FACTORY CALIBRATION PROCEDURE

CONTENTS:

This is the guide for calibrating new instruments in Product Manufacturing. The procedure consists of 4 sections:

Equipment Required

Factory Test Limits - Factory Test Limits are limits an instrument must meet before leaving Manufacturing. These limits are often more stringent than advertised performance requirements. This is to insure that the instrument will meet advertised requirements after shipment, allows for individual differences in test equipment used, and (or) allows for changes in environmental conditions.

Short Form Procedure - The Short Form Procedure has the same sequence of steps and the same limits on checks or adjustments as the Main Procedure.

Main Procedure - The Main Procedure gives more detailed instructions for the calibration of the instrument. This procedure may require that some checks and adjustments be made so that performance is better than that required by the Factory Test Limits. This insures the Factory Test Limits will be met when side panels are added, permits some normal variation in test equipment and plug-in scopes, etc.

Abbreviations in this procedure will be found listed in TEKTRONIX STANDARD A-100. Definitions of terms used in this procedure may be found in TEKTRONIX STANDARD A-101.

In this procedure, all front panel control labels and Tektronix instrument names are in capital letters (VOLT/DIV, etc). Internal adjustment labels are capitalized only (Gain Adj, etc).

This procedure is company confidential

SWEPT FREQUENCY CONVERTER (015-0107-00)

June 1968

For all serial numbers.

CHANGE INFORMATION:

This procedure has been prepared by Product Manufacturing Staff Engineering. For information on changes made to this procedure, to make suggestions for changing this procedure, or to order additional copies: please contact PMSE, 39-307. (HD)

EQUIPMENT REQUIRED:

The following equipment is necessary to complete this procedure:

a. TEKTRONIX Instruments

1	TYPE 540B SERIES OSCILLOSCOPE with
* 1	TYPE 1A1 PLUG-IN UNIT and
1	TYPE 6028 X1 PASSIVE PROBE and
1	TYPE 6006 X10 PASSIVE PROBE (test scope)
1	TYPE 1L5 SPECTRUM ANALYZER (test scope)
* 1	TYPE 184 TIME MARK GENERATOR
1	TYPE 191 SINE WAVE GENERATOR
1	TYPE 76TU LINE-VOLTAGE CONTROL UNIT [1]
1	TYPE 540 B SERIES OSCILLOSCOPE with
1	TYPE 1L5 SPECTRUM ANALYZER (calibration scope)

b. Test Fixtures and Accessories

1	Filter (067-0575-00)
1	600Ω Termination (011-0092-00)
2	BNC 93Ω Cable (012-0075-00)
1	BNC 50Ω Cable (012-0057-01)
1	BNC to dual binding post Adapter (013-0094-00)
1	50Ω BNC Termination (011-0049-00)

c. Other Equipment

1	2:1 Step-up Transformer (067-0052-00)

* This equipment must be traceable to NBS for certification of measurement characteristics.

[1] Check Accuracy at 45VAC and 136VAC

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.

FACTORY TEST LIMITS

QUALIFICATION

Factory Test Limits are qualified by the conditions specified in the main body of the Factory Calibration Procedure. The numbers and letters to the left of the limits correspond to the procedure steps where the check or adjustment is made. Steps without Factory Test Limits (set-ups, presets, etc.) are not listed. Instruments may not meet Factory Test Limits if calibration or checkout methods and test equipment differ substantially from those in this procedure.

4. POWER SUPPLY

a. -10V; ±10%; ripple ≤100mV
   90VAC to 272VAC
b. +10V: ±10%; ripple ≤100mV
   90VAC to 272VAC

* 5. 3MHz OSCILLATOR

b. FREQUENCY range: 3MHz, + & - 238Hz

6. OUTPUT AMPLITUDE

a. Max output: 4V to 8V P-P
b. OUTPUT AMPLITUDE range: 17.7 to 1

7. FAST-SLOW

a. Recovery time: 10 seconds
b. SLOW amplitude ±1%

8. OUTPUT RESISTANCE

600Ω ±15%

* 9. AMPLITUDE FLATNESS

±2.5%, 50Hz to 1MHz

10. 1MHz HARMONIC DISTORTION

3rd harmonic: ≤2.5%

11. INPUT VOLTAGE RANGE

Amplitude: ±1%, 0.8V to 2V

12. HARMONIC DISTORTION

3rd harmonic: ≤2%

THE END

* Indicates measurement characteristics; test equipment must be traceable to NBS for instrument certification.

SHORT FORM PROCEDURE

Factory TEST LIMITS are limits an instrument must meet before it leaves Manufacturing; therefore, it must be possible to inspect to these limits. Because of normal variations in test equipment and plug-in scopes, addition of side panels, etc, it is necessary to set up some circuits so their performance is better than required by Factory Test Limits. Therefore, the instructions given in the Factory Calibration Procedure may call for checks or adjustments which result in less error than that allowed by the Factory Test Limits.

1. FUSES

a. Check fuses F80 and F82: 1/16 A SLO BLO

2. RESISTANCE CHECK

a. Check Supplies

Pin No	Supply	Meter Scale	Approx Resistance
P	-10V	x1k	2kΩ
R	+10V	x10	70Ω

b. Check transformer primary

	To	Approx Resistance
Gnd pin	chassis	0Ω
Power pin	chassis	inf
Power pin	power pin	180Ω

3. PRESETS

4. POWER SUPPLY

a. Check Voltages: 10V ±1V
b. Check ripple: ≤100mV, 90 to 272VAC

5. 3MHz OSCILLATOR

a. Setup
b. Adjust L41 for zero beat
c. Check FREQUENCY range: + and - 250Hz

6. OUTPUT AMPLITUDE

a. Maximum output: 4 to 8V P-P
b. Range: 17.7 to 1

7. FAST-SLOW

a. Recovery Time: 10 seconds
b. Check SLOW Amplitude: ±0.5mm

†8. OUTPUT RESISTANCE

a. Check output resistance: 600Ω ±15% (2cm ±1.5mm)

9. AMPLITUDE FLATNESS

a. Setup: 5cm at 50Hz
b. 10kHz amplitude: ±1.0mm
† c. 100kHz amplitude: ±1.0mm
† d. 300kHz amplitude: ±1.0mm
e. 1MHz amplitude: ±1.0mm

10. 1MHz HARMONIC DISTORTION

a. Setup
b. Check distortion: 1cm

11. INPUT VOLTAGE

a. Setup : 5cm with 1.5V input
b. Check .65V input: ±0.5mm
† c. Check 2V input: ±0.5mm

12. HARMONIC DISTORTION

a. Setup
b. 10kHz distortion: ≤1.6cm
† c. 100kHz distortion: ≤1.6cm
† d. 300kHz distortion: ≤1.6cm
e. 50Hz distortion: ≤1.6cm

† These checks are not made on 100% of the instruments but are done on a sampling basis.

THE END

CALIBRATION

NOTES

1. FUSES

Check fuses, F80 and F82.
1/16 A, SLO BLO

2. RESISTANCE CHECK

a. Check supplies

Measure resistance to ground at:

Pin No	Supply	Meter Scale	Approx Resistance
P	-10V	x1k	2kΩ
R	+10V	x10	70Ω

b. Check transformer primary

Turn POWER switch to ON.
Measure from power plug:

	To	Approx Resistance
Gnd pin	chassis	0Ω
Power pin	chassis	inf
Power pin	power pin	180Ω

b. Instrument not connected to TYPE 76TU.

3. PRESETS

a. Test Scope with 1A1 installed

TIME/CM	5mSEC
TRIGGER MODE	AUTO
TRIGGER SLOPE	+
TRIGGER SOURCE	LINE
CH 1 VOLTS/CM	.05
CH 2 VOLTS/CM	1

b. SWEPT FREQUENCY CONVERTER

FAST-SLOW	FAST
FREQUENCY	set 180° cw from fully ccw
OUTPUT AMPLITUDE	fully cw
POWER	OFF

3. (cont'd)

c. TYPE 1L5

CENTER FREQUENCY-Hz	500k
DISPERSION Hz/CM	100k
SWEEP MODE	MANUAL
MANUAL	midrange

4. POWER SUPPLY

a. Check voltages: 10V ±1V

Connect the SFC (SWEPT FREQUENCY CONVERTER) to the TYPE 76TU via a 2:1 step-up transformer. Set the TYPE 76TU for 57.5VAC. (The step-up transformer will convert this to 115VAC.) Switch POWER to ON.

Measure the voltage at pin P of the circuit board for -9 to -11V.

Measure the voltage at pin R for +9 to +11V.

b. Check ripple:
≤100mV, 90 to 272VAC

Connect a X1 probe from CH 1 of the TYPE 1A1 to pin P. Vary the TYPE 76TU from 45 to 136VAC and check ripple for 100mV, max.

Connect the X1 probe to pin R. Vary the TYPE 76TU between 45 and 136VAC and check ripple for 100mV, max.

Return the TYPE 76TU to 57.5VAC.

5. 3MHz OSCILLATOR

a. Setup

Connect a 93Ω BNC cable with adapter between CH 2 and the SFC OUTPUT. Connect a 50Ω BNC cable from the TYPE 184 MARKER OUT to the SFC OSC IN. Set the TYPE 184 for 1μs markers.

5a. (cont'd)

Switch the TYPE 1A1 to CH 2. Set Test Scope TIME/CM to 1μs and TRIGGER SOURCE to NORM.

b. Adjust L41: zero beat

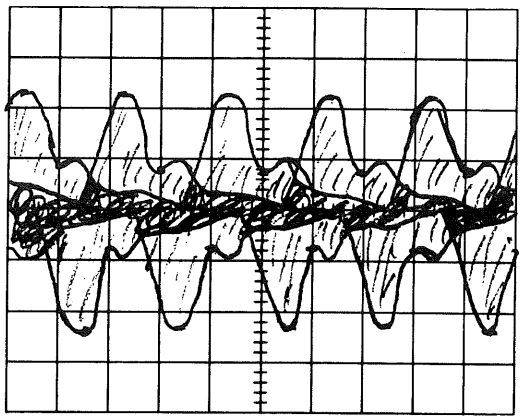
Adjust L41 until the Test Scope displays 1MHz sine waves. The sine wave amplitude will vary slowly as "zero beat" is approached. Adjust L41 for minimum variation at "zero beat".

c. Check FREQUENCY range: + and - 250Hz

Set the TYPE 184 for 5μs markers. Switch Test Scope TIME/CM to 2mSEC, TRIGGER MODE to TRIG, and LEVEL for a stable display. Check for at least 5 peaks in 8cm with FREQUENCY fully cw. Rotate FREQUENCY fully ccw and check for at least 5 peaks in 8cm. Readjust L41 if necessary.

Remove the cable from TYPE 184 MARKER OUTPUT.

c.



5 peaks in 8cm

6. OUTPUT AMPLITUDE

a. Maximum output: 4 to 8V P-P

Connect the TYPE 1L5 OSC OUT to the SFC OSC IN with 93Ω cable. Set TYPE 1A1 CH 2 VOLTS/CM to 2. Check for 2 to 4cm display.

b. Range: 17.7 to 1

Switch CH 2 VOLTS/CM to 1. Adjust VARIABLE for 3.55cm of display. Change CH 2 VOLTS/CM to .1. Turn SFC OUTPUT AMPLITUDE fully ccw. Check for no more than 2cm of display.

7. FAST-SLOW

a. Recovery time: 10 seconds

Return OUTPUT AMPLITUDE fully cw. Adjust TYPE 1A1 CH 2 VOLTS/CM and VARIABLE for 5cm display. Set 1L5 CENTER FREQUENCY-Hz to 0000 and DISPERSION Hz/CM to 1k. Set MANUAL SCAN fully clockwise.

Switch FAST-SLOW from FAST to SLOW. Display must return to former amplitude within 10 seconds.

b. Amplitude: ±0.5mm

Check SLOW amplitude for 4.95 to 5.05cm.

†8. OUTPUT RESISTANCE 600Ω ±15%

Set CH 2 VARIABLE for 4cm of display. Place 600Ω Terminator on CH 2 end of 93Ω cable.

Check for 1.85 to 2.15cm display.

9. AMPLITUDE FLATNESS

a. Setup: 5cm at 50Hz

Set TYPE 1L5 CENTER FREQUENCY-Hz to 000 and DISPERSION Hz/CM to 100. Set Test Scope TIME/CM to 20mSEC. Adjust TYPE 1L5 MANUAL SCAN for 1 cycle/cm. Set CH 2 VARIABLE for 5cm display.

b. 10kHz amplitude: ±1.0mm

Set TYPE 1L5 CENTER FREQUENCY-Hz to 9900 and DISPERSION Hz/CM to 1K. Check for 4.9 to 5.1cm display.

†c. 100kHz amplitude: ±1.0mm

Set TYPE 1L5 CENTER FREQUENCY-Hz to 100k. Check for 4.9 to 5.1cm display.

†These checks are not made on 100% of the instruments but are done on a sampling basis.

a. Be sure output is terminated in 600Ω.

9. (cont'd)

d. 300kHz amplitude: ±1.0mm

Set TYPE 1L5 CENTER FREQUENCY-Hz to 300k. Check for 4.9 to 5.1cm display.

e. 1MHz amplitude: ±1.0mm

e. Measure from trace center to trace center.

Set Test Scope TIME/CM to 1μSEC. Set TYPE 1L5 CENTER FREQUENCY-Hz to 990k. Adjust MANUAL SCAN for 1 cycle per cm.

Check for sine wave amplitude of 4.9 to 5.1cm.

10. 1MHz HARMONIC DISTORTION

a. Setup

Connect Filter to the SFC OUTPUT. Connect a 93Ω BNC cable to the Filter OUTPUT. Connect a X10 probe from TYPE 1A1 CH 2 INPUT to Filter INPUT.

b. Check distortion: 1cm

Adjust CH 2 VOLTS/CM to .05 and VARIABLE for 5cm of display. Disconnect the X10 probe and connect the 93Ω cable to CH 2 INPUT. Check for 1cm maximum display of 3MHz.

11. INPUT VOLTAGE

a. Setup

Replace the Filter with adapter and connect the 93Ω cable to the SFC OUTPUT. Place the 600Ω Terminator at the 1A1 end of the cable. Switch CH 2 VOLTS/CM .5.

Connect TYPE 191 OUTPUT though a 50Ω Terminator to the TYPE 1A1 CH 1. Set CH 1 VOLTS/CM to .5. Adjust TYPE 191 AMPLITUDE for 3cm at 2.5MHz.

11a. (cont'd)

Connect TYPE 191 to SFC OSC IN. Set TYPE 1A1 to CH 2. Adjust CH 2 VARIABLE for 5cm. Switch FAST-SLOW to FAST.

b. Check 0.65V input: ±0.5mm

Connect TYPE 191 to TYPE 1A1 CH 1. Adjust TYPE 191 AMPLITUDE for 1.3cm of display.

Connect TYPE 191 to SFC OSC IN. Switch 1A1 to CH 2. Check for 4.95 to 5.05cm of display.

†*c. Check 2V input: ±0.5mm*

Connect TYPE 191 to TYPE 1A1 CH 1. Adjust TYPE 191 AMPLITUDE for 4cm of display.

Connect TYPE 191 to SFC OSC IN. Switch TYPE 1A1 to CH 2. Check for 4.95 to 5.05cm of display.

12. HARMONIC DISTORTION

a. Setup

Set calibration Scope 1L5 CENTER FREQUENCY-Hz to 9900 and DISPERSION Hz/CM to 1k. Connect OSC OUT to SFC OSC IN with 93Ω cable.

Set Test Scope TIME/CM to .2SEC. Replace the TYPE 1A1 with the second 1L5. Connect SWEEP A to SWEEP INPUT and set SWEEP MODE to EXT. Set Test Scope 1L5 CENTER FREQUENCY-Hz to 50k, VERTICAL DISPLAY to LOG and DISPERSION Hz/CM to 10k. Connect the SFC OUTPUT through the 600Ω Terminator to the Test Scope 1L5 INPUT. Adjust the Test Scope 1L5 INPUT. Adjust the Test Scope 1L5 VOLTS/CM and VARIABLE for 5cm display at 10kHz.

12. (cont'd)

b. 10kHz distortion: ≤ 1.6cm

Check for 1.6cm or less display at 30kHz.

c. 100kHz distortion: ≤ 1.6cm

Change Calibration Scope 1L5 CENTER FREQUENCY-Hz to 100k. Change Test Scope 1L5 CENTER FREQUENCY-Hz to 500k and DISPERSION-Hz/CM to 100k. Check for 1.6cm or less display at 300kHz.

d. 300kHz distortion: ≤1.6cm

Change Calibration Scope 1L5 CENTER FREQUENCY-Hz to 300k. Check for 1.6cm or less display at 900kHz.

e. 50Hz distortion: ≤1.6cm

Change Calibration Scope 1L5 CENTER FREQUENCY-Hz to 000 and DISPERSION Hz/CM to 100. Change Test Scope CENTER FREQUENCY-Hz to 100, DISPERSION Hz/CM to 20.

Switch SFC FAST-SLOW to SLOW.

Adjust Calibration Scope MANUAL sweep for a 5cm display of 50Hz. (Test Scope VARIABLE VOLTS/CM may need readjustment.)

Check for 1.6cm or less at 150Hz.

THE END