

# \*TB 1-4920-444-24

DEPARTMENT OF THE ARMY TECHNICAL BULLETIN

## CALIBRATION PROCEDURE FOR DC400 DIGITAL FUEL QUANTITY TEST SET, BARFIELD, P/N102-00805 (NSN 4920-01-208-3635)

Headquarters, Department of the Army, Washington, DC

5 August 2008

*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, 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](mailto: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.

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\*This bulletin supersedes TB 1-4920-444-35, dated 29 February 1988, including all changes.

**SECTION I  
IDENTIFICATION AND DESCRIPTION**

**1. Test Instrument Identification.** This bulletin provides instructions for the calibration of DC Digital Fuel Quantity Test Set, Barfield, P/N 102-00805 (NSN 4920-01-208-3635). 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 1 hour, 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
Power requirement	9 Vdc ±0.1V
LO + BAT Warning	Range: 6.8 Vdc Accuracy: ±0.1V
Oscillator Frequency/Voltage	Range: 6 kHz Accuracy: ±50 Hz Range: 20 Vac Accuracy: ±0.3V
Reference Voltage	Range: 1.0 Vdc Accuracy: ±0.002 V
Capacitance	Range: 200 pF Accuracy: ±0.3 pF Range: 1000 pF Accuracy: ±2.0 pF
Meter Zero Offset	Range: 0 V Accuracy: ±0.1 mV
Monitor/lbs	Range: 1534 lbs Accuracy: ±3 lbs
Monitor/volts	Range: 19.9 Vdc Accuracy: ±0.03 V
Liquid Level Dry	Range: 4.5 Vdc Accuracy: ±5.0%
Liquid Level Wet	Range: 2.1 Vdc Accuracy: ±5.0%
Capacitance Ref	Range: 100 pF Accuracy: ±0.3 pF

## 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. 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 required for this calibration are common usage accessories, issued as indicated in paragraph 4 above, and are not listed in this calibration procedure. The following peculiar accessory is required for this calibration: DC Power Supply, Elgar, model DCS40-30EM10.

Table 2. Minimum Specifications of Equipment Required

Common name	Minimum use specifications	Manufacturer and model (part number)
CALIBRATOR	Range: 1.0 Vdc Accuracy: $\pm 0.05\%$	Fluke, Model 5720A (5720A) (p/o MIS-35947)
CAPACITOR STANDARD/ ADAPTER BOX	Range: pF value on name plate Accuracy: $\pm 0.075\%$	Barfield / P/N101-00816
FREQUENCY COUNTER	Range: 6 kHz Accuracy: $\pm 10$ Hz	Fluke, Model PM6681/656 (PM6681/656)
MULTIMETER	Range: 19.7 to 20.3 Vac Accuracy: $\pm 0.38\%$ Range: 0 to 19.9 Vdc Accuracy: $\pm 0.038\%$	Hewlett Packard, Model 3458A (3458A)
RESISTANCE STANDARD	Range: 470 $\Omega$ Accuracy: $\pm 1.0\%$	Biddle-Gray, Model 71-631 (7910328)

## 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 in the manufacturers' manuals for this TI.

d. 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 TI power switch to **OFF**.

b. Remove TI adapter module and DC digital fuel quantity test set from case by removing 3 screws on top panel.

c. Disconnect battery from TI.

d. Connect DC power supply to TI battery terminals. Use multimeter to monitor DC power supply output.

e. Adjust DC power supply output for a 9 Vdc  $\pm$ 0.1 Vdc on multimeter.

f. Set DC power supply to off.

## **8. LO-BAT Warning Check**

### **a. Performance Check**

(1) Set TI power to **ON**.

(2) Set DC power supply to **ON**.

(3) Decrease the output of the DC power supply until **LO-BAT** legend just starts to appear on TI digital indicator. Multimeter will indicate between 6.7 and 6.9 Vdc. If not, perform **b** below.

(4) Readjust DC power supply for a 9 Vdc indication on multimeter.

### **b. Adjustment**

(1) Adjust DC power supply for a 6.8 Vdc indication on multimeter.

(2) Adjust P1 and PCB2 board (fig. 1) until the LO-BAT legend just starts to appear on TI digital indicator.

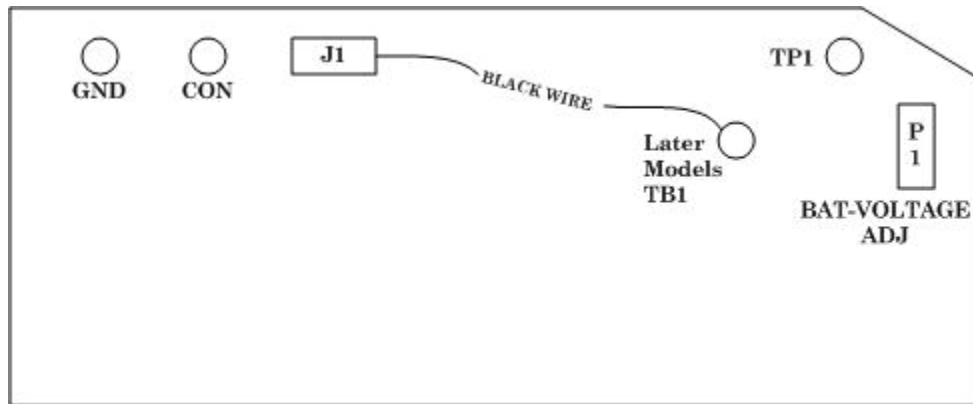


Figure 1. PCB2 Board adjustments.

## 9. Oscillator Frequency/Voltage Check

### a. Performance Check

- (1) Position TI controls as listed in (a) through (d) below.
  - (a) **ON/OFF** power switch to **OFF**.
  - (b) **200(pF)-1000(pF)** range selector to **200(pF)**.
  - (c) **TEST FUNCTION** selector to **PROBE(S)**.
  - (d) **CAP SIM(pF)** 10's and 100's thumbwheels to **Blank** and **0**.
- (2) Using an X10 attenuator, connect frequency counter to TI LZ (+) and COM (-) on PCB1 board (fig. 2).
- (3) Set DC power supply and TI power to **ON**.
- (4) Depress and hold TI **PRESS TO READ CAP(pF)** pushbutton. Frequency counter will indicate  $6 \text{ kHz} \pm 50\text{Hz}$ . If not, perform **b** (1) below. Release TI **PRESS TO READ CAP(pF)** pushbutton.
- (5) Set TI **ON/OFF** switch to **OFF**.
- (6) Set DC power supply to **OFF**.
- (7) Disconnect frequency counter from set-up.
- (8) Connect multimeter to TI L-Z (+) and COM (-) on PCB1 board (fig. 2).
- (9) Set DC power supply to **ON** and TI **ON/OFF** switch to **ON**.
- (10) Depress and hold TI **PRESS TO READ CAP(pF)** pushbutton. Multimeter will indicate  $6 \text{ kHz} \pm 50\text{Hz}$ . If not, perform **b** (2) below. Release TI **PRESS TO READ CAP(pF)** pushbutton.
- (11) Set test equipment power to off. Disconnect multimeter from set-up.

### b. Adjustments

- (1) Depress and hold TI **PRESS TO READ CAP(pF)** pushbutton and adjust P1 on PCB1 board, (fig. 2), for 6 kHz on frequency counter.

(2) Depress and hold TI **PRESS TO READ CAP(pF)** pushbutton and adjust P3 on PCB1 board, (fig. 2), for 20 Vac on multimeter.

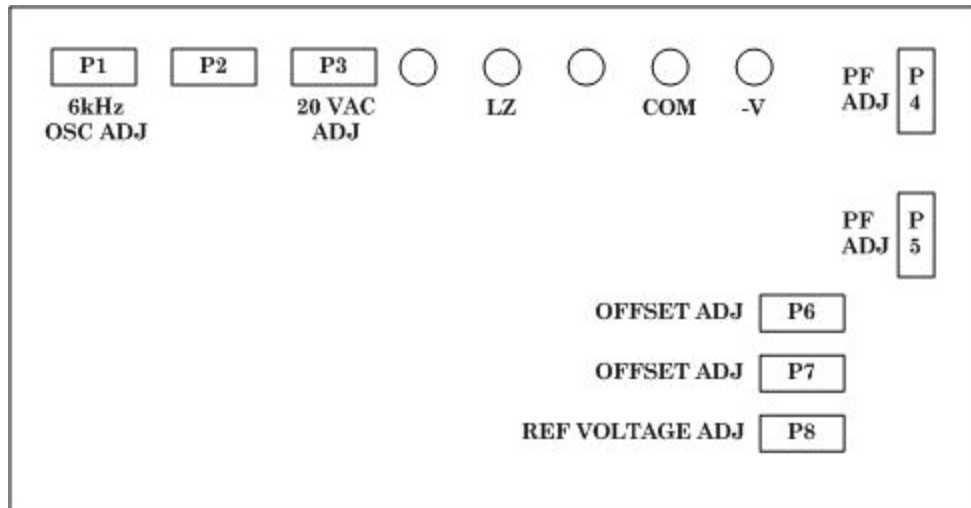


Figure 2. PCB1 board adjustments.

## 10. Digital Indicator Zero Check

### a. Performance Check

- (1) Set TI power to **ON**.
- (2) Set **200(pF)-1000(pF)** range selector to **200(pF)**.
- (3) Depress and hold TI **PRESS TO READ(pF)** pushbutton. TI digital indicator will indicate 0.00. If not, perform **b** (1) and (2) below.
- (4) Set **200(pF)-1000(pF)** range selector to **1000(pF)**.
- (5) Depress and hold TI **PRESS TO READ(pF)** pushbutton. TI digital indicator will indicate 000. If not, perform **b** (3) and (4) below.
- (6) Set TI power to **OFF**.

### b. Adjustments

- (1) Connect multimeter positive input to junction of R17, R18 and C20 and negative input to COM on PCB1 board (fig. 2).
- (2) Set TI and DC power supply to **ON**. Adjust P4 on PCB1 board (fig. 2) for 0 volts  $\pm$  0.0001V on multimeter.
- (3) Repeat technique of **b** (1) above with multimeter positive input connected to junction of R19 and C21 and negative input connected to COM on PCB1 board (fig. 2).
- (4) Repeat technique of **b** (2) above using adjustment P5 on PCB1 board (fig. 2) for 0 volts  $\pm$  0.0001V on multimeter.

## 11. Reference Voltage

### a. Performance Check

- (1) Connect multimeter positive input to TP1 and negative input to COM on PCB2 board as shown in fig. 1. (Substitute TB1 for TP1 on some later models).
- (2) Set DC power supply to **ON**.
- (3) Set TI **ON/OFF** power switch to **ON**.
- (4) Multimeter will indicate 1.0 Vdc  $\pm$  0.002 V. If not, perform **b** below.
- (5) Set test equipment power to off. Disconnect multimeter from TI.

**b. Adjustments.** Adjust P8 on PCB1 board (fig. 2) for 1.0 Vdc on multimeter.

## 12. 200(pF)-1000(pF) Check

### a. Performance Check

- (1) Disconnect adapter module from DC digital fuel quantity module and remove ribbon connector from TI adapter module.
- (2) Connect capacitance standard/adapter box to the DC digital fuel quantity module and set **200(pF) -1000(pF)** switch to **200(pF)**.
- (3) Connect calibrator to **1V** input jacks on capacitance standard/adapter box and set calibrator for 1 Vdc output.
- (4) Set capacitance standard/adapter box to **RANGE** position.
- (5) Set TI and DC power supply to **ON**.
- (6) Depress and hold TI **PRESS TO READ CAP(pF)** pushbutton. TI digital indicator will indicate between 99.7 and 100.3(pF). If not, perform **b** (1) below.
- (7) Release TI **PRESS TO READ CAP(pF)** pushbutton.
- (8) Set TI **200(pF) -1000(pF)** switch to **1000(pF)**.
- (9) Depress and hold TI **PRESS TO READ CAP(pF)** pushbutton. TI digital indicator will indicate between 98.0 and 102.0(pF). If not, perform **b** (2) below.
- (10) Release TI **PRESS TO READ CAP(pF)** pushbutton.
- (11) Set test equipment power to **OFF** and disconnect capacitance standard/adapter box from TI DC digital fuel quantity module.
- (12) Reconnect DC digital fuel quantity module ribbon connector to adapter module.

### b. Adjustments

- (1) Depress and hold **PRESS TO READ CAP(pF)** pushbutton and adjust P6 on PCB1 board (fig. 2) for 100pF on TI digital indicator.
- (2) Depress and hold **PRESS TO READ CAP(pF)** pushbutton and adjust P7 on PCB1 board (fig. 2) for 100pF on TI digital indicator.

### 13. Monitor/Liquid Level

#### a. Performance Check

- (1) Position TI controls as listed in (a) through (d) below.
  - (a) **ON/OFF** power switch to **OFF**.
  - (b) **TEST FUNCTION** selector to **PROBE(S)**.
  - (c) **MONITOR** to **lbs.**
  - (d) **LIQUID LEVEL** to **NORM.**
- (2) Disconnect DC power supply and reconnect 9 V battery in case of TI.
- (3) Connect equipment as shown in fig. 3.

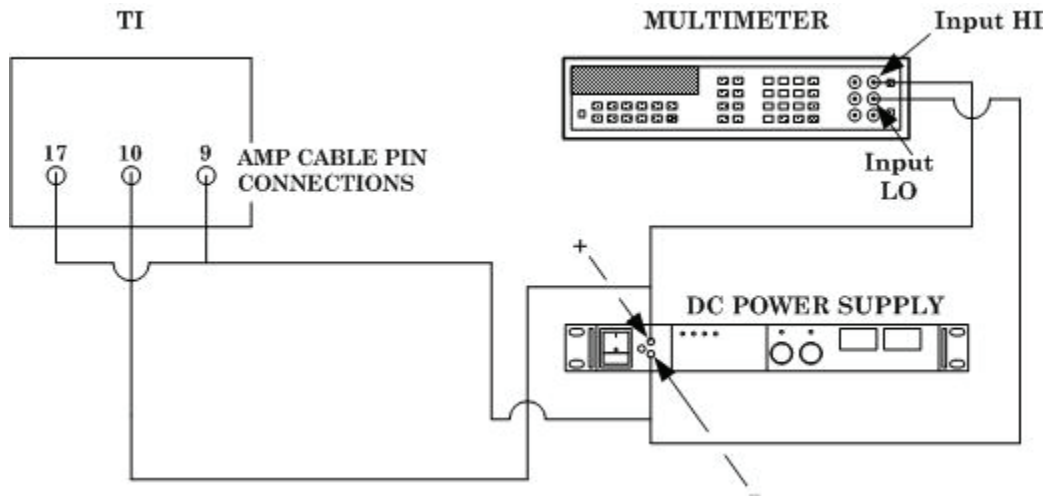


Figure 3. Monitor (LBS) and (VOLTS) equipment setup.

- (4) Adjust DC power supply for 10 Vdc on multimeter.
- (5) Set TI power to **ON**.
- (6) TI digital indicator will indicate between 1531 and 1537 lbs. If not, perform **b** below.
- (7) Set TI and DC power supply to **OFF**.

#### b. Adjustments

- (1) Remove TI adapter module case for access to P2 adjustment.
- (2) Adjust P2 on adapter module printed circuit board, (fig. 6), for a display of 1534 lbs on TI digital indicator.

### 14. Monitor/Volts

#### a. Performance Check

- (1) Set **MONITOR** switch to **VOLTS**.
- (2) Adjust DC power supply for 19.90 volts on multimeter.
- (3) Set TI power switch to **ON**.



(4) TI digital indicator will indicate between 19.87 and 19.93 volts. If not, perform **b** below.

(5) Set TI power switch to **OFF** and disconnect DC power supply leads from TI AMP connector pins 9 and 10.

(6) Connect equipment as shown in fig. 4, and adjust resistance standard to 470 ohms.

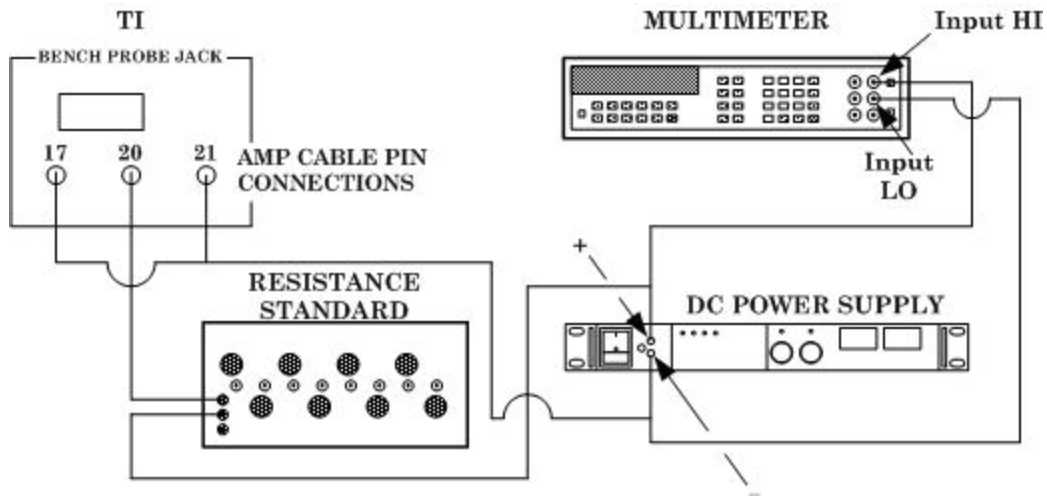


Figure 4. Monitoring (THERM) equipment setup.

(7) Set **MONITOR/LIQUID LEVEL** switch to **WET** and **MONITOR** switch to **THERM**.

(8) Set TI power to **ON**.

(9) Adjust DC power supply for 28 volts on multimeter. TI digital indicator will indicate between 4.20 and 4.70 Vdc.

(10) Turn TI **MONITOR/LIQUID LEVEL** switch from **WET** to **DRY**. TI digital indicator will indicate between 1.90 and 2.20 Vdc.

(11) Set TI and DC power supply to **OFF**.

(12) Disconnect TI from test equipment.

### **b. Adjustments**

(1) Remove TI adapter module case for access to P1 adjustment if not previously removed in paragraph **13 b**.

(2) Adjust P1 on adapter module printed circuit board (fig. 6) for a display of 19.90 Vdc on digital indicator.

## **15. CAP Ref Cal**

### **a. Performance Check**

(1) Connect equipment with capacitor standard/adapter box as shown in fig. 5.

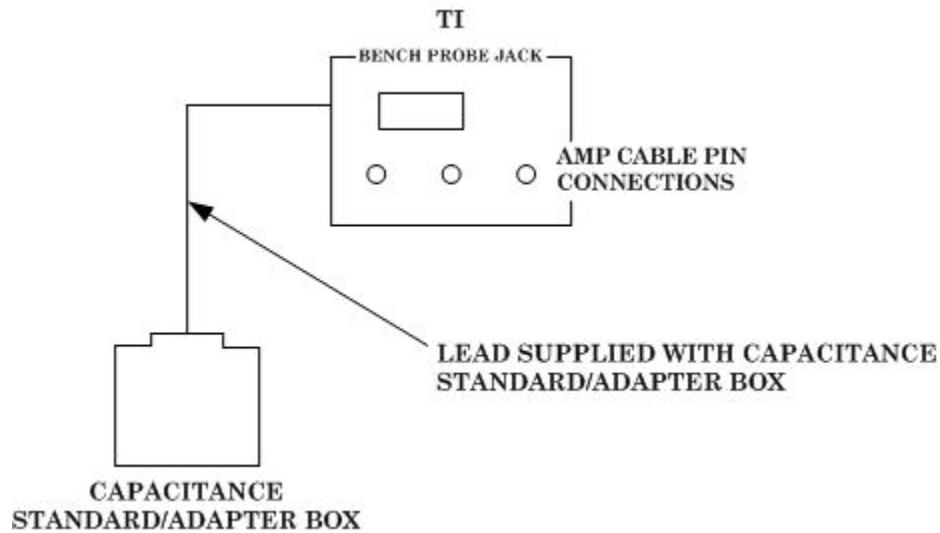


Figure 5. Monitoring capacitance (PF) equipment setup.

- (2) Position TI controls as listed in (a) through (d) below.
    - (a) **TEST FUNCTION** selector to **PROBE(S)**.
    - (b) **200(pF)-1000(pF)** switch to **200(pF)**.
    - (c) Power switch to **ON**.
    - (d) Depress and hold **PRESS TO READ CAP(pF)** pushbutton.
  - (3) TI digital indicator will indicate value of capacitor standard/adapter box within  $\pm 0.3\text{pf}$ . If not, perform **b** below.
  - (4) Set **200(pF)-1000(pF)** switch to **1000(pF)**.
  - (5) Depress and hold **PRESS TO READ CAP(pF)** pushbutton.
  - (6) TI digital indicator will indicate value of capacitor standard/adapter box within  $\pm 2.0\text{pf}$ .
  - (7) Set TI power switch to **OFF**.
  - (8) Disconnect capacitor standard/adapter box leads from TI bench test probe receptacle.
- b. Adjustments.** Adjust capacitor C2 on adapter module circuit board, (fig. 6), for (pf) value of capacitor standard/adapter box on TI digital indicator.

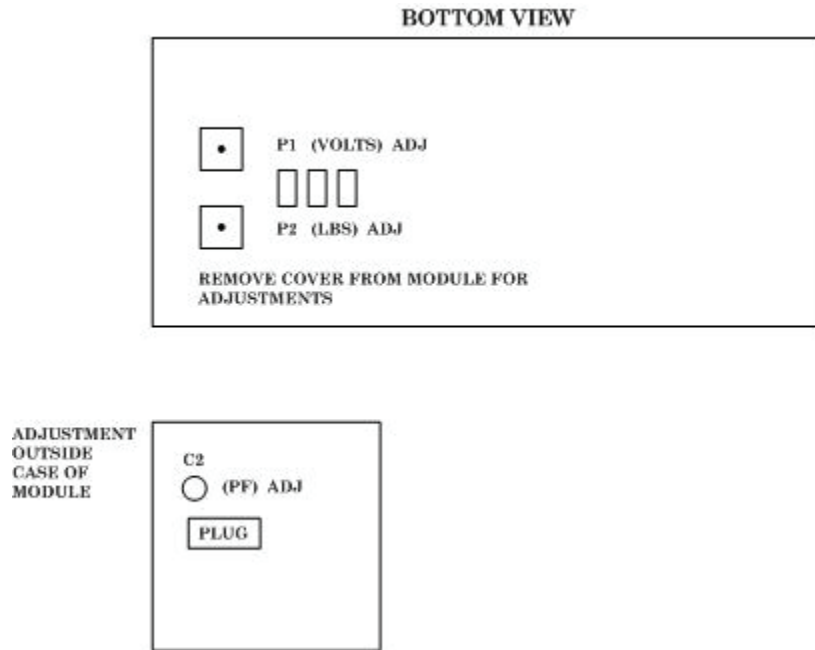


Figure 6. Adapter module monitor (LBS), (VOLTS) and (PF) adjustments.

## 16. Final Procedure

- a. Deenergize and disconnect all equipment and reinstall TI protective cover.
- b. Annotate and affix DA label/form in accordance with TB 750-25.



By Order of the Secretary of the Army:

Official:



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*Administrative Assistant to the  
Secretary of the Army*

0816402

GEORGE W. CASEY, JR.  
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From: "Whomever" [whomever@redstone.army.mil](mailto: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.







