

## TYPE 315 CALIBRATION PROCEDURE

### Equipment required:

1. Test Scope, 5-mc passband (Type 315 or equivalent)
2. Marker Generator, Type 180
3. Fast-rise Square-wave Generator, Type 105
4. 20,000 Ohms/v meter
5. Constant-amplitude signal generator, Type 190
6. Delay line dummy load (1.1-k precision resistor)
7. Variable line supply, 105-125 v.

### Power-Off Checks:

1. Visually inspect for burned or damaged wiring and for evidence of overheated components.
2. Center all "Screwdriver Adj" pots.
3. Disconnect delay line and tape the bare ends of the leads, they are at +100 v jumper pin 6 of V4 to pin 7 of V8 and connect junction through 1.1k precision resistor to +100 v supply.
4. Check Power Supply resistance to ground. A convenient point is the terminal board at rear of sweep chassis. Typical readings are:

SUPPLY	WIRE	RESISTANCE
-150	0-1-5-1	5k
+100	9-1-0-1	20k
+225	9-2-2-1	20k
+350	9-3-5-1	30k

Because of the electrolytic capacitors, the ohmmeter should be connected in the same polarity as the power supply being checked.

### POWER ON:

(Instrument upside down)

1. Set "adj to -150 v", located on left hand center side, for -150 v measured on 0-1-5-1 wire.
2. Check 100 v supply ( $\pm 2v$ )

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3. Check 225-v supply ( $\pm 5$  v)
4. Check 350-v supply (not less than 335 v)
5. Adjust "HV Adjust" for -1650 v measured at orange lead on R&I board.
6. a. Check voltage at center connection of TRIGGER AMPLITUDE DISCRIMINATOR for swing (+50 to -50 v "ext trig").  
b. With TRIGGER AMPLITUDE DISCRIMINATOR centered, check for balance of V201. The voltage at pin 2 of V202 should be the same in "+ext" and "-ext" within 5 v. If not, select V201.  
c. With the TRIGGER AMPLITUDE DISCRIMINATOR centered, adjust R202 "Int. trig. dc level" (mini-pot located on TRIGGER SELECTOR switch) so that the voltage at Pin 2, V202 is the same in "+int" and "-int" of the TRIGGER SELECTOR switch.

To accomplish balance, there must be at least +70 v at the junction of R203 and C202 (connected to the plate, pin 6 of V3). Select V3 to get 70 v at this point.

7. With CALIBRATOR off, set "cal adj", located at center left front, for 100 v at pin 3 of V602 (top of R620 on CALIBRATOR). To check CALIBRATOR duty cycle, the voltage at this point should drop to 50 volts (within 10%) when CALIBRATOR is switched to any range.
8. Return scope to upright position;
9. Adjust "Astig Pot", located top center of back frame, for 185 v (center arm).
10. With no trigger present and STABILITY CW, RANGE TIME/DIVISION to 100  $\mu$ Sec/div, adjust "Multi Stability" (located lower right side), for center of free run. Check STABILITY control for ability to stop free run.
11. With line trigger and "Trig Sens" CW, (located at lower right side), adjust STABILITY just below multi free run. Turn "Trig Sens" slowly CCW and observe point at which sweep "blinks". Adjust "Trig Sens" 20 degrees CCW from this point.
12. Set "Swp Length", located at lower right side, for 10-1/2 divisions.
13. Rotate CRT until the sweep is parallel to the horizontal graticule lines. Push CRT tight to graticule and clamp. With no signal input, check the range of VERTICAL POSITION. (Off the scope in both directions) Select V<sub>4</sub> for vertical-position range.

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14. Check DC balance of the vertical amplifier:
  - a. Jumper plates of the 12BY7 output tubes
  - b. Jumper grids of same. (select 12BY7's for balance)
  - c. Jumper pin 7 to pin 2 of V8. (select V8 for balance)
  - d. Sweep should center for each step (plus or minus 1/2 div.).
15. Check for input grid current (with volts/div switch on .1 DC pos., Ground the input terminal. Trace should not shift more than 1/4 div). To correct for grid current, select V3. If V3 is changed, recheck step 6.
16. Short input terminal to ground and check Vert Amp for hum and microphonics.
17. Switch MULTIPLIER to 10-1 and adjust "Vert Amp DC", (located at upper right-hand side, center), so that the VARIABLE VERTICAL ATTENUATOR does not shift the trace.
18. Set MAIN AMP gain.
  - a. MULTIPLIER to X1
  - b. AMPLITUDE V/DIV to .1 AC
  - c. CALIBRATOR to 1 v
  - d. Patch CAL OUTPUT to VERTICAL INPUT. MAIN AMP SENSITIVITY is adjusted by small screw in center of AMPLIFIER V/DIV switch. Adjust for 10 divisions deflection.
19. Set MULTIPLIER GAIN
  - a. Amplitude V/div to .1
  - b. CALIBRATOR to 1
  - c. Patch CAL OUT to VERT IN.
  - d. Switch MULTIPLIER to 2X and adjust R51 for 5 divisions deflection.
  - e. Switch MULTIPLIER to 5X and adjust R53 for 2 divisions deflection.
  - f. Switch MULTIPLIER to 10-1
  - g. Check deflection for 10 divisions with VARIABLE CONTROL CW and less than 1 div with VARIABLE CONTROL CCW.

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20. Set PREAMP GAIN
  - a. MULTIPLIER to X1
  - b. AMPLITUDE V/DIV to .01
  - c. CALIBRATOR to .1
  - d. Patch CAL OUTPUT to VERTICAL INPUT and adjust "Preamp gain adj" for 10 divisions deflection.
21.
  - a. Check all DC input ranges for deflection sensitivity versus CALIBRATOR output.
  - b. If DC positions disagree with AC positions by more than 2%, change 12BY7's and repeat steps 14 through 21.
22. Set DC Shift Compensation
  - a. MULTIPLIER X1
  - b. AMPLITUDE V/DIV 10 DC
  - c. CALIBRATOR 100 V
  - d. Patch CAL OUTPUT to VERTICAL INPUT. Switch calibrator through its ranges. The trace reference should not shift.
  - e. Adjust "DC Shift Comp." to compensate for drift.
23. Check Power-supply ripple and regulation (Line voltage from 105 to 125). Typical values are:

a.	-150 v	10 mv
	100 v	10 mv
	225 v	10 mv
	350 v	100 mv
	330 v unregulated	20 v (gray white)
	480 v unregulated	30 v (white)
24. Check Front Panel Waveforms
  - a. Gate 25 v peak to peak
  - b. Sweep 135 v peak to peak

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25. Compensate the probe and Vert. Atten. Adjust for best square wave as follows:
- | Input                        | Volts/div             | Adjust                         |
|------------------------------|-----------------------|--------------------------------|
| a. 1 kc square wave from 105 | 1 v/div X1            | C3 (side rear of v/div switch) |
| b. 1 kc square wave from 105 | 10 v/div X1           | C6 (top of v/div switch)       |
| c. Cal and Probe             | .1 v/div X1           | Adjust probe                   |
| d. Cal and Probe             | .1 v/div X10<br>(CCW) | C15                            |
- Repeat c. and d. until inter-action is overcome
- |                  |                   |                              |
|------------------|-------------------|------------------------------|
| e. Cal and Probe | 1 v/div X10 (CCW) | C2 (side front v/div switch) |
| f. Cal and Probe | 10 v/div X1       | C5 (top of v/div switch)     |
| g. Cal and Probe | .01 v/div X10     | C10                          |
26. Sync approximately one cycle of the Calibrator waveform and turn up the INTENSITY until the leading edge and the point of trigger is visible. Adjust R202 "Int Trig DC level" (mini-pot located on TRIGGER SELECTOR switch) until "+int" and "-int" triggers on the same percentage of the waveform.
27. Check external trigger sensitivity for 1 volt on fast-rise plus and minus, AC and DC.
28. Jumper calibrator output to CRT cathode terminal and check for blanking.
29. With a 1-mc square wave from the Type 105 properly terminated (.1v/div X1) adjust the high frequency compensations in the vertical amplifier. (L3, L4, L5, L6 and L7). Adjust for compromise between best rise time and flat top.
30. Remove the 1.1-k precision resistor, and connect the delay line. With a 450-kc square wave from the Type 105 properly terminated, tune the delay line for best square-wave. (.1 v/div X1)
31. Using the same input, adjust the preamp compensations for best square wave. (.01 v/div X1) (L1 and L2)
32. Check the band width of the main amp and preamp. (Not more than 3db down at 5 megacycles).

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33. Set Sweep timing (3%)

Sweep	Markers	Adjust
a. 1 msec X1	1 msec	(mag off) sweep cal. (mag on) mag gain mag center

Check sweep linearity (nonlinearity probably indicates trouble in time base and sweep will not time)

b. 1 msec	X1 10 msec X2 X5 X10	(no adjustment-check V213 and/or timing cond.)
c. 100 $\mu$ sec	100 $\mu$ sec	(no adjustment)
d. 10 $\mu$ sec	10 $\mu$ sec	C280 E for 3rd thru 10th pip.
f. 1 $\mu$ sec	1 $\mu$ sec	C290
g. 1.0 $\mu$ sec	X2 10 $\mu$ sec X5 10 $\mu$ sec X10 10 $\mu$ sec	(no adj.)
h. .1 $\mu$ sec	X5 1 $\mu$ sec	C280G
i. .1 $\mu$ sec	X1 10 mc	C303 3rd thru 10th pip. C276 first 2 pips.
j. .1 $\mu$ sec	X1 10 mc	C260 to correct fold over on end of sweep.

If no 10-mc sync, check V205

Repeat steps d. through j.

k. Check all other sweeps for 3% (1 sec/div, 5%)

34. Increase intensity and check for blooming (regulation of -1650 supply)

### 315 TIME BASE TROUBLE SHOOTING PROCEDURE

Adjust -150v

Check 100v, 225v, and 300v

Adjust -1650 volts

Check 47 ohm, 1/2w resistors on terminal board of sweep chassis for overheating and/or opens

Check sweep-chassis filaments for opens. Two separate filaments in each tube except 6AK6.

Set "Sweep Length" CCW and "Stability" CCW.  
Sweep Spec to 1 millisec/div

Test Point --	Multi-Stab CW	CCW	Tube to suspect
<u>Multi and Hold Off</u>			
Remove V213			
P6/V211	145 ±10v	225v	V211, V210, V203 (Check L246 for open)
P8/V210	150 ±10v	225v	V210
P7/V205	-17v	0	V205
P6/V205	100v	15v	V205, V204
P8/V204	105v	20v	V204
P1/V203	85v	10v	V203, V204
P1/V212	215v	145v (10v)	V212

#### Sweep Trigger and Miller Sweep

Replace V213 and pull V212 - Multi Stab CW

P2/V214	-11v		V215, V214
P7/V214	-5v		V214
P5/V215	-5v		V215, V213, V220
P5/V220	35v		V220
P3/V221	40v		V221