

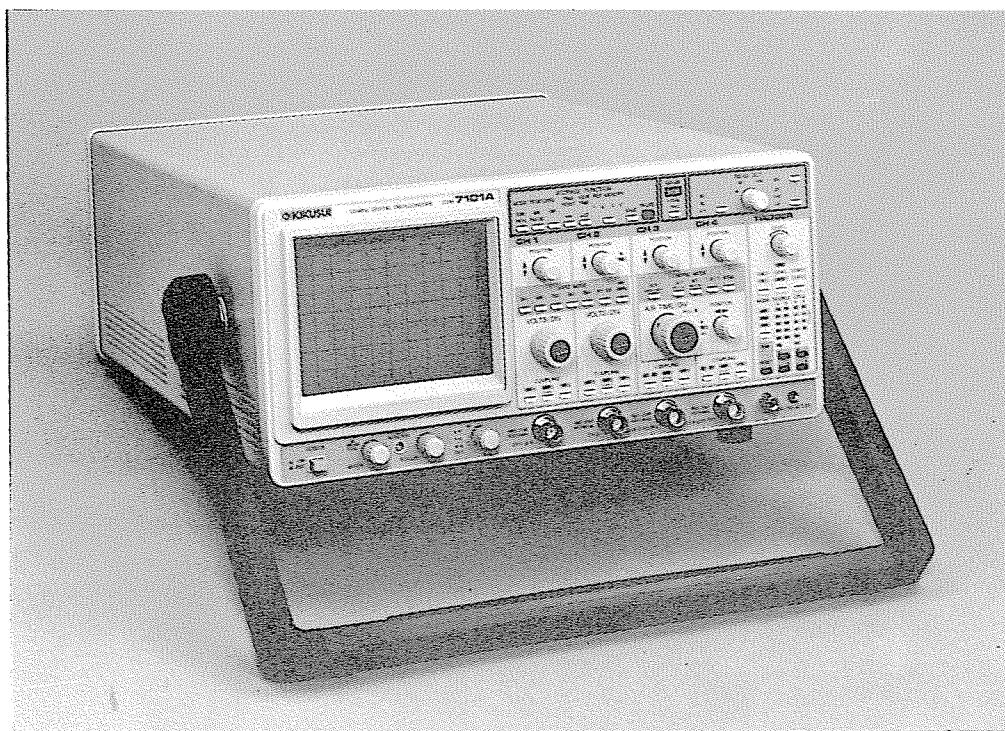
# S E R V I C E M A N U A L

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# 1. GENERAL

## 1-1. Description

The COM7101A/7100A have a frequency bandwidth of between DC and 100MHz, a maximum sensitivity of 1mV/DIV, and a maximum sweep speed of 2ns/DIV. In addition, four vertical and horizontal cursors are available to permit a multi-function CRT readout function.

Particularly, the COM7101A is provided with a digital storage function having a maximum sampling speed of 20ns, enabling instantaneously decaying events to be memorized.

The COM7101A is also provided with a GP-IB function, enabling data held by the digital storage function or CRT readout function to be sent to a computer or other device.

## 1-2. Features

### 1-2-1 Common Features of COM7101A/COM7100A

#### (1) CRT readout

All information concerning measurement together with the waveform of the signal being measured, are displayed on the CRT. The displayed items include the vertical sensitivity, input coupling mode, and timebase sweep speed and delay time, together with the measured values obtained using the cursor lines, and the measured values obtained from the internal digital voltmeter and frequency counter.

#### (2) 4-channel display

The oscilloscope employs a multi-mode select system which permits any combination of the four channels to be selected. All of the four channels provide the specified highest frequency range either at the BNC input terminals or at the probe tips.

#### (3) Cursor function

The two cursors displayed on the CRT permit measurement of voltage difference, time difference, and phase difference. In addition, the results of measurement are digitally displayed on the CRT.

When the tracking mode is activated, the two cursors can be moved while maintaining a constant distance between them.

#### (4) Digital voltmeter and frequency counter functions

The Oscilloscope contains a digital voltmeter and frequency counter. The digital voltmeter is a 3-1/2 digit auto-range digital multimeter which measures the DC, AC RMS, or peak-to-peak voltage of the signal applied to the input terminal of channel 1. The frequency counter is a 4-digit auto-range counter which measures the frequency of the trigger signal selected by the trigger source switch. The measured values are displayed on the CRT.

(5) Extensive use of ICs and self calibration function

A large number of newly developed ICs are employed in the main circuits of the oscilloscope, thereby minimizing the number of discrete components. As a result, reliability and maintainability are improved. The circuits are self-calibrating, ensuring reliable measurement.

(6) Memory for panel setting

All data for panel setting is stored in the internal memory of the oscilloscope and is not destroyed even when the power is turned off. When the power switch is turned on again, the panel setting is automatically restored.

(7) Programmable functions

By using the RC01-COM remote controller in combination with the oscilloscope, up to 100 different panel settings can be memorized and recalled by a simple pushbutton operation.

(8) Requirement line voltage

Both the COM7101A/COM7100A operate on any line voltage within a range of 90 to 250 VAC without requiring any switching procedure.

(9) Automatic triggering level control, requiring no manual adjustment

(10) 4-channel alternate triggering, allowing input signals of different frequencies to be triggered

(11) A TV synchronizing separator for TV.V or TV.H

(12) A linear focus circuit, requiring no manual focus adjustment each time intensity is varied

(13) 3-channel X-Y operation

### 1-2-2 Features of COM7101A

(1) Sampling rate of up to 50MS/sec

The maximum sampling rate is 50MS/sec and the vertical resolution is 8 bits, allowing to capture one-shot phenomena of up to 20MHz.

(2) Digitizing of periodic signals up to 100MHz

Periodic signals of up to 100MHz can be captured by equivalent sampling. the equivalent sampling rate in this case is as high as 10 GS/sec.

(3) Envelope mode for detecting one-shot glitches of down to 20ns

The oscilloscope has a peak value detector circuit which is able to capture periodic pulses of as narrow as 20ns within one sampling period, and to display the maximum and minimum values. This circuit can thus detect pulses of very short duration which occur in slowly changing phenomena and, even when the frequency of the input signal has become higher than one-half of the sampling frequency, aliasing that may cause measuring error can be identified.

(4) Reference memory for storing up to four waveforms

In addition to the display memory, the storage section has a reference memory for up to four waveforms which can be arbitrarily re-written. The reference memory is internally backed up, enabling the stored data to be maintained for a long period.

(5) Other

Various convenient functions are realized with the digital storage, such as pretriggering for viewing the signal waveform preceding the trigger point, interpolation which is convenient for measuring high-speed one-shot phenomena, expansion of time base up to 100 times for stored signal magnification, roll mode which is convenient for monitoring low-speed continuous signals, and delayed magnification which allows high-speed sampling of any portion of a signal sampled at a slow rate.

(6) GP-IB interface functions

Waveform data and front panel setting informations can be transferred to computer in the storage mode, enabling the oscilloscope to be used as a fully programmable digital storage instrument.

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## 2. SPECIFICATION

### 2-1. Vertical Axis

Item	Specification	Remarks
CH1, CH2		
Deflection factor	1mV / DIV to 5V / DIV	1-2-5 sequence, 12 settings
Accuracy	5mV / DIV to 5V / DIV : $\pm 2\%$ 1mV / DIV, 2mV / DIV : $\pm 4\%$	15 to 35°C, 1kHz, 4 to 5 DIV reference
Frequency bandwidth	DC to 100MHz within -3dB DC to 30MHz within -3dB (1mV / DIV, 2mV / DIV) Lower limit frequency of AC coupling : 10Hz	50kHz 8 DIV reference COM7101A : REAL MODE
Variable Factor	Continuously variable attenuation to 1/2.5 or less of set value	
Input impedance	$1M\Omega \pm 1\%$ , $20PF \pm 3PF$	
CH3, CH4		
Deflection factor	0.1V / DIV, 0.5V / DIV	2 settings
Accuracy	$\pm 5\%$	15 to 35°C 1 kHz, 4 to 5 DIV reference
Frequency bandwidth	DC to 100MHz within -3dB Lower limit of AC coupling : 10Hz	50kHz 8 DIV reference COM7101A : REAL MODE
Input impedance	$1M\Omega \pm 1\%$ , $20PF \pm 3PF$	
Maximum safe input voltage	400V peak (DC + AC peak)	AC : 1kHz max
Input coupling	AC, GND, DC	
Rise time	Approx. 3.5ns ; Approx. 11.7ns (1mV / DIV, 2mV / DIV)	Theoretic values COM7101A : REAL MODE
Channel modes	CH1, ADD (CH1 + CH2), CH2, CH3, CH4 Any combination of the above. X-Y display with CH1 as X and any or all of CH2, CH3 and CH4 as Y.	
Time Difference Among Channels	$\pm 500ps$ (of all channels)	Except 1mV / DIV, 2mV / DIV ranges
Signal delay time	Approx. 40ns	
CHOP frequency	Approx. 1MHz	
Bandwidth limiter	20MHz $\pm 5$ MHz within -3dB	
Polarity select	For CH2 only	
CH1 Signal output	Open : Approx, 50mV/DIV Terminated ( $50\Omega$ ) : Approx, 25mV/DIV  Freq.band width : DC to 100MHz within -3dB	

## 2-2. Triggering

Item	Specification	Remarks
A trigger		
Signal	CH1, CH2, CH3, CH4, LINE, and V-MODE (In the V-MODE, channels which normally operate in the VERT modes are used as signal sources. In the ADD mode, CH1 is used as a signal source. In the CHOP mode or AUTO LEVEL mode, the leftmost of the operating channels indicated by the VERT mode lamps on the panel is used as a signal source.)	V-MODE is effective in the ALT SWEEP mode or SINGLE SWEEP mode, or when the AUTO LEVEL mode is cancelled.
Coupling	AC, LF REJ, HF REJ, DC, TV-V, TV-H	
Polarity	+ or -	
Sensitivity	DC to 10MHz : 0.4 DIV DC to 100MHz : 1.5 DIV TV-V, TV-H : 1.0 DIV  AC : Attenuates signal components of 10 Hz and lower  LF-REJ : Attenuates signal components of 50kHz and lower  HF-REJ : Attenuates signal components of 50kHz and higher	
AUTO LEVEL	Add 0.5 DIV to above values.	For sinusoidal waves
Modes	AUTO : When no triggering signal is applied, sweep runs automatically.  NORM : When triggering signal is lost, trace disappears, and sweep goes into READY state.  SINGL : When triggering signal is applied, sweep runs only once. When RESET key is pressed, sweep is reset to READY state. And ready LED lights.	COM7101A : REAL MODE
B trigger		
Triggering signal source	CH1, CH2, CH3, CH4, and V-MODE (In the V-MODE, channels which normally operate in the VERT modes are used as signal sources. In the ADD mode, CH1 is used as a signal source. In the CHOP mode or AUTO LEVEL mode, the leftmost of the operating channels indicated by the VERT mode lamps on the panel is used as a signal source.)	V-MODE is effective in ALT SWEEP mode or SINGLE SWEEP mode or when AUTO LEVEL mode is cancelled.
Coupling	AC, LF REJ, HF REJ, DC	
Polarity	+ and -	
Sensitivity	DC to 10MHz : 0.4 DIV DC to 100MHz : 1.5 DIV AC : Attenuates signal components of 10 Hz and lower  LF REJ : Attenuates signal components of 50 kHz and lower  HF REJ : Attenuates signal components of 50 kHz and above	
AUTO LEVEL	Add 0.5 DIV to above value.	For sinusoidal waves

### 2-3. Horizontal Axis

Item	Specification	Remarks
A sweep		
Sweep speed	COM7100A 20ns / DIV to 0.5s / DIV COM7101A REAL : 20ns / DIV to 0.5s / DIV STORAGE : 20ns / DIV to 5s / DIV	1-2-5 sequence
Sweep error	Within $\pm 2\%$	15 to 35°C ; Accuracy for 8 DIV at center of CRT
Sweep variable	Sweep speed can be increased to at least 2.5 times set value.	COM7101A : REAL MODE
Variable hold-off	Provided	COM7101A : REAL MODE
B sweep		
Sweep speed	COM7100A 20ns / DIV to 0.5s / DIV COM7101A REAL : 20ns / DIV to 0.5s / DIV STORAGE : 20ns / DIV to 50ms / DIV	1-2-5 sequence
Accuracy	within $\pm 2\%$	15 to 35°C ; Accuracy for 8 DIV at center of CRT
Delayed sweep		
Type of sweep	Continuous delay, triggered delay	
Delay jitter	Less than 1 / 10,000	
Sweep magnification	10 times Maximum sweep speed : 2ns / DIV	In ALT mode, B sweep alone is magnified.
Accuracy of sweep magnification	COM7101A 5ns / DIV to 0.5s / DIV : $\pm 4\%$ 2ns / DIV : $\pm 8\%$  COM7100A 5ns / DIV to 50ms / DIV : $\pm 4\%$ 2ns / DIV : $\pm 8\%$	15 to 35°C ; Accuracy for 8 DIV at center of CRT
X-Y operation		COM7101A : REAL MODE
X-Y operation	X axis : CH1 Y axis : CH2, CH3, CH4 (X-Y operation of up to 3 channels)	Y axis : CHOP Operation
Deflection factor	Identical to those of CH1, CH2, CH3 and CH4	
Accuracy	X axis : $\pm 3\%$ (5mV to 5V / DIV) $\pm 5\%$ (1mV / DIV, 2mV / DIV) Y axis : $\pm 2\%$ (CH2), $\pm 5\%$ (CH3, 4)	15 to 35°C, 1kHz, 4 to 5 DIV reference
Frequency bandwidth	DC to 2MHz within -3dB	X axis : For CH1; Y axis : Identical to CH2, CH3, and CH4
X-Y phase difference	Within 3° between DC and 100kHz	

## 2-4. CRT Readout

Item	Specification	Remarks
Setting display		
Vertical axis	CH1, CH2, CH3, and CH4 DEFLECTION FACTOR and COUPLING ; Display when 10 : 1 probe is used ; CH1 and CH2 UNCAL status ; BWL	BWL=Band Width Limiter
Sweep	A and B sweep speed. A sweep UNCAL status ; HOLD OFF ; Delay time	
Cursor	$\Delta$ REF cursor and $\Delta$ cursor $\Delta V$ , voltage ratio, $\Delta T$ , $1/\Delta T$ , and time ratio Phase difference	
Others	Frequency counter and DVM reading	
Storage	Display of DEFLECTION FACTOR and coupling modes of reference memory Reference memory sweep speed ; Predelay trigger point ; Magnification point ; Delay start point ; View time	COM7101A : STORAGE MODE
DLY	Delay time	
Delay time range ;	0.5 to 10.00 times A sweep setting of highest sweep speed range to 0.5s / DIV range	
Accuracy	Within $\pm 2\%$	
$\Delta V$	Voltage between $\Delta$ RFF cursor and $\Delta$ cursor is measured and displayed.	In CH2 SINGLE SWEEP mode or in CH21 and CH3 / CH4 channel modes, DEFLECTION FACTOR is that of CH2 ; in other cases, it is that of CH1.
Measuring range	$\pm 3.6$ DIV from center of CRT	Minimum guaranteed value
Accuracy	Within $\pm 3\%$	
Voltage ratio	Displays the ratio of voltage between $\Delta$ RFF cursor and $\Delta$ cursor with respect to 5 DIV on CRT as reference (100%).	For $\Delta V$ measurement, GAIN VARIABLE is displayed in UNCAL status.
Measuring range	$\pm 3.6$ DIV from center of CRT	Minimum guarantee value
Accuracy	Within $\pm 3\%$	
$\Delta T$	Time between $\Delta$ RFF cursor and $\Delta$ cursor is displayed.	Minimum guaranteed value
Measuring range	$\pm 4.6$ DIV from center of CRT	
Accuracy	Within $\pm 3\%$	

Item	Specification	Remarks
1 / ΔT	Reciprocal (frequency) of ΔT is displayed.	
Time ratio	Displays the ratio of time interval between ΔREF cursor and Δcursor with respect to 5 DIV or CRT as reference (100%).	For ΔT measurement, SWEEP VARIABLE is displayed in UNCAL status.
Measuring range	± 4.6 DIV from center of CRT	Minimum guaranteed value
Accuracy	Within ± 3%	
Phase difference	Displays in degrees the phase difference between ΔREF cursor and Δcursor with respect to 5 DIV on CRT as reference (360 degrees).	For 1 / ΔT measurement, SWEEP VARIABLE is displayed in UNCAL status.
Measuring range	± 4.6 DIV from center of CRT	Minimum guarantee value
Accuracy	Within ± 3%	
ΔDelay	Measures ΔT or 1 / ΔT by using B sweep instead of ΔREF cursor and Δcursor.	Operates in ALT sweep and B sweep modes at the same time.
Measuring range	3.6 DIV from center of CRT	Minimum guarantee value
Accuracy	Within ± 2% (excluding 0.5 DIV from left hand end of CRT)	
DVM	Displays using 3-1/2 digits in auto-range system the CH1 input for up to ± 10 DIV on CRT (AC voltage, DC voltage, p-p voltage)	COM7101A : Excluding storage mode
AC measuring	Measures AC voltage as RMS value between 20Hz and 100kHz accuracy ; within ± 4%	Tcal ± 5% Tcal = Self Calibration Temperature (20~30°C) at center of CRT
DC measuring	Measures DC voltage accuracy ; within ± 3%	Tcal ± 5% Tcal = Self Calibration Temperature (20~30°C) at center of CRT
p-p measuring	Measures peak-to-peak voltage of AC component between 20Hz and 10MHz ; accuracy 20Hz ~ 5MHz ; within ± 5% 5MHz ~ 10MHz ; within ± 10%	Tcal ± 5% Tcal = Self Calibration Temperature (20~30°C) at center of CRT
FREQUENCY	Measures frequency of input channel signal selected by TRIG SOURCE switch 4-digit display, auto-range	Operates simultaneously with DVM. Not effective when two or more triggering source signals are selected.
Measuring range	1.0Hz to 100MHz	
Error	± 0.1%	

## 2-5. Storage Mode (COM7101A only)

Item	Specification	Remarks
Vertical axis resolution	8 bits (25 points / DIV)	
Horizontal axis resolution	10 bits (100 points / DIV)	
Sampling rate ;	In single channel mode or multi-channel ALT mode : 20 samples / sec to 50M samples / sec In CHOP or ALT mode : 20 samples / sec to 20M samples / sec	
Accuracy	$\pm 0.02\%$	
Effective storage frequency	100MHz (repeat mode) : For 1μs / DIV to 20ns / DIV range (in CHOP mode, 2μs / DIV to 10ns / DIV range), and periodic signals.  20MHz : For 2μs / DIV to 20ns / DIV range excluding CHOP mode.  8MHz : 5μs DIV to 10ns / DIV, in SINGLE SWEEP	With Sine Interpolation effective storage frequency band is 100MHz : -3dB maximum vertical axis
Effective rise time	3.5ns max (repeat mode) : 1μs / DIV to 20ns / DIV range (2μs / DIV to 20ns / DIV range for CHOP mode), and periodic signals.  32ns max : 2μs / DIV to 20ns / DIV range, excluding CHOP mode.  80 ns max : 5μs DIV to 10ns / DIV, in SINGLE SWEEP	With pulse interpolation
Operating modes	SINGLE SWEEP : CH1, CH2, CH3, CH4 ALT : Any combination of CH1 through CH4 CHOP : CH1 and CH2	
Repecat mode	For single channel or ALT sweep : 1μs / DIV to 20ns / DIV For CHOP : 2μs / DIV to 20ns / DIV	Except for SINGLE SWEEP mode in random equivalent time sampling
ROLL mode	5s / DIV to 0.1s / DIV	For single channel mode or 2-channel mode
ENVELOPE mode	Operating ranges : 50ms / DIV to 10μs / DIV	
Waveform magnification	Waveform can be expanded up to $\times 100$ of the timebase setting. Reference position for magnification : 0 DIV to 10 DIV in 1-DIV steps, 11 positions  Interpolation : Sine or pulse	
Display memory	(1.024 words per channel) $\times 4$	
Reference memory	For 4 waveforms	
Pre-triggering	Trigger point ; 0,2,4,6,8 DIV at CRT	For PAUSE status
View time	0 to about 10 seconds	4 steps

## 2-6. GP-IB Interface Functions (COM7101A only)

Item	Specification	Remarks
Interface functions (IEEE488-1978) (IEC625)	SH1 : All source handshake AH1 : All acceptor handshake T6 : Talker L3 : Listener SR1 : All service request RL1 : All remote / local PP0 : No parallel poll DC1 : All device clear DT0 : No device trigger C0 : No control	
Programmable functions	All functions except VARIABLE, FOCUS, TRACE ROTATION	
Format	Device commands: ASCII Waveform data : Binary or ASCII (selectable)	

## 2-7. Programmable Control Functions (by using RC01-COM in conjunction)

Item	Specification	Remarks
Program steps	100 (00 to 99)	Displayed on 7 SEG LED
Programmable functions	All functions except INTEN, FOCUS, and TRACE ROTATION	Only models provided with GP-IB interface
Program backup	Provided	
External control function	Can be connected to probe selector (PS01-COM)	
Step address output	BCD code	

## 2-8. Z axis

Item	Specification	Remarks
Sensitivity	Intensity modulation discernible with 3 Vp-p input signal. Negative-going signal for brighter trace and positive-going signal for dimmer trace.	
Frequency range	DC to 10 MHz	
Input resistance	$5 \text{ k}\Omega \pm 10\%$	
Maximum safe input voltage	50V peak (DC+AC peak)	AC components not higher than 1 kHz

## 2-9. Signal Outputs

Item	Specification	Remarks
Sweep signal output	A sweep singal : Approx. 1 Vp-p	BNC terminal at rear panel
Sweep gate output	A sweep gate signal output : Approx. 5 Vp-p  B sweep gate signal output : Approx. 5 Vp-p	BNC terminal at rear panel

## 2-10. Calibration Voltage

Item	Specification	Remarks
Waveform	Positive pulse singal	
Frequency	1 kHz $\pm$ 0.1%	
Output voltage	0.5 Vp-p $\pm$ 2%	
Output resistance	Approx. 2 k $\Omega$	

## 2-11. Pen Out Signals (COM7101A)

Item	Specification	Remarks
X-Y recorder output	Operates in storage mode	
X axis output	0.1 V / DIV $\pm$ 10% (Speed automatically varies in response to Y-axis amplitude)	BNC terminal at rear panel (common with sweep signal output terminal)
Y axis output	0.1 V / DIV $\pm$ 10%	BNC terminal at rear panel
SYNC output	TTL level, positive output	BNC terminal at rear panel (common with A sweep gate terminal)

## 2-12. CRT

Item	Specification	Remarks
Cathode-ray tube	6-inch square screen, with internal white graticule Effective screen area : 8×10 cm (3.15×3.94 in.) Acceleration voltage : Approx. 20 kV	

## 2-13. Power Requirements

Item	Specification	Remarks
Line voltage	90V to 250V	No voltage selection required
Line frequency	48 Hz to 62 Hz	
Power consumption	COM7100A : Approx. 65W COM7101A : Approx. 103W	

## 2-14. Ambient Conditions

Item	Specification	Remarks
Operating range	Temperature : 5°C to 40°C ; Humidity : 90% max	
Maximum operating range	Temperature : 0°C to 50°C ; Humidity : 95% max	

## 2-15. Dimensions and Weights

Item	Specification	Remarks
Dimensions	318W×150H×400D (mm)	
Weight	COM7100A : Approx. 8 kg ; COM7101A : Approx. 10 kg	

## 2-16. Accessories

Item	Specification	Remarks
Probe	P100 - S type × two	10 : 1

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### 3. CIRCUIT DESCRIPTION

#### 3.1 BLOCK DIAGRAM

##### 3.1.1 General

COM7101A consists of real time section and storage section.

COM7100A consists of real time section only.

##### 3.1.2 Real time section

Figure 3-1 shows oscilloscope section and Fig. 3-2 shows control section.

Most of mechanical switches used in conventional oscilloscopes are replaced with electronics switches in the COM7000A series. These switches are controlled by digital signals.

And gain, sweep variables, H, V-axis positions are also controlled digitally.

Thus most of the functions can be controlled remotely by GP-IB.

Majority of the circuits are built on HIC (Hybrid Integrated Circuit).

Self-calibration is provided so that V-axis gain, DC-balance and sweep speed are automatically checked and adjusted.

For instance, when the DC-balance to be adjusted.

1. Output voltage of the V-axis is digitized then checked by C.P.U.
2. The C.P.U determine whether the voltage is within the range or not.
3. The C.P.U calculate how much voltage have to be applied to the V-axis amplifier to compensate if the voltage was out of the range.
4. These processes are repeated till the voltage fall into the range.

When the V-axis gain to be adjusted.

1. Set the volt/div at 5 mV/div.
2. Reference voltage of 30.0 mV is applied to the V-axis input.
3. C.P.U determines whether the gain is within the range or not comparing the output voltage and the reference voltage.
4. The C.P.U feeds voltage to where the gain is controlled.

When the sweep speed to be adjusted

1. Read the time between two points where 8 div apart in H-axis.
2. The C.P.U determines that the time is within the range or not.
3. The C.P.U controls the sweep variable circuit till the time falls into the range.

Nearly half of the adjustments are performed automatically.

The control section is handled by main C.P.U (Z80, 8 bit). All the front panel informations are read and made necessary changes by the C.P.U.

The main C.P.U also communicates with the sub-C.P.U in case of COM7100A.

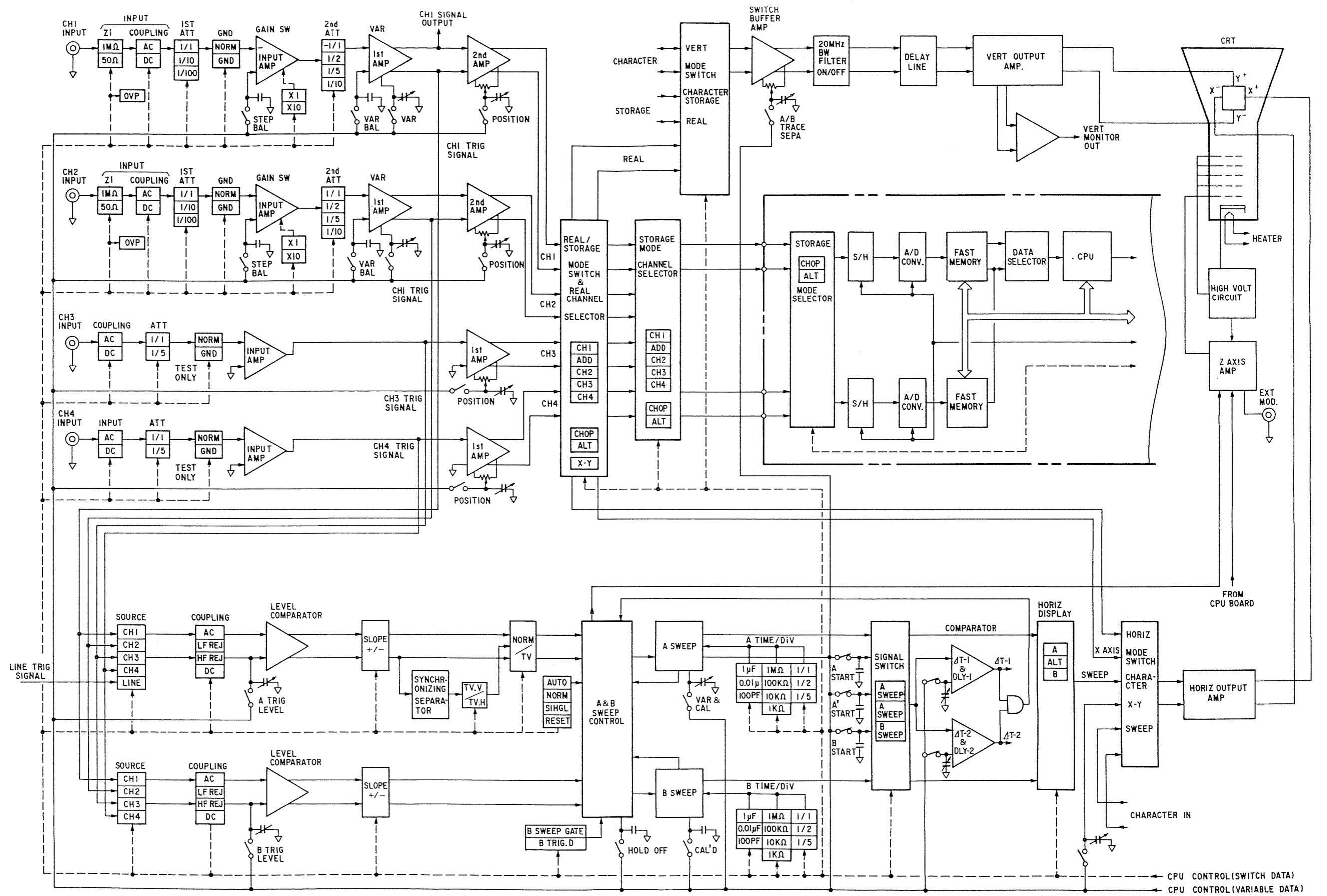


Figure 3-1 Block Diagram (Real Time System, Oscilloscope Section)

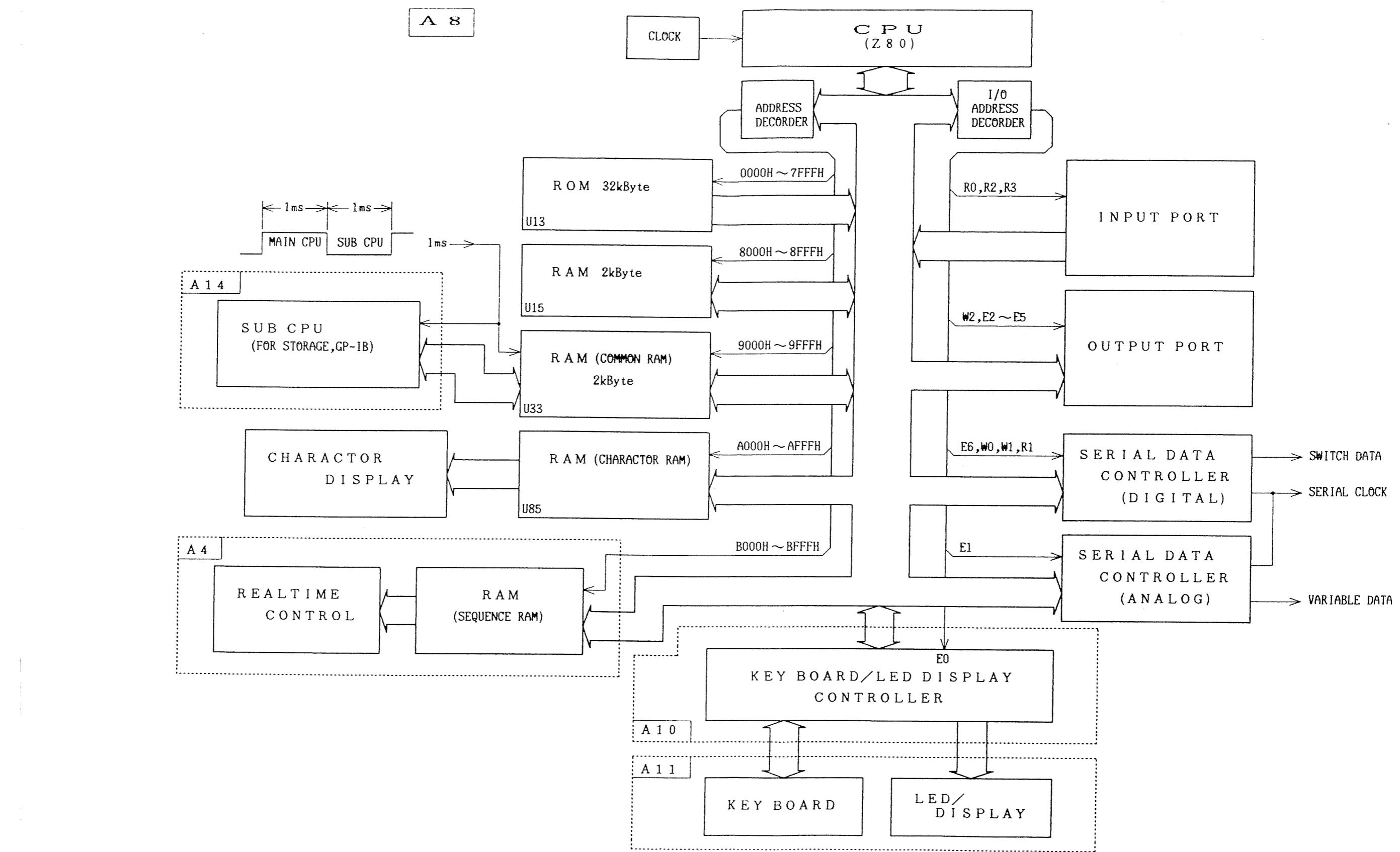


Figure 3-2 Block Diagram (Real Time System, Control Section)

### 3.1.3 Storage section

Block diagram for the storage section is shown in Fig. 3-3.

The storage section consists of analog processing, A/D memory, acquisition control, storage display and sub-C.P.U section.

The analog processing section amplify and convert the impedance of the signal picked-off from the real time section then fed to the A/D memory section. In case of "envelope" mode is selected the signal is routed to "envelope peak hold circuit" then to the A/D memory section.

The A/D memory section consists of sample and hold circuit, A/D converter, high speed memory, address counter, and timing generator. The maximum sampling frequency is 50 MHz. Two A/D converters are used alternately to achieve 50 MHz.

The timing generator produces sequential sampling pulses and random sampling pulses when in "repeat" mode.

The acquisition control section consists of clock generator, programmable divider, jitter meter, pre-trig, counter, analog multiplexer, and D/A converter.

The storage display section consists of display RAM, Y-axis D/A converter display address counter, interpolator, storage deglitcher, and X-Y recorder output circuit.

The sub-C.P.U section employs 8 bit C.P.U (Z80) to manage the storage section. Necessary informations are fed from the main C.P.U through common RAM. Also interface function is provided for step controller or GP-IB.

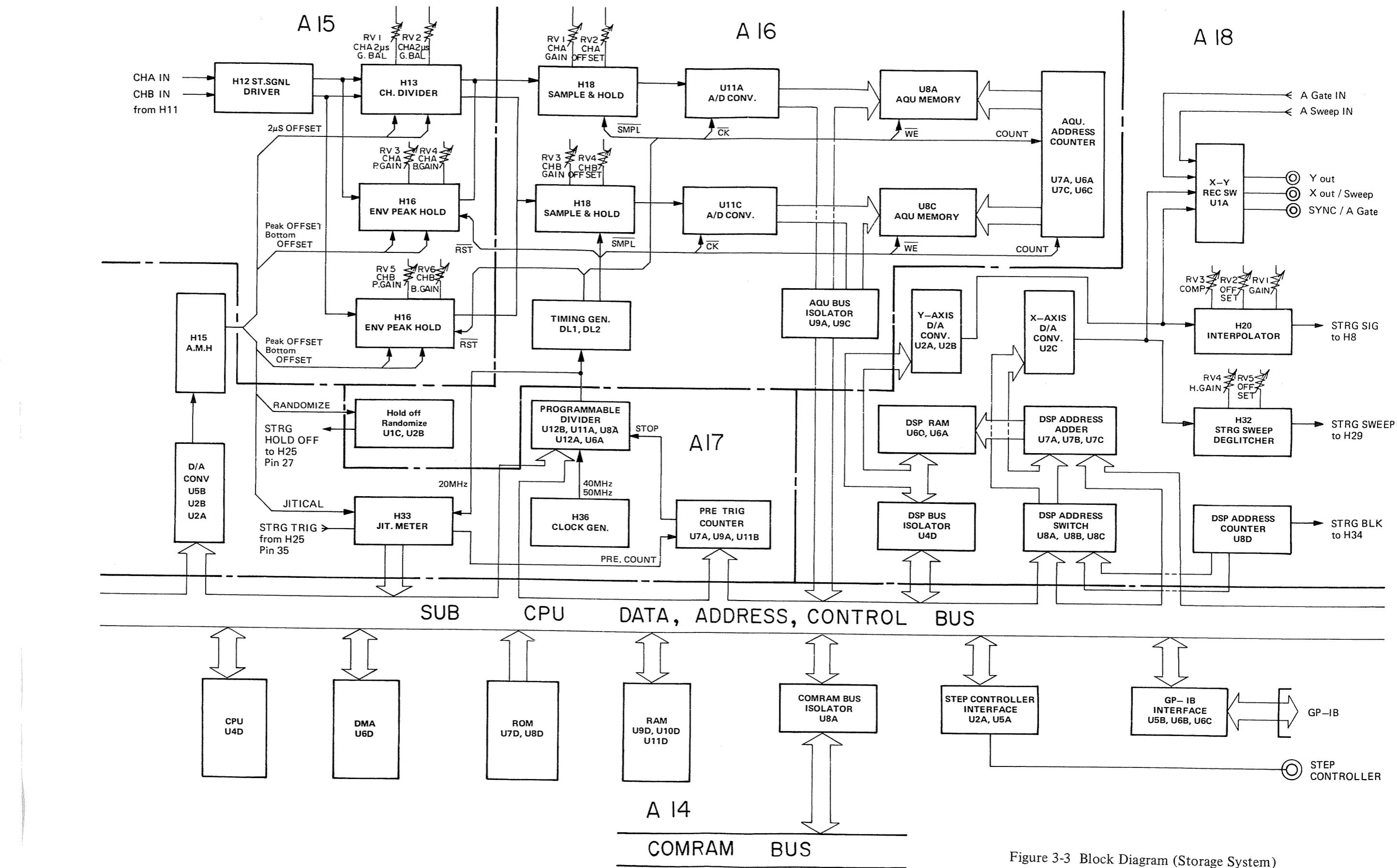


Figure 3-3 Block Diagram (Storage System)

## 3.2 CIRCUIT DESCRIPTION

### 3.2.1 CRT Section

#### 1) High voltage Generator Circuit (A6 PCB)

High voltage generator circuit comprises DC-DC converter which is called BLOCKING generator.

Approximately 50 kHz sine wave from the BLOCKING generator is stepped up by secondary winding of the high voltage transformer, and rectified to -2,100 V to accelerate the beam. The voltage is fed back to OP AMP via resistor. The OP AMP controls drive transistor of the BLOCKING generator to obtain constant -2,100 V. The secondary voltage is applied to multiplier circuit and used for post acceleration of the CRT beam. Voltage from secondary center tap of the transformer is used for intensity and focus control circuits.

#### 2) Z-axis Circuit (A6 PCB)

Z-axis circuit amplifier comprises HIC. Blanking signal and focus signal are applied to differential AMP, which controls proper focus regardless to the brightness or delay sweep control.

#### 3) Character Generator Circuit (A8-PCB)

Data (ASCII code) for the characters are fed to character RAM (A8-U85 6116). The data are then routed to character ROMs (A8-U105 2764) as the address signal. X-axis and Y-axis data are fed out from the ROMs. These data are latched and converted to analog signal by D/A converter.

These signals are called as CHR-X and CHR-Y.

#### 4) DVM Circuit (A4 PCB)

By using CH1 2nd ATT (A4-U3 H5) output signal, the DVM circuit measures DC and AC voltage. Both RMS and P-P are measured. True RMS converter measures RMS, and + and - PEAK DETECTOR in HIC and differential OP AMP measures P-P.

### 3.2.2 Vertical Axis Section

#### 1) Attenuator Circuit (A1, A3, A4 PCB)

Attenuator circuit consists of ATT (A1) for CH1 and 2, and ATT (A3) for CH3 and 4.

The ATT (A1) employs semiconductor switches and relays, and comprises 1st ATT of HIC (H3) and 2nd ATT on A4 PCB. The ATT includes input signal attenuation (10 mV ~ 5 V / DIV, 9 steps), input coupling (AC/DC/GND), and x 10 MAG circuit for 1 mV and 2 mV/DIV sensitivity setting.

ATT (A3) houses two channel in a case, and employs semiconductor switches and relays same as A1. It includes (H4) input signal attenuation (1/1, 1/5, 2 steps), input coupling (AC/DC/GND) and input impedance switching.

2) Preamplifier Circuit

There are two types of preamplifiers are used.

One is commonly used on CH1 and CH2, which is providing 1st AMP and 2nd AMP.

Other one for CH3 and CH4 which is providing input AMP and 2nd AMP.

The 1st AMP consists of unbalance to balance converter,  $\times 2$  MAG (when in 5 mV/DIV setting), step balance, and variable gain controls.

The position control, position centering, internal trigger-pickoff and V-axis gain circuits are provided in the 2nd AMP.

The input AMP for CH3 and CH4 consists of impedance converter, and attenuator.

3) Switching Circuit

Balanced signals from CH1, 2, 3, 4 and storage circuit are selected by the switching circuit (A4-U20 H8).

Real mode signal, X-Y mode signal, and storage signals are fed out. CH2 INV function is also provided.

4) Delay Line Circuit

Delay line circuit comprises delay line driver (A4-U25 H9) and delay line, and delays vertical signal, switches observation signal and character. BEAM FIND and BWL (Band Width Limit) are also provided.

5) Final Stage

Final stage comprises HIC (A5-U2 H10), deflector drive transistor (A5-Q2, Q3) and deflector potential detector circuit (A5-U1). Deflector drive transistor, with HIC internal transistor makes cascade amplifier for wide band amplification.

the Deflector potential detector circuit is for data feedback during self-calibration, it detects DC balance of differential amplifier in HIC, applies the potential to A/D converter [D/A converter on A10 (A10-U13)], and feeds back to C.P.U.

### 3.2.3 Trigger Section

#### 1) Trigger Pickoff

Internal trigger signal is picked off from 2nd AMP (A4-U13-U16) of CH1 ~ CH4. It picks off half a differential signal, and feeds the signal to TRIG SOURCE SW circuit (A4-U27) in current mode.

#### 2) Trigger Source and Coupling

TRIG SOURCE SW (A4-U27) selects internal trigger signal obtained from trigger pickoff circuit and line trigger signal as A or B trigger signal. The line trigger signal at primary input voltage of power supply circuit (A12-PC1), is detected by transistor (A12-Q1), isolated by photo-coupler (A12-PC1), impedance converted (A12-Q15), then applied to TRIG SOURCE SW circuit (A4-U27) via mother board.

A trigger signal from TRIG SOURCE SW circuit is applied to TRIG COUPLING circuit (A4-U28) and DC, AC, HF REJECT, or LF REJECT coupling will be selected.

And the output signal is applied to trig level comparator circuit (A4-U30) then shaped to square waveform.

The square waveform is fed to sweep controller circuit (A4-U48).

TRIG LEVEL COMPARATOR circuit output includes a signal 180° differs from SWEEP CONTROLLER output signal in phase, which applied to TV SYNC circuit (A4-U32) to separate TV synch signals (vertical synch signal, horizontal synch signal), and the signal is applied to SWEEP CONTROLLER circuit as TV TRIG signal.

B trigger circuit provides no TV SYNC circuit, and other functions are same as A trigger circuit.

### 3.2.4 Horizontal axis Section

#### 1) Triggering and Sweep (A/B)

Trigger signal from the trigger circuit is applied to the sweep circuit and produces sweep signal. The sweep circuit comprises SWEEP CONTROLLER circuit (A4-U48), A/B SWEEP GEN circuit (A4-U43, A4-U44) mentioned below, and generates 10 ns/DIV maximum sweep signal to 0.5 s/DIV sweep signal. (Sweep signal in STORAGE MODE is generated in other circuit.)

The SWEEP CONTROLLER comprises A and B SWEEP GENERATORS, and controls sweep signal (A/B) synchronization by trigger signal, SWEEP MODE (AUTO, NORM, SINGLE selection), continuous and triggered delay.

#### 2) Sweep Timing Circuit

Sweep timing circuit determines A/B sweep time respectively. This circuit is built in the A/B SWEEP GEN circuit with a Miller integrator circuit and a constant current circuit, and controls sweep signal in accurate timing. Component used in the circuit have better temperature coefficient.

#### 3) X-Y function

The CH1 operates as X-axis and the CH2, 3, and 4 operate as Y-axis. Vert mode SW circuit (A4-U20) controls the vertical mode.

#### 4) Switching Circuit

Horizontal axis switching circuit comprises SWEEP COMP SW circuit (A4-U52 H29) and HORIZ SW & DRIVE AMP circuit (A4-U55 H30).

The SWEEP COMP SW circuit switches A, B sweep signal and sweep signal in the STORAGE mode to panel operation. It has "HORI OUT" to be applied to next stage HORIZ SW & DRIVE AMP circuit, and "COMP OUT" to be applied to DELAY TIME COMP. circuit (A4-U56, H28).

The HORIZ SW & DRIVE AMP circuit switches sweep signal (A, B sweep signal and sweep signal during STORAGE MODE), X-axis signal for X-Y function, and character X-axis signal. Also controls  $\times 10$  MAG and BEAM FIND function.

#### 5) Final Stage

Final stage is designed with HORIZ FINAL AMP (A5-U3 H31). The circuit is non-saturation type amplifier which employs Active Load and has good linearity to higher amplitude: double high frequency injection is provided to improve rise and fall time. Also composite horizontal axis signal (A5-Q4 ~ Q6) is applied to FOCUS DRIVE circuit (A6-U601 H31) to improve corner image of the CRT.

### 3.2.5 Storage Section

#### 1) Input Signal and Channel Divider

Two A/D converters are used to facilitate 50 MHz/Sampling. And two A/D input signals, CHA and CHB, are routed from VERT MODE SW circuit.

Table 3-1 shows function of the VERT MODE SW circuit in the STORAGE mode.

SETTING		OUTPUT		SIGNALS FOR DIGITIZING
		CHA	CHB	
Single trace	CH1	CH1	CH2/CH4	CHA signal.
	CH2	CH1/CH3	CH2	CHB signal.
	CH3	CH3	CH2/CH4	CHA signal.
	CH4	CH1/CH3	CH4	CHB signal.
Dual trace	ALT	CH1/CH2	CH1	CHA/CHB signals alternately.
		CH1/CH3	CH1/CH3	CHA signals (CH1 and CH3) alternately.
		CH1/CH4	CH1	CHA/CHB alternately.
		CH2/CH3	CH3	CHA/CHB signals alternately.
		CH2/CH4	CH1/CH3	CHB signals (CH2 and CH4) alternately.
		CH3/CH4	CH3	CHA/CHB alternately.
CHOP	CH1/CH2	CH1	CH2	CHA/CHB signals. Unable to select CH3 or CH4 in CHOP mode.

Table 3-1 Function of VERT MODE SW circuit in STORAGE mode.

Output signal of the VERT MODE SW circuit is applied to the ST SIGNAL BUFFER circuit (A4-U26 H11), then converted to voltage from current, then routed to the ANALOG PROCESSING BOARD (A15).

The ANALOG PROCESSING BOARD routes the OUTPUT SIGNAL to the GND REF circuit (A15-CR1 ~ CR8, Q3, Q4).

The GND REF circuit switches its input signal between ground level and the output signal from the VERT MODE SW circuit when in the SELF CAL MODE.

The output of the GND REF circuit is applied to the STORAGE SIGNAL DRIVE circuit (A15-H12) for amplification and impedance conversion.

The STORAGE SIGNAL DRIVER output signal is fed to the CHANNEL DIVIDER circuit (A15-U6 H13). When the ENVELOPE MODE is not selected, Table 3-2 shows function of the CHANNEL DIVIDER circuit.

SETTING		INPUT		OUTPUT		SIGNAL FOR DIGITIZING
		CHA (20-21pin)	CHB (2-3pin)	CHA (32-33pin)	CHB (34-35pin)	
Single trace	CH1	CH1	CH2/CH4	CH1	CH1	
	CH2	CH1/CH3	CH2	CH2	CH2	
	CH3	CH3	CH2/CH4	CH3	CH3	
	CH4	CH1/CH3	CH4	CH4	CH4	
Dual trace	ALT	CH1/CH2	CH1	CH2	CH1/CH2	CH1 and CH2 signals alternately.
		CH1/CH3	CH1/CH3	CH2/CH4	CH1/CH3	CH1 and CH3 signals alternately.
		CH1/CH4	CH1	CH4	CH1/CH4	CH1 and CH4 signals alternately.
		CH2/CH3	CH3	CH2	CH2/CH3	CH2 and CH3 signals alternately.
		CH2/CH4	CH1/CH3	CH2/CH4	CH2/CH4	CH2 and CH4 signals alternately.
		CH3/CH4	CH3	CH4	CH3/CH4	CH3 and CH4 signal alternately.
	CHOP	CH1/CH2	CH1	CH2	CH1	CH2

Table 3-2 Function of CHANNEL DIVIDER circuit

Thus the signals are divided and routed to the A/D, and memory board (A16).

## 2) Peak Hold Circuit

Peak Hold circuit functions when in the ENVELOPE MODE, and when the ENVELOPE MODE is not selected, output of this circuit is off. When in the ENVELOPE MODE, input signal is fed to the ENV PEAK HOLD circuit (A15-U7 U8 H16), then + and - PEAK are detected.

U8 detects CHA (CH1/CH3), and U7 detects CH3 (CH2/CH4), and holds the value until next sampling. Output of the ENV PEAK HOLD circuit is connected in parallel to output of the CHANNEL DIVIDER circuit.

## 3) Sample Hold and High Speed A/D Converter

A pair of signals routed from analog processing board (A15) are fed to a pair of differential to single signal converters (A160Q1 ~ Q4) on the A/D and memory board (A16).

The signal then routed to a pair of SAMPLE and HOLD circuits (A16-U12A, U12C H18). The clock frequency is upto 25 MHz.

The signals are digitized by a pair of 8 bit A/D converters (A16-U11A, U11C UVC3120).

The sampling pulses are slightly delayed by delay cables (A16-DL1, DL2) and the associated circuit.

This delay circuit feed various delayed signals to MEMORY CIRCUIT (A16-U8A, U8C TMM2018-35), address counter circuit (A16-U6A, U6C, U7A, U7C, F269, F169) and so on.

4) High speed Memory and Address Counter

High speed devices are utilized to meet the high speed operation for following circuitry;  
memory (A16-U8A, U18C TMM2018-35) data bus buffer (A16-U10A, U10C F541)  
address counter (A16-U6A, U6C, U7A, U7C, F269, F169).

5) Random Sampling

Random sampling technic is used for the REPEAT MODE.

The input signal is sampled in random manner and repeated over 1000 times to fill the memory.

The sampling timing is produced by jitter interval meter circuit (A17-U3B H33).

The circuit consists of charging and discharging circuit with counter and the time constants of these circuit are managed very tightly.

6) Roll Function

Roll mode is executed by the program.

The latest data captured is placed in the lead address and all data in the memory are shifted one address to the end.

7) Linear and Sine Interpolation

Linear INTERPOLATION circuit (A18-U1B H20) is located next to vertical axis D/A convertor (A18-U2A DACO8EN) of STORAGE DISPLAY PCB (A18).  
the Interpolation is also called dot-join circuit, and it joins D/A converted vertical axis data with straight line. It detects potential across two points and integrates it and adds the value to the head data. When the integration finished, it results in same value of the hind data.

The STORAGE SWEEP DEGLITCHER circuit (A18-U1C, H32) located next to horizontal D/A convertor (A18-U2C HA17012PB) eliminate conversion noise and joins horizontal axis steps with straight line.

Noises are eliminated by the SAMPLE and HOLD circuit and the step voltage is converted to slope by the integrator.

At least 2.5 datas per cycle are necessary to complete the calculation of the locus for 360°.

### 3.2.6 CPU Circuit

#### 1) CPU Function

CPU circuit comprises Z-80 (A8-U12 later called MAIN CPU) to control real time section and other Z-80 (A14-U4D later called SUB CPU) to control STORAGE and GP-IB.

The MAIN CPU detects SWITCH or KNOB operation via KEYBOARD circuit, and controls internal circuit. Simultaneously displays internal status on the PANEL or on the CRT. When cursors are used, the DATA across the CURSORS are displayed on the CRT. Also controls automatic self-diagnosis, key operation, and automatic self-calibration.

The SUB CPU circuit controls STORAGE and GP-IB circuit, etc., on basis of instructions from the MAIN CPU, and handles self-diagnosis and self-calibration of STORAGE circuit.

#### 2) Address MAP

Figure 3-4 shows the MAIN CPU ADDRESS MAP. Table 3-3 shows ROM/RAM REFERENCE DESIGNATOR and parts name .

ROM and RAM	REF. DESIGNATOR and PARTS NAME
ROM	A8-U13 27256
RAM	A8-U15 6116-3
COMMON RAM	A8-U33 6117-3
CHARACTER RAM	A8-U85 6116-3
SEQUENCER RAM	A4-U59 H41

Note) The SEQUENCER RAM employs 4416 (1 k Byte) in H41.

Table 3-3 ROM/RAM circuit figure number.

The COMMON RAM works as buffer memory for the MAIN and SUB C.P.U. The DATA are switched in 1 ms interval.

The CHARACTER RAM displays PANEL DATA and CURSOR DATA on the CRT.

The SEQUENCE CONTROLLER (A4-U59 H41) controls vertical and horizontal mode on basis of PANEL setting.

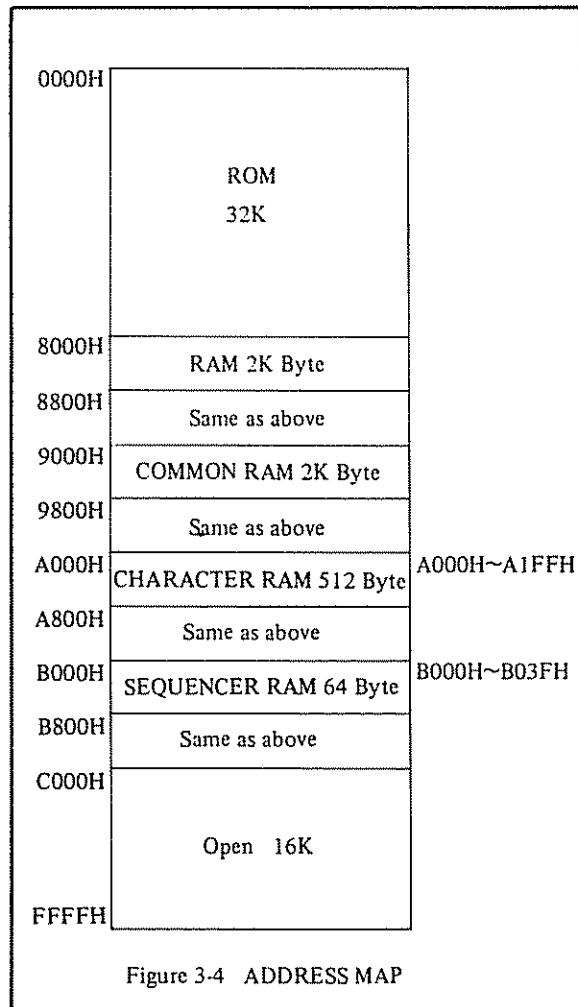


Figure 3-4 ADDRESS MAP

3) I/O Map

Table 3-4 shows MAIN CPU I/O MAP

PORt No.	IN/OUT	DEVICE	DESCRIPTION
00H(E0)	IN/OUT	A10-U17 8279	INPUT DATA from KEY SW MATRIX CKT and OUTPUT DATA to LED DRIVE CKT.
01H	IN/OUT	A10-U17 8279	READ STATUS of 8279 & WRITE COMMAND of 8279.
10H(E1)	INPUT	A10-U7 HC541	PULSE COUNT DATA of CH1/CH2 VOLTS/DIV.
11H	INPUT	A10-U8 HC541	FLAG of CH1/CH2 UNCAL/CAL, TIME/DIV A/B and UNCAL/CAL, PULSE COUNT DATA of TIME/DIV.
12H	OUTPUT	A10-U11 HC574	PANEL SETTING DATA, D/A CONVERT DATA (4 Bit).
13H	OUTPUT	A10-U13 HC193	Clear signal for PULSE COUNT DATA. (CH1 VOLTS/DIV)
		A10-U14 HC193	Clear signal for PULSE COUNT DATA. (CH2 VOLTS/DIV)
		A10-U15 HC193	Clear signal for PULSE COUNT DATA. (TIME/DIV)
		A10-U6 MC14538	Clear signal for IRQ OUTPUT.
14H	OUTPUT	A10-U12 HC574	Data for D/A CONVERT DATA (8 Bit).
15H	INPUT	A10-U16 HC365	Buffer for output data of comparator.
20H(E2)	IN/OUT	A8-U01 HC74	Clear signal for 2 ms INT.
30H(E3)	IN/OUT	A4-U10 HC74	Clear signal for OVER LOAD PROTECTOR INT.
40H(E4)	IN/OUT	A8-U63 HC107	Clear signal for COUNTER INT.
50H(E5)	IN/OUT	A8-U51 HC107	Clear signal for COUNTER DATA.
		A8-U55 HC390	Clear signal for COUNTER DATA.
		A8-U65 HC74	Clear signal for COUNTER DATA.
60H(E6)	OUTPUT	A8-U107 HC4094	LATCH PULSE for SERIAL DATA of U107.
70H(R0)	INPUT	A8-U36 HC541	INT (Interrupt) REQ FLAG.
70H(W0)	OUTPUT	A8-U37 HC174	Select function mode of U38.
74H(R1)	INPUT	A8-U38 HC299	Data for serial output.
74H(W1)	OUTPUT	A8-U38 HC299	CLOCK for SERIAL DATA.
78H(R2)	INPUT	A8-U HC257	COUNTER DATA & STATUS.
		A8-U56 HC257	COUNTER DATA.
78H(W2)	OUTPUT	A8-U102 HC4049	LATCH PULSE for SERIAL DATA of U102.
7CH(R3)	INPUT	A8-U113 HC74	FRAME REQUEST CLOCK.
7CH(W3)	OUTPUT	A8-U62 HC4049	LATCH PULSE for SERIAL DATA of U62.

Table 3-4 MAIN CPU I/O MAP

#### 4) Keyboard Circuit

Keyboard circuit is entirely similar to personal computer keyboard. All panel switches are located above key-matrix. The circuit comprises PROGRAMMABLE KEYBOARD/DISPLAY CONTROLLER (A10-U17 8279), 3-8 LINE DECODER (A11-U8 HC138) and KEY MATRIX circuit.

Fig. 3-5 Shows Keyboard Circuit.

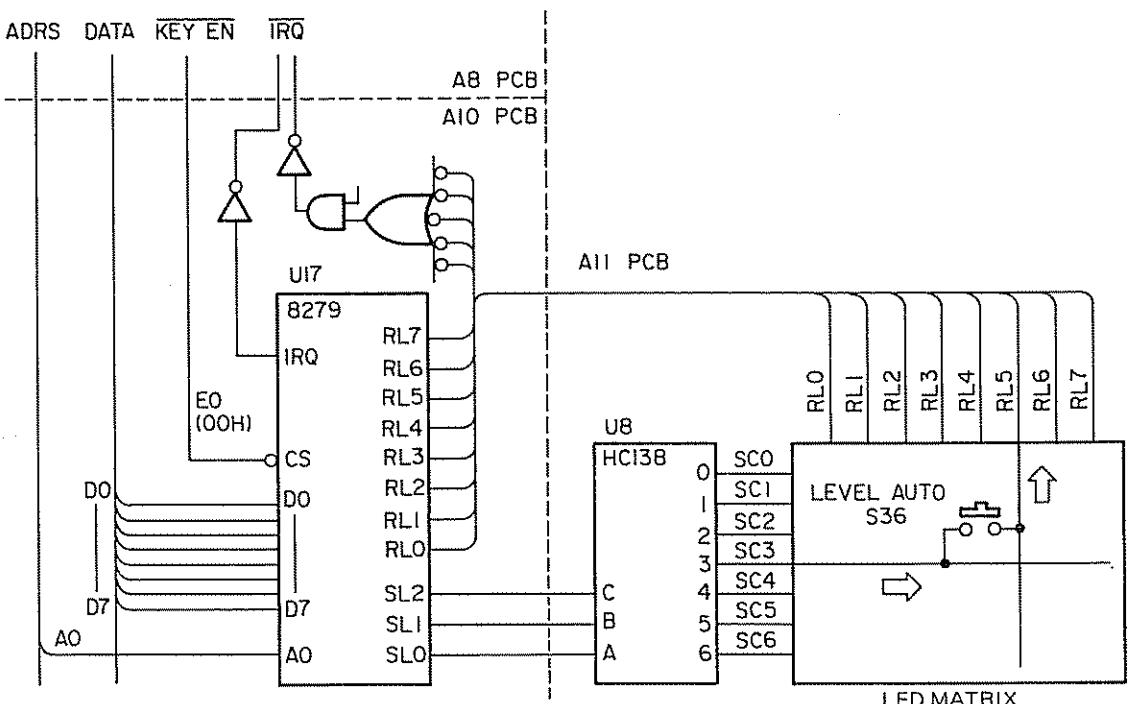


Fig. 3-5 Keyboard Circuit

The PROGRAMMABLE KEYBOARD/DISPLAY CONTROLLER (A10-U17) continuously scans the matrix keys. SL0 ~ SL2 continuously feed BINARY CORD for the scanning. 3-8 LINE DECODER (A11-U8) decodes the BINARY CODE and continuously scans all key matrix keys.

When if “LEVEL AUTO” key (A11-S36) is pressed, each SC0 ~ SC6 LINE consecutively turn to “H”, and when SC3 turns to “H”, the signal is sent to RL5. Thus determine which matrix key has been pressed. U17 feed preset CODE to DATA BUS.

When “H” is sent to RL5, CPU is ready to accept the data from DATA BUS. The CPU accepts the DATA and detects “LEVEL AUTO” key has been pressed.

KEY EN signal is a chip select signal from I/O ADDRESS DECODER (A8-U45 HC138), which delivered to 00H ~ 0FH.

However U17 functions only when 00H ~ 01H I/O address is selected since A0 is fed from the ADDRESS BUS.

Table 3-5 Shows Panel Format above the Key matrix

	RL0	RL1	RL2	RL3	RL4	RL5	RL6	RL7		
SC0	S01	S02	S03	S04	S05	S06	BINT/SCAL /READOUT	BEAM FIND		
	CH1 COUPLING			CH2 COUPLING						
	AC/DC	GND	50Ω	AC/DC	GND	50Ω				
SC1	S11	S12	S13	S14	S15	S16				
	CH3 COUPLING			CH4 COUPLING						
	AC/DC	GND	÷5	AC/DC	GND	÷5				
SC2	S21	S22	S23	S24	S25	S26	S27	S28		
	VERT MODE						BW 20MHz	X-Y (PEN OUT)		
SC3	HORIZ. MODE				A/B TRIGGER	LEVEL AUTO	SLOPE +/-	X 10 MAG		
	S31	S32	S33	S34						
	A	ALT	B	B TRIG						
SC4	S41	S42(S49)	S43	S44	S45	S46'				
	RESET	(READY)	SOURCE B	SOURCE A	COUPLING B	COUPLING A				
SC5	S51	S52		S54	S55					
	ΔT/ΔV	DLY		Ho	AC/DC/PP					
SC6	S61	S62	S63	S64	S65	S66	S67	S68		
	PAUSE	SAVE	REF MEMO	VIEW TIME	TRIG POINT	ENV	SIN/ PULSE	STRG/ REAL		

NOTE: BIND/SCAL/READ OUT & BEAM FIND SWITCH are located on the CRT CONTROL board (A7 PCB).

Table 3-5 Panel Switch Format

## 5) LED Display Circuit

LED display circuit employs display function of PROGRAMMABLE KEYBOARD/DISPLAY CONTROLLER (A10-U17 8279).

PANEL LEDs are located above matrix as same as keyboard switches.

LED display circuit comprises the PROGRAMMABLE KEYBOARD/DISPLAY CONTROLLER (A10-U17 8279), 3-8 LINE DECODER (A11-U2, U4 HC138), DISPLAY DRIVER (A11-U1, U3, U5), and LED matrix.

Figure 3-6 shows LED Display Circuit.

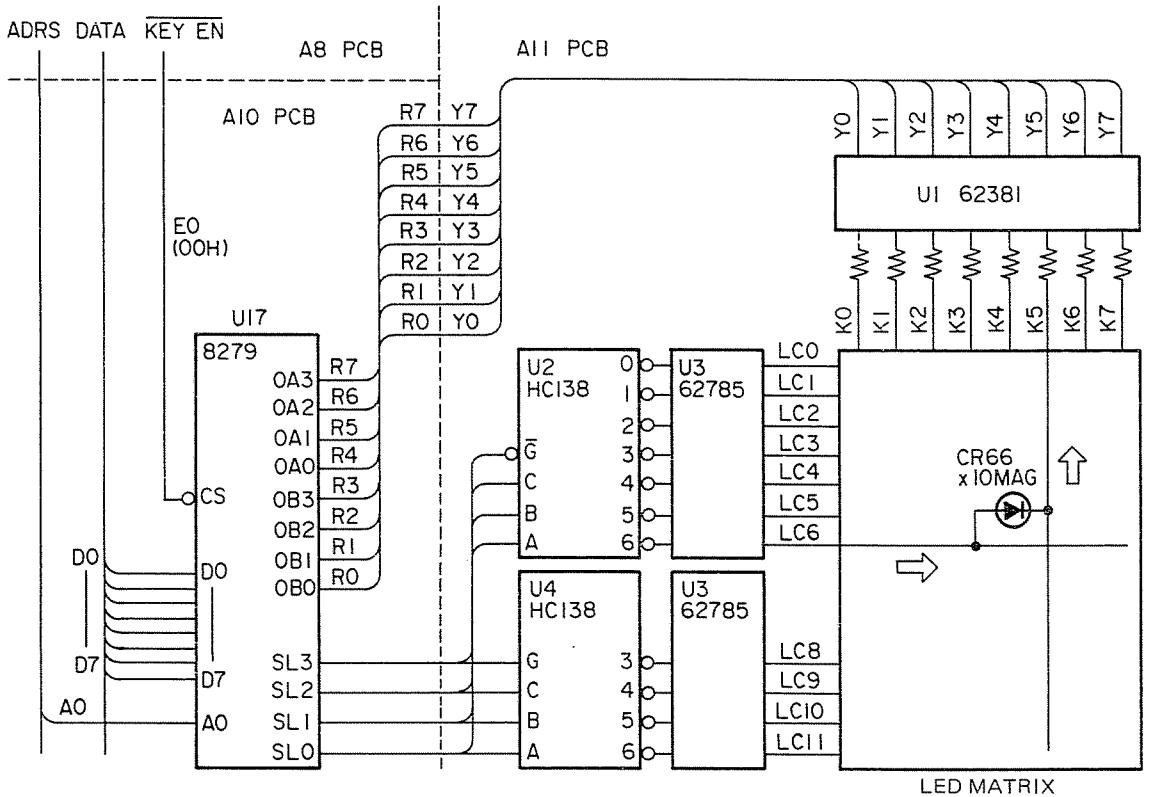


Figure 3-6 LED Display Circuit

The PROGRAMMABLE KEYBOARD/DISPLAY CONTROLLER (A10-U17) scans keys on the keyboard, and displays LED.

SL0 ~ SL3 continuously feed BINARY CODE. 3-8 LINE DOECODER (A11-U2, U4 HC138) decodes the BINARY CODE, and continuously scans LED MATRIX LEDs. U3 (TD62785) located next to 3-8 LINE DECODER is INVERTED BUFFER, and each LC0 ~ LC11 LINE consecutively turns to "H".

When if "x 10 MAG" LED (A11-CR66) is in "ON", output of U17 OA1 is "H", and LC6 is also "H" at the same time.

Table 3-6 Shows Panel LED Format above the LED Matrix.

	K0	K1	K2	K3	K4	K5	K6	K7					
LC0	CR01	CR02	CR03	CR04	CR05	CR06	CR07	CR08					
	CH1 COUPLING							CH2 COUPLING					
	AC	DC	GND	50Ω	AC	DC	GND	50Ω					
LC1	CR11	CR12	CR13	CR14	CR15	CR16	CR17	CR18					
	CH3 COUPLING				CH4 COUPLING								
	AC	DC	GND	+5	AC	DC	GND	+5					
LC2	CR21	CR22	CR23	CR24	CR25	CR26	CR27	CR28					
	VERT MODE												
	CH1	ADD	CH2	CH3	CH4	ALT	CHOP	20 MHz					
LC3	CR31	CR32	CR33	CR34	CR35	CR36	CR37	CR38					
	TRIGGER		A TRIGGER LEVEL			B TRIGGER LEVEL							
	A	B	AUTO	+	-	AUTO	+	-					
LC4	CR41	CR42	CR43	CR44	CR45	CR46	CR47	CR48					
	A TRIGGER SOURCE				B TRIGGER SOURCE								
	CH1	CH2	CH3	CH4	CH1	CH2	CH3	CH4					
LC5	CR51	CR52	CR53	CR54	CR55	CR56	CR57	CR58					
	MODE			SOURCE LINE	A TRIGGER COUPLING		TRIGGER SOURCE						
	AUTO	NORM	SINGLE		TV-H	TV-V	V-M (A)	V-M (B)					
LC6	CR61	CR62	CR63	CR64	CR65	CR66	CR67						
	HORIZONTAL MODE					HORIZ. X10MAG	CH2 INV						
	A	ALT	B	B TRIG	X-Y								
LC8	CR81	CR82	CR83	CR84	CR85	CR86	CR87	CR88					
	A TRIGGER COUPLING				B TRIGGER COUPLING								
	AC	LF REJ	HF REJ	DC	AC	LF REJ	HF REJ	DC					
LC9			CR93	CR94	CR95								
			READOUT										
			Ho	A ≠ B	DLY								
LC10	CR101	CR102	CR103	CR104	CR105	CR106							
	DVM			CURSOR									
	AC	DC	P-P	Δt	1/ΔV	ΔV							
LC11	CR111	CR112	CR113	CR114	CR115	CR116	CR117	CR118					
	GP-IB RMT	REFERENCE MEMORY					STORAGE						
		4	3	2	1	ENV	SIN/PULSE	STRG/REAL					

Table 3-6 Panel LED Format

### 3.2.7 Power Supply Circuit

Power Supply Circuit comprises two pairs of multi output switching circuit and series regulator to stabilize the output.

The switching circuit is called ON/OFF convertor.

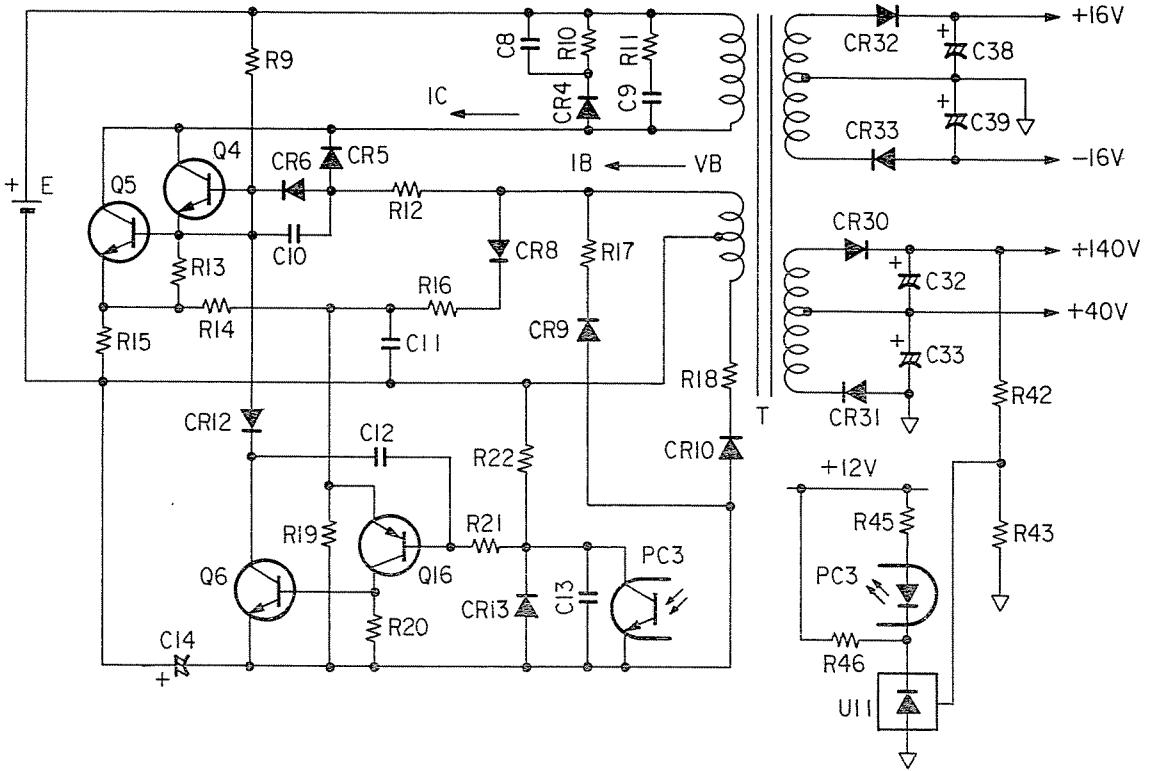


Figure 3-7 Switching Circuit

When the power is turned ON, unregulated voltage (E) is applied to the convertor circuit.

The base current of Q4 via starting resistor (R9), turns switching transistor (Q5) ON which induce the base winding voltage (VB) that turns the switching transistor (Q5) ON till saturate.

When the base winding voltage (VB) comes high before the transformer magnetic flux saturates, transistors (Q16, Q6) of the voltage regulator circuit turn diode (CR8) ON, which pull the base potential of Q4 to negative potential, and turn transistor (Q5) OFF. Then the energy stored in transformer is sent to the secondary rectifier circuit. And when the energy is fully transferred, the switching transistor (Q5) turn ON.

Output voltage from the secondary rectifier is detected by shunt regulator (U1) in reference to +12, isolated by photo-coupler (PC3), and stabilized by the voltage control circuits.

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## 4. CALIBRATION

### 4-1 General

Recommended calibration cycle for this oscilloscope is one year under normal operation. Shorter calibratin cycle may be recommended when the ambient condition are not well controlled.

Calibration consists of function operation checks and adjustments. First, operation checks of the functions are performed in which the units performance and functions are checked. These checks include a check of the specifications.

If there are items in the performance, functions or standards which cannot be satisfied, they will be readjusted in the adjustment procedure. At this time you should check that the adjustment item has been independently adjusted and that the operation has been completed as well as checking if the adjustment procedure has had an effect on another item (e.g., adjustment of the supply voltage).Fig. 4-1 shows the flow chart of the calibration procedure.

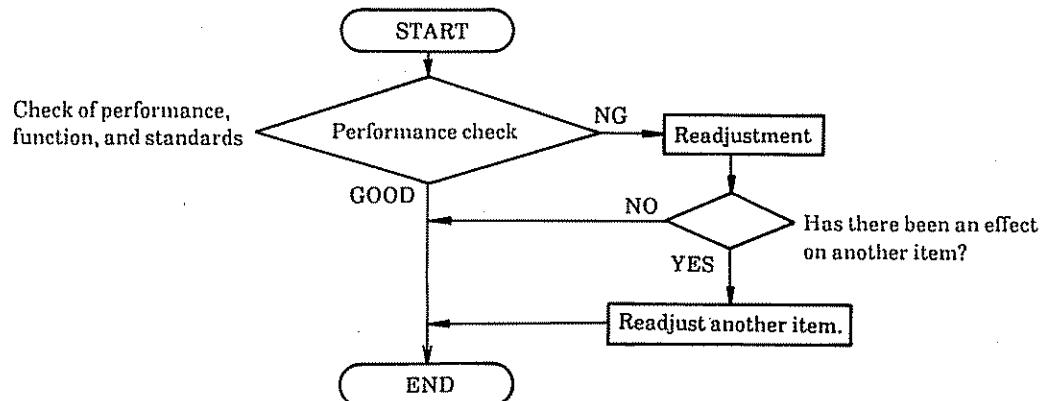


Fig. 4-1 Calibration Procedure Flow Chart

Optimum environmental conditions for the calibration of the unit are a temperature of  $23^{\circ}\text{C} \pm 2^{\circ}\text{C}$  and humidity of  $60\% \pm 5\%$ . Care should be taken when calibration are made at a location that receives wind from , for instance, the opening and closing of doors since calibration faults may occur in unexpected places.

When making calibration use calibrator which have been correctly calibrated and be careful of the supply voltage that is applied to them.

Perform sufficient warm up time on each piece of equipment used including this unit.

## 4-2 Preparations for Calibration

### 4-2-1 Table of instruments

The measuring instruments that are necessary for calibrating this oscilloscope are shown below.

Measuring instrument		Performance		Remarks
DC voltmeter (1) (low voltage)		Measuring range : 0 to 200V accuracy : Within $\pm 0.1\%$		Checking internal power supply voltage
DC voltmeter (2) (high voltage)		Measuring range : 0 to 3kV accuracy : Within $\pm 1\%$		Checking accelerator voltage
Capacitance meter		Measuring range : 0 to 50pF accuracy : Within $\pm 3\%$		Checking input capacitance
Vertical axis calibrator	Standard amplitude square wave generator	Output voltage : 1mV to 50Vp-p accuracy : within $\pm 0.3\%$		Vertical axis and X-Y calibration 1kHz
	Fastrise square wave generator	Output waveform : Square wave Frequency : 10Hz to 1MHz Rise time : 1.0ns max Flatness : Within $\pm 0.5\%$		Square wave flatness adjustment
Time mark generator		Mark output : 5s to 1ns Output stability : Within $\pm 0.1\%$		Time axis calibration
Constant amplitude signal generator		Frequency range : 250kHz to 250MHz Frequency accuracy : Within $\pm 1\%$ Output voltage : 5mV to 5.5Vp-p Output flatness : Within $\pm 2\%$		Vertical axis and X-Y frequency bandwidth calibration 50kHz reference
Oscilloscope		Deflection factor : 5mV to 5V/DIV Frequency band : DC to 100MHz Time axis : 0.5s to 20ns		
Connecting cable		Characteristic impedance : 50ohms ; Length : Approx 1m		At least two
Terminator		Characteristic impedance : 50ohms ; Power consumption : 1/2W min		Two
Attenuator		Characteristic impedance : 50ohms ; Power consumption : 1/2W min		
Screwdriver		3mm screwdriver		
Adjusting screwdriver		Low capacitance type		

Table 4-1 Instruments necessary for calibration

#### 4-2-2 Removing the case

The main unit can be pulled our from the case by first removing the four (4mm) screws of the rear panel cord winding setion as shown in Fig.4-2.

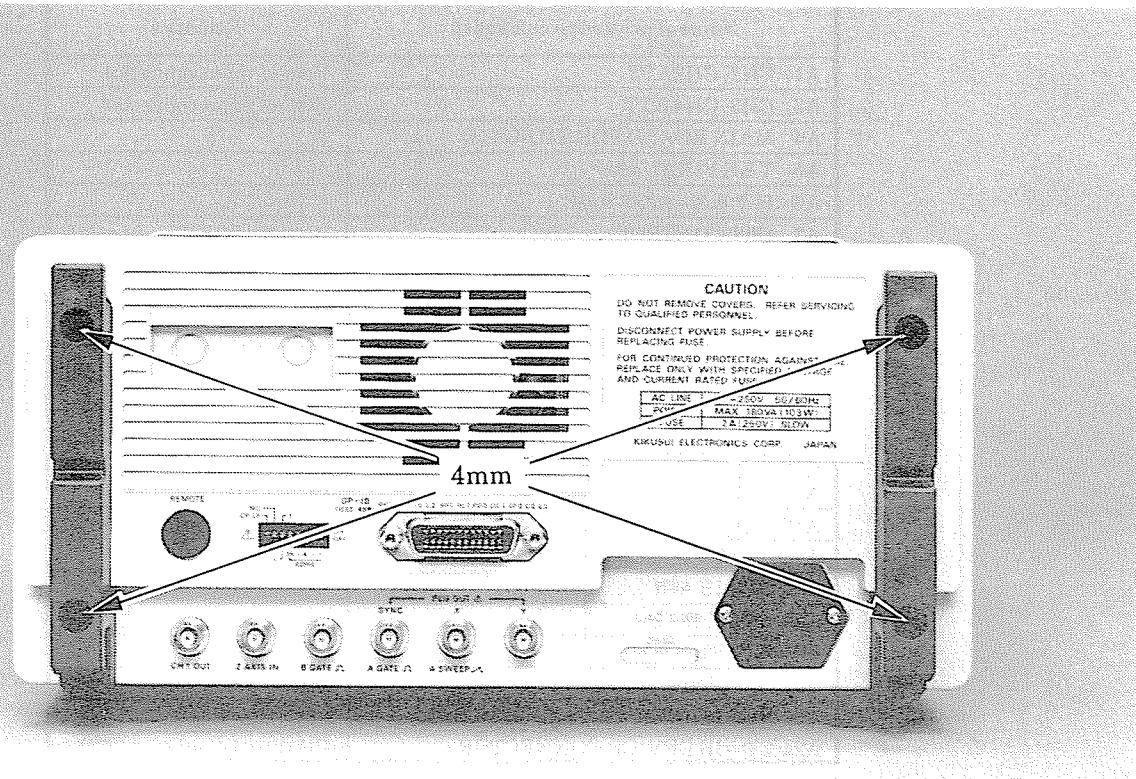


Fig 4-2 Removing the Case

### 4-2-3 Board layout

The printed circuit boards used in this oscilloscope are shown in Table 4-2, and their layout is shown in Fig. 4-2.

Name of printed circuit board	Remarks
A1 CH1, CH2ATT	Rear of input connector
A3 CH3, CH4 ATT	Rear of input connector
A4 MAIN BOARD FOR STORAGE	
A5 V&H FINAL AMP	
A6 H-V & Z-AXIS AMP	
A7 CRT CONTROL	Bottom of CRT
A8 MAIN CPU BOARD	
A10 FRONT PANEL CONTROL	Behind panel
A11 FRONT PANEL SWITCH	Behind panel
A12 STORAGE POWER SUPPLY	
A13 MOTHER BOARD STORAGE	
A14 SUB CPU	
A15 ANALOG PROCESSING	COM 7101A only
A16 A/D, MEMORY	COM 7101A only
A17 ACQUISITION CONTROL	COM 7101A only
A18 STORAGE DISPLAY	COM 7101A only
A19 GP-IB ADDRESS SWITCH	COM 7101A only
A20 LINE FILTER	
A21 CRT SOCKET	
A22 H. V UNIT	Inside of H. V UNIT
A23 BUS BOARD	
A24 GP-IB DEVICE CONNECTOR	COM 7101A only

Table 4-2 Printed circuit boards

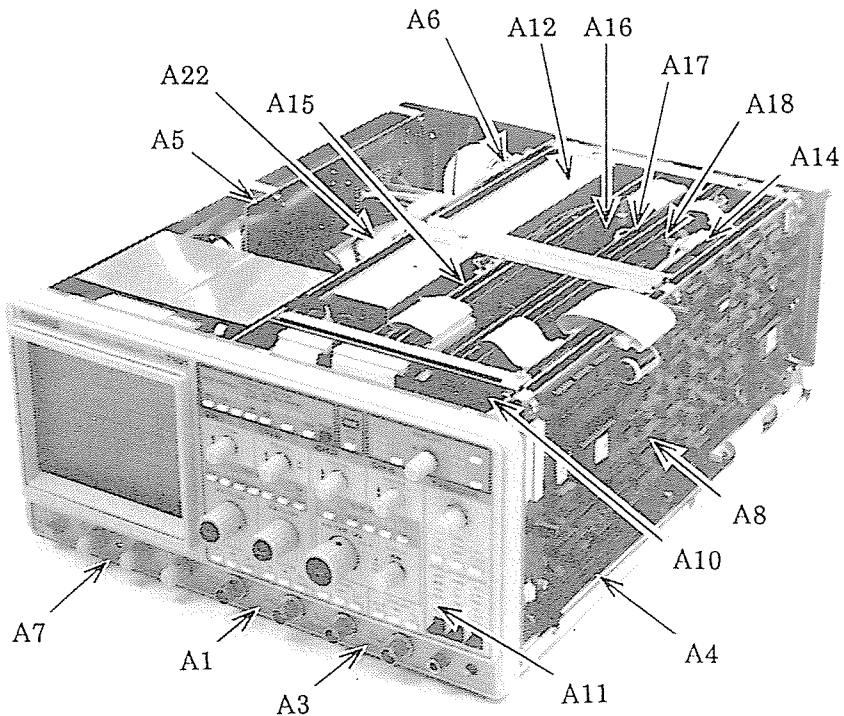


Fig. 4-3 Layout of printed circuit boards

## 4-3 Performance Checks

### 4-3-1 General

Most of the functions can be checked by performing separate checks of the unit's functions as shown below. For details on the check method see the Instruction Manual and the specification items in this Service Manual.

### 4-3-2 CRT System

#### 1) INTEN Check

- (1) No signal, or set the input coupling of the vertical axis to GND.
- (2) Rotate the INTEN knob and check that the trace is extinguished when the knob is at a positions between 9 o'clock and 11 o'clock and that the there is a suitable brightness at a position between 1 o'clock and 3 o'clock.
- (3) Switch the sweep time from slow speed through to high speed and check that there is no brightness irregularity of the trace on the CRT.

#### 2) FOCUS Check

- (1) Rotate the FOCUS knob and check that the focus can be properly adjusted.
- (2) Check that the best focus occurs at a position between 11o'clock and 1o'clock.

#### 3) Astigmatism Check

- (1) Apply an 8 DIV signal to the vertical axis so that raster appears on the CRT.
- (2) Check that there is not a barrel type or spool type of distortion on the raster.

#### 4) CRT Readout Check

- (1) Check that there are no errors in the characters of the readout.
- (2) Check that there is no dispersion of the readout or blurring of the focus .
- (3) Apply a signal to the CH1 input and check that the voltage display and the time display are within the specifications.

### 4-3-3 Vertical Axis System

#### 1) Sensitivity Check of Each Channel

- (1) Connect the output of the vertical axis calibrator to the input of CH1.
- (2) Check that the sensitivity of CH1 is within the specifications.
- (3) Perform steps (1) and (2) for each of the channels and check that the sensitivity of each of the channels is within the specifications.

#### 2) Frequency Bandwidth Check of Each Channel

- (1) Connect the output of the signal generator used for frequency bandwidth checks to the input of CH1.
- (2) Check that the frequency bandwidth of CH1 is within the specifications.
- (3) Perform steps (1) and (2) for each of the channels and check that the frequency bandwidth of each of the channels is within the specifications.

**3) Check of the Square Wave Characteristics of Each Channel**

- (1) Connect the output of the fast rise square signal generator to the input of CH1.
- (2) Check that the square wave characteristics of CH1 are within the specifications.
- (3) Perform steps (1) and (2) for each of the channel.

**4) Input Coupling Check**

- (1) Apply the AC signal accompanying the direct current to the input of CH1.
- (2) Set the input coupling of CH1 to AC.
- (3) Check that the waveform displayed on the CRT screen is only an AC signal.
- (4) Set the input coupling of CH1 to DC.
- (5) Check that the waveform displayed on the CRT screen is the AC signal accompanying the direct current.
- (6) Set the input coupling of CH1 to GND.
- (7) Check that the waveform on the CRT screen is distinguished and that only the straight line remains.
- (8) Disconnect the input signal.
- (9) Switch between AC- DC - GND position and check that there is no trace shift.
- (10) Perform steps (1) through (8) for each channel.

**5) DC Balance Check**

- (1) Set the input coupling of CH1 to GND.
- (2) While switching the input sensitivity of CH1 from 1mV/DIV through to 5 V/DIV check that there is no movement of the bright line.
- (3) Operate the CH1 variable and check that there is no movement of the bright line.
- (4) Performs steps(1) through (3) for each channel.

**6) Check of Vertical position range.**

- (1) Set the input coupling of CH1 to GND.
- (2) Rotate the CH1 vertical axis position knob and check that the trace moves in excess of  $\pm 8\text{DIV}$ .
- (3) Perform steps (1) and (2) for each channel.

**7) Operation Checks of Single and Double Phenomena**

- (1) Set the input coupling of each channel to GND.
- (2) Press "CH1," "CH2," "CH3," and "CH4" of the "VERT MODE" in order and check for the occurrence of phenomena 1 through 4.
- (3) Switch "ALT/CHOP" of the "VERT MODE" and check that the ALT sweep and the CHOP sweep operate properly.

**8) INV Operation Check**

- (1) Apply a time mark signal to the CH2 input.
- (2) Press the CH2 knob and check that the waveform inverts.

**9) ADD Operation Check**

- (1) Apply the same signal to CH1 and CH2.
- (2) Press the ADD key and set the unit to the ADD condition.
- (3) Check that twice the amplitude of CH1 or CH2 can be observed on the screen.

**10) BWL (20 MHz) Operation Check**

- (1) Apply a 100MHz signal to the CH1 input.
- (2) Press the BW key and set the BANDWIDTH LIMIT condition.
- (3) Check that the amplitude of the waveform on the screen decreases.

**4-3-4 Trigger System**

**1) Trigger Sensitivity Check**

- (1) Connect the output of the constant amplitude signal generator to the CH1 input.
- (2) Vary the frequency and output level of the signal and check that the sensitivity of the INT-A trigger is within the standard.
- (3) Perform steps (1) and (2) for each channel.
- (4) Perform the same check for the B trigger.

**2) Trigger Level Check**

- (1) Connect the output of a low-frequency oscillator set to 50 kHz to the CH1 input.
- (2) Adjust the output of the low-frequency oscillator and set the amplitude of the CRT screen to 8 DIV.
- (3) Check that the position of the trigger can be varied from the positive peak to the negative peak of the observed waveform.
- (4) Perform the same check for the B trigger.

**3) Check of the Polarity (SLOPE = + / -)**

- (1) Adjust the output of the low-frequency oscillator to 4 DIV.
- (2) Check that the trigger has been applied with a positive slope when the trigger slope has been set to "+" as well as with a negative slope when the trigger slope has been set to "-".
- (3) Perform the same check for the B trigger.

**4) Check of the Sweep Mode (AUTO, NORM, SINGLE)**

- (1) Set the sweep mode to AUTO.
- (2) turn the trigger level knob to C.C.W or C.W position, observe that the trace is free running.
- (3) Set the sweep mode to NORM.
- (4) Check that the trace is not swept when in the same condition mentioned above.
- (5) Adjust the trigger level knob to have stable display.
- (6) Temporarily disconnect the output of the low-frequency oscillator connected to the CH1 input.
- (7) Set the sweep mode to SINGLE.

- (8) Press the mode select level down further and check that the unit enters the sweep standby mode and that the "READY" LED light up.
- (9) Reconnect the output of the low-frequency oscillator to the CH1 input.
- (10) Check that a single sweep is performed only once.

#### 4-3-5 Horizontal Axis System

##### 1) Check of the Sweep Time

- (1) Connect a time marker generator to the CH1 input.
- (2) Check that the A sweep time is within the specifications.
- (3) Check that the B sweep time is within the specifications.

##### 2) Sweep magnifier Check

- (1) Connect a time marker generator to the CH1 input.
- (2) Turn the  $\times 10$  MAG switch on, check that the sweep accuracy is within the specifications.
- (3) Repeat the check for B-sweep too, set the  $\times 10$  MAG switch at off position after completion of the check.

##### 3) Check of the hold-off Time

- (1) Connect a time marker generator to the CH1 input.
- (2) Rotate the hold-off knob and check that the hold-off time varies.

##### 4) Check of the Delayed Sweep Operation

- (1) Connect a time marker generator to the CH1 input.
- (2) Select a continuous delay operation.
- (3) Vary DELAY TIME and check that there are no irregularities in the continuous delay operation.
- (4) Set the triggered after delay operation.
- (5) Vary DELAY TIME and check that there are no irregularities in the triggerable after delay operation.

##### 5) Check of the X-Y Operation

- (1) Connect the output of the vertical axis calibrator to the X-axis (CH1) input.
- (2) Set the X-Y operation.
- (3) Check that the sensitivity of the X-axis (CH1) is within the specifications.
- (4) Connect the output of the constant amplitude signal generator to the input of the X-axis (CH1).
- (5) Check that the frequency bandwidth of the X-axis (CH1) is within the specifications.
- (6) Check the Y-axis (CH2) in the same way.

#### **4-3-6 Storage System (COM 7101A only)**

##### **1) A/D Conversion Check**

- (1) Apply a 50kHz, 8divisions amplitude sin wave from constant amplitude signal generator to the CH1 input.
- (2) Set the unit to storage mode.
- (3) Check that the 8 DIV waveform (storage) is on the CRT screen.

##### **2) Repeat Operation Check**

- (1) Apply a 10MHz, 8divisions amplitude sin wave from constant amplitude signal generator to the CH1 input.
- (2) Set the unit to storage mode.
- (3) Set the unit's time axis to the region of repeat operation. (1  $\mu$ s/DIV to 10 ns/DIV)
- (4) Check that the unit has entered the repeat operation and that the 8 DIV waveform (storage) is observable on the CRT screen.

##### **3) Role Operation Check**

- (1) Connect the output of a low frequency signal generator set to 1Hz to the CH1 input.
- (2) Adjust the output of the signal generator and set the amplitude of the CRT screen to 4 DIV.
- (3) Set the unit to storage mode.
- (4) Set the unit's time axis to the region of role operation. (5 s/DIV to 0.1 s/DIV)
- (5) Check that the unit has entered the role operation, the waveform, (storage) on the CRT screen to the left , and that a new waveform continues to be observed.

##### **4) Envelope Operation Check**

- (1) Connect the output of a consantt amplitude signal generator set to 50MHz to the CH1 input.
- (2) Adjust the output of the signal generator and set the amplitude of the CRT to 6 DIV.
- (3) Set the unit to storage mode.
- (4) Set the unit's time axis to 10 $\mu$ s/DIV.
- (5) Vary the frequency of the signal generator slightly and check the aliasing.
- (6) Set the unit to envelope operation.
- (7) Check that the unit has entered the envelope operation and that an envelope display waveform is observed on the CRT screen.

##### **5) Save Operation Check**

- (1) Connect the output of a signal generator set to 50kHz to the CH1 input.
- (2) Adjust the output of the signal generator and set the amplitude of the CRT screen to 2 DIV.
- (3) Set the unit to storage mode.

- (4) Set the unit to the pause condition and designate REF MEMORY 1.
- (5) Press the SAVE key and store the signal that has been input to CH1 in the memory .
- (6) For REF MEMORY 2 through 4, perform steps (4) and (5) and check the operation.

#### 4-3-7 GP-IB Section (with COM 7101A and GP-IB function only)

Prepare a personal computer with the GP-IB function (hereafter abbreviated as CPU) and connect it to the unit.

See the Operation Manual for the various commands.

##### 1). Check of Each of the Function Settings

- (1) Send the vertical axis system command from the CPU and check that the setting is made properly.
- (2) Send the trigger system command from the CPU and check that the setting is made properly.
- (3) Send the horizontal axis system command from the CPU and check that the setting is made properly.
- (4) Send the cursor command from the CPU and check that the setting is made properly.
- (5) Send the DVM and the counter commands from the CPU and check that the settings are made properly.
- (6) Send the storage command from the CPU and check that the setting is made properly.  
(Note that the remote control (RC01-COM is used.)
- (7) Send the step control command from the CPU and check that the setting is made properly.  
(Note, that the remote control RCO1-COM is used.)

##### 2) Waveform Data Transmission Check

Send the waveform data input/output commands from the CPU and check that the settings are made properly.

## 4-4 Calibration

### 4-4-1 Calibration procedure

This oscilloscope must be calibrated correctly using the same procedure as that used when it is initially calibrated at the factory. The calibration procedure is set out in this manual so that the oscilloscope can be calibrated accurately and in as short a period as possible. Be sure, therefore, to observe this procedure.

#### 1) Initial setting

The settings of the common items using the controls and switches on the panel of the oscilloscope are shown in Table 4-3. These are the initial settings.

FUNCTION		SETTING	REMARKS
Power supply	POWER	ON	
	INTEN	Adequate brightness	
	FOCUS	Set to best focus	
	SCALE	Turn fully left (MIN)	
Vertical circuit	VERT MODE	CH1 only, other channels off	
	VOLT/DIV	10mv/DIV	
	VARIABLE	CAL'D	
	COUPLING	DC (GND is OFF)	
	POSITION (CH1)	Center	
	BW [20MHz]	OFF	
	CH2 INV	OFF	
Trigger circuit	MODE	AUTO	
	SOURCE	V-MODE (CH1)	
	COUPLING	AC	
	TRIG LEVEL	Center	
	LEVEL AUTO	ON	
	SLOPE	+	
Sweep circuit	HORIZ MODE	A	
	A/B TIME/DIV	1ms/DIV	
	VARIABLE	CAL'D	
Horizontal circuit	POSITION (H)	Set so that trace is at center	
	×10 MAG	OFF	
Readout	CURSOR SW	HO	
	READOUT CONT	Turn fully left	(KNOB)
	DVM SW	OFF	
Others	STORAGE MODE	REAL	COM 7101A only

Table 4-3 *Initial setting of common items*

## 2) Self calibration

Perform self-calibration. The method of starting self-calibration of the COM7101A is slightly different to that of the COM7100A. Table 4-4 shows the method of self-calibrating model.

Model	Method
COM7101A	Press the "DVM" switch while pressing the "(2nd)" function key.
COM7100A	Press the "INTEN" knob, momentarily release it, then while the CRT screen is in the BEAM FIND status press the "DVM" switch.

Table 4-4 Method of starting self-calibration

While self-calibration is taking place, "SELF CAL" and also the content of calibration will appear on the CRT screen.

The self calibration period is about 2minutes and 15seconds for the COM7101A, and about 45seconds for the COM7100A.

The contents which are calibrated by the self calibration function are shown below Table 4-5, 4-6.

Section	Display		Content of calibration
Vertical section	VERT CH1	STEP BAL	CH1 STEP BALANCE
		VAR B 5	CH1 VARIABLE BALANCE (5mV / DIV RANGE)
		GAIN 5	CH1 GAIN (5mV / DIV RANGE)
		PC C 5	CH1 POSITION CENTER (5mV / DIV RANGE)
		VAR B 10	CH1 VARIABLE BALANCE (10mV / DIV RANGE)
		GAIN 10	CH1 GAIN (10mV / DIV RANGE)
		PC C 10	CH1 POSITION CENTER (10mV / DIV RANGE)
	VERT CH2	STEP BAL	CH2 STEP BALANCE
		VAR B 5	CH2 VARIABLE BALANCE (5mV / DIV RANGE)
		GAIN 5	CH2 GAIN (5mV / DIV RANGE)
		PC C 5	CH2 POSITION CENTER (5mV / DIV RANGE)
		VAR B 10	CH2 VARIABLE BALANCE (10mV / DIV RANGE)
		GAIN 10	CH2 GAIN (10mV / DIV RANGE)
		PC C 10	CH2 POSITION CENTER (10mV / DIV RANGE)
Sweep circuit	HORIZ	PC C 5 CH2 INV	CH2 POSITION CENTER (10mV / DIV RANGE) and CH2 INV BALANCE
		PC C 10 CH2 INV	CH2 POSITION CENTER (10mV / DIV RANGE) and CH2 INV BALANCE
		START A	A SWEEP POINT
		START B	B SWEEP POINT
		START COMP	DELAY TIME COMPARATOR
		GAIN A 1m	A SWEEP SPEED (1ms / DIV RANGE)
		GAIN A 2m	A SWEEP SPEED (2ms / DIV RANGE)

Table 4-5 Content of self calibration (1 / 2)

Section	Display		Content of calibration
Sweep circuit	HORIZ	GAIN A 5m	A SWEEP SPEED (5ms / DIV RANGE)
		GAIN A 5m	A SWEEP SPEED (.5ms / DIV RANGE)
		GAIN A 10m	A SWEEP SPEED (10ms / DIV RANGE)
		GAIN A 50 $\mu$	A SWEEP SPEED (50 $\mu$ s / DIV RANGE)
		GAIN A 1mN	A SWEEP SPEED (1ms / DIV combination)
		GAIN A 1mN	A SWEEP SPEED (.1ms / DIV combination)
		GAIN B 1m	B SWEEP SPEED (1ms / DIV RANGE)
		GAIN B 2m	B SWEEP SPEED (2ms / DIV RANGE)
		GAIN B 5m	B SWEEP SPEED (5ms / DIV RANGE)
		GAIN B .5m	B SWEEP SPEED (.5ms / DIV RANGE)
		GAIN B 10m	B SWEEP SPEED (10ms / DIV RANGE)
		GAIN B 50 $\mu$	B SWEEP SPEED (50 $\mu$ s / DIV RANGE)
		GAIN B 1mN	B SWEEP SPEED (1ms / DIV combination)
		GAIN B .1mN	B SWEEP SPEED (.1ms / DIV combination)
DVM section	DVM	DC AUTO ZERO	OFFSET calibration for DC MODE of DIGITAL VOLTMETER function
		AC RMS OFFS	OFFSET calibration for RMS MODE of DIGITAL VOLTMETER function
		AC AUTO ZERO	OFFSET calibration for AC MODE of DIGITAL VOLTMETER function
		P-P AUTO ZERO	OFFSET calibration of P-P DETECTOR
		GAIN MESUR (DC)	DC GAIN calibration of DIGITAL VOLTMETER
		GAIN MESUR (DC)	DC GAIN calibration of DIGITAL VOLTMETER
Storage	No indication		Each function in the storage circuit (COM7201A) only

Note : The term "combination" pertaining to sweep speed means that this combination is not possible in the normal sweep mode. By performing this "combination" sweep, the sweep speed will be calibrated not only in the medium speed area but also in the low speed and high speed areas as well.

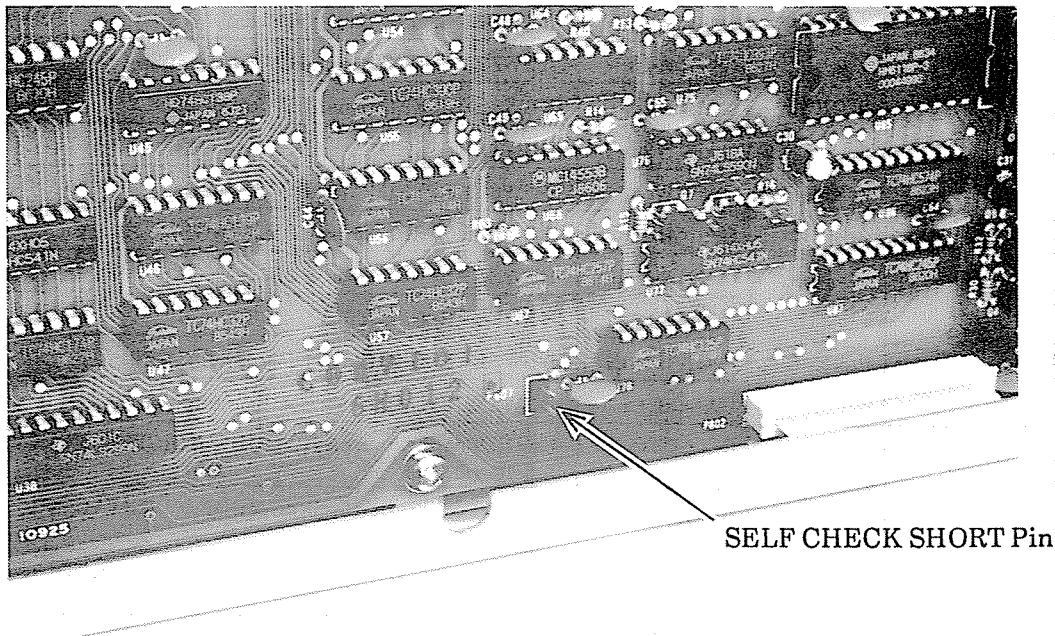
Table 4-6 Content of self calibration (2/2)

After the completion of the calibration, the pannel setting will return to the original setting.

### 3) Checking for self calibration defects

By performing the following operation, the calibration setting values will be displayed on this oscilloscope, enabling the oscilloscope to be checked for possible calibration defects.

- (1) SHORT the SELF CHECK SHORT PIN on board A8 (MAIN CPU board) shown in Fig. 4-4.



**Fig. 4-4 Position of SELF CHECK SHORT PIN**

- (2) Press the "INTEN" knob and momentarily release it, then press the "OUT" (SCAL) knob while the CRT screen is in the BEAM FIND status.
  - (3) The HEX display (calibration setting value) will appear on the CRT screen.
  - (4) Confirm that neither "FFF" nor "000" appears in the HEX display on the CRT screen. If it does, perform self calibration once again by way of precaution, and perform steps (1) to (5) once again. If "FFF" or "000" still appears in the HEX display, refer to Fig. 4-5 and Table 4-7 (table of calibration setting values), and find out at what stage of the calibration procedure the calibration defect occurred. Next, search for the function concerned and carry out repair.

#### **NOTE**

The HEX value is data which is sent from the CPU to the D/A converter. This value is different for each set, hence it is not possible to compare the data between sets and judge whether or not it is satisfactory.

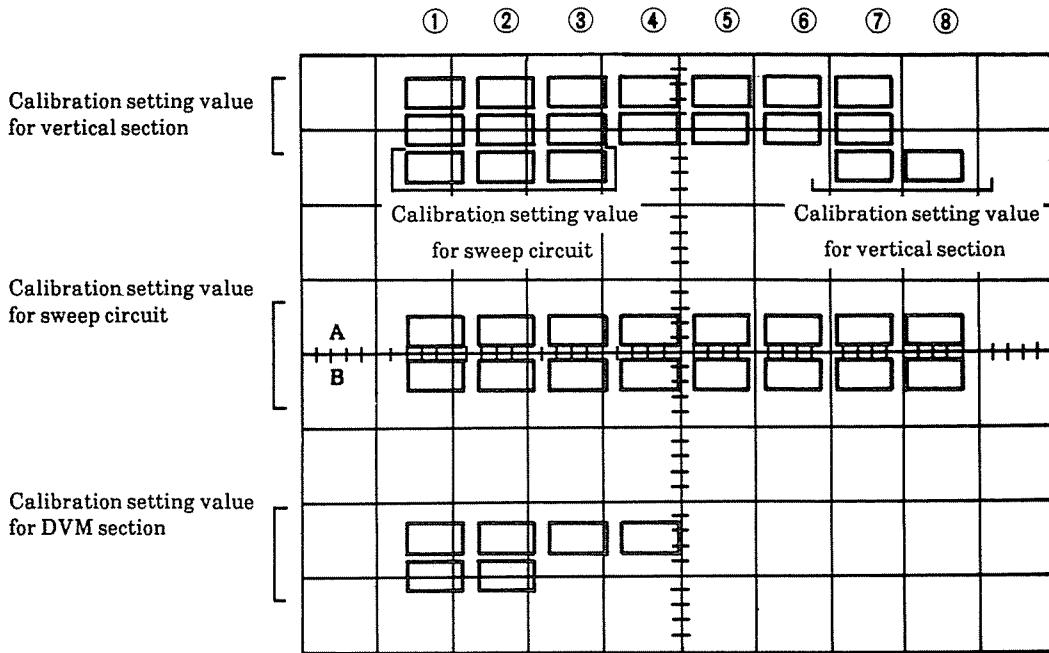


Fig. 4-5

■ Calibration setting value for vertical section

	①	②	③	④	⑤	⑥	⑦	⑧
CH1	STEP BAL	VAR B 5	GAIN 5	PC C 5	VAR B 10	GAIN 10	PC C 10	
CH2	STEP BAL	VAR B 5	GAIN 5	PC C 5	VAR B 10	GAIN 10	PC C 10	
								PC C 5 CH2 INV      PC C 10 CH2 INV

■ Calibration setting value for sweep circuit

	START A	START B	START COMP					
A	1 ms	2 ms	5 ms	.5 ms	10 ms	50 µs	1 mN	.1 mN
B	1 ms	2 ms	5 ms	.5 ms	10 ms	50 µs	1 mN	.1 mN

■ Calibration setting value for DVM section

	DC AUTO ZERO	AC RMS OFFS	AC AUTO ZERO	P-P AUTO ZERO
	GAIN MESUR DC	GAIN MESUR AC		

Table 4-7 Table of calibration setting values

#### 4-4-2 Checking and adjusting internal power supply voltage

##### 1) Internal power supply voltage

The +12V power supply contained in this oscilloscope constitutes the reference for all other power supply voltages. For this reason, be sure to check the +12V power supply first and foremost. If the +12V power supply voltage is outside the range indicated in Table 4-8, adjust +12V ADJ (RV1) on board A12. After this, simply check the other power supply voltages. Do not adjust them. Table 4-8 shows the value of each power supply voltage. The point for checking each voltage and also the adjustment position of +12V ADJ (RV1) are shown in Fig. 4-7 and 4-8

Power supply voltage	Voltage range	Remarks
+12V	+11.94V~+12.06V	+12V ADJ (RV1 – A12 PCB)
-12V	-11.94V~-12.06V	
+5Va	+4.75V~+5.25V	For analog circuit
+5Vd	+4.75V~+5.25V	For digital circuit
-5Vd	-4.75V~-5.25V	For digital circuit
+70V	+69V~+72V	
+140V	+133V~+147V	
-2100V	-2050V~2150V	

Table 4-8 Range of each internal power supply voltage

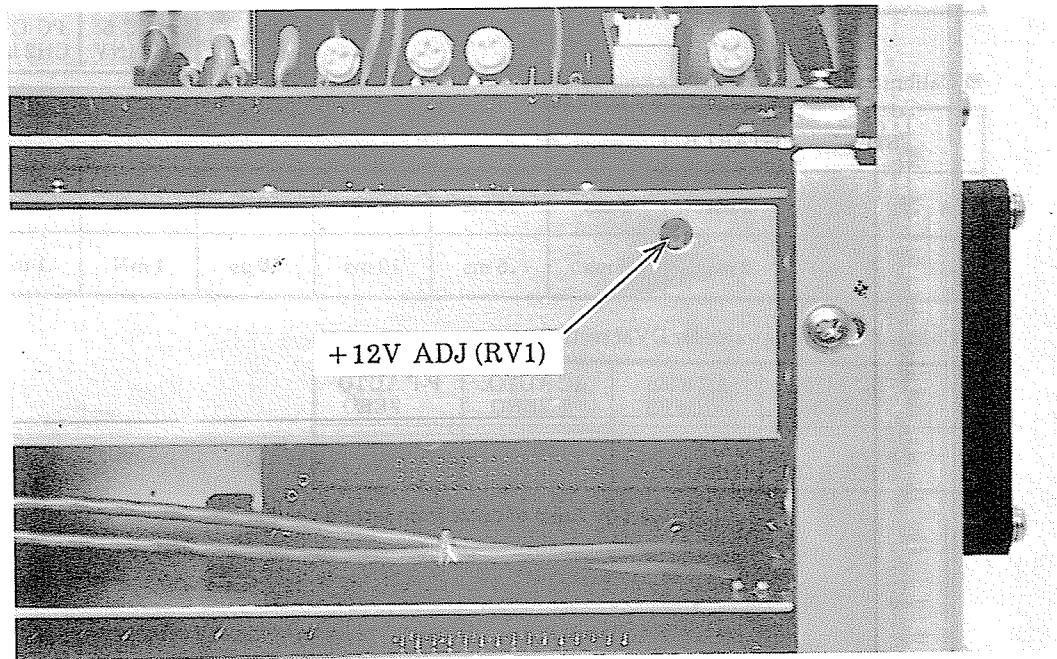


Fig. 4-6 Adjustment position of +12V ADJ (RV1)

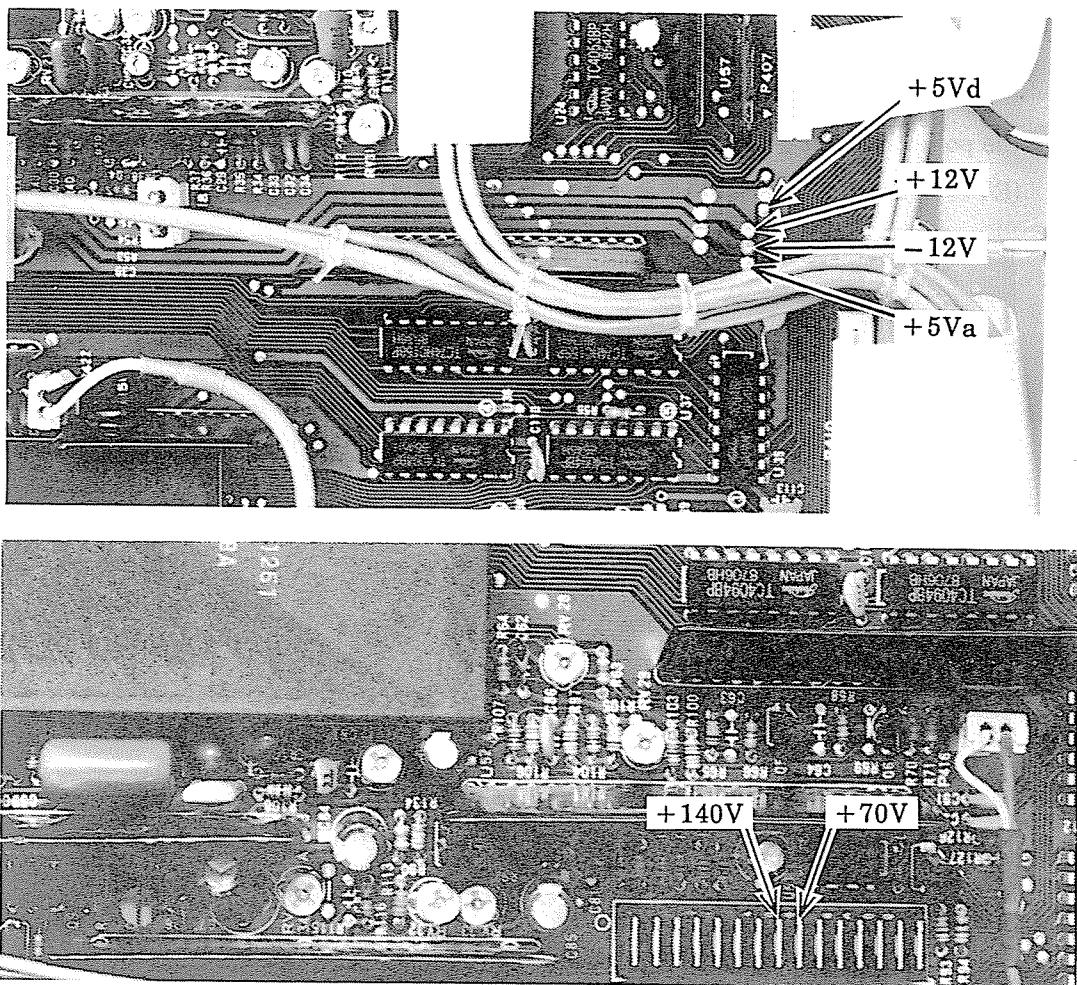


Fig. 4-7 Power supply voltage checking position

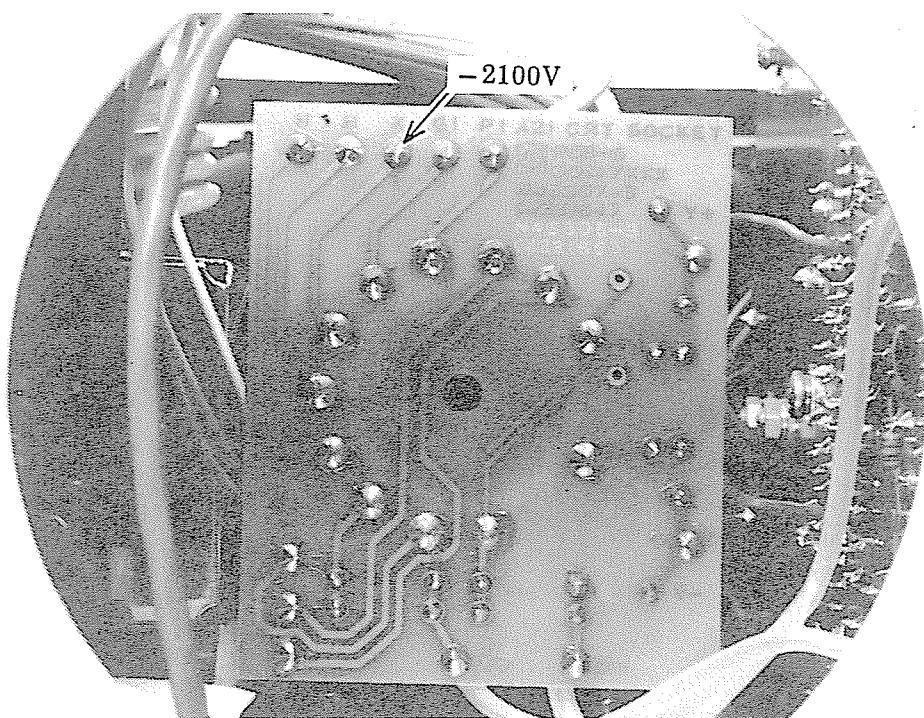


Fig. 4-8 Checking position of -2100V

## 2) V.REF 30 mV

Using a DC digital voltmeter, check the voltage at the R4 on board A4. It is satisfactory, if the potential is between 30.01 mV and 30.09 mV. If it is outside this range, adjust V REF (RV1) on board A4 shown in Fig. 4-9.

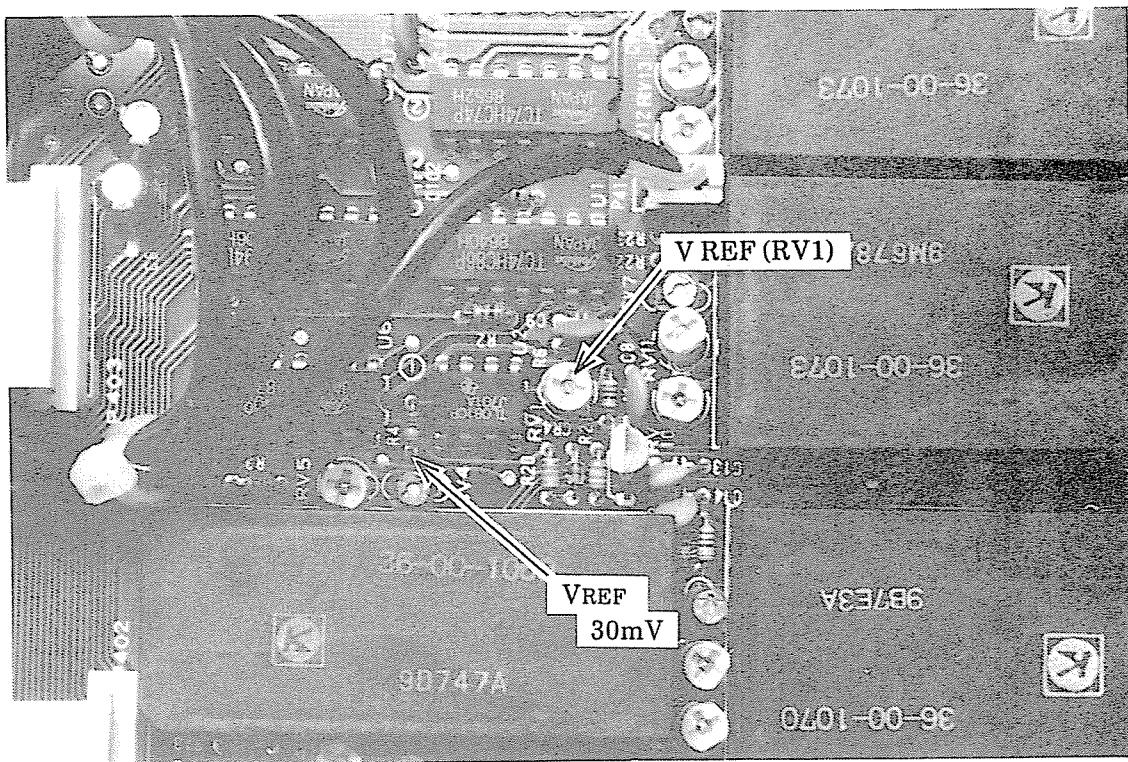


Fig. 4-9 Adjustment position of V REF (RV1)

#### 4-4-3 Checking and adjusting CRT circuit

##### NOTE

If the voltage in the CRT circuit are adjusted in the same way as described in the previous sub-section "Checking and adjusting internal power supply voltages", the deflection factor will be affected. After adjusting these voltages, therefore, be sure to check the vertical and horizontal deflection factor and the sweep speed.

#### 1) GEOMETRY

Check the distortion of the CRT.

- (1) Apply a 50kHz, 8DIV amplitude signal to CH1 input from signal generator.
- (2) Confirm that the waveform on the CRT is not distorted. If it is distorted, adjust GEOMETRY (RV4) on board A6 indicated in Fig. 4-10.

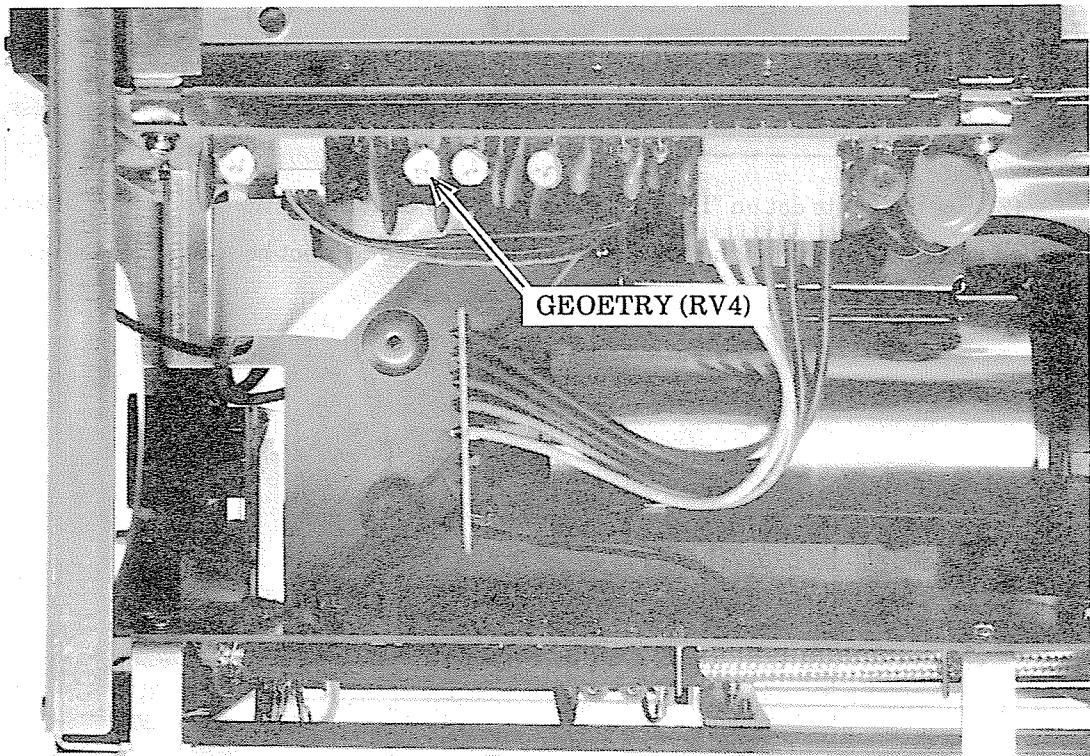


Fig. 4-10 Adjustment position of GEOMETRY (RV4)

## 2) ASTIG

- (1) Set the input coupling of CH1 and CH2 to "GND".
- (2) Set "HORIZ MODE" to "X-Y", and using each of the horizontal and vertical "POSITION" controls, output a bright spot at the center of the CRT screen.
- (3) Rotate "FOCUS" knob to a suitable position, and confirm whether or not the bright spot can be made to approach a circle without limit. If the bright spot does not approach a circle, adjust ASTIG (RV5) on board A6 shown in Fig. 4-11.

## 3) SUB FOCUS

Set the white dot on "FOCUS" knob to the 12 O'clock position, and confirm whether or not the electron beam is correctly focused. If the electron beam cannot be correctly focused when "FOCUS" knob is set to the 12 O'clock position, adjust SUB FOCUS (RV3) on board A6 shown in Fig. 4-11.

## 4) HALATION

Confirm that the characters near the periphery of the CRT are not blurred. If they are blurred, adjust HALATION (RV6) on board A6 shown in Fig. 4-11.

## 5) SUB INTEN

- (1) Set "TIME/DIV" to 1ms/DIV, and draw a single horizontal line trace across the CRT screen.
- (2) Set the white dot on "INTEN" knob to the 10 O'clock position, and confirm that the trace is faintly visible. If the trace is either too bright or cannot be seen at all, adjust CRT BIAS (RV2) on board A6 shown in Fig. 4-11.

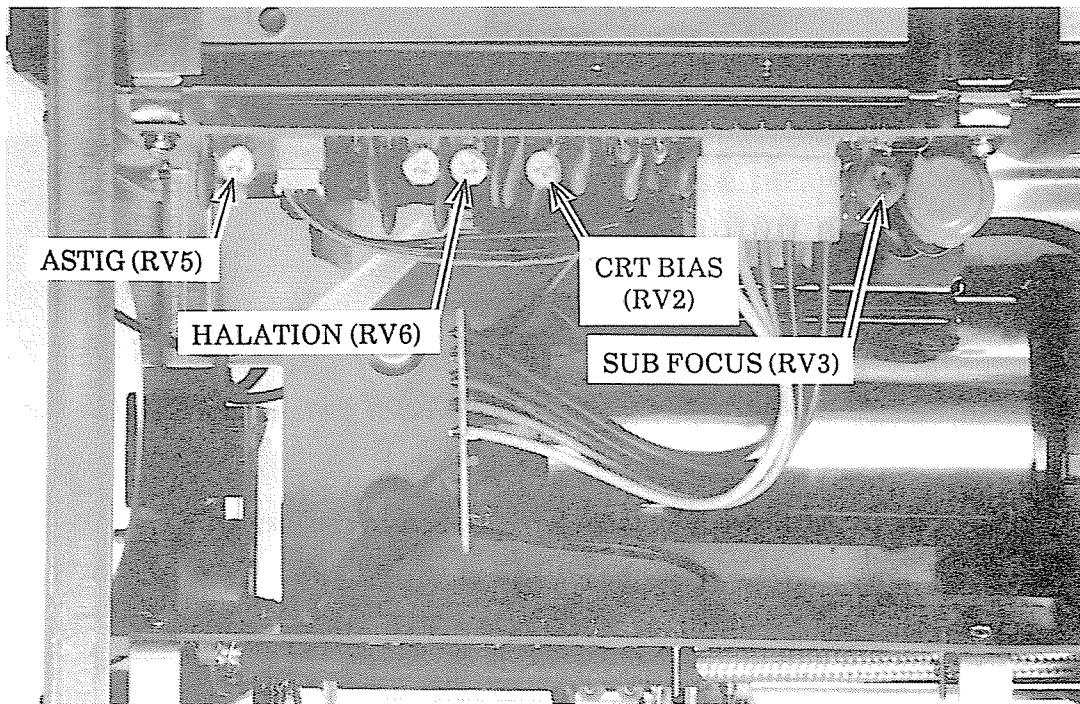


Fig. 4-11 Adjustment position of CRT circuit [ASTIG (RV5), SUB FOCUS (RV3) HALLATION (RV6), CRT BIAS (RV2)]

## 6) X DEFLECTION FACTOR

- (1) Perform initial setting of the oscilloscope in accordance with Table 4-3.
- (2) Apply a 1ms time mark signal to CH1 input (terminated in 50ohms), then adjust the VOLT / DIV to get approx. 2DIV amplitude on the screen.
- (3) Confirm that the displayed period of the waveform on the CRT screen is within  $\pm 2\%$ . If it is not, adjust HORIZ GAIN ADJ (RV7) on board A5 shown in Fig. 4-12.

**NOTE**

*Sweep accuracy for all TIME/DIV setting. It should be within  $\pm 2\%$  for all ranges between 0.5s and 10ns.*

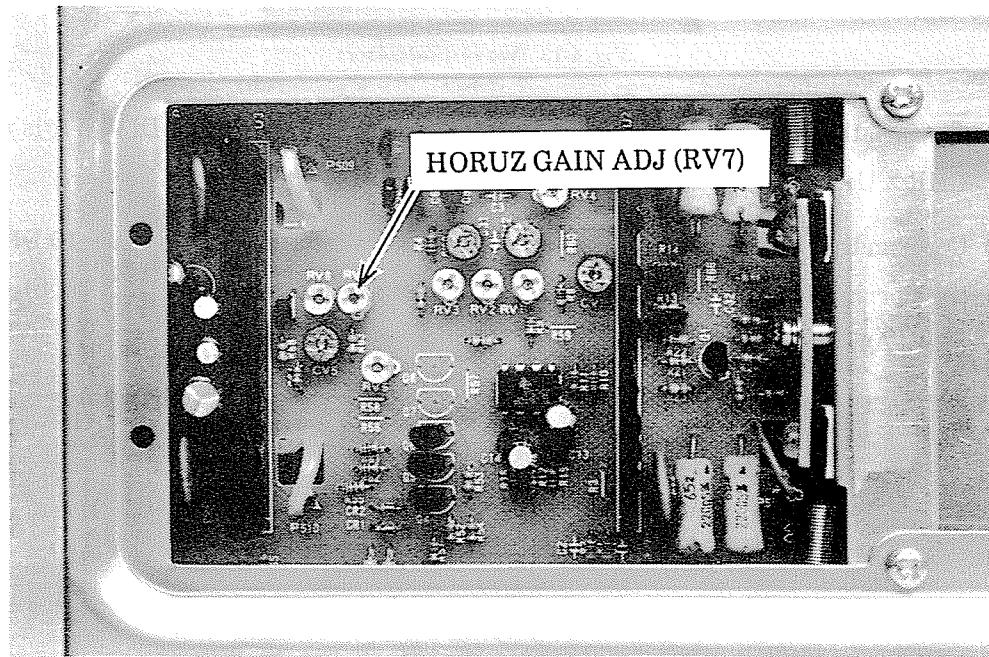


Fig. 4-12 Adjustment position of HORIZ GAIN ADJ (RV7)

## 7) X-axis position of characters and gain

- (1) Perform initial setting of the instrument in accordance with Table 4-3.
- (2) Turn “ $\Delta T$ ” on and display two vertical cursors on the CRT screen.
- (3) Turn the read-out control knob until the distance between the two cursors is maximum.  
(See Fig.4-13.) (For details of the method of moving the cursors, read the instruction manual.)

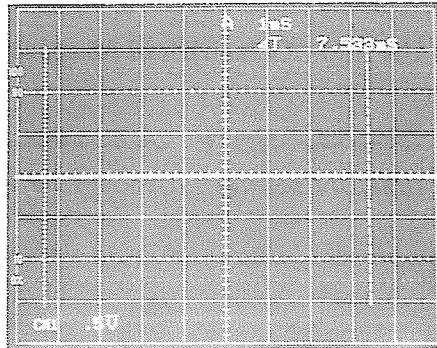


Fig. 4-13 Two vertical cursors

- (4) Confirm that the distance between the two cursors is  $10 \text{ DIV} \pm 0.1 \text{ DIV}$ . If it is not, adjust CHR X GAIN (RV33) on board A4 shown in Fig.4-14.
- (5) Confirm that the positions of the two cursors are within  $\pm 0.1 \text{ DIV}$  of the 10 DIV point on the horizontal axis of the CRT screen. If they are not, adjust CHR X POSI (RV32) on board A4 shown in Fig.4-14.

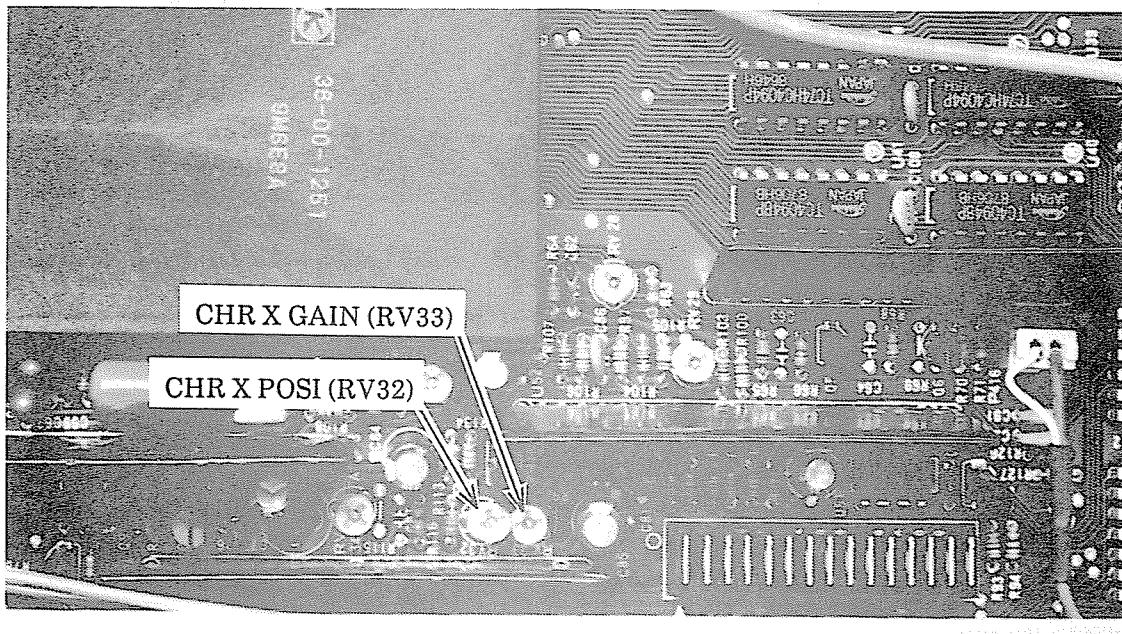


Fig. 4-14 Adjustment positions of CHR X GAIN (RV33) and CHR X POSI (RV32)

## 8) Y DEFLECTION FACTOR

- (1) Perform initial setting in accordance with Table 4-3.
- (2) Set "TIME / DIV" to 1ms / DIV.
- (3) Connect the amplitude calibration signal output of the vertical axis calibrator which has been set to 50mVp-p, to the input of CH1 (unterminated), and confirm that the amplitude in the vertical direction is within  $5 \text{ DIV} \pm 0.1 \text{ DIV}$ . If it is not, adjust VERT GAIN (RV3) on board A5 shown in Fig. 4-15.

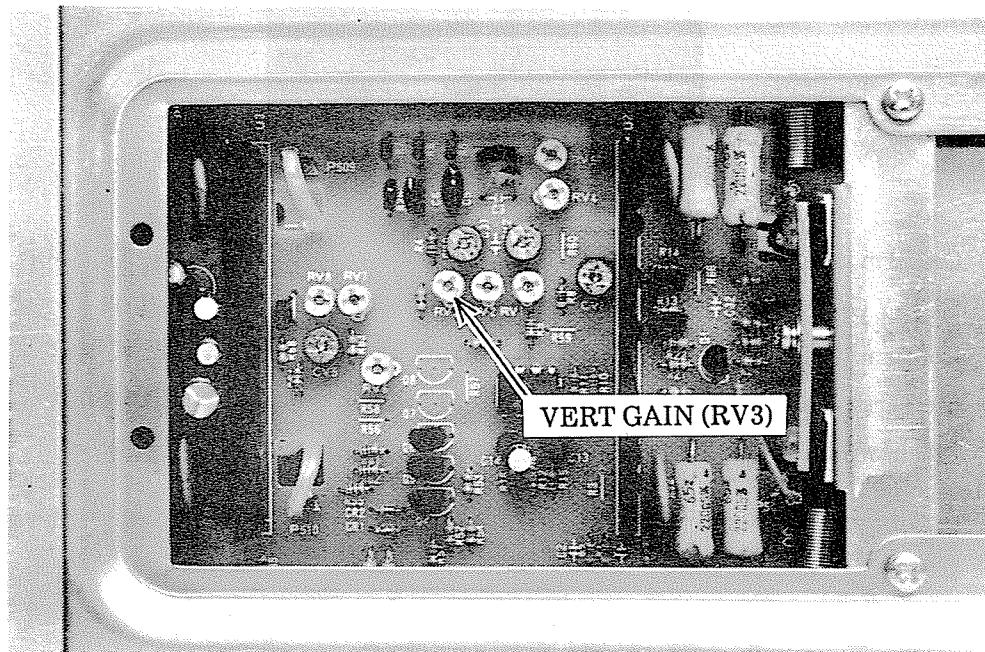


Fig. 4-15 Adjustment position of VERT GAIN (RV3)

## 9) Y-axis position of characters and gain

- (1) Perform initial setting of the instrument in accordance with Table 4-3.
- (2) Turn “ $\Delta V$ ” on and display two horizontal cursors on the CRT screen.
- (3) Turn the read-out control knob until the distance between the two cursors is maximum.  
(See Fig.4-16.) (For details of the method of moving the cursor, read the instruction manual.)

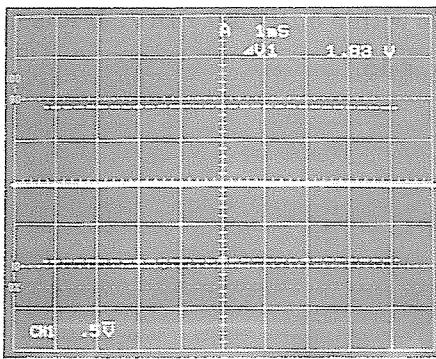


Fig. 4-16 Two horizontal cursors

- (4) Confirm that the distance between the two cursors is  $8 \text{ DIV} \pm 0.1 \text{ DIV}$ . If it is not, adjust CHR Y GAIN (RV21) on board A4 shown in Fig. 4-17.
- (5) Confirm that the positions of the two cursors are within  $\pm 0.1 \text{ DIV}$  of the 8 DIV point on the vertical axis of the CRT screen. If they are not, adjust CHR Y POSI (RV22) on board A4 shown in Fig. 4-17.

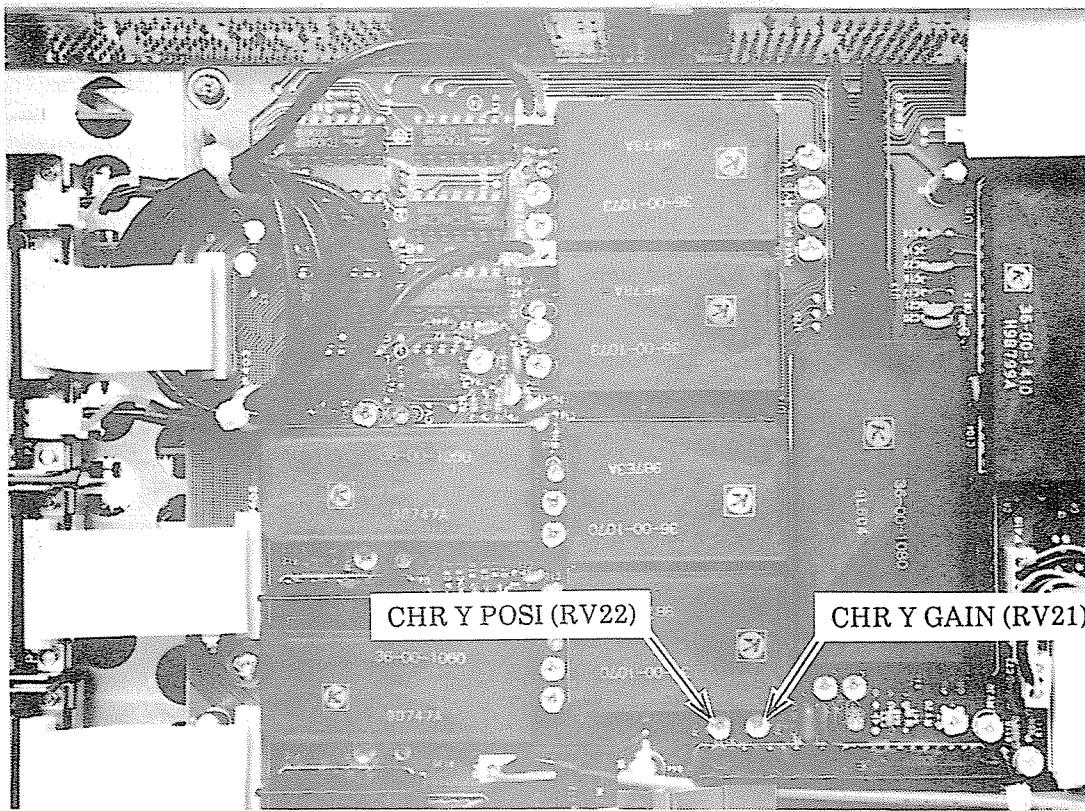


Fig. 4-17 Adjustment positions of CHR Y GAIN (RV21) and CHR Y POSI (RV22)

#### 4-4-4 Vertical Circuit

##### 1) ADD BALANCE

- (1) Perform initial setting of this oscilloscope in accordance with Table 4-3.
- (2) Press the "CH2" "VERT MODE" switch to put the oscilloscope into the dual trace mode.
- (3) Accurately align the traces of CH1 and CH2 with the center of the oscilloscope.
- (4) Set "VERT MODE" to "ADD", and confirm that the position of the ADD trace is within  $\pm 0.5$  divisions with respect to CH1 and CH2. If it is not, adjust ADD BAL (RV20) on board A4 shown in Fig. 4-18.

##### 2) CH1 SIGNAL OUT OFFSET

- (1) Perform initial setting in accordance with Table 4-3.
- (2) Set the input coupling of CH1 to "GND".
- (3) Connect the CH1 SIGNAL OUTPUT to the CH2 input terminal, using coaxial cable. (Do not terminate it in 50ohms.)
- (4) Press the "CH2" "VERT MODE" switch and move the CH2 trace to the center of the CRT screen. (It is recommended that CH1 be turned OFF.)
- (5) Switch the input coupling of CH2 through "DC"  $\Rightarrow$  "GND"  $\Rightarrow$  "DC", and confirm that the trace on the CRT screen does not move more than 1 DIV. If it does, adjust CH1 SIGNAL OUT (RV18) on board A4 shown in Fig. 4-18.

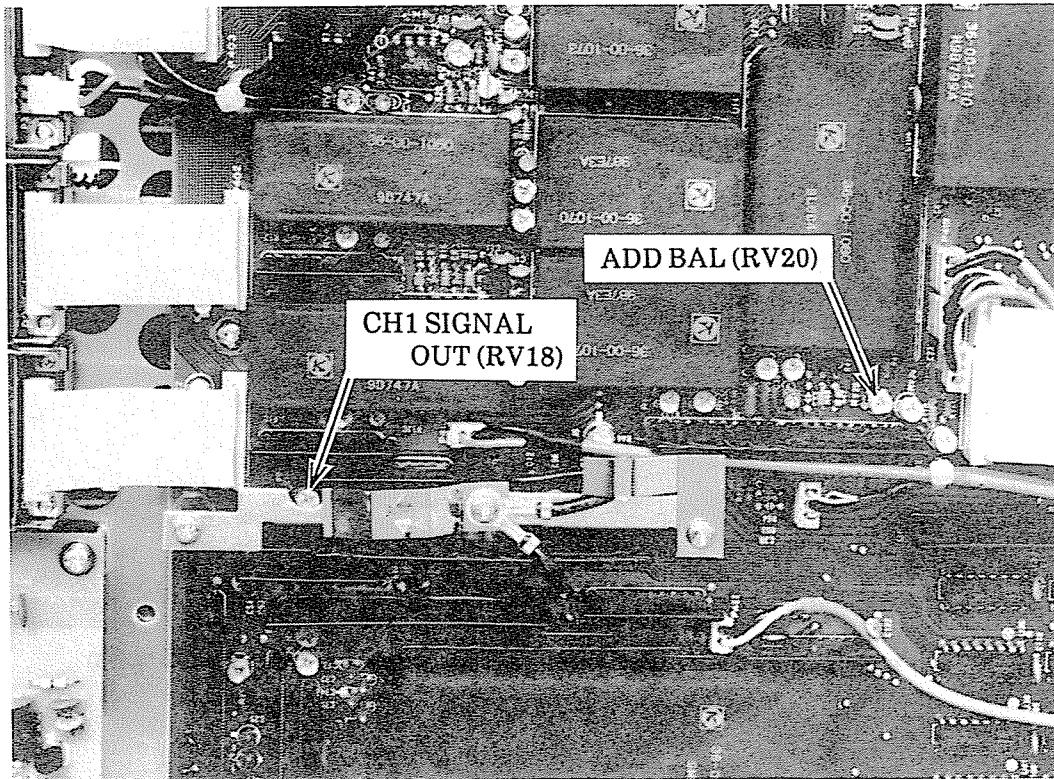


Fig. 4-18 Adjustment position of ADD BAL (RV20), and CH1 SIGNAL OUT (RV18)

### 3) CH3 POSITION CENTER

- (1) Perform initial setting in accordance with Table 4-3.
- (2) Press the "CH3" "VERT MODE" switch to display the trace of CH3 on the CRT screen.  
(It is recommended that CH1 be turned OFF.)
- (3) Confirm that when the dot on the CH3 POSITION knob is set to the 12 O'clock position, the CH3 trace is at the center of the CRT screen. If it is not, adjust CH3 POSITION CENTER (RV14) on board A4 shown in Fig. 4-19.

### 4) CH4 POSITION CENTER

- (1) Perform initial setting in accordance with Table 4-3.
- (2) Press the "CH4" "VERT MODE" switch to display the trace of CH4 on the CRT screen.  
(It is recommended that CH1 be turned OFF.)
- (3) Confirm that when the dot on the CH4 POSITION knob is set to the 12 O'clock position, the CH4 trace is at the center of the CRT screen. If it is not, adjust CH4 POSITION CENTER (RV15) on board A4 shown in Fig. 4-19.

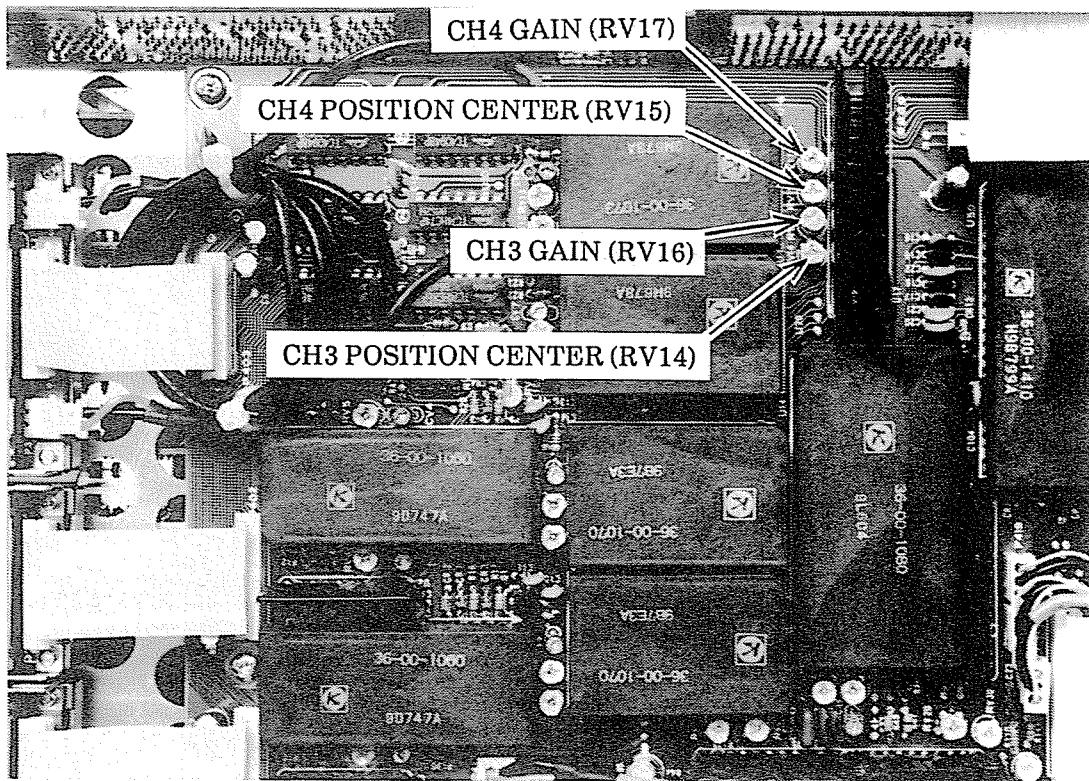


Fig. 4-19 Adjustment positions of CH3 and CH4 POSITION CENTER (RV14 and RV15)

Adjustment position of CH3 GAIN (RV16) and CH4 GAIN (RV17)

## 5) CH3 GAIN

- (1) Perform initial setting in accordance with Table 4-3.
- (2) Select “VERT MODE” switch to have only CH3 display.
- (3) Set the input coupling of CH3 to “DC”, and the input deflection factor to 0.1V (“GND” OFF).
- (4) Set “TIME / DIV” to 1 ms / DIV.
- (5) Connect the amplitude calibration signal output of the vertical axis calibrator which has been set to 0.5Vp-p, to the input of CH3 (unterminated), and confirm that the amplitude in the vertical direction is within 5 DIV $\pm$ 0.1 DIV. If it is not, adjust CH3 GAIN (RV16) on board A4 shown in Fig. 4-19.

## 6) CH4 GAIN

- (1) Perform initial setting in accordance with Table 4-3.
- (2) Select “VERT MODE” switch to have only CH4 display.
- (3) Set the input coupling of CH4 to “DC”, and the input deflection factor to 0.1V. (“GND” OFF).
- (4) Set “TIME / DIV” to 1ms / DIV.
- (5) Connect the amplitude calibration signal output of the vertical axis calibrator which has been set to 0.5Vp-p, to the input of CH4 (unterminated), and confirm that the amplitude in the vertical direction is within 5 DIV $\pm$ 0.1 DIV. If it is not, adjust CH4 GAIN (RV17) on board A4 shown in Fig. 4-19.

## 7) CH1 and CH2 input attenuator (ATT)

- (1) Perform initial setting in accordance with Table 4-3.
- (2) Connect the fast rise square wave of 10kHz from the vertical axis calibrator to the input terminal of CH1 (terminated in 50 ohms), and set “TIME / DIV” of the oscilloscope to 0.5ms / DIV.
- (3) Set the oscilloscope to each range of CH1 shown in Table 4-9, and confirm that the flatness of the square waves when the amplitude of the waveform on the CRT screen is 6 DIV, is within  $\pm$ 3%. If it is not, adjust the CH1 phase compensator (C5, C8, and RV1) on board CH1-ATT shown in Fig. 4-21.
- (4) Press the “CH2” “VERT MODE” switch to put the oscilloscope into the dual trace mode, and connect the signal output to CH2.

- (5) Using exactly the same method as described in (3), check the flatness characteristics of the square wave for CH2 as well.
- (6) Connect a capacitance meter to the input terminal of CH1.
- (7) Set the deflection factor of CH1 to 10mV, and confirm that the input capacitance is  $20\text{pF} \pm 3\text{pF}$ . (The input capacitance is based on the 10mV range is 21pF, adjust the input capacitance of the 0.1V and 1V ranges to 21pF. Do likewise for CH2.)  
Confirm that the input capacitance of each range of CH1 shown in Table 4-9 is within  $\pm 1\text{pF}$  compared to the input capacitance of the 10mV range. If it is not, adjust the CH1 input capacitance (C4, C7) on board CH1-ATT shown in Fig. 4-21.
- (8) Connect the input of the capacitance meter to CH2.
- (9) Using exactly the same method as described in (7), check and adjust the input capacitance of CH2 as well.

		R A N G E			
		1 m V	1 0 m V	0 . 1 V	1 V
C H 1	Phase compensation	RV1	—	C5	C8
	Input capacitance	—	Reference	C4	C7
C H 2	Phase compensation	RV1	—	C5	C8
	Input capacitance	—	Reference	C4	C7

Table 4-9 Adjusting CH1 / CH2 input attenuator (ATT)

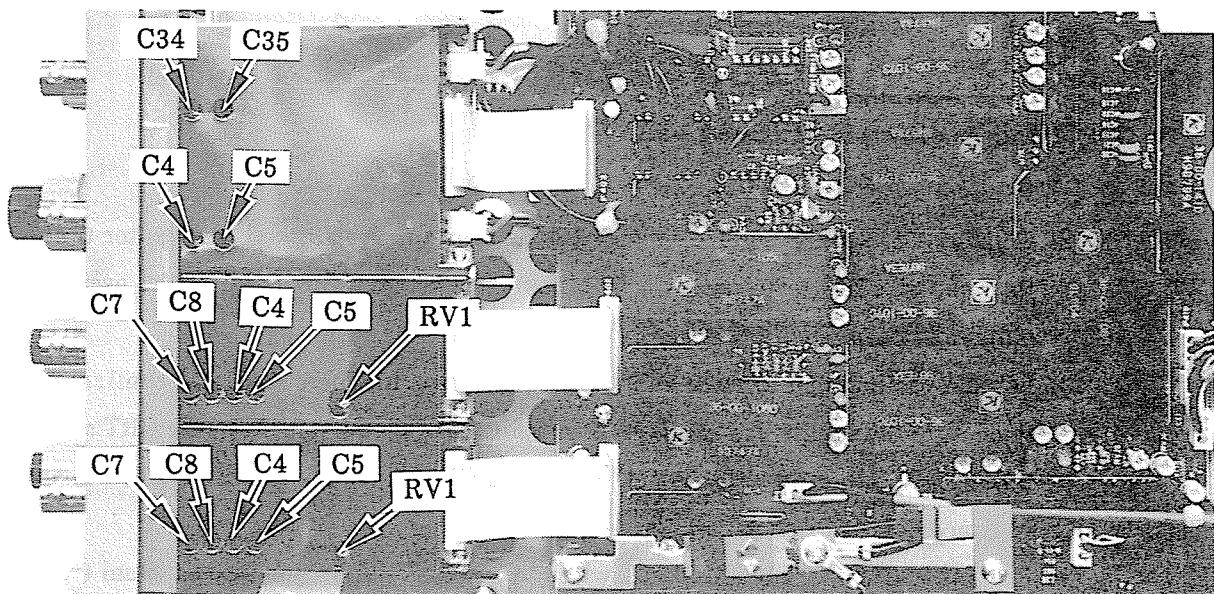


Fig. 4-21 Adjustment position of input attenuator (ATT)

8) CH3 and CH4 input attenuators (ATT)

- (1) Perform initial setting in accordance with Table 4-3.
- (2) Press the "CH3" and "CH4" "VERT MODE" switches. Turn "CH1" OFF and turn CH3 and CH4 ON (dual trace mode).
- (3) Set the deflection factor of CH3 and CH4 to 0.1V.
- (4) Set "TIME / DIV" of the oscilloscope to 0.5ms / DIV.
- (5) Connect the fast rise square wave of about 10kHz from the vertical axis calibrator to the input terminal of CH3 (terminated in 50ohms), and adjust the signal output to 6 DIV.
- (6) Confirm that the flatness characteristics of the square wave are within  $\pm 3\%$ . The flatness characteristics of the 0.1V range constitute the reference for the CH3 amplifier. If the flatness is not within  $\pm 3\%$ , replace the CH3 / CH4 - ATT unit.
- (7) Set the deflection factor of CH3 to 0.5V.
- (8) Adjust the amplitude of the waveform on the CRT screen to 6 DIV.
- (9) Confirm that the flatness characteristics of the square wave on the CRT screen are within  $\pm 3\%$ . If they are not, adjust the CH3 phase compensator (C5) on the CH3 / CH4 - ATT board shown in Fig. 4-21.
- (10) Connect the fast rise square wave signal to CH4.
- (11) Using exactly the same method as described in (5) to (9), check and adjust the square wave characteristics of CH4 as well.
- (12) Connect a capacitance meter to the input terminals of CH3.
- (13) Set the deflection factor of CH3 to 0.1V, and confirm that the input capacitance is  $20pF \pm 3pF$ . (The input capacitance of the 0.1V range constitutes a reference. For example, if the input capacitance of the 0.1V range is  $21pF$ , adjust the input Capacitance of the 0.5V range to  $21pF$ . Do likewise for CH4.)  
Confirm that the input capacitance of each range of CH3 shown in Table 4-9 is within  $\pm 1pF$  compared to the input capacitance of the 0.1V range. If it is not, adjust the CH3 input capacitance (C4) on board CH3 / CH4 - ATT shown in Fig. 4-21.
- (14) Connect the input of the capacitance meter to CH4.
- (15) Using exactly the same method as described in (13), check and adjust the input capacitance of CH4 as well.

		R	A	N	G	E
		0.1V	0.5V			
CH3	Phase compensation	None	C5			
	Input capacitance	Refernce	C4			
CH4	Phase compensation	None	C35			
	Input capacitance	Refernce	C34			

Table 4-10 Adjustment of CH3 / CH4 input attenuator

## 9) Flat characteristics of square waves of CH1 and CH2

- (1) Perform initial setting of the instrument in accordance with Table 4-3.
- (2) Set "VERT MODE" to CH2 ONLY, and the input coupling of CH2 to "DC".
- (3) Set "A TIME/DIV" to 0.2 us/DIV.
- (4) Connect the fast rise square wave output of a vertical axis calibrator which has been set to about 1 MHz, to the CH2 input, and adjust the signal output to 5 DIV.
- (5) Confirm that the flat characteristics of the square waves, including overshoot and ringing, are within  $\pm 3\%$ . If they are not, adjust HIGH FREQUENCY COMPENSATION (RV23, RV24, CV9, RV9, CV6, RV4 and CV3) on board A4, and also HIGH FREQUENCY COMPENSATION (RV1, RV2, RV5, CV1, CV2, and CV3) on board A5, shown in Figs.4-22 and 4-23.
- (6) Connect the signal output to CH1, and set "VERT MODE" to CH1 ONLY.
- (7) Confirm that the flat characteristics of the square waves, including overshoot and ringing, are within  $\pm 3\%$ . If they are not, adjust HIGH FREQUENCY COMPENSATION (RV7, CV5, RV2, AND CV1) on board A4 showing in Fig.4-22.
- (8) SET "VOLTS/DIV" of CH1 to 5 mV/DIV.
- (9) Confirm that the flat characteristics of the square waves, including overshoot and ringing, are within  $\pm 3\%$ . If they are not, adjust HIGH FREQUENCY COMPENSATION (RV3, CV2) on board A4 shown in Fig.4-22.

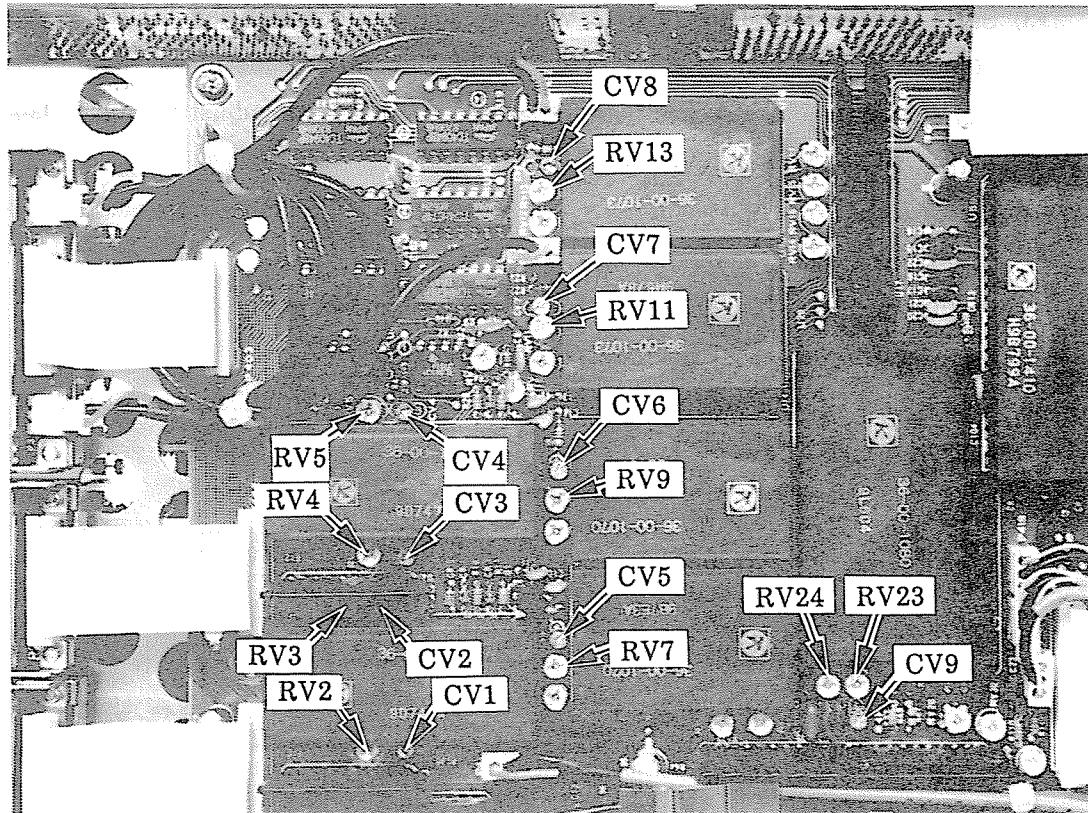


Fig. 4-22 Adjustment position of HIGH FREQUENCY COMPENSATION on board A4

- (10) Connect the signal output to CH2, and set "VERT MODE" to CH2 ONLY.
  - (11) Set "VOLTS/DIV" of CH2 to 5 mV/DIV.
  - (12) Confirm that the flat characteristics of the square waves, including overshoot and ringing, are within  $\pm 3\%$ . If they are not, adjust HIGH FREQUENCY COMPENSATION (RV5, CV4) on board A4 shown in Fig.4-22.
- 10) Flat characteristics of square waves in CH3 and CH4**
- (1) Perform initial setting of the instrument in accordance with 4-3.
  - (2) Set "VERT MODE" to CH3 ONLY, and the input coupling of CH3 to "DC".
  - (3) Set " $\div 5$ " of CH3 to OFF.
  - (4) Connect the fast rise square wave output of a vertical axis calibrator which has been set to about 1 MHz, to the CH3 input, and adjust the signal output so that the waveform on the screen is 5 DIV.
  - (5) Confirm that the flat characteristics of the square waves, including overshoot and ringing, are within  $\pm 5\%$ . If they are not, adjust HIGH FREQUENCY COMPENSATION (RV11, CV7) of board A4 shown if Fig.4-22.
  - (6) Connect the signal output to CH4, and set "VERT MODE" to CH4 ONLY.
  - (7) Set " $\div 5$ " of CH4 to OFF.
  - (8) Confirm that the flat characteristics of the square waves, including overshoot and ringing, are within  $\pm 5\%$ . If they are not, adjust HIGH FREQUENCY COMPENSATION (RV13, CV8) on board A4 shown in Fig.4-22.

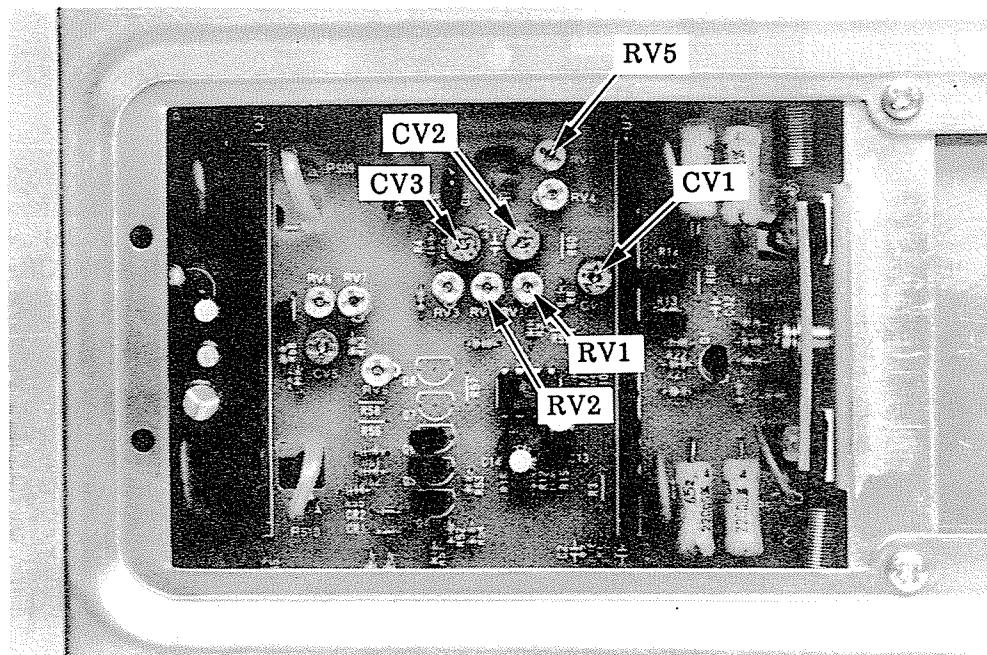


Fig. 4-23 Adjustment position of HIGH FREQUENCY COMPENSATION on board A5

#### 4-4-5 Checking and adjusting Trigger Circuit

##### 1) TRIG AUTO CENTER

- (1) Perform initial setting of the oscilloscope in accordance with Table 4-3.
- (2) Set the input coupling of CH1 to "AC".
- (3) Connect the output of a signal generator which has been set to about 50kHz, to the input terminal of CH1, and adjust the signal output so that the amplitude of the waveform on the CRT is 8 DIV.
- (4) Set "TIME / DIV" to 5 $\mu$ s / DIV.
- (5) Confirm that the trigger point is at the center of the amplitude of the waveform. If it is not, adjust TRIG CENTER (1) (RV25) on board A4 shown in Fig. 4-24.
- (6) Set "TIME/DIV" to 10 $\mu$ s/DIV.
- (7) Set "HORIZ MODE" to "B", and "B TIME/DIV" to 5 $\mu$ s/DIV.
- (8) Set "DELAY TIME" to 0.00 $\mu$ s, and "B TRIG'D" to ON.
- (9) Confirm that the trigger point is at the center of the amplitude of the waveform. If it is not, adjust TRIG CENTER (2) (RV26) on board A4 shown in Fig. 4-24.

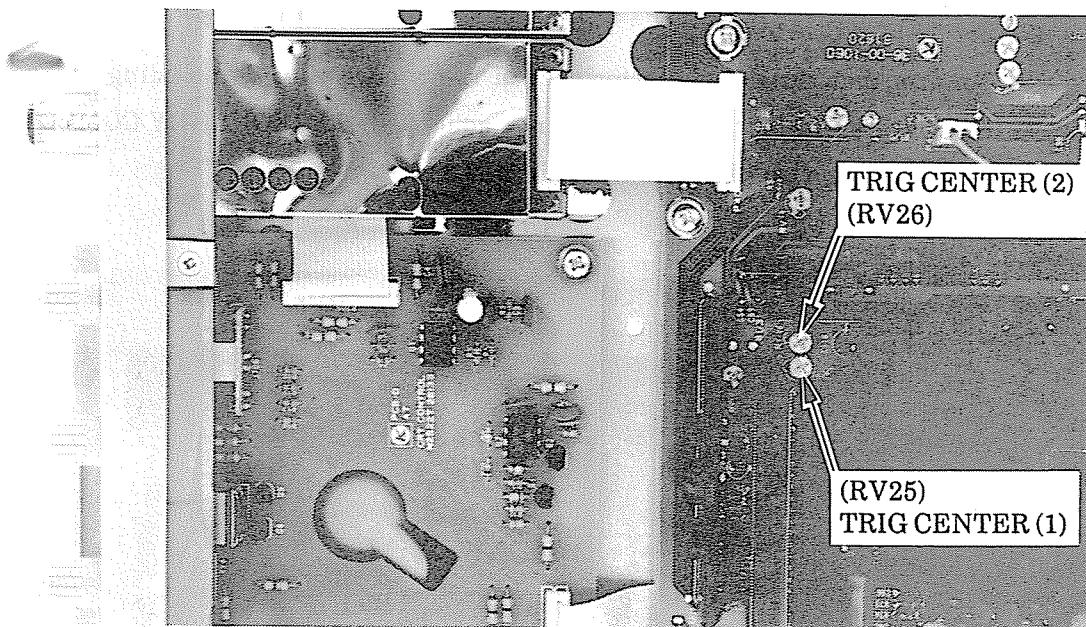


Fig. 4-24 Adjustment position of TRIG CENTER (1) (RV25) and TRIG CENTER (2) (RV26)

## 2) TRIG DC OFFSET

### ★ CH1 TRIG DC OFFSET

- (1) Perform initial setting of the oscilloscope in accordance with Table 4-3.
- (2) Set the input coupling of CH1 to "AC", and the input deflection factor to 0.1V.
- (3) Set "AUTO TRIG" to OFF.
- (4) Connect the output of a signal generator which has been set to about 50kHz, to the input terminal of CH1, and adjust the signal output so that the amplitude of the waveform on the CRT is 8 DIV.
- (5) Set "TIME / DIV" to 5 $\mu$ s / DIV.
- (6) Adjust "TIME / DIV" so that the trigger point moves to the center of the amplitude of the waveform.
- (7) Confirm that when "TRIG COUPLING" is switched from "AC" to "DC", or vice-versa, the trigger point does not move at the center of the amplitude of the waveform. If it does, adjust CH1 TRIG OFFSET (RV6) on board A4 shown in Fig. 4-25.

### ★ CH2 TRIG DC OFFSET

- (1) Set "VERT MODE" to "CH2", and set the input deflection factor to 0.1V.
- (2) Set the input coupling of CH2 to "AC", and connect the signal output to CH2.
- (3) Set "TRIG COUPLING" to "AC", and adjust "TRIG LEVEL" so that the trigger point moves to the center of the amplitude waveform.
- (4) Confirm that when "TRIG COUPLING" is switched from "AC" to "DC", or vice-versa, the trigger point does not move at the center of the amplitude of the waveform. If it does, adjust CH2 TRIG OFFSET (RV8) on board A4 shown in Fig. 4-25.

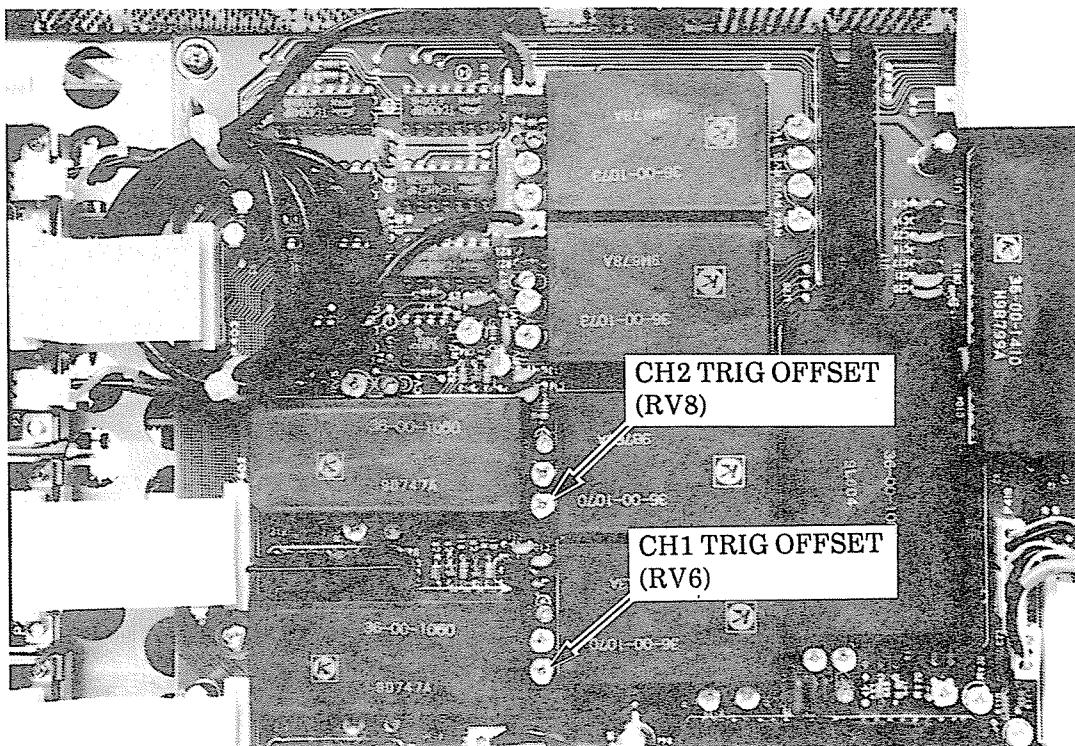


Fig. 4-25 Adjustment positions of CH1 and CH2 TRIG OFFSET (RV6 and RV8)

### ★ CH3 TRIG DC OFFSET

- (1) Set "VERT MODE" to "CH3", and set the input deflection factor to 0.1 V.
- (2) Set the input coupling of CH3 to "AC", and connect the signal output to CH3.
- (3) Set "TRIG COUPLING" to "AC", and adjust "TRIG LEVEL" so that the trigger point moves to the center of the amplitude of the waveform.
- (4) Confirm that when "TRIG COUPLING" is switched from "AC" to "DC", or vice-versa, the trigger point does not move at the center of the amplitude of the waveform. If it does, adjust CH3 TRIG OFFSET (RV10) on board A4 shown in Fig. 4-26.

### ★ CH4 TRIG DC OFFSET

- (1) Set "VERT MODE" to "CH4", and set the input deflection factor to 0.1 V.
- (2) Set the input coupling of CH4 to "AC", and connect the signal output to CH4.
- (3) Set "TRIG COUPLING" to "AC", and adjust "TRIG LEVEL" so that the trigger point moves to the center of the amplitude of the waveform.
- (4) Confirm that when "TRIG COUPLING" is switched from "AC" to "DC", or vice-versa, the trigger point does not move at the center of the amplitude of the waveform. If it does, adjust CH4 TRIG OFFSET (RV12) on board A4 shown in Fig. 4-26.

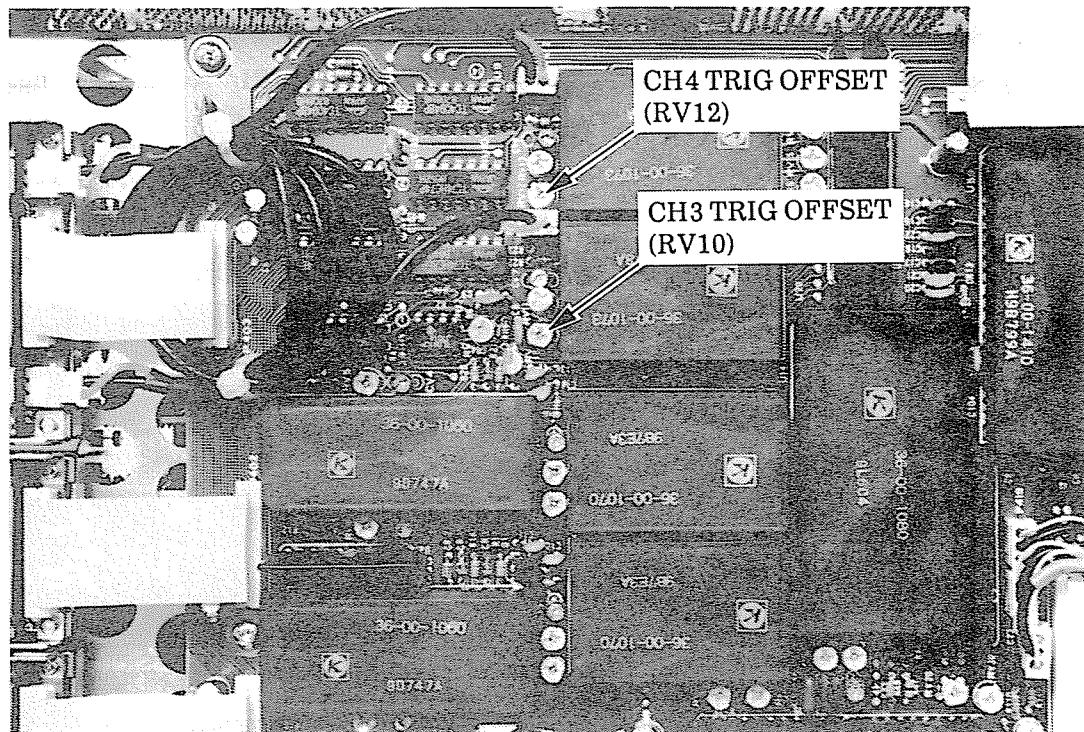


Fig. 4-26 Adjustment positions of CH3 and CH4 TRIG OFFSET (RV10 and RV12)

#### 4-4-6 Checking and adjusting horizontal circuit

##### 1) Comparator start

- (1) Perform initial setting of the oscilloscope in accordance with table 4-3.
- (2) Using the  $\Delta T$  function, set the value of  $\Delta T$  on the CRT screen to within "8.000 ms"  $\pm 0.04\text{ms}$ .
- (3) Set "HORIZ MODE" to "ALT", and "B TIME/DIV" to 10  $\mu\text{s}$ . (Set "B TRIG" to OFF.)
- (4) Set the input coupling of CH1 to "GND", then adjust the brightness of A and B so that the two bright spots (lines) on the CRT screen can be clearly observed.  
(See Fig. 4-27.)

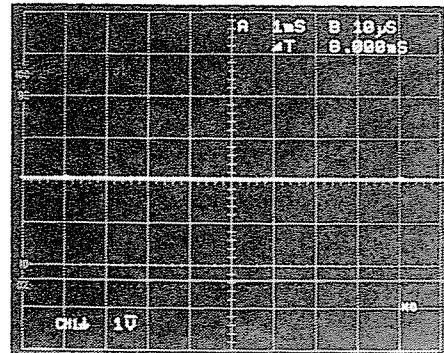


Fig. 4-27 Two bright spots (lines)

- (5) Confirm that the position between the two bright spots (lines) on the CRT screen is within  $8.0 \pm 0.1 \text{ DIV}$ .

If it is not, adjust COMP START ADJ (RV29) on board A4 shown in Fig. 4-28.

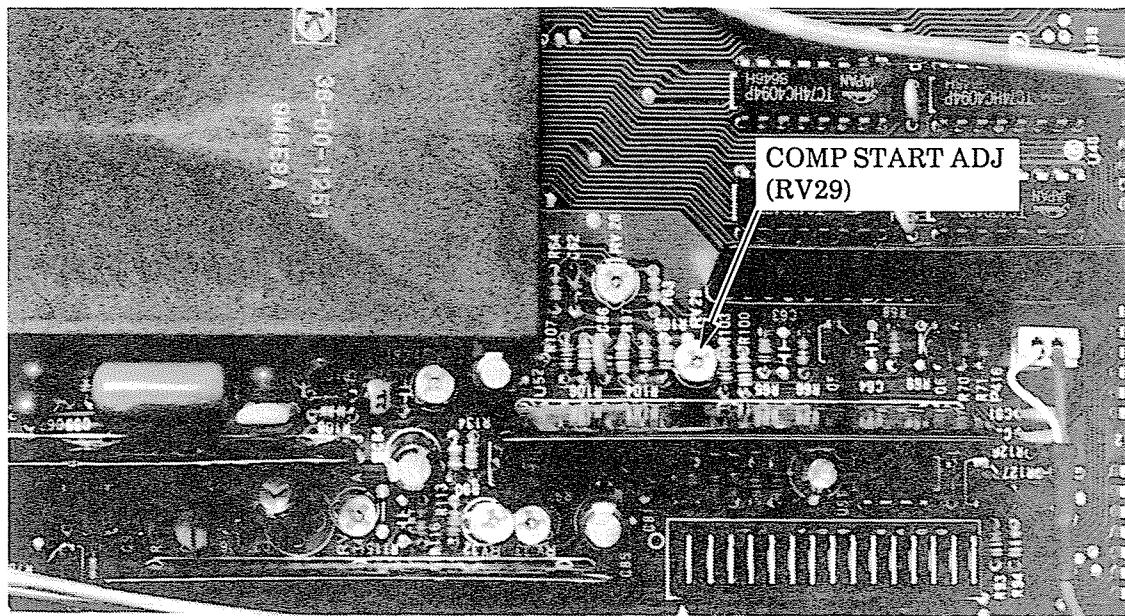


Fig. 4-28 Adjustment position of COMP START ADJ (RV29)

## 2) X-Y CENTER

- (1) Perform initial setting in accordance with Table 4-3.
- (2) Accurately align the trace of CH1 with the center of the CRT screen.
- (3) Set "HORIZ MODE" to "X-Y".
- (4) Confirm that the bright spot is within  $\pm 1$  DIV from the center of the CRT screen. If it is not, adjust X POSITION (RV30) on board A4 shown in Fig. 4-29.

## 3) X-Y GAIN

- (1) Perform initial setting in accordance with Table 4-3.
- (2) Set the "HORIZ MODE" switch at X-Y mode.
- (3) Apply a 50mVpp calibration signal output to the CH1 input, and confirm that the amplitude in the horizontal direction is within  $5 \text{ DIV} \pm 0.1 \text{ DIV}$ . If it is not, adjust X-Y GAIN (RV31) on board A4 shown in Fig. 4-29.

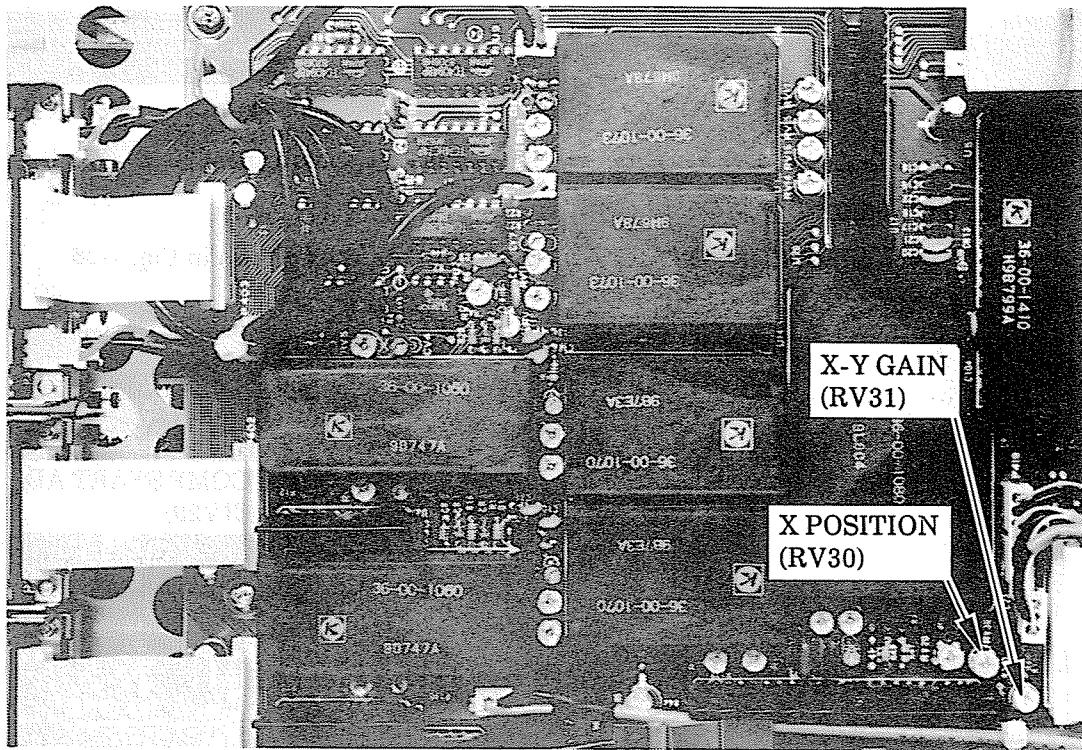


Fig. 4-29 Adjustment positions of X POSITION (RV30), and X-Y GAIN (RV31)

#### 4) SWEEP LENGTH

- (1) Perform initial setting in accordance with Table 4-3.
- (2) Apply a 1ms time marker signal output, to the CH1 input (terminated in 50 ohms), and adjust the VOLT/DIV switch so that the amplitude of the waveform on the CRT screen is about 2 DIV.
- (3) Count the time markers and confirm that the sweep length is within  $11.5 \pm 0.5$  DIV. If it is not, adjust the A SWEEP LENGTH (RV27) on board A4 shown in Fig. 4-30.
- (4) Set "HORIZ MODE" to "ALT", and set "BTRG" to ON.
- (5) Set the B sweep to 1ms/DIV, and the A sweep to 2ms/DIV.
- (6) Set "DLY" to ON, and turn the "READ OUT" knob to the left to set the DELAY TIME POSITION to 0.
- (7) Set "HORIZ MODE" to "B".
- (8) Count the timer markers and confirm that the sweep length is within  $11.5 \pm 0.5$  DIV. If it is not, adjust the B SWEEP LENGTH (RV28) on board A4 shown in Fig. 4-30.

#### 5) Horizontal axis $\times 10$ MAG GAIN

- (1) Perform initial setting in accordance with Table 4-3.
- (2) Connect a 0.1ms time marker signal, to the CH1 input (terminated in 50 ohms), and adjust the input factor so that the amplitude of the waveform on the CRT screen is about 2 DIV.
- (3) Set " $\times 10$ MAG" to ON.
- (4) Confirm that the sweep accuracy is within  $\pm 4\%$ . If it is not, adjust  $\times 10$ MAG GAIN (RV34) on board A4 shown in Fig. 4-30.

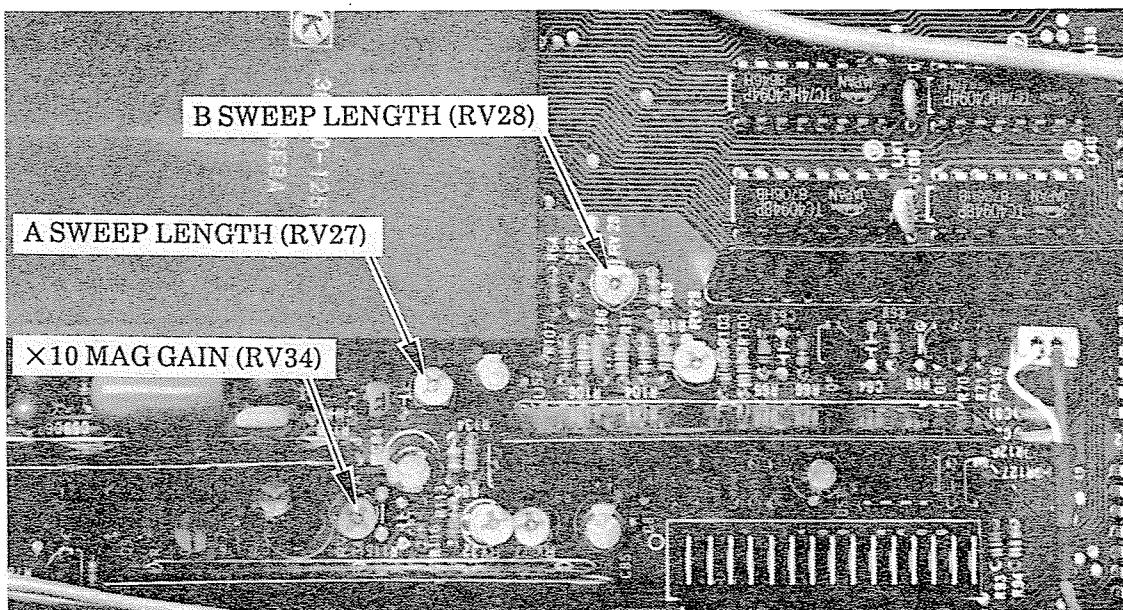


Fig. 4-30 Adjustment positions of A and B SWEEP LENGTH (RV27 and RV28) and  $\times 10$  MAG GAIN (RV34)

#### 4-4-7 Checking and adjusting DVM COMPEN

- (1) Perform initial setting in accordance with Table 4-3.
- (2) Apply 1MHz fast rise signal to the input of CH1 (terminated in 50ohms), and adjust the signal output to 6 DIV.
- (3) Connect the oscilloscope to pin 16 of U21 on board A4 shown in Fig. 4-31, and adjust the deflection factor of the oscilloscope so that the amplitude of the waveform on the CRT screen is  $5 \text{ DIV} \pm 0.2 \text{ DIV}$ .
- (4) Confirm that the averrations of the waveform is within  $\pm 3\%$ . If it is not, adjust DVM COMPEN (RV19) on board A4 shown in Fig. 4-32.

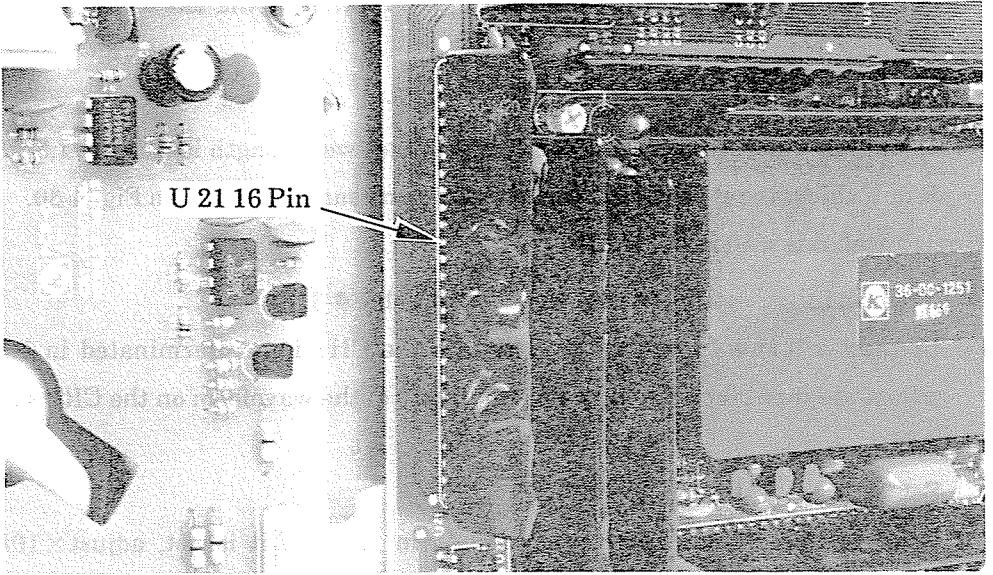


Fig. 4-31 Connection position of oscilloscope (pin 16 of U21)

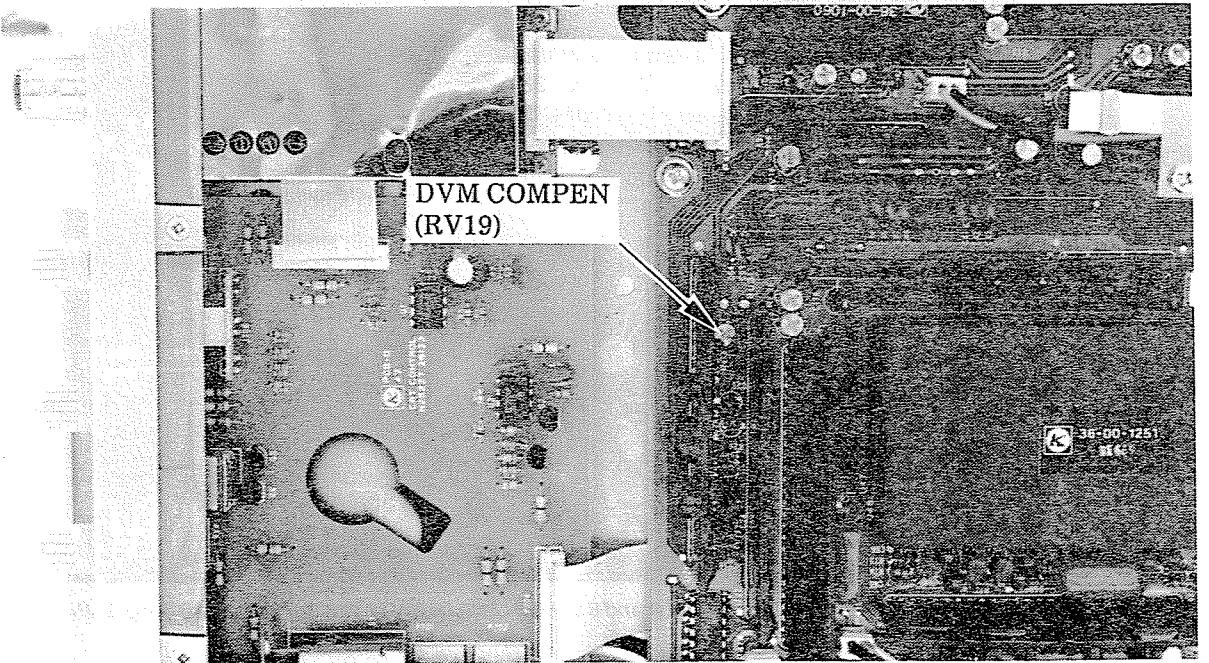


Fig. 4-32 Adjustment position of DVM COMPEN (RV19)

#### 4-4-8 Checking and adjusting storage system

##### ~~~~~ Caution ~~~~

*Before checking the storage system, confirm that the real time system has been checked and adjusted. If it has not, be sure to check and adjust it before adjusting the storage system.*

##### 1) Method of displaying service waveform

- (1) Perform initial setting of the instrument in accordance with Table 4-3.
- (2) Align the starting point of the sweep with the first graticule at the left of the CRT screen.
- (3) Set "STORAGE/REAL" to "STORAGE".
- (4) Short the self check short pin on the A8 MAIN CPU board shown in Fig.4-33. By simultaneously pressing the 2nd function key and the "SAVE" key indicated in Fig. 4-34, the service waveform shown in Fig.4-35 will be displayed.

Note: To cancel the service waveform, press "A" of "HORI.MODE".

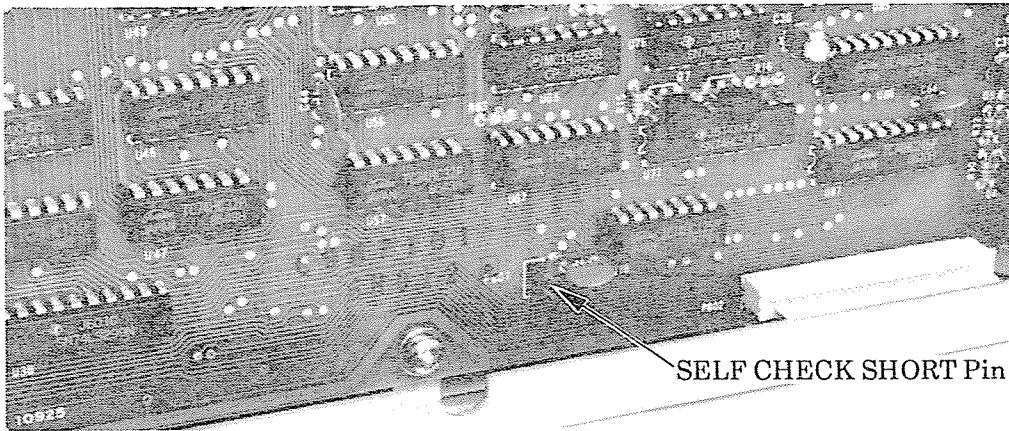


Fig. 4-33 Self check short pin (A8 MAIN CPU board)

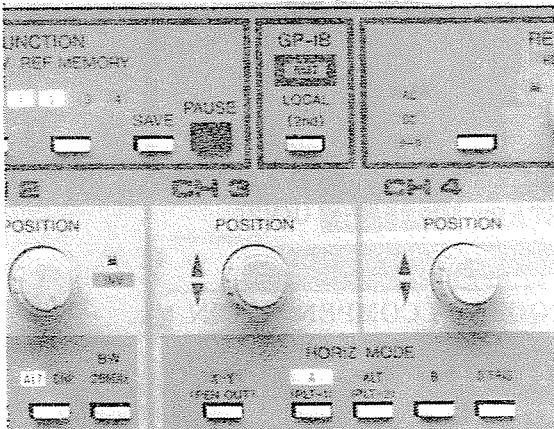


Fig. 4-34 2nd function key and SAVE key

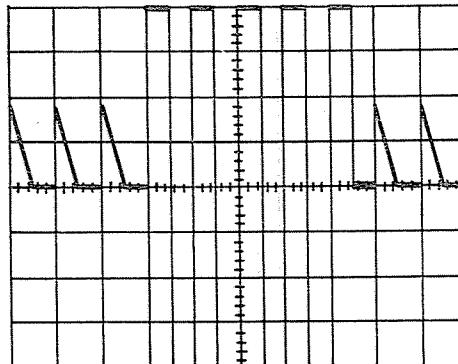


Fig. 4-35 Service waveform

## 2) Sweep position

- (1) Perform initial switching of the instrument in accordance with Table 4-3.
- (2) Align the starting point of the sweep with the first graticule at the left of the CRT screen. (Do not change this setting.)
- (3) Confirm that when "STORAGE/REAL" is set to "STORAGE", the starting of the sweep is within  $\pm 0.1$  DIV with the first graticule at the left edge. If it is not, adjust SWEEP START (RV5) on board A18 shown if Fig. 4-37.

## 3) Sweep gain

- (1) Display the service waveform. [For details, see 1).]
- (2) Confirm that the clearance between A and B shown in Fig. 4-36 (2nd and 9th graticule) is within  $8 \text{ DIV} \pm 0.1 \text{ DIV}$ . If it is not, adjust SWEEP GAIN (RV4) on board A18 shown in Fig. 4-37.

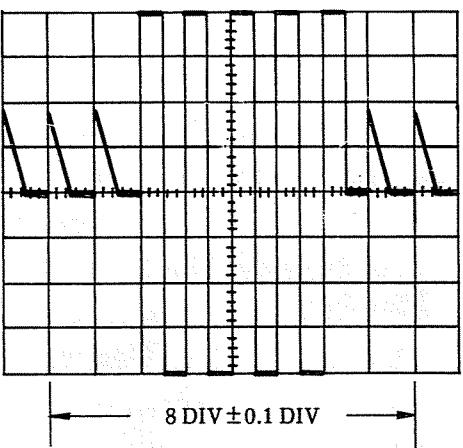


Fig. 4-36 AdjustING sweep gain

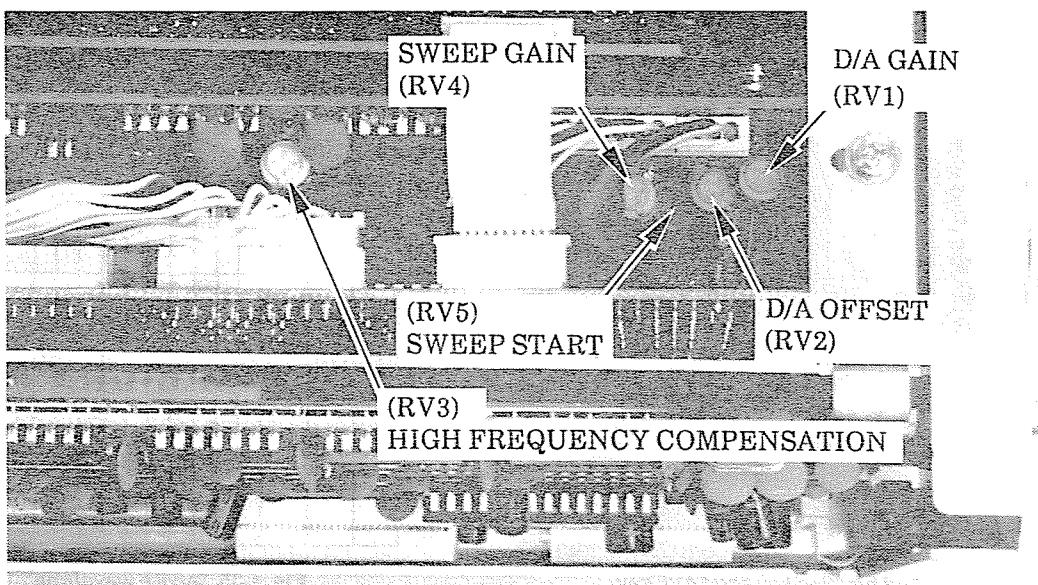


Fig. 4-37 Adjustment position of D/A GAIN (RV1), D/A OFFSET (RV2), HIGH FREQUENCY COMPENSATION (RV3), SWEEP GAIN (RV4) and SWEEP START (RV5)

#### 4) Vertical gain

- (1) Display the service waveform. [For details, see 1).]
- (2) Confirm that the amplitude of the square wave portion of the service waveform is within  $8 \text{ DIV} \pm 0.1 \text{ DIV}$ , as shown in Fig.4-38. If it is not, adjust D/A GAIN (RV1) on board A18 shown if Fig. 4-37.

#### 5) Vertical POSITION

- (1) Display the service waveform. [For details, see 1).]
- (2) Confirm that the vertical position of the service waveform is at the center of the CRT, as shown in Fig. 4-38. If it is not, adjust D/A OFFSET (RV2) on board A18 shown if Fig.4-37.

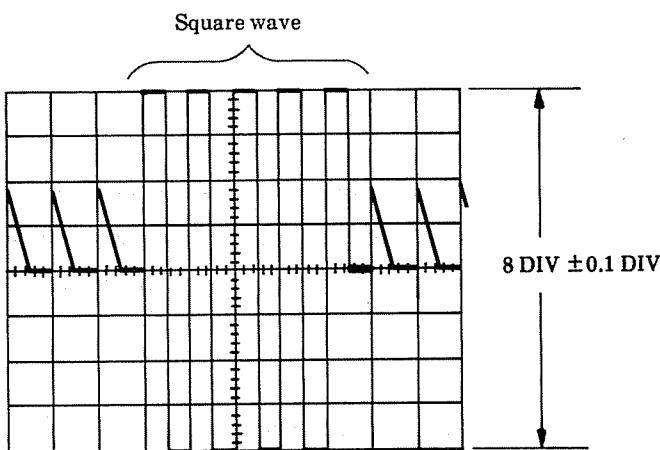


Fig. 4-38 Adjusting vertical position and gain

#### 6) High frequency compensation

- (1) Display the service waveform. [for details, see 1).]
- (2) Confirm that the high frequency characteristics of the square wave portion of the service waveform (see Fig.4-39) are flat. If they are not, adjust HIGH FREQUENCY COMPENSATION (RV3) on board A18 shown in Fig.4-37.

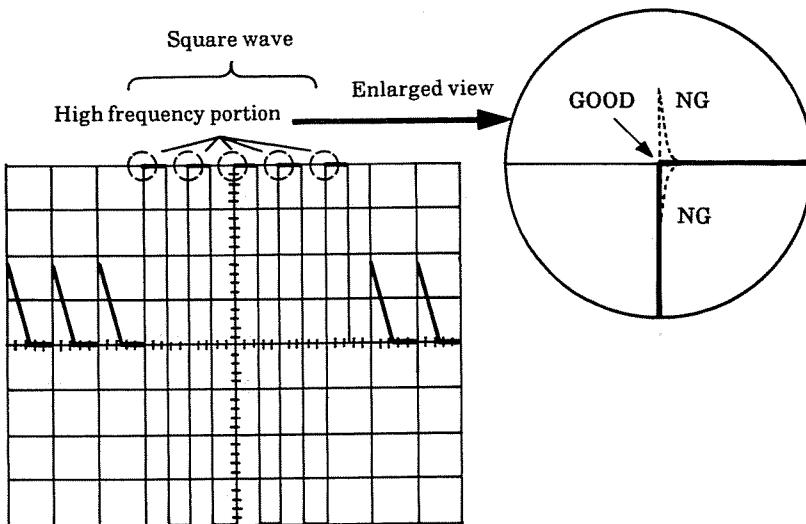


Fig. 4-39 High frequency portion of square wave

## **7) CH1 A/D GAIN**

- (1) Perform initial setting of the instrument in accordance with Table 4-3.
- (2) Apply a 50mVp-p standard amplitude generator output to the CH1 input. (If the sweep speed is not suitable, select another sweep speed.)
- (3) Confirm that the amplitude displayed on the screen is within 5 DIV $\pm$ 0.1 DIV. (If it is not, return to the real time system adjustment and re-adjust.)
- (4) Set "STORAGE/REAL" to "STORAGE".
- (5) Confirm that the amplitude is within 5 DIV $\pm$ 0.1 DIV. If it is not, adjust CH1 A/D GAIN (RV1) on board A16 shown in Fig.4-40.

## **8) CH1 A/D OFFSET**

- (1) Perform initial setting of the instrument in accordance with Table 4-3.
- (2) Set the input coupling of CH1 to "GND".
- (3) Rotate "CH1 POSITION" knob until the trace of CH1 is at the center of the CRT screen.
- (4) Set "STORAGE/REAL" to "STORAGE", and confirm that the trace shift is within  $\pm$ 0.1 DIV. If it is not, adjust CH1 A/D OFFSET (RV2) on board A16 shown in Fig. 4-40.

## **9) CH2 A/D GAIN**

- (1) Perform initial setting of the instrument in accordance with Table 4-3.
- (2) Set "VERT MODE" to "CH2".
- (3) Apply a 50mVp-p standard amplitude generator output to the CH2 input. (If the sweep speed is not suitable, select another sweep speed.)
- (4) Confirm that the amplitude in the vertical direction of the CRT screen is within 5 DIV  $\pm$  0.1 DIV. (If it is not, return to the real time system adjustment and re-adjust the system.)
- (5) Set "STORAGE/REAL" to "STORAGE".
- (6) Confirm that the amplitude in the vertical direction of the CRT screen is within 5 DIV  $\pm$  0.1 DIV. If it is not, adjust CH1 A/D GAIN (RV3) on board A16 shown in Fig. 4-40.

## **10) CH2 A/D OFFSET**

- (1) Perform initial setting of the instrument in accordance with Table 4-3.
- (2) Set "VERT MODE" to "CH2".
- (3) Set the input coupling of CH2 to "GND".
- (4) Rotate "CH2 POSITION" knob until the trace of CH2 is at the center of the CRT screen.
- (5) Set "STORAGE/REAL" to "STORAGE", and confirm that the trace shift is within  $\pm$  0.1DIV. If it is not, adjust CH2 A/D OFFSET (RV4) on board A16 shown in Fig. 4-40.

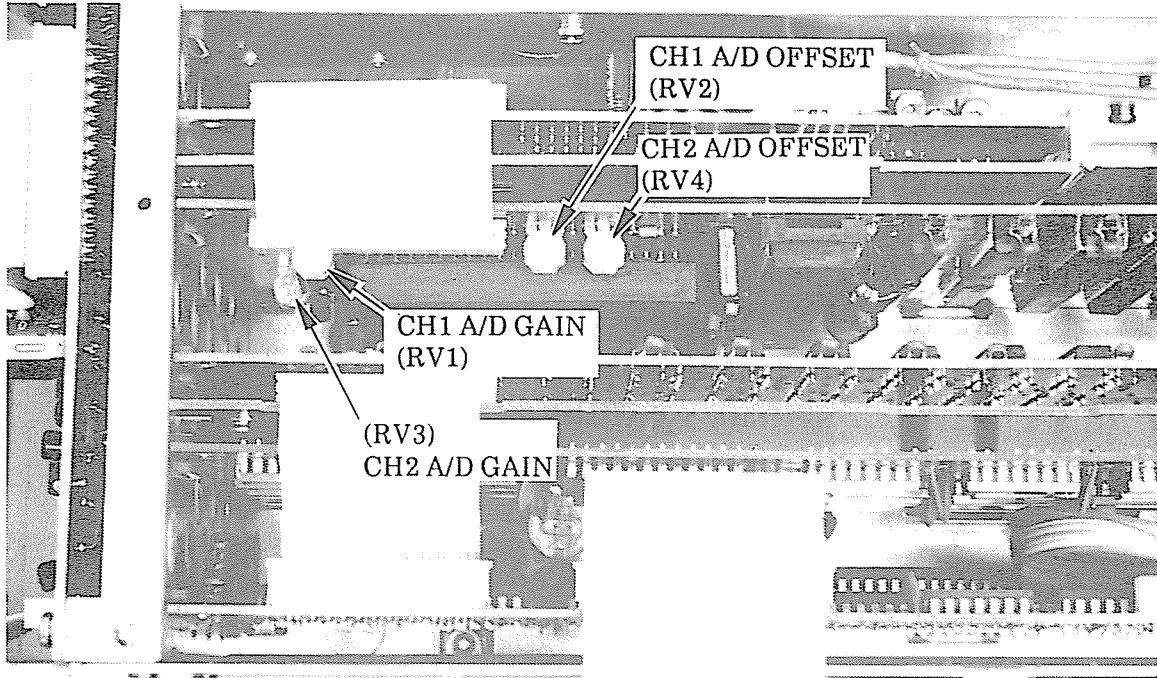


Fig. 4-40 Adjustment positions of CH1 GAIN (RV1) and CH1 A/D OFFSET (RV2)  
Adjustment positions of CH2 A/D GAIN (RV3) and CH2 A/D OFFSET (RV4)

### 11) 2 $\mu$ s GAIN BAL.

- (1) Turn off the power switch, and remove the bracket shown in Fig. 4-41.
- (2) Slacken the outer frame of connector P1053, and remove the flat cable.
- (3) Remove board A15 from the chassis, and place it on the unit with an insulating sheet beneath it.
- (4) Insert the end of the flat cable into connector P1053.

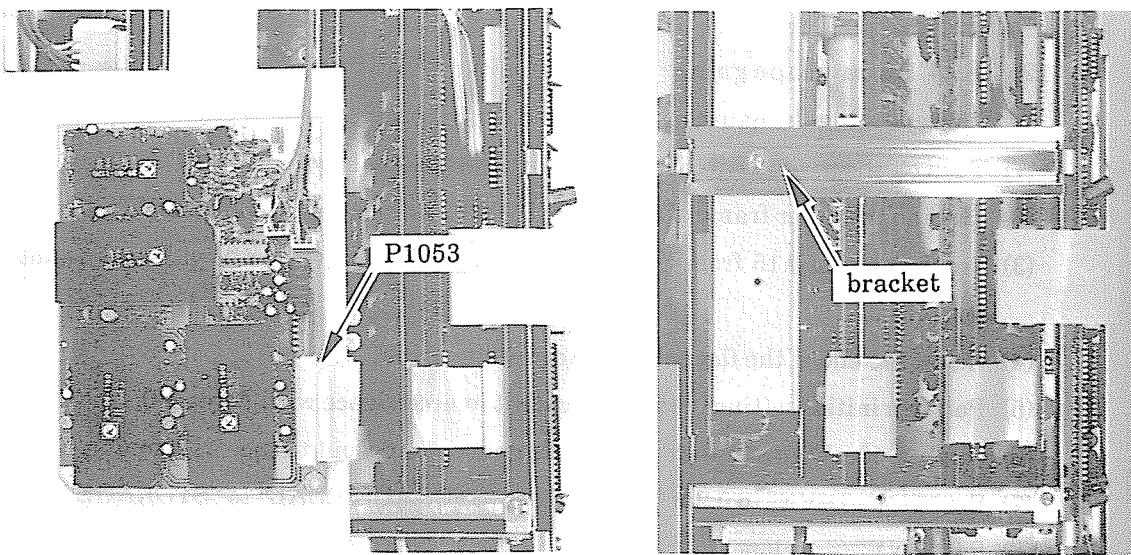


Fig. 4-41 Positions of BRACKET and CONNECTOR (P1053)

- (5) Perform initial setting of the instrument in accordance with Table 4-3.

- (6) Apply a 50kHz sin wave from constant amplitude generator to CH1 input, and adjust the signal output so that the waveform on the CRT screen is 6 DIV.
  - (7) Set "TIME/DIV" to  $2\mu\text{s}/\text{DIV}$ , and set "STORAGE/REAL" to "STORAGE".
  - (8) Confirm that a clean sine wave appears on the CRT screen, as shown in Fig. 4-42 (A). If the waveform contains a chopped component, as shown in Fig. 4-42 (B) adjust CH1 GAIN ADJ (RV1) on board A15 shown in Fig. 4-44.
  - (9) Set "VERT MODE" to CH2 ONLY, and connect the signal output to CH2.
  - (10) Confirm that a clean sine wave appears on the CRT as shown in Fig. 4-42 (A). If the waveform contains a chopped component as shown in Fig. 4-42 (B) adjust CH2 GAIN ADJ (RV2) on board A15 shown in Fig. 4-44.
  - (11) Turn off the power switch, and reinstall the board.  
(When proceeding to the next sub-section, it is permissible to leave board A15 as is and start from step (5) of the next sub-section.)

(When proceeding to the next sub-section, it is permissible to leave board A15 as is and start from step (5) of the next sub-section.)

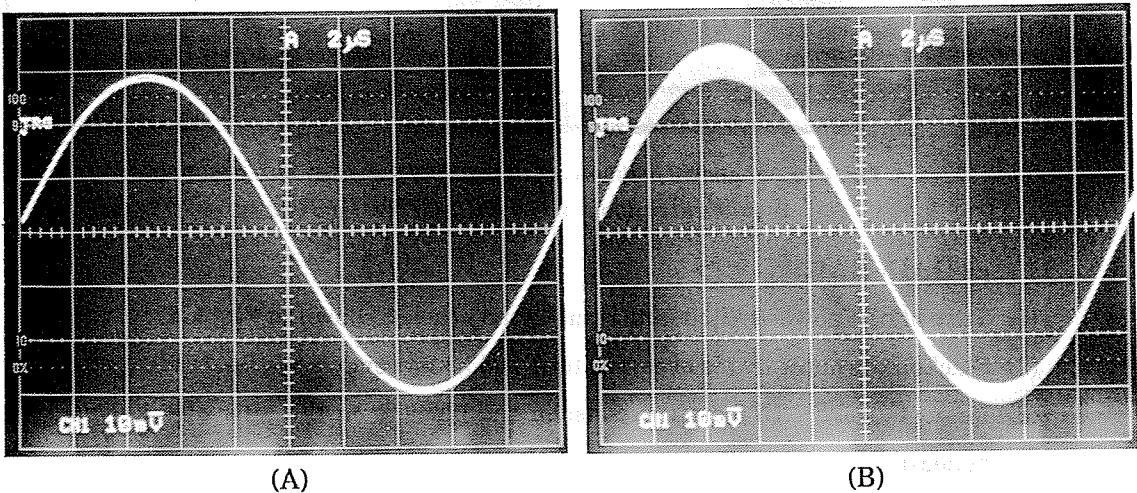


Fig. 4-42 Storage waveform obtained when adjusting 2μs sweep

### 12) CH1/CH2 envelope gain

When checking the gain continuing on from the previous sub-section, start from step (5).

- (1) Turn off the power switch, and remove the bracket shown in Fig. 4-41.
  - (2) Slacken the outer frame of connector P1053, and remove the flat cable.
  - (3) Remove board A15 from the chassis, and place it on the unit with an insulating sheet beneath it.
  - (4) Insert the end of the flat cable into connector P1053.
  - (5) Perform initial setting of the instrument in accordance with Table 4-3.
  - (6) Apply a 50mVp-p standard amplitude generator output to the CH1 input.
  - (7) Set "TIME/DIVE" to 0.2ns/DIV, and set "STORAGE/REAL" to "STORAGE".
  - (8) Set "ENV" (envelope) to "ON".
  - (9) Confirm that a clean sine wave appears on the CRT screen, as shown in Fig. 4-43 (A). If the waveform contains a noise component as shown in Fig. 4-43 (B) adjust CH1 BOTTOM GAIN (RV6) and also CH1 PEAK GAIN (RV5) on board A15 shown in Fig. 4-44.

- (10) Set "TIME/DIV" TO CH2 ONLY, and connect the signal output to CH2.
- (11) Like CH1, confirm that the waveform on the CRT screen is clean as shown in Fig. 4-43 (A).

If the waveform contains noise as shown in Fig. 4-43(B), adjust CH2 BOTTOM GAIN (RV4) and CH2 PEAK GAIN (RV3) on board A15 shown in Fig. 4-44 so that the amplitude of the waveform is  $5 \text{ DIV} \pm 0.1 \text{ DIV}$

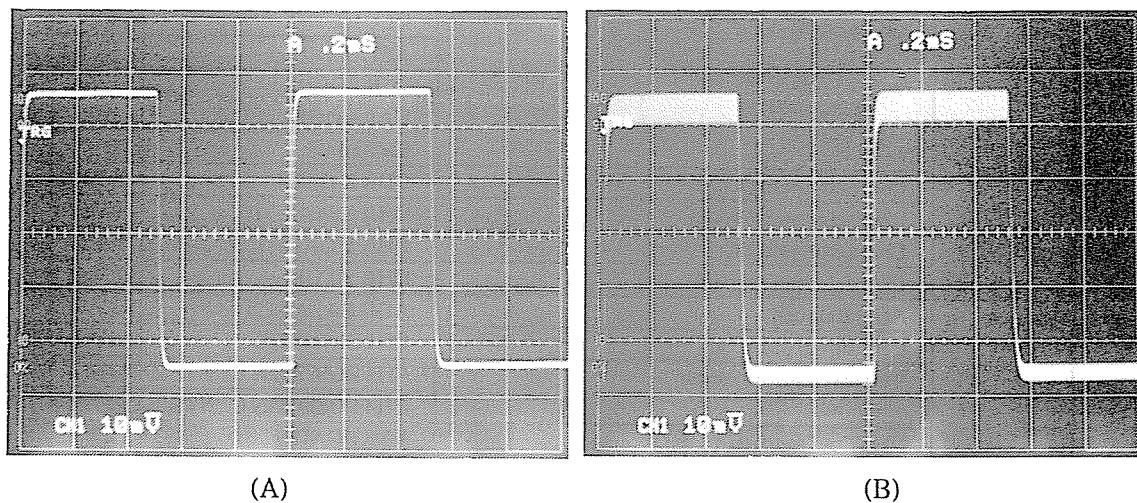


Fig. 4-43 Waveform when adjusting envelope gain

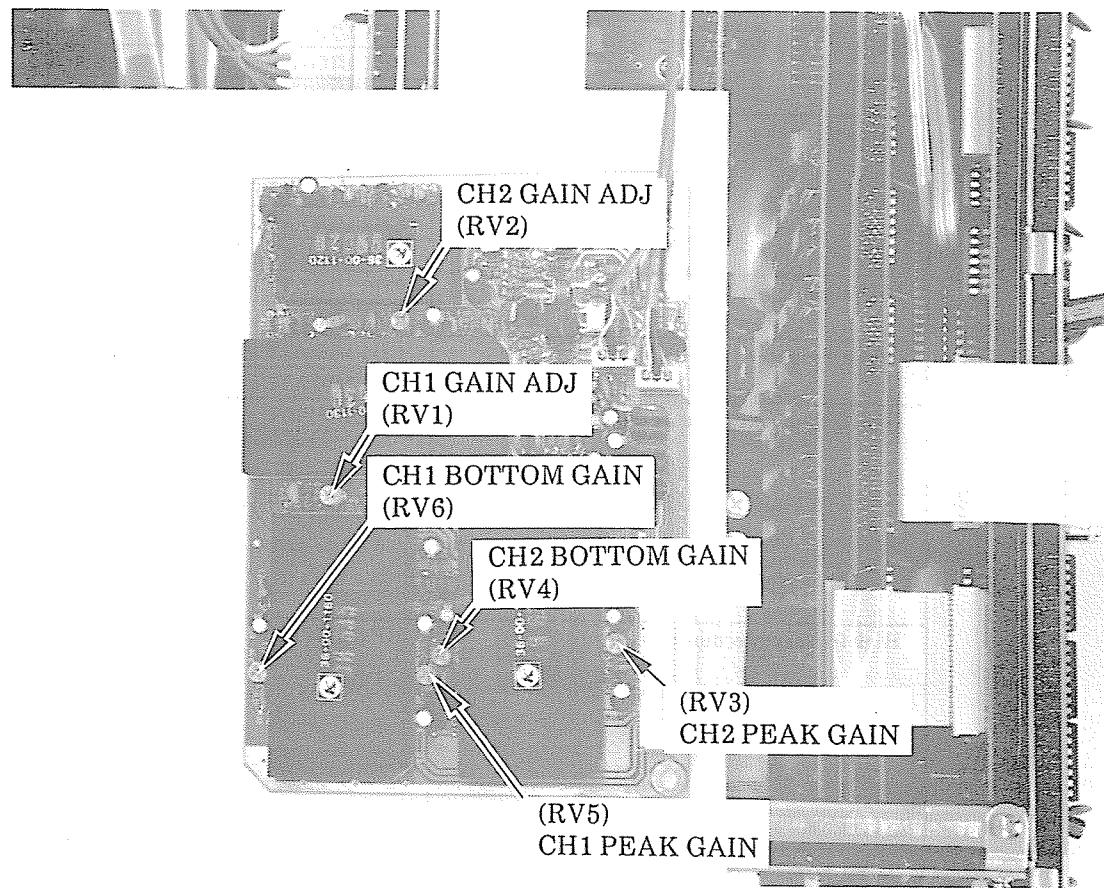


Fig. 4-44 Adjustment positions of CH1 GAIN ADJ (RV1) and CH2 GAIN ADJ (RV2), CH1 BOTTOM GAIN (RV6), CH1 PEAK GAIN (RV5). CH2 BOTTOM GAIN (RV4) and CH2 PEAK GAIN (RV3)

#### 4-4-9 Adjustment Table

Adjustment Items are shown in Table 4-11 to 4-12.

Item	Adjustment	Adjustment name	Circuit No.	Board
Power Supply	Power supply voltage	+12V ADJ	RV1	A12
	Reference voltage	V REF 30mV	RV1	A4
CRT Circuit	CRT system	GEOMETRY	RV4	A6
		ASTIG	RV5	A6
		SUB FOCUS	RV3	A6
		HALATION	RV6	A6
		CRT BIAS	RV2	A6
	Charactor gain (X)	CHR X GAIN	RV33	A4
	Charactor position (X)	CHR X POSI	RV32	A4
	Charactor gain (Y)	CHR Y GAIN	RV21	A4
	Charactor position (Y)	CHR Y POSI	RV22	A4
Vertical Circuit	ADD Balance	ADD BALANCE	RV20	A4
	CH1 signal out offset	CH1 SIGNAL OUT	RV18	A4
	Vertical position center	CH3 POSITION CENTER	RV14	A4
		CH4 POSITION CENTER	RV15	A5
	Vert final amp gain	VERT GAIN	RV3	A4
	CH3 gain	CH3 GAIN	RV16	A4
	CH4 gain	CH4 GAIN	RV17	A4
	CH1 attenuator	CH1 1/1 ATT COMP	RV1	A1 (CH1)
		CH1 1/10 ATT PHASE	C5	A1 (CH1)
		CH1 1/10 ATT CAP	C4	A1 (CH1)
		CH1 1/100 ATT PHASE	C8	A1 (CH1)
		CH1 1/100 ATT CAP	C7	A1 (CH1)
	CH2 attenuator	CH2 1/1 ATT COMP	RV1	A1 (CH2)
		CH2 1/10 ATT PHASE	C5	A1 (CH2)
		CH2 1/10 ATT CAP	C4	A1 (CH2)
		CH2 1/100 ATT PHASE	C8	A1 (CH2)
		CH2 1/100 ATT CAP	C7	A1 (CH2)
	CH3 attenuator	CH3 1/10 ATT PHASE	C5	A3 (CH3)
		CH3 1/10 ATT CAP	C4	A3 (CH3)
	CH4 attenuator	CH4 1/10 ATT PHASE	C35	A3 (CH4)
		CH4 1/10 ATT CAP	C34	A3 (CH4)
	High frequency compensation	HF COMPEN	RV23	A4
			CV9	A4
			RV24	A4
		HF COMPEN (CH2)	RV9	A4
			CV6	A4
			RV4	A4
			CV3	A4
	High frequency compensation	HF COMPEN	RV1	A5
			CV2	A5
			RV2	A5
			CV3	A5
			RV4	A5
			RV5	A5
			CV1	A5

Table 4-11 Adjustment Table (1)

Item	Adjustment	Adjustment name	Circuit No.	Board
Vertical Circuit	High frequency compensation	HF COMPEN (CH1)	RV7	A4
			CV5	A4
			RV2	A4
			CV1	A4
			RV3	A4
			CV2	A4
		HF COMPEN (CH2)	RV5	A4
			CV4	A4
		HF COMPEN (CH3)	RV11	A4
			CV7	A4
Trigger Circuit	Trigger level (AUTO)	TRIG CENTER ①	RV25	A4
			RV26	A4
	Trigger DC offset	CH1 TRIG OFFSET	RV6	A4
		CH2 TRIG OFFSET	RV8	A4
		CH3 TRIG OFFSET	RV10	A4
		CH4 TRIG OFFSET	RV12	A4
Horizontal Circuit	Horizontal amp gain	HORIZ GAIN ADJ	RV7	A5
	Comparator start	COMP START ADJ	RV29	A4
	X-Y center	X POSITION	RV30	A4
Horizontal Circuit	X-Y gain	X-Y GAIN	RV31	A4
	Sweep length	A SWEEP LENGTH	RV27	A4
		B SWEEP LENGTH	RV28	A4
	Horizontal amp ×10mag gain	×10MAG GAIN	RV34	A4
	5ns/DIV, 2ns/DIV sweep time	H-AMP HF COMPEN	RV8	A5
			RV5	A5
DVM	DVM compensation	DVM COMPEN	RV19	A4
STORAGE	Storage horizontal positon	SWEEP START	RV5	A18
	Storage horizontal gain	SWEEP GAIN	RV4	A18
	Storage vertical gain	D/A GAIN	RV1	A18
	Storage vertical positoin	D/A OFFSET	RV2	A18
	storage HF compensation	HF COMPEN (STR)	RV3	A18
	CH1 A/D gain	CH1 A/D GAIN	RV1	A16
	CH1 A/D offset	CH1 A/D OFFSET	RV2	A16
	CH2 A/D gain	CH2 A/D GAIN	RV3	A16
	CH2 A/D offset	CH2 A/D GAIN	RV4	A16
	A/D gain balance	CH1 A/D GAIN ADJ	RV1	A15
		CH2 A/D GAIN ADJ	RV2	A15
	CH1 envelope gain	CH1 BOTTOM GAIN	RV6	A15
		CH1 PEAK GAIN	RV4	A15
	CH2 envelope gain	CH2 BOTTOM GAIN	RV5	A15
		CH2 PEAK GAIN	RV3	A15

Table 4-12 Adjustment Table (2)

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## **5. MAINTENANCE**

### **5.1 Preventive Maintenance**

#### **5.1.1 Description**

Preventive maintenance consist of cleaning and visual inspection.

By performing such maintenance periodically, unforeseen breakdown can be minimized.

#### **5.1.2 Cleaning**

Remove all dirt and dust from inside the unit. Either blow them away using an air compressor or suck them up with a vacuum cleaner. Especially those stuck on the high voltage portions. Also the heat sink should be kept clean.

#### **CAUTION**

This unit must not be cleaned with water or cleaning agent. Including case, panel, etc. it is recommended to use a cloth moistened with Diflon to wipe out a part dirt and dust.

Never use benzine, thinner, toluene, for this purpose.

#### **5.1.3 Visual inspection**

After completion of the cleaning, visually inspect the unit. Pay attention to the connectors, sockets, inner connecting cables, loose screws, and soon.

#### **5.1.4 Lubrication to a fan motor**

Since a maintenance-free type fan motor is used, no lubrication is needed.

#### **5.1.5 Semiconductor check**

There is no need to check transistors and other semiconductors of this unit. Periodically as long as the unit operate properly.

## 5.2 Troubleshooting

### 5.2.1 Description

If the operation of this unit seems to be abnormal, have a performance check. If the performance check shows abnormal operation, examine which section of the unit (vertical system, horizontal system, or CRT and its related circuit) the malfunction belongs, and thoroughly understand the directions of signal conveying routes with the block diagram.

Also, look at the circuit diagram to find a defective circuit. Parts location on the board, etc. will be a great help at this time. After reaching a defective circuit and find out a defective part, refer to the parts list (electronic) for a capacity or a value. This unit utilizes the special parts to the circuit when it requires. When replacing, be sure to verify a capacity or a value of the defective part, and use the company's specified one or an equivalent one.

In addition, when repairing is performed, follow the calibrating items to adjust the defective portion or to make entire adjustments.

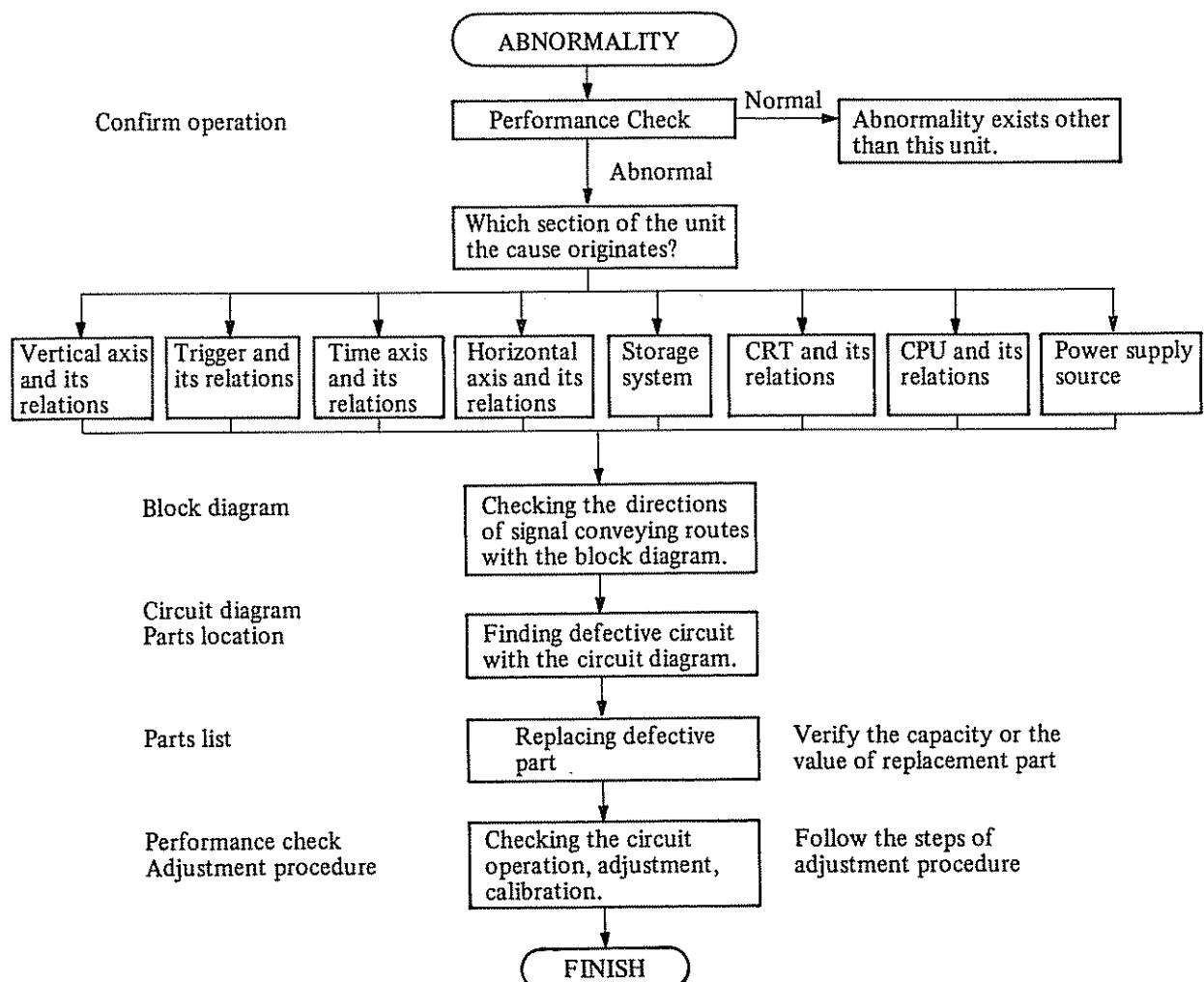
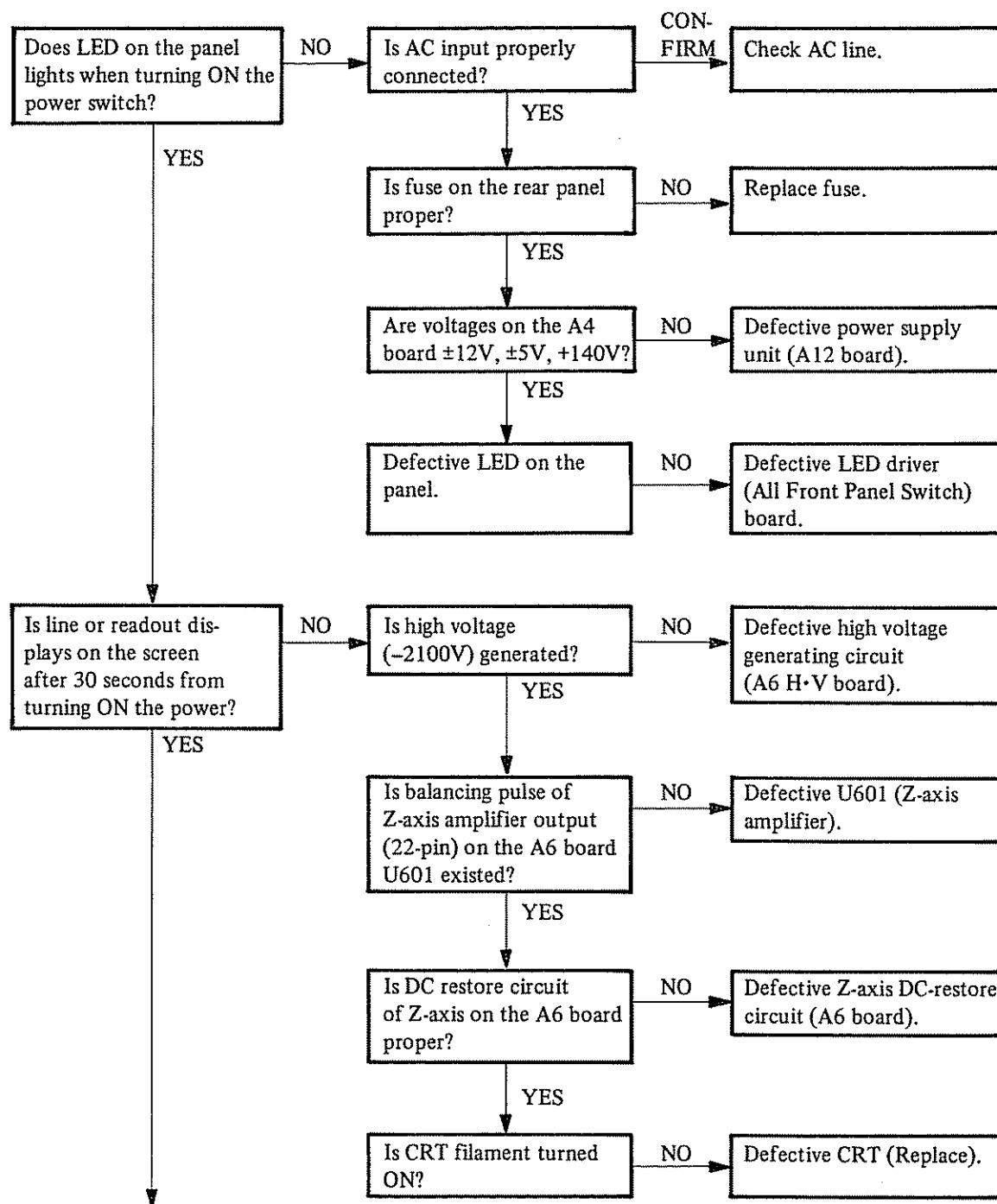
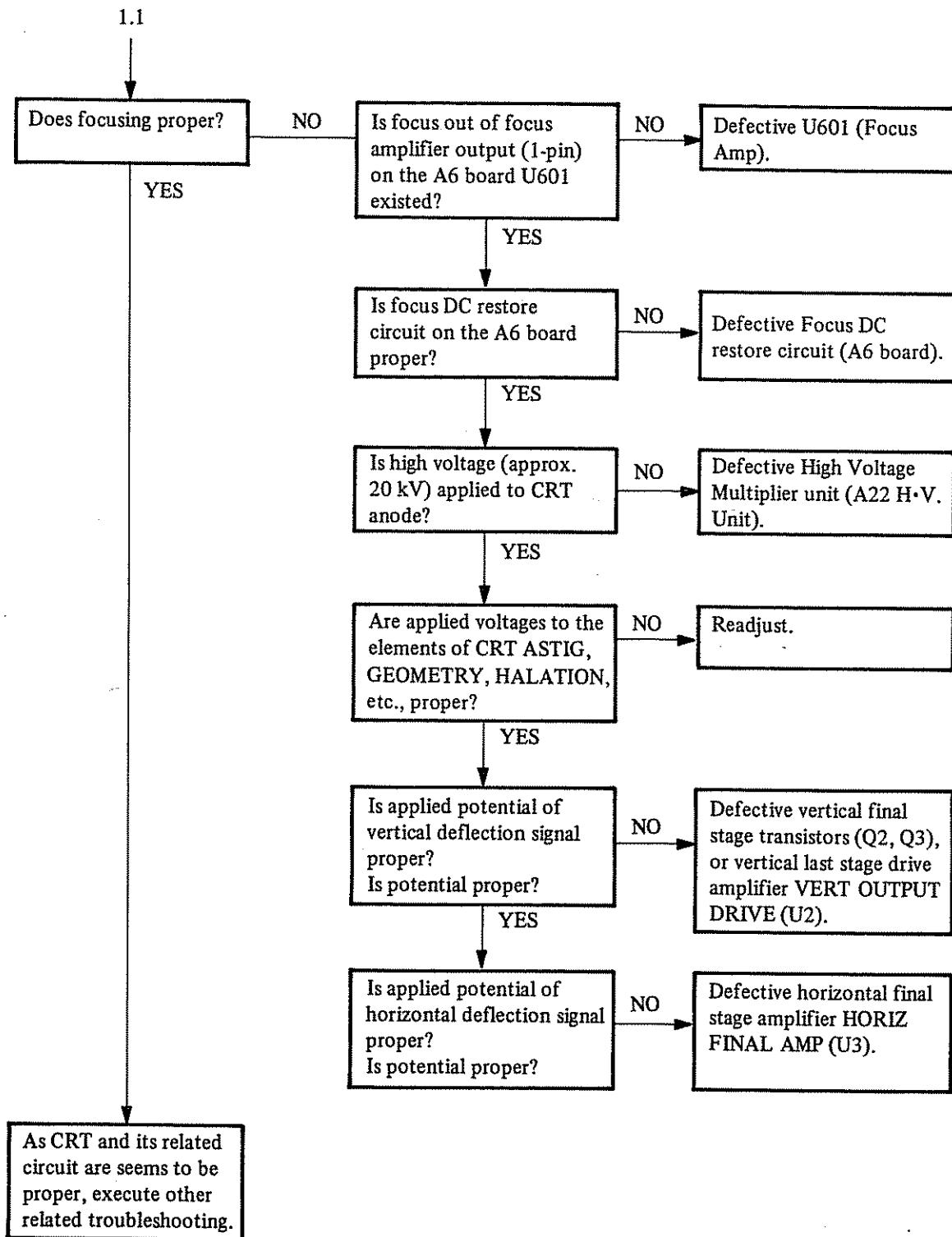


Figure 5-1 Flow Chart of Troubleshooting

### 5.2.2 Power supply, CRT and its related circuit



Continued to 1.1



### 5.2.3 Vertical system

Table 5-1 shows the vertical system troubleshooting chart.

Defective Functions		Symptom	Defective Circuits	Replacement Parts			
				Board	CKT No.	Code No.	Name of Parts
ATTENUATOR	CH1/CH2	Defective AC/DC/GND/50Ω or 1/1, 1/10, 1/100 ATT.	1st ATT Unit RELAY	A1 A1		36-00-1032 71-07-0370	H3 VERTICAL 1st ATT (CH1/CH2) RELAY
		Defective 1/2, 1/5 ATT.	2nd ATT Unit	A4	U3/U4	36-00-1052	H5 VERTICAL 2nd ATT
	CH3/CH4	Defective AC/DC/GND or 1/1, 1/5 ATT.	ATT Unit	A3		36-00-1042	H4 VERTICAL 1st ATT (CH3/CH4)
VARIABLE	CH1	Defective VARIABLE DC BAL or VARIABLE not functions.	CH1 1st AMP	A4	U11	36-00-1062	H6 VERTICAL 1st AMPLIFIER
	CH2	Defective VARIABLE DC BAL or VARIABLE not functions.	CH2 1st AMP	A4	U12	36-00-1062	H6 VERTICAL 1st AMPLIFIER
POSITION control	CH1	In despite of proper deflection factor, POSITION malfunctions.	CH1 2nd AMP	A4	U13	36-00-1072	H7 VERTICAL 2nd AMPLIFIER
	CH2	In despite of proper deflection factor, POSITION malfunctions.	CH2 2nd AMP	A4	U14	36-00-1072	H7 VERTICAL 2nd AMPLIFIER
	CH3	In despite of proper deflection factor, POSITION malfunctions.	CH3 2nd AMP	A4	U15	36-00-1074	H7 VERTICAL 2nd AMPLIFIER (CH3/CH4)
	CH4	In despite of proper deflection factor, POSITION malfunctions.	CH4 2nd AMP	A4	U15	36-00-1082	H7 VERTICAL 2nd AMPLIFIER (CH3/CH4)
DEFLECTION factor	CH1 only	In despite of proper CH1 signal out, DEFLECTION factor is defective.	VERT MODE SWITCH circuit	A4	U20	36-90-1082	H8 VERT MODE SWITCH
		Defective CH1 signal out, also POSITION malfunctions.	CH1 2nd AMP	A4	U13	36-00-1072	H7 VERTICAL 2nd AMPLIFIER
		In despite of defective CH1 signal out, POSITION properly functions	CH1 1st AMP	A4	U11	36-00-1062	H6 VERTICAL 1st AMPLIFIER
	CH2 only	In despite of defective CH2 POSITION, CH2 VARIABLE, trigger is proper by CH2 signal.	VERT MODE SWITCH circuit	A4	U20	36-00-1082	H8 VERT MODE SWITCH
		Defective CH2 POSITION, CH2 VARIABLE, also trigger is defective by CH2 signal.	CH2 2nd AMP	A4	U14	36-00-1072	H7 VERTICAL 2nd AMPLIFIER
	CH3 only	In despite of defective CH2 VARIABLE, CH2 POSITION is proper.	CH2 1st AMP	A4	U12	36-00-1062	H6 VERTICAL 1st AMPLIFIER
		CH3 POSITION is also defective.	VERT MODE SWITCH circuit	A4	U20	36-00-1082	H8 VERT MODE SWITCH
	CH4 only	CH3 POSITION is proper.	CH3 2nd AMP	A4	U15	36-00-1074	H7 VERTICAL 2nd AMPLIFIER (CH3/CH4)
		CH4 POSITION is also defective.	VERT MODE SWITCH circuit	A4	U20	36-00-1082	H8 VERT MODE SWITCH
	CH4 thru CH4 all Defective	CH4 POSITION is proper.	CH4 2nd AMP	A4	U15	36-00-1074	H7 VERTICAL 2nd AMPLIFIER (CH3/CH4)
		CRT graphic display is proper.	VERT MODE SWITCH circuit	A4	U20	36-00-1082	H8 VERT MODE SWITCH
		CRT graphic display is also defective.	DELAY LINE DRIVER or VERT OUT DRIVER circuit	A4 A5	U25 U2	36-00-1092 36-00-1102	H9 DELAY LINE DRIVER H10 VERTICAL FINAL DRIVER

Table 5-1 Troubleshooting Chart for Vertical System

#### 5.2.4 Trigger system

Table 5-2 shows the trigger system troubleshooting chart.

Defective Functions		Symptom	Defective Circuits	Replacement Parts			
				Board	CKT No.	Code No.	Name of Parts
Does not A TRIGGER	CH1 only	In case of signal level is lesser when compared with CH2 trigger by observing the scope at A4 board U275-pin (A trigger out).	CH1 2nd AMP	A4	U13	36-00-1072	H7 VERTICAL 2nd AMPLIFIER
	CH2 only	In case of signal level is lesser when compared with CH1 trigger by observing the scope at A4 board U275-pin (A trigger out).	CH2 2nd AMP	A4	U14	36-00-1072	H7 VERTICAL 2nd AMPLIFIER
	CH3 only	In case of signal level is lesser when compared with CH4 trigger by observing the scope at A4 board U275-pin (A trigger out).	CH3 2nd AMP	A4	U15	36-00-1074	H7 VERTICAL 2nd AMPLIFIER
	CH4 only	In case of signal level is lesser when compared with CH3 trigger by observing the scope at A4 board U275-pin (A trigger out).	CH4 2nd AMP	A4	U16	36-00-1074	H7 VERTICAL 2nd AMPLIFIER
	CH1 thru CH4 all defective	Trigger signal is existing at A4 board U48 52-pin (A trig in), and B trigger functions.	SWEEP CONTROLLER	A4	U48	36-00-1252	H25 SWEEP CONTROLLER
		Trigger signal is existing at A4 board U30 2-pin, but the same level trigger signal not exists at the same IC 21-pin (change trigger level for trial).	A TRIGGER LEVEL COMPARATOR circuit	A4	U30	36-00-1232	H23 TRIGGER LEVEL COMPARATOR
		Trigger signal is existing at A4 board U28 2-pin, but the same level trigger signal not exists at the same IC 4-pin (switch trigger coupling for trial).	B TRIGGER COUPLING circuit	A4	U28	36-00-1220	H22 TRIGGER COUPLING
		No trigger signal at A4 board U27 5-pin, but B trigger functions.	A/B TRIGGER SOURCE SWITCH	A4	U27	36-00-1212	H21 TRIGGER SOURCE SWITCH
Does not B TRIGGER	CH1 only	In case of signal level is lesser when compared with CH2 trigger by observing the scope at A4 board U27 22-pin (B trigger out).	CH1 2nd AMP	A4	U13	36-00-1072	H7 VERTICAL 2nd AMPLIFIER
	CH2 only	In case of signal level is lesser when compared with CH1 trigger by observing the scope at A4 board U27 22-pin (B trigger out).	CH2 2nd AMP	A4	U14	36-00-1072	H7 VERTICAL 2nd AMPLIFIER
	CH3 only	In case of signal level is lesser when compared with CH4 trigger by observing the scope at A4 board U27 22-pin (B trigger out).	CH3 2nd AMP	A4	U15	36-00-1074	H7 VERTICAL 2nd AMPLIFIER
	CH4 only	In case of signal level is lesser when compared with CH3 trigger by observing the scope at A4 board U27 22-pin (B trigger out).	CH4 2nd AMP	A4	U16	36-00-1074	H7 VERTICAL 2nd AMPLIFIER
	CH1 thru CH4 all defective	Trigger signal is existing at A4 board U48 50-pin (B trig in), and A trigger functions.	SWEEP CONTROLLER	A4	U48	36-00-1252	H25 SWEEP CONTROLLER
		Trigger signal is existing at A4 board U31 2-pin, but the same level trigger signal not exists at the same IC 21-pin (change trigger level for trial).	B TRIGGER LEVEL COMPARATOR circuit	A4	U31	36-00-1232	TRIGGER LEVEL COMPARATOR
		Trigger signal is existing at A4 board U29 2-pin, but the same level trigger signal not exists at the same IC 4-pin (switch trigger coupling for trial).	B TRIGGER COUPLING circuit	A4	U29	36-00-1220	TRIGGER COUPLING
		No trigger signal at A4 board U27 22-pin, but A trigger functions.	TRIGGER SOURCE SWITCH	A4	U27	36-00-1212	TRIGGER SOURCE SWITCH
Do not A/B TRIGGER	In case of no trigger signal are existing both at A4 board U27 5-pin (A trigger out) and 22-pin (B trigger out).		TRIGGER SOURCE SWITCH	A4	U27	36-00-1212	TRIGGER SOURCE SWITCH
	In case of trigger signals are existing both at A4 board U48 52-pin (A trig in) and 50-pin (B trig in).		SWEEP CONTROLLER	A4	U48	36-00-1252	H25 SWEEP CONTROLLER

Table 5-2 Troubleshooting Chart for Trigger System

### 5.2.5 Time axis system

Table 5-3 shows the time axis system troubleshooting chart.

Defective Function		Symptom	Defective Circuits	Replacement Parts			
				Board	CKT No.	Code No.	Name of Parts
A SWEEP NO SWEEP	All ranges	Sweep waveform is existing at A4 board U48 18-pin or U43 3-pin. Character display on the CRT is proper.	SWEEP & COMPARATOR SWITCH	A4	U52	36-00-1290	H29 SWEEP & COMPARATOR SWITCH
		Trigger signal is existing at A4 board U48 52-pin (A trig in) and X-Y function. No sweep waveform exists at A4 board U48 18-pin or U43 3-pin.	SWEEP CONTROLLER, or SWEEP GENERATOR	A4	U48	36-00-1252	H25 SWEEP CONTROLLER
	Some of the ranges	Phenomenon on the CRT and the generated sweep waveform at A4 board U48 18-pin or U43 3-pin coincide.		A4	U43	36-00-1270	H27 SWEEP GENERATOR
A SWEEP TIME out of spec.		Character display on the CRT is proper.	SWEEP GENERATOR	A4	U43	36-00-1270	H27 SWEEP GENERATOR
B SWEEP NO SWEEP	All ranges	Sweep waveform is existing at A4 board U48 6-pin or U44 3-pin. Character display on the CRT is proper.	SWEEP & COMPARATOR SWITCH	A4	U52	36-00-1290	H29 SWEEP & COMPARATOR SWITCH
		A sweep is normal. No sweep waveform exists at A4 board U52 20-pin.	SWEEP & COMPARATOR SWITCH	A4	U52	36-00-1290	H29 SWEEP & COMPARATOR SWITCH
		A sweep is normal. Sweep waveform is existing at A4 board U52 20-pin, but no signal exists at the same IC 11-pin or 12-pin.	DELAY TIME COMPARATOR	A4	U56	36-00-1281	H28 DELAY TIME COMPARATOR
		A sweep is normal. Signal is delivered to A4 board U48 28, 29-pin (DLY TRIG IN) from Comparator. No sweep waveform exists at A4 board U48 6-pin or U44 3-pin.	SWEEP CONTROLLER or SWEEP GENERATOR	A4	U48	36-00-1252	H25 SWEEP CONTROLLER
	Some of the ranges	Phenomenon on the CRT and the generated sweep waveform at A4 board U48 6-pin or U44 3-pin coincide.	SWEEP GENERATOR	A4	U44	36-00-1270	H27 SWEEP GENERATOR
B SWEEP TIME out of spec.		Character display on the CRT is proper.	SWEEP GENERATOR	A4	U44	36-00-1270	H27 SWEEP GENERATOR

Table 5-3 Troubleshooting Chart for Time Axis System

### 5.2.6 Horizontal axis system

Table 5-4 shows the horizontal axis system troubleshooting

Defective Function		Symptom	Defective Circuits	Replacement Parts			
				Board	CKT No.	Code No.	Name of Parts
SWEEP NO SWEEP		X-Y function, character display on the CRT, and horizontal position are normal.	U52 SWEEP COMPARATOR SWITCH	A4	U52	36-00-1290	H29 SWEEP & COMPARATOR SWITCH
		Horizontal position is abnormal, X-Y function and character display on the CRT are normal.	U55 HORIZONTAL SWITCHING & DRIVER	A4	U55	36-00-1302	H30 HORIZONTAL SWITCHING & DRIVER
		X-Y function, character display on the CRT, and horizontal position are abnormal.	HORIZONTAL FINAL AMP	A5	U3	36-00-1312	H31 HORIZONTAL FINAL AMPLIFIER
Abnormal HORIZONTAL POSITION		Sweep, X-Y function, and character display on the CRT are normal.	ANALOG MPX	A4	U66	36-00-1140	H14 ANALOG MULTIPLEXER
Abnormal x10 MAG		In despite of A4 board U55 16-pin in "L", x10 MAG is abnormal.	U55 HORIZONTAL SWITCHING & DRIVER	A4	U55	36-00-1302	H30 HORIZONTAL SWITCHING & DRIVER

Table 5-4 Troubleshooting Chart for Horizontal Axis System

### 5.2.7 Storage system

Table 5-5 shows the storage system troubleshooting chart.

Real time operation is in normal as a general rule.

Defective Function			Symptom	Defective Circuits	Replacement Part				
					Board	CKT No.	Code No.	Name of Parts	
STOR-AGE no-storage	CH1 only	No input signal at A4 board U26 6/5-pin and 10/9-pin. Input signal exists when the unit's vert mode is in CH2.	VERT MODE SWITCH, or STORAGE SIGNAL BUFFER.	A4	U20	36-00-1082	H8 VERT MODE SWITCH		
		No input signal at A4 board U26 6/5-pin and 10/9-pin. Input signal exists when the unit's vert mode is in CH1.							
	Sweep functions (previous stage to A/D converter)	Input signal is existing at A4 board U26 6/5-pin and 10/9-pin, but no input signal exists at A15 board H12 17/16-pin and 24/23-pin.	STORAGE SIGNAL DRIVER.	A15	U5	36-00-1120	H12 STORAGE SIGNAL DRIVER		
		Input signal is existing at A15 board H12 17/16-pin and 24/23-pin, but no input signal exists at A16 board U12A 23-pin.	A15 CHANNEL DIVIDER.	A15	U6	36-00-1130	H13 STORAGE CHANNEL DIVIDER		
		Input signal is existing at A16 board U12A 23-pin, but no signal exists at A16 board U12A 3-pin (SAMPLING OUT). (Compare with U12C 3-pin.)	A16 SAMPLE AND HOLD.	A16	U12A	36-00-1180	H18 SAMPLE and HOLD		
	(Subsequent stage to D/A converter)	Input signal is existing at A16 board U12C 23-pin, but no signal exists at A16 board U12C 3-pin (SAMPLING OUT). (Compare with U12A 3-pin.)	A16 SAMPLE AND HOLD.	A16	U12C	36-00-1180	H18 SAMPLE and HOLD		
		“Sample and hold” input signal is existing at A16 board U11A 21-pin, but storage not functions.	A16 A/D CONVERTER.	A16	U11A	34-21-0000	A/D CONVERTER		
		“Sample and hold” input signal is existing at A16 board U11C 21-pin, but storage not functions.	A16 A/D CONVERTER.	A16	U11C	34-21-0000	A/D CONVERTER		
	Sweep not functions	Character display is normal on the CRT. Reemerged input waveform is observed at A18 board U1B 10-pin.	A4 U20 VERT MODE SWITCH.	A4	U20	36-00-1082	H8 VERT MODE SWITCH		
		Character display is normal on the CRT. D/A converted output signal is existing at A18 board U1B 5-pin (D/A SIGNAL IN), but no signal exists at the same IC 10-pin (OUT).	A18 U1B INTERPOLATOR.	A18	U1B	36-00-1200	H20 INTERPOLATOR		
ENVELOPE does not function	All CHs	Character display is normal on the CRT. Sweep signal (STORAGE) is observed at A18 board U1C 10-pin.	A4 U52 SWEEP COMPARATOR SWITCH.	A4	U52	36-00-1290	H29 SWEEP & COMPARATOR SWITCH		
	All CHs	Character display is normal on the CRT. Sweep signal (STORAGE) is observed at A18 board U1C 4-pin, but not at A18 board U1C 10-pin.	A18 U1C STORAGE DEGLITCHER.	A18	U1C	36-00-1320	H32 STORAGE DEGLITCHER		
Abnormal REPEAT function		Storage function (sweep time 50ms ~ 0.5 μs DIV) is normal in other than REPEAT MODE, but no waveform can be observed in REPEAT MODE.	A17 U3B JITTER INTERVAL METER.	A17	U3B	36-00-1330	H33 JITTER INTERVAL METER		
Abnormal dot joint		Connecting function for each dot linking on the CRT screen waveform is defective that the CRT screen shows a staircase-like waveform. Or no waveform is displayed. (OVER SCALE.)	A18 U1B INTERPOLATOR.	A18	U1B	36-00-1200	H20 INTERPOLATOR		
Noise on the horizontal direction		Apply an approx. 6 DIV 1 kHz sine wave, and when displaying 1 cycle on the CRT screen, a horizontal noise is observed.	A18 U1C STORAGE SWEEP DEGLITCHER.	A18	U1C	36-00-1320	H32 STORAGE SWEEP DEGLITCHER		

Table 5-5 Troubleshooting Chart for Storage System

### 5.2.8 List of board with the parts

Table 5-6 and 5-7 show the list of board with the parts employed in this unit.

#### 1) COM7101A

Assembly No.	KIKUSUI Parts No.	Name of Board
A1	36-00-1030	H3 CH1, CH2 1st ATTENUATOR
A3	36-00-1040	H4 CH3, CH4 1st ATTENUATOR
A4	97-11-0230	A4 COM7101A MAIN BOARD FOR STORAGE
A5	97-11-0032	A5 COM71xxA VERTICAL & HORIZONTAL FINAL AMPLIFIER
A6	97-11-0040	A6 COM71xxA HIGH VOLTAGE & Z-AXIS AMPLIFIER *1
A7	97-11-0050	A7 COM7xxxA CRT CONTROL
A8	97-11-0060	A8 COM7xxxA MAIN CPU BOARD *2
A10	97-11-0070	A10 COM7xxxA FRONT PANEL CONTROL
A11	97-11-0261	A11 COM7101A FRONT PANEL SWITCH
A12	97-11-0280	A12 COM7101A STORAGE POWER SUPPLY
A13	97-11-0250	A13 COM7101A MOTHER BOARD STORAGE
A14	97-11-0121	A14 COM7101A SUB CPU BANK VERSION
A15	97-11-0170	A15 COM7101A ANALOG PROCESSING
A16	97-11-0150	A16 COM7101A A/D MEMORY
A17	97-11-0140	A17 COM7101A ACQUISITION CONTROL
A18	97-11-0130	A18 COM7101A STORAGE DISPLAY
A22	97-11-0200	A22 COM71xxA H.V. UNIT *1

Note: \*1. A22 (H.V. UNIT) is not included in A6 (HIGH VOLTAGE & Z-AXIS AMPLIFIER).

\*2. Because of PROGRAM ROM is built-in, specify the name of model when placing an order.

Table 5-6 List of Board with the Parts for COM7101A

2) COM7100A

Assembly No.	KIKUSUI Parts No.	Name of Board
A1	36-00-1030	H3 CH1, CH2 1st ATTENUATOR
A3	36-00-1040	H4 CH3, CH4 1st ATTENUATOR
A4	97-11-0021	A4 COM7100A MAIN BOARD
A5	97-11-0030	A5 COM71xxA VERTICAL & HORIZONTAL FINAL AMPLIFIER
A6	97-11-0040	A6 COM71xxA HIGH VOLTAGE & Z-AXIS AMPLIFIER *1
A7	97-11-0050	A7 COM7xxxA CRT CONTROL
A8	97-11-0060	A8 COM7xxxA MAIN CPU BOARD *2
A10	97-11-0070	A10 COM7xxxA FRONT PANEL CONTROL
A11	97-11-0081	A11 COM7100A FRONT PANEL SWITCH
A12	97-11-0090	A12 COM7100A POWER SUPPLY
A13	97-11-0100	A13 COM7100A MOTHER BOARD
A22	97-11-0200	A22 COM71xxA H.V. UNIT *1

Note: \*1. A22 (H.V. UNIT) is not included in A6 (HIGH VOLTAGE & Z-AXIS AMPLIFIER).  
 \*2. Because of PROGRAM ROM is built-in, specify the name of model when placing an order.

Table 5-7 List of Board with the Parts for COM7100A

### 5.2.9 Table of HIC functions

Functions of HIC utilized in this unit are as follows:

HIC for other than board assembly

CKT NO.	HIC NAME	KIKUSUI'S PARTS NO.	FUNCTION	DESCRIPTIONS
	H3	36-00-1030	VERTICAL 1st ATT (CH1)	Coupling of CH1 signal (AC, DC, GND), and attenuation (1/1, 1/10, 1/100).
	H3	36-00-1030	VERTICAL 1st ATT (CH2)	Coupling of CH2 signal (AC, DC, GND), and attenuation (1/1, 1/10, 1/100).
	H4	36-00-1040	VERTICAL 1st ATT (CH3/CH4)	Coupling of CH3 and CH4 (AC, DC, GND), and attenuation (1/1, 1/5).

HIC for A4 board assembly

CKT NO.	HIC NAME	KIKUSUI'S PARTS NO.	FUNCTION	DESCRIPTIONS
U3	H5	36-00-1050	VERTICAL 2nd ATT	CH1 signal (1/1, 1/2, 1/5).
U4	H5	36-00-1050	VERTICAL 2nd ATT	CH2 signal (1/1, 1/2, 1/5).
U11	H6	36-00-1060	VERTICAL 1st AMPLIFIER	CH1 AMPLITUDE AND VARIABLE GAIN CONTROL.
U12	H6	36-00-1060	VERTICAL 1st AMPLIFIER	CH2 AMPLITUDE AND VARIABLE GAIN CONTROL.
U13	H7	36-00-1070	VERTICAL 2nd AMPLIFIER	CH1 AMPLITUDE AND POSITION CONTROL.
U14	H7	36-00-1070	VERTICAL 2nd AMPLIFIER	CH2 AMPLITUDE AND POSITION CONTROL.
U15	H7	36-00-1073	VERTICAL 2nd AMPLIFIER (CH3/CH4)	CH3 AMPLITUDE AND POSITION CONTROL.
U16	H7	36-00-1073	VERTICAL 2nd AMPLIFIER (CH3/CH4)	CH4 AMPLITUDE AND POSITION CONTROL.
U17	H14	36-00-1140	ANALOG MULTIPLEXER	Hold data (CH1, GAIN, CH1 POSITION, CH1 POSITION CENTER, CH1 VARIABLE, CH1 INPUT OFFSET, CH1 STEP BALANCE, DVM AUTO ZERO, DVM RMS OFFSET).
U18	H14	36-00-1140	ANALOG MULTIPLEXER	Hold data (CH2 GAIN, CH2 POSITION, CH2 POSITION CENTER, CH2 VARIABLE, CH2 INPUT OFFSET, CH2 STEP BALANCE, CH3 POSITION, CH4 POSITION).
U19	H19	36-00-1190	CH1 SIGNAL OUTPUT AMPLIFIER	CH1 SIGNAL OUTPUT.
U20	H8	36-00-1080	VERTICAL MODE SWITCH	Switching of each vertical axis signal (CH1, CH2, CH3, CH4), and output (REAL SIGNAL, FOR X-Y SIGNAL (X AXIS), CHA & CHB SIGNAL (FOR STORAGE)).
U21	H42	36-00-1420	DVM TRUE RMS CONVERTER	True RMS conversion of vertical axis CH1 2nd ATT OUT, and output of each DVM function mode (DC, RMS, P-P, V-MONI).
U22	H43	36-00-1430	DVM PEAK DETECTOR	Peak detector of H42 (DVM true RMS converter) To P-P signal, and re-outputs to H42 FROM P-P input.
U25	H9	36-00-1090	DELAY LINE DRIVER	Delay line driver (VERTICAL REALTIME SIGNAL & VERTICAL CHARACTER SIGNAL).
U26	H11	36-00-1110	STORAGE SIGNAL BUFFER	Buffering H8 (vertical mode switch) CHA and CHB signals, and outputs to A15 (Analog processing board). Band width limiter for storage is built-in.
U27	H21	36-00-1210	TRIGGER SOURCE SWITCH	Switching of each vertical axis trigger signal (CH1, CH2, CH3, CH4), and A/B 2-SYSTEM trigger output of line trigger signal.
U28	H22	36-00-1220	TRIGGER COUPLING SWITCH	A trigger signal coupling (AC, LF REJ, HF REJ, DC, TV-V, TV-H).
U29	H22	36-00-1220	TRIGGER COUPLING SWITCH	B trigger signal coupling (AC, LF REJ, HF REJ, DC, TV-V, TV-H).
U30	H23	36-00-1230	TRIGGER LEVEL COMPARATOR	A trigger comparator and slope control.
U31	H23	36-00-1230	TRIGGER LEVEL COMPARATOR	B trigger comparator and slope control.
U32	H24	36-00-1240	TV SYNCHRONIZE SEPARATOR	TV sync. separator circuit to detect TV synchro signal from A trigger signal.
U43	H27	36-00-1270	SWEET GENERATOR	A sweep generator.
U44	H27	36-00-1270	SWEET GENERATOR	B sweep generator.
U48	H25	36-00-1250	SWEET CONTROLLER	Overall controlling of A/B sweep circuit.
U52	H29	36-00-1290	SWEET & COMPARATOR SWITCH	Switching circuit of A/B sweep signals.
U55	H30	36-00-1302	HORIZONTAL SWITCHING & DRIVER	Selecting and amplifying of horizontal axis signal (A/B sweep signals, X-Y signals, horizontal character signal), horizontal position, beam find, x10 magnifier, etc.
U56	H28	36-00-1280	DELAY TIME COMPARATOR	Delay sweep comparator circuit, making B sweep gate signal from A sweep signal.
U57	H34	36-00-1340	Z AXIS SWITCH & Z AXIS DRIVER	Switching circuit of each Z axis signal (A/B sweep gate, character intergate, storage intergate, ext Z in, etc.), and output buffer circuit.
U58	H26	36-00-1260	PRESCALER	For frequency counter (switches to 1/1, 1/10, 1/100 according to the input frequency).

HIC for A4 board assembly (continued)

CKT NO.	HIC NAME	KIKUSUI'S PARTS NO.	FUNCTION	DESCRIPTION
U59	H41	36-00-1410	SEQUENCE CONTROLLER	Vertical mode and display mode on the panel.
U65	H14	36-00-1140	ANALOG MULTIPLEXER	Hold data ((A/B TRIG LEVEL, SWEEP HOLDOFF, A/B SWEEP VARIABLE, A SWEEP POSITION, B SWEEP POSITION, COMPARATOR LEVEL)
U66	H14	36-00-1140	ANALOG MULTIPLEXER	Hold data (CURSOR 1/2 LEVEL, B SWEEP INTEN, CHARACTER INTEN, HORIZONTAL POSITION, SCALE ILLUMINATION, TRACE SEPARATION).

HIC for A5 board assembly

CKT NO.	HIC NAME	KIKUSUI'S PARTS NO.	FUNCTION	DESCRIPTION
U2	H10	36-00-1100	VERTICAL FINAL DRIVER	Amplifying vertical signal, and drive final stage transistor.
U3	H31	36-00-1310	HORIZONTAL FINAL AMPLIFIER	Amplifying horizontal signal, and final stage.

HIC for A6 board assembly

CKT NO.	HIC NAME	KIKUSUI'S PARTS NO.	FUNCTION	DESCRIPTION
U601	H31	36-00-1310	HORIZONTAL FINAL AMPLIFIER	Amplifying Z axis signal, and final stage of Z axis.

HIC for A15 board assembly

CKT NO.	HIC NAME	KIKUSUI'S PARTS NO.	FUNCTION	DESCRIPTION
U5	H12	36-00-1120	STORAGE SIGNAL DRIVER	Impedance conversion circuit for H13 & H16.
U6	H13	36-00-1130	STORAGE CHANNEL DRIVER	Switching circuit obtains 2 pairs of balanced in and output and enable to set output according to dual mode/single mode, ALT chop, and sampling speed (Sweep speed of storage mode).
U7	H16	36-00-1160	STORAGE ENVELOPE PEAK HOLD	Peak and bottom hold circuit for CHA (CH1 or CH3) (obtains 2 sets of peak hold circuit, performs reversing and non-reversing of differential).
U8	H16	36-00-1160	STORAGE ENVELOPE PEAK HOLD	Peak and bottom hold circuit for CHB (CH2 or CH4) (obtains 2 sets of peak hold circuit, performs reversing and non-reversing of differential).

HIC for A16 board assembly

CKT NO.	HIC NAME	KIKUSUI'S PARTS NO.	FUNCTION	DESCRIPTION
U12A	H18	36-00-1180	SAMPLE & HOLD	Sample and hold circuit for CHA (CH1 or CH3) with reference voltage for A/D converter.
U12C	H18	36-00-1180	SAMPLE & HOLD	Sample and hold circuit for CHB (CH2 or CH4) with reference voltage for A/D converter.

HIC for A17 board assembly

CKT NO.	HIC NAME	KIKUSUI'S PARTS NO.	FUNCTION	DESCRIPTION
U1B	H15	36-00-1150	ANALOG MULTIPLEXER DIP	Hold data (JITCAL, HOLDOFF RANDOMIZED, CHA BAL, CHB BAL, CHA PEAK OFFSET, CHA BOTTOM OFFSET, CHB PEAK OFFSET, CHB BOTTOM OFFSET)
U14C	H36	36-00-1360	CLOCK GENERATOR	Obtains 50MHz and 40MHz crystal oscillator and OR circuit, delivers one of which signal according to sampling speed.
U3B	H33	36-00-1330	JITTER INTERVAL METER	Expanding circuit of time from trigger signal to random sample signal by double integrally.

HIC for A18 board assembly

CKT NO.	HIC NAME	KIKUSUI'S PARTS NO.	FUNCTION	DESCRIPTION
U1B	H20	36-00-1200	INTERPOLATOR	Dot joiner to connect staircase-like vertical axis converter output signal in straight line at storage mode.
U1C	H32	36-00-1320	STORAGE SWEEP DEGLITCHER	Removing circuit to remove glitch noise with horizontal axis converter output integrally at storage mode.

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6.1.2 Notes for circuit diagram .....	6-2
6.2 Circuit Diagram .....	6-2
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## 6. CIRCUIT DIAGRAM

### 6.1 Description

This chapter shows the COM 7101A circuit diagram. The circuit diagram of COM 7100A is composed basically the same as COM 7101A except the storage and GP-IB sections are excluded.

#### 6.1.1 List of circuit diagrams

Table 6-1 shows the list of circuit diagrams classified by assembly.

MODEL	ASSEMBLY	NAME OF CIRCUIT DIAGRAM	DRAWING No.
COM 7101A	A1	CH1, CH2 ATTENUATOR	0
COM 7100A	A3	CH3, CH4 ATTENUATOR	0
	A4	VERTICAL PREAMPLIFIER	1 26317
	A4	TRIG & A/B SWEEP GENERATOR	2 26318
	A4	HORIZONTAL SWITCH & Z AXIS CONTROL	3 26319
	A5	VERTICAL OUTPUT AMPLIFIER & HORIZONTAL OUTPUT AMPLIFIER	4 322462
	A6, A22	Z AXIS AMPLIFIER & HIGH VOLTAGE UNIT	5 322463
	A7	CRT CONTROL	6 322464
	A8	MAIN CPU (1/2)	7 26497
	A8	MAIN CPU (2/2)	8 26498
	A10	PANEL CONTROLS (1/2)	9 26500
	A11	PANEL CONTROLS (2/2)	10 26980
	A12	POWER SUPPLY UNIT	11 26501
	A13	BUS INTERCONNECTIONS	12 26521
	A20	LINE FILTER	13 422725
	A21	CRT SOCKET	13 422713
COM 7101A	A14	SUB CPU (1/2)	14 322465
	A14	SUB CPU (2/2)	15 322466
	A15	SIGNAL PICKOFF FOR A/D CONVERTER, CHANNEL DIVIDER & PEAK HOLD	16 322467
	A16	A/D CONVERTER & MEMORY	17 322525
	A17	AQUISITION CONTROL	18 322469
	A18	DISPLAY CONTROL (1/2)	19 322470
	A19	DISPLAY CONTROL (2/2)	20 322471
	A19, A23, A24	GP-IB INTERCONNECTIONS	21 322614

Table 6-1 List of Circuit Diagrams

### 6.1.2 Notes for circuit diagram

Table 6-2 explains the omitted units and capacities of the parts in the circuit diagram.

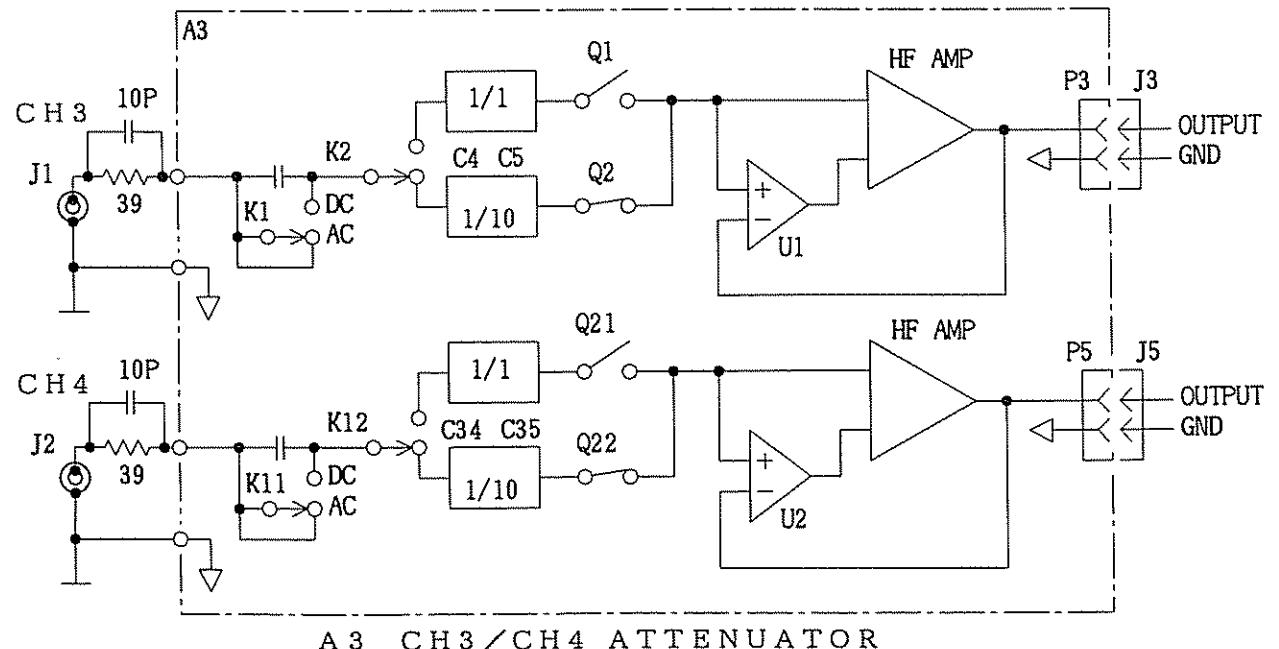
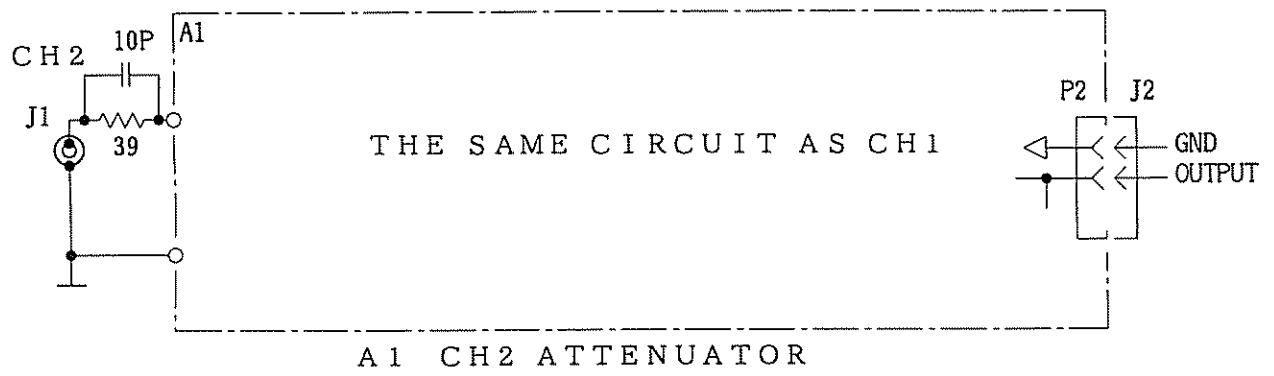
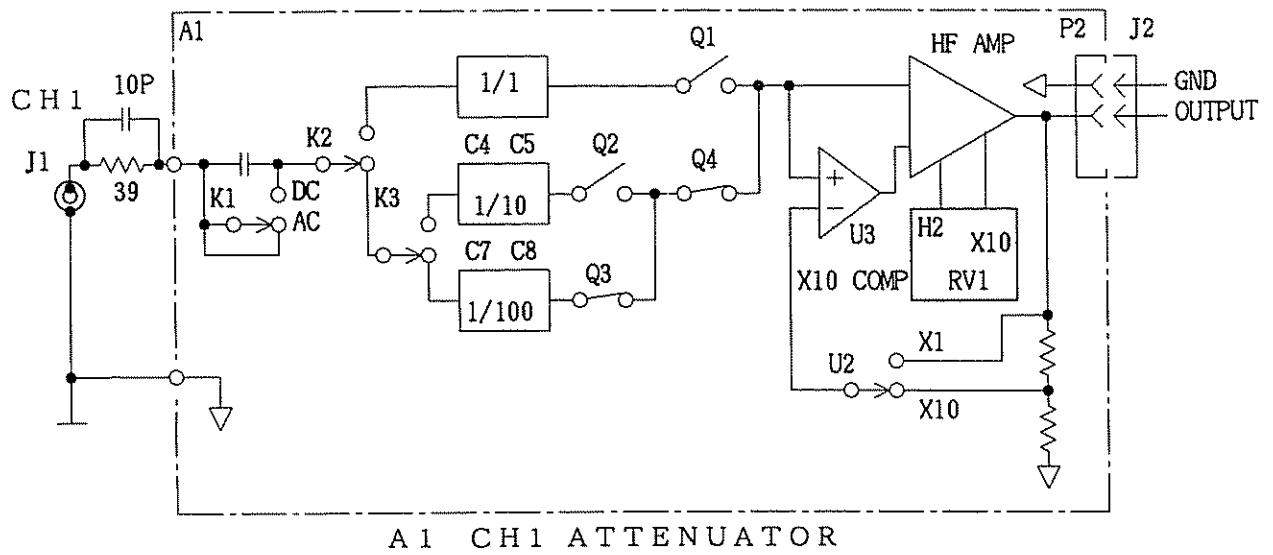
Parts Name	Omitted Unit	Omitted Capacity
Resistor	$\Omega$ (ohm)	Unless otherwise specified, resistance value accuracy is $\pm 5\%$ , carbon film resistor. Refer to the parts list for tolerance power.
Capacitor	F (Farad)	Refer to the parts list for details.
Inductance	H (Henry)	Refer to the parts list for details.

Table 6-2 List of Omitted Units and Capacities

Table 6-3 also explains the special symbols using in the circuit diagram.

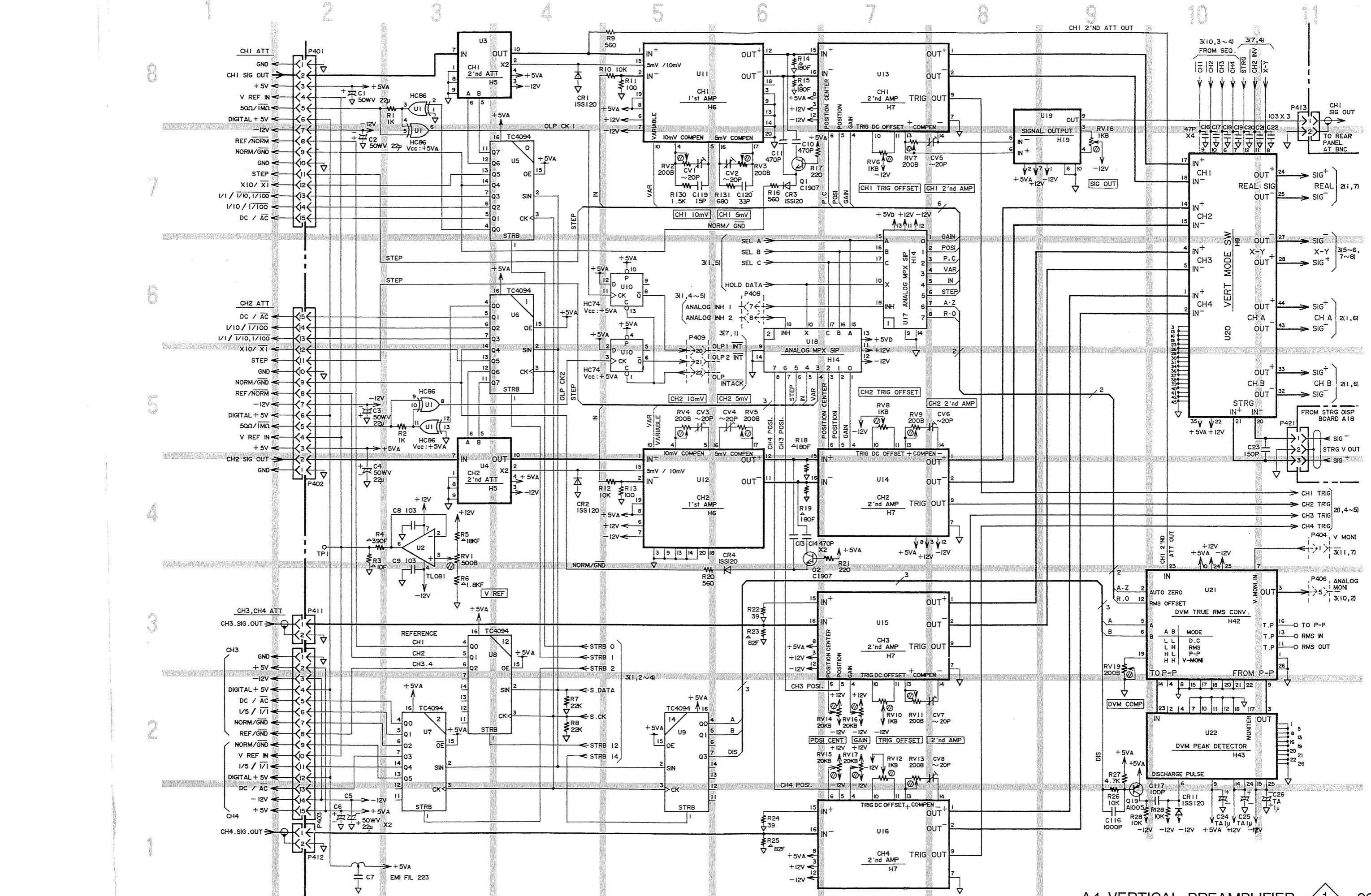
Symbol	Description
$\triangle$	Indicates metal film resistor.
$\textcircled{Z}$	Indicates semi-fixed adjustment resistor and capacitor inside the case.
$\textcircled{A}$	Indicates semi-fixed resistor adjustable from the outside.
$\ast$	Typical value is shown. Actual value may differ.

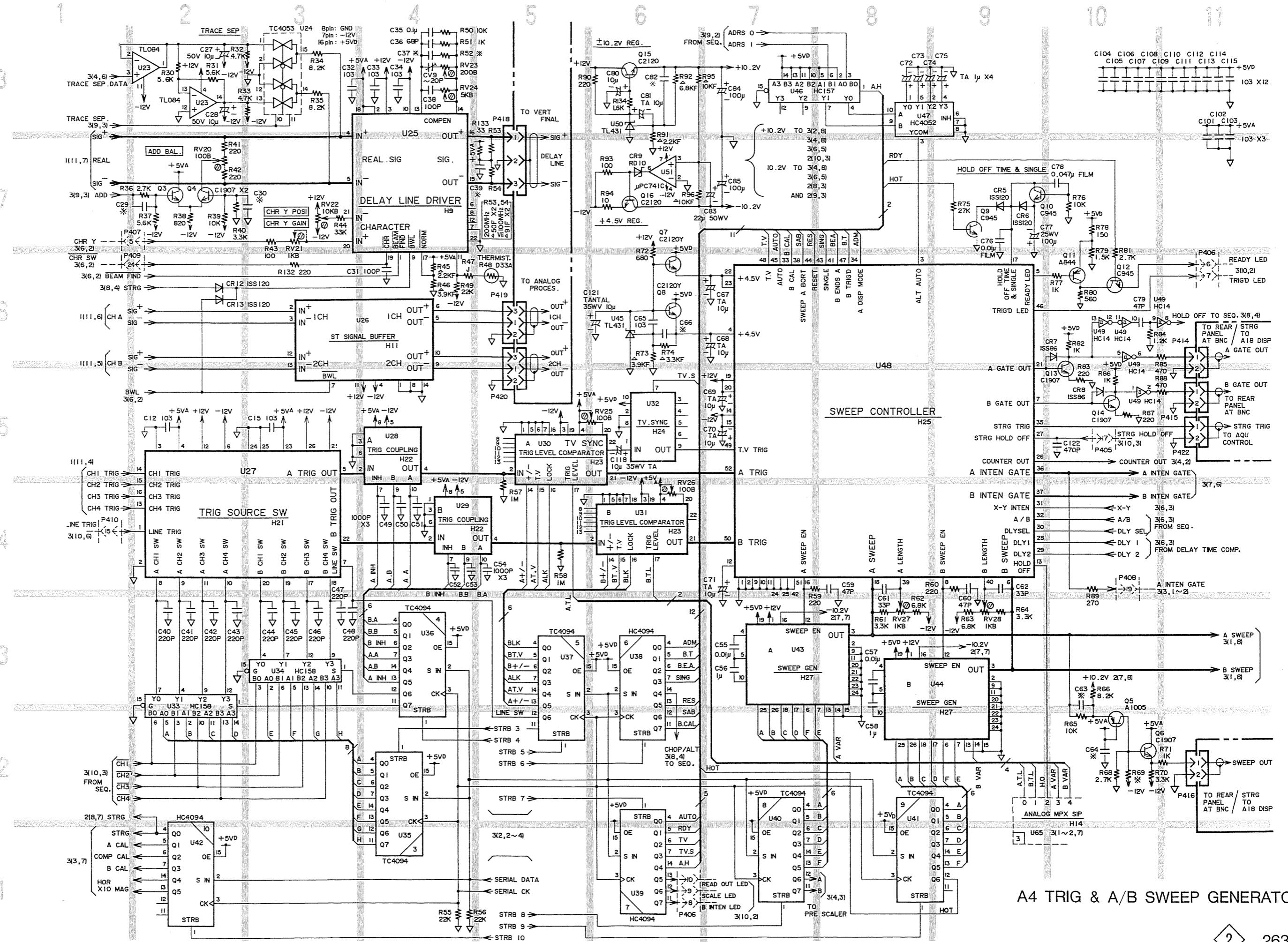
Table 6-3 Special Symbol and its Description



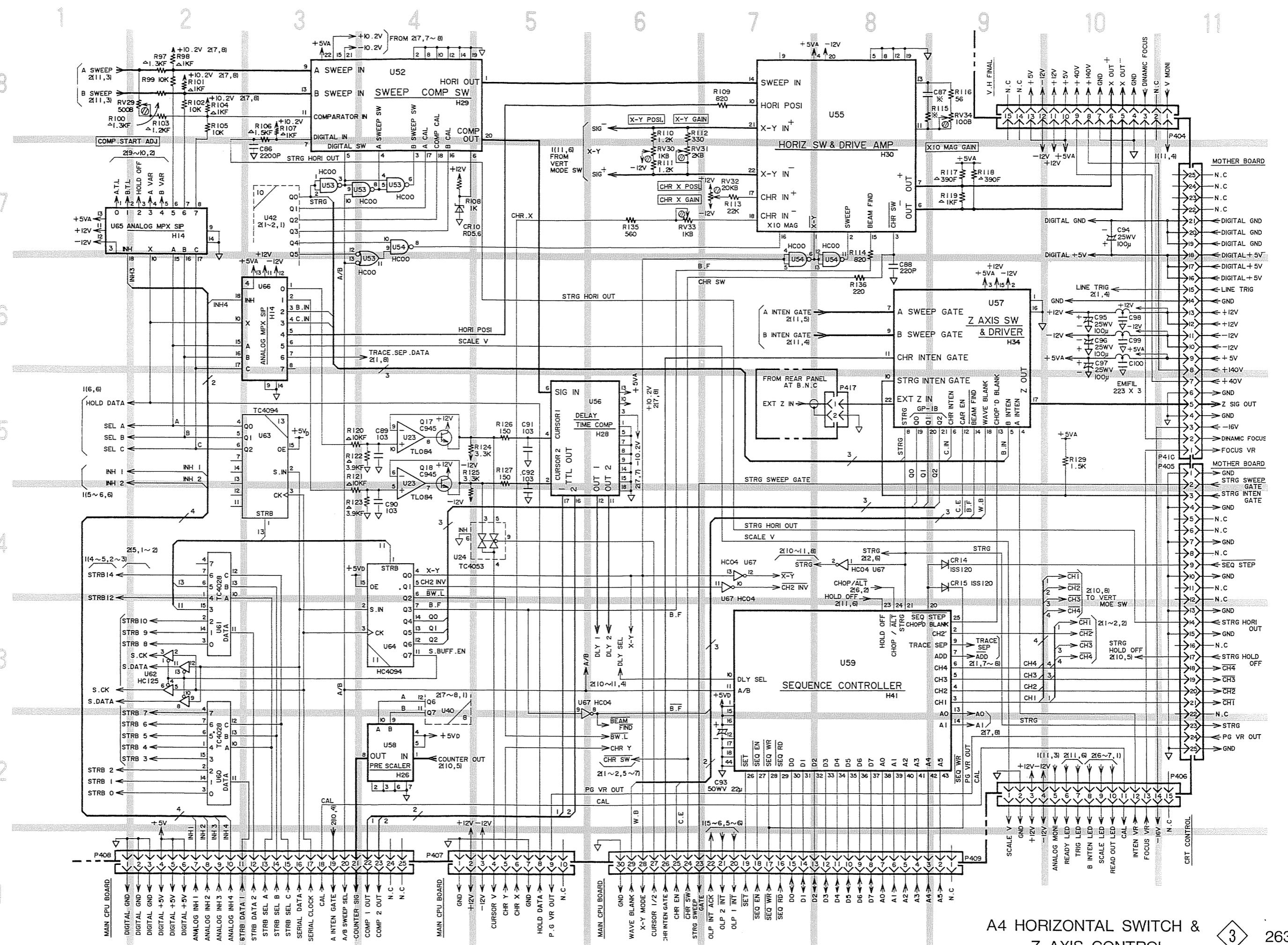
A1 CH1, CH2 ATTENUATOR  
A3 CH3, CH4 ATTENUATOR

0

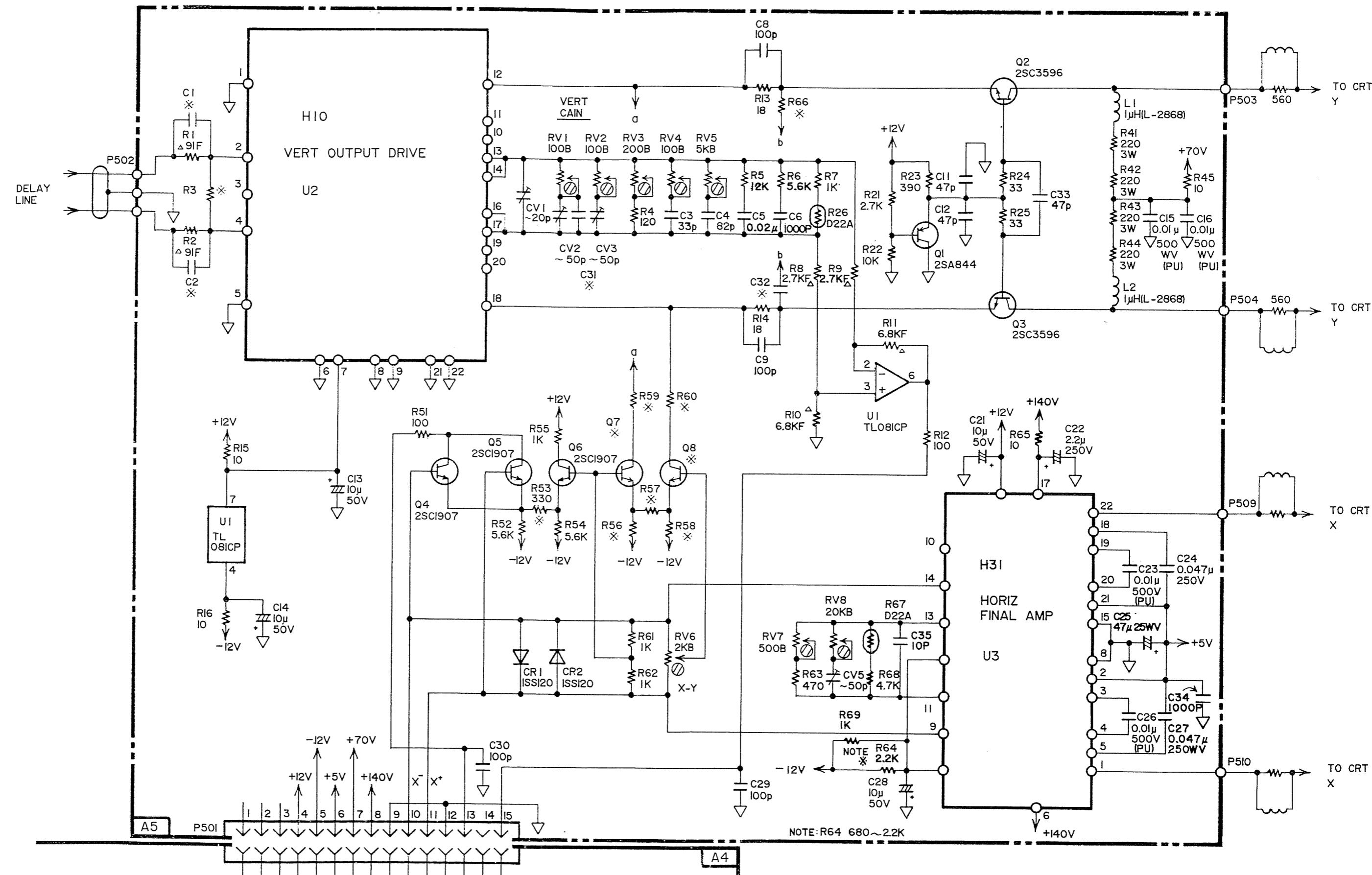




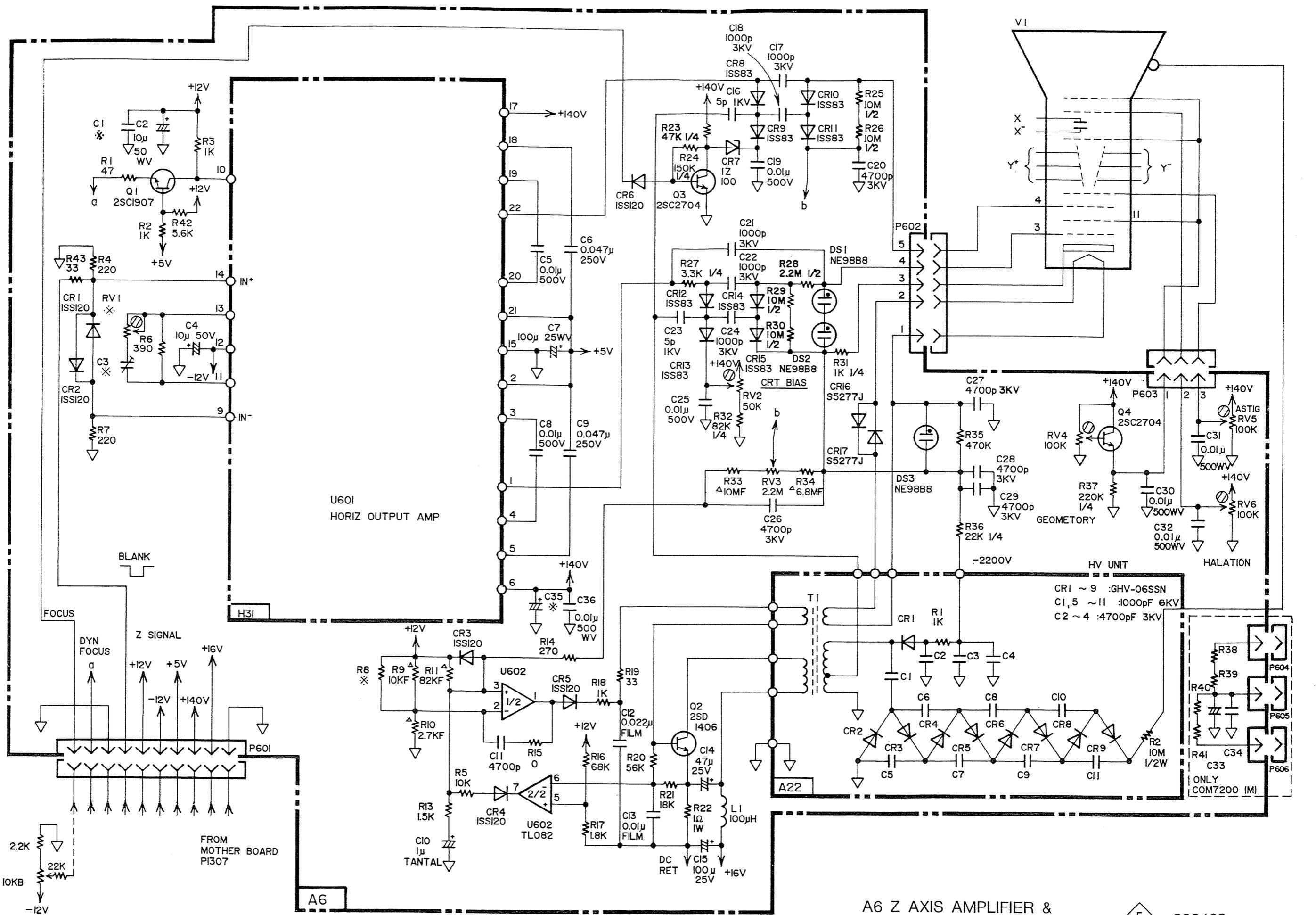
#### A4 TRIG & A/B SWEEP GENERATOR



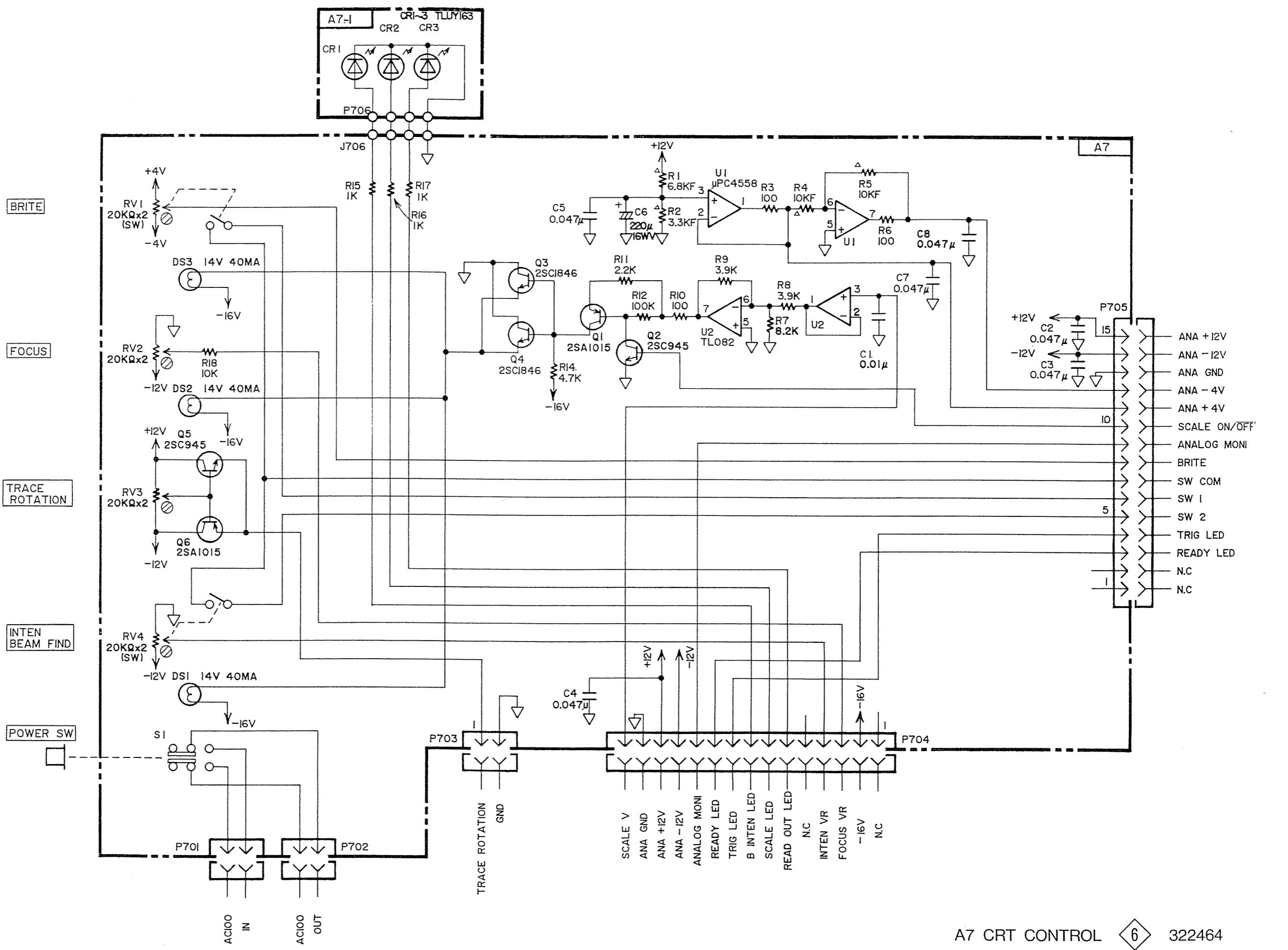
A4 HORIZONTAL SWITCH &  
Z AXIS CONTROL

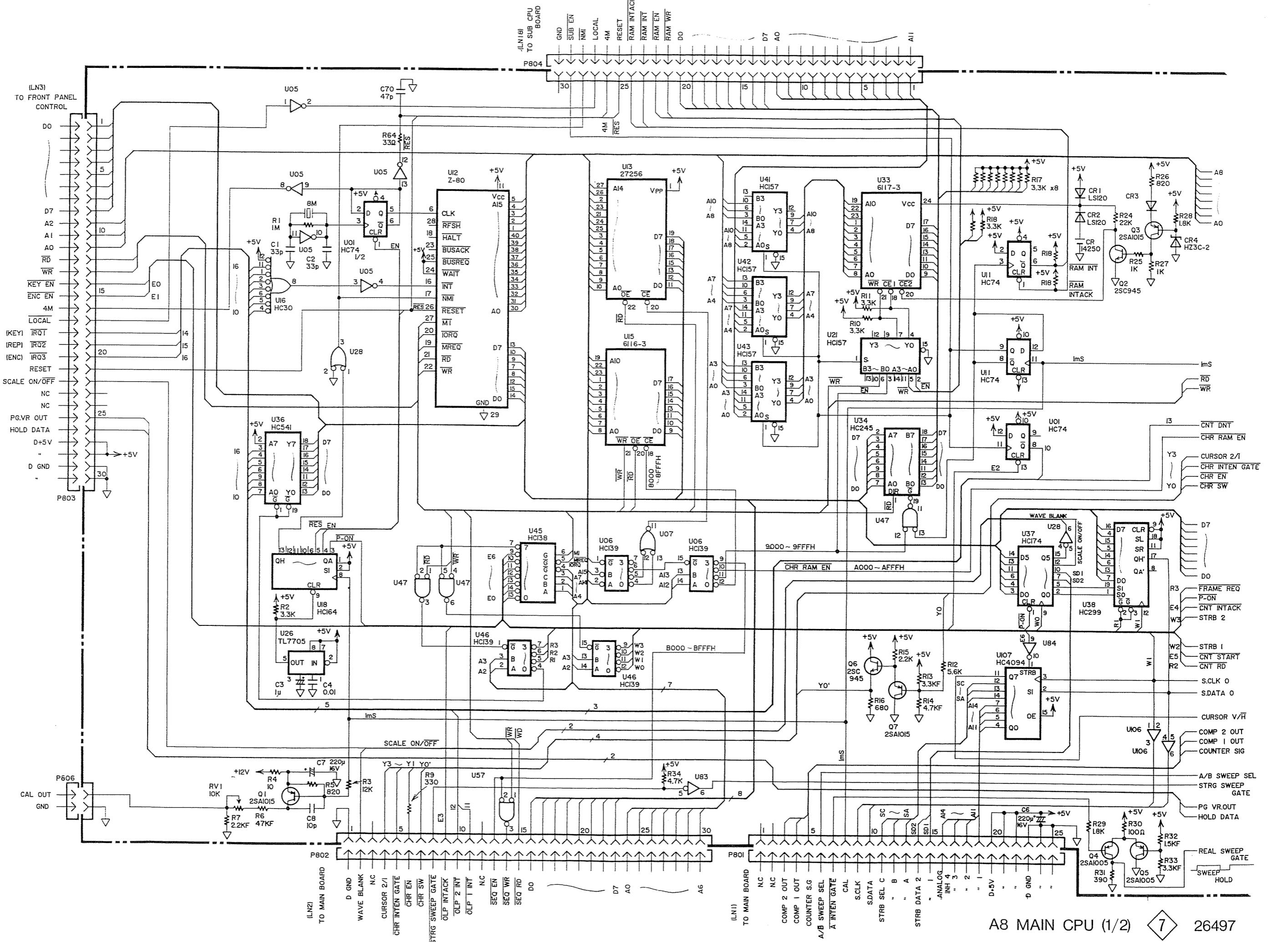


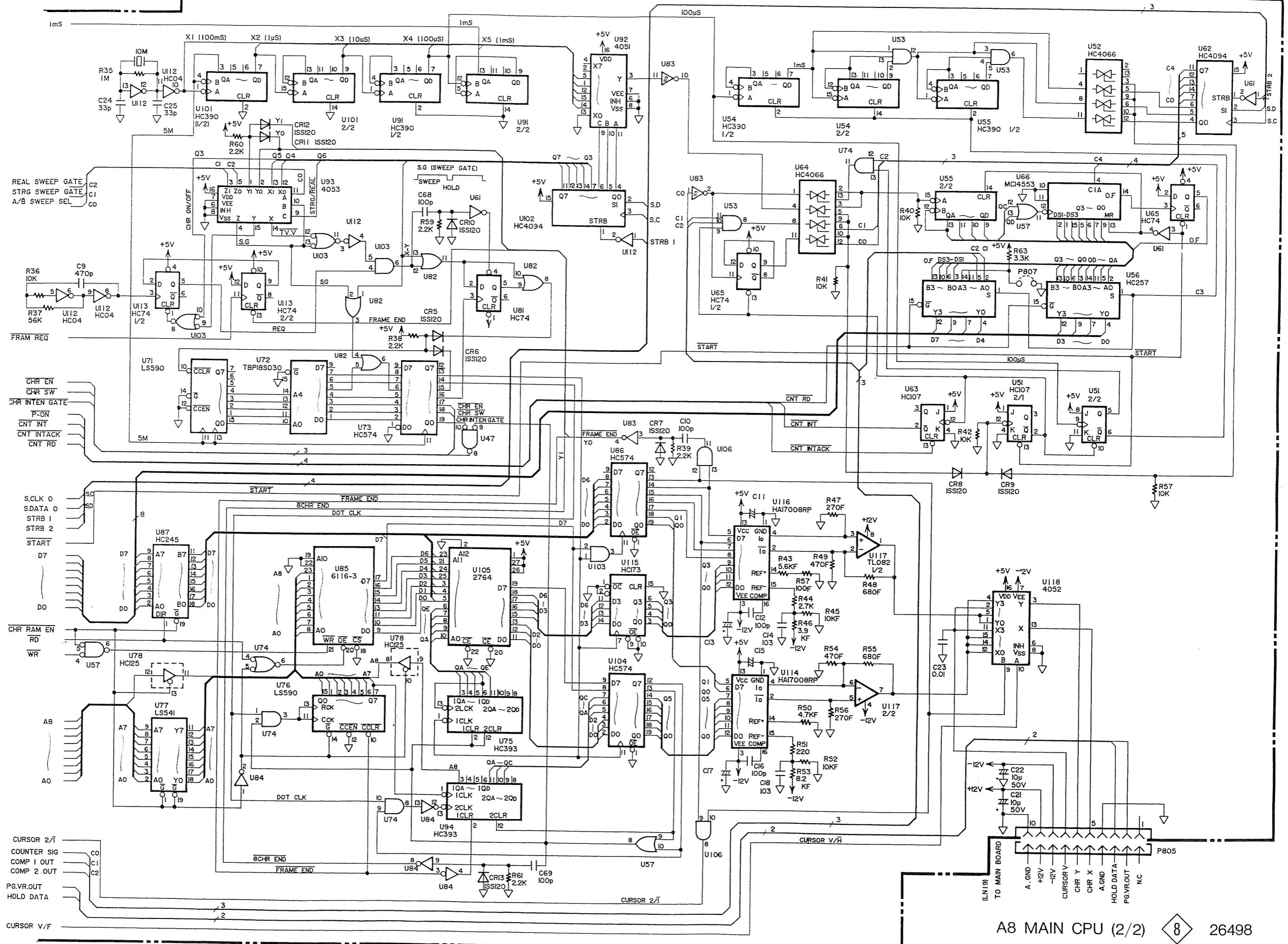
## A5 VERTICAL OUTPUT AMPLIFIER & HORIZONTAL OUTPUT AMPLIFIER

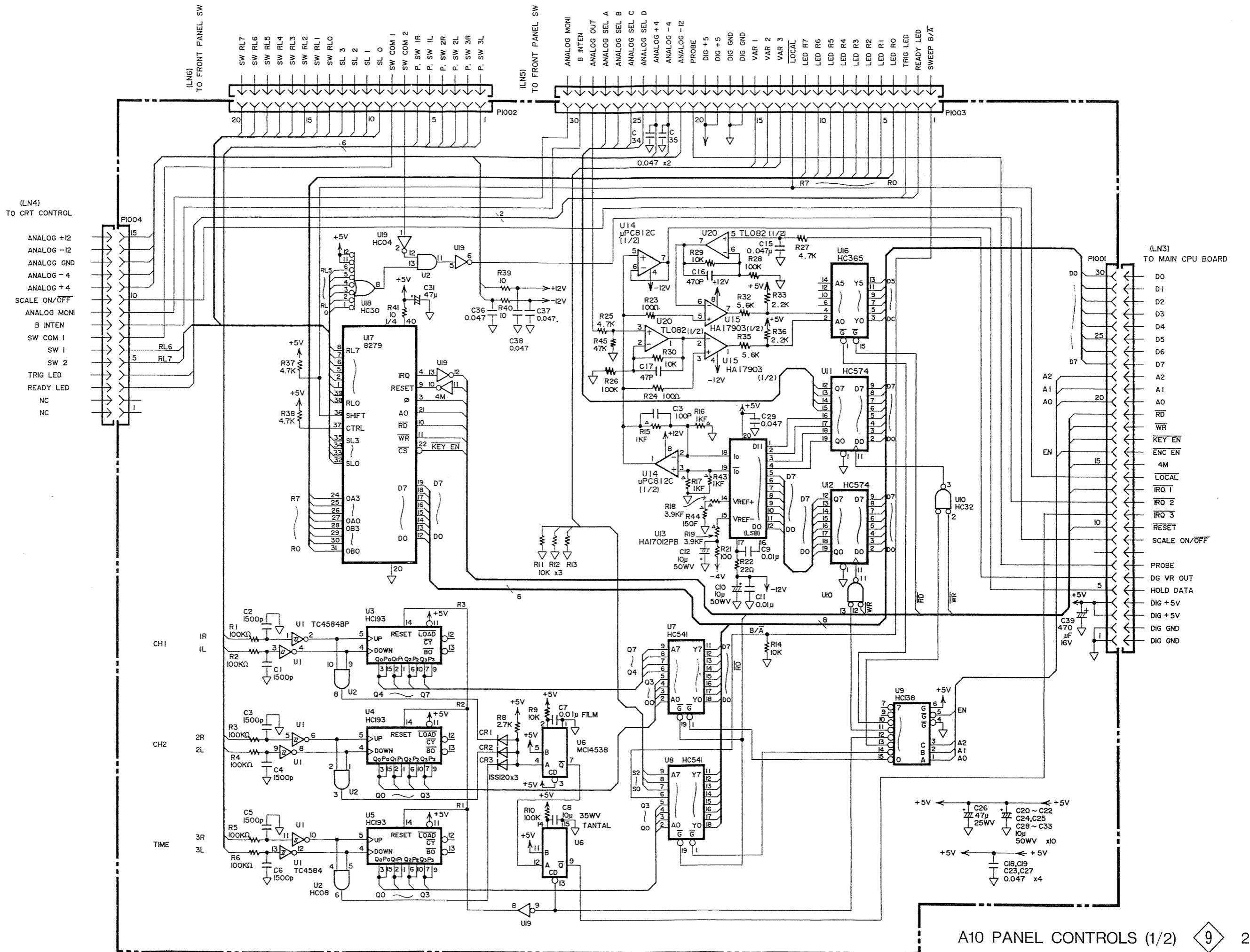


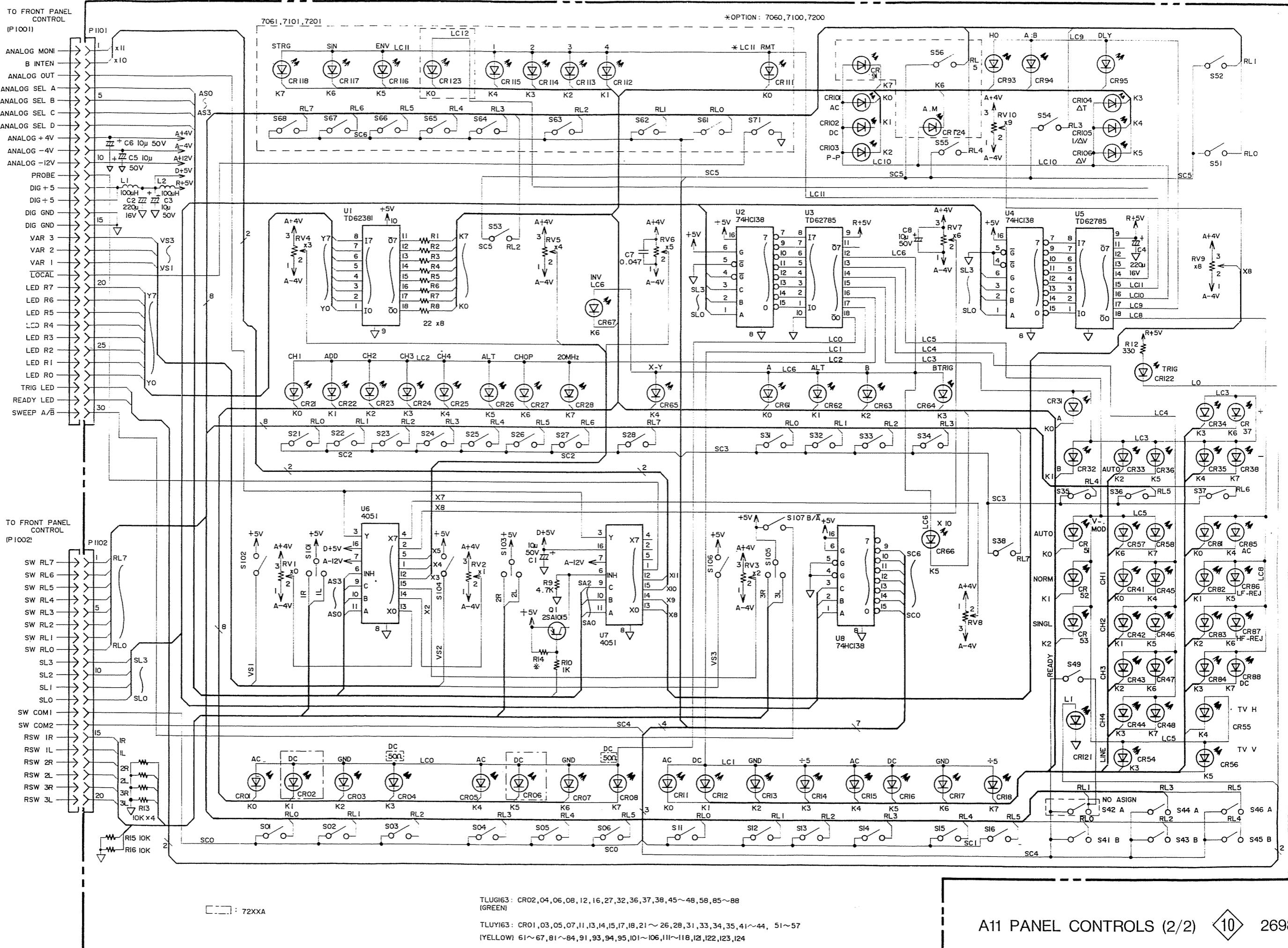
A6 Z AXIS AMPLIFIER &  
A22 HIGH VOLTAGE UNIT

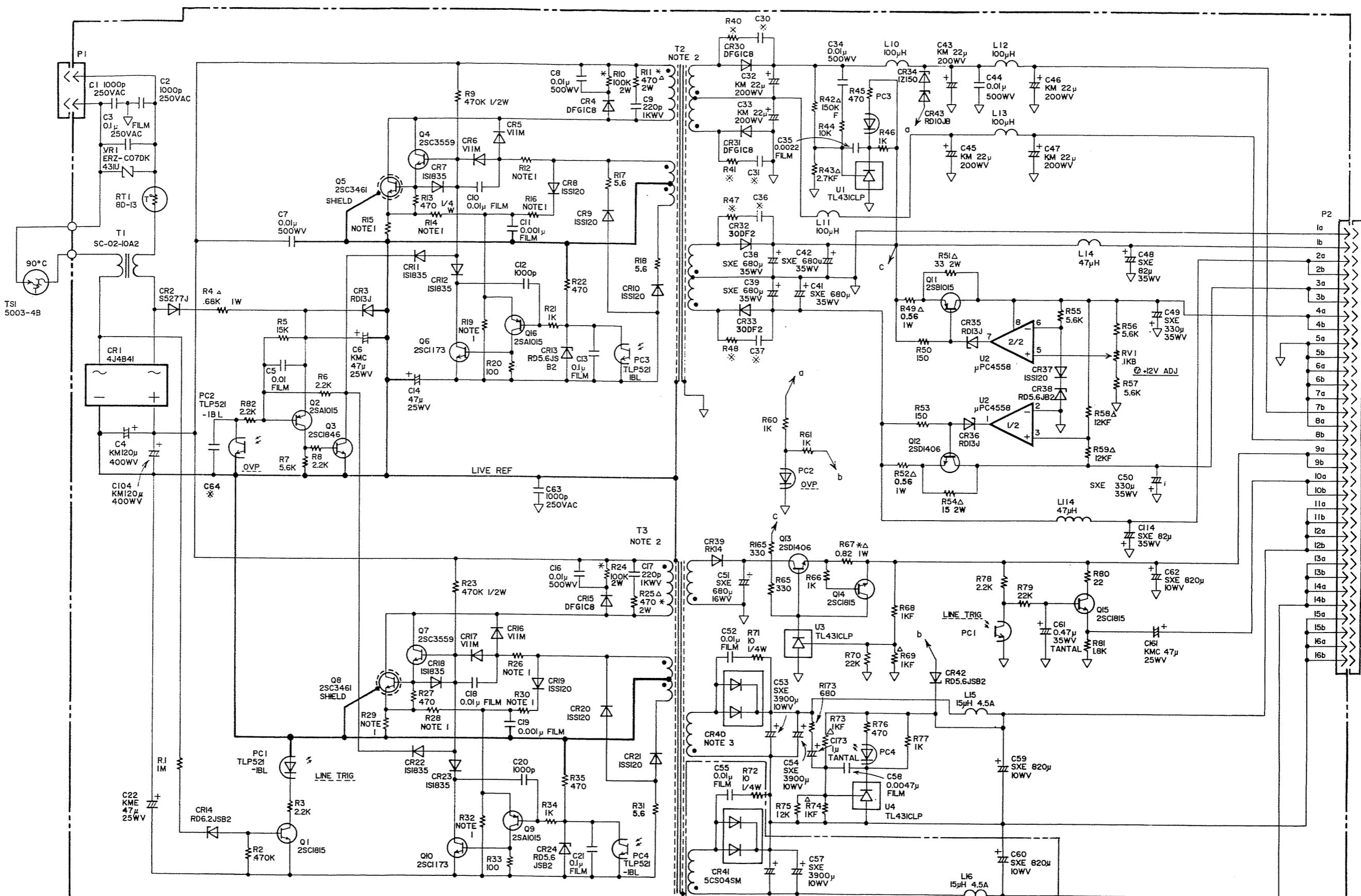












NOTE 1		7060	7100	7200	7061	7101	7201
R12	330 IW	"	"				330 IW
R14	330F/4	"	"				33F I.
R15	ERX0.470	"	"				0.22 I
R16	680F	"	"				680F
R19	3300F	"	"				330F
R26	330 IW	"	"				330 IW
R28	220F	"	"				22F
R29	ERXI.21	"	"				0.47 IW
R30	560F	"	"				560F
R32	390F	"	"				390F

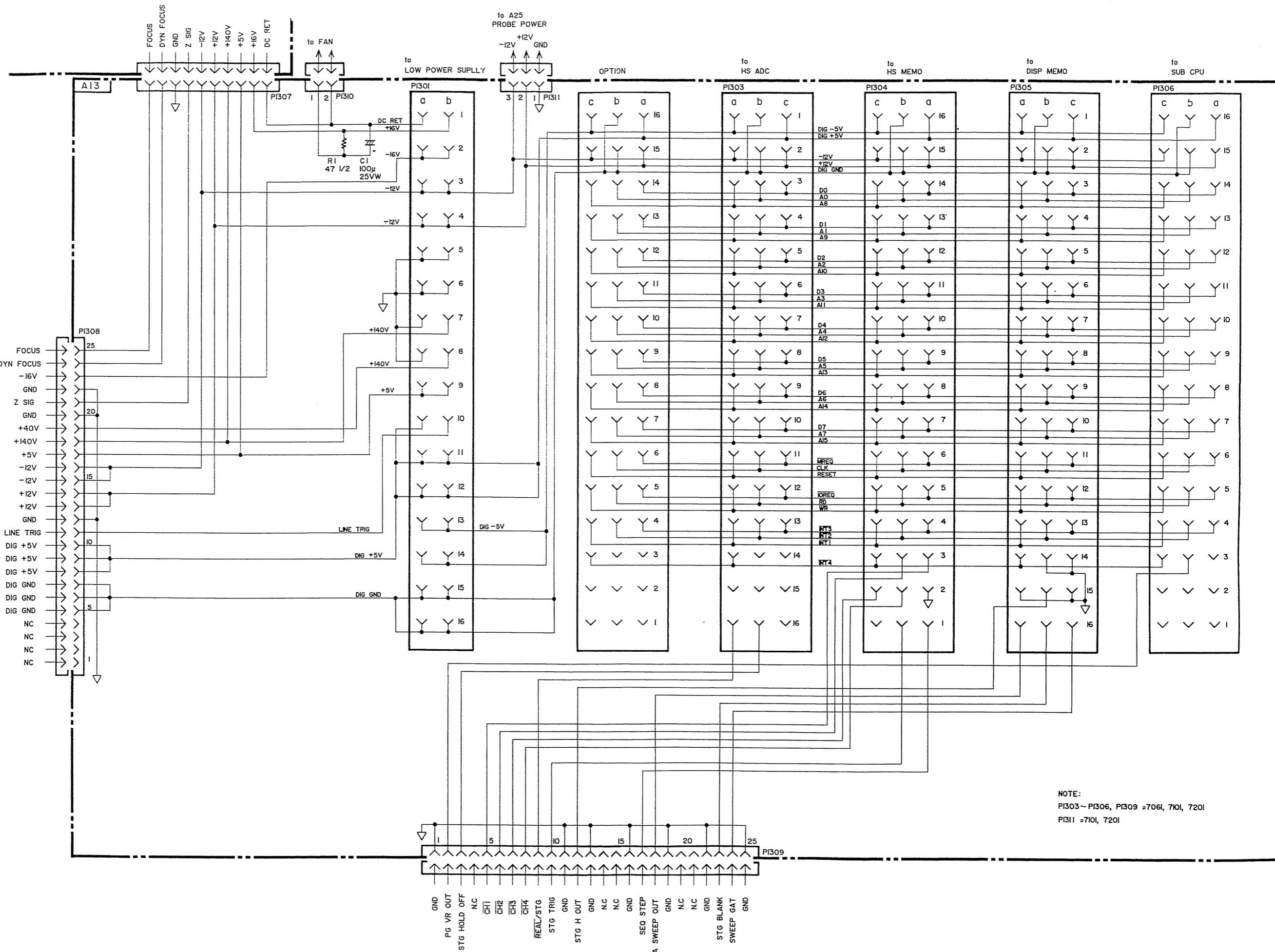
**NOTE 3**

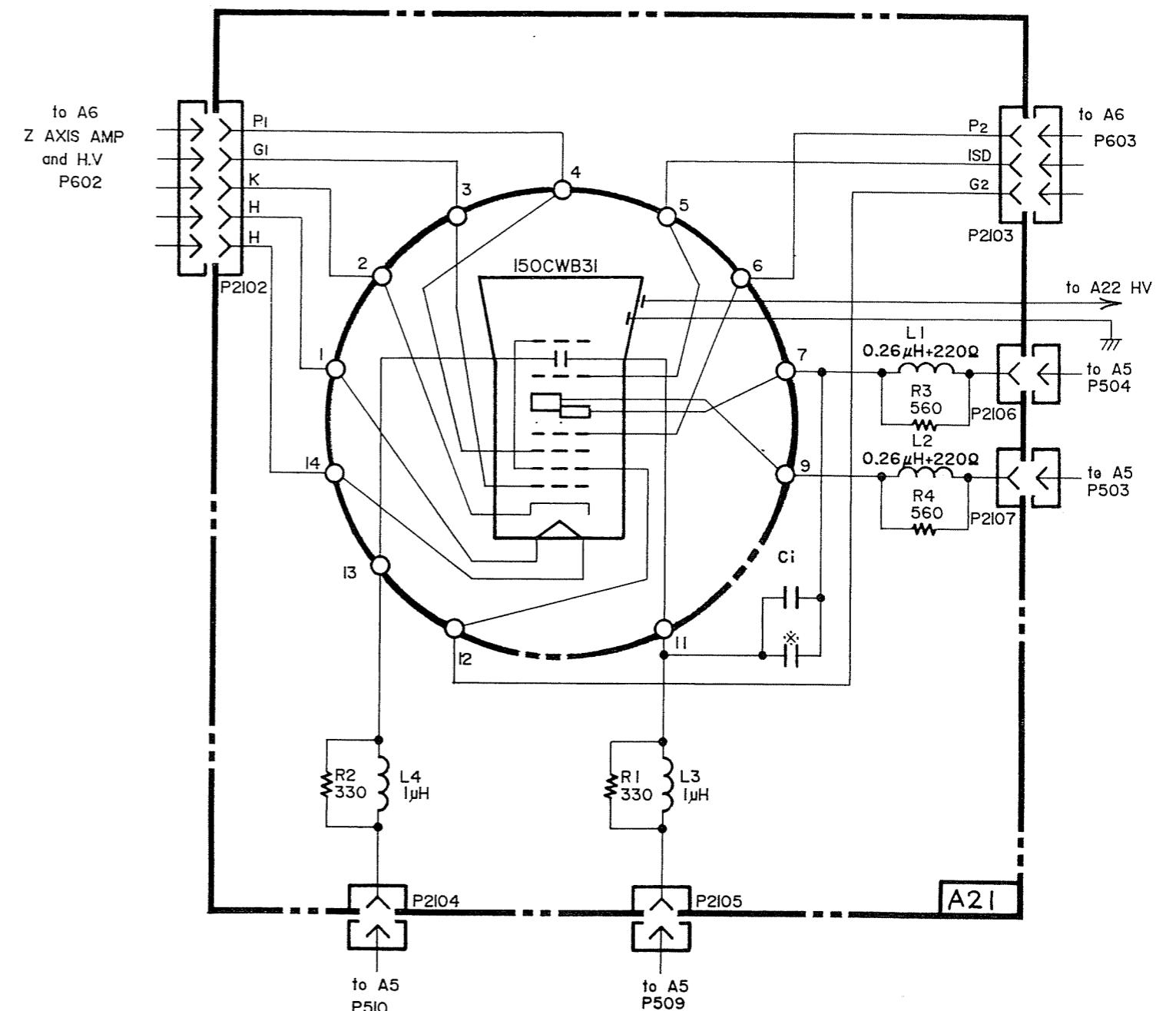
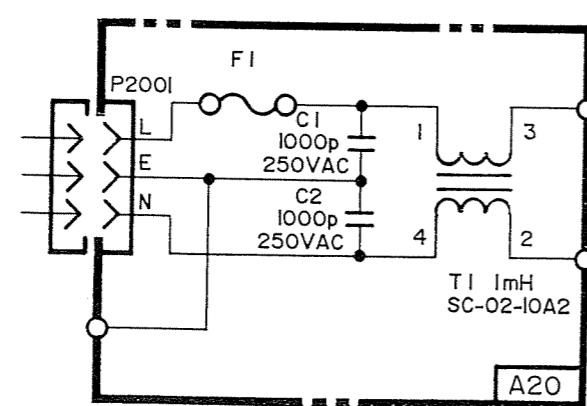
	7XX0	7XX1
CR40	5CS004SM	C8P049

NOTE 2

	7060 7100	7200	70611 7101	7201
T2	T3W YELLOW BLACK •	T2B YELLOW RED •	T4BL II WHITE	T5R BLUE
T3	TIY YELLOW	TIY YELLOW	T6G GREEN	T6G GREEN

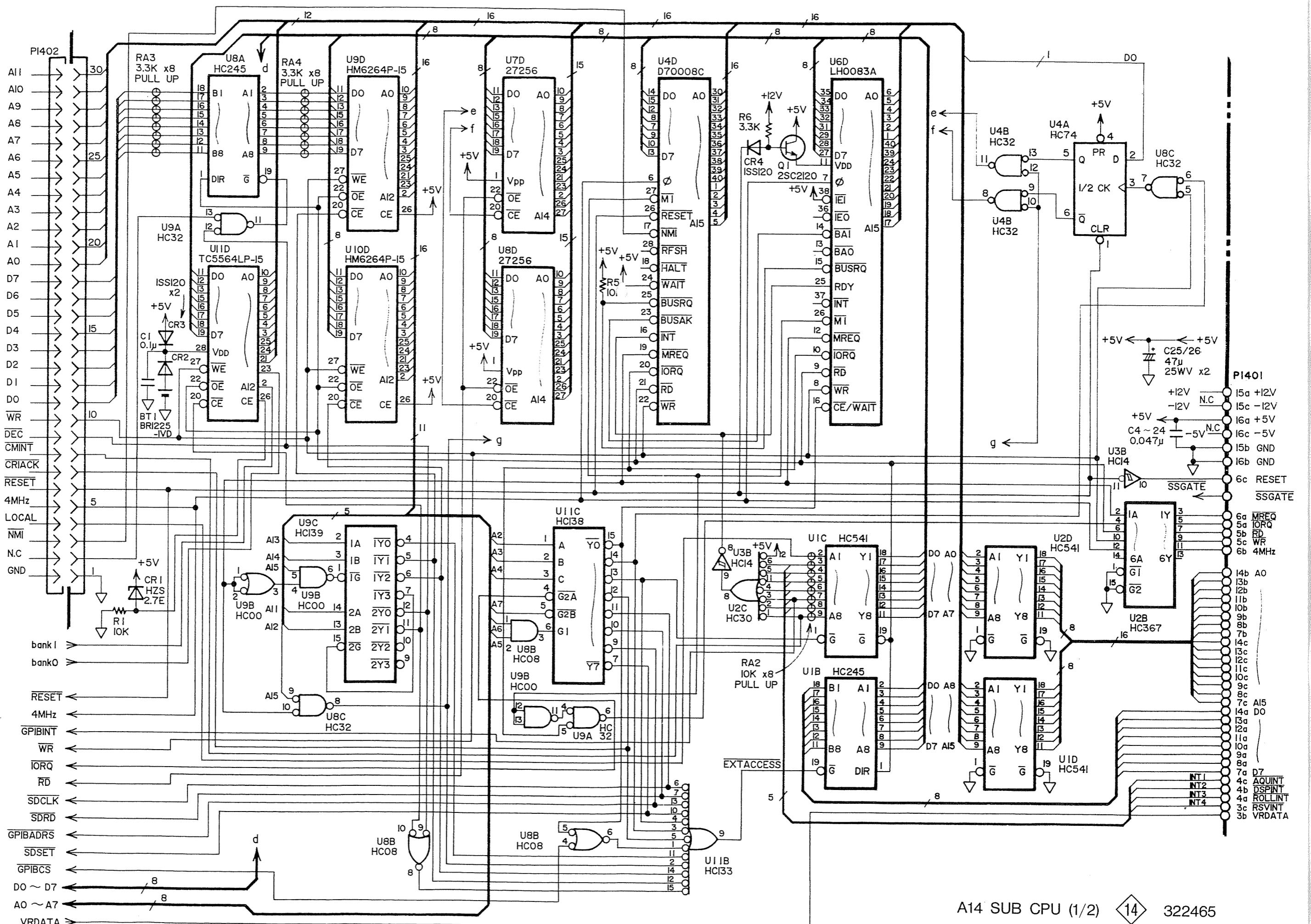
CODE NO	
7060	97-11-0090
7200	97-11-0092
7061	97-11-0280
7201	97-11-0282

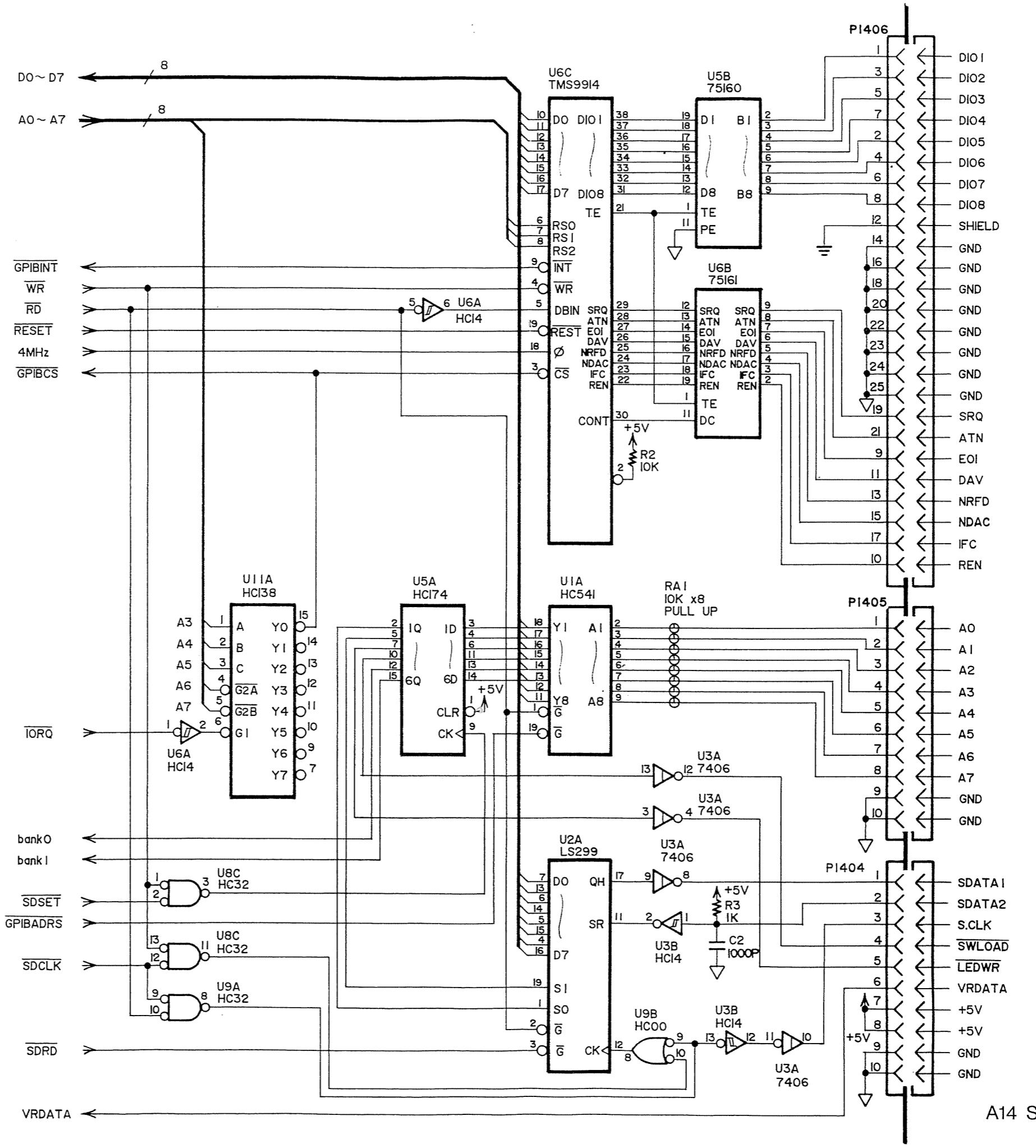


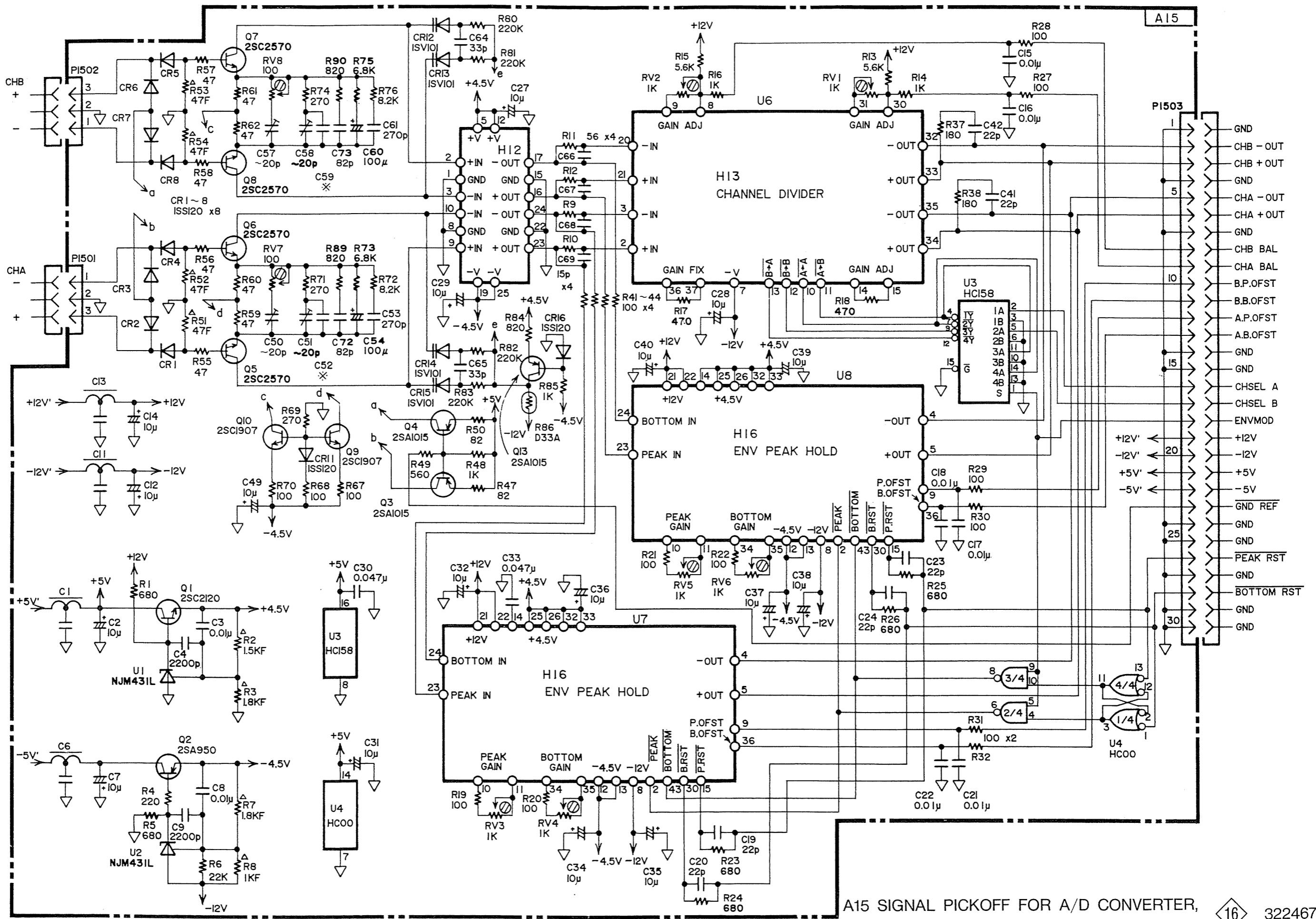


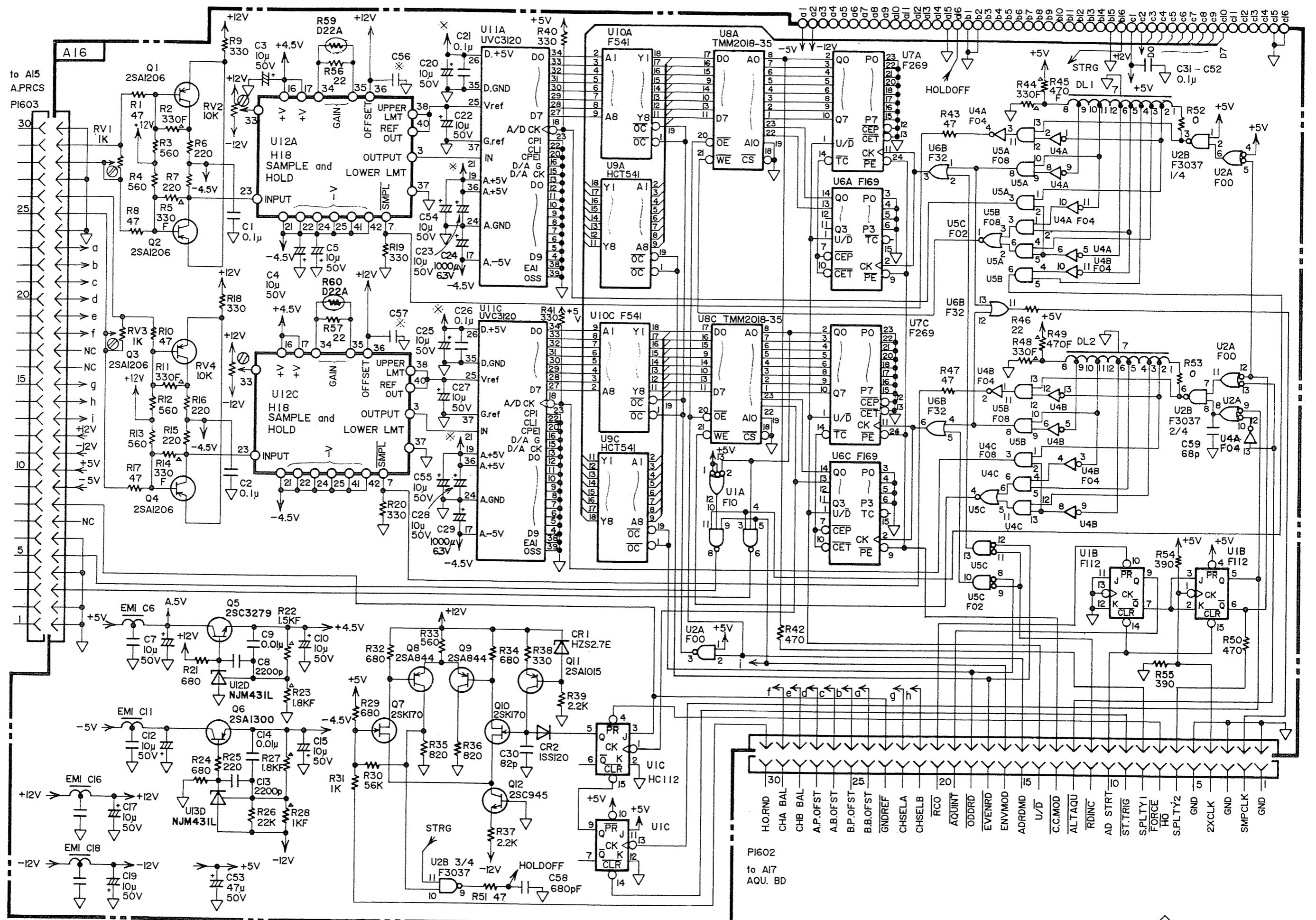
A20 LINE FILTER  
A21 CRT SOCKET

422725  
13  
422713

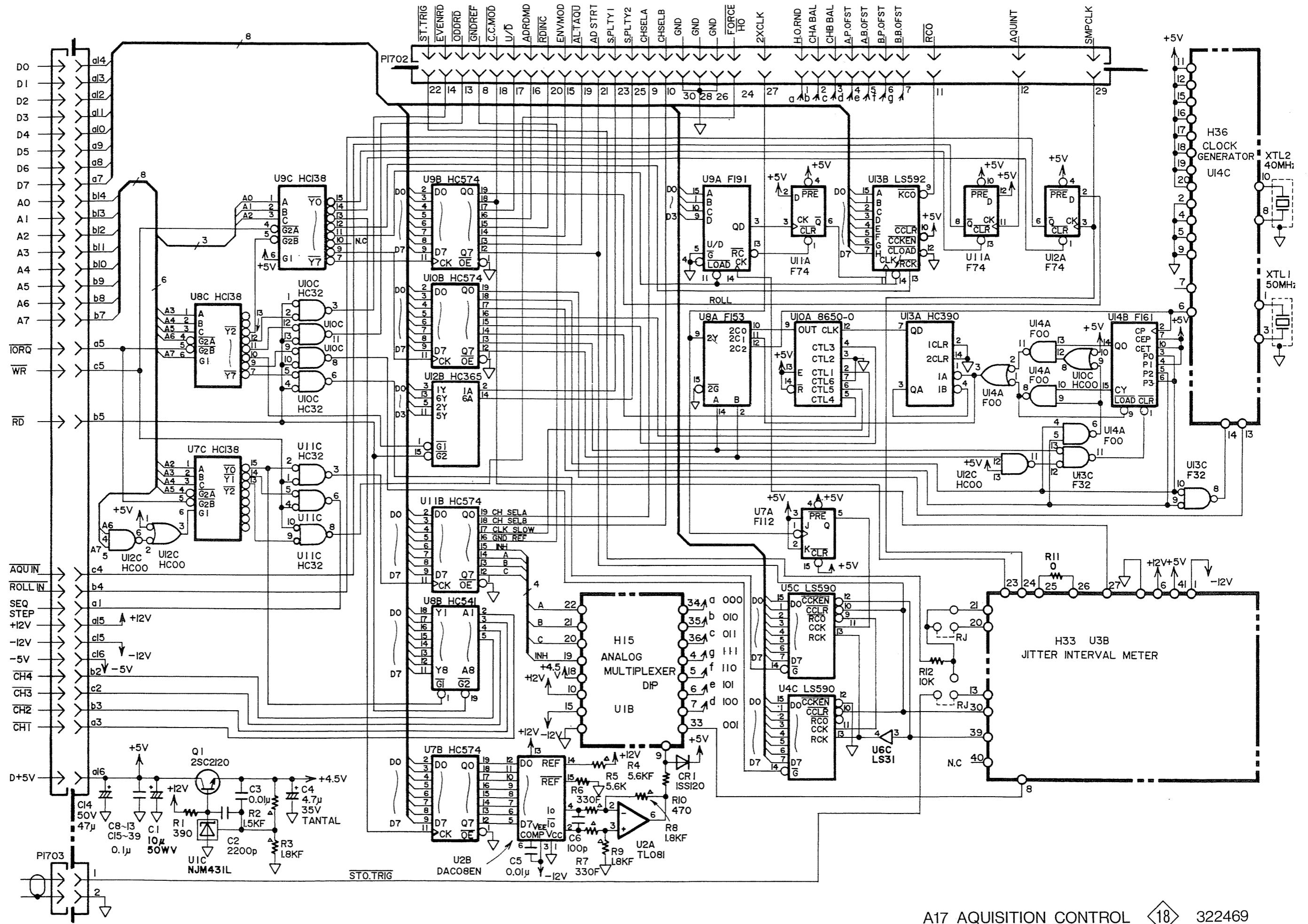


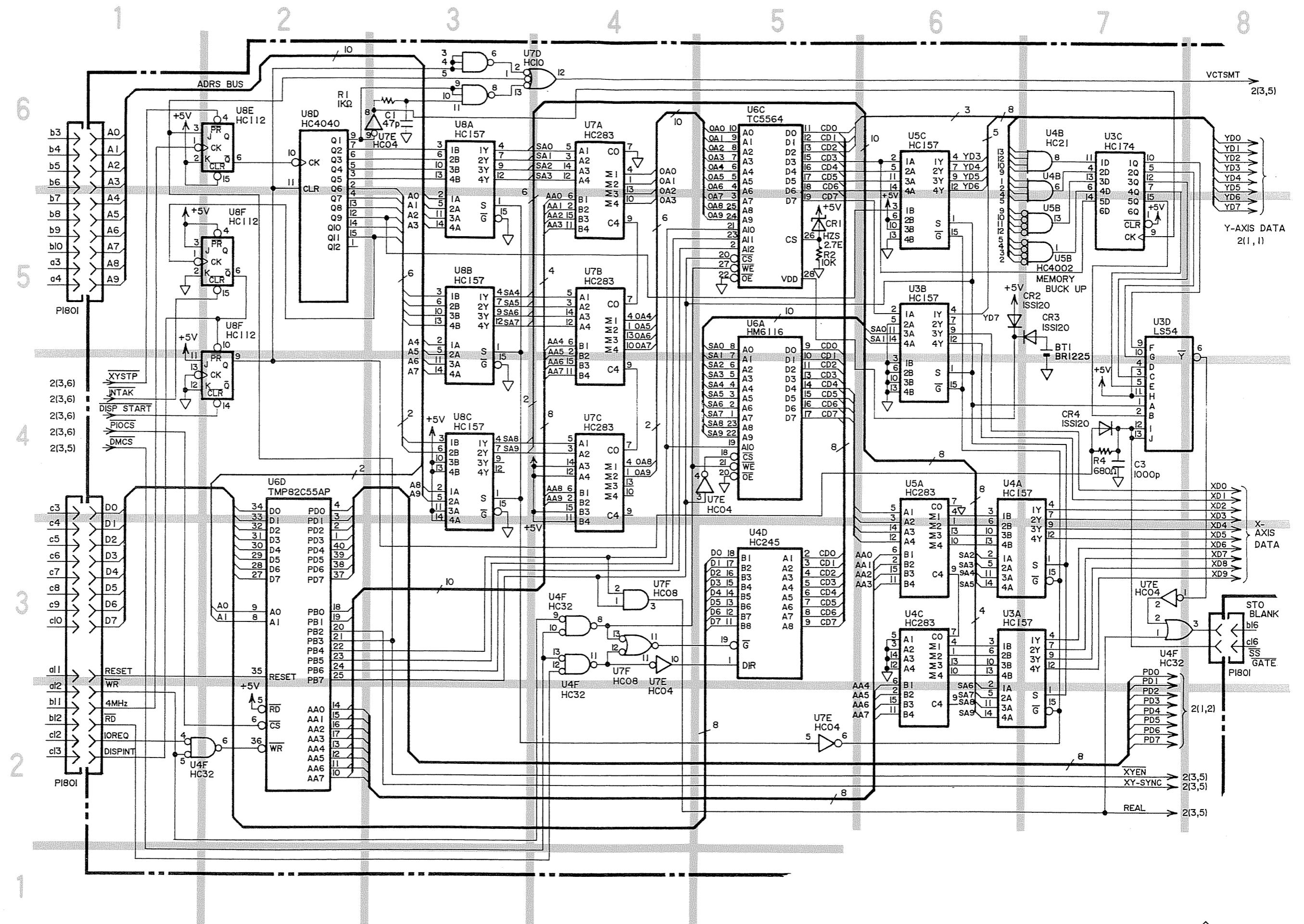


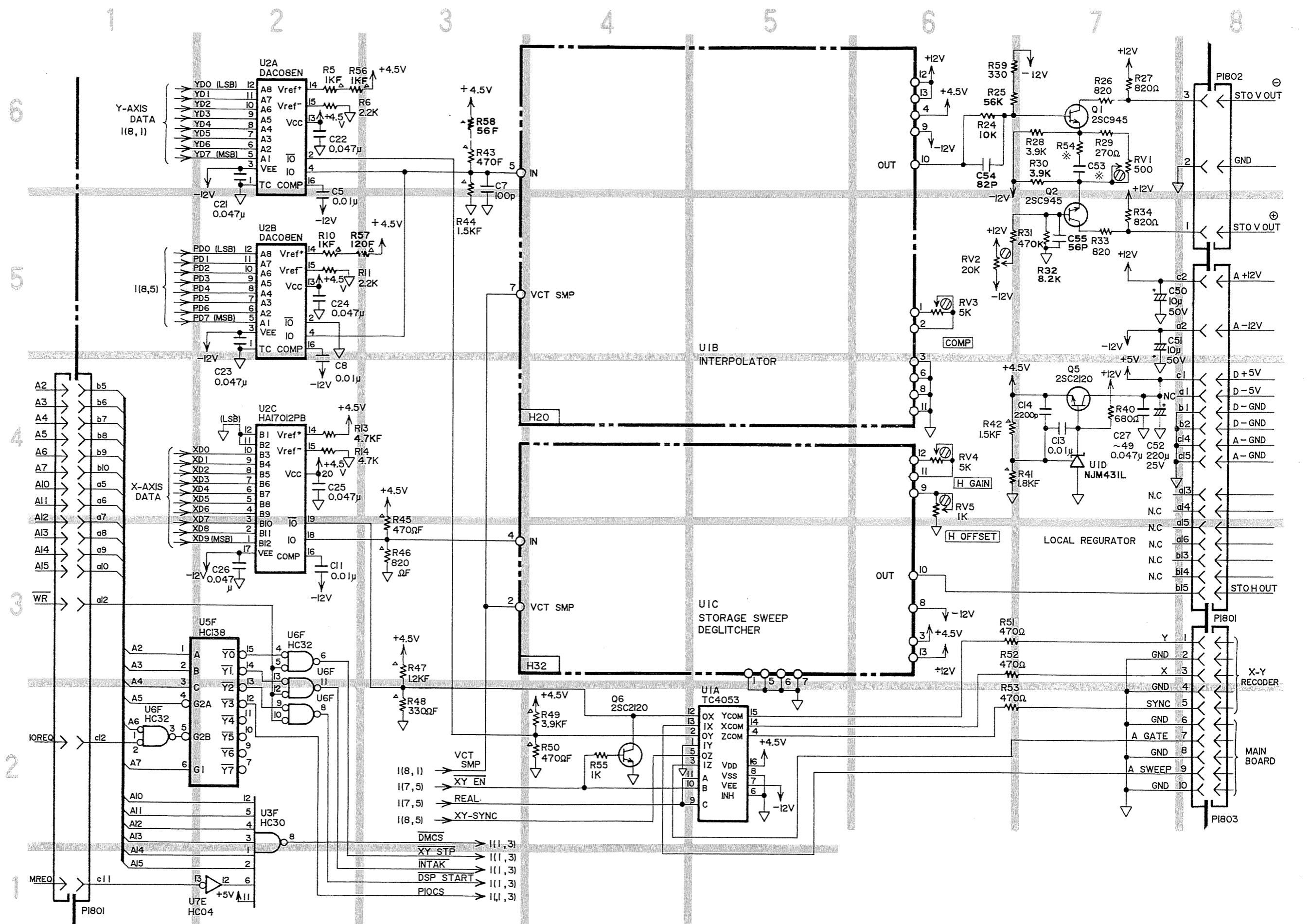


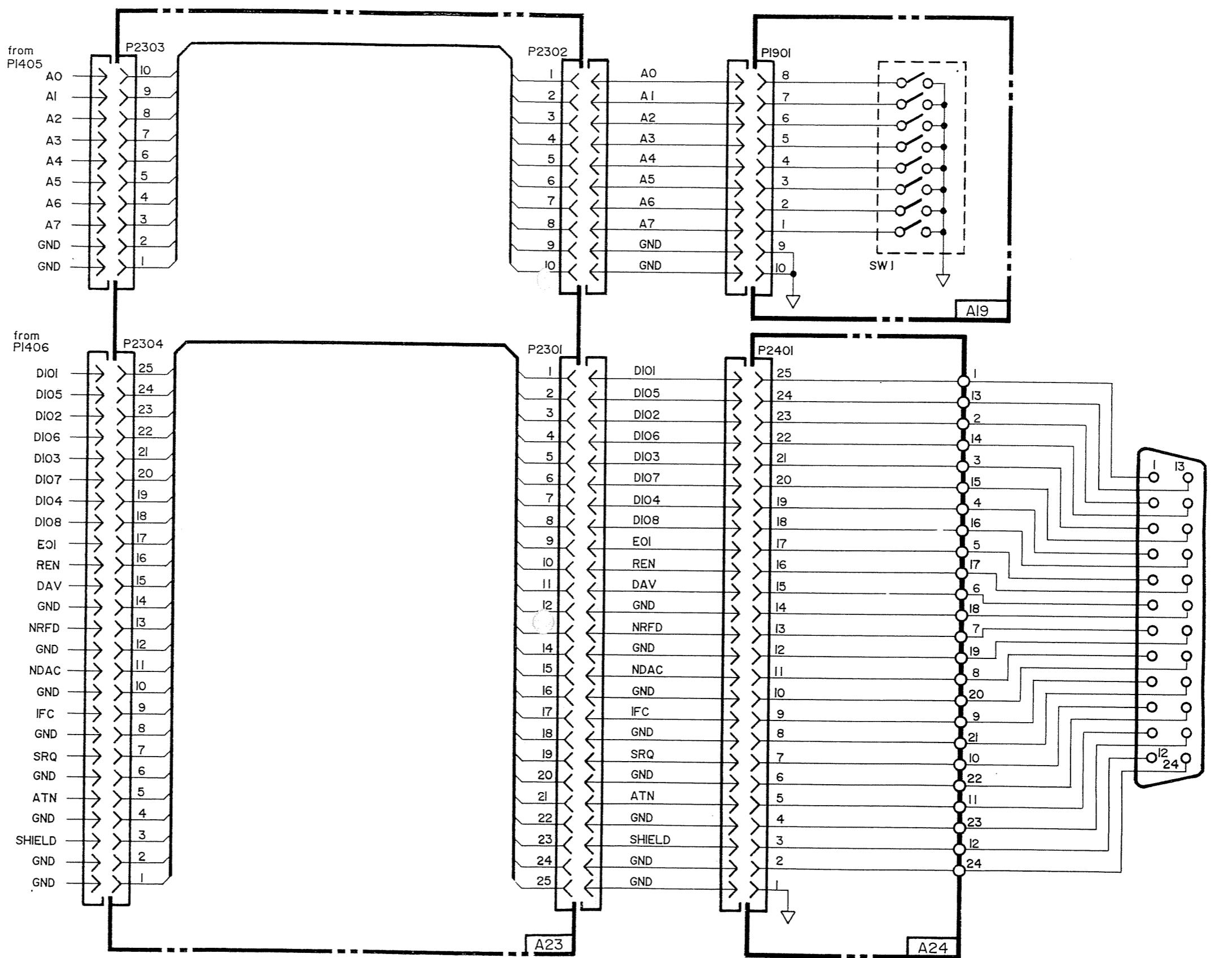


A16 A/D CONVERTER & MEMORY









### 6. 3 PARTS LOCATION

This section describes location of the parts on the boards used in the oscilloscope. Table 6-4 shows the list of each boards.

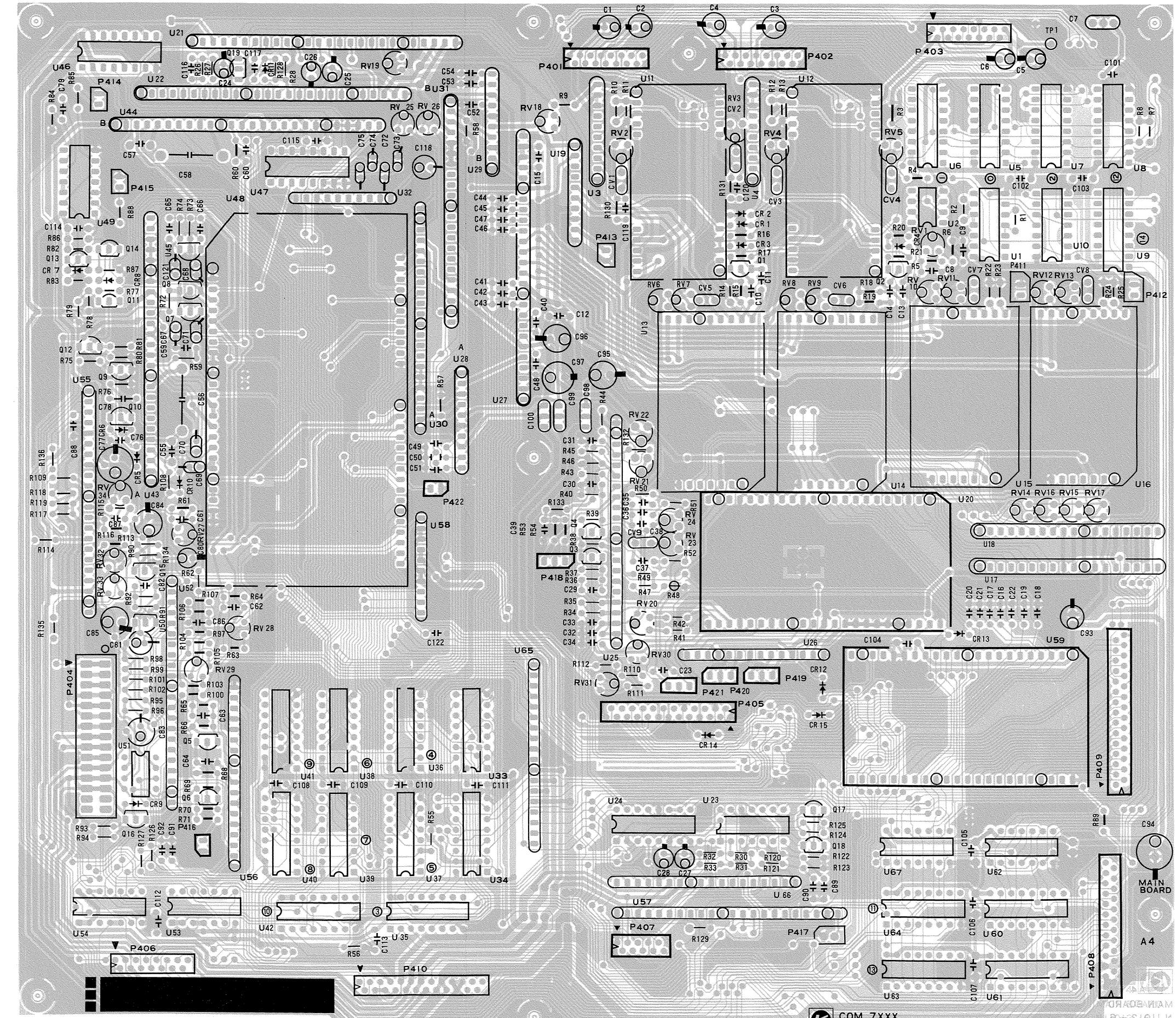
CODE NO.	NAME	MODEL	Page
90-50-4320	A4 MAIN BOARD	COM7101A/7100A	6-45
90-50-4240	A5 VERT & HORIZONTAL OUTPUT AMPLIFIER	COM7101A/7100A	6-47
90-50-4250	A6 Z-AXIS AMPLIFIER	COM7101A/7100A	6-47
90-50-4260	A7 CRT CONTROL	COM7101A/7100A	6-47
90-50-4260	A8 MAIN CPU	COM7101A/7100A	6-49
90-50-4280	A10 PANEL CONTROLS (1/2)	COM7101A/7100A	6-49
90-50-4291	A11 PANEL CONTROLS (2/2)	COM7101A/7100A	6-49
90-50-4350	A12 POWER SUPPLY UNIT	COM7101A/7100A	6-51
90-50-4340	A13 BUS INTERCONNECTIONS	COM7101A/7100A	6-51
90-50-4161	A14 SUB CPU	COM7101A ONLY	6-53
90-50-4170	A15 SIGNAL PICKOFF FOR A/D CONVERTER, CHANNEL DIVIDER & PEAK HOLD	COM7101A ONLY	6-51
90-50-4192	A16 A/D CONVERTER & MEMORY	COM7101A ONLY	6-53
90-50-4201	A17 AQUISITION CONTROL	COM7101A ONLY	6-55
90-50-4210	A18 DISPLAY CONTROL	COM7101A ONLY	6-55

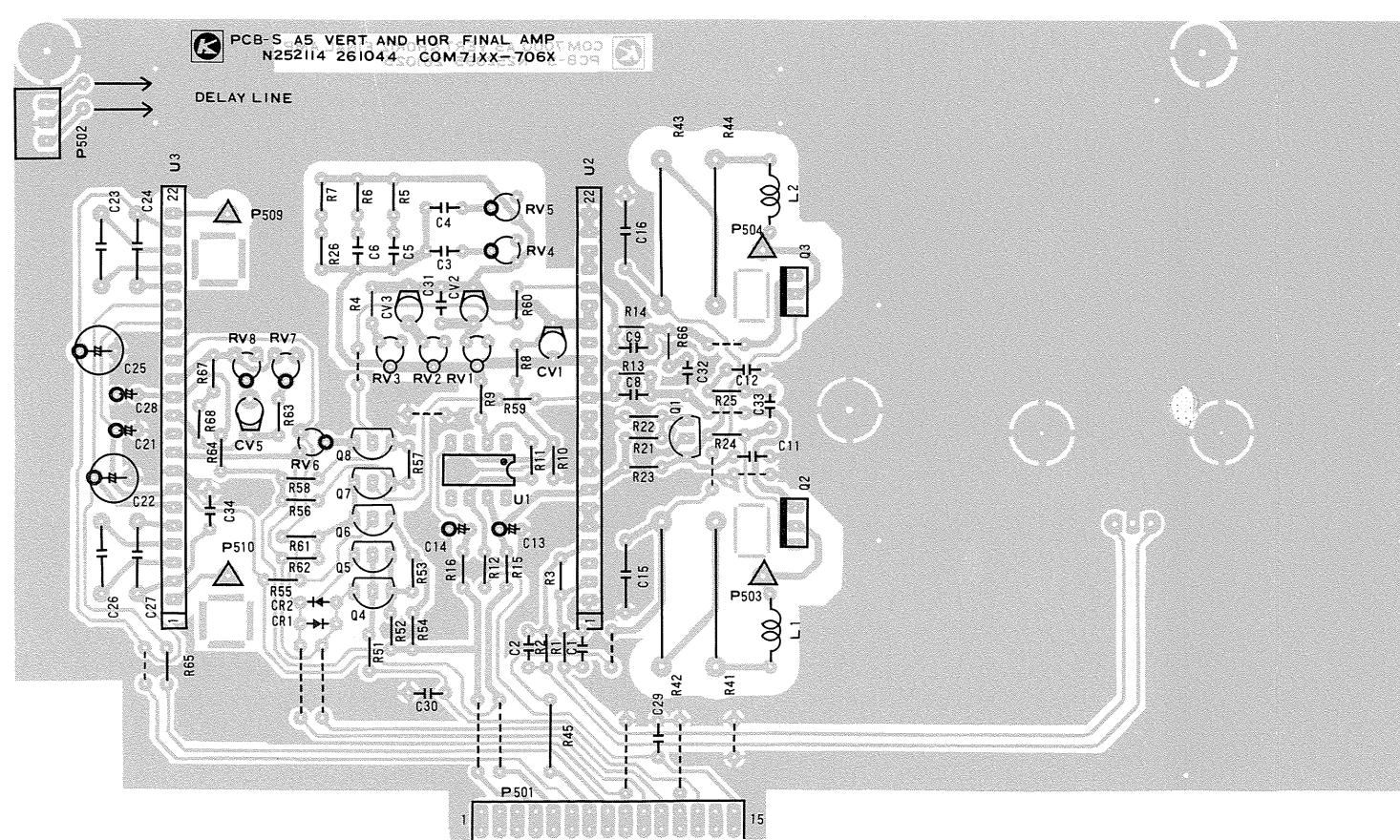
Note : "CODE NO." in this list does not show assemble board.

Table 6-4 List of each boards

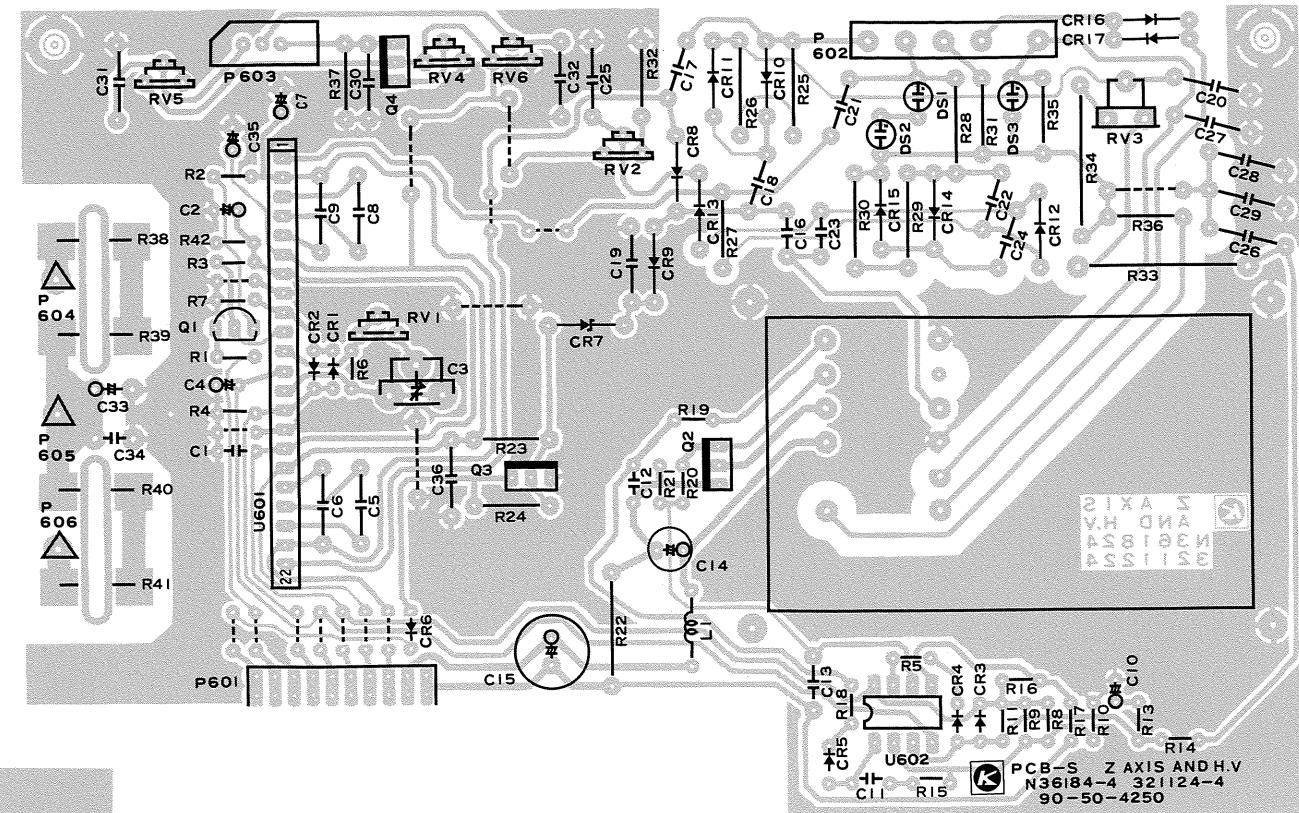
A4 MAIN BOARD  
(Parts side view)

(Parts side view)

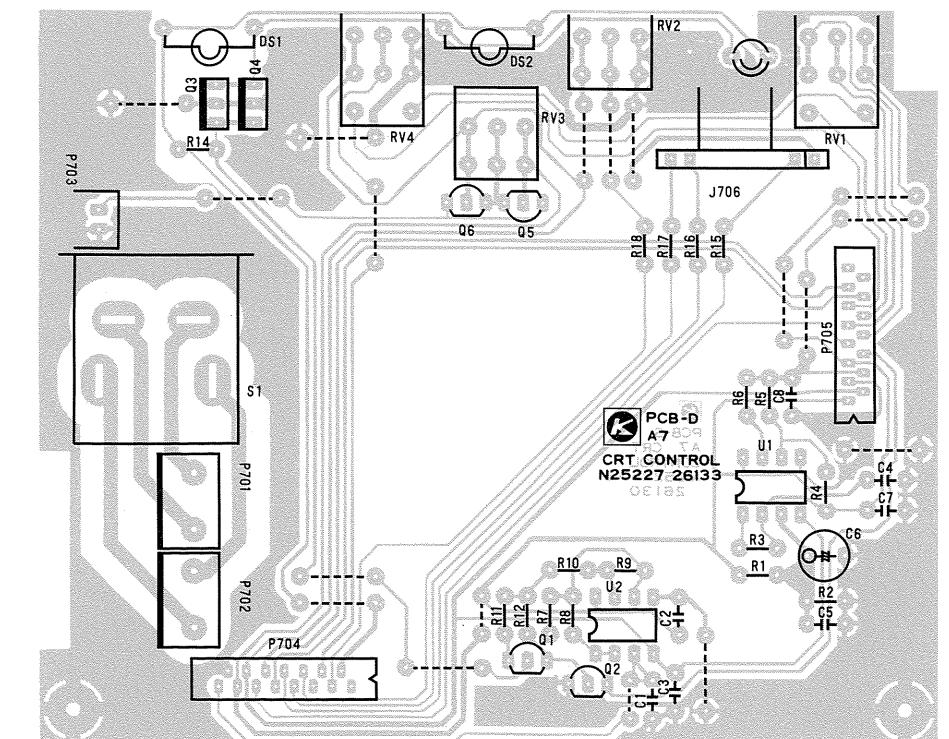




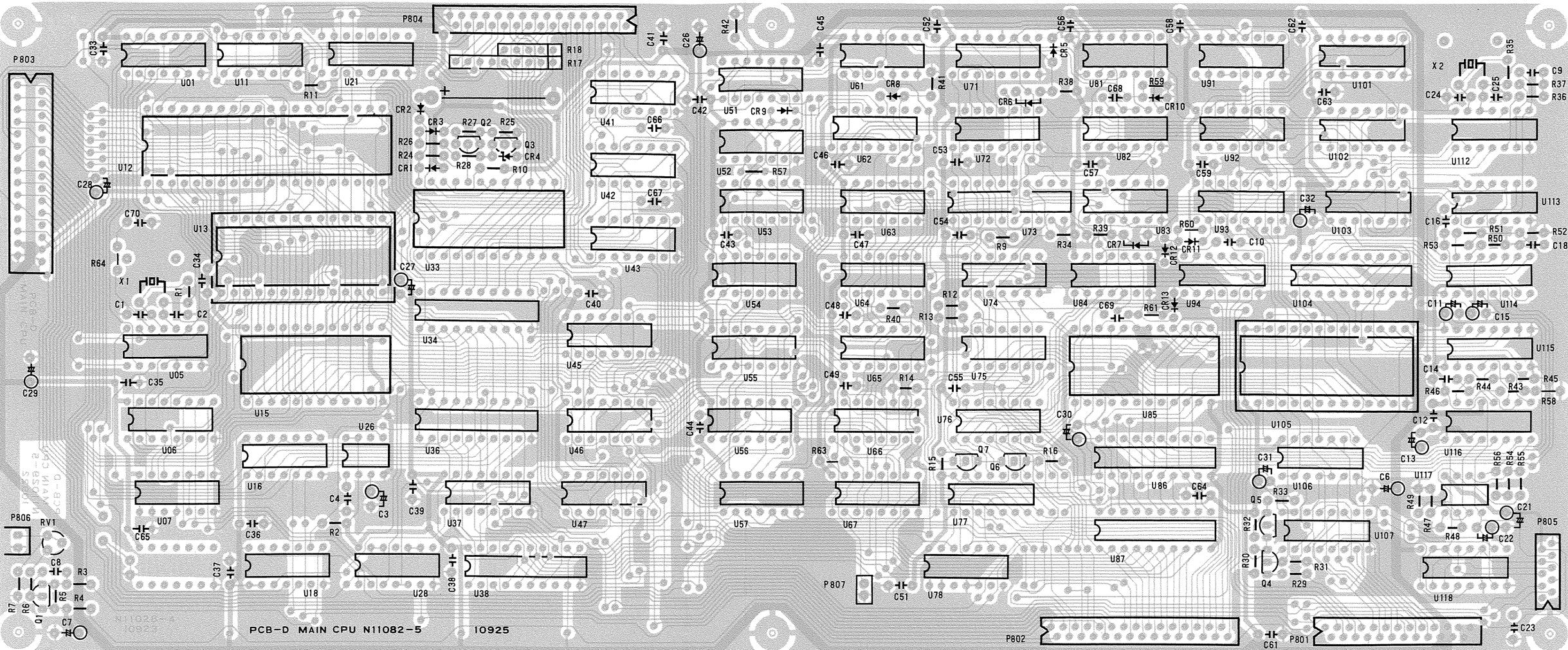
A5 VERT & HORIZONTAL AMPLIFIER (Parts side view)



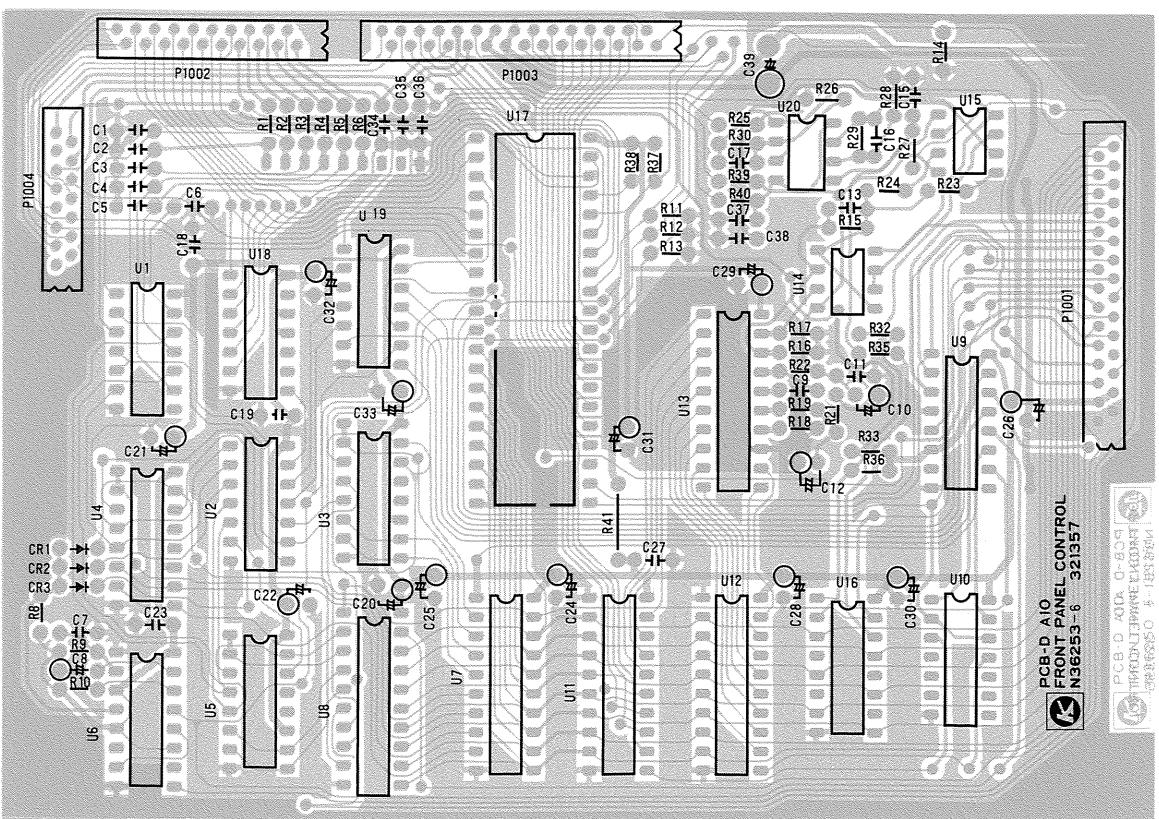
A6 Z-AXIS AMP (Parts side view)



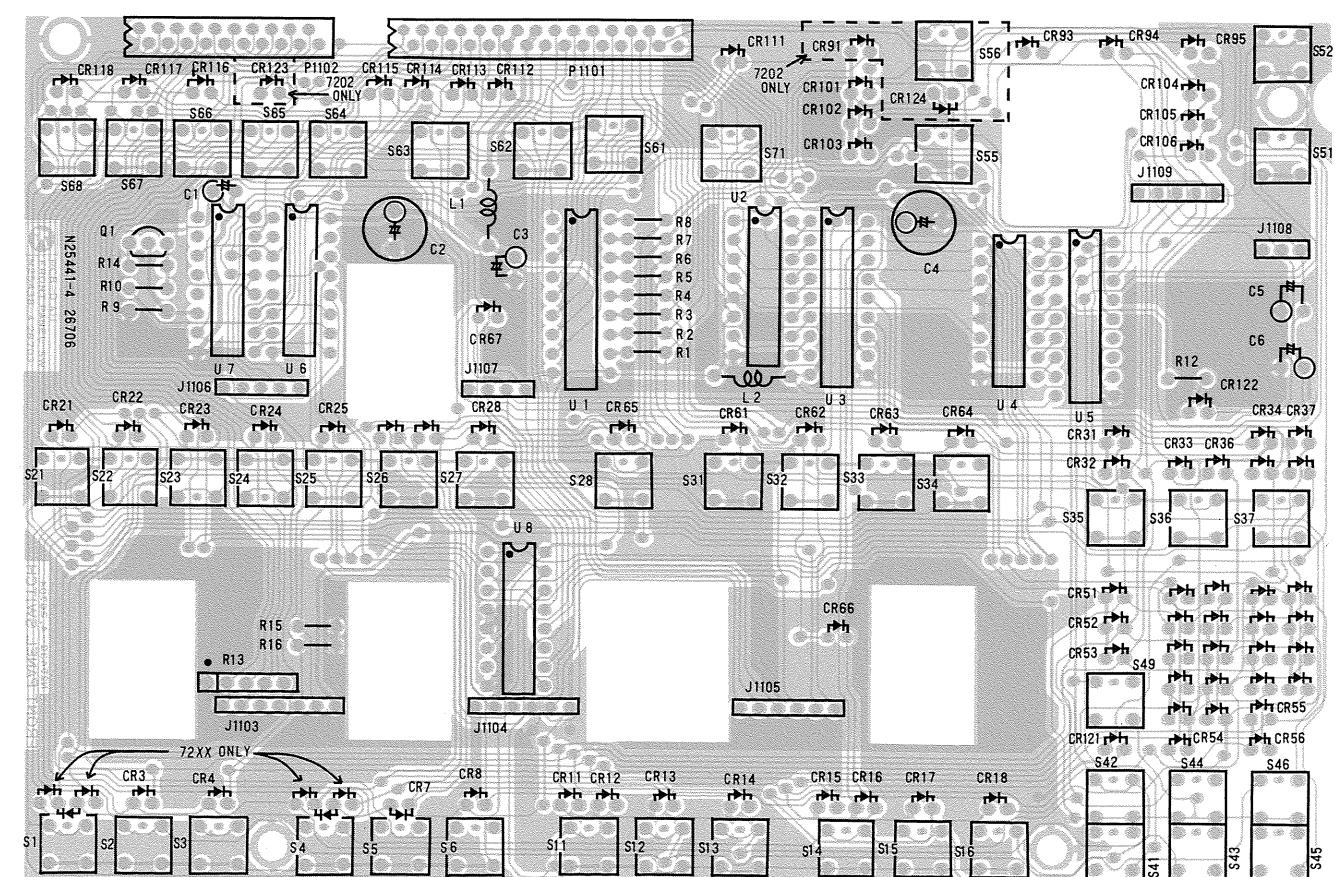
A7 CRT CONTROL (Parts side view)



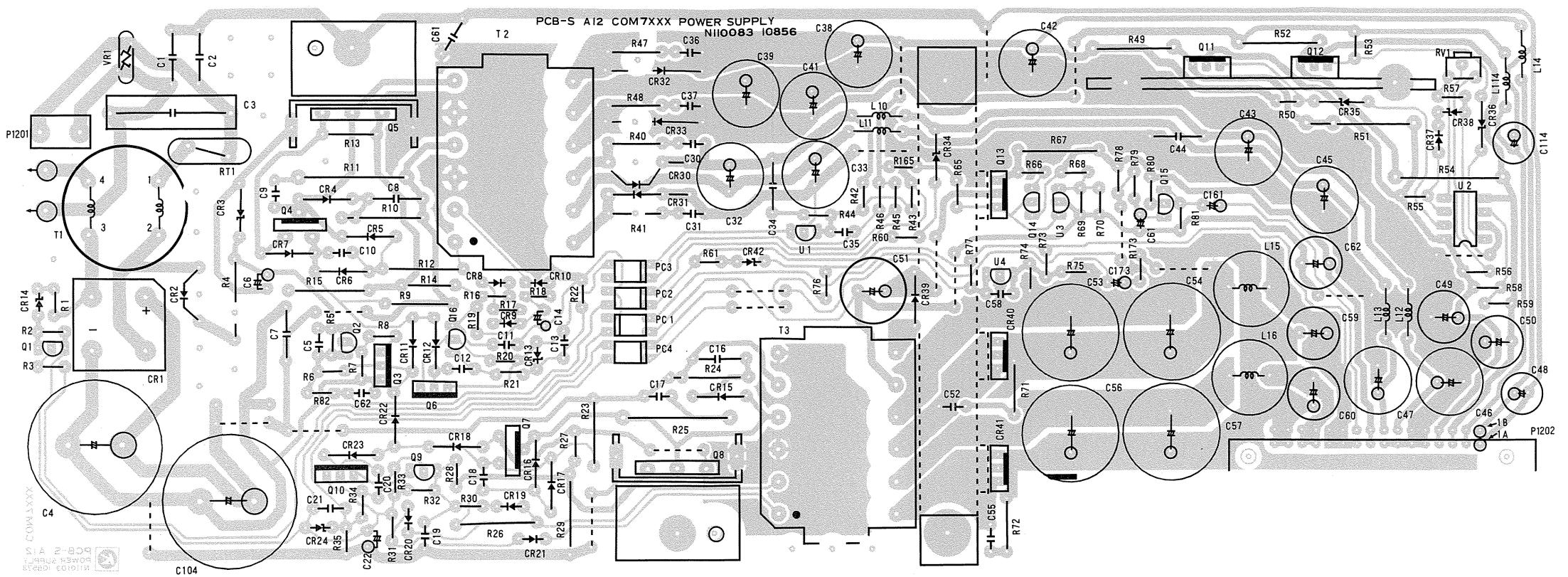
## A8 MAIN CPU (Parts side view)



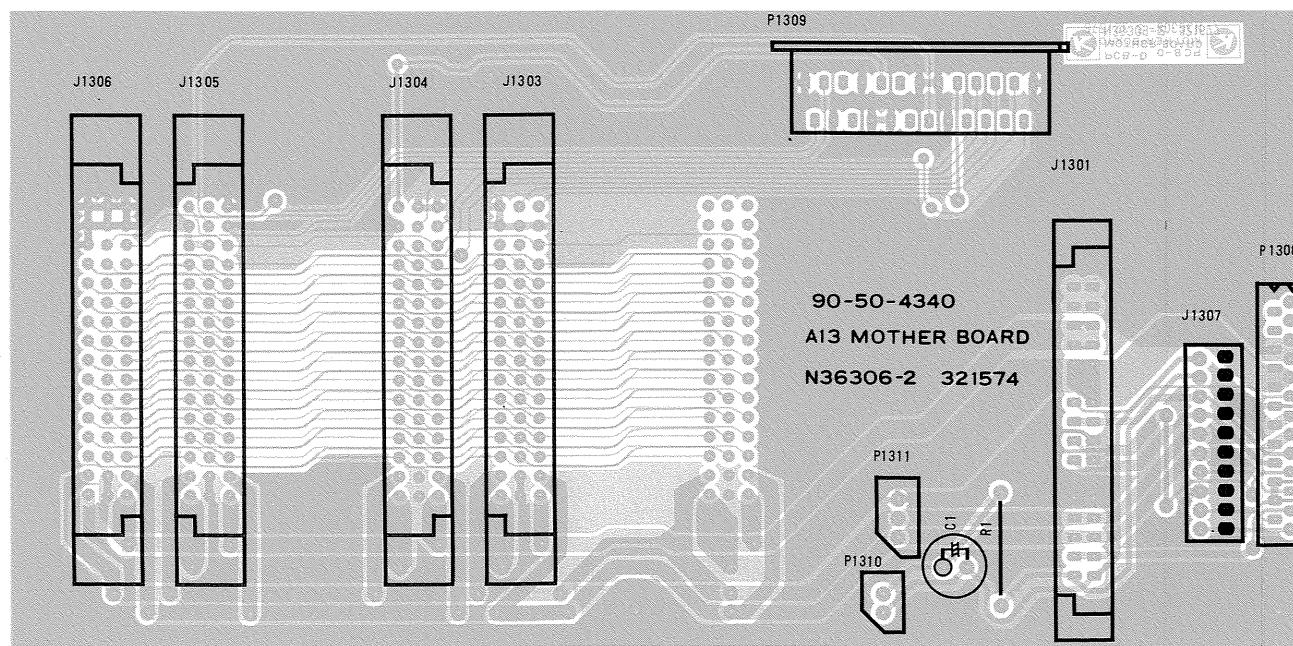
## A10 PANEL CONTROLS (1/2) (Parts side view)



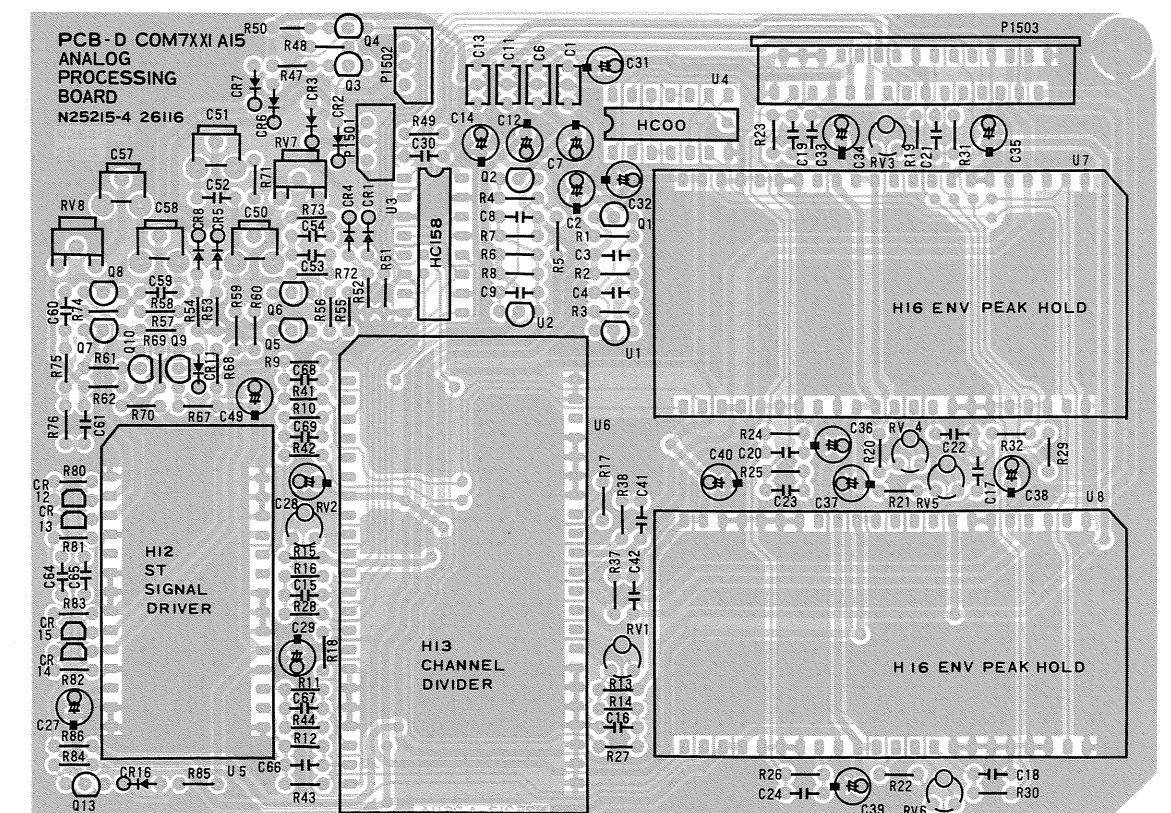
#### A11 PANEL CONTROLS (2/2)



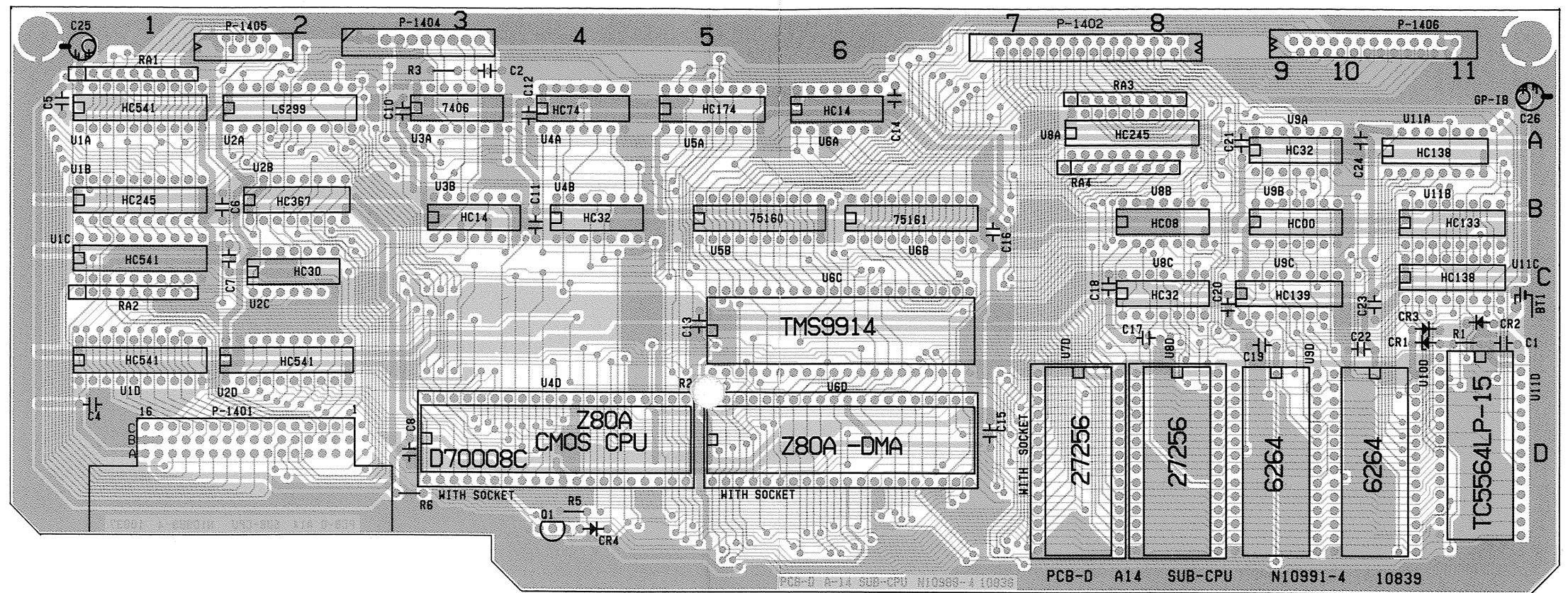
## A12 POWER SUPPLY UNIT (Parts side view)



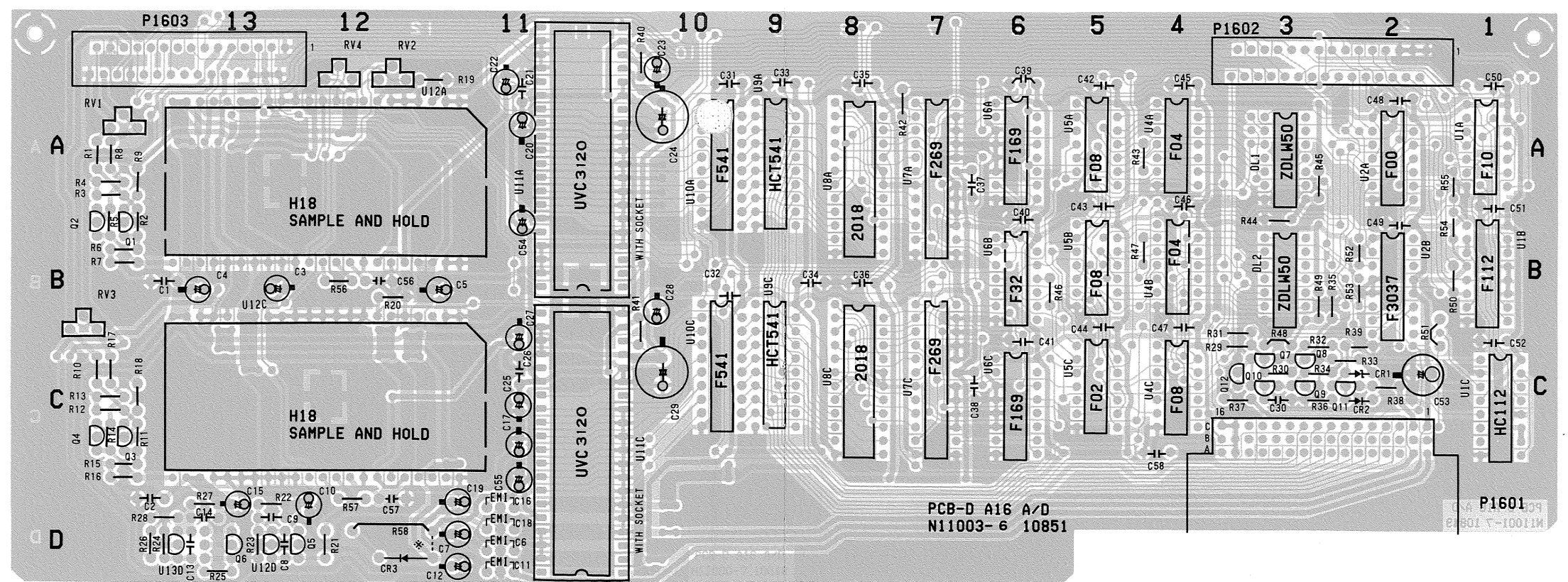
## A13 BUS INTERCONNECTIONS (Parts side view)



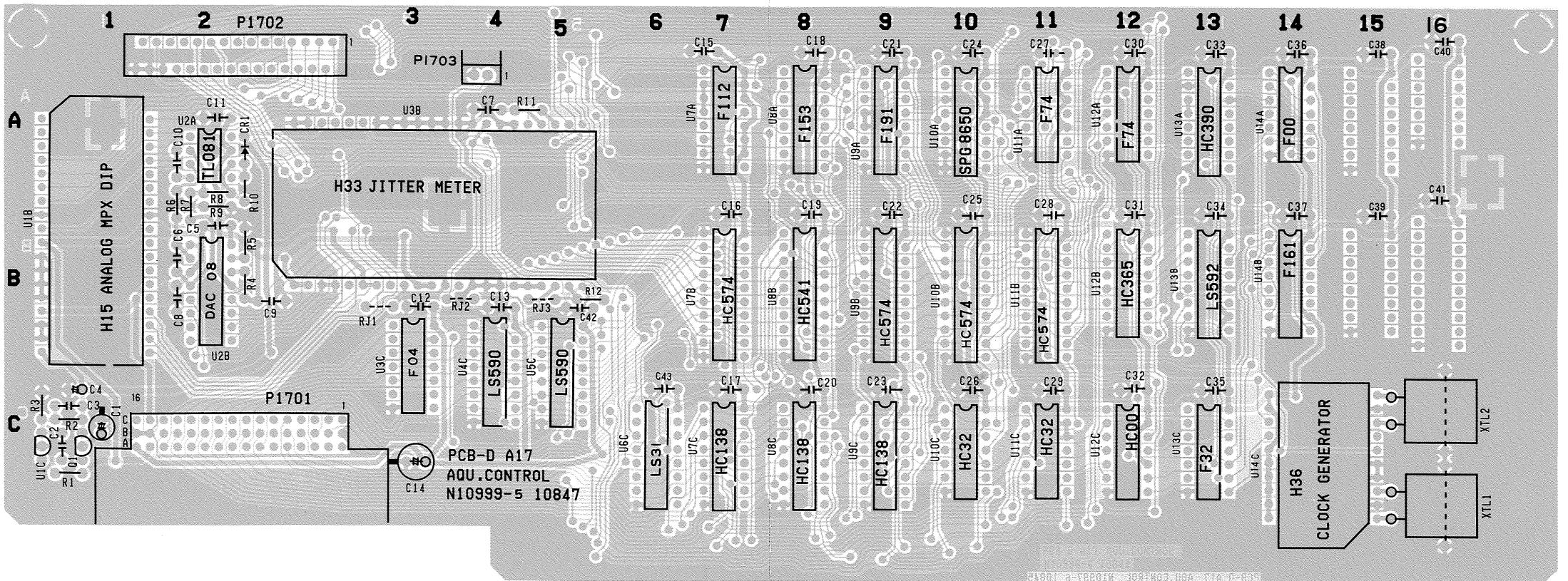
## A15 SIGNAL PICKOFF FOR A/D CONVERTER, CHANNEL DIVIDER & PEAK HOLD (Parts side view)



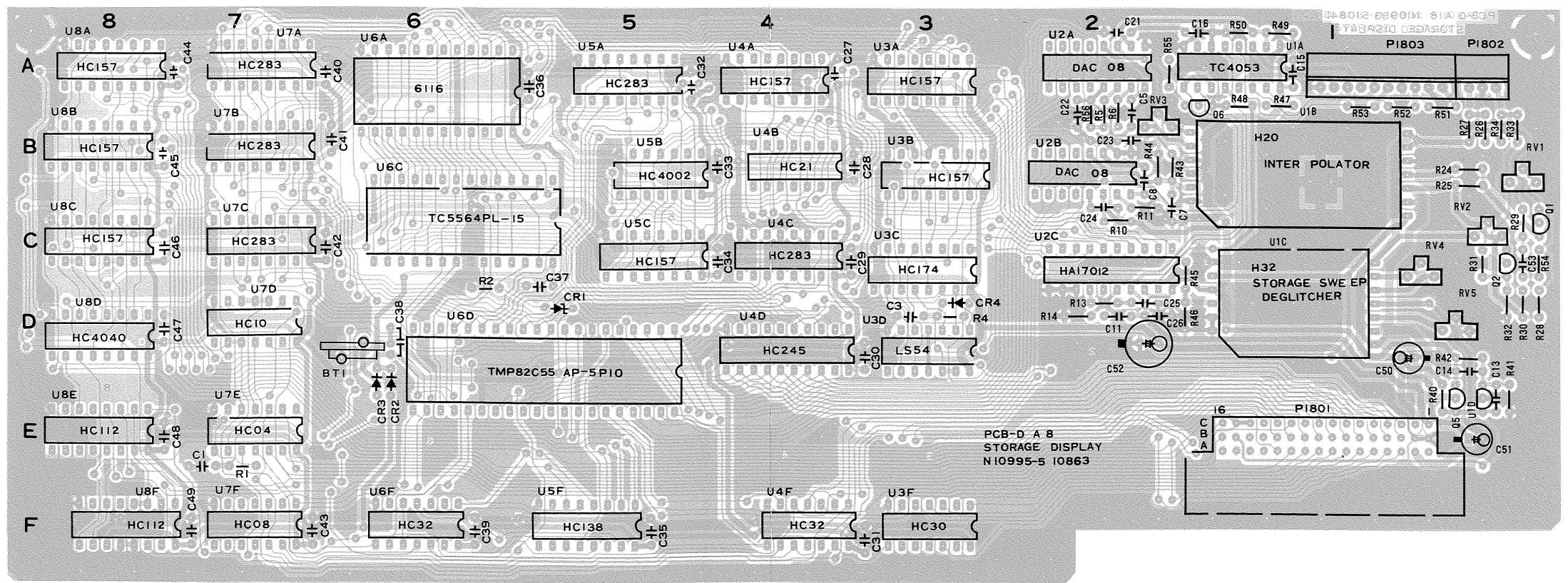
A14 SUB CPU (Parts side view)



A16 A/D CONVERTER & MEMORY (Parts side view)



A17 AQUISITION CONTROL (Parts side view)



A18 STORAGE DISPLAY CONTROL (Parts side view)

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<b>7.1.2 COM7101A parts list .....</b>	<b>7-3</b>
<b>7.1.3 COM 7100A parts list .....</b>	<b>7-55</b>

## 7. PARTS LIST

### 7.1 Parts List (Electronic)

#### 7.1.1 Description

This chapter shows the parts list (Electronic) classified by model and separated in each assembly (in board unit). When replacing the parts using in this unit for repairing, thoroughly understand the capacities described in the parts list, and use the same parts or equivalent ones.

If the parts are not available, or a damaged part is the exclusive one, please ask directly to our International Division. In this case be sure to specify the name of model, KIKUSUI PARTS NO., and the name parts Figure 7-1 explains how to read the parts list.

Example:

REFERENCE DESIGNATOR	KIKUSUI PARTS NO.	DESCRIPTION	xx-xx-xxxx
U6	35-69-0010	DUAL MONOSTABLE MULTI	MOTOROLA MC14538BCP
Circuit diagram number.	KIKUSUI's Part Number.	Description of the Parts.	Manufacturer. Manufacturer's Part Number.

Figure 7-1 How to Read the Parts List

#### \* About the KIKUSUI PART NUMBER.

KIKUSUI classifies the code of electronic parts as in Table 7-1 shows.

Code No.	Classification	Description
2x-xx-xxxx	Electronic tube	CRT, neon tube, etc.
3x-xx-xxxx	Semiconductor	Transistor, FET, diode, IC, etc.
4x-xx-xxxx	Resistor	Fixed resistor, semi-fixed resistor, etc.
5x-xx-xxxx	Capacitor	Electrolytic, ceramic, polystyrene, etc.
6x-xx-xxxx	Electromagnetic parts (Stationary type)	Transformer, choke coil, etc.
7x-xx-xxxx	Electromagnetic parts (Movable type)	Meter, relay, etc.
8x-xx-xxxx	Contact parts	Switch, connector, socket, etc.
9x-xx-xxxx	Others	PC board, wire, fuse, etc.

Table 7-1 Code Number Classification and Description

\* About the abbreviation of description.

The certain words in the description are using abbreviations. Table 7-2 is the list of abbreviations.

Abbreviation	Description	Abbreviation	Description
CER	CERAMIC	M FILM	METAL FILM
C FILM	CARBON FILM	M GLAZE	METAL GLAZE
C COMP	CARBON COMPOSITION	M OX	METAL OXIDE
CRT	CATHODE RAY TUBE	M PLSTC FILM	METALIZED PLASTIC FILM
ELECT	ELECTROLYTIC	SI	SILICON
FET	FIELD EFFECT TRANSISTOR	TANT ELECT	TANTALUM ELECTROLYTIC
FXD	FIXED	VAR	VARIABLE
LED	LIGHT EMITTING DIODE	WW	WIRE WOUND

Table 7-2 List of Abbreviations

\* About the manufacturer.

Some manufacturers are using abbreviations for their names. Table 7-3 is the list of the abbreviations.

Abbreviation	Name of Manufacturer	Abbreviation	Name of Manufacturer
B.B	BURR-BROWN RESEARCH	SANKEN	SANKEN
FAIRCHILD	FAIRCHILD	SANYO	SANYO
FUJIDENKI	FUJIDENKI	SINETICS	SINETICS
FUJITSU	FUJITSU	SILICONIX	SILICONIX
HITACHI	HITACHI	SINDENGEN	SHINDENGEN
ITT	ITT SEMICONDUCTOR	SHARP	SHARP
NEC	NEC ELECTRON	SONY	SONY
MATSUSHITA	PANASONIC	TEXAS INS.	TEXAS INSTRUMENTS
MOTOROLA	MOTOROLA SEMICONDUCTOR	TOSHIBA	TOSHIBA
N. INTER	NIHON INTER	TRW	TRW
N.S.	NATIONAL SEMICONDUCTOR		
PMI	PRECISION MONOLITHICS, INC		
RCA	RCA		

Table 7-3 List of Manufacturers

### 7.1.2 COM 7101A Parts List

Table 7-4 shows each parts used for COM 7101A by assembly.

Assembly	CODE NO.	Description
B ASSEMBLY		Parts used for Chassis.
A1 ASSEMBLY	36-00-1030	Parts used for CH1 and CH2 ATTENUATOR boards. Note that the chip parts are not included.
A3 ASSEMBLY	36-00-1040	Parts used for CH3 and CH4 ATTENUATOR boards. Note that the chip parts are not included.
A4 ASSEMBLY	97-11-0230	Parts used for MAIN board. (VERTICAL PREAMPLIFIER, TRIG & A/B SWEEP GENERATOR and HORIZONTAL SWITCH & Z AXIS CONTROL board.)
A5 ASSEMBLY	97-11-0030	Parts used for VERTICAL & HORIZONTAL OUTPUT AMPLIFIER board.
A6 ASSEMBLY	97-11-0040	Parts used for Z AXIS AMPLIFIER board.
A7 ASSEMBLY	97-11-0050	Parts used for CRT CONTROL board.
A8 ASSEMBLY	97-11-0060	Parts used for MAIN CPU board.
A10 ASSEMBLY	97-11-0070	Parts used for PANEL CONTROLS (1/2) board.
A11 ASSEMBLY	97-11-0261	Parts used for PANEL CONTROLS (2/2) board.
A12 ASSEMBLY	97-11-0280	Parts used for POWER SUPPLY UNIT board.
A13 ASSEMBLY	97-11-0250	Parts used for BUS INTERCONNECTIONS board.
A14 ASSEMBLY	97-11-0121	Parts used for SUB CPU board.
A15 ASSEMBLY	97-11-0170	Parts used for SIGNAL PICKOFF FOR A/D CONVERTER, CHANNEL DIVIDER & PEAK HOLD board.
A16 ASSEMBLY	97-11-0150	Parts used for A/D CONVERTER & MEMORY board.
A17 ASSEMBLY	97-11-0140	Parts used for AQUISITION CONTROL board.
A18 ASSEMBLY	97-11-0130	Parts used for DISPLAY CONTROL board.
A20 ASSEMBLY	97-11-0110	Parts used for LINE FILTER board.
A22 ASSEMBLY	97-11-0200	Parts used for HIGH VOLTAGE UNIT board.

Table 7-4 List of ASSEMBLIES for COM 7101A

REFERENCE DESIGNATOR	KIKUSUI PARTS NO.	DESCRIPTION
----------------------	-------------------	-------------

### B ASSEMBLY

V1	21-46-0614	CATHODE RAY TUBE	TOSHIBA	150CWB31
**	66-21-0082	ROTATION COIL	KIKUSUI	S8607331
**	76-52-0051	FAN (DC 12V)		

### A1 ASSEMBLY (CH1)

H3	36-00-1030	HIC (H3 CH1,CH2 1ST ATT)	KIKUSUI	B0009/03
J1	83-30-1190	BNC CONNECTOR		*1
K1	71-07-0370	RELAY (DC 5V)	DS1-S	*1
K2	71-07-0370	RELAY (DC 5V)	DS1-S	*1
K3	71-07-0370	RELAY (DC 5V)	DS1-S	*1

### A1 ASSEMBLY (CH2)

H3	36-00-1030	HIC (H3 CH1,CH2 1ST ATT)	KIKUSUI	B0009/03
J1	83-30-1190	BNC CONNECTOR		*1
K1	71-07-0370	RELAY (DC 5V)	DS1-S	*1
K2	71-07-0370	RELAY (DC 5V)	DS1-S	*1
K3	71-07-0370	RELAY (DC 5V)	DS1-S	*1

### A3 ASSEMBLY

H4	36-00-1040	HIC (H4 CH3/CH4 1ST ATT)	KIKUSUI	B0109/02
J1	83-30-1190	BNC CONNECTOR		*2
J2	83-30-1190	BNC CONNECTOR		*2
K1	71-07-0370	RELAY (DC 5V)	DS1-S	*2
K2	71-07-0370	RELAY (DC 5V)	DS1-S	*2
K11	71-07-0370	RELAY (DC 5V)	DS1-S	*2
K12	71-07-0370	RELAY (DC 5V)	DS1-S	*2

NOTE : \*1. The H3 is a Attenuator unit consisted of case,shield plate,bracket,PC Board, J1,K1,K2,K3 and other component.

\*2. The H4 is a Attenuator unit consisted of case,shield plate,bracket,PC Board, J1,J2,K1,K2,K11,K12 and other component.

REFERENCE KIKUSUI  
DESIGNATOR PARTS NO. DESCRIPTION 97-11-0230

A4 ASSEMBLY

C1	54-40-1210	FXD	ELECT	22MF	50WV		
C2	54-40-1210	FXD	ELECT	22MF	50WV		
C3	54-40-1210	FXD	ELECT	22MF	50WV		
C4	54-40-1210	FXD	ELECT	22MF	50WV		
C5	54-40-1210	FXD	ELECT	22MF	50WV		
C6	54-40-1210	FXD	ELECT	22MF	50WV		
C7	56-48-1000	FXD	CER	EMI FILTER			
C8	52-05-2468	FXD	CER	0.01UF +80-20%	50V	TYPE2	
C9	52-05-2468	FXD	CER	0.01UF +80-20%	50V	TYPE2	
C10	52-01-2305	FXD	CER	470PF	10%	50V	TYPE2
C11	52-01-2305	FXD	CER	470PF	10%	50V	TYPE2
C12	52-05-2468	FXD	CER	0.01UF +80-20%	50V	TYPE2	
C13	52-01-2305	FXD	CER	470PF	10%	50V	TYPE2
C14	52-01-2305	FXD	CER	470PF	10%	50V	TYPE2
C15	52-05-2468	FXD	CER	0.01UF +80-20%	50V	TYPE2	
C16	52-06-2184	FXD	CER	47PF	10%	50V	TYPE1
C17	52-06-2184	FXD	CER	47PF	10%	50V	TYPE1
C18	52-06-2184	FXD	CER	47PF	10%	50V	TYPE1
C19	52-06-2184	FXD	CER	47PF	10%	50V	TYPE1
C20	52-05-2468	FXD	CER	0.01UF +80-20%	50V	TYPE2	
C21	52-05-2468	FXD	CER	0.01UF +80-20%	50V	TYPE2	
C22	52-05-2468	FXD	CER	0.01UF +80-20%	50V	TYPE2	
C23	52-01-2305	FXD	CER	470PF	10%	50V	TYPE2
C24	55-37-2050	FXD	TANT	ELECT	1UF	35V	
C25	55-37-2050	FXD	TANT	ELECT	1UF	35V	
C26	55-37-2050	FXD	TANT	ELECT	1UF	35V	
C27	54-40-1200	FXD	ELECT	10MF	50WV		
C28	54-40-1200	FXD	ELECT	10MF	50WV		
C31	52-06-2225	FXD	CER	100PF	10%	50V	TYPE1
C32	52-05-2468	FXD	CER	0.01UF +80-20%	50V	TYPE2	
C33	52-05-2468	FXD	CER	0.01UF +80-20%	50V	TYPE2	
C34	52-05-2468	FXD	CER	0.01UF +80-20%	50V	TYPE2	
C35	50-45-3530	FXD	PLSTC	FILM	0.1MF	5%	63WV
C36	52-06-2245	FXD	CER	150PF	10%	50V	TYPE1
C38	52-06-2245	FXD	CER	150PF	10%	50V	TYPE1
C40	52-01-2265	FXD	CER	220PF	10%	50V	TYPE2
C41	52-01-2265	FXD	CER	220PF	10%	50V	TYPE2
C42	52-01-2265	FXD	CER	220PF	10%	50V	TYPE2
C43	52-01-2265	FXD	CER	220PF	10%	50V	TYPE2
C44	52-01-2265	FXD	CER	220PF	10%	50V	TYPE2
C45	52-01-2265	FXD	CER	220PF	10%	50V	TYPE2
C46	52-01-2265	FXD	CER	220PF	10%	50V	TYPE2
C47	52-01-2265	FXD	CER	220PF	10%	50V	TYPE2
C48	52-01-2265	FXD	CER	220PF	10%	50V	TYPE2
C49	52-01-2345	FXD	CER	1000PF	10%	50V	TYPE2
C50	52-01-2345	FXD	CER	1000PF	10%	50V	TYPE2

MMH

REFERENCE	KIKUSUI		
DESIGNATOR	PARTS NO.	DESCRIPTION	97-11-0230

C51	52-01-2345	FXD	CER	1000PF	10%	50V	TYPE2	
C52	52-01-2345	FXD	CER	1000PF	10%	50V	TYPE2	
C53	52-01-2345	FXD	CER	1000PF	10%	50V	TYPE2	
C54	52-01-2345	FXD	CER	1000PF	10%	50V	TYPE2	
C55	50-65-3570	FXD	PLSTC	FILM	0.01MF	5%	100WV	AWS
C56	50-65-0540	FXD	M	PLSTC	FILM	1UF	5%	100WV
C57	50-65-3570	FXD	PLSTC	FILM	0.01MF	5%	100WV	AWS
C58	50-65-0540	FXD	M	PLSTC	FILM	1UF	5%	100WV
C59	52-06-2184	FXD	CER	47PF	10%	50V	TYPE1	
C60	52-06-2184	FXD	CER	47PF	10%	50V	TYPE1	
C61	52-06-2184	FXD	CER	47PF	10%	50V	TYPE1	
C62	52-06-2184	FXD	CER	47PF	10%	50V	TYPE1	
C65	52-05-2468	FXD	CER	0.01UF	+80-20%	50V	TYPE2	
C67	55-37-2100	FXD	TANT	ELECT	10UF	35V		
C68	55-37-2100	FXD	TANT	ELECT	10UF	35V		
C69	55-37-2100	FXD	TANT	ELECT	10UF	35V		
C70	55-37-2100	FXD	TANT	ELECT	10UF	35V		
C71	55-37-2100	FXD	TANT	ELECT	10UF	35V		
C72	55-37-2050	FXD	TANT	ELECT	1UF	35V		
C73	55-37-2050	FXD	TANT	ELECT	1UF	35V		
C74	55-37-2050	FXD	TANT	ELECT	1UF	35V		
C75	55-37-2050	FXD	TANT	ELECT	1UF	35V		
C76	50-67-0030	FXD	PLSTC	FILM	0.01MF	10%	100WV	
C77	54-30-1970	FXD	ELECT	100MF	25WV			
C78	50-67-0050	FXD	PLSTC	FILM	0.047MF	10%	100WV	
C79	52-06-2204	FXD	CER	68P	10%	50V	TYPE1	
C80	54-40-1200	FXD	ELECT	10MF	50WV			
C81	55-37-2100	FXD	TANT	ELECT	10UF	35V		
C83	54-40-1210	FXD	ELECT	22MF	50WV			
C84	54-30-1970	FXD	ELECT	100MF	25WV			
C85	54-30-1970	FXD	ELECT	100MF	25WV			
C86	52-01-2385	FXD	CER	2200PF	10%	50V	TYPE2	
C88	52-01-2265	FXD	CER	220PF	10%	50V	TYPE2	
C89	52-05-2468	FXD	CER	0.01UF	+80-20%	50V	TYPE2	
C90	52-05-2468	FXD	CER	0.01UF	+80-20%	50V	TYPE2	
C91	52-05-2468	FXD	CER	0.01UF	+80-20%	50V	TYPE2	
C92	52-05-2468	FXD	CER	0.01UF	+80-20%	50V	TYPE2	
C93	54-40-1210	FXD	ELECT	22MF	50WV			
C94	54-30-1970	FXD	ELECT	100MF	25WV			
C95	54-30-1970	FXD	ELECT	100MF	25WV			
C96	54-30-1970	FXD	ELECT	100MF	25WV			
C97	54-30-1970	FXD	ELECT	100MF	25WV			
C98	56-48-1000	FXD	CER	EMI	FILTER			
C99	56-48-1000	FXD	CER	EMI	FILTER			
C100	56-48-1000	FXD	CER	EMI	FILTER			
C101	52-05-2468	FXD	CER	0.01UF	+80-20%	50V	TYPE2	
C102	52-05-2468	FXD	CER	0.01UF	+80-20%	50V	TYPE2	
C103	52-05-2468	FXD	CER	0.01UF	+80-20%	50V	TYPE2	
C104	52-05-2468	FXD	CER	0.01UF	+80-20%	50V	TYPE2	
C105	52-05-2468	FXD	CER	0.01UF	+80-20%	50V	TYPE2	
C106	52-05-2468	FXD	CER	0.01UF	+80-20%	50V	TYPE2	
C107	52-05-2468	FXD	CER	0.01UF	+80-20%	50V	TYPE2	
C108	52-05-2468	FXD	CER	0.01UF	+80-20%	50V	TYPE2	
C109	52-05-2468	FXD	CER	0.01UF	+80-20%	50V	TYPE2	

REFERENCE DESIGNATOR	KIKUSUI PARTS NO.	DESCRIPTION		97-11-0230
C110	52-05-2468	FXD CER 0.01UF +80-20% 50V TYPE2		
C111	52-05-2468	FXD CER 0.01UF +80-20% 50V TYPE2		
C112	52-05-2468	FXD CER 0.01UF +80-20% 50V TYPE2		
C113	52-05-2468	FXD CER 0.01UF +80-20% 50V TYPE2		
C114	52-05-2468	FXD CER 0.01UF +80-20% 50V TYPE2		
C115	52-05-2468	FXD CER 0.01UF +80-20% 50V TYPE2		
C116	52-01-2345	FXD CER 1000PF 10% 50V TYPE2		
C117	52-06-2225	FXD CER 100PF 10% 50V TYPE1		
C118	55-37-2050	FXD TANT ELECT 1UF 35V		
C119	52-06-2102	FXD CER 10P 10% 50V TYPE1		
C120	52-06-2165	FXD CER 33PF 10% 500V TYPE1		
C121	55-37-2100	FXD TANT ELECT 10UF 35V		
C122	52-01-2305	FXD CER 470PF 10% 50V TYPE2		
C124	52-05-2468	FXD CER 0.01UF +80-20% 50V TYPE2		
C125	52-06-3125	FXD CER 15PF 10% 500V TYPE1		
C126	52-06-3125	FXD CER 15PF 10% 500V TYPE1		
C132	52-06-2102	FXD CER 10P 10% 50V TYPE1		
C134	52-01-2345	FXD CER 1000PF 10% 50V TYPE2		
C135	52-01-2345	FXD CER 1000PF 10% 50V TYPE2		
CR1	32-30-1200	DIODE VR=60V IO=1A	HITACHI	1SS120
CR2	32-30-1200	DIODE VR=60V IO=1A	HITACHI	1SS120
CR3	32-30-1200	DIODE VR=60V IO=1A	HITACHI	1SS120
CR4	32-30-1200	DIODE VR=60V IO=1A	HITACHI	1SS120
CR5	32-30-1200	DIODE VR=60V IO=1A	HITACHI	1SS120
CR6	32-30-1200	DIODE VR=60V IO=1A	HITACHI	1SS120
CR7	32-30-0860	DIODE VR=30V IO=30MA	HITACHI	1SS86
CR8	32-30-0860	DIODE VR=30V IO=30MA	HITACHI	1SS86
CR9	32-92-0100	ZENER VZ=10.1-10.6V P=0.4W	NEC	RD10JB3
CR10	32-92-0056	ZENER VZ=5.5 - 5.8V P=0.4W	NEC	RD5.6JB2
CR11	32-30-1200	DIODE VR=60V IO=1A	HITACHI	1SS120
CR12	32-30-1200	DIODE VR=60V IO=1A	HITACHI	1SS120
CR13	32-30-1200	DIODE VR=60V IO=1A	HITACHI	1SS120
CR14	32-30-1200	DIODE VR=60V IO=1A	HITACHI	1SS120
CR15	32-30-1200	DIODE VR=60V IO=1A	HITACHI	1SS120
CV1	57-10-1242	VAR CER 5.6-20PF	ALPS	CTZ31E
CV2	57-10-1242	VAR CER 5.6-20PF	ALPS	CTZ31E
CV3	57-10-1242	VAR CER 5.6-20PF	ALPS	CTZ31E
CV4	57-10-1242	VAR CER 5.6-20PF	ALPS	CTZ31E
CV5	57-10-1242	VAR CER 5.6-20PF	ALPS	CTZ31E
CV6	57-10-1242	VAR CER 5.6-20PF	ALPS	CTZ31E
CV7	57-10-1242	VAR CER 5.6-20PF	ALPS	CTZ31E
CV8	57-10-1242	VAR CER 5.6-20PF	ALPS	CTZ31E
CV9	57-10-1242	VAR CER 5.6-20PF	ALPS	CTZ31E
Q1	30-31-9071	TR SI NPN	HITACHI	2SC1907
Q2	30-31-9071	TR SI NPN	HITACHI	2SC1907
Q3	30-31-9071	TR SI NPN	HITACHI	2SC1907
Q4	30-31-9071	TR SI NPN	HITACHI	2SC1907
Q5	30-11-0051	TR SI PNP	NEC	2SA1005-L
Q6	30-31-9071	TR SI NPN	HITACHI	2SC1907
Q7	30-32-1201	TR SI NPN	TOSHIBA	2SC2120-Y
Q8	30-32-1201	TR SI NPN	TOSHIBA	2SC2120-Y

REFERENCE DESIGNATOR	KIKUSUI PARTS NO.	DESCRIPTION	97-11-0230
Q9	30-30-9451	TR SI NPN	NEC 2SC945-Q
Q10	30-30-9451	TR SI NPN	NEC 2SC945-Q
Q11	30-10-8441	TR SI PNP	HITACHI 2SA844-D
Q12	30-30-9451	TR SI NPN	NEC 2SC945-Q
Q13	30-31-9071	TR SI NPN	HITACHI 2SC1907
Q14	30-31-9071	TR SI NPN	HITACHI 2SC1907
Q15	30-32-1201	TR SI NPN	TOSHIBA 2SC2120-Y
Q16	30-32-1201	TR SI NPN	TOSHIBA 2SC2120-Y
Q17	30-30-9451	TR SI NPN	NEC 2SC945-Q
Q18	30-30-9451	TR SI NPN	NEC 2SC945-Q
Q19	30-11-0051	TR SI PNP	NEC 2SA1005-L
R1	40-16-2101	FXD C FILM 1K	OHM 5% 1/6W RD1/6FS
R2	40-16-2101	FXD C FILM 1K	OHM 5% 1/6W RD1/6FS
R3	42-80-0101	FXD M FILM 10	OHM 1% 1/6W RN1/6FS
R4	42-80-1391	FXD M FILM 390	OHM 1% 1/6W RN1/6FS
R5	42-80-3181	FXD M FILM 18K	OHM 1% 1/6W RN1/6FS
R6	42-80-2181	FXD M FILM 1.8K	OHM 1% 1/6W RN1/6FS
R7	40-16-3221	FXD C FILM 22K	OHM 5% 1/6W RD1/6FS
R8	40-16-3221	FXD C FILM 22K	OHM 5% 1/6W RD1/6FS
R9	40-16-1561	FXD C FILM 560	OHM 5% 1/6W RD1/6FS
R10	40-16-3101	FXD C FILM 10K	OHM 5% 1/6W RD1/6FS
R11	40-16-1101	FXD C FILM 100	OHM 5% 1/6W RD1/6FS
R12	40-16-3101	FXD C FILM 10K	OHM 5% 1/6W RD1/6FS
R13	40-16-1101	FXD C FILM 100	OHM 5% 1/6W RD1/6FS
R14	42-80-1181	FXD M FILM 180	OHM 1% 1/6W RN1/6FS
R15	42-80-1181	FXD M FILM 180	OHM 1% 1/6W RN1/6FS
R16	40-16-1561	FXD C FILM 560	OHM 5% 1/6W RD1/6FS
R17	40-16-1221	FXD C FILM 220	OHM 5% 1/6W RD1/6FS
R18	42-80-1181	FXD M FILM 180	OHM 1% 1/6W RN1/6FS
R19	42-80-1181	FXD M FILM 180	OHM 1% 1/6W RN1/6FS
R20	40-16-1561	FXD C FILM 560	OHM 5% 1/6W RD1/6FS
R21	40-16-1221	FXD C FILM 220	OHM 5% 1/6W RD1/6FS
R22	40-16-0391	FXD C FILM 39	OHM 5% 1/6W RD1/6FS
R23	42-80-0821	FXD M FILM 82	OHM 1% 1/6W RN1/6FS
R24	40-16-0391	FXD C FILM 39	OHM 5% 1/6W RD1/6FS
R25	42-80-0821	FXD M FILM 82	OHM 1% 1/6W RN1/6FS
R26	40-16-3101	FXD C FILM 10K	OHM 5% 1/6W RD1/6FS
R27	40-16-2471	FXD C FILM 4.7K	OHM 5% 1/6W RD1/6FS
R28	40-16-3101	FXD C FILM 10K	OHM 5% 1/6W RD1/6FS
R30	40-16-2561	FXD C FILM 5.6K	OHM 5% 1/6W RD1/6FS
R31	40-16-2561	FXD C FILM 5.6K	OHM 5% 1/6W RD1/6FS
R32	40-16-2471	FXD C FILM 4.7K	OHM 5% 1/6W RD1/6FS
R33	40-16-2471	FXD C FILM 4.7K	OHM 5% 1/6W RD1/6FS
R34	40-16-2821	FXD C FILM 8.2K	OHM 5% 1/6W RD1/6FS
R35	40-16-2821	FXD C FILM 8.2K	OHM 5% 1/6W RD1/6FS
R36	40-16-2271	FXD C FILM 2.7K	OHM 5% 1/6W RD1/6FS
R37	40-16-2561	FXD C FILM 5.6K	OHM 5% 1/6W RD1/6FS
R38	40-16-1821	FXD C FILM 820	OHM 5% 1/6W RD1/6FS
R39	40-16-3101	FXD C FILM 10K	OHM 5% 1/6W RD1/6FS
R40	40-16-2331	FXD C FILM 3.3K	OHM 5% 1/6W RD1/6FS
R41	40-16-1221	FXD C FILM 220	OHM 5% 1/6W RD1/6FS
R42	40-16-1221	FXD C FILM 220	OHM 5% 1/6W RD1/6FS
R43	40-16-1101	FXD C FILM 100	OHM 5% 1/6W RD1/6FS

REFERENCE KIKUSUI  
DESIGNATOR PARTS NO. DESCRIPTION 97-11-0230

R44	40-16-3331	FXD	C	FILM	33K	OHM	5%	1/6W	RD1/6FS
R45	42-80-2221	FXD	M	FILM	2.2K	OHM	1%	1/6W	RN1/6FS
R46	42-80-2391	FXD	M	FILM	3.9K	OHM	1%	1/6W	RN1/6FS
R47	40-16-0001	FXD	C	FILM	0	OHM	5%	1/6W	RD1/6FS
R48	38-00-0080	THERMISTOR			2500	OHM			TOSHIBA D33A
R49	40-16-3221	FXD	C	FILM	22K	OHM	5%	1/6W	RD1/6FS
R50	40-16-3101	FXD	C	FILM	10K	OHM	5%	1/6W	RD1/6FS
R51	40-16-2101	FXD	C	FILM	1K	OHM	5%	1/6W	RD1/6FS
R53	42-80-0911	FXD	M	FILM	91	OHM	1%	1/6W	RN1/6FS
R54	42-80-0911	FXD	M	FILM	91	OHM	1%	1/6W	RN1/6FS
R55	40-16-3221	FXD	C	FILM	22K	OHM	5%	1/6W	RD1/6FS
R56	40-16-3221	FXD	C	FILM	22K	OHM	5%	1/6W	RD1/6FS
R57	40-16-5101	FXD	C	FILM	1M	OHM	5%	1/6W	RD1/6FS
R58	40-16-5101	FXD	C	FILM	1M	OHM	5%	1/6W	RD1/6FS
R59	40-16-1221	FXD	C	FILM	220	OHM	5%	1/6W	RD1/6FS
R60	40-16-1221	FXD	C	FILM	220	OHM	5%	1/6W	RD1/6FS
R61	40-16-2331	FXD	C	FILM	3.3K	OHM	5%	1/6W	RD1/6FS
R62	40-16-2681	FXD	C	FILM	6.8K	OHM	5%	1/6W	RD1/6FS
R63	40-16-2681	FXD	C	FILM	6.8K	OHM	5%	1/6W	RD1/6FS
R64	40-16-2331	FXD	C	FILM	3.3K	OHM	5%	1/6W	RD1/6FS
R65	40-16-3101	FXD	C	FILM	10K	OHM	5%	1/6W	RD1/6FS
R66	40-16-2821	FXD	C	FILM	8.2K	OHM	5%	1/6W	RD1/6FS
R68	40-16-2271	FXD	C	FILM	2.7K	OHM	5%	1/6W	RD1/6FS
R70	40-16-2331	FXD	C	FILM	3.3K	OHM	5%	1/6W	RD1/6FS
R71	40-16-1471	FXD	C	FILM	470	OHM	5%	1/6W	RD1/6FS
R72	40-16-1681	FXD	C	FILM	680	OHM	5%	1/6W	RD1/6FS
R73	42-80-2391	FXD	M	FILM	3.9K	OHM	1%	1/6W	RN1/6FS
R74	42-80-2331	FXD	M	FILM	3.3K	OHM	1%	1/6W	RN1/6FS
R75	40-16-3271	FXD	C	FILM	27K	OHM	5%	1/6W	RD1/6FS
R76	40-16-3101	FXD	C	FILM	10K	OHM	5%	1/6W	RD1/6FS
R77	40-16-2101	FXD	C	FILM	1K	OHM	5%	1/6W	RD1/6FS
R78	40-16-1151	FXD	C	FILM	150	OHM	5%	1/6W	RD1/6FS
R79	40-16-2151	FXD	C	FILM	1.5K	OHM	5%	1/6W	RD1/6FS
R80	40-16-1561	FXD	C	FILM	560	OHM	5%	1/6W	RD1/6FS
R81	40-16-2271	FXD	C	FILM	2.7K	OHM	5%	1/6W	RD1/6FS
R82	40-16-2101	FXD	C	FILM	1K	OHM	5%	1/6W	RD1/6FS
R83	40-16-1221	FXD	C	FILM	220	OHM	5%	1/6W	RD1/6FS
R84	40-16-2121	FXD	C	FILM	1.2K	OHM	5%	1/6W	RD1/6FS
R85	40-16-1471	FXD	C	FILM	470	OHM	5%	1/6W	RD1/6FS
R86	40-16-2101	FXD	C	FILM	1K	OHM	5%	1/6W	RD1/6FS
R87	40-16-1221	FXD	C	FILM	220	OHM	5%	1/6W	RD1/6FS
R88	40-16-2101	FXD	C	FILM	1K	OHM	5%	1/6W	RD1/6FS
R89	40-16-1271	FXD	C	FILM	270	OHM	5%	1/6W	RD1/6FS
R90	40-16-1221	FXD	C	FILM	220	OHM	5%	1/6W	RD1/6FS
R91	42-80-2221	FXD	M	FILM	2.2K	OHM	1%	1/6W	RN1/6FS
R92	42-80-2681	FXD	M	FILM	6.8K	OHM	1%	1/6W	RN1/6FS
R93	40-16-1101	FXD	C	FILM	100	OHM	5%	1/6W	RD1/6FS
R94	40-16-0101	FXD	C	FILM	10	OHM	5%	1/6W	RD1/6FS
R95	42-80-3101	FXD	M	FILM	10K	OHM	1%	1/6W	RN1/6FS
R96	42-80-3101	FXD	M	FILM	10K	OHM	1%	1/6W	RN1/6FS
R97	42-80-2131	FXD	M	FILM	1.3K	OHM	1%	1/6W	RN1/6FS
R98	42-80-2101	FXD	M	FILM	1K	OHM	1%	1/6W	RN1/6FS
R99	40-16-3101	FXD	C	FILM	10K	OHM	5%	1/6W	RD1/6FS
R100	42-80-2131	FXD	M	FILM	1.3K	OHM	1%	1/6W	RN1/6FS

REFERENCE DESIGNATOR	KIKUSUI PARTS NO.	DESCRIPTION	97-11-0230				
R101	42-80-2101	FXD M FILM 1K	OHM 1% 1/6W		RN1/6FS		
R102	40-16-3101	FXD C FILM 10K	OHM 5% 1/6W		RD1/6FS		
R103	42-80-2121	FXD M FILM 1.2K	OHM 1% 1/6W		RN1/6FS		
R104	42-80-2101	FXD M FILM 1K	OHM 1% 1/6W		RN1/6FS		
R105	40-16-3101	FXD C FILM 10K	OHM 5% 1/6W		RD1/6FS		
R106	42-80-2151	FXD M FILM 1.5K	OHM 1% 1/6W		RN1/6FS		
R107	42-80-2101	FXD M FILM 1K	OHM 1% 1/6W		RN1/6FS		
R108	40-16-2101	FXD C FILM 1K	OHM 5% 1/6W		RD1/6FS		
R109	40-16-1681	FXD C FILM 680	OHM 5% 1/6W		RD1/6FS		
R110	40-16-2121	FXD C FILM 1.2K	OHM 5% 1/6W		RD1/6FS		
R111	40-16-2121	FXD C FILM 1.2K	OHM 5% 1/6W		RD1/6FS		
R112	40-16-1331	FXD C FILM 330	OHM 5% 1/6W		RD1/6FS		
R113	40-16-3221	FXD C FILM 22K	OHM 5% 1/6W		RD1/6FS		
R114	40-16-1821	FXD C FILM 820	OHM 5% 1/6W		RD1/6FS		
R116	40-16-0561	FXD C FILM 56	OHM 5% 1/6W		RD1/6FS		
R117	42-80-1391	FXD M FILM 390	OHM 1% 1/6W		RN1/6FS		
R118	42-80-1391	FXD M FILM 390	OHM 1% 1/6W		RN1/6FS		
R119	42-80-2101	FXD M FILM 1K	OHM 1% 1/6W		RN1/6FS		
R120	42-80-3101	FXD M FILM 10K	OHM 1% 1/6W		RN1/6FS		
R121	42-80-3101	FXD M FILM 10K	OHM 1% 1/6W		RN1/6FS		
R122	42-80-2391	FXD M FILM 3.9K	OHM 1% 1/6W		RN1/6FS		
R123	42-80-2391	FXD M FILM 3.9K	OHM 1% 1/6W		RN1/6FS		
R124	40-16-2331	FXD C FILM 3.3K	OHM 5% 1/6W		RD1/6FS		
R125	40-16-2331	FXD C FILM 3.3K	OHM 5% 1/6W		RD1/6FS		
R126	40-16-1151	FXD C FILM 150	OHM 5% 1/6W		RD1/6FS		
R127	40-16-1151	FXD C FILM 150	OHM 5% 1/6W		RD1/6FS		
R128	40-16-3101	FXD C FILM 10K	OHM 5% 1/6W		RD1/6FS		
R129	40-16-2151	FXD C FILM 1.5K	OHM 5% 1/6W		RD1/6FS		
R130	40-16-2151	FXD C FILM 1.5K	OHM 5% 1/6W		RD1/6FS		
R131	40-16-1681	FXD C FILM 680	OHM 5% 1/6W		RD1/6FS		
R132	40-16-1221	FXD C FILM 220	OHM 5% 1/6W		RD1/6FS		
R133	40-16-0331	FXD C FILM 33	OHM 5% 1/6W		RD1/6FS		
R134	40-16-2181	FXD C FILM 1.8K	OHM 5% 1/6W		RD1/6FS		
R135	40-16-1561	FXD C FILM 560	OHM 5% 1/6W		RD1/6FS		
R136	40-16-1221	FXD C FILM 220	OHM 5% 1/6W		RD1/6FS		
R139	40-16-3101	FXD C FILM 10K	OHM 5% 1/6W		RD1/6FS		
R140	40-16-3101	FXD C FILM 10K	OHM 5% 1/6W		RD1/6FS		
R141	40-16-3101	FXD C FILM 10K	OHM 5% 1/6W		RD1/6FS		
R146	40-16-1561	FXD C FILM 560	OHM 5% 1/6W		RD1/6FS		
R147	40-16-1151	FXD C FILM 150	OHM 5% 1/6W		RD1/6FS		
R148	40-16-1151	FXD C FILM 150	OHM 5% 1/6W		RD1/6FS		
R149	40-16-1151	FXD C FILM 150	OHM 5% 1/6W		RD1/6FS		
R150	40-16-1151	FXD C FILM 150	OHM 5% 1/6W		RD1/6FS		
R152	41-10-2221	FXD M GLAZE 2.2K	OHM 5% 1/8W		CHIP RESI.		
R153	41-10-2221	FXD M GLAZE 2.2K	OHM 5% 1/8W		CHIP RESI.		
RV1	48-37-1500	VAR M GLAZE 500	OHM B		TEITSU	VM5CKPV	
RV2	48-37-1200	VAR M GLAZE 200	OHM B		TEITSU	VM5CKPV	
RV3	48-37-1200	VAR M GLAZE 200	OHM B		TEITSU	VM5CKPV	
RV4	48-37-1200	VAR M GLAZE 200	OHM B		TEITSU	VM5CKPV	
RV5	48-37-1200	VAR M GLAZE 200	OHM B		TEITSU	VM5CKPV	
RV6	48-37-2100	VAR M GLAZE 1K	OHM B		TEITSU	VM5CKPV	
RV7	48-37-1200	VAR M GLAZE 200	OHM B		TEITSU	VM5CKPV	
RV8	48-37-2100	VAR M GLAZE 1K	OHM B		TEITSU	VM5CKPV	

REFERENCE DESIGNATOR	KIKUSUI PARTS NO.	DESCRIPTION				97-11-0230	
RV9	48-37-1200	VAR M GLAZE	200	OHM B	TEITSU	VM5CKPV	
RV10	48-37-2100	VAR M GLAZE	1K	OHM B	TEITSU	VM5CKPV	
RV11	48-37-1200	VAR M GLAZE	200	OHM B	TEITSU	VM5CKPV	
RV12	48-37-2100	VAR M GLAZE	1K	OHM B	TEITSU	VM5CKPV	
RV13	48-37-1200	VAR M GLAZE	200	OHM B	TEITSU	VM5CKPV	
RV14	48-37-3200	VAR M GLAZE	20K	OHM B	TEITSU	VM5CKPV	
RV15	48-37-3200	VAR M GLAZE	20K	OHM B	TEITSU	VM5CKPV	
RV16	48-37-3200	VAR M GLAZE	20K	OHM B	TEITSU	VM5CKPV	
RV17	48-37-3200	VAR M GLAZE	20K	OHM B	TEITSU	VM5CKPV	
RV18	48-37-2100	VAR M GLAZE	1K	OHM B	TEITSU	VM5CKPV	
RV19	48-37-1200	VAR M GLAZE	200	OHM B	TEITSU	VM5CKPV	
RV20	48-37-1100	VAR M GLAZE	100	OHM B	TEITSU	VM5CKPV	
RV21	48-37-2100	VAR M GLAZE	1K	OHM B	TEITSU	VM5CKPV	
RV22	48-37-3100	VAR M FILM	10K	OHM B		VM5CKPV	
RV23	48-37-1200	VAR M GLAZE	200	OHM B	TEITSU	VM5CKPV	
RV24	48-37-2500	VAR M GLAZE	5K	OHM B	TEITSU	VM5CKPV	
RV25	48-37-1100	VAR M GLAZE	100	OHM B	TEITSU	VM5CKPV	
RV26	48-37-1100	VAR M GLAZE	100	OHM B	TEITSU	VM5CKPV	
RV27	48-37-2100	VAR M GLAZE	1K	OHM B	TEITSU	VM5CKPV	
RV28	48-37-2100	VAR M GLAZE	1K	OHM B	TEITSU	VM5CKPV	
RV29	48-37-1500	VAR M GLAZE	500	OHM B	TEITSU	VM5CKPV	
RV30	48-37-2100	VAR M GLAZE	1K	OHM B	TEITSU	VM5CKPV	
RV31	48-37-2200	VAR M GLAZE	2K	OHM B	TEITSU	VM5CKPV	
RV32	48-37-3200	VAR M GLAZE	20K	OHM B	TEITSU	VM5CKPV	
RV33	48-37-2100	VAR M GLAZE	1K	OHM B	TEITSU	VM5CKPV	
RV34	48-37-1100	VAR M GLAZE	100	OHM B	TEITSU	VM5CKPV	
U1	35-53-0864	QUAD 2-INPUT EXCLUSIVE-OR			TOSHIBA	TC74HC86P	
U2	34-00-0215	J-FET INPUT OPE-AMP			TEXAS INS.	TL081CP	
U3	36-00-1050	HIC (H5 2ND ATT)			KIKUSUI	B0209/12	
U4	36-00-1050	HIC (H5 2ND ATT)			KIKUSUI	B0209/12	
U5	35-56-0940	8-STAGE SHIHT REGISTER			TOSHIBA	TC4094BP	
U6	35-56-0940	8-STAGE SHIHT REGISTER			TOSHIBA	TC4094BP	
U7	35-56-0940	8-STAGE SHIHT REGISTER			TOSHIBA	TC4094BP	
U8	35-56-0940	8-STAGE SHIHT REGISTER			TOSHIBA	TC4094BP	
U9	35-56-0940	8-STAGE SHIHT REGISTER			TOSHIBA	TC4094BP	
U10	35-70-0746	DUAL D F-F EDGE TRIGGER			TOSHIBA	TC74HC74P	
U11	36-00-1060	HIC (H6 1ST AMP)			KIKUSUI	B0309/9	
U12	36-00-1060	HIC (H6 1ST AMP)			KIKUSUI	B0309/9	
U13	36-00-1070	HIC (H7 2ND AMP)			KIKUSUI	B0409/10	
U14	36-00-1070	HIC (H7 2ND AMP)			KIKUSUI	B0409/10	
U15	36-00-1073	HIC (H7 2ND AMP CH3/CH4)			KIKUSUI	B0439/10	
U16	36-00-1073	HIC (H7 2ND AMP CH3/CH4)			KIKUSUI	B0439/10	
U17	36-00-1140	HIC (H14 ANALOG MPX SP)			KIKUSUI	B1109/9	
U18	36-00-1140	HIC (H14 ANALOG MPX SP)			KIKUSUI	B1109/9	
U19	36-00-1190	HIC (H19 SIGNAL OUTPUT AMP)			KIKUSUI	B1609/12	
U20	36-00-1080	HIC (H8 VERT MODE SWITCH)			KIKUSUI	B0509/4	
U21	36-00-1420	HIC (H42 DVM TRUE RMS CONV.)			KIKUSUI	B3809/6	
U22	36-00-1430	HIC (H43 DVM PEAK DETECTOR)			KIKUSUI	B3909/6	
U23	34-00-0210	FET OPE-AMP			TEXAS INS.	TL084CN	
U24	34-69-0030	TRIPLE 2-CHANNEL MULTIPLEXER			TOSHIBA	TC4053BP	
U25	36-00-1090	HIC (H9 DELAY LINE DRIVER)			KIKUSUI	B0609/6	
U26	36-00-1110	HIC (H11 ST SIGNAL BUFFER)			KIKUSUI	B0809/9	
U27	36-00-1210	HIC (H21 TRIG SOUCE SWITCHI)			KIKUSUI	B1709/6	

REFERENCE DESIGNATOR	KIKUSUI PARTS NO.	DESCRIPTION	97-11-0230	
U28	36-00-1220	HIC (H22 TRIG COUPLE SWITCHI)	KIKUSUI	B1809/12
U29	36-00-1220	HIC (H22 TRIG COUPLE SWITCHI)	KIKUSUI	B1809/12
U30	36-00-1230	HIC (H23 TRIG LEVEL COMP.)	KIKUSUI	B1909/9
U31	36-00-1230	HIC (H23 TRIG LEVEL COMP.)	KIKUSUI	B1909/9
U32	36-00-1240	HIC (H24 TV SYNC SEPRATOR)	KIKUSUI	B2009/12
U33	35-53-1584	QUAD 2-TO-1 DATA SELECTOR(INV)	TOSHIBA	TC74HC158P
U34	35-53-1584	QUAD 2-TO-1 DATA SELECTOR(INV)	TOSHIBA	TC74HC158P
U35	35-56-0940	8-STAGE SHIHT REGISTER	TOSHIBA	TC4094BP
U36	35-56-0940	8-STAGE SHIHT REGISTER	TOSHIBA	TC4094BP
U37	35-56-0945	8 BIT SHIFT/STORE RESISTER	TOSHIBA	TC74HC4094
U38	35-56-0945	8 BIT SHIFT/STORE RESISTER	TOSHIBA	TC74HC4094
U39	35-56-0945	8 BIT SHIFT/STORE RESISTER	TOSHIBA	TC74HC4094
U40	35-56-0940	8-STAGE SHIHT REGISTER	TOSHIBA	TC4094BP
U41	35-56-0940	8-STAGE SHIHT REGISTER	TOSHIBA	TC4094BP
U42	35-56-0945	8 BIT SHIFT/STORE RESISTER	TOSHIBA	TC74HC4094
U43	36-00-1270	HIC (H27 SWEEP GENERATOR)	KIKUSUI	B2309/6
U44	36-00-1270	HIC (H27 SWEEP GENERATOR)	KIKUSUI	B2309/6
U45	34-90-0051	REGULATOR	TEXAS INS.	TL431CLPB
U46	35-70-1576	QUAD 2-TO-1 DATA SELECTORS	TOSHIBA	TC74HC157P
U47	35-56-0525	DUAL 4CH ANALOG MPX	MATSUSITA	MN74HC4052
U48	36-00-1250	HIC (H25 SWEEP CONTROLLER)	KIKUSUI	B2109/3
U49	35-53-0144	HEX SHMITT-TRIG INVERTER	TOSHIBA	TC74HC14P
U50	34-90-0051	REGULATOR	TEXAS INS.	TL431CLPB
U51	34-00-0090	OPE-AMP	NEC	UPC741C
U52	36-00-1290	HIC (H29 SWEEP & COMP.SWITCH)	KIKUSUI	B2509/6
U53	35-70-0006	QUAD 2-INPUT POSI-NAND	TOSHIBA	TC74HC00P
U54	35-70-0006	QUAD 2-INPUT POSI-NAND	TOSHIBA	TC74HC00P
U55	36-00-1300	HIC (H30 HORIZ SW. & DRIVER)	KIKUSUI	B2609/6
U56	36-00-1280	HIC (H28 DELAY TIME COMP.)	KIKUSUI	B2409/9
U57	36-00-1340	HIC (H34 Z-AXIS SW. & DRIVER)	KIKUSUI	B3009/6
U58	36-00-1260	HIC (H26 PRESCALER)	KIKUSUI	B2209/12
U59	36-00-1410	HIC (H41 SEQUENCE CONT.)	KIKUSUI	B3709/4
U60	35-56-0280	BCD TO DECIMAL DECODER	TOSHIBA	TC4028BP
U61	35-56-0280	BCD TO DECIMAL DECODER	TOSHIBA	TC4028BP
U62	35-53-1254	QUAD BUS BUFFER GATES (3-ST)	TOSHIBA	TC74HC125P
U63	35-56-0940	8-STAGE SHIHT REGISTER	TOSHIBA	TC4094BP
U64	35-56-0945	8 BIT SHIFT/STORE RESISTER	TOSHIBA	TC74HC4094
U65	36-00-1140	HIC (H14 ANALOG MPX SP)	KIKUSUI	B1109/9
U66	36-00-1140	HIC (H14 ANALOG MPX SP)	KIKUSUI	B1109/9
U67	35-70-0046	HEX INVERTERS	TOSHIBA	TC74HC04P

REFERENCE KIKUSUI  
DESIGNATOR PARTS NO.      DESCRIPTION 97-11-0030

A5 ASSEMBLY

C3	52-06-2165	FXD CER	33PF	10%	500V	TYPE1		
C4	52-06-2215	FXD CER	82PF	10%	500V	TYPE1		
C5	50-67-0040	FXD PLSTC	FILM	0.022MF	10%	100WV		
C6	50-67-0000	FXD PLSTC	FILM	0.001MF	10%	100WV		
C8	52-06-2225	FXD CER	100PF	10%	50V	TYPE1		
C9	52-06-2225	FXD CER	100PF	10%	50V	TYPE1		
C11	52-06-2184	FXD CER	47PF	10%	50V	TYPE1		
C12	52-06-2184	FXD CER	47PF	10%	50V	TYPE1		
C13	54-40-1200	FXD ELECT	10MF		50WV			
C14	54-40-1200	FXD ELECT	10MF		50WV			
C15	52-03-3469	FXD CER	0.01UF	+100-0%	500V	TYPE2		
C16	52-03-3469	FXD CER	0.01UF	+100-0%	500V	TYPE2		
C21	54-40-1200	FXD ELECT	10MF		50WV			
C22	54-70-1080	FXD ELECT	2.2MF		250WV			
C23	52-03-3469	FXD CER	0.01UF	+100-0%	500V	TYPE2		
C24	50-77-3500	FXD PLSTC	FILM	0.047MF	20%	250WV		
C25	54-30-1960	FXD ELECT	47MF		25WV			
C26	52-03-3469	FXD CER	0.01UF	+100-0%	500V	TYPE2		
C27	50-77-3500	FXD PLSTC	FILM	0.047MF	20%	250WV		
C28	54-40-1200	FXD ELECT	10MF		50WV			
C29	52-06-2225	FXD CER	100PF	10%	50V	TYPE1		
C30	52-06-2225	FXD CER	100PF	10%	50V	TYPE1		
C33	52-06-2184	FXD CER	47PF	10%	50V	TYPE1		
C34	52-01-2345	FXD CER	1000PF	10%	50V	TYPE2		
C35	52-06-3102	FXD CER	10PF	10%	500V	TYPE1		
C36	52-06-2285	FXD CER	330PF	10%	50V	TYPE1		
CR1	32-30-1200	DIODE	VR=60V	IO=1A			HITACHI	ISS120
CR2	32-30-1200	DIODE	VR=60V	IO=1A			HITACHI	ISS120
CV1	57-10-1203	VAR CER	5-20PF					
CV2	57-10-1223	VAR CER	8-50PF					
CV3	57-10-1223	VAR CER	8-50PF					
CV5	57-10-1223	VAR CER	8-50PF					
L1	67-05-0000	INDUCTOR	L-2868					
L2	67-05-0000	INDUCTOR	L-2868					
Q1	30-10-8441	TR SI PNP					HITACHI	2SA844-D
Q2	30-33-5961	TR SI NPN	(80V 0.3A		W)			2SC3596-D
Q3	30-33-5961	TR SI NPN	(80V 0.3A		W)			2SC3596-D
Q4	30-31-9071	TR SI NPN					HITACHI	2SC1907
Q5	30-31-9071	TR SI NPN					HITACHI	2SC1907
Q6	30-31-9071	TR SI NPN					HITACHI	2SC1907
R1	42-80-0911	FXD M FILM	91	OHM	1%	1/6W		RN1/6FS
R2	42-80-0911	FXD M FILM	91	OHM	1%	1/6W		RN1/6FS
R4	40-16-1121	FXD C FILM	120	OHM	5%	1/6W		RD1/6FS
R5	40-16-3121	FXD C FILM	12K	OHM	5%	1/6W		RD1/6FS
R6	40-16-2561	FXD C FILM	5.6K	OHM	5%	1/6W		RD1/6FS

REFERENCE DESIGNATOR	KIKUSUI PARTS NO.	DESCRIPTION	97-11-0030			
R7	40-16-2101	FXD C FILM 1K	OHM 5% 1/6W	RD1/6FS		
R8	42-80-2271	FXD M FILM 2.7K	OHM 1% 1/6W	RN1/6FS		
R9	42-80-2271	FXD M FILM 2.7K	OHM 1% 1/6W	RN1/6FS		
R10	42-80-2681	FXD M FILM 6.8K	OHM 1% 1/6W	RN1/6FS		
R11	42-80-2681	FXD M FILM 6.8K	OHM 1% 1/6W	RN1/6FS		
R12	40-16-1101	FXD C FILM 100	OHM 5% 1/6W	RD1/6FS		
R13	40-16-0181	FXD C FILM 18	OHM 5% 1/6W	RD1/6FS		
R14	40-16-0181	FXD C FILM 18	OHM 5% 1/6W	RD1/6FS		
R15	40-16-0101	FXD C FILM 10	OHM 5% 1/6W	RD1/6FS		
R16	40-16-0101	FXD C FILM 10	OHM 5% 1/6W	RD1/6FS		
R21	40-16-2271	FXD C FILM 2.7K	OHM 5% 1/6W	RD1/6FS		
R22	40-16-3101	FXD C FILM 10K	OHM 5% 1/6W	RD1/6FS		
R23	40-16-1391	FXD C FILM 390	OHM 5% 1/6W	RD1/6FS		
R24	40-16-0331	FXD C FILM 33	OHM 5% 1/6W	RD1/6FS		
R25	40-16-0331	FXD C FILM 33	OHM 5% 1/6W	RD1/6FS		
R26	38-00-0070	THERMISTOR 200	OHM	TOSHIBA	D22A	
R41	44-57-0550	FXD M FILM 220	OHM 5% 3W		ERG3SJ	
R42	44-57-0550	FXD M FILM 220	OHM 5% 3W		ERG3SJ	
R43	44-57-0550	FXD M FILM 220	OHM 5% 3W		ERG3SJ	
R44	44-57-0550	FXD M FILM 220	OHM 5% 3W		ERG3SJ	
R45	40-27-0102	FXD C FILM 10	OHM 5% 1/4W		NAS1/4S	
R51	40-16-1101	FXD C FILM 100	OHM 5% 1/6W		RD1/6FS	
R52	40-16-2561	FXD C FILM 5.6K	OHM 5% 1/6W		RD1/6FS	
R53	40-16-1331	FXD C FILM 330	OHM 5% 1/6W		RD1/6FS	
R54	40-16-2561	FXD C FILM 5.6K	OHM 5% 1/6W		RD1/6FS	
R55	40-16-2101	FXD C FILM 1K	OHM 5% 1/6W		RD1/6FS	
R61	40-16-2101	FXD C FILM 1K	OHM 5% 1/6W		RD1/6FS	
R62	40-16-2101	FXD C FILM 1K	OHM 5% 1/6W		RD1/6FS	
R63	40-16-1471	FXD C FILM 470	OHM 5% 1/6W		RD1/6FS	
R64	40-16-2221	FXD C FILM 2.2K	OHM 5% 1/6W		RD1/6FS	
R65	40-16-0101	FXD C FILM 10	OHM 5% 1/6W		RD1/6FS	
R67	40-16-4391	FXD C FILM 390K	OHM 5% 1/6W		RD1/6FS	
R68	40-16-2471	FXD C FILM 4.7K	OHM 5% 1/6W		RD1/6FS	
R69	40-16-2101	FXD C FILM 1K	OHM 5% 1/6W		RD1/6FS	
R70	38-00-0070	THERMISTOR 200	OHM	TOSHIBA	D22A	
RV1	48-37-1100	VAR M GLAZE 100	OHM B	TEITSU	VM5CKPV	
RV2	48-37-1100	VAR M GLAZE 100	OHM B	TEITSU	VM5CKPV	
RV3	48-37-1200	VAR M GLAZE 200	OHM B	TEITSU	VM5CKPV	
RV4	48-37-1100	VAR M GLAZE 100	OHM B	TEITSU	VM5CKPV	
RV5	48-37-2500	VAR M GLAZE 5K	OHM B	TEITSU	VM5CKPV	
RV6	48-37-2200	VAR M GLAZE 2K	OHM B	TEITSU	VM5CKPV	
RV7	48-37-1500	VAR M GLAZE 500	OHM B	TEITSU	VM5CKPV	
RV8	48-37-3200	VAR M GLAZE 20K	OHM B	TEITSU	VM5CKPV	
U1	34-00-0215	J-FET INPUT OPE-AMP		TEXAS INS.	TL081CP	
U2	36-00-1100	HIC (H10 VERT FINAL DRIVER)		KIKUSUI	B0709/6	
U3	36-00-1310	HIC (H31 HORIZ FINAL AMP)		KIKUSUI	B2709/6	

REFERENCE KIKUSUI  
DESIGNATOR PARTS NO. DESCRIPTION 97-11-0040

A6 ASSEMBLY

C2	54-40-1200	FXD ELECT	10MF	50WV		
C4	54-40-1200	FXD ELECT	10MF	50WV		
C5	52-03-3469	FXD CER	0.01UF	+100-0%	500V	TYPE2
C6	50-77-3500	FXD PLSTC	FILM	0.047MF	20%	250WV
C7	54-30-1970	FXD ELECT	100MF	25WV		
C8	52-03-3469	FXD CER	0.01UF	+100-0%	500V	TYPE2
C9	50-77-3500	FXD PLSTC	FILM	0.047MF	20%	250WV
C10	55-37-2050	FXD TANT	ELECT	1UF	35V	
C11	52-01-2425	FXD CER	4700PF	10%	50V	TYPE2
C12	50-67-0040	FXD PLSTC	FILM	0.022MF	10%	100WV
C13	50-67-0030	FXD PLSTC	FILM	0.01MF	10%	100WV
C14	54-30-1960	FXD ELECT	47MF	25WV		
C15	54-30-1970	FXD ELECT	100MF	25WV		
C16	52-96-1170	FXD CER	5PF	1KV		
C17	52-98-1020	FXD CER	1000PF	+80	-20%	3.15KV
C18	52-98-1020	FXD CER	1000PF	+80	-20%	3.15KV
C19	52-03-3469	FXD CER	0.01UF	+100-0%	500V	TYPE2
C20	52-98-1000	FXD CER	4700PF	+80-20%	3.15KV	TYPE1
C21	52-98-1020	FXD CER	1000PF	+80	-20%	3.15KV
C22	52-98-1020	FXD CER	1000PF	+80	-20%	3.15KV
C23	52-96-1170	FXD CER	5PF	1KV		
C24	52-98-1020	FXD CER	1000PF	+80	-20%	3.15KV
C25	52-03-3469	FXD CER	0.01UF	+100-0%	500V	TYPE2
C26	52-98-1000	FXD CER	4700PF	+80-20%	3.15KV	TYPE1
C27	52-98-1000	FXD CER	4700PF	+80-20%	3.15KV	TYPE1
C28	52-98-1000	FXD CER	4700PF	+80-20%	3.15KV	TYPE1
C29	52-98-1000	FXD CER	4700PF	+80-20%	3.15KV	TYPE1
C30	52-03-3469	FXD CER	0.01UF	+100-0%	500V	TYPE2
C31	52-03-3469	FXD CER	0.01UF	+100-0%	500V	TYPE2
C32	52-03-3469	FXD CER	0.01UF	+100-0%	500V	TYPE2
C36	52-03-3469	FXD CER	0.01UF	+100-0%	500V	TYPE2
CR1	32-30-1200	DIODE	VR=60V	IO=1A	HITACHI	1SS120
CR2	32-30-1200	DIODE	VR=60V	IO=1A	HITACHI	1SS120
CR3	32-30-1200	DIODE	VR=60V	IO=1A	HITACHI	1SS120
CR4	32-30-1200	DIODE	VR=60V	IO=1A	HITACHI	1SS120
CR5	32-30-1200	DIODE	VR=60V	IO=1A	HITACHI	1SS120
CR6	32-30-1200	DIODE	VR=60V	IO=1A	HITACHI	1SS120
CR7	32-91-2310	ZENER	VZ= 90	- 110V P=1W	TOSHIBA	1Z100
CR8	32-90-3130	DIODE	VR=250V	IO=0.2A	MATSUSITA	MA185
CR9	32-90-3130	DIODE	VR=250V	IO=0.2A	MATSUSITA	MA185
CR10	32-90-3130	DIODE	VR=250V	IO=0.2A	MATSUSITA	MA185
CR11	32-90-1820	DIODE	VR=2KV	FAST RECOVERY	HITACHI	ERB26-20
CR12	32-90-3130	DIODE	VR=250V	IO=0.2A	MATSUSITA	MA185
CR13	32-90-3130	DIODE	VR=250V	IO=0.2A	MATSUSITA	MA185
CR14	32-90-3130	DIODE	VR=250V	IO=0.2A	MATSUSITA	MA185
CR15	32-90-1820	DIODE	VR=2KV	FAST RECOVERY	HITACHI	ERB26-20
CR16	32-90-0523	DIODE	VR=600V	IO=1A	TOSHIBA	S5277J
CR17	32-90-0523	DIODE	VR=600V	IO=1A	TOSHIBA	S5277J

DS1 23-70-0100 LAMP NEON

REFERENCE DESIGNATOR	KIKUSUI PARTS NO.	DESCRIPTION	97-11-0040
DS2	23-70-0100	LAMP NEON	
DS3	23-70-0100	LAMP NEON	
L1	67-10-0890	INDUCTOR 100MH 10%	
Q1	30-31-9071	TR SI NPN	HITACHI 2SC1907
Q2	30-41-4060	TR SI NPN (60V 3A 25W)	TOSHIBA 2SD1406-Y
Q3	30-32-7041	TR SI NPN	TOSHIBA 2SC2704-0
Q4	30-32-7041	TR SI NPN	TOSHIBA 2SC2704-0
R1	40-16-0471	FXD C FILM 47 OHM 5% 1/6W	RD1/6FS
R2	40-16-2101	FXD C FILM 1K OHM 5% 1/6W	RD1/6FS
R3	40-16-2101	FXD C FILM 1K OHM 5% 1/6W	RD1/6FS
R4	40-16-1221	FXD C FILM 220 OHM 5% 1/6W	RD1/6FS
R5	40-16-3101	FXD C FILM 10K OHM 5% 1/6W	RD1/6FS
R6	40-16-1391	FXD C FILM 390 OHM 5% 1/6W	RD1/6FS
R7	40-16-1221	FXD C FILM 220 OHM 5% 1/6W	RD1/6FS
R9	42-80-3101	FXD M FILM 10K OHM 1% 1/6W	RN1/6FS
R10	42-80-2271	FXD M FILM 2.7K OHM 1% 1/6W	RN1/6FS
R11	42-80-3821	FXD M FILM 82K OHM 1% 1/6W	RN1/6FS
R13	40-16-2151	FXD C FILM 1.5K OHM 5% 1/6W	RD1/6FS
R14	40-16-1271	FXD C FILM 270 OHM 5% 1/6W	RD1/6FS
R15	40-16-0001	FXD C FILM 0 OHM 5% 1/6W	RD1/6FS
R16	40-16-3681	FXD C FILM 68K OHM 5% 1/6W	RD1/6FS
R17	40-16-2181	FXD C FILM 1.8K OHM 5% 1/6W	RD1/6FS
R18	40-16-2101	FXD C FILM 1K OHM 5% 1/6W	RD1/6FS
R19	40-16-0331	FXD C FILM 33 OHM 5% 1/6W	RD1/6FS
R20	40-16-3561	FXD C FILM 56K OHM 5% 1/6W	RD1/6FS
R21	40-16-3181	FXD C FILM 18K OHM 5% 1/6W	RD1/6FS
R22	44-91-8101	FXD M OXIDE 1 OHM 5% 1W	MATSUSITA ERX1ANJ
R23	40-27-3472	FXD C FILM 47K OHM 5% 1/4W	
R24	40-27-4152	FXD C FILM 150K OHM 5% 1/4W	
R25	40-37-6101	FXD C FILM 10M OHM 5% 1/2W	
R26	40-37-6101	FXD C FILM 10M OHM 5% 1/2W	
R27	40-27-2332	FXD C FILM 3.3K OHM 5% 1/4W	
R28	40-37-5221	FXD C FILM 2.2M OHM 5% 1/2W	
R29	40-37-6101	FXD C FILM 10M OHM 5% 1/2W	
R30	40-37-6101	FXD C FILM 10M OHM 5% 1/2W	
R31	40-27-2102	FXD C FILM 1K OHM 5% 1/4W	NAS1/4S
R32	40-27-3822	FXD C FILM 82K OHM 5% 1/4W	
R33	42-44-0330	FXD T FILM 10M OHM 1% 1W	
R34	42-34-2190	FXD M GLAZE 6.8M OHM 1% 0.8W	
R35	40-27-4472	FXD C FILM 470K OHM 5% 1/4W	
R36	40-27-3222	FXD C FILM 22K OHM 5% 1/4W	
R37	40-27-4222	FXD C FILM 220K OHM 5% 1/4W	
R42	40-16-2561	FXD C FILM 5.6K OHM 5% 1/6W	RD1/6FS
R43	40-16-0331	FXD C FILM 33 OHM 5% 1/6W	RD1/6FS
RV2	48-31-3500	FXD M GLAZE 50K OHM B PH	
RV3	48-26-5221	VAR M GLAZE 2.2M OHM	
RV4	48-31-4100	VAR M GLAZE 100K OHM B PH	
RV5	48-31-4100	VAR M GLAZE 100K OHM B PH	
RV6	48-31-4100	VAR M GLAZE 100K OHM B PH	
U601	36-00-1310	HIC (H31 HORIZ FINAL AMP)	KIKUSUI B2709/6

REFERENCE DESIGNATOR	KIKUSUI PARTS NO.	DESCRIPTION	97-11-0040
U602	34-00-0340	FET INPUT DUAL OP AMP	TEXAS INS.TL082CP
A7 ASSEMBLY		97-11-0050	
C1	52-05-2468	FXD CER 0.01UF +80-20% 50V TYPE2	
C2	52-37-1000	FXD CER 0.047UF 20% 25V TYPE1	
C3	52-37-1000	FXD CER 0.047UF 20% 25V TYPE1	
C4	52-37-1000	FXD CER 0.047UF 20% 25V TYPE1	
C5	52-37-1000	FXD CER 0.047UF 20% 25V TYPE1	
C6	54-20-1210	FXD ELECT 220MF 16WV	KME16VB220
C7	52-37-1000	FXD CER 0.047UF 20% 25V TYPE1	
C8	52-37-1000	FXD CER 0.047UF 20% 25V TYPE1	
CR1	37-00-0440	LAMP LED RED	TOSHIBA TLUY163
CR2	37-00-0440	LAMP LED RED	TOSHIBA TLUY163
CR3	37-00-0440	LAMP LED RED	TOSHIBA TLUY163
DS1	23-43-0000	LAMP FILAMENT 14V 40MA	RM314V40
DS2	23-43-0000	LAMP FILAMENT 14V 40MA	RM314V40
DS3	23-43-0000	LAMP FILAMENT 14V 40MA	RM314V40
Q1	30-11-0151	TR SI PNP	TOSHIBA 2SA1015-Y
Q2	30-30-9451	TR SI NPN	NEC 2SC945-Q
Q3	30-31-8461	TR SI NPN	MATSUSITA 2SC1846-R
Q4	30-31-8461	TR SI NPN	MATSUSITA 2SC1846-R
Q5	30-30-9451	TR SI NPN	NEC 2SC945-Q
Q6	30-11-0151	TR SI PNP	TOSHIBA 2SA1015-Y
R1	42-80-2681	FXD M FILM 6.8K OHM 1% 1/6W	RN1/6FS
R2	42-80-2331	FXD M FILM 3.3K OHM 1% 1/6W	RN1/6FS
R3	40-16-1101	FXD C FILM 100 OHM 5% 1/6W	RD1/6FS
R4	42-80-3101	FXD M FILM 10K OHM 1% 1/6W	RN1/6FS
R5	42-80-3101	FXD M FILM 10K OHM 1% 1/6W	RN1/6FS
R6	40-16-1101	FXD C FILM 100 OHM 5% 1/6W	RD1/6FS
R7	40-16-2821	FXD C FILM 8.2K OHM 5% 1/6W	RD1/6FS
R8	40-16-2391	FXD C FILM 3.9K OHM 5% 1/6W	RD1/6FS
R9	40-16-2391	FXD C FILM 3.9K OHM 5% 1/6W	RD1/6FS
R10	40-16-1101	FXD C FILM 100 OHM 5% 1/6W	RD1/6FS
R11	40-16-2221	FXD C FILM 2.2K OHM 5% 1/6W	RD1/6FS
R12	40-16-4101	FXD C FILM 100K OHM 5% 1/6W	RD1/6FS
R14	40-16-2471	FXD C FILM 4.7K OHM 5% 1/6W	RD1/6FS
R15	40-16-2101	FXD C FILM 1K OHM 5% 1/6W	RD1/6FS
R16	40-16-2101	FXD C FILM 1K OHM 5% 1/6W	RD1/6FS
R17	40-16-2101	FXD C FILM 1K OHM 5% 1/6W	RD1/6FS
R18	40-16-3101	FXD C FILM 10K OHM 5% 1/6W	RD1/6FS
RV1	45-01-0810	VAR C COMP 20K/20K OHM B	KIKUSUI V12LG3S
RV2	45-02-0280	VAR C COMP 20K/20K OHM B	KIKUSUI V12LG3N
RV3	45-02-0285	VAR C COMP 20K/20K OHM B	V12LG3N
RV4	45-01-0810	VAR C COMP 20K/20K OHM B	KIKUSUI V12LG3S
S1	81-01-0270	PUSH SWITCH	ALPS SDG5P-E
U1	34-00-0240	DUAL OPE-AMP	NEC UPC4558C

REFERENCE KIKUSUI  
DESIGNATOR PARTS NO. DESCRIPTION 97-11-0050

U2 34-00-0340 FET INPUT DUAL OP AMP TEXAS INS.TL082CP

A8 ASSEMBLY 97-11-0060

BT1	94-00-0200	BATTERY LITHIUM	CR14250P31
C1	52-06-3165	FXD CER 33PF 10% 500V TYPE1	
C2	52-06-3165	FXD CER 33PF 10% 500V TYPE1	
C3	55-37-2050	FXD TANT ELECT 1UF 35V	
C4	52-05-2468	FXD CER 0.01UF +80-20% 50V TYPE2	
C6	54-20-1210	FXD ELECT 220MF 16WV	KME16VB220
C7	54-20-1210	FXD ELECT 220MF 16WV	KME16VB220
C8	52-06-2102	FXD CER 10P 10% 50V TYPE1	
C9	52-01-3305	FXD CER 470PF 10% 500V TYPE2	
C10	52-06-2225	FXD CER 100PF 10% 50V TYPE1	
C11	54-40-1200	FXD ELECT 10MF 50WV	
C12	52-06-2225	FXD CER 100PF 10% 50V TYPE1	
C14	52-01-2345	FXD CER 1000PF 10% 50V TYPE2	
C15	54-40-1200	FXD ELECT 10MF 50WV	
C16	52-06-2225	FXD CER 100PF 10% 50V TYPE1	
C18	52-01-2345	FXD CER 1000PF 10% 50V TYPE2	
C21	54-40-1200	FXD ELECT 10MF 50WV	
C22	54-40-1200	FXD ELECT 10MF 50WV	
C23	52-01-2345	FXD CER 1000PF 10% 50V TYPE2	
C24	52-06-3165	FXD CER 33PF 10% 500V TYPE1	
C25	52-06-3165	FXD CER 33PF 10% 500V TYPE1	
C26	54-20-1210	FXD ELECT 220MF 16WV	KME16VB220
C27	54-40-1200	FXD ELECT 10MF 50WV	
C28	54-40-1200	FXD ELECT 10MF 50WV	
C29	54-20-1210	FXD ELECT 220MF 16WV	KME16VB220
C30	54-40-1200	FXD ELECT 10MF 50WV	
C31	54-40-1200	FXD ELECT 10MF 50WV	
C32	54-40-1200	FXD ELECT 10MF 50WV	
C33	52-37-1000	FXD CER 0.047UF 20% 25V TYPE1	
C34	52-37-1000	FXD CER 0.047UF 20% 25V TYPE1	
C35	52-37-1000	FXD CER 0.047UF 20% 25V TYPE1	
C36	52-37-1000	FXD CER 0.047UF 20% 25V TYPE1	
C37	52-37-1000	FXD CER 0.047UF 20% 25V TYPE1	
C38	52-37-1000	FXD CER 0.047UF 20% 25V TYPE1	
C39	52-37-1000	FXD CER 0.047UF 20% 25V TYPE1	
C40	52-37-1000	FXD CER 0.047UF 20% 25V TYPE1	
C41	52-37-1000	FXD CER 0.047UF 20% 25V TYPE1	
C42	52-37-1000	FXD CER 0.047UF 20% 25V TYPE1	
C43	52-37-1000	FXD CER 0.047UF 20% 25V TYPE1	
C44	52-37-1000	FXD CER 0.047UF 20% 25V TYPE1	
C45	52-37-1000	FXD CER 0.047UF 20% 25V TYPE1	
C46	52-37-1000	FXD CER 0.047UF 20% 25V TYPE1	
C47	52-37-1000	FXD CER 0.047UF 20% 25V TYPE1	
C48	52-37-1000	FXD CER 0.047UF 20% 25V TYPE1	
C49	52-37-1000	FXD CER 0.047UF 20% 25V TYPE1	
C51	52-37-1000	FXD CER 0.047UF 20% 25V TYPE1	
C52	52-37-1000	FXD CER 0.047UF 20% 25V TYPE1	
C53	52-37-1000	FXD CER 0.047UF 20% 25V TYPE1	
C54	52-37-1000	FXD CER 0.047UF 20% 25V TYPE1	

REFERENCE KIKUSUI  
DESIGNATOR PARTS NO. DESCRIPTION 97-11-0060

C55	52-37-1000	FXD CER	0.047UF	20%	25V	TYPE1
C56	52-37-1000	FXD CER	0.047UF	20%	25V	TYPE1
C57	52-37-1000	FXD CER	0.047UF	20%	25V	TYPE1
C58	52-37-1000	FXD CER	0.047UF	20%	25V	TYPE1
C59	52-37-1000	FXD CER	0.047UF	20%	25V	TYPE1
C61	52-37-1000	FXD CER	0.047UF	20%	25V	TYPE1
C62	52-37-1000	FXD CER	0.047UF	20%	25V	TYPE1
C63	52-37-1000	FXD CER	0.047UF	20%	25V	TYPE1
C64	52-37-1000	FXD CER	0.047UF	20%	25V	TYPE1
C65	52-37-1000	FXD CER	0.047UF	20%	25V	TYPE1
C66	52-37-1000	FXD CER	0.047UF	20%	25V	TYPE1
C67	52-37-1000	FXD CER	0.047UF	20%	25V	TYPE1
C68	52-06-2225	FXD CER	100PF	10%	50V	TYPE1
C69	52-06-2225	FXD CER	100PF	10%	50V	TYPE1
C70	52-06-2184	FXD CER	47PF	10%	50V	TYPE1

CR1	32-30-1200	DIODE VR=60V	IO=1A	HITACHI	ISS120
CR2	32-30-1200	DIODE VR=60V	IO=1A	HITACHI	ISS120
CR3	32-30-1200	DIODE VR=60V	IO=1A	HITACHI	ISS120
CR4	32-92-0033	ZENER VZ=3.2 - 3.4V		HITACHI	HZ3C-2
CR5	32-30-1200	DIODE VR=60V	IO=1A	HITACHI	ISS120
CR6	32-30-1200	DIODE VR=60V	IO=1A	HITACHI	ISS120
CR7	32-30-1200	DIODE VR=60V	IO=1A	HITACHI	ISS120
CR8	32-30-1200	DIODE VR=60V	IO=1A	HITACHI	ISS120
CR9	32-30-1200	DIODE VR=60V	IO=1A	HITACHI	ISS120
CR10	32-30-1200	DIODE VR=60V	IO=1A	HITACHI	ISS120
CR11	32-30-1200	DIODE VR=60V	IO=1A	HITACHI	ISS120
CR12	32-30-1200	DIODE VR=60V	IO=1A	HITACHI	ISS120
CR13	32-30-1200	DIODE VR=60V	IO=1A	HITACHI	ISS120
CR14	32-92-0056	ZENER VZ=5.5 - 5.8V P=0.4W		NEC	RD5.6JB2

Q1	30-11-0151	TR SI PNP		TOSHIBA	2SA1015-Y
Q2	30-30-9451	TR SI NPN		NEC	2SC945-Q
Q3	30-11-0151	TR SI PNP		TOSHIBA	2SA1015-Y
Q4	30-11-0051	TR SI PNP		NEC	2SA1005-L
Q5	30-11-0051	TR SI PNP		NEC	2SA1005-L
Q6	30-30-9451	TR SI NPN		NEC	2SC945-Q
Q7	30-11-0151	TR SI PNP		TOSHIBA	2SA1015-Y

R1	40-16-5101	FXD C FILM	1M	OHM	5%	1/6W	RD1/6FS
R2	40-16-2331	FXD C FILM	3.3K	OHM	5%	1/6W	RD1/6FS
R3	40-16-2561	FXD C FILM	5.6K	OHM	5%	1/6W	RD1/6FS
R4	40-16-0101	FXD C FILM	10	OHM	5%	1/6W	RD1/6FS
R5	40-16-1821	FXD C FILM	820	OHM	5%	1/6W	RD1/6FS
R6	42-80-3471	FXD M FILM	47K	OHM	1%	1/6W	RN1/6FS
R7	42-80-2221	FXD M FILM	2.2K	OHM	1%	1/6W	RN1/6FS
R9	40-16-1331	FXD C FILM	330	OHM	5%	1/6W	RD1/6FS
R10	40-16-2331	FXD C FILM	3.3K	OHM	5%	1/6W	RD1/6FS
R11	40-16-2331	FXD C FILM	3.3K	OHM	5%	1/6W	RD1/6FS
R12	40-16-2561	FXD C FILM	5.6K	OHM	5%	1/6W	RD1/6FS
R13	42-80-2331	FXD M FILM	3.3K	OHM	1%	1/6W	RN1/6FS
R14	42-80-2471	FXD M FILM	4.7K	OHM	1%	1/6W	RN1/6FS
R15	40-16-2221	FXD C FILM	2.2K	OHM	5%	1/6W	RD1/6FS
R16	40-16-1681	FXD C FILM	680	OHM	5%	1/6W	RD1/6FS

REFERENCE DESIGNATOR	KIKUSUI PARTS NO.	DESCRIPTION	97-11-0060	
R17	44-07-0070	FXD M GLAZE R-NET	3.3K OHM X8	
R18	44-07-0150	FXD M GLAZE R-NET	4.7K OHM X4	
R24	40-16-3221	FXD C FILM 22K	OHM 5% 1/6W	RD1/6FS
R25	40-16-2101	FXD C FILM 1K	OHM 5% 1/6W	RD1/6FS
R26	40-16-1821	FXD C FILM 820	OHM 5% 1/6W	RD1/6FS
R27	40-16-2101	FXD C FILM 1K	OHM 5% 1/6W	RD1/6FS
R28	40-16-2181	FXD C FILM 1.8K	OHM 5% 1/6W	RD1/6FS
R29	40-16-2181	FXD C FILM 1.8K	OHM 5% 1/6W	RD1/6FS
R30	40-16-1101	FXD C FILM 100	OHM 5% 1/6W	RD1/6FS
R31	40-16-1391	FXD C FILM 390	OHM 5% 1/6W	RD1/6FS
R32	42-80-2151	FXD M FILM 1.5K	OHM 1% 1/6W	RN1/6FS
R33	42-80-2331	FXD M FILM 3.3K	OHM 1% 1/6W	RN1/6FS
R34	40-16-2471	FXD C FILM 4.7K	OHM 5% 1/6W	RD1/6FS
R35	40-16-5101	FXD C FILM 1M	OHM 5% 1/6W	RD1/6FS
R36	40-16-3101	FXD C FILM 10K	OHM 5% 1/6W	RD1/6FS
R37	40-16-3561	FXD C FILM 56K	OHM 5% 1/6W	RD1/6FS
R38	40-16-2221	FXD C FILM 2.2K	OHM 5% 1/6W	RD1/6FS
R39	40-16-2221	FXD C FILM 2.2K	OHM 5% 1/6W	RD1/6FS
R40	40-16-3101	FXD C FILM 10K	OHM 5% 1/6W	RD1/6FS
R41	40-16-3101	FXD C FILM 10K	OHM 5% 1/6W	RD1/6FS
R42	40-16-3101	FXD C FILM 10K	OHM 5% 1/6W	RD1/6FS
R43	42-80-2561	FXD M FILM 5.6K	OHM 1% 1/6W	RN1/6FS
R44	40-16-2271	FXD C FILM 2.7K	OHM 5% 1/6W	RD1/6FS
R45	42-80-3101	FXD M FILM 10K	OHM 1% 1/6W	RN1/6FS
R46	42-80-2391	FXD M FILM 3.9K	OHM 1% 1/6W	RN1/6FS
R47	42-80-1271	FXD M FILM 270	OHM 1% 1/6W	RN1/6FS
R48	42-80-1681	FXD M FILM 680	OHM 1% 1/6W	RN1/6FS
R49	42-80-1471	FXD M FILM 470	OHM 1% 1/6W	RN1/6FS
R50	42-80-2471	FXD M FILM 4.7K	OHM 1% 1/6W	RN1/6FS
R51	40-16-1221	FXD C FILM 220	OHM 5% 1/6W	RD1/6FS
R52	42-80-3101	FXD M FILM 10K	OHM 1% 1/6W	RN1/6FS
R53	42-80-2821	FXD M FILM 8.2K	OHM 1% 1/6W	RN1/6FS
R54	42-80-1471	FXD M FILM 470	OHM 1% 1/6W	RN1/6FS
R55	42-80-1681	FXD M FILM 680	OHM 1% 1/6W	RN1/6FS
R56	42-80-1271	FXD M FILM 270	OHM 1% 1/6W	RN1/6FS
R57	40-16-3101	FXD C FILM 10K	OHM 5% 1/6W	RD1/6FS
R58	42-80-1101	FXD M FILM 100	OHM 1% 1/6W	RN1/6FS
R59	40-16-2221	FXD C FILM 2.2K	OHM 5% 1/6W	RD1/6FS
R60	40-16-2221	FXD C FILM 2.2K	OHM 5% 1/6W	RD1/6FS
R61	40-16-2221	FXD C FILM 2.2K	OHM 5% 1/6W	RD1/6FS
R63	40-16-2331	FXD C FILM 3.3K	OHM 5% 1/6W	RD1/6FS
R64	40-16-1101	FXD C FILM 100	OHM 5% 1/6W	RD1/6FS
R65	40-16-2221	FXD C FILM 2.2K	OHM 5% 1/6W	RD1/6FS
RV1	48-37-3100	VAR M FILM 10K	OHM B	VM5CKPV
U01	35-70-0746	DUAL D F-F EDGE TRIGGER		TOSHIBA TC74HC74P
U05	35-70-0046	HEX INVERTERS		TOSHIBA TC74HC04P
U06	35-70-1396	2LINE TO 4LINE DECODER		TOSHIBA TC74HC139P
U07	35-70-0086	QUAD 2-INPUT POSI-AND		TOSHIBA TC74HC08P
U11	35-70-0746	DUAL D F-F EDGE TRIGGER		TOSHIBA TC74HC74P
U12	36-90-0110	Z80A-CPU 4MHZ		SHARP LH0080A
U13	35-05-0010	EPROM 32K X 8BIT 250NS (CMOS)		27C256
U15	35-56-0111	S-RAM 2KX8BIT CMOS		HITACHI HM6116P-3

REFERENCE DESIGNATOR	KIKUSUI PARTS NO.	DESCRIPTION	97-11-0060
U16	35-53-0304	8-INPUT POSI-NAND GATE	TOSIHB A TC74HC30P
U18	35-70-1646	8BIT PARALOAD SHIFTREGISTER	HITACHI HD74HC164P
U21	35-70-1576	QUAD 2-TO-1 DATA SELECTORS	TOSHIBA TC74HC157P
U26	34-44-0010	RESET IC	TEXAS INS. TL7705CP
U28	35-70-0006	QUAD 2-INPUT POSI-NAND	TOSHIBA TC74HC00P
U33	35-56-0080	S-RAM 2KW X 8BIT 200NS	HITACHI HM6117LP-4
U34	35-53-2454	OCTAL BUS TRANSCEIVER	TOSHIBA TC74HC245P
U36	35-53-5414	OCTAL BUFFER	TEXAS INS. SN7HCS541N
U37	35-53-1744	HEX D-TYPE FLIP FLOP	TOSHIBA TC74HC174P
U38	35-70-2991	8 BIT SHIFT RESISTER	TEXAS INS. SN74LS299N
U41	35-70-1576	QUAD 2-TO-1 DATA SELECTORS	TOSHIBA TC74HC157P
U42	35-70-1576	QUAD 2-TO-1 DATA SELECTORS	TOSHIBA TC74HC157P
U43	35-70-1576	QUAD 2-TO-1 DATA SELECTORS	TOSHIBA TC74HC157P
U45	35-70-1386	3LINE TO 8LINE DECORDER	HITACHI HD74HC138P
U46	35-70-1396	2LINE TO 4LINE DECORDER	TOSHIBA TC74HC139P
U47	35-70-0326	QUAD 2-INPUT POSI-OR	TOSHIBA TC74HC32P
U51	35-53-1074	DUAL J-K F-F WITH P/C	TOSHIBA TC74HC107P
U52	35-56-0665	QUAD BILATERAL SWITCH	TOSHIBA TC74HC4066
U53	35-70-0111	TRI 3-INPUT POSI-AND	HITACHI HD74LS11P
U54	35-53-3904	DUAL DECADE COUNTERS	TOSHIBA TC74HC390P
U55	35-53-3904	DUAL DECADE COUNTERS	TOSHIBA TC74HC390P
U56	35-53-2574	QUAD DATA SELEC./MULTI.	TOSHIBA TC74HC257P
U57	35-70-0326	QUAD 2-INPUT POSI-OR	TOSHIBA TC74HC32P
U61	35-70-0046	HEX INVERTERS	TOSHIBA TC74HC04P
U62	35-56-0945	8 BIT SHIFT/STORE RESISTER	TOSHIBA TC74HC4094
U63	35-53-1074	DUAL J-K F-F WITH P/C	TOSHIBA TC74HC107P
U64	35-56-0665	QUAD BILATERAL SWITCH	TOSHIBA TC74HC4066
U65	35-70-0746	DUAL D F-F EDGE TRIGGER	TOSHIBA TC74HC74P
U66	35-57-0530	3 DIG BCD COUNTER	MOTOROLA MC14553B
U67	35-53-2574	QUAD DATA SELEC./MULTI.	TOSHIBA TC74HC257P
U71	35-73-5900	8 BIT BINARY COUNTER/RESISTER	TEXAS INS. SN74LS590N
U72	35-42-0010	P ROM 32 X 8BIT 25NS	TEXAS INS. TBP18S030N
U73	35-70-5746	OCTAL D TYPE EDGE TRIG F/F	TOSHIBA TC74HC574P
U74	35-70-0086	QUAD 2-INPUT POSI-AND	TOSHIBA TC74HC08P
U75	35-53-3934	DUAL 4 BIT BINALY COUNTER	TOSHIBA TC74HC393P
U76	35-73-5900	8 BIT BINARY COUNTER/RESISTER	TEXAS INS. SN74LS590N
U77	35-53-5414	OCTAL BUFFER	TEXAS INS. SN7HCS541N
U78	35-53-1254	QUAD BUS BUFFER GATES (3-ST)	TOSHIBA TC74HC125P
U81	35-70-0746	DUAL D F-F EDGE TRIGGER	TOSHIBA TC74HC74P
U82	35-70-0326	QUAD 2-INPUT POSI-OR	TOSHIBA TC74HC32P
U83	35-53-0144	HEX SHMITT-TRIG INVERTER	TOSHIBA TC74HC14P
U84	35-70-0046	HEX INVERTERS	TOSHIBA TC74HC04P
U85	35-56-0111	S-RAM 2KX8BIT CMOS	HITACHI HM6116P-3
U86	35-70-5746	OCTAL D TYPE EDGE TRIG F/F	TOSHIBA TC74HC574P
U87	35-53-2454	OCTAL BUS TRANSCEIVER	TOSHIBA TC74HC245P
U91	35-53-3904	DUAL DECADE COUNTERS	TOSHIBA TC74HC390P
U92	34-69-0080	TRIPLE 8-CHANNEL MULTIPLEXER	TOSHIBA TC4051BP
U93	34-69-0030	TRIPLE 2-CHANNEL MULTIPLEXER	TOSHIBA TC4053BP
U94	35-53-3934	DUAL 4 BIT BINALY COUNTER	TOSHIBA TC74HC393P
U101	35-53-3904	DUAL DECADE COUNTERS	TOSHIBA TC74HC390P
U102	35-56-0945	8 BIT SHIFT/STORE RESISTER	TOSHIBA TC74HC4094
U103	35-70-0086	QUAD 2-INPUT POSI-AND	TOSHIBA TC74HC08P
U104	35-70-5746	OCTAL D TYPE EDGE TRIG F/F	TOSHIBA TC74HC574P
U105	35-05-0010	EPROM 32K X 8BIT 250NS (CMOS)	27C256

REFERENCE KIKUSUI  
DESIGNATOR PARTS NO. DESCRIPTION 97-11-0060

U106	35-70-0086	QUAD 2-INPUT POSI-AND	TOSHIBA	TC74HC08P
U107	35-56-0945	8 BIT SHIFT/STORE RESISTER	TOSHIBA	TC74HC4094
U112	35-70-0046	HEX INVERTERS	TOSHIBA	TC74HC04P
U113	35-70-0746	DUAL D F-F EDGE TRIGGER	TOSHIBA	TC74HC74P
U114	34-22-0010	D/A CONVERTER 8BIT 85NS	HITACHI	HA17008RP
U115	35-70-1736	4 BIT D TYPE RESISTERS	TOSHIBA	TC74HC173P
U116	34-22-0010	D/A CONVERTER 8BIT 85NS	HITACHI	HA17008RP
U117	34-00-0340	FET INPUT DUAL OP AMP	TEXAS INS.	TL082CP
U118	34-69-0070	ANALOG MULTIPLEXER	HITACHI	HD14052B
X1	93-00-0180	QUARTS HC-49/U 8MHZ	KIKUSUI	S8409201
X2	93-00-0230	QUARTS HC-49/U 10MHZ (AT)	KIKUSUI	S8510031

REFERENCE KIKUSUI  
DESIGNATOR PARTS NO. DESCRIPTION 97-11-0070

A10 ASSEMBLY

C1	52-01-3365	FXD	CER	1500PF	10%	50V	TYPE2		
C2	52-01-3365	FXD	CER	1500PF	10%	50V	TYPE2		
C3	52-01-3365	FXD	CER	1500PF	10%	50V	TYPE2		
C4	52-01-3365	FXD	CER	1500PF	10%	50V	TYPE2		
C5	52-01-3365	FXD	CER	1500PF	10%	50V	TYPE2		
C6	52-01-3365	FXD	CER	1500PF	10%	50V	TYPE2		
C7	50-67-0030	FXD	PLSTC FILM	0.01MF	10%	100WV			
C8	55-37-2100	FXD	TANT ELECT	10UF		35V			
C9	52-05-2468	FXD	CER	0.01UF	+80-20%	50V	TYPE2		
C10	54-40-1200	FXD	ELECT	10MF		50WV			
C11	52-05-2468	FXD	CER	0.01UF	+80-20%	50V	TYPE2		
C12	54-40-1200	FXD	ELECT	10MF		50WV			
C13	52-06-2225	FXD	CER	100PF	10%	50V	TYPE1		
C15	52-37-1000	FXD	CER	0.047UF	20%	25V	TYPE1		
C16	52-01-2305	FXD	CER	470PF	10%	50V	TYPE2		
C17	52-06-2184	FXD	CER	47PF	10%	50V	TYPE1		
C18	52-37-1000	FXD	CER	0.047UF	20%	25V	TYPE1		
C19	52-37-1000	FXD	CER	0.047UF	20%	25V	TYPE1		
C20	54-40-1200	FXD	ELECT	10MF		50WV			
C21	54-40-1200	FXD	ELECT	10MF		50WV			
C22	54-40-1200	FXD	ELECT	10MF		50WV			
C23	52-37-1000	FXD	CER	0.047UF	20%	25V	TYPE1		
C24	54-40-1200	FXD	ELECT	10MF		50WV			
C25	54-40-1200	FXD	ELECT	10MF		50WV			
C26	54-30-1960	FXD	ELECT	47MF		25WV			
C27	52-37-1000	FXD	CER	0.047UF	20%	25V	TYPE1		
C28	54-40-1200	FXD	ELECT	10MF		50WV			
C29	54-40-1200	FXD	ELECT	10MF		50WV			
C30	54-40-1200	FXD	ELECT	10MF		50WV			
C31	54-30-1960	FXD	ELECT	47MF		25WV			
C32	54-40-1200	FXD	ELECT	10MF		50WV			
C33	54-40-1200	FXD	ELECT	10MF		50WV			
C34	52-37-1000	FXD	CER	0.047UF	20%	25V	TYPE1		
C35	52-37-1000	FXD	CER	0.047UF	20%	25V	TYPE1		
C36	52-37-1000	FXD	CER	0.047UF	20%	25V	TYPE1		
C37	52-37-1000	FXD	CER	0.047UF	20%	25V	TYPE1		
C38	52-37-1000	FXD	CER	0.047UF	20%	25V	TYPE1		
C39	54-20-1220	FXD	ELECT	470MF		16WV		KME16VB470	
CR1	32-30-1200		DIODE	VR=60V	IO=1A		HITACHI	1SS120	
CR2	32-30-1200		DIODE	VR=60V	IO=1A		HITACHI	1SS120	
CR3	32-30-1200		DIODE	VR=60V	IO=1A		HITACHI	1SS120	
R1	40-16-4101	FXD	C	FILM	100K	OHM	5%	1/6W	RD1/6FS
R2	40-16-4101	FXD	C	FILM	100K	OHM	5%	1/6W	RD1/6FS
R3	40-16-4101	FXD	C	FILM	100K	OHM	5%	1/6W	RD1/6FS
R4	40-16-4101	FXD	C	FILM	100K	OHM	5%	1/6W	RD1/6FS
R5	40-16-4101	FXD	C	FILM	100K	OHM	5%	1/6W	RD1/6FS
R6	40-16-4101	FXD	C	FILM	100K	OHM	5%	1/6W	RD1/6FS
R8	40-16-2271	FXD	C	FILM	2.7K	OHM	5%	1/6W	RD1/6FS

REFERENCE DESIGNATOR	KIKUSUI PARTS NO.	DESCRIPTION	97-11-0070	
R9	40-16-3101	FXD C FILM 10K	OHM 5% 1/6W	RD1/6FS
R10	40-16-4101	FXD C FILM 100K	OHM 5% 1/6W	RD1/6FS
R11	40-16-3101	FXD C FILM 10K	OHM 5% 1/6W	RD1/6FS
R12	40-16-3101	FXD C FILM 10K	OHM 5% 1/6W	RD1/6FS
R13	40-16-3101	FXD C FILM 10K	OHM 5% 1/6W	RD1/6FS
R14	40-16-3101	FXD C FILM 10K	OHM 5% 1/6W	RD1/6FS
R15	42-80-2101	FXD M FILM 1K	OHM 1% 1/6W	RN1/6FS
R16	42-80-2101	FXD M FILM 1K	OHM 1% 1/6W	RN1/6FS
R17	42-80-2101	FXD M FILM 1K	OHM 1% 1/6W	RN1/6FS
R18	42-80-2391	FXD M FILM 3.9K	OHM 1% 1/6W	RN1/6FS
R19	42-80-2391	FXD M FILM 3.9K	OHM 1% 1/6W	RN1/6FS
R21	40-16-1101	FXD C FILM 100	OHM 5% 1/6W	RD1/6FS
R22	40-16-0221	FXD C FILM 22	OHM 5% 1/6W	RD1/6FS
R23	40-16-1101	FXD C FILM 100	OHM 5% 1/6W	RD1/6FS
R24	40-16-1101	FXD C FILM 100	OHM 5% 1/6W	RD1/6FS
R25	40-16-2471	FXD C FILM 4.7K	OHM 5% 1/6W	RD1/6FS
R26	40-16-4101	FXD C FILM 100K	OHM 5% 1/6W	RD1/6FS
R27	40-16-2471	FXD C FILM 4.7K	OHM 5% 1/6W	RD1/6FS
R28	40-16-4101	FXD C FILM 100K	OHM 5% 1/6W	RD1/6FS
R29	40-16-3101	FXD C FILM 10K	OHM 5% 1/6W	RD1/6FS
R30	40-16-3101	FXD C FILM 10K	OHM 5% 1/6W	RD1/6FS
R32	40-16-2561	FXD C FILM 5.6K	OHM 5% 1/6W	RD1/6FS
R33	40-16-2221	FXD C FILM 2.2K	OHM 5% 1/6W	RD1/6FS
R35	40-16-2561	FXD C FILM 5.6K	OHM 5% 1/6W	RD1/6FS
R36	40-16-2221	FXD C FILM 2.2K	OHM 5% 1/6W	RD1/6FS
R37	40-16-2471	FXD C FILM 4.7K	OHM 5% 1/6W	RD1/6FS
R38	40-16-2471	FXD C FILM 4.7K	OHM 5% 1/6W	RD1/6FS
R39	40-16-0101	FXD C FILM 10	OHM 5% 1/6W	RD1/6FS
R40	40-16-0101	FXD C FILM 10	OHM 5% 1/6W	RD1/6FS
R41	40-27-0102	FXD C FILM 10	OHM 5% 1/4W	NAS1/4S
R43	42-80-2101	FXD M FILM 1K	OHM 1% 1/6W	RN1/6FS
R44	42-80-1151	FXD M FILM 150	OHM 1% 1/6W	RN1/6FS
R45	40-16-3471	FXD C FILM 47K	OHM 5% 1/6W	RD1/6FS
U1	35-57-0840	HEX SCHMITT TRIGGER	TOSHIBA	TC4584BP
U2	35-70-0086	QUAD 2-INPUT POSI-AND	TOSHIBA	TC74HC08P
U3	35-70-1936	4 BIT UP/DOWN BINARY COUNTERS	TOSHIBA	TC74HC193P
U4	35-70-1936	4 BIT UP/DOWN BINARY COUNTERS	TOSHIBA	TC74HC193P
U5	35-70-1936	4 BIT UP/DOWN BINARY COUNTERS	TOSHIBA	TC74HC193P
U6	35-69-0010	DUAL MONOSTABLE MULTI	MOTOROLA	MC14538BCP
U7	35-53-5414	OCTAL BUFFER	TEXAS INS.	SN7HCS541N
U8	35-53-5414	OCTAL BUFFER	TEXAS INS.	SN7HCS541N
U9	35-70-1386	3LINE TO 8LINE DECODER	HITACHI	HD74HC138P
U10	35-70-0326	QUAD 2-INPUT POSI-OR	TOSHIBA	TC74HC32P
U11	35-70-5746	OCTAL D TYPE EDGE TRIG F/F	TOSHIBA	TC74HC574P
U12	35-70-5746	OCTAL D TYPE EDGE TRIG F/F	TOSHIBA	TC74HC574P
U13	36-20-0100	D/A CONVERTER 12BIT	HITACHI	HA17012PB
U14	34-00-0390	FET INPUT DUAL OP AMP	NEC	UPC812C
U15	34-20-0130	DUAL COMPARATORS	HITACHI	HA17903PS
U16	35-53-3654	HEX BUS DRIVERS	TOSHIBA	TC74HC365P
U17	35-02-0020	PROG. KEY & DISP CONTROL	NEC	UPD8279C-
U18	35-53-0304	8-INPUT POSI-NAND GATE	TOSHIBA	TC74HC30P
U19	35-70-0046	HEX INVERTERS	TOSHIBA	TC74HC04P
U20	34-00-0340	FET INPUT DUAL OP AMP	TEXAS INS.	TL082CP

REFERENCE KIKUSUI  
DESIGNATOR PARTS NO.

DESCRIPTION 97-11-0261

A11 ASSEMBLY

C1	54-40-1200	FXD	ELECT	10MF	50WV	
C2	54-20-1210	FXD	ELECT	220MF	16WV	KME16VB220
C3	54-40-1200	FXD	ELECT	10MF	50WV	
C4	54-20-1210	FXD	ELECT	220MF	16WV	KME16VB220
C5	54-40-1200	FXD	ELECT	10MF	50WV	
C6	54-40-1200	FXD	ELECT	10MF	50WV	
C7	52-37-1000	FXD	CER	0.047UF	20% 25V TYPE1	
C8	54-40-1200	FXD	ELECT	10MF	50WV	
CR1	37-00-0440	LAMP	LED	RED	TOSHIBA	TLUY163
CR3	37-00-0440	LAMP	LED	RED	TOSHIBA	TLUY163
CR4	37-00-0430	LAMP	LED	GREEN	TOSHIBA	TLUG163
CR5	37-00-0440	LAMP	LED	RED	TOSHIBA	TLUY163
CR7	37-00-0440	LAMP	LED	RED	TOSHIBA	TLUY163
CR8	37-00-0430	LAMP	LED	GREEN	TOSHIBA	TLUG163
CR11	37-00-0440	LAMP	LED	RED	TOSHIBA	TLUY163
CR12	37-00-0430	LAMP	LED	GREEN	TOSHIBA	TLUG163
CR13	37-00-0440	LAMP	LED	RED	TOSHIBA	TLUY163
CR14	37-00-0440	LAMP	LED	RED	TOSHIBA	TLUY163
CR15	37-00-0440	LAMP	LED	RED	TOSHIBA	TLUY163
CR16	37-00-0430	LAMP	LED	GREEN	TOSHIBA	TLUG163
CR17	37-00-0440	LAMP	LED	RED	TOSHIBA	TLUY163
CR18	37-00-0440	LAMP	LED	RED	TOSHIBA	TLUY163
CR21	37-00-0440	LAMP	LED	RED	TOSHIBA	TLUY163
CR22	37-00-0440	LAMP	LED	RED	TOSHIBA	TLUY163
CR23	37-00-0440	LAMP	LED	RED	TOSHIBA	TLUY163
CR24	37-00-0440	LAMP	LED	RED	TOSHIBA	TLUY163
CR25	37-00-0440	LAMP	LED	RED	TOSHIBA	TLUY163
CR26	37-00-0440	LAMP	LED	RED	TOSHIBA	TLUY163
CR27	37-00-0430	LAMP	LED	GREEN	TOSHIBA	TLUG163
CR28	37-00-0440	LAMP	LED	RED	TOSHIBA	TLUY163
CR31	37-00-0440	LAMP	LED	RED	TOSHIBA	TLUY163
CR32	37-00-0430	LAMP	LED	GREEN	TOSHIBA	TLUG163
CR33	37-00-0440	LAMP	LED	RED	TOSHIBA	TLUY163
CR34	37-00-0440	LAMP	LED	RED	TOSHIBA	TLUY163
CR35	37-00-0440	LAMP	LED	RED	TOSHIBA	TLUY163
CR36	37-00-0430	LAMP	LED	GREEN	TOSHIBA	TLUG163
CR37	37-00-0430	LAMP	LED	GREEN	TOSHIBA	TLUG163
CR38	37-00-0430	LAMP	LED	GREEN	TOSHIBA	TLUG163
CR41	37-00-0440	LAMP	LED	RED	TOSHIBA	TLUY163
CR42	37-00-0440	LAMP	LED	RED	TOSHIBA	TLUY163
CR43	37-00-0440	LAMP	LED	RED	TOSHIBA	TLUY163
CR44	37-00-0440	LAMP	LED	RED	TOSHIBA	TLUY163
CR45	37-00-0430	LAMP	LED	GREEN	TOSHIBA	TLUG163
CR46	37-00-0430	LAMP	LED	GREEN	TOSHIBA	TLUG163
CR47	37-00-0430	LAMP	LED	GREEN	TOSHIBA	TLUG163
CR48	37-00-0430	LAMP	LED	GREEN	TOSHIBA	TLUG163
CR51	37-00-0440	LAMP	LED	RED	TOSHIBA	TLUY163
CR52	37-00-0440	LAMP	LED	RED	TOSHIBA	TLUY163
CR53	37-00-0440	LAMP	LED	RED	TOSHIBA	TLUY163

REFERENCE DESIGNATOR	KIKUSHI PARTS NO.	DESCRIPTION	97-11-0261
CR54	37-00-0440	LAMP LED RED	TOSHIBA TLUY163
CR55	37-00-0440	LAMP LED RED	TOSHIBA TLUY163
CR56	37-00-0440	LAMP LED RED	TOSHIBA TLUY163
CR57	37-00-0440	LAMP LED RED	TOSHIBA TLUY163
CR58	37-00-0430	LAMP LED GREEN	TOSHIBA TLUG163
CR61	37-00-0440	LAMP LED RED	TOSHIBA TLUY163
CR62	37-00-0440	LAMP LED RED	TOSHIBA TLUY163
CR63	37-00-0440	LAMP LED RED	TOSHIBA TLUY163
CR64	37-00-0440	LAMP LED RED	TOSHIBA TLUY163
CR65	37-00-0440	LAMP LED RED	TOSHIBA TLUY163
CR66	37-00-0440	LAMP LED RED	TOSHIBA TLUY163
CR67	37-00-0440	LAMP LED RED	TOSHIBA TLUY163
CR81	37-00-0440	LAMP LED RED	TOSHIBA TLUY163
CR82	37-00-0440	LAMP LED RED	TOSHIBA TLUY163
CR83	37-00-0440	LAMP LED RED	TOSHIBA TLUY163
CR84	37-00-0440	LAMP LED RED	TOSHIBA TLUY163
CR85	37-00-0430	LAMP LED GREEN	TOSHIBA TLUG163
CR86	37-00-0430	LAMP LED GREEN	TOSHIBA TLUG163
CR87	37-00-0430	LAMP LED GREEN	TOSHIBA TLUG163
CR88	37-00-0430	LAMP LED GREEN	TOSHIBA TLUG163
CR93	37-00-0440	LAMP LED RED	TOSHIBA TLUY163
CR94	37-00-0440	LAMP LED RED	TOSHIBA TLUY163
CR95	37-00-0440	LAMP LED RED	TOSHIBA TLUY163
CR101	37-00-0440	LAMP LED RED	TOSHIBA TLUY163
CR102	37-00-0440	LAMP LED RED	TOSHIBA TLUY163
CR103	37-00-0440	LAMP LED RED	TOSHIBA TLUY163
CR104	37-00-0440	LAMP LED RED	TOSHIBA TLUY163
CR105	37-00-0440	LAMP LED RED	TOSHIBA TLUY163
CR106	37-00-0440	LAMP LED RED	TOSHIBA TLUY163
CR111	37-00-0440	LAMP LED RED	TOSHIBA TLUY163
CR112	37-00-0440	LAMP LED RED	TOSHIBA TLUY163
CR113	37-00-0440	LAMP LED RED	TOSHIBA TLUY163
CR114	37-00-0440	LAMP LED RED	TOSHIBA TLUY163
CR115	37-00-0440	LAMP LED RED	TOSHIBA TLUY163
CR116	37-00-0440	LAMP LED RED	TOSHIBA TLUY163
CR117	37-00-0440	LAMP LED RED	TOSHIBA TLUY163
CR118	37-00-0440	LAMP LED RED	TOSHIBA TLUY163
CR121	37-00-0440	LAMP LED RED	TOSHIBA TLUY163
CR122	37-00-0440	LAMP LED RED	TOSHIBA TLUY163
L1	67-10-0890	INDUCTOR 100MH 10%	
L2	67-10-0890	INDUCTOR 100MH 10%	
Q1	30-11-0151	TR SI PNP	TOSHIBA 2SA1015-Y
R1	40-16-0221	FXD C FILM 22 OHM 5% 1/6W	RD1/6FS
R2	40-16-0221	FXD C FILM 22 OHM 5% 1/6W	RD1/6FS
R3	40-16-0221	FXD C FILM 22 OHM 5% 1/6W	RD1/6FS
R4	40-16-0221	FXD C FILM 22 OHM 5% 1/6W	RD1/6FS
R5	40-16-0221	FXD C FILM 22 OHM 5% 1/6W	RD1/6FS
R6	40-16-0221	FXD C FILM 22 OHM 5% 1/6W	RD1/6FS
R7	40-16-0221	FXD C FILM 22 OHM 5% 1/6W	RD1/6FS
R8	40-16-0221	FXD C FILM 22 OHM 5% 1/6W	RD1/6FS
R9	40-16-2471	FXD C FILM 4.7K OHM 5% 1/6W	RD1/6FS

REFERENCE DESIGNATOR	KIKUSUI PARTS NO.	DESCRIPTION		97-11-0261				
R10	40-16-2101	FXD	C FILM	1K	OHM	5%	1/6W	RD1/6FS
R12	40-16-1331	FXD	C FILM	330	OHM	5%	1/6W	RD1/6FS
R13	44-07-0020	FXD	M GLAZE	R-NET	10K	OHM	X4	
R15	40-16-3101	FXD	C FILM	10K	OHM	5%	1/6W	RD1/6FS
R16	40-16-3101	FXD	C FILM	10K	OHM	5%	1/6W	RD1/6FS
RV1	45-01-0820	VAR	C COMP					KIKUSUI V12L5DM1S
RV2	45-01-0820	VAR	C COMP					KIKUSUI V12L5DM1S
RV3	45-01-0830	VAR	C COMP					KIKUSUI V12L5DM1S
RV4	45-02-0280	VAR	C COMP	20K/20K	OHM	B		KIKUSUI V12LG3N
RV5	45-01-0810	VAR	C COMP	20K/20K	OHM	B		KIKUSUI V12LG3S
RV6	45-02-0280	VAR	C COMP	20K/20K	OHM	B		KIKUSUI V12LG3N
RV7	45-02-0280	VAR	C COMP	20K/20K	OHM	B		KIKUSUI V12LG3N
RV8	45-01-0810	VAR	C COMP	20K/20K	OHM	B		KIKUSUI V12LG3S
RV9	45-02-0280	VAR	C COMP	20K/20K	OHM	B		KIKUSUI V12LG3N
RV10	45-01-0810	VAR	C COMP	20K/20K	OHM	B		KIKUSUI V12LG3S
S1	81-01-0870	PUSH	SWITCH					TM1-01
S2	81-01-0870	PUSH	SWITCH					TM1-01
S3	81-01-0870	PUSH	SWITCH					TM1-01
S4	81-01-0870	PUSH	SWITCH					TM1-01
S5	81-01-0870	PUSH	SWITCH					TM1-01
S6	81-01-0870	PUSH	SWITCH					TM1-01
S11	81-01-0870	PUSH	SWITCH					TM1-01
S12	81-01-0870	PUSH	SWITCH					TM1-01
S13	81-01-0870	PUSH	SWITCH					TM1-01
S14	81-01-0870	PUSH	SWITCH					TM1-01
S15	81-01-0870	PUSH	SWITCH					TM1-01
S16	81-01-0870	PUSH	SWITCH					TM1-01
S21	81-01-0870	PUSH	SWITCH					TM1-01
S22	81-01-0870	PUSH	SWITCH					TM1-01
S23	81-01-0870	PUSH	SWITCH					TM1-01
S24	81-01-0870	PUSH	SWITCH					TM1-01
S25	81-01-0870	PUSH	SWITCH					TM1-01
S26	81-01-0870	PUSH	SWITCH					TM1-01
S27	81-01-0870	PUSH	SWITCH					TM1-01
S28	81-01-0870	PUSH	SWITCH					TM1-01
S31	81-01-0870	PUSH	SWITCH					TM1-01
S32	81-01-0870	PUSH	SWITCH					TM1-01
S33	81-01-0870	PUSH	SWITCH					TM1-01
S34	81-01-0870	PUSH	SWITCH					TM1-01
S35	81-01-0870	PUSH	SWITCH					TM1-01
S36	81-01-0870	PUSH	SWITCH					TM1-01
S37	81-01-0870	PUSH	SWITCH					TM1-01
S41	81-01-0870	PUSH	SWITCH					TM1-01
S43	81-01-0870	PUSH	SWITCH					TM1-01
S44	81-01-0870	PUSH	SWITCH					TM1-01
S45	81-01-0870	PUSH	SWITCH					TM1-01
S46	81-01-0870	PUSH	SWITCH					TM1-01
S49	81-01-0870	PUSH	SWITCH					TM1-01
S51	81-01-0870	PUSH	SWITCH					TM1-01
S52	81-01-0870	PUSH	SWITCH					TM1-01
S55	81-01-0870	PUSH	SWITCH					TM1-01
S61	81-01-0870	PUSH	SWITCH					TM1-01

REFERENCE KIKUSUI  
 DESIGNATOR PARTS NO. DESCRIPTION 97-11-0261

S62	81-01-0870	PUSH SWITCH		TM1-01
S63	81-01-0870	PUSH SWITCH		TM1-01
S64	81-01-0870	PUSH SWITCH		TM1-01
S65	81-01-0870	PUSH SWITCH		TM1-01
S66	81-01-0870	PUSH SWITCH		TM1-01
S67	81-01-0870	PUSH SWITCH		TM1-01
S68	81-01-0870	PUSH SWITCH		TM1-01
S71	81-01-0870	PUSH SWITCH		TM1-01
S107	81-01-0860	PUSH SWITCH	ALPS	SSCTP1
U1	35-91-0010	8-LINE DRIVER	TOSHIBA	TD62381P
U2	35-70-1386	3LINE TO 8LINE DECODER	HITACHI	HD74HC138P
U3	35-91-0020	8-LINE DRIVER	TOSHIBA	TD62785P
U4	35-70-1386	3LINE TO 8LINE DECODER	HITACHI	HD74HC138P
U5	35-91-0020	8-LINE DRIVER	TOSHIBA	TD62785P
U6	35-62-0010	8-CH ANALOG MULTI-PLX	HITACHI	HD14051BP
U7	35-62-0010	8-CH ANALOG MULTI-PLX	HITACHI	HD14051BP
U8	35-70-1386	3LINE TO 8LINE DECODER	HITACHI	HD74HC138P

REFERENCE KIKUSUI  
DESIGNATOR PARTS NO.

DESCRIPTION 97-11-0280

A12 ASSEMBLY

C1	52-77-1010	FXD CER	1000PF	250VAC	FOR UL & CSA
C2	52-77-1010	FXD CER	1000PF	250VAC	FOR UL & CSA
C3	50-77-3510	FXD PLSTC FILM	0.1MF	20% 250AC	
C4	54-80-1110	FXD ELECT	120MF	400WV	KME400VNSN
C5	50-67-0030	FXD PLSTC FILM	0.01MF	10% 100WV	
C6	54-30-1960	FXD ELECT	47MF	25WV	
C7	52-03-3469	FXD CER	0.01UF	+100-0% 500V TYPE2	
C8	52-03-3469	FXD CER	0.01UF	+100-0% 500V TYPE2	
C9	52-01-4030	FXD CER	220PF	10% 1KVV	MATSUSITA ECKD3A221K
C10	50-67-0030	FXD PLSTC FILM	0.01MF	10% 100WV	
C11	50-67-0000	FXD PLSTC FILM	0.001MF	10% 100WV	
C12	52-01-3345	FXD CER	1000PF	10% 500V TYPE2	
C13	50-67-0060	FXD PLSTC FILM	0.1MF	10% 100WV	
C14	54-30-1960	FXD ELECT	47MF	25WV	
C16	52-03-3469	FXD CER	0.01UF	+100-0% 500V TYPE2	
C17	52-01-4030	FXD CER	220PF	10% 1KVV	MATSUSITA ECKD3A221K
C18	50-67-0030	FXD PLSTC FILM	0.01MF	10% 100WV	
C19	50-67-0000	FXD PLSTC FILM	0.001MF	10% 100WV	
C20	52-01-3345	FXD CER	1000PF	10% 500V TYPE2	
C21	50-67-0060	FXD PLSTC FILM	0.1MF	10% 100WV	
C22	54-30-1960	FXD ELECT	47MF	25WV	
C32	54-60-2070	FXD ELECT	22MF	200WV	KME200VB22
C33	54-60-2070	FXD ELECT	22MF	200WV	KME200VB22
C34	52-03-3469	FXD CER	0.01UF	+100-0% 500V TYPE2	
C35	50-67-0010	FXD PLSTC FILM	0.0022MF	10% 100WV	
C38	54-30-2800	FXD ELECT	680MF	35WV	SXE35VB680
C39	54-30-2800	FXD ELECT	680MF	35WV	SXE35VB680
C41	54-30-2800	FXD ELECT	680MF	35WV	SXE35VB680
C42	54-30-2800	FXD ELECT	680MF	35WV	SXE35VB680
C43	54-60-2070	FXD ELECT	22MF	200WV	KME200VB22
C44	52-03-3469	FXD CER	0.01UF	+100-0% 500V TYPE2	
C45	54-60-2070	FXD ELECT	22MF	200WV	KME200VB22
C46	54-60-2070	FXD ELECT	22MF	200WV	KME200VB22
C47	54-60-2070	FXD ELECT	22MF	200WV	KME200VB22
C48	54-30-2790	FXD ELECT	82MF	35WV	SXE35VB82
C49	54-30-2780	FXD ELECT	330MF	35WV	SXE35VB330
C50	54-30-2780	FXD ELECT	330MF	35WV	SXE35VB330
C51	54-20-1190	FXD ELECT	680MF	16WV	SXE16VB680
C52	50-67-0030	FXD PLSTC FILM	0.01MF	10% 100WV	
C53	54-10-2750	FXD ELECT	3900MF	10WV	SXE10VB
C54	54-10-2750	FXD ELECT	3900MF	10WV	SXE10VB
C55	50-67-0030	FXD PLSTC FILM	0.01MF	10% 100WV	
C56	54-10-2750	FXD ELECT	3900MF	10WV	SXE10VB
C57	54-10-2750	FXD ELECT	3900MF	10WV	SXE10VB
C58	50-67-0020	FXD PLSTC FILM	0.0047MF	10% 100WV	
C59	54-10-2740	FXD ELECT	820MF	10WV	SXE10VB820
C60	54-10-2740	FXD ELECT	820MF	10WV	SXE10VB820
C61	55-37-2030	FXD TANT ELECT	0.47MF	35V	
C62	54-10-2740	FXD ELECT	820MF	10WV	SXE10VB820
C63	52-77-1010	FXD CER	1000PF	250VAC	FOR UL & CSA

REFERENCE DESIGNATOR	KIKUSUI PARTS NO.	DESCRIPTION	97-11-0280	
C104	54-80-1110	FXD ELECT 120MF 400WV		KME400VNSN
C114	54-30-2790	FXD ELECT 82MF 35WV		SXE35VB82
C161	54-30-1960	FXD ELECT 47MF 25WV		
C173	55-37-2050	FXD TANT ELECT 1UF 35V		
CR1	32-90-2281	DIODE BRIGE VRM=600V IO=4A	TOSHIBA	4J4B41
CR2	32-90-0523	DIODE VR=600V IO=1A	TOSHIBA	S5277J
CR3	32-92-0130	ZENER VZ=12.4-13.1V P=0.4W	NEC	RD13JB1
CR4	32-90-3050	DIODE VR=800V IO=1A	HITACHI	DFG1C8
CR5	32-90-0550	DIODE VR=1KV IO=1A	HITACHI	V11M
CR6	32-90-0550	DIODE VR=1KV IO=1A	HITACHI	V11M
CR7	32-11-8350	DIODE VR=600V IO=1.0A	TOSHIBA	1S1835
CR8	32-30-1200	DIODE VR=60V IO=1A	HITACHI	1SS120
CR9	32-30-1200	DIODE VR=60V IO=1A	HITACHI	1SS120
CR10	32-30-1200	DIODE VR=60V IO=1A	HITACHI	1SS120
CR11	32-11-8350	DIODE VR=600V IO=1.0A	TOSHIBA	1S1835
CR12	32-11-8350	DIODE VR=600V IO=1.0A	TOSHIBA	1S1835
CR13	32-91-1805	ZENER VZ=5.48-5.76V P=0.4W	NEC	RD5.6JSB2
CR14	32-92-0062	ZENER VZ=5.8 - 6.6V P=0.4W	NEC	RD6.2JB
CR15	32-90-3050	DIODE VR=800V IO=1A	HITACHI	DFG1C8
CR16	32-90-0550	DIODE VR=1KV IO=1A	HITACHI	V11M
CR17	32-90-0550	DIODE VR=1KV IO=1A	HITACHI	V11M
CR18	32-11-8350	DIODE VR=600V IO=1.0A	TOSHIBA	1S1835
CR19	32-30-1200	DIODE VR=60V IO=1A	HITACHI	1SS120
CR20	32-30-1200	DIODE VR=60V IO=1A	HITACHI	1SS120
CR21	32-30-1200	DIODE VR=60V IO=1A	HITACHI	1SS120
CR22	32-11-8350	DIODE VR=600V IO=1.0A	TOSHIBA	1S1835
CR23	32-11-8350	DIODE VR=600V IO=1.0A	TOSHIBA	1S1835
CR24	32-91-1805	ZENER VZ=5.48-5.76V P=0.4W	NEC	RD5.6JSB2
CR30	32-90-3050	DIODE VR=800V IO=1A	HITACHI	DFG1C8
CR31	32-90-3050	DIODE VR=800V IO=1A	HITACHI	DFG1C8
CR32	32-90-1843	DIODE VR=200V IO=3A	N. INTER	30DF2
CR33	32-90-1843	DIODE VR=200V IO=3A	N. INTER	30DF2
CR34	32-91-2300	ZENER VZ=135 - 165V P=1W	TOSHIBA	1Z150
CR35	32-92-0130	ZENER VZ=12.4-13.1V P=0.4W	NEC	RD13JB1
CR36	32-92-0130	ZENER VZ=12.4-13.1V P=0.4W	NEC	RD13JB1
CR37	32-30-1200	DIODE VR=60V IO=1A	HITACHI	1SS120
CR38	32-92-0056	ZENER VZ=5.5 - 5.8V P=0.4W	NEC	RD5.6JB2
CR39	32-90-2970	DIODE VR= 40V IO=1.7A	SANKEN	RK14
CR40	32-90-2420	DIODE BRIGE VRM=40V IO=8A	N. INTER	C8P04Q
CR41	32-90-2980	DIODE VR= 40V IO=5A	NEC	5CS04SM
CR42	32-91-1805	ZENER VZ=5.48-5.76V P=0.4W	NEC	RD5.6JSB2
CR43	32-92-0100	ZENER VZ=10.1-10.6V P=0.4W	NEC	RD10JB3
L10	67-10-0890	INDUCTOR 100MH 10%		
L11	67-10-0890	INDUCTOR 100MH 10%		
L12	67-10-0890	INDUCTOR 100MH 10%		
L13	67-10-0890	INDUCTOR 100MH 10%		
L14	67-10-0921	INDUCTOR 470UH 10%		LAL04NA
L15	67-15-0320	INDUCTOR 15UH 4.5A		HP10D150M
L16	67-15-0320	INDUCTOR 15UH 4.5A		HP10D150M
L114	67-10-0921	INDUCTOR 470UH 10%		LAL04NA
PC1	37-30-0111	PHOT COUPLER	TOSHIBA	TLP521-1BL

REFERENCE DESIGNATOR	KIKUSUI PARTS NO.	DESCRIPTION	97-11-0280		
PC2	37-30-0111	PHOT COUPLER		TOSHIBA	TLP521-1BL
PC3	37-30-0111	PHOT COUPLER		TOSHIBA	TLP521-1BL
PC4	37-30-0111	PHOT COUPLER		TOSHIBA	TLP521-1BL
Q1	30-31-8151	TR SI NPN (50V 0.15A 0.4W)		TOSHIBA	2SC1815-Y
Q2	30-11-0151	TR SI PNP		TOSHIBA	2SA1015-Y
Q3	30-31-8461	TR SI NPN		MATSUSITA	2SC1846-R
Q4	30-33-5590	TR SI NPN (800V 3A 40W)		TOSHIBA	2SC3559
Q5	30-33-5520	TR SI NPN (1100V 12A 150W)		SANYO	2SC3552
Q6	30-31-1731	TR SI NPN (30V 3A 10W )		TOSHIBA	2SC1173-Y
Q7	30-33-5590	TR SI NPN (800V 3A 40W)		TOSHIBA	2SC3559
Q8	30-33-4610	TR SI NPN (1100V 8A 140W)		SANYO	2SC3461
Q9	30-11-0151	TR SI PNP		TOSHIBA	2SA1015-Y
Q10	30-31-1731	TR SI NPN (30V 3A 10W )		TOSHIBA	2SC1173-Y
Q11	30-21-0150	TR SI PNP (60V 3A 25W)		TOSHIBA	2SB1015-Y
Q12	30-41-4060	TR SI NPN (60V 3A 25W)		TOSHIBA	2SD1406-Y
Q13	30-41-4060	TR SI NPN (60V 3A 25W)		TOSHIBA	2SD1406-Y
Q14	30-31-8151	TR SI NPN (50V 0.15A 0.4W)		TOSHIBA	2SC1815-Y
Q15	30-31-8151	TR SI NPN (50V 0.15A 0.4W)		TOSHIBA	2SC1815-Y
Q16	30-11-0151	TR SI PNP		TOSHIBA	2SA1015-Y
R1	40-16-5101	FXD C FILM 1M OHM 5% 1/6W			RD1/6FS
R2	40-16-4471	FXD C FILM 470K OHM 5% 1/6W			RD1/6FS
R3	40-16-2221	FXD C FILM 2.2K OHM 5% 1/6W			RD1/6FS
R4	44-91-3684	FXD M OXIDE 68K OHM 5% 1W	MATSUSITA		ERG1ANJ
R5	40-16-3151	FXD C FILM 15K OHM 5% 1/6W			RD1/6FS
R6	40-16-2221	FXD C FILM 2.2K OHM 5% 1/6W			RD1/6FS
R7	40-16-2561	FXD C FILM 5.6K OHM 5% 1/6W			RD1/6FS
R8	40-16-2221	FXD C FILM 2.2K OHM 5% 1/6W			RD1/6FS
R9	40-37-4471	FXD C FILM 470K OHM 5% 1/2W			
R10	44-57-0540	FXD M OXIDE 100K OHM 5% 2W	MATSUSITA		ERG2SJ
R11	44-92-1474	FXD M OXIDE 470 OHM 5% 2W	MATSUSITA		ERG2ANJ
R12	44-91-1334	FXD M OXIDE 330 OHM 5% 1W	MATSUSITA		ERG1ANJ
R13	40-27-1472	FXD C FILM 470 OHM 5% 1/4W			
R14	42-83-0330	FXD M FILM 33 OHM 1% 1/4W			
R15	44-91-9224	FXD M OXIDE 0.22 OHM 5% 1W	MATSUSITA		ERX1ANJ
R16	42-80-1681	FXD M FILM 680 OHM 1% 1/6W			RN1/6FS
R17	40-16-8561	FXD C FILM 5.6 OHM 5% 1/6W			RD1/6FS
R18	40-16-8561	FXD C FILM 5.6 OHM 5% 1/6W			RD1/6FS
R19	42-80-1331	FXD M FILM 330 OHM 1% 1/6W			RN1/6FS
R20	40-16-1101	FXD C FILM 100 OHM 5% 1/6W			RD1/6FS
R21	40-16-2101	FXD C FILM 1K OHM 5% 1/6W			RD1/6FS
R22	40-16-1471	FXD C FILM 470 OHM 5% 1/6W			RD1/6FS
R23	40-37-4471	FXD C FILM 470K OHM 5% 1/2W			
R24	44-57-0540	FXD M OXIDE 100K OHM 5% 2W	MATSUSITA		ERG2SJ
R25	44-92-1474	FXD M OXIDE 470 OHM 5% 2W	MATSUSITA		ERG2ANJ
R26	44-91-1334	FXD M OXIDE 330 OHM 5% 1W	MATSUSITA		ERG1ANJ
R27	40-16-1471	FXD C FILM 470 OHM 5% 1/6W			RD1/6FS
R28	42-80-0221	FXD M FILM 22 OHM 1% 1/6W			RN1/6FS
R29	44-91-9474	FXD M OXIDE 0.47 OHM 5% 1W	MATSUSITA		ERX1ANJ
R30	42-80-1561	FXD M FILM 560 OHM 1% 1/6W			RN1/6FS
R31	40-16-8561	FXD C FILM 5.6 OHM 5% 1/6W			RD1/6FS
R32	42-80-1391	FXD M FILM 390 OHM 1% 1/6W			RN1/6FS
R33	40-16-1101	FXD C FILM 100 OHM 5% 1/6W			RD1/6FS

REFERENCE DESIGNATOR	KIKUSUI PARTS NO.	DESCRIPTION	97-11-0280
R34	40-16-2101	FXD C FILM 1K	OHM 5% 1/6W RD1/6FS
R35	40-16-1471	FXD C FILM 470	OHM 5% 1/6W RD1/6FS
R42	42-80-4151	FXD M FILM 150K	OHM 1% 1/6W RN1/6FS
R43	42-80-2271	FXD M FILM 2.7K	OHM 1% 1/6W RN1/6FS
R44	40-16-3101	FXD C FILM 10K	OHM 5% 1/6W RD1/6FS
R45	40-16-1471	FXD C FILM 470	OHM 5% 1/6W RD1/6FS
R46	40-16-2101	FXD C FILM 1K	OHM 5% 1/6W RD1/6FS
R49	44-91-9564	FXD M OXIDE 0.56	OHM 5% 1W MATSUSITA ERX1ANJ
R50	40-16-1151	FXD C FILM 150	OHM 5% 1/6W RD1/6FS
R51	44-92-0334	FXD M OXIDE 33	OHM 5% 2W MATSUSITA ERG2ANJ
R52	44-91-9564	FXD M OXIDE 0.56	OHM 5% 1W MATSUSITA ERX1ANJ
R53	40-16-1151	FXD C FILM 150	OHM 5% 1/6W RD1/6FS
R54	44-92-0151	FXD M OXIDE 15	OHM 5% 2W MATSUSITA ERG2ANJ
R55	40-16-2561	FXD C FILM 5.6K	OHM 5% 1/6W RD1/6FS
R56	40-16-2561	FXD C FILM 5.6K	OHM 5% 1/6W RD1/6FS
R57	40-16-2561	FXD C FILM 5.6K	OHM 5% 1/6W RD1/6FS
R58	42-80-2201	FXD M FILM 2K	OHM 1% 1/6W RN1/6FS
R59	42-80-2201	FXD M FILM 2K	OHM 1% 1/6W RN1/6FS
R60	40-16-2101	FXD C FILM 1K	OHM 5% 1/6W RD1/6FS
R61	40-16-2101	FXD C FILM 1K	OHM 5% 1/6W RD1/6FS
R65	40-16-1331	FXD C FILM 330	OHM 5% 1/6W RD1/6FS
R66	40-16-2101	FXD C FILM 1K	OHM 5% 1/6W RD1/6FS
R67	44-91-9824	FXD M OXIDE 0.82	OHM 5% 1W MATSUSITA ERX1ANJ
R68	42-80-2101	FXD M FILM 1K	OHM 1% 1/6W RN1/6FS
R69	42-80-2101	FXD M FILM 1K	OHM 1% 1/6W RN1/6FS
R70	40-16-3221	FXD C FILM 22K	OHM 5% 1/6W RD1/6FS
R71	40-27-0102	FXD C FILM 10	OHM 5% 1/4W NAS1/4S
R72	40-27-0102	FXD C FILM 10	OHM 5% 1/4W NAS1/4S
R73	42-80-2101	FXD M FILM 1K	OHM 1% 1/6W RN1/6FS
R74	42-80-2101	FXD M FILM 1K	OHM 1% 1/6W RN1/6FS
R75	40-16-3121	FXD C FILM 12K	OHM 5% 1/6W RD1/6FS
R76	40-16-1471	FXD C FILM 470	OHM 5% 1/6W RD1/6FS
R77	40-16-2101	FXD C FILM 1K	OHM 5% 1/6W RD1/6FS
R78	40-16-2221	FXD C FILM 2.2K	OHM 5% 1/6W RD1/6FS
R79	40-16-3221	FXD C FILM 22K	OHM 5% 1/6W RD1/6FS
R80	40-16-0221	FXD C FILM 22	OHM 5% 1/6W RD1/6FS
R81	40-16-2181	FXD C FILM 1.8K	OHM 5% 1/6W RD1/6FS
R82	40-16-2221	FXD C FILM 2.2K	OHM 5% 1/6W RD1/6FS
R165	40-16-1331	FXD C FILM 330	OHM 5% 1/6W RD1/6FS
R173	40-16-1681	FXD C FILM 680	OHM 5% 1/6W RD1/6FS
RT1	38-00-0120	THERMISTOR	8D13
RV1	48-31-2100	VAR M GLAZE 1K	OHM B PH
T1	67-10-1760	INDUCTOR 1MH	2.5A SC-02-10A2
T2	63-94-2140	SWITCHING TRANS T-4BL2 (BLK)	KIKUSUI S8513691
T3	63-94-2160	SWITCHING TRANS T6-6G (GRN)	KIKUSUI S8510481
TS1	82-91-0350	THERMOSTAT UL	5003F90B4
U1	34-90-0051	REGULATOR	TEXAS INS.TL431CLPB
U2	34-00-0240	DUAL OPE-AMP	NEC UPC4558C
U3	34-90-0051	REGULATOR	TEXAS INS.TL431CLPB

REFERENCE DESIGNATOR	KIKUSUI PARTS NO.	DESCRIPTION	97-11-0280
U4	34-90-0051	REGULATOR	TEXAS INS.TL431CLPB
VR1	39-00-0410	SURGE ABSORBER (430V)	MATSUSITA ERZC07DK

A13 ASSEMBLY	97-11-0250
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C1	54-30-1970	FXD ELECT	100MF	25WV
R1	40-37-0331	FXD C FILM	33	OHM 5% 1/2W

REFERENCE KIKUSUI  
DESIGNATOR PARTS NO. DESCRIPTION 97-11-0121

A14 ASSEMBLY

BT1	94-00-0210	BATTERY	3.0V	38MAH	LITHIUM	BR1225-IVD
C1	52-48-1050	FXD CER	0.1UF	20%	25V	D33Y5V1E
C2	52-01-2345	FXD CER	1000PF	10%	50V TYPE2	
C4	52-37-1000	FXD CER	0.047UF	20%	25V TYPE1	
C5	52-37-1000	FXD CER	0.047UF	20%	25V TYPE1	
C6	52-37-1000	FXD CER	0.047UF	20%	25V TYPE1	
C7	52-37-1000	FXD CER	0.047UF	20%	25V TYPE1	
C8	52-37-1000	FXD CER	0.047UF	20%	25V TYPE1	
C10	52-37-1000	FXD CER	0.047UF	20%	25V TYPE1	
C11	52-37-1000	FXD CER	0.047UF	20%	25V TYPE1	
C12	52-37-1000	FXD CER	0.047UF	20%	25V TYPE1	
C13	52-37-1000	FXD CER	0.047UF	20%	25V TYPE1	
C14	52-37-1000	FXD CER	0.047UF	20%	25V TYPE1	
C15	52-37-1000	FXD CER	0.047UF	20%	25V TYPE1	
C16	52-37-1000	FXD CER	0.047UF	20%	25V TYPE1	
C17	52-37-1000	FXD CER	0.047UF	20%	25V TYPE1	
C18	52-37-1000	FXD CER	0.047UF	20%	25V TYPE1	
C19	52-37-1000	FXD CER	0.047UF	20%	25V TYPE1	
C20	52-37-1000	FXD CER	0.047UF	20%	25V TYPE1	
C21	52-37-1000	FXD CER	0.047UF	20%	25V TYPE1	
C22	52-37-1000	FXD CER	0.047UF	20%	25V TYPE1	
C23	52-37-1000	FXD CER	0.047UF	20%	25V TYPE1	
C24	52-37-1000	FXD CER	0.047UF	20%	25V TYPE1	
C25	54-30-1960	FXD ELECT	47MF	25WV		
C26	54-30-1960	FXD ELECT	47MF	25WV		
CR1	32-92-0027	ZENER	VZ=2.5 - 2.8V		HITACHI	HZS-2.7EB1
CR2	32-30-1200	DIODE	VR=60V IO=1A		HITACHI	ISS120
CR3	32-30-1200	DIODE	VR=60V IO=1A		HITACHI	ISS120
CR4	32-30-1200	DIODE	VR=60V IO=1A		HITACHI	ISS120
Q1	30-32-1201	TR SI	NPN		TOSHIBA	2SC2120-Y
R1	40-16-3101	FXD C	FILM	10K OHM 5% 1/6W		RD1/6FS
R2	40-16-3101	FXD C	FILM	10K OHM 5% 1/6W		RD1/6FS
R3	40-16-2101	FXD C	FILM	1K OHM 5% 1/6W		RD1/6FS
R5	40-16-3101	FXD C	FILM	10K OHM 5% 1/6W		RD1/6FS
R6	40-16-2331	FXD C	FILM	3.3K OHM 5% 1/6W		RD1/6FS
RA1	44-08-0010	FXD M	GLAZE R-NET	10K OHM X8		TNA09A103J
RA2	44-08-0010	FXD M	GLAZE R-NET	10K OHM X8		TNA09A103J
RA3	44-07-0070	FXD M	GLAZE R-NET	3.3K OHM X8		
RA4	44-07-0070	FXD M	GLAZE R-NET	3.3K OHM X8		
U1A	35-53-5414	OCTAL	BUFFER		TEXAS INS.	SN7HCS541N
U1B	35-53-2454	OCTAL	BUS TRANSCEIVER		TOSHIBA	TC74HC245P
U1C	35-53-5414	OCTAL	BUFFER		TEXAS INS.	SN7HCS541N
U1D	35-53-5414	OCTAL	BUFFER		TEXAS INS.	SN7HCS541N
U10D	35-07-0040	S-RAM	8K X 8BIT 150NS		HITACHI	HM6264LP-

REFERENCE DESIGNATOR	KIKUSUI PARTS NO.	DESCRIPTION	97-11-0121	
U11A	35-70-1386	3LINE TO 8LINE DECODER	HITACHI	HD74HC138P
U11B	35-53-1334	13-INPUT POSITIVE-NAND GATES	TOSHIBA	TC74HC133P
U11C	35-70-1386	3LINE TO 8LINE DECODER	HITACHI	HD74HC138P
U11D	35-07-0060	S-RAM 8K X 8BIT 150NS	TOSHIBA	TC5564LP-
U2A	35-70-2991	8 BIT SHIFT RESISTER	TEXAS INS.	SN74LS299N
U2B	35-53-3674	HEX BUS DRIVERS	TOSHIBA	TC74HC367P
U2C	35-53-0304	8-INPUT POSI-NAND GATE	TOSIHLBA	TC74HC30P
U2D	35-53-5414	OCTAL BUFFER	TEXAS INS.	SN7HCS541N
U3A	35-70-0060	HEX INVERTER BUFFERS/DRIVERS	TEXAS INS.	SN7406N
U3B	35-53-0144	HEX SHMITT-TRIG INVERTER	TOSHIBA	TC74HC14P
U4A	35-70-0746	DUAL D F-F EDGE TRIGGER	TOSHIBA	TC74HC74P
U4B	35-70-0326	QUAD 2-INPUT POSI-OR	TOSHIBA	TC74HC32P
U4D	35-01-0000	Z80A-CPU 4MHZ (CMOS)	NEC	UPD70008C
U5A	35-53-1744	HEX D-TYPE FLIP FLOP	TOSHIBA	TC74HC174P
U5B	36-90-0230	GP-IB DATA TRANSCEIVER	TEXAS INS.	SN75160AN
U6A	35-53-0144	HEX SHMITT-TRIG INVERTER	TOSHIBA	TC74HC14P
U6B	36-90-0240	GP-IB CONTROL INTERFACE	TEXAS INS.	SN75161AN
U6C	36-90-0220	GP-IB (IEEE-488) ADAPTOR	TEXAS INS.	TMS9914ANL
U6D	36-90-0130	Z80-DMA 4MHZ	SHARP	LH0083A
U7D	35-05-0010	EPROM 32K X 8BIT 250NS (CMOS)		27C256
U8A	35-53-2454	OCTAL BUS TRANSCEIVER	TOSHIBA	TC74HC245P
U8B	35-70-0086	QUAD 2-INPUT POSI-AND	TOSHIBA	TC74HC08P
U8C	35-70-0326	QUAD 2-INPUT POSI-OR	TOSHIBA	TC74HC32P
U8D	35-05-0010	EPROM 32K X 8BIT 250NS (CMOS)		27C256
U9A	35-70-0326	QUAD 2-INPUT POSI-OR	TOSHIBA	TC74HC32P
U9B	35-70-0006	QUAD 2-INPUT POSI-NAND	TOSHIBA	TC74HC00P
U9C	35-70-1396	2LINE TO 4LINE DECODER	TOSHIBA	TC74HC139P
U9D	35-07-0040	S-RAM 8K X 8BIT 150NS	HITACHI	HM6264LP-

REFERENCE KIKUSUI  
DESIGNATOR PARTS NO.

DESCRIPTION 97-11-0170

A15 ASSEMBLY

C1	56-48-1000	FXD CER EMI FILTER				
C2	54-40-1200	FXD ELECT 10MF 50WV				
C3	52-05-2468	FXD CER 0.01UF +80-20% 50V TYPE2				
C4	52-01-2385	FXD CER 2200PF 10% 50V TYPE2				
C6	56-48-1000	FXD CER EMI FILTER				
C7	54-40-1200	FXD ELECT 10MF 50WV				
C8	52-05-2468	FXD CER 0.01UF +80-20% 50V TYPE2				
C9	52-01-2385	FXD CER 2200PF 10% 50V TYPE2				
C11	56-48-1000	FXD CER EMI FILTER				
C12	54-40-1200	FXD ELECT 10MF 50WV				
C13	56-48-1000	FXD CER EMI FILTER				
C14	54-40-1200	FXD ELECT 10MF 50WV				
C15	52-05-2468	FXD CER 0.01UF +80-20% 50V TYPE2				
C16	52-05-2468	FXD CER 0.01UF +80-20% 50V TYPE2				
C17	52-05-2468	FXD CER 0.01UF +80-20% 50V TYPE2				
C18	52-05-2468	FXD CER 0.01UF +80-20% 50V TYPE2				
C19	52-06-2145	FXD CER 22PF 10% 500V TYPE1				
C20	52-06-2145	FXD CER 22PF 10% 500V TYPE1				
C21	52-05-2468	FXD CER 0.01UF +80-20% 50V TYPE2				
C22	52-05-2468	FXD CER 0.01UF +80-20% 50V TYPE2				
C23	52-06-2145	FXD CER 22PF 10% 500V TYPE1				
C24	52-06-2145	FXD CER 22PF 10% 500V TYPE1				
C27	54-40-1200	FXD ELECT 10MF 50WV				
C28	54-40-1200	FXD ELECT 10MF 50WV				
C29	54-40-1200	FXD ELECT 10MF 50WV				
C30	52-37-1000	FXD CER 0.047UF 20% 25V TYPE1				
C31	54-40-1200	FXD ELECT 10MF 50WV				
C32	54-40-1200	FXD ELECT 10MF 50WV				
C33	52-37-1000	FXD CER 0.047UF 20% 25V TYPE1				
C34	54-40-1200	FXD ELECT 10MF 50WV				
C35	54-40-1200	FXD ELECT 10MF 50WV				
C36	54-40-1200	FXD ELECT 10MF 50WV				
C37	54-40-1200	FXD ELECT 10MF 50WV				
C38	54-40-1200	FXD ELECT 10MF 50WV				
C39	54-40-1200	FXD ELECT 10MF 50WV				
C40	54-40-1200	FXD ELECT 10MF 50WV				
C41	52-06-2145	FXD CER 22PF 10% 500V TYPE1				
C42	52-06-2145	FXD CER 22PF 10% 500V TYPE1				
C49	54-40-1200	FXD ELECT 10MF 50WV				
C50	57-10-1202	VAR CER 5-20PF		ALPS		CTZ53E
C51	57-10-1202	VAR CER 5-20PF		ALPS		CTZ53E
C53	52-06-2274	FXD CER 270P 10% 50V TYPE1				
C54	54-10-2590	FXD ELECT 100MF 10WV				SM10VB100
C57	57-10-1202	VAR CER 5-20PF		ALPS		CTZ53E
C58	57-10-1202	VAR CER 5-20PF		ALPS		CTZ53E
C60	54-10-2590	FXD ELECT 100MF 10WV				SM10VB100
C61	52-06-2274	FXD CER 270P 10% 50V TYPE1				
C64	52-06-2165	FXD CER 33PF 10% 500V TYPE1				
C65	52-06-2165	FXD CER 33PF 10% 500V TYPE1				
C66	52-06-2125	FXD CER 15PF 10% 500V TYPE1				

REFERENCE KIKUSUI  
DESIGNATOR PARTS NO. DESCRIPTION 97-11-0170

C67	52-06-2125	FXD CER	15PF	10%	500V	TYPE1
C68	52-06-2125	FXD CER	15PF	10%	500V	TYPE1
C69	52-06-2125	FXD CER	15PF	10%	500V	TYPE1
C72	52-06-2215	FXD CER	82PF	10%	500V	TYPE1
C73	52-06-2215	FXD CER	82PF	10%	500V	TYPE1

CR1	32-30-1200	DIODE	VR=60V	I0=1A	HITACHI	1SS120
CR2	32-30-1200	DIODE	VR=60V	I0=1A	HITACHI	1SS120
CR3	32-30-1200	DIODE	VR=60V	I0=1A	HITACHI	1SS120
CR4	32-30-1200	DIODE	VR=60V	I0=1A	HITACHI	1SS120
CR5	32-30-1200	DIODE	VR=60V	I0=1A	HITACHI	1SS120
CR6	32-30-1200	DIODE	VR=60V	I0=1A	HITACHI	1SS120
CR7	32-30-1200	DIODE	VR=60V	I0=1A	HITACHI	1SS120
CR8	32-30-1200	DIODE	VR=60V	I0=1A	HITACHI	1SS120
CR11	32-30-1200	DIODE	VR=60V	I0=1A	HITACHI	1SS120
CR12	32-99-0000	DIODE	VAR,CAP		TOSHIBA	1SV101
CR13	32-99-0000	DIODE	VAR,CAP		TOSHIBA	1SV101
CR14	32-99-0000	DIODE	VAR,CAP		TOSHIBA	1SV101
CR15	32-99-0000	DIODE	VAR,CAP		TOSHIBA	1SV101
CR16	32-30-1200	DIODE	VR=60V	I0=1A	HITACHI	1SS120

Q1	30-32-1201	TR SI	NPN		TOSHIBA	2SC2120-Y
Q2	30-10-9501	TR SI	PNP	HFE=160-320	TOSHIBA	2SA950-Y
Q3	30-11-0151	TR SI	PNP		TOSHIBA	2SA1015-Y
Q4	30-11-0151	TR SI	PNP		TOSHIBA	2SA1015-Y
Q5	30-32-5700	TR SI	NPN		NEC	2SC2570
Q6	30-32-5700	TR SI	NPN		NEC	2SC2570
Q7	30-32-5700	TR SI	NPN		NEC	2SC2570
Q8	30-32-5700	TR SI	NPN		NEC	2SC2570
Q9	30-31-9071	TR SI	NPN		HITACHI	2SC1907
Q10	30-31-9071	TR SI	NPN		HITACHI	2SC1907
Q13	30-11-0151	TR SI	PNP		TOSHIBA	2SA1015-Y

R1	40-16-1681	FXD C	FILM	680	OHM	5%	1/6W	RD1/6FS
R2	42-80-2151	FXD M	FILM	1.5K	OHM	1%	1/6W	RN1/6FS
R3	42-80-2181	FXD M	FILM	1.8K	OHM	1%	1/6W	RN1/6FS
R4	40-16-1221	FXD C	FILM	220	OHM	5%	1/6W	RD1/6FS
R5	40-16-1681	FXD C	FILM	680	OHM	5%	1/6W	RD1/6FS
R6	40-16-3121	FXD C	FILM	12K	OHM	5%	1/6W	RD1/6FS
R7	42-80-2181	FXD M	FILM	1.8K	OHM	1%	1/6W	RN1/6FS
R8	42-80-2101	FXD M	FILM	1K	OHM	1%	1/6W	RN1/6FS
R9	40-16-0561	FXD C	FILM	56	OHM	5%	1/6W	RD1/6FS
R10	40-16-0561	FXD C	FILM	56	OHM	5%	1/6W	RD1/6FS
R11	40-16-0561	FXD C	FILM	56	OHM	5%	1/6W	RD1/6FS
R12	40-16-0561	FXD C	FILM	56	OHM	5%	1/6W	RD1/6FS
R13	40-16-2561	FXD C	FILM	5.6K	OHM	5%	1/6W	RD1/6FS
R14	40-16-2101	FXD C	FILM	1K	OHM	5%	1/6W	RD1/6FS
R15	40-16-2561	FXD C	FILM	5.6K	OHM	5%	1/6W	RD1/6FS
R16	40-16-2101	FXD C	FILM	1K	OHM	5%	1/6W	RD1/6FS
R17	40-16-1471	FXD C	FILM	470	OHM	5%	1/6W	RD1/6FS
R18	40-16-1471	FXD C	FILM	470	OHM	5%	1/6W	RD1/6FS
R19	40-16-1101	FXD C	FILM	100	OHM	5%	1/6W	RD1/6FS
R20	40-16-1101	FXD C	FILM	100	OHM	5%	1/6W	RD1/6FS
R21	40-16-1101	FXD C	FILM	100	OHM	5%	1/6W	RD1/6FS

REFERENCE DESIGNATOR KIKUSUI PARTS NO. DESCRIPTION 97-11-0170

R22	40-16-1101	FXD C FILM	100	OHM 5%	1/6W	RD1/6FS
R23	40-16-1681	FXD C FILM	680	OHM 5%	1/6W	RD1/6FS
R24	40-16-1681	FXD C FILM	680	OHM 5%	1/6W	RD1/6FS
R25	40-16-1681	FXD C FILM	680	OHM 5%	1/6W	RD1/6FS
R26	40-16-1681	FXD C FILM	680	OHM 5%	1/6W	RD1/6FS
R27	40-16-1101	FXD C FILM	100	OHM 5%	1/6W	RD1/6FS
R28	40-16-1101	FXD C FILM	100	OHM 5%	1/6W	RD1/6FS
R29	40-16-1101	FXD C FILM	100	OHM 5%	1/6W	RD1/6FS
R30	40-16-1101	FXD C FILM	100	OHM 5%	1/6W	RD1/6FS
R31	40-16-1101	FXD C FILM	100	OHM 5%	1/6W	RD1/6FS
R32	40-16-1101	FXD C FILM	100	OHM 5%	1/6W	RD1/6FS
R37	40-16-1181	FXD C FILM	180	OHM 5%	1/6W	RD1/6FS
R38	40-16-1181	FXD C FILM	180	OHM 5%	1/6W	RD1/6FS
R41	40-16-1101	FXD C FILM	100	OHM 5%	1/6W	RD1/6FS
R42	40-16-1101	FXD C FILM	100	OHM 5%	1/6W	RD1/6FS
R43	40-16-1101	FXD C FILM	100	OHM 5%	1/6W	RD1/6FS
R44	40-16-1101	FXD C FILM	100	OHM 5%	1/6W	RD1/6FS
R47	40-16-0821	FXD C FILM	82	OHM 5%	1/6W	RD1/6FS
R48	40-16-2101	FXD C FILM	1K	OHM 5%	1/6W	RD1/6FS
R49	40-16-1561	FXD C FILM	560	OHM 5%	1/6W	RD1/6FS
R50	40-16-0821	FXD C FILM	82	OHM 5%	1/6W	RD1/6FS
R51	42-80-0471	FXD M FILM	47	OHM 1%	1/6W	RN1/6FS
R52	42-80-0471	FXD M FILM	47	OHM 1%	1/6W	RN1/6FS
R53	42-80-0471	FXD M FILM	47	OHM 1%	1/6W	RN1/6FS
R54	42-80-0471	FXD M FILM	47	OHM 1%	1/6W	RN1/6FS
R55	40-16-0471	FXD C FILM	47	OHM 5%	1/6W	RD1/6FS
R56	40-16-0471	FXD C FILM	47	OHM 5%	1/6W	RD1/6FS
R57	40-16-0471	FXD C FILM	47	OHM 5%	1/6W	RD1/6FS
R58	40-16-0471	FXD C FILM	47	OHM 5%	1/6W	RD1/6FS
R59	40-16-0471	FXD C FILM	47	OHM 5%	1/6W	RD1/6FS
R60	40-16-0471	FXD C FILM	47	OHM 5%	1/6W	RD1/6FS
R61	40-16-0471	FXD C FILM	47	OHM 5%	1/6W	RD1/6FS
R62	40-16-0471	FXD C FILM	47	OHM 5%	1/6W	RD1/6FS
R67	40-16-1101	FXD C FILM	100	OHM 5%	1/6W	RD1/6FS
R68	40-16-1101	FXD C FILM	100	OHM 5%	1/6W	RD1/6FS
R69	40-16-1271	FXD C FILM	270	OHM 5%	1/6W	RD1/6FS
R70	40-16-1101	FXD C FILM	100	OHM 5%	1/6W	RD1/6FS
R71	40-16-1271	FXD C FILM	270	OHM 5%	1/6W	RD1/6FS
R72	40-16-2821	FXD C FILM	8.2K	OHM 5%	1/6W	RD1/6FS
R73	40-16-2681	FXD C FILM	6.8K	OHM 5%	1/6W	RD1/6FS
R74	40-16-1271	FXD C FILM	270	OHM 5%	1/6W	RD1/6FS
R75	40-16-2681	FXD C FILM	6.8K	OHM 5%	1/6W	RD1/6FS
R76	40-16-2821	FXD C FILM	8.2K	OHM 5%	1/6W	RD1/6FS
R80	40-16-4221	FXD C FILM	220K	OHM 5%	1/6W	RD1/6FS
R81	40-16-4221	FXD C FILM	220K	OHM 5%	1/6W	RD1/6FS
R82	40-16-4221	FXD C FILM	220K	OHM 5%	1/6W	RD1/6FS
R83	40-16-4221	FXD C FILM	220K	OHM 5%	1/6W	RD1/6FS
R84	40-16-1821	FXD C FILM	820	OHM 5%	1/6W	RD1/6FS
R85	40-16-2101	FXD C FILM	1K	OHM 5%	1/6W	RD1/6FS
R86	38-00-0080	THERMISTOR	2500	OHM		TOSHIBA D33A
R89	40-16-1821	FXD C FILM	820	OHM 5%	1/6W	RD1/6FS
R90	40-16-1821	FXD C FILM	820	OHM 5%	1/6W	RD1/6FS
RV1	48-37-2100	VAR M GLAZE	1K	OHM B		TEITSU VM5CKPV

REFERENCE DESIGNATOR	KIKUSUI PARTS NO.	DESCRIPTION	97-11-0170	
RV2	48-37-2100	VAR M GLAZE 1K	OHM B	TEITSU VM5CKPV
RV3	48-37-2100	VAR M GLAZE 1K	OHM B	TEITSU VM5CKPV
RV4	48-37-2100	VAR M GLAZE 1K	OHM B	TEITSU VM5CKPV
RV5	48-37-2100	VAR M GLAZE 1K	OHM B	TEITSU VM5CKPV
RV6	48-37-2100	VAR M GLAZE 1K	OHM B	TEITSU VM5CKPV
RV7	48-31-1100	VAR M GLAZE 100	OHM B PH	
RV8	48-31-1100	VAR M GLAZE 100	OHM B PH	
U1	34-40-0430	ADJUSTABLE SHUNT REGULATOR		NJM431L
U2	34-40-0430	ADJUSTABLE SHUNT REGULATOR		NJM431L
U3	35-53-1584	QUAD 2-TO-1 DATA SELECTOR (INV)	TOSHIBA	TC74HC158P
U4	35-70-0006	QUAD 2-INPUT POSI-NAND	TOSHIBA	TC74HC00P
U5	36-00-1120	HIC (H12 ST SIGNAL DRIVER)	KIKUSUI	B0909/9
U6	36-00-1130	HIC (H13 CHANNEL DRIVER)	KIKUSUI	B1009/4
U7	36-00-1160	HIC (H16 ENV PEAK HOLD)	KIKUSUI	B1309/4
U8	36-00-1160	HIC (H16 ENV PEAK HOLD)	KIKUSUI	B1309/4

REFERENCE KIKUSUI  
DESIGNATOR PARTS NO.

DESCRIPTION 97-11-0150

A16 ASSEMBLY

C1	52-48-1050	FXD CER 0.1UF 20% 25V	D33Y5V1E
C2	52-48-1050	FXD CER 0.1UF 20% 25V	D33Y5V1E
C3	54-40-1200	FXD ELECT 10MF 50WV	
C4	54-40-1200	FXD ELECT 10MF 50WV	
C5	54-40-1200	FXD ELECT 10MF 50WV	
C6	56-48-1000	FXD CER EMI FILTER	
C7	54-40-1200	FXD ELECT 10MF 50WV	
C8	52-01-2385	FXD CER 2200PF 10% 50V TYPE2	
C9	52-05-2468	FXD CER 0.01UF +80-20% 50V TYPE2	
C10	54-40-1200	FXD ELECT 10MF 50WV	
C11	56-48-1000	FXD CER EMI FILTER	
C12	54-40-1200	FXD ELECT 10MF 50WV	
C13	52-01-2385	FXD CER 2200PF 10% 50V TYPE2	
C14	52-05-2468	FXD CER 0.01UF +80-20% 50V TYPE2	
C15	54-40-1200	FXD ELECT 10MF 50WV	
C16	56-48-1000	FXD CER EMI FILTER	
C17	54-40-1200	FXD ELECT 10MF 50WV	
C18	56-48-1000	FXD CER EMI FILTER	
C19	54-40-1200	FXD ELECT 10MF 50WV	
C20	54-40-1200	FXD ELECT 10MF 50WV	
C21	52-48-1050	FXD CER 0.1UF 20% 25V	D33Y5V1E
C22	54-40-1200	FXD ELECT 10MF 50WV	
C23	54-40-1200	FXD ELECT 10MF 50WV	
C24	54-09-2000	FXD ELECT 1000MF 6.3WV	KME
C25	54-40-1200	FXD ELECT 10MF 50WV	
C26	52-48-1050	FXD CER 0.1UF 20% 25V	D33Y5V1E
C27	54-40-1200	FXD ELECT 10MF 50WV	
C28	54-40-1200	FXD ELECT 10MF 50WV	
C29	54-09-2000	FXD ELECT 1000MF 6.3WV	KME
C30	52-06-2215	FXD CER 82PF 10% 500V TYPE1	
C31	52-48-1050	FXD CER 0.1UF 20% 25V	D33Y5V1E
C32	52-48-1050	FXD CER 0.1UF 20% 25V	D33Y5V1E
C33	52-48-1050	FXD CER 0.1UF 20% 25V	D33Y5V1E
C34	52-48-1050	FXD CER 0.1UF 20% 25V	D33Y5V1E
C35	52-48-1050	FXD CER 0.1UF 20% 25V	D33Y5V1E
C36	52-48-1050	FXD CER 0.1UF 20% 25V	D33Y5V1E
C37	52-48-1050	FXD CER 0.1UF 20% 25V	D33Y5V1E
C38	52-48-1050	FXD CER 0.1UF 20% 25V	D33Y5V1E
C39	52-48-1050	FXD CER 0.1UF 20% 25V	D33Y5V1E
C40	52-48-1050	FXD CER 0.1UF 20% 25V	D33Y5V1E
C41	52-48-1050	FXD CER 0.1UF 20% 25V	D33Y5V1E
C42	52-48-1050	FXD CER 0.1UF 20% 25V	D33Y5V1E
C43	52-48-1050	FXD CER 0.1UF 20% 25V	D33Y5V1E
C44	52-48-1050	FXD CER 0.1UF 20% 25V	D33Y5V1E
C45	52-48-1050	FXD CER 0.1UF 20% 25V	D33Y5V1E
C46	52-48-1050	FXD CER 0.1UF 20% 25V	D33Y5V1E
C47	52-48-1050	FXD CER 0.1UF 20% 25V	D33Y5V1E
C48	52-48-1050	FXD CER 0.1UF 20% 25V	D33Y5V1E
C49	52-48-1050	FXD CER 0.1UF 20% 25V	D33Y5V1E
C50	52-48-1050	FXD CER 0.1UF 20% 25V	D33Y5V1E

REFERENCE DESIGNATOR	KIKUSUI PARTS NO.	DESCRIPTION	97-11-0150	
C51	52-48-1050	FXD CER 0.1UF	20% 25V	D33Y5V1E
C52	52-48-1050	FXD CER 0.1UF	20% 25V	D33Y5V1E
C53	54-30-1960	FXD ELECT 47MF	25WV	
C54	54-40-1200	FXD ELECT 10MF	50WV	
C55	54-40-1200	FXD ELECT 10MF	50WV	
C58	52-01-2325	FXD CER 680PF	10% 50V TYPE2	
C59	52-06-2204	FXD CER 68P	10% 50V TYPE1	
C60	52-06-2204	FXD CER 68P	10% 50V TYPE1	
C61	52-06-2204	FXD CER 68P	10% 50V TYPE1	
CR1	32-92-0027	ZENER VZ=2.5 - 2.8V		HITACHI HZS-2.7EB1
CR2	32-30-1200	DIODE VR=60V IO=1A		HITACHI 1SS120
DL1	91-90-0007	DELAY LINE 200 OHM 50NS		
DL2	91-90-0007	DELAY LINE 200 OHM 50NS		
Q1	30-11-2061	TR SI PNP		NEC 2SA1206-L
Q2	30-11-2061	TR SI PNP		NEC 2SA1206-L
Q3	30-11-2061	TR SI PNP		NEC 2SA1206-L
Q4	30-11-2061	TR SI PNP		NEC 2SA1206-L
Q5	30-33-2791	TR SI NPN (10V 2A 750MW)		TOSHIBA 2SC3279L
Q6	30-11-3001	TR SI PNP (10V 2A 750MW)		TOSHIBA 2SA1300Y
Q7	31-20-1701	FET		TOSHIBA 2SK170-V
Q8	30-10-8441	TR SI PNP		HITACHI 2SA844-D
Q9	30-10-8441	TR SI PNP		HITACHI 2SA844-D
Q10	31-20-1701	FET		TOSHIBA 2SK170-V
Q11	30-11-0151	TR SI PNP		TOSHIBA 2SA1015-Y
Q12	30-30-9451	TR SI NPN		NEC 2SC945-Q
R1	40-16-0471	FXD C FILM 47	OHM 5% 1/6W	RD1/6FS
R2	42-80-1331	FXD M FILM 330	OHM 1% 1/6W	RN1/6FS
R3	40-16-1561	FXD C FILM 560	OHM 5% 1/6W	RD1/6FS
R4	40-16-1561	FXD C FILM 560	OHM 5% 1/6W	RD1/6FS
R5	42-80-1331	FXD M FILM 330	OHM 1% 1/6W	RN1/6FS
R6	40-16-1221	FXD C FILM 220	OHM 5% 1/6W	RD1/6FS
R7	40-16-1221	FXD C FILM 220	OHM 5% 1/6W	RD1/6FS
R8	40-16-0471	FXD C FILM 47	OHM 5% 1/6W	RD1/6FS
R9	40-16-1331	FXD C FILM 330	OHM 5% 1/6W	RD1/6FS
R10	40-16-0471	FXD C FILM 47	OHM 5% 1/6W	RD1/6FS
R11	42-80-1331	FXD M FILM 330	OHM 1% 1/6W	RN1/6FS
R12	40-16-1561	FXD C FILM 560	OHM 5% 1/6W	RD1/6FS
R13	40-16-1561	FXD C FILM 560	OHM 5% 1/6W	RD1/6FS
R14	42-80-1331	FXD M FILM 330	OHM 1% 1/6W	RN1/6FS
R15	40-16-1221	FXD C FILM 220	OHM 5% 1/6W	RD1/6FS
R16	40-16-1221	FXD C FILM 220	OHM 5% 1/6W	RD1/6FS
R17	40-16-0471	FXD C FILM 47	OHM 5% 1/6W	RD1/6FS
R18	40-16-1331	FXD C FILM 330	OHM 5% 1/6W	RD1/6FS
R19	40-16-1331	FXD C FILM 330	OHM 5% 1/6W	RD1/6FS
R20	40-16-1331	FXD C FILM 330	OHM 5% 1/6W	RD1/6FS
R21	40-16-1681	FXD C FILM 680	OHM 5% 1/6W	RD1/6FS
R22	42-80-2151	FXD M FILM 1.5K	OHM 1% 1/6W	RN1/6FS
R23	42-80-2181	FXD M FILM 1.8K	OHM 1% 1/6W	RN1/6FS
R24	40-16-1681	FXD C FILM 680	OHM 5% 1/6W	RD1/6FS
R25	40-16-1221	FXD C FILM 220	OHM 5% 1/6W	RD1/6FS

REFERENCE DESIGNATOR	KIKUSUI PARTS NO.	DESCRIPTION	97-11-0150					
R26	40-16-3221	FXD C FILM 22K	OHM 5% 1/6W					RD1/6FS
R27	42-80-2181	FXD M FILM 1.8K	OHM 1% 1/6W					RN1/6FS
R28	42-80-2101	FXD M FILM 1K	OHM 1% 1/6W					RN1/6FS
R29	40-16-1681	FXD C FILM 680	OHM 5% 1/6W					RD1/6FS
R30	40-16-3561	FXD C FILM 56K	OHM 5% 1/6W					RD1/6FS
R31	40-16-2101	FXD C FILM 1K	OHM 5% 1/6W					RD1/6FS
R32	40-16-1681	FXD C FILM 680	OHM 5% 1/6W					RD1/6FS
R33	40-16-1561	FXD C FILM 560	OHM 5% 1/6W					RD1/6FS
R34	40-16-1681	FXD C FILM 680	OHM 5% 1/6W					RD1/6FS
R35	40-16-1821	FXD C FILM 820	OHM 5% 1/6W					RD1/6FS
R36	40-16-1821	FXD C FILM 820	OHM 5% 1/6W					RD1/6FS
R37	40-16-2221	FXD C FILM 2.2K	OHM 5% 1/6W					RD1/6FS
R38	40-16-1331	FXD C FILM 330	OHM 5% 1/6W					RD1/6FS
R39	40-16-2221	FXD C FILM 2.2K	OHM 5% 1/6W					RD1/6FS
R40	40-16-1331	FXD C FILM 330	OHM 5% 1/6W					RD1/6FS
R41	40-16-1331	FXD C FILM 330	OHM 5% 1/6W					RD1/6FS
R42	40-16-1471	FXD C FILM 470	OHM 5% 1/6W					RD1/6FS
R43	40-16-0471	FXD C FILM 47	OHM 5% 1/6W					RD1/6FS
R44	42-80-1331	FXD M FILM 330	OHM 1% 1/6W					RN1/6FS
R45	42-80-1471	FXD M FILM 470	OHM 1% 1/6W					RN1/6FS
R46	40-16-0221	FXD C FILM 22	OHM 5% 1/6W					RD1/6FS
R47	40-16-0471	FXD C FILM 47	OHM 5% 1/6W					RD1/6FS
R48	42-80-1331	FXD M FILM 330	OHM 1% 1/6W					RN1/6FS
R49	42-80-1471	FXD M FILM 470	OHM 1% 1/6W					RN1/6FS
R50	40-16-1471	FXD C FILM 470	OHM 5% 1/6W					RD1/6FS
R51	40-16-0471	FXD C FILM 47	OHM 5% 1/6W					RD1/6FS
R52	40-16-0001	FXD C FILM 0	OHM 5% 1/6W					RD1/6FS
R53	40-16-0001	FXD C FILM 0	OHM 5% 1/6W					RD1/6FS
R54	40-16-1391	FXD C FILM 390	OHM 5% 1/6W					RD1/6FS
R55	40-16-1391	FXD C FILM 390	OHM 5% 1/6W					RD1/6FS
R56	40-16-0221	FXD C FILM 22	OHM 5% 1/6W					RD1/6FS
R57	40-16-0221	FXD C FILM 22	OHM 5% 1/6W					RD1/6FS
R59	38-00-0070	THERMISTOR	200 OHM			TOSHIBA	D22A	
R60	38-00-0070	THERMISTOR	200 OHM			TOSHIBA	D22A	
RV1	48-31-2100	VAR M GLAZE	1K OHM B PH					
RV2	48-31-3100	FXD M GLAZE	10K OHM B PH					
RV3	48-31-2100	VAR M GLAZE	1K OHM B PH					
RV4	48-31-3100	FXD M GLAZE	10K OHM B PH					
U1A	35-70-0103	TRI 3-INPUT POSI-NAND GATES				FAIRCHILD	F74F10PC	
U1B	35-76-1122	DUAL J-K F-F WITH P/C				FAIRCHILD	F74F112PC	
U1C	35-70-1126	DUAL J-K F-F WITH P/C				TOSHIBA	TC74HC112P	
U10A	35-76-5412	OCTAL BUFFER				FAIRCHILD	F74F541N	
U10C	35-76-5412	OCTAL BUFFER				FAIRCHILD	F74F541N	
U11A	34-21-0000	A/D CONVERTER 8 BIT 38.5MSPS				ITT	UVC3120	
U11C	34-21-0000	A/D CONVERTER 8 BIT 38.5MSPS				ITT	UVC3120	
U12A	36-00-1180	HIC (H18 SAMPLE & HOLD)				KIKUSUI	B1509/4	
U12C	36-00-1180	HIC (H18 SAMPLE & HOLD)				KIKUSUI	B1509/4	
U12D	34-40-0430	ADJUSTABLE SHUNT REGULATOR					NJM431L	
U13D	34-40-0430	ADJUSTABLE SHUNT REGULATOR					NJM431L	
U2A	35-70-0003	QUAD 2-INPUT POSI-NAND				FAIRCHILD	74F00PC	
U2B	35-79-0020	QUAD 2-INPUT POSI-NOR				FAIRCHILD	F74F3037N	
U4A	35-71-0040	HEX INVERTERS				FAIRCHILD	F74F04PC	

REFERENCE DESIGNATOR	KIKUSUI PARTS NO.	DESCRIPTION	97-11-0150
U4B	35-71-0040	HEX INVERTERS	FAIRCHILD F74F04PC
U4C	35-71-0080	QUAD 2-INPUT POSI-AND	FAIRCHILD F74F08PC
U5A	35-71-0080	QUAD 2-INPUT POSI-AND	FAIRCHILD F74F08PC
U5B	35-71-0080	QUAD 2-INPUT POSI-AND	FAIRCHILD F74F08PC
U5C	35-71-0020	QUAD 2-INPUT POSI-NOR	FAIRCHILD F74F02PC
U6A	35-71-1690	4-BIT UP/DOWN SYNC-BIN-COUNTER	FAIRCHILD F74F169PC
U6B	35-71-0320	QUAD 2-INPUT POSI-OR	FAIRCHILD F74F32PC
U6C	35-71-1690	4-BIT UP/DOWN SYNC-BIN-COUNTER	FAIRCHILD F74F169PC
U7A	35-76-2692	8-BIT BINARY COUNTER	FAIRCHILD F74F269N
U7C	35-76-2692	8-BIT BINARY COUNTER	FAIRCHILD F74F269N
U8A	35-07-0055	S-RAM 2KW X 8BIT 35NS	TMM2018D-
U8C	35-07-0055	S-RAM 2KW X 8BIT 35NS	TMM2018D-
U9A	35-53-5417	OCTAL BUFFER	TEXAS INS. SN74HC541N
U9C	35-53-5417	OCTAL BUFFER	TEXAS INS. SN74HC541N

REFERENCE KIKUSUI  
DESIGNATOR PARTS NO. DESCRIPTION 97-11-0140

A17 ASSEMBLY

C1	54-40-1200	FXD ELECT	10MF	50WV		
C2	52-01-2385	FXD CER	2200PF	10% 50V	TYPE2	
C3	52-05-2468	FXD CER	0.01UF	+80-20%	50V	TYPE2
C4	55-37-2080	FXD TANT	ELECT	4.7UF	35V	
C5	52-05-2468	FXD CER	0.01UF	+80-20%	50V	TYPE2
C6	52-06-2225	FXD CER	100PF	10%	50V	TYPE1
C8	52-48-1050	FXD CER	0.1UF	20%	25V	D33Y5V1E
C9	52-48-1050	FXD CER	0.1UF	20%	25V	D33Y5V1E
C10	52-48-1050	FXD CER	0.1UF	20%	25V	D33Y5V1E
C11	52-48-1050	FXD CER	0.1UF	20%	25V	D33Y5V1E
C12	52-48-1050	FXD CER	0.1UF	20%	25V	D33Y5V1E
C13	52-48-1050	FXD CER	0.1UF	20%	25V	D33Y5V1E
C14	54-30-1960	FXD ELECT	47MF	25WV		
C15	52-48-1050	FXD CER	0.1UF	20%	25V	D33Y5V1E
C16	52-48-1050	FXD CER	0.1UF	20%	25V	D33Y5V1E
C17	52-48-1050	FXD CER	0.1UF	20%	25V	D33Y5V1E
C18	52-48-1050	FXD CER	0.1UF	20%	25V	D33Y5V1E
C19	52-48-1050	FXD CER	0.1UF	20%	25V	D33Y5V1E
C20	52-48-1050	FXD CER	0.1UF	20%	25V	D33Y5V1E
C21	52-48-1050	FXD CER	0.1UF	20%	25V	D33Y5V1E
C22	52-48-1050	FXD CER	0.1UF	20%	25V	D33Y5V1E
C23	52-48-1050	FXD CER	0.1UF	20%	25V	D33Y5V1E
C24	52-48-1050	FXD CER	0.1UF	20%	25V	D33Y5V1E
C25	52-48-1050	FXD CER	0.1UF	20%	25V	D33Y5V1E
C26	52-48-1050	FXD CER	0.1UF	20%	25V	D33Y5V1E
C27	52-48-1050	FXD CER	0.1UF	20%	25V	D33Y5V1E
C28	52-48-1050	FXD CER	0.1UF	20%	25V	D33Y5V1E
C29	52-48-1050	FXD CER	0.1UF	20%	25V	D33Y5V1E
C30	52-48-1050	FXD CER	0.1UF	20%	25V	D33Y5V1E
C31	52-48-1050	FXD CER	0.1UF	20%	25V	D33Y5V1E
C32	52-48-1050	FXD CER	0.1UF	20%	25V	D33Y5V1E
C33	52-48-1050	FXD CER	0.1UF	20%	25V	D33Y5V1E
C34	52-48-1050	FXD CER	0.1UF	20%	25V	D33Y5V1E
C35	52-48-1050	FXD CER	0.1UF	20%	25V	D33Y5V1E
C36	52-48-1050	FXD CER	0.1UF	20%	25V	D33Y5V1E
C37	52-48-1050	FXD CER	0.1UF	20%	25V	D33Y5V1E
C38	52-48-1050	FXD CER	0.1UF	20%	25V	D33Y5V1E
C39	52-48-1050	FXD CER	0.1UF	20%	25V	D33Y5V1E
C40	52-48-1050	FXD CER	0.1UF	20%	25V	D33Y5V1E
C41	52-48-1050	FXD CER	0.1UF	20%	25V	D33Y5V1E
C42	52-48-1050	FXD CER	0.1UF	20%	25V	D33Y5V1E
C43	52-48-1050	FXD CER	0.1UF	20%	25V	D33Y5V1E
C44	52-06-2245	FXD CER	150PF	10%	50V	TYPE1
CR1	32-30-1200	DIODE	VR=60V	I0=1A		HITACHI 1SS120
Q1	30-32-1201	TR SI	NPN			TOSHIBA 2SC2120-Y
R1	40-16-1391	FXD C	FILM	390	OHM	5% 1/6W RD1/6FS
R2	42-80-2151	FXD M	FILM	1.5K	OHM	1% 1/6W RN1/6FS

REFERENCE DESIGNATOR	KIKUSUI PARTS NO.	DESCRIPTION	97-11-0140	
R3	42-80-2181	FXD M FILM 1.8K OHM 1% 1/6W		RN1/6FS
R4	42-80-2561	FXD M FILM 5.6K OHM 1% 1/6W		RN1/6FS
R5	40-16-2561	FXD C FILM 5.6K OHM 5% 1/6W		RD1/6FS
R6	42-80-1331	FXD M FILM 330 OHM 1% 1/6W		RN1/6FS
R7	42-80-1331	FXD M FILM 330 OHM 1% 1/6W		RN1/6FS
R8	42-80-2181	FXD M FILM 1.8K OHM 1% 1/6W		RN1/6FS
R9	42-80-2181	FXD M FILM 1.8K OHM 1% 1/6W		RN1/6FS
R10	40-16-1471	FXD C FILM 470 OHM 5% 1/6W		RD1/6FS
R11	40-16-0001	FXD C FILM 0 OHM 5% 1/6W		RD1/6FS
R12	40-16-3101	FXD C FILM 10K OHM 5% 1/6W		RD1/6FS
U1B	36-00-1150	HIC (H15 ANALOG MPX DIP)	KIKUSUI	B1209/9
U1C	34-40-0430	ADJUSTABLE SHUNT REGULATOR		NJM431L
U10A	35-59-0100	PROGRAMMABLE DIVIDER 5MHZ		SPG8650-0
U10B	35-70-5746	OCTAL D TYPE EDGE TRIG F/F	TOSHIBA	TC74HC574P
U10C	35-70-0326	QUAD 2-INPUT POSI-OR	TOSHIBA	TC74HC32P
U11A	35-71-0740	DUAL D F-F EDGE TRIGGER	TEXAS INS.	F74F74PC
U11B	35-70-5746	OCTAL D TYPE EDGE TRIG F/F	TOSHIBA	TC74HC574P
U11C	35-70-0326	QUAD 2-INPUT POSI-OR	TOSHIBA	TC74HC32P
U12A	35-71-0740	DUAL D F-F EDGE TRIGGER	TEXAS INS.	F74F74PC
U12B	35-53-3654	HEX BUS DRIVERS	TOSHIBA	TC74HC365P
U12C	35-70-0006	QUAD 2-INPUT POSI-NAND	TOSHIBA	TC74HC00P
U13A	35-53-3904	DUAL DECADE COUNTERS	TOSHIBA	TC74HC390P
U13B	35-73-5920	8-BIT REGISTERS/BIN-COUNTERS	TEXAS INS.	SN74LS592N
U13C	35-71-0320	QUAD 2-INPUT POSI-OR	FAIRCHILD	F74F32PC
U14A	35-70-0003	QUAD 2-INPUT POSI-NAND	FAIRCHILD	74F00PC
U14B	35-70-1613	SYNC 4-BIT BINARY COUNTERS	FAIRCHILD	F74F161PC
U14C	36-00-1360	HIC (H36 CLOCK GENERATOR)	KIKUSUI	B3209/12
U2A	34-00-0215	J-FET INPUT OPE-AMP	TEXAS INS.	TL081CP
U2B	34-22-0011	D/A CONVERTER 8BIT 70NS	SIGNETICS	DAC-08EN
U3B	36-00-1330	HIC (H33 JITTER METER)	KIKUSUI	B2909/4
U3C	35-71-0040	HEX INVERTERS	FAIRCHILD	F74F04PC
U4C	35-73-5900	8 BIT BINARY COUNTER/RESISTER	TEXAS INS.	SN74LS590N
U5C	35-73-5900	8 BIT BINARY COUNTER/RESISTER	TEXAS INS.	SN74LS590N
U6C	35-70-0311	DELAY ELEMENTS	TEXAS INS.	SN74LS31N
U7A	35-76-1122	DUAL J-K F-F WITH P/C	FAIRCHILD	F74F112PC
U7B	35-70-5746	OCTAL D TYPE EDGE TRIG F/F	TOSHIBA	TC74HC574P
U7C	35-70-1386	3LINE TO 8LINE DECODER	HITACHI	HD74HC138P
U8A	35-71-1530	DUAL 4-TO-1 DATA SELECTORS	FAIRCHILD	F74F153PC
U8B	35-53-5414	OCTAL BUFFER	TEXAS INS.	SN7HCS541N
U8C	35-70-1386	3LINE TO 8LINE DECODER	HITACHI	HD74HC138P
U9A	35-76-1912	4 BIT UP/DOWN BIN. COUNTER	FAIRCHILD	F74F191PC
U9B	35-70-5746	OCTAL D TYPE EDGE TRIG F/F	TOSHIBA	TC74HC574P
U9C	35-70-1386	3LINE TO 8LINE DECODER	HITACHI	HD74HC138P
XTL1	93-00-0250	QUARTS HC-18/U 50MHZ	KIKUSUI	S8506221
XTL2	93-00-0240	QUARTS HC-18/U 40MHZ	KIKUSUI	S8506211

REFERENCE KIKUSUI  
DESIGNATOR PARTS NO.

DESCRIPTION 97-11-0130

A18 ASSEMBLY

BT1	94-00-0210	BATTERY	3.0V	38MAH	LITHIUM	BR1225-IVD
C1	52-06-2184	FXD CER	47PF	10%	50V	TYPE1
C3	52-01-2345	FXD CER	1000PF	10%	50V	TYPE2
C5	52-05-2468	FXD CER	0.01UF	+80-20%	50V	TYPE2
C7	52-06-2225	FXD CER	100PF	10%	50V	TYPE1
C8	52-05-2468	FXD CER	0.01UF	+80-20%	50V	TYPE2
C11	52-05-2468	FXD CER	0.01UF	+80-20%	50V	TYPE2
C13	52-05-2468	FXD CER	0.01UF	+80-20%	50V	TYPE2
C14	52-01-2385	FXD CER	2200PF	10%	50V	TYPE2
C15	52-37-1000	FXD CER	0.047UF	20%	25V	TYPE1
C16	52-37-1000	FXD CER	0.047UF	20%	25V	TYPE1
C21	52-37-1000	FXD CER	0.047UF	20%	25V	TYPE1
C22	52-37-1000	FXD CER	0.047UF	20%	25V	TYPE1
C23	52-37-1000	FXD CER	0.047UF	20%	25V	TYPE1
C24	52-37-1000	FXD CER	0.047UF	20%	25V	TYPE1
C25	52-37-1000	FXD CER	0.047UF	20%	25V	TYPE1
C26	52-37-1000	FXD CER	0.047UF	20%	25V	TYPE1
C27	52-37-1000	FXD CER	0.047UF	20%	25V	TYPE1
C28	52-37-1000	FXD CER	0.047UF	20%	25V	TYPE1
C29	52-37-1000	FXD CER	0.047UF	20%	25V	TYPE1
C30	52-37-1000	FXD CER	0.047UF	20%	25V	TYPE1
C31	52-37-1000	FXD CER	0.047UF	20%	25V	TYPE1
C32	52-37-1000	FXD CER	0.047UF	20%	25V	TYPE1
C33	52-37-1000	FXD CER	0.047UF	20%	25V	TYPE1
C34	52-37-1000	FXD CER	0.047UF	20%	25V	TYPE1
C35	52-37-1000	FXD CER	0.047UF	20%	25V	TYPE1
C36	52-37-1000	FXD CER	0.047UF	20%	25V	TYPE1
C37	52-37-1000	FXD CER	0.047UF	20%	25V	TYPE1
C38	52-37-1000	FXD CER	0.047UF	20%	25V	TYPE1
C39	52-37-1000	FXD CER	0.047UF	20%	25V	TYPE1
C40	52-37-1000	FXD CER	0.047UF	20%	25V	TYPE1
C41	52-37-1000	FXD CER	0.047UF	20%	25V	TYPE1
C42	52-37-1000	FXD CER	0.047UF	20%	25V	TYPE1
C43	52-37-1000	FXD CER	0.047UF	20%	25V	TYPE1
C44	52-37-1000	FXD CER	0.047UF	20%	25V	TYPE1
C45	52-37-1000	FXD CER	0.047UF	20%	25V	TYPE1
C46	52-37-1000	FXD CER	0.047UF	20%	25V	TYPE1
C47	52-37-1000	FXD CER	0.047UF	20%	25V	TYPE1
C48	52-37-1000	FXD CER	0.047UF	20%	25V	TYPE1
C49	52-37-1000	FXD CER	0.047UF	20%	25V	TYPE1
C50	54-40-1200	FXD ELECT	10MF	50WV		
C51	54-40-1200	FXD ELECT	10MF	50WV		
C52	54-20-1210	FXD ELECT	220MF	16WV		KME16VB220
C54	52-06-2215	FXD CER	82PF	10%	500V	TYPE1
C55	52-06-2194		*****	*****		
CR1	32-92-0027	ZENER	VZ=2.5 - 2.8V		HITACHI	HZS-2.7EB1
CR2	32-30-1200	DIODE	VR=60V IO=1A		HITACHI	1SS120
CR3	32-30-1200	DIODE	VR=60V IO=1A		HITACHI	1SS120

REFERENCE DESIGNATOR	KIKUSUI PARTS NO.	DESCRIPTION		97-11-0130			
CR4	32-30-1200	DIODE	VR=60V	I0=1A	HITACHI	1SS120	
Q1	30-30-9451	TR	SI	NPN	NEC	2SC945-Q	
Q2	30-30-9451	TR	SI	NPN	NEC	2SC945-Q	
Q5	30-32-1201	TR	SI	NPN	TOSHIBA	2SC2120-Y	
Q6	30-32-1201	TR	SI	NPN	TOSHIBA	2SC2120-Y	
R1	40-16-2101	FXD	C	FILM	1K	OHM 5% 1/6W	RD1/6FS
R2	40-16-3101	FXD	C	FILM	10K	OHM 5% 1/6W	RD1/6FS
R4	40-16-1681	FXD	C	FILM	680	OHM 5% 1/6W	RD1/6FS
R5	42-80-2101	FXD	M	FILM	1K	OHM 1% 1/6W	RN1/6FS
R6	40-16-2221	FXD	C	FILM	2.2K	OHM 5% 1/6W	RD1/6FS
R10	42-80-2101	FXD	M	FILM	1K	OHM 1% 1/6W	RN1/6FS
R11	40-16-2221	FXD	C	FILM	2.2K	OHM 5% 1/6W	RD1/6FS
R13	42-80-2471	FXD	M	FILM	4.7K	OHM 1% 1/6W	RN1/6FS
R14	40-16-2471	FXD	C	FILM	4.7K	OHM 5% 1/6W	RD1/6FS
R24	40-16-3101	FXD	C	FILM	10K	OHM 5% 1/6W	RD1/6FS
R25	42-80-3561	FXD	M	FILM	56K	OHM 1% 1/6W	RN1/6FS
R26	40-16-1821	FXD	C	FILM	820	OHM 5% 1/6W	RD1/6FS
R27	40-16-1821	FXD	C	FILM	820	OHM 5% 1/6W	RD1/6FS
R28	40-16-2391	FXD	C	FILM	3.9K	OHM 5% 1/6W	RD1/6FS
R29	40-16-1271	FXD	C	FILM	270	OHM 5% 1/6W	RD1/6FS
R30	40-16-2391	FXD	C	FILM	3.9K	OHM 5% 1/6W	RD1/6FS
R31	40-16-4471	FXD	C	FILM	470K	OHM 5% 1/6W	RD1/6FS
R32	40-16-2821	FXD	C	FILM	8.2K	OHM 5% 1/6W	RD1/6FS
R33	40-16-1821	FXD	C	FILM	820	OHM 5% 1/6W	RD1/6FS
R34	40-16-1821	FXD	C	FILM	820	OHM 5% 1/6W	RD1/6FS
R40	40-16-1681	FXD	C	FILM	680	OHM 5% 1/6W	RD1/6FS
R41	42-80-2181	FXD	M	FILM	1.8K	OHM 1% 1/6W	RN1/6FS
R42	42-80-2151	FXD	M	FILM	1.5K	OHM 1% 1/6W	RN1/6FS
R43	42-80-1471	FXD	M	FILM	470	OHM 1% 1/6W	RN1/6FS
R44	42-80-2151	FXD	M	FILM	1.5K	OHM 1% 1/6W	RN1/6FS
R45	42-80-1471	FXD	M	FILM	470	OHM 1% 1/6W	RN1/6FS
R46	42-80-1821	FXD	M	FILM	820	OHM 1% 1/6W	RN1/6FS
R47	42-80-2121	FXD	M	FILM	1.2K	OHM 1% 1/6W	RN1/6FS
R48	42-80-1331	FXD	M	FILM	330	OHM 1% 1/6W	RN1/6FS
R49	42-80-2391	FXD	M	FILM	3.9K	OHM 1% 1/6W	RN1/6FS
R50	42-80-1471	FXD	M	FILM	470	OHM 1% 1/6W	RN1/6FS
R51	40-16-1471	FXD	C	FILM	470	OHM 5% 1/6W	RD1/6FS
R52	40-16-1471	FXD	C	FILM	470	OHM 5% 1/6W	RD1/6FS
R53	40-16-1471	FXD	C	FILM	470	OHM 5% 1/6W	RD1/6FS
R55	40-16-2101	FXD	C	FILM	1K	OHM 5% 1/6W	RD1/6FS
R56	42-80-2101	FXD	M	FILM	1K	OHM 1% 1/6W	RN1/6FS
R57	42-80-1121	FXD	M	FILM	120	OHM 1% 1/6W	RN1/6FS
R58	42-80-0561	FXD	M	FILM	56	OHM 1% 1/6W	RN1/6FS
R59	40-16-1331	FXD	C	FILM	330	OHM 5% 1/6W	RD1/6FS
RV1	48-31-1500	VAR	M	GLAZE	500	OHM B PH	
RV2	48-31-3200	FXD	M	GLAZE	20K	OHM B PH	
RV3	48-31-2500	VAR	M	GLAZE	5K	OHM B PH	
RV4	48-31-2500	VAR	M	GLAZE	5K	OHM B PH	
RV5	48-31-2100	VAR	M	GLAZE	1K	OHM B PH	
U1A	34-69-0030	TRIPLE 2-CHANNEL MULTIPLEXER		TOSHIBA	TC4053BP		

REFERENCE DESIGNATOR	KIKUSUI PARTS NO.	DESCRIPTION	97-11-0130
U1B	36-00-1200	HIC (H20 INTERPOLATOR)	KIKUSUI B4009/9
U1C	36-00-1320	HIC (H32 ST.SWEEP DEGLITCHER)	KIKUSUI B2809/12
U1D	34-40-0430	ADJUSTABLE SHUNT REGULATOR	NJM431L
U2A	34-22-0011	D/A CONVERTER 8BIT 70NS	SINETICS DAC-08EN
U2B	34-22-0011	D/A CONVERTER 8BIT 70NS	SINETICS DAC-08EN
U2C	36-20-0100	D/A CONVERTER 12BIT	HITACHI HA17012PB
U3A	35-70-1576	QUAD 2-TO-1 DATA SELECTORS	TOSHIBA TC74HC157P
U3B	35-70-1576	QUAD 2-TO-1 DATA SELECTORS	TOSHIBA TC74HC157P
U3C	35-53-1744	HEX D-TYPE FLIP FLOP	TOSHIBA TC74HC174P
U3D	35-70-0541	4-WIDE 2-INPUT AND-OR-INV GATE	TEXAS INS. SN74LS54N
U3F	35-53-0304	8-INPUT POSI-NAND GATE	TOSHIBA TC74HC30P
U4A	35-70-1576	QUAD 2-TO-1 DATA SELECTORS	TOSHIBA TC74HC157P
U4B	35-53-0214	DUAL 4-INPUT POSI-AND	TOSHIBA TC74HC21P
U4C	35-53-2834	4 BIT BINARY FULL ADDER	TOSHIBA TC74HC283P
U4D	35-53-2454	OCTAL BUS TRANSCEIVER	TOSHIBA TC74HC245P
U4F	35-70-0326	QUAD 2-INPUT POSI-OR	TOSHIBA TC74HC32P
U5A	35-53-2834	4 BIT BINARY FULL ADDER	TOSHIBA TC74HC283P
U5B	35-56-0025	DUAL 4-INPUT NOR GATES	TOSHIBA TC74HC4002
U5C	35-70-1576	QUAD 2-TO-1 DATA SELECTORS	TOSHIBA TC74HC157P
U5F	35-70-1386	3LINE TO 8LINE DECORDER	HITACHI HD74HC138P
U6A	35-56-0111	S-RAM 2KX8BIT CMOS	HITACHI HM6116P-3
U6C	35-07-0060	S-RAM 8K X 8BIT 150NS	TOSHIBA TC5564LP-
U6D	35-02-0010	PIO	TMP82C55AP
U6F	35-70-0326	QUAD 2-INPUT POSI-OR	TOSHIBA TC74HC32P
U7A	35-53-2834	4 BIT BINARY FULL ADDER	TOSHIBA TC74HC283P
U7B	35-53-2834	4 BIT BINARY FULL ADDER	TOSHIBA TC74HC283P
U7C	35-53-2834	4 BIT BINARY FULL ADDER	TOSHIBA TC74HC283P
U7D	35-53-0104	TRIPLE 3-INPUT POSI-NAND GATE	TOSHIBA TC74HC10P
U7E	35-70-0046	HEX INVERTERS	TOSHIBA TC74HC04P
U7F	35-70-0086	QUAD 2-INPUT POSI-AND	TOSHIBA TC74HC08P
U8A	35-70-1576	QUAD 2-TO-1 DATA SELECTORS	TOSHIBA TC74HC157P
U8B	35-70-1576	QUAD 2-TO-1 DATA SELECTORS	TOSHIBA TC74HC157P
U8C	35-70-1576	QUAD 2-TO-1 DATA SELECTORS	TOSHIBA TC74HC157P
U8D	35-56-0405	12 STAGE BINARY COUNTER	TOSHIBA TC74HC4040
U8E	35-70-1126	DUAL J-K F-F WITH P/C	TOSHIBA TC74HC112P
U8F	35-70-1126	DUAL J-K F-F WITH P/C	TOSHIBA TC74HC112P

REFERENCE KIKUSUI  
DESIGNATOR PARTS NO. DESCRIPTION 97-11-0110

A20 ASSEMBLY

C1	52-77-1010	FXD CER	1000PF	250VAC	FOR UL & CSA
C2	52-77-1010	FXD CER	1000PF	250VAC	FOR UL & CSA
T1	67-10-1760	INDUCTOR	1MH	2.5A	SC-02-10A2

A21 ASSEMBLY

97-11-0180

L1	67-95-0010	INDUCTOR	L-2874		
L2	67-95-0010	INDUCTOR	L-2874		
L3	67-10-0870	INDUCTOR	1UH		
L4	67-10-0870	INDUCTOR	1UH		
R1	40-27-1332	FXD C FILM	330	OHM 5% 1/4W	
R2	40-27-1332	FXD C FILM	330	OHM 5% 1/4W	
R3	40-16-1561	FXD C FILM	560	OHM 5% 1/6W	
R4	40-16-1561	FXD C FILM	560	OHM 5% 1/6W	RD1/6FS

A22 ASSEMBLY

C1	52-98-1010	FXD CER	1000PF	+80-20%	6.3KV	TYPE1	
C2	52-98-1000	FXD CER	4700PF	+80-20%	3.15KV	TYPE1	
C3	52-98-1000	FXD CER	4700PF	+80-20%	3.15KV	TYPE1	
C4	52-98-1000	FXD CER	4700PF	+80-20%	3.15KV	TYPE1	
C5	52-98-1010	FXD CER	1000PF	+80-20%	6.3KV	TYPE1	
C6	52-98-1010	FXD CER	1000PF	+80-20%	6.3KV	TYPE1	
C7	52-98-1010	FXD CER	1000PF	+80-20%	6.3KV	TYPE1	
C8	52-98-1010	FXD CER	1000PF	+80-20%	6.3KV	TYPE1	
C9	52-98-1010	FXD CER	1000PF	+80-20%	6.3KV	TYPE1	
C10	52-98-1010	FXD CER	1000PF	+80-20%	6.3KV	TYPE1	
C11	52-98-1010	FXD CER	1000PF	+80-20%	6.3KV	TYPE1	
C12	52-03-3469	FXD CER	0.01UF	+100-0%	500V	TYPE2	
CR1	32-90-1951	DIODE VR=6KV	FAST RECOVERY	SANKEN	GHV-06SSN		
CR2	32-90-1951	DIODE VR=6KV	FAST RECOVERY	SANKEN	GHV-06SSN		
CR3	32-90-1951	DIODE VR=6KV	FAST RECOVERY	SANKEN	GHV-06SSN		
CR4	32-90-1951	DIODE VR=6KV	FAST RECOVERY	SANKEN	GHV-06SSN		
CR5	32-90-1951	DIODE VR=6KV	FAST RECOVERY	SANKEN	GHV-06SSN		
CR6	32-90-1951	DIODE VR=6KV	FAST RECOVERY	SANKEN	GHV-06SSN		
CR7	32-90-1951	DIODE VR=6KV	FAST RECOVERY	SANKEN	GHV-06SSN		
CR8	32-90-1951	DIODE VR=6KV	FAST RECOVERY	SANKEN	GHV-06SSN		
CR9	32-90-1951	DIODE VR=6KV	FAST RECOVERY	SANKEN	GHV-06SSN		
R1	40-16-2101	FXD C FILM	1K	OHM 5% 1/6W			RD1/6FS
R2	40-37-6101	FXD C FILM	10M	OHM 5% 1/2W			
T1	63-92-0190	SWITING TRANS	HV-6	KIKUSUI	S8513932		

### 7.1.3 COM 7100A Parts List

Table 7-5 shows each parts used for COM 7100A by assembly.

Assembly	CODE NO.	Description
B ASSEMBLY		Parts used for Chassis.
A1 ASSEMBLY	36-00-1030	Parts used for CH1 and CH2 ATTENUATOR boards. Note that the chip parts are not included.
A3 ASSEMBLY	36-00-1040	Parts used for CH3 and CH4 ATTENUATOR boards. Note that the chip parts are not included.
A4 ASSEMBLY	97-11-0021	Parts used for MAIN board. (VERTICAL PREAMPLIFIER, TRIG & A/B SWEEP GENERATOR and HORIZONTAL SWITCH & Z AXIS CONTROL board.)
A5 ASSEMBLY	97-11-0030	Parts used for VERTICAL & HORIZONTAL OUTPUT AMPLIFIER board.
A6 ASSEMBLY	97-11-0040	Parts used for Z AXIS AMPLIFIER board.
A7 ASSEMBLY	97-11-0050	Parts used for CRT CONTROL board.
A8 ASSEMBLY	97-11-0060	Parts used for MAIN CPU board.
A10 ASSEMBLY	97-11-0070	Parts used for PANEL CONTROLS (1/2) board.
A11 ASSEMBLY	97-11-0081	Parts used for PANEL CONTROLS (2/2) board.
A12 ASSEMBLY	97-11-0090	Parts used for POWER SUPPLY UNIT board.
A13 ASSEMBLY	97-11-0100	Parts used for BUS INTERCONNECTIONS board.
A20 ASSEMBLY	97-11-0110	Parts used for LINE FILTER board.
A22 ASSEMBLY	97-11-0200	Parts used for HIGH VOLTAGE UNIT board.

Table 7-5 List of ASSEMBLIES for COM 7100A

REFERENCE DESIGNATOR	KIKUSUI PARTS NO.	DESCRIPTION
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#### B ASSEMBLY

V1	21-46-0614	CATHODE RAY TUBE	TOSHIBA	150CWB31
**	66-21-0082	ROTATION COIL	KIKUSUI	S8607331
**	76-52-0051	FAN (DC 12V)		

#### A1 ASSEMBLY (CH1)

H3	36-00-1030	HIC (H3 CH1,CH2 1ST ATT)	KIKUSUI	B0009/03
J1	83-30-1190	BNC CONNECTOR		*1
K1	71-07-0370	RELAY (DC 5V)	DS1-S	*1
K2	71-07-0370	RELAY (DC 5V)	DS1-S	*1
K3	71-07-0370	RELAY (DC 5V)	DS1-S	*1

#### A1 ASSEMBLY (CH2)

H3	36-00-1030	HIC (H3 CH1,CH2 1ST ATT)	KIKUSUI	B0009/03
J1	83-30-1190	BNC CONNECTOR		*1
K1	71-07-0370	RELAY (DC 5V)	DS1-S	*1
K2	71-07-0370	RELAY (DC 5V)	DS1-S	*1
K3	71-07-0370	RELAY (DC 5V)	DS1-S	*1

#### A3 ASSEMBLY

H4	36-00-1040	HIC (H4 CH3/CH4 1ST ATT)	KIKUSUI	B0109/02
J1	83-30-1190	BNC CONNECTOR		*2
J2	83-30-1190	BNC CONNECTOR		*2
K1	71-07-0370	RELAY (DC 5V)	DS1-S	*2
K2	71-07-0370	RELAY (DC 5V)	DS1-S	*2
K11	71-07-0370	RELAY (DC 5V)	DS1-S	*2
K12	71-07-0370	RELAY (DC 5V)	DS1-S	*2

NOTE : \*1. The H3 is a Attenuator unit consisted of case,shield plate,bracket,PC Board, J1,K1,K2,K3 and other component.

\*2. The H4 is a Attenuator unit consisted of case,shield plate,bracket,PC Board, J1,J2,K1,K2,K11,K12 and other component.

REFERENCE KIKUSUI  
DESIGNATOR PARTS NO.

DESCRIPTION 97-11-0021

A4 ASSEMBLY

C1	54-40-1210	FXD	ELECT	22MF	50WV	
C2	54-40-1210	FXD	ELECT	22MF	50WV	
C3	54-40-1210	FXD	ELECT	22MF	50WV	
C4	54-40-1210	FXD	ELECT	22MF	50WV	
C5	54-40-1210	FXD	ELECT	22MF	50WV	
C6	54-40-1210	FXD	ELECT	22MF	50WV	
C7	56-48-1000	FXD	CER	EMI FILTER		
C8	52-05-2468	FXD	CER	0.01UF +80-20%	50V TYPE2	
C9	52-05-2468	FXD	CER	0.01UF +80-20%	50V TYPE2	
C10	52-01-2305	FXD	CER	470PF	10% 50V	TYPE2
C11	52-01-2305	FXD	CER	470PF	10% 50V	TYPE2
C12	52-05-2468	FXD	CER	0.01UF +80-20%	50V TYPE2	
C13	52-01-2305	FXD	CER	470PF	10% 50V	TYPE2
C14	52-01-2305	FXD	CER	470PF	10% 50V	TYPE2
C15	52-05-2468	FXD	CER	0.01UF +80-20%	50V TYPE2	
C16	52-06-2184	FXD	CER	47PF	10% 50V	TYPE1
C17	52-06-2184	FXD	CER	47PF	10% 50V	TYPE1
C18	52-06-2184	FXD	CER	47PF	10% 50V	TYPE1
C19	52-06-2184	FXD	CER	47PF	10% 50V	TYPE1
C20	52-05-2468	FXD	CER	0.01UF +80-20%	50V TYPE2	
C21	52-05-2468	FXD	CER	0.01UF +80-20%	50V TYPE2	
C22	52-05-2468	FXD	CER	0.01UF +80-20%	50V TYPE2	
C23	52-06-2245	FXD	CER	150PF	10% 50V	TYPE1
C24	55-37-2050	FXD	TANT	ELECT	1UF 35V	
C25	55-37-2050	FXD	TANT	ELECT	1UF 35V	
C26	55-37-2050	FXD	TANT	ELECT	1UF 35V	
C27	54-40-1200	FXD	ELECT	10MF	50WV	
C28	54-40-1200	FXD	ELECT	10MF	50WV	
C31	52-06-2225	FXD	CER	100PF	10% 50V	TYPE1
C32	52-05-2468	FXD	CER	0.01UF +80-20%	50V TYPE2	
C33	52-05-2468	FXD	CER	0.01UF +80-20%	50V TYPE2	
C34	52-05-2468	FXD	CER	0.01UF +80-20%	50V TYPE2	
C35	50-45-3530	FXD	PLSTC FILM	0.1MF	5% 63WV	MMH
C36	52-06-2245	FXD	CER	150PF	10% 50V	TYPE1
C38	52-06-2245	FXD	CER	150PF	10% 50V	TYPE1
C40	52-01-2265	FXD	CER	220PF	10% 50V	TYPE2
C41	52-01-2265	FXD	CER	220PF	10% 50V	TYPE2
C42	52-01-2265	FXD	CER	220PF	10% 50V	TYPE2
C43	52-01-2265	FXD	CER	220PF	10% 50V	TYPE2
C44	52-01-2265	FXD	CER	220PF	10% 50V	TYPE2
C45	52-01-2265	FXD	CER	220PF	10% 50V	TYPE2
C46	52-01-2265	FXD	CER	220PF	10% 50V	TYPE2
C47	52-01-2265	FXD	CER	220PF	10% 50V	TYPE2
C48	52-01-2265	FXD	CER	220PF	10% 50V	TYPE2
C49	52-01-2345	FXD	CER	1000PF	10% 50V	TYPE2
C50	52-01-2345	FXD	CER	1000PF	10% 50V	TYPE2

REFERENCE DESIGNATOR	KIKUSUI PARTS NO.	DESCRIPTION	97-11-0021
C51	52-01-2345	FXD CER 1000PF 10% 50V TYPE2	
C52	52-01-2345	FXD CER 1000PF 10% 50V TYPE2	
C53	52-01-2345	FXD CER 1000PF 10% 50V TYPE2	
C54	52-01-2345	FXD CER 1000PF 10% 50V TYPE2	
C55	50-65-3570	FXD PLSTC FILM 0.01MF 5% 100WV	AWS
C56	50-65-0540	FXD M PLSTC FILM 1UF 5% 100WV	
C57	50-65-3570	FXD PLSTC FILM 0.01MF 5% 100WV	AWS
C58	50-65-0540	FXD M PLSTC FILM 1UF 5% 100WV	
C59	52-06-2184	FXD CER 47PF 10% 50V TYPE1	
C60	52-06-2184	FXD CER 47PF 10% 50V TYPE1	
C61	52-06-2184	FXD CER 47PF 10% 50V TYPE1	
C62	52-06-2184	FXD CER 47PF 10% 50V TYPE1	
C65	52-05-2468	FXD CER 0.01UF +80-20% 50V TYPE2	
C67	55-37-2100	FXD TANT ELECT 10UF 35V	
C68	55-37-2100	FXD TANT ELECT 10UF 35V	
C69	55-37-2100	FXD TANT ELECT 10UF 35V	
C70	55-37-2100	FXD TANT ELECT 10UF 35V	
C71	55-37-2100	FXD TANT ELECT 10UF 35V	
C72	55-37-2050	FXD TANT ELECT 1UF 35V	
C73	55-37-2050	FXD TANT ELECT 1UF 35V	
C74	55-37-2050	FXD TANT ELECT 1UF 35V	
C75	55-37-2050	FXD TANT ELECT 1UF 35V	
C76	50-67-0030	FXD PLSTC FILM 0.01MF 10% 100WV	
C77	54-30-1970	FXD ELECT 100MF 25WV	
C78	50-67-0050	FXD PLSTC FILM 0.047MF 10% 100WV	
C79	52-06-2204	FXD CER 68P 10% 50V TYPE1	
C80	54-40-1200	FXD ELECT 10MF 50WV	
C81	55-37-2100	FXD TANT ELECT 10UF 35V	
C83	54-40-1210	FXD ELECT 22MF 50WV	
C84	54-30-1970	FXD ELECT 100MF 25WV	
C85	54-30-1970	FXD ELECT 100MF 25WV	
C86	52-01-2385	FXD CER 2200PF 10% 50V TYPE2	
C88	52-01-2265	FXD CER 220PF 10% 50V TYPE2	
C89	52-05-2468	FXD CER 0.01UF +80-20% 50V TYPE2	
C90	52-05-2468	FXD CER 0.01UF +80-20% 50V TYPE2	
C91	52-05-2468	FXD CER 0.01UF +80-20% 50V TYPE2	
C92	52-05-2468	FXD CER 0.01UF +80-20% 50V TYPE2	
C93	54-40-1210	FXD ELECT 22MF 50WV	
C94	54-30-1970	FXD ELECT 100MF 25WV	
C95	54-30-1970	FXD ELECT 100MF 25WV	
C96	54-30-1970	FXD ELECT 100MF 25WV	
C97	54-30-1970	FXD ELECT 100MF 25WV	
C98	56-48-1000	FXD CER EMI FILTER	
C99	56-48-1000	FXD CER EMI FILTER	
C100	56-48-1000	FXD CER EMI FILTER	
C101	52-05-2468	FXD CER 0.01UF +80-20% 50V TYPE2	
C102	52-05-2468	FXD CER 0.01UF +80-20% 50V TYPE2	
C103	52-05-2468	FXD CER 0.01UF +80-20% 50V TYPE2	
C104	52-05-2468	FXD CER 0.01UF +80-20% 50V TYPE2	
C105	52-05-2468	FXD CER 0.01UF +80-20% 50V TYPE2	
C106	52-05-2468	FXD CER 0.01UF +80-20% 50V TYPE2	
C107	52-05-2468	FXD CER 0.01UF +80-20% 50V TYPE2	
C108	52-05-2468	FXD CER 0.01UF +80-20% 50V TYPE2	
C109	52-05-2468	FXD CER 0.01UF +80-20% 50V TYPE2	

REFERENCE DESIGNATOR	KIKUSUI PARTS NO.	DESCRIPTION		97-11-0021
C110	52-05-2468	FXD CER 0.01UF	+80-20% 50V	TYPE2
C111	52-05-2468	FXD CER 0.01UF	+80-20% 50V	TYPE2
C112	52-05-2468	FXD CER 0.01UF	+80-20% 50V	TYPE2
C113	52-05-2468	FXD CER 0.01UF	+80-20% 50V	TYPE2
C114	52-05-2468	FXD CER 0.01UF	+80-20% 50V	TYPE2
C115	52-05-2468	FXD CER 0.01UF	+80-20% 50V	TYPE2
C116	52-01-2345	FXD CER 1000PF	10% 50V	TYPE2
C117	52-06-2225	FXD CER 100PF	10% 50V	TYPE1
C118	55-37-2050	FXD TANT ELECT	1UF 35V	
C119	52-06-2102	FXD CER 10P	10% 50V	TYPE1
C120	52-06-2165	FXD CER 33PF	10% 500V	TYPE1
C121	55-37-2100	FXD TANT ELECT	10UF 35V	
C122	52-01-2305	FXD CER 470PF	10% 50V	TYPE2
C124	52-05-2468	FXD CER 0.01UF	+80-20% 50V	TYPE2
C125	52-06-3125	FXD CER 15PF	10% 500V	TYPE1
C126	52-06-3125	FXD CER 15PF	10% 500V	TYPE1
C132	52-06-2102	FXD CER 10P	10% 50V	TYPE1
C134	52-01-2345	FXD CER 1000PF	10% 50V	TYPE2
C135	52-01-2345	FXD CER 1000PF	10% 50V	TYPE2
CR1	32-30-1200	DIODE VR=60V	IO=1A	HITACHI 1SS120
CR2	32-30-1200	DIODE VR=60V	IO=1A	HITACHI 1SS120
CR3	32-30-1200	DIODE VR=60V	IO=1A	HITACHI 1SS120
CR4	32-30-1200	DIODE VR=60V	IO=1A	HITACHI 1SS120
CR5	32-30-1200	DIODE VR=60V	IO=1A	HITACHI 1SS120
CR6	32-30-1200	DIODE VR=60V	IO=1A	HITACHI 1SS120
CR7	32-30-0860	DIODE VR=30V	IO=30MA	HITACHI 1SS86
CR8	32-30-0860	DIODE VR=30V	IO=30MA	HITACHI 1SS86
CR9	32-92-0100	ZENER VZ=10.1-10.6V	P=0.4W	NEC RD10JB3
CR10	32-92-0056	ZENER VZ=5.5 - 5.8V	P=0.4W	NEC RD5.6JB2
CR11	32-30-1200	DIODE VR=60V	IO=1A	HITACHI 1SS120
CR12	32-30-1200	DIODE VR=60V	IO=1A	HITACHI 1SS120
CR13	32-30-1200	DIODE VR=60V	IO=1A	HITACHI 1SS120
CR14	32-30-1200	DIODE VR=60V	IO=1A	HITACHI 1SS120
CR15	32-30-1200	DIODE VR=60V	IO=1A	HITACHI 1SS120
CV1	57-10-1242	VAR CER	5.6-20PF	ALPS CTZ31E
CV2	57-10-1242	VAR CER	5.6-20PF	ALPS CTZ31E
CV3	57-10-1242	VAR CER	5.6-20PF	ALPS CTZ31E
CV4	57-10-1242	VAR CER	5.6-20PF	ALPS CTZ31E
CV5	57-10-1242	VAR CER	5.6-20PF	ALPS CTZ31E
CV6	57-10-1242	VAR CER	5.6-20PF	ALPS CTZ31E
CV7	57-10-1242	VAR CER	5.6-20PF	ALPS CTZ31E
CV8	57-10-1242	VAR CER	5.6-20PF	ALPS CTZ31E
CV9	57-10-1242	VAR CER	5.6-20PF	ALPS CTZ31E
Q1	30-31-9071	TR SI NPN		HITACHI 2SC1907
Q2	30-31-9071	TR SI NPN		HITACHI 2SC1907
Q3	30-31-9071	TR SI NPN		HITACHI 2SC1907
Q4	30-31-9071	TR SI NPN		HITACHI 2SC1907
Q5	30-11-0051	TR SI PNP		NEC 2SA1005-L
Q6	30-31-9071	TR SI NPN		HITACHI 2SC1907
Q7	30-32-1201	TR SI NPN		TOSHIBA 2SC2120-Y
Q8	30-32-1201	TR SI NPN		TOSHIBA 2SC2120-Y

REFERENCE KIKUSUI  
DESIGNATOR PARTS NO. DESCRIPTION 97-11-0021

Q9	30-30-9451	TR SI NPN	NEC	2SC945-Q	
Q10	30-30-9451	TR SI NPN	NEC	2SC945-Q	
Q11	30-10-8441	TR SI PNP	HITACHI	2SA844-D	
Q12	30-30-9451	TR SI NPN	NEC	2SC945-Q	
Q13	30-31-9071	TR SI NPN	HITACHI	2SC1907	
Q14	30-31-9071	TR SI NPN	HITACHI	2SC1907	
Q15	30-32-1201	TR SI NPN	TOSHIBA	2SC2120-Y	
Q16	30-32-1201	TR SI NPN	TOSHIBA	2SC2120-Y	
Q17	30-30-9451	TR SI NPN	NEC	2SC945-Q	
Q18	30-30-9451	TR SI NPN	NEC	2SC945-Q	
Q19	30-11-0051	TR SI PNP	NEC	2SA1005-L	
R1	40-16-2101	FXD C FILM	1K	OHM 5% 1/6W	RD1/6FS
R2	40-16-2101	FXD C FILM	1K	OHM 5% 1/6W	RD1/6FS
R3	42-80-0101	FXD M FILM	10	OHM 1% 1/6W	RN1/6FS
R4	42-80-1391	FXD M FILM	390	OHM 1% 1/6W	RN1/6FS
R5	42-80-3181	FXD M FILM	18K	OHM 1% 1/6W	RN1/6FS
R6	42-80-2181	FXD M FILM	1.8K	OHM 1% 1/6W	RN1/6FS
R7	40-16-3221	FXD C FILM	22K	OHM 5% 1/6W	RD1/6FS
R8	40-16-3221	FXD C FILM	22K	OHM 5% 1/6W	RD1/6FS
R9	40-16-1561	FXD C FILM	560	OHM 5% 1/6W	RD1/6FS
R10	40-16-3101	FXD C FILM	10K	OHM 5% 1/6W	RD1/6FS
R11	40-16-1101	FXD C FILM	100	OHM 5% 1/6W	RD1/6FS
R12	40-16-3101	FXD C FILM	10K	OHM 5% 1/6W	RD1/6FS
R13	40-16-1101	FXD C FILM	100	OHM 5% 1/6W	RD1/6FS
R14	42-80-1181	FXD M FILM	180	OHM 1% 1/6W	RN1/6FS
R15	42-80-1181	FXD M FILM	180	OHM 1% 1/6W	RN1/6FS
R16	40-16-1561	FXD C FILM	560	OHM 5% 1/6W	RD1/6FS
R17	40-16-1221	FXD C FILM	220	OHM 5% 1/6W	RD1/6FS
R18	42-80-1181	FXD M FILM	180	OHM 1% 1/6W	RN1/6FS
R19	42-80-1181	FXD M FILM	180	OHM 1% 1/6W	RN1/6FS
R20	40-16-1561	FXD C FILM	560	OHM 5% 1/6W	RD1/6FS
R21	40-16-1221	FXD C FILM	220	OHM 5% 1/6W	RD1/6FS
R22	40-16-0391	FXD C FILM	39	OHM 5% 1/6W	RD1/6FS
R23	42-80-0821	FXD M FILM	82	OHM 1% 1/6W	RN1/6FS
R24	40-16-0391	FXD C FILM	39	OHM 5% 1/6W	RD1/6FS
R25	42-80-0821	FXD M FILM	82	OHM 1% 1/6W	RN1/6FS
R26	40-16-3101	FXD C FILM	10K	OHM 5% 1/6W	RD1/6FS
R27	40-16-2471	FXD C FILM	4.7K	OHM 5% 1/6W	RD1/6FS
R28	40-16-3101	FXD C FILM	10K	OHM 5% 1/6W	RD1/6FS
R30	40-16-2561	FXD C FILM	5.6K	OHM 5% 1/6W	RD1/6FS
R31	40-16-2561	FXD C FILM	5.6K	OHM 5% 1/6W	RD1/6FS
R32	40-16-2471	FXD C FILM	4.7K	OHM 5% 1/6W	RD1/6FS
R33	40-16-2471	FXD C FILM	4.7K	OHM 5% 1/6W	RD1/6FS
R34	40-16-2821	FXD C FILM	8.2K	OHM 5% 1/6W	RD1/6FS
R35	40-16-2821	FXD C FILM	8.2K	OHM 5% 1/6W	RD1/6FS
R36	40-16-2271	FXD C FILM	2.7K	OHM 5% 1/6W	RD1/6FS
R37	40-16-2561	FXD C FILM	5.6K	OHM 5% 1/6W	RD1/6FS
R38	40-16-1821	FXD C FILM	820	OHM 5% 1/6W	RD1/6FS
R39	40-16-3101	FXD C FILM	10K	OHM 5% 1/6W	RD1/6FS
R40	40-16-2331	FXD C FILM	3.3K	OHM 5% 1/6W	RD1/6FS
R41	40-16-1221	FXD C FILM	220	OHM 5% 1/6W	RD1/6FS
R42	40-16-1221	FXD C FILM	220	OHM 5% 1/6W	RD1/6FS
R43	40-16-1101	FXD C FILM	100	OHM 5% 1/6W	RD1/6FS

REFERENCE DESIGNATOR	KIKUSUI PARTS NO.	DESCRIPTION	97-11-0021	
R44	40-16-3331	FXD C FILM	33K OHM 5% 1/6W	RD1/6FS
R45	42-80-2221	FXD M FILM	2.2K OHM 1% 1/6W	RN1/6FS
R46	42-80-2391	FXD M FILM	3.9K OHM 1% 1/6W	RN1/6FS
R47	40-16-0001	FXD C FILM	0 OHM 5% 1/6W	RD1/6FS
R48	38-00-0080	THERMISTOR	2500 OHM	TOSHIBA D33A
R49	40-16-3221	FXD C FILM	22K OHM 5% 1/6W	RD1/6FS
R50	40-16-3101	FXD C FILM	10K OHM 5% 1/6W	RD1/6FS
R51	40-16-2101	FXD C FILM	1K OHM 5% 1/6W	RD1/6FS
R53	42-80-0911	FXD M FILM	91 OHM 1% 1/6W	RN1/6FS
R54	42-80-0911	FXD M FILM	91 OHM 1% 1/6W	RN1/6FS
R55	40-16-3221	FXD C FILM	22K OHM 5% 1/6W	RD1/6FS
R56	40-16-3221	FXD C FILM	22K OHM 5% 1/6W	RD1/6FS
R57	40-16-5101	FXD C FILM	1M OHM 5% 1/6W	RD1/6FS
R58	40-16-5101	FXD C FILM	1M OHM 5% 1/6W	RD1/6FS
R59	40-16-1221	FXD C FILM	220 OHM 5% 1/6W	RD1/6FS
R60	40-16-1221	FXD C FILM	220 OHM 5% 1/6W	RD1/6FS
R61	40-16-2331	FXD C FILM	3.3K OHM 5% 1/6W	RD1/6FS
R62	40-16-2681	FXD C FILM	6.8K OHM 5% 1/6W	RD1/6FS
R63	40-16-2681	FXD C FILM	6.8K OHM 5% 1/6W	RD1/6FS
R64	40-16-2331	FXD C FILM	3.3K OHM 5% 1/6W	RD1/6FS
R65	40-16-3101	FXD C FILM	10K OHM 5% 1/6W	RD1/6FS
R66	40-16-2821	FXD C FILM	8.2K OHM 5% 1/6W	RD1/6FS
R68	40-16-2271	FXD C FILM	2.7K OHM 5% 1/6W	RD1/6FS
R70	40-16-2331	FXD C FILM	3.3K OHM 5% 1/6W	RD1/6FS
R71	40-16-1471	FXD C FILM	470 OHM 5% 1/6W	RD1/6FS
R72	40-16-1681	FXD C FILM	680 OHM 5% 1/6W	RD1/6FS
R73	42-80-2391	FXD M FILM	3.9K OHM 1% 1/6W	RN1/6FS
R74	42-80-2331	FXD M FILM	3.3K OHM 1% 1/6W	RN1/6FS
R75	40-16-3271	FXD C FILM	27K OHM 5% 1/6W	RD1/6FS
R76	40-16-3101	FXD C FILM	10K OHM 5% 1/6W	RD1/6FS
R77	40-16-2101	FXD C FILM	1K OHM 5% 1/6W	RD1/6FS
R78	40-16-1151	FXD C FILM	150 OHM 5% 1/6W	RD1/6FS
R79	40-16-2151	FXD C FILM	1.5K OHM 5% 1/6W	RD1/6FS
R80	40-16-1561	FXD C FILM	560 OHM 5% 1/6W	RD1/6FS
R81	40-16-2271	FXD C FILM	2.7K OHM 5% 1/6W	RD1/6FS
R82	40-16-2101	FXD C FILM	1K OHM 5% 1/6W	RD1/6FS
R83	40-16-1221	FXD C FILM	220 OHM 5% 1/6W	RD1/6FS
R84	40-16-2121	FXD C FILM	1.2K OHM 5% 1/6W	RD1/6FS
R85	40-16-1471	FXD C FILM	470 OHM 5% 1/6W	RD1/6FS
R86	40-16-2101	FXD C FILM	1K OHM 5% 1/6W	RD1/6FS
R87	40-16-1221	FXD C FILM	220 OHM 5% 1/6W	RD1/6FS
R88	40-16-2101	FXD C FILM	1K OHM 5% 1/6W	RD1/6FS
R89	40-16-1271	FXD C FILM	270 OHM 5% 1/6W	RD1/6FS
R90	40-16-1221	FXD C FILM	220 OHM 5% 1/6W	RD1/6FS
R91	42-80-2221	FXD M FILM	2.2K OHM 1% 1/6W	RN1/6FS
R92	42-80-2681	FXD M FILM	6.8K OHM 1% 1/6W	RN1/6FS
R93	40-16-1101	FXD C FILM	100 OHM 5% 1/6W	RD1/6FS
R94	40-16-0101	FXD C FILM	10 OHM 5% 1/6W	RD1/6FS
R95	42-80-3101	FXD M FILM	10K OHM 1% 1/6W	RN1/6FS
R96	42-80-3101	FXD M FILM	10K OHM 1% 1/6W	RN1/6FS
R97	42-80-2131	FXD M FILM	1.3K OHM 1% 1/6W	RN1/6FS
R98	42-80-2101	FXD M FILM	1K OHM 1% 1/6W	RN1/6FS
R99	40-16-3101	FXD C FILM	10K OHM 5% 1/6W	RD1/6FS
R100	42-80-2131	FXD M FILM	1.3K OHM 1% 1/6W	RN1/6FS

REFERENCE DESIGNATOR	KIKUSUI PARTS NO.	DESCRIPTION	97-11-0021
R101	42-80-2101	FXD M FILM 1K	OHM 1% 1/6W RN1/6FS
R102	40-16-3101	FXD C FILM 10K	OHM 5% 1/6W RD1/6FS
R103	42-80-2121	FXD M FILM 1.2K	OHM 1% 1/6W RN1/6FS
R104	42-80-2101	FXD M FILM 1K	OHM 1% 1/6W RN1/6FS
R105	40-16-3101	FXD C FILM 10K	OHM 5% 1/6W RD1/6FS
R106	42-80-2151	FXD M FILM 1.5K	OHM 1% 1/6W RN1/6FS
R107	42-80-2101	FXD M FILM 1K	OHM 1% 1/6W RN1/6FS
R108	40-16-2101	FXD C FILM 1K	OHM 5% 1/6W RD1/6FS
R109	40-16-1681	FXD C FILM 680	OHM 5% 1/6W RD1/6FS
R110	40-16-2121	FXD C FILM 1.2K	OHM 5% 1/6W RD1/6FS
R111	40-16-2121	FXD C FILM 1.2K	OHM 5% 1/6W RD1/6FS
R112	40-16-1331	FXD C FILM 380	OHM 5% 1/6W RD1/6FS
R113	40-16-3221	FXD C FILM 22K	OHM 5% 1/6W RD1/6FS
R114	40-16-1821	FXD C FILM 820	OHM 5% 1/6W RD1/6FS
R116	40-16-0561	FXD C FILM 56	OHM 5% 1/6W RD1/6FS
R117	42-80-1391	FXD M FILM 390	OHM 1% 1/6W RN1/6FS
R118	42-80-1391	FXD M FILM 390	OHM 1% 1/6W RN1/6FS
R119	42-80-2101	FXD M FILM 1K	OHM 1% 1/6W RN1/6FS
R120	42-80-3101	FXD M FILM 10K	OHM 1% 1/6W RN1/6FS
R121	42-80-3101	FXD M FILM 10K	OHM 1% 1/6W RN1/6FS
R122	42-80-2391	FXD M FILM 3.9K	OHM 1% 1/6W RN1/6FS
R123	42-80-2391	FXD M FILM 3.9K	OHM 1% 1/6W RN1/6FS
R124	40-16-2331	FXD C FILM 3.3K	OHM 5% 1/6W RD1/6FS
R125	40-16-2331	FXD C FILM 3.3K	OHM 5% 1/6W RD1/6FS
R126	40-16-1151	FXD C FILM 150	OHM 5% 1/6W RD1/6FS
R127	40-16-1151	FXD C FILM 150	OHM 5% 1/6W RD1/6FS
R128	40-16-3101	FXD C FILM 10K	OHM 5% 1/6W RD1/6FS
R129	40-16-0001	FXD C FILM 0	OHM 5% 1/6W RD1/6FS
R130	40-16-2151	FXD C FILM 1.5K	OHM 5% 1/6W RD1/6FS
R131	40-16-1681	FXD C FILM 680	OHM 5% 1/6W RD1/6FS
R132	40-16-1221	FXD C FILM 220	OHM 5% 1/6W RD1/6FS
R133	40-16-0331	FXD C FILM 33	OHM 5% 1/6W RD1/6FS
R134	40-16-2181	FXD C FILM 1.8K	OHM 5% 1/6W RD1/6FS
R135	40-16-1561	FXD C FILM 560	OHM 5% 1/6W RD1/6FS
R136	40-16-1221	FXD C FILM 220	OHM 5% 1/6W RD1/6FS
R139	40-16-3101	FXD C FILM 10K	OHM 5% 1/6W RD1/6FS
R140	40-16-3101	FXD C FILM 10K	OHM 5% 1/6W RD1/6FS
R141	40-16-3101	FXD C FILM 10K	OHM 5% 1/6W RD1/6FS
R146	40-16-1561	FXD C FILM 560	OHM 5% 1/6W RD1/6FS
R147	40-16-1151	FXD C FILM 150	OHM 5% 1/6W RD1/6FS
R148	40-16-1151	FXD C FILM 150	OHM 5% 1/6W RD1/6FS
R149	40-16-1151	FXD C FILM 150	OHM 5% 1/6W RD1/6FS
R150	40-16-1151	FXD C FILM 150	OHM 5% 1/6W RD1/6FS
R152	41-10-2221	FXD M GLAZE 2.2K	OHM 5% 1/8W CHIP RESI.
R153	41-10-2221	FXD M GLAZE 2.2K	OHM 5% 1/8W CHIP RESI.
RV1	48-37-1500	VAR M GLAZE 500	OHM B TEITSU VM5CKPV
RV2	48-37-1200	VAR M GLAZE 200	OHM B TEITSU VM5CKPV
RV3	48-37-1200	VAR M GLAZE 200	OHM B TEITSU VM5CKPV
RV4	48-37-1200	VAR M GLAZE 200	OHM B TEITSU VM5CKPV
RV5	48-37-1200	VAR M GLAZE 200	OHM B TEITSU VM5CKPV
RV6	48-37-2100	VAR M GLAZE 1K	OHM B TEITSU VM5CKPV
RV7	48-37-1200	VAR M GLAZE 200	OHM B TEITSU VM5CKPV
RV8	48-37-2100	VAR M GLAZE 1K	OHM B TEITSU VM5CKPV

REFERENCE DESIGNATOR	KIKUSUI PARTS NO.	DESCRIPTION				97-11-0021	
RV9	48-37-1200	VAR M GLAZE	200	OHM B		TEITSU	VM5CKPV
RV10	48-37-2100	VAR M GLAZE	1K	OHM B		TEITSU	VM5CKPV
RV11	48-37-1200	VAR M GLAZE	200	OHM B		TEITSU	VM5CKPV
RV12	48-37-2100	VAR M GLAZE	1K	OHM B		TEITSU	VM5CKPV
RV13	48-37-1200	VAR M GLAZE	200	OHM B		TEITSU	VM5CKPV
RV14	48-37-3200	VAR M GLAZE	20K	OHM B		TEITSU	VM5CKPV
RV15	48-37-3200	VAR M GLAZE	20K	OHM B		TEITSU	VM5CKPV
RV16	48-37-3200	VAR M GLAZE	20K	OHM B		TEITSU	VM5CKPV
RV17	48-37-3200	VAR M GLAZE	20K	OHM B		TEITSU	VM5CKPV
RV18	48-37-2100	VAR M GLAZE	1K	OHM B		TEITSU	VM5CKPV
RV19	48-37-1200	VAR M GLAZE	200	OHM B		TEITSU	VM5CKPV
RV20	48-37-1100	VAR M GLAZE	100	OHM B		TEITSU	VM5CKPV
RV21	48-37-2100	VAR M GLAZE	1K	OHM B		TEITSU	VM5CKPV
RV22	48-37-3100	VAR M FILM	10K	OHM B			VM5CKPV
RV23	48-37-1200	VAR M GLAZE	200	OHM B		TEITSU	VM5CKPV
RV24	48-37-2500	VAR M GLAZE	5K	OHM B		TEITSU	VM5CKPV
RV25	48-37-1100	VAR M GLAZE	100	OHM B		TEITSU	VM5CKPV
RV26	48-37-1100	VAR M GLAZE	100	OHM B		TEITSU	VM5CKPV
RV27	48-37-2100	VAR M GLAZE	1K	OHM B		TEITSU	VM5CKPV
RV28	48-37-2100	VAR M GLAZE	1K	OHM B		TEITSU	VM5CKPV
RV29	48-37-1500	VAR M GLAZE	500	OHM B		TEITSU	VM5CKPV
RV30	48-37-2100	VAR M GLAZE	1K	OHM B		TEITSU	VM5CKPV
RV31	48-37-2200	VAR M GLAZE	2K	OHM B		TEITSU	VM5CKPV
RV32	48-37-3200	VAR M GLAZE	20K	OHM B		TEITSU	VM5CKPV
RV33	48-37-2100	VAR M GLAZE	1K	OHM B		TEITSU	VM5CKPV
RV34	48-37-1100	VAR M GLAZE	100	OHM B		TEITSU	VM5CKPV
U1	35-53-0864	QUAD 2-INPUT EXCLUSIVE-OR				TOSHIBA	TC74HC86P
U2	34-00-0215	J-FET INPUT OPE-AMP				TEXAS INS.	TL081CP
U3	36-00-1050	HIC (H5 2ND ATT)				KIKUSUI	B0209/12
U4	36-00-1050	HIC (H5 2ND ATT)				KIKUSUI	B0209/12
U5	35-56-0940	8-STAGE SHIHT REGISTER				TOSHIBA	TC4094BP
U6	35-56-0940	8-STAGE SHIHT REGISTER				TOSHIBA	TC4094BP
U7	35-56-0940	8-STAGE SHIHT REGISTER				TOSHIBA	TC4094BP
U8	35-56-0940	8-STAGE SHIHT REGISTER				TOSHIBA	TC4094BP
U9	35-56-0940	8-STAGE SHIHT REGISTER				TOSHIBA	TC4094BP
U10	35-70-0746	DUAL D F-F EDGE TRIGGER				TOSHIBA	TC74HC74P
U11	36-00-1060	HIC (H6 1ST AMP)				KIKUSUI	B0309/9
U12	36-00-1060	HIC (H6 1ST AMP)				KIKUSUI	B0309/9
U13	36-00-1070	HIC (H7 2ND AMP)				KIKUSUI	B0409/10
U14	36-00-1070	HIC (H7 2ND AMP)				KIKUSUI	B0409/10
U15	36-00-1073	HIC (H7 2ND AMP CH3/CH4)				KIKUSUI	B0439/10
U16	36-00-1073	HIC (H7 2ND AMP CH3/CH4)				KIKUSUI	B0439/10
U17	36-00-1140	HIC (H14 ANALOG MPX SP)				KIKUSUI	B1109/9
U18	36-00-1140	HIC (H14 ANALOG MPX SP)				KIKUSUI	B1109/9
U19	36-00-1190	HIC (H19 SIGNAL OUTPUT AMP)				KIKUSUI	B1609/12
U20	36-00-1080	HIC (H8 VERT MODE SWITCH)				KIKUSUI	B0509/4
U21	36-00-1420	HIC (H42 DVM TRUE RMS CONV.)				KIKUSUI	B3809/6
U22	36-00-1430	HIC (H43 DVM PEAK DETECTOR)				KIKUSUI	B3909/6
U23	34-00-0210	FET OPE-AMP				TEXAS INS.	TL084CN
U24	34-69-0030	TRIPLE 2-CHANNEL MULTIPLEXER				TOSHIBA	TC4053BP
U25	36-00-1090	HIC (H9 DELAY LINE DRIVER)				KIKUSUI	B0609/6
U27	36-00-1210	HIC (H21 TRIG SOUCE SWITCH)				KIKUSUI	B1709/6
U28	36-00-1220	HIC (H22 TRIG COUPLE SWITCH)				KIKUSUI	B1809/12

REFERENCE DESIGNATOR	KIKUSUI PARTS NO.	DESCRIPTION	97-11-0021
U29	36-00-1220	HIC (H22 TRIG COUPLE SWITCH)	KIKUSUI B1809/12
U30	36-00-1230	HIC (H23 TRIG LEVEL COMP.)	KIKUSUI B1909/9
U31	36-00-1230	HIC (H23 TRIG LEVEL COMP.)	KIKUSUI B1909/9
U32	36-00-1240	HIC (H24 TV SYNC SEPRATOR)	KIKUSUI B2009/12
U33	35-53-1584	QUAD 2-TO-1 DATA SELECTOR (INV)	TOSHIBA TC74HC158P
U34	35-53-1584	QUAD 2-TO-1 DATA SELECTOR (INV)	TOSHIBA TC74HC158P
U35	35-56-0940	8-STAGE SHIHT REGISTER	TOSHIBA TC4094BP
U36	35-56-0940	8-STAGE SHIHT REGISTER	TOSHIBA TC4094BP
U37	35-56-0945	8 BIT SHIFT/STORE RESISTER	TOSHIBA TC74HC4094
U38	35-56-0945	8 BIT SHIFT/STORE RESISTER	TOSHIBA TC74HC4094
U39	35-56-0945	8 BIT SHIFT/STORE RESISTER	TOSHIBA TC74HC4094
U40	35-56-0940	8-STAGE SHIHT REGISTER	TOSHIBA TC4094BP
U41	35-56-0940	8-STAGE SHIHT REGISTER	TOSHIBA TC4094BP
U42	35-56-0945	8 BIT SHIFT/STORE RESISTER	TOSHIBA TC74HC4094
U43	36-00-1270	HIC (H27 SWEEP GENERATOR)	KIKUSUI B2309/6
U44	36-00-1270	HIC (H27 SWEEP GENERATOR)	KIKUSUI B2309/6
U45	34-90-0051	REGULATOR	TEXAS INS. TL431CLPB
U46	35-70-1576	QUAD 2-TO-1 DATA SELECTORS	TOSHIBA TC74HC157P
U47	35-56-0525	DUAL 4CH ANALOG MPX	MATSUSITA MN74HC4052
U48	36-00-1250	HIC (H25 SWEEP CONTROLLER)	KIKUSUI B2109/3
U49	35-53-0144	HEX SHMITT-TRIG INVERTER	TOSHIBA TC74HC14P
U50	34-90-0051	REGULATOR	TEXAS INS. TL431CLPB
U51	34-00-0090	OPE-AMP	NEC UPC741C
U52	36-00-1290	HIC (H29 SWEEP & COMP.SWITCH)	KIKUSUI B2509/6
U53	35-70-0006	QUAD 2-INPUT POSI-NAND	TOSHIBA TC74HC00P
U54	35-70-0006	QUAD 2-INPUT POSI-NAND	TOSHIBA TC74HC00P
U55	36-00-1300	HIC (H30 HORIZ SW. & DRIVER)	KIKUSUI B2609/6
U56	36-00-1280	HIC (H28 DELAY TIME COMP.)	KIKUSUI B2409/9
U57	36-00-1340	HIC (H34 Z-AXIS SW. & DRIVER)	KIKUSUI B3009/6
U58	36-00-1260	HIC (H26 PRESCALER)	KIKUSUI B2209/12
U59	36-00-1410	HIC (H41 SEQUENCE CONT.)	KIKUSUI B3709/4
U60	35-56-0280	BCD TO DECIMAL DECODER	TOSHIBA TC4028BP
U61	35-56-0280	BCD TO DECIMAL DECODER	TOSHIBA TC4028BP
U62	35-53-1254	QUAD BUS BUFFER GATES (3-ST)	TOSHIBA TC74HC125P
U63	35-56-0940	8-STAGE SHIHT REGISTER	TOSHIBA TC4094BP
U64	35-56-0945	8 BIT SHIFT/STORE RESISTER	TOSHIBA TC74HC4094
U65	36-00-1140	HIC (H14 ANALOG MPX SP)	KIKUSUI B1109/9
U66	36-00-1140	HIC (H14 ANALOG MPX SP)	KIKUSUI B1109/9
U67	35-70-0046	HEX INVERTERS	TOSHIBA TC74HC04P

REFERENCE KIKUSUI  
 DESIGNATOR PARTS NO. DESCRIPTION 97-11-0030

A5 ASSEMBLY

C3	52-06-2165	FXD CER	33PF	10%	500V	TYPE1		
C4	52-06-2215	FXD CER	82PF	10%	500V	TYPE1		
C5	50-67-0040	FXD PLSTC FILM	0.022MF	10%	100WV			
C6	50-67-0000	FXD PLSTC FILM	0.001MF	10%	100WV			
C8	52-06-2225	FXD CER	100PF	10%	50V	TYPE1		
C9	52-06-2225	FXD CER	100PF	10%	50V	TYPE1		
C11	52-06-2184	FXD CER	47PF	10%	50V	TYPE1		
C12	52-06-2184	FXD CER	47PF	10%	50V	TYPE1		
C13	54-40-1200	FXD ELECT	10MF		50WV			
C14	54-40-1200	FXD ELECT	10MF		50WV			
C15	52-03-3469	FXD CER	0.01UF	+100-0%	500V	TYPE2		
C16	52-03-3469	FXD CER	0.01UF	+100-0%	500V	TYPE2		
C21	54-40-1200	FXD ELECT	10MF		50WV			
C22	54-70-1080	FXD ELECT	2.2MF		250WV			
C23	52-03-3469	FXD CER	0.01UF	+100-0%	500V	TYPE2		
C24	50-77-3500	FXD PLSTC FILM	0.047MF	20%	250WV			
C25	54-30-1960	FXD ELECT	47MF		25WV			
C26	52-03-3469	FXD CER	0.01UF	+100-0%	500V	TYPE2		
C27	50-77-3500	FXD PLSTC FILM	0.047MF	20%	250WV			
C28	54-40-1200	FXD ELECT	10MF		50WV			
C29	52-06-2225	FXD CER	100PF	10%	50V	TYPE1		
C30	52-06-2225	FXD CER	100PF	10%	50V	TYPE1		
C33	52-06-2184	FXD CER	47PF	10%	50V	TYPE1		
C34	52-01-2345	FXD CER	1000PF	10%	50V	TYPE2		
C35	52-06-3102	FXD CER	10PF	10%	500V	TYPE1		
C36	52-06-2285	FXD CER	330PF	10%	50V	TYPE1		
CR1	32-30-1200	DIODE VR=60V	I0=1A				HITACHI	1SS120
CR2	32-30-1200	DIODE VR=60V	I0=1A				HITACHI	1SS120
CV1	57-10-1203	VAR CER	5-20PF					
CV2	57-10-1223	VAR CER	8-50PF					
CV3	57-10-1223	VAR CER	8-50PF					
CV5	57-10-1223	VAR CER	8-50PF					
L1	67-05-0000	INDUCTOR	L-2868					
L2	67-05-0000	INDUCTOR	L-2868					
Q1	30-10-8441	TR SI PNP					HITACHI	2SA844-D
Q2	30-33-5961	TR SI NPN	(80V 0.3A		W)			2SC3596-D
Q3	30-33-5961	TR SI NPN	(80V 0.3A		W)			2SC3596-D
Q4	30-31-9071	TR SI NPN					HITACHI	2SC1907
Q5	30-31-9071	TR SI NPN					HITACHI	2SC1907
Q6	30-31-9071	TR SI NPN					HITACHI	2SC1907
R1	42-80-0911	FXD M FILM	91		OHM 1% 1/6W			RN1/6FS
R2	42-80-0911	FXD M FILM	91		OHM 1% 1/6W			RN1/6FS
R4	40-16-1121	FXD C FILM	120		OHM 5% 1/6W			RD1/6FS
R5	40-16-3121	FXD C FILM	12K		OHM 5% 1/6W			RD1/6FS
R6	40-16-2561	FXD C FILM	5.6K		OHM 5% 1/6W			RD1/6FS

REFERENCE DESIGNATOR	KIKUSUI PARTS NO.	DESCRIPTION	97-11-0030			
R7	40-16-2101	FXD C FILM	1K	OHM 5% 1/6W	RD1/6FS	
R8	42-80-2271	FXD M FILM	2.7K	OHM 1% 1/6W	RN1/6FS	
R9	42-80-2271	FXD M FILM	2.7K	OHM 1% 1/6W	RN1/6FS	
R10	42-80-2681	FXD M FILM	6.8K	OHM 1% 1/6W	RN1/6FS	
R11	42-80-2681	FXD M FILM	6.8K	OHM 1% 1/6W	RN1/6FS	
R12	40-16-1101	FXD C FILM	100	OHM 5% 1/6W	RD1/6FS	
R13	40-16-0181	FXD C FILM	18	OHM 5% 1/6W	RD1/6FS	
R14	40-16-0181	FXD C FILM	18	OHM 5% 1/6W	RD1/6FS	
R15	40-16-0101	FXD C FILM	10	OHM 5% 1/6W	RD1/6FS	
R16	40-16-0101	FXD C FILM	10	OHM 5% 1/6W	RD1/6FS	
R21	40-16-2271	FXD C FILM	2.7K	OHM 5% 1/6W	RD1/6FS	
R22	40-16-3101	FXD C FILM	10K	OHM 5% 1/6W	RD1/6FS	
R23	40-16-1391	FXD C FILM	390	OHM 5% 1/6W	RD1/6FS	
R24	40-16-0331	FXD C FILM	33	OHM 5% 1/6W	RD1/6FS	
R25	40-16-0331	FXD C FILM	33	OHM 5% 1/6W	RD1/6FS	
R26	38-00-0070	THERMISTOR	200	OHM	TOSHIBA	D22A
R41	44-57-0550	FXD M FILM	220	OHM 5% 3W	ERG3SJ	
R42	44-57-0550	FXD M FILM	220	OHM 5% 3W	ERG3SJ	
R43	44-57-0550	FXD M FILM	220	OHM 5% 3W	ERG3SJ	
R44	44-57-0550	FXD M FILM	220	OHM 5% 3W	ERG3SJ	
R45	40-27-0102	FXD C FILM	10	OHM 5% 1/4W	NAS1/4S	
R51	40-16-1101	FXD C FILM	100	OHM 5% 1/6W	RD1/6FS	
R52	40-16-2561	FXD C FILM	5.6K	OHM 5% 1/6W	RD1/6FS	
R53	40-16-1331	FXD C FILM	330	OHM 5% 1/6W	RD1/6FS	
R54	40-16-2561	FXD C FILM	5.6K	OHM 5% 1/6W	RD1/6FS	
R55	40-16-2101	FXD C FILM	1K	OHM 5% 1/6W	RD1/6FS	
R61	40-16-2101	FXD C FILM	1K	OHM 5% 1/6W	RD1/6FS	
R62	40-16-2101	FXD C FILM	1K	OHM 5% 1/6W	RD1/6FS	
R63	40-16-1471	FXD C FILM	470	OHM 5% 1/6W	RD1/6FS	
R64	40-16-2221	FXD C FILM	2.2K	OHM 5% 1/6W	RD1/6FS	
R65	40-16-0101	FXD C FILM	10	OHM 5% 1/6W	RD1/6FS	
R67	40-16-4391	FXD C FILM	390K	OHM 5% 1/6W	RD1/6FS	
R68	40-16-2471	FXD C FILM	4.7K	OHM 5% 1/6W	RD1/6FS	
R69	40-16-2101	FXD C FILM	1K	OHM 5% 1/6W	RD1/6FS	
R70	38-00-0070	THERMISTOR	200	OHM	TOSHIBA	D22A
RV1	48-37-1100	VAR M GLAZE	100	OHM B	TEITSU	VM5CKPV
RV2	48-37-1100	VAR M GLAZE	100	OHM B	TEITSU	VM5CKPV
RV3	48-37-1200	VAR M GLAZE	200	OHM B	TEITSU	VM5CKPV
RV4	48-37-1100	VAR M GLAZE	100	OHM B	TEITSU	VM5CKPV
RV5	48-37-2500	VAR M GLAZE	5K	OHM B	TEITSU	VM5CKPV
RV6	48-37-2200	VAR M GLAZE	2K	OHM B	TEITSU	VM5CKPV
RV7	48-37-1500	VAR M GLAZE	500	OHM B	TEITSU	VM5CKPV
RV8	48-37-3200	VAR M GLAZE	20K	OHM B	TEITSU	VM5CKPV
U1	34-00-0215	J-FET INPUT OPE-AMP			TEXAS INS.	TL081CP
U2	36-00-1100	HIC (H10 VERT FINAL DRIVER)			KIKUSUI	B0709/6
U3	36-00-1310	HIC (H31 HORIZ FINAL AMP)			KIKUSUI	B2709/6

REFERENCE KIKUSUI  
DESIGNATOR PARTS NO.

DESCRIPTION 97-11-0040

A6 ASSEMBLY

C2	54-40-1200	FXD ELECT	10MF	50WV		
C4	54-40-1200	FXD ELECT	10MF	50WV		
C5	52-03-3469	FXD CER	0.01UF	+100-0%	500V	TYPE2
C6	50-77-3500	FXD PLSTC FILM	0.047MF	20%	250WV	
C7	54-30-1970	FXD ELECT	100MF	25WV		
C8	52-03-3469	FXD CER	0.01UF	+100-0%	500V	TYPE2
C9	50-77-3500	FXD PLSTC FILM	0.047MF	20%	250WV	
C10	55-37-2050	FXD TANT	ELECT 1UF	35V		
C11	52-01-2425	FXD CER	4700PF	10%	50V	TYPE2
C12	50-67-0040	FXD PLSTC FILM	0.022MF	10%	100WV	
C13	50-67-0030	FXD PLSTC FILM	0.01MF	10%	100WV	
C14	54-30-1960	FXD ELECT	47MF	25WV		
C15	54-30-1970	FXD ELECT	100MF	25WV		
C16	52-96-1170	FXD CER	5PF 1KV			
C17	52-98-1020	FXD CER	1000PF	+80 -	-20%	3.15KV
C18	52-98-1020	FXD CER	1000PF	+80 -	-20%	3.15KV
C19	52-03-3469	FXD CER	0.01UF	+100-0%	500V	TYPE2
C20	52-98-1000	FXD CER	4700PF	+80-20%	3.15KV	TYPE1
C21	52-98-1020	FXD CER	1000PF	+80 -	-20%	3.15KV
C22	52-98-1020	FXD CER	1000PF	+80 -	-20%	3.15KV
C23	52-96-1170	FXD CER	5PF 1KV			
C24	52-98-1020	FXD CER	1000PF	+80 -	-20%	3.15KV
C25	52-03-3469	FXD CER	0.01UF	+100-0%	500V	TYPE2
C26	52-98-1000	FXD CER	4700PF	+80-20%	3.15KV	TYPE1
C27	52-98-1000	FXD CER	4700PF	+80-20%	3.15KV	TYPE1
C28	52-98-1000	FXD CER	4700PF	+80-20%	3.15KV	TYPE1
C29	52-98-1000	FXD CER	4700PF	+80-20%	3.15KV	TYPE1
C30	52-03-3469	FXD CER	0.01UF	+100-0%	500V	TYPE2
C31	52-03-3469	FXD CER	0.01UF	+100-0%	500V	TYPE2
C32	52-03-3469	FXD CER	0.01UF	+100-0%	500V	TYPE2
C36	52-03-3469	FXD CER	0.01UF	+100-0%	500V	TYPE2
CR1	32-30-1200	DIODE	VR=60V	IO=1A	HITACHI	1SS120
CR2	32-30-1200	DIODE	VR=60V	IO=1A	HITACHI	1SS120
CR3	32-30-1200	DIODE	VR=60V	IO=1A	HITACHI	1SS120
CR4	32-30-1200	DIODE	VR=60V	IO=1A	HITACHI	1SS120
CR5	32-30-1200	DIODE	VR=60V	IO=1A	HITACHI	1SS120
CR6	32-30-1200	DIODE	VR=60V	IO=1A	HITACHI	1SS120
CR7	32-91-2310	ZENER	VZ= 90 - 110V	P=1W	TOSHIBA	1Z100
CR8	32-90-3130	DIODE	VR=250V	IO=0.2A	MATSUSITA	MA185
CR9	32-90-3130	DIODE	VR=250V	IO=0.2A	MATSUSITA	MA185
CR10	32-90-3130	DIODE	VR=250V	IO=0.2A	MATSUSITA	MA185
CR11	32-90-1820	DIODE	VR=2KV	FAST RECOVERY	HITACHI	ERB26-20
CR12	32-90-3130	DIODE	VR=250V	IO=0.2A	MATSUSITA	MA185
CR13	32-90-3130	DIODE	VR=250V	IO=0.2A	MATSUSITA	MA185
CR14	32-90-3130	DIODE	VR=250V	IO=0.2A	MATSUSITA	MA185
CR15	32-90-1820	DIODE	VR=2KV	FAST RECOVERY	HITACHI	ERB26-20
CR16	32-90-0523	DIODE	VR=600V	IO=1A	TOSHIBA	S5277J
CR17	32-90-0523	DIODE	VR=600V	IO=1A	TOSHIBA	S5277J
DS1	23-70-0100	LAMP NEON				

REFERENCE DESIGNATOR	KIKUSUI PARTS NO.	DESCRIPTION	97-11-0040
DS2	23-70-0100	LAMP NEON	
DS3	23-70-0100	LAMP NEON	
L1	67-10-0890	INDUCTOR 100MH 10%	
Q1	30-31-9071	TR SI NPN	HITACHI 2SC1907
Q2	30-41-4060	TR SI NPN (60V 3A 25W)	TOSHIBA 2SD1406-Y
Q3	30-32-7041	TR SI NPN	TOSHIBA 2SC2704-0
Q4	30-32-7041	TR SI NPN	TOSHIBA 2SC2704-0
R1	40-16-0471	FXD C FILM 47 OHM 5% 1/6W	RD1/6FS
R2	40-16-2101	FXD C FILM 1K OHM 5% 1/6W	RD1/6FS
R3	40-16-2101	FXD C FILM 1K OHM 5% 1/6W	RD1/6FS
R4	40-16-1221	FXD C FILM 220 OHM 5% 1/6W	RD1/6FS
R5	40-16-3101	FXD C FILM 10K OHM 5% 1/6W	RD1/6FS
R6	40-16-1391	FXD C FILM 390 OHM 5% 1/6W	RD1/6FS
R7	40-16-1221	FXD C FILM 220 OHM 5% 1/6W	RD1/6FS
R9	42-80-3101	FXD M FILM 10K OHM 1% 1/6W	RN1/6FS
R10	42-80-2271	FXD M FILM 2.7K OHM 1% 1/6W	RN1/6FS
R11	42-80-3821	FXD M FILM 82K OHM 1% 1/6W	RN1/6FS
R13	40-16-2151	FXD C FILM 1.5K OHM 5% 1/6W	RD1/6FS
R14	40-16-1271	FXD C FILM 270 OHM 5% 1/6W	RD1/6FS
R15	40-16-0001	FXD C FILM 0 OHM 5% 1/6W	RD1/6FS
R16	40-16-3681	FXD C FILM 68K OHM 5% 1/6W	RD1/6FS
R17	40-16-2181	FXD C FILM 1.8K OHM 5% 1/6W	RD1/6FS
R18	40-16-2101	FXD C FILM 1K OHM 5% 1/6W	RD1/6FS
R19	40-16-0331	FXD C FILM 33 OHM 5% 1/6W	RD1/6FS
R20	40-16-3561	FXD C FILM 56K OHM 5% 1/6W	RD1/6FS
R21	40-16-3181	FXD C FILM 18K OHM 5% 1/6W	RD1/6FS
R22	44-91-8101	FXD M OXIDE 1 OHM 5% 1W	MATSUSITA ERX1ANJ
R23	40-27-3472	FXD C FILM 47K OHM 5% 1/4W	
R24	40-27-4152	FXD C FILM 150K OHM 5% 1/4W	
R25	40-37-6101	FXD C FILM 10M OHM 5% 1/2W	
R26	40-37-6101	FXD C FILM 10M OHM 5% 1/2W	
R27	40-27-2332	FXD C FILM 3.3K OHM 5% 1/4W	
R28	40-37-5221	FXD C FILM 2.2M OHM 5% 1/2W	
R29	40-37-6101	FXD C FILM 10M OHM 5% 1/2W	
R30	40-37-6101	FXD C FILM 10M OHM 5% 1/2W	
R31	40-27-2102	FXD C FILM 1K OHM 5% 1/4W	NAS1/4S
R32	40-27-3822	FXD C FILM 82K OHM 5% 1/4W	
R33	42-44-0330	FXD T FILM 10M OHM 1% 1W	
R34	42-34-2190	FXD M GLAZE 6.8M OHM 1% 0.8W	
R35	40-27-4472	FXD C FILM 470K OHM 5% 1/4W	
R36	40-27-3222	FXD C FILM 22K OHM 5% 1/4W	
R37	40-27-4222	FXD C FILM 220K OHM 5% 1/4W	
R42	40-16-2561	FXD C FILM 5.6K OHM 5% 1/6W	RD1/6FS
R43	40-16-0331	FXD C FILM 33 OHM 5% 1/6W	RD1/6FS
RV2	48-31-3500	FXD M GLAZE 50K OHM B PH	
RV3	48-26-5221	VAR M GLAZE 2.2M OHM	
RV4	48-31-4100	VAR M GLAZE 100K OHM B PH	
RV5	48-31-4100	VAR M GLAZE 100K OHM B PH	
RV6	48-31-4100	VAR M GLAZE 100K OHM B PH	
U601	36-00-1310	HIC (H31 HORIZ FINAL AMP)	KIKUSUI B2709/6

REFERENCE KIKUSUI  
DESIGNATOR PARTS NO. DESCRIPTION 97-11-0040

U602 34-00-0340 FET INPUT DUAL OP AMP TEXAS INS.TL082CP

A7 ASSEMBLY

C1	52-05-2468	FXD CER	0.01UF	+80-20%	50V	TYPE2		
C2	52-37-1000	FXD CER	0.047UF	20%	25V	TYPE1		
C3	52-37-1000	FXD CER	0.047UF	20%	25V	TYPE1		
C4	52-37-1000	FXD CER	0.047UF	20%	25V	TYPE1		
C5	52-37-1000	FXD CER	0.047UF	20%	25V	TYPE1		
C6	54-20-1210	FXD ELECT	220MF		16WV		KME16VB220	
C7	52-37-1000	FXD CER	0.047UF	20%	25V	TYPE1		
C8	52-37-1000	FXD CER	0.047UF	20%	25V	TYPE1		
CR1	37-00-0440	LAMP LED	RED				TOSHIBA	TLUY163
CR2	37-00-0440	LAMP LED	RED				TOSHIBA	TLUY163
CR3	37-00-0440	LAMP LED	RED				TOSHIBA	TLUY163
DS1	23-43-0000	LAMP FILAMENT	14V	40MA				RM314V40
DS2	23-43-0000	LAMP FILAMENT	14V	40MA				RM314V40
DS3	23-43-0000	LAMP FILAMENT	14V	40MA				RM314V40
Q1	30-11-0151	TR SI	PNP				TOSHIBA	2SA1015-Y
Q2	30-30-9451	TR SI	NPN				NEC	2SC945-Q
Q3	30-31-8461	TR SI	NPN				MATSUSITA	2SC1846-R
Q4	30-31-8461	TR SI	NPN				MATSUSITA	2SC1846-R
Q5	30-30-9451	TR SI	NPN				NEC	2SC945-Q
Q6	30-11-0151	TR SI	PNP				TOSHIBA	2SA1015-Y
R1	42-80-2681	FXD M	FILM	6.8K	OHM	1%	1/6W	RN1/6FS
R2	42-80-2331	FXD M	FILM	3.3K	OHM	1%	1/6W	RN1/6FS
R3	40-16-1101	FXD C	FILM	100	OHM	5%	1/6W	RD1/6FS
R4	42-80-3101	FXD M	FILM	10K	OHM	1%	1/6W	RN1/6FS
R5	42-80-3101	FXD M	FILM	10K	OHM	1%	1/6W	RN1/6FS
R6	40-16-1101	FXD C	FILM	100	OHM	5%	1/6W	RD1/6FS
R7	40-16-2821	FXD C	FILM	8.2K	OHM	5%	1/6W	RD1/6FS
R8	40-16-2391	FXD C	FILM	3.9K	OHM	5%	1/6W	RD1/6FS
R9	40-16-2391	FXD C	FILM	3.9K	OHM	5%	1/6W	RD1/6FS
R10	40-16-1101	FXD C	FILM	100	OHM	5%	1/6W	RD1/6FS
R11	40-16-2221	FXD C	FILM	2.2K	OHM	5%	1/6W	RD1/6FS
R12	40-16-4101	FXD C	FILM	100K	OHM	5%	1/6W	RD1/6FS
R14	40-16-2471	FXD C	FILM	4.7K	OHM	5%	1/6W	RD1/6FS
R15	40-16-2101	FXD C	FILM	1K	OHM	5%	1/6W	RD1/6FS
R16	40-16-2101	FXD C	FILM	1K	OHM	5%	1/6W	RD1/6FS
R17	40-16-2101	FXD C	FILM	1K	OHM	5%	1/6W	RD1/6FS
R18	40-16-3101	FXD C	FILM	10K	OHM	5%	1/6W	RD1/6FS
RV1	45-01-0810	VAR C	COMP	20K/20K	OHM	B	KIKUSUI	V12LG3S
RV2	45-02-0280	VAR C	COMP	20K/20K	OHM	B	KIKUSUI	V12LG3N
RV3	45-02-0285	VAR C	COMP	20K/20K	OHM	B		V12LG3N
RV4	45-01-0810	VAR C	COMP	20K/20K	OHM	B	KIKUSUI	V12LG3S
S1	81-01-0270	PUSH SWITCH					ALPS	SDG5P-E
U1	34-00-0240	DUAL OPE-AMP					NEC	UPC4558C

REFERENCE KIKUSUI  
DESIGNATOR PARTS NO. DESCRIPTION 97-11-0050

U2 34-00-0340 FET INPUT DUAL OP AMP TEXAS INS.TL082CP

A8 ASSEMBLY 97-11-0060

BT1	94-00-0200	BATTERY LITHIUM	CR14250P31
C1	52-06-3165	FXD CER 33PF 10% 500V TYPE1	
C2	52-06-3165	FXD CER 33PF 10% 500V TYPE1	
C3	55-37-2050	FXD TANT ELECT 1UF 35V	
C4	52-05-2468	FXD CER 0.01UF +80-20% 50V TYPE2	
C6	54-20-1210	FXD ELECT 220MF 16WV	KME16VB220
C7	54-20-1210	FXD ELECT 220MF 16WV	KME16VB220
C8	52-06-2102	FXD CER 10P 10% 50V TYPE1	
C9	52-01-3305	FXD CER 470PF 10% 500V TYPE2	
C10	52-06-2225	FXD CER 100PF 10% 50V TYPE1	
C11	54-40-1200	FXD ELECT 10MF 50WV	
C12	52-06-2225	FXD CER 100PF 10% 50V TYPE1	
C14	52-01-2345	FXD CER 1000PF 10% 50V TYPE2	
C15	54-40-1200	FXD ELECT 10MF 50WV	
C16	52-06-2225	FXD CER 100PF 10% 50V TYPE1	
C18	52-01-2345	FXD CER 1000PF 10% 50V TYPE2	
C21	54-40-1200	FXD ELECT 10MF 50WV	
C22	54-40-1200	FXD ELECT 10MF 50WV	
C23	52-01-2345	FXD CER 1000PF 10% 50V TYPE2	
C24	52-06-3165	FXD CER 33PF 10% 500V TYPE1	
C25	52-06-3165	FXD CER 33PF 10% 500V TYPE1	
C26	54-20-1210	FXD ELECT 220MF 16WV	KME16VB220
C27	54-40-1200	FXD ELECT 10MF 50WV	
C28	54-40-1200	FXD ELECT 10MF 50WV	
C29	54-20-1210	FXD ELECT 220MF 16WV	KME16VB220
C30	54-40-1200	FXD ELECT 10MF 50WV	
C31	54-40-1200	FXD ELECT 10MF 50WV	
C32	54-40-1200	FXD ELECT 10MF 50WV	
C33	52-37-1000	FXD CER 0.047UF 20% 25V TYPE1	
C34	52-37-1000	FXD CER 0.047UF 20% 25V TYPE1	
C35	52-37-1000	FXD CER 0.047UF 20% 25V TYPE1	
C36	52-37-1000	FXD CER 0.047UF 20% 25V TYPE1	
C37	52-37-1000	FXD CER 0.047UF 20% 25V TYPE1	
C38	52-37-1000	FXD CER 0.047UF 20% 25V TYPE1	
C39	52-37-1000	FXD CER 0.047UF 20% 25V TYPE1	
C40	52-37-1000	FXD CER 0.047UF 20% 25V TYPE1	
C41	52-37-1000	FXD CER 0.047UF 20% 25V TYPE1	
C42	52-37-1000	FXD CER 0.047UF 20% 25V TYPE1	
C43	52-37-1000	FXD CER 0.047UF 20% 25V TYPE1	
C44	52-37-1000	FXD CER 0.047UF 20% 25V TYPE1	
C45	52-37-1000	FXD CER 0.047UF 20% 25V TYPE1	
C46	52-37-1000	FXD CER 0.047UF 20% 25V TYPE1	
C47	52-37-1000	FXD CER 0.047UF 20% 25V TYPE1	
C48	52-37-1000	FXD CER 0.047UF 20% 25V TYPE1	
C49	52-37-1000	FXD CER 0.047UF 20% 25V TYPE1	
C51	52-37-1000	FXD CER 0.047UF 20% 25V TYPE1	
C52	52-37-1000	FXD CER 0.047UF 20% 25V TYPE1	
C53	52-37-1000	FXD CER 0.047UF 20% 25V TYPE1	
C54	52-37-1000	FXD CER 0.047UF 20% 25V TYPE1	

REFERENCE DESIGNATOR	KIKUSUI PARTS NO.	DESCRIPTION	97-11-0060
C55	52-37-1000	FXD CER 0.047UF 20% 25V TYPE1	
C56	52-37-1000	FXD CER 0.047UF 20% 25V TYPE1	
C57	52-37-1000	FXD CER 0.047UF 20% 25V TYPE1	
C58	52-37-1000	FXD CER 0.047UF 20% 25V TYPE1	
C59	52-37-1000	FXD CER 0.047UF 20% 25V TYPE1	
C61	52-37-1000	FXD CER 0.047UF 20% 25V TYPE1	
C62	52-37-1000	FXD CER 0.047UF 20% 25V TYPE1	
C63	52-37-1000	FXD CER 0.047UF 20% 25V TYPE1	
C64	52-37-1000	FXD CER 0.047UF 20% 25V TYPE1	
C65	52-37-1000	FXD CER 0.047UF 20% 25V TYPE1	
C66	52-37-1000	FXD CER 0.047UF 20% 25V TYPE1	
C67	52-37-1000	FXD CER 0.047UF 20% 25V TYPE1	
C68	52-06-2225	FXD CER 100PF 10% 50V TYPE1	
C69	52-06-2225	FXD CER 100PF 10% 50V TYPE1	
C70	52-06-2184	FXD CER 47PF 10% 50V TYPE1	
CR1	32-30-1200	DIODE VR=60V IO=1A	HITACHI 1SS120
CR2	32-30-1200	DIODE VR=60V IO=1A	HITACHI 1SS120
CR3	32-30-1200	DIODE VR=60V IO=1A	HITACHI 1SS120
CR4	32-92-0033	ZENER VZ=3.2 - 3.4V	HITACHI HZ3C-2
CR5	32-30-1200	DIODE VR=60V IO=1A	HITACHI 1SS120
CR6	32-30-1200	DIODE VR=60V IO=1A	HITACHI 1SS120
CR7	32-30-1200	DIODE VR=60V IO=1A	HITACHI 1SS120
CR8	32-30-1200	DIODE VR=60V IO=1A	HITACHI 1SS120
CR9	32-30-1200	DIODE VR=60V IO=1A	HITACHI 1SS120
CR10	32-30-1200	DIODE VR=60V IO=1A	HITACHI 1SS120
CR11	32-30-1200	DIODE VR=60V IO=1A	HITACHI 1SS120
CR12	32-30-1200	DIODE VR=60V IO=1A	HITACHI 1SS120
CR13	32-30-1200	DIODE VR=60V IO=1A	HITACHI 1SS120
CR14	32-92-0056	ZENER VZ=5.5 - 5.8V P=0.4W	NEC RD5.6JB2
Q1	30-11-0151	TR SI PNP	TOSHIBA 2SA1015-Y
Q2	30-30-9451	TR SI NPN	NEC 2SC945-Q
Q3	30-11-0151	TR SI PNP	TOSHIBA 2SA1015-Y
Q4	30-11-0051	TR SI PNP	NEC 2SA1005-L
Q5	30-11-0051	TR SI PNP	NEC 2SA1005-L
Q6	30-30-9451	TR SI NPN	NEC 2SC945-Q
Q7	30-11-0151	TR SI PNP	TOSHIBA 2SA1015-Y
R1	40-16-5101	FXD C FILM 1M OHM 5% 1/6W	RD1/6FS
R2	40-16-2331	FXD C FILM 3.3K OHM 5% 1/6W	RD1/6FS
R3	40-16-2561	FXD C FILM 5.6K OHM 5% 1/6W	RD1/6FS
R4	40-16-0101	FXD C FILM 10 OHM 5% 1/6W	RD1/6FS
R5	40-16-1821	FXD C FILM 820 OHM 5% 1/6W	RD1/6FS
R6	42-80-3471	FXD M FILM 47K OHM 1% 1/6W	RN1/6FS
R7	42-80-2221	FXD M FILM 2.2K OHM 1% 1/6W	RN1/6FS
R9	40-16-1331	FXD C FILM 330 OHM 5% 1/6W	RD1/6FS
R10	40-16-2331	FXD C FILM 3.3K OHM 5% 1/6W	RD1/6FS
R11	40-16-2331	FXD C FILM 3.3K OHM 5% 1/6W	RD1/6FS
R12	40-16-2561	FXD C FILM 5.6K OHM 5% 1/6W	RD1/6FS
R13	42-80-2331	FXD M FILM 3.3K OHM 1% 1/6W	RN1/6FS
R14	42-80-2471	FXD M FILM 4.7K OHM 1% 1/6W	RN1/6FS
R15	40-16-2221	FXD C FILM 2.2K OHM 5% 1/6W	RD1/6FS
R16	40-16-1681	FXD C FILM 680 OHM 5% 1/6W	RD1/6FS

REFERENCE	KIKUSUI		
DESIGNATOR	PARTS NO.	DESCRIPTION	97-11-0060

R17	44-07-0070	FXD	M	GLAZE	R-NET	3.3K	OHM	X8	
R18	44-07-0150	FXD	M	GLAZE	R-NET	4.7K	OHM	X4	
R24	40-16-3221	FXD	C	FILM	22K	OHM	5%	1/6W	RD1/6FS
R25	40-16-2101	FXD	C	FILM	1K	OHM	5%	1/6W	RD1/6FS
R26	40-16-1821	FXD	C	FILM	820	OHM	5%	1/6W	RD1/6FS
R27	40-16-2101	FXD	C	FILM	1K	OHM	5%	1/6W	RD1/6FS
R28	40-16-2181	FXD	C	FILM	1.8K	OHM	5%	1/6W	RD1/6FS
R29	40-16-2181	FXD	C	FILM	1.8K	OHM	5%	1/6W	RD1/6FS
R30	40-16-1101	FXD	C	FILM	100	OHM	5%	1/6W	RD1/6FS
R31	40-16-1391	FXD	C	FILM	390	OHM	5%	1/6W	RD1/6FS
R32	42-80-2151	FXD	M	FILM	1.5K	OHM	1%	1/6W	RN1/6FS
R33	42-80-2331	FXD	M	FILM	3.3K	OHM	1%	1/6W	RN1/6FS
R34	40-16-2471	FXD	C	FILM	4.7K	OHM	5%	1/6W	RD1/6FS
R35	40-16-5101	FXD	C	FILM	1M	OHM	5%	1/6W	RD1/6FS
R36	40-16-3101	FXD	C	FILM	10K	OHM	5%	1/6W	RD1/6FS
R37	40-16-3561	FXD	C	FILM	56K	OHM	5%	1/6W	RD1/6FS
R38	40-16-2221	FXD	C	FILM	2.2K	OHM	5%	1/6W	RD1/6FS
R39	40-16-2221	FXD	C	FILM	2.2K	OHM	5%	1/6W	RD1/6FS
R40	40-16-3101	FXD	C	FILM	10K	OHM	5%	1/6W	RD1/6FS
R41	40-16-3101	FXD	C	FILM	10K	OHM	5%	1/6W	RD1/6FS
R42	40-16-3101	FXD	C	FILM	10K	OHM	5%	1/6W	RD1/6FS
R43	42-80-2561	FXD	M	FILM	5.6K	OHM	1%	1/6W	RN1/6FS
R44	40-16-2271	FXD	C	FILM	2.7K	OHM	5%	1/6W	RD1/6FS
R45	42-80-3101	FXD	M	FILM	10K	OHM	1%	1/6W	RN1/6FS
R46	42-80-2391	FXD	M	FILM	3.9K	OHM	1%	1/6W	RN1/6FS
R47	42-80-1271	FXD	M	FILM	270	OHM	1%	1/6W	RN1/6FS
R48	42-80-1681	FXD	M	FILM	680	OHM	1%	1/6W	RN1/6FS
R49	42-80-1471	FXD	M	FILM	470	OHM	1%	1/6W	RN1/6FS
R50	42-80-2471	FXD	M	FILM	4.7K	OHM	1%	1/6W	RN1/6FS
R51	40-16-1221	FXD	C	FILM	220	OHM	5%	1/6W	RD1/6FS
R52	42-80-3101	FXD	M	FILM	10K	OHM	1%	1/6W	RN1/6FS
R53	42-80-2821	FXD	M	FILM	8.2K	OHM	1%	1/6W	RN1/6FS
R54	42-80-1471	FXD	M	FILM	470	OHM	1%	1/6W	RN1/6FS
R55	42-80-1681	FXD	M	FILM	680	OHM	1%	1/6W	RN1/6FS
R56	42-80-1271	FXD	M	FILM	270	OHM	1%	1/6W	RN1/6FS
R57	40-16-3101	FXD	C	FILM	10K	OHM	5%	1/6W	RD1/6FS
R58	42-80-1101	FXD	M	FILM	100	OHM	1%	1/6W	RN1/6FS
R59	40-16-2221	FXD	C	FILM	2.2K	OHM	5%	1/6W	RD1/6FS
R60	40-16-2221	FXD	C	FILM	2.2K	OHM	5%	1/6W	RD1/6FS
R61	40-16-2221	FXD	C	FILM	2.2K	OHM	5%	1/6W	RD1/6FS
R63	40-16-2331	FXD	C	FILM	3.3K	OHM	5%	1/6W	RD1/6FS
R64	40-16-1101	FXD	C	FILM	100	OHM	5%	1/6W	RD1/6FS
R65	40-16-2221	FXD	C	FILM	2.2K	OHM	5%	1/6W	RD1/6FS
RV1	48-37-3100	VAR	M	FILM	10K	OHM	B		VM5CKPV
U01	35-70-0746	DUAL D	F-F	EDGE TRIGGER					TOSHIBA TC74HC74P
U05	35-70-0046	HEX INVERTERS							TOSHIBA TC74HC04P
U06	35-70-1396	2LINE TO 4LINE	DECODER						TOSHIBA TC74HC139P
U07	35-70-0086	QUAD 2-INPUT	POSI-AND						TOSHIBA TC74HC08P
U11	35-70-0746	DUAL D	F-F	EDGE TRIGGER					TOSHIBA TC74HC74P
U12	36-90-0110	Z80A-CPU	4MHZ						SHARP LH0080A
U13	35-05-0010	EPROM	32K X 8BIT	250NS (CMOS)					27C256
U15	35-56-0111	S-RAM	2KX8BIT		CMOS				HME116P-3

REFERENCE DESIGNATOR	KIKUSUI PARTS NO.	DESCRIPTION	97-11-0060
U16	35-53-0304	8-INPUT POSI-NAND GATE	TOSIHBATC74HC30P
U18	35-70-1646	8BIT PARALOAD SHIFTREGISTER	HITACHIHD74HC164P
U21	35-70-1576	QUAD 2-TO-1 DATA SELECTORS	TOSHIBATC74HC157P
U26	34-44-0010	RESET IC	TEXAS INS.TL7705CP
U28	35-70-0006	QUAD 2-INPUT POSI-NAND	TOSHIBATC74HC00P
U33	35-56-0080	S-RAM 2KW X 8BIT 200NS	HITACHIHM6117LP-4
U34	35-53-2454	OCTAL BUS TRANSCEIVER	TOSHIBATC74HC245P
U36	35-53-5414	OCTAL BUFFER	TEXAS INS.SN7HCS541N
U37	35-53-1744	HEX D-TYPE FLIP FLOP	TOSHIBATC74HC174P
U38	35-70-2991	8 BIT SHIFT RESISTER	TEXAS INS.SN74LS299N
U41	35-70-1576	QUAD 2-TO-1 DATA SELECTORS	TOSHIBATC74HC157P
U42	35-70-1576	QUAD 2-TO-1 DATA SELECTORS	TOSHIBATC74HC157P
U43	35-70-1576	QUAD 2-TO-1 DATA SELECTORS	TOSHIBATC74HC157P
U45	35-70-1386	3LINE TO 8LINE DECODER	HITACHIHD74HC138P
U46	35-70-1396	2LINE TO 4LINE DECODER	TOSHIBATC74HC139P
U47	35-70-0326	QUAD 2-INPUT POSI-OR	TOSHIBATC74HC32P
U51	35-53-1074	DUAL J-K F-F WITH P/C	TOSHIBATC74HC107P
U52	35-56-0665	QUAD BILATERAL SWITCH	TOSHIBATC74HC4066
U53	35-70-0111	TRI 3-INPUT POSI-AND	HITACHIHD74LS11P
U54	35-53-3904	DUAL DECADE COUNTERS	TOSHIBATC74HC390P
U55	35-53-3904	DUAL DECADE COUNTERS	TOSHIBATC74HC390P
U56	35-53-2574	QUAD DATA SELEC./MULTI.	TOSHIBATC74HC257P
U57	35-70-0326	QUAD 2-INPUT POSI-OR	TOSHIBATC74HC32P
U61	35-70-0046	HEX INVERTERS	TOSHIBATC74HC04P
U62	35-56-0945	8 BIT SHIFT/STORE RESISTER	TOSHIBATC74HC4094
U63	35-53-1074	DUAL J-K F-F WITH P/C	TOSHIBATC74HC107P
U64	35-56-0665	QUAD BILATERAL SWITCH	TOSHIBATC74HC4066
U65	35-70-0746	DUAL D F-F EDGE TRIGGER	TOSHIBATC74HC74P
U66	35-57-0530	3 DIG BCD COUNTER	MOTOROLA MC14553B
U67	35-53-2574	QUAD DATA SELEC./MULTI.	TOSHIBATC74HC257P
U71	35-73-5900	8 BIT BINARY COUNTER/RESISTER	TEXAS INS.SN74LS590N
U72	35-42-0010	P ROM 32 X 8BIT 25NS	TEXAS INS.TBP18S030N
U73	35-70-5746	OCTAL D TYPE EDGE TRIG F/F	TOSHIBATC74HC574P
U74	35-70-0086	QUAD 2-INPUT POSI-AND	TOSHIBATC74HC08P
U75	35-53-3934	DUAL 4 BIT BINALY COUNTER	TOSHIBATC74HC393P
U76	35-73-5900	8 BIT BINARY COUNTER/RESISTER	TEXAS INS.SN74LS590N
U77	35-53-5414	OCTAL BUFFER	TEXAS INS.SN7HCS541N
U78	35-53-1254	QUAD BUS BUFFER GATES (3-ST)	TOSHIBATC74HC125P
U81	35-70-0746	DUAL D F-F EDGE TRIGGER	TOSHIBATC74HC74P
U82	35-70-0326	QUAD 2-INPUT POSI-OR	TOSHIBATC74HC32P
U83	35-53-0144	HEX SHMITT-TRIG INVERTER	TOSHIBATC74HC14P
U84	35-70-0046	HEX INVERTERS	TOSHIBATC74HC04P
U85	35-56-0111	S-RAM 2KX8BIT CMOS	HITACHIHM6116P-3
U86	35-70-5746	OCTAL D TYPE EDGE TRIG F/F	TOSHIBATC74HC574P
U87	35-53-2454	OCTAL BUS TRANSCEIVER	TOSHIBATC74HC245P
U91	35-53-3904	DUAL DECADE COUNTERS	TOSHIBATC74HC390P
U92	34-69-0080	TRIPLE 8-CHANNEL MULTIPLEXER	TOSHIBATC4051BP
U93	34-69-0030	TRIPLE 2-CHANNEL MULTIPLEXER	TOSHIBATC4053BP
U94	35-53-3934	DUAL 4 BIT BINALY COUNTER	TOSHIBATC74HC393P
U101	35-53-3904	DUAL DECADE COUNTERS	TOSHIBATC74HC390P
U102	35-56-0945	8 BIT SHIFT/STORE RESISTER	TOSHIBATC74HC4094
U103	35-70-0086	QUAD 2-INPUT POSI-AND	TOSHIBATC74HC08P
U104	35-70-5746	OCTAL D TYPE EDGE TRIG F/F	TOSHIBATC74HC574P
U105	35-05-0010	EPROM 32K X 8BIT 250NS (CMOS)	27C256

REFERENCE KIKUSUI  
DESIGNATOR PARTS NO. DESCRIPTION 97-11-0060

U106	35-70-0086	QUAD 2-INPUT POSI-AND	TOSHIBA	TC74HC08P
U107	35-56-0945	8 BIT SHIFT/STORE RESISTER	TOSHIBA	TC74HC4094
U112	35-70-0046	HEX INVERTERS	TOSHIBA	TC74HC04P
U113	35-70-0746	DUAL D F-F EDGE TRIGGER	TOSHIBA	TC74HC74P
U114	34-22-0010	D/A CONVERTER 8BIT 85NS	HITACHI	HA17008RP
U115	35-70-1736	4 BIT D TYPE RESISTERS	TOSHIBA	TC74HC173P
U116	34-22-0010	D/A CONVERTER 8BIT 85NS	HITACHI	HA17008RP
U117	34-00-0340	FET INPUT DUAL OP AMP	TEXAS INS.	TL082CP
U118	34-69-0070	ANALOG MULTIPLEXER	HITACHI	HD14052B
X1	93-00-0180	QUARTS HC-49/U 8MHZ	KIKUSUI	S8409201
X2	93-00-0230	QUARTS HC-49/U 10MHZ (AT)	KIKUSUI	S8510031

REFERENCE KIKUSUI  
DESIGNATOR PARTS NO. DESCRIPTION 97-11-0070

A10 ASSEMBLY

C1	52-01-3365	FXD CER	1500PF	10%	50V	TYPE2		
C2	52-01-3365	FXD CER	1500PF	10%	50V	TYPE2		
C3	52-01-3365	FXD CER	1500PF	10%	50V	TYPE2		
C4	52-01-3365	FXD CER	1500PF	10%	50V	TYPE2		
C5	52-01-3365	FXD CER	1500PF	10%	50V	TYPE2		
C6	52-01-3365	FXD CER	1500PF	10%	50V	TYPE2		
C7	50-67-0030	FXD PLSTC FILM	0.01MF	10%	100WV			
C8	55-37-2100	FXD TANT ELECT	10UF		35V			
C9	52-05-2468	FXD CER	0.01UF	+80-20%	50V	TYPE2		
C10	54-40-1200	FXD ELECT	10MF		50WV			
C11	52-05-2468	FXD CER	0.01UF	+80-20%	50V	TYPE2		
C12	54-40-1200	FXD ELECT	10MF		50WV			
C13	52-06-2225	FXD CER	100PF	10%	50V	TYPE1		
C15	52-37-1000	FXD CER	0.047UF	20%	25V	TYPE1		
C16	52-01-2305	FXD CER	470PF	10%	50V	TYPE2		
C17	52-06-2184	FXD CER	47PF	10%	50V	TYPE1		
C18	52-37-1000	FXD CER	0.047UF	20%	25V	TYPE1		
C19	52-37-1000	FXD CER	0.047UF	20%	25V	TYPE1		
C20	54-40-1200	FXD ELECT	10MF		50WV			
C21	54-40-1200	FXD ELECT	10MF		50WV			
C22	54-40-1200	FXD ELECT	10MF		50WV			
C23	52-37-1000	FXD CER	0.047UF	20%	25V	TYPE1		
C24	54-40-1200	FXD ELECT	10MF		50WV			
C25	54-40-1200	FXD ELECT	10MF		50WV			
C26	54-30-1960	FXD ELECT	47HF		25WV			
C27	52-37-1000	FXD CER	0.047UF	20%	25V	TYPE1		
C28	54-40-1200	FXD ELECT	10MF		50WV			
C29	54-40-1200	FXD ELECT	10MF		50WV			
C30	54-40-1200	FXD ELECT	10MF		50WV			
C31	54-30-1960	FXD ELECT	47HF		25WV			
C32	54-40-1200	FXD ELECT	10MF		50WV			
C33	54-40-1200	FXD ELECT	10MF		50WV			
C34	52-37-1000	FXD CER	0.047UF	20%	25V	TYPE1		
C35	52-37-1000	FXD CER	0.047UF	20%	25V	TYPE1		
C36	52-37-1000	FXD CER	0.047UF	20%	25V	TYPE1		
C37	52-37-1000	FXD CER	0.047UF	20%	25V	TYPE1		
C38	52-37-1000	FXD CER	0.047UF	20%	25V	TYPE1		
C39	54-20-1220	FXD ELECT	470MF		16WV			KME16VB470
CR1	32-30-1200	DIODE VR=60V	IO=1A				HITACHI	1SS120
CR2	32-30-1200	DIODE VR=60V	IO=1A				HITACHI	1SS120
CR3	32-30-1200	DIODE VR=60V	IO=1A				HITACHI	1SS120
R1	40-16-4101	FXD C FILM	100K	OHM	5%	1/6W		RD1/6FS
R2	40-16-4101	FXD C FILM	100K	OHM	5%	1/6W		RD1/6FS
R3	40-16-4101	FXD C FILM	100K	OHM	5%	1/6W		RD1/6FS
R4	40-16-4101	FXD C FILM	100K	OHM	5%	1/6W		RD1/6FS
R5	40-16-4101	FXD C FILM	100K	OHM	5%	1/6W		RD1/6FS
R6	40-16-4101	FXD C FILM	100K	OHM	5%	1/6W		RD1/6FS
R8	40-16-2271	FXD C FILM	2.7K	OHM	5%	1/6W		RD1/6FS

REFERENCE DESIGNATOR	KIKUSUI PARTS NO.	DESCRIPTION	97-11-0070	
R9	40-16-3101	FXD C FILM 10K	0HM 5% 1/6W	RD1/6FS
R10	40-16-4101	FXD C FILM 100K	0HM 5% 1/6W	RD1/6FS
R11	40-16-3101	FXD C FILM 10K	0HM 5% 1/6W	RD1/6FS
R12	40-16-3101	FXD C FILM 10K	0HM 5% 1/6W	RD1/6FS
R13	40-16-3101	FXD C FILM 10K	0HM 5% 1/6W	RD1/6FS
R14	40-16-3101	FXD C FILM 10K	0HM 5% 1/6W	RD1/6FS
R15	42-80-2101	FXD M FILM 1K	0HM 1% 1/6W	RN1/6FS
R16	42-80-2101	FXD M FILM 1K	0HM 1% 1/6W	RN1/6FS
R17	42-80-2101	FXD M FILM 1K	0HM 1% 1/6W	RN1/6FS
R18	42-80-2391	FXD M FILM 3.9K	0HM 1% 1/6W	RN1/6FS
R19	42-80-2391	FXD M FILM 3.9K	0HM 1% 1/6W	RN1/6FS
R21	40-16-1101	FXD C FILM 100	0HM 5% 1/6W	RD1/6FS
R22	40-16-0221	FXD C FILM 22	0HM 5% 1/6W	RD1/6FS
R23	40-16-1101	FXD C FILM 100	0HM 5% 1/6W	RD1/6FS
R24	40-16-1101	FXD C FILM 100	0HM 5% 1/6W	RD1/6FS
R25	40-16-2471	FXD C FILM 4.7K	0HM 5% 1/6W	RD1/6FS
R26	40-16-4101	FXD C FILM 100K	0HM 5% 1/6W	RD1/6FS
R27	40-16-2471	FXD C FILM 4.7K	0HM 5% 1/6W	RD1/6FS
R28	40-16-4101	FXD C FILM 100K	0HM 5% 1/6W	RD1/6FS
R29	40-16-3101	FXD C FILM 10K	0HM 5% 1/6W	RD1/6FS
R30	40-16-3101	FXD C FILM 10K	0HM 5% 1/6W	RD1/6FS
R32	40-16-2561	FXD C FILM 5.6K	0HM 5% 1/6W	RD1/6FS
R33	40-16-2221	FXD C FILM 2.2K	0HM 5% 1/6W	RD1/6FS
R35	40-16-2561	FXD C FILM 5.6K	0HM 5% 1/6W	RD1/6FS
R36	40-16-2221	FXD C FILM 2.2K	0HM 5% 1/6W	RD1/6FS
R37	40-16-2471	FXD C FILM 4.7K	0HM 5% 1/6W	RD1/6FS
R38	40-16-2471	FXD C FILM 4.7K	0HM 5% 1/6W	RD1/6FS
R39	40-16-0101	FXD C FILM 10	0HM 5% 1/6W	RD1/6FS
R40	40-16-0101	FXD C FILM 10	0HM 5% 1/6W	RD1/6FS
R41	40-27-0102	FXD C FILM 10	0HM 5% 1/4W	NAS1/4S
R43	42-80-2101	FXD M FILM 1K	0HM 1% 1/6W	RN1/6FS
R44	42-80-1151	FXD M FILM 150	0HM 1% 1/6W	RN1/6FS
R45	40-16-3471	FXD C FILM 47K	0HM 5% 1/6W	RD1/6FS
U1	35-57-0840	HEX SCHMITT TRIGGER	TOSHIBA	TC4584BP
U2	35-70-0086	QUAD 2-INPUT POSI-AND	TOSHIBA	TC74HC08P
U3	35-70-1936	4 BIT UP/DOWN BINARY COUNTERS	TOSHIBA	TC74HC193P
U4	35-70-1936	4 BIT UP/DOWN BINARY COUNTERS	TOSHIBA	TC74HC193P
U5	35-70-1936	4 BIT UP/DOWN BINARY COUNTERS	TOSHIBA	TC74HC193P
U6	35-69-0010	DUAL MONOSTABLE MULTI	MOTOROLA	MC14538BCP
U7	35-53-5414	OCTAL BUFFER	TEXAS INS.	SN7HCS541N
U8	35-53-5414	OCTAL BUFFER	TEXAS INS.	SN7HCS541N
U9	35-70-1386	3LINE TO 8LINE DECODER	HITACHI	HD74HC138P
U10	35-70-0326	QUAD 2-INPUT POSI-OR	TOSHIBA	TC74HC32P
U11	35-70-5746	OCTAL D TYPE EDGE TRIG F/F	TOSHIBA	TC74HC574P
U12	35-70-5746	OCTAL D TYPE EDGE TRIG F/F	TOSHIBA	TC74HC574P
U13	36-20-0100	D/A CONVERTER 12BIT	HITACHI	HA17012PB
U14	34-00-0390	FET INPUT DUAL OP AMP	NEC	UPC812C
U15	34-20-0130	DUAL COMPARATORS	HITACHI	HA17903PS
U16	35-53-3654	HEX BUS DRIVERS	TOSHIBA	TC74HC365P
U17	35-02-0020	PROG. KEY & DISP CONTROL	NEC	UPD8279C-2
U18	35-53-0304	8-INPUT POSI-NAND GATE	TOSIHLBA	TC74HC30P
U19	35-70-0046	HEX INVERTERS	TOSHIBA	TC74HC04P
U20	34-00-0340	FET INPUT DUAL OP AMP	TEXAS INS.	TL082CP

REFERENCE KIKUSUI  
 DESIGNATOR PARTS NO. DESCRIPTION 97-11-0081

A11 ASSEMBLY

C1	54-40-1200	FXD ELECT	10MF	50WV		
C2	54-20-1210	FXD ELECT	220MF	16WV	KME16VB220	
C3	54-40-1200	FXD ELECT	10MF	50WV		
C4	54-20-1210	FXD ELECT	220MF	16WV	KME16VB220	
C5	54-40-1200	FXD ELECT	10MF	50WV		
C6	54-40-1200	FXD ELECT	10MF	50WV		
C7	52-37-1000	FXD CER	0.047UF	20% 25V TYPE1		
C8	54-40-1200	FXD ELECT	10MF	50WV		
CR1	37-00-0440	LAMP LED	RED		TOSHIBA	TLUY163
CR3	37-00-0440	LAMP LED	RED		TOSHIBA	TLUY163
CR4	37-00-0430	LAMP LED	GREEN		TOSHIBA	TLUG163
CR5	37-00-0440	LAMP LED	RED		TOSHIBA	TLUY163
CR7	37-00-0440	LAMP LED	RED		TOSHIBA	TLUY163
CR8	37-00-0430	LAMP LED	GREEN		TOSHIBA	TLUG163
CR11	37-00-0440	LAMP LED	RED		TOSHIBA	TLUY163
CR12	37-00-0430	LAMP LED	GREEN		TOSHIBA	TLUG163
CR13	37-00-0440	LAMP LED	RED		TOSHIBA	TLUY163
CR14	37-00-0440	LAMP LED	RED		TOSHIBA	TLUY163
CR15	37-00-0440	LAMP LED	RED		TOSHIBA	TLUY163
CR16	37-00-0430	LAMP LED	GREEN		TOSHIBA	TLUG163
CR17	37-00-0440	LAMP LED	RED		TOSHIBA	TLUY163
CR18	37-00-0440	LAMP LED	RED		TOSHIBA	TLUY163
CR21	37-00-0440	LAMP LED	RED		TOSHIBA	TLUY163
CR22	37-00-0440	LAMP LED	RED		TOSHIBA	TLUY163
CR23	37-00-0440	LAMP LED	RED		TOSHIBA	TLUY163
CR24	37-00-0440	LAMP LED	RED		TOSHIBA	TLUY163
CR25	37-00-0440	LAMP LED	RED		TOSHIBA	TLUY163
CR26	37-00-0440	LAMP LED	RED		TOSHIBA	TLUY163
CR27	37-00-0430	LAMP LED	GREEN		TOSHIBA	TLUG163
CR28	37-00-0440	LAMP LED	RED		TOSHIBA	TLUY163
CR31	37-00-0440	LAMP LED	RED		TOSHIBA	TLUY163
CR32	37-00-0430	LAMP LED	GREEN		TOSHIBA	TLUG163
CR33	37-00-0440	LAMP LED	RED		TOSHIBA	TLUY163
CR34	37-00-0440	LAMP LED	RED		TOSHIBA	TLUY163
CR35	37-00-0440	LAMP LED	RED		TOSHIBA	TLUY163
CR36	37-00-0430	LAMP LED	GREEN		TOSHIBA	TLUG163
CR37	37-00-0430	LAMP LED	GREEN		TOSHIBA	TLUG163
CR38	37-00-0430	LAMP LED	GREEN		TOSHIBA	TLUG163
CR41	37-00-0440	LAMP LED	RED		TOSHIBA	TLUY163
CR42	37-00-0440	LAMP LED	RED		TOSHIBA	TLUY163
CR43	37-00-0440	LAMP LED	RED		TOSHIBA	TLUY163
CR44	37-00-0440	LAMP LED	RED		TOSHIBA	TLUY163
CR45	37-00-0430	LAMP LED	GREEN		TOSHIBA	TLUG163
CR46	37-00-0430	LAMP LED	GREEN		TOSHIBA	TLUG163
CR47	37-00-0430	LAMP LED	GREEN		TOSHIBA	TLUG163
CR48	37-00-0430	LAMP LED	GREEN		TOSHIBA	TLUG163
CR51	37-00-0440	LAMP LED	RED		TOSHIBA	TLUY163
CR52	37-00-0440	LAMP LED	RED		TOSHIBA	TLUY163
CR53	37-00-0440	LAMP LED	RED		TOSHIBA	TLUY163

REFERENCE DESIGNATOR	KIKUSUI PARTS NO.	DESCRIPTION	97-11-0081
CR54	37-00-0440	LAMP LED RED	TOSHIBA TLUY163
CR55	37-00-0440	LAMP LED RED	TOSHIBA TLUY163
CR56	37-00-0440	LAMP LED RED	TOSHIBA TLUY163
CR57	37-00-0440	LAMP LED RED	TOSHIBA TLUY163
CR58	37-00-0430	LAMP LED GREEN	TOSHIBA TLUG163
CR61	37-00-0440	LAMP LED RED	TOSHIBA TLUY163
CR62	37-00-0440	LAMP LED RED	TOSHIBA TLUY163
CR63	37-00-0440	LAMP LED RED	TOSHIBA TLUY163
CR64	37-00-0440	LAMP LED RED	TOSHIBA TLUY163
CR65	37-00-0440	LAMP LED RED	TOSHIBA TLUY163
CR66	37-00-0440	LAMP LED RED	TOSHIBA TLUY163
CR67	37-00-0440	LAMP LED RED	TOSHIBA TLUY163
CR81	37-00-0440	LAMP LED RED	TOSHIBA TLUY163
CR82	37-00-0440	LAMP LED RED	TOSHIBA TLUY163
CR83	37-00-0440	LAMP LED RED	TOSHIBA TLUY163
CR84	37-00-0440	LAMP LED RED	TOSHIBA TLUY163
CR85	37-00-0430	LAMP LED GREEN	TOSHIBA TLUG163
CR86	37-00-0430	LAMP LED GREEN	TOSHIBA TLUG163
CR87	37-00-0430	LAMP LED GREEN	TOSHIBA TLUG163
CR88	37-00-0430	LAMP LED GREEN	TOSHIBA TLUG163
CR93	37-00-0440	LAMP LED RED	TOSHIBA TLUY163
CR94	37-00-0440	LAMP LED RED	TOSHIBA TLUY163
CR95	37-00-0440	LAMP LED RED	TOSHIBA TLUY163
CR101	37-00-0440	LAMP LED RED	TOSHIBA TLUY163
CR102	37-00-0440	LAMP LED RED	TOSHIBA TLUY163
CR103	37-00-0440	LAMP LED RED	TOSHIBA TLUY163
CR104	37-00-0440	LAMP LED RED	TOSHIBA TLUY163
CR105	37-00-0440	LAMP LED RED	TOSHIBA TLUY163
CR106	37-00-0440	LAMP LED RED	TOSHIBA TLUY163
CR121	37-00-0440	LAMP LED RED	TOSHIBA TLUY163
CR122	37-00-0440	LAMP LED RED	TOSHIBA TLUY163
L1	67-10-0890	INDUCTOR 100MH 10%	
L2	67-10-0890	INDUCTOR 100MH 10%	
Q1	30-11-0151	TR SI PNP	TOSHIBA 2SA1015-Y
R1	40-16-0221	FXD C FILM 22 OHM 5% 1/6W	RD1/6FS
R2	40-16-0221	FXD C FILM 22 OHM 5% 1/6W	RD1/6FS
R3	40-16-0221	FXD C FILM 22 OHM 5% 1/6W	RD1/6FS
R4	40-16-0221	FXD C FILM 22 OHM 5% 1/6W	RD1/6FS
R5	40-16-0221	FXD C FILM 22 OHM 5% 1/6W	RD1/6FS
R6	40-16-0221	FXD C FILM 22 OHM 5% 1/6W	RD1/6FS
R7	40-16-0221	FXD C FILM 22 OHM 5% 1/6W	RD1/6FS
R8	40-16-0221	FXD C FILM 22 OHM 5% 1/6W	RD1/6FS
R9	40-16-2471	FXD C FILM 4.7K OHM 5% 1/6W	RD1/6FS
R10	40-16-2101	FXD C FILM 1K OHM 5% 1/6W	RD1/6FS
R12	40-16-1331	FXD C FILM 330 OHM 5% 1/6W	RD1/6FS
R13	44-07-0020	FXD M GLAZE R-NET 10K OHM X4	
R15	40-16-3101	FXD C FILM 10K OHM 5% 1/6W	RD1/6FS
R16	40-16-3101	FXD C FILM 10K OHM 5% 1/6W	RD1/6FS
RV1	45-01-0820	VAR C COMP	KIKUSUI V12L5DM1S
RV2	45-01-0820	VAR C COMP	KIKUSUI V12L5DH1S

REFERENCE DESIGNATOR KIKUSUI PARTS NO. DESCRIPTION 97-11-0081

RV3	45-01-0830	VAR C COMP	KIKUSUI	V12L5DM1S
RV4	45-02-0280	VAR C COMP	20K/20K OHM B	KIKUSUI V12LG3N
RV5	45-01-0810	VAR C COMP	20K/20K OHM B	KIKUSUI V12LG3S
RV6	45-02-0280	VAR C COMP	20K/20K OHM B	KIKUSUI V12LG3N
RV7	45-02-0280	VAR C COMP	20K/20K OHM B	KIKUSUI V12LG3N
RV8	45-01-0810	VAR C COMP	20K/20K OHM B	KIKUSUI V12LG3S
RV9	45-02-0280	VAR C COMP	20K/20K OHM B	KIKUSUI V12LG3N
RV10	45-01-0810	VAR C COMP	20K/20K OHM B	KIKUSUI V12LG3S

S1	81-01-0870	PUSH SWITCH	TM1-01
S2	81-01-0870	PUSH SWITCH	TM1-01
S3	81-01-0870	PUSH SWITCH	TM1-01
S4	81-01-0870	PUSH SWITCH	TM1-01
S5	81-01-0870	PUSH SWITCH	TM1-01
S6	81-01-0870	PUSH SWITCH	TM1-01
S11	81-01-0870	PUSH SWITCH	TM1-01
S12	81-01-0870	PUSH SWITCH	TM1-01
S13	81-01-0870	PUSH SWITCH	TM1-01
S14	81-01-0870	PUSH SWITCH	TM1-01
S15	81-01-0870	PUSH SWITCH	TM1-01
S16	81-01-0870	PUSH SWITCH	TM1-01
S21	81-01-0870	PUSH SWITCH	TM1-01
S22	81-01-0870	PUSH SWITCH	TM1-01
S23	81-01-0870	PUSH SWITCH	TM1-01
S24	81-01-0870	PUSH SWITCH	TM1-01
S25	81-01-0870	PUSH SWITCH	TM1-01
S26	81-01-0870	PUSH SWITCH	TM1-01
S27	81-01-0870	PUSH SWITCH	TM1-01
S28	81-01-0870	PUSH SWITCH	TM1-01
S31	81-01-0870	PUSH SWITCH	TM1-01
S32	81-01-0870	PUSH SWITCH	TM1-01
S33	81-01-0870	PUSH SWITCH	TM1-01
S34	81-01-0870	PUSH SWITCH	TM1-01
S35	81-01-0870	PUSH SWITCH	TM1-01
S36	81-01-0870	PUSH SWITCH	TM1-01
S37	81-01-0870	PUSH SWITCH	TM1-01
S41	81-01-0870	PUSH SWITCH	TM1-01
S43	81-01-0870	PUSH SWITCH	TM1-01
S44	81-01-0870	PUSH SWITCH	TM1-01
S45	81-01-0870	PUSH SWITCH	TM1-01
S46	81-01-0870	PUSH SWITCH	TM1-01
S49	81-01-0870	PUSH SWITCH	TM1-01
S51	81-01-0870	PUSH SWITCH	TM1-01
S52	81-01-0870	PUSH SWITCH	TM1-01
S55	81-01-0870	PUSH SWITCH	TM1-01
S107	81-01-0860	PUSH SWITCH	ALPS SSCTP1

U1	35-91-0010	8-LINE DRIVER	TOSHIBA	TD62381P
U2	35-70-1386	3LINE TO 8LINE DECODER	HITACHI	HD74HC138P
U3	35-91-0020	8-LINE DRIVER	TOSHIBA	TD62785P
U4	35-70-1386	3LINE TO 8LINE DECODER	HITACHI	HD74HC138P
U5	35-91-0020	8-LINE DRIVER	TOSHIBA	TD62785P
U6	35-62-0010	8-CH ANALOG MULTI-PLX	HITACHI	HD14051BP
U7	35-62-0010	8-CH ANALOG MULTI-PLX	HITACHI	HD14051BP

REFERENCE KIKUSUI  
DESIGNATOR PARTS NO. DESCRIPTION 97-11-0081

U8 35-70-1386 3LINE TO 8LINE DECORDER HITACHI HD74HC138P

REFERENCE KIKUSUI  
DESIGNATOR PARTS NO. DESCRIPTION 97-11-0090

A12 ASSEMBLY

C1	52-77-1010	FXD CER	1000PF	250VAC	FOR UL & CSA
C2	52-77-1010	FXD CER	1000PF	250VAC	FOR UL & CSA
C3	50-77-3510	FXD PLSTC FILM	0.1MF	20% 250AC	
C4	54-80-1110	FXD ELECT	120MF	400WV	KME400VNSN
C5	50-67-0030	FXD PLSTC FILM	0.01MF	10% 100WV	
C6	54-30-1960	FXD ELECT	47MF	25WV	
C7	52-03-3469	FXD CER	0.01UF	+100-0% 500V TYPE2	
C8	52-03-3469	FXD CER	0.01UF	+100-0% 500V TYPE2	
C9	52-01-4030	FXD CER	220PF	10% 1KVV	MATSUSITA ECKD3A221K
C10	50-67-0030	FXD PLSTC FILM	0.01MF	10% 100WV	
C11	50-67-0000	FXD PLSTC FILM	0.001MF	10% 100WV	
C12	52-01-3345	FXD CER	1000PF	10% 500V TYPE2	
C13	50-67-0060	FXD PLSTC FILM	0.1MF	10% 100WV	
C14	54-30-1960	FXD ELECT	47MF	25WV	
C16	52-03-3469	FXD CER	0.01UF	+100-0% 500V TYPE2	
C17	52-01-4030	FXD CER	220PF	10% 1KVV	MATSUSITA ECKD3A221K
C18	50-67-0030	FXD PLSTC FILM	0.01MF	10% 100WV	
C19	50-67-0000	FXD PLSTC FILM	0.001MF	10% 100WV	
C20	52-01-3345	FXD CER	1000PF	10% 500V TYPE2	
C21	50-67-0060	FXD PLSTC FILM	0.1MF	10% 100WV	
C22	54-30-1960	FXD ELECT	47MF	25WV	
C32	54-60-2070	FXD ELECT	22MF	200WV	KME200VB22
C33	54-60-2070	FXD ELECT	22MF	200WV	KME200VB22
C34	52-03-3469	FXD CER	0.01UF	+100-0% 500V TYPE2	
C35	50-67-0000	FXD PLSTC FILM	0.001MF	10% 100WV	
C38	54-30-2800	FXD ELECT	680MF	35WV	SXE35VB680
C39	54-30-2800	FXD ELECT	680MF	35WV	SXE35VB680
C41	54-30-2800	FXD ELECT	680MF	35WV	SXE35VB680
C42	54-30-2800	FXD ELECT	680MF	35WV	SXE35VB680
C43	54-60-2070	FXD ELECT	22MF	200WV	KME200VB22
C44	52-03-3469	FXD CER	0.01UF	+100-0% 500V TYPE2	
C45	54-60-2070	FXD ELECT	22MF	200WV	KME200VB22
C46	54-60-2070	FXD ELECT	22MF	200WV	KME200VB22
C47	54-60-2070	FXD ELECT	22MF	200WV	KME200VB22
C48	54-30-2790	FXD ELECT	82MF	35WV	SXE35VB82
C49	54-30-2780	FXD ELECT	330MF	35WV	SXE35VB330
C50	54-30-2780	FXD ELECT	330MF	35WV	SXE35VB330
C51	54-20-1190	FXD ELECT	680MF	16WV	SXE16VB680
C52	50-67-0030	FXD PLSTC FILM	0.01MF	10% 100WV	
C53	54-10-2750	FXD ELECT	3900MF	10WV	SXE10VB
C54	54-10-2750	FXD ELECT	3900MF	10WV	SXE10VB
C58	50-67-0010	FXD PLSTC FILM	0.0022MF	10% 100WV	
C59	54-10-2740	FXD ELECT	820MF	10WV	SXE10VB820
C61	55-37-2030	FXD TANT ELECT	0.47MF	35V	
C62	54-10-2740	FXD ELECT	820MF	10WV	SXE10VB820
C63	52-77-1010	FXD CER	1000PF	250VAC	FOR UL & CSA
C104	54-80-1110	FXD ELECT	120MF	400WV	KME400VNSN
C114	54-30-2790	FXD ELECT	82MF	35WV	SXE35VB82
C161	54-30-1960	FXD ELECT	47MF	25WV	
C173	55-37-2050	FXD TANT ELECT	1UF	35V	

REFERENCE KIKUSUI  
DESIGNATOR PARTS NO. DESCRIPTION 97-11-0090

CR1	32-90-2281	DIODE BRIGE VRM=600V IO=4A	TOSHIBA	4J4B41
CR2	32-90-0523	DIODE VR=600V IO=1A	TOSHIBA	S5277J
CR3	32-92-0130	ZENER VZ=12.4-13.1V P=0.4W	NEC	RD13JB1
CR4	32-90-3050	DIODE VR=800V IO=1A	HITACHI	DFG1C8
CR5	32-90-0550	DIODE VR=1KV IO=1A	HITACHI	V11M
CR6	32-90-0550	DIODE VR=1KV IO=1A	HITACHI	V11M
CR7	32-11-8350	DIODE VR=600V IO=1.0A	TOSHIBA	1S1835
CR8	32-30-1200	DIODE VR=60V IO=1A	HITACHI	1SS120
CR9	32-30-1200	DIODE VR=60V IO=1A	HITACHI	1SS120
CR10	32-30-1200	DIODE VR=60V IO=1A	HITACHI	1SS120
CR11	32-11-8350	DIODE VR=600V IO=1.0A	TOSHIBA	1S1835
CR12	32-11-8350	DIODE VR=600V IO=1.0A	TOSHIBA	1S1835
CR13	32-91-1805	ZENER VZ=5.48-5.76V P=0.4W	NEC	RD5.6JSB2
CR14	32-92-0062	ZENER VZ=5.8 - 6.6V P=0.4W	NEC	RD6.2JB
CR15	32-90-3050	DIODE VR=800V IO=1A	HITACHI	DFG1C8
CR16	32-90-0550	DIODE VR=1KV IO=1A	HITACHI	V11M
CR17	32-90-0550	DIODE VR=1KV IO=1A	HITACHI	V11M
CR18	32-11-8350	DIODE VR=600V IO=1.0A	TOSHIBA	1S1835
CR19	32-30-1200	DIODE VR=60V IO=1A	HITACHI	1SS120
CR20	32-30-1200	DIODE VR=60V IO=1A	HITACHI	1SS120
CR21	32-30-1200	DIODE VR=60V IO=1A	HITACHI	1SS120
CR22	32-11-8350	DIODE VR=600V IO=1.0A	TOSHIBA	1S1835
CR23	32-11-8350	DIODE VR=600V IO=1.0A	TOSHIBA	1S1835
CR24	32-91-1805	ZENER VZ=5.48-5.76V P=0.4W	NEC	RD5.6JSB2
CR30	32-90-3050	DIODE VR=800V IO=1A	HITACHI	DFG1C8
CR31	32-90-3050	DIODE VR=800V IO=1A	HITACHI	DFG1C8
CR32	32-90-1843	DIODE VR=200V IO=3A	N. INTER	30DF2
CR33	32-90-1843	DIODE VR=200V IO=3A	N. INTER	30DF2
CR34	32-91-2300	ZENER VZ=135 - 165V P=1W	TOSHIBA	1Z150
CR35	32-92-0130	ZENER VZ=12.4-13.1V P=0.4W	NEC	RD13JB1
CR36	32-92-0130	ZENER VZ=12.4-13.1V P=0.4W	NEC	RD13JB1
CR37	32-30-1200	DIODE VR=60V IO=1A	HITACHI	1SS120
CR38	32-92-0056	ZENER VZ=5.5 - 5.8V P=0.4W	NEC	RD5.6JB2
CR39	32-90-2970	DIODE VR= 40V IO=1.7A	SANKEN	RK14
CR40	32-90-2980	DIODE VR= 40V IO=5A	NEC	5CS04SM
CR42	32-91-1805	ZENER VZ=5.48-5.76V P=0.4W	NEC	RD5.6JSB2
CR43	32-92-0100	ZENER VZ=10.1-10.6V P=0.4W	NEC	RD10JB3

L10	67-10-0890	INDUCTOR 100MH 10%		
L11	67-10-0890	INDUCTOR 100MH 10%		
L12	67-10-0890	INDUCTOR 100MH 10%		
L13	67-10-0890	INDUCTOR 100MH 10%		
L14	67-10-0921	INDUCTOR 470UH 10%		LAL04NA
L15	67-15-0320	INDUCTOR 15UH 4.5A		HP10D150M
L114	67-10-0921	INDUCTOR 470UH 10%		LAL04NA
PC1	37-30-0111	PHOT COUPLER	TOSHIBA	TLP521-1BL
PC2	37-30-0111	PHOT COUPLER	TOSHIBA	TLP521-1BL
PC3	37-30-0111	PHOT COUPLER	TOSHIBA	TLP521-1BL
PC4	37-30-0111	PHOT COUPLER	TOSHIBA	TLP521-1BL
Q1	30-31-8151	TR SI NPN (50V 0.15A 0.4W)	TOSHIBA	2SC1815-Y
Q2	30-11-0151	TR SI PNP	TOSHIBA	2SA1015-Y
Q3	30-31-8461	TR SI NPN	MATSUSITA	2SC1846-R

REFERENCE DESIGNATOR	KIKUSUI PARTS NO.	DESCRIPTION	97-11-0090
Q4	30-33-5590	TR SI NPN (800V 3A 40W)	TOSHIBA 2SC3559
Q5	30-33-4610	TR SI NPN (1100V 8A 140W)	SANYO 2SC3461
Q6	30-31-1731	TR SI NPN (30V 3A 10W )	TOSHIBA 2SC1173-Y
Q7	30-33-5590	TR SI NPN (800V 3A 40W)	TOSHIBA 2SC3559
Q8	30-33-4610	TR SI NPN (1100V 8A 140W)	SANYO 2SC3461
Q9	30-11-0151	TR SI PNP	TOSHIBA 2SA1015-Y
Q10	30-31-1731	TR SI NPN (30V 3A 10W )	TOSHIBA 2SC1173-Y
Q11	30-21-0150	TR SI PNP (60V 3A 25W)	TOSHIBA 2SB1015-Y
Q12	30-41-4060	TR SI NPN (60V 3A 25W)	TOSHIBA 2SD1406-Y
Q13	30-41-4060	TR SI NPN (60V 3A 25W)	TOSHIBA 2SD1406-Y
Q14	30-31-8151	TR SI NPN (50V 0.15A 0.4W)	TOSHIBA 2SC1815-Y
Q15	30-31-8151	TR SI NPN (50V 0.15A 0.4W)	TOSHIBA 2SC1815-Y
Q16	30-11-0151	TR SI PNP	TOSHIBA 2SA1015-Y
R1	40-16-5101	FXD C FILM 1M	OHM 5% 1/6W RD1/6FS
R2	40-16-4471	FXD C FILM 470K	OHM 5% 1/6W RD1/6FS
R3	40-16-2221	FXD C FILM 2.2K	OHM 5% 1/6W RD1/6FS
R4	44-91-3684	FXD M OXIDE 68K	OHM 5% 1W MATSUSITA ERG1ANJ
R5	40-16-3151	FXD C FILM 15K	OHM 5% 1/6W RD1/6FS
R6	40-16-2221	FXD C FILM 2.2K	OHM 5% 1/6W RD1/6FS
R7	40-16-2561	FXD C FILM 5.6K	OHM 5% 1/6W RD1/6FS
R8	40-16-2221	FXD C FILM 2.2K	OHM 5% 1/6W RD1/6FS
R9	40-37-4471	FXD C FILM 470K	OHM 5% 1/2W
R10	44-57-0540	FXD M OXIDE 100K	OHM 5% 2W MATSUSITA ERG2SJ
R11	44-92-1474	FXD M OXIDE 470	OHM 5% 2W MATSUSITA ERG2ANJ
R12	44-91-1334	FXD M OXIDE 330	OHM 5% 1W MATSUSITA ERG1ANJ
R13	40-27-1472	FXD C FILM 470	OHM 5% 1/4W
R14	42-83-0330	FXD M FILM 33	OHM 1% 1/4W
R15	44-91-9474	FXD M OXIDE 0.47	OHM 5% 1W MATSUSITA ERX1ANJ
R16	42-80-1681	FXD M FILM 680	OHM 1% 1/6W RN1/6FS
R17	40-16-8561	FXD C FILM 5.6	OHM 5% 1/6W RD1/6FS
R18	40-16-8561	FXD C FILM 5.6	OHM 5% 1/6W RD1/6FS
R19	42-80-1331	FXD M FILM 330	OHM 1% 1/6W RN1/6FS
R20	40-16-1101	FXD C FILM 100	OHM 5% 1/6W RD1/6FS
R21	40-16-2101	FXD C FILM 1K	OHM 5% 1/6W RD1/6FS
R22	40-16-1471	FXD C FILM 470	OHM 5% 1/6W RD1/6FS
R23	40-37-4471	FXD C FILM 470K	OHM 5% 1/2W
R24	44-57-0540	FXD M OXIDE 100K	OHM 5% 2W MATSUSITA ERG2SJ
R25	44-92-1474	FXD M OXIDE 470	OHM 5% 2W MATSUSITA ERG2ANJ
R26	44-91-1334	FXD M OXIDE 330	OHM 5% 1W MATSUSITA ERG1ANJ
R27	40-16-1471	FXD C FILM 470	OHM 5% 1/6W RD1/6FS
R28	42-80-0221	FXD M FILM 22	OHM 1% 1/6W RN1/6FS
R29	44-91-8124	FXD M OXIDE 1.2	OHM 5% 1W MATSUSITA ERX1ANJ
R30	42-80-1561	FXD M FILM 560	OHM 1% 1/6W RN1/6FS
R31	40-16-8561	FXD C FILM 5.6	OHM 5% 1/6W RD1/6FS
R32	42-80-1391	FXD M FILM 390	OHM 1% 1/6W RN1/6FS
R33	40-16-1101	FXD C FILM 100	OHM 5% 1/6W RD1/6FS
R34	40-16-2101	FXD C FILM 1K	OHM 5% 1/6W RD1/6FS
R35	40-16-1471	FXD C FILM 470	OHM 5% 1/6W RD1/6FS
R42	42-80-4151	FXD M FILM 150K	OHM 1% 1/6W RN1/6FS
R43	42-80-2271	FXD M FILM 2.7K	OHM 1% 1/6W RN1/6FS
R44	40-16-3101	FXD C FILM 10K	OHM 5% 1/6W RD1/6FS
R45	40-16-1471	FXD C FILM 470	OHM 5% 1/6W RD1/6FS
R46	40-16-2101	FXD C FILM 1K	OHM 5% 1/6W RD1/6FS

REFERENCE DESIGNATOR	KIKUSUI PARTS NO.	DESCRIPTION	97-11-0090
R49	44-91-9564	FXD M OXIDE 0.56	OHM 5% 1W MATSUSITA ERX1ANJ
R50	40-16-1101	FXD C FILM 100	OHM 5% 1/6W RD1/6FS
R51	44-92-0334	FXD M OXIDE 33	OHM 5% 2W MATSUSITA ERG2ANJ
R52	44-91-9564	FXD M OXIDE 0.56	OHM 5% 1W MATSUSITA ERX1ANJ
R53	40-16-1101	FXD C FILM 100	OHM 5% 1/6W RD1/6FS
R54	44-92-0151	FXD M OXIDE 15	OHM 5% 2W MATSUSITA ERG2ANJ
R55	40-16-2561	FXD C FILM 5.6K	OHM 5% 1/6W RD1/6FS
R56	40-16-2561	FXD C FILM 5.6K	OHM 5% 1/6W RD1/6FS
R57	40-16-2561	FXD C FILM 5.6K	OHM 5% 1/6W RD1/6FS
R58	42-80-2201	FXD M FILM 2K	OHM 1% 1/6W RN1/6FS
R59	42-80-2201	FXD M FILM 2K	OHM 1% 1/6W RN1/6FS
R60	40-16-2101	FXD C FILM 1K	OHM 5% 1/6W RD1/6FS
R61	40-16-2101	FXD C FILM 1K	OHM 5% 1/6W RD1/6FS
R65	40-16-1331	FXD C FILM 330	OHM 5% 1/6W RD1/6FS
R66	40-16-2101	FXD C FILM 1K	OHM 5% 1/6W RD1/6FS
R67	44-91-9824	FXD M OXIDE 0.82	OHM 5% 1W MATSUSITA ERX1ANJ
R68	42-80-2101	FXD M FILM 1K	OHM 1% 1/6W RN1/6FS
R69	42-80-2101	FXD M FILM 1K	OHM 1% 1/6W RN1/6FS
R70	40-16-3221	FXD C FILM 22K	OHM 5% 1/6W RD1/6FS
R71	40-27-0102	FXD C FILM 10	OHM 5% 1/4W NAS1/4S
R73	42-80-2101	FXD M FILM 1K	OHM 1% 1/6W RN1/6FS
R74	42-80-2101	FXD M FILM 1K	OHM 1% 1/6W RN1/6FS
R75	40-16-3121	FXD C FILM 12K	OHM 5% 1/6W RD1/6FS
R76	40-16-1471	FXD C FILM 470	OHM 5% 1/6W RD1/6FS
R77	40-16-2101	FXD C FILM 1K	OHM 5% 1/6W RD1/6FS
R78	40-16-2221	FXD C FILM 2.2K	OHM 5% 1/6W RD1/6FS
R79	40-16-3221	FXD C FILM 22K	OHM 5% 1/6W RD1/6FS
R80	40-16-0221	FXD C FILM 22	OHM 5% 1/6W RD1/6FS
R81	40-16-2181	FXD C FILM 1.8K	OHM 5% 1/6W RD1/6FS
R82	40-16-2221	FXD C FILM 2.2K	OHM 5% 1/6W RD1/6FS
R165	40-16-1331	FXD C FILM 330	OHM 5% 1/6W RD1/6FS
R173	40-16-1681	FXD C FILM 680	OHM 5% 1/6W RD1/6FS
RT1	38-00-0120	THERMISTOR	8D13
RV1	48-31-2100	VAR M GLAZE 1K	OHM B PH
T1	67-10-1760	INDUCTOR 1MH	2.5A SC-02-10A2
T2	63-94-2130	SWITCHING TRANS	T-3W 2 KIKUSUI S8513642
T3	63-94-2110	SWITCHING TRANS	T-1 KIKUSUI S8508312
TS1	82-91-0350	THERMOSTAT UL	5003F90B4
U1	34-90-0051	REGULATOR	TEXAS INS.TL431CLPB
U2	34-00-0240	DUAL OPE-AMP	NEC UPC4558C
U3	34-90-0051	REGULATOR	TEXAS INS.TL431CLPB
U4	34-90-0051	REGULATOR	TEXAS INS.TL431CLPB
VR1	39-00-0410	SURGE ABSORBER (430V)	MATSUSITA ERZC07DK

REFERENCE KIKUSUI  
DESIGNATOR PARTS NO. DESCRIPTION 97-11-0100

A13 ASSEMBLY

C1	54-30-1970	FXD ELECT	100MF	25WV
R1	40-37-0331	FXD C FILM	33	OHM 5% 1/2W

A20 ASSEMBLY 97-11-0110

C1	52-77-1010	FXD CER	1000PF	250VAC	FOR UL & CSA
C2	52-77-1010	FXD CER	1000PF	250VAC	FOR UL & CSA
T1	67-10-1760	INDUCTOR	1MH	2.5A	SC-02-10A2

A21 ASSEMBLY 97-11-0200

L1	67-95-0010	INDUCTOR	L-2874		
L2	67-95-0010	INDUCTOR	L-2874		
L3	67-10-0870	INDUCTOR	1UH		
L4	67-10-0870	INDUCTOR	1UH		
R1	40-27-1332	FXD C FILM	330	OHM 5% 1/4W	
R2	40-27-1332	FXD C FILM	330	OHM 5% 1/4W	
R3	40-16-1561	FXD C FILM	560	OHM 5% 1/6W	RD1/6FS
R4	40-16-1561	FXD C FILM	560	OHM 5% 1/6W	RD1/6FS

REFERENCE KIKUSUI  
DESIGNATOR PARTS NO.      DESCRIPTION      97-11-0200

A22 ASSEMBLY

C1	52-98-1010	FXD CER	1000PF	+80-20%	6.3KV	TYPE1	
C2	52-98-1000	FXD CER	4700PF	+80-20%	3.15KV	TYPE1	
C3	52-98-1000	FXD CER	4700PF	+80-20%	3.15KV	TYPE1	
C4	52-98-1000	FXD CER	4700PF	+80-20%	3.15KV	TYPE1	
C5	52-98-1010	FXD CER	1000PF	+80-20%	6.3KV	TYPE1	
C6	52-98-1010	FXD CER	1000PF	+80-20%	6.3KV	TYPE1	
C7	52-98-1010	FXD CER	1000PF	+80-20%	6.3KV	TYPE1	
C8	52-98-1010	FXD CER	1000PF	+80-20%	6.3KV	TYPE1	
C9	52-98-1010	FXD CER	1000PF	+80-20%	6.3KV	TYPE1	
C10	52-98-1010	FXD CER	1000PF	+80-20%	6.3KV	TYPE1	
C11	52-98-1010	FXD CER	1000PF	+80-20%	6.3KV	TYPE1	
C12	52-03-3469	FXD CER	0.01UF	+100-0%	500V	TYPE2	
CR1	32-90-1951	DIODE VR=6KV	FAST RECOVERY	SANKEN	GHV-06SSN		
CR2	32-90-1951	DIODE VR=6KV	FAST RECOVERY	SANKEN	GHV-06SSN		
CR3	32-90-1951	DIODE VR=6KV	FAST RECOVERY	SANKEN	GHV-06SSN		
CR4	32-90-1951	DIODE VR=6KV	FAST RECOVERY	SANKEN	GHV-06SSN		
CR5	32-90-1951	DIODE VR=6KV	FAST RECOVERY	SANKEN	GHV-06SSN		
CR6	32-90-1951	DIODE VR=6KV	FAST RECOVERY	SANKEN	GHV-06SSN		
CR7	32-90-1951	DIODE VR=6KV	FAST RECOVERY	SANKEN	GHV-06SSN		
CR8	32-90-1951	DIODE VR=6KV	FAST RECOVERY	SANKEN	GHV-06SSN		
CR9	32-90-1951	DIODE VR=6KV	FAST RECOVERY	SANKEN	GHV-06SSN		
R1	40-16-2101	FXD C FILM	1K OHM 5% 1/6W				RD1/6FS
R2	40-37-6101	FXD C FILM	10M OHM 5% 1/2W				
T1	63-92-0190	SWITING TRANS	HV-6	KIKUSUI	S8513932		