

6. Maintenance, Repair and Storage

- (1) This equipment is composed of many high-precision components and components which require high internal pressure, care is required when handling or storing this equipment.
- (2) Occasionally, clean the graticule scale with a clean, soft cloth.
- (3) Ideal ambient temperature range when storing this equipment is -10 to $+60^{\circ}\text{C}$.

Calibration Period

order to maintain this equipment in stable and efficient operating condition, calibrate the equipment after every 1,000 hours operating time, or every 6 month; whichever is shorter.

7. Test Equipment Required

Description	Minimum specification	Usage
1. Constant amplitude signal generator	50KHz refernce frequency; maximum frequency 70KHz; variable amplitude	Check horizontal, vertical and trigger bandwith.
2. Standard amplitude calibrator	Amplitude accuracy:0.25% variable amplitude; 5mV to 40V; frequency:1 KHz square wave	Check horizontal and vertical gain
3. Square-wave generator	Variable frequency: 10Hz to 1MHz; output amplitude; 10mV to 100V	Check probe and vertical compensation.
4. Digital voltmeter	0.1% accuracy	Check power supply
5. Time mark generator	0.1% accuracy	Check horizontal timing.
6. Cable	Impedance, 50 ohms; length, 42inches, connectors, BNC	External trigger operation check. Horizontal gain check and adjustment.
7. Termination	Impedance, 50ohm; connectors, BNC	Vertical amplifier compensation checks and adjustment.
8. Attenuator	Ratio, 1/10; connectors, BNC; impedance, 50ohms	Vertical amplifier bandwidth check
9. T-connector	Connectors, BNC	External trigger operation check.

8. Initial Starting Procedure

1. Rotate the INTENSITY control to the midrange and set the POWER switch to ON.
2. Wait a few seconds for the cathode ray tube (CRT) to warm up.
A trace should appear on the CRT.
3. If trace disappears, increase (clockwise) the INTENSITY control setting until the trace is easily observed, or roughly check/adjust the DC blance to get a trace as same as NO.
4. Adjust the FOCUS control for the best focused display.
5. Readjust the POSITION control if necessary, to center the trace.

9. POWER SUPPLY SYSTEM

NOTE

Before you start operation, see the adjustment location in pullout pages.

Control settings

Preset the controls as given in the preliminary control setting.

①-1. Check low-voltage supply, if necessary.

- a. Connect the digital multimeter(DMM) between the V line (P602-1) and ground.

:+209V to +231V (+220V) -->6502

:+114V to +126V (+120V) -->6504/06

- b. Connect the digital multimeter(DMM) between the V line (P602-2) and ground.

:+114V to +126V (+120V) -->6502

:+71.25 to +78.75V(+75V) -->6504/06

- c. Connect the digital multimeter(DMM) between the V line (P602-3) and ground.

:+7.6V to +8.4V (+8V)

- d. Connect the digital multimeter(DMM) between the V line (P602-4) and ground.

:+4.75V to +5.25V(+5V)

- e. Connect the digital multimeter(DMM) between the V line (P602-5) and ground.

:-7.6V to -8.4V (-8V)

①-2. Check high voltage supply.

- a. Connect the DMM to the H.V. test point P506-3 with a high-voltage probe(100:1)

- b. Check for a reading of -1.85KV to -1.95KV (-1.90KV) -->6502

-1.60KV to -1.70KV (-1.65KV) -->6504/06

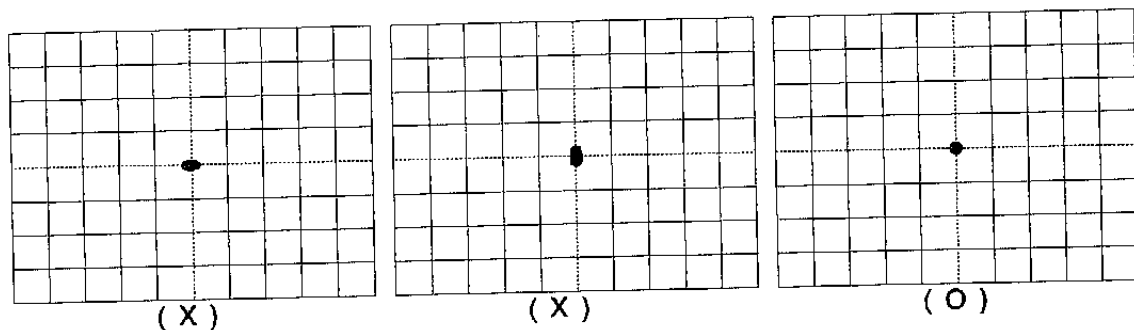
10. DISPLAY

Control settings

Preset the controls as given in the preliminary control setting.

②-1. Check / adjust ASTIG and FOCUS

- Put the focus control knob at center position and press the X-Y switch.
- Set the INTENSITY control for a small spot, as the following figure, using the position controls.
- Check that the spot is round.
- Adjust the FOCUS adjustment and ASTIG adjustment VR1035 for a round spot.



②-2. Check / adjust INTENSITY.

- Put the INTENSITY control knob at the position of 10 o'clock and adjust semi-fixed resistor VR1021 in V-PCB assembly until the trace line fades away.

②-3. Check / adjust trace rotation.

- Position the trace to the center graticule line.
- Check that the trace is in parallel with the center horizontal line.
- Adjust TRACE ROTATION (screwdriver adjustment on front panel) for a trace that is in parallel with the horizontal graticule line.

11. VERTICAL SYSTEM

Control settings

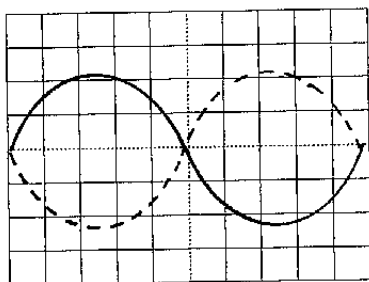
- ③-1. Check / adjust Step attenuator balance
- Set the VOLTS/DIV switch to 5mV position.
 - Position the trace to the horizontal center line.
 - Change the VOLTS/DIV switch to the 10mV position.
 - Adjust the CH1, CH2 STEP BAL adjustment, VR22 or VR122, for a trace at the horizontal center line.
 - Repeat the part a. through d. until less than $\pm 2.5\%$ shift is noted when changing the VOLTS/DIV setting.
- ③-2. Check / adjust VARIABLE BALANCE.
- Position the trace to the horizontal center line.
 - The knob is turned all the way in the opposite to the arrow.
 - Adjust the CH1, CH2 VAL /BAL adjustment, VR60 or VR160, for a trace at the horizontal center line.
 - Repeat the part a. through c. until less than $\pm 2.5\%$ shift is noted when the knob is turned.
- ④. Check / adjust CH2-INVERT, CH-1.2 POSITION, CRT CENTER
(CH2 only)
- Set the CH1 and CH2 input coupling switches to GND.
 - Set to the V MODE switch to CH2, and repeat the CH2 INVERT switch of push or full.
 - This time, adjust the CH2 POSITION adjustment VR163 so that the trace aligns with stop moving.
 - Next, set the CH2 POSITION knob to the midposition, and adjust the CRT CENTER adjustment VR334 so that the trace aligns with the center horizontal graticule line.

(CH1 only)

- e. Set the V MODE switch to CH1
- f. Set the CH1 POSITION knob to the midposition, and adjust the CH1 POSITION adjustment VR63 so that the trace aligns with the center horizontal graticule line.
- g. Next, adjust the vertical position controls CH1 and CH2 so that the trace aligns with the center horizontal graticule line
- h. Set the V MODE switch to ADD.
- i. Check that the trace aligns with the center horizontal graticule line within ± 0.15 division.

⑤. Check / adjust TRIG center.

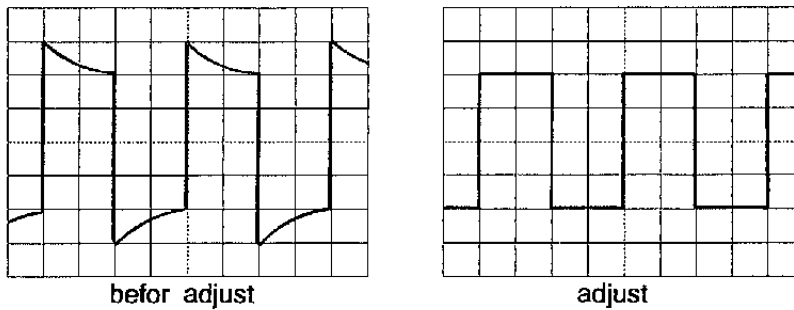
- a. Set the TRIG SOURCE switch to the INT, V-MODE switch to the CH1, CH-COUPLING switch to the AC, TRIG-MODE switch to the AUTO.
- b. Set the TRIG LEVEL VR to midposition.
- c. Connect the sine-wave generator to the input connector for a 0.5 div (1KHz)
- d. When the SLOPE switch push or pull, start position of trace line(SLOPE +, -) is in accord with start point (+, -)
- e. Next, adjust VR420 to the center start point



⑥-1. Check / adjust AC GAIN.

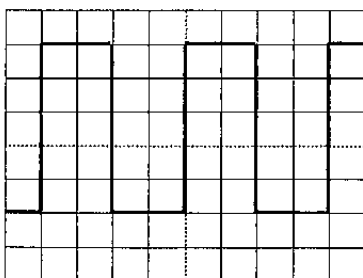
- a. Set the VOLTS/DIV switch to the 0.1V position.
- b. Connect the square-wave generator(using 1 KHz output range).
- c. Adjust the output amplitude of that generator for 5 division deflection of screen.

d. Check the AC GAIN VR33(CH1), VR133(CH2) adjustment for a flat level.



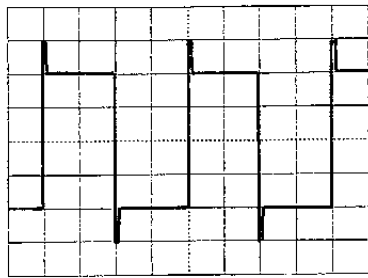
⑥-2. Check / adjust vertical GAIN.

- Set the VOLTS/DIV switch to the 10mV position and the CH-coupling switch to DC.
- Connect the square-wave generator(using 1 KHz output range).
- Set the standard amplitude calibrator for a 50mVp-p(5 division for display) signal.
- Check for a display of 5 division.
- Adjust the GAIN adjustment VR62(CH1), VR162(CH2) for a display of 5 divisions.
- Check all the VOLTS/DIV switch setting.

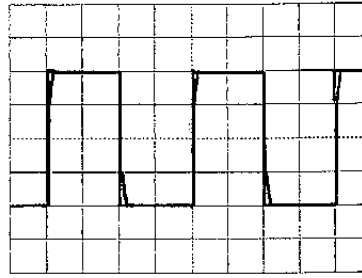


⑦-1. Check / adjust attenuation compensation. (ATT: /100, /10)

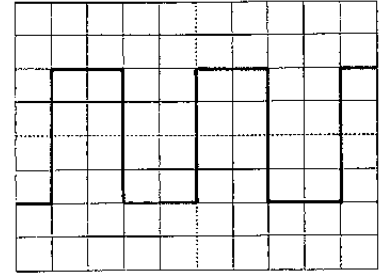
- Set the CH-coupling switch to DC
- Connect the square-wave generator to the CH1(CH2) input terminal check for a square-wave(1KHz) that is flat(flat top) under the following setting.



Over shoot



Under shoot



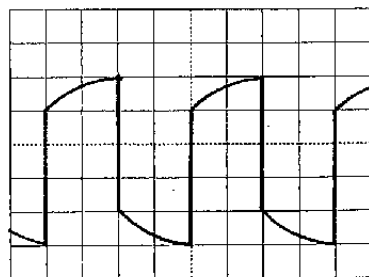
- c. Adjust the trimmer capacitors (refer to the circuit board illustration with adjustment location) for a square-wave(1KHz) that is flat(flat top) under the following setting.

ATT	VOLTS/DIV	Square-wave generator output	Adjust CH1 (CH2)
/10	0.1V	0.5V	CV7(CV107)
/100	1V	5V	CV4(CV104)

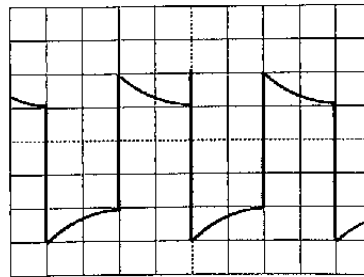
⑦-2. Check / adjust input capacity. (ATT: /10, /100)

- Connect the 10:1 probe(OP20) to the input connector.
- Check the input capacity matching (Adjust probe trimmer to the input square-wave is flat).
- Adjust the trimmer capacitors (refer to the circuit board illustration with adjustment location) for a square-wave(1KHz) that is flat(flat top) under the following setting.

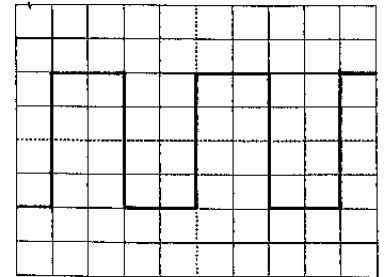
ATT	VOLTS/DIV	Adjust CH1 (CH2)
/10	0.1V	CV3 (CV103)
/100	1V	CV6 (CV106)



Capacitance excessive



Capacitance too low



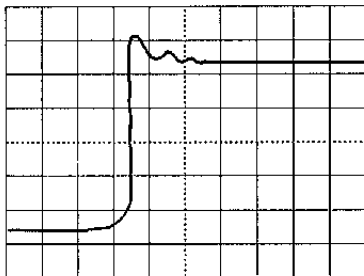
Optimal condition

⑧. Check / adjust vertical step response.

- a. Set the VOLTS/DIV switch to the 5mV position.
- b. Set the TIME/DIV switch to the 0.5mS position.
- c. Connect the fast-rise, positive output (50mV, 1MHz) of the square-wave generator to the input. Use a 50 ohm termination and cable.
- d. Adjust the square-wave generator output for a 5-divisions display.
- e. CH1 - Adjust CV366,CV337 so that a square wave is flat.

CH2 - Adjust CV161,CV366,CV337 so that a square wave is flat.

For over shoot of 8%(0.2DIV),under shoot of 8%(0.2DIV), sag of 3%,ringing of 3%.



⑨. Check / adjust INT TRIG.

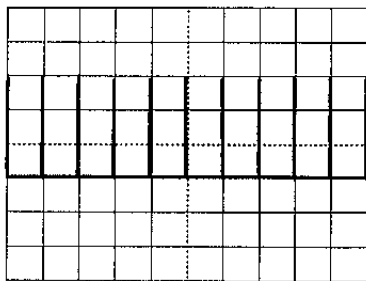
- a. Set the Mode switch CH1, CH-COUPLING switch to the DC, TRIG-MODE switch to the AUTO
- b. Connect the digital multimeter(DMM) to the P200-1 and ground.
- c. Adjust the adjustment VR185 so that be equal to both INT position and CH2 position for the DC LEVEL.

12. HORIZONTAL SYSTEM

Control settings

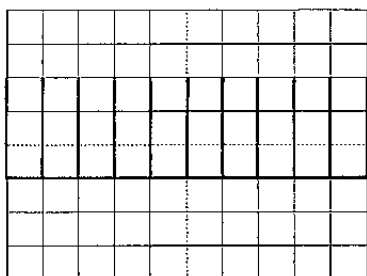
Preset the controls as given in the preliminary control settings.

- ⑩-1. Check / adjust horizontal gain(adjust TIME 1mS).
- Set the CH-COUPLING switch to the DC, TIME/DIV switch to the 1mS position, TRIG.MODE switch to the AUTO, SOURCE switch to the INT.
 - Connect the cable to the output of the time mark generator.
 - Set the time mark generator for 1mS time marks. Use a 50 ohm termination and cable.
 - Check that the time marks align with the graticule lines over the middle ten-divisions, within 3%.
 - Adjust the horizontal gain(TIME 1mS) adjustment VR824 so that the time marks coincide with the middle ten graticule lines.



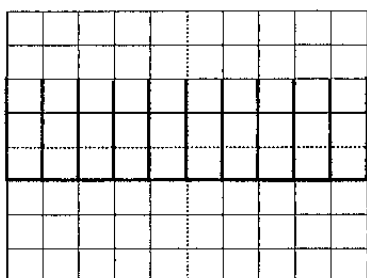
- ⑩-2. Check / adjust low speed sweep accuracy(adjust TIME 10mS).
- Set the CH-COUPLING switch to the DC, TIME/DIV switch to the 10mS position, TRIG.MODE switch to the AUTO, SOURCE switch to the INT.
 - Connect the cable to the output of the time mark generator.
 - Set the time mark generator for 10mS time marks. Use a 50 ohm termination and cable.
 - Check that the time marks align with the graticule lines over the center ten-divisions, within 3%.

- e. Adjust the TIME 10mS adjustment VR542 so that the time marks coincide with the middle ten graticule lines.



⑪-1. Check / adjust TIME 1 μ S.

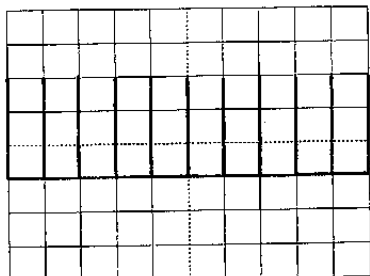
- Set the CH-COUPLING switch to the DC, TIME/DIV switch to the 1 μ S position, TRIG.MODE switch to the AUTO, SOURCE switch to the INT.
- Connect the cable to the output of the time mark generator.
- Set the time mark generator for 1 μ S time marks. Use a 50 ohm termination and cable.
- Check that the time marks align with the graticule line over the middle ten-divisions, within 3%.
- Adjust the TIME 1 μ S adjustment VC520 so that the time marks coincide with the middle ten graticule lines.



⑪-2. Check / adjust TIME 0.1 μ S.

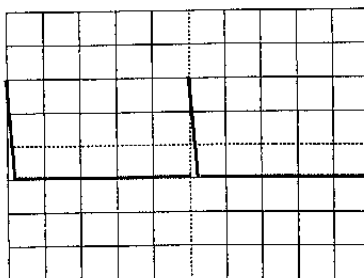
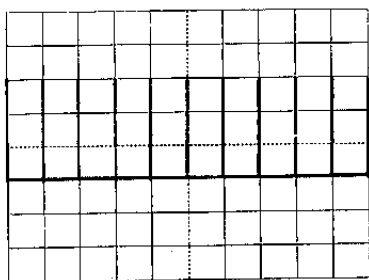
- Set the CH-COUPLING switch to the DC, TIME/DIV switch to the 0.1 μ S position, TRIG.MODE switch to the AUTO, SOURCE switch to the INT.
- Connect the cable to the output of the time mark generator.
- Set the time mark generator for 0.1 μ S time marks. Use a 50 ohm termination and cable.

- d. Check that the time marks align with the graticule line over the middle ten-divisions, within 3%.
- e. Adjust the TIME 0.1 μ S adjustment VR580 so that the time marks coincide with the middle ten graticule lines.

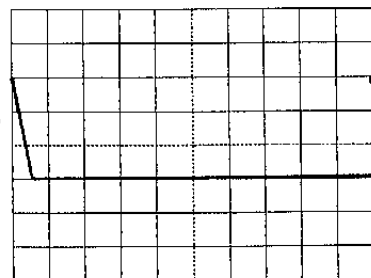


⑫-1. Check / adjust Horizontal $\times 5$ ($\times 10$) MAG.--->(6504/6)

- a. Set the TIME/DIV switch to 1ms.
- b. Connect the cable to the output of the time mark generator.
- c. Push in the $\times 5$ ($\times 10$) MAG.
- d. Set the time mark generator for 1mS time marks. Use a 50 ohm termination and cable.
- e. Check that the one-cycle time marks align with the five(ten)-divisions graticule lines, within 5%.
- f. adjust the MAG GAIN adjustment VR831 so that one-cycle time marks coincide with the five(ten)-divisions graticule lines.
- g. Push in the MAG switch after adjustment and check.



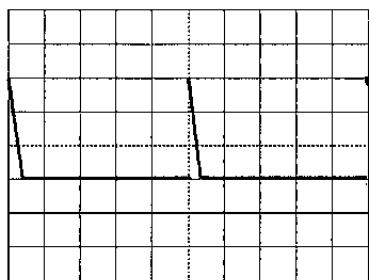
6502



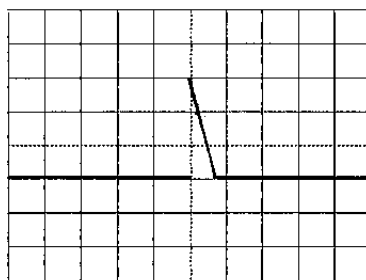
6504/06

⑫-2. Check / adjust CRT CENTER, MAG CENTER.

- a. Set the V-MODE switch to the CH1, VOLTS/DIV switch to the 1V position, TIME/DIV switch to the 0.2mS.
- b. Adjust the TIME POSITION so that the trace aligns left end of vertical graticule line.
- c. Connect the cable to the output of the time mark generator.
- d. Set the time mark generator for 1mS time marks. Use a 50 ohm termination and cable.
- e. Adjust the adjustment VR802 so that the first time mark to the trace aligns left end of vertical graticule line.
- f. This time, push in the MAG $\times 5$ ($\times 10$) switch.
- g. Adjust the adjustment VR802 so that the extension time mark to the coincide of the screen trace center.
- h. Again, push full MAG $\times 5$ ($\times 10$) switch and adjust the adjustment VR821 so that the first time mark to the coincide left end of the screen trace.
- i. Repeat the park a. through h.



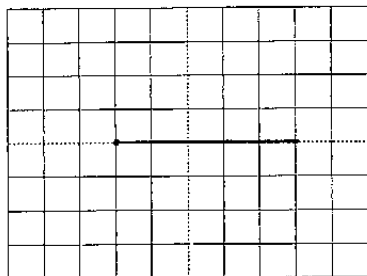
$\times 1$



$\times 5$ ($\times 10$)

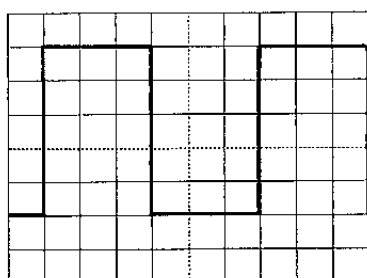
⑬. Check / adjust X gain.

- a. Set the VOLTS/DIV switch to the 0.1V, SWEEP MODE switch to the X-Y, position TRIG MODE switch to the AUTO.
- b. Connect the standard amplitude calibrator to the CH1 input connector.
- c. Set the standard amplitude calibrator for 0.5V.
- d. Check for a display of five divisions.
- e. Adjust the X gain adjustment VR550 for a display of five divisions.



⑭. Check / adjust CAL terminal(0.5Vp-p 1KHz)

- a. Set the VOLTS/DIV switch to the 0.1V position, TIME/DIV switch to the 0.1mS position..
- b. Connect the CAL terminal to the CH1 input terminal.
- c. Check for a display of five divisions
- e. Adjust the CAL adjustment VR1201 for the CAL output of five divisions.(3%)



← A → ← B →

A:B = 48:52 or 52:48