

# FACTORY CALIBRATION PROCEDURE

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## INTRODUCTION:

This is the guide for calibrating brand-new instruments, it therefore, calls out many procedures and adjustments that are rarely required for subsequent recalibration. *This procedure is company confidential.* In this procedure, all front panel control labels or Tektronix equipment names are in capital letters (VOLTS/DIV, etc.) internal adjustment labels are capitalized only (Gain Adj, etc.).

Tek form number:

0-427

May 1967

For all serial numbers.



P6009

010-0170-00  
(20pF)

## FACTORY TEST LIMITS:

We initially calibrate the instrument to Factory Test Limits. These limits are often more stringent than advertised performance requirements. This helps insure that the instrument will meet advertised requirements after shipment, allows for inaccuracies of test equipment used, and may allow for changes in environmental conditions.

## QUALIFICATION:

Factory test limits are qualified by the conditions specified in the main body of the calibration procedure. The numbers and letters to the left of the limits correspond to the factory calibration procedure steps where the check or adjustment is made. Instruments may not meet factory test limits if calibration or check-out methods and test equipment differ substantially from those in this procedure.

## ABBREVIATIONS:

Abbreviations in this procedure will be found listed in TEKTRONIX STANDARD A-100.

## CHANGE INFORMATION:

This procedure has been prepared by Product Manufacturing Staff Engineering. For information on changes that have been made to this procedure, to make suggestions for changing this procedure, or to order additional copies: please contact PMSE, 47-261. (DH)



PMSE

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EQUIPMENT REQUIRED:

The following equipment is necessary to complete this procedure:

a. *TEKTRONIX Test Equipment*

- 1 TYPE 546 OSCILLOSCOPE
- 1 TYPE K PLUG-IN UNIT (modified)(see note 1)
- 1 TYPE 647A OSCILLOSCOPE
- 1 TYPE 10A2A DUAL TRACE AMPLIFIER
- 1 TYPE 11B1 TIME BASE
- 1 TYPE 109 PULSE GENERATOR
- 1 TYPE 113 DELAY CABLE
- 1 TYPE 130 L-C METER
- 1 TYPE 191 CONSTANT AMPLITUDE SIGNAL GENERATOR

b. *Test Fixtures and Accessories*

- 1 Standard Amplitude Calibrator (SAC)(067-0502-00)
- 1 3000 VDC Power Supply (See note 2)
- 3 BNC to Probe Adapters (013-0054-00)
- 2 GR to BNC Adapters (017-0063-00)
- 2 RG 8A/U 50 $\Omega$  5ns cables (017-0502-00)
- 1 50 $\Omega$  Termination (011-0049-00)
- 1 50 $\Omega$  Termination (017-0083-00)

NOTE 1: See PMPE drawing No. 1521-B.

NOTE 2: See PMPE drawing No. 665-A, 493-B, 494-B, 495-B, 496-B, 497-B, 352-C, 353-C and 354-C.

Substitute test equipment may be used. The Plant Staff Engineer must approve any substitutions. All equipment listed must perform within its manufacturer's specifications, unless otherwise stated.

It is assumed that all equipment is provided with BNC connectors; if equipment used has other than BNC connectors, adapters, not listed, may be needed.

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## FACTORY TEST LIMITS

### QUALIFICATION

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1. PRELIMINARY INSPECTION
2. PRESET CONTROLS
3. ATTENUATION, COMPENSATION NOISE AND COMPENSATION RANGE
  - a. Check Attenuation Accuracy:  $\pm 2\%$
  - b. Check Compensation Noise:  $\leq 10\text{mV}$
  - c. Check Compensation Range: 15 to 55pF, min
4. HOOK AND COMPENSATION CHANGE
  - a. Check Hook: 0.5% or less
  - b. Check Compensation Change:  $\pm 5\%$  or less and must return to  $\pm 2\%$  or less
5. HF COMPENSATION

Adjust HF Compensations for Optimum response: aberrations 2% P-P, max
6. BANDWIDTH  $\geq 87\text{ MHz}$
7. INPUT CAPACITY 2.5pF  $\pm 10\%$
8. HIGH VOLTAGE 3000 VDC

THE END

1. PRELIMINARY INSPECTION

Check physical appearance, workmanship, cables and connector. Check for obvious scratches, bubbles or other blemishes in the finished surface. Unscrew the locking nut and remove the Compensating Box cover. Check for long ends, unsoldered joints and protruding parts.

2. PRESET CONTROLS

Set the TYPE 546 controls with the modified TYPE K installed.

|                     |            |
|---------------------|------------|
| HORIZONTAL DISPLAY  | A          |
| TRIGGERING LEVEL    | 0          |
| TRIGGERING MODE     | auto       |
| TRIGGERING SLOPE    | +          |
| TRIGGERING COUPLING | AC         |
| TRIGGERING SOURCE   | NORM INT   |
| TIME/CM             | .2mSEC     |
| VARIABLE TIME/CM    | CALIBRATED |
| HORIZONTAL POSITION | midr       |

Set the modified TYPE K controls:

|                    |      |
|--------------------|------|
| VERTICAL POSITION  | midr |
| ATTENUATION SWITCH | 1/1  |
| CAPACITY           | 15   |

Set the TYPE 647A controls with the TYPE 10A2A and 11B1 installed.

|            |      |
|------------|------|
| HORIZONTAL | midr |
| FINE       | midr |

Set the TYPE 11B1 controls.

|                     |            |
|---------------------|------------|
| TIME/CM             | .2mSEC     |
| TRIGGERING MODE     | AUTO LEVEL |
| TRIGGERING SLOPE    | +          |
| TRIGGERING COUPLING | AC         |
| TRIGGERING SOURCE   | INT        |

## 2. (cont'd)

Set the TYPE 10A2A controls.

|                       |      |
|-----------------------|------|
| MODE                  | CH1  |
| TRIGGER               | NORM |
| CH1 AC-GND-DC         | DC   |
| CH1 VOLTS/CM          | .01  |
| CH1 VARIABLE VOLTS/CM | CAL  |
| CH1 POSITION          | midr |

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3. ATTENUATION, COMPENSATION NOISE AND  
COMPENSATION RANGE

*a. Check Attenuation Accuracy:  $\pm 2\%$*

Connect a 50 $\Omega$  cable from the SAC OUTPUT to the TYPE K INPUT. Set the SAC AMPLITUDE to .2 VOLTS and adjust the scope STABILITY and TRIGGERING LEVEL controls for a stable display. Set the TYPE K GAIN ADJ for exactly 4cm of deflection. Remove the 50 $\Omega$  cable from the SAC and TYPE K INPUT.

Connect a BNC to probe adapter to the SAC OUTPUT and set the AMPLITUDE control to 20 VOLTS. Connect the probe Compensating Box to the TYPE K INPUT and insert the probe tip into the BNC to probe adapter. Remove the Compensating Box cover. Rotate all potentiometers in the Compensating Box to the clockwise position. Adjust C114 so that minimum spike is observed. Loosen the probe locking sleeve and adjust the probe body for a flat top on the display. Check the display amplitude for 4cm  $\pm 2\%$ .

*b. Check Compensation Noise: less than 10mV*

Hold the probe body stationary and slowly rotate the base bushing approximately 180° in both directions. The noise observed on the display must be less than 2mm.

b. If the noise is too great, remove the probe body and apply a small amount of Bearing and Control Oil (#2008-1) to the Compensating sleeve. Reinstall the probe body and repeat the noise check.

*c. Check Compensation Range: 15 to 55pF*

Rotate the probe body with respect to the base bushing and check for visible rolloff on the waveform. Set the TYPE K capacity switch to 55 and again rotate the probe body. It must be possible to obtain a visible spike. Set the TYPE K capacity switch to 20. Recompensate the probe for a flat-top waveform.

#### 4. HOOK AND COMPENSATION CHANGE

a. *Check Hook: .5% or less*

Set the SAC AMPLITUDE control to 50 VOLTS and move the top of the waveform onto the screen using the VERTICAL POSITION control. Check for less than 1/2mm of hook.

b. *Check Compensation Change:  $\pm 5\%$  or less and must return to  $\pm 2\%$  or less*

Hold the probe with one hand and slowly rotate the cable relief cover (on the probe end). The probe compensation must not vary more than  $\pm 5\text{mm}$ . The compensation must return to within  $\pm 2\text{mm}$  of correct compensation with the cable relief cover released.

#### 5. HF COMPENSATION

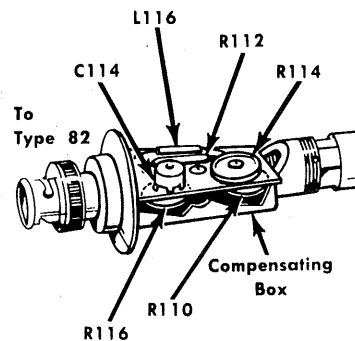
a. *Setup*

Remove the probe Compensating Box from the TYPE K INPUT and connect it to the TYPE 10A2A CH1 INPUT. Set the SAC AMPLITUDE control to 5 VOLTS and adjust the probe body for a flat top on the display. Remove the probe tip from the SAC. Connect two RG8A/U 5ns cables from the TYPE 109 PULSE GENERATOR CHG LINE 1 and CHG LINE 2 connectors to the TYPE 113 DELAY CABLE. Connect a GR to BNC female adapter to the 50 $\Omega$  OUTPUT and attach a 50 $\Omega$  BNC Termination. Connect a BNC to probe adapter to the 50 $\Omega$  Termination and insert the probe into the adapter.

b. *Adjust HF Compensations for Optimum response: aberrations 2% P-P, max*

Set the TYPE 11B1 TIME/CM control to .1 $\mu\text{SEC}$  and adjust the STABILITY and TRIGGERING LEVEL controls for a stable display. Adjust the TYPE 109 AMPLITUDE and VOLTAGE RANGE controls for a 4cm display. Position the fast rise portion of the display to the graticule center. Pull and unlock the TYPE 11B1 MAGNIFIER and set to 50nSEC. Adjust R116 so the ringing disappears. Adjust R110 so that the rolloff disappears and the front corner is on the same level as the rest of the pulse. Adjust R110, R114 and R116 for optimum response. Repeated adjustments of all high frequency compensations may be necessary due to interaction.\*

\* If necessary, slight adjustment of C114 can be made to reduce aberration. If this is done, recompensation of the probe body will be necessary.



## 5b. (cont'd)

Set the TYPE 11B1 TIME/CM control to .1 $\mu$ SEC and lock the TYPE 11B1 MAGNIFIER. Check aberrations to be 2% P-P or less. Replace the Compensating Box cover.

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6. BANDWIDTH

87 MHz

Connect a 50 $\Omega$  GR Termination to the TYPE 10A2A CH1 INPUT. Connect a RG8A/U 5ns cable from the Termination to the TYPE 191 OUTPUT.

Set the TYPE 11B1 TIME/CM control to .1mSEC and TRIGGER MODE to FREE RUN. Set the TYPE 191 to 50 kHz and adjust the AMPLITUDE and AMPLITUDE RANGE controls to obtain a 4cm display. Increase the TYPE 191 frequency to 100 MHz and note the display amplitude.

Remove the 50 $\Omega$  cable and 50 $\Omega$  GR Termination from the TYPE 191 and TYPE 10A2A. Connect the 50 $\Omega$  BNC Termination to the GR to BNC female adapter on the TYPE 191 and to this attach a BNC to probe adapter. Insert the probe into the adapter and attach the probe Compensating Box to the TYPE 10A2A CH1 INPUT. Set the TYPE 191 to 50 kHz and adjust the AMPLITUDE and AMPLITUDE RANGE controls to obtain a 4cm display. Increase the TYPE 191 frequency to 87 MHz and again note the display amplitude. It must be equal to or greater than that noted above.

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7. INPUT CAPACITY2.5pF  $\pm$ 10%

Connect a BNC to probe adapter to the TYPE 130 UNKNOWN L or C jack. Insert the probe tip and check input capacity.

8. HIGH VOLTAGE

3000 VDC

Set the TYPE 10A2A CH1 VOLTS/CM to 10.  
Touch the probe tip to the output of the  
3000 VDC SUPPLY and note a 3cm shift of  
the trace. Check the trace for any  
indication of arcing. Remove the probe  
from the high voltage supply and the  
TYPE 10A2A.

THE END