

**CALIBRATION
PROCEDURE**

**MODEL 2160
60 MHz
OSCILLOSCOPE**



BK PRECISION®

I. POWER SUPPLIES AND CRT CIRCUIT —
PWB 2381, 2381-A1

A. POWER SUPPLIES:

1. +12 V: Adjust VR502 for +12.05 V to 12.10 V, measuring at J31.
2. -12 V: Check voltage at J32, 12 V ± .2 V.
3. +5 V: Check voltage at J33, 4.9 V to 5 V.
4. +145 V: Check voltage at J5, +140 to +150 V.
5. -1250 V: Adjust VR901 for -1250 V ± 5 V at J6, using high voltage probe.

B. CRT CIRCUIT:

1. Intensity:
 - a. Obtain a trace on 1 ms/div time base; rotate INTENSITY knob to 9 o'clock position, then, adjust VR803 till the trace is just visible.
 - b. Rotate the INTENSITY knob to extreme CW then, adjust VR802 till the thickness of the trace is about 0.2 div.
2. Astigmatism:
 - a. Select X-Y mode, 50 mv/div, and GND on inputs.

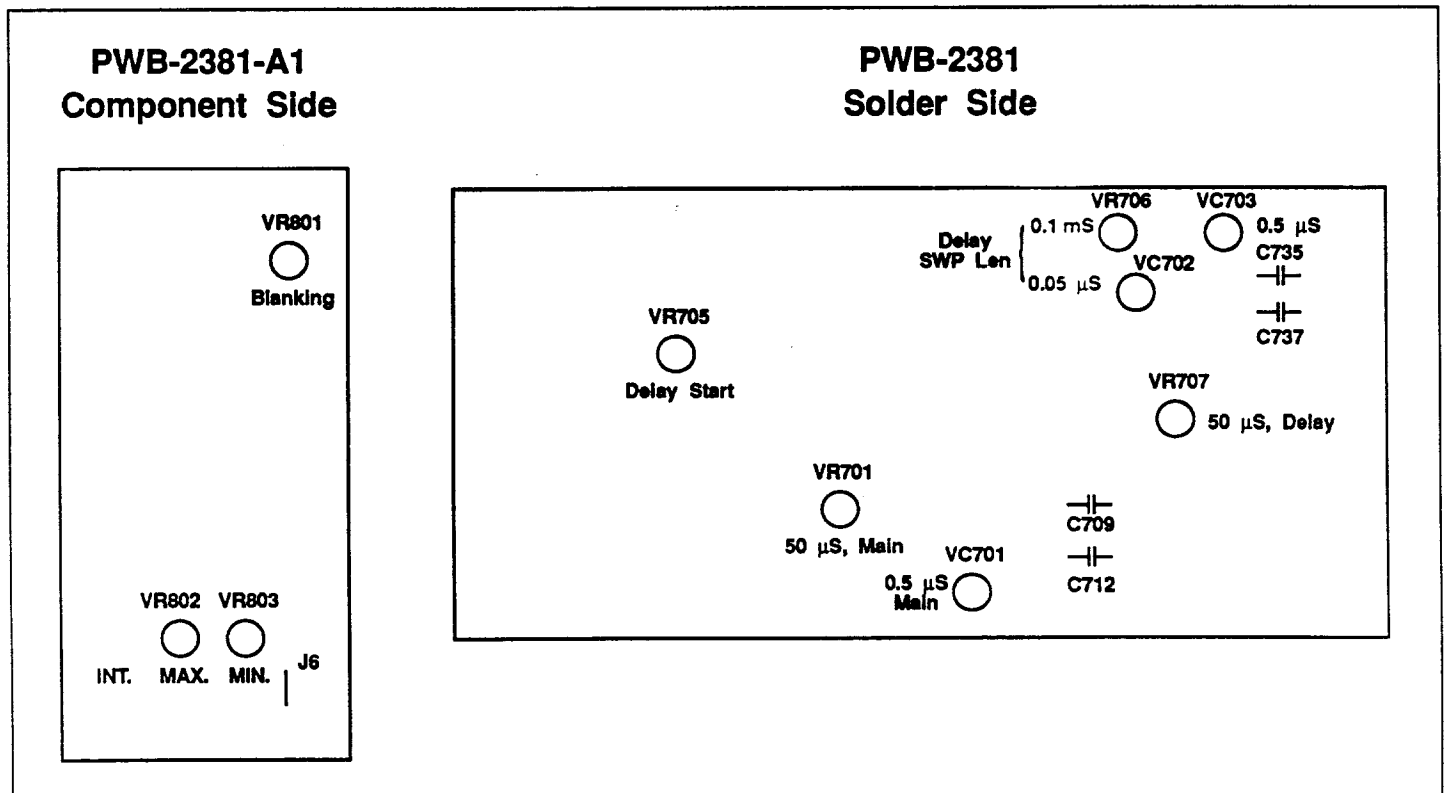
- b. Center the dot on the CRT, then, adjust VR806 for a round dot.
3. Blanking:
 - a. Set Main Time Base to 1 ms, delay Time Base to 50 μs, and Sweep Mode to DELAY.
 - b. Adjust VR801 from its extreme CW position till the bright dot on the starting point of the trace is invisible.
 - c. Display a proper waveform on the CRT, no re-trace should be seen on the CRT (readjust VR801 if necessary).

II. VERTICAL SYSTEM — PWB 2382, 2383

A. DC BALANCE:

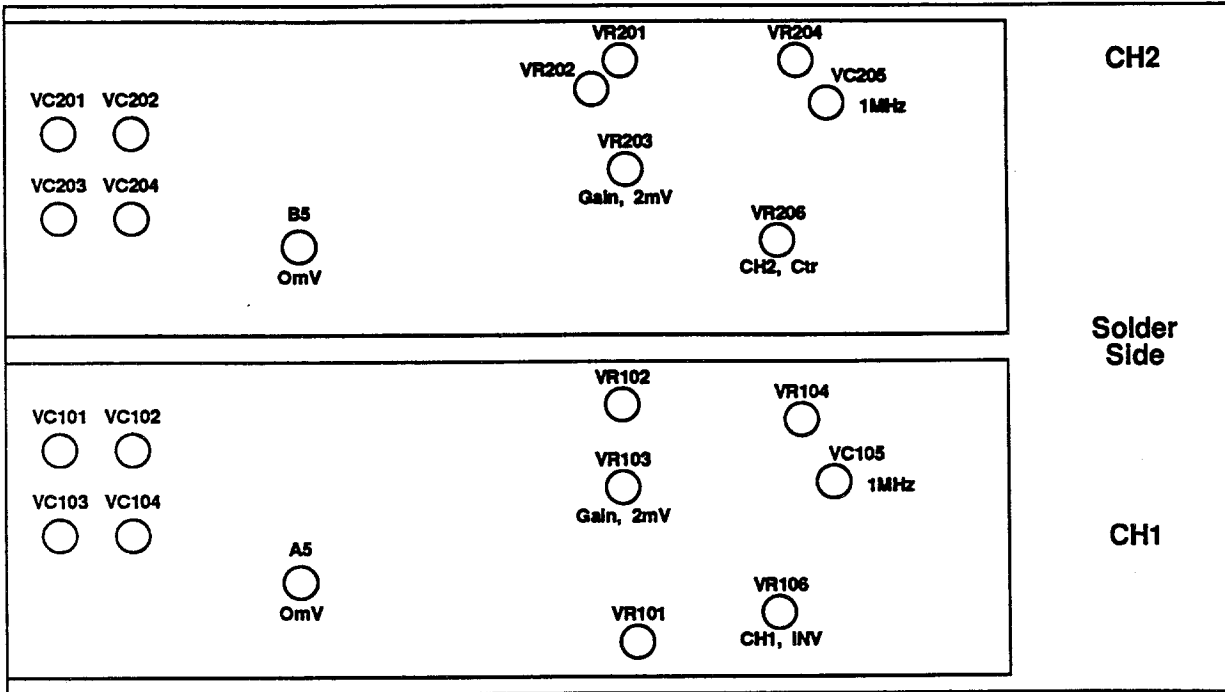
Ground CH1 and CH2 inputs; Select 5 V/div.

1. Step:
 - a. Adjust VR101 for 0.00 mv at A5, and adjust VR201 for 0.00 mv at B5.
 - b. Rotate VOLTS/DIV from 5 V to 5 mv range, the trace should not be shifted more than 0.1 division.
 - c. Adjust VR102 to minimize the trace shift when the VOLTS/DIV SW is switched back and forth between 5 mV and 2 mV for CH1 trace.
 - d. Repeat step c for CH2 trace but adjust VR202.

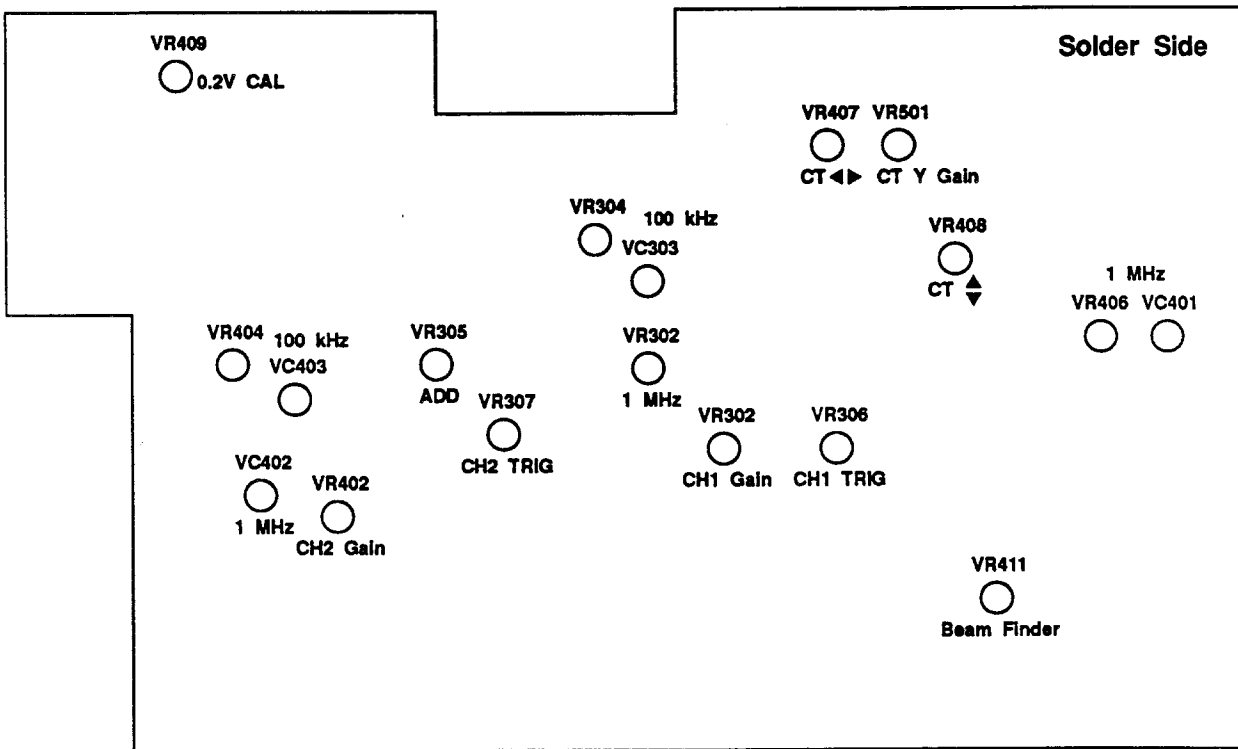


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PWB-2382



PWB-2383

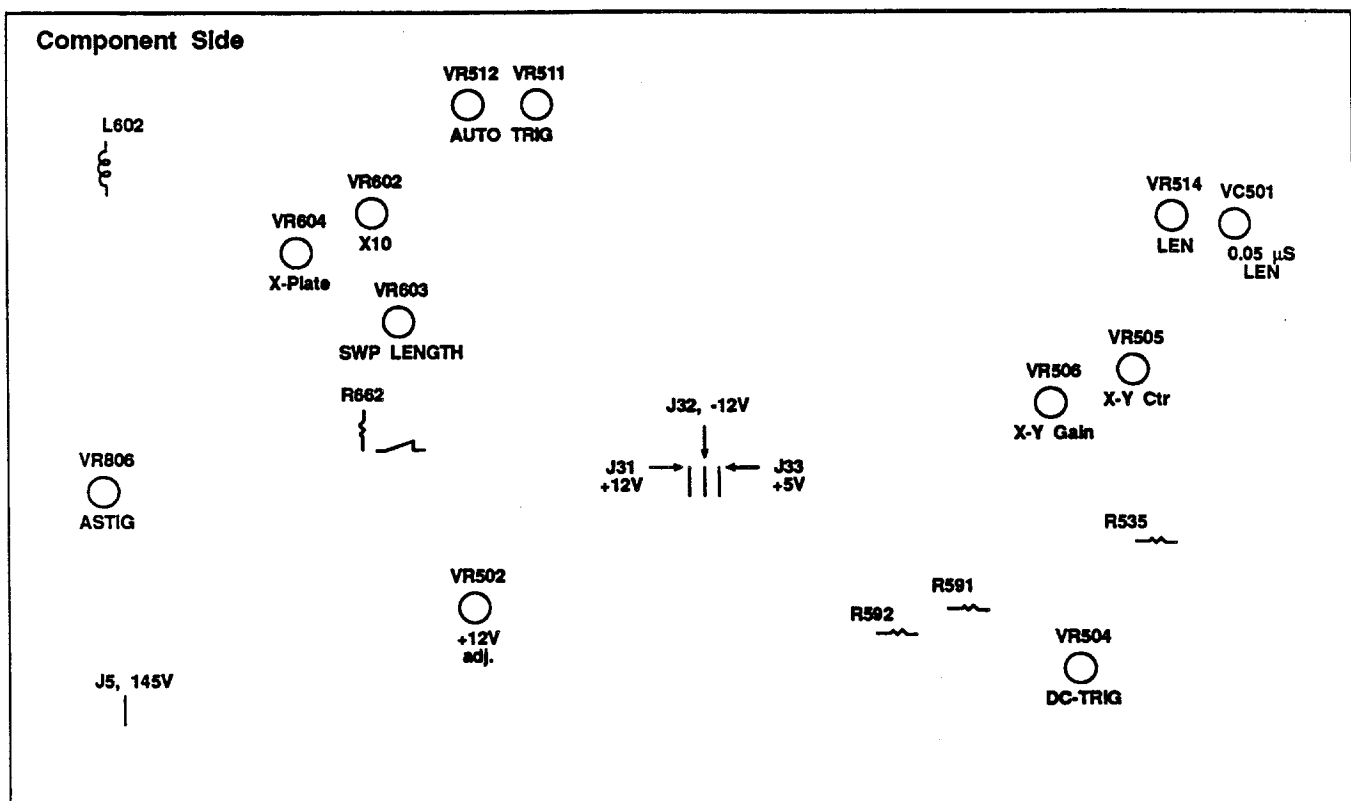


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2. Variable:
 - a. Adjust VR104 to minimize the trace shift while rotating the VAR knob on CH1.
 - b. Adjust VR204 to minimize the trace shift while rotating the VAR knob on CH2.
- B. CH1 INVERT:
 - a. Obtain a CH1 trace.
 - b. Adjust VR106 for zero trace shift while pushing CH1 INV SW in and out.
- C. ADD MODE:
 - a. Ground CH1 and CH2 inputs; obtain two traces on the CRT; then, align both traces to center horizontal line.
 - b. Set Vertical Mode SW to MONO, then, push in ADD mode SW.
 - c. Adjust VR305 till the trace aligns to the center horizontal line.
 - d. Repeat step a through c once.
- D. CH2 SYMETRY:
 - a. Obtain a CH2 trace, then, rotate CH2 Y-POS knob to its mechanical center.
 - b. Adjust VR206 till the trace aligns to center horizontal line.
- E. GAIN:
VAR to CAL position.
 1. CH1:
 - a. Adjust VR302, on 50 mV range, for a 6 div. deflection with a 300 mV p-p input.
 - b. Adjust VR103, on 2 mV range, for a 6 div. deflection with a 12 mV p-p input.
 2. CH2:
 - a. Adjust VR402, on 50mV range, for a 6 div. deflection with a 300 mV p-p input.
 - b. Adjust VR203, on 2mV range, for a 6 div. deflection with a 12 mV p-p input.
- F. FREQUENCY COMPENSATION:
 1. 100 kHz \square :
 - a. Input a 100 kHz squarewave, 250 mV p-p, to both CH1 and CH2 inputs; set VOLTS/DIV to 50 mV/DIV.
 - b. Adjust VR304 and VC303 for an optional squarewave display on CH1 trace.
 - c. Adjust VR404 and VC403 for an optional squarewave display on CH2 trace.
 2. 1MHz \square :
 - a. Input a 1 MHz squarewave, 250 mV p-p, to both CH1 and CH2 inputs; set VOLTS/DIV to 50 mV/DIV.
 - b. Adjust VR406, VC401, VC105, and VC302 till the overshoot of the displayed squarewave on CH1 trace is 2 - 3%.
 - c. Adjust VC402 and VC205 till the overshoot of the squarewave displayed on CH2 trace is 2 -3%.
- G. BANDWIDTH:
 - a. Set both VOLTS/DIV to 50 mV and TIME/DIV to 20 μ s.
 - b. Input a 50 kHz sinewave to CH1, and adjust the input level for 6 division of deflection on CRT.
 - c. Increase the frequency to 60 MHz, while maintaining the same input level, the deflection on CRT must be greater than 4.2 div., otherwise repeat Step F-2.
 - d. Repeat b and c steps on CH2.
- H. ATTENUATOR COMPENSATION:
Use 1KHz squarewave, 6 div., and x10 probe.
 1. CH1:
 - a. Adjust x10 probe compensation on 50 mV/div.
 - b. Adjust VC103 and VC104 on 1V/div.
 - c. Adjust VC101 and VC102 on 1V/div.
 2. CH2:
 - a. Adjust x10 probe compensation on 50 mV/div.
 - b. Adjust VC203 and VC204 on 1V/div.
 - c. Adjust VC201 and VC202 on 1V/div.
- I. 0.2 V CAL:
 - a. Select CH1, 50 mV/div, DC coupling, and Main sweep. (The gain should have been calibrated per Step E).
 - b. Input 0.2 V CAL out to CH1 through a x1 probe.
 - c. Adjust VR409 for 4 divisions deflection.

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PWB-2380



III. HORIZONTAL SYSTEM — PWB 2380-2381

A. SWEEP LENGTH:

- Set SWEEP MODE to MAIN and Main Time/Div to 50 μ Sec.
- Adjust VR514 for a 5 V p-p sweep on R662 (monitored by 2160)
- Obtain a trace on Auto Trigger mode, and adjust VR603 till the trace length reaches to 10 ± 0.1 divisions.
- Re-adjust VR514 till the trace length reaches to 11 divisions.
- Set Main Time/Div to 0.05 μ Sec, then adjust VC501 till the trace length reaches to 11.5 divisions.
- Set Main Time/Div to 1 ms, Delay Time/Div to 0.1 ms, and SWEEP MODE to DELAY, then adjust VR706 till the trace length is 11.5 divisions.
- Set Delay Time/Div to 0.05 μ s and Main Time/Div to 5 μ s, then, adjust VC702 till the trace length is 11.5 divisions.

B. X — PLATE VOLTAGE:

- Select X-Y Mode and rotate the position control knobs to the mechanical centers.
- Adjust VR505 to align the dot to the center vertical line.
- Adjust VR604 for 72 V on L602.

C. MIX SWEEP:

- Select MIX mode, 0.1 ms Main Time/Div, and 1 μ s Delay Time/Div.
- Rotate VAR Delay Time Base to its extreme CCW position, then, adjust VR705 (PWB-2381) till the Main sweep is 0.5 division approximately.

D. TIME/DIV:

1. MAIN:

- Select Main Sweep and VAR to CAL.
- Adjust VR701 to calibrate 50 μ s/div.
- Adjust VC701 to calibrate 0.5 μ s/div.
- Adjust VR602 to calibrate X-MAGX10.

- e. Check the accuracy of 0.5 ms/div; increase or decrease C709 if necessary.
- f. Check the accuracy of 50 ms/div; increase or decrease C712 if necessary.

2. DELAY:

- a. Select Delay Sweep and VAR to CAL.
- b. Adjust VR707 to calibrate 50 μ s/div.
- c. Adjust VC703 to calibrate 0.5 μ s/div.
- d. Check 0.5 ms/div accuracy; increase or decrease C735 if necessary.
- e. Check 50 ms/div accuracy; increase or decrease C737 if necessary.

E. TRIGGERING:

1. AUTO Trig.:

- a. Set Vertical Mode to CH1; Trigger Source to CH1; AC-GND-DC to AC; Trigger Coupling to AC; Main Time/Div to 20 μ s; Auto Trig. SW in.
- b. Input a 50 KHz sinewave to CH1 with 0.8 division of deflection.
- c. Rotate TRIG LEVEL to its extreme CW position, then, adjust VR511 from its extreme CW position till triggering just occurs.
- d. Rotate TRIG LEVEL to its extreme CCW position, then, adjust VR512 from its extreme CW position till triggering just occurs.

2. DC Trig.:

- a. Set Auto Trig. SW to out position AC-GND-DC to GND, Coupling to AC, and TRIG LEVEL to extreme CW position.
- b. Select CH1 trigger source, then, adjust VR504 for 0 ± 1 mV at the junction of R591 and R592.
- c. Adjust VR306 (PWB-2380) for 0 ± 1 mV at R535.
- d. Select CH2 trigger source, then, adjust VR307 for 0 ± 1 mV at R535.

F. X-Y GAIN AND CENTERING:

- a. Set scope to Main Sweep, VAR Time/Div to CAL, Vertical Mode to CH2, AC Coupling.
- b. Obtain a sinewave with 8 div of deflection and align the starting of the trace to the first vertical graticule line.
- c. Set the Vertical Mode to CH1 and SWEEP MODE to X-Y.
- d. Adjust VR506 (PWB-2380 for a horizontal deflection of 8 divisions; and adjust VR505 (PWB-2380) to center the trace.

IV. COMPONENT TEST AND BEAM FINDER — PWB 2383

A. COMPONENT TEST:

Push in COMPONENT TEST SW to obtain a horizontal trace.

1. X-Axis:

- a. Adjust VR408 to align the horizontal trace to the center horizontal graticule line.
- b. Rotate the horizontal position control knob ($\blacktriangleleft \blacktriangleright$) to center the trace horizontally.

2. Y-Axis:

- a. Connect a jumper to COMP TEST jacks to obtain a vertical trace.
- b. Adjust VR407 till the trace aligns to the center vertical graticule line. Be sure that the $\blacktriangleleft \text{POS} \blacktriangleright$ is on proper center position.
- c. Adjust VR501 till the length of the vertical trace equals to that of X-axis.

B. BEAM FINDER:

- a. With input grounded, obtain a trace on the CRT.
- b. Rotate vertical position control knob to align the trace to center horizontal graticule line.
- c. Push and hold BEAM FIND SW to IN position, then, adjust VR411 till the shortened trace aligns to the center line again.