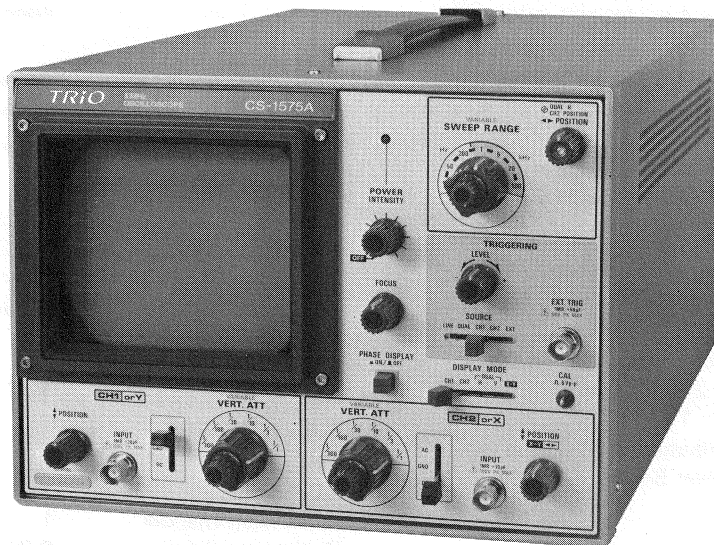


# CS-1575A

(DUAL TRACE OSCILLOSCOPE)



# TRIO

# SPECIFICATIONS

## CATHODE RAY TUBE

Type : 130BEB31  
Acceleration voltage : 2 kV  
Useful measuring : 8 divx10 div (1 div = 1 cm)

## VERTICAL AXIS (for both CH1 and CH2)

Sensitivity : 10 mV/div or higher  
Attenuator : 1-3 steps, 1/1 to 1/300, 6 ranges, precisely adjustable between ranges.  
Inter-channel error is  $\pm 5\%$ .  
Input impedance : 1 M $\Omega$   $\pm 3\%$   
Approx. 30 pF

Frequency response :  
DC : DC to 5 MHz (-3 dB),  
DC to 7 MHz (-6 dB)  
AC : 5 Hz to 5 MHz (-3 dB),  
5 Hz to 7 MHz (-6 dB)  
Risetime : 70 nsec  
Crosstalk : Less than -40 dB (at 1 kHz)

Operating mode :  
CH1 : Channel 1 only, single trace  
CH2 : Channel 2 only, single trace  
DUAL-H : Horizontal dual trace  
DUAL-V : Vertical dual trace  
X-Y : CH1 = Y axis, CH2 = X axis  
Dual-trace selection : Automatic selection of CHOP and ALT (Switched to CHOP at about 80 kHz when SWEEP RANGE is set to 10-50 Hz and TRIG.SOURCE is in LINE, CH1, CH2 or EXT. Switched to ALT at other settings.)  
Phase indication : X and Y are simultaneously displayed by PHASE DISPLAY. Zero phase Lissajous' figure is displayed at the same time during X-Y operation.

 Maximum input voltage :

600 Vp-p or  
300 V (DC + AC peak)

## SWEEP


Sweep system : Auto free-run sweep (free-run sweep at no-signal)  
Sweep frequency : 10 Hz-50 Hz, 50 Hz-200 Hz, 200 Hz-1 kHz, 1 kHz-5 kHz, 5 kHz-20 kHz and 20 kHz-100 kHz  
Fine adjustment in 6 ranges.  
Linearity : Less than 5%

## TRIGGERING

Source :  
LINE : Fixed to supply frequency.  
DUAL : Source is automatically selected to the waveform of CH1 or CH2  
CH1 : Fixed to CH1 signal.  
CH2 : Fixed to CH2 signal.  
EXT : Fixed to external signal.

Triggering level : Set by the TRIG.LEVEL switch.  
Slope : Positive only  
Coupling : AC only (inclusive of EXT)

External triggering :  
Input impedance : Approx. 1 M $\Omega$ , approx. 50 pF

 Maximum input voltage :  
100 Vp-p or  
50 V (DC + AC peak)

Triggering range :  
Internal  
(DUAL, CH1, CH2) : 0.5 div (50 Hz-3 MHz)  
1 div (20 Hz-5 MHz)  
External (EXT) : 0.5 Vp-p (50 Hz-3 MHz)  
1 Vp-p (20 Hz-5 MHz)

## HORIZONTAL AXIS (CH2)

Operating mode : X-Y mode is selected by DISPLAY MODE switch.

CH1: Y axis, CH2: X axis  
Sensitivity : Same as vertical axis (CH1)  
Input impedance : Same as vertical axis (CH1)

Frequency response :  
DC : DC to 1 MHz (-3 dB),  
DC to 1.5 MHz (-6 dB)  
AC : 5 Hz to 1 MHz (-3 dB),  
5 Hz to 1.5 MHz (-6 dB)

X-Y phase difference : Less than 3° at 50 kHz  
X-Y distortionless  
amplitude : More than 8 div x 8 div at 100 kHz (POSITION: Center)

## CALIBRATION VOLTAGE :

0.6 Vp-p  $\pm 5\%$   
Positive square wave of power supply frequency

## POWER SUPPLY

Power supply voltage : AC 100/120/220/240 V  
 $\pm 10\%$ , 50/60 Hz  
Power consumption : Approx. 25 W

## DIMENSIONS

Width : 260 mm (260 mm)  
Height : 190 mm (214 mm)  
Depth : 375 mm (440 mm)  
Figures in ( ) show maximum size.

WEIGHT : 8 kg

## ACCESSORIES :

BNC cord : 2  
AC cord : 1  
Instruction manual : 1  
Replacement fuse : 0.3A 2  
0.7A 2

## OPTIONAL ACCESSORIES :

PC-20 (attenuator probe)  
Attenuation : 1/10, 1/1  
Input impedance : 10 M $\Omega$ , less than 18 pF (1/10)  
1 M $\Omega$ , less than 100 pF (1/1)

# SPECIFICATIONS

## CRT 130BEB 31 SPECIFICATIONS

### Screen and Shape

#### Dimensions;

Overall length; 365 ± 10 mm  
 Face plate dimensions; 133 ± 3 mm  
 Screen shape; Round and flat face

#### Deflection and focusing system;

Electrostatic deflection,  
 electrostatic focusing

#### Color;

Green

#### Persistence;

Medium short

#### Useful display area;

Y axis.....80 mm  
 X axis.....100 mm

### Heating

Heater voltage; 6.3 V  
 Heater current; 0.3 A

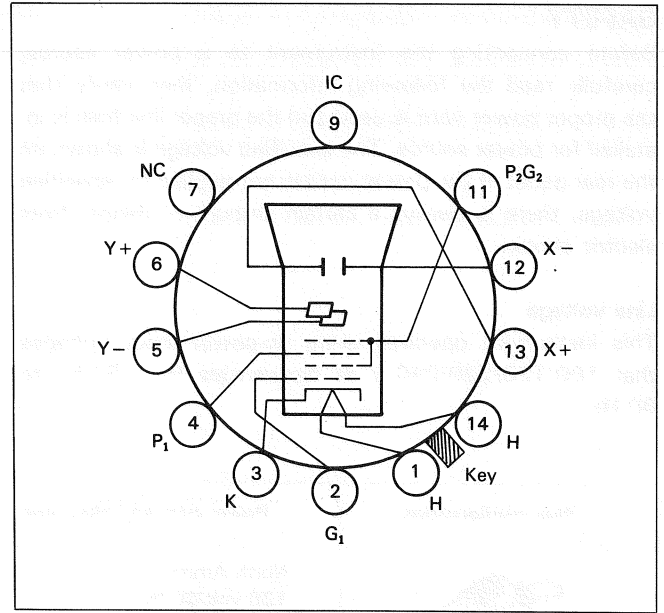


Fig. 1 130BEB31 Basing

# SAFETY

## SAFETY

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

### Line voltage

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

### Power cord

The ground wire of the 3-wire ac power plug places the chassis and housing of the oscilloscope at earth ground. Do not attempt to defeat the ground wire connection or float the oscilloscope; to do so may pose a great safety hazard. The appropriate power cord is supplied by an option that is specified when the instrument is ordered. The optional power cords are shown as follows in Fig. 2.

### Line fuse

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





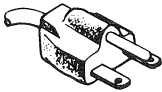
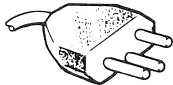
Plug configuration	Power cord and plug type	Factory installed instrument fuse	Line cord plug fuse	Parts No. for power cord
	North American 120 volt/60 Hz Rated 15 amp (12 amp max; NEC)	0.7 A, 250 V Fast blow AGC/3AG	None	E30-1820-05
	Universal Europe 220 volt/50 Hz Rated 16 amp	0.3 A, 250 V Fast blow 5 x 20 mm	None	E30-1819-05
	U.K. 240 volt/50 Hz Rated 13 amp	0.3 A, 250 V Fast blow 5 x 20 mm	0.3 A Type C	—
	Australian 240 volt/50 Hz Rated 10 amp	0.3 A, 250 V Fast blow 5 x 20 mm	None	E30-1821-05
	North American 240 volt/60 Hz Rated 15 amp (12 amp max; NEC)	0.3 A, 250 V Fast blow AGC/3AG	None	—
	Switzerland 240 volt/50 Hz Rated 10 amp	0.3 A, 250 V Fast blow AGC/3AG 5 x 20 mm	None	—

Fig. 2 Power Input Voltage Configuration

# CIRCUIT DESCRIPTION

## VERTICAL AMPLIFIER CIRCUIT

**Note:** Parts symbols in ( ) are for CH2.

The vertical amplifier circuit has two identical preamplifiers for CH1 and CH2.

A signal applied to the BNC INPUT terminal passes through the AC-GND-DC switch and is fed to the 1st attenuator where the signal is attenuated to 1/1, 1/10 or 1/100 so as to be inputted to the gate of Q2 (Q12).

Q2 (Q12) is a dual FET which has excellent DC balance against changes in temperatures and also has a high input impedance.

Q1 (Q11) is an input protection circuit utilizing the excellent diode characteristics of FET, which is used to protect Q2 (Q12) from excessive input. The source circuit of Q2 (Q12) has VR8 (VR18) to adjust VARI. ATT and DC. BALANCE.

The signal from Q2 (Q12) is fed through the emitter follower Q3 and Q4 (Q13 and Q14) to the 2nd attenuator Q5 and Q6 (Q15 and Q16).

The collector of Q5 and Q6 (Q15 and Q16) forms an attenuator to attenuate the signal to 1/1 or 1/3, while VR3 (VR13) is used to adjust STEP ATT and DC. BALANCE. VR2 (VR12) in the emitter circuit of these transistors is used to adjust the gain (VARIABLE ATT). The gain is calibrated by VR1 (VR11).

The signal from the 2nd attenuator is fed to the preamplifier Q7 and Q8 (Q17 and Q18). VR5 (VR15) in the emitter circuit of these transistors is the  $\blacklozenge$  POSITION control and VR4 (VR14) is the ADJUST control.

The signal from the preamplifier is fed to the vertical mode logic circuit consisting of diode gate (D3 ~ D10) inserted to the cascode amplifier Q9 (Q19), Q10 (Q20), Q21 and Q22 and the cascode junction, in which the signal is switched to a dual trace signal and is fed to the vertical main amplifier Q25 ~ Q28 through the drive amplifier Q23 and Q24 where the center position of CRT is adjusted by VR6 inserted in the emitter circuit of Q25 and Q26 to prevent the dynamic range of the output of Q21 and Q22 from being biased.

The signal from the preamplifier is sampled and is fed through Q9 and Q10 (Q19 and Q20) to the trigger amplifier Q29 and Q30 (Q31 and Q32), which is further fed to sync circuit. The gain of the "X" amplifier is calibrated by VR17 while the X-POSITION is adjusted by VR16.

The signal is then amplified through the vertical main amplifier to provide sufficient bandwidth so as to be applied to the vertical deflection plate of CRT.

## SYNC SWEEP CIRCUIT

The signal from the vertical preamplifier is fed through the trigger amplifier to the limiter circuit Q2 and Q3 (Q4 and Q5) where the trigger level is adjusted by VR1. The CH2 limiter circuit Q4 and Q5 also functions as a limiter circuit

for external triggering; line signal and an external trigger signal which pass through the external trigger amplifier Q21 and a CH2 trigger signal are selected by the trigger source switch and is applied to the base of Q5.

The trigger signal from the limiter circuit is shaped to square wave signal through the Schmidt circuit "A" (A') IC2a and b (IC2c and d) and is fed to the mono multi-circuit IC3a and b (IC3c and d).

The mono multi-circuit is controlled through Q6 (Q7) by the auto-free-run circuit D3 and D4 (D5 and D6) which DC restores the output of the Schmidt circuit "A" (A'), and the trigger mode logic circuit IC1a, b and d, to produce negative pulses of about 40 nsec only at the falling time of the output of the Schmidt circuit "A" (A'). These pulses are attenuated to 1/2 by R27 and R33. Since the negative pulse is in the middle of the threshold level of the Schmidt circuit "B" IC4c and d, it inverts the output of this circuit from "H (1)" to "0". The circuits IC4a-d, Q8-Q11 and D13-D16 form one loop to constitute a saw-tooth wave generating circuit.

At first, the output of the Schmidt circuit "B" is "H (or 1)", so D14 ~ D16 are ON and, hence, the output of the mirror integration circuit is almost 0 V. This voltage is fed through the emitter follower Q8 and Q9 to the Schmidt circuit "C" IC4a and b, the output of which becomes "L (0)" and, therefore, D13 is set to "ON".

If, at this time, a negative pulse is fed by the mono multicircuit, the output of the Schmidt circuit "B" becomes "L (0)" which turns D14 ~ D16 to OFF and thus the time base capacitor C21 starts charging through the mirror integration circuit.

The charge current is determined by the voltage set by VR2 (SWEEP VARI) while R44, 73, 45 and 46 are selected by the SWEEP RANGE control; the charge current is applied through the emitter follower Q22.

The charge voltage from the integration circuit is fed to the Schmidt circuit "C" via R76 and R90, Q8 and Q9 and when it reaches the threshold level, then the Schmidt circuit "B" is driven where the output is inverted from "L (0)" to "H (1)" and at the same time D13 is turned to OFF. When the output of the Schmidt circuit becomes H (1); D15 and D16 turn to ON and the integration circuit is discharged quickly until D14 turns to ON.

Also, the voltage charged in the hold-off capacitor C18 through Q8 is discharged slowly through R42 because D13 is OFF; this voltage is fed through Q9 to the Schmidt circuit "C" where the output is inverted and D13 turns to ON, thereby returning to the original condition.

# CIRCUIT DESCRIPTION

## HORIZONTAL AMPLIFIER CIRCUIT

The output of the mirror integration circuit Q10 and Q11 is fed to the emitter of Q14 through VR4 (WIDTH ADJUST), VR104 (POSITION) and VR5 (◀▶ POSITION ADJUST). Q14 and Q15 are cascode connected; the collector of Q15 is connected to the collector of Q16 which is also cascode connected to Q32 of the vertical axis to supply X axis signal during X-Y operation. These two cascode amplifiers are switched by IC7 through D11 and D12 to feed saw-tooth wave signal (SWEEP) or X axis signal (X-Y) to the "H" (horizontal) amplifier Q17-Q20, and the signal thus amplified is directly connected to the horizontal deflection plate of CRT.

## DISPLAY MODE CIRCUIT

The output of the Schmidt circuit "B" is inverted by IC5d and is NAND connected through IC5c to the output of the CHOP signal generator IC5a and b to produce UN-BLANKING signal. This signal passes through VR101 (INTENSITY) and is fed to the BLANKING amplifier and, at the same time, it is inverted by IC1c to produce clock signal to IC6. Therefore, IC6 generates gate signal which switches CH1 and CH2 of vertical axis at each sweep or each cycle of CHOP signal.

## PHASE DISPLAY CIRCUIT

When the PHASE DISPLAY is OFF in DUAL mode, IC6 generates a gate signal with selects CH1 and CH2 alternately.

When the PHASE DISPLAY is ON, the 3-dividing circuit consisting of IC6 and IC7 displays CH1, CH2 and X-Y in turn.

When the PHASE DISPLAY is ON in X-Y mode, the display shows X-Y and 0-phase Lissajous' waveform alternately due to the output of IC6.

## DUAL-H MODE CIRCUIT

When DISPLAY MODE is DUAL-H, Q12 is OFF, so the peak value of saw-tooth wave from the integration circuit is reduced to 1/2 of that in the other state. This saw-tooth wave signal is fed to the input of the horizontal amplifier circuit but the base input of Q18 of this amplifier is given from Q13.

Q13 is normally OFF and, hence, the base voltage of Q18 is 5 V. In DUAL-H mode, the emitter of Q13 is earthed through D22 and the emitter of Q13 is supplied with the output signal from IC6 and IC7, which is AND coupled through D9 and D10.

Therefore, the emitter of Q13 is earthed through D22 only when IC6 is in CH2 mode and IC7 is in sweep mode and thus the output signal from IC6 and IC7, which is AND coupled through D9 and D10, is applied to the base. Accordingly, Q13 is ON only when IC6 is in CH2 mode and IC7 is in sweep mode. At this time, the collector voltage is inputted to the base of Q18 through VR105 (DUAL-H CH2

◀▶ POSITION).

With these signals applied, the horizontal main amplifier outputs two saw-tooth wave signals, each having a different DC component, which are synchronized with the output of IC6, thereby displaying CH1 signal on the left half and CH2 signal on the right half sections of CRT.

## BLANKING CIRCUIT

The unblanking signal from IC5c passes through VR101 (INTENSITY) and is fed to the unblanking amplifier Q45 ~ Q47. Q45 and Q46 are cascode connected and its output is fed back to the base of Q45 through the current regulated emitter follower D47 and Q47 and, at the same time, it amplitude modulates the output of Q48 through D50 and D49. The output of the amplifier composed of Q48 and D48 is determined by the frequency of the DC-DC converter. The anode of D49 is connected to VR23 (INTENSITY ADJ.) to adjust the blanking position of INTENSITY.

The amplitude modulated signal is DC-restored by D51 and D52, which is applied to the grid of CRT to produce a trace during sweep operation.

## CRT POWER CIRCUIT

The CRT ASTIG electrode voltage from VR22 (ASTIG) is fully stabilized through the emitter follower Q52.

In the high voltage circuit, D54, Q51, T1 form a DC-DC converter circuit; the output from T1 secondary is rectified by D41 and is connected to the cathode of CRT and, at the same time, it is fed back to the regulation circuit Q49 and Q50 while feeding FOCUS electrode voltage to CRT via VR102 (FOCUS). The output voltage is adjusted by VR21 (-1.9 kV ADJ.).

## POWER CIRCUIT

Power voltage required to drive the oscilloscope circuits is stabilized by the tracking regulator IC1a and b, IC2a and b, Q41 ~ Q44, and is supplied through D44 ~ D46 and VR24 (+180 V ADJ.).

## CALIBRATING VOLTAGE CIRCUIT

The oscilloscope calibrating voltage utilizes 0.6 Vp-p square wave obtained by switching Q1 with power frequency.

# CIRCUIT DESCRIPTION

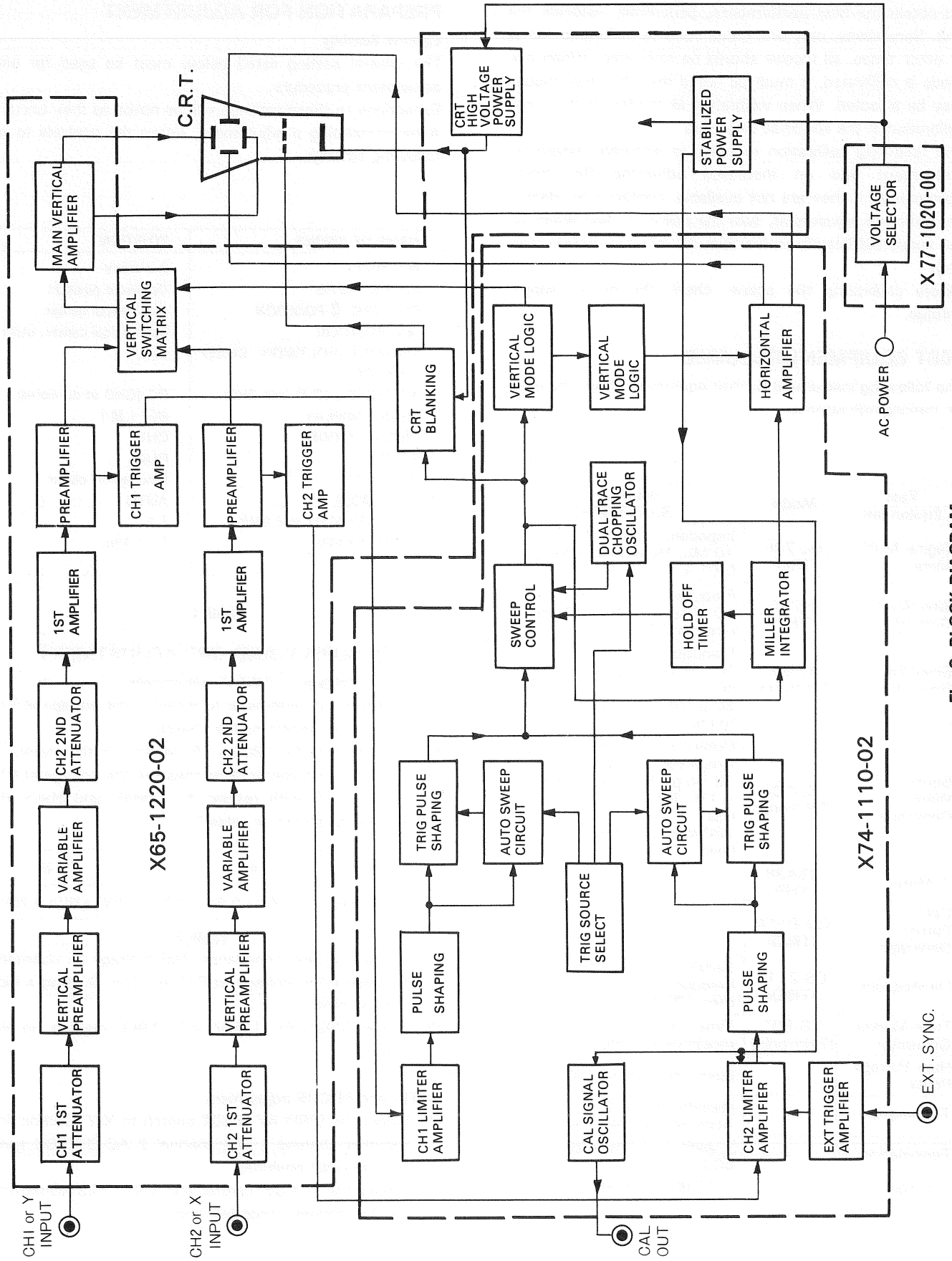


Fig. 3 BLOCK DIAGRAM

# ADJUSTMENT

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

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

Before calibrating the scope, check the power supply voltage.

## TEST EQUIPMENT REQUIRED

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

Test Equipment	Model	Minimum Specification
Digital Multi-Meter	DL-706 (TRIO)	Impedance: More than 10 M $\Omega$ , Measuring range: 0.01 V to 199 V
Sine-Wave Generator	651 B (YHP)	Frequency: 10 Hz to 10 MHz, constant voltage over tuning range
Sine-Wave Generator	SG-503 (Tektronix)	Frequency: 50 kHz to 100 MHz, Output impedance: 50 $\Omega$ , constant voltage over tuning range.
Square-Wave Generator	PG-506 (Tektronix)	Output signal: 1 kHz, Amplitude: 10 mVp-p to 10 Vp-p, Accuracy: within $\pm 1\%$ , Rise time: 35ns or less 100 kHz, Rise time: 1 ns or less
Q Meter	4343B (YHP)	—
Color Pattern Generator	CG-911A (TRIO)	—
Oscilloscope	CS-2110 (TRIO)	Sensitivity: more than 5 mV Frequency response: More than 100 MHz
Time-Marker Generator	TG-501 (Tektronix)	Time mark: 0.5 s to 0.1 $\mu$ s repetitive waveform
High-Voltage Probe	—	Input Impedance: 1000 M $\Omega$
Termination	—	Impedance: 50 $\Omega$ Accuracy: within 3%
Termination	—	3 watts type impedance: 50 $\Omega$
Attenuator	—	-20 dB attenuation (50 $\Omega$ )

Table 1

## PREPARATION FOR ADJUSTMENT

### Control Setting

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

Exceptions to these settings will be noted as they occur.

After completing a adjustment, return the controls to the following settings.

NAME OF KNOBS	POSITION
INTENSITY	3 o'clock
FOCUS, ASTIG	Optimum position
CH1, CH2 $\blacktriangledown$ POSITION	Mechanical center
$\blacktriangleleft$ $\blacktriangleright$ POSITION	Mechanical center, push
VARIABLE (VOLTS/DIV, SWEEP RANGE)	CAL
AC-GND-DC (CH1 and CH2)	DC (GND at no signal)
PHASE DISPLAY	OFF (■)
DISPLAY MODE	CH1
SOURCE	DUAL
TRIG. LEVEL	Mechanical center
TRIG. MODE	AUTO
VERT ATT (CH1 and CH2)	1/1
SWEEP RANGE	2~1 kHz

Table 2

## POWER SUPPLY AND CRT ADJUSTMENT

### Reference Voltage (+180 V) adjustment

- Connect a dc voltmeter to measure the voltage at P13 pin 1 with respect to the chassis.
- Adjust VR24 for 180V  $\pm 1\%$  reading on the meter.
- Connect a dc voltmeter to measure the voltage at P13 pin 4, 5, 6 with respect to chassis and check the voltage as shown in table 3.

Pin No.	4	5	6
Voltage	+10V $\pm 0.5V$	-10V $\pm 0.5V$	+5V $\pm 0.25V$

Table 3

- Connect a high impedance, high voltage dc voltmeter to measure the voltage at P11 pin 2 or 3 using a high voltage probe.
- Adjust VR21 for 1.9kV  $\pm 0.019kV$  reading on the meter.

### ASTIG and FOCUS adjustment

- Select the DISPLAY MODE switch to X-Y position and together channel 1 and channel 2 AC-GND-DC switches to GND positions.
- Adjust the FOCUS control and VR22 (ASTIGmatism) for the sharpest, roundest spot.



# ADJUSTMENT

## Intensity adjustment

- (1) Select the DISPLAY MODE switch to X-Y position and together channel 1 and channel 2 AC-GND-DC switches to GND positions.
- (2) Adjust VR23 so the spot just disappears at 11 o'clock position of INTENSITY control.

## CRT Centering adjustment

- (1) Select the DISPLAY MODE switch to CH1 position.
- (2) Short together TP1 and TP2 test points.
- (3) Adjust VR6 to vertically center trace on the crt.

## Blanking adjustment

- (1) Select the channel 1 AC-GND-DC switch to GND position and SWEEP RANGE to 50 ~ 100kHz position.
- (2) Adjust TC11 so that the brightness begins as near the start of the trace as possible.

## VERTICAL AXIS ADJUSTMENT

### Channel 1 DC Balance adjustment

- (1) Select the channel 1 AC-GND-DC switch to GND position.
- (2) Rotate channel 1 VARIABLE control back and forth.
- (3) Adjust VR8 for zero minimum vertical shift of trace as channel 1 VARIABLE control is rotated.

### Channel 1 Attenuator Balance adjustment

- (1) Select channel 1 AC-GND-DC switch to GND position.
- (2) Rotate channel 1 VERT ATT control back and forth.
- (3) Adjust VR3 for zero or minimum vertical shift of trace as VERT ATT control is rotated.

### Channel 2 DC Balance adjustment

- (1) Select the channel 2 AC-GND-DC switch to GND position.
- (2) Rotate channel 2 VARIABLE control back and forth.
- (3) Adjust VR18 for zero or minimum vertical shift of trace as VARIABLE control is rotated.

### Channel 2 Attenuator Balance adjustment

- (1) Select channel 2 AC-GND-DC switch to GND position.
- (2) Rotate channel 2 VERT ATT control back and forth.
- (3) Adjust VR13 for zero or minimum vertical shift of trace as VERT ATT control.

### Channel 1 Position Center adjustment

- (1) Select channel 1 AC-GND-DC switch to GND position and channel 1 POSITION control to its mechanical center (12 o'clock position).

- (2) Adjust VR4 so that the trace is superimposed in exact vertical center of screen.
- (3) Rotate POSITION control to fully clockwise position. Trace must move up at least 5 divisions.
- (4) Rotate channel 1 POSITION control to fully counterclockwise position. Trace must move at least 5 divisions below center line.

### Channel 2 Position Center adjustment

- (1) Select the channel 2 AC-GND-DC switch to GND position and channel 2 POSITION control to its mechanical center (12 o'clock position).
- (2) Adjust VR14 so the trace is superimposed in exact vertical center screen.
- (3) Rotate channel 2 POSITION control to fully clockwise position. Trace must move up at least 5 divisions.
- (4) Rotate channel 2 POSITION control to fully counterclockwise position. Trace must move at least 5 divisions below center line.

### Channel 1 Gain adjustment

- (1) Select channel 1 VERT ATT control to 1/1 position and VARIABLE control to its maximum clockwise position.
- (2) Apply a 50mV peak to peak 1 kHz square wave signal to channel 1 input jack.
- (3) Adjust VR1 for exactly 5 divisions vertical amplitude.

### Channel 2 Gain adjustment

- (1) Select channel 2 VERT ATT control to 1/1 position and VARIABLE control to its maximum clockwise position.
- (2) Apply a 50 mV peak to peak 1 kHz square wave signal to channel 2 input jack.
- (3) Adjust VR11 for exactly 5 divisions vertical amplitude.

### Channel 1 Wave Shape

- (1) Apply a 1 kHz square wave signal to channel 1 input jack to display a waveform of 4 to 7 divisions vertical amplitude.
- (2) Adjust the trimmer capacitors in the sequence listed below for best square wave characteristic.

VERT ATT	Adj control
1/1	check
1/10	TC1
1/100	TC2

Table 4

# ADJUSTMENT

## Channel 2 Wave Shape

- (1) Select the DISPLAY MODE to CH2 position.
- (2) Apply a 1 kHz square wave signal to channel 2 input jack to display a waveform of 4 to 7 divisions vertical amplitude.
- (3) Adjust the trimmer capacitors in sequence listed in table below for the best square wave.

VERT ATT	Adj control
1/1	check
1/10	TC6
1/100	TC7

Table 5

## Channel 1 Overshoot Compensation

- (1) Select the SWEEP RANGE to 20 kHz ~ 100 kHz position.
- (2) Apply a 100 kHz square wave signal to channel 1 input jack to display a waveform of 4 divisions vertical amplitude.
- (3) Adjust the trimmer capacitors in the sequence listed below for the best square wave characteristic.

Sequence	Adj cont.	Procedure
1	VR7	High frequency range compensation for the best flat-top waveform. However, do not completely eliminate overshoot, as high frequency response will be degraded.
2	TC12	Mid frequency range compensation for the best flat-top waveform.
3	TC5	High frequency range compensation for the best flat-top waveform.

Table 6

## Channel 2 Overshoot Compensation

- (1) Select the DISPLAY MODE to CH2 position.
- (2) Apply a 100 kHz square wave signal to channel 2 input jack to display a waveform of 4 divisions vertical amplitude.
- (3) Adjust TC10 for the best flat-top waveform in the high frequency range.

## HORIZONTAL AXIS ADJUSTMENT

### Sweep Width adjustment

- (1) Select the channel 1 VERT ATT control to 1/100 range, SWEEP RANGE control to 0.2 ~ 1 kHz range and SWEEP VARIABLE control to maximum clockwise position.
- (2) Apply a 0.5 ms marker signal to channel 1 input jack.
- (3) Adjust VR4 so the 2nd markers span exactly 6 horizontal divisions on the display.

### Horizontal Position adjustment

- (1) Perform "Sweep width" adjustment.
- (2) Rotate the ◀▶ POSITION control to its mechanical center position.
- (3) Adjust VR5 so the 1st marker exactly coincides with the extreme left line on the graticule scale.

### Sweep Range adjustment

- (1) Select the channel 1 VERT ATT control to 1/100 range, SWEEP RANGE to between 1 and 5 kHz range and SWEEP VARIABLE control to maximum clockwise position.
- (2) Apply a 0.1ms marker signal to channel 1 input jack.
- (3) Adjust TC1 so the 2nd markers span exactly 6 horizontal divisions on the display.

### X Position Centering adjustment

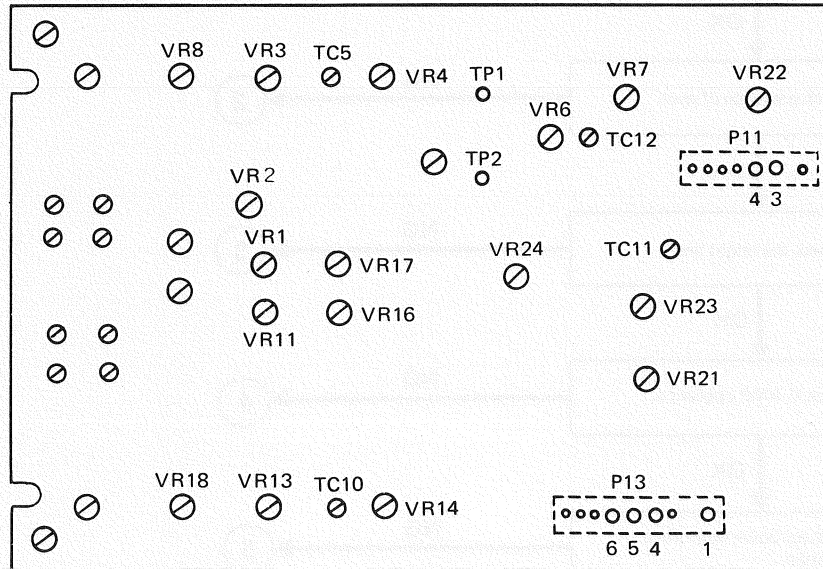
- (1) Select together channel 1 and channel 2 AC-GND-DC switches to GND positions.
- (2) Select the DISPLAY MODE switch to CH2 positions.
- (3) Adjust channel 1 and channel 2 ◀▶ POSITION controls to superimpose both traces in the vertical center of the screen.
- (4) Select the DISPLAY MODE switch to X-Y position.
- (5) Adjust VR16 so the spot is in horizontal center of the screen.

### X Gain adjustment

- (1) Select the DISPLAY MODE switch to X-Y position.
- (2) Apply a 150 mV peak to peak 1 kHz square wave signal to channel 1 input jack.
- (3) Adjust VR17 for 6 divisions of horizontal deflection (may appear as two dots, 6 divisions apart).

# ADJUSTMENT

X65-1220-02



X74-1110-02

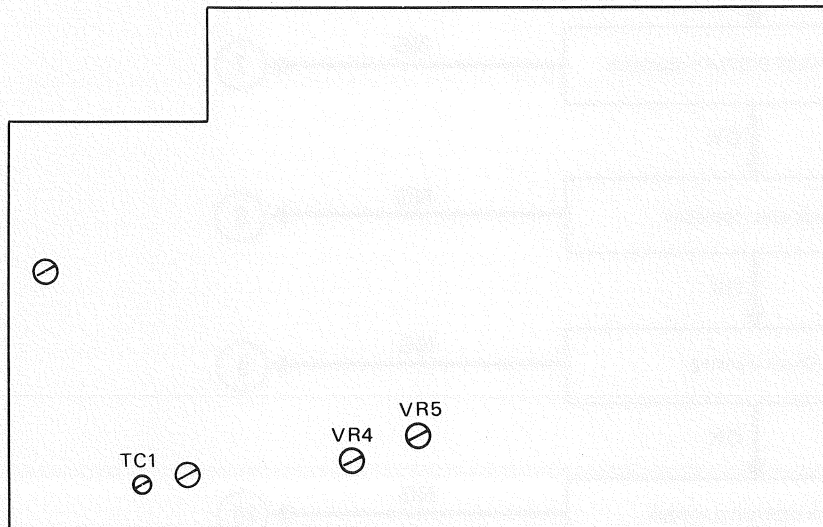
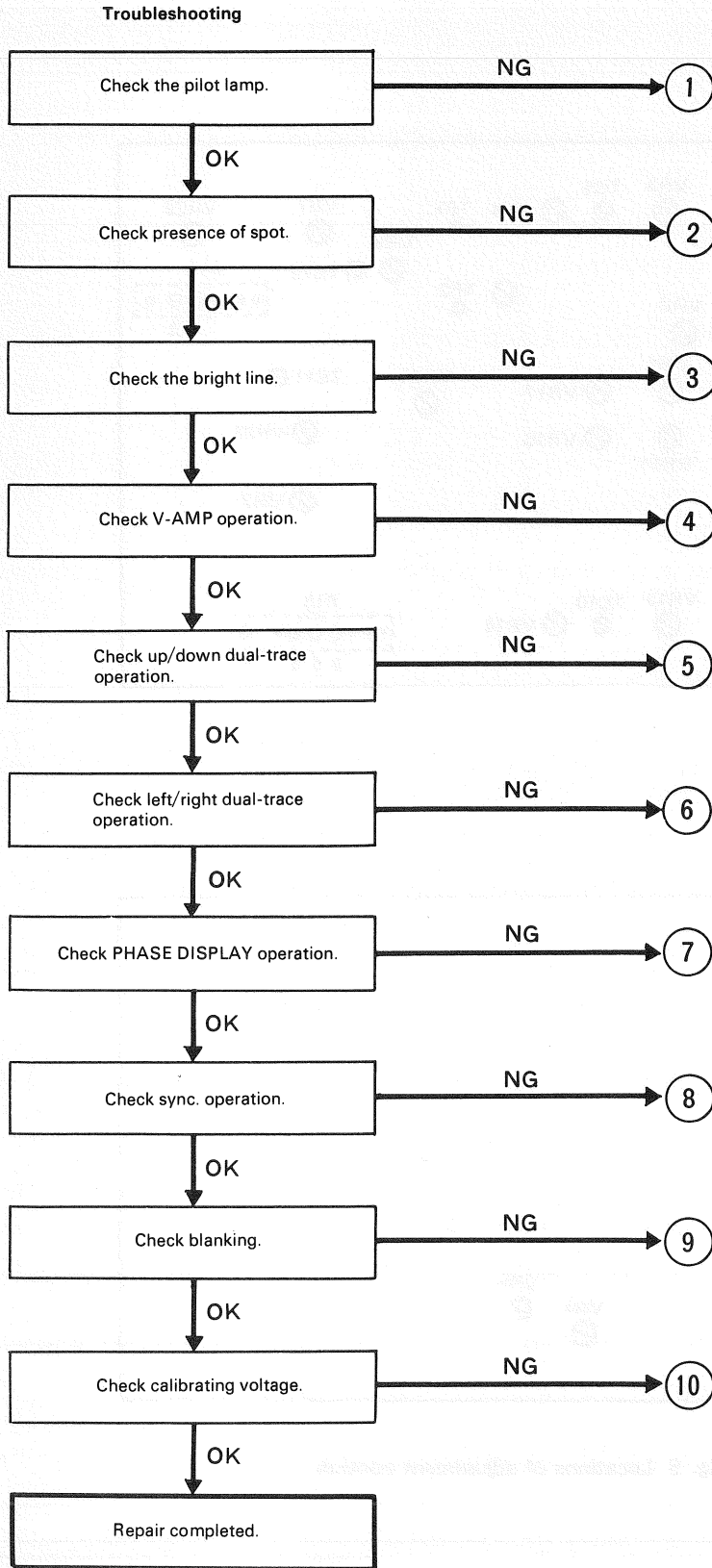
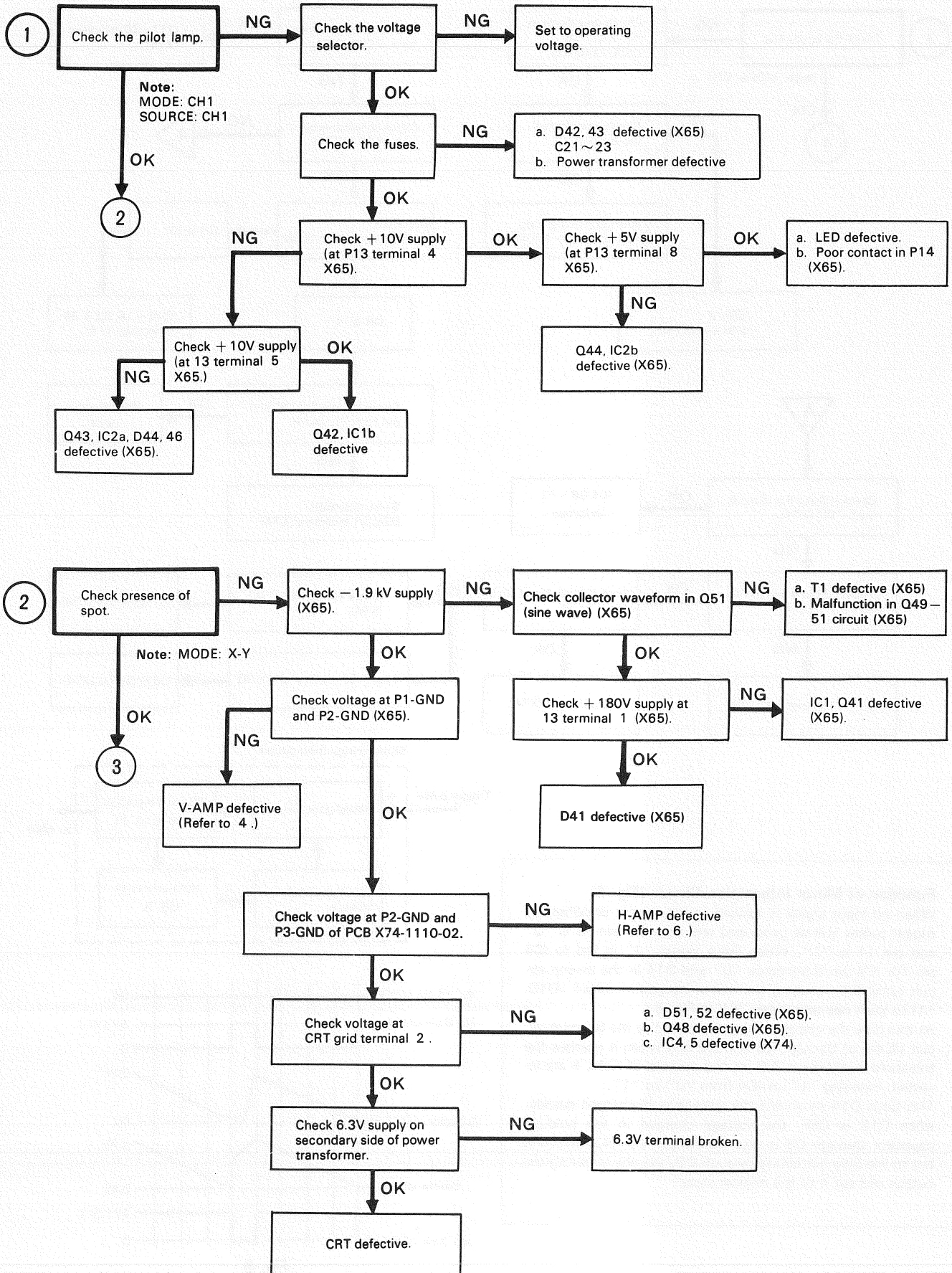


Fig. 5 Locations of adjustment controls

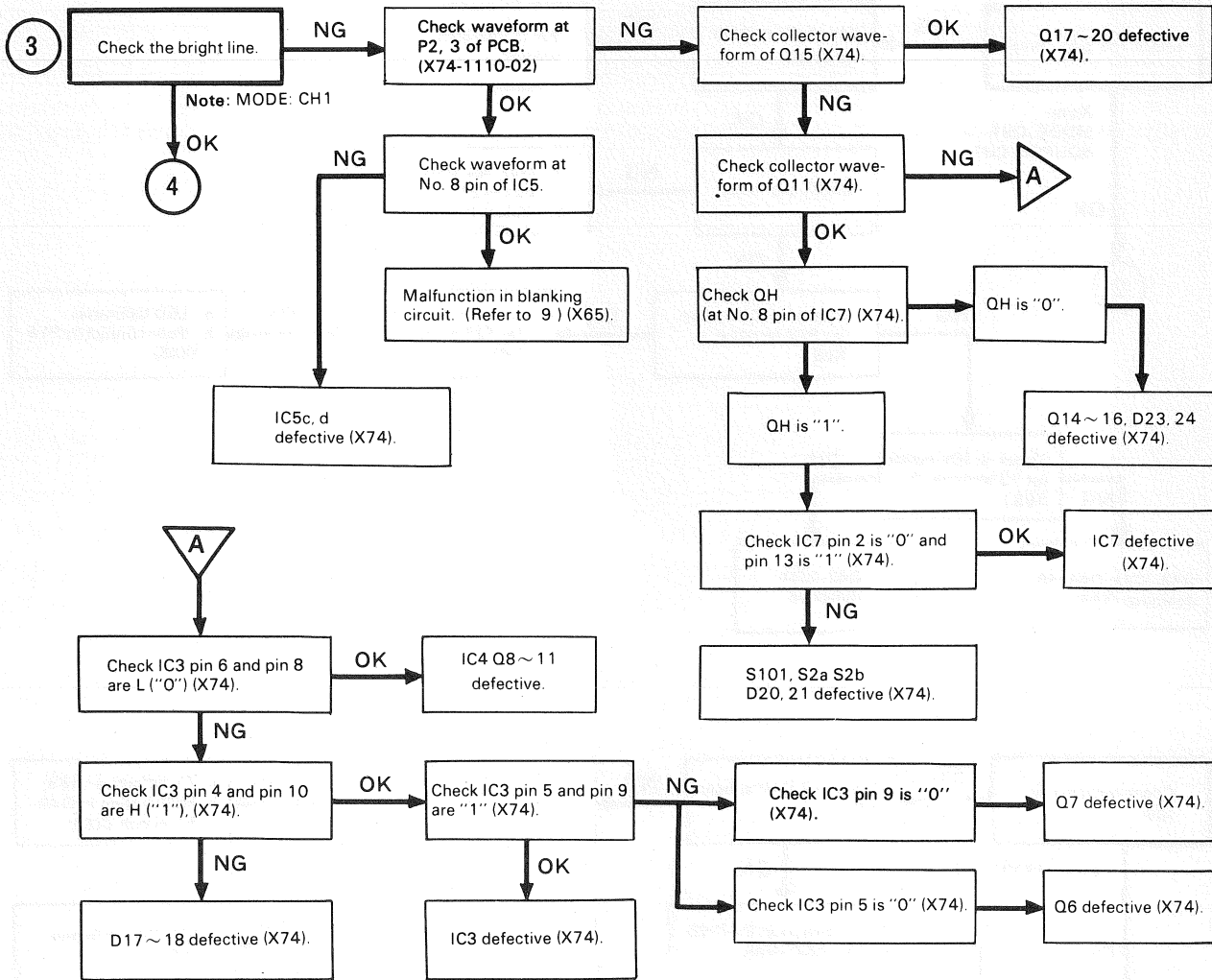
# TROUBLESHOOTING



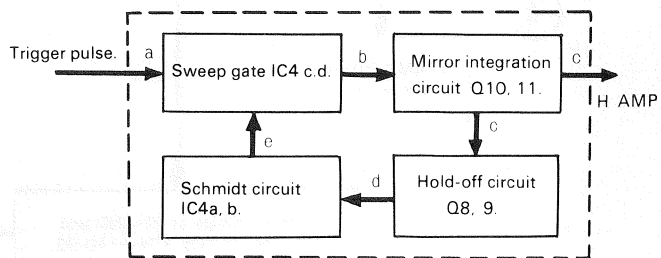
# TROUBLESHOOTING



# TROUBLESHOOTING



Mirror integration circuit



## Function of Mirror Integration Circuit (Fig. 6)

When no input signal is applied to the trigger amplifier, no trigger pulses will be generated and thus IC4 pin-13 is "0" and pin 11 is "1". When input signal "1" is fed to IC4 pin-10, IC4 pin-8 becomes "0" and D14 in the sweep circuit turns OFF, causing the mirror integration circuit (Q10, 11) to start operating (see "C" in Fig. 6.).

At this time the charge voltage is applied to the Schmidt circuit (IC4a, b) through Q8 and Q9 and when it reaches the threshold level (about 2.5 V), the outputs of IC4a, b are inverted, inverting "C" of IC4 from "0" to "1".

This turns D14 to on and the voltage is discharged quickly, since D13 is OFF, the voltage charged in the hold-off capacitor through Q8 is also discharged via R42, which is fed to the Schmidt circuit through Q9, thereby inverting the output and set it to the original state.

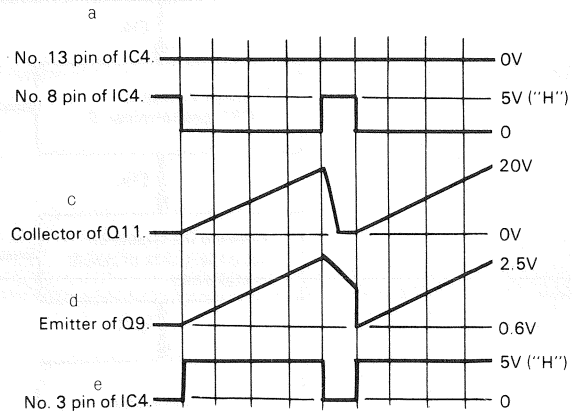


Fig. 6

# TROUBLESHOOTING

\* For items 4~9, check should be made with a signal applied to CH1 and CH2.

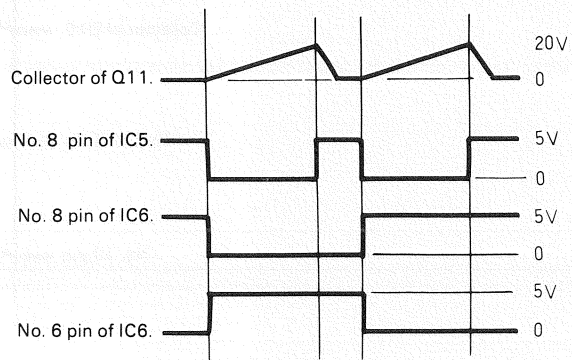
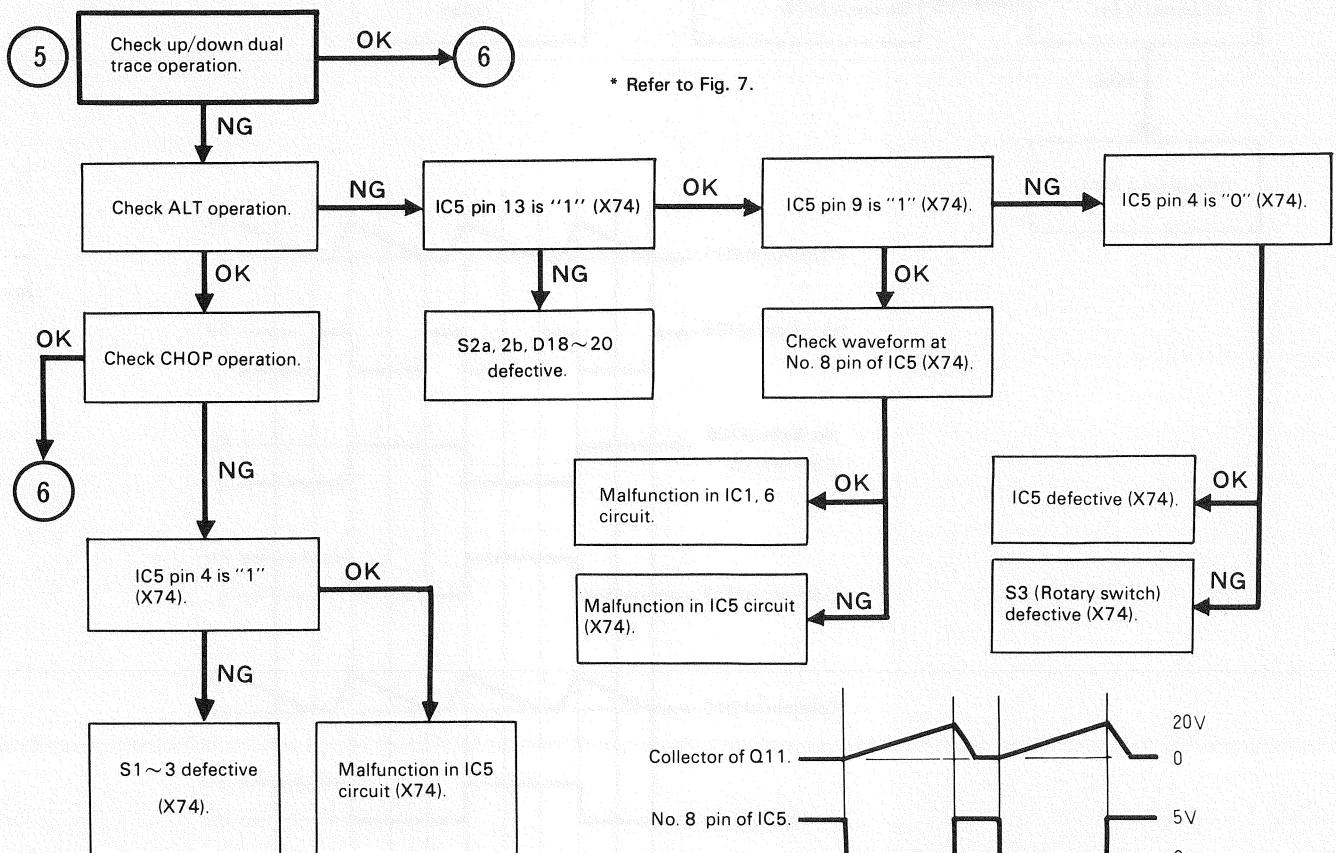
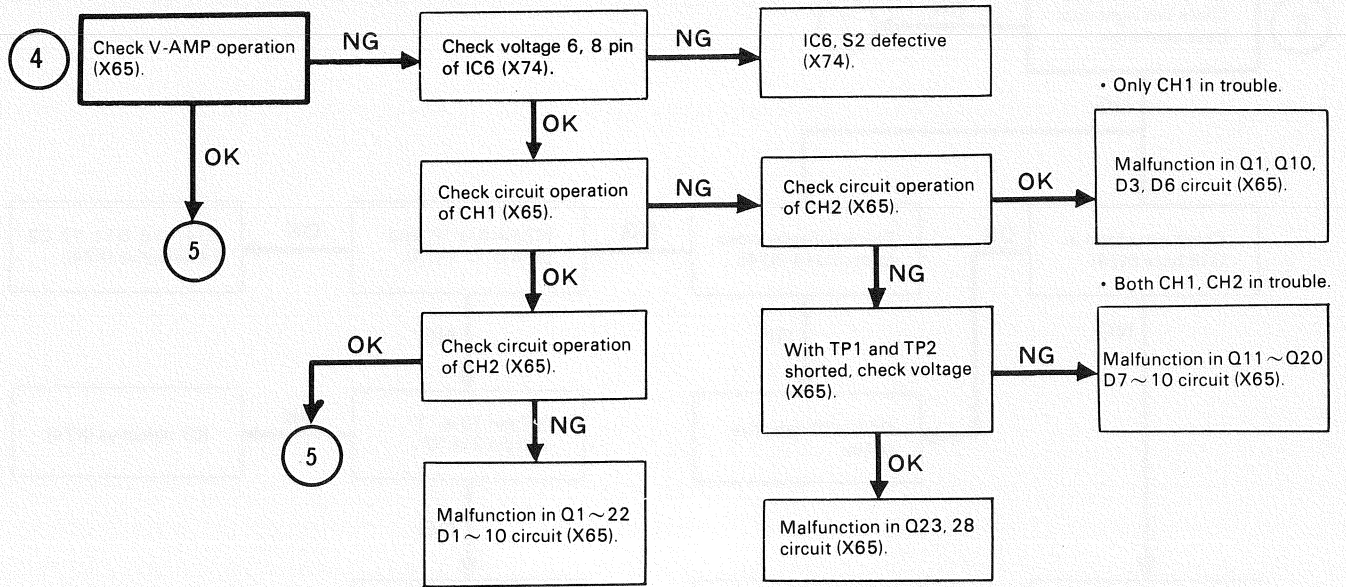


Fig. 7

# TROUBLESHOOTING

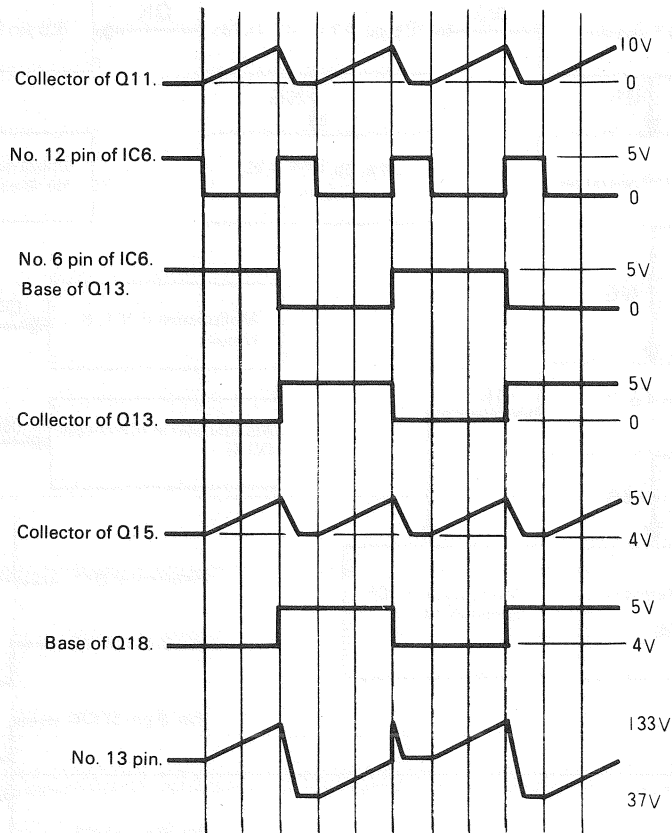
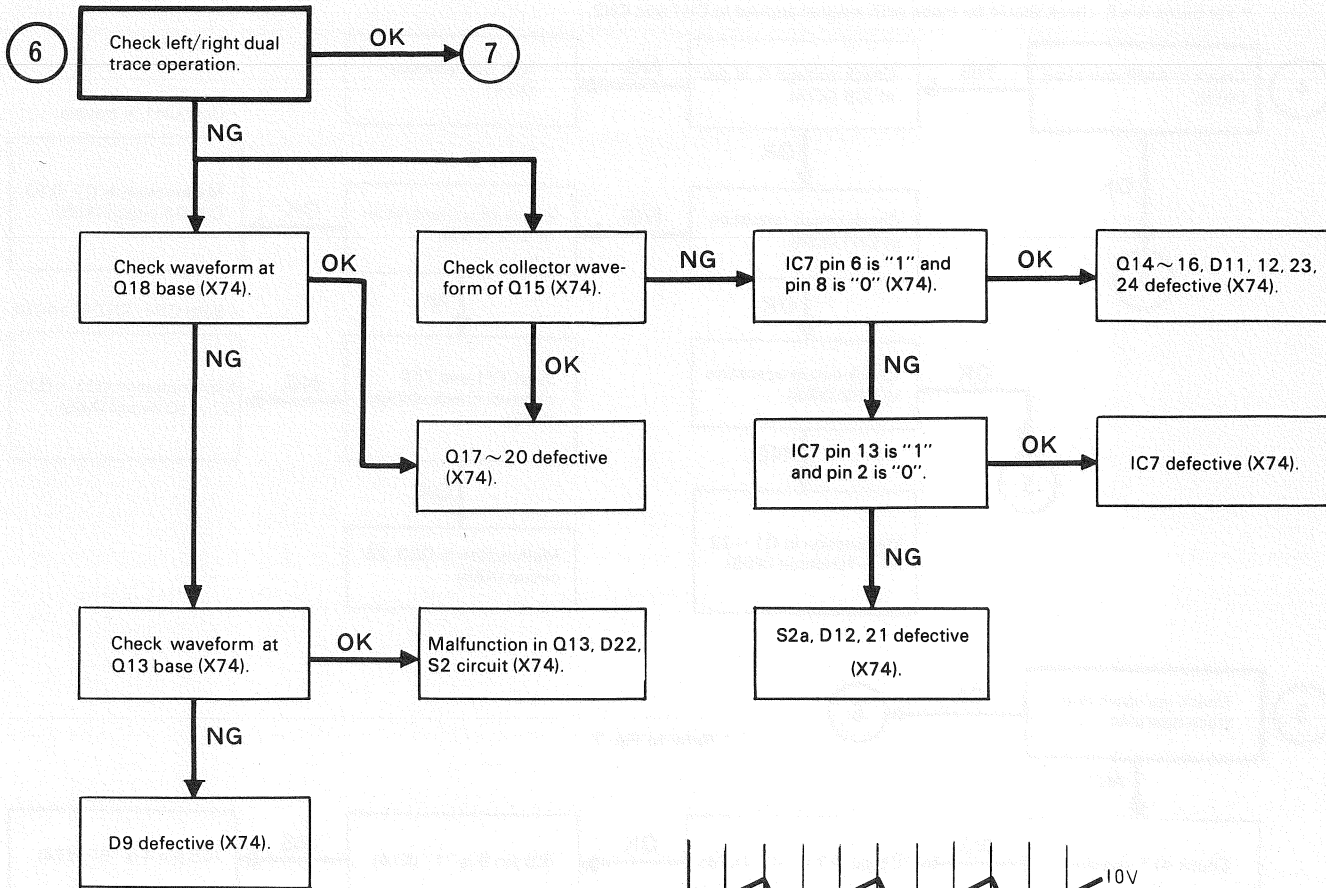


Fig. 8



# TROUBLESHOOTING

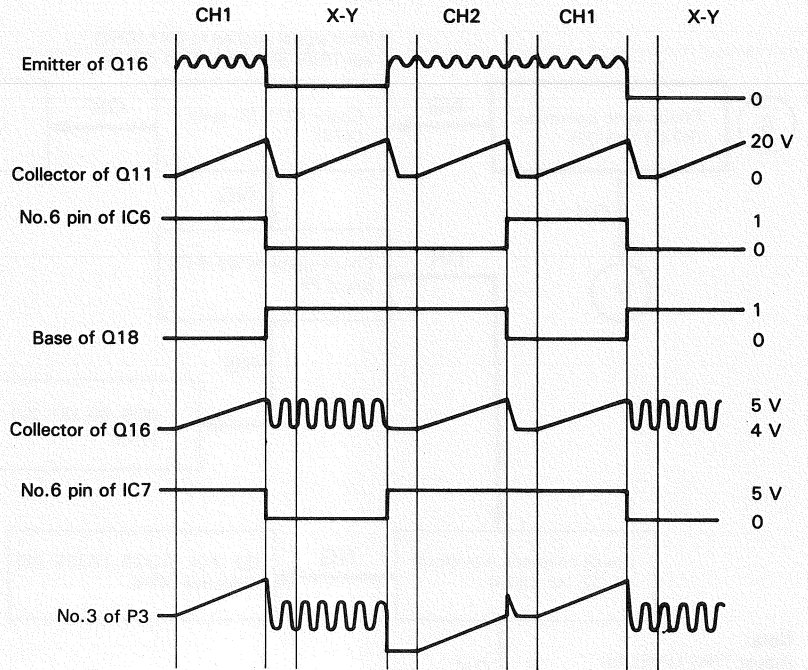
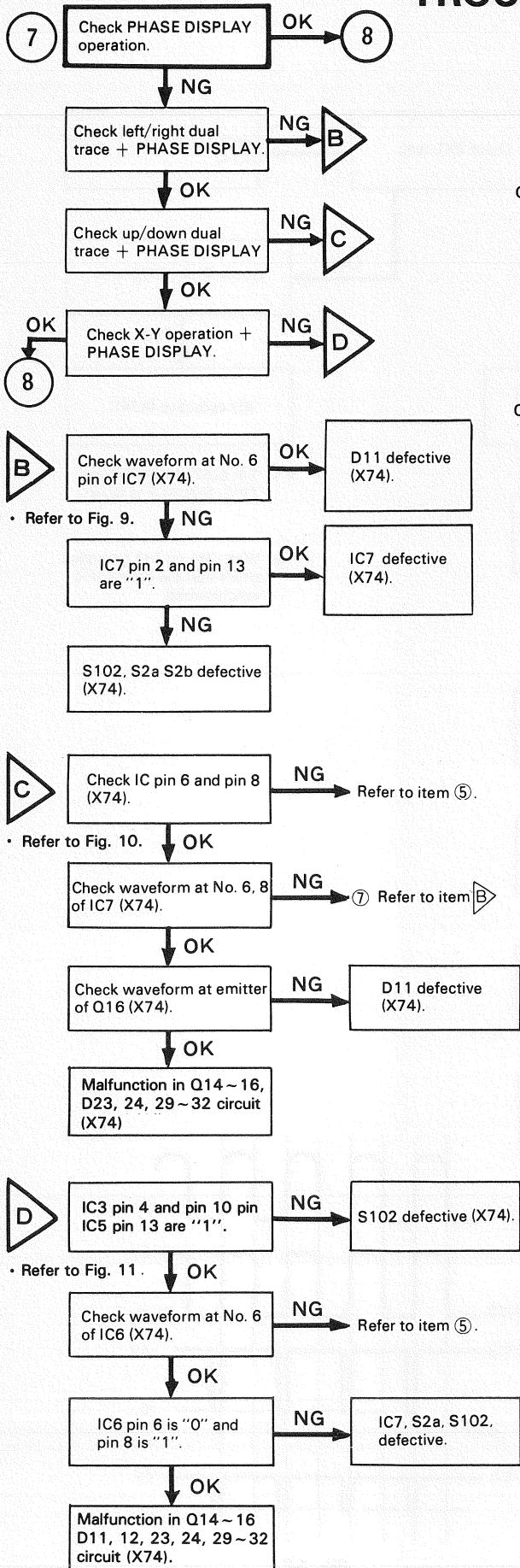


Fig. 9

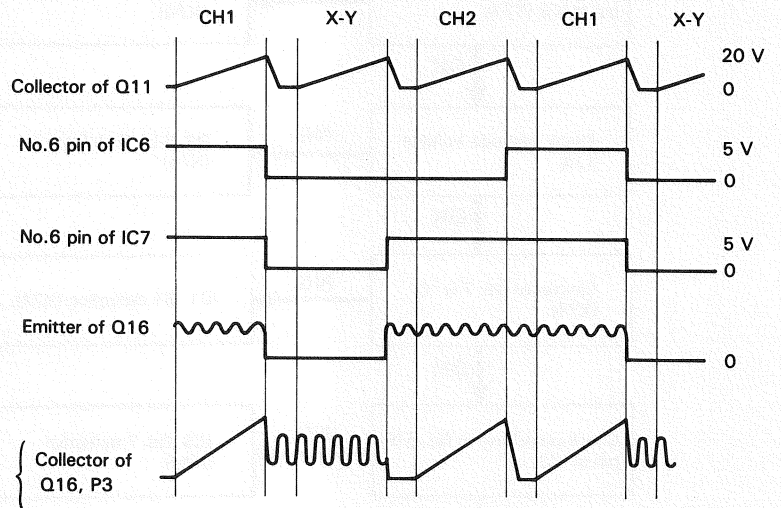


Fig. 10

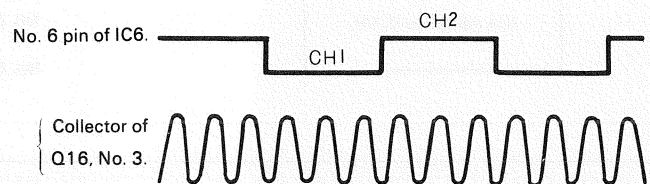


Fig. 11

# TROUBLESHOOTING

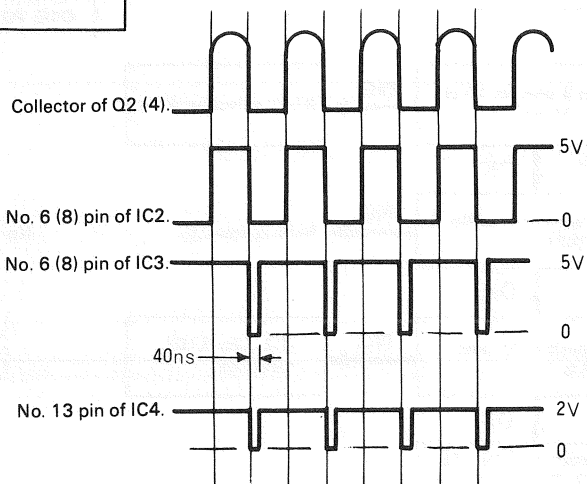
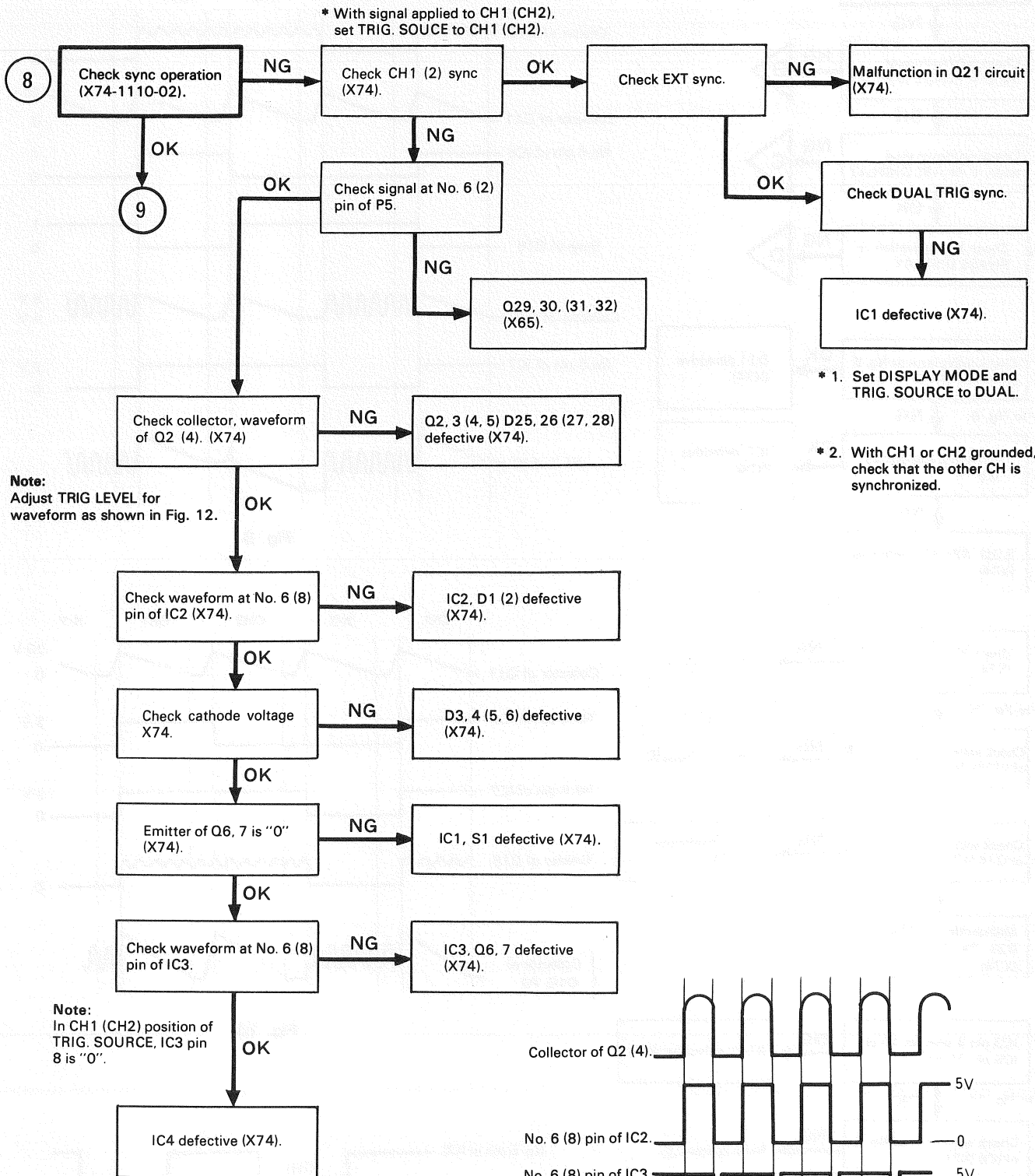


Fig. 12

\* Add any signal to CH1 or CH2 EXT TRIG. terminal.

# TROUBLESHOOTING

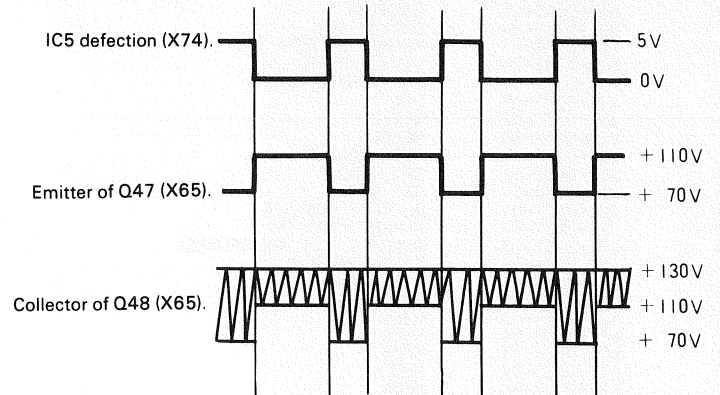
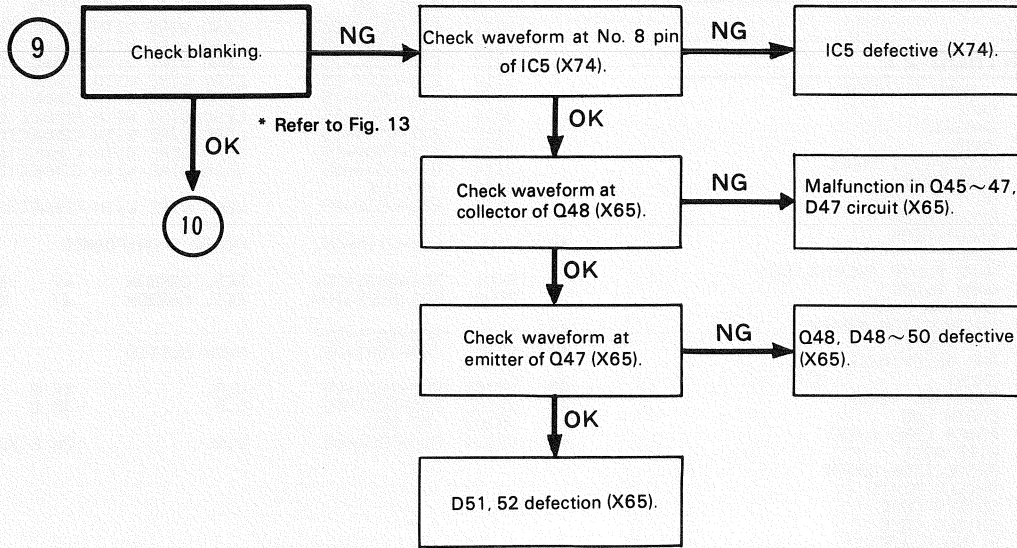
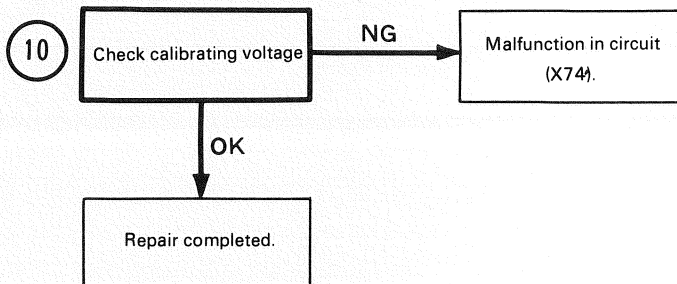


Fig. 13



# PARTS LIST

## MAIN CHASSIS

### Y70-1500-21

REF.NO	PARTS NO	NAME & DESCRIPTION	REF.NO	PARTS NO	NAME & DESCRIPTION	
	A01-1126-02	CASE	J111	E31-0540-05	LEAD WIRE WITH CONNECTOR	
1	A10-1419-32	CHASSIS	J112	E31-0541-15	LEAD WIRE WITH CONNECTOR	
2	A20-2776-02	PANEL	J113	E30-0554-25	LEAD WIRE WITH CONNECTOR	
3	A21-1063-03	DECORATIVE PANEL	J114	E31-0507-15	LEAD WIRE WITH CONNECTOR	
4	A23-1653-02	REAR PANEL	J115	E31-0509-15	LEAD WIRE WITH CONNECTOR	
5	A40-0705-12	BOTTOM PLATE	J116	E31-0509-15	LEAD WIRE WITH CONNECTOR	
6	B07-0704-04	ESCUTCHEON	J117	E31-0509-15	LEAD WIRE WITH CONNECTOR	
7	B07-0707-03	ESCUTCHEON	J118	E31-0509-15	LEAD WIRE WITH CONNECTOR	
8	B20-0901-14	SCALE	J119	E31-0538-05	LEAD WIRE WITH CONNECTOR	
9	B40-2765-04	NAME PLATE (SERIAL NO)	J120	NO USE		
10	B40-2810-03	NAME PLATE	J121	E31-0532-05	LEAD WIRE WITH CONNECTOR	
	B41-0701-14	CAUTION LABEL	42	J124	L01-9116-05	POWER TRANSFORMER
	B50-7549-00	INSTRUCTION MANUAL	R001	RD14BB2E470J	RES. CARBON 47 5% 1/4W	
11	E01-1403-05	CRT SOCKET	R002	RD14BB2E470J	RES. CARBON 47 5% 1/4W	
12	E04-0251-05	BNC RECEPTACLE	43	S101	R03-1021-05	PUSH SWITCH
13	E18-0351-05	INLET 3 P	44	S102	S40-2501-05	
14	E21-0654-04	TERMINAL (CAL)	43	VR101	R03-1021-05	V.R. 1K B
	E23-0018-04	EARTH LUG	45	VR102	R05-8001-05	V.R. 3M B
	E30-1818-05	POWER CORD (JIS)		VR103	NO USE	
	E33-0911-00	WIRE ASSY	46	VR104	R06-1501-05	V.R. 2K B X2
47	F07-0901-04	PROTECTION COVER				
15	F10-1524-04	SHIELD PLATE				
16	F11-0230-13	SHIELD CASE				
17	F11-0902-13	SHIELD CASE				
	F15-0138-04	BLIND PLATE				
	F15-0186-04	BLIND PLATE				
	F15-0701-04	BLIND PLATE				
18	G13-0090-04	CUSHION				
	H01-5743-04	CARTON BOX				
	H10-2801-03	FOAMED STYRENE PAD				
	H20-1701-24	VINYL COVER				
	H25-0029-04	POLYETHYLENE BAG				
19	J02-0501-05	LEG				
20	J10-0072-02	BEZEL				
	J10-0404-03	BEZEL				
21	J13-0033-15	FUSE HOLDER				
22	J19-0457-14	CRT BAND				
23	J19-0458-14	CRT BAND				
24	J21-2802-04	BLACKET FOR PCB				
25	J21-2817-14	BLACKET FOR SW				
26	J21-2851-03	BLACKET FOR TRANSFORMER				
	J61-0039-05	CRIP FOR LEAD				
	J61-0049-05	WIRE BAND				
27	K01-0518-05	HANDLE				
28	K21-0819-03	KNOB				
29	K21-0820-04	KNOB				
30	K21-0822-14	KNOB				
31	K21-0825-04	KNOB				
32	K27-0507-04	KNOB				
33	K27-0525-04	KNOB				
34	K27-0526-04	KNOB FOR LEVER				
	N08-0606-05	DRESSED SCREW				
	N09-0078-05	SCREW				
	N10-2030-46	NUT, HEX				
	N10-2040-46	NUT				
	N10-2060-46	NUT				
	N15-1030-41	WASHER, FLAT FOR M3				
	N15-1040-46	WASHER				
	N16-0060-46	SPRING WASHER				
	N17-1030-46	TOOTHED LOCK WASHER FOR M3				
	N19-0702-04	WASHER				
	N19-0704-04	WASHER				
	N30-3006-41	SCREW, PAN HD M 3X6				
	N30-3008-41	SCREW, PAN HD M 3X8				
	N30-3010-41	SCREW, PAN HD M 3X10				
	N30-3014-46	SCREW, PAN HD M 3X14				
	N30-4006-41	SCREW, PAN HD M 4X6				
	N30-4040-46	SCREW, PAN HD M 4X40				
	N32-3006-46	SCREW, FLAT HD M 3X6				
	N88-3008-41	SCREW, FLAT HD TAP TITE				
	N89-3006-41	SCREW, BINDING TAP TITE				
	N89-3006-46	SCREW, BINDING TAP TITE				
	N89-3010-46	SCREW, BINDING TAP TITE				
35	W01-0058-04	CORD WRAP				
36	X65-1220-02	VERT/POWER SUPPLY UNIT				
37	X74-1110-02	SWEEP UNIT				
38	X77-1020-00	VOLTAGE SECTOR UNIT				
	Y87-1450-00	ACCESSORY CORD CA-41				
39	130BEB31	CRT				
	212-1018-05	TUBE (PLASTIC)				
40	D101	B30-0904-15	LAMP			
41	F101	F05-3011-05	FUSE 0.3A			
41	F101	F05-7011-05	FUSE 0.7A			
	J101	E31-2515-05	LEAD WIRE WITH CONNECTOR			
	J102	E31-2516-05	LEAD WIRE WITH CONNECTOR			
	J103	NO USE				
	J104	E31-0543-05	LEAD WIRE WITH CONNECTOR			
	J105	E31-0539-15	LEAD WIRE WITH CONNECTOR			
	J106	B30-0904-15	LAMP			

# PARTS LIST

## X65-1220-02

REF.NO	PARTS NO	NAME & DESCRIPTION	REF.NO	PARTS NO	NAME & DESCRIPTION
	E33-4068-00	WIRE ASSY	D045	1S1555	DIODE
	F01-0231-14	HEAT SINK	D046	1S1555	DIODE
	F01-0813-05	HEAT SINK	D047	MTZ5.1JB	DIODE, ZENER 5V
	F10-1526-04	SHIELD PLATE	D048	1S1555	DIODE
	F11-0147-24	SHIELD CASE	D049	W06C	DIODE
	F20-0622-05	INSULATOR	D050	1SS83	DIODE
	J25-2827-32	PCB (UNMOUNTED)	D051	W06C	DIODE
	N10-2030-46	NUT, HEX	D052	W06C	DIODE
	N17-1030-41	LOCK WASHER	D053	1S1555	DIODE
	N19-0191-05	WASHER NONMETAL	D054	1S1555	DIODE
	N30-3004-46	SCREW, PAN HD M 3X4	IC001	UPC4558C	IC
	N30-3008-46	SCREW, PAN HD M 3X8	IC002	UPC4558C	IC
	R92-0150-05	JUMPING RES. ZERO OHM	L001	L40-4711-03	FERRI INDUCTOR 470UH
	001-1001-05	COATING WIRE	L002	L40-4791-02	FERRI INDUCTOR 4.7UH
C001	C91-0501-05	CAP. METAL FILM 0.047 10% 630V	N001	NE-2	NEON GLOW LAMP
C002	CM93BD2A470J	CAP. MICA 47P 5% 100V	N002	NE-2	NEON GLOW LAMP
C003	CM93BD2A471J	CAP. MICA 470P 5% 100V	N003	NE-2	NEON GLOW LAMP
C004	C91-0502-05	CAP. METAL FILM 0.01 20% 630V	P001	E23-0047-04	TERMINAL
C005	CC45CH1H680J	CAP. CERAMIC 68P 5% 50V	P002	E23-0047-04	TERMINAL
C006	CC45CH1H680J	CAP. CERAMIC 68P 5% 50V	P003	E40-0503-05	PIN CONNECTOR 5 P
C007	NO USE		P004	E40-0303-05	PIN CONNECTOR 3 P
C008	CC45CH1H181J	CAP. CERAMIC 180P 5% 50V	P011	E40-0703-05	PIN CONNECTOR 7 P
C009	CC45CH1H470J	CAP. CERAMIC 47P 5% 50V	P012	E40-0303-05	PIN CONNECTOR 3 P
C010	CC45CH1H680J	CAP. CERAMIC 68P 5% 50V	P013	E40-0936-05	PIN CONNECTOR 9 P
C011	C91-0501-05	CAP. METAL FILM 0.047 10% 630V	P014	E40-0303-05	PIN CONNECTOR 3 P
C012	CM93BD2A470J	CAP. MICA 47P 5% 100V	P015	E40-0532-05	PIN CONNECTOR 5 P
C013	CM93BD2A471J	CAP. MICA 470P 5% 100V	P016	E40-0201-05	PIN CONNECTOR 2 P
C014	C91-0502-05	CAP. METAL FILM 0.01 20% 630V	Q001	2SK30A(D)	FET, N-CHANNEL
C015	CC45CH1H470J	CAP. CERAMIC 47P 5% 50V	Q002	UPA71A(K,L)	FET, DUAL-CHANNEL
C016	CC45CH1H330J	CAP. CERAMIC 33P 5% 50V	Q003	2SC945(P)	TR. SI, NPN
C017	NO USE		Q004	2SC945(P)	TR. SI, NPN
C018	CC45CH1H470J	CAP. CERAMIC 47P 5% 50V	Q005	2SA733(Q)	TR. SI, PNP
C019	CE04W1A101	CAP. ELECTRO 100 10V	Q006	2SA733(Q)	TR. SI, PNP
C020	C90-0298-05	CAP. CERAMIC 0.1 20% 12V	Q007	2SC945(Q)	TR. SI, NPN
C021	CE04W2F330	CAP. ELECTRO 33 310V	Q008	2SC945(Q)	TR. SI, NPN
C022	CE04W1E102	CAP. ELECTRO 1000 25V	Q009	2SC945(P)	TR. SI, NPN
C023	CE04W1E222	CAP. ELECTRO 2200 25V	Q010	2SC945(P)	TR. SI, NPN
C024	CE04W2E100	CAP. ELECTRO 10 250V	Q011	2SK30A(D)	FET, N-CHANNEL
C025	CE04W1E101	CAP. ELECTRO 100 25V	Q012	UPA71A(K,L)	FET, DUAL-CHANNEL
C026	CE04W1E101	CAP. ELECTRO 100 25V	Q013	2SC945(P)	TR. SI, NPN
C027	CE04W1A101	CAP. ELECTRO 100 10V	Q014	2SC945(P)	TR. SI, NPN
C028	CE04W1C101	CAP. ELECTRO 100 16V	Q015	2SA733(Q)	TR. SI, PNP
C029	CE04W1C101	CAP. ELECTRO 100 16V	Q016	2SA733(Q)	TR. SI, PNP
C030	CK45B2H103K	CAP. CERAMIC 0.01 10% 500V	Q017	2SC945(Q)	TR. SI, NPN
C031	CK45B2H103K	CAP. CERAMIC 0.01 10% 500V	Q018	2SC945(Q)	TR. SI, NPN
C032	CK45E3D103P	CAP. CERAMIC 0.01 2K	Q019	2SC945(P)	TR. SI, NPN
C033	CK45E3D103P	CAP. CERAMIC 0.01 2K	Q020	2SC945(P)	TR. SI, NPN
C034	CK45E3D103P	CAP. CERAMIC 0.01 2K	Q021	2SC945(P)	TR. SI, NPN
C035	CK45E3D103P	CAP. CERAMIC 0.01 2K	Q022	2SC945(P)	TR. SI, NPN
C036	CK45B2H103K	CAP. CERAMIC 0.01 10% 500V	Q023	2SC945(P)	TR. SI, NPN
C037	CE04W2E3R3	CAP. ELECTRO 3.3 250V	Q024	2SC945(P)	TR. SI, NPN
C038	CK45F1H103Z	CAP. CERAMIC 0.01 50V	Q025	2SC945(P)	TR. SI, NPN
C039	C093M1H682K	CAP. MYLAR 6800P 10% 50V	Q026	2SC945(P)	TR. SI, NPN
C040	CE04W1H471	CAP. ELECTRO 470 50V	Q027	2SC2068	TR. SI, NPN
C041	CE04BW1HR47M	CAP. ELECTRO 0.47 20% 50V	Q028	2SC2068	TR. SI, NPN
C042	CK45E3D102P	CAP. CERAMIC 1000P 2K	Q029	2SC945(P)	TR. SI, NPN
C043	CE04W1A101	CAP. ELECTRO 100 10V	Q030	2SC945(P)	TR. SI, NPN
C044	CC45CH2H020C	CAP. CERAMIC 2P 0.25P 500V	Q031	2SC945(P)	TR. SI, NPN
C045	C90-0298-05	CAP. CERAMIC 0.1 20% 12V	Q032	2SC945(P)	TR. SI, NPN
C046	CE04W2E3R3	CAP. ELECTRO 3.3 250V	Q041	2SB546A	TR. SI, PNP
C049	CE04W1E100	CAP. ELECTRO 10 25V	Q042	2SD1135(C)	TR. SI, NPN
C054	CC45CH1H101J	CAP. CERAMIC 100P 5% 50V	Q043	2SB633(E)	TR. SI, PNP
C055	NO USE		Q044	2SD1135(C)	TR. SI, NPN
C056	CC45CH1H101J	CAP. CERAMIC 100P 5% 50V	Q045	2SC535(B)	TR. SI, NPN
C060	CE04W1E100	CAP. ELECTRO 10 25V	Q046	2SC2271(E)	TR. SI, NPN
C061	NO USE		Q047	2SC2068	TR. SI, NPN
C062	CC45CH1H100D	CAP. CERAMIC 10P 0.5P 50V	Q048	2SC2271(E)	TR. SI, NPN
C063	CC45CH1H100D	CAP. CERAMIC 10P 0.5P 50V	Q049	2SC945(P)	TR. SI, NPN
C064	CC45CH1H330J	CAP. CERAMIC 33P 5% 50V	Q050	2SA733(Q)	TR. SI, PNP
C069	CC45CH2H100D	CAP. CERAMIC 10P 0.5P 500V	Q051	2SD401A(K)	TR. SI, NPN
C070	CC45CH2H100D	CAP. CERAMIC 10P 0.5P 500V	Q052	2SC2271(E)	TR. SI, NPN
C071	CC45CH2H100D	CAP. CERAMIC 10P 0.5P 500V	R001	RN14BK2H9003F	RES. METAL FILM 900K 1% 1/2W
C072	CC45CH2H100D	CAP. CERAMIC 10P 0.5P 500V	R002	RN14BK2E1113F	RES. METAL FILM 111K 1% 1/4W
D001	1S1555	DIODE	R003	RN14BK2H9903F	RES. METAL FILM 990K 1% 1/2W
D002	1S1555	DIODE	R004	RN14BK2E1012F	RES. METAL FILM 10.1K 1% 1/4W
D003	1S1555	DIODE	R005	RN14BK2H1004F	RES. METAL FILM 1M 1% 1/2W
D004	1S1555	DIODE	R006	RD14BY2H104J	RES. CARBON 100K 5% 1/2W
D005	1S1555	DIODE	R007	RD14CB2E101J	RES. CARBON 100 5% 1/4W
D006	1S1555	DIODE	R008	RD14BB2E223J	RES. CARBON 22K 5% 1/4W
D007	1S1555	DIODE	R009	RD14BB2E223J	RES. CARBON 22K 5% 1/4W
D008	1S1555	DIODE	R010	RD14CB2E561J	RES. CARBON 560 5% 1/4W
D009	1S1555	DIODE	R011	RD14BB2E332J	RES. CARBON 3.3K 5% 1/4W
D010	1S1555	DIODE	R012	RD14CB2E392J	RES. CARBON 3.9K 5% 1/4W
D011	MTZ3.0JB	DIODE, ZENER 3.0V	R013	RD14CB2E470J	RES. CARBON 47 5% 1/4W
D041	Y16JA	DIODE	R014	RD14CB2E470J	RES. CARBON 47 5% 1/4W
D042	S1VB60	DIODE	R015	RD14BB2E392J	RES. CARBON 3.9K 5% 1/4W
D043	S1VB60	DIODE	R016	RN14BK2E3601G	RES. METAL FILM 3.6K 2% 1/4W
D044	MTZ10JC	DIODE, ZENER 10V	R017	RD14BB2E181J	RES. CARBON 180 5% 1/4W
			R018	RN14BK2E8200F	RES. METAL FILM 820 1% 1/4W

# PARTS LIST

REF. NO	PARTS NO	NAME & DESCRIPTION	REF. NO	PARTS NO	NAME & DESCRIPTION
R019	RD14BB2E120J	RES. CARBON 12 5% 1/4W	R118	RD14BB2E102J	RES. CARBON 1K 5% 1/4W
R020	RN14BK2E1600F	RES. METAL FILM 160 1% 1/4W	R119	RN14BK2E1502F	RES. METAL FILM 15K 1% 1/4W
R021	RD14BB2E222J	RES. CARBON 2.2K 5% 1/4W	R120	RN14BK2E1502F	RES. METAL FILM 15K 1% 1/4W
R022	RD14BB2E222J	RES. CARBON 2.2K 5% 1/4W	R121	RD14BB2E103J	RES. CARBON 10K 5% 1/4W
R023	RD14BB2E470J	RES. CARBON 47 5% 1/4W	R122	RD14BB2E152J	RES. CARBON 1.5K 5% 1/4W
R024	RD14BB2E470J	RES. CARBON 47 5% 1/4W	R123	RD14BB2E2R2J	RES. CARBON 2.2 5% 1/4W
R025	RD14BB2E222J	RES. CARBON 2.2K 5% 1/4W	R124	RN14BK2H2703F	RES. METAL FILM 270K 1% 1/2W
R026	RD14BB2E222J	RES. CARBON 2.2K 5% 1/4W	R125	RN14BK2E1502F	RES. METAL FILM 15K 1% 1/4W
R027	RD14BB2E333J	RES. CARBON 33K 5% 1/4W	R126	RN14BK2E7501F	RES. METAL FILM 7.5K 1% 1/4W
R028	RD14BB2E392J	RES. CARBON 3.9K 5% 1/4W	R127	RN14BK2E1502F	RES. METAL FILM 15K 1% 1/4W
R029	RD14BB2E392J	RES. CARBON 3.9K 5% 1/4W	R128		NO USE
R030	RN14BK2E3001F	RES. METAL FILM 3K 1% 1/4W	R129	RD14BB2E472J	RES. CARBON 4.7K 5% 1/4W
R031	RN14BK2E3001F	RES. METAL FILM 3K 1% 1/4W	R130	RD14BB2E103J	RES. CARBON 10K 5% 1/4W
R032	RD14BB2E470J	RES. CARBON 47 5% 1/4W	R131	RD14BB2E100J	RES. CARBON 10 5% 1/4W
R033	RD14BB2E470J	RES. CARBON 47 5% 1/4W	R132	RD14BB2E473J	RES. CARBON 47K 5% 1/4W
R034	RD14BB2E392J	RES. CARBON 3.9K 5% 1/4W	R133	RD14BB2E470J	RES. CARBON 47 5% 1/4W
R035	RD14BB2E392J	RES. CARBON 3.9K 5% 1/4W	R134	RD14BB2E472J	RES. CARBON 4.7K 5% 1/4W
R036	RD14BB2E471J	RES. CARBON 470 5% 1/4W	R135	RD14BB2E393J	RES. CARBON 39K 5% 1/4W
R037	RD14BB2E470J	RES. CARBON 47 5% 1/4W	R136	RD14BB2E102J	RES. CARBON 1K 5% 1/4W
R038	RD14BB2E470J	RES. CARBON 47 5% 1/4W	R137	RD14BB2E471J	RES. CARBON 470 5% 1/4W
R039	RD14BB2E392J	RES. CARBON 3.9K 5% 1/4W	R138	RD14BB2E104J	RES. CARBON 100K 5% 1/4W
R040	RD14BB2E392J	RES. CARBON 3.9K 5% 1/4W	R139	RD14BB2E101J	RES. CARBON 100 5% 1/4W
R041	RD14BB2E102J	RES. CARBON 1K 5% 1/4W	R140	RD14BB2E104J	RES. CARBON 100K 5% 1/4W
R042	RD14BB2E221J	RES. CARBON 220 5% 1/4W	R141	RD14BB2E102J	RES. CARBON 1K 5% 1/4W
R043	RD14BB2E152J	RES. CARBON 1.5K 5% 1/4W	R142	RD14BB2E101J	RES. CARBON 100 5% 1/4W
R044	RD14BB2E101J	RES. CARBON 100 5% 1/4W	R143	RC05GF2H105J	RES. SOLID 1M 5% 1/2W
R045	RD14BB2E152J	RES. CARBON 1.5K 5% 1/4W	R144	RC05GF2H226K	RES. SOLID 22M 10% 1/2W
R046	RD14BB2E152J	RES. CARBON 1.5K 5% 1/4W	R145	RC05GF2H226K	RES. SOLID 22M 10% 1/2W
R047	RD14BB2E470J	RES. CARBON 47 5% 1/4W	R146	RC05GF2H473J	RES. SOLID 47K 5% 1/2W
R048	RD14BB2E470J	RES. CARBON 47 5% 1/4W	R147	RD14BB2E470J	RES. CARBON 47 5% 1/4W
R049	RD14BB2E332J	RES. CARBON 3.3K 5% 1/4W	R148	RD14BB2E682J	RES. CARBON 6.8K 5% 1/4W
R050	RD14BB2E332J	RES. CARBON 3.3K 5% 1/4W	R149	RD14BB2E472J	RES. CARBON 4.7K 5% 1/4W
R051	RD14BB2E220J	RES. CARBON 22 5% 1/4W	R150	RD14BB2E222J	RES. CARBON 2.2K 5% 1/4W
R052	RD14BB2E220J	RES. CARBON 22 5% 1/4W	R151	RD14BB2E473J	RES. CARBON 47K 5% 1/4W
R053	RD14BB2E152J	RES. CARBON 1.5K 5% 1/4W	R152	R92-0707-05	RES. FIXED
R054	RD14BB2E152J	RES. CARBON 1.5K 5% 1/4W	R153	RD14BB2E124J	RES. CARBON 120K 5% 1/4W
R055	RD14BB2E101J	RES. CARBON 100 5% 1/4W	R154	RD14BB2E224J	RES. CARBON 220K 5% 1/4W
R056	RD14BB2E101J	RES. CARBON 100 5% 1/4W	R155	RD14BB2E181J	RES. CARBON 180 5% 1/4W
R057	RS14GB3F123J	RES. METAL FILM 12K 5% 3W	R156		NO USE
R058	RS14GB3F123J	RES. METAL FILM 12K 5% 3W	R157	RD14BB2E622J	RES. CARBON 8.2K 5% 1/4W
R059	RD14BB2E271J	RES. CARBON 270 5% 1/4W	R161	RD14BB2E223J	RES. CARBON 22K 5% 1/4W
R060	RD14CB2E101J	RES. CARBON 100 5% 1/4W	R162	RD14BB2E103J	RES. CARBON 10K 5% 1/4W
R061	RN14BK2H9003F	RES. METAL FILM 900K 1% 1/2W	R163	RD14BB2E333J	RES. CARBON 33K 5% 1/4W
R062	RN14BK2E1113F	RES. METAL FILM 111K 1% 1/4W	R168	RD14BB2E681J	RES. CARBON 680 5% 1/4W
R063	RN14BK2H9903F	RES. METAL FILM 990K 1% 1/2W	S001	S32-4007-05	SLIDE SWITCH
R064	RN14BK2E1012F	RES. METAL FILM 10.1K 1% 1/4W	S002	S03-4501-05	ROTARY SWITCH
R065	RN14BK2H1004F	RES. METAL FILM 1M 1% 1/2W	S003	S32-4007-05	SLIDE SWITCH
R066	RD14BY2H104J	RES. CARBON 100K 5% 1/2W	S004	S03-4501-05	ROTARY SWITCH
R067	RD14CB2E101J	RES. CARBON 100 5% 1/4W	T001	L19-0019-05	CONVERTOR TRANSFORMER
R068	RD14BB2E223J	RES. CARBON 22K 5% 1/4W	TC001	C05-0403-05	CAP. TRIMMER 2P
R069	RD14BB2E223J	RES. CARBON 22K 5% 1/4W	TC002	C05-0403-05	CAP. TRIMMER 2P
R070	RD14CB2E561J	RES. CARBON 560 5% 1/4W	TC005	C05-0405-05	CAP. TRIMMER 20P
R071	RD14BB2E332J	RES. CARBON 3.3K 5% 1/4W	TC006	C05-0403-05	CAP. TRIMMER 2P
R072	RD14CB2E392J	RES. CARBON 3.9K 5% 1/4W	TC007	C05-0403-05	CAP. TRIMMER 2P
R073	RD14CB2E470J	RES. CARBON 47 5% 1/4W	TC010	C05-0405-05	CAP. TRIMMER 20P
R074	RD14CB2E470J	RES. CARBON 47 5% 1/4W	TC011	C05-0405-05	CAP. TRIMMER 20P
R075	RD14BB2E392J	RES. CARBON 3.9K 5% 1/4W	TC012	C05-0405-05	CAP. TRIMMER 20P
R076	RN14BK2E3601G	RES. METAL FILM 3.6K 2% 1/4W	TP001	E23-0508-04	TEST TERMINAL
R077	RD14BB2E331J	RES. CARBON 330 5% 1/4W	TP002	E23-0508-04	TEST TERMINAL
R078	RN14BK2E8200F	RES. METAL FILM 820 1% 1/4W	VR001	R12-0509-05	RES. SEMI FIXED 220 B
R079	RN14BK2E3300F	RES. METAL FILM 330 1% 1/4W	VR002	R01-0503-05	V.R. 500 B
R080	RD14BB2E220J	RES. CARBON 22 5% 1/4W	VR003	R12-0509-05	RES. SEMI FIXED 220 B
R081	RD14BB2E222J	RES. CARBON 2.2K 5% 1/4W	VR004	R12-0509-05	RES. SEMI FIXED 220 B
R082	RD14BB2E222J	RES. CARBON 2.2K 5% 1/4W	VR005	R01-1013-25	V.R. 1K B
R083	RD14BB2E470J	RES. CARBON 47 5% 1/4W	VR006	R12-0510-05	RES. SEMI FIXED 680 B
R084	RD14BB2E470J	RES. CARBON 47 5% 1/4W	VR007	R12-1002-05	RES. SEMI FIXED 1K B
R085	RD14BB2E222J	RES. CARBON 2.2K 5% 1/4W	VR008	R12-1004-05	RES. SEMI FIXED 4.7K B
R086	RD14BB2E222J	RES. CARBON 2.2K 5% 1/4W	VR011	R12-0509-05	RES. SEMI FIXED 220 B
R087	RD14BB2E333J	RES. CARBON 33K 5% 1/4W	VR012	R01-0503-05	V.R. 500 B
R088	RD14BB2E392J	RES. CARBON 3.9K 5% 1/4W	VR013	R12-0509-05	RES. SEMI FIXED 220 B
R089	RD14BB2E392J	RES. CARBON 3.9K 5% 1/4W	VR014	R12-0509-05	RES. SEMI FIXED 220 B
R090	RN14BK2E3001F	RES. METAL FILM 3K 1% 1/4W	VR015	R01-1013-25	V.R. 1K B
R091	RN14BK2E3001F	RES. METAL FILM 3K 1% 1/4W	VR016	R12-1002-05	RES. SEMI FIXED 1K B
R092	RD14BB2E470J	RES. CARBON 47 5% 1/4W	VR017	R12-1002-05	RES. SEMI FIXED 1K B
R093	RD14BB2E470J	RES. CARBON 47 5% 1/4W	VR018	R12-1004-05	RES. SEMI FIXED 4.7K B
R094	RD14BB2E392J	RES. CARBON 3.9K 5% 1/4W	VR021	R12-3004-05	RES. SEMI FIXED 47K B
R095	RD14BB2E392J	RES. CARBON 3.9K 5% 1/4W	VR022	R12-6005-05	RES. SEMI FIXED 330K B
R096	RD14BB2E471J	RES. CARBON 470 5% 1/4W	VR023	R12-3004-05	RES. SEMI FIXED 47K B
R097	RD14BB2E470J	RES. CARBON 47 5% 1/4W	VR024	R12-1003-05	RES. SEMI FIXED 2.2K B
R098	RD14BB2E470J	RES. CARBON 47 5% 1/4W			
R099	RD14BB2E392J	RES. CARBON 3.9K 5% 1/4W			
R100	RD14BB2E332J	RES. CARBON 3.3K 5% 1/4W			
R101	RD14BB2E561J	RES. CARBON 560 5% 1/4W			
R102	RD14BB2E152J	RES. CARBON 1.5K 5% 1/4W			
R103	RD14CB2E101J	RES. CARBON 100 5% 1/4W			
R104	RD14BB2E122J	RES. CARBON 1.2K 5% 1/4W			
R105	RN14BK2E1800F	RES. METAL FILM 180 1% 1/4W			
R106	RD14BB2E392J	RES. CARBON 3.9K 5% 1/4W			
R107	RD14BB2E392J	RES. CARBON 3.9K 5% 1/4W			
R111	RD14BB2E560J	RES. CARBON 56 5% 1/4W			
R112	RD14BB2E560J	RES. CARBON 56 5% 1/4W			
R113	RD14BB2E220J	RES. CARBON 22 5% 1/4W			
R114	RD14BB2E220J	RES. CARBON 22 5% 1/4W			
R115	RD14BB2E2R2J	RES. CARBON 2.2 5% 1/4W			
R116	RD14BB2E2R2J	RES. CARBON 2.2 5% 1/4W			
R117	RD14BB2E104J	RES. CARBON 100K 5% 1/4W			

# PARTS LIST

## X74-1110-02

REF. NO	PARTS NO	NAME & DESCRIPTION	REF. NO	PARTS NO	NAME & DESCRIPTION
	E33-4066-00	WIRE ASSY	P001	E23-0047-04	TERMINAL
	J25-2828-23	PCB (UNMOUNTED)	P002	E23-0047-04	TERMINAL
	R92-0150-05	JUMPING RES. ZERO OHM	P003	E23-0047-04	TERMINAL
C001	C90-0298-05	CAP. CERAMIC 0.1 20% 12V	P004	E40-0903-05	PIN CONNECTOR 9 P
C002	CE04BW1H010M	CAP. ELECTRO 1 20% 50V	P005	E40-0603-05	PIN CONNECTOR 6 P
C003	CE04BW1H4R7M	CAP. ELECTRO 4.7 20% 50V	P006	E40-0403-05	PIN CONNECTOR 4 P
C004	CE04BW1H010M	CAP. ELECTRO 1 20% 50V	P007	E40-0403-05	PIN CONNECTOR 4 P
C005	NO USE				
C006	CE04BW1H010M	CAP. ELECTRO 1 20% 50V	Q001	2SA733(Q)	TR. SI, PNP
C007	NO USE		Q002	2SC945(P)	TR. SI, NPN
C008	CE04W1A101	CAP. ELECTRO 100 10V	Q003	2SC945(P)	TR. SI, NPN
C009	CE04BW1H010M	CAP. ELECTRO 1 20% 50V	Q004	2SC945(P)	TR. SI, NPN
C010	CE04BW1H010M	CAP. ELECTRO 1 20% 50V	Q005	2SC945(P)	TR. SI, NPN
C011	CE04BW1H010M	CAP. ELECTRO 1 20% 50V	Q006	2SC945(P)	TR. SI, NPN
C012	CE04BW1H010M	CAP. ELECTRO 1 20% 50V	Q007	2SC945(P)	TR. SI, NPN
C013	CC45CH1H330J	CAP. CERAMIC 33P 5% 50V	Q008	2SC945(P)	TR. SI, NPN
C014	CC45CH1H330J	CAP. CERAMIC 33P 5% 50V	Q009	2SC945(P)	TR. SI, NPN
C015	CQ93M1H472K	CAP. MYLAR 4700P 10% 50V	Q010	2SK30A(Q)	FET, N-CHANNEL
C016	CQ93M1H472K	CAP. MYLAR 4700P 10% 50V	Q011	2SC945(P)	TR. SI, NPN
C017	CC45SL1H151J	CAP. CERAMIC 150P 5% 50V	Q012	2SC945(P)	TR. SI, NPN
C018	CK45B1H332K	CAP. CERAMIC 3300P 10% 50V	Q013	2SC945(P)	TR. SI, NPN
C019	CC45CH1H680J	CAP. CERAMIC 68P 5% 50V	Q014	2SC945(P)	TR. SI, NPN
C020	CK45B1H391K	CAP. CERAMIC 390P 10% 50V	Q015	2SC945(P)	TR. SI, NPN
C021	CQ93BP2A472F	CAP. MYLAR 4700P 1% 100V	Q016	2SC945(P)	TR. SI, NPN
C022	CM93BD2A330J	CAP. MICA 33P 5% 100V	Q017	2SC945(P)	TR. SI, NPN
C023	CC45SL1H220J	CAP. CERAMIC 22P 5% 50V	Q018	2SC945(P)	TR. SI, NPN
C024	CE04W1E100	CAP. ELECTRO 10 25V	Q019	2SC2068	TR. SI, NPN
C025	CE04W1E100	CAP. ELECTRO 10 25V	Q020	2SC2068	TR. SI, NPN
C026	CE04W1C101	CAP. ELECTRO 100 16V	Q021	2SA733(Q)	TR. SI, PNP
C027	CK45B1H102K	CAP. CERAMIC 1000P 10% 50V	Q022	2SA733(Q)	TR. SI, PNP
C028	CE04W1A101	CAP. ELECTRO 100 10V	R001	RN14BK2E3000F	RES. METAL FILM 300 1% 1/4W
C029	CE04W1A101	CAP. ELECTRO 100 10V	R002	RN14BK2E2201F	RES. METAL FILM 2.2K 1% 1/4W
C030	CC45SL1H100D	CAP. CERAMIC 10P 0.5P 50V	R003	RD14BB2E152J	RES. CARBON 1.5K 5% 1/4W
C031	CC45CH1H050C	CAP. CERAMIC 5P 0.25P 50V	R004	RD14BB2E681J	RES. CARBON 680 5% 1/4W
C032	CE04W2E3R3	CAP. ELECTRO 3.3 250V	R005	RD14BB2E103J	RES. CARBON 10K 5% 1/4W
C033	C90-0298-05	CAP. CERAMIC 0.1 20% 12V	R006	RD14BB2E103J	RES. CARBON 10K 5% 1/4W
C034	CE04W1A101	CAP. ELECTRO 100 10V	R007	RD14BB2E821J	RES. CARBON 820 5% 1/4W
C035	CE04W1C101	CAP. ELECTRO 100 16V	R008	RD14BB2E101J	RES. CARBON 100 5% 1/4W
C036	CE04W1A101	CAP. ELECTRO 100 10V	R009	RD14BB2E122J	RES. CARBON 1.2K 5% 1/4W
C037	CE04W1C330	CAP. ELECTRO 33 16V	R010	RD14BB2E103J	RES. CARBON 10K 5% 1/4W
C038	NO USE				
C039	CE04W1A101	CAP. ELECTRO 100 10V	R014	RD14BB2E821J	RES. CARBON 820 5% 1/4W
C045	CQ93M1H104K	CAP. MYLAR 0.1 10% 50V	R015	RD14BB2E101J	RES. CARBON 100 5% 1/4W
C048	CC45SL1H151J	CAP. CERAMIC 150P 5% 50V	R016	RD14BB2E122J	RES. CARBON 1.2K 5% 1/4W
C049	CE04BW1H010M	CAP. ELECTRO 1 20% 50V	R017	RD14BB2E103J	RES. CARBON 10K 5% 1/4W
C050	C90-0298-05	CAP. CERAMIC 0.1 20% 12V	R018	RD14CB2E684J	RES. CARBON 680K 5% 1/4W
D001	1S1555	DIODE	R019	RD14CB2E105J	RES. CARBON 1M 5% 1/4W
D002	1S1555	DIODE	R020	RD14CB2E222J	RES. CARBON 2.2K 5% 1/4W
D003	1S1555	DIODE	R021	RD14BB2E222J	RES. CARBON 2.2K 5% 1/4W
D004	1S1555	DIODE	R022	RD14BB2E102J	RES. CARBON 1K 5% 1/4W
D005	1S1555	DIODE	R023	RD14BB2E202J	RES. CARBON 2K 5% 1/4W
D006	1S1555	DIODE	R024	RD14BB2E104J	RES. CARBON 100K 5% 1/4W
D007	1S1555	DIODE	R025	RD14BB2E104J	RES. CARBON 100K 5% 1/4W
D008	1S1555	DIODE	R026	RD14BB2E561J	RES. CARBON 560 5% 1/4W
D009	1S1555	DIODE	R027	RD14BB2E222J	RES. CARBON 2.2K 5% 1/4W
D010	1S1555	DIODE	R028	RD14BB2E102J	RES. CARBON 1K 5% 1/4W
D011	1S1555	DIODE	R029	RD14BB2E202J	RES. CARBON 2K 5% 1/4W
D012	1S1555	DIODE	R030	RD14BB2E104J	RES. CARBON 100K 5% 1/4W
D013	1S1555	DIODE	R031	RD14BB2E104J	RES. CARBON 100K 5% 1/4W
D014	1S1555	DIODE	R032	RD14BB2E561J	RES. CARBON 560 5% 1/4W
D015	1S1555	DIODE	R033	RD14BB2E222J	RES. CARBON 2.2K 5% 1/4W
D016	1S1555	DIODE	R034	RD14BB2E102J	RES. CARBON 1K 5% 1/4W
D017	1S1555	DIODE	R035	RD14BB2E122J	RES. CARBON 1.2K 5% 1/4W
D018	1S1555	DIODE	R036	RD14BB2E102J	RES. CARBON 1K 5% 1/4W
D019	1S1555	DIODE	R037	RD14BB2E122J	RES. CARBON 1.2K 5% 1/4W
D020	1S1555	DIODE	R038	RD14CB2E102J	RES. CARBON 1K 5% 1/4W
D021	1N60	DIODE	R039	RD14CB2E102J	RES. CARBON 1K 5% 1/4W
D022	1S1555	DIODE	R040	RD14BB2E222J	RES. CARBON 2.2K 5% 1/4W
D023	1S1555	DIODE	R041	RD14BB2E102J	RES. CARBON 1K 5% 1/4W
D024	1S1555	DIODE	R042	RD14BB2E105J	RES. CARBON 1M 5% 1/4W
D029	1N60	DIODE	R043	RD14BB2E472J	RES. CARBON 4.7K 5% 1/4W
D030	1S1555	DIODE	R044	RN14BK2H7503F	RES. METAL FILM 750K 1% 1/2W
D031	1S1555	DIODE	R045	RN14BK2E1503F	RES. METAL FILM 150K 1% 1/4W
D032	1S1555	DIODE	R046	RN14BK2E4992F	RES. METAL FILM 49.9K 1% 1/4W
IC001	SN7400N	IC	R047	RN14BK2E9100F	RES. METAL FILM 910 1% 1/4W
IC002	SN7400N	IC	R048	NO USE	
IC003	SN7400N	IC	R049	RD14BB2E153J	RES. CARBON 15K 5% 1/4W
IC004	SN7400N	IC	R050	RS14GB3D393J	RES. METAL FILM 39K 5% 2W
IC005	SN7400N	IC	R051	RN14BK2E1801F	RES. METAL FILM 1.8K 1% 1/4W
IC006	SN7472N	IC	R052	RN14BK2E3001F	RES. METAL FILM 3K 1% 1/4W
IC007	SN7472N	IC	R053	RD14BB2E183J	RES. CARBON 18K 5% 1/4W
J001	E40-0906-05	PIN CONNECTOR 9 P	R054	RD14BB2E122J	RES. CARBON 1.2K 5% 1/4W
L005	L40-1511-03	FERRI INDUCTOR 150UH	R055	RD14BB2E104J	RES. CARBON 100K 5% 1/4W
L006	L40-2711-03	FERRI INDUCTOR 270UH	R056	RD14BB2E472J	RES. CARBON 4.7K 5% 1/4W
L006	L40-4711-03	FERRI INDUCTOR 470UH	R057	RD14BB2E332J	RES. CARBON 3.3K 5% 1/4W
			R058	RD14BB2E272J	RES. CARBON 2.7K 5% 1/4W
			R059	RD14BB2E222J	RES. CARBON 2.2K 5% 1/4W
			R060	RD14BB2E332J	RES. CARBON 3.3K 5% 1/4W
			R061	RD14BB2E222J	RES. CARBON 2.2K 5% 1/4W
			R062	RD14BB2E561J	RES. CARBON 560 5% 1/4W
			R063	RD14BB2E222J	RES. CARBON 2.2K 5% 1/4W
			R064	RD14BB2E220J	RES. CARBON 22 5% 1/4W
			R065	RD14BB2E220J	RES. CARBON 22 5% 1/4W
			R066	RN14BK2E3001F	RES. METAL FILM 3K 1% 1/4W
			R067	RN14BK2E3001F	RES. METAL FILM 3K 1% 1/4W
			R068	RN14BK2E3000F	RES. METAL FILM 300 1% 1/4W

# PARTS LIST

REF.NO	PARTS NO	NAME & DESCRIPTION			
R069	RD14BB2E391J	RES. CARBON	390	5%	1/4W
R070	RS14GB3F183J	RES. METAL FILM	18K	5%	3W
R071	RS14GB3F183J	RES. METAL FILM	18K	5%	3W
R072	RD14CB2E101J	RES. CARBON	100	5%	1/4W
R073	RN14BK2E4992F	RES. METAL FILM	49.9K	1%	1/4W
R074	RD14BB2E103J	RES. CARBON	10K	5%	1/4W
R075	NO USE				
R076	RD14BB2E332J	RES. CARBON	3.3K	5%	1/4W
R077	RD14BB2E102J	RES. CARBON	1K	5%	1/4W
R080	RD14BB2E102J	RES. CARBON	1K	5%	1/4W
R081	RD14BB2E103J	RES. CARBON	10K	5%	1/4W
R082	RD14BB2E103J	RES. CARBON	10K	5%	1/4W
R083	RD14CB2E332J	RES. CARBON	3.3K	5%	1/4W
R084	RD14BB2E103J	RES. CARBON	10K	5%	1/4W
R085	RD14BB2E682J	RES. CARBON	6.8K	5%	1/4W
R086	RD14CB2E101J	RES. CARBON	100	5%	1/4W
R087	RD14CB2E102J	RES. CARBON	1K	5%	1/4W
R088	RD14CB2E682J	RES. CARBON	6.8K	5%	1/4W
R089	RD14BB2E562J	RES. CARBON	5.6K	5%	1/4W
R090	RD14BB2E682J	RES. CARBON	6.8K	5%	1/4W
R091	RD14BB2E562J	RES. CARBON	5.6K	5%	1/4W
R092	RD14CB2E241J	RES. CARBON	240	5%	1/4W
S001	S33-2501-05	LEVER SWITCH			
S002	S33-2501-05	LEVER SWITCH			
S003	S03-2501-15	ROTARY SWITCH			
TC001	C05-0405-05	CAP. TRIMMER	20P		
VR001	R01-2503-05	V.R.	10K B		
VR002	R01-2501-05	V.R.	5K B		
VR003	NO USE				
VR004	R12-3002-05	RES. SEMI FIXED	10K B		
VR005	R12-1003-05	RES. SEMI FIXED	2.2K B		

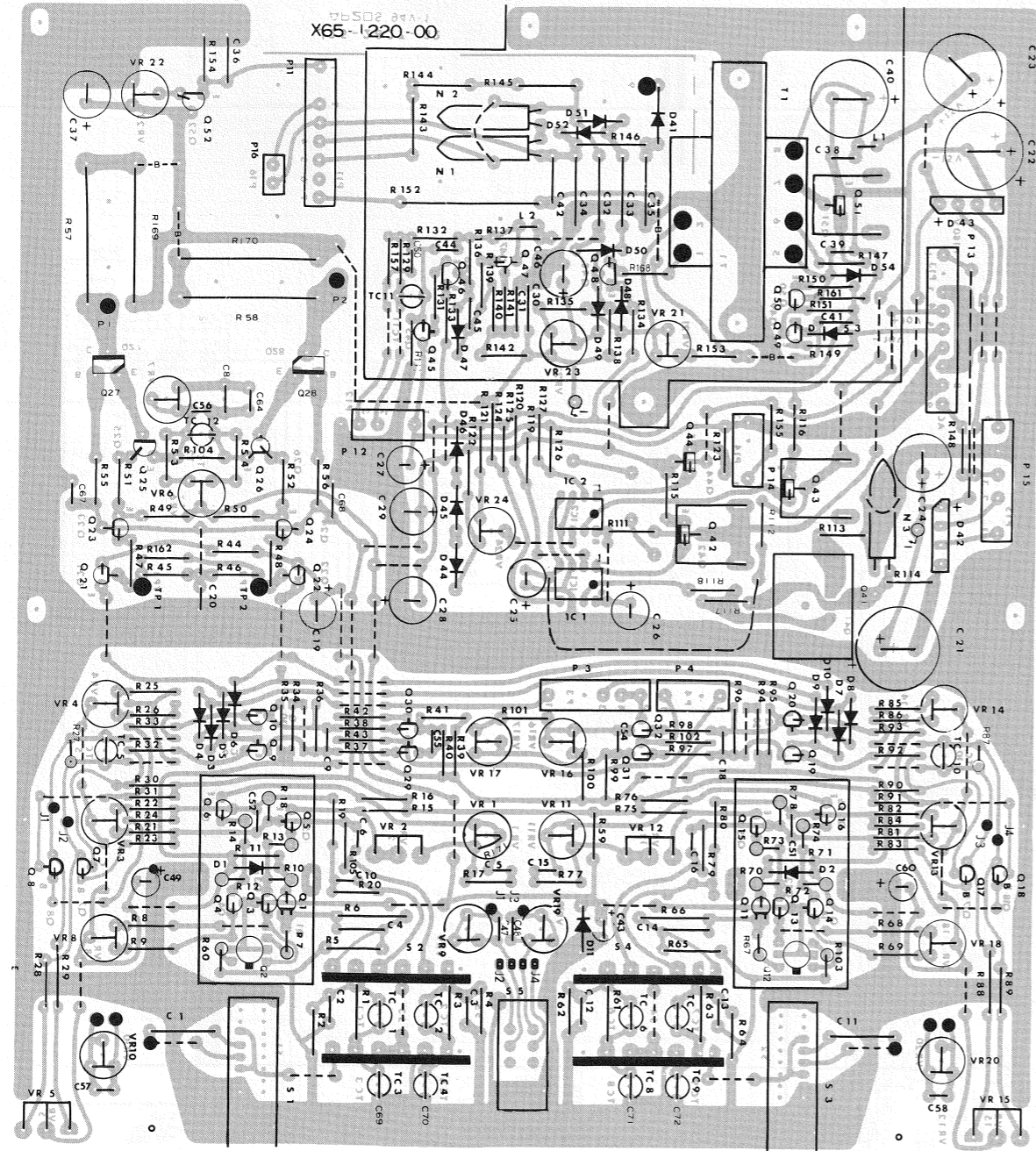
## X77-1020-00

REF.NO	PARTS NO	NAME & DESCRIPTION
	E08-1081-05	VOLTAGE SELECTOR RECEPTACLE
	E09-0681-05	VOLTAGE SELECTOR PLUG
	E23-0047-04	TERMINAL
	E40-0233-05	PIN CONNECTOR 2P
	E40-0533-05	PIN CONNECTOR
	E40-0635-05	PIN CONNECTOR
	F19-0703-04	VOLTAGE SELECTOR PLATE
	J12-0501-14	MOLDED PIN
	J25-2805-14	PCB (UNMOUNTED)

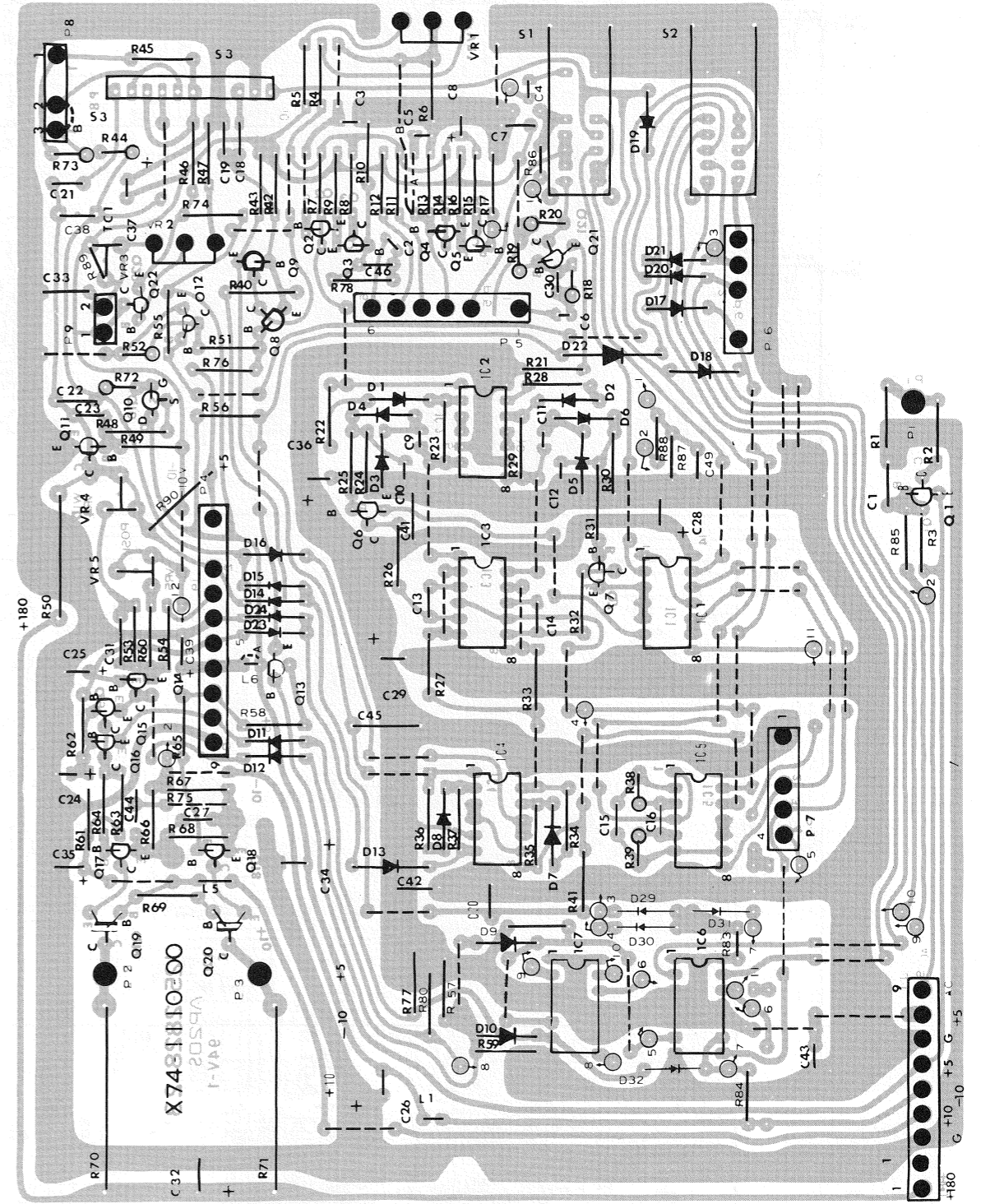


# P.C. BOARD

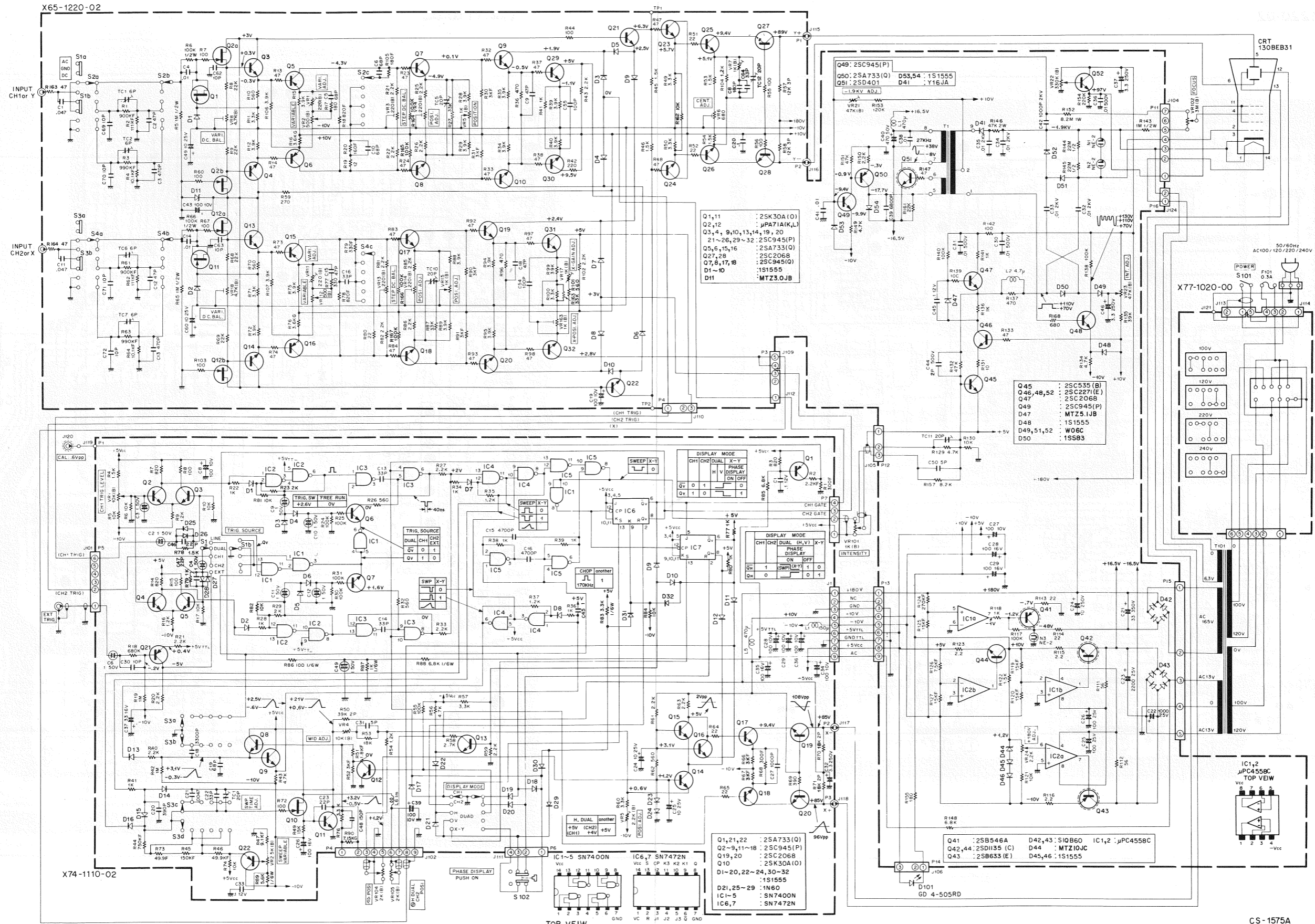
X65-1220-02



X74-1110-02



# SCHEMATIC DIAGRAM



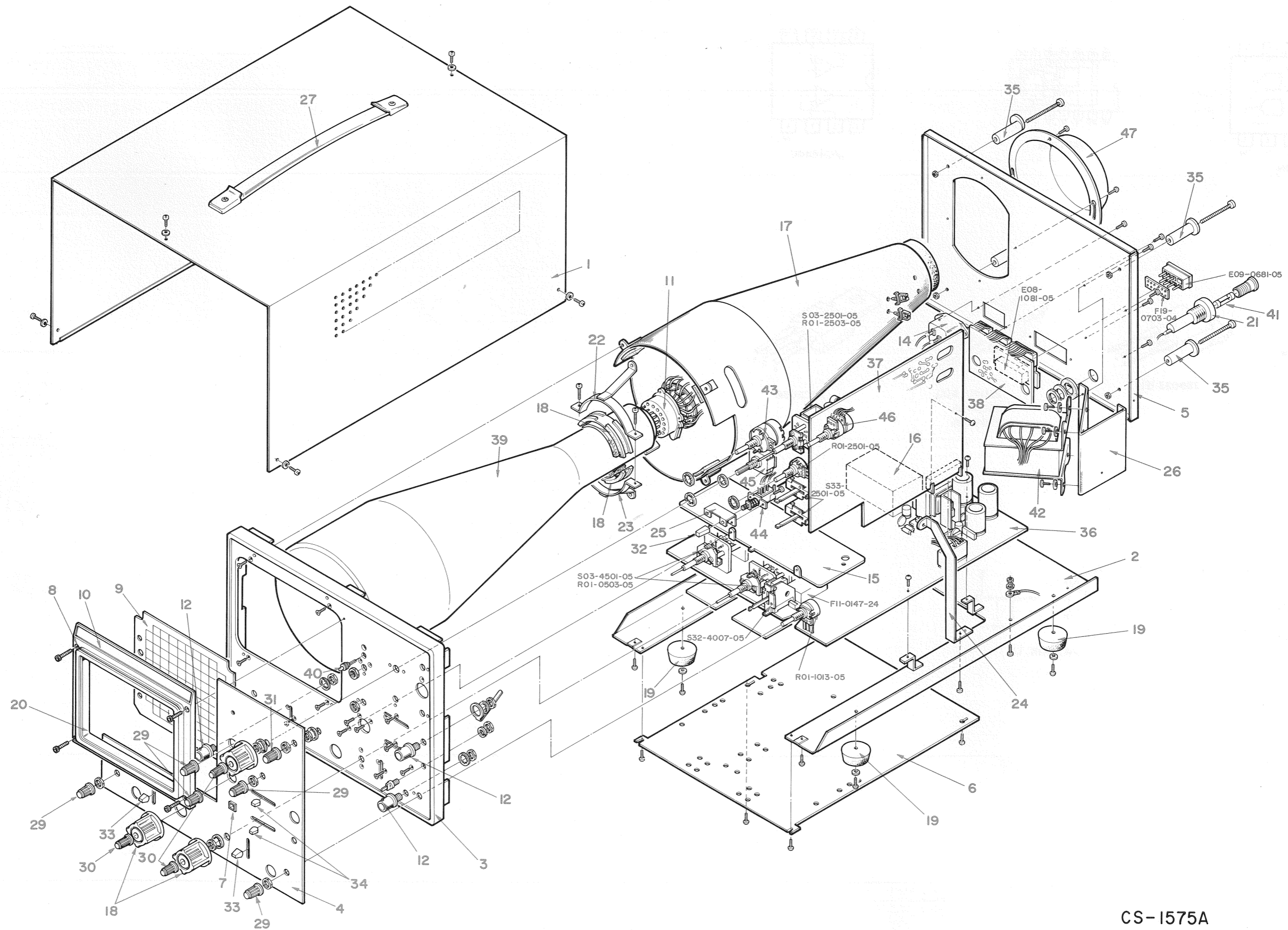
Q1,11 : 2SK30A(O)  
 Q2,12 : JPA71A(K,L)  
 Q3,4,9,10,13,14,19,20  
 21~26,29~32: 2SC945(P)  
 Q5,6,15,16 : 2SA733(O)  
 Q27,28 : 2SC2068  
 Q7,8,17,18 : 2SC945(O)  
 D1~10 : 1S1555  
 D11 : MTZ3.0JB

Q45 : 2SC555(B)  
 Q46,48,52 : 2SC945(P)  
 Q47 : 2SC2068  
 Q49 : 2SC945(P)  
 D47 : MTZ5.1JB  
 D48 : 1S1555  
 D49,51,52 : W06C  
 D50 : 1S583

Q1,21,22 : 2SA733(O)  
 Q2~9,11~18 : 2SC945(P)  
 Q19,20 : 2SC2068  
 Q10 : 2SK30A(O)  
 D1~20,22~24,30~32  
 : 1S1555  
 D21,25~29 : 1N60  
 IC1~5 : SN7400N  
 IC6,7 : SN7472N

Q41 : 2SB546A  
 Q42,44 : 2SD135(C)  
 Q43 : 2SB633(E)  
 D42,43 : 5Q1860  
 D44 : MTZ10JC  
 D45,46 : 1S1555  
 IC1,2 : JPC4558C  
 IC1~5 : SN7400N  
 IC6,7 : SN7472N

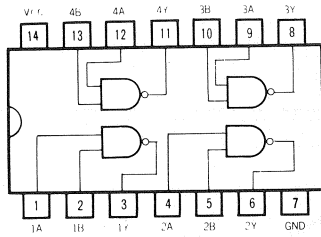
# DISASSEMBLY



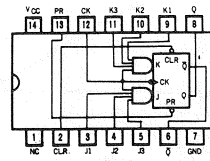
CS-1575A

# SEMICONDUCTORS

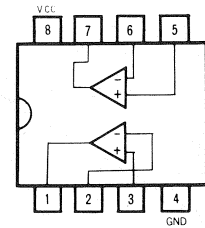
## TTL IC



SN7400N

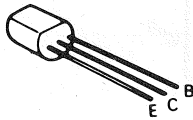


SN7472N

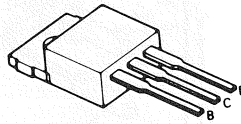


μPC4558C

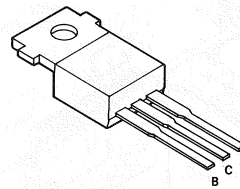
## TRANSISTOR



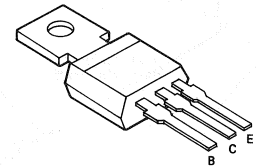
- 2SC535(B)
- 2SC945(P)
- 2SC2271
- 2SA733



2SB633 (E)

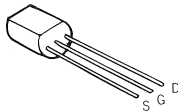


- 2SD401A(K)
- 2SD1135
- 2SB546A

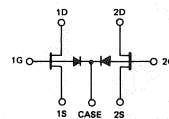
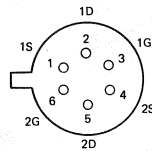


2SC2068

## FET



2SK30A(O)



μPA71A(K, L)