

# COMPANY CONFIDENTIAL

524

524D

## Timing procedure:

1. Sweep time 100  $\mu$ sec, sweep time mult. 1, 100  $\mu$ sec marks, adjust R330, LF sweep time, for 1 mark/cm.
2. Set mult. to 10, 1 ms marks, check for 1 mark/cm.
3. Set sweep time to 1000  $\mu$ sec, sweep mult. to 1, 1 ms marks, check for 1 mark/cm.
4. Set mult. to 10, 10 ms marks, check for 1 mark/cm.
5. Set sweep time to 10  $\mu$ sec, sweep mult. to 1, 10  $\mu$ sec marks, check for 1 mark/cm.
6. Sweep mult. to 10, 100  $\mu$ sec marks, check for 1 mark/cm.

When the first three ranges of sweep time meet spec, ( $\pm 3\%$ ), proceed to step 7.

7. With mag off, start trace at left graticule line. Set sweep time to 0.1  $\mu$ sec, sweep mult. to 10, sweep mag to 10x. Apply 10mc signal triggered externally by 10  $\mu$ sec marks. With C305A and C231A centered, adjust C301 for best linearity. (Neglect timing.) (Reposition horizontally only slightly to aid in making this adjustment.) *set toward long end.*
8. Set sweep time to 1  $\mu$ sec, sweep mult. to 1, mag 10x, 10 mc signal, adjust C305A, HF sweep time, for 1 cycle/cm.
9. Set sweep time to 0.1  $\mu$ sec, sweep mult. to 10, mag 10x, 10 mc signal, adjust C231A for 1 cycle/cm.
10. Set sweep time to 0.1  $\mu$ sec, sweep mult. to 1, mag off, 10 mc signal, adjust C302C for 1 cycle/cm.  
  
Repeat steps 7 through 10 as many times as necessary due to interaction.
11. Set sweep time to 0.1  $\mu$ sec, sweep mult. to 3, mag 3x, 10 mc signal, adjust ~~C210B~~ *C302B* for 1 cycle/cm.

7/17/62

Timing procedure:

1. Sweep time 100  $\mu$ sec, sweep rate mult. 1, 100  $\mu$ sec marks, adjust R330, 10 sweep time for 1 mark/cm.
2. Set mult. to 10, 1 ms marks, check for 1 mark/cm.
3. Set sweep time to 1000  $\mu$ sec, sweep mult. to 1, 1 ms marks, check for 1 mark/cm.
4. Set mult. to 10, 10 ms marks, check for 1 mark/cm.
5. Set sweep time to 10  $\mu$ sec, sweep mult. to 1, 10  $\mu$ sec marks, check for 1 mark/cm.
6. Sweep mult. to 10, 100  $\mu$ sec marks, check for 1 mark/cm.

When the first three ranges of sweep time meet spec, (432), proceed to step 7.

7. With osc. old, start trace on left horizontal line. Set sweep time to 0.1  $\mu$ sec, sweep mult. to 10, sweep mag to 10x. Apply 10mc sig. not triggered externally by 10  $\mu$ sec marks. With C302A and C31A centered, adjust C301 for best linearity. (Neglect timing.) (position horizontally only slightly to aid in making this adjustment.)

8. Set sweep time to 1  $\mu$ sec, sweep mult. to 1, mag 10x, 10 mc signal, adjust C302A, 10 sweep time for 1 cycle/cm.
9. Set sweep time to 0.1  $\mu$ sec, sweep mult. to 10, mag 10x, 10 mc signal, adjust C31A for 1 cycle/cm.
10. Set sweep time to 0.1  $\mu$ sec, sweep mult. to 1, mag off, 10 mc signal, adjust C302C for 1 cycle/cm.

Repeat steps 7 through 10 as many times as necessary due to interaction:

11. Set sweep time to 0.1  $\mu$ sec, sweep mult. to 3, mag 3x, 10 mc signal, adjust C302B for 1 cycle/cm.

# COMPANY CONFIDENTIAL

524AD CALIBRATION PROCEDURE

1. Install simulated delay line assembly as shown on the back page.
2. Administer a careful visual inspection and preset panel and internal adjustments.

INTERNAL POTS	Midrange
Trimmers	90°
Coil Slugs	Middle of Coil (L6 and L7 should be set so that slug is just entering coil form)
Response Switch	Normal

3. Check Power Supply Resistances to Ground

-150V	9K
+120V	25K
+225V	15K
+450V	30 to 40K
+330V (unregulated)	20K

4. -150 Volt Adjustment (Adjust to exactly -150 volts)

5. -1500 Volt Adjustment. Adjust R807 for -1500 volts as measured from pin 18 of T401 to ground.

6. Check for the following voltages

Anode of V806	-1600V	(Time/Cm sw to ext. SWP)
Anode of V806	-1700V	(Time/Cm sw to 1000 usec.)
+120 Volts	+ 2.4 V.	
+225 Volts	+ 4.5 V.	
+450 Volts	+ 9.0 V.	
+105 Volts	(Measure at Pin 1, V14)	

7. Vertical Amplifier Current Adjust. Adjust R66 for exactly 37.5 volts as measured across R87 (or Pin 5 of 6AG7 tubes in Distributed Amplifier to ground.

8. Align CRT and check for Geometry.

	<u>Standard</u>	<u>RCA</u>
Axial misalignment	1°	1.5°
Curvature of trace	1mm	2mm

9. Magnifier Position Adjust. Set time/cm switch to Ext. Swp, and adjust HORIZONTAL POSITION for no trace shift when switching from MAG OFF to X10 MAG. Then adjust MAG POSITION so display is in exact center of graticule.

10. Sweep Amplifier Current Adjust. Adjust SWEEP CURRENT ADJ until horizontal deflection plate DC potential equals the vertical DC potential. This should fall between 150 to 157 volts. (It may be necessary to install a 2 watt, 100KΩ, 10% resistor across R224 on some instruments)

11. Low Frequency Timing Preset. Insert 100 usec markers from time mark generator and adjust R330 for approximately 1 marker/cm. (The MAG POS, SWP CURRENT ADJ, and LOW FREQ TIMING adjustments all interact and must be readjusted later)

CONFIDENTIAL

# COMPANY CONFIDENTIAL

12. Check Power Supply Ripple and Regulation. ~~Check ripple on all~~ regulated supplies to within the specified ripple tolerances. Power supply must regulate between 105 and 125 line volts.
 

-150 v	10 mv maximum
+120 v	5 mv maximum
+225 v	10 mv maximum
+450 v	30 mv maximum
  
13. Vertical Variable Attenuator Balance. Adjust variable balance pot until there is no trace shift when rotating the variable attenuator knob.
  
14. Check Vertical for Balance, Microphonics, and Gas.
  - Hum on each vertical plate should be less than 70 millivolts.
  - Microphonics shall not exceed 2mm (main amplifier) or 1 cm through the preamp.
  - Trace shift due to gas (main amplifier) must not exceed 2 mm.
  - Compression must be less than 1 mm out of 2 cm deflection within graticule.
  
15. Set Calibrator Variable Voltage Knob. Set knob so pointer is set at zero when a signal just begins to appear with the Cal Voltage Range at 50V.
  
16. Set Calibrator Voltage. With DUTY CYCLE set to extreme CW position, adjust CALIB ADJUST for about 49.5 volts as read on a meter from the Calibrator Output Jack to ground. Check operation of Duty cycle control.
  
17. Set Vertical Gain Stops. Set vertical gain stops so that with variable attenuator set at maximum, the CRT shows exactly 6 cm deflection with 9 ~~v~~ volts (back stop) and in the CCW position, 6 cm is displayed with 3 volts input (front stop). These settings are made in the .15 to .5 position of the input selector switch.
  
18. Set Pre-amp gain. Adjust R-16 for 6 cm of deflection with the volts/cm switch set to .015-.05 range, input 90 mv.
  
19. Check Cal Voltage range attenuator with Volts/cm Switch. Tolerances must be within  $\pm$  2% (1mm in 5 CM).
  
20. Check External Trigger Sensitivity. A stable display must be obtained using 2mm deflection (internal triggering) and 100 mv of externally applied calibrator signal.
  
21. Check External Sweep Sensitivity. Jumper Cal Out to ?External Sweep Input Jack. The display should be one cm or more of horizontal deflection with 250 mv calibrator signal applied. (Ext Sweep Attenuator CW, X10 MAG ON.) *Check that 25v modulates CRT.*
  
22. Adjust Distributed Amplifier Compensations. *(USE NORMAL RESPONSE)* Adjust caps using output from 107 (3 cm), and adjust L6 and L7 for leading edge. Check response for 11 mc bandpass. (4.5 cm of deflection with 10 mc input).
  
23. Adjust Delay Line. Turn off scope, install delay line, and adjust for optimum square wave response. Check bandpass for 11 mc.
  
24. Adjust IRE-FLAT Switch Response. Adjust L-17 and L-18 for 6 cm of deflection to a 5mc input in the FLAT position. (Return switch to NORMAL position.)
  
25. Check Preamp bandpass. Preamp bandpass should be not less than 10 mc and not more than 11 mc. (Adjust C9 if necessary to limit bandpass)

SECRET



# COMPANY - 3 - CONFIDENTIAL

- 26. Set C-28 and C-31. Apply 1 kc signal to Input No. 2 with volts/cm selector in .15 to .5 volts position. Adjust C-31 for best square wave as observed on test scope with X10 probe connected to pin 8 of V23. Adjust C28 for best presentation on the 524.
- 27. Adjust Input Attenuator and Probe Compensations. These adjustments are made in Input No. 2 position. Use X10 Probe connected to INPUT NO. 2.

<u>VOLTS/CM SWITCH</u>	<u>ADJUST</u>	<u>FREQUENCY</u>
.15 to .5	Probe Trimmer	1Kc
.5 to 1.5	C103 and C104	1Kc
1.5 to 5	C105 and C106	1Kc
5 to 15	(no adjustment) C103 & C104	1Kc
15 to 50	C111 and C112	1Kc
.015 to .05	R10 (Low Freq Comp)	50 cycles
.015 to .05	C1	1Kc
.05 to .15	C101 and C102	1Kc

Move probe to Input No. 1 and adjust C136, volts/cm switch set to .15 to .5 volts position. (NOT IN 524-D)

- 28. Check internal 60 cycle sweep. Observe at least 12 cm with STABILITY pot full CW, MAG POSITION- X10, and Time/Cm Switch set to INTERNAL 60 CYCLE.
- 29. Check 60 cycle phase shift. Set MAG POSITION to X3, put a lead into Input 2 and let hang. Vary internal 60 cycle sweep phase control to observe a minimum phase shift of 150°. (Other controls as set in Step 28).
- 30. Adjust Main Sweep Timing. Recheck MAG POSITION ADJUST, SWEEP AMP CURRENT ADJUST, and LOW FREQ TIMING. (CHECK 10X MAG ON 100 USEC SPEED.)

<u>TIME MARKERS</u>	<u>TIME/CM</u>	<u>MULT</u>	<u>MAG</u>	<u>ADJUST</u>
1 usec	1 usec	1	OFF	C305A
1 usec	.1 usec	10	OFF	C231A
1 usec	.1	10	X10	C301 (use 6th and 7th markers)
10 mc	.1	1	OFF	C302C
1 usec	.1	3	X3	C302B (use 2d and 3d markers)
10 usec	10 usec	1	OFF	(short) Check accuracy $\pm$ 2%
1000 usec	1000 usec	1	OFF	(long) Check accuracy $\pm$ 2%

Check linearity of usec/cm multipliers.

- 31. Check Front Panel Waveforms.

Positive and Negative Gate Outputs	-	approx 40 volts
Sweep Output	-	approx 30 volts
- 32. Check Unblinking Pulse. Set sweep time at 100 usec, TRIGGER SELECTOR at 60 cycle undelayed and advance stability control until sweep free runs. Connect test scope to pin 4, V-213 and observe an unblinking pulse of approximately 40 volts amplitude.

CONFIDENTIAL



# COMPANY - CONFIDENTIAL

### 33. Check for 60 cycle Delayed Sine Wave

Connect Test Scope to junction point of C-205 and C-206. (White wire connecting to upper rear wafer of trigger selector switch). A sine wave of at least 15 V P-P must be present when trigger selector is in the 60 cycle delayed position.

### 34. Check Phantastrom Run Down Time.

Connect test scope to pin 5 V-204, the trigger selector must be in 60 cycle delayed, the phantastrom rundown time should be between 25 to 30 milliseconds. Move test scope probe to pin 8 or 3 V-205. By varying the 0-25 milli-second sweep delay pot from a CW position to a CCW position the phantastrom run down will diminish till only a spike is left where run down started.

### 35. Adjust Time Mark Generator.

Careful adjustment of intensity and time marker amp is necessary, time marker amp should be adjusted to approx. 90 percent cw, stability and trigger controls completely cw (may have to be adjusted). Time Cm Control set at 1 usec. Adjust coils, while rotating phase control, until the marks appear to go together in a parallel manner with no shift up or down on either end. This is accomplished by using a special marker generator calibrated to match the time mark generator of scope, when beat against each other.

<u>Time Marker</u>	<u>Marker Gen.</u>	<u>Adjust</u>	<u>Remarks</u>
.05	.05 or 10mc	L-601	Two bright portion every <i>cycle</i>
.1	.1 or 10mc	L-602	Two bright portion every <i>cycle</i>
1	1 usec	L-603	One bright portion every 5 <i>cycle</i>
.005H	3.15mc .005H	L-604	One bright portion every cycle
.025H	3.15mc <del>.025H</del> .005H	L-608	One bright portion per 5 cycle

### 36. Adjust Hum balance and check probe power. Use C.F. probe.

Time/cm sw	Int 60 cycle sweep
Stability Pot	Full cw
Mag Position	3x
Volts/cm sw	.015-.05

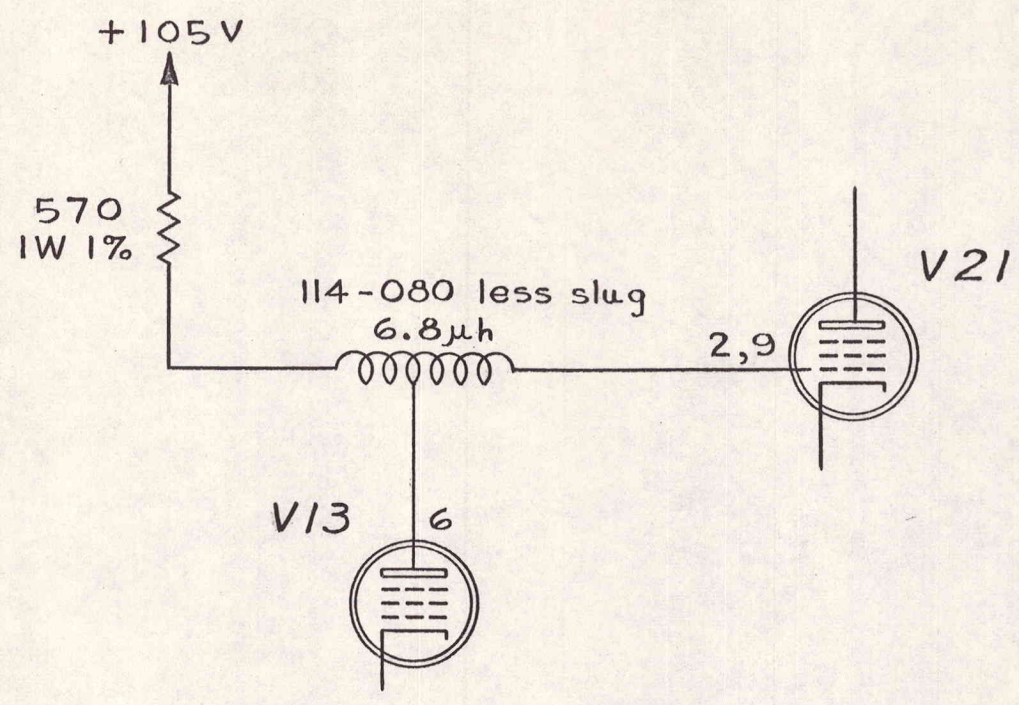
Adjust hum balance pot for a single horiz trace. Check probe power by touching end of probe and noting change in CRT display.

### 37. Check Delay Trigger

Time/Cm set at 100 usec. Input is composite TV signal. Trigger selector in ± Sig on Int as appropriate in delay position. Adjust stability and amplitude pots for stable display. By operating "field shift" button in conjunction with the "Sweep Delay" control, any particular horizontal-sync pulse, line or lines can be observed on CRT must shift fields. Check line intensifier (video out) located on back panel with test scope as above checks are being made.

CONFIDENTIAL - SECURITY INFORMATION

# COMPANY CONFIDENTIAL



This assembly simulates one section of the delay line and makes possible normal compensation of the distributed amplifier. The vertical amplifier may be checked for risetime and bandwidth with this network installed. It makes possible delay line adjustment without further vertical distributed amplifier tuning. (It is possible to tune the distributed amp without the "T" coil but with poorer results.)

