

FACTORY CALIBRATION PROCEDURE

CONTENTS:

General	1
Equipment required	2
Factory test limits	3
Factory calibration procedure	4

INTRODUCTION:

292

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:

0-426

April 1967

For all serial numbers.



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. (DC)



PMSE

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EQUIPMENT REQUIRED:

The following equipment is necessary to complete this procedure:

- a. *TEKTRONIX Instruments*
 - 1 TYPE 540B SERIES OSCILLOSCOPE
 - 1 TYPE D PLUG-IN UNIT
 - 1 TYPE 76TU LINE VOLTAGE CONTROL UNIT
- b. *Test Fixtures and Accessories*
 - * 1 292 CALIBRATION Unit (PMPE Drawing No. 1449-B)
 - 1 30-400pF Cap Picker (PMPE Drawing No. 1665-A)
 - 4 Patch cords, Banana plug (012-0031-00)
 - 1 50Ω BNC cable (012-0057-00)
- c. *Other Equipment*
 - * 1 John Fluke Differential DC Voltmeter, Model 801

* This equipment must be traceable to NBS for instrument certification.

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. C662

b. Select C662, Ripple: 4mV, max

4. BIAS CURRENT SUPPLY

* b. Adjust and check bias current supply. Check voltages and ripples at 105 VAC line and 125 VAC line as in the following table:

<u>Load</u>	<u>BIAS CURRENT mAMPS</u>	<u>DC Voltage ±2.5%, max</u>
1k	.1	100mV
1k	.2	200mV
1k	.5	500mV
1k	1	1V
1k	2	2V
1k	5	5V
100Ω	10	1V
100Ω	20	2V
100Ω	50	5V
100Ω	100	10V
100Ω	200	20V
100Ω	200 (VARIABLE ccw)	2V or less
<u>Ripple P-P</u>		
1k	.1 thru 20	4mV, max
100Ω	50	0.8mV, max
100Ω	100	1.5mV, max
100Ω	200	7.5mV, max

5. CHECK BIAS CURRENT SUPPLY FOR OVERHEATING

6. TEST VOLTS SUPPLY

* b. Adjust and check test volts supply. Check voltages and ripples at 105 VAC line and 125 VAC line as in the following table:

<u>Load</u>	<u>TEST VOLTS</u>	<u>DC Voltage ±2.5%, max</u>
100Ω	1	1V
100Ω	2	2V
100Ω	5	5V
100Ω	10	10V
100Ω	20	20V
100Ω	20 (VARIABLE ccw)	2V or less
<u>Ripple P-P</u>		
OPEN CRT	1	3mV, max
100Ω	20	3mV, max

7. CHECK TEST VOLTS SUPPLY FOR OVERHEATING

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

THE END

1. PRELIMINARY INSPECTION*a. General Examination*

Inspect the case for defects in the paint or metal parts. Remove the bottom cover and check for unsoldered joints, rosin joints, lead dress and long leads. Check controls and switches for smooth mechanical operation, proper indexing and clearance between knobs and front panel. Correct all defects found.

b. Check Fuse

Line Voltage	Fuse (F601)
117 VAC	.3A 3AG S10-B10 159-0029-00
234 VAC	.15A 3AG S10-B10 159-0054-00

a. Leave the bottom cover off, it will be replaced later in the procedure.

2. PRESET CONTROLS*a. Test Scope*

MILLIVOLTS/CM	1
MV/CM MULTIPLIER	1
Input Selector	A-AC
TIME/CM	5mSEC

b. 292 CALIBRATION UNIT

Load Selector	1K 0.3%
DC CHECK- RIPPLE CHECK	RIPPLE CHECK

c. TYPE 292

BIAS CURRENT - mAMPS	5
VARIABLE	CALIB
BIAS CURRENT	INVERTED
TEST VOLTS	OFF
TEST VOLTS	1
VARIABLE	CALIB

d. Internal Adjustments

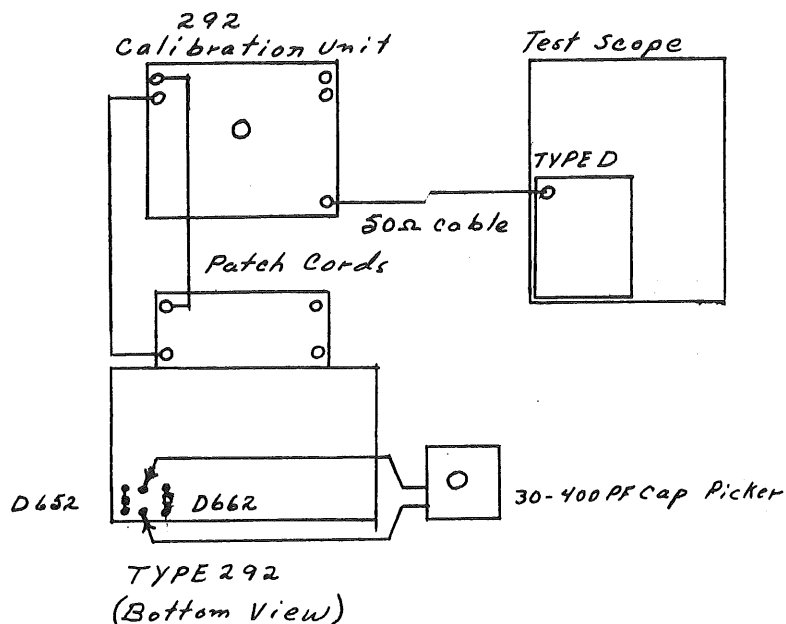
Volts Cal, R623	midr
Current Cal, R676	midr
R624A	midr

d. R624A is the pot located at the rear of the center switch (SW624).

3. C662

a. Setup

Make connections as in the following diagram:



Connect the TYPE 292 power cord to the TYPE 76TU outlet and set the TYPE 76TU for 117 VAC output.

Note: C662 may have to be re-selected for Ripple on Mod 02. (234V)

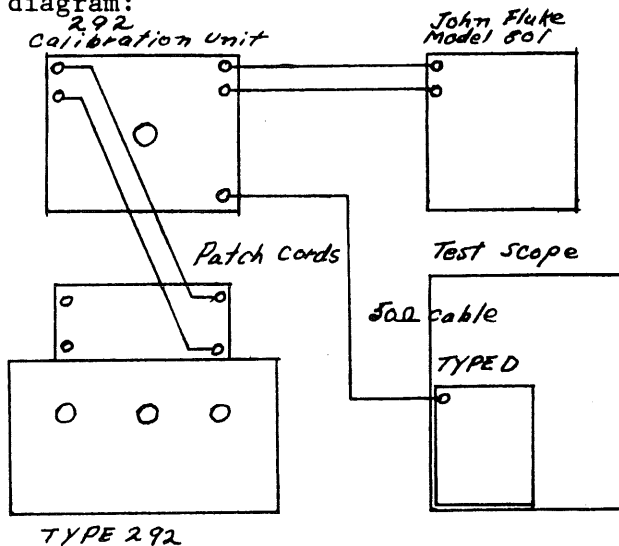
b. Select C662 Ripple: 4mV, max

Adjust the 30-400pF cap picker for minimum ripple as displayed on the test scope. Turn the TYPE 76TU power off and install the correct value capacitor for C662 as determined by the 30-400pF cap picker. Check for a maximum of 4mV of ripple on test scope.

4. BIAS CURRENT SUPPLY

a. Setup

Make connections as in the following diagram:



Change the 292 calibration unit DC CHECK-RIPPLE CHECK switch to DC CHECK.

b. Adjust and check bias current supply

Adjust R676 for exactly 5 VDC as read on the John Fluke Model 801 voltmeter. Check voltages and ripples at 105 VAC line and 125 VAC line as in the following table:

292 Calibration Unit switch positions		TYPE 292 switch positions		BIAS CURRENT	DC Voltage	Test Limit:
Load Selector	DC CHECK- RIPPLE CHECK	BIAS CURRENT mAMPS	VARIABLE			
1K 0.3%	DC CHECK	.1	CALIB	NORMAL	100mV	±2.5%, max
1K 0.3%	DC CHECK	.2	CALIB	NORMAL	200mV	±2.5mV, max
1K 0.3%	DC CHECK	.5	CALIB	NORMAL	500mV	±5mV, max
1K 0.3%	DC CHECK	1	CALIB	NORMAL	1 V	±12.5mV, max
1K 0.3%	DC CHECK	2	CALIB	NORMAL	2 V	±25mV, max
1K 0.3%	DC CHECK	5	CALIB	NORMAL	5 V	±50mV, max
100Ω 0.3%	DC CHECK	10	CALIB	NORMAL	5 V	±125mV, max
100Ω 0.3%	DC CHECK	20	CALIB	NORMAL	1 V	±25mV, max
100Ω 0.3%	DC CHECK	50	CALIB	NORMAL	2 V	±50mV, max
100Ω 0.3%	DC CHECK	100	CALIB	NORMAL	5 V	±125mV, max
100Ω 0.3%	DC CHECK	200	CALIB	NORMAL	10 V	±250mV, max
100Ω 0.3%	DC CHECK	200	CALIB	NORMAL	20 V	±500mV, max
100Ω 0.3%	DC CHECK	200	full ccw	NORMAL	2 V	2V or less (≥10:1 ratio)
Ripple P-P						
1K 0.3%	RIPPLE CHECK	.1 thru 20	CALIB	NORMAL	4mV, max	
100Ω 0.3%	RIPPLE CHECK	50	CALIB	NORMAL	0.8mV, max	
100Ω 0.3%	RIPPLE CHECK	100	CALIB	NORMAL	1.5mV, max	
100Ω 0.3%	RIPPLE CHECK	200	CALIB	NORMAL	7.5mV, max	

4b. (cont'd)

Repeat the checks in the table with the TYPE 292 BIAS CURRENT switch in the INVERTED position. Return the TYPE 76TU output voltage to 117 VAC.

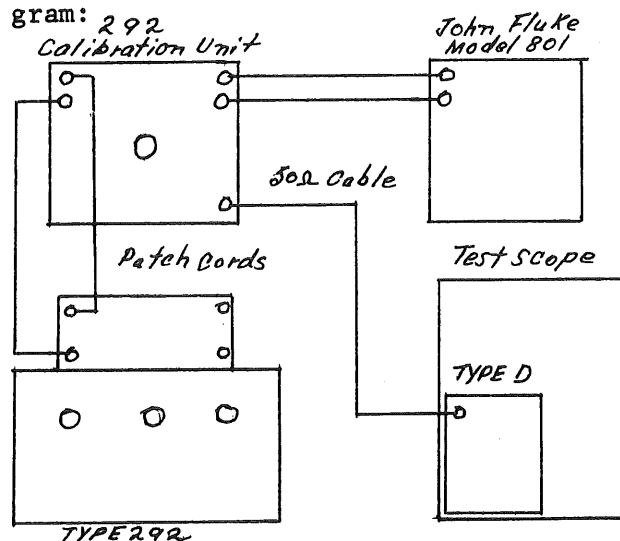
5. CHECK BIAS CURRENT SUPPLY FOR OVERHEATING

Set the TYPE 292 BIAS CURRENT mAMPS to 20. Set the 292 calibration unit load selector to OPEN CKT. Check for overheating of components over a one minute interval.

6. TEST VOLTS SUPPLY

a. Setup

Make connections as in the following diagram:



Set controls as follows:

<u>TYPE 292</u>	
VARIABLE	CALIB
TEST VOLTS	1
BIAS CURRENT	Any Position
TEST VOLTS	NPN

292 Calibration Unit

Load Selector	100Ω 0.3%
DC CHECK - RIPPLE CHECK	DC CHECK

6. (cont'd)

b. Adjust and Check Test Volts Supply

Adjust R624A for exactly 1V as read on the John Fluke Model 801 voltmeter. Change the TYPE 292 TEST VOLTS switch to 20.

Adjust R623 for exactly 20V as read on the John Fluke Model 801 Voltmeter. Check voltages and ripples at 105 VAC line and 125 VAC line as in the following table.

292 Calibration Unit
Switch Positions

TYPE 292
Switch Positions

Load Selector	DC CHECK RIPPLE CHECK	TEST VOLTS	VARIABLE	TEST VOLTS	DC Voltage	Test Limit ±2.5%, max
100Ω 0.3%	DC CHECK	1	CALIB	NPN	1V	±25mV, max
100Ω 0.3%	DC CHECK	2	CALIB	NPN	2V	±50mV, max
100Ω 0.3%	DC CHECK	5	CALIB	NPN	5V	±125mV, max
100Ω 0.3%	DC CHECK	10	CALIB	NPN	10V	±250mV, max
100Ω 0.3%	DC CHECK	20	CALIB	NPN	20V	±500mV, max
100Ω 0.3%	DC CHECK	20	full ccw	NPN	2V	2 volts or less (≥10:1 ratio)
<u>Ripple P-P</u>						
OPEN CKT	RIPPLE CHECK	1	CALIB	NPN	3mV, max	
100Ω 0.3%	RIPPLE CHECK	20	CALIB	NPN	3mV, max	

Repeat the checks in the above table with the TYPE 292 TEST VOLTS switch in the PNP position. Return the TYPE 76TU output to 117 VAC.

7. CHECK TEST VOLTS SUPPLY FOR OVERHEATING

Set the TEST VOLTS to 20. Change the 292 Calibration Unit load selector to SHORT CKT. Check for overheating of components over a one minute interval. Replace the bottom cover.

THE END