

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 G PLUG-IN
FACTORY CALIBRATION PROCEDURE

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 5:1 L Pad (B52-L5)
- 1 52Ω TERMINATING RESISTOR (B52R)
- 2 52Ω Cable
- 1 Special Dual Input Connector. 003-036

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

<u>HORIZONTAL DISPLAY</u>	541 <u>INTERNAL SWEEP</u> 545 <u>MAIN SWEEP NORMAL</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 52Ω cable, terminated with an <u>INPUT CAPACITANCE STANDARDIZER (CS 47)</u>
<u>TYPE 107</u>	Use a 52Ω cable, terminated with a <u>TERMINATING RESISTOR (B52R)</u>

"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 normal 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.

PRE-CHECK

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

AMPHENOL CONNECTOR PIN NUMBER	RESISTANCE TO GROUND IN Ω
1	10 K
2	0
3	10 K
4	Infinite
5	"
6	"
7	"
8	"
9	50 K
10	1.8 K
11	7 K
12	Infinite
13	"
14	"
15	150
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)
Input Selector Switch	<u>A-B DC</u>
<u>DC BAL.</u>	mid-range
<u>DIFF. BAL.</u>	mid-range
<u>GAIN ADJ.</u>	full right (cw)
VERT. POS. RANGE	mid-range
H.F. PEAKING	mid-range

Pre-set all coil slugs below the windings

Pre-set all capacitors to mid-range

Plug G 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

With VERTICAL POSITION knob set at mid-range, adjust VERT. POS. RANGE control to center trace on graticule "Vertical System Electrical Center".

4. CHECK GAS AND MICROPHONICS

Gas check: Turn Input Selector switch to A DC and turn the VOLTS/CM switch from .05 to .1. Observe vertical shift in trace. (2 mm maximum) Turn mode switch to B DC and repeat the same procedure on "B" channel.

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

5. CHECK INPUT SELECTOR SWITCH

Set up plug-in as follows:

<u>VOLTS/CM</u>	<u>.05</u>
<u>VARIABLE VOLTS/CM</u>	full right (cw)

Set Input Selector to A DC and from the SQUARE-WAVE CALIBRATOR apply .2 volts to INPUT A. Position the base line of the calibrator waveform to the center graticule line. Now turn input selector switch to A 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 "B" channel.

6. SET GAIN ADJ.

Set up plug-in as follows:

<u>VOLTS/CM</u>	<u>.05</u>
<u>VARIABLE VOLTS/CM</u>	full right (cw)
Input Selector switch	<u>A DC</u>

From SQUARE-WAVE CALIBRATOR apply .2 volts to INPUT A and set GAIN ADJ. for 4 cm of vertical deflection.

7. CHECK VOLTS/CM SWITCH STEPS

Set up plug-in as follows:

<u>VARIABLE VOLTS/CM</u>	full right (cw)
Input Selector switch	<u>A DC</u>

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

7. Con't.

<u>SQUARE-WAVE CALIBRATOR</u>	<u>VOLTS/CM SWITCH</u>	<u>DEFLECTION</u>
.2	.05	4 cm
.2	.1	2 cm
.5	.2	2.5 cm
2	.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

Repeat procedure using "B" channel.

8. ADJUST INPUT CAPACITORS

Set up plug-in as follows:

<u>VOLTS/CM</u>	<u>.05</u>
Input Selector switch	<u>A DC</u>

From TYPE 105 apply 1 kc signal to INPUT A through the CS47 standard and adjust 105 OUTPUT AMPLITUDE control to produce 3.5 cm of vertical deflection. Adjust C3327 for optimum flat top. Now turn Input Selector switch to B DC and repeat procedure on "B" channel. Adjust C4327 for optimum flat top.

9. ADJUST VOLTS/CM SWITCH COMPENSATIONS

Set up plug-in as follows:

Input Selector switch	<u>A DC</u>
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From TYPE 105 apply 1 kc signal to INPUT A and adjust 105 OUTPUT AMPLITUDE control to produce 3.5 cm of vertical deflection on each step.

<u>VOLTS/CM SWITCH</u>	<u>ADJ. FOR OPTIMUM SQUARE-CORNER</u>	<u>ADJ. FOR OPTIMUM FLAT TOP</u>
.1	C3247	C3237
.2	C3187	C3177
.5	C3137	C3127
5	C3087	C3077

Turn input selector switch to B DC and repeat same procedure on "B" channel.

<u>VOLTS/CM SWITCH</u>	<u>ADJ. FOR OPTIMUM SQUARE CORNER</u>	<u>ADJ. FOR OPTIMUM FLAT TOP</u>
.1	C4247	C4237
.2	C4187	C4177
.5	C4137	C4127
5	C4087	C4077

10. ADJUST HF COMPENSATIONS

Set up plug-in as follows:

<u>VOLTS/CM</u>	<u>.05</u>
<u>VARIABLE VOLTS/CM</u>	full right
Input Selector switch	<u>A DC</u>

Reset the following scope controls:

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

From TYPE 107 apply 3 cm of signal at approximately 450 kc to INPUT A. Adjust hf compensations L3617, L4617, L3467, L4467 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 square wave.

11. ADJUST DIFF. BAL.

From the TYPE 105 apply a 1 kc square wave, 2 volts in amplitude, to both inputs through special dual input connector. With input selector switch set at A-B DC adjust DIFF. BAL. for minimum deflection. Turn Input Selector switch to A-B AC and check waveform. Turn the 105 to 50~ and recheck differential balance for 2 mm total deflection. From TYPE 190 apply 2 volts at 350 kc to both INPUT A and INPUT B. With Input Selector switch in A-B AC check differential balance. It may be necessary to slightly retouch DIFF. BAL. adjustment. Turn to A-B DC check to see that deflection is less than 2 mm.

12. ADJUST HF DIFFERENTIAL BALANCE

Set TYPE 190 to 20 mc and adjust C3387 and C4387 for minimum vertical deflection. Now vary the frequency of the TYPE 190 from 20 mc to 350 kc. The amplifiers must maintain differential balance throughout this range. It may be helpful to readjust the hf compensations slightly to maintain balance on the higher frequencies. Check hf differential balance with the input selector switch set to A-B AC. If it were necessary to retouch hf compensations to obtain minimum deflection, recheck Step 10, as these steps interact. Final adjustment is attained when we have optimum square wave response and hf differential balance check on A-B DC is at a minimum.

13. 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)

13. Con't.

Set up plug-in as follows:

<u>VOLTS/CM</u>	<u>.05</u>
<u>VARIABLE VOLTS/CM</u>	full right (cw)
Input Selector Switch	<u>A DC</u>

Terminate TYPE 190 ATTENUATOR Box with a 5:1 L PAD. From TYPE 190 apply 3 cm of signal at 50 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)