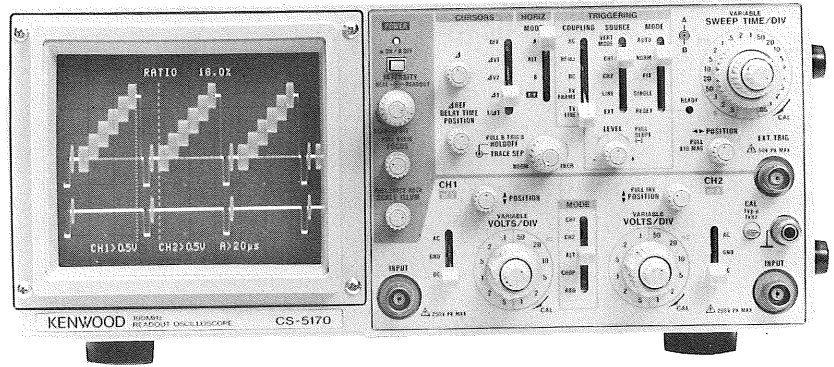


100MHz READOUT OSCILLOSCOPE

CS-5170

SERVICE MANUAL

KENWOOD



WARNING

The following instructions are for use by qualified personnel only. To avoid electric shock, do not perform any servicing other than contained in the operating instructions unless you are qualified to do so.



CONTENTS

SPECIFICATIONS	3
SAFETY	6
CIRCUIT DESCRIPTION	7
BLOCK DIAGRAM	10
ADJUSTMENT	11
TROUBLESHOOTING	23
PARTS LIST.....	30
DISASSEMBLY.....	31
PARTS LIST (ELECTRICAL).....	32
SCHEMATIC DIAGRAM.....	44
P.C. BOARD	49
SEMICONDUCTORS	53

SPECIFICATIONS

		CS-5170
CRT		150 mm rectangular with internal graticule
Acceleration Voltage		12 kV
Display Area		8 × 10 div (1 div = 10 mm)
VERTICAL AXIS (CH1 and CH2)		
Sensitivity		1 mV/div to 5 V/div: 1 mV to 2 mV/div ± 5%, 5 mV/div to 5 V/div ± 3%
Attenuator		12 steps, 1 mV/div to 5 V/div in 1-2-5 sequence Vernier control for fully adjustable sensitivity between steps
Input Impedance		1 MΩ ± 2%, approx. 30 pF
Frequency Response	DC	DC to 100 MHz, within -3 dB (5 mV/div to 5 V/div) DC to 20 MHz, within -3 dB (1 mV/div to 2 mV/div)
	AC	5 Hz to 100 MHz, within -3 dB (5 mV/div to 5 V/div) 5 Hz to 20 MHz, within -3 dB (1 mV/div to 2 mV/div)
Rise Time		3.5 ns (5 mV/div to 5 V/div) 17.5 ns (1 mV/div & 2 mV/div)
Signal Delay Time		Adequate to identify leading edge
Crosstalk		-40 dB or less (at 1 kHz)
Operating Modes	CH1	Single trace
	CH2	Single trace
	ALT	Two-waveform display, alternately
	CHOP	Two-waveform display, chopped
	ADD	CH1 + (± CH2) added display
Chop Frequency		Approx. 300 kHz
Channel Polarity		Normal or inverted, channel 2 only inverted
Maximum Input Voltage		500 V _{p-p} or 250 V (DC + AC peak)
HORIZONTAL AXIS Input thru CH2, × 10 MAG not included		
Operating Modes		X-Y operation is selectable with HORIZ MODE switch CH1 : Y axis CH2 : X axis
Sensitivity		Same as vertical axis (CH2)
Input Impedance		Same as vertical axis (CH2)
Frequency Response	DC	DC to 1 MHz, within -3 dB
	AC	5 Hz to 1 MHz, within -3 dB
X-Y Phase Difference		3° or less at 100 kHz
⚠ Maximum Input Voltage		Same as vertical axis (CH2)
SWEEP		
Type	A	A sweep
	ALT	A sweep (intensified for duration of B sweep) and B sweep (delayed sweep) alternating
	B	Delayed sweep
	X-Y	X-Y oscilloscope operation
Sweep Time	A	0.05 μs/div to 0.5 s/div ± 3%, in 22 ranges, in 1-2-5 sequence Vernier control for fully adjustable sweep time between steps
	B	0.2 μs/div to 50 ms/div ± 3%, in 19 ranges, in 1-2-5 sequence
Sweep Magnification		× 10 (ten times) ± 5% (± 8% in 0.05 μs-to-0.5 μs range)
Linearity		± 3% (± 5% for × 10 magnification)
Holdoff		Continuously variable from NORM to more than ten time (MAX)

SPECIFICATIONS

CS-5170		
Trace Separation	Shifts B sweep trace continuously in vertical direction by 4 divisions or more with respect to A sweep	
Delayed Sweep	Continuous delay (AFTER DELAY) & triggered delay (B TRIG' D: triggered by A trigger)	
Delay Time	Continuous adjustable from 0.2 μ s/div to 0.5 s/div	
Delay Accuracy	\pm (3% of set value + 1% of full scale) + (0 to 300 ns)	
Delayed Jitter	10000 : 1 of decoupled time axis A set value	
TRIGGERING		
Modes	AUTO, NORM, FIX, & SINGLE-RESET	
Trigger Source	VERT MODE	Triggered by input signal selected with vertical MODE selector
	CH1	Triggered by CH1 vertical signal
	CH2	Triggered by CH2 vertical signal
	LINE	Triggered by line frequency
	EXT	Triggered by external trigger signal
External Trigger Input Impedance	1 M Ω \pm 2%, approx. 30 pF	
 MAX. EXT. Input Voltage	50 V (DC + AC peak)	
Coupling	AC, HFREJ, DC, TV-FRAME, & TV-LINE	
Trigger Sensitivity	At NORM position	
	AC	Trigger frequency range 10 Hz to 50 MHz (INT: 1 div, EXT: 0.15 Vp-p) 10 Hz to 100 MHz (INT: 1.5 div, EXT: 0.2 Vp-p)
	DC	Trigger frequency range DC to 50 MHz (INT: 1 div, EXT: 0.15 Vp-p) DC to 100 MHz (INT: 1.5 div, EXT: 0.2 Vp-p)
	HFREJ	Trigger frequency range is more than 50 kHz, and minimum amplitude (voltage) required for sync is increased.
	TV	FRAME, LINE INT: 1.5 div, EXT: 0.2 Vp-p
AUTO: Same as above specifications for above 50 Hz		FIX: 50 Hz to 50 MHz (INT: 1.5 div, EXT: 200 mV) 50 Hz to 100 MHz (INT: 2.0 div, EXT: 250 mV)
CALIBRATION VOLTAGE	1 V p-p \pm 3%, square wave, positive polarity, approx. 1 kHz	
INTENSITY MODULATION		
Sensitivity	+ 5 V, positive voltage decreases brightness	
Input Impedance	Approx. 10 k Ω	
Usable Frequency Range	DC to 5 MHz	
 Maximum Input Voltage	50 V (DC + AC peak)	
VERTICAL AXIS SIGNAL OUTPUT (CH1 only)		
Output voltage	Approx. 50 mVp-p/div (50 Ω termination)	
Output Impedance	Approx. 50 Ω	
Frequency Response	100 Hz to 100 MHz, - 3 dB/50 Ω termination (1 mV/div, 2 mV/div: 100 Hz to 20 MHz, - 3 dB)	

SPECIFICATIONS

		CS-5170
READOUT		
Set Value		CH1/CH2 scale factor (with probe detection); V-UNCAL, ADD, INVERT A/B sweep scale factor (magnification conversion): SWEEP-UNCAL, AFTER DELAY, TRIG' D, X-Y
Cursor Mode A mode only	$\Delta V1$	Voltage difference between ΔREF and Δ cursors on a CH1 scale factor basis
	$\Delta V2$	Voltage difference between ΔREF and Δ cursors on a CH2 scale factor basis
	ΔT	Time difference between ΔREF and Δ cursors on the basis of A sweep scale factor
	$1/\Delta T$	Frequency between ΔREF and Δ cursors on the basis of A sweep scale factor
		Phase: Phase difference between ΔREF and Δ cursors, supposing 5-division on the CRT as 360°
NOTE: The X-Y mode allows $\Delta V1$ measurement only.		
Cursor Measurement	Resolution	10 bits
	Measurement accuracy	$\pm 4\%$
	Measurable range	ΔV , Ratio: ± 3.6 div or more from the CRT center ΔT , $1/\Delta T$, Ratio, Phase: ± 4.6 div or more from the CRT center
TRACE ROTATION (Electrical, adjustable from front panel)		
POWER REQUIREMENT		
Line Voltage		AC 100 V/120 V/220 V $\pm 10\%$ 216V—250V
Line Frequency		50/60 Hz
Power Consumption		Approx. 59 W
DIMENSIONS (W×H×D)		319 (341)×132 (145)×380 (455) mm () dimensions include protrusion from basic outline dimensions
WEIGHT		9.2 kg
ENVIRONMENTAL		
Within Specifications		10°C to 35°C, 85% max. relative humidity
Full Operation		0°C to 40°C, 85% max. relative humidity
ACCESSORIES SUPPLIED		
Probe		PC-31 (READOUT compatible probe) × 2
Attenuation		1/10
Input impedance		10 M Ω , 22 pF $\pm 10\%$
Replacement Fuse		1.2 A × 2, 0.7 A × 2
Instruction Manual		1

* Circuit and rating are subject to change without notice due to developments in technology.

SAFETY

SAFETY

Before connecting the instrument to a power source, carefully read the following information, then verify that the proper power cord is used and the proper line fuse is installed for power source. The specified voltage is shown at the fuse holder of the AC inlet. If the power cord is not applied for specified voltage, there is always a certain amount of danger from electric shock.

Line voltage

This instrument operates using ac-power input voltages that 100/120/220/240 V at frequencies from 50 Hz to 60 Hz.

Power cord

The ground wire of the 3-wire ac power plug places the chassis and housing of the oscilloscope at earth ground. Do not attempt to defeat the ground wire connection or float the oscilloscope; to do so may pose a great safety hazard. The appropriate power cord is supplied by an option that is specified when the instrument is ordered.

The optional power cords are shown as follows in Fig. 1.

Line fuse

The fuse holder is located on the rear panel and contains the line fuse. Verify that the proper fuse is installed by replacing the line fuse.

Voltage conversion

This oscilloscope may be operated from either a 100 V to 240 V, 50/60 Hz power source. Use the following procedure to change from 100 to 240 volt operation or vice versa.

1. Remove the fuse holder.
2. Replace fuse F 1 with a fuse of appropriate value, 1.2 amp for 100 VAC to 120 VAC operation, 0.7 amp for 220 VAC to 240 VAC operation.
3. Reinsert it for appropriate voltage range.
4. When performing the reinsertion of fuse holder for the voltage conversion, the appropriate power cord should be used. (See Fig. 1.)

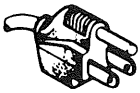


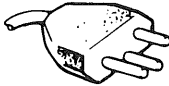
Plug configuration	Power cord and plug type	Factory installed instrument fuse	Line cord plug fuse	Parts No. for power cord and plate
	North American 120 volt/60 Hz Rated 15 amp (12 amp max; NEC)	1.2 A, 250 V Fast blow 6 × 30 mm	None	Cord: E30-1820-05
	Universal Europe 220 volt/50 Hz Rated 16 amp	North Europe 630 mA, 250 V Slow blow 5 × 20 mm	None	Cord: E30-1819-05
		Other Europe 0.7 A, 250 V Fast blow 6 × 30 mm		
	U.K. 240 volt/50 Hz Rated 13 amp	0.7 A, 250 V Fast blow 6 × 30 mm	0.8 A Type C	—
	Australian 240 volt/50 Hz Rated 10 amp	0.7 A, 250 V Fast blow 6 × 30 mm	None	Cord: E30-1821-05
	North American 240 volt/60 Hz Rated 15 amp (12 amp max; NEC)	0.7 A, 250 V Fast blow 6 × 30 mm	None	—
	Switzerland 240 volt/50 Hz Rated 10 amp	0.7 A, 250 V Fast blow 6 × 30 mm	None	—

Fig. 1 Power Input Voltage Configuration

CIRCUIT DESCRIPTION

VERTICAL PREAMP CIRCUIT (X73-1830-00)

The signal for the input terminal CH1 or Y, CH2 or X is increased to the appropriate value by ATT and sent to the head amplifier Q2-Q5 (CH2: Q102-105). It is then sent to the cascade amplifier U2, Q6, Q7 (CH2: U102, Q106, Q107) through the GAIN switch unit (linked with the ATT) (1/1, 1/2, 1/4 and 1/10).

The feedback of the direct current is applied by the operation amplifier U1 (CH2: U101) to reduce the drift in the head amplifier.

The first cascade amplifier is a gain switch type amplifier. It increases the amplification degree 5X greater than the normal level within a range of 1 mV/div and 2 mV/div.

The signal from the first cascade amplifier is input to the diode gate D2-D5 (CH2: D102-D105 through the 2nd cascade amplifier Q8-Q11 (CH2: Q108-Q113).

The CH1 and CH2 signal is then sent to the delay line driver Q201 and Q202 selected by the V mode switch.

Q112 and Q113 of CH2 are used for current inversion.

TRIGGER SIGNAL CIRCUIT (X73-1830-00)

The signal output by CH1 and CH2 of the cascade amplifier emitter is sent to the CH1 OUT/CH1 trigger pickoff amplifier Q12-Q15 and CH2 trigger pickoff amplifier Q114 - Q116 for the trigger signal. The signal amplified by CH1 and CH2 in the pickoff amplifier is sent to the H-unit trigger pre-amplifier by the P5 selected by the switching signal sent from the H-unit through P7.

The signal removed by the collector Q13 in the CH1 trigger pickoff amplifier Q13 passes through the emitter follower Q15 and is output by P1.

VERTICAL FINAL AMPLIFIER (X73-1840-00)

The signal sent through the delay line is terminated and amplified by the second level cascade amplifier Q1-Q9.

The signal that is converted to low impedance in the Q12 and Q13 of the emitter follower is amplified to the appropriate level so it can drive the CRT converter by the final amplifier Q14 - Q15.

READOUT Y-CHARACTER SIGNAL SWITCH CIRCUIT (X73-1840-00)

The Y-signal from the readout unit (X77-1510-01) and the request signal pass through the comparator Q103 and Q104 from P35 and are then sent to Q401 and Q102.

The gain from the Y-character signal and the center are determined, supplied to the vertical final amplifier Q3 and Q4 emitter and drive the vertical final amplifier.

POWER SUPPLY CIRCUIT (X73-1830-00)

The power supply contains seven stabilized systems and two unstabilized systems. Stabilization is provided for +12 V and -12 V power supplies. There are two +5 V systems, one which is supplied to the oscilloscope unit and the other which is supplied to the readout unit (X77-1510-01) and the timing unit (X74-1500-00). Both

+5 V systems are stabilized at -12 V. The +55 V and +145 V power supplies are stabilized at a reference voltage of -12 V. The +20 V power supply is stabilized at the #3 pin of U304. The power supply for the scale illumination circuit is ± 18 V and the voltage rectified at D301 is sent to the H-unit scale illumination through P10. The +18 V voltage is supplied to the H-unit high-voltage oscillation circuit of the primary side through P10.

CAL CIRCUIT (X73-1830-00)

The oscillation circuit creates a 1-KHz square wave at the multivibrator using the 1/4 and 2/4 of the C-MOSIC U351. It then produces a square waveform at 3/4 and 4/4 of U351 and outputs a 1 Vp-p CAL signal from P9 using resistance separation.

TRIGGER CIRCUIT (X74-1500-00)

The trigger signal from the vertical system is sent from P4 to the source and coupling switches through the Q1 and Q2 signal comparator. It is added to the U1, Q7 and Q8 of the level comparator, which is the differential amplifier for the low impedance signal, by Q5, Q6 of the FET and the U1 emitter follower.

This signal is added to the Schmitt trigger by the buffer amplifier Q13 and Q15 through the slope switch and shaped as a square wave to operate the A and B sweep gate of the sweep circuit and the auto free-run circuit.

Q9 and Q10 are the error detection circuits for the FIX synchronization. The signal is amplified at U2, the mid-range voltage is removed and then the signal is sent to the Schmitt circuit.

Q11, Q12 and Q14 and U3 4/4 are the synchronization signal separation circuits for the television signal. The X-signal for the X-Y operation is obtained from the CH2 trigger pick-off and added to the horizontal amplifier Q202 (X73-1840-00) through the Q19, Q20 and Q21 output circuits.

HORIZONTAL SWEEP CIRCUIT (X74-1500-00)

If the trigger pulse is added to the flip-flop U102 1/2, the output is transferred, and the mirror integration circuit configured at Q104 - Q109 and U103 starts the sweep.

The sweep length for this sweep signal is determined at Q114 and the flip-flop U102 2/2. After a break time determined by Q111, Q112 and Q113 of the hold-off circuit, the trigger signal is obtained again.

The output from the U102 1/2 flip-flop is transferred for the B-sweep after a delay determined by the voltage from the delay pick-off comparator Q213-Q216 and the delay time position.

The sweep signals from both the A-sweep and the B-sweep are switched by the H-mode switch, U104 and U203 of the horizontal switching circuit and added to the horizontal amplifier Q302.

CIRCUIT DESCRIPTION

HORIZONTAL AMPLIFIER CIRCUIT (X73-1840-00)

The sweep signal of the sweep circuit is added to Q201 to Q204 of the drive amplifier. The gain X1 and X10 are selected at this time. The power supply amplification signal is switched to the voltage signal at Q205 and Q206 and amplified to an adequate level to drive the CRT deflection board by the high amplification ratio and low output impedance of the final amplifier Q207 to Q214.

READOUT X CHARACTER SIGNAL SWITCH CIRCUIT (X73-1840-00)

The X-signal from the readout unit (X77-1510-01) and the request signal pass through the comparator Q107 and Q108 from P36 and are sent to the Q105 and Q106 of the switching amplifier.

The character signal gain and the gain center are determined at this time, supplied to the base of Q205 and Q206 of the horizontal amplifier and drive the horizontal final amplifier. The final voltage is converted to high voltage by D408 and D409 of the direct voltage reproduction circuit and is the drive for the primary anode electrode.

The -1500 V cathode electrode drive voltage is formed at the DC-DC converter by the control circuit U401 and blocking oscillator Q409.

The third electrode voltage forms the secondary coil voltage of the DC-DC converter for the 7X voltage rectification.

READOUT Z-AXIS SIGNAL SWITCH CIRCUIT (X73-1830-00)

The blanking signal from the readout unit (X77-1510-01) ends at P37 and is added to U501. The pulse width output signal from the R517 and C502 timing is sent to the Z-axis input.

The unblanking signal ends Q505 and Q506 from P37 and is sent to the Z-axis input.

This signal passes through the operating amplifier U502 and is sent for the readout off signal to the readout unit from P37.

TRACE ROTATION AND SCALE ELIMINATION CIRCUITS (X73-1830-00)

The trace rotation circuit drives the rotator coil that is positioned at the CRT cone by the voltage from the common emitter phase correction transistor Q410 and Q411.

The scale elimination circuit performs the optical volume adjustment at Q412.

R/O UNIT (X77-1510-01)

The readout unit functions include the three features described below.

1) Import unit

This unit imports the data for each switch for the CRT readout display. (This consists of U17-U24 in the IC).

2) Display unit

This forms the X-axis and Y-axis for the CRT readout

display. (This includes the U1-U5, U7, U8, U13, and R33 of each IC and the voltage).

3) Cursor unit

This includes of A/D converter and calculator for the cursor measurement.

(This includes U6, U8-U11, U14, U23 of the IC.)

Import unit

This unit imports data for each switch operation. A one-chip MPU U23 transfers the data to the character generator (U7). A reference clock is provided from a 10-MHz oscillator that uses U16 and X1.

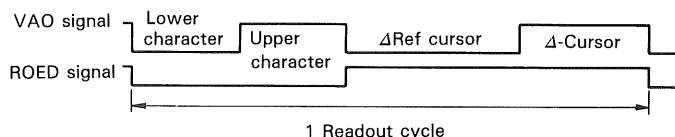
The A0 - A7 low order addresses are output to the data bus by time assignment. U18 latches the low order addresses by the ALE signal output from the MPU.

The switch data necessary for the monitor display is imported to the MPU every 80 ms through the I/O port of U19 - U22. U17 is output by the I/O port decoder and the output signal RS0-RS3 is output in 80 ms cycles.

Display unit

The character display is controls the character generator U7 by the character counter (U8 DC1-CD7) and the dot counter (U8 DC0-DC4) using the random scan method (X-Y display).

The readout display is performed in 13.5 ms for each cycle. One cycle of the readout display is separated into four parts, low characters, high characters, the Δ REF cursor and the Δ -Cursor. The timing is then switched by pins U8-89 of the ROED signal and pins U8-U16 of the VAO signal.



5 \times 7 dot configuration character data is input to the character generator U7.

The three bits DD0 - DD2 are X-axis data and the four bits DD3 - DD6 are Y-axis data. DD7 is the character start and end control bit.

The digital signal output from U7 is converted to each analog signal by the data converter U1 for the X-axis signal, V33 and R33 and the D/A converter for the Y-axis signal configured by U3 and R33. The X-axis and Y-axis signals are sent through analog switch U4 and U5 and U13 of the buffer amplifier to the final unit (X73-1840-00).

The character dot display is controlled by the ROUB signal (U8-86 pin), ROB signal (U8-87 pin) and the ROQ signal (U8-88 pin).

CIRCUIT DESCRIPTION

The real waveform display is cleared by the ROB signal, the real waveform and the readout switch are performed by the ROQ signal and the readout dot display is performed by the ROUB signal.

The three signals described above are controlled by the RO SP signal in pin 83 of U8 (readout off signal R/O OFF).

Cursor Unit

The ± 1.25 V cursor reference voltage is formed by the low-resistance separation of the +10 V power supply voltage and output through U11, U15, Q1 and Q2. This ± 1.25 V corresponds to the full scale voltage of the 10-bit separation function of the cursor measurement.

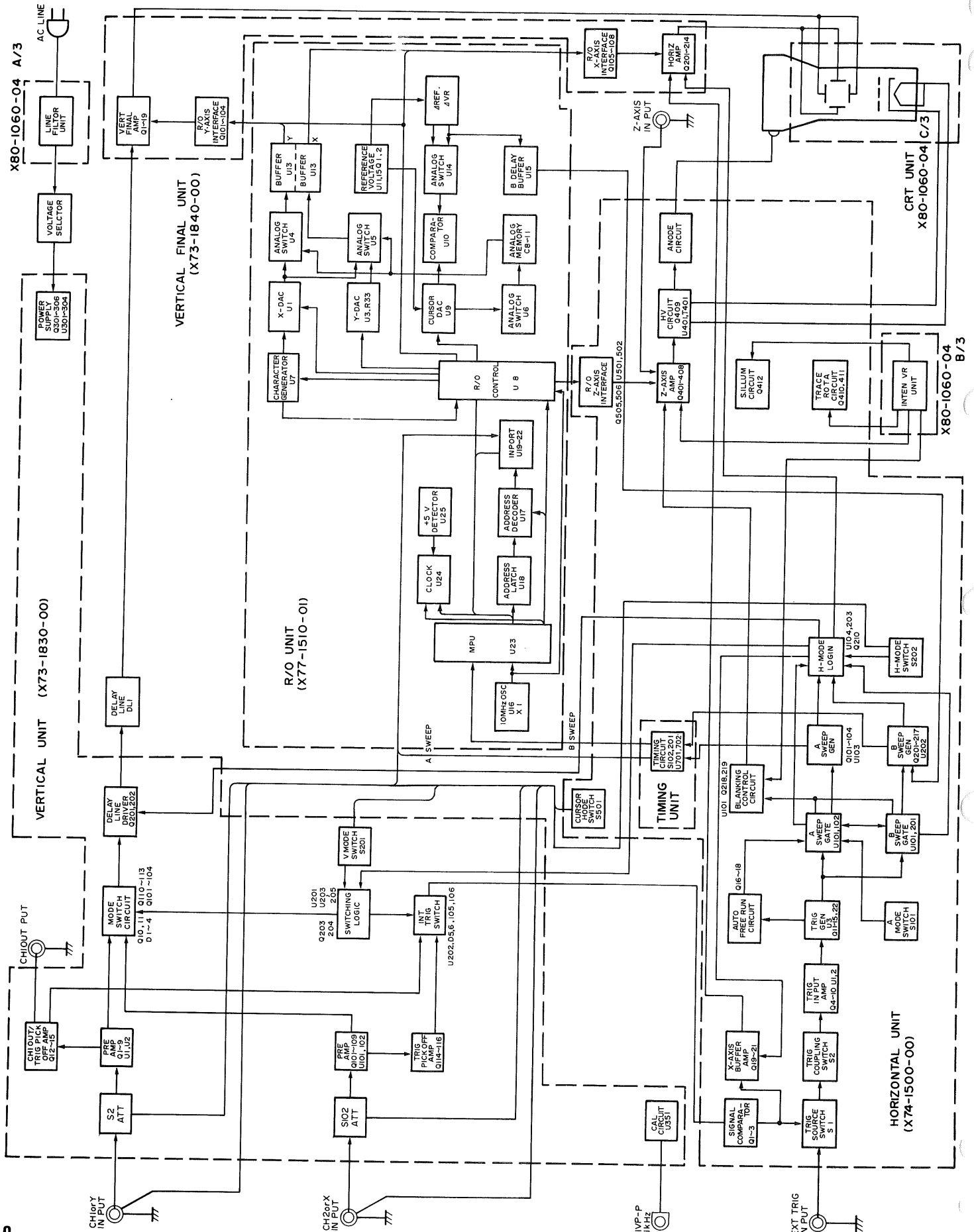
The voltage set by the cursor VR is sent directly to the analog switch U14 for the X-axis measurement and reduced 80% for the Y-axis measurement. U14 performs the ΔT and ΔV switching and the ΔREF and Δ -Cursor switching.

The MPU U23 sends the 10-bit data to the D/A converter U9 where the data is converted to analog voltage. The converter U10 compares the voltage from analog voltage and the cursor VR and returns the output to MPU U23.

U8, U9, U10 and U23 obtained by this process configure the A/D converter. This A/D converter converts the analog voltage from the ΔREF and Δ -Cursor VR to 10-bit digital data. The conversion speed for the A/D converter is 80 ms.

Next, the MPU performs the cursor calculations using this converted 10-bit digital data. The analog voltage output from the D/A converter U9 is converted to the ΔREF and Δ -Cursor by analog switch U6 and is maintained in each hold circuit every 80 ms for the hold voltage.

BLOCK DIAGRAM



ADJUSTMENT

To obtain the best performance, periodically calibrate the unit. Sometimes, only one mode need be calibrated, while at other times, all modes should be calibrated. When one mode is calibrated, it must be noted that the other modes may be affected. When calibrating all modes, perform the calibration in the specified sequence.

The following calibration required an accurate measuring instrument and an insulated adjusting flat blade screwdriver. If they are not available, contact your dealer. For optimum adjustment, turn the power on and warm up the scope sufficiently (more than 30 minutes) before starting.

Before calibrating the scope, check the power supply voltage.

TEST EQUIPMENT REQUIRED

The following instrument or their equivalent should be used for making adjustment.

Test Equipment	Model	Minimum Specification
Digital Multi-Meter	DL-711 (KENWOOD)	Impedance: More than 10 M Ω , Measuring range: 0.01 V to 199 V
Sine-Wave Generator	651 B (YHP)	Frequency: 10 Hz to 10 MHz, constant voltage over tuning range
Sine-Wave Generator	SG-503 (Tektronix)	Frequency: 50 kHz to 100 MHz, Output impedance: 50 Ω , constant voltage over tuning range
Square-Wave Generator	PG-506 (Tektronix)	Output signal: 1 kHz, Amplitude: 10 mVp-p to 10 Vp-p, Accuracy: within $\pm 1\%$, Rise time: 35ns or less 100 kHz, Rise time: 1 ns or less
Q Meter	4343B (YHP)	—
Color Pattern Generator	CG-911A (KENWOOD)	—
Oscilloscope	475A (Tektronix)	Sensitivity: more than 5 mV Frequency response: More than 250 MHz
Time-Marker Generator	TG-501 (Tektronix)	Time mark: 0.5 s to 0.1 μ s repetitive waveform
High-Voltage Probe	—	Input Impedance: 1000 M Ω
Termination	—	Impedance: 50 Ω Accuracy: within 3%
Termination	—	3 watts type impedance: 50 Ω
Attenuator	—	- 20 dB attenuation (50 Ω)

Table 1

PREPARATION FOR ADJUSTMENT

Control Settings

The control settings listed below must be used for each adjustment procedure.

Exceptions to these settings will be noted as they occur. After completing a adjustment, return the controls to the following settings.

NAME OF KNOBS	POSITION
INTEN	12 o'clock
FOCUS, ASTIG	Optimum position
CH1, CH2 \blacktriangledown POSITION	Mechanical center
CH1, CH2 STORAGE POSI	Mechanical center
\blacktriangleleft \blacktriangleright POSITION/PULL $\times 10$ MAG VARIABLE, H.VARIABLE	Mechanical center, push CAL
(VOLTS/DIV, SWEEP TIME/DIV)	
AC-GND-DC (CH1 and CH2)	DC (GND at no signal)
Vertical MODE	CH1
CH2 PULL INV	Push (NORM)
TRIGGERING COUPLING	AC
TRIGGERING SOURCE	CH1
TRIGGERING LEVEL	Mechanical center, push
TRIGGERING MODE	AUTO
VOLTS/DIV (CH1 and CH2)	5 mV/DIV
A, B SWEEP TIME/DIV	1 ms/DIV
TRACE SEP	Fully CCW
HOLDOFF	Fully CCW, NORM, Push
HORIZONTAL MODE	A
DELAY TIME POSITION	Optimum position

Table 2

ADJUSTMENT

1. POWER SUPPLY AND CRT SECTION ADJUSTMENTS

Item	Adjustment VR (TC)	P.C.B.	Procedure
+ 12 V	VR301	X73-1830	Adjust VR301 so that the voltage at pin 5 of the connector P14 is + 12 V.
CRT Center	VR2	X73-1840	By CH2 posi, locate a point at which luminance line does not move on the PULL and PUSH setting of CH2 INV. Keep CH2 posi as it is, and adjust VR2 to center on the screen.
Vertical Center Voltage	VR5	X73-1840	Adjust VR5 so that the voltage between CRT socket pin "9" and GND is 37 V. * CRT socket pin "9" refers to titanium oxide porcelain capacitor C5.
Focus Center	VR402	X74-1500	Push the FOCUS knob in (for the FOCUS operation) and then set it to the mechanical center position. Pull the knob out (for the ASTIG operation), display a spot on the screen, and adjust the ASTIG control and VR402 to minimize the dimension of the spot.
B Intensity	VR403	X74-1500	Turn fully counterclockwise
Intensity	VR401	X74-1500	Display the spot on the CRT screen, and adjust VR401 so that the spot disappears when the INTEN knob is set to the 10-o'clock position.

2. VERTICAL SECTION ADJUSTMENTS

Item	Adjustment VR (TC)	P.C.B.	Procedure
CH1 Waveform Shaping	TC2 TC4	X73-1830	AC-GND-DC : DC Apply 10 kHz square wave to CH1 INPUT (with the amplitude extending over 4 to 6 div). Set CH1 VOLTS/DIV to 0.1 V range (and 1 V range), and adjust TC2 (and TC4) so that the waveform becomes flat in both ranges.
CH2 Waveform Shaping	TC102 TC104	X73-1830	Adjust in the same way as for CH1.
CH1 Input Capacity	TC1 TC3	X73-1830	AC-GND-DC : DC CH1 VOLTS/DIV : 5 mV Connect the capacity meter to the CH1 INPUT, and measure the input capacity in the 5 mV range. Adjust TC1 and TC3, alternately, so that the input capacity in the 0.1 V and the 1 V ranges equals the same capacity as in the 5 mV range.
CH2 Input Capacity	TC101 TC103	X73-1830	Adjust in the same way as for CH1.
CH1 Step ATT Balance	VR1 VR2	X73-1830	Adjust VR1 so that the position of the luminescent line does not change even when the vertical attenuator is selected between 5 and 10 mV range. Switch the range between 2 and 5 mV ranges, and perform the same adjustment using VR2.
CH1 Variable Balance	VR7	X73-1830	VOLTS/DIV : 5 mV Adjust VR7 so that the position of the luminescent line does not change even if the VARIABLE knob is rotated.

ADJUSTMENT

Item	Adjustment VR (TC)	P.C.B.	Procedure
CH2 Step ATT Balance	VR101 VR102	X73-1830	Adjust in the same way as for CH1.
CH2 Variable Balance	VR107	X73-1830	Adjust in the same way as for CH1.
CH1 Position Center	VR9	X73-1830	CH1 POSITION : Mechanical center position CH1 VOLTS/DIV : 5 mV Adjust VR9 so that the trace is located on the center of the screen.
CH2 Position Center	VR109	X73-1830	Adjust in the same way as for CH1.
ADD position	VR201	X73-1830	Set the channel 1 and channel 2 position controls so that the trace is located on the center of the screen and select the vertical MODE switch to ADD position. Adjust VR201 to center the trace vertically.
CH1 Gain	VR10	X73-1830	CH1 VOLTS/DIV : 10 mV Input a square wave signal having an amplitude of 50 mV, and adjust VR10 so that the CRT amplitude becomes 5 div.
CH1 1 mV Range Gain	VR4	X73-1830	CH1 VOLTS/DIV : 1 mV Input a square wave signal having an amplitude of 5 mV, and adjust VR4 so that the CRT amplitude becomes 5 div.
CH2 Gain	VR110	X73-1830	Adjust in the same way as for CH1.
CH2 1 mV Range Gain	VR104	X73-1830	Adjust in the same way as for CH1.
X Gain	VR3	X74-1500	CH2 VOLTS/DIV : 10 mV HORIZONTAL MODE : X-Y Input the square wave signal having an amplitude of 50 mV into CH2 INPUT, and adjust VR3 so that the CRT amplitude in the horizontal direction becomes 5 div.
TRIG. SLOPE	VR2	X74-1500	TRIGGERING MODE : AUTO TRIGGERING SOURCE : CH1 TRIGGERING COUPLING : AC CH1 VOLTS/DIV : 5 mV Input a sinewave signal of 1 KHz frequency and 6 DIV amplitude into CH1 INPUT. Synchronize by TRIG. LEVEL knob Change the TRIG. SLOP from " + " to " - ", and adjust by VR2 knob so that the start point becomes same as the " + ".

ADJUSTMENT

3. TRIGGER SECTION ADJUSTMENTS

Item	Adjustment VR (TC)	P.C.B.	Procedure
Trigger Level Center	VR1	X74-1500	TRIGGERING MODE : AUTO SOURCE : CH1 COUPLING : AC LEVEL : Mechanical center position SLOPE : + Input a 1 kHz sine wave into CH1 INPUT, and adjust the oscillator so that the CRT amplitude becomes 6 div. Adjust VR1 so that start point of the luminescent line is at the center of the CRT (vertical direction).
CH1 Trigger DC Coupling	VR11	X73-1830	After adjusting the trigger level center, set the TRIGGERING COUPLING to the DC position. Adjust VR11 so that the start point of the luminescent line is at the same position as in the AC mode.
CH2 Trigger DC Coupling	VR111	X73-1830	TRIGGERING MODE : AUTO SOURCE : CH2 COUPLING : AC CH2 VOLTS/DIV : 5 mV Input a 1 kHz sine wave to CH2 INPUT, and adjust the oscillator so that the CRT amplitude becomes 6 div. Adjust the TRIGGERING LEVEL so that the start point of the luminescent line is at the center of the CRT. Set the TRIGGERING COUPLING to the DC position. Adjust VR111 so that the start point of the luminescent line is at the same position as in the AC mode.

4. HORIZONTAL SECTION ADJUSTMENTS

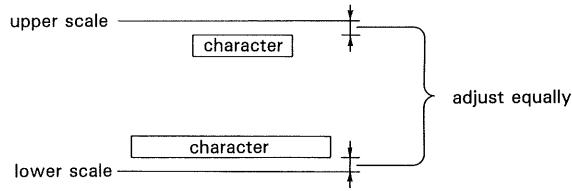
Item	Adjustment VR (TC)	P.C.B.	Procedure
B Sweep Start Point	VR204	X74-1500	HORIZONTAL MODE : ALT A and B SWEEP TIME/DIV: 1 ms Adjust VR204 to coincide the start point of B sweep with that of A sweep.
1 ms Range Sweep Time	VR101 VR201	X74-1500	SWEEP TIME/DIV : 1 ms Input a 1 ms marker signal into CH1 INPUT. Adjust VR101 and VR201 so that the peak of the marker signal matches the CRT scale divided in 1 div.
1 μ s Range Sweep Time	TC101 TC201	X74-1500	SWEEP TIME/DIV : 1 μ s Input a 1 μ s marker signal into CH1 INPUT, and adjust in the same way as for 1 ms adjustment.
$\times 10$ MAG Gain	VR202	X74-1840	HORIZONTAL MODE : A A SWEEP TIME/DIV : 1 ms Input a 1 ms marker signal into CH1 INPUT, and match the peak of the marker signal with the CRT scale divided in 1 div. Pull the PULL $\times 10$ MAG knob (to set to the $\times 10$ MAG status), and adjust VR202 so that the interval between peaks becomes 10 div.
$\times 10$ MAG Center	VR201	X74-1840	A SWEEP TIME/DIV : 1 ms Input a 5 ms marker signal into CH1 INPUT. Pull the PULL $\times 10$ MAG knob (to set to the $\times 10$ MAG status), and adjust the horizontal POSITION so that the peak of the waveform is at the vertical scale line at the center of the CRT. Push the PULL $\times 10$ MAG knob (to release the $\times 10$ MAG mode) and adjust VR201 so that the peak of the waveform matches the vertical scale line at the center of the CRT.

ADJUSTMENT

Item	Adjustment VR (TC)	P.C.B.	Procedure
Delay Time Position	VR203 VR202	X74-1500	HORIZONTAL MODE : ALT A SWEEP TIME/DIV : 0.1 ms B SWEEP TIME/DIV : 1 μ s Turn the DELAY TIME POSITION knob until you have [DELAY 0.030 ms] on the screen. Adjust to 0.3 DIV by VR203 knob. Then, turn the DELAY TIME POSITION knob to have [DELAY 0.980 ms] on the screen. Adjust to 9.8 DIV by VR203 knob. * Repeat for any other values.
X Position Center	VR4	X74-1500	Adjust the horizontal POSITION knob so that the sweep start point moves to the vertical scale line at the left end of CRT. Switch to the X-Y mode and adjust VR4 to bring the spot to the center of CRT screen.

ADJUSTMENT

5. CURSOR SECTION ADJUSTMENT

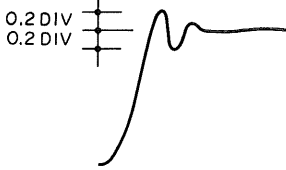
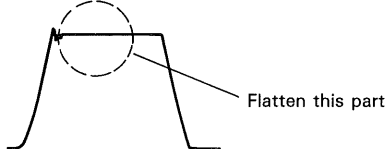
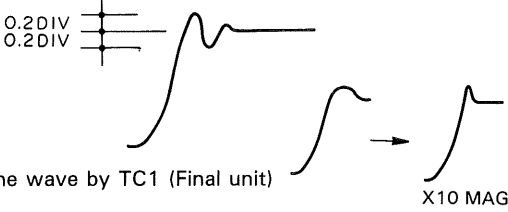
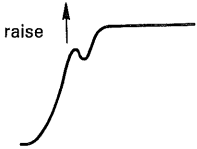
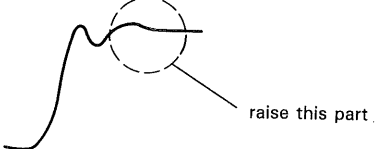
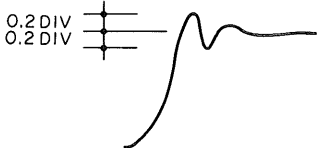
Item	Adjustment VR (TC)	P.C.B.	Procedure
Cursor Y Gain and Position	VR101 VR102	X73-1840	<p>CURSORS : $\Delta V1$ Δ : Turn fully clockwise ΔREF : Turn fully counterclockwise</p> <p>Adjust VR101 so that the interval between cursors becomes 8 div. Adjust VR102 so that the two cursors move to the upper and lower ends of the horizontal scale line in the CRT. If it is impossible, adjust the interval between cursors and the horizontal scale line becomes the same for both upper and lower ends.</p>
R/O CHARACTER Position	VR2	X77-1510	<p>Use VR2 to adjust the read out characters so that they have same distance from that upper and lower scales of the screen.</p> 
Cursor X Gain and Position	VR103 VR104	X73-1840	<p>CURSORS : ΔT Δ : Turn fully clockwise ΔREF : Turn fully counterclockwise</p> <p>Adjust VR103 so that the interval between two cursors becomes 10 div. Adjust VR104 so that the two cursors move onto the vertical scale lines at the left the right ends of CRT.</p>
R/O Cursor Length	VR1	X77-1510	<p>CURSORS : $\Delta V1$</p> <p>Adjust VR1 to bring the left end of the cursor on the vertical scale line at the first division to the right of the left side of CRT screen.</p>
CHARACTER	VR203	X73-1840	<p>CURSORS : ΔT A SWEEP TIME/DIV : $2\mu s$ X10 MAG : ON</p> <p>Adjust VR203 until the cursor and characters stop vibrating horizontally.</p>

ADJUSTMENT

6. OVERSHOOT AND CAL ADJUSTMENTS

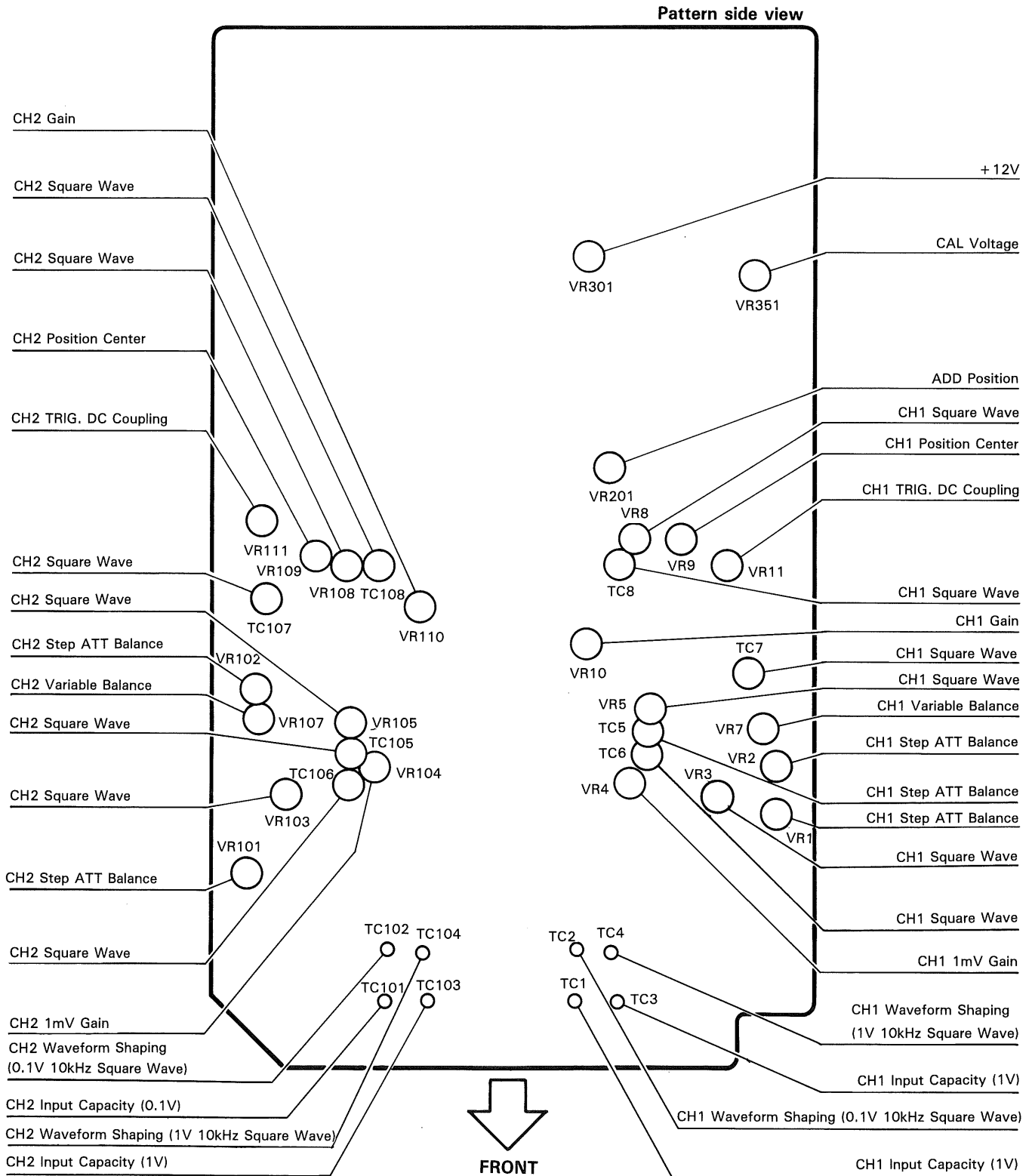
Item	Adjustment VR (TC)	P.C.B.	Procedure
Overshoot Adjustment	<For CH1> TC108 VR108 TC107 VR105 TC105 VR103 TC106 <For CH2> VR8 TC8 TC7 VR5 TC5 VR3 TC6	X73-1830	CH1, 2 VOLTS/DIV : 5 mV CH1, 2 AC-GND-DC : DC SWEEP TIME/DIV : 0.2 μ s Input a square wave signal of 1 MHz frequency and 6 DIV amplitude into CH1 INPUT. Turn the VOLUME knob fully clockwise. VR6 (final unit) VR3, 103 (vertical unit) Turn the VOLUME knob fully counterclockwise. VR1, 3, 4 (final unit) Turn the VOLUME knob halfway. VR8 (vertical unit) Obtain as high as possible overshoot by TC4 (final unit)
	TC4 VR6 VR4 TC3 TC1 VR1 TC2 VR3		X73-1840

ADJUSTMENT

Item	Adjustment VR (TC)	P.C.B.	Procedure
			<ul style="list-style-type: none"> • Get an overshoot by TC5 (vertical unit) VR5  <p>Set the SWEEP TIME/DIV on 0.2 μs</p> <ul style="list-style-type: none"> • Flatten the delay part by VR3, TC3 (final unit)  <p>Set the SWEEP TIME/DIV on 0.05 μs</p> <ul style="list-style-type: none"> • Confirm the setting of the overshooting and readjust if necessary. TC5, 6, VR5 (vertical unit)  <ul style="list-style-type: none"> • Adjust the top of the wave by TC1 (Final unit) <p>Input a square wave signal of 1 MHz frequency and 6 div amplitude into CH2 INPUT.</p> <ul style="list-style-type: none"> • Obtain as high as possible overshoot by TC107 (vertical unit)  <ul style="list-style-type: none"> • Raise the wave as high as possible by TC108 (vertical unit)  <ul style="list-style-type: none"> • Use VR108 (vertical unit) to flatten the part which is moved by TC108. • Get an overshoot by TC105, 106, VR105 (vertical unit) 
CAL Adjustment	VR351	X73-1830	Connect the oscilloscope to the CAL terminal and set it to 0.2 V/div. Adjust VR351 so that the amplitude is of 5 divisions for 40 MHz input.

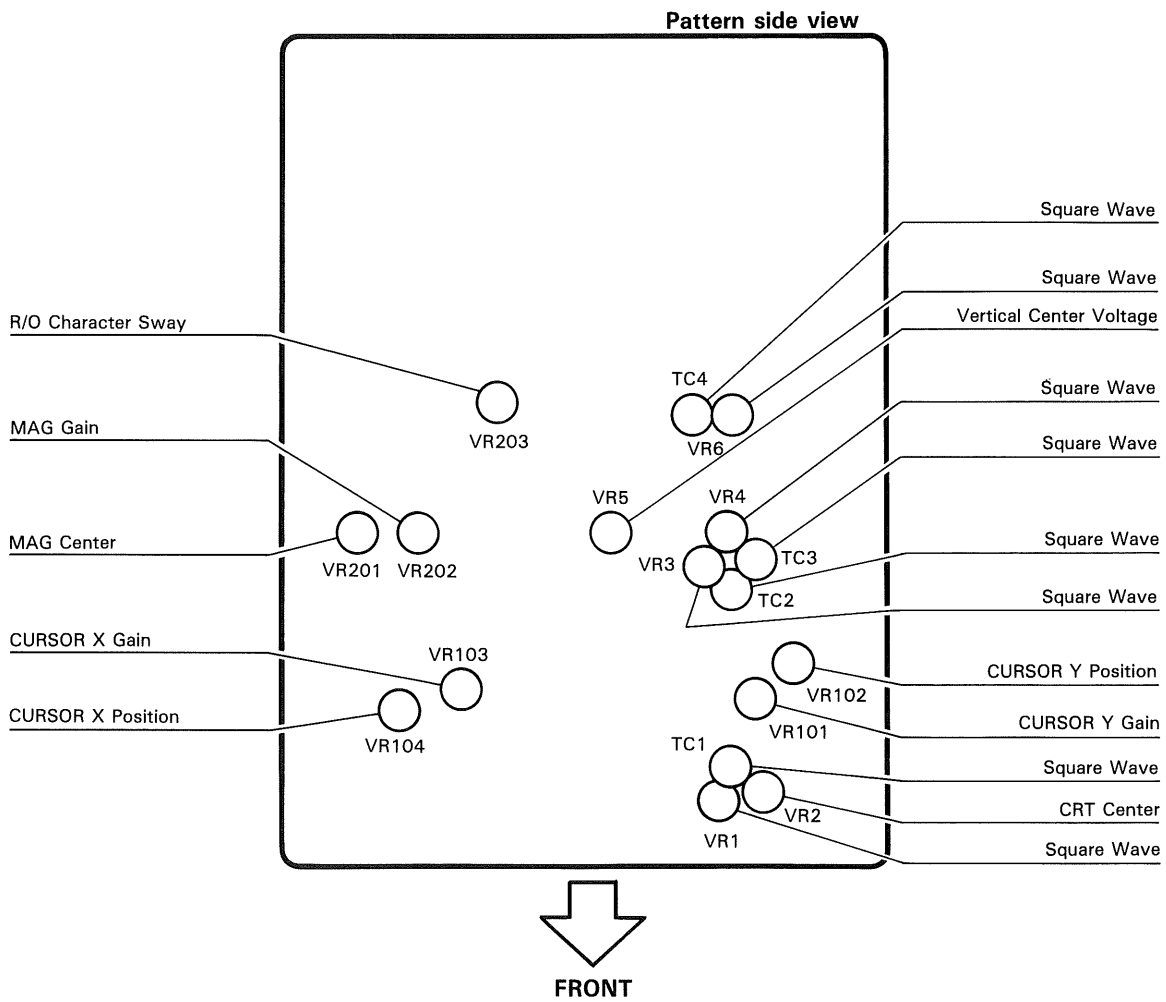
ADJUSTMENT

VERTICAL UNIT (X73-1830-00)



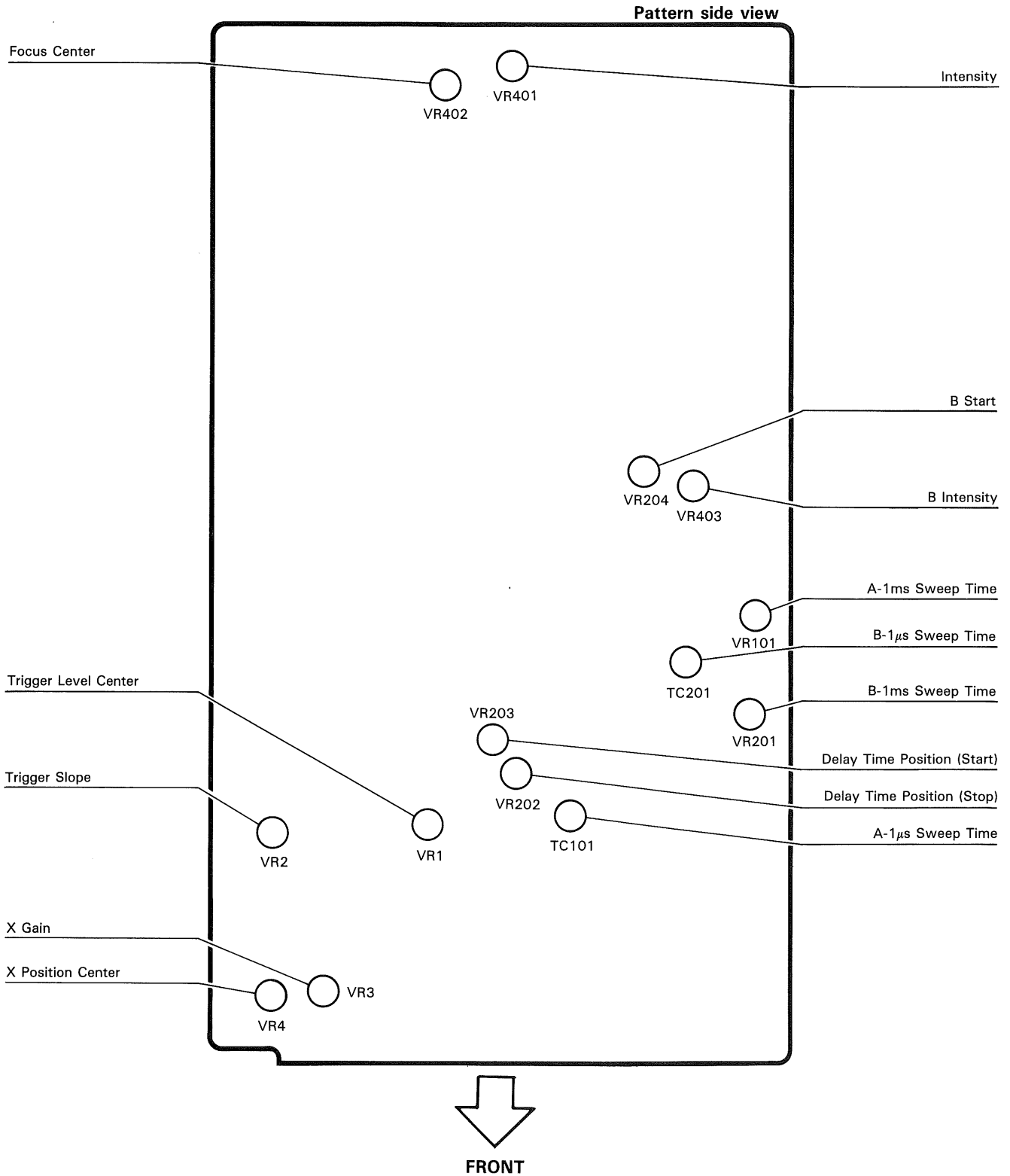
ADJUSTMENT

VERTICAL FINAL UNIT (X73-1840-00)



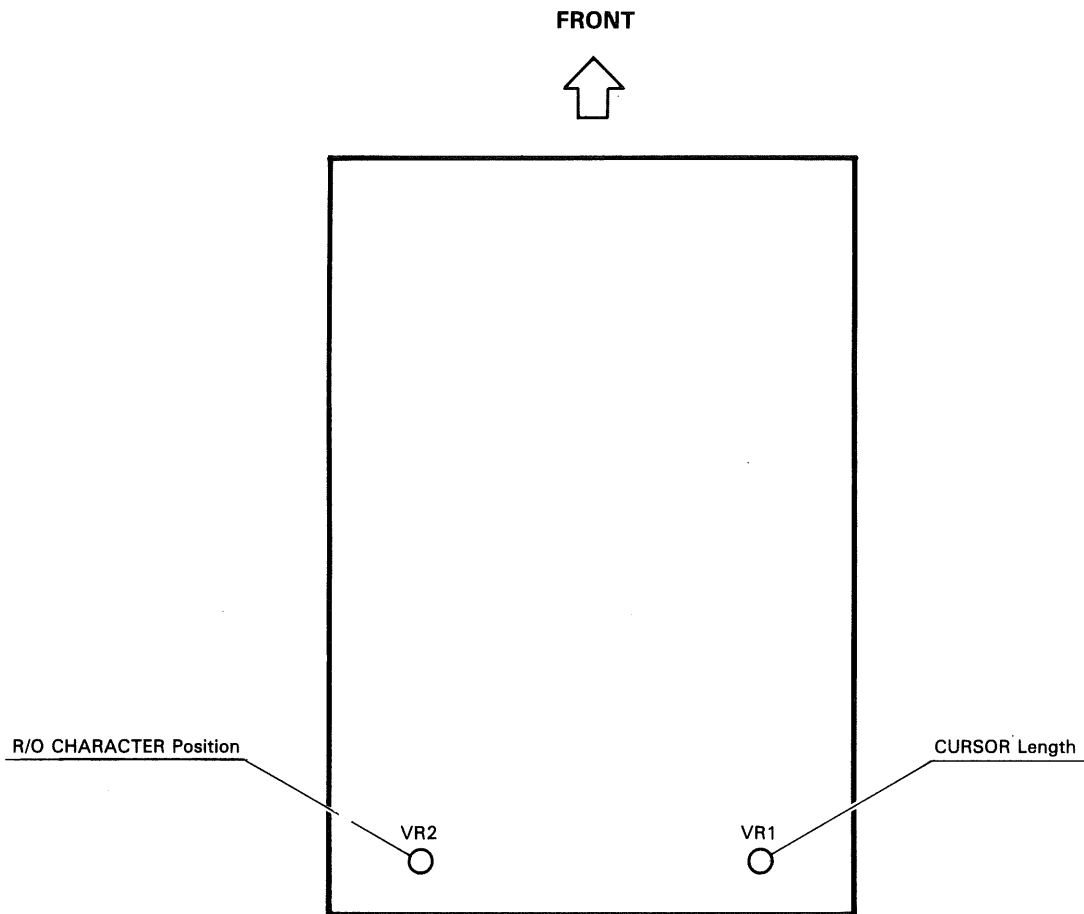
ADJUSTMENT

HORIZONTAL UNIT (X74-1500-00)



ADJUSTMENT

R/O UNIT (X77-1510-01)



TROUBLESHOOTING

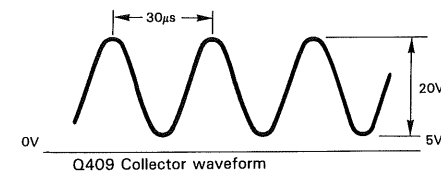
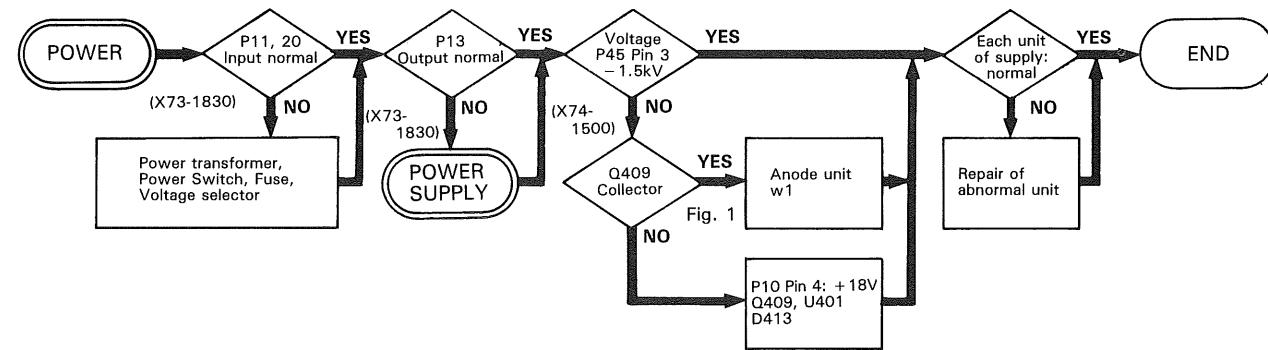
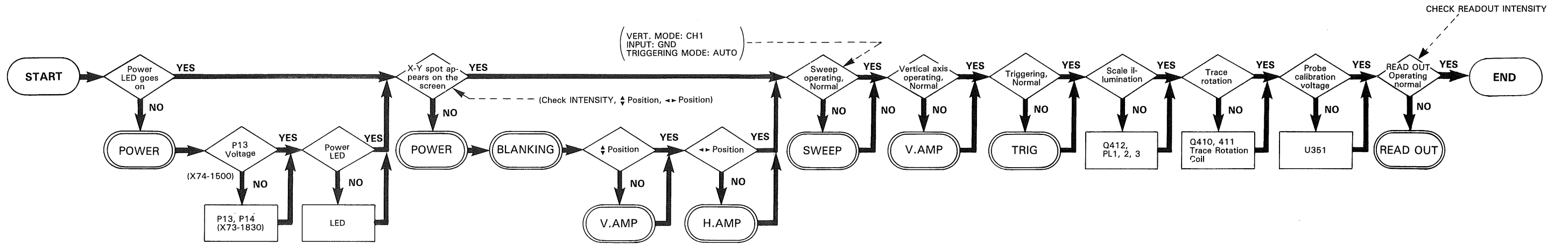


Fig. 1

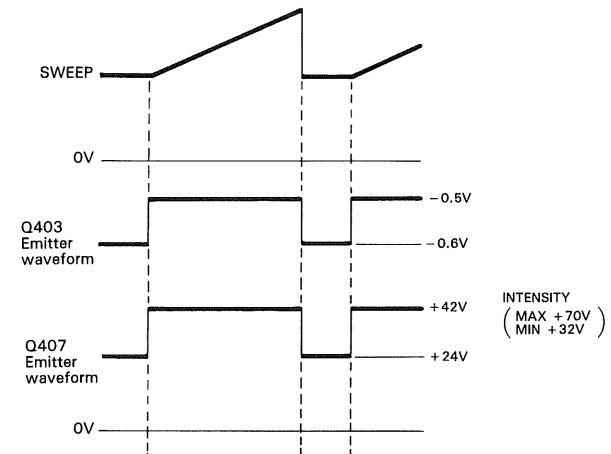
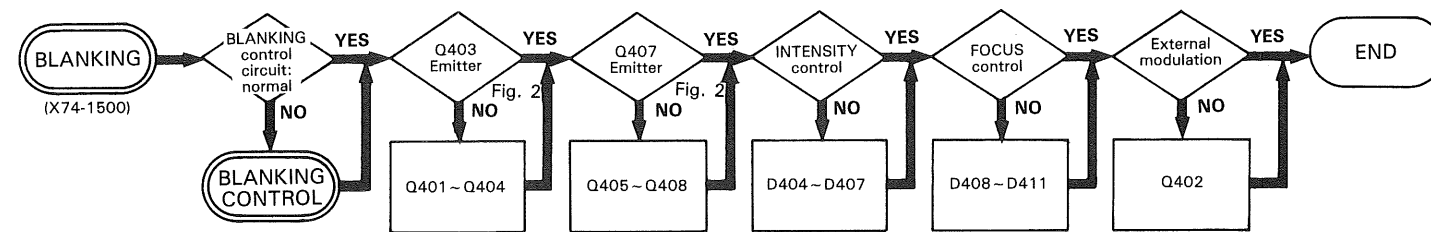
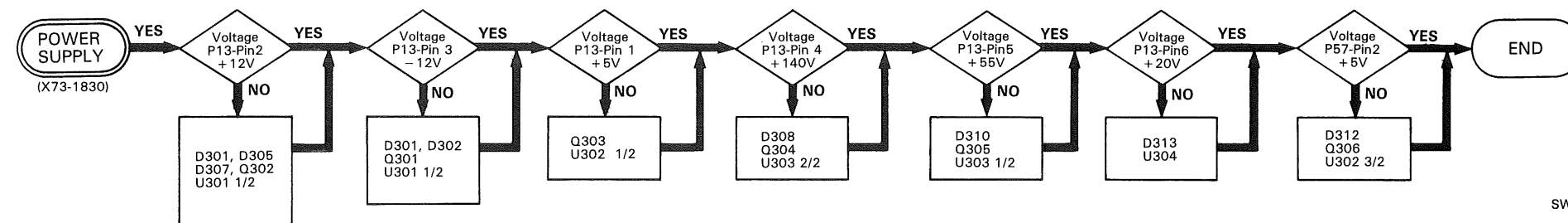
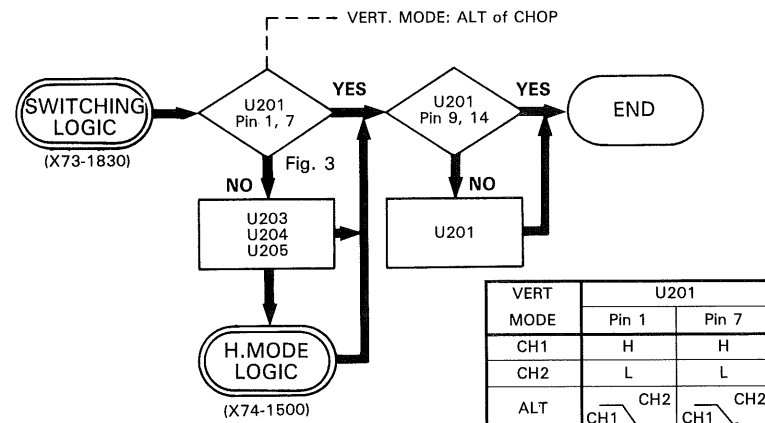
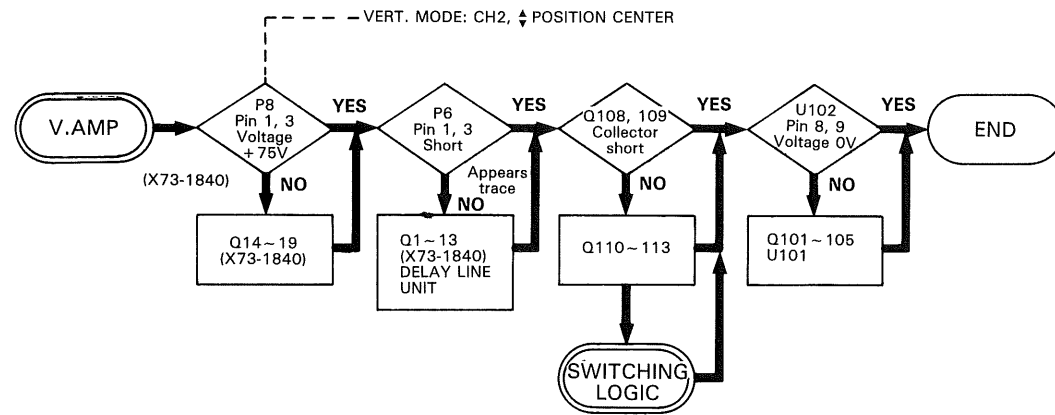
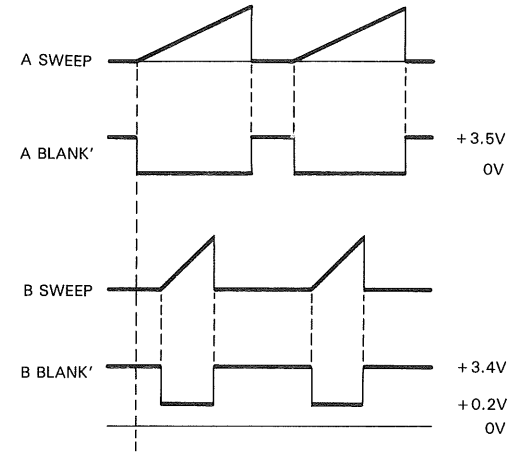
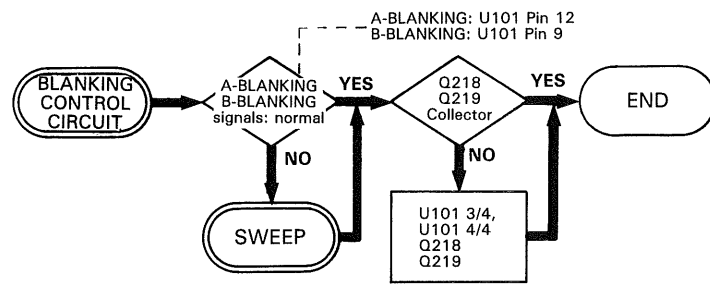


Fig. 2

TROUBLESHOOTING



VERT MODE	U201	
	Pin 1	Pin 7
CH1	H	H
CH2	L	L
ALT	CH1 CH2	CH1 CH2
CHOD	CH1 CH2	CH1 CH2
ADD	L	H

Fig. 3

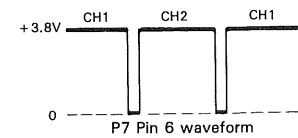
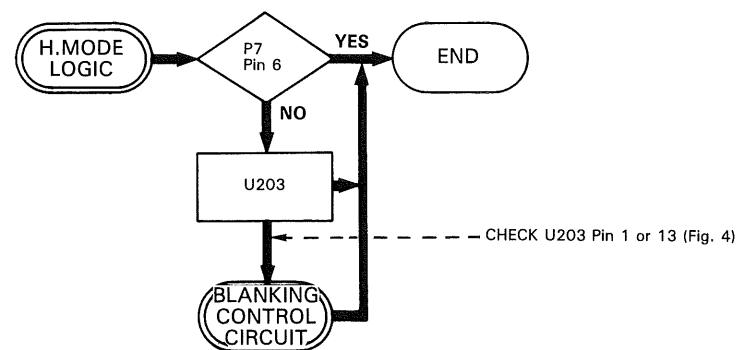


Fig. 4

TROUBLESHOOTING

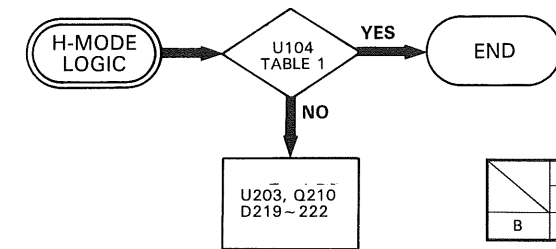
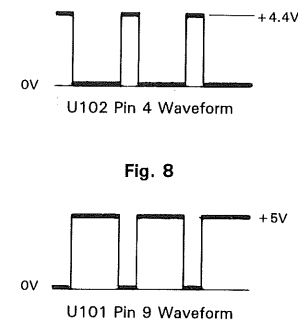
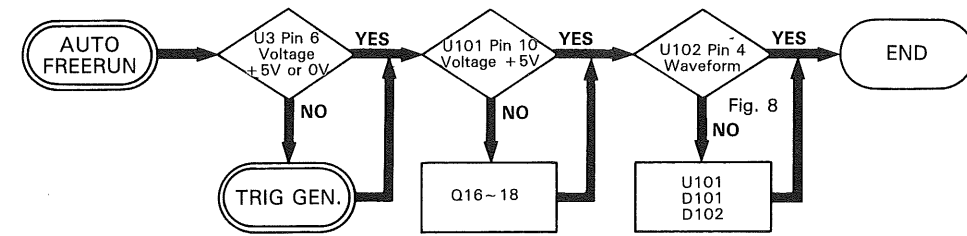
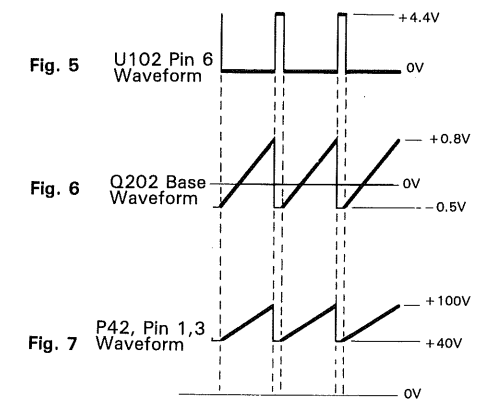
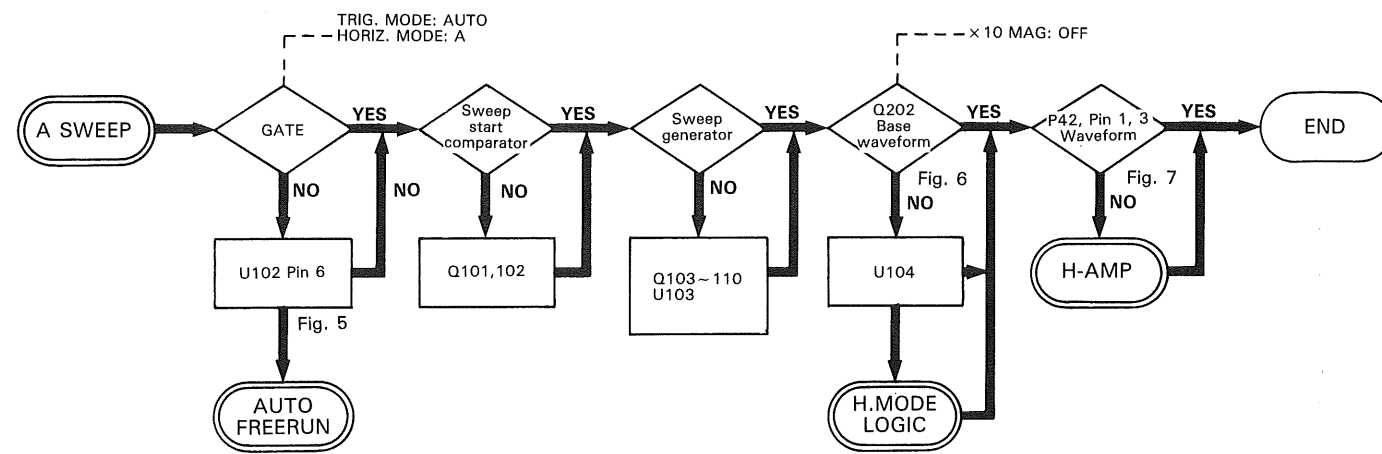
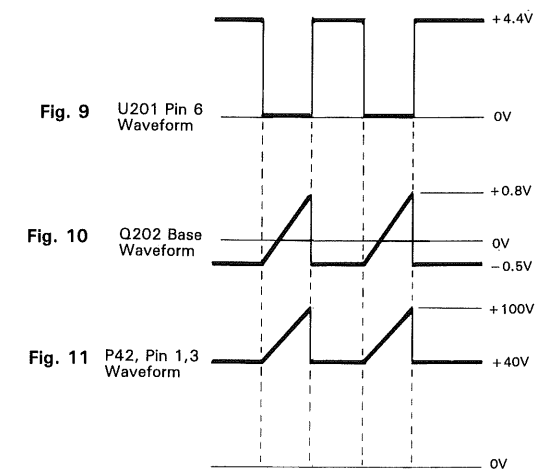
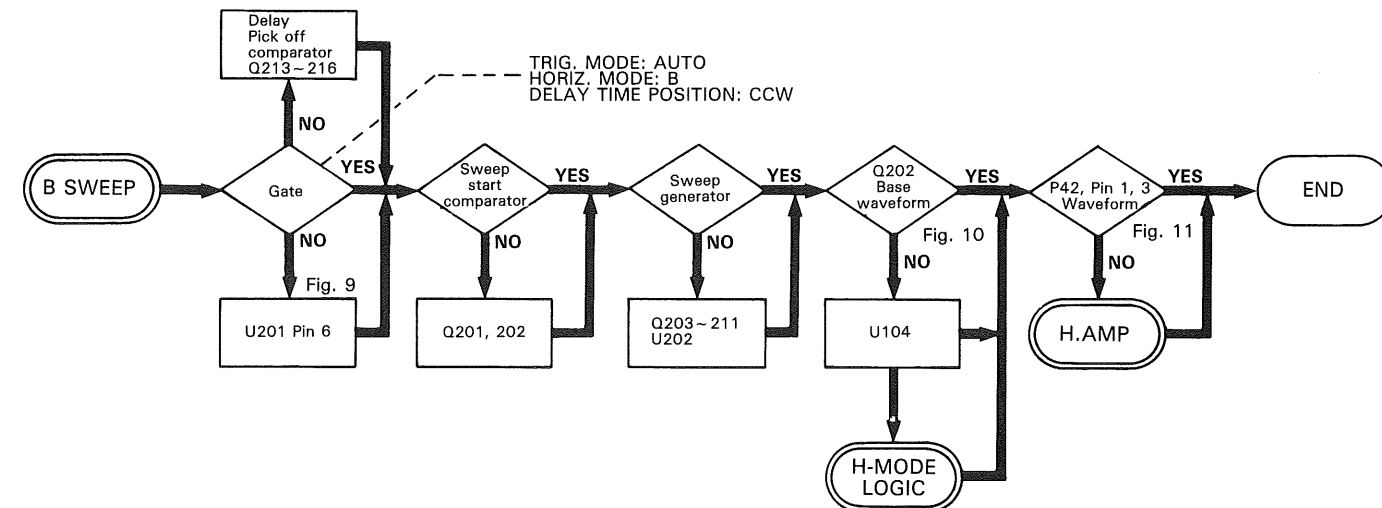


TABLE 1

U104				
	Pin 9	Pin 10	Pin 11	Pin 15
B	H	L	H	H



TROUBLESHOOTING

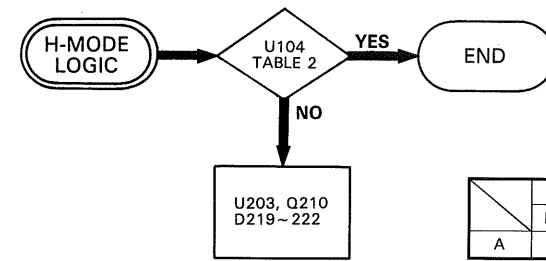
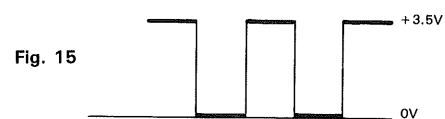
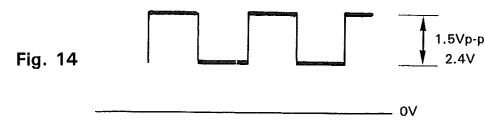
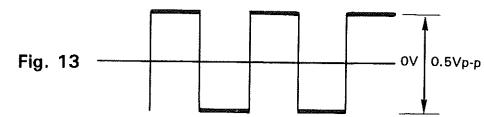
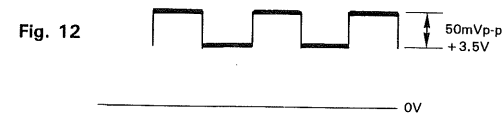
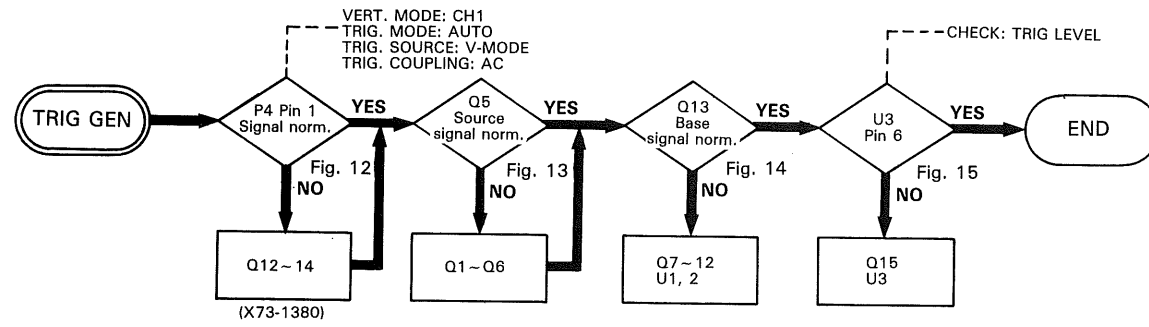
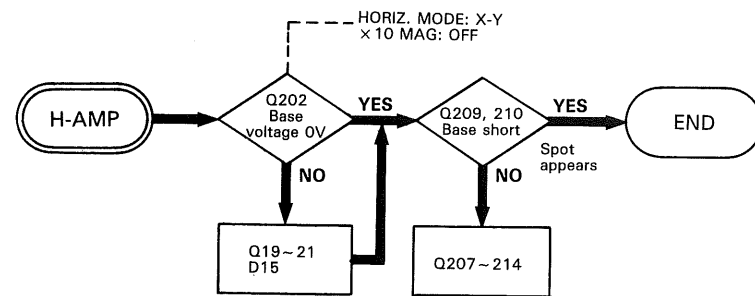


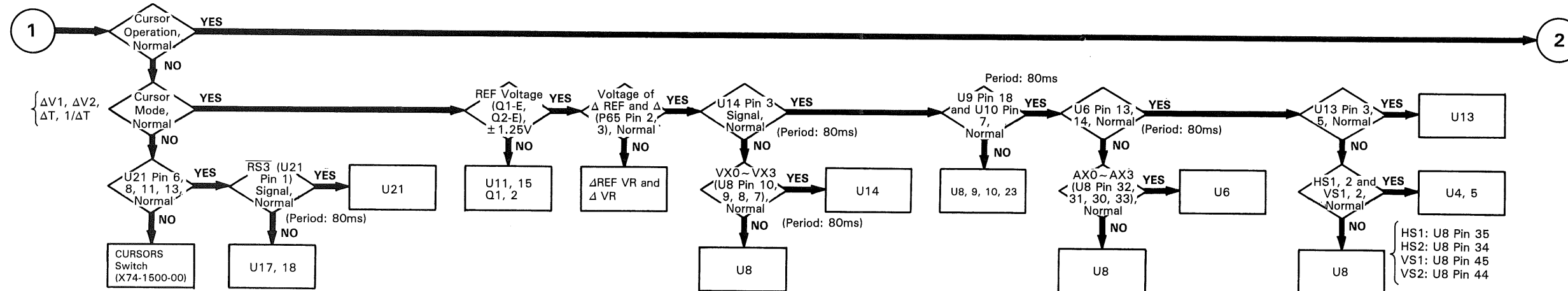
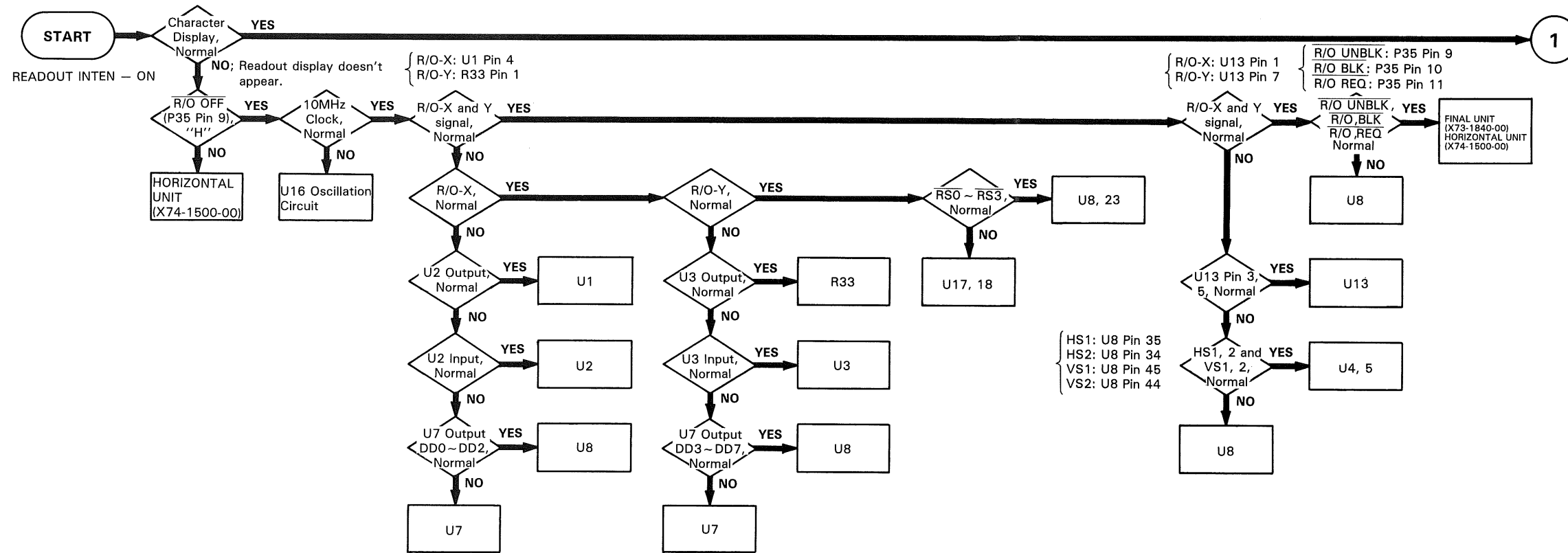
TABLE 2

U104				
	Pin 9	Pin 10	Pin 11	Pin 15
A	H	H	L	L

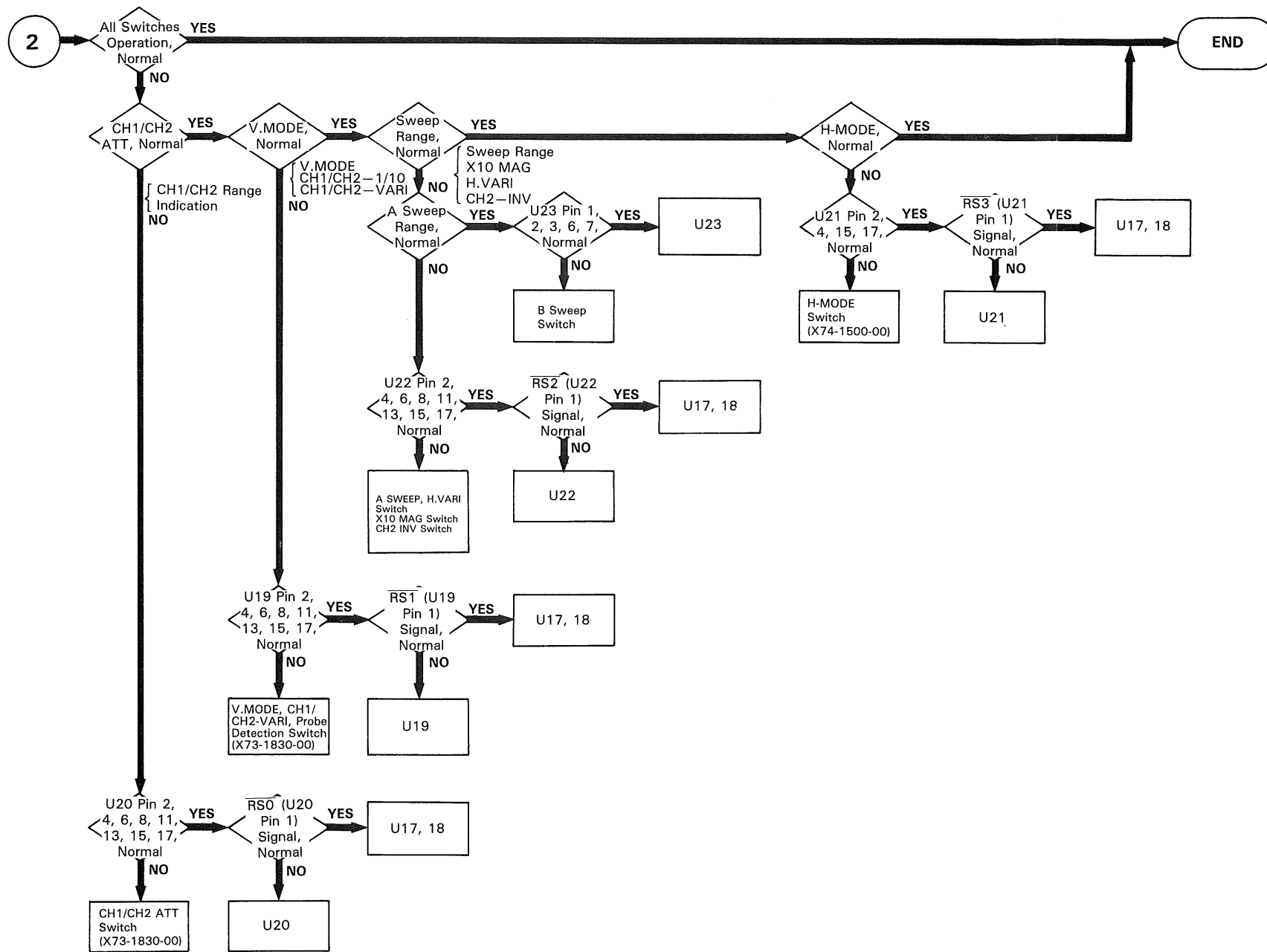


TROUBLESHOOTING

READOUT SECTION R/O UNIT (X77-1510-01)



TROUBLESHOOTING



TROUBLESHOOTING

READOUT SIGNAL TABLE

(1) CH1 (CH2) Vertical Attenuator

VOLTS/DIV	U20 Pin 13 (17) "ATT3"	U20 Pin 6 (2) "ATT2"	U20 Pin 11 (15) "ATT1"	U20 Pin 8 (4) "ATT0"	Display
1 mV	1	1	1	1	CH1 (CH2) 1 mV
2 mV	1	1	1	0	CH1 (CH2) 2 mV
5 mV	1	1	0	1	CH1 (CH2) 5 mV
10 mV	1	1	0	0	CH1 (CH2) 10 mV
20 mV	1	0	1	1	CH1 (CH2) 20 mV
50 mV	1	0	1	0	CH1 (CH2) 50 mV
0.1 V	1	0	0	1	CH1 (CH2) 0.1 V
0.2 V	1	0	0	0	CH1 (CH2) 0.2 V
0.5 V	0	1	1	1	CH1 (CH2) 0.5 V
1 V	0	1	1	0	CH1 (CH2) 1 V
2 V	0	1	0	1	CH1 (CH2) 2 V
5 V	0	1	0	0	CH1 (CH2) 5 V

(2) CH1 (CH2) Vertical Gain VARIABLE

V. VARIABLE	U19 Pin 8 (11) "CH1 (CH2)/VARI"	Display
CAL	1	Space
UNCAL	0	>

(7) Horizontal Magnification

Magnification (PULL × 10 MAG)	U22 Pin 15 "H-MAG"	Display
Normal	1	SWEEP TIME/DIV × 1 Indication
× 10 MAG	0	SWEEP TIME/DIV × 1/10 Indication

(8) Sweep Time VARIABLE

H.VARIABLE	U22 Pin 2 "H-VARI"	Display
CAL	1	Space
UNCAL	0	>

(9) Horizontal MODE

H.MODE	U21 Pin 4 "X-Y"	Display
Sweep	1	Space
X-Y	0	X-Y

(3) CH1 (CH2) Probe

Probe	U19 Pin 6 (13) "CH1 (CH2)/PROBE"	Display
1/1	1	VOLTS/DIV × 1 Indication
1/10	0	VOLTS/DIV × 10 Indication

(4) CH2 Polarity

Polarity (PULL INV)	U22 Pin 17 "CH2/INV"	Display
Normal	1	Space
Invert	0	↓

(10) Cursor MODE

CURSORS	U21 Pin 13 "CURSOR- MODE 3"	U21 Pin 6 "CURSOR- MODE 2"	U21 Pin 11 "CURSOR- MODE 1"	U21 Pin 8 "CURSOR- MODE 0"	Display
OFF	1	1	1	1	No Cursor Line
ΔV1	1	1	1	0	Two Horizontal Cursor Lines
ΔV2	1	1	0	1	Two Horizontal Cursor Lines
ΔT	1	0	1	1	Two Vertical Cursor Lines
1/ΔT	0	1	1	1	Two Vertical Cursor Lines

(5) Vertical MODE

MODE	U19 Pin 17 "V.MODE 3"	U19 Pin 2 "V.MODE 2"	U19 Pin 15 "V.MODE 1"	U19 Pin 4 "V.MODE 0"	Display
CH1	1	1	1	1	CH1
CH2	1	1	1	0	CH1 CH2
ATL	1	1	0	1	CH1 CH2
CHOP	1	0	1	1	CH1 CH2
ADD	0	1	1	1	CH1 + CH2

(6) A Sweep Range

SWEEP TIME/DIV	U22 Pin 4 "SWEEP 4"	U22 Pin 13 "SWEEP 3"	U22 Pin 6 "SWEEP 2"	U22 Pin 11 "SWEEP 1"	U22 Pin 8 "SWEEP 0"	Display
0.5 s	1	1	1	0	0	A: 0.5 s
0.2 s	1	1	0	1	1	A: 0.2 s
0.1 s	1	1	0	1	0	A: 0.1 s
50 ms	1	1	0	0	1	A: 50 ms
20 ms	1	1	0	0	0	A: 20 ms
10 ms	1	0	1	1	1	A: 10 ms
5 ms	1	0	1	1	0	A: 5 ms
2 ms	1	0	1	0	1	A: 2 ms
1 ms	1	0	1	0	0	A: 1 ms
0.5 ms	1	0	0	1	1	A: 0.5 ms
0.2 ms	1	0	0	1	0	A: 0.2 ms
0.1 ms	1	0	0	0	1	A: 0.1 ms
50 μs	1	0	0	0	0	A: 50 μs
20 μs	0	1	1	1	1	A: 20 μs
10 μs	0	1	1	1	0	A: 10 μs
5 μs	0	1	1	0	1	A: 5 μs
2 μs	0	1	1	0	0	A: 2 μs
1 μs	0	1	0	1	1	A: 1 μs
0.5 μs	0	1	0	1	0	A: 0.5 μs
0.2 μs	0	1	0	0	1	A: 0.2 μs
0.1 μs	0	1	0	0	0	A: 0.1 μs
50 ns	0	0	1	1	1	A: 50 ns

B Sweep Range

SWEEP TIME/DIV	U23 Pin 7 "SWEEP 4"	U23 Pin 6 "SWEEP 3"	U23 Pin 3 "SWEEP 2"	U23 Pin 2 "SWEEP 1"	U23 Pin 1 "SWEEP 0"	Display
50 ms	1	1	0	0	1	B: 50 ms
20 ms	1	1	0	0	0	B: 20 ms
10 ms	1	0	1	1	1	B: 10 ms
5 ms	1	0	1	1	0	B: 5 ms
2 ms	1	0	1	0	1	B: 2 ms
1 ms	1	0	1	0	0	B: 1 ms
0.5 ms	1	0	0	1	1	B: 0.5 ms
0.2 ms	1	0	0	1	0	B: 0.2 ms
0.1 ms	1	0	0	0	1	B: 0.1 ms
50 μs	1	0	0	0	0	B: 50 μs
20 μs	0	1	1	1	1	B: 20 μs
10 μs	0	1	1	1	0	B: 10 μs
5 μs	0	1	1	0	1	B: 5 μs
2 μs	0	1	1	1	0	B: 2 μs
1 μs	0	1	0	1	1	B: 1 μs
0.5 μs	0	1	0	1	0	B: 0.5 μs
0.2 μs	0	1	0	0	1	B: 0.2 μs
0.1 μs	0	1	0	0	0	B: 0.1 μs
50 ns	0	0	1	1	1	B: 50 ns

PARTS LIST

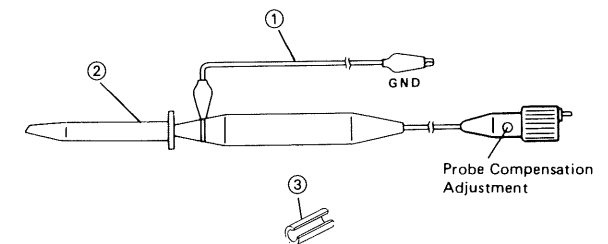
CS-5170 UNIT

(Y70-1670-00)

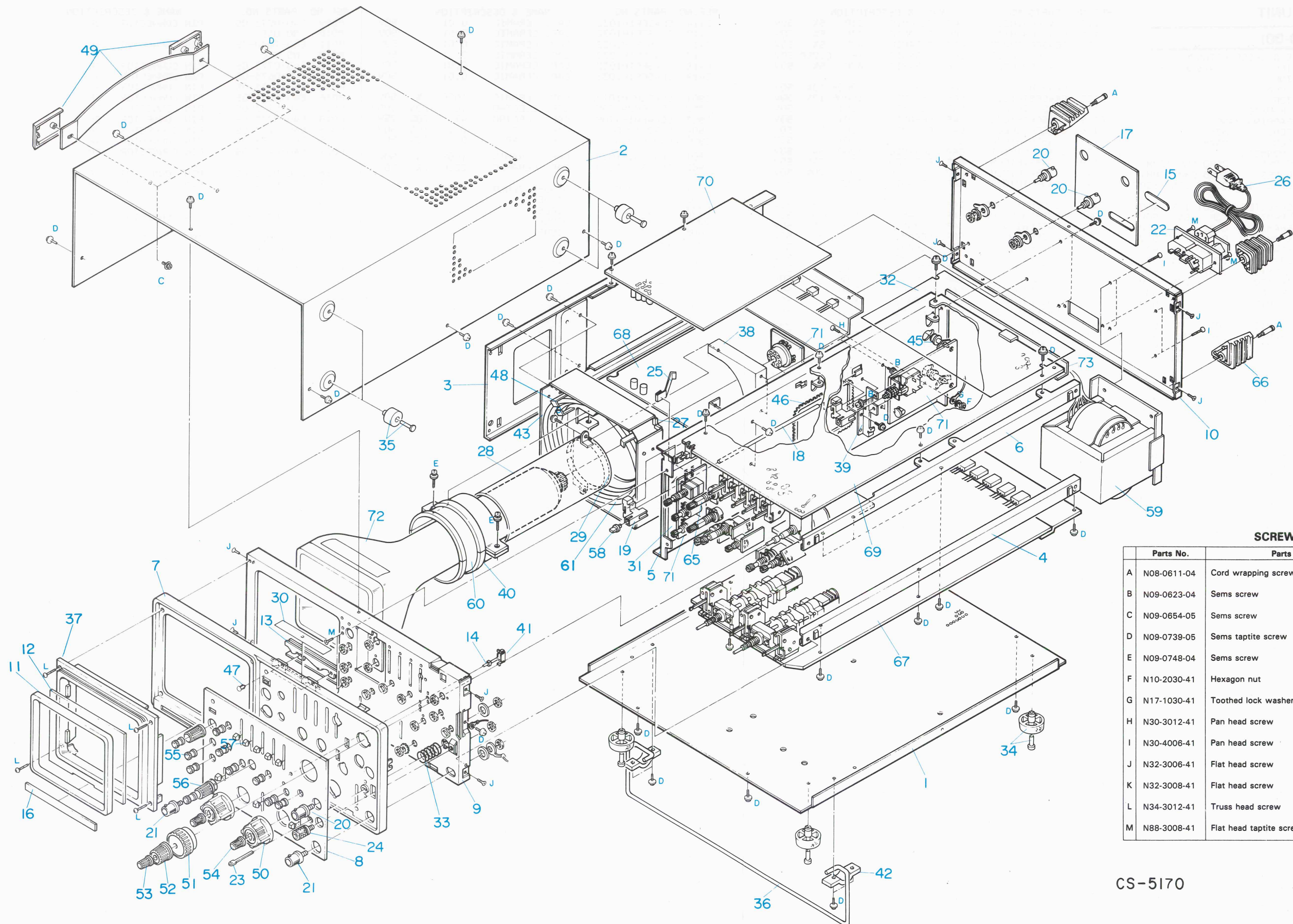
REF. NO	PARTS NO	NAME & DESCRIPTION
	B30-0952-05	LAMP (T4.2 8V 0.15A)
	B41-0710-04	CAUTION LABEL (HIGH VOLTAGE)
	B50-7687-00	INSTRUCTION MANUAL, JAPANESE
	B50-7688-00	INSTRUCTION MANUAL, ENGLISH
	CC45CH1H470J	CAP. CERAMIC 47P 5% 50V
	E23-0513-05	EARTH LUG, BNC
	E31-0564-05	WIRE ASS'Y (GND GREEN)
	E31-2861-05	WIRE ASS'Y (INLET-FILTER P69)
	E31-5501-05	WIRE ASS'Y (CH1 BNC P18)
	E31-5502-05	WIRE ASS'Y (CH1 OUT P1)
	E31-5506-05	WIRE ASS'Y (CH2 BNC P19)
	E31-5526-05	WIRE ASS'Y (Z AXIS P45)
	E31-5537-05	WIRE ASS'Y (CURSOR VR P65)
	E31-5644-05	WIRE ASS'Y (P30, 50, 52)
	E31-5678-05	WIRE ASS'Y (EXT P23)
	E31-5679-05	WIRE ASS'Y (CAL P9)
	E31-5680-05	WIRE ASS'Y (P26)
	E31-5681-05	WIRE ASS'Y (GND P63)
	E31-5685-05	WIRE ASS'Y (P56)
	E31-5686-05	WIRE ASS'Y (P60)
	E31-5687-05	WIRE ASS'Y (P61)
	E31-5688-05	WIRE ASS'Y
	E31-5691-05	WIRE ASS'Y
	E31-5696-05	WIRE ASS'Y (P4)
	F01-0868-03	HEAT SINK
	F05-1224-05	FUSE 1.2A (6X30MM) FOR 100/120V
	F05-6313-05	FUSE (5X20MM) 0.63AT
	F09-0510-04	EDGING
	H01-5904-04	CARTON BOX
	H10-2828-12	FOAMED STYRENE PAD (FRONT)
	H10-2829-12	FOAMED STYRENE PAD (REAR)
	H20-1727-04	VINYL COVER
	H25-0029-04	POLYETHYLENE BAG (FUSE)
	N19-0191-05	WASHER NONMETAL
	RD14BB2C470J	RES. CARBON 47 5% 1/6W
	RD14BB2E101J	RES. CARBON 100 5% 1/4W
	W03-2301-15	R/O PROBE, PC-31
	X81-2710-01	VR UNIT
C1	CC45CH1H101J	CAP. CERAMIC 100P 5% 50V
C2	CC45CH1H101J	CAP. CERAMIC 100P 5% 50V
C3	CK45F1H1032	CAP. CERAMIC 0.01 50V
C4	CK45F1H1032	CAP. CERAMIC 0.01 50V
0302	2S8834(Y)	TR. SI, PNP
0305	2SA1668	TR. SI, PNP
0306	2SD880(Y)	TR. SI, NPN
R1	RD14BB2E220J	RES. CARBON 22 5% 1/4W
R2	RD14BB2E220J	RES. CARBON 22 5% 1/4W
1	A01-1154-22	CASE (BOTTOM)
2	A01-1193-02	CASE (TOP)
3	A13-0914-02	FRAME (L)
4	A13-0917-02	FRAME (R. LOWER)
5	A13-0922-22	FRAME (CENTER)
6	A13-0923-02	FRAME (R. UPPER)
7	A20-2822-21	MOLDED PANEL
8	A21-1152-03	DECORATIVE PANEL
9	A22-0870-02	SUB PANEL
10	A23-1682-02	REAR PANEL
11	B07-0716-03	FILTER FRAME
12	B19-0749-04	FILTER
13	B30-0951-25	SCALE ILLUMI LAMP ASS'Y
14	B30-0957-05	LED (LN322GPT)
15	B40-2765-04	NAME PLATE (SERIAL NO)
16	B40-2923-03	NAME PLATE (MODEL NO)
17	B41-0808-04	CAUTION LABEL (MODEL)
18	D21-0915-04	EXTENSION SHAFT
19	D22-0501-04	JOINT & COUPLING
20	E04-0259-05	BNC RECEPTACLE
21	E04-0260-05	BNC RECEPTACLE (READOUT)
22A	E18-0365-05	AC SELECTOR WITH 6X30MM FUSE
22B	E18-0366-15	AC SELECTOR WITH 5X20MM FUSE
23	E21-0660-04	TERMINAL, CAL
24	E21-0667-05	METAL TERMINAL
25	E23-0552-04	EARTH TERMINAL
26A	E30-1818-05	JIS POWER CORD
26B	E30-1819-05	CEE POWER CORD
26C	E30-1820-05	UL/CSA POWER CORD
26D	E30-1821-05	SAA POWER CORD
26E	E30-1644-15	BS POWER CORD

REF. NO	PARTS NO	NAME & DESCRIPTION
27	F09-0512-04	EDGING
28	F11-1206-03	CRT SHIELD
29	F15-0733-04	FELT (CRT SHIELD)
30	F20-0658-04	INSULATED SHEET
31	F20-0667-04	INSULATED SHEET
32	F20-0685-14	INSULATED SHEET
33	G01-0909-04	COIL SPRING (CAL SHIELD)
34	J02-0089-05	RUBBER FOOT
35	J02-0512-05	FOOT (SMALL)
36	J02-0515-04	TILT STAND
37	J10-0418-12	BEZEL
38	J19-1651-04	BLACKET
39	J19-1652-04	BLACKET FOR P.C.B.
40	J19-1653-23	HOLDER FOR CRT
41	J19-1654-14	HOLDER FOR LED
42	J21-2573-04	HOLDER FOR LEG
43	J21-4594-23	BRACKET FOR CRT
45	J61-0516-05	SUPPORT
46	J42-0533-04	BUSHING (FREE)
47	J59-0403-05	NYLON RIVET (ILLUMI)
48	J61-0530-05	WIRE SADDLE
49	K01-0409-05	HANDLE
50	K21-0892-03	KNOB (VOLTS/DIV)
51	K21-0895-03	KNOB (A SWEEP)
52	K21-0896-03	KNOB (B SWEEP)
53	K21-0897-14	KNOB
54	K21-0899-04	KNOB
55	K23-0808-03	KNOB (10 USED)
56	K23-0809-03	KNOB
57	K27-0537-04	KNOB (FOR LEVER SWITCH)
58	K27-0538-04	KNOB (FOR PUSH SWITCH)
59	L01-9846-05	POWER TRANSFORMER
60	L39-0526-25	ROTATOR COIL
61	L76-0114-05	DELAY LINE
65	R29-1501-05	V.R. 1KB
66	W01-0503-04	REAR RUBBER FOOT/CORD WRAP
67	X73-1830-00	VERTICAL UNIT
68	X73-1840-00	FINAL UNIT
69	X74-1500-00	HORIZONTAL UNIT
70	X77-1510-01	R/O UNIT
71	X80-1060-04	LINE FILTER UNIT
72	150VTM31	CRT
73	A13-0942-13	FRAME

MODEL PC-31 (LOW CAPACITY PROBE)



ITEM	DESCRIPTION	PARTS NO.
①	Ground Wire Assembly	E30-1883-08
②	Retractable Hook Tip	E29-0540-08
③	Marker (Orange)	B42-1950-08



SCREWS

Parts No.	Parts Name	Figure
A N08-0611-04	Cord wrapping screw	
B N09-0623-04	Sems screw (M3 x 8)	
C N09-0654-05	Sems screw (M4 x 8)	
D N09-0739-05	Sems taptite screw (3 x 8)	
E N09-0748-04	Sems screw (M4 x 12)	
F N10-2030-41	Hexagon nut	
G N17-1030-41	Toothed lock washer	
H N30-3012-41	Pan head screw (M3 x 12)	
I N30-4006-41	Pan head screw (M4 x 6)	
J N32-3006-41	Flat head screw (M3 x 6)	
K N32-3008-41	Flat head screw (M3 x 8)	
L N34-3012-41	Truss head screw (M3 x 12)	
M N88-3008-41	Flat head taptite screw (3 x 8)	

CS-5170

PARTS LIST

VERTICAL UNIT

(X73-1830-00)

Table with 4 columns: REF.NO, PARTS NO, NAME & DESCRIPTION, and a multi-column list of values (e.g., 0.001 10% 400V). Rows include parts like F01-0863-03 HEAT SINK, C004 C91-1270-05 CAP. POLYESTER, and C104 C91-1270-05 CAP. POLYESTER.

Table with 4 columns: REF.NO, PARTS NO, NAME & DESCRIPTION, and a multi-column list of values. Rows include parts like C125 CC45FCH1H330J CAP. CERAMIC, C201 CC45FCH1H090D CAP. CERAMIC, and C401 CK45FF1H1032 CAP. CERAMIC.

Table with 4 columns: REF.NO, PARTS NO, NAME & DESCRIPTION, and a multi-column list of values. Rows include parts like C414 CK45FF1H1032 CAP. CERAMIC, D001 HZS6.8J(B2) DIODE, ZENER, and D301 S4VB40F1 DIODE, BRIDGE.

Table with 4 columns: REF.NO, PARTS NO, NAME & DESCRIPTION, and a multi-column list of values. Rows include parts like P009 E40-0273-05 PIN CONNECTOR, Q001 2SC1907 TR. SI, NPN, and R001 RD148B2C100J RES. CARBON.

PARTS LIST

PARTS LIST

REF.NO	PARTS NO	NAME & DESCRIPTION	REF.NO	PARTS NO	NAME & DESCRIPTION
R035	RD14BB2C470J	RES. CARBON 47 5% 1/6W	R139	RD14BB2C181J	RES. CARBON 180 5% 1/6W
R036	RD14BB2C470J	RES. CARBON 47 5% 1/6W	R140	RN14BK2E3300F	RES. METAL FILM 330 1% 1/4W
R037	RD14BB2C392J	RES. CARBON 3.9K 5% 1/6W	R141	RD14BB2C224J	RES. CARBON 220K 5% 1/6W
R038	RD14BB2C392J	RES. CARBON 3.9K 5% 1/6W	R142	RD14BB2C100J	RES. CARBON 10 5% 1/6W
R039	RD14BB2C181J	RES. CARBON 180 5% 1/6W	R143	RN14BK2E3300F	RES. METAL FILM 330 1% 1/4W
R040	RN14BK2C3300F	RES. METAL FILM 330 1% 1/6W	R144	RN14BK2E1200F	RES. METAL FILM 120 1% 1/4W
R041	RD14BB2C224J	RES. CARBON 220K 5% 1/6W	R145	RN14BK2E1200F	RES. METAL FILM 120 1% 1/4W
R042	RD14BB2C100J	RES. CARBON 10 5% 1/6W	R146	RD14BB2C392J	RES. CARBON 3.9K 5% 1/6W
R043	RN14BK2E3300F	RES. METAL FILM 330 1% 1/4W	R147	RD14BB2C392J	RES. CARBON 3.9K 5% 1/6W
R044	RN14BK2E1200F	RES. METAL FILM 120 1% 1/4W	R148	RD14BB2C681J	RES. CARBON 680 5% 1/6W
R045	RN14BK2E1200F	RES. METAL FILM 120 1% 1/4W	R149	RD14BB2C181J	RES. CARBON 180 5% 1/6W
R046	RD14BB2C392J	RES. CARBON 3.9K 5% 1/6W	R150	RD14BB2C181J	RES. CARBON 180 5% 1/6W
R047	RD14BB2C392J	RES. CARBON 3.9K 5% 1/6W	R151	RN14BK2C3300F	RES. METAL FILM 33.0 1% 1/6W
R048	RD14BB2C681J	RES. CARBON 680 5% 1/6W	R152	RN14BK2C3300F	RES. METAL FILM 33.0 1% 1/6W
R049	RD14BB2C181J	RES. CARBON 180 5% 1/6W	R153	RD14BB2C560J	RES. CARBON 56 5% 1/6W
R050	RD14BB2C181J	RES. CARBON 180 5% 1/6W	R154	RD14BB2C330J	RES. CARBON 33 5% 1/6W
R051	RN14BK2C3300F	RES. METAL FILM 33.0 1% 1/6W	R155	RN14BK2C3900F	RES. METAL FILM 390 1% 1/6W
R052	RN14BK2C3300F	RES. METAL FILM 33.0 1% 1/6W	R156	RN14BK2C3900F	RES. METAL FILM 390 1% 1/6W
R053	RD14BB2C560J	RES. CARBON 56 5% 1/6W	R157	RN14BK2C3300F	RES. METAL FILM 33.0 1% 1/6W
R054	RD14BB2C330J	RES. CARBON 33 5% 1/6W	R158	RN14BK2C3300F	RES. METAL FILM 33.0 1% 1/6W
R055	RN14BK2C3900F	RES. METAL FILM 390 1% 1/6W	R159	RN14BK2C1800F	RES. METAL FILM 180 1% 1/6W
R056	RN14BK2C3900F	RES. METAL FILM 390 1% 1/6W	R160	RN14BK2C3900F	RES. METAL FILM 390 1% 1/6W
R057	RN14BK2C3300F	RES. METAL FILM 33.0 1% 1/6W	R161	RN14BK2C3900F	RES. METAL FILM 390 1% 1/6W
R058	RN14BK2C3300F	RES. METAL FILM 33.0 1% 1/6W	R162	RD14BB2C470J	RES. CARBON 47 5% 1/6W
R059	RN14BK2C1800F	RES. METAL FILM 180 1% 1/6W	R163	RD14BB2C470J	RES. CARBON 47 5% 1/6W
R060	RN14BK2C3900F	RES. METAL FILM 390 1% 1/6W	R164	RN14BK2C1200F	RES. METAL FILM 120 1% 1/6W
R061	RN14BK2C3900F	RES. METAL FILM 390 1% 1/6W	R165	RD14BB2C122J	RES. CARBON 1.2K 5% 1/6W
R062	RD14BB2C470J	RES. CARBON 47 5% 1/6W	R166	RD14BB2C122J	RES. CARBON 1.2K 5% 1/6W
R063	RD14BB2C470J	RES. CARBON 47 5% 1/6W	R167	RD14BB2C181J	RES. CARBON 180 5% 1/6W
R064	RN14BK2C1200F	RES. METAL FILM 120 1% 1/6W	R168	RD14BB2C181J	RES. CARBON 180 5% 1/6W
R065	RD14BB2C122J	RES. CARBON 1.2K 5% 1/6W	R169	RN14BK2C1000F	RES. METAL FILM 100 1% 1/6W
R066	RD14BB2C122J	RES. CARBON 1.2K 5% 1/6W	R170	RD14BB2C822J	RES. CARBON 8.2K 5% 1/6W
R067	RD14BB2C181J	RES. CARBON 180 5% 1/6W	R171	RD14BB2C822J	RES. CARBON 8.2K 5% 1/6W
R068	RD14BB2C181J	RES. CARBON 180 5% 1/6W	R172	RD14BB2C330J	RES. CARBON 33 5% 1/6W
R069	RN14BK2C1000F	RES. METAL FILM 100 1% 1/6W	R173	RD14BB2C330J	RES. CARBON 33 5% 1/6W
R070	RD14BB2C822J	RES. CARBON 8.2K 5% 1/6W	R174	RD14BB2C330J	RES. CARBON 33 5% 1/6W
R071	RD14BB2C822J	RES. CARBON 8.2K 5% 1/6W	R175	RD14BB2C330J	RES. CARBON 33 5% 1/6W
R072	RD14BB2C330J	RES. CARBON 33 5% 1/6W	R176	RD14BB2C182J	RES. CARBON 1.8K 5% 1/6W
R073	RD14BB2C330J	RES. CARBON 33 5% 1/6W	R177	RD14BB2C182J	RES. CARBON 1.8K 5% 1/6W
R074	RD14BB2C221J	RES. CARBON 220 5% 1/6W	R178	RD14BB2C221J	RES. CARBON 220 5% 1/6W
R075	RD14BB2C561J	RES. CARBON 560 5% 1/6W	R179	RD14BB2C221J	RES. CARBON 220 5% 1/6W
R076	RD14BB2C332J	RES. CARBON 3.3K 5% 1/6W	R180	RD14BB2C100J	RES. CARBON 10 5% 1/6W
R077	RD14BB2C682J	RES. CARBON 6.8K 5% 1/6W	R181	RD14BB2C100J	RES. CARBON 10 5% 1/6W
R078	RD14BB2C100J	RES. CARBON 10 5% 1/6W	R182	RD14BB2C470J	RES. CARBON 47 5% 1/6W
R079	RD14BB2C100J	RES. CARBON 10 5% 1/6W	R183	RD14BB2C122J	RES. CARBON 1.2K 5% 1/6W
R080	RD14BB2C470J	RES. CARBON 47 5% 1/6W	R184	RD14BB2C122J	RES. CARBON 1.2K 5% 1/6W
R081	RD14BB2C122J	RES. CARBON 1.2K 5% 1/6W	R185	RD14BB2C220J	RES. CARBON 22 5% 1/6W
R082	RD14BB2C122J	RES. CARBON 1.2K 5% 1/6W	R186	RD14BB2C392J	RES. CARBON 3.9K 5% 1/6W
R083	RD14BB2C220J	RES. CARBON 22 5% 1/6W	R187	RD14BB2C682J	RES. CARBON 6.8K 5% 1/6W
R084	RD14BB2C392J	RES. CARBON 3.9K 5% 1/6W	R188	RN14BK2C3300F	RES. METAL FILM 330 1% 1/6W
R085	RD14BB2C682J	RES. CARBON 6.8K 5% 1/6W	R189	RD14BB2C562J	RES. CARBON 5.6K 5% 1/6W
R086	RD14BB2C101J	RES. CARBON 100 5% 1/6W	R190	RD14BB2C100J	RES. CARBON 10 5% 1/6W
R087	RD14BB2E102J	RES. CARBON 1K 5% 1/4W	R201	RD14BB2C391J	RES. CARBON 390 5% 1/6W
R088	RD14BB2C472J	RES. CARBON 4.7K 5% 1/6W	R202	RD14BB2C391J	RES. CARBON 390 5% 1/6W
R089	RD14BB2C112J	RES. CARBON 1.1K 5% 1/6W	R203	RN14BK2C3300F	RES. METAL FILM 330 1% 1/6W
R090	RD14BB2C101J	RES. CARBON 100 5% 1/6W	R204	RN14BK2C3300F	RES. METAL FILM 330 1% 1/6W
R091	RD14BB2C360J	RES. CARBON 36 5% 1/6W	R207	RD14BB2C682J	RES. CARBON 6.8K 5% 1/6W
R092	RD14BB2C330J	RES. CARBON 33 5% 1/6W	R208	RD14BB2C682J	RES. CARBON 6.8K 5% 1/6W
R093	RD14BB2C100J	RES. CARBON 10 5% 1/6W	R209	RD14BB2C821J	RES. CARBON 820 5% 1/6W
R094	RD14BB2E562J	RES. CARBON 5.6K 5% 1/4W	R210	RD14BB2C821J	RES. CARBON 820 5% 1/6W
R101	RD14BB2C100J	RES. CARBON 10 5% 1/6W	R211	RD14BB2C820J	RES. CARBON 82 5% 1/6W
R102	RD14BB2C105J	RES. CARBON 1M 5% 1/6W	R212	RD14BB2C820J	RES. CARBON 82 5% 1/6W
R113	RN14BK2E1004F	RES. METAL FILM 1M 1% 1/4W	R213	RD14BB2C100J	RES. CARBON 10 5% 1/6W
R114	RD14BB2E824J	RES. CARBON 820K 5% 1/4W	R214	RD14BB2C103J	RES. CARBON 10K 5% 1/6W
R115	RD14BB2C102J	RES. CARBON 1K 5% 1/6W	R215	RD14BB2C103J	RES. CARBON 10K 5% 1/6W
R116	RD14BB2C681J	RES. CARBON 680 5% 1/6W	R216	RD14BB2C103J	RES. CARBON 10K 5% 1/6W
R117	RD14BB2C274J	RES. CARBON 270K 5% 1/6W	R217	RD14BB2E103J	RES. CARBON 10K 5% 1/4W
R118	RD14BB2C101J	RES. CARBON 100 5% 1/6W	R218	RD14BB2E103J	RES. CARBON 10K 5% 1/4W
R119	RD14BB2C561J	RES. CARBON 560 5% 1/6W	R219	RD14BB2E103J	RES. CARBON 10K 5% 1/4W
R120	RD14BB2C392J	RES. CARBON 3.9K 5% 1/6W	R220	R90-0645-05	RES. NETWORK 4X10K 5%
R121	RD14BB2C822J	RES. CARBON 8.2K 5% 1/6W	R221	RD14BB2C102J	RES. CARBON 1K 5% 1/6W
R122	RD14BB2C680J	RES. CARBON 68 5% 1/6W	R222	RD14BB2C103J	RES. CARBON 10K 5% 1/6W
R123	RD14BB2C562J	RES. CARBON 5.6K 5% 1/6W	R223	RD14BB2C102J	RES. CARBON 1K 5% 1/6W
R124	RD14BB2E100J	RES. CARBON 10 5% 1/4W	R224	RD14BB2C102J	RES. CARBON 1K 5% 1/6W
R125	RD14BB2C391J	RES. CARBON 390 5% 1/6W	R225	RD14BB2E101J	RES. CARBON 100 5% 1/4W
R126	RD14BB2C122J	RES. CARBON 1.2K 5% 1/6W	R226	RD14BB2E101J	RES. CARBON 100 5% 1/4W
R127	RD14BB2E100J	RES. CARBON 10 5% 1/4W	R227	RD14BB2C100J	RES. CARBON 10 5% 1/6W
R135	RD14BB2C470J	RES. CARBON 47 5% 1/6W	R228	RD14BB2C100J	RES. CARBON 10 5% 1/6W
R136	RD14BB2C470J	RES. CARBON 47 5% 1/6W	R229	RD14BB2C100J	RES. CARBON 10 5% 1/6W
R137	RD14BB2C392J	RES. CARBON 3.9K 5% 1/6W	R230	RD14BB2C681J	RES. CARBON 680 5% 1/6W
R138	RD14BB2C392J	RES. CARBON 3.9K 5% 1/6W	R231	RD14BB2C681J	RES. CARBON 680 5% 1/6W
			R232	RD14BB2E100J	RES. CARBON 10 5% 1/4W

PARTS LIST

REF.NO	PARTS NO	NAME & DESCRIPTION
R301	RS14GB3D2R2J	RES. METAL FILM 2.2 5% 2W
R302	RD14BB2E101J	RES. CARBON 100 5% 1/4W
R303	RS14GB3D470J	RES. METAL FILM 47 5% 2W
R304	RN14BK2C1202F	RES. METAL FILM 12K 1% 1/6W
R305	RN14BK2C1202F	RES. METAL FILM 12K 1% 1/6W
R306	RS14GB3D010J	RES. METAL FILM 1 5% 2W
R307	RS14GB3F270J	RES. METAL FILM 27 5% 3W
R308	RN14BK2C5601F	RES. METAL FILM 5.6K 1% 1/6W
R309	RN14BK2C5601F	RES. METAL FILM 5.6K 1% 1/6W
R310	RN14BK2C5601F	RES. METAL FILM 5.6K 1% 1/6W
R311	RS14GB3D220J	RES. METAL FILM 22 5% 2W
R312	RN14BK2C3901F	RES. METAL FILM 3.9K 1% 1/6W
R313	RN14BK2C9101F	RES. METAL FILM 9.1K 1% 1/6W
R314	RS14GB3A270J	RES. METAL FILM 27 5% 1W
R315	RS14GB3D272J	RES. METAL FILM 2.7K 5% 2W
R316	NO USE	
R317	RD14BB2E4R7J	RES. CARBON 4.7 5% 1/4W
R318	RD14BB2C101J	RES. CARBON 100 5% 1/6W
R319	RD14BB2C561J	RES. CARBON 560 5% 1/6W
R320	RN14BK2C1153F	RES. METAL FILM 115K 1% 1/6W
R321	RN14BK2E1002F	RES. METAL FILM 10K 1% 1/4W
R322	RS14GB3A270J	RES. METAL FILM 27 5% 1W
R323	RS14GB3A472J	RES. METAL FILM 4.7K 5% 1W
R324	RD14BB2C4R7J	RES. CARBON 4.7 5% 1/6W
R325	RD14BB2C101J	RES. CARBON 100 5% 1/6W
R326	RD14BB2E221J	RES. CARBON 220 5% 1/4W
R327	RN14BK2C5602F	RES. METAL FILM 56K 1% 1/6W
R328	RD14BB2C561J	RES. CARBON 560 5% 1/6W
R334	RN14BK2C1152F	
R335	RD14BB2C561J	RES. CARBON 560 5% 1/6W
R336	RS14GB3D010J	RES. METAL FILM 1 5% 2W
R337	RS14GB3D330J	RES. METAL FILM 33 5% 2W
R338	RN14BK2C3741F	RES. METAL FILM 3.74K 1% 1/6W
R339	RN14BK2E9101F	RES. METAL FILM 9.1K 1% 1/4W
R340	RD14BB2E225J	RES. CARBON 2.2M 5% 1/4W
R341	RD14BB2C104J	RES. CARBON 100K 5% 1/6W
R351	RD14BB2C184J	RES. CARBON 180K 5% 1/6W
R352	RD14BB2C103J	RES. CARBON 10K 5% 1/6W
R353	RD14BB2C103J	RES. CARBON 10K 5% 1/6W
R354	RD14BB2C104J	RES. CARBON 100K 5% 1/6W
R355	RD14BB2C104J	RES. CARBON 100K 5% 1/6W
R356	RD14BB2C224J	RES. CARBON 220K 5% 1/6W
R357	RD14BB2C474J	RES. CARBON 470K 5% 1/6W
R358	RD14BB2C474J	RES. CARBON 470K 5% 1/6W
R359	RD14BB2C471J	RES. CARBON 470 5% 1/6W
R360	RN14BK2C1102F	RES. METAL FILM 11K 1% 1/6W
R361	RN14BK2C7500F	RES. METAL FILM 750 1% 1/6W
R362	NO USE	
R363	RD14BB2C100J	RES. CARBON 10 5% 1/6W
R401	R90-0642-05	RES. NETWORK 6X100K
R402	R90-0643-05	RES. NETWORK 7X100K
R403	R90-0667-05	RES. NETWORK 4X4.7K
R801	RD14BB2C101J	RES. CARBON 100 5% 1/6W
R802	RD14BB2C390J	RES. CARBON 39 5% 1/6W
R803	RD14BB2E331J	RES. CARBON 330 5% 1/4W
R804	RD14BB2C470J	RES. CARBON 47 5% 1/6W
R805	RD14BB2C470J	RES. CARBON 47 5% 1/6W
R806	RD14BB2C331J	RES. CARBON 330 5% 1/6W
R807	RD14BB2E910J	RES. CARBON 91 5% 1/4W
R808	RD14BB2E910J	RES. CARBON 91 5% 1/4W
R901	RD14BB2C104J	RES. CARBON 100K 5% 1/6W
S001	S32-4007-05	LEVER SWITCH 4-3
S002	S02-4513-05	
S101	S32-4007-05	LEVER SWITCH 4-3
S102	S02-4513-05	
S201	S32-4008-05	LEVER SWITCH 4-5
TC005	C05-0453-05	CAP. TRIMMER 10P
TC006	C05-0453-05	CAP. TRIMMER 10P
TC007	C05-0456-05	CAP. TRIMMER 60PF
TC008	C05-0456-05	CAP. TRIMMER 60PF
TC105	C05-0453-05	CAP. TRIMMER 10P
TC106	C05-0453-05	CAP. TRIMMER 10P
TC107	C05-0456-05	CAP. TRIMMER 60PF
TC108	C05-0456-05	CAP. TRIMMER 60PF

REF.NO	PARTS NO	NAME & DESCRIPTION
TH001	SDT100	THERMISTOR
TH002	111-400-3	THERMISTOR
TH101	SDT100	THERMISTOR
TH102	111-400-3	THERMISTOR
U001	LF411CN	IC, DUAL JFET INPUT OP AMP
U002	CA3127E	IC. TR. ARRY N-P-N
U101	LF411CN	IC, DUAL JFET INPUT OP AMP
U102	CA3127E	IC. TR. ARRY N-P-N
U201	SN74LS47N	IC. DECODER/DRIVER
U202	SN74LS00N	IC, QUAD 2-INPUT NAND GATE
U203	SN74LS00N	IC, QUAD 2-INPUT NAND GATE
U204	SN74LS112AN	IC, DUAL JK-FF
U205	SN74LS00N	IC, QUAD 2-INPUT NAND GATE
U301	NJM4558D	IC, DUAL OP AMP
U302	NJM4558D	IC, DUAL OP AMP
U303	NJM4558D	IC, DUAL OP AMP
U304	78020AP	
U351	TC4011BP	IC, QUAD 2-INPUT NAND GATE
VR001	R12-4516-05	RES. SEMI FIXED 50K B
VR002	R12-3550-05	RES. SEMI FIXED 20K B
VR003	R12-0577-05	RES. SEMI FIXED 500 B
VR004	R12-0575-05	RES. SEMI FIXED 100 B
VR005	R12-1546-05	RES. SEMI FIXED 2K B
VR006	NO USE	
VR007	R12-3550-05	RES. SEMI FIXED 20K B
VR008	R12-0576-05	RES. SEMI FIXED 200 B
VR009	R12-0577-05	RES. SEMI FIXED 500 B
VR010	R12-1545-05	RES. SEMI FIXED 1K B
VR011	R12-1545-05	RES. SEMI FIXED 1K B
VR101	R12-4516-05	RES. SEMI FIXED 50K B
VR102	R12-3550-05	RES. SEMI FIXED 20K B
VR103	R12-0577-05	RES. SEMI FIXED 500 B
VR104	R12-0575-05	RES. SEMI FIXED 100 B
VR105	R12-1546-05	RES. SEMI FIXED 2K B
VR106	NO USE	
VR107	R12-3550-05	RES. SEMI FIXED 20K B
VR108	R12-0576-05	RES. SEMI FIXED 200 B
VR109	R12-0577-05	RES. SEMI FIXED 500 B
VR110	R12-1545-05	RES. SEMI FIXED 1K B
VR111	R12-1545-05	RES. SEMI FIXED 1K B
VR201	R12-0575-05	RES. SEMI FIXED 100 B
VR301	R12-1545-05	RES. SEMI FIXED 1K B
VR351	R12-0577-05	RES. SEMI FIXED 500 B

PARTS LIST

VERTICAL FINAL UNIT

(X73-1840-00)

REF.NO	PARTS NO	NAME & DESCRIPTION
	F02-0511-05	HEAT SINK(Q13,14)
	J25-5347-13	PCB (UNMOUNTED)
	J30-0605-05	SPACER
	L92-0110-05	FERRITE BEADS
	R92-1061-05	JUMPING RES. ZERO OHM (5MM)
C002	CC45CH1H271J	CAP. CERAMIC 270P 5% 50V
C003	CK45FB1H222K	CAP. CERAMIC 2200P 10% 50V
C004	CQ92FM1H104K	CAP. MYLAR 0.1 10% 50V
C005	C91-1275-05	CAP. ELECTRO 0.033F 5.5V
C006	C91-1275-05	CAP. ELECTRO 0.033F 5.5V
C007	NO USE	
C008	CK45FF1H103Z	CAP. CERAMIC 0.01 50V
C009	NO USE	
C010	CE04HW1C100M	CAP. ELECTRO 10 20% 16V
C011	CK45FF1H103Z	CAP. CERAMIC 0.01 50V
C012	CK45FF1H103Z	CAP. CERAMIC 0.01 50V
C013	CK45FF1H103Z	CAP. CERAMIC 0.01 50V
C014	CK45FF1H103Z	CAP. CERAMIC 0.01 50V
C015	CK45FF1H103Z	CAP. CERAMIC 0.01 50V
C016	C91-0753-05	CAP. CERAMIC 470P 10% 50V
C017	CK45FB1H102K	CAP. CERAMIC 1000P 10% 50V
C018	CQ92FM1H473K	CAP. MYLAR 0.047 10% 50V
C019	C91-0769-05	CAP. AXIAL 0.01 20% 16V
C020	C91-0769-05	CAP. AXIAL 0.01 20% 16V
C021	CK45B2H103K	CAP. CERAMIC 0.01 10% 500V
C022	CK45B2H103K	CAP. CERAMIC 0.01 10% 500V
C023	CQ92FM1H104K	CAP. MYLAR 0.1 10% 50V
C024	CE04EW1E470M	CAP. ELECTRO 47 20% 25V
C025	CQ92FM1H104K	CAP. MYLAR 0.1 10% 50V
C026	CE04EW1E470M	CAP. ELECTRO 47 20% 25V
C027	CQ92FM1H104K	CAP. MYLAR 0.1 10% 50V
C028	CE04EW1E470M	CAP. ELECTRO 47 20% 25V
C029	CK45B2H103K	CAP. CERAMIC 0.01 10% 500V
C030	CK45B2H103K	CAP. CERAMIC 0.01 10% 500V
C031	CK45B2H103K	CAP. CERAMIC 0.01 10% 500V
C032	CQ92FM1H104K	CAP. MYLAR 0.1 10% 50V
C033	CE04EW1E470M	CAP. ELECTRO 47 20% 25V
C034	CK45FF1H103Z	CAP. CERAMIC 0.01 50V
C035	CK45FF1H103Z	CAP. CERAMIC 0.01 50V
C036	CE04W2C010M	CAP. ELECTRO 1 20% 160V
C101	CK45FF1H103Z	CAP. CERAMIC 0.01 50V
C102	CK45FF1H103Z	CAP. CERAMIC 0.01 50V
C103	NO USE	
C104	CK45FF1H103Z	CAP. CERAMIC 0.01 50V
C201	CE04EW1E100M	CAP. ELECTRO 10 20% 25V
C202	CK45FF1H103Z	CAP. CERAMIC 0.01 50V
C203	CK45FB1H102K	CAP. CERAMIC 1000P 10% 50V
C204	NO USE	
C205	CC45FCH1H680J	CAP. CERAMIC 68P 5% 50V
C206	CK45FF1H103Z	CAP. CERAMIC 0.01 50V
C207	CC45FCH1H330J	CAP. CERAMIC 33P 5% 50V
C208	CK45FF1H103Z	CAP. CERAMIC 0.01 50V
C209	CC45FCH1H330J	CAP. CERAMIC 33P 5% 50V
C210	CE04EW1E100M	CAP. ELECTRO 10 20% 25V
C211	CE04EW1E100M	CAP. ELECTRO 10 20% 25V
C212	CK45B2H103K	CAP. CERAMIC 0.01 10% 500V
C213	CK45B2H103K	CAP. CERAMIC 0.01 10% 500V
C214	C91-1269-05	CAP. POLYESTER 0.047 10% 250V
C215	C91-1269-05	CAP. POLYESTER 0.047 10% 250V
C216	CE04EW1E100M	CAP. ELECTRO 10 20% 25V
C217	CK45FF1H103Z	CAP. CERAMIC 0.01 50V
C218	CK45FF1H103Z	CAP. CERAMIC 0.01 50V
C219	CK45FF1H103Z	CAP. CERAMIC 0.01 50V
C801	CQ92M1H104K	CAP. MYLAR 0.1 10% 50V
D001	MA700	DIODE
D002	MA700	DIODE
D101	MA700	DIODE
D102	MA700	DIODE
D103	1S5132	DIODE
D104	1S5132	DIODE
D105	MA700	DIODE
D106	NO USE	
D107	1S5132	DIODE
D108	MA700	DIODE

REF.NO	PARTS NO	NAME & DESCRIPTION
D109	NO USE	
D110	1S5132	DIODE
D201	1S5132	DIODE
D202	MA700	DIODE
D203	MA700	DIODE
L001	L40-4701-03	FERRI INDUCTOR 47UH 10%
L002	L40-4701-03	FERRI INDUCTOR 47UH 10%
L003	L40-4701-03	FERRI INDUCTOR 47UH 10%
L004	L40-4701-03	FERRI INDUCTOR 47UH 10%
L005	L40-4701-03	FERRI INDUCTOR 47UH 10%
L006	L40-4701-03	FERRI INDUCTOR 47UH 10%
L007	L40-3381-70	FERRI INDUCTOR 0.33UH 10%
L008	L40-3381-70	FERRI INDUCTOR 0.33UH 10%
P006	E40-0373-05	PIN CONNECTOR 3P
P007	NO USE	
P008	E40-0373-05	PIN CONNECTOR 3P
P013	E40-0773-05	PIN CONNECTOR 7P
P029	E40-0873-05	PIN CONNECTOR 8P
P034	E23-0401-05	PIN TERMINAL
P035	E40-0373-05	PIN CONNECTOR 3P
P036	E40-0373-05	PIN CONNECTOR 3P
P048	E40-0473-05	PIN CONNECTOR 4P
P062	E40-0373-05	PIN CONNECTOR 3P
Q001	2SC2671(H)	TR. SI, NPN
Q002	2SC2671(H)	TR. SI, NPN
Q003	2SA1206(K)	TR. SI, PNP
Q004	2SA1206(K)	TR. SI, PNP
Q005	2SC2671(H)	TR. SI, NPN
Q006	2SC2671(H)	TR. SI, NPN
Q007	2SC2785(F)	TR. SI, NPN
Q008	2SA1206(K)	TR. SI, PNP
Q009	2SA1206(K)	TR. SI, PNP
Q012	2SC2671(H)	TR. SI, NPN
Q013	2SC2671(H)	TR. SI, NPN
Q014	2SC3779(D)	TR. SI, NPN
Q015	2SC3779(D)	TR. SI, NPN
Q016	2SC3779(D)	TR. SI, NPN
Q017	2SC3779(D)	TR. SI, NPN
Q018	2SC1164(D)	TR. SI, NPN
Q019	2SC1164(D)	TR. SI, NPN
Q101	2SC1907	TR. SI, NPN
Q102	2SC1907	TR. SI, NPN
Q103	2SA1005(K)	TR. SI, PNP
Q104	2SA1005(K)	TR. SI, PNP
Q105	2SC1907	TR. SI, NPN
Q106	2SC1907	TR. SI, NPN
Q107	2SA1005(K)	TR. SI, PNP
Q108	2SA1005(K)	TR. SI, PNP
Q201	2SC1907	TR. SI, NPN
Q202	2SC1907	TR. SI, NPN
Q203	2SA1015(Y)	TR. SI, PNP
Q204	2SA1015(Y)	TR. SI, PNP
Q205	2SC1907	TR. SI, NPN
Q206	2SC1907	TR. SI, NPN
Q207	2SA1005(K)	TR. SI, PNP
Q208	2SA1005(K)	TR. SI, PNP
Q209	2SC1907	TR. SI, NPN
Q210	2SC1907	TR. SI, NPN
Q211	2SC3423	TR. SI, NPN
Q212	2SC3423	TR. SI, NPN
Q213	2SA1360(Y)	TR. SI, PNP
Q214	2SA1360(Y)	TR. SI, PNP
R001	RN14BK2C91R0F	RES. METAL FILM 91.0 1% 1/6W
R002	RN14BK2C91R0F	RES. METAL FILM 91.0 1% 1/6W
R003	RD14BB2C470J	RES. CARBON 47 5% 1/6W
R004	RD14BB2C470J	RES. CARBON 47 5% 1/6W
R005	RN14BK2C82R0F	RES. METAL FILM 82.0 1% 1/6W
R006	RD14BB2C471J	RES. CARBON 470 5% 1/6W
R007	RD14BB2C471J	RES. CARBON 470 5% 1/6W
R008	RD14BB2C472J	RES. CARBON 4.7K 5% 1/6W

PARTS LIST

REF.NO	PARTS NO	NAME & DESCRIPTION			
R009	RD14BB2C682J	RES. CARBON	6.8K	5%	1/6W
R010	RD14BB2C203J	RES. CARBON	20K	5%	1/6W
R011	RD14BB2C473J	RES. CARBON	47K	5%	1/6W
R012	RD14BB2C473J	RES. CARBON	47K	5%	1/6W
R013	RD14BB2C331J	RES. CARBON	330	5%	1/6W
R014	RD14BB2C331J	RES. CARBON	330	5%	1/6W
R017	RN14BK2C2701F	RES. METAL FILM	2.7K	1%	1/6W
R018	RN14BK2C2201F	RES. METAL FILM	2.2K	1%	1/6W
R019	RN14BK2C3000F	RES. METAL FILM	300	1%	1/6W
R020	RN14BK2C3000F	RES. METAL FILM	300	1%	1/6W
R021	RN14BK2C2700F	RES. METAL FILM	270	1%	1/6W
R022	RD14BB2C220J	RES. CARBON	22	5%	1/6W
R023	RD14BB2C220J	RES. CARBON	22	5%	1/6W
R024	RN14BK2C1000F	RES. METAL FILM	100	1%	1/6W
R025	RN14BK2C1000F	RES. METAL FILM	100	1%	1/6W
R026	RD14BB2C331J	RES. CARBON	330	5%	1/6W
R027	RN14BK2C4701F	RES. METAL FILM	4.7K	1%	1/6W
R028	RN14BK2C3601F	RES. METAL FILM	3.6K	1%	1/6W
R029	RD14BB2C681J	RES. CARBON	680	5%	1/6W
R030	RD14BB2C681J	RES. CARBON	680	5%	1/6W
R031	RD14BB2C470J	RES. CARBON	47	5%	1/6W
R032	RD14BB2C470J	RES. CARBON	47	5%	1/6W
R033	RN14BK2C3900F	RES. METAL FILM	390	1%	1/6W
R034	RN14BK2C3900F	RES. METAL FILM	390	1%	1/6W
R037	RN14BK2C91R0F	RES. METAL FILM	91.0	1%	1/6W
R042	RN14BK2E3900F	RES. METAL FILM	390	1%	1/4W
R043	RN14BK2E3900F	RES. METAL FILM	390	1%	1/4W
R044	RD14BB2C220J	RES. CARBON	22	5%	1/6W
R045	RD14BB2C220J	RES. CARBON	22	5%	1/6W
R046	RD14BB2E361J	RES. CARBON	360	5%	1/4W
R047	RD14BB2E361J	RES. CARBON	360	5%	1/4W
R048	RD14BB2C101J	RES. CARBON	100	5%	1/6W
R049	RD14BB2C101J	RES. CARBON	100	5%	1/6W
R050	RD14BB2C220J	RES. CARBON	22	5%	1/6W
R051	RD14BB2C220J	RES. CARBON	22	5%	1/6W
R052	RD14BB2C220J	RES. CARBON	22	5%	1/6W
R053	RD14BB2C220J	RES. CARBON	22	5%	1/6W
R054	RN14BK2E33R0F	RES. METAL FILM	33.0	1%	1/4W
R055	RN14BK2E33R0F	RES. METAL FILM	33.0	1%	1/4W
R056	RD14BB2E100J	RES. CARBON	10	5%	1/4W
R057	RD14BB2C822J	RES. CARBON	8.2K	5%	1/6W
R058	RD14BB2C103J	RES. CARBON	10K	5%	1/6W
R059	RD14BB2C752J	RES. CARBON	7.5K	5%	1/6W
R060	RD14BB2E220J	RES. CARBON	22	5%	1/4W
R061	RD14BB2E220J	RES. CARBON	22	5%	1/4W
R062	RS14GB3F911J	RES. METAL FILM	910	5%	3W
R063	RS14GB3F102J	RES. METAL FILM	1K	5%	3W
R064	RS14GB3F911J	RES. METAL FILM	910	5%	3W
R065	RS14GB3F102J	RES. METAL FILM	1K	5%	3W
R066	RD14BB2E391J	RES. CARBON	390	5%	1/4W
R067	RD14BB2E391J	RES. CARBON	390	5%	1/4W
R068	RD14BB2C271J	RES. CARBON	270	5%	1/6W
R069	RD14BB2C511J	RES. CARBON	510	5%	1/6W
R070	RD14BB2C163J	RES. CARBON	16K	5%	1/6W
R101	RD14BB2C103J	RES. CARBON	10K	5%	1/6W
R102	RD14BB2C332J	RES. CARBON	3.3K	5%	1/6W
R103	RD14BB2C102J	RES. CARBON	1K	5%	1/6W
R104	RD14BB2C561J	RES. CARBON	560	5%	1/6W
R105	RD14BB2C561J	RES. CARBON	560	5%	1/6W
R106	RD14BB2C331J	RES. CARBON	330	5%	1/6W
R107	RD14BB2C103J	RES. CARBON	10K	5%	1/6W
R108	RD14BB2C103J	RES. CARBON	10K	5%	1/6W
R109	RD14BB2C102J	RES. CARBON	1K	5%	1/6W
R110	RN14BK2C8201F	RES. METAL FILM	8.2K	1%	1/6W
R111	RN14BK2E1601F	RES. METAL FILM	1.6K	1%	1/4W
R112	RN14BK2C3300F	RES. METAL FILM	330	1%	1/6W
R113	RN14BK2C4700F	RES. METAL FILM	470	1%	1/6W
R114	RN14BK2C4700F	RES. METAL FILM	470	1%	1/6W
R115	RD14BB2C102J	RES. CARBON	1K	5%	1/6W
R116	NO USE				
R117	RD14BB2C103J	RES. CARBON	10K	5%	1/6W
R118	RD14BB2C332J	RES. CARBON	3.3K	5%	1/6W
R119	RD14BB2C102J	RES. CARBON	1K	5%	1/6W
R120	RD14BB2C332J	RES. CARBON	3.3K	5%	1/6W
R121	RD14BB2C332J	RES. CARBON	3.3K	5%	1/6W
R122	RN14BK2C1201F	RES. METAL FILM	1.2K	1%	1/6W
R123	RD14BB2C471J	RES. CARBON	470	5%	1/6W
R124	RD14BB2C103J	RES. CARBON	10K	5%	1/6W
R125	RD14BB2C103J	RES. CARBON	10K	5%	1/6W

REF.NO	PARTS NO	NAME & DESCRIPTION			
R126	RD14BB2C102J	RES. CARBON	1K	5%	1/6W
R127	RD14BB2C104J	RES. CARBON	100K	5%	1/6W
R128	RD14BB2C104J	RES. CARBON	100K	5%	1/6W
R129	RN14BK2C8201F	RES. METAL FILM	8.2K	1%	1/6W
R130	RN14BK2C2201F	RES. METAL FILM	2.2K	1%	1/6W
R131	RN14BK2C8200F	RES. METAL FILM	820	1%	1/6W
R132	RD14BB2C103J	RES. CARBON	10K	5%	1/6W
R133	RD14BB2C104J	RES. CARBON	100K	5%	1/6W
R134	RD14BB2C472J	RES. CARBON	4.7K	5%	1/6W
R135	RD14BB2E103J	RES. CARBON	10K	5%	1/4W
R201	RN14BK2C4700F	RES. METAL FILM	470	1%	1/6W
R202	RN14BK2C3741F	RES. METAL FILM	3.74K	1%	1/6W
R203	RD14BB2C561J	RES. CARBON	560	5%	1/6W
R204	RN14BK2C4700F	RES. METAL FILM	470	1%	1/6W
R205	RD14BB2E682J	RES. CARBON	6.8K	5%	1/4W
R206	RN14BK2C2401F	RES. METAL FILM	2.4K	1%	1/6W
R207	RD14BB2C182J	RES. CARBON	1.8K	5%	1/6W
R208	RD14BB2C182J	RES. CARBON	1.8K	5%	1/6W
R209	RD14BB2C152J	RES. CARBON	1.5K	5%	1/6W
R210	RD14BB2C152J	RES. CARBON	1.5K	5%	1/6W
R211	RN14BK2E47R0F	RES. METAL FILM	47.0	1%	1/4W
R212	RD14BB2C331J	RES. CARBON	330	5%	1/6W
R213	RD14BB2C104J	RES. CARBON	100K	5%	1/6W
R214	RD14BB2C104J	RES. CARBON	100K	5%	1/6W
R215	RD14BB2C102J	RES. CARBON	1K	5%	1/6W
R216	RD14BB2C102J	RES. CARBON	1K	5%	1/6W
R217	RN14BK2C6800F	RES. METAL FILM	680	1%	1/6W
R218	RD14BB2C471J	RES. CARBON	470	5%	1/6W
R219	RD14BB2C471J	RES. CARBON	470	5%	1/6W
R220	RD14BB2E822J	RES. CARBON	8.2K	5%	1/4W
R221	RN14BK2C1002F	RES. METAL FILM	10K	1%	1/6W
R222	RD14BB2C242J	RES. CARBON	2.4K	5%	1/6W
R223	RD14BB2C222J	RES. CARBON	2.2K	5%	1/6W
R224	RD14BB2C222J	RES. CARBON	2.2K	5%	1/6W
R225	RD14BB2C222J	RES. CARBON	2.2K	5%	1/6W
R226	RD14BB2C222J	RES. CARBON	2.2K	5%	1/6W
R227	RD14BB2C124J	RES. CARBON	120K	5%	1/6W
R228	RD14BB2C124J	RES. CARBON	120K	5%	1/6W
R229	RD14BB2C222J	RES. CARBON	2.2K	5%	1/6W
R230	RD14BB2C222J	RES. CARBON	2.2K	5%	1/6W
R231	RD14BB2C391J	RES. CARBON	390	5%	1/6W
R232	RD14BB2C391J	RES. CARBON	390	5%	1/6W
R233	NO USE				
R234	RD14BB2C470J	RES. CARBON	47	5%	1/6W
R235	RD14BB2C470J	RES. CARBON	47	5%	1/6W
R236	RD14BY2H473J	RES. CARBON	47K	5%	1/2W
R237	RD14BY2H473J	RES. CARBON	47K	5%	1/2W
R238	RD14BY2H683J	RES. CARBON	68K	5%	1/2W
R239	RD14BY2H683J	RES. CARBON	68K	5%	1/2W
R240	NO USE				
R241	RN14BK2C1201F	RES. METAL FILM	1.2K	1%	1/6W
R242	RN14BK2C1201F	RES. METAL FILM	1.2K	1%	1/6W
R801	RD14BB2C124J	RES. CARBON	120K	5%	1/6W
R902	RD14BB2C471J	RES. CARBON	470	5%	1/6W
R903	RD14BB2C391J	RES. CARBON	390	5%	1/6W
R904	RD14BB2E154J	RES. CARBON	150K	5%	1/4W
R905	RD14BB2E471J	RES. CARBON	470	5%	1/4W
R906	RD14BB2C432J	RES. CARBON	4.3K	5%	1/6W
TC001	C05-0454-05	CAP. TRIMMER	20PF		
TC002	C05-0454-05	CAP. TRIMMER	20PF		
TC003	C05-0455-05	CAP. TRIMMER	30PF		
TC004	C05-0453-05	CAP. TRIMMER	10P		
TH901	SDT1000	THERMISTOR			
VR001	R12-1545-05	RES. SEMI FIXED	1K B		
VR002	R12-0576-05	RES. SEMI FIXED	200 B		
VR003	R12-3550-05	RES. SEMI FIXED	20K B		
VR004	R12-1546-05	RES. SEMI FIXED	2K B		
VR005	R12-0577-05	RES. SEMI FIXED	500 B		
VR006	R12-0575-05	RES. SEMI FIXED	100 B		
VR101	R12-0576-05	RES. SEMI FIXED	200 B		
VR102	R12-1545-05	RES. SEMI FIXED	1K B		
VR103	R12-0577-05	RES. SEMI FIXED	500 B		
VR104	R12-1545-05	RES. SEMI FIXED	1K B		
VR201	R12-1545-05	RES. SEMI FIXED	1K B		
VR202	R12-0575-05	RES. SEMI FIXED	100 B		
VR203	R12-7508-05	RES. SEMI FIXED	500K B		

PARTS LIST

HORIZONTAL UNIT

(X74-1500-00)

REF.NO	PARTS NO	NAME & DESCRIPTION
	E31-5533-15	LEAD WIRE WITH CONNECTOR,P39
	F01-0867-05	HEAT SINK
	F11-1208-03	SHIELD CASE
	F15-0727-04	HOLDER (NEON LAMP)
	J25-5268-04	PCB (UNMOUNTED) 86X46
	J25-5348-12	PCB (UNMOUNTED)
	J42-0538-04	BUSHING
	L92-0110-05	FERRITE BEADS
	N30-3006-41	SCREW, PAN HD M3X6
	R92-0150-05	JUMPING RES. ZERO OHM(10MM)
	R92-1061-05	JUMPING RES. ZERO OHM (5MM)
	S29-4503-05	ROTARY SWITCH WITH V.R.
C001	CC45FCH1H010C	CAP. CERAMIC 1P 0.25P 50V
C002	CE04EW1E100M	CAP. ELECTRO 10 20% 25V
C003	CE04EW1E100M	CAP. ELECTRO 10 20% 25V
C004	CQ92FM1H223K	CAP. MYLAR 0.022 10% 50V
C005	CC45FSL1H221J	CAP. CERAMIC 220P 5% 50V
C006	CQ92FM1H222K	CAP. MYLAR 2200P 10% 50V
C007	CK45FB1H102K	CAP. CERAMIC 1000P 10% 50V
C008	CE04EW1E100M	CAP. ELECTRO 10 20% 25V
C009	CE04EW1E100M	CAP. ELECTRO 10 20% 25V
C013	CC45FCH1H050C	CAP. CERAMIC 5P 0.25P 50V
C016	CK45FF1H103Z	CAP. CERAMIC 0.01 50V
C019	CK45FF1H103Z	CAP. CERAMIC 0.01 50V
C020	CK45FF1H103Z	CAP. CERAMIC 0.01 50V
C021	CS15E1V010M	CAP. TANTALUM 1 20% 35V
C022	CS15E1V010M	CAP. TANTALUM 1 20% 35V
C023	CK45FF1H103Z	CAP. CERAMIC 0.01 50V
C024	CE04BW1E220M	CAP. ELECTRO 22 20% 25V
C025	CE04EW1E100M	CAP. ELECTRO 10 20% 25V
C026	CE04EW1E470M	CAP. ELECTRO 47 20% 25V
C027	CK45FF1H103Z	CAP. CERAMIC 0.01 50V
C028	CK45FF1H103Z	CAP. CERAMIC 0.01 50V
C029	CQ92FM1H223K	CAP. MYLAR 0.022 10% 50V
C030	CC45FCH1H150J	CAP. CERAMIC 15P 5% 50V
C031	CE04EW1E100M	CAP. ELECTRO 10 20% 25V
C032	CE04EW1E100M	CAP. ELECTRO 10 20% 25V
C033	CK45FF1H103Z	CAP. CERAMIC 0.01 50V
C034	CE04EW1E100M	CAP. ELECTRO 10 20% 25V
C035	NO USE	
C036	CK45FF1H103Z	CAP. CERAMIC 0.01 50V
C037	CK45FF1H103Z	CAP. CERAMIC 0.01 50V
C038	NO USE	
C039	CK45FF1H103Z	CAP. CERAMIC 0.01 50V
C040	CS15E1V100M	CAP. TANTALUM 10 20% 35V
C041	C91-1303-05	CAP. CERAMIC 0.1 10% 50V
C042	CK45FF1H103Z	CAP. CERAMIC 0.01 50V
C043	CK45FF1H103Z	CAP. CERAMIC 0.01 50V
C046	CE04EW1E100M	CAP. ELECTRO 10 20% 25V
C051	CC45FSL1H151J	CAP. CERAMIC 150P 5% 50V
C052	NO USE	
C053	CE04EW1E100M	CAP. ELECTRO 10 20% 25V
C101	CC45FCH1H100D	CAP. CERAMIC 10P 0.5P 50V
C102	C91-1304-05	CAP. 3-TERMINAL 270P 20% 100V
C103	CC45FCH1H470J	CAP. CERAMIC 47P 5% 50V
C104	CC45FSL1H271J	CAP. CERAMIC 270P 5% 50V
C105	CQ92FM1H104K	CAP. MYLAR 0.1 10% 50V
C106	CK45FF1H103Z	CAP. CERAMIC 0.01 50V
C107	CE04EW1E100M	CAP. ELECTRO 10 20% 25V
C108	CC45CH1H820J	CAP. CERAMIC 82P 5% 50V
C109	C91-0574-05	CAP. MYLAR 1 5% 100V
C110	CC45FCH1H120J	CAP. CERAMIC 12P 5% 50V
C111	CE04EW1E100M	CAP. ELECTRO 10 20% 25V
C112	CK45FF1H103Z	CAP. CERAMIC 0.01 50V
C113	CC45FSL1H221J	CAP. CERAMIC 220P 5% 50V
C114	CE04EW1H010M	CAP. ELECTRO 1 20% 50V
C115	CK45FF1H103Z	CAP. CERAMIC 0.01 50V
C116	CQ92FM1H683K	CAP. MYLAR 0.068 10% 50V
C117	CQ92FM1H472K	CAP. MYLAR 4700P 10% 50V
C118	CE04EW1E101M	CAP. ELECTRO 100 20% 25V
C119	CK45FF1H103Z	CAP. CERAMIC 0.01 50V
C120	CK45FB1H102K	CAP. CERAMIC 1000P 10% 50V
C121	CC45FCH1H470J	CAP. CERAMIC 47P 5% 50V

REF.NO	PARTS NO	NAME & DESCRIPTION
C122	CE04EW1E100M	CAP. ELECTRO 10 20% 25V
C123	CE04EW1E100M	CAP. ELECTRO 10 20% 25V
C124	CK45FF1H103Z	CAP. CERAMIC 0.01 50V
C125	CK45FF1H103Z	CAP. CERAMIC 0.01 50V
C126	CK45FF1H103Z	CAP. CERAMIC 0.01 50V
C127	CE04EW1E100M	CAP. ELECTRO 10 20% 25V
C128	CK45FF1H103Z	CAP. CERAMIC 0.01 50V
C129	CS15E1C3R3M	CAP. TANTALUM 3.3 20% 16V
C130	CK45FF1H103Z	CAP. CERAMIC 0.01 50V
C201	C91-1304-05	CAP. 3-TERMINAL 270P 20% 100V
C202	CC45FSL1H271J	CAP. CERAMIC 270P 5% 50V
C203	CS15E1C3R3M	CAP. TANTALUM 3.3 20% 16V
C204	CQ92FM1H104K	CAP. MYLAR 0.1 10% 50V
C205	CK45FF1H103Z	CAP. CERAMIC 0.01 50V
C206	CE04EW1E100M	CAP. ELECTRO 10 20% 25V
C207	CC45CH1H820J	CAP. CERAMIC 82P 5% 50V
C208	C91-0574-05	CAP. MYLAR 1 5% 100V
C209	CC45FCH1H050C	CAP. CERAMIC 5P 0.25P 50V
C210	CK45FF1H103Z	CAP. CERAMIC 0.01 50V
C211	CC45FCH1H120J	CAP. CERAMIC 12P 5% 50V
C212	CE04EW1E100M	CAP. ELECTRO 10 20% 25V
C213	CC45FCH1H470J	CAP. CERAMIC 47P 5% 50V
C214	CC45FCH1H050C	CAP. CERAMIC 5P 0.25P 50V
C215	CC45FCH1H100D	CAP. CERAMIC 10P 0.5P 50V
C216	CE04BW1C100M	CAP. ELECTRO 10 20% 16V
C217	CK45FF1H103Z	CAP. CERAMIC 0.01 50V
C218	CK45FF1H103Z	CAP. CERAMIC 0.01 50V
C219	CK45FF1H103Z	CAP. CERAMIC 0.01 50V
C220	CK45FF1H103Z	CAP. CERAMIC 0.01 50V
C221	CK45FF1H103Z	CAP. CERAMIC 0.01 50V
C222	CC45FSL1H151J	CAP. CERAMIC 150P 5% 50V
C223	CC45FSL1H471J	CAP. CERAMIC 470P 5% 50V
C224	CE04EW1E100M	CAP. ELECTRO 10 20% 25V
C225	CK45FF1H103Z	CAP. CERAMIC 0.01 50V
C226	CE04EW1E100M	CAP. ELECTRO 10 20% 25V
C227	CE04EW1E100M	CAP. ELECTRO 10 20% 25V
C228	CK45FF1H103Z	CAP. CERAMIC 0.01 50V
C229	C91-0769-05	CAP. AXIAL 0.01 20% 16V
C230	CC45FSL1H271J	CAP. CERAMIC 270P 5% 50V
C231	CE04EW1E100M	CAP. ELECTRO 10 20% 25V
C232	CK45FF1H103Z	CAP. CERAMIC 0.01 50V
C233	CE04EW1E100M	CAP. ELECTRO 10 20% 25V
C401	CK45FF1H103Z	CAP. CERAMIC 0.01 50V
C402	CC45FSL1H561J	CAP. CERAMIC 560P 5% 50V
C403	CE04EW1E100M	CAP. ELECTRO 10 20% 25V
C404	CE04EW1E100M	CAP. ELECTRO 10 20% 25V
C405	CK45FF1H103Z	CAP. CERAMIC 0.01 50V
C406	CK45FF1H103Z	CAP. CERAMIC 0.01 50V
C407	CK45B2H103K	CAP. CERAMIC 0.01 10% 500V
C408	C91-1266-05	CAP. CERAMIC 1000P 6KV
C409	C91-1266-05	CAP. CERAMIC 1000P 6KV
C410	C91-1266-05	CAP. CERAMIC 1000P 6KV
C411	CK45B2H103K	CAP. CERAMIC 0.01 10% 500V
C412	C91-1266-05	CAP. CERAMIC 1000P 6KV
C413	C91-1266-05	CAP. CERAMIC 1000P 6KV
C414	C91-1267-05	CAP. CERAMIC 4700P 3KV
C415	CK45B2H103K	CAP. CERAMIC 0.01 10% 500V
C416	C91-1267-05	CAP. CERAMIC 4700P 3KV
C417	CE04EW1H010M	CAP. ELECTRO 1 20% 50V
C418	CK45FB1H222K	CAP. CERAMIC 2200P 10% 50V
C419	CQ92FM1H104K	CAP. MYLAR 0.1 10% 50V
C420	NO USE	
C421	CE04EW1E101M	CAP. ELECTRO 100 20% 25V
C422	C91-1264-05	CAP. CERAMIC 22P 3KV
C423	C91-1267-05	CAP. CERAMIC 4700P 3KV
C424	C91-1267-05	CAP. CERAMIC 4700P 3KV
C425	C91-1267-05	CAP. CERAMIC 4700P 3KV
C426	CE04W2C010M	CAP. ELECTRO 1 20% 160V
C427	CE04W2C100M	CAP. ELECTRO 10 20% 160V
C428	CK45B2H103K	CAP. CERAMIC 0.01 10% 500V
C429	CK45FF1H103Z	CAP. CERAMIC 0.01 50V
C430	CK45B2H103K	CAP. CERAMIC 0.01 10% 500V
C431	CQ92FM1H104K	CAP. MYLAR 0.1 10% 50V
C432	CQ92FM1H104K	CAP. MYLAR 0.1 10% 50V
C433	CQ92FM1H104K	CAP. MYLAR 0.1 10% 50V
C434	CE04EW1E100M	CAP. ELECTRO 10 20% 25V
C435	CK45B2H103K	CAP. CERAMIC 0.01 10% 500V
C436	CE04EW1E100M	CAP. ELECTRO 10 20% 25V
C501	CC45FSL1H331J	CAP. CERAMIC 330P 5% 50V
C502	NO USE	
C503	CK45FF1H103Z	CAP. CERAMIC 0.01 50V

PARTS LIST

REF. NO	PARTS NO	NAME & DESCRIPTION	REF. NO	PARTS NO	NAME & DESCRIPTION
P040	NO USE		0401	2SA1005(K)	TR. SI, PNP
P041	E40-0273-05	PIN CONNECTOR 2P	0402	2SA1005(K)	TR. SI, PNP
P042	E40-0373-05	PIN CONNECTOR 3P	0403	2SC1907	TR. SI, NPN
P043	NO USE		0404	2SC1907	TR. SI, NPN
P044	E40-7033-05	PIN CONNECTOR 2P	0405	2SD668A(C)	TR. SI, NPN
P045	E40-7032-05	PIN CONNECTOR 5P	0406	2SD668A(C)	TR. SI, NPN
P046	E40-0373-05	PIN CONNECTOR 3P	0407	2SD668A(C)	TR. SI, NPN
P047	E40-0273-05	PIN CONNECTOR 2P	0408	2SD668A(C)	TR. SI, NPN
P048	E40-0273-05	PIN CONNECTOR 2P	0409	2SD880(Y)	TR. SI, NPN
P049	E40-0273-05	PIN CONNECTOR 2P	0410	2SC945(Q)	TR. SI, NPN
P050	E40-0473-05	PIN CONNECTOR 4P	0411	2SA1015(Y)	TR. SI, PNP
P051	E40-0273-05	PIN CONNECTOR 2P	Q505	2SA1005(K)	TR. SI, PNP
P052	E40-0473-05	PIN CONNECTOR 4P	Q506	2SC945(Q)	TR. SI, NPN
P053	E40-0273-05	PIN CONNECTOR 2P	R001	RD148B2C470J	RES. CARBON 47 5% 1/6W
P054	E23-0401-05	PIN TERMINAL	R002	RD148B2C821J	RES. CARBON 820 5% 1/6W
P063	E23-0401-05	PIN TERMINAL	R003	RD148B2C182J	RES. CARBON 1.8K 5% 1/6W
P071	E40-0373-05	PIN CONNECTOR 3P	R004	RD148B2C471J	RES. CARBON 470 5% 1/6W
P080	E40-0673-05	PIN CONNECTOR 6P	R005	RD148B2C822J	RES. CARBON 8.2K 5% 1/6W
P801	E40-0216-05	PIN CONNECTOR 2P	R006	RD148B2C272J	RES. CARBON 2.7K 5% 1/6W
Q001	2SA1206	TR. SI, PNP	R007	RD148B2C101J	RES. CARBON 100 5% 1/6W
Q002	2SA1206	TR. SI, PNP	R008	RD148B2C220J	RES. CARBON 22 5% 1/6W
Q003	2SC1907	TR. SI, NPN	R009	RD148B2C220J	RES. CARBON 22 5% 1/6W
Q004	2SC1907	TR. SI, NPN	R010	RD148B2C222J	RES. CARBON 2.2K 5% 1/6W
Q005	2SK304(E)	FET. N-CHANNEL	R011	RD148B2C100J	RES. CARBON 10 5% 1/6W
Q006	NO USE		R012	RD148B2C103J	RES. CARBON 10K 5% 1/6W
Q007	2SA1206	TR. SI, PNP	R013	RD148B2C473J	RES. CARBON 47K 5% 1/6W
Q008	2SA1206	TR. SI, PNP	R014	RN14BK2E1004F	RES. METAL FILM 1M 1% 1/4W
Q009	2SAB38(B)	TR. SI, PNP	R015	RD148B2C474J	RES. CARBON 470K 5% 1/6W
Q010	2SAB38(B)	TR. SI, PNP	R016	RD148B2C100J	RES. CARBON 10 5% 1/6W
Q011	2SC945(Q)	TR. SI, NPN	R027	RD148B2C122J	RES. CARBON 1.2K 5% 1/6W
Q012	2SK117(BL)	FET. N-CHANNEL	R028	RD148B2C122J	RES. CARBON 1.2K 5% 1/6W
Q013	2SA1005(K)	TR. SI, PNP	R029	RD148B2C151J	RES. CARBON 150 5% 1/6W
Q014	2SA1015(Y)	TR. SI, PNP	R030	RD148B2C123J	RES. CARBON 12K 5% 1/6W
Q015	2SC1907	TR. SI, NPN	R031	RD148B2C123J	RES. CARBON 12K 5% 1/6W
Q016	2SA1005(K)	TR. SI, PNP	R032	RD148B2C222J	RES. CARBON 2.2K 5% 1/6W
Q017	2SC1907	TR. SI, NPN	R033	RD148B2C222J	RES. CARBON 2.2K 5% 1/6W
Q018	2SC945(Q)	TR. SI, NPN	R034	RD148B2C222J	RES. CARBON 2.2K 5% 1/6W
Q019	2SC945(Q)	TR. SI, NPN	R035	RD148B2C221J	RES. CARBON 220 5% 1/6W
Q020	2SC945(Q)	TR. SI, NPN	R036	RD148B2C202J	RES. CARBON 2K 5% 1/6W
Q021	2SAB44(D)	TR. SI, PNP	R037	RD148B2C562J	RES. CARBON 5.6K 5% 1/6W
Q022	2SC945(Q)	TR. SI, NPN	R040	RD148B2C220J	RES. CARBON 22 5% 1/6W
Q101	2SAB44(D)	TR. SI, PNP	R041	RD148B2C220J	RES. CARBON 22 5% 1/6W
Q102	2SAB44(D)	TR. SI, PNP	R042	RD148B2C620J	RES. CARBON 62 5% 1/6W
Q103	2SAB44(D)	TR. SI, PNP	R043	RD148B2C272J	RES. CARBON 2.7K 5% 1/6W
Q104	2SAB38(B)	TR. SI, PNP	R044	RD148B2C272J	RES. CARBON 2.7K 5% 1/6W
Q105	2SC1345(E)	TR. SI, NPN	R045	NO USE	
Q106	2SK170(V)	FET. N-CHANNEL	R046	RD148B2C221J	RES. CARBON 220 5% 1/6W
Q107	2SK304(F)	FET. N-CHANNEL	R047	RD148B2C221J	RES. CARBON 220 5% 1/6W
Q108	2SC1907	TR. SI, NPN	R048	RD148B2C471J	RES. CARBON 470 5% 1/6W
Q109	2SA1015(Y)	TR. SI, PNP	R049	RD148B2C471J	RES. CARBON 470 5% 1/6W
Q110	2SAB44(D)	TR. SI, PNP	R050	RD148B2C331J	RES. CARBON 330 5% 1/6W
Q111	2SA1175(F)	TR. SI, PNP	R051	RD148B2C331J	RES. CARBON 330 5% 1/6W
Q112	2SC945(Q)	TR. SI, NPN	R052	RD148B2C562J	RES. CARBON 5.6K 5% 1/6W
Q113	2SC945(Q)	TR. SI, NPN	R053	RD148B2C562J	RES. CARBON 5.6K 5% 1/6W
Q114	2SC945(Q)	TR. SI, NPN	R054	RD148B2C102J	RES. CARBON 1K 5% 1/6W
Q201	2SAB44(D)	TR. SI, PNP	R055	NO USE	
Q202	2SAB44(D)	TR. SI, PNP	R056	RD148B2C103J	RES. CARBON 10K 5% 1/6W
Q203	2SAB44(D)	TR. SI, PNP	R057	RD148B2C103J	RES. CARBON 10K 5% 1/6W
Q204	2SAB38(B)	TR. SI, PNP	R058	RD148B2C105J	RES. CARBON 1M 5% 1/6W
Q205	2SC1345(E)	TR. SI, NPN	R059	RD148B2C105J	RES. CARBON 1M 5% 1/6W
Q206	2SK170(V)	FET. N-CHANNEL	R060	RD148B2C105J	RES. CARBON 1M 5% 1/6W
Q207	2SK304(F)	FET. N-CHANNEL	R061	RD148B2C102J	RES. CARBON 1K 5% 1/6W
Q208	2SC1907	TR. SI, NPN	R062	RD148B2C682J	RES. CARBON 6.8K 5% 1/6W
Q209	2SA1015(Y)	TR. SI, PNP	R063	RD148B2C224J	RES. CARBON 220K 5% 1/6W
Q210	2SA1015(Y)	TR. SI, PNP	R064	RD148B2C152J	RES. CARBON 1.5K 5% 1/6W
Q211	2SAB44(D)	TR. SI, PNP	R065	L40-1091-03	FERRI INDUCTOR 1UH
Q212	2SC945(Q)	TR. SI, NPN	R066	RD148B2C680J	RES. CARBON 68 5% 1/6W
Q213	UPA68H		R067	RD148B2C331J	RES. CARBON 330 5% 1/6W
Q214	2SC945(Q)	TR. SI, NPN	R068	RD148B2E101J	RES. CARBON 100 5% 1/4W
Q215	2SAB44(D)	TR. SI, PNP	R069	RD148B2C183J	RES. CARBON 18K 5% 1/6W
Q216	2SAB44(D)	TR. SI, PNP	R070	RD148B2C103J	RES. CARBON 10K 5% 1/6W
Q217	2SC945(Q)	TR. SI, NPN	R071	RD148B2C102J	RES. CARBON 1K 5% 1/6W
Q218	2SA1005(K)	TR. SI, PNP	R072	RD148B2C474J	RES. CARBON 470K 5% 1/6W
Q219	2SA1005(K)	TR. SI, PNP	R073	RD148B2C103J	RES. CARBON 10K 5% 1/6W
Q220	2SC945(Q)	TR. SI, NPN	R074	RD148B2C103J	RES. CARBON 10K 5% 1/6W
Q221	2SC945(Q)	TR. SI, NPN	R075	RD148B2C103J	RES. CARBON 10K 5% 1/6W
Q222	2SC945(Q)	TR. SI, NPN	R076	RD148B2E102J	RES. CARBON 1K 5% 1/4W
Q223	2SC945(Q)	TR. SI, NPN	R077	RD148B2C331J	RES. CARBON 330 5% 1/6W
Q224	2SC945(Q)	TR. SI, NPN	R078	RD148B2C222J	RES. CARBON 2.2K 5% 1/6W

PARTS LIST

REF.NO	PARTS NO	NAME & DESCRIPTION	REF.NO	PARTS NO	NAME & DESCRIPTION
R079	RD148B2C330J	RES. CARBON 33 5% 1/6W	R204	RD148B2C181J	RES. CARBON 180 5% 1/6W
R080	RD148B2C101J	RES. CARBON 100 5% 1/6W	R205	RD148B2C151J	RES. CARBON 150 5% 1/6W
R081	RD148B2C681J	RES. CARBON 680 5% 1/6W	R206	RD148B2C470J	RES. CARBON 47 5% 1/6W
R082	RD148B2C220J	RES. CARBON 22 5% 1/6W	R207	RD148B2C470J	RES. CARBON 47 5% 1/6W
R083	RD148B2C220J	RES. CARBON 22 5% 1/6W	R208	RD148B2C152J	RES. CARBON 1.5K 5% 1/6W
R084	RD148B2C123J	RES. CARBON 12K 5% 1/6W	R209	RD148B2C331J	RES. CARBON 330 5% 1/6W
R085	RD148B2C562J	RES. CARBON 5.6K 5% 1/6W	R210	RD148B2C101J	RES. CARBON 100 5% 1/6W
R086	RD148B2C331J	RES. CARBON 330 5% 1/6W	R211	RD148B2C223J	RES. CARBON 22K 5% 1/6W
R087	RD148B2C103J	RES. CARBON 10K 5% 1/6W	R212	RD148B2C680J	RES. CARBON 68 5% 1/6W
R088	RD148B2C271J	RES. CARBON 270 5% 1/6W	R213	RD148B2C103J	RES. CARBON 10K 5% 1/6W
R089	RD148B2C103J	RES. CARBON 10K 5% 1/6W	R214	RD148B2C101J	RES. CARBON 100 5% 1/6W
R090	RD148B2C103J	RES. CARBON 10K 5% 1/6W	R215	RD148B2C103J	RES. CARBON 10K 5% 1/6W
R091	RD148B2C561J	RES. CARBON 560 5% 1/6W	R216	RD148B2C103J	RES. CARBON 10K 5% 1/6W
R092	RD148B2C271J	RES. CARBON 270 5% 1/6W	R217	RD148B2C392J	RES. CARBON 3.9K 5% 1/6W
R093	RD148B2C272J	RES. CARBON 2.7K 5% 1/6W	R218	RD148B2C183J	RES. CARBON 18K 5% 1/6W
R094	RD148B2C272J	RES. CARBON 2.7K 5% 1/6W	R219	RD148B2C121J	RES. CARBON 120 5% 1/6W
R095	RD148B2C152J	RES. CARBON 1.5K 5% 1/6W	R220	RN148K2C2201F	RES. METAL FILM 2.2K 1% 1/6W
R096	RD148B2C911J	RES. CARBON 910 5% 1/6W	R221	RD148B2C222J	RES. CARBON 2.2K 5% 1/6W
R097	RD148B2C682J	RES. CARBON 6.8K 5% 1/6W	R222	RD148B2C103J	RES. CARBON 10K 5% 1/6W
R098	RD148B2C562J	RES. CARBON 5.6K 5% 1/6W	R223	RN148K2C1202F	RES. METAL FILM 12K 1% 1/6W
R099	RD148B2C333J	RES. CARBON 33K 5% 1/6W	R224	RD148B2C103J	RES. CARBON 10K 5% 1/6W
R100	RD148B2C332J	RES. CARBON 3.3K 5% 1/6W	R225	RN148K2E3004F	RES. METAL FILM 3M 1% 1/4W
R101	RD148B2C103J	RES. CARBON 10K 5% 1/6W	R226	RN148K2C1004F	RES. METAL FILM 1M 1% 1/6W
R102	RD148B2C101J	RES. CARBON 100 5% 1/6W	R227	RN148K2C5003F	RES. METAL FILM 500K 1% 1/6W
R103	RD148B2C181J	RES. CARBON 180 5% 1/6W	R228	RN148K2C3003F	RES. METAL FILM 300K 1% 1/6W
R104	RD148B2E151J	RES. CARBON 150 5% 1/4W	R229	RN148K2C1003F	RES. METAL FILM 100K 1% 1/6W
R105	RD148B2C470J	RES. CARBON 47 5% 1/6W	R230	RN148K2C5002F	RES. METAL FILM 50K 1% 1/6W
R106	RD148B2C470J	RES. CARBON 47 5% 1/6W	R231	RN148K2C3002F	RES. METAL FILM 30K 1% 1/6W
R107	RD148B2C152J	RES. CARBON 1.5K 5% 1/6W	R232	RN148K2C1002F	RES. METAL FILM 10K 1% 1/6W
R108	RD148B2C102J	RES. CARBON 1K 5% 1/6W	R233	RN148K2C5001F	RES. METAL FILM 5K 1% 1/6W
R109	RD148B2C102J	RES. CARBON 1K 5% 1/6W	R234	RN148K2C3001F	RES. METAL FILM 3K 1% 1/6W
R110	RD148B2C101J	RES. CARBON 100 5% 1/6W	R235	RN148K2C1001F	RES. METAL FILM 1K 1% 1/6W
R111	RD148B2C331J	RES. CARBON 330 5% 1/6W	R236	RN148K2C1001F	RES. METAL FILM 1K 1% 1/6W
R112	RD148B2C223J	RES. CARBON 22K 5% 1/6W	R237	RN148K2C2202F	RES. METAL FILM 22K 1% 1/6W
R113	RD148B2C680J	RES. CARBON 68 5% 1/6W	R238	RN148K2C3002F	RES. METAL FILM 30K 1% 1/6W
R114	RD148B2C103J	RES. CARBON 10K 5% 1/6W	R239	RD148B2C222J	RES. CARBON 2.2K 5% 1/6W
R115	RD148B2C101J	RES. CARBON 100 5% 1/6W	R240	RD148B2C471J	RES. CARBON 470 5% 1/6W
R116	RD148B2C103J	RES. CARBON 10K 5% 1/6W	R241	RD148B2C223J	RES. CARBON 22K 5% 1/6W
R117	RD148B2C103J	RES. CARBON 10K 5% 1/6W	R242	RD148B2C153J	RES. CARBON 15K 5% 1/6W
R118	RD148B2C392J	RES. CARBON 3.9K 5% 1/6W	R243	RD148B2C152J	RES. CARBON 1.5K 5% 1/6W
R119	RD148B2C183J	RES. CARBON 18K 5% 1/6W	R244	RD148B2C472J	RES. CARBON 4.7K 5% 1/6W
R120	RD148B2C121J	RES. CARBON 120 5% 1/6W	R245	RD148B2C822J	RES. CARBON 8.2K 5% 1/6W
R121	RN148K2C2201F	RES. METAL FILM 2.2K 1% 1/6W	R246	RD148B2C242J	RES. CARBON 2.4K 5% 1/6W
R122	RD148B2C272J	RES. CARBON 2.7K 5% 1/6W	R247	RD148B2C563J	RES. CARBON 56K 5% 1/6W
R123	RD148B2C103J	RES. CARBON 10K 5% 1/6W	R248	RD148B2C222J	RES. CARBON 2.2K 5% 1/6W
R124	RD148B2C123J	RES. CARBON 12K 5% 1/6W	R249	RD148B2C561J	RES. CARBON 560 5% 1/6W
R125	RD148B2C472J	RES. CARBON 4.7K 5% 1/6W	R250	RD148B2C561J	RES. CARBON 560 5% 1/6W
R126	RN148K2E3004F	RES. METAL FILM 3M 1% 1/4W	R251	RD148B2C221J	RES. CARBON 220 5% 1/6W
R127	RN148K2C1004F	RES. METAL FILM 1M 1% 1/6W	R252	RN148K2C1801F	RES. METAL FILM 1.8K 1% 1/6W
R128	RN148K2C5003F	RES. METAL FILM 500K 1% 1/6W	R253	RD148B2C561J	RES. CARBON 560 5% 1/6W
R129	RN148K2C3003F	RES. METAL FILM 300K 1% 1/6W	R254	RD148B2C473J	RES. CARBON 47K 5% 1/6W
R130	RN148K2C1003F	RES. METAL FILM 100K 1% 1/6W	R255	RD148B2E470J	RES. CARBON 47 5% 1/4W
R131	RN148K2C5002F	RES. METAL FILM 50K 1% 1/6W	R256	RD148B2C562J	RES. CARBON 5.6K 5% 1/6W
R132	RN148K2C3002F	RES. METAL FILM 30K 1% 1/6W	R257	RD148B2C682J	RES. CARBON 6.8K 5% 1/6W
R133	RN148K2C1002F	RES. METAL FILM 10K 1% 1/6W	R258	RD148B2E470J	RES. CARBON 47 5% 1/4W
R134	RN148K2C5001F	RES. METAL FILM 5K 1% 1/6W	R259	RD148B2C332J	RES. CARBON 3.3K 5% 1/6W
R135	RN148K2C3001F	RES. METAL FILM 3K 1% 1/6W	R260	RD148B2C682J	RES. CARBON 6.8K 5% 1/6W
R136	RN148K2C1001F	RES. METAL FILM 1K 1% 1/6W	R261	RD148B2C471J	RES. CARBON 470 5% 1/6W
R137	RN148K2C1001F	RES. METAL FILM 1K 1% 1/6W	R262	RD148B2C332J	RES. CARBON 3.3K 5% 1/6W
R138	RD148B2C103J	RES. CARBON 10K 5% 1/6W	R263	RD148B2C102J	RES. CARBON 1K 5% 1/6W
R139	RD148B2C561J	RES. CARBON 560 5% 1/6W	R264	RD148B2C101J	RES. CARBON 100 5% 1/6W
R140	RD148B2C101J	RES. CARBON 100 5% 1/6W	R265	RD148B2C102J	RES. CARBON 1K 5% 1/6W
R141	RD148B2C103J	RES. CARBON 10K 5% 1/6W	R266	RD148B2C101J	RES. CARBON 100 5% 1/6W
R142	RD148B2C821J	RES. CARBON 820 5% 1/6W	R267	RD148B2C181J	RES. CARBON 180 5% 1/6W
R143	RD148B2C562J	RES. CARBON 5.6K 5% 1/6W	R268	RD148B2C103J	RES. CARBON 10K 5% 1/6W
R144	RD148B2C561J	RES. CARBON 560 5% 1/6W	R269	RD148B2C103J	RES. CARBON 10K 5% 1/6W
R145	RD148B2E101J	RES. CARBON 100 5% 1/4W	R270	RD148B2C101J	RES. CARBON 100 5% 1/6W
R146	RD148B2C332J	RES. CARBON 3.3K 5% 1/6W	R271	RD148B2C222J	RES. CARBON 2.2K 5% 1/6W
R147	RD148B2C680J	RES. CARBON 68 5% 1/6W	R272	RD148B2C100J	RES. CARBON 10 5% 1/6W
R148	RD148B2C103J	RES. CARBON 10K 5% 1/6W	R273	RD148B2E151J	RES. CARBON 150 5% 1/4W
R149	RD148B2C822J	RES. CARBON 8.2K 5% 1/6W	R274	RD148B2E151J	RES. CARBON 180 5% 1/4W
R150	RD148B2E102J	RES. CARBON 1K 5% 1/4W	R275	RD148B2C100J	RES. CARBON 10 5% 1/6W
R151	RD148B2C682J	RES. CARBON 6.8K 5% 1/6W	R276	RD148B2C151J	RES. CARBON 150 5% 1/6W
R152	RD148B2C222J	RES. CARBON 2.2K 5% 1/6W	R277	RD148B2C102J	RES. CARBON 1K 5% 1/6W
R153	RD148B2C180J	RES. CARBON 18 5% 1/6W	R278	RD148B2E103J	RES. CARBON 10K 5% 1/4W
R154	RD148B2C100J	RES. CARBON 10 5% 1/6W	R401	RD148B2C332J	RES. CARBON 3.3K 5% 1/6W
R155	RD148B2E100J	RES. CARBON 10 5% 1/4W	R402	RD148B2C561J	RES. CARBON 560 5% 1/6W
R156	RD148B2C100J	RES. CARBON 10 5% 1/6W	R403	RD148B2C101J	RES. CARBON 100 5% 1/6W
R157	RN148K2C2202F	RES. METAL FILM 22K 1% 1/6W	R404	RD148B2C123J	RES. CARBON 12K 5% 1/6W
R158	RN148K2C3002F	RES. METAL FILM 30K 1% 1/6W	R405	RD148B2C101J	RES. CARBON 100 5% 1/6W
R201	RD148B2C101J	RES. CARBON 100 5% 1/6W	R406	RD148B2C101J	RES. CARBON 100 5% 1/6W
R202	RD148B2C103J	RES. CARBON 10K 5% 1/6W	R407	RD148B2C332J	RES. CARBON 3.3K 5% 1/6W
R203	RD148B2C332J	RES. CARBON 3.3K 5% 1/6W	R408	RD148B2C331J	RES. CARBON 330 5% 1/6W

PARTS LIST

REF. NO	PARTS NO	NAME & DESCRIPTION	REF. NO	PARTS NO	NAME & DESCRIPTION
R409	RD148B2C472J	RES. CARBON 4.7K 5% 1/6W	S202	S32-4009-05	LEVER SWITCH 4-4
R410	RD148B2C472J	RES. CARBON 4.7K 5% 1/6W	S501	S33-2501-05	LEVER SWITCH 2-5
R411	RD148B2C682J	RES. CARBON 6.8K 5% 1/6W	T401	L19-0421-05	CONVERTOR TRANSFORMER
R412	RD148B2C473J	RES. CARBON 47K 5% 1/6W	TC101	C05-0454-05	CAP. TRIMMER 20PF
R413	RD148B2C201J	RES. CARBON 200 5% 1/6W	TC201	C05-0454-05	CAP. TRIMMER 20PF
R414	RD148B2C472J	RES. CARBON 4.7K 5% 1/6W	U001	CA3127E	IC. TR, ARRY N-P-N
R415	RD148B2C222J	RES. CARBON 2.2K 5% 1/6W	U002	TL081CP	IC. BI-FET O.P AMP
R416	RD14DB2H473J	RES. CARBON 47K 5% 1/2W	U003	SN74FOON	IC. QUAD 2-INPUT NAND GATE
R417	RS14GB3A333J	RES. METAL FILM 33K 5% 1W	U101	SN74LS00N	IC. QUAD 2-INPUT NAND GATE
R418	RD148B2C561J	RES. CARBON 560 5% 1/6W	U102	SN74F74N	IC. DUAL D-FLIP-FLOP
R419	RD148B2C681J	RES. CARBON 680 5% 1/6W	U103	TL081CP	IC. BI-FET O.P AMP
R420	RS14GB3A223J	RES. METAL FILM 22K 5% 1W	U104	TC4053BP	IC. 2-CH ANALOG MULTIPLEXER
R421	RD14DB2H473J	RES. CARBON 47K 5% 1/2W	U201	SN74F74N	IC. DUAL D-FLIP-FLOP
R422	RD148B2C101J	RES. CARBON 100 5% 1/6W	U202	TL081CP	IC. BI-FET O.P AMP
R423	RD148B2E101J	RES. CARBON 100 5% 1/4W	U203	SN74LS112AN	IC. DUAL JK-FF
R424	R92-1057-05	RES. METAL FILM 2.2M 5% 1/2W	U401	LF13741N	IC. MONOLITHIC JFET INPUT OP
R425	R92-1007-05	RES. CARBON 10M 5% 1/2W	U501	TC74HC123AP	IC. DUAL RETRIGG. MONO. MULTIVI
R426	R92-1007-05	RES. CARBON 10M 5% 1/2W	U502	NJM4558D	IC. DUAL OP AMP
R427	RD148B2E102J	RES. CARBON 1K 5% 1/4W	U701	DTM-5020	IC. GATE ARRAY
R428	RD148B2E102J	RES. CARBON 1K 5% 1/4W	U702	DTM-5020	IC. GATE ARRAY
R429	RD148B2C473J	RES. CARBON 47K 5% 1/6W	VR001	R12-0577-05	RES. SEMI FIXED 500 B
R430	R92-1057-05	RES. METAL FILM 2.2M 5% 1/2W	VR002	R12-2522-05	RES. SEMI FIXED 5K B
R431	RD148B2E101J	RES. CARBON 100 5% 1/4W	VR003	R12-0575-05	RES. SEMI FIXED 100 B
R432	RD148B2C101J	RES. CARBON 100 5% 1/6W	VR004	R12-0576-05	RES. SEMI FIXED 200 B
R433	R92-1057-05	RES. METAL FILM 2.2M 5% 1/2W	VR101	R12-3549-05	RES. SEMI FIXED 10K B
R434	R92-1007-05	RES. CARBON 10M 5% 1/2W	VR102	R06-3502-05	V.R. 10K B
R435	R92-1007-05	RES. CARBON 10M 5% 1/2W	VR201	R12-3549-05	RES. SEMI FIXED 10K B
R436	RD148B2C103J	RES. CARBON 10K 5% 1/6W	VR202	R12-3549-05	RES. SEMI FIXED 10K B
R437	R92-1418-05	RES. METAL 6.8M 1% 1W	VR203	R12-0577-05	RES. SEMI FIXED 500 B
R438	R92-1419-05	RES. METAL FILM 10M 1% 1W	VR204	R12-1545-05	RES. SEMI FIXED 1K B
R439	RD148B2C471J	RES. CARBON 470 5% 1/6W	VR401	R12-4516-05	RES. SEMI FIXED 50K B
R440	RN14BK2C1203F	RES. METAL FILM 120K 1% 1/6W	VR402	R12-8501-05	RES. SEMI FIXED 2.2M B
R441	RD148B2C152J	RES. CARBON 1.5K 5% 1/6W	VR403	R12-3549-05	RES. SEMI FIXED 10K B
P454	RN14BK2C1002F	RES. METAL FILM 10K 1% 1/6W	W001	W02-0474-05	HIGH VOLTAGE BLOCK
R455	RD148B2C393J	RES. CARBON 39K 5% 1/6W			
R456	RN14BK2C1202F	RES. METAL FILM 12K 1% 1/6W			
R457	NO USE				
R458	RD148B2C102J	RES. CARBON 1K 5% 1/6W			
R459	NO USE				
R460	RS14GB3A1R0J	RES. METAL FILM 1 5% 1W			
R461	RD148B2E223J	RES. CARBON 22K 5% 1/4W			
R462	RD148B2C104J	RES. CARBON 100K 5% 1/6W			
R463	RD148B2C473J	RES. CARBON 47K 5% 1/6W			
R464	RD148B2C681J	RES. CARBON 680 5% 1/6W			
R465	RD148B2C470J	RES. CARBON 47 5% 1/6W			
R466	RS14GB3A101J	RES. METAL FILM 100 5% 1W			
R467	RS14GB3A101J	RES. METAL FILM 100 5% 1W			
R468	RS14GB3A102J	RES. METAL FILM 1K 5% 1W			
R469	RD148B2C561J	RES. CARBON 560 5% 1/6W			
R517	RN14BK2C1002F	RES. METAL FILM 10K 1% 1/6W			
R518	RD148B2C472J	RES. CARBON 4.7K 5% 1/6W			
R519	RD148B2C472J	RES. CARBON 4.7K 5% 1/6W			
R520	RD148B2C101J	RES. CARBON 100 5% 1/6W			
R521	RD148B2C222J	RES. CARBON 2.2K 5% 1/6W			
R522	RD148B2C102J	RES. CARBON 1K 5% 1/6W			
R523	RD148B2C103J	RES. CARBON 10K 5% 1/6W			
R524	RD148B2C103J	RES. CARBON 10K 5% 1/6W			
R525	RD148B2C303J	RES. CARBON 30K 5% 1/6W			
R526	RD148B2C103J	RES. CARBON 10K 5% 1/6W			
R527	RD148B2C474J	RES. CARBON 470K 5% 1/6W			
R528	RD148B2C472J	RES. CARBON 4.7K 5% 1/6W			
R529	RD148B2C472J	RES. CARBON 4.7K 5% 1/6W			
R530	R90-0665-05	RES. NETWORK 7X10K			
R531	NO USE				
R532	RD148B2C103J	RES. CARBON 10K 5% 1/6W			
R701	R90-0664-05	RES. NETWORK 10X10K			
R702	R90-0664-05	RES. NETWORK 10X10K			
R801	RD148B2C103J	RES. CARBON 10K 5% 1/6W			
R802	RD148B2C121J	RES. CARBON 120 5% 1/6W			
R901	RD148B2C331J	RES. CARBON 330 5% 1/6W			
R902	RD148B2C103J	RES. CARBON 10K 5% 1/6W			
R903	RD148B2C222J	RES. CARBON 2.2K 5% 1/6W			
R904	RD148B2C472J	RES. CARBON 4.7K 5% 1/6W			
S001	S33-2501-05	LEVER SWITCH 2-5			
S002	S33-2501-05	LEVER SWITCH 2-5			
S101	S33-4503-05	LEVER SWITCH 4-5 (H.MODE)			

PARTS LIST

R/O UNIT

(X77-1510-01)

REF.NO	PARTS NO	NAME & DESCRIPTION			
	J25-5232-02	PCB (UNMOUNTED)			
C001	CE04EW1A470M	CAP. ELECTRO	47	20%	10V
C002	C91-1245-05	CAP. CERAMIC	0.1		12V
C003	C91-0769-05	CAP. AXIAL	0.01	20%	16V
C004	CK45FF1H103Z	CAP. CERAMIC	0.01		50V
C005	NO USE				
C006	CC45FSL1H331J	CAP. CERAMIC	330P	5%	50V
C007	CC45FCH1H680J	CAP. CERAMIC	68P	5%	50V
C008	CF92FV1H334J	CAP. POLYESTER	0.33	5%	50V
C009	CF92FV1H334J	CAP. POLYESTER	0.33	5%	50V
C010	CF92FV1H334J	CAP. POLYESTER	0.33	5%	50V
C011	CF92FV1H334J	CAP. POLYESTER	0.33	5%	50V
C012	NO USE				
C013	CC45FCH1H101J	CAP. CERAMIC	100P	5%	50V
C016	CK45FF1H103Z	CAP. CERAMIC	0.01		50V
C017	CK45FF1H103Z	CAP. CERAMIC	0.01		50V
C018	CK45FF1H103Z	CAP. CERAMIC	0.01		50V
C019	CE04EW1C220M	CAP. ELECTRO	22	20%	16V
C020	CK45FF1H103Z	CAP. CERAMIC	0.01		50V
C021	CK45FF1H103Z	CAP. CERAMIC	0.01		50V
C022	CK45FF1H103Z	CAP. CERAMIC	0.01		50V
C023	CK45FF1H103Z	CAP. CERAMIC	0.01		50V
C024	CK45FF1H103Z	CAP. CERAMIC	0.01		50V
C025	CE04EW1C220M	CAP. ELECTRO	22	20%	16V
C026	CK45FF1H103Z	CAP. CERAMIC	0.01		50V
C027	CK45FF1H103Z	CAP. CERAMIC	0.01		50V
C028	CK45FF1H103Z	CAP. CERAMIC	0.01		50V
C029	CK45FF1H103Z	CAP. CERAMIC	0.01		50V
C030	CE04EW1C220M	CAP. ELECTRO	22	20%	16V
C031	CK45FF1H103Z	CAP. CERAMIC	0.01		50V
C032	C91-1245-05	CAP. CERAMIC	0.1		12V
C033	CK45FF1H103Z	CAP. CERAMIC	0.01		50V
C034	CK45FF1H103Z	CAP. CERAMIC	0.01		50V
C035	CK45FF1H103Z	CAP. CERAMIC	0.01		50V
C036	CK45FF1H103Z	CAP. CERAMIC	0.01		50V
C037	CE04EW1C220M	CAP. ELECTRO	22	20%	16V
C038	CK45FF1H103Z	CAP. CERAMIC	0.01		50V
C039	CK45FF1H103Z	CAP. CERAMIC	0.01		50V
C042	CK45FF1H103Z	CAP. CERAMIC	0.01		50V
C043	CK45FF1H103Z	CAP. CERAMIC	0.01		50V
C046	C91-1245-05	CAP. CERAMIC	0.1		12V
C047	CK45FF1H103Z	CAP. CERAMIC	0.01		50V
C048	CE04EW1C220M	CAP. ELECTRO	22	20%	16V
C049	CE04EW1C220M	CAP. ELECTRO	22	20%	16V
C050	C91-0769-05	CAP. AXIAL	0.01	20%	16V
C051	C91-0769-05	CAP. AXIAL	0.01	20%	16V
C052	C91-0769-05	CAP. AXIAL	0.01	20%	16V
C053	C91-0769-05	CAP. AXIAL	0.01	20%	16V
C054	CE04EW1A101M	CAP. ELECTRO	100	20%	10V
C055	NO USE				
C056	C91-1245-05	CAP. CERAMIC	0.1		12V
C057	C91-1245-05	CAP. CERAMIC	0.1		12V
C058	C91-1245-05	CAP. CERAMIC	0.1		12V
C059	C91-1245-05	CAP. CERAMIC	0.1		12V
C060	C91-1245-05	CAP. CERAMIC	0.1		12V
C061	C91-1245-05	CAP. CERAMIC	0.1		12V
C062	C91-1245-05	CAP. CERAMIC	0.1		12V
C066	CC45FCH1H470J	CAP. CERAMIC	47P	5%	50V
C067	CC45FCH1H470J	CAP. CERAMIC	47P	5%	50V
C068	CC45FCH1H470J	CAP. CERAMIC	47P	5%	50V
C071	C91-1249-05	CAP. NETWORK	0.01X13		
C072	C91-1249-05	CAP. NETWORK	0.01X13		
C073	CK45FF1H103Z	CAP. CERAMIC	0.01		50V
C074	CK45FF1H103Z	CAP. CERAMIC	0.01		50V
C075	CK45FF1H103Z	CAP. CERAMIC	0.01		50V
C076	CK45FF1H103Z	CAP. CERAMIC	0.01		50V
C077	CK45FF1H103Z	CAP. CERAMIC	0.01		50V
C078	CK45FF1H103Z	CAP. CERAMIC	0.01		50V
C079	CK45FF1H103Z	CAP. CERAMIC	0.01		50V
C080	CK45FF1H103Z	CAP. CERAMIC	0.01		50V
C081	CK45FF1H103Z	CAP. CERAMIC	0.01		50V
C082	CK45FF1H103Z	CAP. CERAMIC	0.01		50V
C083	CK45FF1H103Z	CAP. CERAMIC	0.01		50V
C084	CK45FF1H103Z	CAP. CERAMIC	0.01		50V
C085	CK45FF1H103Z	CAP. CERAMIC	0.01		50V

REF.NO	PARTS NO	NAME & DESCRIPTION			
C901	CK45F1H103Z	CAP. CERAMIC	0.01		50V
D001	MA700	DIODE			
D002	MA700	DIODE			
L001	L40-1011-04	FERRI INDUCTOR	100UH		
P015	E40-0473-05	PIN CONNECTOR	4P		
P016	E40-1373-05	PIN CONNECTOR	13P		
P033	E40-1173-05	PIN CONNECTOR	11P		
P034	NO USE				
P035	E40-0973-05	PIN CONNECTOR	9P		
P057	E40-0473-05	PIN CONNECTOR	4P		
P065	E40-0473-05	PIN CONNECTOR	4P		
P080	E40-1173-05	PIN CONNECTOR	11P		
Q001	2SC2785(F)	TR. SI. NPN			
Q002	2SA1175(F)	TR. SI. PNP			
R001	RD148B2C682J	RES. CARBON	6.8K	5%	1/6W
R002	RD148B2C512J	RES. CARBON	5.1K	5%	1/6W
R005	RD148B2C103J	RES. CARBON	10K	5%	1/6W
R006	RD148B2C102J	RES. CARBON	1K	5%	1/6W
R007	RD148B2C104J	RES. CARBON	100K	5%	1/6W
R008	RN148K2C1202F	RES. METAL FILM	12K	1%	1/6W
R009	RD148B2C123J	RES. CARBON	12K	5%	1/6W
R010	RN148K2C6200F	RES. METAL FILM	620	1%	1/6W
R011	RN148K2C6200F	RES. METAL FILM	620	1%	1/6W
R012	RN148K2C9531F	RES. METAL FILM	9.53K	1%	1/6W
R013	RN148K2C1301F	RES. METAL FILM	1.3K	1%	1/6W
R014	RN148K2C9101F	RES. METAL FILM	9.1K	1%	1/6W
R015	RD148B2C102J	RES. CARBON	1K	5%	1/6W
R016	RD148B2C331J	RES. CARBON	330	5%	1/6W
R017	RN148K2C9101F	RES. METAL FILM	9.1K	1%	1/6W
R018	RD148B2C102J	RES. CARBON	1K	5%	1/6W
R019	RD148B2C331J	RES. CARBON	330	5%	1/6W
R020	RN148K2C3602F	RES. METAL FILM	36K	1%	1/6W
R021	RD148B2C622J	RES. CARBON	6.2K	5%	1/6W
R022	RN148K2C7501F	RES. METAL FILM	7.5K	1%	1/6W
R023	RN148K2C7501F	RES. METAL FILM	7.5K	1%	1/6W
R024	RN148K2C3602F	RES. METAL FILM	36K	1%	1/6W
R025	RD148B2C622J	RES. CARBON	6.2K	5%	1/6W
R026	RD148B2C473J	RES. CARBON	47K	5%	1/6W
R027	RD148B2C473J	RES. CARBON	47K	5%	1/6W
R028	NO USE				
R029	RN148K2C1202F	RES. METAL FILM	12K	1%	1/6W
R030	RN148K2C1101F	RES. METAL FILM	1.1K	1%	1/6W
R031	RD148B2C562J	RES. CARBON	5.6K	5%	1/6W
R032	RD148B2C622J	RES. CARBON	6.2K	5%	1/6W
R033	R90-0654-05	RES. NETWORK	COMPLEX		Y
R034	NO USE				
R035	RD148B2C5R6J	RES. CARBON	5.6	5%	1/6W
R036	RD148B2C103J	RES. CARBON	10K	5%	1/6W
R037	RD148B2C103J	RES. CARBON	10K	5%	1/6W
R038	NO USE				
R039	RD148B2C472J	RES. CARBON	4.7K	5%	1/6W
R040	RD148B2C103J	RES. CARBON	10K	5%	1/6W
R043	R90-0653-05	RES. NETWORK	8X10K	5%	
R044	RD148B2C472J	RES. CARBON	4.7K	5%	1/6W
R045	NO USE				
R046	RD148B2C101J	RES. CARBON	100	5%	1/6W
R050	RD148B2C301J	RES. CARBON	300	5%	1/6W
R051	RD148B2C301J	RES. CARBON	300	5%	1/6W
R052	RD148B2C301J	RES. CARBON	300	5%	1/6W
U001	DAC0808LCN	IC. 8-BIT D/A CONVERTER			
U002	HD74HC564AP	IC. OCTAL D FLIP-FLOP			
U003	HD74HC244AP	IC. OCTAL BUFFER			
U004	HD14052BP	IC. DUAL ANALOG MULTIPLEXER			
U005	HD14052BP	IC. DUAL ANALOG MULTIPLEXER			
U006	HD14051BP	IC. ANALOG MULTIPLEXER			
U007	MBM27C64*T	IC. CHARACTER GENERATOR			
U008	CTM5020	IC. GATE ARRAY (R/O CONTROLLER)			
U009	AM6012DC	IC. 12-BIT D/A CONVERTER			
U010	NJM311D	IC. COMPARATOR			
U011	NJM4558D	IC. DUAL OP AMP			
U012	R90-0655-05	CR NETWORK			

PARTS LIST

REF.NO	PARTS NO	NAME & DESCRIPTION
U013	NJM072BD	IC,JFET INPUT OP AMP
U014	HD14051BP	IC,ANALOG MULTIPLEXER
U015	NJM4558D	IC, DUAL OP AMP
U016	SN74LS04N	IC,HEX INVERTER
U017	HD74HC138AP	IC,3 TO 8 DECORDER MULTIPLEXER
U018	HD74HC373AP	IC,OCAL D-LATCHES
U019	SN74LS244N	IC,OCAL BUFFER
U020	SN74LS244N	IC,OCAL BUFFER
U021	SN74LS244N	IC,OCAL BUFFER
U022	SN74LS244N	IC,OCAL BUFFER
U023	CTMS040	IC, CPU
VR001	R12-1538-05	RES. SEMI FIXED 1KB
VR002	R12-2520-05	RES. SEMI FIXED 5KB
X001	L78-0107-05	CERAMIC RESONATOR (10MHZ)

LINE FILTER UNIT

(X80-1060-04)

REF.NO	PARTS NO	NAME & DESCRIPTION
	E01-0103-05	CRT SOCKET
	E31-5532-05	WIRE ASS'Y (P1,G1,K)
	E31-5674-05	WIRE ASS'Y (+Y,-Y)
	E31-5675-05	WIRE ASS'Y (+X,-X)
	E31-5676-05	WIRE ASS'Y (P2,K2)
	J25-5179-33	PCB (UNMOUNTED)
	R92-0150-05	JUMPING RES. ZERO OHM(10MM)
	R92-1061-05	JUMPING RES. ZERO OHM (5MM)
C001	C91-0575-05	CAP. CERAMIC 1000P 4KV
C002	C91-0575-05	CAP. CERAMIC 1000P 4KV
C003	C91-0551-05	CAP. POLYESTER 0.22 10% 630V
C004	CC45CH2H010C	CAP. CERAMIC 1P 0.25P 500V
C005		NO USE
C006	CK45F1H103Z	CAP. CERAMIC 0.01 50V
C007	CK45F1H103Z	CAP. CERAMIC 0.01 50V
C008	CK45F1H103Z	CAP. CERAMIC 0.01 50V
C009	CK45F1H103Z	CAP. CERAMIC 0.01 50V
C010	CK45B2H103K	CAP. CERAMIC 0.01 10% 500V
C011	CK45B2H103K	CAP. CERAMIC 0.01 10% 500V
C012	CK45B2H103K	CAP. CERAMIC 0.01 10% 500V
C013	CK45F1H103Z	CAP. CERAMIC 0.01 50V
L001	L33-0808-05	CHOKO COIL
L801	L40-3381-70	FERRI INDUCTOR 0.33UH 10%
L802	L40-3381-70	FERRI INDUCTOR 0.33UH 10%
P030	E40-0574-05	PIN CONNECTOR 5P
P050	E40-0474-05	PIN CONNECTOR 4P
P051		NO USE
P052	E40-0474-05	PIN CONNECTOR 4P
P069	E40-0530-05	PIN CONNECTOR 5P
P073	E40-0330-05	PIN CONNECTOR 3P
R001	RD14BY2H225J	RES. CARBON 2.2M 5% 1/2W
R002	RD14BB2C101J	RES. CARBON 100 5% 1/6W
R003	RD14BB2C101J	RES. CARBON 100 5% 1/6W
R801	RD14BB2C471J	RES. CARBON 470 5% 1/6W
R802	RD14BB2C471J	RES. CARBON 470 5% 1/6W
S001	S40-2524-05	PUSH SWITCH (POWER)
VR001	R10-9508-05	V.R.(INTENSITY) 10KB/20KB
VR002	R10-9506-05	V.R.(FOCUS/ASTIG) 200KB/100KB
VR003	R10-9507-05	V.R.(ILLUM/ROTA) 10KB/20KB

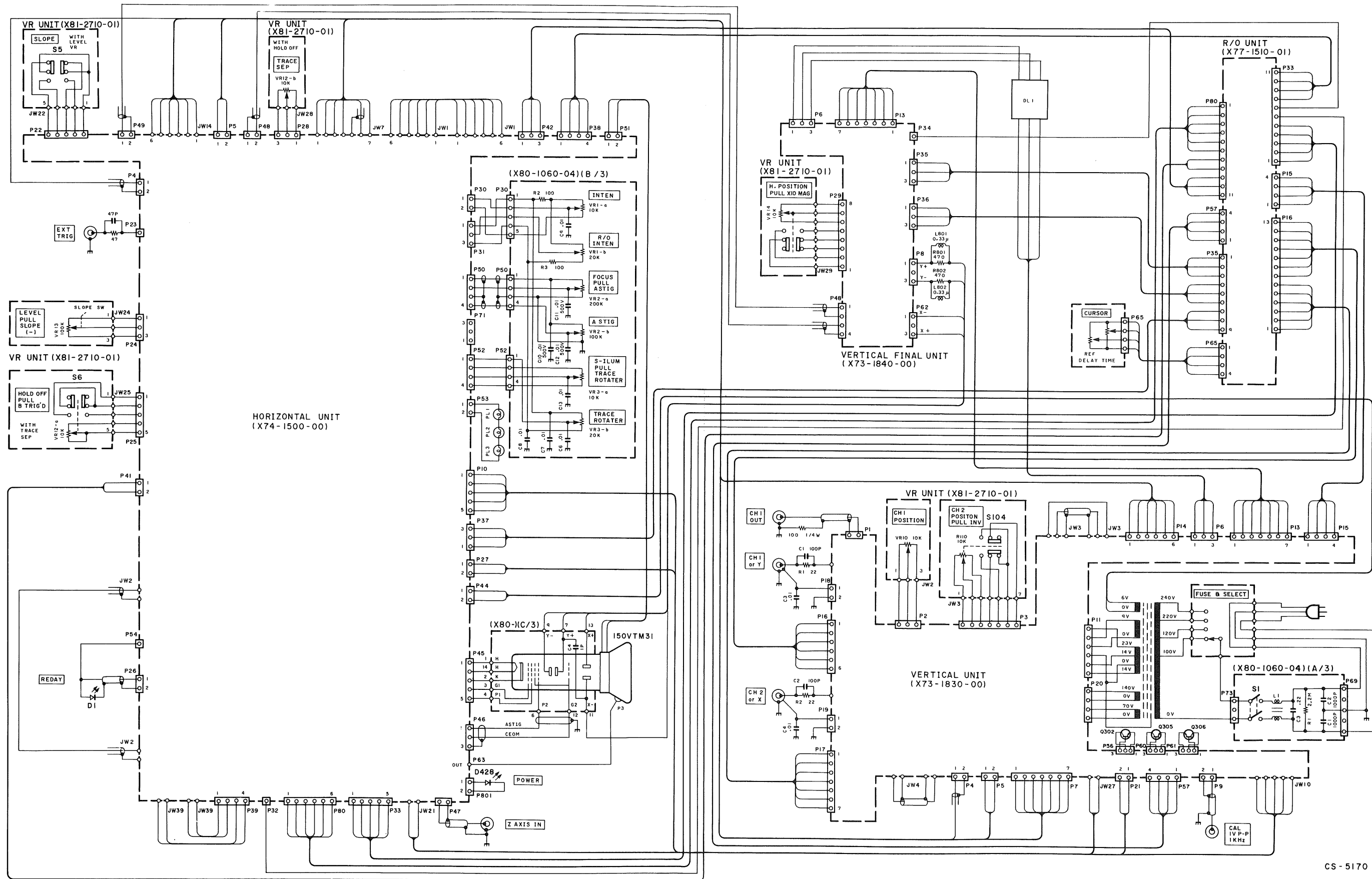
PARTS LIST

VR UNIT

(X81-2710-01)

REF.NO	PARTS NO	NAME & DESCRIPTION
	J25-5354-03	PCB (UNMOUNTED)
JW002	E31-5503-05	LEAD WIRE WITH CONNECTOR
JW003	E31-5722-05	LEAD WIRE WITH CONNECTOR
JW022	E31-5721-05	LEAD WIRE WITH CONNECTOR
JW023		NO USE
JW024	E31-5518-05	LEAD WIRE WITH CONNECTOR
JW025	E31-5520-05	LEAD WIRE WITH CONNECTOR
JW028	E31-5522-05	LEAD WIRE WITH CONNECTOR
JW029	E31-5677-15	LEAD WIRE WITH CONNECTOR
VR010	R01-3522-05	V.R. 2X10K B
VR011		NO USE
VR012	R06-2505-05	VR WITH SWITCH 2X10K B
VR013	R01-5513-05	VR WITH SWITCH 100K B
VR014	R01-3523-05	VR WITH SWITCH 10K B
VR110	R01-3523-05	VR WITH SWITCH 10K B

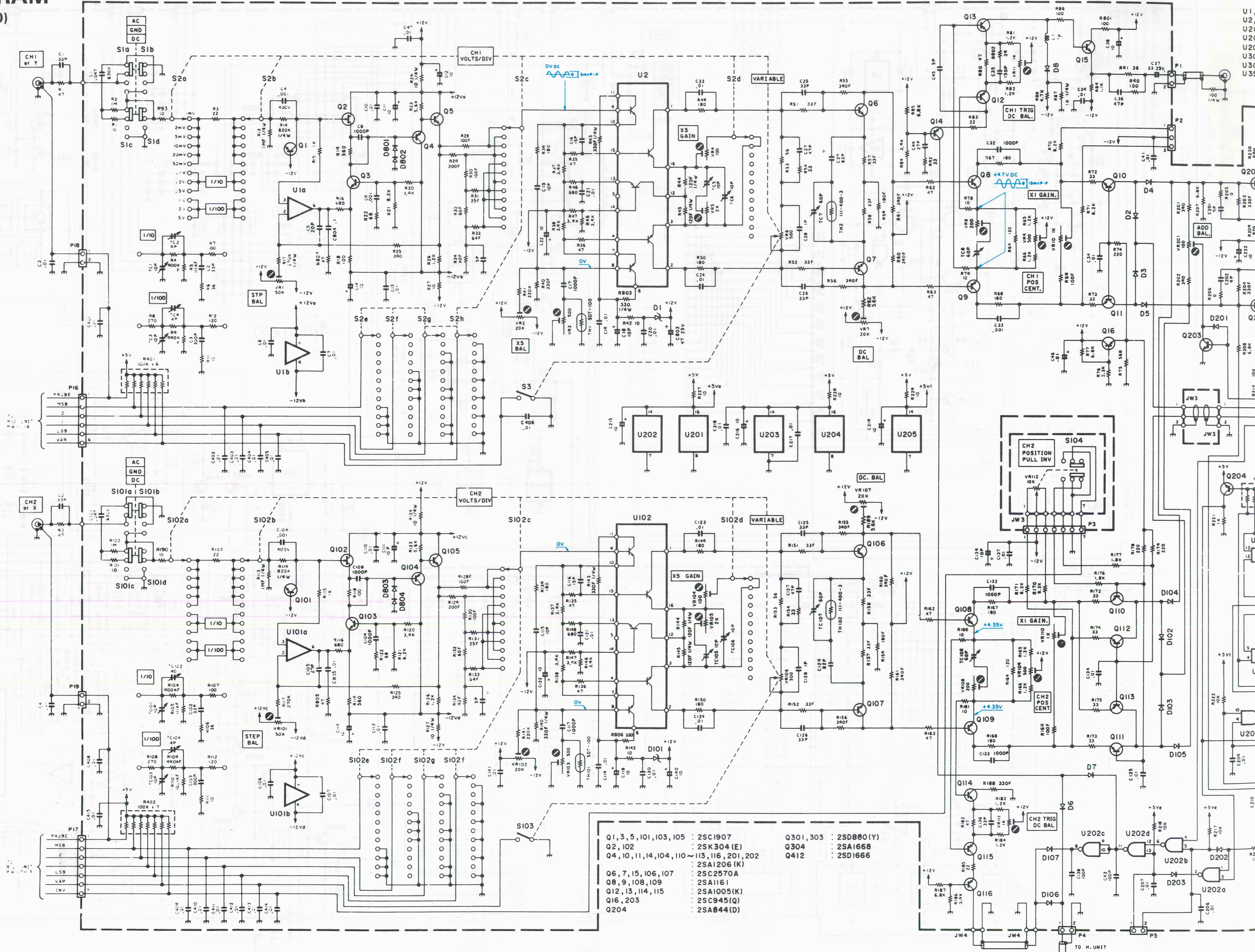
SCHEMATIC DIAGRAM



SCHEMATIC DIAGRAM

VERTICAL UNIT (X73-1830-00)

VERTICAL UNIT (X73-1830-00)



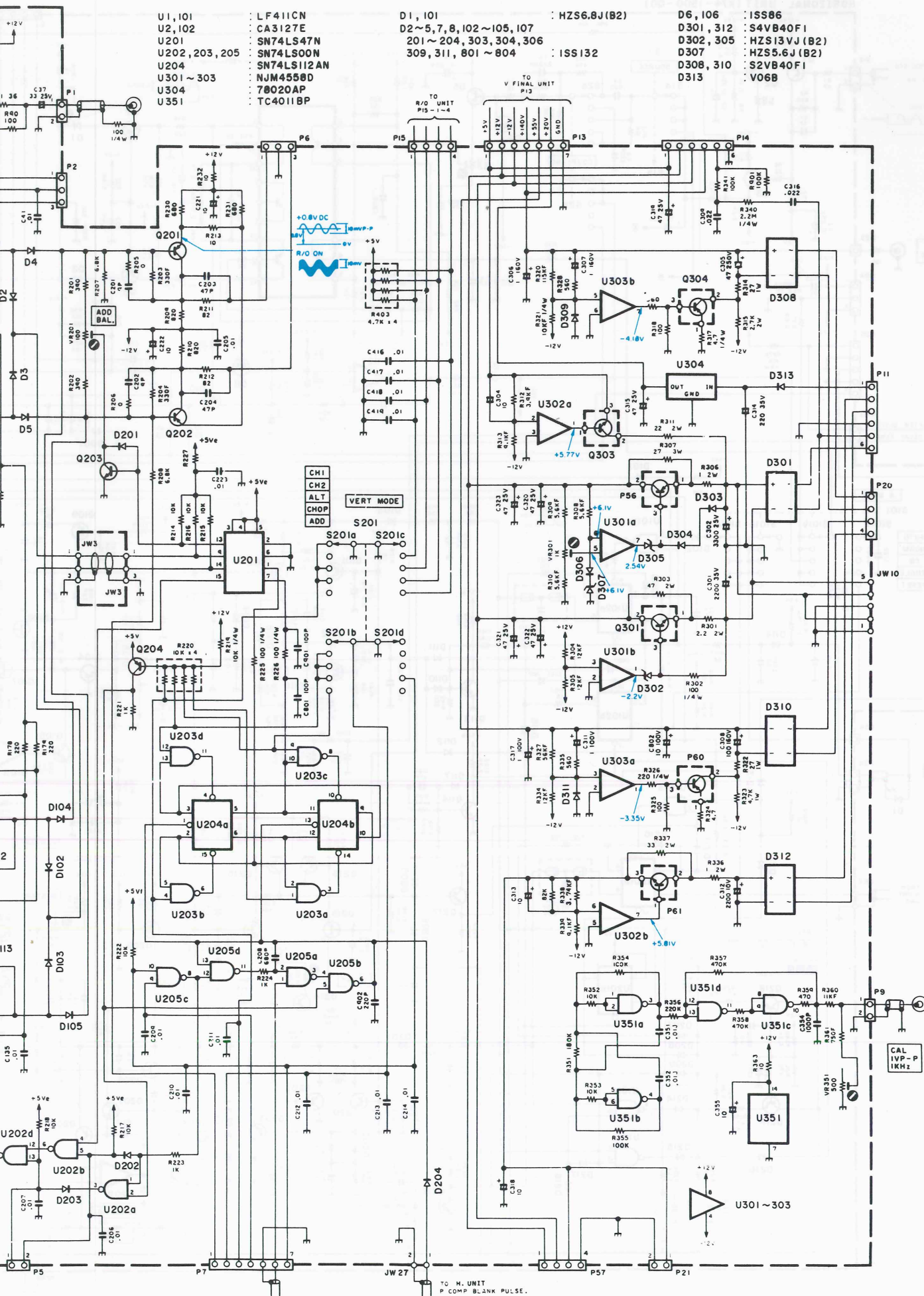
- | | | | |
|-----------------------------------------------|--------------|-----------|-------------|
| Q1, 3, 5, 101, 103, 105 | : 2SC1907 | Q301, 303 | : 2SD880(Y) |
| Q2, 102 | : 2SK304(E) | Q304 | : 2SA1668 |
| Q4, 10, 11, 14, 104, 110 ~ 113, 116, 201, 202 | : 2SA1206(K) | Q412 | : 2SD1666 |
| Q6, 7, 15, 106, 107 | : 2SC2570A | | |
| Q8, 9, 108, 109 | : 2SA1161 | | |
| Q12, 13, 114, 115 | : 2SA1005(K) | | |
| Q16, 203 | : 2SC945(Q) | | |
| Q204 | : 2SA844(D) | | |

U1, 10
U2, 10
U201
U202
U204
U301
U304
U351

U2
U205

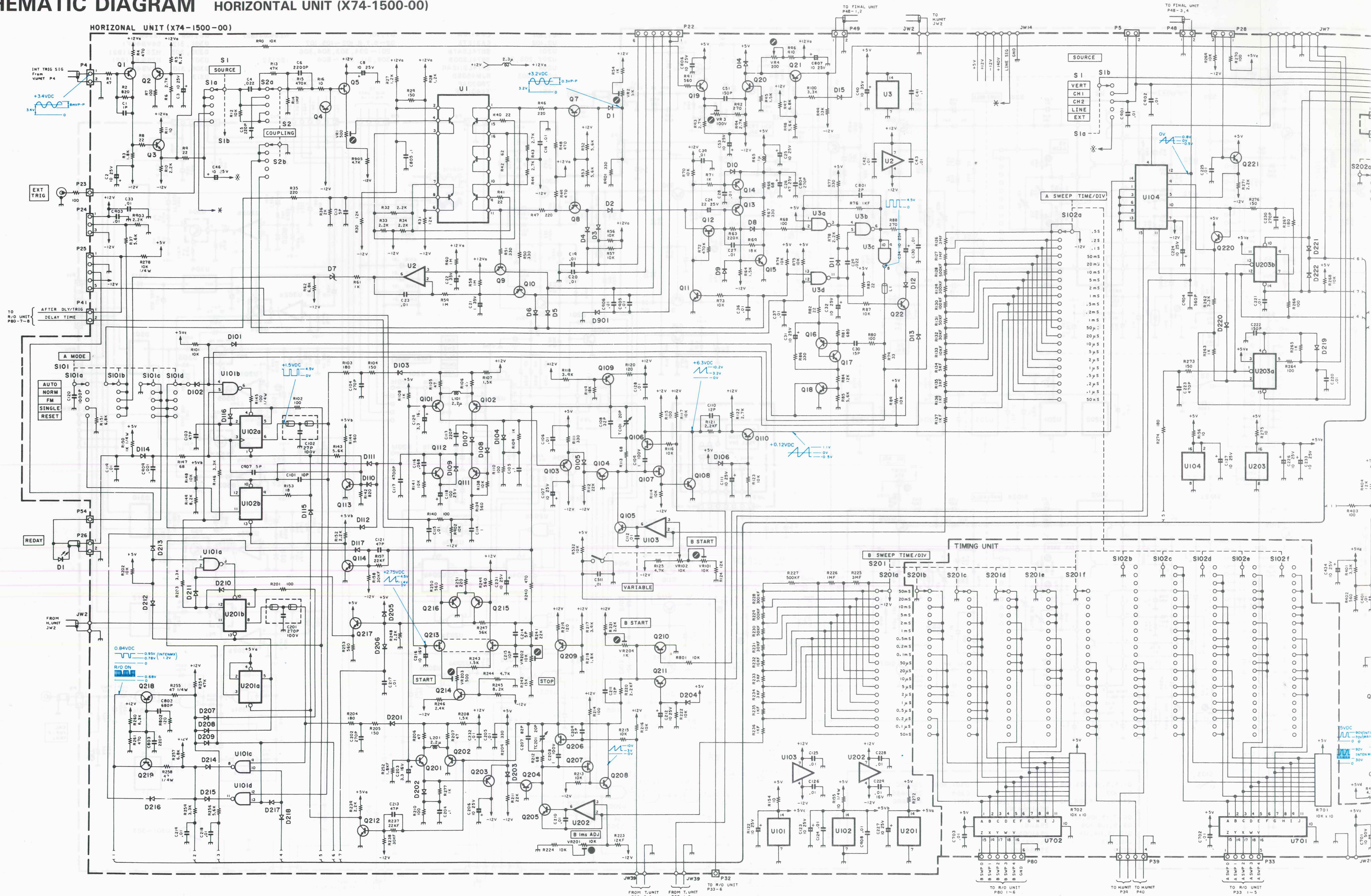
U202c
U202d
U202b
U202a

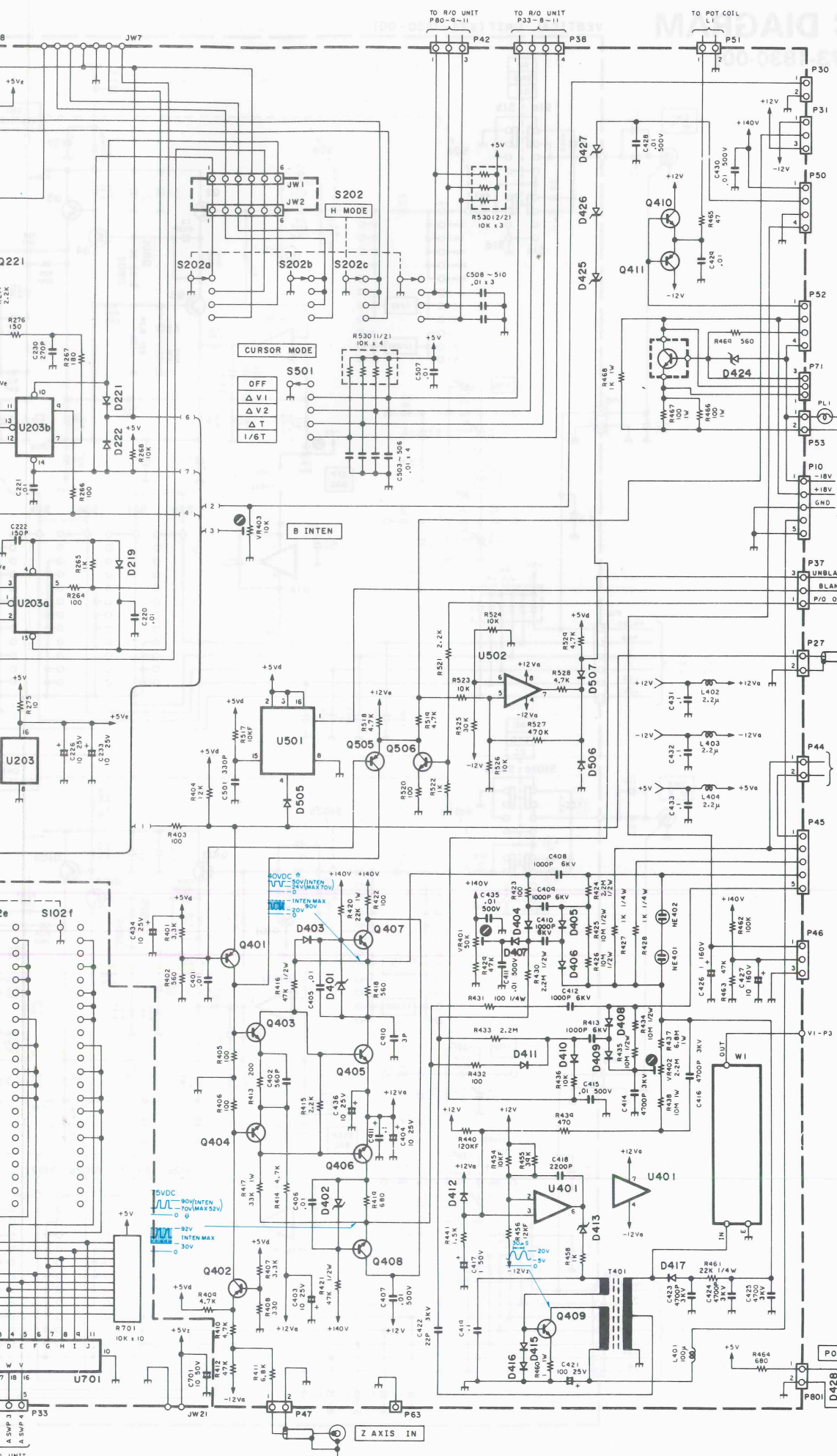
TO H. UNIT



- | | | | | | |
|----------------|---------------|--------------------------|---------------|-----------|---------------|
| U1, 101 | : LF411CN | D1, 101 | : HZS6.8J(B2) | D6, 106 | : ISS86 |
| U2, 102 | : CA3127E | D2~5, 7, 8, 102~105, 107 | | D301, 312 | : S4VB40F1 |
| U201 | : SN74LS47N | 201~204, 303, 304, 306 | | D302, 305 | : HZS13VJ(B2) |
| U202, 203, 205 | : SN74LS00N | 309, 311, 801~804 | : ISS132 | D307 | : HZS5.6J(B2) |
| U204 | : SN74LS112AN | | | D308, 310 | : S2VB40F1 |
| U301~303 | : NJM4558D | | | D313 | : V06B |
| U304 | : 7802AP | | | | |
| U351 | : TC4011BP | | | | |

SCHEMATIC DIAGRAM HORIZONTAL UNIT (X74-1500-00)



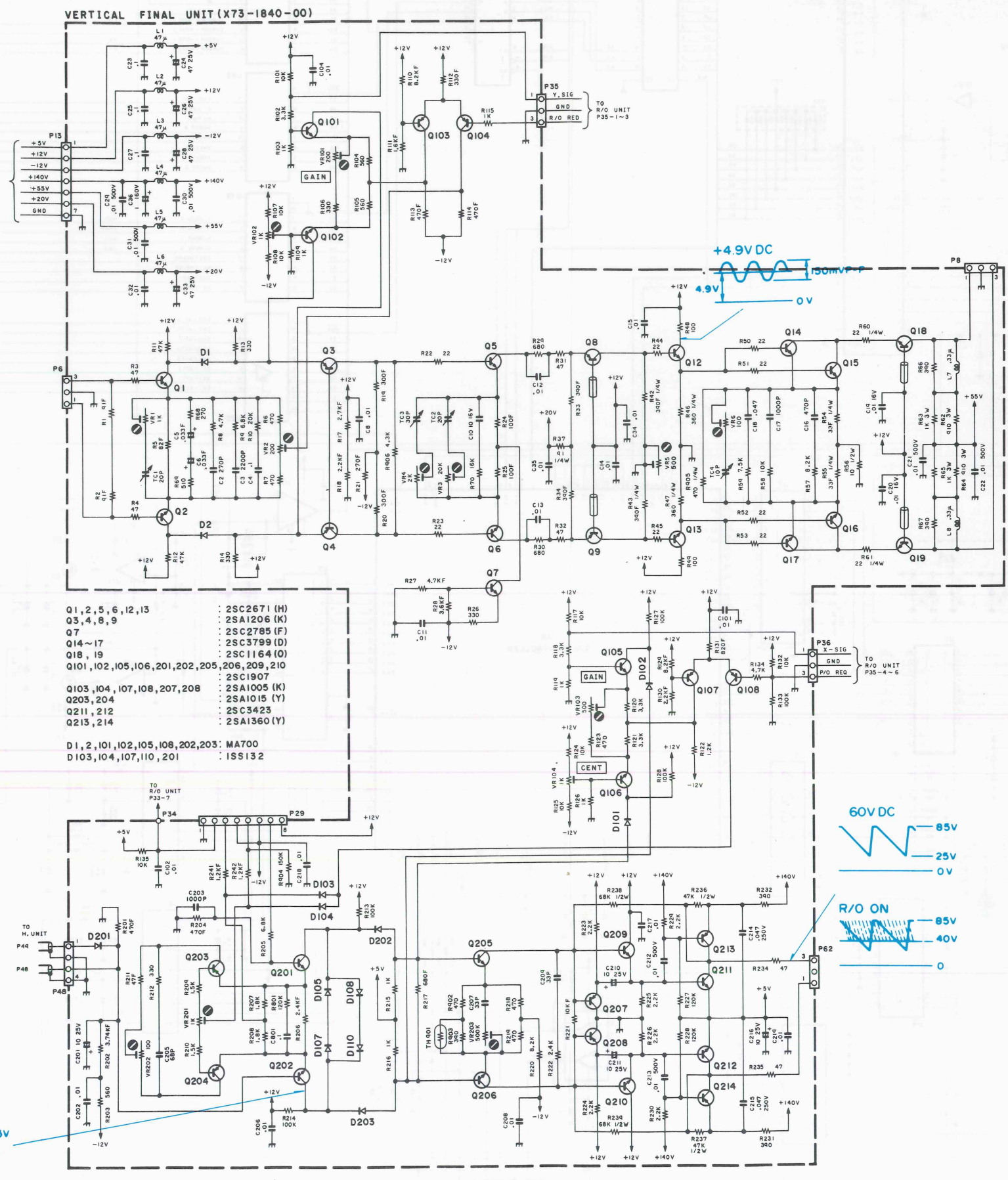


- | | |
|---------------------------------------------------------------------------------------------------|-----------------|
| U1 | : CA3127E |
| U2, 103, 202 | : TL081CP |
| U3 | : SN74FO0N |
| U101 | : SN74LS00N |
| U102, 201 | : SN74F74N |
| U104 | : TC4053BP |
| U203 | : 74LS12AN |
| U401 | : LF1374IN |
| U501 | : TC74HC123P |
| U502 | : NJM4558D |
| U701,702 | : DTM-5020 |
| Q1, 2, 7, 8 | : 2SA1206 |
| Q3, 4, 15, 17, 108, 208 | : 403, 404 |
| | : 2SC1907 |
| Q5, 6 | : 2SK304(E) |
| Q9, 10, 104, 204 | : 2SA838(B) |
| Q11, 18~20, 22, 112~114, 212, 214, 217 | : 2SC945(Q) |
| 220, 221, 410, 506 | : 2SK117 (BL) |
| Q12 | : 2SK117 (BL) |
| Q13, 16, 218, 219, 401, 402, 505 | : 2SA1005(K) |
| Q14, 109, 209, 210, 411 | : 2SA1015(Y) |
| Q21, 101~103, 110, 201~203, 211, 215, 216 | : 2SA844(D) |
| Q105, 205 | : 2SC1345(E) |
| Q106, 206 | : 2SK170(V) |
| Q107, 207 | : 2SK304(F) |
| Q111 | : 2SA1175(F) |
| Q213 | : JPA68H |
| Q405 ~ 408 | : 2SD668A(C) |
| Q409 | : 2SD880(Y) |
| D1 ~ 6, 9, 10~15, 101~112, 114~117, 201~210, 212~215, 217~222, 403, 412, 415, 416, 505 ~ 507, 901 | : 1SS132 |
| D7, 413 | : HZ55.6 J (B2) |
| D8, 211, 216 | : 1SS86 |
| D401, 402 | : HZ2(B3) |
| D404 ~ 411 | : 1SS83 |
| D417 | : Y10GA |
| D424 | : MT Z30JC |
| D425 ~ 427 | : HZ36-2C |
| D428 | : B30-0957-05 |

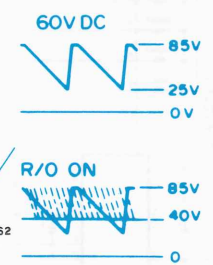
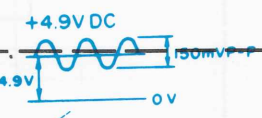
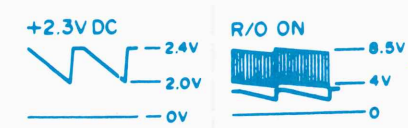
SCHEMATIC DIAGRAM
VERTICAL UNIT

SCHEMATIC DIAGRAM

VERTICAL FINAL UNIT (X73-1840-00)



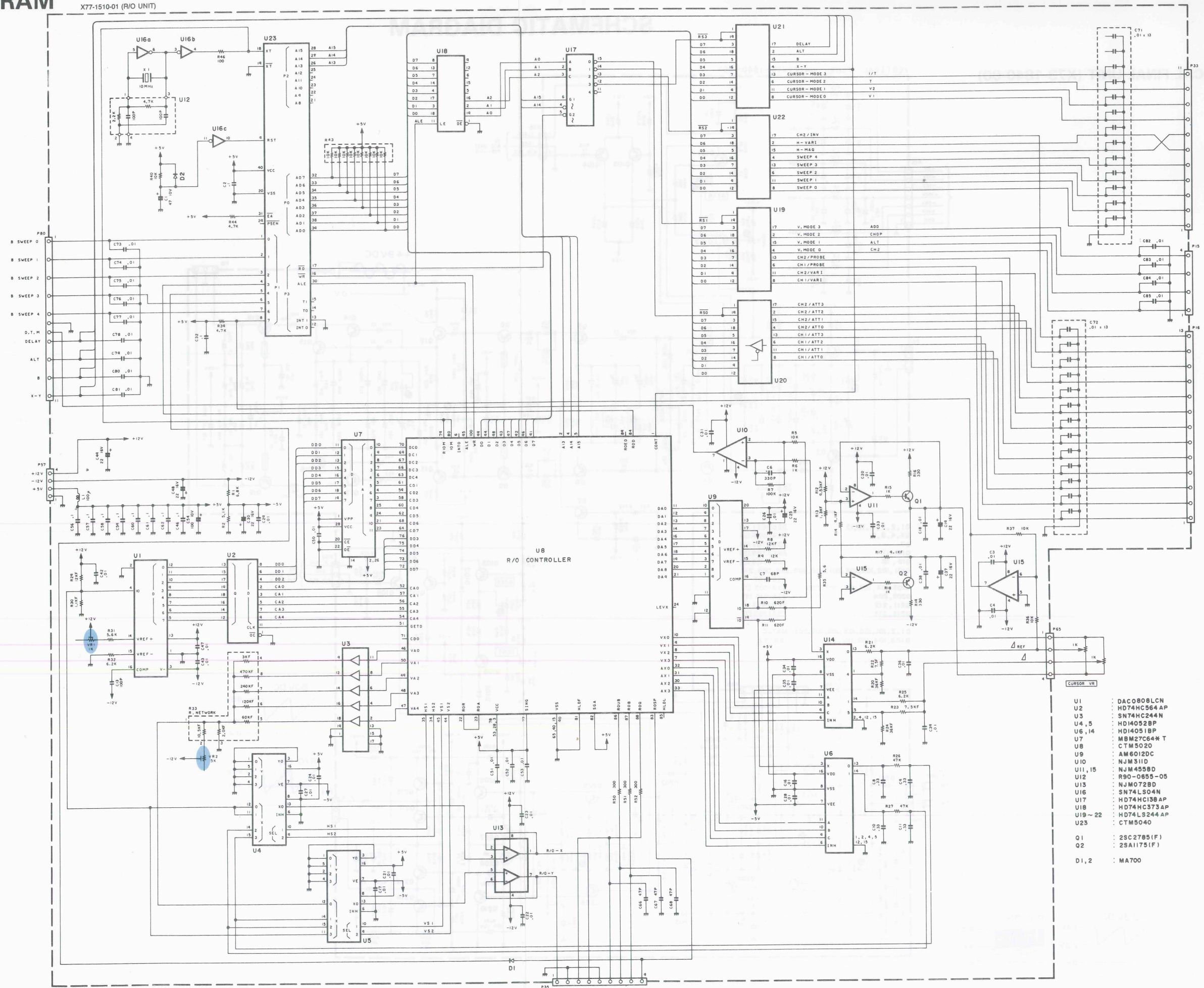
- Q1, 2, 5, 6, 12, 13 : 2SC2671 (H)
- Q3, 4, 8, 9 : 2SA1206 (K)
- Q7 : 2SC2785 (F)
- Q14~17 : 2SC3789 (D)
- Q18, 19 : 2SC1164 (I)
- Q101, 102, 105, 106, 201, 202, 205, 206, 209, 210 : 2SC1907
- Q103, 104, 107, 108, 207, 208 : 2SA1005 (K)
- Q203, 204 : 2SA1015 (Y)
- Q211, 212 : 2SC3423
- Q213, 214 : 2SA1360 (Y)
- D1, 2, 101, 102, 105, 108, 202, 203 : MA700
- D103, 104, 107, 110, 201 : ISS132



SCHEMATIC DIAGRAM

R/O UNIT (X77-1510-01)

X77-1510-01 (R/O UNIT)

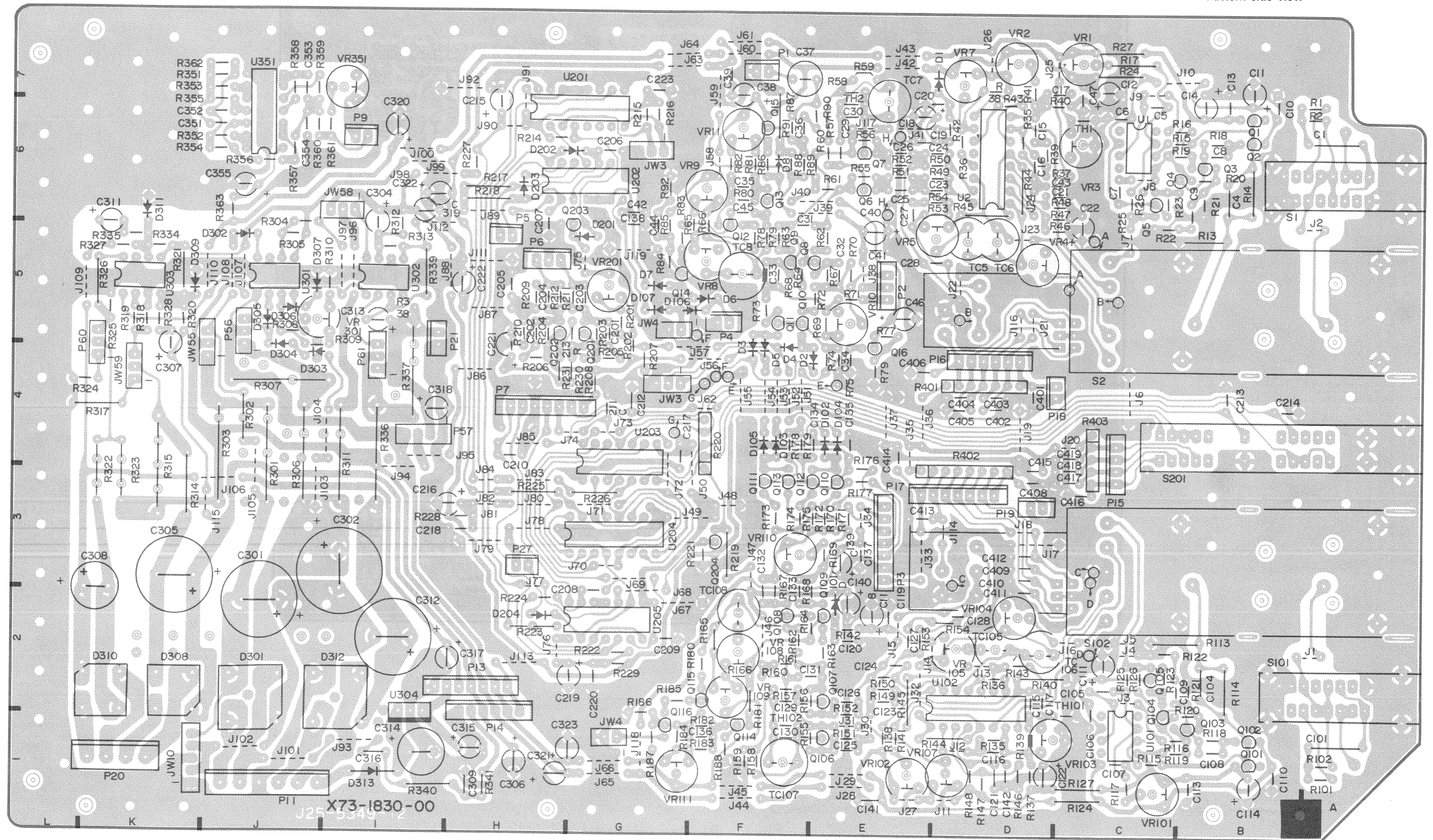


- U1 : DAC0808LCN
- U2 : HD74HC564 AP
- U3 : SN74HC244N
- U4, 5 : HD14052BP
- U6, 14 : HD14051BP
- U7 : MBM27C64#T
- U8 : CTM5020
- U9 : AM6012DC
- U10 : NJM311D
- U11, 15 : NJM4558D
- U12 : R90-0855-05
- U13 : NJM072BD
- U16 : SN74LS04N
- U17 : HD74HC38 AP
- U18 : HD74HC373 AP
- U19 ~ 22 : HD74LS244 AP
- U23 : CTM5040
- Q1 : 2SC2785(F)
- Q2 : 2SA1175(F)
- D1, 2 : MA700

P.C. BOARD

VERTICAL UNIT (X73-1830-00)

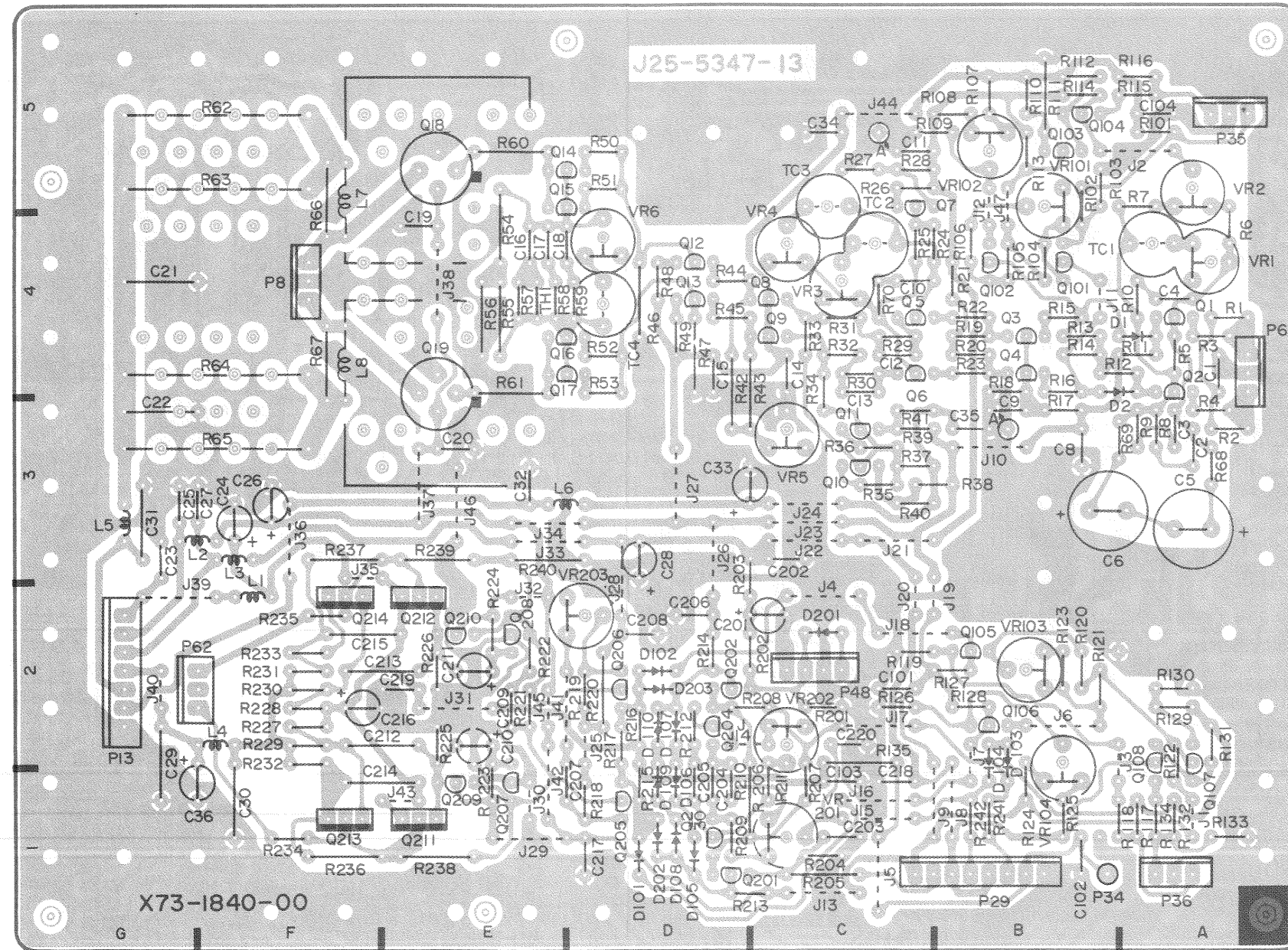
Pattern side view



P.C. BOARD

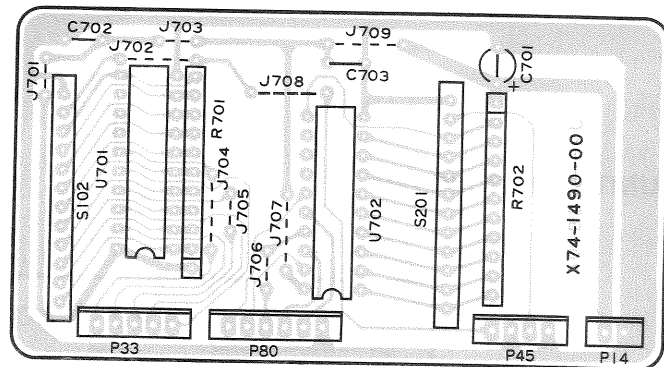
VERTICAL FINAL UNIT (X73-1840-00)

Pattern side view

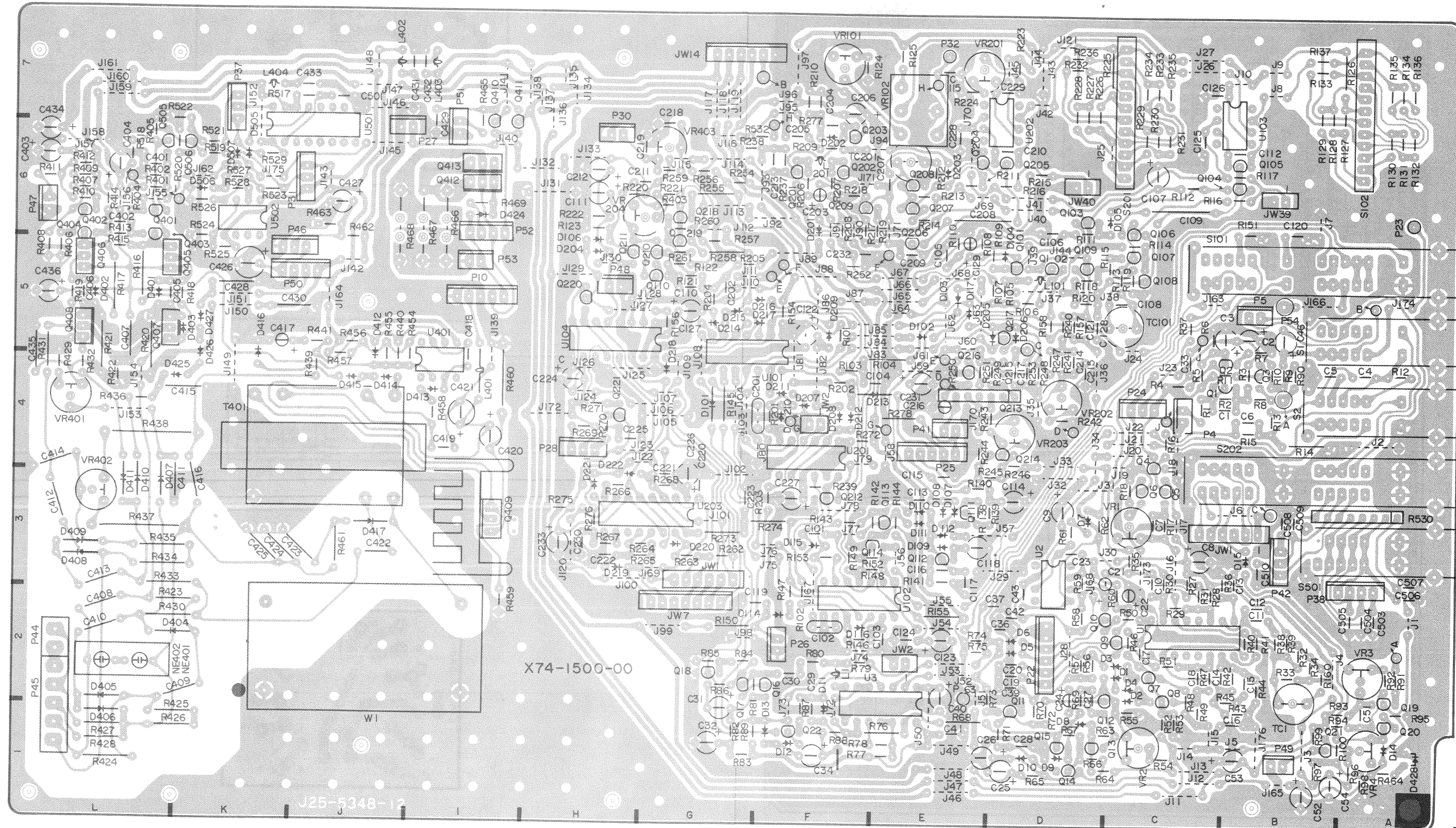


P.C. BOARD

HORIZONTAL UNIT (X74-1500-00)

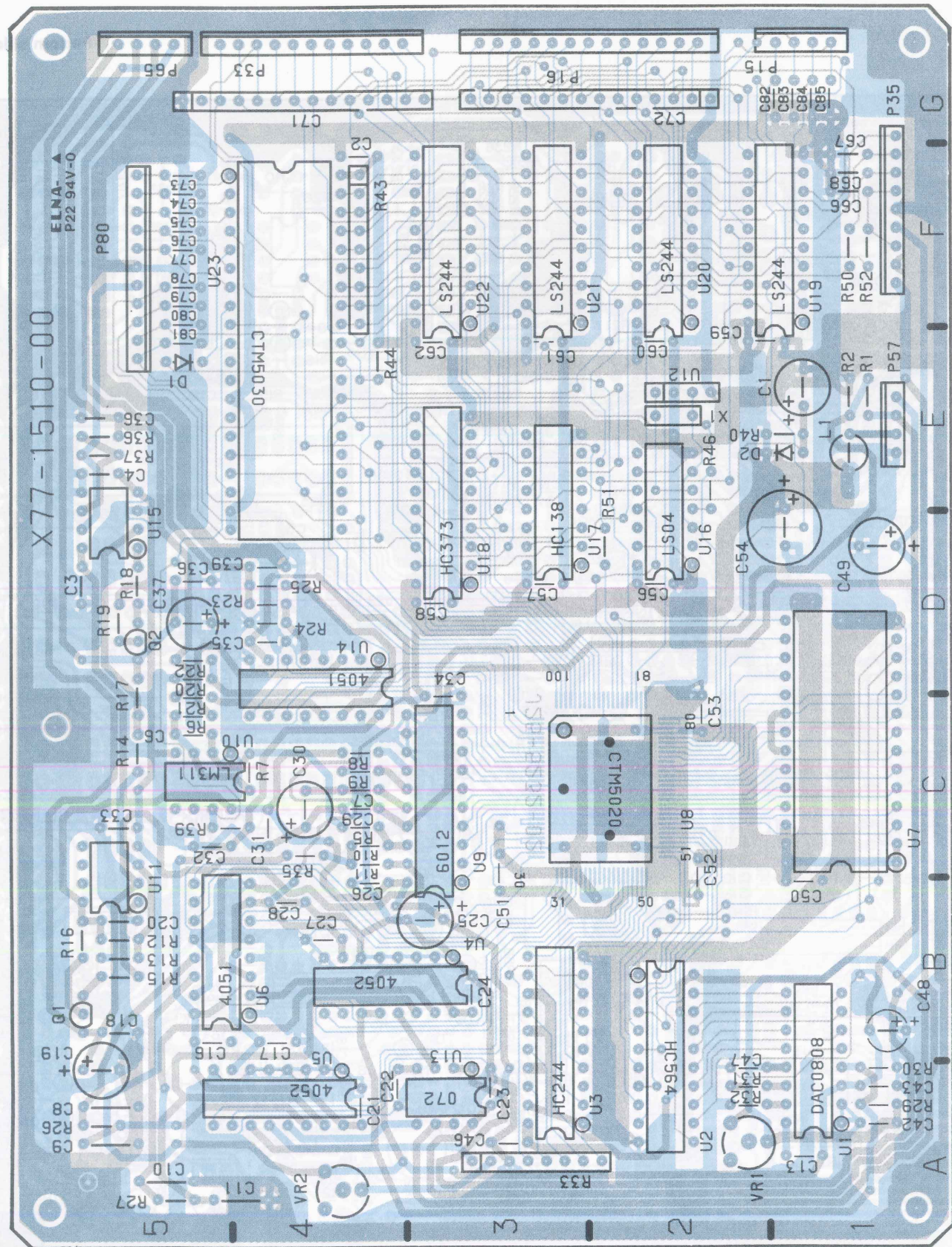


Pattern side view

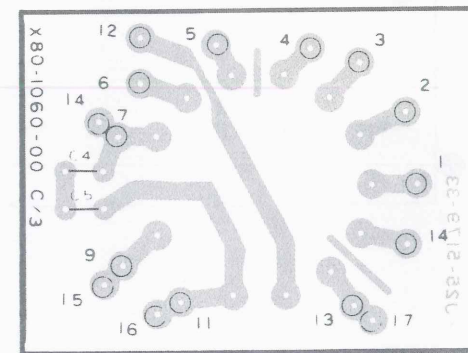
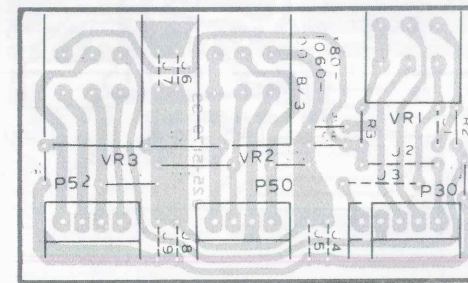
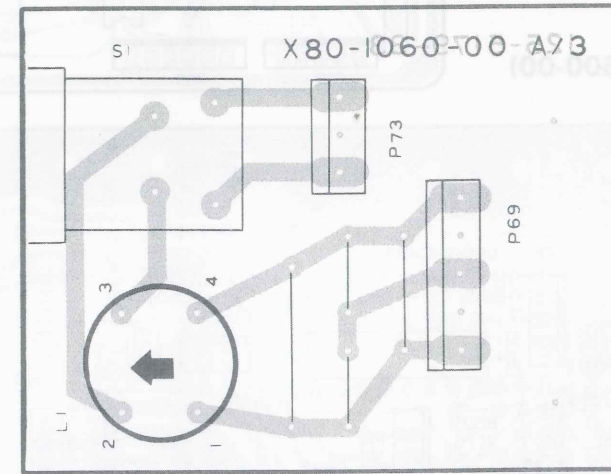


P.C. BOARD

R/O UNIT (X77-1510-01)

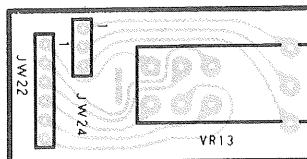
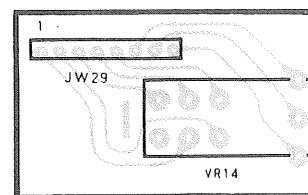
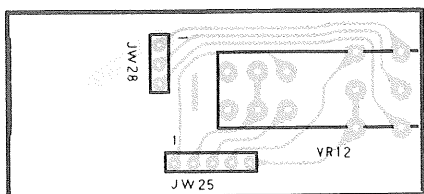
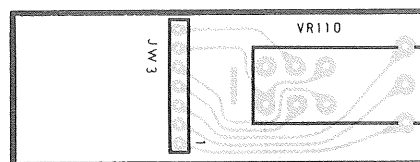
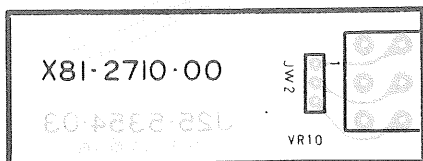


LINE FILTER UNIT (X80-1060-04)

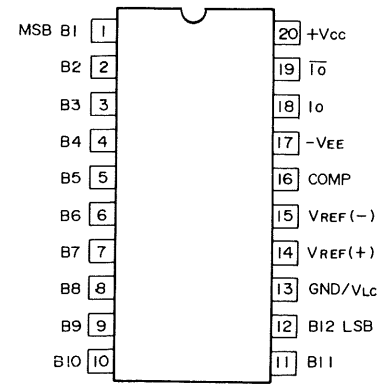


P.C. BOARD

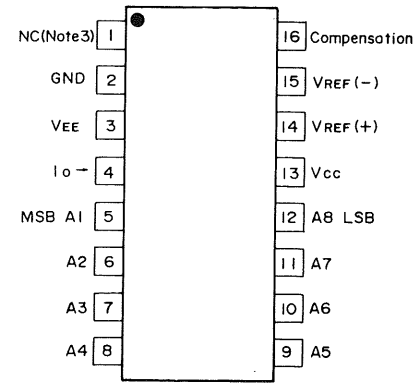
VR UNIT (X81-2710-01)



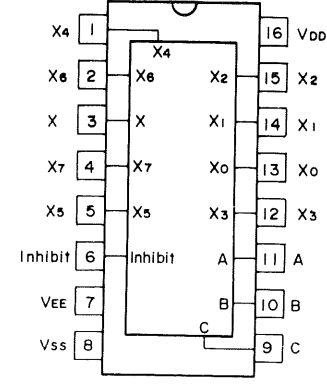
SEMICONDUCTORS



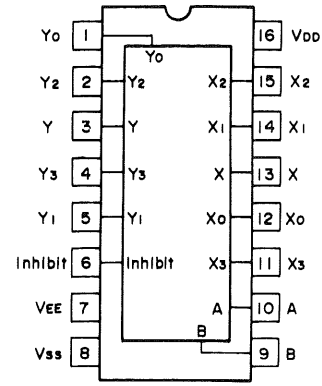
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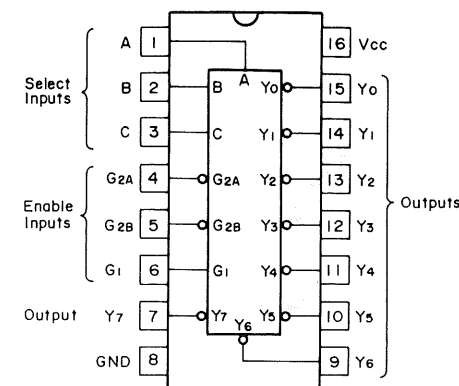
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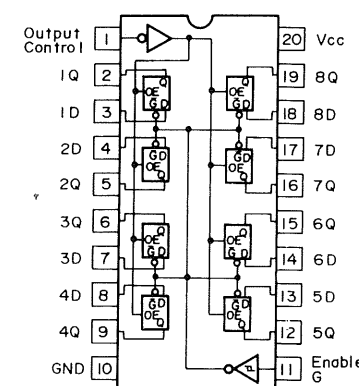
HD14051BP



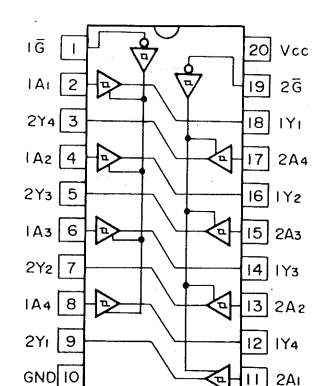
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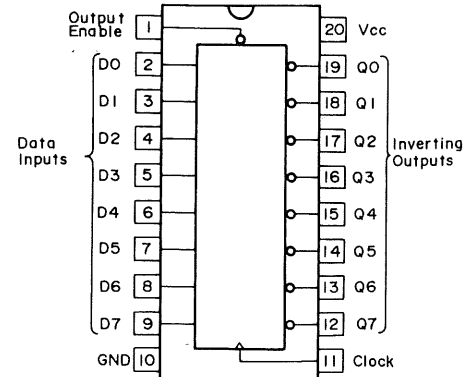
HD74HC138AP



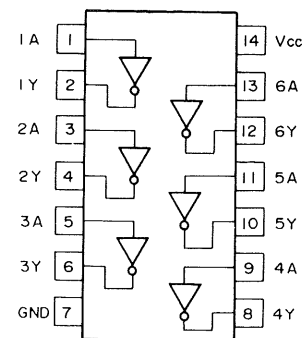
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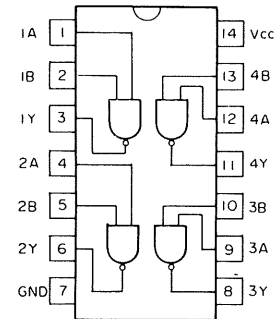
SN74LS244N
HD74HC244AP



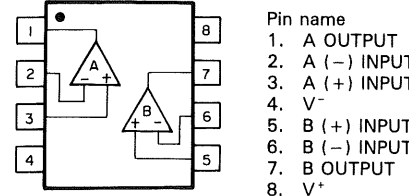
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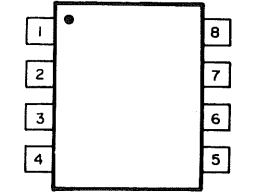
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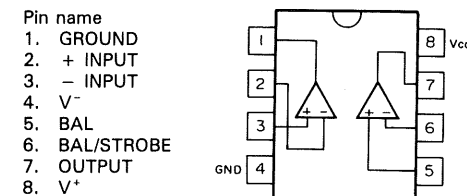
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SN74LSOON



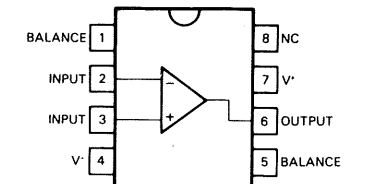
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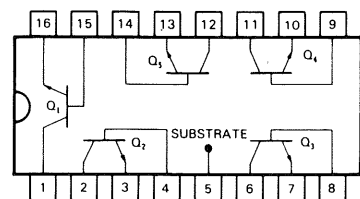
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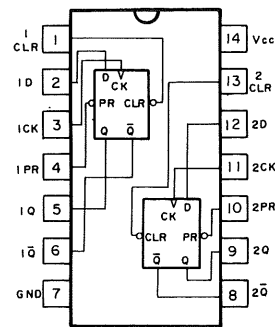
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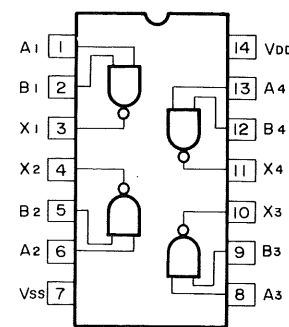
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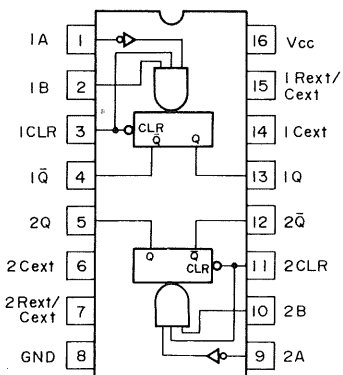
CA3127E



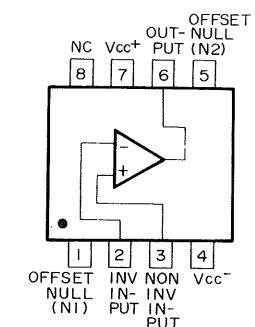
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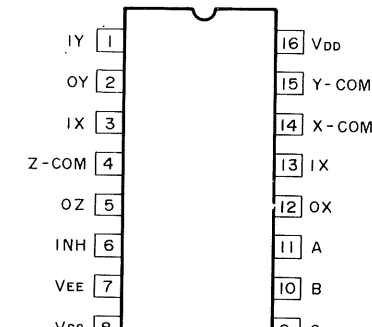
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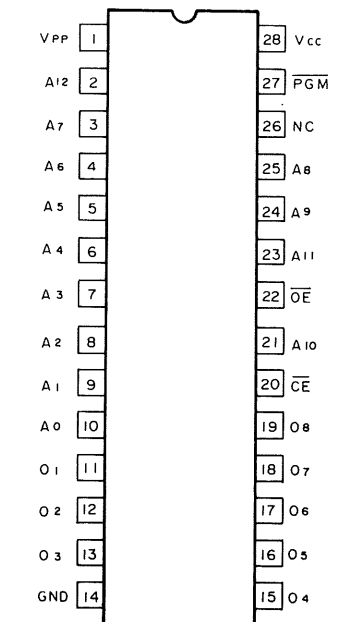
TC74HC123AP



TC081CP

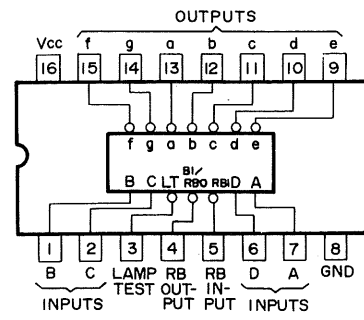


TC4053BP

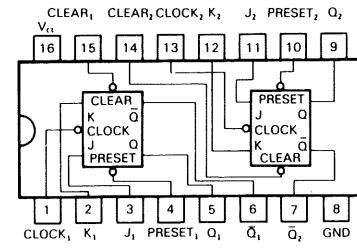


MBM27C64 * T

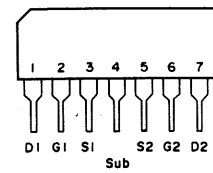
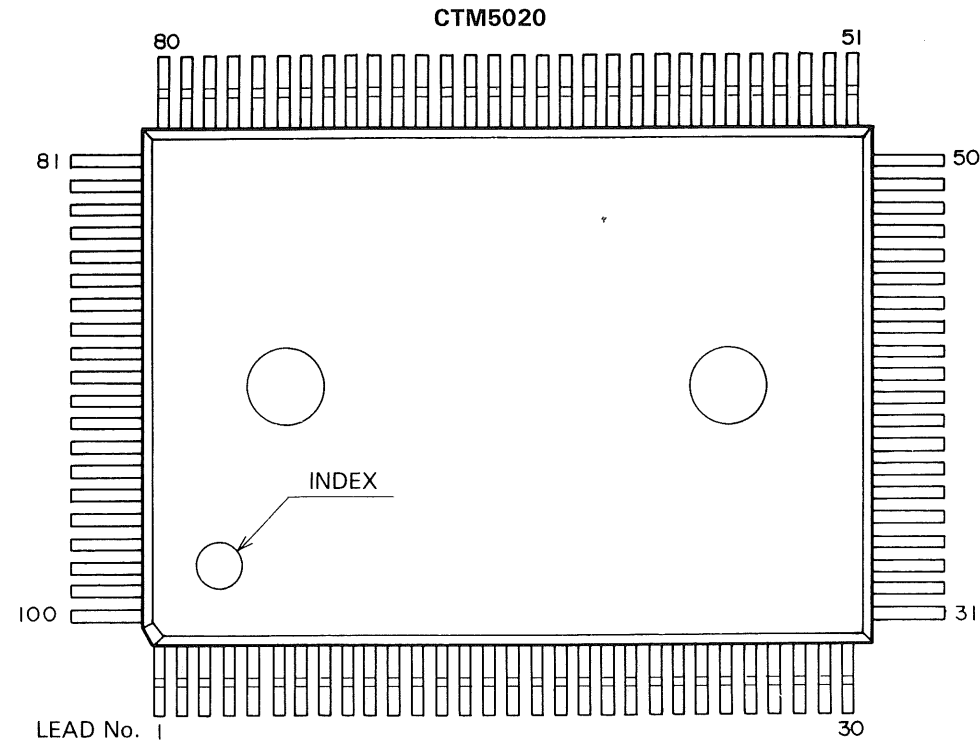
SEMICONDUCTORS



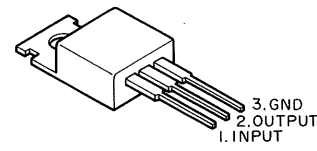
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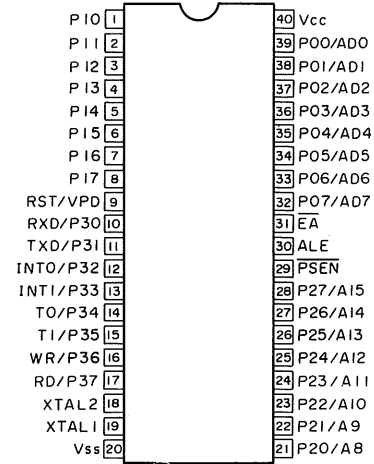
SN74LS112AN



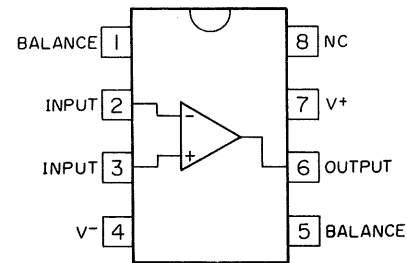
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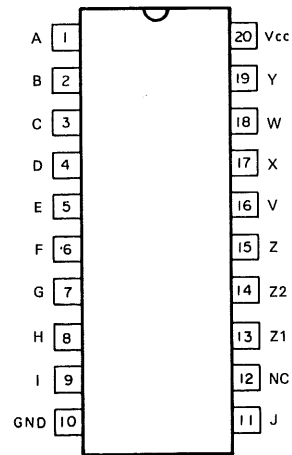
TA78020AP



CTM5040



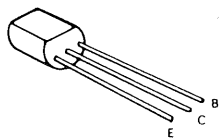
LF13741N



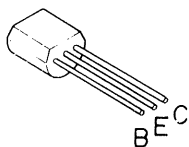
DTM-5020

Pin No.	Pin Name	Pin No.	Pin Name	Pin No.	Pin Name	Pin No.	Pin Name
1	CONT	26	TSD0	51	GETD	76	DD3
2	A13	27	TSD1	52	CA0	77	SING
3	VDD	28	VDD	53	VDD	78	VDD
4	A14	29	TSD2	54	CA4	79	R10M
5	A15	30	AX2	55	CA3	80	10M
6	INT0	31	AX1	56	CA2	81	HLDF
7	VX3	32	AX0	57	CA1	82	SGA
8	VX2	33	AX3	58	CD3	83	ROSP
9	VX1	34	HS2	59	CD2	84	ROD
10	VX0	35	HS1	60	CD4	85	HLDL
11	DA0	36	TDIO	61	CD1	86	ROUB
12	DA1	37	TWE	62	CD5	87	ROB
13	DA2	38	TCK1	63	DC4	88	ROQ
14	DA3	39	TST1	64	CD7	89	ROED
15	VSS	40	VSS	65	VSS	90	VSS
16	DA4	41	TST2	66	DC3	91	D7
17	DA5	42	TADD	67	DC2	92	D5
18	DA6	43	TCK2	68	CD6	93	D3
19	DA7	44	VS2	69	DC1	94	D1
20	DA8	45	VS1	70	DC0	95	ALE
21	DA9	46	VA0	71	CD0	96	D6
22	ROR	47	VA4	72	DD7	97	D4
23	ROA	48	VA3	73	DD6	98	D2
24	LEVX	49	VA2	74	DD5	99	D0
25	TCL	50	VA1	75	DD4	100	WR

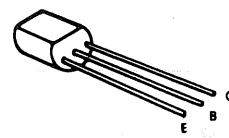
SEMICONDUCTORS



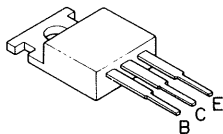
2SA844 (D)
 2SA838 (B)
 2SA1005 (K)
 2SA1015 (Y)
 2SC945 (Q)
 2SC1345 (E)
 2SC1907



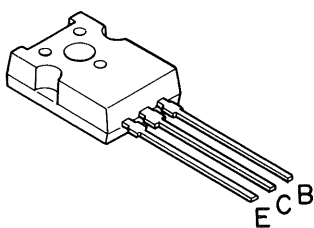
2SA1161
 2SC2671
 2SC3779 (D)



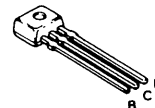
2SA1206 (K)



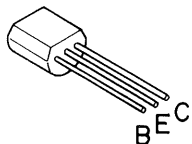
2SB834 (Y)
 2SD88 (Y)



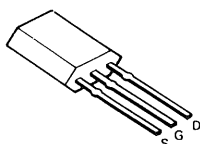
2SA1360 (Y)
 2SC3423



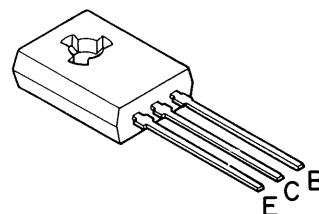
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 2SC2785 (F)



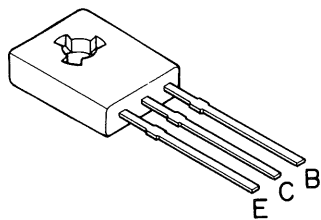
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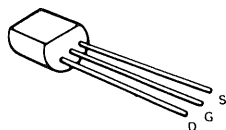
2SK304 (E)



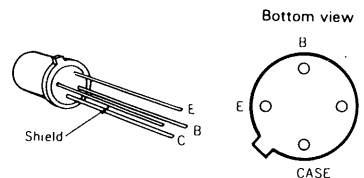
2SC1846



2SD668A (C)



2SK170 (V)



2SC1164 (O)

A product of
KENWOOD CORPORATION
17-5, 2-chome, Shibuya, Shibuya-ku, Tokyo 150, Japan

B51-1076-00 (T)

KENWOOD

CS-5170

IMPROVEMENTS

KENWOOD CORPORATION

SERVICE TECHNICAL REPORT

This report describes circuit improvement on 100-MHz Oscilloscope, CS-5170, to solve its initial clamis occured during last six months. The circuit improvement was already done for serial No. 0120001 and afterwards and the under listed serial numbers. If you have and will receive the CS-5170 other thans above mentioned, it is desirable to improve their circuit in accordance with this report.

S/No.	S/No.	S/No.	S/No.	S/No.
0050050	0090140	0100049	0100175	0110043
0070133	0090151	0100050	0100176	0110044
0070142	0090152	0100051	0100178	0110045
0070143	0090153	0100053	0100179	0110046
0070144	0090154	0100054	0100180	0110047
0070145	0090155	0100055	0100181	0110048
0070146	0090156	0100056	0100182	0110049
0070148	0090157	0100057	0100183	0110050
0070149	0090158	0100058	0100184	0110051
0070150	0090159	0100059	0100189	0110052
0070249	0090160	0100060	0100190	0110053
0070250	0090161	0100061	0100191	0110054
0090031	0090163	0100062	0100192	0110055
0090045	0090164	0100063	0100193	0110056
0090073	0090165	0100064	0100194	0110057
0090078	0090170	0100065	0110001	0110058
0090081	0090171	0100066	0110002	0110059
0090087	0090183	0100104	0110004	0110060
0090088	0090186	0100107	0110005	0110061
0090089	0090188	0100119	0110006	0110062
0090090	0090190	0100120	0110007	0110063
0090091	0090191	0100122	0110008	0110064
0090092	0100001	0100124	0110009	0110065
0090095	0100003	0100126	0110010	0110066
0090096	0100004	0100128	0110011	0110067
0090098	0100005	0100131	0110012	0110068
0090101	0100006	0100132	0110013	0110069
0090104	0100007	0100134	0110014	0110070
0090106	0100008	0100135	0110015	
0090108	0100009	0100136	0110016	
0090109	0100010	0100137	0110017	
0090110	0100011	0100140	0110018	
0090111	0100012	0100141	0110019	
0090112	0100013	0100148	0110021	
0090116	0100014	0100149	0110022	
0090118	0100015	0100150	0110023	
0090121	0100016	0100151	0110024	
0090122	0100017	0100153	0110025	
0090123	0100018	0100154	0110026	
0090124	0100019	0100156	0110027	
0090125	0100020	0100157	0110028	
0090126	0100021	0100158	0110029	
0090127	0100022	0100159	0110030	
0090128	0100023	0100160	0110031	
0090129	0100024	0100161	0110032	
0090130	0100025	0100163	0110033	
0090131	0100026	0100164	0110034	
0090132	0100027	0100166	0110035	
0090133	0100028	0100167	0110036	
0090134	0100029	0100168	0110037	
0090135	0100030	0100169	0110038	
0090136	0100031	0100170	0110039	
0090137	0100041	0100171	0110040	
0090138	0100044	0100172	0110041	
0090139	0100048	0100174	0110042	

CIRCUIT IMPROVEMENT ON 100-MHZ OSCILLOSCOPE, MODEL CS-5170

This trouble shooting is to solve the following initial claims occurred on 100-MHz oscilloscope, CS-5170.

- 1) Hold-off time
- 2) Aberration of 1-kHz square waveform
- 3) Oscillation from power supply circuit
- 4) Horizontal fluctuation of readout displays
- 5) Vertical fluctuation of readout displays
- 6) Interruption of trace influenced by readout displays
- 7) Fluctuation of readout displays

1. Hold-off time

1) Phenomenon

Waveform twinkled when video-signal is measured.

2) Counter-measure

Unit : X74-1500-00, Horizontal Unit

<u>Ref No.</u>	<u>Before Improvement</u>	<u>After Improvement</u>	<u>Part No.</u>
C118	100 micro, 25 V	1 micro, 50 V,	CE04EW1H010M
R157	22 kF	21 kF	RN14BK2C2102F

2. Aberration of 1-kHz square waveform

1) Phenomenon

When CAL waveform is measured using probe, rising part of square waveform is aberrant.

2) Counter-measure

Unit : X73-1830-00, Vertical Unit

<u>Ref. No.</u>	<u>Before Improvement</u>	<u>After Improvement</u>	<u>Part No.</u>
C4	0.001	0.01	C91-0502-05
C104	0.001	0.01	C91-0502-05

3. Oscillation from power supply circuit

1) Phenomenon

Noise appears on a waveform at the following conditions;

Input waveform : 2.5-kHz square waveform
Readout : Off
CH-1 : 1-V range
Sweep : 5-ms X10
Intensity : Maximum

2) Counter-measure

Unit : X73-1830-00, Vertical Unit

<u>Ref. No.</u>	<u>Before Improvement</u>	<u>After Improvement</u>	<u>Part No.</u>
C304	10 micro, 50 V	to be deleted	
C313	10 micro, 50 V	to be deleted	
C908	not available	to be added	CK45B1H102K
C909	not available	to be added	CK45BIH102K

Remarks :

- (1) C908 is mounted between 6-pin and 7-pin of U302 on a back-side.
- (2) C909 is mounted between 1-pin and 2-pin of U302 on a back-side.

4. Horizontal fluctuation of readout displays

1) Phenomenon

When sweep at 5-ms range is magnified using X10MAG, readout displays are horizontally swung.

2) Counter-measure

Unit No. : X73-1840-00, Final Unit

<u>Ref. No.</u>	<u>Before Improvement</u>	<u>After Improvement</u>	<u>Part No.</u>
C207	33 pF	7 pF	CC45FCH1H070D

5. Vertical fluctuation of readout displays

1) Phenomenon

When vertical mode is selected to ALT, readout displays are vertically swung.

2) Counter-measure

Unit No. : X73-1840-00, Final Unit

<u>Ref. No.</u>	<u>Before Improvement</u>	<u>After Improvement</u>	<u>Part No.</u>
R68	270 ohm	to be deleted	
R69	510 ohm	to be deleted	
TC2	20 pF	to be deleted	
VR3	20 kB	to be deleted	
VR4	2 kB	to be deleted	
R57	8.2 k	to be deleted	
R58	10 k	to be deleted	
R59	7.5 k	to be deleted	
C16	470 pF	to be deleted	
C17	1,000 pF	to be deleted	
C18	0.047 pF	to be deleted	
R70	16 k	18 k	RD14BB2C183J
C904 *1	not available	47 pF	CC45CH1H470J
R804 *2	not available	15 k	RD14BB2C153J
R802 *3	not available	20 k	RD14BB2C203J
C802 *3	not available	1,000 pF	CQ92M1H102K
R803 *3	not available	22 k	RD14BB2C223J
C803 *3	not available	0.022	CQ92M1H223K
R907 *4	not available	680 ohm	RD14BB2C681J
C901 *4	not available	68 pF	CQ92M1H104K
R909 *4	not available	1.6 k	RD14BB2C162J
C903 *4	not available	91 pF	CC45CH1H910J
R910 *5	not available	1.6 k	CC45CH1H162J
R911 *6	not available	1 k	RD14BB2C102J
R908 *7	not available	2.4 k	RD14BB2C242J
C902 *7	not available	91 pF	CC45CH1H910J

Remarks :

*1 : Parallely mounted to TC3.

*2 : Mounted after dismantling VR4.

*3 : R802 and C802 are connected in series and R803 and C803 are also connected in series. Both R802-C802 and R803-C803 are mounted between emitters of Q5 and Q6.

*4 : R907 and C901 are connected in series and R909 and C803 are also connected in series. Both R907-C901 and R909-C903 are mounted between emitters of Q1 and Q2.

*5 : Mounted between positive side of C6 and Q6 emitter.

*6 : Mounted between positive side of C5 and Q5 emitter.

*7 : R908 and C902 are connected in series and mounted between 1-pin and 3-pin of P6.

6. Interruption of trace influenced by readout displays

1) Phenomenon

Trace on B-sweep is interrupted for 1-division (5 micro sec.) at the following modes.

Input	:	GND
A-Sweep time-base	:	2-ms
B-Sweep time-base	:	5 micro sec.
Horizontal mode	:	ALT
Readout	:	Max.

2) Counter-measure

Unit No. : X74-1500-00, Horizontal Unit

<u>Ref. No.</u>	<u>Before Improvement</u>	<u>After Improvement</u>	<u>Part No.</u>
R518	6.8k	4.7 k	RD14BB2C472J
C501	560 pF	330 pF	CC45FSL1H070D

Remarks :

(1) When 74H123P is used as for U501, no change is required. However when 74H123AP is used as for U501, R517 is requested to replace from 10 k ohm to 6.2 k ohm. This change enables length of interruption of waveform to be 3 micro sec., instead of 5 micro sec.

7. Fluctuation of readout displays

1) Phenomenon

While in cursor-measurement, especially at the time of 1/delta-T measurement, and when cursor is at standstill, both readout displays and traces are twinkle

2) Counter-measure


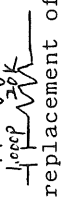

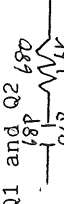


Unit No. : X77-1510-01, R/O Unit

<u>Ref No.</u>	<u>Before Improvement</u>	<u>After Improvement</u>	<u>Part No.</u>
R39	4.7 k	15 k	RD14BB2C153J

List of Necessary Components for the Counter-Measure

<u>Part No.</u>	<u>Qty per unit</u>	<u>Ref. No.</u>
CC45CH1H470J	1	C904
CC45CH1H910J	2	C902, C903
CC45FCH1H070D	1	C207
CC45FSL1H331J	1	C501
CEO4EW1H010M	1	C118
CK45B1H102K	2	C908, C909
CQ92M1H102K	1	C802
CQ92M1H104K	1	C901
CQ92M1H223K	1	C803
C91-0502-05	2	C4, C104
RD14BB2C681J	1	R907
RD14BB2C102J	1	R911
RD14BB2C162J	2	R909, R910
RD14BB2C242J	1	R908
RD14BB2C472J	1	R518
RD14BB2C622J	1	R517
RD14BB2C153J	2	R804, R39
RD14BB2C183J	1	R70
RD14BB2C203J	1	R802
RD14BB2C223J	1	R803
RN14BK2C2102F	1	R157

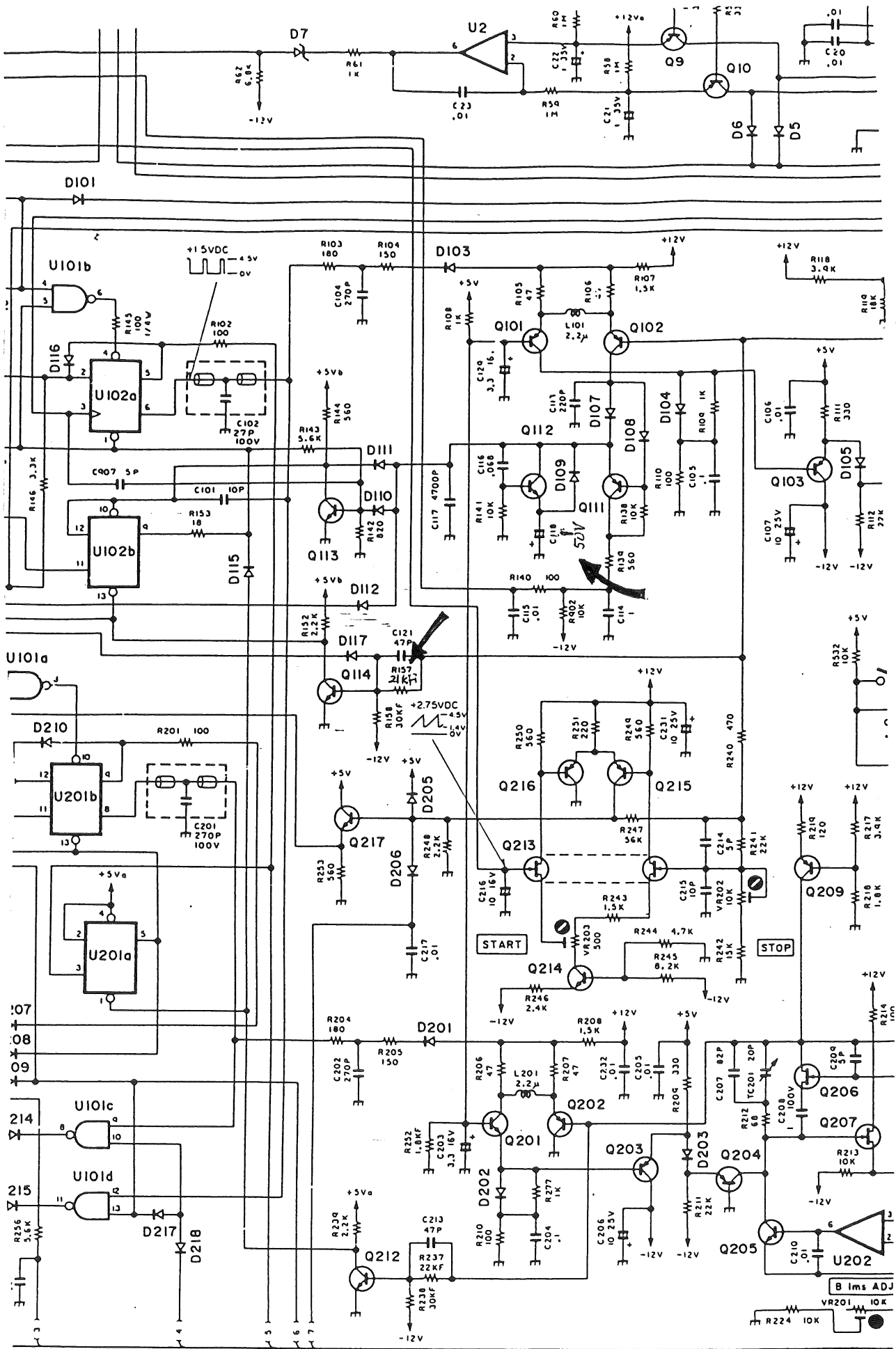
Summary for Circuit Improvement on 100-MHz Oscilloscope, model CS-5170

Item	Phenomena	Unit No.	Ref. No.	Description of Improvement
1	Interruption of trace by R/O	X74-1500-00, Horizontal Unit	R518	from 6.8 k to 4.7 k
2	-do-	-do-	C501	from 560 p to 330 p
3	Improvement of hold off time	-do-	C118	from 100 micro, 25 V to 1 micro, 50 V
4	-do-	-do-	R157	from 22 kF to 21 kF
5	Aberration of 1-kHz Squarewave	X73-1830-00, Vertical Unit	C4	from 0.001 to 0.01
6	-do-	-do-	C104	from 0.001 to 0.01
7	Oscillation from PSU circuit	-do-	C304	10 micro, 25 V to be deleted
8	-do-	-do-	C313	10 micro, 25 V to be deleted
9	-do-	-do-	C908	1,000 p to be added
10	-do-	-do-	C909	1,000 p to be added
11	Fluctuation of R/O characters	X77-1510-01, R/O Unit	R39	from 4.7 k to 15 k
12	Vertical fluctuation of R/O	X73-1840-00, Final Unit	R68	270 ohm to be deleted
13	-do-	-do-	R69	510 ohm to be deleted
14	-do-	-do-	TC2	20 p to be deleted
15	-do-	-do-	C16	470 p to be deleted
16	-do-	-do-	C17	1,000 p to be deleted
17	-do-	-do-	C18	0.047 to be deleted
18	-do-	-do-	R57	8.2 k to be deleted
19	-do-	-do-	R58	10 k to be deleted
20	-do-	-do-	R59	7.5 k to be deleted
21	-do-	-do-	(new)	47 p to be added, parallely mounted on TC3
22	-do-	-do-	C803	0.022 to be added, between emitters,
23	-do-	-do-	C802	1,000 p to be added } Q5 and Q6
24	-do-	-do-	R802	20 k to be added } 
25	-do-	-do-	R803	22 k to be added } 
26	-do-	-do-	R804	15 k to be added, as replacement of VR4
27	-do-	-do-	R911	1 k to be added from C5 to Q5 emitter
28	-do-	-do-	R910	1.6 k to be added from C6 to Q6 emitter
29	-do-	-do-	R70	from 16 k to 18 k
30	-do-	-do-	VR4	2 k to be deleted
31	-do-	-do-	VR3	20 k to be deleted
32	-do-	-do-	C902	91 p to be added } 
33	-do-	-do-	R908	2.4 k to be added } between emitters,
34	-do-	-do-	C903	91 p to be added } Q1 and Q2
35	-do-	-do-	C909	1.6 k to be added } 
36	-do-	-do-	C901	68 p to be added } 
37	-do-	-do-	R907	680 ohm to be added } 
38	Horizontal fluctuation of R/O	-do-	C207	from 33 p to 7 p

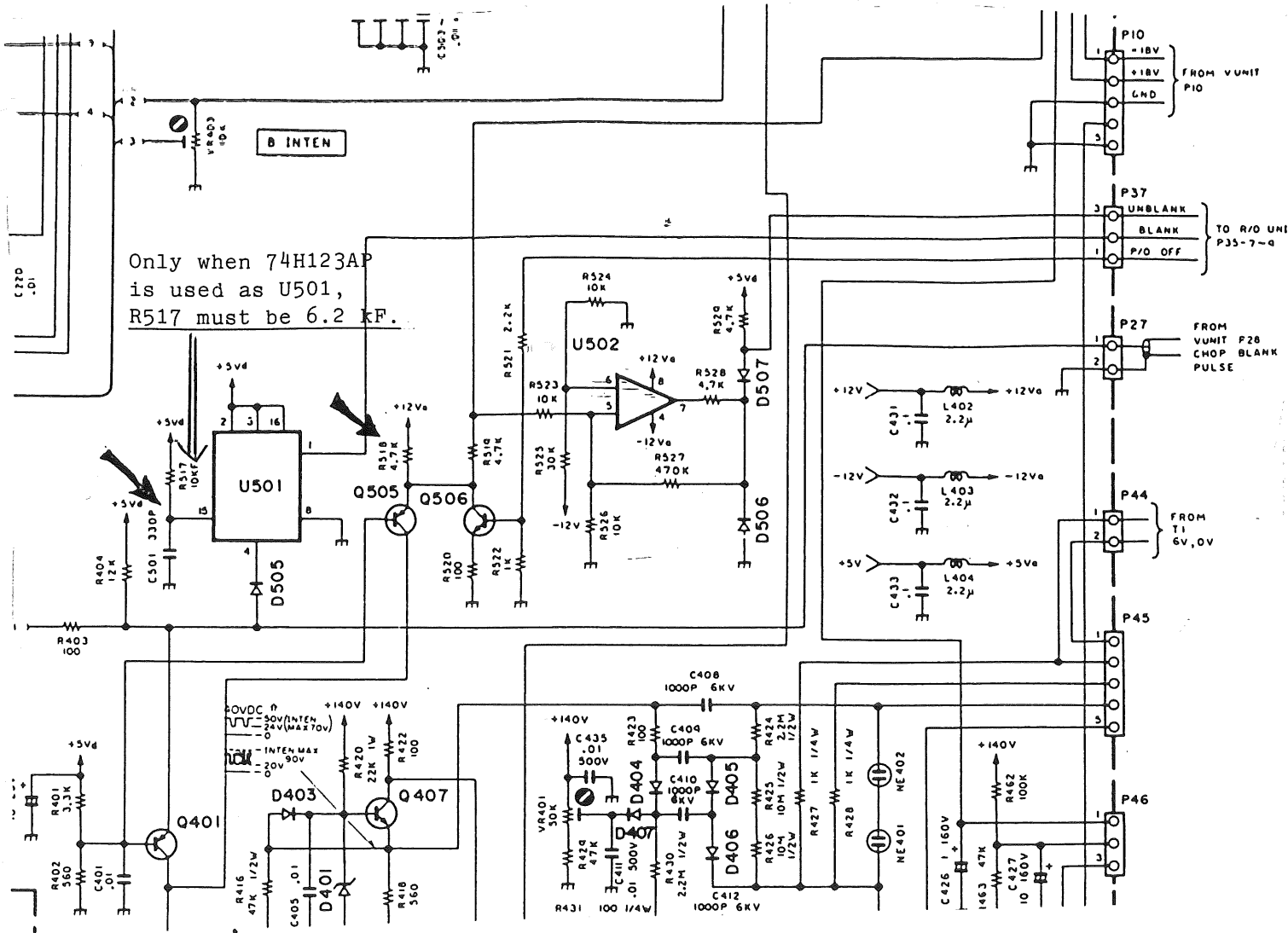
SCHMATIC DIAGRAM

X74-1500-00, Horizontal Unit

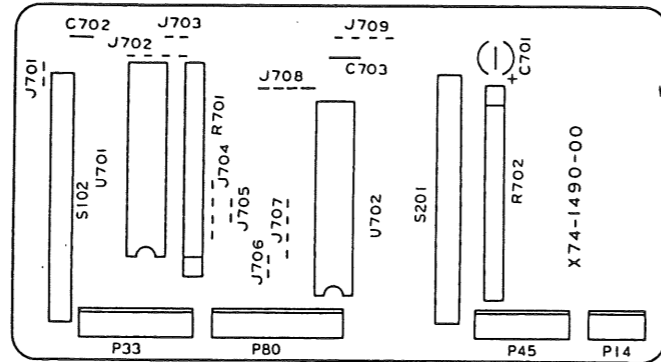
(After Improvement)



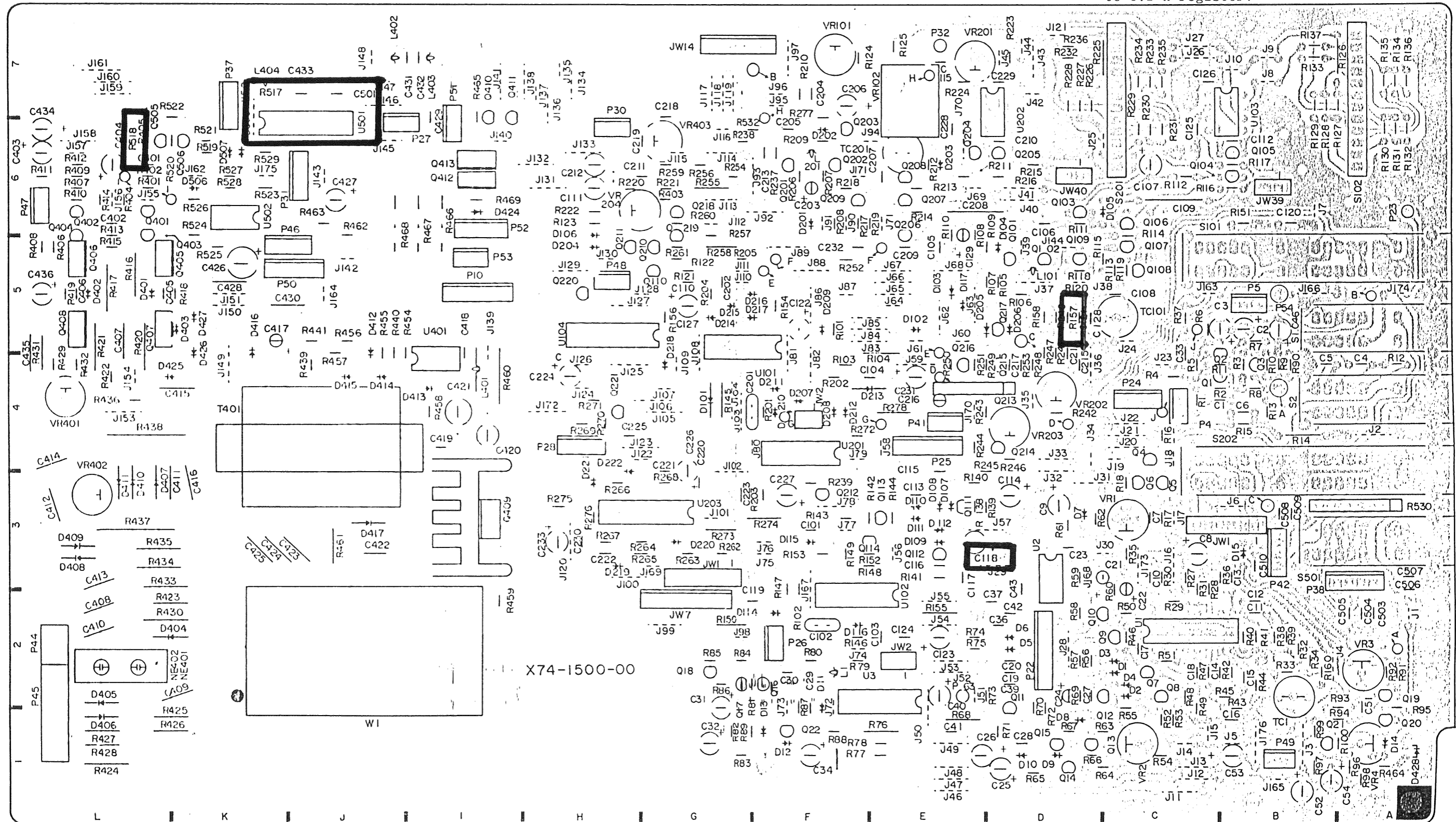
SCHEMATIC DIAGRAM
X74-1500-00, Horizontal Unit
(After Improvement)



X74-1500-00, Horizontal Unit
Location of C118, R157, R518,
R517, C501, U501



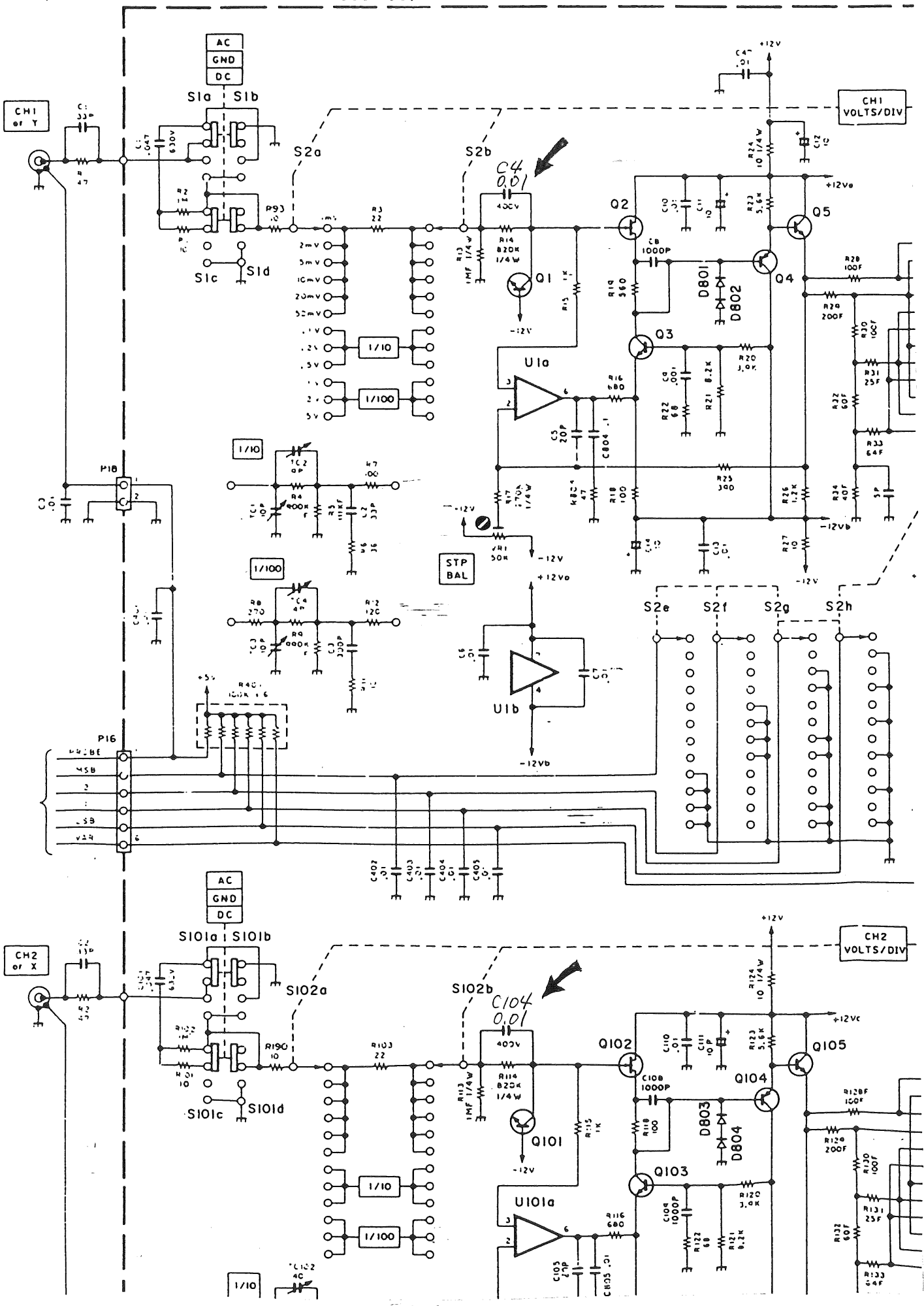
Remarks :
Only when 74H123AP is used
as U501, R517 is changed
to 6.2 k resistor.



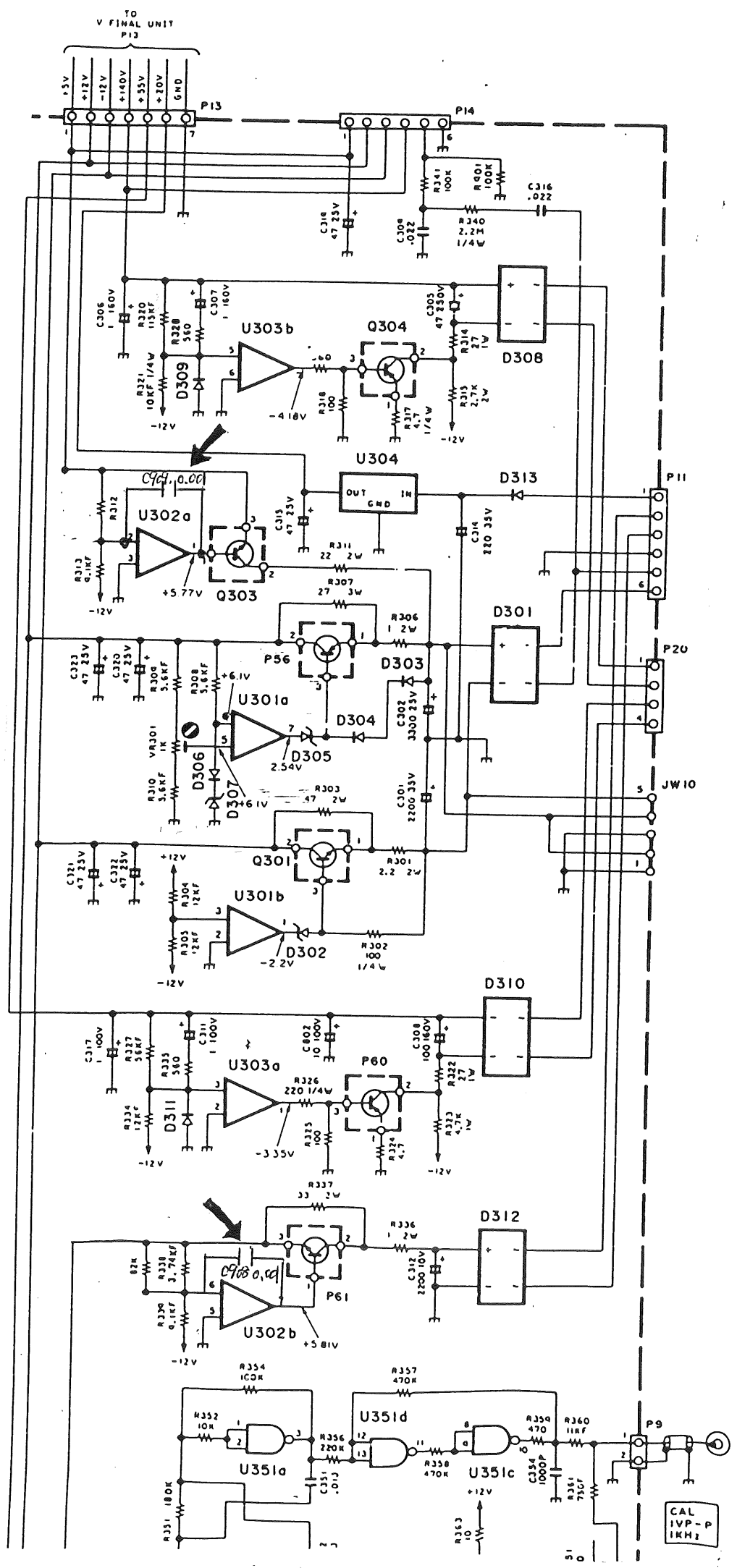
SCHEMATIC DIAGRAM

X73-1830-00, Vertical Unit

(After Improvement)

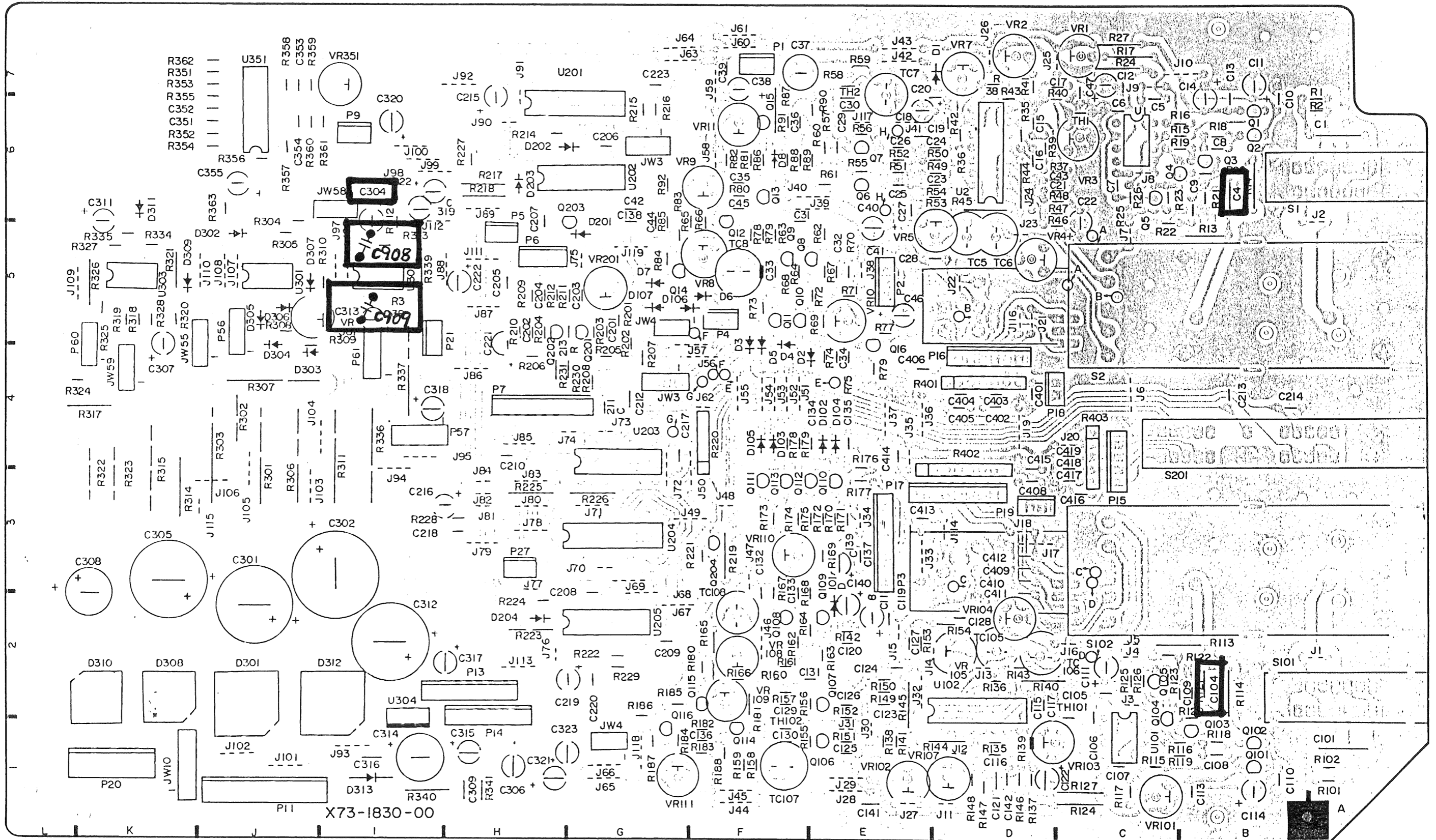


SCHEMATIC DIAGRAM
X73-1830-00, Vertical Unit
(After Improvement)



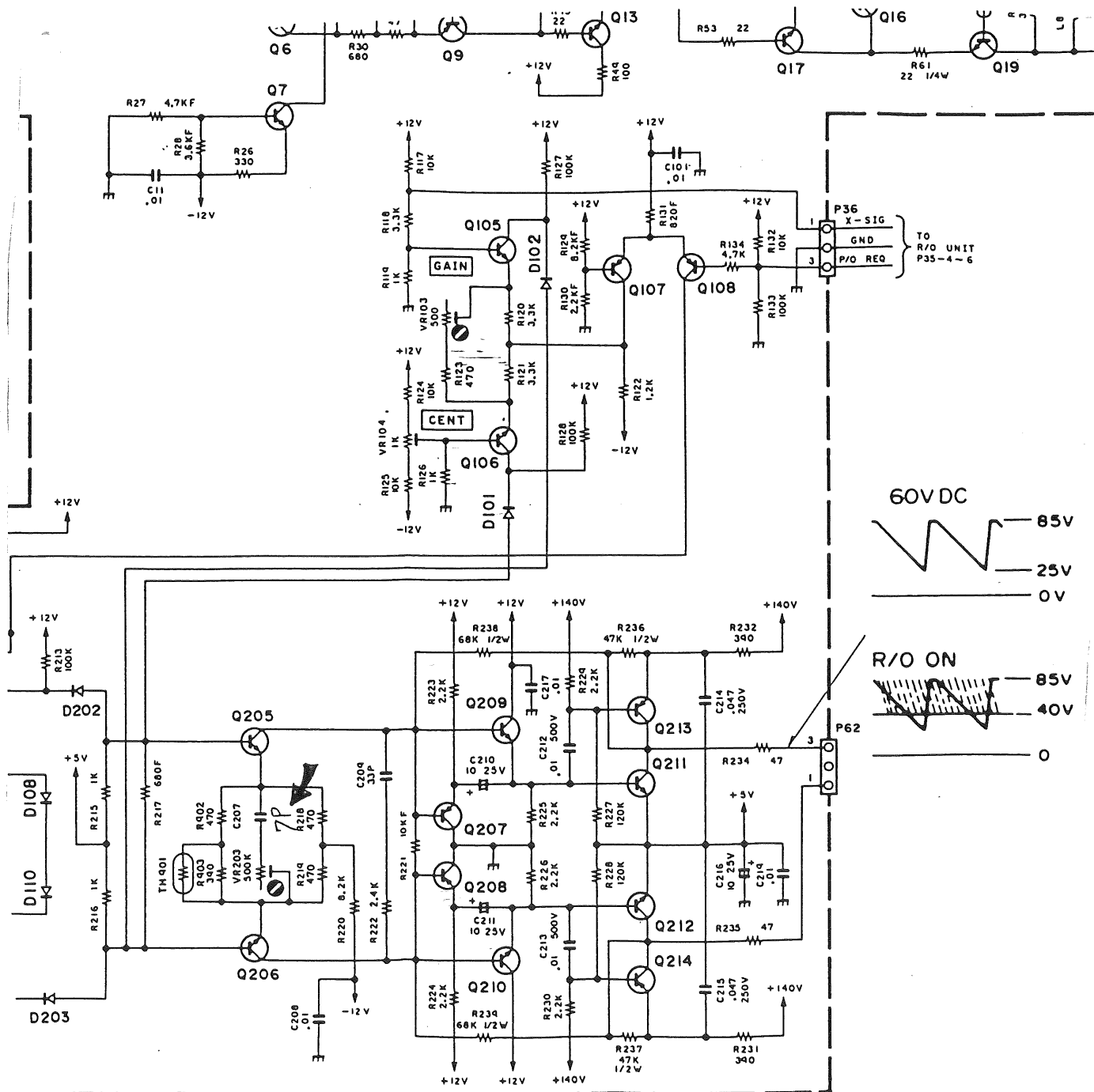
X73-1830-00, Vertical Unit

Location of C104, C4, C909, C908, C313, C304



X73-1830-00

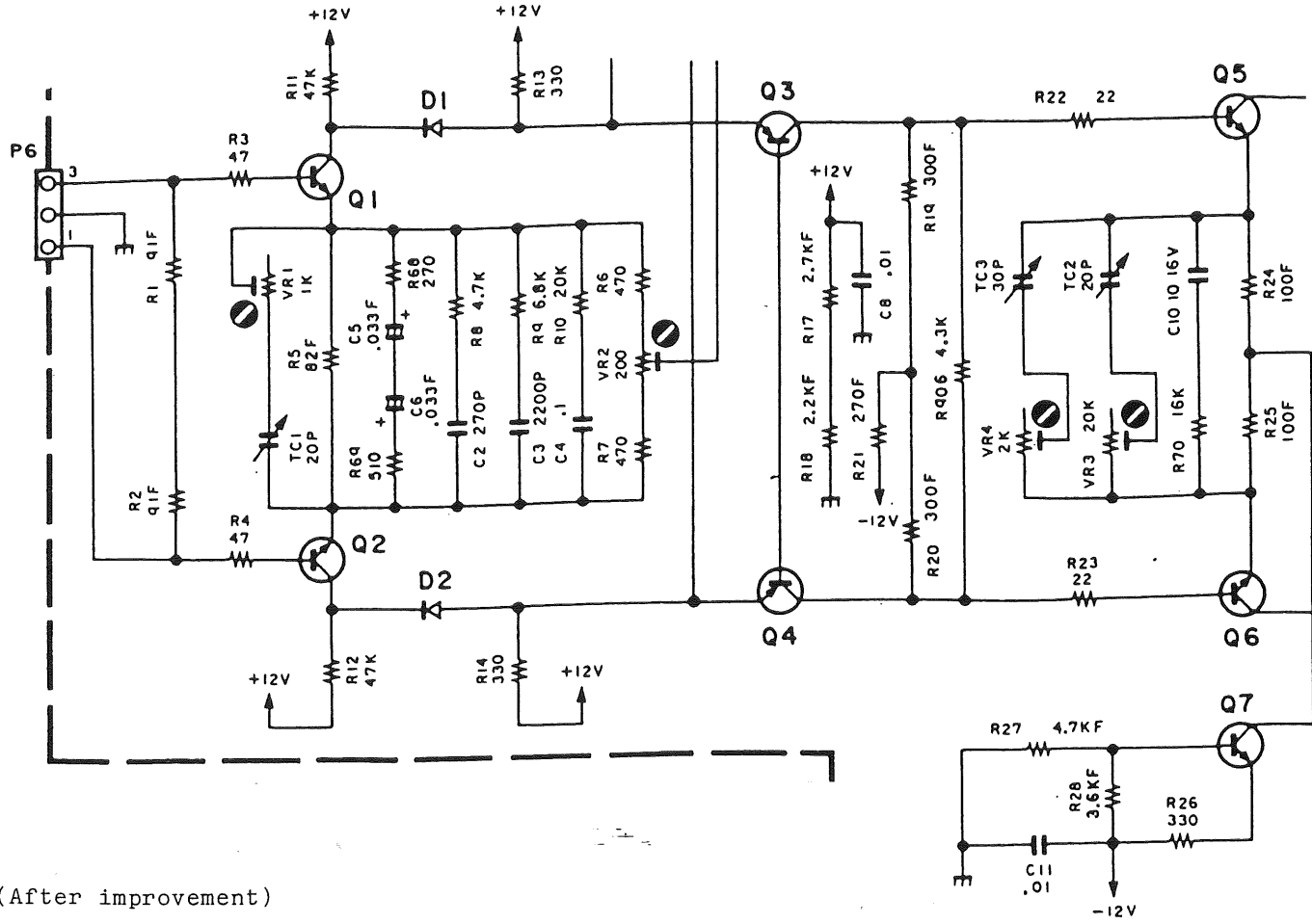
SCHEMATIC DIAGRAM
X73-1840-00, Final Unit
(After Improvement)



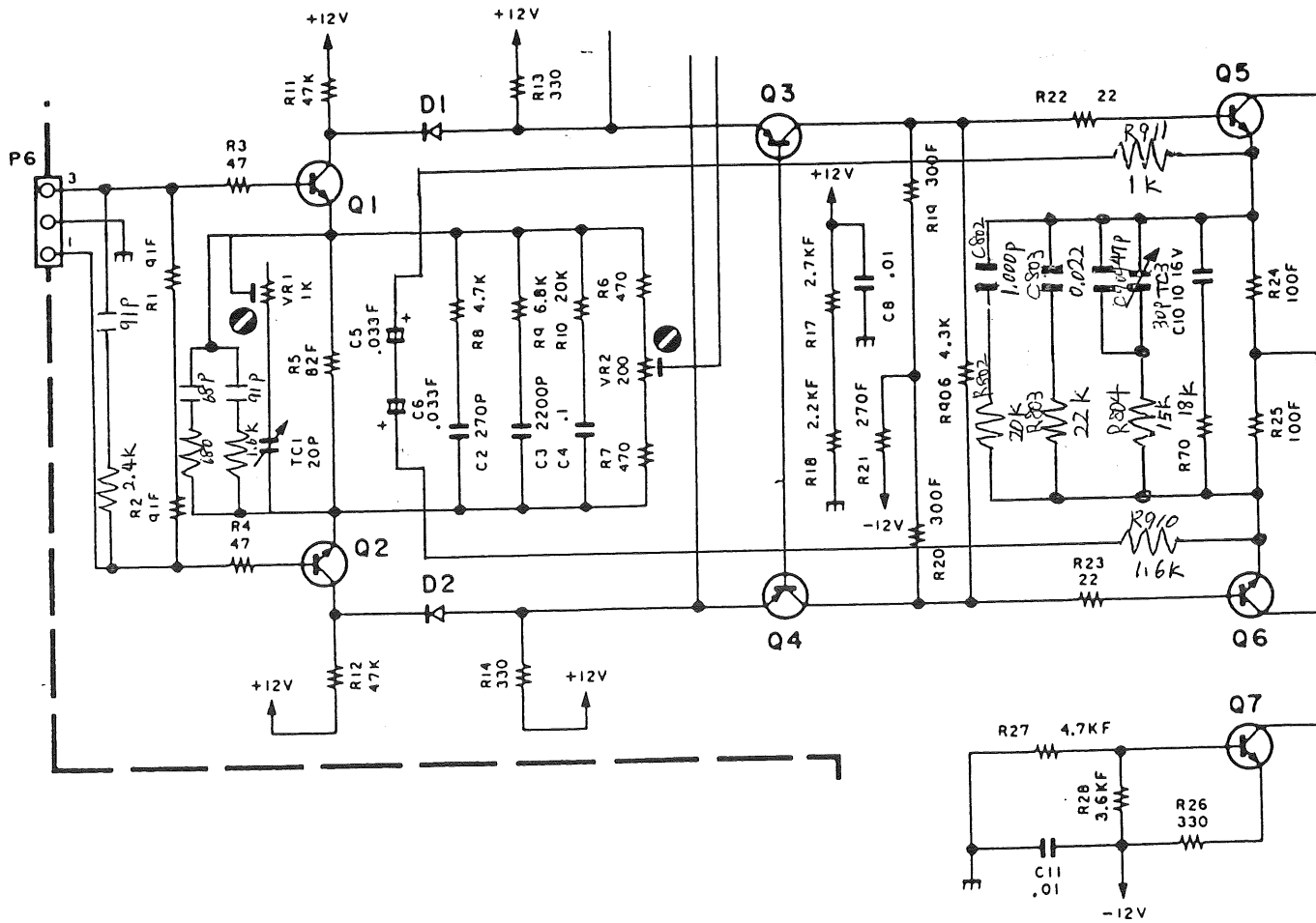
SCHEMATIC DIAGRAM

Vertical Final Unit, X73-1840-00

(Before improvement)

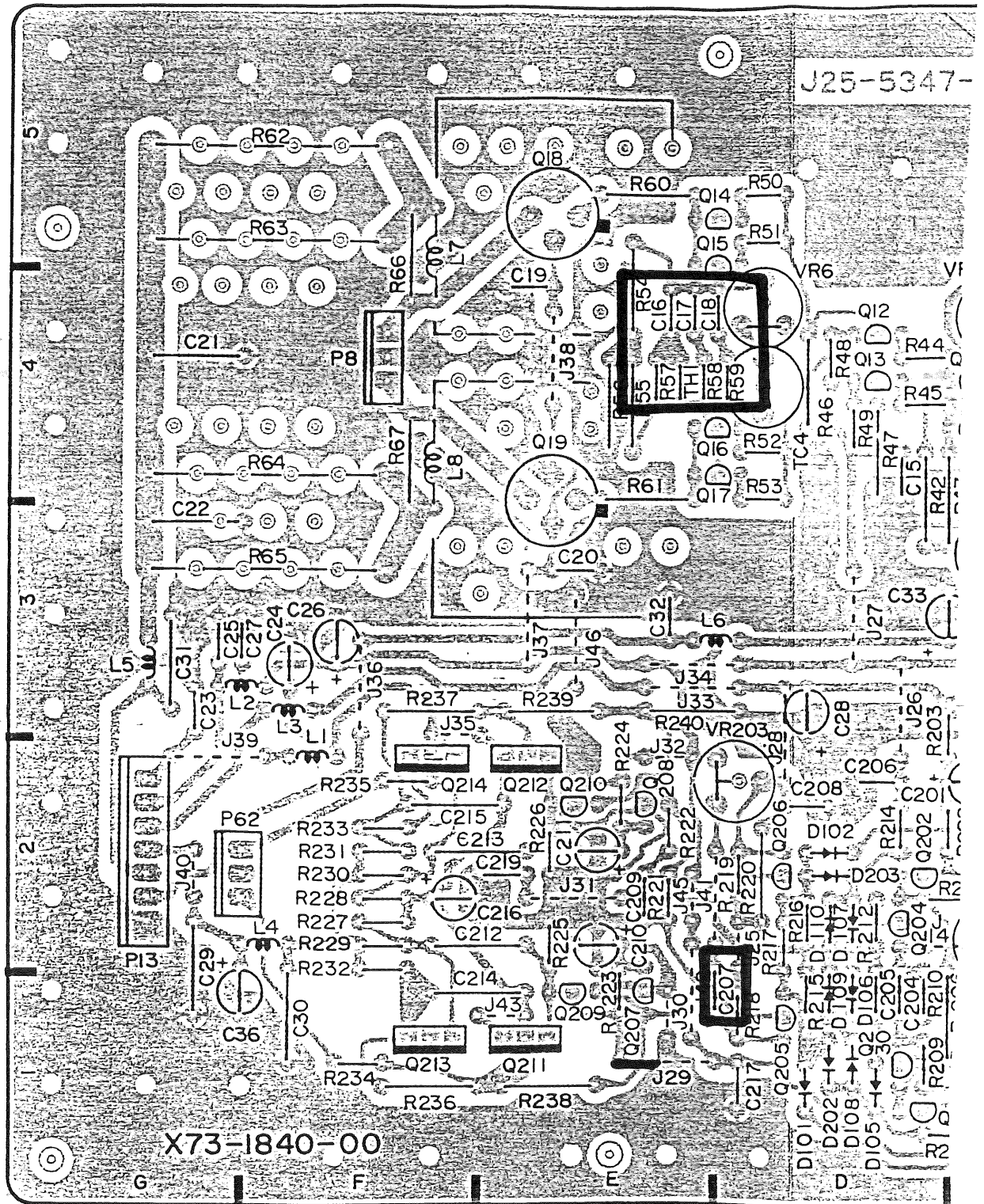


(After improvement)



X73-1840-00, Final Unit

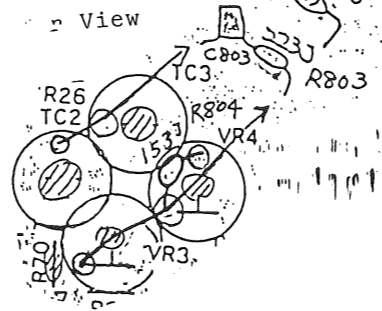
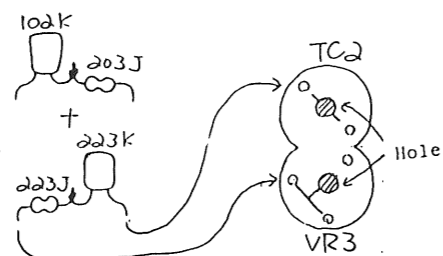
Location of C207, R57, R58, R59, C16, C17, and C18



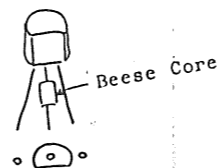
PC BOARD LAYOUT (FRONT)
Vertical Final Unit, X73-1840-00

R802, R803, C802, C803 Mounting

Both R802 and R803 are inserted and soldered in one hole as well as C802 and C803. In such a case, soldered points between R802 and C802 and between R803 and C803 may not be contacted.

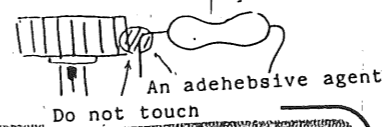


Q8, Q9 Mounting



R62 Through R65 Mounting

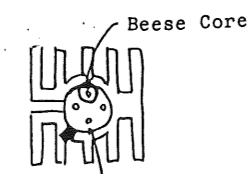
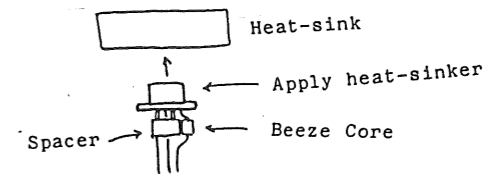
Leads are fixed using an adhesive agent at a small distance from a heat-sink.



C17, C18 Mounting

C17 and C18 are mounted to be drawn up close to VR6 but not to be touched on a heat-sink.

Q18, Q19 Mounting



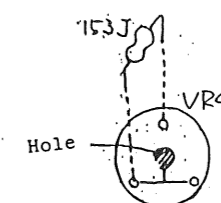
Case terminal

Viewed from the bottom

In order to avoid a heat-sink bent when it is mounted on a PC board, a slit of the heat-sink and projection of transistor are slid into 45°. (to be parallel to terminal and heat-sink)

Remarks :
Leads from beeze core are wired to C19 and C20 patterns and case-terminal are wired to ground pattern.

R804 Mounting

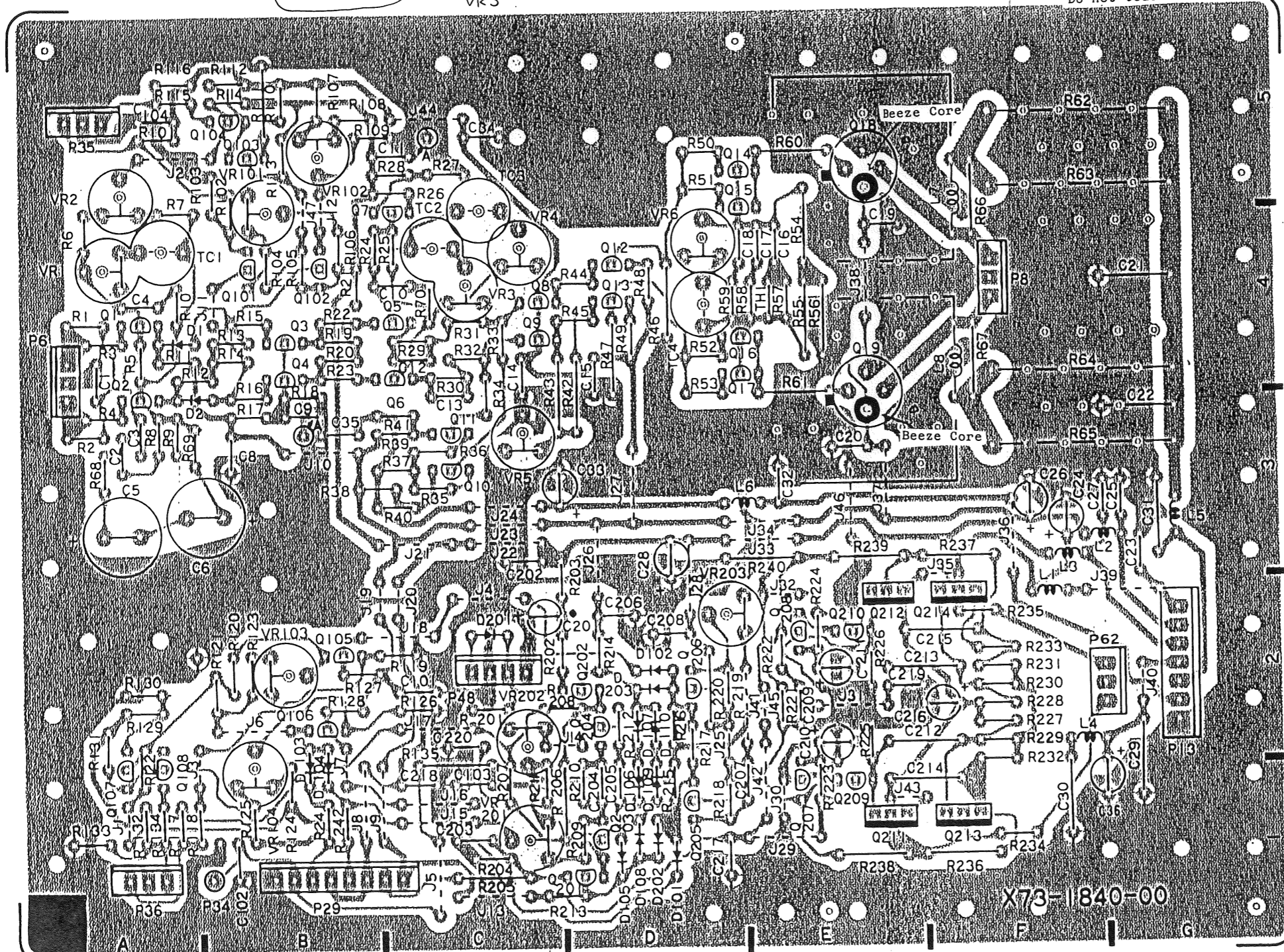
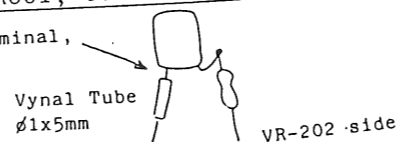


C32 Mounting

In order to keep away from heat-sink, C32 is tipped over towards J27.

R801, C801 Mounting

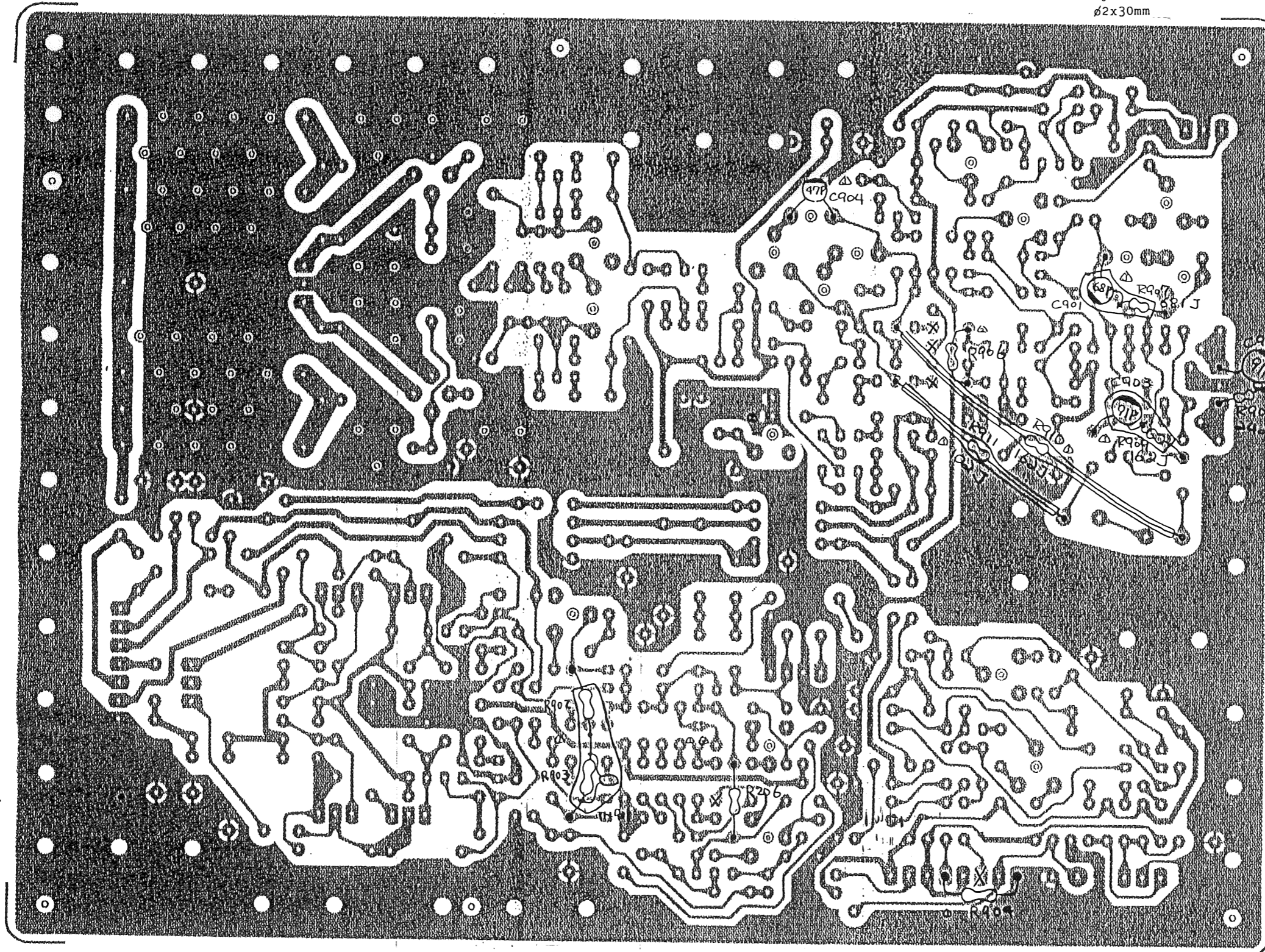
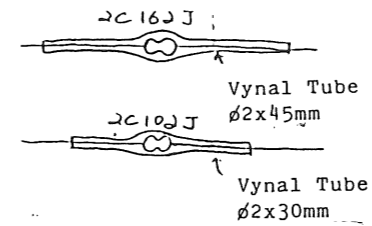
In order not to touch to VR201 terminal, they are inserted deeply.



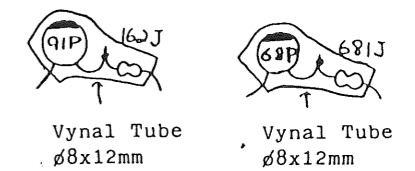
ATTENSIVE INSTRUCTION
FOR BACK-SIDEWIRING

1. The following components must be mounted after testing by incircuit tester.
R902, R903, R907, R908, R909, R910, R911, TH901, C901, C902, C903, C904
2. Other components as specified as above must be;
 - 1) mounted to keep away from testing points as marked (X) on a drawing,
 - 2) mounted as close as possible to the surface of the back-side with having as short as possible legs.
3. Vynal tube is not required to wire R908 and C902.

R910, R911 Mounting

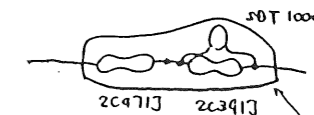


R907, R909, C901,
C903 Mounting

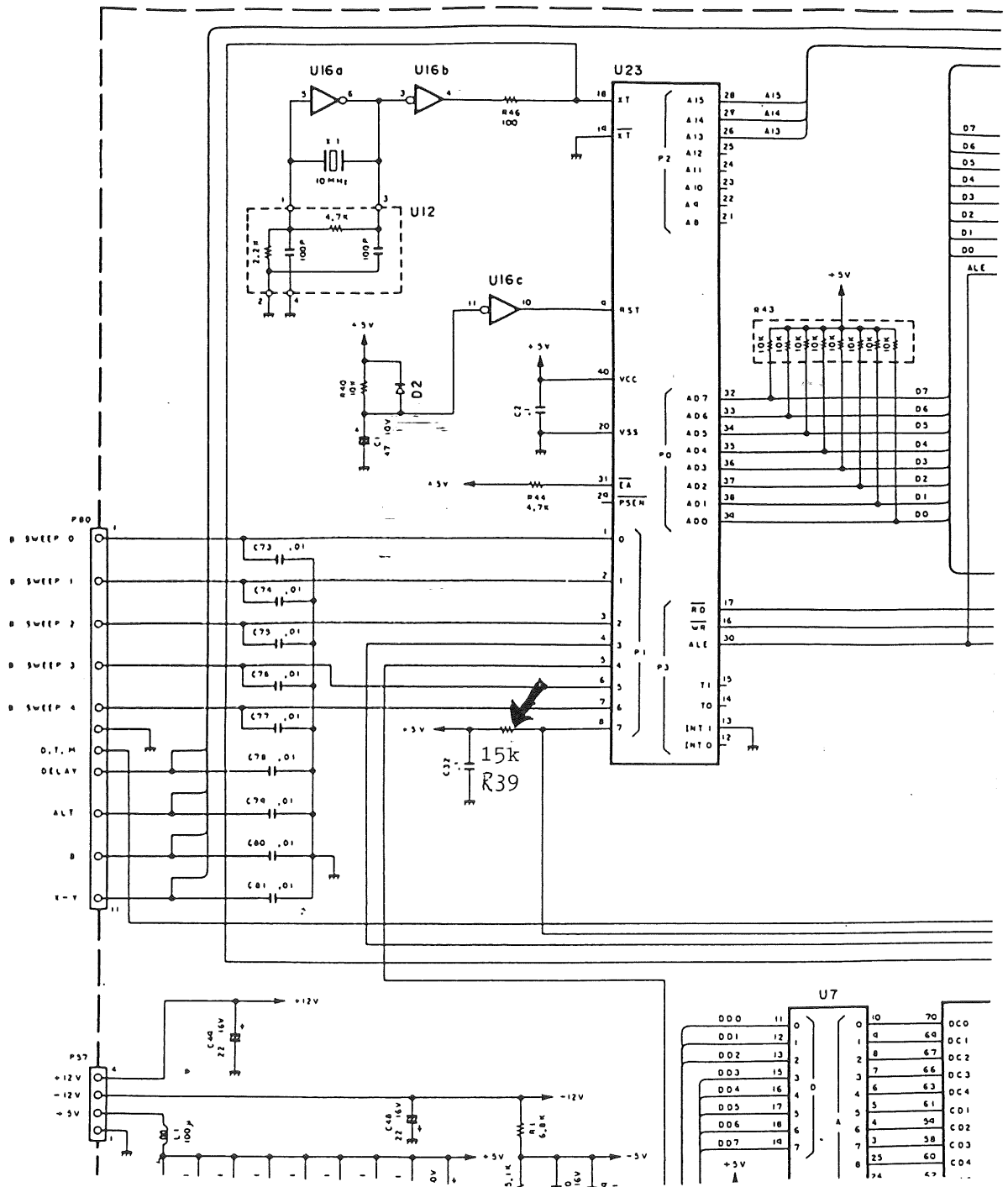


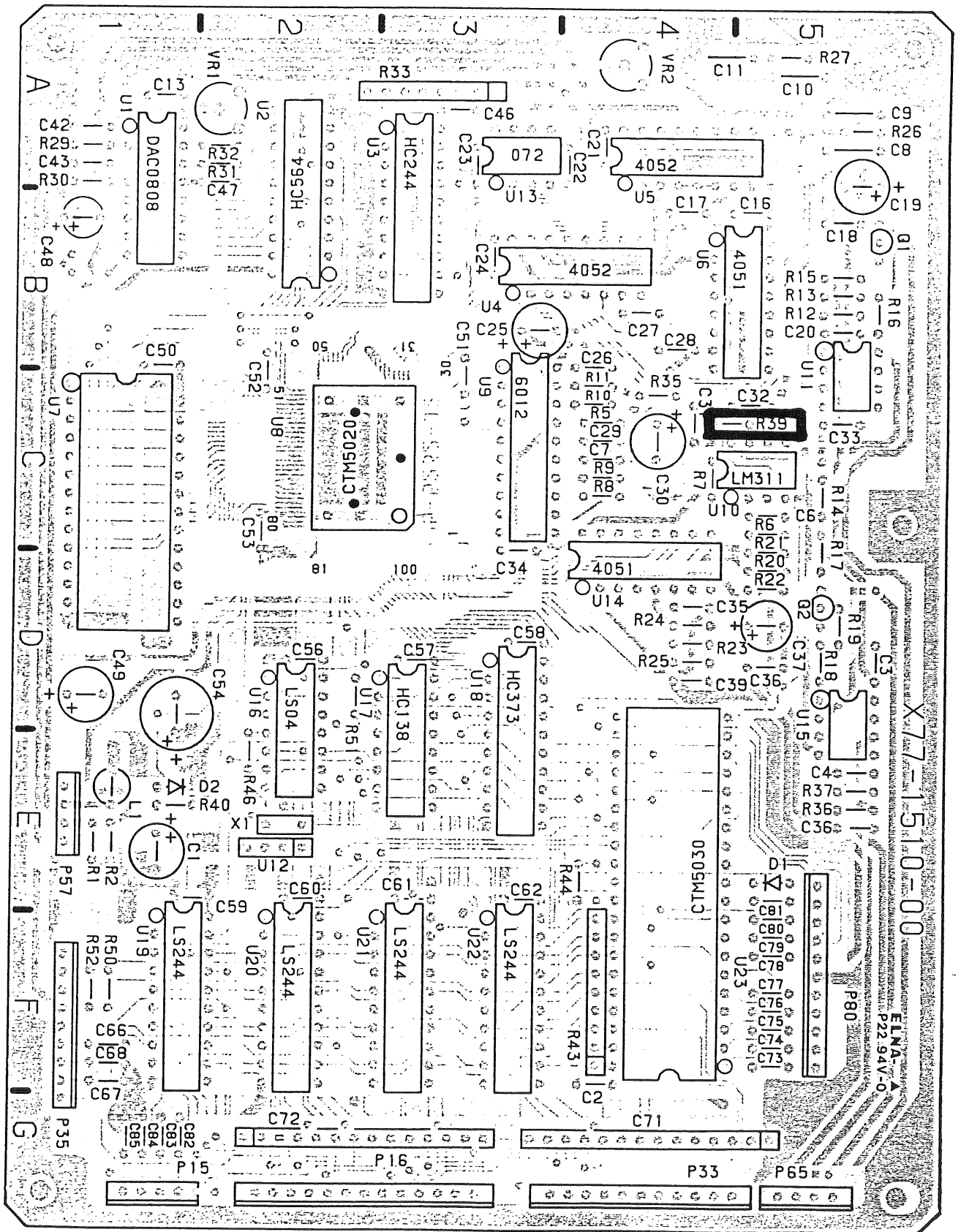
After cutting leads surrounded, R907-C901 and R909-C903 are mounted.

R902, R903, TH901 Mounting



SCHEMATIC DIAGRAM
 X77-1510-01, R/O Unit
 (After Improvement)





KENWOOD CORPORATION

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