

NOTE REGARDING FACTORY CALIBRATION PROCEDURES
AND TEST SPECIFICATIONS

Factory Calibration Procedures and Test Specifications are intended for use at the factory as a general guide for calibrators and quality control men. Most of the tolerances listed in these sheets are closer than advertised specifications. This is done purposely in order to insure that the instrument will meet or exceed advertised specifications when it reaches the customer.

These calibration procedures and test specifications should be used, therefore, as a guide only.

Some of the test equipment referred to in the calibration procedures is not available commercially; the Tektronix field engineer will be glad to suggest alternate approaches.

TYPE 53B CALIBRATION PROCEDURE

Serial Number 101 thru 3300

The 530 series oscilloscope used should have been previously checked for power supply outputs, power supply ripple and regulation, vertical amplifier gain, vertical amplifier band pass, and calibrator accuracy.

The EP53 plug-in extension is necessary to allow access to the input attenuators and the peaking coils.

1. Determine zero input vertical level of scope (jumper plug-in outputs together and observe the vertical level of the trace).
2. Adjust DC BAL so that the VARIABLE ATTEN control does not move the trace.
3. Center the front panel VERTICAL POSITION and with "positioning adj," center the trace to the level determined in step 1.
4. Check input tube for grid current.

When the VOLTS/CM control is switched through its range there should not be more than 1 mm shift in the trace. In the preamp positions a momentary 1 cm shift is permissible.

5. Check for hum and microphonics.

With the VARIABLE ATTEN control to its most sensitive position there should be no noticeable hum on the trace. Microphonics should not exceed 2 mm.

6. Adjust the vertical gain.

- a. VOLTS/CM to .05.

VARIABLE ATTEN clockwise.

With .2 volts from the calibrator adj. GAIN ADJ 1 for 4 cm defl.

- b. VOLTS/CM to .005

VARIABLE ATTEN clockwise.

With 20 millivolts from the calibrator, adj. GAIN ADJ. 2 for 4 cm defl.

7. Check attenuation ratio.

VOLTS/CM to .05.

CALIBRATOR to .5 volts

Type 53B Calibration Procedure

Adj. VARIABLE ATTEN control for 5 cm deflection.

Rotate the VOLTS/CM control counter-clockwise and at the same time rotate the CALIBRATOR switch clockwise. 5 cm deflection should result from each pair of switch positions within 3%.

8. Standardize the input capacity to 47 pf.

VOLTS/CM to .05

VARIABLE ATTEN clockwise.

1 kc square wave from 105 through a 530 standards probe.

Adj. C3002 for best square wave.

Turn VARIABLE ATTEN counter-clockwise and adjust C4022 for best square wave. Repeat these two adjustments until there is no further interaction.

9. Compensate the attenuators.

VARIABLE ATTEN clockwise.

1 kc square wave from 105 terminated by a 530 standards probe only.

Adjust trimmers for best square wave as follows:

VOLTS/CM	Adjust
.1	C3162 C3172
.2	C3192 C3202
.5	C3092 C3102
5.0	C3132 C3142

Check all other "main amp" attenuator ranges for proper stacking of attenuators. There should be no more than 1 mm of spike on a 6 cm square wave. If excessive spiking is present on "stacked" attenuator positions, check the accuracy of the dc input resistance. R4002 should be 1 meg \pm 1%.

10. Adjust input capacitance of preamp.

VOLTS/CM to .005

VARIABLE ATTEN clockwise

1 kc from 105 through 10/1 L pad and 530 standards probe.

Adjust C3322 for best square wave. Compromise between .005, .01, and .02 VOLTS/CM. If no satisfactory compromise select V3302.

Type 53B Calibration Procedure

11. Adjust preamp low-freq compensation

VOLTS/CM to .005.

VARIABLE ATTEN clockwise

50 cycles from 105 through 10/1 L pad and 530 standards probe.

Adjust R3622 "low freq comp" for flat top on square wave.

12. Adjust high-freq compensation

VOLTS/CM to .05

VARIABLE ATTEN clockwise

350 kc from 105 properly terminated (termination to match cable)

Adjust L4402 and L4202 for best square wave. (In some low serial numbers a similar compensation must be made to the preamp-- adjust L3602 in the same fashion if it is variable).

13. Check band pass.

Remove EP53 extension and plug the unit directly into the scope. Should be no more than 3 db down at 10 mc for the main amp, no more than 3 db down at 9 mc for the preamp.

14. Check dc output level.

The voltage at pin 1 and 3 of the amphenol connector must be between 65 and 70 volts with the trace centered.

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FACTORY CALIBRATION PROCEDURE

Type B and Type 53/54 B Plug-In Units - Serial No. 3301 - up

The following instruments and equipment are needed:

- 1 TYPE 540-Series Oscilloscope
- 1 TYPE 190 CONSTANT-AMPLITUDE SIGNAL GENERATOR
- 1 TYPE 105 SQUARE-WAVE GENERATOR
- 1 TYPE 107 SQUARE-WAVE GENERATOR
- 1 INPUT CAPACITANCE STANDARDIZER (CS 47)
- 1 52 Ω TERMINATING RESISTOR (B52-R)
- 1 5:1 L Pad (B52-L5)
- 2 52- Ω cable

The 540-Series oscilloscope should be set up as follows unless otherwise stated:

<u>HORIZONTAL DISPLAY</u>	<u>INTERNAL SWEEP (Type 541)</u> <u>MAIN SWEEP NORMAL (Type 545)</u>
<u>TRIGGERING MODE</u>	<u>AUTOMATIC</u>
<u>TRIGGER SLOPE</u>	<u>-INT</u>
<u>STABILITY</u>	<u>PRESET</u>
<u>TIME/CM</u>	<u>1 MILLISEC</u>
<u>MULTIPLIER</u>	<u>1</u>
<u>TYPE 105</u>	Use a 52- Ω cable, terminated with an <u>INPUT CAPACITANCE STANDARDIZER (CS 47)</u> .
<u>TYPE 107</u>	Use a 52- Ω cable, terminated with a <u>TERMINATING RESISTOR (B52-R)</u> .

TYPE 190 ATTENUATOR box should be terminated with a 5:1 L PAD.

The "Vertical-System Electrical Center" of the 540-Series oscilloscope should be determined in the following manner:

Using a TEST LOAD UNIT, depress the PRESS TO SHORT INPUT button and observe the vertical level of the trace. If you use a Type 53/54 Plug-in unit, jumper between pins 1 and 3 on the 16 pin connector and

observe the vertical level of the trace. This level will be referred to later in the calibration procedure.

PRECHECK

Make a careful visual inspection of the unit for proper wire dress and check controls for smooth mechanical operations. Make the following resistance to ground checks on the amphenol 16-pin connector:

AMPHENOL CONNECTOR PIN NUMBER	RESISTANCE TO GROUND IN Ω
1	9 K
2	0
3	9 K
4	Infinite
5	"
6	"
7	"
8	"
9	22 K
10	3.5 K
11	10 K
12	Infinite
13	"
14	"
15	190
16	Infinite

PRESET CONTROLS

<u>VERTICAL POSITION</u>	mid-range
<u>VOLTS/CM</u>	<u>.05</u>
<u>VARIABLE VOLTS/CM</u>	full right (cw)
<u>INPUT SELECTOR</u>	<u>DC "A"</u> channel
<u>DC BAL.</u>	mid-range
<u>GAIN ADJ. 1 and 2</u>	full right (cw)
VERT. POS. RANGE	mid-range
H.F. PEAKING	mid-range
LOW FREQ. COMP.	mid-range
Preset all coil slugs below windings.	
Preset all trimmers mid-range.	
Plug <u>53/54 B</u> unit into scope.	

1. CHECK DC OUTPUT LEVEL

Measure between pin 1 and ground and pin 3 and ground of the 16 pin amphenol plug (65-70 v).

2. ADJUST DC BAL.

Position trace to about the center horizontal graticule line with the VERT. POS. RANGE control. Adjust DC BAL. so that the trace remains stationary on the screen as the VARIABLE VOLTS/CM knob is varied throughout its range.

3. ADJUST VERT. POS RANGE

Set VERTICAL POSITION knob at mid-range. Adjust the VERT. POS. RANGE control to center trace on graticule "Vertical-System Electrical Center".

4. CHECK GAS AND MICROPHONICS

Gas check: Main amplifier: Switch the VOLTS/CM switch from .05 to .1 position and observe vertical shift in trace (2mm maximum).
Preamplifier: Switch the VOLTS/CM switch from .05 to .005 position and observe vertical shift in trace (1 cm ac maximum) (2 mm dc maximum).

Microphonics check: Rap lightly on the front panel of the plug-in unit and watch for excessive ringing type of microphonics.

5. CHECK INPUT SELECTOR SWITCH

Set INPUT SELECTOR switch to DC "B" channel and apply 100 millivolts from SQUARE-WAVE CALIBRATOR to INPUT B. Position the base line of the calibrator waveform to the center graticule line. Now set INPUT SELECTOR switch to AC. The waveform should shift down so that the center graticule line is now approximately through the center of the display. Repeat the same procedure on "A" channel.

6. SET GAIN ADJ.

Set up plug-in as follows:

<u>INPUT SELECTOR</u>	<u>DC</u> ("A" channel)
<u>VOLTS/CM</u>	<u>.05</u>

(Step 6 continued on next page)

6. (Cont)

VARIABLE VOLTS/CM

full right (cw)

From SQUARE-WAVE CALIBRATOR, apply .2 volts to INPUT A and set GAIN ADJ. 1 for 4 cm of vertical deflection. Set VOLTS/CM switch to .005 and apply 20 millivolts from SQUARE-WAVE CALIBRATOR to INPUT A. Set GAIN ADJ. 2 for 4 cm of vertical deflection.

7. CHECK VOLTS/CM SWITCH STEPS

Set up plug-in as follows:

INPUT SELECTOR

DC ("A" channel)

VARIABLE VOLTS/CM

full right (cw)

From SQUARE-WAVE CALIBRATOR, apply signal to INPUT A and check for proper deflection.

SQUARE-WAVE CALIBRATOR

VOLTS/CM SWITCH

DEFLECTION

20 MILLIVOLTS

.005

4 cm

20 "

.01

2 cm

50 "

.02

2.5 cm

.2 VOLTS

.05

4 cm

.2 "

.1

2 cm

.5 "

.2

2.5 cm

1 "

.5

4 cm

2 "

1

2 cm

5 "

2

2.5 cm

20 "

5

4 cm

20 "

10

2 cm

50

20

2.5 cm

8. ADJUST INPUT CAPACITOR (MAIN AMPLIFIER)

Set up plug-in as follows:

VOLTS/CM

.05

VARIABLE VOLTS/CM

full right (cw)

INPUT SELECTOR

DC ("A" channel)

From TYPE 105, apply 1-kc signal to INPUT A. Adjust TYPE 105 OUTPUT AMPLITUDE control to produce 3.5 cm of vertical deflection. Adjust C3262 for optimum flat top.

9. ADJUST VOLTS/CM SWITCH COMPENSATIONS

Set up plug-in as follows:

INPUT SELECTOR

DC ("A" channel)

From TYPE 105, apply 1-kc signal to INPUT A. Adjust TYPE 105 OUTPUT AMPLITUDE control to produce 3.5 cm of vertical deflection.

VOLTS/CM
SWITCH

ADJ. FOR OPTIMUM
SQUARE CORNER

ADJ. FOR OPTIMUM
FLAT TOP

.1
.2
.5
5

C3232
C3172
C3112
C3072

C3222
C3162
C3102
C3062

10. ADJUST INPUT CAPACITOR (PREAMPLIFIER)

Set up plug-in as follows:

VOLTS/CM

.005

VARIABLE VOLTS/CM

full right (cw)

INPUT SELECTOR

DC ("A" channel)

From TYPE 105 apply 1-kc signal to INPUT A. Adjust TYPE 105 OUTPUT AMPLITUDE control to produce 3.5 cm of vertical deflection. Adjust C4322 for optimum flat top.

11. SET LOW FREQUENCY COMPENSATION

Set up plug-in as follows:

VOLTS/CM

.005

VARIABLE VOLTS/CM

full right (cw)

INPUT SELECTOR

DC ("A" channel)

From TYPE 105 apply 50-cycle signal to INPUT A. Adjust TYPE 105 OUTPUT AMPLITUDE control to produce 3.5 cm of vertical deflection. Adjust LOW FREQ. COMP. for flat top.

12. ADJUST MAIN AMPLIFIER HF COMPENSATIONS

Reset scope as follows:

TIME/CM

.1 MICROSEC

MULTIPLIER

2

(Step 12 continued on next page)

12. (Cont.)

Set up plug-in as follows:

<u>VOLTS/CM</u>	<u>.05</u>
<u>VARIABLE VOLTS/CM</u>	full right (cw)
<u>INPUT SELECTOR</u>	<u>DC</u> ("A" channel)

From TYPE 107 apply 3 cm of signal at approximately 450 kc to INPUT A.

Adjust hf compensations L3402 and L3582 for optimum leading edge and slope back of leading edge. Adjust H.F. PEAKING control for optimum square corner with no overshoot. These controls are interacting, so you must readjust them as necessary to keep the flattest top possible with no overshoot on squarewave.

13. ADJUST PREAMPLIFIER HF COMPENSATIONS

Reset the scope as follows:

<u>TIME/CM</u>	<u>.1 MICROSEC</u>
<u>MULTIPLIER</u>	<u>2</u>

Set up plug-in as follows:

<u>VOLTS/CM</u>	<u>.005</u>
<u>VARIABLE VOLTS/CM</u>	full right (cw)
<u>INPUT SELECTOR</u>	<u>DC</u> ("A" channel)

From TYPE 107 apply 3 cm of signal at approximately 450 kc to INPUT A.

Adjust hf compensations L4032, L4042, and L4162 for optimum leading edge and slope back of leading edge.

14. CHECK FREQUENCY RESPONSE

Reset scope as follows:

<u>TRIGGERING MODE</u>	<u>AC SLOW</u>
<u>TIME/CM</u>	<u>100 MICROSEC</u>
<u>STABILITY</u>	full right (cw)

(Step 14 continued on next page)

14. (Cont.)

Set up plug-in as follows:

<u>VOLTS/CM</u>	<u>.05</u>
<u>VARIABLE VOLTS/CM</u>	full right (cw)
<u>INPUT SELECTOR</u>	<u>DC</u> ("A" channel)

From TYPE 190 apply 3 cm of signal at approximately 370 kc to INPUT A. Adjust TYPE 190 to obtain a frequency of 20 mc (do not change TYPE 190 OUTPUT AMPLITUDE) and see that there is at least 2.1 cm of vertical deflection remaining (3 db point).

Reset VOLTS/CM switch to .005

Repeat the same procedure on the preamplifier, but check for 2.1 cm at 12 mc.