*TB 9-6625-2097-24

DEPARTMENT OF THE ARMY TECHNICAL BULLETIN

CALIBRATION PROCEDURE FOR RECORDERS, INK WRITING, GOULD, MODEL 2200S (SERIES); WITH RMS CONVERTER, GOULD, MODEL 13-4618-10; AND FREQUENCY DEVIATION CONVERTER, GOULD, MODEL 13-4618-00

Headquarters, Department of the Army, Washington, DC
19 December 2007

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, U.S. Army Aviation and Missile Command, ATTN: AMSAM-MMC-MA-NP, Redstone Arsenal, AL 35898-5000. A reply will be furnished to you. You may also send in your comments electronically to our E-mail address: 2028@redstone.army.mil or by fax 256-842-6546/DSN 788-6546. For the World Wide Web use: https://amcom2028.redstone.army.mil. Instructions for sending an electronic 2028 can be found at the back of this manual.

*This bulletin supersedes TB 9-6625-2097-35, dated 22 November 1983, including all changes.

SECTION I
IDENTIFICATION AND DESCRIPTION

1. Test Instrument Identification. This bulletin provides instructions for the calibration of Recorders, Ink Writing, Gould, Model 2200S (Series); with RMS Converter, Gould, Model 13-4618-10; and Frequency Deviation Converter, Gould, Model 13-4618-00. 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. None.

b. Time and Technique. The time required for this calibration is approximately 3 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
Recorders, Ink Writing, Model 2200S (Series)	
Input signal	Range: 0 to 5 V at dc to 50 Hz
Frequency response	Range: 100 div at 100 mm amplitude, dc to 30 Hz Accuracy: ±1 div Range: 50 div at 50 mm amplitude, dc to 50 Hz Accuracy: ±1 div
Overshoot	Range: 100 mm amplitude Accuracy: Less than 8 ms Range: 50 mm amplitude Accuracy: Less than 5 ms overshoot less than 1% between 10 to 90% FS
Input power	100, 115, 200, and 230 V, ±10%, 50 to 400 Hz
RMS Converter, Model 13-4618-10	
Converter output	Range: 0 to 5 V dc linear Accuracy: ±0.2% of reading when reference to input voltage with accuracy of ±0.05%
Converter input	Range: X1 V 0.05 to 10 V X100 V 5 to 1000 V
Frequency Deviation Converter, Model 13-4618-00	
Frequency Deviation	Range: ±0.5, 1, 2.5, and 5 Hz at 50 or 60 Hz center frequency ±5, 10, 25, and 50 Hz at 400 Hz center frequency Output voltage: 2.5 V dc FS proportional to frequency deviation at each range switch setting Accuracy: ±0.3% when input frequency is ±0.075%

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/GMS-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 provided a four-to-one ratio between the standard and TI. Where the four-to-one ratio cannot be met, the actual accuracy of the equipment is shown in parenthesis.

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 the calibration procedure. The following peculiar accessories are also required for this calibration: Recorder, Gould, Model 2200S (Series) and Extender Card and Assembly, Gould, P/N 887291(supplied with TI).

Table 2. Minimum Specifications of Equipment Required

AUTOTRANSFORMER	Range: 105 to 125 V ac Accuracy: ±1%	Ridge, Model 9020A (9020A)
CALIBRATOR	Frequency Range: DC to 400 Hz Accuracy: ±0.00625% Amplitude Range: 0 to 10 V Accuracy: ±0.025%	Fluke, Model 5720A (5720A) (p/o MIS-35947); w amplifier, Fluke 5725A/AR (5725A/AR)
FUNCTION/ARBITRARY GENERATOR	Frequency Range: 1 to 400 Hz Accuracy: ±0.00625% Amplitude Range: 0 to 4 Vp-p Flatness: ±1%	Agilent, Model 33250A (33250A)
MULTIMETER	Range: 0 to 5.025 V Accuracy: 0.1%	Fluke, Model 8840A/AF05 (AN/GSM-64D)

SECTION III
CALIBRATION PROCESS FOR RECORDERS, INK WRITING GOULD, MODEL 2200S (SERIES)

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 bulletin 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 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.

d. 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 setup within the performance check where applicable.

a. Remove top protective cover from TI.

b. Slide all manual ink valves with tubing attached to **ON** position.

c. Remove preamplifiers from CH 1 and CH 2 of TI.

d. Press **STOP** pushbutton.

e. Connect TI to autotransformer.

f. Connect autotransformer to 115 V ac source and adjust for 115 V.

g. Energize equipment and allow 15 minutes for warm-up and stabilization.

h. Press **5 mm/sec CHART SPEED** pushbutton and **VARIABLE SPEED** control fully ccw.

i. Turn **CH 1 POSITION** control fully ccw. Adjust CH 1 R202, LIMIT LEFT (CH 2 R202) (fig. 1) for 1.5 mm pen deflection beyond the left channel margin.

j. Turn **CH 1 POSITION** control fully cw. Adjust CH 1 R203 LIMIT RIGHT (CH 2 R203) (fig. 1) for 1.5 mm pen deflection beyond the right channel margin.

k. Adjust **CH 1 POSITION** control to center pen on chart (0, line).

1. Repeat technique of (i) through (k) above for **CH 2 POSITION** control.

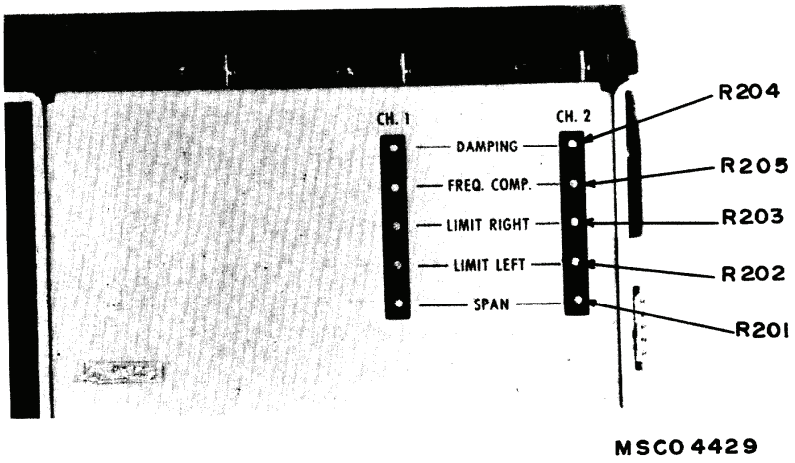

Figure 1. Model 2200S (Series) - top view.

8. Channel Span Gain

a. Performance Check

(1) Connect calibrator to SIGNAL INPUT I (fig. 2).

(2) Adjust calibrator output for 25 mm pen deflection to the left on TI. If calibrator does not indicate between 2.490 and 2.510 V dc, perform **b** below.

(3) Vary autotransformer between 105 and 125 V while maintaining a 25 mm pen deflection on TI with calibrator. If calibrator indication does not remain between 2.490 and 2.510 V dc and **b** was not performed in (2) above, perform **b** below.

(4) Set calibrator for 25 mm pen deflection to the right on TI. Calibrator will indicate between -2.490 and -2.510 V dc.

(5) Repeat techniques of (1) through (4) above for SIGNAL INPUT 2 (fig. 2).

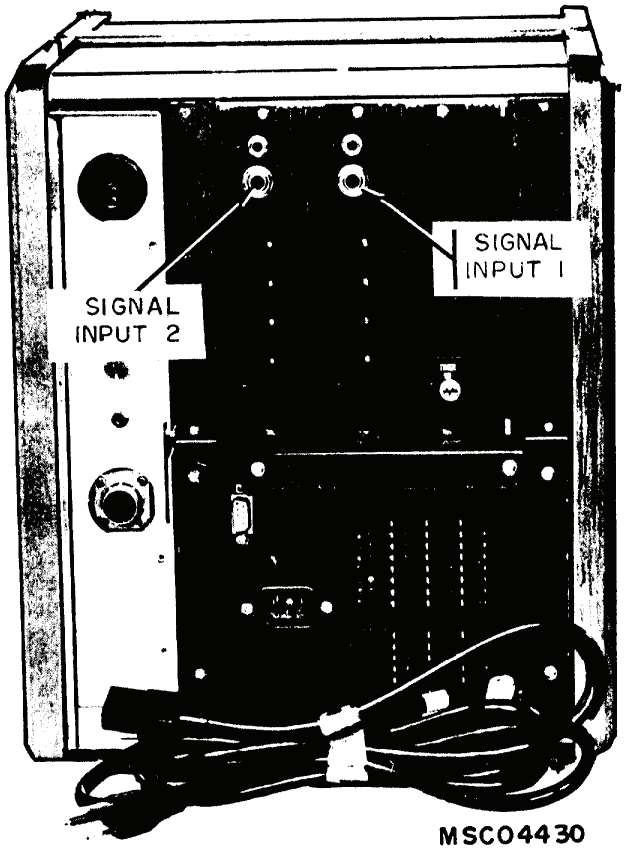

Figure 2. Model 2200S (Series) - rear view.

b. Adjustments

(1) Set calibrator output for 2.500 V dc.

(2) Adjust CH 1 R201 SPAN (CH. 2 R201 SPAN) (fig. 1) for a 25 mm pen deflection to the left on TI.

9. Overshoot

a. Performance Check

(1) Adjust function/arbitrary generator for 1 Hz square wave at 4 V p-p.

(2) Connect function/arbitrary generator to SIGNAL INPUT 1 (fig. 2).

(3) Turn **VARIABLE SPEED** control to fully cw. If waveform on TI does not indicate less than 1 percent overshoot, perform **b** below.

(4) Repeat technique of (2) above for SIGNAL INPUT 2 (fig. 2).

b. Adjustments. Adjust CH 1 R204 DAMPING (CH 2 R204 DAMPING) (fig. 1) for minimum overshoot or undershoot.

10. Frequency Response

a. Performance Check

(1) Press **25 mm/sec** pushbutton.

(2) Connect function/arbitrary generator to SIGNAL INPUT 1 (fig. 2).

(3) Adjust function/arbitrary generator frequency for 10 Hz and output for 30 mm pen deflection on TI.

(4) Sweep function/arbitrary generator frequency to 50 Hz. If pen deflection does not remain between 29.1 and 30.9 mm, perform **b** below.

(5) Repeat techniques of (2) through (4) above for SIGNAL INPUT 2 (fig. 2).

(6) Slide all manual ink valves with tubing attached to **OFF** position.

b. Adjustments. Adjust CH 1 R205 FREQ COMP (CH. 2 R205 FREQ COMP) (fig. 1) for a 30 mm pen deflection (R).

11. Final Procedure

a. Deenergize and disconnect all equipment.

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

SECTION IV
CALIBRATION PROCESS FOR RMS CONVERTER, MODEL 13-4618-10

12. Preliminary Instructions

a. The instructions outlined in paragraphs **12** and **13** 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 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 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.

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

13. Equipment Setup

a. Remove protective cover from TI.

b. Slide all manual ink valves with tubing attached to **ON** position on recorder.

c. Connect TI to recorder, using extender.

d. Set front panel controls as listed in (1) through (7) below:

(1) **FULL SCALE** switch to **1**.

(2) **ZERO SUPPRESSION** switch **OFF**.

(3) **ZERO SUPPRESSION** control ccw to **0**.

(4) **FILTER** switch **OFF**.

(5) **MODE** switch to **X1 VOLTS**.

(6) **SENSITIVITY** control fully cw.

(7) **RANGE** switch to **X1**.

e. Set **DC INPUT** switch S201 to left (fig. 3).

f. Energize equipment and allow 15 minutes for warm-up and stabilization.

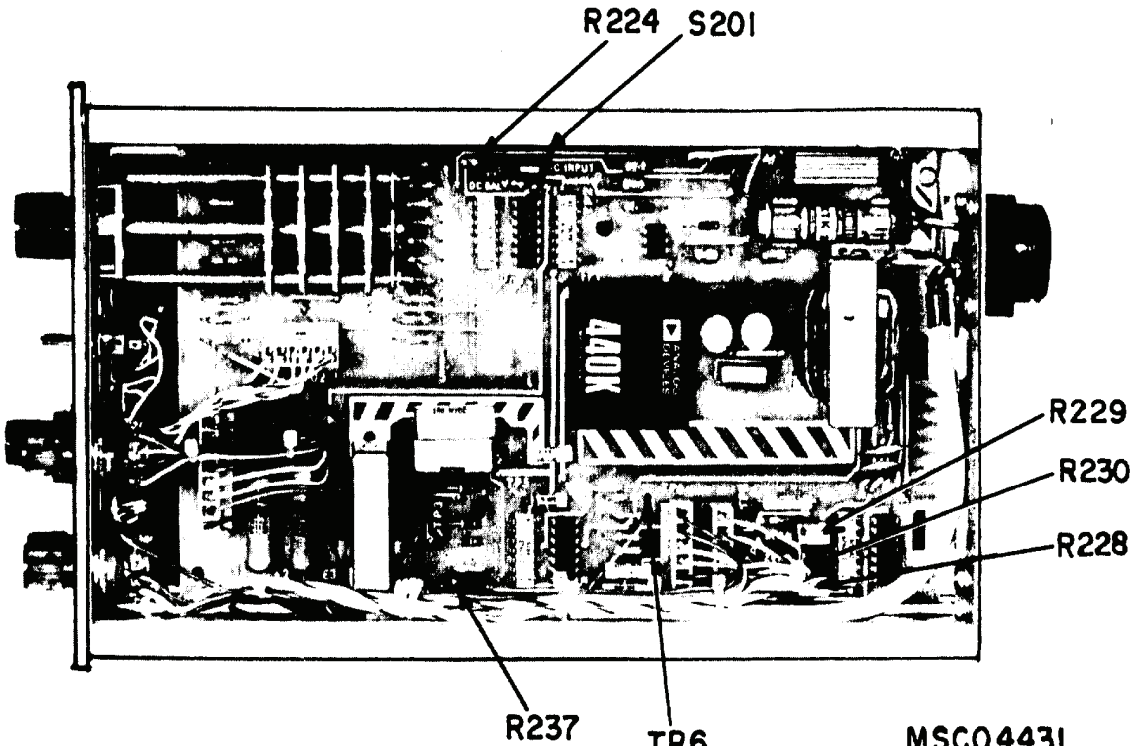

Figure 3. Model 13-4618-10 - right side view.

14. Converter Output

a. Performance Check

(1) Connect calibrator to pins 1 and 2 of **J-101**, input connector on rear of TI.

(2) Set **CHART SPEED** to **5**, **VARIABLE SPEED** control fully ccw, and adjust **H.1 POSITION** control for pen deflection to right zero line on chart paper.

(3) Set calibrator for a pen deflection of 50 mm on recorder. If calibrator does not indicate between 0.999 and 1.001 V dc, perform **b** below.

(4) Set calibrator for a pen deflection of 10 mm on recorder. If calibrator does not indicate between 0.1998 and 0.2002 V dc, perform **b** below.

b. Adjustments

(1) Disconnect calibrator.

(2) Set **RANGE** switch to **X.1**.

(3) Connect multimeter negative lead to TP7 and positive lead to TP6 (fig. 3) on TI.

(4) Turn **SENSITIVITY** control on front panel fully ccw. Adjust R230 ZERO (fig. 3) for 0 +.005 V indication on multimeter.

(5) Turn **SENSITIVITY** control on front panel fully cw, set S201 to DC INPUT (right) (fig. 3), and short pins 1 and 2 of 101. Adjust R237 OFFSET (fig. 3) for 0 ±.005 V indication on multimeter.

(6) Set **RANGE** switch to **X1** on front panel and set S201 to DC BAL (left) (fig. 3).

(7) Connect calibrator to pins 1 and 2 of **J-101**. Set calibrator for 1.000 VDC output and record multimeter indication.

(8) Set calibrator to -1.000 VDC. If multimeter does not indicate voltage recorded in (7) above, adjust R224 DC BAL (fig. 3) for same reading within ±0.002 V. Repeat (7) and (8) above until no further adjustment is needed (R).

(9) Adjust R229 SPAN (fig. 3) for multimeter reading of 5 ±0.005 V (R).

(10) Adjust **ZERO SUPPRESSION** control cw to 100 percent, set **ZERO SUPPRESSION** switch **ON**, and **RANGE** switch to X.1. Adjust R228 SUP ADJ (fig. 3) for 0 ±.005V indication on multimeter.

(11) Repeat (1) through (10) above to eliminate interaction.

(12) Slide all manual ink valves with tubing attached to **OFF** position on recorder.

15. Final Procedure

a. Deenergize and disconnect all equipment.

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

SECTION V
CALIBRATION PROCESS FOR FREQUENCY DEVIATION CONVERTER MODEL 13-4618-00

16. Preliminary Instructions

a. The instructions outlined in paragraphs **16** and **17** 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 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 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.

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

17. Equipment Setup

a. Remove protective cover from TI.

b. Slide all manual ink valves with tubing attached to **ON** position on recorder.

c. Connect TI to recorder, using extender.

d. Set **CENTER FREQUENCY** switch to **50**.

e. Energize equipment and allow 30 minutes for warm-up and stabilization.

18. Span Gain

a. Performance Check

(1) Connect multimeter negative lead to TP3 and positive lead to TP4 (fig. 4).

(2) Set **DEVIATION RANGE** switch to **OFF**. If multimeter does not indicate 0 ±10 mV, perform **b** (1) below.

(3) Connect calibrator to TI input (rear) connector pins 1 and 2.

(4) Set **DEVIATION RANGE** switch to .**5**.

(5) Set calibrator for a 10 V at 50 Hz output. If multimeter does not indicate 0 ±100 mV, perform **b** (2) below.

(6) Set **CENTER FREQUENCY** switch to **60**.

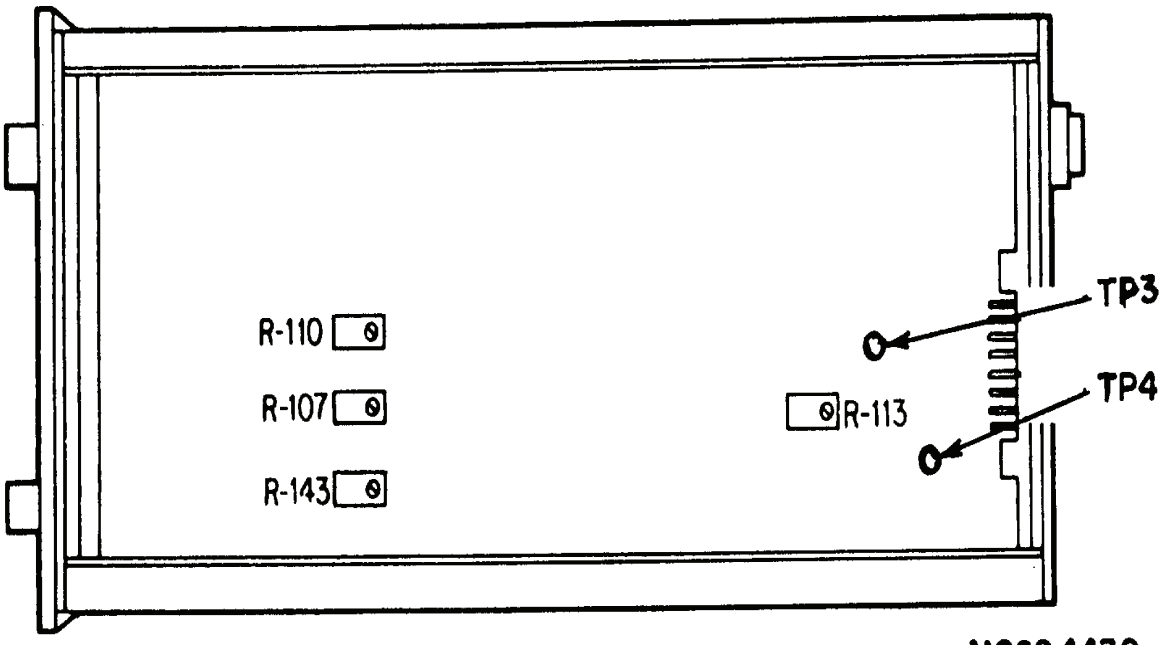

Figure 4. Model 13-4618-00 - side view.

(7) Adjust calibrator frequency for 60 Hz. If multimeter does not indicate 0 ±100 mV, perform **b** (3) below.

(8) Zero the multimeter.

(9) Adjust calibrator frequency for 59 Hz. If the multimeter does not indicate between -4.975 and -5.025 V, perform **b** (4) through (7) below.

(10) Repeat technique of (7) through (9) above for **DEVIATION RANGE** switch positions listed in table 4. Multimeter indicator differences will be within limits specified.

Table 4. Span Gain Accuracy

Test instrument **DEVIATION RANGE** switch settings	Multimeter indications (V)	
	Min	Max
1	-2.4875	-2.5125
2.5	-0.9950	-1.0050
5	-0.4975	-0.5025

(11) Set **DEVIATION RANGE** switch to blue range.

(12) Set TI **CENTER FREQUENCY** switch to **400**.

(13) Adjust calibrator frequency for 400 Hz. Multimeter should indicate 0 ±100 mV.

(14) Zero the multimeter.

(15) Adjust calibrator frequency for 390 Hz. Multimeter should indicate between -4.9700 and -5.0300 V.

(16) Repeat technique of (13) through (15) above for **DEVIATION RANGE** switch positions listed in table 5. Multimeter will indicate within limits specified.

Table 5. Span Gain Accuracy

Test instrument **DEVIATION RANGE** switch settings	Multimeter indications (V)	
	Min	Max
10	-2.4850	-2.5150
25	-0.9925	-1.0075
50	-0.4970	-0.5030

b. Adjustments

(1) Adjust R-113 ZERO (fig. 4) for 0.0 V indication on multimeter (R).

(2) Adjust R-110 50 HZ (fig. 4) for 0.0 V indication on multimeter (R).

(3) Adjust R-107 60 HZ (fig. 4) for 0.0 V indication on multimeter (R).

(4) Set **DEVIATION RANGE** switch to **5**.

NOTE

The following adjustments; R-107 and R-143 are interactive.

(5) Adjust calibrator for 10 V at 55 Hz output and adjust R-107 60 HZ (fig. 4) for a multimeter reading of -2.500 V (R).

(6) Adjust calibrator for 10 V at 65 Hz output and adjust R-143 SPAN (fig. 4) for a multimeter reading of +2.500 V (R).

(7) Repeat (5) and (6) above to eliminate interaction.

(8) Slide all manual ink valves with tubing attached to **OFF** position on recorder.

19. Final Procedure

a. Deenergize and disconnect all equipment.

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

By Order of the Secretary of the Army:

Official:

GEORGE W. CASEY, JR.
General, United States Army
Chief of Staff

JOYCE E. MORROW
Administrative Assistant to the
Secretary of the Army

0729022

Distribution:

To be distributed in accordance with the initial distribution number (IDN) 342231, requirements for calibration procedure TB 9-6625-2097-24.

INSTRUCTIONS FOR SUBMITTING AN ELECTRONIC 2028

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.

PIN: 084482-000