TB 9-4931-290-50

Change 4

DEPARTMENT OF THE ARMY TECHNICAL BULLETIN

CALIBRATION PROCEDURE FOR VOLTAGE CALIBRATOR BALLANTINE, MODELS 420, 421A, AND 421A-S2

Headquarters, Department of the Army, Washington, DC
24 April 1986

TB 9-4931-290-50, 31 May 1979, is changed as follows:

1. Remove old pages and insert new pages as indicated below. New or changed material is indicated by a vertical bar in the margin of the page.

Remove pages	Insert pages
1 and 2	1 and 2
5 and 6	5 and 6
9 and 10	9 and 10
13	13

2. File this change sheet in front of the publication for reference purposes.

By Order of the Secretary of the Army:

JOHN A. WICKHAM, JR.
General, United States Army
Chief of Staff

Official:

R. L. DILWORTH
Brigadier General, United States Army
The Adjutant General

Distribution:
To be distributed in accordance with DA Form 12-34C, Block No. 319, requirements for calibration procedures publications.

PIN NO: 009027-004

TB 9-4931-290-50

Change 3

DEPARTMENT OF THE ARMY TECHNICAL BULLETIN

CALIBRATION PROCEDURE FOR VOLTAGE CALIBRATOR BALLANTINE, MODELS 420, 421A, AND 421A-S2

Headquarters, Department of the Army, Washington, DC
7 November 1983

TB 9-4931-290-50, 31 May 1979, is changed as follows:

1. Remove old pages and insert new pages as indicated below. New or changed material is indicated by a vertical bar in the margin of the page.

Remove pages	Insert pages
1 through 4	1 through 4
9 and 10	9 and 10

2. File this change sheet in front of the publication for reference purposes.

By Order of the Secretary of the Army:

JOHN A. WICKHAM, JR.
General, United States Army
Chief of Staff

Official:

ROBERT M. JOYCE
Major General, United States Army
The Adjutant General

Distribution:
To be distributed in accordance with DA Form 12-34C, Block No. 319, requirements for calibration procedures publications.

PIN NO: 009027-003

TB 9-4931-290-50

Change 2

DEPARTMENT OF THE ARMY TECHNICAL BULLETIN

CALIBRATION PROCEDURE FOR VOLTAGE CALIBRATOR BALLANTINE, MODELS 420, 421A, AND 421A-S2

Headquarters, Department of the Army, Washington, DC
15 April 1981

TB 9-4931-290-50, 31 May 1979, is changed as follows:

1. Remove old pages and insert new pages as indicated below. New or changed material is indicated by a vertical bar in the margin of the page.

Remove pages	Insert pages
7 through 10	7 through 10

2. File this change sheet in front of the publication for reference purposes.

By Order of the Secretary of the Army:

E. C. MEYER
General, United States Army
Chief of Staff

Official:

J. C. PENNINGTON
Major General, United States Army
The Adjutant General

Distribution:
To be distributed in accordance with DA Form 12-34C, Block No. 319, requirements for calibration procedures publications.

*This change supersedes Change 1, 31 January 1980.

PIN NO: 009027-002

*TB 9-4931-290-50

DEPARTMENT OF THE ARMY TECHNICAL BULLETIN

CALIBRATION PROCEDURE FOR VOLTAGE CALIBRATOR BALLANTINE MODELS 420, 421A, AND 421A-S2

Headquarters, Department of the Army, Washington, DC
31 May 1979

REPORTING OF ERRORS

You can help improve this publication by calling attention to errors and by recommending improvements and stating your reasons for the recommendations. Your letter or DA Form 2028, Recommended Changes to Publications, should be mailed directly to Commander, U.S. Army Aviation and Missile Command, ATTN: AMSAM-TMD-EP, Redstone Arsenal, A1 35898-5400. You may also contact this office electronically. E-mail address is tmde-e@redstone.army.mil. FAX to DSN 788-2313 (commercial 256-842-2313). A reply will be furnished directly to you.

*This bulletin supersedes TB 9-4931-290-50, 10 September 1976, including all changes.

SECTION I
IDENTIFICATION AND DESCRIPTION

1. Test Instrument Identification. This bulletin provides instructions for the calibration of Voltage Calibrator, Ballantine Models 420, 421A, and 421A-S2. The manufacturer's instruction 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. Model 421A-S2 is the rack mounted version of model 421A and is not referred to in the procedure.

b. Time and Technique. The time required for this calibration is approximately 2 hours, using the dc (direct current) 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 TB 750-25. DA Form 2416 must be annotated in accordance with TB 750-25 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) 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 for Model 420

Test instrument parameters	Performance specifications
Ac and dc volts	
Range	0 - 10 v
Accuracy	±0. 5%
Stability	
Range	105 to 125 V ac
Accuracy	±0.15%
Frequency	
Range	1000 kHz
Accuracy	±1%
Distortion	Less than 0.25%

Table 2. Calibration Description for Models 421A and 421A-S2

Test instrument parameters	Performance specifications
Dc volts	
Range	0 to 111 V
Accuracy	±(0.2% setting +0.007% range +25 μV)
Ac volts	
1 kHz	
Range	0 to 111 V
Accuracy	±(0.15% setting +0.005% range +3 μ V)
400 Hz	
Range	0 to 100 V
Accuracy	±(0.25% setting +0.005% range +3 μV)
400 Hz	
Range	100 to 1000 V
Accuracy	±(0.45% setting +0.005% range +3 μ V)
Stability	
Range	105 to 125 V
Accuracy	±0.09%
Frequency	
Range	400 Hz or 1 kHz
Accuracy	±3%
Distortion	Less than 0.2%

SECTION II
EQUIPMENT REQUIREMENTS

4. Equipment Required. Table 3 identifies the specific equipment used in this procedure. This equipment is issued with Secondary Transfer Standards Calibration Set NSN 6695-00-621-7877 and is to be used in performing this procedure. Alternate items may be used by the calibrating activity when the equipment listed in table 3 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 3. The accuracies listed in table 3 provide a four-to-one ratio between the standard and TI.

Table 3. Minimum Specifications of Equipment Required

Item	Common name and/or (official nomenclature)	Minimum use specifications	Manufacturer, model, and part number
A1	AC VOLTAGE STANDARD (AC CALIBRATION PRECISION STANDARD)	Range: 0.99847 to 100.1550 V ac Accuracy: ±0.039%	Hewlett-Packard, Model 745AC90 (MIS-10342 Type 1)
A2	AUTOTRANSFORMER (VARIABLE POWER TRANSFORMER)	Range: 105 to 125 V ac Accuracy: ± 1%	General Radio, Model W10MT3AS3 (7910809)
A3	DIFFERENTIAL VOLTMETER	Ac range: 99.84 mV to 1004.5 V ac Accuracy: ±0.025% (.05%) Dc range: 973 mV to 100 V Accuracy: ±0.025%	John Fluke, Model 887ABAN (887ABAN)

Table 3. Minimum Specifications of Equipment Required - Continued.

Item	Common name and/or (official nomenclature)	Minimum use specifications	Manufacturer, model, and part number
A4	DISTORTION ANALYZER (SPECTRUM ANALYZER)	Sensitivity: 0.25% harmonic content	Hewlett-Packard, Model 334A (7911957)
A5	FREQUENCY COUNTER (ELECTRONIC DIGITAL COUNTER)	Range: 380 to 1030 Hz Accuracy: ±0.5%	Systron-Donner, Model 1037M (7910823)
A6	RATIO TRANSFORMER	Range: 1 to. 001 V ac	North Atlantic, Model RB503/10 MIS-10232)
A7	RESISTANCE DECADE (DECADE RESISTOR)	Range: 20 kilohms to 1 megohm Accuracy: Nominal	Winslow, Model 336 7907234)

5. Accessories Required. The accessories listed in table 4 are issued as indicated in paragraph 4 above and are to be used in this calibration procedure. When necessary, these items may be substituted by equivalent items unless specifically prohibited.

Table 4. Accessories Required

Item	Common name and/or (official nomenclature)	Description and part number
B1	CABLE[1] (RF CABLE ASSEMBLY)	30-in., RF cable with double banana plug terminations (7907470)
B2	LEAD (TEST LEAD)	36-in., RG58/U, BNC plug and double banana plug terminations (7907471)
B3	LEAD[2] (ELECTRICAL LEAD)	24-in., test lead, single banana plug terminations (black) (7907498)
B4	LEAD[2] (TEST LEAD)	24-in., test lead, single banana plug terminations (red) (7907497)

[1]Three required.
[2]Two required.

SECTION III
CALIBRATION PROCESS FOR MODEL 420

6. Preliminary Instructions

a. The instructions outlined in this paragraph 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 3 and 4. For the identification of equipment referenced by item numbers prefixed with A, see table 3, and for prefix B, see table 4.

WARNING

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

NOTE

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

NOTE

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

7. Output Stability

a. Performance Check

(1) Connect autotransformer (A2) to a 115-V ac (volt alternating current) source and adjust for a 115-V output.

(2) Connect TI to autotransformer and differential voltmeter (A3) to TI OUTPUT terminals, using leads (B3 and B4).

(3) Position controls as listed in (a) through (d) below:

(a) Output selector switch to DC.

(b) MILLIVOLTS DIVIDER, ÷ 1 pushbutton depressed.

(c) Output voltage switch to 6000.

(d) Output voltage dial to 000.

(4) Allow TI to warm up and stabilize for 15 minutes.

(5) Adjust output voltage controls to obtain indication of 6.000000 V dc on differential voltmeter.

(6) Vary autotransformer output from 105 to 125 V and back to 115 V. Differential voltmeter indication will remain between 5.991000 and 6.009000 V dc throughout autotransformer variations.

b. Adjustments. No adjustments can be made.

8. Dc Voltage Output

a. Performance Check

(1) Set output voltage switch to 1000 and output voltage dial to 0.

(2) Record differential voltmeter (A3) indication.

(3) Set output voltage switch to 0 and output voltage dial to 1000. If differential voltmeter indication is not within ±0.1 percent of indication recorded in (2) above, perform **b**(1) below.

(4) Set output voltage switch to 9000 and output voltage dial to 900. Differential voltmeter will indicate between 9.850500 and 9.949500 V dc.

(5) Repeat technique of (4) above, using settings and indications listed in table 5. Differential voltmeter will indicate within specified limits.

Table 5. Dc Output

Test instrument switch settings			Differential voltmeter indications (V)	
Voltage switch	Voltage dial	Millivolts divider	Min	Max
9000	800	÷ 1	9.751000	9.849000
9000	700	÷ 1	9.651500	9.748500
9000	600	÷ 1	9.552000	9.648000
9000	500	÷ 1	9.452500	9.547500
9000	400	÷ 1	9.353000	9.447000
9000	300	÷ 1	9.253500	9.346500
9000	200	÷ 1	9.154000	9.246000
9000	100	÷ 1	9.054500	9.145500
9000	1000	÷ 10[1]	.995000	1.005000
9000	1000	÷ 1	9.950000	10.05000
9000	1000	÷ 100	.0995000	.10050
9000	1000	÷ 1000	.009950000	.0100500
8000	1000	÷ 1	8.955000	9.045000
7000	1000	÷ 1	7.960000	8.040000
6000	1000	÷ 1	6.965000	7.035000
5000	1000	÷ 1	5.970000	6.030000
4000	1000	÷ 1	4.975000	5.025000
3000	1000	÷ 1	3.980000	4.020000
2000	1000	÷ 1	2.985000	3.015000
1000	1000	÷ 1	1.990000	2.010000

[1]If not within tolerance, perform *b*(2) below.

b. Adjustments

(1) Adjust R27 (fig. 1) until differential voltmeter indications observed in **a**(2) and (3) above are within ±0.03 percent of each other (R).

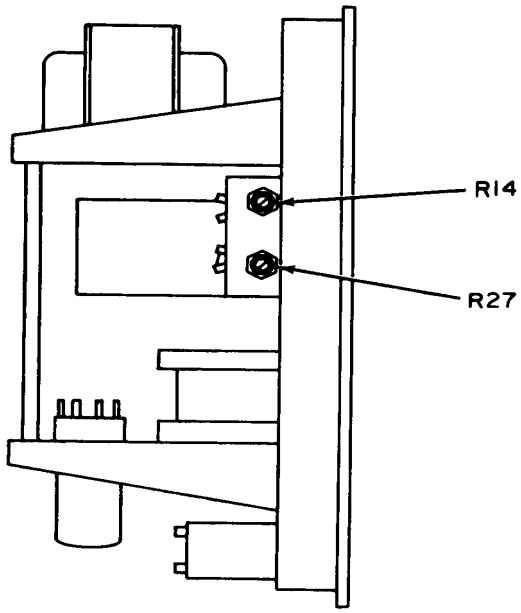

Figure 1. Left-side view of model 420

(2) Adjust R12 (fig. 2) for a 1.000000 V dc indications on differential voltmeter (R).

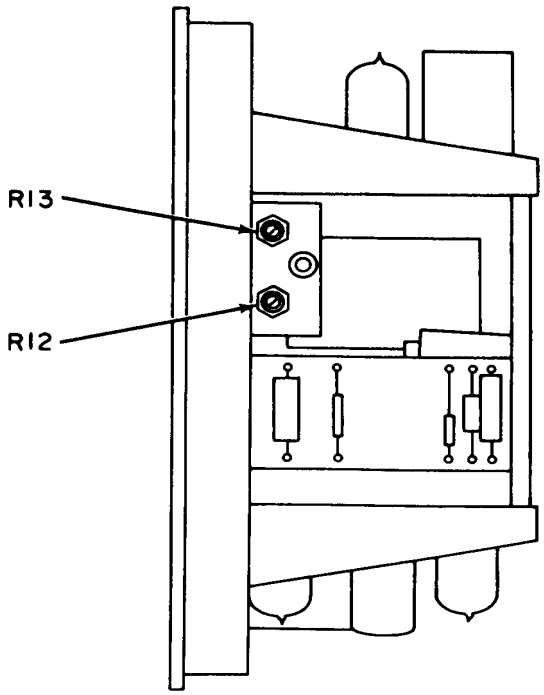

Figure 2. Right-side view of model 420

9. Ac Voltage

a. Performance Check

(1) Position controls as listed in (a) through (c) below:

(a) Output voltage switch to 9000.

(b) Output voltage dial to 100.

(c) Output selector switch to RMS.

(2) If differential voltmeter (A3) does not indicate between 9.054500 and 9.145500 V, perform **b**(1) below.

(3) Set output selector switch to P-P. If differential voltmeter does not indicate between 3.200800 and 3.233000 V, perform **b**(2) below.

b. Adjustments

(1) Adjust R14 (fig. 1) for a 9.1000000 indication on differential voltmeter (R).

(2) Adjust R13 (fig. 2) for a 3.216900 V indication on differential voltmeter (R)

10. Output Frequency and Distortion

a. Performance Check

(1) Connect frequency counter (A5) to TI OUTPUT terminals, using cable (B2).

(2) Measure frequency. Frequency will be between 990 and 1010 Hz (hertz).

(3) Substitute distortion analyzer (A4) in place of frequency counter, using leads (B3 and B4).

(4) Measure distortion. Distortion will be less than 0.25 percent.

b. Adjustments. No adjustments can be made.

11. Final Procedure

a. Deenergize and disconnect all equipment.

b. When all parameters are within tolerance, annotate and affix DA Label 80 (U.S. Army Calibrated Instrument). When the TI receives limited or special calibration, annotate and affix DA Label 163 (U.S. Army Limited or Special Calibration). When the TI cannot be adjusted within tolerance, repair the TI in accordance with the maintenance manual. When repair is delayed for any reason or the TI cannot be repaired with local

resources, annotate and affix DA Form 2417 (U.S. Army Calibration System Rejected Instrument) and inform the owner/user accordingly in accordance with TB 750-25.

SECTION IV
CALIBRATION PROCESS FOR MODEL 421A

12. Preliminary Instructions

a. The instructions outlined in this paragraph 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 3 and 4. For the identification of equipment referenced by item numbers prefixed with A, see table 3, and for prefix B, see table 4.

WARNING

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

NOTE

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

NOTE

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

13. Output Stability

a. Performance Check

(1) Connect autotransformer (A2) to a 115-V ac source and adjust for a 115-V output.

(2) Connect TI to autotransformer and equipment as shown in figure 3, connection A.

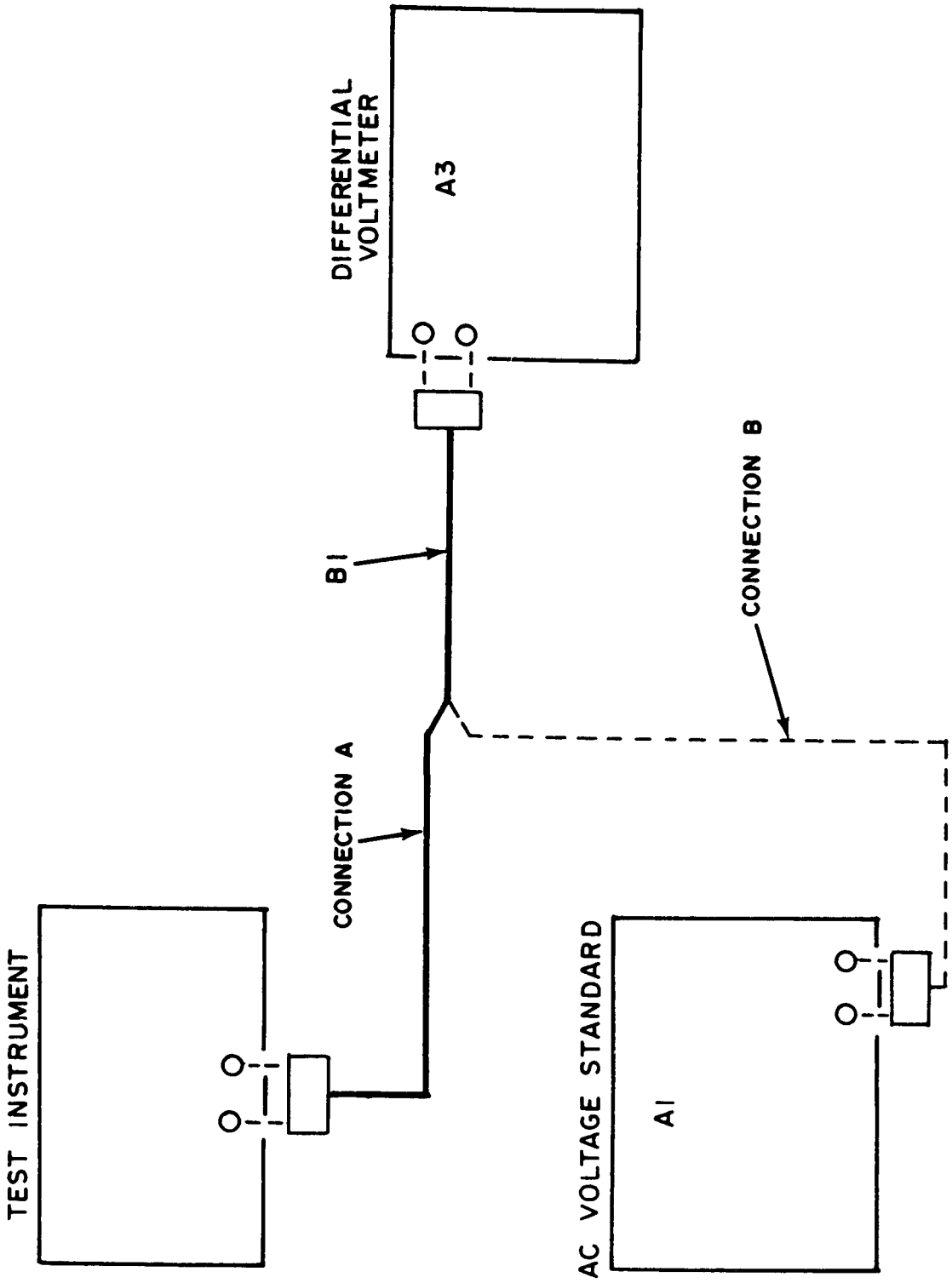

Figure 3. Voltage accuracy - equipment setup.

(3) Position controls as listed (a) through (d) below:

(a) RANGE switch to 10 V.

(b) MODE switch to DC POS.

(c) POWER switch to ON.

(d) OUTPUT VOLTAGE controls to TEN.000.

(4) Allow 2 hours for equipment to warm up and stabilize.

(5) Obtain null indication on differential voltmeter (A3). Record indication.

(6) Vary autotransformer from 105 to 125 V and return to 115 V. Differential voltmeter indication will remain within ±.009 V of indication recorded in (5) above throughout autotransformer variations.

b. Adjustments. No adjustments can be made.

14. Ac Voltage

a. Performance Check

(1) Position controls as listed in (a) through (c) below:

(a) MODE switch to 1 kc RMS.

(b) RANGE switch to 100 V.

(c) OUTPUT VOLTAGE controls to TEN0.00.

(2) Adjust differential voltmeter (A3) to obtain null indication and leave its readout dials set.

(3) Connect equipment as shown in figure 3, connection B.

NOTE

Insure that ac voltage standard frequency is same as TI function being tested.

(4) Adjust ac voltage standard (A1) to obtain null indication on differential voltmeter with its readout dials set as in (2) above. If ac voltage standard does not indicate between 99.8450 and 100.1550, perform **b**(1), (2), and (3) below.

(5) Repeal technique of (1) through (4) above for each TI output listed in table 6.

Table 6. Ac Voltage

Test instrument switch setting			Ac voltage standard indications (V)		Test instrument adjustments
Mode switch	Range switch (V)	Output voltage controls	Min	Max	
1 kc RMS	100	99.90	99.745	100.055	---
1 kc RMS	100	88.80	88.645	88.955	---
1 kc RMS	100	77.70	77.545	77.855	---
1 kc RMS	100	66.60	66.445	66.755	---
1 kc RMS	100	55.50	55.345	55.655	---
1 kc RMS	100	44.40	44.245	44.555	---
1 kc RMS	100	33.30	33.145	33.455	
1 kc RMS	100	22.20	22.045	22.355	---
1 kc RMS	100	11.10	10.945	11.255	---
1 kc RMS	10	TEN.000	9.9845	10.0155	
1 kc RMS	1	.TEN0.00	0.99845	1.00155	---
0.4 kc RMS	100	TEN0.00	99.745	100.255	**b**(4),(5) and (6)
1 kc P-P	100	TEN0.00	35.2952	35.40479	**b**(7),(8), and (9)
0.4 kc P-P	100	TEN0.00	35.25985	35.44015	---

(6) Connect equipment as shown in figure 4, connection A.

(7) Position controls as listed in (a) through (c) below:

(a) MODE switch to 1 kc RMS.

(b) RANGE switch to 100 m V.

(c) OUTPUT VOLTAGE controls to TEN0.00.

(8) Set distortion analyzer (A4) to voltmeter function and 1 V range.

(9) Adjust differential voltmeter to obtain null indication and leave its readout dials set.

(10) Connect equipment as shown in figure 4, connection B.

(11) Adjust ratio transformer (A6) to .100000 and ac voltage standard for a nominal 1-V output.

(12) Adjust ac voltage standard output to obtain null indication on differential voltmeter with its readout dials set as in (9) above. Ac voltage standard will indicate between .998420 and 1.001580 V.

(13) Connect equipment as shown in figure 4, connection A.

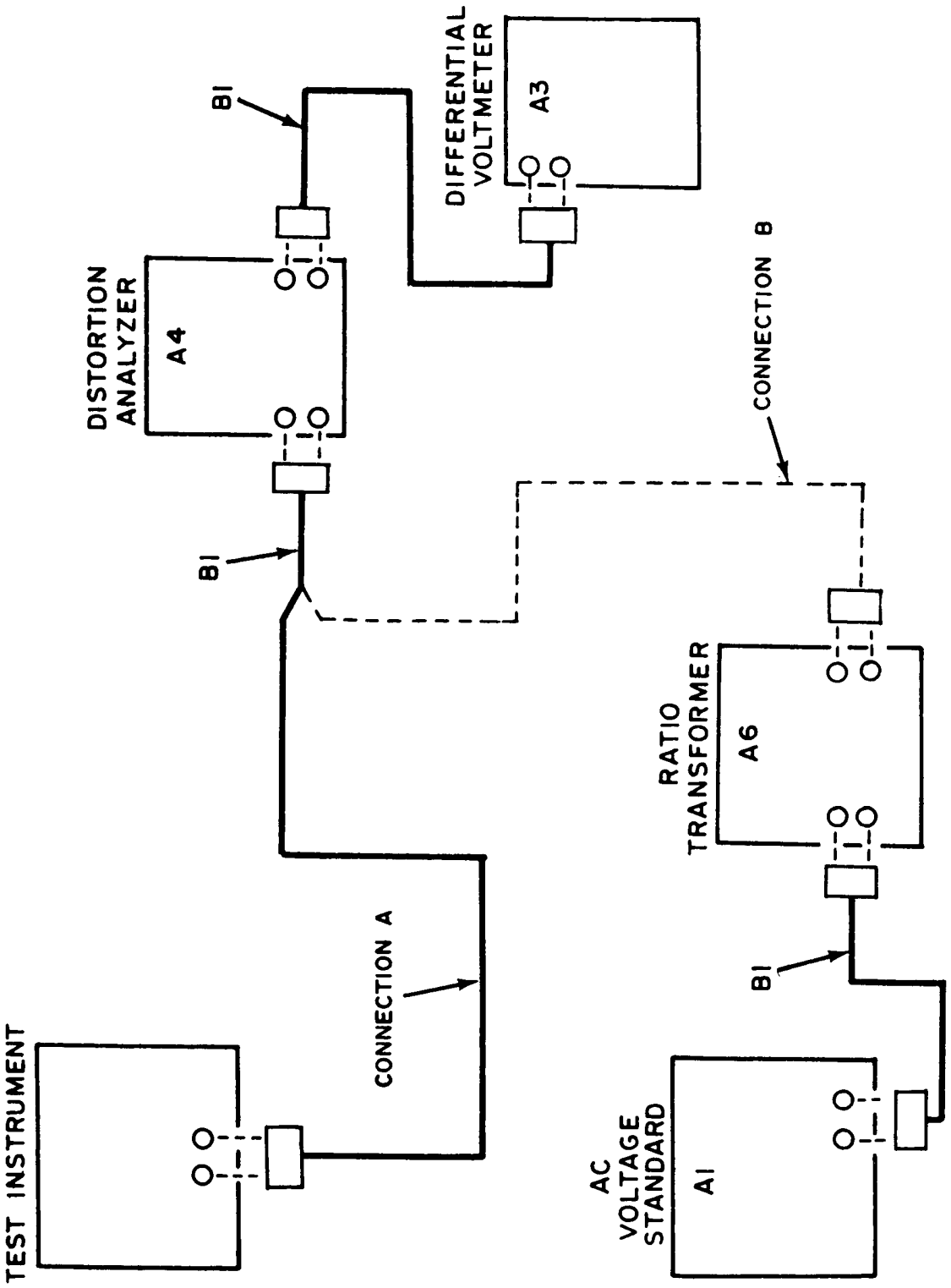

Figure 4. Low voltage accuracy - equipment setup.

NOTE

For performance checks below 10 mV, it may be necessary to break ground loop by disconnecting ground strap on distortion analyzer.

(14) Set RANGE switch to 10 mV and OUTPUT VOLTAGE controls to TEN.000.

(15) Set distortion analyzer to .01 range.

(16) Adjust differential voltmeter to obtain null indication and leave its readout dials set.

(17) Connect equipment as shown in figure 4, connection B.

(18) Adjust ratio transformer to .010000 and ac voltage standard for a nominal 1-V output.

(19) Adjust ac voltage standard output to obtain null indication on differential voltmeter with its readout dials set as in (16) above. If ac voltage standard does not indicate between .99847 and 1.001553 V, perform **b**(10) through (12) below.

(20) Connect equipment as shown in figure 4, connection A.

(21) Set RANGE switch to 1 mV and OUTPUT VOLTAGE controls to .TEN000.

(22) Set distortion analyzer to .001 range.

(23) Adjust differential voltmeter to obtain null indication and leave its readout dials set.

(24) Connect equipment as shown in figure 4, connection B.

(25) Adjust ratio transformer to .001000 and ac voltage standard for a nominal 1-V output.

(26) Adjust ac voltage standard output to obtain null indication on differential voltmeter with its readout dials set as in (23) above. If ac voltage standard does not indicate between .99847 and 1.001553, perform **b**(10) through (12) below.

(27) Position controls as listed in **(a)** through **(c)** below:

(a) MODE switch to 0.4 kc RMS.

(b) RANGE switch to 100 V.

(c) OUTPUT VOLTAGE controls to TEN0.00.

(28) Connect differential voltmeter to TI ±0.3% 0.4 kc ONLY output jack and GND, using leads (B3 and B4).

(29) Differential voltmeter will indicate between 995.45 and 1004.550 V ac.

(30) Set MODE switch to 0.4 kc P-P. Differential voltmeter will indicate between 351.8915 and 355.10843 V ac.

b. Adjustments

NOTE

Adjustment of R69, R71, or R73 affects the 100 mV (millivolt), 1 V and 10 V ranges as well as the 100 V range. They should be adjusted for the best overall indication on all ranges.

(1) Adjust the voltage standard to obtain a 100-V output at 1 kHz (kilohertz). Adjust differential voltmeter to obtain null indication and leave its readout dials set.

(2) Connect equipment as shown in figure 3, connection A.

(3) Adjust R69 (1 kc LEVEL) (fig. 5 or 6) to obtain null indication with its readout dials set as in (1) above (R).

(4) Adjust ac voltage standard to obtain a 100-V output at 400 Hz. Adjust differential voltmeter to obtain null indication and leave its readout dials set.

(5) Connect equipment as shown in figure 3, connection A.

(6) Adjust R71 (.4 kc LEVEL) (fig. 5 or 6) to obtain null indication on differential voltmeter with its readout dials set as in (4) above (R).

(7) Adjust ac voltage standard to obtain a 35.35-V output at 1 kHz. Adjust differential voltmeter to obtain null indication and leave its readout dials set.

(8) Connect equipment as shown in figure 3, connection A.

(9) Adjust R73 (P-P LEVEL) (fig. 5 or 6) to obtain null indication on differential voltmeter with its readout dials set as in (7) above (R).

(10) Adjust ac voltage standard to obtain a 1-V output at 1 kHz. Adjust differential voltmeter to obtain null indication and leave its readout dials set.

(11) Connect equipment as shown in figure 4, connection A.

(12) Adjust R46 (1 and 10 mV ac) (fig. 5 or 6) to obtain null indication on differential voltmeter with its readout dials set as in (10) above (R).

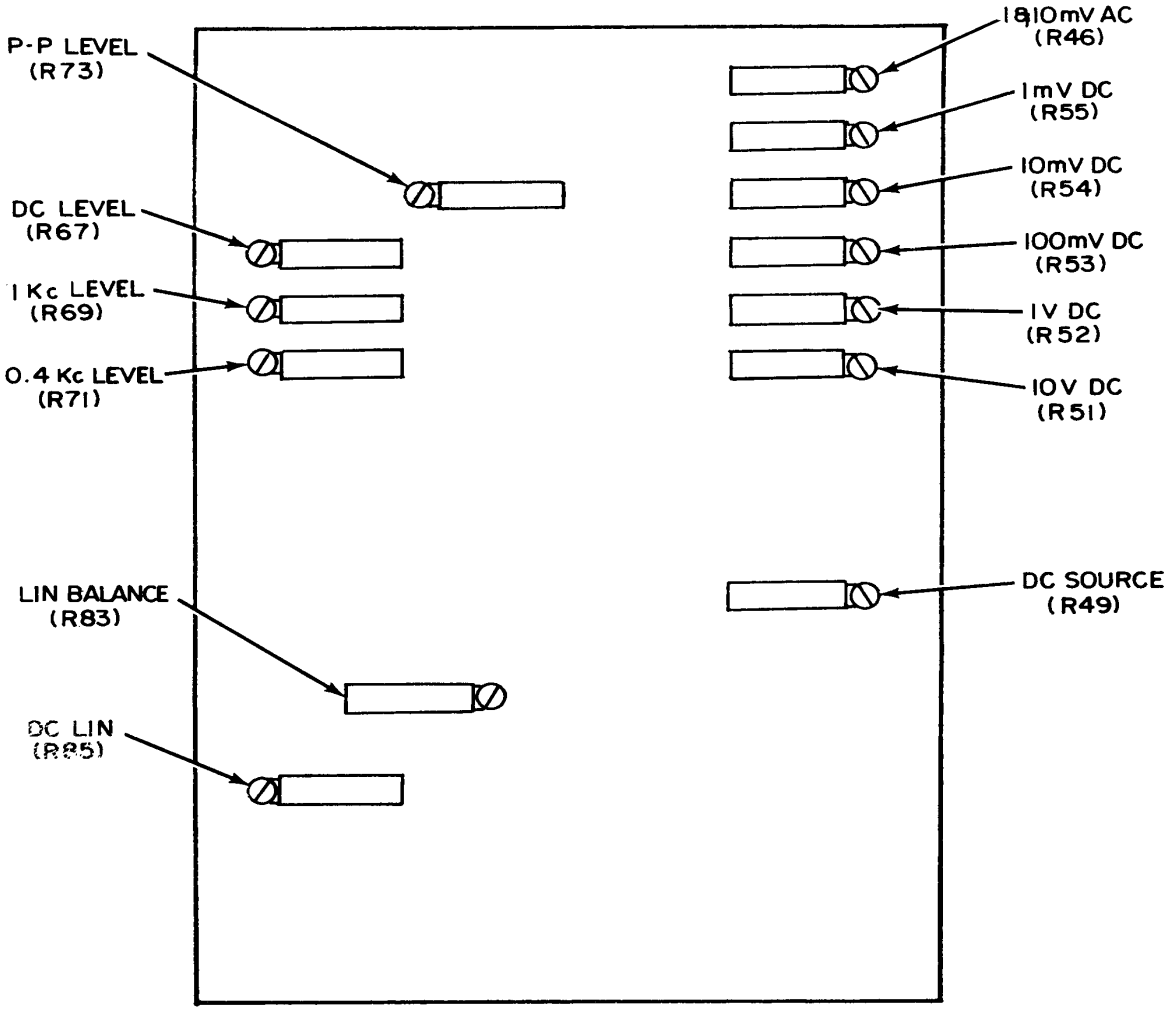

Figure 5. Model 421A (above SIN 901) adjustments.

NOTE

R46 (1 and 10 mV ac) (fig. 5 or 6) affects the 1 mV range as well as the 10 mV range and should be adjusted for best overall indication on both ranges.

15. Dc Voltage

a. Performance Check

(1) Adjust resistance decade (A7) to 1 megohm (999.999 ohms on model 330) and connect across TI output, using two leads (B3 and B4). This connection remains throughout the dc voltage check except where instructed specifically to change.

(2) Connect equipment as shown in figure 3, connection A.

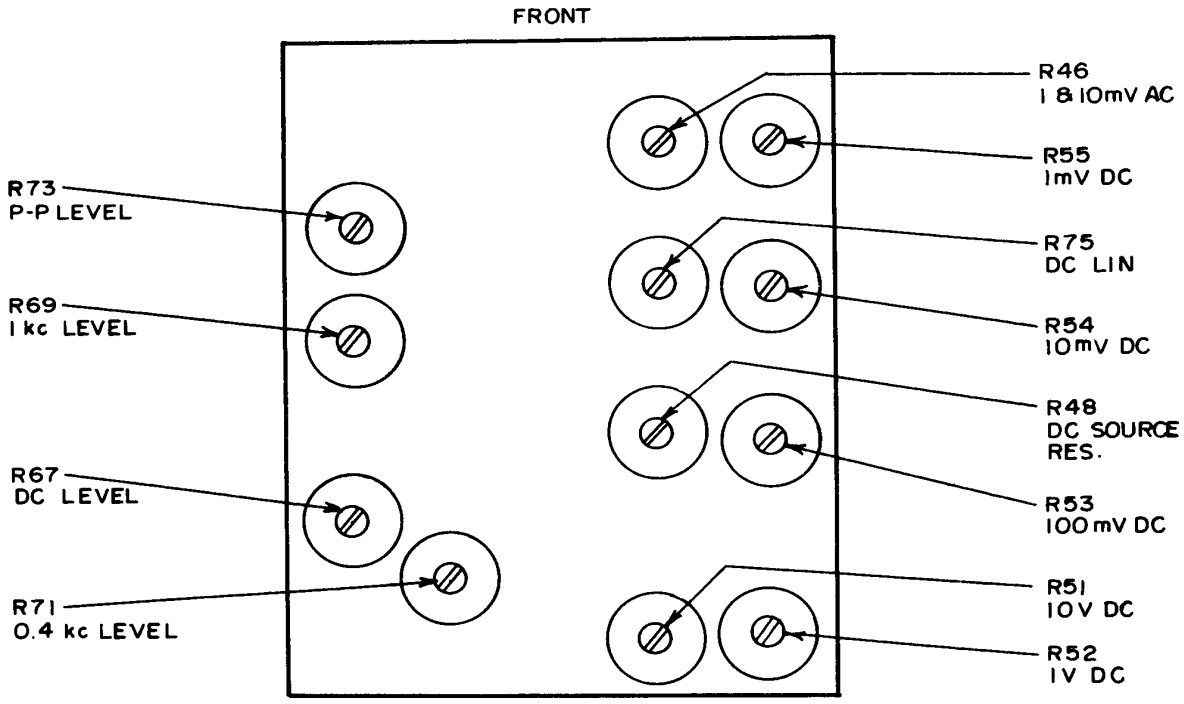

Figure 6. Model 421A (below SIN 901) adjustments

(3) Position controls as listed in (a) through (c) below:

(a) MODE switch to DC POS.

(b) RANGE switch to 100 V.

(c) OUTPUT VOLTAGE controls to TEN0.00.

(4) Measure and record TI output for each RANGE listed in table 7.

Table 7. Dc Voltage

RANGE switch setting	OUTPUT VOLTAGE control setting	Differential voltmeter indications (V)		Adjustments
		Min	Max	
100 v	TEN0.00	99.7929	100.2070	**b**(10) through (15)
10 v	TEN.000	9.97928	10.02073	**b**(16) and (17)
1 v	.TEN000	.997905	1.00210	**b**(18) and (19)
100 mV	TEN0.00	.099768	.100232	**b**(20) and (21)
10 mV	TEN.000	.009954	.010046	**b**(22) and (23)
1 mV	.TEN000	.000973	.001027	**b**(24) and (25)

(5) Analyze recorded indications. If all indications are within specified limits, proceed to paragraph 16. If error is approximately the same magnitude and polarity on all ranges, perform **b**(1) through (10) below. If error is only on individual ranges, perform adjustments as specified in table 7.

b. Adjustments

(1) Set RANGE switch to 100 V and OUTPUT VOLTAGE controls to TEN0.00.

(2) Adjust R67 (DC LEVEL) (fig. 5 or 6) for a 100.0-V dc indication on differential voltmeter (R).

(3) Set OUTPUT VOLTAGE controls to 10.00.

(4) Adjust R85 (DC LIN) (fig. 5) [R75 (fig. 6) for TI with S/N below 900] for a 10.0-V dc indication on differential voltmeter (R).

NOTE

Omit steps (5) through (9) for TI's with serial numbers below 900.

(5) Set MODE switch to DC NEG.

(6) Note differential voltmeter indication and adjust R83 (DC BALANCE) (fig. 6) to eliminate half the error from 10 V (R).

(7) Adjust R85 (DC LIN) (fig. 5) for a 10-V indication on differential voltmeter (R).

(8) Set MODE switch to DC POS.

(9) Repeat technique of (1) through (8) as necessary for best overall indications.

(10) Set RANGE switch to 100 V and OUTPUT VOLTAGE controls to TEN0.00.

(11) Disconnect resistant decade from TI.

(12) Measure and record TI output.

(13) Adjust resistance decade to 20 kilohms and reconnect to TI output.

(14) Adjust R48 (DC RESOURCE RES) (fig. 5) [(R49) (fig. 6) for TI with S/N below 900] to obtain differential voltmeter indication of value recorded in (12) above, minus 4.762 V (R).

(15) Adjust resistance decade to 1 megohm.

(16) Set RANGE switch to 10 V and OUTPUT VOLTAGE controls to TEN.000.

(17) Adjust R51 (10 V DC) (fig. 5 or 6) for a 10.0-V indication on differential voltmeter (R).

(18) Set RANGE switch to 1 V and OUTPUT VOLTAGE controls to .TEN000.

(19) Adjust R52 (1 V DC) (fig. 5 or 6) for a 1.0-V indication on differential voltmeter (R).

(20) Set RANGE switch to 100 mV and OUTPUT VOLTAGE controls to TEN0.00.

(21) Adjust R53 (100 mV DC) (fig. 5 or 6) for a l00-mv (millivolt) indication on differential voltmeter (R).

(22) Set RANGE switch to 10 mV and OUTPUT VOLTAGE controls to TEN.000.

(23) Adjust R54 (10 mV DC) (fig. 5 or 6) for a 10.0-mV indication on differential voltmeter (R).

(24) Set RANGE switch to 1 mV and OUTPUT VOLTAGE controls to .TEN000.

(25) Adjust R55 (1 mV DC) (fig. 5 or 6) for a 1.0-mV indication on differential voltmeter (R).

16. Distortion and Frequency

a. Performance Check

(1) Connect distortion analyzer (A4) to TI OUTPUT terminals, using cable (B1).

(2) Position controls as listed in (a) through (c) below:

(a) MODE switch to 1 kc RMS.

(b) RANGE switch to 10 V.

(c) OUTPUT VOLTAGE controls to TEN.000.

(3) Measure distortion. Distortion will be less than 0.2 percent.

(4) Set MODE switch to 0.4 kc RMS.

(5) Measure distortion. Distortion will be less than 0.2 percent.

(6) Substitute frequency counter (A5) in place of distortion analyzer, using cable (B2). Measure frequency. Frequency will be between 388 and 412 Hz.

(7) Set MODE switch to 1 kc RMS. Measure frequency. Frequency will be between 970 and 1030 Hz.

b. Adjustments. No adjustments can be made.

17. Final Procedure

a. Deenergize and disconnect all equipment.

b. When all parameters are within tolerance, annotate and affix DA Label 90 (U.S. Army Calibrated Instrument). When the TI receives limited or special calibration, annotate and affix DA Label 163 (U.S. Army Limited or Special Calibration). When the TI cannot be adjusted within tolerance, repair the TI in accordance with the maintenance manual. When repair is delayed for any reason or the TI cannot be repaired with local resources, annotate and affix DA Form 2417 (U.S. Army Calibration System Rejected Instrument) and inform the owner/user accordingly in accordance with TB 750-25.

TB 9-4931-290-50

By Order of the Secretary of the Army:

BERNARD W. ROGERS
General, United States Army
Chief Of Staff

Official:

J. C. PENNINGTON
Major General, United States Army
The Adjutant General

Distribution:
To be distributed in accordance with DA Form 12-34A, (qty rqr block No. 75), requirements for calibration procedures publications.

US GOVERNMENT PRINTING OFFICE: 1986 491 - 885/40674

PIN NO: 009027-000