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

067-0521-01

July 1969

For all serial numbers.

CHANGE INFORMATION:

This procedure has been prepared by Test-Final Staff Engineering. For information on changes made to this procedure, to make suggestions for changing this procedure, or to order additional copies: please contact T-FSE, 39-307.

EQUIPMENT REQUIRED

All TEKTRONIX test equipment must be calibrated to Factory Test Limits using methods specified in the applicable TEKTRONIX Factory Calibration Procedure. Other test equipment should be calibrated to its manufacturer's specifications. Exceptions to calibration procedures, which are necessary to improve the measurement capability of some test equipment, e.g. calibrated to ±0.5% accuracy at some specific setting, are noted on this Equipment Required List.

Equivalent test equipment may be used. A Test-Final Staff Engineer must approve any substitutions.

a. TEKTRONIX Instruments

1 TYPE 191 CONSTANT-AMPLITUDE SIGNAL GENERATOR
1 TYPE 561B OSCILLOSCOPE
1 TYPE 3S1 DUAL-TRACE SAMPLING UNIT
1 TYPE 3T2 SAMPLING SWEEP
2 TYPE 547 OSCILLOSCOPE
1 TYPE 1A1 DUAL-TRACE UNIT
1 TYPE 184 TIME MARK GENERATOR

b. Test Fixtures and Accessories

2 P6008 10x PROBE
1 50Ω 5ns Cable (017-0502-00)
1 50Ω Termination, GR to BNC (017-0083-00)
1 50Ω BNC Cable 42" (012-0057-00)
2 50Ω GR Coupling capacitors (017-0028-00)
1 STANDARD AMPLITUDE CALIBRATOR (067-0502-00)
1 RISETIME CHECKER ADAPTER (DWG. NO. 975-B)
1 PLUG-IN EXTENSION (013-0055-00)

c. Miscellaneous Equipment

1 20,000Ω/VDC Multimeter
1 John Fluke Voltmeter
1 Beckman/Shasta Resistance Bridge Accuracy .15%

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 (setups, 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.

3. RESISTANCE CHECKS

b. With D80 shorted

Pin	Low Load	High Load
9	38k ±5%	2.4k ±5%
10	10.6k ±5%	1.44k ±5%
11	14.5k ±5%	2.28k ±5%
12	inf	14k ±5%
15	500Ω ±1%	500Ω ±1%

4. INPUT DIVIDER

*b. Input divider check 250:1 (400mV ±2mV)

6. +225v ±10%, FRONT PANEL

7. VARIABLE GAIN

a. VARIABLE GAIN Range (50MHz) $\leq$0.5cm to $\geq$3cm
b. VARIABLE GAIN Range (1kHz) 0 to ≈1cm

8. PLUG-IN TRIGGER

a. Trigger Amplitude: 100mV ±20%
b. POSITION Range: 6cm signal off graticule

9. GAIN SET

a. EXT. INPUT DC level, ±5v or less

11. ALTERNATE

b. Alternate at all sweep speeds

13. CHOPPED

a. Check Chop Rate: 100kHz ±20%

14. PULSER

a. Drive Balance, (R40); equal amplitude ±5%
*b. Pulse DC Level, (R30); +67.5V ±2.5%
c. Overshoot, Undershoot, and Ringing, 1% P-P or less
d. REPETITION RATE:

Repetition Rate	Period
1 kHz	1mSEC ±20%
4 kHz	250µSEC ±20%
15 kHz	66µSEC ±20%
80 kHz	12.5µSEC ±20%
500 kHz	2µSEC ±20%

e. AMPLITUDE range $\leq$2.8cm to $\geq$5.6cm
g. Risetime: 2.9ns or less

* Indicates measurement characteristic

This instrument must meet Factory Test Limits 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, this procedure may require that some checks and adjustments be made so that performance is better than that required by Factory Test Limits.

1. PRELIMINARY INSPECTION

a. Install current modifications
b. Check fuse: 1/16 amp fast-blo (159-0024-00)

2. PRESET The 067-0521-01

3. RESISTANCE CHECKS

a. Check protection diode (D54)
b. HIGH and LOW LOAD Resistance checks

4. INPUT DIVIDER

a. Setup
b. Check Input Divider 250:1 (400mv ±2mv)

5. TYPE 547 SET UP

6. +225v ±10%, FRONT PANEL

7. VARIABLE GAIN

a. VARIABLE GAIN range (50MHz)
b. VARIABLE GAIN range (1kHz)

8. PLUG-IN TRIGGER

a. Trigger Amplitude 100mV ±20%
b. POSITION Range

9. GAIN SET

a. EXT. INPUT DC level, ±5v or less
b. Adjust front corner

10. COMMON MODE

11. ALTERNATE

a. Setup
b. Alternate sweep at all speeds

12. SLAVE OPERATION

13. CHOPPED

a. Check chop rate: 100kHz ±20%
b. Chopped blanking

14. PULSER

a. Adjust Drive Balance (R40)
b. Adjust Pulse DC Level (R30) 67.5v
c. Overshoot, Undershoot and ringing, 1% p-p or less
d. REPETITION RATE
e. AMPLITUDE Range
f. Set up
g. Rise Time: 2.9ns or less

THE END

1. PRELIMINARY INSPECTION

a. Install current modifications

b. Check fuse: 1/16 amp fast-blo (159-0024-00)

2. PRESET 067-0521-01

VARIABLE	midr
VERTICAL POSITION	midr
AMPLITUDE	midr
REPETITION RATE	MED
TEST FUNCTION	COMMON MODE
Drive Balance (R40)	midr
Pulse DC Level	midr

3. RESISTANCE CHECKS

a. Check protection diode (D54)

Check protection diode D54 for open or short. Check between pins 1 and 3 on interconnecting plug for about 300Ω. Check pin 1 or 3 to gnd for about 110K. Check between pins 13 and 14 for about 1.5Ω.

b. HIGH and LOW LOAD Resistance Checks

Short D80 (CSA 12 - CSB 12) with a jumper. Read the interconnecting plug pins resistance to gnd with the TEST FUNCTION switch in HIGH LOAD and LOW LOAD.

PIN	LOW LOAD	HIGH LOAD
1	110kΩ	110kΩ
2	0Ω	0Ω
3	40kΩ	40kΩ
4	0Ω	0Ω
5	17kΩ	17kΩ
6	inf	inf
7	inf	inf
8	0Ω	0Ω
9	38kΩ ±5%	2.4kΩ ±5%
10	10.6kΩ ±5%	1.44kΩ ±5%
11	14.6kΩ ±5%	2.28kΩ ±5%
12	inf	14kΩ ±5%
13	inf	inf
14	inf	inf
15	500Ω ±1%	500Ω ±1%
16	116kΩ	116kΩ

4. INPUT DIVIDER

a. Setup

Change TEST FUNCTION switch to GAIN SET. Ground the +100v wire at CSB6 with jumper. Apply +100v from SAC to EXT. INPUT.

b. Check Input Divider 250:1 (400mv ±2mv)

Measure the voltage at the junction of R18 and R21, CS A 6. Use the John Fluke Voltmeter and check for 400mV ±2mV. Remove the Voltmeter and the jumper.

5. TYPE 547 SET UP

TYPE 547 preset:

HORIZONTAL DISPLAY	A
NORMAL-SINGLE SWEEP	NORMAL
TRIGGERING: (Both)	
MODE	AUTO
SLOPE	+
COUPLING	AC
SOURCE	NORM

Insert the 067-0521-01 into TYPE 547.

Turn TYPE 547 power on.

6. +225V ±10% FRONT PANEL

Change the TEST FUNCTION switch to LOW LOAD. Connect voltmeter from ground to +225V jack, push red button, and check for +225V ±10%. Release red button and note that voltage drops to zero.

7. VARIABLE GAIN

a. VARIABLE GAIN Range (50MHz)

Connect the TYPE 191 through a 5ns GR cable and a 50 GR to BNC Terminator to the TYPE 067-0521-01 EXT INPUT. Adjust the 191 for 4v of 50MHz signal. With the TYPE

Amplitude of 50MHz signal can be checked with a sampling system.

7.a. (CONT'D)

067-0521-01 VARIABLE ccw, check for a maximum of 0.5cm of display. Turn VARIABLE cw and check for a minimum display of 3cm. Remove TYPE 191.

b. VARIABLE GAIN Range (1kHz)

Apply 0.5v signal from SAC to the EXT INPUT of the TYPE 067-0521-01. Turn VARIABLE cw and check for about 1cm of display. Turn VARIABLE ccw and note no display. Repeat in HIGH LOAD.

8. PLUG-IN TRIGGER

a. Trigger Amplitude 100mV ±20%

Change TYPE 547 TRIGGER SOURCE to PLUG-IN. Change the SAC to 5v and adjust TYPE 067-0521-01 VARIABLE for 5.5cm of display. With test scope measure pin 5 of interconnecting plug for 100mv, ±20% of signal.

b. POSITION Range

Adjust VARIABLE for 6cm display. Check that the display can be positioned vertically off the graticule in both HIGH LOAD and LOW LOAD positions. Remove the SAC signal and change the TEST FUNCTION switch to GAIN SET.

9. GAIN SET

a. EXT. INPUT DC Level

With test scope set at 5v/DIV DC, check EXT INPUT for a DC voltage of less than ±5v.

b. Adjust front corner

Apply 100v squarewave from SAC to EXT. INPUT and note 4cm display. Dress the 9-0 wire at CSB 1 and the 9-6 wire at CSB 3 for the best front corner.

10. COMMON MODE

Change SAC to 2v and change TEST FUNCTION to COMMON MODE. Check pins 1 and 3 interconnecting plug for 2V signal on each pin.

Vertical position is switched out in the COMMON MODE position. DC balance of TYPE 547 vertical amplifier may be checked in this position.

11. ALTERNATE

a. Set up

Change TEST FUNCTION to ALTERNATE. Apply 100v square wave from SAC to the 067-0521-01 EXT INPUT. Pull out both TYPE 547 TRIGGERING LEVEL controls and turn cw.

b. Alternate sweep at all Speeds

Check for alternate sweep on all sweep speeds of TYPE 547. SAC signal will be on lower trace and serve as identification at slow sweep speeds.

12. SLAVE OPERATION

Change TYPE 547 HORIZONTAL DISPLAY to A ALT B. Two traces should be present; the trace with the signal may be moved by the TRACE SEPARATION control on the TYPE 547.

If four traces are present, trouble in the slave pulse circuit is indicated.

13. CHOPPED

a. Check chop rate: 100kHz ±20%

Remove SAC signal. Return TYPE 547 to A sweep and push in TRIGGER LEVEL knob. Change A sweep rate to 10μs/cm. Change the 067-0521-01 TEST FUNCTION switch to CHOPPED. Check chopper rate: 100kHz ±20%

b. Chopped blanking

Switch TYPE 547 to CHOPPED BLANKING (rear panel) and note that leading and trailing edges of chopped waveform are blanked. Reset (rear panel) switch to EXTERNAL CRT CATHODE.

14. PULSER

a. Adjust Drive Balance (R40)

Change TEST FUNCTION to + PULSE and adjust PULSER AMPLITUDE for 4cm. Connect CH 1 and 2 of test scope to pins 1 and 3 on interconnecting plug, resp; change test scope MODE to ALT. Adjust Drive Balance (R40) for equal amplitude.

b. Adjust Pulse DC Level (R30)

Connect the John Fluke Voltmeter from gnd to + end of C42 and adjust Pulse DC Level (R30) for 67.5v. Remove voltmeter.

c. Overshoot, undershoot, and ringing, 1% p-p or less

Check display pulse for overshoot, undershoot and ringing: 1% p-p or less, (+ pulse only, 80 kHz rep rate).

d. Pulser Rep Rate:

Check rep rate of pulser by measuring the square wave periods in + PULSE and - PULSE:

REPETITION RATE	PERIOD
1kHz	1ms ±20%
4kHz	250µs ±20%
15kHz	66µs ±20%
80kHz	12.5µs ±20%
500kHz	2µs ±20%

e. AMPLITUDE Range

Turn AMPLITUDE control fully cw and check for a minimum of 5.6cm of Pulse display. Turn AMPLITUDE Control fully ccw and check for a maximum of 2.8cm of pulse. Check in both + and - PULSE.

f. Set up

Remove the 067-0521-01 and reinstall on the special extension (Risetime Checker Adapter). Plug TYPE 3S1 and TYPE 3T2 into TYPE 561B and allow to warm up. Connect Pin 1 GR lead through a GR 50Ω Coupling Capacitor

14.f. (CONT'D)

to the TYPE 3S1 A INPUT. Connect Pin 3 GR lead through a GR 50Ω Coupling Capacitor to the TYPE 3S1 B INPUT. Set the controls on the TYPE 3S1 and 3T2 as follows:

TYPE 3S1

CH A mVOLTS/DIV	50mV/div
VARIABLE	CAL
CH B mVOLTS/DIV	50mV/div
VARIABLE	CAL
MODE	A + B
CH A INVERT-NORM	NORM
CH B INVERT-NORM	INVERT
INTERNAL TRIGGER	A
SAMPLING MODE	TRIGGERED

TYPE 3T2

TIME POSITION	cw
FINE	midr
HORIZ POSITION	midr
SAMPLES/DIV	cw
RANGE	100ns
START POINT	WITH TRIGGER
TIME MAGNIFIER	X10
VARIABLE	CAL
DISPLAY MODE	NORMAL
POLARITY (Trig)	+
SOURCE (Trig)	INT

Adjust the TYPE 3T2 TRIG SENSITIVITY and RECOVERY TIME for a stable display.

TYPE 3T2 HORIZ and TYPE 3S1 VERT GAINS should be checked and adjusted if necessary.

g. RiseTime: 2.9ns or less

Adjust the 067-0521-01 AMPLITUDE for a 5div display on the TYPE 561B. Check the + PULSE risetime 2.9ns or less. Remove all equipment.

THE END