*TB 9-6625-2204-35

DEPARTMENT OF THE ARMY TECHNICAL BULLETIN

CALIBRATION PROCEDURE FOR TRANSPONDER TEST SET, AN/APM-239A (INCLUDING TRANSPONDER SET TEST SET TS-2681/APM-239A AND MULTIMETER ME-358/APM-239A)

Headquarters, Department of the Army, Washington, DC
5 April 2005

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.

*This bulletin supersedes TB 9-6625-2204-35, dated 24 June 1988, including all changes.

SECTION I
IDENTIFICATION AND DESCRIPTION

1. Test Instrument Identification. This bulletin provides instructions for the calibration of Transponder Test Set, AN/APM-239A (including Transponder Set Test Set TS-2681/APM-239A and Multimeter ME-358/APM-239A). TM 116625-842-15 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 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
Voltmeter	Range: 0 to 150 V ac 0 to 50 V dc Accuracy: ± 4% FS
Ammeter	Range: 0 to 2 A ac 0 to 10 A dc Accuracy: ± 4% FS
Pulse characteristics	Amplitude: 5 V ± 0.5 V Width: 0.5 µs ± 0.05 µs Rise time: ≤ 0.1 µs Delay: ≤ 0.25 µs Negative overshoot: ≤ 1.5 V
Output voltage	Range: 20 V dc Accuracy: ± 1.5 V dc
MULTIMETER	
Dc voltage	Range: 10 to 30 V Accuracy: ± 4% FS
Ac voltage	Range: 10 V Accuracy: ± 5% FS
Dc current	Range: 5 to 10 mA Accuracy: ± 4% FS

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. 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 listed in table 3 are locally procured items which are used in this calibration procedure. Interconnecting leads and adapters used in this procedure are issued with Secondary Calibration Standards Set AN/GSM-286.

Table 2. Minimum Specifications of Equipment Required

Common name	Minimum use specifications	Manufacturer and model (part number)
MULTIMETER	Range: 1 to 30.2 V dc 106 to 124 V ac Accuracy: ± 1% Range: 3Ω to 120Ω Accuracy: ± 0.5%	Fluke, Model 8840A/AF05 (AN/GSM-64D)
CALIBRATOR	Range: 9.6 to 31.2 V dc 4.6 to 10.5 mA dc 9.5 to 10.5 V ac Accuracy: ± 1%	Fluke, Model 5720A (5700A/EP) (p/o MIS-35947); w amplifier, Fluke 5725A/AR (5725A/AR)
OSCILLOSCOPE	Range: 4.5 to 5.5 V 0.1 to 5.5 μs Accuracy: ± 3%	(OS 303/G)
PULSE GENERATOR	Range: Frequency: 1 kHz Width: 0.5 μs Amplitude: 5.0 V	LeCroy, Model 9210 (9210) w/plug-ins, LeCroy, Models 9211 (9211) and 9215 (9215) (MIS 45839)

Table 3. Accessories Required

Common name	Description (part number)
RESISTOR	92 Ω, (Nominal) 12 to 15 W (NSN 5905-00-729-0434 or 5905-00-852-1570 or 5905-00-141-1305)
RESISTOR[1]	39 Ω, 91 W (NSN 5905-00-969-6813)
RESISTOR[2]	16 Ω, 68 W (NSN 5905-00-500-9792)
RESISTOR	160 Ω, 10 W (NSN 5905-00-853-8737)
RESISTOR	4700 Ω, 5 W (NSN 5905-00-926-0493)
RESISTOR	0.1 Ω, 5 W (NSN 5905-00-781-5486 or 5905-01-068-9281)

[1]Three required.
[2]Four required.

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 bulletin before beginning the calibration.

b. Items of equipment used in this procedure are referenced within the text by common name in tables 2 and 3.

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 TM 11-6625-842-15 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 step within the performance check where applicable.

a. Mechanically zero TI panel meters if required.

b. Set **6 AMP POWER** circuit breaker to **OFF** and connect TI to 115 V ac, 400 Hz, using cable W3 (P/0 TI).

c. Construct test loads as shown in figure 1A and B.

d. Using multimeter, measure resistance value of ac load (fig. 1A). If resistance value exceeds 117.8 Ω, add 4700 Ω, resistor as shown in figure 1A.

e. Repeat d above for dc load (fig. 1B). If resistance value exceeds 4.l Ω, add 160 Ω resistor as shown in figure 1B. If dc load is less than 3.9 Ω, add 0.1 Ω resistor as shown in figure 1B.

f. Connect one end of ac load (fig. 1A) to **TRANSPONDER** J2 pin C15 (fig. 2), using appropriate lead. Connect other end of ac load to **TRANSPONDER** J2 pins C14 and C13 (fig. 2), using appropriate leads.

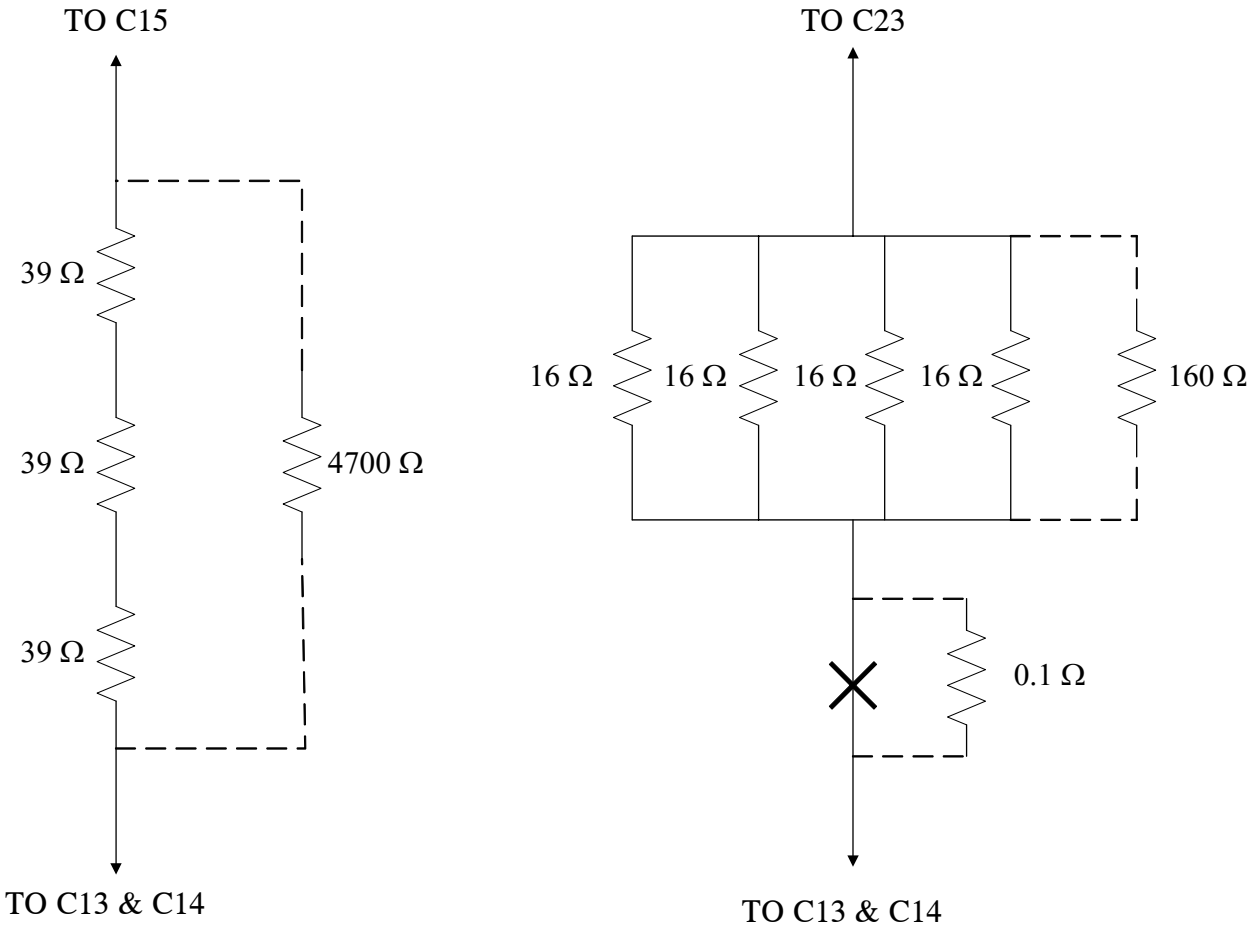

Figure 1. Test loads - construction diagram.

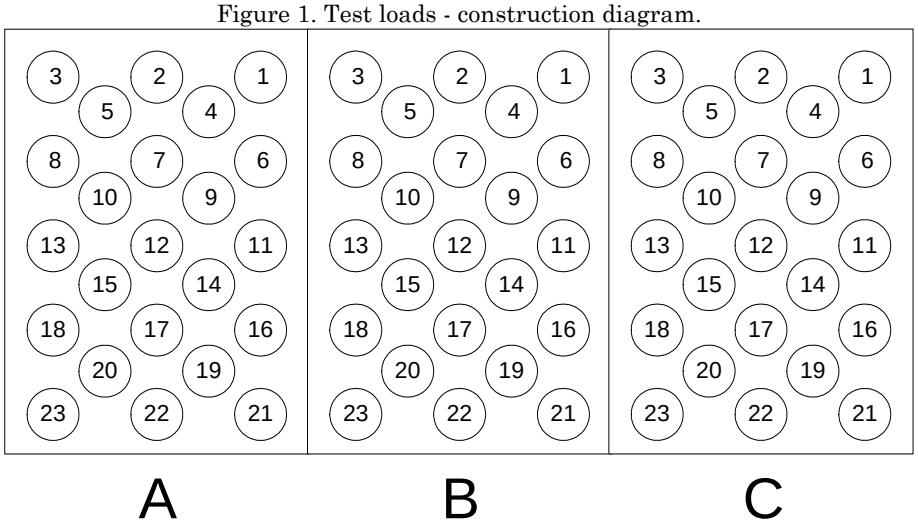

Figure 2. Transponder J2 - pin locations.

g. Connect multimeter across ac load, common lead (-) to C13 (fig. 1A) side and positive (+) to C15 (fig. 1A) side of load. Set multimeter controls to measure AC V.

h. Remove jumper plug P5 from **MODE C ENCODER** J5.

8. Meter and Output Voltage Accuracy

a. Performance Check

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

(a) **AC CONTROL** fully ccw.
(b) **DC CONTROL** fully ccw.
(c) **METER SELECT** switch to **AC**.
(d) **POWER MODE** switch to **AC/DC**.
(e) **ALTITUDE DIGITIZER** switch to **IN**.
(f) **X PULSE** switch to **OFF**.
(g) **PANEL LIGHTS** switch to **OFF**.
(h) **TEST CONDITION** switch to **OHMS**.
(i) **MODE 4 LDG GR** switch to **UP**.
(j) **MODE 4 ZEROIZE** switch to **OFF**.
(k) **MODE 4 REPLY/INTERRUPT** switch to **REPLY**.
(l) **DC 4 DISPARITY/INTERRUPT** switch to **DISPARITY**.
(m) All **MODE C ENCODER SIMULATOR** switches (**C1, A1, C2, A2, C4, A4, B1, B2, D2, B4,** and **D4 IDENT**) to **ON**.

(2) Set **6 AMP POWER** circuit breaker to **ON**. Adjust **AC CONTROL** from a 115 V ac indication on TI voltmeter. Multimeter will indicate between 109 and 121 V ac.

(3) Adjust **AC CONTROL** for a 1 A indication on TI ammeter. Multimeter will indicate between 106 and 124 V ac.

(4) Set **AC CONTROL** fully ccw and **6 AMP POWER** circuit breaker to **OFF**.

(5) Disconnect ac load and multimeter from TI.

(6) Connect one end of dc load (fig. 1B) to **TRANSPONDER** J2 pin C23, using appropriate lead. Connect other end of dc load to **TRANSPONDER** J2, pins C13 and C14, using appropriate leads.

(7) Connect multimeter across dc load using appropriate leads. Set multimeter to measure DC V.

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

(a) **METER SELECT** switch to **DC**.
(b) **POWER MODE** switch to **DC ONLY**.
(c) **6 AMP POWER** circuit breaker to **ON**.

(9) Adjust **DC CONTROL** for a 28 V dc indication on TI voltmeter. Multimeter will indicate between 26.6 and 29.4 V dc.

(10) Adjust **DC CONTROL** for a 7 A indication on TI ammeter. Multimeter will indicate between 25.8 and 30.2 V dc. Set **DC CONTROL** fully ccw.

(11) Disconnect multimeter and connect oscilloscope to dc load, using appropriate leads.

(12) Adjust **DC CONTROL** for a 28 V dc indication on TI voltmeter.

(13) Using standard measurement technique, measure the ripple voltage with oscilloscope. The ripple voltage as indicated by oscilloscope will not exceed 2 V p-p.

(14) Set **DC CONTROL** fully ccw and set **6 AMP POWER** circuit breaker **OFF**. Disconnect dc load and oscilloscope from TI.

(15) Set **6 AMP POWER** circuit breaker to **ON** and set **TEST CONDITION** switch to **VOLTS.**

(16) Connect multimeter to **MODE C ENCODER** J5 pin s and chassis ground, using appropriate leads.

(17) Adjust **DC CONTROL** for a 28 V dc indication on TI voltmeter. Multimeter will indicate between 1 and 2 V dc.

(18) Set all **MODE C ENCODER SIMULATOR** switches to **OFF**.

(19) Multimeter will indicate between 18.5 and 21.5 V dc.

(20) Disconnect multimeter from pin s and connect to pins g, b, f, m, p, J, L, P, T, and F respectively. Multimeter will indicate as specified in (19) above for each pin.

(21) Set **DC CONTROL** fully ccw and **6 AMP POWER** circuit breaker **OFF.**

b. Adjustments. No adjustments can be made

9. Pulse Characteristics

a. Performance Check

(1) Connect equipment as shown in figure 3.

(2) Set pulse generator controls for a positive (+) pulse output at a **1** kHz rate.

(3) Adjust pulse generator controls for a 0.5 μs pulse 10 V in amplitude as indicated on oscilloscope **CH 2.**

(4) Set **6 AMP POWER** circuit breaker to **ON** and adjust **DC CONTROL** for a 28 V dc indication on TI voltmeter.

(5) Using standard measurement techniques, measure the pulse characteristics listed in table 4 for the **REPLY** pulse on **CH 1** of oscilloscope. Indications as observed on oscilloscope will be as specified in table 4.

Table 4. Reply Pulse Characteristics

Pulse characteristics	Indication as observed on oscilloscope
Amplitude	4.5 to 5.5 V
Width	0. 45 to 0. 55 μs
Rise time	≤ 0.1 μs
Delay	≤ 0.25 μs
Negative overshoot	≤ 1.5 V

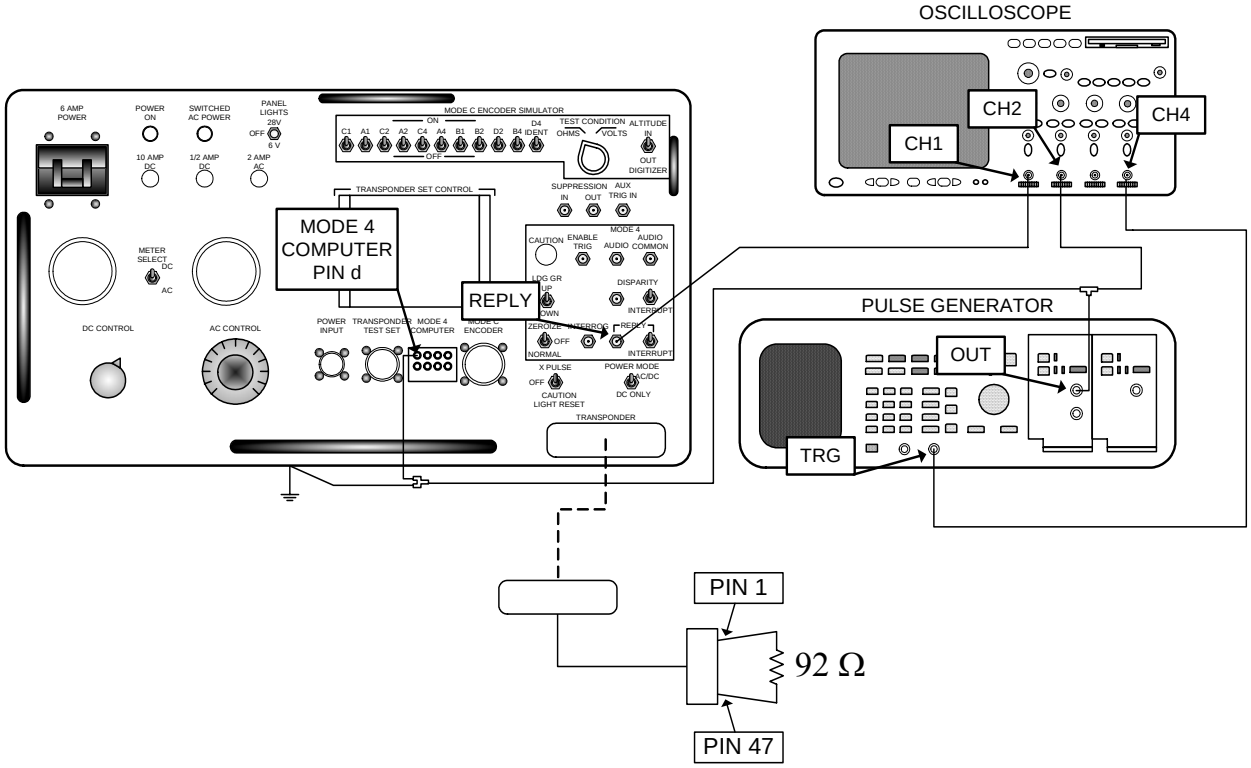

Figure 3. Pulse characteristics - equipment setup.

(6) Set **DC CONTROL** fully ccw and **6 AMP POWER** circuit breaker **OFF**.

(7) Reinstall jumper plug P5 removed in **7 h** above.

b. Adjustments. No adjustments can be made.

NOTE

Multimeter ME-358/APM-239A is not supplied with all Transponder Set Test Sets AN/APM-239A. Perform paragraph 10 only if applicable.

10. Multimeter Accuracy

a. Performance Check

(1) Connect calibrator positive (+) output terminal to multimeter (ME-358/APM-239A) connector J1 pin B, using appropriate lead. Connect calibrator negative (-) output terminal to multimeter connector J1 pin M, using appropriate lead.

(2) Set multimeter function switch to **MOD BIAS (25 VDC).** Adjust calibrator output controls for a 30 V dc indication on multimeter.

(3) Calibrator will indicate between 28.8 and 31.2 V dc.

(4) Adjust calibrator output controls for a 20 V dc indication on multimeter. Calibrator will indicate between 18.8 and 21.2 V dc.

(5) Set calibrator controls for a 0.0 V output and move lead from multimeter J1 pin B to pin P.

(6) Set multimeter function switch to **+6 VDC** and adjust calibrator for a 10 V dc indication on multimeter. Calibrator will indicate between 9.6 and 10.4 V dc.

(7) Set calibrator controls for a 0.0 V output and set multimeter function switch to **6.3 VAC.**

(8) Move lead from multimeter J1 pin P to pin D. Adjust calibrator controls for 400 Hz and a 10 V ac indication on multimeter. Calibrator will indicate between 9.5 and 10.5 V ac.

(9) Set calibrator controls for a 0.0 V output and set multimeter function switch to **XTAL CUR MA DC.**

(10) Move lead from multimeter J1 pin D to pin F. Adjust calibrator controls for a 10 mA dc indication on multimeter. Calibrator will indicate between 9.6 and 10.4 mA dc.

(11) Adjust calibrator controls for a 5 mA dc indication on multimeter. Calibrator will indicate between 4.6 and 5.4 mA dc.

b. Adjustments. No adjustments can be made.

11. 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:

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

Official

SANDRA R. RILEY
Administrative Assistant to the
Secretary of the Army

0503804

Distribution:

To be distributed in accordance with the initial distribution number (IDN) 342284, requirements for calibration procedure TB 9-6625-2204-35.

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.milT
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.