

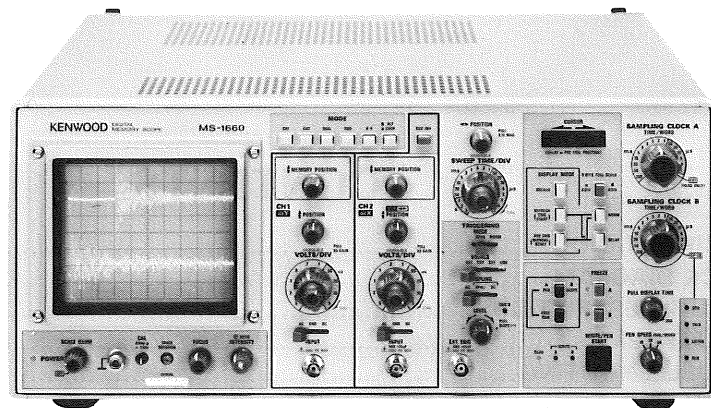
KENWOOD

DIGITAL MEMORY SCOPE

# MS-1660

## 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 60000 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 when the housing is removed from the unit. Contacting exposed high voltage could result in fatal electric shock.

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# SPECIFICATIONS

## CRT

Model: 150 FTM31: Rectangular, with internal graticule  
 Acceleration voltage: 6 kV  
 Display area:  $8 \times 10$  div (1 div = 10 mm)

## VERTICAL AXIS (Common to CH1 and CH2)

Sensitivity: 1 mV/div to 5V/div  $\pm 3\%$   
 Attenuator: 5 mV/div to 5V/div  
 1-2-5 sequence, fine adjustment between 10 ranges  
 Input impedance:  $1M\Omega \pm 2\%$ , Approx. 25 pF

Frequency response:  
 DC: DC to 20 MHz (Within  $-3$  dB at 5mV/div to 5V/div)  
 DC to 10 MHz (Within  $-3$  dB at X5 GAIN)

AC: 5 Hz to 20 MHz (Within  $-3$  dB at 5 mV/div to 5 V/div)  
 5 Hz to 10 MHz (Within  $-3$  dB at X5 GAIN)

Rise time X1: Less than 17.5 ns  
 X5 GAIN: Less than 35 ns  
 Crosstalk: Less than  $-40$  dB (CH1 & CH2 in same range)

Operating modes:  
 CH1: CH1, single trace  
 CH2: CH2, single trace  
 DUAL: CH1 and CH2, dual trace  
 ADD: CH1 + CH2 (added) display  
 ALT: Dual or quad trace alternating  
 CHOP: Dual or quad trace chopped  
 X-Y: X-Y oscilloscope  
 CHOP frequency: Approx. 250 kHz  
 Polarity reversal: Available for CH2 only

Maximum input voltage: 500 V<sub>p-p</sub> or 250 V (dc + ac peak)  
 Maximum undistorted amplitude: 8 div, minimum (DC to 20 MHz)

## HORIZONTAL AXIS (Channel 2 input, except X10MAG)

Modes: X-Y mode is switch selectable  
 CH1: Y axis  
 CH2: X axis  
 Sensitivity: Same as vertical axis (CH2)  
 Input impedance: Same as vertical axis (CH2)  
 Frequency response:  
 DC: DC to 1 MHz (Within  $-3$  dB)  
 AC: 5 Hz to 1 MHz (Within  $-3$  dB)  
 X-Y phase difference: Less than  $3^\circ$  at 100 kHz  
 Maximum allowable input voltage: Same as vertical axis (CH2)

## SWEEP

Sweep: NORM; Trigger sweep  
 AUTO; Automatic free run function while signals are not fed  
 Sweep time: 0.2  $\mu$ s/div. to 0.5 s/div  $\pm 3\%$ , in 1-2-5 sequence with in 20 ranges, fine adjustment between 20 ranges  
 Sweep magnification: X10  $\pm 5\%$   
 Linearity:  $\pm 3\%$  (0.2  $\mu$ s/div  $\pm 5\%$  with X10 magnification)

## TRIGGERING

CH1: Triggered with vertical input signal on CH1.  
 CH2: Triggered with vertical input signal on CH2.  
 EXT: Triggered with external synchronizing signal.  
 LINE: Triggered with line frequency  
 External triggering:  
 Input impedance:  $1M\Omega \pm 2\%$ , Approx. 25 pF  
 Maximum input voltage: 50 V (DC + AC peak)  
 Coupling modes: AC, HF<sub>REJ</sub>, DC  
 Sync sensitivity

SYNC COUPLING	SYNC. FREQ. RANGE	MIN. SYNC AMPLITUDE (VOLTAGE)	
		INT	EXT
DC	DC ~ 20 MHz	1 div	0.1 V <sub>p-p</sub>
AC	10 Hz ~ 20 MHz	1 div	0.1 V <sub>p-p</sub>
DC HF <sub>REJ</sub>	At 1.5 kHz or over, min. amplitude (voltage), required for sync increases.		

## PROBE CALIBRATING VOLTAGE

0.5 V  $\pm 2\%$  of positive square wave, approx. 1 kHz

## INTENSITY MODULATION

Input voltage: Intensity increases with TTL level.  
 Input impedance: Approx. 10 k $\Omega$   
 Frequency range: DC to 5 MHz  
 Maximum input voltage: 50 V (DC + AC peak)

## VERTICAL AXIS OUTPUT

CH1 signal output  
 Output voltage: Approx. 50 mV/div (50 $\Omega$  load)  
 Output impedance: Approx. 50 $\Omega$   
 Frequency response:  
 X1: 100 Hz to 20 MHz (within  $\pm 3$  dB), at 50  $\Omega$  load  
 X5 GAIN: 100 Hz to 10 MHz (within  $\pm 3$  dB), at 50  $\Omega$  load

## GATE OUTPUT

Output waveform: Positive pulse triggered to sweep  
 Output voltage: TTL level  
 Series resistance: Approx. 220  $\Omega$

## DATA CONVERTER

Converting method: Successive comparison, A/D converter  
 Resolution: 8 bits (0.4%)  
 Frequency response: DC to 250 kHz (within  $-3$  dB)

## MEMORY

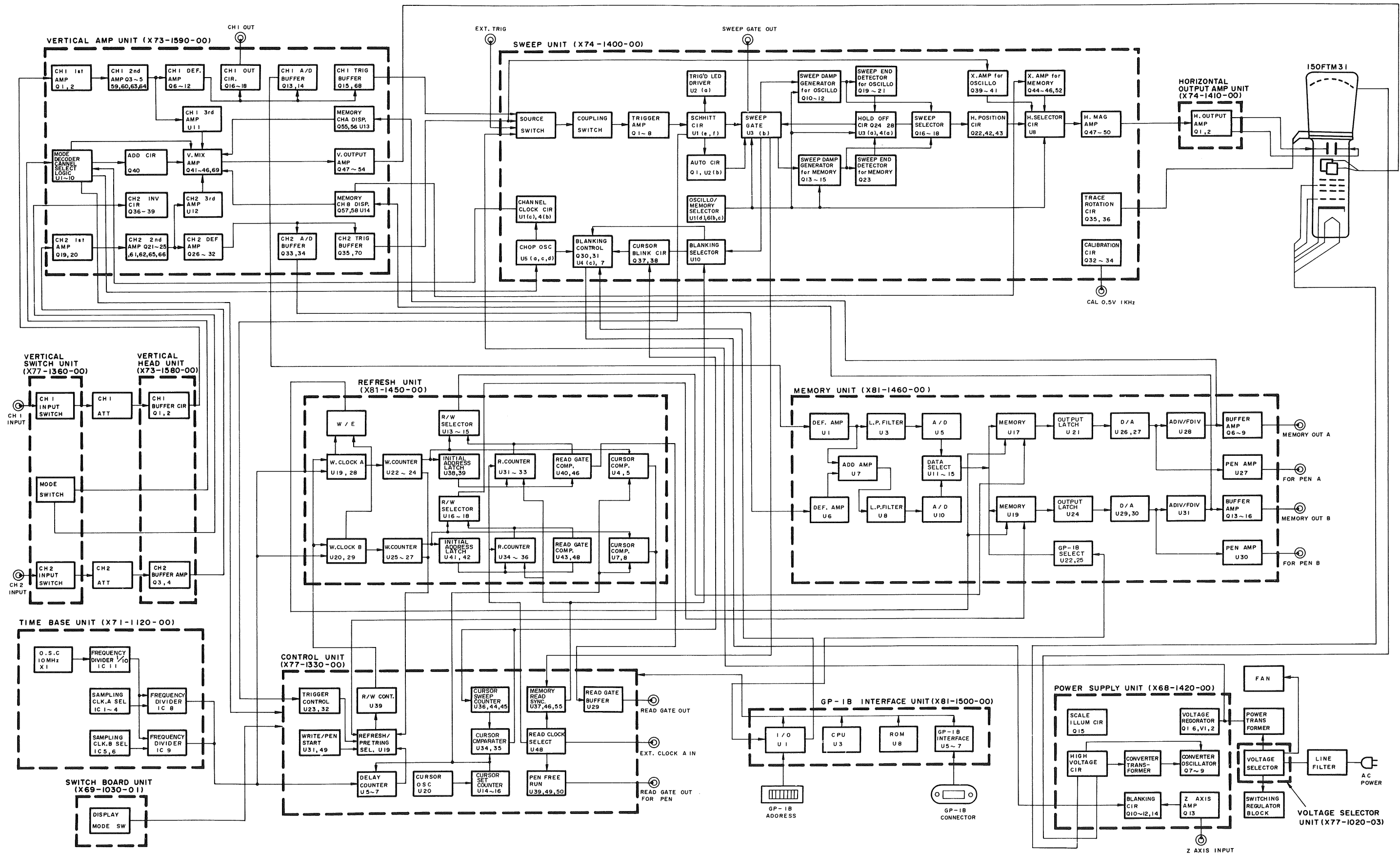
Memory capacity: 8 bits  $\times$  2048 words/CH  $\times$  2 (Full memory capacity of 4096 words)  
 Memory devices: C-MOS static RAMs  
 Write speed: 1  $\mu$ s to 100 ms/word, with 1-2-5 steps in 16 ranges (with independent channel setting)

# SPECIFICATIONS

Read speed		<b>POWER SOURCE</b>	
INT:	MEMORY OUT: 1 $\mu$ s/word (fixed) SCOPE: 1 $\mu$ s/word (fixed) FOR PEN: 10, 20, 50 ms/word (3 ranges)	Line voltage:	100/120/220/240 Vac $\pm$ 10% 50/60 Hz
EXT:	TTL level, repetitive square wave of less than 1 MHz High-level pulse width; More than 500 ns Low-level pulse width; More than 500 ns Rise time; Less than 500 ns	Power consumption	Approx. 70W
FREEZE function:	Rewrite-protectable for each channel	<b>DIMENSIONS</b>	
Memory backup:	Full memory holding. Holding time of more than 200h.	Width	426 mm (433 mm)
		Height	177 mm (190 mm)
		Depth	411 mm (475 mm)
			Figures in ( ) includes projecting parts.
<b>OPERATING FUNCTIONS</b>		<b>WEIGHT</b>	Approx. 13 kg
REFRESH: (TRIG START)	Write is started with the trigger signal (or manually). Write prohibition variable time be- tween 1 to 20 sec (DISPLAY TIME)	<b>ENVIRONMENT</b>	
PRE TRIG: (MANUAL START)	A write is started manually. Per- forms pretrigger operation (nega- tive delay) according to cursor setting. Automatic, repeated write/read operations are available (read time can be set from approx. 1 to 20 sec.) Address is simultane- ously displayed in other channel. Cursor is continuously movable within addresses between 2 and 2000 words. Shifting resolution 1 word (speed variable in 2 steps)	Operating temperature and humidity for guaranteed specifi- cations:	10 to 35°C, 85% RH max.
DELAY:		Full operating tempera- ture and humidity range:	0 to 45°C, 85% RH max.
Cursor setting		<b>ACCESSORIES</b>	
		Probe (PC-20)	2
		Attenuation:	1/10, 1/1
		Input impedance:	1/10: 10 M $\Omega$ , below 18 pF 1/ 1: 1 M $\Omega$ , below 100 pF
		Instruction manual:	1
		AC power cord:	1
		Replacement fuse:	1
		<b>OPTION</b>	GP-IB cable (CB-2420P)
<b>DATA OUTPUT</b>			
D/A converter:	8-bit resolution		
Output level:	MEMORY OUT: 1.6 V <sub>P-P</sub> $\pm$ 3% relative to input full scale FOR PEN: 2.0 V <sub>P-P</sub> $\pm$ 3% relative to input full scale (Over 1 k $\Omega$ load)		
Output impedance:	MEMORY OUT: Approx. 22 $\Omega$		
<b>CONTROL OUTPUT</b>			
READ GATE OUT			
Output waveform:	Positive pulse equivalent to 1 word of last address		
Output voltage:	TTL level (Common to both channels)		
Series resistance:	Approx. 220 $\Omega$		
<b>READ GATE OUT FOR PEN</b>			
Control signal for PEN			
Output signal:	Negative logic (activated about 2 sec after pen start ON)		
Output voltage:	TTL level		
Series resistance:	Approx. 220 $\Omega$		
<b>EXTERNAL CONTROL</b>			
The data in memory is controllable via GP-IB.			
Governing standard:	IEEE STD 488-1978		
Subsets to be used:	SH1, AH1, TEO, LEO, T6, L4, SR1, RL1, PRO, DC1, and DTO		



# BLOCK DIAGRAM



# CIRCUIT DESCRIPTION

## 1. Circuit Description

### 1-1. Vertical Switch Unit (X77-1360-00)

The vertical switch unit consists of the input coupling switches of CH1 and CH2, and also the vertical mode selector switches. The input coupling switches are used to change the input coupling method between AC-GND-DC. The vertical mode switches are used to set the CRT display to CH1, CH2, DUAL, ADD, or X-Y, or NORM or INV of CH2. Also, when DUAL is selected, a further selection can be made between DUAL and CHOP.

A priority sequence is allocated to the five modes between CH1 and X-Y. When two or more switches are pressed simultaneously, the mode having the highest priority is selected. The priority sequence going from the highest priority is CH1, CH2, DUAL, ADD, and X-Y. When all the switches are released, CH1 is selected.

### 1-2. Vertical Attenuator Unit (S02-4503-05)

The input attenuator of this oscilloscope has three stages. The attenuation ratio of the first stage is 1/100, that of the second stage is 1/10, and that of the third stage 1/2 or 1/4. By combining these attenuation ratios, a 1, 2, or 5 step 10-point input attenuation ratio can be obtained.

This attenuator consists of resistors and capacitors alone. It does not vary the gain of the amplifier. Consequently, there is no need to adjust the step attenuator balance.

### 1-3. Vertical Head Unit (X73-1580-00)

The signal which is output from the attenuator enters the vertical head amplifier, where impedance conversion is performed by a source follower and emitter follower, and is then fed to the vertical amplifier.

VR1 and VR2 adjust the DC balance in CH1 and CH2, respectively. In this unit, they are used to adjust the balance when the X5 GAIN switch on the vertical amplifier is turned ON and OFF.

### 1-4. Vertical Amplifier Unit (X73-1590-00)

The vertical amplifier is a 4-channel amplifier system having a dual trace function for the REAL waveform and a dual trace function for the MEMORY waveform.

The signal which comes from the head amplifier is differentially amplified by dual transistor Q1.

By changing the resistance between the emitters of Q1a and b, the amplifier gain is changed to perform X5 GAIN operation. Q3 and the subsequent circuit constitutes the second stage amplifier. This stage contains the vertical variable adjuster and the vertical position adjuster. U11 is the third stage amplifier. This circuit can be turned ON and OFF by the channel selector. It can be selected by the MODE and DISPLAY MODE switches on the front panel.

Q6 to 10 is a common amplifier which generates the trigger signal, CH1 OUT signal, and also the analog signal which is

to be sent to the memory unit. These signals are output via Q15, Q16 to 18, and Q13 and 14, to the sweep unit, the output terminals on the rear panel of the oscilloscope, and the memory unit, respectively.

The circuit of CH2 is similar to that of CH1 except that CH2 INV operation takes place when Q22 and 23 are switched over to Q24 and 25. The selector switch which achieves this consists of Q36 to 39.

Q55, 56, and U13 comprise an amplifier which is used to output the memorized waveform on the A side of sampling clock to the screen. It is provided with a memory position adjuster.

Q57, 58, and U14 perform a similar function on the B side of the sampling clock. Also, the X signal is sent from here to the sweep unit during memory X-Y operation.

The signals selected by the MODE switch and the DISPLAY MODE switch are mixed at Q41 and 42, amplified by one more stage at Q43 and 44, then fed to the output amplifier. Q40 is an ADD selector switch.

Q47 to 54 constitute the output amplifier which consists of a cascode circuit and a constant current load. The output of this amplifier is connected to the vertical deflection plates of the CRT.

U1 to 10 constitute a circuit which generates a control signal corresponding to each display mode of the oscilloscope and memory selected by the MODE and DISPLAY MODE switches.

### 1-5. Sweep Unit (X74-1400-00)

The input sync signal is switched to CH1, CH2, EXT, or LINE by the source switch, and the coupling format is set to AC, HF<sub>REJ</sub>, or DC by the coupling switch. Subsequently, the input sync signal is amplified by the trigger amplifier consisting of Q1 to 8. This amplifier contains a trigger level adjuster and a trigger slope selector. Next, the signal is wave-shaped by a Schmitt trigger circuit consisting of U1f and 1e to become the trigger signal.

In the oscilloscope mode, when the trigger signal enters V3b the gate opens and one of capacitors C13 to 15 which is selected by rotary switch S6 starts to charge, causing the sweep wave to be generated. When the sweep wave reaches the specified level, the comparator consisting of Q20 and 21 detects the sweep wave and emits an output. This output passes through Q19, 24, and U4a, causing U3a to be inverted. As a result, U3b is inverted, the gate closes, and the sweep wave falls. At the same time, the hold-off circuit operates, and one of C21 to 23 starts to charge. When the specified value is reached, U3a is inverted via Q28, the hold-off period is ended, and U3b waits for the arrival of the trigger. In the memory mode as well, a similar operation takes place. In this case, however, Q13 to 15 and Q23 operate instead. Also, the sweep and hold-off capacitors are C17 and C22 alone, hence the sweep time is fixed at 0.2 mS/DIV.

U2b, Q9, and U4d comprise an auto circuit. When S4 is set to the AUTO side, free-run operation takes place while the

trigger signal is absent.

The sawtooth waves of the sweep pass through the position adjusting circuit in Q22, 42, and 43, and enter the horizontal switching amplifier circuit U8. Also, the X-axis signal of the oscilloscope is amplified by Q39 and 40, and the X-axis signal of the memory by Q45 and 46. These signals then enter U8 where either the sweep signal, oscilloscope X-axis signal, or the memory X-axis signal is selected. The output is amplified by Q48, 49, and the horizontal output amplifier, and applied to the horizontal deflection plates of the CRT.

By selecting the resistance between the emitters of Q48 and 49, MAG X10 is obtained. The gate signal, which is synchronized with the sweep signal, passes through U10, U7, Q30, and Q31 and enters the blanking amplifier of the power supply unit.

Also, Q37 and 38 constitute the amplifier for the cursor brightness modulating signal during memory operation.

U5c and 5d constitute a chop generator. The chop signal passes through U4c, the chop blanking circuit, and U4b to become the chop selector signal.

Q32 to 34 constitute a calibration signal generator, and Q33 and 34 constitute an astable multivibrator circuit. The generated signal, which undergoes an impedance reduction at Q32, is output as a calibration voltage.

Q35 and 36 constitute a trace rotation circuit.

### 1-6. Horizontal Output Unit (X74-1410-00)

The horizontal output unit in combination with Q48 and 49 of the sweep unit comprise a cascode amplifier which outputs a signal to the horizontal deflector plates of the CRT.

### 1-7. Power Supply Unit (X68-1420-00)

The regulated power supply circuit constitutes a tracking regulator in which an operational amp is used as an error amplifier. Q1 to 4 are control transistors, and U1a 1b, 1a, and 2b constitute the error amplifier.

+10 V is generated using zener diode D5 as a reference, -V is generated using +10 V as a reference, and +20 V and +140 V are generated using -10 V as a reference.

The high voltage power supply for the CRT beam acceleration is a feedback-type constant voltage circuit which employs a DC-DC converter consisting of Q7 and T1 and also an error amplifier consisting of Q8 and 9. It generates -1.5 kV using +10 V as a reference. Also, the post-deflection acceleration voltage of +4.5 V is generated by a voltage tripler and rectifier block, D10.

The blanking signal from the sweep unit is amplified by Q10 to 12, DC-restored by D11 and 12, then applied to the CRT grid.

The Z-axis signal is amplified by Q13, then sent to the blanking circuit where the brightness signal is amplified to the TTL level.

Q15 is a scale illumination transistor.

# CIRCUIT DESCRIPTION

## 1-8. Control Unit (X77-1330-00)

This unit consists of the memory read and write control circuit for each mode (U39), the PEN and pen FREERUN selector circuit (U50, 49, and 39), the sync circuit for the SCOPE blanking signal (U46 and 55), the sync signal circuit for memory read (U37), the DELAY counter (U5, 6, and 7), and the cursor setting counter (U14, 15, and 16).

Memory write takes place as follows: As a result of the TRIG signal and the manual start, single shot pulses are emitted from monostable multivibrator U49, causing flip-flop U39 to be set. As a result, the  $\bar{R}/W$  C signal becomes "H", the write counter of the refresh unit (X81-145-00) starts, and write operation takes place. When the count on the write counter reaches 2048, the  $\bar{W}/C$  signal is output, causing flip-flop U39 to be reset. This stops write operation. Memory read takes place as follows: The SWP signal (2 mS) output from the sweep unit (74X-1400-00) is synchronized with the read clock, and the blanking signal TRIGE generated and output to the sweep unit. At the same time, the LOAD signal which sets the initial address of the read counter of the refresh unit is generated by monostable multivibrator U37, and output to the refresh unit.

There are three read clocks, INT (1  $\mu$ sec/w), EXT, and PEN (10 msec/w to 50 msec/w) which are selected by U48.

In the PEN mode, PEN START creates a 2-second PEN operation wait interval in IC U49. Subsequently, flip-flop U39 is set, the PEN mode read operation starts, and when 2048 bytes have been read, the DIHA signal is sent from the refresh unit, U39 is reset, and read is completed.

Also, in the case of PEN FREERUN, as soon as read is completed IC U49 is operated, and write operation starts. In the PRE TRIG mode, WRITE START causes IC U49 to operate and enters a write status. At the same time, TRIG ADDRESS (U14 to 16), which was set by the cursor, is set by the DELAY counter (U5 to 7), thus determining the end of write operation.

The cursor setting section consists of the cursor setting counter (U14 to 16), cursor read counter (U44, 45, and 36), comparator (U24 and 25), and oscillator circuit (U30 and 20). If the cursor switch is pressed, the cursor setting counter counts one pulse. If the switch is pressed continuously, the oscillator circuit operates, and the output pulse drives the setting counter and sets the cursor. Readout of the cursor point is synchronized with the SWP signal and causes the cursor read counter to operate. When the read counter reaches the value of the setting counter, a single shot pulse is emitted from IC U37, and a brightness modulation signal is output.

### 1-9. Refresh Unit (X81-1450-00)

This unit consists of a read counter (U31 to 36) which determines the address of the memory, write counter (U22 to 27), read/write selector (U13 to 18), initial address register (U38, 39, 41, and 42), comparator (U46, 40, 48, 43, 4, 5, 7, and 7), and write clock selector timing circuit for low speed/high speed writing (U19 and 20).

# CIRCUIT DESCRIPTION

The write clock is generated by synchronizing the W/CLK signal, which is selected by SAMPLING CLOCK SW and sent from the time base unit (X71-1120-00), with the A/D START signal which is sent from the memory unit (X81-1460-00). The write clock causes the write counter to operate and determines the address during memory write. Also, the W/E signal (U28 and 29) which is necessary for writing to the memory is generated in synchronism with the write clock. The read counter is operated by the R CLK signal which is sent from the control unit when the start address for reading the memory is determined by the initial address register, and memory read takes place. Also, the read counter and initial address register are compared with each other, and when they match each other, the READ GATE signal is output from U40.

Read/write select is performed by the R/WC signal which is sent from the control unit. For high speed reading in which SAMPLING CLOCK is between 1  $\mu$ s and 50  $\mu$ s/WORD, when the R/WC signal is "H", the write counter is selected; when the R/WC signal is "L", the read counter is selected. For low speed reading in which SAMPLING CLOCK is between 0.1 mS and 100 mS/WORD, when the R/W C signal is "H", the write counter is selected in synchronism with the write clock for exactly 1  $\mu$ s; in all other cases, the read counter is selected.

The initial address register memorizes the write end address of the write counter by means of the LAS signal generated by the write counter and the delay counter of the control unit, and operates as the start address of memory read.

## 1-10. Memory Unit (X81-1460-00)

This unit consists of an A/D converter, DATA selector circuit for each mode, memory, GP-IB DATA selector circuit, D/A converter, output amplifier, and memory backup circuit. The input amplifier consists of OP AMPs U1 to 4 and 6 to 9. The input signal sent from the vertical amplifier unit (X73-1590-00) is received by differential amplifier U1 and 6. Subsequently, this signal passes through a low-pass filter (300 KHz) consisting of U3 and 8, an attenuator amplifier consisting of U4 and 9, and a level shift circuit, to an A/D converter consisting of U5 and 10. The input level of the A/D converter is adjusted to  $\pm 0.225$  V FULL SCALE centered about  $-0.25$  V.

When the MODE is ADD, FET switch Q3 goes ON, and amplifier U7 adds the signals of CH1 and CH2 which are then connected to the A/D converter on the CH2 side.

The A/D converter free-runs at a frequency of 1 MHz, which is converted into an 8-bit binary code every 1  $\mu$ Sec by the 10 MHz conversion clock, and latched by the register consisting of U11 and 14. The converted digital data passes through the MODE selector circuit consisting of U12, 13, and 15, then is stored in a 2048 word memory consisting of U17 and 19. The bidirectional bus switch U13 operates under the DISPLAY MODE to transfer CH1 data to the CH2 memory, and CH2 data to the CH1 memory.

External data is written or internal data read by GP-IB when the bidirectional bus switch consisting of U22 and 25 goes ON and the memory data bus is connected to the data bus of the GP-IB interface unit (X81-1500-00).

When data memorized in the memory is to be read, it is first latched in the output register consisting of U21 and 24, then converted to an analog signal by the D/A converter consisting of U26 and 29. This signal then passes through a current/voltage converter consisting of U27 and 30 and also a level shift circuit, resulting in an output signal of  $\pm 0.8$ V (1.6 V/F.S.) at TP7 and 9. This output passes through a 4 DIV/8 DIV (0.8V/1.6 V F.S.) switching circuit consisting of U28 and 31, and is sent to the vertical amplifier unit (X73-1590-00) from P3-2 and P6-2 as a SCOPE OUT signal. This signal also passes through a buffer consisting of Q6 to 9 and 13 to 16, and is sent to the MEMORY OUT terminal as a MEMORY OUT signal.

In the PEN OUT MODE, the FET switch consisting of Q5 and 12 is turned ON, the signal is amplified to 2 V/F.S. by the amplifier consisting of U27 and 30, and is then output to the PEN OUT terminal as a PEN OUT signal from P4-2 and P7-2. Memory back-up operation takes place as follows: When the +5 V power supply voltage falls to about +4.4V, this is detected by the POWER DOWN detection IC U23 which makes the control terminal of the analog switch U18 "L" and connects the back-up power supply for the memory IC.

## 1-11. Signal Names

### < CLOCK signals >

W/CLK A.B	Write CLOCK	W.MODE
R CLK 1.2	Read CLOCK	R.MODE
EXT C	External read CLOCK	R.MODE
100 nS CLK	10 MHZ CLOCK	CLK
1 $\mu$ S CLK	1 MHz CLOCK	CLK
SWP.SWP'	Sweep gate CLOCK	CLK
W/E A.B	Memory write CLOCK	W.MODE
A/D START	A/D conversion START CLOCK	W.MODE

### < CONTROL signals >

R/W C A.B	Read and write control signal	R/W MODE
COMP A.B	Sub-channel write start signal	W.MODE
W/C A.B	WRITE COUNTER STOP signal	R.MODE
LOAD	READ COUNTER PRESET signal	R.MODE
DIHA	Read end address signal	R.MODE
RG0	Read end address signal	R.MODE
RGOS	READ GATE OUT signal	R.MODE
RGOP	PEN DOWN OUT signal	R.MODE
PAN 1.2	PEN mode control signal	R.MODE
ASP 1.2	PEN mode control signal	R.MODE
ZBC	Cursor bright point signal	R.MODE
EXT.S	EXT CLK control signal	R.MODE
PSC	PEN/MONI selector signal	R.MODE
WSTR	Manual write start signal	W.MODE
DISTV.DIST	DISPLAY TIME control signal	
DC0 to DC10	PRE TRIG COUNTER output signal	W.MODE
ADC	Control signal for add (ADD) mode	W.MODE

# CIRCUIT DESCRIPTION

LAS A,B	Initial address latch signal	W.MODE
FZ 1.2	Memory re-write stop signal	
PWC	Initial clear at power-on	
RFC	REFRESH CONTROL signal	
NTC	NORMAL/DELAY select signal	
NTS	NORMAL/DELAY select signal	
MNC	NORMAL/DELAY select signal	
MDC	Memory connecting direction select signal	
A <sub>0</sub> to A <sub>2</sub>	Mode select control signal (3 bit)	
TRIG, TRIG', TRIG'	Trigger pulse	W.MODE
RNCA, RNCB	Low speed write high speed read	W.MODE
MOC A B	Memory output latch clear signal	R.MODE
ADA $\emptyset\emptyset$ to 1 $\emptyset$	A address signal	R/W MODE
ADB $\emptyset$ to 1 $\emptyset$	B address signal	R/W MODE
MOLA B	Memory output latch CLK	R.MODE
DGC	4DIV/8DIV control signal	R.MODE

UP,DOWN	Cursor control signal	W.MODE
WLEA,WLEB	Write LED control signal	W.MODE
R LED	Read LED control signal	R.MODE
PNCLR	PEN mode memory output latch clear signal	R.MODE
WRSTR	Write start signal	W.MODE
PRDEL	Pre-trigger delay control signal	W.MODE
DEN	A/D output data select signal	W.MODE
SELT	A/D output data select signal	W.MODE

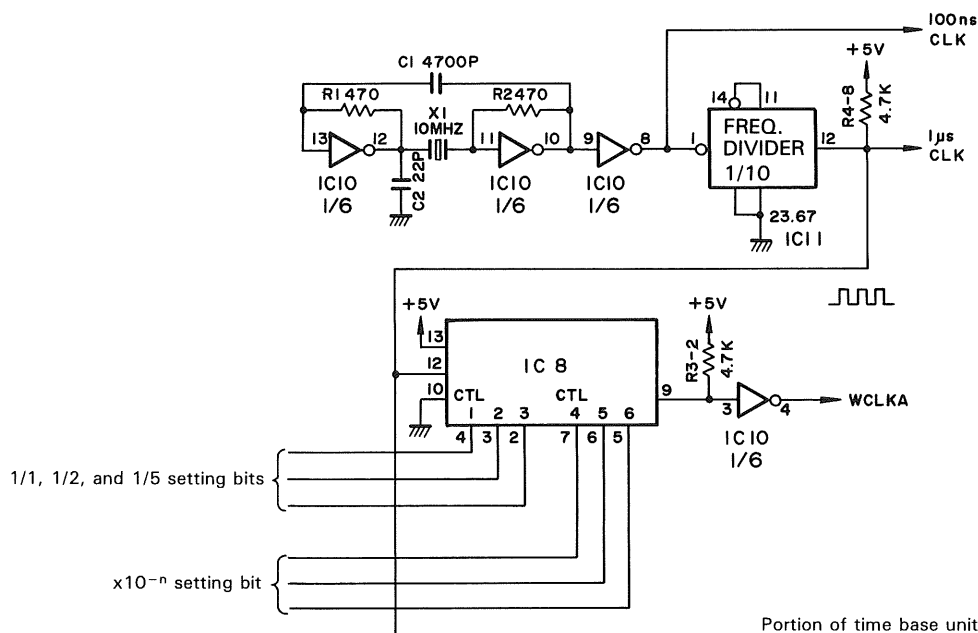
## < GP-IB interface signals >

OPEN	GP-IB interrupt control signal
IWRA, B	Memory write enable signal
ICEA, B	Data send/receive enable signal
D $\emptyset$ to 7	Memory data signal
IRD	Memory data read/write control signal
TWREN	LOCAL write in progress

## 1-12. Others

### (1) CLOCK

#### (a) CLOCK generator circuit (time base unit)



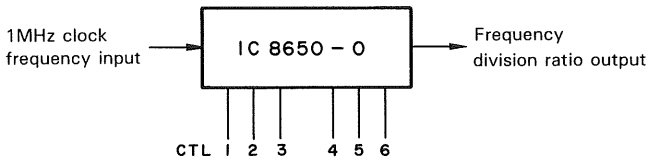
TIME BASE is generated as the frequency-divided output of a 10 MHz crystal oscillator circuit. 100ns CLK of the basic CLOCK is used as a conversion clock of the A/D converter. The 1  $\mu$ s CLK obtained by 1/10 frequency-dividing IC11 is used for starting A/D conversion, and also as a write coun-

ter sync clock and read counter sync clock. The frequency division ratio of the write sampling clock WCLK is determined by control signals CTL1 to 6 which are in turn selected by the frequency division IC, IC8.

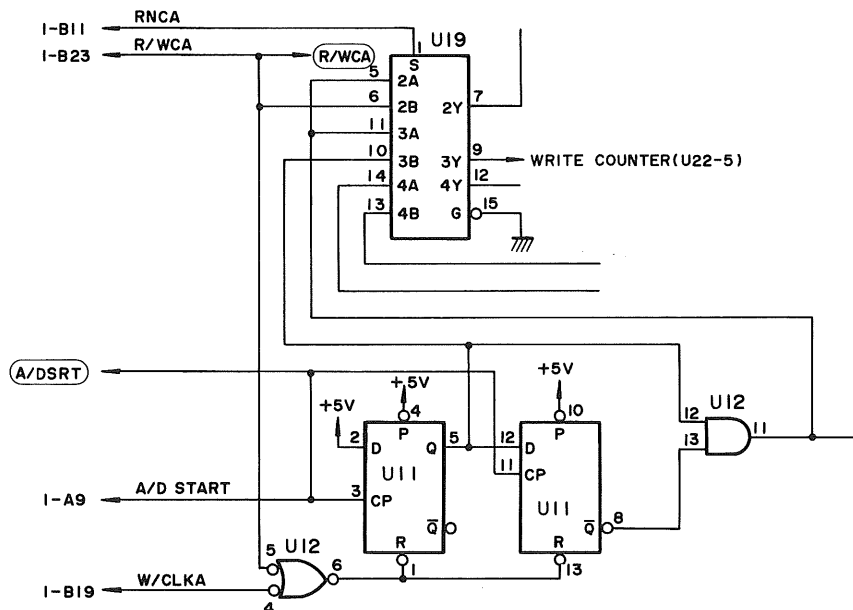
# CIRCUIT DESCRIPTION

TIME/WORD	1 MHz clock	CTL 1	CTL 2	CTL 3	CTL 4	CTL 5	CTL 6	Frequency-divided clock output.
1 μS	1 MHz	0	0	0	0	0	0	1/1
2	500 KHz	0	1	0	0	0	0	1/2
5	200	1	0	1	0	0	0	1/5
10	100	0	0	0	0	0	1	1/10
20	50	0	1	0	0	0	1	1/20
50	20	1	0	1	0	0	1	1/50
100	10	0	0	0	0	1	0	1/100
200	5	0	1	0	0	1	0	1/200
500	2	1	0	1	0	1	0	1/500
1 mS	1	0	0	0	0	1	1	1/1000
2	0.5	0	1	0	0	1	1	1/2000
5	0.2	1	0	1	0	1	1	1/5000
10	0.1	0	0	0	1	0	0	1/10000
20	0.05	0	1	0	1	0	0	1/20000
50	0.02	1	0	1	1	0	0	1/50000
100	0.01	0	0	0	1	0	1	1/100000

Relation between control signal and frequency division ratio



## (b) WRITE CLOCK (Refresh unit)

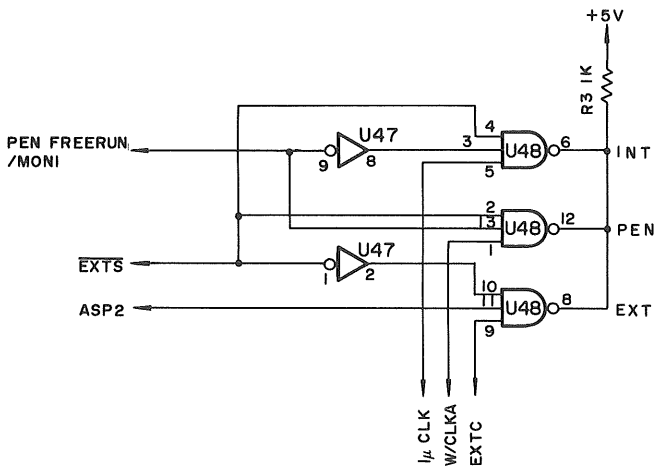


# CIRCUIT DESCRIPTION

WRITE CLOCK is generated by the W/CLK signal sent from the TIME BASE unit and the A/D START signal sent from the MEMORY unit.

W/CLK is synchronized with the leading edge of A/D START, and is connected from U19-9 to WRITE COUNTER.

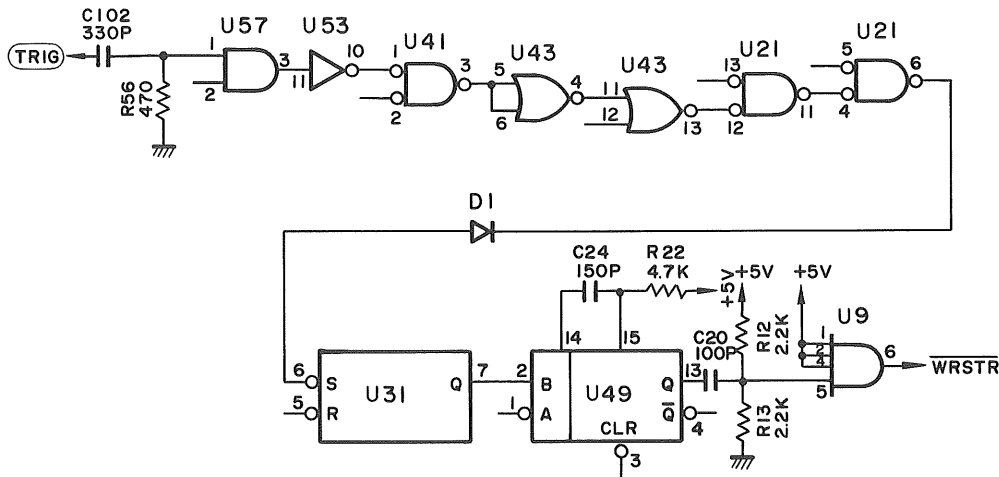
## (C) READ CLOCK (control unit)



There are three types of READ CLOCK; INT CLOCK, PEN CLOCK, and EXT CLOCK. These can be selected by the open-collector IC, U48.

INT CLOCK is fixed at 1  $\mu$ S/word, and operates in the SCOPE MODE.

## (b) WRITE START in REFRESH MODE (control unit)



In the REFRESH MODE, the monostable multivibrator U49 is operated by the TRIG signal, and the output signal is

There are three types of PEN CLOCK between 10 mS and 50 mS/word which can be selected by PEN SPEED.

EXT CLOCK is a clock which is input from the EXT CLOCK terminal on the rear panel.

## (2) WRITE MODE

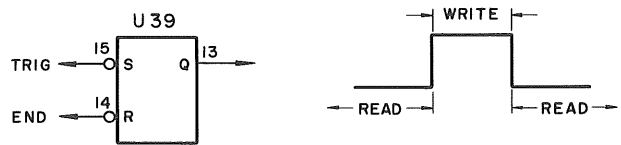
Write operation starts when either a TRIGGER signal is input or the WRITE START switch is pressed.

When the DISPLAY MODE is refreshed, the  $\bar{R}/W$  C signal is made "H" by the TRIG signal sent from the sweep unit. When 2 Kwords of write is completed, the  $\bar{R}/W$  C signal is made "L" by the W/C signal output from the WRITE COUNTER, causing the READ MODE to be activated.

When the DISPLAY MODE is PRE TRIG and the WRITE START switch is pressed, the  $\bar{R}/W$  C signal becomes "H", and write starts.

—DELAY COUNTER counts the trigger point set by the cursor. When counting is completed, the  $\bar{R}/W$  C signal is made "L" by the END signal of —DELAY COUNTER, causing the READ MODE to be activated.

## (a) $\bar{R}/W$ C (control unit)

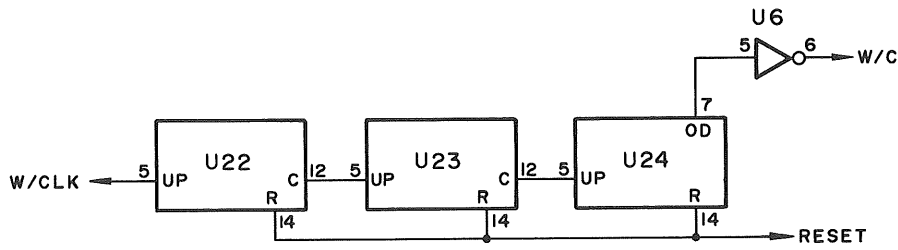


The  $\bar{R}/W$  C signal consists of R-S FF. It is set by the TRIG signal, and reset by the write end signal.

differentiated. Then the  $\overline{WRSTR}$  signal is output from U9-6 and used as a set signal for R/W C signal.

# CIRCUIT DESCRIPTION

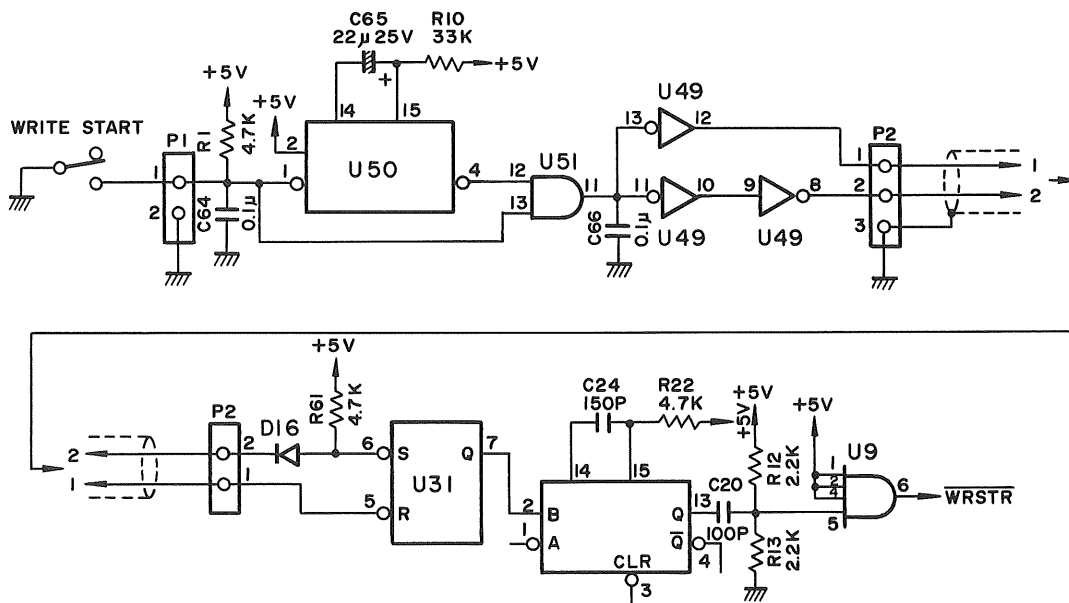
## (c) WRITE END in REFRESH MODE (refresh unit)



When the WRITE COUNTER (U22 to 24) completes 2048 counts, it outputs a W/C signal as an END signal. This W/C signal resets the  $\bar{R}/W$  C signal and ends the WRITE MODE.

## (d) WRITE START in PRE TRIG MODE

(Refresh unit → control unit)

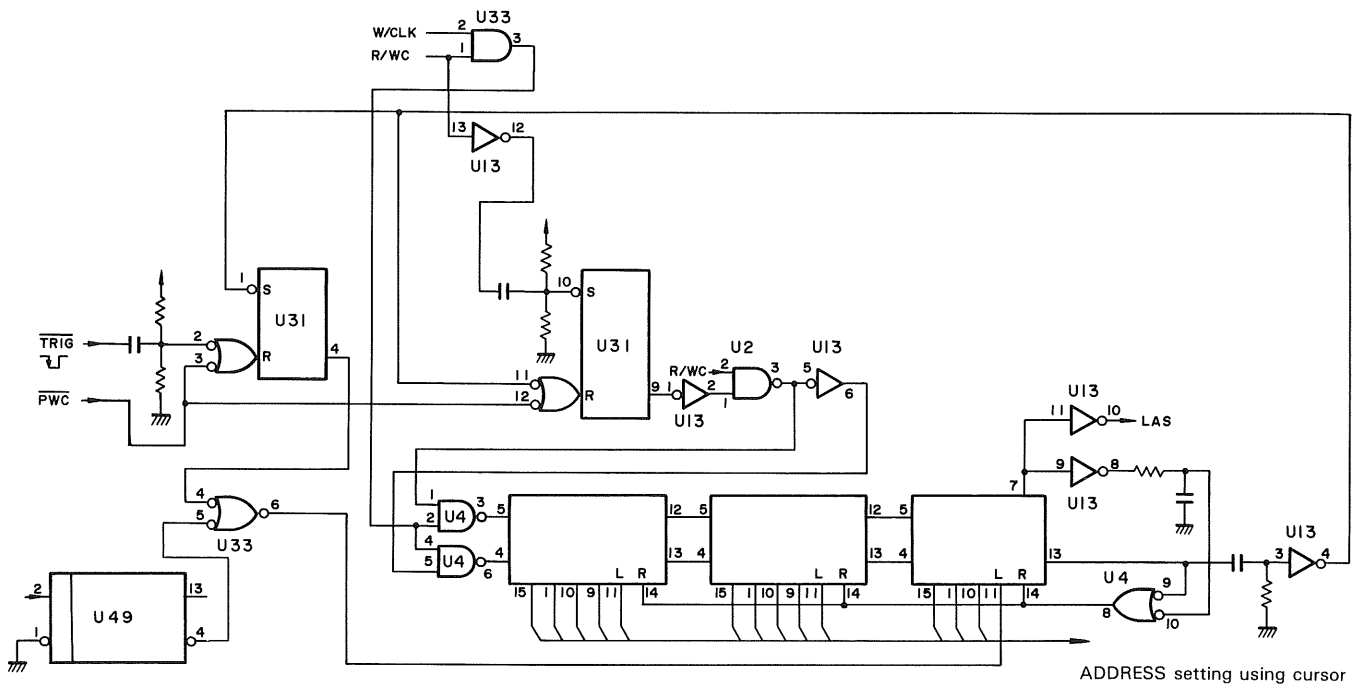


In the PRE TRIG MODE, when the WRITE START switch is pressed the control unit IC U49 is operated, causing the set signal of the  $\bar{R}/W$  C signal to be generated. The circuit in the

refresh unit is designed to eliminate chattering caused by the WRITE START switch.

# CIRCUIT DESCRIPTION

## (e) WRITE END (-DELAY) in PRE TRIG MODE (control unit)



When the WRITE START switch is pressed, a single shot pulse is output from U32-4. This pulse causes -DELAY COUNTER (U5 to 7) to load TRIG ADDRESS by means of the cursor. Next, the W/CLK signal causes DOWN COUNT to start. Upon completion of DOWN COUNT, the system goes

into the TRIG signal wait status. When the TRIG signal is input, -DELAY COUNTER is re-loaded, and UP COUNT starts. When the (2048 - cursor setting address) count is completed, the LAS signal is output from U13-10, causing R/W C signal to be reset.

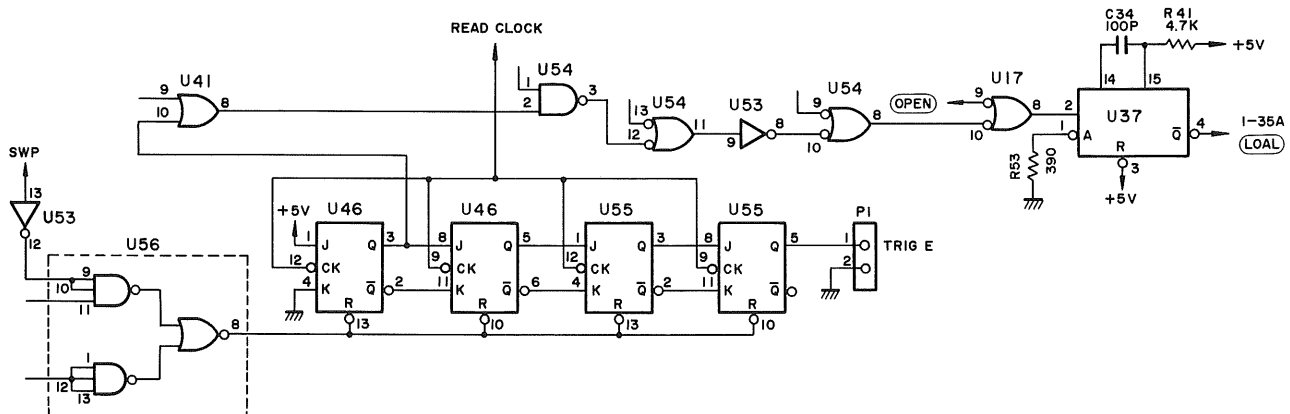
## (3) READ MODE

Three types of read operation, SCOPE, PEN, and EXT CLOCK, can be selected. In the SCOPE mode, synchronization is automatically applied by means of internal operation. For the other read modes, an external monitor is used. In the case of the PEN mode, a PEN DOWN signal is used as a syncsig-

nal, while for the EXT CLOCK mode, the READ GATE signal is used.

Also, when the SAMPLING CLOCK is between 0.1 mS and 100 mS/word, read takes place simultaneously with write, even when the WRITE MODE is activated.

## (a) SCOPE (control unit)



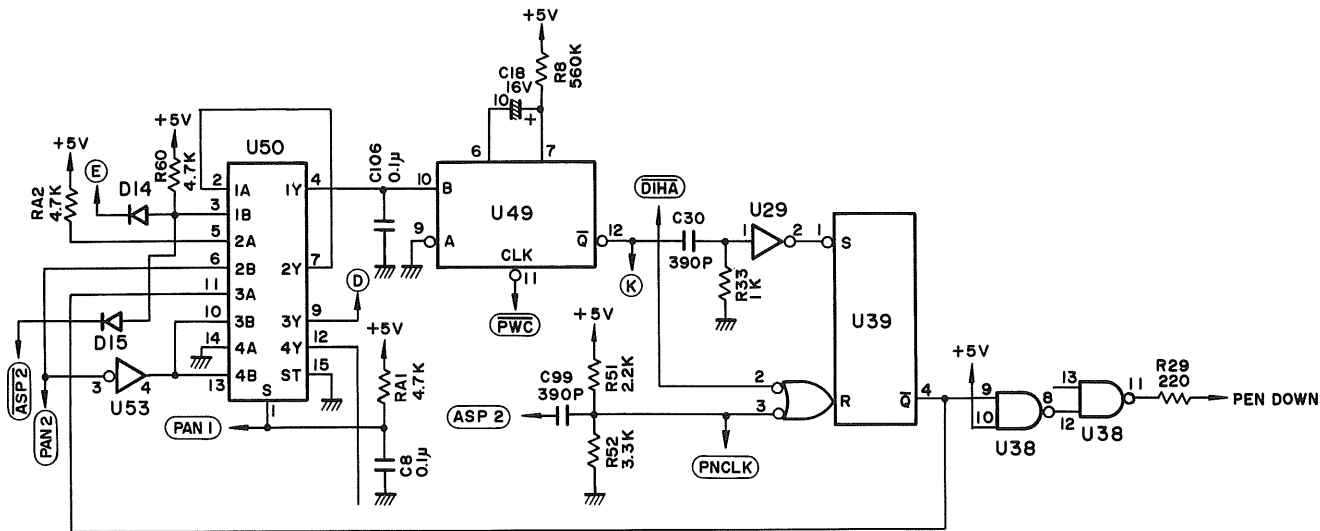


# CIRCUIT DESCRIPTION

The SWP signal generated in the sweep unit and READ CLOCK are synchronized by the sync counter consisting of U46 and 55, causing the TRIGE signal (TRIG  $\uparrow$ ) to be

generated. The LOAD signal which sets the initial address of READ COUNTER (refresh unit) is generated at the leading edge of the U46-3 signal output from U37-4.

## (b) PEN READ (control unit)

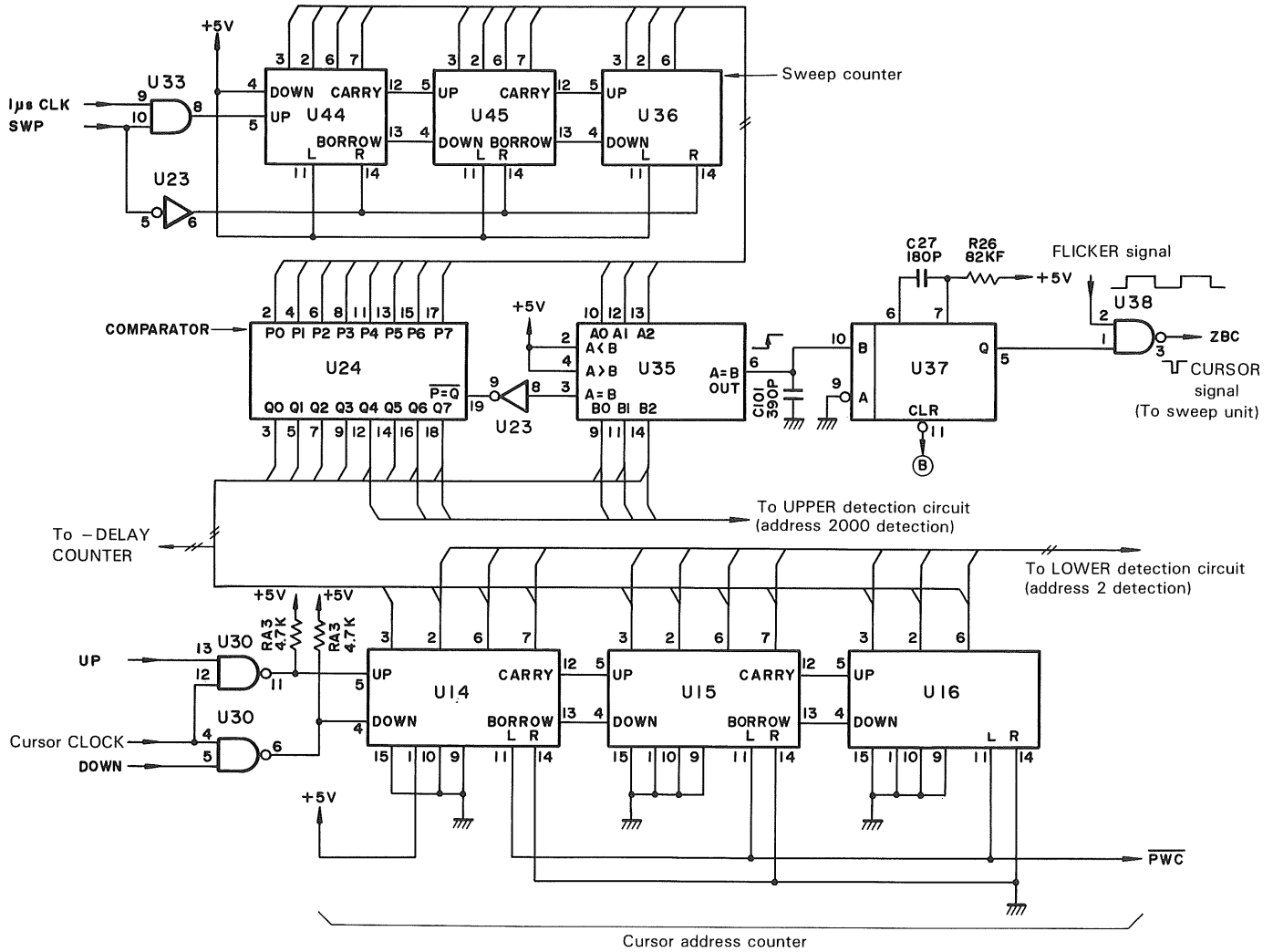


When the PEN switch is pressed, the  $\overline{ASP2}$  signal becomes "H" and the PEN START SW signal is connected to (E) ( $\uparrow$ ). Next, when the PEN START switch is pressed, a pulse of about 2 seconds ( $\square$ ) is generated at U49-12. At the leading edge of this pulse, R-S FF of U39 is set, and PEN MODE read takes place. When 2048 words have been out-

put, the  $\overline{DIHA}$  signal from the refresh unit is output, R-S FF of U39 is reset, and the system goes into a standby status. Also, in the PEN FREE RUN mode, the  $\overline{R/W}$  C signal is connected to U50-1, and upon completion of WRITE, a pulse of about 2 sec is output to U49-12, causing PEN read to start.

# CIRCUIT DESCRIPTION

## (4) Cursor signal generator circuit and -DELAY ADDRESS (control unit)



When the cursor switch is pressed once to set the cursor address, the cursor address counter U14 to 16 counts 1. when the cursor switch is held pressed, the cursor clock oscillator circuit operates to perform a continuous count. The left switch functions as DOWN COUNT and the right switch functions as UP COUNT. The data of the cursor address counter becomes TRIG ADDRESS of -DELAY COUNTER. The cursor signal consists of the SWP signal which is sent from

the sweep unit and the 1  $\mu$ S read clock and input to the sweep counter. The sweep counter, consisting of U44, 45, and 36, and the cursor address counter are compared with each other. When they agree with other, a 1  $\mu$ S pulse is emitted from U35-6. The width of this pulse is expanded by IC U46, and resulting signal ZBC which is provided with the FLICKER signal is output from C37-8.

# CIRCUIT DESCRIPTION

## 2. Description of Adjusters and Terminals

### 2-1. Description of Adjusters and Terminals on Front Panel

#### Verticals axis

##### CH1 or Y adjusters and terminals

- INPUT: CH1 or Y axis input terminal
- AC-GND-DC: CH1 or Y axis input selector
- VOLTS/DIV: CH1 or Y axis input attenuator
- VARIABLE: CH1 or Y axis fine adjustment attenuator
- PULL X5 GAIN: CH1 or Y axis input sensitivity multiplier
- $\blacklozenge$  POSITION: [oscillo mode] CH1 vertical position adjuster or Y axis position adjuster  
[memory mode] CH1 DC OFF-SET adjuster
- $\blacklozenge$  MEMORY POSITION: Memory waveform vertical position adjuster

##### CH2 or X adjuster and terminals

- INPUT: CH2 or X axis input terminal
- AC-GND-DC: CH2 or X axis input selector
- VOLTS/DIV: CH2 or X axis input attenuator
- VARIABLE: CH2 or X axis fine adjustment attenuator
- PULL X5 GAIN: CH2 or X axis input sensitivity multiplier
- $\blacklozenge$  POSITION: [oscillo mode] CH2 vertical position adjuster or X axis position adjuster  
[memory mode] CH2 DC OFF-SET adjuster
- $\blacklozenge$  MEMORY POSITION: Memory waveform vertical position adjuster
- CH2 INV: CH2 or X axis polarity inverter
- MODE: Operating mode selector  
(CH1, CH2, DUAL, ADD, X-Y)
- ALT, CHOP: Display method selector

##### Power supply and CRT adjusters and terminals

- POWER: Power switch
- SCALE ILLUM: Scale illumination adjuster
- $\perp$  (GND): Ground terminal
- CAL 0.5  $V_{p-p}$  1 KHz: Calibration voltage output terminal
- TRACE ROTATION: Trace tilt adjuster
- FOCUS: Focus adjuster
- INTENSITY: Brightness adjuster
- ASTIG: Astigmatism adjuster

##### Horizontal axis and trigger adjusters and terminals

- $\blacktriangleleft\blacktriangleright$  POSITION: Horizontal direction position adjuster

- PULL X10 MAG: Time axis multiplier
- SWEEP TIME/DIV: Oscillo scope sweep time selector
- VARIABLE: Oscillo scope sweep time fine adjuster
- TRIGGERING MODE: Trigger mode selector  
(AUTO, NORM)
- SOURCE: Trigger signal selector  
(CH1, CH2, EXT, LINE)
- COUPLING: Trigger signal input coupling selector  
(AC, HF<sub>FREJ</sub>, DC)
- LEVEL: Trigger signal level adjuster
- PULL SLOPE: Trigger signal polarity selector
- EXT TRIG: External sync signal input terminal

##### Memory operation adjusters and terminals

- DISPLAY MODE Display type and memory write operation selector switch
- OSCILLO  
Oscilloscope operates as dual trace oscilloscope.
- REFRESH-NORM  
Memory write is started by the trigger signal or WRITE/PEN START. When 2048 words have been written, the write operation stops and the system goes into standby in a read status until the next trigger signal or manual start is input.
- REFRESH-DELAY  
The basic operation of REFRESH DELAY is the same as that of REFRESH-NORM except for the following.  
The data after the cursor point is written in the 2048 word memory on another channel by the sampling clock of that channel. When write operation for both channels is completed, the system goes into standby in a read status until the next trigger signal or manual start is input. When the MODE is DUAL, the same operation as REFRESH-NORM takes place. In the case of ADD, data after the cursor point is written to the CH1 side by SAMPLING CLOCK A.
- PRE TRIG-NORM  
Memory write is performed by WRITE/PEN START. The point set by the CURSOR switch becomes the trigger address of the memory. When the trigger signal is input, NS QEIRW OPWERION OD (2kw-cursor set w) completed, the system goes into standby in a read status until the start button is pressed again. However, PULL DISPLAY TIME is OFF. Using this mode, the waveform prior to the trigger signal can be observed.  
When the MODE is DUAL, CH1 performs the above operation. When write to CH1 is completed, write to CH2 is also completed.
- PRE TRIG-DELAY  
At the channel specified by MODE, the same operation as PRE TRIG-NORM takes place, and 2048 words of data after the cursor point are written to another channel by the sampling clock of that channel. Upon completion of

# CIRCUIT DESCRIPTION

write operation to both channels, the system goes into standby in a read status until the start button is pressed again. However, PULL DISPLAY TIME is OFF.

When the MODE is DUAL, PRE TRIG-NORM operation takes place on the CH1 side, and data after the CH1 cursor point (CH1 trigger point) starts to be written in the memory on the CH2 side. When 2048 words have been written, write operation stops.

- PEN/SCOPE: SCOPE MODE, PEN MODE selector switch
- FREE RUN: Memory write, PEN OUT read repeat switch
- WRITE/PEN START: Memory write manual start and pen start button
- CURSOR: (DELAY or PRE TRIG POSITION) Minus delay point and sub-channel write point setting switch
- FREEZE: Write operation stop switch
- SAMPLING CLOCK A, B: Sampling frequency selector
- PULL DISPLAY TIME: Display time setting switch
- PEN SPEED: PEN SPEED selector
- 8DIV/4DIV: 8DIV, 4DIV selector switch

## LEDs

- LED (red) POWER: Power indicator
- LED (green) TRIG'D: Trigger indicator
- LED (green) READ: Read status indicator
- LED (red) WRITE A, B: Write status indicator
- LED (green) CURSOR: Cursor advance direction indicator
- LED (green) FREEZE: Write operation stop indicator
- LED (green) GP-IB: SRQ, TALK, LISTEN, REN indicator

## 2-2. Description of Adjusters and Terminals on Real Panel

- MEMORY OUT A, B: Digital to analog conversion signal output terminal
- FOR PEN A, B: Pen recorder signal output terminal
- READ GATE OUT: Memory final address output terminal
- READ GATE OUT FOR PEN: Pen down signal output terminal
- EXT CLOCK: read-only external clock input terminal
- SWEEP GATE 220 $\Omega$ : Sweep gate output terminal
- Z AXIS 10K $\Omega$  50V: External brightness modulation input terminal
- CH1 OUT mV/DIV 50 $\Omega$ : CH1 vertical signal output terminal
- ADDRESS: GP-IB address setting switch
- GP-IB connector: GP-IB connector
- Power supply connector: AC power supply input connector
- FUSE: Fuse holder
- Voltage selector: AC voltage selector
- GND: Ground terminal
- Fan: Cooling fan inside cabinet

# ADJUSTMENT

## 1. Adjustment Preparations

### 1-1. Presettings

Knob	Set position
POWER	ON
FOCUS	Optimum adjustment point
ASTIG	Optimum adjustment point
INTENSITY	3 o'clock position after adjustment
MODE	CH1 (■) depressed; other mode switches (■) released
MEMORY POSITION	Mechanical center (both CH1 and CH2)
POSITION	Mechanical center (both CH1 and CH2)
VOLTS/DIV	5mV (both CH1 and CH2)
VARIABLE PULL × 5 GAIN	CAL PUSH (both CH1 and CH2)
AC-GND-DC	DC (both CH1 and CH2)
POSITION PULL × 10 MAG	Mechanical center PUSH
SWEEP TIME/DIV	.1mS
VARIABLE	CAL
TRIGGERING MODE	AUTO
TRIGGERING SOURCE	CH1
TRIGGERING COUPLING	AC
TRIGGERING LEVEL	Mechanical center and PUSH
DISPLAY MODE	OSCILLO
8 BITS FULL SCALE	8 DIV
DISPLAY MODE NORM, DELAY	NORM (■)
PEN SCOPE	SCOPE (■)
FREE RUN	OFF (■)
SAMPLING CLOCK	5μS (both A and B)
PULL DISPLAY TIME	Fully counterclockwise and PULL
PEN SPEED	10mS
ADDRESS	φ7

### 1-2. Instruments Used

The instruments used must be those shown below or those with at least equivalent performance.

Type of instrument	Model name	Maker	Remarks
Multimeter	DL-720	Trio	
High voltage probe		HIOKI	Modified
Pulse generator	PG-506	Tektronix	
Timer marker	TG-501	Tektronix	
Sine wave generator	SG-503	Tektronix	

Type of instrument	Model name	Maker	Remarks
Sine wave generator	651B	HP	
Q-meter		Trio	
10dB ATT			
50 Ω terminator			
BNC T-3 JACKS			
Square wave generator	211B	HP	
Wattmeter			
Insulation tester			
Dielectric strength tester			
Oscilloscope	CS-2110	Trio	
DC standard			
Frequency counter			

### 1-3. Checking Each Voltage

Voltage	Range
+ 5V	+ 4.75 ~ 5.25V
+ 10V	+ 9.7 ~ 10.3V
+ 20V	+ 19.4 ~ 20.6V
+ 140V	+ 135.8 ~ 144.2V

### 1-4. - 10V Adjustment

Adjust VR1 (power supply unit) so that pin 4 of P21 of the power supply unit becomes - 10 V.

Rating: - 9.7V to - 10.3V

### 1-5. High Voltage Adjustment

Adjust VR2 (power supply unit) so that pin 3 of P40 of the power supply unit becomes 1.5 kV ± 0.01 kV

**Note:** Use a high voltage probe.

When measuring waveforms using MEMORY OUT and SWEEP GAIN, connect the oscilloscope as shown below.

MS-1660	External Oscilloscope
MEMORY OUT	CH1, CH2
SWEEP GATE	EXT TRIG

Set position of external oscilloscope

VOLTS/DIV : 0.2V/div  
 SWEEP TIM/DIV : 0.2ms/div  
 TRIG' SOUCE : EXT

# ADJUSTMENT

## 2. CRT Adjustment

### 2-1. INTENSITY Adjustment

TRIG MODE: X-Y AC-GND-DC: GND

Adjust VR3 (power supply unit) so that the trace goes out when the INTENSITY knob is at the 9:30 position. Turning the knob clockwise should increase the brightness of the trace, and turning it counterclockwise should decrease that brightness.

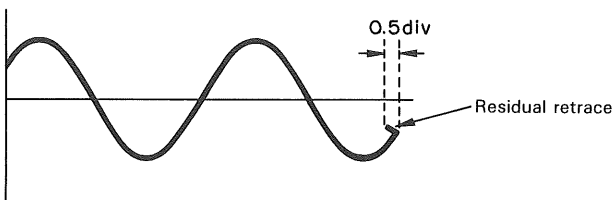
### 2-2. Blanking Adjustment

MODE: CH1, AC-GND-DC: AC

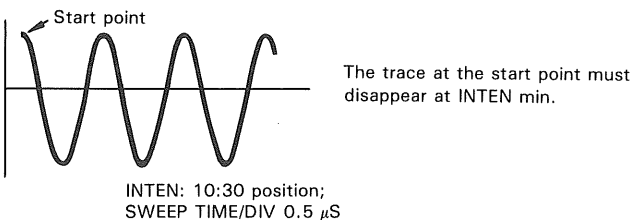
SWEEP TIME/DIV:  $2\mu\text{S}$  (PULL x10 MAG)

INTENSITY: Fully clockwise VOLTS/DIV: 5 mV

1. Input a 1 MHz sine wave to the CH1 INPUT and set the amplitude to 3 divisions.
2. Adjust TC1 (power supply unit) so that the brightness of the trace at the start of the waveform has minimal non-uniformity and also the return of the trace (retrace) at the end of the waveform is as small as possible. Note that according to this adjustment the size of the residual retrace at the end of the sweep and also the brightness of the trace at the start of the sweep will change.



Perform adjustment so that the residual retrace is within 0.5 div in the horizontal direction.



### 2-3. Adjusting Trace Centering

1. Place a shorting bar across the test pins of the vertical amplifier unit.
2. Adjust VR20 (vertical amplifier unit) so that the trace comes to the horizontal center of the screen.

### 2-4. Adjusting 55 V

AC-GND-DC: GND

1. Short-circuit R197 and 198 of the vertical amplifier unit.
2. Adjust VR19 (vertical amplifier unit) so that the +Y (or -y) voltage becomes  $55\text{ V} \pm 0.5\text{ V}$ . If the center of the trace shifts during this adjustment, repeat adjustment from procedure 2-3.

## 3. Adjusting Vertical Amplifier

### 3-1. Adjusting CH1X5 DC BAL

AC-GND-DC: GND

Adjust VR1 (vertical head amplifier unit) so that the trace does not move up and down in either the CH1 PULL X5 GAIN or NORM mode.

### 3-2. Adjusting CH1 DC BAL

AC-GND-DC: GND

Adjust VR1 (vertical amplifier unit) so that the trace does not move up or down when the VARIABLE knob is rotated at a setting of VOLTS/DIV 5 mV.

### 3-3. Adjusting CH1 POSITION

Adjust VR3 (vertical amplifier unit) so that when the CH1 POSITION knob is at its mechanical center, the trace comes to the center of the screen.

### 3-4. Adjust CH1 GAIN

MODE: CH1 VOLTS/DIV: 5 mV

Apply a 20 mVp-p 1 kHz square wave to CH1 INPUT, and adjust VR4 (vertical amplifier unit) so that the amplitude of the waveform becomes 4 divisions.

### 3-5. Adjusting CH2 DC BAL

Adjust CH2 DC BAL (MODE: CH2) in the same way as for CH1 using VR2 (vertical head amplifier unit).

### 3-6. Adjusting CH2 DC BAL

Adjust CH2 DC BAL (MODE: CH2) in the same way as for CH1 using VR9 (vertical amplifier unit).

### 3-7. Adjusting CH2 INV DC BAL

Adjust CH2 INV DC BAL (MODE: CH2 INV) using VR8 (vertical amplifier unit).

### 3-8. Adjusting CH2 POSITION

Adjust CH2 POSITION (MODE: CH2) in the same way as for CH1 using VR12 (vertical amplifier unit).

### 3-9. Adjusting CH2 INV POSITION

MODE: CH2 AC-GND-DC: GND

1. Move CH2 POSITION so that the trace comes to the center of the screen.
2. Adjust VR11 (vertical amplifier unit) so that when CH2 INV is depressed, the trace comes to the center of the screen.

# ADJUSTMENT

## 3-10. Adjusting CH2 GAIN

MODE: CH2 VOLTS/DIV: 5 mV

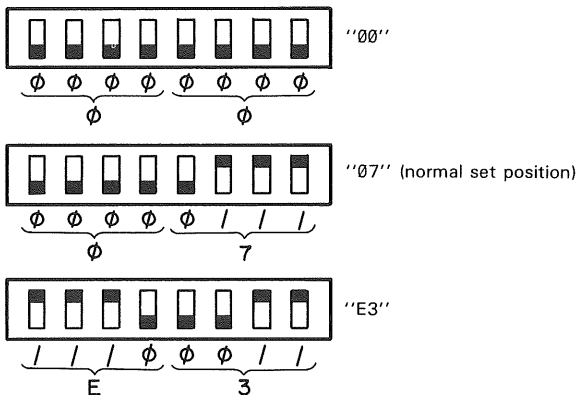
Apply a 20 mVp-p 1 kHz square wave to CH2 INPUT, and adjust VR14 (vertical amplifier) so that the amplitude of the waveform becomes 4 divisions. The amplitude must not change when CH2 INV is depressed.

## 4. Setting memory board address switches

Be careful of the following points when operating the address switches at the back of the oscilloscope in order to adjust the memory board unit.

1) When an address switch is in the top position, it represents "1". When the switch is in the bottom position, it represents "0". In the adjustment procedure, an address is represented in hexadecimal notation. When changing an address, first turn off the oscilloscope and then operate the switches.

Upon completion of adjustment, set the switches to "07".



Because adjustment is the same for both CH1 and CH2, the description is based on CH1; the VR numbers and test pin numbers for CH2 are given in parenthesis.

SAMPLING CLOCK A, B: 0.1 mS/WORD TRIGGERING SOURCE: LINE Use pins 1 and 2 of input terminal P1 (P2) as GND, and pin 3 as input.

### 4-1. Adjusting DC Offset (1)

Set VR11 (VR18) to 0Ω (turn fully counterclockwise). Set input P1 (P2) to 0 V and adjust VR2 (VR6) so that the voltage of TP2 (TP5) becomes  $-250 \text{ mV} \pm 1.5 \text{ mV}$ .

### 4-2. Adjusting Input GAIN

AC-GND-DC: GND

1. Apply  $-800 \text{ mVDC}$  to input P1 (P2), and adjust VR1 (VR5) so that the voltage at TP2 (TP5) becomes  $-475 \text{ mV} \pm 2.5 \text{ mV}$ .
2. Apply  $+800 \text{ mVDC}$  to input P1 (P2) and verify that the voltage at TP2 (TP5) is  $-25 \text{ mV} \pm 1 \text{ mV}$ . If it is not, repeat steps 1 and 2.
- \* Set GAIN to  $-450 \text{ mV}$ . Next alternately input  $-800 \text{ mV}$  and  $+800 \text{ mV}$  to P1 (P2) and adjust so that  $-475.0 \text{ mV}$  and  $25.0 \text{ mV}$  are obtained at TP2 (TP5).  
It is also possible to perform adjustment so that the lowest digits become the same.

### 4-3. Adjusting A/D $V_{\text{ref}}$

Adjust VR3 (VR7) so that the voltage at TP3 (TP6) becomes  $-500 \text{ mV} \pm 0.5 \text{ mV}$ .

### 4-4. Adjusting D/A GAIN

1. The WRITE LED must be out when TRIG is not applied (the TRIG LEVEL knob is set to the maximum + or - position).
2. Turn off the oscilloscope, then set the ADDRESS switch to "E3" and once again turn on the oscilloscope. Adjust VR13 (VR20) so that the voltage at TP7 (TP9) becomes  $+1.776 \text{ V} \pm 2 \text{ mV}$ . (Before this adjustment, remove the DC bias jumper J1 (J2).)
3. Connect J1 (J2) and adjust VR14 (VR21) so that the voltage at TP7 (TP9) becomes  $+888 \text{ mV} \pm 4 \text{ mV}$ . Upon completion of adjustment, reset the address to "07".

### 4-5. Re-adjusting D/A Gain (1)

Apply  $+800 \text{ mVDC}$  to input P1 (P2), and adjust VR2 (VR6) so that the voltage at TP7 (TP9) becomes  $-800 \text{ mV} \pm 8 \text{ mV}$ .

### 4-6. Re-adjusting D/A Gain (2)

Apply  $-800 \text{ mVDC}$  to input P2 (P2), and adjust VR3 (VR7) so that the voltage at TP7 (TP9) becomes  $+800 \text{ mV} \pm 8 \text{ mV}$ .

### 4-7. Re-adjusting DC offset

Set input P1 (P2) to 0 V, and re-adjust VR14 (VR21) so that the voltage at TP7 (TP9) becomes  $0 \text{ V} \pm 2 \text{ mV}$ .

### 4-8. PEN OUT Adjustment

1. Set input P1 (P2) to 0 V. Using VR14 (VR21), adjust the voltage at TP7 (TP9) to  $0 \text{ V} \pm 1 \text{ mV}$ . Next, adjust VR12 (VR19) so that the voltage at TP8 (TP10) becomes  $0 \text{ V} \pm 1 \text{ mV}$ .
2. Set the PEN/SCOPE switch to the PEN position (▲) and press the WRITE/PEN START switch. After about 2 seconds, data will start to be output. At this time, adjust VR14 (VR21) so that the voltage at the PEN OUT A(B)

# ADJUSTMENT

terminal (rear panel) becomes  $0\text{ V} \pm 2\text{ mV}$ . Upon completion of adjustment, set the PEN/SCOPE switch to the SCOPE position (■).

3. Apply  $+800\text{ mVDC}$  to input P1 (P2), and depress the PEN/MONI switch (■). Press the WRITE/PEN START switch. After about 2 seconds, data output will start. At this time, adjust VR8 (VR15) so that the voltage at the PEN OUT A(B) terminal becomes  $+1,000\text{ V} \pm 10\text{ mV}$ . After adjustment, re-press the PEN/MONI switch (■).
4. Apply  $-800\text{ mVDC}$  to input P1 (P2), and depress the PEN/MONI switch (■). Press the WRITE/PEN START switch. After about 2 seconds, data output will start. At this time, verify that the voltage at the PEN OUT A(B) terminal is  $-1,000\text{ V} \pm 10\text{ mV}$ . After adjustment, re-press the PEN/MONI switch (■).

When adjusting the PEN OUT output, set PEN SPEED to 50 mS/word. Next, press the WRITE/PEN START switch. About 2 seconds later, data will be output for about 100 seconds. To repeat the PEN OUT operation (repetition of 2 seconds waiting time and 100 seconds data output time), depress the FREE RUN switch (■).

## 4-9. Adjusting MEMORY OUT (1)

Set input P1 (P2) to 0 V, and adjust VR14 (VR21) so that the voltage at the MEMORY OUT terminal becomes  $0\text{ V} \pm 2\text{ mV}$ .

## 4-10. Adjusting MEMORY OUT (2)

1. Apply  $+800\text{ mVDC}$  to input P1 (P2), and adjust VR10 (VR17) so that the voltage at the MEMORY OUT A(B) terminal becomes  $+800\text{ mV} \pm 8\text{ mV}$ .
2. Apply  $-800\text{ mVDC}$  to input P1 (P2), and verify that the voltage at the MEMORY OUT A(B) terminal is  $-800\text{ mV} \pm 8\text{ mV}$ .

Note: Output from MEMORY OUT for  $+800\text{ mVDC}$  input:  $\alpha$

Output from MEMORY OUT for  $-800\text{ mVDC}$  input:  $\beta$

$\alpha + \beta$  must be  $1.6\text{ V} \pm 8\text{ mV}$ .

## 4-11. Adjusting 8-BIT FULL SCALE

1. Set the 8-BIT FULL SCALE switch to 4 DIV (■), apply  $+800\text{ mVDC}$  to input P1 (P2), and adjust VR9 (VR11) so that the voltage at the MEMORY OUT terminal becomes  $+400\text{ mV} \pm 4\text{ mV}$ .
2. Apply  $-800\text{ mVDC}$  to P1 (P2), and verify that the voltage at the MEMORY OUT terminal is  $-400\text{ mV} \pm \text{mV}$ .  
Output from MEMORY OUT for  $+800\text{ mVDC}$  input:  $\alpha$   
Output from MEMORY OUT for  $-800\text{ mVDC}$  input:  $\beta$   
 $\alpha + \beta$  must be  $1600\text{ mV} \pm 16\text{ mV}$ .

## 4-12. Adjusting AD Signal and Trigger Signal

VOLTS/DIV: 5 mV MODE: CH1 AC-GND-DC: GND

DISPLAY MODE: OSCILLO

1. Connect connectors P1 and P2. Next, using the CH1 POSITION knob, align the trace with the horizontal center of the screen.
2. Set the DISPLAY MODE to REFRESH, and adjust VR5 (vertical amplifier) so that pins 1 and 3 of P12 become the same potential.
3. Adjust VR7 (vertical amplifier) so that the voltage at pin 2 of P17 becomes  $0\text{ V} \pm 2\text{ mV}$ . Re-check step 2, and if the adjustment has changed, repeat steps 2 and 3.
4. Set AC-GND-DC to DC, and CH1 VOLTS/DIV to 5 mV. Next, apply  $+20\text{ mVDC}$  to CH1 INPUT, and adjust VR6 (vertical amplifier) so that the output at the MEMORY OUT A terminal (rear panel) is  $800\text{ mV} \pm 8\text{ mV}$ .
5. Apply  $-20\text{ mVDC}$  to CH1 INPUT, and verify that the voltage at the MEMORY OUT terminal is  $-800\text{ mV} \pm 8\text{ mV}$ .

**Note:** After inputting a signal or changing the polarity, wait for about 10 seconds before performing measurement or adjustment.

For steps 4 and 5, set SOURCE to LINE.

## 4-13. Adjusting AD Signal and Trigger Signal

Perform adjustment in a similar way to that of CH1.

P12	→	P13
VR5	→	VR15
VR7	→	VR17
VR6	→	VR16
VR17	→	P18
MEMORY	→	MEMORY
OUT A	→	OUT B

## 4-14. Adjusting MEMORY POSITION

MODE: CH1 AC-GND-DC: GND

DISPLAY MODE: OSCILLO

1. Using CH1  $\blacktriangle$  POSITION, align the trace with the center of the screen. Next, set DISPLAY MODE to REFRESH, and rotate the MEMORY POSITION knob to its mechanical center. SOURCE: LINE
2. Using VR21 (vertical unit), align the trace with the center of the screen.



# ADJUSTMENT

## 4-15. Adjusting MEMORY CH1 GAIN

DISPLAY MODE: REFRESH-NOM AC-GND-DC: DC  
MODE: CH1 VOLTS/DIV: 5 mV SOURCE: LINE

1. Apply +20 mVDC to CH1 INPUT, and adjust VR22 (vertical unit) so that the trace comes to the +4 division.
2. Input -20 mVDC to CH1 INPUT and verify that the trace comes to the -4 division.

**Note:** After inputting a signal or reversing the polarity of the input signal, wait for about 10 seconds before performing measurement or adjustment.  
If MEMORY CH1 POSITION shifts as the result of this adjustment, repeat adjustment from 4-14.

## 4-16. Adjusting MEMORY CH2 POSITION

Perform adjustment in a similar way to that for CH1 (MODE: CH2).

VR21 → VR23

## 4-17. Adjusting MEMORY CH2 GAIN

Perform adjustment in a similar way to that for CH1 (MODE: CH2).

VR22 → VR24

## 4-18. Adjusting ADD

VOLTS/DIV: 5 mV MODE: CH2  
AC-GND-DC: GND DISPLAY MODE: OSCILLO

1. Connect connectors P1 and P2, and adjust the CH2 POSITION knob so that the voltage at pin 6 of U7 becomes  $0\text{ V} \pm 1\text{ mV}$ .
2. Set the MODE to ADD, and adjust the CH1 POSITION knob so that the voltage at pin 6 of U7 becomes  $0\text{ V} \pm 1\text{ mV}$ . Next, apply +10 mV DC to CH1 INPUT and CH2 INPUT, and adjust VR4 so that the voltage at pin 6 of U7 becomes  $800\text{ mV} \pm 4\text{ mV}$ .
3. Apply -10 mVDC to CH1 INPUT and CH2 INPUT, and verify that the voltage at pin 6 of U7 is  $-800\text{ mV} \pm 4\text{ mV}$ .

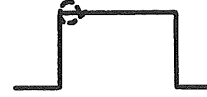
## 4-19. Adjusting CH1 Overshoot

AC-GND-DC: DC VOLTS/DIV: 5 mV  
SWEEP TIME/DIV: 0.2  $\mu\text{s}$

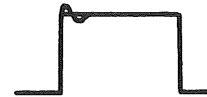
1. Apply a 1 MHz square wave to CH1 INPUT, and adjust the amplitude of the waveform to 6 divisions.
2. Using TC1 (vertical amplifier unit), make the middle and low frequency components of the waveform flat.



3. Set TC2 (vertical amplifier unit) to its mechanical center.
4. Using TC3 (vertical amplifier unit), make the middle frequency component flat.



5. Using TC6 (vertical amplifier unit) and VR25 (vertical amplifier unit), adjust the high frequency component.



6. Repeat steps 4 and 5 until the waveform becomes square.

## 4-20. CH2 Wave-shaping and Overshoot Adjustment

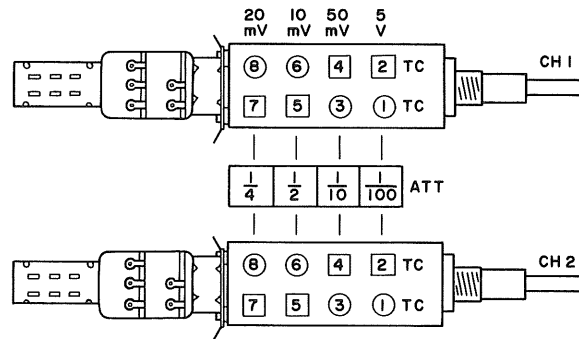
Perform adjustment in a similar way to that of CH1.

TC3 → TC5  
TC6 → TC4  
VR25 → VR26

Perform steps 3, 4, and 5 of 4-19 in accordance with the above conditions. If adjustment is impossible, finely adjust TC2.

## 4-21. CH1 and CH2 Wave-shaping and Input Capacity Adjustment

1. Input a 1 kHz square wave and set the amplitude to 6 divisions.
2. Make the waveform in the 10 mV range flat.
3. Next, perform waveform shaping in the 20 mV range, adjust the 10 mV input capacity, adjust the 20 mV input capacity, perform wave-shaping and input capacity adjustment in the 50 mV range, and finally perform wave-shaping and input capacity adjustment in the .5V range.



# ADJUSTMENT

	□ mark	○ mark
	Input capacity	Wave-shaping
5 mV reference	_____	_____
10 mV 1/2	TC5	TC6
20 mV 1/4	TC7	TC8
50 mV 1/10	TC4	TC3
.5 V 1/100	TC2	TC1

## Adjustment sequence

- ① 10 mV wave-shaping  
→ ② 20 mV wave-shaping  
→ ③ 10 mV input capacity
- ④ 20 mV input capacity  
→ ⑤ 50 mV wave-shaping and input capacity
- ⑥ .5 V wave-shaping and input capacity

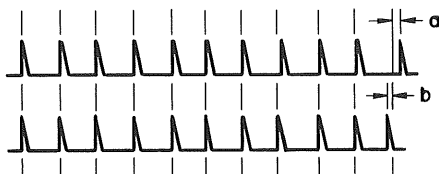
**Note:** .1 V wave-shaping: When overshoot is found, adjust TC5.

.2 V wave-shaping: When overshoot is found, adjust TC7.

## 5. Sweep Unit

### 5-1. SWEEP TIME Adjustment

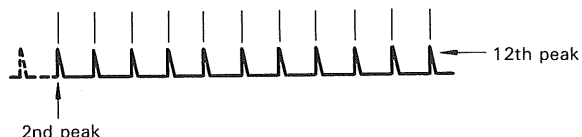
- Set SWEEP TIME/DIV to 0.1 mS, then apply a 0.1 mS marker signal to V INPUT.
- Adjust VR14 (sweep unit) so that when the first peak of the marker signal is aligned with the left edge of the graduated scale on the screen, the 11th peak coincides with the right edge of the scale.
- Set SWEEP TIME/DIV to 10 mS, then apply a 10 mS marker signal to V INPUT and check whether or not the first peak of the marker coincides with the left edge of the graduated scale on the screen and the 11th peak with the right edge. If the peaks are misaligned, set SWEEP TIME/DIV to 0.1 mS and 10 mS, respectively, and adjust VR14 (sweep unit) so that the error is the same in both cases.



**Note:** Perform adjustment so that  $a = b$ .

### 5-2. SWEEP LENGTH Adjustment

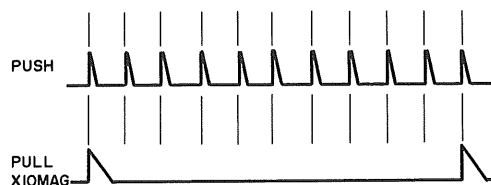
- Apply a 0.1 mS marker signal to CH1 INPUT.
- Verify that when the first peak is aligned with the left edge of the graduated scale on the screen, the 11th peak coincides with the right edge of the scale. Using the ◀ ▶ POSITION knob, shift the waveform by one peak to the left and adjust VR9 (sweep unit) so that the 12th peak coincides with the right edge of the scale.



### 5-3. Adjusting $\times 10$ MAG GAIN

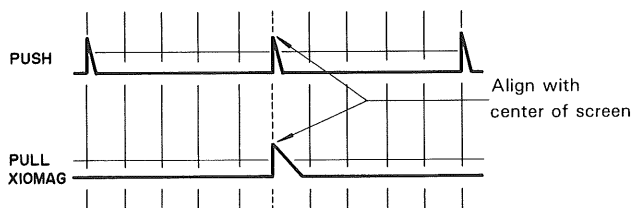
MODE: CH1 VOLTS/DIV: 1V

- Apply a 0.1 mS marker signal to CH1 INPUT, and align the first and 11th peaks with the scale on the screen.
- Adjust VR19 (sweep unit) so that when the PULL  $\times 10$  MAG knob is pulled, the interval between the peaks of the marker signal becomes 10 divisions.



### 5-4. Adjusting $\times 10$ MAG Center

- Apply a 0.5 mS marker signal to CH1 INPUT.
- Set PULL  $\times 10$  MAG to PULL, and rotate the H POSITION knob until the center peak comes to the center of the screen.
- In this condition, adjust VR20 (sweep unit) so that when the PULL  $\times 10$  MAG knob is pushed, the center peak comes to the center of the screen.
- Repetively change the PULL  $\times 10$  MAG knob between PULL and PUSH several times and verify that the peak of the marker signal at the center of the screen does not move.

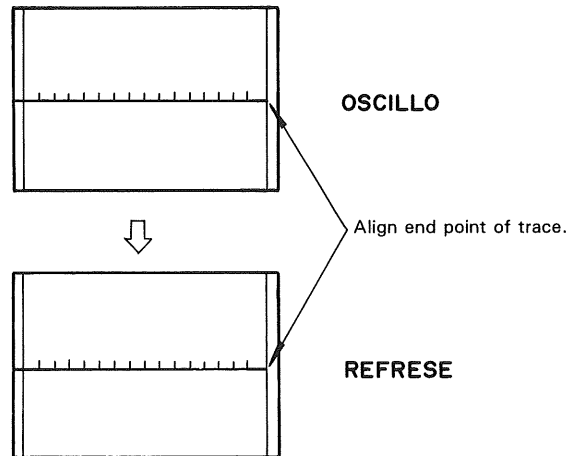
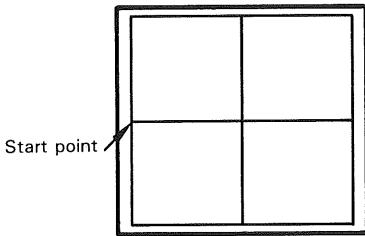


# ADJUSTMENT

## 5-5. Adjusting SWEEP POSITION

AC-GND-DC: GND

1. Rotate the H POSITION knob to its mechanical center.
2. Adjust VR16 (sweep unit) so that the start point of the trace comes to the left edge of the scale.



## 5-6. Adjusting SWEEP TIME 5 $\mu$ S

1. Set SWEEP TIME/DIV to 5  $\mu$ S, then apply a 5  $\mu$ S marker signal to CH1 INPUT.
2. Adjust TC1 (sweep unit) so that the first peak of the marker signal on the screen coincides with the left edge of the scale on the screen, and the 11th peak with the right edge of the scale.

## 5-7. Adjusting MEMORY SWEEP TIME

DISPLAY MODE: REFRESH MODE: CH1  
SAMPLING CLOCK A: 1  $\mu$ S/word

1. Apply a 0.2 mS marker signal to CH1 INPUT.
2. Adjust VR7 (sweep unit) so that the first peak of the marker signal coincides with the left edge of the scale on the screen, and the 11th peak with the right edge of the scale.

## 5-8. Aligning Start Point of MEMORY OSCILLO SWEEP

AC-GND-DC: GND SWEEP TIME/DIV: 0.1 mS  
SOURCE: LINE DISPLAY MODE: OSCILLO  
SAMPLING CLOCK A: 0.1 mS/word INTEN: MAX

1. Align the start point of the trace with the left edge of the scale on the screen.
2. Set DISPLAY MODE to REFRESH, and adjust VR6 (sweep unit) so that the start point of the trace coincides with the left edge of the scale on the screen.

## 5-9. Adjusting MEMORY SWEEP LENGTH

1. Set DISPLAY MODE to OSCILLO, and align the right edge of the trace with the right edge of the scale on the screen.
2. Set DISPLAY MODE to REFRESH, and adjust VR8 (sweep unit) so that the end point of the trace coincides with the right edge of the scale on the screen.

## 5-10. Adjusting $\times$ GAIN

MODE: X-Y AC-GND-DC: AC VOLTS/DIV: 5 mV

Apply a 20 mVp-p square wave signal to CH2 INPUT, and adjust VR13 (sweep unit) so that the horizontal amplitude becomes 4 divisions.

**Note:** make the horizontal amplitude 4 divisions symmetrical about the center of the screen.

## 5-11. Adjusting $\times$ POSITION

MODE: CH2 AC-GND-DC: GND

Adjust the CH2 POSITION knob so that the trace comes to the center of the screen. In this condition, set MODE to X-Y and adjust VR12 (sweep unit) so that the beam spot comes to the center of the screen.

Move the CH2 POSITION knob to its mechanical center and verify that the error between the spot and the center of the screen is within 0.5 divisions. Next, rotate the CH2 POSITION knob fully clockwise and counterclockwise, and verify that the spot moves at least 5 divisions from the center to the right and left, respectively.

## 5-12. Adjusting MEMORY $\times$ POSITION Center

MODE: CH2 SOURCE: LINE  
SAMPLING CLOCK: 0.1 mS/word

1. Using the CH2  $\blacklozenge$  POSITION knob, move the trace to the center of the screen. Next, set DISPLAY MODE to REFRESH, and using the CH2 MEMORY POSITION knob bring the trace to the center of the screen.
2. Set MODE to X-Y and adjust VR18 (sweep unit) so that the beam spot comes to the center of the screen.

## 5-13. Adjusting MEMORY $\times$ GAIN

MODE: CH2 SOURCE: LINE DISPLAY MODE: OSCILLO

1. Using the CH2  $\blacklozenge$  POSITION knob, align the trace with

# ADJUSTMENT

the center of the screen. Next, set DISPLAY MODE to REFRESH, then using the CH2  $\blacktriangle$  MEMORY POSITION knob move the trace to the center of the screen.

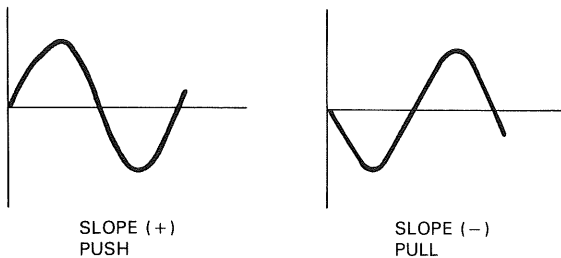
2. Change MODE to X-Y and set AC-GND-DC to DC. Next, apply +20V mVDC to CH2 INPUT and adjust VR17 (sweep unit) so that the horizontal axis is +4 divisions with respect to the center of the screen.
3. Apply -20 mVDC to CH2 INPUT and verify that the beam spot is -4 divisions from the center. If it is not, repeat the above adjustments.

**Note:** After changing the input, allow at least 10 seconds before performing adjustment.

## 5-14. Adjusting TRIG SLOPE

AC-GND-DC: AC SWEEP TIME/DIV: 0.2 mS

1. Apply a 1 kHz sine wave to CH1 INPUT and set the amplitude to 6 divisions.
2. Adjust the TRIG LEVEL and CH1  $\blacktriangle$  POSITION knobs so that the amplitude of the waveform is symmetrical about the horizontal scale passing through the center of the screen.
3. Adjust VR3 (sweep unit) so that when TRIG SLOPE is set to - (PULL) and + (PUSH), respectively, the start points are the same.



## 5-15. Adjusting TRIG Level Center

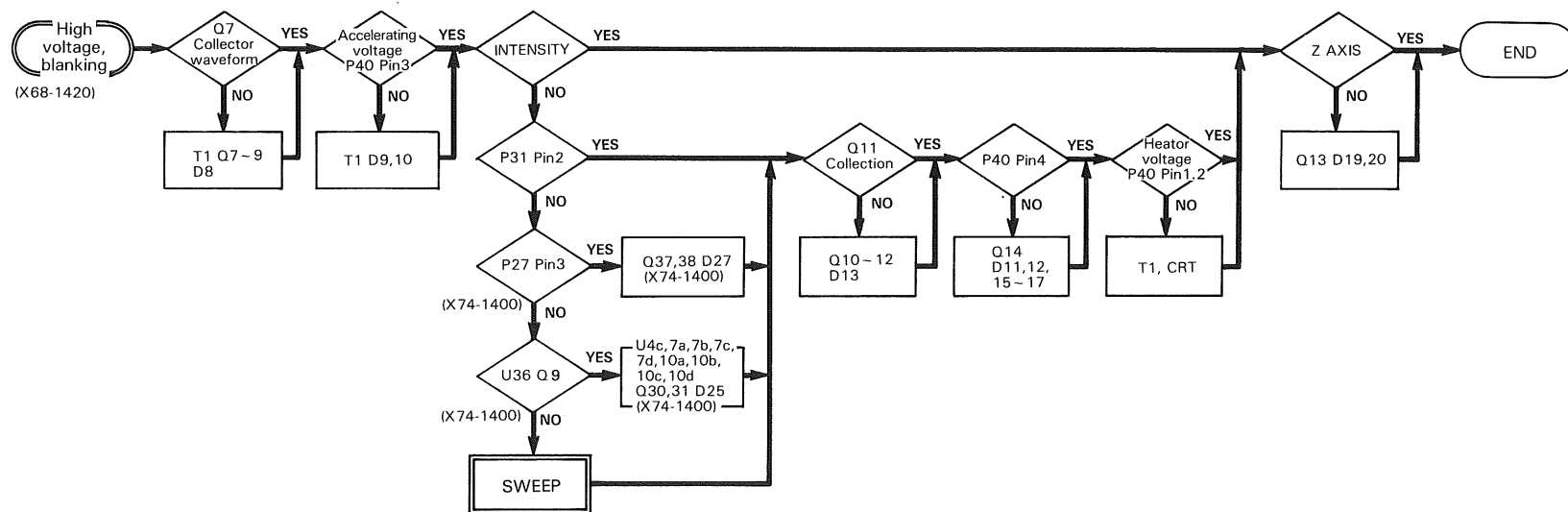
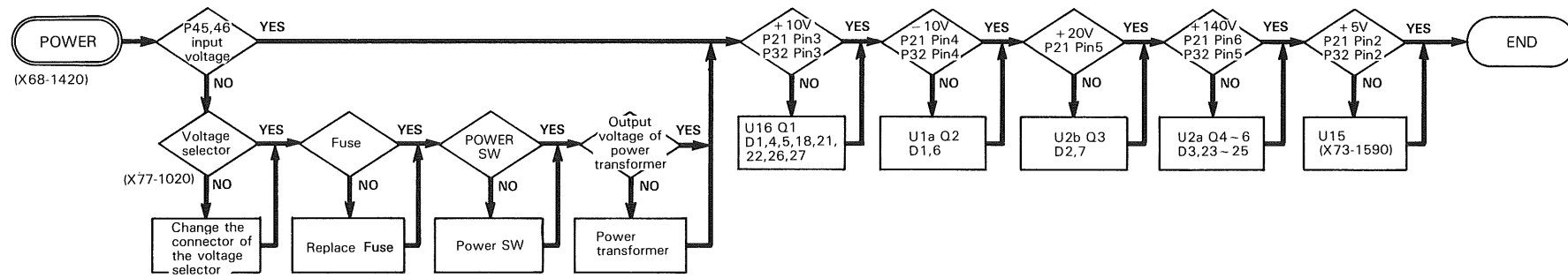
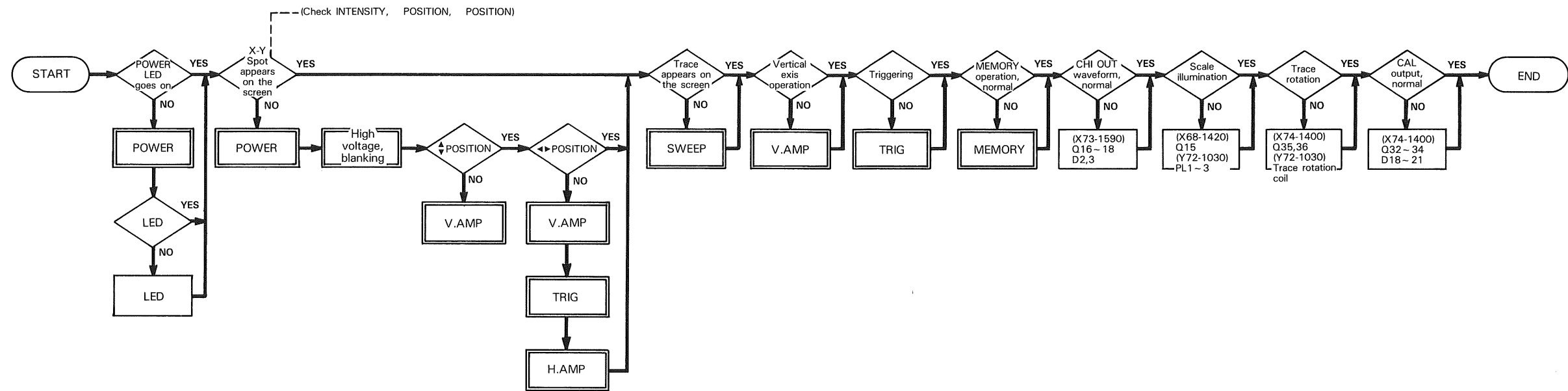
AC-GND-DC: AC

1. Move the TRIG LEVEL knob to its mechanical center.
2. Apply a 1 kHz sine wave to CH1 INPUT, and set the amplitude to 6 divisions.
3. Adjust the CH1  $\blacktriangle$  POSITION knob so that the waveform amplitude is symmetrical about the horizontal center of the screen.
4. Adjust VR2 (sweep unit) so that the start point of the waveform coincides with the left edge of the horizontal scale passing through the center of the screen.

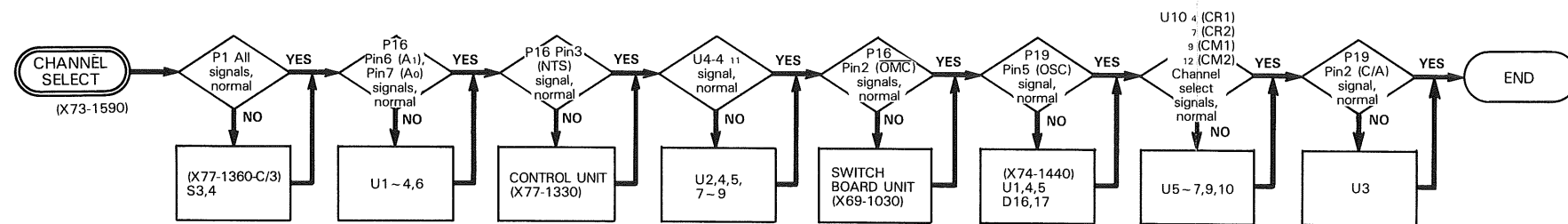
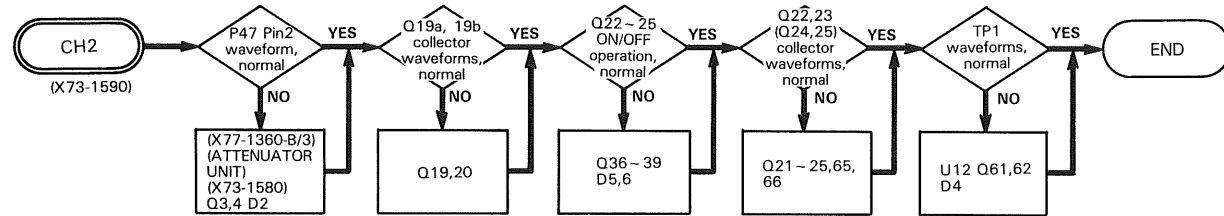
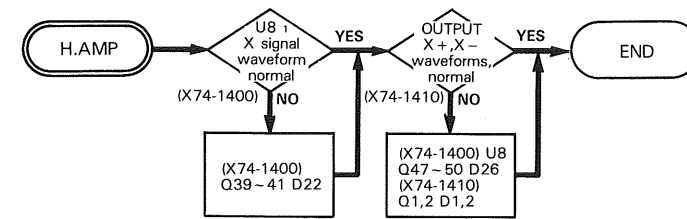
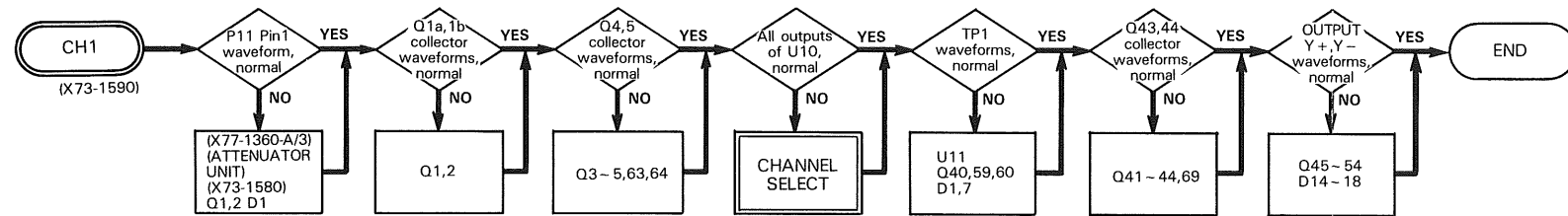
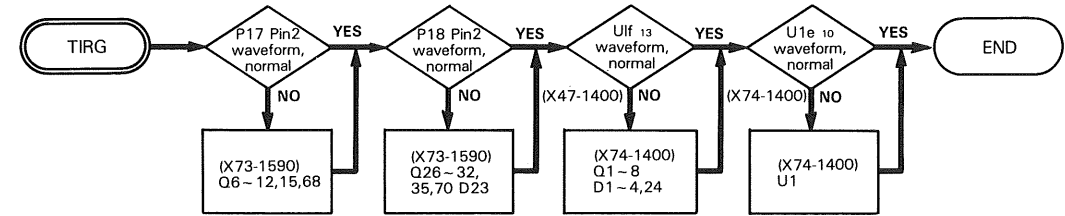
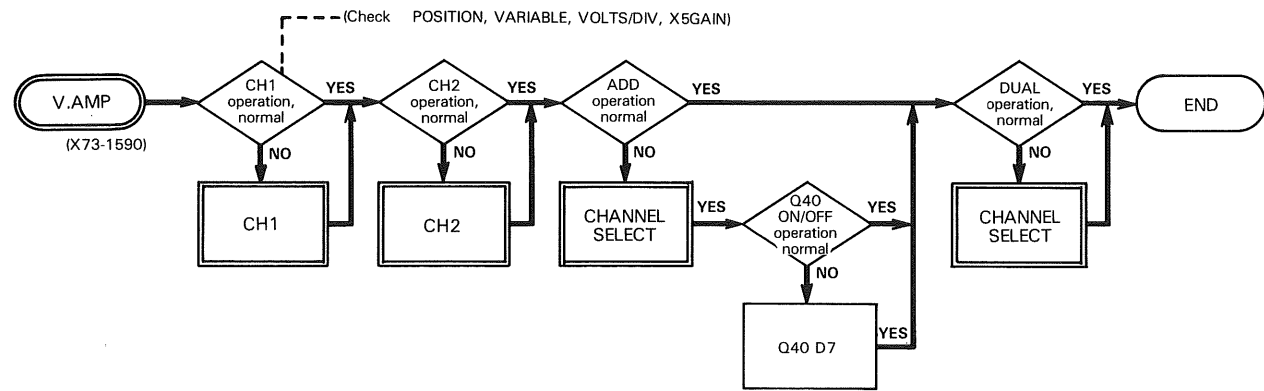
## 5-16. Adjusting CAL Output

1. Using a calibrated oscilloscope (0.1 V/DIV), adjust VR10 (sweep unit) so that the amplitude of the CAL output becomes 0.5 Vp-p.
2. Using a frequency counter, adjust VR11 (sweep unit) so that the CAL output frequency becomes 1 kHz.

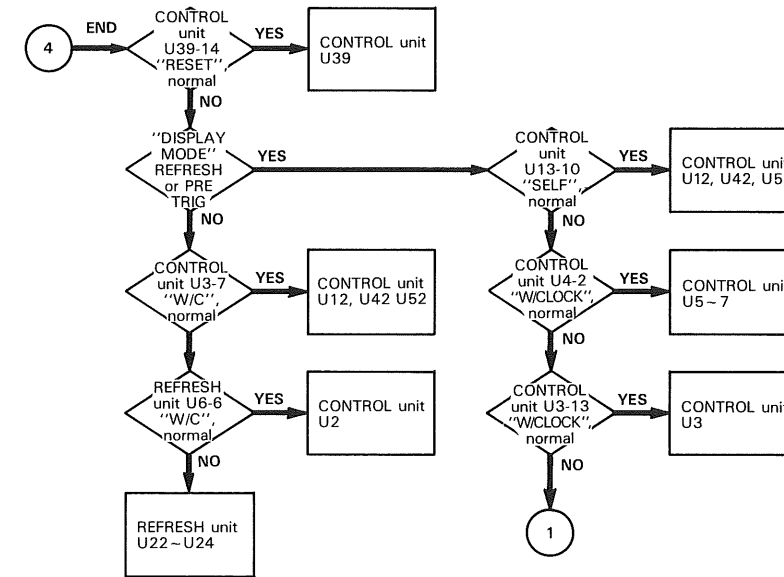
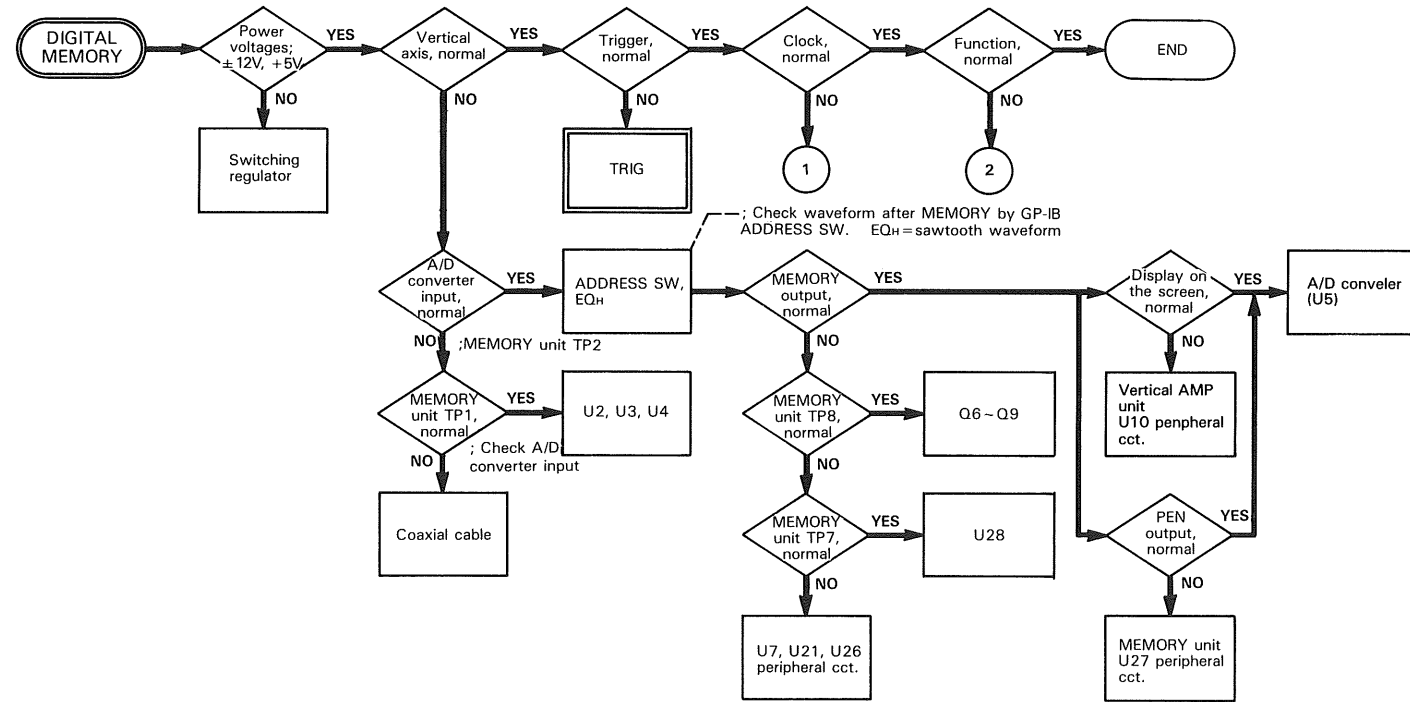
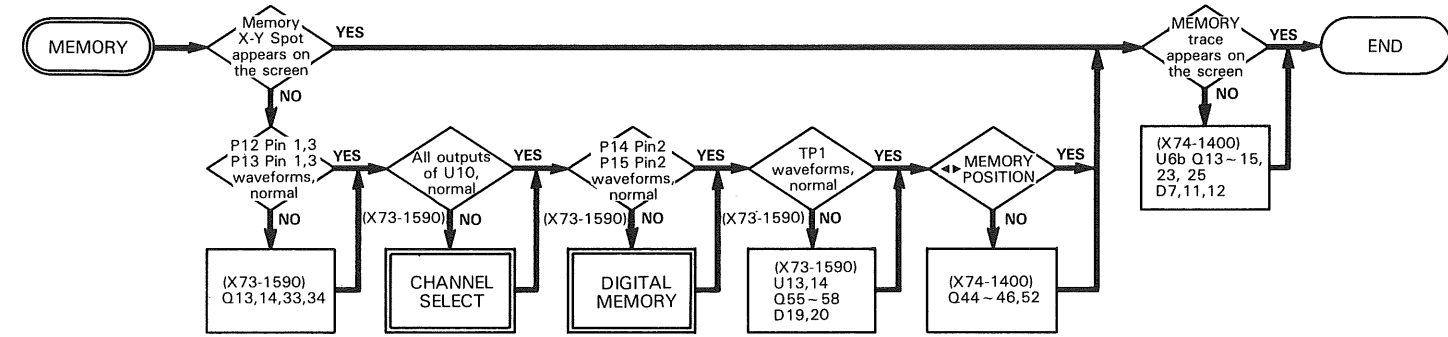
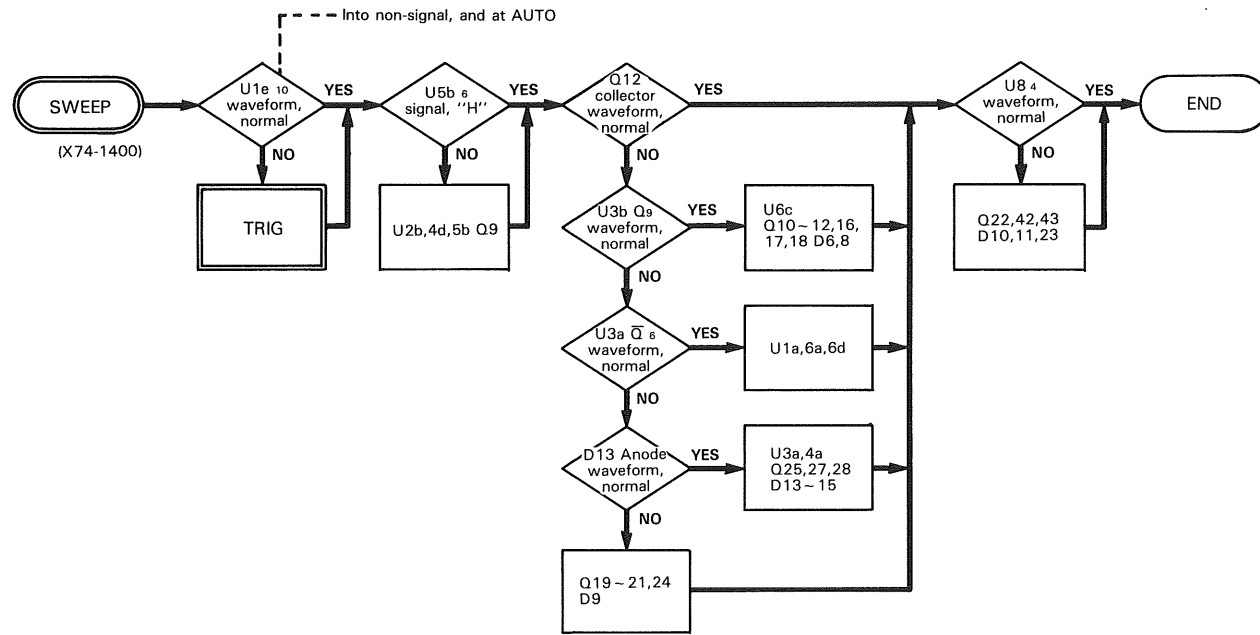
# TROUBLESHOOTING



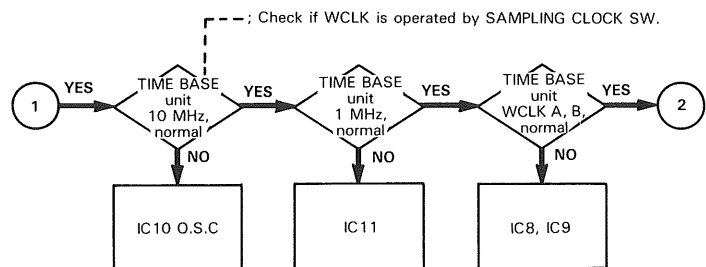
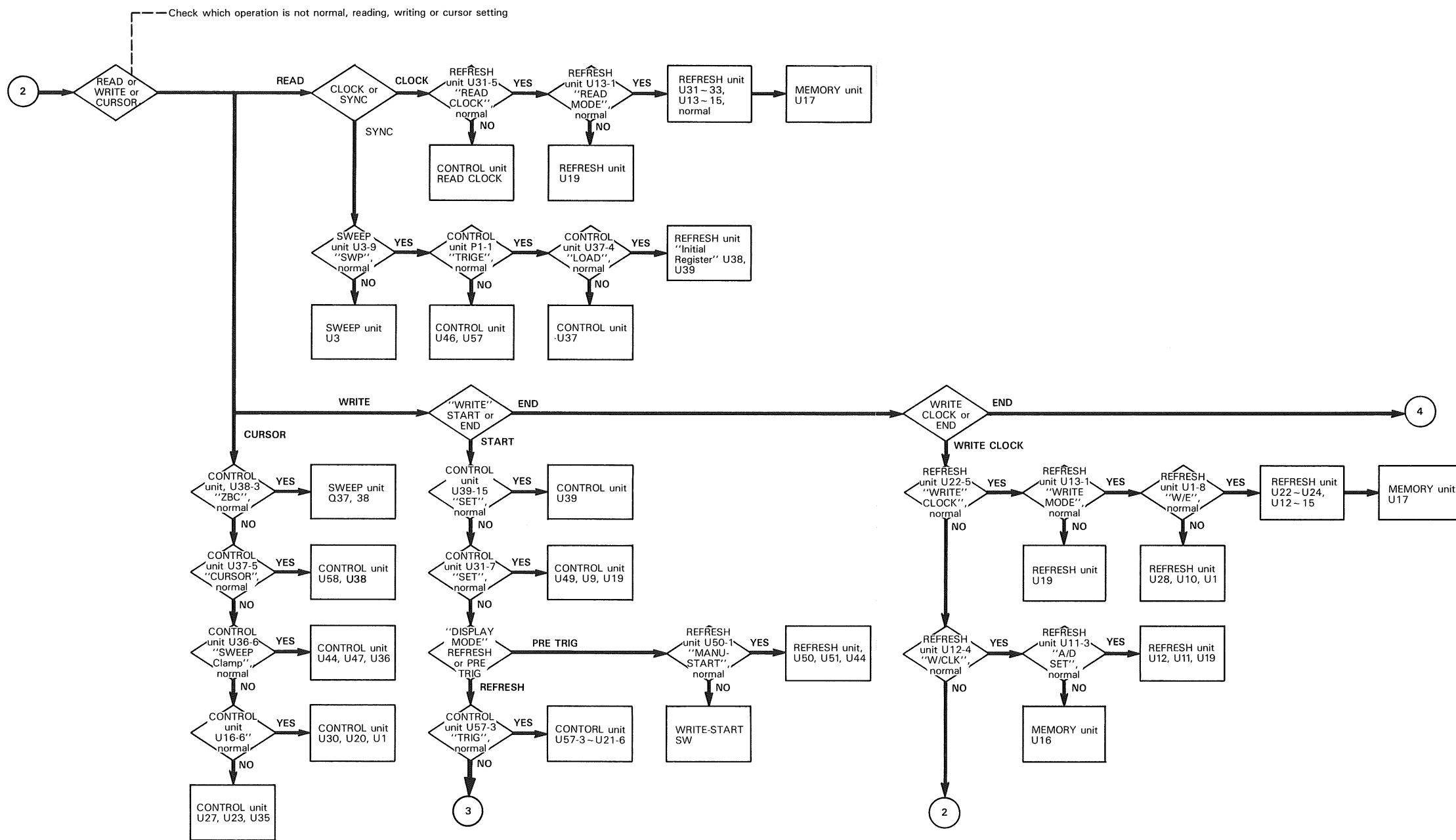
# TROUBLESHOOTING



# TROUBLESHOOTING



# TROUBLESHOOTING

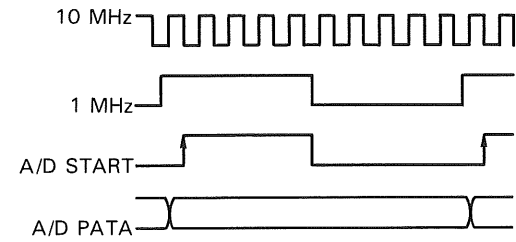




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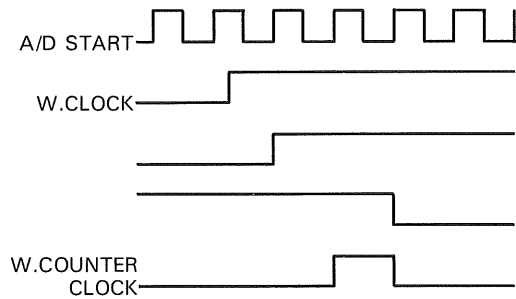
## (1) A/D START

- a) "L" during READ cycle
- b) SAMPLING CLOCK 0.1m Sec max.



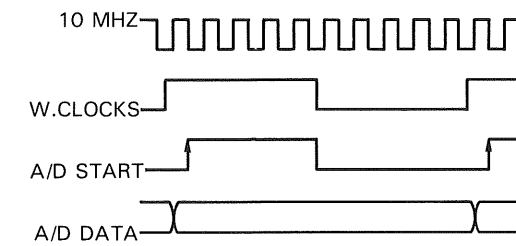
## (2) WRITE COUNTER CLOCK

- a) SHAMPLING CLOCK 0.1m Sec max.



- b) OAMPLING CLOCK 50μ Sec min.  
A/D START = W.COUNTER CLOCK

- c) SHAMPLING CLOCK 50μ Sec max.



## (3) READ/WRITE SELECTOR

- a) SAMPLING CLOCK 0.1m Sec max.

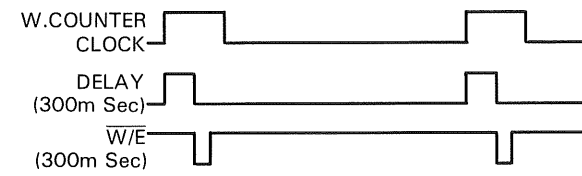
W.COUNTER CLOCK = R/W SELECT

- b) SAMPLING CLOCK 50μ Sec min.

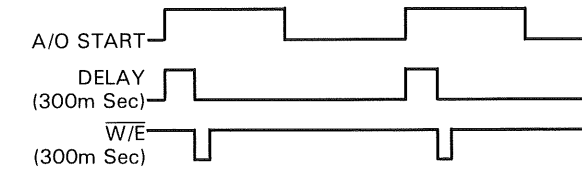
$\bar{R}/W C = \bar{R}/W SELECT$

## (4) $\bar{W}/E$

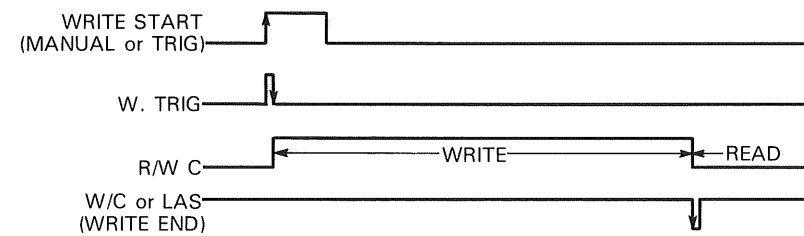
- a) SAMPLING CLOCK 0.1m Sec max.



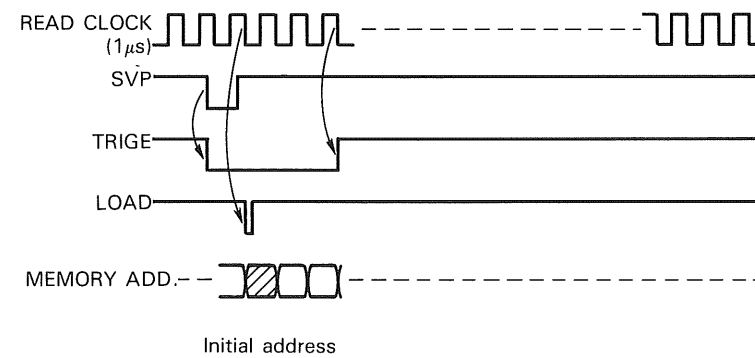
- b) SAMPLING CLOCK 50μ Sec min.



## (5) WRITE MODE

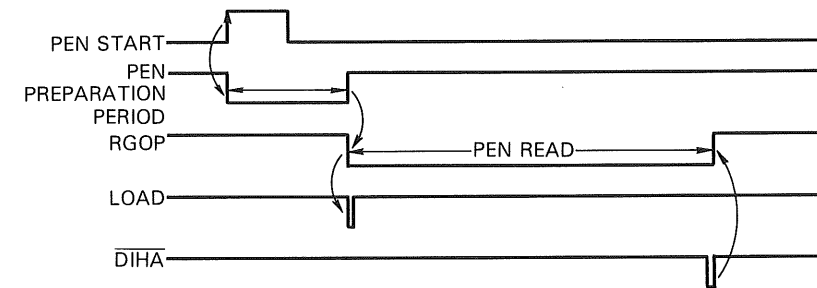


## (6) READ MODE

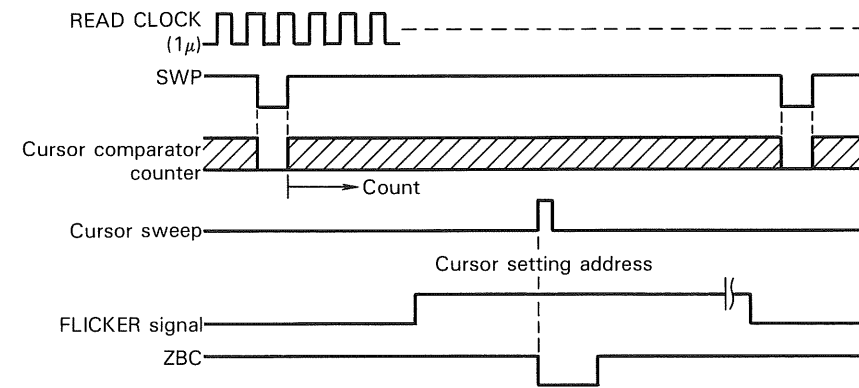


## (7) PEN MODE

Approx



## (8) CURSOR OUT



# TROUBLESHOOTING

		MODE	OMC	NTS	A <sub>0</sub>	A <sub>1</sub>	A <sub>2</sub>	C/A	U9 <sup>4</sup> PR	U9 <sup>15</sup> CLR	U9 <sup>1</sup> CK	CR1	CR2	CM1	CM2	U4 <sup>11</sup> CADD
OSCILLO	CH1	L	L	L	H	H	L	L	H	H	H	L	L	L	L	H
	CH2	L	L	H	L	H	L	H	L	L	L	H	L	L	L	H
	DUAL	ALT	L	L	H	H	H	L	H	H	( Fig 1 )		L	L	L	H
		CHOP						H			( Fig 2 )					
	ADD	L	L	L	L	H	L	L	L	L	H	H	H	L	L	L
X-Y	L	L	L	H	L	L	L	L	H	H	H	L	L	L	L	H
MEMORY	NORM	CH1	H	L	L	H	H	L	L	H	H	L	L	H	L	H
		CH2	H	L	H	L	H	L	H	L	H	L	L	L	H	H
		DUAL	H	L	H	H	H	L	H	H	(Fig3)	L	L	(Fig 3)		H
		ADD	H	L	L	L	H	L	H	L	H	L	L	L	H	H
		X-Y	H	L	L	H	L	L	L	H	H	L	L	H	L	H
	DELAY	CH1	H	H	H	L	H	H	L	H	H	(Fig 3)	L	L	(Fig 3)	H
		CH2	H	H	H	H	L	H	L	H	H		L	L		H
		DUAL	H	L	H	H	H	H	L	H	H		L	L		H
		ADD	H	H	H	L	L	H	L	H	H		L	L		H
		X-Y	H	L	H	L	H	L	L	L	H		H	L		L

REFRESH
PRE TRIG

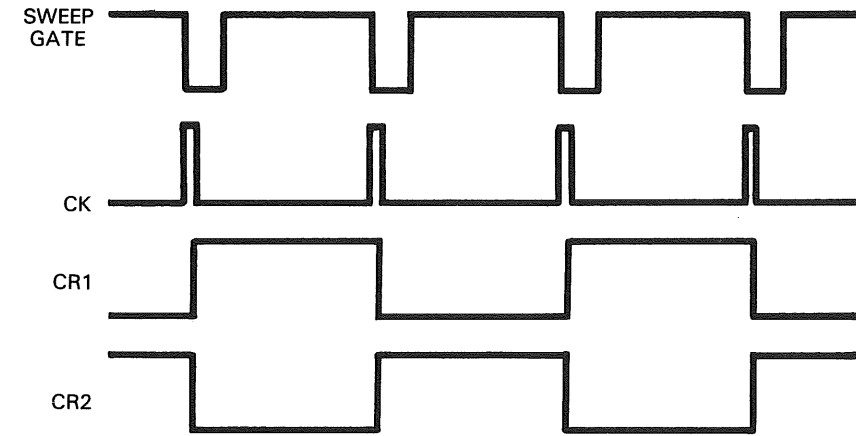


Fig. 1

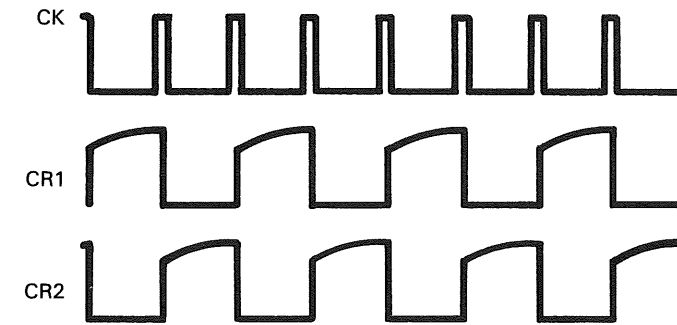


Fig. 2

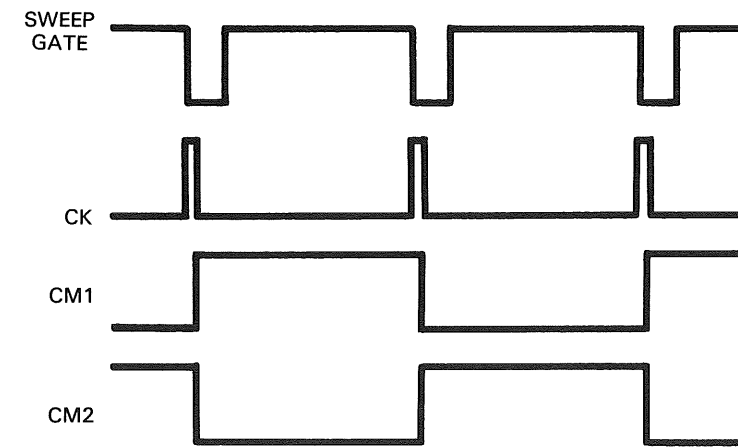


Fig. 3

# PARTS LIST

## MS-1660 MAIN CHASSIS

Y72-1030-61

REF. NO	PARTS NO	NAME & DESCRIPTION
1	A01-0274-05	CASE
2	A01-1135-02	CASE
3	A01-1136-02	CASE
4	A10-1442-02	CHASSIS
5	A11-0503-13	SUB CHASSIS
6	A13-0736-13	FRAME
7	A13-0738-03	FRAME
8	A13-0781-15	FRAME
9	A13-0784-02	FRAME
10	A21-1070-02	DECORATIVE PANEL
11	A22-0843-02	SUB PANEL
12	A23-1656-22	REAR PANEL
-	A33-0502-05	REFLECTOR W/LAMP ASS'Y
-	A33-0503-05	REFLECTOR W/LAMP ASS'Y
13	A50-0506-13	SIDE PANEL
14	A50-0507-13	SIDE PANEL
15	A50-0508-13	SIDE PANEL
16	A50-0509-13	SIDE PANEL
17	B07-0122-04	ESCUTCHEON
18	B07-0706-04	ESCUTCHEON
19	B07-0712-13	ESCUTCHEON FOR FILTER
20	B19-0726-04	FILTER
-	B30-0941-05	LAMP
21	B30-0949-05	LAMP ASS'Y
22	B30-0950-05	LAMP ASS'Y (ILLUM)
-	B40-2765-04	NAME PLATE (SERIAL NO)
-	B41-0710-04	CAUTION LABEL (HIGH VOLTAGE)
-	B41-0717-14	CAUTION LABEL
-	B50-7559-20	INSTRUCTION MANUAL
23	E01-1403-05	CRT SOCKET
24	E04-0251-05	BNC RECEPTACLE
25	E21-0209-13	DUAL BINDING POST
26	E21-0654-04	TERMINAL (CAL)
27	E21-0657-04	TERMINAL (GND)
-	E23-0513-05	EARTH LUG
-	E23-0520-05	EARTH LUG
-	E23-0557-04	EARTH LUG
28	E29-0506-04	SHORTING BAR (PANEL)
-	E30-1819-05	CEE CORD
-	E31-0564-05	LEAD WIRE WITH CONNECTOR
-	E31-2542-05	LEAD WIRE WITH CONNECTOR
-	E33-4083-00	WIRE ASSY
-	F01-0848-04	HEAT SINK
-	F06-5015-05	FUSE 0.5A
29	F09-0041-05	FAN
30	F10-1575-13	SHIELD PLATE
31	F10-1594-03	SHIELD PLATE
32	F10-1595-04	SHIELD PLATE
33	F10-1596-03	SHIELD PLATE
34	F11-0990-13	SHIELD CASE
-	F15-0733-04	FELT
-	F15-0735-04	SHEET
-	F20-0516-05	INSULATOR
35	F20-0649-04	INSULATOR
36	G02-0607-04	SPRING FOR CRT
37	G16-0611-04	REFLECTOR SHEET (L)
38	G16-0612-04	REFLECTOR SHEET (R)
39	G16-0614-04	REFLECTOR SHEET
-	H01-5759-14	CARTON BOX
-	H10-2819-02	FOAMED STYRENE PAD
-	H20-1721-04	VINYL COVER
-	H25-0029-04	POLYETHYLENE BAG (FUSE)
40	J02-0089-05	RUBBER LEG
41	J02-0512-05	LEG
42	J10-0100-22	BEZEL
43	J13-0033-15	FUSE HOLDER
-	J19-1620-05	CORD CLAMP
-	J19-1633-13	HOLDER FOR CRT
44	J19-1634-04	HOLDER FOR LEAD
45	J21-1425-04	MOUNTING HARDWARE
-	J21-2816-04	BLACKET FOR VR
-	J21-2912-05	HOLDER FOR LED
46	J21-2970-23	BLACKET FOR CRT
47	J21-4512-04	BLACKET FOR CRT
47-1	J21-4516-04	BLACKET FOR PCB
48	J21-4517-03	MOUNTING HARDWARE
49	J21-4518-03	BLACKET FOR PCB
50	J21-4519-03	BLACKET FOR PCB
51	J21-4521-04	MOUNTING HARDWARE
52	J21-4522-04	MOUNTING HARDWARE

REF. NO	PARTS NO	NAME & DESCRIPTION
53	J21-4523-04	MOUNTING HARDWARE
-	J32-0780-04	BOSS
-	J32-0844-04	BOSS
-	J32-0860-04	BOSS
54	J42-0523-04	BUSHING
-	J42-0529-04	BUSHING
-	J59-0403-05	NYLON RIVET
-	J61-0049-05	WIRE BAND
55	J61-0516-05	SUPPORT (T TYPE)
-	J61-0518-05	SUPPORT (T TYPE)
56	J90-0502-05	GUIDE
57	K01-0523-05	HANDLE
58	K21-0868-03	KNOB
59	K21-0869-04	KNOB
60	K21-0870-04	KNOB
61	K21-0872-04	KNOB
62	K21-0879-03	KNOB
63	K21-0883-04	KNOB
63-1	K27-0530-14	KNOB
64	K27-0531-04	KNOB
65	K27-0533-04	KNOB
66	K27-0534-04	KNOB
67	K29-0186-05	KNOB
68	L01-9456-15	POWER TRANSFORMER
69	L39-0521-15	COIL
70	L79-0502-05	LINE FILTER
-	N09-0710-05	SCREW, SEMS PAN HD
-	N09-0711-05	SCREW
71	N09-0715-05	SCREW
-	N09-0718-05	SCREW
-	N09-0747-04	SCREW
-	N10-2030-46	NUT, HEX
-	N10-2060-46	NUT
-	N14-0602-34	NUT
-	N14-0603-34	NUT
-	N15-1030-41	WASHER, FLAT FOR M3
-	N16-0030-46	SPRING WASHER
-	N17-1030-41	LOCK WASHER
-	N17-1060-46	LOCK WASHER
-	N19-0191-05	WASHER NONMETAL
-	N19-0702-04	WASHER
-	N19-0704-04	WASHER
-	N30-3006-41	SCREW, PAN HD M 3X6
-	N30-3008-41	SCREW, PAN HD M 3X8
-	N30-3010-41	SCREW, PAN HD M 3X10
-	N30-3016-41	SCREW, PAN HD M 3X16
-	N30-4012-41	SCREW, PAN HD M 4X12
-	N32-3006-41	SCREW, FLAT HD M 3X6
-	N32-3008-41	SCREW, FLAT HD M 3X8
-	N32-3010-41	SCREW, FLAT HD M 3X10
-	N34-3012-41	SCREW, TRUSS M 3X8
-	N88-3008-41	SCREW, FLAT HD TAP TITE
-	N89-3006-41	SCREW, BINDING TAP TITE
-	N89-3008-41	SCREW, BINDING TAP TITE
-	N89-3010-41	SCREW, BINDING TAP TITE
-	RD14BB2E151J	RES. CARBON 150 5% 1/4W
72	S02-4503-05	ROTARY SWITCH
73	T40-0022-05	INDUCTION MOTOR
74	W01-0507-03	CORD WRAP
75	W02-0420-15	SWITCHING POWER SUPPLY
-	X68-1420-00	POWER SUPPLY UNIT
76	X69-1030-01	SWITCH BOARD
77	X71-1120-00	TIME BASE UNIT
78	X73-1580-00	VERTICAL HEAD AMP UNIT
79	X73-1590-00	VERTICAL AMP UNIT
80	X74-1400-00	SWEEP UNIT
81	X74-1410-00	HORIZONTAL OUTPUT UNIT
82	X77-1020-03	VOLTAGE SELECTOR
83	X77-1330-00	CONTROL UNIT
84	X77-1360-00	VERTICAL SWITCH UNIT
85	X81-1440-01	MOTHER BOARD UNIT
86	X81-1450-00	REFRESH UNIT
87	X81-1460-00	MEMORY UNIT
88	X81-1500-00	GP-IB INTERFACE UNIT
89	X81-1510-00	CONNECTOR BOARD UNIT
-	Y87-2260-00	PROBE PC-30
-	002-0001-05	BRAIDED WIRE
90	150PTH31	CRT
-	212-2014-05	TUBE (PLASTIC)
-	J001 E31-2532-15	LEAD WIRE WITH CONNECTOR
-	J002 E31-2531-05	LEAD WIRE WITH CONNECTOR
-	J003 E31-2531-05	LEAD WIRE WITH CONNECTOR
-	J004 E31-2531-05	LEAD WIRE WITH CONNECTOR
-	J005 E31-2531-05	LEAD WIRE WITH CONNECTOR

# PARTS LIST

REF. NO	PARTS NO	NAME & DESCRIPTION
- J006	E31-2610-05	LEAD WIRE WITH CONNECTOR
- J007	E31-2608-05	LEAD WIRE WITH CONNECTOR
- J008	E31-2608-05	LEAD WIRE WITH CONNECTOR
- J009	E31-2608-05	LEAD WIRE WITH CONNECTOR
- J010	E31-2608-05	LEAD WIRE WITH CONNECTOR
- J011	NO USE	
- J012	E31-2540-05	LEAD WIRE WITH CONNECTOR
- J013	E31-2540-05	LEAD WIRE WITH CONNECTOR
- J020	E31-2540-05	LEAD WIRE WITH CONNECTOR
- J021	NO USE	
- J022	E31-2536-15	LEAD WIRE WITH CONNECTOR
- J023	E31-2536-15	LEAD WIRE WITH CONNECTOR
- J024	E31-2600-05	LEAD WIRE WITH CONNECTOR
- J034	E31-2535-05	LEAD WIRE WITH CONNECTOR
- J035	E31-2537-15	LEAD WIRE WITH CONNECTOR
- J036	E31-2537-15	LEAD WIRE WITH CONNECTOR
- J039	E31-2534-05	LEAD WIRE WITH CONNECTOR
- J040	E31-2534-05	LEAD WIRE WITH CONNECTOR
- J041	NO USE	
- J042	E31-2534-05	LEAD WIRE WITH CONNECTOR
- J047	E31-2609-05	LEAD WIRE WITH CONNECTOR
- J048	E31-2538-05	LEAD WIRE WITH CONNECTOR
- J048	E31-2785-15	LEAD WIRE WITH CONNECTOR
- J049	E31-2538-05	LEAD WIRE WITH CONNECTOR
- J050	E31-2530-15	LEAD WIRE WITH CONNECTOR
- J051	E31-2530-15	LEAD WIRE WITH CONNECTOR
- J052	E31-2530-15	LEAD WIRE WITH CONNECTOR
- J053	E31-2530-15	LEAD WIRE WITH CONNECTOR
- J054	E31-2530-15	LEAD WIRE WITH CONNECTOR
- J055	E31-2529-05	LEAD WIRE WITH CONNECTOR
- J056	E31-2529-05	LEAD WIRE WITH CONNECTOR
- J057	E31-2529-05	LEAD WIRE WITH CONNECTOR
- J064	E31-2541-35	LEAD WIRE WITH CONNECTOR
- J065	E31-2541-35	LEAD WIRE WITH CONNECTOR
- J070	E31-2704-25	LEAD WIRE WITH CONNECTOR
- J071	E31-2705-05	LEAD WIRE WITH CONNECTOR
- J072	E31-2733-05	LEAD WIRE WITH CONNECTOR
- J073	E31-2749-05	LEAD WIRE WITH CONNECTOR
- J074	E31-2601-05	LEAD WIRE WITH CONNECTOR
- J075	E31-2602-15	LEAD WIRE WITH CONNECTOR
- L001	L40-1592-13	FERRI INDUCTOR 10UH
- L002	L40-1592-13	FERRI INDUCTOR 10UH
- Q001	2SB940A(P)	TR. SI, PNP
- Q002	2SC2591(R)	TR. SI, NPN
- Q003	2SA1111(Q)	TR. SI, PNP
- Q004	2SD1263A(P)	TR. SI, NPN
- Q005	2SC1505	TR. SI, NPN
- Q006	2SD401A	TR. SI, NPN
91 S001	S02-1501-05	ROTARY SWITCH
92 TH001	4W25	POWER THERMISTER
93 VR001	R01-1011-05	V.R. 1K B
94 VR002	R01-1011-05	V.R. 1K B
95 VR003	R01-0041-05	V.R. 500 B
96 VR004	R01-0041-05	V.R. 500 B
97 VR005	R19-9508-05	V.R. 500 B, 250K B
98 VR006	R01-3027-05	V.R. 10K B
99 VR007	R03-2507-05	V.R. 5K B
100 VR008	R05-8001-05	V.R. 3M B
101 VR009	R19-9508-05	V.R. 500 B, 250K B
102 VR010	R01-8504-05	V.R. 2M B

## POWER SUPPLY UNIT

### X68-1420-00

REF. NO	PARTS NO	NAME & DESCRIPTION			
	F01-0848-04	HEAT SINK			
	F20-0516-05	INSULATOR			
	J21-2905-14	BLACKET FOR PCB			
	J25-5078-13	PCB (UNMOUNTED)			
	J61-0049-05	WIRE BAND			
	N09-0718-05	SCREW			
	N19-0191-05	WASHER NONMETAL			
	N30-3008-41	SCREW, PAN HD	M 3X8		
	212-2014-05	TUBE (PLASTIC)			
C001	CE04BW1H010M	CAP. ELECTRO	1	20%	50V
C002	CE04W1V222M	CAP. ELECTRO	2200	20%	35V
C003	NO USE				
C004	CE04W1E471M	CAP. ELECTRO	470	20%	25V
C005	CK45FF1H103Z	CAP. CERAMIC	0.01		50V
C006	CE04W1C221M	CAP. ELECTRO	220	20%	16V
C007	CE04W1V222M	CAP. ELECTRO	2200	20%	35V
C008	NO USE				
C009	CE04W1E471M	CAP. ELECTRO	470	20%	25V
C010	CK45FF1H103Z	CAP. CERAMIC	0.01		50V
C011	CE04W1H471M	CAP. ELECTRO	470	20%	50V
C012	NO USE				
C013	CE04W1E471M	CAP. ELECTRO	470	20%	25V
C014	CK45FF1H103Z	CAP. CERAMIC	0.01		50V
C015	C90-0954-05	CAP. ELECTRO	33		350V
C016	CE04W2E100	CAP. ELECTRO	10		250V
C017	CE04W2E100	CAP. ELECTRO	10		250V
C018	NO USE				
C019	CE04W2E100	CAP. ELECTRO	10		250V
C020	CE04W2E100	CAP. ELECTRO	10		250V
C021	CK45B2H103K	CAP. CERAMIC	0.01	10%	500V
C022	CE04W1C471M	CAP. ELECTRO	470	20%	16V
C023	CQ92M1H104K	CAP. MYLAR	0.1	10%	50V
C024	CE04W1E471M	CAP. ELECTRO	470	20%	25V
C025	CK45FF1H103Z	CAP. CERAMIC	0.01		50V
C026	CE04W1E331M	CAP. ELECTRO	330	20%	25V
C027	CQ93M1H223K	CAP. MYLAR	0.022	10%	50V
C028	CK45E3D102P	CAP. CERAMIC	1000P		2K
C029	C91-0571-05	CAP. CERAMIC	0.01		2KV
C030	C91-0571-05	CAP. CERAMIC	0.01		2KV
C031	C91-0571-05	CAP. CERAMIC	0.01		2KV
C032	C91-0571-05	CAP. CERAMIC	0.01		2KV
C033	C91-0571-05	CAP. CERAMIC	0.01		2KV
C034	C91-0571-05	CAP. CERAMIC	0.01		2KV
C035	C91-0571-05	CAP. CERAMIC	0.01		2KV
C036	C91-0571-05	CAP. CERAMIC	0.01		2KV
C039	C90-0298-05	CAP. CERAMIC	0.1	20%	12V
C040	NO USE				
C041	CE04W2E3R3	CAP. ELECTRO	3.3		250V
C042	CK45FF1H103Z	CAP. CERAMIC	0.01		50V
C043	CC45CH1H220J	CAP. CERAMIC	22P		5V
C044	CK45B2H103K	CAP. CERAMIC	0.01	10%	500V
C045	CE04W1C330M	CAP. ELECTRO	33	20%	16V
C046	CK45FF1H103Z	CAP. CERAMIC	0.01		50V
C047	CK45FF1H103Z	CAP. CERAMIC	0.01		50V
D001	S2VB40F	DIODE, BRIDGE			
D002	S1VB60	DIODE			
D003	S1VB60	DIODE			
D004	MTZ16JA	DIODE ZENER	15V		
D005	MTZ5.1JB	DIODE ZENER	5V		
D006	MTZ16JA	DIODE ZENER	15V		
D007	MTZ16JA	DIODE ZENER	15V		
D008	1SS132	DIODE			
D009	Y16JA	DIODE			
D010	W02-0401-05	HIGH VOL. RECTIFIER			
D011	V11-N	DIODE			
D012	V11-N	DIODE			
D013	MTZ5.1JB	DIODE ZENER	5V		
D014	NO USE				
D015	1SS132	DIODE			
D016	1SS83	DIODE			
D017	1SS83	DIODE			
D018	MTZ9.1JC	DIODE ZENER	9V		
D019	1SS132	DIODE			
D020	1SS132	DIODE			
D021	MTZ5.1JB	DIODE ZENER	5V		
D022	MTZ5.1JB	DIODE ZENER	5V		
D023	1SS132	DIODE			
D024	1SS132	DIODE			
D025	1SS132	DIODE			

# PARTS LIST

REF. NO	PARTS NO	NAME & DESCRIPTION
D026	1SS132	DIODE
D027	1SS132	DIODE
J064	E31-2541-35	LEAD WIRE WITH CONNECTOR
J065	E31-2541-35	LEAD WIRE WITH CONNECTOR
L001	L40-1025-04	FERRI INDUCTOR 1.0MH
L002	L40-1011-04	FERRI INDUCTOR 100UH
L003	L40-1011-04	FERRI INDUCTOR 100UH
L004	L40-4791-02	FERRI INDUCTOR 4.7UH
N001	NE-2B	NEON LAMP
N002	NE-2B	NEON LAMP
P021	E40-0673-05	PIN CONNECTOR 6 P
P030	E40-0273-05	PIN CONNECTOR 2 P
P031	E40-0273-05	PIN CONNECTOR 2 P
P032	E40-0573-05	PIN CONNECTOR 5 P
P037	E40-0273-05	PIN CONNECTOR 2 P
P038	E40-0273-05	PIN CONNECTOR 2 P
P039	E40-0330-05	PIN CONNECTOR 3 P
P040	E40-0530-05	PIN CONNECTOR 5 P
P041	E40-0373-05	PIN CONNECTOR 3 P
P042	E40-0273-05	PIN CONNECTOR 2 P
P043	E40-0373-05	PIN CONNECTOR 3 P
P044	E40-0273-05	PIN CONNECTOR 2 P
P045	E40-0530-05	PIN CONNECTOR 5 P
P046	E40-0230-05	PIN CONNECTOR 2 P
P047	NO USE	
P048	E40-0373-05	PIN CONNECTOR 3 P
P064	E40-0973-05	PIN CONNECTOR 9 P
P065	E40-0673-05	PIN CONNECTOR 6 P
P072	E40-0273-05	PIN CONNECTOR 2 P
Q001	2SB940A(P)	TR. SI, PNP
Q002	2SC2591(R)	TR. SI, NPN
Q003	2SA1111(Q)	TR. SI, PNP
Q004	2SD1263A(P)	TR. SI, NPN
Q005	2SC1505	TR. SI, NPN
Q006	2SC2271	TR. SI, NPN
Q007	2SD401A	TR. SI, NPN
Q008	2SC3311(Q, R)	TR. SI, NPN
Q009	2SA1309(Q, R)	TR. SI, PNP
Q010	2SA1210(S)	TR. SI, PNP
Q011	2SC2912(S)	TR. SI, NPN
Q012	2SC3315(C, D)	TR. SI, NPN
Q013	2SC3311(Q, R)	TR. SI, NPN
Q014	2SC2912(S)	TR. SI, NPN
R001	RD14BB2C473J	RES. CARBON 47K 5% 1/6W
R002	RD14BB2C202J	RES. CARBON 2K 5% 1/6W
R003	RD14BB2E152J	RES. CARBON 1.5K 5% 1/4W
R004	RN14BK2C4701F	RES. METAL FILM 4.7K 1% 1/6W
R005	RN14BK2C2201F	RES. METAL FILM 2.2K 1% 1/6W
R006	RD14BB2C561J	RES. CARBON 560 5% 1/6W
R007	RD14BB2E152J	RES. CARBON 1.5K 5% 1/4W
R008	RN14BK2C4701F	RES. METAL FILM 4.7K 1% 1/6W
R009	RN14BK2C4701F	RES. METAL FILM 4.7K 1% 1/6W
R010	RD14BB2C331J	RES. CARBON 330 5% 1/6W
R011	RN14BK2C2002F	RES. METAL FILM 20K 1% 1/6W
R012	RN14BK2C1002F	RES. METAL FILM 10K 1% 1/6W
R013	RS14AB3D622J	RES. METAL FILM 6.2K 5% 2W
R014	RS14AB3D622J	RES. METAL FILM 6.2K 5% 2W
R015	RD14BB2C821J	RES. CARBON 820 5% 1/6W
R016	RD14BB2C102J	RES. CARBON 1K 5% 1/6W
R017	RD14BB2C4R7J	RES. CARBON 4.7 5% 1/6W
R018	NO USE	
R019	RN14BK2C3000F	RES. METAL FILM 300 1% 1/6W
R020	RN14BK2C6201F	RES. METAL FILM 6.2K 1% 1/6W
R021	RN14BK2C9102F	RES. METAL FILM 91K 1% 1/6W
R022	RD14BB2C102J	RES. CARBON 1K 5% 1/6W
R023	RN14BK2C1103F	RES. METAL FILM 110K 1% 1/6W
R024	RD14BB2C151J	RES. CARBON 150 5% 1/6W
R025	RD14BB2C104J	RES. CARBON 100K 5% 1/6W
R026	RD14BB2C563J	RES. CARBON 56K 5% 1/6W
R027	RD14BB2C103J	RES. CARBON 10K 5% 1/6W
R028	RD14BB2C102J	RES. CARBON 1K 5% 1/6W
R029	RD14BB2C473J	RES. CARBON 47K 5% 1/6W
R030	RD14BY2H4R7J	RES. CARBON 4.7 5% 1/2W
R031	RD14BY2H472J	RES. CARBON 4.7K 5% 1/2W
R032	RD14BY2H473J	RES. CARBON 47K 5% 1/2W
R033	RD14BB2C104J	RES. CARBON 100K 5% 1/6W

REF. NO	PARTS NO	NAME & DESCRIPTION
R034	R92-0756-05	RES. FIXED 47M 5% 1/2W
R035	R92-1031-05	RES. FIXED 4.7M 5% 1/2W
R036	R92-0800-05	RES. FIXED 10M 5% 1W
R037	R92-0800-05	RES. FIXED 10M 5% 1W
R038	NO USE	
R039	RD14BB2C682J	RES. CARBON 6.8K 5% 1/6W
R040	RD14BB2C473J	RES. CARBON 47K 5% 1/6W
R041	RD14BB2C511J	RES. CARBON 510 5% 1/6W
R042	RD14BB2C101J	RES. CARBON 100 5% 1/6W
R043	RD14BB2C332J	RES. CARBON 3.3K 5% 1/6W
R044	NO USE	
R045	RD14BB2C101J	RES. CARBON 100 5% 1/6W
R046	RD14BB2C101J	RES. CARBON 100 5% 1/6W
R047	RD14BB2C122J	RES. CARBON 1.2K 5% 1/6W
R048	RD14BB2C331J	RES. CARBON 330 5% 1/6W
R049	RD14BY2H472J	RES. CARBON 4.7K 5% 1/2W
R050	RD14BB2C472J	RES. CARBON 4.7K 5% 1/6W
R051	RD14BB2C332J	RES. CARBON 3.3K 5% 1/6W
R052	RD14BB2C123J	RES. CARBON 12K 5% 1/6W
R053	RD14BB2C224J	RES. CARBON 220K 5% 1/6W
R054	RD14BB2C363J	RES. CARBON 36K 5% 1/6W
R055	RD14BB2C102J	RES. CARBON 1K 5% 1/6W
R056	RD14BB2C333J	RES. CARBON 33K 5% 1/6W
R057	RD14BB2C101J	RES. CARBON 100 5% 1/6W
R058	RD14BB2C473J	RES. CARBON 47K 5% 1/6W
R059	RD14BB2C473J	RES. CARBON 47K 5% 1/6W
R060	RD14BB2C103J	RES. CARBON 10K 5% 1/6W
R061	RD14BB2C103J	RES. CARBON 10K 5% 1/6W
R062	NO USE	
R063	RD14BB2C470J	RES. CARBON 47 5% 1/6W
R064	RD14BB2C470J	RES. CARBON 47 5% 1/6W
R065	RD14BY2H220J	RES. CARBON 22 5% 1/2W
R066	RD14BB2C681J	RES. CARBON 680 5% 1/6W
R067	RD14BB2C472J	RES. CARBON 4.7K 5% 1/6W
R068	RD14BB2C154J	RES. CARBON 150K 5% 1/6W
R069	RD14BB2C101J	RES. CARBON 100 5% 1/6W
R070	RD14BB2C101J	RES. CARBON 100 5% 1/6W
T001	L19-0417-05	CONVERTOR TRANSFORMER
TC001	C05-0401-05	CAP. TRIMMER 20P
U001	NJM4556D	
U002	NJM4556D	
VR001	R12-1029-05	RES. SEMI FIXED 1K B
VR002	R12-3502-05	RES. SEMI FIXED 33K B
VR003	R12-3042-05	RES. SEMI FIXED 47K B

# PARTS LIST

## SWITCH BOARD UNIT

### X69-1030-01

REF. NO	PARTS NO	NAME & DESCRIPTION
	E40-0218-05	PIN CONNECTOR 2 P
	J25-5052-13	PCB (UNMOUNTED)
	J30-0617-04	SPACER
	K29-0808-05	KNOB
D001	LN322GP	DIODE
D002	LN322GP	DIODE
D003	LN222RP	LED
D004	LN222RP	LED
D005	LN322GP	DIODE
D006	LN322GP	DIODE
D007	LN322GP	DIODE
D008	LN322GP	DIODE
D009	LN322GP	DIODE
D010	1SS132	DIODE
D011	1SS132	DIODE
P001	E40-2686-05	PIN CONNECTOR 26P
P002	E40-0473-05	PIN CONNECTOR 4 P
P003	E40-0473-05	PIN CONNECTOR 4 P
R001	RD14BB2C472J	RES. CARBON 4.7K 5% 1/6W
R002	RD14BB2E221J	RES. CARBON 220 5% 1/4W
R003	RD14BB2E221J	RES. CARBON 220 5% 1/4W
R004	RD14BB2E221J	RES. CARBON 220 5% 1/4W
R005	RD14BB2E221J	RES. CARBON 220 5% 1/4W
R006	RD14BB2E221J	RES. CARBON 220 5% 1/4W
R007	RD14BB2E221J	RES. CARBON 220 5% 1/4W
R008	RD14BB2E221J	RES. CARBON 220 5% 1/4W
R009	RD14BB2C472J	RES. CARBON 4.7K 5% 1/6W
S001	S42-5507-05	PUSH SWITCH
S002	S42-5508-05	PUSH SWITCH
S003	S40-2520-05	PUSH SWITCH
S004	S40-1520-05	PUSH SWITCH
S005	S40-1520-05	PUSH SWITCH

## TIME BASE UNIT

### X71-1120-00

REF. NO	PARTS NO	NAME & DESCRIPTION
	J25-5053-02	PCB (UNMOUNTED)
	R92-1061-05	JUMPING RES. ZERO OHM
C001	CK45B1H472K	CAP. CERAMIC 4700P 10% 50V
C002	CC45S1H220J	CAP. CERAMIC 22P 5% 50V
C003	CE04W1C221M	CAP. ELECTRO 220 20% 16V
C004	C90-0298-05	CAP. CERAMIC 0.1 20% 12V
C005	C90-0298-05	CAP. CERAMIC 0.1 20% 12V
C006	C90-0298-05	CAP. CERAMIC 0.1 20% 12V
C007	C90-0298-05	CAP. CERAMIC 0.1 20% 12V
C008	C90-0298-05	CAP. CERAMIC 0.1 20% 12V
C009	C90-0298-05	CAP. CERAMIC 0.1 20% 12V
C010	C90-0298-05	CAP. CERAMIC 0.1 20% 12V
IC001	SN74LS157N	IC
IC002	SN74LS148N	IC
IC003	SN74LS148N	IC
IC004	SN74LS157N	IC
IC005	SN74LS148N	IC
IC006	SN74LS148N	IC
IC007	SN74LS21N	IC
IC008	8650-0	IC
IC009	8650-0	IC
IC010	SN74LS04N	IC
IC011	SN74LS90N	IC
P001	E40-2086-05	PIN CONNECTOR 20P
P002	E40-0473-05	PIN CONNECTOR 4 P
R001	RD14BB2B471J	RES. CARBON 470 5% 1/8W
R002	RD14BB2B471J	RES. CARBON 470 5% 1/8W
R003	R90-0609-05	RES. NETWORK 4.7K
R004	R90-0609-05	RES. NETWORK 4.7K
R005	R90-0609-05	RES. NETWORK 4.7K
R006	R90-0609-05	RES. NETWORK 4.7K
R007	R90-0609-05	RES. NETWORK 4.7K
S001	S01-2513-05	ROTARY SWITCH
S002	S01-2513-05	ROTARY SWITCH
X001	L77-1002-05	CRYSTAL RESONATOR

## VERTICAL HEAD AMP UNIT

### X73-1580-00

REF. NO	PARTS NO	NAME & DESCRIPTION
	J21-4520-04	MOUNTING HARDWARE
	J25-5079-24	PCB (UNMOUNTED)
	N09-0718-05	SCREW
	002-0001-05	BRAIDED WIRE
	212-7004-05	TUBE (PLASTIC)
	420-0008-05	ADHESIVES
C001	C91-0502-05	CAP. METAL FILM 0.01 20% 630V
C002	NO USE	
C003	C91-0502-05	CAP. METAL FILM 0.01 20% 630V
C004	NO USE	
C005	CK45F1H103Z	CAP. CERAMIC 0.01 50V
C006	CE04W1C101M	CAP. ELECTRO 100 20% 16V
C007	CK45F1H103Z	CAP. CERAMIC 0.01 50V
C008	CE04W1C101M	CAP. ELECTRO 100 20% 16V
C009	CK45F1H103Z	CAP. CERAMIC 0.01 50V
C010	CE04W1C101M	CAP. ELECTRO 100 20% 16V
C011	CK45F1H103Z	CAP. CERAMIC 0.01 50V
C012	CE04W1C101M	CAP. ELECTRO 100 20% 16V
C013	CC45CH1020C	CAP. CERAMIC 2P 0.25P 50V
D001	1S1544A	DIODE
D002	1S1544A	DIODE
J001	R92-1061-05	JUMPING RES. ZERO OHM
J002	R92-1061-05	JUMPING RES. ZERO OHM
J003	R92-1061-05	JUMPING RES. ZERO OHM
J004	R92-1061-05	JUMPING RES. ZERO OHM
J005	R92-0150-05	JUMPING RES. ZERO OHM
J006	R92-0150-05	JUMPING RES. ZERO OHM
J007	R92-1061-05	JUMPING RES. ZERO OHM
L001	L40-1011-04	FERRI INDUCTOR 100UH
L002	L40-1011-04	FERRI INDUCTOR 100UH
P011	E40-0916-05	PIN CONNECTOR 9P
P047	E40-0273-05	PIN CONNECTOR 2 P
Q001	DN1901	FET, DUAL SI, N-CHANNEL
Q002	2SC3066(F,G)	TR. SI, NPN
Q003	DN1901	FET, DUAL SI, N-CHANNEL
Q004	2SC3066(F,G)	TR. SI, NPN
R001	RD14BB2C100J	RES. CARBON 10 5% 1/6W
R002	RN14BK2E1004F	RES. METAL FILM 1M 1% 1/4W
R003	RD14BB2E474J	RES. CARBON 470K 5% 1/4W
R004	RD14BB2C101J	RES. CARBON 100 5% 1/6W
R005	RN14BK2C5601F	RES. METAL FILM 5.6K 1% 1/6W
R006	RN14BK2C5601F	RES. METAL FILM 5.6K 1% 1/6W
R007	RD14BB2C470J	RES. CARBON 47 5% 1/6W
R008	RD14BB2C470J	RES. CARBON 47 5% 1/6W
R009	RD14BB2C562J	RES. CARBON 5.6K 5% 1/6W
R010	RD14BB2C562J	RES. CARBON 5.6K 5% 1/6W
R011	RD14BB2C101J	RES. CARBON 100 5% 1/6W
R012	RD14BB2C100J	RES. CARBON 10 5% 1/6W
R013	RN14BK2E1004F	RES. METAL FILM 1M 1% 1/4W
R014	RD14BB2E474J	RES. CARBON 470K 5% 1/4W
R015	RD14BB2C101J	RES. CARBON 100 5% 1/6W
R016	RN14BK2C5601F	RES. METAL FILM 5.6K 1% 1/6W
R017	RN14BK2C5601F	RES. METAL FILM 5.6K 1% 1/6W
R018	RD14BB2C470J	RES. CARBON 47 5% 1/6W
R019	RD14BB2C470J	RES. CARBON 47 5% 1/6W
R020	RD14BB2C562J	RES. CARBON 5.6K 5% 1/6W
R021	RD14BB2C562J	RES. CARBON 5.6K 5% 1/6W
R022	RD14BB2C101J	RES. CARBON 100 5% 1/6W
T003	E23-0503-05	TERMINAL
T004	E23-0503-05	TERMINAL
T005	E23-0503-05	TERMINAL
T006	E23-0503-05	TERMINAL
T007	E29-0504-05	TEFLON TERMINAL
T008	E29-0504-05	TEFLON TERMINAL
VR001	R12-0567-05	RES. SEMI FIXED 500 B
VR002	R12-0567-05	RES. SEMI FIXED 500 B

# PARTS LIST

## VERTICAL AMP UNIT

### X73-1590-00

REF. NO	PARTS NO	NAME & DESCRIPTION			
	E23-0503-05	TERMINAL			
	E33-4103-00	WIRE ASSY			
	F01-0813-05	HEAT SINK			
	F01-0849-05	HEAT SINK			
	F15-0727-04	HOLDER (NEON TUBE)			
	F20-0516-05	INSULATOR			
	J21-4525-04	MOUNTING HARDWARE			
	J25-5080-23	PCB (UNMOUNTED)			
	N09-0718-05	SCREW			
	N19-0191-05	WASHER NONMETAL			
	N30-3008-46	SCREW, PAN HD	M	3X8	
	212-7004-05	TUBE (PLASTIC)			
	420-0008-05	ADHESIVES			
C003	CC45CH1H390J	CAP. CERAMIC	39P	5%	50V
C008	CK45FF1H103Z	CAP. CERAMIC	0.01		50V
C009	CC45CH1H100D	CAP. CERAMIC	10P	0.5P	50V
C010	CC45CH1H040C	CAP. CERAMIC	4P	0.25P	50V
C011	NO USE				
C012	CE04W1E221M	CAP. ELECTRO	47	20%	50V
C015	CC45CH1H390J	CAP. CERAMIC	39P	5%	50V
C020	CC45CH1H100D	CAP. CERAMIC	10P	0.5P	50V
C021	CC45CH1H040C	CAP. CERAMIC	4P	0.25P	50V
C026	CC45CH1H050C	CAP. CERAMIC	5P	0.25P	50V
C027	CC45CH1H150J	CAP. CERAMIC	15P	5%	50V
C028	CC45CH2H010C	CAP. CERAMIC	1P	0.25%	500V
C029	CC45CH2H010C	CAP. CERAMIC	1P	0.25%	500V
C030	CK45B2H103K	CAP. CERAMIC	0.01	10%	500V
C033	CK45B2H332K	CAP. CERAMIC	3300P	10%	500V
C034	CK45B2H332K	CAP. CERAMIC	3300P	10%	500V
C035	CK45B2H103K	CAP. CERAMIC	0.01	10%	500V
C042	C90-0298-05	CAP. CERAMIC	0.1	20%	12V
C043	C90-0298-05	CAP. CERAMIC	0.1	20%	12V
C044	C90-0298-05	CAP. CERAMIC	0.1	20%	12V
C045	C90-0298-05	CAP. CERAMIC	0.1	20%	12V
C046	C90-0298-05	CAP. CERAMIC	0.1	20%	12V
C047	C90-0298-05	CAP. CERAMIC	0.1	20%	12V
C048	CK45FF1H103Z	CAP. CERAMIC	0.01		50V
C049	CE04W1E221M	CAP. ELECTRO	220	20%	25V
C050	CE04W1C470M	CAP. ELECTRO	47	20%	16V
C051	CE04W1C470M	CAP. ELECTRO	47	20%	16V
C052	CK45FF1H103Z	CAP. CERAMIC	0.01		50V
C053	CK45FF1H103Z	CAP. CERAMIC	0.01		50V
C054	NO USE				
C055	CK45FF1H103Z	CAP. CERAMIC	0.01		50V
C056	CK45FF1H103Z	CAP. CERAMIC	0.01		50V
C057	CK45FF1H103Z	CAP. CERAMIC	0.01		50V
C058	CK45FF1H103Z	CAP. CERAMIC	0.01		50V
C059	CK45FF1H103Z	CAP. CERAMIC	0.01		50V
C060	CK45FF1H103Z	CAP. CERAMIC	0.01		50V
C061	CE04W1E221M	CAP. ELECTRO	220	20%	25V
C062	CE04W1C101M	CAP. ELECTRO	100	20%	16V
C063	CK45FF1H103Z	CAP. CERAMIC	0.01		50V
C064	CK45FF1H103Z	CAP. CERAMIC	0.01		50V
C065	NO USE				
C066	CK45FF1H103Z	CAP. CERAMIC	0.01		50V
C067	NO USE				
C068	CK45FF1H103Z	CAP. CERAMIC	0.01		50V
C069	CE04W1E221M	CAP. ELECTRO	220	20%	25V
C070	CK45FF1H103Z	CAP. CERAMIC	0.01		50V
C071	CK45FF1H103Z	CAP. CERAMIC	0.01		50V
C072	CK45FF1H103Z	CAP. CERAMIC	0.01		50V
C073	CK45FF1H103Z	CAP. CERAMIC	0.01		50V
C074	CK45B2H103K	CAP. CERAMIC	0.01	10%	500V
C075	CE04W2C220	CAP. ELECTRO	22		160V
C076	CK45B2H103K	CAP. CERAMIC	0.01	10%	500V
C077	CE04W1E221M	CAP. ELECTRO	220	20%	25V
C078	CK45FF1H103Z	CAP. CERAMIC	0.01		50V
C079	CK45FF1H103Z	CAP. CERAMIC	0.01		50V
C080	CE04W1E221M	CAP. ELECTRO	220	20%	25V
C081	CK45FF1H103Z	CAP. CERAMIC	0.01		50V
C082	CK45FF1H103Z	CAP. CERAMIC	0.01		50V
C083	CE04W1E221M	CAP. ELECTRO	220	20%	25V
C084	NO USE				
C085	C90-0298-05	CAP. CERAMIC	0.1	20%	12V
C086	C90-0298-05	CAP. CERAMIC	0.1	20%	12V

REP. NO	PARTS NO	NAME & DESCRIPTION			
C087	C90-0298-05	CAP. CERAMIC	0.1	20%	12V
C088	C90-0298-05	CAP. CERAMIC	0.1	20%	12V
C089	C90-0298-05	CAP. CERAMIC	0.1	20%	12V
C090	C90-0298-05	CAP. CERAMIC	0.1	20%	12V
C091	C90-0298-05	CAP. CERAMIC	0.1	20%	12V
C092	C90-0298-05	CAP. CERAMIC	0.1	20%	12V
C093	C90-0298-05	CAP. CERAMIC	0.1	20%	12V
C094	C90-0298-05	CAP. CERAMIC	0.1	20%	12V
C095	CK45FF1H103Z	CAP. CERAMIC	0.01		50V
C096	CK45FF1H103Z	CAP. CERAMIC	0.01		50V
C097	CE04W1C221M	CAP. ELECTRO	220	20%	16V
C098	CK45FF1H103Z	CAP. CERAMIC	0.01		50V
C099	CK45FF1H103Z	CAP. CERAMIC	0.01		50V
C100	CK45FF1H103Z	CAP. CERAMIC	0.01		50V
C101	CK45FF1H103Z	CAP. CERAMIC	0.01		50V
C102	CK45FF1H103Z	CAP. CERAMIC	0.01		50V
C103	CK45FF1H103Z	CAP. CERAMIC	0.01		50V
C104	NO USE				
C105	CK45FF1H103Z	CAP. CERAMIC	0.01		50V
C106	CK45FF1H103Z	CAP. CERAMIC	0.01		50V
C107	CK45FF1H103Z	CAP. CERAMIC	0.01		50V
C108	CK45FF1H103Z	CAP. CERAMIC	0.01		50V
C109	CK45FF1H103Z	CAP. CERAMIC	0.01		50V
C110	CK45FF1H103Z	CAP. CERAMIC	0.01		50V
C111	CK45FF1H103Z	CAP. CERAMIC	0.01		50V
C112	CK45FF1H103Z	CAP. CERAMIC	0.01		50V
C113	CE04W1C470M	CAP. ELECTRO	47	20%	16V
C114	CE04W1C470M	CAP. ELECTRO	47	20%	16V
C115	NO USE				
C116	CE04W1A221M	CAP. ELECTRO	220	20%	10V
C117	CE04W1A221M	CAP. ELECTRO	220	20%	10V
C118	CE04W1C470M	CAP. ELECTRO	47	20%	16V
C119	CK45FF1H103Z	CAP. CERAMIC	0.01		50V
C120	CK45FF1H103Z	CAP. CERAMIC	0.01		50V
C121	CC45CH1H150J	CAP. CERAMIC	15P	5%	50V
C122	CC45CH1H121J	CAP. CERAMIC	120P	5%	50V
C123	CC45CH1H270J	CAP. CERAMIC	27P	5%	50V
C124	NO USE				
C125	CC45CH1H220J	CAP. CERAMIC	22P	5%	50V
C126	CC45CH1H220J	CAP. CERAMIC	22P	5%	50V
C127	CC45SL1H220J	CAP. CERAMIC	22P	5%	50V
C128	CC45SL1H220J	CAP. CERAMIC	22P	5%	50V
C129	CK45FF1H103Z	CAP. CERAMIC	0.01		50V
C130	CK45FF1H103Z	CAP. CERAMIC	0.01		50V
C131	CK45FF1H103Z	CAP. CERAMIC	0.01		50V
C132	CK45FF1H103Z	CAP. CERAMIC	0.01		50V
C133	NO USE				
C134	CK45FF1H103Z	CAP. CERAMIC	0.01		50V
C135	CK45FF1H103Z	CAP. CERAMIC	0.01		50V
C136	CK45FF1H103Z	CAP. CERAMIC	0.01		50V
C139	CK45FF1H103Z	CAP. CERAMIC	0.01		50V
C140	CK45FF1H103Z	CAP. CERAMIC	0.01		50V
C141	CK45FF1H103Z	CAP. CERAMIC	0.01		50V
C142	CC45CH1H390J	CAP. CERAMIC	39P	5%	50V
C143	CC45CH1H330J	CAP. CERAMIC	33P	5%	50V
C144	CC45CH1H070D	CAP. CERAMIC	7P	0.5P	50V
C145	CC45CH1H100D	CAP. CERAMIC	10P	0.5P	50V
C146	CE04W1C330M	CAP. ELECTRO	33	20%	16V
C147	CC45CH1H070D	CAP. CERAMIC	7P	0.5P	50V
C148	CC45CH1H100D	CAP. CERAMIC	10P	0.5P	50V
C149	CE04W1C330M	CAP. ELECTRO	33	20%	16V
C150	CC45SL1H220J	CAP. CERAMIC	22P	5%	50V
C151	CK45FF1H103Z	CAP. CERAMIC	0.01		50V
C152	CK45FF1H103Z	CAP. CERAMIC	0.01		50V
C153	CC45CH1H181J	CAP. CERAMIC	180P	5%	50V
C154	CE04W1E101M	CAP. ELECTRO	100	20%	25V
C155	CC45CH1H100D	CAP. CERAMIC	10P	0.5P	50V
D001	1SS132	DIODE			
D002	1SS132	DIODE			
D003	1SS132	DIODE			
D004	1SS132	DIODE			
D005	1SS132	DIODE			
D006	1SS132	DIODE			
D007	MTZ5.1JB	DIODE ZENER	5V		
D014	MTZ10JC	DIODE, ZENER	10V		
D015	MTZ10JC	DIODE, ZENER	10V		
D016	1SS132	DIODE			
D017	1SS132	DIODE			
D018	MTZ10JC	DIODE, ZENER	10V		
D019	1SS132	DIODE			
D020	1SS132	DIODE			
D021	1SS132	DIODE			

# PARTS LIST

REF. NO	PARTS NO	NAME & DESCRIPTION
D022	1SS132	DIODE
D023	MTZ8.2JB	DIODE, ZENER 8.1V
L004	L40-1011-04	FERRI INDUCTOR 100UH
L005	L40-1011-04	FERRI INDUCTOR 100UH
L006	L40-1011-04	FERRI INDUCTOR 100UH
L007	L40-1011-04	FERRI INDUCTOR 100UH
P001	E40-0873-05	PIN CONNECTOR 8 P
P002	E40-0373-05	PIN CONNECTOR 3 P
P003	E40-0373-05	PIN CONNECTOR 3 P
P004	E40-0373-05	PIN CONNECTOR 3 P
P005	E40-0373-05	PIN CONNECTOR 3 P
P006	E40-0273-05	PIN CONNECTOR 2 P
P007	E40-0273-05	PIN CONNECTOR 2 P
P008	E40-0273-05	PIN CONNECTOR 2 P
P009	E40-0273-05	PIN CONNECTOR 2 P
P010	E40-0273-05	PIN CONNECTOR 2 P
P011	E40-0911-05	PIN CONNECTOR 9P
P012	E40-0373-05	PIN CONNECTOR 3 P
P013	E40-0373-05	PIN CONNECTOR 3 P
P014	E40-0273-05	PIN CONNECTOR 2 P
P015	E40-0273-05	PIN CONNECTOR 2 P
P016	E40-0873-05	PIN CONNECTOR 8 P
P017	E40-0273-05	PIN CONNECTOR 2 P
P018	E40-0273-05	PIN CONNECTOR 2 P
P019	E40-0673-05	PIN CONNECTOR 6 P
P020	E40-0373-05	PIN CONNECTOR 3 P
P021	E40-0673-05	PIN CONNECTOR 6 P
P047	E40-0473-05	PIN CONNECTOR 4 P
P072	E40-0273-05	PIN CONNECTOR 2 P
Q001	2SC3066(F,G)	TR. SI, NPN
Q002	2SC3315(C,D)	TR. SI, NPN
Q003	2SC3066(P,G)	TR. SI, NPN
Q004	2SA1323(B,C)	TR. SI, PNP
Q005	2SA1323(B,C)	TR. SI, PNP
Q006	2SC3315(C,D)	TR. SI, NPN
Q007	2SC3315(C,D)	TR. SI, NPN
Q008	2SC3315(C,D)	TR. SI, NPN
Q009	2SA1323(B,C)	TR. SI, PNP
Q010	2SA1323(B,C)	TR. SI, PNP
Q011	2SC3315(C,D)	TR. SI, NPN
Q012	2SC3315(C,D)	TR. SI, NPN
Q013	2SA1323(B,C)	TR. SI, PNP
Q014	2SA1323(B,C)	TR. SI, PNP
Q015	2SA1323(B,C)	TR. SI, PNP
Q016	2SA1323(B,C)	TR. SI, PNP
Q017	2SC3315(C,D)	TR. SI, NPN
Q018	2SA1323(B,C)	TR. SI, PNP
Q019	2SC3066(F,G)	TR. SI, NPN
Q020	2SC3315(C,D)	TR. SI, NPN
Q021	2SC3066(P,G)	TR. SI, NPN
Q022	2SA1323(B,C)	TR. SI, PNP
Q023	2SA1323(B,C)	TR. SI, PNP
Q024	2SA1323(B,C)	TR. SI, PNP
Q025	2SA1323(B,C)	TR. SI, PNP
Q026	2SC3315(C,D)	TR. SI, NPN
Q027	2SC3315(C,D)	TR. SI, NPN
Q028	2SC3315(C,D)	TR. SI, NPN
Q029	2SA1323(B,C)	TR. SI, PNP
Q030	2SA1323(B,C)	TR. SI, PNP
Q031	2SC3315(C,D)	TR. SI, NPN
Q032	2SC3315(C,D)	TR. SI, NPN
Q033	2SA1323(B,C)	TR. SI, PNP
Q034	2SA1323(B,C)	TR. SI, PNP
Q035	2SA1323(B,C)	TR. SI, PNP
Q036	2SC3315(C,D)	TR. SI, NPN
Q037	2SC3315(C,D)	TR. SI, NPN
Q038	2SC3315(C,D)	TR. SI, NPN
Q039	2SC3315(C,D)	TR. SI, NPN
Q040	2SA1323(B,C)	TR. SI, PNP
Q041	2SC3315(C,D)	TR. SI, NPN
Q042	2SC3315(C,D)	TR. SI, NPN
Q043	2SC2786(K)	TR. SI, NPN
Q044	2SC2786(K)	TR. SI, NPN
Q045	2SC2786(K)	TR. SI, NPN
Q046	2SC2786(K)	TR. SI, NPN
Q047	2SC1973(T)	TR. SI, NPN
Q048	2SC1973(T)	TR. SI, NPN
Q049	2SC2912(S)	TR. SI, NPN
Q050	2SC2912(S)	TR. SI, NPN
Q051	2SA1210(S)	TR. SI, PNP

REF. NO	PARTS NO	NAME & DESCRIPTION
Q052	2SA1210(S)	TR. SI, PNP
Q053	2SC1973(T)	TR. SI, NPN
Q054	2SC1973(T)	TR. SI, NPN
Q055	2SA1323(B,C)	TR. SI, PNP
Q056	2SA1323(B,C)	TR. SI, PNP
Q057	2SA1323(B,C)	TR. SI, PNP
Q058	2SA1323(B,C)	TR. SI, PNP
Q059	2SC3315(C,D)	TR. SI, NPN
Q060	2SC3315(C,D)	TR. SI, NPN
Q061	2SC3315(C,D)	TR. SI, NPN
Q062	2SC3315(C,D)	TR. SI, NPN
Q063	2SC3315(C,D)	TR. SI, NPN
Q064	2SC3315(C,D)	TR. SI, NPN
Q065	2SC3315(C,D)	TR. SI, NPN
Q066	2SC3315(C,D)	TR. SI, NPN
Q067	NO USE	
Q068	2SC3311(Q,R)	TR. SI, NPN
Q069	2SK30A(O)	FET, N-CHANNEL
Q070	2SC3311(Q,R)	TR. SI, NPN
R001	RD14BB2C470J	RES. CARBON 47 5% 1/6W
R002	RD14BB2C470J	RES. CARBON 47 5% 1/6W
R003	RN14BK2C2200P	RES. METAL FILM 220 1% 1/6W
R004	RN14BK2C2200P	RES. METAL FILM 220 1% 1/6W
R005	NO USE	
R006	RN14BK2C4301F	RES. METAL FILM 4.3K 1% 1/6W
R007	RN14BK2C5601F	RES. METAL FILM 5.6K 1% 1/6W
R008	RN14BK2C1201F	RES. METAL FILM 1.2K 1% 1/6W
R009	RN14BK2C1001F	RES. METAL FILM 1K 1% 1/6W
R010	RD14BB2C302J	RES. CARBON 3K 5% 1/6W
R011	RD14BB2C302J	RES. CARBON 3K 5% 1/6W
R012	RD14BB2C470J	RES. CARBON 47 5% 1/6W
R013	RD14BB2C470J	RES. CARBON 47 5% 1/6W
R014	RN14BK2C5601F	RES. METAL FILM 5.6K 1% 1/6W
R015	RN14BK2C5601F	RES. METAL FILM 5.6K 1% 1/6W
R016	RN14BK2C4700F	RES. METAL FILM 470 1% 1/6W
R017	RD14BB2C104J	RES. CARBON 100K 5% 1/6W
R018	NO USE	
R019	RN14BK2C1001F	RES. METAL FILM 1K 1% 1/6W
R020	RN14BK2C1001F	RES. METAL FILM 1K 1% 1/6W
R021	RD14BB2C101J	RES. CARBON 100 5% 1/6W
R022	RD14BB2C101J	RES. CARBON 100 5% 1/6W
R023	RN14BK2C4301F	RES. METAL FILM 4.3K 1% 1/6W
R024	RN14BK2C5601F	RES. METAL FILM 5.6K 1% 1/6W
R025	RD14BB2C101J	RES. CARBON 100 5% 1/6W
R026	RD14BB2C101J	RES. CARBON 100 5% 1/6W
R030	RD14BB2C101J	RES. CARBON 100 5% 1/6W
R031	RD14BB2C101J	RES. CARBON 100 5% 1/6W
R032	RD14BB2C302J	RES. CARBON 3K 5% 1/6W
R033	RD14BB2C302J	RES. CARBON 3K 5% 1/6W
R034	RN14BK2C1200F	RES. METAL FILM 120 1% 1/6W
R035	RN14BK2C6801F	RES. METAL FILM 6.8K 1% 1/6W
R036	RN14BK2C3301F	RES. METAL FILM 3.3K 1% 1/6W
R037	RD14BB2C101J	RES. CARBON 100 5% 1/6W
R038	RD14BB2C101J	RES. CARBON 100 5% 1/6W
R039	RN14BK2C6801F	RES. METAL FILM 6.8K 1% 1/6W
R040	RN14BK2C2201F	RES. METAL FILM 2.2K 1% 1/6W
R041	RN14BK2C1201F	RES. METAL FILM 1.2K 1% 1/6W
R042	RN14BK2C1201F	RES. METAL FILM 1.2K 1% 1/6W
R043	RN14BK2C1201F	RES. METAL FILM 1.2K 1% 1/6W
R044	RN14BK2C1201F	RES. METAL FILM 1.2K 1% 1/6W
R045	RD14BB2C472J	RES. CARBON 4.7K 5% 1/6W
R046	NO USE	
R047	RD14BB2C101J	RES. CARBON 100 5% 1/6W
R048	RD14BB2C101J	RES. CARBON 100 5% 1/6W
R049	RN14BK2C6801F	RES. METAL FILM 6.8K 1% 1/6W
R050	RN14BK2C1201F	RES. METAL FILM 1.2K 1% 1/6W
R051	RN14BK2C1800F	RES. METAL FILM 180 1% 1/6W
R052	RN14BK2C9100F	RES. METAL FILM 910 1% 1/6W
R053	RN14BK2C9100F	RES. METAL FILM 910 1% 1/6W
R054	RN14BK2C6800F	RES. METAL FILM 680 1% 1/6W
R055	RD14BB2C222J	RES. CARBON 2.2K 5% 1/6W
R056	RN14BK2C6800F	RES. METAL FILM 680 1% 1/6W
R057	RN14BK2C6800F	RES. METAL FILM 680 1% 1/6W
R058	RD14BB2C101J	RES. CARBON 100 5% 1/6W
R059	RD14BB2C101J	RES. CARBON 100 5% 1/6W
R060	RN14BK2C4300F	RES. METAL FILM 430 1% 1/6W
R061	RN14BK2C4301F	RES. METAL FILM 4.3K 1% 1/6W
R062	RN14BK2C2001F	RES. METAL FILM 2K 1% 1/6W
R063	RN14BK2C2001F	RES. METAL FILM 2K 1% 1/6W
R064	RD14BB2C470J	RES. CARBON 47 5% 1/6W
R065	RD14BB2C470J	RES. CARBON 47 5% 1/6W
R066	RD14BB2C472J	RES. CARBON 4.7K 5% 1/6W
R067	RD14BB2C472J	RES. CARBON 4.7K 5% 1/6W



# PARTS LIST

REF.NO	PARTS NO	NAME & DESCRIPTION
R068	RD14BB2C102J	RES. CARBON 1K 5% 1/6W
R069	RD14BB2C102J	RES. CARBON 1K 5% 1/6W
R070	RD14BB2C472J	RES. CARBON 4.7K 5% 1/6W
R071	RD14BB2C472J	RES. CARBON 4.7K 5% 1/6W
R072	RD14BB2C101J	RES. CARBON 100 5% 1/6W
R073	RD14BB2C152J	RES. CARBON 1.5K 5% 1/6W
R074	RD14BB2C101J	RES. CARBON 100 5% 1/6W
R075	RD14BB2C472J	RES. CARBON 4.7K 5% 1/6W
R076	RD14BB2C152J	RES. CARBON 1.5K 5% 1/6W
R077	RD14BB2C152J	RES. CARBON 1.5K 5% 1/6W
R078	RD14BB2C220J	RES. CARBON 22 5% 1/6W
R079	RD14BB2C220J	RES. CARBON 22 5% 1/6W
R080	RD14BB2C360J	RES. CARBON 36 5% 1/6W
R081	RD14BB2C103J	RES. CARBON 10K 5% 1/6W
R082	RD14BB2C470J	RES. CARBON 47 5% 1/6W
R083	RD14BB2C470J	RES. CARBON 47 5% 1/6W
R084	RN14BK2C2200F	RES. METAL FILM 220 1% 1/6W
R085	RN14BK2C2200F	RES. METAL FILM 220 1% 1/6W
R086	NO USE	
R087	RN14BK2C4301F	RES. METAL FILM 4.3K 1% 1/6W
R088	RN14BK2C5601F	RES. METAL FILM 5.6K 1% 1/6W
R089	RN14BK2C1201F	RES. METAL FILM 1.2K 1% 1/6W
R090	RN14BK2C1001F	RES. METAL FILM 1K 1% 1/6W
R091	RD14BB2C302J	RES. CARBON 3K 5% 1/6W
R092	RD14BB2C302J	RES. CARBON 3K 5% 1/6W
R093	RD14BB2C470J	RES. CARBON 47 5% 1/6W
R094	RD14BB2C470J	RES. CARBON 47 5% 1/6W
R095	RN14BK2C5601F	RES. METAL FILM 5.6K 1% 1/6W
R096	RN14BK2C5601F	RES. METAL FILM 5.6K 1% 1/6W
R097	RN14BK2C5601F	RES. METAL FILM 5.6K 1% 1/6W
R098	RN14BK2C5601F	RES. METAL FILM 5.6K 1% 1/6W
R099	RN14BK2C4700F	RES. METAL FILM 470 1% 1/6W
R100	RD14BB2C104J	RES. CARBON 100K 5% 1/6W
R101	NO USE	
R102	RN14BK2C1001F	RES. METAL FILM 1K 1% 1/6W
R103	RN14BK2C1001F	RES. METAL FILM 1K 1% 1/6W
R104	RD14BB2C101J	RES. CARBON 100 5% 1/6W
R105	RD14BB2C101J	RES. CARBON 100 5% 1/6W
R106	RD14BB2C101J	RES. CARBON 100 5% 1/6W
R107	RD14BB2C101J	RES. CARBON 100 5% 1/6W
R108	RD14BB2C101J	RES. CARBON 100 5% 1/6W
R109	RD14BB2C101J	RES. CARBON 100 5% 1/6W
R110	RD14BB2C101J	RES. CARBON 100 5% 1/6W
R114	RD14BB2C101J	RES. CARBON 100 5% 1/6W
R115	RD14BB2C101J	RES. CARBON 100 5% 1/6W
R116	RD14BB2C302J	RES. CARBON 3K 5% 1/6W
R117	RD14BB2C302J	RES. CARBON 3K 5% 1/6W
R118	RN14BK2C1200F	RES. METAL FILM 120 1% 1/6W
R119	RN14BK2C6801F	RES. METAL FILM 6.8K 1% 1/6W
R120	RN14BK2C3301F	RES. METAL FILM 3.3K 1% 1/6W
R121	RD14BB2C101J	RES. CARBON 100 5% 1/6W
R122	RD14BB2C101J	RES. CARBON 100 5% 1/6W
R123	RN14BK2C6801F	RES. METAL FILM 6.8K 1% 1/6W
R124	RD14BB2C2201F	RES. METAL FILM 2.2K 1% 1/6W
R125	RD14BB2C101J	RES. CARBON 100 5% 1/6W
R126	RD14BB2C101J	RES. CARBON 100 5% 1/6W
R127	RN14BK2C6201F	RES. METAL FILM 6.2K 1% 1/6W
R128	RN14BK2C1201F	RES. METAL FILM 1.2K 1% 1/6W
R129	RN14BK2C2200F	RES. METAL FILM 220 1% 1/6W
R130	RN14BK2C9100F	RES. METAL FILM 910 1% 1/6W
R131	RN14BK2C9100F	RES. METAL FILM 910 1% 1/6W
R132	RN14BK2C6800F	RES. METAL FILM 680 1% 1/6W
R133	RD14BB2C362J	RES. CARBON 3.6K 5% 1/6W
R134	RN14BK2C6800F	RES. METAL FILM 680 1% 1/6W
R135	RN14BK2C6800F	RES. METAL FILM 680 1% 1/6W
R136	RD14BB2C101J	RES. CARBON 100 5% 1/6W
R137	RD14BB2C101J	RES. CARBON 100 5% 1/6W
R138	RN14BK2C4300F	RES. METAL FILM 430 1% 1/6W
R139	RN14BK2C4301F	RES. METAL FILM 4.3K 1% 1/6W
R140	RN14BK2C2001F	RES. METAL FILM 2K 1% 1/6W
R141	RN14BK2C2001F	RES. METAL FILM 2K 1% 1/6W
R142	RD14BB2C470J	RES. CARBON 47 5% 1/6W
R143	RD14BB2C470J	RES. CARBON 47 5% 1/6W
R144	RD14BB2C472J	RES. CARBON 4.7K 5% 1/6W
R145	RD14BB2C472J	RES. CARBON 4.7K 5% 1/6W
R146	RD14BB2C102J	RES. CARBON 1K 5% 1/6W
R147	RD14BB2C102J	RES. CARBON 1K 5% 1/6W
R148	RD14BB2C472J	RES. CARBON 4.7K 5% 1/6W
R149	RD14BB2C472J	RES. CARBON 4.7K 5% 1/6W
R150	RD14BB2C101J	RES. CARBON 100 5% 1/6W
R151	RD14BB2C152J	RES. CARBON 1.5K 5% 1/6W
R152	RD14BB2C102J	RES. CARBON 1K 5% 1/6W
R153	RD14BB2C102J	RES. CARBON 1K 5% 1/6W
R154	RD14BB2C153J	RES. CARBON 15K 5% 1/6W

REF.NO	PARTS NO	NAME & DESCRIPTION
R155	RD14BB2C102J	RES. CARBON 1K 5% 1/6W
R156	RD14BB2C222J	RES. CARBON 2.2K 5% 1/6W
R157	RD14BB2C562J	RES. CARBON 5.6K 5% 1/6W
R158	RD14BB2C222J	RES. CARBON 2.2K 5% 1/6W
R159	RD14BB2C912J	RES. CARBON 9.1K 5% 1/6W
R160	RD14BB2C561J	RES. CARBON 560 5% 1/6W
R161	RD14BB2C101J	RES. CARBON 100 5% 1/6W
R162	RD14BB2C912J	RES. CARBON 9.1K 5% 1/6W
R163	RD14BB2C561J	RES. CARBON 560 5% 1/6W
R164	RD14BB2C101J	RES. CARBON 100 5% 1/6W
R165	RN14BK2C5101F	RES. METAL FILM 5.1K 1% 1/6W
R166	RN14BK2C5101F	RES. METAL FILM 5.1K 1% 1/6W
R167	RN14BK2C4301F	RES. METAL FILM 4.3K 1% 1/6W
R168	RN14BK2C4301F	RES. METAL FILM 4.3K 1% 1/6W
R169	RD14BB2C101J	RES. CARBON 100 5% 1/6W
R170	RD14BB2C101J	RES. CARBON 100 5% 1/6W
R171	RD14BB2C182J	RES. CARBON 1.8K 5% 1/6W
R172	RD14BB2C182J	RES. CARBON 1.8K 5% 1/6W
R173	RD14BB2C101J	RES. CARBON 100 5% 1/6W
R174	RD14BB2C101J	RES. CARBON 100 5% 1/6W
R175	RN14BK2C1001F	RES. METAL FILM 1K 1% 1/6W
R176	RN14BK2C1001F	RES. METAL FILM 1K 1% 1/6W
R177	RN14BK2C3001F	RES. METAL FILM 3K 1% 1/6W
R180	RN14BK2C1501F	RES. METAL FILM 1.5K 1% 1/6W
R181	RN14BK2C1501F	RES. METAL FILM 1.5K 1% 1/6W
R182	RD14BB2C470J	RES. CARBON 47 5% 1/6W
R183	RD14BB2C470J	RES. CARBON 47 5% 1/6W
R184	RD14BB2C222J	RES. CARBON 2.2K 5% 1/6W
R185	RD14BB2C222J	RES. CARBON 2.2K 5% 1/6W
R186	RD14BB2C470J	RES. CARBON 47 5% 1/6W
R187	RD14BB2C470J	RES. CARBON 47 5% 1/6W
R188	NO USE	
R189	RD14BB2C622J	RES. CARBON 6.2K 5% 1/6W
R190	RD14BB2C622J	RES. CARBON 6.2K 5% 1/6W
R191	RD14BB2C362J	RES. CARBON 3.6K 5% 1/6W
R192	RD14BB2C362J	RES. CARBON 3.6K 5% 1/6W
R193	RD14BB2C751J	RES. CARBON 750 5% 1/6W
R194	RD14BB2C751J	RES. CARBON 750 5% 1/6W
R195	RD14BB2C470J	RES. CARBON 47 5% 1/6W
R196	RD14BB2C470J	RES. CARBON 47 5% 1/6W
R197	RN14BK2H6802F	RES. METAL FILM 68K 1% 1/2W
R198	RN14BK2H6802F	RES. METAL FILM 68K 1% 1/2W
R199	RD14BY2H333J	RES. CARBON 33K 5% 1/2W
R200	RD14BB2C470J	RES. CARBON 47 5% 1/6W
R201	RD14BB2C470J	RES. CARBON 47 5% 1/6W
R202	RD14BB2E752J	RES. CARBON 7.5K 5% 1/4W
R203	RD14BY2H102J	RES. CARBON 1K 5% 1/2W
R204	NO USE	
R205	RD14BY2H102J	RES. CARBON 1K 5% 1/2W
R206	NO USE	
R207	RD14BB2C472J	RES. CARBON 4.7K 5% 1/6W
R208	RD14BB2C472J	RES. CARBON 4.7K 5% 1/6W
R209	RS14GB3D821J	RES. METAL FILM 820 5% 2W
R210	RD14BB2C472J	RES. CARBON 4.7K 5% 1/6W
R211	RD14BB2C561J	RES. CARBON 560 5% 1/6W
R212	RD14BB2C103J	RES. CARBON 10K 5% 1/6W
R213	RD14BB2C103J	RES. CARBON 10K 5% 1/6W
R214	RD14BB2C102J	RES. CARBON 1K 5% 1/6W
R215	RD14BB2C331J	RES. CARBON 330 5% 1/6W
R216	RD14BB2C472J	RES. CARBON 4.7K 5% 1/6W
R217	RD14BB2C472J	RES. CARBON 4.7K 5% 1/6W
R218	RD14BB2C272J	RES. CARBON 2.7K 5% 1/6W
R219	RD14BB2C272J	RES. CARBON 2.7K 5% 1/6W
R220	RD14BB2C470J	RES. CARBON 47 5% 1/6W
R221	RD14BB2C470J	RES. CARBON 47 5% 1/6W
R222	RD14BB2C222J	RES. CARBON 2.2K 5% 1/6W
R223	RD14BB2C222J	RES. CARBON 2.2K 5% 1/6W
R224	RN14BK2C6800F	RES. METAL FILM 680 1% 1/6W
R225	RD14BB2C101J	RES. CARBON 100 5% 1/6W
R226	RD14BB2C101J	RES. CARBON 100 5% 1/6W
R227	RN14BK2C6801F	RES. METAL FILM 6.8K 1% 1/6W
R228	RN14BK2C3301F	RES. METAL FILM 3.3K 1% 1/6W
R229	RN14BK2C6801F	RES. METAL FILM 6.8K 1% 1/6W
R230	RN14BK2C2201F	RES. METAL FILM 2.2K 1% 1/6W
R231	RD14BB2C472J	RES. CARBON 4.7K 5% 1/6W
R232	RD14BB2C561J	RES. CARBON 560 5% 1/6W
R233	RD14BB2C103J	RES. CARBON 10K 5% 1/6W
R234	RD14BB2C103J	RES. CARBON 10K 5% 1/6W
R235	RD14BB2C102J	RES. CARBON 1K 5% 1/6W
R236	RD14BB2C331J	RES. CARBON 330 5% 1/6W
R237	RD14BB2C472J	RES. CARBON 4.7K 5% 1/6W
R238	RD14BB2C472J	RES. CARBON 4.7K 5% 1/6W
R239	RD14BB2C272J	RES. CARBON 2.7K 5% 1/6W
R240	RD14BB2C272J	RES. CARBON 2.7K 5% 1/6W

# PARTS LIST

REF. NO	PARTS NO	NAME & DESCRIPTION
R241	RD14BB2C470J	RES. CARBON 47 5% 1/6W
R242	RD14BB2C470J	RES. CARBON 47 5% 1/6W
R243	RD14BB2C222J	RES. CARBON 2.2K 5% 1/6W
R244	RD14BB2C222J	RES. CARBON 2.2K 5% 1/6W
R245	RN14BK2C6800F	RES. METAL FILM 680 1% 1/6W
R246	RD14BB2C101J	RES. CARBON 100 5% 1/6W
R247	RD14BB2C101J	RES. CARBON 100 5% 1/6W
R248	RN14BK2C6801F	RES. METAL FILM 6.8K 1% 1/6W
R249	RN14BK2C3301F	RES. METAL FILM 3.3K 1% 1/6W
R250	RN14BK2C6801F	RES. METAL FILM 6.8K 1% 1/6W
R251	RN14BK2C2201F	RES. METAL FILM 2.2K 1% 1/6W
R252	RD14BB2C392J	RES. CARBON 3.9K 5% 1/6W
R253	RD14BB2C392J	RES. CARBON 3.9K 5% 1/6W
R254	RD14BB2C392J	RES. CARBON 3.9K 5% 1/6W
R255	RD14BB2C392J	RES. CARBON 3.9K 5% 1/6W
R256	RD14BB2C392J	RES. CARBON 3.9K 5% 1/6W
R257	RD14BB2C392J	RES. CARBON 3.9K 5% 1/6W
R258	RD14BB2C332J	RES. CARBON 3.3K 5% 1/6W
R259	RD14BB2C332J	RES. CARBON 3.3K 5% 1/6W
R260	RD14BB2C332J	RES. CARBON 3.3K 5% 1/6W
R261	RD14BB2C332J	RES. CARBON 3.3K 5% 1/6W
R262	RD14BB2C332J	RES. CARBON 3.3K 5% 1/6W
R263	RD14BB2C332J	RES. CARBON 3.3K 5% 1/6W
R264	R90-0622-05	RES. NETWORK
R265	RN14BK2C3601F	RES. METAL FILM 3.6K 1% 1/6W
R266	RN14BK2C3601F	RES. METAL FILM 3.6K 1% 1/6W
R267	RN14BK2C6800F	RES. METAL FILM 680 1% 1/6W
R268	RN14BK2C6800F	RES. METAL FILM 680 1% 1/6W
R269	RD14BB2C101J	RES. CARBON 100 5% 1/6W
R270	RD14BB2C101J	RES. CARBON 100 5% 1/6W
R271	RD14BB2C102J	RES. CARBON 1K 5% 1/6W
R272	RD14BB2C102J	RES. CARBON 1K 5% 1/6W
R273	RD14BB2C101J	RES. CARBON 100 5% 1/6W
R274	RD14BB2C101J	RES. CARBON 100 5% 1/6W
R275	RD14BB2C102J	RES. CARBON 1K 5% 1/6W
R276	RD14BB2C102J	RES. CARBON 1K 5% 1/6W
R279	RD14BB2C102J	RES. CARBON 1K 5% 1/6W
R280	RD14BB2C102J	RES. CARBON 1K 5% 1/6W
R283	RD14BB2C102J	RES. CARBON 1K 5% 1/6W
R284	RN14BK2C1202F	RES. METAL FILM 12K 1% 1/6W
R285	RN14BK2C1202F	RES. METAL FILM 12K 1% 1/6W
R286	RD14BB2C562J	RES. CARBON 5.6K 5% 1/6W
R287	RD14BB2C562J	RES. CARBON 5.6K 5% 1/6W
R288	RD14BB2C472J	RES. CARBON 4.7K 5% 1/6W
R289	RD14BB2C472J	RES. CARBON 4.7K 5% 1/6W
R290	RD14BB2C392J	RES. CARBON 3.9K 5% 1/6W
R291	RD14BB2C392J	RES. CARBON 3.9K 5% 1/6W
R292	RD14BB2C103J	RES. CARBON 10K 5% 1/6W
R293	RD14BB2C162J	RES. CARBON 1.6K 5% 1/6W
R294	RN14BK2C1202F	RES. METAL FILM 12K 1% 1/6W
R295	RN14BK2C1202F	RES. METAL FILM 12K 1% 1/6W
R296	RD14BB2C562J	RES. CARBON 5.6K 5% 1/6W
R297	RD14BB2C562J	RES. CARBON 5.6K 5% 1/6W
R298	RD14BB2C472J	RES. CARBON 4.7K 5% 1/6W
R299	RD14BB2C472J	RES. CARBON 4.7K 5% 1/6W
R300	RD14BB2C392J	RES. CARBON 3.9K 5% 1/6W
R301	RD14BB2C392J	RES. CARBON 3.9K 5% 1/6W
R302	RD14BB2C392J	RES. CARBON 3.9K 5% 1/6W
R303	RD14BB2C392J	RES. CARBON 3.9K 5% 1/6W
R304	RD14BB2C132J	RES. CARBON 1.3K 5% 1/6W
R305	RD14BB2C132J	RES. CARBON 1.3K 5% 1/6W
R306	RD14BB2C101J	RES. CARBON 100 5% 1/6W
R307	NO USE	
R308	RN14BK2C51R0P	RES. METAL FILM 51.0 1% 1/6W
R309	RN14BK2C30R0P	RES. METAL FILM 30.0 1% 1/6W
R310	RN14BK2C4700F	RES. METAL FILM 470 1% 1/6W
R313	RN14BK2C51R0P	RES. METAL FILM 51.0 1% 1/6W
R314	RN14BK2C30R0P	RES. METAL FILM 30.0 1% 1/6W
R315	RN14BK2C4700F	RES. METAL FILM 470 1% 1/6W
R316	NO USE	
R317	RD14BB2C102J	RES. CARBON 1K 5% 1/6W
R318	RD14BB2C102J	RES. CARBON 1K 5% 1/6W
R321	RD14BB2C470J	RES. CARBON 47 5% 1/6W
R322	RD14BB2C272J	RES. CARBON 2.7K 5% 1/6W
R323	RD14BB2C203J	RES. CARBON 20K 5% 1/6W
R324	RD14BB2C100J	RES. CARBON 10 5% 1/6W
R325	RD14BB2C362J	RES. CARBON 3.6K 5% 1/6W
R326	RD14BB2C203J	RES. CARBON 20K 5% 1/6W
R327	NO USE	
R328	RD14BB2C100J	RES. CARBON 10 5% 1/6W
R329	RD14BB2C102J	RES. CARBON 1K 5% 1/6W

REF. NO	PARTS NO	NAME & DESCRIPTION
R330	RN14BK2C1002F	RES. METAL FILM 10K 1% 1/6W
R331	RD14BB2C331J	RES. CARBON 330 5% 1/6W
R332	RD14BB2C331J	RES. CARBON 330 5% 1/6W
R333	RD14BB2C331J	RES. CARBON 330 5% 1/6W
R334	RD14BB2C331J	RES. CARBON 330 5% 1/6W
R335	RD14BB2C560J	RES. CARBON 56 5% 1/6W
R336	RD14BB2C560J	RES. CARBON 56 5% 1/6W
R337	RD14BB2C471J	RES. CARBON 470 5% 1/6W
R338	RD14BB2C822J	RES. CARBON 8.2K 5% 1/6W
R339	RD14BB2C911J	RES. CARBON 910 5% 1/6W
R340	RD14BB2C911J	RES. CARBON 910 5% 1/6W
R341	RD14BB2C132J	RES. CARBON 1.3K 5% 1/6W
R342	RD14BB2C911J	RES. CARBON 910 5% 1/6W
R343	RD14BB2C911J	RES. CARBON 910 5% 1/6W
R344	RD14BB2C132J	RES. CARBON 1.3K 5% 1/6W
R345	RD14BB2C152J	RES. CARBON 1.5K 5% 1/6W
R346	RD14BB2C822J	RES. CARBON 8.2K 5% 1/6W
R347	RD14BB2C471J	RES. CARBON 470 5% 1/6W
R348	RD14BB2C152J	RES. CARBON 1.5K 5% 1/6W
TC001	C05-0412-05	CAP. TRIMMER 20P
TC002	C05-0410-05	CAP. TRIMMER 6P
TC003	C05-0412-05	CAP. TRIMMER 20P
TC004	C05-0411-05	CAP. TRIMMER 10P
TC005	C05-0412-05	CAP. TRIMMER 20P
TC006	C05-0411-05	CAP. TRIMMER 10P
TH001	SDT100	THERMISTOR
TH002	SDT100	THERMISTOR
TH003	SDT20	THERMISTOR
TH004	SDT100	THERMISTOR
TH005	SDT1000	THERMISTOR
TH006	SDT1000	THERMISTOR
TH007	SDT20	THERMISTOR
TP001	E40-0211-05	PIN CONNECTOR 2 P
U001	MC14584BCP	IC
U002	SN74LS04N	IC
U003	SN74LS11N	IC
U004	SN74LS00N	IC, QUAD 2-INPUT NAND GATE
U005	SN74LS51N	IC
U006	SN74LS51N	IC
U007	SN74LS00N	IC, QUAD 2-INPUT NAND GATE
U008	SN74LS32N	IC, QUAD 2-INPUT OR GATE
U009	SN74LS112AN	IC, DUAL JK-FF
U010	SN74LS157N	IC
U011	CA3102E	IC
U012	CA3102E	IC
U013	CA3102E	IC
U014	CA3102E	IC
U015	MC78M05CT	VOLTAGE REGULATOR (5V, 100MA)
VR001	R12-1533-05	RES. SEMI FIXED 1K B
VR002	NO USE	
VR003	R12-1534-05	RES. SEMI FIXED 2K B
VR004	R12-0565-05	RES. SEMI FIXED 100 B
VR005	R12-0565-05	RES. SEMI FIXED 100 B
VR006	R12-1534-05	RES. SEMI FIXED 2K B
VR007	R12-0567-05	RES. SEMI FIXED 500 B
VR008	R12-1533-05	RES. SEMI FIXED 1K B
VR009	R12-1533-05	RES. SEMI FIXED 1K B
VR010	NO USE	
VR011	R12-1534-05	RES. SEMI FIXED 2K B
VR012	R12-1534-05	RES. SEMI FIXED 2K B
VR013	NO USE	
VR014	R12-0565-05	RES. SEMI FIXED 100 B
VR015	R12-0565-05	RES. SEMI FIXED 100 B
VR016	R12-1534-05	RES. SEMI FIXED 2K B
VR017	R12-0567-05	RES. SEMI FIXED 500 B
VR018	NO USE	
VR019	R12-1533-05	RES. SEMI FIXED 1K B
VR020	R12-1533-05	RES. SEMI FIXED 1K B
VR021	R12-0567-05	RES. SEMI FIXED 500 B
VR022	R12-0567-05	RES. SEMI FIXED 500 B
VR023	R12-0567-05	RES. SEMI FIXED 500 B
VR024	R12-0567-05	RES. SEMI FIXED 500 B
VR025	R12-0567-05	RES. SEMI FIXED 500 B
VR026	R12-0567-05	RES. SEMI FIXED 500 B

# PARTS LIST

## SWEEP UNIT

### X74-1400-00

REF. NO	PARTS NO	NAME & DESCRIPTION			
	A22-0845-04	SUB PANEL			
	E23-0503-05	TERMINAL			
	E33-4090-00	WIRE ASSY			
	J25-5081-22	PCB (UNMOUNTED)			
	N32-3006-41	SCREW, FLAT HD M 3X6			
C001	C91-0502-05	CAP. METAL FILM	0.01	20%	630V
C002	CQ93M1H102K	CAP. MYLAR	1000P	10%	50V
C003	C91-0502-05	CAP. METAL FILM	0.01	20%	630V
C004	CK45FF1H103Z	CAP. CERAMIC	0.01		50V
C005	NO USE				
C006	CC45CH1H470J	CAP. CERAMIC	47P	5%	50V
C009	CE04W1H3R3M	CAP. ELECTRO	3.3	20%	50V
C010	CE04W1H3R3M	CAP. ELECTRO	3.3	20%	50V
C011	CK45FF1H103Z	CAP. CERAMIC	0.01		50V
C012	NO USE				
C013	C91-0548-05	CAP. METALIZED POLYESTER			
C014	CQ93BP2A103F	CAP. MYLAR	0.01	1%	100V
C015	CM93BD2A680J	CAP. MICA	68P	5%	100V
C016	CK45FF1H103Z	CAP. CERAMIC	0.01		50V
C017	CQ93BP2A103F	CAP. MYLAR	0.01	1%	100V
C018	CC45CH1H270J	CAP. CERAMIC	27P	5%	50V
C019	C90-0298-05	CAP. CERAMIC	0.1	20%	12V
C020	C90-0298-05	CAP. CERAMIC	0.1	20%	12V
C021	CE04W1E100M	CAP. ELECTRO	10	20%	25V
C022	C90-0298-05	CAP. CERAMIC	0.1	20%	12V
C023	CK45B1H472K	CAP. CERAMIC	4700P	10%	50V
C024	CK45B1H222K	CAP. CERAMIC	2200P	10%	50V
C025	CM93BD2A331J	CAP. MICA	330P	5%	100V
C026	CM93BD2A331J	CAP. MICA	330P	5%	100V
C027	CC45CH1H181J	CAP. CERAMIC	180P	5%	50V
C028	CC45CH1H221J	CAP. CERAMIC	220P	5%	50V
C029	CC45CH1H330J	CAP. CERAMIC	33P	5%	50V
C030	CC45CH1H330J	CAP. CERAMIC	33P	5%	50V
C031	CE04W1C101M	CAP. ELECTRO	100	20%	16V
C032	CK45FF1H103Z	CAP. CERAMIC	0.01		50V
C033	CQ93BP2A472F	CAP. MYLAR	4700P	1%	100V
C034	CQ93BP2A472F	CAP. MYLAR	4700P	1%	100V
C035	CK45FF1H103Z	CAP. CERAMIC	0.01		50V
C036	CC45CH1H560J	CAP. CERAMIC	56P	5%	50V
C037	CC45CH1H020C	CAP. CERAMIC	2P	0.25P	50V
C038	NO USE				
C039	CQ93M1H332K	CAP. MYLAR	3300P	10%	50V
C043	CE04W2C220	CAP. ELECTRO	22		160V
C044	CK45B2H103K	CAP. CERAMIC	0.01	10%	500V
C045	CE04W2C220	CAP. ELECTRO	22		160V
C046	CK45B2H103K	CAP. CERAMIC	0.01	10%	500V
C047	CK45B2H103K	CAP. CERAMIC	0.01	10%	500V
C048	CE04W1C331M	CAP. ELECTRO	330	20%	16V
C049	CK45FF1H103Z	CAP. CERAMIC	0.01		50V
C050	CE04W1C331M	CAP. ELECTRO	330	20%	16V
C051	CK45FF1H103Z	CAP. CERAMIC	0.01		50V
C052	CE04W1C331M	CAP. ELECTRO	330	20%	16V
C053	CK45FF1H103Z	CAP. CERAMIC	0.01		50V
C054	CK45FF1H103Z	CAP. CERAMIC	0.01		50V
C055	CE04W1C331M	CAP. ELECTRO	330	20%	16V
C056	CK45FF1H103Z	CAP. CERAMIC	0.01		50V
C057	CE04W1C101M	CAP. ELECTRO	100	20%	16V
C058	CK45FF1H103Z	CAP. CERAMIC	0.01		50V
C059	CK45FF1H103Z	CAP. CERAMIC	0.01		50V
C060	CE04W1C471M	CAP. ELECTRO	470	20%	16V
C061	CK45FF1H103Z	CAP. CERAMIC	0.01		50V
C062	CE04W1C331M	CAP. ELECTRO	330	20%	16V
C063	CE04W1C331M	CAP. ELECTRO	330	20%	16V
C064	CK45FF1H103Z	CAP. CERAMIC	0.01		50V
C065	CK45FF1H103Z	CAP. CERAMIC	0.01		50V
C066	CE04W1C331M	CAP. ELECTRO	330	20%	16V
C067	CK45FF1H103Z	CAP. CERAMIC	0.01		50V
C068	C90-0298-05	CAP. CERAMIC	0.1	20%	12V
C069	C90-0298-05	CAP. CERAMIC	0.1	20%	12V
C070	C90-0298-05	CAP. CERAMIC	0.1	20%	12V
C071	C90-0298-05	CAP. CERAMIC	0.1	20%	12V
C072	C90-0298-05	CAP. CERAMIC	0.1	20%	12V
C073	C90-0298-05	CAP. CERAMIC	0.1	20%	12V
C074	C90-0298-05	CAP. CERAMIC	0.1	20%	12V
C075	CE04W1C331M	CAP. ELECTRO	330	20%	16V
C076	CK45FF1H103Z	CAP. CERAMIC	0.01		50V
C077	CK45FF1H103Z	CAP. CERAMIC	0.01		50V
C078	NO USE				
C079	CC45CH1H270J	CAP. CERAMIC	27P	5%	50V

REF. NO	PARTS NO	NAME & DESCRIPTION			
C080	CC45CH1H100D	CAP. CERAMIC	10P	0.5P	50V
C081	CE04W1A470M	CAP. ELECTRO	47	20%	10V
C082	CE04W1A470M	CAP. ELECTRO	47	20%	10V
C083	CE04W1C471M	CAP. ELECTRO	470	20%	16V
C084	NO USE				
C085	CK45FF1H103Z	CAP. CERAMIC	0.01		50V
C086	CC45SL1H331J	CAP. CERAMIC	330P	5%	50V
C087	CK45FF1H103Z	CAP. CERAMIC	0.01		50V
C088	CK45FF1H103Z	CAP. CERAMIC	0.01		50V
C089	CK45B1H102K	CAP. CERAMIC	1000P	10%	50V
C090	NO USE				
C091	CC45SL1H221J	CAP. CERAMIC	220P	5%	50V
C092	CC45CH1H050C	CAP. CERAMIC	5P	0.25P	50V
C093	C90-0298-05	CAP. CERAMIC	0.1	20%	12V
D001	1SS135	DIODE			
D002	1SS132	DIODE			
D003	1SS132	DIODE			
D004	1SS132	DIODE			
D005	LN322GP	DIODE			
D006	1SS132	DIODE			
D007	1SS132	DIODE			
D008	1SS132	DIODE			
D009	1SS132	DIODE			
D010	1SS132	DIODE			
D011	1SS132	DIODE			
D012	1SS132	DIODE			
D013	1SS132	DIODE			
D014	1SS132	DIODE			
D015	1SS132	DIODE			
D016	1SS132	DIODE			
D017	1SS132	DIODE			
D018	MTZ6.2JB	DIODE ZENER	6.1V		
D019	1N60	DIODE			
D020	1SS132	DIODE			
D021	1SS132	DIODE			
D022	MTZ3.3JA	DIODE, ZENER	3.2V		
D023	MTZ6.2JB	DIODE ZENER	6.1V		
D024	1SS132	DIODE			
D025	1N60	DIODE			
D026	1SS132	DIODE			
D027	1SS132	DIODE			
JP003	R92-0150-05	JUMPING RES.	ZERO OHM		
L001	L40-1011-04	FERRI INDUCTOR	100UH		
L002	L40-1011-04	FERRI INDUCTOR	100UH		
L003	L40-1011-04	FERRI INDUCTOR	100UH		
L004	L40-1011-04	FERRI INDUCTOR	100UH		
L005	NO USE				
L006	L40-1011-04	FERRI INDUCTOR	100UH		
L007	L40-1011-04	FERRI INDUCTOR	100UH		
P017	E40-0273-05	PIN CONNECTOR	2 P		
P018	E40-0273-05	PIN CONNECTOR	2 P		
P019	E40-0673-05	PIN CONNECTOR	6 P		
P020	E40-0373-05	PIN CONNECTOR	3 P		
P024	E40-0273-05	PIN CONNECTOR	2 P		
P025	E40-0273-05	PIN CONNECTOR	2 P		
P026	E40-0273-05	PIN CONNECTOR	2 P		
P027	E40-0373-05	PIN CONNECTOR	3 P		
P028	E40-0273-05	PIN CONNECTOR	2 P		
P029	E40-0373-05	PIN CONNECTOR	3 P		
P030	E40-0273-05	PIN CONNECTOR	2 P		
P031	E40-0273-05	PIN CONNECTOR	2 P		
P032	E40-0573-05	PIN CONNECTOR	5 P		
P033	E40-0473-05	PIN CONNECTOR	4 P		
P034	E40-0573-05	PIN CONNECTOR	5 P		
P066	E40-0216-05	PIN CONNECTOR	2 P		
P071	E40-0273-05	PIN CONNECTOR	2 P		
Q001	2SK30A(O)	FET, N-CHANNEL			
Q002	2SK30A(O)	FET, N-CHANNEL			
Q003	2SC3315(C,D)	TR. SI, NPN			
Q004	2SC3315(C,D)	TR. SI, NPN			
Q005	2SC3311(Q,R)	TR. SI, NPN			
Q006	2SA1323(B,C)	TR. SI, PNP			
Q007	2SA1323(B,C)	TR. SI, PNP			
Q008	2SC3311(Q,R)	TR. SI, NPN			
Q009	2SC3311(Q,R)	TR. SI, NPN			
Q010	2SA1323(B,C)	TR. SI, PNP			
Q011	2SK30A(O)	FET, N-CHANNEL			

# PARTS LIST

REF. NO	PARTS NO	NAME & DESCRIPTION
Q012	2SC3311(Q,R)	TR. SI, NPN
Q013	2SA1323(B,C)	TR. SI, PNP
Q014	2SK30A(O)	FET, N-CHANNEL
Q015	2SC3311(Q,R)	TR. SI, NPN
Q016	2SC3311(Q,R)	TR. SI, NPN
Q017	2SC3311(Q,R)	TR. SI, NPN
Q018	2SA1323(B,C)	TR. SI, PNP
Q019	2SA1323(B,C)	TR. SI, PNP
Q020	2SA1323(B,C)	TR. SI, PNP
Q021	2SA1323(B,C)	TR. SI, PNP
Q022	2SC2591(Q)	TR. SI, NPN
Q023	2SA1323(B,C)	TR. SI, PNP
Q024	2SC3311(Q,R)	TR. SI, NPN
Q025	2SC3311(Q,R)	TR. SI, NPN
Q026	2SC3311(Q,R)	TR. SI, NPN
Q027	2SA1323(B,C)	TR. SI, PNP
Q028	2SC3311(Q,R)	TR. SI, NPN
Q029	2SC3311(Q,R)	TR. SI, NPN
Q030	2SA1323(B,C)	TR. SI, PNP
Q031	2SA1323(B,C)	TR. SI, PNP
Q032	2SA1323(B,C)	TR. SI, PNP
Q033	2SA1323(B,C)	TR. SI, PNP
Q034	2SA1323(B,C)	TR. SI, PNP
Q035	2SC1384(R)	TR. SI, NPN
Q036	2SA684(R)	TR. SI, PNP
Q037	2SC3311(Q,R)	TR. SI, NPN
Q038	2SC3311(Q,R)	TR. SI, NPN
Q039	2SC3311(Q,R)	TR. SI, NPN
Q040	2SC3311(Q,R)	TR. SI, NPN
Q041	2SC3311(Q,R)	TR. SI, NPN
Q042	2SC3315(C,D)	TR. SI, NPN
Q043	2SC1973(T)	TR. SI, NPN
Q044	2SC3311(Q,R)	TR. SI, NPN
Q045	2SC3311(Q,R)	TR. SI, NPN
Q046	2SC3311(Q,R)	TR. SI, NPN
Q047	2SC3315(C,D)	TR. SI, NPN
Q048	2SC1973(T)	TR. SI, NPN
Q049	2SC1973(T)	TR. SI, NPN
Q050	2SC3311(Q,R)	TR. SI, NPN
Q051	2SC3311(Q,R)	TR. SI, NPN
Q052	2SC3311(Q,R)	TR. SI, NPN
R001	RD14BB2C104J	RES. CARBON 100K 5% 1/6W
R002	RN14BK2E1004F	RES. METAL FILM 1M 1% 1/4W
R003	RD14BB2C104J	RES. CARBON 100K 5% 1/6W
R004	RD14BB2C103J	RES. CARBON 10K 5% 1/6W
R005	RD14BB2C103J	RES. CARBON 10K 5% 1/6W
R006	RD14BB2C470J	RES. CARBON 47 5% 1/6W
R007	RD14BB2C102J	RES. CARBON 1K 5% 1/6W
R008	RD14BB2C103J	RES. CARBON 10K 5% 1/6W
R009	RD14BB2C103J	RES. CARBON 10K 5% 1/6W
R010	RD14BB2C470J	RES. CARBON 47 5% 1/6W
R011	RD14BB2C470J	RES. CARBON 47 5% 1/6W
R012	RN14BK2C5600F	RES. METAL FILM 560 1% 1/6W
R013	RN14BK2C1102F	RES. METAL FILM 11K 1% 1/6W
R014	RN14BK2C1002F	RES. METAL FILM 10K 1% 1/6W
R015	RN14BK2C3300F	RES. METAL FILM 330 1% 1/6W
R016	RN14BK2C3300F	RES. METAL FILM 330 1% 1/6W
R017	RD14BB2C122J	RES. CARBON 1.2K 5% 1/6W
R018	RD14BB2C122J	RES. CARBON 1.2K 5% 1/6W
R019	RD14BB2C470J	RES. CARBON 47 5% 1/6W
R020	RD14BB2C470J	RES. CARBON 47 5% 1/6W
R021	RN14BK2C3001F	RES. METAL FILM 3K 1% 1/6W
R022	RN14BK2C3601F	RES. METAL FILM 3.6K 1% 1/6W
R023	RD14BB2C220J	RES. CARBON 22 5% 1/6W
R024	RD14BB2C222J	RES. CARBON 2.2K 5% 1/6W
R025	RD14BB2C112J	RES. CARBON 1.1K 5% 1/6W
R026	RD14BB2C391J	RES. CARBON 390 5% 1/6W
R027	RD14BB2C391J	RES. CARBON 390 5% 1/6W
R028	RD14BB2C112J	RES. CARBON 1.1K 5% 1/6W
R029	RD14BB2C101J	RES. CARBON 100 5% 1/6W
R030	RD14BB2C152J	RES. CARBON 1.5K 5% 1/6W
R031	RD14BB2C101J	RES. CARBON 100 5% 1/6W
R032	RD14BB2C682J	RES. CARBON 6.8K 5% 1/6W
R033	RD14BB2C333J	RES. CARBON 33K 5% 1/6W
R034	RD14BB2C102J	RES. CARBON 1K 5% 1/6W
R035	RD14BB2C471J	RES. CARBON 470 5% 1/6W
R036	RD14BB2C101J	RES. CARBON 100 5% 1/6W
R037	RD14BB2C183J	RES. CARBON 18K 5% 1/6W
R038	RD14BB2C331J	RES. CARBON 330 5% 1/6W
R039	RD14BB2C121J	RES. CARBON 120 5% 1/6W
R040	RD14BB2C472J	RES. CARBON 4.7K 5% 1/6W
R041	RD14BB2C472J	RES. CARBON 4.7K 5% 1/6W
R042	RD14BB2C102J	RES. CARBON 1K 5% 1/6W
R043	RD14BB2C332J	RES. CARBON 3.3K 5% 1/6W

REF. NO	PARTS NO	NAME & DESCRIPTION
R044	RD14BB2C152J	RES. CARBON 1.5K 5% 1/6W
R045	RD14BB2C751J	RES. CARBON 750 5% 1/6W
R046	RN14BK2E2002F	RES. METAL FILM 20K 1% 1/4W
R047	RN14BK2E3002F	RES. METAL FILM 30K 1% 1/4W
R048	RN14BK2E5002F	RES. METAL FILM 50K 1% 1/4W
R049	RN14BK2E1003F	RES. METAL FILM 100K 1% 1/4W
R050	RN14BK2E3003F	RES. METAL FILM 300K 1% 1/4W
R051	RN14BK2H5003F	RES. METAL FILM 500K 1% 1/2W
R052	RN14BK2H1004F	RES. METAL FILM 1M 1% 1/2W
R053	RN14BK2H3004F	RES. METAL FILM 3M 1% 1/2W
R054	RD14BB2C101J	RES. CARBON 100 5% 1/6W
R055	RD14BB2C103J	RES. CARBON 10K 5% 1/6W
R056	RS14GB3D273J	RES. METAL FILM 27K 5% 2W
R057	RD14BB2C102J	RES. CARBON 1K 5% 1/6W
R058	RD14BB2C272J	RES. CARBON 2.7K 5% 1/6W
R059	RD14BB2C102J	RES. CARBON 1K 5% 1/6W
R060	RN14BK2C1503F	RES. METAL FILM 150K 1% 1/6W
R061	RD14BB2C101J	RES. CARBON 100 5% 1/6W
R062	RD14BB2C103J	RES. CARBON 10K 5% 1/6W
R063	RS14GB3D273J	RES. METAL FILM 27K 5% 2W
R064	RN14BK2C1102F	RES. METAL FILM 11K 1% 1/6W
R065	RN14BK2C1001F	RES. METAL FILM 1K 1% 1/6W
R066	RD14BB2C103J	RES. CARBON 10K 5% 1/6W
R067	RD14BB2C473J	RES. CARBON 47K 5% 1/6W
R068	RD14BB2C103J	RES. CARBON 10K 5% 1/6W
R069	RD14BB2C473J	RES. CARBON 47K 5% 1/6W
R070	RD14BB2C682J	RES. CARBON 6.8K 5% 1/6W
R071	RD14BB2C152J	RES. CARBON 1.5K 5% 1/6W
R072	RD14BB2C472J	RES. CARBON 4.7K 5% 1/6W
R073	RD14BB2C822J	RES. CARBON 8.2K 5% 1/6W
R074	RD14BB2C303J	RES. CARBON 30K 5% 1/6W
R075	RD14BB2C102J	RES. CARBON 1K 5% 1/6W
R076	RD14BB2C102J	RES. CARBON 1K 5% 1/6W
R077	RN14BK2C3601F	RES. METAL FILM 3.6K 1% 1/6W
R078	RN14BK2C5101F	RES. METAL FILM 5.1K 1% 1/6W
R079	RD14BB2C101J	RES. CARBON 100 5% 1/6W
R080	RD14BB2C102J	RES. CARBON 1K 5% 1/6W
R081	RD14BB2C102J	RES. CARBON 1K 5% 1/6W
R082	RD14BB2C101J	RES. CARBON 100 5% 1/6W
R083	RN14BK2C3901F	RES. METAL FILM 3.9K 1% 1/6W
R084	RN14BK2C3901F	RES. METAL FILM 3.9K 1% 1/6W
R085	RD14BB2C223J	RES. CARBON 22K 5% 1/6W
R086	RD14BB2C101J	RES. CARBON 100 5% 1/6W
R087	RD14BY2H103J	RES. CARBON 10K 5% 1/2W
R088	RD14BB2C182J	RES. CARBON 1.8K 5% 1/6W
R089	RD14BB2C102J	RES. CARBON 1K 5% 1/6W
R090	RD14BB2C472J	RES. CARBON 4.7K 5% 1/6W
R091	RD14BB2C563J	RES. CARBON 56K 5% 1/6W
R092	RD14BB2C472J	RES. CARBON 4.7K 5% 1/6W
R093	RD14BB2C563J	RES. CARBON 56K 5% 1/6W
R094	RD14BB2C222J	RES. CARBON 2.2K 5% 1/6W
R095	RD14BB2C681J	RES. CARBON 680 5% 1/6W
R096	RD14BB2C222J	RES. CARBON 2.2K 5% 1/6W
R097	RD14BB2C103J	RES. CARBON 10K 5% 1/6W
R098	RD14BB2C153J	RES. CARBON 15K 5% 1/6W
R099	RD14BB2C272J	RES. CARBON 2.7K 5% 1/6W
R100	RD14BB2C103J	RES. CARBON 10K 5% 1/6W
R101	RD14BB2C223J	RES. CARBON 22K 5% 1/6W
R102	RD14BB2C103J	RES. CARBON 10K 5% 1/6W
R103	RD14BB2C103J	RES. CARBON 10K 5% 1/6W
R104	RD14BB2C103J	RES. CARBON 10K 5% 1/6W
R105	RD14BB2C102J	RES. CARBON 1K 5% 1/6W
R106	RD14BB2C102J	RES. CARBON 1K 5% 1/6W
R107	RD14BB2C151J	RES. CARBON 150 5% 1/6W
R108	RD14BB2C332J	RES. CARBON 3.3K 5% 1/6W
R109	RD14BB2C202J	RES. CARBON 2K 5% 1/6W
R110	RD14BB2C683J	RES. CARBON 68K 5% 1/6W
R111	RD14BB2C683J	RES. CARBON 68K 5% 1/6W
R112	RD14BB2C182J	RES. CARBON 1.8K 5% 1/6W
R113	RN14BK2C3300F	RES. METAL FILM 330 1% 1/6W
R114	RN14BK2C4701F	RES. METAL FILM 4.7K 1% 1/6W
R115	RD14BB2C223J	RES. CARBON 22K 5% 1/6W
R116	RD14BB2C103J	RES. CARBON 10K 5% 1/6W
R117	RD14BB2C223J	RES. CARBON 22K 5% 1/6W
R118	RN14BK2C1203F	RES. METAL FILM 120K 1% 1/6W
R119	RN14BK2C1203F	RES. METAL FILM 120K 1% 1/6W
R120	RD14BB2C682J	RES. CARBON 6.8K 5% 1/6W
R123	RD14BB2C102J	RES. CARBON 1K 5% 1/6W
R124	NO USE	
R125	RD14BB2C470J	RES. CARBON 47 5% 1/6W
R126	RD14BB2C470J	RES. CARBON 47 5% 1/6W
R127	RD14BB2C102J	RES. CARBON 1K 5% 1/6W
R128	RD14BB2C102J	RES. CARBON 1K 5% 1/6W
R129	RD14BB2C102J	RES. CARBON 1K 5% 1/6W

# PARTS LIST

REF.NO	PARTS NO	NAME & DESCRIPTION
R130	RD14BB2C472J	RES. CARBON 4.7K 5% 1/6W
R131	RD14BB2C472J	RES. CARBON 4.7K 5% 1/6W
R132	RD14BB2C221J	RES. CARBON 220 5% 1/6W
R133	RD14BB2C101J	RES. CARBON 100 5% 1/6W
R134	RD14BB2C101J	RES. CARBON 100 5% 1/6W
R135	RD14BB2C332J	RES. CARBON 3.3K 5% 1/6W
R136	RD14BB2C122J	RES. CARBON 1.2K 5% 1/6W
R137	RD14BB2C122J	RES. CARBON 1.2K 5% 1/6W
R138	RD14BB2C122J	RES. CARBON 1.2K 5% 1/6W
R139	RD14BB2C271J	RES. CARBON 270 5% 1/6W
R140	RD14BB2C101J	RES. CARBON 100 5% 1/6W
R141	RD14BB2C302J	RES. CARBON 3K 5% 1/6W
R142	RD14BB2C102J	RES. CARBON 1K 5% 1/6W
R143	RD14BB2C101J	RES. CARBON 100 5% 1/6W
R144	RD14BB2C203J	RES. CARBON 20K 5% 1/6W
R145	RD14BB2C153J	RES. CARBON 15K 5% 1/6W
R146	RD14BB2C682J	RES. CARBON 6.8K 5% 1/6W
R147	RD14BB2C101J	RES. CARBON 100 5% 1/6W
R148	RD14BB2C472J	RES. CARBON 4.7K 5% 1/6W
R149	RD14BB2C103J	RES. CARBON 10K 5% 1/6W
R150	RD14BB2C101J	RES. CARBON 100 5% 1/6W
R151	RD14BB2C242J	RES. CARBON 2.4K 5% 1/6W
R152	RD14BB2C362J	RES. CARBON 3.6K 5% 1/6W
R153	RN14BK2C3301P	RES. METAL FILM 3.3K 1% 1/6W
R154	RD14BB2C122J	RES. CARBON 1.2K 5% 1/6W
R155	RD14BB2C122J	RES. CARBON 1.2K 5% 1/6W
R156	RD14BB2C362J	RES. CARBON 3.6K 5% 1/6W
R157	RD14BB2C101J	RES. CARBON 100 5% 1/6W
R158	RD14BB2C101J	RES. CARBON 100 5% 1/6W
R159	RD14BB2C122J	RES. CARBON 1.2K 5% 1/6W
R160	NO USE	
R161	RD14BB2C101J	RES. CARBON 100 5% 1/6W
R162	RD14BB2C472J	RES. CARBON 4.7K 5% 1/6W
R163	RD14BB2C101J	RES. CARBON 100 5% 1/6W
R164	RD14BB2C103J	RES. CARBON 10K 5% 1/6W
R167	RN14BK2C1200P	RES. METAL FILM 120 1% 1/6W
R168	RN14BK2C1200P	RES. METAL FILM 120 1% 1/6W
R169	RN14BK2C1500P	RES. METAL FILM 150 1% 1/6W
R170	RN14BK2C3301P	RES. METAL FILM 3.3K 1% 1/6W
R171	RN14BK2C1801P	RES. METAL FILM 1.8K 1% 1/6W
R172	NO USE	
R173	RD14BB2C221J	RES. CARBON 220 5% 1/6W
R174	RD14BB2C221J	RES. CARBON 220 5% 1/6W
R175	RD14BB2C472J	RES. CARBON 4.7K 5% 1/6W
R176	RD14BB2C103J	RES. CARBON 10K 5% 1/6W
R177	RD14BB2C100J	RES. CARBON 10 5% 1/6W
R180	RD14BB2C183J	RES. CARBON 18K 5% 1/6W
R181	RN14BK2C2202P	RES. METAL FILM 22K 1% 1/6W
R182	RN14BK2C1801P	RES. METAL FILM 1.8K 1% 1/6W
R183	RD14BB2C151J	RES. CARBON 150 5% 1/6W
R184	RN14BK2C33R0F	RES. METAL FILM 33.0 1% 1/6W
S001	S37-2005-05	LEVER SWITCH
S002	S32-2012-05	LEVER SWITCH
S003	NO USE	
S004	S32-2013-05	SLIDE SWITCH
S005	S31-1501-05	SLIDE SWITCH
S006	S29-2510-15	ROTARY SWITCH
TC001	C05-0414-05	CAP. TRIMMER 40P
TH001	SDT100	THERMISTOR
TH002	SDT100	THERMISTOR
U001	SN74LS04N	IC
U002	SN74LS123N	IC
U003	SN74LS112AN	IC, DUAL JK-FF
U004	SN74LS132N	IC
U005	SN74LS00N	IC, QUAD 2-INPUT NAND GATE
U006	SN74LS00N	IC, QUAD 2-INPUT NAND GATE
U007	SN74LS00N	IC, QUAD 2-INPUT NAND GATE
U008	MC14051BCP	IC
U009	UA78M05UC	IC
U010	SN74LS00N	IC, QUAD 2-INPUT NAND GATE
VR001	R01-4503-05	V. R. 50K B
VR002	R12-3540-05	RES. SEMI FIXED 10K B
VR003	R12-1534-05	RES. SEMI FIXED 2K B
VR006	R12-1533-05	RES. SEMI FIXED 1K B
VR007	R12-5525-05	RES. SEMI FIXED 100K B
VR008	R12-1534-05	RES. SEMI FIXED 2K B
VR009	R12-2519-05	RES. SEMI FIXED 5K B

REF.NO	PARTS NO	NAME & DESCRIPTION
VR010	R12-0542-05	RES. SEMI FIXED 200 B
VR011	R12-5525-05	RES. SEMI FIXED 100K B
VR012	R12-1533-05	RES. SEMI FIXED 1K B
VR013	R12-1534-05	RES. SEMI FIXED 2K B
VR014	R12-3541-05	RES. SEMI FIXED 20K B
VR015	R01-2504-05	V. R. 5K B
VR016	R12-3540-05	RES. SEMI FIXED 10K B
VR017	R12-2519-05	RES. SEMI FIXED 5K B
VR018	R12-1533-05	RES. SEMI FIXED 1K B
VR019	R12-0541-05	RES. SEMI FIXED 100 B
VR020	R12-0541-05	RES. SEMI FIXED 100 B

# PARTS LIST

## HORIZONTAL OUTPUT UNIT

### X74-1410-00

REF. NO	PARTS NO	NAME & DESCRIPTION
	E23-0503-05	TERMINAL
	F01-0846-05	HEAT SINK
	N19-0191-05	WASHER NONMETAL
	N30-3006-46	SCREW, PAN HD M 3X6
C001	CE04W1C221M	CAP. ELECTRO 220 20% 16V
C002	CK45F1H103Z	CAP. CERAMIC 0.01 50V
C003	CE04W1C101M	CAP. ELECTRO 100 20% 16V
C004	CK45F1H103Z	CAP. CERAMIC 0.01 50V
C005	CK45B2H103K	CAP. CERAMIC 0.01 10% 500V
C006	CE04W2C220	CAP. ELECTRO 22 160V
C007	CK45B2H103K	CAP. CERAMIC 0.01 10% 500V
C008	CK45F1H103Z	CAP. CERAMIC 0.01 50V
C009	CK45F1H103Z	CAP. CERAMIC 0.01 50V
D001	1SS83	DIODE
D002	1SS83	DIODE
J001	R92-0150-05	JUMPING RES. ZERO OHM
J002	R92-0150-05	JUMPING RES. ZERO OHM
J003	R92-0150-05	JUMPING RES. ZERO OHM
L001	L40-3311-03	FERRI INDUCTOR 330UH
L002	L40-3311-03	FERRI INDUCTOR 330UH
L003	L40-1011-04	FERRI INDUCTOR 100UH
L004	L40-1011-04	FERRI INDUCTOR 100UH
P034	E40-0573-05	PIN CONNECTOR 5 P
Q001	2SC1505	TR. SI, NPN
Q002	2SC1505	TR. SI, NPN
R001	RD14BB2C821J	RES. CARBON 820 5% 1/6W
R002	RD14BB2C821J	RES. CARBON 820 5% 1/6W
R003	RD14BB2C201J	RES. CARBON 200 5% 1/6W
R004	RD14BB2C201J	RES. CARBON 200 5% 1/6W
R005	RS14GB3D682J	RES. METAL FILM 6.8K 5% 2W
R006	RS14GB3D682J	RES. METAL FILM 6.8K 5% 2W
R007	RD14BY2H391J	RES. CARBON 390 5% 1/2W
R008	RD14BY2H391J	RES. CARBON 390 5% 1/2W

## VOLTAGE SELECTOR UNIT

### X77-1020-03

REF. NO	PARTS NO	NAME & DESCRIPTION
	E08-1081-05	VOLTAGE SELECTOR RECEPTACLE
	E09-0681-05	VOLTAGE SELECTOR PLUG
	E23-0047-04	TERMINAL
	E40-0533-05	PIN CONNECTOR
	E40-0635-05	PIN CONNECTOR
	F19-0703-04	VOLTAGE SELECTOR PLATE
	J12-0501-14	MOLDED PIN
	J25-2805-14	PCB (UNMOUNTED)
	R92-0150-05	JUMPING RES. ZERO OHM

## VERTICAL SWITCH UNIT

### X77-1360-00

REF. NO	PARTS NO	NAME & DESCRIPTION
	A22-0844-13	SUB PANEL
	E04-0251-05	BNC RECEPTACLE
	J61-0049-05	WIRE BAND
	N32-3006-41	SCREW, FLAT HD M 3X6
	002-0001-05	BRAIDED WIRE
	212-2014-05	TUBE (PLASTIC)
C001	C91-0501-05	CAP. METAL FILM 0.047 10% 630V
C002	C91-0501-05	CAP. METAL FILM 0.047 10% 630V
J001	R92-0150-05	JUMPING RES. ZERO OHM
J002	R92-0150-05	JUMPING RES. ZERO OHM
P001	E40-0874-05	PIN CONNECTOR 8P
P070	E40-0374-05	PIN CONNECTOR 3 P
R001	RD14BB2E220J	RES. CARBON 22 5% 1/4W
R002	RD14BB2E105J	RES. CARBON 1M 5% 1/4W
R003	RD14BB2C220J	RES. CARBON 22 5% 1/6W

REF. NO	PARTS NO	NAME & DESCRIPTION
R004	RD14BB2E220J	RES. CARBON 22 5% 1/4W
R005	RD14BB2E105J	RES. CARBON 1M 5% 1/4W
R006	RD14BB2C220J	RES. CARBON 22 5% 1/6W

S001	S32-4007-05	LEVER SWITCH
S002	S32-4007-05	LEVER SWITCH
S003	S42-6507-05	PUSH SWITCH
S004	S40-2519-05	PUSH SWITCH

## CONTROL UNIT

### X77-1330-00

REF. NO	PARTS NO	NAME & DESCRIPTION
	J11-0503-05	EJECTOR
	J25-5054-32	PCB (UNMOUNTED)
C001	CE04W1C221M	CAP. ELECTRO 220 20% 16V
C002	CS15E1V2R2M	CAP. TANTALUM 2.2 20% 35V
C003	CS15E1V2R2M	CAP. TANTALUM 2.2 20% 35V
C006	CS15E1V2R2M	CAP. TANTALUM 2.2 20% 35V
C007	CS15E1V2R2M	CAP. TANTALUM 2.2 20% 35V
C008	CS15E1V2R2M	CAP. TANTALUM 2.2 20% 35V
C009	CS15E1V2R2M	CAP. TANTALUM 2.2 20% 35V
C010	CS15E1V2R2M	CAP. TANTALUM 2.2 20% 35V
C011	CC45SL1H471J	CAP. CERAMIC 470P 5% 50V
C012	CE04W1C100M	CAP. ELECTRO 10 20% 16V
C013	CK45B1H103K	CAP. CERAMIC 0.01 10% 50V
C017	CC45CH1H101J	CAP. CERAMIC 100P 5% 50V
C018	CE04W1C100M	CAP. ELECTRO 10 20% 16V
C019	CK45B1H102K	CAP. CERAMIC 1000P 10% 50V
C020	CC45CH1H101J	CAP. CERAMIC 100P 5% 50V
C021	CC45SL1H221J	CAP. CERAMIC 220P 5% 50V
C022	CK45B1H102K	CAP. CERAMIC 1000P 10% 50V
C023	CC45SL1H221J	CAP. CERAMIC 220P 5% 50V
C024	CC45CH1H151J	CAP. CERAMIC 150P 5% 50V
C025	CE04W1C100M	CAP. ELECTRO 10 20% 16V
C026	CE04W1C220M	CAP. ELECTRO 22 20% 16V
C027	CC45CH1H181J	CAP. CERAMIC 180P 5% 50V
C028	CC45SL1H331J	CAP. CERAMIC 330P 5% 50V
C029	NO USE	
C030	CC45SL1H391J	CAP. CERAMIC 390P 5% 50V
C031	CK45B1H102K	CAP. CERAMIC 1000P 10% 50V
C032	CC45SL1H331J	CAP. CERAMIC 330P 5% 50V
C033	CC45SL1H221J	CAP. CERAMIC 220P 5% 50V
C034	CC45CH1H100D	CAP. CERAMIC 10P 0.5P 50V
C035	CE04W1C470M	CAP. ELECTRO 47 20% 16V
C036	CE04W1C470M	CAP. ELECTRO 47 20% 16V
C037	CC45SL1H221J	CAP. CERAMIC 220P 5% 50V
C038	CG93M1H223K	CAP. MYLAR 0.022 10% 50V
C039	CC45SL1H221J	CAP. CERAMIC 220P 5% 50V
C040	CC45SL1H221J	CAP. CERAMIC 220P 5% 50V
C041	C90-0298-05	CAP. CERAMIC 0.1 20% 12V
C042	C90-0298-05	CAP. CERAMIC 0.1 20% 12V
C043	C90-0298-05	CAP. CERAMIC 0.1 20% 12V
C044	C90-0298-05	CAP. CERAMIC 0.1 20% 12V
C045	C90-0298-05	CAP. CERAMIC 0.1 20% 12V
C046	C90-0298-05	CAP. CERAMIC 0.1 20% 12V
C047	C90-0298-05	CAP. CERAMIC 0.1 20% 12V
C048	C90-0298-05	CAP. CERAMIC 0.1 20% 12V
C049	C90-0298-05	CAP. CERAMIC 0.1 20% 12V
C050	C90-0298-05	CAP. CERAMIC 0.1 20% 12V
C051	C90-0298-05	CAP. CERAMIC 0.1 20% 12V
C052	C90-0298-05	CAP. CERAMIC 0.1 20% 12V
C053	C90-0298-05	CAP. CERAMIC 0.1 20% 12V
C054	C90-0298-05	CAP. CERAMIC 0.1 20% 12V
C055	C90-0298-05	CAP. CERAMIC 0.1 20% 12V
C056	C90-0298-05	CAP. CERAMIC 0.1 20% 12V
C057	C90-0298-05	CAP. CERAMIC 0.1 20% 12V
C058	C90-0298-05	CAP. CERAMIC 0.1 20% 12V
C059	C90-0298-05	CAP. CERAMIC 0.1 20% 12V
C060	C90-0298-05	CAP. CERAMIC 0.1 20% 12V
C061	C90-0298-05	CAP. CERAMIC 0.1 20% 12V
C062	C90-0298-05	CAP. CERAMIC 0.1 20% 12V
C063	C90-0298-05	CAP. CERAMIC 0.1 20% 12V
C064	C90-0298-05	CAP. CERAMIC 0.1 20% 12V
C065	C90-0298-05	CAP. CERAMIC 0.1 20% 12V
C066	C90-0298-05	CAP. CERAMIC 0.1 20% 12V
C067	C90-0298-05	CAP. CERAMIC 0.1 20% 12V
C068	C90-0298-05	CAP. CERAMIC 0.1 20% 12V
C069	C90-0298-05	CAP. CERAMIC 0.1 20% 12V
C070	C90-0298-05	CAP. CERAMIC 0.1 20% 12V
C071	C90-0298-05	CAP. CERAMIC 0.1 20% 12V

# PARTS LIST

REF. NO	PARTS NO	NAME & DESCRIPTION
C072	C90-0298-05	CAP. CERAMIC 0.1 20% 12V
C073	C90-0298-05	CAP. CERAMIC 0.1 20% 12V
C074	C90-0298-05	CAP. CERAMIC 0.1 20% 12V
C075	C90-0298-05	CAP. CERAMIC 0.1 20% 12V
C076	C90-0298-05	CAP. CERAMIC 0.1 20% 12V
C077	C90-0298-05	CAP. CERAMIC 0.1 20% 12V
C078	C90-0298-05	CAP. CERAMIC 0.1 20% 12V
C079	C90-0298-05	CAP. CERAMIC 0.1 20% 12V
C080	C90-0298-05	CAP. CERAMIC 0.1 20% 12V
C081	C90-0298-05	CAP. CERAMIC 0.1 20% 12V
C082	C90-0298-05	CAP. CERAMIC 0.1 20% 12V
C083	C90-0298-05	CAP. CERAMIC 0.1 20% 12V
C084	C90-0298-05	CAP. CERAMIC 0.1 20% 12V
C085	C90-0298-05	CAP. CERAMIC 0.1 20% 12V
C086	C90-0298-05	CAP. CERAMIC 0.1 20% 12V
C087	C90-0298-05	CAP. CERAMIC 0.1 20% 12V
C088	C90-0298-05	CAP. CERAMIC 0.1 20% 12V
C089	C90-0298-05	CAP. CERAMIC 0.1 20% 12V
C090	C90-0298-05	CAP. CERAMIC 0.1 20% 12V
C091	C90-0298-05	CAP. CERAMIC 0.1 20% 12V
C092	C90-0298-05	CAP. CERAMIC 0.1 20% 12V
C093	C90-0298-05	CAP. CERAMIC 0.1 20% 12V
C094	C90-0298-05	CAP. CERAMIC 0.1 20% 12V
C095	C90-0298-05	CAP. CERAMIC 0.1 20% 12V
C096	C90-0298-05	CAP. CERAMIC 0.1 20% 12V
C097	C90-0298-05	CAP. CERAMIC 0.1 20% 12V
C098	C90-0298-05	CAP. CERAMIC 0.1 20% 12V
C099	CC45SL1H391J	CAP. CERAMIC 390P 5% 50V
C100	CC45SL1H471J	CAP. CERAMIC 470P 5% 50V
C101	CC45SL1H391J	CAP. CERAMIC 390P 5% 50V
C102	CC45SL1H331J	CAP. CERAMIC 330P 5% 50V
C103	CC45SL1H471J	CAP. CERAMIC 470P 5% 50V
C104	CC45SL1H471J	CAP. CERAMIC 470P 5% 50V
C105	CK45B1H102K	CAP. CERAMIC 1000P 10% 50V
C106	CK45B1H103K	CAP. CERAMIC 0.01 10% 50V
C107	NO USE	
C108	CC45SL1H471J	CAP. CERAMIC 470P 5% 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
D009	1SS132	DIODE
D010	1SS132	DIODE
D011	1SS132	DIODE
D012	1SS132	DIODE
D013	1SS132	DIODE
D014	1SS132	DIODE
D015	1SS132	DIODE
D016	1SS132	DIODE
P001	E40-0273-05	PIN CONNECTOR 2 P
P002	E40-0273-05	PIN CONNECTOR 2 P
Q001	2SC1815(GR)	TR. SI, NPN
R001	RN14BK2C1802P	RES. METAL FILM 18K 1% 1/6W
R002	NO USE	
R003	RD14BB2C102J	RES. CARBON 1K 5% 1/6W
R004	NO USE	
R005	RD14BB2C222J	RES. CARBON 2.2K 5% 1/6W
R006	RD14BB2C222J	RES. CARBON 2.2K 5% 1/6W
R007	RD14BB2C472J	RES. CARBON 4.7K 5% 1/6W
R008	RD14BB2C564J	RES. CARBON 560K 5% 1/6W
R009	RD14BB2C102J	RES. CARBON 1K 5% 1/6W
R010	RD14BB2C102J	RES. CARBON 1K 5% 1/6W
R011	RD14BB2C104J	RES. CARBON 100K 5% 1/6W
R012	RD14BB2C222J	RES. CARBON 2.2K 5% 1/6W
R013	RD14BB2C222J	RES. CARBON 2.2K 5% 1/6W
R014	RD14BB2C222J	RES. CARBON 2.2K 5% 1/6W
R015	RD14BB2C222J	RES. CARBON 2.2K 5% 1/6W
R016	RD14BB2C221J	RES. CARBON 220 5% 1/6W
R017	RD14BB2C391J	RES. CARBON 390 5% 1/6W
R018	RD14BB2C222J	RES. CARBON 2.2K 5% 1/6W
R019	RD14BB2C222J	RES. CARBON 2.2K 5% 1/6W
R020	RD14BB2C222J	RES. CARBON 2.2K 5% 1/6W
R021	RD14BB2C222J	RES. CARBON 2.2K 5% 1/6W
R022	RD14BB2C472J	RES. CARBON 4.7K 5% 1/6W
R023	RD14BB2C103J	RES. CARBON 10K 5% 1/6W
R024	RD14BB2C124J	RES. CARBON 120K 5% 1/6W
R025	RD14BB2C473J	RES. CARBON 47K 5% 1/6W

REF. NO	PARTS NO	NAME & DESCRIPTION
R026	RN14BK2C8202F	RES. METAL FILM 82K 1% 1/6W
R027	RD14BB2C331J	RES. CARBON 330 5% 1/6W
R028	RD14BB2C471J	RES. CARBON 470 5% 1/6W
R029	RD14BB2C221J	RES. CARBON 220 5% 1/6W
R030	RD14BB2C221J	RES. CARBON 220 5% 1/6W
R033	RD14BB2C102J	RES. CARBON 1K 5% 1/6W
R034	RD14BB2C103J	RES. CARBON 10K 5% 1/6W
R035	RD14BB2C103J	RES. CARBON 10K 5% 1/6W
R036	RD14BB2C103J	RES. CARBON 10K 5% 1/6W
R037	RD14BB2C473J	RES. CARBON 47K 5% 1/6W
R038	RD14BB2C222J	RES. CARBON 2.2K 5% 1/6W
R039	NO USE	
R040	RD14BB2C222J	RES. CARBON 2.2K 5% 1/6W
R041	RD14BB2C472J	RES. CARBON 4.7K 5% 1/6W
R042	RD14BB2C104J	RES. CARBON 100K 5% 1/6W
R043	RD14BB2C221J	RES. CARBON 220 5% 1/6W
R044	RD14BB2C561J	RES. CARBON 560 5% 1/6W
R045	RD14BB2C561J	RES. CARBON 560 5% 1/6W
R046	RD14BB2C221J	RES. CARBON 220 5% 1/6W
R047	RD14BB2C222J	RES. CARBON 2.2K 5% 1/6W
R048	RD14BB2C222J	RES. CARBON 2.2K 5% 1/6W
R049	RD14BB2C222J	RES. CARBON 2.2K 5% 1/6W
R050	RD14BB2C222J	RES. CARBON 2.2K 5% 1/6W
R051	RD14BB2C222J	RES. CARBON 2.2K 5% 1/6W
R052	RD14BB2C332J	RES. CARBON 3.3K 5% 1/6W
R053	RD14BB2C391J	RES. CARBON 390 5% 1/6W
R054	NO USE	
R055	RD14BB2C103J	RES. CARBON 10K 5% 1/6W
R056	RD14BB2C471J	RES. CARBON 470 5% 1/6W
R057	RD14BB2C102J	RES. CARBON 1K 5% 1/6W
R058	RD14BB2C222J	RES. CARBON 2.2K 5% 1/6W
R059	RD14BB2C472J	RES. CARBON 4.7K 5% 1/6W
R060	RD14BB2C472J	RES. CARBON 4.7K 5% 1/6W
R061	RD14BB2C472J	RES. CARBON 4.7K 5% 1/6W
R062	RD14BB2C103J	RES. CARBON 10K 5% 1/6W
R063	RD14BB2C222J	RES. CARBON 2.2K 5% 1/6W
R064	RD14BB2C104J	RES. CARBON 100K 5% 1/6W
R065	RD14BB2C222J	RES. CARBON 2.2K 5% 1/6W
RA001	R90-0609-05	RES. NETWORK 4.7K
RA002	R90-0609-05	RES. NETWORK 4.7K
RA003	R90-0609-05	RES. NETWORK 4.7K
U001	TC40H002P	IC
U002	SN74LS00N	IC, QUAD 2-INPUT NAND GATE
U003	SN74LS157N	IC
U004	SN74LS00N	IC, QUAD 2-INPUT NAND GATE
U005	SN74LS193N	IC
U006	SN74LS193N	IC
U007	SN74LS193N	IC
U008	SN74LS04N	IC
U009	SN74LS21N	IC
U010	SN74LS86N	IC
U011	LM556CN	IC
U012	SN74LS157N	IC
U013	SN74LS04N	IC
U014	SN74LS193N	IC
U015	SN74LS193N	IC
U016	SN74LS193N	IC
U017	SN74LS32N	IC, QUAD 2-INPUT OR GATE
U018	SN74LS08N	IC, QUAD 2-INPUT AND GATE
U019	SN74LS157N	IC
U020	TC40H004P	IC
U021	SN74LS32N	IC, QUAD 2-INPUT OR GATE
U022	SN74LS51N	IC
U023	SN74LS04N	IC
U024	SN74LS682N	IC
U025	SN74LS27N	IC
U026	SN74LS20N	IC
U027	SN74LS51N	IC
U028	SN74LS27N	IC
U029	SN74LS04N	IC
U030	TC40H000P	IC
U031	SN74LS279N	IC
U032	SN74LS04N	IC
U033	SN74LS08N	IC, QUAD 2-INPUT AND GATE
U034	SN74LS30N	IC
U035	SN74LS85N	IC
U036	SN74LS193N	IC
U037	SN74LS123N	IC
U038	SN74LS00N	IC, QUAD 2-INPUT NAND GATE
U039	SN74LS279N	IC
U040	SN74LS00N	IC, QUAD 2-INPUT NAND GATE
U041	SN74LS32N	IC, QUAD 2-INPUT OR GATE

# PARTS LIST

REF.NO	PARTS NO	NAME & DESCRIPTION
U042	SN74LS157N	IC
U043	SN74LS02N	IC
U044	SN74LS193N	IC
U045	SN74LS193N	IC
U046	SN74LS107AN	IC
U047	SN74LS04N	IC
U048	SN74LS12N	IC
U049	SN74LS123N	IC
U050	SN74LS157N	IC
U051	SN74LS11N	IC
U052	SN74LS21N	IC
U053	SN74LS04N	IC
U054	SN74LS00N	IC, QUAD 2-INPUT NAND GATE
U055	SN74LS107AN	IC
U056	SN74LS51N	IC
U057	SN74LS08N	IC, QUAD 2-INPUT AND GATE
U058	SN74LS132N	IC

## MOTHER BOARD UNIT

### X81-1440-01

REF.NO	PARTS NO	NAME & DESCRIPTION
	J25-5055-12	PCB (UNMOUNTED)
C001	C91-0590-05	CAP. CERAMIC 3P 0.25P 3KV
C002	C90-0298-05	CAP. CERAMIC 0.1 20% 12V
C003	C90-0298-05	CAP. CERAMIC 0.1 20% 12V
C004	C90-0298-05	CAP. CERAMIC 0.1 20% 12V
C005	C90-0298-05	CAP. CERAMIC 0.1 20% 12V
D001	1SS132	DIODE
J001	E10-0062-05	EDGE CARD CONNECTOR
J002	E10-5662-05	EDGE CARD CONNECTOR
J002	R92-1061-05	JUMPING RES. ZERO OHM
J003	E10-0062-05	EDGE CARD CONNECTOR
J004	E10-5662-05	EDGE CARD CONNECTOR
J005	E10-0062-05	EDGE CARD CONNECTOR
J006	E10-5662-05	EDGE CARD CONNECTOR
J007	E10-5662-05	EDGE CARD CONNECTOR
P001	E10-2664-05	EDGE CARD CONNECTOR
P002	E10-2061-05	EDGE CARD CONNECTOR
P008	E40-0473-05	PIN CONNECTOR 4 P
P004	E40-0673-05	PIN CONNECTOR 6 P
P005	E40-0873-05	PIN CONNECTOR 8 P
P006	E40-0473-05	PIN CONNECTOR 4 P
P007	E40-0632-05	PIN CONNECTOR 6 P
P008	E40-0273-05	PIN CONNECTOR 2 P
P009	E40-0332-05	PIN CONNECTOR 3 P
R001	RD14BB2E220J	RES. CARBON 22 5% 1/4W
U001	SN74LS74AN	IC
U002	SN74LS32N	IC, QUAD 2-INPUT OR GATE
U003	SN74LS00N	IC, QUAD 2-INPUT NAND GATE
U004	SN74LS02N	IC

## REFRESH UNIT

### X81-1450-00

REF.NO	PARTS NO	NAME & DESCRIPTION
	J11-0503-05	EJECTOR
	J25-5056-22	PCB (UNMOUNTED)
C001	CE04W1C221M	CAP. ELECTRO 220 20% 16V
C002	CC45SL1H331J	CAP. CERAMIC 330P 5% 50V
C003	CC45SL1H101J	CAP. CERAMIC 100P 5% 50V
C004	CK45B1H102K	CAP. CERAMIC 1000P 10% 50V
C005	CC45SL1H101J	CAP. CERAMIC 100P 5% 50V
C006	CC45SL1H331J	CAP. CERAMIC 330P 5% 50V
C007	CC45CH1H101J	CAP. CERAMIC 100P 5% 50V
C008	CC45CH1H101J	CAP. CERAMIC 100P 5% 50V
C009	CK45B1H102K	CAP. CERAMIC 1000P 10% 50V
C010	C90-0298-05	CAP. CERAMIC 0.1 20% 12V
C011	C90-0298-05	CAP. CERAMIC 0.1 20% 12V
C012	C90-0298-05	CAP. CERAMIC 0.1 20% 12V
C013	C90-0298-05	CAP. CERAMIC 0.1 20% 12V
C014	C90-0298-05	CAP. CERAMIC 0.1 20% 12V
C015	C90-0298-05	CAP. CERAMIC 0.1 20% 12V
C016	C90-0298-05	CAP. CERAMIC 0.1 20% 12V
C017	C90-0298-05	CAP. CERAMIC 0.1 20% 12V

REF.NO	PARTS NO	NAME & DESCRIPTION
C018	C90-0298-05	CAP. CERAMIC 0.1 20% 12V
C019	C90-0298-05	CAP. CERAMIC 0.1 20% 12V
C020	C90-0298-05	CAP. CERAMIC 0.1 20% 12V
C021	C90-0298-05	CAP. CERAMIC 0.1 20% 12V
C022	C90-0298-05	CAP. CERAMIC 0.1 20% 12V
C023	C90-0298-05	CAP. CERAMIC 0.1 20% 12V
C024	C90-0298-05	CAP. CERAMIC 0.1 20% 12V
C025	C90-0298-05	CAP. CERAMIC 0.1 20% 12V
C026	C90-0298-05	CAP. CERAMIC 0.1 20% 12V
C027	C90-0298-05	CAP. CERAMIC 0.1 20% 12V
C028	C90-0298-05	CAP. CERAMIC 0.1 20% 12V
C029	C90-0298-05	CAP. CERAMIC 0.1 20% 12V
C030	C90-0298-05	CAP. CERAMIC 0.1 20% 12V
C031	C90-0298-05	CAP. CERAMIC 0.1 20% 12V
C032	C90-0298-05	CAP. CERAMIC 0.1 20% 12V
C033	C90-0298-05	CAP. CERAMIC 0.1 20% 12V
C034	C90-0298-05	CAP. CERAMIC 0.1 20% 12V
C035	C90-0298-05	CAP. CERAMIC 0.1 20% 12V
C036	C90-0298-05	CAP. CERAMIC 0.1 20% 12V
C037	C90-0298-05	CAP. CERAMIC 0.1 20% 12V
C038	C90-0298-05	CAP. CERAMIC 0.1 20% 12V
C039	C90-0298-05	CAP. CERAMIC 0.1 20% 12V
C040	C90-0298-05	CAP. CERAMIC 0.1 20% 12V
C041	C90-0298-05	CAP. CERAMIC 0.1 20% 12V
C042	C90-0298-05	CAP. CERAMIC 0.1 20% 12V
C043	C90-0298-05	CAP. CERAMIC 0.1 20% 12V
C044	C90-0298-05	CAP. CERAMIC 0.1 20% 12V
C045	C90-0298-05	CAP. CERAMIC 0.1 20% 12V
C046	C90-0298-05	CAP. CERAMIC 0.1 20% 12V
C047	C90-0298-05	CAP. CERAMIC 0.1 20% 12V
C048	C90-0298-05	CAP. CERAMIC 0.1 20% 12V
C049	C90-0298-05	CAP. CERAMIC 0.1 20% 12V
C050	C90-0298-05	CAP. CERAMIC 0.1 20% 12V
C051	C90-0298-05	CAP. CERAMIC 0.1 20% 12V
C052	C90-0298-05	CAP. CERAMIC 0.1 20% 12V
C053	C90-0298-05	CAP. CERAMIC 0.1 20% 12V
C054	C90-0298-05	CAP. CERAMIC 0.1 20% 12V
C055	C90-0298-05	CAP. CERAMIC 0.1 20% 12V
C056	C90-0298-05	CAP. CERAMIC 0.1 20% 12V
C057	C90-0298-05	CAP. CERAMIC 0.1 20% 12V
C058	C90-0298-05	CAP. CERAMIC 0.1 20% 12V
C059	C90-0298-05	CAP. CERAMIC 0.1 20% 12V
C060	C90-0298-05	CAP. CERAMIC 0.1 20% 12V
C061	C90-0298-05	CAP. CERAMIC 0.1 20% 12V
C062	CC45CH1H101J	CAP. CERAMIC 100P 5% 50V
C063	CC45CH1H101J	CAP. CERAMIC 100P 5% 50V
C064	CS15E1V2R2M	CAP. TANTALUM 2.2 20% 35V
C065	CE04W1E220M	CAP. ELECTRO 22 20% 25V
C066	C90-0298-05	CAP. CERAMIC 0.1 20% 12V
C067	CC45SL1H221J	CAP. CERAMIC 220P 5% 50V
C068	CC45SL1H221J	CAP. CERAMIC 220P 5% 50V
C069	CK45B1H102K	CAP. CERAMIC 1000P 10% 50V
C070	CK45B1H102K	CAP. CERAMIC 1000P 10% 50V

P001	E40-0273-05	PIN CONNECTOR 2 P
P002	E40-0373-05	PIN CONNECTOR 3 P
R001	RD14BB2C472J	RES. CARBON 4.7K 5% 1/6W
R002	RD14BB2C222J	RES. CARBON 2.2K 5% 1/6W
R003	RD14BB2C222J	RES. CARBON 2.2K 5% 1/6W
R004	RD14BB2C222J	RES. CARBON 2.2K 5% 1/6W
R005	RD14BB2C222J	RES. CARBON 2.2K 5% 1/6W
R006	RD14BB2C471J	RES. CARBON 470 5% 1/6W
R007	RN14BK2C4701F	RES. METAL FILM 4.7K 1% 1/6W
R008	RN14BK2C4701F	RES. METAL FILM 4.7K 1% 1/6W
R009	RD14BB2C471J	RES. CARBON 470 5% 1/6W
R010	RD14BB2C333J	RES. CARBON 33K 5% 1/6W
R011	RN14BK2C4701F	RES. METAL FILM 4.7K 1% 1/6W
R012	RN14BK2C4701F	RES. METAL FILM 4.7K 1% 1/6W

RA001	R90-0609-05	RES. NETWORK 4.7K
RA002	R90-0609-05	RES. NETWORK 4.7K
RA003	R90-0609-05	RES. NETWORK 4.7K
RA004	R90-0609-05	RES. NETWORK 4.7K
RA005	R90-0609-05	RES. NETWORK 4.7K

U001	SN74LS32N	IC, QUAD 2-INPUT OR GATE
U002	SN74LS04N	IC
U003	SN74LS74AN	IC
U004	SN74LS684N	IC
U005	SN74LS85N	IC
U006	SN74LS04N	IC
U007	SN74LS684N	IC
U008	SN74LS85N	IC
U009	SN74LS04N	IC



# PARTS LIST

REF. NO	PARTS NO	NAME & DESCRIPTION
U010	SN74LS10N	IC, TRIPLE 3-INPUT NAND GATE
U011	SN74LS74AN	IC
U012	SN74LS08N	IC, QUAD 2-INPUT AND GATE
U013	SN74LS157N	IC
U014	SN74LS157N	IC
U015	SN74LS157N	IC
U016	SN74LS157N	IC
U017	SN74LS157N	IC
U018	SN74LS157N	IC
U019	SN74LS157N	IC
U020	SN74LS157N	IC
U021	SN74LS08N	IC, QUAD 2-INPUT AND GATE
U022	SN74LS193N	IC
U023	SN74LS193N	IC
U024	SN74LS193N	IC
U025	SN74LS193N	IC
U026	SN74LS193N	IC
U027	SN74LS193N	IC
U028	SN74LS123N	IC
U029	SN74LS123N	IC
U030	SN74LS04N	IC
U031	SN74LS193N	IC
U032	SN74LS193N	IC
U033	SN74LS193N	IC
U034	SN74LS193N	IC
U035	SN74LS193N	IC
U036	SN74LS193N	IC
U037	SN74LS27N	IC
U038	MC74HC174N	IC
U039	MC74HC174N	IC
U040	SN74LS85N	IC
U041	MC74HC174N	IC
U042	MC74HC174N	IC
U043	SN74LS85N	IC
U044	SN74LS02N	IC
U045	SN74LS08N	IC, QUAD 2-INPUT AND GATE
U046	SN74LS684N	IC
U047	SN74LS04N	IC
U048	SN74LS684N	IC
U049	SN74LS04N	IC
U050	SN74LS123N	IC
U051	SN74LS08N	IC, QUAD 2-INPUT AND GATE
U052	SN74LS32N	IC, QUAD 2-INPUT OR GATE

REF. NO	PARTS NO	NAME & DESCRIPTION
C030	CK45B1H102K	CAP. CERAMIC 1000P 10% 50V
C031	C91-0591-05	CAP. CERAMIC 0.22 50V
C032	CK45B1H472K	CAP. CERAMIC 4700P 10% 50V
C033	CE04W1E470M	CAP. ELECTRO 47 20% 25V
C034	C91-0591-05	CAP. CERAMIC 0.22 50V
C035	CE04W1E470M	CAP. ELECTRO 47 20% 25V
C036	C90-0298-05	CAP. CERAMIC 0.1 20% 12V
C037	CS15E1V2R2M	CAP. TANTALUM 2.2 20% 35V
C038	CK45B1H102K	CAP. CERAMIC 1000P 10% 50V
C039	CE04W1E470M	CAP. ELECTRO 47 20% 25V
C040	CE04W1E470M	CAP. ELECTRO 47 20% 25V
C041	C91-0591-05	CAP. CERAMIC 0.22 50V
C042	CE04W1A101M	CAP. ELECTRO 100 20% 10V
C043	CE04W1A101M	CAP. ELECTRO 100 20% 10V
C044	C91-0591-05	CAP. CERAMIC 0.22 50V
C045	CE04W1E470M	CAP. ELECTRO 47 20% 25V
C046	C91-0591-05	CAP. CERAMIC 0.22 50V
C047	CC45CH1H470J	CAP. CERAMIC 47P 5% 50V
C048	C91-0591-05	CAP. CERAMIC 0.22 50V
C049	CE04W1A101M	CAP. ELECTRO 100 20% 10V
C050	CC45CH1H050C	CAP. CERAMIC 5P 0.25P 50V
C051	CC45CH1H220J	CAP. CERAMIC 22P 5% 50V
C052	NO USE	
C053	CC45CH1H100D	CAP. CERAMIC 10P 0.5P 50V
C054	CC45CH1H050C	CAP. CERAMIC 5P 0.25P 50V
C055	C91-0591-05	CAP. CERAMIC 0.22 50V
C056	CE04W1A101M	CAP. ELECTRO 100 20% 10V
C057	NO USE	
C058	CC45CH1H050C	CAP. CERAMIC 5P 0.25P 50V
C059	CC45CH1H220J	CAP. CERAMIC 22P 5% 50V
C060	CE04W1E470M	CAP. ELECTRO 47 20% 25V
C061	C91-0591-05	CAP. CERAMIC 0.22 50V
C062	CE04W1E470M	CAP. ELECTRO 47 20% 25V
C063	C91-0591-05	CAP. CERAMIC 0.22 50V
C064	CE04W1E470M	CAP. ELECTRO 47 20% 25V
C065	C91-0591-05	CAP. CERAMIC 0.22 50V
C066	CC45CH1H470J	CAP. CERAMIC 47P 5% 50V
C067	C91-0591-05	CAP. CERAMIC 0.22 50V
C068	CE04W1E470M	CAP. ELECTRO 47 20% 25V
C069	CC45CH1H050C	CAP. CERAMIC 5P 0.25P 50V
C070	CC45CH1H220J	CAP. CERAMIC 22P 5% 50V
C071	C91-0591-05	CAP. CERAMIC 0.22 50V
C072	CC45CH1H100D	CAP. CERAMIC 10P 0.5P 50V
C073	CC45CH1H050C	CAP. CERAMIC 5P 0.25P 50V
C074	NO USE	
C075	CC45CH1H220J	CAP. CERAMIC 22P 5% 50V
C076	CC45CH1H050C	CAP. CERAMIC 5P 0.25P 50V
C077	CE04W1E470M	CAP. ELECTRO 47 20% 25V
C078	C91-0591-05	CAP. CERAMIC 0.22 50V
C079	CE04W1E470M	CAP. ELECTRO 47 20% 25V
C080	C91-0591-05	CAP. CERAMIC 0.22 50V
C081	CE04W1A101M	CAP. ELECTRO 100 20% 10V
C082	C90-0298-05	CAP. CERAMIC 0.1 20% 12V
C083	C90-0298-05	CAP. CERAMIC 0.1 20% 12V
C084	C90-0298-05	CAP. CERAMIC 0.1 20% 12V
C085	C90-0298-05	CAP. CERAMIC 0.1 20% 12V
C086	C90-0298-05	CAP. CERAMIC 0.1 20% 12V
C087	C90-0298-05	CAP. CERAMIC 0.1 20% 12V
C088	C90-0298-05	CAP. CERAMIC 0.1 20% 12V
C089	C90-0298-05	CAP. CERAMIC 0.1 20% 12V
C090	C90-0298-05	CAP. CERAMIC 0.1 20% 12V
C091	C90-0298-05	CAP. CERAMIC 0.1 20% 12V
C092	C90-0298-05	CAP. CERAMIC 0.1 20% 12V
C093	C90-0298-05	CAP. CERAMIC 0.1 20% 12V
C094	C90-0298-05	CAP. CERAMIC 0.1 20% 12V
C095	C90-0298-05	CAP. CERAMIC 0.1 20% 12V
C096	CE04W1E101M	CAP. ELECTRO 100 20% 25V
C097	C91-0591-05	CAP. CERAMIC 0.22 50V
C098	CE04W1E470M	CAP. ELECTRO 47 20% 25V
C099	CE04W1E470M	CAP. ELECTRO 47 20% 25V
C100	C91-0591-05	CAP. CERAMIC 0.22 50V
C101	C91-0591-05	CAP. CERAMIC 0.22 50V
C102	CE04W1E101M	CAP. ELECTRO 100 20% 25V
C103	C91-0591-05	CAP. CERAMIC 0.22 50V
C104	CE04W1E470M	CAP. ELECTRO 47 20% 25V
C105	C91-0591-05	CAP. CERAMIC 0.22 50V
C106	C91-0591-05	CAP. CERAMIC 0.22 50V
C107	C91-0591-05	CAP. CERAMIC 0.22 50V
C108	C91-0591-05	CAP. CERAMIC 0.22 50V
C109	C91-0591-05	CAP. CERAMIC 0.22 50V
C110	C91-0591-05	CAP. CERAMIC 0.22 50V
C111	C91-0591-05	CAP. CERAMIC 0.22 50V
C112	C91-0591-05	CAP. CERAMIC 0.22 50V
C113	C91-0591-05	CAP. CERAMIC 0.22 50V
C114	C91-0591-05	CAP. CERAMIC 0.22 50V

## MEMORY UNIT

### X81-1460-00

REF. NO	PARTS NO	NAME & DESCRIPTION
	F01-0847-05	HEAT SINK
	J11-0503-05	EJECTOR
	J25-5060-12	PCB (UNMOUNTED)
	N10-2030-46	NUT, HEX
	N16-0030-46	SPRING WASHER
	N30-3010-41	SCREW, PAN HD M 3X10
C001	CC45CH1H050C	CAP. CERAMIC 5P 0.25P 50V
C002	CK45B1H103K	CAP. CERAMIC 0.01 10% 50V
C003	CK45B1H102K	CAP. CERAMIC 1000P 10% 50V
C004	CC45CH1H050C	CAP. CERAMIC 5P 0.25P 50V
C005	CM93BD2A331J	CAP. MICA 330P 5% 100V
C006	CM93BD2A681J	CAP. MICA 680P 5% 100V
C007	CM93BD2A151J	CAP. MICA 150P 5% 100V
C008	CC45CH1H100D	CAP. CERAMIC 10P 0.5P 50V
C009	C91-0591-05	CAP. CERAMIC 0.22 50V
C010	CK45B1H102K	CAP. CERAMIC 1000P 10% 50V
C011	CK45B1H472K	CAP. CERAMIC 4700P 10% 50V
C012	C91-0591-05	CAP. CERAMIC 0.22 50V
C013	C91-0591-05	CAP. CERAMIC 0.22 50V
C014	CE04W1E470M	CAP. ELECTRO 47 20% 25V
C015	CE04W1E470M	CAP. ELECTRO 47 20% 25V
C016	C90-0298-05	CAP. CERAMIC 0.1 20% 12V
C017	CS15E1V2R2M	CAP. TANTALUM 2.2 20% 35V
C018	CK45B1H102K	CAP. CERAMIC 1000P 10% 50V
C019	CE04W1A101M	CAP. ELECTRO 100 20% 10V
C020	C91-0591-05	CAP. CERAMIC 0.22 50V
C021	CC45CH1H050C	CAP. CERAMIC 5P 0.25P 50V
C022	CK45B1H103K	CAP. CERAMIC 0.01 10% 50V
C023	CK45B1H102K	CAP. CERAMIC 1000P 10% 50V
C024	CC45CH1H050C	CAP. CERAMIC 5P 0.25P 50V
C025	CM93BD2A331J	CAP. MICA 330P 5% 100V
C026	CM93BD2A681J	CAP. MICA 680P 5% 100V
C027	CM93BD2A151J	CAP. MICA 150P 5% 100V
C028	CC45CH1H100D	CAP. CERAMIC 10P 0.5P 50V
C029	G91-0591-05	CAP. CERAMIC 0.22 50V

# PARTS LIST

REF. NO	PARTS NO	NAME & DESCRIPTION	REF. NO	PARTS NO	NAME & DESCRIPTION
C115	C91-0591-05	CAP. CERAMIC 0.22 50V	R026	RN14BK2C3001F	RES. METAL FILM 3K 1% 1/6W
C116	C91-0591-05	CAP. CERAMIC 0.22 50V	R027	RN14BK2C2201F	RES. METAL FILM 2.2K 1% 1/6W
C117	C91-0591-05	CAP. CERAMIC 0.22 50V	R028	RN14BK2C1003F	RES. METAL FILM 100K 1% 1/6W
C118	C91-0591-05	CAP. CERAMIC 0.22 50V	R029	RN14BK2C3300F	RES. METAL FILM 330 1% 1/6W
C119	C91-0591-05	CAP. CERAMIC 0.22 50V	R030	RN14BK2C1201F	RES. METAL FILM 1.2K 1% 1/6W
C120	C91-0591-05	CAP. CERAMIC 0.22 50V	R031	RN14BK2C1500F	RES. METAL FILM 150 1% 1/6W
C121	C91-0591-05	CAP. CERAMIC 0.22 50V	R032	RN14BK2C1301F	RES. METAL FILM 1.3K 1% 1/6W
C122	C91-0591-05	CAP. CERAMIC 0.22 50V	R033	RN14BK2C9100F	RES. METAL FILM 910 1% 1/6W
C123	C91-0591-05	CAP. CERAMIC 0.22 50V	R034	RD14BB2E680J	RES. CARBON 68 5% 1/4W
C124	C91-0591-05	CAP. CERAMIC 0.22 50V	R035	RD14BB2E680J	RES. CARBON 68 5% 1/4W
C125	C91-0591-05	CAP. CERAMIC 0.22 50V	R036	RN14BK2C1202F	RES. METAL FILM 12K 1% 1/6W
C126	C91-0591-05	CAP. CERAMIC 0.22 50V	R037	RN14BK2C2701F	RES. METAL FILM 2.7K 1% 1/6W
C127	C91-0591-05	CAP. CERAMIC 0.22 50V	R038	RN14BK2C4301F	RES. METAL FILM 4.3K 1% 1/6W
C128	C91-0591-05	CAP. CERAMIC 0.22 50V	R039	RN14BK2C4703F	RES. METAL FILM 470K 1% 1/6W
C129	C91-0591-05	CAP. CERAMIC 0.22 50V	R040	RN14BK2C1202F	RES. METAL FILM 12K 1% 1/6W
C130	C90-0298-05	CAP. CERAMIC 0.1 20% 12V	R041	RN14BK2C4701F	RES. METAL FILM 4.7K 1% 1/6W
C131	C90-0298-05	CAP. CERAMIC 0.1 20% 12V	R042	RD14BB2C472J	RES. CARBON 4.7K 5% 1/6W
C132	C093M1H153K	CAP. NYLAR 0.015 10% 50V	R043	RD14BB2C472J	RES. CARBON 4.7K 5% 1/6W
C133	C093M1H153K	CAP. NYLAR 0.015 10% 50V	R044	RN14BK2C6800F	RES. METAL FILM 680 1% 1/6W
D001	1SS132	DIODE	R045	RN14BK2C5600F	RES. METAL FILM 560 1% 1/6W
D002	1SS132	DIODE	R046	RN14BK2C2701F	RES. METAL FILM 2.7K 1% 1/6W
D003	1SS132	DIODE	R047	RN14BK2C4701F	RES. METAL FILM 4.7K 1% 1/6W
D004	1SS132	DIODE	R048	RN14BK2C4700F	RES. METAL FILM 470 1% 1/6W
D005	1SS132	DIODE	R049	RN14BK2C5601F	RES. METAL FILM 5.6K 1% 1/6W
D006	1SS132	DIODE	R050	RN14BK2C1001F	RES. METAL FILM 1K 1% 1/6W
D007	1SS132	DIODE	R051	RN14BK2C4700F	RES. METAL FILM 470 1% 1/6W
D008	1SS132	DIODE	R052	RD14BB2C331J	RES. CARBON 330 5% 1/6W
D009	1SS132	DIODE	R053	RN14BK2C1002F	RES. METAL FILM 10K 1% 1/6W
D010	9491AJ	DIODE, ZENER 1.22V	R054	RD14BB2C472J	RES. CARBON 4.7K 5% 1/6W
D011	1SZ58	DIODE, ZENER 6.5V	R055	RD14BB2C473J	RES. CARBON 47K 5% 1/6W
L001	L40-1011-04	FERRI INDUCTOR 100UH	R056	RN14BK2C9101F	RES. METAL FILM 9.1K 1% 1/6W
P001	E40-0373-05	PIN CONNECTOR 3 P	R057	RN14BK2C9101F	RES. METAL FILM 9.1K 1% 1/6W
P002	E40-0373-05	PIN CONNECTOR 3 P	R058	RD14BB2C331J	RES. CARBON 330 5% 1/6W
P003	E40-0273-05	PIN CONNECTOR 2 P	R059	RN14BK2C4701F	RES. METAL FILM 4.7K 1% 1/6W
P004	E40-0273-05	PIN CONNECTOR 2 P	R060	RN14BK2C1000F	RES. METAL FILM 100 1% 1/6W
P005	E40-0273-05	PIN CONNECTOR 2 P	R061	RN14BK2C9101F	RES. METAL FILM 9.1K 1% 1/6W
P006	E40-0273-05	PIN CONNECTOR 2 P	R062	RD14BB2C473J	RES. CARBON 47K 5% 1/6W
P007	E40-0273-05	PIN CONNECTOR 2 P	R063	RN14BK2C4701F	RES. METAL FILM 4.7K 1% 1/6W
P008	E40-0273-05	PIN CONNECTOR 2 P	R064	RN14BK2C1202F	RES. METAL FILM 12K 1% 1/6W
Q001	2SA838(C)	TR. SI, PNP	R065	RD14BB2C331J	RES. CARBON 330 5% 1/6W
Q002	2SC1047(C)	TR. SI, NPN	R066	RD14BB2C332J	RES. CARBON 3.3K 5% 1/6W
Q003	2SK117(GR)	PET. N-CHANNEL	R067	RD14BB2C332J	RES. CARBON 3.3K 5% 1/6W
Q004	2SK117(GR)	PET. N-CHANNEL	R068	RD14BB2E220J	RES. CARBON 22 5% 1/4W
Q005	2SK117(GR)	PET. N-CHANNEL	R069	RD14BB2E220J	RES. CARBON 22 5% 1/4W
Q006	2SA1175(F)	TR. SI, PNP	R070	RN14BK2C5600F	RES. METAL FILM 560 1% 1/6W
Q007	2SC2785(F)	TR. SI, NPN	R071	RN14BK2C2701F	RES. METAL FILM 2.7K 1% 1/6W
Q008	2SC1384(R)	TR. SI, NPN	R072	RN14BK2C5601F	RES. METAL FILM 5.6K 1% 1/6W
Q009	2SA684(R)	TR. SI, PNP	R073	RN14BK2C4700F	RES. METAL FILM 470 1% 1/6W
Q010	2SK117(GR)	PET. N-CHANNEL	R074	RN14BK2C4701F	RES. METAL FILM 4.7K 1% 1/6W
Q011	2SA733(Q)	TR. SI, PNP	R075	RN14BK2C1001F	RES. METAL FILM 1K 1% 1/6W
Q012	2SK117(GR)	PET. N-CHANNEL	R076	RN14BK2C4700F	RES. METAL FILM 470 1% 1/6W
Q013	2SA1175(F)	TR. SI, PNP	R077	RD14BB2C331J	RES. CARBON 330 5% 1/6W
Q014	2SC2785(F)	TR. SI, NPN	R078	RD14BB2C473J	RES. CARBON 47K 5% 1/6W
Q015	2SC1384(R)	TR. SI, NPN	R079	RN14BK2C9101F	RES. METAL FILM 9.1K 1% 1/6W
Q016	2SA684(R)	TR. SI, PNP	R080	RN14BK2C1002F	RES. METAL FILM 10K 1% 1/6W
R001	RD14BB2C302J	RES. CARBON 3K 5% 1/6W	R081	RN14BK2C9101F	RES. METAL FILM 9.1K 1% 1/6W
R002	RN14BK2C1001F	RES. METAL FILM 1K 1% 1/6W	R082	RD14BB2C331J	RES. CARBON 330 5% 1/6W
R003	RN14BK2C1001F	RES. METAL FILM 1K 1% 1/6W	R083	RN14BK2C4701F	RES. METAL FILM 4.7K 1% 1/6W
R004	RN14BK2C1001F	RES. METAL FILM 1K 1% 1/6W	R084	RN14BK2C9101F	RES. METAL FILM 9.1K 1% 1/6W
R005	RN14BK2C1002F	RES. METAL FILM 10K 1% 1/6W	R085	RD14BB2C103J	RES. CARBON 10K 5% 1/6W
R006	RN14BK2C3001F	RES. METAL FILM 3K 1% 1/6W	R086	RD14BB2C103J	RES. CARBON 10K 5% 1/6W
R007	RN14BK2C2201F	RES. METAL FILM 2.2K 1% 1/6W	R087	RD14BB2C103J	RES. CARBON 10K 5% 1/6W
R008	RN14BK2C1003F	RES. METAL FILM 100K 1% 1/6W	R088	RD14BB2C473J	RES. CARBON 47K 5% 1/6W
R009	RN14BK2C3300F	RES. METAL FILM 330 1% 1/6W	R089	RN14BK2C4701F	RES. METAL FILM 4.7K 1% 1/6W
R010	RN14BK2C1201F	RES. METAL FILM 1.2K 1% 1/6W	R090	RN14BK2C1202F	RES. METAL FILM 12K 1% 1/6W
R011	RN14BK2C1500F	RES. METAL FILM 150 1% 1/6W	R091	RD14BB2C331J	RES. CARBON 330 5% 1/6W
R012	RN14BK2C9100F	RES. METAL FILM 910 1% 1/6W	R092	RN14BK2C1000F	RES. METAL FILM 100 1% 1/6W
R013	RN14BK2C1301F	RES. METAL FILM 1.3K 1% 1/6W	R093	RD14BB2C332J	RES. CARBON 3.3K 5% 1/6W
R014	RN14BK2C2401F	RES. METAL FILM 2.4K 1% 1/6W	R094	RD14BB2C332J	RES. CARBON 3.3K 5% 1/6W
R015	RN14BK2C9101F	RES. METAL FILM 9.1K 1% 1/6W	R095	RD14BB2E220J	RES. CARBON 22 5% 1/4W
R016	RD14BB2C103J	RES. CARBON 10K 5% 1/6W	R096	RD14BB2E220J	RES. CARBON 22 5% 1/4W
R017	RD14BB2C223J	RES. CARBON 22K 5% 1/6W	R097	RN14BK2C9103P	RES. METAL FILM 910K 1% 1/6W
R018	RD14BB2C223J	RES. CARBON 22K 5% 1/6W	R098	RN14BK2C9103P	RES. METAL FILM 910K 1% 1/6W
R019	RD14BB2C103J	RES. CARBON 10K 5% 1/6W	R099	RD14BB2C332J	RES. CARBON 3.3K 5% 1/6W
R020	RD14BB2C103J	RES. CARBON 10K 5% 1/6W	RA001	R90-0640-05	TERMINAL
R021	RD14BB2C302J	RES. CARBON 3K 5% 1/6W	RA002	R90-0640-05	TERMINAL
R022	RN14BK2C1001F	RES. METAL FILM 1K 1% 1/6W	TP001	#23-0512-05	TERMINAL
R023	RN14BK2C1001F	RES. METAL FILM 1K 1% 1/6W	TP002	E23-0512-05	TERMINAL
R024	RN14BK2C1001F	RES. METAL FILM 1K 1% 1/6W	TP003	E23-0512-05	TERMINAL
R025	RN14BK2C1002F	RES. METAL FILM 10K 1% 1/6W	TP004	E23-0512-05	TERMINAL
			TP005	E23-0512-05	TERMINAL
			TP006	E23-0512-05	TERMINAL
			TP007	E23-0512-05	TERMINAL

# PARTS LIST

REF. NO	PARTS NO	NAME & DESCRIPTION
TP008	E23-0512-05	TERMINAL
TP009	E23-0512-05	TERMINAL
TP010	E23-0512-05	TERMINAL
U001	LM318N	IC
U002	LM318N	IC
U003	LF411CN	IC, DUAL JFET INPUT OP-AMP
U004	LM318N	IC
U005	TDC1001J	IC
U006	LM318N	IC
U007	LM318N	IC
U008	LF411CN	IC, DUAL JFET INPUT OP-AMP
U009	LM318N	IC
U010	TDC1001J	IC
U011	SN74LS374N	IC, OCTAL 3S D-FFS
U012	SN74LS465N	IC
U013	SN74LS245N	IC
U014	SN74LS374N	IC, OCTAL 3S D-FFS
U015	SN74LS465N	IC
U016	SN74S112N	IC
U017	MB8416-20LP-GRA	IC
U018	MC14066BCP	IC
U019	MB8416-20LP-GRA	IC
U020	SN74LS08N	IC, QUAD 2-INPUT AND GATE
U021	SN74LS273N	IC, OCTAL D-TYPE FLIP-FLOPS
U022	SN74LS245N	IC
U023	MB3761M	IC
U024	SN74LS273N	IC, OCTAL D-TYPE FLIP-FLOPS
U025	SN74LS245N	IC
U026	DAC08HP	IC, 8-BIT D/A CONVERTER
U027	LF412CN	IC, DUAL JFET INPUT OP-AMP
U028	LF411CN	IC, DUAL JFET INPUT OP-AMP
U029	DAC08HP	IC, 8-BIT D/A CONVERTER
U030	LF412CN	IC, DUAL JFET INPUT OP-AMP
U031	LF411CN	IC, DUAL JFET INPUT OP-AMP
U032	LM7905CT	REGULATOR
VR001	R12-1523-05	RES. SEMI FIXED 1K B
VR002	R12-0557-05	RES. SEMI FIXED 500 B
VR003	R12-0556-05	RES. SEMI FIXED 100 B
VR004	R12-1523-05	RES. SEMI FIXED 1K B
VR005	R12-1523-05	RES. SEMI FIXED 1K B
VR006	R12-0557-05	RES. SEMI FIXED 500 B
VR007	R12-0556-05	RES. SEMI FIXED 100 B
VR008	R12-1523-05	RES. SEMI FIXED 1K B
VR009	R12-1523-05	RES. SEMI FIXED 1K B
VR010	R12-1530-05	RES. SEMI FIXED 2K B
VR011	R12-1523-05	RES. SEMI FIXED 1K B
VR012	R12-3527-05	RES. SEMI FIXED 10K B
VR013	R12-0557-05	RES. SEMI FIXED 500 B
VR014	R12-1530-05	RES. SEMI FIXED 2K B
VR015	R12-1523-05	RES. SEMI FIXED 1K B
VR016	R12-1523-05	RES. SEMI FIXED 1K B
VR017	R12-1530-05	RES. SEMI FIXED 2K B
VR018	R12-1523-05	RES. SEMI FIXED 1K B
VR019	R12-3527-05	RES. SEMI FIXED 10K B
VR020	R12-0557-05	RES. SEMI FIXED 500 B
VR021	R12-1530-05	RES. SEMI FIXED 2K B

REF. NO	PARTS NO	NAME & DESCRIPTION
D003	MTZ5.1JB	DIODE ZENER 5V
D004	MTZ3.3JA	DIODE, ZENER 3.2V
D005	1SS132	DIODE
P002	E40-3485-05	PIN CONNECTOR
P003	E40-0373-05	PIN CONNECTOR 3 P
Q001	2SC945(P)	TR. SI, NPN
Q002	2SC945(P)	TR. SI, NPN
Q003	2SC945(P)	TR. SI, NPN
Q004	2SC945(P)	TR. SI, NPN
R001	RD14BB2E221J	RES. CARBON 220 5% 1/4W
R002	RD14BB2E221J	RES. CARBON 220 5% 1/4W
R003	RD14BB2E271J	RES. CARBON 270 5% 1/4W
R004	RD14BB2E103J	RES. CARBON 10K 5% 1/4W
R005	RD14BB2E103J	RES. CARBON 10K 5% 1/4W
R006	RD14BB2E271J	RES. CARBON 270 5% 1/4W
R007	RD14BB2E103J	RES. CARBON 10K 5% 1/4W
R008	RD14BB2E103J	RES. CARBON 10K 5% 1/4W
R009	RD14BB2E271J	RES. CARBON 270 5% 1/4W
R010	RD14BB2E103J	RES. CARBON 10K 5% 1/4W
R011	RD14BB2E103J	RES. CARBON 10K 5% 1/4W
R012	RD14BB2E472J	RES. CARBON 4.7K 5% 1/4W
R013	RD14BB2E101J	RES. CARBON 100 5% 1/4W
R014	RD14BB2E221J	RES. CARBON 220 5% 1/4W
R015	RD14BB2E122J	RES. CARBON 1.2K 5% 1/4W
R016	RD14BB2E391J	RES. CARBON 390 5% 1/4W
R017	RD14BB2E472J	RES. CARBON 4.7K 5% 1/4W
R018	RD14BB2E271J	RES. CARBON 270 5% 1/4W
R019	RD14BB2E103J	RES. CARBON 10K 5% 1/4W
R020	RD14BB2E154J	RES. CARBON 150K 5% 1/4W
R021	RD14BB2E333J	RES. CARBON 33K 5% 1/4W
R022	RD14BB2E103J	RES. CARBON 10K 5% 1/4W
R023	RD14BB2E563J	RES. CARBON 56K 5% 1/4W
U001	TMP8155P	IC
U002	SN74LS155N	IC
U003	UPD8085AC	IC
U004	SN74LS125AN	IC
U005	UPD7210C	IC
U006	SN75161AN	IC
U007	SN75160AN	IC
U008	MB8516ZC	IC
U009	SN74LS373N	IC
U010	NJM4558D	IC
VR001	R12-1512-05	RES. SEMI FIXED 1K B
X001	L78-0103-05	RESONATOR

## GP-IB UNIT

### X81-1500-00

REF. NO	PARTS NO	NAME & DESCRIPTION
	E02-0135-15	SEMICONDUCTOR SOCKET
	J25-5074-12	PCB (UNMOUNTED)
C001	CE04W1E470M	CAP. ELECTRO 47 20% 25V
C002	CE04W1E470M	CAP. ELECTRO 47 20% 25V
C003	CE04W1E470M	CAP. ELECTRO 47 20% 25V
C004	C90-0298-05	CAP. CERAMIC 0.1 20% 12V
C005	C90-0298-05	CAP. CERAMIC 0.1 20% 12V
C006	C90-0298-05	CAP. CERAMIC 0.1 20% 12V
C007	C90-0298-05	CAP. CERAMIC 0.1 20% 12V
C008	C90-0298-05	CAP. CERAMIC 0.1 20% 12V
C009	C90-0298-05	CAP. CERAMIC 0.1 20% 12V
C010	C90-0298-05	CAP. CERAMIC 0.1 20% 12V
C011	C90-0298-05	CAP. CERAMIC 0.1 20% 12V
C012	C90-0298-05	CAP. CERAMIC 0.1 20% 12V
C013	C90-0298-05	CAP. CERAMIC 0.1 20% 12V
C014	CE04W1C100M	CAP. ELECTRO 10 20% 16V
D001	MTZ12JC	DIODE, ZENER 12V
D002	MTZ12JC	DIODE, ZENER 12V

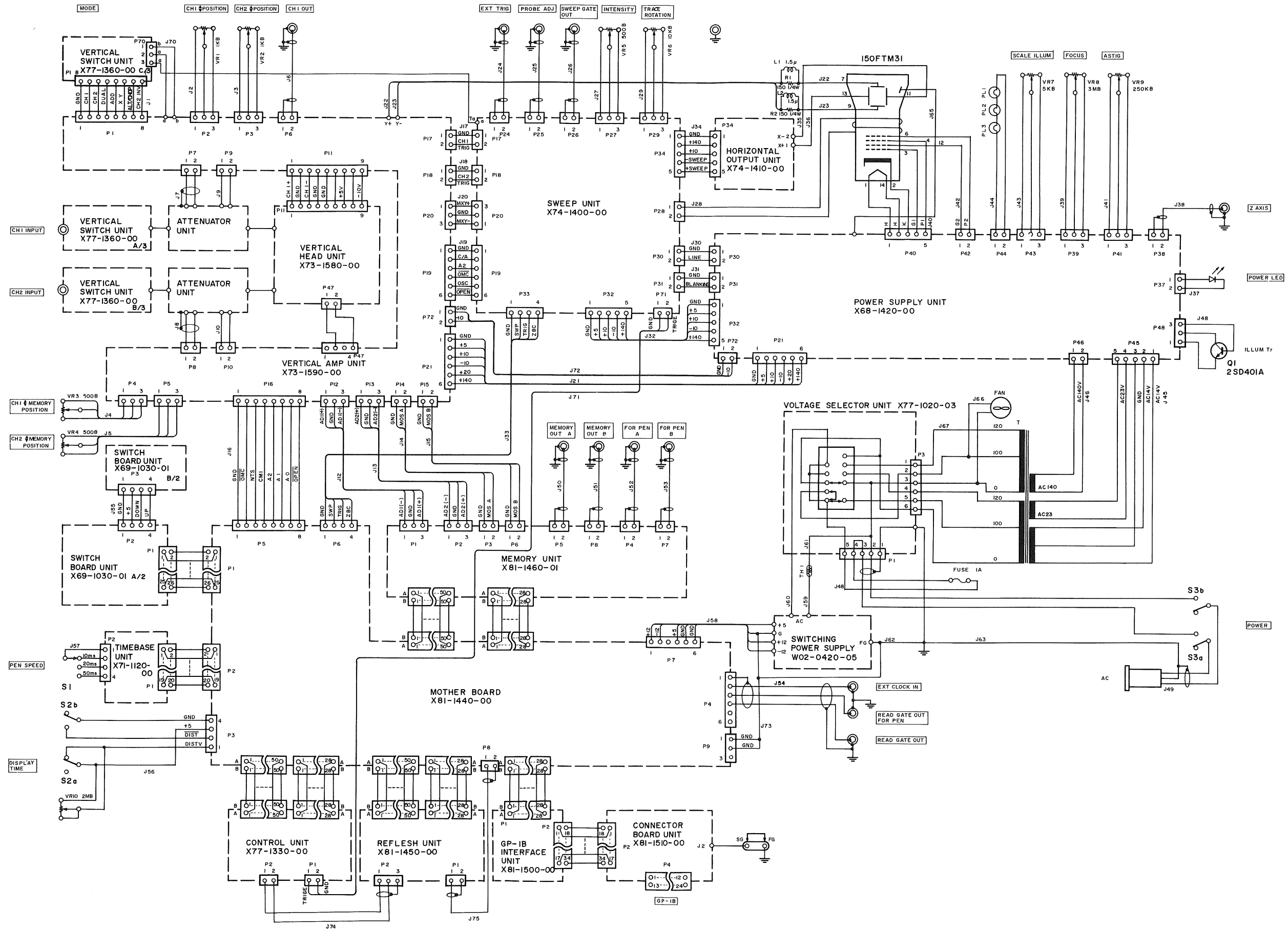
# PARTS LIST

## CONNECTOR UNIT

### X81-1510-00

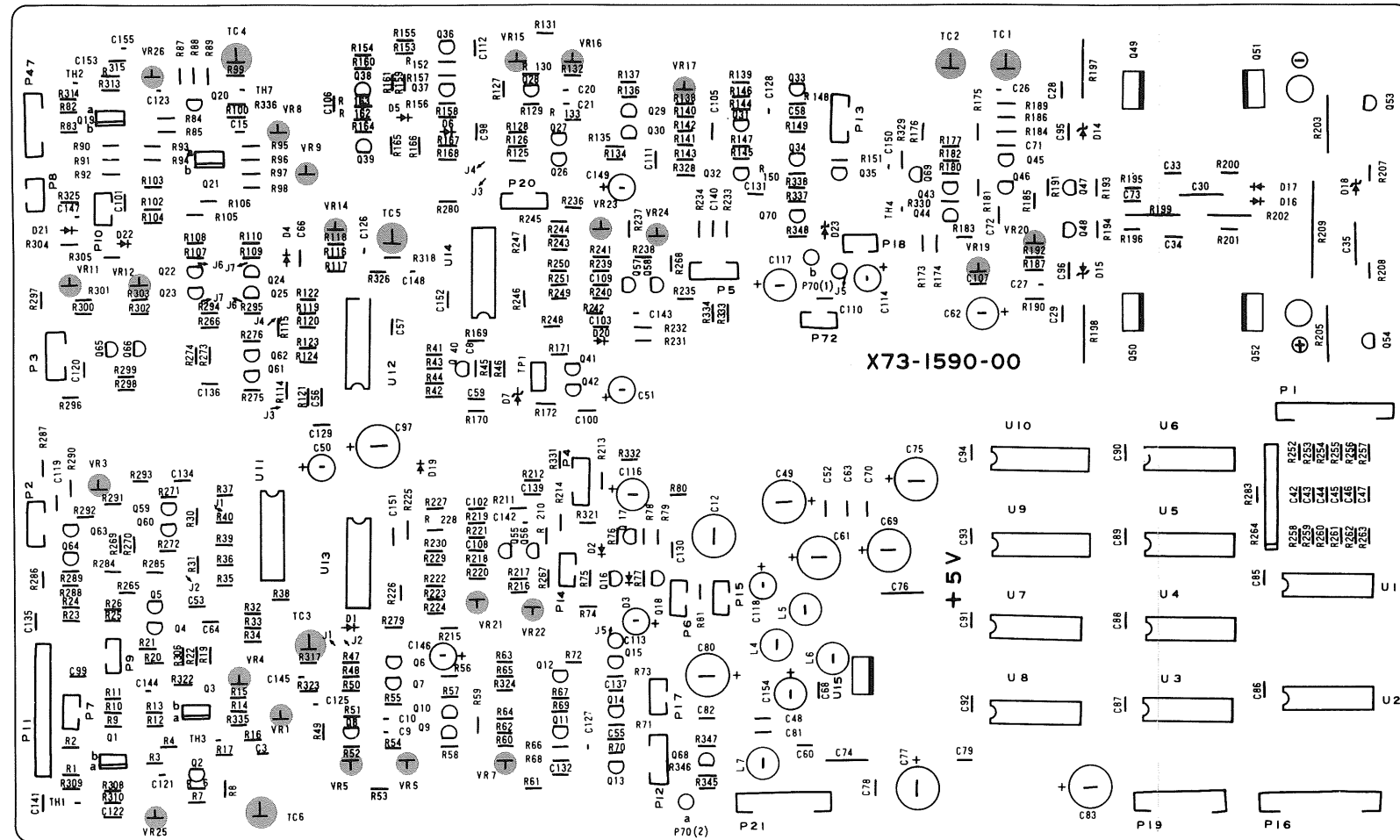
REF. NO	PARTS NO	NAME & DESCRIPTION
	E08-2485-05	CONNECTOR 2 P
	E31-2543-05	LEAD WIRE WITH CONNECTOR
	E33-4081-00	WIRE ASSY
	J25-5075-03	PCB (UNMOUNTED)
	N30-3006-46	SCREW, PAN HD M 3X6
	R90-0609-05	RES. NETWORK 4.7K
	S31-8502-05	DIP SWITCH

# SCHEMATIC DIAGRAM

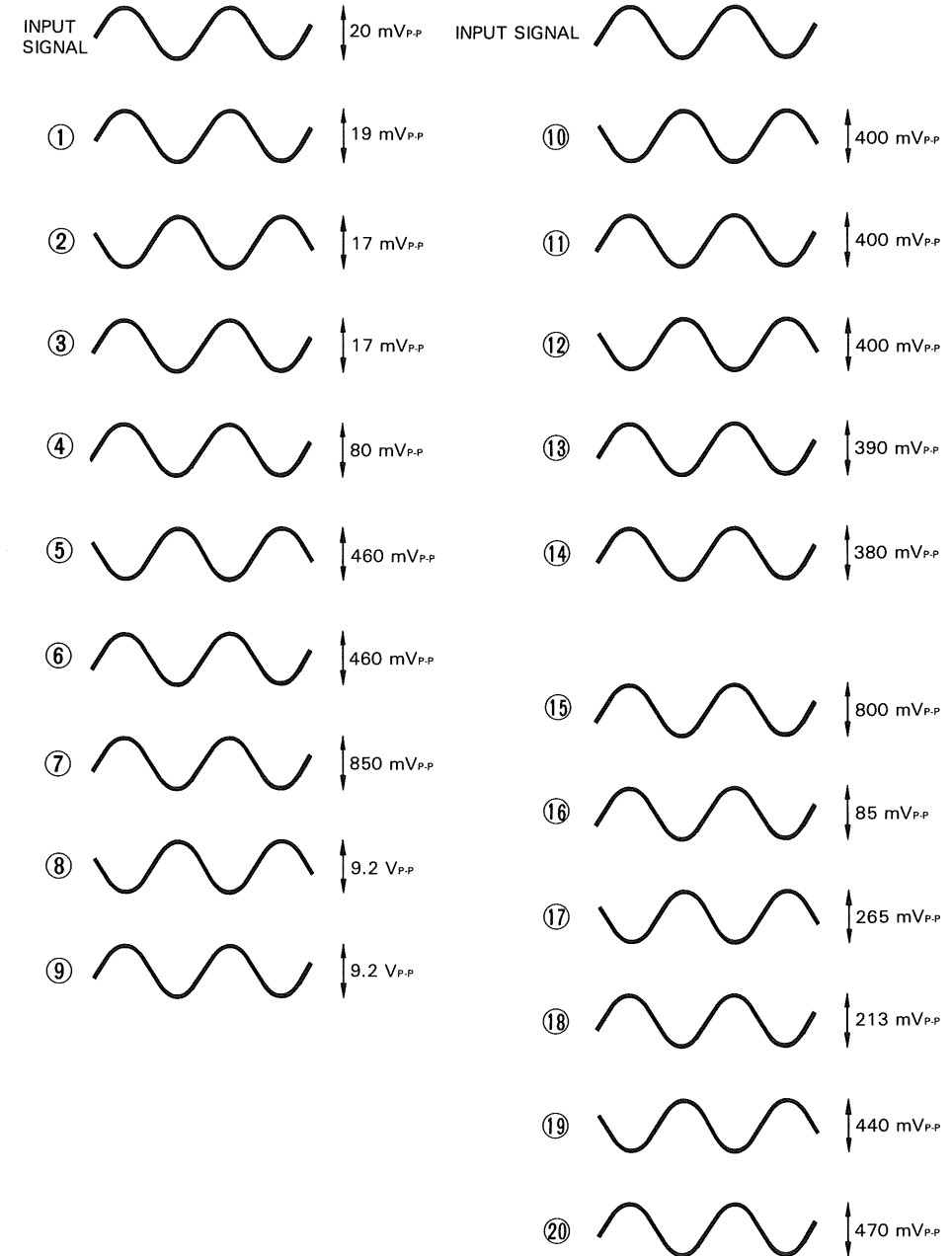


# P. C. BOARD

## VERTICAL AMP UNIT (X73-1590-00)



VOLTS/DIV : 5 mV/DIV



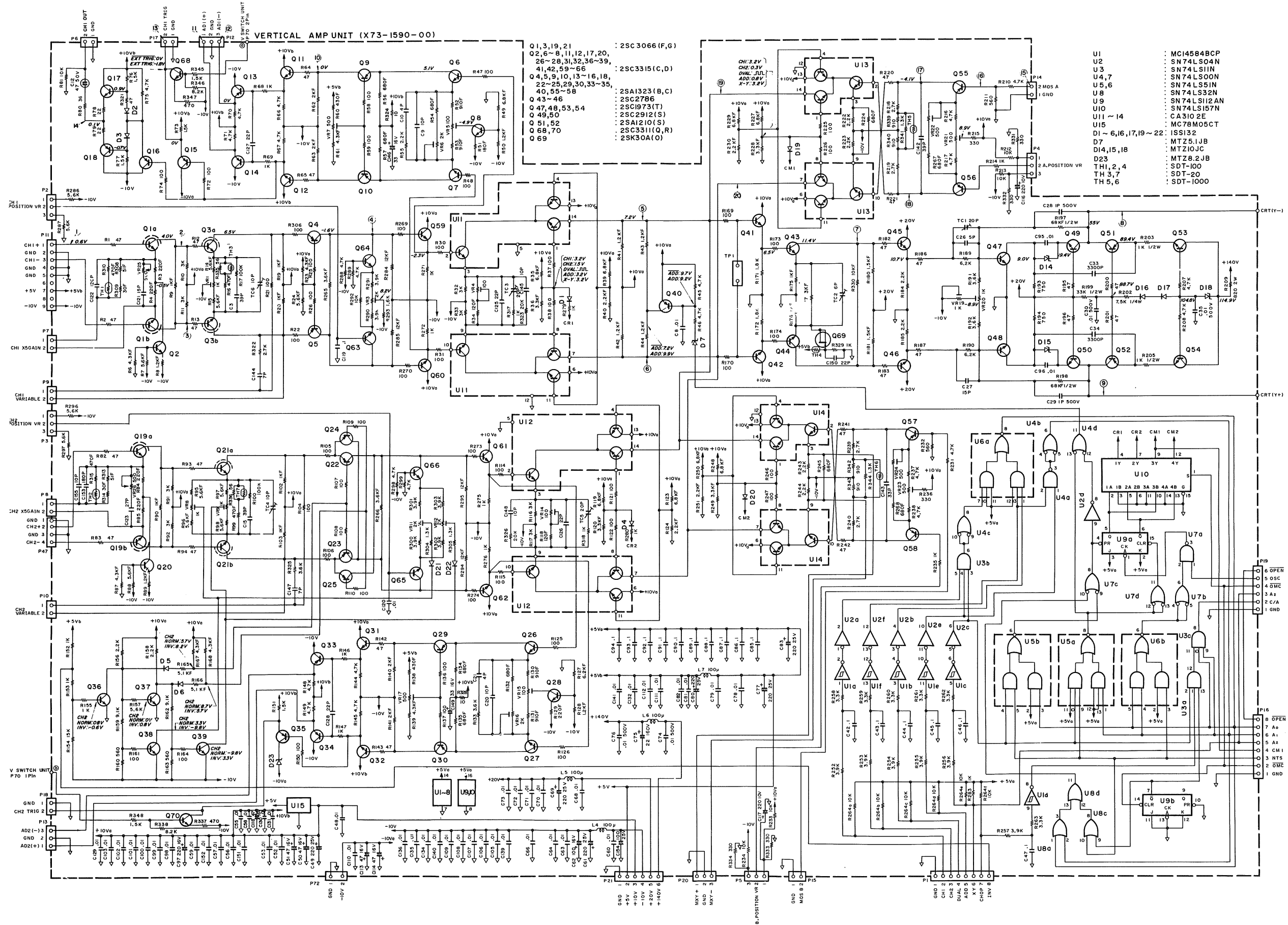
- VR1 CH1 VARIABLE balance adjustment
- VR3 CH1 POSITION adjustment
- VR4 CH1 GAIN adjustment
- VR5 CH1 AD output balance adjustment
- VR6 CH1 AD output gain adjustment
- VR7 CH1 Trigger DC level adjustment
- VR8 CH2 INV VARIABLE balance adjustment
- VR9 CH2 NORM VARIABLE balance adjustment

- VR11 CH2 INV POSITION adjustment
- VR12 CH2 NORM POSITION adjustment
- VR14 CH2 Gain adjustment
- VR15 CH2 AD output balance adjustment
- VR16 CH2 AD output gain adjustment
- VR17 CH2 Trigger DC level adjustment
- VR19 Vertical output operation point adjustment
- VR20 CRT center adjustment

- VR21 CH A MEMORY POSITION adjustment
- VR22 CH A memory gain adjustment
- VR23 CH B MEMORY POSITION adjustment
- VR24 CH B memory gain adjustment
- VR25 CH1 High-range square waveform compensation
- VR26 CH2 High-range square waveform compensation
- TC1 Mid range square waveform compensation
- TC2 High range overshoot adjustment
- TC3 CH1 Mid and high-range square waveform compensation
- TC4 CH2 High-range overshoot adjustment
- TC5 CH2 Mid and high-range square waveform compensation
- TC6 CH1 High-range overshoot adjustment

# SCHEMATIC DIAGRAM

## VERTICAL AMP UNIT (X-73-1590-00)

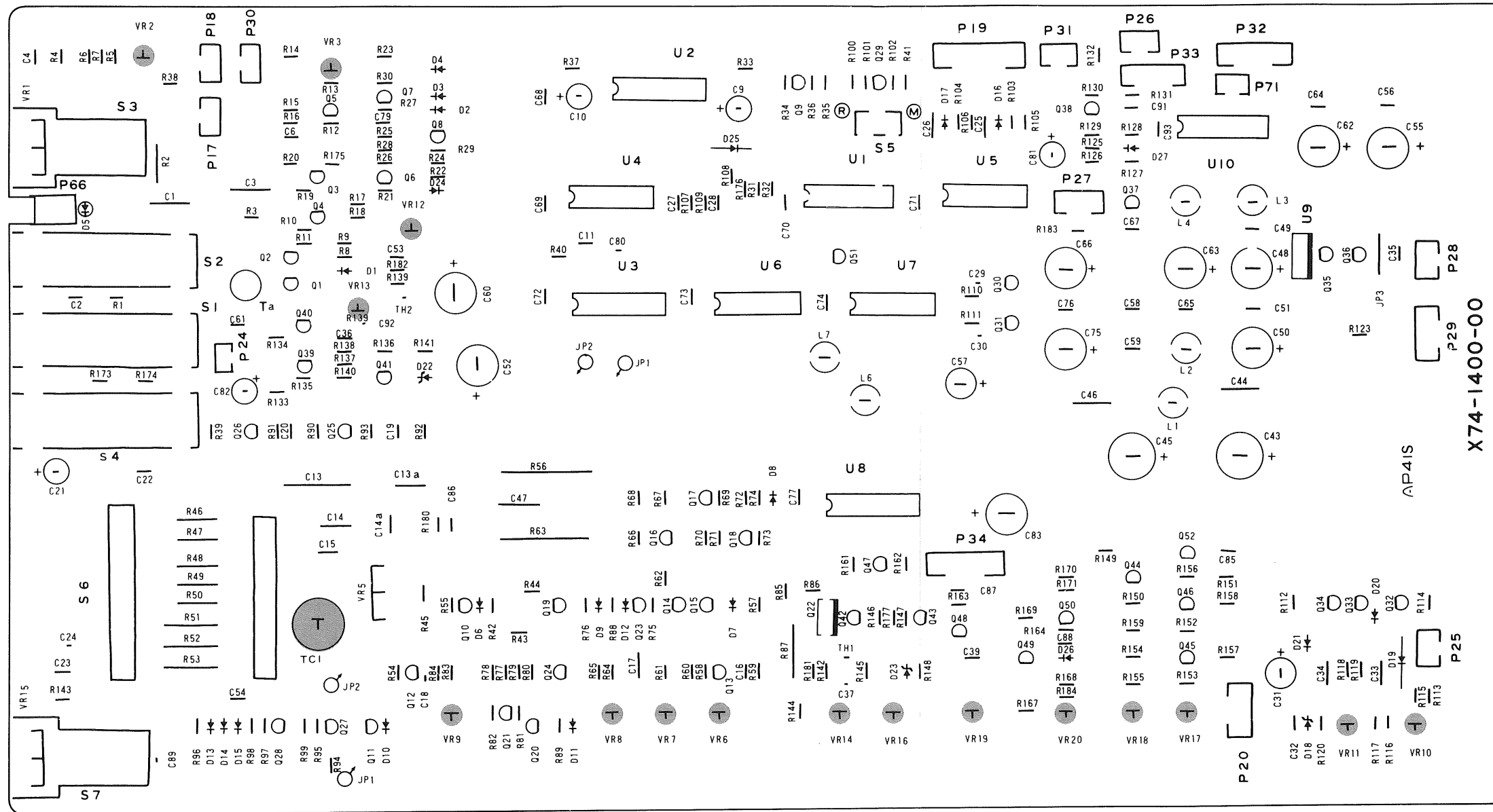


- Q1,3,19,21 : 2SC3066(F,G)
- Q2,6-8,11,12,17,20, 26-28,31,32,36-39, 41,42,59-66 : 2SC3315(C,D)
- Q4,5,9,10,13-16,18, 22-25,29,30,33-35, 40,55-58 : 2SA1323(B,C)
- Q43-46 : 2SC2786
- Q47,48,53,54 : 2SC1973(T)
- Q49,50 : 2SC2912(S)
- Q51,52 : 2SA110(S)
- Q68,70 : 2SC3311(Q,R)
- Q69 : 2SK30A(O)

- U1 : MC14584BCP
- U2 : SN74LS04N
- U3 : SN74LS11N
- U4,7 : SN74LS00N
- U5,6 : SN74LS51N
- U8 : SN74LS32N
- U9 : SN74LS12AN
- U10 : SN74LS157N
- U11-14 : CA3102E
- U15 : MC78M05CT
- D1-6,16,17,19-22 : 1SS132
- D7 : MT25.1JB
- D14,15,18 : MT210JC
- D23 : MT28.2JB
- TH1,2,4 : SDT-100
- TH3,7 : SDT-20
- TH5,6 : SDT-1000

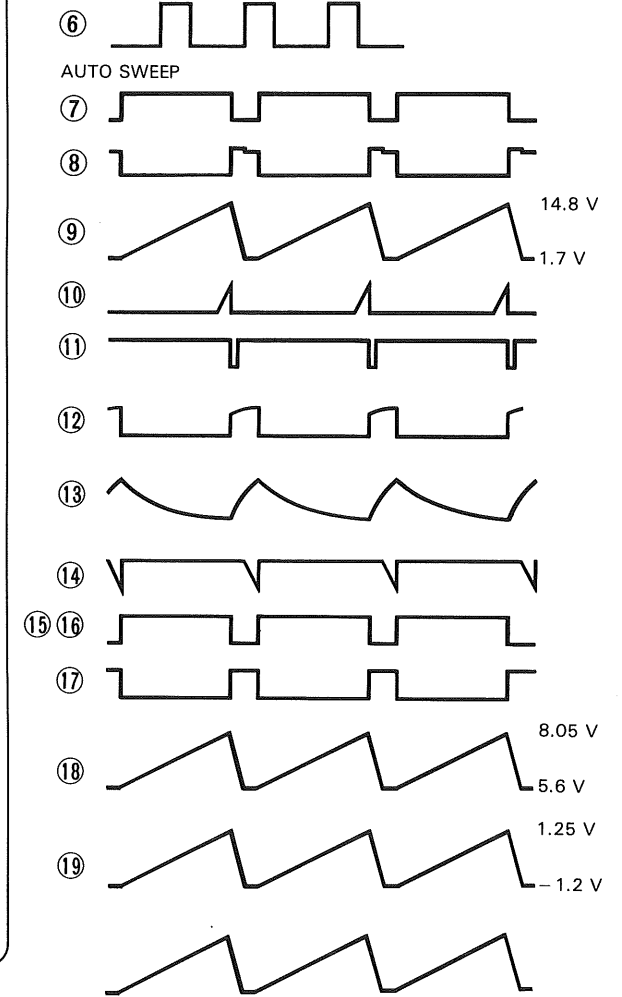
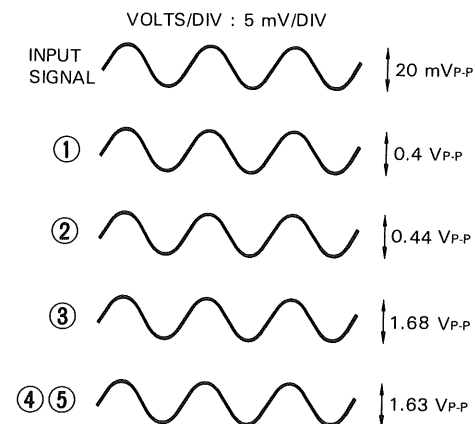
# P. C. BOARD

SWEEP UNIT (X74-1400-00)



- VR2 TRIG. LEVEL center adjustment
- VR3 TRIG. SLOPE center adjustment
- VR6 For memory, sweep start point adjustment
- VR7 For memory, sweep time adjustment
- VR8 For memory, sweep length adjustment
- VR9 For oscilloscope, sweep length adjustment
- VR10 Calibration voltage output adjustment
- VR11 Calibration voltage frequency adjustment
- VR,12 X-Y POSITION adjustment

- VR13 X-Y gain adjustment
- VR14 Sweep time adjustment
- VR16 Sweep POSITION adjustment
- VR17 Memory X-Y gain adjustment
- VR18 Memory X-Y POSITION adjustment
- VR19 X10MAG. gain adjustment
- VR20 X10MAG. balance adjustment
- TC1 Fast sweep time adjustment

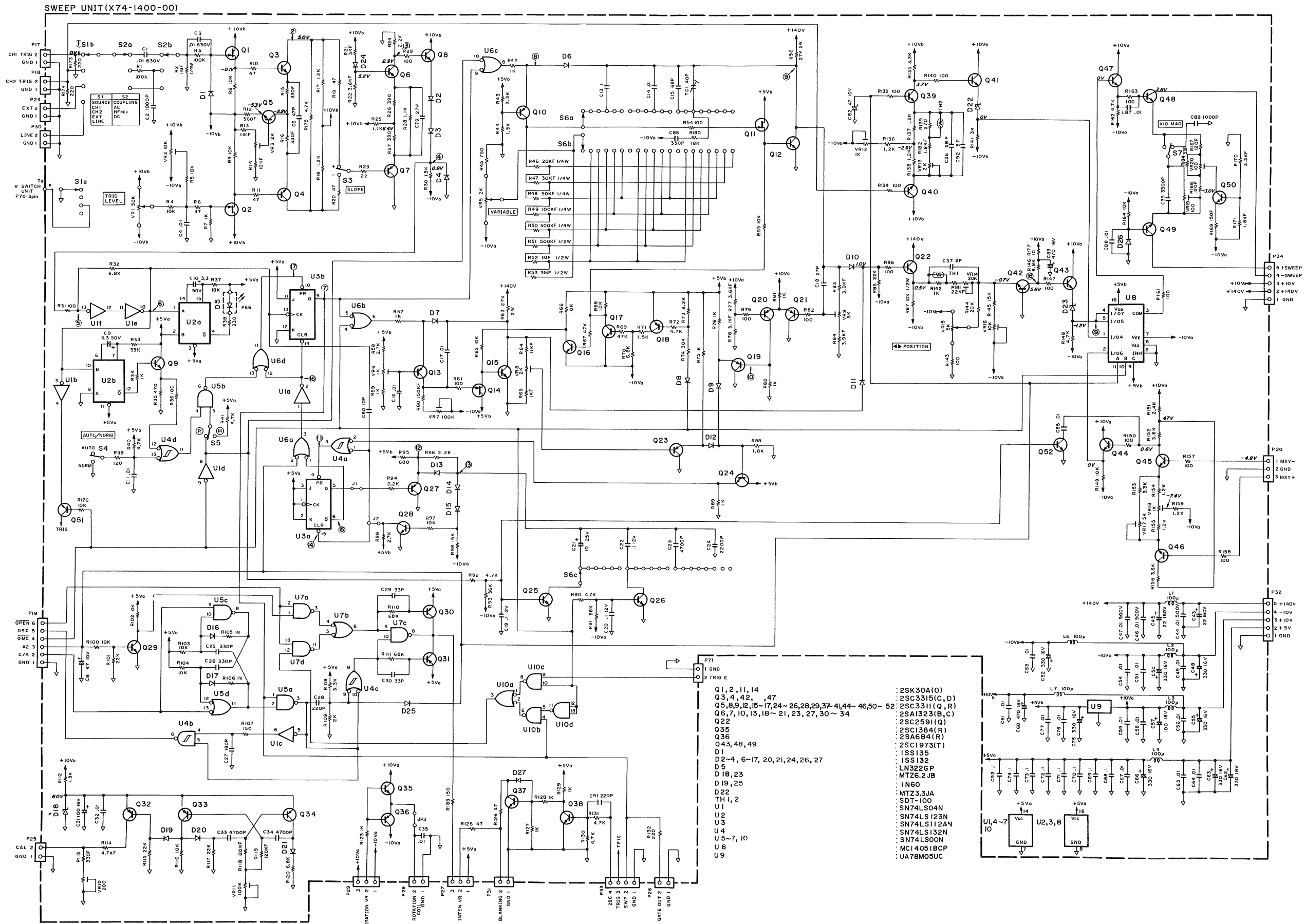


X74-1400-00



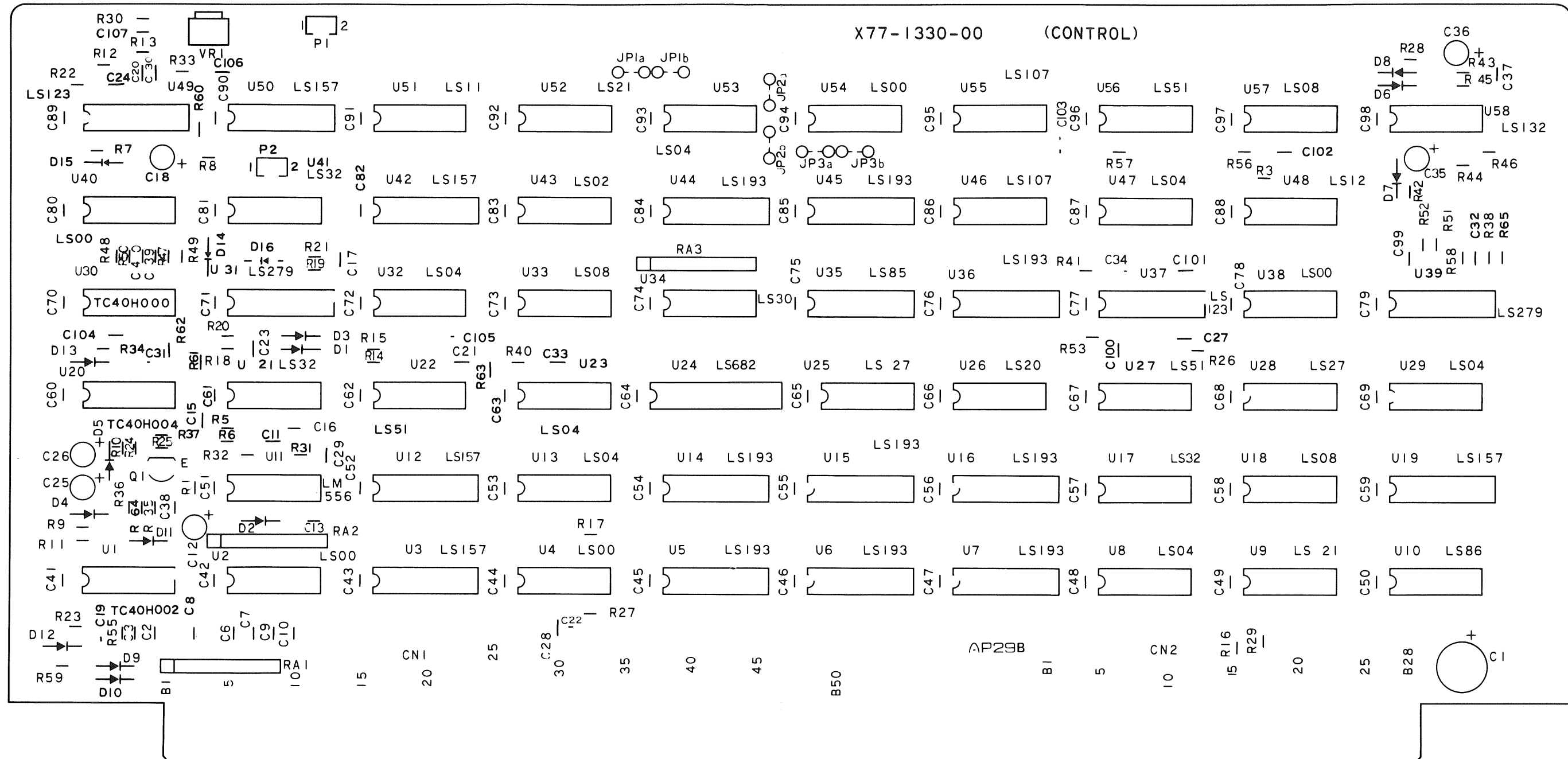
# SCHEMATIC DIAGRAM

## SWEEP UNIT (X74-1400-00)



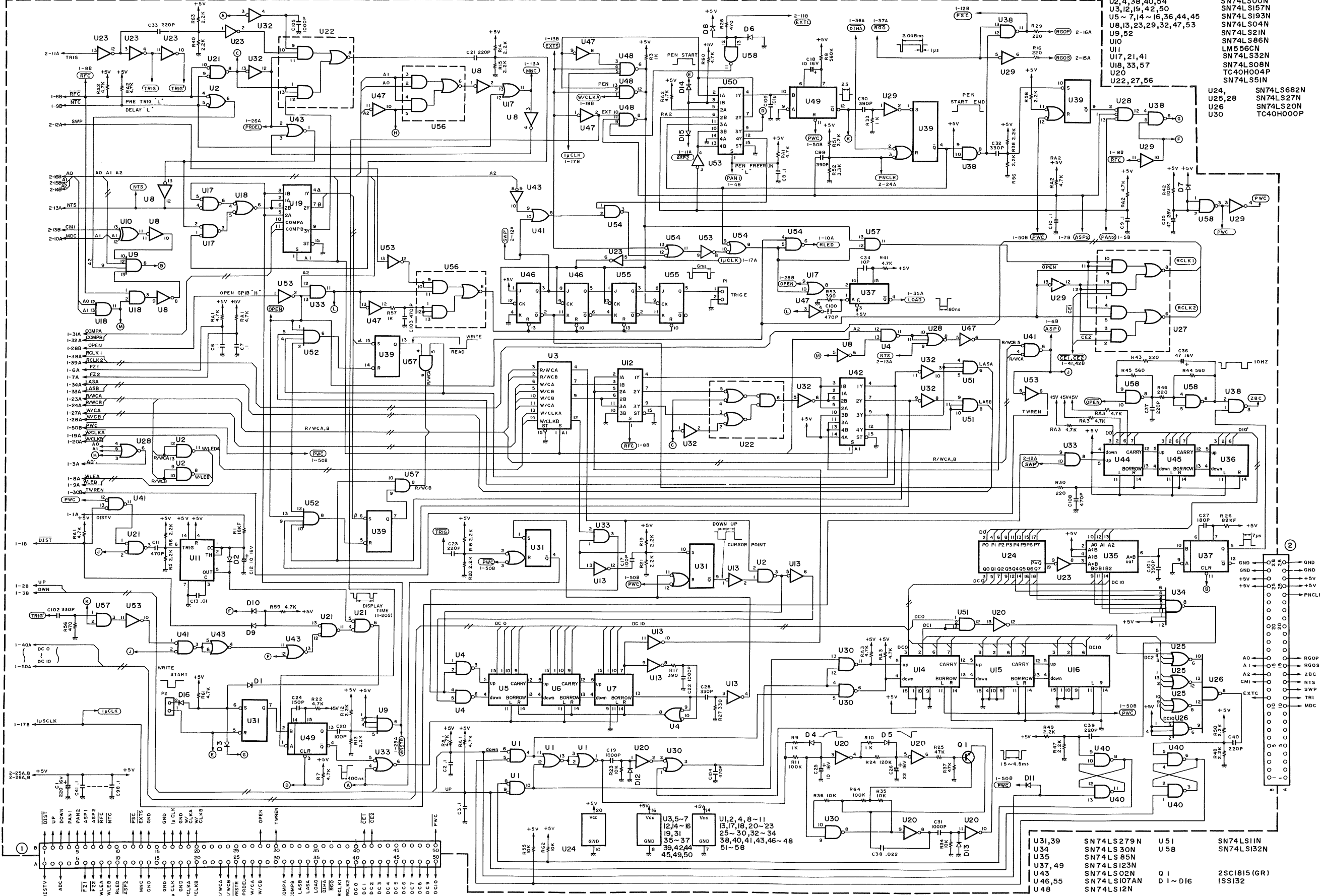
# P. C. BOARD

CONTROL UNIT (X77-1330-00)



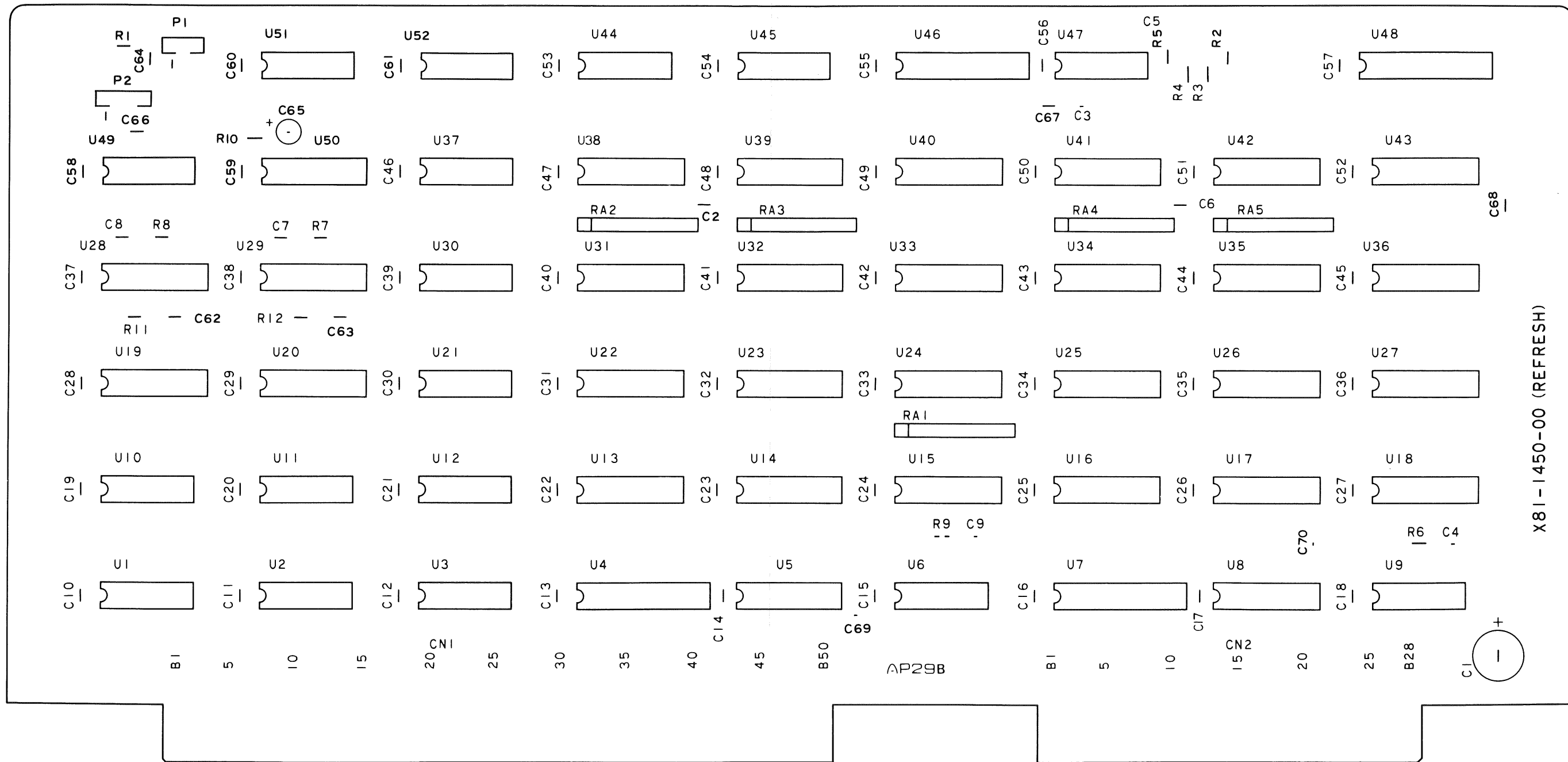
# SCHEMATIC DIAGRAM

CONTROL UNIT (X77-1330-00)



# P. C. BOARD

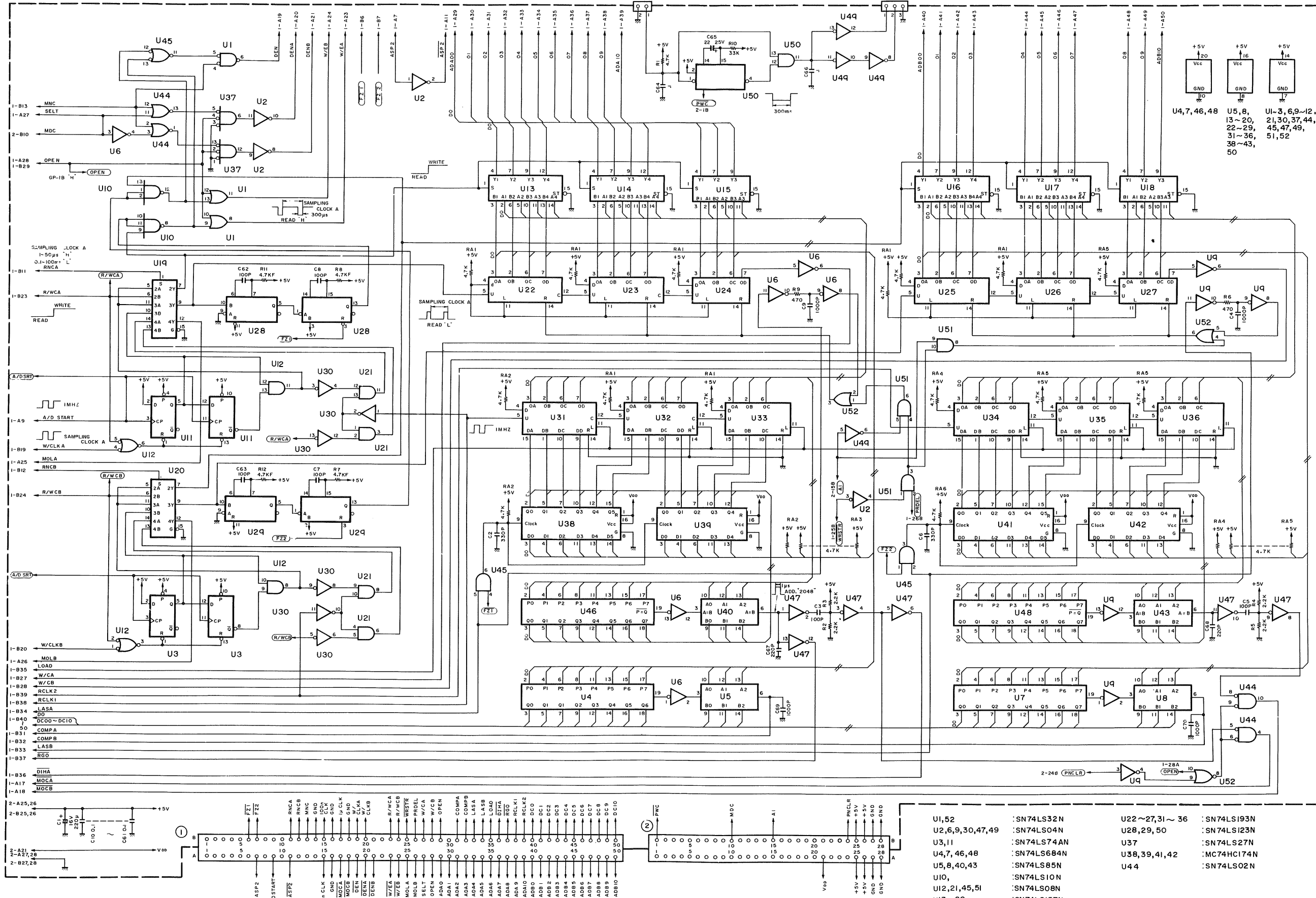
REFRESH UNIT (X81-1450-00)



X81-1450-00 (REFRESH)

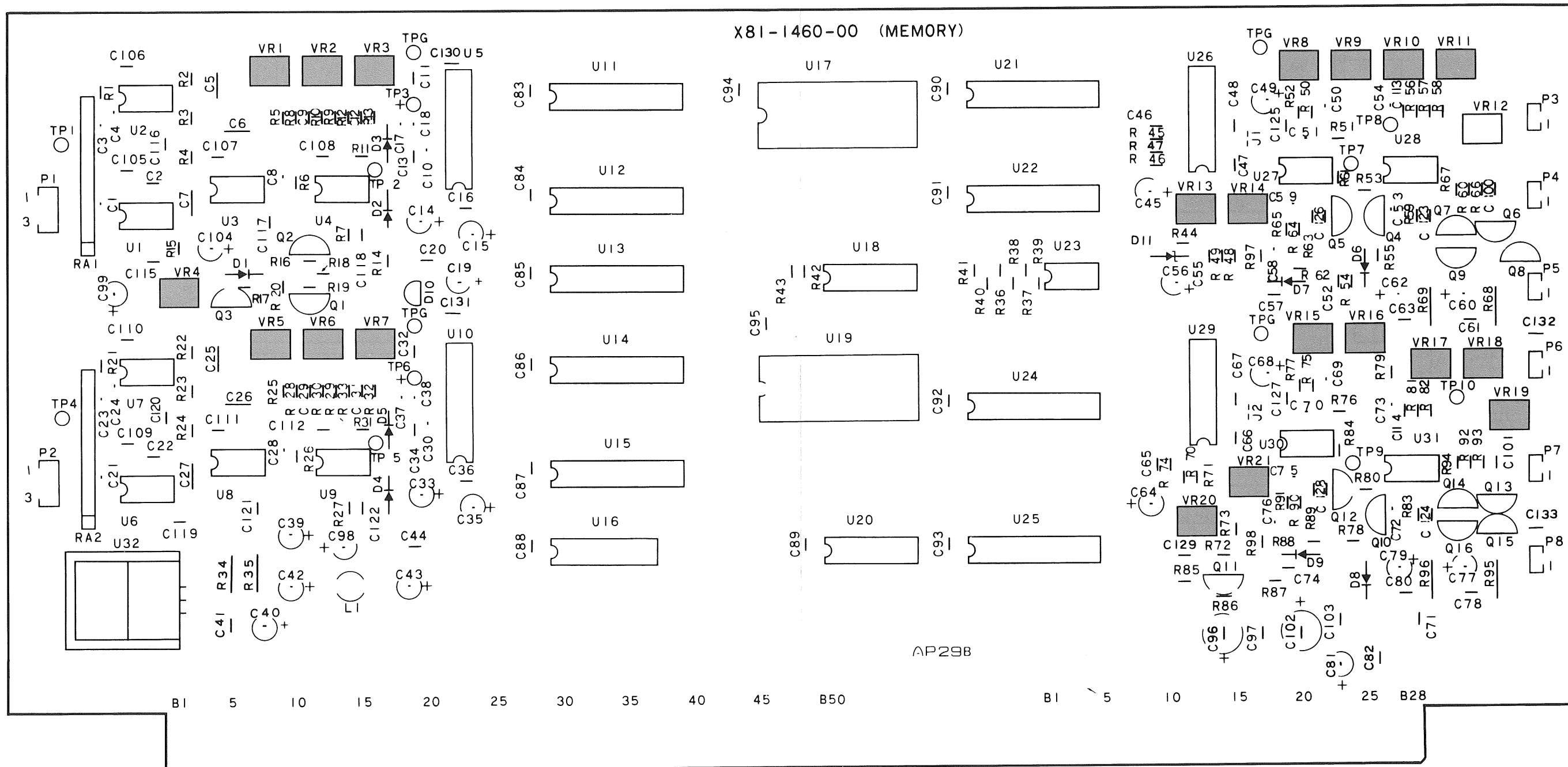
# SCHEMATIC DIAGRAM

REFRESH UNIT (X81-1450-00)



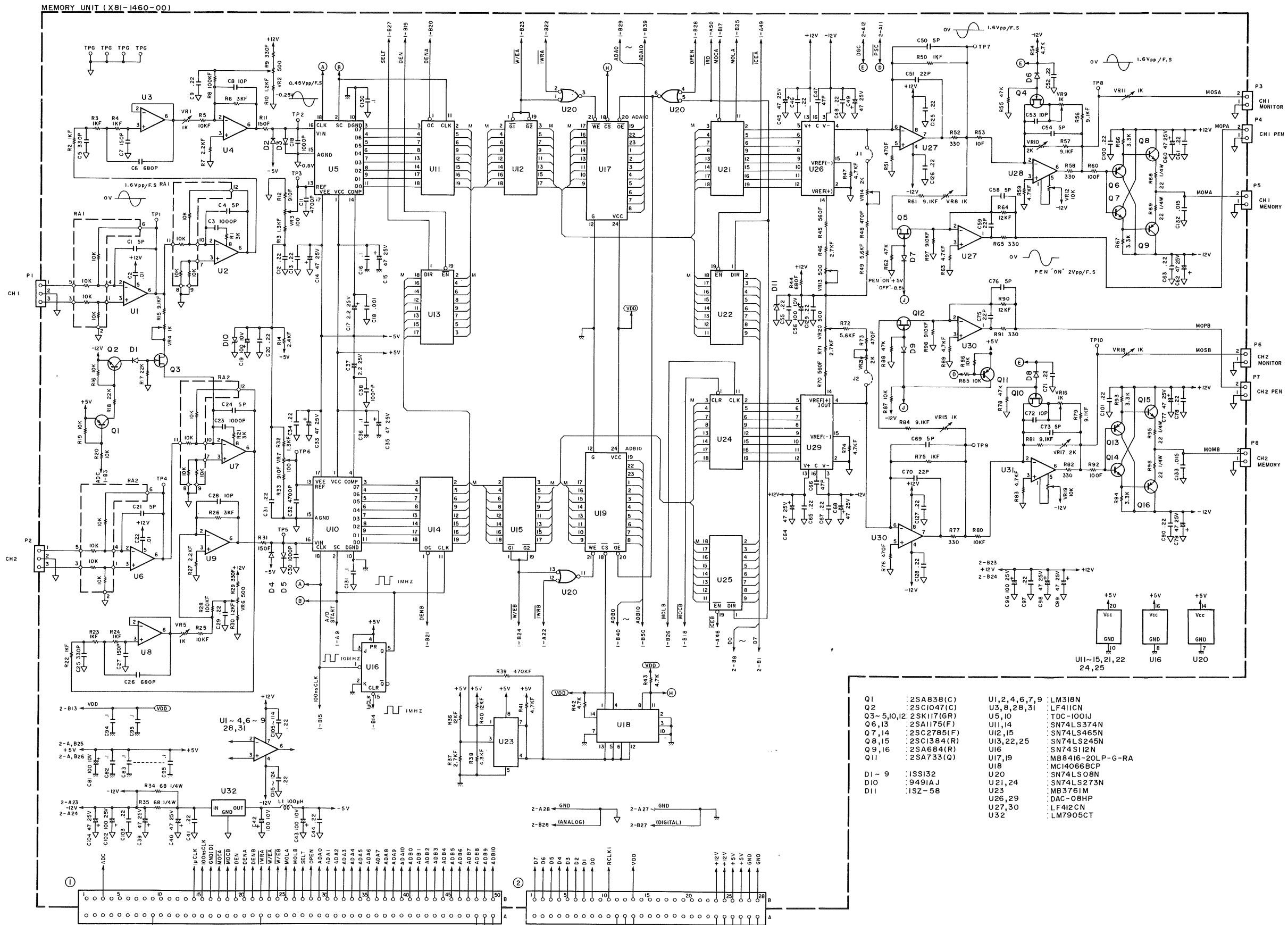
# P. C. BOARD

## MEMORY UNIT (X81-1460-00)



- |      |                                     |      |  |
|------|-------------------------------------|------|--|
| VR1  | CH1 gain adjustment                 | VR12 | CH1 4 div/8 div select offset adjustment |
| VR2  | CH1 input offset adjustment         | VR13 | CH1 D/A gain adjustment                  |
| VR3  | CH1 A/D V <sub>REF</sub> adjustment | VR14 | CH1 D/A offset adjustment                |
| VR4  | ADD gain adjustment                 | VR15 | CH2 PEN OUT gain adjustment              |
| VR5  | CH2 input gain adjustment           | VR16 | CH2 4 div gain adjustment                |
| VR6  | CH2 input offset adjustment         | VR17 | CH2 MEMORY OUT gain adjustment           |
| VR7  | CH2 A/D V <sub>REF</sub> adjustment | VR18 | CH2 MONITOR OUT gain adjustment          |
| VR8  | CH1 PEN OUT gain adjustment         | VR19 | CH2 4 div/8 div select offset adjustment |
| VR9  | CH1 4 div gain adjustment           | VR20 | CH2 D/A gain adjustment                  |
| VR10 | CH1 MEMORY OUT gain adjustment      | VR21 | CH2 D/A offset adjustment                |
| VR11 | CH1 MONITOR OUT gain adjustment     |      |  |

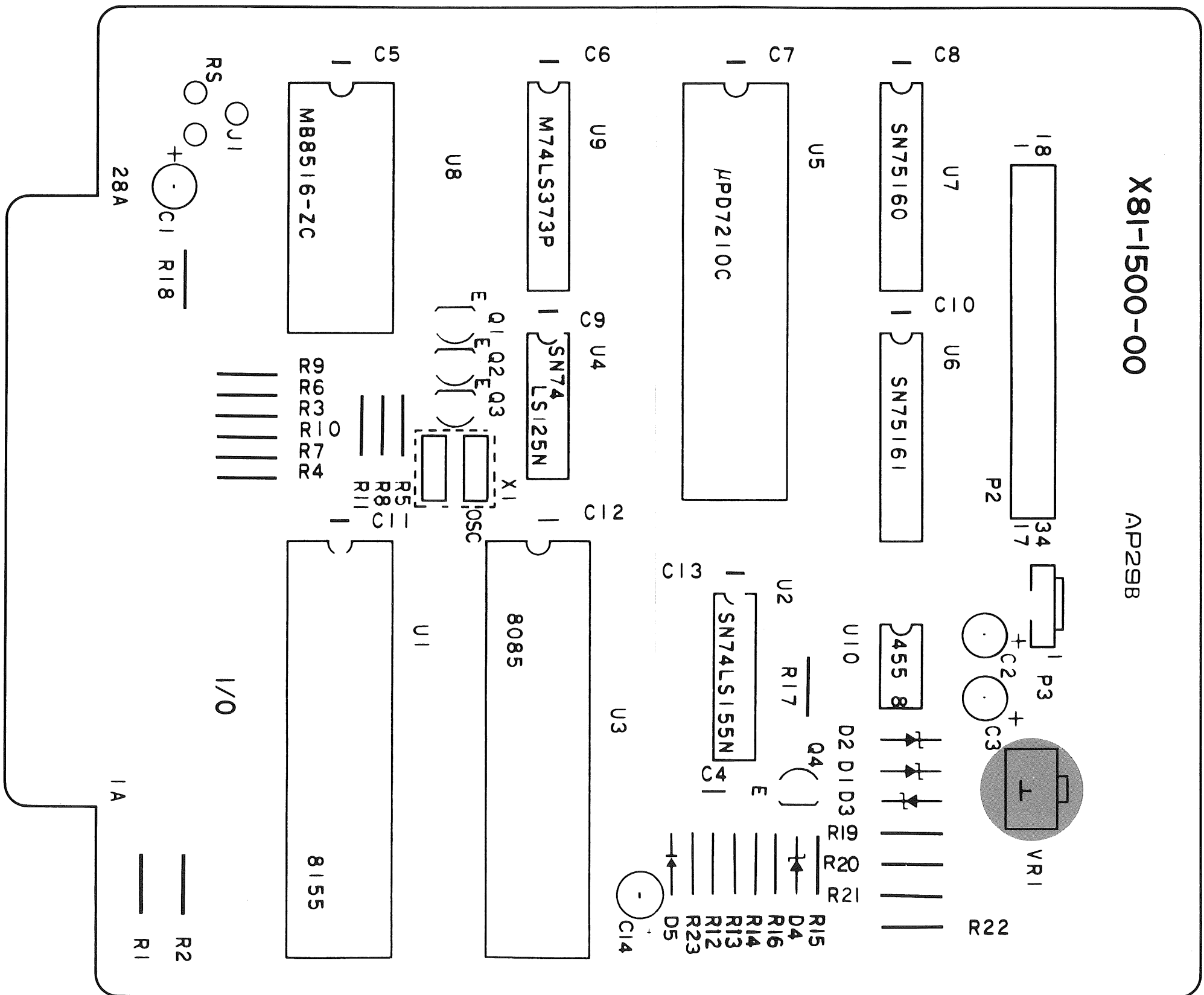
# SCHEMATIC DIAGRAM



Q1	: 2SA838(C)	U1, 2, 4, 6, 7, 9	: LM318N
Q2	: 2SC1047(C)	U3, 8, 28, 31	: LF411CN
Q3-5, 10, 12	: 2SK117(GR)	U5, 10	: TDC-100IJ
Q6-13	: 2SA1175(F)	U11, 14	: SN74LS374N
Q7, 14	: 2SC2785(F)	U12, 15	: SN74LS465N
Q8, 15	: 2SC1384(R)	U13, 22, 25	: SN74LS245N
Q9, 16	: 2SA684(R)	U16	: SN74S112N
Q11	: 2SA733(O)	U17, 19	: MB8416-20LP-G-RA
		U18	: MC14066BCP
		U20	: SN74LS08N
		U21, 24	: SN74LS273N
		U23	: MB3761M
		U26, 29	: DAC-08HP
		U27, 30	: LF412CN
		U32	: LM7905CT

# P. C. BOARD

GP-IB UNIT (X81-1500-00)

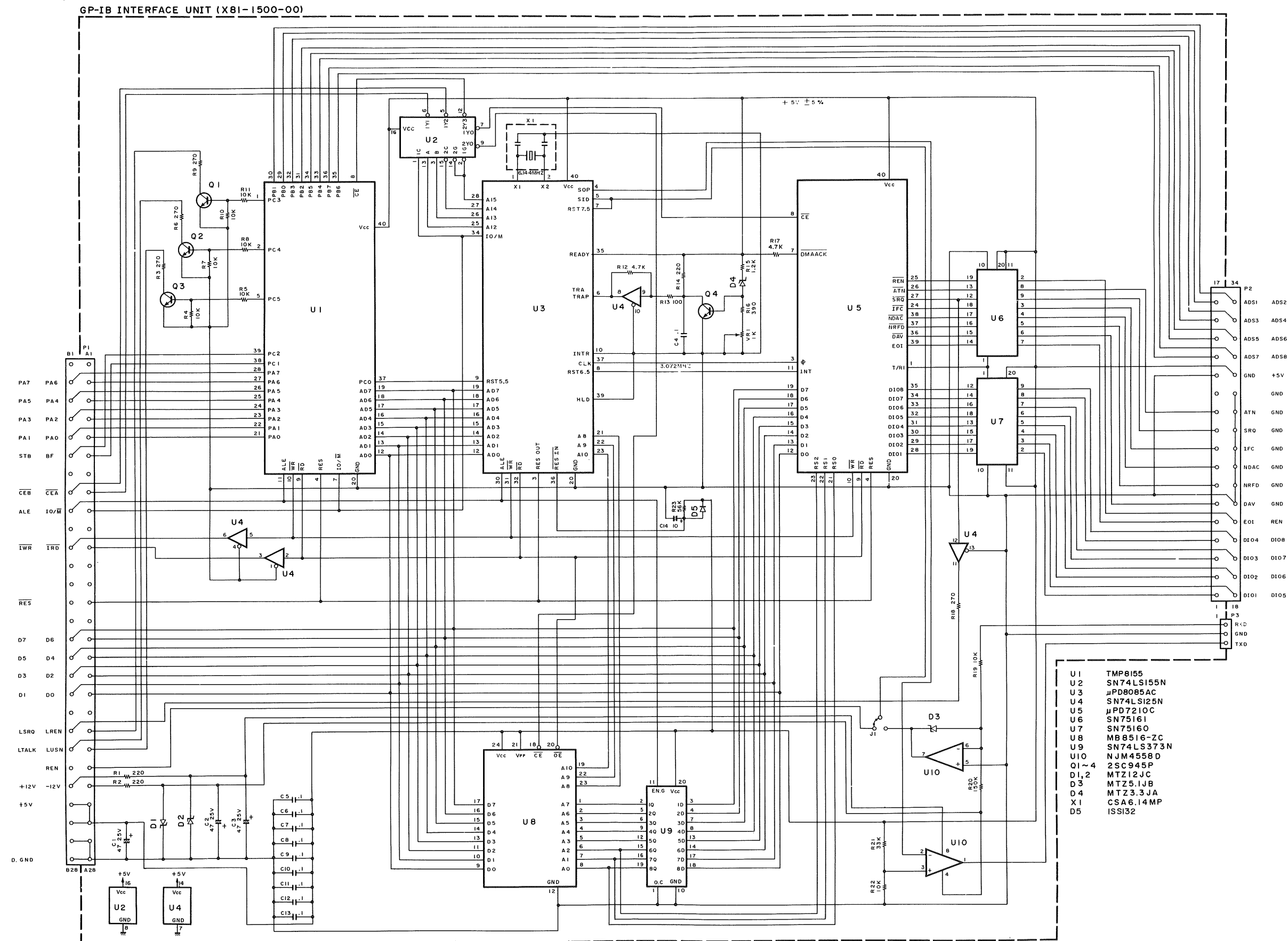


VR1 Power supply down adjustment



# SCHEMATIC DIAGRAM

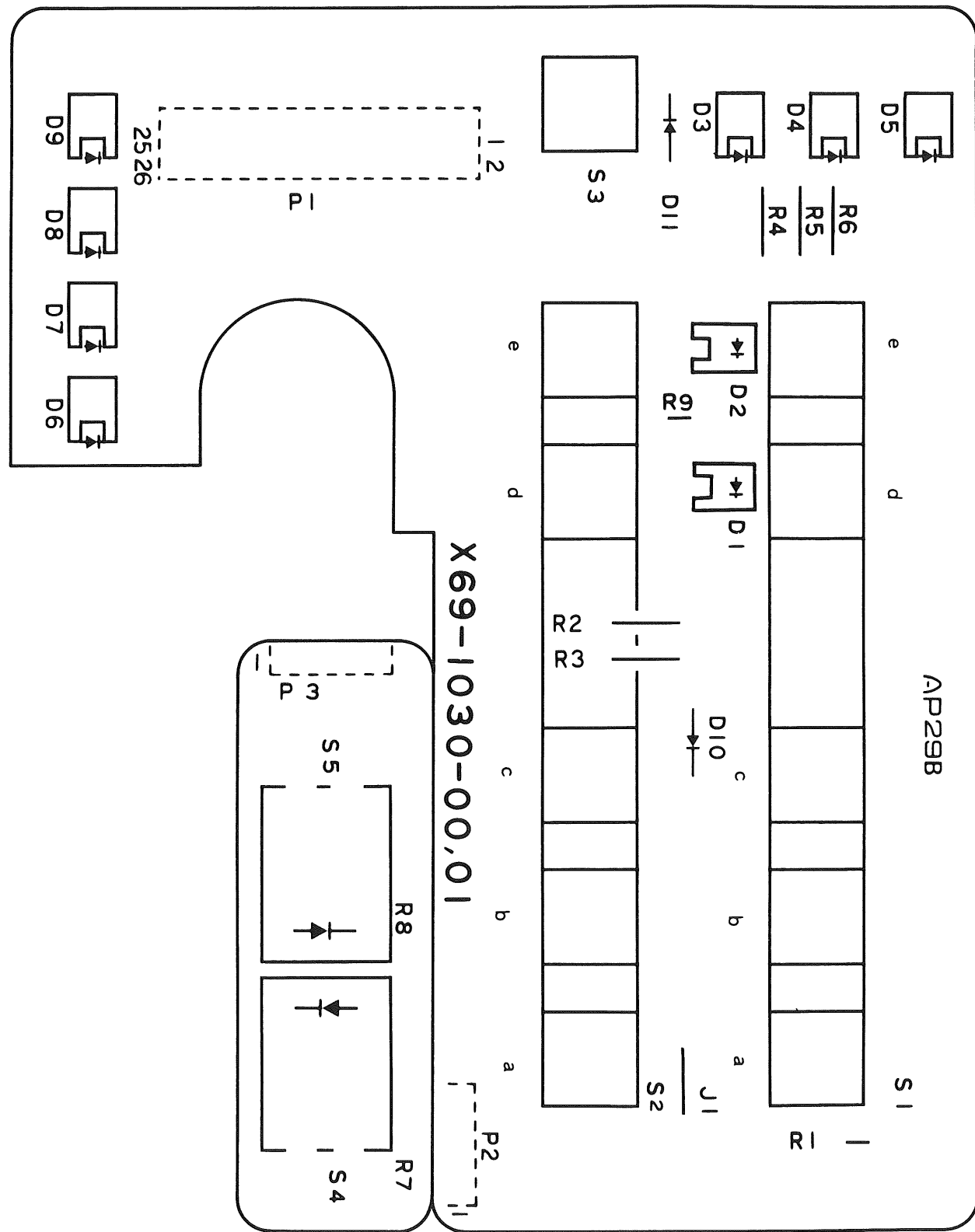
GP-IB UNIT (X81-1500-00)



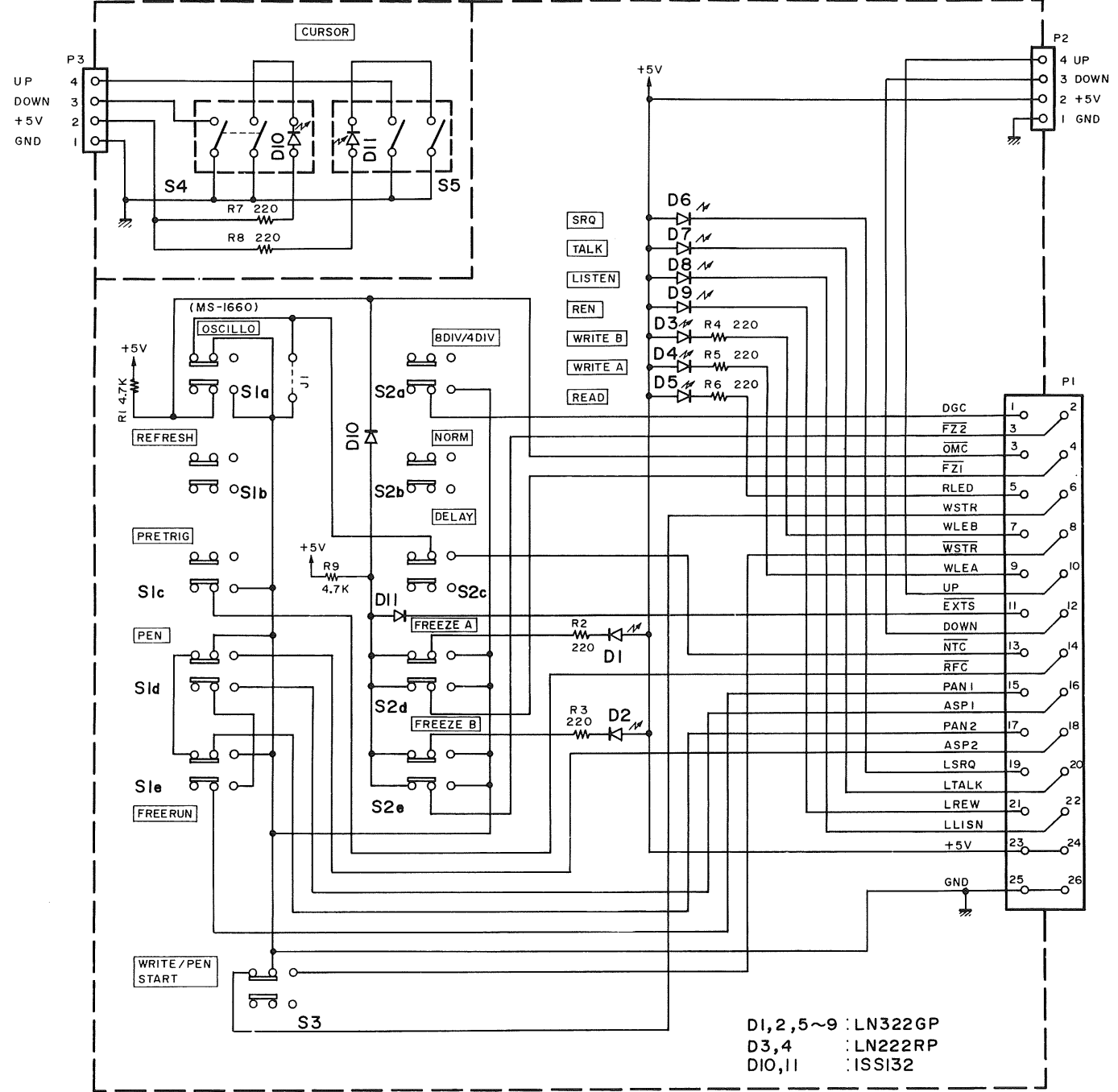


# P. C. BOARD/SCHEMATIC DIAGRAM

SWITCH BOARD UNIT (X69-1030 00)

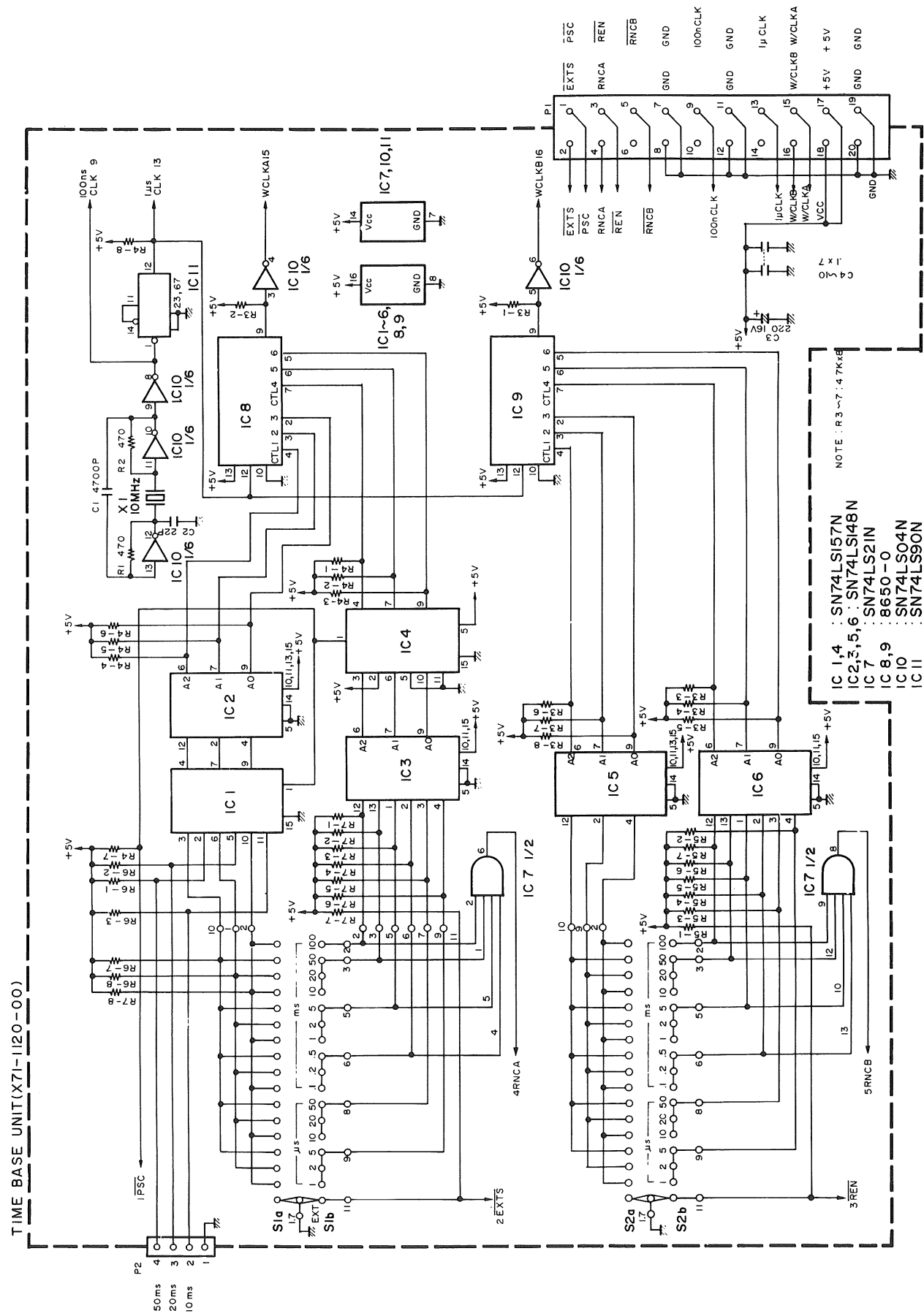
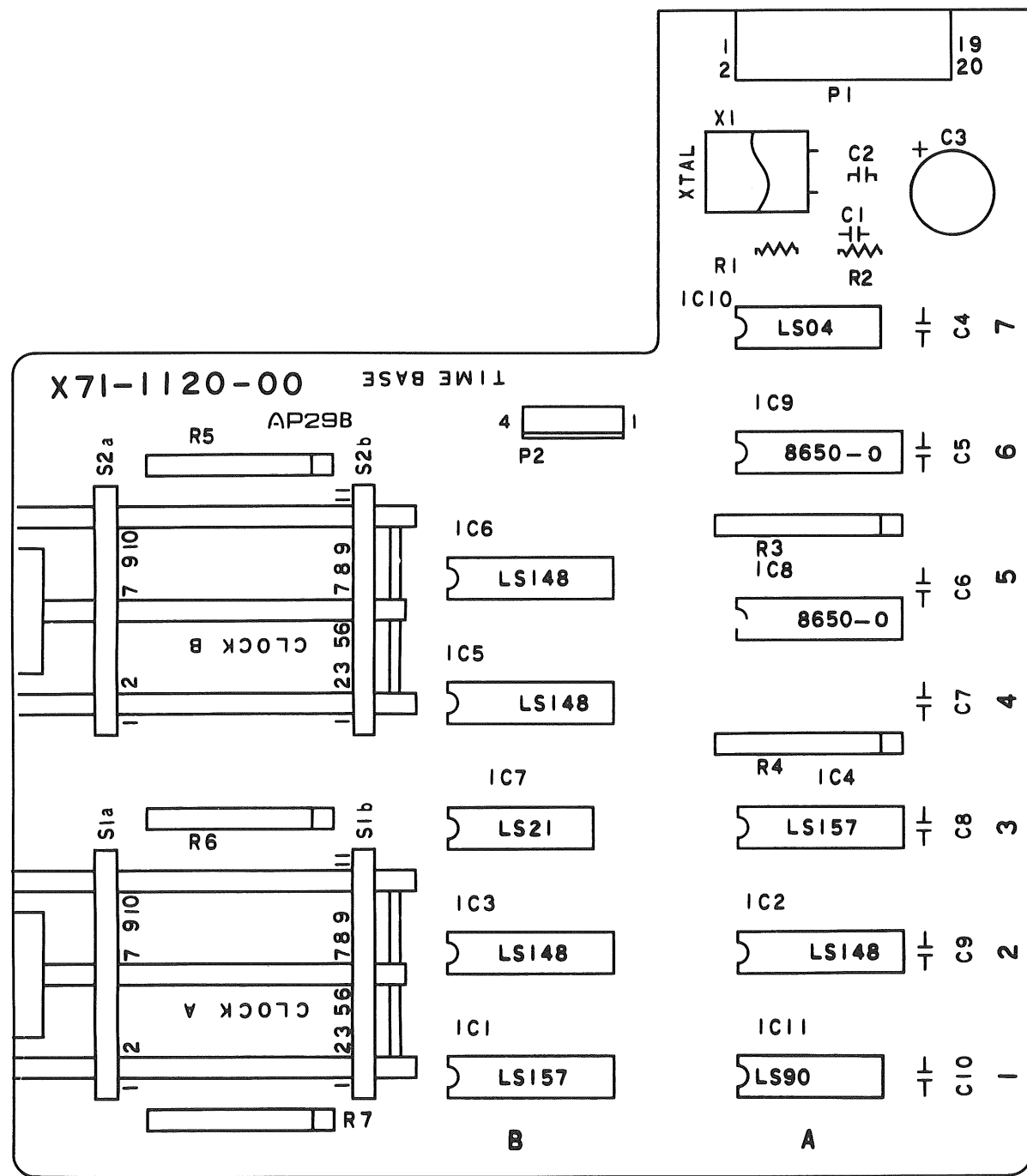


SWITCH BOARD UNIT (X69-1030-00,01)



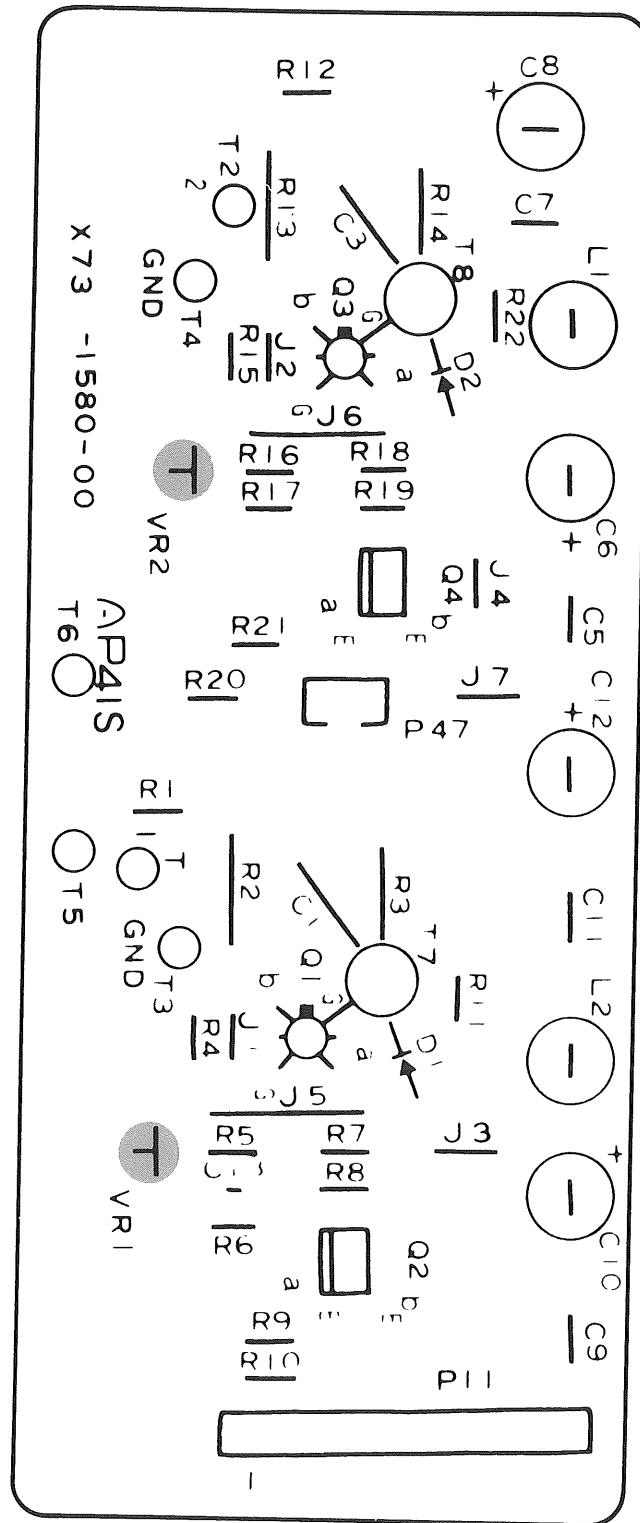
# P. C. BOARD/SCHEMATIC DIAGRAM

TIME BASE UNIT (X71-1170-00)

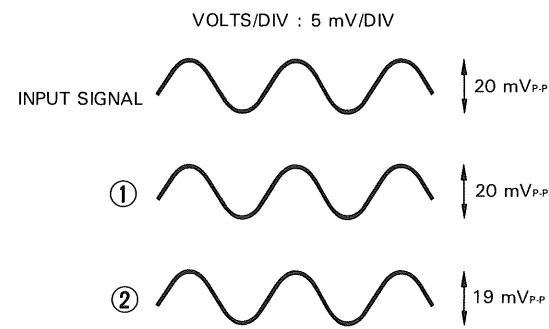


# P. C. BOARD/SCHEMATIC DIAGRAM

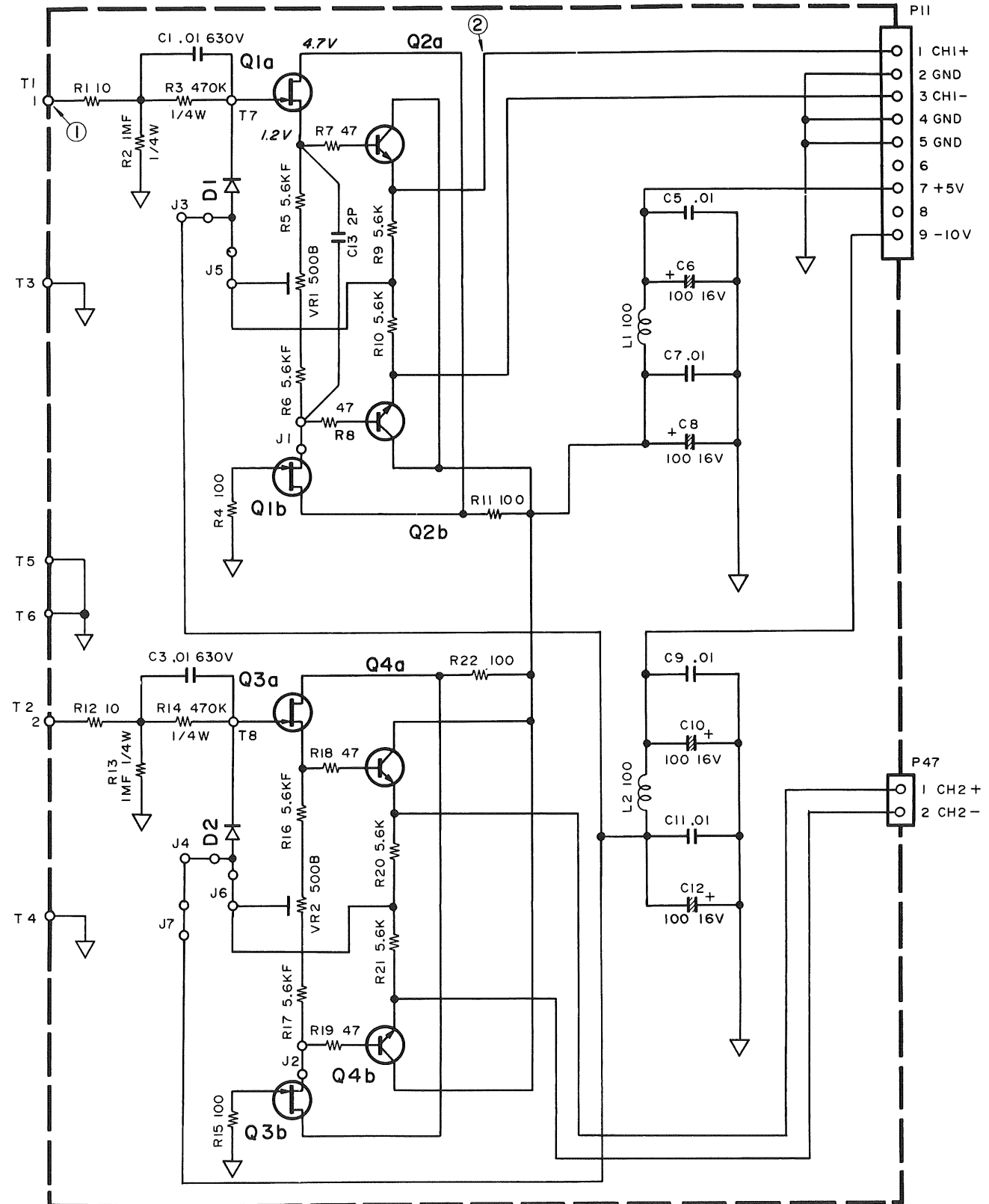
VERTICAL HEAD UNIT (X-73-1580-00)



VR1 CH1×5 GAIN balance adjustment  
VR2 CH2×5 GAIN balance adjustment



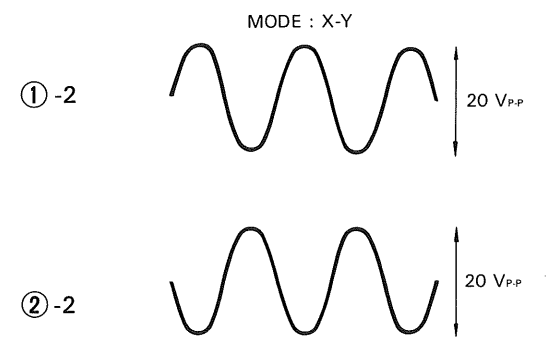
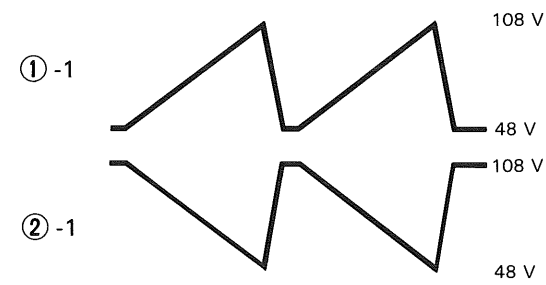
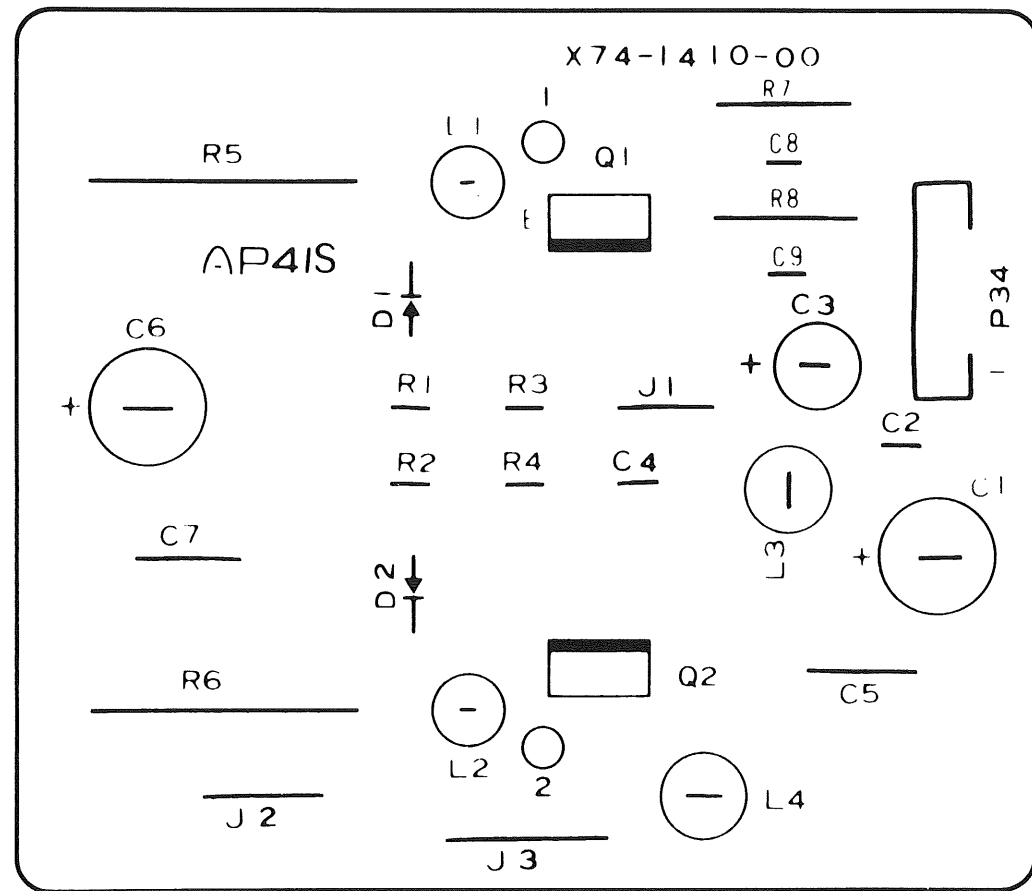
VERTICAL HEAD UNIT (X73-1580-00)



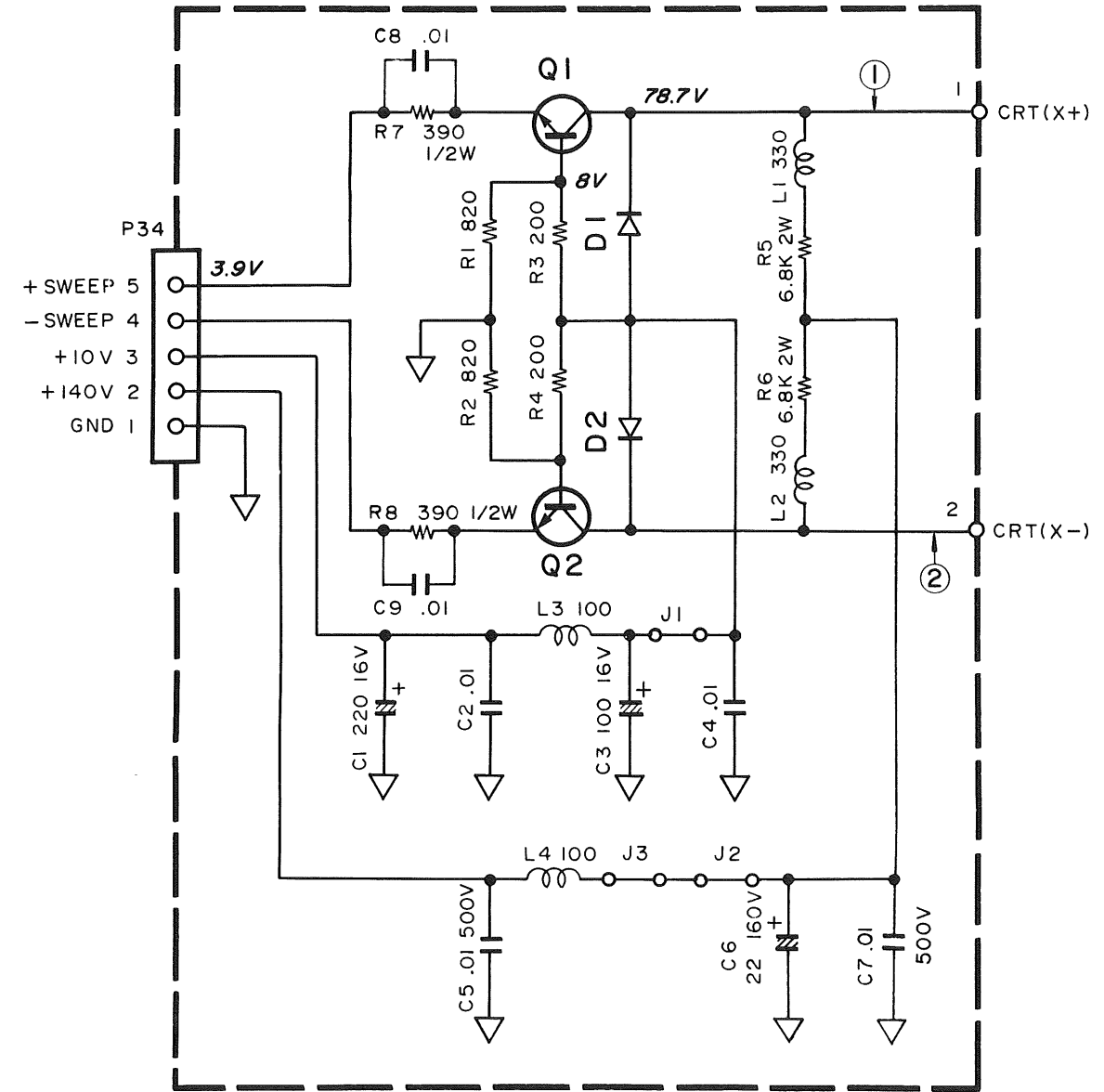
Q1,3 : DNI90I  
Q2,4 : 2SC3066(F,G)  
D1,2 : IS1544A

# P. C. BOARD/SCHEMATIC DIAGRAM

HORIZONTAL OUTPUT UNIT (X74-1440-00)



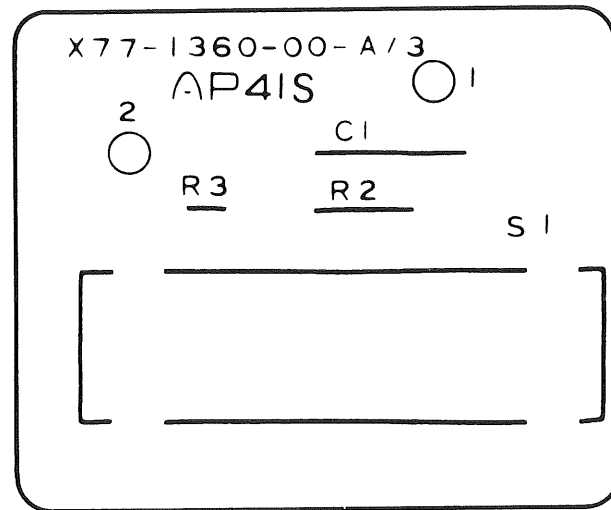
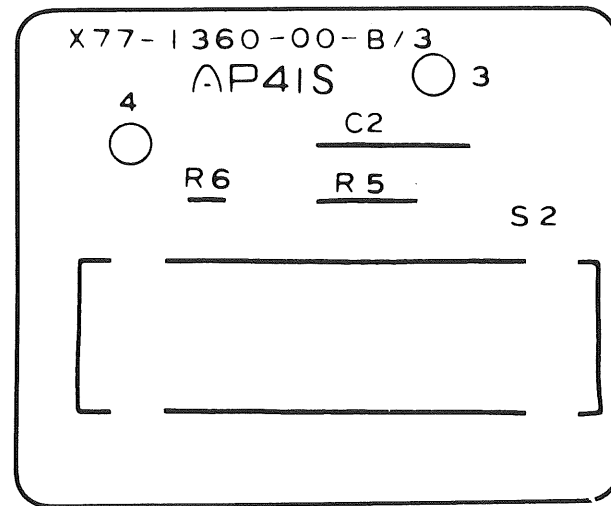
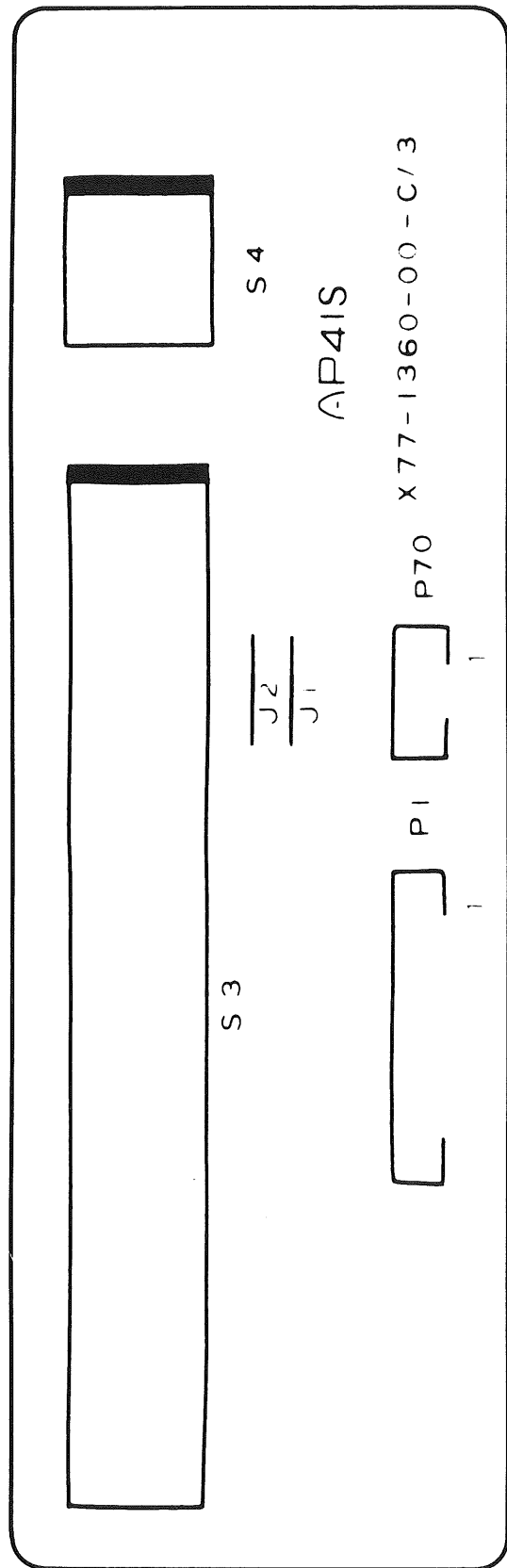
HORIZONTAL OUTPUT AMP UNIT (X74-1410-00)



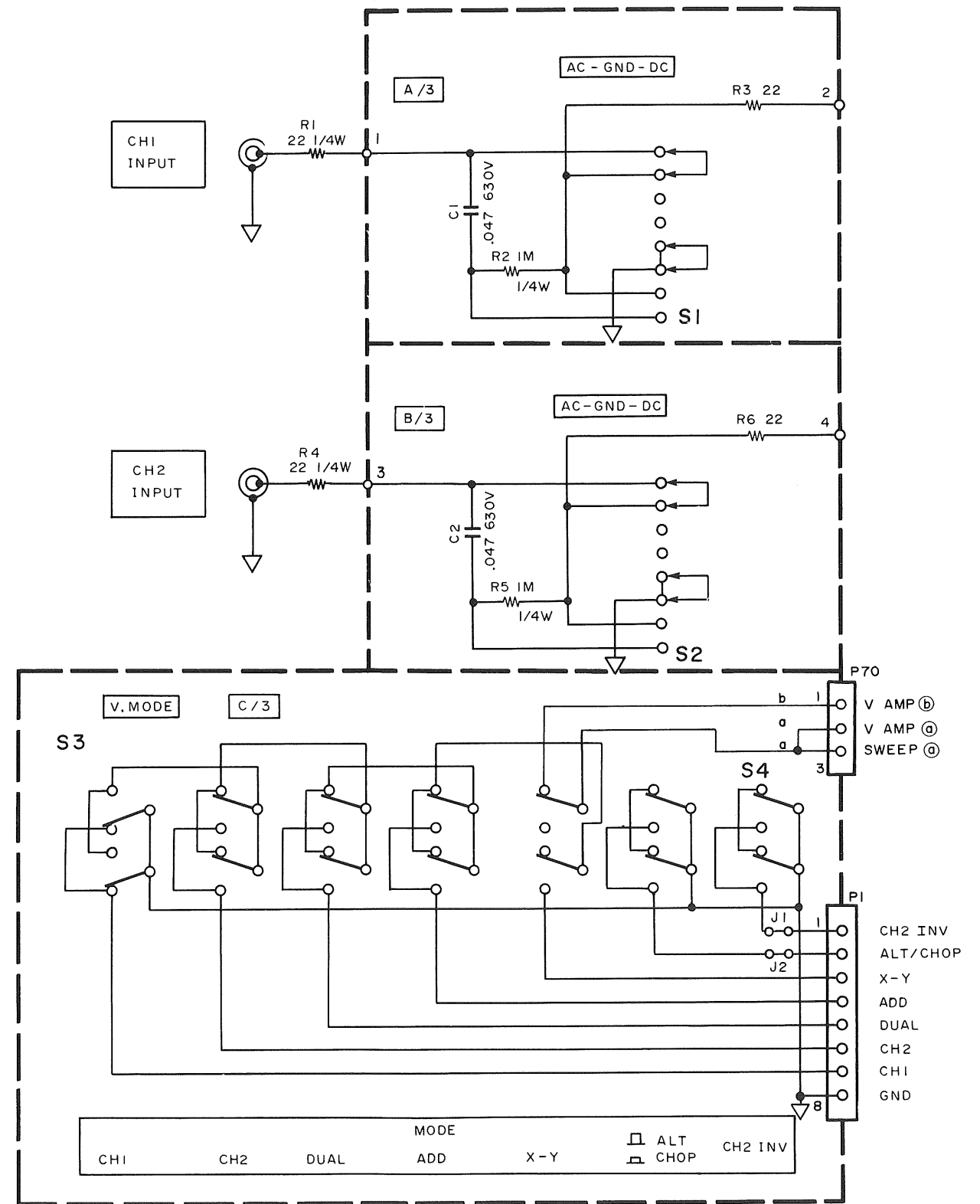
Q1,2 : 2SC1505  
D1,2 : ISS83

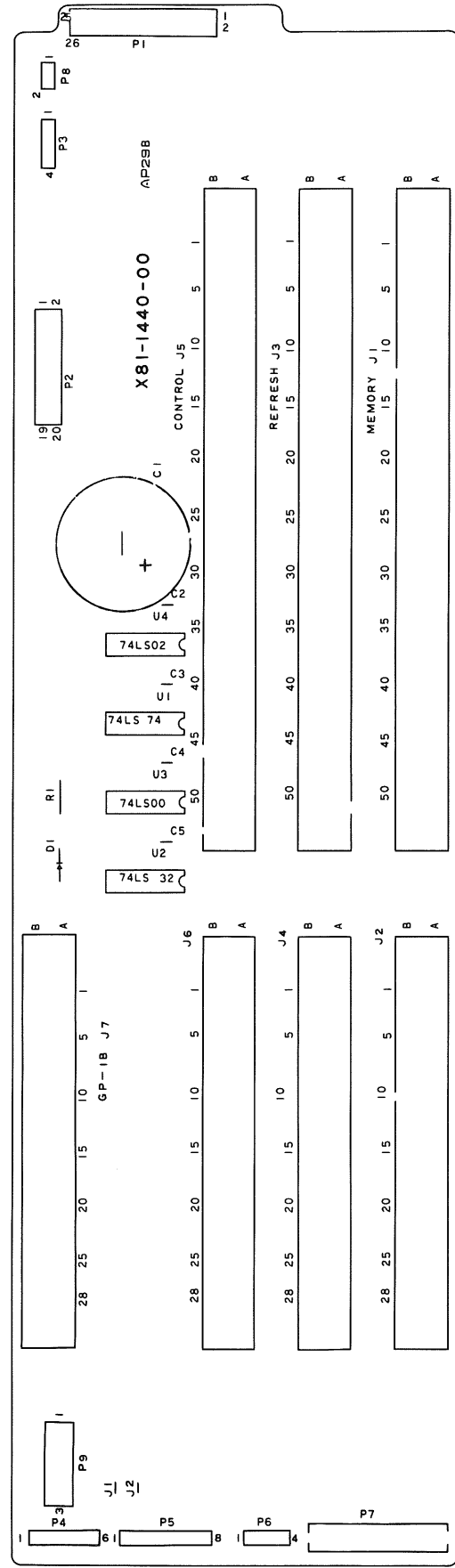
# P. C. BOARD/SCHEMATIC DIAGRAM

VERTICAL SWITCH UNIT (X77-1360-00)

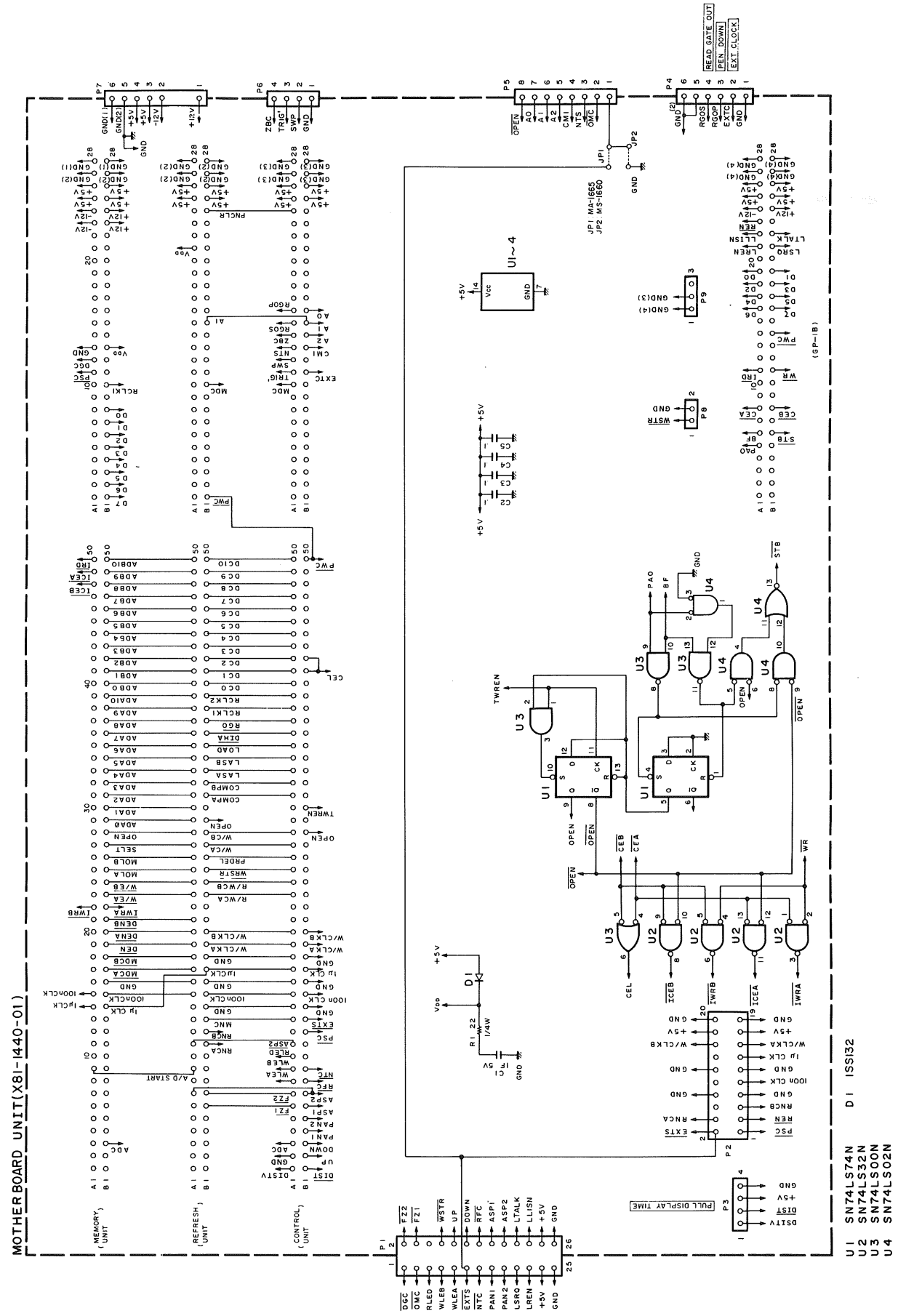


VERTICAL SWITCH UNIT (X77-1360-00)





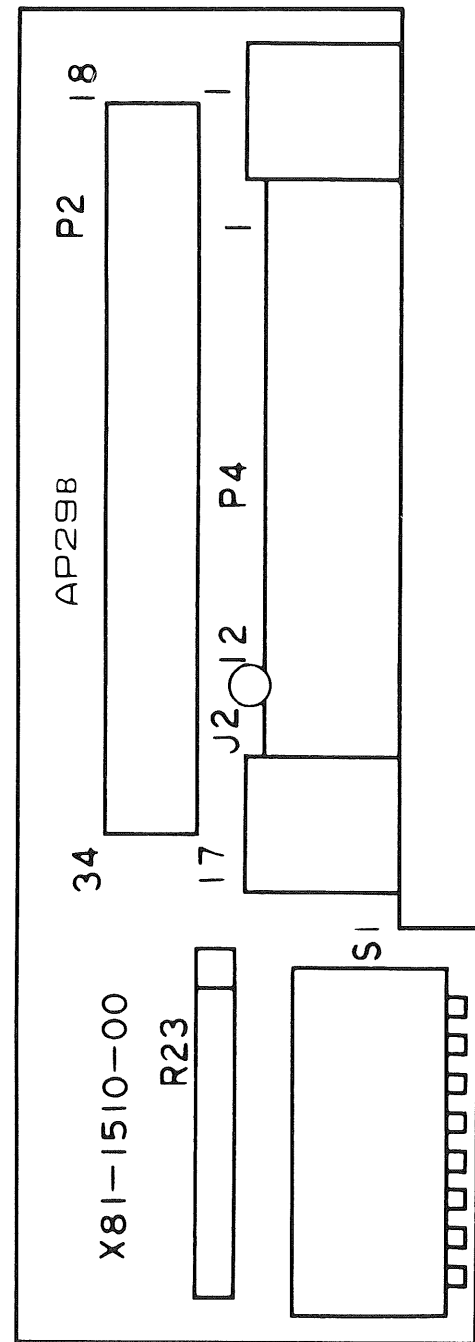
P. C. BOARD/SCHEMATIC DIAGRAM



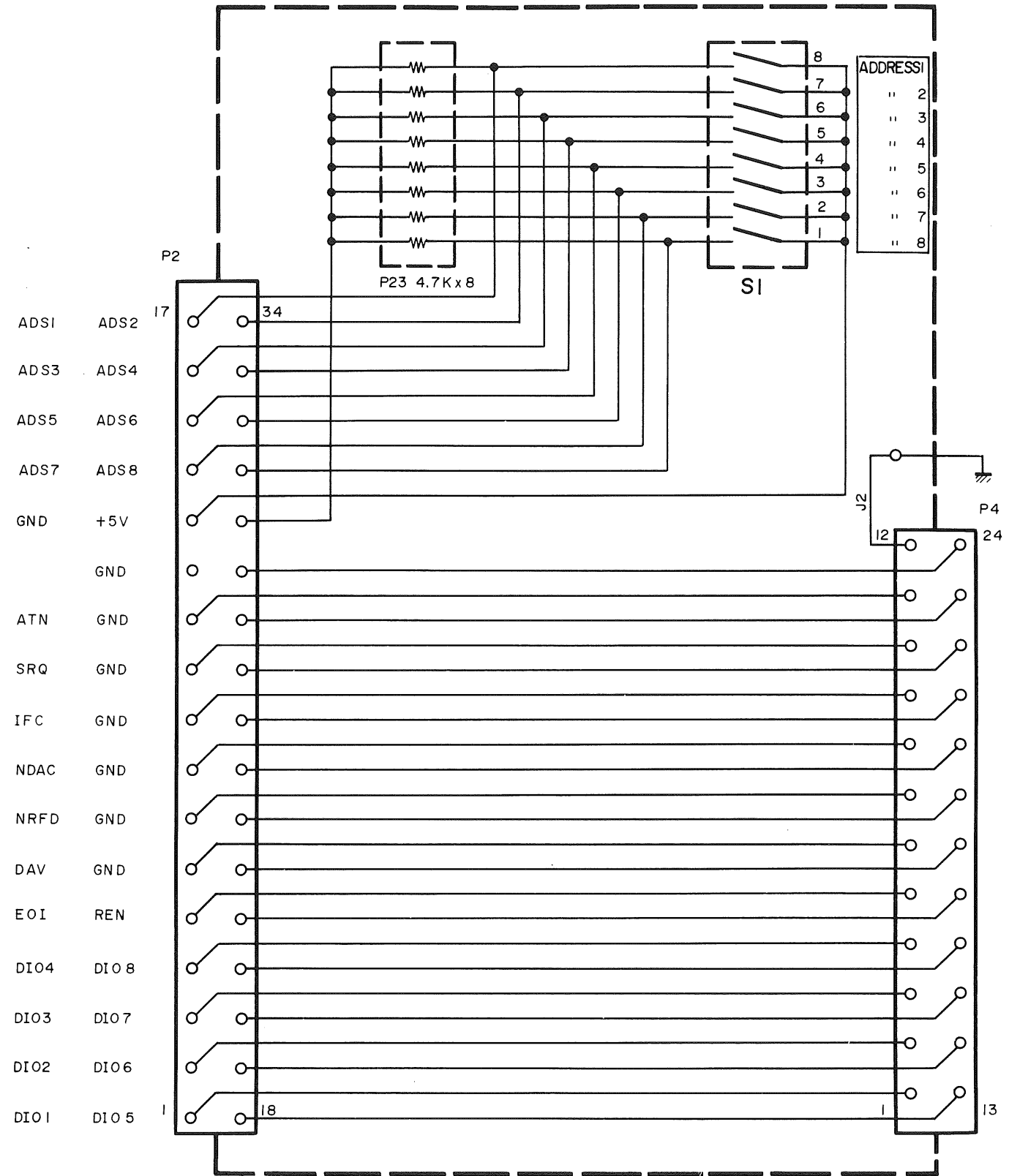


# P. C. BOARD/SCHEMATIC DIAGRAM

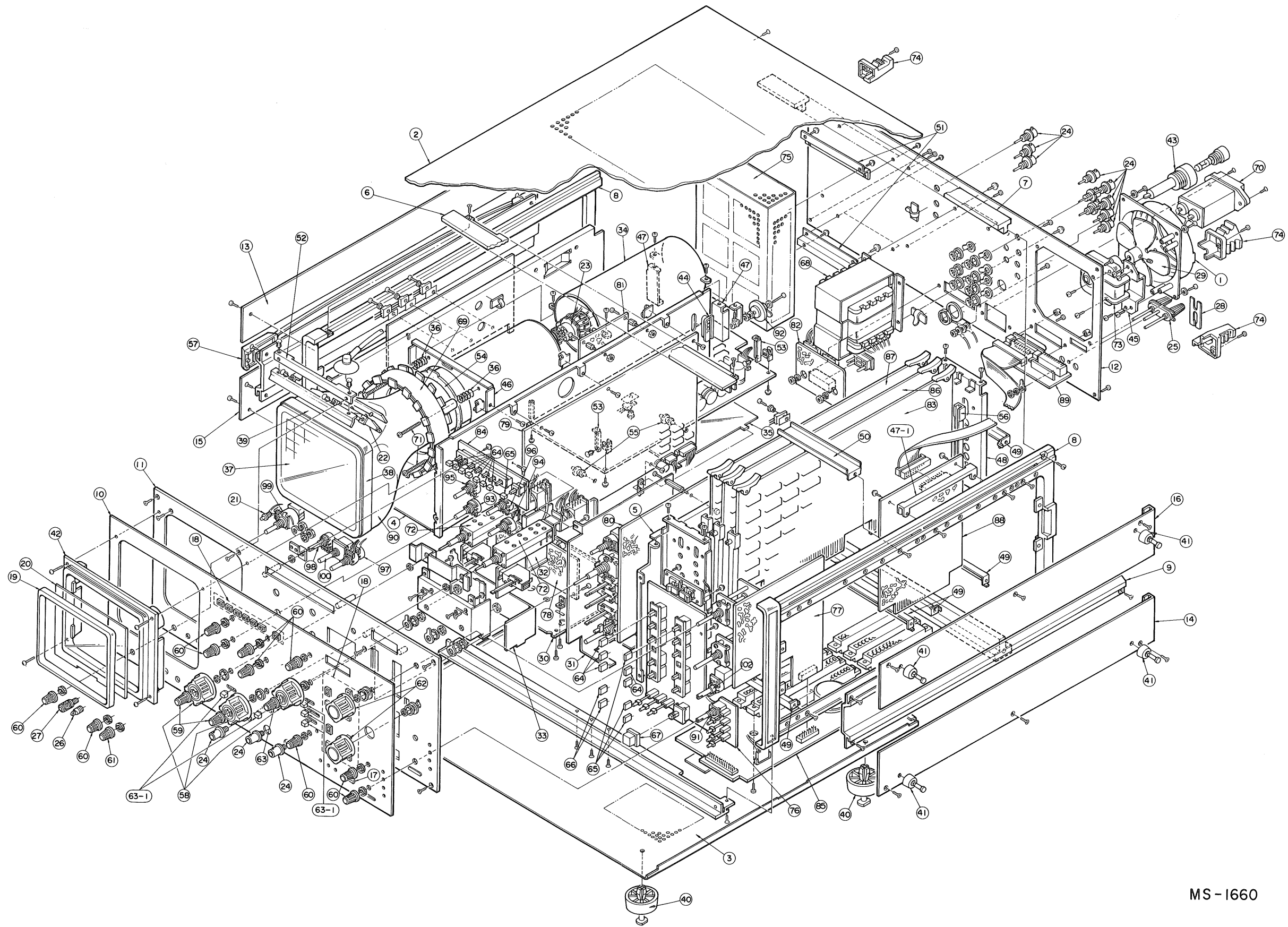
CONNECTOR BOARD UNIT (X81-1510-00)



CONNECTOR BOARD UNIT (X81-1510-00)

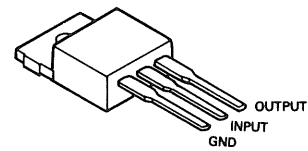


# DISASSEMBLY

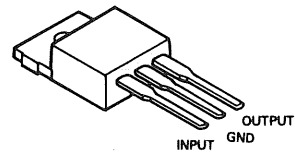


MS - 1660

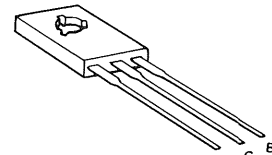
# SEMICONDUCTORS



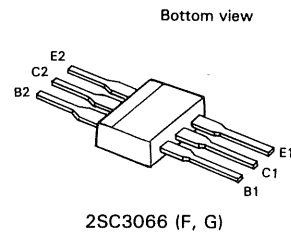
LM7905CT



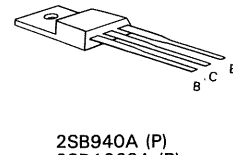
µA78M05UC  
MC78M05CT



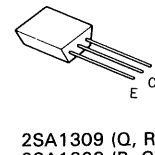
2SA1210 (S)  
2SC2912 (S)



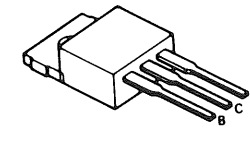
2SC3066 (F, G)



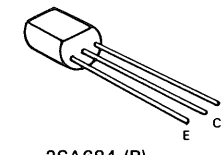
2SB940A (P)  
2SD1263A (P)



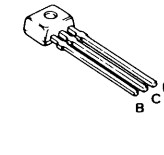
2SA1309 (Q, R)  
2SA1323 (B, C)  
2SC3311 (Q, R)  
2SC3315 (C, D)



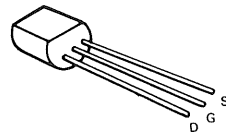
2SA1111 (Q)  
2SC2591 (Q)  
2SC1505  
2SD401A



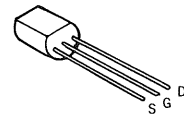
2SA684 (R)  
2SA838 (C)  
2SA733 (Q)  
2SC1973 (T)  
2SC1815 (GR)  
2SC1384 (R)  
2SC1047 (C)  
2SC945 (P)  
2SC2271



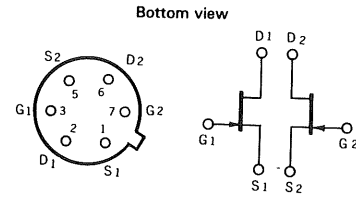
2SA1175 (F)  
2SC2786 (K)  
2SC2785 (F)



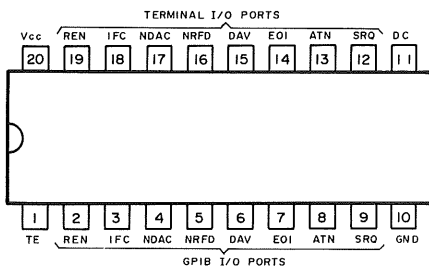
2SK117 (GR)



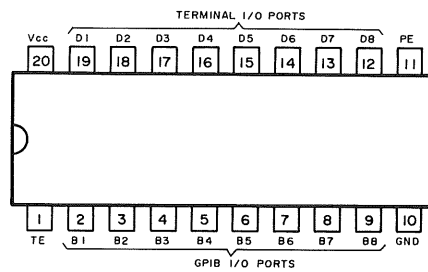
2SK30A (O)



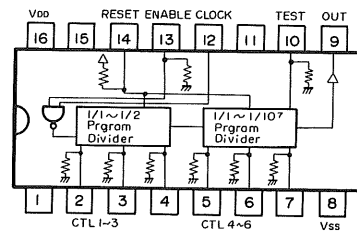
DN1901



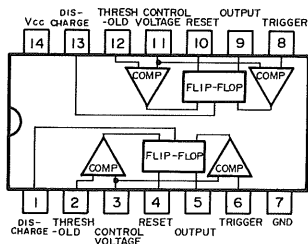
SN75161N



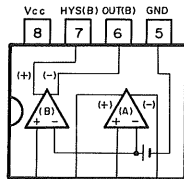
SN75160AN



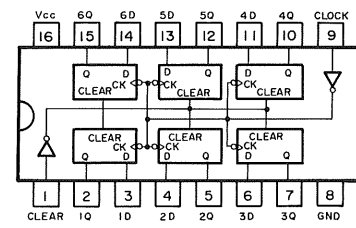
8650-O



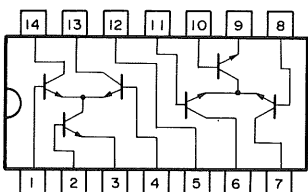
LM556CN



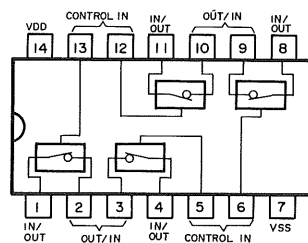
MB3761M



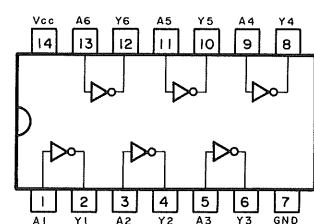
MC74HC174N



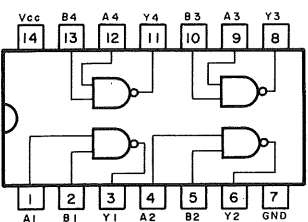
CA3102E



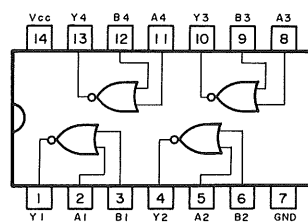
MC14066BCP



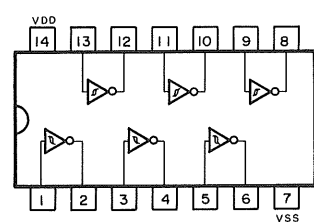
TC40H004P



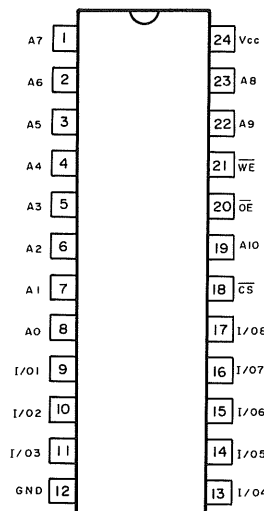
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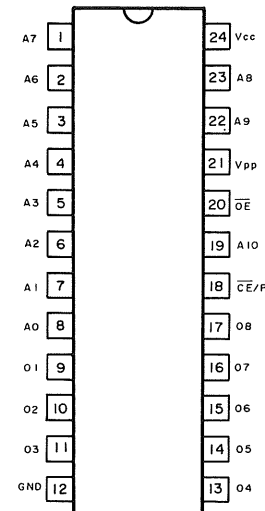
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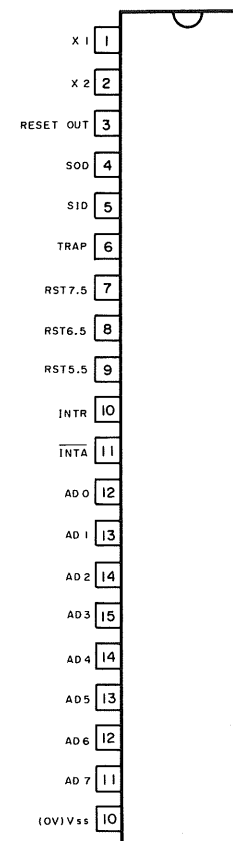
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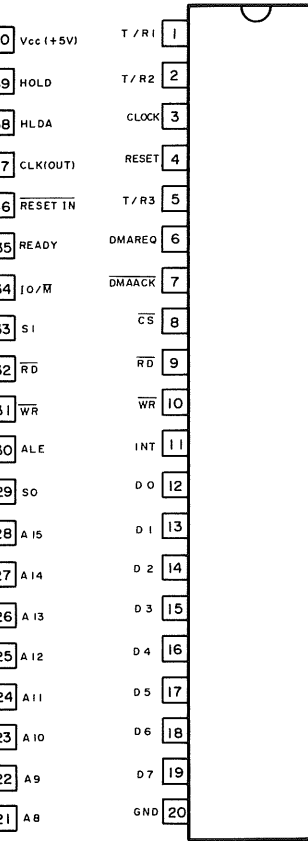
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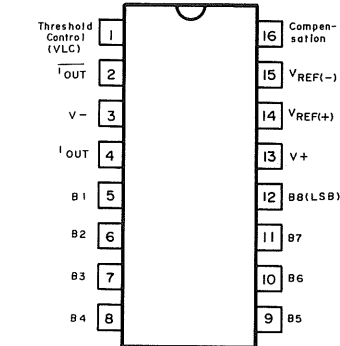
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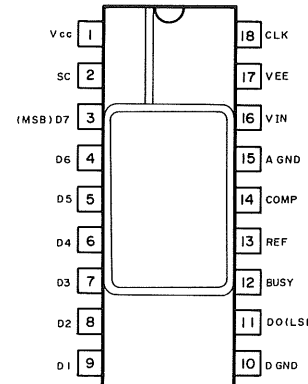
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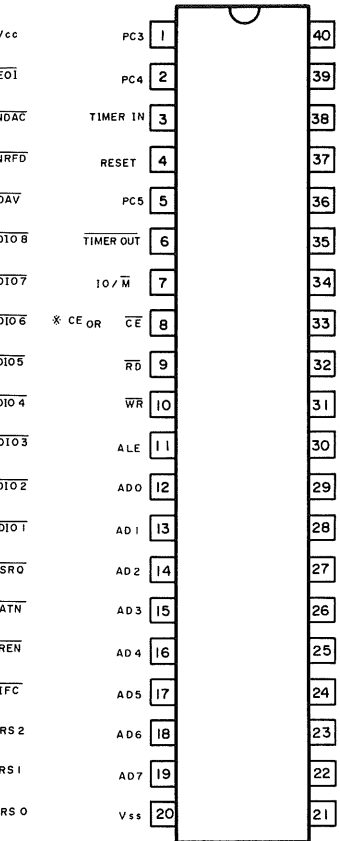
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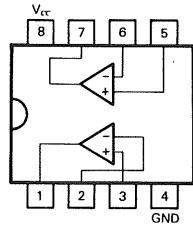


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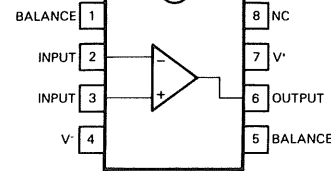


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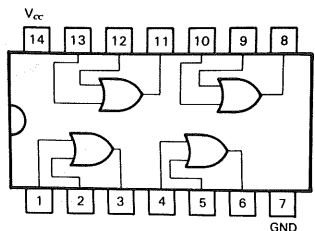
# SEMICONDUCTORS



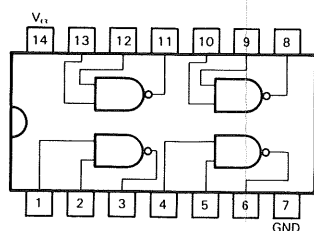
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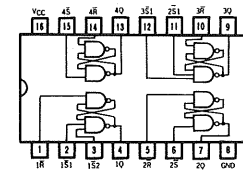
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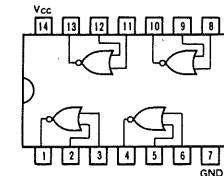
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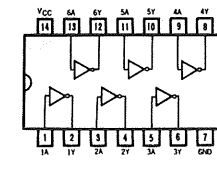
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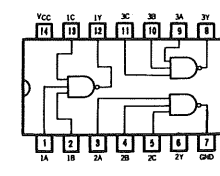
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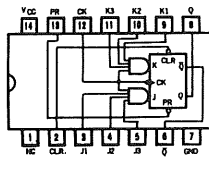
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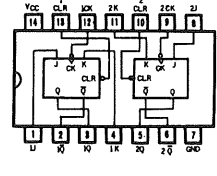
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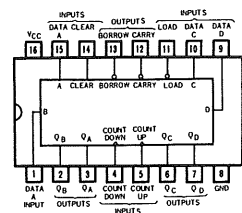
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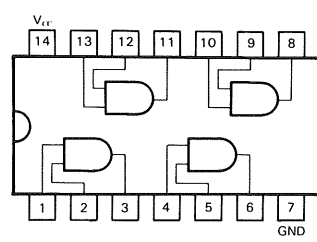
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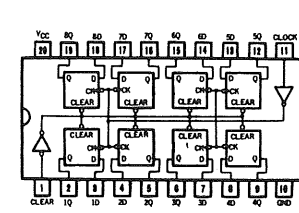
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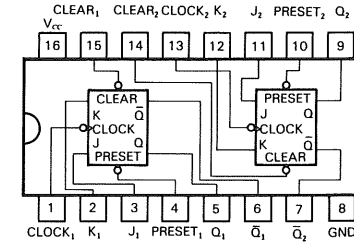
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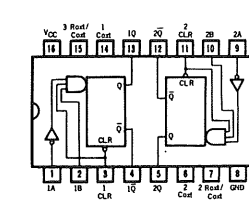
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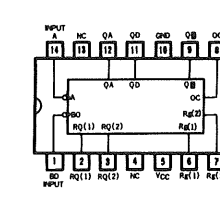
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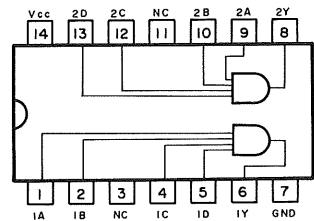
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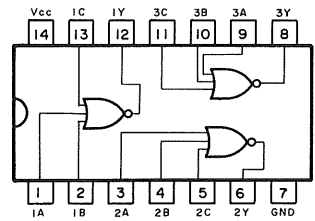
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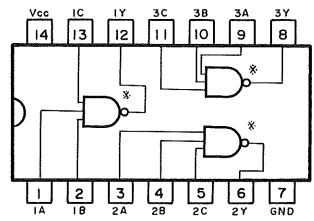
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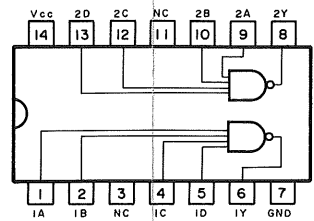
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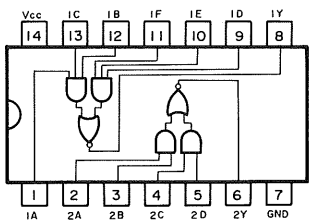
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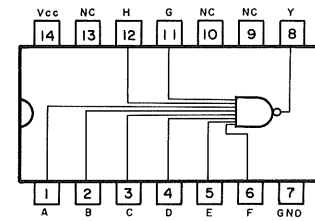
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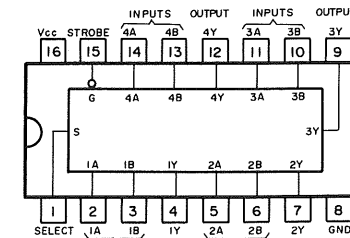
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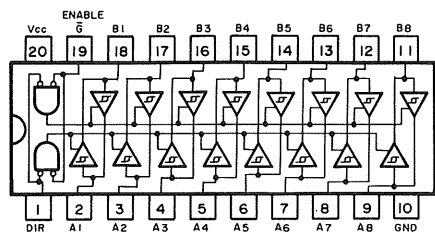
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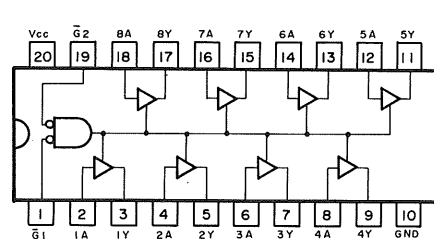
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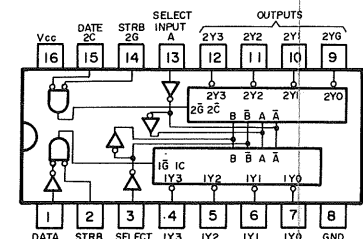
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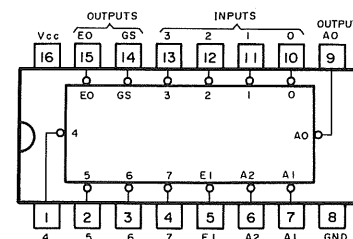
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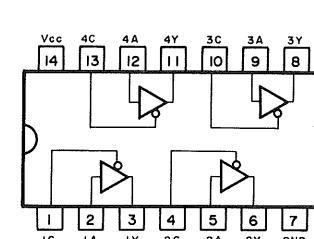
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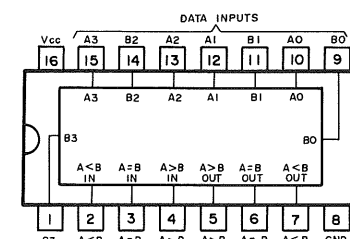
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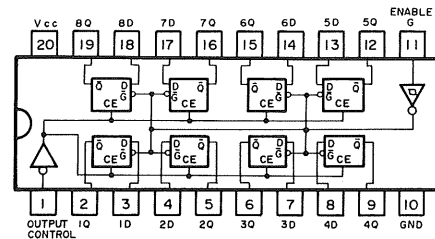
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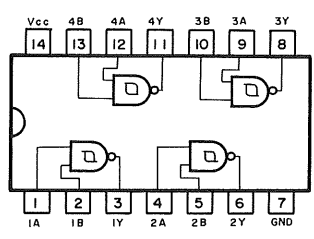
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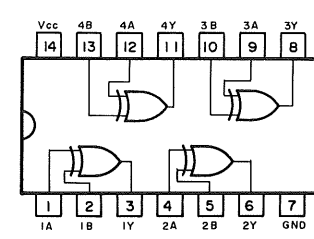
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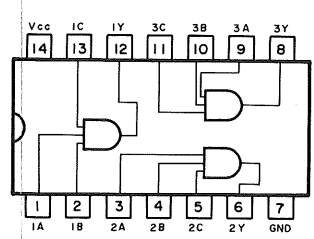
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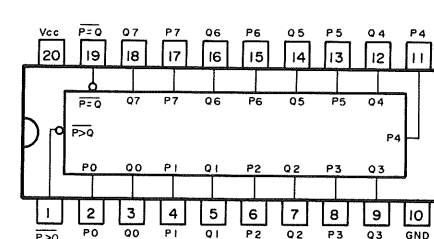
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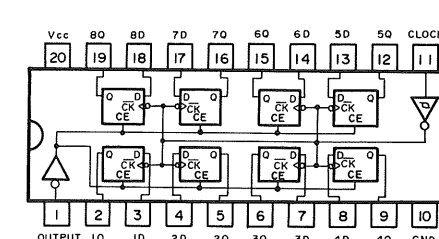
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SN74LS374N

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