TM 11-6625-203-35

DEPARTMENT OF THE ARMY TECHNICAL MANUAL

FIELD AND DEPOT MAINTENANCE

MULTIMETER AN/URM-105

INCLUDING MULTIMETER ME-77/U

This reprint includes all changes in effect at the time of publication; changes 1 through 3.

HEADQUARTERS, DEPARTMENT OF THE ARMY

JULY 1959

TECHNICAL MANUAL

Field and Depot Maintenance Manual

MULTIMETER AN/URM-105 INCLUDING MULTIMETER ME-77/U

TM 11-6625-203-35
CHANGES No. 1

HEADQUARTERS,
DEPARTMENT OF THE ARMY
WASHINGTON 25, D.C., *28 August 1961*

TM 11-6625-203-35, 22 July 1959, is changed as follows:

Page 19, chapter 3. Change the heading of chapter 3 to: FOURTH ECHELON TESTING PROCEDURES AND FINAL TESTING

Add section I below the heading of chapter 3:

Section I. FOURTH ECHELON TESTING PROCEDURES

12.1. General

a. Testing procedures are prepared for use by Signal Field Maintenance Shops and Signal Service organizations responsible for fourth echelon maintenance to determine the acceptability of repaired signal equipment. These procedures set forth specific requirements that repaired signal equipment *must* meet before it is returned to the using organization. A summary of the performance standards is given in paragraph 12.8.

b. Each test depends on the preceding one for certain operating procedures and, where applicable, for test equipment calibrations. Comply with the instructions preceding each chart before proceeding to the chart. Perform each test in sequence. *Do not vary the sequence.* For each step, perform all the actions required in the *Test equipment control settings* and *Equipmen: under test control settings* columns; then perform each specific test procedure and verify it against its performance standard.

12.2. Test Equipment and Materials

All test equipment, materials, and other equipment required to perform the testing procedures given in this section are listed in the following chart and are authorized under TA 11–17, Signal Field Maintenance Shops, and TA 11-100 (11-17), Allowance of signal Corps Expendable Supplies for signal Field Maintenance Shops. Continental United States, except as noted.

Nomenclat	Federal stock No.	Reference
Meter Test Set TS-682 (*)/GSM-1[a].	6625-669-0747	TM 11-2535A TM 11-2535B
Resistor,[b] fixed film, 900K ohms ±1% (precision resistor).	5905-655-3687	None
Decade Resistor ZM-16/U and ZM-16A/U[c].	6625-669-0266	TM 11-5102
Battery BA-58/U (2 required).	6135-120-1030	None
Battery BA-261/U (1 required).	6135-160-7159	None

[a] Indicates Meter Test Set TS-682/GSM-1 and TS-682A/GSM-1.
[b] Repair part for Multimeter ME-77/U. Required only if Decade Resistor ZM-16/U is not available.
[c] Decade Resistor TS-679/U can be used in lieu of ZM-16/U or ZM-16A/U.

12.3. Special Requirements

a. The location and labeling of certain controls and test jacks differ on Meter Test Set TS-682A/GSM-1 from those on Meter Test Set TS-682/GSM–1. Reference to controls, control settings, and test jacks in the charts and illustrations apply to Meter Test Set TS-682/GSM-1. If Meter Test Set TS-682A/GSM-1 is used, make connections to corresponding test jacks where physical location is different and to the jack nearest the higher voltage value where a jack of the specified voltage does not exist.

b. To perform the ohmmeter circuit test (par. 12.7), install the dry batteries (par. 12.2) in the ME–77/U under test.

c. When the ohmmeter circuit test (par. 12.7) is performed, several resistance values of a high degree of accuracy are required. Decade Resistor ZM-16/U or ZM-16A/U may be set to each of the resistance values required. However, Decade Resistor TS-679/U has an upper limit of 111,111 ohms, and the precision fixed resistor listed in the chart (par. 12.2) or one of equal accuracy and value must be used in conjunction with the TS 679/U.

12.4. Physical Test and Inspection

a. Test Equipment and Materials.

Battery BA-58/U (2 ea)

Batterv BA-261/U (1 ea)

b. Test Connections and Conditions. Remove the cover from the ME-77/U.

c. Procedure.

Step No.	Test equipment control settings	Equipment under test control settings	Test procedure	Performance standard
1	None	Selector switch: OFF.	*a.* Inspect the ME-77/U for loose or missing screws, washers, or other parts.	*a.* There are no parts missing. All screws are tight.
			b. Inspect the ME-77/U case and cover for cracks, chips, and other damage, and the cover gasket for condition.	*b.* There are no cracks, chips, or other damage of a serious nature in evidence. The cover gasket is in good condition, free from cuts, nicks, or signs of serious deterioration. *Note.* Minor chips, cracks, or mars on the case should not be cause for rejection if they do not impair the operation of the equipment or its waterproof qualities.
			c. Inspect the test leads for condition of the prods and the lead wire.	*c.* The test lead prods are in serviceable condition. The tips are tight in the prod bodies and unbent. Test lead wire is in serviceable condition, free from insulation cuts, abrasions, burns, and broken conductors. Test leads are of proper color (negative black, positive red) and not less than 30 inches long.
			d. If the alligator and electrical clips have been submitted with the ME-77/U under test, inspect them for serviceability.	*d.* The clips are free from damage and fit firmly on the test lead prods.
2	None	Selector switch: OFF.	*a.* Lay the ME-77/U on a horizontal work surface, face up, and note the condition and position of the meter pointer. Adjust meter zero adjustment for zero indication (fig. 8).	*a.* The meter pointer is not bent or otherwise damaged and is directly over the 0 mark at the left edge of the ac and dc volts scale.
			b. Turn the selector switch knob to each of its indicated positions.	*b.* The switch operates smoothly without binding. Switch detent action is positive. The knob is tight on its shaft and properly indexed.
			c. Turn the OHMS ADJ. control knob throughout its limits of travel.	*c.* The control operates smoothly without binding. The knob is tight on its shaft and does not rub the panel.

Step No.	Test equipment control settings	Equipment under test control settings	Test procedure	Performance standard
3	....	Selector switch: OFF.	*a*. Remove the four retaining screws that secure the panel to the case and remove the panel. *b*. Inspect the battery holder clips for signs of corrosion and spring tension. *c*. Inspect the remainder of the exposed components for signs of damage and poor workmanship where repairs have been made. *Note*. Before proceeding to the ohmmeter test (par. 12.7), prepare the ME-77/U for ohms measurement as follows: Install the three dry batteries in the battery holders and replace th panel in the case; secure it with the four retaining screws.	*a*. None. *b*. The battery holder clips are free from corrosion. The clips have sufficient tension to hold the batteries firmly in place. *c*. No damage is evident. Workmanship where repairs have been made is satisfactory.

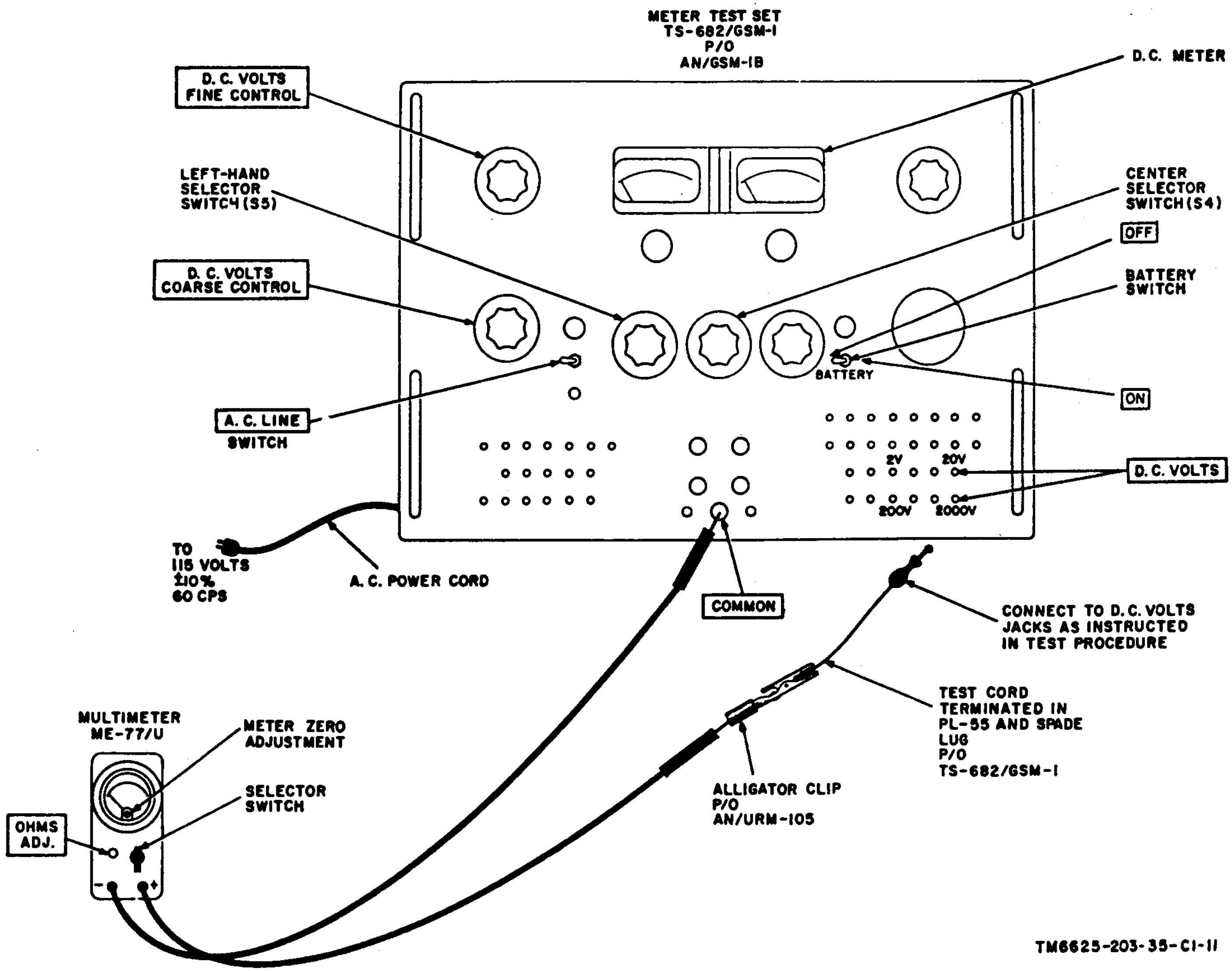

Figure 8. (Added). *Dc voltmeter test.*

12.5. Dc Voltmeter Test

(fig. 8)

a. Test Equipment and Materials.

Meter Test Set TS–682/GSM–1.

b. Test Connections and Conditions. Do *not* connect the ME–77/U positive test lead to the TS–682/GSM–1 until instructed to do so in the test procedure.

c. Procedure.

Step No.	Test equipment control settings	Equipment under test control settings	Test procedure	Performance standard
1	*TS–682/GSM–1* D.C. VOLTS COARSE CONTROL: fully counter-clockwise. D.C. VOLTS FINE CONTROL: midposition. Center selector switch (S4): A.C.V.–D.C.V. Left-hand selector switch (S5): 100 MV D.C. to 400 V.D.C. BATTERY SWITCH: OFF. A.C. LINE SWITCH: ON.	Selector switch: 1 (D.C. VOLTS bracket).	*a.* Connect the equipment as shown in figure 8, with the test cord plugged into the 2V jack of the D.C. VOLTS jacks. *b.* Adjust the TS–682/GSM–1 D.C. VOLTS COARSE CONTROL and D.C. FINE CONTROL for a full scale deflection of the ME–77/U meter pointer (A.C. and D.C. volts scale). *c.* Tap the glass of the TS–682/GSM–1 D.C. meter gently with the fingers (to overcome friction and note the meter indication). ***Caution:* Turn the D.C. VOLTS COARSE CONTROL on the TS–682/GSM–1 fully counterclockwise before proceeding.**	*a.* None. *b.* None. *c.* The indication on the 0–100 scale of the TS–682/GSM–1 D.C. meter must be within the limits 48.5–51.5 (.97 to 1.03 volts).
2	Same as step No. 1	Selector switch: 10 (D.C. VOLTS bracket).	*a.* Connect the test cord plug to the 20V jack of the D.C. VOLTS jacks. *b.* Repeat step No. 1*b* and *c*. ***Caution:* Turn the D.C. VOLTS COARSE CONTROL on the TS–682/GSM–1 fully counterclockwise before proceeding.**	*a.* None. *b.* The indication on the 0–100 scale of the TS–682/GSM–1 D.C. meter must be within 48.5–51.5 (9.7 to 10.3 volts).
3	Same as step No. 1	Selector switch: 100 (D.C. VOLTS bracket).	*a.* Connect the test cord plug to the 200V jack of the D.C. VOLTS jacks. *b.* Repeat step No. 1*b* and *c*. ***Caution:* Turn the D.C. VOLTS COARSE CONTROL on the TS–682/GSM–1 fully counterclockwise before proceeding.**	*a.* None. *b.* The indication on the 0–100 scale of the TS–682/GSM–1 D.C. meter must be within 48.5–51.5 (97 to 103 volts).
4	*TS–682/GSM–1* D.C. VOLTS COARSE CONTROL: fully counterclockwise. D.C. VOLTS FINE CONTROL: midposition. Center selector switch (S4): A.C.V.–D.C.V. Left-hand selector switch (S5): 2000 V.D.C. BATTERY SWITCH: OFF. A.C. LINE SWITCH: ON.	Selector switch: 1000 (D.C. VOLTS bracket).	*a.* Connect the test cord plug to the 2000V jack of the D.C. VOLTS jacks. *b.* Repeat step No. 1*b* and *c*. ***Caution:* Turn the D.C. VOLTS COARSE CONTROL on the TS–682/GSM–1 fully counterclockwise before proceeding.**	*a.* None. *b.* The indication on the 0–100 scale of the TS–682/GSM–1 D.C. meter must be within 48.5–51.5 (970 to 1,030 volts).

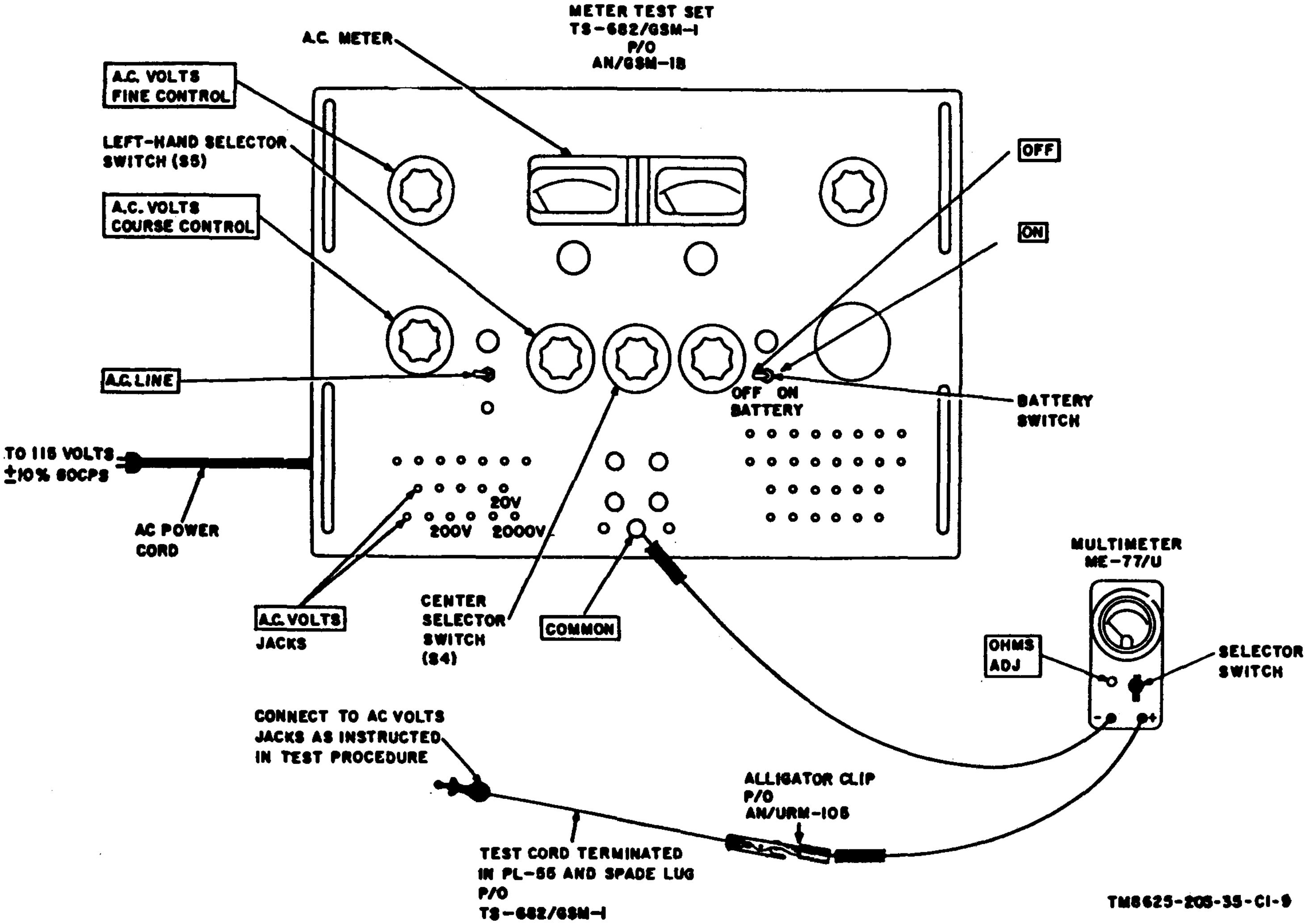

Figure 9. (Added) *Ac voltmeter test.*

12.6. Ac Voltmeter Test

(fig. 9)

a. Test Equipment and Materials.
Meter Test Set TS–682/GSM–1

b. Test Connections and Conditions. Do *not* connect the ME–77/U positive test lead to the TS–682/GSM–1 until instructed to do so in the test procedure.

c. Procedure.

Step No.	Test equipment control settings	Equipment under test control settings	Test procedure	Performance standard
1	*TS–682/GSM–1* A.C. VOLTS COARSE CONTROL: fully counterclockwise.	Selector switch: 10 (A.C. VOLTS bracket).	*a.* Connect the equipment as shown in figure 9, with the test cord plugged into the 20V jack of the A.C. VOLTS jacks.	*a.* None.
	A.C. VOLTS FINE CONTROL: fully counterclockwise. Center selector switch (S4): A.C.V.–D.C.V. Left-hand selector switch (S5): A.C.V. BATTERY switch: OFF A.C. LINE switch: ON.		*b.* Adjust the TS–682/GSM–1 A.C. VOLTS COARSE CONTROL and A.C. VOLTS FINE CONTROL for a full scale deflection of the multimeter meter pointer (A.C. and D.C. volts scale). Note the indication on the TS–682/GSM–1 A.C. meter. **Caution: Turn the A.C. VOLTS COARSE CONTROL on the TS–682/GSM–1 fully counterclockwise before proceeding.**	*b.* The indication on the 0–100 scale of the TS–682/GSM–1 A.C. meter must be within the limits 48–52 (9.6 to 10.4 volts).
2	Same as step No. 1	Selector switch: 100 (A.C. VOLTS bracket).	*a.* Connect the test cord plug to the 200V jack of the A.C. VOLTS jacks. *b.* Repeat step No. 1*b*. **Caution: Turn the A.C. VOLTS COARSE CONTROL on the TS–682/GSM–1 fully counterclockwise before proceeding.**	*a.* None. *b.* The indication on the 0–100 scale of the TS–682/GSM–1 A.C. meter must be within 48–52 (96 to 104 volts).
3	Same as step No. 1	Selector switch: 1000 (A.C. VOLTS bracket).	*a.* Connect the test cord plug to the 2000V jack of the A.C. VOLTS jacks. *b.* Repeat step No. 1*b*. **Caution: Turn the A.C. VOLTS COARSE CONTROL on the meter test set fully counterclockwise before proceeding.**	*a.* None. *b.* The indication on the 0–100 scale of the TS–682/GSM–1 A.C. meter must be within 48–52 (960 to 1,040 volts).

12.7. Ohmmeter Circuit Test

(fig. 10)

a. Test Equipment and Materials.

Decade Resistor ZM-16(*)/U or Decade Resistor TS-679/U and Precision resistor, 900K ohms ±1%.

b. Test Connections and Conditions. Connect the equipment as shown in A or B (1), figure 10, depending on which equipment is available.

c. Procedure.

Step No.	Test equipment control settings	Equipment under test control settings	Test procedure	Performance standard
1	*ZM-16A/U or TS-679/U*	Selector switch: XI (OHMS bracket).	*a.* Adjust the ME-77/U OHMS ADJ. control for a 0 indication on the multimeter meter (OHMS scale).	*a.* None.
	All decade switches to 0		*b.* Adjust the X10 and X1 switches on the ZM-16A/U or tens and units switches on the TS-679/U until the ME-77/U indicates 100 (on the OHMS scale). Note the resistance indicated by the switch settings.	*b.* The resistance indicated by the dc switch settings must be within the limits 95-105 ohms.
2	Same as step No. 1	Selector switch: X10 (OHMS bracket).	*a.* Adjust the ME-77/U OHMS ADJ. control for a 0 indication on the multimeter meter (OHMS scale).	*a.* None.
			b. Adjust the X100 and X10 switches on the ZM-16A/U or the HUNDREDS and TENS switches on the TS-679/U until the ME-77/U indicates 100 (on the OHMS scale). Note the resistance indicated by the switch settings.	*b.* The resistance indicated by the decade switch settings must be within the limits 950-1,050 ohms.
3	Same as step No. 1	Selector switch: X100 (OHMS bracket).	*a.* Adjust the ME-77/U OHMS ADJ. control for a 0 indication on the multimeter meter (OHMS scale).	*a.* None.
			b. Adjust the X1000 and X100 switches on the ZM-16A/U or the THOUSANDS and HUNDREDS switches on the TS-679/U until the ME-77/U indicates 100 (on the OHMS scale). Note the resistance indicated by the switch settings.	*b.* The resistance indicated by the decade switch settings must be within the limits 9,500-10,500 ohms.
4	Same as step No. 1	Selector switch: X1K (OHMS bracket).	*a.* Adjust the ME-77/U OHMS ADJ. control for a 0 indication on the ME-77/U meter (OHMS scale).	*a.* None.
			b. Adjust the X10000 and X1000 switches on the ZM-16A/U or the TEN THOUSANDS and THOUSANDS switches on the TS-679/U until the ME-77/U indicates 100 (OHMS scale). Note the resistance indicated by the switch settings.	*b.* The resistance indicated by the decade switch settings must be within the limits 95,000-105,000 ohms.
5	Same as step No. 1	Selector switch: X10K (OHMS bracket).	*a.* Adjust the ME-77/U OHMS ADJ. control for a 0 indication on the multimeter meter (OHMS scale).	*a.* None.

		b. If Decade Resistor TS–679/U is used, reconnect the equipment as shown in B,(2) figure 10.	*b.* None.
		c. Adjust the X1 MEG and X10000 switches on the ZM–16A/U or the TEN THOUSANDS and THOUSANDS switches on the TS–679/U until the ME–77/U indicates 100 (OHMS scale). Note the resistance indicated by the switch settings.	*c.* The resistance indicated by the decade switch settings must be within the limits 950,000–1,050,000 ohms.
		Note. Before returning the ME–77/U to the user, remove the dry batteries as follows: (1) Remove the four retaining screws that secure the panel and remove the panel from the case. (2) Remove the three dry batteries and replace the panel in the case; secure it with the four retaining screws.	*Note.* If Decade Resistor TS–679/U and the precision resistor B,(2) connection are used, add the value of the resistor to the resistance indicated by the switch settings to obtain the performance figure.

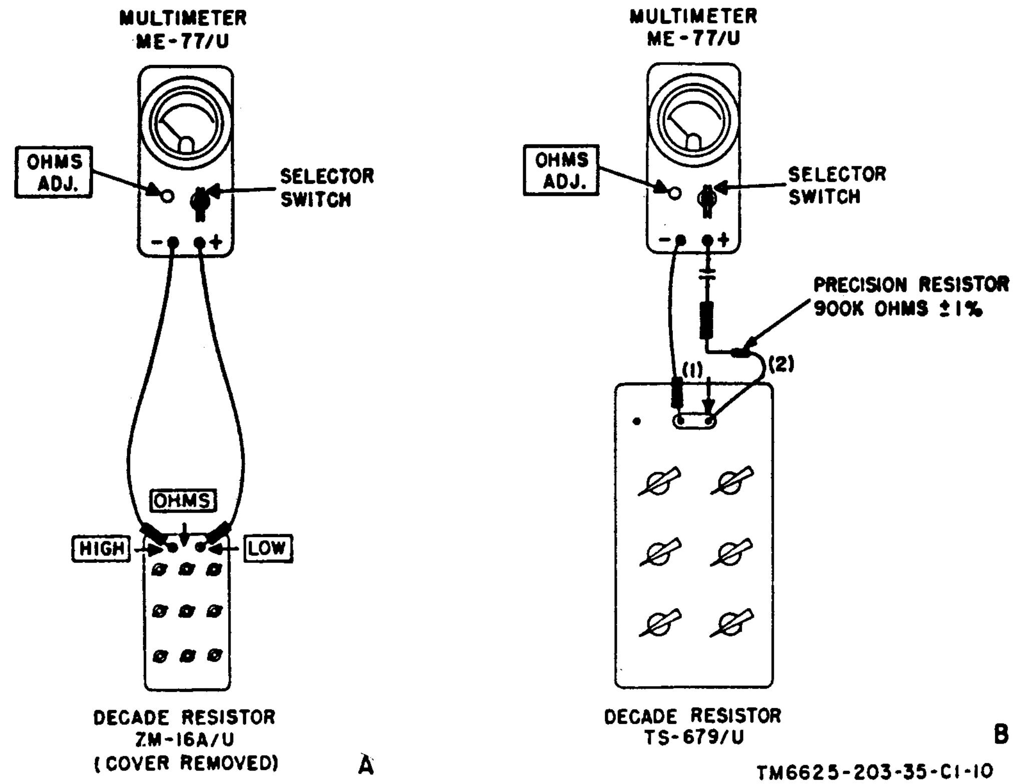

Figure 10. (Added) *Ohmmeter circuit test.*

12.8. Performance Standard Summary

Function	*Performance Standard*
a. Dc voltmeter (all ranges)	±3 %
b. Ac voltmeter (all ranges)	±4 %
c. Ohmmeter	±5 % (of indicated value)

Note. The tolerances listed in *a* through *c* above are for operation at normal room temperatures (68° –78°F).

Add section II heading after section I:

Section II. FINAL TESTING

BY ORDER OF THE SECRETARY OF THE ARMY:

G. H. DECKER
General, United States Army,
Chief of Staff.

Official:

R. V. LEE,
Major General, United States Army,
The Adjutant General

Dictribution:

Active Army:

DASA (6)
USASA (2)
CNGB (1)
Tech Stf, DA (1) except CSigO (15)
Tech Stf Bd (1)
USCONARC (4)
USAARTYBD (1)
USAARMBD (2)
USAIB (1)
USARADBD (2)
USAABELCTBD (1)
USAAVNBD (1)
USAATBD (1)
ARADCOM (2)
ARADCOM Rgn (2)
OS Maj Comd (2)
OS Base Comd (2)
LOGCOMD (2)
MDW (1)
Armies (2)
Corps (5)
USATC AD (2)
USATC Armor (2)
USATC Engr (2)
USATC FA (2)
USATC Inf (2)
Svc Colleges (2)
Br Svc Sch (2)
GENDEP (2) except Atlanta GENDEP (None)
Sig Sec. GENDEP (5)
Sig Dep (12)
Ord Dep (2)
Granite City Engr Dep (2)
Louisville Med Dep (2)
Ft Lee (2), Ft Monmouth (63)
1st GM Bde (2)
1st FA Msl Bde (2)
BAMC (2)
Gen Hosp (2)
Cml Arsenal (2)
Ord Arsenal (2)
Ord SW Ammo Comd (2)
USA Sp Warfare Cen (2)
USAMOAMA (2)
AFIP (1)
WRAMC (1)
AFSSC (1)
USAEPG (2)
EMC (2)
USACA (2)
USASEA (1)
USA Carib Sig Agcy (1)
USA Sig Msl Spt Agcy (12)
USASSA (20)
USASSAMRO (1)
Army Pictorial Cen (2)
USAOMC (4)
USA Trans Tml Comd (1)
Army Tml (1)
POE (1)
OSA (1)
AMS (1)
Sig Fld Maint Shop (2)
JBUSMC (2)
Units organized under following TOE's: Two copies to each unless otherwise indicated:
11–5
11–6
11–7
11–8
11–15
11–16
11–17
11–18
11–45
11–46
11–54
11–55
11–56
11–57
11–58
11–66
11–67
11–85
11–86
11–87
11–95
11–96
11–97
11–98
11–99
11–117
11–155
11–156
11–157
11–158
11–165
11–166
11–167
11–237
11–500 (AA–AE) (4)
11–555
11–557
11–587
11–592
11–597
11–608
29–56

NG: State AG (3); units—same as Active Army except allowance is one copy to each unit.
USAR: None.
For explanation of abbreviations used, see AR 320–50.

Changes in force: C 1 and C 2

CHANGE No. 2

HEADQUARTERS
DEPARTMENT OF THE ARMY
WASHINGTON, D. C., *27 May 1966*

Field and Depot Maintenance Manual

MULTIMETER AN/URM-105 INCLUDING MULTIMETER ME-77/U

TM 11-6625-203-35, 22 July 1959, is changed as follows:

Page 13, chapter 3. Add chapter 4 after chapter 3.

CHAPTER 4

DEPOT OVERHAUL STANDARDS

19. Applicability of Depot Overhaul Standards

The tests outlined in this chapter are designed to measure the performance capability of a repaired equipment. Equipment that is to be returned to stock should meet the standards given in these tests.

20. Applicable References

a. Repair Standards. Applicable procedures of the depots performing these tests and the general standards for repaired electronic equipment given in TB SIG 355-1, TB SIG 355-2, and TB SIG 355-3 form a part of the requirements for testing this equipment.

b. Technical Publications. The only other publication applicable to this equipment is TM 1-6625-203-12.

c. Modification Work Orders. Perform all modification work orders applicable to this equipment before making the tests specified. DA Pam 310-4 lists all available MWO'S.

21. Test Facilities Required

The following items are required for depot testing:

Item	Technical manual	Common name
Meter Test Set TS-682A/GSM-1.	TM 11-2635B	Meter test set
Resistor, Decade ZM-16A/U.	TM 11-5102	Decade resistor

22. Meter Movement Test

Check the accuracy of the meter movement to be sure that. 50 ua applied to the meter will produce full-scale deflection of the meter pointer.

a. Place the shorting screw in the multimeter in the closed position (TM 11-6625-203-12)

b. Set the selector switch to EXT. SHUNT.

c. Connect the black test lead to the common binding post. on the meter test set.

d. Connect the red test lead to the 100-ua dc jack.

e. Adjust the meter test set for a dc current output of 50 ua.

f. The meter indication should be 10 percent ± 0.75 of full-scale value.

23. DC Voltmeter Test

Check the accuracy of the dc voltmeter at full-scale on each dc voltage range.

a. Set the multimeter selector switch to the position listed in column 1 of the chart in *e* below,

b. Connect the black test lead to the common binding poet on the meter test set.

c. Connect the red test lead to the meter test jack listed in column 3.

d. Adjust the meter test set for the dc voltage listed in column 2.

e. The dc voltage indication on the multimeter should be the value listed in column 2, ± 3 percent of full-scale value.

Selector switch setting	Meter test set voltage (dc)	Meter test set output jack
DC VOLTS 1	1	1 volt dc
DC VOLTS 10	10	10 volts dc
DC VOLTS 100	100	100 volts dc
DC VOLTS 1000	1000	1,000 volts dc

24. AC Voltmeter Test

Check the accuracy of the ac voltmeter at full-sale value on each ac voltage range.

a. Set the selector switch to the position listed in column 1 of the chart in *e* below.

b. Connect the black test lead to the common binding post on the meter test set.

c. Connect the red test lead to the meter test jack listed in column 3.

d. Adjust tne meter test set for the ac voltage listed in column 2.

e. The ac voltage indication on the meter will be the value listed in column 2, ± 4 percent of full-scale value.

Selector switch setting	Meter test set voltage (ac)	Meter test set output jack
AC VOLTS 10	10	10 volts ac
AC VOLTS 100	100	100 volts ac
AC VOLTS 1000	1000	1,000 volts ac

25. Ohmmeter Test

Check the accuracy of the ohmmeter by comparing the multimeter resistance indication with the resistance of the decade resistor.

a. Turn the selector switch to the position listd in column 1 of the chart in *e* below.

b. Set the decade resistor for the resistance value indicated in column 2.

c. Zero-adjust the ohmmeter on each range before checking the resistance.

d. Connect the multimeter test leads to the output terminals on the decade resistor.

e. The resistance indication on the multimeter will be the value listed in column 2, ± 5 percent of the indicated value.

Selector switch setting	Decade resistor setting (ohms)
OHMS X1	100
OHMS X10	1,000
OHMS X100	10,000
OHMS X1K	100,000
OHMS X10K	1,000,000

By Order of the Secretary of the Army:

HAROLD K. JOHNSON,
General, United States Army,
Chief of Staff.

Official:
J. C. LAMBERT,
Major General, United States Army,
The Adjutant General.

Distribution:

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CNGB (1)
CC-E (7)
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CofEngrs (1)
TSG (1)
CofSptS (1)
USAAESWBD (5)
USACDCEA (1)
USACDCCBRA (1)
USACDCCEA (1)
USACDCCEA:
Ft Huachuca (1)
USACDCOA (1)
USACDCQMA (1)
USACDCTA (1)
USACDCADA (1)
USACDCARMA (1)
USACDCAVNA (1)
USACDCARTYA (1)
USACDCSWA (1)
USAMC (5)
USCONARC (5)
ARADCOM (5)
ARADCOM Rgn (2)
OS Maj Comd (4)
USASCC ME (5)
USATCFE (5)
USAREUR (5)
LOGCOMD (2)
USAMICOM (4)
USASMC (2)
USASCC (4)
MDW (1)
Armies (2) except
First (5)
Third (5)
Fourth (5)
EUSA (5)
Corps (2)
USAC (3)
507th USASA Gp (5)
508th USASA Gp (5)
318th USASA Bn (5)
319th USASA Bn (5)
320th USASA Bn (5)
USAEPG (5)
USAG AHS (5)
Svc Colleges (2)
Br Svc Sch (2) except
USASESCS (60)
USACMLCS (5)
USAAMS (5)
USAARMS (5)
USAADS (5)
USATSCH (5)
USAAVNS (5)
USAWC (5)
USASTC (2)
USATC Armor (2)
USATC Engr (2)
USATC Inf (2)
Army Pic Cen (2)
USACDCEC (10)
USAMEDTC (5)
USAJFKCENSPWAR (5)
WRAMC (1)
GENDEP (2)
Sig Sec GENDEP (5)
Sig Dep (12)
A Dep (2) except
LBAD (14)

SAAD (30)
TOAD (14)
FTWOAD (10)
LEAD (7)
SHAD (3)
NAAD (5)
SVAD (5)
CHAD (3)
ATAD (10)
SCAD (5)
FTWIAD (5)
Instl (2) except
Ft Monmouth (70)
Ft Hancock (4)
Ft Gordon (10)
Ft Huachuca (10)
Ft Carson (21)
Ft Knox (12)
Ft Lee (5)
Ft Belvoir (5)
JPG (5)
Sig FLDMS (2)
AMS (1)
USAERDAA (2)
USAERDAW (13)
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NG: State AG (3); units—same as Active Army except allowance is one copy.

USA R: None.

For explanation of abbreviations used, see AR 320-50.

Changes in force: C 1, C 2 and C 3

TM 11-6625-203-35
C3

CHANGE No. 3

HEADQUARTERS
DEPARTMENT OF THE ARMY
WASHINGTON, DC, *12 July 1976*

Direct Suppotg General Support and Depot Maintenance Manual MULTIMETERS AN/URM-105 (NSN 6625-00-581-2036) AND AN/URM 105C (NSN 6625-00-999-6282) INCLUDING MULTIMETERS ME-77/U (NSN 6625-00-284-0854) AND ME-77C/U (NSN 6625-00-999-6625)

TM 11-6625-203-35, 22 July 1959, is changed as follows:

Title is changed to read as shown above

Page 2. Paragraph 1 is superseded as follows:

1. Scope

a. This manual covers general support and depot maintenance for Multimeters AN/URM-105 (NSN 6625-00-581-2036) and AN/URM-105C (NSN 6625-00-999-6282). It includes instructions for troubleshooting, testing, and repairing the equipment and lists the tools and test equipments required for general support and depot maintenance.

b. The major components of the AN/URM-105 and the AN/URM-105C are Multimeter ME-77/U (NSN 6625-00-284-0854) and Multimeter ME-77 C/U (NSN 6625-00-999-6625) respectively, and are referred to in this manual as multimeter.

c. All references to Multimeter AN/URM-105 and Multimeter ME-77/U will also apply to the AN/URM-105C and the ME-77C/U.

d Complete technical instructions for this equipment are included in TM 11-6625-203-12, and TM 11-6625-203-24P.

e. Applicable forms and records are listed in TM 11-6625-203-12.

Paragraph 1.1 is added after paragraph 1.

1.1. Reporting of Errors

The reporting of errors, omissions, and recommendations for improving this publication by the individual user is encouraged. Reports should be submitted on DA Form 2028 (Recommended Changes to Publications and Blank Forms), and forwarded direct to Commander, US Army Electronics Command ATTN: DRSEL-MA-Q Fort Monmouth, NJ 07703.

Page 8, paragraph 9. Delete second line of chart and substitute "Tool Kit, Electronic Equipment TK-100/G".

Page 13, chapter 4. Paragraph 22 is rescinded.

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For explanation of abbreviations used, see AR 310-50.

TECHNICAL MANUAL
No. 11-6625-203-35

HEADQUARTERS,
DEPARTMENT OF THE ARMY
WASHINGTON 25, D. C., *22 July 1969*

MULTIMETER AN/URM-105, INCLUDING MULTIMETER ME-77/U

CHAPTER 1
THEORY

Section I. GENERAL

1. Scope

a. This manual covers field and depot maintenance for Multimeter AN/URM-105. It includes instructions appropriate to fourth and fifth echelons for troubleshooting, testing, and repairing the equipment, and lists tool and test equipments required for fourth and fifth echelon maintenance. Detailed functions of the equipment are covered in paragraphs 3 through 6.

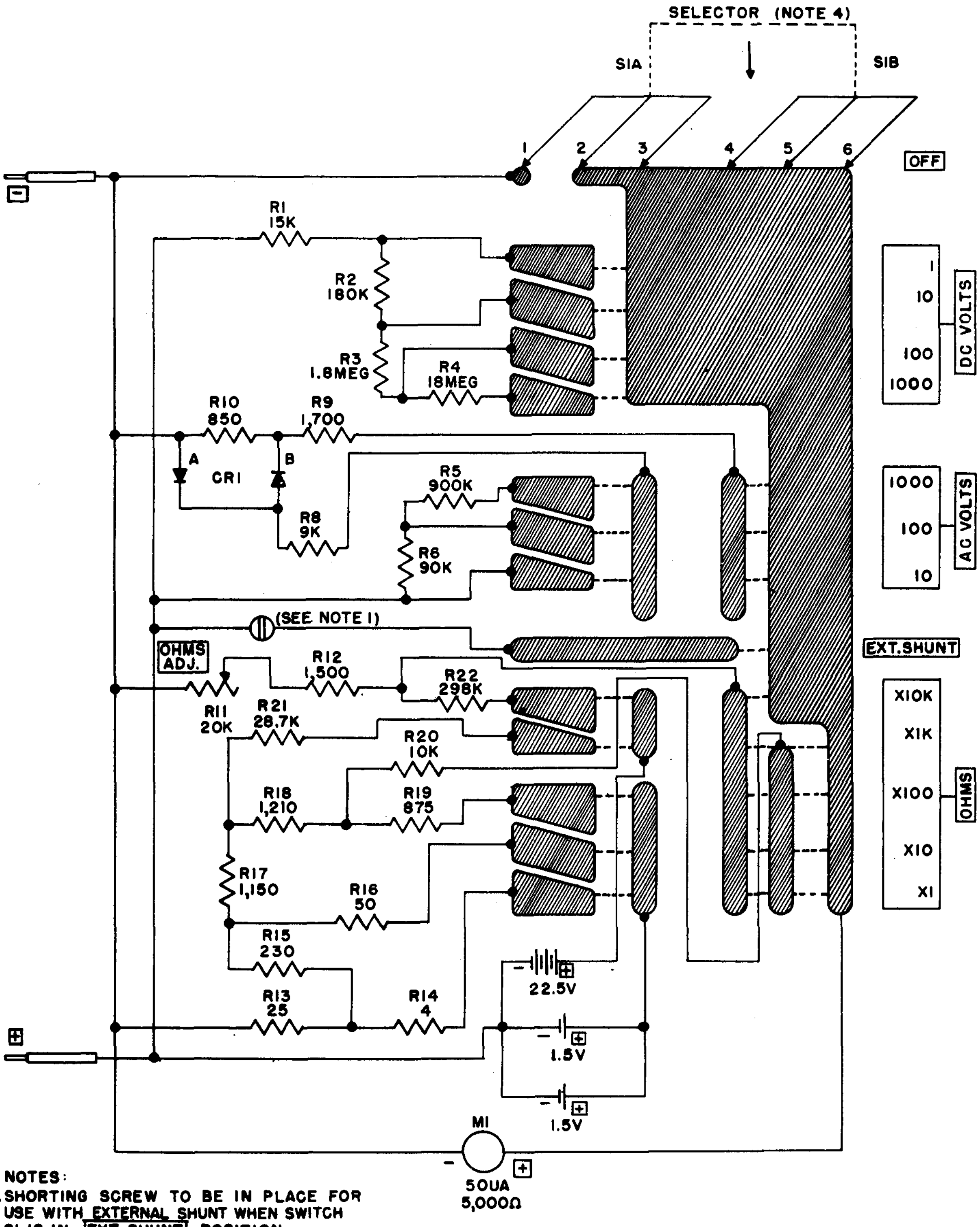
b. Complete technical instructions for this equipment include TM 11-6625-203-12, which contains instructions for Operation and Organizational Maintenance; TM 11-6625-203-12P, which lists Operator's and Organizational Maintenance Repair Parts and Special Tools; and TM 11-6625-203-35P, which lists Field and Depot Maintenance Repair Parts and Special Tools.

c. Applicable forms and records are listed in TM 11-6625-203-12.

d. Forward comments, concerning this manual to the Commanding Officer, United States Army Signal Publications Agency, Fort Monmounth, N. J.

2. General Theory

The multimeter uses various combinations of series and parallel resistors in conjunction with a 50 microampere (ua) meter to enable the measurement of direct-current (dc) voltage (par. 3), alternating-current (at) voltage (par. 4), resistance (par. 5), or current (par. 6). Selector switch S1 (fig. 1) selects the particular meter circuit for each range position. In general, the voltage or resistance to be measured is applied across the test prods; the circuit voltage or resistance being measured is then coupled by the selector switch, through the appropriate series or parallel resistors, to the meter. For complete circuit details, refer to the overall schematic diagram (fig. 1).



NOTES:
1. SHORTING SCREW TO BE IN PLACE FOR USE WITH EXTERNAL SHUNT WHEN SWITCH S1 IS IN EXT. SHUNT POSITION.
2. ▭ INDICATES EQUIPMENT MARKING.
3. UNLESS OTHERWISE INDICATED, RESISTANCES ARE IN OHMS.
4. SIX SWITCH CONTACTS SLIDE ALONG PRINTED CIRCUIT ON PANEL, COMPLETING CIRCUITS AS INDICATED.

TM6625-203-35-1

Figure 1. Multimeter ME-77/U, schematic diagram.

Section II. CIRCUIT ANALYSIS

3. Dc Voltmeter Circuit
(figs. 1 and 2)

a. The simplified dc voltmeter circuit (B, fig. 2) consists of a voltage dropping (multiplier) resistor in series with the meter. The value of the multiplier resistor in series with the resistance of the meter produces a voltmeter sensitivity of 20,000 ohms per volt. Changing the value of the multiplier resistor will change the dc voltage range.

b. Selector switch S1 (A, fig. 2) selects the multiplier resistor or series combination of multiplier resistors required for the particular dc voltage range. Resistors R1, R2, R3, and R4 are the multiplier resistors.

4. Ac Voltmeter Circuit
(figs. 1 and 3)

a. The simplified ac voltmeter circuit (B, fig. 3) consists of the meter with series resistor R9 and this series combination is in parallel with resistor R10; this series-parallel circuit in series with the resistance of rectifier CR1B and multiplier resistor R produces a voltmeter sensitivity of approximately 1,000 ohms per volt. Changing the value of the multiplier resistor will change the ac voltage range.

b. Selector switch S1 (A, fig. 3) selects the multiplier resistor or series combination of multiplier resistors required for the particular ac voltage range. Resistors R5, R6, and R8 are the multiplier resistors.

c. Current flow through the meter circuit (B, fig.3) is as follows:

(1) When point X is negative with respect to point Y, rectifier CR1B conducts and rectifier CR1A is not conducting. Current flows from point X to the junction of resistor R10, the meter, and rectifier CR1A. Most of the current will flow through shunt resistor R10; a small portion of the current will flow through the meter and current limiting resistor R9 and combine with the current flowing through resistor R10. The current then flows through rectifier CR1B and multiplier resistor R to point Y.

(2) When point Y is negative with respect to point X, rectifier CR1A conducts and rectifier CR1B is not conducting. Current flows from point Y, through rectifier CR1A, to point X. When rectifier CR1A conducts, it acts as a short circuit for the remainder of the meter

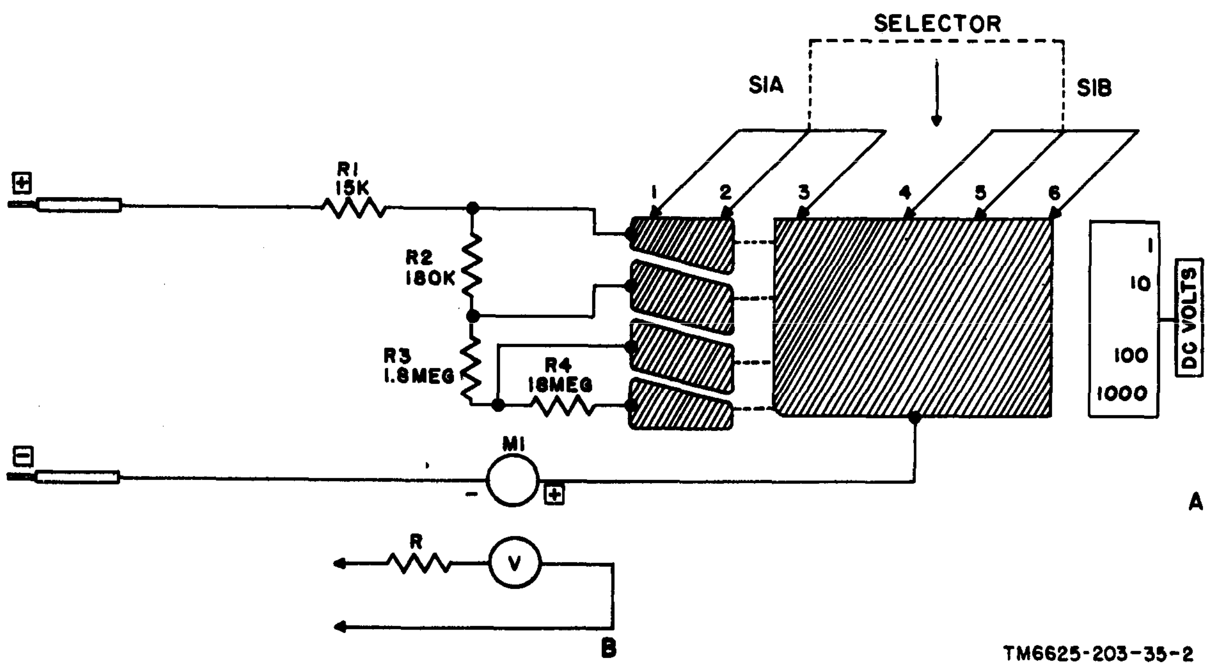


Figure 2. Dc voltmeter circuit, partial and simplified schematic diagram.

circuit and no current flows through the meter. This condition will provide a more accurate meter indication, prevent a high inverse voltage from being applied to rectifier CR1B, and maintain a relatively constant load on the ac voltage source.

5. Ohmmeter Circuit

(figs. 1 and 4)

a. The ohmmeter circuit (B, fig. 4) uses a combination of series and parallel resistance to limit the maximum current to the 50 microampere required for full scale deflection. Maximum current flows through the meter when the input to the ohmmeter circuit is shorted. Touching the tips of the test prods together shorts the input and enables adjustment of OHMS ADJ. control R11 for zero indication (maximum right-hand deflection of meter pointer) on the OHMS scale. Connecting a resistance across the test prods will cause the current through the meter to decrease; as a result of this decreased current, the meter pointer will move to the left and indicate the resistance value. Resistor R12 and OHMS ADJ. control R11 in series are in parallel with the meter.

b. Selector switch S1 (A, fig. 4) selects the series and parallel resistors and the voltage source for the particular resistance range. The specific resistors represented by RA (B, fig. 4), RB, and RC and the voltage source represented by V for each resistance range are listed in the following chart:

Selector switch setting	RA	RB	RC	V
OHMS X1	R15, R17, R18, and R20	R13	R14	1.5-volt batteries.
OHMS X10	R17, R18, and R20	R13 and R15	R16	1.5-volt batteries.
OHMS X100	R20	R13, R15, R17, and R18	R19	1.5-volt batteries.
OHMS X1K	R18 and R20	R13, R15, and R17	R21	22.5-volt battery.
OHMS X10K	Not used	Not used	R22	22.5-volt battery.

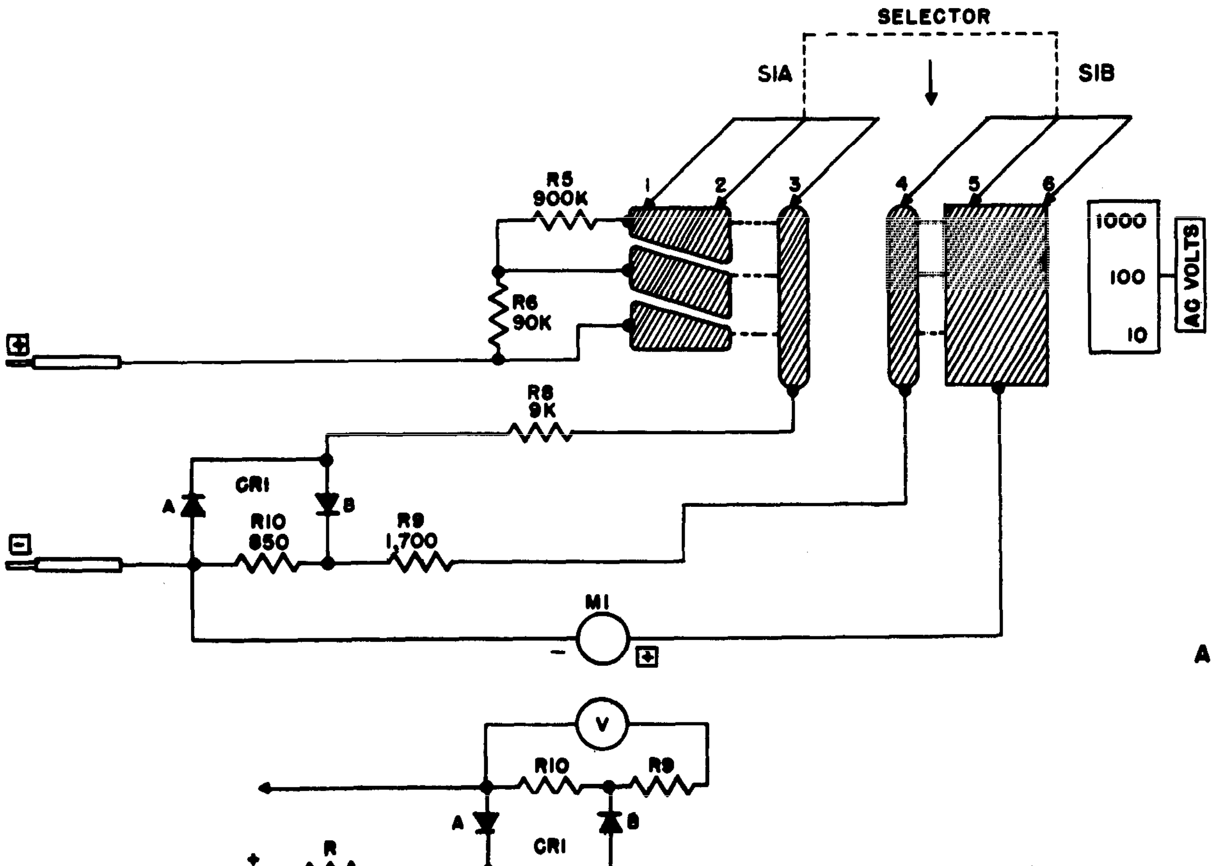


Figure 3. Ac voltmeter circuit, partial and simplified schematic diagram.

6. Ammeter Circuit

(figs. 1 and 6)

a. When selector switch S1 (A, fig. 5) is in the EXT. SHUNT position and the shorting screw is in the closed position, the meter is connected directly across the test leads.

b. With the addition of an external shunt resistor (B, fig. 5) connected in parallel with the meter, the multimeter may be used for current measurement. The value of the shunt resistor used will determine the current range.

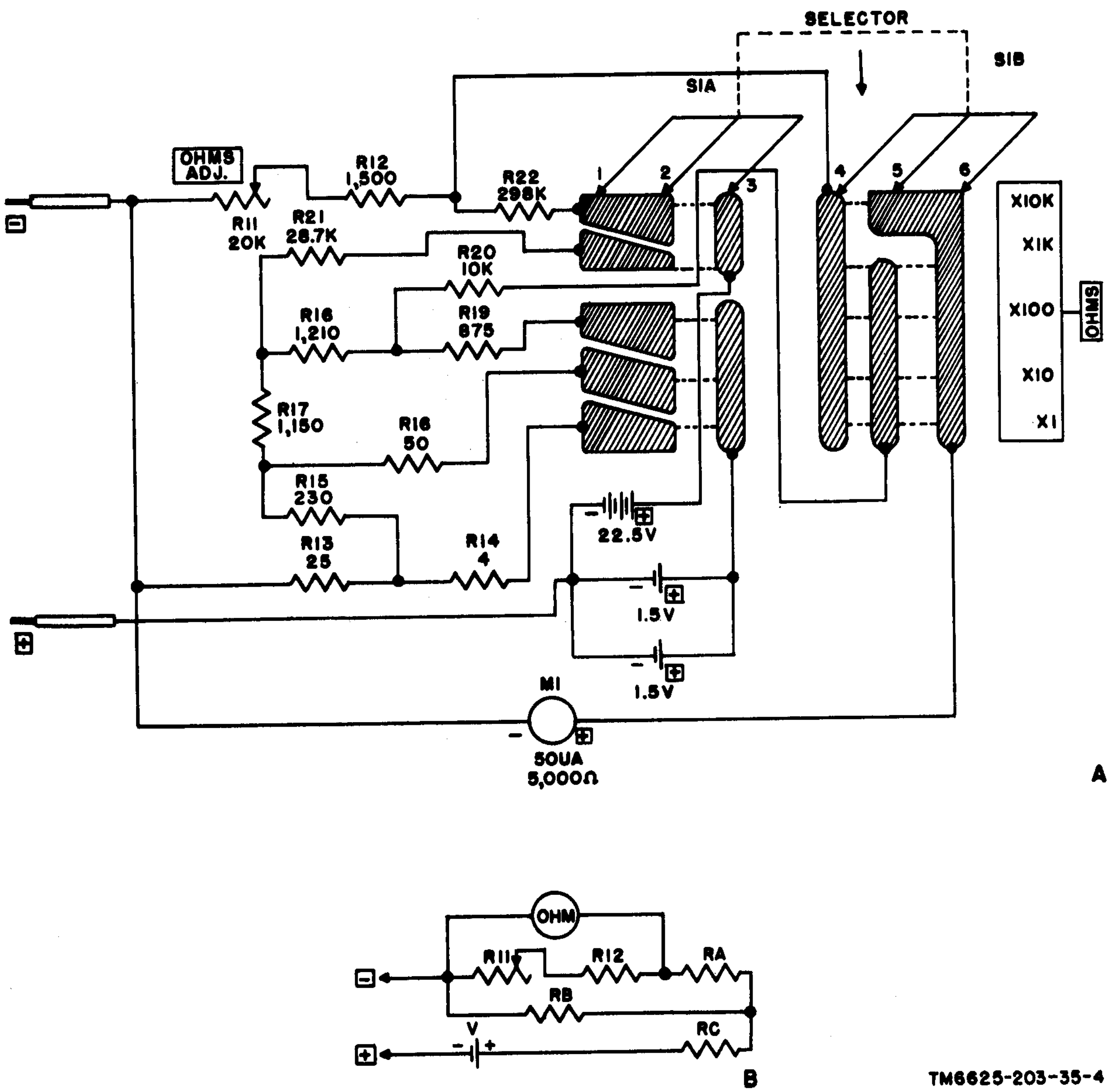


Figure 4. Ohmmeter circuit, partial and simplified schematic diagram.

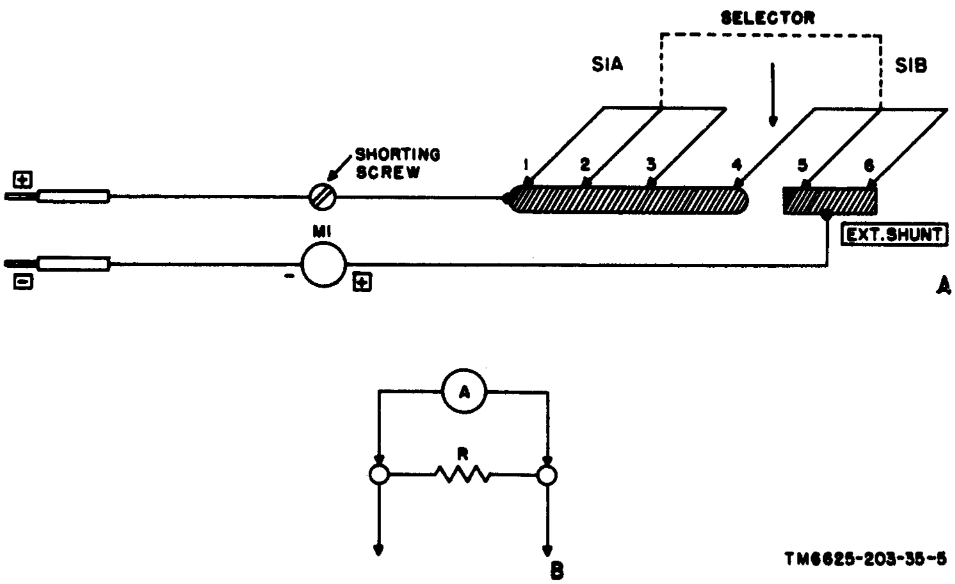


Figure 5. Ammeter circuit, partial and simplified schematic diagram.

CHAPTER 2

TROUBLESHOOTING

7. General Instructions

Troubleshooting at field and depot maintenance level includes all the techniques outlined for organizational maintenance and any special or additional techniques required to isolate a defective part. The field and depot maintenance procedures are not complete in themselves but supplement the procedures described in organizational maintenance (TM 11-6625-203-12). The systematic troubleshooting procedure, which begins with the operational checks that can be performed at an organizational level, must be completed by additional localizing and isolating techniques.

8. Troubleshooting Procedures

a. General. The first step in servicing a defective multimeter is to localize the fault to the circuit responsible for abnormal operation. The second step is to isolate the fault to a defective part which is responsible for the abnormal condition. Some faults, such as burnt-out resistors, can often be located by sight, smell, and hearing, The majority of faults, however, must be isolated by checking continuity of the suspected circuit.

b. Localization. The multimeter can be used to measure dc voltage, ac voltage, direct current, and resistance, The first step is to determine the circuit or circuits at fault by the following methods:

(1) Visual inspection. The purpose of visual inspection is to locate faults without testing or measuring circuits. All meter readings and other visual signs should be observed to try to localize the fault to a particular circuit.

(2) Operational *test.* Perform an operational test on the multimeter (TM 11-6625-203-12) to obtain a symptom; the operational test will frequently localize the trouble to a particular circuit. In practically all instances, the operational test will help in determining the exact nature of the fault.

c. Isolation. After the trouble has been localized to a particular circuit, isolate the trouble within that circuit to a particular part. The items listed below will aid in isolating the trouble.

(1) *Continuity measurements.* Set the selector switch to the OFF position and check the suspected circuit for continuity. Compare resistance measured with the values indicated on the schematic diagram (fig. 1).

(2) *Troubleshooting chart.* The trouble symptoms listed in the chart (par. 10) will also aid in isolating the fault to a particular part.

9. Tools and Test Equipment Required

The following chart lists the tool and test equipments required for troubleshooting the multimeter.

Item	Technical manual
Multimeter AN/URM-105-------	TM 11-0625-203-12
Tool Equipment TK-21/G -------	

10. Isolating Troubles

a. General. In the troubleshooting chart (c below), procedures are outlined for isolating troubles to a particular. component part. Parts locations are indicated in figures 6 and 7. Resistance values are indicated on the schematic diagram (fig. 1). Depending on the nature of the operational symptoms, one or more of the isolating procedures will be necessary.

b. *Use of Chart.* The troubleshooting chart is designed to supplement operational checks which can be performed at an organizational level. If previous operational checks have resulted in reference to a particular item of the chart, go directly to the referenced item, If no operational symptoms are known, perform an operational check (TM 11-6626-203-12) to obtain a symptom of trouble.

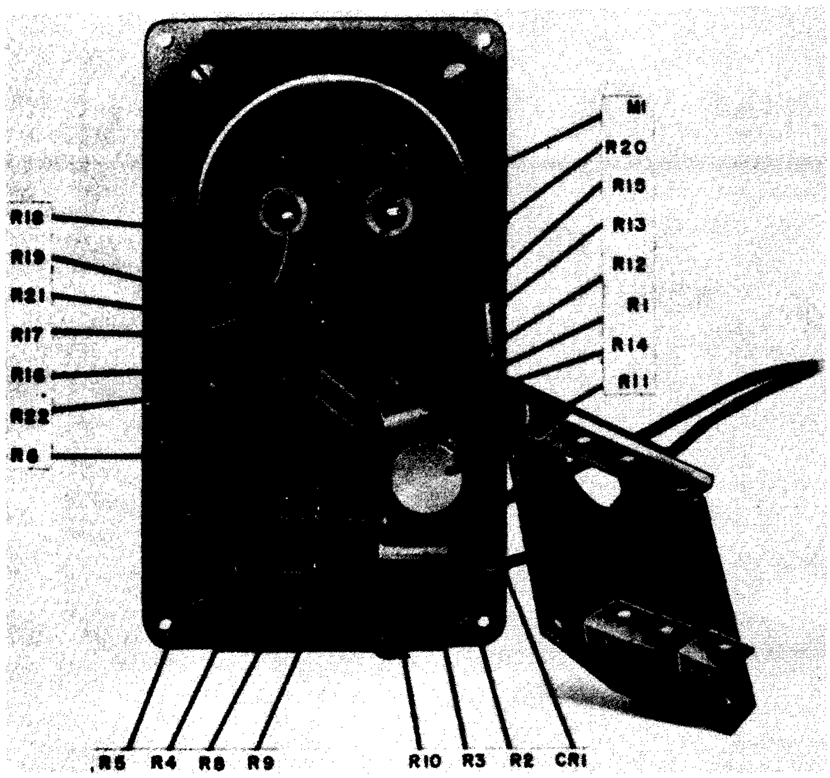


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Figure 6. Multimeter ME-77/U, rear view of panel, showing location of parts.

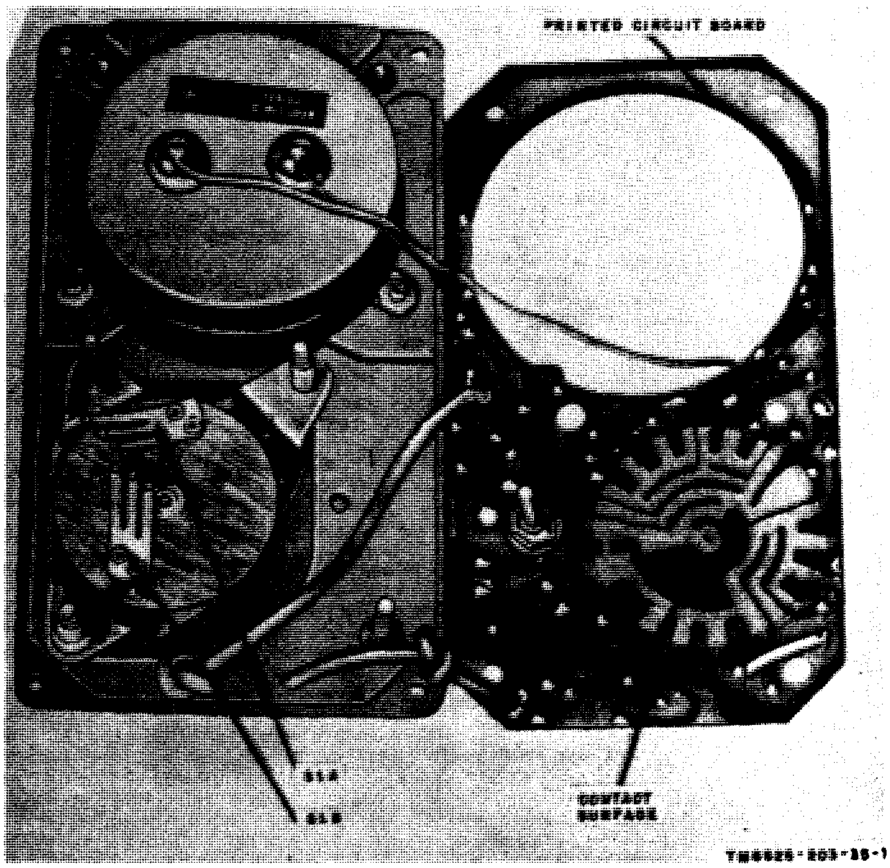

Figure 7. Multimeter ME-77/U, rear view of panel with printed circuit board removed, showing selector switch contacts and printed circuit.

c. Troubleshooting Chart (figs. 6 and 7).

Symptom	Probable trouble	Correction
No meter indication in any position of selector switch.	Defective test leads	Repair or replace test leads.
	Defective meter M1	Replace meter (fig. 6).
	Defective selector switch contacts	Clean or replace switch contacts (fig. 7).
	Defective printed circuit	Replace printed circuit board.
Erratic or inaccurate meter indication in any position of meter switch.	Dirty contacts on selector switch S1	Clean switch contacts.
	Defective printed circuit	Replace printed circuit board
No meter indication with selector switch in any DC VOLTS position.	Open resistor R1	Replace resistor (fig. 6).
No meter indication with selector switch in 10, 100, or 1000 DC VOLTS position.	Open resistor R2	Replace resistor.
No meter indication with selector switch in 100 or 1000 DC VOLTS position.	Open resistor R3	Replace resistor.
No meter indication with selector switch in 1000 DC VOLTS position.	Open resistor R4	Replace resistor.
No meter indication with selector switch in any AC VOLTS position.	Defective rectifier CR1	Replace rectifier
	Open resistor R8 or R9	Replace defective resistor.
Meter pointer pegs right with selector switch in any AC VOLTS position.	Open resistor R10	Replace resistor.
No meter indication with selector switch in 100 or 1000 AC VOLTS position.	Open resistor R6	Replace resistor.
No meter indication with selector switch in 1000 AC VOLTS position.	Open resistor R5	Replace resistor.
No meter indication with selector switch in EXT. SHUNT position and multimeter connected to an external shunt.	Shorting screw in open position	Place shorting screw in closed position (TM 11-5625-203-12).
	Defective printed circuit	Replace printed circuit board.
Meter pointer pegs right and cannot be adjusted to zero with selector switch in any OHMS position.	Defective OHMS ADJ. control R11	Replace control.
	Defective resistor R12	Replace resistor.
Meter pointer cannot be adjusted to zero with selector switch in X1K or X10K range.	Weak 22.5-volt battery	Replace battery.
Meter pointer cannot be adjusted to zero with selector switch in X1, X10, or X100 range.	Weak 1.5-volt batteries	Replace batteries.
Inaccurate meter indication on all OHMS ranges except the X10K range.	Open resistor R13, R15, R17, R18, or R20.	Replace defective resistor.
Meter pointer does not deflect to right when test prods are touched together and selector switch is set to one of OHMS ranges:		
X1	Open resistor R14, R15, R17, R18, or R20.	Replace defective resistor.
X10	Open resistor R16, R17, R18, or R20	Replace defective resistor.
X100	Open resistor R19 or R20	Replace defective resistor.
X1K	Open resistor R18, R20, or R21	Replace defective resistor.
X10K	Open resistor R22	Replace resistor.

11. Replacement of Parts

Most of the multimeter parts (fig. 6) are mounted on the printed circuit board. When a part is to be replaced, remove the battery holder for access to the part and remove the printed circuit board for access to the printed wiring. Refer to TB SIG 222 for soldering techniques employed when replacing parts on the printed circuit board.

12. Calibration

If the accuracy of the multimeter on one or more ranges is not within the limits specified in the final test procedures, the multimeter will require calibration. Calibration is accomplished by substituting resistors in the circuit that requires calibration until the accuracy of that circuit is within the specified limits.

CHAPTER 3

FINAL TESTING

13. Purpose of Final Testing

The tests outlined in this chapter measure the performance capability of a repaired equipment. Equipment that meets the minimum standards stated in the tests will furnish satisfactory operation, equivalent to that of new equipment.

14. Test Equipment Required for Final Testing

The test equipments listed in the chart are required for final testing of the multimeter; these test equipments are part of Meter Test Equipment AN/GSM-1C (TM 11-2535A). Refer to the appropriate technical manuals for instructions on the use of the test equipments.

Item	Technical manual	Common name
Meter Test Set TS-682A/GSM-1.	TM 11-2535B	Meter test set.
Decade Resistor ZM-16A/U	TM 11-5102	Decade resistor.

15. Meter Movement Test

Check the accuracy of the meter movement to be sure that 50 ua applied to the meter will produce full scale deflection of the meter pointer.

a. Adjust the meter test set for a dc current output of 50 ua,

b. Place the shorting screw in the multimeter in the closed position (TM 11-6626-203-12).

c. Set the selector switch to the EXT. SHUNT position.

d. Connect the black test lead to the common binding post on the meter test set; connect the red test lead to the 50-ua dc jack.

e. The meter indication should be 10 ±2 percent of full scale value.

16. Dc Voltmeter Test

Check the accuracy of the dc voltmeter on the 100-volt range, If the multimeter accuracy cm the 100-volt range is within the specified tolerance (d below), it will provide satisfactory operation on the remaining dc voltage ranges.

a. Adjust the meter test set for a dc voltage output of 100 volts.

b. Set the selector switch on the multimeter to the 100 DC VOLTS range.

c. Connect the black test lead to the common binding post on the meter test set; connect the red test lead to the 100-volt dc jack.

d. The meter indication should be 100 volts ±3 percent of full-scale value.

17. Ac Voltmeter Test

Check the accuracy of the ac voltmeter at full-scale value on each ac voltage range.

a. Set the selector switch to the position listed in column 1 of the chart in *e* below.

b. Adjust the meter test set for the ac voltage listed in column 2.

c. Connect the black test lead to the common binding post on the meter test set.

d. Connect the red test lead to the meter test jack listed in column 3.

e. The ac voltage indication on the meter will be the value listed in column 2, ±4 percent of full-scale value.

Selector switch setting	Meter test equipment voltage (ac)	Meter test set output jack
AC VOLTS 10	10	10-volt ac
AC VOLTS 100	100	100-volt ac
AC VOLTS 1000	1,000	1,000-volt ac

18. Ohmmeter Test

Check the accuracy of the ohmmeter by comparing the multimeter resistance indication with the resistance settings of the decade resistor.

a. Turn the selector switch to the position listed in column 1 of the chart in *e* below.

b. Set the decade resistor for the resistance value indicated in column 2.

c. Zero adjust the ohmmeter on each range before checking the resistance.

d. Connect the multimeter test leads to the output terminals on the decade resistor.

e. The resistance indication on the multimeter will be the value listed in column 2, ±5 percent of the indicated value.

Selector switch setting	Decade resistor setting
OHMS X1	100
OHMS X10	1,000
OHMS X100	10,000
OHMS X1K	100,000
OHMS X10K	1,000,000

APPENDIX I

REFERENCES

The following applicable publications are available to the field and depot maintenance repairmen of Multimeter AN/URM-105.

TM 11-2536A	Meter Test Equipments AN/GSM-lB and AN/GSM-1C.
TM 11-2535B	Meter Test Set TS-682A/GSM-1.
TM 11-5102	Decade Resistors ZM-16/U and ZM-16A/U.
TM 11-6625-203-12	Multimeter AN/URM-105, Including Multimeter ME-77/U, Operation and Organizational Maintenance.
TM 11-6625-203-12P	Operator's and Organizational Maintenance Repair Parts and Special Tools List for Multimeter AN/URM-105.
TM 11-6625-203-35P	Field and Depot Maintenance Repair Parts and Special Tools List for Multimeter AN/URM-l05.
TB SIG 222	Solder and Soldering.

[AG 413.6 (2 July 59)]

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