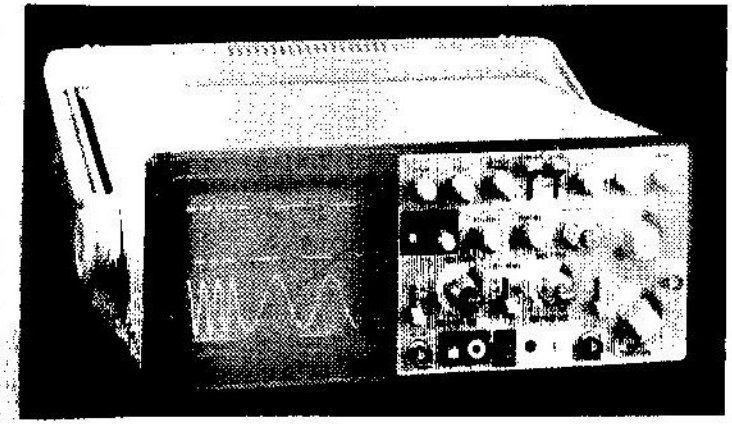
TINSE0003S4

SERVICE-MANUAL

20MHz OSCILLOSCOPE



PINTEK

PS-200 **PS-201** **PS-205**

INDEX

1. GENERAL

1-1 DESCRIPTION

The model PS-200/201/205 oscilloscope is a dual-channel oscilloscope with frequency bandwidth DC to 20 MHz at −3dB, maximum sweep time 10 nsec/DIV, and maximum sensitivity 1 mV/DIV. Waveforms are accurately presented on the oscilloscope's 150 mm rectangular CRT screen with internal graticule. Model PS-201 has illumination, component test, and beam find functions more than model PS-200. Model PS-205 has delay sweep, two sweep mix, CHB output, and Z-modulation besides functions of model PS-201.

The oscilloscope is rugged, easy to operate, and exhibits a high operation reliability. These models provide many conveninent features and special functions which make itself be an ideal instrument for diversified types of research, production, education, and development of electronic equipment or circuitry.

1-2 CHARACTER

(1) Easy to operate
Locations of all switchs and functions are laid out taking purposes and frequencies of their uses into consideration.

(2) High input impedance
The CHA and CHB have the same input impedance. The input impedance of CHA, CHB is 1MΩ +/− 2%, 25PF +/− 10PF, allowing the use of 10X probes.

(3) Variable holdoff function
Signals with complex repeating periods which resist triggering can be stably triggered with a simple adjustment of the hold off level.

(4) 2 channel X-Y operation
X-Y waveform analysis is achieved by switching the CHA signal into horizontal deflection circuits and the CHB signal into the vertical deflection circuits.

(5) 2 sweep mix function
The main sweep and the delayed sweep can be viewed at the same time.

(6) CHB output (PS-205 only)
Its output is on rear panel of model PS-205. The CHB signal output allows connection to frequency counters and other devices.

(7) Z-modulation connector (PS-205 only)
Its input is on rear panel of model PS-205. Input terminal is used for external intensity modulation signal.

(8) Ext trig input jack
For introducing an external signal for use as a trigger signal. TRIGGER SOURCE switch must be in EXT position for external trigger signal to work.

(9) Trigger of TV sync.
The oscilloscope has a sync separator circuit, which allows triggering for TV. V signal and TV. H signal.

(10) Feature
- 1mV/DIV MAX. VERT. SENSITIVITY.
- 15V/DIV MIN. VERT. SENSITIVITY.
- 10nS/DIV MAX. SWEEP RATE.
- BUILT-IN CONPONENT TESTER. (PS-201/205 only)
- BEAM FINDER, HOLD-OFF, ILLUMINATE.
- WITH DELAY SWEEP. (PS-205 only)
- TWO SWEEP MIX FUNCTION. (PS-205 only)
- 100V/120V/220V/240V POWER SOURCE.

2 SPECIFICATION

CATHODE RAY TUBE

150mm rectangular screen with internal graticule
8*10 DIV, 10mm/DIV P31 phosphor, 2.1KV Accel. Voltage

VERTICAL DEFLECTION(Y)

Bandwidth	DC – 20MHz (–3dB), DC – 30MHz (–6dB)
Sensitivity	1mV/DIV (10MHz, –3dB)
Attenuator	5mV/DIV – 5V/DIV on 1-2-5 sequence, 10 ranges +/– 3% x5 MAG +/– 5%, variable control with 3:1 (15mV/DIV – 15V/DIV)
Input Impedance	1MΩ +/– 2%, 25PF +/– 10PF
Max. Input	400V (DC+AC peak)
Rise TIme	About 17.5nS
Over Shoot	Less than 5% (1KHz SQU. WAVE)
Operation Mode	CHA, CHB, DUAL, alternate, chopped (approx. 500KHz)
Algebraic Addition	CHA+CHB, CHA-CHB
Inverter	CHB only

HORIZONTAL DEFLECTION(X)

Operation Mode	X-Y mode CHA: X axis CHB: Y axis
Bandwidth	DC – 1MHz (–3dB)
Phase Shift	Less than 3° at 50KHz

TIMEBASE SYSTEM

Horizontal Display: Main, Mix (both main sweep and delay sweep display), Delay. (PS-205 only)
Hold Off Time: 5:1 continuously variable (.1μS/DIV)

MAIN TIMEBASE

Sweep Rate	.2S/DIV – .1μS/DIV, 20 steps, in 1-2-5 sequence
Accuracy	+/– 3%
Variable Time Control	5:1, uncalibrated, continuously variable between steps and to at least 1S/DIV.
Magnifier	*10 additional error +/– 10%, extend sweep rate up to

	10nS/DIV
DELAY TIMEBASE	(PS-205 only)
Sweep Rate	.2S/DIV – .1μS/DIV, 20 steps in 1-2-5 sequence
Accuracy	+/– 3%
Magnifier	*10 additional error +/– 10% extend sweep rate up to 10nS/DIV
Delay Time Position	Variable control to locate desirable waveform for extending

TRIGGERING SENSITIVITY

SYNC.	BANDWIDTH	INT	EXT
TV-V	DC – 1KHz	More than 0.5 DIV	⩾0.05Vp-p
TV-H	1KHz – 100KHz	More than 0.5 DIV	⩾0.05Vp-p
AUTO	100Hz – 40MHz	More than 1.5 DIV	⩾0.1Vp-p
NORM	100Hz – 40MHz	More than 1.5 DIV	⩾0.1Vp-p

SYNCHRONIZATION

Source	CHA, CHB, LINE, EXT, ALT
Slope	+/–
Coupling	AUTO, NORM, TV-V, TV-H

COMPONENT TESTER	(PS-201, PS-205 only)
Test Voltage	Max. 6 Vrms (open circuit)
Test Current	Max. 11mA (Shorted)
Test Freq.	Line Frequency
Components	Capacitor, Inductor, Diode, Thyristor, Transistor, Zener, etc.

GENERAL.

CHB Output (PS-205 only)	Output level 100mV/DIV (no load) 50mV/DIV (with 50 load) Bandwidth: 20Hz – 20MHz (–3dB)
Graticule Illumination	Adjustable (PS-205, PS-201 only)
Beam Finder (PS-205 PS-201 only)	Compresses trace for ease in locating off-screen signals
Calibrator	About 1KHz, 2Vp-p +/– 3%. Square wave
Z-Modulation (PS-205 only)	Positive TTL signal, low level blank intensity at any intensity, high level unblank any intensity
Trace Rotation	Adjustable on front panel
Power Source	110V, 125V, 220V, 240V AC, 50/60Hz
Power Consumption	Approx. 40 Watts (maximum)
Dimensions	324(W)*398(D)*132(H)mm (body)
Net Weight	Approx. 7.6kg
Rated Range of Use	10°C – 35°C, 10 – 80% R.H.
Limits of Operation	0°C – 50°C, 10 – 80% R.H.
Storage Environment	–30°C – 70°C, 10 – 90% R.H.

*The specifications are subject to change without notice.

3. NOTICE BEFORE OPERATING

3-1 Unpack the oscilloscope

Upon receipt of the instrument, immediately unpack and inspect it for any damage which might have been sustained when in transportation or shortage of accessories. If any sign of damage and shortage of accessories are found, immediately notify the dealer.

3-2 Environments

Normally operational temperature of the oscilloscope is 10° to 35°C (50° to 95°F). Operation of the instrument outside of this temperature range may cause damage to the circuits.

Do not use the instrument in a place where strong magnetic or electric field exists. Such fields may disturb the measurement.

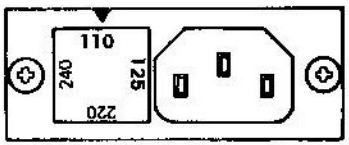
3-3 Check the Line Voltage

The oscilloscope can operate on any one of the line voltages shown in the below table, by inserting the line voltage selector plug in the corresponding position on the rear panel. Before connecting the power plug to an AC line outlet, be sure to check that the voltage selector plug is set in the correct position corresponding to the line voltage. Note the oscilloscope may not properly operate or may be damaged if it is connected to a wrong voltage AC line.

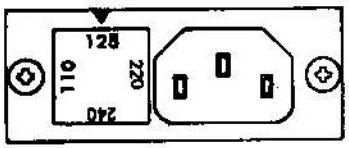
When line voltages are changed, replace fuses also as required.

Nominal voltage	Voltage tolerance	Fuse
110 V	99 – 121 V	800mA
125 V	110 – 137 V	
220V	198 – 242 V	600mA
240 V	216 – 264 V	

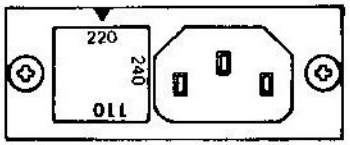
Voltage selector plug on rear panel of instrument is shown below.



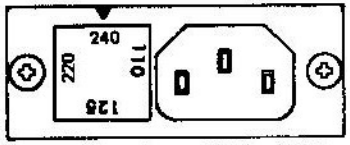
Line Voltage Range: 99 V ~ 121 V
Fuse: 800mA
Selector: 110 V



Line Voltage Range: 110 V ~ 137 V
Fuse: 800mA
Selector: 125 V



Line Voltage Range: 198V ~ 242V
Fuse: 600mA
Selector: 220V



Line Voltage Range: 216V ~ 264V
Fuse: 600mA
Selector: 240V

3-4 CRT Intensity

In order to prevent permanent damage to the CRT phosphor, do not make the CRT trace excessively bright or leave the spot stationary for an unreasonably long time.

3-5 Operating within maximum signal input limits

The maximum input voltage of each input connector and probe input is shown in the following table. NEVER apply a voltage higher than specified.

Input terminal	Maximum allowable input voltage
CHA, CHB, inputs	400 Vpeak (DC + AC peak)
EXT TRIG input	300 Vpeak (DC + AC peak)
Probe inputs (X10)	600 Vpeak (DC + AC peak)
Z-Modulation input	30 Vpeak (DC + AC peak)

3-6 Hints for operating oscilloscope

Observe the following suggestions for successful instrument operation:

- NEVER place heavy objects on oscilloscope.
- NEVER operate with input voltages exceeding maximum limits.
- Do not insert wires, pins, or other metal objects into ventilation holes.
- NEVER place a hot soldering iron on or near the cabinet or especially near the CRT screen.
- Do not place a magnet or magnetic generating device near the cabinet.
- Do not move or pull oscilloscope with power cord or input probe cord. Especially never move instrument when power cord or signal input lead is connected to a circuit.

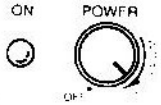
4. OPERATING CONTROLS, INDICATORS, AND CONNECTORS

4-1 FRONT PANEL;

Fig 4-1/4-2/4-3 show the model PS-200/201/205 oscilloscope front panel operating controls, indicators, and signal input connectors.

○ CRT circuits:

POWER . . . . . (30) Main power switch of the instrument. When this switch is turned on, the LED (32) above the switch is also turned on.



ILLUM . . . . . (30) Graticule illumination adjustment (PS-201/205 only).

INTENSITY control . . . . . (31) Controls brightness of display. Clockwise rotation increases brightness.

FOCUS control. . . . . (28) After obtaining appropriate brightness with INTENSITY, adjust FOCUS for clearest line.

BEAM FIND pushbutton . . (12) Brings beam trace to center area of screen regardless of location (PS-201/205 only).

TRACE ROTATION. . . . . (29) Semi-fixed potentiometer for aligning the horizontal trace in parallel with graticule lines.

Bezel. . . . . (33) For installing a camera mount in one-touch operation.

Filter . . . . . (34) Gray filter for ease of waveform viewing. Can be removed in onetouch operation.

○ Vetical axis:

CHA (X) input . . . . . (1) Vertical input terminal of CHA. During X-Y operation, this becomes X-axis (abscissa) input terminal.

CHB (Y) input . . . . . (13) Vertical input terminal of CHB. During X-Y operation, this becomes Y-axis (ordinate) input terminal.

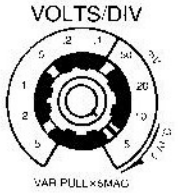
DC/GND/AC switches . . (2)(14) Selects following input coupling options for CHA(1), CHB (13):

DC: dc coupling, all signal are directly connected to attenuator.

GND: input signal is switched off and attenuator is grounded.

AC: blocks dc signal component allowing only AC signal to pass into attenuator.

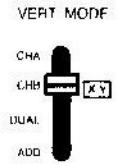
CH1/CH2 VOLT/DIV switches. . . . . (4)(10) CHA(X)/CHB(Y) attenuator. Selects deflection factor from 5v/div to 5mv/div (1-2-5 sequence, 10 positions).



VARIABLE . . . . . (5)(11) Fine adjustment of sensitivity, with a factor of 1/3 or lower of the panel-indicated value. At the CAL'D position, sensitivity is calibrated to the panel-indicated value. When this knob is pulled out (x5 MAG state), the amplifier sensitivity is multiplied by 5 times.

POSITION . . . . . (25) CHB vertical position control of trace or spot. Pulling up position is inverter.

VERT MODE . . . . . (7) Selects the operation mode of the vertical axis.
CHA: CHA operates alone.
CHB: CHB operates alone and X-Y switch.
DUAL: Dual-channel operation with CHA and CHB swept alternately. Suitable for observation with fast sweep speeds.
CHOP: The operation between channels chopped at a frequency of approximately 500 kHz of displayed channels. Suitable for observation with slow sweep speeds. When use chop, pull up HOLDOFF switch.
ADD: For measurement of algebraic sum or difference of CHA and CHB signals, employing the function of CHB PULL INV switch.

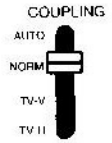


○ Triggering

TRIGGER SOURCE switch . . . . . (23) Four positions switch:
CHA: A sample of signal derived from CHA input connector is used as one of a trigger signal and X-Y or ALT TRIG.
CHB: A sample of signal derived from CHB input connector is used as a trigger signal.
LINE: AC line signal is used as the trigger signal.
EXT: Trigger signal is obtained from EXT TRIG connector.

EXT TRIG . . . . . (16) This terminal is used in common for external triggering signal and external horizontal signal. To use this terminal, set SOURCE switch 23 to the EXT position.
input terminal

TRIGGER COUPLING switch . . . . . (24) Chooses trigger type:
AUTO: Automatically operates trigger action. Trigger level is obtained from trigger signal peak-to-peak value. TRIG LEVEL control is adjusted to a level within peak range of signal. Bandwidth is 100 ~ 40MHz when signal is more than 1 DIV and level between −5V ~ +5V.
NORM: Trigger level range is obtained by adjusting TRIG LEVEL control. Bandwidth is 100 ~ 40MHz when signal is more than 1 DIV and level between −5V ~ +5V.
TV-V: Trigger bandwidth range is DC ~ 1KHz when signal is more than 1 DIV and level between −5V ~ +5V.
TV-H: Trigger bandwidth range is 1KHz ~ 100KHz when signal is more than 1 DIV and level between −5V ~ +5V.



SLOPE AND TRIG LEVEL . . . . . (26) Selects triggering slope:
"+" Triggering occurs when trigger signal crosses trigger level in a positive-going direction. Push down to be slop "+".
"−" Triggering occurs when trigger signal crosses trigger level in a negative-going direction. Pull up to be slop "−".

"+" slope

Triggering point

"−" slope

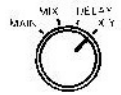
Triggering point

TRIG LEVEL knob is for displaying a synchronized stationary waveform and setting a start point for the waveform.
As this knob is turned in clockwise direction, the triggering level moves upward on the displayed waveform; as the knob is turned in counterclockwise, the triggering level moves downward.

HOLD OFF control . . . . . (21) When the measured signal has a complex waveform with two or more repetition frequencies (periods), triggering with the abovementioned LEVEL control alone may not be sufficient for attaining a stable waveform display.

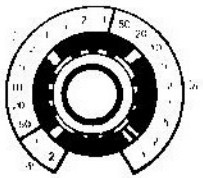
○ Time Base

MAIN, MIX AND DELAY switch . . . . . (19) Selects the sweep for the main, mix or delayed sweep mode and for X-Y switch.



(PS-205 only, (19) of PS-200 and PS-201 is X-Y pushbutton)

MAIN TIME/DIV . . . . . (15) Twenty positions ranging from: 0.2 sec/div to 0.1 us/div in 1-2-5 sequence.

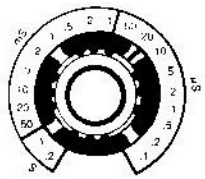


MAIN
TIME/DIV

VAR Control . . . . . (22) Provides continuously variable sweep rate by a factor of 5.

POSITION (PULL x 10) . . (18) Positions the display horizontally. Pulling control out increases the displayed sweep rate by a factor of 10.

DELAY TIME/DIV. . . . . (17) Selects the sweep time for delayed sweep. (PS-205 only)

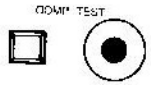


DELAY
TIME/DIV

DELAY TTIME POSITION . . . . . (20) Variable control to locate desirable waveform for extending. (PS-205 only)

○ OTHERS

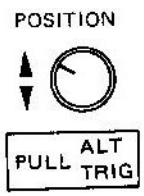
COMP TEST jacks . . . . . (3)(6) Input banana jacks to test component function (PS-201/205 only).



CAL (Vp-p). . . . . (9) This terminal delivers the calibration voltage of 2 Vp-p, approximately 1 kHz, positive square wave.

GND . . . . . (8) Ground terminal of oscilloscope mainframe.

POSITION . . . . . (27) CHA Vertical position control of trace or spot. Pulling up position is ALT TRIG.



4-2 REAR PANEL (Fig 4-4)

Z AXIS INPUT . . . . . (38) Input terminal for external intensity modulation signal.
(PS-205 only)

CHB(Y) SIGNAL OUTPUT . . . . . (39) Delivers the CHB signal with a voltage of approximately 100 mV per 1 DIV of graticule. When terminated with 50 ohms, the signal is attenuated to about a half. May be used for frequency counting, etc.
(PS-205 only)

AC power input connector . . . . . (37) Input connector of the AC power of the instrument. Connect the AC power cord (supplied) to this connector.

AC voltage selector plug and fuse. . . . . (36) For selecting the AC voltage of the instrument by aligning its arrowhead mark in the corresponding position and fuse is inside.

Studs . . . . . (40) Studs for laying the oscilloscope on its back to operate it in the upward posture. Also used to take up the power cord.

PS-200 FRONT PANEL

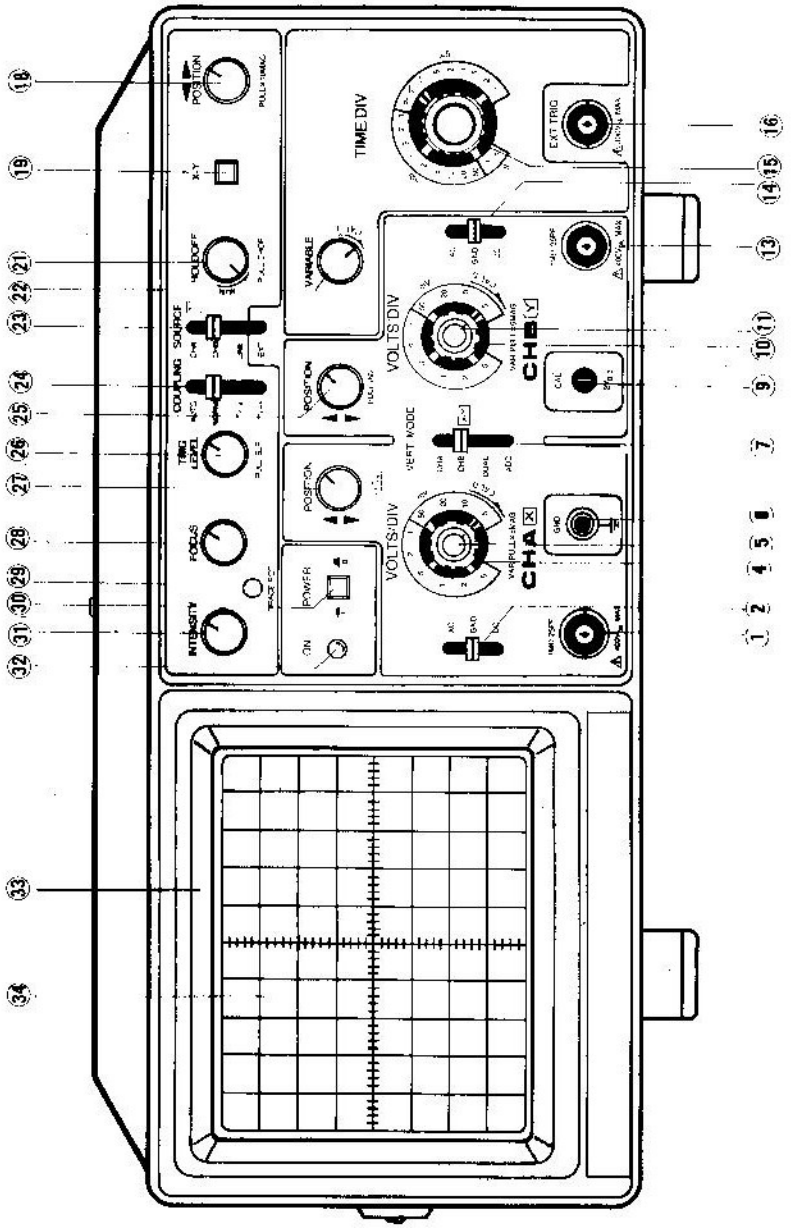


Fig. 4-1

PS-201 FRONT PANEL

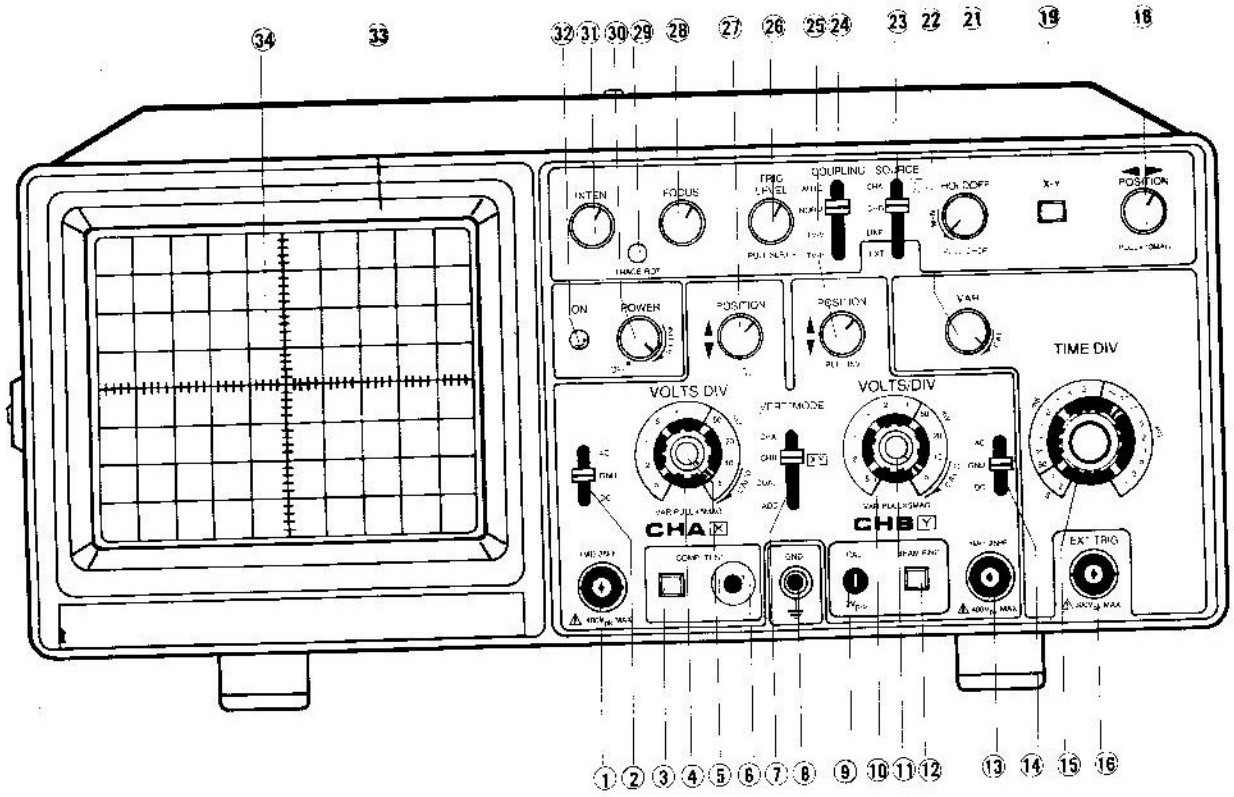


Fig. 4-2

PS-205 FRONT PANEL

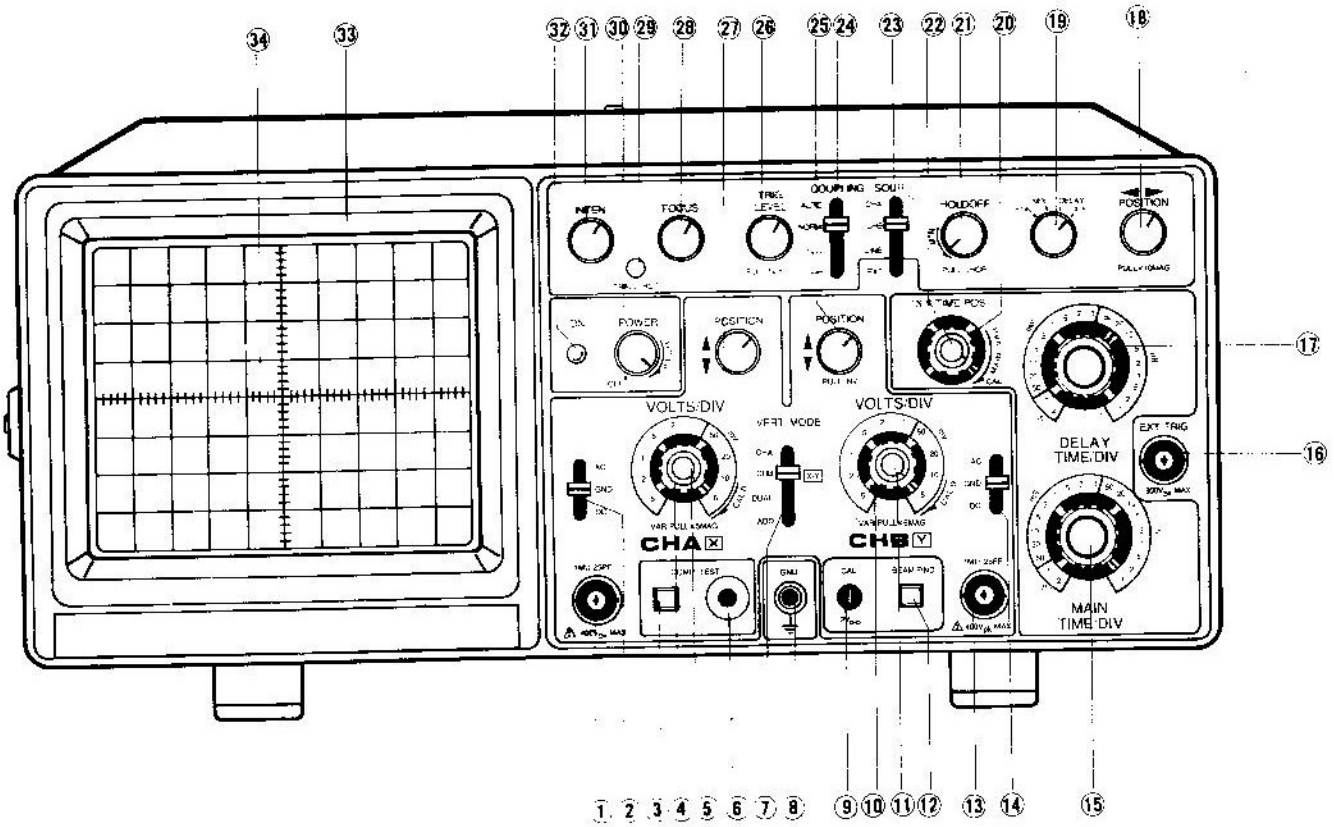


Fig. 4-3

PS-200/PS-201 REAR PANEL

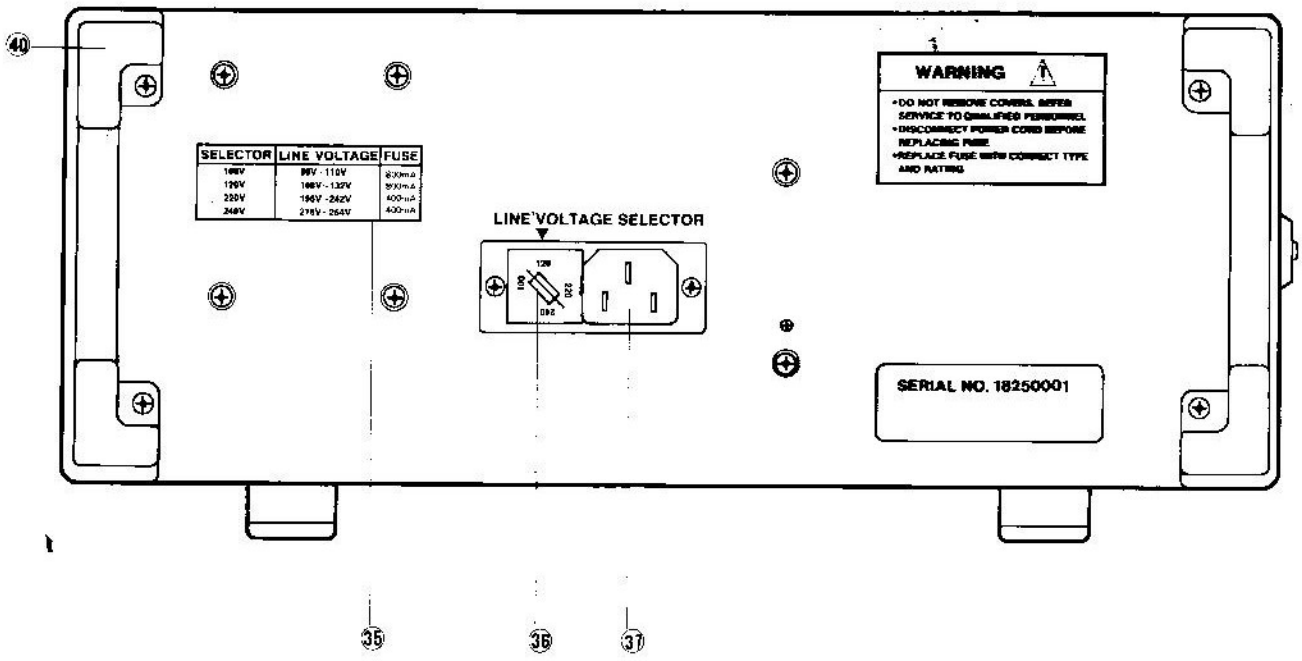


Fig. 4-4

PS-205 REAR PANEL

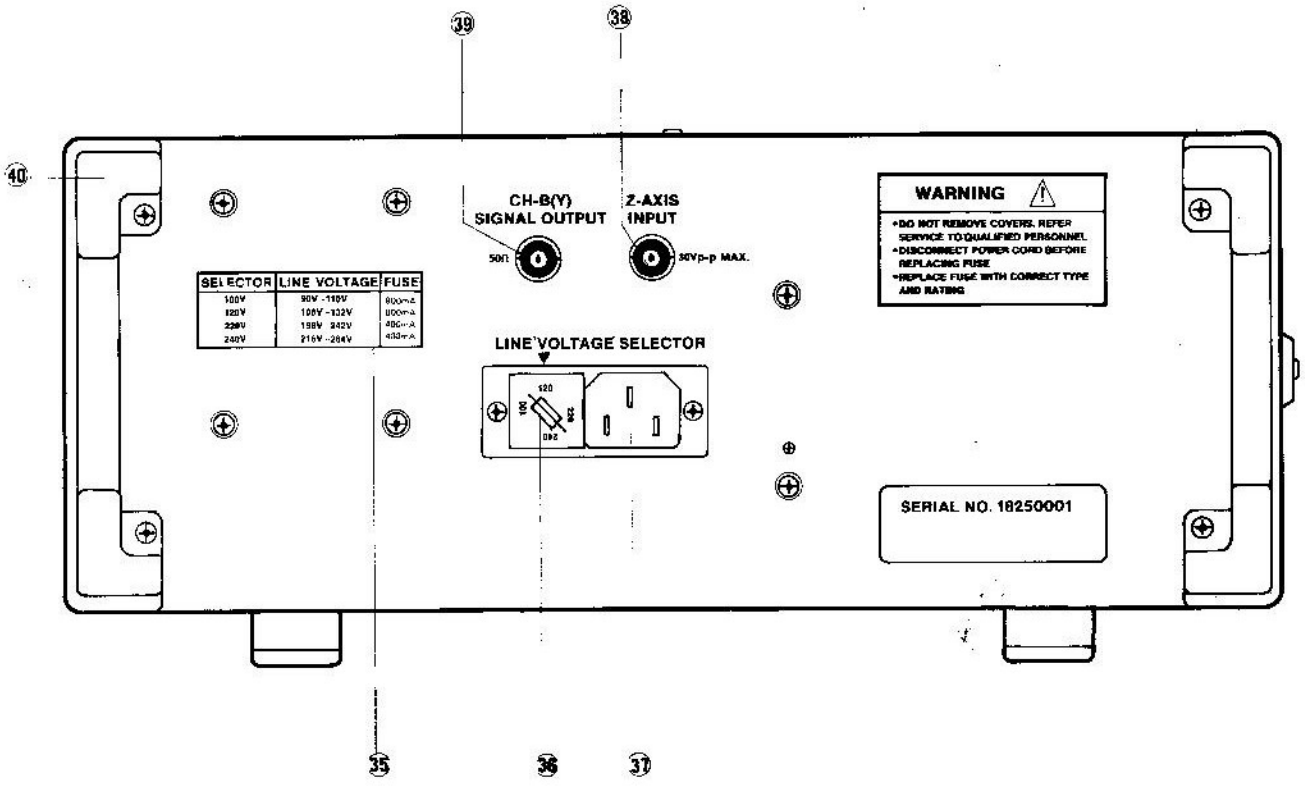


Fig. 4-5

5. OPERATING PROCEDURES AND METHODS

5-1 PREPARE BEFORE USE

1. Check the AC line voltage selector plug on the rear panel of the oscilloscope in correct position for the AC line voltage before connecting the power cord to the AC line outlet.
2. Set the switches and controls of the front panel as shown below:
   * POWER (30) in OFF position.
   * INTENSITY (31) fully counterclockwise.
   * FOCUS (28) In mid-position.
   * VERT MODE (7) in CHA position.
   * CHA and CHB amplitude VAR (5) (11) to CAL.
   * CHA-position and CHB-position (25) (27) to mid-position.
   * AC-GND-DC (2) (14) in GND.
   * VOLT/DIV (4) (10) to 50 mV/DIV.
   * TIME/DIV (15) to 0.5mS/DIV.
   * Sweep VAR (22) to CAL.
   * COUPLING (24) in AUTO position.
   * SOURCE (23) in CHA position.
   * TRIG LEVEL (26) is push down to "+".
   * MIAN/MIX/DELAY (X-Y) (19) to MAIN position. (PS-205 only)
   * POSITION (18) to mid-position.

5-2 BASIC OPERATING PROCEDURE

1. Plug the power cord into AC power outlet then turn the power switch on and make sure that the power pilot LED is lit.
2. Adjust INTENSITY control for comfortable view of traces. If base lines are not found, press BEAM FIND button to locate traces and adjust CHA POS controls and horizontal POS control to center traces on CRT display.
3. Connect the probe (in the 10:1 division ratio, supplied) to the CHA INPUT terminal, and apply the 2 Vp-p CALIBRATOR signal to the probe tip.
4. Set the AC-GND-DC switch in the AC state. A waveform as shown in Fig. 5-1.

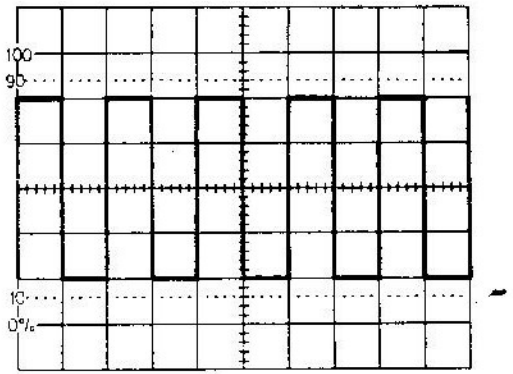


Fig. 5-1

5. Adjust the FOCUS control until the sharpest trace image becomes available.
6. Single-channel operation with CHB also can be made in a similar manner.

5-3 DUAL-CHANNEL OPERATION

Dual-channel includes ALT (set VERT MODE in DUAL position and push down the HOLDOFF switch) and CHOP (set VERT MODE in DUAL position and pull out the HOLDOFF switch).
When in the ALT mode, one channel is displayed for an entire sweep, then the next channel is displayed for an entire sweep. This mode is used primarily for display of high frequency signals at fast sweep speeds.
When in the CHOP mode, the channel signals are chopped in sequence at a rate of about 2 μsec (500KHz). Dual-channel traces are simultaneously displayed in a time-slicing method. This mode is used primarily for display of low frequency signals at low sweep speeds.

5-4 ADD OPERATION

Set the VERT MODE switch in the ADD position then signals of CHA and CHB can be added as an algebraic sum on the screen.
When the CHB position knob is pulled out (pull INV), the signals of CHA and CHB become the difference between them on the screen.

5-5 X-Y OPERATION

When MAIN/MIX/DELAY X-Y switch (19) is set at the X-Y position, the VERT MODE switch (7) is set to the CHB [X-Y] and source switch (23) to the CHA [X-Y] position, the oscilloscope operates as an X-Y scope with the CHA signal for the X-axis and the CHB signal for the Y-axis. The X-Y position is controled by the horizontal position knob. The bandwidth of the X-axis becomes DC to 1MHz (−3dB). When high frequency signals are displayed in the X-Y operation, pay attention to the frequency bandwidths of the phase difference between X and Y axes.

5-6 TRIGGERING:

Proper triggering is essential for efficient operation of an oscilloscope. The user of the oscilloscope must make himself thoroughly familiar with the triggering functions and procedures.

(1) Function of SOURCE switch:
To display a stationary pattern on the CRT screen, the displayed signal itself or a trigger signal which has a time relationship with the displayed signal is required to be

applied to the trigger circuit. The SOURCE switch selects such a trigger source.

CHA– The signal applied to the input terminal of CHA is picked off from respective preamplifier in order to be used as CHA trigger signal.

CHB– The signal applied to the input terminal of CHB is picked off from respective preamplifier in order to be used as CHB trigger signal.

This CHA or CHB trigger method is used most commonly. The signal applied to the vertical input terminal (the measured signal) is branched off from a point in the amplifier circuit and is fed to the trigger circuit through the SOURCE switch. Since the trigger signal is the measured signal itself, a very stable waveform can be readily displayed on the CRT screen.

LINE–The AC power line frequency signal is used as the trigger signal. This method is effective when the measured signal has a relationship with the AC line frequency, especially for measurements of low level AC noise of audio circuits, thyristor circuits, etc.

EXT– The sweep is triggered with an external signal applied to the external trigger input terminal.
An external signal which has a periodic relationship with respect to the measured signal is used. Since the measured signal (vertical input signal) is not used as the trigger signal, the waveform display can be done independent of the measured signal.

(2) Functions of COUPLING switch:

This switch is used to select the coupling of the triggering signal to the trigger circuit in accordance with the characteristics of the measured signal.

AUTO: When no triggering signal is applied or when triggering signal frequency is more than 100Hz, sweep runs in the free run mode.

NORM: When no triggering signal is applied, sweep is in a ready state and the trace is blanked out. Used primarily for observation of signals of 100Hz or lower.

TV-V: Trigger bandwidth range is DC ~ 1KHz when signal is more than 1 DIV and level between –5V ~ +5V.

TV-H: Trigger bandwidth range is 1KHz ~ 100KHz when signal is more than 1 DIV and level between –5V ~ +5V.

(3) Functions of VERT MODE

The triggering circuits are designed with certain relationships to the vertical mode selector switches. These relationships are shown in the following table.

VERT MODE	CHA	CHB	DUAL	ADD	CHOP
TRIG	Triggered by CHA sig.	Triggered by CHB sig.	Triggered by CHA or CHB sig.	Triggered by CHA or CHB sig.	Triggered by CHA or CHB sig.

Note that jittery may be produced when the sweep speed is slow if the SOURCE switch is set for AC coupling.

(4) a. Function of SLOP switch

This switch selects the slope (polarity) of the triggering signal.

Push down the switch to be set in the "+" state,triggering occurs as the triggering signal crosses the triggering level in the direction of signal increase (i.e, positive direction).

Pull up the switch to be set in the "–" state,triggering occurs as the triggering signal crosses the triggering level in the direction of signal decrease (i.e, negative direction).

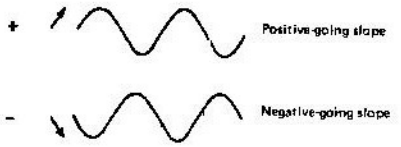


Fig. 5-2

b. Function of TRIG LEVEL

Used to select a level within signal peak range from which the sweep can be triggered at a proper input signal starting edge.

The trigger level changes in the positive direction (upward) as this control knob is turned clockwise and it changes in the negative direction (downward) as the knob is turned counter-clockwise.

(5) Function of HOLD OFF

Controls hold-off time between sweep signals to obtain stable display when triggering an unperiodic signal. The control hold off time ranges from 1 to 5 times timebase.

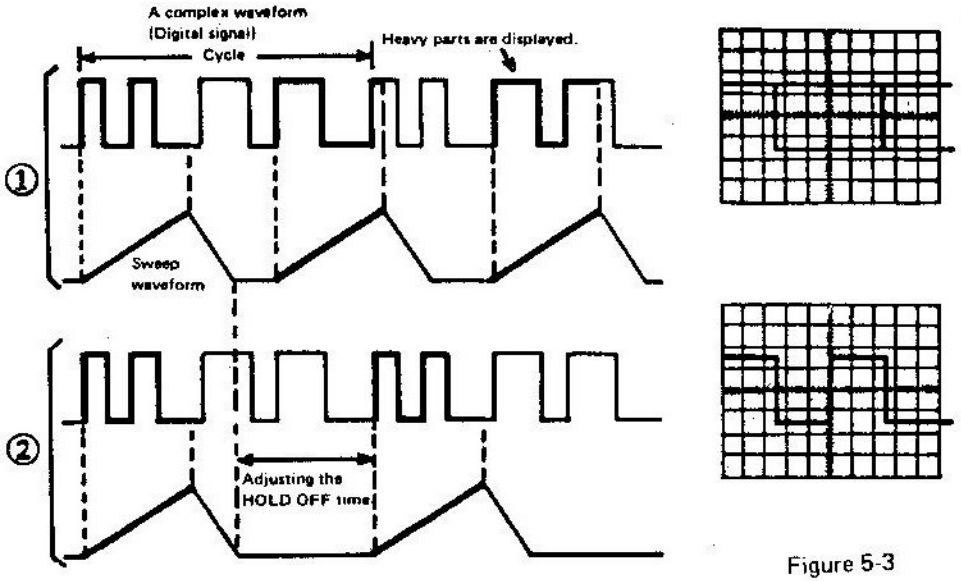


Figure 5-3

Figure 5-3 ① shows a case for HOLD OFF knob at the NORM position. Various different waveforms are overlapped on the screen, making the signal observation unsuccessful.
Figure 5-3 ② shows a case in which the undesirable portion of the signal is hold off. The same wavefotms are displayed on the screen without overlapping.
In such a case, the sweep can be stably synchronized to the measured signal waveform by adjusting the HOLD OFF time (sweep pause time) of the sweep waveform.

(6) Sweep Magnification

When a certain position of the displayed waveform is needed to be expanded time-wise, a faster sweep speed may be used. However, if the required portion is far away from the starting point of the sweep, the required portion may run off the CRT screen. In such a case, pull out (set in the x10 MAG state) the POSITION switch KNOB ⑱ . When this is done, the displayed waveform is expanded by 10 times to right or left with the center of screen at the center of expansion.

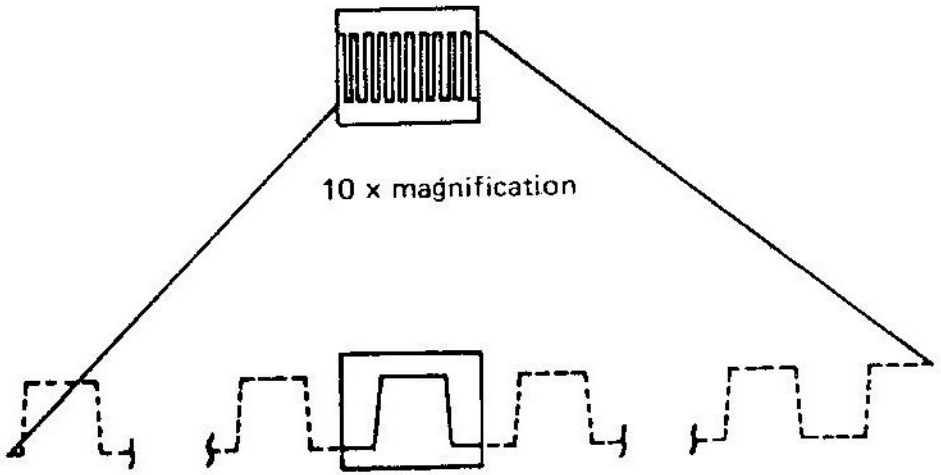


Figure 5-4

The sweep time during the magnification operation is obtained as follows:

(Value indicated by TIME/DIV switch) x 1/10

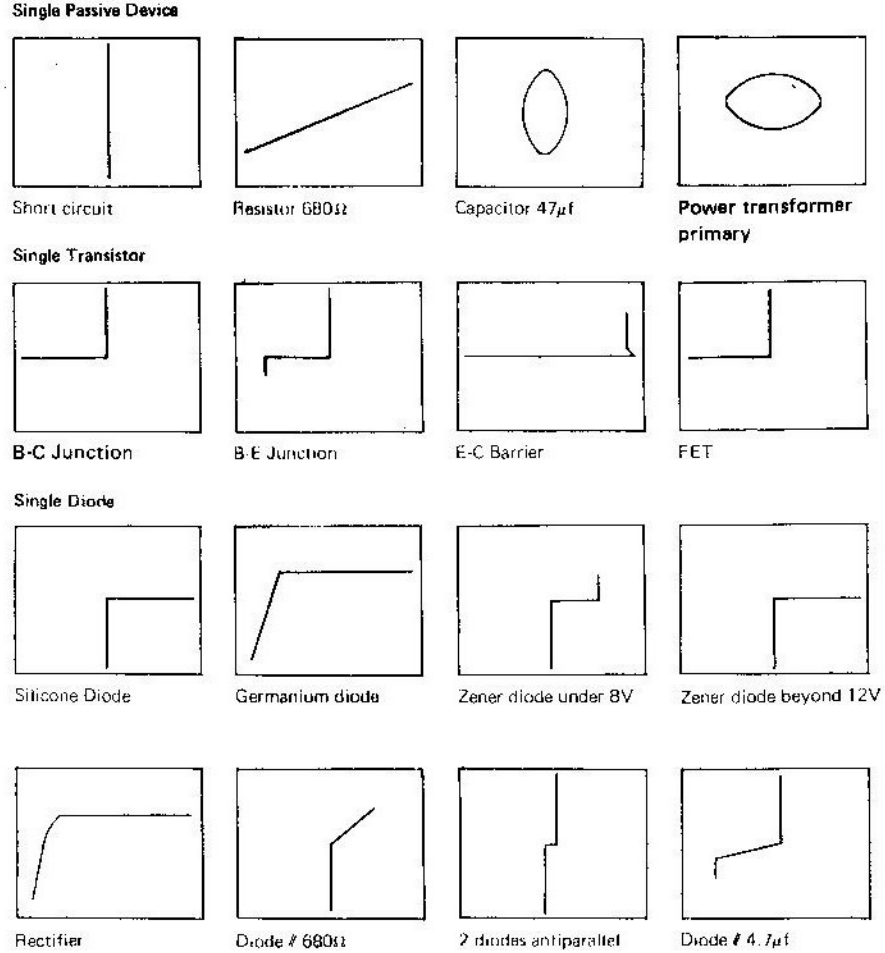
Thus, the unmagnified maximum sweep speed (0.2 μsec/DIV) can be made faster with magnification as follows:

0.2 μsec/DIV x 1/10 = 20 nsec/DIV

When the sweep is magnified and the sweep speed has become faster than 0.2 μsec/DIV, the trace may become darker.

(7) Component Tester Checkout

1. Press in COMP TEST pushbutton to place oscilloscope in component test operating mode.
2. Disconnect CHA and CHB input connectors.
3. Insert diode or zener diode, LED, capacitor, etc., between COMP TEST socket and ground.
4. Verify that displayed waveform are similar to the Test Patterns shown in Figure 5-5.
5. When you have finished component testing, press COMP TEST pushbutton to out position. This disables component test mode of operation.



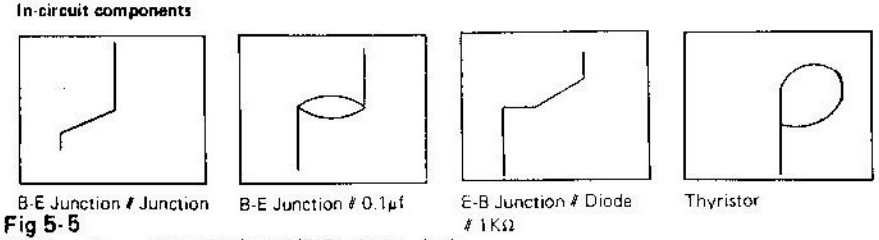


Fig 5-5

(8) Function of MAIN/MIX/DELAY switch

When turn the switch to MAIN position, the waveform of display on the screen is main sweep only.

When turn the switch to MIX position, the waveform of display on the screen is shown in Fig 5-6.

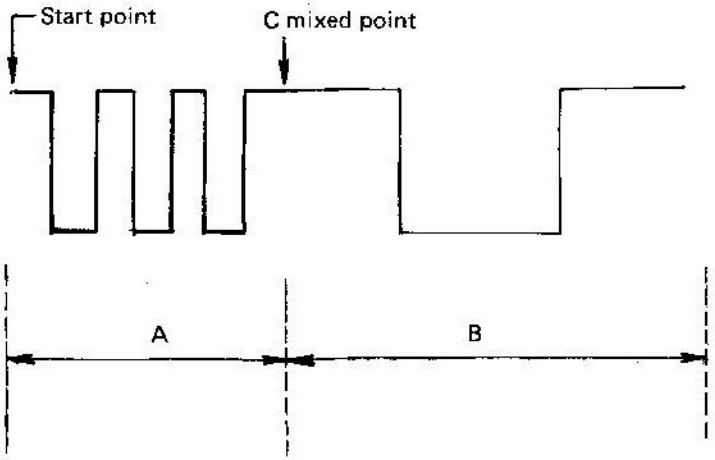


Fig 5-6

The portion of A is main sweep which is set by the MAIN TIMEBASE. The portion of B is delay sweep which is set by the DELAY TIMEBASE. The mixed point C is continuously variable by means of the DELAY TIME POSITION (20) switch.

When turn the switch to DELAY position. A portion of Fig 5-6 disappears, the mixed point C replaces the position of starting point and B portion of Fig 5-6 displays only on the screen.

Note: DELAY timebase must be faster than MAIN timebase and not exceed 10 times.

(9) Adjustment of probe

When the probe is used in X1 position it does not require frequency compensation adjustment but in X10 position the probe must be properly frequency compensation adjustment before use. Procedure of adjustment is indicated and shown below.

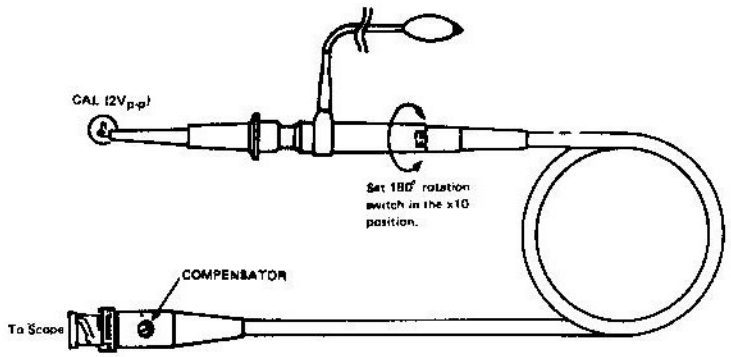


Figure 5-7

Connect the probe BNC to the INPUT terminal of CHA or CHB and set VOLTS/DIV switch at 50 mV. Connect the probe tip to the calibration voltage output terminal and adjust the COMPENSATOR control with an insulated screwdriver so that an ideal waveform as illustrated below is obtained.

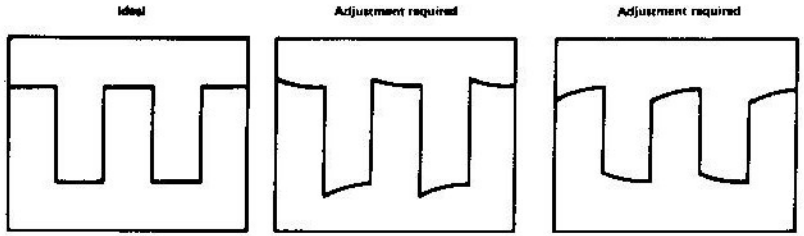
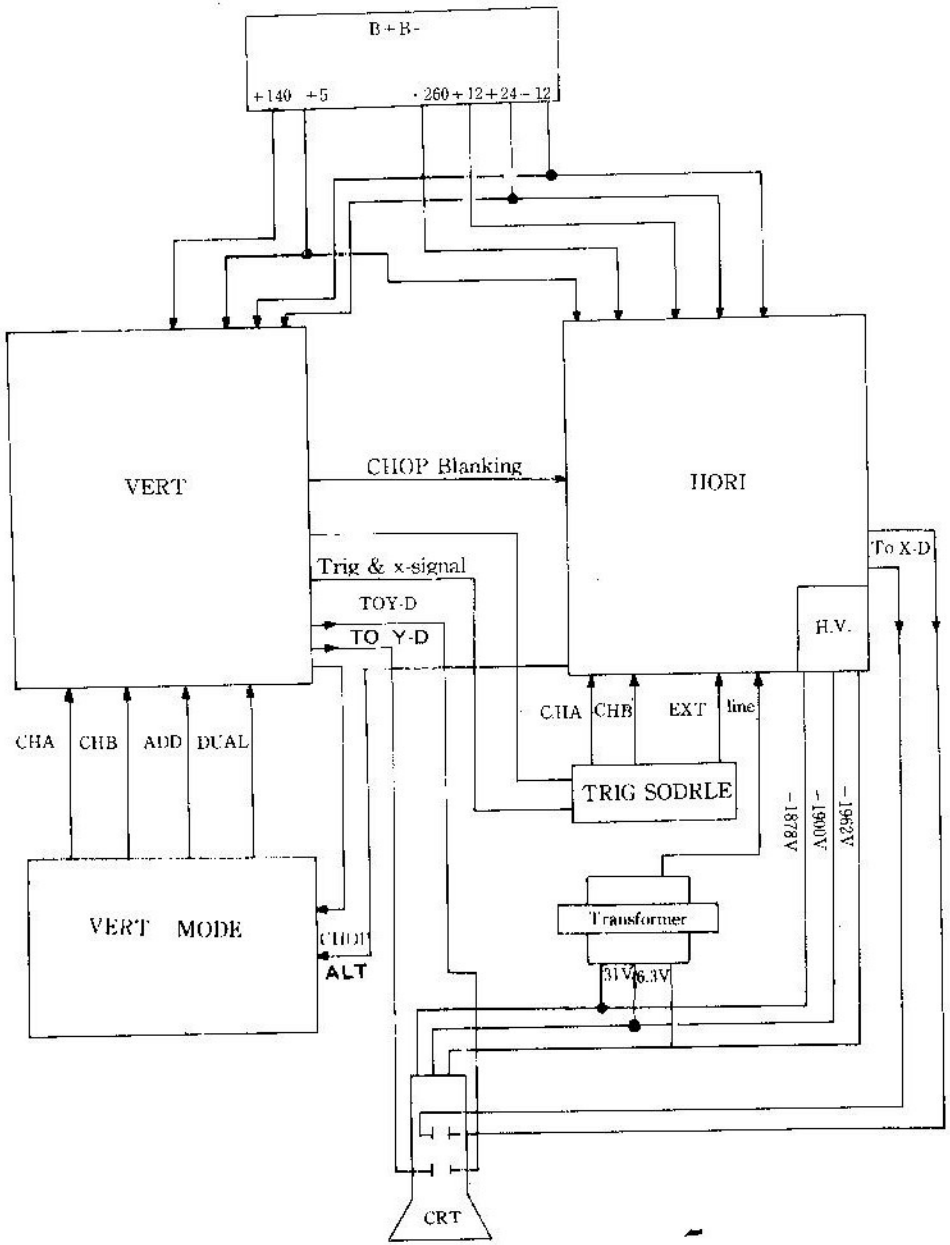
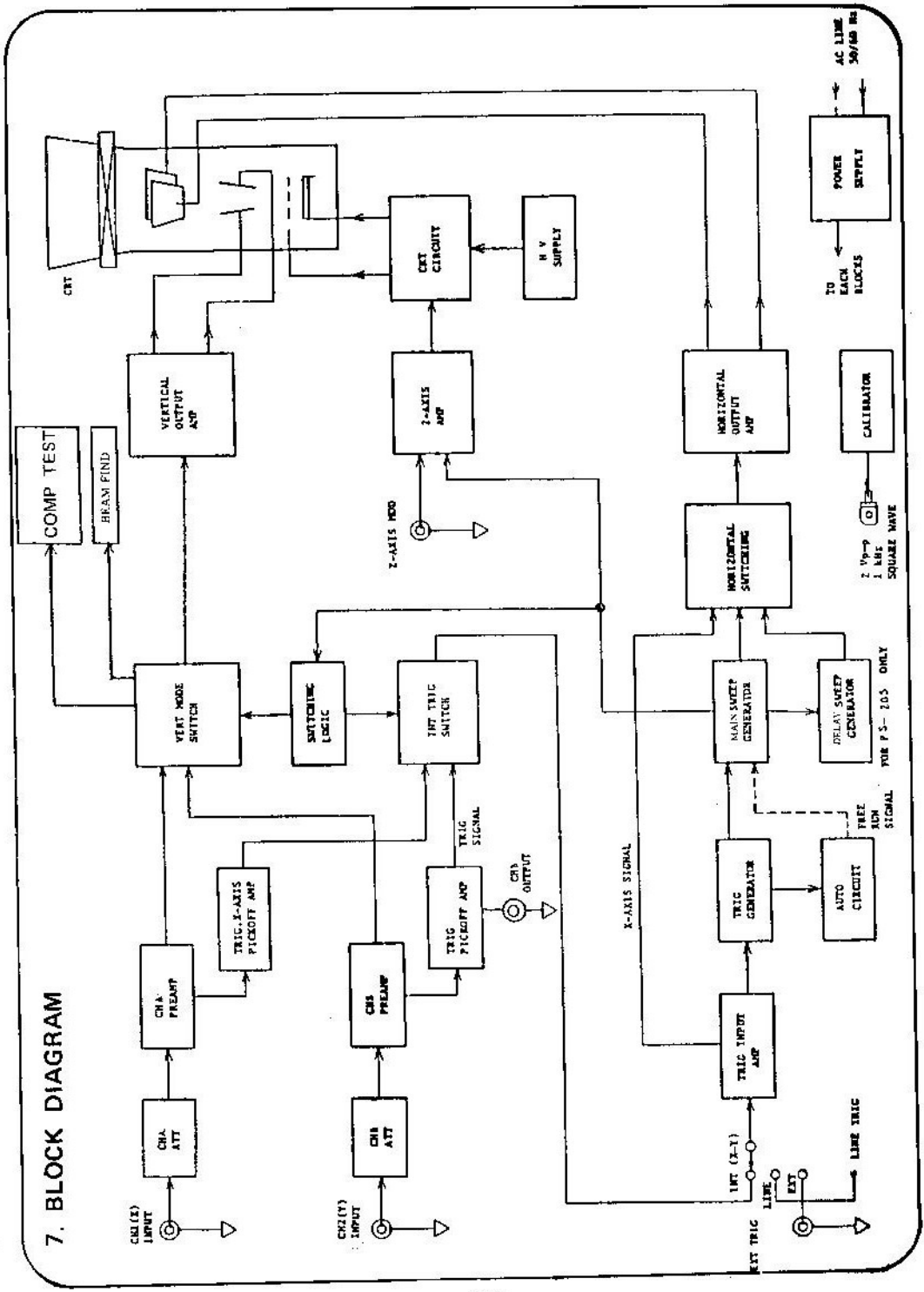


Figure 5-8

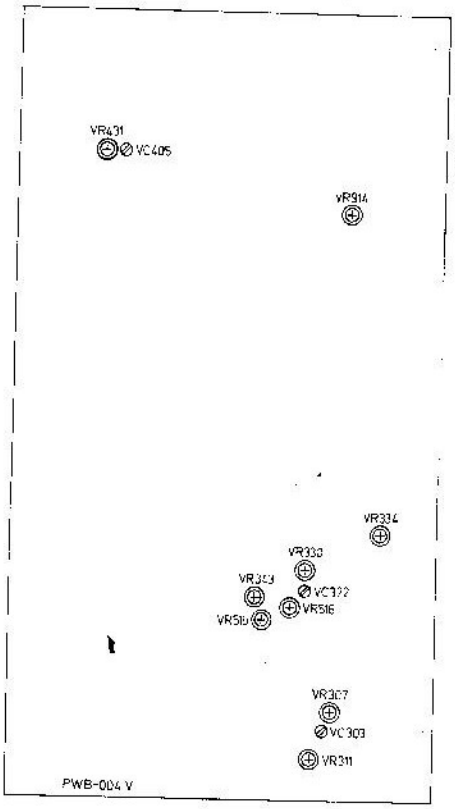
PS 200/201/205 Interface



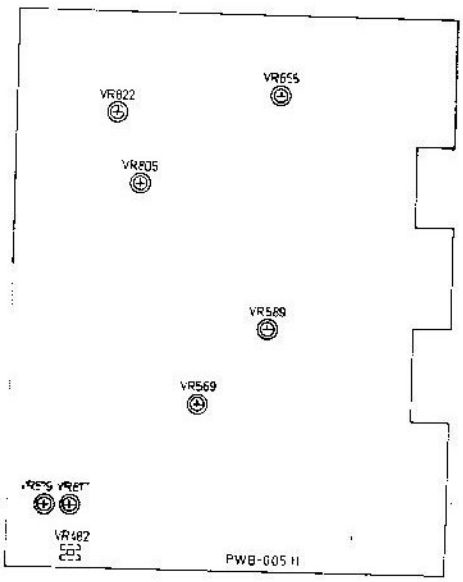
7. BLOCK DIAGRAM



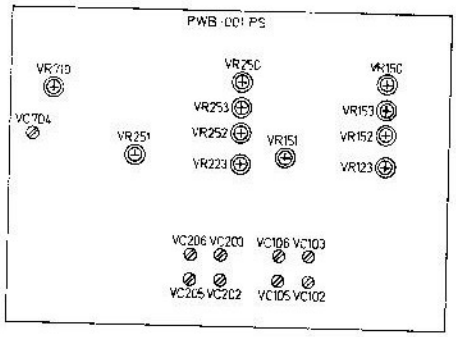
8. ADJUSTMENT DIAGRAM



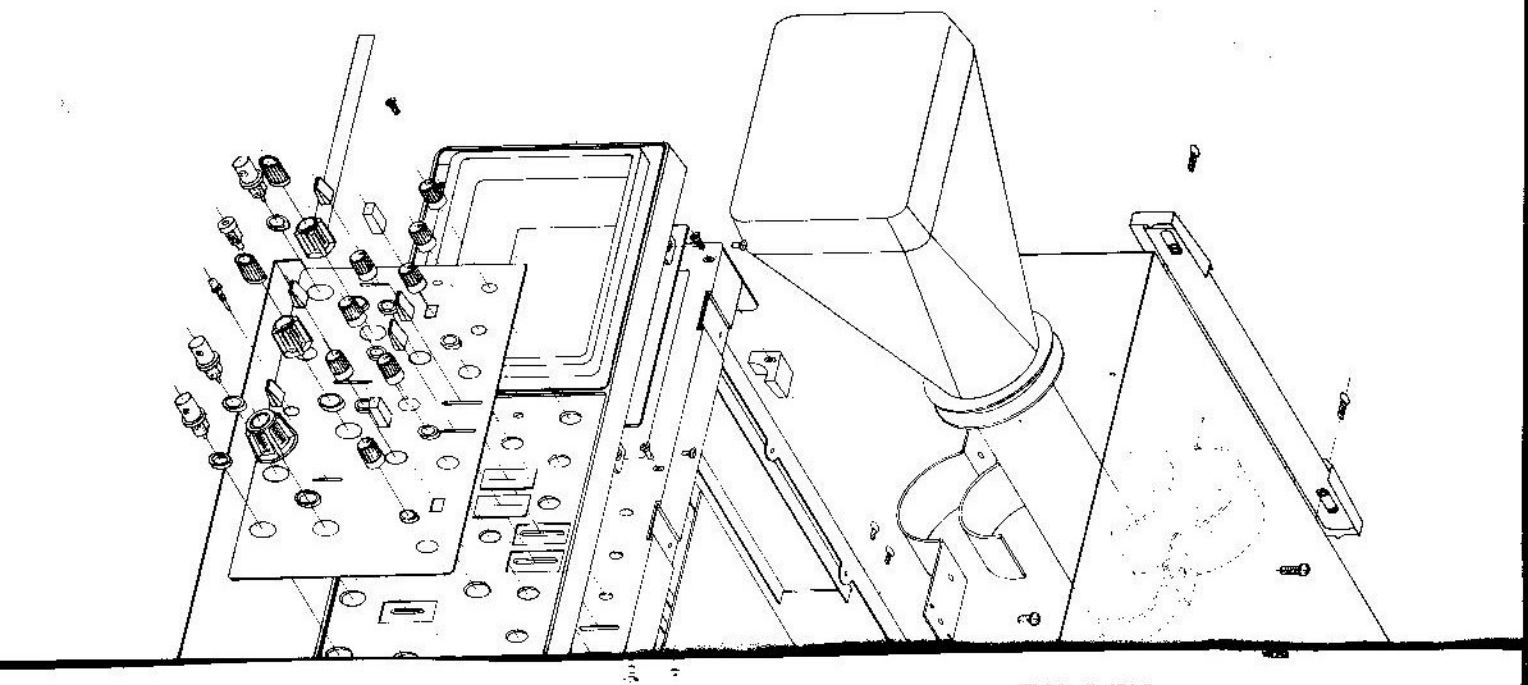
VR431: VERT FINAL SQU WAVE ADJ
VR914: DC +12V ADJ
VR334: CHA VERT GAIN ADJ
VR330: CHA VERT SQU WARE ADJ
VR343: ADD DC BALANCE ADJ
VR516: X-GAIN ADJ
VR519: CHA TRIG DC LEVEL ADJ
VR307: CHB VERT SQU WAVE ADJ
VC405: VERT FINAL SQU WAVE ADJ
VC322: CHA VERT SQU WAVE ADJ
VC303: CHB VERT SQU WAVE ADJ



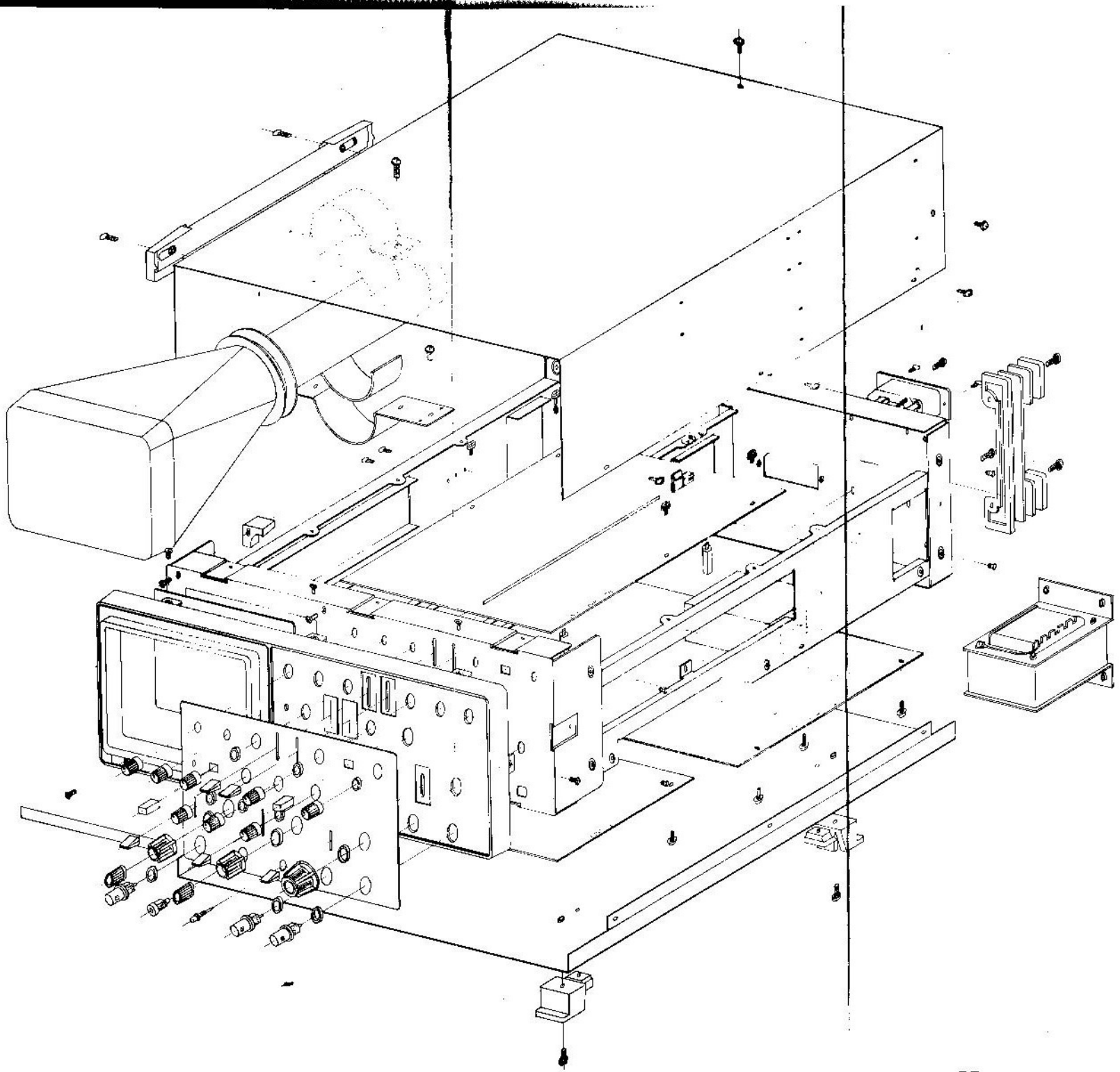
VR655: SWEEP MAG x10 ADJ.
VR822: ASTIGM ADJ.
VR805: UNBLANKING ADJ.
VR569: X-DC LEVEL ADJ.
VR569: TRIG LEVEL FINE ADJ.
VR819: MIN. INTENSITY ADJ.
VR817: MAX. INTENSITY ADJ.
VR482: TRACE ROTATION ADJ.



VR250: CHB x5 GAIN ADJ.
VR150: CHA x5 GAIN ADJ.
VR253: CHB VAR DC-BAL ADJ.
VR153: CHA VAR DC-BAL ADJ.
VR252: CHB MAG DC-BAL ADJ.
VR152: CHA MAG DC-BAL ADJ.
VR719: MAIN TIMEBASE 0.5mS CAL
VR251: CHB BANDWITH ADJ.
VR151: CHA BANDWITH ADJ.
VR223: CHB STEP DC-BAL ADJ.
VR123: CHA STEP DC-BAL ADJ.
VC704: MAIN TIMEBASE 0.5μS CAL
VC206: CHB 1V SQU WAVE ADJ.
VC203: CHB 0.1V SQU WAVE ADJ.
VC106: CHA 1V SQU WAVE ADJ.
VC103: CHA 0.1V SQU WAVE ADJ.
VC205: CHB 1V INPUT CAP ADJ.
VC202: CHB 0.1V INPUT CAP ADJ.
VC105: CHA 1V INPUT CAP ADJ.
VC102: CHA 0.1V INPUT CAP ADJ.

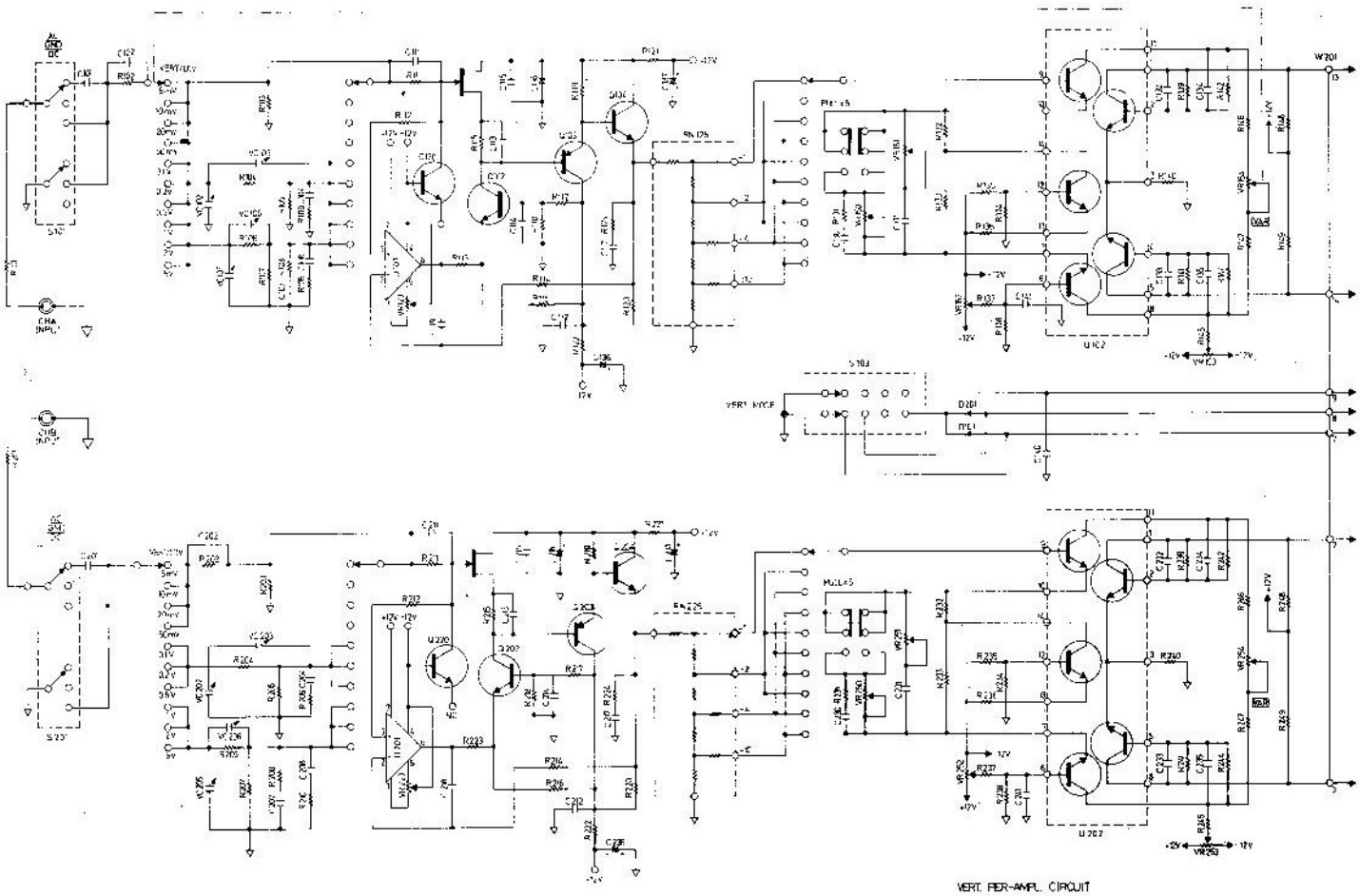


VERT PRE-AMPL CIRCUIT

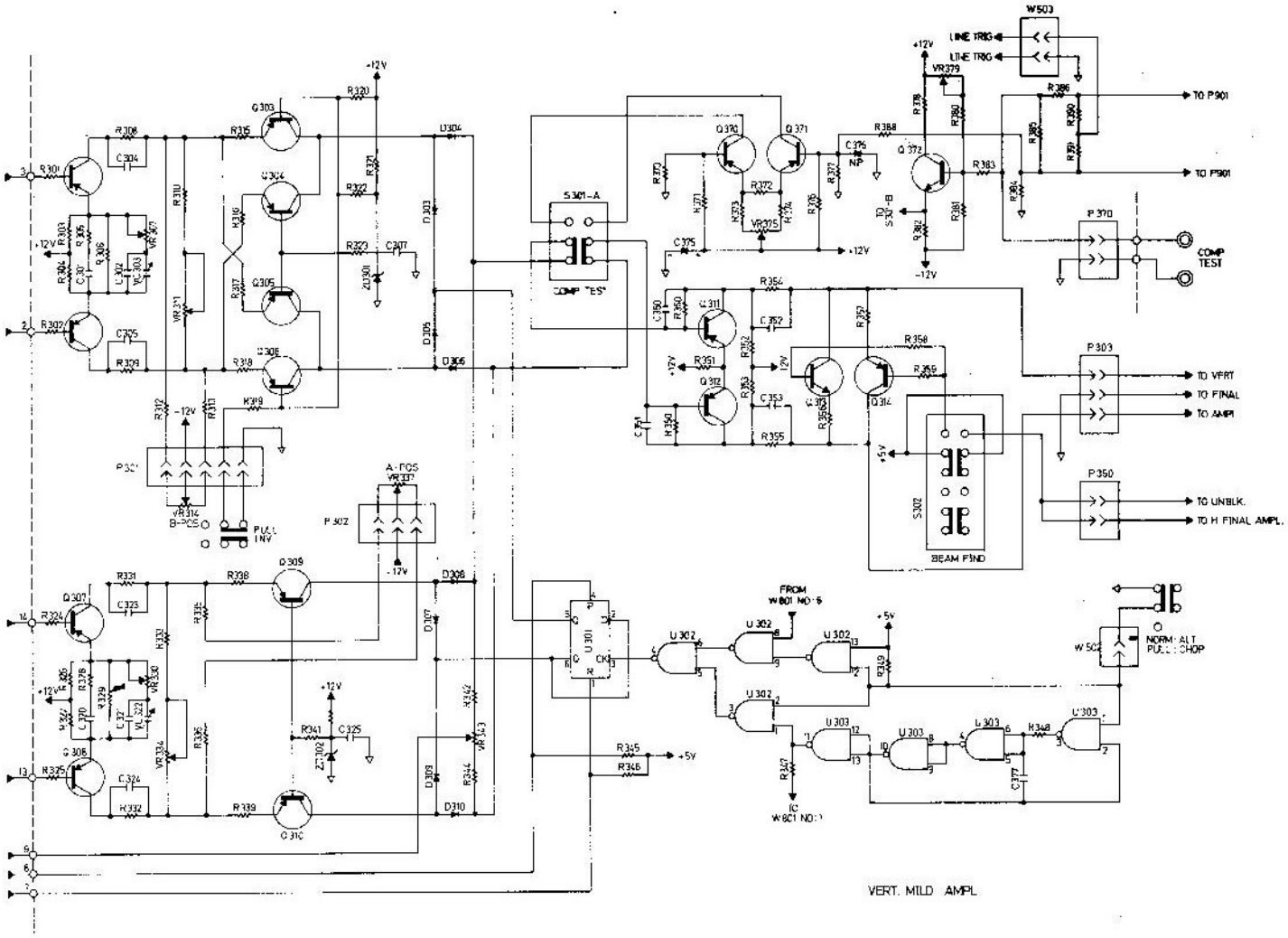


8. ADJUSTMENT DIAGRAM

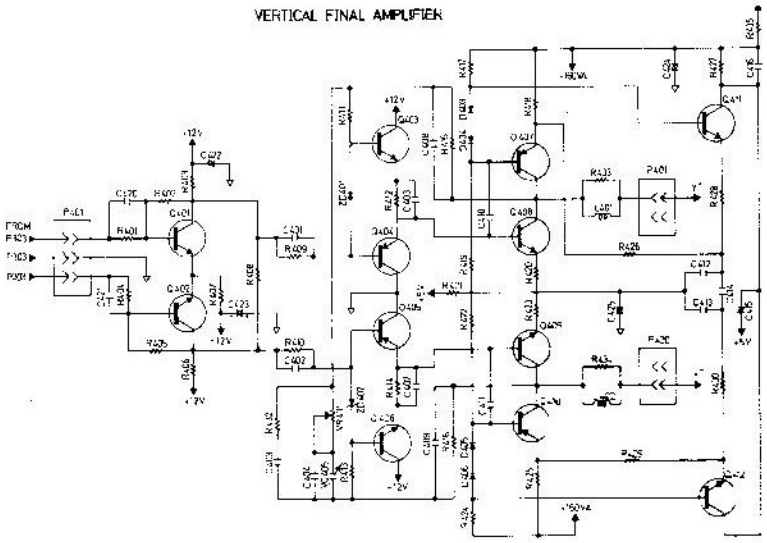
VR655 : SWEEP MAG x10 ADJ.
VR822 : ASTIGM ADJ.



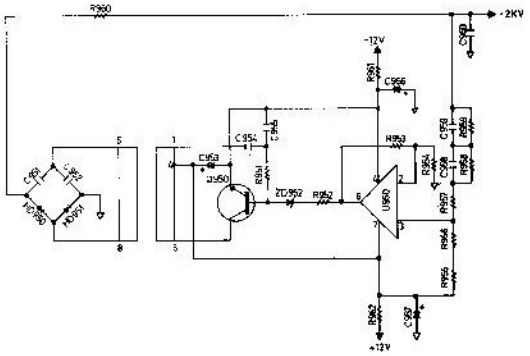
VERT. PRE-AMPL. CIRCUIT



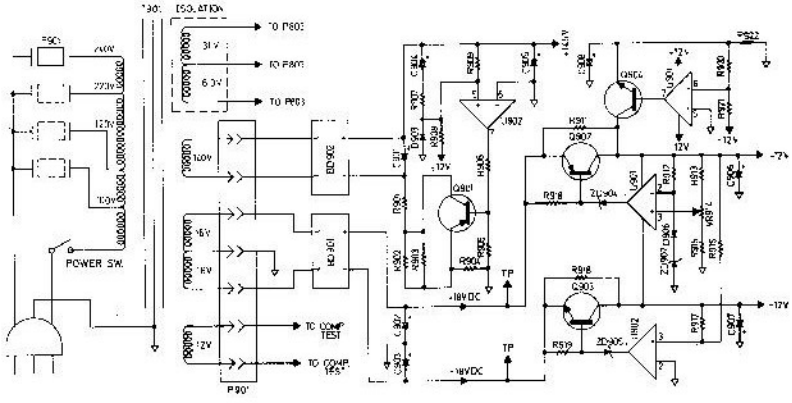
VERTICAL FINAL AMPLIFIER



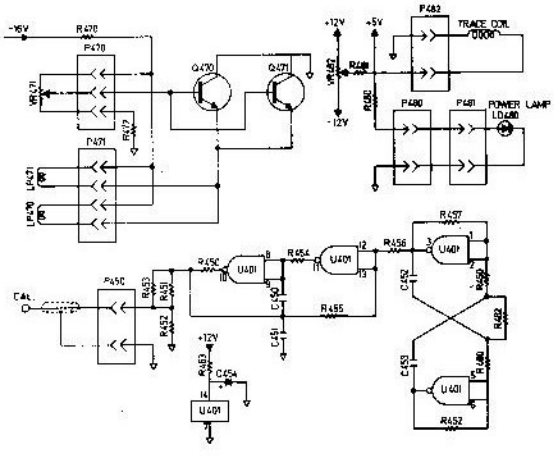
H.V GENERATOR CURCUIT

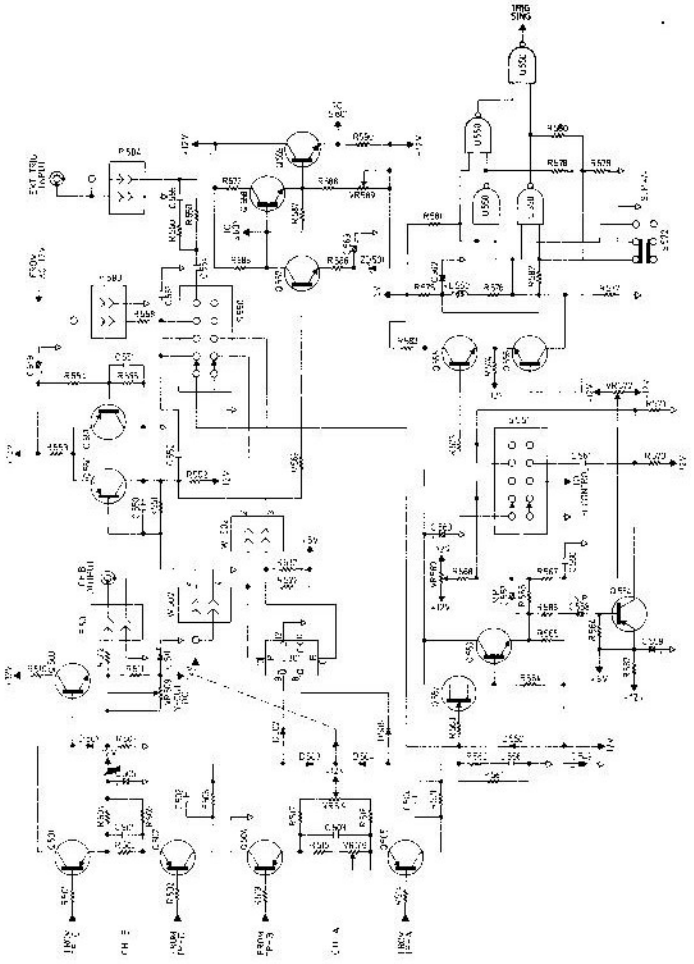


POWER SUPPLY

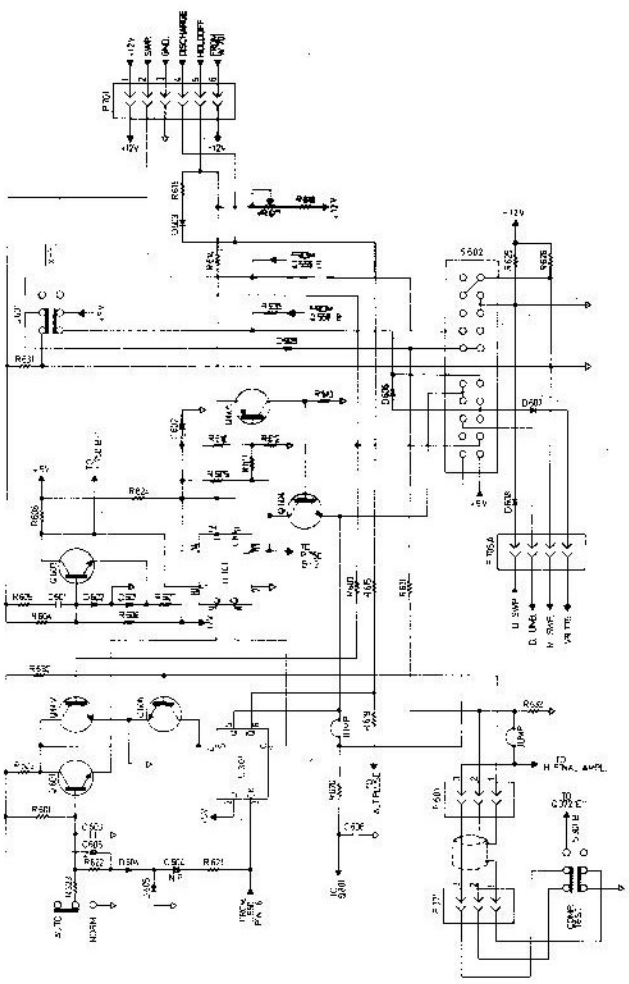


CALIBRATOR, ILLUM, TRACE ROT.



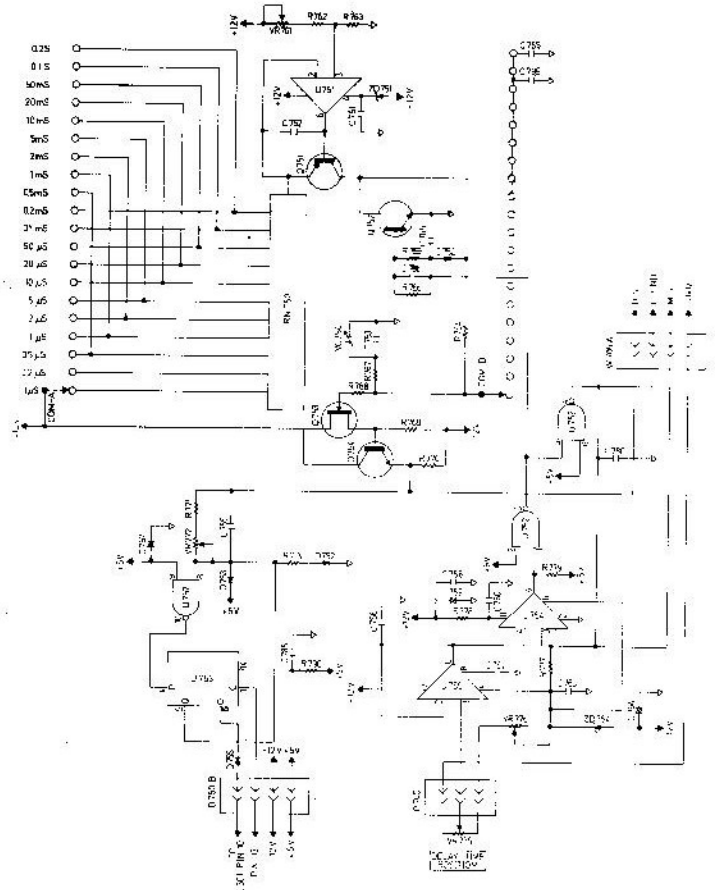


TRIG GENERATOR

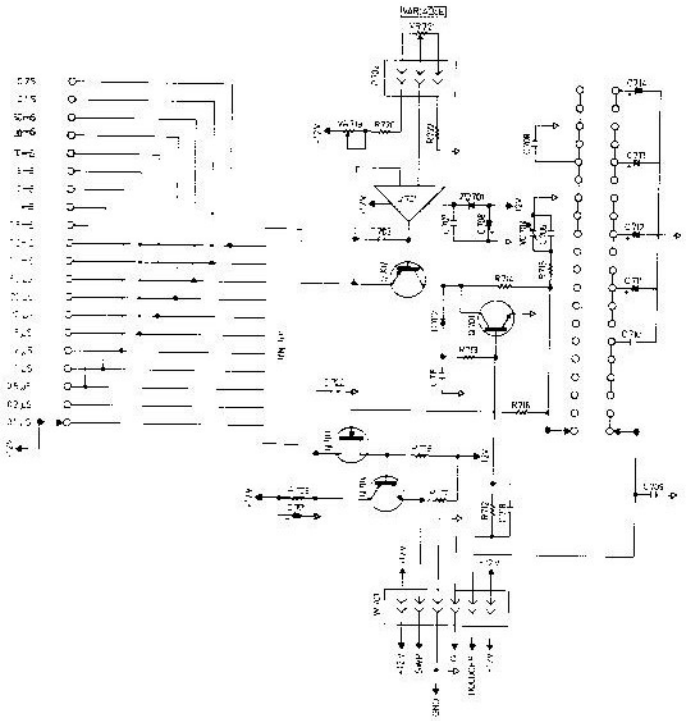


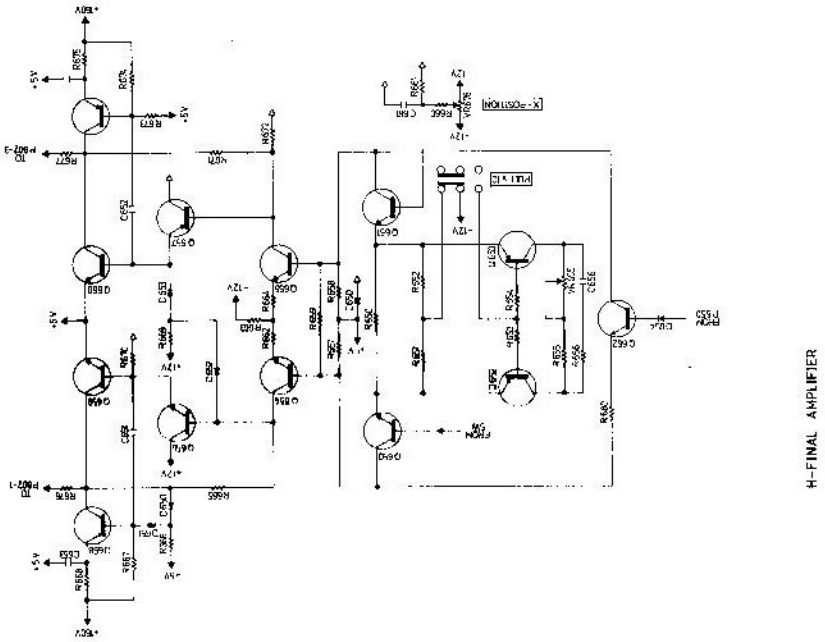
H. CONTROL CKT.

DELAY CIRCUIT

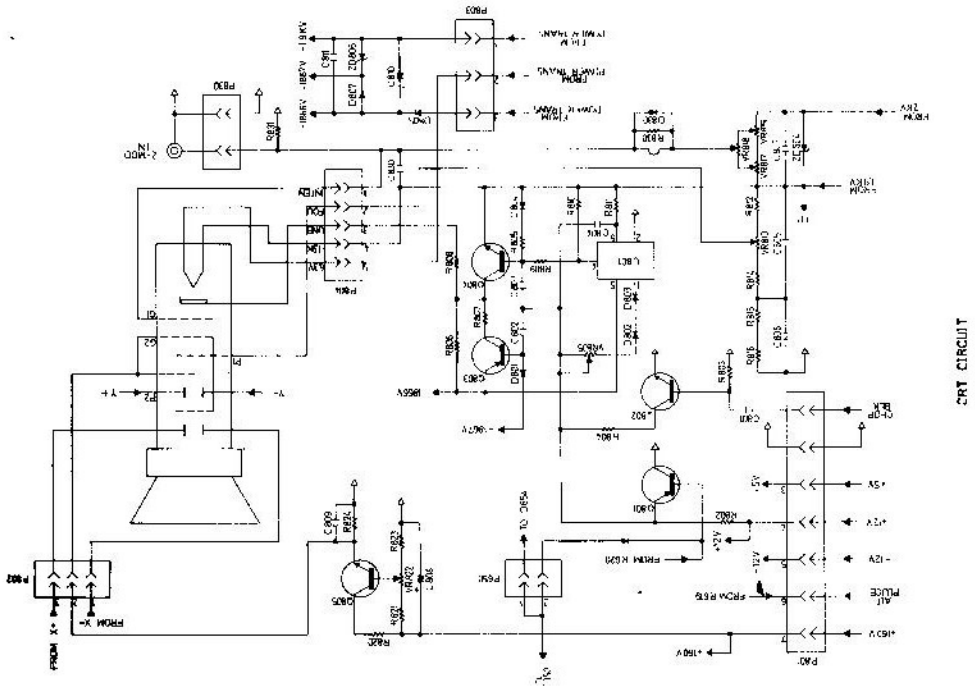


TIME BASE CIRCUIT





H-FINAL AMPLIFIER



CRT CIRCUIT

SCHEMATIC SYMBOL	DESCRIPTION		
VBRT PER-AMPL CIRCUIT (CHA)			
C101	.022μF	±10%	630V
C102	.001μF	±10%	50V
VC102	10PF	±20%	50V
VC103	6PF	±20%	50V
C104	33PF	±10%	50V
VC105	10PF	±20%	50V
VC106	6PF	±20%	50V
C107	330PF	±10%	50V
C108	220PF	±10%	50V
C111	.0022μF	±10%	400V
C112	0.022μF	±10%	50V
C113	1000PF	±10%	50V
C114	1000PF	±10%	50V
C115	0.022μF	±10%	50V
C116	10μF	±20%	50V
C119	10PF	±20%	50V
C130	100PF	±20%	50V
VC131	56PF	±20%	50V
C132	5PF	±20%	50V
C133	5PF	±20%	50V
C134	82PF	±20%	50V
C135	82PF	±20%	50V
C136	10μF	±20%	50V
C137	10μF	±20%	50V
C140	.01μF	±10%	50V
D101	1N4148		
Q101	2SK107	FET	
Q102	2SC945	NPN	
Q103	2SA844	PNP	
Q104	2SC945	NPN	
Q120	2SC1907	NPN	
R101	47Ω	±5%	¼W
R102	33Ω	±5%	¼W
R103	1MΩ	±1%	½W
R104	900KΩ	±0.5%	½W
R105	111KΩ	±0.5%	¼W
R106	990KΩ	±0.5%	¼W
R107	10.1KΩ	±0.5%	¼W
R108	27Ω	±5%	¼W
R109	68Ω	±5%	¼W
R110	10Ω	±5%	¼W
R111	470KΩ	±5%	½W
R112	1KΩ	±5%	¼W
R113	1KΩ	±5%	¼W
R114	390Ω	±5%	¼W

SCHEMATIC SYMBOL	DESCRIPTION		
R115	100Ω	±5%	¼W
R116	680Ω	±5%	¼W
R117	3.9KΩ	±5%	¼W
R118	8.2KΩ	±5%	¼W
R119	5.6KΩ	±5%	¼W
R120	1.2KΩ	±5%	¼W
R121	10Ω	±5%	¼W
R122	10Ω	±5%	¼W
VR123	20KΩ	±20%	¼W
R131	100Ω	±20%	¼W
R132	120Ω	±20%	¼W
R133	120Ω	±20%	¼W
R134	5.6KΩ	±20%	¼W
R135	5.6KΩ	±20%	¼W
R136	681Ω	±1%	¼W
R137	100KΩ	±5%	¼W
R138	100Ω	±5%	¼W
R139	475Ω	±1%	¼W
R140	270Ω	±5%	¼W
R141	475Ω	±1%	¼W
R142	56.2Ω	±1%	¼W
R144	56.2Ω	±1%	¼W
R145	47KΩ	±5%	¼W
R146	27Ω	±5%	¼W
R147	27Ω	±5%	¼W
R148	681Ω	±1%	¼W
R149	681Ω	±1%	¼W
VR150	100Ω	±20%	¼W
VR151	500Ω	±20%	¼W
VR152	20KΩ	±20%	¼W
VR153	20KΩ	±20%	¼W
VR154	1KΩ	±20%	¼W
U101	LF13741N		
U102	CA3086		
VERT. PRE-AMPL CIRCUIT (CHB)			
C201	.022μF	±10%	630V
C202	.001μF	±10%	50V
VC202	10PF	±20%	50V
VC203	6PF	±20%	50V
C204	33PF	±10%	50V
VC205	10PF	±20%	50V
VC206	6PF	±20%	50V
C207	330PF	±10%	50V
C208	220PF	±10%	50V
C211	.0022μF	±10%	400V
C212	.022μF	±10%	50V

SCHEMATIC SYMBOL	DESCRIPTION		
C213	1000PF	±10%	50V
C214	1000PF	±10%	50V
C215	.022μF	±10%	50V
C216	10μF	±20%	50V
C218	10PF	±10%	50V
C230	100PF	±10%	50V
VC231	56PF	±10%	50V
C232	5PF	±10%	50V
C233	5PF	±10%	50V
C234	82PF	±10%	50V
C235	82PF	±10%	
C236	10μF	±20%	
C237	10μF	±20%	
D201	1N4148		
Q201	2SK107		
Q202	2SC945	NPN	
Q203	2SA844	PNP	
Q204	2SC945	NPN	
Q220	2SC1907	NPN	
R201	47Ω	±5%	
R202	33Ω	±5%	
R203	1MΩ	±1%	
R204	900KΩ	±0.5%	
R205	111KΩ	±0.5%	
R206	990KΩ	±0.5%	¼W
R207	10KΩ	±0.5%	¼W
R208	27Ω	±5%	¼W
R209	68Ω	±5%	¼W
R210	10Ω	±5%	¼W
R211	470KΩ	±5%	½W
R212	1KΩ	±5%	¼W
R214	390Ω	±5%	¼W
R215	100Ω	±5%	¼W
R216	680Ω	±5%	¼W
R217	3.9KΩ	±5%	¼W
R218	8.2KΩ	±5%	¼W
R219	5.6KΩ	±5%	¼W
R220	1.2KΩ	±5%	¼W
R221	10Ω	±5%	¼W
R222	10Ω	±5%	¼W
R223	1KΩ	±5%	¼W
VR223	20KΩ	±20%	
R231	100Ω	±5%	¼W
R232	120Ω	±5%	¼W
R233	120Ω	±5%	¼W
R234	5.6KΩ	±5%	¼W

SCHEMATIC SYMBOL	DESCRIPTION		
R235	5.6KΩ	±5%	¼W
R236	681Ω	±1%	¼W
R237	100KΩ	±5%	¼W
R238	100Ω	±5%	¼W
R239	475Ω	±1%	¼W
R240	270Ω	±5%	¼W
R241	475Ω	±1%	¼W
R242	56.2Ω	±1%	¼W
R244	56.2Ω	±1%	¼W
R245	47KΩ	±5%	¼W
R246	27Ω	±5%	¼W
R247	27Ω	±5%	¼W
R248	681Ω	±1%	¼W
R249	681Ω	±1%	¼W
VR250	100Ω	±20%	
VR251	500Ω	±20%	
VR252	20KΩ	±20%	
VR253	20KΩ	±20%	
VR254	1KΩ	±20%	
U201	LF13741N		
U202	CA3086		
VERT. MILD AMPL.			
C301	.0022μF	±10%	50V
VC303	50PF	±20%	50V
C304	.01μF	±10%	50V
C305	.01μF	±10%	50V
C307	.01μF	±10%	50V
C320	.0022μF	±10%	50V
VC322	50PF	±20%	50V
C323	.01μF	±10%	50V
C324	.01μF	±10%	50V
C325	.01μF	±10%	50V
C337	1μF	±5%	50V
C350	3PF	±5%	50V
C351	3PF	±5%	50V
C352	47PF	±5%	50V
C353	47PF	±5%	50V
C360	680PF	±20%	25V
C375	10μF	±20%	25V
C376	10μF	±20%	50V
C377	10μF	±10%	50V
C378	10μF	±10%	50V
ZD301	HZ3C2		
ZD302	HZ3C2		

SCHEMATIC SYMBOL	DESCRIPTION		
D303	1N4148		
D304	1N4148		
D305	1N4148		
D306	1N4148		
D307	1N4148		
D308	1N4148		
D309	1N4148		
D310	1N4148		
Q301	2SA1206	PNP	
Q302	2SA1206	PNP	
Q303	2SA838	PNP	
Q304	2SA838	PNP	
Q305	2SA838	PNP	
Q306	2SA838	PNP	
Q307	2SA1206	PNP	
Q308	2SA1206	PNP	
Q309	2SA838	PNP	
Q310	2SA838	PNP	
Q311	2SA1206	PNP	
Q312	2SA1206	PNP	
Q313	2SC535	NPN	
Q314	2SC535	NPN	
Q370	2SA838	PNP	
Q371	2SA838	PNP	
Q372	2SC1815		
R301	47Ω	±5%	¼W
R302	47Ω	±5%	¼W
R303	1.5KΩ	±5%	¼W
R304	1.5KΩ	±5%	¼W
R305	7.5KΩ	±5%	¼W
R306	150Ω	±5%	¼W
VR307	500Ω	±20%	
R308	180Ω	±5%	¼W
R309	180Ω	±5%	¼W
R310	51Ω	±5%	¼W
VR311	1KΩ	±20%	
R312	5.6KΩ	±5%	¼W
R313	5.6KΩ	±5%	¼W
VR314	10KΩ	±20%	
R315	33Ω	±5%	¼W
R316	33Ω	±5%	¼W
R317	33Ω	±5%	¼W
R318	33Ω	±5%	¼W
R319	909Ω	±1%	¼W
R320	6.8KΩ	±5%	¼W
R321	2.2KΩ	±5%	¼W
R322	220Ω	±5%	¼W

SCHEMATIC SYMBOL	DESCRIPTION		
R323	22Ω	±5%	¼W
R324	47Ω	±5%	¼W
R325	47Ω	±5%	¼W
R326	1.5KΩ	±5%	¼W
R327	1.5KΩ	±5%	¼W
R328	7.5Ω	±5%	¼W
R329	150Ω	±5%	¼W
VR330	500Ω	±20%	
R331	180Ω	±5%	¼W
R332	180Ω	±5%	¼W
R333	51Ω	±5%	¼W
VR334	1KΩ	±20%	
R335	5.6KΩ	±5%	¼W
R336	5.6KΩ	±5%	¼W
VR377	10KΩ	±20%	
R338	33Ω	±5%	¼W
R339	33Ω	±5%	¼W
R340	5.6KΩ	±5%	¼W
R341	22Ω	±5%	¼W
R342	330Ω	±5%	¼W
VR343	300Ω	±20%	
R344	330Ω	±5%	¼W
R345	47KΩ	±5%	¼W
R346	47KΩ	±5%	¼W
R347	220Ω	±5%	¼W
R348	1KΩ	±5%	¼W
R349	47KΩ	±5%	¼W
R350	475Ω	±1%	¼W
R351	1KΩ	±5%	¼W
R352	820Ω	±5%	¼W
R353	820Ω	±5%	¼W
R354	82Ω	±5%	¼W
R355	82Ω	±5%	¼W
R356	12Ω	±5%	¼W
R357	12Ω	±5%	¼W
R358	2.7KΩ	±5%	¼W
R359	2.7KΩ	±5%	¼W
R360	475Ω	±1%	¼W
R370	2.2KΩ	±5%	¼W
R371	10KΩ	±5%	¼W
R372	2.7KΩ	±5%	¼W
R373	2.2KΩ	±5%	¼W
R374	2.2KΩ	±5%	¼W
VR375	500Ω	±20%	
R376	10KΩ	±5%	¼W
R377	2.7KΩ	±5%	¼W
R378	1KΩ	±5%	¼W

SCHEMATIC SYMBOL	DESCRIPTION		
VR379	500KΩ	±20%	
R380	470KΩ	±5%	¼W
R381	1MΩ	±5%	¼W
R382	10KΩ	±5%	¼W
R383	3.3MΩ	±5%	¼W
R384	51Ω	±5%	¼W
R385	1KΩ	±5%	¼W
R386	1KΩ	±5%	¼W
R388	560Ω	±5%	¼W
R390	15KΩ	±5%	¼W
R391	1KΩ	±5%	¼W
U301	74LS74		
U302	CD4011		
U303	CD4011		
VERTICAL FINAL AMPLIFIER			
C401	27PF	±10%	50V
C402	27PF	±10%	50V
C403	.01μF	±10%	50V
VC405	50PF	±10%	50V
C440	.01μF	±10%	50V
C407	.01μF	±10%	50V
C408	.47PF	±10%	50V
C409	.47PF	±10%	50V
C410	.047μF	±10%	250V
C411	.047μF	±10%	250V
C412	.022μF	±10%	50V
C413	.022μF	±10%	50V
C414	.047μF	±10%	50V
C415	1μF	±20%	200V
C416	.1μF	±10%	50V
C420	10PF	±10%	50V
C421	10PF	±10%	50V
C422	10μF	±20%	25V
C423	10μF	±20%	25V
C424	1μF	±20%	200V
C425	10μF	±20%	25V
C454	10μF	±20%	25V
ZD401	HB-2B-3		
ZD402	HB-2B-3		
D403	1N4148		
D404	1N4148		
D405	1N4148		
D406	1N4148		
L401	33μF		
L402	33μF		

SCHEMATIC SYMBOL	DESCRIPTION		
Q401	2SC1907	NPN	
Q402	2SC1907	NPN	
Q403	2SC1907	NPN	
Q404	2SA1206	PNP	
Q405	2SA1206	PNP	
Q406	2SC1907	NPN	
Q407	649A	PNP	
Q408	669A	NPN	
Q409	669A	NPN	
Q410	649A	PNP	
Q411	2SC2570	NPN	
Q412	2SC2570	NPN	
R401	90.9Ω	±1%	¼W
R402	475Ω	±1%	¼W
R403	560Ω	±5%	¼W
R404	90.0Ω	±1%	¼W
R405	475Ω	±1%	¼W
R406	560Ω	±5%	¼w
R407	680Ω	±5%	¼W
R408	680Ω	±5%	¼W
R409	560Ω	±5%	¼W
R410	560Ω	±5%	¼W
R411	220Ω	±5%	¼W
R412	22Ω	±5%	¼W
R413	220Ω	±5%	¼W
R414	22Ω	±5%	¼W
R415	22K	±1%	1W
R416	22K	±1%	1W
R417	3.3KΩ	±5%	¼W
R418	1KΩ	±5%	¼W
R419	39K	±5%	¼W
R420	4.7Ω	±5%	¼W
R421	10Ω	±5%	¼W
R422	39K	±5%	¼W
R423	4.7Ω	±5%	¼W
R424	3.3KΩ	±5%	¼W
R425	1KΩ	±5%	¼W
R426	4.7Ω	±5%	¼W
R427	82Ω	±5%	¼W
R428	4.7Ω	±5%	¼W
R429	4.7Ω	±5%	¼W
R430	4.7Ω	±5%	¼W
VR431	2KΩ	±20%	
R432	33KΩ	±5%	¼W
R433	150Ω	±5%	¼W
R434	150Ω	±5%	¼W
R435	10Ω	±5%	¼W

SCHEMATIC SYMBOL	DESCRIPTION		
CALIBRATOR, ILLUM, TRACE ROT.			
C450	5PF	±10%	50V
C451	1000PF	±10%	50V
C452	.01μF	±10%	50V
C453	.01μF	±10%	50V
C454	10μF	±20%	25V
Q470	2SC11162	NPN	
Q471	2SC1162	NPN	
R450	10K	±5%	¼W
R451	10KΩ	±10%	¼W
R452	3.3K	±10%	¼W
VR453	75KΩ	±5%	¼W
R454	470KΩ	±5%	¼W
R455	470KΩ	±5%	¼W
R456	220KΩ	±5%	¼W
R457	100KΩ	±5%	¼W
R458	15K	±5%	¼W
R459	10KΩ	±5%	¼W
R460	10KΩ	±5%	¼W
R462	180K	±5%	¼W
R470	3.3Ω	±5%	¼W
VR471	10KΩ	±20%	¼W
R472	1.5KΩ	±5%	¼W
R480	100Ω	±5%	¼W
R481	100Ω	±5%	¼W
VR482	2KΩ	±20%	¼W
U401	CD4011		
TRIG GENERATOR			
C501	180P	±10%	50V
C502	0.01F	±10%	50V
C503	33PF	±10%	50V
C504	0.01	±10%	50V
C505	10μF	±20%	25V
C511	10μF	±20%	25V
C548	10μF	±20%	25V
C549	10μF	±20%	25V
C550	10P	±10%	50V
C551	.01μF	±10%	50V
C552	1μF	±10%	50V
C553	1000DF	±10%	50V
C554	.047μF	±10%	400V
C555	22PF	±10%	500V
C557	10μF	±20%	25V

SCHEMATIC SYMBOL	DESCRIPTION		
C560	.01μF	±10%	50V
C561	.1μF	±10%	50V
C562	47μF	±20%	50V
C563	10μF	±20%	25V
C565	10μF	±20%	25V
D501	1N4148		
ZD501	HZ9C1		
D502	1N4148		
D503	1N4148		
D504	1N4148		
D505	1N4148		
D550	1N4148		
D551	1N4148		
L550	6.8μ		
Q501	2SA1206	PNP	
Q502	2SA1206	PNP	
Q503	2SC1907	NPN	
Q504	2SA1206	PNP	
Q505	2SA1206	PNP	
Q550	2SA838	PNP	
Q551	2SA838	PNP	
Q552	2SK404E	FET	
Q553	2SC458	NPN	
Q555	2SC535C	NPN	
Q556	2SC535C	NPN	
Q557	2SC1907	NPN	
Q558	2SA1206	PNP	
Q559	2SC1907	NPN	
R501	100Ω	±5%	¼W
R502	100Ω	±5%	¼W
R503	82Ω	±5%	¼W
R504	1.5KΩ	±5%	¼W
R505	1.5KΩ	±5%	¼W
R506	220Ω	±5%	¼W
R507	1KΩ	±5%	¼W
R508	2.7KΩ	±5%	¼W
VR509	2KΩ	±20%	
R510	10Ω	±5%	¼W
R511	1.5KΩ	±5%	¼W
R512	51Ω	±1%	¼W
R513	100Ω	±5%	¼W
R514	100Ω	±5%	¼W
R515	22Ω	±5%	¼W

SCHEMATIC SYMBOL	DESCRIPTION		
VR516	100Ω	±20%	
R517	1KΩ	±5%	¼W
R518	1KΩ	±5%	¼W
VR519	1KΩ	±20%	
R520	220Ω	±5%	¼W
R521	220Ω	±5%	¼W
R522	47KΩ	±5%	¼W
R523	47KΩ	±5%	¼W
R550	47Ω	±5%	¼W
R551	1KΩ	±1%	¼W
R552	1.5K	±5%	¼W
R553	1K	±5%	¼W
R554	8.2KΩ	±5%	¼W
R555	2.7KΩ	±5%	¼W
R558	390Ω	±5%	¼W
R559	470KΩ	±5%	½W
R560	68Ω	±5%	¼W
R561	470KΩ	±5%	¼W
R563	100Ω	±5%	¼W
R565	2.7KΩ	±5%	¼W
R567	15KΩ	±5%	¼W
R568	15KΩ	±5%	¼W
R569	1KΩ	±5%	¼W
VR569	10KΩ	±20%	
R572	1KΩ	±5%	¼W
VR572	10KΩ	±20%	
R573	100Ω	±5%	¼W
R574	1.5KΩ	±5%	¼W
R575	10Ω	±5%	¼W
R576	680Ω	±5%	¼W
R577	2.7KΩ	±5%	¼W
R578	39K	±5%	¼W
R579	470Ω	±5%	¼W
R580	39K	±5%	¼W
R581	47KΩ	±5%	¼W
R582	47KΩ	±5%	¼W
R583	10Ω	±5%	¼W
R585	1KΩ	±5%	¼W
R586	560Ω	±5%	¼W
R587	10KΩ	±5%	¼W
R588	4.7KΩ	±5%	¼W
VR589	2KΩ	±20%	

SCHEMATIC SYMBOL	DESCRIPTION		
R590	1KΩ	±5%	¼W
R595	1KΩ	±5%	¼W
R596	1KΩ	±5%	¼W
R598	10KΩ	±5%	¼W
R599	10KΩ	±5%	¼W
U301	74LS74		
U550	74 SOON		
HOR. CONTROL CKT.			
C601	120PF	±10%	50V
C602	10μF	±20%	25V
C603	.022μF	±10%	50V
C604	1μF	±20%	25V
C605	1μF	±20%	25V
C606	180PF	±10%	50V
D601	1N4148		
D602	1N4148		
D603	1N4148		
D604	1N4148		
D605	1N4148		
D606	1N4148		
D607	1N4148		
D608	1N4148		
D609	1N4148		
Q601	2SC1815	NPN	
Q602	2SC1815	NPN	
Q603	2SC1815	NPN	
Q604	2SC1815	NPN	
Q605	2SA1029	PNP	
Q606	2SC1815	NPN	
R601	100KΩ	±5%	¼W
R602	4.7KΩ	±5%	¼W
R603	10KΩ	±5%	¼W
R604	1KΩ	±5%	¼W
R605	100Ω	±5%	¼W
R606	2.2KΩ	±5%	¼W
R607	4.7KΩ	±5%	¼W
R608	10KΩ	±5%	¼W
R609	10KΩ	±5%	¼W
R610	2.2KΩ	±5%	¼W
R611	22KΩ	±5%	¼W
R612	1.5KΩ	±5%	¼W
R613	100KΩ	±5%	¼W
R614	1.5KΩ	±5%	¼W
R615	51Ω	±5%	¼W
R616	470Ω	±5%	¼W

SCHEMATIC SYMBOL	DESCRIPTION		
VR617	10KΩ	±20%	
R618	10K	±5%	¼W
R619	1KΩ	±5%	¼W
R620	220Ω	±5%	¼W
R621	270Ω	±5%	¼W
R622	10KΩ	±5%	¼W
R623	10KΩ	±5%	¼W
R624	10Ω	±5%	¼W
R625	5.6KΩ	±5%	¼W
R626	5.6KΩ	±5%	¼W
R630	100KΩ	±5%	¼W
R631	1KΩ	±5%	¼W
R632	1KΩ	±5%	¼W
R635	47Ω	±5%	¼W
U601	74LS74		
H-FINAL AMPLIFIER			
C650	10μF	±20%	50V
C651	.01μF	±10%	500V
C652	.01μF	±10%	500V
C653	.01μF	±10%	500V
C654	.01μF	±10%	500V
C656	330PF	±10%	50V
C661	1000PF	±10%	50V
D650	1N4148		
D651	1N4148		
D652	1N4148		
D653	1N4148		
D654	1N4148		
Q650	2SC945	NPN	
Q651	2SC945	NPN	
Q652	2SA1015	PNP	
Q653	3SA1015	PNP	
Q654	2SC1907	NPN	
Q655	2SC1907	NPN	
Q656	2SC1907	NPN	
Q657	2SA838	PNP	
Q658	2SB649	PNP	
Q659	2SD669	NPN	
Q660	2SD669	NPN	
Q661	2SB649	PNP	
Q662	2SC1815	NPN	
R650	1.5K	±5%	¼W
R651	5.6KΩ	±5%	¼W
R652	5.6KΩ	±5%	¼W
R653	5.6KΩ	±5%	¼W
R654	5.6KΩ	±5%	¼W

SCHEMATIC SYMBOL	DESCRIPTION		
R655	68Ω	±5%	¼W
VR655	100VR	±20%	
R656	22Ω	±5%	¼W
R657	1KΩ	±1%	¼W
R658	1KΩ	±1%	¼W
R659	270Ω	±5%	¼W
R660	1.8K	±5%	¼W
R661	750Ω	±5%	¼W
R662	330Ω	±5%	¼W
R663	10KΩ	±5%	¼W
R664	330Ω	±5%	¼W
R665	100KΩ	±1%	¼W
R666	100KΩ	±5%	¼W
R667	1.5KΩ	±5%	¼W
R668	330Ω	±5%	¼W
R669	2.2KΩ	±5%	¼W
R670	2.2KΩ	±5%	¼W
R671	100KΩ	±1%	¼W
R672	100KΩ	±5%	¼W
R673	100KΩ	±5%	¼W
R674	1.5KΩ	±5%	¼W
R675	330Ω	±5%	¼W
R676	47Ω	±5%	¼W
R677	47Ω	±5%	¼W
VR678	10KΩ	±20%	
R680	100Ω	±5%	¼W
TIME BASE CIRCUIT			
C701	10μF	±20%	25V
C702	.022μF	±10%	50V
C703	.01μF	±10%	50V
VC704	50PF	±10%	50V
C705	910PF	±5%	50V
C706	1μF	±5%	100V
C707	.022μF	±10%	50V
C708	10μF	±20%	25V
C709	.022μF	±10%	50V
C710	.022μF	±10%	50V
C711	.33μF	±20%	100V
C712	4.7μF	±20%	25V
C713	47μF	±20%	25V
C714	470μF	±20%	25V
C715	47PF	±10%	50V
ZD701	HZ6B1		
D702	1N4148		
Q701	BSX20		

SCHEMATIC SYMBOL	DESCRIPTION		
Q702	2SA1051	PNP	
Q703	2SK404		
Q704	2SC458	NPN	
R712	4.7KΩ	±5%	¼W
R713	15KΩ	±5%	¼W
R714	51Ω	±5%	¼W
R715	39Ω	±5%	¼W
R716	51Ω	±5%	¼W
R717	1.8KΩ	±5%	¼W
R718	10KΩ	±5%	¼W
VR719	100K VR	±20%	
R720	47KΩ	±5%	¼W
VR721	100KB	±20%	
R722	270KΩ	±5%	¼W
R723	10Ω	±5%	¼W
U701	TL081		

DELAY CIRCUIT			
C751	.022μF	±10%	50V
C752	.01μF	±10%	50V
C753	910PF	±5%	50V
VC754	50PF	±10%	50V
C755	22PF	±10%	50V
C756	.022μF	±10%	50V
C757	10μF	±20%	25V
C758	.022μF	±10%	50V
C759	10μF	±20%	25V
C760	.022μF	±10%	50V
C762	220PF	±10%	50V
C763	.022μF	±10%	50V
C764	10μF	±20%	25V
C765	1μF	±5%	100V
C767	47PF	±10%	50V
C780	270PF	±10%	50V
C785	.022μF	±10%	50V
ZD751	HZ6B1		
D752	1N4148		
D753	1N4148		
ZD754	HZ6B1		
D755	1N4148		
D756	1N4148		
Q751	2SA1015	PNP	
Q752	BSX20		
Q753	2SK404		
Q754	2SC458	NPN	

SCHEMATIC SYMBOL	DESCRIPTION		
VR761	100KΩ	±20%	
R762	47KΩ	±5%	¼W
R763	270KΩ	±5%	¼W
R764	51Ω	±5%	¼W
R765	15KΩ	±5%	¼W
R766	4.7KΩ	±5%	¼W
R767	39Ω	±5%	¼W
R768	51Ω	±5%	¼W
R769	10KΩ	±5%	¼W
R770	1.8KΩ	±5%	¼W
R771	4.7KΩ	±5%	¼W
VR772	2KΩ	±20%	
R773	47KΩ	±5%	¼W
R774	3.3KΩ	±5%	¼W
VR775	100KΩ	±20%	
VR776	200KΩ	±20%	
R777	1KΩ	±5%	¼W
R778	10Ω	±5%	¼W
R779	1KΩ	±5%	¼W
R780	1MΩ	±5%	¼W
R790	10Ω	±5%	¼W
U751	LM741CN		
U752	TL081		
U753	74LS74N		
U754	LM710CN		
U755	LM308N		

CRT CIRCUIT			
C801	120PF	±10%	50V
C802	68PF	±10%	3KV
C803	68PF	±10%	3KV
C804	68PF	±10%	3KV
C805	.22μF	±20%	1KV
C806	.22μF	±20%	1KV
C807	.33μF	±10%	100V
C808	2.2μF	±20%	200V
C809	.047μF	±10%	200V
C810	10μF	±20%	50V
C811	.1μF	±10%	50V
C830	33PF	±10%	50V
C831	4700PF	±10%	3KV
D801	1N4148		
D802	1N4148		
D803	1N4148		
D804	1N4148		
ZD804	ZPY100		
D805	IN4003		

SCHEMATIC SYMBOL	DESCRIPTION		
ZD806	RD33EB		
D807	1N4148		
D830	1N4148		
Q801	2SA1015	PNP	
Q802	2SC1815	NPN	
Q803	2SA1029	PNP	
Q804	2SC1815	NPN	
Q805	BF422		
R802	2.2KΩ	±5%	¼W
R803	10KΩ	±5%	¼W
R804	100Ω	±5%	¼W
R805	330Ω	±5%	¼W
VR805	5KΩ	±20%	
R806	220KΩ	±5%	¼W
R807	51Ω	±5%	¼W
R808	51Ω	±5%	¼W
R809	10KΩ	±5%	¼W
R810	10KΩ	±5%	¼W
R811	680KΩ	±5%	¼W
R812	2.2MΩ	±5%	¼W
VR813	500KΩ	±20%	
R814	1MΩ	±5%	½W
R815	1.5MΩ	±5%	½W
R816	1.5MΩ	±5%	½W
VR817	500KΩ	±20%	
VR818	500KΩ	±20%	
VR819	500KΩ	±20%	
R820	10KΩ	±5%	¼W
R821	100KΩ	±5%	¼W
VR822	50KΩ	±20%	
R823	10K	±5%	¼W
R824	120KΩ	±5%	¼W
R825	4.7KΩ	±5%	¼W
R830	1MΩ	±5%	¼W
R831	100KΩ	±5%	¼W
U801	CQY80		

POWER SUPPLY			
C901	47μF	±20%	200V
C902	1000μF	±20%	25V
C903	1000μF	±20%	25V
C904	1μF	±20%	200V
C905	2.2μF	±20%	200V
C906	47μF	±20%	25V
C907	47μF	±20%	25V
C908	47μF	±20%	25V

SCHEMATIC SYMBOL	DESCRIPTION		
D903	1N4148		
ZD904	HZ12B1		13V
ZD905	HZ12B1		13V
D906	1N4148		
ZD907	HZ6B1		5.6V
Q901	2SB861	PNP	
Q902	2SB861	PNP	
Q903	2SD880	NPN	
Q904	2SD880	NPN	
R901	82Ω	±5%	1W
R902	2.7KΩ	±5%	2W
R903	2.7KΩ	±5%	2W
R904	4.7Ω	±5%	¼W
R905	100Ω	±5%	¼W
R906	220Ω	±5%	¼W
R907	560Ω	±5%	¼W
R908	10KΩ	±1%	¼W
R909	121KΩ	±1%	¼W
R910	470Ω	±5%	¼W
R911	33Ω	±5%	2W
R912	5.6KΩ	±5%	¼W
R913	5.6KΩ	±5%	¼W
VR914	1KΩ	±5%	¼W
R915	5.6KΩ	±5%	¼W
R916	12.1KΩ	±1%	¼W
R917	12.1KΩ	±1%	¼W
R918	82Ω	±5%	1W
R919	470Ω	±5%	¼W
R920	5.11K	±1%	¼W
R921	12.1K	±5%	¼W
R922	150Ω	±5%	¼W
R923	82Ω	±5%	1W
U901	UPC4558		
U902	UPC4558		

H.V GENERATOR CIRCUIT			
C951	4700PF	±10%	3KV
C952	4700PF	±10%	3KV
C953	100μF	±20%	50V
C954	.1μF	±10%	100V
C955	.1μF	±10%	100V
C956	100μF	±20%	25V
C957	10μF	±20%	25V
C958	68PF	±10%	3KV
C959	4700PF	±10%	3KV
C960	4700PF	±10%	3KV
HD950	R3000		
HD951	R3000		

SCHEMATIC SYMBOL	DESCRIPTION		
ZD952	HZ12B1		12V
Q950	BD237		
R951	150Ω	±5%	¼W
R952	510Ω	±5%	¼W
R953	10MΩ	±5%	¼W
R954	10KΩ	±5%	¼W
R955	33KΩ	±5%	¼W
R956	39KΩ	±5%	¼W
R957	22KΩ	±5%	¼W
R958	1.5MΩ	±5%	¼W
R959	3.3MSL	±5%	¼W
R960	270Ω	±5%	¼W
R962	3.3MΩ	±5%	¼W
U950	LM741CN		
L961	68μH		
L962	68μH		