TB 9-6695-298-35

CHANGE 1

DEPARTMENT OF THE ARMY TECHNICAL BULLETIN

CALIBRATION PROCEDURE FOR FORCE TORQUE READOUT MIS-38934 TYPE 1 AND TYPE 11

Headquarters, Department of the Army, Washington, DC
18 March 2002

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TB 9-6695-298-35, 25 March 1994, 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
7 and 8	7 and 8

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

By Order of the Secretary of the Army:

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DEPARTMENT OF THE ARMY TECHNICAL BULLETIN

CALIBRATION PROCEDURE FOR FORCE TORQUE READOUT MIS-38934 TYPE I AND TYPE II

Headquarters, Department of the Army, Washington, DC
25 March 1994

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REPORTING OF ERRORS AND RECOMMENDING IMPROVEMENTS

You can help improve this publication. If you find any mistakes or if you know of a way to improve the procedure, please let us know. Mail your letter or DA Form 2028 to: Commander, U. S. Army Aviation and Missile Command, ATTN: AMSAM-MMC-MA-NP, Redstone Arsenal, AL 35898-5230. 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 FAX 256-842-6546/DSN 788-6546

SECTION I
IDENTIFICATION AND DESCRIPTION

1. Test Instrument Identification. This bulletin provides instructions for the calibration of Force Torque Readout MIS-38934 Type I and Type II. The manufacturer's manual was used as the prime data source 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 4 hours, using the dc and low frequency techniques.

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. 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
Readout calibration	Static mode: ±0.01 % FS Dynamic mode: ±0.2% FS
Power supply	Range / Accuracy + 5 V / ±1.0% +15 V / ±0.33% -15 V / ±0.33% +18 V / ±0.55%

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-287. 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	Minimum use specifications	Manufacturer and model (part number)
DIGITAL MULTIMETER	Frequency range: Dc Voltage range: 0 to +20.00 V dc Accuracy: ±0.001 V dc	John Fluke, Model 8506A/CT (p/o MIS-35947)
STRAIN GAGE SIMULATOR	Range: -100% to +100%FS Accuracy: ±0.0025% of FS	(P/O MIS-38934 Type 1 and Type 2)

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 section 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 the manufacturer's manual for this TI.

d. When indications specified in paragraph **7** are not within tolerance, perform the power supply check prior to making adjustments. After adjustments are made, repeat paragraph **7.** Do not perform power supply check if all other parameters are within tolerance.

e. Unless otherwise specified, all controls and control settings in this section 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. Set power switch on rear panel of TI to the off position if it is not already off.

b. Disconnect any transducers that may be connect to TI.

c. Remove top cover of TI (four screws on top and two on each side).

d. Install connector plug P1 into J1 (fig. 1) and P2 into J2 (fig. 1) of TI if not already installed.

e. Connect the strain gage simulator to CHANNEL 1 (J1, fig. 2) of TI and set it to 0 percent.

f. Insert EEPROM module into MODULE COMPARTMENT (fig. 3) (if it is not installed).

g. Replace top cover on TI.

h. Connect 115V ac power to 105-130 VAC 50/60 Hz FUSE 2A (fig. 2) power input on rear panel of TI.

i. Set power switch on rear panel of TI to the on position and allow 30 minutes for warmup.

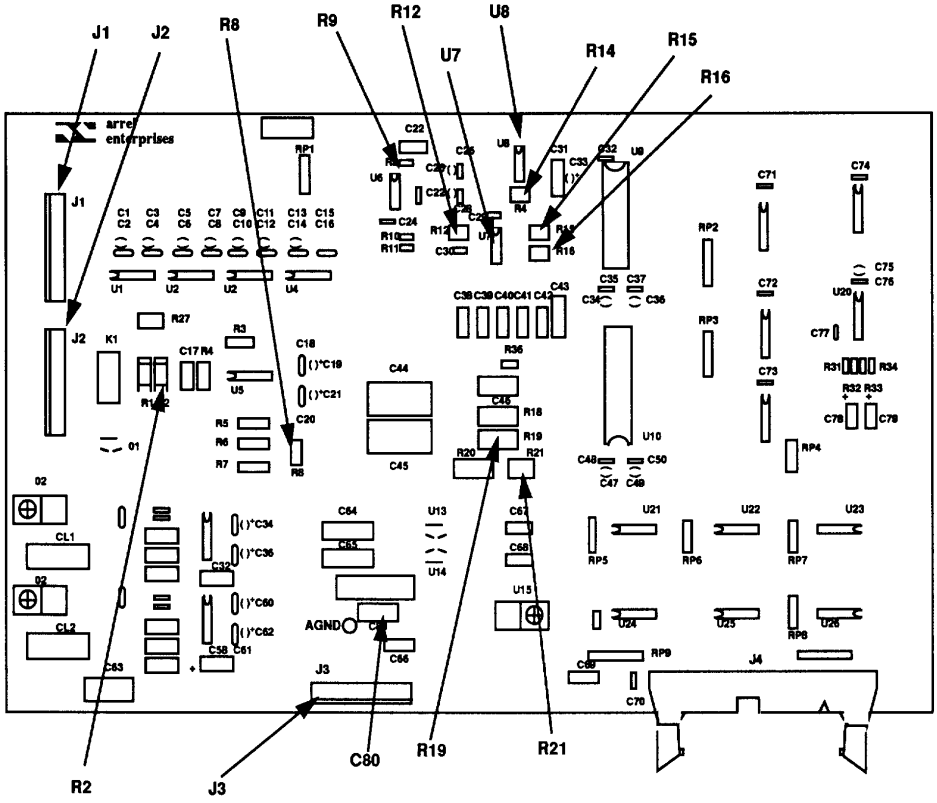

Figure 1. A1 adjustments board.

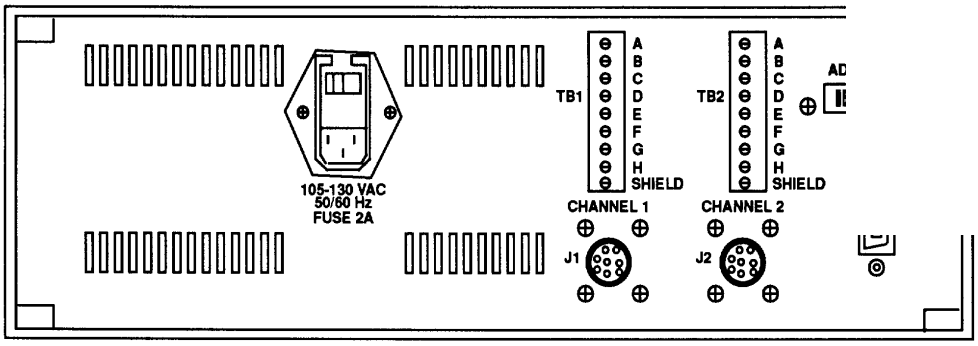

Figure 2. Force-torque - rear panel.

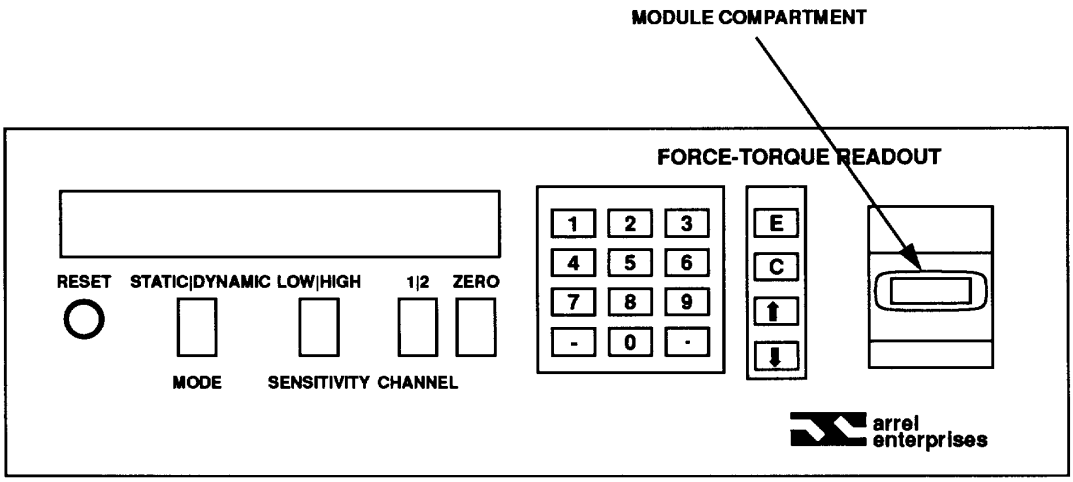

Figure 3. Force-torque readout - front panel.

j. Make sure the instrument passes all of the power-up self-test. When **SN=XXXXX** (where **XXXXX** is the serial number) is displayed, all self-tests have been successfully completed.

k. Verify that the serial number on display is the same as as the force torque readout unit. If correct, press the **E** key; if incorrect, press **C** key then enter the correct serial number.

l. Load EEPROM data should now be displayed. Set the **CHANNEL** switch to select channel 1. Set the **MODE** switch to select the **STATIC** mode. Set the **SENSITIVITY** switch to select **HIGH** sensitivity.

m. Press **E** key to load the transducer data from the EEPROM module.

n. Item = Simulator/Frc should be the first item displayed. If not, pressing the **C** key selects the next item. Once **Item = Simulator/ Frc** is displayed, pressing **E** key selects that item as the transducer under test. After pressing the **E** key, the TI will perform an auto zero/auto gain then start sampling. The leftmost display segment should have a flashing * and approximately 0.00000 mV/V should be displayed. If not, select unit of measurement, mV/V, by pressing either the up arrow or down arrow keys on the front panel.

NOTE

For the highest possible accuracy, the force torque readout should be calibrated at room temperature (23 degrees Celsius, 73 degrees Fahrenheit) with at least a 30 minute warmup period.

8. Readout Calibration

a. Performance Check

(1) With strain gage simulator set to 0 percent, set the polarity switch to the + (positive) position.

(2) Press the **ZERO** pushbutton.

(3) Record the displayed reading in mV/V.

(4) Set the strain gage simulator to 10 percent.

(5) Record the displayed reading in mV/V.

(6) Repeat (4) and (5) above in 10 percent steps until readings have been recorded up to and to include 100 percent.

(7) Return the strain gage simulator to 0 percent and set the polarity switch to the - (negative) position.

(8) Repeat (2) through (6) above.

(9) Connect the strain gage simulator to J2 (fig. 2) and set **CHANNEL** switch to select **2.**

(10) Repeat (1) through (8) above for channel **2.**

(11) Compare each of the displayed readings for channels **1** and **2** in mV/V to the corresponding strain gage simulator outputs recorded on the calibration chart attached to the strain gage simulator. At each point the displayed readings shall be within 0.0004 mV/V of the strain gage simulator output; if not, perform **b** below.

b. Adjustments

(1) Enable the calibration mode and repeat **7j** through **n** above.

NOTE

To enable the calibration mode, the **ZERO** pushbutton and 0 key must be pressed and held simultaneously while the **RESET** pushbutton is pressed and released. The **ZERO** pushbutton and 0 key must be held until the message **CAL MODE ENABLED!** is displayed, accompanied by several short beeps. The calibration mode is now enabled and can be activated at any time by pressing the 0 key. After releasing the 0 key, the message **Enter Cal Mode Num!** will be displayed. This message will be followed by the calibration menu. The menu will continue scrolling until the operator makes a selection. To deactivate the calibration mode, press 0 key and the flashing * will reappear.

(2) Activate the calibration mode by pressing the 0 key.

(3) With menu scrolling, select **AUTO SCALE VTEST** calibration mode **6.**

(4) Connect strain gage simulator to J1 (fig. 2) then press **E** key.

(5) Set **CHANNEL** switch to select channel 1 then press **E** key.

(6) Set **MODE** switch to **STATIC** then press **E** key.

(7) Set polarity switch to + (positive) position on strain gage simulator and ensure simulator is at 100 percent.

(8) Enter the value recorded on the strain gage simulator calibration sheet for +100 percent.

(9) Set strain gage simulator to 0 percent then press **E** key.

(10) When **SET SIMULATOR = 100%** is displayed, set strain gage simulator to 100 percent then press **E** key.

(11) The readout will display the scale factor for channel 1. Press **E** key to continue.

(12) Connect strain gage simulator to J2 (fig. 2) then press **E** key.

(13) Set **CHANNEL** switch to select channel **2** then press **E** key.

(14) Repeat (8) through (10) above.

(15) The readout will display the scale factor for channel **2.** Press **E** key to continue.

(16) Connect strain gage simulator to J1 (fig. 2) and set **CHANNEL** switch to select channel 1.

(17) Set strain gage simulator to 0 percent then press **E** key.

(18) Perform a(2) through (11) above and, if readings are still not within specified limits, perform power supply check.

9. Power Supply

a. Performance Check

NOTE

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

(1) Measure the +5 V power supply with the digital multimeter by connecting the + (positive) lead to the +S terminal and the -(negative) lead to the -S terminal of POWER SUPPLY BOARD NO. 1 (fig. 4).

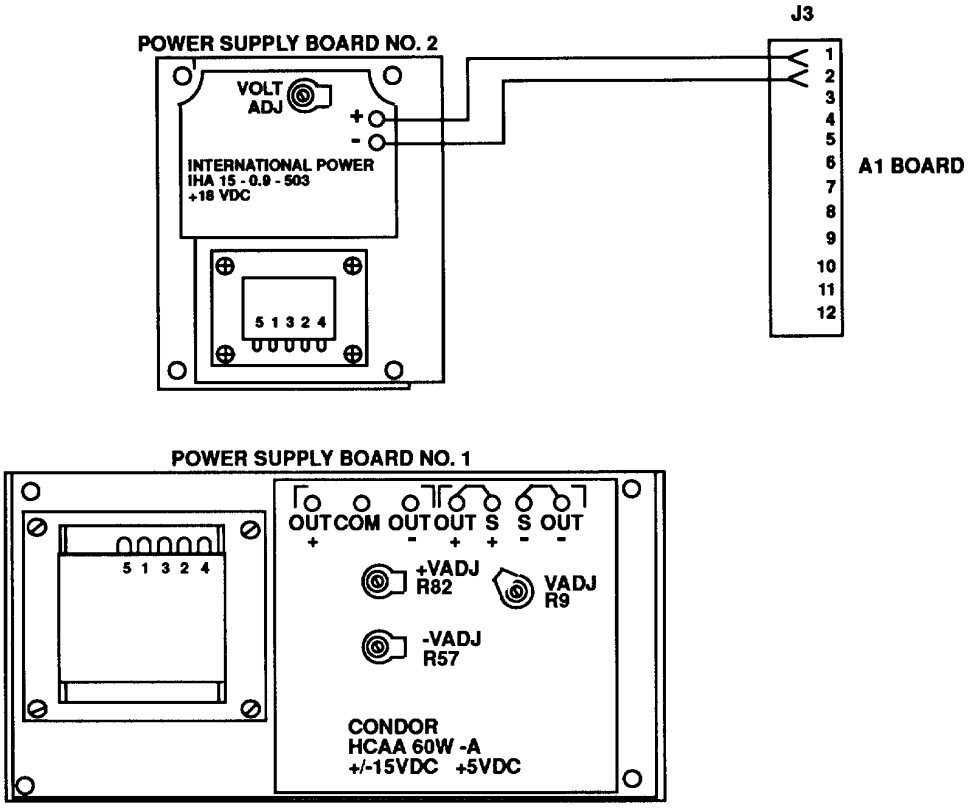

Figure 4. Test instrument power supply.

(2) Digital multimeter will indicate between +4.95 and +5.05 V dc; if not, perform b(l) below.

(3) Measure the +15 V power supply with the digital multimeter by connecting the + (positive) lead to the +OUT terminal and the -(negative) lead to the COM terminal on POWER SUPPLY BOARD NO. 1 (fig. 4).

(4) Digital multimeter will indicate between +14.95 and +15.05 V dc; if not, perform b(2) below.

(5) Measure the -15 V power supply with the digital multimeter by connecting the + (positive) lead to the -OUT terminal and the -(negative) lead to the COM terminal on POWER SUPPLY BOARD NO. 1 (fig. 4)

(6) Digital multimeter will indicate between -14.95 and -15.05 V dc; if not, perform b(3) below.

(7) Measure the +18 V power supply with the digital multimeter by connecting the + (positive) lead to pin 1 and the - (negative) lead to pin 2 of J3 (fig. 1) on the Al board.

(8) Digital multimeter will indicate between +17.90 and +18.10 V dc; if not, perform b(4) below.

(9) Measure the excitation voltage with the digital multimeter by connecting the + (positive) lead to the left side of R2 when facing the front of TI and the - (negative) lead to the -(negative) side of C80 (fig. 1) on the A1 board.

(10) Digital multimeter will indicate approximately +15.0000 V dc. Record this voltage to 4 decimal places.

(11) Multiply the voltage in (10) above by 1.7 then divide the results by 15. The resulting voltage should be approximately 1.70000 V dc. Record this voltage to 5 decimal places.

(12) Measure the 15-bit A/D converter reference voltage with the digital multimeter by connecting the + (positive) lead to the front end of R19 (fig. 1) and the - (negative) lead to the AGND (fig. 1) on the Al board. Record this voltage to 5 decimal places.

(13) The voltage measured in (12) above should be equal to the voltage calculated in (11) above; if not, perform **b(5)** below and record the final voltage to 5 decimal places.

(14) Set the **MODE** switch to select the **DYNAMIC** mode.

(15) Measure the excitation voltage with the digital multimeter by connecting the + (positive) lead to the left side of R2 (fig. 1) when facing the front of the TI and the - (negative) lead to the - (negative) side of C80 (fig. 1) on the A1 board.

(16) Digital multimeter will indicate approximately +15.0000 V dc. Record this voltage to 4 decimal places.

(17) Multiply the voltage measured in (16) above by 10 then divide the results by 15. The resulting voltage should be approximately 10.0000 V dc. Record this voltage to 4 decimal places.

(18) Measure the 11 bit A/D converter reference voltage by connecting the digital multimeter + (positive) lead to pin 6 of U7 (fig. 1) and the - (negative) lead to the - (negative) side of C80 (fig. 1). Record this voltage to 4 decimal places.

(19) The voltage measured in (18) above should equal the voltage calculated in (17) above; if not, perform **b**(6) below. Record this voltage to 4 decimal places.

(20) Set the **MODE** switch to **STATIC.** Press and release 0 key. The message Enter **Cal Mode Num!** should be displayed.

(21) Press **2** key to ground the input of the amplifier. A flashing **C** will be displayed. This indicates that the calibration mode is active.

(22) Repeatedly press and release the down arrow key until the displayed units are **Unc Avg.**

(23) Display will flicker between ±0; if not, perform b(7) below.

(24) With the digital multimeter measure the voltage between AGND (fig. 1) and jumper R9 (fig. 1) by connecting the + (positive) lead to jumper R9 and the - (negative) lead to the AGND pad. This voltage should be close to 0 V do. Record this voltage.

(25) With the digital multimeter measure the voltage between U8 (fig. 1) pin 5 and AGND (fig. 1) by connecting the + (positive) lead to U8 pin 5 and the - (negative) lead to the AGND pad.

(26) Digital multimeter will indicate the same voltage as measured in (24) above; if not, perform b(8) below.

(27) Press 0 key to deactivate the calibration mode.

(28) Press 0 key to activate the calibration mode; the message Enter **Cal Mode Num!** should be displayed.

(29) Press **5** key to read the strain gage simulator input signal. A flashing **C** should be displayed in the leftmost display segment. This indicates the calibration mode is active.

(30) Set the strain gage simulator to 0 percent and the polarity switch to the + (positive) position.

(31) Press the **ZERO** pushbutton to perform an auto gain/auto zero.

(32) Select the **Unc Avg** display units.

(33) Set the **MODE** switch for **STATIC.**

(34) Set the strain gage simulator to +100 percent. Record the reading on the TI; the reading should be approximately 25,835.

(35) Set the strain gage simulator polarity switch to the - (negative) position. Record the reading on the TI; the reading should be approximately -25,835.

(36) Multiply each of these readings by 0.0425 and record these numbers as +D.R. and -D.R. Set strain gage simulator to 0%.

(37) Set the **MODE** switch to **DYNAMIC.** Set strain gage simulator to 100%.

(38) Adjust R16 (fig. 1) to obtain the -D.R. value.

(39) Set the strain gage simulator polarity switch to the + (positive) position.

(40) Adjust R15 (fig. 1) to obtain the +D.R. value.

NOTE

These two adjustments are interactive and several iterations will be necessary to obtain the two desired values.

(41) Select the mV/V display units.

(42) Set the strain gage simulator to 0 percent.

(43) Press the **ZERO** pushbutton to perform an auto gain/auto zero.

(44) Compare the readings for +100 percent and -100 percent strain gage simulator settings for both the static and dynamic modes. The dynamic mode readings should be within ±.0075 mV/V of the static mode readings.

(45) Press **0** key to deactivate the calibration mode.

(46) Repeat **8a(1)** through (11) above.

b. Adjustments

(1) Adjust VADJ R9 (fig. 4) for a +5.00 V dc indication on digital multimeter.

(2) Adjust +VADJ R82 (fig. 4) for a **+**15.00 V dc indication on digital multimeter.

(3) Adjust-VADJ R57(fig. 4) for a -15.00V dc indication on digital multimeter.

(4) Adjust VOLT ADJ potentiometer on POWER SUPPLY BOARD NO. 2 (fig. 4) for a +18.00 V dc indication on digital multimeter.

(5) Adjust R21 (fig. 1) as necessary.

(6) Adjust R12 (fig. 1) as necessary.

(7) Adjust R8 (fig. 1) until display alternates as close as possible to ±0.

(8) Adjust R14 (fig. 1) to make this voltage as close as possible to the voltage measured at jumper R9 (fig. 1).

10. Final Procedure

a. Deenergize and disconnect all equipment.

b. Annotate and affix DA Label/Form in accordance with TB 750-25.

TB 9-6695-298-35

By Order of the Secretary of the Army:

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General, United States Army
Chief of Staff

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Secretary of the Army
06105

Distribution:

To be distributed in accordance with DA Form 12-34-E, Block No. 4484, requirements for calibration procedure TB 9-6695-298-35.