

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).

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)

*This procedure is
company confidential*

600 Ω
STEP
ATTENUATOR
011-0093-00



July 1968
For all serial
numbers.

©, 1968 TEKTRONIX, INC., PO Box 500
BEAVERTON, OREGON. All rights reserved.



EQUIPMENT REQUIRED:

The following equipment is necessary to complete this procedure:

a. TEKTRONIX Instruments

- 1 TYPE 453 OSCILLOSCOPE (test scope)
- 1 TYPE 191 CONSTANT AMPLITUDE SINE WAVE GENERATOR

b. Test Fixtures and Accessories

- 2 93 Ω 42in BNC Coax Cables (012-0075-00)
- 2 Female BNC to Dual Binding Post Adapters (013-0094-00)
- 1 BNC "T" Male to 2 Female connector (103-0030-00)
- 1 BNC Female to GR adapter (017-0063-00)

c. Other Equipment

- 1 Digital Multimeter, Fairchild Model 7000
- 1 Variable Power Supply, Trygon Model HH 14-3
- 1 Min Loss 50 Ω to 600 Ω "L" Pad (Dwg #2032-A)
- 1 600 Ω \pm .05% Series Load (Dwg #2030-A)
- 1 600 Ω \pm .05% Shunt Load (Dwg #2031-A)

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.

1. INPUT RESISTANCE

- c. $600\Omega \pm 1\%$

2. ATTENUATOR RATIOS

- b. $\pm 0.03\text{dB/dB}$ except
 $\pm 0.05\text{dB}$ at 1dB

3. BANDPASS

- b. $\leq 3\text{dB}$ down at 3.0MHz
 $\leq 6\text{dB}$ down at 5.5MHz

THE END

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. INPUT RESISTANCE

- a. Setup
- b. Set voltage: 10.000VDC
Check input resistance:
4.975V to 5.025V

2. ATTENUATOR RATIOS

- a. Setup
- b. Set Voltage: 05.000V
- c. Check ratios

1dB	_____	04.431	to	04.482V
2dB	_____	03.945	to	03.999V
4dB	_____	03.112	to	03.198V
8dB	_____	01.937	to	02.046V
16dB	_____	0.7500	to	0.8375V
20dB	_____	0.4670	to	0.5355V

3. BANDPASS

- a. Setup
- c. Set 4div at 50kHz
Check Bandpass
 >2.8div at 3.0MHz
 >2.0div at 5.5MHz

THE END

1. INPUT RESISTANCE

a. Setup

Connect a BNC to Dual Binding Post Adapter to the Variable Power Supply. Connect the Series Load via a BNC T connector to one of the INPUT-OUTPUT connectors on the Step attenuator. Connect the Variable Power Supply to the Series Load with a 93Ω BNC cable.

Connect the Shunt Load to the remaining INPUT-OUTPUT connector on the Step Attenuator.

Connect a BNC to Dual Binding Post Adapter to the Digital Multimeter. Connect the Digital Multimeter to the remaining connection on the BNC T connector with a 93Ω BNC cable.

Set the Digital Multimeter FUNCTION to V DC and RANGE to AUTO.

b. Set Voltage

Disconnect the BNC "T" connector from the Step Attenuator.

Set Variable Power Supply CURRENT fully cw. Adjust VOLTAGE for +10.000 VDC as read on the Digital Multimeter.

Reconnect the BNC "T" connector to the Step Attenuator.

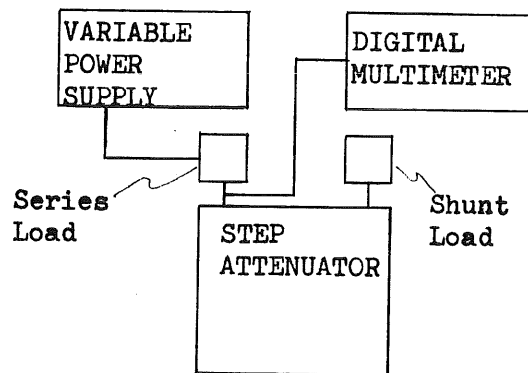
c. Check Input Resistance: $600\Omega \pm 1\%$

Switch all toggles to OUT.

Switch the 1dB toggle up. Check the Digital Multimeter for a reading of +04.975 to +05.025 VDC. Switch the 1dB toggle to OUT.

Repeat for 2,4,8,16, and 20dB toggle switches.

Interchange the BNC "T" connector with the Shunt Load on the Step Attenuator and repeat checks.



Setup 1

2. ATTENUATOR RATIOS

a. Setup

Disconnect the Digital Multimeter from the BNC "T" connector. Connect the Digital Multimeter to the Shunt Load.

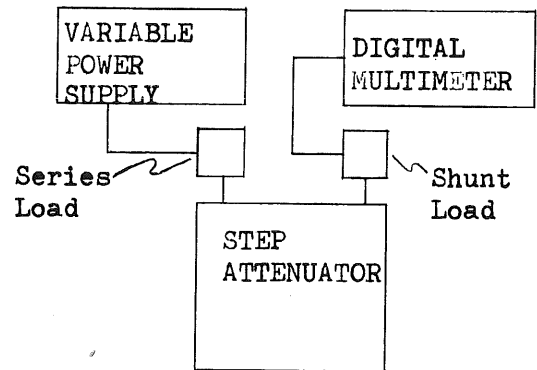
Switch all toggles on the Step Attenuator to OUT. Adjust the Variable Power Supply VOLTAGE for +05.000VDC as read on the Digital Multimeter.

b. Check Attenuator ratios: $\pm 0.03\text{dB/dB}$ except $.05\text{dB}$ at 1dB

Check each attenuator ratio per the following table:

Toggle Switch Up	Digital Multimeter Reads
1dB	+04.431 VDC to +04.482 VDC
2dB	+03.945 VDC to +03.999 VDC
4dB	+03.112 VDC to +03.198 VDC
8dB	+01.937 VDC to +02.046 VDC
16dB	+0.7500 VDC to +0.8375 VDC
20dB	+0.4670 VDC to +0.5355 VDC

Interchange the BNC "T" connector with the Shunt Load on the Step Attenuator and repeat.



Setup 2

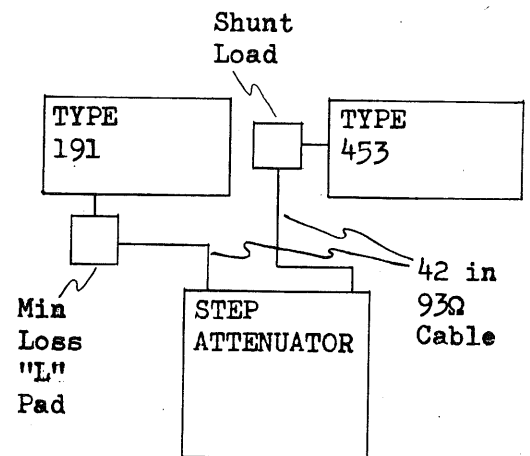
3. BANDWIDTH

a. Setup

Connect a GR to Female BNC adapter to the TYPE 191 OUTPUT. Connect the Min Loss "L" Pad to the adapter. Connect the Min Loss "L" Pad to one of the INPUT-OUTPUT connectors on the Step Attenuator with a 42 in. 93Ω BNC cable.

Connect the Shunt Load to the CH 1 INPUT of the TYPE 453.

Connect the Shunt Load to the other INPUT-OUTPUT connector with a 42in. 93Ω BNC cable.



Setup 3

3. (cont'd)

Preset the TYPE 453, TYPE 191,
and Step Attenuator controls as follows:

TYPE 453

CH 1 VOLTS/DIV	.5V
VARIABLE	CAL
AC-GND-DC	DC
MODE	CH 1
HORIZ DISPLAY	A
A SWEEP LENGTH	cw
A TIME/DIV	1mS
MAG	OFF
A SWEEP MODE	AUTO TRIG

TYPE 191

FREQUENCY RANGE	50kHz ONLY
AMPLITUDE	40
AMPLITUDE RANGE	.5-5V

STEP ATTENUATOR

All toggles	OUT
-------------	-----

b. Check Bandpass: $\geq 2.8\text{div}$ at 3.0MHz
 $\geq 2.0\text{div}$ at 5.5MHz

Adjust the TYPE 191 VARIABLE for 4div
of display on the TYPE 453.

Change TYPE 191 FREQUENCY RANGE to
1.6 -3.6. Set for 3.0MHz out. Check
for at least 2.8div of display on the
TYPE 453.

Set the TYPE 191 FREQUENCY RANGE to
3.6 -8. Set the TYPE 191 for 5.5MHz
out. Check for at least 2.0div of
display.

THE END