

TB 9-6625-091-35

*CHANGE 2

DEPARTMENT OF THE ARMY TECHNICAL BULLETIN

CALIBRATION PROCEDURE FOR PREAMPLIFIER PLUG-IN AM-2153/USM (TEKTRONIX TYPES K AND 53/54K)

Headquarters, Department of the Army, Washington, DC
6 September 1976

TB 9-6625-091-35, 24 November 1975, is changed as follows:

Page 4, figure 1. Change adjustment "R6081" to read "R6401."

Table 4, 2d column, 5th line. Change "2.744" to read "2.743."

By Order of the Secretary of the Army:

FRED C. WEYAND
General, United States Army
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REPRINT INCLUDES CHANGE 2, WHICH SUPERSEDES CHANGE 1.

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CALIBRATION PROCEDURE FOR PREAMPLIFIER PLUG-IN AM-2153/USM (TEKTRONIX TYPES K AND 53/54K)

Headquarters, Department of the Army, Washington, DC
24 November 1975

◆REPORTING OF ERRORS◆

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		Paragraph	Page
SECTION	I.	IDENTIFICATION AND DESCRIPTION	
		Test instrument identification	1
		Calibration data card, DA Form 2416	2
		Calibration description.....	3
	II.	EQUIPMENT REQUIREMENTS	
		Equipment required	4
		Accessories required	5
	III.	PRELIMINARY OPERATIONS	
		Preliminary instructions	6
		Equipment setup	7
	IV.	CALIBRATION PROCESS	
		Vertical gain and attenuator	8
	Attenuator compensation	9	
	Input capacitance	10	
	Rise time.....	11	
	Final procedure.....	12	

*This bulletin supersedes TB 9-6625-091-50, 17 September 1970.

**SECTION I
IDENTIFICATION AND DESCRIPTION**

1. Test Instrument Identification. This bulletin provides instructions for the calibration of Preamplifier Plug-in AM-2153/USM (Tektronix Types K and 53/54K). The manufacturer's instruction manual was used as the prime data source in compiling these instructions. The preamplifier plug-in will be referred to as the TI (test instrument) throughout this bulletin.

a. Model Variations. Plug-ins with earlier S/N's were designated type 53/54K; later versions were designed type K. Some units have BNC input connectors. When necessary, use adapters (B1 and B2, table 3).

b. Time and Technique. The time required for this calibration is approximately 2 hours, using the dc and low frequency technique.

2. Calibration Data Card, DA Form 2416

a. Forms, records, and reports required for calibration personnel at all levels are prescribed by TM 38-750. DA Form 2416 must be annotated in accordance with TM 38-750 for each calibration performed.

b. Adjustments to be reported on DA Form 2416 are designated (R) at the end of the sentence in which they appear. When adjustments are in tables, the (R) will follow, the designated adjustment. Report only those adjustments made and designated with (R).

3. Calibration Description. TI parameters and performance specifications which pertain to this calibration are listed in table 1.

Table 1. Calibration Description

Test instrument parameters.	Performance specifications
Rise time: For plug-in alone For oscilloscope type: 541, 541A, 543, 545, 545A, and 555. 531, 531A, 533, 535, and 535A 551	6 nsec 12 nsec 31 nsec 14 nsec
Frequency response (for oscilloscope type): 541, 541A, 543, 545, 545A, and 555. 531, 531A, 533, 535, and 535A. 551	Dc to 30 MHz; down 3 dB ± 0.5 dB at 30 MHz. Dc to 15 MHz Dc to 25 MHz
Step attenuator Range Accuracy	0.05 to 20v/cm in 9 ranges. $\pm 3\%$ on any 1 step.
Input impedance ¹	1 megohm, 20 pF
Maximum input ¹	Combined dc and peak ac, 600v.

¹This specification is for information only and is not necessarily verified in this bulletin.

**SECTION II
EQUIPMENT REQUIREMENTS**

4. Equipment Required. Table 2 identifies the specific equipment used in this calibration procedure. This equipment is issued with secondary transfer calibration standards set 6695-00-621-7877 and maintenance set 4931-00-525-8175 and is to be used in performing this procedure. Alternate items may be used by the calibrating activity when the equipment listed in table 2 is not available. The items selected must be verified to perform satisfactorily prior to use and must bear evidence of current calibration. The equipment must meet or exceed the minimum use specifications listed in table 2. The accuracies listed in table 2 provide a four-to-one accuracy ratio between the standard and TI. Where the four-to-one ratio cannot be met, the actual accuracy of the equipment selected is shown in parenthesis.

5. Accessories. Required. The accessories listed in table 3 are issued with the secondary transfer calibration standards set 6695-00-621-7877 and maintenance set 4931-00-525-8175 and are to be used in this calibration procedure. When necessary, these items may be substituted by equivalent items unless specifically prohibited.

Table 2. Minimum Specification of Equipment Required

Item	Common Name	Minimum use specifications	Manufacturer, model, and part number	
			Transfer (6695-00-621-7877)	Maintenance (4931-00-525-8175)
A1	AC CALIBRATOR	Range: .0686 to 29.128 v rms Accuracy: ±0.75%	Hewlett-Packard, Model 745-C90 (MIS- 10342 Type 1).	Balantine, Model 421A-S2 (6625-00-105-8198)
A2	OSCILLOSCOPE	Must be compatible with TI.	Tektronix, Type 530, 540, or 550 series.	Same ¹
A3	SQUARE-WAVE GENERATOR	Frequency: 1 and 500 kHz at 200 mv to 12 v Rise time: 12 nsec or less.	Tektronix, Type 106 (MIS-10284-1).	Hewlett-Packard, Model 211B (6625-00-212-7365).

¹Must be furnished by user.

Table 3. Accessories Required

Item	Common name	Description and part number
B1	ADAPTER	BNC jack to UHF plug (10519439)
B2	ADAPTER	BNC plug to UHF jack (8109698)
B3	CABLE	36-in., RG-58/U; BNC plug and double banana plug terminations (7907471).
B4	EXTENSION	Tektronix, Type 013-0055-00; 16 pins, extends TI from oscilloscope to facilitate adjustments (013-0055-00).
B5	STANDARDIZER	Variable 5 to 80 pF (SKD-4850-44)

**SECTION III
PRELIMINARY OPERATIONS**

6. Preliminary Instructions

a. The instructions outlined in this section are preparatory to the calibration process. Personnel should become familiar with the entire bulletin before beginning the calibration.

b. Items of equipment used in this procedure are referenced within the text by common name and item identification number as listed in tables 2 and 3. For the identification of equipment referenced by item numbers prefixed with A, see table 2, and for prefix B, see table 3.

WARNING

HIGH VOLTAGE is used during the performance of this calibration. DEATH ON CONTACT may result if personnel fail to observe safety precautions.

7. Equipment Setup

a. Remove bottom and side covers from oscilloscope (A2).

b. Connect extension (B4) to TI and insert into vertical compartment of oscilloscope.

c. Energize equipment and allow at least 15 minutes for warm-up.

d. Turn TI **VOLTS/CM** switch to **.05** and **AC-DC** switch to **AC**.

e. Using TI **VERTICAL POSITION** control, position trace on crt graticule centerline. If trace cannot be positioned to centerline, set **VERTICAL POSITION** control to midrange and adjust **R6821** (fig. 1) until trace is positioned on crt graticule centerline.

f. Turn TI **VARIABLE** control throughout its range and observe that trace does not move vertically. If necessary, adjust **DC BAL** control (front panel) until trace stabilizes.

g. Turn TI **VARIABLE** control to **CALIBRATED**.

**SECTION IV
CALIBRATION PROCESS**

NOTE

Unless otherwise specified, verify the results of each test and take corrective action whenever the test requirement is not met before continuing with the calibration.

8. Vertical Gain and Attenuator

a. Performance Check

(1) Connect ac calibrator (A1) to TI **INPUT**, using cable (B3) and, if required, adapter (B1).

(2) Adjust ac calibrator to 1 kHz and amplitude output for 4 centimeters of vertical deflection on oscilloscope (A2) crt. If ac calibrator does not indicate between .0686 and .0728 volt rms, perform **b**(1) and (2) below.

(3) Repeat technique of (2) above for TI **VOLTS/CM** switch positions listed in table 4. Ac calibrator will indicate within limits specified.

Table 4. Attenuator Accuracy

Test instrument VOLTS/CM switch settings.	Ac calibrator indications (v rms).	
	Min	Max
.1	.1372	.1456
.2	.2743	.2913
.5	.6858	.7282
1	1.372	1.456
2	2.743	2.913
5	6.858	7.282
10	13.716	14.564
20	27.432	29.128

b. Adjustments

(1) Adjust ac calibrator to .0707 volt rms.

(2) Adjust TI **GAIN ADJ** control (front panel) for 4 centimeters of vertical deflection on oscilloscope crt.

9. Attenuator Compensation

a. Performance Check

(1) Connect square-wave generator (A3) hi amplitude output to TI **INPUT**, using cable and termination supplied with square-wave generator, and if required adapter (B1).

(2) Turn TI **VOLTS/CM** switch to **.1**.

(3) Adjust square-wave generator frequency to 1 kHz and amplitude for 4 centimeters of vertical deflection on oscilloscope (A2) crt. If leading edge of square wave does not have square corners, perform **b** below.

(4) Repeat technique of (2) and (3) above for TI **VOLTS/CM** switch settings and adjustments listed in table 5.

Table 5. Attenuator Compensation

Test instrument VOLTS/CM switch settings.	Adjustments
.2	C5111 (fig. 1) (R)
.5	C5161 (fig. 1) (R)
1	C5211 (fig. 1) (R)
2	C5261 (fig. 2) (R)
5 ¹	C5311 (fig. 2) (R)
10	C5361 (fig. 2) (R)
20	C5411 (fig. 2) (R)

¹Adjust square-wave generator form maximum output.

b. Adjustments. Adjust **C5061** (fig. 1) for square waves with optimum square corners (R).

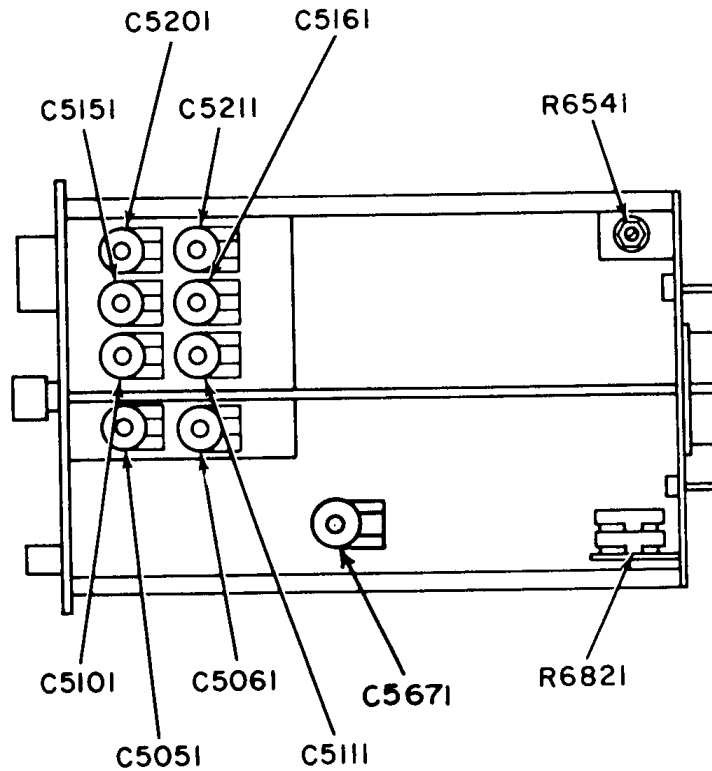


Figure 1. Plug in - bottom view.

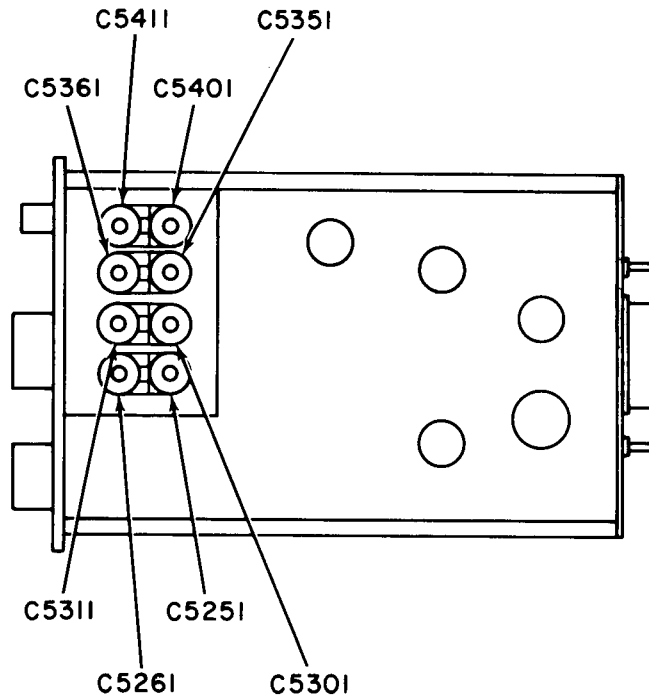


Figure 2. Plug-in - top view

10. Input Capacitance

a. Performance Check

(1) Connect square-wave generator (A3) hi amplitude output to TI **INPUT**, using cable and termination supplied with square-wave generator, standardizer (B5), adapter (B1), and if required, adapter (B2).

(2) Turn TI **VOLTS/CM** switch to **.05**.

(3) Adjust square-wave generator amplitude for 4 centimeters of vertical deflection on oscilloscope (A2) crt.

(4) Adjust standardizer for optimum square-wave display on crt. If square waves do not have flat tops, adjust **C5671** (fig. 1) to midrange and readjust standardizer for optimum square waves.

(5) Repeat technique of (2) and (3) above for TI **VOLTS/CM** switch settings listed in table 6. Adjust for optimum square-wave display. Do not readjust standardizer.

Table 6. Input Compensation

Test instrument VOLTS/CM switch settings.	Adjustments
.1	C5051 (R) (fig. 1)
.2	C5101 (R) (fig. 1)
.5	C5151 (R) (fig. 1)
1	C5201 (R) (fig. 1)
2	C5251 (R) (fig. 2)
5 ¹	C5301 (R) (fig. 2)
10	C5351 (R) (fig. 2)
20	C5401 (R) (fig. 2)

¹Adjust square-wave generator form maximum output.

b. Adjustments. Adjust **C5051** (fig. 1) for square waves with flat tops (R).

11. Rise Time

a. Performance Check

- (1) Turn Oscilloscope (A2) power switch to off position and remove extension.
- (2) Insert TI directly into vertical compartment of oscilloscope and turn power switch to on position.
- (3) Turn TI **VOLTS/CM** switch to **.05**.
- (4) Connect square-wave generator (A3) fast rise + output to TI **INPUT**, using cable and termination supplied with square-wave generator, and if required, adapter (B1).
- (5) Adjust square-wave generator frequency to 500 kHz and amplitude for 4 centimeters of vertical deflection on oscilloscope crt.
- (6) Measure rise time, using standard rise-time technique. Rise time will be as specified in table 1 for the type of oscilloscope used. If rise time is not within limits specified, perform **b** below.

b. Adjustments. Adjust **R6541** (fig. 1) (for S/N 353 and up) for best rise time (R).

12. Final Procedure

a. Deenergize and disconnect all equipment and replace protective covers on oscilloscope.

b. In accordance with TM 38-750, annotate and affix DA Label 80 (US Army Calibration System). When the TI cannot be adjusted within tolerance, annotate and affix DA Form 2417 (Unserviceable or Limited Use) tag.

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