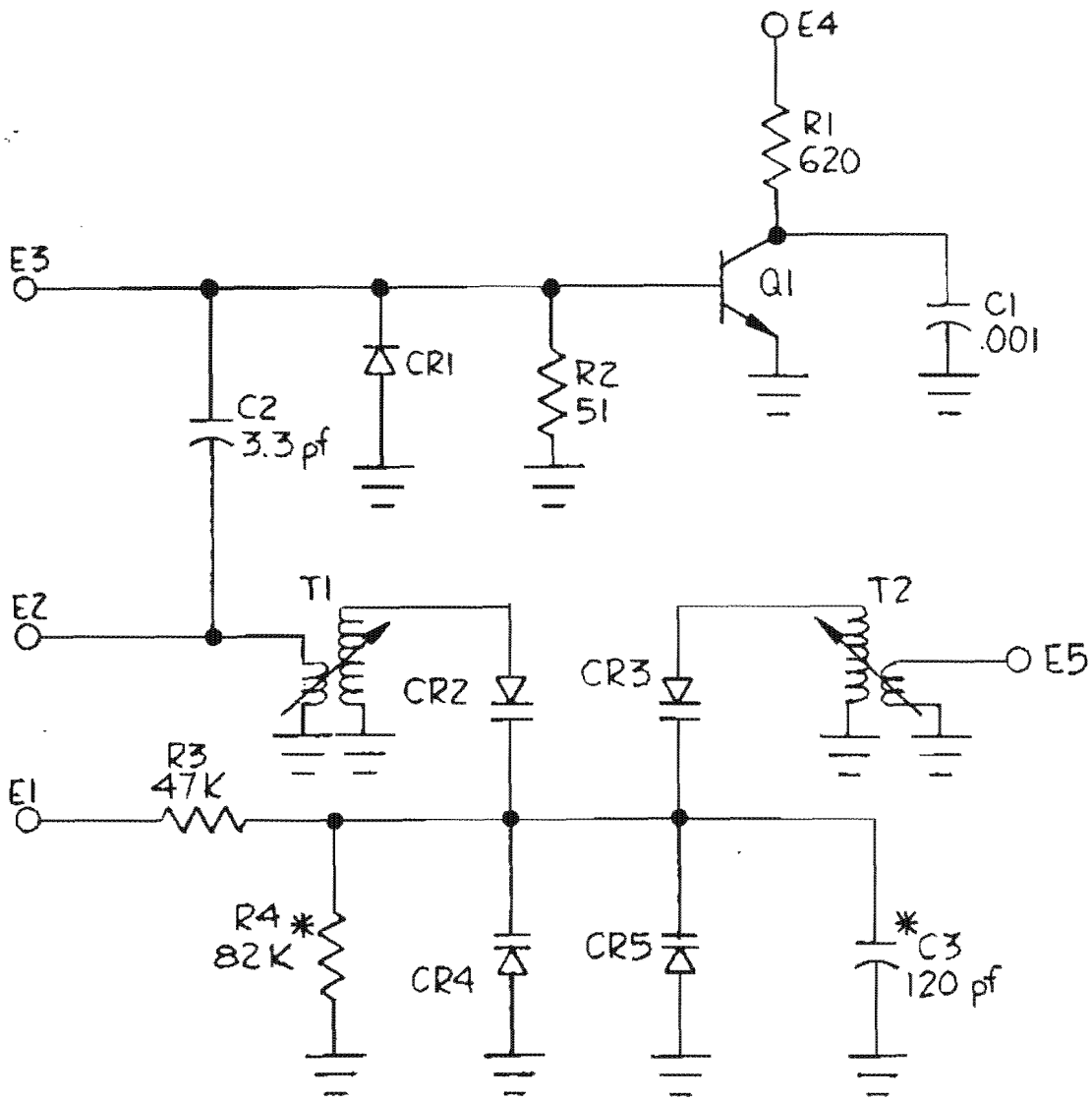
QEI CORPORATION

IMAGE BOARD
A8 ASSEMBLY

DRAWN BY John H.	SCALE N/A	MATERIAL
CHK'D	DATE	DRAWING NO.
TRACED	APP'D	



* SELECTED IN TEST, NOMINAL SHOWN

REVISIONS		
NO.	DATE	BY
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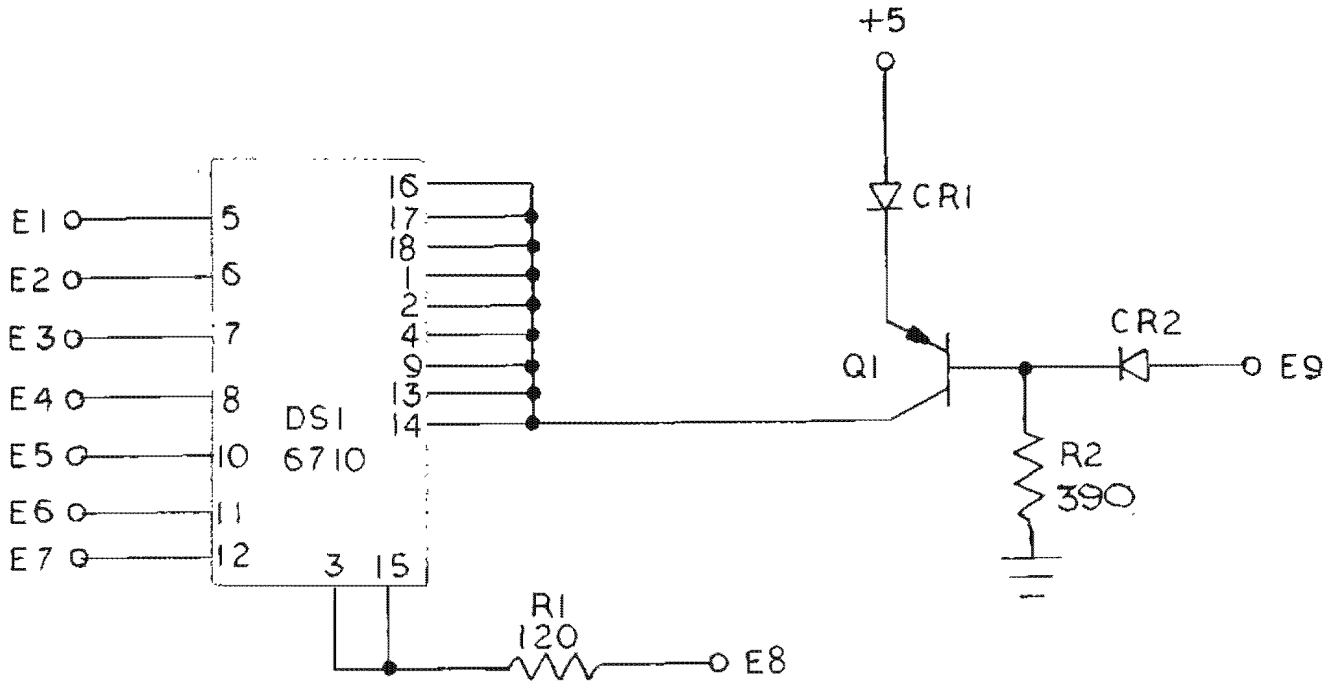
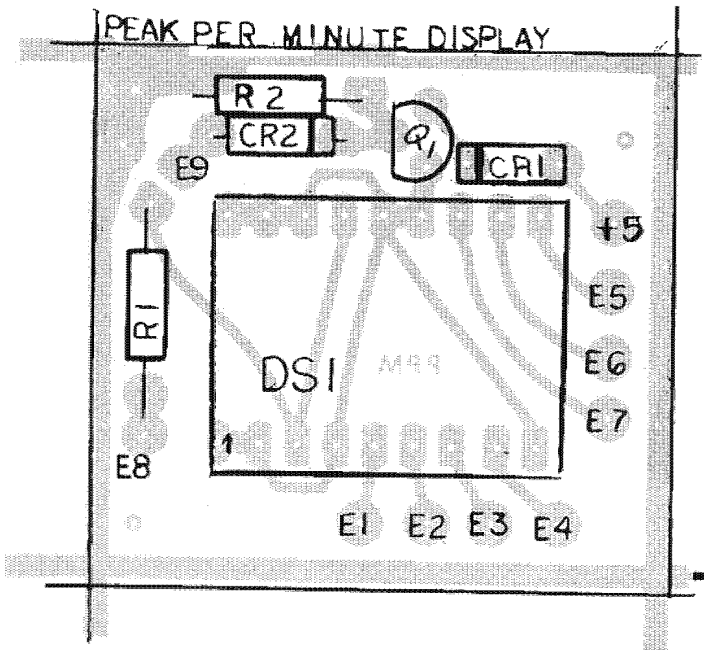
QEI CORPORATION

IMAGE BOARD
A8 ASSEMBLY

DRAWN BY	SCALE	MATERIAL
J.H.		
CHK'D J	DATE 3-22-80	DRAWING NO. 6911008
TRACED	APP'D	

TELEDYNE POST 18AE-01E-8½X11





REVISIONS		
NO.	DATE	BY
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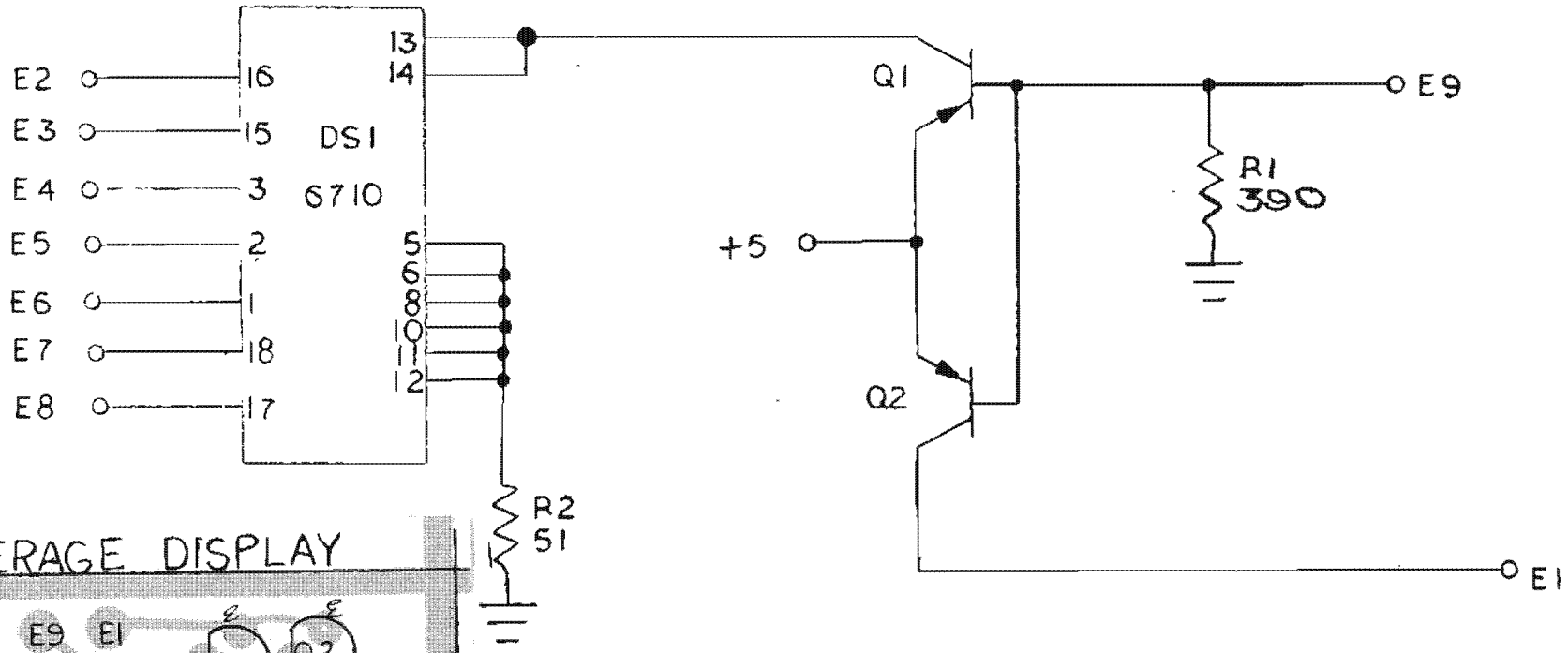
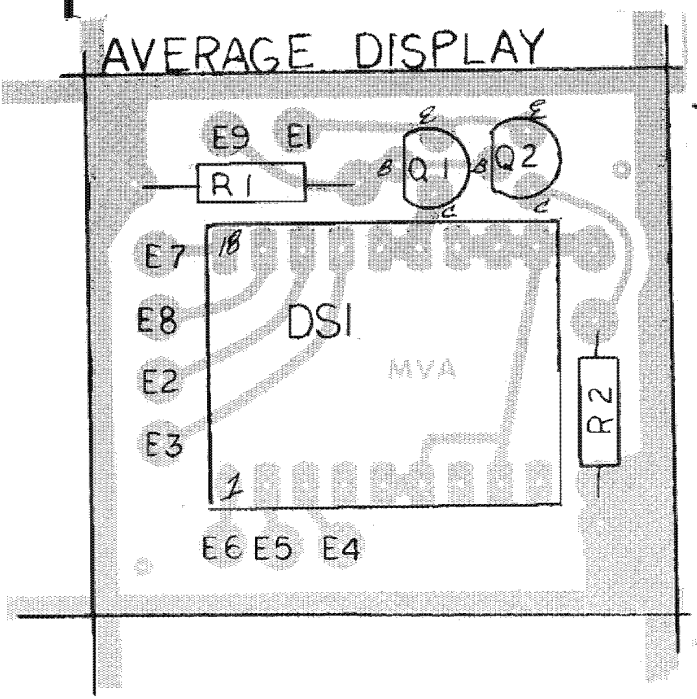
QEI CORPORATION

PPM DISPLAY A9

DRAWN BY	SCALE N/A	MATERIAL
CHK'D	DATE 3/14/80	DRAWING NO.
TRACED	APP'D	6911009





REVISIONS		
NO.	DATE	BY
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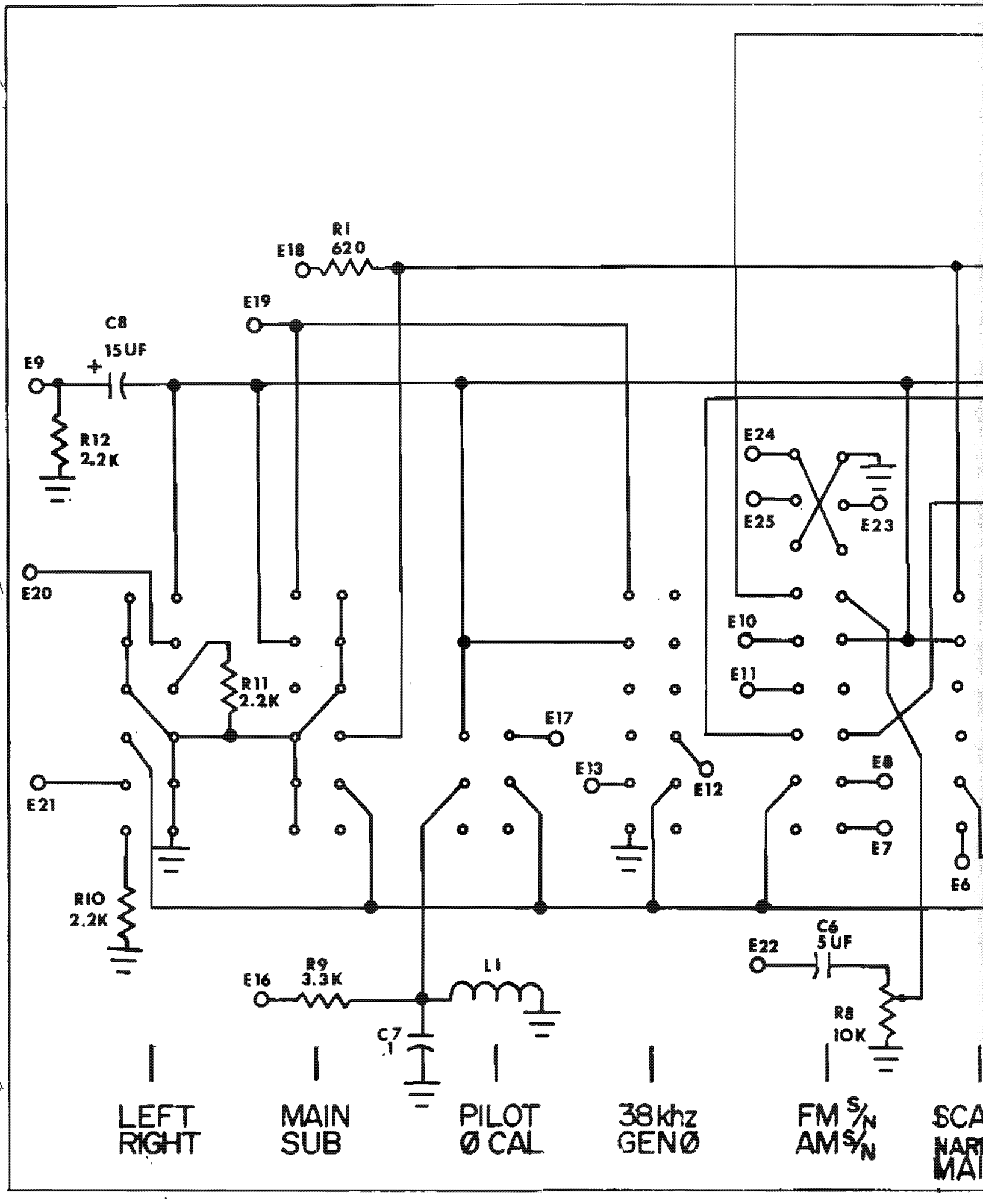
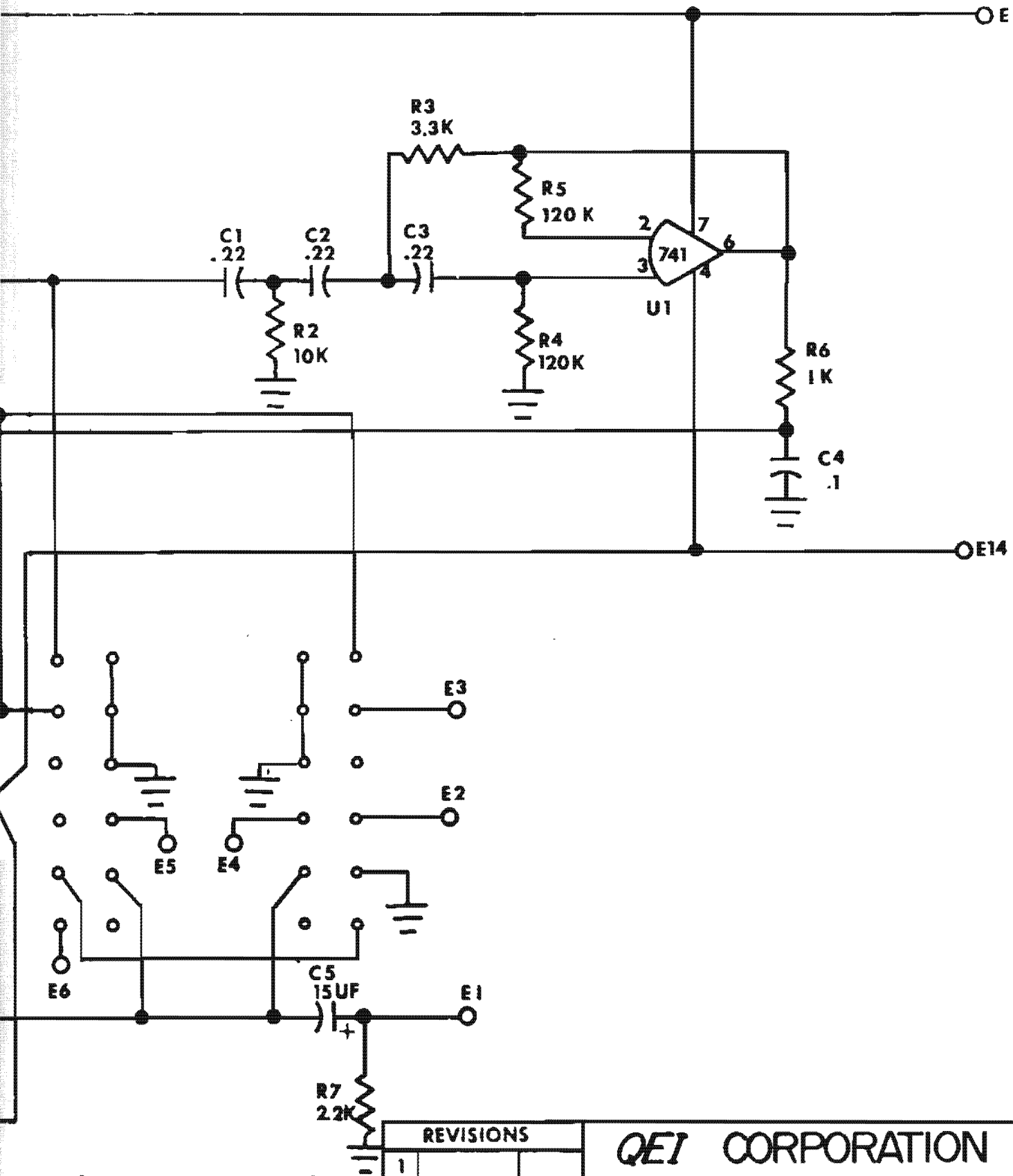
CORPORATION

AVM DISPLAY A10A &B

DRAWN BY	SCALE N/A	MATERIAL
CHK'D	DATE 3/14/80	DRAWING NO. 6911010
TRACED	APP'D	


R1
620
E18
E19
C8
15UF
E9
R12
2.2K
E24
E25
E23
E20
E10
E11
R11
2.2K
E17
E13
E12
E8
E21
E7
E6
R10
2.2K
C6
5UF
E22
E16
R9
3.3K
L1
R8
10K
C7
.1
LEFT
RIGHT
MAIN
SUB
PILOT
Ø CAL
38khz
GENØ
FM S/N
AM S/N
SCA



REVISIONS		
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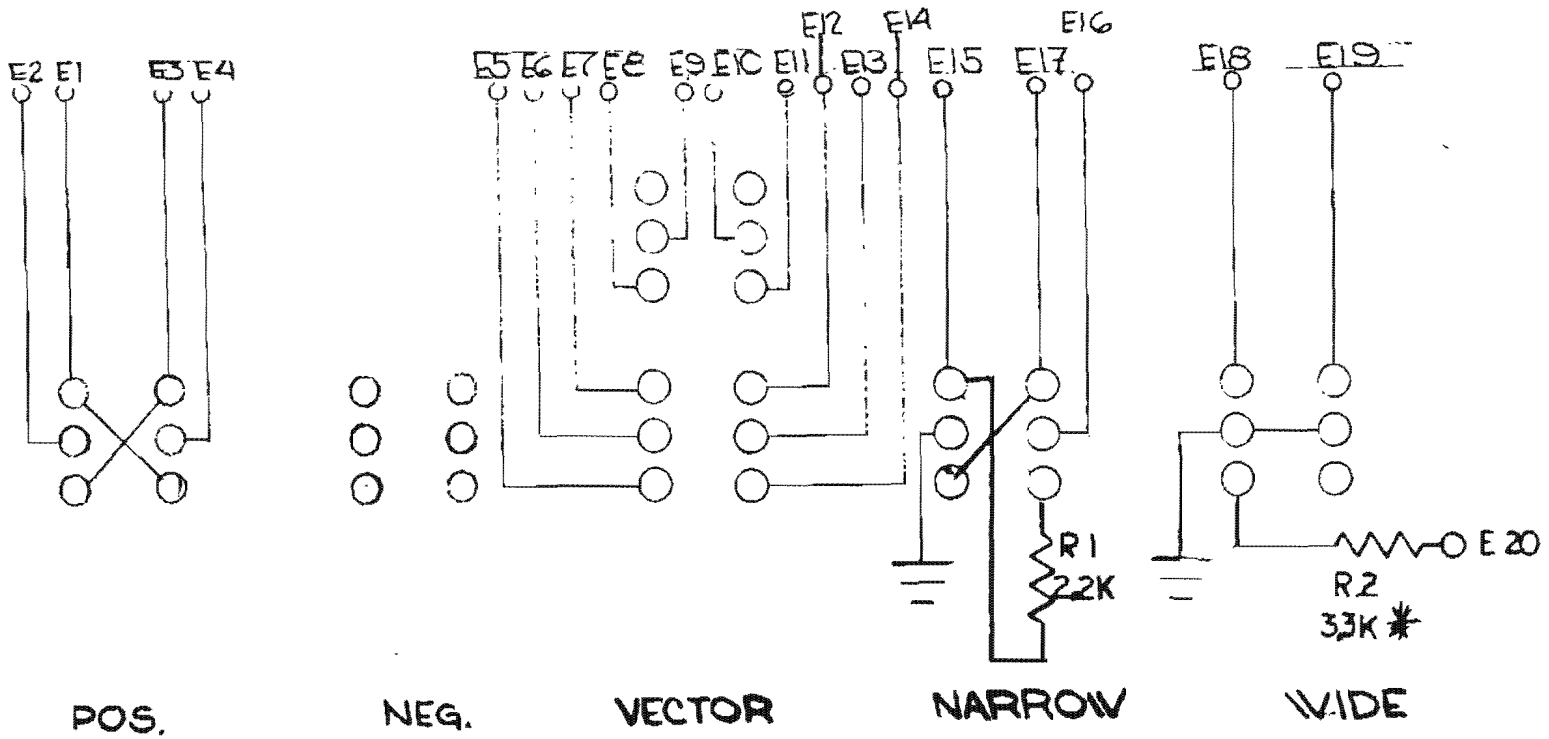
QEI CORPORATION

SWITCH A11 ASS'Y

DR BY	SCALE N/A	MAT
	DATE 3/80	NO. 6912011

SCA NARROW MAIN

SCA WIDE SCA INJ MOD



* SELECTED IN TEST

REVISIONS		
NO.	DATE	BY
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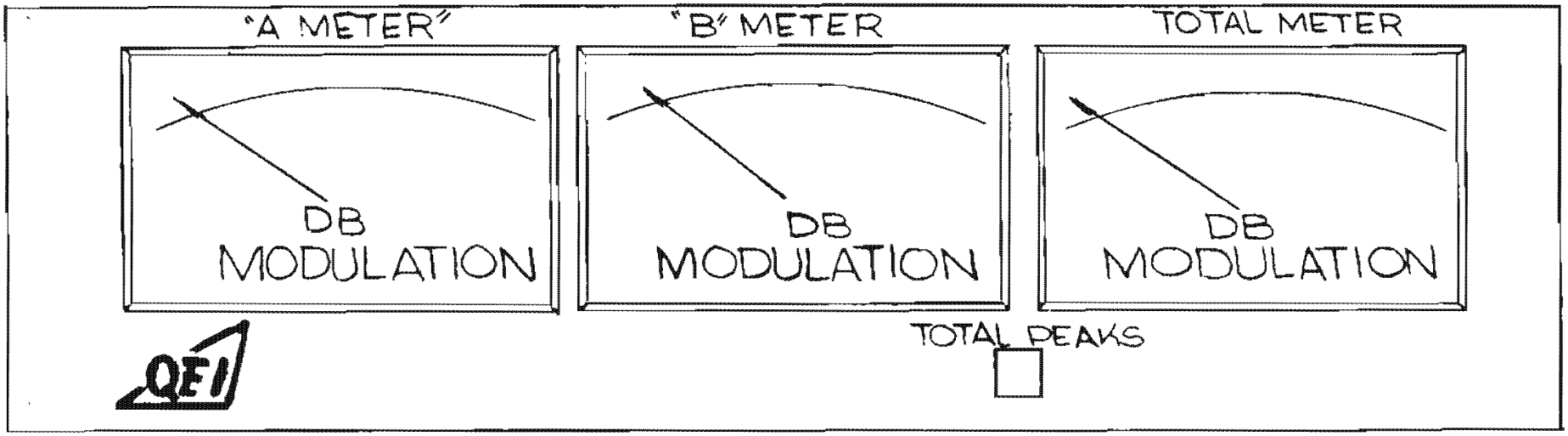
QEI CORPORATION

SWITCH A12 ASS'Y

DRAWN BY	SCALE	MATERIAL
CHK'D	DATE	DRAWING NO.
TRACED	APP'D	6911012

TELEDYNE POST 18AE-01E-8½X11

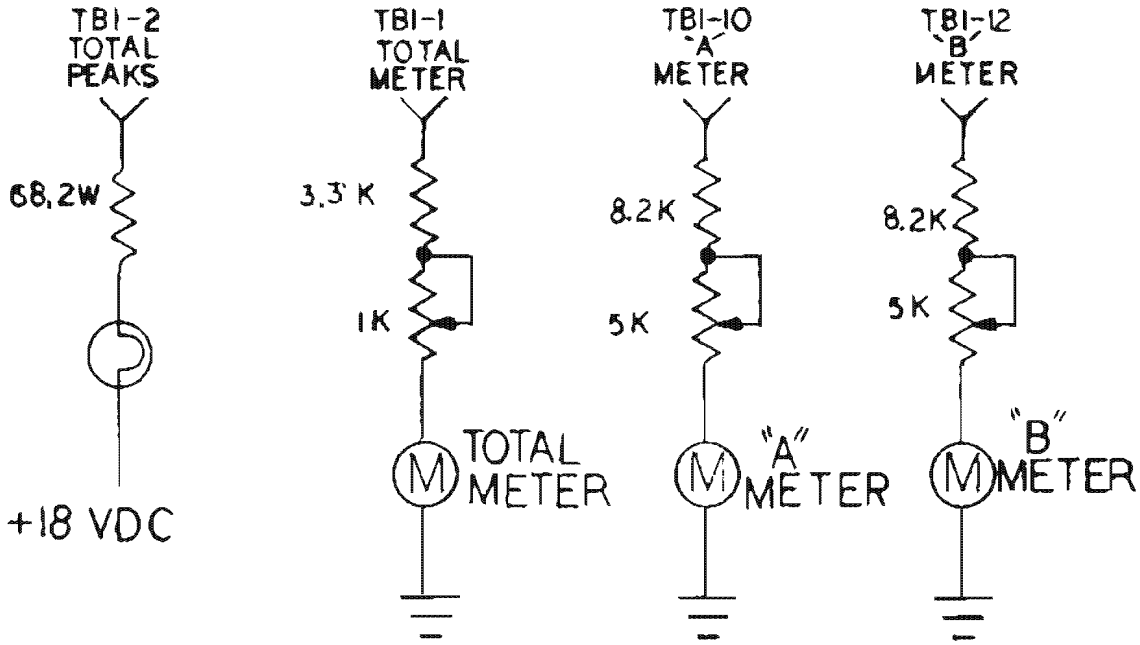


TOLERANCES (EXCEPT AS NOTED)	REVISIONS		
	NO.	DATE	BY
DECIMAL ±	1		
	2		
FRACTIONAL ±	3		
	4		
ANGULAR ±	5		

QEI CORPORATION

REMOTE PNL. (691)

DRAWN BY	SCALE	MATERIAL
SK	—	—
CHK'D	DATE 4-14-82	DRAWING NO.
TRACED	APP'D	



~NOTE~

REMOTE METERS AND LAMPS SHOULD BE WIRED TO MONITOR AS SHOWN.

TOLERANCES (EXCEPT AS NOTED)	REVISIONS		
DECIMAL ±	NO.	DATE	BY
FRACTIONAL ±	1		
ANGULAR ±	2		
	3		
	4		
	5		

QEI CORPORATION

REMOTE METER INTERFACE
691 MONITOR

DRAWN BY	SCALE	MATERIAL
S.K.	—	—
CHK'D	DATE 4-14-82	DRAWING NO.
TRACED	APP'D	

ADDENDUM

691 INSTRUCTION MANUAL
ADDITIONAL TESTING

HOW TO GET AN AMPLIFIED DISPLAY OF MULTIPATH USING THE QEI MODEL 691 FM MODULATION MONITOR/TEST SET

With the oscilloscope in the X-Y mode, connect the horizontal input to the composite output of the 691. Attach the scope vertical input to the 691 front panel Scope output. Set the Output Select switch to the Channel B position and select the AM Signal-to-Noise position of the Display Select switch bank in the lower right-hand corner of the 691. Momentarily move the Channel B Meter Select switch from the FCC position to the AUTO position until the auto-range display shows 20 dB. The instant 20 dB is shown, move the Meter Select switch to the HOLD position. The scope should now show an amplified view of any multipath that is present.

OPERATING INSTRUCTIONS

FOR THE /02 OPTION OF THE 691 MONITOR

The /02 option to the 691 Monitor changes the features of the standard 691 Monitor as follows:

1. The SCA NARROW, MAIN position of the DISPLAY SELECT switch is deleted and replaced with SCA #1 INJ, SCA #1 MOD.

2. The SCA WIDE, SCA MOD position of the DISPLAY SELECT switch is deleted and replaced with SCA #2 INJ, SCA #2 MOD.

OPERATION

1. SCA #1 will always be 67 kHz. With the DISPLAY SELECT switch in any position except SCA #2 INJ, SCA #2 MOD, the SCA PRESENT lamp and demodulated audio will be that of the 67 kHz. When the SCA #1 INJ, SCA #1 MOD position is selected, the SCA #1 injection is displayed on the CHANNEL A meter. The SCA #1 Modulation is displayed on the CHANNEL B meter.

2. When the SCA #2 INJ, SCA #2 MOD position is selected, the SCA #2 Injection (92 kHz) is displayed on the CHANNEL A meter and the SCA #2 modulation is displayed on the CHANNEL B meter. Also, the SCA PRESENT lamp and demodulated SCA will be that of the SCA #2 frequency (92 kHz).

691 OPTION 02

TABLE OF CONTENTS

USING THE PPM COUNTER WITH SCA

The Peaks Per Minute counter is set at the factory to detect modulation peak levels greater than 100%.

FCC rule changes permit, in certain instances, an increase in the percentage level of modulation when using an SCA.

The Peaks Per Minute voltage references can be reset to your station's legal modulation limit.

Refer to Section 5 "Alignment and Troubleshooting", review Section 5-2 items 1 - 11 before proceeding. With reference to items 5-2, 4 & 5. Changing the voltage setting of TP3 & 4 by approximately 30 M.V. + and - with respect to TP1 & 2 will change the PPM detection point by approximately 1%.

The following table lists the approximate voltage settings for TP3 and TP4, needed to change the PPM detection point.

Ex. TP1 = TP2 = 3.00 V.

* TP3 & 4	*PPM%
3.00V.	100%
3.03V.	101%
3.15V.	105%
3.30V.	110%

*(All values are nominal)

Recheck items 5-2, 2 through 11. Substitute the new values where applicable.

02 OPTION

PARTS LIST SUPPLEMENT

The following list of component changes apply to the 02 Option, (Dual 67 & 92 kHz SCA).

Circuit Board Assy.	Component #	Change From	Change To	QEI Part #
A2	R82	8.2K ohm	6.8K ohm	RC20GF682J
A2	R85	8.2K ohm	6.8K ohm	RC20GF682J
A2	C28	15 pf	5 pf	110-1050
A3	C113	15 uf	200 uf	110-3207
A4	NO CHANGES			
A5	NO CHANGES			
A6	R2	2.2K ohm	1.2K*	RC20GF122J
	R3	10K ohm	750 ohm	RC20GF751J
	R4	2.2K ohm	1.0K ohm	RC20GF102J
	R8	220 ohm	DELETE	
	R9	1.0K St.Pot	10.0K St.Pot	167-3103
	R26	10K ohm	DELETE	
	R52	(Added New #)	1.5K	RC20GF152J
	C1	.1 uf	DELETE	
	C7	15 uf	200 uf	110-3207
	C21	5 uf	200 uf	110-3207
	C26	(Added New #)	27 pf	110-1270
A7, 8, 9, 10	NO CHANGES			
A11	C8	50 uf	200 uf	110-3207

5-5 DUAL SCA DEMODULATOR ALIGNMENT (A6 Assembly)

1. Complete alignment of A2 assembly (Section 5-2) and A3 assembly (Section 5-3).

2. Apply an input signal of 92 kHz. into the COMP IN (A1J13). Adjust input level until MOD PEAK lamp just lights at 100%.

3. Reduce input level by exactly 20 dB.

4. Depress SCA 2, SCA 2 MOD button on DISPLAY SELECT switch (A1S11).

5. Adjust A6R25 until CH.A meter (A1M2A) reads 100%. This is equal to 10% SCA injection.

6. Repeat steps 2 & 3 with an input signal of 67 kHz.

7. Depress SCA 1, SCA 1 MOD button on DISPLAY SELECT switch (A1S11).

8. Adjust A6R9 until CH. A meter (A1M2A) reads 100%. This is equal to 10% SCA injection.

9. Reduce SCA injection to 3%. Adjust A6R39 until SCA PRESENT lamp (A1DS4) just lights.

10. Remove the input signal from A1J13. Connect a frequency counter probe to A6U2-9. Adjust A6R33 until the free running frequency on A6U2-9 is 80 kHz.

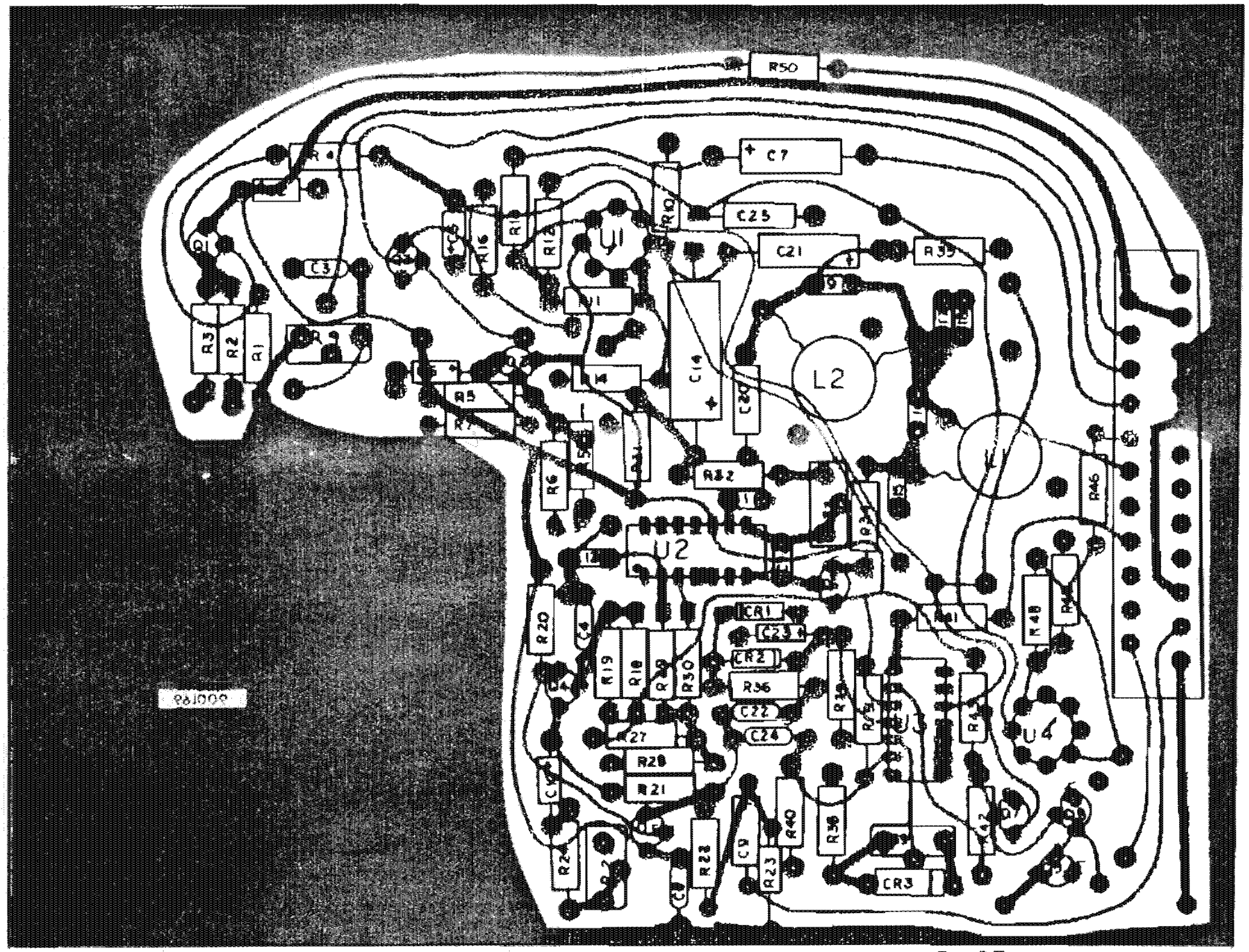
11. Connect your 92 kHz generator to the COMP IN (A1J13) and also a low frequency spectrum analyzer. Adjust COMP LEVEL (A1R4) for 10% injection.

12. Depress SCA 2, SCA 2 MOD button on DISPLAY SELECT switch (A1S11). Place DEV switch (A1S9) in 4 kHz position.

13. Modulate the SCA generator with a frequency of 1660 Hz. Increase the audio input until the 92 kHz carrier displayed on the spectrum analyzer nulls for the first time. NOTE: this is a Bessel null function for 4 kHz deviation.

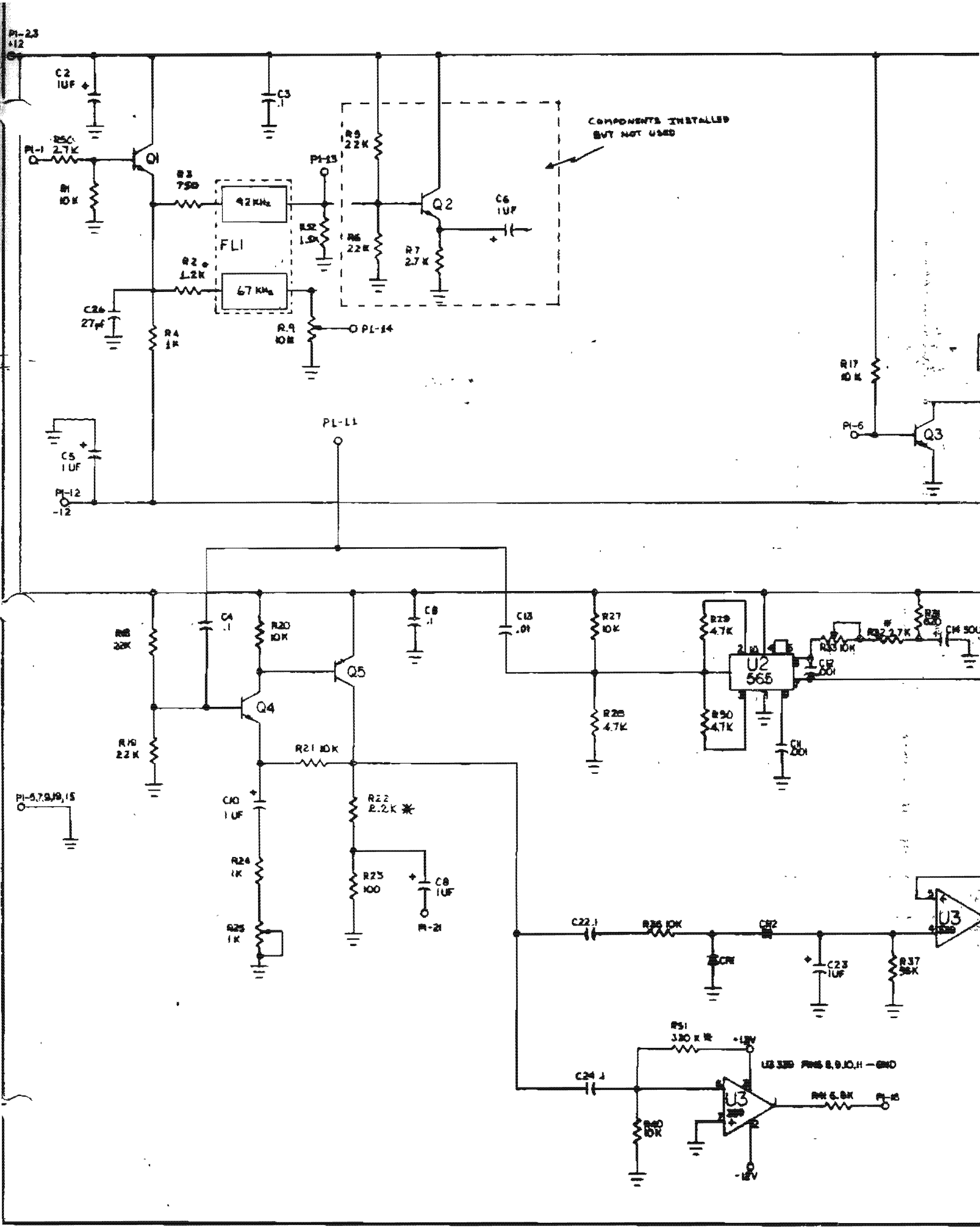
14. Adjust A6R15 until CH. B meter (A1M2B) reads 100%.

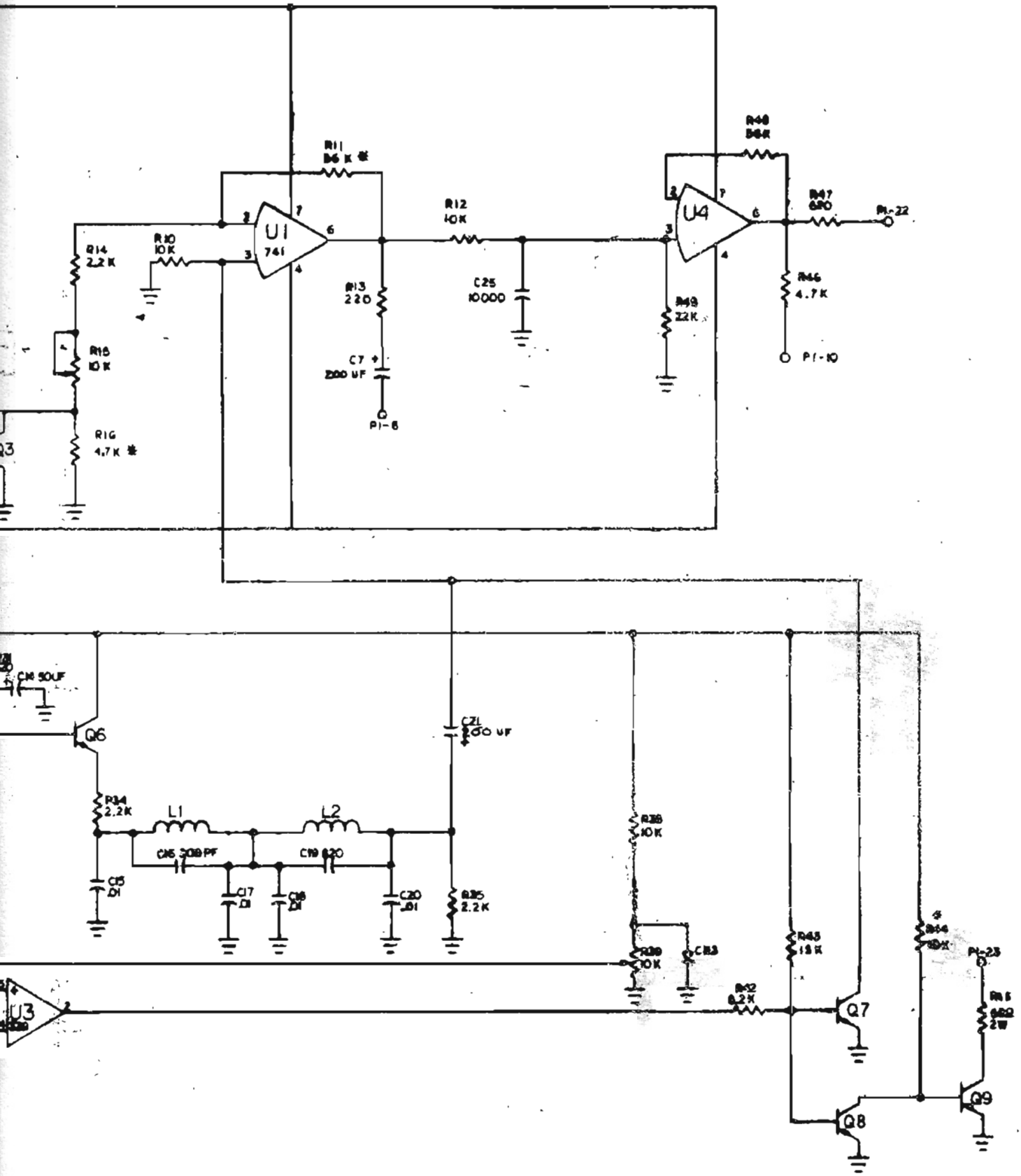
15. Repeat steps 11, 12, 13, and 14 except use a 67 kHz SCA generator, and select the SCA 1, SCA MOD position.



VIEW COMPONENT SIDE

REVISIONS			CEI CORPORATION
NO	DATE	BY	/02 OPTION
1			A6 ASSY
2			DRAWN BY / SCALE / MATERIAL
3			CHK'D / DATE / DRAWING NO
4			TRACED / APP'D


P1-23
+12
C2
1UF
C3
.1
COMPONENTS INSTALLED
BUT NOT USED
R5
22K
P1-1
2.7K
Q1
R3
750
P1-13
Q2
C6
1UF
R1
10K
42 KHz
FL1
R52
1.5K
R6
22K
R7
2.7K
R2
1.2K
67 KHz
C26
27pf
R4
1K
R9
10K
P1-14
R17
10K
P1-11
P1-6
Q3
C5
1UF
P1-12
-12
C4
.1
R20
10K
C8
.1
C13
.01
R27
10K
R29
4.7K
U2
565
R33 10K
R32 2.7K
C12
.001
R18
22K
Q5
Q4
R19
22K
R21 10K
R28
4.7K
R30
4.7K
C11
.001
P1-5,7,9,10,15
C10
1UF
R22
2.2K
R24
1K
R23
100
C8
1UF
P1-21
R25
1K
C22 .1
R36 10K
CR2
CR1
C23
1UF
R37
36K
U3
R51
330 K
+12V
C24 .1
R40
10K
U3
-12V

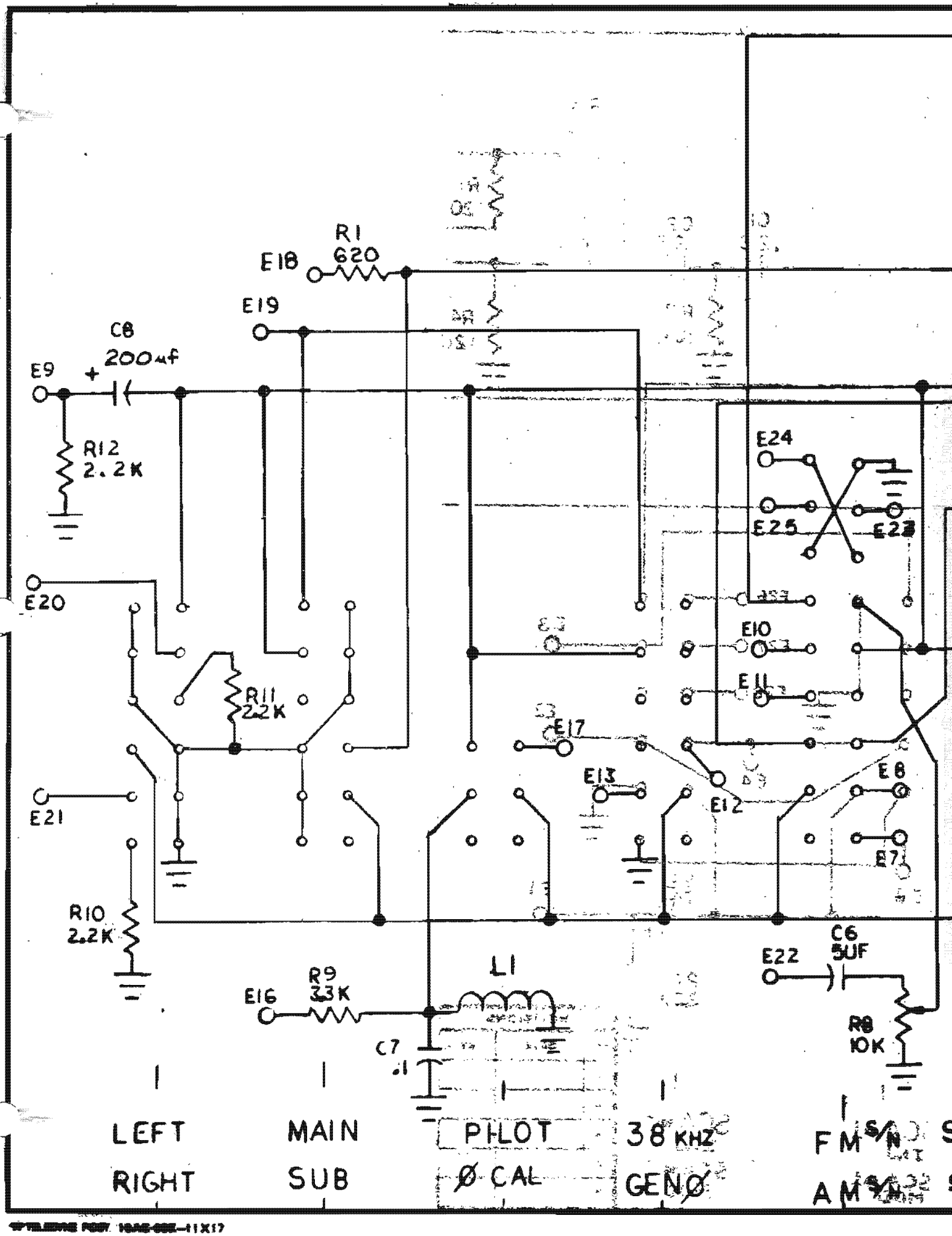


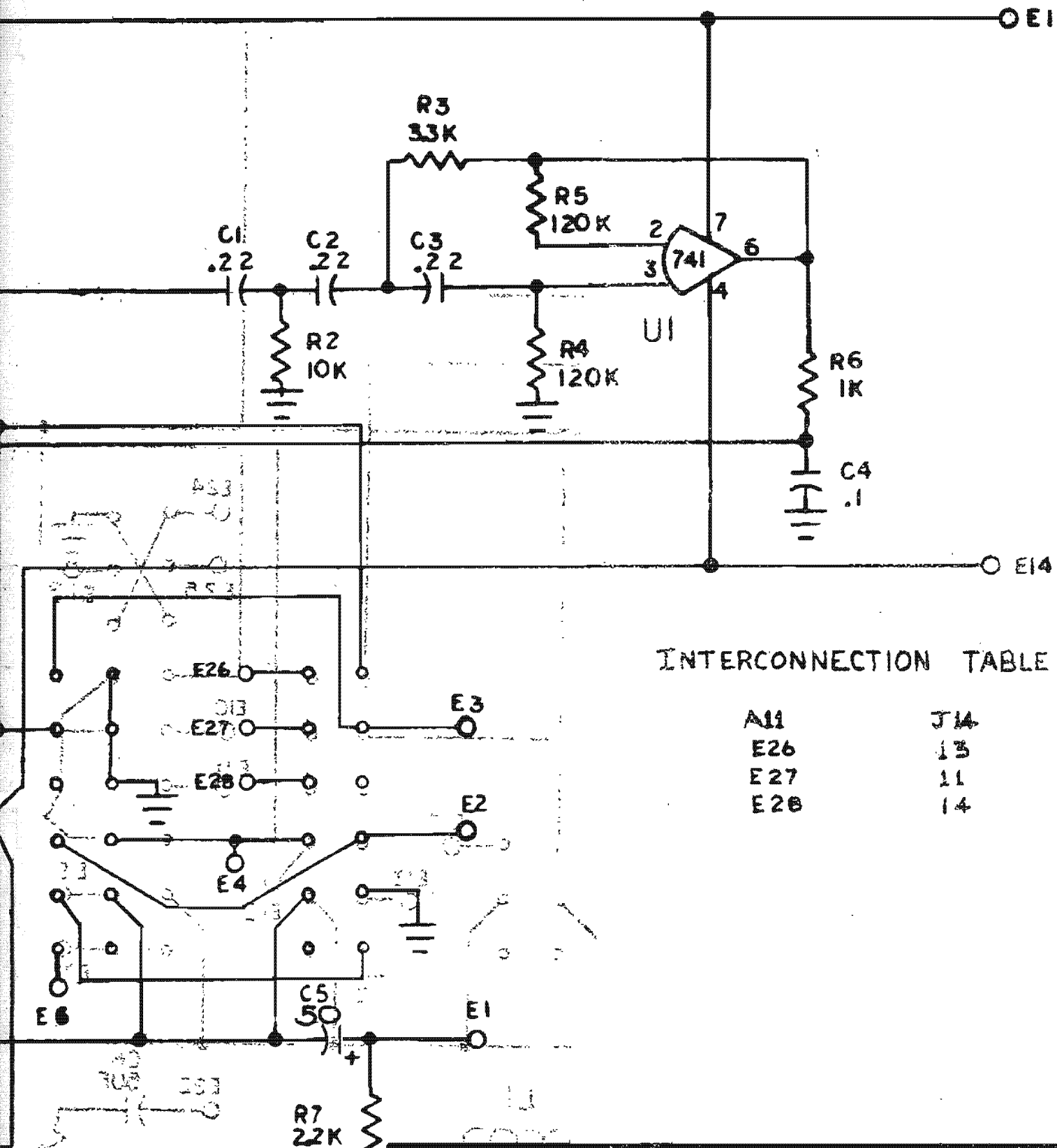
NOTE:

* VALUE SELECTED IN TEST

P1 CONNECTED TO A1J14

			A6 SCA DEMOD. ASS'Y /02 OPTION
			8914006


R1
620
E18
E19
C8
200uf
E9
R12
2.2K
E24
E25
E23
E20
E10
E11
R11
2.2K
E17
E13
E12
E8
E21
E7
R10
2.2K
C6
5UF
E22
L1
R9
33K
E16
R8
10K
C7
.1
LEFT
RIGHT
MAIN
SUB
PILOT
Ø CAL
38 KHZ
GENØ
FM S/N
AM



INTERCONNECTION TABLE

A11	J14
E26	13
E27	11
E28	14

SCA #1 INJ

SCA #1 MOD

SCA #2 INJ

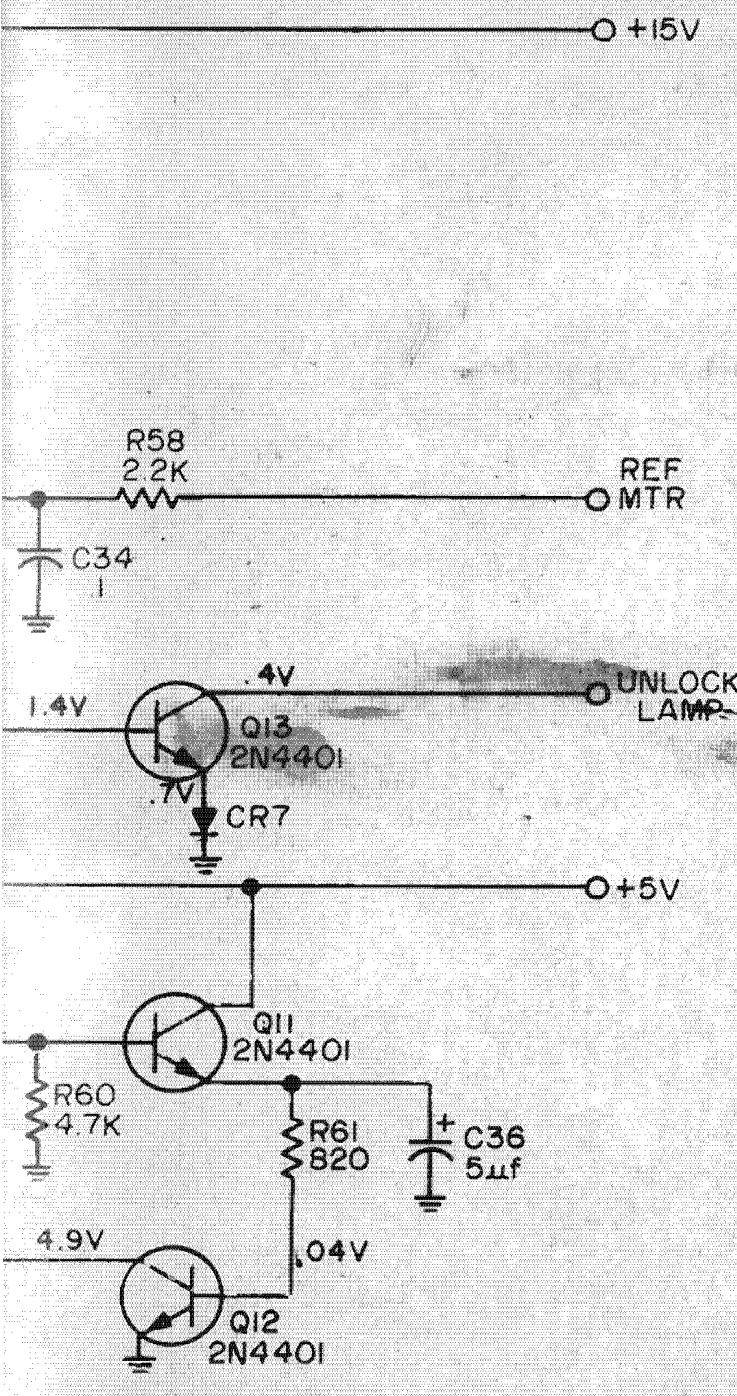
SCA #2 MOD

REVISIONS		
NO.	DATE	BY
1		
2		
3		
4		
5		

MI CORPORATION

A11 SWITCH ASS'Y /02 OPTION

DRAWN BY	SCALE	MATERIAL
JF	~A	
CHK'D	DATE 3/80	DRAWING NO.
TRACED	APP'D	6912011



VTVM

TO WAVEFORMS

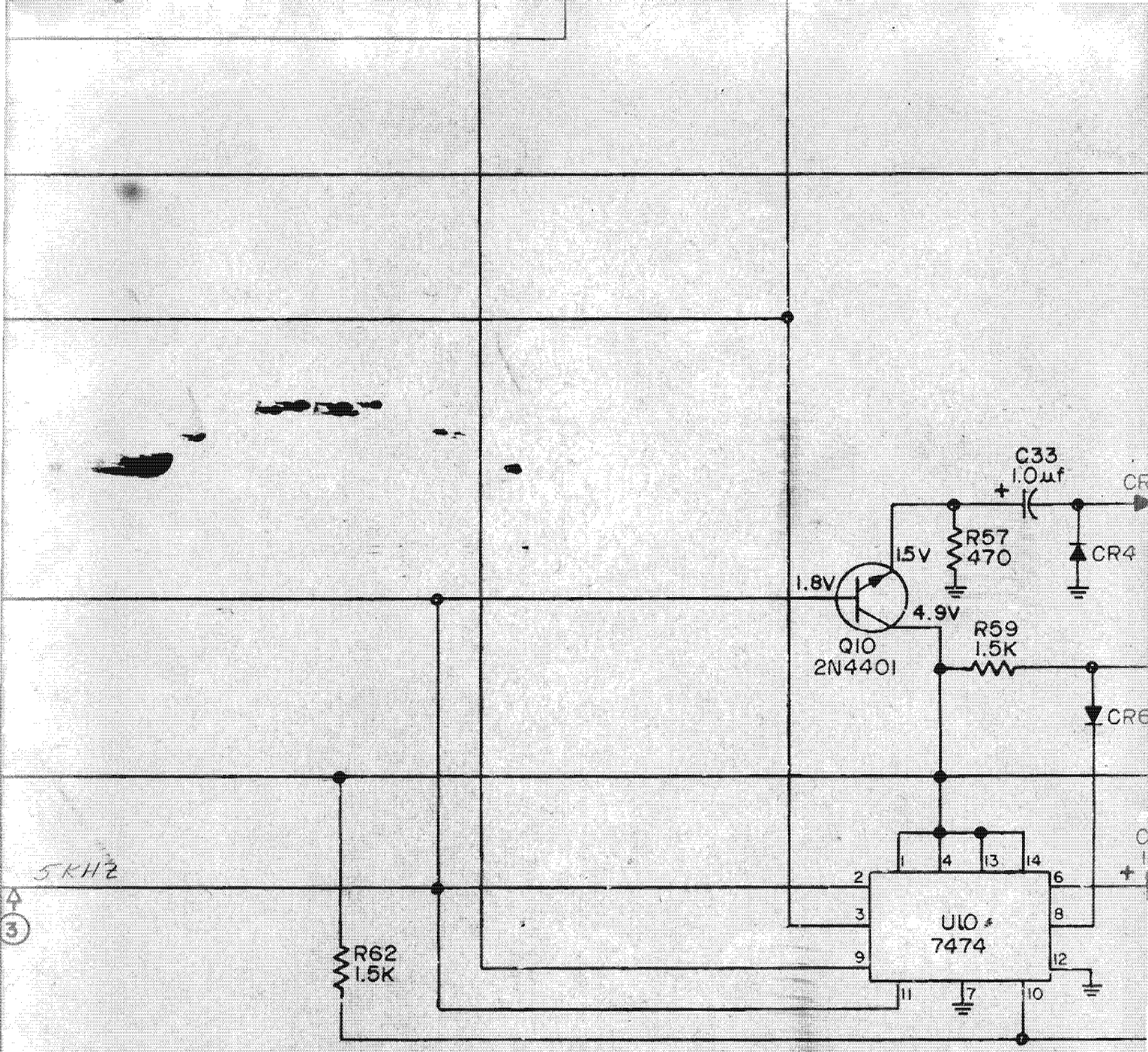
REVISIONS		
No.	Date	By
1	9/13/78	E.E.
2	1/23/80	J.E
3	-	
4		
5		

QEI CORPORATION

SCHEMATIC DIAGRAM
FMO & PHASE LOCK ASS'Y

Used on:

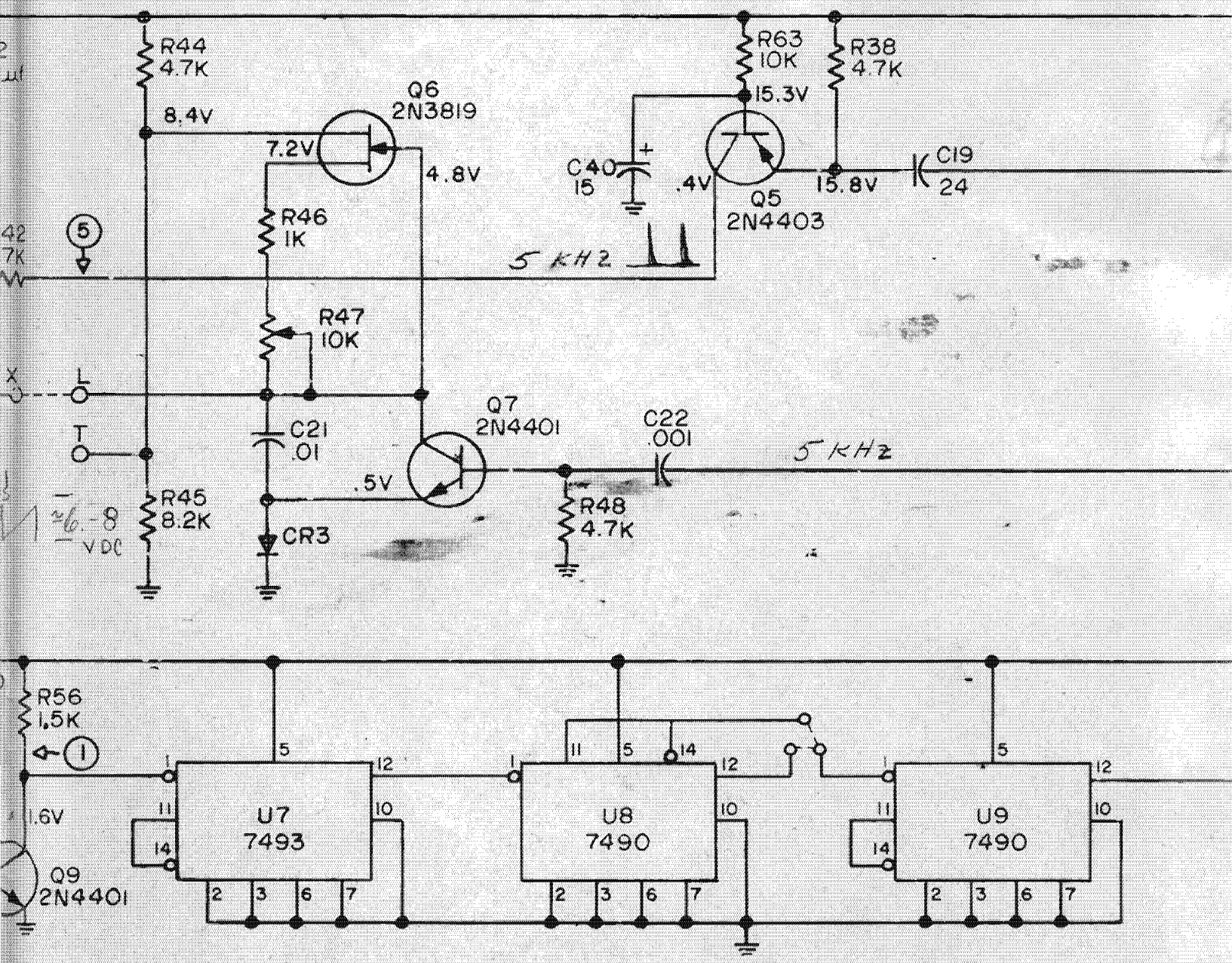
Drawn By	Date	Drawing No.
NAL	-13-76	6753003
Approved	Date	



1. ALL VOLTAGES MEASURED WI

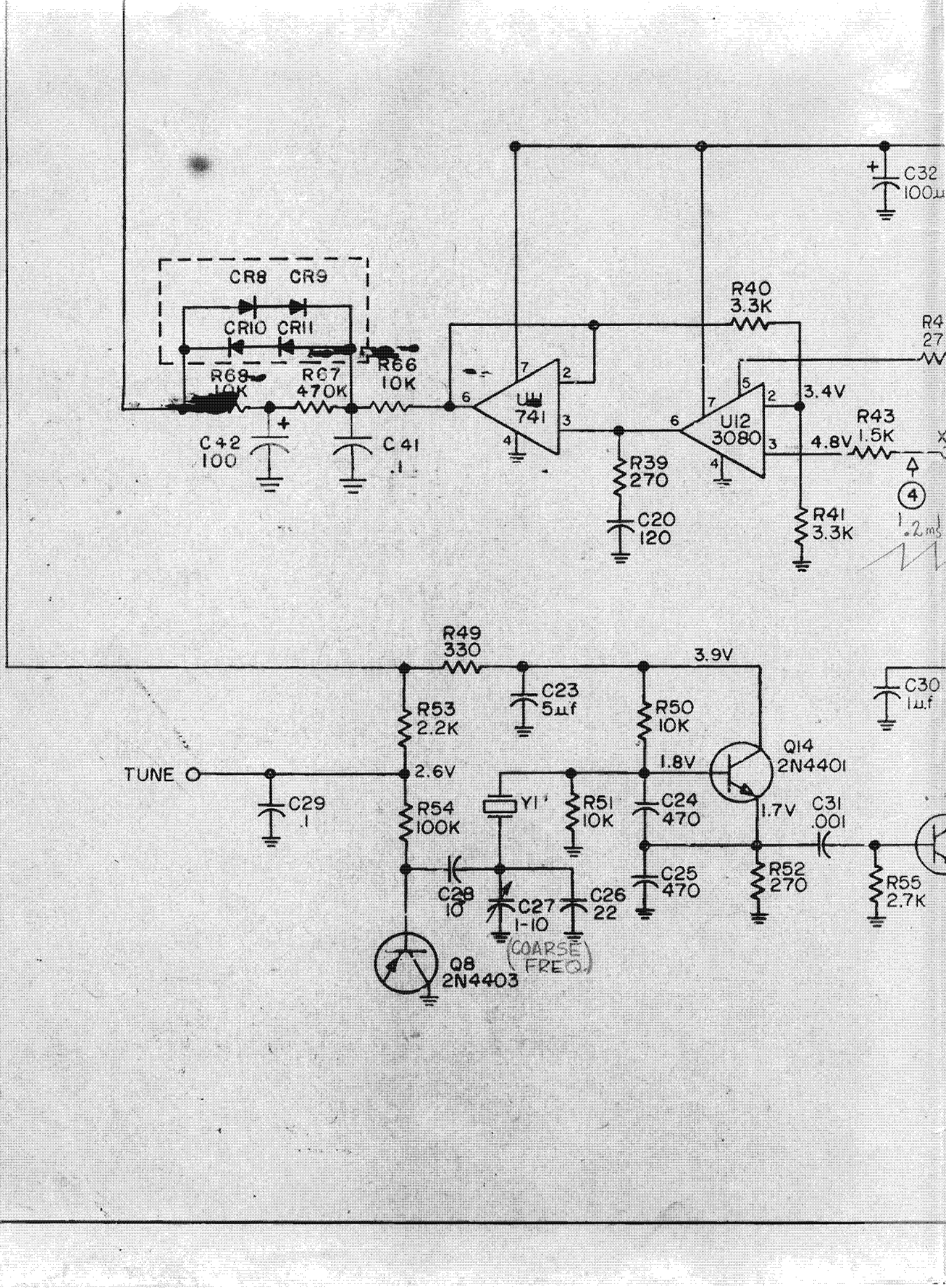
INPUT = 10 MEGOH

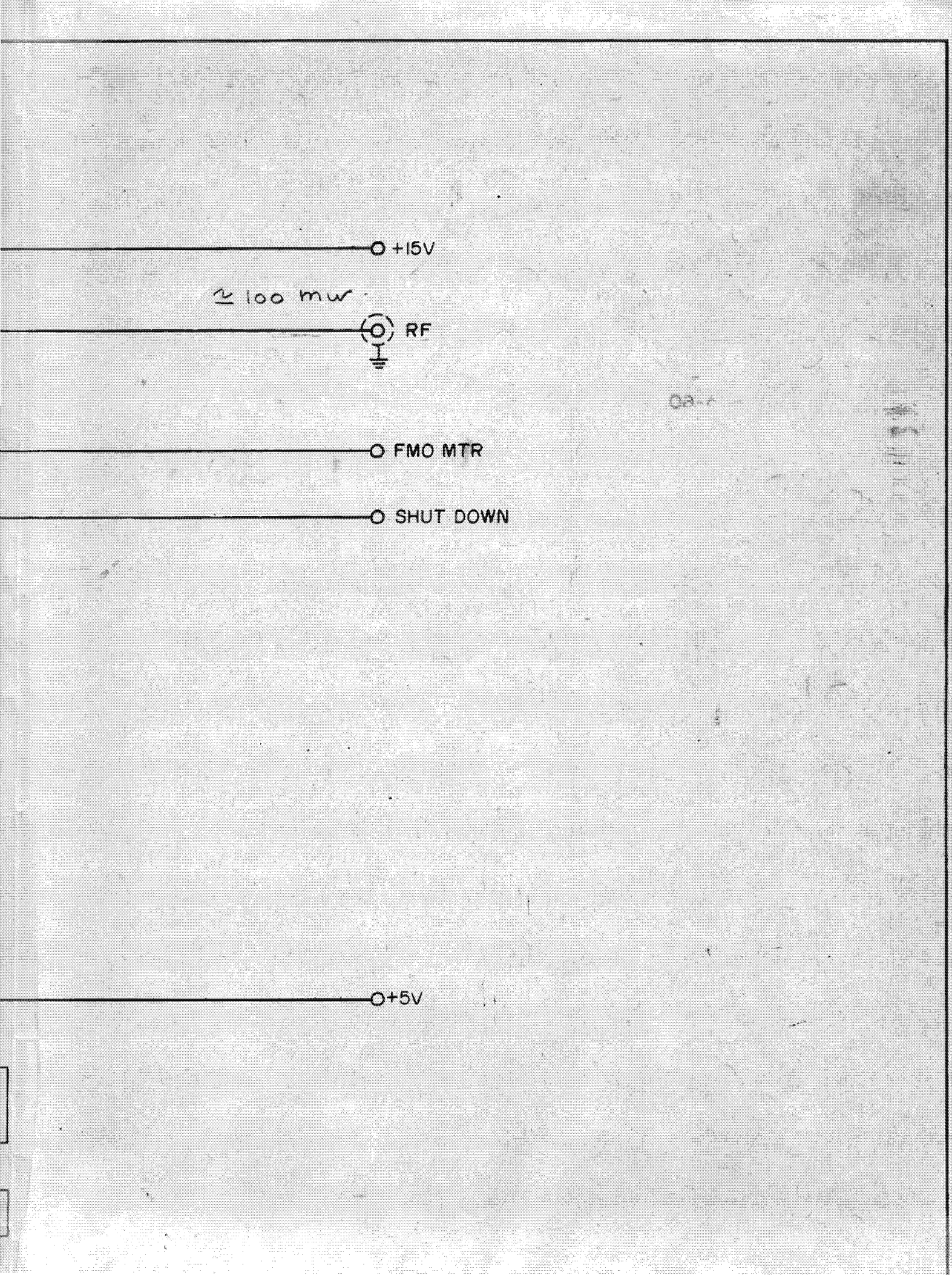
2. CIRCLED NUMBERS CORRESPON

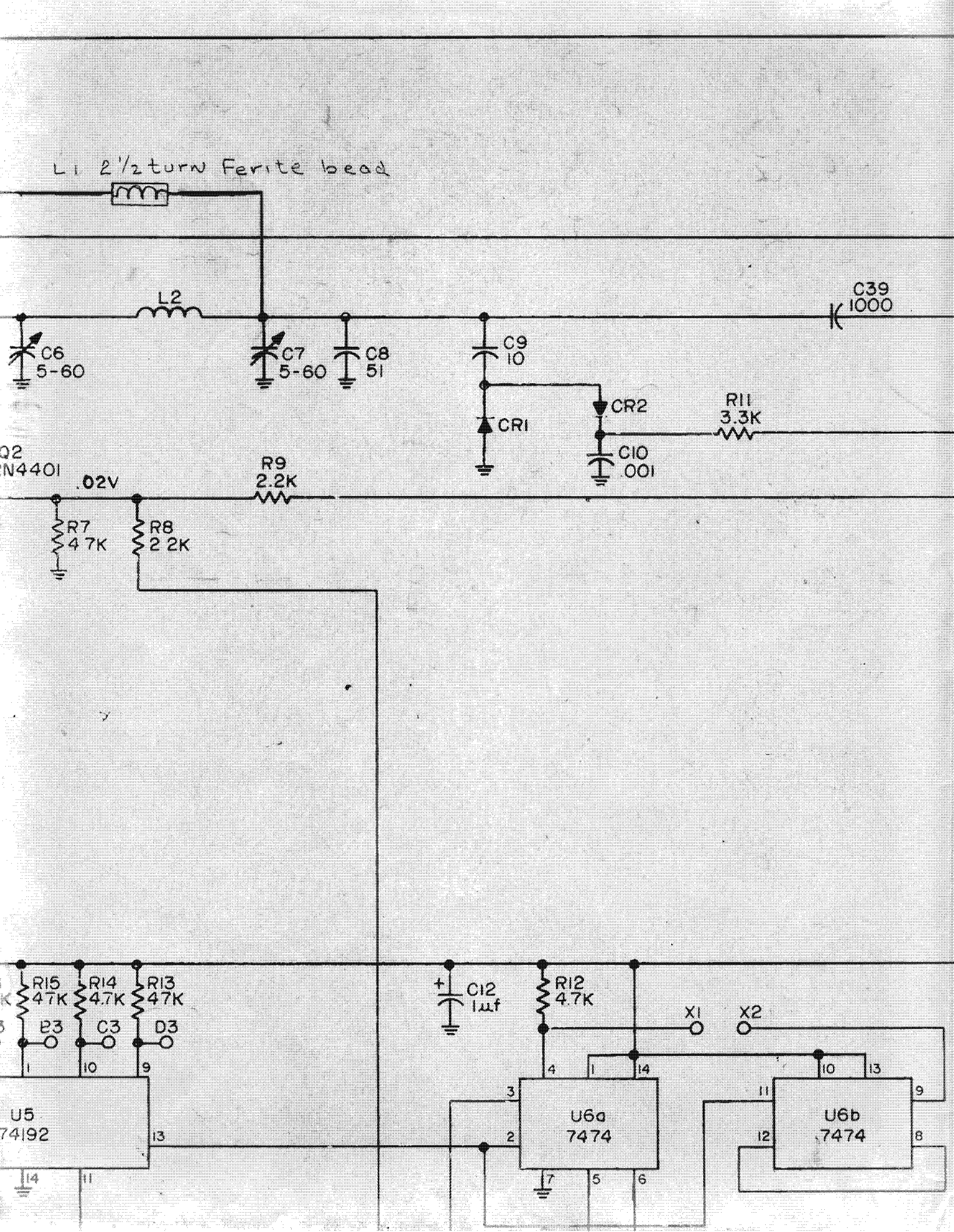


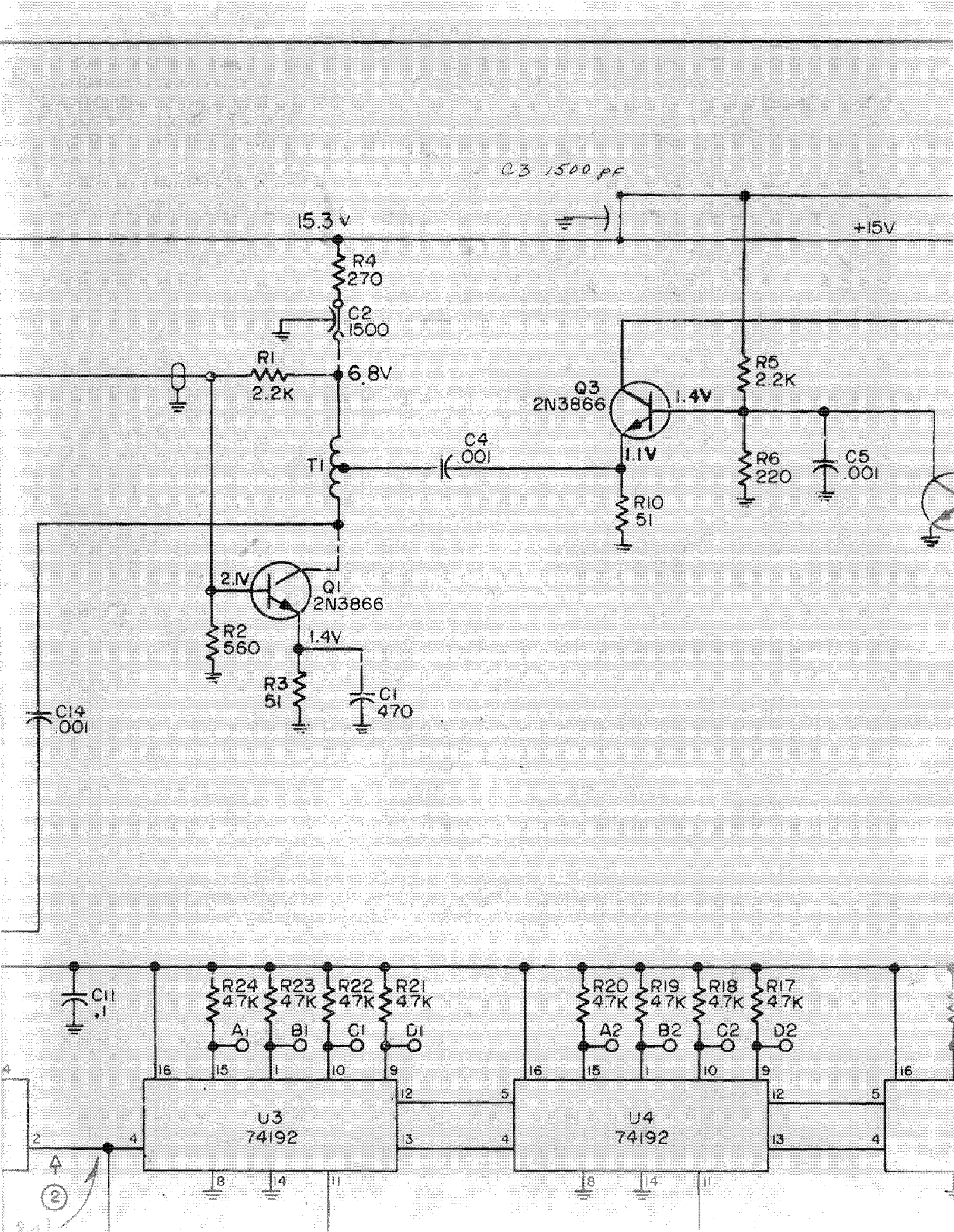
LAST USED

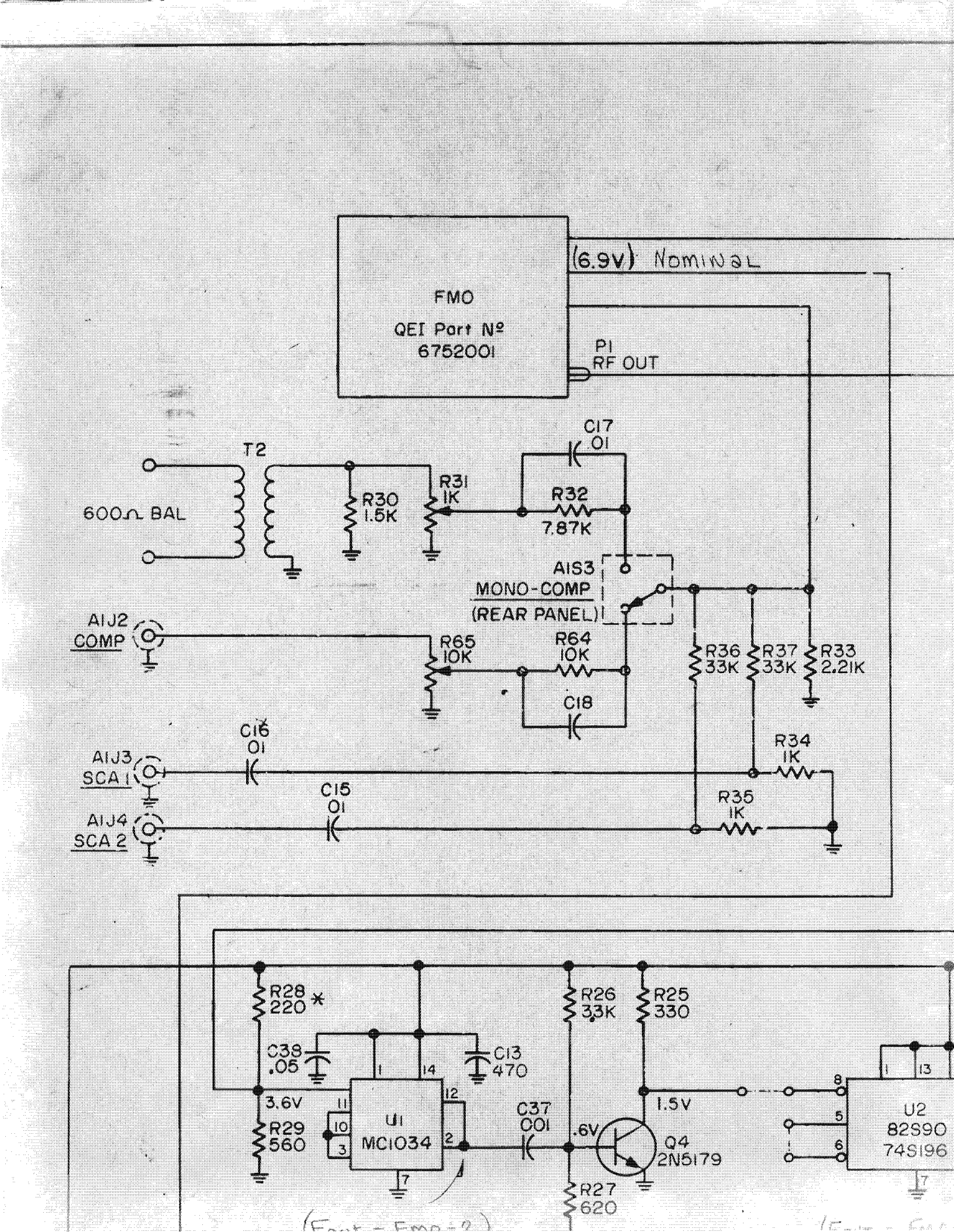
C42
CR11
L2
P1
Q14
R68
T2
U12
Y1


CR8
CR9
CR10
CR11
R68
10K
R67
470K
R66
10K
C42
100
C41
.1
U11
741
R40
3.3K
C32
100µ
U12
3080
3.4V
4.8V
R43
1.5K
R39
270
C20
120
R41
3.3K
4
1.2ms
R49
330
3.9V
C23
5µf
R53
2.2K
R50
10K
C30
1µf
Q14
2N4401
TUNE
2.6V
1.8V
C29
.1
R54
100K
Y1
R51
10K
C24
470
1.7V
C31
.001
C28
10
C27
1-10
C26
22
C25
470
R52
270
R55
2.7K
Q8
2N4403
COARSE
FREQ.


+15V
≥ 100 mw
RF
FMO MTR
SHUT DOWN
+5V


L1 2 1/2 turn Ferite bead
L2
C6
5-60
C7
5-60
C8
51
C9
10
CR1
CR2
C10
.001
R11
3.3K
C39
1000
Q2
N4401
.02V
R9
2.2K
R7
4.7K
R8
2.2K
R15
4.7K
R14
4.7K
R13
4.7K
B3
C3
D3
U5
74192
C12
1μf
R12
4.7K
X1
X2
U6a
7474
U6b
7474


C3 1500 pF
15.3 V
+15V
R4
270
C2
1500
R1
2.2K
6.8V
Q3
2N3866
1.4V
R5
2.2K
C4
001
T1
1.1V
R6
220
C5
.001
R10
51
2.1V
Q1
2N3866
R2
560
1.4V
R3
51
C1
470
C14
.001
C11
.1
R24
47K
R23
47K
R22
47K
R21
47K
A1
B1
C1
D1
R20
47K
R19
47K
R18
47K
R17
47K
A2
B2
C2
D2
U3
74192
U4
74192
16
15
1
10
9
12
5
13
4
2
8
14
11
3
(2)


FMO
QEI Part Nº
6752001
P1
RF OUT
(6.9V) NOMINAL
T2
600Ω BAL
R30
1.5K
R31
1K
C17
.01
R32
7.87K
A1S3
MONO-COMP
(REAR PANEL)
A1J2
COMP
R65
10K
R64
10K
C18
R36
33K
R37
33K
R33
2.21K
A1J3
SCA 1
C16
.01
A1J4
SCA 2
C15
.01
R34
1K
R35
1K
R28
220 *
C38
.05
C13
470
3.6V
R29
560
U1
MC1034
C37
.001
R26
33K
R25
330
1.5V
.6V
Q4
2N5179
R27
620
U2
82S90
74S196