

*TB 9-6625-2084-35

DEPARTMENT OF THE ARMY TECHNICAL BULLETIN

CALIBRATION PROCEDURE FOR OSCILLOSCOPE, OS-262(P)/U (TEKTRONIX, TYPE 7623A) AND TEKTRONIX, TYPES 7623, 7613/R7613, R7623A, 7633/R7633, AND 7633 OPT 5

Headquarters, Department of the Army, Washington, DC

17 February 2004

Distribution Statement A: Approved for public release, distribution is unlimited.

REPORTING OF ERRORS AND RECOMMENDING IMPROVEMENTS

You can improve this manual. If you find any mistakes or if you know of a way to improve these procedures, please let us know. Mail your letter or DA Form 2028 (Recommended Changes to Publications and Blank Forms) directly to: Commander, US Army Aviation and Missile Command, AMSAM-MMC-MA-NP, Redstone Arsenal, AL 35898-5000. A reply will be furnished to you. You may also provide DA Form 2028 information to AMCOM via e-mail, fax, or the World Wide Web. Our fax number is DSN 788-6546 or Commercial 256-842-6546. Our e-mail address is 2028@redstone.army.mil. Instructions for sending an electronic 2028 may be found at the back of this manual. For the World Wide Web, use <https://amcom2028.redstone.army.mil>.

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*This bulletin supersedes TB 9-6625-2084-35, dated 10 April 1989, including all changes.

**SECTION I
IDENTIFICATION AND DESCRIPTION**

1. Test Instrument Identification. This bulletin provides instructions for the calibration of Oscilloscope, OS-262(P)/U (Tektronix, Type 7623A) and Tektronix, Types 7623, 7613/R7613, R7623A, 7633/R7633, and 7633 Opt 5. The manufacturers' manuals were used as the prime data sources in compiling these instructions. The equipment being calibrated will be referred to as the TI (test instrument) throughout this bulletin.

a. Model Variations. Types 7633/R7633 have reduced span capabilities. Types with Option 5 operate from 50 to 400 Hz line frequency. OS-262(P)/U is military designation for Type 7623A.

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

2. Forms, Records, and Reports

a. Forms, records, and reports required for calibration personnel at all levels are prescribed by TB 750-25.

b. Adjustments to be reported are designated (R) at the end of the sentence in which they appear. When adjustments are in tables the (R) follows 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
Input power requirements	115 V \pm 1%, 50 to 60 Hz
Vertical and horizontal linearity	Range: Dc to 1 MHz Accuracy: \pm 0.5 minor division
Calibrated sweep rate	Range: 10 ns to 1 ms Accuracy: \pm 0.5 minor division
Calibrator output	Range: 40 mV, 0.4 and 4.0 V dc Accuracy: \pm 1%
Risetime	3.5 ns or less

**SECTION II
EQUIPMENT REQUIREMENTS**

4. Equipment Required. Table 2 identifies the specific equipment to be used in this calibration procedure. This equipment is issued with Secondary Transfer Calibration Standards Set AN/GSM-286, AN/GSM-287, or AN/GSM-705. Alternate items may be used by the calibrating activity. 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 ratio between the standard and TI.

5. Accessories Required. The accessories required for this calibration are common usage accessories issued as indicated in paragraph 4 above, and are not listed in this calibration procedure.

Table 2. Minimum Specifications of Equipment Required

Common name (official nomenclature)	Minimum use specifications	Manufacturer and model (part number)
CALIBRATION FIXTURE (STANDARDIZER)	Range: 1 kHz to 1 MHz Risetime: 0.875 ns	Tektronix, Type 067-0587-02 (067-0587-02)
OSCILLOSCOPE CALIBRATOR	Voltage output: Range: 50 mV to 5 V at 1 kHz Accuracy: 0.25% Time marker: Range: 5 ns to 1 ms Accuracy: ±3% Voltage input: Range: 1520 to +135 V dc Accuracy: ±0.25%	John Fluke, Model 5820A-5C-GHZ (5820A-5C-GHZ)
TIME BASE ¹	Must be compatible w/test instrument and vertical amplifier	Tektronix, Type 7B Series
VERTICAL AMPLIFIER ¹	Must be compatible w/test instrument and time base	Tektronix, Type 7A Series

¹Provided with TI.

SECTION III CALIBRATION PROCESS

6. Preliminary Instructions

a. The instructions outlined in paragraphs 6 and 7 are preparatory to the calibration process. Personnel should become familiar with the entire procedure before beginning the calibration.

b. Items of equipment used in this procedure are referenced within the text by common name as listed in table 2.

c. Unless otherwise specified, verify the result of each test, and whenever the test requirement is not met, take corrective action before continuing with this calibration. Adjustments required to calibrate the TI are included in this procedure. Additional maintenance information is contained in the manufacturers' manuals for this TI.

d. When indications specified in paragraphs 8 through 13 are not within tolerance, perform the power supply check prior to making adjustments. After adjustments are made, repeat paragraphs 8 through 13. Do not perform power supply check if all other parameters are within tolerance.

e. Unless otherwise specified, all controls and control settings refer to the TI.

7. Equipment Setup

WARNING

HIGH VOLTAGE is used or exposed during the performance of this calibration. DEATH ON CONTACT may result if personnel fail to observe safety precautions. REDUCE OUTPUT(S) to minimum after each step within the performance check where applicable.

- a.** Remove protective covers from TI as required to make adjustments. Replace cover after completing the adjustments.
- b.** Install calibration fixture in TI left vertical compartment and time base in horizontal compartment.
- c.** Position controls as listed in (1) through (9) below:
 - (1) **INTENSITY** control fully ccw.
 - (2) **VERT MODE LEFT** pushbutton pressed.
 - (3) **TRIG SOURCE LEFT** pushbutton pressed.
 - (4) **NON-STORE** pushbutton pressed.
 - (5) **VAR PERSISTENCE** pushbutton pressed (ccw **(MAX)** for Type 7613).
 - (6) **READOUT** control to **OFF** (detent).
 - (7) **REDUCED SCAN** control to **OFF**. (Type 7633/R7633).
 - (8) Press **POWER OFF/ON** pushbutton to **ON** and allow at least 20 minutes for warm-up.
 - (9) Adjust **INTENSITY** control for suitable viewing on TI.
- d.** Position calibration fixture controls as listed in (1) and (2) below:
 - (1) **TEST** switch to **VERT** or **HORIZ GAIN**.
 - (2) **REP RATE 1 kHz** pushbutton pressed.
- e.** Position time base controls as listed in (1) through (8) below:
 - (1) **MAIN TRIGGERING MODE AUTO** pushbutton pressed.
 - (2) **MAIN TRIGGERING COUPLING AC** pushbutton pressed.
 - (3) **MAIN TRIGGERING SOURCE INT** pushbutton pressed.
 - (4) **TIME/DIV OR DLY TIME** switch to **50 μ s**.
 - (5) **MAG** pushbutton to **X1**.
 - (6) **DLY'D TRIG SLOPE** pushbutton to **-**.
 - (7) **DLY'D TRIG COUPLING AC** pushbutton pressed.
 - (8) **DLY'D SOURCE INT** pushbutton pressed.

8. Vertical Gain and Linearity

a. Performance Check

CAUTION

Set power switch to **OFF** when installing and removing plug-ins.

(1) Adjust calibration fixture position control to align intensified trace on horizontal graticule center line. If TI does not display 6 divisions ± 5 minor division of vertical deflection for 7 center horizontal lines, perform **b** (1) below.

(2) Remove calibration fixture from left vertical compartment and install in right vertical compartment.

(3) Press **VERT MODE RIGHT** and **TRIG SOURCE RIGHT** pushbuttons.

(4) Repeat technique of (1) above. If TI does not display 6 divisions ± 5 minor division of vertical deflection for 7 center horizontal lines, perform **b** below.

b. Adjustments

(1) Adjust GAIN R2446 (fig. 1A) for Types 7613/R7613 with SN B150000 and above, 7633/R7633, 7623 and 7623A/R7623A. Adjust R447 (fig. 1B) for 7623 and 7613/R7613 with SN B149999 and below for 6 divisions of vertical deflection (R).

(2) Repeat technique of **a** (1) through (4) above for best compromise and optimum gain for both vertical compartments (R).

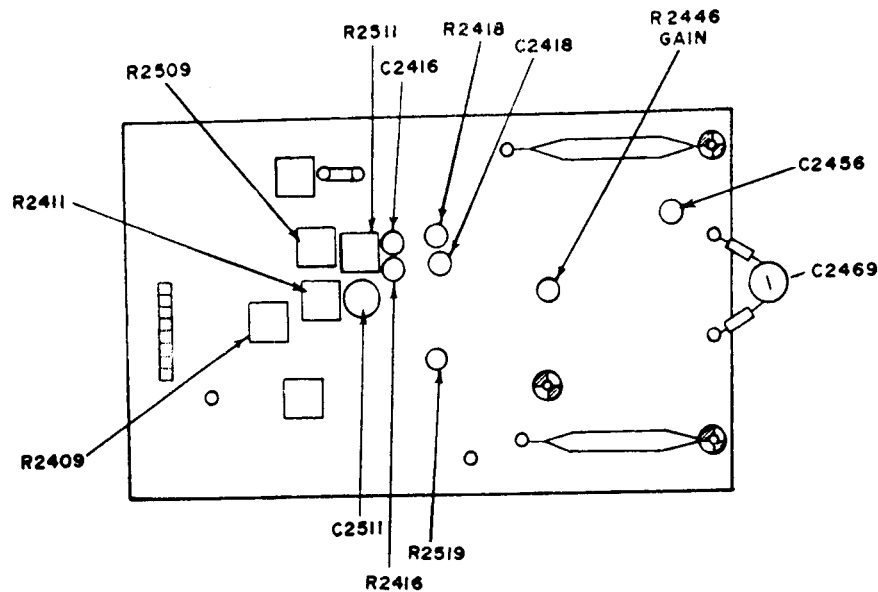


Figure 1A. Board A5 adjustments - left side view - Tektronix, Types 7613/R7613, SN B150000 and above, 7623A/R7623A and 7633/R7633.

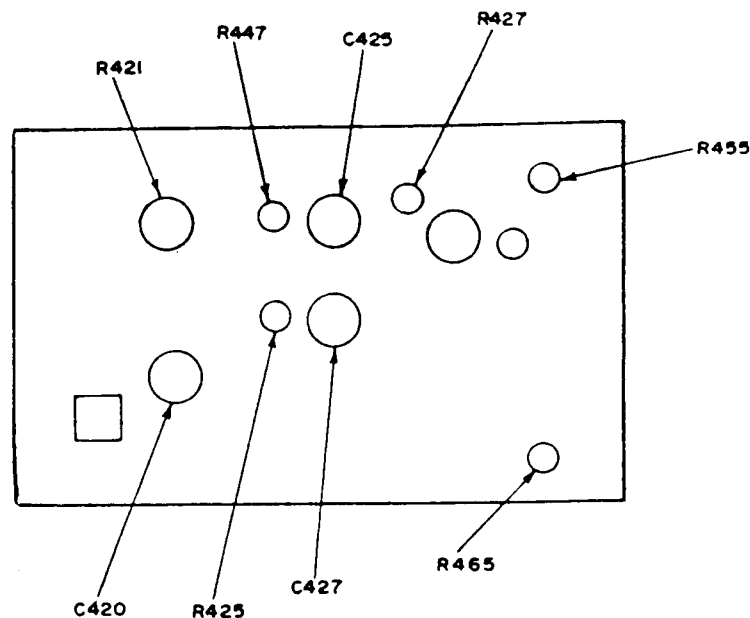


Figure 1B. Board A5 adjustments - left side view - Tektronix, Types 7623 and 7613/R7613, SN B149999 and below.

9. High Frequency Compensation

a. Performance Check

- (1) Position calibration fixture controls as listed in (a) and (b) below:
 - (a) **TEST** switch **VERT** or **HORIZ** to **+ STEP RESP.**
 - (b) **REP RATE 100 kHz** pushbutton pressed.
- (2) Set time base **TIME/DIV OR DLY TIME** switch to **1 μ s**. (Type 7613/R7613, **5 ns** for SN 149999 and below).
- (3) Adjust calibration fixture **AMPLITUDE** and **POSITION** controls for a 6-division display.
- (4) Adjust time base **POSITION** control to position top front corner of display to center graticule line. If display does not have square leading corner and aberrations exceed 1 minor division, perform **b** below.
- (5) Repeat technique of (3) and (4) above for calibration fixture **REP RATE** settings and time base **TIME/DIV OR DLY TIME** switch settings and adjustments listed in table 3.

Table 3. High Frequency Compensation

Calibration fixture REP RATE switch settings	Time base sweep rate TIME/DIV or DLY TIME switch settings	Test instrument adjustments		Pulse area affected (ns)
		Tektronix, types 7613/R7613, SN B150000 and above, 76232A/R7623A and 7633/R7633 (fig. 1A)	Tektronix type 7623 and 7613/R7613, SNB149999 and below (fig. 1B)	
100 kHz	0.5 μs	R2509	---	500
1 MHz	0.1 μs	R2511 C2511	---	120
1 MHz	5 ns ¹ (.05 μs X10 MAG)	R2411	---	30
1 MHz	50 ns (.05)	---	C420 R421	50 ---
1 MHz	20 ns ^{1 2 3} (0.05 μs X10 MAG)	---	C425 R421	20 ---
		C2416 R2416 R2519	---	10 ---
		---	C427 R427	5 ---
	5 ns ^{1 3} (.05 μs X10 MAG)	C2418 R2418 C2456	---	5 ---

¹For models without ns switch positions, use corresponding fast sweep ranges.

²Adjust C2469 (fig. 1A) for minimum overall aberrations (R).

³Adjust for best compromise.

NOTE

Adjustments listed in table 3 interact and may be necessary to repeat various steps to obtain optimum response with minimum aberrations.

(6) Remove calibration fixture from right vertical compartment and install in left vertical compartment.

(7) Press **VERT MODE LEFT** pushbutton and **TRIG SOURCE LEFT** pushbutton and repeat technique of (1) through (5) above for left vertical compartment.

b. Adjustments. Adjust R2409 (fig. 1A) for Types 7613/R7613, SN B150000 and above, 7623A/R7623A and 7633/R7633. Adjust R455 and R465 (fig. 1B) for 7623 and 7613/R7613, SN B149999 and below for flat top and minimum aberrations (R).

10. Horizontal Gain and Linearity

a. Performance Check

(1) Install time base in left vertical compartment and calibration fixture in horizontal compartment.

(2) Set calibration fixture **TEST** switch to **VERT** or **HORIZ GAIN** and **REP RATE 100 kHz** pushbutton pressed.

(3) Set time base **TIME/DIV OR DLY TIME** switch to **10 μs**.

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(4) Adjust calibration fixture **POSITION** control to align 1st trace on 1st vertical graticule line. If TI does not display 1 trace per division ± 5 minor division between 2d and 10th lines (over center 8 divisions), perform **b** (1) below.

(5) Set calibration fixture **TEST** switch to **TRIGGERING GAIN**. If trace is not centered, perform **b** (2) below.

(6) Set calibration fixture **TEST** switch to **VERT** or **HORIZ +STEP RESP.** Adjust **AMPLITUDE** and **POSITION** controls for a 2-division display centered on TI.

(7) Using **POSITION** control, align left trace on 1st vertical graticule line. Right trace will be 2 divisions, ± 5 minor division from first vertical graticule line.

(8) Using **POSITION** control, align right trace on 10th vertical graticule line. Left trace will be 2 divisions ± 5 minor division from 10th vertical graticule line.

b. Adjustments

(1) Adjust R512 GAIN (fig. 2) for 8 divisions of deflection between the 2d and 10th vertical graticule lines (R).

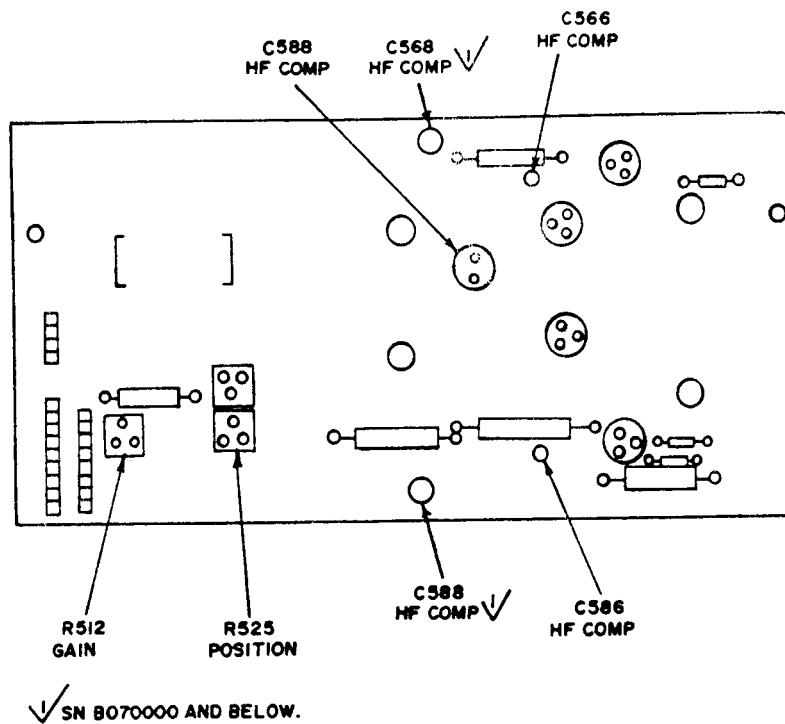


Figure 2. Board A6 horizontal amplifier adjustments - top rear view.

(2) Adjust R525 POSITION (fig. 2) to position trace on center graticule line (R).

11. High-Frequency Timing

a. Performance Check

NOTE

For time bases without nanosecond switch settings, check the fastest ranges.

NOTE

For vertical amplifiers without 50 Ω input impedance, use 50 Ω feedthrough termination to connect oscilloscope calibrator.

(1) Install vertical amplifier in TI left vertical compartment and time base in horizontal compartment.

(2) Connect oscilloscope calibrator **SOURCE/MEASURE CHAN 1** to vertical amplifier **CH1 INPUT**.

(3) Set oscilloscope calibrator for a **CHAN 1, MARKER** mode output of **1 ms**.

(4) Set time base **TIME/DIV OR DLY TIME** switch to **1 ms** and **MAG** pushbutton to **X1**.

(5) Set vertical amplifier **CH 1** and **CH 2 VOLTS/DIV** switches to **.5 V** and **DISPLAY MODE** switch to **CH 1**.

(6) Adjust time base **POSITION** control to align 1st marker with 1st vertical graticule line.

(7) Adjust time base **SWP CAL** control (front panel) for 1 marker per division (over center 8 divisions).

(8) Set oscilloscope calibrator for a **CHAN 1, MARKER** mode output of **10 ns**.

(9) Set time base **TIME/DIV OR DLY TIME** switch to **0.1 μ s** and **MAG** pushbutton to **X10**.

(10) Adjust time base **POSITION** control to align nearest marker with 2d vertical graticule line. Rotate oscilloscope calibrator knob, below **EDIT FIELD** pushbutton, to align 10th time marker with 10th vertical graticule line. If oscilloscope calibrator **err** readout indication is not within $\pm 3\%$, perform **b (1)** below.

(11) Set time base **TIME/DIV OR DLY TIME** switch to **0.05 μ s**.

(12) Adjust time base **POSITION** control to align nearest marker on 2d vertical graticule line. Rotate oscilloscope calibrator knob, below **EDIT FIELD** pushbutton, to align 5th time marker with 10th vertical graticule line. If oscilloscope calibrator **err** readout indication is not within $\pm 3\%$, perform **b (2)** below.

b. Adjustments

(1) Adjust C588 HF COMP (fig. 2), (Types 7623 and 7613/R7613, SN B070000 and above) C568 HF COMP and C588 HF COMP (7613/R7613, SN B069999 and below) for 1 marker per division (R).

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(2) Adjust C566 HF COMP (fig. 2) and C586 HF COMP (Type 7623 and 7613/R7613, SN B070000 and above) for 1 marker per 2 divisions. Readjust C568 and C588 (Types 7613/R7613, SN B069999 and below) for best compromise between 5 and 10 ns (R).

12. Risetime

a. Performance Check

(1) Install calibration fixture in **LEFT VERT** compartment and time base in **HORIZ** compartment. Press **VERT MOD LEFT** pushbutton.

(2) Set calibration fixture **TEST** switch to **VERT** or **HORIZ + STEP RES** and **REP RATE 100 kHz** pushbutton pressed.

(3) Adjust calibration fixture **AMPLITUDE** and **POSITION** controls for convenient display.

(4) Press time base **AUTO**, **AC**, **INT**, and **X10** pushbuttons. Set **TIME/DIV** switch to obtain risetime display. Measure risetime using standard risetime technique. Risetime will be 3.5 ns or less.

(5) Remove calibration fixture from **LEFT VERT** compartment and install **RIGHT VERT** compartment.

(6) Press **VERT MODE RIGHT** pushbutton.

(7) Repeat technique of (3) and (4) above for right compartment.

b. Adjustments. No further adjustments can be made.

13. Calibrator Output

a. Performance Check

(1) Install vertical amplifier in **LEFT VERT** compartment.

(2) Connect vertical amplifier **CH 1** input to TI **CALIBRATOR 4-V** output and **GND** (front panel).

(3) Set vertical amplifier **VOLTS/DIV** switch to **1 V** and adjust vertical amplifier variable gain for 4 major divisions on TI.

(4) Connect oscilloscope calibrator **SOURCE/MEASURE CHAN 1** to vertical amplifier **CH 1** input.

(5) Set oscilloscope calibrator for a **CHAN 1, DC VOLTAGE** mode output of **4 V**. Rotate oscilloscope calibrator knob below **EDIT FIELD** pushbutton to adjust amplitude for 4 major divisions on TI. If oscilloscope calibrator **err** display does not indicate within $\pm 1\%$, perform **b** below.

b. Adjustments

(1) Rotate oscilloscope calibrator knob below **EDIT FIELD** pushbutton for **0%** indication on calibrator **err** display and adjust vertical amplifier variable gain for 4 major divisions on TI.

(2) Disconnect oscilloscope calibrator from vertical amplifier **CH 1** input.

(3) Connect vertical amplifier **CH 1** input to TI **CALIBRATOR** 4-V output and **GND** (front panel).

(4) Adjust CAL ADJ R1459 for Types 7623A, 7633, and R1077 for 7613 (fig. 3) for 4 divisions of vertical deflection on TI (R).

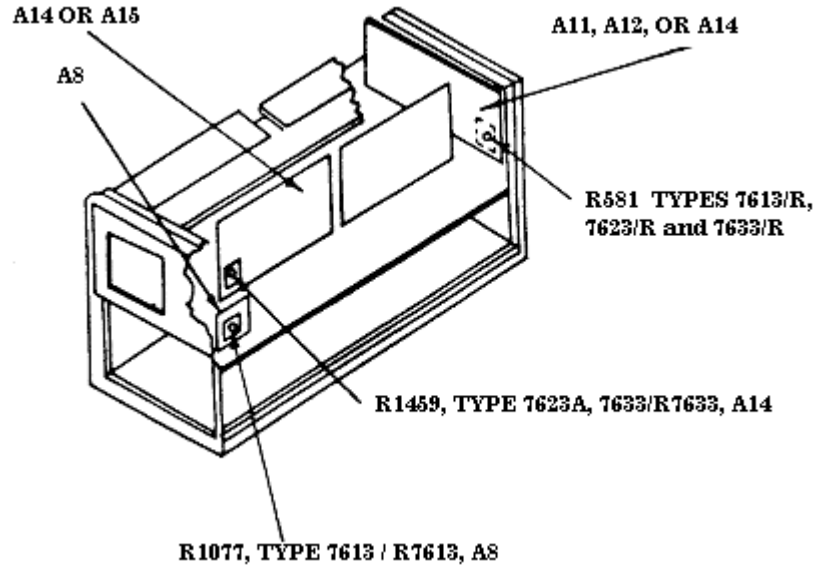


Figure 3. A14 or A15 board - adjustment locations - (Tektronix, Types 7633/R7633) and A8 board - adjustment locations (7613/R7613).

14. Power Supply

a. Performance Check

NOTE

Do not perform supply check if all other parameters are within tolerance.

(1) Remove all plug-ins from TI compartments and position controls as listed in (a) through (c) below:

- (a) **INTENSITY** control fully ccw.
- (b) **VERT MODE LEFT** pushbutton pressed.
- (c) **TRIG SOURCE LEFT** pushbutton pressed.

(2) Connect digital voltmeter to -50 V test point (fig. 4) and chassis ground. If digital voltmeter does not indicate between -49.9 and -50.1 V dc, perform **b** below.

(3) Connect digital voltmeter to test points listed in table 4 and chassis ground. Digital voltmeter will indicate within limits specified.

(4) Set **POWER OFF/ON** switch to **OFF** and connect digital voltmeter between **HIGH VOLTAGE TEST POINT** (fig. 4) and chassis ground, using high voltage probe supplied with digital voltmeter.

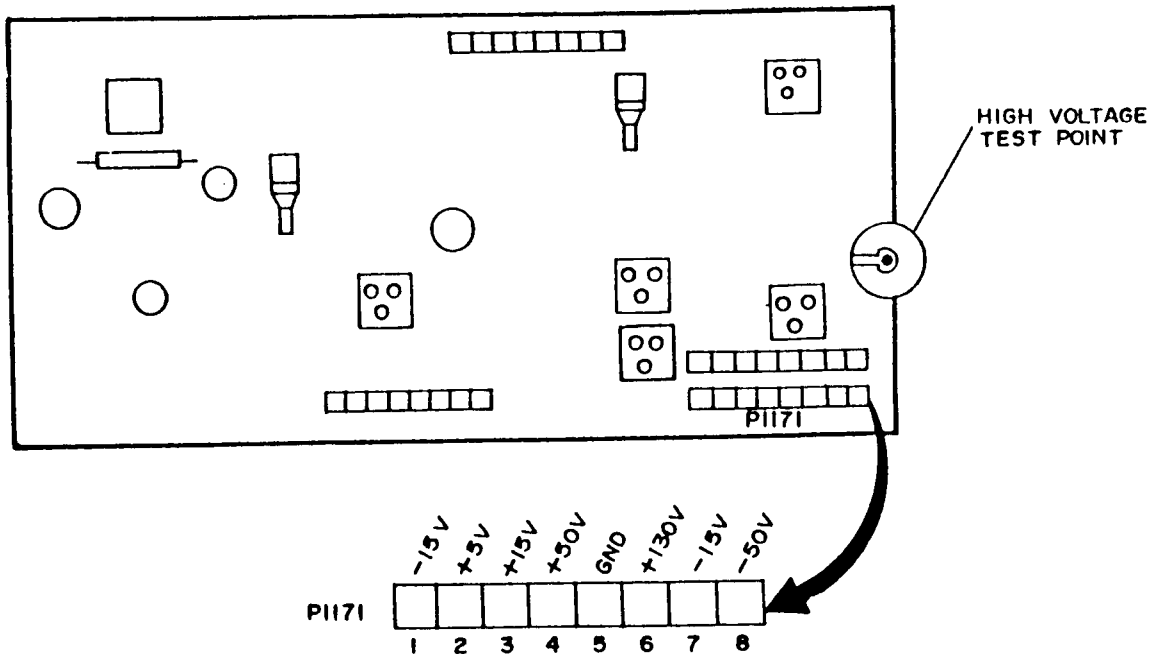


Figure 4. Board all power supply - top right rear view.

Table 4. Power Supply Check

Test instrument test points (fig. 4)	Digital voltmeter indications (V dc)	
	Min	Max
-15 Pin 1	-14.9	-15.1
+5 Pin 2	+4.9	+5.1
+15 Pin 3	+14.9	+15.1
+50 Pin 4	+49.7	+50.3
+130 Pin 6	+125	+135

(5) Set **POWER OFF/ON** switch to **ON**. Digital voltmeter will indicate between -1430 and -1520 V dc.

(6) Set **POWER OFF/ON** switch to **OFF** and disconnect digital voltmeter.

b. Adjustments. Adjust -50 V R881 (fig. 3) for a -50-V indication on digital voltmeter (R).

15. Final Procedure

a. Deenergize and disconnect all equipment and reinstall protective cover on TI.

b. Annotate and affix DA label/form in accordance with TB 750-25.

By Order of the Secretary of the Army:

Official:

PETER J. SCHOOMAKER
General, United States Army
Chief of Staff



JOEL B. HUDSON
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0334903

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The following format must be used if submitting an electronic 2028. The subject line must be exactly the same and all fields must be included; however, only the following fields are mandatory: 1, 3, 4, 5, 6, 7, 8, 9, 10, 13, 15, 16, 17, and 27.

From: "Whomever" whomever@redstone.army.mil

To: <2028@redstone.army.mil

Subject: DA Form 2028

1. **From:** Joe Smith
2. **Unit:** home
3. **Address:** 4300 Park
4. **City:** Hometown
5. **St:** MO
6. **Zip:** 77777
7. **Date Sent:** 19-OCT-93
8. **Pub no:** 55-2840-229-23
9. **Pub Title:** TM
10. **Publication Date:** 04-JUL-85
11. **Change Number:** 7
12. **Submitter Rank:** MSG
13. **Submitter FName:** Joe
14. **Submitter MName:** T
15. **Submitter LName:** Smith
16. **Submitter Phone:** 123-123-1234
17. **Problem:** 1
18. **Page:** 2
19. **Paragraph:** 3
20. **Line:** 4
21. **NSN:** 5
22. **Reference:** 6
23. **Figure:** 7
24. **Table:** 8
25. **Item:** 9
26. **Total:** 123
27. **Text**

This is the text for the problem below line 27.

