

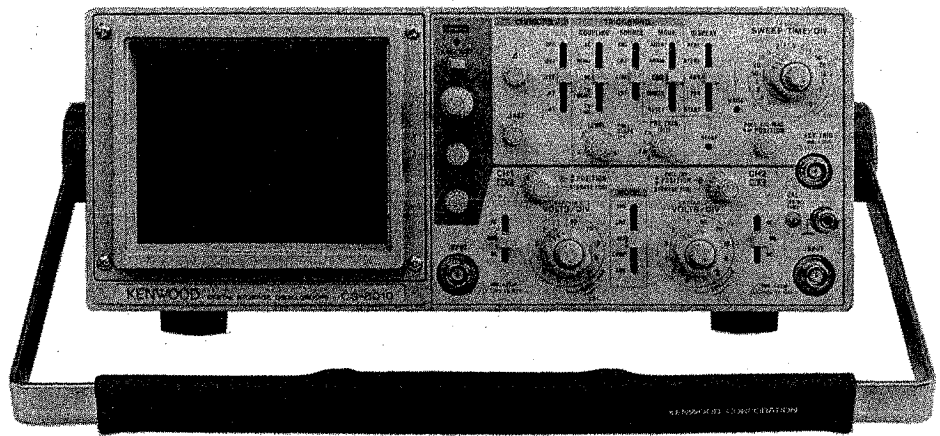
**KENWOOD**

DIGITAL STORAGE OSCILLOSCOPE

**CS-8010**

**SERVICE MANUAL**

KENWOOD CORPORATION



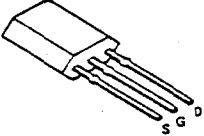
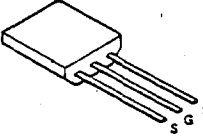
**WARNING**

1. The following instructions are for use by qualified personnel only. To avoid electric shock, do not perform servicing other than contained in the operating instructions unless you are qualified to do so.
  
2. High voltage up to 12000 volts DC is present when the oscilloscope is operating. Line voltage (100 to 240 VAC) is present on the power transformer, on-off switch, fuse holder, and line voltage selector any time the oscilloscope is connected to an AC power source, even if turned off. Always observe caution whether the AC plug is removed from the AC power source. Contacting exposed high voltage could result in fatal electric shock.

## CONTENTS

<b>SPECIFICATIONS</b> .....	<b>3</b>
<b>SAFETY</b> .....	<b>6</b>
<b>CIRCUIT DESCRIPTION</b> .....	<b>7</b>
<b>BLOCK DIAGRAM</b> .....	<b>18</b>
<b>ADJUSTMENT</b> .....	<b>19</b>
<b>TROUBLESHOOTING</b> .....	<b>31</b>
<b>PARTS LIST</b> .....	<b>42</b>
<b>SCHEMATIC DIAGRAM</b> .....	<b>57</b>
<b>P.C. BOARD</b> .....	<b>64</b>
<b>DISASSEMBLY</b> .....	<b>70</b>
<b>SEMICONDUCTORS</b> .....	<b>71</b>

# E R R A T A

PAGE		REF. NO	INCORRECT	CORRECT
42	Y70-1590-61	14	LED (LN322GPT, POWER)	LED (LN322GPT) READY or WRITE
		67	X80-1060-00	X80-1060-01
47	X73-1740-00	S002	NO USE	ROTARY SW ASS'Y
				S02-4507-05 with SW
		S102	NO USE	ROTARY SW ASS'Y
				S02-4507-05 with SW
		S201	(CURSOR)	(V. MODE)
		VR006	----	S02-4507-05 with VR
		VR007	----	S02-4507-05 with VR
		VR106	----	S02-4507-05 with VR
		VR107	----	S02-4507-05 with VR
50	X74-1460-00	VR002	(TRIG, H. POSI)	(TRIG)
51		VR205	(TRIG, H. POSI)	(H. POSI)
52	X77-1450-01	VAR1	----	S29-1504-05 with VR
		X02B	L77-1229-05	L77-1299-05
54	X80-1060-00	-	X80-1060-00	X80-1060-01
		S001	(POWER, UL)	(POWER)
57	CURSOR VR	VR1	10KB	1KB
		VR2	10KB	1KB
	CONNECTOR	P9	-12V	-22V (INPUT of REG.)
		P57	-12V	-22V (INPUT of REG.)
58	ROTATION, ILLUM		----	X80- (B/3) VR3
	FOCUS, ASTIG		----	X80- (B/3) VR2
	CONNECTOR	P9	---- (6th pin)	-22V
	H. V BLOCK		----	W02-0431-05
59	CONNECTOR	P9	-12V	-22V
		P57	-12V	-22V
60	SWEEP TIME/DIV	ROTARY	----	S101
61	CONNECTOR	P57	-12V	-22V
69	TA79L012P		INPUT	GROUND
			GROUND	INPUT
71	DAC0808LCN	1	NC (Note3)	NC
		4	I <sub>o</sub> →	I <sub>out</sub>
74	2SK304 (E)			
			2SK304(E)	2SK304(E)

# SPECIFICATIONS

<b>CRT</b>		
Model		150VTM31
Type		150 mm rectangular, with internal graticule
Acceleration Voltage		12 kV
Display Area		8 × 10 div (1 div = 10 mm)
<b>VERTICAL AXIS (CH1 and CH2)</b>		
Sensitivity		1 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. 22 pF
Frequency Response	DC	Real time DC to 20 MHz, within -3 dB (5 mV/div to 5 V/div) DC to 5 MHz, within -3 dB (1 mV/div and 2 mV/div)
	AC	Real time 5 Hz to 20 MHz, within -3 dB (5 mV/div to 5 V/div) 5 Hz to 5 MHz, within -3 dB (1 mV/div and 2 mV/div)
Rise Time		Real time 17.5 ns or less (20 MHz) 70 ns or less (5 MHz)
Crosstalk		-40 dB or less
Operating Modes	CH1	CH1 Single trace
	CH2	CH2 Single trace
	ALT	Two-waveform display, alternately
	CHOP	Two-waveform display, chopped
	ADD (CH1 + CH2)	CH1 + CH2 added display
CHOP Frequency		Approx. 250 kHz
Channel Polarity		Normal or inverted, channel 2 only inverted
Maximum Input voltage		500 Vp-p or 250 V (DC + AC peak)
<b>HORIZONTAL AXIS</b> Input thru CH2, × 10 MAG not included		
Operating Modes		With TRIG MODE switch, X-Y operation is selectable (storage mode is read only). CH1 ; Y axis CH2 ; X axis
Sensitivity		Same as vertical axis (CH2)
Input Impedance		Same as vertical axis (CH2)
Frequency Response	DC	DC to 500 kHz, within -3 dB
	AC	5 Hz to 500 kHz, within -3 dB
X-Y Phase Difference		3° or less at 50 kHz
Maximum Input Voltage		Same as vertical axis (CH2)
<b>SWEEP</b>		
Type	NORM	Triggering sweep
	AUTO	Sweep free runs in absence of trigger
	SINGLE	Single sweep
Sweep Time		1 s/div to 0.5 μs/div, ±3%, in 20 ranges, in 1-2-5 sequence Vernier control provides fully adjustable sweep time between steps.
Sweep Magnification		× 10 (ten times) ±5%
Linearity		±3% all ranges

# SPECIFICATIONS

<b>TRIGGERING</b>		
Internal Sync	CH1	Triggered by CH1 input signal
	CH2	Triggered by CH2 input signal
	LINE	Triggered by line frequency
External Sync	EXT	Triggered by signal applied to EXT TRIG INPUT jack
External Sync Input Impedance		Approx. 1 M $\Omega$ , approx. 32 pF
Max. External Trigger Voltage		50 V (DC + AC peak)
Coupling		AC, HFREJ, DC, TV FRAME, TV LINE
Sync sensitivity	At NORM position	
	AC	Sync frequency range: 10 Hz to 20 MHz INT: 1 div, EXT: 0.1 Vp-p
	DC	Sync frequency range: DC to 20 MHz INT: 1 div, EXT: 0.1 Vp-p
	HFREJ	When the sync frequency is more than 10 kHz, the minimum amplitude (voltage) required for sync is increased.
	TV	FRAME, LINE INT: 1 div, EXT: 0.1 Vp-p
AUTO: Rating shown above is provided at 50 Hz or over.		
<b>CALIBRATION VOLTAGE</b>		1 V $\pm$ 3%, square wave, positive polarity, 1 kHz $\pm$ 3%
<b>INTENSITY MODULATION</b>		
Sensitivity		+ 5 V, positive voltage decreases brightness.
Input Impedance		Approx. 10 k $\Omega$
Usable Frequency Range		DC to 2 MHz
Maximum Input Voltage		50 V (DC + AC peak)
<b>DIGITAL STORAGE MODE (CH1 and CH2)</b>		
Vertical resolution		8 bits (25 dots/div)
Frequency response	DC	Effective Storage Frequency Bandwidth DC to 400 kHz
	AC	Effective Storage Frequency Bandwidth 5 Hz to 400 kHz
Rise time		Effective rise time: 160 ns or less
Horizontal resolution		11 bits (200 dots/div): 1 s/div to 20 $\mu$ s/div (100 dots/div to 5 dots/div): 10 $\mu$ s/div to 0.5 $\mu$ s/div
Sampling time		5 ms/word to 100 ns/word (1 s/div to 20 $\mu$ s/div) Fixed to 100 ns/word (above 20 $\mu$ s/div)
PEN OUT	Output voltage	0.5 V/div $\pm$ 10%
	Output impedance	Approx. 2 k $\Omega$
	Readout speed	50 ms/word
Pre triggering		0 div, 2.5 div, 5 div, and 7.5 div
Operating Modes	REAL	Real-time waveform display
	STORE	Write/read of storage waveform
	R & S	Simultaneous display of real-time waveform and storage waveform (readout only)
	PEN	Storage waveform display (readout only)
	START	Outputs storage waveform at PEN OUT terminals
<b>READOUT</b>		
Calendar		Year/Month/Day/O'clock/Minute Clock accuracy: $\pm$ 2 min./month Battery life: About 20,000 hours (at room temperature)

# SPECIFICATIONS

Set value		CH1/CH2 scale factor (with probe detection), V-UNCAL, ADD, INVERT Sweep scale factor (magnification conversion), SWEEP VARIABLE-UNCAL, X-Y
Cursor mode	$\Delta V1$	Voltage difference between $\Delta REF$ and $\Delta$ cursors on the basis of a CH1 scale factor
	$\Delta V2$	Voltage difference between $\Delta REF$ and $\Delta$ cursors on the basis of a CH2 scale factor
	$\Delta T$	Time difference between $\Delta REF$ and $\Delta$ cursors on the basis of sweep scale factor
	$1/\Delta T$	Frequency between $\Delta REF$ and $\Delta$ cursors on the basis of sweep scale factor
	RATIO	Voltage ratio and time ratio between $\Delta REF$ and $\Delta$ cursors, supposing 5 div on the CRT as 100%
	PHASE	Phase difference between $\Delta REF$ and $\Delta$ cursors, supposing 5 div on the CRT as 360°
NOTE: The X-Y mode allows $\Delta V1$ measurement only.		
Cursor measurement	Resolution	10 bits
	Measurement accuracy	± 4 %
	Measurable range	$\Delta V$ , RATIO: ± 3.6 div or more from the CRT center $\Delta T$ , $1/\Delta T$ , RATIO, PHASE: ± 4.6 div or more from the CRT center
<b>TRACE ROTATION</b> (Electrical, adjustable from front panel)		
<b>POWER REQUIREMENT</b>		
Line Voltage	100 V/120 V/220 V/240 V AC ± 10%	
Line Frequency	50/60 Hz	
Power Consumption	Approx. 58 W	
<b>DIMENSIONS (W × H × D)</b>	319 (341) × 132 (145) × 380 (442) mm ( ) dimensions include protrusion from basic outline dimensions	
<b>WEIGHT</b>	Approx. 9.6 kg	
<b>ENVIRONMENT</b>		
Within Specifications	10°C to 35°C, 85% max. relative humidity	
Full Operation	0°C to 40°C, 85% max. relative humidity	
<b>ACCESSORIES SUPPLIED</b>		
Probe	PC-31 (READOUT compatible probe) × 2 Attenuation: 1/10 Input Impedance: 10 MΩ 16 pF or less	
Replacement Fuse	1.2A × 2, 0.8A × 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 cover of the fuse holder on the rear panel. 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. Replace fuse F 1 with a fuse of appropriate value, 1.2 amp for 100 VAC to 120 VAC operation, 0.8 amp for 220 VAC to 240 VAC operation.
2. When performing the reinsertion of leadwire for the voltage conversion, the appropriate power cord should be used. (See Fig. 1.)

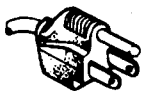





Plug configuration	Power cord and plug type	Factory installed instrument fuse	Line cord plug fuse	Parts No. for power cord and plate
	North American 120 volt/60 Hz Rated 15 amp (12 amp max; NEC)	1.2 A, 250 V Fast blow 6 × 30 mm	None	Cord: E30-1820-05
	Universal Europe 220 volt/50 Hz Rated 16 amp	0.8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

Fig. 1 Power Input Voltage Configuration

# CIRCUIT DESCRIPTION

## Vertical Attenuator Circuit (X73-1740-00)

The vertical attenuator rotary switch unit is a single unit comprising an attenuator circuit and range selection switch. The vertical input signal from the BNC input terminal is input to the initial stage attenuator circuit after selection of the input coupling method by the AC-GND-DC switch. The signal input to the initial stage circuit is switched to pass through either a 1/1, 1/10, or 1/100 attenuator by the vertical rotary switch, and is sent to the initial stage buffer amp.

The initial stage buffer amp is comprised of Q1, 2, 3, 4, 5, and U1 (CH2: Q101, 102, 103, 104, 105, and U101). The signal input to the initial stage buffer amp is separated into the high frequency components and low frequency components. The high and low frequency components are impedance converted by Q3 (Q103) and U1 (U101) respectively, synthesized by the base of Q5 (Q105), and output from the emitter. U1 (U101) is an OP amp with low DC offset drift, and the output of Q5 (Q105) is stabilized in relation to temperature.

This output signal is input to the second stage attenuator, is attenuated to either 1/1, 1/2, 1/4, or 1/10, and is sent to the 2nd amp. Attenuated output with good frequency characteristics can be obtained as this second stage attenuator has low impedance. When the 1 mV or 2 mV/DIV range is selected, there is a switch for setting the 2nd amp to 5X amplification. Q4 (Q104) is a constant-current source for the Q3 (Q103) load. Q1, 2, and D1 (Q101, Q102, and D101) are components to protect the circuit from excessive input.

**Adjusters:** VR1 (VR101) is the step attenuator balance adjuster, and VR2 (VR102) is the low frequency gain adjuster.

## Vertical Pre-amp Circuit (X73-1740-00)

The signals output from the attenuator circuit are sent to the 2nd amp formed from the U2 and U3 (U102 and U103) dual transistor. The 2nd amp is a gain selection-type amp and operates either U2 or U3 (U102 or U103) by switching the current source of Q9 and Q10 (Q109 and Q110). When a range other than 1 mV or 2 mV/DIV is set, Q9 (Q109) is selected and the U2 (U102) amp functions. When the 1 mV or 2 mV/DIV range is set, Q10 (Q110) is selected and the U3 (U103) amp functions to provide amplification 5X that of normal. TH1 (TH2) is connected to the emitter of U3 (U103) for gain drift compensation when the range is 1 mV or 2 mV/DIV. D4 and D5 (D104 and D105) are connected to the collector of U3 (U103) to improve isolation with U2 (U102). The variable terminal of the 2-gain variable resistor attached to the attenuator is connected to the output of the 2nd amp. The method of output from the other terminal of this VR to the next stage allows for a continuous variable attenuator with good frequency characteristics.

The 2nd amp output signal are output to the 3rd amp formed by Q14 and Q15 (Q114 and Q115). In order to realize high CMRR in this stage, a constant-current source is used for the emitter load of the differential transistors. Also, in order to minimize the effect on the feedback capacity of the transistors at high frequencies, the output stage has a cascode amplifier construction with Q16 and 17 (Q116 to Q119) connected to the base ground. On the CH2 side, the collectors of Q117 and Q119, and Q118 and Q116 are connected and the base potential of Q117, Q118, and Q116, Q119 is switched by S104 to output signals with positive and negative polarity.

**Adjusters:** VR3 (VR103) is the MAG/NORM balance adjuster, VR5 (VR105) is the variable balance adjuster, VR108 is the CH2 INV balance adjuster, and TC1 (TC101) is the adjuster for compensation of frequency characteristics.

The output signals from the 3rd amp are input to the 4th amp. The 4th amp is a cascode amp comprised of Q20, 21, 301, and 302 (Q112, 123, 401, and 402), and there is a vertical position adjuster attached to the collectors of Q20 and 21 (Q122 and 123). Trigger signals are output from the emitters of Q20 and 21 (Q122 and 123) through Q215 and 216 (Q217 and 218). On the CH2 side, a signal with the reverse polarity of the trigger signal is output as the X signal.

**Adjusters:** VR9 (VR110) is the position adjuster, TC2 (TC102) and VR10 (VR111) are adjusters for compensation of frequency characteristics, VR202 (VR203) is the CH1 (CH2) trigger DC adjuster, and VR204 is the X gain adjuster.

The 4th amp output passes through the Q303 and 304 (Q403 and 404) emitter follower and is sent to the MIX amp. The MIX amp is also a cascode amp and is comprised of Q305, 306, 203 and 204 (Q405, 406, 207 and 208). The CH1 output terminals, collectors of Q203 and 204, are connected to the CH2 output terminals, collectors of Q207 and 208, and the emitters of Q203, 204, 207, and 208 are connected to the emitters of the transistors for channel selection, Q201, 202, 205, and 206, respectively.

The channel selection signals passes through Q201, Q202, Q205, and Q206, switch the output transistors Q203, Q204 and Q207, Q208 ON/OFF, and select the vertical mode. Also, Q209 is a transistor to reduce fluctuations in the operating point of the ADD mode and other modes.

**Adjusters:** VR403 is the CH2 gain adjuster, and TC301 (TC401) is an adjuster for the compensation of frequency characteristics.

The output of the MIX amp passes through the Q210 and 211 emitter follower and is input to the base of Q212 and 213. Q212 and 213 form a cascode amp together with the Q1, 2 of the final amp. Thus, the vertical pre-amp output signals are current output.



# CIRCUIT DESCRIPTION

**Adjusters:** TC201 is the adjuster for compensation of frequency characteristics.

## A/D Pre-amp (X73-1740-00)

The output from the emitters of Q303 and 304 (Q403 and 404) which is the output from the 4th amp of the vertical pre-amp passes through the A/D pre-amp Q307 to Q311 (Q407 to Q411) and is sent to the A/D unit (X78-1030-00). Additionally at this stage, balanced input signals are converted to unbalanced output signals. Q311 (Q411) forms a cascode amp together with Q1 (Q101) of the A/D unit, and the output signal is current output. VR301 (VR401) is the storage position adjuster and VR302 (VR402) is the storage gain adjuster.

## Trigger Signal Selection Circuit (X73-1740-00)

The trigger signals output differentially from the various channels pass through the Q215 and 216 (Q217 and 218) trigger output amp and enter the trigger selection circuit formed by Q255 to 262.

The EXT trigger signal and signal for line trigger from the power supply circuit also enter this circuit.

The various trigger enable signals are input to the base of Q255 to Q258, and Q259 to Q262 are switched ON/OFF to select the trigger signal. The selected signal is sent to the sweep unit.

## Vertical Final Amp (X80-1090-01)

The signal sent from the vertical pre-amp is amplified at the base ground stage of the Q1 and Q2 cascode amp, passes through the emitter follower of Q3 and Q4 and is sent to the next stage amp. Q5, 6, 7, and 8 also form a cascode amp. Thermistor TH1 for gain temperature drift compensation and R16, 17, C50, and 51 for ultra-low frequency compensation are located between the Q5 and 6 emitters. The output of this stage passes through the emitter followers of Q9 and 10, and is sent to the Q11, 13, 15, and 16 output amp for amplification to 2.5 V/div (one side).

VR1 is a variable resistor (VR) for gain adjustment and VR2 is a VR for CRT center adjustment. VR5 is a VR for adjustment of the operating point and the voltage of P37 is set to +37 V by adjustment of this adjuster.

The storage readout Y signal (Y R/O SIG signal) is input to Q17 and Q18. Switching between the REAL signal and Y R/O SIG signal is performed by switching Q19 and 20. D1 and 2 are included to improve isolation. The cursor gain is adjusted by VR3 and the storage position is adjusted by VR4.

## Power Supply Circuit (X68-1480-00)

The power supply consists of a five-system regulated power supply, two-system non-regulated power supply,

and scale illumination power supply system.

When the power switch is turned on, -10 V is first turned on by Q2, U1, and D8. The -10 V voltage is regulated based on D8. The other voltages of +10 V, +5 V, +65 V, and +120 V are regulated based upon -10 V.

The +10 V, +5 V, and -10 V power supplies use the collector output method in order to reduce power consumption, the +65 V and +120 V power supplies use the emitter output method as there is little current.

The scale illumination circuit is a circuit for illuminating the lamps by controlling the voltage rectified by D1 by Q8.

## Trace Rotation and CAL Circuit (X68-1480-00)

The trace rotation circuit consists of the emitter followers of the Q17 and 18 complementary transistors, and is the circuit supplies current to the rotation coil positioned in the CRT cone section.

The CAL circuit is comprised of U2, D26, and D27. A 1 kHz square wave is created by the U2 multi-vibrator oscillation circuit and this is switched by D26 and 27 to create the 1 Vp-p CAL signal. The frequency is adjusted by VR5 and the level is adjusted by VR6.

## Blanking Circuit and High Voltage Circuit (X68-1480-00)

The unblanking signal from P26 is inverted and amplified by the blanking amp formed by Q11 to Q13 and is overlapped with the cathode voltage by the DC regeneration circuit D18 to D20. Q9 and 10 is an inverting amplifier for auto focusing, and it creates the focus voltage from the blanking signal. The focus voltage is overlapped with the high voltage at the DC regeneration circuit D14 to D16, and drives the focus electrode. The -1.5 kV power for the cathode is generated by the Q15 oscillation transistor and the high voltage convertor block (W02-0431-05). In order for the convertor oscillation circuit to obtain stable high voltage, negative feedback is applied from the cathode to the error amplifier U4 and Q14.

## Trigger Circuit (X74-1460-00)

The trigger signal selected by the vertical pre-amp is input to the trigger amp Q1 and Q2 through P11. The coupling method for the Q2 output is selected by TRIGGER COUPLING switch S2. Input is to the Q3 to Q8 circuit when AC, HF REJ, or DC, and to the Q10, 11, 13, 14, and 15 circuit when TV sync, and the input is amplified to the level at which the ECL logic operates. Q10, D4 and 5 form a polarity selection circuit for TV sync. The sync tip is clamped by Q13 and D6 and the sync pulses are extracted by Q15. The vertical sync pulses are obtained by the R52, C15, and C16 integration circuit.

The trigger slope of the signal output from the trigger amp is switched by U101a after waveform shaping by the

# CIRCUIT DESCRIPTION

U101b, c Schmitt circuit. The next stage horizontal sweep circuit is driven by this signal sync pulse.

The trigger pulse passes through the U103d and D103 detection circuit and is input to the Q101 and 102 flip-flop. When there is a trigger pulse, the base of Q101 goes to "H" and the collector of Q102 goes to "H". It further passes through U103c and the U102b RESET terminal goes to "L". At this time, U102b is in a state able to receive trigger pulses. When there is no trigger pulse, the U102b RESET terminal goes to "H", the RESET state is selected, and auto freerun starts.

## Horizontal Sweep Circuit (X74-1460-00)

When the trigger pulse triggers flip-flop U102b, the output of U102b is inverted and Q105 is controlled through Q114. A sweep signal matching the CR time constant selected by U105, 106 and Q107, 108 is then generated. This sweep signal passes through U206 and Q203 and is sent to the horizontal output selection circuit. This signal is also sent to the Q115 and 116 comparator circuit and the sweep length is determined here. The holdoff time is determined by C121, 122, and 123 which are switched by U104a, R137 and Q110, 111. The TENB signal input to U103b is a signal to make sure there is no sweep for a certain constant period during the storage operation pre-trigger, and sweep does not start while the TENB signal is "H".

U105	← sec										← msec										← μsec		
U106	1	.5	.2	.1	50	20	10	5	2	1	.5	.2	.1	50	20	10	5	2	1	.5			
A	L	H	L	H	L	H	L	H	L	H	L	H	L	H	L	H	L	H	L	H			
B	L	L	H	H	L	L	H	H	H	H	L	L	H	H	H	H	L	L	H	H			
C	L	L	L	L	H	H	H	H	L	L	H	H	H	H	L	L	H	H	H	H			

## Blanking Circuit (X74-1460-00)

The output signal from the sweep gate flip-flop U102b enters the Q118 and 119 ECL to TTL conversion circuit. The Q118 output is used as the storage sweep gate (write start signal) and the output from Q119 is sent to Q211 through the various gates, U201a, U201d, and U201c.

U202c, U202d is a CHOP oscillator which oscillates at approx. 500 kHz. This CHOP signal is mixed with the sweep gate by U201a. It is then divided by 1/2 by U204, passes through U202a and b, and is sent to the vertical amp board (X73-1740-00) from P12 as the vertical selection signal.

The  $\overline{R/O}$  BL signal and  $\overline{ST}$ . BLA signal are mixed by U303d, and mixed with the sweep gate signal by U201c. Then, the  $\overline{R/O}$  UNBL signal and  $\overline{ST}$ . UNBL signal are mixed by U303c and sent to Q213. The blanking signal and unblanking signal are mixed by Q212, Q214 and output from Q215. U205a, and Q216 is an absolute value amp and is set so that the storage brightness disappears at the VR center position and is MAX at both extremes of the VR. U205b is a comparator to create the  $\overline{R/O}$  OFF signal.

## Horizontal Output Selection Circuit (X74-1460-00)

The real sweep signal, real XY signal, storage sweep signal, or storage XY signal is selected by Q204 to Q207 and Q303 to Q306, passes through Q208 and 209, and is sent to the horizontal final amp from P24.

This selection signal is created by U301 combining the  $\overline{REAL REQ}$  signal and  $\overline{ST}$ . REQ signal from the A/D UNIT (X78-1030-00), and XY switch information.

Q301, U302b, and Q302 is a mirror sweep circuit for

storage and it generates a sawtooth wave synchronized with the  $\overline{ST}$  SWP-E signal from the A/D unit.

## Horizontal Final Circuit (X80-1090-01)

The horizontal signal input from P24 passes through the emitter follower of Q23, Q24, and is then sent to Q25, Q26 or Q27, Q28 (for X10 MAG). Switching between Q25, Q26 and Q27, Q28 is by the selection circuit formed from Q44 and Q45. Q29, Q30 is the base ground stage of the cascode amp and the D12 to D21 limiters are connected to the output collector. The horizontal signal is impedance converted by the Q31, Q32 emitter follower, and is amplified to approx. 6 V/div (one side) by the Q33 to Q40 and Q50 final amp.

Thermistor TH3 for compensation of gain temperature drift is mounted between the Q25 and Q26 emitters. There is also thermistor TH4 for compensation of gain temperature drift between the Q27 and Q28 emitters.

VR6 is a VR for horizontal position adjustment and VR7 is for adjustment of the NORM/MAG center. VR7 is mounted on the NORM side in order to allow for a full variable range. VR9 is a VR for adjustment of the operating point, and this is used to set the output operating point to +60 V.

The readout signal is input to Q47 and Q48. Switching between Q47, 48 and Q25, Q26 (or Q27, Q28) is performed by the  $\overline{RO REQUEST}$  signal. D5 and 6 have been added to improve isolation between Q47, 48 and Q25, 26 (or Q27, Q28). VR11 is a VR for adjustment of the cursor gain and VR10 is for adjustment of the cursor position.

# CIRCUIT DESCRIPTION

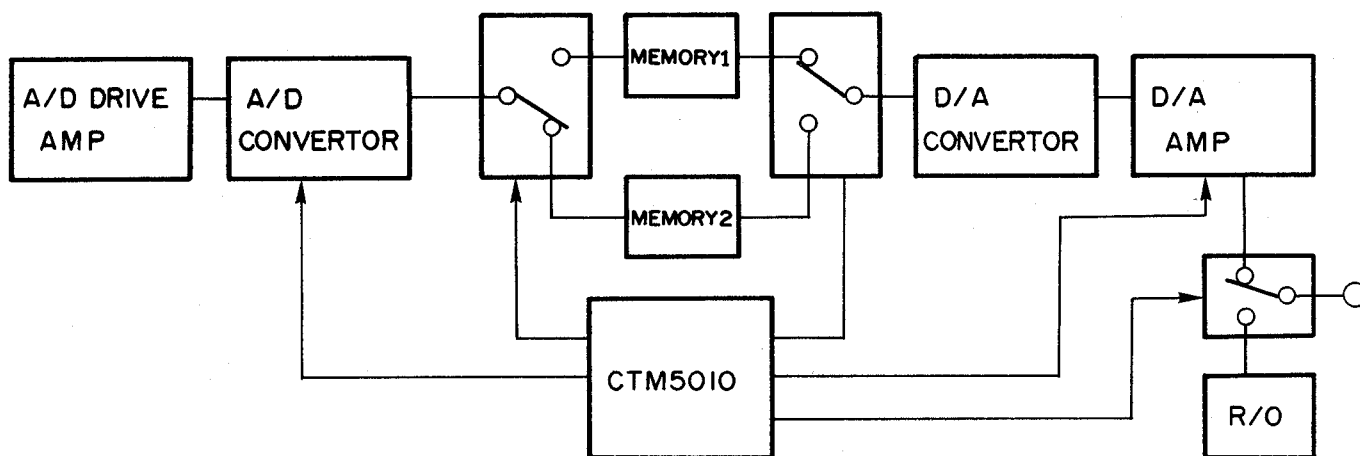
## Overview of Storage

With the CS-8010, an A/D convertor capable of 20 MS/s together with 2k bytes of memory with an access time of 35 nsec are used in order to allow for a sampling speed of 10 MS/s.

An MPU is not used in the CS-8010 for the control of the A/D convertor and memory, with both controlled by hardware. Gate array CTM5010 is used for control as use of discrete parts would result in a great increase in the number of parts. In the memory system, the data and display memory are not separate. There is two memory units for each channel with each used as both data and display memory. For example, in the case of CH1, U5 functions as the display memory when U4 functions as the data memory. When writing to U4 is completed, U4 becomes the display memory and U5 becomes the data memory. In

other words, there is no need for data transfer from the data memory to the display memory. It also means that averaging and interpolation, etc., cannot be performed.

The relationship between STORAGE and R/O is not chopping but alternating. In other words, the storage period (read cycle) starts at the trailing edge of ENDB ( $\overline{R/O\ END}$ ), RSTR ( $\overline{R/O\ START}$ ) goes to "H", and readout stops. When the storage period (read cycle) stops, RSTR ( $\overline{R/O\ START}$ ) goes to "L" and readout starts. When the readout period is completed, ENDB ( $\overline{R/O\ END}$ ) goes from "H" to "L" and the storage period is selected. In other words, if there is no ENDB ( $\overline{R/O\ END}$ ) signal, storage does not start, and if RSTR ( $\overline{R/O\ START}$ ) is not "L", readout does not start.



## A/D UNIT (X78-1030-00)

### CH1 A/D DRIVE AMP

The CH1 A/D drive amp is comprised of Q1 and Q2. Q1 is a base grounded amp and comprises a cascode amp with Q311 on X73-1740-00. Q2 is a buffer for driving A/D convertor U1 and is an emitter follower. Also as the drive amp is an unbalanced circuit, the linear resistor with positive temperature coefficient R47 is used for  $V_{BE}$  temperature drift compensation.

The Q2 emitter follower output is 2.5 Vdc and the sensitivity is 200 mV/div at the center of the real vertical position. The full scale is 10 div as the input range of U1 is from +1.5 V to +3.5 V at 2 Vp-p.

### CH2 A/D DRIVE AMP

The CH2 A/D drive amp is comprised of Q101 and Q102. Q101 is a base grounded amp and comprises a cascode amp with Q411 on X73-1740-00. Q102 is a buffer for driving A/D convertor U1 and is an emitter follower. Also

as the drive amp is an unbalanced circuit, the linear resistor with positive temperature coefficient R147 is used for  $V_{BE}$  temperature drift compensation.

The Q102 emitter follower output is 2.5 Vdc and the sensitivity is 200 mV/div at the center of the real vertical position. The full scale is 10 div as the input range of U1 is from +1.5 V to +3.5 V at 2 Vp-p.

## A/D REFERENCE VOLTAGE

U202, Q201, and Q202 form a reference voltage circuit for U1 and U101. U1 and U101 require two reference voltages: +3.5 V and +1.5 V. The reference voltages are obtained by using resistors to divide the +10 V power supply. The reference ladder resistor for U1 and U101 is about 180  $\Omega$  and the reference current is about 11 mA. The reference voltage is sent to U1 and U101 after it is buffered by the low drift op amp U202 and current booster Q201 and Q202.

Resistors are attached to the collectors of Q201 and Q202 in order to reduce transistor power consumption.

# CIRCUIT DESCRIPTION

## A/D Converter

U1 (U101) is a C-MOS 8-bit A/D converter capable of 20 MS/s. It is used at a maximum of 10 MS/s in this instrument. The analog input range is +1.5 V to +3.5 V at 2 Vp-p.

Although the sampling clock input allows for balanced input, unbalanced input is used in this instrument as less parts are required, and the threshold level for one of the input terminals is set by R8 and R9 (R108 and R109).

R10 and R11 (R110 and R111) are  $1.1\text{ k}\Omega \times 4$  ladder resistors and are used as terminating resistance to speed up the trailing edge of the U1 (U101) digital output.

The U1 (U101) digital output is in the hold state when the sampling clock is at the "H" level, and uncertain when at the "L" level.

## Memory Circuit

In this instrument, the data memory and display memory is not separate. There is two memory systems for both channels (CH1 and CH2) with each used as both data and display memory. For example, when U4 (U104) functions as display memory, U5 (U105) functions as data memory. Then when U5 (U105) functions as display memory, U4 (U104) functions as data memory. U2 and U3 (U102 and U103) are the A/D converter latches. HC-CMOS devices are used for these latches as the drive capabilities of U1 (U101) are limited.

U4 and U5 (U104 and U105) are high-speed C-MOS static RAM. In order to handle the sampling speed of 10 MS/s, memory with an access time of 35 nsec and a  $2 \times 8$  bit configuration is used. U6 and U7 (U106 and U107) are latches for memory data output. ALS-type latches are used as the memory output level is TTL level.

## D/A Converter

U8 (U108) is a general-purpose, 8-bit, current output-type D/A converter. The reference current to this D/A converter is the current to +REF (Pin 14). +REF (Pin 14) and -REF (Pin 15) are equivalent to the op amp input and have an imaginary short relationship.

Thus, +REF (Pin 14) and -REF (Pin 15) are 0 Vdc and the current through R12 and VR1 (R112 and VR101) is the reference current. The reference current is set to 2 mA by adjusting VR1 (VR101). R13 (R113) is a resistor for cancelling the offset caused by the bias current. C15 (C115) is a capacitor for phase compensation.

The U8 (U108) output is the complementary output. This is a two system output with I- (Pin 2) and I+ (Pin 4) and both are attraction current outputs. I- (Pin 2) is used as the CRT output and I+ (Pin 4) as the pin output.

## D/A Amp

Q3 and Q5 (Q103 and Q105) is a base grounded amp for amplifying the U8 (U108) output current. Q12 (Q112) is a

VBE temperature compensation transistor for Q3 (Q103). Q4 (Q104) is a switching transistor for controlling Q3 (Q103) and selecting CH1 or CH2. The CH1 and CH2 signals are mixed by the Q5 and Q105 collector and sent to Q6.

Q204 and Q206 is a base grounded amp for the R/O Y signal. The position of the R/O Y signal on the screen is adjusted by VR203. Q205 is the VBE temperature compensation transistor for Q204.

The R/O Y signal and STO signal are mixed at the collector of Q6 and Q206, and the current is converted to voltage by R28 and R29. Q7 is an emitter follower for driving the final amp.

Q106 and Q107 is the X-axis amp for XY operation, and the gain is adjusted by VR102.

Q203 is a switching transistor for selecting the R/O Y signal or STO signal.

C20 and R30 are for compensation of square wave characteristics, and overshooting from dot to dot is corrected by this time constant.

During ADD, the Q5 and Q105 collector current is added and the bias current becomes double. Then the excess current is eliminated by using the Q207 current source. If R226 were  $910\ \Omega$ , VBE temperature compensation would be performed, but due to the power supply voltage, use of a  $910\ \Omega$  resistor is not possible. Thus, the linear resistor with positive temperature coefficient R224 is used for temperature compensation.

STO waveform position movement is performed by controlling the current of R16 (R116).

## Pen Out Amp

As the U8 D/A converter output is lead-in current, the current is converted to voltage by a resistor. As the reference current is 2 mA, the full scale current is also 2 mA.

As the load resistance is  $1\text{ k}\Omega$  by  $(R46+R34) // R33 // (R35+R36)$ , the full scale voltage is 2 Vp-p. Furthermore, R33 is connected to +10 V in order to obtain 0 V center.

As the U108 D/A converter output is lead-in current, the current is converted to voltage by a resistor. As the reference current is 2 mA, the full scale current is also 2 mA.

As the load resistance is  $1\text{ k}\Omega$  by  $(R146+R134) // R133 // (R135+R136)$ , the full scale voltage is 2 Vp-p. Furthermore, R133 is connected to +10 V in order to obtain 0 V center. As the pen out sensitivity is 500 mV/div, the full scale is 5 Vp-p. Thus in order to align with the polarity of the screen, amplification of -2.5 times is performed by U204. The circuit of U204 is basically an inversion amplifier. Q8 and Q9 (Q108 and Q109) are analog switches which short the input of U204 to 0 V when the pen is off. Q8 and Q9 (Q108 and Q109) are off when the pen is on.

Q110, Q111, R144 and R145 add the CH2 signal to the CH1 pen amp when the V. MODE is ADD. The output im-

# CIRCUIT DESCRIPTION

pedance of the pen amp is 2 k $\Omega$  in order to provide shorting protection for the output of U204. D102 and D103 are logic circuit to stop CH2 pen amp output when the V. MODE is ADD.

## R & S CHOP Oscillator

U203 is a C-MOS type UPD5555C which oscillates at approx. 400 kHz. Thus, switching between real and storage is performed at a speed of about 200 kHz. The CTM5010 RS signal is input to the U203 RESET terminal and oscillation is stopped at all times except when the display mode is R & S. The U203 oscillation output is sent to CCLK of CTM5010, and the oscillation output delayed by R214 and C208 is sent to CDCK of CTM5010.

## Clock

The reference oscillator is a 20 MHz crystal oscillator (X1). This 20 MHz oscillation output is divided by U205, and the reference oscillation (20 MHz) and divided output are multiplexed by U206. As shown in the table below, the pen out speed can be set in five stages. This setting is made by switching by U206 the clock applied to CTM5010. The factory set speed is 50 msec/word.

SWEEP CODE VS CLOCK

TIME/DIV	SWEEP CODE					ADCK	RLCK
	SC4	SC3	SC2	SC1	SC0		
1 sec	H	H	H	L	H	200 Hz	2 MHz
0.5 sec	H	H	H	L	L	400 Hz	2 MHz
0.2 sec	H	H	L	H	H	1 kHz	2 MHz
0.1 sec	H	H	L	H	L	2 kHz	2 MHz
50 msec	H	H	L	L	H	4 kHz	2 MHz
20 msec	H	H	L	L	L	10 kHz	2 MHz
10 msec	H	L	H	H	H	20 kHz	2 MHz
5 msec	H	L	H	H	L	40 kHz	2 MHz
2 msec	H	L	H	L	H	100 kHz	2 MHz
1 msec	H	L	H	L	L	200 kHz	2 MHz
0.5 msec	H	L	L	H	H	400 kHz	2 MHz
0.2 msec	H	L	L	H	L	1 MHz	2 MHz
0.1 msec	H	L	L	L	H	2 MHz	2 MHz
50 $\mu$ sec	H	L	L	L	L	4 MHz	2 MHz
20 $\mu$ sec	L	H	H	H	H	10 MHz	2 MHz
10 $\mu$ sec	L	H	H	H	L	10 MHz	1 MHz
5 $\mu$ sec	L	H	H	L	H	10 MHz	500 kHz
2 $\mu$ sec	L	H	H	L	L	10 MHz	200 kHz
1 $\mu$ sec	L	H	L	H	H	10 MHz	100 kHz
0.5 $\mu$ sec	L	H	L	H	L	10 MHz	50 kHz
PEN	NONE					NONE	20 Hz

CONNECTION	PEN SPEED	PATTERN CUT
U206 ⑤ U205 ④	10 msec/word	U206 ⑤ U205 ⑦
U206 ⑤ U205 ⑦	50 msec/word	NONE
U206 ⑤ U205 ③	100 msec/word	U206 ⑤ U205 ⑦
U206 ⑤ U205 ⑬	200 msec/word	U206 ⑤ U205 ⑦
U206 ⑤ U205 ⑨	500 msec/word	U206 ⑤ U205 ⑦

# CIRCUIT DESCRIPTION

## A/D CONTROLLER CTM5010 PIN ASSIGNMENT

NO.	I/O	NAME	NO.	I/O	NAME	NO.	I/O	NAME	NO.	I/O	NAME
1	OUT	2A6	36	IN	TMD2	71	OUT	4A3	106	OUT	TS02
2	OUT	2A5	37	IN	TMD5	72	OUT	4A5	107	—	N.C.
3	OUT	2A7	38	OUT	ADR	73	OUT	4A7	108	—	N.C.
4	OUT	WLC2	39	OUT	WLC1	74	OUT	4A9	109	—	N.C.
5	IN	CDCK	40	OUT	WE1B	75	OUT	PON1	110	—	Vss
6	OUT	ADCK	41	OUT	1A1	76	OUT	CH2K	111	—	Vdd
7	IN	TST3	42	OUT	1A3	77	IN	VMD5	112	—	N.C.
8	IN	TSCK	43	OUT	1A5	78	IN	DMD2	113	—	N.C.
9	IN	XTL1	44	OUT	1A7	79	IN	DMD5	114	—	Vss
10	—	N.C.	45	OUT	1A9	80	OUT	WLED	115	OUT	4A10
11	IN	PRB	46	IN	SC3	81	OUT	RREQ	116	IN	VMD2
12	OUT	WLC3	47	IN	SC1	82	OUT	SBLK	117	OUT	RSTR
13	OUT	OC4B	48	OUT	OC2B	83	IN	TMD1	118	OUT	REQB
14	OUT	3A0	49	OUT	OC1B	84	IN	SGB	119	—	Vss
15	OUT	3A2	50	OUT	2A0	85	OUT	CH1K	120	—	Vdd
16	OUT	3A4	51	OUT	2A2	86	OUT	1A0	121	IN	0B
17	OUT	3A6	52	OUT	2A4	87	OUT	1A4	122	IN	25B
18	OUT	3A8	53	OUT	2A3	88	OUT	1A6	123	—	Vss
19	OUT	3A10	54	—	N.C.	89	OUT	1A8	124	OUT	1A2
20	OUT	WLC4	55	OUT	2A10	90	OUT	1A10	125	IN	5B
21	OUT	4A0	56	IN	TST1	91	IN	SC4	126	—	N.C.
22	OUT	4A2	57	IN	CCLK	92	IN	SC2	127	—	N.C.
23	OUT	4A4	58	IN	TST2	93	IN	SC0	128	—	Vss
24	OUT	4A6	59	IN	GENB	94	OUT	WE2B	129	—	Vdd
25	OUT	4A8	60	IN	TST5	95	OUT	2A8	130	OUT	RS
26	OUT	PADD	61	OUT	WSTT	96	OUT	2A1	131	—	N.C.
27	OUT	PON2	62	OUT	OC3B	97	—	N.C.	132	—	Vss
28	OUT	XYB	63	OUT	WE3B	98	OUT	2A9	133	OUT	RLCK
29	IN	VMD1	64	OUT	3A1	99	—	N.C.	134	OUT	TENB
30	IN	ENDB	65	OUT	3A3	100	—	N.C.	135	IN	TMD3
31	IN	DMD1	66	OUT	3A5	101	—	Vss			
32	IN	DMD3	67	OUT	3A7	102	—	Vdd			
33	OUT	SSGB	68	OUT	3A9	103	IN	TST4			
34	OUT	SREQ	69	OUT	WE4B	104	OUT	TS01			
35	OUT	UNBL	70	OUT	4A1	105	—	Vss			

# CIRCUIT DESCRIPTION

## CTM5010 PIN DESCRIPTION INPUT PIN

V. MODE	VMD1 (29)	VMD2 (116)	VMD5 (77)
CH1	L	H	H
CH2	H	L	H
ALT	H	H	H
CHOP	H	H	H
ADD	H	H	L

D. MODE	DMD1 (31)	DMD2 (78)	DMD3 (32)	DMD5 (79)
REAL	L	H	H	H
STO	H	L	H	H
R&S	H	H	L	H
PEN	H	H	H	H
PEN START	H	H	H	L

T. MODE	TMD1 (83)	DMD2 (36)	DMD3 (135)	DMD5 (37)
AUTO	L	H	H	H
NORM	H	L	H	H
XY	H	H	L	H
SINGLE	H	H	H	H
RESET	H	H	H	L

PRE TRIG	OB (121)	25B (122)	5B (125)
0	L	H	H
2.5	H	L	H
5	H	H	H
7.5	H	H	H

SGB (84) Sweep gate input (Write start signal)  
 CDCK (5) CHOP selection signal input at D.MODE R & S  
 CCLK (57) CHOP selection signal input at D.MODE R & S  
 TST1 (56)  
 TST2 (58)  
 TST3 (7)  
 TST4 (103) Test pin for the CTM5010 maker  
 TST5 (60)  
 TSCK (8)  
 GENB (59)  
 XTL1 (9) Clock input  
 PRB (11) Reset terminal  
 ENDB (30) R/O END signal; STORAGE START signal; Trailing edge trigger

## OUTPUT PIN

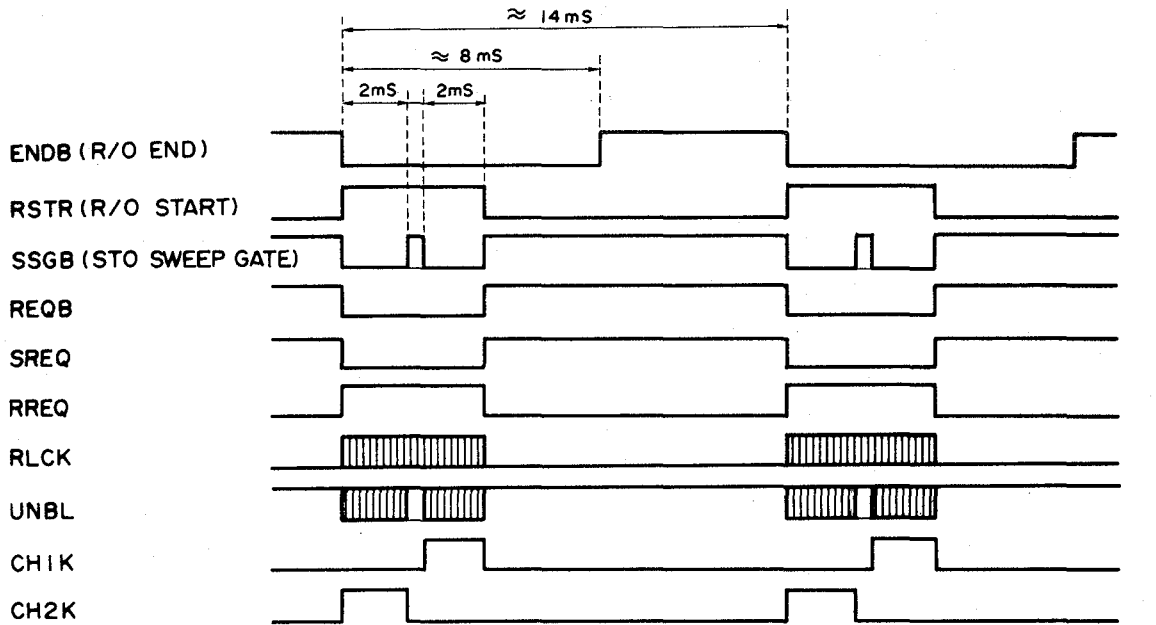
1A0-1A10 U4 address bus  
 2A0-2A10 U5 address bus  
 3A0-3A10 U104 address bus  
 4A0-4A10 U105 address bus  
 WLC1 (39) U2 latch clock  
 WLC2 (4) U3 latch clock  
 WLC3 (12) U102 latch clock  
 WLC4 (20) U103 latch clock  
 WE1B (40) U4 write enable pulse  
 WE2B (94) U5 write enable pulse  
 WE3B (63) U104 write enable pulse  
 WE4B (69) U105 write enable pulse  
 ADCK (6) U1, U101 sampling clock  
 OC1B (49) U4, U5 selection signal between read mode and write mode  
 OC2B (48) OC1B = Invert of OC2B  
 OC3B (62) U104, U105 selection signal between read mode and write mode  
 OC4B (13) OC3B = Invert of OC4B  
 XYB (28) "L" at the T.MODE XY  
 RS (130) "H" at the D.MODE R & S; U203 RESET signal  
 ADR (38) "H" at the V.MODE ADD  
 SSGB (33) Storage sweep gate  
 SREQ (34) Storage selection signal  
 UNBL (35) Storage unblanking signal  
 RREQ (81) Real selection signal  
 SBLK (82) Real blanking signal for the storage display  
 WSTT (61) Test pin for the CTM5010 maker  
 TS01 (104) Test pin for the CTM5010 maker  
 TS02 (106) Test pin for the CTM5010 maker  
 WLED (80) "H" at the memory writing  
 CH1K (85) CH1 display at "H"  
 CH2K (76) CH2 display at "H"  
 RSTR (117) "L" - R/O display "H" - Storage display  
 REQB (118) "H" - R/O display "L" - Storage display  
 RLCK (133) U6, U7, U106, U107 read latch pulse  
 TENB (134) Ignore trigger in sweep circuit at "H"

# CIRCUIT DESCRIPTION

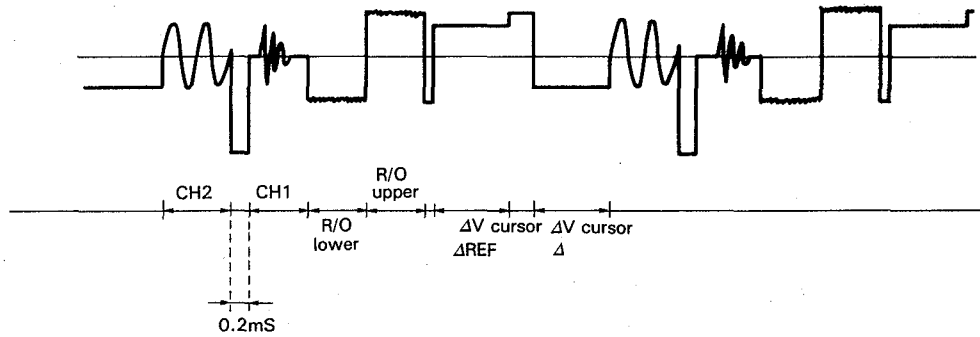
## OUTPUT FROM THE CTM5010 AT D. MODE REAL

PIN NAME		PIN NAME		PIN NAME		PIN NAME	
WLED	L	WE3B	H	WLC4	L	SSGB	H
ADCK	H	WE4B	H	RSTR	L	UNBL	H
RLCK	L	WLC1	L	SREQ	H	TENB	L
WE1B	H	WLC2	L	SBLK	H	REQB	H
WE2B	H	WLC3	L	RREQ	L		

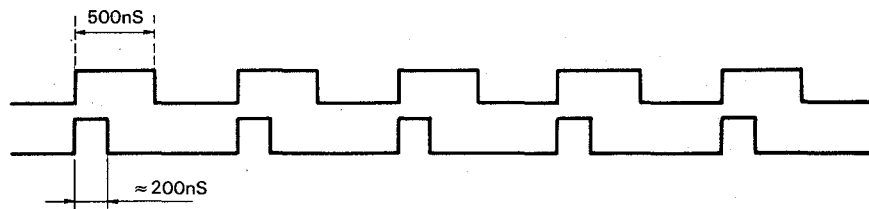
### READ CYCLE



STO R/O Y  
Q7 (E)



R LCK  
UNBL



< Setting condition >

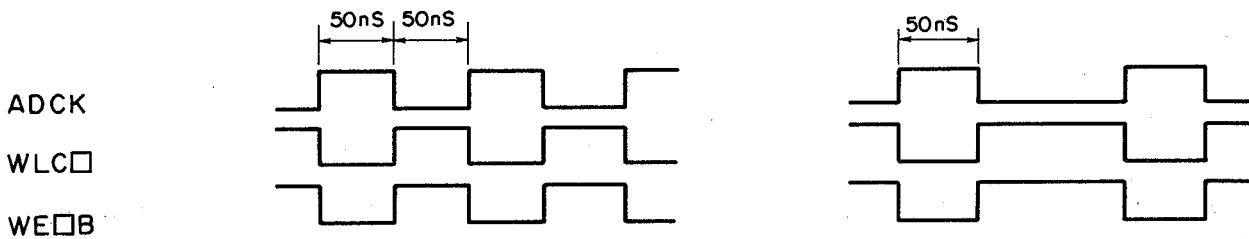
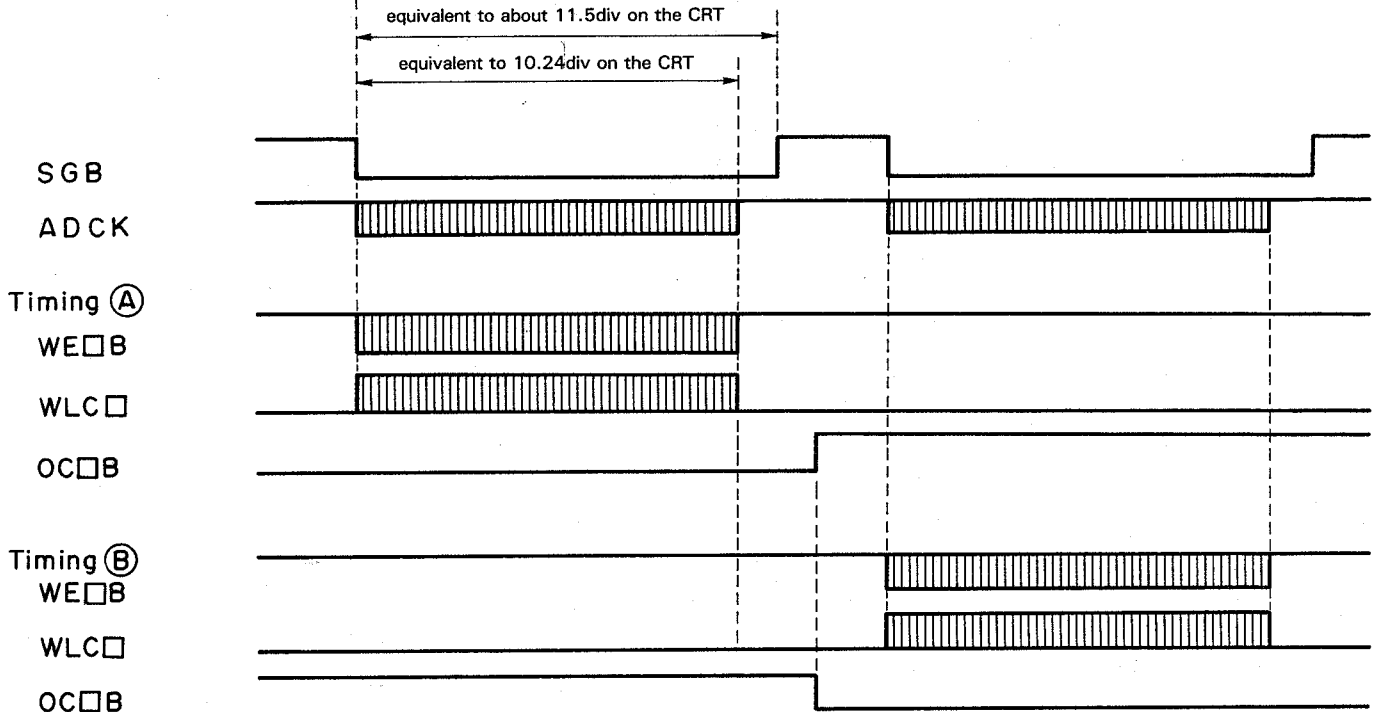
D. MODE

STO or PEN



# CIRCUIT DESCRIPTION

## WRITE CYCLE



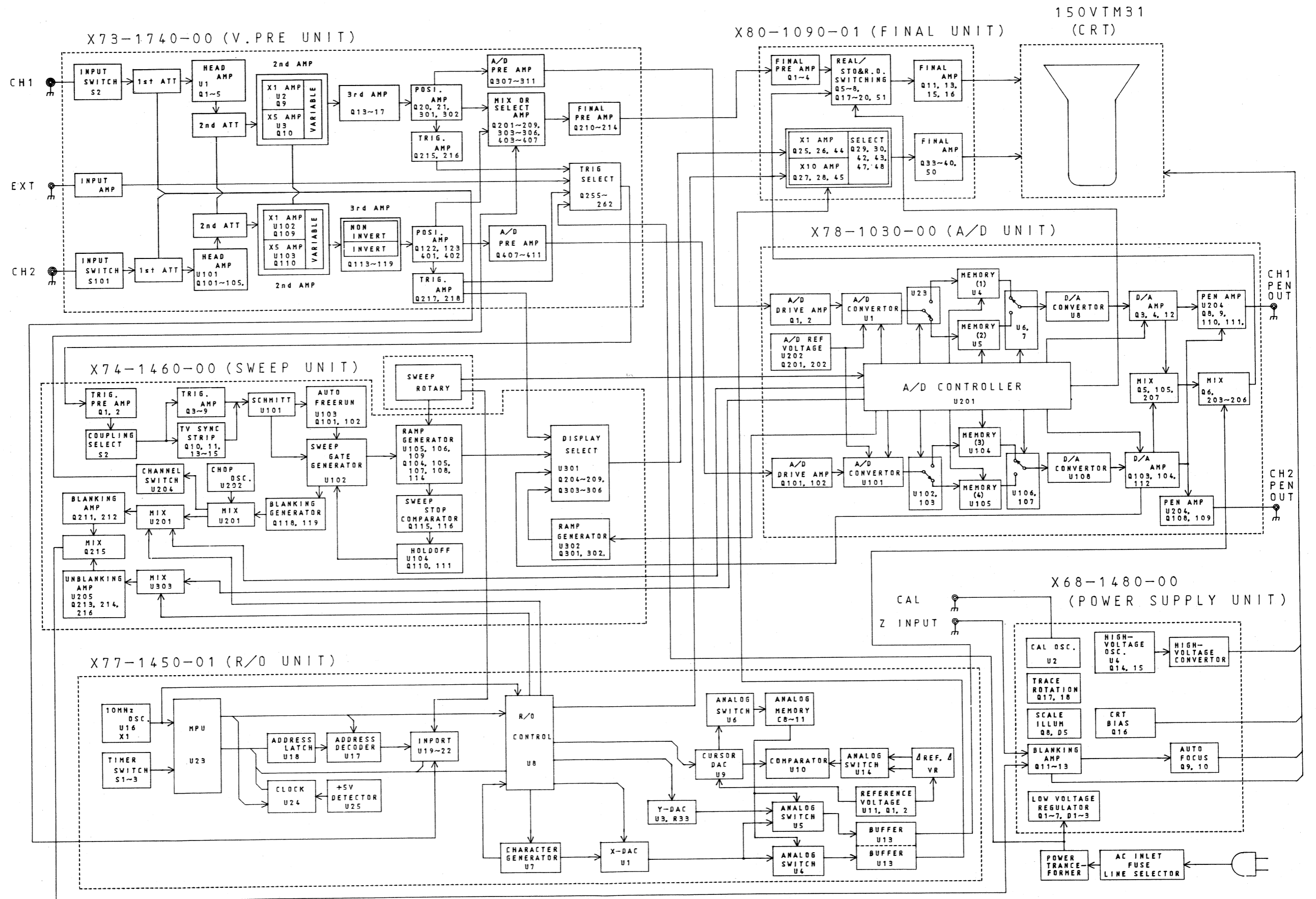
□ : 1 ~ 4

The **OC□B** is changed while the WRITE operation ends and the **RSTR** is "L".

<Setting condition>

D. MODE STO

# BLOCK DIAGRAM



## CIRCUIT DESCRIPTION

### Overview of Readout R/O Unit (X77-1450-01)

The R/O unit is configured from the following three functional blocks.

#### 1) Inport section

Section which fetches switch information and clock data for the CRT readout display (Configured by ICs U17 to U24)

#### 2) Display section

Section which creates X-axis signal and Y-axis signal for the CRT readout display (Configured by ICs and resistors U1 to U5, U7, U8, U13, and R33)

#### 3) Cursor section

A/D conversion section and calculation section for the cursor measurement

(Configured by ICs U6, U8 to U11, U14, and U23)

#### Inport Section

Fetching the information from the various operation switches and the clock data and sending these data to the character generator U7 are performed by the single-chip MPU U23. The reference clock is given from the 10 MHz oscillator configured from U16 and X1. This MPU outputs the lower address A0 to A7 onto the data bus by time division.

U18 latches the lower address by the ALE signal output from the MPU.

The switch information need for screen display passes through the input ports configured by U19 to U22, and this is fetched by the MPU every 80 msec. U17 is the input port decoder, and the output signals  $\overline{RS0}$  to  $\overline{RS3}$  are output at a cycle of 80 msec.

The information from time setting switches S1 to S3 passes through MPU I/O port P1 and is fetched by the MPU every 80 msec.

If the pulses output from Pin 1 of the clock IC U24 every 1 minute apply an interrupt to the MPU, the MPU accesses U24 and fetches the clock data.

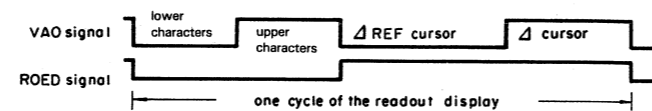
Even when the power is off, U24 is backed up by lithium battery B1, and the 32.768 kHz reference clock is properly generated by crystal oscillator X2. If the battery becomes old and the voltage is less than 2 V when the power is off, the clock will slow down as this reference clock will not be properly generated, and the BATT. DOWN indication will appear on the screen. Clock data protection when the power is switched on/off is performed by IC U25 for +5 V power detection (detection level: TYP +4.4 V).

#### Display Section

Character display is by the random scan method (X-Y display), and the character generator U7 is controlled by the character counter (U8 CD1 to CD7) and the dot counter (U8 DC0 to DC4) of the R/O controller U8. In the real mode, readout display is performed at a period of 13.5 msec. In the storage mode, readout display and storage display is per-

formed by time division with a readout display period of approx. 10 msec and a storage display period of approx. 4 msec. The control signals in this case are the ROED ( $\overline{R/O\ END}$ ) signal and the RSTR ( $\overline{R/O\ START}$ ) signal from the A/D unit (X78-1030-00). (In the storage display period, RSTR becomes "H" and the readout operation stops.)

One cycle of the readout display is divided into four and this consists of the lower characters, upper characters,  $\Delta$  REF cursor, and  $\Delta$  cursor. This timing is switched by the U8-Pin89 ROED signal and U8-Pin46 VAO signal.



The character generator U7 contains character data with a  $5 \times 7$  dot configuration. The 3 bits DD0 to DD2 are the X-axis data, the 4 bits DD3 to DD6 are the Y-axis data, and DD7 is a control bit for character start and end. The digital signals output from U7 are converted to analog signals by the X-axis signal D/A convertor U1 and the Y-axis signal D/A convertor configured by U3 and R33. These signals pass through the analog switches U4 and U5 and the buffer amp U13, and the X-axis signal is fed to the final unit (X80-1090-01) and the Y-axis signal to the A/D unit (X78-1030-00). The character dot display is controlled by the ROUB signal (U8-Pin86), ROB signal (U8-Pin87), and ROQ signal (U8-Pin88). The real waveform display is deleted by the ROB signal, switching between the real waveform and readout is by the ROQ signal, and readout dot display is by the ROUB signal. The above three types of signals are controlled by the ROESP signal (readout off signal  $\overline{R/O\ OFF}$ ) from the Pin 83 of U8.

#### Cursor Section

The reference voltage for the cursor is  $\pm 1.25$  V, created by resistor division of the power supply voltage of +10 V. It passes through U11, Q1, and Q2, and is output. This reference voltage of  $\pm 1.25$  V corresponds to the full scale voltage for 10 bit cursor measurement resolution, and is fed to both terminals of the cursor VR. The voltage set by the cursor VR is fed directly to analog switch U14 in the case of X-axis measurement, and for Y-axis measurement it is attenuated to 80% before being fed to the same analog switch. U14 is for switching between  $\Delta$  T and  $\Delta$  V and for switching between  $\Delta$  REF and  $\Delta$ .

## CIRCUIT DESCRIPTION

MPU U23 sends 10bit data to D/A convertor U9, and this 10bit data is converted to analog voltage. Comparator U10 compares this analog voltage and voltage from the cursor VR, and returns the output to MPU U23. By this process, an A/D convertor is configured by U8, U9, U10, and U23. This A/D convertor converts the analog voltage from  $\Delta$  REF and  $\Delta$  cursor VR to 10bit digital data. The conversion speed of this A/D conversion is 80 msec. Next, this converted 10bit digital data is used for cursor calculation by MPU U23.

The analog voltage output from D/A convertor U9 is converted into  $\Delta$  REF and  $\Delta$  cursor signals by analog switch U6, and is held every 80 msec as the cursor display voltage by the various hold circuits.

# 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-706 (KENWOOD)	Impedance: More than 10 M $\Omega$ , 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 $\Omega$ , 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	CS-2110 (KENWOOD)	Sensitivity: more than 5 mV Frequency response: More than 100 MHz
Time-Marker Generator	TG-501 (Tektronix)	Time mark: 0.5 s to 0.1 $\mu$ s repetitive waveform
High-Voltage Probe	—	Input Impedance: 1000 M $\Omega$
Termination	—	Impedance: 50 $\Omega$ Accuracy: within 3%
Termination	—	3 watts type impedance: 50 $\Omega$
Attenuator	—	-20 dB attenuation (50 $\Omega$ )

Table 1

## PREPARATION FOR ADJUSTMENT

### Control Setting

The control setting 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
READOUT INTEN	Fully CW
FOCUS, ASTIG	Optimum position
CH1, CH2 $\blacktriangle$ POSITION	Mechanical center
CH1, CH2 STORAGE POSI	Mechanical center
$\blacktriangleleft$ POSITION/PULL $\times$ 10MAG	Mechanical center, push
VARIABLE, H.VARIABLE (VOLTS/DIV, SWEEP TIME/DIV)	CAL
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)	10 mV/DIV
SWEEP TIME/DIV	1 ms/DIV
DISPLAY	REAL

Table 2

# ADJUSTMENT

## 1. POWER SUPPLY AND CRT SECTION ADJUSTMENTS

Item	Adjustment VR (TC)	P.C.B.	Procedure
- 10 V Adjustment	VR1	X68-1480	Adjust VR1 so that the voltage at pin 2 of the connector P41 is - 10 V.
Focus Center Adjustment	VR4	X68-1480	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 VR4 to minimize the dimension of the spot.
Intensity Adjustment	VR2	X68-1480	Display the spot on the CRT screen, and adjust VR2 so that the spot disappears when the INTEN knob is set to the 10-o'clock position.
CRT Center Adjustment	VR2	X80-1090	Short circuit the line between Q1's collector and Q2's collector. Adjust VR2 so that the luminescent line is moved to the center of the CRT screen.
Vertical Center Voltage Adjustment	VR5	X80-1090	With the line between Q1's collector and Q2's collector short-circuited, adjust VR5 so that the voltage at pin 1 of the connector P42 becomes 37 V.
Horizontal Center Voltage Adjustment	VR9	X80-1090	Activate the X-Y operation mode, and set so that the spot moves to the center of the CRT. Adjust VR9 so that the voltage at pin 1 of the connector P43 becomes 60 V.

## 2. VERTICAL SECTION ADJUSTMENTS

Item	Adjustment VR (TC)	P.C.B.	Procedure
CH1 Step ATT Balance Adjustment	VR1 VR3	X73-1740 X73-1740	Adjust VR1 so that the position of the luminescent line does not change even when the vertical attenuator is selected between 1 and 2 mV range. Switch the range between 2 and 5 mV ranges, and perform the same adjustment using VR3.
CH1 Variable Balance Adjustment	VR5	X73-1740	VOLTS/DIV: 10 mV Adjust VR5 so that the position of the luminescent line does not change even if the VARIABLE knob is rotated. Vary the settings of the VOLTS/DIV and VARIABLE controls and see if the trace position also moves; if it does, adjust VR1, 3 and 5 again.
CH2 Step ATT Balance Adjustment	VR101 VR103	X73-1740 X73-1740	Adjust in the same way as for CH1.
CH2 Variable Balance Adjustment	VR105	X73-1740	Adjust in the same way as for CH1.
CH2 INV Balance Adjustment	VR108	X73-1740	CH2 POSITION: Mechanical center position (12-o'clock position) CH2 VOLTS/DIV: 1 mV Adjust VR108 so that the position of the luminescent line does not change even if the polarity of CH2 is switched over between NORM and INV positions (with the CH2 POSITION knob set to PUSH and PULL status).
CH2 Position Center Adjustment	VR110	X73-1740	CH2 POSITION: Mechanical center position CH2 VOLTS/DIV: 10 mV Adjust VR110 so that the trace is located on the center of the screen.
CH1 Position Center Adjustment	VR9	X73-1740	Adjust in the same way as for CH2.

# ADJUSTMENT

Item	Adjustment VR (TC)	P.C.B.	Procedure
CH1 100 Hz Square Wave Adjustment	VR2	X73-1740	CH1 VOLTS/DIV: 10 mV Adjust the output of the square wave oscillator so that the amplitude on the CRT screen becomes 6 div. Adjust VR2 so that the waveform becomes flat.
CH2 100 Hz Square Wave Adjustment	VR102	X73-1740	Adjust in the same way as for CH1.
CH1 Waveform Shaping	TC903 TC904	X73-1740 X73-1740	AC-GND-DC: DC Apply 1 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 TC903 (and TC904) so that the waveform becomes flat in both ranges.
CH2 Waveform Shaping	TC913 TC914	X73-1740 X73-1740	Adjust in the same way as for CH1.
CH1 Input Capacity Adjustment	TC901 TC902	X73-1740 X73-1740	AC-GND-DC: DC CH1 VOLTS/DIV: 10 mV Connect the capacity meter to the CH1 INPUT, and measure the input capacity in the 10 mV range. Adjust TC901 and TC902, alternately, so that the input capacity in the 0.1 V and the 1 V ranges equals the same capacity as in the 10 mV range.
CH2 Input Capacity Adjustment	TC911 TC912	X73-1740 X73-1740	Adjust in the same way as for CH1.
CH1 Gain Adjustment	VR1	X80-1090	CH1 VOLTS/DIV: 10 mV Input a square wave signal having an amplitude of 50 mV, and adjust VR1 so that the CRT amplitude becomes 5 div.
CH1 1 mV Range Gain Adjustment	VR4	X73-1740	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 Adjustment	VR403	X73-1740	Adjust in the same way as for CH1.
CH2 1 mV Range Gain Adjustment	VR104	X73-1740	Adjust in the same way as for CH1.
X Gain Adjustment	VR204	X73-1740	CH2 VOLTS/DIV: 10 mV TRIGGERING MODE: X-Y Input the square wave signal having an amplitude of 50 mV into CH2 INPUT, and adjust VR204 so that the CRT amplitude in the horizontal direction becomes 5 div.

# ADJUSTMENT

## 3. TRIGGER SECTION ADJUSTMENTS

Item	Adjustment VR (TC)	P.C.B.	Procedure
Trigger Level Center Adjustment	VR1	X74-1460	TRIGGERING MODE : AUTO SOURCE : CH1 COUPLING : AC LEVEL : Mechanical center CH1 VOLTS/DIV : 10 mV 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 Adjustment	VR202	X73-1740	After adjusting the trigger level center, set the TRIGGERING COUPLING to the DC position. Adjust VR202 so that the start point of the luminescent line is at the same position as in the AC mode.
CH2 Trigger DC Coupling Adjustment	VR203	X73-1740	TRIGGERING MODE : AUTO SOURCE : CH2 COUPLING : AC CH2 VOLTS/DIV : 10 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 VR203 so that the start point of the luminescent line is at the same position as in the AC mode.
EXT Trigger Center Adjustment	VR251	X73-1740	TRIGGERING MODE : AUTO SOURCE : EXT COUPLING : AC LEVEL : Mechanical center CH2 VOLTS/DIV : 0.1 V Input the 1 kHz sine wave to CH2 INPUT and EXT.TRIG, 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 VR251 so that the start point of the luminescent line is at the same position as in the AC mode.

# ADJUSTMENT

## 4. HORIZONTAL SECTION ADJUSTMENTS

Item	Adjustment VR (TC)	P.C.B.	Procedure
1 ms Range Sweep Time Adjustment	VR201	X74-1460	SWEEP TIME/DIV: 1 ms Input a 1 ms marker signal into CH1 INPUT. Adjust VR201 so that the peak of the marker signal matches the CRT scale divided in 1 div.
10 ms Range Sweep Time Adjustment	VR101	X74-1460	SWEEP TIME/DIV: 10 ms Input a 10 ms marker signal into CH1 INPUT, and adjust in the same way as for 1 ms adjustment.
1 $\mu$ s Range Sweep Time Adjustment	TC101	X74-1460	SWEEP TIME/DIV: 1 $\mu$ s Input a 1 $\mu$ s marker signal into CH1 INPUT, and adjust in the same way as for 1 ms adjustment.
X10 MAG Gain Adjustment	VR8	X80-1090	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 X10 MAG knob (to set to the X10 MAG status), and adjust VR8 so that the interval between peaks becomes 10 div.
X10 MAG Center Adjustment	VR7	X80-1090	SWEEP TIME/DIV: 1 ms Input a 5 ms marker signal into CH1 INPUT. Pull the PULL X10 MAG knob (to set to the X10 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 X10 MAG knob (to release the X10 MAG mode) and adjust VR7 so that the peak of the waveform matches the vertical scale line at the center of the CRT.
X10 MAG Linearity Adjustment	TC4	X80-1090	SWEEP TIME/DIV: 0.5 $\mu$ s PULL X10 MAG: PULL Input a 0.5 $\mu$ s marker signal into CH1 INPUT, and match the second peak of the waveform with the vertical scale line at the left end of the CRT. Change the marker signal to 50 ns, and adjust TC4 so that the peaks of the marker signal waveform match the CRT scale divided in 1 div.
Horizontal Position Center Adjustment	VR6	X80-1090	SWEEP TIME/DIV: 1 ms Horizontal POSITION: Mechanical center Input a 5 ms marker signal into CH1 INPUT. Adjust VR6 so that the peak of the waveform at the start point of the luminescent line matches the vertical scale line at the left end of the CRT.
X Position Center Adjustment	VR202	X74-1460	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 VR202 to bring the spot to the center of CRT screen.



# ADJUSTMENT

## 5. OVERSHOOT AND CAL ADJUSTMENTS

Item	Adjustment VR (TC)	P.C.B.	Procedure
Overshoot Adjustment	TC1 TC2  TC201 <For CH1> VR10 TC1 TC2 TC301 <For CH2> VR111 TC101 TC102 TC401	X80-1090 X80-1090  X73-1740 X73-1740 X73-1740 X73-1740 X73-1740 X73-1740 X73-1740 X73-1740 X73-1740 X73-1740	CH1, 2 VOLTS/DIV : 10 mV CH1, 2 AC-GND-DC : DC SWEEP TIME/DIV : 1 $\mu$ s PULL X10 MAG : PULL <ul style="list-style-type: none"> <li>Input a 1 MHz square wave signal into CH1 INPUT (with a CRT amplitude of 6 div.). <ul style="list-style-type: none"> <li>Adjust TC1 and 2 (X80) so that the middle frequency band of the waveform becomes flat.</li> <li>Adjust TC201 (X73) so that the overshoot becomes minimum.</li> <li>Adjust TC301 (X73) so that the low frequency band of the waveform becomes flat.</li> <li>Turn VR10 (X73) fully clockwise.</li> <li>Adjust TC1 and 2 (X73) to shape the waveform (set the overshoot to zero).</li> <li>If the middle frequency band adjustment is not sufficient, readjust TC1 and 2 (X80).</li> </ul> </li> <li>Input the 1 MHz square wave signal into CH2 INPUT (with the CRT amplitude of 6 div.). <ul style="list-style-type: none"> <li>Adjust TC401 (X73) so that the low frequency band of the waveform becomes flat.</li> <li>Turn VR111 (X73) fully clockwise.</li> <li>Adjust TC101 and 102 (X73) to shape the waveform (and set the overshoot to zero).</li> </ul> </li> </ul> <p>After adjustment, check if the frequency response is more than 21 MHz (-3 dB).</p>
CAL Adjustment	VR5 VR6	X68-1480 X68-1480	Connect an oscilloscope having a measurement band of 100 MHz (-3 dB) or more to CAL terminal, and set the VOLTS/DIV to 0.2 V and the SWEEP TIME/DIV to 0.1 ms. (The oscilloscope should be calibrated beforehand.) Adjust VR5 so that one period becomes 1 ms (10 div.). Adjust VR6 so that the amplitude becomes 1 V (5 div.).

## 6. CURSOR AND STORAGE SECTION ADJUSTMENT

Item	Adjustment VR (TC)	P.C.B.	Procedure
CH1 A/D Center Coarse Adjustment	VR301	X73-1740	TRIGGERING MODE : AUTO DISPLAY : REAL CH1 VOLTS/DIV : 10 mV CH1 POSITION : Set the luminescent line to the center of CRT Adjust VR301 so that the voltage at TP1 of A/D unit becomes $2.5 \text{ V} \pm 0.05 \text{ V}$ .
CH2 A/D Center Coarse Adjustment	VR401	X73-1740	Adjust in the same way as for CH1. (The test point should be changed to TP101.)
CH1 Storage Position Center Coarse Adjustment	VR4	X80-1090	Set the unit in the same way as the CH1 A/D Center Coarse Adjustment. CH1 STORAGE POSI: Mechanical center Change the DISPLAY to STORE, and adjust VR4 so that the luminescent line comes in a range between $\pm 1$ div, from the center of CRT.

# ADJUSTMENT

Item	Adjustment VR (TC)	P.C.B.	Procedure
Cursor Y Gain Adjustment	VR3 VR203	X80-1090 X78-1030	<p>CURSORS : <math>\Delta</math> V1  <math>\Delta</math> : Turn fully clockwise  <math>\Delta</math> REF : Turn fully counterclockwise            CH1 VOLTS/DIV : 10 mV</p> <ul style="list-style-type: none"> <li>Adjust VR3 so that the interval between cursors becomes 8 div. To facilitate the adjustment of VR3, adjust VR203 of A/D unit to move the cursor in the Y direction.</li> <li>Then, input a square wave signal having an amplitude of 50 mV into CH1 INPUT.</li> </ul> <p>After confirming that the CRT amplitude is 5 div., adjust the <math>\Delta</math> and <math>\Delta</math> REF knobs to move the cursor on the waveform.</p> <p>Confirm that the cursor data indication is 50.0 mV <math>\pm</math> 3%. (48.5 - 51.5 mV) If it is not within the above allowable range, adjust the <math>\Delta</math> REF knob so that the data indication becomes 50.0 mV, and readjust VR3 (X80-1090) and VR203 (X78-1030) so that the cursor is on the square wave.</p>
CH1 Saturation Level Adjustment	VR301 VR1	X73-1740 X78-1030	<p>TRIGGERING MODE : AUTO            DISPLAY : REAL            MODE : CH1            CH1 VOLTS/DIV : 10 mV            CH1 POSITION : Set the luminescent line to the center of CRT.</p> <p>Change the DISPLAY to STORE, and input the 1 kHz sine wave signal having an amplitude of 200 mVp-p or more into CH1 INPUT.</p> <p>Move the CH1 STORAGE POSI so that the saturation level of the upper peak moves to the horizontal scale line of 3 div. above the center of CRT.</p> <p>Set the CH1 AC-GND-DC to GND, and adjust VR301 so that the luminescent line moves to the horizontal scale line of 2 div. below the center of CRT.</p> <p>Move the CH1 STORAGE POSI so that the luminescent line moves to the horizontal scale line of 2 div. above the center of CRT.</p> <p>Set the CH1 AC-GND-DC to DC and check that the saturation level of lower peak moves to the position of 3 div. <math>\pm</math> 0.1 div. below the center of CRT.</p> <p>If it is not within the above allowable range, adjust VR1 so that the saturation level moves to the horizontal scale line of 3 div. below the center of CRT, then perform the above adjustment again.</p>
CH2 Saturation Level Adjustment	VR401 VR101	X73-1740 X78-1030	Set the MODE to CH2, and perform adjustment in the same way as for CH1.
CH1 Storage Gain Adjustment	VR302	X73-1740	<p>TRIGGERING MODE : AUTO            DISPLAY : REAL            CH1 VOLTS/DIV : 10 mV</p> <p>Input the square wave signal having an amplitude of 50 mV into CH1 INPUT, and adjust the CH1 POSITION so that the waveform moves to the center of the CRT.</p> <p>Change the DISPLAY to STORE.</p> <p>Align the waveform position using the CH1 STORAGE POSI control, then adjust VR302 so that the amplitude at the screen center is 5 div.</p>
CH2 Storage Gain Adjustment	VR402	X73-1740	Adjust in the same way as for CH1.

# ADJUSTMENT

Item	Adjustment VR (TC)	P.C.B.	Procedure
CH1 A/D Center Adjustment	VR301	X73-1740	TRIGGERING MODE : AUTO DISPLAY : REAL MODE : CH1 CH1 VOLTS/DIV : 10 mV CH1 POSITION : Set the luminescent line to the center of CRT. Measure the voltage at C11 of the A/D unit (with an accuracy of 1 mV). — Approx. 2.5 V Adjust VR301 so that the voltage at TP1 of the A/D unit becomes the voltage of C11 ± 10 mV.
CH2 A/D Center Adjustment	VR401	X73-1740	Perform adjustment in the same way as for CH1. (However, the test point should be changed to TP101.)
CH1 Storage Position Center Adjustment	VR4	X80-1090	TRIGGERING MODE : AUTO DISPLAY : REAL CH1 VOLTS/DIV : 10 mV CH1 POSITION : Set the luminescent line to the center of CRT. CH1 STORAGE POSI: Mechanical center Change the DISPLAY to STORE, and adjust VR4 so that the luminescent line moves to the center of CRT.
Storage ADD Position Center Adjustment	VR201	X78-1030	TRIGGERING MODE : AUTO DISPLAY : STORE MODE : ALT or CHOP CH1 POSITION : Mechanical center CH2 POSITION : Mechanical center CH1 STORAGE POSI: Set the CH1 luminescent line to the center of CRT. CH2 STORAGE POSI: Set the CH2 luminescent line to the center of CRT. Change the MODE to ADD, and adjust VR201 so that the luminescent line moves to the center of CRT.
Cursor Y Position Adjustment	VR203	X78-1030	CURSORS : Δ V1 Δ : Turn fully clockwise Δ REF : Turn fully counterclockwise Adjust VR203 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.
Storage 1 ms Range Sweep Time Adjustment	VR302	X74-1460	TRIGGERING MODE : AUTO DISPLAY : STORE SWEEP TIME/DIV : 1 ms Input the 1 ms marker signal into CH1 INPUT. Adjust VR302 so that the peak of the marker signal waveform matches the CRT scale divided in 1 div.
Storage Horizontal Position Center Adjustment	VR301	X74-1460	TRIGGERING MODE : AUTO DISPLAY : STORE SWEEP TIME/DIV : 1 ms Input the 5 ms marker signal into CH1 INPUT. Change the DISPLAY to R & S. Adjust the CH1 POSITION control to align the vertical position relationship between the REAL and STORE waveforms. Adjust VR301 so that the peaks at the start points of the two waveforms match each other.

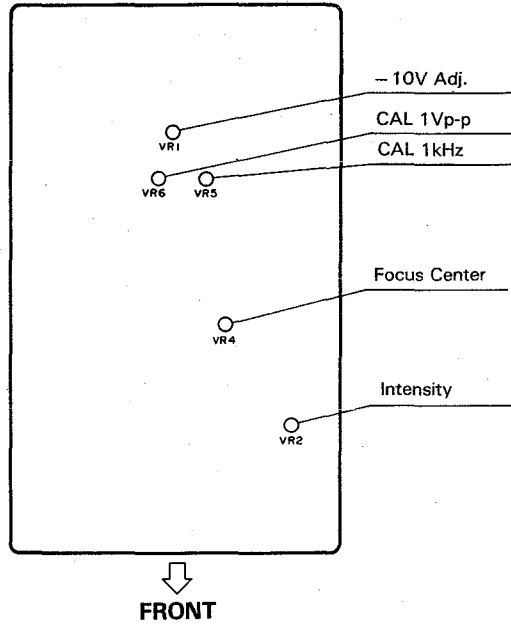
# ADJUSTMENT

Item	Adjustment VR (TC)	P.C.B.	Procedure
Storage X Gain Adjustment	VR102	X78-1030	<p>TRIGGERING MODE : AUTO            DISPLAY : REAL            MODE : ALT or CHOP            CH2 VOLTS/DIV : 10 mV            CH1 AC-GND-DC : GND            CH2 AC-GND-DC : DC            SWEEP TIME/DIV : 0.5 ms</p> <p>Input a square wave signal having an amplitude of 50 mV into CH2 INPUT. Set the waveform to the center of CRT by adjusting CH2 POSITION. Change the DISPLAY to STORE, and check the amplitude is 5 div., then, change the TRIGGERING MODE to X-Y. Adjust VR102 so that the length of the luminescent line in the horizontal direction becomes 5 div.</p>
Storage X Position Center Adjustment	VR303	X74-1460	<p>TRIGGERING MODE : AUTO            DISPLAY : STORE            MODE : ALT or CHOP            CH1, 2 POSITION : Mechanical center            CH1, 2 STORAGE POSI : Mechanical center            CH1, 2 AC-GND-DC : GND</p> <p>Set the CH2 luminescent line to the center of CRT by adjusting the CH2 STORAGE POSI. Adjust the horizontal POSITION knob to set the start point of the luminescent line to the vertical scale line at the left end of CRT. Change the TRIGGERING MODE to X-Y, and adjust VR303 so that the spot moves to the center in the horizontal direction.</p>
Cursor X Gain and Position Adjustment	VR10 VR11	X80-1090 X80-1090	<p>CURSORS : <math>\Delta</math> T  <math>\Delta</math> : Turn fully clockwise  <math>\Delta</math> REF : Turn fully counterclockwise</p> <ul style="list-style-type: none"> <li>Adjust VR11 so that the interval between two cursors becomes 10 div. Adjust VR10 so that the two cursors move onto the vertical scale lines at the left and right ends of CRT.</li> <li>Then set the SWEEP TIME/DIV to 1 ms, and input the 1 ms marker signal into the CH1 INPUT. After checking that the sweep time is displayed correctly, adjust the <math>\Delta</math> REF and <math>\Delta</math> knobs so that the cursors move to the second peak and 10th peak of the waveform, respectively. Check that the cursor data indication is 8.00 ms <math>\pm</math> 3% (7.76 - 8.24 ms). If the displayed value is out of the range above, turn the <math>\Delta</math> REF control until the data display indicates 8.00 ms, then adjust VR10 and VR11 so as to align the cursors with the 2nd and 10th peaks of the waveform.</li> <li>Turn the <math>\Delta</math> knob fully clockwise again, and turn the <math>\Delta</math> REF knob fully counterclockwise. If the cursor positions and the vertical scale lines (at the left end and at the right end) are shifted, adjust VR10 so that the interval becomes the same value for both left and right ends.</li> </ul>
R/O Cursor Length Adjustment	VR1	X77-1450	<p>CURSORS : <math>\Delta</math> 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>

# ADJUSTMENT

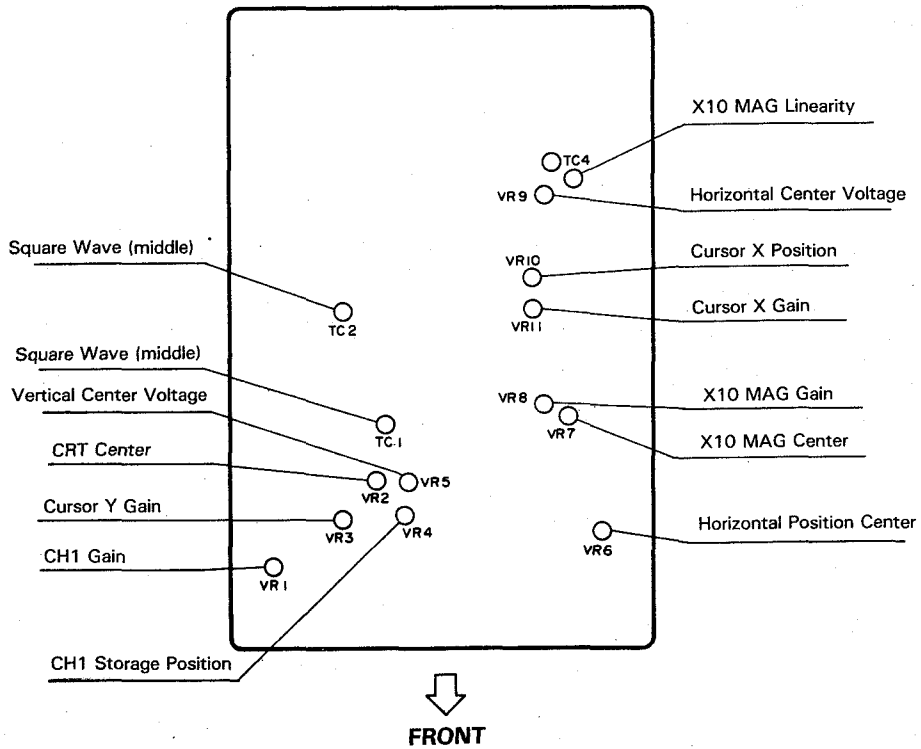
## POWER SUPPLY UNIT (X68-1480-00)

PATTERN SIDE



## FINAL UNIT (X80-1090-01)

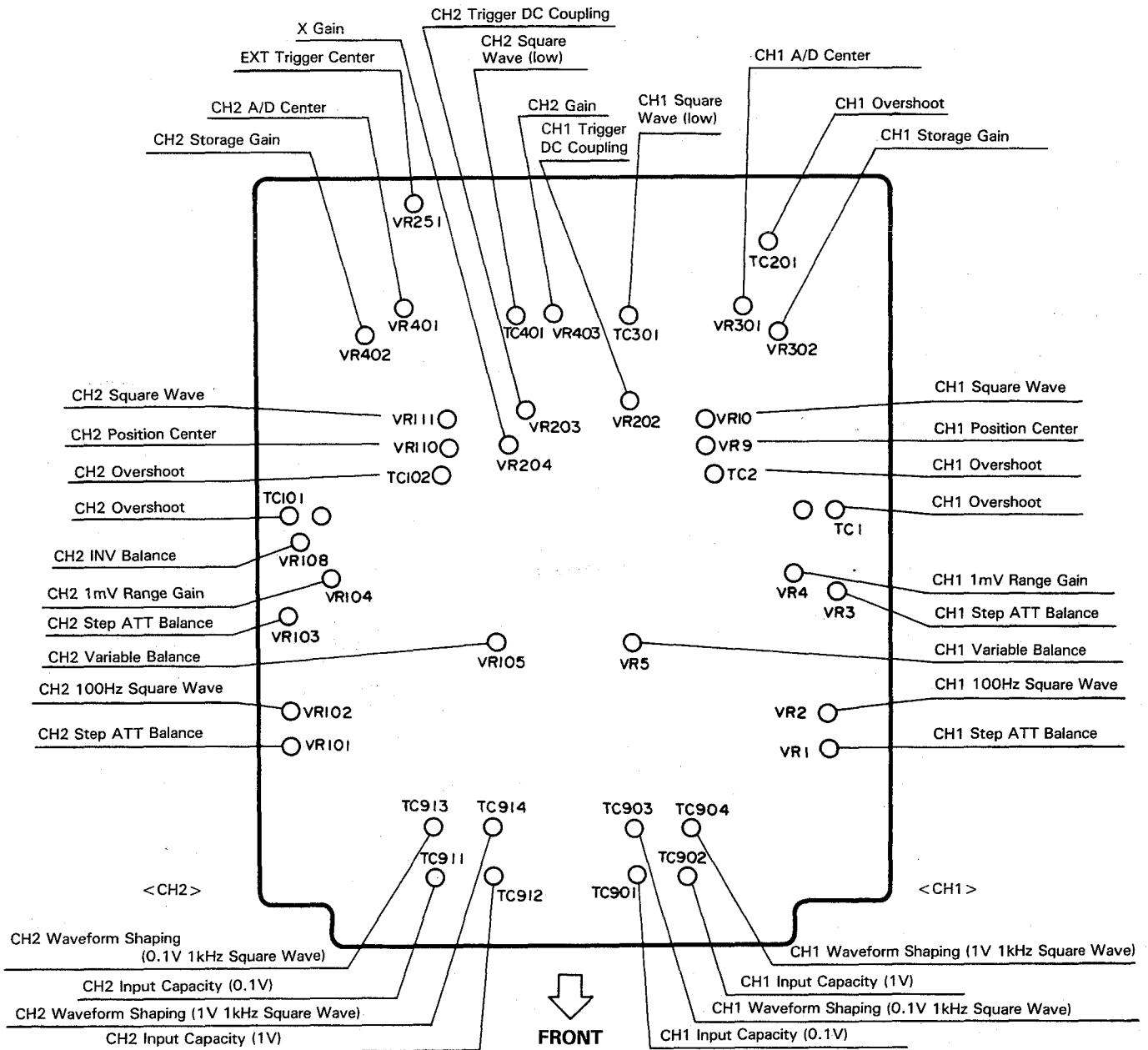
PATTERN SIDE



# ADJUSTMENT

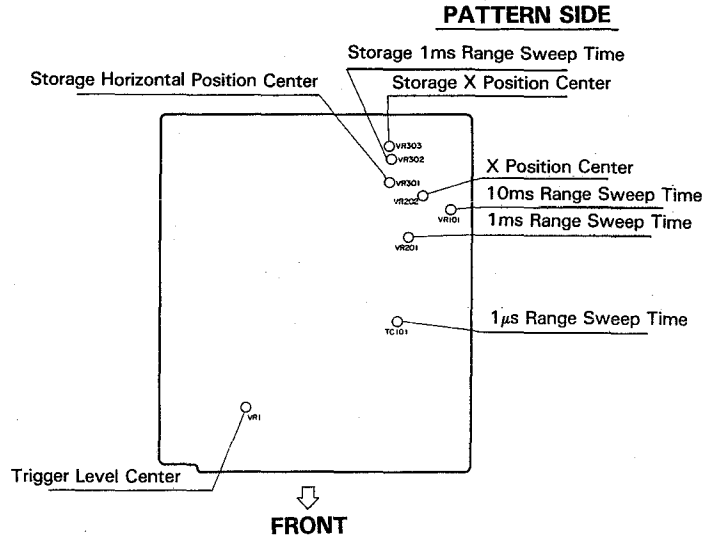
## V.PRE UNIT (X73-1740-00)

**PATTERN SIDE**

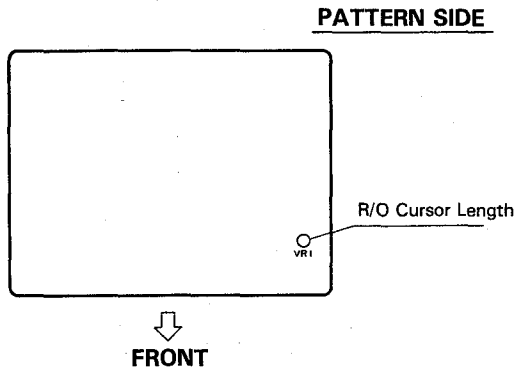


# ADJUSTMENT

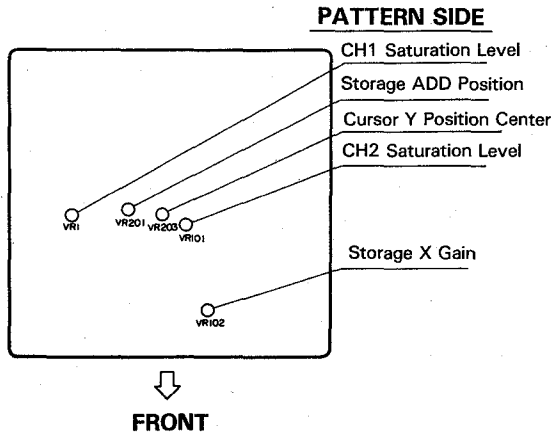
## SWEEP UNIT (X74-1460-00)



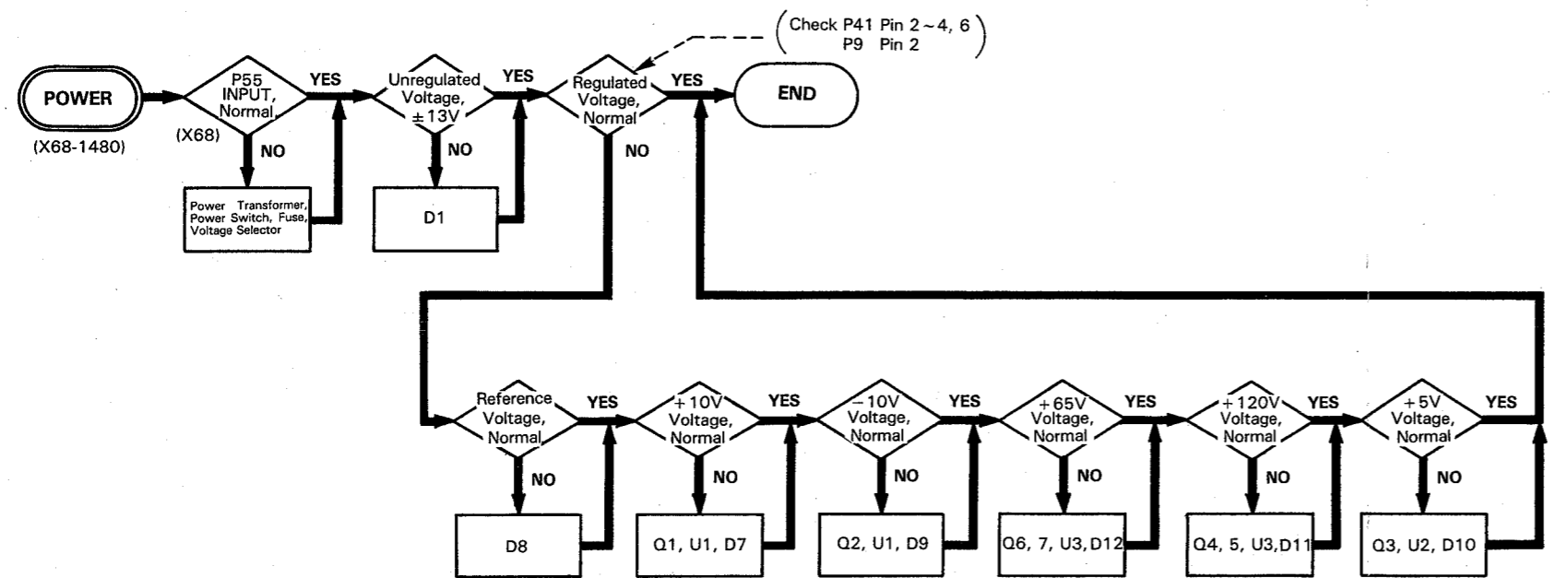
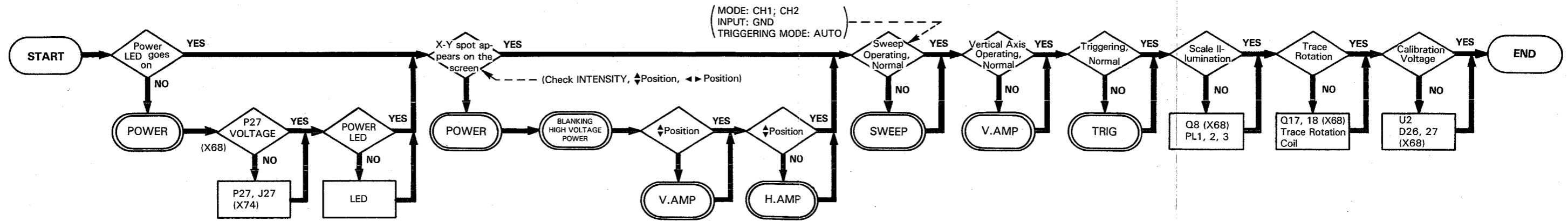
## R/O UNIT (X77-1450-01)



## A/D UNIT (X78-1030-00)

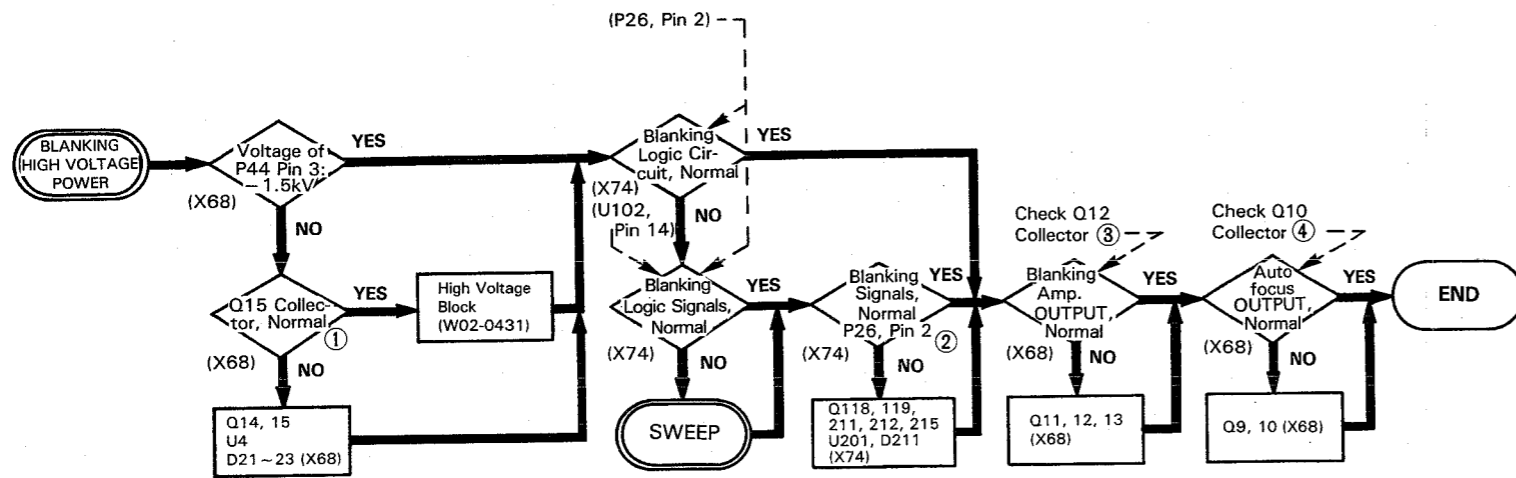


# TROUBLESHOOTING

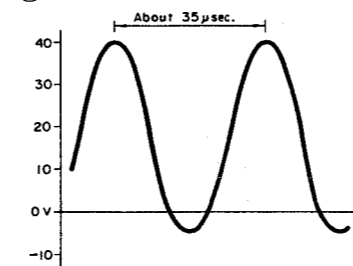




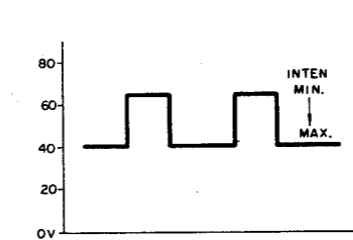
# TROUBLESHOOTING



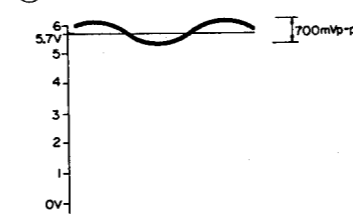
① (X68) Q15 Collector Waveform



④ (X68) Q10 Collector Waveform

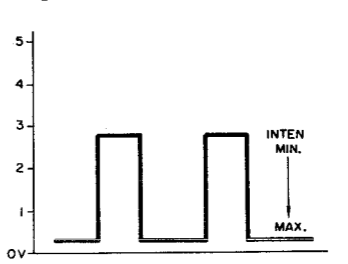


⑦ (X73) Q210, 211 Base Waveform

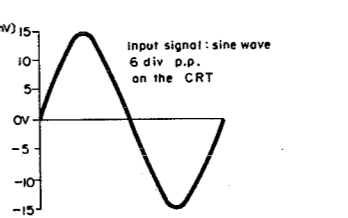


WAVEFORM OF CIRCUIT DIAGRAM

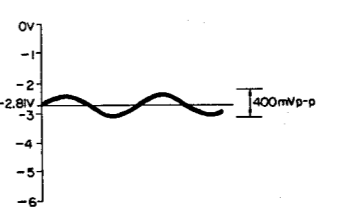
② (X74) P26, Pin 2 Waveform



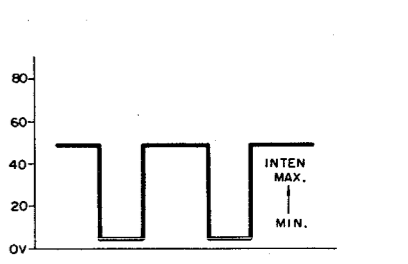
⑤ (X73) U2a Base: CH1 U102a Base: CH2 Waveform



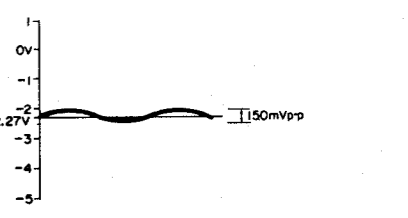
⑧ (X80) Q3, 4 Base Waveform



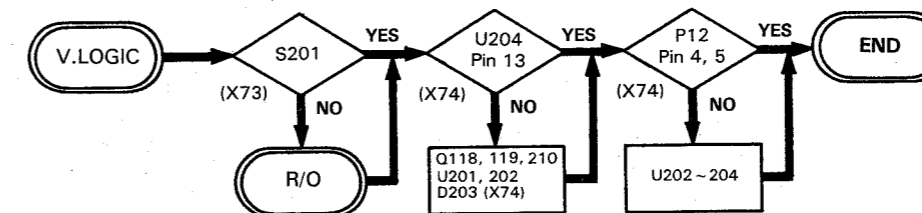
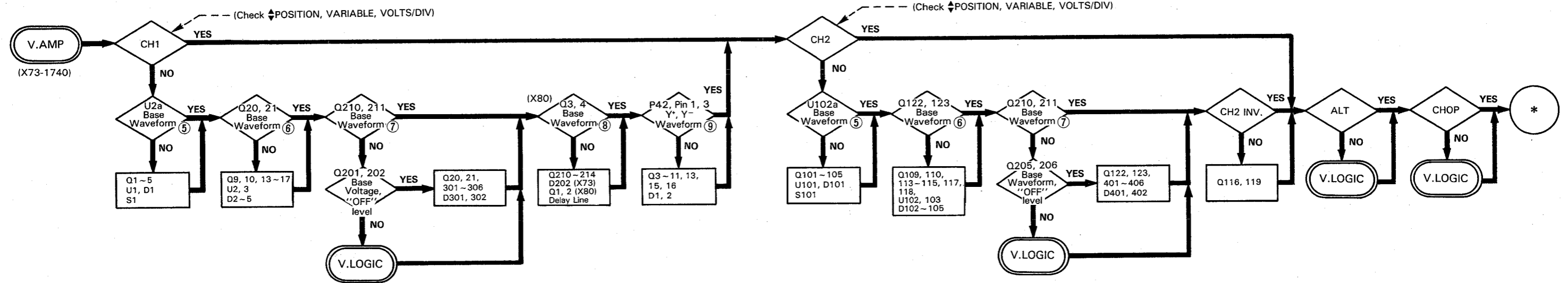
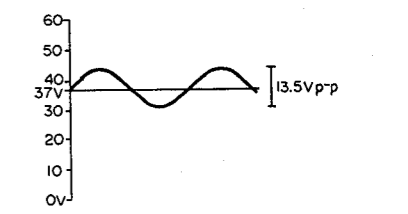
③ (X68) Q12 Collector Waveform



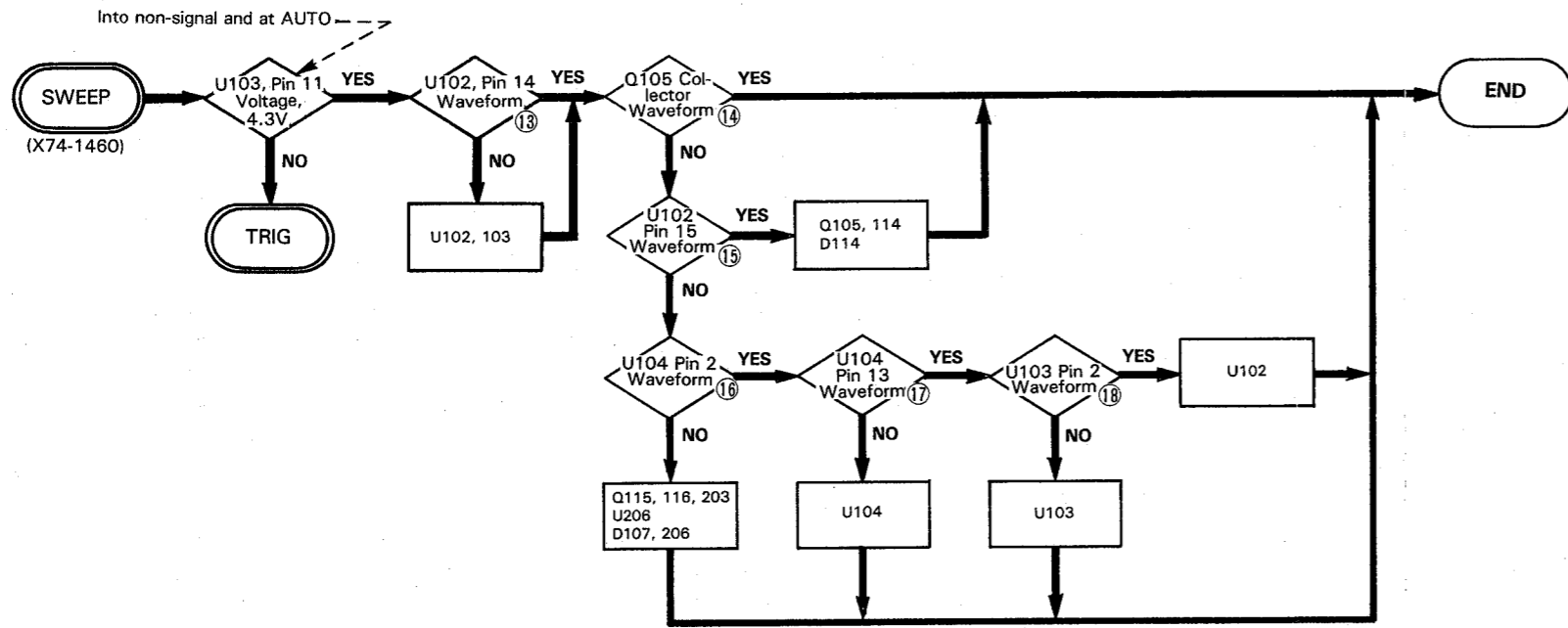
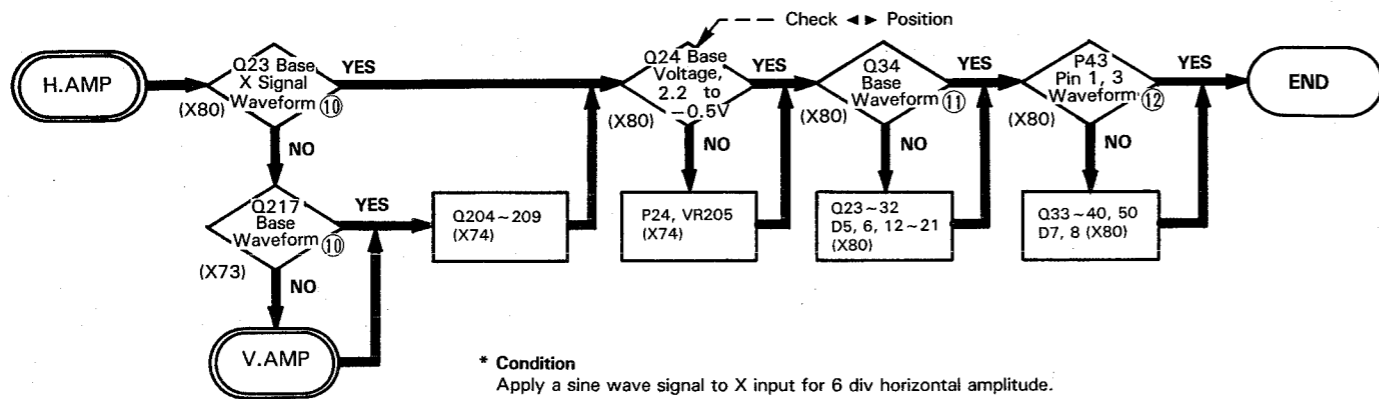
⑥ Q20, 21 Base: CH1 Q122, 123 Base: CH2 Waveform



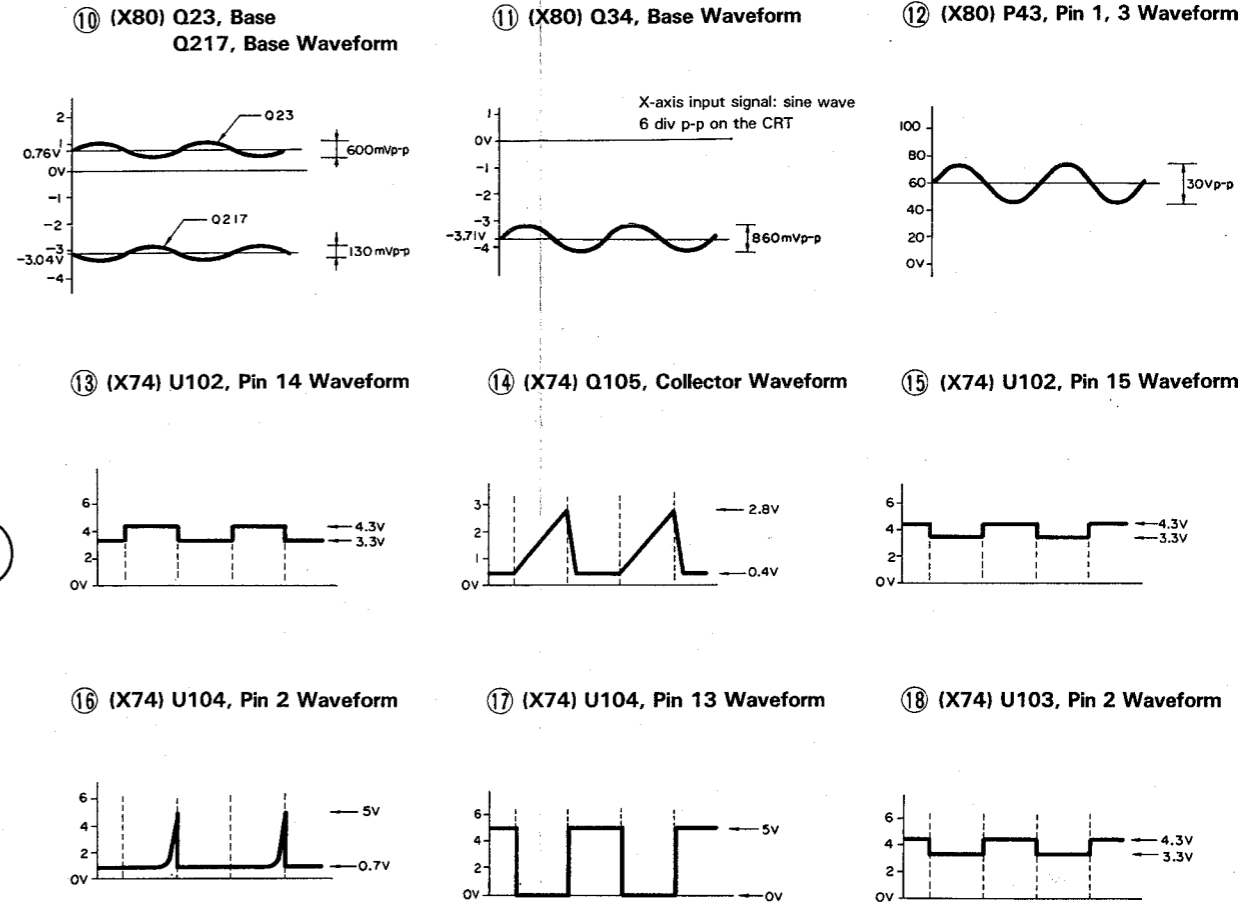
⑨ (X73) P42, Pin 1, 3 Waveform



# TROUBLESHOOTING

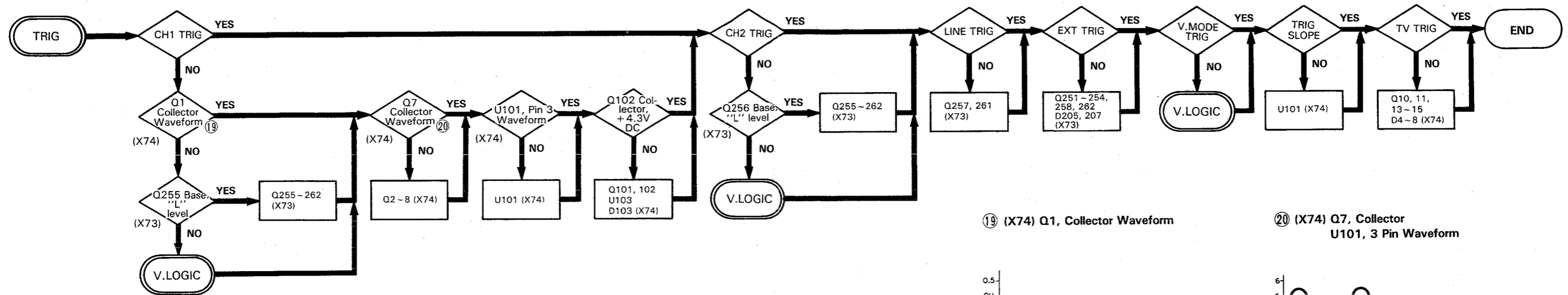


## WAVEFORM OF CIRCUIT DIAGRAM



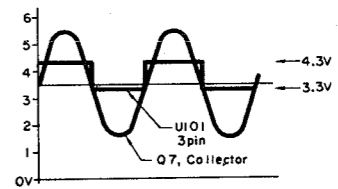
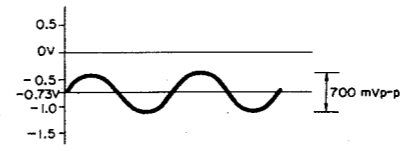
	P12 (X74)	U204 (X74)		U202 (X74)	U201 (X74)	CH. Switch Signal P12 (X73)	
	Pin 1 CHOP	Pin 10 PR	Pin 14 CLR	Pin 11	Pin 6	Pin 1 CH1-E	Pin 2 CH2-E
CH1	H	H	L	H		L	H
CH2	H	L	H	H		H	L
ALT	H	H	H	H			
CHOP	L	H	H				
ADD	H	L	L	H		L	L
X-Y	-	-	L	H	-	L	H

# TROUBLESHOOTING

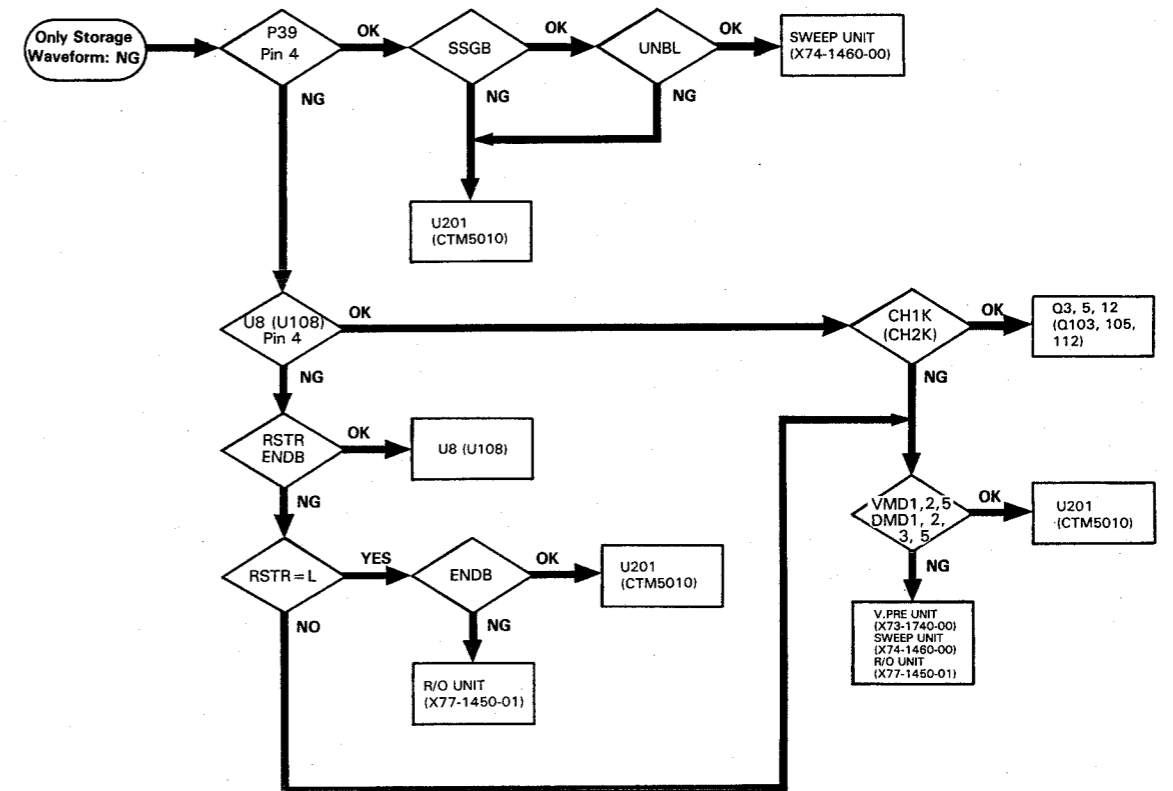
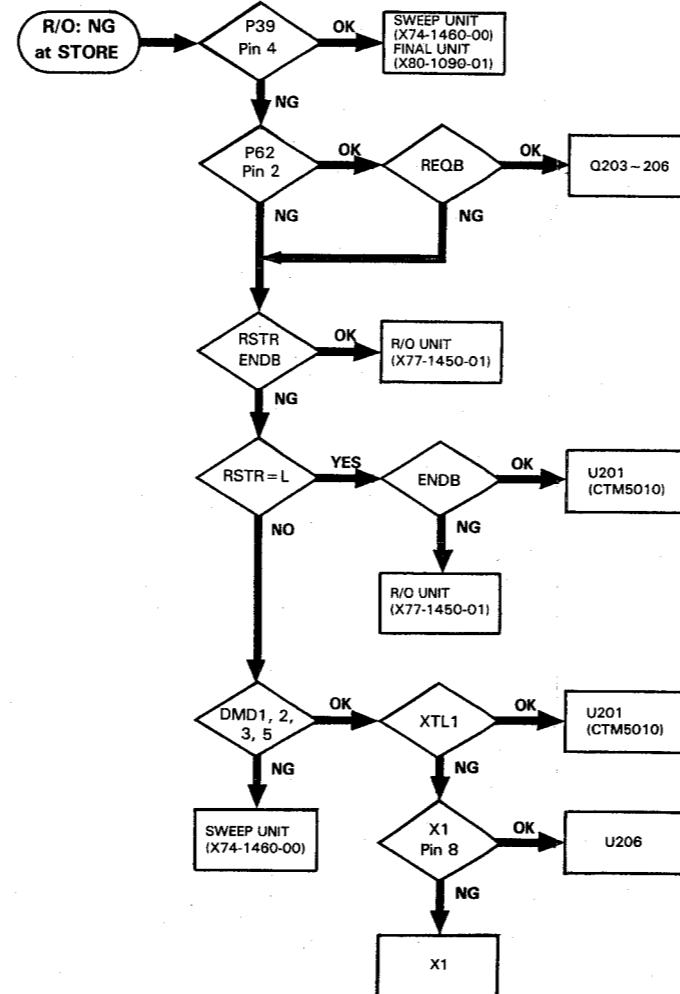
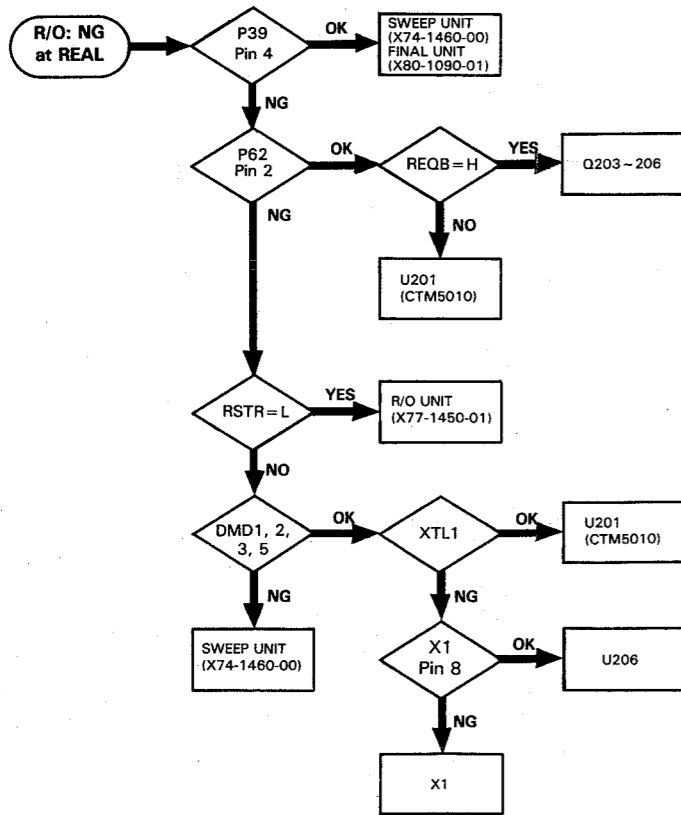


① (X74) Q1, Collector Waveform

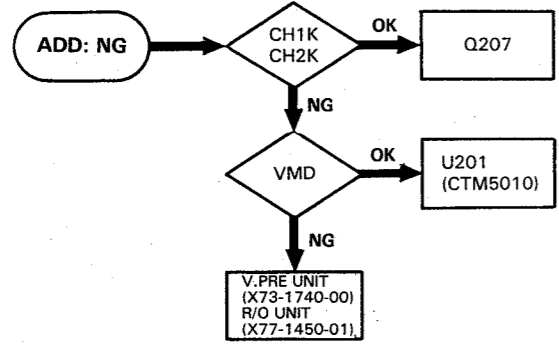
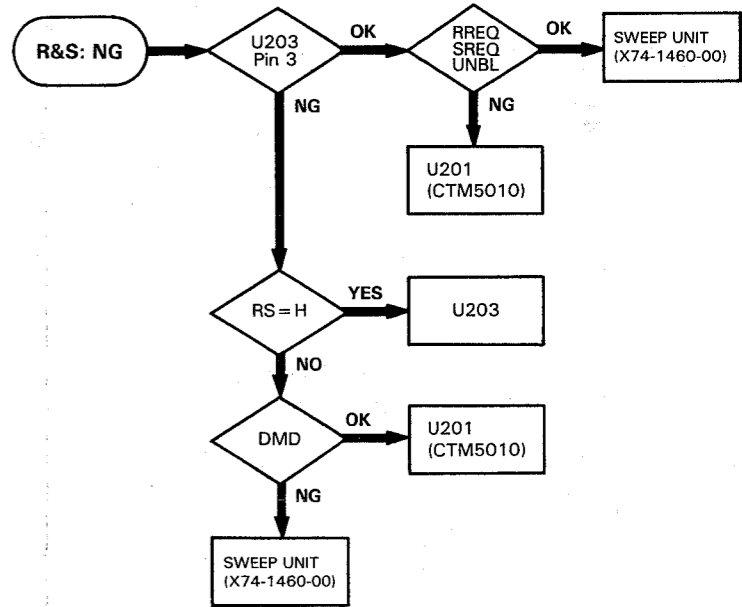
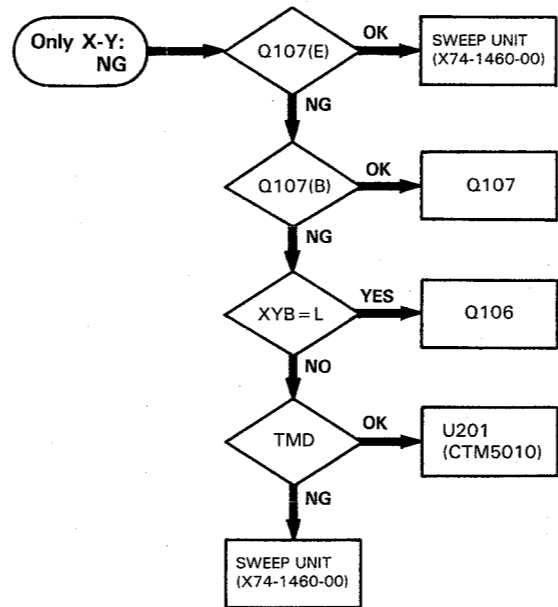
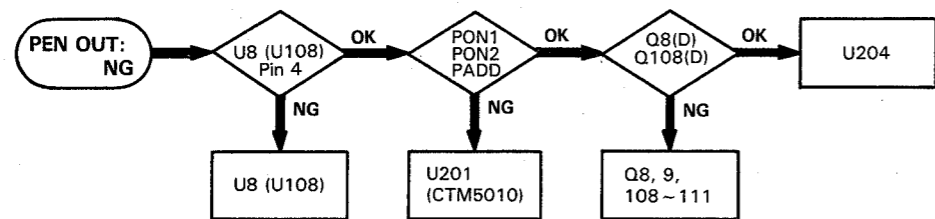
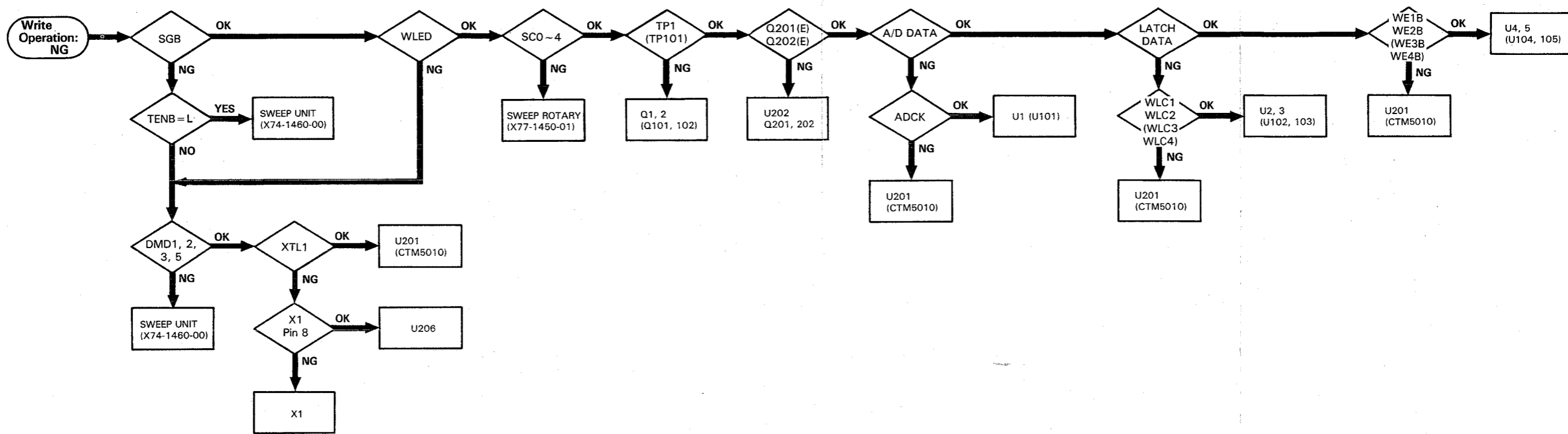
② (X74) Q7, Collector U101, 3 Pin Waveform



## A/D SECTION TROUBLESHOOTING A/D UNIT (X78-1030-00)

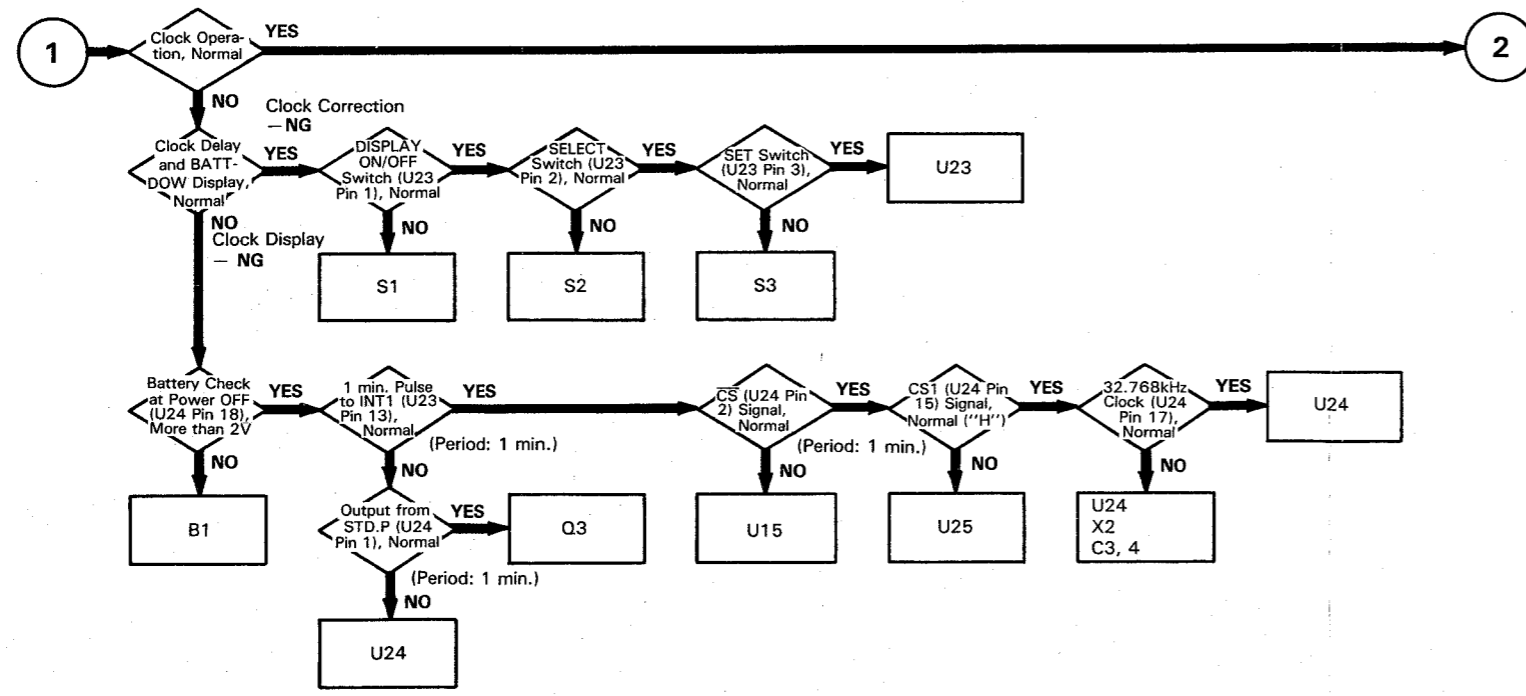
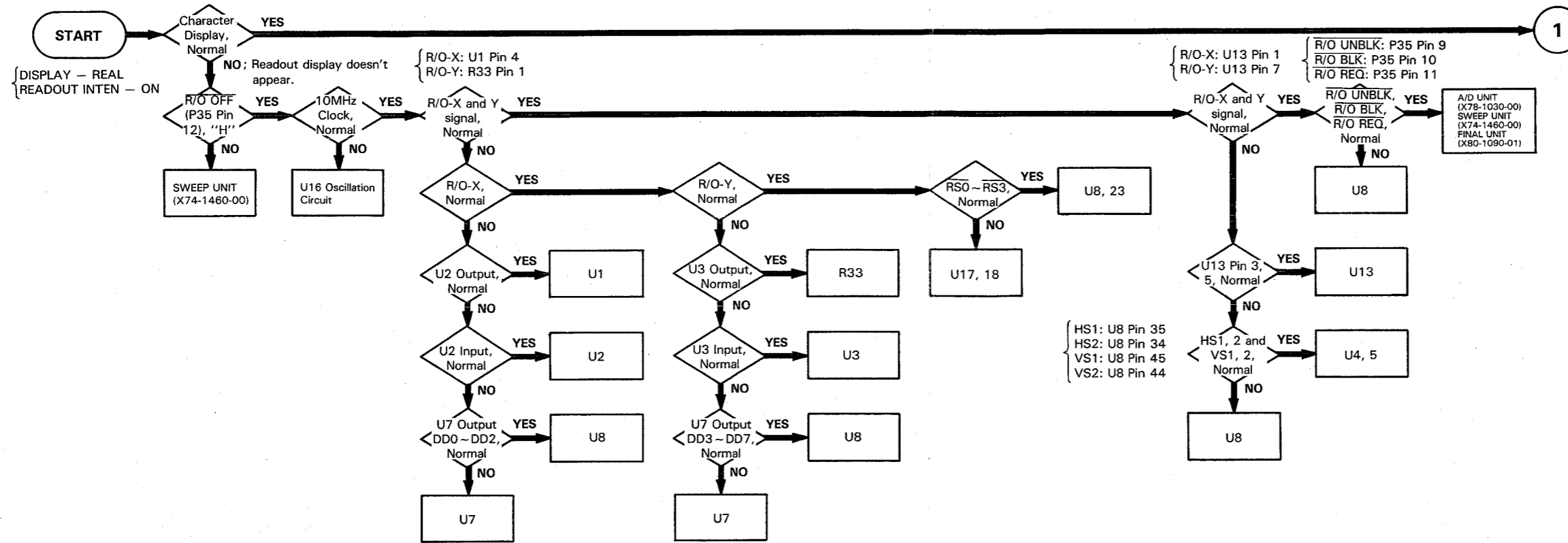


# TROUBLESHOOTING

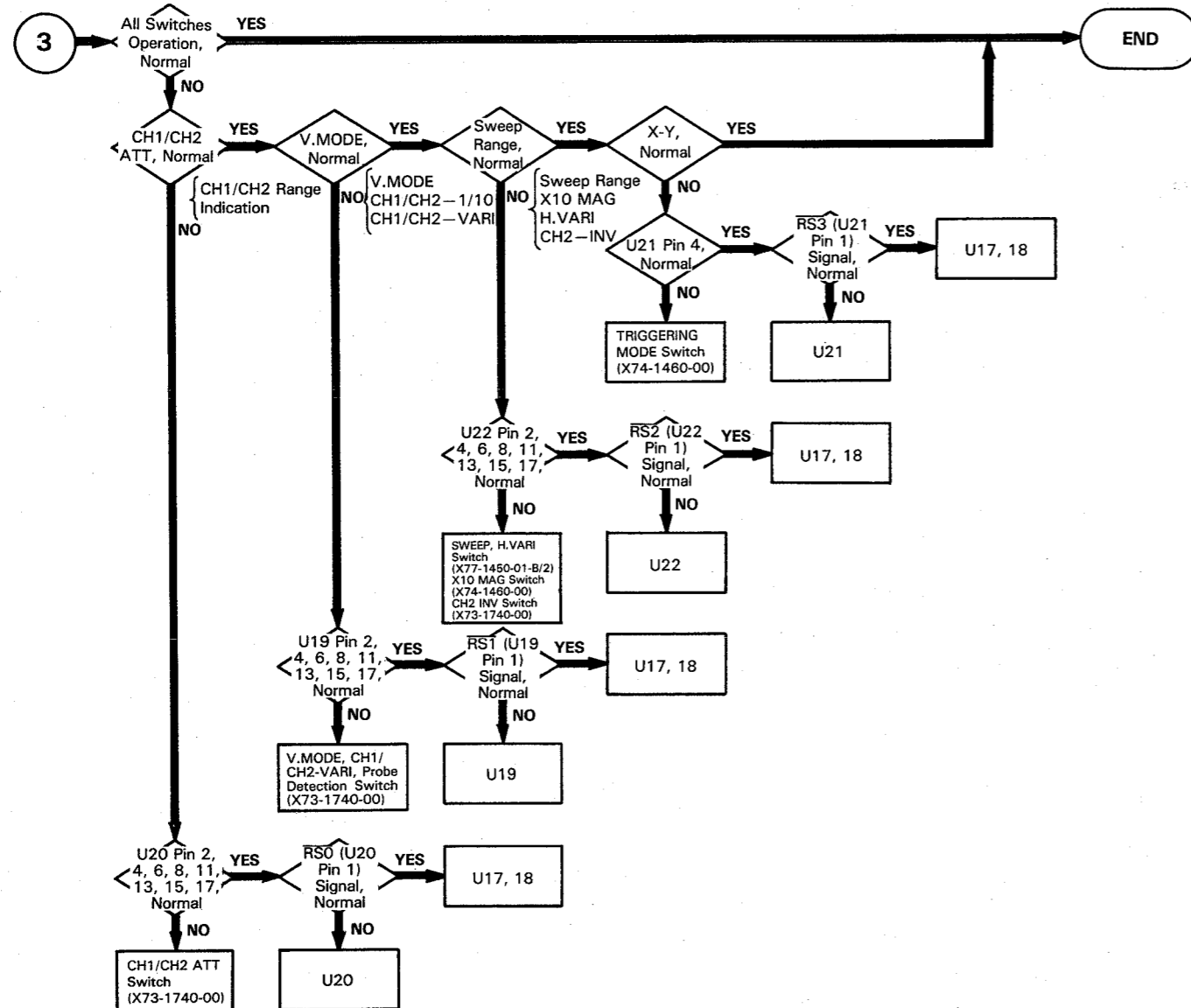
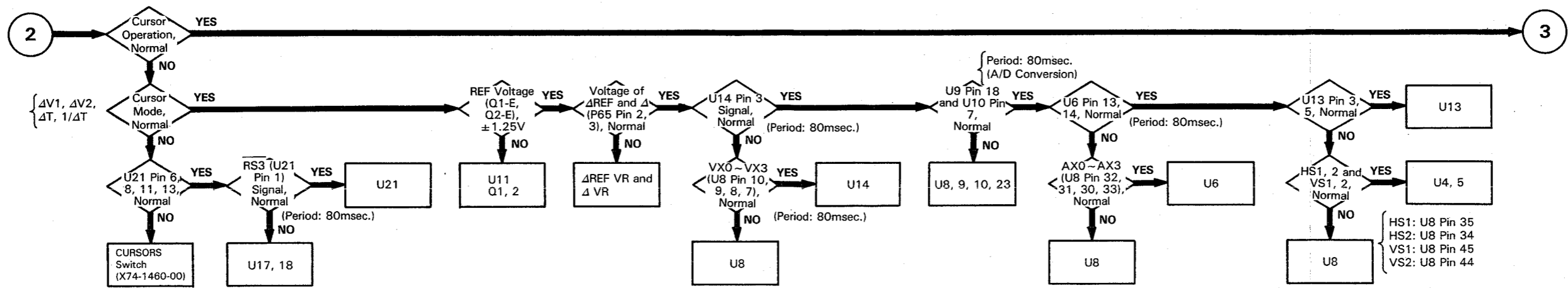


# TROUBLESHOOTING

## READOUT SECTION TROUBLESHOOTING R/O UNIT (X77-1450-01)



# 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) "ATTO"	Display
1 mV	I	I	I	I	CH1 (CH2) 1 mV
2 mV	I	I	I	O	CH1 (CH2) 2 mV
5 mV	I	I	O	I	CH1 (CH2) 5 mV
10 mV	I	I	O	O	CH1 (CH2) 10 mV
20 mV	I	O	I	I	CH1 (CH2) 20 mV
50 mV	I	O	I	O	CH1 (CH2) 50 mV
0.1 V	I	O	O	I	CH1 (CH2) 0.1 V
0.2 V	I	O	O	O	CH1 (CH2) 0.2 V
0.5 V	O	I	I	I	CH1 (CH2) 0.5 V
1 V	O	I	I	O	CH1 (CH2) 1 V
2 V	O	I	O	I	CH1 (CH2) 2 V
5 V	O	I	O	O	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	I

### (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
ALT	1	1	0	1	CH1 CH2
CHOP	1	0	1	1	CH1 CH2
ADD	0	1	1	1	CH1 + CH2

### (6) 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
1 S	I	I	I	O	I	1 S
0.5 S	I	I	I	O	O	0.5 S
0.2 S	I	I	O	I	I	0.2 S
0.1 S	I	I	O	I	O	0.1 S
50 mS	I	I	O	O	I	50 mS
20 mS	I	I	O	O	O	20 mS
10 mS	I	O	I	I	I	10 mS
5 mS	I	O	I	I	O	5 mS
2 mS	I	O	I	O	I	2 mS
1 mS	I	O	I	O	O	1 mS
0.5 mS	I	O	O	I	I	0.5 mS
0.2 mS	I	O	O	I	O	0.2 mS
0.1 mS	I	O	O	O	I	0.1 mS
50 μS	I	O	O	O	O	50 μS
20 μS	O	I	I	I	I	20 μS
10 μS	O	I	I	I	O	10 μS
5 μS	O	I	I	O	I	5 μS
2 μS	O	I	I	O	O	2 μS
1 μS	O	I	O	I	I	1 μS
0.5 μS	O	I	O	I	O	0.5 μS

### (10) Cursor MODE

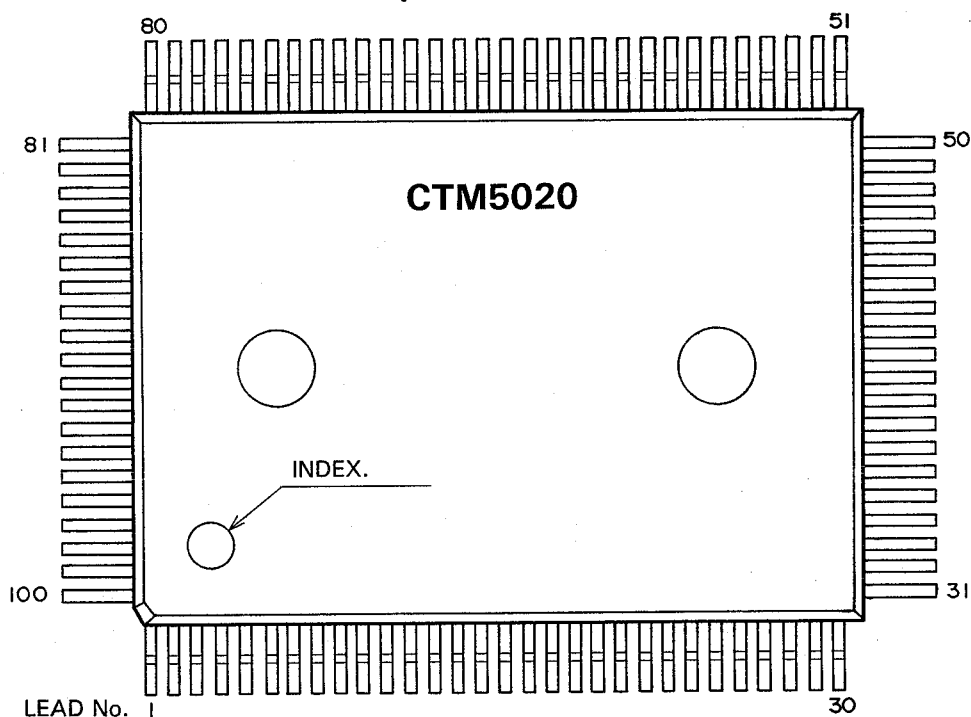
CURSORS	U21 Pin 13 "CURSOR- MODE 3"	U21 Pin 6 "CURSOR- MODE 2"	U21 Pin 11 "CURSOR- MODE 1"	U21 Pin 8 "CURSOR- MODE 0"	Display
OFF	1	1	1	1	No Cursor Line
ΔV1	I	I	I	O	Two Horizontal Cursor Lines
ΔV2	I	I	O	I	Two Horizontal Cursor Lines
ΔT	I	O	I	I	Two Vertical Cursor Lines
1/ΔT	O	I	I	I	Two Vertical Cursor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

### (11) Calendar and Clock Display

DATE	Operation and Function
DISPLAY (ON/OFF)	1 : ON — Display 0 : OFF — Vanishment
SELECT	Selection of the corrected section (Year, Month, Day, O'clock and Minute)
SET	Correction of the calendar and clock display

# TROUBLESHOOTING

## CTM5020 PIN ASSIGNMENT (100-pin FPT) (with RAM)



### CTM5020 PIN DESCRIPTION

Pin No.	I/O	Pin Name	Function
1	I	CONT	Selection between X-Y mode and normal mode
2	I	A13	Address bus A13
3	-	VDD	+5 V power supply
4	I	A14	Address bus A14
5	I	A15	Address bus A15
6	O	INT0	1/2 period of ROSF signal
7	O	VX3	Selection signal of analog switch to input the cursor VR voltage
8	O	VX2	Selection signal of analog switch to input the cursor VR voltage
9	O	VX1	Selection signal of analog switch to input the cursor VR voltage
10	O	VX0	Selection signal of analog switch to input the cursor VR voltage
11	O	DA0	Output (8004H) D0 D/A data (LSB)
12	O	DA1	Output (8004H) D1 D/A data
13	O	DA2	Output (8004H) D2 D/A data
14	O	DA3	Output (8004H) D3 D/A data
15	-	VSS	GND
16	O	DA4	Output (8004H) D4 D/A data
17	O	DA5	Output (8004H) D5 D/A data
18	O	DA6	Output (8004H) D6 D/A data
19	O	DA7	Output (8004H) D7 D/A data
20	O	DA8	Output (8005H) D0 D/A data
21	O	DA9	Output (8005H) D1 D/A data (MSB)
22	O	ROR	Readout monitor terminal

Pin No.	I/O	Pin Name	Function
23	I	ROA	Readout monitor terminal
24	O	LEVX	Output (8005H) D7
25	I	TCL	Test pin
26	I	TSD0	Test pin
27	I	TSD1	Test pin
28	-	VDD	+5 V power supply
29	I	TSD2	Test pin
30	O	AX2	Selection signal of analog switch to output the cursor voltage
31	O	AX1	Selection signal of analog switch to output the cursor voltage
32	O	AX0	Selection signal of analog switch to output the cursor voltage
33	O	AX3	Selection signal of analog switch to output the cursor voltage
34	O	HS2	Selection signal of analog switch for the readout X-axis signal
35	O	HS1	Selection signal of analog switch for the readout X-axis signal
36	O	TDIO	Test pin
37	I	TWE	Test pin
38	I	TCK1	Test pin
39	I	TST1	Test pin
40	-	VSS	GND
41	I	TST2	Test pin
42	I	TADD	Test pin



# TROUBLESHOOTING

Pin No.	I/O	Pin Name	Function
43	I	TCK2	Test pin
44	O	VS2	Selection signal of analog switch for the readout Y-axis signal
45	O	VS1	Selection signal of analog switch for the readout Y-axis signal
46	O	VA0	Character Y-axis DAC data
47	O	VA4	Character Y-axis DAC data
48	O	VA3	Character Y-axis DAC data
49	O	VA2	Character Y-axis DAC data
50	O	VA1	Character Y-axis DAC data
51	O	GETD	Character X-axis data latch clock
52	O	CA0	Character counter data
53	—	VDD	+5 V power supply
54	O	CA4	Character counter data
55	O	CA3	Character counter data
56	O	CA2	Character counter data
57	O	CA1	Character counter data
58	O	CD3	Character ROM address
59	O	CD2	Character ROM address
60	O	CD4	Character ROM address
61	O	CD1	Character ROM address
62	O	CD5	Character ROM address
63	O	DC4	Dot counter data
64	O	CD7	Character ROM address
65	—	VSS	GND
66	O	DC3	Dot counter data
67	O	DC2	Dot counter data
68	O	CD6	Character ROM address
69	O	DC1	Dot counter data
70	O	DC0	Dot counter data
71	O	CD0	Character ROM address

Pin No.	I/O	Pin Name	Function
72	I	DD7	Character ROM Y-axis DAC data
73	I	DD6	Character ROM Y-axis DAC data
74	I	DD5	Character ROM Y-axis DAC data
75	I	DD4	Character ROM Y-axis DAC data
76	I	DD3	Character ROM Y-axis DAC data
77	I	SING	Terminal for SINGLE signal
78	—	VDD	+5 V power supply
79	I	R10M	10 MHz clock
80	I	10M	10 MHz clock
81	I	HLDF	Holdoff input
82	I	SGA	Sweep gate
83	I	ROSP	Readout off
84	I	ROD	Character counter reset
85	O	HLDL	Holdoff output
86	O	ROUB	Readout unblanking
87	O	ROB	Readout blanking
88	O	ROQ	Readout request
89	O	ROED	Readout end
90	—	VSS	GND
91	I	D7	Data bus D7
92	I	D5	Data bus D5
93	I	D3	Data bus D3
94	I	D1	Data bus D1
95	I	ALE	Address/Data latch
96	I	D6	Data bus D6
97	I	D4	Data bus D4
98	I	D2	Data bus D2
99	I	D0	Data bus D0
100	I	WR	Write timing signal



# PARTS LIST

## CS-8010 UNIT

### Y70-1590-61

REF. NO	PARTS NO	NAME & DESCRIPTION
	B41-0710-04	CAUTION LABEL (HIGH VOLTAGE)
	B50-7624-10	INSTRUCTION MANUAL
	E31-0717-05	WIRE ASS'Y (POWER, GND P71)
	E31-2831-05	WIER ASS'Y (SINGLE LED P31)
	E31-2832-05	WIER ASS'Y (W. LED P32)
	E31-2836-05	WIER ASS'Y (X-VARI. P37)
	E31-2837-05	WIER ASS'Y (SWEEP CODE P38)
	E31-2848-05	WIER ASS'Y (2-IN P54)
	E31-2854-05	WIER ASS'Y (PEN OUT P61)
	E31-2858-05	WIER ASS'Y (CURSOR V.R P65)
	E31-2861-05	WIER ASS'Y (INLET-FILTER P69)
	E31-2899-05	LEAD WIRE WITH HARNESSSES (A)
	E31-2900-05	LEAD WIRE WITH HARNESSSES (B)
	E31-2924-05	WIRE ASS'Y (EXT. IN P3)
	F05-1224-05	FUSE 1.2A(6X30MM) FOR 100-120V
	F05-8013-05	FUSE 0.8A(5X20MM) FOR 220-240V
	F05-8015-05	FUSE 0.8A(6X30MM) FOR 220-240V
	H01-5880-04	CARTON BOX
	H10-2828-12	FOAMED STYRENE PAD (FRONT)
	H10-2829-12	FOAMED STYRENE PAD (REAR)
	H12-0564-04	PAD
	H20-1719-04	VINYL COVER
	H25-0029-04	POLYETHYLENE BAG (FUSE)
	J61-0408-05	WIRE WRAPPING BAND
	J61-0509-05	WIRE WRAPPING BAND
	N08-0611-04	SCREW, (CORD WRAP)
	N09-0623-04	SCREW, SEMS M3X8
	N09-0705-05	SCREW, HEX SOCKET FLAT HD M4X8
	N09-0739-05	SCREW, SEMS TAP TITE M3X8
	N09-0744-04	SCREW, SEMS M3X12
	N10-2030-46	NUT, HEX
	N17-1030-46	TOOTHED LOCK WASHER FOR M3
	N30-3012-41	SCREW, PAN HD M3X12
	N30-4008-41	SCREW, PAN HD M4X8
	N32-3006-41	SCREW, FLAT HD M3X6
	N32-3008-41	SCREW, FLAT HD M3X8
	N34-3012-41	SCREW, TRUSS M3X12
	N88-3008-41	SCREW, FLAT HD TAP TITE M3X8
	RD148B2E220J	RES. CARBON 22 5% 1/4W
	212-3017-05	TUBE (PLASTIC)
1	A01-1179-02	CASE (TOP)
2	A01-1180-12	CASE (BOTTOM)
3	A13-0914-02	FRAME (L)
4	A13-0915-12	FRAME (CENTER)
5	A13-0916-02	FRAME (R. UPPER)
6	A13-0917-02	FRAME (R. LOWER)
7	A20-2822-11	MOLDED PANEL
8	A21-1125-03	DECORATIVE PANEL
9	A22-0855-02	SUB PANEL
10	A23-1676-02	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 (LN3226PT, POWER)
15	B40-2765-04	NAME PLATE (SERIAL NO)
16	B40-2900-03	NAME PLATE (MODEL)
17	B41-0798-04	CAUTION LABEL
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 FOR 6X30MM FUSE
22B	E18-0366-05	AC SELECTOR FOR 5X20MM FUSE
23	E21-0660-04	TERMINAL (CAL)
24	E21-0667-05	METAL TERMINAL
25	E23-0513-05	SOLDER LUG (BNC)
26	E23-0552-04	EARTH TERMINAL
27A	E30-1818-05	JIS POWER CORD
27B	E30-1819-05	CEE POWER CORD
27C	E30-1820-05	UL/CSA POWER CORD
27D	E30-1821-05	SAA POWER CORD
27E	E30-1644-15	BS POWER CORD
28	F07-0936-04	HANDLE COVER
29	F09-0512-04	EDGING
30	F11-1206-03	CRT SHIELD
31	F15-0733-04	FELT
32	F20-0658-04	INSULATION SHEET
33	F20-0667-04	INSULATION SHEET
34	F20-0668-14	INSULATION PLATE
35	G01-0909-04	COIL SPRING (CAL SHIELD)
36	G02-0606-14	SPRING FOR HANDLE
37	J02-0089-05	RUBBER LEG

REF. NO	PARTS NO	NAME & DESCRIPTION
38	J10-0418-02	BEZEL
39	J19-1651-04	BLACKET
40	J19-1652-04	BLACKET FOR P.C.B.
41	J19-1654-14	HOLDER FOR LED
42	J21-2906-05	GEAR FOR HANDLE
43	J21-2907-05	RING FOR HANDLE
44	J21-4594-03	BRACKET FOR CRT
45	J30-0621-04	SPACER
46	J42-0533-04	BUSHING (FREE)
47	J59-0403-05	NYLON RIVET
48	J61-0516-05	SUPPORT (T TYPE)
49	K01-0524-15	HANDLE
50	K21-0892-03	KNOB (VOLTS/DIV)
51	K21-0893-03	KNOB (SWEEP/DIV)
52	K21-0894-04	KNOB (VARIABLE)
53	K23-0808-03	KNOB
54	K23-0809-03	KNOB
55	K27-0537-04	KNOB (LEVER SW)
56	K27-0538-04	KNOB (PUSH SW)
57	L01-9695-05	POWER TRANSFORMER
58	L39-0526-15	ROTATION COIL
59	N19-0710-05	WASHER
60	R29-1501-05	V.R. 1KB (CURSOR)
61	W01-0503-04	CORD WRAP
62	X68-1480-00	POWER SUPPLY UNIT
63	X73-1740-00	V. PRE UNIT
64	X74-1460-00	SWEEP UNIT
65	X77-1450-01	R/D UNIT
66	X78-1030-00	A/D UNIT
67	X80-1060-00	LINE FILTER UNIT
68	X80-1090-01	FINAL UNIT
69	150VTM31	CRT

## POWER SUPPLY UNIT

### X68-1480-00

REF. NO	PARTS NO	NAME & DESCRIPTION
	F01-0813-05	HEAT SINK (CONVERTER)
	F01-0858-03	HEAT SINK (POWER TR.)
	F10-1601-04	SHIELD PLATE
	F15-0727-04	HOLDER (NEON LAMP)
	J25-5182-22	PCB (UNMOUNTED)
	N09-0623-04	SCREW, SEMS M3X8
	N09-0731-05	SCREW M3X12
	N14-0626-04	NUT
	W02-0431-05	HIGH VOLTAGE BLOCK
C001	C90-0970-05	CAP. ELECTRO 3900 25V
C002	C90-0970-05	CAP. ELECTRO 3900 25V
C003	CE04EW1C472M	CAP. ELECTRO 4700 20% 16V
C004	CE04W2E470M	CAP. ELECTRO 47 20% 250V
C005	C90-0969-05	CAP. ELECTRO 560 100V
C006	CE04EW1E101M	CAP. ELECTRO 100 20% 25V
C007	CE04EW1E101M	CAP. ELECTRO 100 20% 25V
C008	CE04EW1E101M	CAP. ELECTRO 100 20% 25V
C009	CE04EW1A221M	CAP. ELECTRO 220 20% 10V
C010	CE04W2C010M	CAP. ELECTRO 1 20% 160V
C011	CE04EW2A100M	CAP. ELECTRO 10 20% 100V
C012	C90-0978-05	CAP. ELECTRO 47 50V
C013	C092FM1H104K	CAP. MYLAR 0.1 10% 50V
C014	CK45FB2H472K	CAP. CERAMIC 4700P 10% 500V
C015	CC45FCH2H010C	CAP. CERAMIC 1P 0.25P 500V
C016	CC45FCH2H020C	CAP. CERAMIC 2P 0.25P 500V
C017	CE04W2C2R2M	CAP. ELECTRO 2.2 20% 160V
C018	C092FM1H104K	CAP. MYLAR 0.1 10% 50V
C019	CK45FB2H472K	CAP. CERAMIC 4700P 10% 500V
C020	CC45FCH2H010C	CAP. CERAMIC 1P 0.25P 500V
C021	CC45FCH2H010C	CAP. CERAMIC 1P 0.25P 500V
C022	C91-0571-05	CAP. CERAMIC 0.01 2KV
C023	C91-0571-05	CAP. CERAMIC 0.01 2KV
C024	CK45FB2H102K	CAP. CERAMIC 1000P 10% 500V
C025	C91-0571-05	CAP. CERAMIC 0.01 2KV
C026	CK45FB2H102K	CAP. CERAMIC 1000P 10% 500V
C027	C91-0571-05	CAP. CERAMIC 0.01 2KV
C028	C91-0571-05	CAP. CERAMIC 0.01 2KV
C029	C91-0571-05	CAP. CERAMIC 0.01 2KV
C030	C91-0571-05	CAP. CERAMIC 0.01 2KV
C031	CK45E3D102P	CAP. CERAMIC 1000P 2KV
C032	C092FM1H154K	CAP. MYLAR 0.15 10% 50V
C033	C092FM1H154K	CAP. MYLAR 0.15 10% 50V
C034	CC45FSL1H471J	CAP. CERAMIC 470P 5% 50V
C035	CK45FB1H472K	CAP. CERAMIC 4700P 10% 50V
C036	CE04EW1E101M	CAP. ELECTRO 100 20% 25V

# PARTS LIST

REF.NO	PARTS NO	NAME & DESCRIPTION	REF.NO	PARTS NO	NAME & DESCRIPTION
C037	CE04EW1E101M	CAP. ELECTRO 100 20% 25V	Q009	2SA1208(S)	TR. SI, PNP
C038	CC45FCH1H220J	CAP. CERAMIC 22P 5% 50V	Q010	2SC2910(S)	TR. SI, NPN
C041	C092FM1H103J	CAP. MYLAR 0.01 5% 50V	Q011	2SA1210(S)	TR. SI, PNP
C042	CE04W2C2R2M	CAP. ELECTRO 2.2 20% 160V	Q012	2SC2912(S)	TR. SI, NPN
C043	CE04W2C2R2M	CAP. ELECTRO 2.2 20% 160V	Q013	2SA1005(K)	TR. SI, PNP
C044	CE04EW1E101M	CAP. ELECTRO 100 20% 25V	Q014	2SA1175(F)	TR. SI, PNP
C045	CE04EW1E101M	CAP. ELECTRO 100 20% 25V	Q015	2SD613(E)	TR. SI, NPN
C046	CE04EW1E101M	CAP. ELECTRO 100 20% 25V	Q016	2SC2271(D)	TR. SI, NPN
C047	C91-0571-05	CAP. CERAMIC 0.01 2KV	Q017	2SC1384(R)	TR. SI, NPN
C048	C91-0571-05	CAP. CERAMIC 0.01 2KV	Q018	2SA684(R)	TR. SI, PNP
C051	CE04EW1H101M	CAP. ELECTRO 100 20% 50V	R001	R92-1402-05	RES. SPR2L15 24 5%
C052	NO USE		R002	RD14BB2C221J	RES. CARBON 220 5% 1/6W
C053	CK45FB2H101K	CAP. CERAMIC 100P 10% 500V	R003	RD14BB2C221J	RES. CARBON 220 5% 1/6W
C054	CK45FB2H472K	CAP. CERAMIC 4700P 10% 500V	R004	R92-1402-05	RES. SPR2L15 24 5%
C055	CK45FB2H472K	CAP. CERAMIC 4700P 10% 500V	R005	RD14BB2C103J	RES. CARBON 10K 5% 1/6W
C056	NO USE		R006	RN14BK2C2002F	RES. METAL FILM 20K 1% 1/6W
C057	CE04HW1H010M	CAP. ELECTRO 1 20% 50V	R007	RN14BK2C2002F	RES. METAL FILM 20K 1% 1/6W
D001	S4VB40F1	DIODE, BRIDGE	R008	RD14BB2C103J	RES. CARBON 10K 5% 1/6W
D002	S2VB40F1	DIODE, BRIDGE	R009	RD14BB2C102J	RES. CARBON 1K 5% 1/6W
D003	S1VB40	DIODE, BRIDGE	R010	RD14BB2C472J	RES. CARBON 4.7K 5% 1/6W
D006	MTZ24JC	DIODE, ZENER 24V	R011	RD14BB2C472J	RES. CARBON 4.7K 5% 1/6W
D007	MTZ10JC	DIODE, ZENER 10V	R012	R92-1401-05	RES. SPR2L15 15 5%
D008	MTZ5.1JB	DIODE, ZENER 5.0V	R013	RD14BB2C221J	RES. CARBON 220 5% 1/6W
D009	MTZ10JC	DIODE, ZENER 10V	R014	RD14BB2C103J	RES. CARBON 10K 5% 1/6W
D010	MTZ5.1JB	DIODE, ZENER 5.0V	R015	RN14BK2C1002F	RES. METAL FILM 10K 1% 1/6W
D011	1SS132	DIODE	R016	RN14BK2C2002F	RES. METAL FILM 20K 1% 1/6W
D012	1SS132	DIODE	R017	R92-1404-05	RES. SPR2L15 4.7K 5%
D013	1SS83	DIODE	R018	R92-1405-05	RES. SPR1/2L10 18K 5%
D014	1SS83	DIODE	R019	RD14BB2C102J	RES. CARBON 1K 5% 1/6W
D015	1SR35-200	DIODE	R020	RD14BB2C102J	RES. CARBON 1K 5% 1/6W
D016	1SR35-200	DIODE	R021	RN14BK2C2403F	RES. METAL FILM 240K 1% 1/6W
D017	1SS83	DIODE	R022	RN14BK2C2002F	RES. METAL FILM 20K 1% 1/6W
D018	1SS83	DIODE	R023	RD14BB2C103J	RES. CARBON 10K 5% 1/6W
D019	1SR35-200	DIODE	R024	R92-1403-05	RES. SPR2L15 1K 5%
D020	1SR35-200	DIODE	R025	R92-1406-05	RES. SPR1/2L10 13K 5%
D021	1SS132	DIODE	R026	RD14BB2C102J	RES. CARBON 1K 5% 1/6W
D022	1SS132	DIODE	R027	RD14BB2C102J	RES. CARBON 1K 5% 1/6W
D023	1SS132	DIODE	R028	RN14BK2C1303F	RES. METAL FILM 130K 1% 1/6W
D024	1SS132	DIODE	R029	RN14BK2C2002F	RES. METAL FILM 20K 1% 1/6W
D025	1SS132	DIODE	R030	RD14BB2C103J	RES. CARBON 10K 5% 1/6W
D026	1SS132	DIODE	R033	RD14BB2C471J	RES. CARBON 470 5% 1/6W
D027	1SS132	DIODE	R034	RD14BB2C220J	RES. CARBON 22 5% 1/6W
D028	1SS132	DIODE	R035	RD14BB2C332J	RES. CARBON 3.3K 5% 1/6W
D029	1SS132	DIODE	R036	RD14BB2C124J	RES. CARBON 120K 5% 1/6W
L001	L40-1011-13	FERRI INDUCTOR 100UH	R037	RD14BB2C102J	RES. CARBON 1K 5% 1/6W
L002	L40-1011-13	FERRI INDUCTOR 100UH	R038	RD14BB2C683J	RES. CARBON 68K 5% 1/6W
L003	L40-1021-03	FERRI INDUCTOR 1MH	R039	RD14BB2C114J	RES. CARBON 110K 5% 1/6W
NL001	NE-2B	NEON LAMP	R040	RD14BB2C912J	RES. CARBON 9.1K 5% 1/6W
NL002	NE-2B	NEON LAMP	R041	RD14BB2E470J	RES. CARBON 47 5% 1/4W
NL003	NE-2B	NEON LAMP	R042	RD14BB2C334J	RES. CARBON 330K 5% 1/6W
NL004	NE-2B	NEON LAMP	R043	RD14BB2C823J	RES. CARBON 82K 5% 1/6W
P009	E40-0673-05	PIN CONNECTOR 6P	R044	RD14BB2C332J	RES. CARBON 3.3K 5% 1/6W
P026	E40-0273-05	PIN CONNECTOR 2P	R045	RD14BB2C124J	RES. CARBON 120K 5% 1/6W
P027	E40-0473-05	PIN CONNECTOR 4P	R046	RD14BB2C751J	RES. CARBON 750 5% 1/6W
P041	E40-0673-05	PIN CONNECTOR 6P	R047	RD14BB2C334J	RES. CARBON 330K 5% 1/6W
P044	E40-0503-05	PIN CONNECTOR 5P	R048	RD14BB2C683J	RES. CARBON 68K 5% 1/6W
P045	NO USE		R049	RD14BB2C152J	RES. CARBON 1.5K 5% 1/6W
P046	E40-0273-05	PIN CONNECTOR 2P	R050	RD14BB2C113J	RES. CARBON 11K 5% 1/6W
P047	E40-0273-05	PIN CONNECTOR 2P	R051	RD14BB2E470J	RES. CARBON 47 5% 1/4W
P048	E40-0273-05	PIN CONNECTOR 2P	R052	R92-1034-05	RES. METAL FILM 47M 5% 1/2W
P049	E40-0273-05	PIN CONNECTOR 2P	R053	R92-1034-05	RES. METAL FILM 47M 5% 1/2W
P050	E40-0473-05	PIN CONNECTOR 4P	R054	R92-1125-05	RES. METAL FILM 7.5M 1% 1W
P051	NO USE		R055	R92-1125-05	RES. METAL FILM 7.5M 1% 1W
P052	E40-0473-05	PIN CONNECTOR 4P	R056	RN14BK2C1003F	RES. METAL FILM 100K 1% 1/6W
P053	NO USE		R057	RD14BB2C104J	RES. CARBON 100K 5% 1/6W
P054	E40-0273-05	PIN CONNECTOR 2P	R058	RD14BB2C102J	RES. CARBON 1K 5% 1/6W
P055	E40-1173-05	PIN CONNECTOR 11P	R059	RD14BB2C562J	RES. CARBON 5.6K 5% 1/6W
Q001	2SB1133(S)	TR. SI, PNP	R060	RD14BB2C821J	RES. CARBON 820 5% 1/6W
Q002	2SD1666(S)	TR. SI, NPN	R061	RD14BB2E473J	RES. CARBON 47K 5% 1/4W
Q003	2SB1133(S)	TR. SI, PNP	R062	R92-1153-05	RES. METAL FILM 5.1M 5% 1W
Q004	2SC3749(N)	TR. SI, NPN	R063	R92-1193-05	RES. METAL FILM 8.2M 5% 1W
Q005	2SC2271(D)	TR. SI, NPN	R064	RD14BB2C753J	RES. CARBON 75K 5% 1/6W
Q006	2SC3749(N)	TR. SI, NPN	R065	RD14BB2C473J	RES. CARBON 47K 5% 1/6W
Q007	2SC2271(D)	TR. SI, NPN	R066	RD14BB2C153J	RES. CARBON 15K 5% 1/6W
Q008	2SD1666(S)	TR. SI, NPN	R067	RD14BB2C393J	RES. CARBON 39K 5% 1/6W
			R068	RD14BB2C513J	RES. CARBON 51K 5% 1/6W
			R069	RD14BB2C433J	RES. CARBON 43K 5% 1/6W
			R070	RD14BB2C132J	RES. CARBON 1.3K 5% 1/6W
			R071	RD14BB2C182J	RES. CARBON 1.8K 5% 1/6W
			R072	RD14BB2C271J	RES. CARBON 270 5% 1/6W
			R073	RD14BB2C102J	RES. CARBON 1K 5% 1/6W
			R074	NO USE	
			R075	RD14BB2C471J	RES. CARBON 470 5% 1/6W
			R076	RD14BB2C301J	RES. CARBON 300 5% 1/6W

# PARTS LIST

REF.NO	PARTS NO	NAME & DESCRIPTION
R077	RD14BB2C362J	RES. CARBON 3.6K 5% 1/6W
R078	RD14BB2C203J	RES. CARBON 20K 5% 1/6W
R079	RD14BB2C203J	RES. CARBON 20K 5% 1/6W
R080	RD14BB2C100J	RES. CARBON 10 5% 1/6W
R081	RD14BB2C103J	RES. CARBON 10K 5% 1/6W
R082	RD14BB2C222J	RES. CARBON 2.2K 5% 1/6W
R083	RD14BB2C473J	RES. CARBON 47K 5% 1/6W
R084	RD14BB2C102J	RES. CARBON 1K 5% 1/6W
R085	RD14BB2C102J	RES. CARBON 1K 5% 1/6W
R086	RD14BB2C104J	RES. CARBON 100K 5% 1/6W
R087	RD14BB2C272J	RES. CARBON 2.7K 5% 1/6W
U001	NJM4558D	IC, OP AMP
U002	NJM4558D	IC, OP AMP
U003	NJM4558D	IC, OP AMP
U004	NJM4558D	IC, OP AMP
VR001	R12-1538-05	RES. SEMI FIXED 1KB
VR002	R12-5526-05	RES. SEMI FIXED 100KB
VR003	NO USE	
VR004	R12-8001-05	RES. SEMI FIXED 2.2MB
VR005	R12-4416-05	RES. SEMI FIXED 50KB
VR006	R12-1538-05	RES. SEMI FIXED 1KB

## V. PRE UNIT

### X73-1740-00

REF.NO	PARTS NO	NAME & DESCRIPTION
	J25-5173-12	PCB (UNMOUNTED)
C001	C91-0501-05	CAP. METAL FILM 0.047 10% 630V
C002	C91-0502-05	CAP. METAL FILM 0.01 20% 630V
C003	CQ92FM1H102K	CAP. MYLAR 1000P 10% 50V
C004	CE04HW1E220M	CAP. ELECTRO 22 20% 25V
C005	CC45FCH1H470J	CAP. CERAMIC 47P 5% 50V
C006	CQ92FM1H103K	CAP. MYLAR 0.01 10% 50V
C007	CC45CH1H150J	CAP. CERAMIC 15P 5% 50V
C008	CC45CH1H220J	CAP. CERAMIC 22P 5% 50V
C009	CK45FF1H103Z	CAP. CERAMIC 0.01 50V
C010	CC45FSL1H471J	CAP. CERAMIC 470P 5% 50V
C013	CC45FCH1H330J	CAP. CERAMIC 33P 5% 50V
C014	NO USE	
C015	CQ92FM1H102K	CAP. MYLAR 1000P 10% 50V
C101	C91-0501-05	CAP. METAL FILM 0.047 10% 630V
C102	C91-0502-05	CAP. METAL FILM 0.01 20% 630V
C103	CQ92FM1H102K	CAP. MYLAR 1000P 10% 50V
C104	CE04HW1E220M	CAP. ELECTRO 22 20% 25V
C105	CC45FCH1H470J	CAP. CERAMIC 47P 5% 50V
C106	CQ92FM1H103K	CAP. MYLAR 0.01 10% 50V
C107	CC45CH1H150J	CAP. CERAMIC 15P 5% 50V
C108	CC45CH1H220J	CAP. CERAMIC 22P 5% 50V
C109	CK45FF1H103Z	CAP. CERAMIC 0.01 50V
C110	CC45FSL1H471J	CAP. CERAMIC 470P 5% 50V
C113	CC45FCH1H330J	CAP. CERAMIC 33P 5% 50V
C114	NO USE	
C115	CQ92FM1H102K	CAP. MYLAR 1000P 10% 50V
C120	CK45FF1H103Z	CAP. CERAMIC 0.01 50V
C121	CK45FF1H103Z	CAP. CERAMIC 0.01 50V
C122	CK45FF1H103Z	CAP. CERAMIC 0.01 50V
C123	CK45FF1H103Z	CAP. CERAMIC 0.01 50V
C124	CK45FF1H103Z	CAP. CERAMIC 0.01 50V
C125	CK45FF1H103Z	CAP. CERAMIC 0.01 50V
C126	CK45FF1H103Z	CAP. CERAMIC 0.01 50V
C201	CC45FCH1H101J	CAP. CERAMIC 100P 5% 50V
C202	CC45FCH1H180J	CAP. CERAMIC 18P 5% 50V
C203	CC45FCH1H180J	CAP. CERAMIC 18P 5% 50V
C204	CC45FCH1H070D	CAP. CERAMIC 7P 0.5P 50V
C205	CC45FCH1H070D	CAP. CERAMIC 7P 0.5P 50V
C206	CE04EWOJ102M	CAP. ELECTRO 1000 20% 6.3V
C207	CC45FSL1H561J	CAP. CERAMIC 560P 5% 50V
C210	CQ92FM1H103K	CAP. MYLAR 0.01 10% 50V
C214	CK45FF1H103Z	CAP. CERAMIC 0.01 50V
C215	CE04EW1A102M	CAP. ELECTRO 1000 20% 10V
C216	CK45FF1H103Z	CAP. CERAMIC 0.01 50V
C217	CK45FF1H103Z	CAP. CERAMIC 0.01 50V
C218	CK45FF1H103Z	CAP. CERAMIC 0.01 50V
C219	CE04HW1E220M	CAP. ELECTRO 22 20% 25V
C220	NO USE	

REF.NO	PARTS NO	NAME & DESCRIPTION
C221	CK45FF1H103Z	CAP. CERAMIC 0.01 50V
C222	CE04EW1C330M	CAP. ELECTRO 33 20% 16V
C230	CE04EW1C101M	CAP. ELECTRO 100 20% 16V
C231	CK45FF1H103Z	CAP. CERAMIC 0.01 50V
C232	CK45FF1H103Z	CAP. CERAMIC 0.01 50V
C233	CQ92FM1H103K	CAP. MYLAR 0.01 10% 50V
C234	CK45FF1H103Z	CAP. CERAMIC 0.01 50V
C235	CK45FF1H103Z	CAP. CERAMIC 0.01 50V
C236	CK45FF1H103Z	CAP. CERAMIC 0.01 50V
C237	CK45FF1H103Z	CAP. CERAMIC 0.01 50V
C238	CK45FF1H103Z	CAP. CERAMIC 0.01 50V
C239	CK45FF1H103Z	CAP. CERAMIC 0.01 50V
C240	CQ92FM1H103K	CAP. MYLAR 0.01 10% 50V
C241	CK45FF1H103Z	CAP. CERAMIC 0.01 50V
C242	CK45FF1H103Z	CAP. CERAMIC 0.01 50V
C243	CK45FF1H103Z	CAP. CERAMIC 0.01 50V
C270	CE04EW1C101M	CAP. ELECTRO 100 20% 16V
C271	CK45FF1H103Z	CAP. CERAMIC 0.01 50V
C272	CK45FF1H103Z	CAP. CERAMIC 0.01 50V
C273	CE04EW1C330M	CAP. ELECTRO 33 20% 16V
C274	CK45FF1H103Z	CAP. CERAMIC 0.01 50V
C275	CE04EW1C330M	CAP. ELECTRO 33 20% 16V
C276	CK45FF1H103Z	CAP. CERAMIC 0.01 50V
C277	NO USE	
C278	CK45FF1H103Z	CAP. CERAMIC 0.01 50V
C279	CK45FF1H103Z	CAP. CERAMIC 0.01 50V
C280	CE04EW1C330M	CAP. ELECTRO 33 20% 16V
C281	CK45FF1H103Z	CAP. CERAMIC 0.01 50V
C282	CE04EW1C330M	CAP. ELECTRO 33 20% 16V
C283	CK45FF1H103Z	CAP. CERAMIC 0.01 50V
C284	CK45FF1H103Z	CAP. CERAMIC 0.01 50V
D001	1SS132	DIODE
D002	1SS132	DIODE
D003	1SS132	DIODE
D004	MA700	DIODE
D005	MA700	DIODE
D101	1SS132	DIODE
D102	1SS132	DIODE
D103	1SS132	DIODE
D104	MA700	DIODE
D105	MA700	DIODE
D201	MT27.5JC	DIODE, ZENER 7.5V
D202	1SS132	DIODE
D203	1SS132	DIODE
D204	1SS132	DIODE
D205	1SS132	DIODE
D206	1SS132	DIODE
D207	MT26.2JB	DIODE, ZENER 6.1V
D301	MT25.1JB	DIODE, ZENER 5.0V
D302	MT25.1JB	DIODE, ZENER 5.0V
D303	1SS132	DIODE
D304	1SS132	DIODE
D401	MT25.1JB	DIODE, ZENER 5.0V
D402	MT25.1JB	DIODE, ZENER 5.0V
D403	1SS132	DIODE
D404	1SS132	DIODE
J004	E31-2809-05	WIRE ASS'Y (CH2 INV)
J005	NO USE	
J006	E31-2810-05	WIRE ASS'Y (CH1 POSI.)
J007	E31-2811-05	WIRE ASS'Y (CH2 POSI.)
J058	E31-2851-05	WIRE ASS'Y (STO CH1 POSI.)
J059	E31-2852-05	WIRE ASS'Y (STO CH2 POSI.)
J072	E31-2807-05	WIRE ASS'Y (EXT. TRIG)
L001	L40-1011-04	FERRI INDUCTOR 100UH (7H)
L002	L40-1011-04	FERRI INDUCTOR 100UH (7H)
L003	L40-1011-70	FERRI INDUCTOR 10UH (LFS.0)
P003	E40-0273-05	PIN CONNECTOR 2P
P004	E40-0573-05	PIN CONNECTOR 5P
P005	NO USE	
P006	E40-0373-05	PIN CONNECTOR 3P
P007	E40-0373-05	PIN CONNECTOR 3P
P008	E40-0473-05	PIN CONNECTOR 4P
P009	E40-0673-05	PIN CONNECTOR 6P
P010	E40-0273-05	PIN CONNECTOR 2P

# PARTS LIST

REF. NO	PARTS NO	NAME & DESCRIPTION
P011	E40-0673-05	PIN CONNECTOR 6P
P012	E40-0273-05	PIN CONNECTOR 2P
P013	E40-0373-05	PIN CONNECTOR 3P
P014	NO USE	
P015	E40-0573-05	PIN CONNECTOR 5P
P016	E40-0773-05	PIN CONNECTOR 7P
P017	E40-0673-05	PIN CONNECTOR 6P
P018	NO USE	
P019	E40-0273-05	PIN CONNECTOR 2P
P020	E40-0273-05	PIN CONNECTOR 2P
P057	E40-0573-05	PIN CONNECTOR 5P
Q001	2SC3354(T.S)	TR. SI. NPN
Q002	2SC3354(T.S)	TR. SI. NPN
Q003	2SK304(E)	FET, N-CHANNEL
Q004	2SC3354(T.S)	TR. SI. NPN
Q005	2SC3354(T.S)	TR. SI. NPN
Q009	2SC3354(T.S)	TR. SI. NPN
Q010	2SC3354(T.S)	TR. SI. NPN
Q013	2SC3354(T.S)	TR. SI. NPN
Q014	2SC3315(C.D)	TR. SI. NPN
Q015	2SC3315(C.D)	TR. SI. NPN
Q016	2SA1005(K)	TR. SI. PNP
Q017	2SA1005(K)	TR. SI. PNP
Q020	2SC3354(T.S)	TR. SI. NPN
Q021	2SC3354(T.S)	TR. SI. NPN
Q101	2SC3354(T.S)	TR. SI. NPN
Q102	2SC3354(T.S)	TR. SI. NPN
Q103	2SK304(E)	FET, N-CHANNEL
Q104	2SC3354(T.S)	TR. SI. NPN
Q105	2SC3354(T.S)	TR. SI. NPN
Q109	2SC3354(T.S)	TR. SI. NPN
Q110	2SC3354(T.S)	TR. SI. NPN
Q113	2SC3354(T.S)	TR. SI. NPN
Q114	2SC3315(C.D)	TR. SI. NPN
Q115	2SC3315(C.D)	TR. SI. NPN
Q116	2SA1005(K)	TR. SI. PNP
Q117	2SA1005(K)	TR. SI. PNP
Q118	2SA1005(K)	TR. SI. PNP
Q119	2SA1005(K)	TR. SI. PNP
Q122	2SC3354(T.S)	TR. SI. NPN
Q123	2SC3354(T.S)	TR. SI. NPN
Q201	2SC2785(F)	TR. SI. NPN
Q202	2SC2785(F)	TR. SI. NPN
Q203	2SC3315(C.D)	TR. SI. NPN
Q204	2SC3315(C.D)	TR. SI. NPN
Q205	2SC2785(F)	TR. SI. NPN
Q206	2SC2785(F)	TR. SI. NPN
Q207	2SC3315(C.D)	TR. SI. NPN
Q208	2SC3315(C.D)	TR. SI. NPN
Q209	2SA1005(K)	TR. SI. PNP
Q210	2SC3354(T.S)	TR. SI. NPN
Q211	2SC3354(T.S)	TR. SI. NPN
Q212	2SA1005(K)	TR. SI. PNP
Q213	2SA1005(K)	TR. SI. PNP
Q214	2SA1005(K)	TR. SI. PNP
Q215	2SC3354(T.S)	TR. SI. NPN
Q216	2SC3354(T.S)	TR. SI. NPN
Q217	2SC3354(T.S)	TR. SI. NPN
Q218	2SC3354(T.S)	TR. SI. NPN
Q251	2SC3354(T.S)	TR. SI. NPN
Q252	2SK304(E)	FET, N-CHANNEL
Q253	2SK304(E)	FET, N-CHANNEL
Q254	2SC3354(T.S)	TR. SI. NPN
Q255	2SC2785(F)	TR. SI. NPN
Q256	2SC2785(F)	TR. SI. NPN
Q257	2SC2785(F)	TR. SI. NPN
Q258	2SC2785(F)	TR. SI. NPN
Q259	2SC3354(T.S)	TR. SI. NPN
Q260	2SC3354(T.S)	TR. SI. NPN
Q261	2SC3354(T.S)	TR. SI. NPN
Q262	2SC3354(T.S)	TR. SI. NPN
Q301	2SC3354(T.S)	TR. SI. NPN
Q302	2SC3354(T.S)	TR. SI. NPN

REF. NO	PARTS NO	NAME & DESCRIPTION
Q303	2SC3315(C.D)	TR. SI. NPN
Q304	2SC3315(C.D)	TR. SI. NPN
Q305	2SC3315(C.D)	TR. SI. NPN
Q306	2SC3315(C.D)	TR. SI. NPN
Q307	2SA1175(F)	TR. SI. PNP
Q308	2SA1175(F)	TR. SI. PNP
Q309	2SA1175(F)	TR. SI. PNP
Q310	2SA1175(F)	TR. SI. PNP
Q311	2SA1175(F)	TR. SI. PNP
Q401	2SC3354(T.S)	TR. SI. NPN
Q402	2SC3354(T.S)	TR. SI. NPN
Q403	2SC3315(C.D)	TR. SI. NPN
Q404	2SC3315(C.D)	TR. SI. NPN
Q405	2SC3315(C.D)	TR. SI. NPN
Q406	2SC3315(C.D)	TR. SI. NPN
Q407	2SA1175(F)	TR. SI. PNP
Q408	2SA1175(F)	TR. SI. PNP
Q409	2SA1175(F)	TR. SI. PNP
Q410	2SA1175(F)	TR. SI. PNP
Q411	2SA1175(F)	TR. SI. PNP
R001	RD148B2C220J	RES. CARBON 22 5% 1/6W
R002	RD148B2C8R2J	RES. CARBON 1M 5% 1/6W
R003	RD148B2C105J	RES. CARBON 470 5% 1/6W
R004	RD148B2C471J	RES. CARBON 10 5% 1/6W
R005	RD148B2C100J	RES. CARBON 10 5% 1/6W
R006	RN148K2C1803F	RES. METAL FILM 180K 1% 1/6W
R007	RN148K2C8203F	RES. METAL FILM 820K 1% 1/6W
R008	RD148B2C684J	RES. CARBON 680K 5% 1/6W
R009	RD148B2C100J	RES. CARBON 10 5% 1/6W
R010	RD148B2C272J	RES. CARBON 2.7K 5% 1/6W
R011	RD148B2C392J	RES. CARBON 3.9K 5% 1/6W
R012	RD148B2C622J	RES. CARBON 6.2K 5% 1/6W
R013	RD148B2C100J	RES. CARBON 10 5% 1/6W
R014	RD148B2C181J	RES. CARBON 180 5% 1/6W
R015	RD148B2C751J	RES. CARBON 750 5% 1/6W
R016	RD148B2C103J	RES. CARBON 10K 5% 1/6W
R017	RD148B2C562J	RES. CARBON 5.6K 5% 1/6W
R018	RD148B2C105J	RES. CARBON 1M 5% 1/6W
R019	RD148B2C472J	RES. CARBON 4.7K 5% 1/6W
R020	RD148B2C100J	RES. CARBON 10 5% 1/6W
R021	RD148B2C103J	RES. CARBON 10K 5% 1/6W
R022	RN148K2C6200F	RES. METAL FILM 620 1% 1/6W
R023	RD148B2C150J	RES. CARBON 15 5% 1/6W
R024	RD148B2C333J	RES. CARBON 33K 5% 1/6W
R025	RD148B2C910J	RES. CARBON 91 5% 1/6W
R026	RN148K2C2700F	RES. METAL FILM 270 1% 1/6W
R027	RN148K2C1001F	RES. METAL FILM 1K 1% 1/6W
R028	RN148K2C1001F	RES. METAL FILM 1K 1% 1/6W
R029	RD148B2C223J	RES. CARBON 22K 5% 1/6W
R030	RD148B2C680J	RES. CARBON 68 5% 1/6W
R031	RD148B2C470J	RES. CARBON 47 5% 1/6W
R032	RD148B2C470J	RES. CARBON 47 5% 1/6W
R033	RD148B2C151J	RES. CARBON 150 5% 1/6W
R034	RN148K2C2200F	RES. METAL FILM 220 1% 1/6W
R035	RN148K2C2200F	RES. METAL FILM 220 1% 1/6W
R036	RN148K2C470F	RES. METAL FILM 47.0 1% 1/6W
R037	RN148K2C820F	RES. METAL FILM 82.0 1% 1/6W
R038	RD148B2C131J	RES. CARBON 130 5% 1/6W
R039	RD148B2C472J	RES. CARBON 4.7K 5% 1/6W
R040	RD148B2C332J	RES. CARBON 3.3K 5% 1/6W
R041	RD148B2C621J	RES. CARBON 620 5% 1/6W
R042	RD148B2C821J	RES. CARBON 820 5% 1/6W
R043	RD148B2C332J	RES. CARBON 3.3K 5% 1/6W
R044	RD148B2C392J	RES. CARBON 3.9K 5% 1/6W
R045	RN148K2C2401F	RES. METAL FILM 2.4K 1% 1/6W
R046	RN148K2C2401F	RES. METAL FILM 2.4K 1% 1/6W
R047	RD148B2C101J	RES. CARBON 100 5% 1/6W
R048	RD148B2C241J	RES. CARBON 240 5% 1/6W
R049	RD148B2C101J	RES. CARBON 100 5% 1/6W
R056	RD148B2C220J	RES. CARBON 22 5% 1/6W
R057	RD148B2C220J	RES. CARBON 22 5% 1/6W
R058	RN148K2C4701F	RES. METAL FILM 4.7K 1% 1/6W
R059	RN148K2C2001F	RES. METAL FILM 2K 1% 1/6W
R060	RN148K2C6800F	RES. METAL FILM 680 1% 1/6W
R061	RN148K2C1201F	RES. METAL FILM 1.2K 1% 1/6W
R062	RN148K2C1201F	RES. METAL FILM 1.2K 1% 1/6W
R063	RN148K2C1800F	RES. METAL FILM 180 1% 1/6W
R064	NO USE	
R065	RN148K2C7500F	RES. METAL FILM 750 1% 1/6W
R066	RN148K2C7500F	RES. METAL FILM 750 1% 1/6W
R067	RD148B2C101J	RES. CARBON 100 5% 1/6W
R068	RD148B2C101J	RES. CARBON 100 5% 1/6W
R069	RN148K2C4701F	RES. METAL FILM 4.7K 1% 1/6W



# PARTS LIST

REF.NO	PARTS NO	NAME & DESCRIPTION	REF.NO	PARTS NO	NAME & DESCRIPTION
R259	RD148B2C101J	RES. CARBON 100 5% 1/6W	R423	RD148B2C101J	RES. CARBON 100 5% 1/6W
R260	RD148B2C101J	RES. CARBON 100 5% 1/6W	R424	RD148B2C101J	RES. CARBON 100 5% 1/6W
R261	RD148B2C101J	RES. CARBON 100 5% 1/6W	R425	RD148B2C222J	RES. CARBON 2.2K 5% 1/6W
R262	RD148B2C101J	RES. CARBON 100 5% 1/6W	R426	RD148B2C222J	RES. CARBON 2.2K 5% 1/6W
R263	RD148B2C101J	RES. CARBON 100 5% 1/6W	R427	RD148B2C101J	RES. CARBON 100 5% 1/6W
R264	RD148B2C101J	RES. CARBON 100 5% 1/6W	R428	RD148B2C101J	RES. CARBON 100 5% 1/6W
R265	RD148B2C101J	RES. CARBON 100 5% 1/6W	R429	RN148K2C1001F	RES. METAL FILM 1K 1% 1/6W
R266	RD148B2C101J	RES. CARBON 100 5% 1/6W	R430	RN148K2C6801F	RES. METAL FILM 6.8K 1% 1/6W
R267	RD148B2C822J	RES. CARBON 8.2K 5% 1/6W	R431	RN148K2C2400F	RES. METAL FILM 240 1% 1/6W
R268	RD148B2C242J	RES. CARBON 2.4K 5% 1/6W	R432	RD148B2C202J	RES. CARBON 2K 5% 1/6W
R269	RD148B2C100J	RES. CARBON 10 5% 1/6W	R433	RN148K2C6800F	RES. METAL FILM 680 1% 1/6W
R270	RD148B2C752J	RES. CARBON 7.5K 5% 1/6W	R434	RN148K2C6800F	RES. METAL FILM 680 1% 1/6W
R271	NO USE		R435	RD148B2C561J	RES. CARBON 560 5% 1/6W
R272	RD148B2C332J	RES. CARBON 3.3K 5% 1/6W	S001	S32-4007-05	LEVER SWITCH
R273	RD148B2C222J	RES. CARBON 2.2K 5% 1/6W	S002	NO USE	
R280	R90-0643-05	RES. NETWORK 100KX7	S003	S02-4507-05	ROTARY SWITCH (VER.ATT)
R281	R90-0642-05	RES. NETWORK 100KX6	S101	S32-4007-05	LEVER SWITCH
R282	R90-0644-05	RES. NETWORK 4.7KX5	S102	NO USE	
R283	RD148B2C472J	RES. CARBON 4.7K 5% 1/6W	S103	S02-4507-05	ROTARY SWITCH (VER.ATT)
R284	RD148B2C472J	RES. CARBON 4.7K 5% 1/6W	S201	S33-2501-05	LEVER SWITCH 2-5 (CURSOR)
R285	RD148B2C562J	RES. CARBON 5.6K 5% 1/6W	TC001	C05-0445-05	CAP. TRIMMER 20P
R286	RD148B2C562J	RES. CARBON 5.6K 5% 1/6W	TC002	C05-0445-05	CAP. TRIMMER 20P
R287	RD148B2C101J	RES. CARBON 100 5% 1/6W	TC101	C05-0445-05	CAP. TRIMMER 20P
R288	RD148B2C101J	RES. CARBON 100 5% 1/6W	TC102	C05-0445-05	CAP. TRIMMER 20P
R289	NO USE		TC201	C05-0445-05	CAP. TRIMMER 20P
R290	RD148B2C271J	RES. CARBON 270 5% 1/6W	TC301	C05-0443-05	CAP. TRIMMER 6P
R301	RD148B2C470J	RES. CARBON 47 5% 1/6W	TC401	C05-0443-05	CAP. TRIMMER 6P
R302	RD148B2C470J	RES. CARBON 47 5% 1/6W	TH001	SDT100	THERMISTOR
R303	NO USE		TH002	SDT100	THERMISTOR
R304	RD148B2C681J	RES. CARBON 680 5% 1/6W	TH003	SDT100	THERMISTOR
R305	RN148K2C1301F	RES. METAL FILM 1.3K 1% 1/6W	TH004	SDT100	THERMISTOR
R306	RN148K2C1301F	RES. METAL FILM 1.3K 1% 1/6W	U001	LF411CN	IC. DUAL JFET INPUT OP-AMP
R307	RN148K2C1201F	RES. METAL FILM 1.2K 1% 1/6W	U002	2SC3066(G,H)	TR. SI, NPN
R308	RD148B2C470J	RES. CARBON 47 5% 1/6W	U003	2SC3381(GR)	TR. SI, NPN
R309	RD148B2C470J	RES. CARBON 47 5% 1/6W	U101	LF411CN	IC. DUAL JFET INPUT OP-AMP
R310	RD148B2C101J	RES. CARBON 100 5% 1/6W	U102	2SC3066(G,H)	TR. SI, NPN
R311	RD148B2C152J	RES. CARBON 1.5K 5% 1/6W	U103	2SC3381(GR)	TR. SI, NPN
R312	RD148B2C152J	RES. CARBON 1.5K 5% 1/6W	VR001	R12-4416-05	RES. SEMI FIXED 50KB
R313	RD148B2C101J	RES. CARBON 100 5% 1/6W	VR002	R12-0571-05	RES. SEMI FIXED 500B
R314	RD148B2C470J	RES. CARBON 47 5% 1/6W	VR003	R12-4416-05	RES. SEMI FIXED 50KB
R315	RD148B2C470J	RES. CARBON 47 5% 1/6W	VR004	R12-0569-05	RES. SEMI FIXED 100B
R316	RN148K2C1501F	RES. METAL FILM 1.5K 1% 1/6W	VR005	R12-0570-05	RES. SEMI FIXED 200B
R317	RN148K2C1501F	RES. METAL FILM 1.5K 1% 1/6W	VR009	R12-0570-05	RES. SEMI FIXED 200B
R318	RN148K2C7500F	RES. METAL FILM 750 1% 1/6W	VR010	R12-0569-05	RES. SEMI FIXED 100B
R319	NO USE		VR011	RO6-2504-05	V.R.(CH1 POSI.) 2KB X2
R320	RD148B2C163J	RES. CARBON 16K 5% 1/6W	VR012	RO6-2504-05	V.R.(CH1 POSI.) 2KB X2
R321	RD148B2C220J	RES. CARBON 22 5% 1/6W	VR101	R12-4416-05	RES. SEMI FIXED 50KB
R322	RD148B2C220J	RES. CARBON 22 5% 1/6W	VR102	R12-0571-05	RES. SEMI FIXED 500B
R323	RD148B2C101J	RES. CARBON 100 5% 1/6W	VR103	R12-4416-05	RES. SEMI FIXED 50KB
R324	RD148B2C101J	RES. CARBON 100 5% 1/6W	VR104	R12-0569-05	RES. SEMI FIXED 100B
R325	RD148B2C222J	RES. CARBON 2.2K 5% 1/6W	VR105	R12-0570-05	RES. SEMI FIXED 200B
R326	RD148B2C222J	RES. CARBON 2.2K 5% 1/6W	VR108	R12-0571-05	RES. SEMI FIXED 500B
R327	RD148B2C101J	RES. CARBON 100 5% 1/6W	VR109	NO USE	
R328	RD148B2C101J	RES. CARBON 100 5% 1/6W	VR110	R12-0570-05	RES. SEMI FIXED 200B
R329	RN148K2C1001F	RES. METAL FILM 1K 1% 1/6W	VR111	R12-0569-05	RES. SEMI FIXED 100B
R330	RN148K2C6801F	RES. METAL FILM 6.8K 1% 1/6W	VR112	RO6-2505-05	V.R.(CH2 POSI.) 10KB X2
R331	RN148K2C2400F	RES. METAL FILM 240 1% 1/6W	VR113	RO6-2505-05	V.R.(CH2 POSI.) 10KB X2
R332	RD148B2C202J	RES. CARBON 2K 5% 1/6W	VR202	R12-0571-05	RES. SEMI FIXED 500B
R333	RN148K2C6800F	RES. METAL FILM 680 1% 1/6W	VR203	R12-0571-05	RES. SEMI FIXED 500B
R334	RN148K2C6800F	RES. METAL FILM 680 1% 1/6W	VR204	R12-0570-05	RES. SEMI FIXED 200B
R335	RD148B2C561J	RES. CARBON 560 5% 1/6W	VR251	R12-0571-05	RES. SEMI FIXED 500B
R401	RD148B2C470J	RES. CARBON 47 5% 1/6W	VR301	R12-0571-05	RES. SEMI FIXED 500B
R402	RD148B2C470J	RES. CARBON 47 5% 1/6W	VR302	R12-0571-05	RES. SEMI FIXED 500B
R403	RD148B2C752J	RES. CARBON 7.5K 5% 1/6W	VR401	R12-0571-05	RES. SEMI FIXED 500B
R404	RD148B2C681J	RES. CARBON 680 5% 1/6W	VR402	R12-0571-05	RES. SEMI FIXED 500B
R405	RN148K2C1301F	RES. METAL FILM 1.3K 1% 1/6W	VR403	R12-0571-05	RES. SEMI FIXED 500B
R406	RN148K2C1301F	RES. METAL FILM 1.3K 1% 1/6W			
R407	RN148K2C1201F	RES. METAL FILM 1.2K 1% 1/6W			
R408	RD148B2C470J	RES. CARBON 47 5% 1/6W			
R409	RD148B2C470J	RES. CARBON 47 5% 1/6W			
R410	RD148B2C101J	RES. CARBON 100 5% 1/6W			
R411	RD148B2C152J	RES. CARBON 1.5K 5% 1/6W			
R412	RD148B2C152J	RES. CARBON 1.5K 5% 1/6W			
R413	RD148B2C101J	RES. CARBON 100 5% 1/6W			
R414	RD148B2C470J	RES. CARBON 47 5% 1/6W			
R415	RD148B2C470J	RES. CARBON 47 5% 1/6W			
R416	RN148K2C1501F	RES. METAL FILM 1.5K 1% 1/6W			
R417	RN148K2C1501F	RES. METAL FILM 1.5K 1% 1/6W			
R418	RN148K2C5100F	RES. METAL FILM 510 1% 1/6W			
R419	NO USE				
R420	RD148B2C163J	RES. CARBON 16K 5% 1/6W			
R421	RD148B2C220J	RES. CARBON 22 5% 1/6W			
R422	RD148B2C220J	RES. CARBON 22 5% 1/6W			



# PARTS LIST

## SWEEP UNIT

### X74-1460-00

REF.NO	PARTS NO	NAME & DESCRIPTION			
	E40-0216-05	PIN CONNECTOR	2P (FOR D207)		
	J25-5176-12	PCB (UNMOUNTED)			
	212-1018-05	TUBE (PLASTIC)			
C002	C91-0769-05	CAP. AXIAL	0.01	20%	16V
C003	C092FM1H152K	CAP. MYLAR	1500P	10%	50V
C004	C092FM1H473K	CAP. MYLAR	0.047	10%	50V
C005	CK45FB1H222K	CAP. CERAMIC	2200P	10%	50V
C006	NO USE				
C007	C092FM1H102K	CAP. MYLAR	1000P	10%	50V
C008	NO USE				
C009	CK45FF1H103Z	CAP. CERAMIC	0.01		50V
C010	CE04HW1E220M	CAP. ELECTRO	22	20%	25V
C013	C092FM1H104K	CAP. MYLAR	0.1	10%	50V
C014	CE04HW1H010M	CAP. ELECTRO	1	20%	50V
C015	CK45FB1H102K	CAP. CERAMIC	1000P	10%	50V
C016	CK45FB1H222K	CAP. CERAMIC	2200P	10%	50V
C017	CK45FF1H103Z	CAP. CERAMIC	0.01		50V
C018	CK45FF1H103Z	CAP. CERAMIC	0.01		50V
C019	CC45FCH1H100D	CAP. CERAMIC	10P	0.5P	50V
C101	CC45FCH1H100D	CAP. CERAMIC	10P	0.5P	50V
C102	CC45FCH1H330J	CAP. CERAMIC	33P	5%	50V
C103	CE04HW1H010M	CAP. ELECTRO	1	20%	50V
C104	CE04EW1C100M	CAP. ELECTRO	10	20%	16V
C105	CK45FF1H103Z	CAP. CERAMIC	0.01		50V
C106	CK45FB1H102K	CAP. CERAMIC	1000P	10%	50V
C107	CK45FF1H103Z	CAP. CERAMIC	0.01		50V
C108	CC45FCH1H150J	CAP. CERAMIC	15P	5%	50V
C109	CC45FCH1H221J	CAP. CERAMIC	220P	5%	50V
C110	CK45FF1H103Z	CAP. CERAMIC	0.01		50V
C111	CK45FB1H102K	CAP. CERAMIC	1000P	10%	50V
C112	CK45FF1H103Z	CAP. CERAMIC	0.01		50V
C113	C91-1246-05	CAP. FILM	4.7	5%	
C114	C91-1247-05	CAP. FILM	0.047	2%	
C115	C093AP2A392J	CAP. MYLAR	3900P	5%	100V
C116	CM93BD2A391J	CAP. MICA	390P	5%	100V
C117	NO USE				
C118	CE04HW1H010M	CAP. ELECTRO	1	20%	50V
C119	CE04HW1H010M	CAP. ELECTRO	1	20%	50V
C120	NO USE				
C121	CE04EW1C100M	CAP. ELECTRO	10	20%	16V
C122	C092FM1H104K	CAP. MYLAR	0.1	10%	50V
C123	CC45FSL1H471J	CAP. CERAMIC	470P	5%	50V
C202	CC45FCH1H390J	CAP. CERAMIC	39P	5%	50V
C205	CC45FCH1H221J	CAP. CERAMIC	220P	5%	50V
C206	CK45FF1H103Z	CAP. CERAMIC	0.01		50V
C207	CC45FCH1H680J	CAP. CERAMIC	68P	5%	50V
C210	CC45FCH1H220J	CAP. CERAMIC	22P	5%	50V
C211	CC45FCH1H101J	CAP. CERAMIC	100P	5%	50V
C212	CC45FCH1H680J	CAP. CERAMIC	68P	5%	50V
C301	C91-1248-05	CAP. FILM	0.01	5%	
C302	NO USE				
C303	CK45FB1H102K	CAP. CERAMIC	1000P	10%	50V
C304	C91-0769-05	CAP. AXIAL	0.01	20%	16V
C305	CK45FF1H103Z	CAP. CERAMIC	0.01		50V
C306	CC45FCH1H270J	CAP. CERAMIC	27P	5%	50V
C307	CC45FCH1H270J	CAP. CERAMIC	27P	5%	50V
C308	CK45B1H102K	CAP. CERAMIC	1000P	10%	50V
C501	CE04EW1C101M	CAP. ELECTRO	100	20%	16V
C502	CK45FF1H103Z	CAP. CERAMIC	0.01		50V
C503	CE04EW1C101M	CAP. ELECTRO	100	20%	16V
C504	CK45FF1H103Z	CAP. CERAMIC	0.01		50V
C505	CE04EW1A221M	CAP. ELECTRO	220	20%	10V
C506	CK45FF1H103Z	CAP. CERAMIC	0.01		50V
C507	CE04EW1C330M	CAP. ELECTRO	33	20%	16V
C508	CE04EW1C330M	CAP. ELECTRO	33	20%	16V
C509	CE04EW1C330M	CAP. ELECTRO	33	20%	16V
C510	CE04EW1C330M	CAP. ELECTRO	33	20%	16V
C511	CE04EW1C330M	CAP. ELECTRO	33	20%	16V
C512	CE04EW1C330M	CAP. ELECTRO	33	20%	16V
C513	CK45FF1H103Z	CAP. CERAMIC	0.01		50V
C514	C91-1245-05	CAP. CERAMIC	0.1		12V
C515	CK45FF1H103Z	CAP. CERAMIC	0.01		50V
C516	C91-1245-05	CAP. CERAMIC	0.1		12V
C517	CK45FF1H103Z	CAP. CERAMIC	0.01		50V
C518	CE04EW1A470M	CAP. ELECTRO	47	20%	10V

REF.NO	PARTS NO	NAME & DESCRIPTION			
C519	CK45FF1H103Z	CAP. CERAMIC	0.01		50V
C520	CK45FF1H103Z	CAP. CERAMIC	0.01		50V
C521	C91-1245-05	CAP. CERAMIC	0.1		12V
C522	CE04EW1A470M	CAP. ELECTRO	47	20%	10V
C523	CK45FF1H103Z	CAP. CERAMIC	0.01		50V
C524	CE04EW1A470M	CAP. ELECTRO	47	20%	10V
C525	NO USE				
C526	CK45FF1H103Z	CAP. CERAMIC	0.01		50V
C527	CK45FF1H103Z	CAP. CERAMIC	0.01		50V
C530	CK45FF1H103Z	CAP. CERAMIC	0.01		50V
C531	CK45FF1H103Z	CAP. CERAMIC	0.01		50V
C532	CE04EW1A470M	CAP. ELECTRO	47	20%	10V
C533	CK45FF1H103Z	CAP. CERAMIC	0.01		50V
C534	CK45FF1H103Z	CAP. CERAMIC	0.01		50V
C535	CK45FF1H103Z	CAP. CERAMIC	0.01		50V
C536	CE04EW1C330M	CAP. ELECTRO	33	20%	16V
C537	CE04EW1C330M	CAP. ELECTRO	33	20%	16V
C538	CK45FF1H103Z	CAP. CERAMIC	0.01		50V
C539	C91-0769-05	CAP. AXIAL	0.01	20%	16V
C540	CE04EW1C330M	CAP. ELECTRO	33	20%	16V
C541	CE04EW1C330M	CAP. ELECTRO	33	20%	16V
C542	CE04EW1A470M	CAP. ELECTRO	47	20%	10V
C543	CK45FF1H103Z	CAP. CERAMIC	0.01		50V
C544	CK45FF1H103Z	CAP. CERAMIC	0.01		50V
C545	CK45FF1H103Z	CAP. CERAMIC	0.01		50V
C546	CK45FF1H103Z	CAP. CERAMIC	0.01		50V
C547	CK45FF1H103Z	CAP. CERAMIC	0.01		50V
C548	CK45FF1H103Z	CAP. CERAMIC	0.01		50V
C549	CK45FF1H103Z	CAP. CERAMIC	0.01		50V
D001	1SS132	DIODE			
D002	1SS132	DIODE			
D003	1SS132	DIODE			
D004	1SS132	DIODE			
D005	1SS132	DIODE			
D006	1SS132	DIODE			
D007	1SS132	DIODE			
D008	1SS132	DIODE			
D101	1SS132	DIODE			
D102	1SS132	DIODE			
D103	1SS132	DIODE			
D104	1SS132	DIODE			
D105	1SS132	DIODE			
D106	1SS132	DIODE			
D107	1SS132	DIODE			
D108	NO USE				
D109	1SS132	DIODE			
D110	1SS132	DIODE			
D111	NO USE				
D112	1SS132	DIODE			
D113	MA700	DIODE			
D114	MA700	DIODE			
D115	1SS132	DIODE			
D116	1SS132	DIODE			
D117	1SS132	DIODE			
D201	1SS132	DIODE			
D202	1SS132	DIODE			
D203	1SS132	DIODE			
D204	1SS132	DIODE			
D205	1SS132	DIODE			
D206	MA700	DIODE			
D207	B30-0957-05	LED (LN322GPT.POWER)			
D210	1SS132	DIODE			
D211	1SS132	DIODE			
D212	MA700	DIODE			
D213	1SS132	DIODE			
D214	1SS132	DIODE			
D215	1SS132	DIODE			
D216	1SS132	DIODE			
D301	1SS132	DIODE			
D302	1SS132	DIODE			
D309	MT25.1JB	DIODE, ZENER	5.0V		
D310	MT25.1JB	DIODE, ZENER	5.0V		
J028	E31-2828-05	WIRE ASS'Y (H.POSI)			
J029	E31-2829-05	WIRE ASS'Y (TRIG LEVEL)			
P010	E40-0273-05	PIN CONNECTOR	2P		
P011	E40-0673-05	PIN CONNECTOR	6P		
P012	E40-0573-05	PIN CONNECTOR	5P		

# PARTS LIST

REF.NO	PARTS NO	NAME & DESCRIPTION	REF.NO	PARTS NO	NAME & DESCRIPTION
P021	E40-1173-05	PIN CONNECTOR 11P	R005	RN14BK2C6200F	RES. METAL FILM 620 1% 1/6W
P024	E40-0473-05	PIN CONNECTOR 4P	R006	RN14BK2C2001F	RES. METAL FILM 2K 1% 1/6W
P025	E40-0473-05	PIN CONNECTOR 4P	R007	RD14BB2C202J	RES. CARBON 2K 5% 1/6W
P026	E40-0273-05	PIN CONNECTOR 2P	R008	RD14BB2C102J	RES. CARBON 1K 5% 1/6W
P027	E40-0473-05	PIN CONNECTOR 4P	R009	RD14BB2C362J	RES. CARBON 3.6K 5% 1/6W
P028	E40-0673-05	PIN CONNECTOR 6P	R010	RD14BB2C105J	RES. CARBON 1M 5% 1/6W
P029	E40-0573-05	PIN CONNECTOR 5P	R011	RD14BB2C101J	RES. CARBON 100 5% 1/6W
P030	E40-0473-05	PIN CONNECTOR 4P	R012	RD14BB2C101J	RES. CARBON 100 5% 1/6W
P031	E40-0273-05	PIN CONNECTOR 2P	R013	RD14BB2C332J	RES. CARBON 3.3K 5% 1/6W
P032	E40-0273-05	PIN CONNECTOR 2P	R014	RD14BB2C332J	RES. CARBON 3.3K 5% 1/6W
P033	E40-0473-05	PIN CONNECTOR 4P	R015	RD14BB2C472J	RES. CARBON 4.7K 5% 1/6W
P034	NO USE		R016	RD14BB2C391J	RES. CARBON 390 5% 1/6W
P035	E40-0673-05	PIN CONNECTOR 6P	R017	RD14BB2C392J	RES. CARBON 3.9K 5% 1/6W
P036	E40-0473-05	PIN CONNECTOR 4P	R018	RD14BB2C220J	RES. CARBON 22 5% 1/6W
P037	E40-0773-05	PIN CONNECTOR 7P	R019	RD14BB2C220J	RES. CARBON 22 5% 1/6W
P038	E40-0873-05	PIN CONNECTOR 8P	R020	RD14BB2C820J	RES. CARBON 82 5% 1/6W
P039	E40-0473-05	PIN CONNECTOR 4P	R021	RD14BB2C820J	RES. CARBON 82 5% 1/6W
P040	E40-0673-05	PIN CONNECTOR 6P	R022	RD14BB2C820J	RES. CARBON 82 5% 1/6W
P056	E40-0473-05	PIN CONNECTOR 4P	R023	NO USE	
Q001	2SA1005(K)	TR. SI, PNP	R024	RN14BK2C2400F	RES. METAL FILM 240 1% 1/6W
Q002	2SA1005(K)	TR. SI, PNP	R025	RN14BK2C2400F	RES. METAL FILM 240 1% 1/6W
Q003	2SK241(Y)	FET, N-CHANNEL	R026	RN14BK2C2701F	RES. METAL FILM 2.7K 1% 1/6W
Q004	2SK241(Y)	FET, N-CHANNEL	R027	RN14BK2C5601F	RES. METAL FILM 5.6K 1% 1/6W
Q005	2SC3354(S,T)	TR. SI, NPN	R028	RD14BB2C470J	RES. CARBON 47 5% 1/6W
Q006	2SC3354(S,T)	TR. SI, NPN	R029	RD14BB2C470J	RES. CARBON 47 5% 1/6W
Q007	2SA1005(K)	TR. SI, PNP	R030	RN14BK2C8200F	RES. METAL FILM 820 1% 1/6W
Q008	2SA1005(K)	TR. SI, PNP	R031	RN14BK2C8200F	RES. METAL FILM 820 1% 1/6W
Q009	2SC2785(F)	TR. SI, NPN	R032	RN14BK2C1602F	RES. METAL FILM 16K 1% 1/6W
Q010	2SC2785(F)	TR. SI, NPN	R033	RN14BK2C5601F	RES. METAL FILM 5.6K 1% 1/6W
Q011	2SC2785(F)	TR. SI, NPN	R034	RN14BK2C3900F	RES. METAL FILM 390 1% 1/6W
Q012	NO USE		R035	RD14BB2C101J	RES. CARBON 100 5% 1/6W
Q013	2SC2785(F)	TR. SI, NPN	R036	RD14BB2C101J	RES. CARBON 100 5% 1/6W
Q014	2SC2785(F)	TR. SI, NPN	R037	RD14BB2C473J	RES. CARBON 47K 5% 1/6W
Q015	2SC2785(F)	TR. SI, NPN	R038	RD14BB2C273J	RES. CARBON 27K 5% 1/6W
Q101	2SC2785(F)	TR. SI, NPN	R039	RD14BB2C202J	RES. CARBON 2K 5% 1/6W
Q102	2SC2785(F)	TR. SI, NPN	R040	RD14BB2C473J	RES. CARBON 47K 5% 1/6W
Q103	2SA1175(F)	TR. SI, PNP	R041	RD14BB2C222J	RES. CARBON 2.2K 5% 1/6W
Q104	2SA1005(K)	TR. SI, PNP	R042	RD14BB2C202J	RES. CARBON 2K 5% 1/6W
Q105	2SC2786(K)	TR. SI, NPN	R043	NO USE	
Q106	2SC2785(F)	TR. SI, NPN	R044	RD14BB2C104J	RES. CARBON 100K 5% 1/6W
Q107	2SC2785(F)	TR. SI, NPN	R045	RD14BB2C102J	RES. CARBON 1K 5% 1/6W
Q108	2SC2785(F)	TR. SI, NPN	R046	NO USE	
Q109	NO USE		R047	RD14BB2C103J	RES. CARBON 10K 5% 1/6W
Q110	2SC2785(F)	TR. SI, NPN	R048	RD14BB2C244J	RES. CARBON 240K 5% 1/6W
Q111	2SC2785(F)	TR. SI, NPN	R049	RD14BB2C754J	RES. CARBON 750K 5% 1/6W
Q114	2SA1175(F)	TR. SI, PNP	R050	RD14BB2C622J	RES. CARBON 6.2K 5% 1/6W
Q115	2SC2785(F)	TR. SI, NPN	R051	RD14BB2C332J	RES. CARBON 3.3K 5% 1/6W
Q116	2SC2785(F)	TR. SI, NPN	R052	RD14BB2C153J	RES. CARBON 15K 5% 1/6W
Q117	2SC2785(F)	TR. SI, NPN	R053	RD14BB2C242J	RES. CARBON 2.4K 5% 1/6W
Q118	2SA1005(K)	TR. SI, PNP	R054	RD14BB2C132J	RES. CARBON 1.3K 5% 1/6W
Q119	2SA1005(K)	TR. SI, PNP	R055	RD14BB2C161J	RES. CARBON 160 5% 1/6W
Q203	2SC3354(S,T)	TR. SI, NPN	R056	RD14BB2C473J	RES. CARBON 47K 5% 1/6W
Q204	2SA1175(F)	TR. SI, PNP	R057	RD14BB2C103J	RES. CARBON 10K 5% 1/6W
Q205	2SA1175(F)	TR. SI, PNP	R058	RD14BB2C272J	RES. CARBON 2.7K 5% 1/6W
Q206	2SA1175(F)	TR. SI, PNP	R059	NO USE	
Q207	2SA1175(F)	TR. SI, PNP	R060	RD14BB2C681J	RES. CARBON 680 5% 1/6W
Q208	2SC2785(F)	TR. SI, NPN	R061	RD14BB2C562J	RES. CARBON 5.6K 5% 1/6W
Q209	2SC2785(F)	TR. SI, NPN	R101	RD14BB2C202J	RES. CARBON 2K 5% 1/6W
Q210	2SA1175(F)	TR. SI, PNP	R102	RD14BB2C102J	RES. CARBON 1K 5% 1/6W
Q211	2SC2785(F)	TR. SI, NPN	R103	RD14BB2C102J	RES. CARBON 1K 5% 1/6W
Q212	2SC2786(K)	TR. SI, NPN	R104	RD14BB2C103J	RES. CARBON 10K 5% 1/6W
Q213	2SC2785(F)	TR. SI, NPN	R105	RD14BB2C103J	RES. CARBON 10K 5% 1/6W
Q214	2SC2786(K)	TR. SI, NPN	R106	RD14BB2C102J	RES. CARBON 1K 5% 1/6W
Q215	2SC2786(K)	TR. SI, NPN	R107	RD14BB2C751J	RES. CARBON 750 5% 1/6W
Q216	2SA1175(F)	TR. SI, PNP	R108	RD14BB2C182J	RES. CARBON 1.8K 5% 1/6W
Q301	2SK117(Y)	FET, N-CHANNEL	R109	RD14BB2C751J	RES. CARBON 750 5% 1/6W
Q302	2SC2785(F)	TR. SI, NPN	R110	RD14BB2C182J	RES. CARBON 1.8K 5% 1/6W
Q303	2SA1175(F)	TR. SI, PNP	R111	R90-0629-05	RES. NETWORK 1KXB 5%
Q304	2SA1175(F)	TR. SI, PNP	R112	RD14BB2C104J	RES. CARBON 100K 5% 1/6W
Q305	2SA1175(F)	TR. SI, PNP	R113	RD14BB2C103J	RES. CARBON 10K 5% 1/6W
Q306	2SA1175(F)	TR. SI, PNP	R114	RD14BB2C182J	RES. CARBON 1.8K 5% 1/6W
Q307	2SC2785(F)	TR. SI, NPN	R115	RD14BB2C362J	RES. CARBON 3.6K 5% 1/6W
Q308	2SC2785(F)	TR. SI, NPN	R116	RD14BB2C682J	RES. CARBON 6.8K 5% 1/6W
R001	RD14BB2C220J	RES. CARBON 22 5% 1/6W	R117	RD14BB2C330J	RES. CARBON 33 5% 1/6W
R002	RN14BK2C5600F	RES. METAL FILM 560 1% 1/6W	R118	RD14BB2C202J	RES. CARBON 2K 5% 1/6W
R003	RN14BK2C4301F	RES. METAL FILM 4.3K 1% 1/6W	R119	RD14BB2C472J	RES. CARBON 4.7K 5% 1/6W
R004	RN14BK2C5101F	RES. METAL FILM 5.1K 1% 1/6W	R120	RD14BB2C472J	RES. CARBON 4.7K 5% 1/6W
			R121	RD14BB2C221J	RES. CARBON 220 5% 1/6W
			R122	RD14BB2C102J	RES. CARBON 1K 5% 1/6W
			R123	RN14BK2C2402F	RES. METAL FILM 24K 1% 1/6W
			R124	RN14BK2C1503F	RES. METAL FILM 150K 1% 1/6W
			R125	RN14BK2C2703F	RES. METAL FILM 270K 1% 1/6W
			R126	RD14BB2C101J	RES. CARBON 100 5% 1/6W
			R127	RD14BB2C103J	RES. CARBON 10K 5% 1/6W
			R128	RD14BB2C103J	RES. CARBON 10K 5% 1/6W

# PARTS LIST

REF.NO	PARTS NO	NAME & DESCRIPTION	REF.NO	PARTS NO	NAME & DESCRIPTION
R129	RD148B2C103J	RES. CARBON 10K 5% 1/6W	R258	R90-0645-05	RES. NETWORK 10KX4 5%
R130	NO USE		R259	RD148B2C103J	RES. CARBON 10K 5% 1/6W
R131	RD148B2C103J	RES. CARBON 10K 5% 1/6W	R262	RD148B2C333J	RES. CARBON 33K 5% 1/6W
R132	RD148B2C103J	RES. CARBON 10K 5% 1/6W	R263	RD148B2C103J	RES. CARBON 10K 5% 1/6W
R135	RD148B2C104J	RES. CARBON 100K 5% 1/6W	R264	NO USE	
R136	RD148B2C104J	RES. CARBON 100K 5% 1/6W	R265	RD148B2C101J	RES. CARBON 100 5% 1/6W
R137	RD148B2C622J	RES. CARBON 6.2K 5% 1/6W	R266	RD148B2C101J	RES. CARBON 100 5% 1/6W
R138	NO USE		R267	RD148B2C103J	RES. CARBON 10K 5% 1/6W
R139	RD148B2C911J	RES. CARBON 910 5% 1/6W	R301	RD148B2C362J	RES. CARBON 3.6K 5% 1/6W
R140	RN148K2C2001F	RES. METAL FILM 2K 1% 1/6W	R302	RN148K2C5600F	RES. METAL FILM 560 1% 1/6W
R141	RN148K2C3001F	RES. METAL FILM 3K 1% 1/6W	R303	RD148B2C101J	RES. CARBON 100 5% 1/6W
R142	RD148B2C331J	RES. CARBON 330 5% 1/6W	R304	RD148B2C222J	RES. CARBON 2.2K 5% 1/6W
R143	RN148K2C6201F	RES. METAL FILM 6.2K 1% 1/6W	R305	RN148K2C1004F	RES. METAL FILM 1M 1% 1/6W
R144	RN148K2C2402F	RES. METAL FILM 24K 1% 1/6W	R306	RD148B2C133J	RES. CARBON 13K 5% 1/6W
R145	RD148B2C472J	RES. CARBON 4.7K 5% 1/6W	R307	RD148B2C272J	RES. CARBON 2.7K 5% 1/6W
R146	RN148K2C2701F	RES. METAL FILM 2.7K 1% 1/6W	R308	RD148B2C822J	RES. CARBON 8.2K 5% 1/6W
R147	RD148B2C470J	RES. CARBON 47 5% 1/6W	R309	RD148B2C243J	RES. CARBON 24K 5% 1/6W
R148	RD148B2C220J	RES. CARBON 22 5% 1/6W	R310	RD148B2C243J	RES. CARBON 24K 5% 1/6W
R149	RD148B2C391J	RES. CARBON 390 5% 1/6W	R311	RD148B2C822J	RES. CARBON 8.2K 5% 1/6W
R150	RD148B2C471J	RES. CARBON 470 5% 1/6W	R312	RD148B2C243J	RES. CARBON 24K 5% 1/6W
R151	RD148B2C132J	RES. CARBON 1.3K 5% 1/6W	R313	RD148B2C243J	RES. CARBON 24K 5% 1/6W
R152	RD148B2C392J	RES. CARBON 3.9K 5% 1/6W	R314	RD148B2C104J	RES. CARBON 100K 5% 1/6W
R153	RD148B2C820J	RES. CARBON 82 5% 1/6W	R315	RD148B2C104J	RES. CARBON 100K 5% 1/6W
R154	R90-0647-05	RES. NETWORK (SWEEP I)	R316	RD148B2C104J	RES. CARBON 100K 5% 1/6W
R155	RD148B2C182J	RES. CARBON 1.8K 5% 1/6W	R317	RD148B2C101J	RES. CARBON 100 5% 1/6W
R156	RD148B2C103J	RES. CARBON 10K 5% 1/6W	R318	RD148B2C271J	RES. CARBON 270 5% 1/6W
R157	RD148B2C102J	RES. CARBON 1K 5% 1/6W	R319	RD148B2C133J	RES. CARBON 13K 5% 1/6W
R160	RD148B2C103J	RES. CARBON 10K 5% 1/6W	R320	RD148B2C184J	RES. CARBON 180K 5% 1/6W
R161	RD148B2C102J	RES. CARBON 1K 5% 1/6W	R321	R90-0645-05	RES. NETWORK 10KX4 5%
R162	RD148B2C392J	RES. CARBON 3.9K 5% 1/6W	R322	R90-0645-05	RES. NETWORK 10KX4 5%
R203	RD148B2C332J	RES. CARBON 3.3K 5% 1/6W	R323	RD148B2C104J	RES. CARBON 100K 5% 1/6W
R204	RD148B2C511J	RES. CARBON 510 5% 1/6W	R324	RD148B2C203J	RES. CARBON 20K 5% 1/6W
R205	RN148K2C6801F	RES. METAL FILM 6.8K 1% 1/6W	R325	RN148K2C2002F	RES. METAL FILM 20K 1% 1/6W
R206	RD148B2C152J	RES. CARBON 1.5K 5% 1/6W	R326	RD148B2C101J	RES. CARBON 100 5% 1/6W
R207	RD148B2C332J	RES. CARBON 3.3K 5% 1/6W	R327	RD148B2C103J	RES. CARBON 10K 5% 1/6W
R208	RN148K2C5600F	RES. METAL FILM 560 1% 1/6W	R328	RD148B2C101J	RES. CARBON 100 5% 1/6W
R209	RD148B2C822J	RES. CARBON 8.2K 5% 1/6W	R329	RD148B2C332J	RES. CARBON 3.3K 5% 1/6W
R210	RD148B2C243J	RES. CARBON 24K 5% 1/6W	R330	NO USE	
R211	RD148B2C243J	RES. CARBON 24K 5% 1/6W	R331	RD148B2C133J	RES. CARBON 13K 5% 1/6W
R212	RD148B2C822J	RES. CARBON 8.2K 5% 1/6W	R332	RD148B2C184J	RES. CARBON 180K 5% 1/6W
R213	RD148B2C243J	RES. CARBON 24K 5% 1/6W	R333	RD148B2C103J	RES. CARBON 10K 5% 1/6W
R214	RD148B2C243J	RES. CARBON 24K 5% 1/6W	R334	RD148B2C103J	RES. CARBON 10K 5% 1/6W
R215	RN148K2C3901F	RES. METAL FILM 3.9K 1% 1/6W	R335	RD148B2C103J	RES. CARBON 10K 5% 1/6W
R216	RN148K2C5101F	RES. METAL FILM 5.1K 1% 1/6W	R336	RD148B2C103J	RES. CARBON 10K 5% 1/6W
R217	RN148K2C1801F	RES. METAL FILM 1.8K 1% 1/6W	R337	RD148B2C103J	RES. CARBON 10K 5% 1/6W
R218	RN148K2C1501F	RES. METAL FILM 1.5K 1% 1/6W	R338	RD148B2C103J	RES. CARBON 10K 5% 1/6W
R219	RD148B2C332J	RES. CARBON 3.3K 5% 1/6W	R339	RD148B2C103J	RES. CARBON 10K 5% 1/6W
R220	RD148B2C470J	RES. CARBON 47 5% 1/6W	R340	RD148B2C104J	RES. CARBON 100K 5% 1/6W
R221	RD148B2C103J	RES. CARBON 10K 5% 1/6W	R341	RD148B2C113J	RES. CARBON 11K 5% 1/6W
R222	RD148B2C271J	RES. CARBON 270 5% 1/6W	R342	RD148B2C271J	RES. CARBON 270 5% 1/6W
R223	RD148B2C472J	RES. CARBON 4.7K 5% 1/6W	S001	S33-2501-05	LEVER SWITCH 2-5 (CURSOR)
R224	RD148B2C101J	RES. CARBON 100 5% 1/6W	S002	S32-4008-05	LEVER SWITCH 4-5 (COUPLING)
R225	RD148B2C272J	RES. CARBON 2.7K 5% 1/6W	S003	S37-2005-05	LEVER SWITCH 2-4 (TRIG SOURCE)
R226	RD148B2C562J	RES. CARBON 5.6K 5% 1/6W	S004	S33-4503-05	LEVER SWITCH 4-5 (H.MODE)
R227	RD148B2C102J	RES. CARBON 1K 5% 1/6W	S005	S33-2505-05	LEVER SWITCH 2-5 (D.MODE)
R228	RD148B2C221J	RES. CARBON 220 5% 1/6W	TC101	C05-0449-05	CAP. TRIMMER 100P
R229	RD148B2C473J	RES. CARBON 47K 5% 1/6W	U101	MC10107L	IC, TRIPLE2-INPUT EXC OR/NOR
R230	RD148B2C332J	RES. CARBON 3.3K 5% 1/6W	U102	MC10131L	IC, DUAL D-FLIP-FLOP
R231	RD148B2C102J	RES. CARBON 1K 5% 1/6W	U103	MC10102L	IC, QUAD 2-INPUT NOR GATE
R232	RD148B2C101J	RES. CARBON 100 5% 1/6W	U104	TC74HC123P	IC, DUAL MONOSTABLE MULTI
R235	RD148B2C101J	RES. CARBON 100 5% 1/6W	U105	MC14051BCP	IC, 8 CH. MULTIPLEXER DEMULTI
R236	RD148B2C392J	RES. CARBON 3.9K 5% 1/6W	U106	MC14051BCP	IC, 8 CH. MULTIPLEXER DEMULTI
R237	RD148B2C681J	RES. CARBON 680 5% 1/6W	U109	TL071CP	IC, JFET-INPUT OP AMP
R238	RD148B2C242J	RES. CARBON 2.4K 5% 1/6W	U201	SN74ALS00AN	IC, QUAD 2 INPUT NAND GATE
R239	RD148B2C392J	RES. CARBON 3.9K 5% 1/6W	U202	HD74HC00P	IC, QUAD 2 INPUT NAND GATE
R240	RD148B2C561J	RES. CARBON 560 5% 1/6W	U203	HD74HC00P	IC, QUAD 2 INPUT NAND GATE
R241	NO USE		U204	HD74HC112P	IC, DUAL FLIP-FLOPS
R242	RD148B2C272J	RES. CARBON 2.7K 5% 1/6W	U205	NJM4558D	IC, OP AMP
R243	RD148B2C561J	RES. CARBON 560 5% 1/6W	U206	2SK332(F)	FET, N-CHANNEL
R244	RD148B2C470J	RES. CARBON 47 5% 1/6W	U301	HD74HC02P	IC, QUAD 2 INPUT NOR GATE
R245	RD148B2C470J	RES. CARBON 47 5% 1/6W	U302	NJM4558D	IC, OP AMP
R246	RD148B2C561J	RES. CARBON 560 5% 1/6W	U303	HD74HC08P	IC, QUAD 2 INPUT AND GATE
R247	RD148B2C162J	RES. CARBON 1.6K 5% 1/6W	U304	HD74HC00P	IC, QUAD 2 INPUT NAND GATE
R248	RD148B2C432J	RES. CARBON 4.3K 5% 1/6W	VR001	R12-4416-05	RES. SEMI FIXED 50KB
R249	RD148B2C470J	RES. CARBON 47 5% 1/6W	VR002	R01-3514-05	V.R. 20KB (TRIG, H.POSI)
R250	RD148B2C472J	RES. CARBON 4.7K 5% 1/6W	VR101	R12-2520-05	RES. SEMI FIXED 5KB

# PARTS LIST

REF.NO	PARTS NO	NAME & DESCRIPTION
VR201	R12-1538-05	RES. SEMI FIXED 1KB
VR202	R12-0571-05	RES. SEMI FIXED 500B
VR205	R01-3514-05	V.R. 20KB (TRIG. H.POSI)
VR301	R12-2520-05	RES. SEMI FIXED 5KB
VR302	R12-0571-05	RES. SEMI FIXED 500B
VR303	R12-1539-05	RES. SEMI FIXED 2KB

## R/O UNIT

### X77-1450-01

REF.NO	PARTS NO	NAME & DESCRIPTION
	J25-5199-32	PCB (UNMOUNTED)
B001	W09-0407-05	LITHIUM BATTERY
C001	CC45FCH1H101J	CAP. CERAMIC 100P 5% 50V
C002	C91-1245-05	CAP. CERAMIC 0.1 12V
C003	CC45FCH1H220J	CAP. CERAMIC 22P 5% 50V
C004	CC45FCH1H220J	CAP. CERAMIC 22P 5% 50V
C005	CE04EW1C220M	CAP. ELECTRO 22 20% 16V
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	CE04EW1E220M	CAP. ELECTRO 22 20% 25V
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
C040	C91-1245-05	CAP. CERAMIC 0.1 12V
C041	NO USE	
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	C91-1245-05	CAP. CERAMIC 0.1 12V
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	CE04EW1A222M	CAP. ELECTRO 2200 20% 10V
C055	C91-1245-05	CAP. CERAMIC 0.1 12V
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
C063	NO USE	
C064	CK45FF1H103Z	CAP. CERAMIC 0.01 50V
C065	NO USE	
C066	CC45FCH1H470J	CAP. CERAMIC 47P 5% 50V
C067	CC45FCH1H470J	CAP. CERAMIC 47P 5% 50V
C068	CC45FCH1H470J	CAP. CERAMIC 47P 5% 50V
C069	NO USE	

REF.NO	PARTS NO	NAME & DESCRIPTION
C070	C91-1250-05	CAP. NETWORK 6PX5
C071	C91-1249-05	CAP. NETWORK 14PX3
C072	C91-1249-05	CAP. NETWORK 14PX3
C101	CK45FF1H103Z	CAP. CERAMIC 0.01 50V
C102	CK45FF1H103Z	CAP. CERAMIC 0.01 50V
C103	CK45FF1H103Z	CAP. CERAMIC 0.01 50V
D001	MA700	DIODE
D002	1SS132	DIODE
D003	MA700	DIODE
D004	MA700	DIODE
D005	MA700	DIODE
D006	MA700	DIODE
L001	L40-1011-04	FERRI INDUCTOR 100UH (7H)
P015	E40-0573-05	PIN CONNECTOR 5P
P016	E40-1373-05	PIN CONNECTOR 13P
P033	E40-1273-05	PIN CONNECTOR 12P
P034	NO USE	
P035	E40-1273-05	PIN CONNECTOR 12P
P036	NO USE	
P037	E40-0773-05	PIN CONNECTOR 7P
P038	E40-0873-05	PIN CONNECTOR 8P
P057	E40-0573-05	PIN CONNECTOR 5P
P062	E40-0873-05	PIN CONNECTOR 8P
P063	E40-0573-05	PIN CONNECTOR 5P
P064	E40-0873-05	PIN CONNECTOR 8P
P065	E40-0473-05	PIN CONNECTOR 4P
Q001	2SC2785(F)	TR. SI. NPN
Q002	2SA1175(F)	TR. SI. PNP
Q003	2SC2785(F)	TR. SI. NPN
R001	RD148B2C101J	RES. CARBON 100 5% 1/6W
R002	RD148B2C101J	RES. CARBON 100 5% 1/6W
R003	RD148B2C153J	RES. CARBON 15K 5% 1/6W
R004	RD148B2C473J	RES. CARBON 47K 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	RN148K2C1002F	RES. METAL FILM 10K 1% 1/6W
R009	RD148B2C103J	RES. CARBON 10K 5% 1/6W
R010	RN148K2C6200F	RES. METAL FILM 620 1% 1/6W
R011	RN148K2C6200F	RES. METAL FILM 620 1% 1/6W
R012	RN148K2C9101F	RES. METAL FILM 9.1K 1% 1/6W
R013	RN148K2C1801F	RES. METAL FILM 1.8K 1% 1/6W
R014	RN148K2C4701F	RES. METAL FILM 4.7K 1% 1/6W
R015	RD148B2C102J	RES. CARBON 1K 5% 1/6W
R016	RD148B2C331J	RES. CARBON 330 5% 1/6W
R017	RN148K2C4701F	RES. METAL FILM 4.7K 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	RD148B2C472J	RES. CARBON 4.7K 5% 1/6W
R029	RN148K2C1002F	RES. METAL FILM 10K 1% 1/6W
R030	RN148K2C1101F	RES. METAL FILM 1.1K 1% 1/6W
R031	RN148K2C4701F	RES. METAL FILM 4.7K 1% 1/6W
R032	RD148B2C512J	RES. CARBON 5.1K 5% 1/6W
R033	R90-0654-05	RES. NETWORK COMPLEXY CHARAC
R034	RD148B2C472J	RES. CARBON 4.7K 5% 1/6W
R035	RD148B2CSR6J	RES. CARBON 5.6 5% 1/6W
R039	RD148B2C472J	RES. CARBON 4.7K 5% 1/6W
R040	RD148B2C472J	RES. CARBON 4.7K 5% 1/6W
R041	RD148B2C103J	RES. CARBON 10K 5% 1/6W
R042	RD148B2C472J	RES. CARBON 4.7K 5% 1/6W
R043	R90-0653-05	RES. NETWORK 10KX8 5%
R044	RD148B2C472J	RES. CARBON 4.7K 5% 1/6W
R045	NO USE	
R046	RD148B2C101J	RES. CARBON 100 5% 1/6W
R047	RD148B2C332J	RES. CARBON 3.3K 5% 1/6W
R050	RD148B2C301J	RES. CARBON 300 5% 1/6W

# PARTS LIST

REF.NO	PARTS NO	NAME & DESCRIPTION
R051	RD148B2C301J	RES. CARBON 300 5% 1/6W
R052	RD148B2C301J	RES. CARBON 300 5% 1/6W
R101	R90-0652-05	RES. NETWORK 10KX6 5%
R102	R90-0652-05	RES. NETWORK 10KX6 5%
R103	R90-0655-05	CR NETWORK
S001	S40-1522-05	SLIDE SWITCH (TIMER)
S002	S40-1521-05	TACT SWITCH (TIMER)
S003	S40-1521-05	TACT SWITCH (TIMER)
S101	S29-1504-05	ROTARY SWITCH (20 CONTACTS)
U001	DAC0808LCN	IC, 8 BIT D/A CONVERTER
U002	HD74HC564P	IC, OCTAL D FLIP-FLOP
U003	HD74HC244P	IC, OCTAL BUFFER
U004	HD14052BP	IC, DUAL ANALOG MULTIPLEXER
U005	HD14052BP	IC, DUAL ANALOG MULTIPLEXER
U006	HD14051BP	IC, ANALOG MULTIPLEXER
U007	MBM2764*S	IC, CHARACTER GENERATOR
U008	CTM5020	IC, GATE ARRAY (R/O CONVERTER)
U009	AM6012DC	IC, 12BIT D/A CONVERTER
U010	LM311N	IC, VOLTAGE COMPARATOR
U011	NJM4558D	IC, OP AMP
U012	NO USE	
U013	TL072CP	IC, JFET-INPUT OP-AMP
U014	HD14051BP	IC, ANALOG MULTIPLEXER
U015	HD74HC10P	TRIPLE 3-INPUT NAND GATE
U016	SN74LS04N	IC, HEX INVERTER
U017	HD74HC138P	3 TO 8 DECODER MULTIPLEXER
U018	HD74HC373P	IC, OCTAL D-LATCHES
U019	SN74LS244N	IC, OCTAL BUFFER
U020	SN74LS244N	IC, OCTAL BUFFER
U021	SN74LS244N	IC, OCTAL BUFFER
U022	SN74LS244N	IC, OCTAL BUFFER
U023	CTM5030	IC, CPU (8051AH)
U024	MSM6242BRS	IC, TIMER
U025	PST518B	IC, RESET
U026	TA79L012P	IC, VOLTAGE REGULATOR (-12V)
VR001	R12-1538-05	RES. SEMI FIXED 1KB
X001	L78-0107-05	CERAMIC RESONATOR (10MHZ)
X02A	L77-1025-05	CRYSTAL RESONATOR (32,768KHZ)
X02B	L77-1229-05	CRYSTAL (SUB L77-1025-05)

## A/D UNIT

### X78-1030-00

REF.NO	PARTS NO	NAME & DESCRIPTION
	J25-S192-22	PCB (UNMOUNTED)
C001	CC45FCH1H150J	CAP. CERAMIC 15P 5% 50V
C002	CE04EW1C220M	CAP. ELECTRO 22 20% 16V
C003	CK45FF1H103Z	CAP. CERAMIC 0.01 50V
C004	CE04EW1C220M	CAP. ELECTRO 22 20% 16V
C005	CK45FF1H103Z	CAP. CERAMIC 0.01 50V
C006	CK45FB1H222K	CAP. CERAMIC 2200P 10% 50V
C007	CK45FB1H222K	CAP. CERAMIC 2200P 10% 50V
C008	CK45FB1H222K	CAP. CERAMIC 2200P 10% 50V
C009	CK45FB1H222K	CAP. CERAMIC 2200P 10% 50V
C010	CK45FB1H222K	CAP. CERAMIC 2200P 10% 50V
C011	CK45FB1H222K	CAP. CERAMIC 2200P 10% 50V
C012	CK45FB1H222K	CAP. CERAMIC 2200P 10% 50V
C013	CE04EW1C220M	CAP. ELECTRO 22 20% 16V
C014	CK45FF1H103Z	CAP. CERAMIC 0.01 50V
C015	CC45FCH1H470J	CAP. CERAMIC 47P 5% 50V
C016	NO USE	
C017	CK45FF1H103Z	CAP. CERAMIC 0.01 50V
C018	CK45FF1H103Z	CAP. CERAMIC 0.01 50V
C019	NO USE	
C020	CC45FCH1H180J	CAP. CERAMIC 18P 5% 50V
C021	C91-1245-05	CAP. CERAMIC 0.1 12V
C022	C91-1245-05	CAP. CERAMIC 0.1 12V
C023	C91-1245-05	CAP. CERAMIC 0.1 12V
C024	C91-1245-05	CAP. CERAMIC 0.1 12V
C025	C91-1245-05	CAP. CERAMIC 0.1 12V
C026	C91-1245-05	CAP. CERAMIC 0.1 12V
C101	CC45FCH1H150J	CAP. CERAMIC 15P 5% 50V
C102	CE04EW1C220M	CAP. ELECTRO 22 20% 16V
C103	CK45FF1H103Z	CAP. CERAMIC 0.01 50V
C104	CE04EW1C220M	CAP. ELECTRO 22 20% 16V
C105	CK45FF1H103Z	CAP. CERAMIC 0.01 50V

REF.NO	PARTS NO	NAME & DESCRIPTION
C106	CK45FB1H222K	CAP. CERAMIC 2200P 10% 50V
C107	CK45FB1H222K	CAP. CERAMIC 2200P 10% 50V
C108	CK45FB1H222K	CAP. CERAMIC 2200P 10% 50V
C109	CK45FB1H222K	CAP. CERAMIC 2200P 10% 50V
C110	CK45FB1H222K	CAP. CERAMIC 2200P 10% 50V
C111	CK45FB1H222K	CAP. CERAMIC 2200P 10% 50V
C112	CK45FB1H222K	CAP. CERAMIC 2200P 10% 50V
C113	CE04EW1C220M	CAP. ELECTRO 22 20% 16V
C114	CK45FF1H103Z	CAP. CERAMIC 0.01 50V
C115	CC45FCH1H470J	CAP. CERAMIC 47P 5% 50V
C118	CK45FF1H103Z	CAP. CERAMIC 0.01 50V
C121	C91-1245-05	CAP. CERAMIC 0.1 12V
C122	C91-1245-05	CAP. CERAMIC 0.1 12V
C123	C91-1245-05	CAP. CERAMIC 0.1 12V
C124	C91-1245-05	CAP. CERAMIC 0.1 12V
C125	C91-1245-05	CAP. CERAMIC 0.1 12V
C126	C91-1245-05	CAP. CERAMIC 0.1 12V
C201	CK45FF1H103Z	CAP. CERAMIC 0.01 50V
C202	CK45FF1H103Z	CAP. CERAMIC 0.01 50V
C203	CK45FF1H103Z	CAP. CERAMIC 0.01 50V
C204	CK45FF1H103Z	CAP. CERAMIC 0.01 50V
C205	CK45FF1H103Z	CAP. CERAMIC 0.01 50V
C206	CC45FSL1H681J	CAP. CERAMIC 680P 5% 50V
C207	CK45FF1H103Z	CAP. CERAMIC 0.01 50V
C208	CC45FCH1H390J	CAP. CERAMIC 39P 5% 50V
C209	CE04EW1C220M	CAP. ELECTRO 22 20% 16V
C210	C91-1245-05	CAP. CERAMIC 0.1 12V
C211	C91-0769-05	CAP. CERAMIC 0.01 20% 16V
C212	C91-0769-05	CAP. CERAMIC 0.01 20% 16V
C213	C91-0769-05	CAP. CERAMIC 0.01 20% 16V
C214	C91-0769-05	CAP. CERAMIC 0.01 20% 16V
C215	CC45FCH1H101J	CAP. CERAMIC 100P 5% 50V
C216	CK45FF1H103Z	CAP. CERAMIC 0.01 50V
C217	CK45FF1H103Z	CAP. CERAMIC 0.01 50V
C218	CK45FF1H103Z	CAP. CERAMIC 0.01 50V
C219	CE04EW1C220M	CAP. ELECTRO 22 20% 16V
C220	CE04EW1C220M	CAP. ELECTRO 22 20% 16V
C221	CK45FF1H103Z	CAP. CERAMIC 0.01 50V
C222	CE04EW1C220M	CAP. ELECTRO 22 20% 16V
C223	CE04EW1C220M	CAP. ELECTRO 22 20% 16V
C224	CK45FF1H103Z	CAP. CERAMIC 0.01 50V
C225	CE04EW1C220M	CAP. ELECTRO 22 20% 16V
C226	NO USE	
C227	CC45FCH1H390J	CAP. CERAMIC 39P 5% 50V
C228	NO USE	
C229	C91-0769-05	CAP. CERAMIC 0.01 20% 16V
D001	1SS132	DIODE
D002	1SS132	DIODE
D003	1SS132	DIODE
D004	1SS132	DIODE
D101	1SS132	DIODE
D102	1SS132	DIODE
D103	1SS132	DIODE
D201	1SS132	DIODE
D202	MA700	DIODE
D203	MA700	DIODE
D204	MA700	DIODE
J060	E31-2853-05	WIRE ASSY (PRE TRIGGER)
P019	E40-0273-05	PIN CONNECTOR 2P
P020	E40-0273-05	PIN CONNECTOR 2P
P021	E40-1173-05	PIN CONNECTOR 11P
P039	E40-0473-05	PIN CONNECTOR 4P
P040	E40-0673-05	PIN CONNECTOR 6P
P056	E40-0473-05	PIN CONNECTOR 4P
P057	NO USE	
P058	E40-0373-05	PIN CONNECTOR 3P
P059	E40-0373-05	PIN CONNECTOR 3P
P060	E40-0473-05	PIN CONNECTOR 4P
P061	E40-0473-05	PIN CONNECTOR 4P
P062	E40-0873-05	PIN CONNECTOR 8P
P063	E40-0573-05	PIN CONNECTOR 5P
Q001	2SC2785(F)	TR. SI, NPN
Q002	2SC2785(F)	TR. SI, NPN
Q003	2SC2785(F)	TR. SI, NPN
Q004	2SA1175(F)	TR. SI, PNP

# PARTS LIST

REF.NO	PARTS NO	NAME & DESCRIPTION	REF.NO	PARTS NO	NAME & DESCRIPTION
Q005	2SA1175(F)	TR. SI. PNP	R111	R90-0650-05	RES. NETWORK 1.1KX4 5%
Q006	2SA1005(K)	TR. SI. PNP	R112	RN14BK2C4701F	RES. METAL FILM 4.7K 1% 1/6W
Q007	2SA1175(F)	TR. SI. PNP	R113	RD14BB2C512J	RES. CARBON 5.1K 5% 1/6W
Q008	2SK583	FET, N-CHANNEL	R114	NO USE	
Q009	2SK583	FET, N-CHANNEL	R115	RD14BB2C101J	RES. CARBON 100 5% 1/6W
Q101	2SC2785(F)	TR. SI. NPN	R116	RN14BK2C1002F	RES. METAL FILM 10K 1% 1/6W
Q102	2SC2785(F)	TR. SI. NPN	R117	RD14BB2C392J	RES. CARBON 3.9K 5% 1/6W
Q103	2SC2785(F)	TR. SI. NPN	R118	RD14BB2C103J	RES. CARBON 10K 5% 1/6W
Q104	2SA1175(F)	TR. SI. PNP	R119	RN14BK2C5101F	RES. METAL FILM 5.1K 1% 1/6W
Q105	2SA1175(F)	TR. SI. PNP	R120	RD14BB2C332J	RES. CARBON 3.3K 5% 1/6W
Q106	2SA1175(F)	TR. SI. PNP	R121	RN14BK2C9100F	RES. METAL FILM 910 1% 1/6W
Q107	2SA1175(F)	TR. SI. PNP	R122	RD14BB2C101J	RES. CARBON 100 5% 1/6W
Q108	2SK583	FET, N-CHANNEL	R126	RN14BK2C8201F	RES. METAL FILM 8.2K 1% 1/6W
Q109	2SK583	FET, N-CHANNEL	R127	RN14BK2C2201F	RES. METAL FILM 2.2K 1% 1/6W
Q110	2SK583	FET, N-CHANNEL	R128	RN14BK2C1801F	RES. METAL FILM 1.8K 1% 1/6W
Q111	2SK583	FET, N-CHANNEL	R129	RN14BK2C1801F	RES. METAL FILM 1.8K 1% 1/6W
Q112	2SC2785(F)	TR. SI. NPN	R130	NO USE	
Q201	2SC2785(F)	TR. SI. NPN	R131	RD14BB2C472J	RES. CARBON 4.7K 5% 1/6W
Q202	2SA1175(F)	TR. SI. PNP	R132	RD14BB2C621J	RES. CARBON 620 5% 1/6W
Q203	2SA1175(F)	TR. SI. PNP	R133	RN14BK2C1002F	RES. METAL FILM 10K 1% 1/6W
Q204	2SC2785(F)	TR. SI. NPN	R134	RN14BK2C1101F	RES. METAL FILM 1.1K 1% 1/6W
Q205	2SC2785(F)	TR. SI. NPN	R135	RN14BK2C1003F	RES. METAL FILM 100K 1% 1/6W
Q206	2SA1175(F)	TR. SI. PNP	R136	RN14BK2C1003F	RES. METAL FILM 100K 1% 1/6W
Q207	2SC3315(C,D)	TR. SI. NPN	R137	RN14BK2C5003F	RES. METAL FILM 500K 1% 1/6W
Q208	2SC2785(F)	TR. SI. NPN	R138	NO USE	
Q209	2SC2785(F)	TR. SI. NPN	R139	RD14BB2C202J	RES. CARBON 2K 5% 1/6W
Q210	2SA1175(F)	TR. SI. PNP	R140	NO USE	
Q211	2SC2785(F)	TR. SI. NPN	R141	RD14BB2C103J	RES. CARBON 10K 5% 1/6W
R001	RN14BK2C2001F	RES. METAL FILM 2K 1% 1/6W	R142	RD14BB2C103J	RES. CARBON 10K 5% 1/6W
R002	RD14BB2C470J	RES. CARBON 47 5% 1/6W	R143	RD14BB2C103J	RES. CARBON 10K 5% 1/6W
R003	RN14BK2C1501F	RES. METAL FILM 1.5K 1% 1/6W	R144	RN14BK2C1003F	RES. METAL FILM 100K 1% 1/6W
R004	RN14BK2C2201F	RES. METAL FILM 2.2K 1% 1/6W	R145	RN14BK2C1003F	RES. METAL FILM 100K 1% 1/6W
R005	RD14BB2C511J	RES. CARBON 510 5% 1/6W	R146	RD14BB2C300J	RES. CARBON 30 5% 1/6W
R006	RD14BB2C470J	RES. CARBON 47 5% 1/6W	R147	R92-1198-05	RES. TEMP. 300 3000PPM 1/6
R007	RD14BB2C104J	RES. CARBON 100K 5% 1/6W	R201	RN14BK2C1302F	RES. METAL FILM 13K 1% 1/6W
R008	RD14BB2C332J	RES. CARBON 3.3K 5% 1/6W	R202	RN14BK2C1302F	RES. METAL FILM 13K 1% 1/6W
R009	RD14BB2C132J	RES. CARBON 1.3K 5% 1/6W	R203	RN14BK2C2001F	RES. METAL FILM 2K 1% 1/6W
R010	R90-0650-05	RES. NETWORK 1.1KX4 5%	R204	RN14BK2C1501F	RES. METAL FILM 1.5K 1% 1/6W
R011	R90-0650-05	RES. NETWORK 1.1KX4 5%	R205	RD14BB2C102J	RES. CARBON 1K 5% 1/6W
R012	RN14BK2C4701F	RES. METAL FILM 4.7K 1% 1/6W	R206	RD14BB2C102J	RES. CARBON 1K 5% 1/6W
R013	RD14BB2C512J	RES. CARBON 5.1K 5% 1/6W	R207	RD14BB2C101J	RES. CARBON 100 5% 1/6W
R014	NO USE		R208	RD14BB2C101J	RES. CARBON 100 5% 1/6W
R015	RD14BB2C101J	RES. CARBON 100 5% 1/6W	R209	RD14BB2C181J	RES. CARBON 180 5% 1/6W
R016	RN14BK2C1002F	RES. METAL FILM 10K 1% 1/6W	R210	RD14BB2C102J	RES. CARBON 1K 5% 1/6W
R017	RD14BB2C392J	RES. CARBON 3.9K 5% 1/6W	R211	RD14BB2C182J	RES. CARBON 1.8K 5% 1/6W
R018	RD14BB2C103J	RES. CARBON 10K 5% 1/6W	R212	RN14BK2C471J	RES. CARBON 470 5% 1/6W
R019	RN14BK2C5101F	RES. METAL FILM 5.1K 1% 1/6W	R213	RD14BB2C472J	RES. CARBON 4.7K 5% 1/6W
R020	RD14BB2C332J	RES. CARBON 3.3K 5% 1/6W	R214	RD14BB2C512J	RES. CARBON 5.1K 5% 1/6W
R021	RN14BK2C9100F	RES. METAL FILM 910 1% 1/6W	R215	RD14BB2C102J	RES. CARBON 1K 5% 1/6W
R022	RD14BB2C101J	RES. CARBON 100 5% 1/6W	R216	RD14BB2C202J	RES. CARBON 2K 5% 1/6W
R023	RN14BK2C6201F	RES. METAL FILM 6.2K 1% 1/6W	R217	RD14BB2C102J	RES. CARBON 1K 5% 1/6W
R024	RN14BK2C3901F	RES. METAL FILM 3.9K 1% 1/6W	R218	RN14BK2C1201F	RES. METAL FILM 1.2K 1% 1/6W
R025	RD14BB2C101J	RES. CARBON 100 5% 1/6W	R219	RD14BB2C132J	RES. CARBON 1.3K 5% 1/6W
R026	RN14BK2C8201F	RES. METAL FILM 8.2K 1% 1/6W	R220	RD14BB2C202J	RES. CARBON 2K 5% 1/6W
R027	RN14BK2C2201F	RES. METAL FILM 2.2K 1% 1/6W	R221	RN14BK2C7500F	RES. METAL FILM 750 1% 1/6W
R028	RN14BK2C1301F	RES. METAL FILM 1.3K 1% 1/6W	R222	RD14BB2C101J	RES. CARBON 100 5% 1/6W
R029	RN14BK2C3001F	RES. METAL FILM 3K 1% 1/6W	R223	RD14BB2C512J	RES. CARBON 5.1K 5% 1/6W
R030	RD14BB2C822J	RES. CARBON 82K 5% 1/6W	R224	R92-1199-05	RES. TEMP. 3K 2000PPM 1/6
R031	RD14BB2C472J	RES. CARBON 4.7K 5% 1/6W	R225	RD14BB2C182J	RES. CARBON 1.8K 5% 1/6W
R032	NO USE		R226	RD14BB2C391J	RES. CARBON 390 5% 1/6W
R033	RN14BK2C1002F	RES. METAL FILM 10K 1% 1/6W	R227	RD14BB2C132J	RES. CARBON 1.3K 5% 1/6W
R034	RN14BK2C1101F	RES. METAL FILM 1.1K 1% 1/6W	R228	RD14BB2C102J	RES. CARBON 1K 5% 1/6W
R035	RN14BK2C1003F	RES. METAL FILM 100K 1% 1/6W	R229	RD14BB2C511J	RES. CARBON 510 5% 1/6W
R036	RN14BK2C1003F	RES. METAL FILM 100K 1% 1/6W	R230	RD14BB2C271J	RES. CARBON 270 5% 1/6W
R037	RN14BK2C5003F	RES. METAL FILM 500K 1% 1/6W	R231	R90-0645-05	RES. NETWORK 10KX4 5%
R038	NO USE		R232	RD14BB2C472J	RES. CARBON 4.7K 5% 1/6W
R039	RD14BB2C202J	RES. CARBON 2K 5% 1/6W	S001	S29-1505-05	ROTARY SWITCH (PRE TRIGGER)
R040	RD14BB2C103J	RES. CARBON 10K 5% 1/6W	U001	HA19209TP	IC, 8-BIT A/D CONVERTER
R041	RD14BB2C103J	RES. CARBON 10K 5% 1/6W	U002	HD74HC574P	IC, OCTAL D-FLIP-FLOP
R046	RD14BB2C180J	RES. CARBON 18 5% 1/6W	U003	HD74HC574P	IC, OCTAL D-FLIP-FLOP
R047	R92-1198-05	RES. TEMP. 300 3000PPM 1/6	U004	CXK5814P-35	IC, S-RAM 2KX8
R101	RN14BK2C2001F	RES. METAL FILM 2K 1% 1/6W	U005	CXK5814P-35	IC, S-RAM 2KX8
R102	RD14BB2C470J	RES. CARBON 47 5% 1/6W	U006	SN74ALS574AN	IC, OCTAL D-FLIP-FLOP
R103	RN14BK2C1501F	RES. METAL FILM 1.5K 1% 1/6W	U007	SN74ALS574AN	IC, OCTAL D-FLIP-FLOP
R104	RN14BK2C2201F	RES. METAL FILM 2.2K 1% 1/6W	U008	OAC0800LCN	IC, 8-BIT D/A CONVERTER
R105	RD14BB2C511J	RES. CARBON 510 5% 1/6W	U101	HA19209TP	IC, 8-BIT A/D CONVERTER
R106	RD14BB2C470J	RES. CARBON 47 5% 1/6W	U102	HD74HC574P	IC, OCTAL D-FLIP-FLOP
R107	RD14BB2C104J	RES. CARBON 100K 5% 1/6W	U103	HD74HC574P	IC, OCTAL D-FLIP-FLOP
R108	RD14BB2C332J	RES. CARBON 3.3K 5% 1/6W	U104	CXK5814P-35	IC, S-RAM 2KX8
R109	RD14BB2C132J	RES. CARBON 1.3K 5% 1/6W	U105	CXK5814P-35	IC, S-RAM 2KX8
R110	R90-0650-05	RES. NETWORK 1.1KX4 5%	U106	SN74ALS574AN	IC, OCTAL D-FLIP-FLOP

# PARTS LIST

REF.NO	PARTS NO	NAME & DESCRIPTION
U107	SN74ALS574AN	IC, DCTAL D-FLIP-FLOP
U108	DAC0800LCN	IC, 8-BIT D/A CONVERTER
U201	CTM5010	IC, GATE ARRAY (A/D CONTROLLER)
U202	LF412CN	IC, DUAL JFET INPUT OP AMP
U203	UPD5555C	IC, CMOS TIMER
U204	LF412CN	IC, DUAL JFET INPUT OP AMP
U205	SN74LS390N	IC, DUAL DECADE COUNTERS
U206	HD74LS00FP	IC, DUAL 2-INPUT NAND GATE
VR001	R12-0571-05	RES. SEMI FIXED 500B
VR101	R12-0571-05	RES. SEMI FIXED 500B
VR102	R12-0571-05	RES. SEMI FIXED 500B
VR201	R12-0570-05	RES. SEMI FIXED 200B
VR202	NO USE	
VR203	R12-0571-05	RES. SEMI FIXED 500B
X001	L77-1026-05	CRYSTAL RESONATOR 20MHZ

## LINE FILTER UNIT

### X80-1060-00

REF.NO	PARTS NO	NAME & DESCRIPTION
	E01-0103-05	CRT SOCKET
	J25-5179-13	PCB (UNMOUNTED)
	L33-0808-05	CHOKO COIL
C001	C91-0575-05	CAP. CERAMIC 1000P 630V
C002	C91-0575-05	CAP. CERAMIC 1000P 630V
C003	C91-0551-05	CAP. POLYESTER 0.22 10% 630V
C004	CC45CH2H010C	CAP. CERAMIC 1P 0.25P 500V
C005	CC45CH2H020C	CAP. CERAMIC 2P 0.25P 500V
J042	E31-2841-05	WIRE ASS'Y (+Y, -Y)
J043	E31-2842-05	WIRE ASS'Y (+X, -X)
J044	E31-2843-05	WIRE ASS'Y (P1, G1, K, H)
J045	NO USE	
J046	E31-2844-05	WIRE ASS'Y (P2, G2)
P030	E40-0474-05	PIN CONNECTOR 4P
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
S001	S40-2524-05	PUSH SWITCH (POWER, UL)
VR001	R23-3502-05	V.R. (INTEN) 20KB X 2
VR002	R23-7501-05	V.R. (FOCUS, ASTING) 500KB X 2
VR003	R23-3503-05	V.R. (ILLUM, ROTAT) 20KB X 2

## FINAL UNIT

### X80-1090-01

REF.NO	PARTS NO	NAME & DESCRIPTION
	F01-0859-04	HEAT SINK
	J25-5183-12	PCB (UNMOUNTED)
	N30-3006-46	SCREW, PAN HD M3X6
C001	CK45F1H1032	CAP. CERAMIC 0.01 50V
C002	CK45F1H1032	CAP. CERAMIC 0.01 50V
C006	CK45F1H1032	CAP. CERAMIC 0.01 50V
C007	CE04EW1C330M	CAP. ELECTRO 33 20% 16V
C008	NO USE	
C009	CC45FCH1H910J	CAP. CERAMIC 91P 5% 50V
C010	NO USE	
C011	CC45FCH1H680J	CAP. CERAMIC 68P 5% 50V
C012	NO USE	
C013	CK45FE2H472P	CAP. CERAMIC 4700P 500V
C014	CK45FE2H472P	CAP. CERAMIC 4700P 500V
C019	CK45F1H1032	CAP. CERAMIC 0.01 50V

REF.NO	PARTS NO	NAME & DESCRIPTION
C020	CK45F1H1032	CAP. CERAMIC 0.01 50V
C021	CK45F1H1032	CAP. CERAMIC 0.01 50V
C022	CK45F1H1032	CAP. CERAMIC 0.01 50V
C023	CK45F1H1032	CAP. CERAMIC 0.01 50V
C028	C91-1232-05	CAP. CERAMIC 5.6P 10% 50V
C029	CC45FCH2H010C	CAP. CERAMIC 1P 0.25P 500V
C030	CC45FCH2H010C	CAP. CERAMIC 1P 0.25P 500V
C031	CK45B2H472K	CAP. CERAMIC 4700P 10% 500V
C032	CK45B2H472K	CAP. CERAMIC 4700P 10% 500V
C033	CQ92FM1H104K	CAP. MYLAR 0.1 10% 50V
C034	CQ92FM1H104K	CAP. MYLAR 0.1 10% 50V
C035	CK45F1H1032	CAP. CERAMIC 0.01 50V
C039	CK45F1H1032	CAP. CERAMIC 0.01 50V
C040	NO USE	
C041	CK45F1H1032	CAP. CERAMIC 0.01 50V
C045	CE04EW1C471M	CAP. ELECTRO 470 20% 16V
C046	CE04EW1C471M	CAP. ELECTRO 470 20% 16V
C047	CE04EW2A470M	CAP. ELECTRO 47 20% 100V
C048	CE04W2C100M	CAP. ELECTRO 10 20% 160V
C049	CK45FE2H472P	CAP. CERAMIC 4700P 500V
C050	CE04EW0J472M	CAP. ELECTRO 4700 20% 6.3V
C051	CE04EW0J472M	CAP. ELECTRO 4700 20% 6.3V
C052	CK45F1H1032	CAP. CERAMIC 0.01 50V
C053	CK45F1H1032	CAP. CERAMIC 0.01 50V
C054	NO USE	
C055	CC45FSL1H471J	CAP. CERAMIC 470P 5% 50V
C056	NO USE	
C057	CQ92FM1H102K	CAP. MYLAR 1000P 10% 50V
C058	CQ92FM1H104K	CAP. MYLAR 0.1 10% 50V
C059	CC45FCH1H470J	CAP. CERAMIC 47P 5% 50V
C060	CK45F1H1032	CAP. CERAMIC 0.01 50V
D001	MA700	DIODE
D002	MA700	DIODE
D003	MA700	DIODE
D004	1SS132	DIODE
D005	MA700	DIODE
D006	MA700	DIODE
D007	1SS132	DIODE
D008	1SS132	DIODE
D009	1SS132	DIODE
D010	1SS132	DIODE
D011	MA700	DIODE
D012	1SS132	DIODE
D013	1SS132	DIODE
D014	1SS132	DIODE
D015	1SS132	DIODE
D016	1SS132	DIODE
D017	1SS132	DIODE
D018	1SS132	DIODE
D019	1SS132	DIODE
D020	1SS132	DIODE
D021	1SS132	DIODE
L001	L40-4782-70	FERRI INDUCTOR 0.47UF
L002	L40-1092-70	FERRI INDUCTOR 1UH
L003	L40-1092-70	FERRI INDUCTOR 1UH
L004	L40-4782-70	FERRI INDUCTOR 0.47UF
P008	E40-0473-05	PIN CONNECTOR 4P
P024	E40-0873-05	PIN CONNECTOR 8P
P041	E40-0673-05	PIN CONNECTOR 6P
P042	E40-0373-05	PIN CONNECTOR 3P
P043	E40-0373-05	PIN CONNECTOR 3P
Q001	2SA1206(K)	TR. SI, PNP
Q002	2SA1206(K)	TR. SI, PNP
Q003	2SC2786(K)	TR. SI, NPN
Q004	2SC2786(K)	TR. SI, NPN
Q005	2SC3354(S)	TR. SI, NPN
Q006	2SC3354(S)	TR. SI, NPN
Q007	2SC2786(K)	TR. SI, NPN
Q008	2SC2786(K)	TR. SI, NPN
Q009	2SC2786(K)	TR. SI, NPN
Q010	2SC2786(K)	TR. SI, NPN
Q011	2SC3779(D)	TR. SI, NPN
Q012	NO USE	
Q013	2SC3779(D)	TR. SI, NPN
Q014	NO USE	
Q015	2SC2911(S)	TR. SI, NPN
Q016	2SC2911(S)	TR. SI, NPN

# PARTS LIST

REF. NO	PARTS NO	NAME & DESCRIPTION
Q017	2SC3315(D)	TR. SI. NPN
Q018	2SC3315(D)	TR. SI. NPN
Q019	2SA1005(K)	TR. SI. PNP
Q020	2SA1005(K)	TR. SI. PNP
Q023	2SC2785(F)	TR. SI. NPN
Q024	2SC2785(F)	TR. SI. NPN
Q025	2SC3354(S)	TR. SI. NPN
Q026	2SC3354(S)	TR. SI. NPN
Q027	2SC3354(S)	TR. SI. NPN
Q028	2SC3354(S)	TR. SI. NPN
Q029	2SA1175(F)	TR. SI. PNP
Q030	2SA1175(F)	TR. SI. PNP
Q031	2SC2785(F)	TR. SI. NPN
Q032	2SC2785(F)	TR. SI. NPN
Q033	2SC3354(S)	TR. SI. NPN
Q034	2SC3354(S)	TR. SI. NPN
Q035	2SC3354(S)	TR. SI. NPN
Q036	2SC3354(S)	TR. SI. NPN
Q037	2SC2911(S)	TR. SI. NPN
Q038	2SA1209(S)	TR. SI. PNP
Q039	2SC2911(S)	TR. SI. NPN
Q040	2SA1209(S)	TR. SI. PNP
Q041	NO USE	
Q042	2SA1005(K)	TR. SI. PNP
Q043	2SA1005(K)	TR. SI. PNP
Q044	2SC2786(K)	TR. SI. NPN
Q045	2SC2786(K)	TR. SI. NPN
Q046	NO USE	
Q047	2SC3315(D)	TR. SI. NPN
Q048	2SC3315(D)	TR. SI. NPN
Q049	2SC2785(F)	TR. SI. NPN
Q050	2SA1005(K)	TR. SI. PNP
Q051	2SC2785(F)	TR. SI. NPN
R001	RN148K2C47ROF	RES. METAL FILM 47.0 1% 1/6W
R002	RN148K2C47ROF	RES. METAL FILM 47.0 1% 1/6W
R003	RD148B2C470J	RES. CARBON 47 5% 1/6W
R004	RD148B2C470J	RES. CARBON 47 5% 1/6W
R005	RD148B2C331J	RES. CARBON 330 5% 1/6W
R006	RN148K2C1501F	RES. METAL FILM 1.5K 1% 1/6W
R007	RN148K2C1501F	RES. METAL FILM 1.5K 1% 1/6W
R008	RD148B2C101J	RES. CARBON 100 5% 1/6W
R009	RD148B2C222J	RES. CARBON 2.2K 5% 1/6W
R010	RD148B2C101J	RES. CARBON 100 5% 1/6W
R011	RD148B2C222J	RES. CARBON 2.2K 5% 1/6W
R012	RD148B2C470J	RES. CARBON 47 5% 1/6W
R013	RD148B2C470J	RES. CARBON 47 5% 1/6W
R014	RD148B2E470J	RES. CARBON 47 5% 1/4W
R015	RD148B2E470J	RES. CARBON 47 5% 1/4W
R016	RD148B2C332J	RES. CARBON 3.3K 5% 1/6W
R017	RD148B2C332J	RES. CARBON 3.3K 5% 1/6W
R018	RD148B2C201J	RES. CARBON 200 5% 1/6W
R019	RD148B2C201J	RES. CARBON 200 5% 1/6W
R020	RD148B2C621J	RES. CARBON 620 5% 1/6W
R021	RD148B2C112J	RES. CARBON 1.1K 5% 1/6W
R024	RD148B2C220J	RES. CARBON 22 5% 1/6W
R025	RD148B2C220J	RES. CARBON 22 5% 1/6W
R026	RN148K2C8200F	RES. METAL FILM 820 1% 1/6W
R027	RN148K2C1001F	RES. METAL FILM 1K 1% 1/6W
R028	RD148B2C101J	RES. CARBON 100 5% 1/6W
R029	RN148K2C1001F	RES. METAL FILM 1K 1% 1/6W
R030	RD148B2C101J	RES. CARBON 100 5% 1/6W
R031	RD148B2C222J	RES. CARBON 2.2K 5% 1/6W
R032	RD148B2C222J	RES. CARBON 2.2K 5% 1/6W
R033	RD148B2C220J	RES. CARBON 22 5% 1/6W
R034	NO USE	
R035	RD148B2C220J	RES. CARBON 22 5% 1/6W
R036	NO USE	
R037	RN148K2E75ROF	RES. METAL FILM 75.0 1% 1/4W
R038	RN148K2E75ROF	RES. METAL FILM 75.0 1% 1/4W
R039	RD148B2C102J	RES. CARBON 1K 5% 1/6W
R042	RD148B2C620J	RES. CARBON 62 5% 1/6W
R043	NO USE	
R044	RD148B2C333J	RES. CARBON 33K 5% 1/6W
R045	RD148B2E220J	RES. CARBON 22 5% 1/4W
R046	RD148B2E220J	RES. CARBON 22 5% 1/4W
R047	RD148B2C471J	RES. CARBON 470 5% 1/6W
R048	RD148B2C821J	RES. CARBON 820 5% 1/6W
R049	RD148B2C821J	RES. CARBON 820 5% 1/6W
R050	RD148B2C471J	RES. CARBON 470 5% 1/6W
R051	R92-1410-05	RES. SPR5L30 910 5%
R054	R92-1410-05	RES. SPR5L30 910 5%

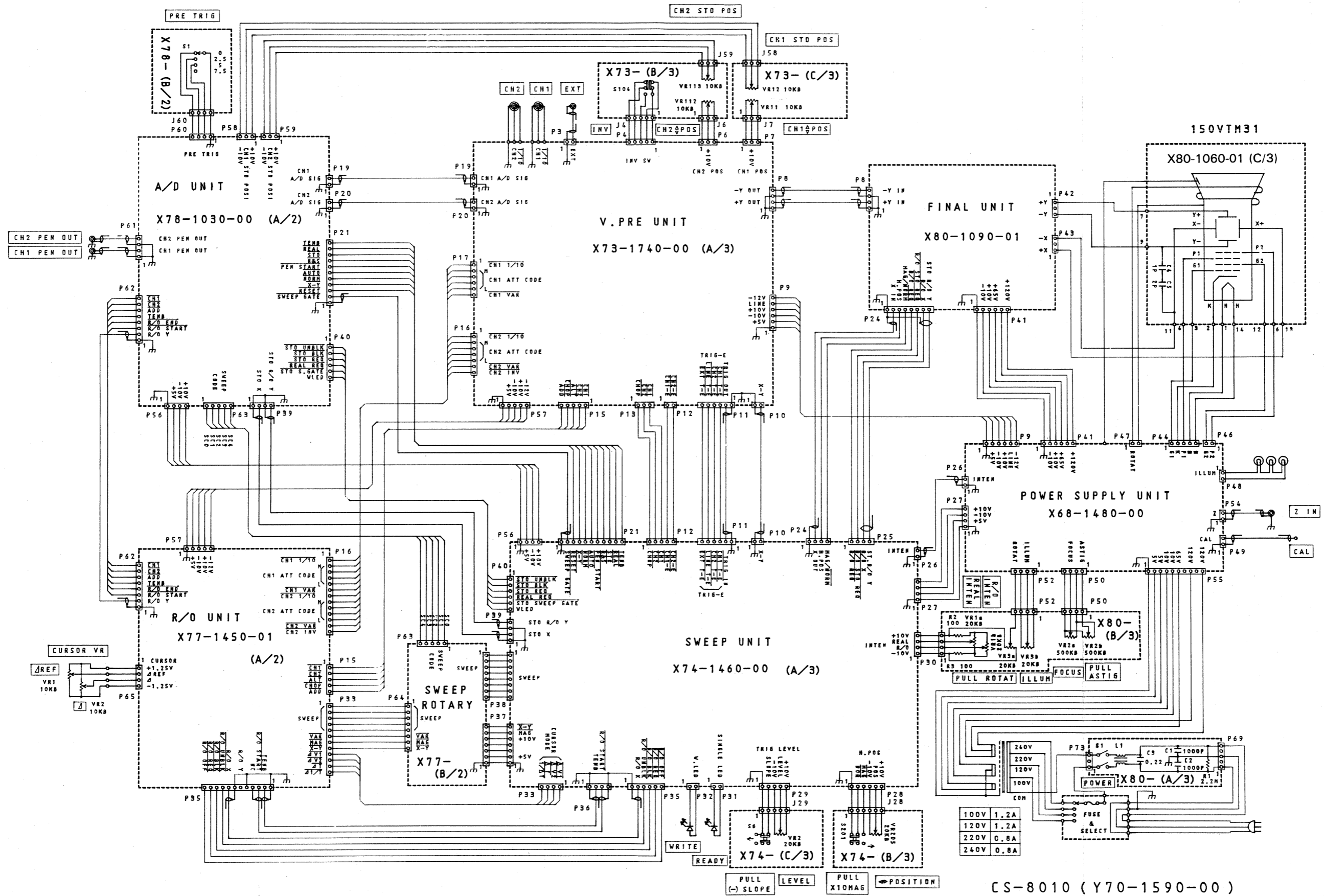
REF. NO	PARTS NO	NAME & DESCRIPTION
R060	RD148B2C101J	RES. CARBON 100 5% 1/6W
R078	RD148B2C101J	RES. CARBON 100 5% 1/6W
R079	RD148B2C622J	RES. CARBON 6.2K 5% 1/6W
R080	RD148B2C112J	RES. CARBON 1.1K 5% 1/6W
R081	RD148B2C472J	RES. CARBON 4.7K 5% 1/6W
R082	RD148B2C472J	RES. CARBON 4.7K 5% 1/6W
R083	RD148B2C470J	RES. CARBON 47 5% 1/6W
R084	RD148B2C470J	RES. CARBON 47 5% 1/6W
R085	NO USE	
R086	RD148B2C133J	RES. CARBON 13K 5% 1/6W
R087	RD148B2C223J	RES. CARBON 22K 5% 1/6W
R088	RN148K2C5600F	RES. METAL FILM 560 1% 1/6W
R089	RN148K2C5600F	RES. METAL FILM 560 1% 1/6W
R090	RD148B2C361J	RES. CARBON 360 5% 1/6W
R091	RD148B2C361J	RES. CARBON 360 5% 1/6W
R092	RD148B2C470J	RES. CARBON 47 5% 1/6W
R093	RD148B2C391J	RES. CARBON 390 5% 1/6W
R094	RD148B2C392J	RES. CARBON 3.9K 5% 1/6W
R095	RN148K2C4301F	RES. METAL FILM 4.3K 1% 1/6W
R096	RN148K2C5601F	RES. METAL FILM 5.6K 1% 1/6W
R097	RN148K2C1001F	RES. METAL FILM 1K 1% 1/6W
R098	RN148K2C1001F	RES. METAL FILM 1K 1% 1/6W
R099	RD148B2C470J	RES. CARBON 47 5% 1/6W
R100	RD148B2C470J	RES. CARBON 47 5% 1/6W
R101	RN148K2C2001F	RES. METAL FILM 2K 1% 1/6W
R102	RN148K2C2001F	RES. METAL FILM 2K 1% 1/6W
R103	RD148B2C392J	RES. CARBON 3.9K 5% 1/6W
R104	RD148B2C392J	RES. CARBON 3.9K 5% 1/6W
R105	RD148B2C470J	RES. CARBON 47 5% 1/6W
R106	RD148B2C470J	RES. CARBON 47 5% 1/6W
R107	RN148K2C1101F	RES. METAL FILM 1.1K 1% 1/6W
R108	RN148K2C1101F	RES. METAL FILM 1.1K 1% 1/6W
R109	NO USE	
R110	RD148B2C102J	RES. CARBON 1K 5% 1/6W
R111	RD148B2C474J	RES. CARBON 470K 5% 1/6W
R112	RN148K2C3001F	RES. METAL FILM 3K 1% 1/6W
R113	RN148K2C3001F	RES. METAL FILM 3K 1% 1/6W
R114	RD148B2C392J	RES. CARBON 3.9K 5% 1/6W
R115	RD148B2C392J	RES. CARBON 3.9K 5% 1/6W
R116	RN148K2H3902F	RES. METAL FILM 39K 1% 1/2W
R117	RN148K2H3902F	RES. METAL FILM 39K 1% 1/2W
R118	RD148B2C470J	RES. CARBON 47 5% 1/6W
R119	RD148B2C470J	RES. CARBON 47 5% 1/6W
R120	RD148B2C102J	RES. CARBON 1K 5% 1/6W
R121	RD148B2C102J	RES. CARBON 1K 5% 1/6W
R122	RN148K2C4301F	RES. METAL FILM 4.3K 1% 1/6W
R123	RN148K2C1003F	RES. METAL FILM 100K 1% 1/6W
R124	RN148K2C1201F	RES. METAL FILM 1.2K 1% 1/6W
R125	RN148K2C1201F	RES. METAL FILM 1.2K 1% 1/6W
R126	RD148B2C101J	RES. CARBON 100 5% 1/6W
R127	RD148B2C101J	RES. CARBON 100 5% 1/6W
R128	RD148B2C682J	RES. CARBON 6.8K 5% 1/6W
R129	RD148B2C472J	RES. CARBON 4.7K 5% 1/6W
R130	RD148B2C103J	RES. CARBON 10K 5% 1/6W
R131	RD148B2C472J	RES. CARBON 4.7K 5% 1/6W
R132	RD148B2C472J	RES. CARBON 4.7K 5% 1/6W
R150	RD148B2C101J	RES. CARBON 100 5% 1/6W
R156	RD148B2C220J	RES. CARBON 22 5% 1/6W
R157	RD148B2C220J	RES. CARBON 22 5% 1/6W
R160	RD148B2C103J	RES. CARBON 10K 5% 1/6W
R161	RD148B2C332J	RES. CARBON 3.3K 5% 1/6W
R162	RD148B2C392J	RES. CARBON 3.9K 5% 1/6W
R163	RD148B2C302J	RES. CARBON 3K 5% 1/6W
R164	RD148B2C622J	RES. CARBON 6.2K 5% 1/6W
R165	RD148B2C301J	RES. CARBON 300 5% 1/6W
R166	RD148B2C151J	RES. CARBON 150 5% 1/6W
R167	RD148B2C151J	RES. CARBON 150 5% 1/6W
R168	RD148B2C151J	RES. CARBON 150 5% 1/6W
R169	RD148B2C622J	RES. CARBON 6.2K 5% 1/6W
R170	RD148B2C362J	RES. CARBON 3.6K 5% 1/6W
R171	RD148B2C103J	RES. CARBON 10K 5% 1/6W
R172	NO USE	
R173	RD148B2C331J	RES. CARBON 330 5% 1/6W
R174	RD148B2C242J	RES. CARBON 2.4K 5% 1/6W
R175	RD148B2C821J	RES. CARBON 820 5% 1/6W
R176	RD148B2C332J	RES. CARBON 3.3K 5% 1/6W
R177	RD148B2C103J	RES. CARBON 10K 5% 1/6W
R178	RD148B2C622J	RES. CARBON 6.2K 5% 1/6W
R179	RD148B2C302J	RES. CARBON 3K 5% 1/6W
R180	RD148B2C163J	RES. CARBON 16K 5% 1/6W
R181	RN148K2C1301F	RES. METAL FILM 1.3K 1% 1/6W



# PARTS LIST

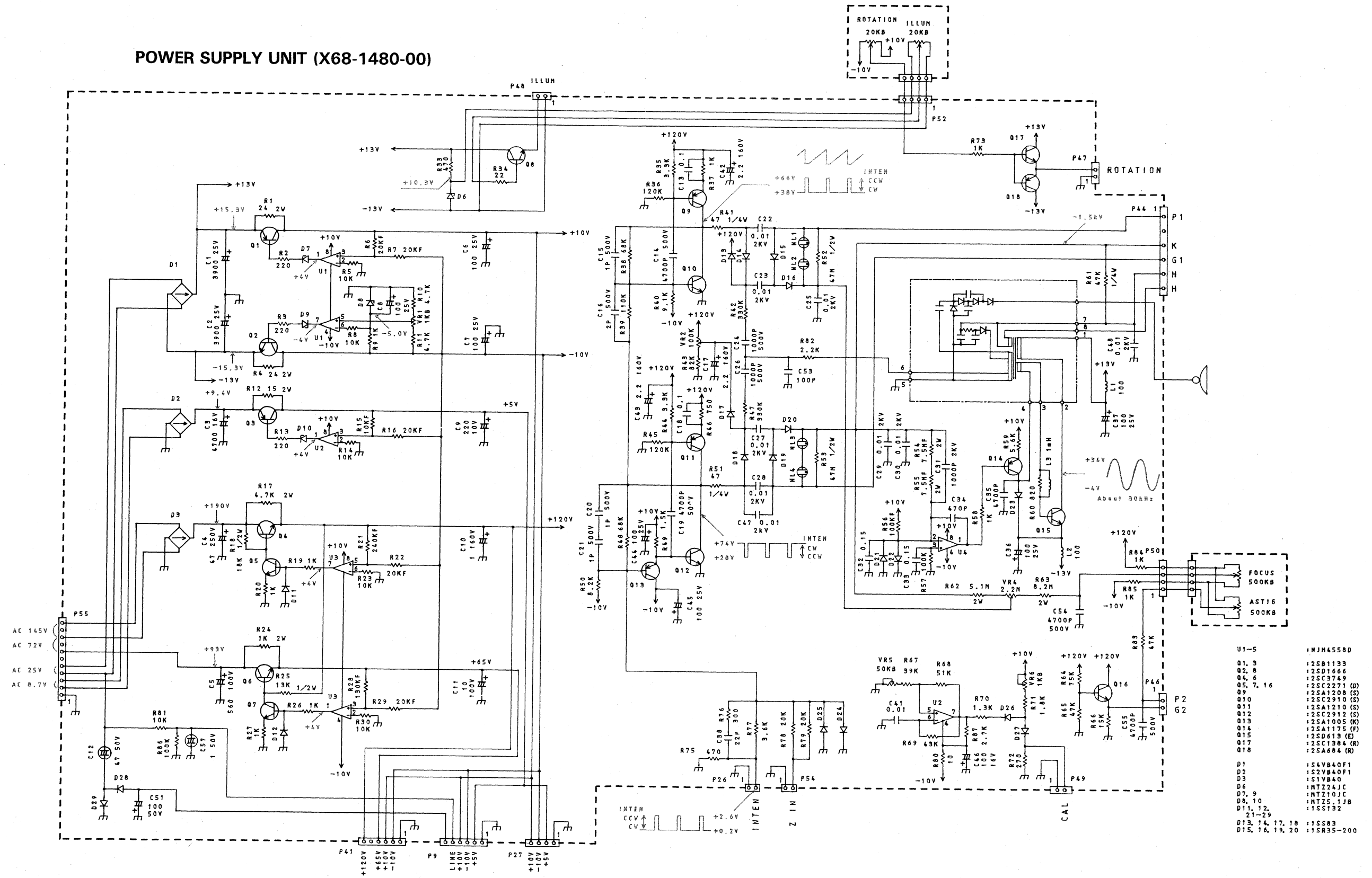
REF. NO	PARTS NO	NAME & DESCRIPTION
R182	RD14BB2C112J	RES. CARBON 1.1K 5% 1/6W
R183	RD14BB2C242J	RES. CARBON 2.4K 5% 1/6W
R184	RD14BB2C821J	RES. CARBON 820 5% 1/6W
R185	RD14BB2C332J	RES. CARBON 3.3K 5% 1/6W
R186	RD14BB2C103J	RES. CARBON 10K 5% 1/6W
R187	RD14BB2C471J	RES. CARBON 470 5% 1/6W
R188	RN14BK2C1001F	RES. METAL FILM 1K 1% 1/6W
R189	RN14BK2C1001F	RES. METAL FILM 1K 1% 1/6W
R190	NO USE	
R191	RD14BB2C622J	RES. CARBON 6.2K 5% 1/6W
R192	RD14BB2C272J	RES. CARBON 2.7K 5% 1/6W
R193	RD14BB2C122J	RES. CARBON 1.2K 5% 1/6W
R194	NO USE	
R195	RD14BB2C471J	RES. CARBON 470 5% 1/6W
R196	RN14BK2C6801F	RES. METAL FILM 6.8K 1% 1/6W
R197	RN14BK2C1501F	RES. METAL FILM 1.5K 1% 1/6W
R198	RN14BK2C1300F	RES. METAL FILM 130 1% 1/6W
R199	RD14BB2C272J	RES. CARBON 2.7K 5% 1/6W
R200	RD14BB2C911J	RES. CARBON 910 5% 1/6W
R201	RD14BB2C301J	RES. CARBON 300 5% 1/6W
R202	RD14BB2C301J	RES. CARBON 300 5% 1/6W
R203	RD14BB2C102J	RES. CARBON 1K 5% 1/6W
R204	RD14BB2C681J	RES. CARBON 680 5% 1/6W
R205	RD14BB2C681J	RES. CARBON 680 5% 1/6W
R206	RD14BB2C223J	RES. CARBON 22K 5% 1/6W
R207	RD14BB2C104J	RES. CARBON 100K 5% 1/6W
R208	RD14BB2C104J	RES. CARBON 100K 5% 1/6W
R209	RD14BB2C104J	RES. CARBON 100K 5% 1/6W
R210	RD14BB2C104J	RES. CARBON 100K 5% 1/6W
R211	RN14BK2C6801F	RES. METAL FILM 6.8K 1% 1/6W
R212	RN14BK2C1301F	RES. METAL FILM 1.3K 1% 1/6W
R213	RN14BK2C4700F	RES. METAL FILM 470 1% 1/6W
TC001	C05-0445-05	CAP. TRIMMER 20P
TC002	C05-0445-05	CAP. TRIMMER 20P
TC003	NO USE	
TC004	C05-0445-05	CAP. TRIMMER 20P
TH001	SOT100	THERMISTOR
TH002	NO USE	
TH003	SOT1000	THERMISTOR
TH004	SOT20	THERMISTOR
VR001	R12-1539-05	RES. SEMI FIXED 2KB
VR002	R12-0569-05	RES. SEMI FIXED 100B
VR003	R12-0571-05	RES. SEMI FIXED 500B
VR004	R12-1538-05	RES. SEMI FIXED 1KB
VR005	R12-0569-05	RES. SEMI FIXED 100B
VR006	R12-4416-05	RES. SEMI FIXED 50KB
VR007	R12-0570-05	RES. SEMI FIXED 200B
VR008	R12-0569-05	RES. SEMI FIXED 100B
VR009	R12-0569-05	RES. SEMI FIXED 100B
VR010	R12-1538-05	RES. SEMI FIXED 1KB
VR011	R12-0571-05	RES. SEMI FIXED 500B

# SCHEMATIC DIAGRAM

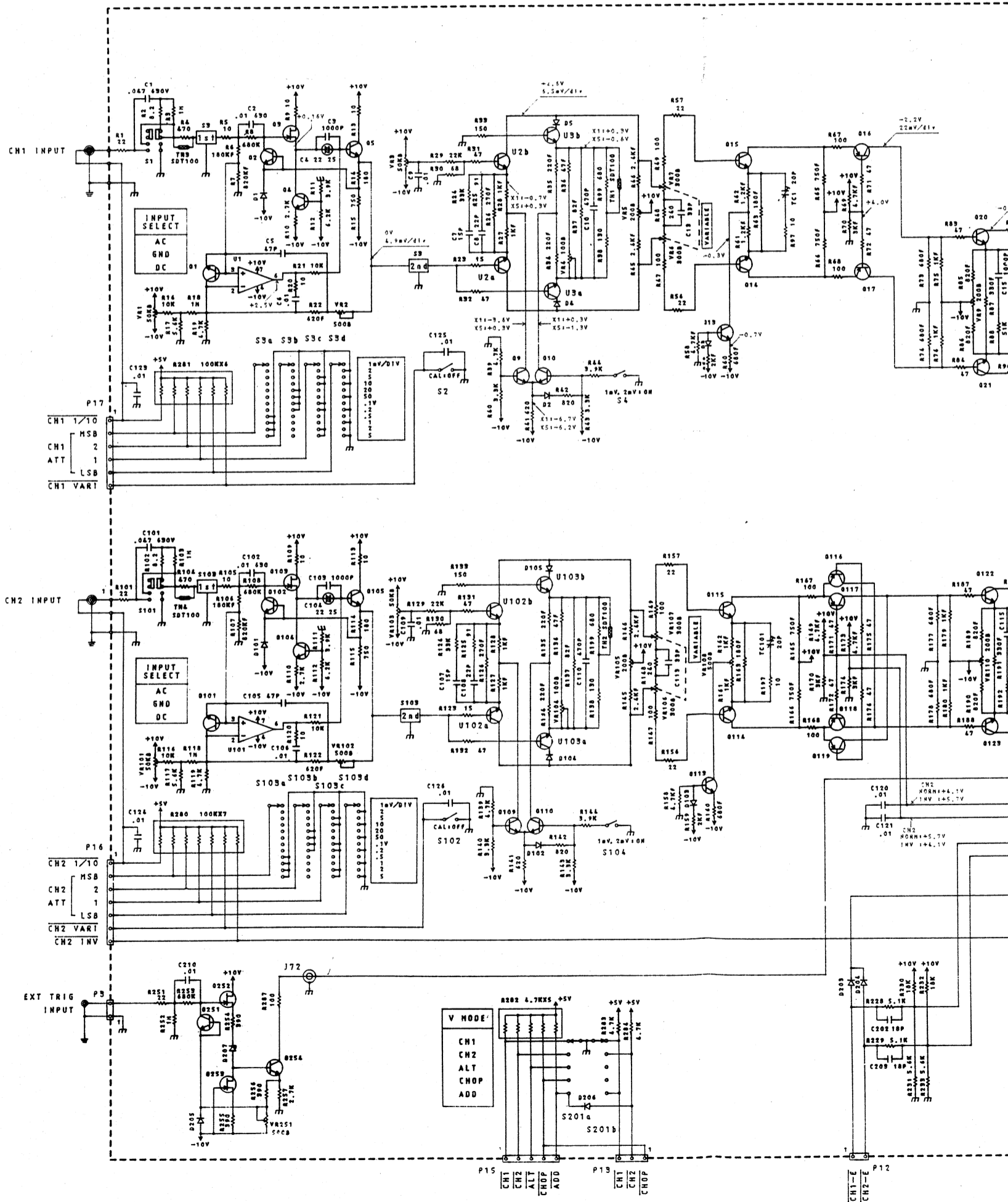


# SCHEMATIC DIAGRAM

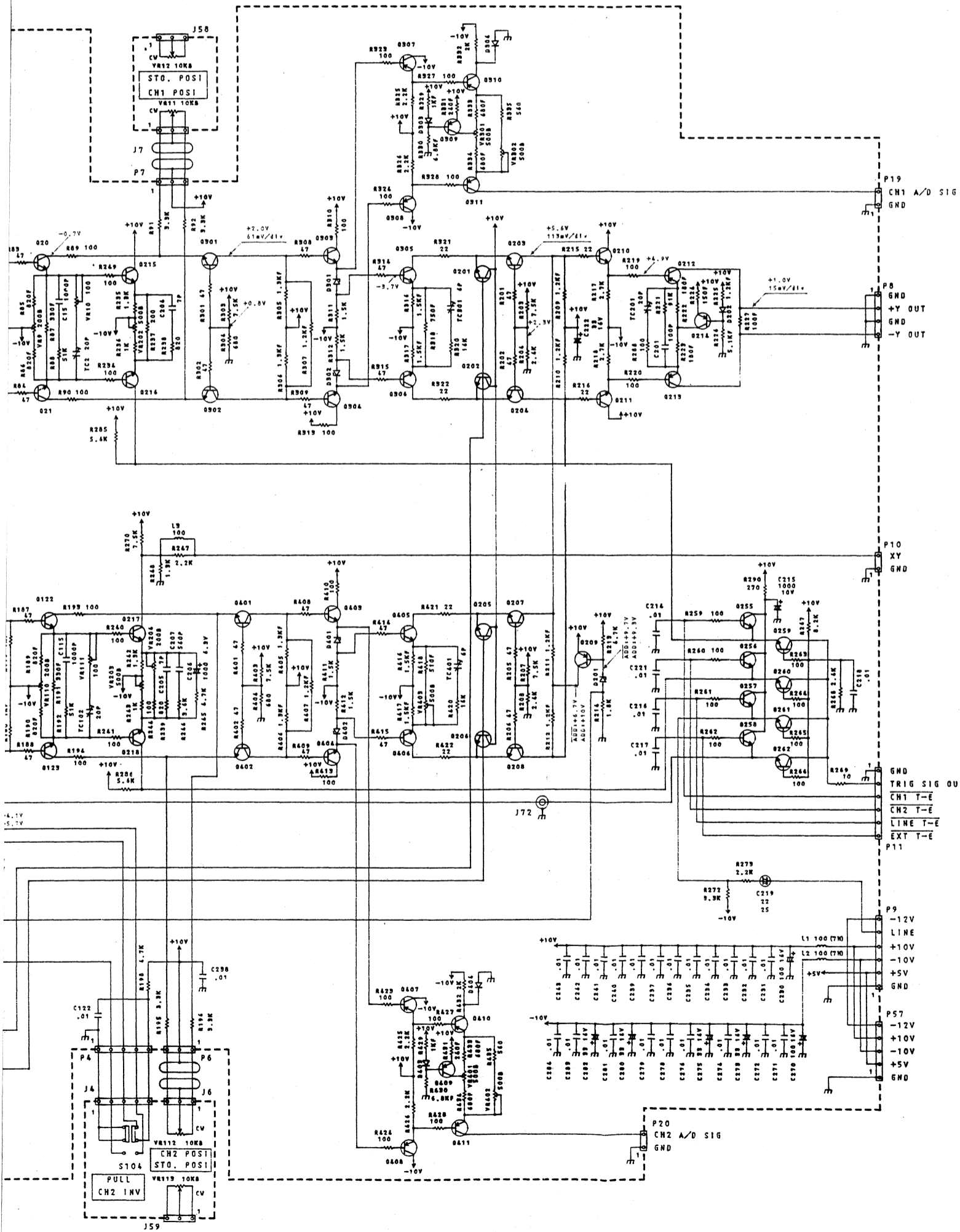
## POWER SUPPLY UNIT (X68-1480-00)



V. PRE UNIT (X73-1740-00)



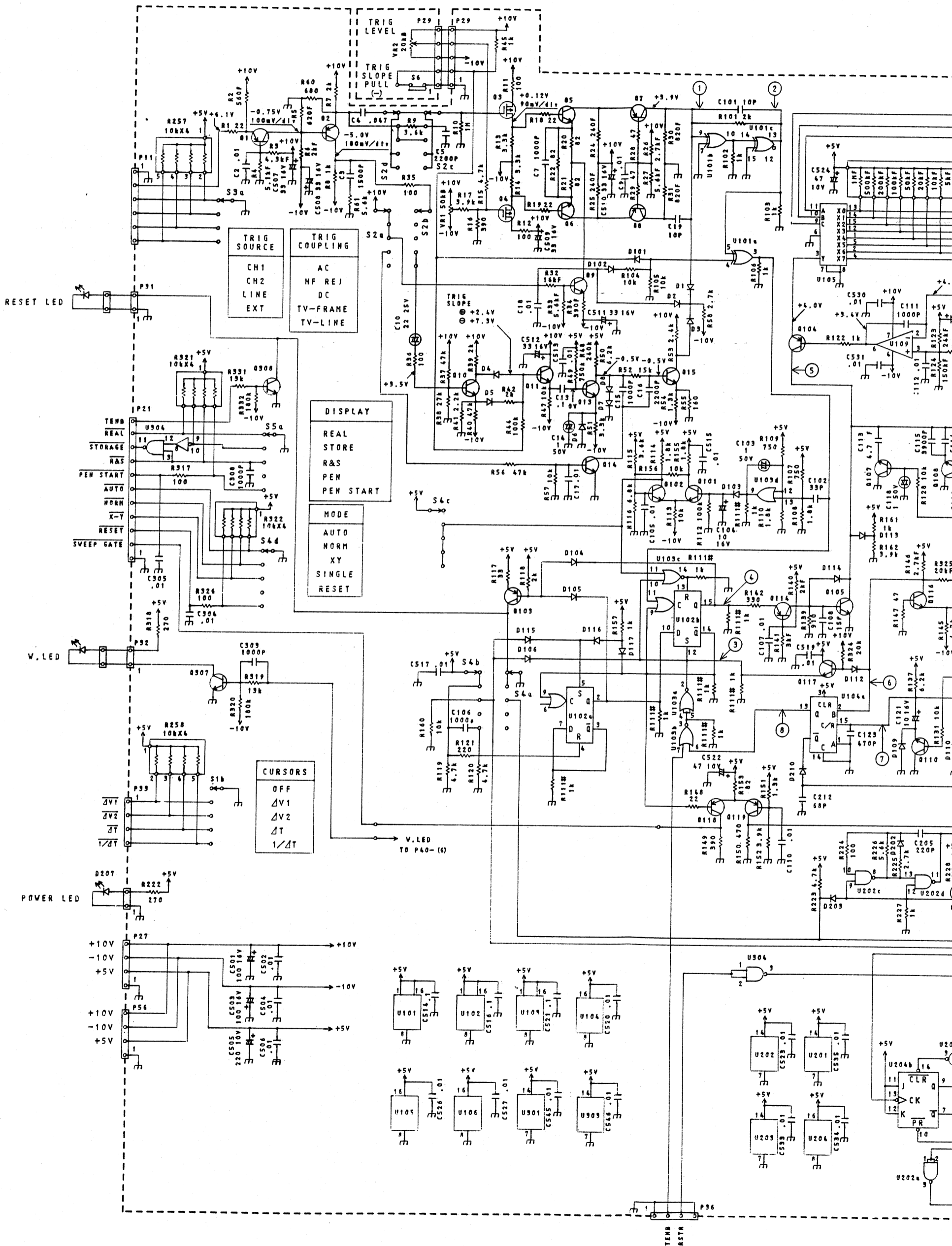
# CHEMATIC DIAGRAM



U 1, 101	: LF411CN
U 2, 102	: 2SC9066 (G, M)
U 3, 103	: 2SC3981 (GR)
Q 1, 2, 4, 5, 9, 10, 13, 20, 21, 101, 102, 104, 105, 109, 110, 113, 122, 123, 210, 211, 215, 216, 217, 218, 251, 254, 259, 260, 261, 262, 301, 302, 401, 402	: 2SC3954 (S, T)
Q 3, 103, 252, 253	: 2SK304 (E)
Q 6, 7, 14, 15, 106, 107, 114, 115, 203, 204, 207, 208, 303, 304, 305, 306, 403, 404, 405, 406	: 2SC3915 (C, D)
Q 16, 17, 116, 117, 118, 119, 209, 212, 213, 214	: 2SA1005 (M)
Q 201, 202, 205, 206, 255, 256, 257, 258	: 2SC2785 (F)
Q 307, 308, 309, 310, 311, 407, 408, 409, 410, 411	: 2SA1175 (F)
D 1, 2, 3, 101, 102, 103, 202, 203, 204, 205, 206, 303, 304, 403, 404	: 1SS192
D 4, 5, 104, 105	: HA7C0
D 201	: HT27.5JC
D 207	: HT26.2JB
D 301, 302, 401, 402	: HT25.1JB

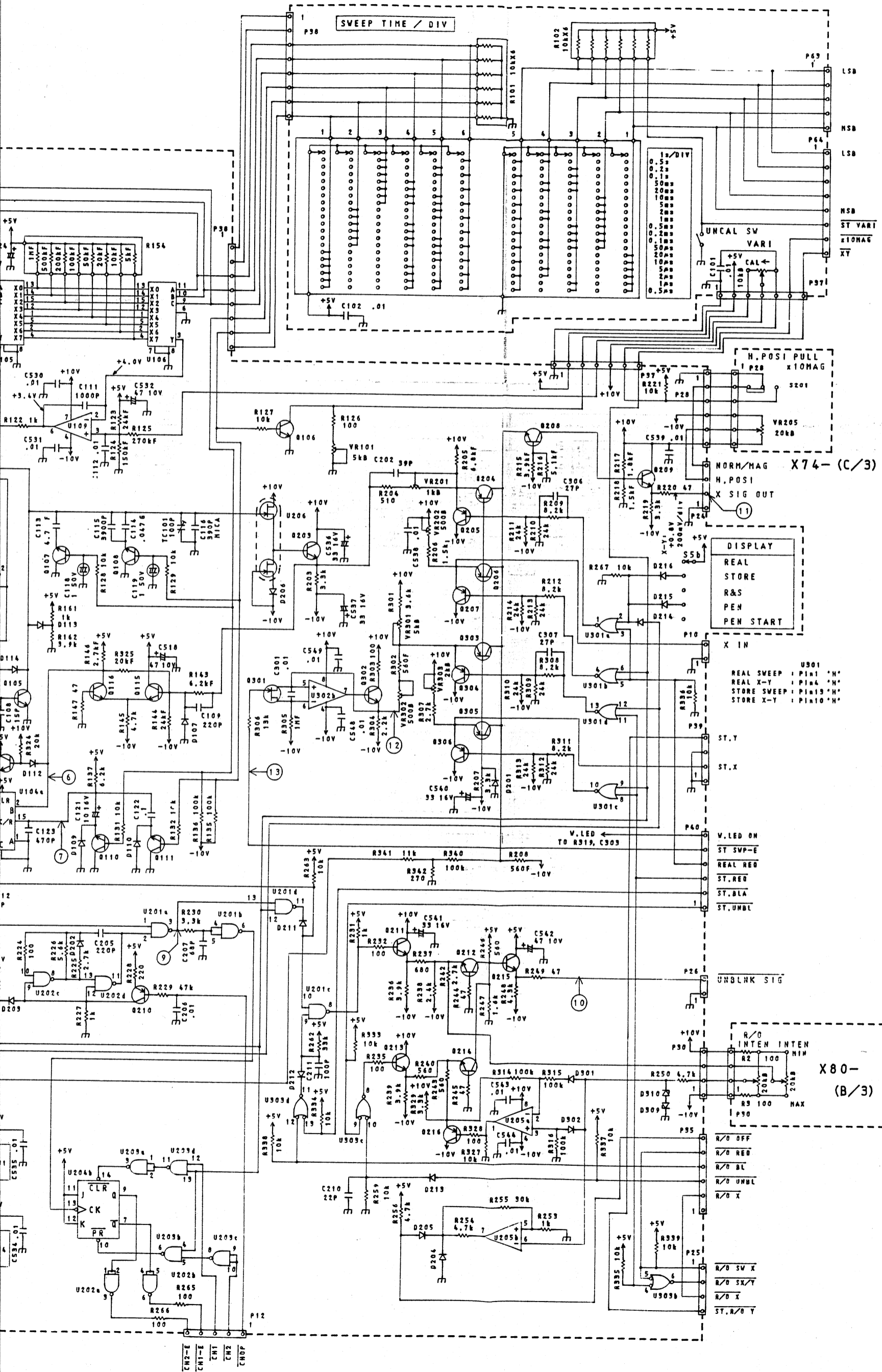
SWEEP UNIT (X74-1460-00-A/3)

X74- (B/3)



# SCHEMATIC DIAGRAM

## SWEEP ROTARY (X77-1450-01-B/2)

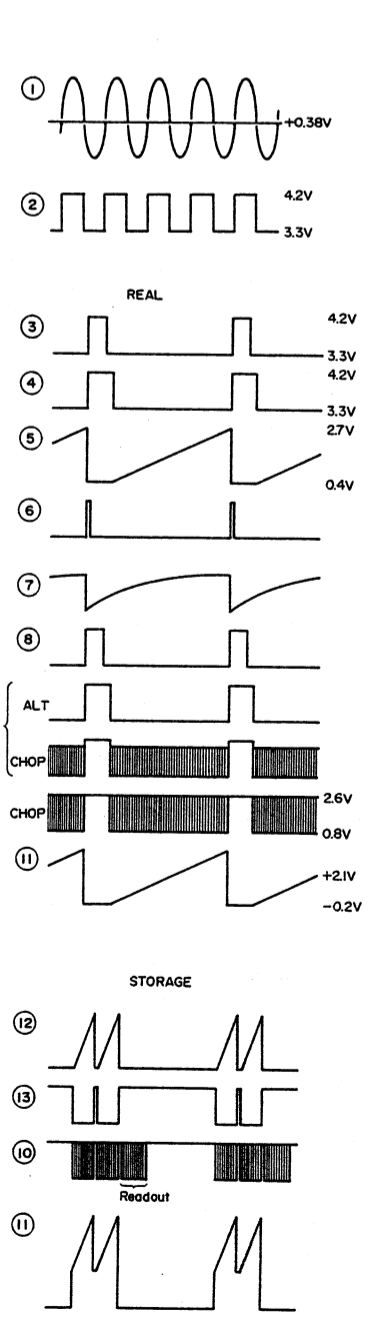


- U101 : MC10107L
- U102 : MC10131L
- U103 : MC10102L
- U104 : TC74HC123P
- U105, 106 : MC14051BCP
- U109 : TL071CP
- U201 : SN74ALS00AN
- U202, 203, 304 : HD74HC00P
- U204 : HD74HC112P
- U205, 302 : NJM4558D
- U206 : 2SK332 (F)
- U301 : HD74HC02P
- U303 : HD74HC08P

- Q1, 2, 7, 8, 104, 118, 119 : 2SA1005 (K)
- Q3, 4 : 2SK241 (Y)
- Q5, 6, 113, 203 : 2SC3354 (S, T)
- Q9, 10, 11, 12, 13, 14, 15, 101, 102, 106, 110, 111, 112, 115, 116, 117, 208, 209, 211, 213, 302, 307 : 2SA1175 (F)
- Q103, 114, 204, 205, 206, 207, 210, 303, 304, 305, 306 : 2SC2786 (K)
- Q105, 107, 108, 109, 212, 214, 215 : 2SK117 (Y)
- Q301 : 2SK117 (Y)

- D1, 2, 3, 4, 5, 6 : 1SS132
- 7, 8, 101, 102, 103, 104, 105, 106, 107, 108, 109, 110, 111, 201, 202, 203, 204, 205, 213, 214, 215, 216, 301, 302, 303 : HA707
- D113, 114, 206, 212 : INTZ5.1JB
- D309, 310 : INTZ5.1JB

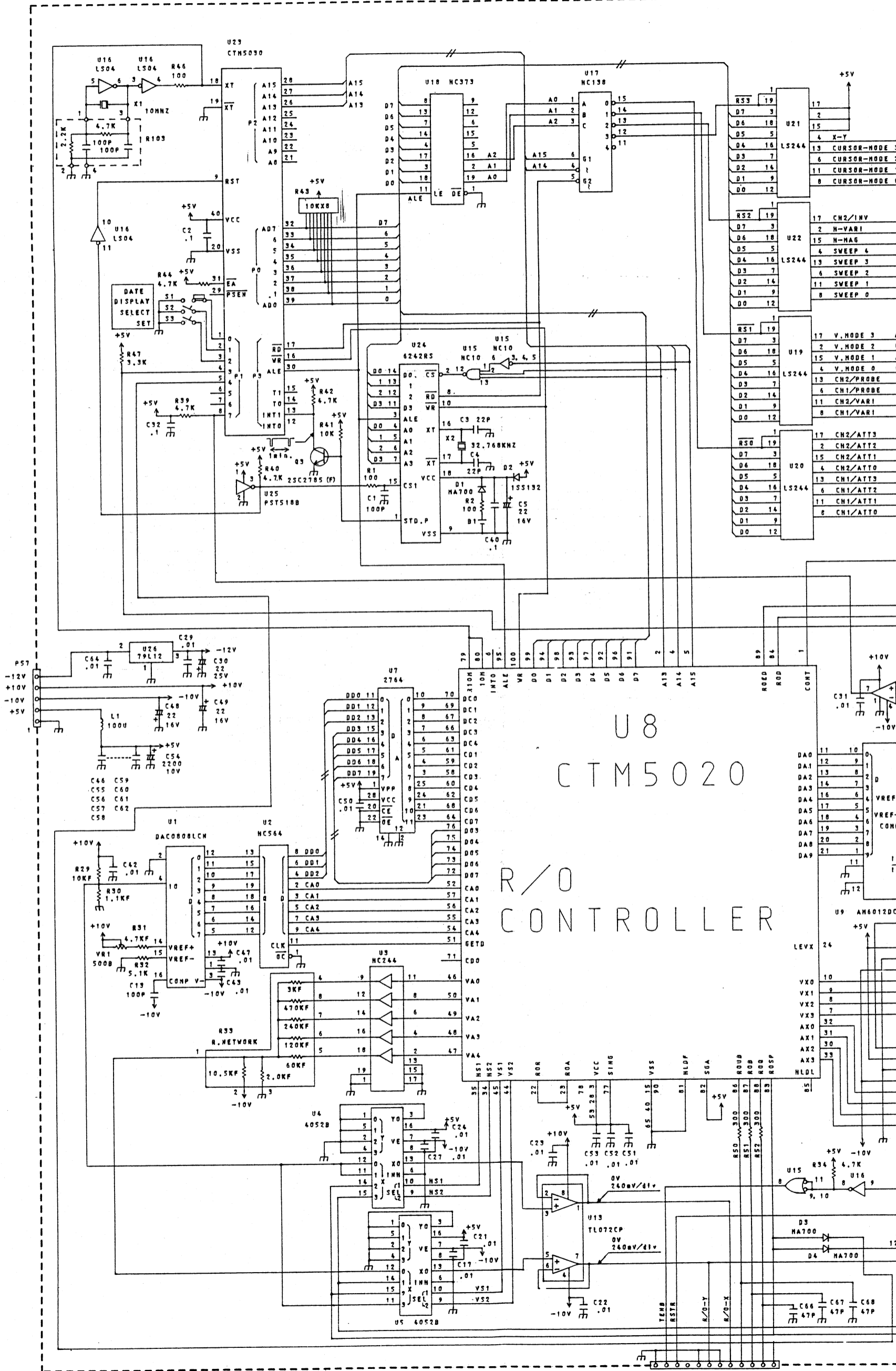
- R111# : 1kx8



ST. Y  
ST. X  
V. LED ON  
ST SWP-E  
REAL RED  
ST. RED  
ST. BLA  
ST. UNBL  
UNBLK SIG  
R/O OFF  
R/O RED  
R/O BL  
R/O UNBL  
R/O X  
R/O SW X  
R/O SX/Y  
R/O X  
ST. R/O Y

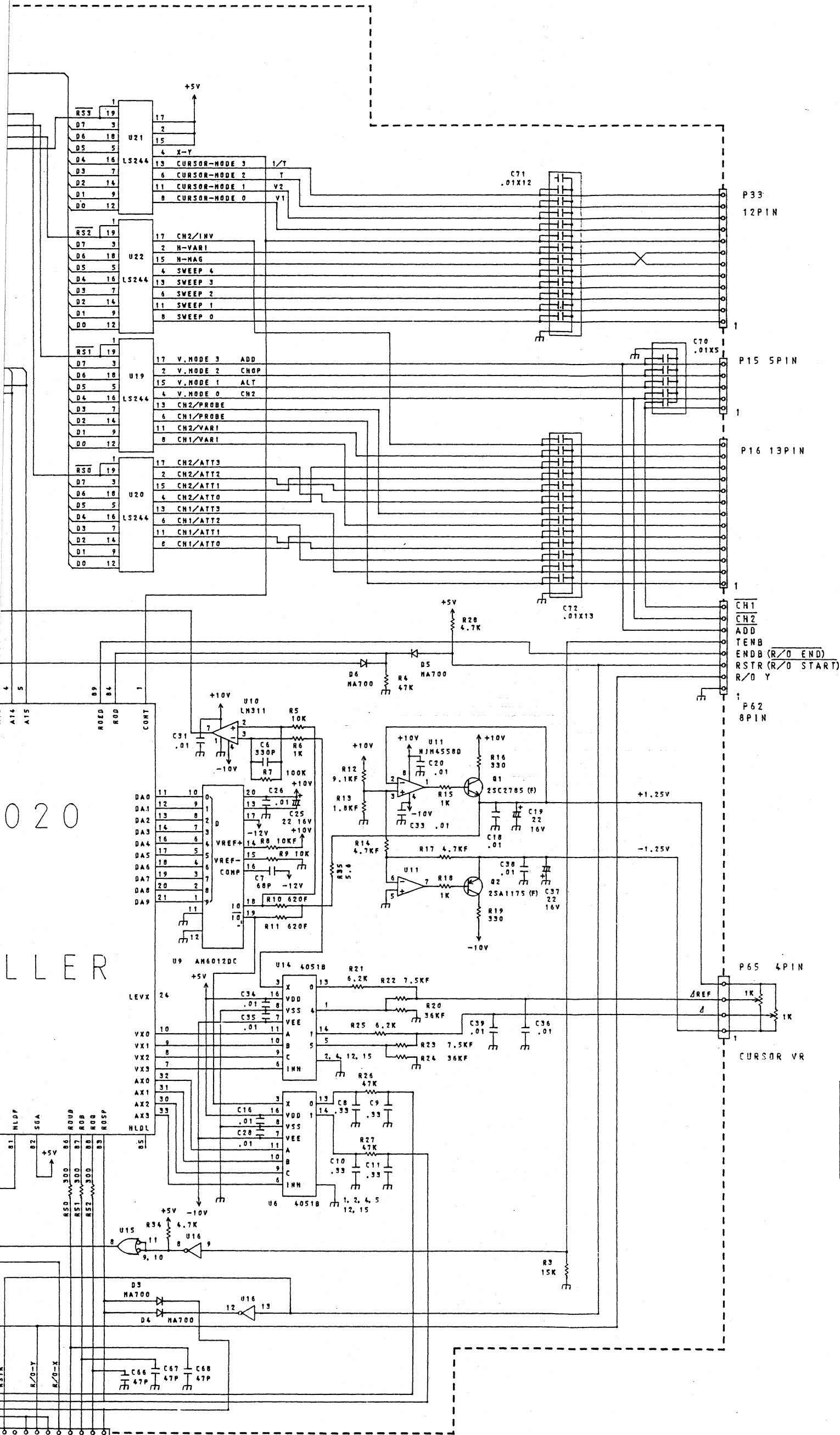
# SCHEMATIC DIAGRAM

R/O UNIT (X77-1450-01-A/2)





# SCHEMATIC DIAGRAM

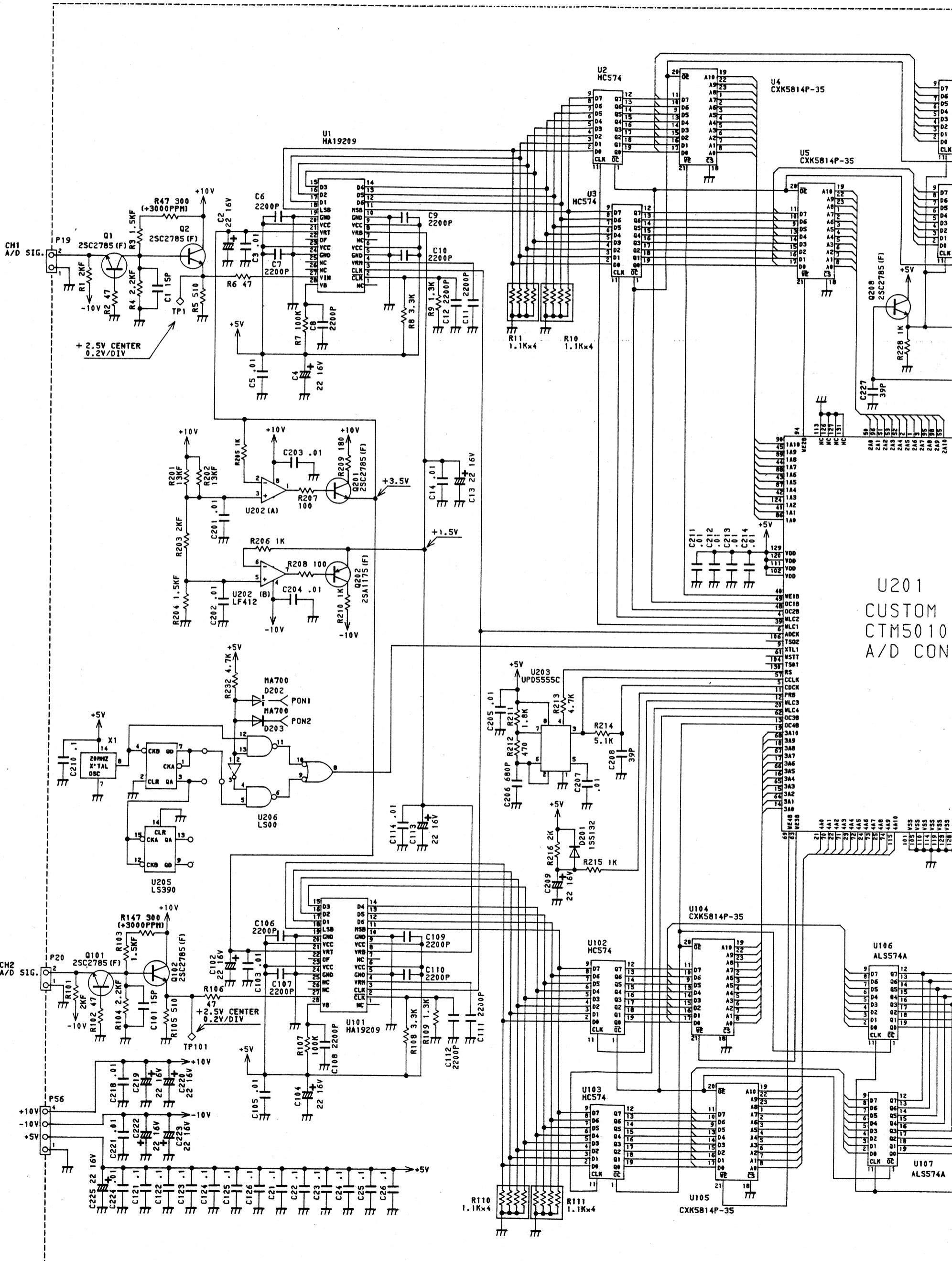


- |                 |               |
|-----------------|---------------|
| U1              | : DAC0808LCN  |
| U2              | : HD74HC564P  |
| U3              | : SN74HC244N  |
| U4, 5           | : HD14052BP   |
| U6, 14          | : HD14051BP   |
| U7              | : MBM2764XS   |
| U8              | : CTH5020     |
| U9              | : AM6012DC    |
| U10             | : LH311       |
| U11             | : NJM4558D    |
| U15             | : HD74HC10P   |
| U16             | : SN74LS04N   |
| U17             | : HD74HC138P  |
| U18             | : HD74HC373P  |
| U23             | : CTH5030     |
| U24             | : MSM6242RS   |
| U25             | : PST518B     |
| U26             | : TA79L012P   |
| U19, 20, 21, 22 | : HD74LS244P  |
| U13             | : TL072CP     |
| Q1, 3           | : 2SC2785 (F) |
| Q2              | : 2SA1175 (F) |
| D1, 3, 4, 5, 6  | : HA700       |
| D2              | : 1SS132      |
| R101            | : CR NETWORK  |

\* NOTE  
C71, C72 & C73 IS  
CAPACITANCE NETWORK

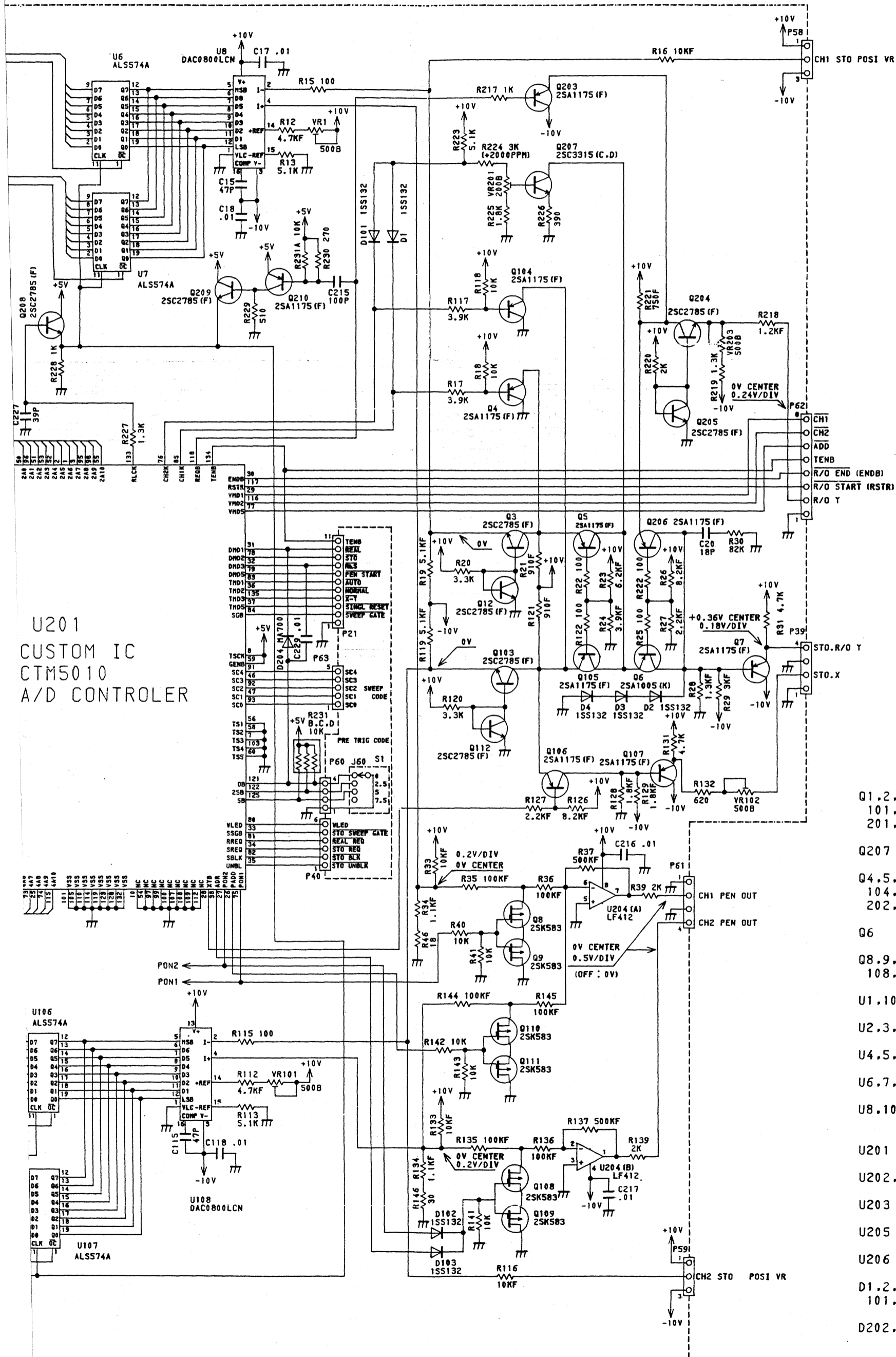
020  
LLER

A/D UNIT (X78-1030-00)



U201  
CUSTOM  
CTM5010  
A/D CON

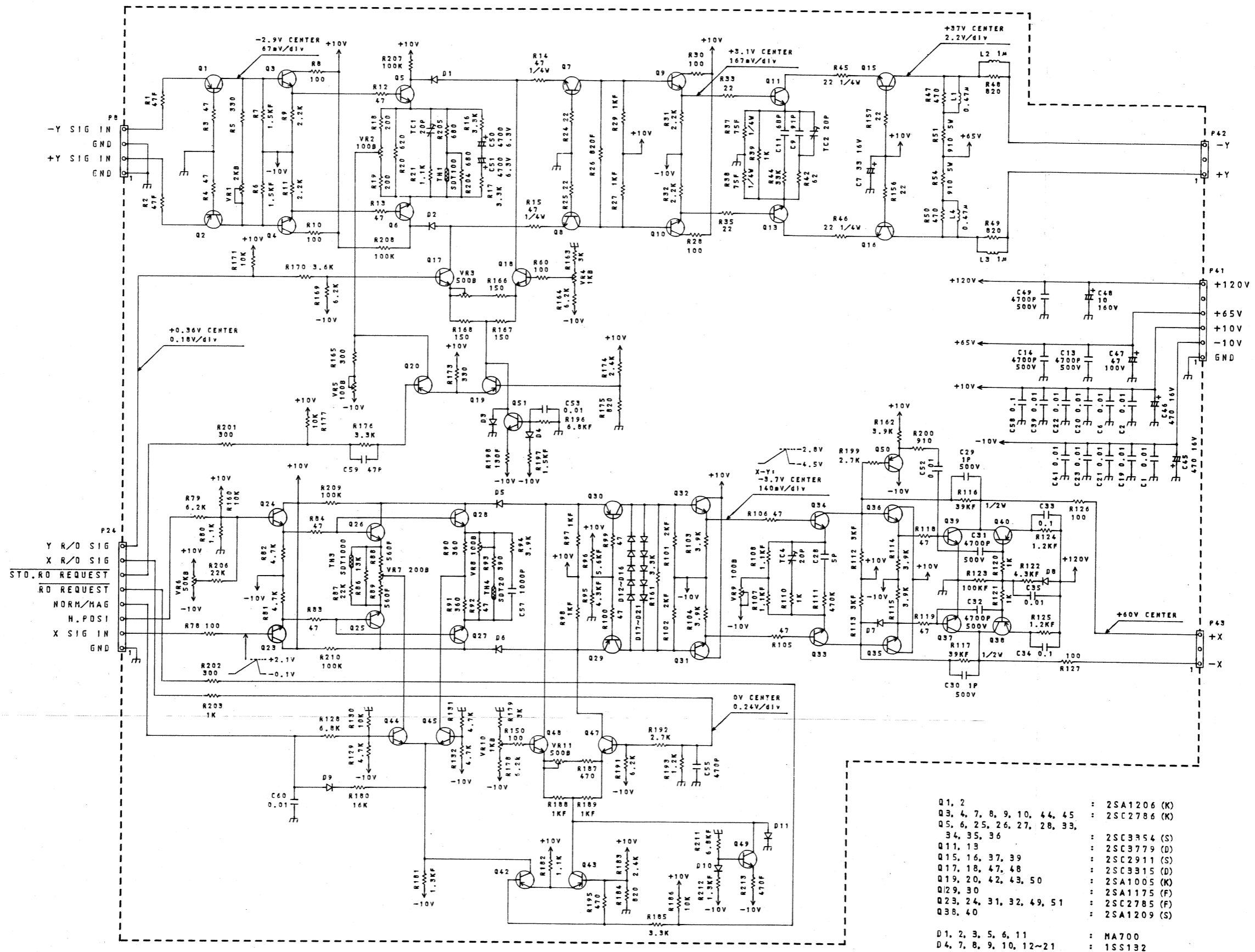
# SCHEMATIC DIAGRAM



- Q1.2.3.12. : 2SC2785 (F)  
101.102.103.112.  
201.204.205.209
- Q207 : 2SC3315 (C.D)
- Q4.5.7. : 2SA1175 (F)  
104.105.106.107.  
202.203.206.210
- Q6 : 2SA1005 (K)
- Q8.9. : 2SK583  
108.109.110.111
- U1.101 : HA19209TP
- U2.3.102.103 : HD74HC574P
- U4.5.104.105 : CXK5814P-35
- U6.7.106.107 : SN74ALS574AN
- U8.108 : DAC0800LCN OR  
UPC624C
- U201 : CTM5010
- U202.204 : LF412CN
- U203 : UPD5555C
- U205 : SN74LS390N
- U206 : HD74LS00FP
- D1.2.3.4. : 1SS132  
101.102.103.201
- D202.203.204 : MA700

# SCHEMATIC DIAGRAM

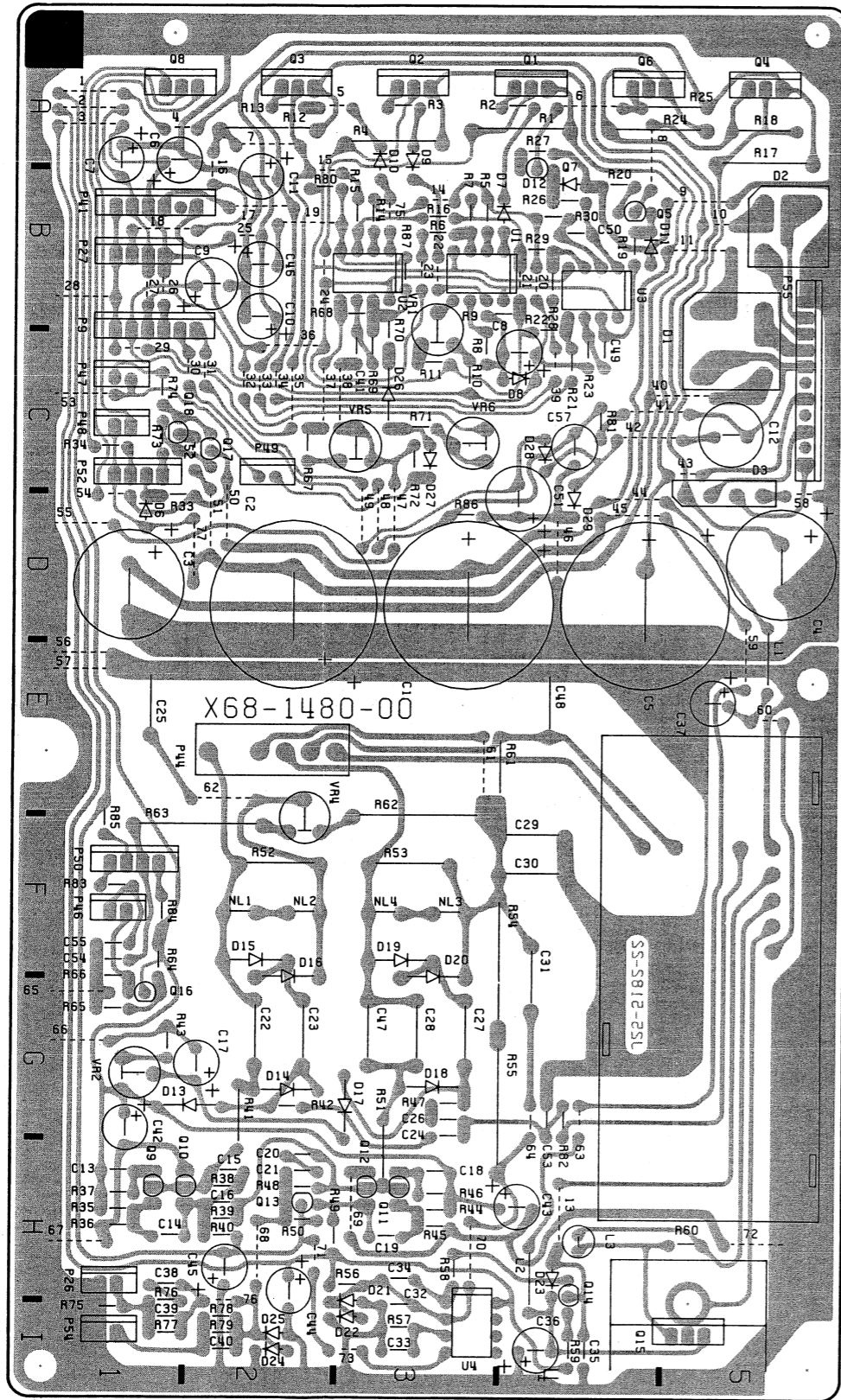
## FINAL UNIT (X80-1090-01)



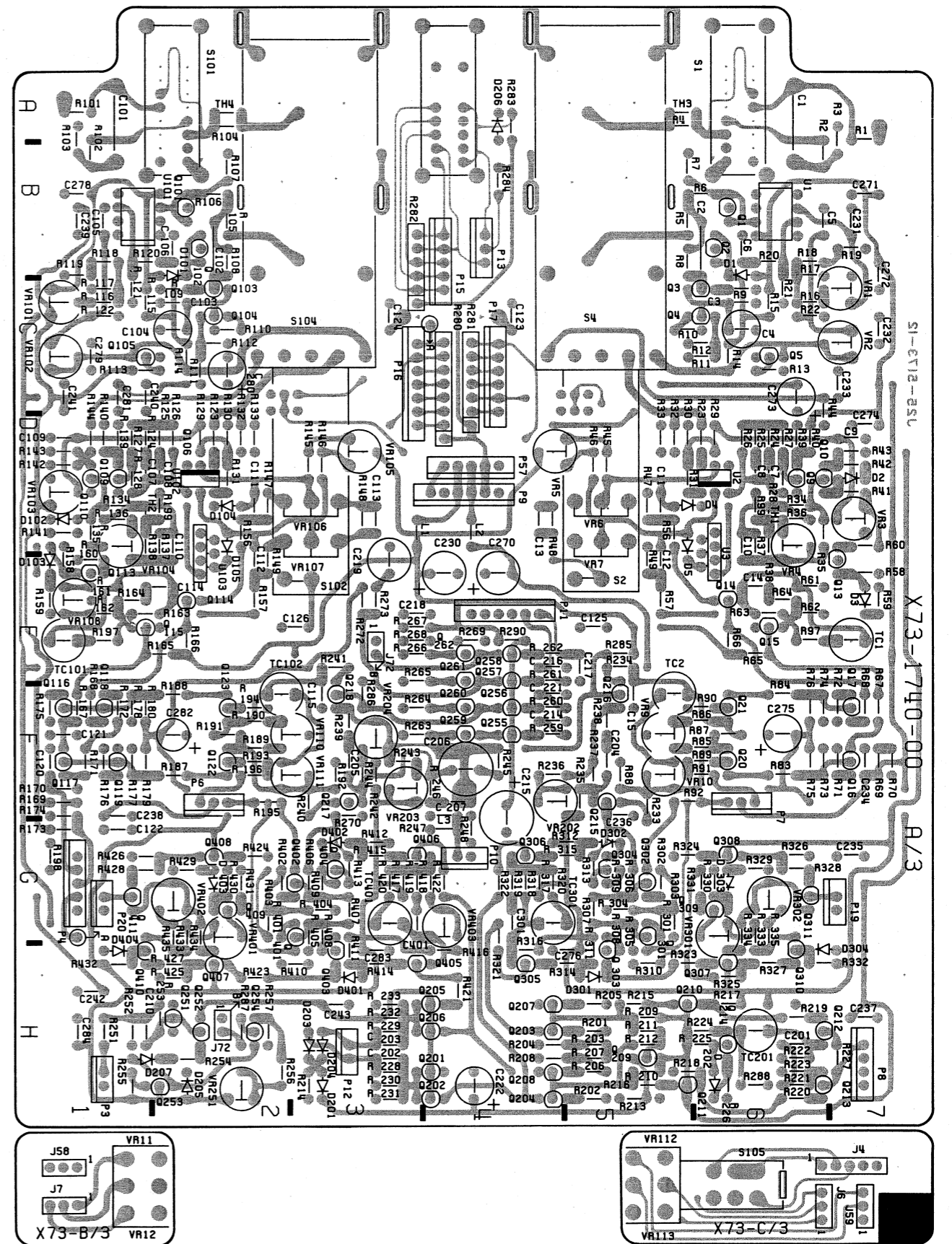
- |  |               |
|--|---------------|
| Q1, 2                                    | : 2SA1206 (K) |
| Q3, 4, 7, 8, 9, 10, 44, 45               | : 2SC2786 (K) |
| Q5, 6, 25, 26, 27, 28, 33,<br>34, 35, 36 | : 2SC3954 (S) |
| Q11, 13                                  | : 2SC3779 (D) |
| Q15, 16, 37, 39                          | : 2SC2911 (S) |
| Q17, 18, 47, 48                          | : 2SC3315 (D) |
| Q19, 20, 42, 43, 50                      | : 2SA1005 (K) |
| Q29, 30                                  | : 2SA1175 (F) |
| Q23, 24, 31, 32, 49, 51                  | : 2SC2785 (F) |
| Q38, 40                                  | : 2SA1209 (S) |
|  |               |
| D1, 2, 3, 5, 6, 11                       | : MA700       |
| D4, 7, 8, 9, 10, 12~21                   | : 1SS132      |

# P.C. BOARD

POWER SUPPLY UNIT (X68-1480-00)

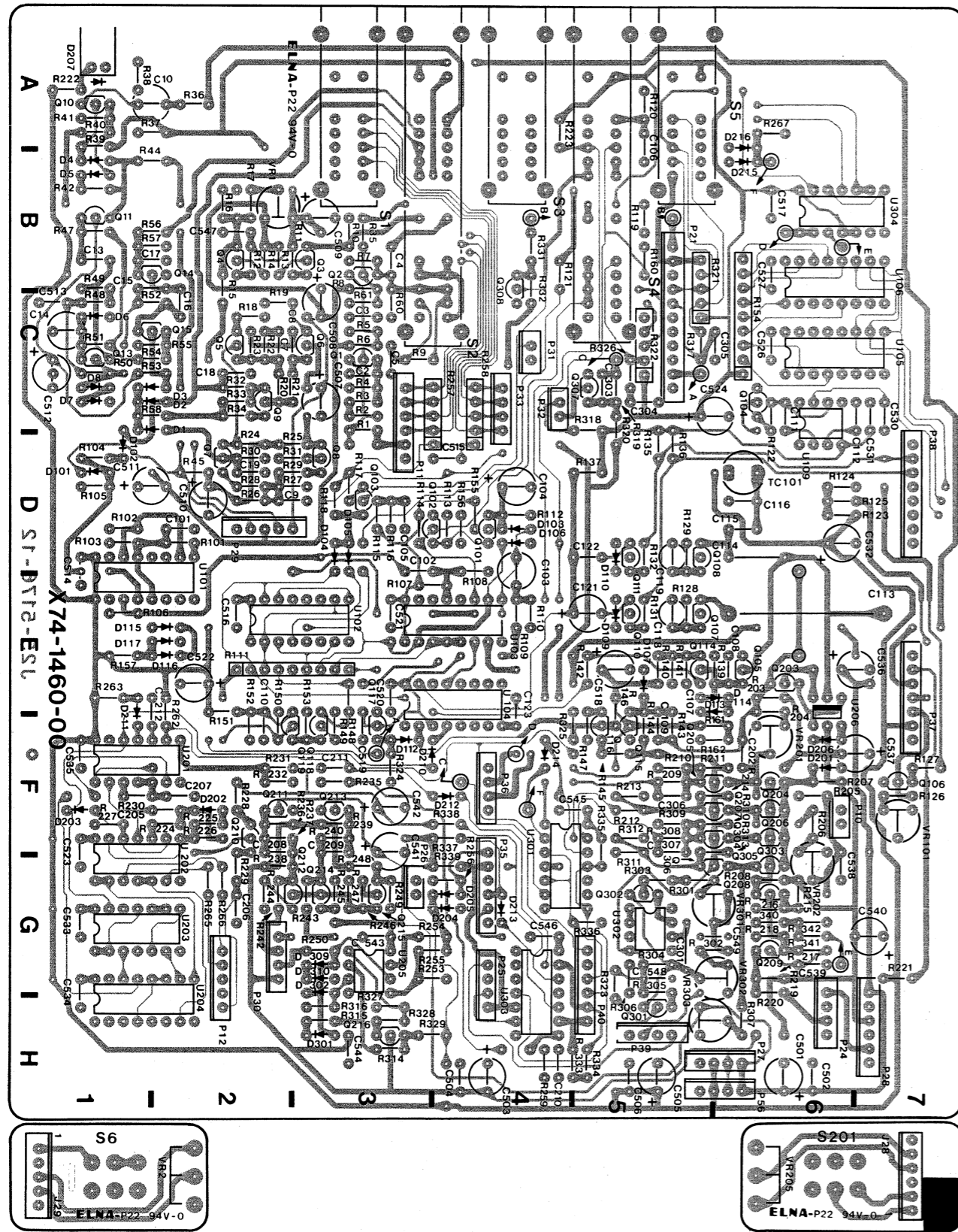


V. PRE UNIT (X73-1740-00)



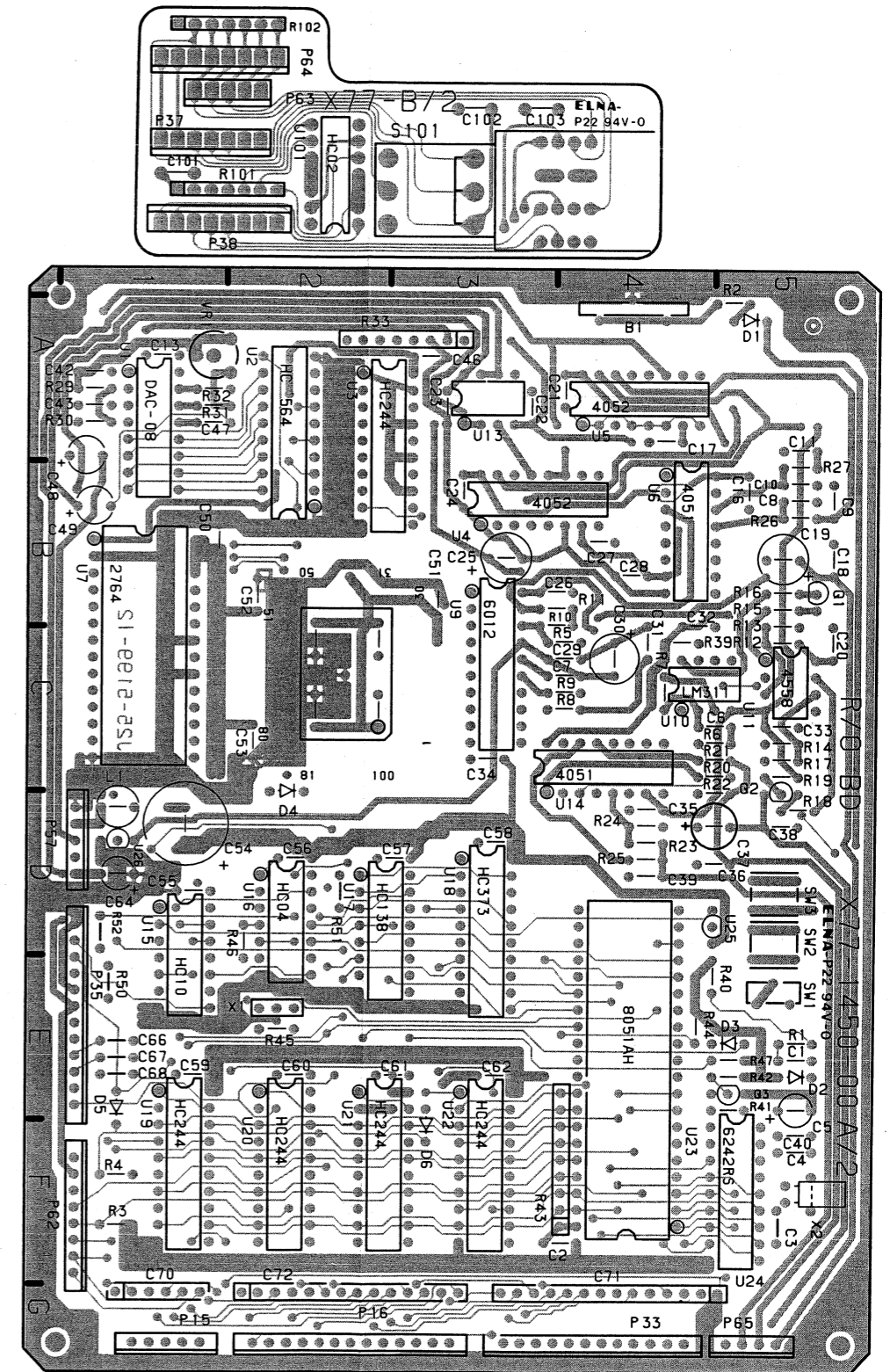
# P.C. BOARD

SWEEP UNIT (X74-1460-00)



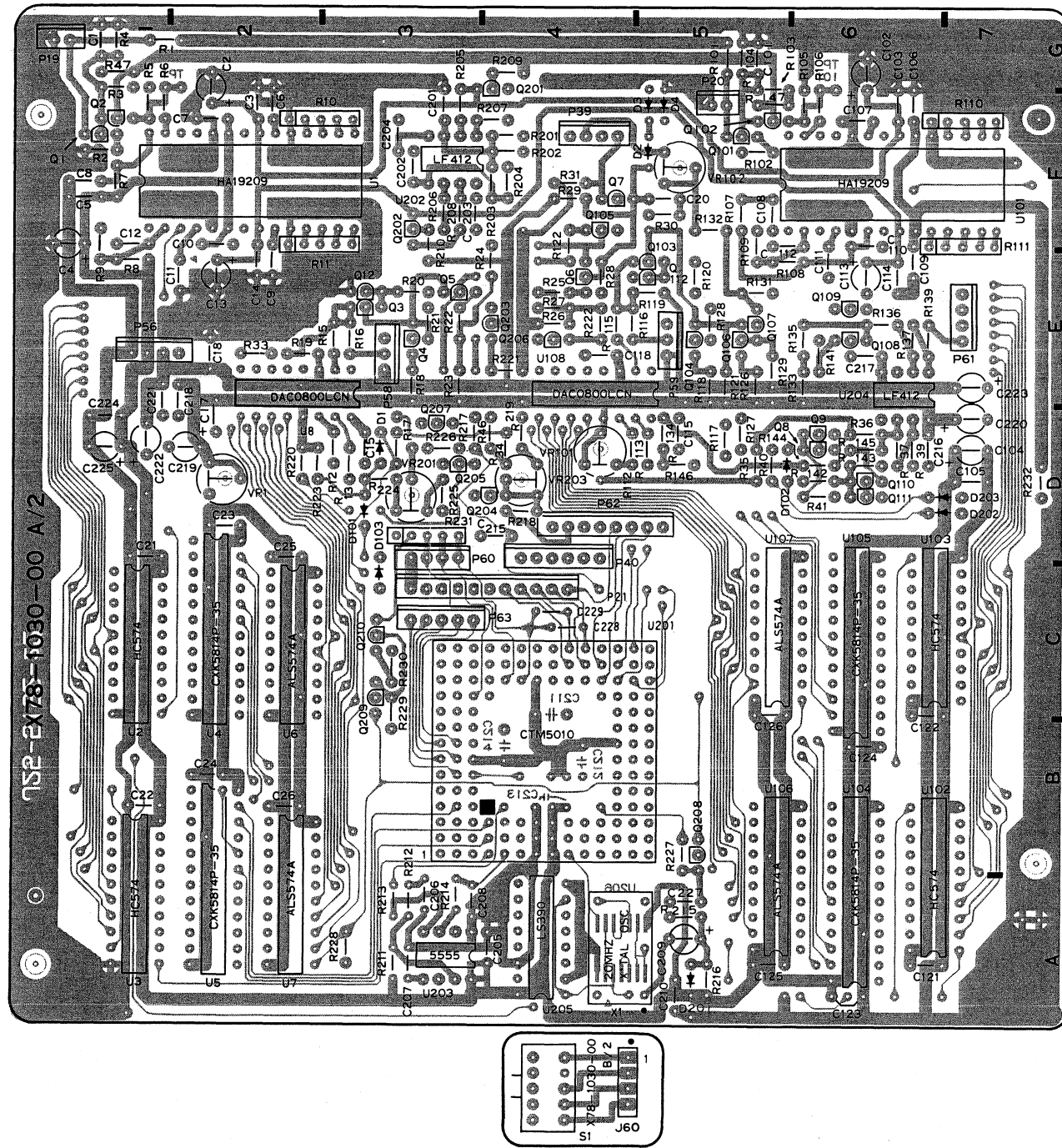
# P.C. BOARD

R/O UNIT (X77-1450-01)



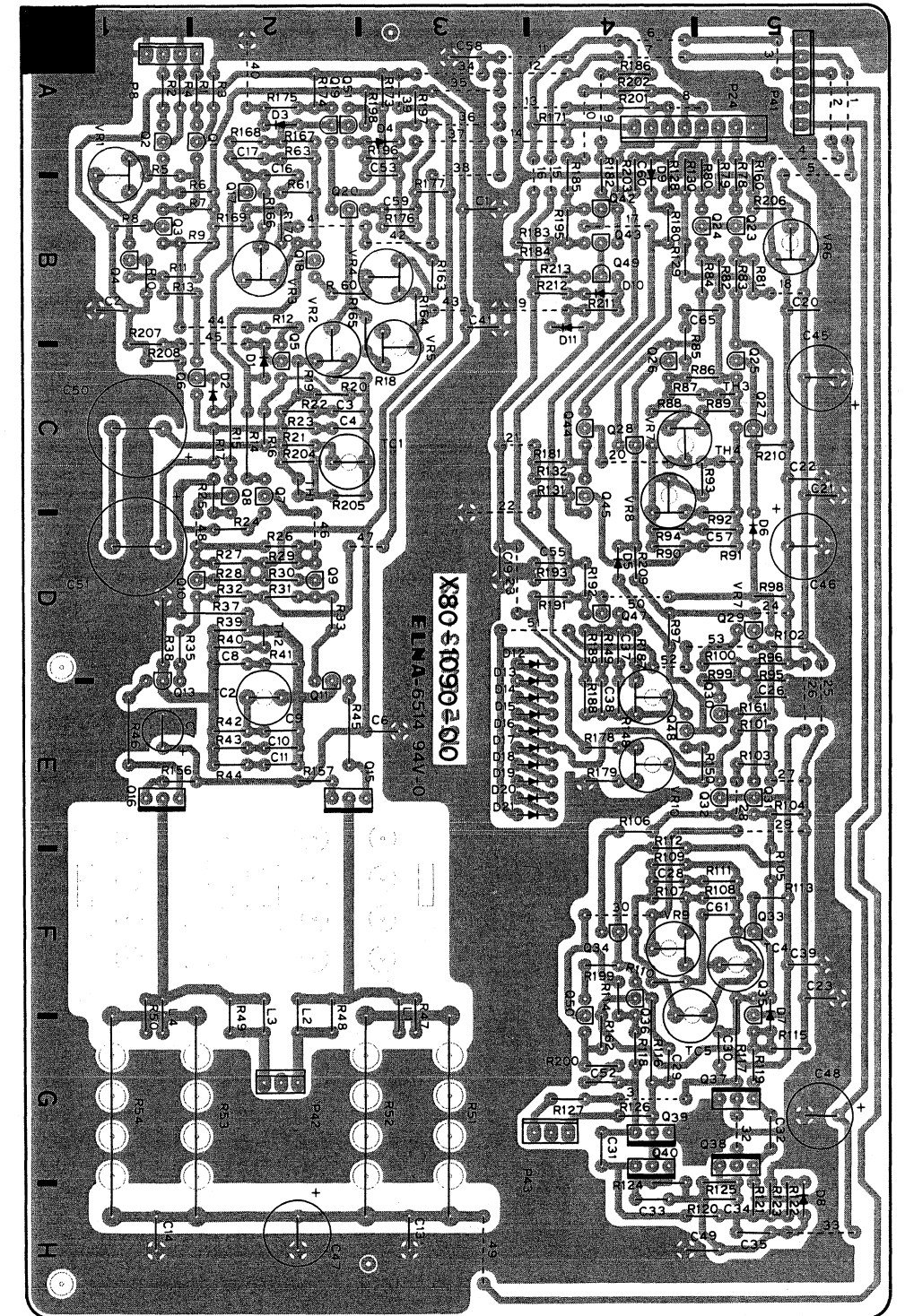
# P.C. BOARD

A/D UNIT (X78-1030-00)



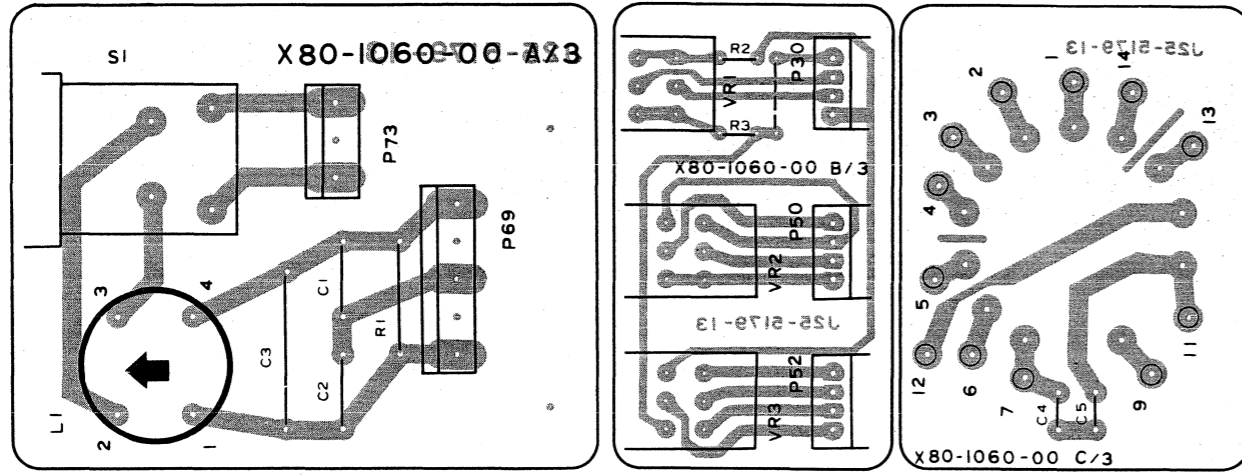
# P.C. BOARD

FINAL UNIT (X80-1090-01)



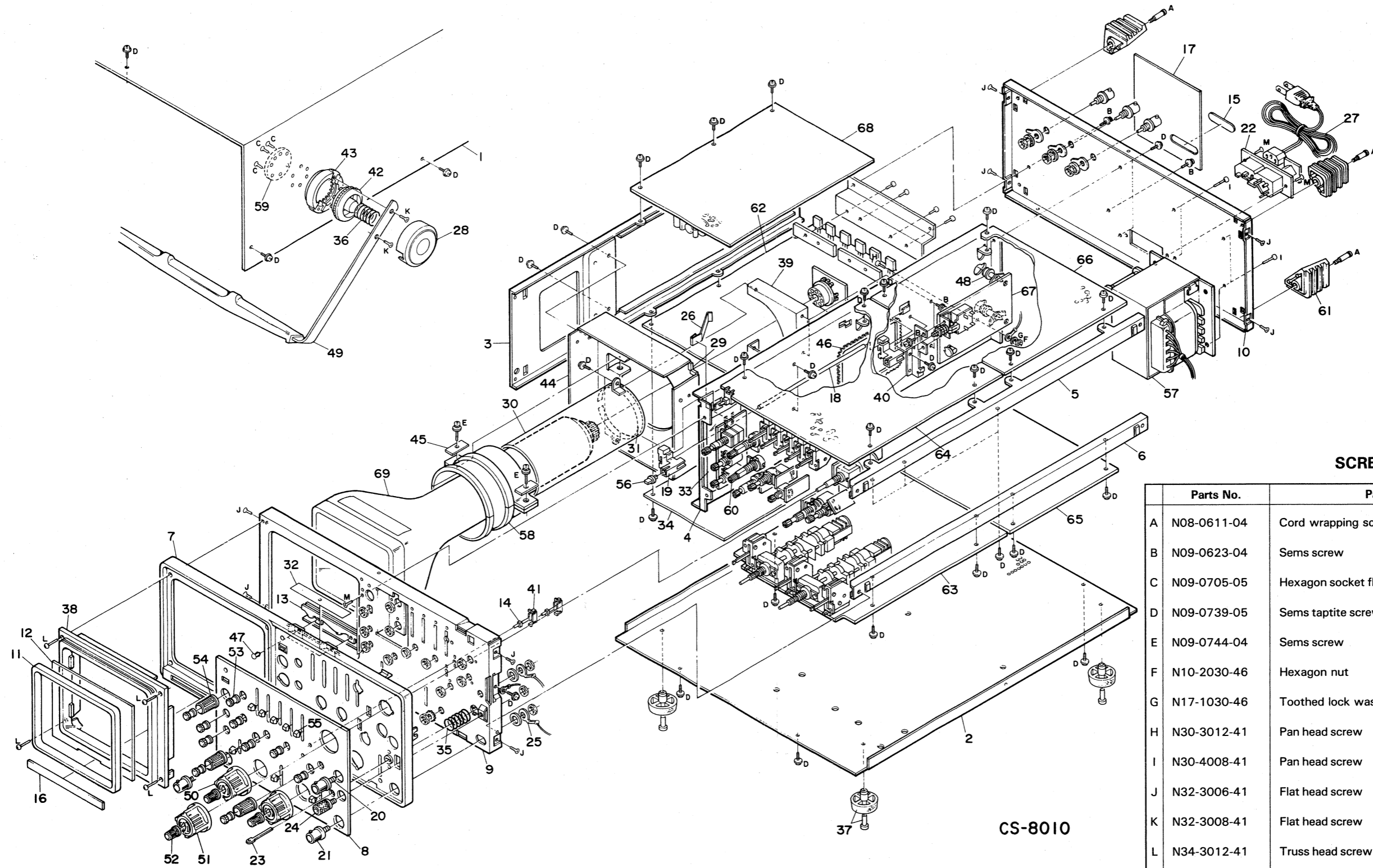
# P.C. BOARD

LINE FILTER UNIT (X80-1060-01)


















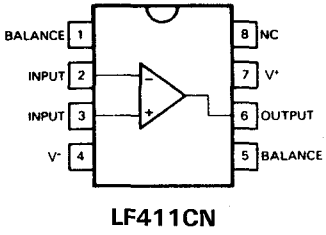
# DISASSEMBLY



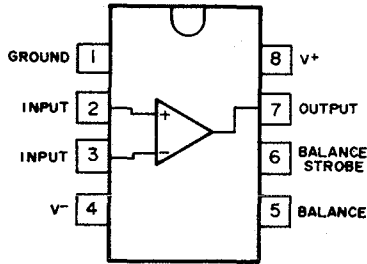
## SCREWS

Parts No.	Parts Name	Figure
A N08-0611-04	Cord wrapping screw	
B N09-0623-04	Sems screw (M3 × 8)	
C N09-0705-05	Hexagon socket flat head screw (M4 × 8)	
D N09-0739-05	Sems taptite screw (M3 × 8)	
E N09-0744-04	Sems screw (M3 × 12)	
F N10-2030-46	Hexagon nut	
G N17-1030-46	Toothed lock washer	
H N30-3012-41	Pan head screw (M3 × 12)	
I N30-4008-41	Pan head screw (M4 × 8)	
J N32-3006-41	Flat head screw (M3 × 6)	
K N32-3008-41	Flat head screw (M3 × 8)	
L N34-3012-41	Truss head screw (M3 × 12)	
M N88-3008-41	Flat head taptite screw (M3 × 8)	

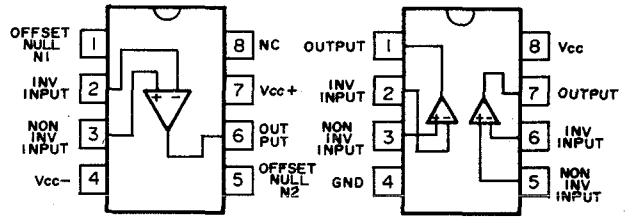
# SEMICONDUCTORS



LF411CN

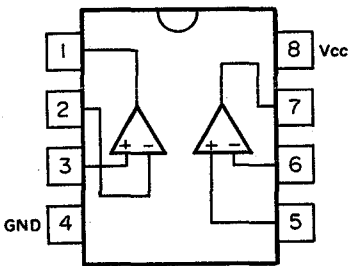


LM311N

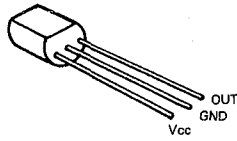


TL071CP

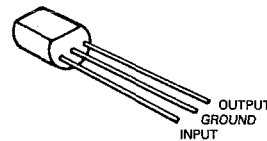
TL072CP



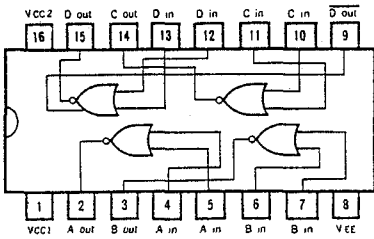
LF412CN  
NJM4558D



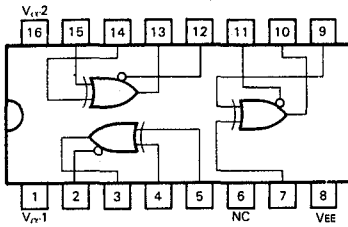
PST518B



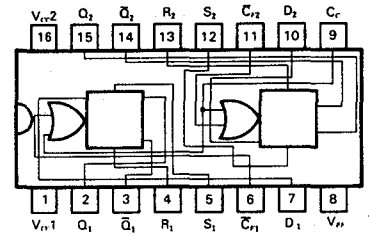
TA79L012P



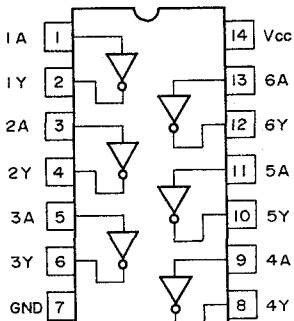
MC10102L



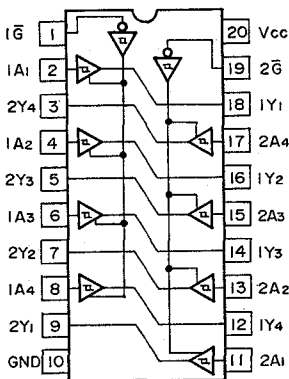
MC10107L



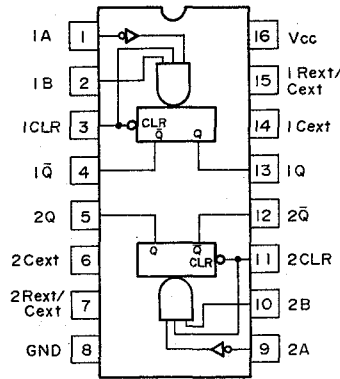
MC10131L



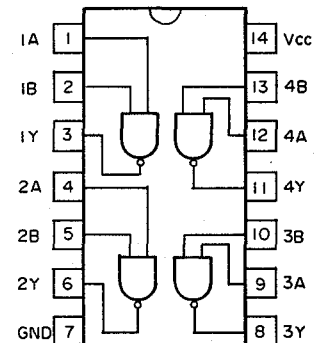
SN74LS04N



SN74LS244N

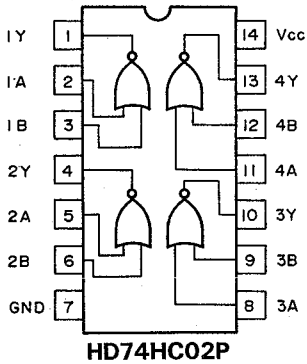


TC74HC123P

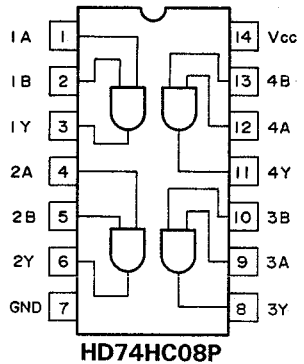


HD74HC00P  
HD74LS00FP  
SN74ALS00AN

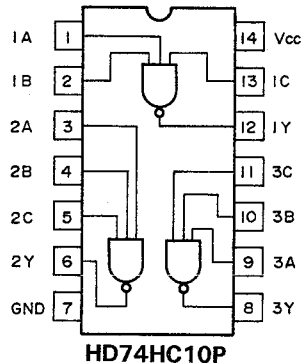
# SEMICONDUCTORS



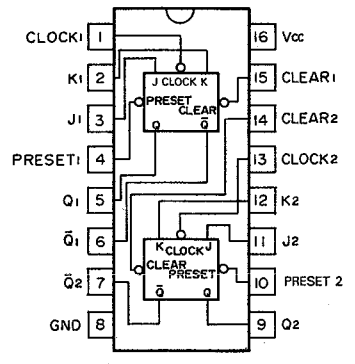
**HD74HC02P**



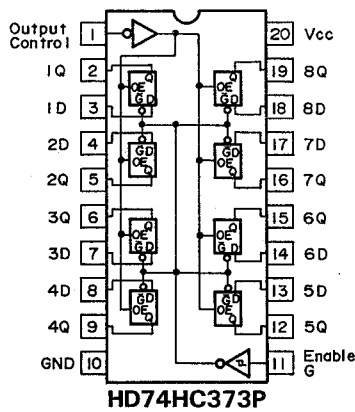
**HD74HC08P**



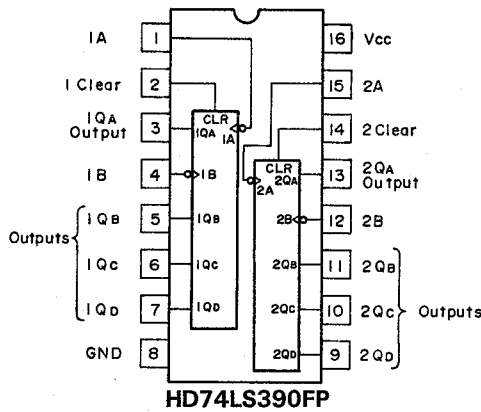
**HD74HC10P**



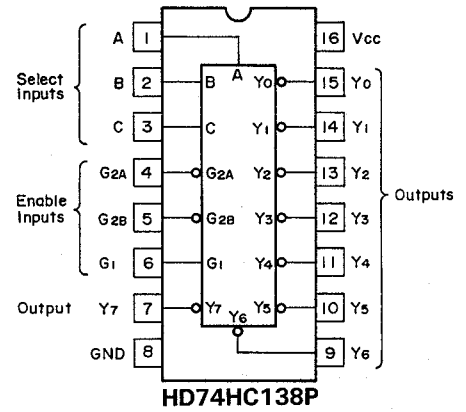
**HD74HC112P**



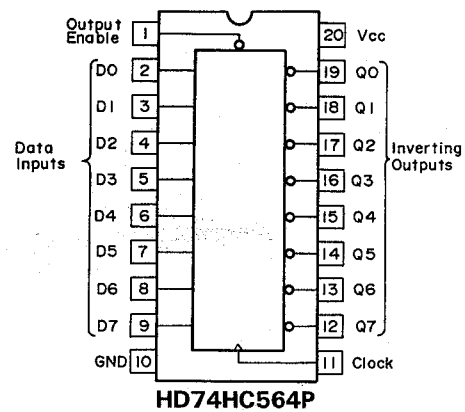
**HD74HC373P**



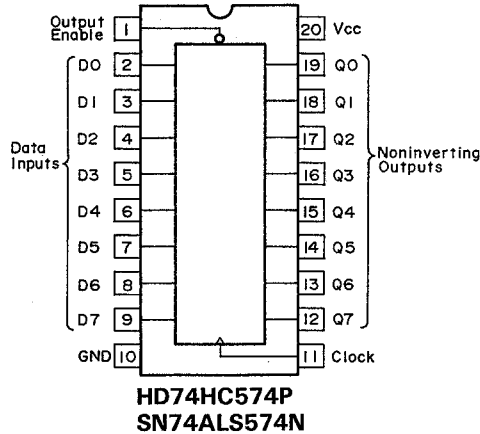
**HD74LS390FP**



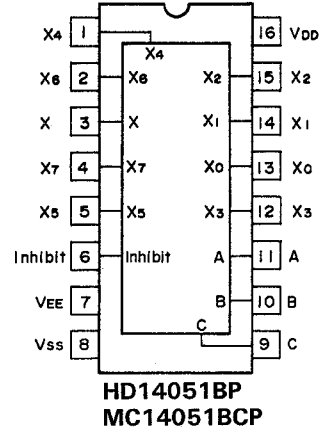
**HD74HC138P**



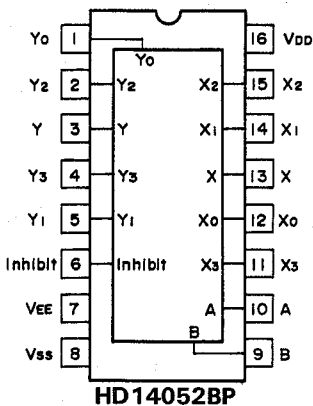
**HD74HC564P**



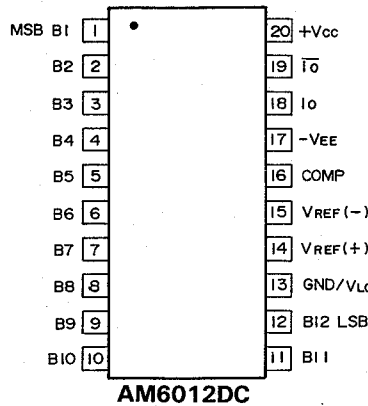
**HD74HC574P  
SN74ALS574N**



**HD14051BP  
MC14051BCP**

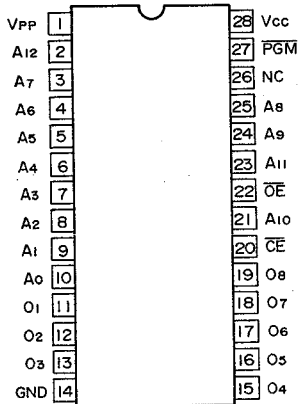


**HD14052BP**

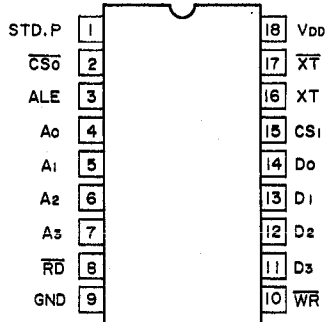


**AM6012DC**

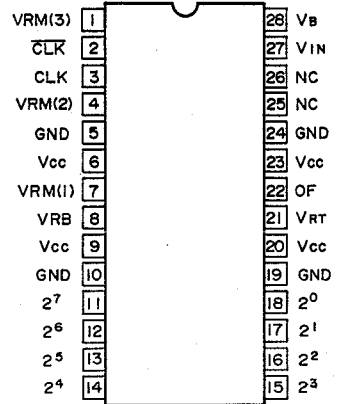
# SEMICONDUCTORS



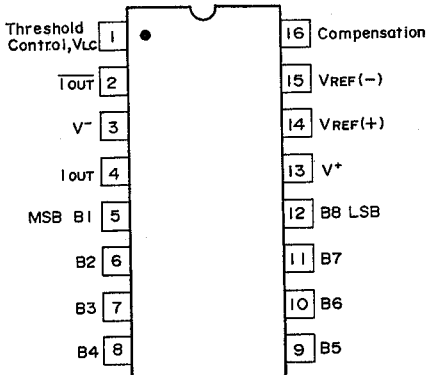
**MBM2764\*S**



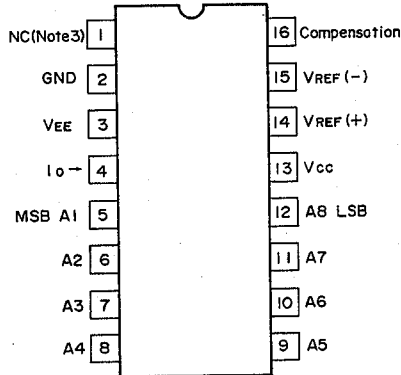
**MSM6242BRS**



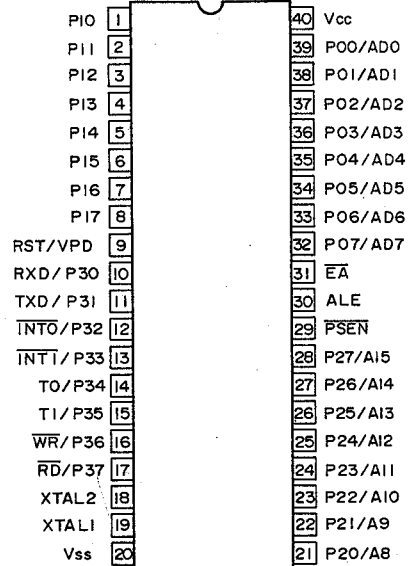
**HA19209TP**



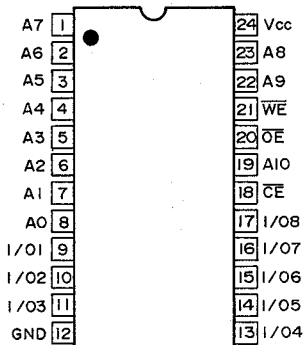
**DAC0800LCN**



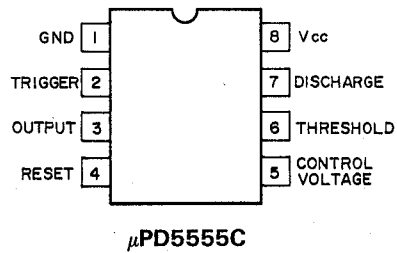
**DAC0808LCN**



**CTM5030**



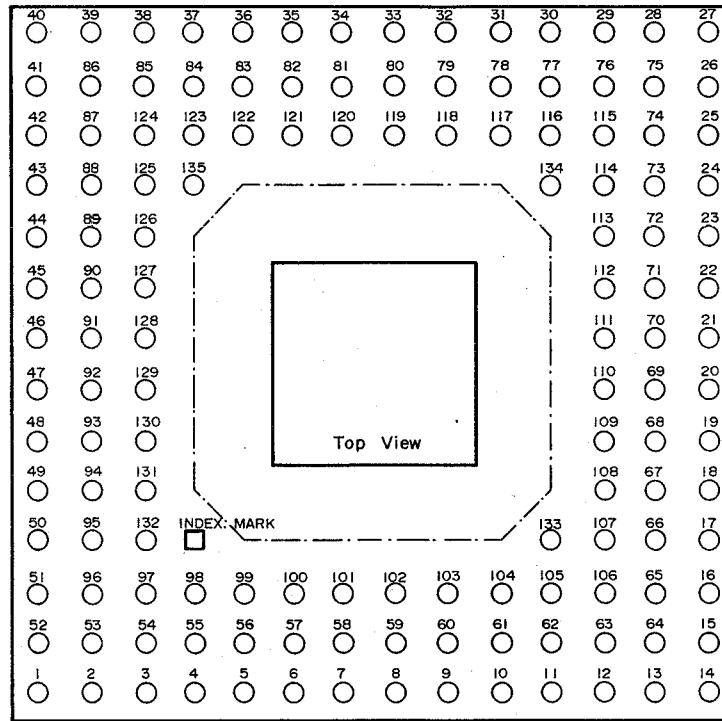
**CXK5814P-35**



**μPD5555C**

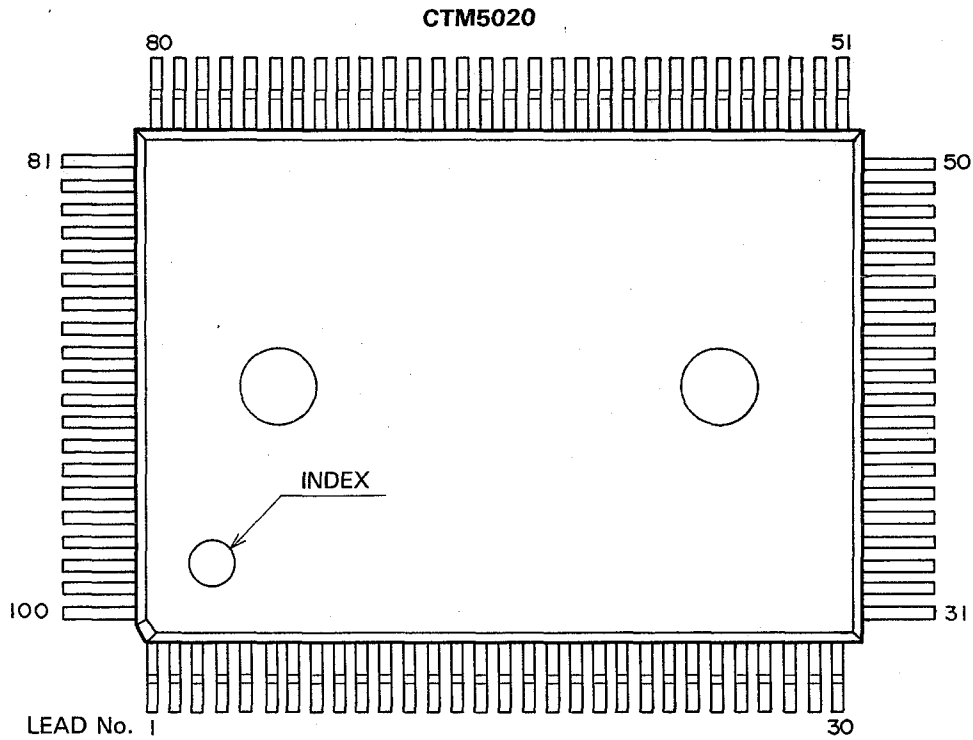
# SEMICONDUCTORS

CTM5010



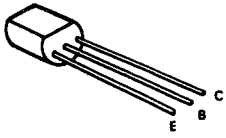
Pin No.	Pin Name	Pin No.	Pin Name	Pin No.	Pin Name	Pin No.	Pin Name
1	2A6	36	TMD2	71	4A3	106	TSO2
2	2A5	37	TMD5	72	4A5	107	N. C
3	2A7	38	ADR	73	4A7	108	N. C
4	WLC2	39	WLC1	74	4A9	109	N. C
5	CDCK	40	WE1B	75	PON1	110	VSS
6	ADCK	41	1A1	76	CH2K	111	VDD
7	TST3	42	1A3	77	VMD5	112	N. C
8	TSCK	43	1A5	78	DMD2	113	N. C
9	XTL1	44	1A7	79	DMD5	114	VSS
10	N. C	45	1A9	80	WLED	115	4A10
11	PRB	46	SC3	81	RREQ	116	VMD2
12	WLC3	47	SC1	82	SBLK	117	RSTR
13	OC4B	48	OC2B	83	TMD1	118	REQB
14	3A0	49	OC1B	84	SGB	119	VSS
15	3A2	50	2A0	85	CH1K	120	VDD
16	3A4	51	2A2	86	1A0	121	OB
17	3A6	52	2A4	87	1A4	122	25B
18	3A8	53	2A3	88	1A6	123	VSS
19	3A10	54	N. C	89	1A8	124	1A2
20	WLC4	55	2A10	90	1A10	125	5B
21	4A0	56	TST1	91	SC4	126	N. C
22	4A2	57	CCLK	92	SC2	127	N. C
23	4A4	58	TST2	93	SC0	128	VSS
24	4A6	59	GENB	94	WE2B	129	VDD
25	4A8	60	TST5	95	2A8	130	RS
26	PADD	61	WSTT	96	2A1	131	N. C
27	PON2	62	OC3B	97	N. C	132	VSS
28	XYB	63	WE3B	98	2A9	133	RLCK
29	VMD1	64	3A1	99	N. C	134	TENB
30	ENDB	65	3A3	100	N. C	135	TMD3
31	DMD1	66	3A5	101	VSS		
32	DMD3	67	3A7	102	VDD		
33	SSGB	68	3A9	103	TST4		
34	SREQ	69	WE4B	104	TSO1		
35	UNBL	70	4A1	105	VSS		

# SEMICONDUCTORS

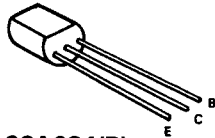


Pin No.	Pin Name	Pin No.	Pin Name	Pin No.	Pin Name	Pin No.	Pin Name
1	CONT	26	TSD0	51	GETD	76	DD3
2	A13	27	TSD1	52	CA0	77	SING
3	VDD	28	VDD	53	VDD	78	VDD
4	A14	29	TSD2	54	CA4	79	R10M
5	A15	30	AX2	55	CA3	80	10M
6	INT0	31	AX1	56	CA2	81	HLDF
7	VX3	32	AX0	57	CA1	82	SGA
8	VX2	33	AX3	58	CD3	83	ROSP
9	VX1	34	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

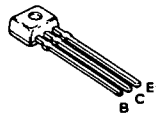
# SEMICONDUCTORS



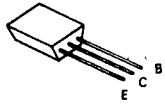
2SA1206(K)



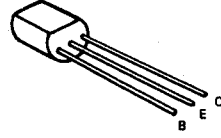
2SA684(R)  
2SA1005(K)  
2SA1208(S)  
2SC1384(R)  
2SC2271(D)  
2SC2910(S)



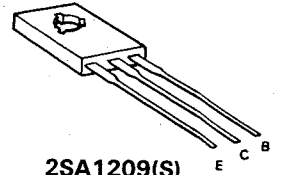
2SA1175(F)  
2SC2785(F)  
2SC2786(K)



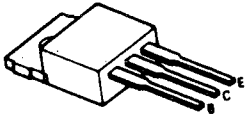
2SC3315(C,D)  
2SC3354(S,T)



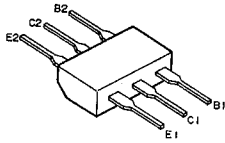
2SC3779(D)



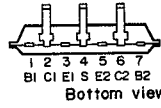
2SA1209(S)  
2SA1210(S)  
2SC2911(S)  
2SC2912(S)



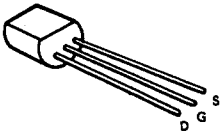
2SB1133(S)  
2SC3749(N)  
2SD613(E)  
2SD1666(S)



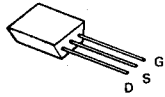
2SC3066(G,H)



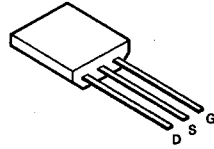
2SC3381(GR)



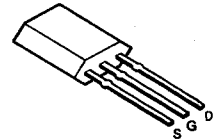
2SK117(Y)  
2SK583



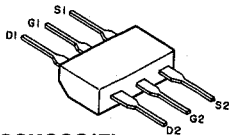
2SK161(GR)



2SK241(Y)



2SK304(E)



2SK332(F)