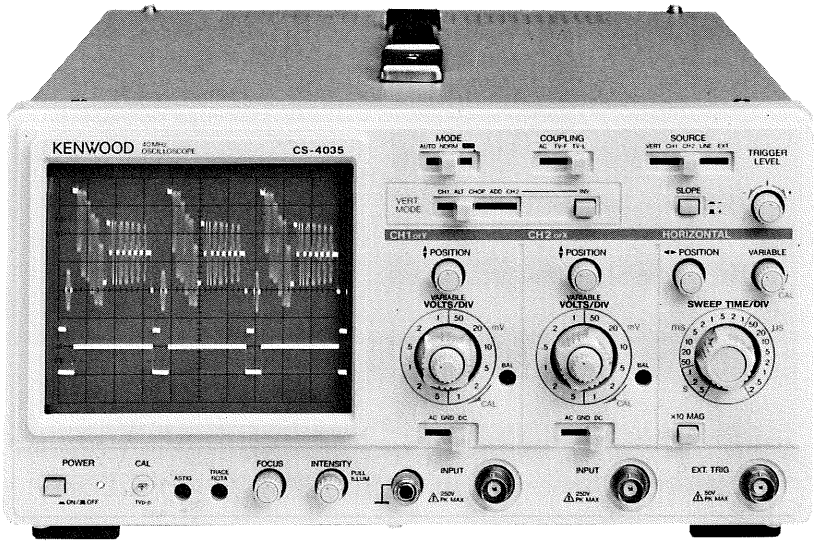
KENWOOD

40MHz OSCILLOSCOPE

CS-4035

SERVICE MANUAL

KENWOOD CORPORATION



WARNING

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

CONTENTS

SPECIFICATIONS

	CS-4035
CRT:	
Type:	Rectangular with internal graticule
Acceleration Voltage:	Approx. 2 kV
Display Area:	8 × 10 div (1 div = 10 mm)
VERTICAL AXIS (CH1 and CH2):	
Sensitivity:	1 mV · 2 mV/div ± 5%; 5 mV to 5 V ± 3%
Attenuator:	1-2-5 step, 12 range with fine adjustment
Input Impedance:	1 MΩ ± 2%, Approx. 28 pF
Frequency Response	
5 mV/div to 5 V/div:	DC: DC to 40 MHz within −3 dB
	AC: 10 Hz to 40 MHz within −3 dB
1 mV/div, 2 mV/div:	DC: DC to 5 MHz within −3 dB
	AC: 10 Hz to 5 MHz within −3 dB
Rise Time:	8.75 ns maximum
	70 ns maximum (5 MHz)
Crosstalk:	−40 dB maximum
Operating Modes:	CH1: CH1 single trace
	CH2: CH2 single trace
	ALT: Alternating display of two signals
	CHOP: Chopped display of two signals
	ADD: Display of combined CH1 + CH2 waveforms
CHOP Frequency:	Approx. 250 kHz
Channel Polarity:	Normal or inverted, channel 2 only inverted
Non-distorted Maximum Amplitude:	More than 8 div (DC to 40 MHz)
⚠ Maximum Input Voltage:	500 $V_{P\text{-}P}$ or 250 V (DC + AC $_{peak}$)
HORIZONTAL AXIS:	
Sensitivity:	Same as vertical axis (CH2)
Input Impedance:	Same as vertical axis (CH2)
Frequency Response:	DC: DC to 500 kHz within −3 dB
	AC: 10 Hz to 500 kHz within −3 dB
X-Y Phase Difference:	3° or less at 50 kHz
Operating Modes:	X-Y operation is selectable with MODE switch CH1: Y-axis CH2: X-axis
⚠ Maximum Input Voltage:	Same as vertical axis (CH2)
SWEEP SYSTEM:	
Sweep Modes:	NORM: Triggered sweep
	AUTO: Auto free run with no signal input
Sweep Time:	0.2 μs/div to 0.5 s/div, ±3%
	1-2-5 step, 19 range with fine adjustment
Sweep Expansion:	10× magnification, ±5%
Linearity:	±3% (±5% at ×10 MAG)

SPECIFICATIONS

	CS-4035
TRIGGERING:	
Trigger Signal Sources:	VERT: Input signal selection with VERT MODE control
	CH1: CH1 input signal
	CH2: CH2 input signal
	LINE: Commercial-use power source
	EXT: Signal input through EXT.TRIG terminal
External trigger:	
Input impedance:	1 MΩ ; Approx 35 pF
⚠ Maximum Input Voltage:	100 V_{P-P} or 50 V (DC + AC $_{peak}$)
Trigger Coupling Modes:	AC: Trigger is capacitively coupled; dc component is blocked.
	TV-F: Vertical sync pulses of a composite video signal are selected for triggering.
	TV-L: Horizontal sync pulses of a composite video signal are selected for triggering.

Trigger Sensitivity:

MODE	COUPLING	SIGNAL FREQ	SOURCE	
			VERT CH1, CH2	EXT
NORM	AC	10 Hz to 20 MHz	1.5 div	0.25 V_{P-P}
		20 MHz to 40 MHz	2.0 div	0.3 V_{P-P}
	TV-F, TV-L	Composite Video Signal	1.0 div	0.2 V_{P-P}
AUTO	Same as above specs at 50 Hz or above			

CALIBRATED SIGNALS:	
Waveform:	Positive square wave
Voltage:	1 V_{P-P}, ±3%
Frequency:	Approx. 1 kHz
INTENSITY MODULATION:	
Sensitivity:	TTL level, positive voltage decreases brightness
Input Impedance:	Approx. 5 kΩ
Usable Frequency Range:	DC ~ 3.5 MHz
⚠ Maximum Input Voltage:	100 V_{P-P} or 50 V (DC + AC $_{peak}$)
CH1 SIGNAL OUTPUT:	
Output Voltage:	Approx. 50 mV/div (50 Ω termination)
Output Impedance:	Approx. 50 Ω
Frequency Response:	10 Hz to 20 MHz within ±3 dB (50 Ω termination)
TRACE ROTATION:	
Adjustment:	Adjustable from front panel
POWER SOURCE:	
Line Voltage:	AC 100 V/120 V/220 V/240 V, ±10%
Line Frequency:	50/60 Hz
Power Consumption:	Approx. 29 W
DIMENSIONS/WEIGHT (figures in parenthesis include attachments):	
Width:	290 mm (290 mm)
Height:	150 mm (170 mm)
Depth:	380 mm (440 mm)
Weight:	Approx. 7 kg

SPECIFICATIONS

	CS-4035
ENVIRONMENTAL:	
Within specifications:	Temp: 10 to 35°C; Humidity: 85% max
Full operation:	Temp: 0 to 40°C; Humidity: 85% max
ACCESSORIES:	
Probes (PC-35)	2 Attenuation: 1/10 Input impedance: 10 MΩ (±2%); 19.5 pF (±10%)
Instruction manual:	1
Power card set:	1
Replacement fuse:	2

Note:
The above specifications are subject to change without notice.

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. If the power cord is not applied for specified voltage, there is always a certain amount of danger from electric shock.

Line voltage

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

Power cord

The ground wire of the 3-wire ac power plug places the chassis and housing of the oscilloscope at earth ground. Do not attempt to defeat the ground wire connection or float the oscilloscope; to do so may pose a great safety hazard.
The appropriate power cord is supplied by an option that is specified when the instrument is ordered.
The optional power cords are shown as follows in Fig. 1.

Line fuse

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

Voltage conversion

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

1. Remove the fuse.
2. Replace fuse F 1 with a fuse of appropriate value, 0.8 amp for 100 VAC to 120 VAC operation, 0.5 amp for 220 VAC to 240 VAC operation.
3. Reinsert it for appropriate voltage range.
4. When performing the reinsertion of fuse holder for the voltage conversion, the appropriate power cord should be used. (See Fig. 1.)

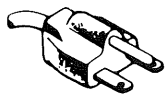
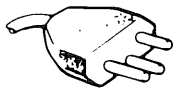
Plug configuration	Power cord and plug type	Factory installed instrument fuse	Line cord plug fuse	Parts No. for power cord or cord set
	North American 120 volt/60 Hz Rated 15 amp (12 amp max; NEC)	0.8 A, 250 V Fast blow 6×30 mm	None	Cord: E30-1854-05 Cord set: E30-1820-05
	Universal Europe 220 volt/50 Hz Rated 16 amp	North Europe 500 mA, 250 V Slow blow 5×20 mm Other Europe 0.5 A, 250 V Fast blow 6×30 mm	None	Cord: E30-1852-05 Cord set: E30-1819-05
	U.K. 240 volt/50 Hz Rated 13 amp	0.5 A, 250 V Fast blow 6×30 mm	0.8 A Type C	—
	Australian 240 volt/50 Hz Rated 10 amp	0.5 A, 250 V Fast blow 6×30 mm	None	Cord: E30-1853-05 Cord set: E30-1821-05
	North American 240 volt/60 Hz Rated 15 amp (12 amp max; NEC)	0.5 A, 250 V Fast blow 6×30 mm	None	—
	Switzerland 240 volt/50 Hz Rated 10 amp	0.5 A, 250 V Fast blow 6×30 mm	None	—

Fig. 1 Power Input Voltage Configuration

CIRCUIT DESCRIPTION

Vertical Attenuator Circuit

The attenuators of channel 1 and 2 basically consist of rotary switches and passive elements (resistors, condensers, and trimmer condensers) on PC boards. The resistors have a precision of 0.5% for minimizing any error between the steps of the attenuators.

Vertical input signals from the BNC input receptacle enter the first-stage attenuator circuit, along the path selected by the AC-GND-DC switch. Then they pass through either attenuator 1/1, 1/10, or 1/100, along the path selected by the vertical rotary switch, and become input into the 1st preamplifier (first-stage buffer amplifier).

The 1st preamplifier consists of U1 and Q1 (CH2: U2 and Q2). The element used for U1 features a wide dynamic range and minimized temperature drifting. U1 functions in the preamplifier as a circuit in which temperature drifting is considered. Input signals, impedance converted in this buffer amplifier, arc sent to the second-stage attenuator where they are passed through either attenuator 1/1, 1/2, 1/4, or 1/10. They are then sent to the vertical amplifier. The second-stage attenuator constitutes a low impedance resistance network with favorable frequency characteristics. The resistors used, as is those of the first-stage attenuator, have a precision of 0.5% for minimizing any error between the steps of the attenuators. The rotary switches in this stage include one which increases the gain of the preamplifier to 5-fold when the sensitivity is 1 mV/div or 2 mV/div.

Q1 (Q2) is provided in the input circuit as a diode equivalent for protecting the elements (U1 and U2) during a great amplitude input.

TC1 (51) and TC3 (53) are input capacitance regulators for attenuator 1/10 and 1/100, respectively; while TC2 (52) and TC4 (54) are 1 kHz square wave characteristic regulators for attenuator 1/10 and 1/100. VR1 (51) and VR2 (52) are step DC balance regulators for attenuators, the former is for user use with adjustment enabled from the front panel.

Vertical Preamplifier Circuit

Signals output from the attenuator circuits are then input into the 2nd preamplifier which consists of a U3 (4) hybrid IC. This IC, with a gain of approximately 12-fold, is an amplifier for suppressing DC level temperature drifting. When the sensitivity is either 1 mV/div or 2 mV/div, the gain is further increased another 5-fold (sum of approximately 60-fold) as a result of the gain resistivity of U3 (4) being switched over by the second attenuator switches S1 d and e. VR3 (53) is the regulator for the DC offset which occurs during this time. Setting the 5-fold gain is done by a resistor with a 1% precision and a non-regulated operation is achieved. VR4 (54) and VR5 (55) are 1 kHz square wave characteristic regulators for the sensitivity of 1 mV/div and 2 mV/div. Signals which become sufficiently amplified in the 2nd preamplifier pass through the variable circuit of the vertical axis sensitivity, constituted by the volume of the attenuator rotary switch, and then become input into the 3rd amplifier. The 3rd amplifier is a U5 (6) hybrid IC. Signals input into this amplifier become as complementary signals 33 and are output to the 4th amplifier as electric current signals. The IC contains the CH1 (CH2) position circuit. CH2 INV circuit, and CH switch circuit. These are controlled by the CH1 (CH2) position volume and CH2 INV switch on the panel unit (X66-1150-00) and the vertical mode switch signals coming from the horizontal side.

VR57 is a sensitivity regulator for CH2 signals while TC6 and TC56 are frequency characteristic regulators for CH1 and CH2, respectively.

CH1 (CH2) trigger signals from the 3rd terminal of U5 (6) become amplified in the feedback amplifier in Q16 (19). These trigger signals are converted into electric current signals in Q17 (20) and sent to the trigger source switch on the horizontal side. CH1 trigger signals become amplified between the collector of Q16 and Q18 and in turn become output as CH1 out signals via the emitter follower of Q23. In contrast, CH2 trigger signals become amplified between the collectors in Q19 to Q21, become X-axis signals by being passed through the emitter follower in Q22, converted into electric current signals in VR151 and R182, and in turn output into the horizontal signal switch circuit on the horizontal side. VR151 is the sensitivity regulator of X signals while VR152 is an X position regulator for regulating the DC level of X signals.

The electric current signals which were switched over in the 3rd amplifier are input into the 4th amplifier consisting of Q4 and Q5. After becoming amplified they are directly input into the output amplifier as voltage signals. The 4th amplifier is a feedback amplifier which features minimized fluctuation in the frequency characteristics even when the 3rd amplifiers of CH1 and CH2 are parallel-connected during ADD. Also, the vertical output amplifier can be driven by low output impedance.

Q3 becomes turned on during ADD. The operating current is passed through R103, R104, and VR101 so that the operating current in the 4th amplifier does not become fluctuated when the operating currents from the 3rd amplifiers of CH1 and CH2 flow into the 4th amplifier. VR101 is the ADD balance regulator.

VR102 is the balance regulator of +Y and -Y on the CRT. Adjustment is made so that the luminescent line comes to the center of the CRT.

Vertical Output Amplifier Circuit

Signals output from the 4th amplifier are amplified about 45-fold in the output amplifier, Q6 through Q15, and drive the Y deflecting plate of the CRT.

This output amplifier is a feedback amplifier. The final stage Q12 and Q14 are driven by complimentary emitter followers Q8 and Q10, Q9 and Q11, respectively. By doing so, the linearity of the first and last transition high frequencies is improved and the input impedance is made higher. Q13 and Q15 work to obtain sufficient gain during constant-current loss in Q12 and Q14, respectively. Negative feedback is sufficiently applied as well. Consequently, this circuit achieves low impedance output of large amplitude signals with good linearity.

VR103 is a sensitivity regulator based on CH1 signals for the entire vertical amplifier. TC101 is a frequency characteristic regulator for the entire vertical amplifier in general and for the output amplifier in particular. VR104 is the operating point voltage regulator for the output amplifier.

CIRCUIT DESCRIPTION

Horizontal System (X65-1380-00)

The horizontal system can be roughly divided into the trigger circuit, sweep circuit, output circuit, and blanking circuit.
The TRIG SOURCE switch on the panel unit drives trigger source switch circuits Q311-Q314, D202-D205, and Q202. Desired trigger signals can be elected. The trigger source switch circuit is connected to an input buffer for trigger signals from each channel coming from the vertical amplifier, line trigger signals from the power source system, and external synchronizing signals generated in Q201.
Selected synchronizing signals are sent to the trigger level setting circuits Q204-Q206 and U202a via the emitter follower in Q201. The trigger level setting circuit constitutes a Schmitt circuit and its threshold level can be adjusted by VOLUME for trigger level setting on the panel unit.
Signals are sent to Q207-Q211 for video-sync separation via C206. Q207, D206 and D207 are polarity switch circuits and Q209 is a sync tip clamper. Q211 is a switch circuit for vertical synchronizing signal separation.
Either ordinary synchronizing signals or video-sync signals become selected at U202c and the sweep gate flip-flop becomes activated.
Gate signals from U204b turn Q221 ON/OFF in both AUTO and NORM modes and control the sweep HIC in U201. The interior of U201 comprises a constant-current charged type ramp wave generating circuit and its time constant becomes determined by an S201 code and C215 or C216. If the S201 code is below 1 ms/div, the time constant adjustment circuit in Q219 becomes activated and VR201 contributes in determining the time constant as well.
If there are no trigger signals during the AUTO mode, the AUTO circuits in Q212-Q214 work and generate sweep gates automatically.
U201 does not generate ramp waves as the sweep gate becomes shut by U205b in the X-Y mode.
Q216-Q218, U205b and U205c determine the upper limit and hold off time of ramp waves.
Ramp waves from U201 become output as sweep signals via Q222. Sweep signals and X-axis signals, the latter from the vertical system, become selected by switching circuit Q223, Q224, Q226, and Q227. They are then applied to output systems after Q301.

Output Circuit

When horizontal signals are input into Q301 and voltage signals, corresponding to the horizontal position, are input into Q306, differential signals become generated by the collectors in Q305 and Q308, Q309 and Q310. Q303-Q311 are feedback amplifiers for constant-current load. They constitute horizontal output amplifiers which feature good linearity and low power consumption. Q315 and Q316 become conductive during X10MAG and increase the horizontal amplifier gain to 10-fold.
Signals from the horizontal output amplifier are sent to the horizontal deflecting plate of the CRT via P7.

Blanking Circuit

Blanking system circuits generate blanking signals for the CRT and signals which switch each channel in the vertical system.
A CHOP transmitter (approx.500 kHz) constitutes U206a and U 206b. Signals from the CHOP transmitter and sweep gate signals become selected at U203b, whereby CHOP signals are selected during a CHOP operation, while sweep gate signals are selected during an ACT operation. The selected signals are divided into 1/2 in U204b, which is T-shaped flip-flop connected, and become channel switching signals.
In contrast, signals from the CHOP transmitter and sweep gate negative-phase signals (U204b Q-signals) are turned into blanking signals in Q230 and U205a. They are then sent to the blanking amplifier in the power supply system.

Low Voltage Circuit

The power supply consists of five regulated circuits and two non-regulated circuits.
U1 constitutes an HIC for controlling 4 circuit lines consisting of those for +/−8 V, +140 V, and +5 V. Each voltage becomes determined based on −8 V.
The +80 V power is generated by Q31 to Q33 using the +12 voltage as the reference.
The +10 V circuits, D6 and C10, are unstable and constitute a power source for the horizontal sweep HIC.
The ±10 V generated with D2, C2 and C3 is a non-regulated power which is supplied to the scale illumination circuit, high-voltage oscillation circuit and trace rotation circuit.

High Voltage Blanking Circuit

Q8 oscillates at approximately 50 kHz applying the reactance of the converter transformer. The oscillation voltage appearing in the high voltage coil are turned into stable.
The oscillation voltage appearing in the high-voltage coil is subjected half-wave rectification then turned into regulated −1500 V by the control circuit formed of Q9 and U2a. (The voltage across the anode and cathode is about 12 kV.)
On the secondary side of the converter transformer, there is the coil for the CRT heater for turning the heater on via R52.
Voltage signals, approximately 300Vp-p, become extracted from the high voltage coil and used as modulated signals for blanking. This is necessary for employing signals from blanking amplifiers Q15, Q6, and Q7 for the cathode potential. The modulated signals drive the DC regeneration circuits, D11-D14, C23 and C24, and provide signals for controlling the brightness of the CRT G1 electrode.
Q10-Q12 are transistors for controlling the focus and they achieve high pressure resistance by being cascade connected.

CAL Circuit (X68-1610-00)

In the oscillation circuit, the multivibrator composed of U31a and U31b of C-MOS IC generates an approximately 1 kHz square wave, U31d and U31c of U31 shape the waveform, and resistances R100, R101 and VR81 split it to adjust and obtain the output voltage of 1 Vp-p.

Trace Rotation Circuit (X68-1610-00)

This circuit consists of a complementary circuit formed with Q13 and Q14, and drives the rotator coil located on the CRT cone by means of the current from their common emitter.

CIRCUIT DESCRIPTION

Scale Illumination Circuit (X68-1610-00)

Q34 and Q35, which are connected in parallel, handles the current flowing through the illumination lamps. They vary the scale illumination VR connected to their common base to control the brightness of the illumination lamps.

OTHER CIRCUIT

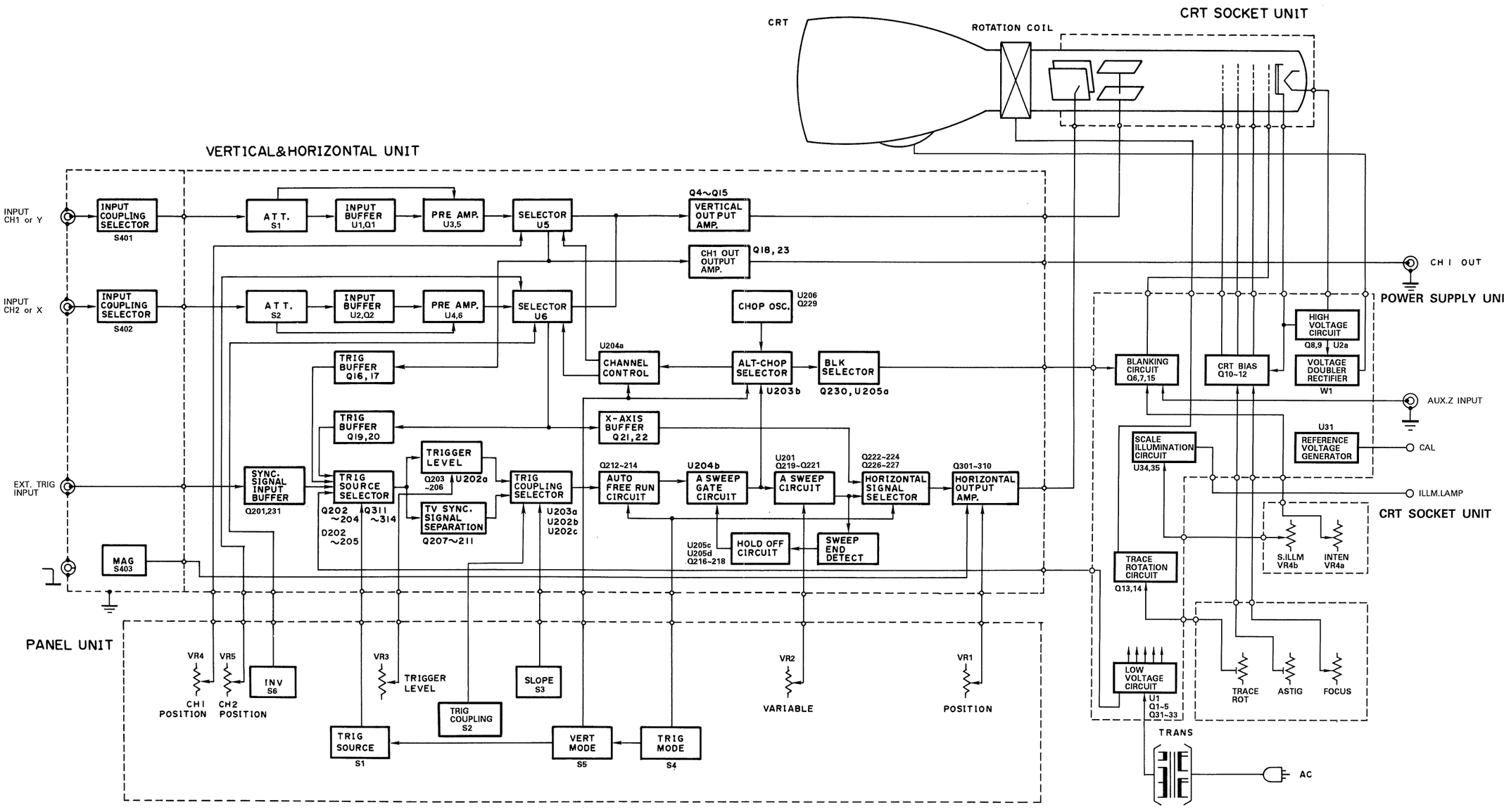
X81-2960-00 B/2 Circuit

VR1 is the semi-fixed VR for the CRT astigmatism adjustment, VR2 is the semi-fixed VR for the bright trace gradient correction, and VR3 is for used in CRT focus adjustment. VR4 is a pull-push type two-series VR which adjusts the brightness in the pushed-in condition and adjusts the scale illumination in the pulled-out condition.

X66-1150-00 Circuit

S1, S2, S4 and S5 are switches which determine the conditions of motion and they control the vertical and horizontal systems. VR4 and VR5 determine the vertical position of each vertical channel, while VR1 determines the horizontal positions. S3 determines the trigger slope and S6 determines the polarity of CH2.

BLOCK DIAGRAM



ADJUSTMENT

To obtain the best performance, periodically calibrate the unit. Sometimes, only one mode need be calibrated, while at other times, all modes should be calibrated. When one mode is calibrated, it must be noted that the other modes may be affected. When calibrating all modes, perform the calibration in the specified sequence.
The following calibration required an accurate measuring instrument and an insulated adjusting flat blade screwdriver. If they are not available, contact your dealer. For optimum adjustment, turn the power on and warm up the scope sufficiently (more than 30 minutes) before starting.
Before calibrating the scope, check the power supply voltage.

TEST EQUIPMENT REQUIRED

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

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

Table 1

PREPARATION FOR ADJUSTMENT

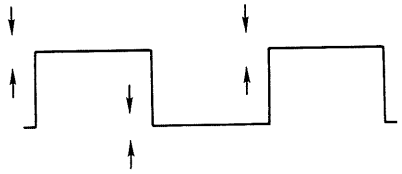
Control Settings

The control settings listed below must be used for each adjustment procedure.
Exceptions to these settings will be noted as they occur. After completing a adjustment, return the controls to the following settings.

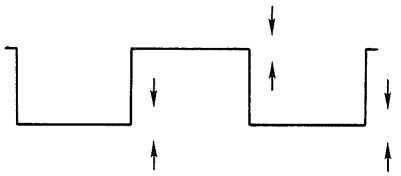
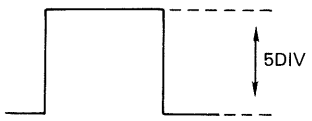
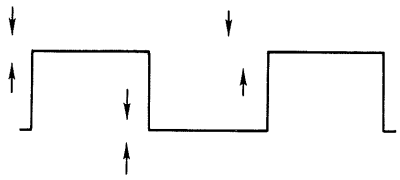
NAME OF KNOBS	POSITION
MODE	AUTO
COUPLING	AC
SOURCE	VERT
VERT MODE	CH1
INV	OFF ▟
SLOPE	▟ +
TRIGGER LEVEL	12 o'clock
CH1/CH2 POSITION	12 o'clock
CH1/CH2 ATT	10 mV/DIV
CH1/CH2 VARIABLE	Fully clockwise
CH1/CH2 AC-GND-DC	DC
SWEEP POSITION	12 o'clock
SWEEP VARIABLE	Fully clockwise
SWEEP ATT	0.1 ms
x10 MAG	OFF ▟

Table 2

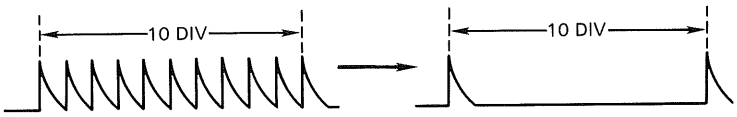
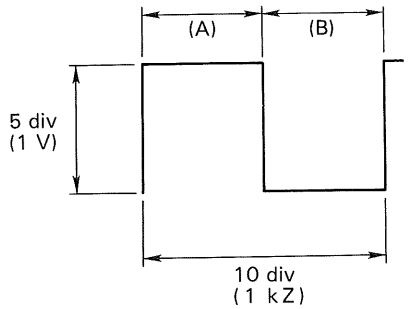
ADJUSTMENT

Item	Adjustment VR (TC)	P.C.B.	Procedure
Supply voltage	VR1	X68-1610	Adjust VR1 to give −8.00 V at pin P1-6 (V.H UNIT).
Intensity	VR2	X68-1610	MODE: X-Y With a spot on the screen, turn the INTENSITY knob to a 9 o'clock position and then adjust VR2 until the spot disappears.
CRT center	VR102	X65-1410	CH1, 2: 50 mV/DIV, GND V-MODE: CH2 Pull and push INV to find a position of CH2 POSITION knob where the luminescent line does not vary. Leaving CH2 POSITION unchanged, adjust to the center of the screen using VR102.
Y operating point	VR104	X65-1410	Position after CRT center adjustment Adjust VR104 to give +37.5 V at pin P6-1.
X operating point	VR301	X65-1410	V-MODE: CH1 H-MODE: X-Y X-POSITION: Center Adjust VR301 to give +68.0 V at pin P7-1.
ASTIG/FOCUS	VR3	X68-1610	H-MODE: X-Y INTENSITY: 12 o'clock FOCUS: 12 o'clock CH1,2: 50 mV/DIV, GND Adjust the spot "." to the best position with the ASTIG knob and VR3. *Best position = smallest spot
CH1 Step ATT Balance	VR2	X65-1410	V-MODE: CH1 CH1: 2 mV/DIV, GND Adjust VR2 so that the luminescent line does not vary when switching between 1 mV/DIV and 2 mV/DIV. Adjust at a voltage of 1 mV with a reference voltage of 2 mV.
CH1 MAG Balance	VR3	X65-1410	Adjust VR3 so that the luminescent line does not vary when switching between 2 mV/DIV and 5 mV/DIV. Adjust at a voltage of 5 mV with a reference voltage of 2 mV.
CH2 Step ATT Balance	VR52	X65-1410	V-MODE: CH2 H-MODE: AUTO CH2: 2 mV/DIV, GND Adjust VR52 so that the luminescent line does not vary when switching between 1 mV/DIV and 2 mV/DIV. Adjust at a voltage of 1 mV with a reference voltage of 2 mV.
CH2 MAG Balance	VR53	X65-1410	Adjust VR53 so that the luminescent line does not vary when switching between 2 mV/DIV and 5 mV/DIV. Adjust at a voltage of 5 mV with a reference voltage of 2 mV.
ADD Position	VR101	X65-1410	V-MODE: ALT H-MODE: AUTO CH1, 2: 10 mV/DIV, GND Bring the luminescent line to the center for both CH1 and CH2. Switch V-MODE to ADD and adjust VR101 so that the luminescent line comes to the center.
CH1 waveform shaping 10 mV 1 mV	VR5 VR4	X65-1410	V-MODE: CH1 H-MODE: AUTO CH1, 2: 10 mV, 1 mV/DIV; DC SWEEP TIME: .5 ms Apply a 1 kHz square wave to CH1 INPUT (with the amplitude extending over 6 div.) Adjust so that CH1 ATT waveform is flat for both 10 mV/DIV and 1 mV/DIV ranges. 10 mV/DIV: VR5 1 mV/DIV: VR4 

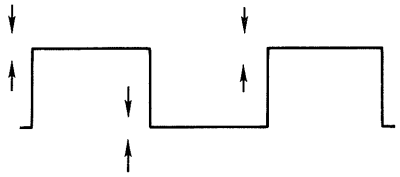
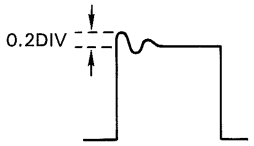
ADJUSTMENT

Item	Adjustment VR (TC)	P.C.B.	Procedure
CH2 waveform shaping 10 mV 1 mV	VR55 VR54	X65-1410	V-MODE: CH2 Apply a 1kHz square wave to CH2 INPUT (with the amplitude extending over 6 div.) Adjust so that CH2 ATT waveform is flat for both 10 mV/DIV and 1 mV/DIV ranges. 10 mV/DIV: VR55 1 mV/DIV: VR54 
CH1 Gain	VR103	X65-1410	V-MODE: CH1 SOURCE: VERT CH1: 10 mV/DIV, DC Apply a 50 mV square wave to CH1 INPUT. Adjust VR103 so that amplitude extends over 5 divisions. 
CH2 Gain	VR57	X65-1410	V-MODE: CH2 CH2: 10 mV/DIV; DC Apply a 50 mV square wave to CH2 INPUT. Adjust VR57 so that amplitude extends over 5 divisions.
CH1 waveform shaping	TC2 TC4	X65-1410	V-MODE: CH1 Apply a 1kHz square wave to CH1 INPUT (with the amplitude extending over 6 div.) Adjust so that CH1 ATT waveform is flat for both 0.1 V/DIV and 1 V/DIV ranges. 0.1 V/DIV: TC2 1 V/DIV: TC4 
CH2 waveform shaping	TC52 TC54	X65-1410	V-MODE: CH2 Apply a 1 kHz square wave to CH2 INPUT (with the amplitude extending over 6 div.) Adjust so that CH2 ATT waveform is flat for both 0.1 V/DIV and 1 V/DIV ranges. 0.1 V/DIV: TC52 1 V/DIV: TC54
CH1 input capacity	TC1 TC3	X65-1410	V-MODE: CH1 Connect a capacity meter to CH1 INPUT. Check that the capacity value for the CH1 10 mV/DIV range is within the standard. (28pF+/−3pF) Adjust so that the same capacity value for 10 mV/DIV is obtained in both 0.1 V/DIV and 1 V/DIV ranges. 0.1 V/DIV: TC1 1 V/DIV: TC3
CH2 input capacity	TC51 TC53	X65-1410	V-MODE: CH2 Connect a capacity meter to CH2 INPUT. Adjust in the same way as for CH1. 0.1 V/DIV: TC51 1 V/DIV: TC53

ADJUSTMENT

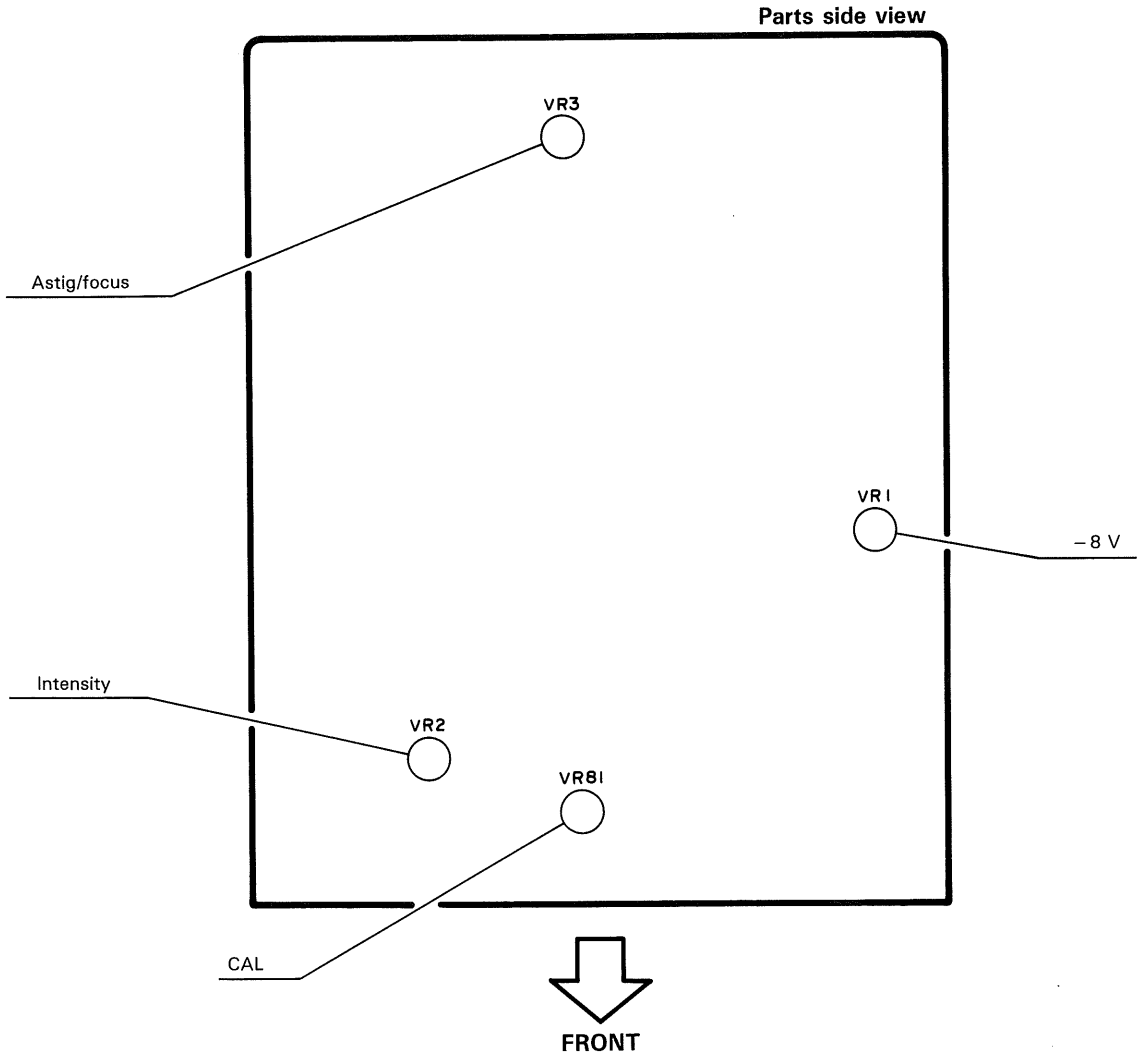
Item	Adjustment VR (TC)	P.C.B.	Procedure
0.1 ms Sweep time	VR202	X65-1410	SWEEP TIME: 0.1 ms/DIV Input a 0.1 ms marker signal to CH1 INPUT. Adjust VR202 so that each marker peak aligns with a division on the scale.
2 ms Sweep time	VR201	X65-1410	SWEEP TIME: 2 ms/DIV Input a 2 ms marker signal to CH1 INPUT. Adjust VR201 so that each marker peak aligns with a division on the scale.
X10 MAG Gain	VR302	X65-1410	SWEEP TIME: 0.1 ms/DIV H.POSITION: Center Input a 0.1 ms marker signal to CH1 INPUT. Turn on X10 MAG and adjust VR302 so that there are 10 divisions on the scale between adjacent marker peaks. 
X10 MAG Center	VR303	X65-1410	SWEEP TIME: 0.1 ms/DIV Input a 0.5 ms marker signal to CH1 INPUT. With X10 MAG on, align the second peak with the center. Adjust VR303 so that the second peak remains aligned with the center when X10 MAG is turned off. Repeat several times to find the center.
X Gain	VR151	X65-1410	MODE: X-Y CH2: 10 mV/DIV; AC Apply a 50 mV square wave to CH2 INPUT. Adjust VR151 so that horizontal amplitude extends over 5 divisions.
X Position Center	VR152	X65-1410	CH1, 2: GND CH1, 2 POSITION: Center H-POSITION: Mechanical center MODE: X-Y Adjust VR152 so that the spot comes to the center
CAL voltage	VR81	X68-1610	Adjust the voltage with a calibrated oscilloscope and frequency counter connected to CAL terminals. Duty ratio (A) : (B) = 47.5 : 52.5  * With the above figure, the oscilloscope range is set to as follows. VOLTS: 0.2 V SWEEP TIME: 0.1 ms

ADJUSTMENT

Item	Adjustment VR (TC)	P.C.B.	Procedure
CH1, 2 1MHz square wave	TC101	X65-1410	Apply a 1 MHz square wave to CH1 (with the amplitude extending over 6 div.) Adjust with TC101 so that the waveform is flat. 
CH1 1 MHz overshoot	TC6 (TC901)	X65-1410	Apply a 1 MHz square wave to CH1 (with the amplitude extending over 6 div.) Adjust the overshoot with TC6.  • If the overshoot at TC6 cannot be adjusted, adjust at TC 901 installed in solder side.
CH2 1 MHz overshoot	TC56	X65-1410	Apply a 1 MHz square wave to CH2 (with the amplitude extending over 6 div.) Adjust the overshoot with TC56.

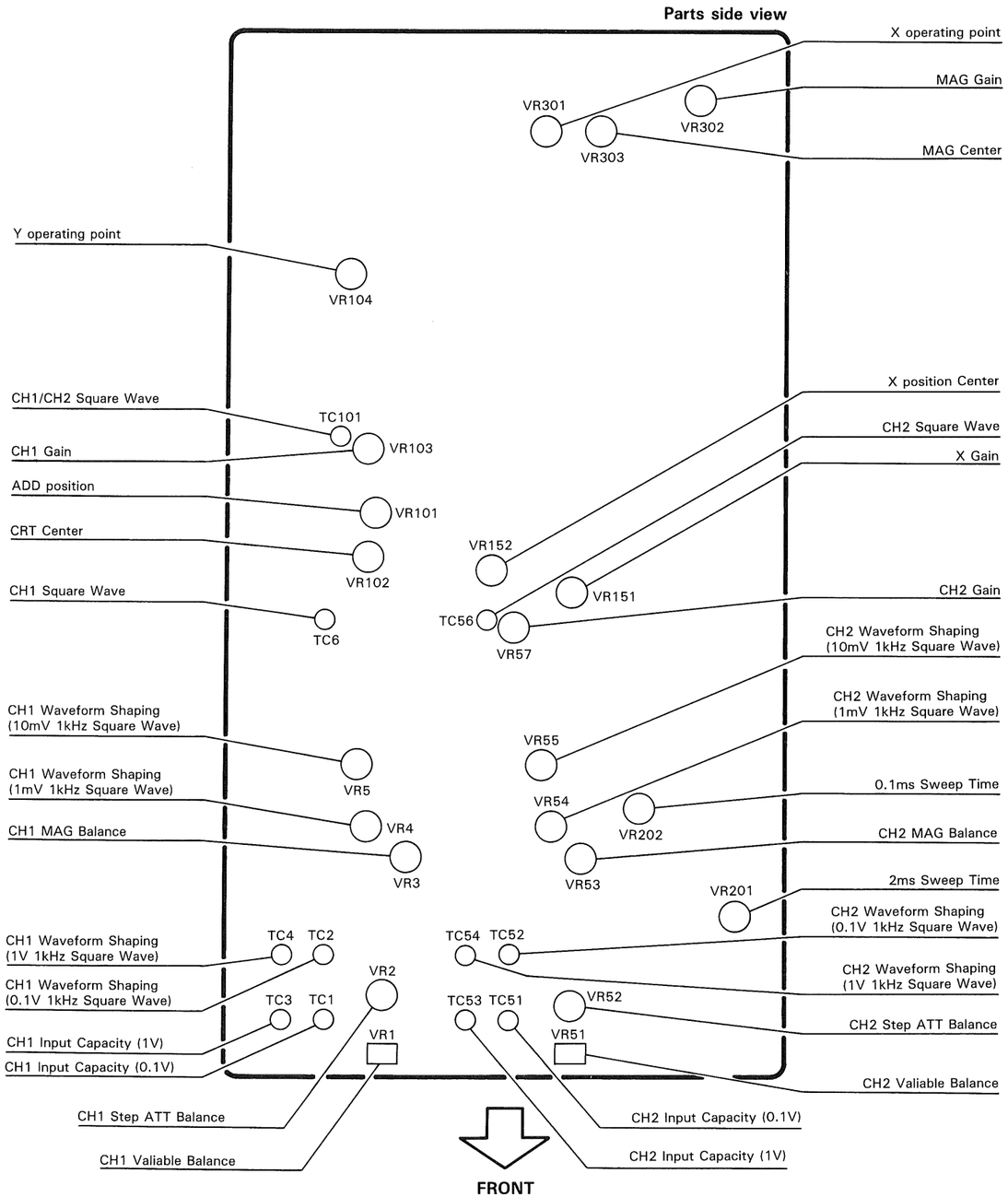
ADJUSTMENT

POWER SUPPLY UNIT (X68-1610-00)



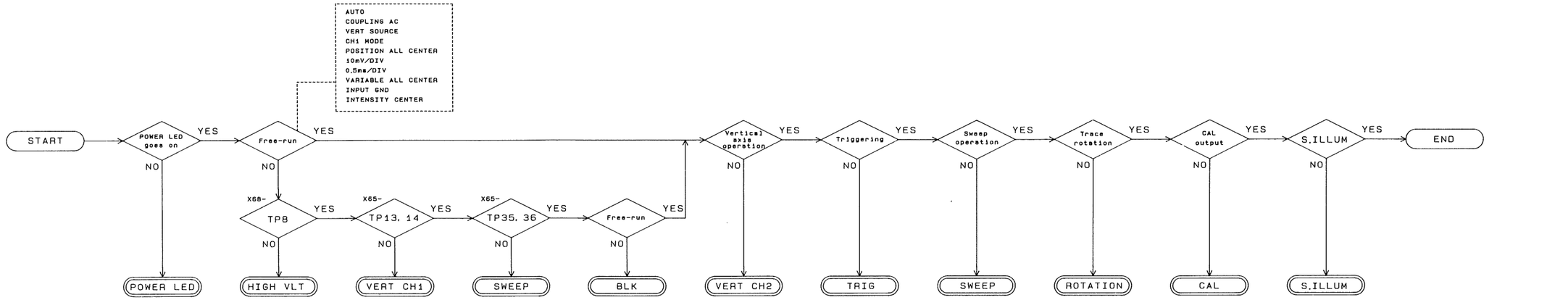
ADJUSTMENT

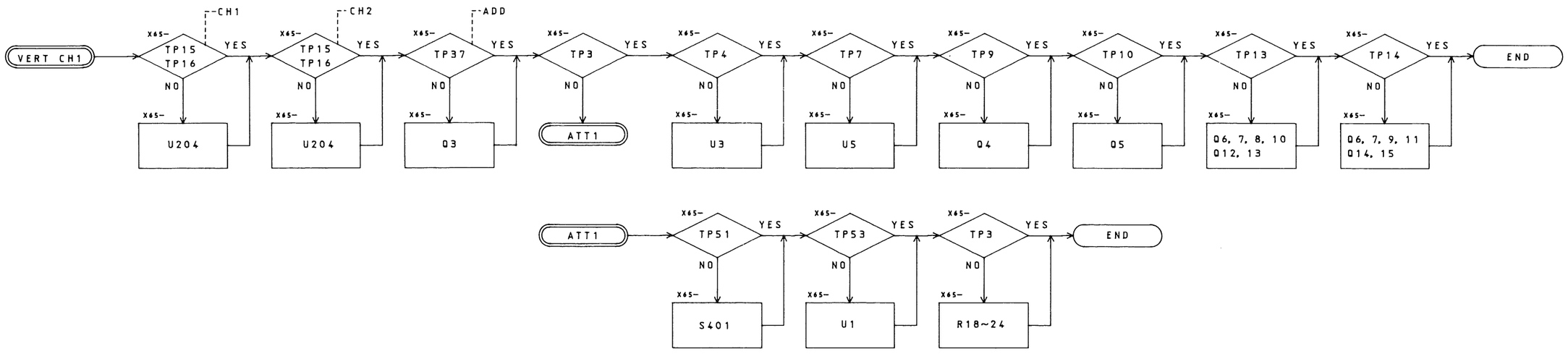
VERTICAL&HORIZONTAL UNIT (X65-1410-00)



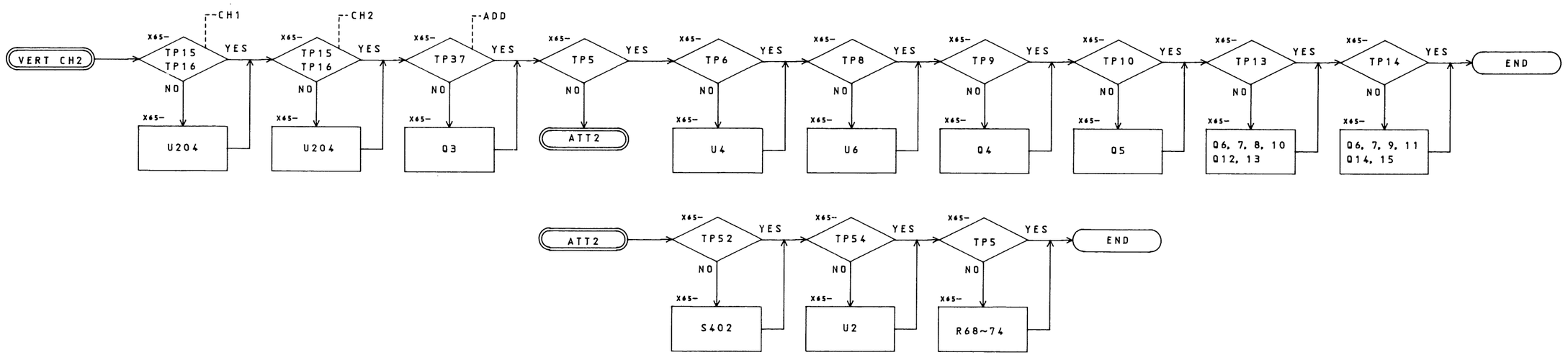
TROUBLESHOOTING

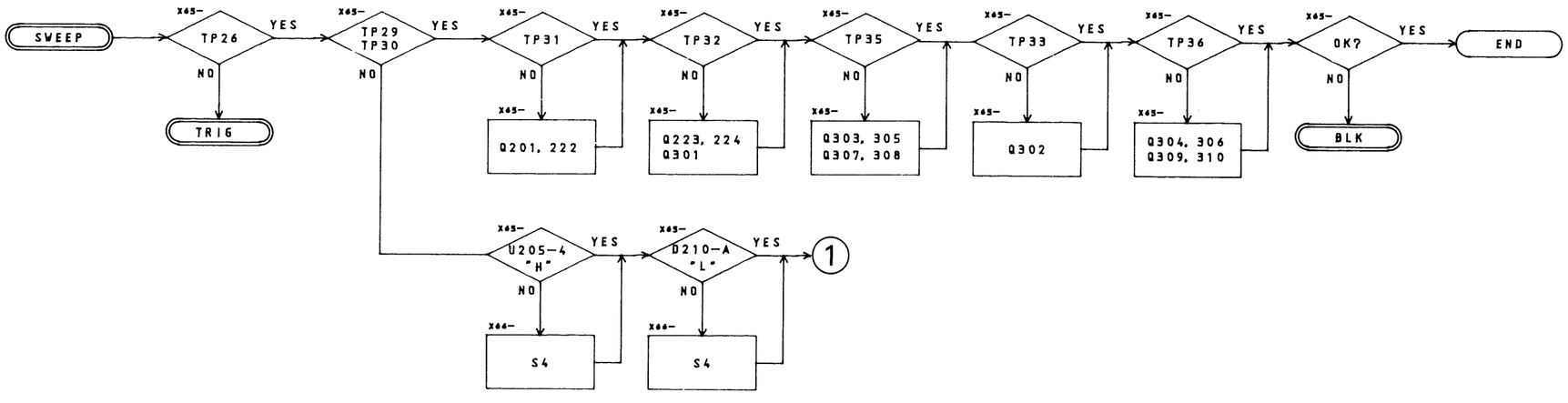
Note: When an index number in the form of ''TP (number)'' is found, refer to the corresponding location (e.g. figure of waveform, etc.) on the circuit diagram.

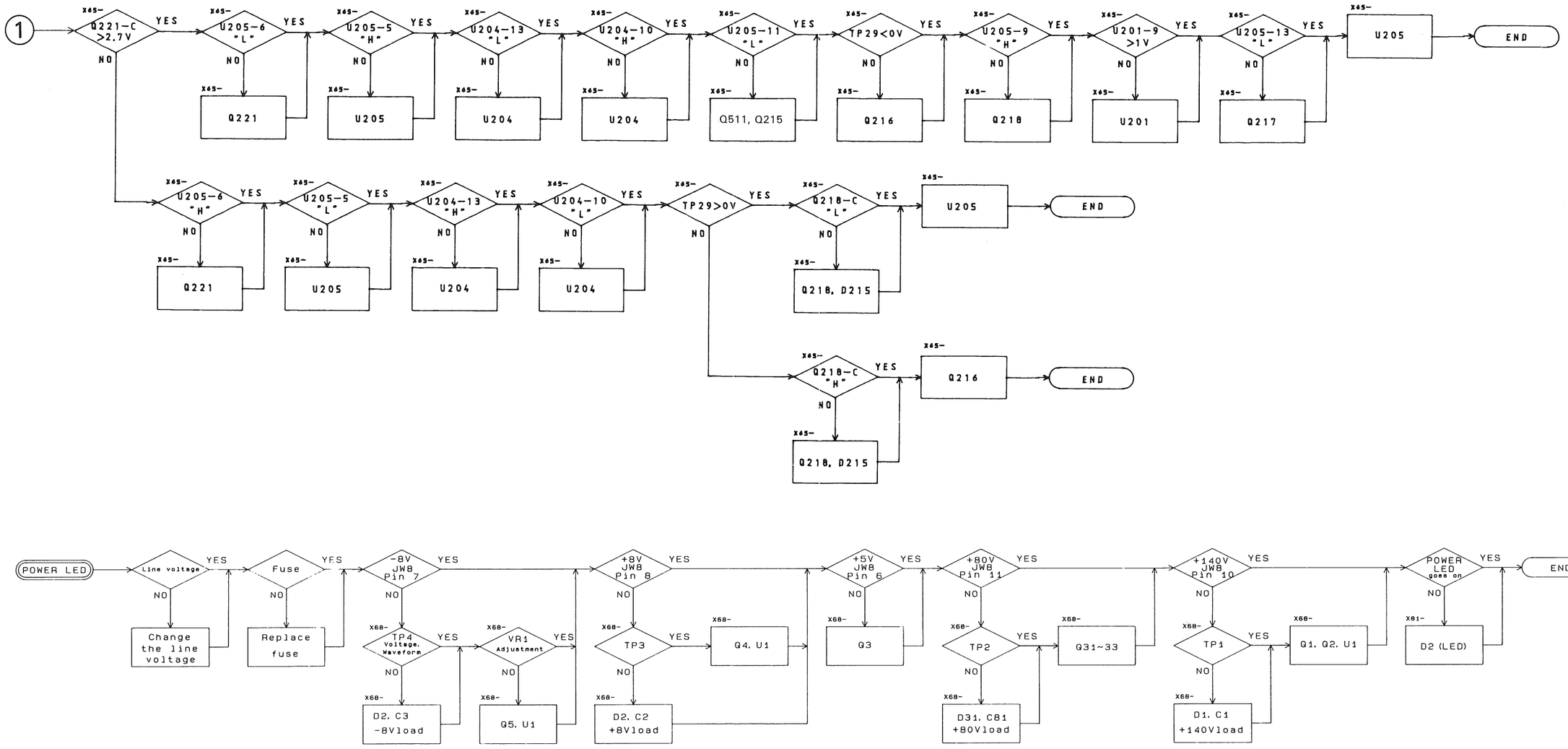




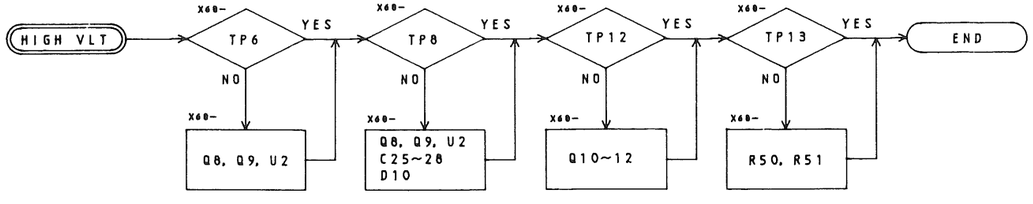
TROUBLESHOOTING



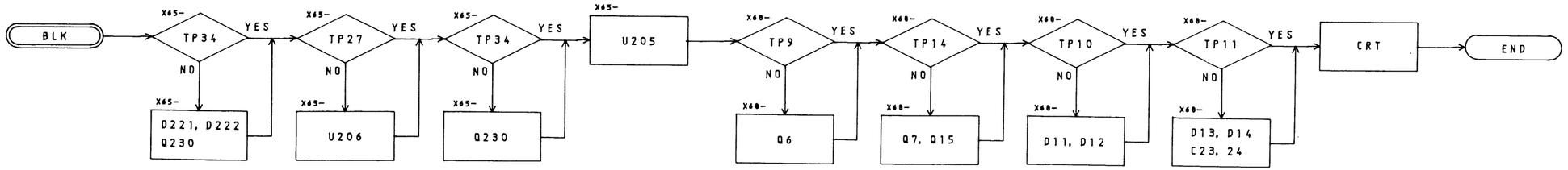


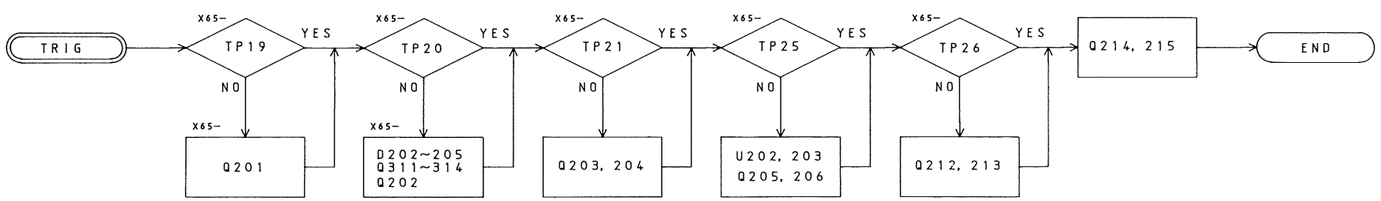

1
X65-
Q221-C >2.7V
YES
NO
Q221
U205-6 "L"
U205
U205-5 "H"
U204
U204-13 "L"
U204
U204-10 "H"
Q511, Q215
U205-11 "L"
Q216
TP29<0V
Q218
U205-9 "H"
U201
U201-9 >1V
Q217
U205-13 "L"
U205
END
U205-6 "H"
U205-5 "L"
U204-13 "H"
U204-10 "L"
TP29>0V
Q218-C "L"
Q218, D215
Q218-C "H"
Q216

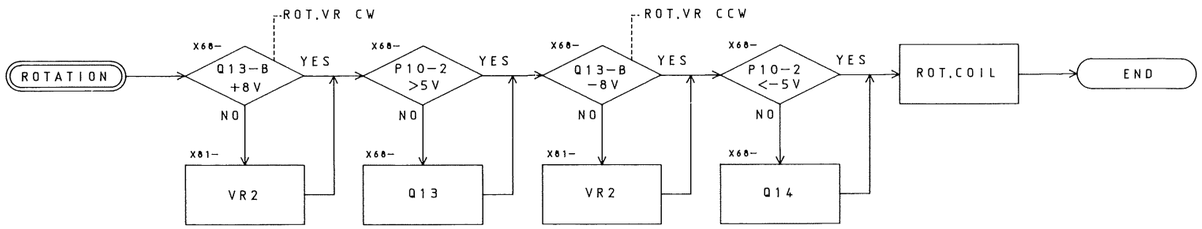
POWER LED
Line voltage
Change the line voltage
Fuse
Replace fuse
-8V JW8 Pin 7
TP4 Voltage, Waveform
D2, C3 -8Vload
VR1 Adjustment
Q5, U1
+8V JW8 Pin 8
TP3
D2, C2 +8Vload
Q4, U1
+5V JW8 Pin 6
Q3
+80V JW8 Pin 11
TP2
D31, C81 +80Vload
Q31~33
+140V JW8 Pin 10
TP1
D1, C1 +140Vload
Q1, Q2, U1
POWER LED goes on
D2 (LED)
END

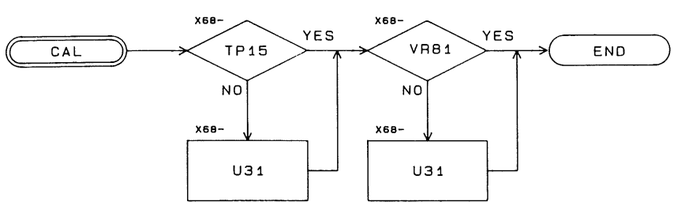

HIGH VLT
TP6
Q8, Q9, U2
TP8
Q8, Q9, U2 C25~28 D10
TP12
Q10~12
TP13
R50, R51
END

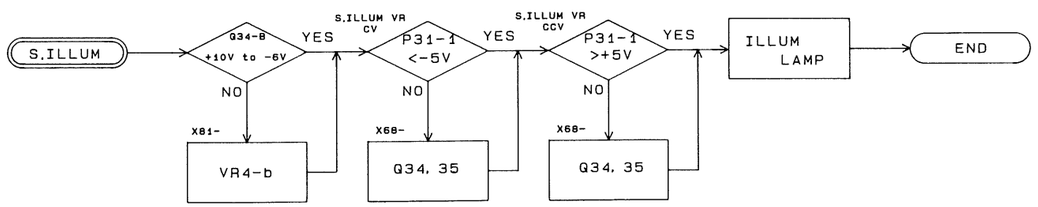
TROUBLESHOOTING











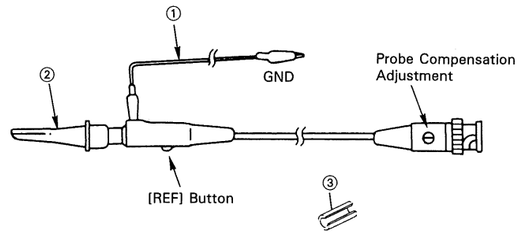
PARTS LIST

CS-4035

(Y70-1730-00)

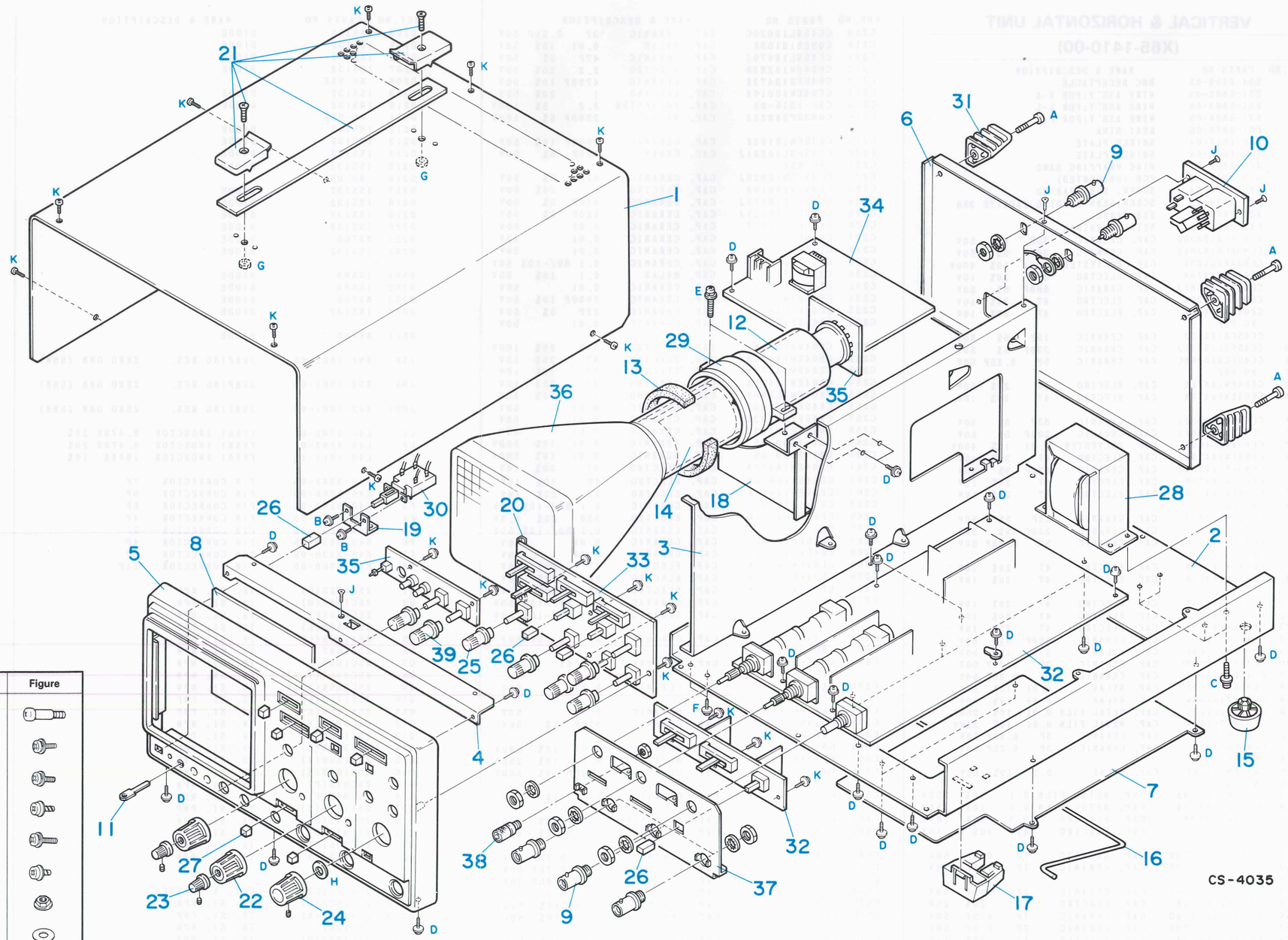
REF.NO	PARTS NO	NAME & DESCRIPTION
	A33-0504-03	REFLECTOR
	B30-0925-05	LAMP
	B30-0996-05	LAMP ASS'Y
	B41-0710-04	CAUTION LABEL;(HIGH VOLTAGE)
	B42-3699-04	SERIAL NO. PLATE
	B50-7731-10	INSTRUCTION MANUAL,JAPANESE
	B50-7732-20	INSTRUCTION MANUAL,ENGLISH
	E23-0552-04	EARTH TERMINAL
	E30-1644-15	BS POWER CORD
	E30-1818-05	JIS POWER CORD SET
	E30-1819-05	CEE POWER CORD SET
	E30-1820-05	UL/CSA POWER CORD SET
	E30-1821-05	SAA POWER CORD SET
	E31-0564-15	WIRE ASS'Y;PROTECTIVE EARTH
	E31-5878-05	WIRE ASS'Y;Z AXIS TO P14
	E31-5879-05	WIRE ASS'Y;CH1 OUTPUT TO P5
	E38-0258-05	WIRE ASS'Y;CAL TO P32
	F05-5013-05	FUSE(6X30MM) 0.5A/250V
	F05-5016-05	FUSE(5X20MM) T500MA/250V
	F05-8015-05	FUSE(6X30MM) 0.8A/250V
	G16-0611-04	REFLECTOR SHEET (L)
	G16-0612-04	REFLECTOR SHEET (R)
	H10-2848-02	FOAMED STYRENE PAD(FRONT)
	H10-2849-02	FOAMED STYRENE PAD(REAR)
	H20-1727-04	VINYL COVER
	H53-0035-04	CARTON BOX
	J19-1620-05	CORD KEEP
	J19-1653-23	HOLDER FOR CRT
	J21-4736-03	BRACKET;FOR CRT,BACKWARD
	J59-0403-05	NYLON RIVET (ILLUMI)
	J61-0408-05	WIRE WRAPPING BAND
	LN322GP	DIODE;POWER LED
	W03-2314-05	PROBE (PC-35)
1	A01-1225-22	CASE
2	A10-1458-22	CHASSIS
3	A13-0946-12	FRAME;CENTER
4	A13-0947-13	FRAME;PANEL
5	A63-0028-01	MOLDED PANEL
6	A83-0015-02	REAR PANEL
7	A40-0715-03	BOTTOM PLATE
8	B11-0518-04	FILTER
9	E04-0259-05	BNC RECEPTACLE
10A	E18-0365-05	AC SELECTOR WITH 6X30MM FUSE
10B	E18-0366-15	AC SELECTOR WITH 5X20MM FUSE
11	E21-0660-04	TERMINAL,CAL
12	F11-1206-03	SHIELD,CRT
13	F15-0733-04	FELT (CRT SHIELD)
15	J02-0089-05	RUBBER FOOT(REAR)
16	J02-0524-04	TILT STAND
17	J02-0525-23	RUBBER FOOT;BOTTOM
18	J21-4695-03	BRACKET,FOR CRT
19	J21-4696-04	BRACKET,FOR POWER SW
20	J21-4737-14	BRACKET,FOR PANEL UNIT
21	K01-0518-05	HANDLE
22	K21-0892-03	KNOB (VOLTS/DIV)
23	K21-0897-14	KNOB(2 USED)
24	K21-0910-03	KNOB(SWEEP TIME/DIV)
25	K23-0811-03	KNOB(6 USED)
26	K27-0590-04	PUSH BOTTON;GRAY
27	K27-0537-04	KNOB,FOR LEVER SWITCH
28	L01-9958-05	POWER TRANSFORMER
29	L39-0534-05	ROTATION COIL
30	S40-2532-05	POWER SW
31	W01-0503-04	REAR RUBBER FOOT/CORD WRAP
32	X65-1410-00	HORIZONTAL/VERTICAL UNIT
33	X66-1150-00	PANEL UNIT
34	X68-1610-00	POWER SUPPLY UNIT
35	X81-2960-00	CRT SOCKET UNIT
36	150VTM31A	CRT
39	K23-0808-03	KNOB

MODEL PC-35 (LOW CAPACITY PROBE)



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

DISASSEMBLY



SCREWS

	Parts No.	Parts Name		Figure
A	N08-0611-04	Cord wrapping screw		
B	N09-0623-04	Sems screw	(M3×8)	
C	N09-0654-05	Sems screw	(M4×8)	
D	N09-0739-05	Sems taptite screw	(3×8)	
E	N09-0748-04	Sems screw	(M4×12)	
F	N09-0757-05	Sems taptite screw	(3×6)	
G	N14-0620-05	Flange nut	(M4)	
H	N19-0709-05	Plain washer	(t=1, ϕ6)	
I	N30-4014-41	Pan head screw	(M4×14)	
J	N88-3008-41	Flat head taptite screw	(3×8)	
K	N89-3008-41	Binding head taptite screw	(3×8)	

PARTS LIST

VERTICAL & HORIZONTAL UNIT

(X65-1410-00)

REF.NO	PARTS NO	NAME & DESCRIPTION
	E04-0259-05	BNC RECEPTACLE
	E31-5882-05	WIRE ASS'Y;FOR K-K
	E31-5883-05	WIRE ASS'Y;FOR L-L
	E31-5884-05	WIRE ASS'Y;FOR F-F
	F01-0879-05	HEAT SINK
	F10-1627-04	SHIELD PLATE
	F10-1628-04	SHIELD PLATE
	J61-0408-05	WIRE WRAPPING BAND
	J73-0047-12	PCB (UNMOUNTED)
	N09-0623-04	SCREW, SEMS PAN HD
	N09-0739-05	SCREW,SEMS BINDING TAPTITE 3X8
37	A22-0878-13	SUB PANEL
38	E21-0667-05	METAL TERMINAL
C1	CC45FCH1H330J	CAP. CERAMIC 33P 5% 50V
C2	CC93FCH1H301J	CAP. CERAMIC 300P 5% 50V
C3	CF93AN2G103K	CAP. POLYESTER 0.01 10% 400V
C4	CE04EW1A470M	CAP. ELECTRO 47 20% 10V
C5	CC45FSL1H681J	CAP. CERAMIC 680P 5% 50V
C6	CE04EW1A470M	CAP. ELECTRO 47 20% 10V
C7	CE04EW1A470M	CAP. ELECTRO 47 20% 10V
C8	NO USE	
C9	CC45CH1H150J	CAP. CERAMIC 15P 5% 50V
C10	CC45FSL1H331J	CAP. CERAMIC 330P 5% 50V
C11	CC45FCH1H050C	CAP. CERAMIC 5P 0.25P 50V
C12	NO USE	
C13	CE04EW1A470M	CAP. ELECTRO 47 20% 10V
C14	CE04EW1A470M	CAP. ELECTRO 47 20% 10V
C51	CC45FCH1H330J	CAP. CERAMIC 33P 5% 50V
C52	CC93FCH1H301J	CAP. CERAMIC 300P 5% 50V
C53	CF93AN2G103K	CAP. POLYESTER 0.01 10% 400V
C54	CE04EW1A470M	CAP. ELECTRO 47 20% 10V
C55	CC45FSL1H681J	CAP. CERAMIC 680P 5% 50V
C56	CE04EW1A470M	CAP. ELECTRO 47 20% 10V
C57	CE04EW1A470M	CAP. ELECTRO 47 20% 10V
C58	NO USE	
C59	CC45CH1H220J	CAP. CERAMIC 22P 5% 50V
C60	CC45FSL1H331J	CAP. CERAMIC 330P 5% 50V
C61	CC45FCH1H050C	CAP. CERAMIC 5P 0.25P 50V
C62	NO USE	
C63	CE04EW1A470M	CAP. ELECTRO 47 20% 10V
C64	CE04EW1A470M	CAP. ELECTRO 47 20% 10V
C101	CE04EW1A470M	CAP. ELECTRO 47 20% 10V
C102	CE04EW1A470M	CAP. ELECTRO 47 20% 10V
C103	CE04EW1A470M	CAP. ELECTRO 47 20% 10V
C104	CC45FSL1H391J	CAP. CERAMIC 390P 5% 50V
C105	CQ92FM1H104K	CAP. MYLAR 0.1 10% 50V
C106	CC45FCH1H030C	CAP. CERAMIC 3P 0.25P 50V
C107	CC45FCH1H030C	CAP. CERAMIC 3P 0.25P 50V
C108	CQ92FM1H103K	CAP. MYLAR 0.01 10% 50V
C109	CQ92FM1H103K	CAP. MYLAR 0.01 10% 50V
C110	CF93AN2E103K	CAP. METAL FILM 0.01 10% 250V
C111	CF93AN2E103K	CAP. METAL FILM 0.01 10% 250V
C112	CC45CH1H030C	CAP. CERAMIC 3P 0.25P 50V
C113	CC45CH1H030C	CAP. CERAMIC 3P 0.25P 50V
C114	NO USE	
C115	CQ92FM1H104K	CAP. MYLAR 0.1 10% 50V
C116	NO USE	
C117	CF93AN2E104K	CAP. METAL FILM 0.1 10% 250V
C118	CF93AN2E104K	CAP. METAL FILM 0.1 10% 250V
C119	CE04W2C3R3M	CAP. ELECTRO 3.3 20% 160V
C120	C90-3016-05	CAP. ELECTRO 47 105°C 10V
C151	CC45FCH1H070D	CAP. CERAMIC 7P 0.5P 50V
C152	CC45FCH1H070D	CAP. CERAMIC 7P 0.5P 50V
C153	NO USE	
C154	CC45FCH1H070D	CAP. CERAMIC 7P 0.5P 50V
C155	CE04BW1E220M	CAP. ELECTRO 22 20% 25V
C156	CC45FCH1H070D	CAP. CERAMIC 7P 0.5P 50V
C157	CC45FCH1H070D	CAP. CERAMIC 7P 0.5P 50V
C158	CE04EW1A470M	CAP. ELECTRO 47 20% 10V
C201	CC45FSL1H220J	CAP. CERAMIC 22P 5% 50V
C202	CE04BW1E220M	CAP. ELECTRO 22 20% 25V
C203	CE04EW1C100M	CAP. ELECTRO 10 20% 16V
C204	CC45SL1H561J	CAP. CERAMIC 560P 5% 50V
C205	NO USE	
C206	CE04HW1H010M	CAP. ELECTRO 1 20% 50V
C207	NO USE	
C208	CQ92M1H473K	CAP. MYLAR 0.047 10% 50V
C209	CC45SL1H030C	CAP. CERAMIC 3P 0.25P 50V
C210	CQ92M1H103K	CAP. MYLAR 0.01 10% 50V
C211	CC45SL1H470J	CAP. CERAMIC 47P 5% 50V
C212	CE04EW1H2R2M	CAP. ELECTRO 2.2 20% 50V
C213	CK45FB1H472K	CAP. CERAMIC 4700P 10% 50V
C214	CE04EW1H010M	CAP. ELECTRO 1 20% 50V
C215	C91-1316-05	CAP. POLYESTER 2.2 5% 100V
C216	CQ93MP2A222J	CAP. MYLAR 2200P 5% 100V
C219	CK45FB1H102K	CAP. CERAMIC 1000P 10% 50V
C220	CC45FSL1H221J	CAP. CERAMIC 220P 5% 50V
C221	NO USE	
C222	CC45FCH1H820J	CAP. CERAMIC 82P 5% 50V
C223	CE04EW1H010M	CAP. ELECTRO 1 20% 50V
C224	CC45FSL1H471J	CAP. CERAMIC 470P 5% 50V
C225	CC45FSL1H221J	CAP. CERAMIC 220P 5% 50V
C226	CK45FF1H103Z	CAP. CERAMIC 0.01 50V
C227	CK45F1H103Z	CAP. CERAMIC 0.01 50V
C228	CK45FF1H103Z	CAP. CERAMIC 0.01 50V
C229	C91-1315-05	CAP. CERAMIC 0.1 80/-10% 50V
C230	CQ92M1H104K	CAP. MYLAR 0.1 10% 50V
C231	CK45FF1H103Z	CAP. CERAMIC 0.01 50V
C232	CK45B1H102K	CAP. CERAMIC 1000P 10% 50V
C233	CC45FSL1H220J	CAP. CERAMIC 22P 5% 50V
C234	CK45FF1H103Z	CAP. CERAMIC 0.01 50V
C251	CE04W2C3R3M	CAP. ELECTRO 3.3 20% 160V
C252	CE04EW1A470M	CAP. ELECTRO 47 20% 10V
C253	CE04EW1A470M	CAP. ELECTRO 47 20% 10V
C254	CE04EW1A470M	CAP. ELECTRO 47 20% 10V
C255	CE04EW1C100M	CAP. ELECTRO 10 20% 16V
C256	CK45FF1H103Z	CAP. CERAMIC 0.01 50V
C257	CK45FF1H103Z	CAP. CERAMIC 0.01 50V
C258	CK45FF1H103Z	CAP. CERAMIC 0.01 50V
C259	C91-1309-05	CAP. CERAMIC 0.01 10% 500V
C260	C91-1309-05	CAP. CERAMIC 0.01 10% 500V
C261	CE04EW1A470M	CAP. ELECTRO 47 20% 10V
C262	CE04EW1A470M	CAP. ELECTRO 47 20% 10V
C263	CE04EW1A470M	CAP. ELECTRO 47 20% 10V
C264	C91-1315-05	CAP. CERAMIC 0.1 80/-10% 50V
C265	CE04EW0J331M	CAP. ELECTRO 330 20% 6.3V
C266	C91-1315-05	CAP. CERAMIC 0.1 80/-10% 50V
C267	CK45FF1H103Z	CAP. CERAMIC 0.01 50V
C268	CK45F1H103Z	CAP. CERAMIC 0.01 50V
C269	CE04EW1A470M	CAP. ELECTRO 47 20% 10V
C270	CE04EW1A220M	CAP. ELECTRO 22 20% 10V
C271	CE04EW1A220M	CAP. ELECTRO 22 20% 10V
C272	C91-1315-05	CAP. CERAMIC 0.1 80/-10% 50V
C273	C91-1315-05	CAP. CERAMIC 0.1 80/-10% 50V
C291	CC45FCH1H050C	CAP. CERAMIC 5P 0.25P 50V
C292	NO USE	
C293	C91-1273-05	CAP. NETWORK 6X0.01 50V
C296	CK45F1H103Z	CAP. CERAMIC 0.01 50V
C301	CK45FF1H103Z	CAP. CERAMIC 0.01 50V
C302	CC45SL1H331J	CAP. CERAMIC 330P 5% 50V
C303	NO USE	
C304	C91-1309-05	CAP. CERAMIC 0.01 10% 500V
C305	CF93AN2E104K	CAP. METAL FILM 0.1 10% 250V
C306	CK45FB2H102K	CAP. CERAMIC 1000P 10% 500V
C391	CC45CH1H220J	CAP. CERAMIC 22P 5% 50V
C401	CF93AN2G223K	CAP. POLYESTER 0.022 10% 400V
C402	CF93AN2G223K	CAP. POLYESTER 0.022 10% 400V
C501	CC45CH1H030C	CAP. CERAMIC 3P 0.25P 50V
C502	CC45CH1H030C	CAP. CERAMIC 3P 0.25P 50V
C503	CC45CH1H030C	CAP. CERAMIC 3P 0.25P 50V
C504	CC45CH1H030C	CAP. CERAMIC 3P 0.25P 50V
C505	CK45FB2H102K	CAP. CERAMIC 1000P 10% 500V
C506	CK45FB2H102K	CAP. CERAMIC 1000P 10% 500V
C511	CK45B1H472K	CAP. CERAMIC 4700P 10% 50V
C531	CE04EW1A101M	CAP. ELECTRO 100 20% 10V
C532	CE04EW1A101M	CAP. ELECTRO 100 20% 10V
C533	CE04EW1A101M	CAP. ELECTRO 100 20% 10V
C534	CE04EW1A101M	CAP. ELECTRO 100 20% 10V
C535	CQ92FM1H104K	CAP. MYLAR 0.1 10% 50V
D202	1SS132	DIODE
D203	1SS132	DIODE
D204	1SS132	DIODE
D205	1SS132	DIODE
D206	1SS132	DIODE
D207	1SS132	DIODE
D208	NO USE	
D209	1SS132	DIODE
D210	1SS132	DIODE
D211	NO USE	
D212	1SS132	DIODE
D213	1SS132	DIODE
D214	1SS132	DIODE
D215	1SS132	DIODE
D216	NO USE	
D217	1SS132	DIODE
D218	1SS132	DIODE
D219	1SS132	DIODE
D220	1SS132	DIODE
D221	MA700	DIODE
D222	1SS132	DIODE
D301	1SS83	DIODE
D302	1SS83	DIODE
D303	MA700	DIODE
D304	1SS132	DIODE
D511	MA700	DIODE
J38	R92-1061-05	JUMPING RES. ZERO OHM (5MM)
J95	R92-1061-05	JUMPING RES. ZERO OHM (5MM)
J901	R92-1061-05	JUMPING RES. ZERO OHM (5MM)
L1	L40-4782-01	FERRI INDUCTOR 0.47UH 20%
L2	L40-4782-01	FERRI INDUCTOR 0.47UH 20%
L3	L40-1011-11	FERRI INDUCTOR 100UH 10%
P1	E40-3242-05	PIN CONNECTOR 7P
P2	E40-5066-05	PIN CONNECTOR 9P
P3	E40-3243-05	PIN CONNECTOR 8P
P4	E40-3239-05	PIN CONNECTOR 4P
P5	E40-3237-05	PIN CONNECTOR 2P
P6	E40-3239-05	PIN CONNECTOR 4P
P7	E40-3238-05	PIN CONNECTOR 3P
P8	E40-5068-05	PIN CONNECTOR 11P
Q1	2SC1923(O)	TR. SI, NPN
Q2	2SC1923(O)	TR. SI, NPN
Q3	2SC945(P)	TR. SI, NPN
Q4	2SA1459(L)	TR. SI, PNP
Q5	2SA1459(L)	TR. SI, PNP
Q6	2SC1907	TR. SI, NPN
Q7	2SC1907	TR. SI, NPN
Q8	2SC3354(T,S)	TR. SI, NPN
Q9	2SC3354(T,S)	TR. SI, NPN
Q10	2SA1459(L)	TR. SI, PNP
Q11	2SA1459(L)	TR. SI, PNP
Q12	2SC3423(Y)	TR. SI, NPN
Q13	2SA1360(Y)	TR. SI, PNP
Q14	2SC3423(Y)	TR. SI, NPN
Q15	2SA1360(Y)	TR. SI, PNP
Q16	2SA1005(K)	TR. SI, PNP
Q17	2SC945(P)	TR. SI, NPN
Q18	2SC945(P)	TR. SI, NPN
Q19	2SA1005(K)	TR. SI, PNP
Q20	2SC945(P)	TR. SI, NPN
Q21	2SC945(P)	TR. SI, NPN
Q22	2SC945(P)	TR. SI, NPN
Q23	2SC945(P)	TR. SI, NPN
Q201	2SK161(GR)	FET, N-CHANNEL
Q202	2SC1923(O)	TR. SI, NPN
Q203	2SA1005(K)	TR. SI, PNP
Q204	2SC1907	TR. SI, NPN
Q205	2SC1923(O)	TR. SI, NPN
Q206	2SC1923(O)	TR. SI, NPN
Q207	2SA733(P)	TR. SI, PNP
Q208	2SC945(P)	TR. SI, NPN
Q209	2SA733(P)	TR. SI, PNP
Q210	2SA733(P)	TR. SI, PNP
Q211	2SC945(P)	TR. SI, NPN
Q212	2SC1923(O)	TR. SI, NPN
Q213	2SA1005(K)	TR. SI, PNP
Q214	2SA733(P)	TR. SI, PNP
Q215	2SC945(P)	TR. SI, NPN
Q216	2SA733(P)	TR. SI, PNP
Q217	2SC945(P)	TR. SI, NPN
Q218	2SC945(P)	TR. SI, NPN
Q219	2SA733(P)	TR. SI, PNP
Q220	2SC945(P)	TR. SI, NPN
Q221	2SC3732(L)	TR. SI, NPN
Q222	2SC945(P)	TR. SI, NPN
Q223	2SA733(P)	TR. SI, PNP
Q224	2SC945(P)	TR. SI, NPN
Q225	NO USE	
Q226	2SA733(P)	TR. SI, PNP
Q227	2SC945(P)	TR. SI, NPN
Q228	NO USE	
Q229	2SC945(P)	TR. SI, NPN
Q230	2SC945(P)	TR. SI, NPN
Q231	2SC945(P)	TR. SI, NPN
Q301	2SC945(P)	TR. SI, NPN
Q302	2SC945(P)	TR. SI, NPN
Q303	2SA1005(K)	TR. SI, PNP
Q304	2SA1005(K)	TR. SI, PNP
Q305	2SC945(P)	TR. SI, NPN
Q306	2SC945(P)	TR. SI, NPN
Q307	2SA1209(S,T)	TR. SI, PNP
Q308	2SC2911(S,T)	TR. SI, NPN
Q309	2SC2911(S,T)	TR. SI, NPN
Q310	2SA1209(S,T)	TR. SI, PNP
Q311	2SC945(P)	TR. SI, NPN
Q312	2SC945(P)	TR. SI, NPN
Q313	2SC945(P)	TR. SI, NPN
Q314	2SC945(P)	TR. SI, NPN
Q315	2SK583	FET, N-CHANNEL
Q316	2SK583	FET, N-CHANNEL
Q511	2SC945(P)	TR. SI, NPN
R1	RD14BB2C220J	RES. CARBON 22 5% 1/6W
R2	RN14BK2E9003D	
R3	RN14BK2E1113D	RES. METAL FILM 111K 0.5% 1/4W
R4	RD14BB2C470J	RES. CARBON 47 5% 1/6W
R5	RD14BB2C101J	RES. CARBON 100 5% 1/6W
R6	RD14BB2C331J	RES. CARBON 330 5% 1/6W
R7	RN14BK2E9903D	
R8	RN14BK2E1012D	RES. METAL FILM 10.1K 0.5% 1/4W
R9	RD14BB2C220J	RES. CARBON 22 5% 1/6W
R10	RD14BB2C391J	RES. CARBON 390 5% 1/6W
R11	RD14BB2C220J	RES. CARBON 22 5% 1/6W
R12	RN14BK2E1004F	RES. METAL FILM 1M 1% 1/4W
R13	RD14BB2C474J	RES. CARBON 470K 5% 1/6W
R14	RD14BB2C470J	RES. CARBON 47 5% 1/6W
R15	RN14BK2C3003F	RES. METAL FILM 300K 1% 1/6W
R16	RD14BB2C470J	RES. CARBON 47 5% 1/6W
R17	RD14BB2C303J	RES. CARBON 30K 5% 1/6W
R18	RD14BB2C510J	RES. CARBON 51 5% 1/6W
R19	RN14BK2C3000D	RES. METAL FILM 300 0.5% 1/6W
R20	RN14BK2C1500D	RES. METAL FILM 150 0.5% 1/6W
R21	RD14BB2C390J	RES. CARBON 39 5% 1/6W
R22	RN14BK2C90R0D	
R23	RD14BB2C101J	RES. CARBON 100 5% 1/6W
R24	RN14BK2C60R0D	
R25	RN14BK2C1004F	RES. METAL FILM 1M 1% 1/6W
R26	RN14BK2C1001F	RES. METAL FILM 1K 1% 1/6W
R27	RN14BK2C62R0F	RES. METAL FILM 62.0 1% 1/6W
R28	RN14BK2C24R0F	RES. METAL FILM 24.0 1% 1/6W
R29	RN14BK2C1100F	RES. METAL FILM 110 1% 1/6W
R30	RD14BB2C201J	RES. CARBON 200 5% 1/6W
R31	RN14BK2C1302F	RES. METAL FILM 13K 1% 1/6W
R32	RN14BK2C5602F	RES. METAL FILM 56K 1% 1/6W
R33	NO USE	
R34	RD14BB2C241J	RES. CARBON 240 5% 1/6W
R35	NO USE	
R36	RD14BB2C102J	RES. CARBON 1K 5% 1/6W
R37	RD14BB2C220J	RES. CARBON 22 5% 1/6W
R38	RD14BB2C220J	RES. CARBON 22 5% 1/6W
R39	RD14BB2C163J	RES. CARBON 16K 5% 1/6W
R40	RD14BB2C102J	RES. CARBON 1K 5% 1/6W
R41	RD14BB2C220J	RES. CARBON 22 5% 1/6W
R42	RD14BB2C222J	RES. CARBON 2.2K 5% 1/6W
R43	NO USE	
R44	RD14BB2C102J	RES. CARBON 1K 5% 1/6W
R45	RN14BK2C3001F	RES. METAL FILM 3K 1% 1/6W
R46	RD14BB2C101J	RES. CARBON 100 5% 1/6W
R51	RD14BB2C220J	RES. CARBON 22 5% 1/6W
R52	RN14BK2E9003D	

PARTS LIST

REF.NO	PARTS NO	NAME & DESCRIPTION			
R241	RD14BB2C223J	RES. CARBON	22K	5%	1/6W
R242	RD14BB2C102J	RES. CARBON	1K	5%	1/6W
R243	RD14BB2C103J	RES. CARBON	10K	5%	1/6W
R244	RD14BB2C103J	RES. CARBON	10K	5%	1/6W
R245	RD14BB2C104J	RES. CARBON	100K	5%	1/6W
R246	RD14BB2C104J	RES. CARBON	100K	5%	1/6W
R247	RD14BB2C472J	RES. CARBON	4.7K	5%	1/6W
R248	RD14BB2C163J	RES. CARBON	16K	5%	1/6W
R249	RD14BB2C513J	RES. CARBON	51K	5%	1/6W
R250	RD14BB2C302J	RES. CARBON	3K	5%	1/6W
R251	RD14BB2C472J	RES. CARBON	4.7K	5%	1/6W
R252	RD14BB2C362J	RES. CARBON	3.6K	5%	1/6W
R253	RD14BB2C102J	RES. CARBON	1K	5%	1/6W
R254	RD14BB2C472J	RES. CARBON	4.7K	5%	1/6W
R255	RD14BB2C102J	RES. CARBON	1K	5%	1/6W
R256	RD14BB2C122J	RES. CARBON	1.2K	5%	1/6W
R257	RD14BB2C103J	RES. CARBON	10K	5%	1/6W
R258	RD14BB2C203J	RES. CARBON	20K	5%	1/6W
R259	RD14BB2C201J	RES. CARBON	200	5%	1/6W
R260	RD14BB2C472J	RES. CARBON	4.7K	5%	1/6W
R261	RD14BB2C512J	RES. CARBON	5.1K	5%	1/6W
R262	RD14BB2C511J	RES. CARBON	510	5%	1/6W
R263	RD14BB2C104J	RES. CARBON	100K	5%	1/6W
R264	RD14BB2C222J	RES. CARBON	2.2K	5%	1/6W
R265	RD14BB2C272J	RES. CARBON	2.7K	5%	1/6W
R266	NO USE				
R267	RD14BB2C104J	RES. CARBON	100K	5%	1/6W
R268	RD14BB2C222J	RES. CARBON	2.2K	5%	1/6W
R269	NO USE				
R270	RD14BB2C432J	RES. CARBON	4.3K	5%	1/6W
R271	NO USE				
R272	RD14BB2C101J	RES. CARBON	100	5%	1/6W
R273	NO USE				
R274	RD14BB2C222J	RES. CARBON	2.2K	5%	1/6W
R275	RD14BB2C823J	RES. CARBON	82K	5%	1/6W
R276	RD14BB2C472J	RES. CARBON	4.7K	5%	1/6W
R277	RD14BB2C122J	RES. CARBON	1.2K	5%	1/6W
R278	RD14BB2C122J	RES. CARBON	1.2K	5%	1/6W
R279	RD14BB2C103J	RES. CARBON	10K	5%	1/6W
R280	RD14BB2C472J	RES. CARBON	4.7K	5%	1/6W
R281	RD14BB2C101J	RES. CARBON	100	5%	1/6W
R282	RD14BB2C302J	RES. CARBON	3K	5%	1/6W
R283	RD14BB2C332J	RES. CARBON	3.3K	5%	1/6W
R284	RD14BB2C103J	RES. CARBON	10K	5%	1/6W
R285	RD14BB2C220J	RES. CARBON	22	5%	1/6W
R286	RD14BB2C103J	RES. CARBON	10K	5%	1/6W
R287	RD14BB2C112J	RES. CARBON	1.1K	5%	1/6W
R288	RD14BB2E221J	RES. CARBON	220	5%	1/4W
R289	RD14BB2C103J	RES. CARBON	10K	5%	1/6W
R290	RD14BB2C103J	RES. CARBON	10K	5%	1/6W
R291	RD14BB2C332J	RES. CARBON	3.3K	5%	1/6W
R292	RD14BB2C272J	RES. CARBON	2.7K	5%	1/6W
R295	RD14BB2C221J	RES. CARBON	220	5%	1/6W
R296	RD14BB2C471J	RES. CARBON	470	5%	1/6W
R297	RD14BB2C101J	RES. CARBON	100	5%	1/6W
R298	RD14BB2E471J	RES. CARBON	470	5%	1/4W
R301	RD14BB2C220J	RES. CARBON	22	5%	1/6W
R302	RD14BB2C622J	RES. CARBON	6.2K	5%	1/6W
R303	RD14BB2C220J	RES. CARBON	22	5%	1/6W
R304	RD14BB2C562J	RES. CARBON	5.6K	5%	1/6W
R305	RD14BB2C622J	RES. CARBON	6.2K	5%	1/6W
R306	RD14BB2C220J	RES. CARBON	22	5%	1/6W
R307	RD14BB2C622J	RES. CARBON	6.2K	5%	1/6W
R308	RD14BB2C220J	RES. CARBON	22	5%	1/6W
R309	RD14BB2C101J	RES. CARBON	100	5%	1/6W
R310	RN14BK2C3003F	RES. METAL FILM	300K	1%	1/6W
R311	RD14BB2C223J	RES. CARBON	22K	5%	1/6W
R314	RD14BB2C221J	RES. CARBON	220	5%	1/6W
R315	NO USE				
R316	RD14BB2C752J	RES. CARBON	7.5K	5%	1/6W
R317	RD14BB2C222J	RES. CARBON	2.2K	5%	1/6W
R318	RD14BB2C222J	RES. CARBON	2.2K	5%	1/6W
R319	RD14BB2C302J	RES. CARBON	3K	5%	1/6W
R320	RD14BB2C823J	RES. CARBON	82K	5%	1/6W
R321	RD14BB2C622J	RES. CARBON	6.2K	5%	1/6W
R322	RD14BB2C302J	RES. CARBON	3K	5%	1/6W
R323	RD14BB2C823J	RES. CARBON	82K	5%	1/6W
R324	RD14BB2C622J	RES. CARBON	6.2K	5%	1/6W
R325	RD14BB2C562J	RES. CARBON	5.6K	5%	1/6W
R326	RD14BB2C164J	RES. CARBON	160K	5%	1/6W
R327	RD14BB2E102J	RES. CARBON	1K	5%	1/4W

REF.NO	PARTS NO	NAME & DESCRIPTION			
R328	RD14BB2C562J	RES. CARBON	5.6K	5%	1/6W
R329	RD14BB2C164J	RES. CARBON	160K	5%	1/6W
R330	RD14BB2E102J	RES. CARBON	1K	5%	1/4W
R334	RD14BB2C471J	RES. CARBON	470	5%	1/6W
R335	RD14BB2C471J	RES. CARBON	470	5%	1/6W
R336	RD14BB2E432J	RES. CARBON	4.3K	5%	1/4W
R337	RD14BB2C622J	RES. CARBON	6.2K	5%	1/6W
R341	R90-0281-05	RES. MULTIPLE	6X10K		
R342	R90-0229-05	RES. MULTIPLE	8X10K		
R343	RD14BB2C473J	RES. CARBON	47K	5%	1/6W
R344	RD14BB2C433J	RES. CARBON	43K	5%	1/6W
R345	RD14BB2C433J	RES. CARBON	43K	5%	1/6W
R346	RD14BB2C362J	RES. CARBON	3.6K	5%	1/6W
R347	RD14BB2C362J	RES. CARBON	3.6K	5%	1/6W
R348	RD14BB2C362J	RES. CARBON	3.6K	5%	1/6W
R401	RN14BK2E1004F	RES. METAL FILM	1M	1%	1/4W
R402	RN14BK2E1004F	RES. METAL FILM	1M	1%	1/4W
R403	RD14BB2C220J	RES. CARBON	22	5%	1/6W
R404	RD14BB2C220J	RES. CARBON	22	5%	1/6W
R405	RD14BB2C220J	RES. CARBON	22	5%	1/6W
R406	RD14BB2C220J	RES. CARBON	22	5%	1/6W
R407	RD14BB2C220J	RES. CARBON	22	5%	1/6W
R501	RD14BB2C470J	RES. CARBON	47	5%	1/6W
R502	RD14BB2C470J	RES. CARBON	47	5%	1/6W
R511	RD14BB2C302J	RES. CARBON	3K	5%	1/6W
R512	RD14BB2C162J	RES. CARBON	1.6K	5%	1/6W
R513	RD14BB2C102J	RES. CARBON	1K	5%	1/6W
R801	RD14BB2C470J	RES. CARBON	47	5%	1/6W
S1	S03-5501-15	ROTARY SWITCH			
S2	S03-5501-15	ROTARY SWITCH			
S201	S60-0601-05	ROTARY SWITCH			
S401	S31-1509-05	SLIDE SWITCH			
S402	S31-1509-05	SLIDE SWITCH			
S403	S40-1532-05	PUSH SWITCH			
TC1	C05-0031-15	CAP. TRIMMER	10P		
TC2	C05-0308-05	CAP. TRIMMER	4P		
TC3	C05-0031-15	CAP. TRIMMER	10P		
TC4	C05-0308-05	CAP. TRIMMER	4P		
TC5	NO USE				
TC6	C05-0469-05	CAP. TRIMMER	10P		
TC51	C05-0031-15	CAP. TRIMMER	10P		
TC52	C05-0308-05	CAP. TRIMMER	4P		
TC53	C05-0031-15	CAP. TRIMMER	10P		
TC54	C05-0308-05	CAP. TRIMMER	4P		
TC55	NO USE				
TC56	C05-0469-05	CAP. TRIMMER	10P		
TC101	C05-0471-05	CAP. TRIMMER	30P		
TC501	C05-0031-15	CAP. TRIMMER	10P		
TH1	SDT100	THERMISTOR			
TH2	SDT100	THERMISTOR			
U1	UPA68H(L)	FET, N-CHANNEL	DUAL		
U2	UPA68H(L)	FET, N-CHANNEL	DUAL		
U3	KMC01	IC, LINEAR			
U4	KMC01	IC, LINEAR			
U5	KMC02	IC, LINEAR			
U6	KMC02	IC, LINEAR			
U201	KMD02	IC, LINEAR			
U202	SN74ALS86N	IC, QUAD 2-EXCLUSIVE-OR			
U203	SN74LS51N	IC,AND-OR-INVERT GATE			
U204	SN74AS74N	IC, DUAL D-F.F.(WITH PR & CLR)			
U205	SN74LS00N	IC,QUAD 2-INPUT NAND GATE			
U206	SN74LS00N	IC,QUAD 2-INPUT NAND GATE			
VR1	R12-3554-05	RES. SEMI FIXED 20KB			
VR2	R12-3550-05	RES. SEMI FIXED 20KB			
VR3	R12-3549-05	RES. SEMI FIXED 10KB			
VR4	R12-0572-05	RES. SEMI FIXED 100 B			
VR5	R12-0572-05	RES. SEMI FIXED 100 B			

PARTS LIST

REF.NO	PARTS NO	NAME & DESCRIPTION
VR51	R12-3554-05	RES. SEMI FIXED 20KB
VR52	R12-3550-05	RES. SEMI FIXED 20KB
VR53	R12-3549-05	RES. SEMI FIXED 10KB
VR54	R12-0572-05	RES. SEMI FIXED 100 B
VR55	R12-0572-05	RES. SEMI FIXED 100 B
VR56	NO USE	
VR57	R12-1546-05	RES. SEMI FIXED 2KB
VR101	R12-0576-05	RES. SEMI FIXED 200 B
VR102	R12-3549-05	RES. SEMI FIXED 10KB
VR103	R12-1546-05	RES. SEMI FIXED 2KB
VR104	R12-0572-05	RES. SEMI FIXED 100 B
VR151	R12-1545-05	RES. SEMI FIXED 1KB
VR152	R12-3549-05	RES. SEMI FIXED 10KB
VR201	R12-2522-05	RES. SEMI FIXED 5KB
VR202	R12-1543-05	RES. SEMI FIXED 1KB
VR301	R12-2522-05	RES. SEMI FIXED 5KB
VR302	R12-0572-05	RES. SEMI FIXED 100 B
VR303	R12-1545-05	RES. SEMI FIXED 1KB

PANEL UNIT

(X66-1150-00)

REF.NO	PARTS NO	NAME & DESCRIPTION		
	J73-0048-22			
C1	CK45FF1H103Z	CAP. CERAMIC	0.01	50V
D1	1SS132	DIODE		
JW1	E38-0283-05	WIRE ASS'Y		
JW2	E38-0284-05	WIRE ASS'Y		
JW3	E38-0285-05	WIRE ASS'Y		
JW4	E38-0286-05	WIRE ASS'Y		
Q1	2SC945(P)	TR. SI, NPN		
R1	RN14BK2C3001F	RES. METAL FILM	3K	1% 1/6W
R2	RD14BB2C473J	RES. CARBON	47K	5% 1/6W
S1	S31-1507-05	SLIDE SWITCH		
S2	S31-1508-05	SLIDE SWITCH		
S3	S40-1532-05	PUSH SWITCH		
S4	S31-2516-05	SLIDE SWITCH		
S5	S31-2518-05	SLIDE SWITCH		
S6	S40-1532-05	PUSH SWITCH		
VR1	R05-3524-05	V.R.		
VR2	R05-3523-05	V.R.		
VR3	R05-3522-05	V.R.		
VR4	R05-3522-05	V.R.		
VR5	R05-3522-05	V.R.		

POWER SUPPLY UNIT

(X68-1610-00)

REF.NO	PARTS NO	NAME & DESCRIPTION			
	E23-0149-05	GND TERMINAL			
	E38-0476-05	WIRE ASS'Y;C			
	F01-0867-05	HEAT SINK			
	J73-0048-22				
	L19-0428-05	CONVERTOR TRANSFORMER			
	N09-0623-04	SCREW, SEMS PAN HD			
C1	CE04W2E101M	CAP. ELECTRO	100	20%	250V
C2	CE04EW1C472M	CAP. ELECTRO	4700	20%	16V
C3	CE04EW1C472M	CAP. ELECTRO	4700	20%	16V
C4	CE04W2C3R3M	CAP. ELECTRO	3.3	20%	160V
C5	CE04EW1A221M	CAP. ELECTRO	220	20%	10V
C6	CE04EW1A221M	CAP. ELECTRO	220	20%	10V
C7	CE04EW1A221M	CAP. ELECTRO	220	20%	10V
C8	NO USE				
C9	CE04HW1H010M	CAP. ELECTRO	1	20%	50V
C10	CE04EW1C101M	CAP. ELECTRO	100	20%	16V
C11	CK45FB2H472K	CAP. CERAMIC	4700P	10%	500V
C12	CK45FB2H472K	CAP. CERAMIC	4700P	10%	500V
C13	CK45B2H472K	CAP. CERAMIC	4700P	10%	500V
C14	CE04W2C3R3M	CAP. ELECTRO	3.3	20%	160V
C15	NO USE				
C16	CK45FB1H222K	CAP. CERAMIC	2200P	10%	50V
C17	CE04EW1A470M	CAP. ELECTRO	47	20%	10V
C18	CE04EW1A470M	CAP. ELECTRO	47	20%	10V
C19	CK45FF1H103Z	CAP. CERAMIC	0.01		50V
C20	CE04EW1C101M	CAP. ELECTRO	100	20%	16V
C21	CE04EW1C101M	CAP. ELECTRO	100	20%	16V
C22	CK45FB2H102K	CAP. CERAMIC	1000P	10%	500V
C23	C91-1317-05	CAP. CERAMIC	0.01		2KV
C24	C91-1317-05	CAP. CERAMIC	0.01		2KV
C25	NO USE				
C26	C91-1317-05	CAP. CERAMIC	0.01		2KV
C27	C91-1317-05	CAP. CERAMIC	0.01		2KV
C28	C91-1317-05	CAP. CERAMIC	0.01		2KV
C29	CK45E3D102P	CAP. CERAMIC	1000P		2KV
C30	CK45FF1H103Z	CAP. CERAMIC	0.01		50V
C31	CK45FB2H472K	CAP. CERAMIC	4700P	10%	500V
C32	CK45E3D472P	CAP. CERAMIC	4700P		2KV
C33	CK45FB2H472K	CAP. CERAMIC	4700P	10%	500V
C34	C91-1309-05	CAP. CERAMIC	0.01	10%	500V
C80	CK45FF1H103Z	CAP. CERAMIC	0.01		50V
C81	CE04W2C101M	CAP. ELECTRO	100	20%	160V
C82	CE04EW2A470M	CAP. ELECTRO	47	20%	100V
C83	NO USE				
C84	CQ92FM1H103J	CAP. MYLAR	0.01	5%	50V
C85	CQ92FM1H103J	CAP. MYLAR	0.01	5%	50V
C86	NO USE				
C87	CK45FB1H102K	CAP. CERAMIC	1000P	10%	50V
C88	CE04EW1A470M	CAP. ELECTRO	47	20%	10V
C89	CQ92FM1H104K	CAP. MYLAR	0.1	10%	50V
C101	CK45FF1H103Z	CAP. CERAMIC	0.01		50V
D1	S1VB60	DIODE,STACK			
D2	RB152	DIODE,STACK			
D3	1SS132	DIODE			
D4	MTZ10JC	DIODE, ZENER	9.95V		
D5	MTZ10JC	DIODE, ZENER	9.95V		
D6	1SS132	DIODE			
D7	1SS132	DIODE			
D8	1SS132	DIODE			
D9	NO USE				
D10	Y10GA	DIODE			
D11	1SS83	DIODE			
D12	1SS83	DIODE			
D13	1SS83	DIODE			
D14	1SS83	DIODE			
D15	NO USE				
D16	1SS132	DIODE			
D31	S1VB60	DIODE,STACK			
JW8	E38-0251-05	WIRE ASS'Y			
L1	L40-1011-04	FERRI INDUCTOR	100UH	10%	
L2	L40-1011-04	FERRI INDUCTOR	100UH	10%	
L3	L40-1021-03	FERRI INDUCTOR	1MH	10%	
L101	L40-1001-03	FERRI INDUCTOR	10UH	10%	
NL1	NE-38B	NEON LAMP			
NL2	NE-38B	NEON LAMP			
P9	E40-4235-05	PIN CONNECTOR	6P		
P10	E40-3237-05	PIN CONNECTOR	2P		
P11	NO USE				
P12	E40-3750-05	PIN CONNECTOR	14P		
P13	E40-5069-05	PIN CONNECTOR	12P		
P14	E40-3238-05	PIN CONNECTOR	3P		
P31	E40-3237-05	PIN CONNECTOR	2P		
P32	E40-3237-05	PIN CONNECTOR	2P		
Q1	2SA1156(L)	TR. SI, PNP			
Q2	2SC2909(S)	TR. SI, NPN			
Q3	2SC1384(R)	TR. SI, NPN			
Q4	2SA684(R)	TR. SI, PNP			
Q5	2SC1384(R)	TR. SI, NPN			
Q6	2SA1208(S)	TR. SI, PNP			
Q7	2SC2910(S)	TR. SI, NPN			
Q8	2SD1666(R)	TR. SI, NPN			
Q9	2SA733(P)	TR. SI, PNP			
Q10	2SA1091(O)	TR. SI, PNP			
Q11	2SA1091(O)	TR. SI, PNP			

PARTS LIST

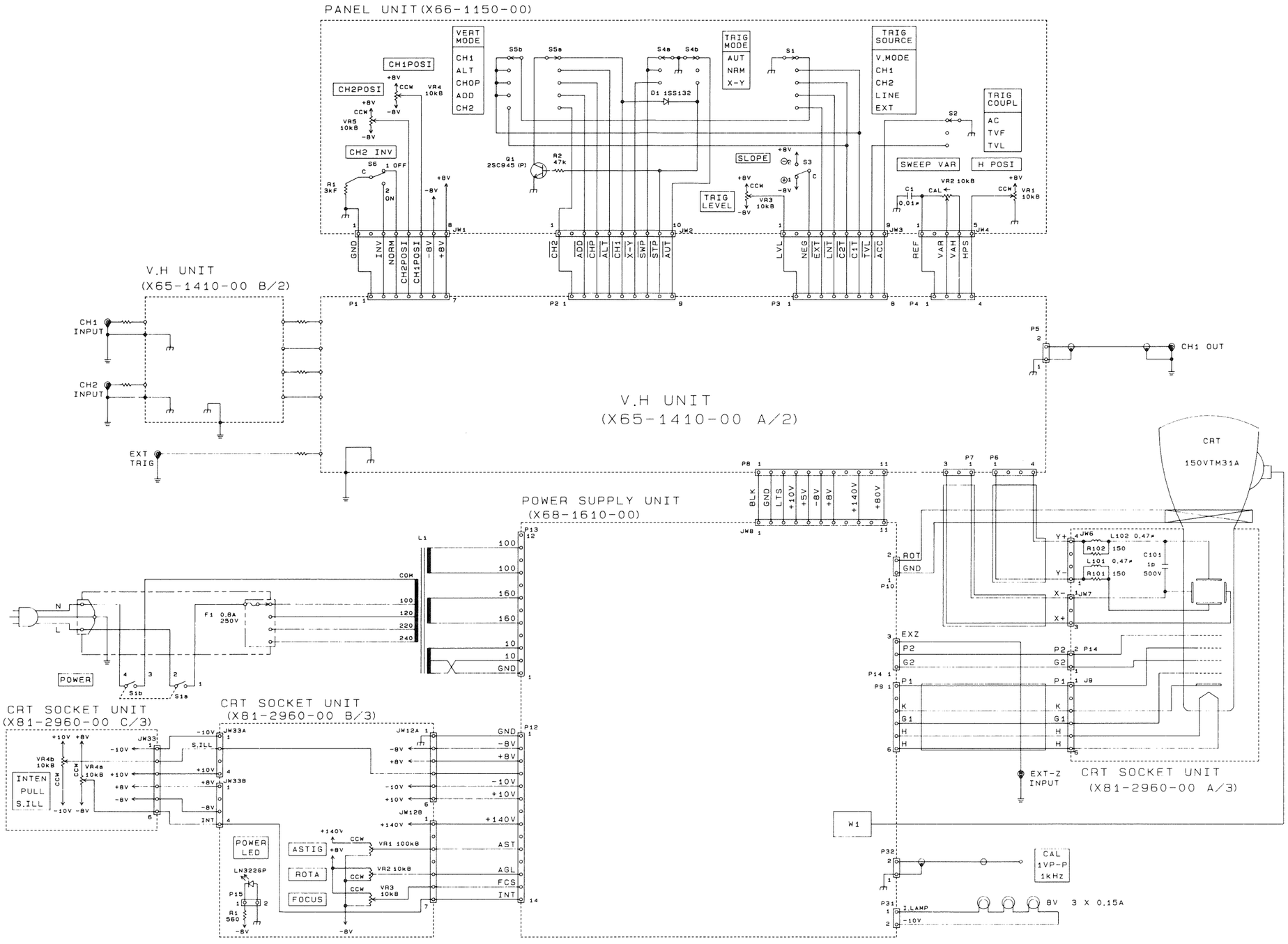
REF.NO	PARTS NO	NAME & DESCRIPTION			
Q12	2SA1091(O)	TR. SI, PNP			
Q13	2SC1384(R)	TR. SI, NPN			
Q14	2SA684(R)	TR. SI, PNP			
Q15	2SA1005(K)	TR. SI, PNP			
Q31	2SA1156(L)	TR. SI, PNP			
Q32	2SC2909(S)	TR. SI, NPN			
Q33	2SC945(Q)	TR. SI, NPN			
Q34	2SC1846(R)	TR. SI, NPN			
Q35	2SC1846(R)	TR. SI, NPN			
R1	RD14KB3A302J	RES. CARBON	3K	5%	1W
R2	RD14BB2C102J	RES. CARBON	1K	5%	1/6W
R3	RD14BB2C102J	RES. CARBON	1K	5%	1/6W
R4	RD14BB2C100J	RES. CARBON	10	5%	1/6W
R5	RD14KB3D240J	RES. SPECIAL	24	5%	2W
R6	RD14BB2C221J	RES. CARBON	220	5%	1/6W
R7	RD14BB2C221J	RES. CARBON	220	5%	1/6W
R8	RD14KB3D240J	RES. SPECIAL	24	5%	2W
R9	NO USE				
R10	RN14BK2C3301F	RES. METAL FILM	3.3K	1%	1/6W
R11	RN14BK2C6201F	RES. METAL FILM	6.2K	1%	1/6W
R12	RD14BB2C223J	RES. CARBON	22K	5%	1/6W
R13	NO USE				
R14	RD14BB2C243J	RES. CARBON	24K	5%	1/6W
R15	RD14BB2C562J	RES. CARBON	5.6K	5%	1/6W
R16	RD14BB2C562J	RES. CARBON	5.6K	5%	1/6W
R17	RD14BB2C164J	RES. CARBON	160K	5%	1/6W
R18	RD14BB2C132J	RES. CARBON	1.3K	5%	1/6W
R19	RD14BB2C823J	RES. CARBON	82K	5%	1/6W
R20	RD14BB2C470J	RES. CARBON	47	5%	1/6W
R21	RD14BB2C103J	RES. CARBON	10K	5%	1/6W
R22	RD14BB2C103J	RES. CARBON	10K	5%	1/6W
R23	RD14BB2C103J	RES. CARBON	10K	5%	1/6W
R24	RD14BB2C334J	RES. CARBON	330K	5%	1/6W
R25	RD14BB2C391J	RES. CARBON	390	5%	1/6W
R26	RD14BB2C222J	RES. CARBON	2.2K	5%	1/6W
R27	RD14BB2C682J	RES. CARBON	6.8K	5%	1/6W
R28	RD14BB2C102J	RES. CARBON	1K	5%	1/6W
R29	RN14BK2C6802F	RES. METAL FILM	68K	1%	1/6W
R30	RD14BB2C563J	RES. CARBON	56K	5%	1/6W
R31	RN14BK2E2204F	RES. METAL FILM	2.2M	1%	1/4W
R32	RN14BK2E2004F	RES. METAL FILM	2M	1%	1/4W
R33	RN14BK2E2204F	RES. METAL FILM	2.2M	1%	1/4W
R34	RN14BK2E2204F	RES. METAL FILM	2.2M	1%	1/4W
R35	RN14BK2E2204F	RES. METAL FILM	2.2M	1%	1/4W
R36	RN14BK2E2004F	RES. METAL FILM	2M	1%	1/4W
R37	RD14BB2C224J	RES. CARBON	220K	5%	1/6W
R38	RD14BB2C474J	RES. CARBON	470K	5%	1/6W
R39	NO USE				
R40	RD14BB2C101J	RES. CARBON	100	5%	1/6W
R41	RD14BB2E395J	RES. CARBON	3.9M	5%	1/4W
R42	RD14BB2E395J	RES. CARBON	3.9M	5%	1/4W
R43	RD14BB2E395J	RES. CARBON	3.9M	5%	1/4W
R44	RD14BB2E225J	RES. CARBON	2.2M	5%	1/4W
R45	RD14BB2E225J	RES. CARBON	2.2M	5%	1/4W
R46	RD14BB2E225J	RES. CARBON	2.2M	5%	1/4W
R47	RD14BB2E205J	RES. CARBON	2M	5%	1/4W
R48	RD14BB2E205J	RES. CARBON	2M	5%	1/4W
R49	RD14BB2E335J	RES. CARBON	3.3M	5%	1/4W
R50	RD14BB2C104J	RES. CARBON	100K	5%	1/6W
R51	RD14BB2C473J	RES. CARBON	47K	5%	1/6W
R52	RD14BB2C7R5J	RES. CARBON	7.5	5%	1/6W
R53	RD14BB2C220J	RES. CARBON	22	5%	1/6W
R54	RD14BB2C100J	RES. CARBON	10	5%	1/6W
R55	RD14BB2C473J	RES. CARBON	47K	5%	1/6W
R56	RD14BB2C473J	RES. CARBON	47K	5%	1/6W
R57	RD14BB2C473J	RES. CARBON	47K	5%	1/6W
R58	RD14BB2E515J	RES. CARBON	5.1M	5%	1/4W
R61	RD14BB2C753J	RES. CARBON	75K	5%	1/6W
R62	RD14BB2C104J	RES. CARBON	100K	5%	1/6W
R63	RD14BB2C752J	RES. CARBON	7.5K	5%	1/6W
R81	RD14KB3A122J	RES. CARBON	1.2K	5%	1W
R82	RD14BB2C563J	RES. CARBON	56K	5%	1/6W
R83	RD14BB2C563J	RES. CARBON	56K	5%	1/6W
R84	RN14BK2C8202F	RES. METAL FILM	82K	1%	1/6W
R85	RD14BB2C101J	RES. CARBON	100	5%	1/6W
R86	RN14BK2C1002F	RES. METAL FILM	10K	1%	1/6W
R87	RD14BB2C470J	RES. CARBON	47	5%	1/6W
R88	RD14KB2H220J	RES. CARBON	22	5%	1/2W
R89	RD14KB2H220J	RES. CARBON	22	5%	1/2W
R90	RD14KB3A271J	RES. CARBON	270	5%	1W
R91	RD14BB2C154J	RES. CARBON	150K	5%	1/6W
R92	RD14BB2C103J	RES. CARBON	10K	5%	1/6W
R93	RD14BB2C103J	RES. CARBON	10K	5%	1/6W
R94	RD14BB2C104J	RES. CARBON	100K	5%	1/6W
R95	RD14BB2C104J	RES. CARBON	100K	5%	1/6W
R96	RD14BB2C224J	RES. CARBON	220K	5%	1/6W
R97	RD14BB2C474J	RES. CARBON	470K	5%	1/6W
R98	RD14BB2C474J	RES. CARBON	470K	5%	1/6W
R99	RD14BB2C471J	RES. CARBON	470	5%	1/6W
R100	NO USE				
R101	RN14BK2C7500F	RES. METAL FILM	750	1%	1/6W
R105	RN14BK2C6801F	RES. METAL FILM	6.8K	1%	1/6W
R121	RD14BB2C272J	RES. CARBON	2.7K	5%	1/6W
U1	KMA01	IC, LINEAR			
U2	NJM4558D	IC,DUAL OP AMP			
U31	TC4011BP	IC, QUAD 2-INPUT NAND GATE			
VR1	R12-1543-05	RES. SEMI FIXED 1KB			
VR2	R12-5528-05	RES. SEMI FIXED 100KB			
VR3	R12-5545-05	RES. SEMI FIXED 2.2MB			
VR81	R12-0567-05	RES. SEMI FIXED 500 B			
W1	W02-0474-05	HIGH VOLTAGE BLOCK			

CRT SOCKET UNIT

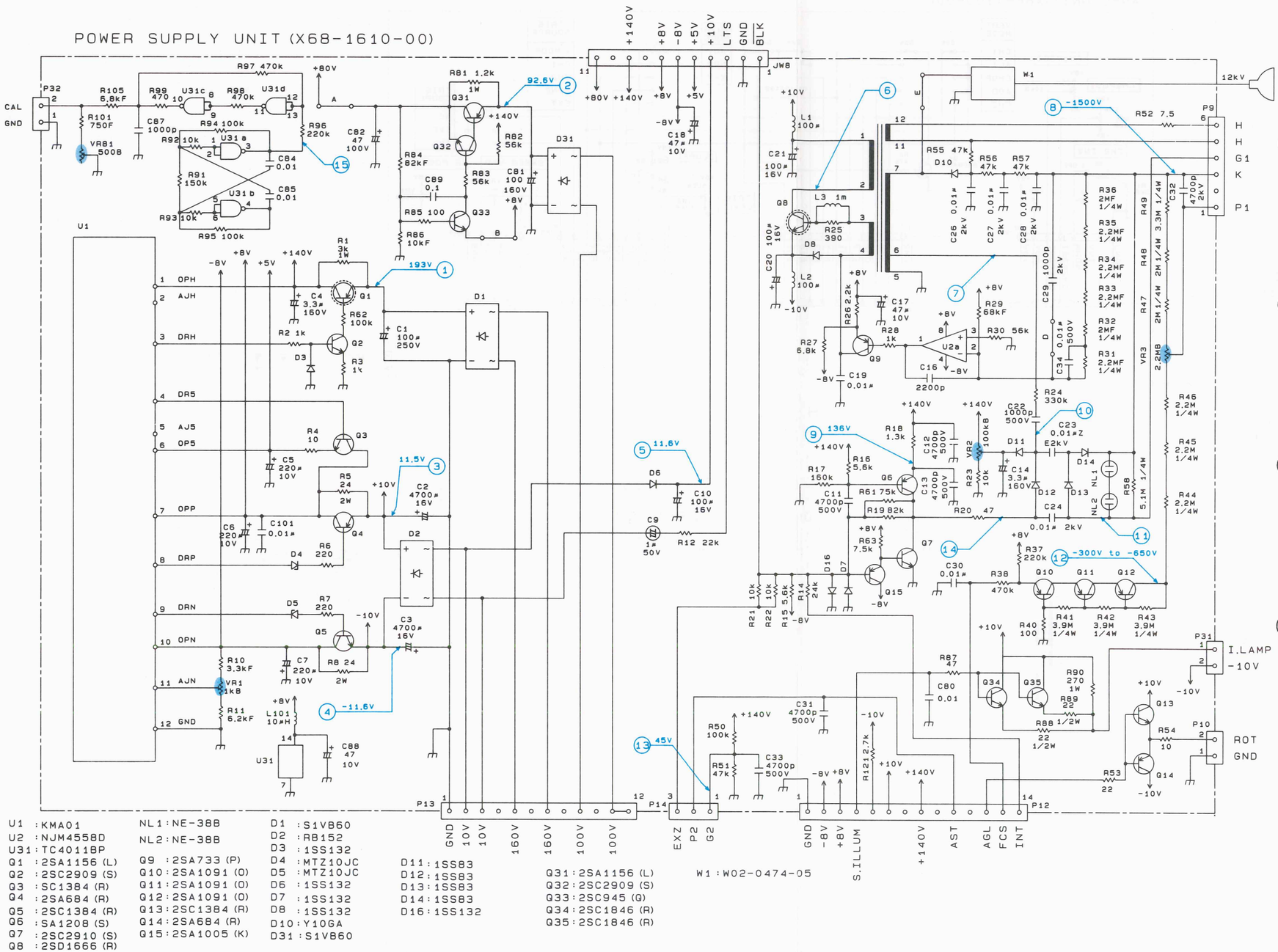
(X81-2960-00)

REF.NO	PARTS NO	NAME & DESCRIPTION			
	E01-0103-05	CRT SOCKET			
	E38-0250-05	WIRE ASS'Y;HIGH VOLTAGE			
	J73-0048-22				
C101	CC45CH2H010C	CAP. CERAMIC	1P	0.25P	500V
JW6	E31-5885-05	WIRE ASS'Y			
JW7	E31-5886-05	WIRE ASS'Y			
JW12	E38-0249-05	WIRE ASS'Y			
JW33	E38-0259-05	WIRE ASS'Y			
L101	L40-4782-70	FERRI INDUCTOR	0.47UF	20%	
L102	L40-4782-70	FERRI INDUCTOR	0.47UF	20%	
P14	E40-3237-05	PIN CONNECTOR	2P		
P15	E40-0218-05	PIN CONNECTOR	2P		
R1	RD14BB2C561J	RES. CARBON	560	5%	1/6W
R101	RD14BB2C151J	RES. CARBON	150	5%	1/6W
R102	RD14BB2C151J	RES. CARBON	150	5%	1/6W
VR1	R12-5540-05	RES. SEMI FIXED	100KB		
VR2	R12-3563-05	RES. SEMI FIXED	10KB		
VR3	R05-3522-05	V.R.			
VR4	R29-3506-05	V.R.			

SCHEMATIC DIAGRAM



SCHEMATIC DIAGRAM/WAVEFORM POWER SUPPLY UNIT (X68-1610-00)



U1 : KMA01
U2 : NJM4558D
U31 : TC4011BP
Q1 : 2SA1156 (L)
Q2 : 2SC2909 (S)
Q3 : SC1384 (R)
Q4 : 2SA684 (R)
Q5 : 2SC1384 (R)
Q6 : SA1208 (S)
Q7 : 2SC2910 (S)
Q8 : 2SD1666 (R)

NL1 : NE-38B
NL2 : NE-38B

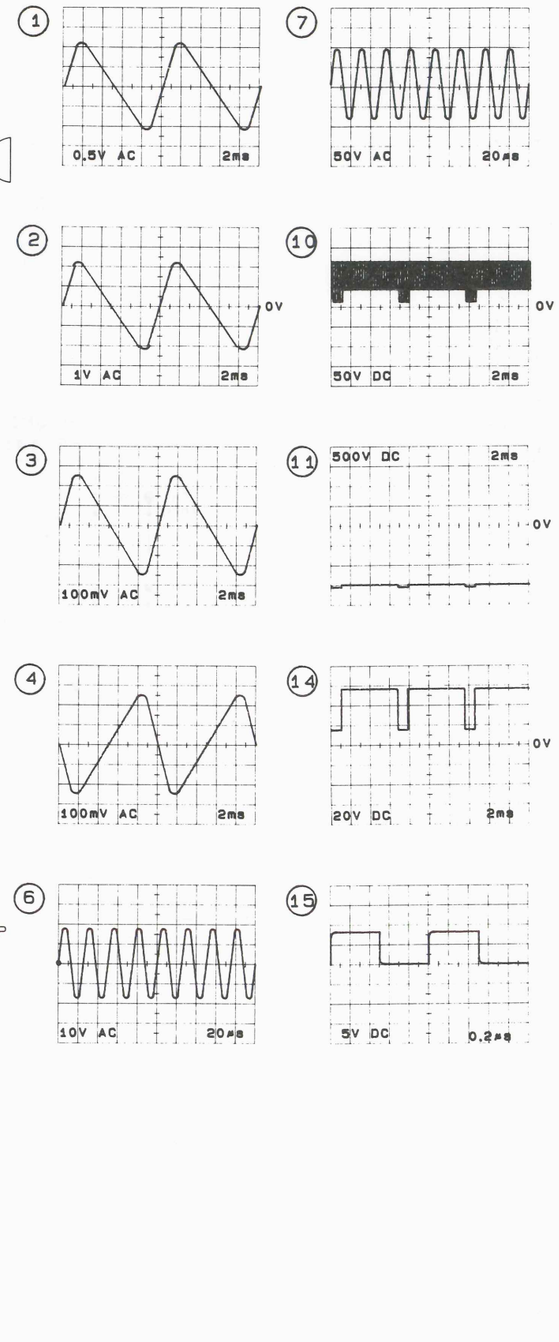
Q9 : 2SA733 (P)
Q10 : 2SA1091 (O)
Q11 : 2SA1091 (O)
Q12 : 2SA1091 (O)
Q13 : 2SC1384 (R)
Q14 : 2SA684 (R)
Q15 : 2SA1005 (K)

D1 : S1VB60
D2 : RB152
D3 : 1SS132
D4 : MTZ10JC
D5 : MTZ10JC
D6 : 1SS132
D7 : 1SS132
D8 : 1SS132
D10 : Y10GA
D31 : S1VB60

D11 : 1SS83
D12 : 1SS83
D13 : 1SS83
D14 : 1SS83
D16 : 1SS132

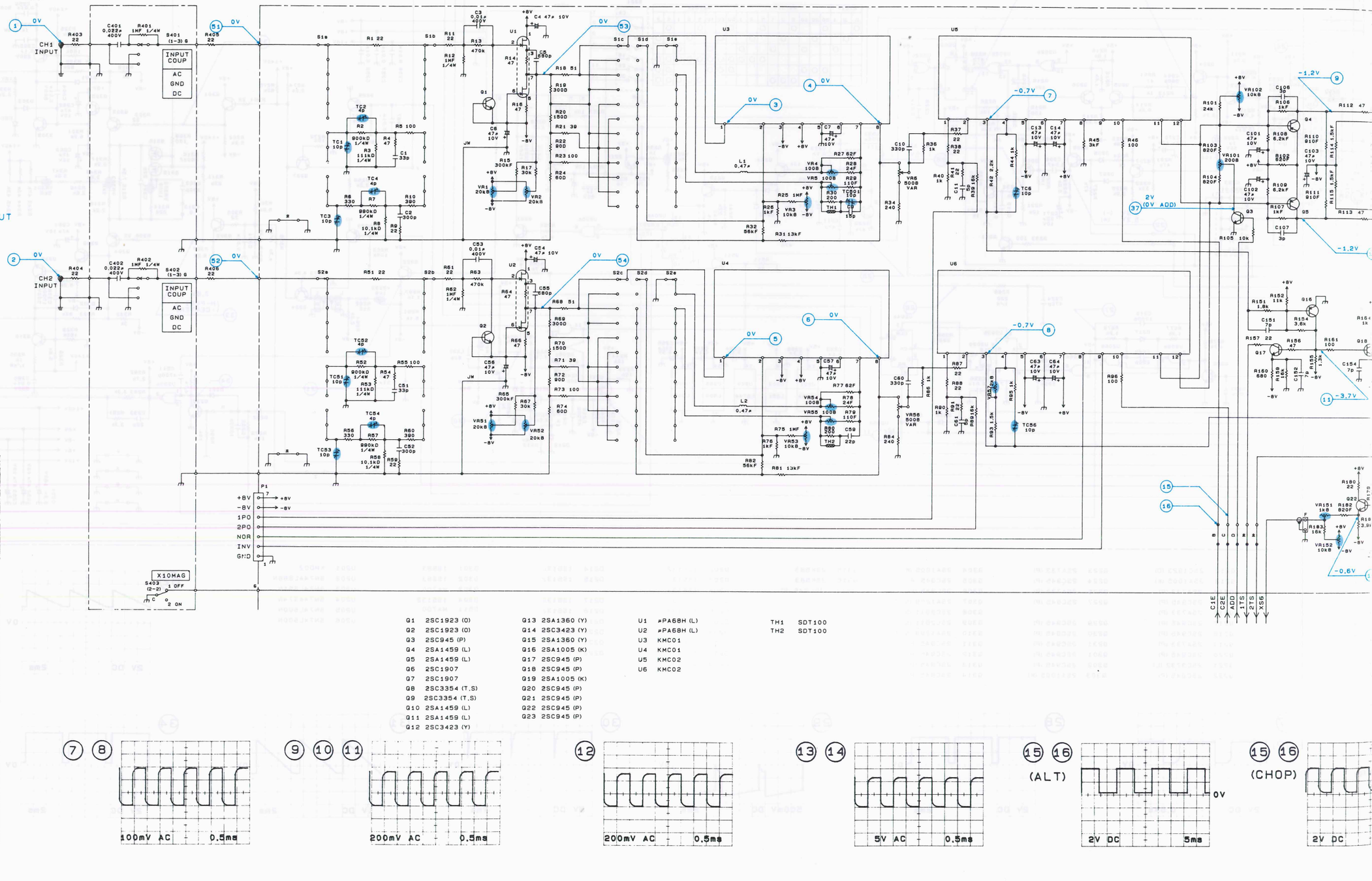
Q31 : 2SA1156 (L)
Q32 : 2SC2909 (S)
Q33 : 2SC945 (Q)
Q34 : 2SC1846 (R)
Q35 : 2SC1846 (R)

W1 : W02-0474-05



SCHEMATIC DIAGRAM/WAVEFORM VERTICAL & HORIZONTAL UNIT (X65-1410-00)(1/2)

V.H UNIT (X65-1410-00)



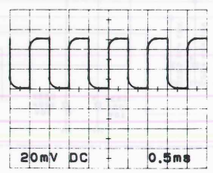
TEST WAVE (ATT:10mV/DIV)

50mVpp 1kHz INPUT

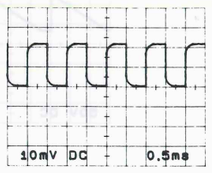
60mVpp CMP.SIG INPUT

Q1	2SC1923 (O)	Q13	2SA1360 (Y)	U1	μPA68H (L)
Q2	2SC1923 (O)	Q14	2SC3423 (Y)	U2	μPA68H (L)
Q3	2SC945 (P)	Q15	2SA1360 (Y)	U3	KMC01
Q4	2SA1459 (L)	Q16	2SA1005 (K)	U4	KMC01
Q5	2SA1459 (L)	Q17	2SC945 (P)	U5	KMC02
Q6	2SC1907	Q18	2SC945 (P)	U6	KMC02
Q7	2SC1907	Q19	2SA1005 (K)		
Q8	2SC3354 (T,S)	Q20	2SC945 (P)	TH1	SDT100
Q9	2SC3354 (T,S)	Q21	2SC945 (P)	TH2	SDT100
Q10	2SA1459 (L)	Q22	2SC945 (P)		
Q11	2SA1459 (L)	Q23	2SC945 (P)		
Q12	2SC3423 (Y)				

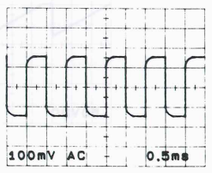
1 2 / 51 52



3 5 / 53 54



4 6



7 8

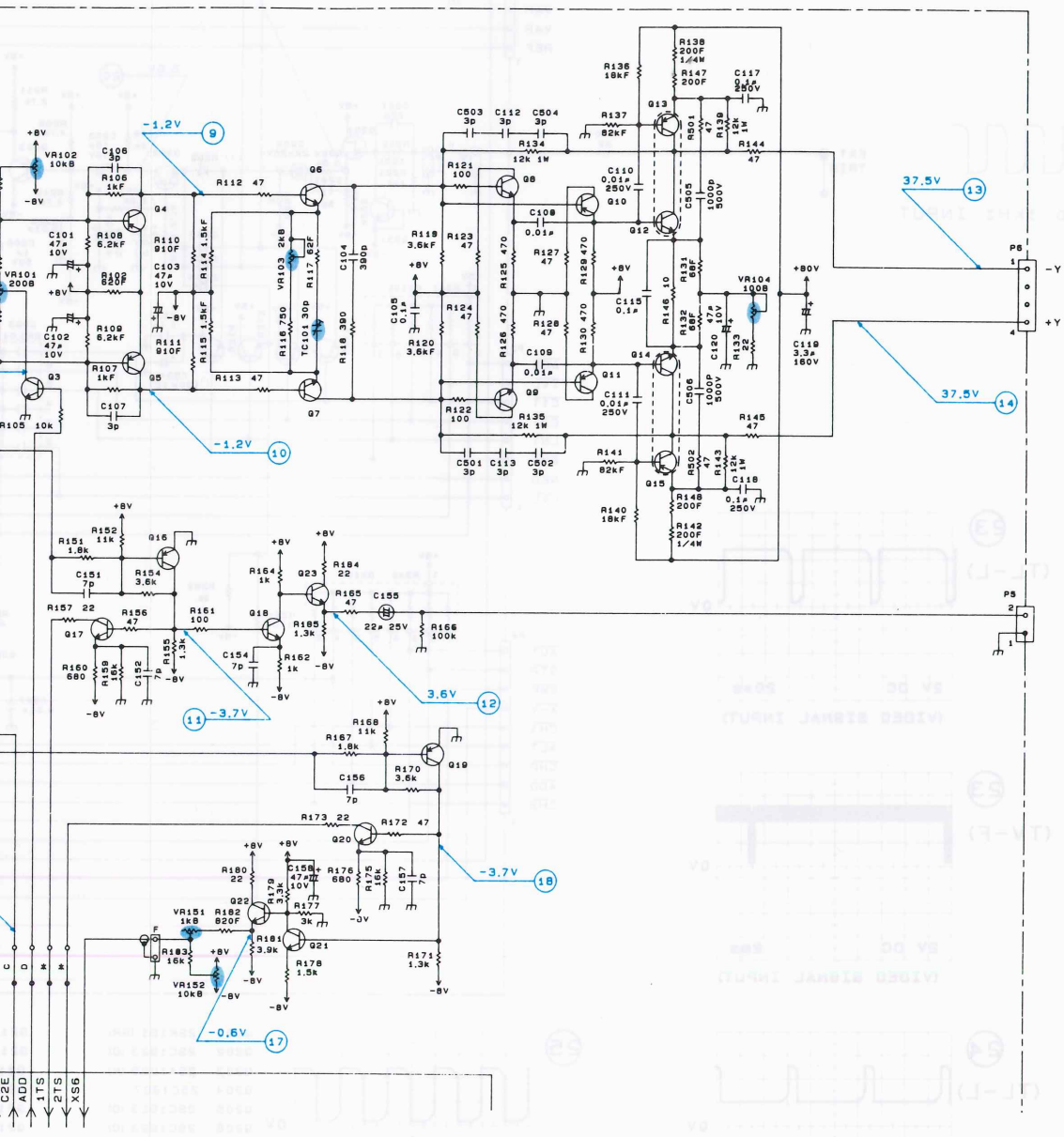
9 10 11

12

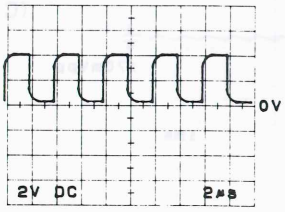
13 14

15 16 (ALT)

15 16 (CHOP)



15 16 (CHOP)



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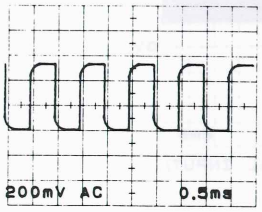
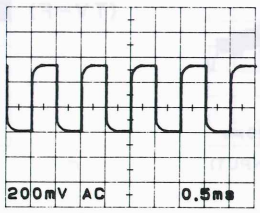
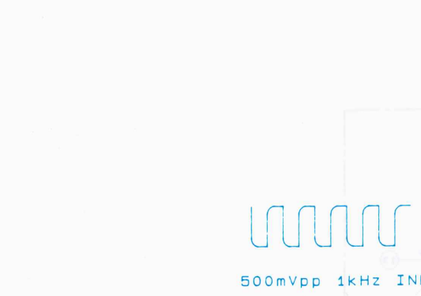


18



SCHEMATIC DIAGRAM/WAVEFORM VERTICAL & HORIZONTAL UNIT (X65-1410-00)(2/2)



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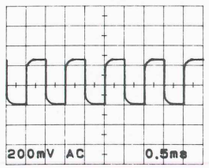
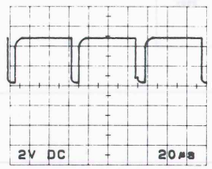
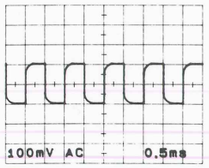
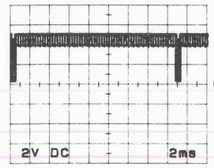


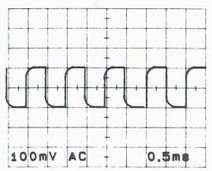
23 (TL-L)


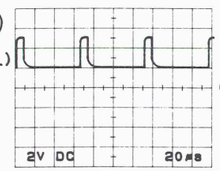
(VIDEO SIGNAL INPUT)

20


23 (TV-F)


(VIDEO SIGNAL INPUT)

21


24 (TL-L)


(VIDEO SIGNAL INPUT)

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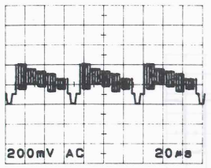
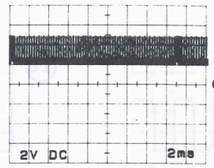


(VIDEO SIGNAL INPUT)

24 (TV-F)


(VIDEO SIGNAL INPUT)

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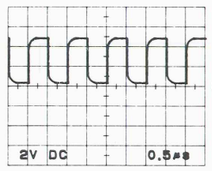

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Q202	2SC1923 (O)	Q213	2SA1005 (K)	Q224	2SC945 (P)	Q305	2SC945 (P)	Q316	2SK583
Q203	2SA1005 (K)	Q214	2SA733 (P)	Q226	2SA733 (P)	Q306	2SC945 (P)	Q511	2SC945 (P)
Q204	2SC1907	Q215	2SC945 (P)	Q227	2SC945 (P)	Q307	2SA1209 (S, T)		
Q205	2SC1923 (O)	Q216	2SA733 (P)			Q308	2SC2911 (S, T)		
Q206	2SC1923 (O)	Q217	2SC945 (P)	Q229	2SC945 (P)	Q309	2SC2911 (S, T)		
Q207	2SA733 (P)	Q218	2SC945 (P)	Q230	2SC945 (P)	Q310	2SA1209 (S, T)		
Q208	2SC945 (P)	Q219	2SA733 (P)	Q231	2SC945 (P)	Q311	2SC945 (P)		
Q209	3SA733 (P)	Q220	2SC945 (P)	Q301	2SC945 (P)	Q312	2SC945 (P)		
Q210	2SA733 (P)	Q221	2SC3732 (L)	Q302	2SC945 (P)	Q313	2SC945 (P)		
Q211	2SC945 (P)	Q222	2SC945 (P)	Q303	2SA1005 (K)	Q314	2SC945 (P)		

D202	1SS132	D214	1SS132	D301	1SS83
D203	1SS132	D215	1SS132	D302	1SS83
D204	1SS132			D303	MA700
D205	1SS132	D217	1SS132	D304	1SS132
D206	1SS132	D218	1SS132	D511	MA700
D207	1SS132	D219	1SS132		
D209	1SS132	D220	1SS132		
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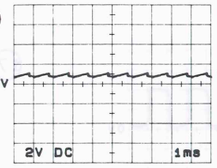
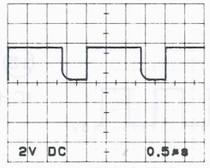
D212	1SS132	D222	1SS132		
D213	1SS132				

26


170mVpp

27 (CHOP)


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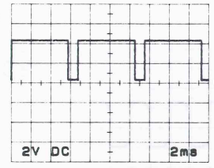

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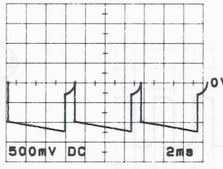

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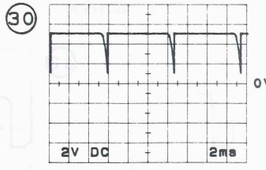

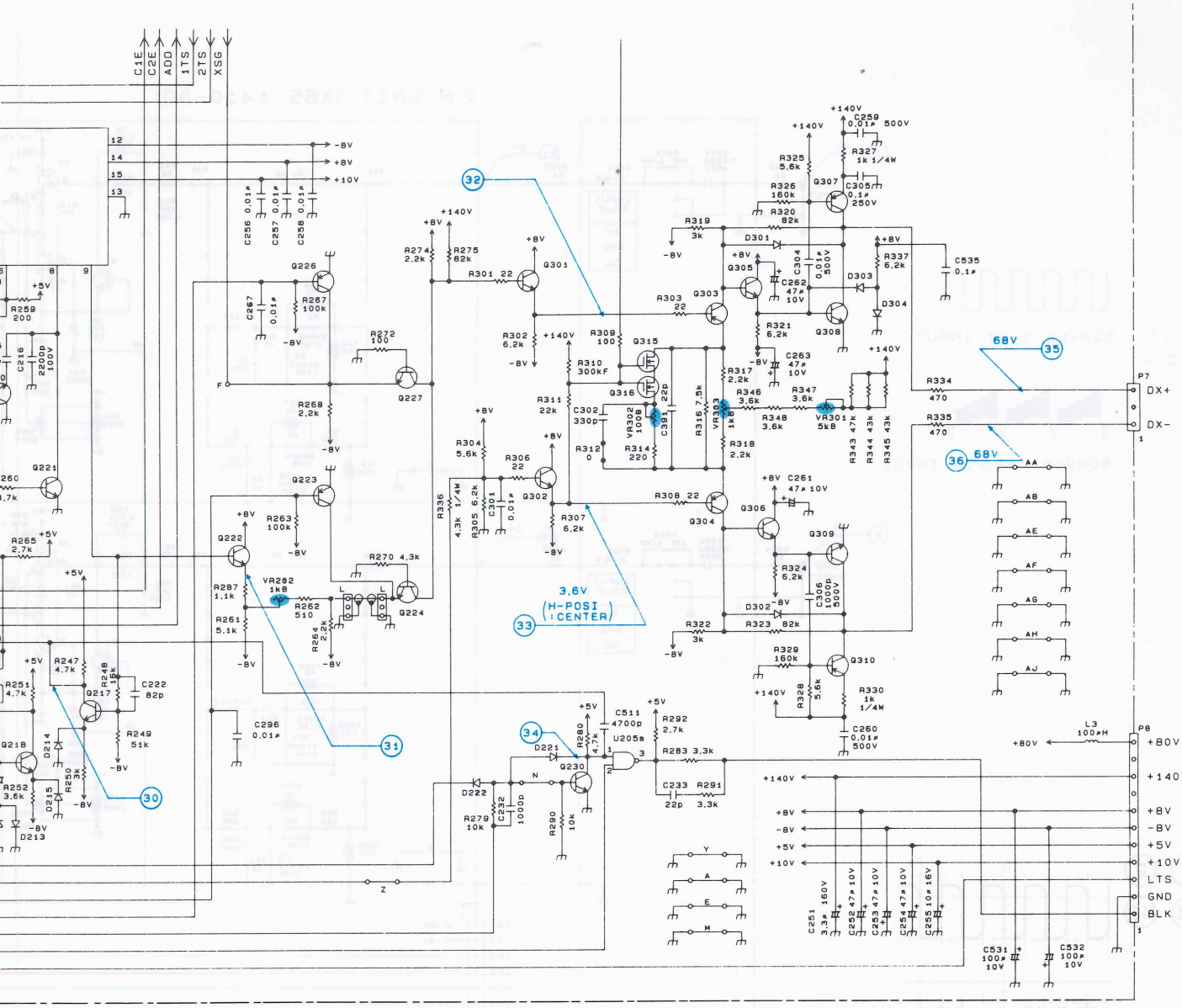

D301	1SS83	U201	KMD02
D302	1SS83	U202	SN74ALS86N
D303	MA700	U203	SN74LS51N
D304	1SS132	U204	SN74AS74N
D511	MA700	U205	SN74LS00N
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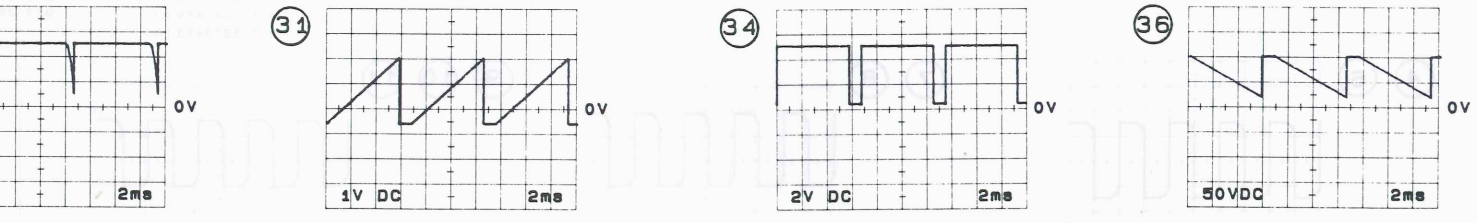
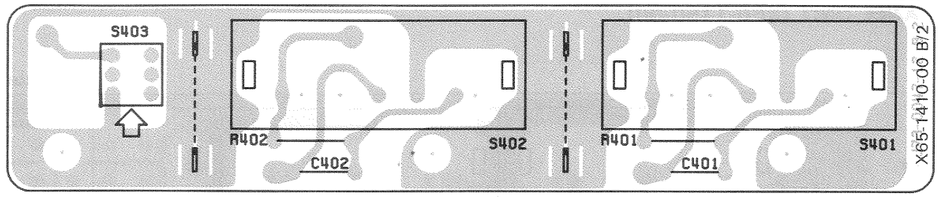
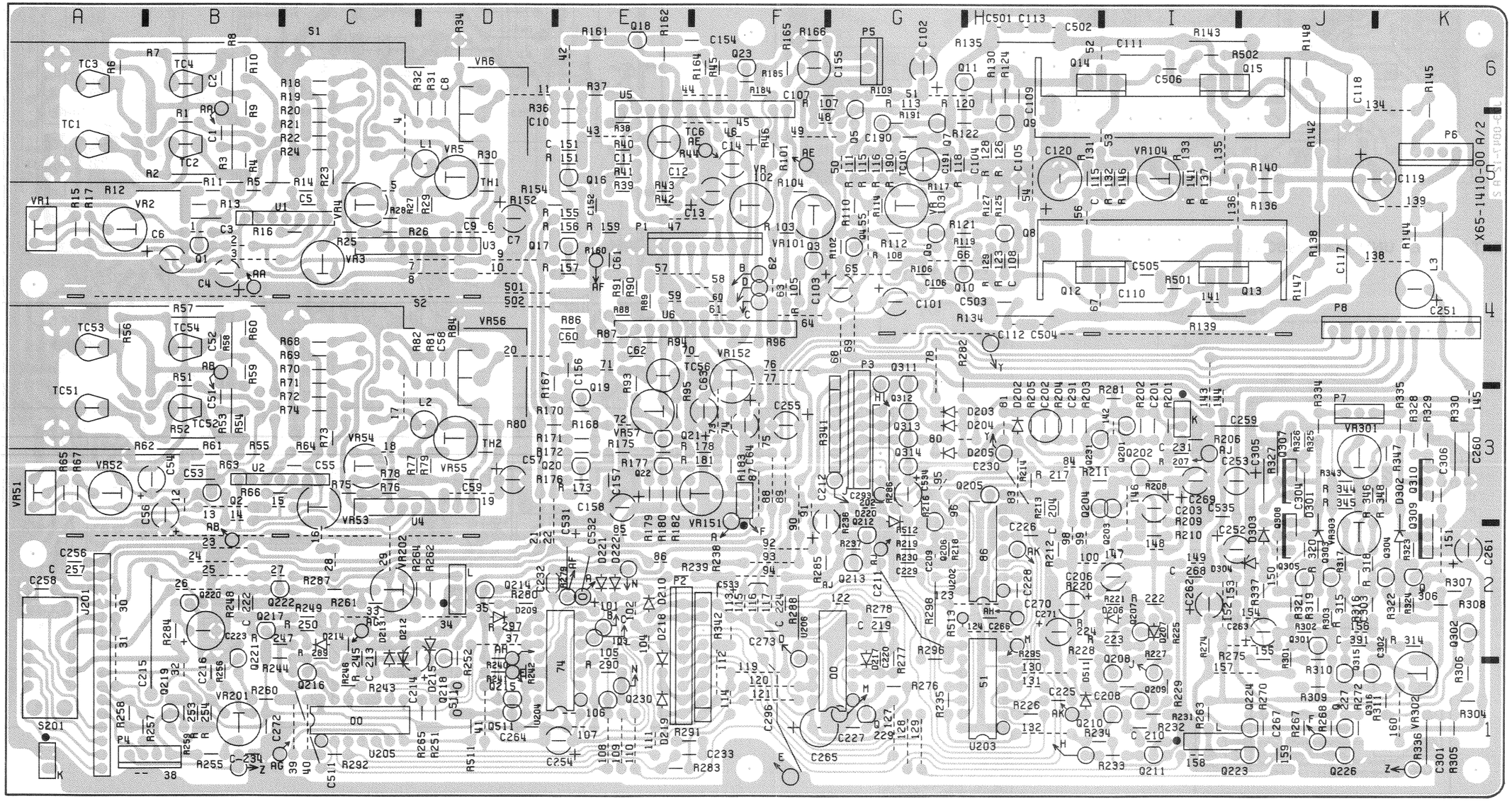


P.C. BOARD

VERTICAL&HORIZONTAL UNIT (X65-1410-00)

Pattern side view

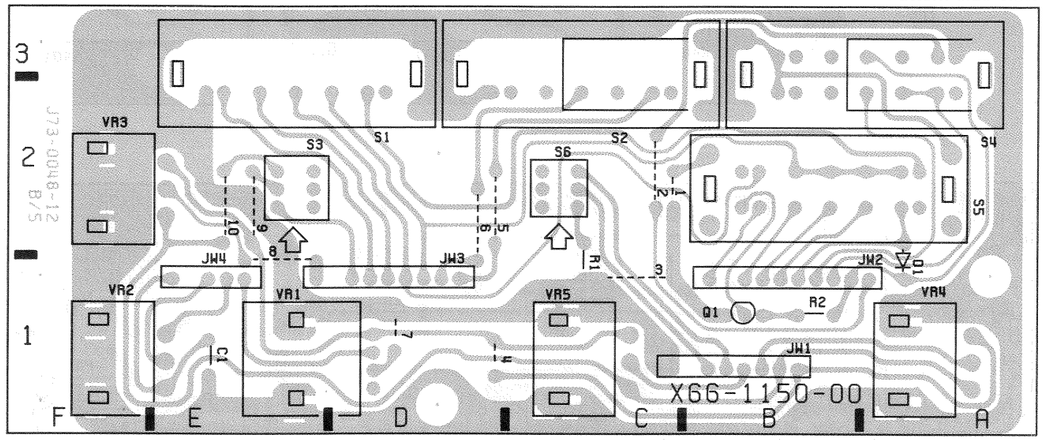




P.C. BOARD

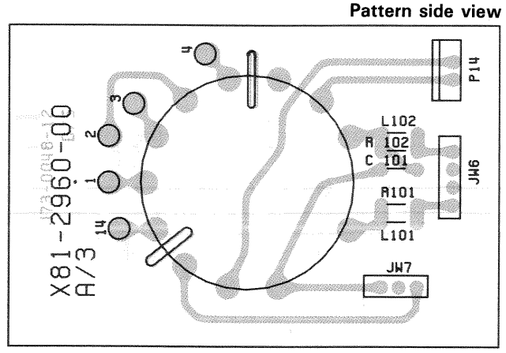
PANEL UNIT (X66-1150-00)

Pattern side view

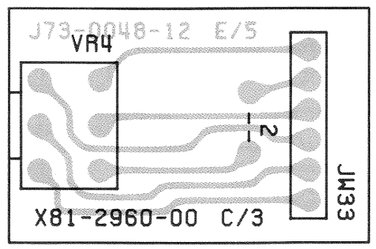


CRT SOCKET UNIT (X81-2960-00)

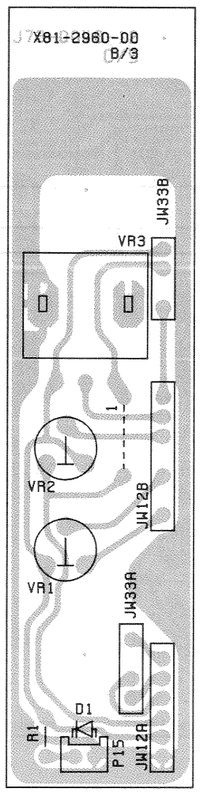
Pattern side view



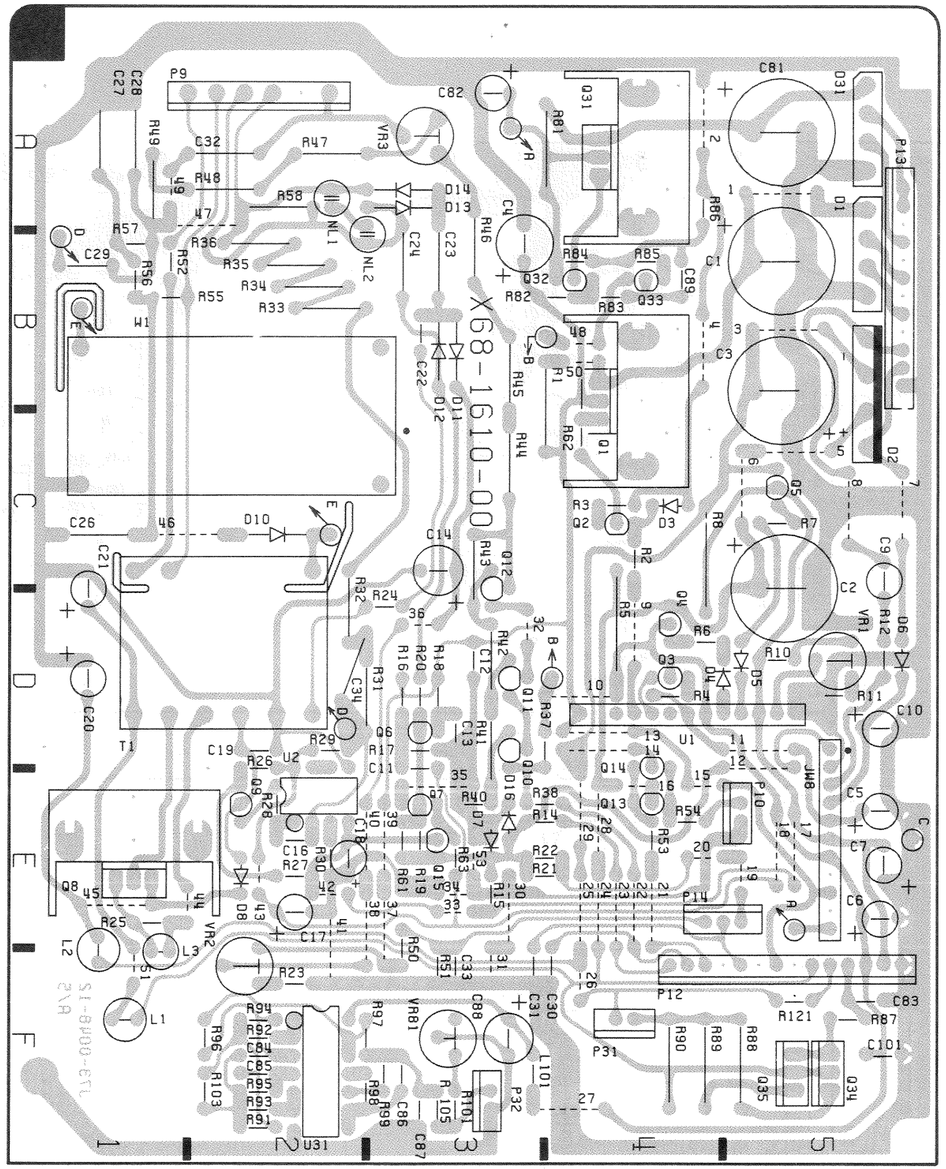
Pattern side view



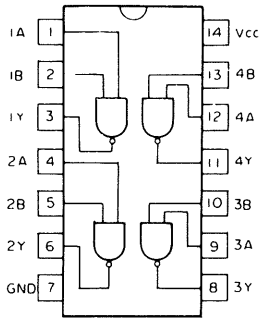
Pattern side view



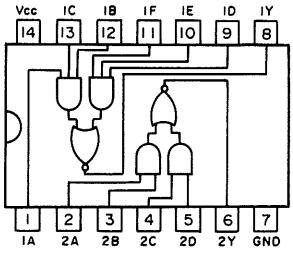
POWER SUPPLY UNIT (X68-1610-00)



SEMICONDUCTORS



SN74LS00N



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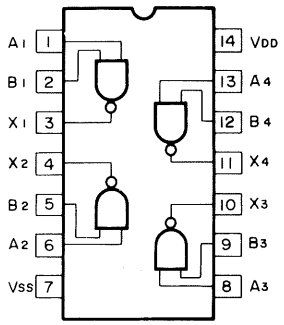
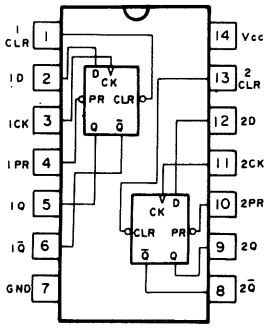
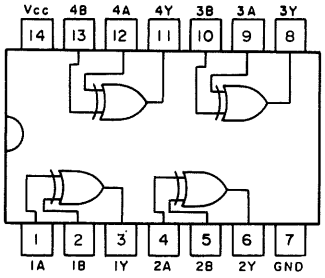


TC4011BP



SN74AS74AN



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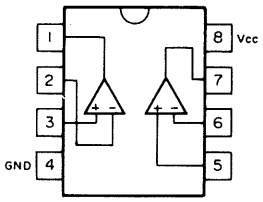

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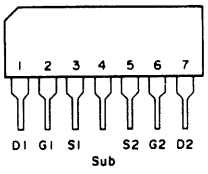
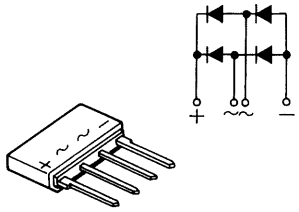
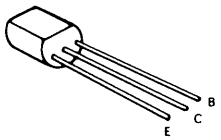


μPA68H(L)

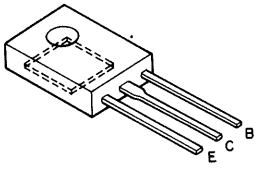


S1VB20
S1VB60

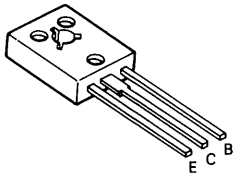


2SA684(R)
2SA733(P)
2SA1005(K)
2SA1091(O)
2SA1208(S)
2SC945(P)

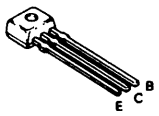
2SC1384(R)
2SC1923(O)
2SC2909(S)
2SC2910(S)
2SC945(Q)
2SC1907



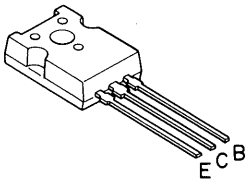
2SA1156(L)



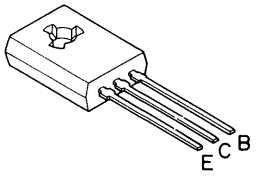
2SA1209(S,T)
2SC2911(S,T)



2SA1459(L)
2SC3732(L)



2SA1360(Y)
2SC3423(Y)



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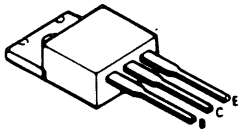
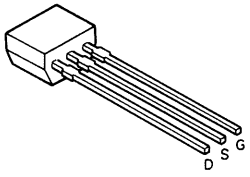


2SD1666(R)



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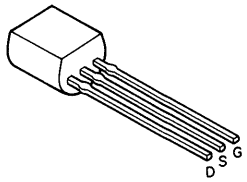

2SK583

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