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DEPARTMENT OF THE ARMY TECHNICAL MANUAL

METER TEST EQUIPMENT AN/GSM-1B

DEPARTMENT OF THE ARMY • FEBRUARY 1952

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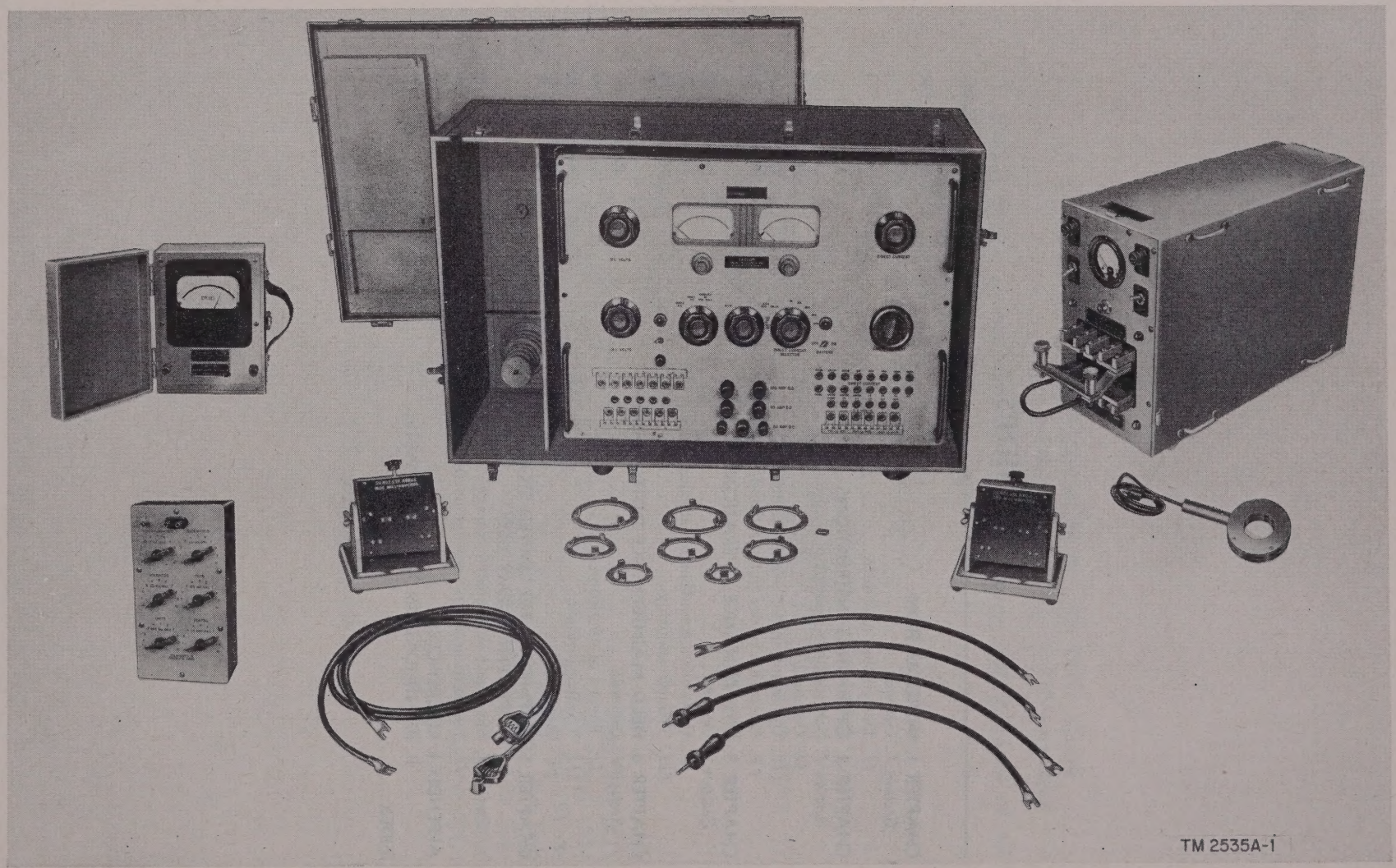
NG: Same as Active Army.

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For explanation of distribution formula, see SR 310–90–1.

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Note. Test Set I–49, Multimeter TS–352/U, Tube Tester I–177–( ), Tube Socket Adapter Kit MX–949( )/U, and Resistance Bridge ZM–9( )/U are not shown.

Figure 1. Meter Test Equipment AN/GSM–1B.

CHAPTER I

INTRODUCTION

Section I. GENERAL

1. Scope

a. These instructions are published for the information and guidance of the personnel to whom this equipment is issued. They contain a description of the equipment; information on operation, organizational manitenance, theory, and field maintenance; instructions for removing the equipment from service and repacking for shipment or limited storage; and instructions for demolishing the equipment to prevent enemy use.

b. Appendix I contains a list of references, including supply catalogs, technical manuals on associated equipment, and other applicable publications. Appendix II contains an identification table of parts.

2. Forms and Records

The following forms will be used for reporting unsatisfactory conditions of Army equipment and in performing preventive maintenance:

a. DD Form 6, Report of Damaged or Improper Shipment, will be filled out and forwarded as prescribed in SR 745–45–5 (Army) and AFR 71–4 (Air Force).

b. DA AGO Form 468, Unsatisfactory Equipment Report, will be filled out and forwarded to the Office of the Chief Signal Officer, as prescribed in SR 700–45–5.

c. AF Form 54, Unsatisfactory Report, will be filled out and forwarded to Commanding General, Air Matériel Command, Wright-Patterson Air Force Base, Dayton, Ohio, as prescribed in 700–45–5 and AFR 65–26.

d. Use other forms and records as authorized.

Section II. DESCRIPTION AND DATA

3. Purpose and Use

a. General. Meter Test Equipment AN/GSM–1B (fig. 1) consists of test equipment provided for use by repair personnel in repair depots and maintenance companies. It is used to check the operation and accuracy of a-c (alternating-current) and d-c (direct-current) ammeters and voltmeters, to check the accuracy of frequency meters and ohmmeters, and to correct the magnetic fields of meter magnets.

b. Components. Meter Test Equipment AN/GSM–1B consists of Meter Test Set TS–682/GSM–1 ((1) below) and the additional components listed in (2) below.

(1) Meter Test Set TS–682/GSM–1 (fig. 2) includes the following components:

(*a*) Meter test set.

(*b*) Two Mountings MT–135A/GSM–1.

(*c*) One set of calibration rings.

(*d*) One cord CX–25A/GSM–1; one cord CX–25B/GSM–1; one cord, terminated in Plug PL–55 at one end and in a spade lug at the other end; one cord, terminated in Plug PL–68 at one end and in a spade lug at the other end; and two cords, each terminated in a spade lug.

(*e*) Case CY–721/GSM–1.

(2) The additional components of Meter Test Equipment AN/GSM–1B are—

(*a*) Magnet Charger TS–336A/GSM–1 and demagnetizing coil.

(*b*) Frequency Meter FR–40/GSM–1.

(*c*) Decade Resistor TS–679/U. (Refer to TM 11–5520.)

(*d*) Test Set I–49. (Refer to TM 11–2019.)

(*e*) Multimeter TS–352/U. (Refer to TM 11–5527.)

(*f*) Tube Tester I–177–( ). (Refer to TM 11–2627.)

(*g*) Tube Socket Adapter Kit MX–949 ( )/U. (Refer to TB 11–2627–2.)

(*h*) Resistance Bridge ZM–9( )/U.

4. Technical Characteristics

a. Meter Test Set TS–682/GSM–1.

(1) Power input:

A-c	115 volts, 60 cycles, single-phase.
D-c	Storage battery, nominal 12 volts.

(2) Meter ranges (fig. 7):

D-c	0–100 ua; 0–200 ua; 0–400 ua; 0–1 ma; 0–2 ma; 0–4 ma; 0–10 ma; 0–20 ma; 0–40 ma; 0–100 ma; 0–200 ma; 0–400 ma; 0–1 amp; 0–2 amp; 0–4 amp; 0–10 amp; 0–20 amp; 0–40 amp; 0–100 amp.
A-c	0–100 ma; 0–200 ma; 0–400 ma; 0–1 amp; 0–2 amp; 0–4 amp; 0–10 amp; 0–20 amp; 0–40 amp; 0–100 amp.
A-c and d-c voltage	0–1 v; 0–2 v; 0–4 v; 0–10 v; 0–20 v; 0–40 v; 0–100 v; 0–200 v; 0–400 v; 0–1,000 v; 0–2,000 v.
D-c voltage	0–100 mv.

(3) Output power:

D-c voltage ranges:	
0–100 mv	30 ma.
0–1 v through 0–1,000 v	15 ma.
0–2,000 v	5 ma.
A-c voltage ranges:	
0–200 v through 0–2,000 v	150 ma.
0–1 v through 0–100 v	0.5 amp.
D-c ranges (all)	750 mv.
A-c ranges:	
0–100 ma through 0–400 ma	2.5 va.
0–1 ampere through 0–100 amperes	10 va.

(4) Output ripple	a-c ripple not more than 5 percent of d-c output voltage.
(5) Accuracy:	
Direct-reading	±1 percent.
With correction charts	±.25 percent.

b. Magnet Charger TS–336A/GSM–1.

(1) Magnet charger:

Input voltage	105 to 125 v, 60 cyc.
Input power	25 w.
Capacitor charging time	4 sec max.
Peak discharge current through magnetizing fixture.	15,000 amp.
Discharge rate	0.002 sec.

(2) Demagnetizing coil:

Input voltage	105 to 125 v, 60 cyc.
Input current	3.5 amp.
Type of duty	intermittent, 30 minutes per hour max.

c. Frequency Meter FR–40/GSM–1.

Input voltage	115 v±10 percent, 50 to 70 cps.
Range	50 to 70 cps.
Accuracy	±.5 percent of 60 cyc.

d. Decade Resistor TS–679/U.

Range	0.1 to 111,111 ohms.
Accuracy	±1 percent on low ranges.
	±.1 percent on high ranges.

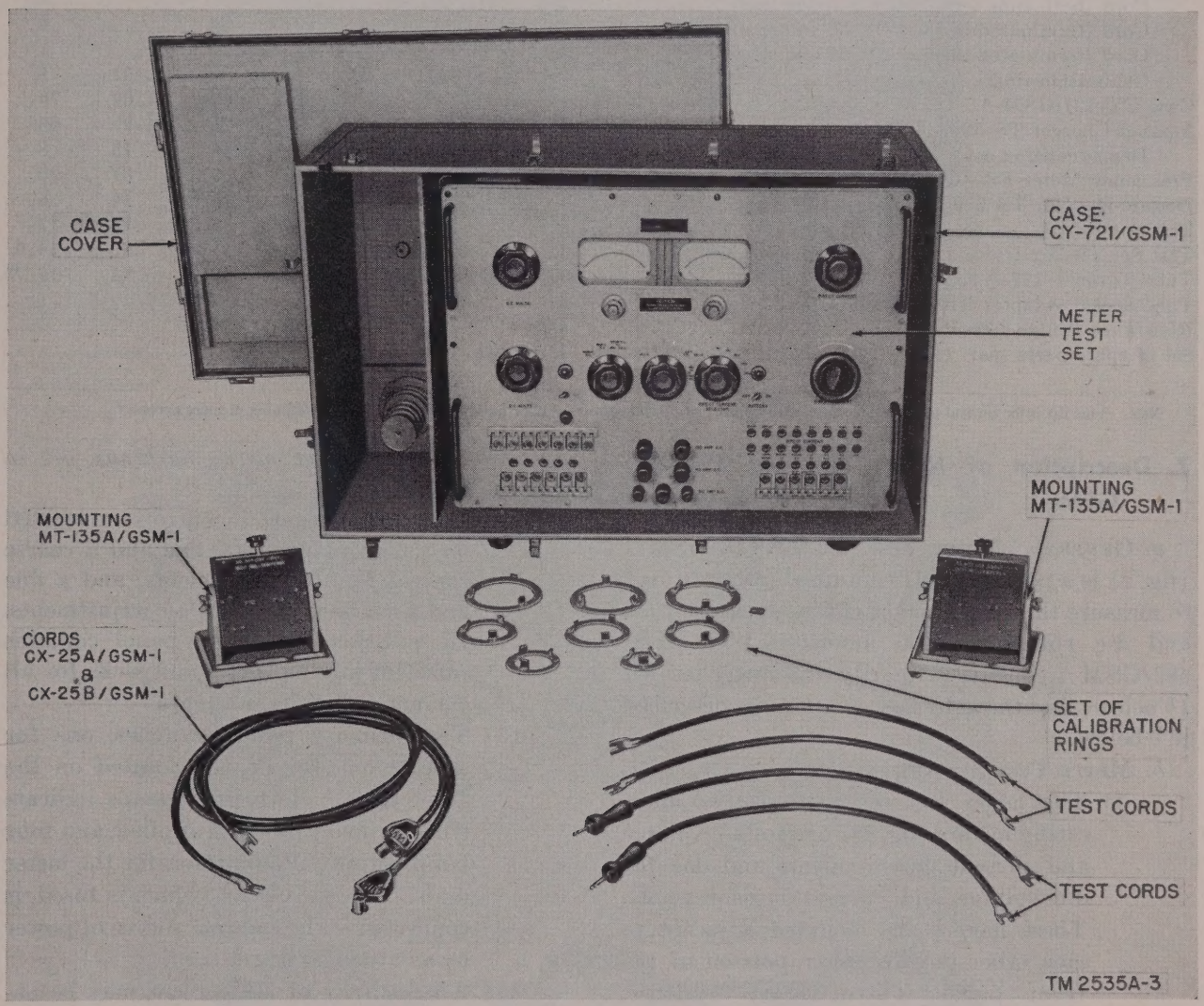


Figure 2. Meter Test Set TS–682/GSM–1, components.

5. Packaging Data

When packaged for export shipment, the components of Meter Test Equipment AN/GSM–1B are packed in a wooden crate. Refer to figure 14 for a cutaway view of an equipment packed for export shipment.

6. Table of Major Components

Component	Required No. (in)	Height (in)	Depth (in)	Length (in)	Volume (cu ft)	Unit weight (lb)
Meter Test Set TS–682/GSM–1	1	21	13½	30	.5	265
Cord CX–25A/GSM–1	1			72		3
Cord CX–25B/GSM–1	1			72		3
Mounting MT–135A/GSM–1	2	7½	8	6	.02	4
Cord (both ends terminated in spade lugs)	2			24		2
Cord (terminated in Plug PL–55 and spade lug)	1			24		1
Cord (terminated in Plug PL–68 and spade lug)	1			24		1
Calibration rings	8	2½ to 5 OD	.095 thk		.01	1
Case CY–721/GSM–1	1	17½	25	39½	1.02	70
Magnet Charger TS–336A/GSM–1	1	12¼	8	21½	1.2	65
Demagnetizing coil	1	2¼	7½	15	.13	8
Frequency Meter FR–40/GSM–1	1	10½	8½	7½	.31	20
Decade Resistor TS–679/U	1	10¾	4¼	5⅝	.14	6
Test Set I–49	1	8⅞	7⅜	5¾	.22	12
Test Set TS–352/U	1	6¼	8¾	11¼	.36	14.5
Tube Tester I–177–( )	1	5¾	15½	8½	.44	15.75
Tube Socket Adapter Kit MX–949( )/U	1					
Resistance Bridge ZM–9( )/U	1	22	8¾	8¼		
Set of spare parts (par. 11)	1					

Note. This list is for general information only. See appropriate publications for information pertaining to requisitioning of spare parts.

7. Description of Meter Test Set TS–682/GSM–1

a. General. Meter Test Set TS–682/GSM–1 (fig. 2) is a portable, self-contained test unit used to measure the performance characteristics of a-c and d-c voltmeters and ammeters. The TS–682/GSM–1 consists primarily of a meter test set (*b* below) and the accessory components described in *c* below.

b. Meter Test Set (fig. 3).

(1) The meter test set contains two indicating meters (fig. 4): one for a-c voltage and current measurements and one for d-c voltage and current measurements. These meters are mounted adjacent to each other on the upper portion of the front panel. Three rotary switches, mounted below the meters on the panel, permit the selection of the appropriate meter ranges for both a-c and d-c measurements. *All a-c designations, including the a-c meter markings, are in purple-blue.*

(2) Four variable output controls are located on the front panel: a fine and a coarse control for d-c adjustments, and a fine and a coarse control for a-c adjustments. In addition, the front panel contains sufficient binding posts and jacks for all current and voltage ranges.

(3) Two primary power switches, one for ac and one for dc, are located on the front panel. Two pilot lamps indicate when primary power is applied, and four lamps supply illumination for the meter dials. The a-c circuit, which is fused, is connected to the external source of power by an attached power cord.

(4) An accuracy of .25 percent may be obtained by using calibration data charts covering all the a-c and d-c current and voltage ranges. These charts are supplied with the equipment and are located

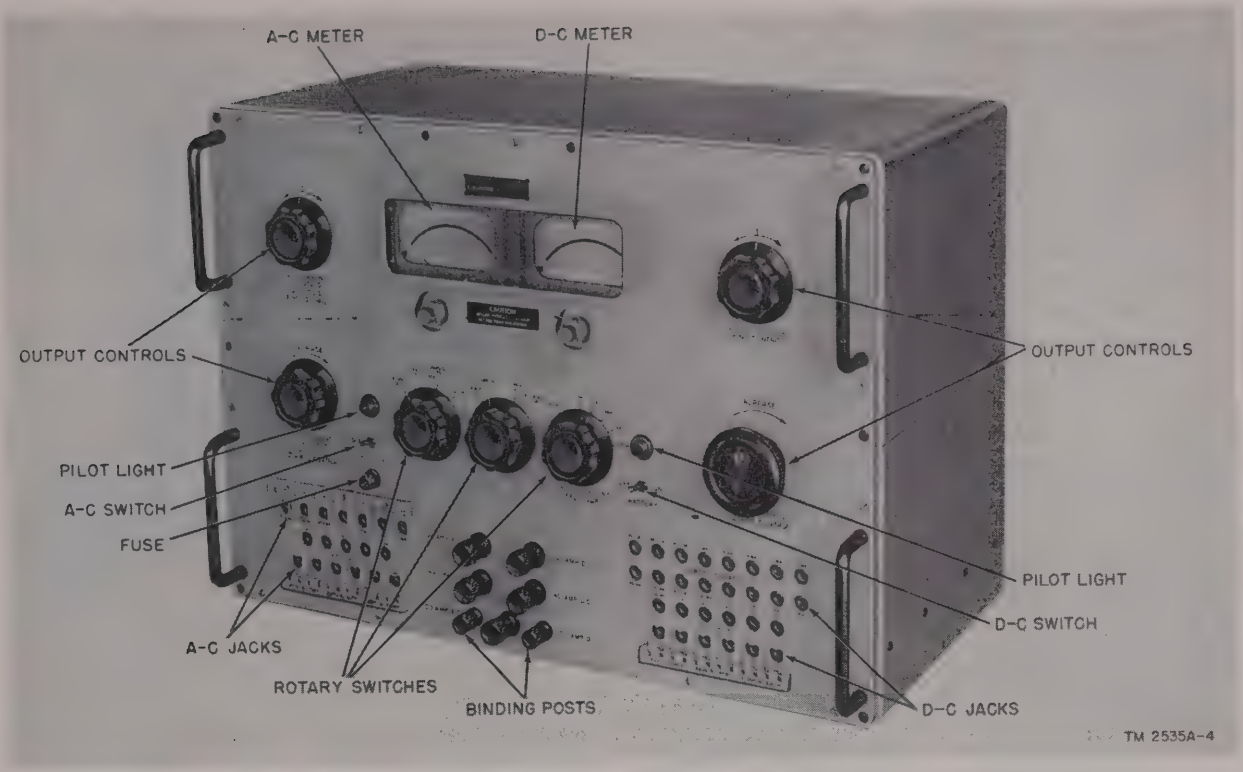


Figure 3. Meter test set.

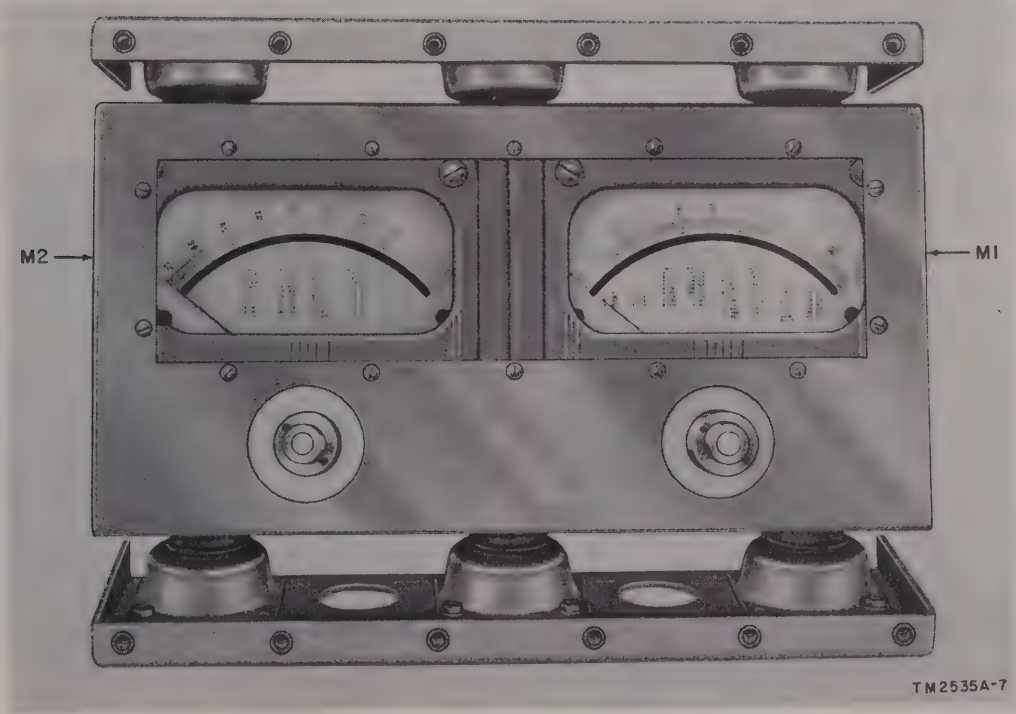


Figure 4. Meters used in meter test set.

in the pocket on the rear cover of the meter test set.

c. Accessories for Meter Test Set TS–682/GSM–1.

(1) *Cords CX–25A/GSM–1 and CX–25B/GSM–1.* These 6-foot rubber insulated cords are used to connect a 12-volt storage battery to the meter test set. Each cord has a battery clip at one end (marked + on the CX–25A/GSM–1 and "—" on the CX–25B/GSM–1) and a spade lug at the other end.

Date 18 SEP 51 CALIBRATION DATA CHART FOR TEST SET TS-682/GSM-1 Serial No. XX

D.C. CURRENT RANGES

0-100UA RANGE		0-200UA RANGE		0-400UA RANGE		0-1MA RANGE		0-2MA RANGE		0-4MA RANGE	
SCALE MARK.	UA	SCALE MARK.	UA	SCALE MARK.	UA	SCALE MARK.	MA	SCALE MARK.	MA	SCALE MARK.	MA
5	5.05	10	10.00	20	20.00	5	.0495	10	.0995	20	.2000
10	10.10	20	20.10	40	40.05	10	.1010	20	.2005	40	.4005
15	15.10	30	30.05	60	60.05	15	.1505	30	.3000	60	.5995
20	20.00	40	40.00	80	80.00	20	.2005	40	.4000	80	.8000
25	25.10	50	50.00	100	100.00	25	.2505	50	.5010	100	1.0005
30	30.10	60	60.05	120	120.05	30	.30[illegible]	60	.6000	120	1.2010
35	35.05	70	70.05	140	140.00	35	[illegible]	70	.7000	140	1.4005
40	40.05	80	79.90	160	160.00	[illegible]	[illegible]	80	.8010	160	1.6010
45	44.95	90	89.95	180	179[illegible]	[illegible]	.[illegible]510	90	.9000	180	1.8000
50	49.90	100	99.90	200	19[illegible]	[illegible]	.5000	100	1.0000	200	2.0000
55	55.05	110	110.05	220	220.[illegible]	55	.5520	110	1.1020	220	2.2020
60	60.50	120	120.30	240	240.20	60	.6085	120	1.2060	240	2.4085
65	65.20	130	130.60	260	260.30	65	.6570	130	1.3050	260	2.6080
70	70.00	140	139.90	280	279.95	70	.7000	140	1.4005	280	2.8000
75	74.90	150	149.85	300	299.95	75	.7505	150	1.5000	300	3.0000
80	79.80	160	159.80	320	319.90	80	.8005	160	1.6000	320	3.2005
85	84.80	170	169.90	340	339.85	85	.8510	170	1.7005	340	3.4000
90	89.90	180	179.90	360	359.90	90	.9025	180	1.8005	360	3.6005
95	95.05	190	190.00	380	380.05	95	.9560	190	1.9050	380	3.8030
100	100.00	200	200.05	400	400.05	100	1.0030	200	2.0020	400	4.0030

SAMPLE

TM 2535A-11

Figure 5. Sample meter calibration chart for Meter Test Set TS–682/GSM–1

(2) *Mounting MT–135A/GSM–1* (figs. 6 and 7). These two units are used to mount and electrically connect panel-type voltmeters and ammeters to the meter test set for repair or calibration. Each unit consists of a wooden box mounted on a wooden pedestal by a metal shaft. The pedestal is mounted on a wooden base, which is provided with a tray to hold any meter hardware that may be removed during meter repair. The box turns on its shaft so that, during test, the meter can be set in its normal operating position. Knifelike jaws inside the box of the mounting unit may be opened or closed by a knob located on the top of the box. These jaws hold the meter firmly to the mounting during repair and test. Two binding posts at the rear of the box provide connections for the meter cables.

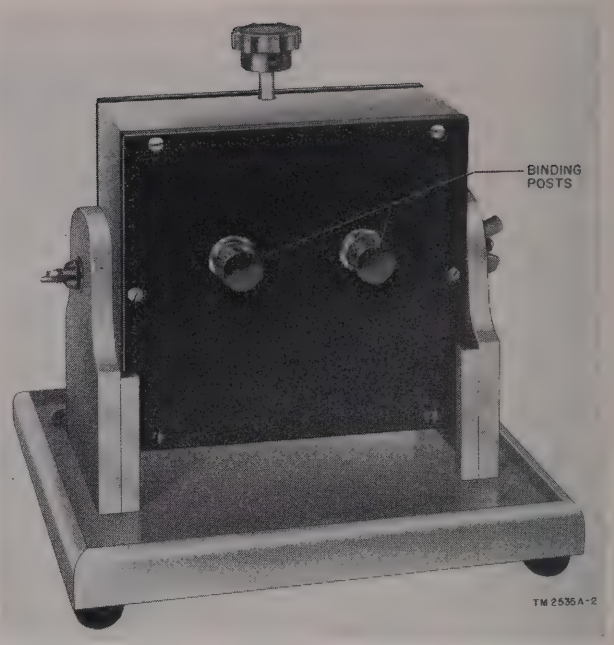


Figure 6. Mounting MT–135A/GSM–1, front.

(3) *Meter test cables* (fig. 2). Four rubber-jacketed cables are supplied to connect the meter mounting units to the meter test set. Two of the cables terminate in



Figure 7. Mounting MT–135A/GSM–1, rear.

spade lugs at both ends. One of these two cables is always used to connect the meter mounting to the COMMON binding post on the meter test set. The other cable is used for connection to one of the binding posts used for high a-c or d-c current connections. Each of the two remaining cables terminates in a spade lug at one end; one of these cables terminates in Plug PL–55 and the other in Plug PL–68 at the other end. Plug PL–55 connects to the voltage jacks on the meter test set. Plug PL–68 connects to the current jacks.

(4) *Set of steel calibration rings* (fig. 2). These steel, cadmium-plated rings are used to simulate steel panels when the meter to be calibrated is mounted on a steel panel in normal use. The eight rings range in inside diameter from 2.05 inches to 3.5 inches to accommodate meters of different sizes. Each ring has three spring-steel meter retainers, placed at 120° intervals around the circumference, to hold the meter in place during calibration.

(5) *Case CY–721/GSM–1* (fig. 8). The case is constructed of plywood and finished in gray enamel. It is used to transport the meter test set and its components. Eight latches hold the cover to the case. Two carrying handles are provided at the sides of the case. The inside of the case is divided into two sections by a partition; one section holds the meter test set, and the other section contains special fittings to hold the other components.

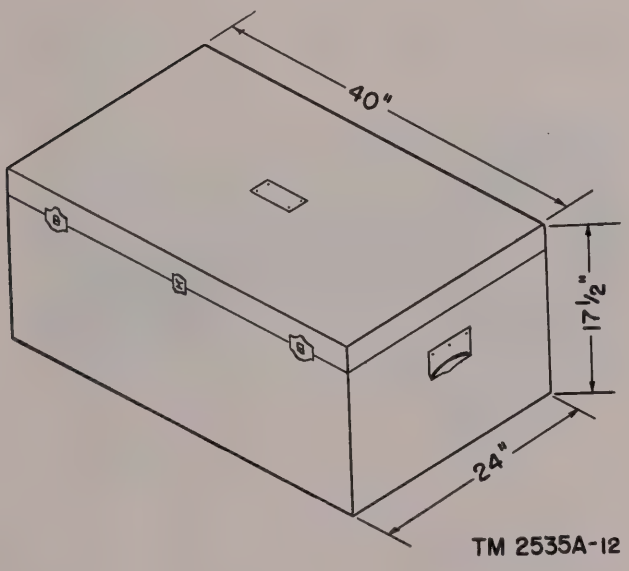


Figure 8. Dimensional drawing of Case CY–721/GSM–1.

8. Description of Magnet Charger TS–336A/GSM–1

(figs. 9, 10, and 11)

Magnet Charger TS–336A/GSM–1 includes the magnet charger (fig. 9) and a demagnetizing coil (fig. 11). The magnet charger is used to remagnetize meter magnets, and the demagnetizing coil is used to reduce the field strength of magnets that have been magnetized too strongly.

a. The magnet charger is mounted in a gray sheet-steel case. On the front panel are a POWER ON-OFF switch, a charging-pulse toggle switch, a pilot lamp, two a-c line fuses, a magnetizing fixture, and a zero- to 600-volt, d-c voltmeter. Terminals E3, E4, E5, and E6, located under the rear access door, are used to connect external booster units, which are not provided with the equipment (fig. 10), and to connect special wire-wound magnet-charging fixtures. The unit may be carried by two cotton-web straps fastened to the sides.

b. The demagnetizing coil is inclosed in a gray, molded bakelite case with a metal handle. A 9-foot power cord attached to the handle is used to connect the demagnetizing coil to a 115-volt, 60-cycle power source.

9. Description of Frequency Meter FR–40/GSM–1

Frequency Meter FR–40/GSM–1 (fig. 12) is used as a standard in calibrating and testing the performance of power frequency meters in the 50- to 70-cps range. The unit is inclosed in a gray metal case with a detachable cover. The meter scale is calibrated in cps, from 50 to 70. Two binding posts on the panel under the meter provide for the connection of exterior leads. The case and panel are constructed so that the interior of the case is shielded from external magnetic fields.

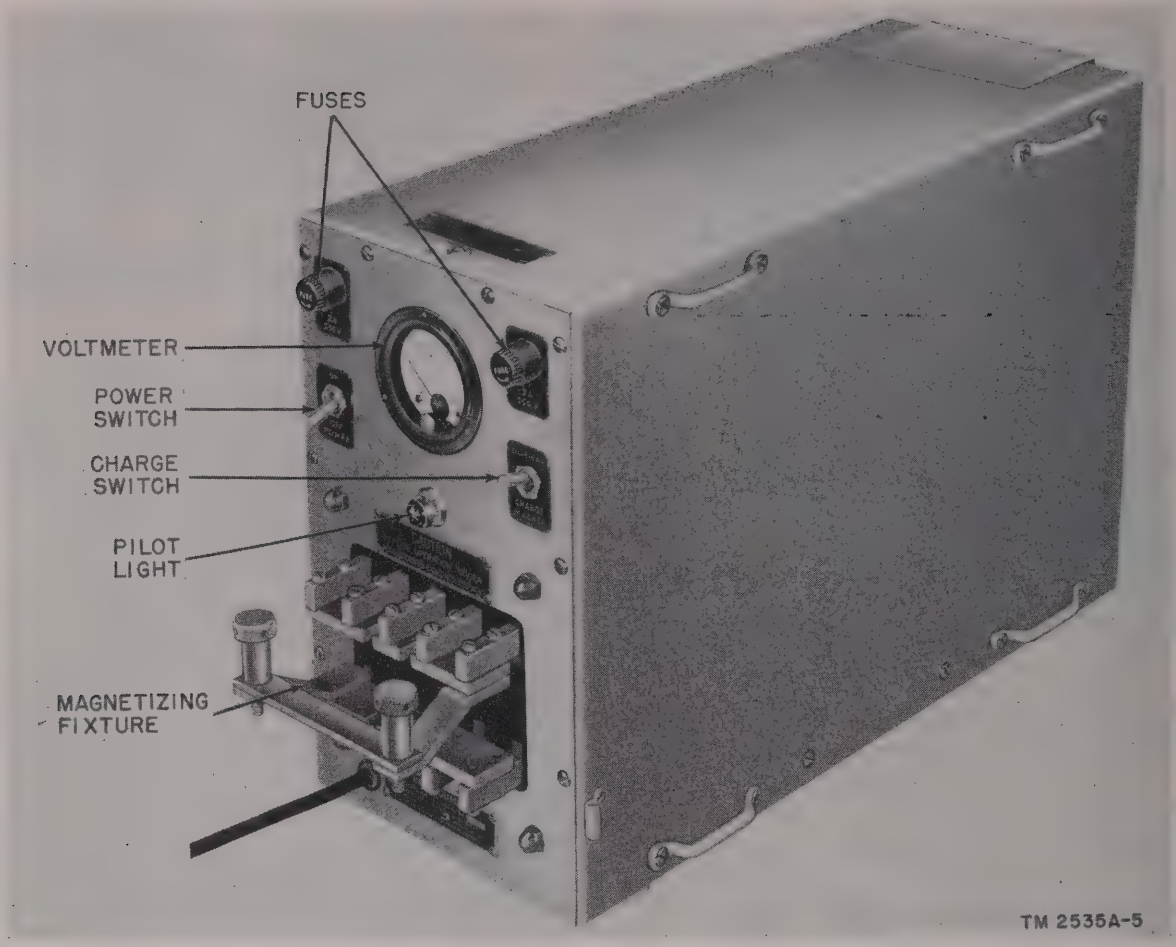


Figure 9. Magnet Charger TS–336A/GSM–1, front view.

10. Description of Decade Resistor TS–679/U and Resistance Bridge ZM–9 ( )/U

a. Decade Resistor TS–679/U. The decade resistor (fig. 13) is used to provide accurately known resistance values when meter circuits are tested. It is also valuable for use as a standard in resistance measurements. Detailed description and information concerning the use of the decade resistor are given in TM 11–5520.

b. Resistance Bridge ZM–9( )/U. The resistance bridge is a Wheatstone bridge with a direct-reading dial, rotary switch type adjustment, and galvanometer detection. It is used to measure resistance between 0.1 megohm and 1,000,000 megohms. Accuracy ranges from 3 percent between 0.1 and 100 megohms to 20 percent between 10,000 and 1,000,000 megohms. The bridge uses 105- to 125- or 210- to 250-volt, 40- to 60-cycle ac.

11. List of Spare Parts

The following group of spare parts, which includes normally expendable items, is supplied with each Meter Test Equipment AN/GSM–1B:

a. For Meter Test Set TS–682/GSM–1.
1 tube type 3B28.
5 fuses (5 amp).
2 pilot lamps.

b. For Magnet Charger TS–336A/GSM–1.
1 tube type 5UG4.
1 tube type WL5550/681.
2 pilot lamps.
2 fuses (2 amp).

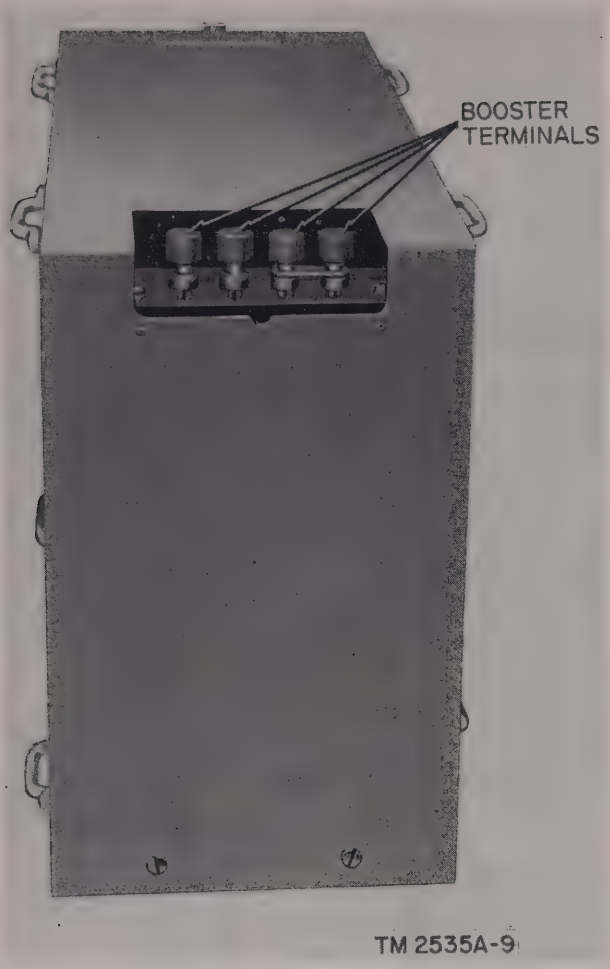


Figure 10. Magnet Charger TS–336A/GSM–1, rear view.

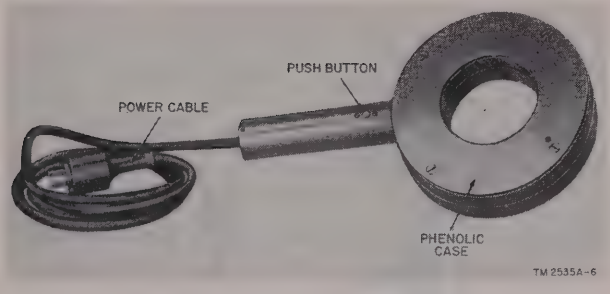


Figure 11. Demagnetizing coil.

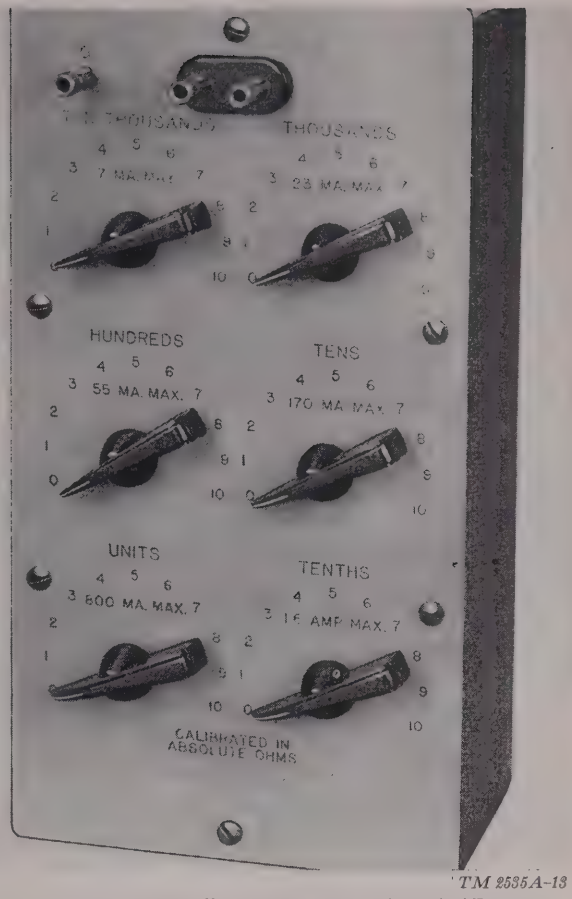


Figure 13. Decade Resistor TS–679/U.

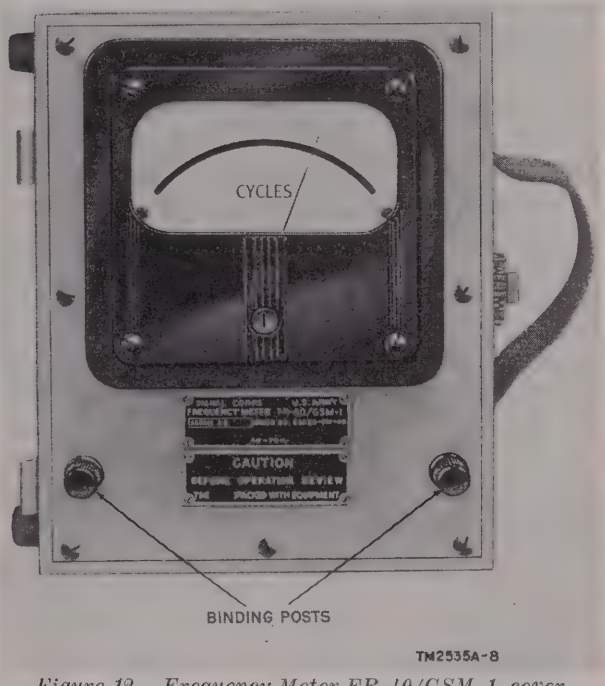


Figure 12. Frequency Meter FR–40/GSM–1, cover removed.

CHAPTER 2

OPERATING INSTRUCTIONS

Section I. SERVICE UPON RECEIPT OF EQUIPMENT

12. Location

a. Meter Test Equipment AN/GSM–1B is designed for use on the test bench in repair depots. The equipment normally is used in a building or shelter at permanent or semipermanent installations.

b. Requirements that must be satisfied by the building or shelter are as follows:

(1) The floor must be capable of sustaining the weight of the equipment without vibration.

(2) Sufficient space must be allowed for possible repair work on the equipment.

(3) An external source of a-c power must be available.

(4) Adequate lighting for day and night operation must be provided.

(5) The ambient temperature should be between 50° F. and 100° F. for optimum operation of the equipment.

13. Uncrating, Unpacking, and Checking New Equipment

Equipment may be shipped in oversea packing cases, in domestic packing cases, or in its own carrying cases. When new equipment is received, select a location, convenient to the permanent or semipermanent location, where the equipment may be unpacked without exposure to the elements.

a. Equipment Shipped in Carrying Cases. Aside from checking to make sure that all carrying cases are present and the equipment is undamaged, no special unpacking and uncrating procedures are necessary for equipment shipped in carrying cases.

Caution: Be careful when uncrating, unpacking, and handling the equipment; it is easily damaged. If it becomes damaged, a complete overhaul may be required or the equipment may be rendered useless.

b. Step-by-Step Instructions for Uncrating and Unpacking Export or Domestic Shipments (figs. 14 and 15).

(1) Place the case as near the operating location as convenient.

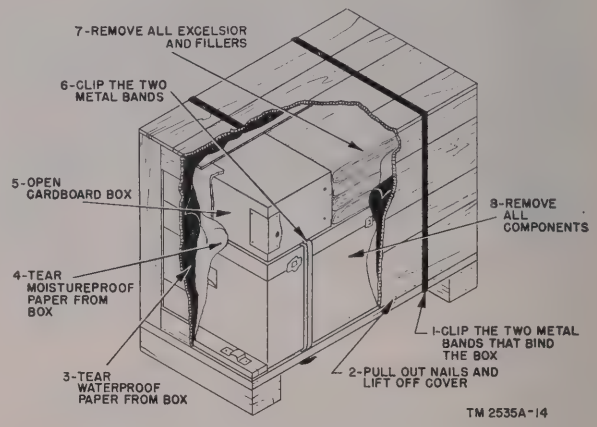


Figure 14. Unpacking procedure, export shipment.

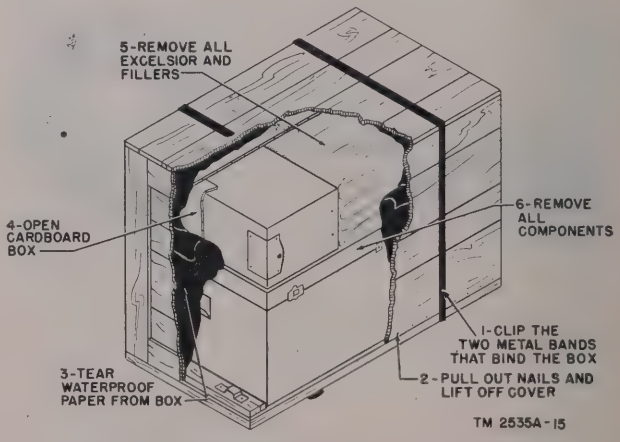


Figure 15. Unpacking procedure, domestic shipment.

(2) Cut and fold back the steel straps.
(3) Remove the nails with a nail puller. Remove the top and one side of the packing case. Do not attempt to pry off the sides and top; the equipment may be damaged.
(4) Remove the waterproof metal container or moistureproof barrier and any excelsior or corrugated paper covering the equipment inside the case. The top of the metal container is soldered to the sides. To open, break the soldered seam by prying the side of the container away from the soldered seam. Wipe off the excess solder with a soldering iron. Never use a torch because the contents of the container may be damaged. With a wooden block or a screw driver, pry the sides from the soldered seam. When the the seam is completely open, pry off the cover. Remove the bags of desiccant and the protective cardboard packing and lift or draw out the packages.
(5) Remove the equipment from its inner case and place it on or near the workbench.
(6) Inspect the equipment for possible damage incurred during shipment.
(7) Check the contents of the packing case against the master packing slip.

Note. Save the original packing cases and containers for both export and domestic shipments. They can be used again when the equipment is repacked for storage or shipment.

14. Service Upon Receipt of Used or Reconditioned Equipment

a. Follow the instructions in paragraph 13 for uncrating, unpacking, and checking the equipment.

b. Check the used or reconditioned equipment for tags or other indications pertaining to changes in the wiring of the equipment. If any changes in wiring have been made, note the change in this manual, preferably on the schematic diagram.

15. Installation of Meter Test Set TS–682/GSM–1

a. Remove the front cover of Case CY–721/GSM–1 (fig. 2) by unfastening the 12 trunk-spring latches. Pull the meter test set from the case by the four handles on the front panel. Set the test set on the workbench.

b. Check tube 3B28 to see that it is seated firmly in its socket. To reach the tube, remove the back cover. The cover is held in place by screws around the edge of the back cover and by the screws that hold the shock mounts in place.

16. Installation of Magnet Charger TS–336A/GSM–1

a. Remove the cover of the magnet charger by unfastening the three trunk-spring latches on the front of the equipment. Place the magnet charger on the workbench.

b. Check the tubes to see that they are set firmly in their sockets. To reach the tubes, remove the equipment cover by removing the screws around the edge of the front panel and on the bottom of the side of the case. Also remove the carrying straps.

c. No special instructions are necessary for installation of the demagnetizing coil.

17. Installation of Frequency Meter FR–40/GSM–1

Open the cover of the frequency meter by unfastening the cover catch. Remove the cover by sliding it to the left.

18. Power Requirements for Meter Test Equipment AN/GSM–1B

a. Power required for the test equipment is a 115-volt (plus or minus 10 volts), 60-cycle (plus or minus 1 cycle), a-c source.

b. The d-c power supply is obtained from an external, 12-volt (plus 4.5 volts or minus 1.5 volt) storage battery. The battery must be capable of supplying 100 amperes for short periods of time.

19. Connections

(fig. 16)

a. General. Connections vary for different operation procedures.

b. Connections for Meter Test Set.

(1) Connect the a-c power to the equipment by the power cord attached to the unit.

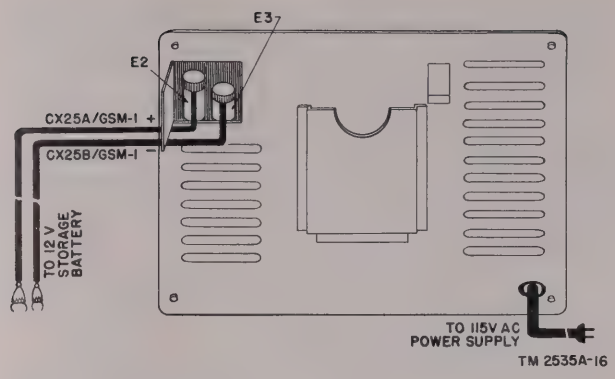


Figure 16. Power supply cording diagram for meter test set.

(2) Connect the d-c power to the equipment by Cords CX–25 A/GSM–1 (positive) and CX–25B/GSM–1 (negative), which are connected to the 12-volt battery by battery clips and to binding posts E2 and E3, located on the rear of the meter test set, by spade lugs (fig. 16).

Caution: Be sure to observe polarity when connecting the cords to the battery and meter test set.

c. Connection for Magnet Charger TS–336A/GSM–1. Connect the magnet charger and the demagnetizing coil to the a-c power supply by the power cord attached to each.

d. Connection for Frequency Meter FR–40/GSM–1. Connect the frequency meter to the source under test by connecting two test leads to the binding posts on the front panel of the equipment and to the source of power (fig. 21).

Section II. CONTROLS

20. General

Controls are located on the front panel of Meter Test Set TS–682/GSM–1 and Magnet Charger TS–336A/GSM–1. Frequency Meter FR–40/GSM–1 has no controls that are to be manipulated.

21. Controls for Meter Test Set TS–682/GSM–1

(fig. 3)

Control	Function
AC LINE ON-OFF switch (S1)	In ON position, applies a-c power to the a-c voltage jacks and to the rectifier circuit for d-c voltage output. The pilot lamp above the switch lights to indicate that a-c power is applied.
BATTERY ON-OFF switch (S2)	In ON position, applies 12-volt battery current to the meter test set for d-c testing. The pilot lamp above the switch lights to indicate that d-c power is applied.
DIRECT CURRENT COARSE CONTROL (R71).	Varies d-c output from zero to full scale, as read on the standard d-c meter.
DIRECT CURRENT FINE CONTROL (R60 and R113).	Used for fine adjustment of output over approximately 10 percent of the selected range.
DIRECT CURRENT SELECTOR (S6).	Selects required d-c output.
Meter selector switch (S4)	Selects meter and meter range to be used.
Voltage selector switch (S5)	Selects voltage output for d-c testing.
ALT. CURRENT AC VOLTS DC VOLTS COARSE CONTROL (T7).	Varies a-c, a-c volts, and d-c volts from zero to full scale in selected range.
ALT. CURRENT AC VOLTS DC VOLTS FINE CONTROL (R1).	Used for fine adjustment of output over approximately 10 percent of the selected range.

22. Controls for Magnet Charger TS–336A/GSM–1

(fig. 9)

Control	Function
POWER ON-OFF switch (S1)	In ON position, applies power to magnet charger and lights pilot lamp.
NORMAL—CHARGE MAGNET switch (S2).	In NORMAL position, charges capacitor to give full output. In CHARGE position, applies output to the charging bar.
Push-button switch (on demagnetizing coil).	When switch is depressed, demagnetizing coil is energized.

Section III. OPERATION UNDER USUAL CONDITIONS

23. General

Most meters in use by Army personnel are normally mounted on a steel panel. When this type of meter is tested and calibrated, a calibration ring of proper size must be used. Select a calibration ring of the approximate diameter of the meter to be tested, and slip it over the body of the meter before mounting the meter in Mounting MT–135A/GSM–1.

24. Preliminary Starting Procedure

Follow the preliminary starting procedures given below before using the starting procedure in paragraph 25.

a. Preliminary Starting Procedure for Meter Test Set TS–682/GSM–1 (fig. 17).

(1) Throw the AC LINE switch to the OFF position.

(2) Throw the BATTERY switch to the OFF position.

(3) Rotate the four control knobs to the extreme counterclockwise position.

(4) Adjust the a-c meter and the d-c meter to zero by means of the zero-adjust control located directly below each meter. To overcome the friction inherent in the pivot of this type of meter, tap the face of the meter lightly with the fingers when zeroing and each time the meter is read when in use.

b. Preliminary Starting Procedure for Magnet Charger TS–336A/GSM–1. Throw the POWER switch to the OFF position.

25. Starting Procedure

Note. Be sure to read paragraph 24 before using the following procedure. If, during the starting procedure, an abnormal result is obtained, see paragraph 48.

a. Starting Procedure for Meter Test Set TS–682/GSM–1.

(1) Throw the AC LINE switch to the ON position. Wait approximately 15 minutes for the unit to warm up.

(2) Throw the BATTERY switch to the ON position.

b. Starting Procedure for Magnet Charger TS–336A/GSM–1. Throw the POWER switch to the ON position.

Caution: Before making any tests, turn each control knob to the extreme counterclockwise position. Never turn the controls on the meter test set from the extreme counterclockwise position until the meter under test has been connected to the binding posts. Failure to observe this precaution may result in damage to the current transformer and to operating personnel.

26. Testing A-c Voltmeters With Meter Test Set TS–682/GSM–1

(figs. 17 and 18)

a. Check all control knobs to be sure that each is in the extreme counterclockwise position.

b. Throw the AC LINE switch to the ON position. Allow 15 minutes for the equipment to warm up.

c. Turn range switches S4 and S5 to the ACV position. (The position of the DIRECT CUR-

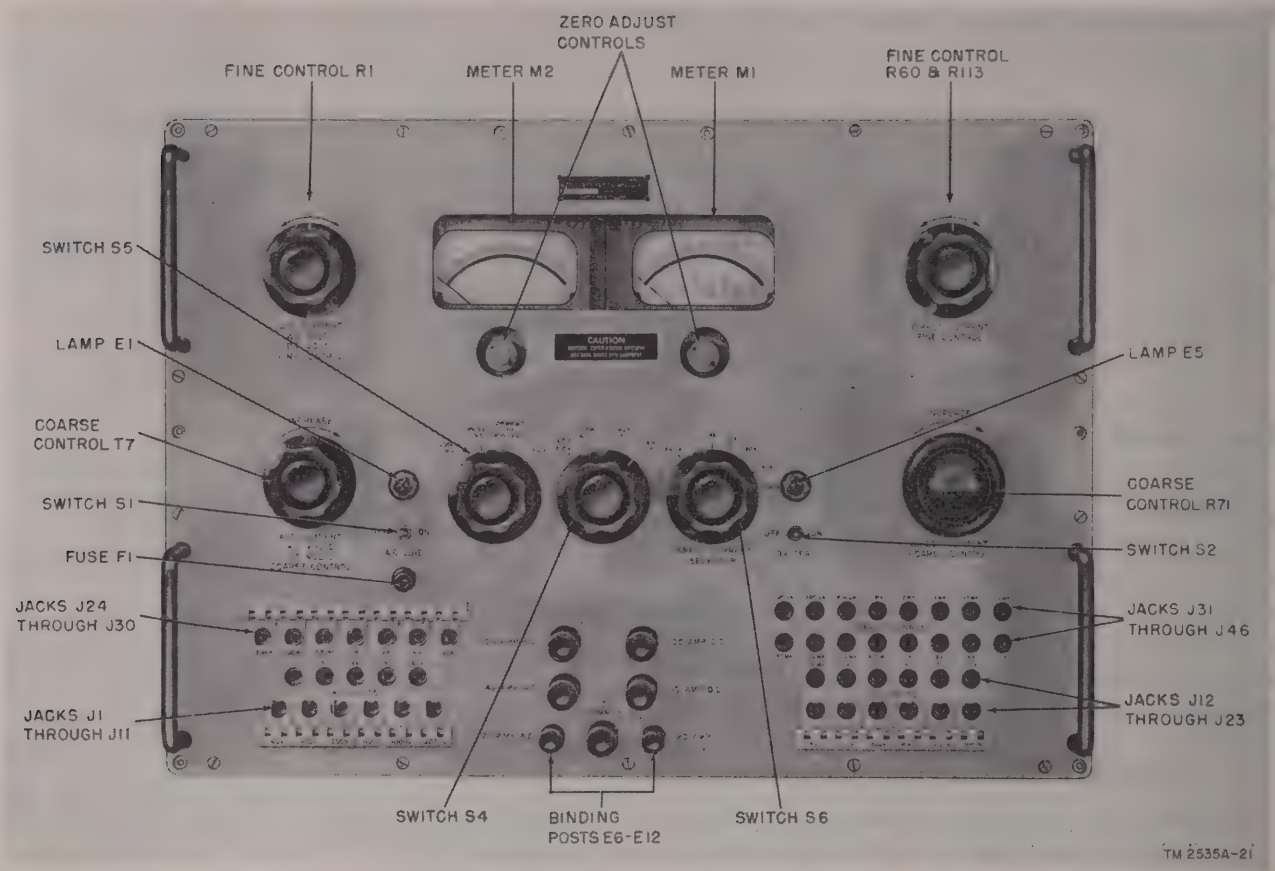


Figure 17. Front panel of meter test set.

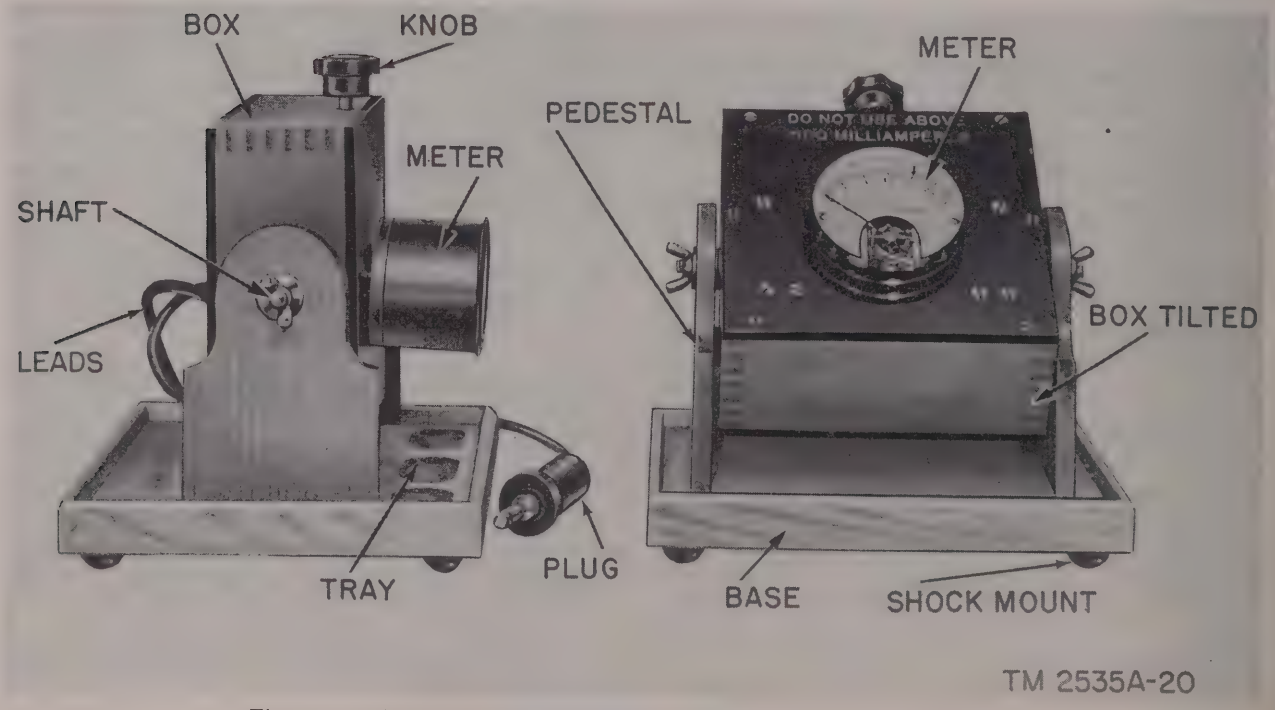


Figure 18. Mounting MT-185A/GSM-1, with meter in test position.

RENT SELECTOR has no effect in this test circuit.)

d. Connect the spade-lug end of the test cord that has Plug PL–55 at the other end to either terminal on the rear of Mounting MT–135A/GSM–1. Connect one end of the cord that has two spade-lug ends to the other terminal on the rear of Mounting MT–135A/GSM–1 and one end to the COMMON binding post on Meter Test Set TS–682/GSM–1.

e. Press down the knob on top of Mounting MT–135A/GSM–1, and place in the mounting the meter to be tested.

f. Insert Plug PL–55 into the appropriate a-c voltage jack on the front panel of the meter test set (fig. 17).

Caution: Always use the lowest range that will provide the required voltage.

g. Rotate the AC VOLTS COARSE CONTROL clockwise slowly until the pointer of the standard a-c meter reaches the desired deflection. Read the scale of the standard a-c meter that corresponds to the rated value of the a-c voltage jack selected.

h. Make a fine adjustment of the scale reading by rotating the AC VOLTS FINE CONTROL.

i. Compare the reading of the meter under test with the reading of the standard a-c meter.

j. Repeat the procedure outlined in *g*, *h*, and *i* above for as many different readings as necessary to test the action and accuracy of the meter under test.

k. To prepare the meter test set for testing another meter, proceed as follows:

(1) Turn the AC VOLTS COARSE CONTROL to the maximum counterclockwise position.

(2) Remove Plug PL–55 from the jack on the front panel of the meter test set.

(3) Press down the knob on top of Mounting MT–135A/GSM–1, and remove the tested meter.

(4) Throw the AC LINE switch to the OFF position.

27. Testing D-c Voltmeters With Meter Test Set TS–682/GSM–1

a. Check all control knobs to be sure that each is in the extreme counterclockwise position.

b. Throw the AC LINE switch to the ON position. Allow 15 minutes for the equipment to warm up.

c. Turn range switch S4 to the DCV position. Set range switch S5 at the DCV position that corresponds to the range of the meter under test. The position of the DIRECT CURRENT SELECTOR switch has no effect in this test circuit.

d. Connect the spade end of the test cord that has Plug PL–55 at the other end to the negative terminal on the rear of Mounting MT–135A/GSM–1. Connect one spade end of the cord that has two spade ends to the positive terminal on the rear of Mounting MT–135A/GSM–1 and one end to the COMMON binding post on the meter test set.

e. Press down on the knob on the top of the mounting and place the meter under test in the mounting.

f. Insert Plug PL–55 into the appropriate d-c voltage jack on the front panel of the meter test set (fig. 17).

Caution: Always use the lowest range that will provide the required voltage.

g. Rotate the DC VOLTS COARSE CONTROL slowly clockwise until the pointer of the standard d-c meter reaches the desired deflection. Read the scale of the d-c meter that corresponds to the rated value of the d-c voltage jack selected.

h. Make a fine adjustment of the scale reading by rotating the DC VOLTS FINE CONTROL.

i. Compare the reading of the meter under test with that of the standard d-c meter.

j. Repeat the procedure outlined in *g*, *h*, and *i* above for as many readings as necessary to test the action and accuracy of the meter under test.

k. To prepare the meter test set for testing another meter, proceed as follows:

(1) Turn the DC VOLTS COARSE CONTROL to the maximum counterclockwise position.

(2) Remove Plug PL–55 from the jack on the front panel of the meter test set.

(3) Press down the knob on top of Mounting MT–135A/GSM–1, and remove the meter.

(4) Throw the AC LINE switch to the OFF position.

28. Testing A-c Ammeters With Meter Test Set TS–682/GSM–1

a. Low A-C Ranges. To test a-c ammeters with ranges up to and including 10 amperes, proceed as follows:

(1) Check all control knobs to see that each is in the maximum counterclockwise position.

(2) Throw the AC LINE switch to the ON position.

(3) Connect the spade end of the test cord that has Plug PL–68 at the other end to either terminal on the rear of Mounting MT–135A/GSM–1. Connect one end of the cord that has two spade ends to the other terminal on the rear of Mounting MT–135A/GSM–1 and the other end to the COMMON binding post on the meter test set.

(4) Press down on the knob on top of the mounting unit and insert the meter to be tested.

(5) Insert Plug PL–68 into the appropriate a-c jack on the front panel of the meter test set.

(6) Turn the ALT CURRENT COARSE CONTROL clockwise slowly until the desired deflection is obtained on the standard a-c meter. Read the scale on the standard a-c meter that corresponds to the rated value of the jack selected on the front panel.

(7) Make a fine adjustment of the scale reading by rotating the ALT CURRENT FINE CONTROL.

(8) Compare the reading of the meter under test with that of the standard a-c meter.

(9) Repeat steps (6), (7), and (8) above to test the meter at as many readings as desired.

(10) Prepare the equipment for testing another meter, as follows:

(*a*) Turn the ALT CURRENT COARSE CONTROL to the extreme counterclockwise position.

(*b*) Remove Plug PL–68 from the jack on the front panel of the meter test set.

(*c*) Press down on the knob on top of the mounting unit and remove the meter.

(*d*) Throw the AC LINE switch to the OFF position.

b. High A-C Ranges. For testing a-c ammeters with ranges above 10 amperes and below 100 amperes, proceed as follows:

(1) Check all controls to be sure that each is in the extreme counterclockwise position.

(2) Connect the test leads with spade lug at each end to the meter under test and to the appropriate a-c binding posts on the meter test set. Be sure the connections are tight enough to prevent arcing.

(3) Throw the AC LINE switch to the ON position.

(4) Turn the ALT CURRENT COARSE CONTROL clockwise slowly until the desired deflection is obtained on the standard a-c meter. Read the standard a-c meter scale that corresponds to the rated value of the a-c binding posts used.

(5) Make a fine adjustment of the scale reading by rotating the ALT CURRENT FINE CONTROL.

(6) Compare the reading of the meter under test with that of the standard a-c meter.

(7) Repeat the steps in (4), (5), and (6) above to test the meter at as many readings as desired.

(8) Prepare the equipment for testing another meter as follows:

(*a*) Turn the ALT CURRENT COARSE CONTROL to the extreme counterclockwise position.

(*b*) Throw the AC LINE switch to the OFF position.

(*c*) Disconnect the test cords from the equipment.

(*d*) Throw the AC LINE switch to the OFF position.

29. Testing D-c Ammeters With Meter Test Set TS–682/GSM–1

a. Low D-C Ranges. For testing d-c ammeters with ranges up to 10 amperes, proceed as follows:

(1) Check all controls to see that each is in the extreme counterclockwise position.

(2) Connect the spade end of the test cord that has Plug PL–68 at the other end to the positive terminal on the rear of

Mounting MT–135A/GSM–1. Connect one end of the cord that has two spade ends to the negative terminal on the rear of Mounting MT–135A/GSM–1 and one end to the COMMON binding post on the meter test set.

(3) Turn the DIRECT CURRENT SELECTOR switch to the appropriate position.

(4) Press down on the knob on top of the mounting unit, and place in the mounting the meter to be tested.

(5) Insert Plug PL–68 into the appropriate DIRECT CURRENT jack on the front panel of the meter test set.

Caution: Always use the lowest range that will provide the required current.

(6) Throw the BATTERY switch to the ON position.

(7) Turn the DIRECT CURRENT COARSE CONTROL clockwise slowly until the desired deflection is obtained on the standard d-c meter. Read the standard d-c meter scale that corresponds to the rated value of the jack selected on the front panel.

(8) Make a fine adjustment of the scale reading by rotating the DIRECT CURRENT FINE CONTROL.

(9) Compare the reading of the meter under test with that of the standard d-c meter.

(10) Repeat the steps in (7), (8), and (9) above to test the meter at as many readings as desired.

(11) Prepare the equipment for testing another meter as follows:

(*a*) Turn the DIRECT CURRENT COARSE CONTROL to the extreme counterclockwise position.

(*b*) Remove Plug PL–68 from the jack on the front panel of the meter test set.

(*c*) Press down the knob on top of the mounting unit, and remove the meter.

(*d*) Throw the BATTERY switch to the OFF position.

b. High D-C Ranges. For testing d-c ammeters with ranges above 10 amperes and below 100 amperes, proceed as follows:

(1) Check all controls to be sure that each is in the extreme counterclockwise position.

(2) Connect the test leads that have a spade lug at each end to the meter under test and to the appropriate d-c binding posts on the meter test set. Be sure the connections are tight enough to prevent arcing.

Note. Connect the negative meter terminal to the COMMON binding post.

(3) Turn the DIRECT CURRENT SELECTOR switch to the appropriate position.

(4) Throw the BATTERY switch to the ON position.

(5) Turn the DIRECT CURRENT COARSE CONTROL clockwise slowly until the desired deflection is obtained on the standard d-c meter. Read the standard d-c meter scale that corresponds to the rated value of the d-c binding posts.

(6) Make a fine adjustment of the scale reading by rotating the DIRECT CURRENT FINE CONTROL.

(7) Compare the reading of the meter under test with that of the standard d-c meter.

(8) Repeat the steps in (4), (5), and (6) above to test the meter at as many readings as desired.

(9) Prepare the equipment for testing the next meter as follows:

(*a*) Turn the DIRECT CURRENT COARSE CONTROL to the extreme counterclockwise position.

(*b*) Throw the BATTERY switch to the OFF position.

(*c*) Disconnect the test cords from the equipment.

(*d*) Throw the BATTERY switch to the OFF position.

30. Charging Meter Magnets With Magnet Charger TS–336A/GSM–1

(figs. 19 and 20)

a. Check the POWER switch to be sure it is in the OFF position, and then connect the magnet charger to a 105- to 125-volt, 60-cycle power source by means of the attached power cord.

b. Remove the meter magnets from their instrument cases.

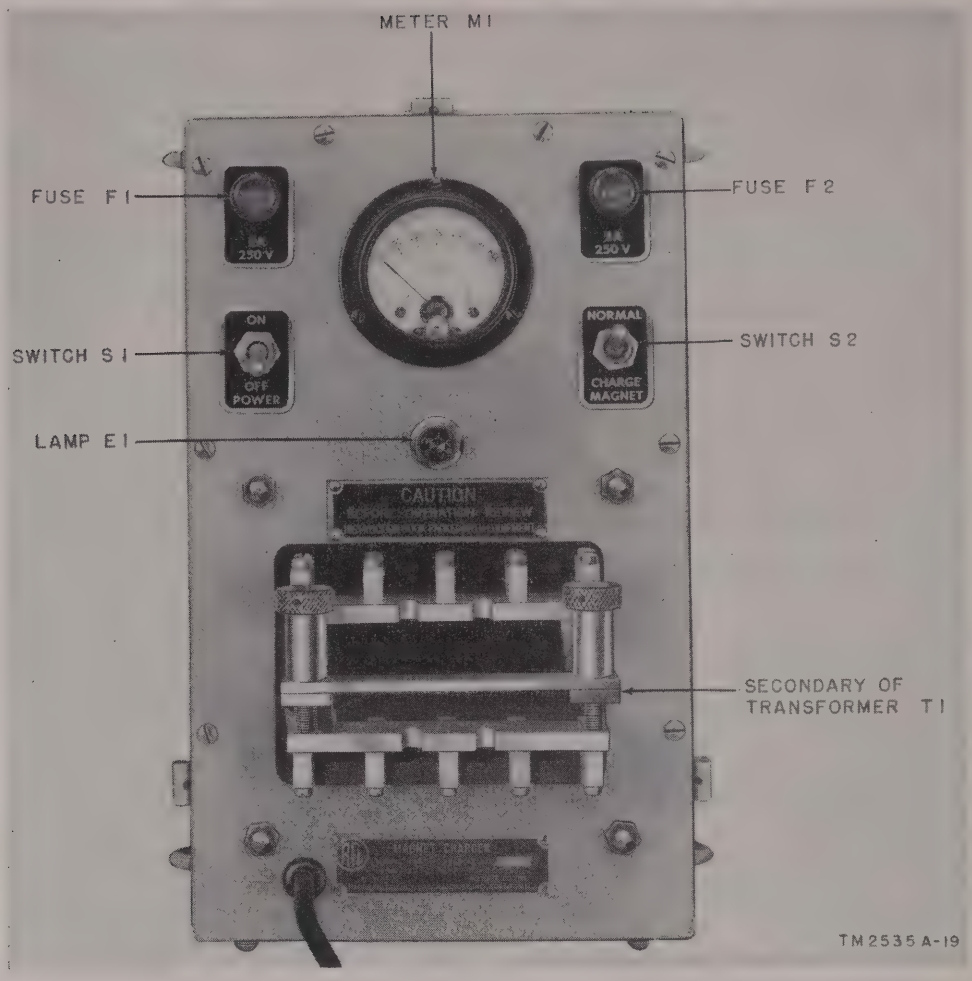


Figure 19. Front panel of Magnet Charger TS–336A/GSM–1.

c. Determine the polarity of the meter magnets to be charged.

(1) Viewed from the rear, the positive north pole of a meter magnet is attached to the left-hand meter terminal.

(2) If the polarity is not known or marked, place one pole near a magnet of known polarity. Like poles repel, and unlike poles attract.

d. If the magnet and moving element cannot be removed as a unit, or if it becomes necessary to detach the moving element for repair purposes, use a soft-iron keeper in place of the moving element to complete the magnetic circuit when charging the meter magnet. If loss of calibration is caused only by a weakened meter magnet, charge the meter magnet without detaching the moving element, so that the magnetic circuit will not be disturbed when the magnet is replaced in its case.

Caution: Be sure to place the meter magnet, coil, and movement in a position so that the moving element will be subjected to a minimum of induced current from the magnetizing fixture. Place a piece of scotch tape over the moving element to anchor it in a stationary position.

e. Place the meter magnet in the charging position as follows:

(1) Loosen the two binding screws that hold the charging bar, and remove the charging bar (fig. 20).

(2) Insert the charging bar through the meter-magnet window so that the south pole of the meter magnet is uppermost, and tighten the two binding screws to secure the bar in place. If the mechani-

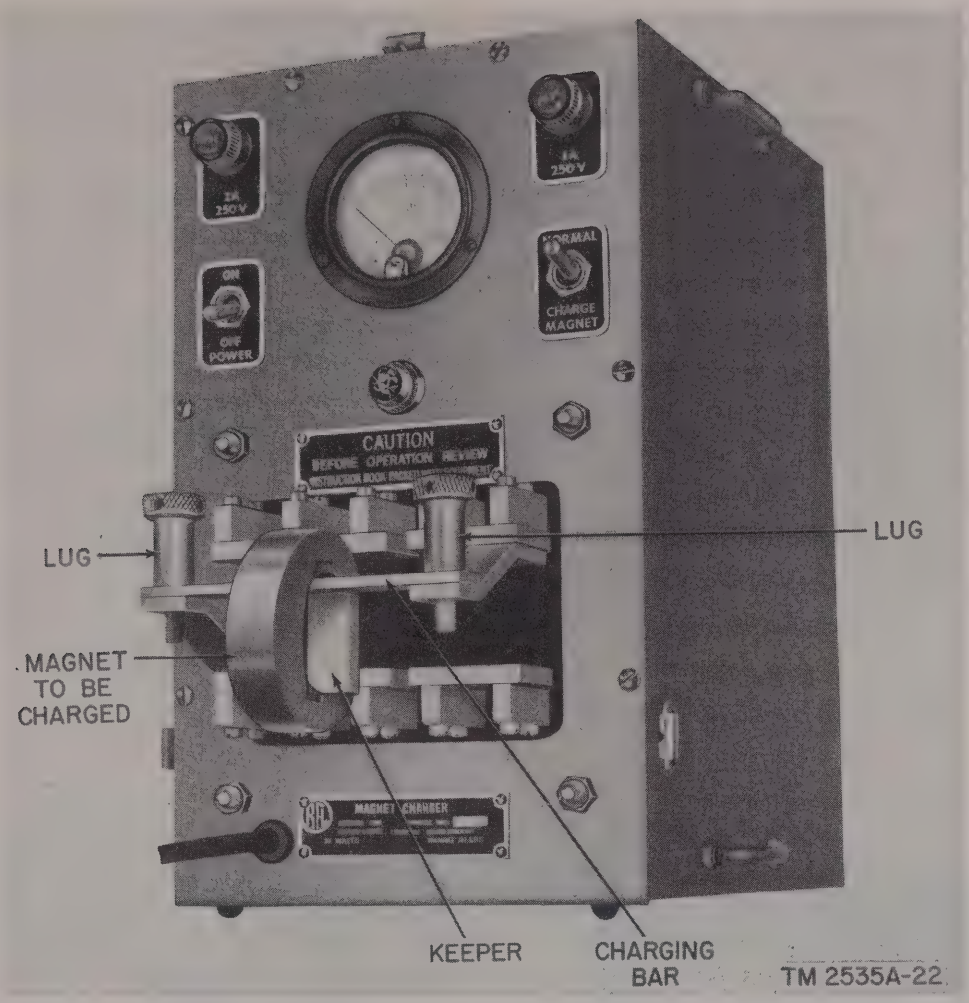


Figure 20. Magnet to be charged in charging position.

cal construction of the magnet requires that the poles be placed away from the panel, place the north pole uppermost.

f. Throw the POWER switch to the ON position.

g. When the equipment has warmed up and is ready to charge the magnet, the meter will read approximately 500 volts. When the meter reads 500 volts, hold the MAGNET switch down in the CHARGE position.

Caution: Do not permit watches or other delicate mechanisms that can be harmed by a magnetic charge to come within the effective range of the magnetic field. Keep these items at least 5 feet away.

h. After a period of approximately 3 seconds, allow the MAGNET switch to return to the NORMAL position.

i. Throw the POWER switch to the OFF position.

j. Remove the charged meter magnet from the magnetizing fixture by reversing the procedure in subparagraph *e* above. The magnet charger is now ready to charge another meter magnet.

k. Replace the meter magnet in its case. If a keeper has been used, be careful not to break the magnetic circuit when replacing the moving element of the meter.

31. Calibration of Recharged Meter Magnets

a. Meter magnets charged by the magnet charger will be too highly magnetized and must be bucked down by the demagnetizing coil (fig. 11).

b. Connect the demagnetizing coil to a 105- to 125-volt, 60-cycle power source by means of the attached power cord.

c. Actuate the charged meter by placing it in testing position (pars. 26 through 29).

d. Set the appropriate standard meter of the meter test set at approximately three-fourths of full-scale deflection. Compare the reading of the newly charged meter with the reading of the standard meter. The reading will be too high.

e. Hold the demagnetizing coil approximately 2 feet from the case of the meter being calibrated.

Caution: Keep the demagnetizing coil at least 2 feet away from the meter test set so that accuracy of the standard meters will not be affected.

f. Press the push button on the handle of the demagnetizing coil, and bring the coil progressively closer to the meter under calibration until the reading of the meter agrees with the reading of the standard meter of the test set. If stronger transient demagnetizing currents are needed, alternately press down and release the push button at a fast rate.

Caution: Do not depress the push button for too long a time. The demagnetizing coil heats up rapidly.

g. When the demagnetizing coil is not in use, remove the power cord from the power source to prevent overheating of the demagnetizing coil through accidental depression of the push button.

32. Determination of Power Frequency With Frequency Meter FR–40/GSM–1

(fig. 21)

a. To determine the accuracy of a power frequency meter, connect it across a 115-volt, 60-cycle (± 10 cycles) power source.

b. Connect Frequency Meter FR–40/GSM–1 to the same power source by test leads (fig. 21).

c. Compare the reading of the standard meter with that of the meter under test.

d. The frequency meter also may be used to determine the frequency of an a-c power source when Meter Test Equipment AN/GSM–1B is set up for the first time or whenever it is necessary to check the frequency of a 105- to 125-volt power source.

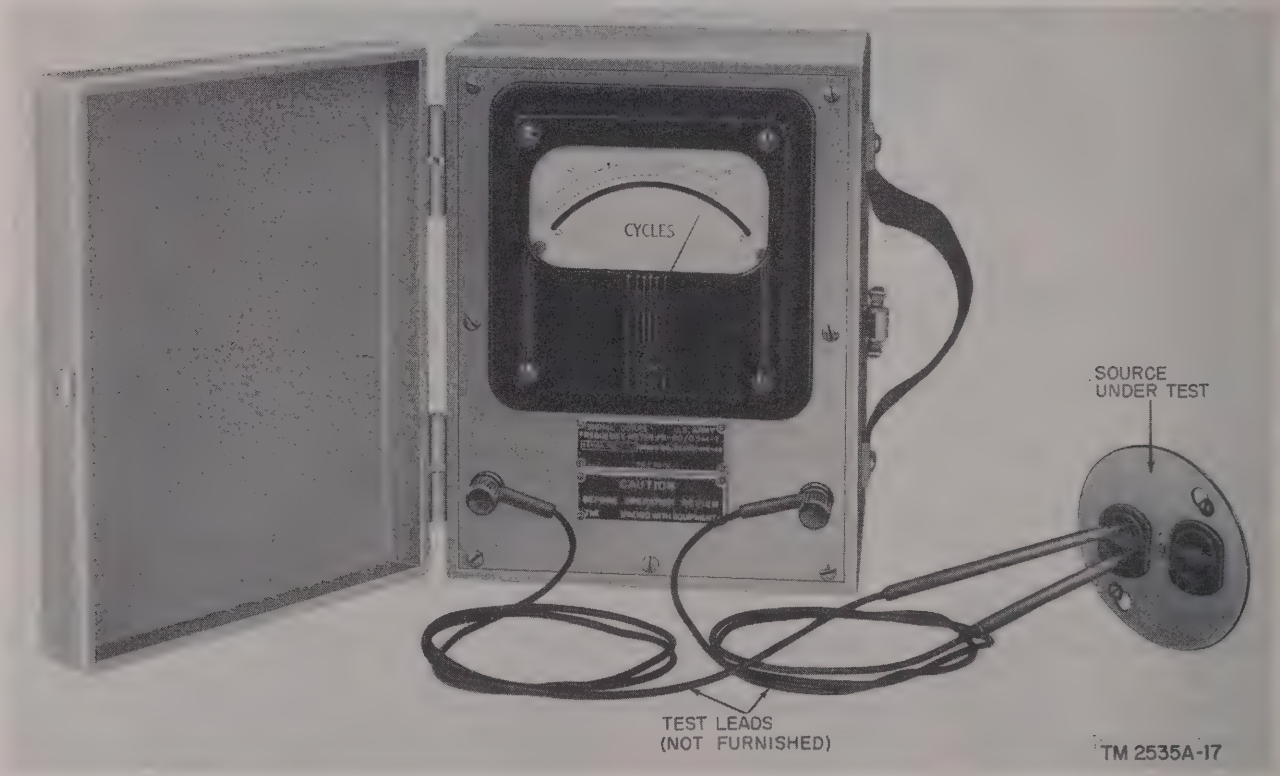


Figure 21. Frequency Meter FR–40/GSM–1 in use.

33. Determination of Resistance Values

For determination of resistance values of the series resistors, multipliers, and shunts used with the meters, refer to TM 11–5520, which is packed with the equipment. When very accurate determination of resistance values is required, use Test Set I–49 in accordance with TM 11–2019.

Section IV. OPERATION UNDER UNUSUAL CONDITIONS

34. General

The operation of Meter Test Equipment AN/GSM–1B may be difficult in regions where extreme climatic conditions prevail. The following paragraphs contain instructions on procedures for minimizing the effect of these conditions.

35. Operation in Arctic Climates

Subzero temperatures and the climatic conditions associated with cold weather lower the efficiency of the equipment.

a. Handle the equipment carefully.

b. Locate the equipment in a heated inclosure where there is no danger from cold drafts when a door is opened. If the inclosure is constructed so that this precaution is impossible, place a blanket or some barrier between the source of the draft and the equipment.

c. Keep the equipment dry. If it is not in a heated inclosure, construct an insulated box for it. If resistor heaters are supplied, keep them turned on, but be sure that use of the heaters does not overtax the power supply. If heaters are not used, keep the filaments of the vacuum tubes lighted constantly when the equipment is not in use.

d. When the equipment has been exposed to cold, it will start to sweat when brought into a warm room. It will also start to sweat when it warms up during the day after exposure during a cold night. When the equipment has reached room temperature, dry it thoroughly.

e. Keep the storage batteries fully charged to minimize the effect of extreme cold. Poorly charged storage batteries may freeze and crack open in subzero temperatures.

36. Operation in Tropical Climates

When operated in tropical climates, Meter Test Equipment AN/GSM–1B may be installed in tents, huts, or underground dugouts. When the equipment is installed below ground or set up in swampy areas, moisture conditions are acute. Ventilation is very poor, and the high relative humidity causes condensation of moisture on the equipment whenever the temperature becomes lower than the ambient air. To minimize this condition, place the equipment on raised open frames, and place a lighted electric bulb under each unit.

37. Operation in Desert Climates

a. Should conditions similar to those encountered in tropical climates prevail in desert areas, follow the instructions given in paragraph 36.

b. The most serious problem in desert areas is the amount of sand, dust, and dirt which enters moving parts of the equipment. If possible, house the equipment in a dustproof shelter. However, since such a building is seldom available and would require air-conditioning, the next best precaution is to make the building in which the equipment is housed as dustproof as possible. Hang wet sacking over the windows and doors, cover the inside walls with heavy paper, and secure the side walls of tents with sand to prevent their flapping in the wind.

c. Never tie power cords or other wiring connections to either the inside or the outside of tents. Desert areas are subject to sudden wind squalls that may jerk the connections loose or break the leads.

d. Make frequent preventive maintenance checks (par. 43).

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CHAPTER 3

MAINTENANCE OPERATIONS

Section 1. GENERAL

38. Preventive Maintenance Test Equipment, Tools, and Materials

The following test equipment, tools and materials are used to perform preventive maintenance:

Carbon tetrachloride.
Cloth, clean, lint-free.
Crocus cloth.
Multimeter TS–352/U.
Tool Equipment TK–21/G.
Tool Equipment TK–22/G.
Tool Equipment TK–3/MSM–2.
Tube Tester TV–2/U.
Shorting stick (par. 39).
Solvent, dry-cleaning (SD).
Sandpaper No. 0000.

39. Shorting Stick

(fig. 22)

a. General. The shorting stick is used to discharge capacitors before preventive maintenance or trouble shooting. Normally, when the power in the equipment is turned off, capacitors will discharge to ground through bleeder resistors or voltage dividers. Should failure occur in a discharging network and the capacitors remain charged, severe burns might result on contact. The use of a shorting stick prevents such accidents.

b. Fabrication of Shorting Stick. Obtain a hardwood dowel approximately ½ inch in diameter and 15 inches long. Drill a ⅛-inch diameter hole 2 inches deep in the end of the dowel (fig. 22). Press-fit a piece of copper or brass bus wire into the hole, leaving approximately 1 inch of wire extending beyond the dowel. Solder one end of a 36-inch length of flexible, stranded, No. 10 wire, to the bus wire as close to the dowel as possible. Attach a battery clamp to the other end of the flexible wire. Apply several layers of friction tape over the soldered connection of the flexible wire and the bus wire, leaving approximately ½ inch of untaped bus wire extended. Continue the tape from the soldered connection down over the dowel to within 2 inches of the soldered joint. Apply two layers of rubber tape and two layers of friction tape around the opposite end of the dowel, and extend

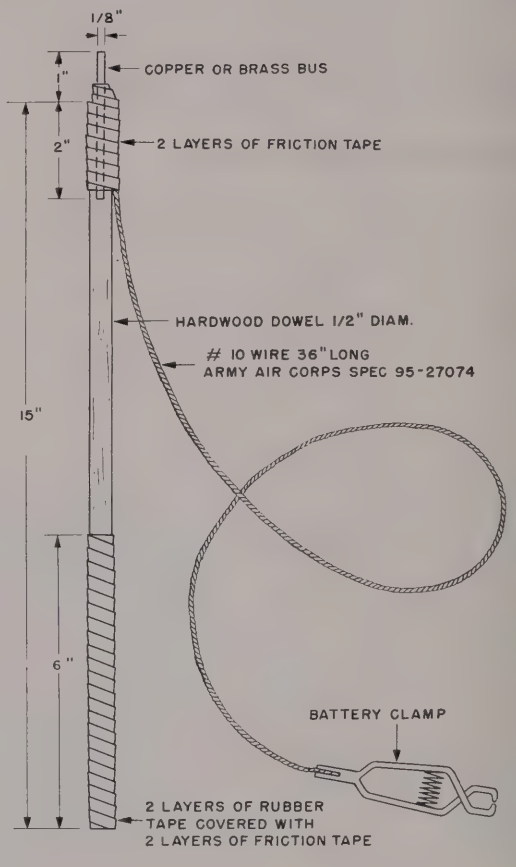


Figure 22. Shorting stick.

the tape wrapping upward 6 inches to form an insulated handle for the shorting stick.

c. Use of Shorting Stick. Connect the battery clamp to any known chassis ground conveniently located near the capacitor to be discharged. Hold the shorting stick by the insulated handle, and touch the exposed bus wire to the capacitor terminals. The capacitor will discharge immediately.

40. Weatherproofing

a. General. Signal Corps equipment, when operated under severe climatic conditions such as prevail in tropical, arctic, and desert regions, requires special treatment and maintenance. Fungus growths, insects, dust, corrosion, salt spray, excessive moisture, and extreme temperatures are harmful to most materials.

b. Tropical Maintenance. A special moistureproofing and fungiproofing treatment has been devised which, if properly applied, provides a reasonable degree of protection. This treatment is explained fully in TB SIG 13 and TB SIG 72.

c. Winter Maintenance. Special precautions to prevent poor performance or total operational failure of equipment in extremely low temperatures are explained fully in TB SIG 66.

d. Desert Maintenance. Special precautions necessary to prevent equipment failure in areas subject to extremely high temperatures, low humidity, and excessive sand and dust are explained fully in TB SIG 75.

Section II. PREVENTIVE MAINTENANCE SERVICES

41. Meaning of Preventive Maintenance

a. Definition. Preventive maintenance is work performed on equipment, usually when it is not in use, to keep it in good condition so that breakdowns and interruptions in service will be kept at a minimum. The object of preventive maintenance is to eliminate the need for trouble shooting and repair.

b. Importance. Since the failure or inefficient operation of a single part may cause the breakdown of the entire equipment, the importance of preventive maintenance is obvious. Operators must maintain equipment in their charge in such condition that it will work at top efficiency at all times.

42. Preventive Maintenance Techniques

a. Use No. 0000 sandpaper to remove corrosion.

b. Use a clean, dry, lint-free cloth or a dry brush for cleaning. Moisten the cloth or brush with solvent (SD); clean the equipment, *except for electrical contacts*, and then wipe the parts dry with a fresh cloth. Clean the electrical contacts with a cloth moistened with carbon tetrachloride; then wipe them dry with a clean cloth.

c. If dry compressed air is available, it may be used at a line pressure not exceeding 40 pounds per square inch to remove dust from inaccessible places in the equipment. If compressed air is used, be very careful not to damage the equipment.

d. Do not tighten screws or nuts carelessly. Fittings tightened beyond the pressure for which they are designed will be damaged or broken.

43. Preventive Maintenance Services

The following preventive maintenance operations should be performed by organizational personnel at the intervals indicated, unless these intervals are reduced by the local commander.

a. Daily Services.

(1) Clean exterior of cabinets.

(2) Check operation of pilot lamps.

b. Weekly Services. Disconnect all power connections before performing the following operations. Discharge all high-voltage capacitors with the shorting stick (par. 39) or a similar tool. Upon completion of checks, reconnect power cables, and check for satisfactory operation.

(1) Clean the exterior of all chassis and all parts accessible without removal from the chassis.

(2) Inspect electrolytic and paper capacitors for leakage of oil or electrolyte, for bulging, and for heating.

(3) Inspect power transformers for excessive heating.

(4) Inspect the fuses and the fuseholders for corrosion and cracks.

(5) Check all the meters for zero adjustment.

c. Monthly Services. Inspect the following, and tighten, clean, and/or replace if necessary.

(1) Tube sockets and pins for loose contacts, dirt, and corrosion. Use a tube checker to check vacuum tubes.
(2) Resistors for blistering, discoloration, and other evidence of overheating.
(3) Switches for dirt, corrosion, loose contacts, and unsatisfactory mechanical action.
(4) Plugs and jacks for dirt, corrosion, and loose contacts.
(5) Wires, cords, and cables for cracked, cut, and frayed insulation.
(6) Terminal boards for cracks, dirt, and loose connections.
(7) Potentiometers for unsatisfactory electrical and mechanical operation.
(8) Mountings, machine screws, and nuts for mechanical looseness.
(9) All visible terminals for loose connections and corrosion.
(10) Moistureproofing and fungiproofiing coatings for breaks. Retouch with a brush if necessary.
(11) Finish for scratches and bare spots. Retouch if necessary (par. 79).
(12) Coils for dirt, corrosion, and damaged turns.
(13) Relays K1, K2, K3, K4, and K5 for pits and build-ups on contacts and for improper alinement (par. 44).

44. Care of Relays, Meter Test Set TS–682/GSM–1

a. Relay Exterior. Brush the exterior of the relays with a soft brush; *do not apply enough force to damage the relay.*

b. Relay Contacts.

(1) Remove loose dust or lint from the relay contacts with a soft-bristle brush.
(2) Inspect the contacts thoroughly. If they are dirty, burned, pitted, or corroded, service them in accordance with the instructions in (*a*) through (*d*) below.

Note. The brown discoloration found on silver or silver-plated contacts is silver oxide and is a good conductor. It should not be removed unless the contacts must be cleaned for some other reason. It may be removed at any time either by burnishing or by cleaning with a cloth moistened with carbon tetrachloride.

(*a*) To clean contacts, insert a clean, flat blade in the burnishing tool. Clean the blade frequently by wiping it with a lint-free cloth moistened with carbon tetrachloride. To burnish normally open contacts, press them together with an orange stick or suitable substitute, or operate the relay manually to exert a slight pressure against the blade of the burnisher. At the same time, move the blade back and forth two or three times to brighten the contacts. *Avoid excessive burnishing.* When burnishing normally closed contacts, the tension of the springs usually will supply enough pressure against the burnisher. If the spring tension is heavy, lift one of the springs sufficiently to insert the burnisher.

(*b*) If burnishing does not eliminate the contact trouble, use carbon tetrachloride to clean the contact surfaces thoroughly. Dip the flat end of a clean toothpick into carbon tetrachloride. Separate the contacts slightly, and deposit the liquid on the contacts *without rubbing.* Use the flat end of another toothpick to deposit more carbon tetrachloride on the contacts to flush away dirt loosened by the first application. *Do not rub.* Be sure to keep carbon tetrachloride away from all insulating materials. After the contacts are thoroughly dry, burnish them ((*a*) above) to remove all deposit or residue.

(*c*) To recondition contact points that are badly pitted or built up, proceed as follows: Remove build-ups with a fine-cut file. Burnish the pits with the ball-point burnisher blade furnished with the burnishing tool. If the pit is small, place the ball point of the burnisher in the pit and rotate the barrel of the tool between the thumb and forefinger, while applying slight pressure. If the

pit is large, move the ball point of the burnisher over the surface of the pit with a circular motion. After removing the build-ups and cleaning the pits again, burnish the contacts with a flat blade of the contact burnisher. *Avoid excessive removal of the contact metal.*

Caution: Never use a highly abrasive material, such as sandpaper, crocus cloth, or emery cloth, to clean the relay contacts. Do not use paper because minute burrs on the contact surface may retain fine shreds of paper and cause faulty operation of the contacts.

(*d*) Relay pole faces and armature faces must be cleaned occasionally. These are the surfaces of the core and armature which touch each other when the relay operates. Need for cleaning is indicated by a tendency to stick during operation. Clean with a burnisher and carbon tetrachloride, or use the following method: Insert a strip of hard-finish bond paper between the armature and the core. Lightly press the armature against the core and withdraw the paper. Repeat with clean paper until there is no evidence of dirt.

Section III. TROUBLE SHOOTING

45. Scope at Organizational Level

a. The trouble shooting and repair work that can be performed at the organizational maintenance level are limited in scope by the tools, test equipment, and replaceable parts issued and by the existing tactical situation.

b. The paragraphs in this section will help the repairman to determine which component of Meter Test Equipment AN/GSM–1B is at fault, and to localize some types of fault in the defective component.

46. Initial Inspection

a. Failure of the test equipment to operate properly will be caused usually by one or more of the following faults:

(1) Cord CX–25A/GSM–1 or CX–25B/GSM–1 improperly connected.
(2) Cords or plugs worn, broken, or disconnected.
(3) Fuses burned out.
(4) Relay contacts burned because of overloads.
(5) Wires broken because of excessive vibration.
(6) Vacuum tubes defective.

b. When a failure is encountered and the cause is not immediately apparent, check as many of the above items as practicable before starting a detailed examination of component parts. If possible, obtain information from the operator regarding performance at the time the trouble occurred.

47. Using Equipment Performance Checklist

a. General. The equipment performance check-list (par. 48) will help the operator to locate trouble in the equipment. The list gives the item to be checked, the action or condition under which the item is to be checked, normal indications and tolerances for correct operation, and corrective measures. *To use this list, follow the items in numerical sequence.*

b. Action or Condition. For some items, the information given in the *Action or condition* column consists of various switch and control settings at which the item is to be checked. For other items it represents an action that must be taken to check the normal indication given in the *Normal indication* column.

c. Normal Indication. The normal indications listed include visible signs that the operator should perceive when he checks the items. If indications are not normal, the operator should apply the recommended corrective measures.

d. Corrective Measures. The corrective measures listed are those the operator can apply without turning the equipment in for repairs. A reference in the table to chapter 4 indicates that the trouble cannot be corrected during operation and that trouble shooting by an experienced repairman is necessary. If the equipment is completely inoperative or if the recommended corrective measures do not yield results, trouble shooting at field level is required.

48. Equipment Performance Checklist

a. Meter Test Set TS–682/GSM–1.

Item No.	Control	Action or condition	Normal indication	Corrective measures
1	AC LINE switch (S1)	Turn to ON position	Pilot lamp lights, rectifier circuit functions, and output is present for d-c voltage, a-c voltage, and a-c current testing.	Check power cord. Check pilot lamp. Check rectifier tube VI. Check fuse.
2	BATTERY switch (S2)	Turn to ON position	Pilot lamp lights, and current is supplied for d-c current testing.	Check power cords. Check pilot lamp. Check battery.
3	ALT CURRENT AC VOLTS DC VOLTS COARSE CONTROL (T7).	Rotate clockwise	Meters M1 and M2 read full scale.	Refer to chapter 4.
4	ALT CURRENT AC VOLTS DC VOLTS FINE CONTROL (R1).	Rotate clockwise and counterclockwise.	Meters M1 and M2 vary within 10 percent of full-scale deflection.	Refer to chapter 4.
5	DIRECT CURRENT COARSE CONTROL (R71).	Rotate clockwise	Meter M1 reads full scale.	Refer to chapter 4.
6	DIRECT CURRENT FINE CONTROL (R60 and R113).	Rotate clockwise and counterclockwise.	Meter M1 varies within 10 percent of full scale.	Refer to chapter 4.
7	DIRECT CURRENT SELECTOR (S6).	Selects desired d-c current output.	Selected output jack or binding post corresponds to selected range.	Refer to chapter 4.
8	Selector switch S4	Selects desired a-c or d-c voltage output.	Selected output corresponds to selected jack or binding post.	Refer to chapter 4.
9	Selector switch S5	Selects desired a-c or d-c voltage output.	Selected output corresponds to selected jack or binding post.	Refer to chapter 4.

b. Magnet Charger TS–336A/GSM–1.

Item No.	Control	Action or condition	Normal indication	Corrective measures
1	POWER ON-OFF switch (S1)	Turn to ON position	Pilot lamp lights, power is supplied to rectifier, and charging circuit is charged.	Check power cord, pilot lamp, tube V101, fuses, meter, and input power.
2	NORMAL—CHARGE MAGNET switch (S2).	Leave in NORMAL position. Hold down in CHARGE position.	Capacitors C2 and C3 charge. Voltmeter reads zero	Refer to chapter 4. Refer to chapter 4.

CHAPTER 4

FIELD MAINTENANCE INSTRUCTIONS

Section I. GENERAL

49. Scope

This chapter contains information for field maintenance. The amount of repair that can be performed by units having field maintenance responsibility is limited only by the tools and test equipment available and by the skill of the repairman.

50. Tools, Test Equipment, and Materials

a. Tools and Materials.
Carbon tetrachloride.
Cloth, clean, lint-free.
Crocus cloth.
Sandpaper No. 0000.
Shorting stick (par. 39).
Solvent, dry-cleaning (SD).
Tool Equipment TK–21/G.
Tool Equipment TK–22/G.
Tool Equipment TK–3/MSM–2.

Note. Gasoline will not be used as a cleaning fluid for any purpose.

b. Test Equipment.
Meter Test Set TS–691/U.
Meter Test Set TS–689/U.
Meter Test Set TS–690/U.
Multimeter TS–352/U.
Test Set I–49.
Tube Tester TV–2/U.

Section II. THEORY OF OPERATION

51. Meter Test Set TS–682/GSM–1

The meter test set consists fundamentally of four circuits: an a-c ammeter test circuit, an a-c voltmeter test circuit, a d-c ammeter test circuit, and a d-c voltmeter test circuit. These circuits are discussed in detail in paragraphs 52, 53, 54, and 55.

52. A-c Ammeter Test Circuit
(figs. 23 and 53)

a. General. When switch S4 is set for checking a-c ammeters, the test circuit consists of four main parts: a primary voltage control consisting of variac T7, auto-transformer T3, and potentiometer R1; current-supply transformers T5 and T8; current transformer T6; and meter M2. When the a-c meter to be tested is connected to one of AC jacks J24 through J29 (200 ma through 10 amp), the series circuit formed includes the secondary of transformer T5, a portion of the primary of transformer T6, one of the secondaries of transformer T8, and the meter under test. The primaries of the two current-supply transformers are connected through various limiting resistors to the output of the primary voltage control. The magnitude of the current produced in this series circuit is controlled by the coarse (T7) and fine (R1) adjustments of the primary voltage control. Since the same current flows through the meter under test and the primary of transformer T6, the reading of the external meter is checked against the standard meter M2, which is connected to the secondary of T6. When jack J30 (100 MA) is used, the meter under test is in series with meter M2 without the use of transformer T6. Since meter M2 is a 100-ma meter, no current transformer is required. When binding posts E8, E7, and E6 (20 AMP, 40 AMP, and 100 AMP) are used, the same circuit is employed, except that transformer T5 is the sole source of current in the meter circuit.

b. Detailed Description of Individual A-C Ranges.

(1) In the 100-ampere a-c range the 100-ampere section (2 and 3) of the primary of transformer T6 is in the series circuit, which includes the meter under test.

(2) In the 40-ampere a-c range, the 40-ampere section (2 and 1) of the primary of transformer T6 is in the series circuit with the meter under test. The parallel combination of resistors R55, R56, and R57 is placed in the series circuit to limit the current.

(3) In the 20-ampere a-c range, the 20-ampere section (2 and 4) of the primary of transformer T6 is in the series circuit

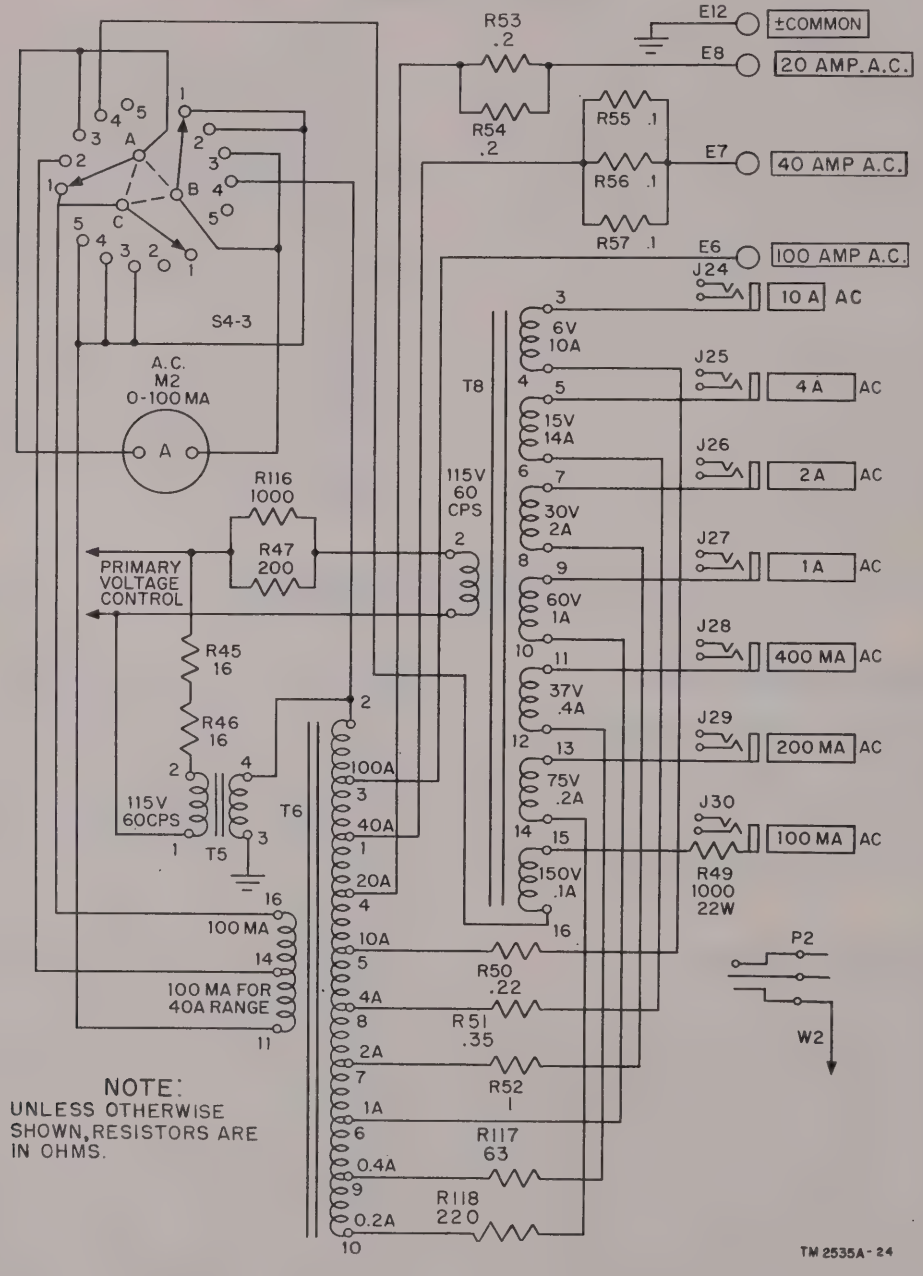


Figure 23. A-c ammeter test circuit, simplified schematic.

with the meter under test. The parallel combination of resistors R53 and R54 is placed in the series circuit to limit the current.

(4) In the 10-ampere a-c range, the series circuit used includes the 10-ampere (3 and 4) secondary of transformer T8, the 10-ampere (2 and 5) section of the primary of current transformer T6, resistor R50, and the meter under test.

(5) In the 4-ampere a-c range, the series circuit used includes the 4-ampere (5 and 6) secondary of transformer T8, the 4-ampere (2 and 8) section of the primary of transformer T6, resistor R51, and the meter under test.

(6) In the 2-ampere a-c range, the series circuit used includes the 2-ampere (7 and 8) secondary of transformer T8, the 2-ampere (2 and 7) section of the primary of transformer T6, resistor R52, and the meter under test.

(7) In the 1-ampere a-c range, the series circuit used includes the 1-ampere (9 and 10) secondary of transformer T8, the 1-ampere (2 and 6) section of the primary of transformer T6, and the meter under test.

(8) In the 400-ma a-c range, the series circuit used includes the 400-ma (2 and 9) section of the primary of transformer T6, resistor R117, and the meter under test.

(9) In the 200-ma a-c range, the series circuit used includes the 200-ma (13 and 14) secondary of transformer T8, the 200-ma (2 and 10) section of the primary of transformer T6, resistor R118, and the meter under test.

(10) In the 100-ma a-c range, transformer T6 is not used and meter M2 is directly in series with the meter under test. Current is supplied by the secondary of transformer T5 and the 100-ma (15 and 16) secondary of transformer T8.

53. A-c Voltmeter Test Circuit

(figs. 24 and 53)

Power is delivered to the a-c voltage test circuit by the primary voltage control circuit which receives its power from the external a-c power source through switch S1 and Fuse F1. The functions of all a-c voltage ranges are identical, except for the 1-volt range.

a. Two-Volt to 2,000-Volt A-C Ranges. Since the functioning of the 2-volt through 2,000-volt a-c ranges is identical, the 2-volt range is used here to explain the functioning of the others.

(1) The meter to be tested is connected to the meter test set as outlined in paragraph 26. When the meter under test is connected to jack J10, the secondary of transformer T1 is energized, the 2-volt section of the primary of transformer T4 is switched across the secondary of transformer T1, and the meter under test is thereby connected to the appropriate voltage source.

(2) The meter under test reads the voltage across the primary of transformer T1. This voltage is varied by means of the primary voltage control circuit.

(3) Meter M2, which is connected to the secondary of transformer T4, measures the voltage applied to the meter under test, since the 2-volt section of the primary of transformer T4 is connected to the same source of voltage.

b. One-Volt A-C Range. In the 1-volt a-c range, jack J11 acts as a switch to connect the 40-volt portion of the secondary of transformer T1 across the primary of transformer T4. Voltage is supplied to the meter under test by the 1-volt portion of the primary of transformer T4. Transformer T4 is designed so that the correct voltage will appear at its secondary, even though the transformer is used to supply voltage to the meter under test.

c. Voltage Multipliers. Resistors R58 and R59 act as voltage multipliers in the circuit of meter M2.

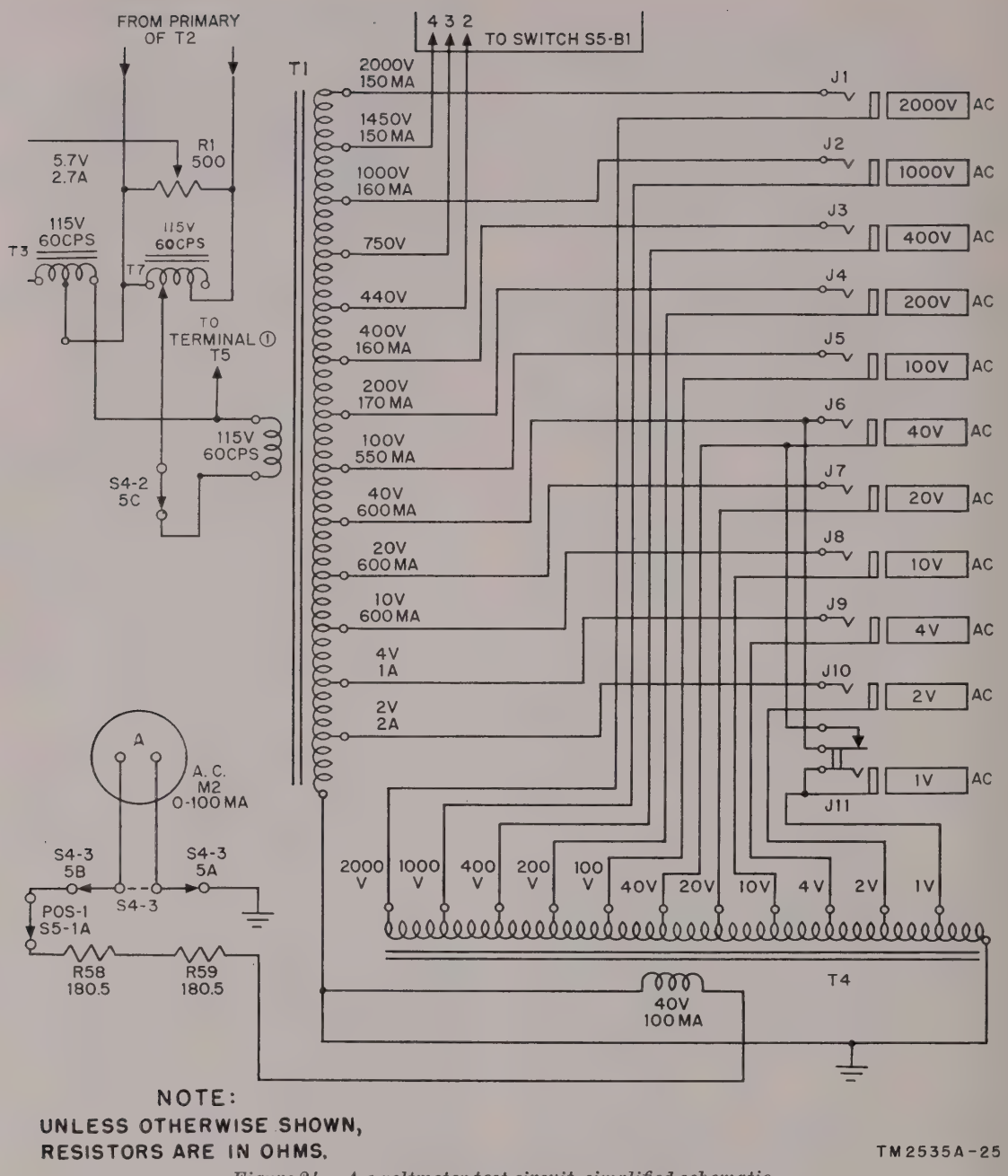


Figure 24. A-c voltmeter test circuit, simplified schematic.

54. D-c Ammeter Test Circuit

(figs 25 through 32, and 53)

a. General.

(1) The current range required is selected by the DIRECT CURRENT SELECTOR (switch S6). Current for testing d-c ammeters is supplied by an external 12-volt storage battery. The test circuit consists of a current-controlling network, meter M1, and the meter to be checked. Meter M1 is connected to the test circuit by an internal shunt so that the range of meter M1 corresponds to the range of the meter under test. The current-controlling network consists of the DIRECT CURRENT FINE CONTROL (rheostats R60 and R113), fixed resistors in various

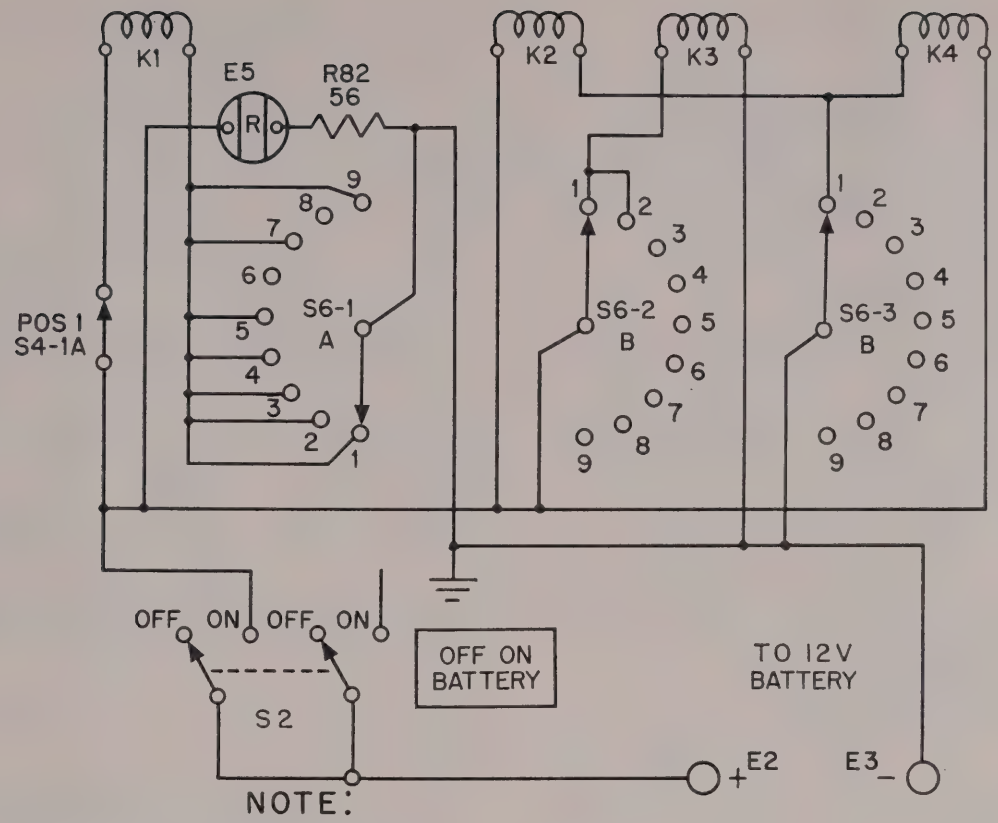


Figure 25. Relays K1, K2, K3, and K5 in d-c ammeter test circuit, simplified schematic.

series and parallel combinations, and five switching relays. Switch S6 selects the proper combination in the current-controlling circuit to give the desired d-c output.

(2) Relay K5 is an overload relay that prevents the meters from reading off-scale and excessive current from appearing at the d-c jacks and terminals. An overload in a test circuit causes sufficient voltage to energize the relay coil circuit. When relay K3 is energized, the parallel resistance of the circuit is increased, and the current output to the meter is decreased. The meter will not read full scale until relay K5 opens when the current is sufficiently decreased by rheostat R71. Relay K5 operates in this manner in all the d-c circuits. Rheostat R48 and resistor R114 connect relay K5 in the circuit.

b. Detailed Description of Individual D-C Range.

(1) *One hundred-ampere range* (fig. 26). When the DIRECT CURRENT SELECTOR switch is in the 100 A position, shunt E23 is connected across meter M1 and relays K1, K2, K3, and K4 are energized. Five parallel paths now exist as follows:

(*a*) Rheostat R60 (DIRECT CURRENT FINE CONTROL) in series with resistors R61 and R62, which are in parallel.

(*b*) Rheostat R71A (section A of DIRECT CURRENT COARSE CONTROL) in series with resistors R63 and R64, which are in parallel.

(*c*) Rheostat R71B in series with resistors R65 and R66, which are in parallel.

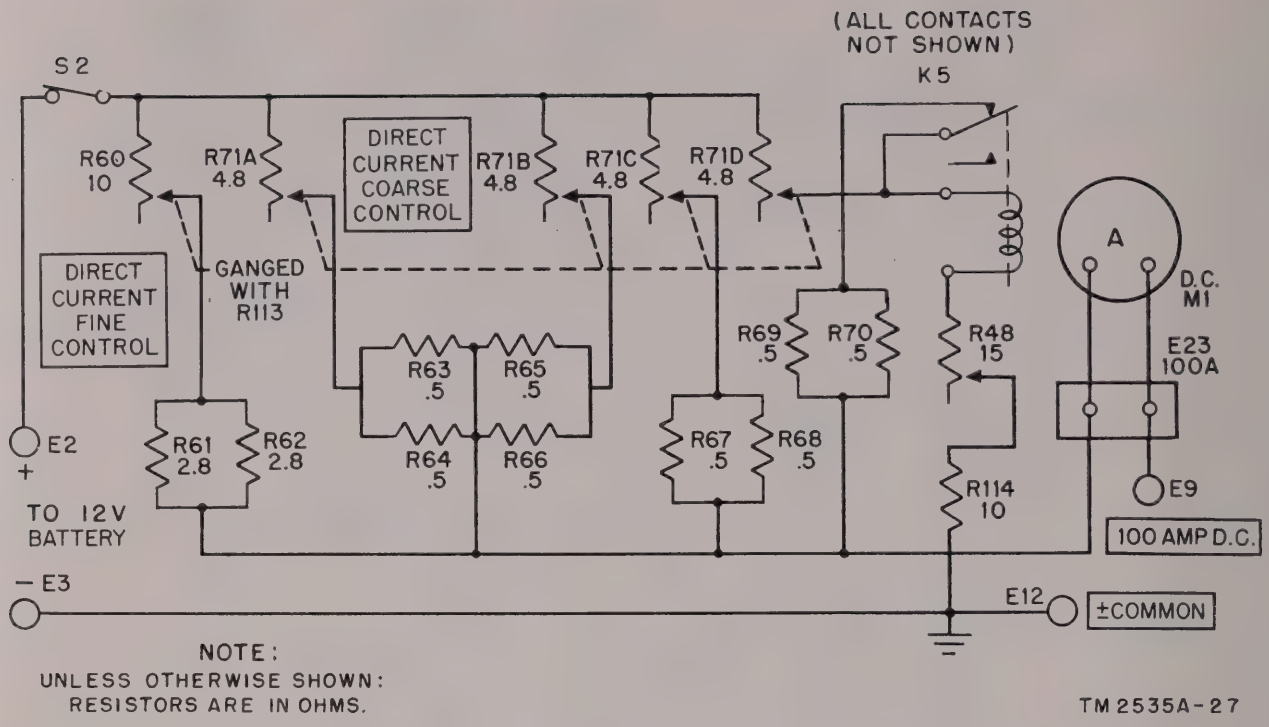


Figure 26. One hundred-ampere d-c test circuit, simplified schematic.

(*d*) Rheostat R71C in series with resistors R67 and R68, which are in parallel.

(*e*) Rheostat R71D in series with resistors R69 and R70, which are in parallel.

(2) *Forty-ampere range* (fig. 27). When the DIRECT CURRENT SELECTOR switch is in the 40 A position, shunt E22 is connected across meter M1 and relay K3 is energized. Three parallel paths now exist as follows:

(*a*) Rheostat R60, part of the DIRECT CURRENT FINE CONTROL, in series with resistor R61 and R62, which are in parallel.

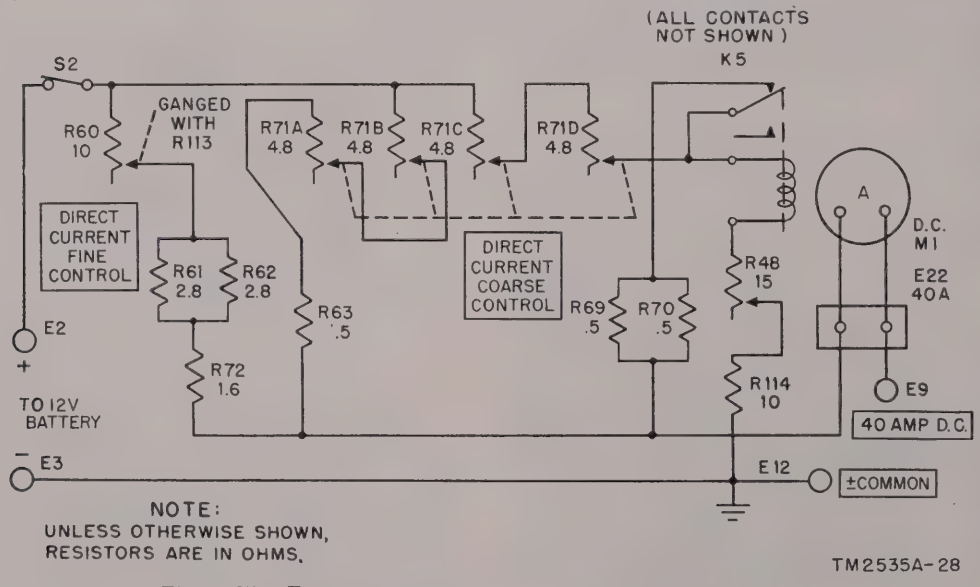


Figure 27. Forty-ampere d-c test circuit, simplified schematic.

(*b*) Rheostats R71A and R71B (sections A and B of DIRECT CURRENT COARSE CONTROL) in series with resistor R63.

(*c*) Rheostats R71C and R71D in series with the parallel combination of resistors R69 and R70.

(3) *Twenty-ampere range* (fig. 28). When the DIRECT CURRENT SELECTOR switch is in the 20 A position, shunt E21 is connected across meter M1, and relay K1 is energized. Two parallel paths now exist as follows:

(*a*) Rheostats R60 and R113 of the DIRECT CURRENT FINE CONTROL, resistors R72 and R73 in series with the parallel combination of resistors R61 and R62.

(*b*) Rheostats R71A, R71B, and R71C of the DIRECT CURRENT COARSE CONTROL are in series with rheostat R71D, which acts as a voltage divider network in series with the parallel combination of resistors R69 and R70.

(4) *Ten-ampere range* (fig. 29). When the DIRECT CURRENT SELECTOR switch is in the 10 A position, shunt E20 is connected across meter M1. The circuit is the same as that described in (3) above, except that resistors R74 and R83 are added.

(5) *Four-ampere range* (fig. 30). When the DIRECT CURRENT SELECTOR switch is in the 4 A position, shunt E19 is connected across meter M1, and relay K1 is energized. Two parallel paths exist as follows:

(*a*) Rheostats R71A, R71B, R71C, and R71D in series with the resistors R83 and R84 and the parallel combination of resistors R69 and R70.

(*b*) Resistors R75 and R79, and rheostat R113 in series.

(6) *One- and 2-ampere ranges* (fig. 31). When the DIRECT CURRENT SELECTOR switch is in the 2 A-1 A position and Plug PL–55 is inserted in jack J34 or J33 and energizes relay K1, the 1-ampere and 2-ampere shunts (E17 and E18, respectively) are connected across meter M1. For the 1-ampere range, resistor R108 is in series with jack J34. Two parallel paths exist as follows:

(*a*) Rheostats R71A, R71B, R71C, and R71D in series with the parallel combination of resistors R69 and R70 and with resistor R85.

(*b*) The series path of resistor R75, rheostat R113, and resistor R76.

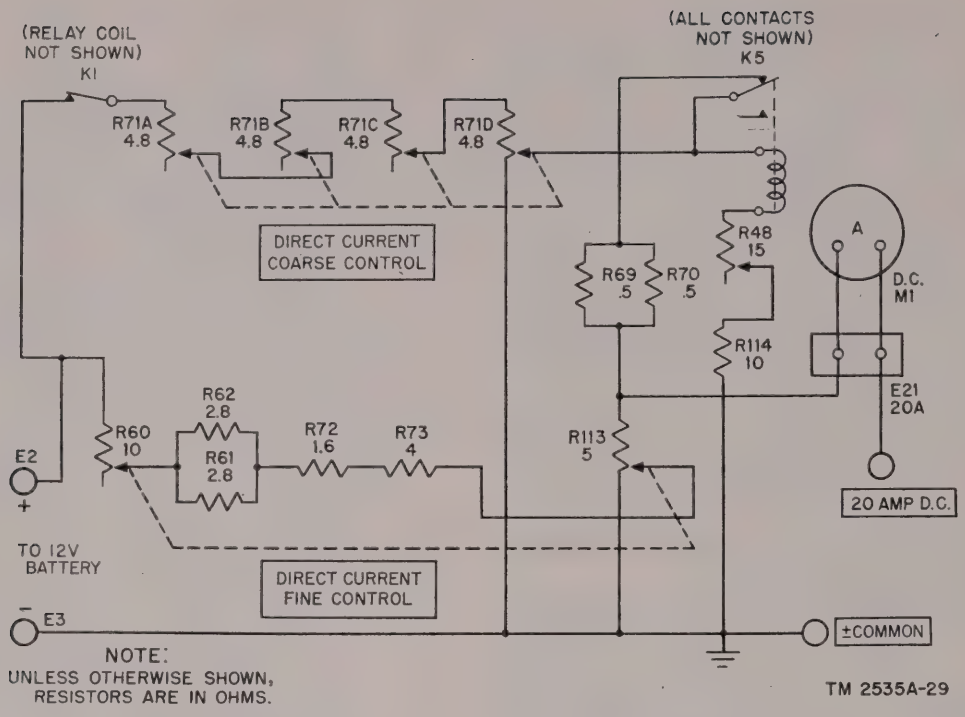


Figure 28. 20-ampere d-c test circuit, simplified schematic.

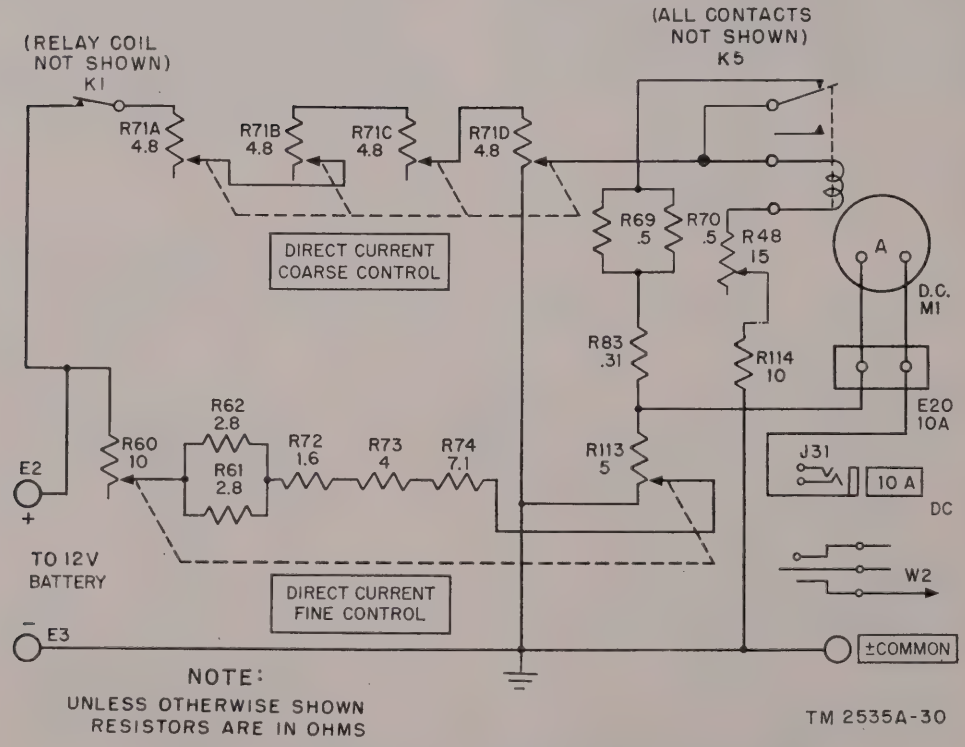


Figure 29. Ten-ampere d-c test circuit, simplified schematic.

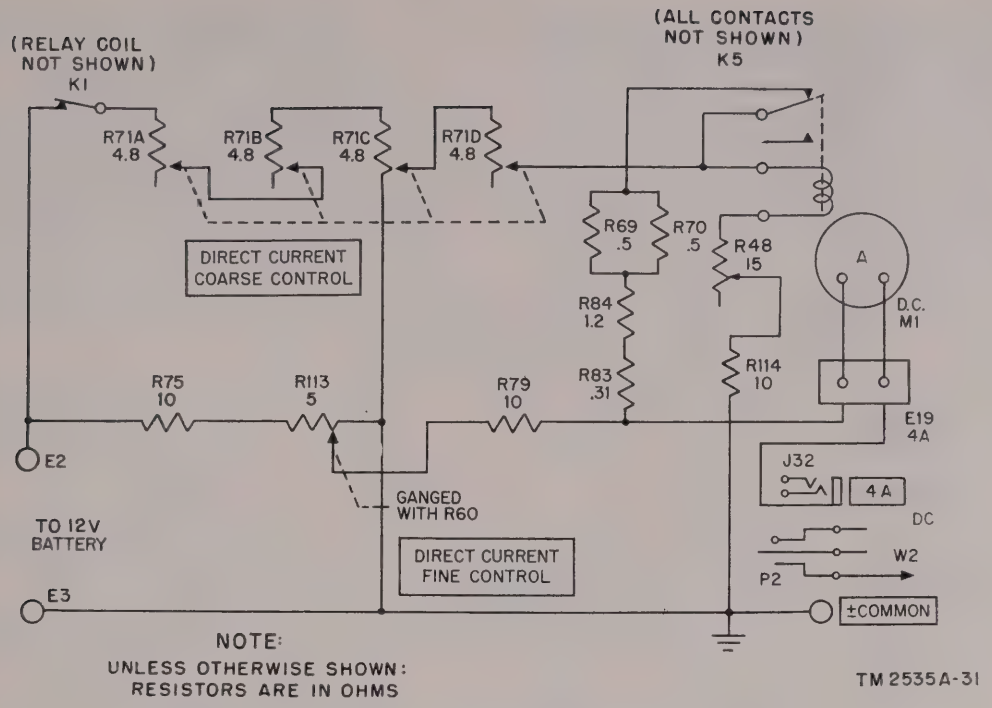


Figure 30. Four-ampere d-c test circuit, simplified schematic.

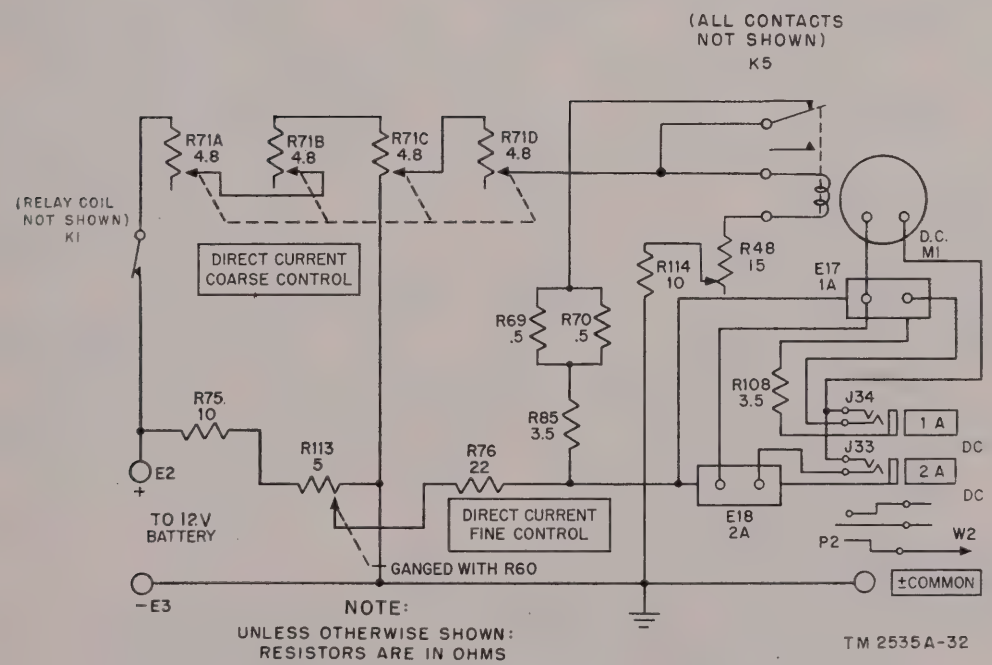
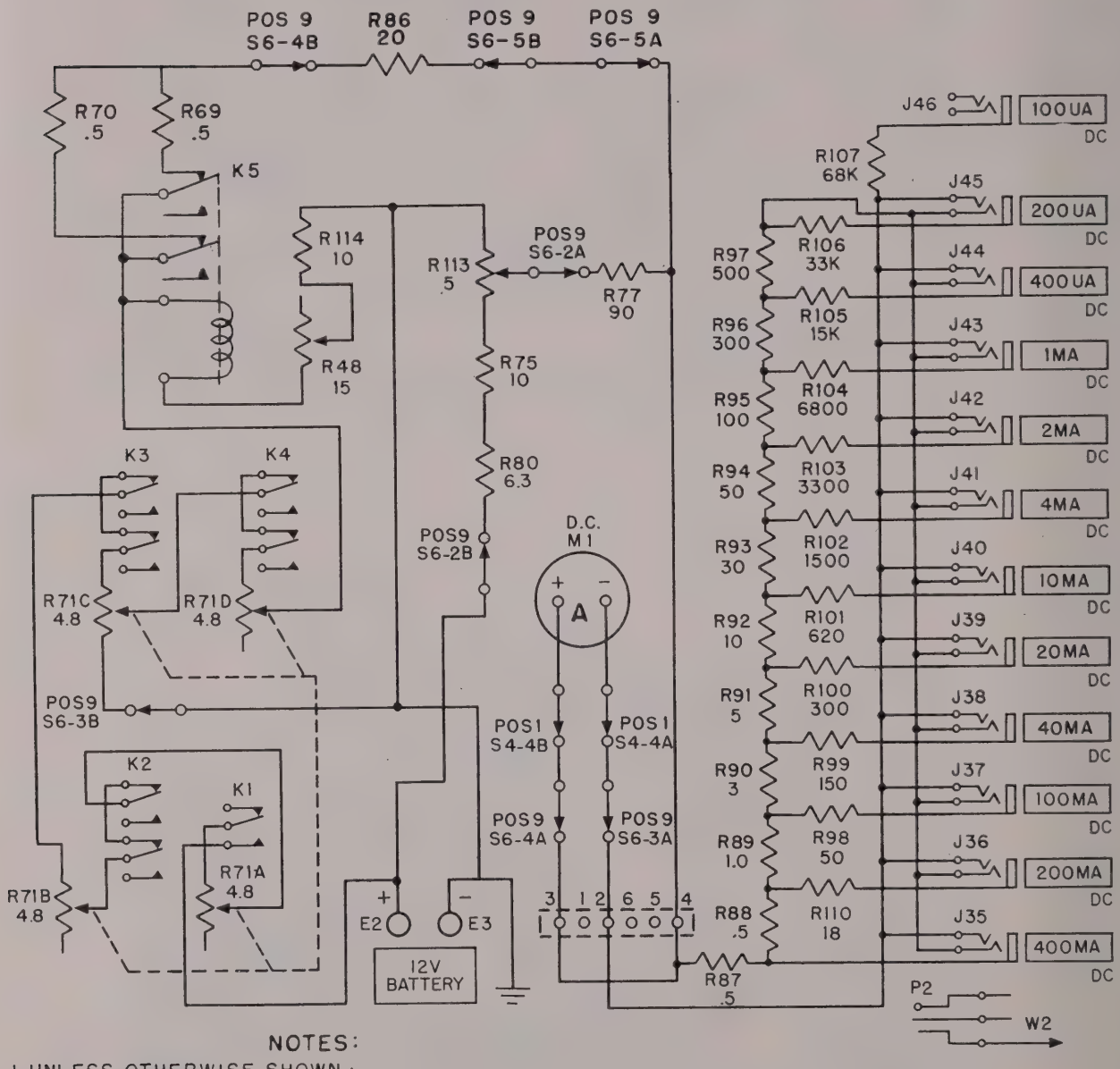


Figure 31. One- and two-ampere d-c test circuit, simplified schematic.

(7) *One hundred-microampere to 400-milliampere range* (fig. 32). When the DIRECT CURRENT SELECTOR switch is in the 100UA-400MA position, relay K1 is energized and two parallel paths are formed to supply current to jacks J35 through J46 through the network of current-limiting resistors R87 through R107 and R110. The two parallel paths are as follows:

(*a*) Rheostats R71A, R71B, R71C, and R71D in series; the parallel combination of resistors R69 and R70; and resistors R86, all in series.

(*b*) Resistors R80, R75, R77, and rheostat R113 in series.



NOTES:

1. UNLESS OTHERWISE SHOWN: RESISTORS ARE IN OHMS.
2. RELAY COILS NOT SHOWN FOR K1, K2, K3, AND K4.

TM 2535A-33

Figure 32. Low d-c test circuit, 100-ua to 400-ua, simplified schematic.

55. D-c Voltmeter Test Circuit
(figs. 33 and 53)

a. General. Rectifier V1 obtains its a-c potential from the taps of transformer T1 by means of switch S5 and current-limiting resistor R2. The d-c voltage output of rectifier V1 is supplied to two composite bleeder networks. One bleeder network, R23 through R32 and R115, is used for the 100-millivolt through 400-volt ranges; the other bleeder network, R32 through R44 and R109, is used for the 1,000-volt and 2,000-volt ranges. The bleeder network, consisting of R33 through R44 and R109, applies potential to meter M1, which is shunted across R109 to ground when switch S4 is in position DCV. A third bleeder network, consisting of R3 through R22, is in the d-c voltage circuit for all ranges. The output of rectifier V1 is filtered by capacitor C1. The voltage supplied to the secondary of transformer T1 is

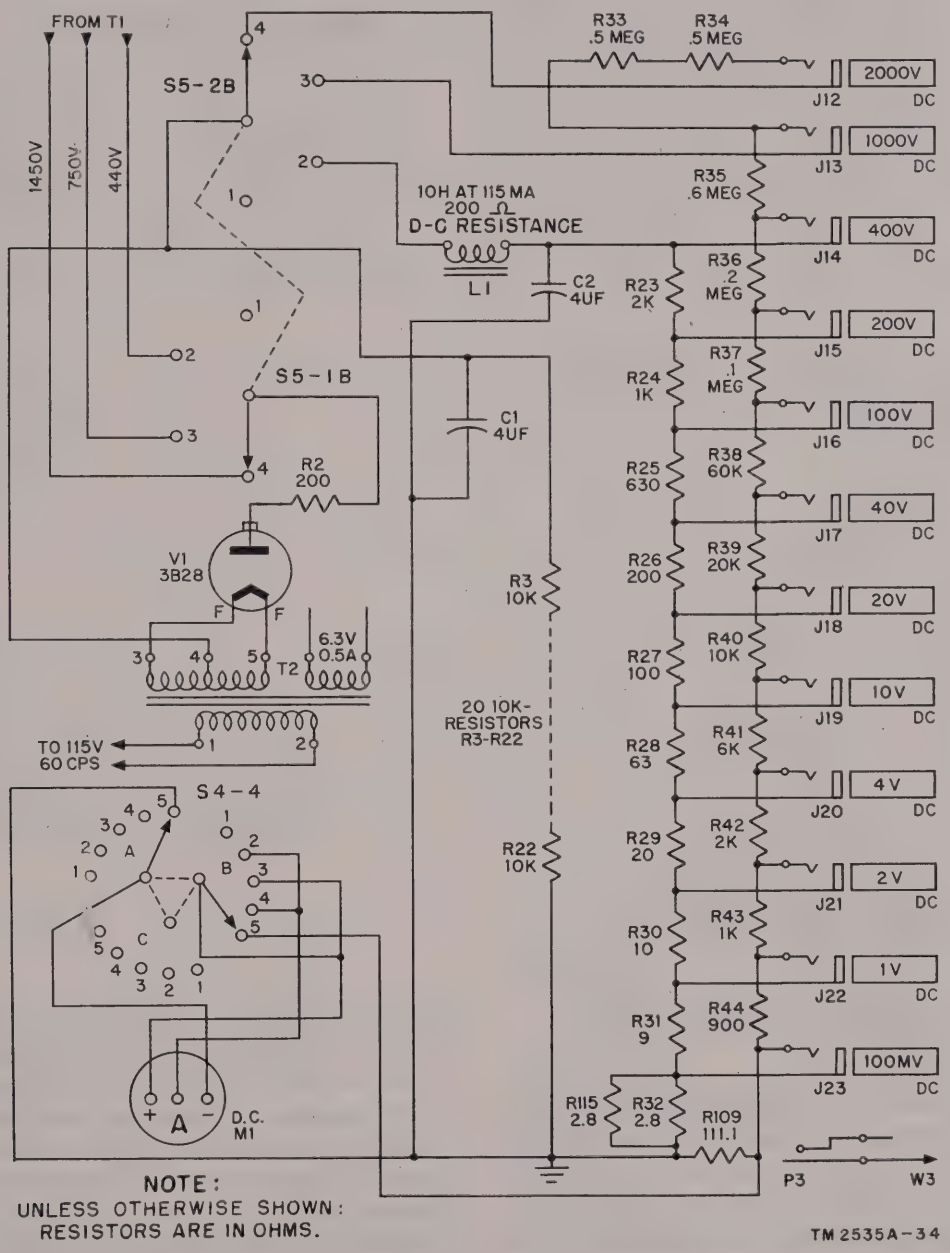


Figure 33. D-c voltage test circuit, simplified schematic.

controlled by a voltage circuit consisting of variac T7, autotransformer T3, and rheostat R1, and connected across the primary of transformer T1. Varying the voltage control circuit varies the input to rectifier V1, and thereby varies the output supplied to the d-c voltage jacks.

b. One Hundred-Millivolt to 400-Volt Ranges. Switch S5 is turned to the 100 MVDC–400 VDC position for these ranges. Switch S5 connects the 440-volt section of the secondary of transformer T1 to rectifier V1. The 400-volt output of the rectifier is connected to switch S5, through L1 and C2, to R23 of the bleeder network. The meter under test, when connected to one of the meter test set jacks (J14 through J23), is shunted across the correct combination of bleeder resistors; the return circuit is to ground.

c. One Thousand-Volt Range. When switch S5 is placed in the 1000 VDC position, rectifier V1 is supplied from the 750-volt section of the secondary of transformer T1. The 1,000-volt output of rectifier V1 is connected through switch S5 to jack J13.

d. Two Thousand-Volt Range. When switch S5 is placed in the 2000 VDC position, rectifier V1 is supplied from the 1,450-volt section of the secondary of transformer T1. The 2,000-volt output of rectifier V1 is connected, through switch S5 and shunting resistors R33 and R34, to jack 12.

56. Meter Illumination Circuit

(fig. 34)

Two lamps are provided in each meter to illuminate the meter face. A simplified schematic of this circuit is shown in figure 34. Resistor R81 is in series with lamps E15 and E16 and resistor R78 is in series with lamps E13 and E14 to reduce voltage on the lamp filaments.

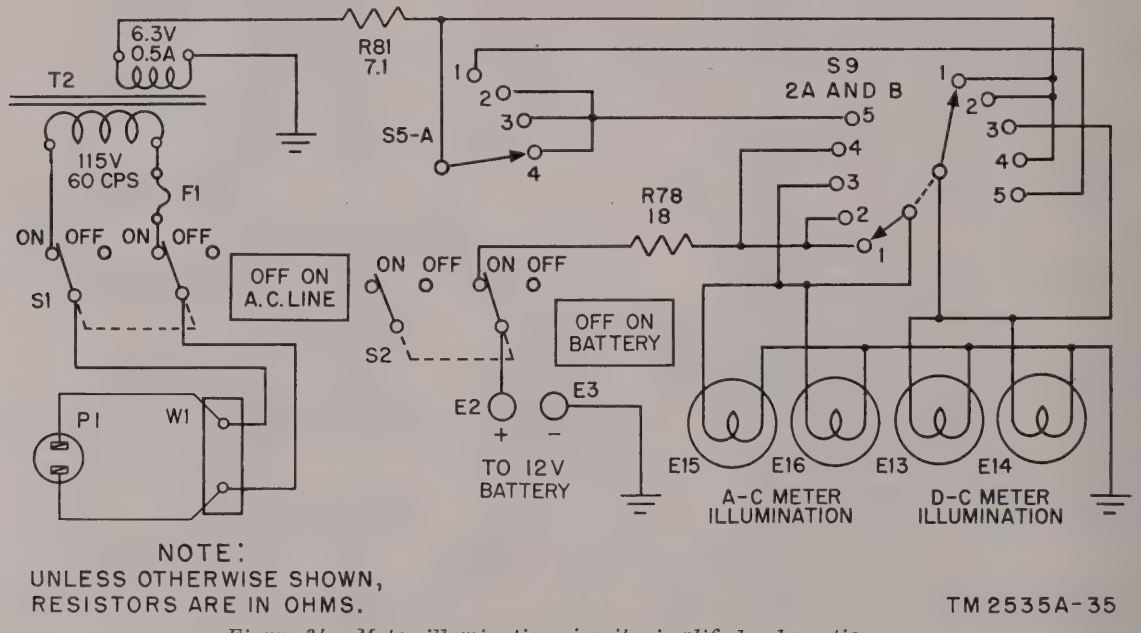


Figure 34. Meter illumination circuit, simplified schematic.

57. Magnet Charger TS–336A/GSM–1

(figs. 35 and 36)

a. Power is supplied to the primary of power transformer T2 through line fuses F1 and F2 and through switch S1. The 6.3-volt secondary of transformer T2 supplies power to pilot lamp E7. Plate voltage for rectifier V1 is supplied by the high-voltage secondary of transformer T2. The filament circuit is supplied by the 5-volt secondary of transformer T2. The output of rectifier V1 is filtered by Resistor R1 and capacitor C1 and then supplied to the ignition control circuit through current-limiting resistor R3. After rectifier V1 has warmed up, capacitors C2 and C3 become charged. The charge is indicated by meter M1, which is across the parallel combination of capacitors C2 and C3. Resistor R2 is a

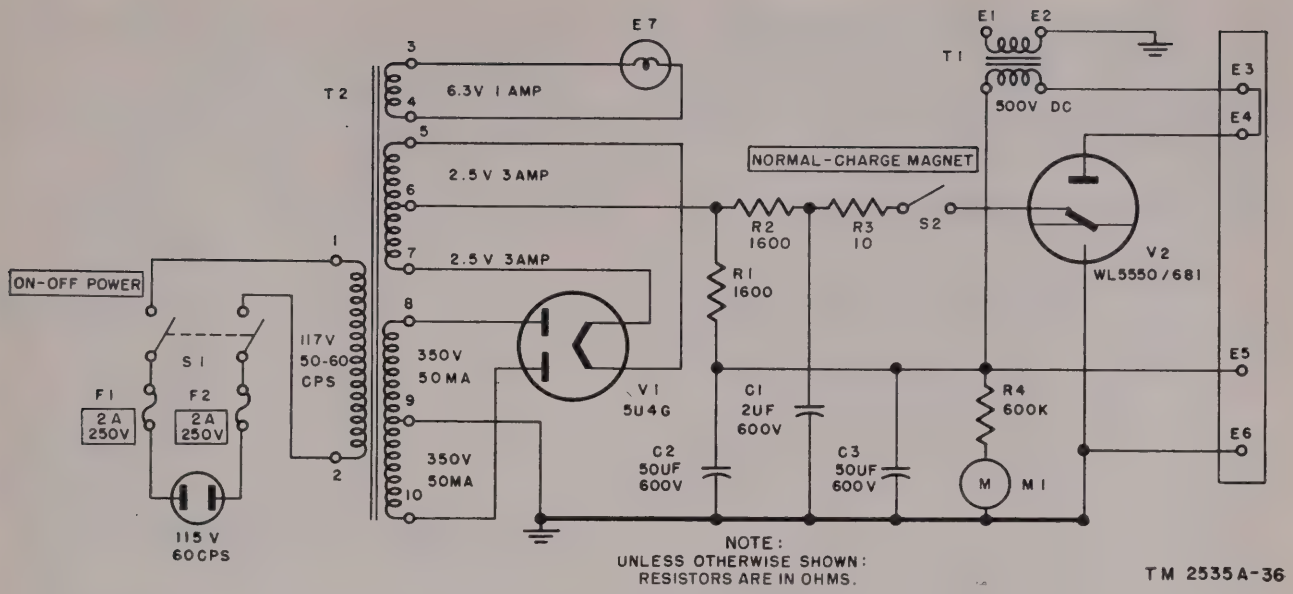


Figure 35. Magnet Charger TS-336A/GSM-1, schematic diagram.

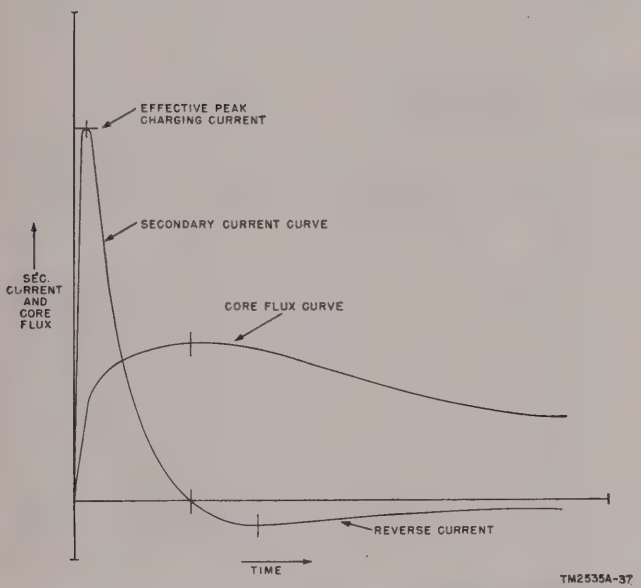


Figure 36. Core-flux and secondary-current curves of magnet charger.

current-limiting resistor. Resistor R4 is in series with the meter and acts as a multiplier to make the full-scale range of meter M1 read 600 volts.

b. When switch S2 is closed, the ignitor rod of V2 is energized, and the mercury in the ignitron becomes ionized so that tube conducts. The ignitron acts as a valve, allowing the charge on capacitors C2 and C3 to discharge within .002 seconds through the primary of transformer T1. The discharge through the primary of transformer T1 energizes the 1-turn secondary, causing a current of approximately 15,000 amperes to flow. The resultant high-flux density field is used to charge meter magnets.

c. The capacitor discharge leaves the core of transformer T1 at a high-flux level that can be returned to zero only by the induction of reverse current in the secondary. However, reactance in the secondary winding is highly damped by the secondary load, causing a very slow rate of flux return and a very small reverse current (fig. 36).

58. Demagnetizing Coil
(fig. 37)

The demagnetizing coil operates on a 115-volt, 60-cycle source; the circuit consists of a single coil and a push-button switch. The demagnetizing coil produces an alternating magnetic field, which is strongest at points near the coil and decreases rapidly as the distance from the coil increases.

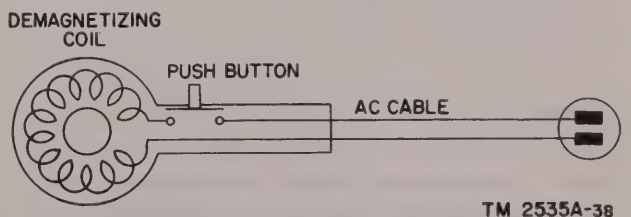


Figure 37. Demagnetizing coil, schematic diagram.

The demagnetizing effect on a meter magnet depends on the distance of the coil from the magnet and the length of time the magnet is subjected to the field. See TM 11–4700 for a discussion of magnetism as applied to meter magnets.

59. Frequency Meter FR–40/GSM–1
(fig. 38)

a. Frequency Meter FR–40/GSM–1 is a crossed-coil, ratio-type meter. The pointer is attached to two perpendicular coils mounted on a shaft, with a control spring to damp the meter pointer.

b. The relative strength of the magnetic fields of coil 1 and coil 2 is determined by the reactor-capacitor combination of L1 and C1. When the frequency is increased, the current decreases through coil 2, and increases through coil 1. This causes a shift in direction of the resultant magnetic field, and the pointer moves to the right on the scale. The opposite effect occurs when the frequency is decreased.

c. For ac, coil 1 is connected effectively in series with capacitor C1 and resistor R1.

d. Choke L2 is used as a harmonic suppressor of the input frequency.

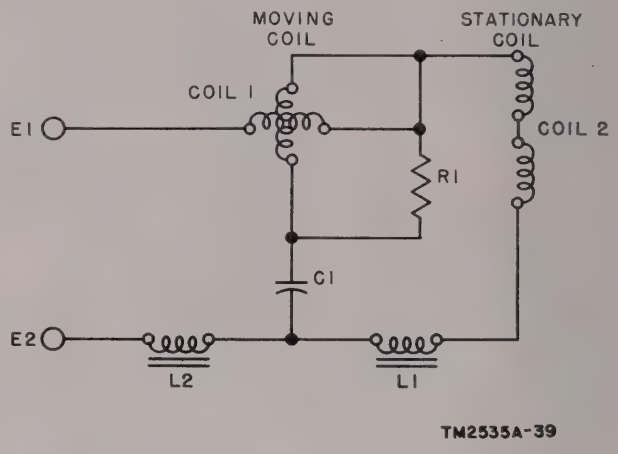


Figure 38. Frequency Meter FR–40/GSM–1, schematic diagram.

Section III. TROUBLE LOCATION

Caution: When servicing the equipment, be extremely careful of high voltages. Always discharge the capacitors before servicing. Refer to paragraph 39 for a description of the shorting stick used to discharge capacitors.

60. General Trouble-Shooting Information

No matter how well equipment is designed and manufactured, faults occur in service. When such faults occur, the repairman must locate and correct them as rapidly as possible to maintain the equipment in usable conditions at all times. This section of the manual contains specific instructions designed to aid repair personnel in trouble shooting.

61. Trouble-Shooting Procedures

a. General. The first step in servicing a defective test equipment component is to sectionalize the fault. Sectionalization means tracing the fault to the *major component or circuit* responsible for the failure. The second step is to localize the fault. Localization means tracing the fault to the defective *part* responsible for the abnormal condition. Some faults, such as burned-out resistors and shorted transformers, can often be located by sight, smell, or hearing. The majority of faults, however, must be localized by *checking voltage and resistance.*

b. Sectionalization and Location. The tests listed below help to isolate the source of trouble. To be effective, the procedures should be followed in the order given. Remember that the servicing procedure should cause no further damage to the equipment. First, trouble should be sectionalized to a single circuit. Then the trouble may be localized within that circuit by appropriate voltage, resistance, and continuity measurements. The service procedure is as follows:

(1) *Visual inspection.* The purpose of visual inspection (par. 48) is to locate any visible trouble. Through this inspection alone, the repairman may discover the trouble. Visual inspection is valuable in preventing failures.

(2) *Operational test.* The operational test (par. 63) is important because it frequently indicates the general location of trouble. In many instances, the exact nature of the fault may be determined.

(3) *Trouble-shooting charts.* The trouble

symptoms listed in these charts (pars. 66 and 68) will help the repairman to localize trouble.

(4) *Intermittents.* In all these tests, the possibility of intermittents should be considered. This type of trouble often may be discovered by tapping or jarring the equipment.

62. Precautions

Whenever the equipment is serviced, observe the following precautions very carefully:

a. To prevent overheating, do not allow the demagnetizing coil to be operated for periods of more than a few minutes; it heats up rapidly.

b. Be careful of high voltage when the panels or covers of the equipment have been removed.

c. Careless replacement of parts often causes new faults. Note the following points:

(1) Before a part is unsoldered, note the position of leads. If the part has a number of connections, tag each wire lead when it is removed.

(2) Be careful not to damage other leads by pulling or pushing them out of the way.

(3) Do not allow drops of solder to fall into the equipment, since they may cause short circuits.

(4) Well-soldered joints are important. A carelessly soldered connection may create a new fault.

(5) When a part is replaced in the meter test set circuits, its value must be exactly the same as the value of the original part. A component with a slightly different value will change the calibration of the unit. Give particular attention to proper grounding when replacing a part. Use the same type of ground as was used in the original wiring.

63. Operational Test

Operate the equipment as described in the equipment performance checklist (par. 48). This checklist is important, because it frequently helps to localize trouble. Listen for crackling or buzzing noises that indicate high-voltage arcing. Check the equipment for burned or overheated parts.

64. Trouble-Shooting Charts

The charts that follow (pars. 66 and 68) are supplied as an aid in locating trouble in the test equipment. These charts list the symptoms which the repairman may observe while making a few simple tests. Once the trouble has been localized to a circuit, a tube check and voltage and resistance measurements ordinarily should be sufficient to isolate the defective part or parts.

65. Checking Meter Test Set

(figs. 39 through 46)

a. AC Voltmeter Circuits and Standard A-C Meter.

(1) Throw the AC LINE switch to the ON position.

(2) Place switches S4 and S5 in the ACV position.

(3) Place an a-c voltmeter of known accuracy, with a 0- to 10-volt range, in test position on Mounting MT–135A/GSM–1; connect the spade lead from the mounting to the COMMON binding post on the meter test set, and insert Plug PL–55 into the a-c 10 V jack.

(4) Follow the testing procedure outlined in paragraph 26, but check the standard a-c meter against the reading of the voltmeter in test position on the mounting.

Caution: Be careful not to subject the testing voltmeter to overvoltage by inserting Plug PL–55 into a jack that supplies a voltage higher than the range of the meter.

(5) Substitute various a-c voltmeters with suitable ranges to check all ranges of the a-c standard meter.

(6) With the ALT CURRENT AC VOLTS DC VOLTS COARSE CONTROL in the maximum clockwise position, the output at each a-c voltage jack should not exceed 150 percent of the value specified on the front panel.

b. AC Ammeter Circuit and Standard A-C Meter.

(1) Throw the AC LINE switch to the ON position.

(2) Place switch S4 in the 100MA AC posi-

tion. (The positions of switches S5 and S6 do not affect the a-c circuit or the a-c meter circuit.)

(3) Place an a-c ammeter of known accuracy, with a full-scale range of 100 ma, in test position on Mounting MT–135A/GSM–1; connect the spade lead from the mounting unit to the COMMON binding post on the meter test set, and insert Plug PL–68 into the a-c 100 MA jack.

(4) Follow the testing procedure outlined in paragraph 28, but check the standard meter against the reading of the ammeter on the mounting.

(5) To test other a-c circuits of the meter test set, substitute a-c ammeters with suitable ranges. Place switch S4 in 40A AC position to test up to 40 amperes and in the AC & DC CUR position to test the 100-ampere circuit.

(6) Substitute d-c ammeters with suitable ranges to check all ranges of the standard d-c meter and circuits.

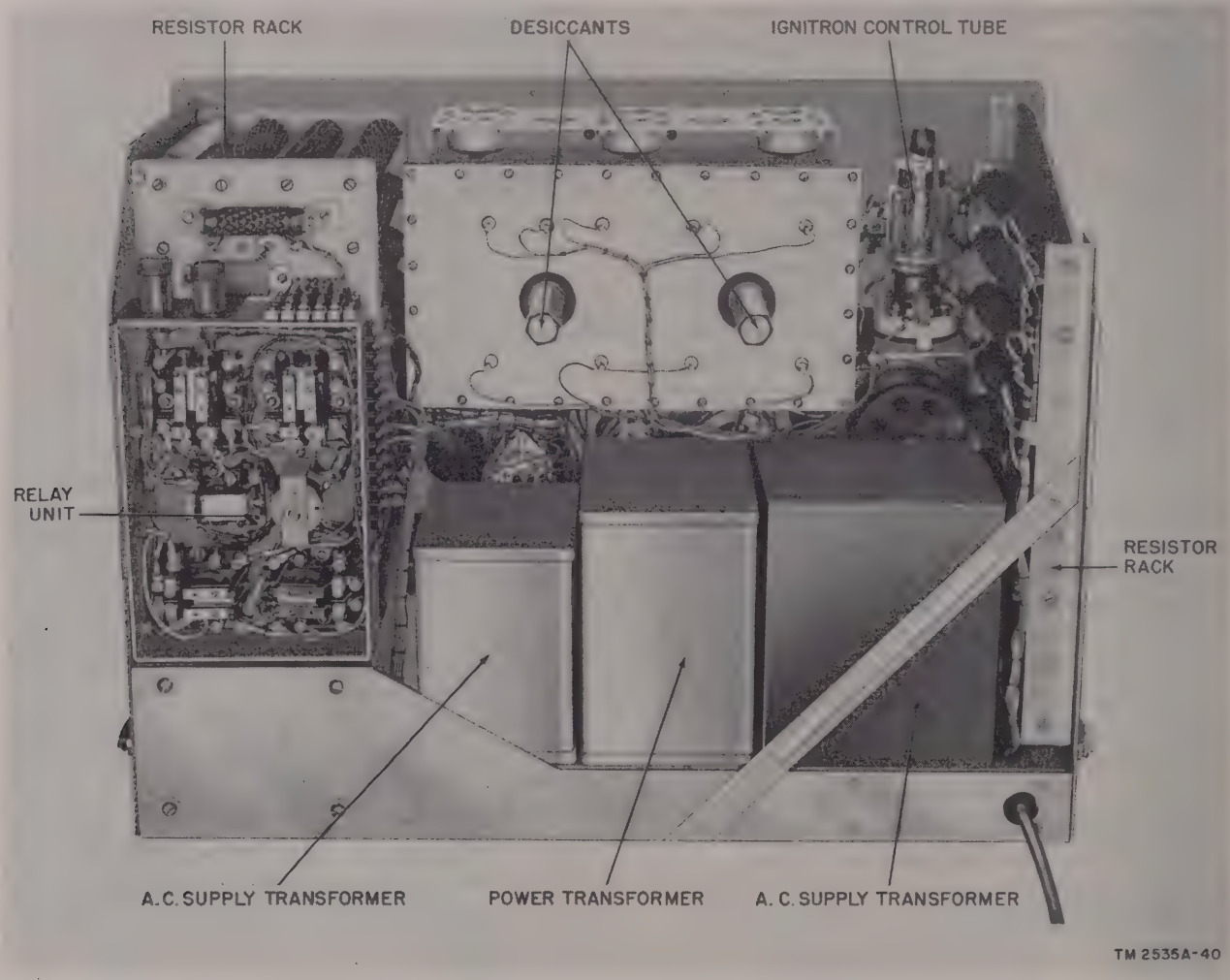


Figure 39. Meter test set, rear view, case removed.

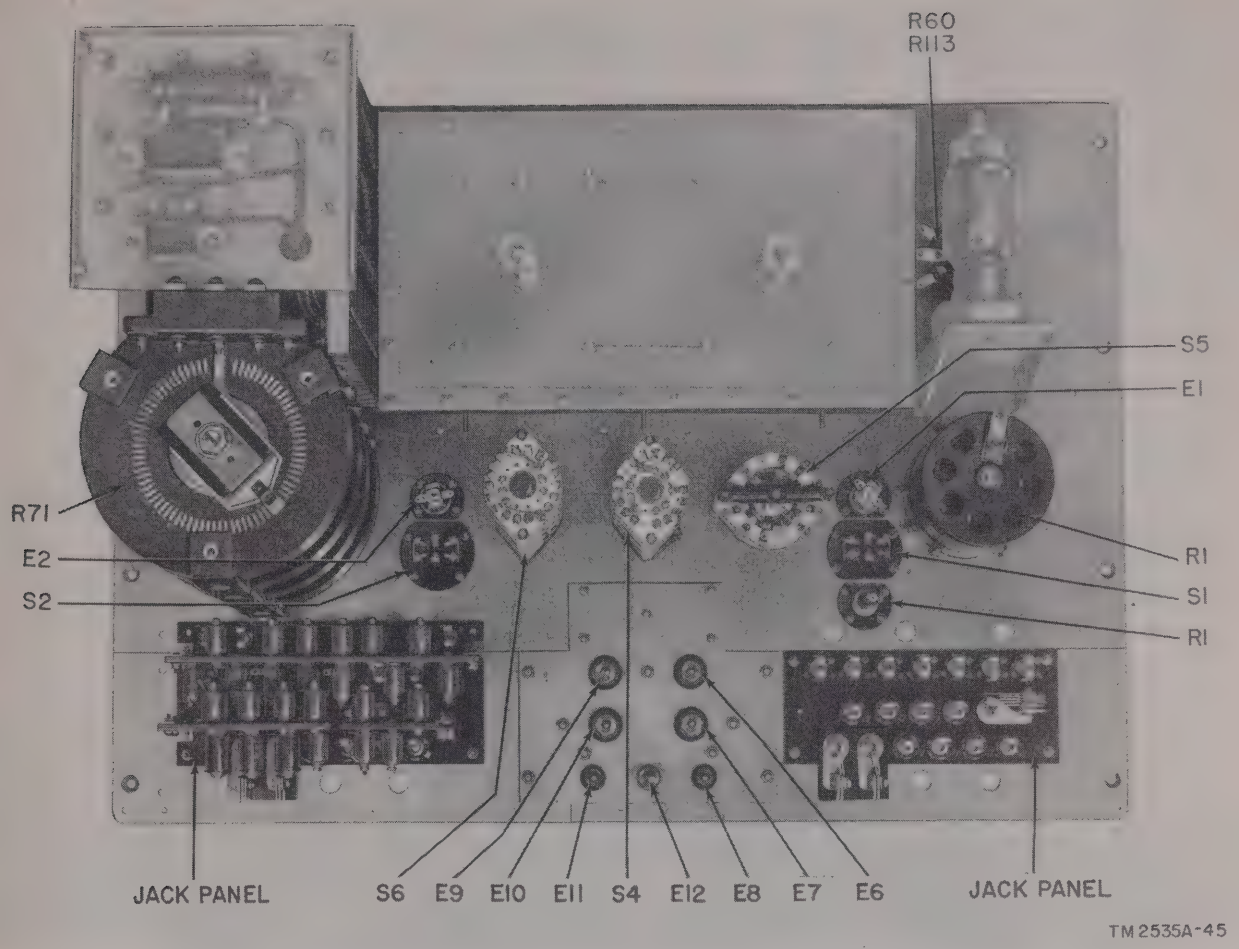


Figure 40. Meter test set, rear view of front panel.

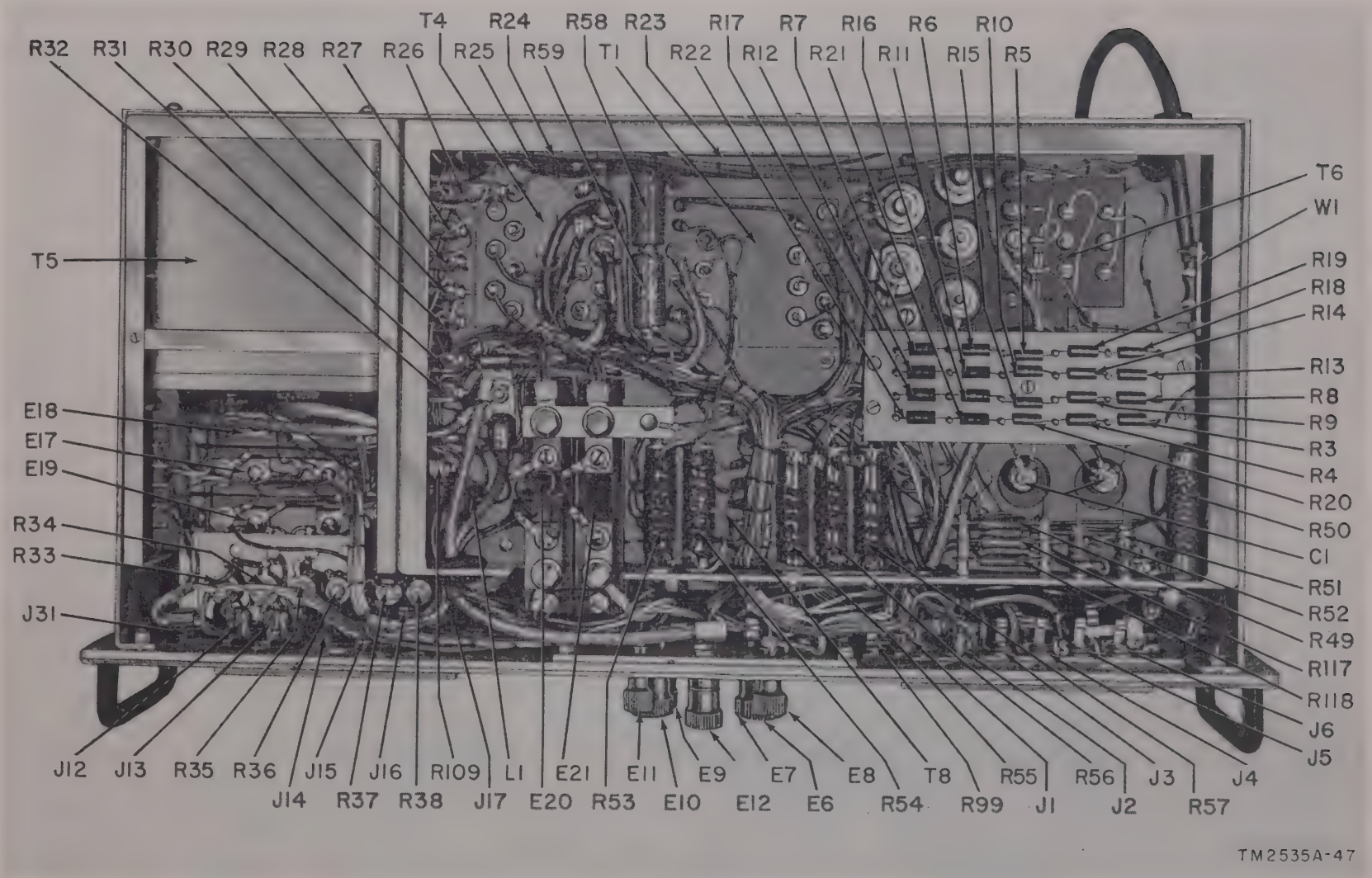
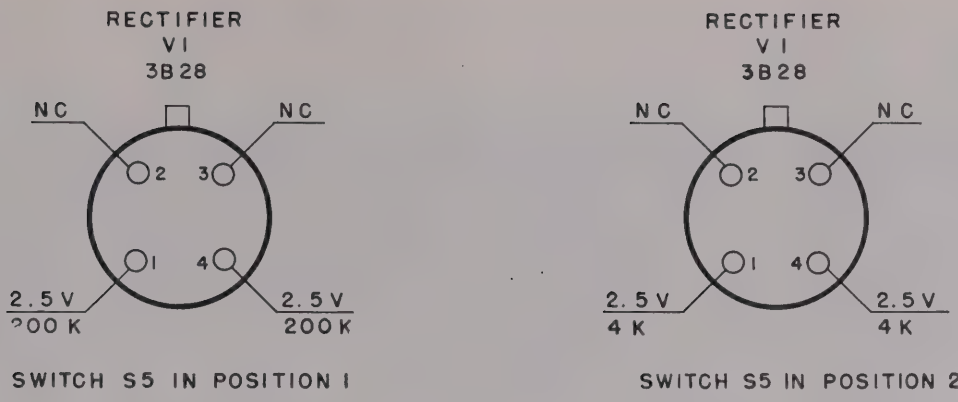


Figure 41. Meter test set, bottom view of chassis.

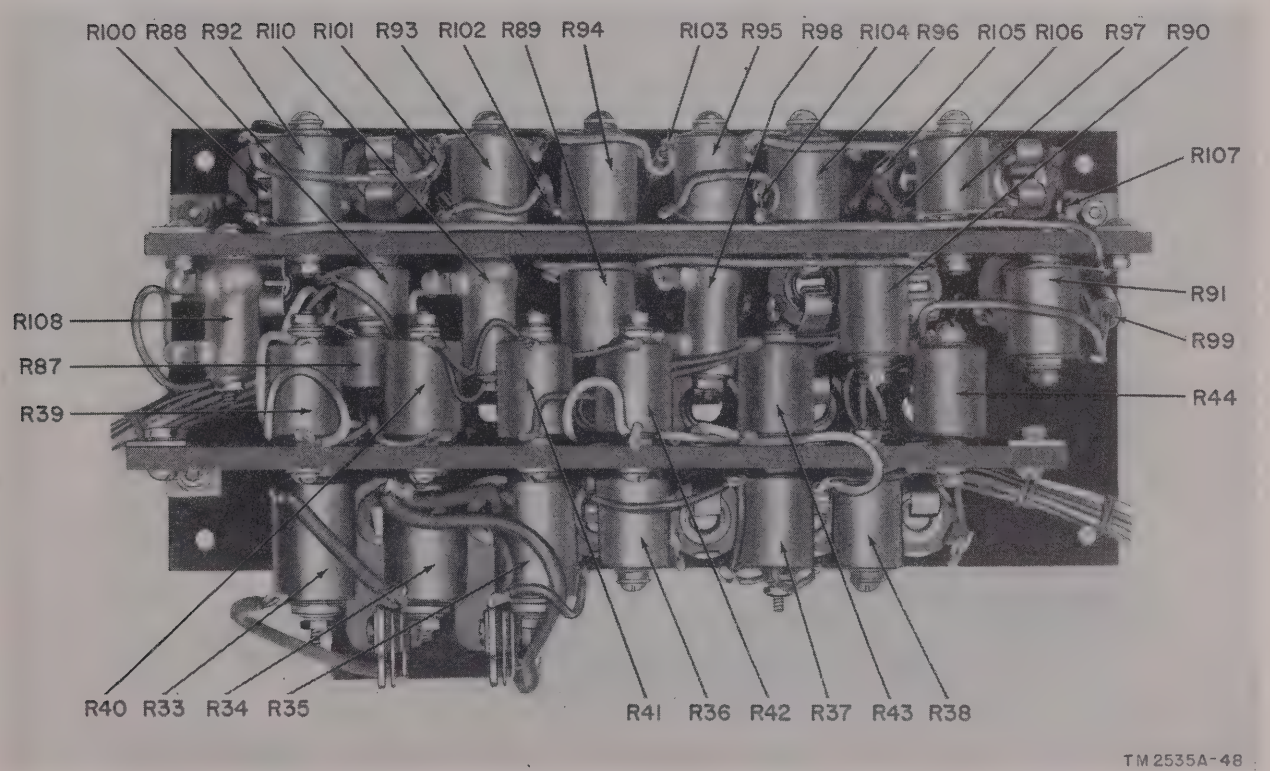


NOTES:

1. VOLTAGE MEASUREMENTS SHOULD ONLY BE TAKEN WITH SWITCH S5 IN POSITION 1.
2. VOLTAGES AND RESISTANCES ARE MEASURED TO GROUND.
3. NC INDICATES NO CONNECTION.
4. ALL RESISTANCE VALUES SHOWN IN OHMS.

TM2535A-46

Figure 42. Meter test set, tube-socket resistance diagram.



TM2535A-48

Figure 43. Meter test set, rear view of d-c current and voltage jack panel.

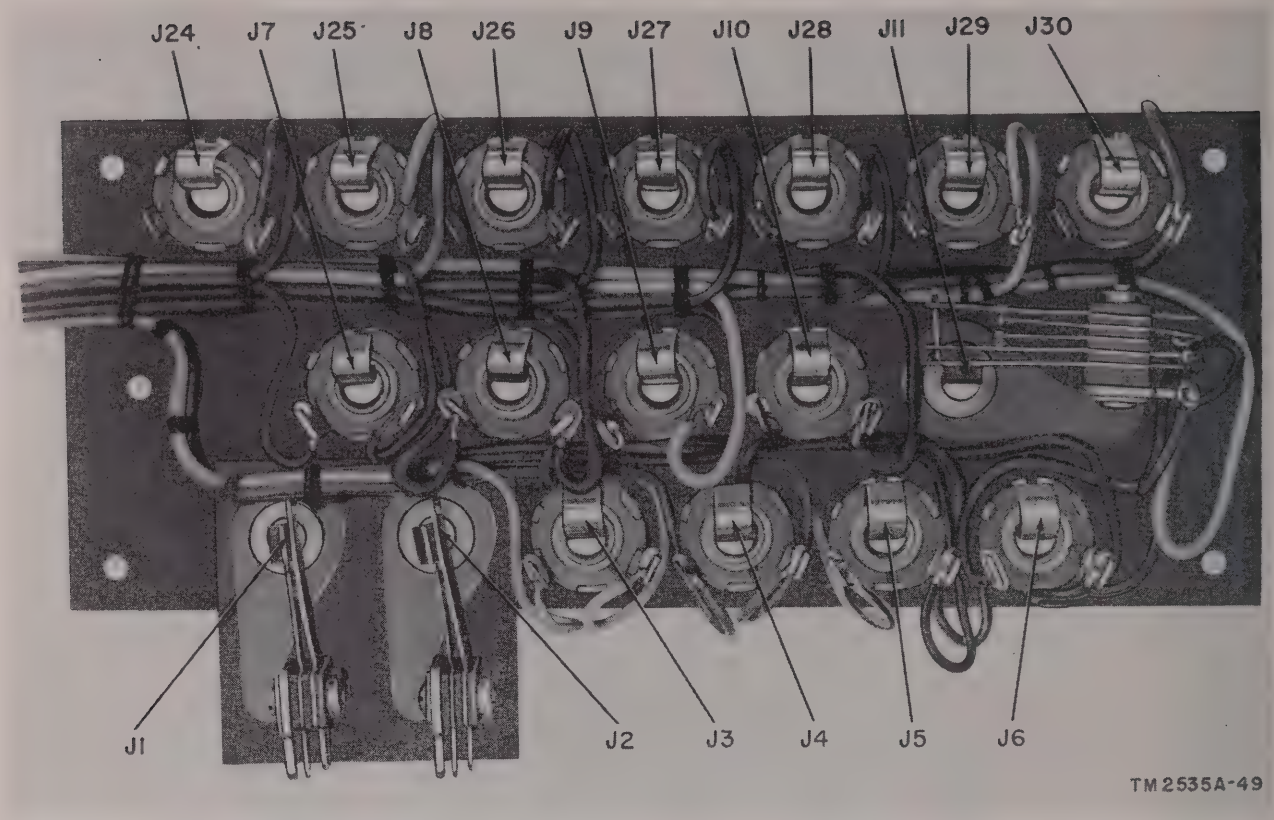


Figure 44. Meter test set, rear view of a-c current and voltage jack panel.

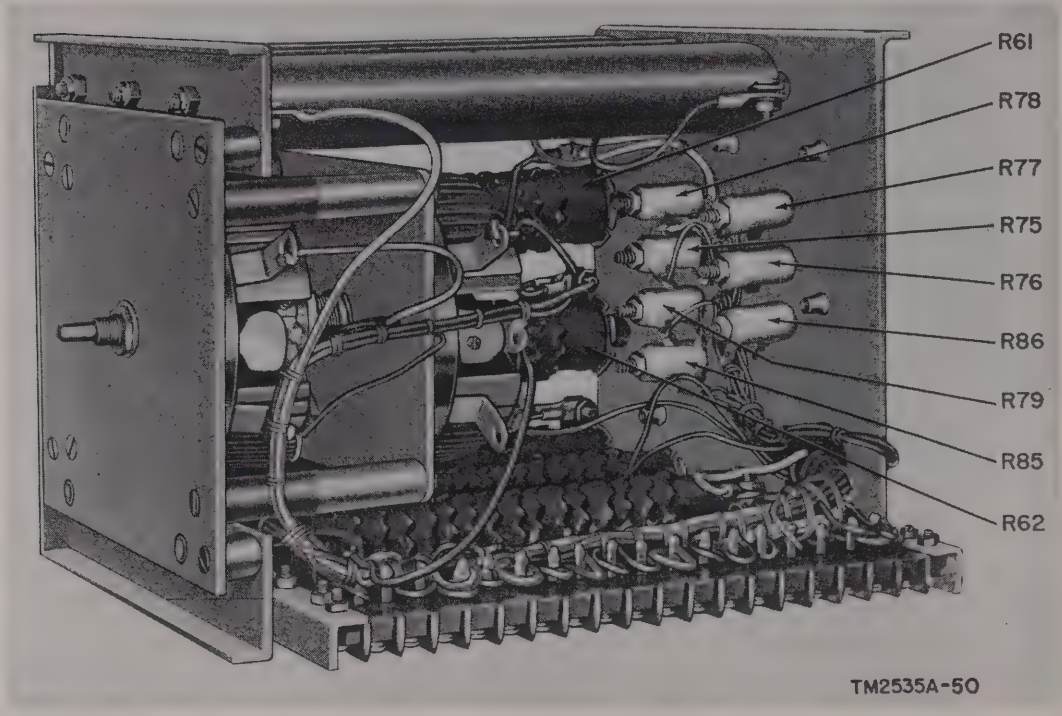


Figure 45. Meter test set, d-c current-limiting resistors.

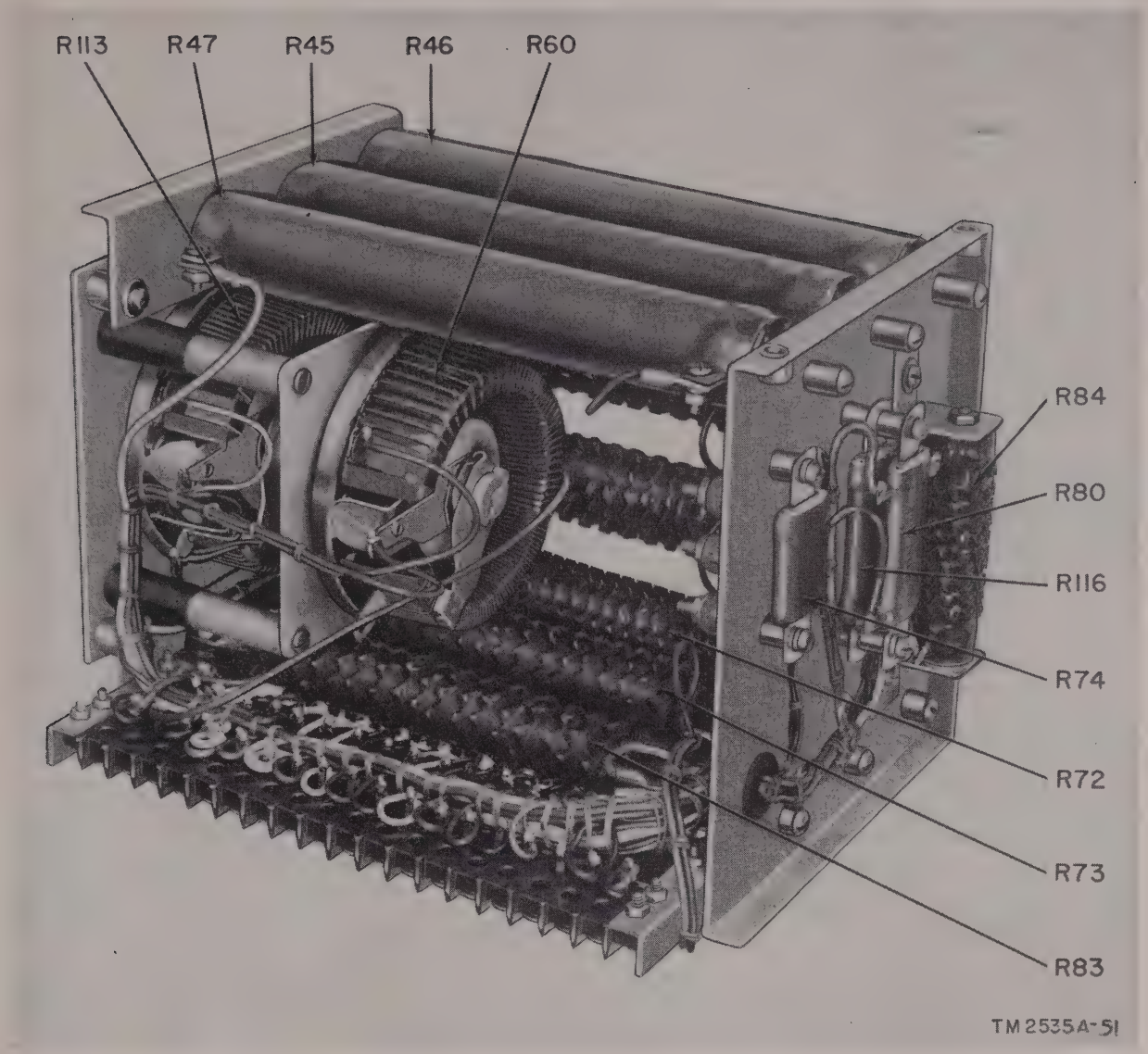


Figure 46. Meter test set, d-c current control circuit.

66. Trouble-Shooting Chart for Meter Test Set TS–682/GSM–1

(figs. 53 through 57)

a. D-C Voltage Supply Circuit (figs. 33 and 34).

Symptom	Probable trouble	Remedy
Pilot lamp E1 does not light	Defective power cord	Check and repair or replace, if necessary.
	Defective lamp	Check and replace, if necessary.
	Defective switch S1	Check and replace, if necessary.
	Defective fuse F1	Check and replace, if necessary.
	Defective primary of transformer T2.	Check and replace, if necessary.
	Defective secondary of transformer T2.	Check and replace, if necessary.
	Defective resistor R81	Check and replace, if necessary.
Lamp E15 or E16 does not light	Defective lamp	Check and replace, if necessary.
Lamp E13 or E14 does not light	Defective lamp	Check and replace, if necessary.
No d-c voltage output present on jacks J12 through J23.	D-c control circuit in zero output position.	Check and turn DIRECT CURRENT COARSE CONTROL clockwise.
	Defective rectifier tube V1	Check and replace if necessary.
	Defective resistor R2	Check and replace if necessary.
	Defective resistor R1	Check and replace if necessary.
	Defective transformer T7	Check and replace if necessary.
	Defective transformer T2	Check and replace if necessary.
	Defective transformer T1	Check and replace if necessary.
No d-c voltage on jack J12 only	Defective resistor R33	Check and replace if necessary.
	Defective resistor R34	Check and replace if necessary.
	Defective jack J12	Check and replace if necessary.
	Defective switch S5	Check and replace if necessary.
No d-c voltage on jack J13 only	Defective jack J13	Check and replace if necessary.
	Defective switch S5	Check and replace if necessary.
No d-c voltage on jacks J12 and J13 only	Defective resistor R35	Check and replace if necessary.
No d-c voltage on any of low-voltage jacks J14 through J23.	Defective resistor, or resistors, in the network of resistors R23 through R32, R36, R44, R115, and R109.	Check and replace resistors found defective.
	Defective inductor L1	Check and replace, if necessary.
Incorrect d-c voltage output on any of low-voltage jacks J14 through J23.	Defective resistor, or resistors, in the network of resistors R23 through R32, R36, R44, R115, and R109.	Check and replace resistors found defective.
Unable to vary d-c voltage output on all d-c ranges.	Defective variac T7	Check and replace, if necessary.
	Defective rheostat R1	Check and replace, if necessary.
No reading on d-c meter M1 for d-c voltage output on any range.	Defective switch S4	Check and replace, if necessary.
	Defective meter M1	Check and replace, if necessary.
Excessive voltage on J12 and J13 for normal rotation of variac T7.	Defective resistor or resistors R3 through R22.	Check and replace, if necessary.

b. D-C Current Supply Circuit (figs. 26 through 32).

Sympton	Probable trouble	Remedy
Pilot lamp E5 does not light	Defective lamp	Check and replace, if necessary.
	External battery dead or not connected properly.	Check and replace, if necessary.
	Defective switch S2	Check and replace, if necessary.
	Defective resistor R82	Check and replace, if necessary.
No d-c output present on jacks J31 through J46.	Defective switch S6	Check and replace, if necessary.
	Defective switch S4	Check and replace, if necessary.
	Defective switch S5	Check and replace, if necessary
D-c meter M1 shows no reading for all ranges	External 12-volt battery improperly connected.	Check and reverse connections on E2 and E3, if necessary.
	Defective meter M1	Check and replace, if necessary.
	Defective relay K5	Check and replace, if necessary.
Relay K5 operates in all positions of switch S6	Defective rheostat R48	Check and adjust or replace, if necessary.
	Defective resistor R114	Check and replace, if necessary.
	Defective resistor R71	Check and replace, if necessary.
No dc present on jack J46	Defective resistor R107	Check and replace, if necessary.
	Defective switch S6	Check and replace, if necessary.
No dc present on one or all of jacks J35 through J45.	Defective resistor or resistors of the network resistors R87 through R106 and R110.	Replace resistors found defective.
	Defective switch S6	Check and replace, if necessary.
No dc present on jack J31	Defective shunt E19	Check and replace, if necessary.
No dc present on jack J32	Defective shunt E19	Check and replace, if necessary.
No dc present on jack J33	Defective shunt E18	Check and replace, if necessary.
No dc present on jack J34	Defective shunt E17	Check and replace, if necessary.
	Defective resistor R108	Check and replace, if necessary.
No dc present on binding post E9	Defective shunt E23	Check and replace, if necessary.
No dc present on binding post E10	Defective shunt E22	Check and replace, if necessary.
No dc present on binding post E11	Defective shunt E21	Check and replace, if necessary.
Excessive dc present on any or all d-c output jacks J31 through J46 or binding posts E9 through E11.	Defective resistor or resistors R61 through R70, R72 through R80, and R83 through R86.	Check and replace resistors found defective.
Unable to vary d-c output with DIRECT CURRENT COARSE CONTROL.	Defective rheostat R71	Check and replace, if necessary.
Unable to vary d-c output with DIRECT CURRENT FINE CONTROL.	Defective rheostat R60	Check and replace, if necessary.
	Defective rheostat R113	Check and replace, if necessary.

c. A-C Voltage Supply Circuit (fig. 24).

Sympton	Probable trouble	Remedy
No a-c voltage output on jacks J1 through J11.	Defective power cord	Check and repair or replace, if necessary.
	Defective switch S1	Check and replace, if necessary.
	Defective fuse F1	Check and replace, if necessary.
	Defective transformer T3	Check and replace, if necessary.
	Defective variac T7	Check and replace, if necessary.
	Defective rheostat R1	Check and replace, if necessary.
	Defective power transformer T1	Check and replace, if necessary.
	Defective switch S4	Check and replace, if necessary.
No control of a-c voltage output	Defective variac T7	Check and replace, if necessary.
	Defective rheostat R1	Check and replace, if necessary.
No reading on a-c meter M2	Defective switch S4	Check and replace, if necessary.
	Defective switch S5	Check and replace, if necessary.
	Defective meter M2	Check and replace, if necessary.
	Defective resistor R58	Check and replace, if necessary.
	Defective resistor R59	Check and replace, if necessary.
Incorrect or no voltage on any of jacks J1 through J11.	Defective secondary of transformer T1.	Check and replace, if necessary.

d. A-C Current Supply Circuit (fig. 23).

Symptom	Probable trouble	Remedy
No output present on jacks J24 through J30 and binding posts E6 through E8.	Defective switch S4	Check and replace, if necessary.
	Defective variac T7	Check and replace, if necessary.
	Defective transformer T3	Check and replace, if necessary.
No control of current output	Defective variac T7	Check and replace, if necessary.
No output present on binding posts E6 through E8.	Defective resistor R45	Check and replace, if necessary.
	Defective resistor R46	Check and replace, if necessary.
	Defective transformer T5	Check and replace, if necessary (be sure to observe polarity).
Excessive or low output on binding posts E6 through E8.	Defective resistor R45	Check and replace, if necessary.
	Defective resistor R46	Check and replace, if necessary.
	Defective transformer T5	Check and replace, if necessary.
No output present on jacks J24 through J30	Defective resistor R47	Check and replace, if necessary.
	Defective resistor R116	Check and replace, if necessary.
	Defective transformer T8	Check and replace, if necessary.
Excessive or low output on jacks J24 through J30.	Defective resistor R47	Check and replace, if necessary.
	Defective resistor R116	Check and replace, if necessary.
Excessive or low output on binding post E7	Defective resistor R55	Check and replace, if necessary.
	Defective resistor R56	Check and replace, if necessary.
	Defective resistor R57	Check and replace, if necessary.
Excessive or low output on binding post E8	Defective resistor R53	Check and replace, if necessary.
	Defective resistor R54	Check and replace, if necessary.
Meter M2 shows no deflection	Defective switch S4	Check and replace, if necessary.
	Defective meter M2	Check and replace, if necessary.
	Defective transformer T6	Check and replace, if necessary.

67. Checking Magnet Charger TS–336A/GSM–1

(figs. 47 and 48)

Whenever the magnet charger does not function properly or does not magnetize meter magnets adequately, locate the source of the trouble by making the checks outlined in subparagraphs *a* through *d* below.

Caution: High voltages are exposed during this trouble-shooting procedure. Only specifically authorized personnel may perform trouble shooting on the interior or the magnet charger. *Observe all safety precautions.*

a. Check the pilot lamp to see that it lights when the POWER switch is thrown to the ON position. If it does light, ac is supplied to the primary of transformer T2. If it does not light, check the lamp to see that it is not burned out, check switch S1 to see that it closes the circuit, and check the primary of transformer T2 to see whether it is open.

b. If the pilot lamp lights, check tubes V1 and V2.

c. Hold the MAGNET switch down in the CHARGE position, and check tube V2 to see that it fires. If it does fire, the grid-control circuit is functioning. If it does not fire, check the voltage across resistors R2 and R3, and check capacitor C2.

d. If tube V2 and its grid-control circuit are normal, and a magnet placed in the charging bar does not become adequately charged when the MAGNET switch is held down in the CHARGE position, check continuity of the discharge circuit through resistor R1 and the primary of transformer T1.

Caution: Leave the MAGNET switch in the NORMAL position to short out high-voltage capacitors C1, C2, and C3 before making any resistance measurements inside the magnet charger.

e. If the meter reads incorrectly or not at all, check resistors R4 and meter M1 for short and open circuits.

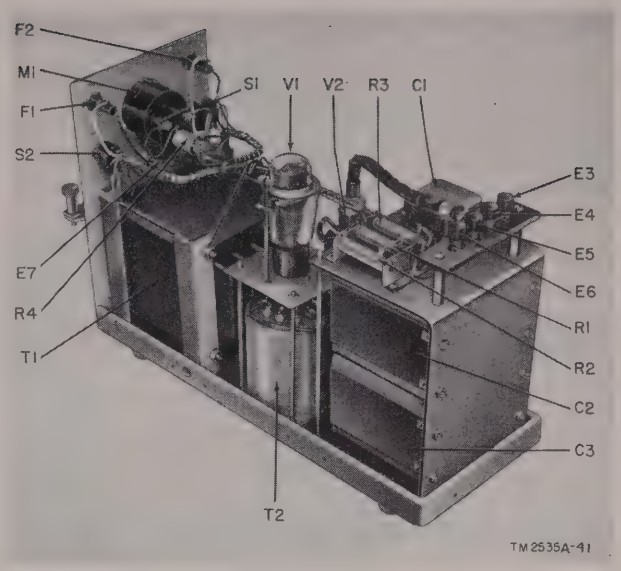
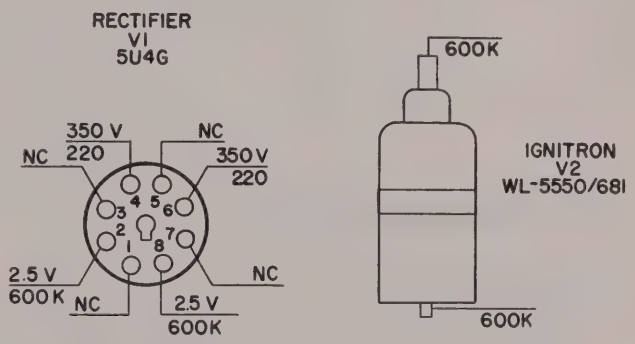


Figure 47. Top view of magnet charger, case removed.



NOTES:
1. VOLTAGES AND RESISTANCES ARE MEASURED TO GROUND.
2. SWITCH S2 IN NORMAL POSITION FOR ALL MEASUREMENTS.
3. NC INDICATES NO CONNECTION.
4. ALL RESISTANCE VALUES IN OHMS, UNLESS OTHERWISE SPECIFIED.
5. DO NOT ATTEMPT TO TAKE VOLTAGE READINGS ON V2.

TM 2535A-52

Figure 48. Magnet charger, tube-socket voltage diagram.

68. Trouble-Shooting Chart for Magnet Charger TS–336A/GSM–1

(fig. 35)

Symptom	Probable trouble	Remedy
Pilot lamp E7 does not light	Defective power cord	Check and repair or replace, if necessary.
	Defective fuse (F1 or F2)	Check and replace, if necessary.
	Defective switch S1	Check and replace, if necessary.
	Defective transformer T2	Check and replace, if necessary.
Voltmeter M1 shows no deflection after equipment has warmed up.	Defective rectifier tube V1	Check and replace, if necessary.
	Defective meter M1	Check and replace, if necessary.
	Defective resistor R4	Check and replace, if necessary.
	Defective resistor R1	Check and replace, if necessary.
	Defective capacitor C1	Check and replace, if necessary.
	Defective transformer T2	Check and replace, if necessary.
No output present at secondary of transformer T1 when MAGNET switch is placed in the CHARGE position.	Defective tube V2	Check and replace, if necessary.
	Defective switch S2	Check and replace, if necessary.
	Defective transformer T1	Check and replace, if necessary.
	Charging bar improperly connected	Check and reconnect or replace, if necessary.
	Binding posts E3 and E4 not connected together.	Check and reconnect or replace, if necessary.
	Defective resistor R2	Check and replace, if necessary.
	Defective resistor R3	Check and replace, if necessary.
	Defective capacitor C2	Check and replace, if necessary.
	Defective capacitor C3	Check and replace, if necessary.
Low or no current output	Defective transformer T1	Check and replace, if necessary.
	Charging bar improperly connected	Check and reconnect or replace, if necessary.
	Defective ignitron V2	Check and replace, if necessary.

Section IV. REPAIRS

69. General Instructions

a. The chassis of each component of Meter Test Equipment AN/GSM–1B can be removed from its case, so that all parts and circuit elements are easily accessible. However, be careful when servicing and repairing this equipment to avoid further damage to delicate mechanisms and circuit elements. Only fully qualified repair personnel should attempt any repair of the components.

b. Always use the correct tools in disassembly procedures. The tools available to personnel of organizations to which Meter Test Equipment AN/GSM–1B is issued are adequate for all repair requirements.

c. Whenever it is necessary to disconnect a number of leads during the removal of a defective part, tag each lead so that it will be replaced in its proper location when the equipment is reassembled.

d. When making solder connections, avoid using more solder than is necessary. Excess solder accidentally dropped into the equipment may cause short-circuits. Do not heat a lug or connection excessively, because of possible damage to nearby circuit elements.

e. Save time and trouble by making a thorough electrical check of any possibly defective part before removing it from the equipment.

Caution: Never change the location of parts or wiring leads. Never substitute a longer lead or a lead of different material or higher gage number. Such changes may materially affect the accuracy of this delicate test equipment by altering the resistance values.

70. Removal of Pluck-out Parts

a. Meter Test Set.

(1) *Removing tube.*

(*a*) Remove the rear panel by removing the screws located around the edge of the panel, and remove the screws that hold the four shock mounts.

(*b*) Remove tube V1 from its socket. Make sure the tube has cooled sufficiently; then pull it out. Do not rock the tube or jiggle it in its socket if it can be extracted by a direct upward pull. Rock it *gently* if it does not release easily.

(2) *Removing fuse.* One fuse, labeled FUSE, is located on the front panel directly beneath the AC LINE switch (fig. 17). To remove the fuse, unscrew the fuse-holder cap. The fuse will be removed with the cap.

(3) *Removing pilot lamps.* There are two pilot lamps located on the front panel, one directly above the AC LINE switch and one directly above the BATTERY switch (fig. 17). Unscrew the jewel guards of the pilot lamps on the front panel and remove the bayonet-base lamps by pushing each in and turning it counterclockwise.

b. Magnet Charger.

(1) *Removing tubes.*

(*a*) Remove the case by removing the screws located around the edge of the front panel and along the bottom of the side panels. Remove the bottom carrying-strap mountings.

(*b*) Remove the tubes from their sockets (fig. 47). Make sure the tubes have cooled sufficiently; then pull them out. Do not rock the tubes or jiggle them in their sockets if they can be extracted by a direct upward pull. Rock the tube gently if it does not release easily. Label each tube as soon as it is removed so that it can be replaced later in its proper socket.

(2) *Removing fuses.* Two fuses, each labeled FUSE, are located in the upper corners of the front panel (fig. 19). Rotate each fuseholder cap ¼ turn counterclockwise and remove it. The fuse will come out with the cap.

(3) *Removing pilot lamp.* Unscrew the jewel guard of the pilot lamp on the front panel (fig. 19) and remove the bayonet-base lamp by pushing it in and turning it counterclockwise.

71. Replacement of Pluck-out Parts

Replace the tubes, fuses, pilot lamps, and pilot-lamp covers. Be sure that each tube is returned to the correct socket. Replace the chassis in their respective cases, replace the panels or covers, and tighten the retaining screws.

72. Removal of Meters From Meter Test Set (figs. 49 and 50)

a. Remove the rear cover of the meter test set.

b. Disconnect the leads to meter M1 or M2.

c. Remove desiccants by unscrewing the containers.

d. Remove the rear cover of the meter mounting by removing the machine screws around the edges of the cover plate.

e. Grasp the meter terminals and pull out the meter.

f. Replace the meter by reversing the steps outlined in *a* through *e* above.

73. Replacement of Meter Illumination Lamps in Meter Test Set

a. After the meter has been removed from the case (figs. 49 and 50), remove the front cover of the meter.

b. Remove illumination lamps E13, E14, E15, and E16 by unscrewing them.

c. When defective lamps have been replaced, replace the meter cover.

74. Removal of High-Current D-c Ammeter Shunts From Meter Test Set

a. Shunts for the high-current d-c ammeter ranges (1, 2, 4, 10, 20, 40, and 100 amperes) are located on the bottom of the meter test set chassis (fig. 41).

b. Be careful when loosening or tightening the main-connection terminal bolts. These bolts are tapped into the tops of the brass terminal posts

that hold the shunt leaves. Use one wrench to hold the terminal posts, and turn the terminal-bolt head with another wrench. As an alternative, insert a tightly fitting block between the terminal post and an adjacent post to prevent the terminal post from being turned. Turning a terminal post puts undue stress on the shunt leaves and may break them loose from their connections.

c. Whenever a high-current d-c ammeter shunt is removed and replaced, inspect thoroughly to insure that all shunt leads are connected tightly to the terminal posts.

75. Adjustment of Relay K5 in Meter Test Set (fig. 51)

a. Relay K5 closes when voltages in excess of 6 volts are applied across its coil. Voltage is varied by adjustment of rheostat R48 (fig. 51). Refer to paragraph 44 before making the adjustments outlined in *b* through *e* below.

b. Connect a d-c voltmeter, with a range of 0 to 10 volts, to the end of the relay coil not connected to R48, and connect the other side of the voltmeter to ground.

c. Place switch S4 in the AC & DC CUR position.

d. Turn the DIRECT CURRENT COARSE CONTROL clockwise until the voltmeter reads 6 volts.

e. Adjust rheostat R48 so that relay K5 closes when voltage in excess of 6 volts is applied.

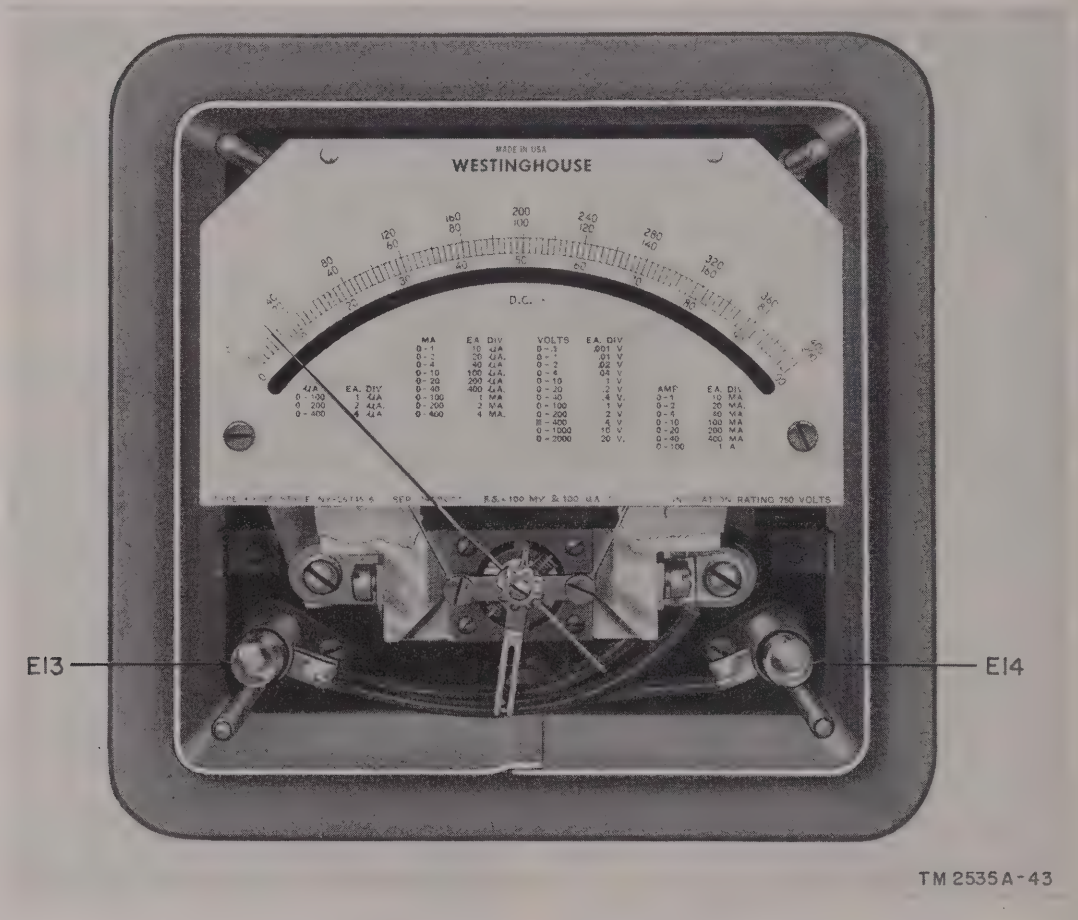


Figure 49. Meter M1, cover removed.

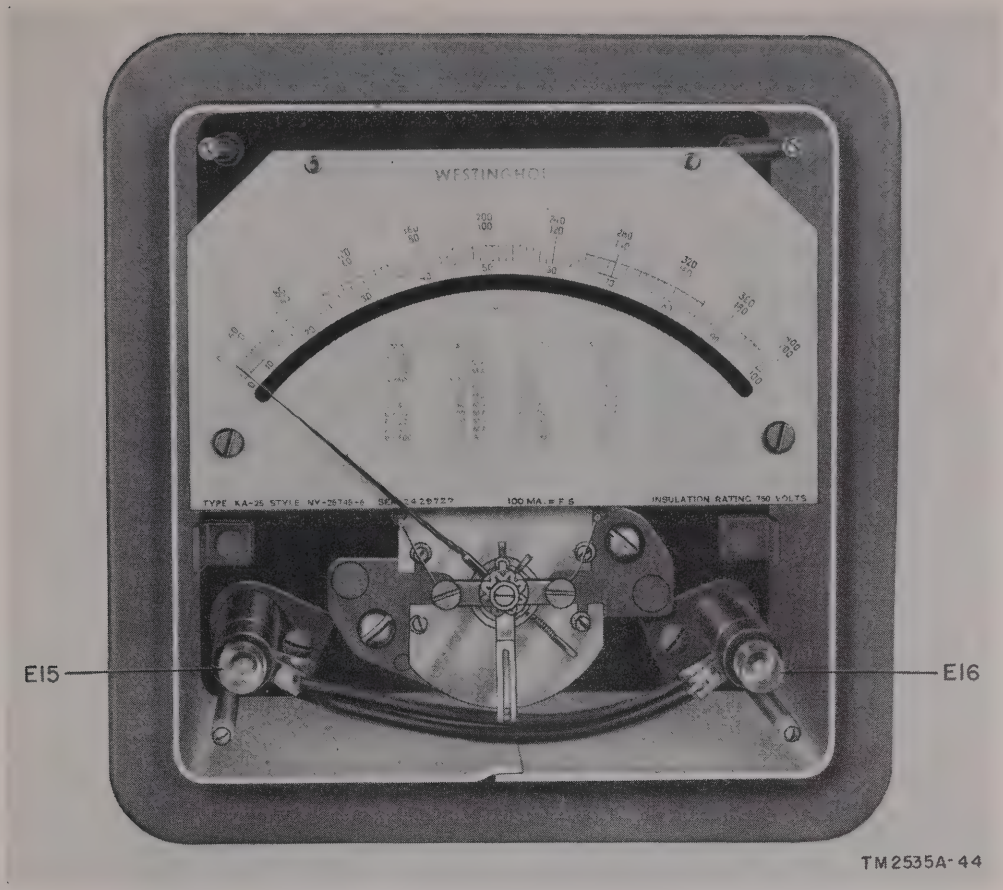


Figure 50. Meter M2, cover removed.

76. Calibration of Frequency Meter FR–40/GSM–1

(fig. 52)

Frequency meter FR–40/GSM–1 can be calibrated if the special apparatus required is available. Use a variable-speed generator and speed-standardizing equipment for calibration. Make adjustments by adjusting reactor L1 to vary the amount of inductive reactance in the circuit.

77. Cleaning, Inspecting, and Testing

a. Tubes.

(1) *Cleaning.* Clean the tubes with a cloth moistened with solvent (SD). If necessary, clean the grid caps and prongs with crocus cloth.

(2) *Inspecting.* Inspect the tubes for cracked glass and bent base or broken prongs.

(3) *Testing.* Use a tube tester to test the tubes for proper emission, leakage, and short circuits.

b. Fuses.

(1) *Inspecting.* Inspect fuse ends for evidence of burning, corrosion, and looseness.

(2) *Cleaning.* Clean fuse ends with emery cloth and wipe them with a clean cloth. If a file is used to remove deep pits, use crocus cloth to leave a smooth contact surface and then wipe them with a clean cloth.

(3) *Testing.* Check fuses for continuity.

c. Pilot Lamps. Inspect the lamps for continuity of filament. Make sure that the lamp bases are not loose.

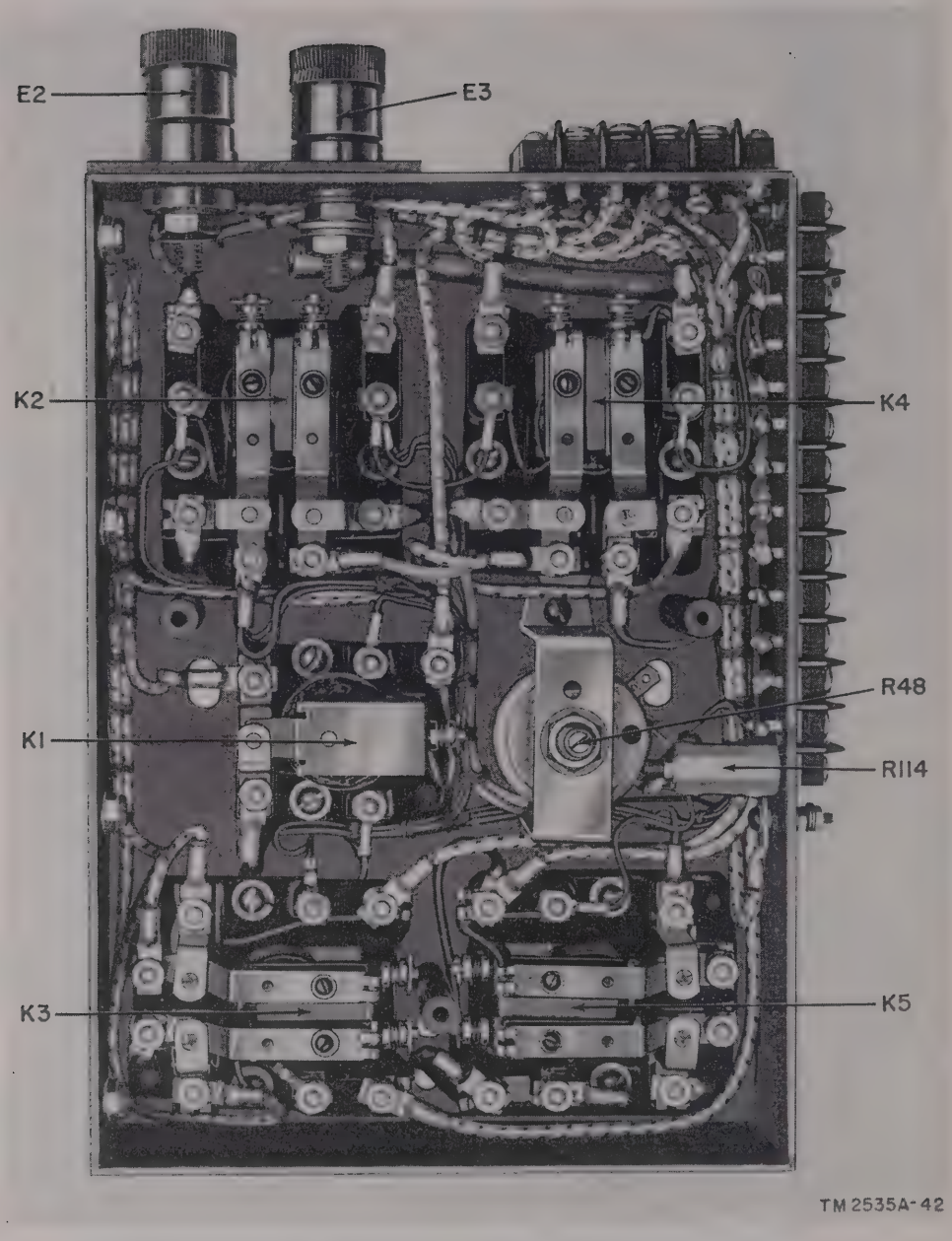


Figure 51. View showing location of rheostat R48 used to adjust relay K5.

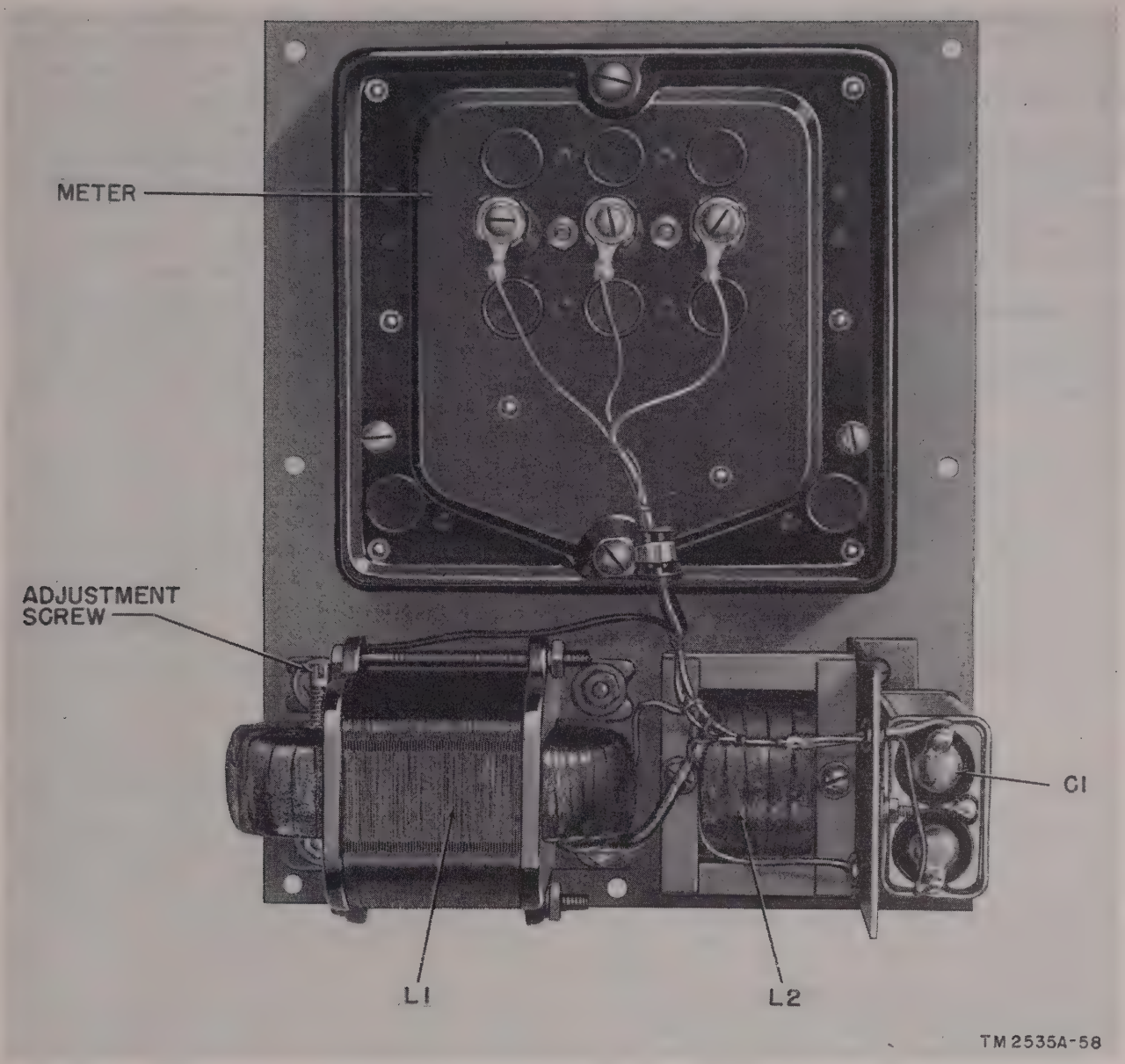


Figure 52. Frequency meter, chassis assembly.

d. Chassis Assemblies.

(1) *Cleaning.* Thorough cleaning of Meter Test Equipment AN/GSM–1B chassis assemblies is necessary to insure optimum performance. Remove loose dirt with a brush or blower. Use a brush or cloth and solvent (SD) to remove dirt and grease that adheres to the chassis and parts. Remove dirt and dust from switch contacts with a small brush or pipe cleaner and carbon tetrachloride.

(2) *Inspecting.* After the chassis assemblies have been cleaned thoroughly, inspect parts and wiring for rust, corrosion, loose connections, frayed and burned insulation, loose screws, and burned or charred resistors and coils. Carefully inspect tube sockets for broken contacts, switches for loose and bent contacts and broken insulation, and terminal boards for broken lugs and signs of burning. In-

spect all set screws and relay contacts for looseness, and tighten them, if necessary.

78. Final Testing

After Meter Test Equipment AN/GSM–1B has been repaired, it must be checked for satisfactory operation. Use the equipment performance checklist (par. 48) to determine that the equipment is in proper operating condition.

79. Refinishing

a. When the finish of a case has been scarred or damaged badly, rust and corrosion can be prevented by touching up bared surfaces. Use No. 00 or No. 000 sandpaper to clean the surface down to the bare metal. Obtain a bright, smooth finish.

Caution: Do not use steel wool. Minute particles may enter the cases and cause harmful internal shorting or grounding of circuits.

b. When a touch-up job is necessary, apply the paint with a small brush. Remove rust from the equipment cases by cleaning the corroded metal with solvent (SD). In severe cases, it may be necessary to soften the rust and to use sandpaper to prepare the surface for repainting. The paint used must be in accordance with existing regulations.

CHAPTER 5

SHIPMENT AND LIMITED STORAGE AND DEMOLITION TO PREVENT ENEMY USE

Section I. SHIPMENT AND LIMITED STORAGE

80. Disassembly

The following instructions are recommended as a guide for preparing Meter Test Equipment AN/GSM–1B for transportation or storage:

a. Disconnect all power cables.

b. Coil power cables and place them in Case CY–721/GSM–1.

c. Set switch S4 of the meter test set at the AC & DC CUR position, and set DIRECT CURRENT SELECTOR at the 100A position.

81. Repacking

a. The exact procedure in repacking for shipment or limited storage depends on the material available and the conditions under which the equipment is to be stored or shipped. Reverse the instructions given in paragraph 13 insofar as possible.

b. Whenever practicable, place a desiccant, such as silica gel, inside the chests. Protect the chests with a waterproof paper barrier. Seal the seams of the paper barrier with waterproof sealing compound or tape. Pack the protected chests in a padded wooden case, providing at least 3 inches of excelsior padding or some similar material between the paper barrier and the packing case.

Section II. DEMOLITION TO PREVENT ENEMY USE

82. Methods of Demolition

a. Smash. Use sledges, axes, handaxes, pickaxes, hammers, crowbars, heavy tools.

b. Cut. Use axes, handaxes, machetes.

c. Burn. Use gasoline, kerosene, oil, flame throwers, incendiary grenades.

d. Explode. Use firearms, grenades, TNT.

e. Dispose. Bury in slit trenches, fox holes, other holes. Throw in streams. Scatter.

f. Other. Use anything immediately available for destruction of this equipment.

83. Destruction of Components

When ordered by your commander, destroy all equipment to prevent its being used or salvaged by the enemy.

a. Smash (par. 82*a*) the controls, tubes, relays, coils, switches, capacitors, transformers, cases, and meters.

b. Cut (par. 82*b*) cords, wiring, and cables.

c. Burn (par. 82*c*) cords, resistors, capacitors, coils, wiring, and technical manuals.

d. Bury or scatter (par. 82*e*) all remaining parts of the equipment.

e. Destroy everything.

APPENDIX I

REFERENCES

Note. For availability of items listed, check SR 310–20–3 for field manuals and JANAP's. Check SR 310–20–4 for technical manuals, technical bulletins, supply bulletins, modification work orders, and changes. Check SR 310–20–5 for Army and Special Regulations.

1. Regulations

a. Army Regulations.

AR 380–5	Military Security—Safeguarding Military Information.
AR 750–5	Maintenance of Supplies and Equipment—Maintenance Responsibility and Shop Operation.

b. Special Regulations.

SR 310–20–3	Index of Training Publications (Field Manuals, Training Circulars, Firing Tables and Charts, Army Training Programs, Mobilization Training Programs, Army Training Tests, Graphic Training Aids, Joint Army-Navy-Air Force Publications, Combined Communications Board Publications, and Army Communications Publications).
SR 310–20–4	Index of Technical Manuals, Technical Regulations, Technical Bulletins, Supply Bulletins, Lubrication Orders, Modification Work Orders, Tables of Organization and Equipment, Reduction Tables, Tables of Allowances, Tables of Organization, and Tables of Equipment.
SR 310–20–5	Index of Administrative Publications (Army Regulations, Special Regulations, Joint Army-Air Force Adjustment Regulations, General Orders, Bulletins, Circulars, Commercial Traffic Bulletins, Joint Procurement Circulars, Department of the Army Pamphlets, and ASF Manuals).
SR 700–45–5	Unsatisfactory Equipment Report (Reports Control Symbol CSGLD–247).
SR 745–45–5/ AFR 71–4	Report of Damaged or Improper Shipment (Reports Control Symbols CSGLD–66 (Army), and AF–MC–U2 (Air Force)).

2. Supply Publications

SB 11–47	Preparation and Submission of Requisitions for Signal Corps Supplies.
SB 11–100	Serviceability Standards for Signal Equipment in Hands of Troops.

3. Technical Manuals on Auxiliary Equipment and Test Equipment

TM 9–2820	Shop Mathematics.
TM 11–453	Shop Work.
TM 11–472	Repair and Calibration of Electrical Measuring Instruments.
TM 11–455	Radio Fundamentals.
TM 11–2019	Test Set I–49.
TM 11–2627	Tube Tester I–177 and I–177–A.
TB 11–2627–2	Tube Test Data Cards for Use with Tube Testers I–177, I–177–A, I–177–B, and with Tube Socket Adapter Kit MX–949/U.
TM 11–5520	Decade Resistor TS–679/U.
TM 11–5527	Test Set TS–352/U.

4. Painting, Preserving, Maintenance, and Lubrication

TB SIG 13	Moistureproofing and Fungiproofing Signal Corps Equipment.
TB SIG 72	Tropical Maintenance of Ground Signal Equipment.
TB SIG 75	Desert Maintenance of Ground Signal Equipment.
TB SIG 123	Preventive Maintenance Practices for Ground Signal Equipment.

5. Packaging and Packing Information

a. Military (JAN) Specifications.

JAN–D–169 (4)	Desiccants (Activated).
JAN–P–100	Packaging and Packing for Overseas Shipment—General Specification.
JAN–P–101	Packaging and Packing for Overseas Shipment—Adhesive, Water-Resistant, for Sealing Fiberboard Boxes.
JAN–P–103 (1)	Packaging and Packing for Overseas Shipment—Boxes; Wood-cleated; Solid Fiberboard.
JAN–P–106A	Packaging and Packing for Overseas Shipment—Boxes; Wood, Nailed (For weight of contents not in excess of 1,000 pounds.)
JAN–P–116 (2)	Packaging and Packing for Overseas Shipment—Preservation, Methods of.
JAN–P–125 (1)	Packaging and Packing for Overseas Shipment—Barrier-Materials, Waterproof, Flexible.
JAN–P–131 (3)	Packaging and packing for Overseas Shipment—Barrier-Material; Moisture-Vaporproof, Flexible.

b. U. S. Army Specification.

100–2E	Marking Shipments by Contractors, Standard Specifications.

c. Signal Corps Instructions.

720–7	Standard Pack.
726–15	Marking of Interior Containers (for Signal Corps Equipment).

APPENDIX II

IDENTIFICATION TABLE OF PARTS

Note. The fact that a part is listed in this table is not sufficient basis for requisitioning the item. Requisitions must cite an authorized basis, such as T/O & E, T/A, SIG 6, SIG 7 & 8, SIG 7–8–10, SIG 10, list of allowances of expendable material, or another authorized supply basis. For an index of available catalogs in the Signal portion of the Department of the Army Supply Catalog, see the latest issue of SIG 1.

1. Meter Test Equipment AN/GSM–1B

Fig. No. or ref. symbol	Name of part and description	Function of part	Signal Corps stock No.
Fig. 1	TEST EQUIPMENT: Sig C AN/GSM–1B; c/o Meter Test Set TS–682/GSM–1, Decade Resistor TS–679/U, Frequency Meter FR–40/GSM–1, Magnet Charger TS–336A/GSM–1, Test Set I–49, Test Set TS–352/U, Tube Tester I–177–( ), Tube Socket Adapter Kit MX–949( )/U, and Resistance Bridge ZM–9( )/U.		3F3941–1
Fig. 11	DEMAGNETIZER: demagnetizing coil. (Part of Magnet Charger TS–336A/GSM–1.)	Used to buck down overcharged magnets.	3Z12200
Fig. 12	METER, frequency indicator: Sig C Frequency Meter FR–40/GSM–1.	Used to determine frequencies between 50 and 70 cycles per second.	3F2789–6
Fig. 9	CHARGER, magnet: Sig C TS–336A/GSM–1. (See app. 2, par. 2.)	Used to charge meter magnets	3H791–14.
Fig. 6	MOUNTING, meter: Sig C MT–135A/GSM–1. (Part of Meter Test Set TS–682/GSM–1.)	Used to mount panel-type meters for calibration.	3F3386–135
Fig. 13	RESISTOR, decade: Sig C TS–679/U	Used to obtain standard values of resistance between .1 ohm and 111, 111 ohms.	3F1800–5
Fig. 2	TEST SET, meter: Sig C TS–682/GSM–1. (See app. 2, par. 3.)	Used to test and calibrate panel-type meters.	3F4325–682
	TEST SET, meter: Sig C I–49	Used to locate circuit faults	3F4049
	TEST SET, meter: Sig C TS–352/U	Used as general-purpose multimeter.	3F4325–352
	TESTER, tube: Sig C I–177–( )	Used to test tubes	3F5700–177
	ADAPTER UNIT, test set: Sig C MX–949( )/U.	Used with Tube Tester I–177–( ) for testing tubes.	2Z5731–949
	BRIDGE, resistance: Sig C ZM–9( )/U	Used to measure resistance between .1 megohm and 1,000,000 megohms.	3F2009–1

2. Magnet Charger TS–336A/GSM–1

Fig. No. or ref. symbol	Name of part and description	Function of part	Signal Corps stock No.
Fig. 9	MAGNET CHARGER: Sig C TS–336A/GSM–1.		3H791–14
Fig. 9	CABLE, power: 2 #18 AWG, stranded cond.	Used to connect magnet charger to power source.	1B818.14

2. Magnet Charger TS–336A/GSM–1—Continued

Fig. No. or ref. symbol	Name of part and description	Function of part	Signal Corps stock No.
C1	CAPACITOR, fixed: paper dielectric; 2 μf +20% −10%.	With resistor R1, filters output of tube V1.	3DB2–53
C3	CAPACITOR, fixed: paper dielectric; 50 μf ±10%.	Discharges through primary of transformer T1, causing current to flow in secondary.	3DB50–102
Fig. 9	CONNECTOR, plug: 2 parallel blades, male cont.	Used to connect magnet-charger power cord to power source.	6Z1727
F1, F2	FUSE, cartridge: 2 amp, 250 v	Line fuses for magnet charger	3Z2602.32
	FUSEHOLDER: 18 amp, 250 v max	Hold line fuses in place	3Z3282–428
E7	LAMP, incandescent: 6 to 8 v, 25 amp	Serves as pilot lamp	2Z5877–31
M1	METER, voltmeter: dc; 0 to 600 v	Indicating meter for magnet charger.	3F8600–6
E3, E4, E5, E6	POST, binding: screw-type	Used to connect external booster units to the magnet charger.	3Z737–66
R1	RESISTOR, fixed: 600,000 ohms ±1%, ½ w.	With capacitor C1, filters output of tube V1.	3RB7–6000
	RETAINER, tube: stainless steel	Retains tube V2 in place	2Z7780–150
	SOCKET, tube: 8 cont	Socket for tube V1	2Z8678.326
S1	SWITCH, toggle: 30 amp, 30 v dc	Used to turn magnet-charger power ON or OFF.	3Z9863–52K
S2	SWITCH, toggle: 15 amp, 30 v dc	When closed, causes ignitor rod of V2 to become energized so that the tube conducts.	3Z9863–42C
T1	TRANSFORMER, pulse: d-c pulse input; 15,000 amp turns; 1 secd output.	Output from secondary results in high-flux density field used to charge meter magnets.	2Z9627–176
T2	TRANSFORMER, power: input 117 v, 60 cyc; 3 output windings.	Supplies power required for operation of magnet charger.	2Z9613.726
V1	TUBE, electron: 5U4G	Rectifier tube which supplies direct current to ignitron control circuit.	2J5U4G
V2	TUBE, electron: Wemco #WL–5550.681	Ignitron which serves as a valve, allowing capacitors C2 and C3 to discharge through primary of transformer T1.	3C12200

3. Meter Test Set TS–682/GSM–1

Fig. No. or ref. symbol.	Name of part and description	Function of part	Signal Corps stock No.
Fig. 2	TEST SET, meter: c/o 1 d-c voltammeter and 1 a-c voltammeter; includes 1 set of Cords CX–25A/GSM–1 and CX–25B/GSM–1, 1 set of calibration rings, and 2 Mountings MT–135A/GSM–1.	Used to test and calibrate panel-type meters.	3F4325–682
E24	BOARD, terminal: 12 brass, nickel pl term	General purpose connecting strip.	3Z770–12.6
E25, E26	BOARD, terminal: 4 brass, nickel pl term	General purpose connecting strips.	3Z770–4.15
E27, E28	BOARD, terminal: 18 brass, nickel pl term	General purpose connecting strips.	3Z770–18.60
W1	CABLE ASSEMBLY, power: 2 #16 AWG cond, rubber ins, 250 v working; 6 ft lg excluding term.	Connects meter test set to a-c power line.	3Z7350.1–9.3
C1	CAPACITOR, fixed: paper dielectric; 4 μf ±10%; 3000 vdcw.	Filter capacitor	3DB4–270

3. Meter Test Set TS–682/GSM–1—Continued

Fig. No. or ref. symbol	Name of part and description	Function of part	Signal Corps stock No.
C2	CAPACITOR, fixed: paper dielectric; 4 μf ±10%; 600 vdcw.	Filter capacitor	3DB4–218
O–9	CLIP, battery: alligator type; 1 screw and lug connection; marked +12 v.	Terminates one end of battery cable.	2Z2712.243
O–10	CLIP, battery: alligator type; 1 screw and lug connection; marked −12 v.	Terminates one end of battery cable.	2Z2712.244
O–11	CLIP, electrical: phosphor bronze; ceramic ins; 1 lug.	Plate clip for tube V	2Z2725.2
P1	CONNECTOR, plug: straight type; 2 flat, parallel, male blades.	Terminates one end of power cable W1.	6Z1735
Fig. 2	CORD: Sig C CY–721/GSM–1	Power cord for meter test unit	6F300–721
Fig. 2	CORD: Sig C CX–25A/GSM–1	Used to connect meter mounting to meter test unit.	3E6000–25A
Fig. 2	CORD: Sig C CX–25B/GSM–1	Used to connect meter mounting to meter test unit.	3E6000–25B
Fig. 2	CORD: term. in spade lug at 1 end; Plug PL–68 at other end.	Used to connect meter mounting to meter test unit.	3E7160–68
Fig. 2	CORD: term. in spade lug at 1 end; Plug PL–55 at other end.	Used to connect meter mounting to meter test unit.	3E7160–70
A10, A11, A12, A13, A14, A15, A16, A17, A18, A19, A20, A21, A22, A23.	COVER: transparent plastic; polished edges	Cover plates for high-voltage jacks.	2Z3351–293
MS1, MS2	DESICCANT: sodium silicate; in clear, plastic container.	Keep meter compartment dry	6G250–6
F1	FUSE, cartridge: 5 amp; glass body; ferrule term.	Used as a-c line fuse	3Z2608.1
O–29	GASKET: neoprene; rectangular		2Z4867.692
E4	HOLDER, fuse: extractor post type; 5 amp, 500 v.	Holds a-c line fuse	3Z1939
E29, E30, E31, E32, E33, E34, E35, E36, E37.	INSULATOR, feed-through: rd, post shape; 6000 v.	Provides path for electrical connection to meter assembly.	3G290–36
J1, J2, J12, J13	JACK, telephone: Switchcraft type 22A	A-c and d-c output jacks	2Z5598–41
J3, J4, J5, J6, J7, J8, J9, J10, J14, J15, J16, J17, J18, J19, J20, J21, J22, J23.	JACK, telephone: Switchcraft type C11	A-c and d-c output jacks	2Z5534
J11	JACK, telephone: Switchcraft type SF–JAX 23.	0- to 1-volt a-c output jack	2Z5598–42
J24, J25, J26, J27, J28, J29, J30, J31, J32, J33, J34, J35, J36, J37, J38, J39, J40, J41, J42, J43, J44, J45, J46.	JACK, telephone: Switchcraft type C12B	A-c and d-c output jacks	2Z5533A
A1	KNOB: rd; black bakelite; white line marker; Kurz-Kasch #S–312–64–BB–BL–E.	Used to vary transformer T7	2Z5850–68
A2, A3, A4, A5, A6	KNOB: rd; black bakelite; white line marker; Kurz-Kasch #S–312–64–BB–BL.	Switch and control knobs	2Z5822–48
A9	KNOB: rd; molded black bakelite; Ward Leonard Electric Co. Handwheel #60–24.	D-c coarse-control knob	2Z5822–601
E1, E5	LAMP, incandescent: 6 to 8 v, 115 amp	E1—Lights to show that a-c power has been turned on. E5—Lights to show that d-c power has been turned on.	2Z5925.1

3. Meter Test Set TS–682/GSM–1—Continued

Fig. No. or ref. symbol	Name of part and description	Function of part	Signal Corps stock No.
I–1, I–2	LIGHT INDICATOR: w/red lens	Red jewels for pilot lamps	2Z5991
M1	METER, ammeter: 0 to 100 μa; .5% accuracy.	Used as standard d-c voltmeter, ammeter, milliammeter and microammeter.	3F871–30
M2	METER, ammeter: 0 to 100 ma; .5% accuracy.	Used as standard a-c volt-meter, ammeter, and milliammeter.	3F871–31
A30, A31, A32, A33, A34, A35, A36, A37	MOUNT, vibration; square mtg; 33 lb	Serve as mounting feet for meter test set.	2Z8405–119
A38, A39, A40, A41, A42, A43	MOUNT, vibration: high shoulder square mtg; 6 lb.	Serve as shock mountings for meter assembly.	2Z8403–19
E2, E6, E7, E9, E10	POST, binding: 1" d; red phenolic	Used as output terminals	3Z741–10.4
E3, E12	POST, binding: 1" d; black phenolic	Used as output terminals	3Z741–10. 5
E8, E11	POST, binding: ¾" d; red phenolic	Used as output terminals	3Z741–10.6
L1	REACTOR: filter choke; 10 h, 115 ma dc	Used as filter choke	3C554–7
K2	RELAY, armature: DPDT; 12 v, 160 ma, 75 ohms, dc; nonpolarized.	Serves as switching relay for 100-ampere d-c range.	2Z7588–124
K1, K3, K4, K5	RELAY, armature: SPDT; 12 v, 160 ma, 75 ohms, dc; nonpolarized.	Used as range-switching relays	2Z7585–206
R33, R34	RESISTOR, fixed: WW; 500,000 ohms; ½ w at 85° C.	Used as d-c voltmeter multipliers.	3Z6750–127
R3, R4, R5, R6, R7, R8, R9, R10, R11, R12, R13, R14, R15, R16, R17, R18, R19, R20, R21	RESISTOR, fixed: 10,000 ohms; 2 w	Bleeder resistors for high-voltage supply.	3RC42BF103J
R98	RESISTOR, fixed: WW; 50 ohms; 8 w at 275° C.	Current-limiting resistor	3RW16507
R99	RESISTOR, fixed: 150 ohms; 2 w	Current-limiting resistor	3RC42F151J
R100	RESISTOR, fixed: 300 ohms; 1 w	Current-limiting resistor	3RC30BF301J
R101	RESISTOR, fixed: 620 ohms, ½ w	Current-limiting resistor	3RC20BF621J
R102	RESISTOR, fixed: 1,500 ohms; ½ w	Current-limiting resistor	3RC20BF152J
R103	RESISTOR, fixed: 3,300 ohms; ½ w	Current-limiting resistor	3RC20BF332J
R104	RESISTOR, fixed: 6,800 ohms; ½ w	Current-limiting resistor	3RC20BF682J
R105	RESISTOR, fixed: 15,000 ohms; ½ w	Current-limiting resistor	3RC20BF153J
R106	RESISTOR, fixed: 33,000 ohms: ½ w	Current-limiting resistor	3RC20BF333J
R107	RESISTOR, fixed: 68,000 ohms; ½ w	Current-limiting resistor	3RC20BF683J
R110	RESISTOR, fixed: 18 ohms; 8 w at 275° C	Current-limiting resistor	3RW13802
R23	RESISTOR, fixed: 2000 ohms; 63 w at 275° C.	D-c voltage divider	3RW26162
R24	RESISTOR, fixed: 1000 ohms; 22 w at 275° C.	D-c voltage divider.	
R25	RESISTOR, fixed: 630 ohms; 22 w at 275° C.	D-c voltage divider	3RW23111
R26	RESISTOR, fixed: 200 ohms; 8 w at 275° C	D-c voltage divider	3RW20104
R27	RESISTOR, fixed: 100 ohms; 8 w at 275° C	D-c voltage divider	3RW18314
R29, R86	RESISTOR, fixed: 20 ohms; 8 w at 275° C	R29—D-c voltage divider R86—Current-limiting resistor.	3RW14102
R31	RESISTOR, fixed: 9 ohms; 8 w at 275° C	D-c voltage divider	3RW12349
R32, R115	RESISTOR, fixed: 2.8 ohms; 8 w at 275° C	D-c voltage dividers	3RW9001
R35	RESISTOR, fixed: 600,000 ohms; ½ w at 85° C.	D-c voltmeter multiplier	3Z6760–24
R36	RESISTOR, fixed: 200,000 ohms; ½ w at 85° C.	D-c voltmeter multiplier	3Z6720–81
R37	RESISTOR, fixed: 100,000 ohms; ½ w at 85° C.	D-c voltmeter multiplier	3Z6700–226

3. Meter Test Set TS–682/GSM–1—Continued

Fig. No. or ref. symbol	Name of part and description	Function of part	Signal Corps stock No.
R38	RESISTOR, fixed: 60,000 ohms; ½ w at 85° C.	D-c voltmeter multiplier	3Z6660–55
R39	RESISTOR, fixed: 20,000 ohms; ½ w at 85° C.	D-c voltmeter multiplier	3Z6620–212
R40	RESISTOR, fixed: 10,000 ohms; ½ w at 85° C.	D-c voltmeter multiplier	3Z6610–341
R41	RESISTOR, fixed: 6000 ohms; ½ w at 85° C.	D-c voltmeter multiplier	3Z6560–85
R42	RESISTOR, fixed: 2000 ohms; ½ w at 85° C.	D-c voltmeter multiplier	3Z6200–223
R43	RESISTOR, fixed: 1000 ohms; ½ w at 85° C.	D-c voltmeter multiplier	3Z6100–310
R44	RESISTOR, fixed: 900 ohms; ½ w at 85° C.	D-c voltmeter multiplier	3Z6090–41
R45, R46	RESISTOR, fixed: 16 ohms; 100 w at 275° C.	Current-limiting resistors	3RW13508
R47	RESISTOR, fixed: 200 ohms; 100 w at 275° C.	Current-limiting resistor	3RW20108
R49, R116	RESISTOR, fixed: 1000 ohms; 22 w at 275° C.	Current-limiting resistors	3RW24366
R52	RESISTOR, fixed: 1 ohm; 8 w at 275° C.	Current-limiting resistor in the a-c ammeter test circuit.	3RW6330
R50	RESISTOR, fixed: .22 ohm; 30 w at 275° C.	Current-limiting resistor in the a-c ammeter test circuit.	3RW2402
R51	RESISTOR, fixed: .35 ohm; 8 w at 275° C.	Current-limiting resistor in the a-c ammeter test circuit.	3RW3602
R117	RESISTOR, fixed: 63 ohms; 15 w at 275° C.	Current-limiting resistor in the a-c ammeter test circuit.	3RW17131
R118	RESISTOR, fixed: 220 ohms; 15 w at 275° C.	Current-limiting resistor in the a-c ammeter test circuit.	3RW20408
R53, R54	RESISTOR, fixed: .2 ohm; 30 w at 275° C.	Current-limiting resistors in the a-c ammeter test circuit.	3RW2103
R55, R56, R57	RESISTOR, fixed: .1 ohm; 30 w at 275° C.	Current-limiting resistors in the a-c ammeter test circuit.	3RW304
R58, R59	RESISTOR, fixed: 180.5 ohms; 2 w at 85° C.	A-c voltmeter multipliers in standard a-c meter circuit.	3Z6018–32
R61, R62	RESISTOR, fixed: 2.8 ohms; 160 w at 275° C.	Current-limiting resistors in the d-c ammeter test circuit.	3RW9002
R63, R64, R65, R66, R67, R68, R69.	RESISTOR, fixed: .5 ohm; 160 w at 275° C.	Current-limiting resistors in the d-c ammeter test circuit.	3RW4503
R72	RESISTOR, fixed: 1.6 ohms; 100 w at 275° C.	Current-limiting resistor in the d-c ammeter test circuit.	3RW7516
R73	RESISTOR, fixed: 4 ohms; 100 w at 275° C.	Current-limiting resistor in the d-c ammeter test circuit.	3RW9921
R74	RESISTOR, fixed: 7.1 ohms; 15 w at 275° C.	Current-limiting resistor in the d-c ammeter test circuit.	3RW11408
R30, R75, R79, R114.	RESISTOR, fixed: 10 ohms; 8 w at 275° C.	Current-limiting resistors	3RW12304
R76	RESISTOR, fixed: 22 ohms; 8 w at 275° C.	Current-limiting resistor	3RW14408
R77	RESISTOR, fixed: 90 ohms; 8 w at 275° C.	Current-limiting resistor	3RW18002
R80	RESISTOR, fixed: 6.3 ohms; 22 w at 275° C.	Current-limiting resistor	3RW11124
R81	RESISTOR, fixed: 7.1 ohms; 8 w at 275° C.	Current-limiting resistor	3RW11407
R83	RESISTOR, fixed: .31 ohm; 100 w at 275° C.	Current-limiting resistor in the d-c ammeter test circuit.	3RW3307
R84	RESISTOR, fixed: 1.2 ohms; 30 w at 275° C.	Current-limiting resistor	3RW6919

3. Meter Test Set TS–682/GSM–1—Continued

Fig. No. or ref. symbol	Name of part and description	Function of part	Signal Corps stock No.
R87, R88	RESISTOR, fixed: .5 ohm; ½ w at 85° C	D-c meter shunts	3Z5985–35
R89	RESISTOR, fixed: 1 ohm; ½ w at 85° C	D-c meter shunt	3Z5991–127
R90	RESISTOR, fixed: 3 ohms; ½ w at 85° C	D-c meter shunt	3Z5993–73
R91	RESISTOR, fixed: 5 ohms; ½ w at 85° C	D-c meter shunt	3Z5995–80
R92	RESISTOR, fixed: 10 ohms; ½ w at 85° C	D-c meter shunt	3Z6001–155
R93	RESISTOR, fixed: 30 ohms; ½ w at 85° C	D-c meter shunt	3Z6003–81
R94	RESISTOR, fixed: 50 ohms; ½ w at 85° C	D-c meter shunt	3Z6005–205
R95	RESISTOR, fixed: 100 ohms; ½ w at 85° C	D-c meter shunt	3Z6010–264
R96	RESISTOR, fixed: 300 ohms; ½ w at 85° C	D-c meter shunt	3Z6030–147
R97	RESISTOR, fixed: 500 ohms; ½ w at 85° C	D-c meter shunt	3Z6050–254
R85, R108	RESISTOR, fixed: 3.5 ohms; 8 w at 275° C	Current-limiting resistors	3RW9607
R113	RESISTOR, variable: 5 ohms; 150 w	Used as d-c fine control	3Z7005–14
R1	RESISTOR, variable: 500 ohms; 50 w at 300° C.	Used as alternating current and a-c and d-c voltage fine control in a-c ammeter test circuit.	3RP6920
R2, R28	RESISTOR, fixed: 63 ohms; 8 w at 275° C	Current-limiting resistors	3RW17103
R48	RESISTOR, variable: 15 ohms; 15 w at 340° C.	Current-limiting adjustment for relay K5.	3Z7015–25
R60	RESISTOR, variable: 10 ohms; first step 10 amp, last step 1 amp.	Part of d-c fine control in d-c ammeter test circuit.	3Z7010–28
R71	RESISTOR, variable: 4 sect. of 4.7 ohms	D-c coarse control	3Z7018H8.
O–1	RING, calibration: 1.525″ ID	Used to simulate metal panel for meter under calibration.	2Z7858–215
O–2	RING, calibration: 2.225″ ID	Used to simulate metal panel for meter under calibration.	2Z7858–214
O–3	RING, calibration: 2.585″ ID	Used to simulate metal panel for meter under calibration.	2Z7858–213
O–4	RING, calibration: 2.825″ ID	Used to simulate metal panel for meter under calibration.	2Z7858–212
O–5	RING, calibration: 2.965″ ID	Used to simulate metal panel for meter under calibration.	2Z7858–211
O–6	RING, calibration: 3.665″ ID	Used to simulate metal panel for meter under calibration.	2Z7858–210
O–7	RING, calibration: 3.785″ ID	Used to simulate metal panel for meter under calibration.	2Z7858–209
O–8	RING, calibration: 3.905″ ID	Used to simulate metal panel for meter under calibration.	2Z7858–208
E17	SHUNT, meter: 1 amp, 100 mv drop	One-ampere shunt for meter M1.	3F33932–1–1
E18	SHUNT, meter: 2 amp; 100 mv drop	Two-ampere shunt for meter M1.	3F33932–2–1
E19	SHUNT, meter: 4 amp, 100 mv drop	Four-ampere shunt for meter M1.	3F33932–4–1
E20	SHUNT, meter: 10 amp, 100 mv drop	Ten-ampere shunt for meter M1.	3F33932–1
E21	SHUNT, meter: 20 amp, 100 mv drop	Twenty-ampere shunt for meter M1.	3F33932–20–1
E22	SHUNT, meter: 40 amp, 100 mv drop	Forty-ampere shunt for meter M1.	3F33932–40–1
E23	SHUNT, meter: 100 amp, 100 mv drop	One-hundred ampere shunt for meter M1.	3F33932–100–1
X1	SOCKET, tube: 4 medium contacts	Holds rectifier tube	2Z8674.179
S1, S2	SWITCH, toggle: 30 amp at 30 v dc	A-c power switch	3Z9863–52N
		D-c power switch	3Z9825–70.17
S4	SWITCH, rotary: 12-pole, 5-position; 2,000 v rms at 20 amp.	A-c and d-c current and voltage switch.	3Z9825–70.18

3. Meter Test Set TS–682/GSM–1—Continued

Fig. No. or ref. symbol	Name of part and description	Function of part	Signal Corps stock No.
S6	SWITCH, rotary: 10-pole, 9-position; 2,000 v rms at 20 amp.	D-c range switch	3Z9825–70.16
T1	TRANSFORMER, power: input 115 v, 60 cyc, lph; 5,000 v rms ins pri, 1,500 v rms secd; 16 solder-type term.	Plate supply and a-c voltage supply in a-c voltmeter test circuit.	2Z9612.349
T2	TRANSFORMER, power: input 115 v, 60 cyc, lph; 5,000 v rms ins; 7 solder-type term. lugs.	Filament and pilot lamp supply	2Z9611.700
T3	TRANSFORMER, power: input 115 v, 60 cyc, lph; 1,000 v rms ins; 3 solder-type term.	Fine-control booster transformer in a-c ammeter test circuit.	2Z9621–226
T4	TRANSFORMER, instrument: input 1 v, 2 v, 4 v, 10 v, 20 v, 40 v, 100 v, 200 v, 400 v, 1,000 v, and 2,000 v; 14 solder-type term.	Potential transformer in a-c voltmeter test circuit.	2Z9612.348
T5	TRANSFORMER, power: input 115 v, 60 cyc, lph; 700 v rms ins; 2 solder-type and 2 screw-type term.	Current-supply transformer in a-c ammeter test circuit.	2Z9900.21
T6	TRANSFORMER, instrument: input 200 ma; 1 amp, 2 amp, 4 amp, 10 amp, 20 amp, 40 amp, and 100 amp, 60 cyc, lph; 2 screw-type and 2 conical stand-off term.	Current transformer in a-c ammeter test circuit.	2Z9900.30
T7	TRANSFORMER, variable power: input 0 to 115 v, 60 cyc, lph; 3 screw-type term.	Alternating current and a-c and d-c voltage coarse control in a-c ammeter test circuit.	2Z9957–46
T8	TRANSFORMER, power: input 115 v, 60 cyc, lph; 1,500 v rms test voltage; 16 solder-type term.	Current-supply transformer in a-c ammeter test circuit.	2Z9613.724
V1	TUBE, electron: diode; type 3B28	Rectifier tube	2J3B28



3. Meter Test Set TS–682/GSM–1—Continued

Fig. No. or ref. symbol	Name of part and description	Function of part	Signal Corps stock No.
S6	SWITCH, rotary: 10-pole, 9-position; 2,000 v rms at 20 amp.	D-c range switch	3Z9825–70.16
T1	TRANSFORMER, power: input 115 v, 60 cyc, lph; 5,000 v rms ins pri, 1,500 v rms secd; 16 solder-type term.	Plate supply and a-c voltage supply in a-c voltmeter test circuit.	2Z9612.349
T2	TRANSFORMER, power: input 115 v, 60 cyc, lph; 5,000 v rms ins; 7 solder-type term. lugs.	Filament and pilot lamp supply	2Z9611.700
T3	TRANSFORMER, power: input 115 v, 60 cyc, lph; 1,000 v rms ins; 3 solder-type term.	Fine-control booster transformer in a-c ammeter test circuit.	2Z9621–226
T4	TRANSFORMER, instrument: input 1 v, 2 v, 4 v, 10 v, 20 v, 40 v, 100 v, 200 v, 400 v, 1,000 v, and 2,000 v; 14 solder-type term.	Potential transformer in a-c voltmeter test circuit.	2Z9612.348
T5	TRANSFORMER, power: input 115 v, 60 cyc, lph; 700 v rms ins; 2 solder-type and 2 screw-type term.	Current-supply transformer in a-c ammeter test circuit.	2Z9900.21
T6	TRANSFORMER, instrument: input 200 ma; 1 amp, 2 amp, 4 amp, 10 amp, 20 amp, 40 amp, and 100 amp, 60 cyc, lph; 2 screw-type and 2 conical stand-off term.	Current transformer in a-c ammeter test circuit.	2Z9900.30
T7	TRANSFORMER, variable power: input 0 to 115 v, 60 cyc, lph; 3 screw-type term.	Alternating current and a-c and d-c voltage coarse control in a-c ammeter test circuit.	2Z9957–46
T8	TRANSFORMER, power: input 115 v, 60 cyc, lph; 1,500 v rms test voltage; 16 solder-type term.	Current-supply transformer in a-c ammeter test circuit.	2Z9613.724
V1	TUBE, electron: diode; type 3B28	Rectifier tube	2J3B28

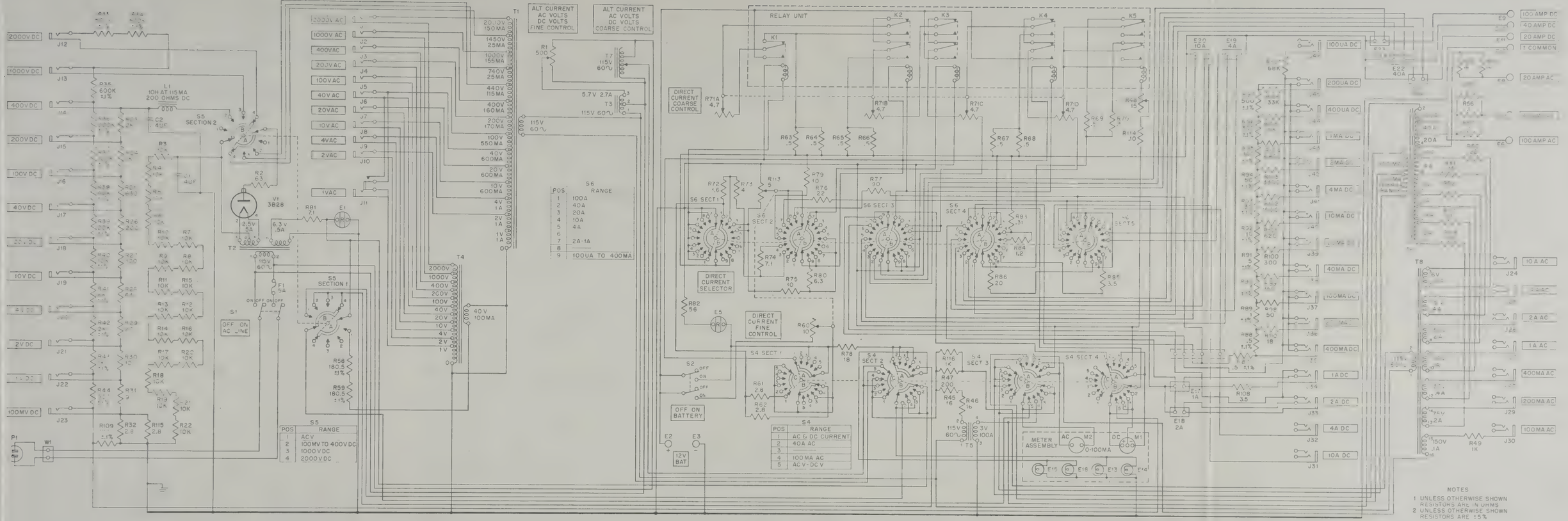


FIGURE 53.—*Meter Test Set TS-682/GSM-1, schematic diagram.*

TM 2535A-53



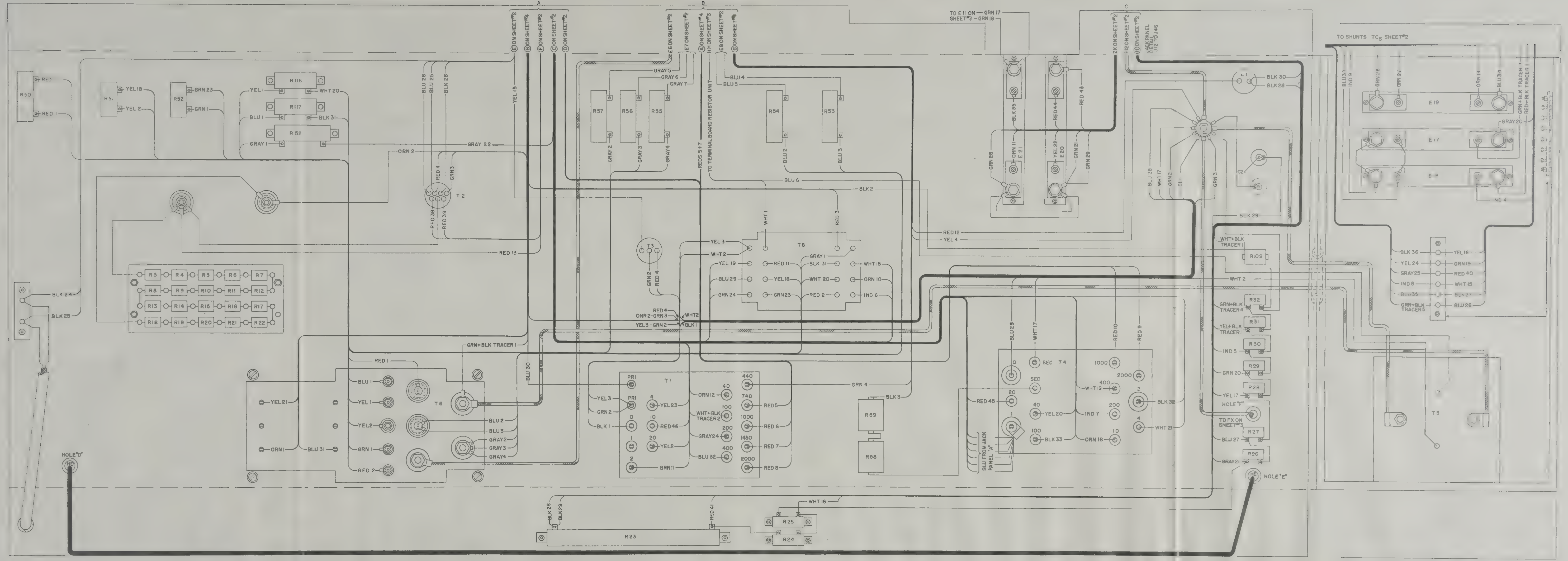
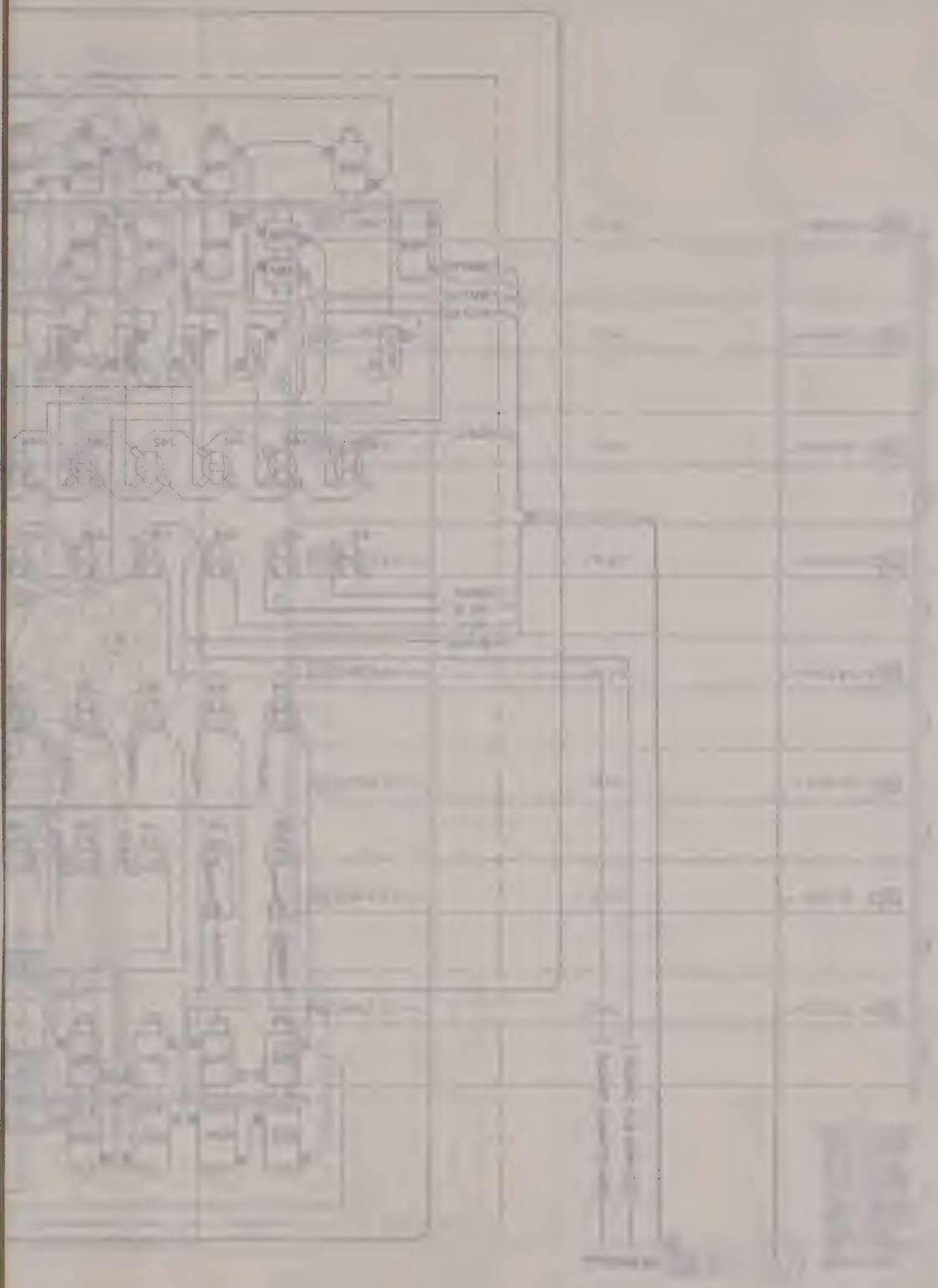


Figure 54.—*Meter Test Set TS-682/GSM-1, bottom of chassis, wiring diagram.*

TM 25354-54



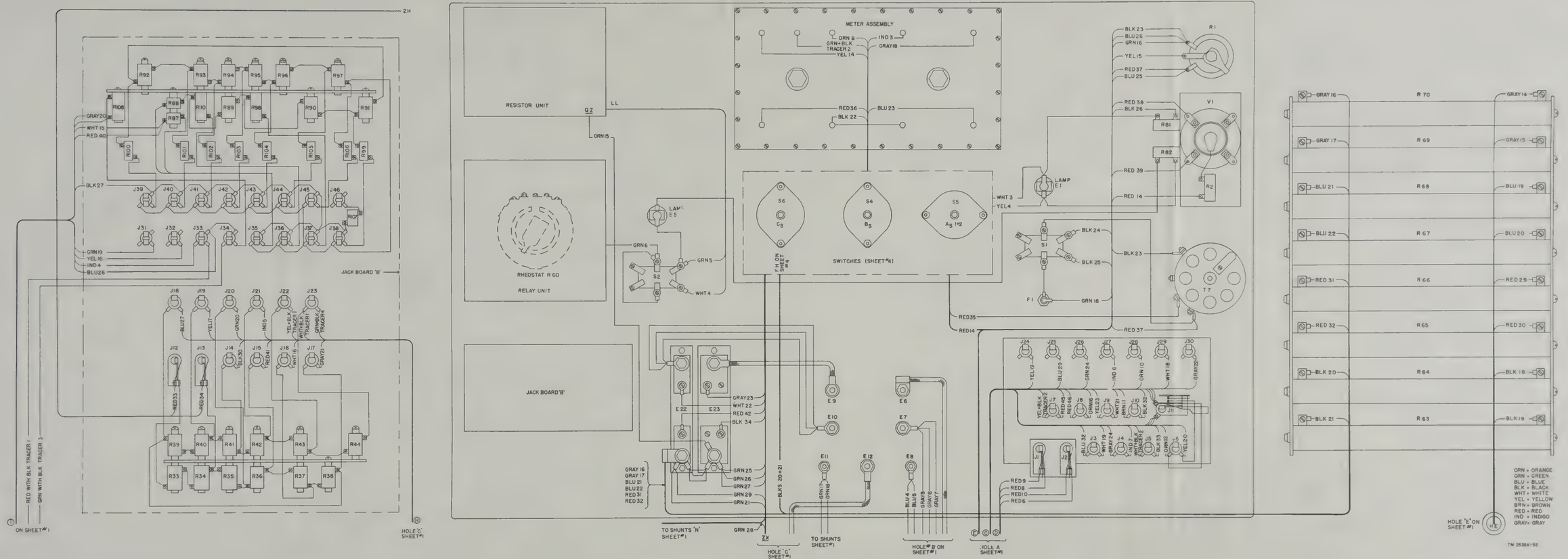
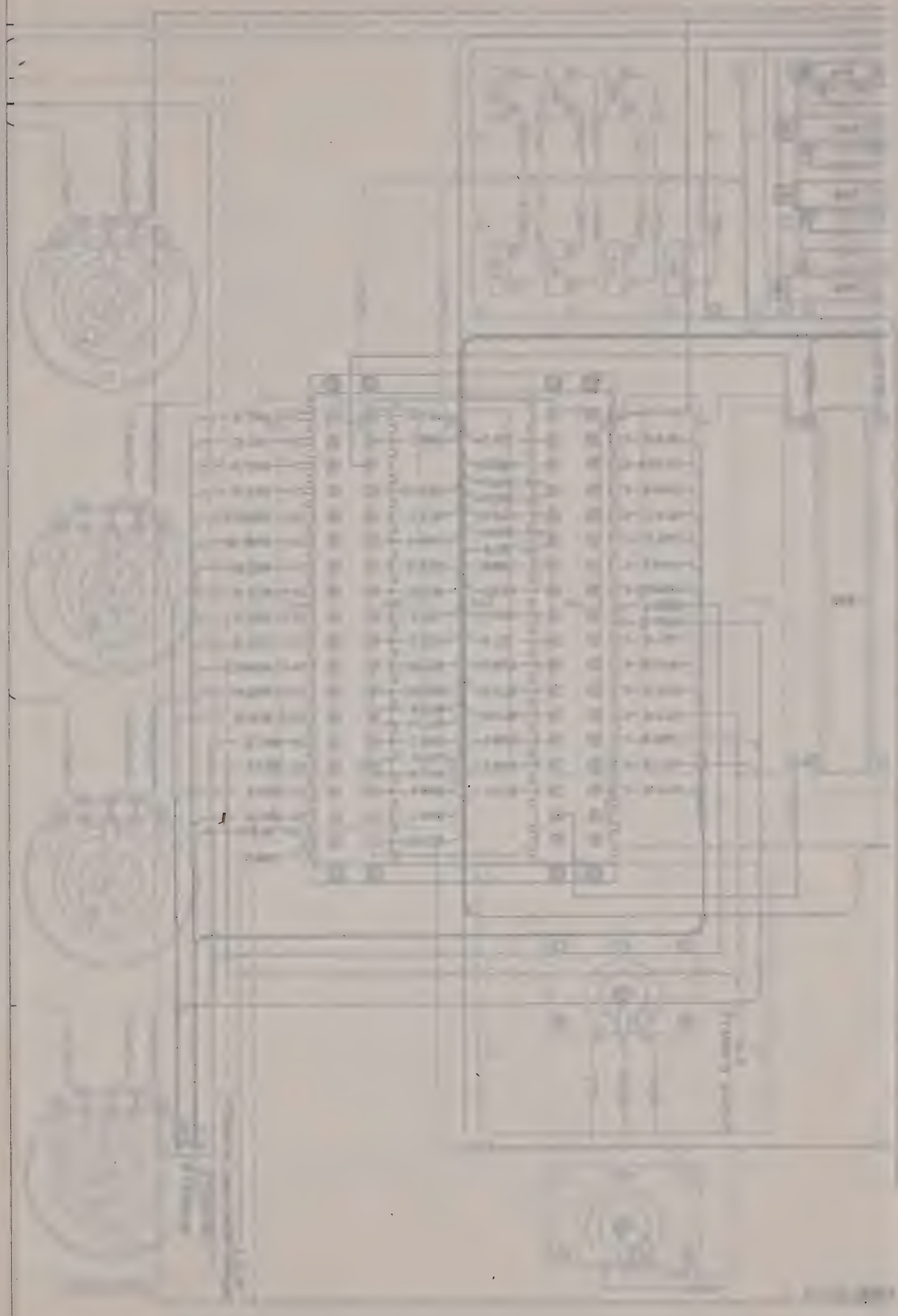


FIGURE 55.—*Meter Test Set TS-682/GSM-1, rear of front panel, wiring diagram.*



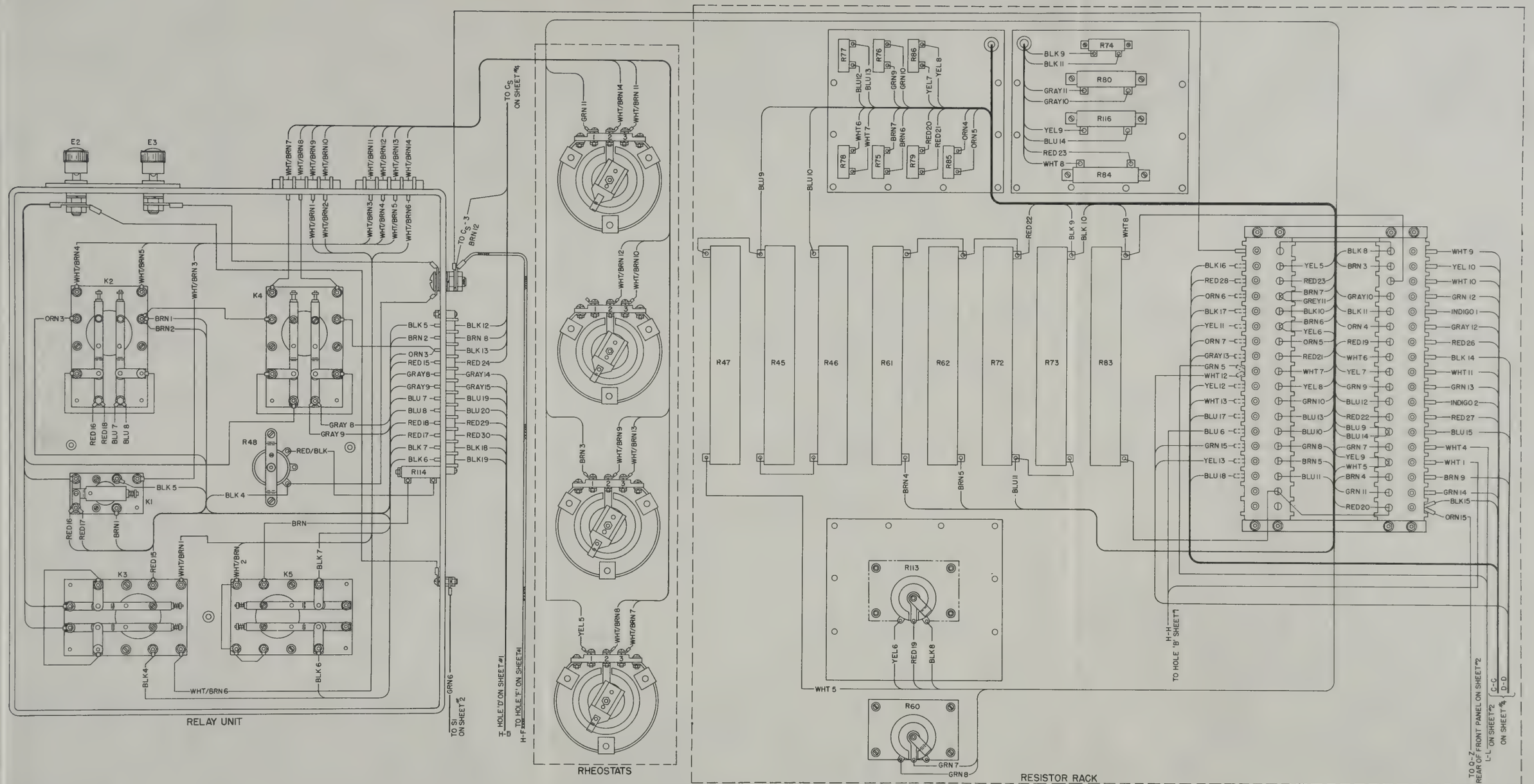
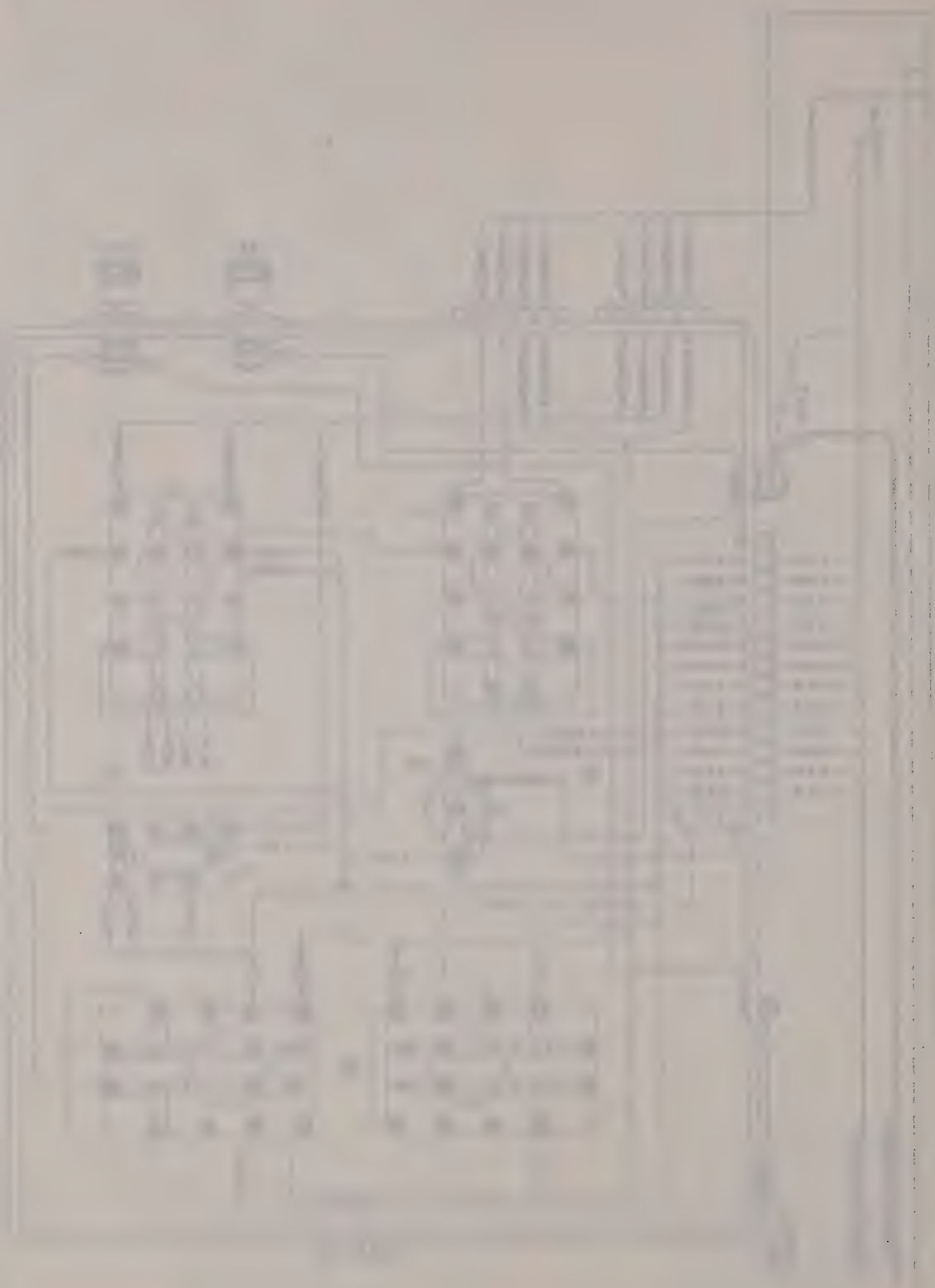
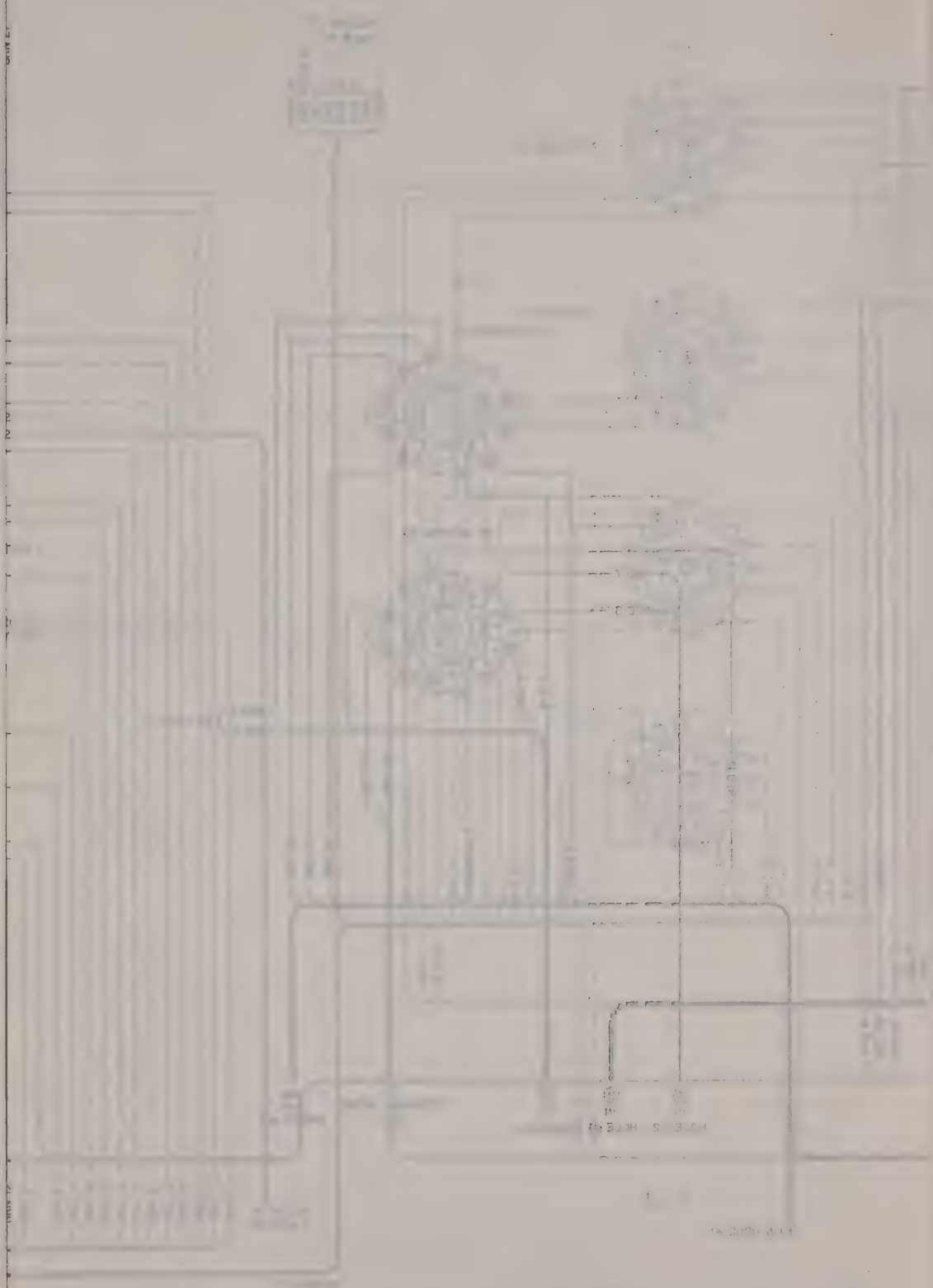
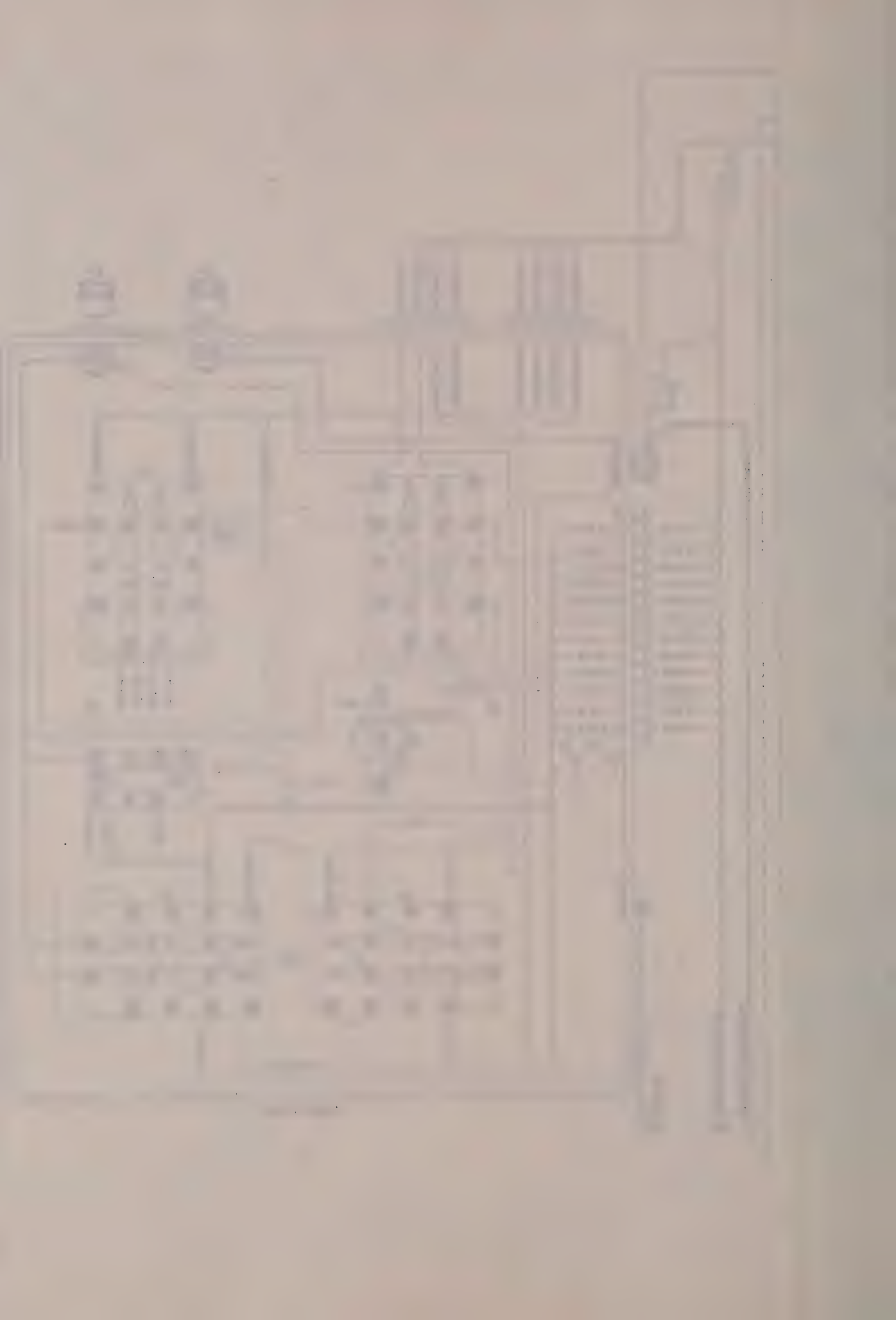


FIGURE 56.—*Meter Test Set TS-682/GSM-1, relay unit and resistor rack, wiring diagram.*







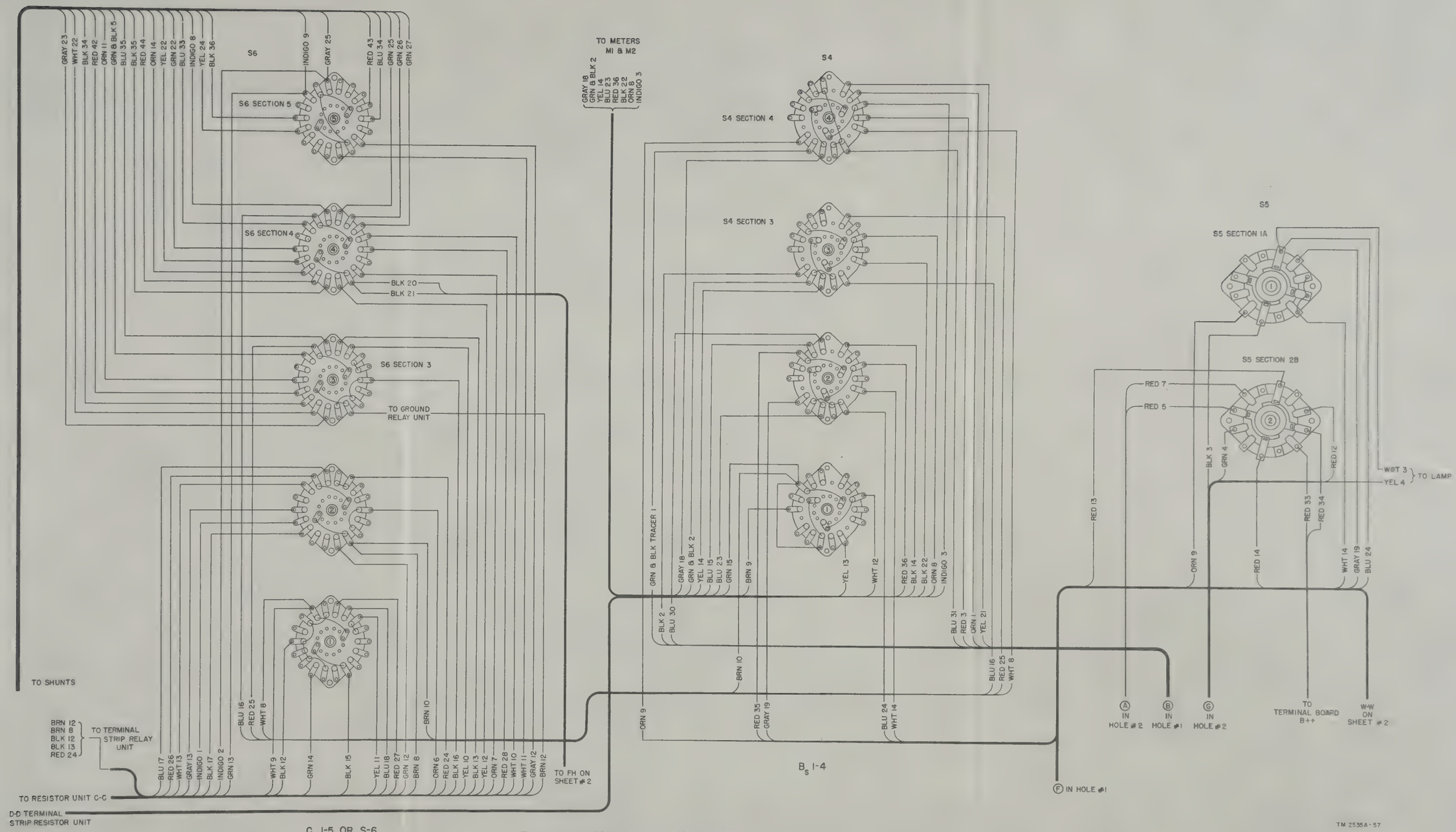
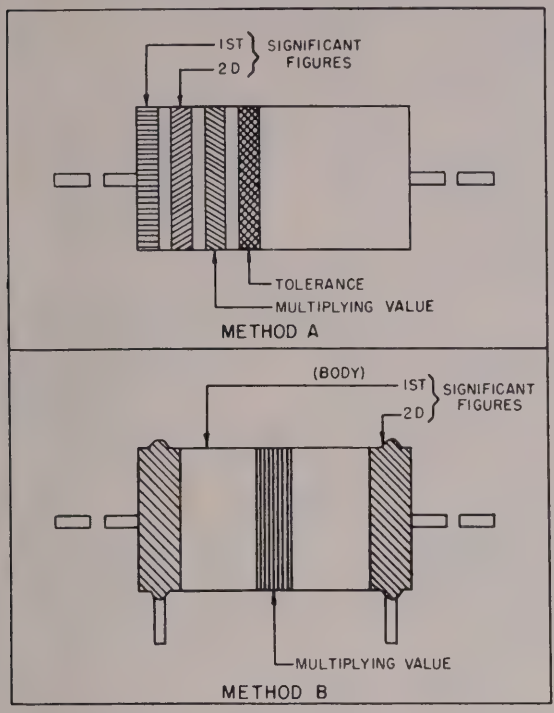


FIGURE 57.—*Meter Test Set TS-682/GSM-1, switch assemblies, wiring diagram.*



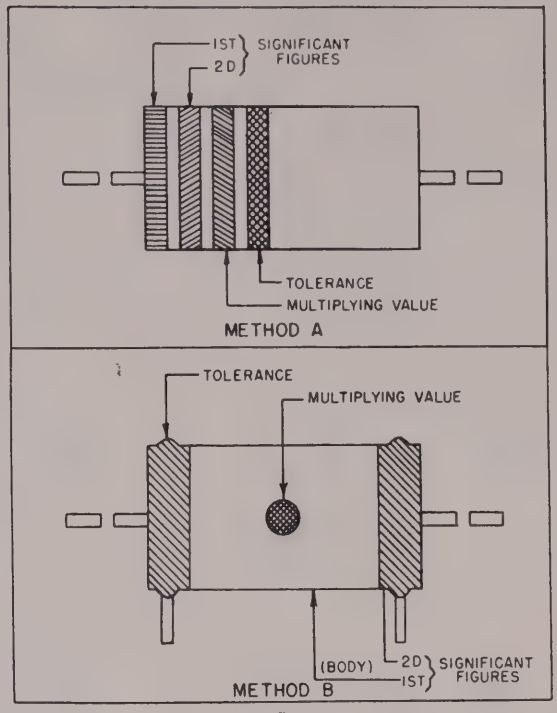
RESISTOR COLOR CODES

RMA COLOR CODE FOR FIXED COMPOSITION RESISTORS*



A

JAN COLOR CODE FOR FIXED COMPOSITION RESISTORS†



B

COLOR	SIGNIFICANT FIGURE	MULTIPLYING VALUE	TOLERANCE (%)
BLACK	0	1	± –
BROWN	1	10	± 1
RED	2	100	± 2
ORANGE	3	1,000	± 3
YELLOW	4	10,000	± 4
GREEN	5	100,000	± 5
BLUE	6	1,000,000	± 6
VIOLET	7	10,000,000	± 7
GRAY	8	100,000,000	± 8
WHITE	9	1,000,000,000	± 9
GOLD	–	0.1	± 5
SILVER	–	0.01	± 10
NO COLOR	–	–	± 20

NOTES

* INSULATED FIXED COMPOSITION RESISTORS WITH AXIAL LEADS ARE DESIGNATED BY A NATURAL TAN BACKGROUND COLOR NON-INSULATED FIXED COMPOSITION RESISTORS WITH AXIAL LEADS ARE DESIGNATED BY A BLACK BACKGROUND.

† RESISTORS WITH AXIAL LEADS ARE INSULATED. RESISTORS WITH RADIAL LEADS ARE NON-INSULATED.

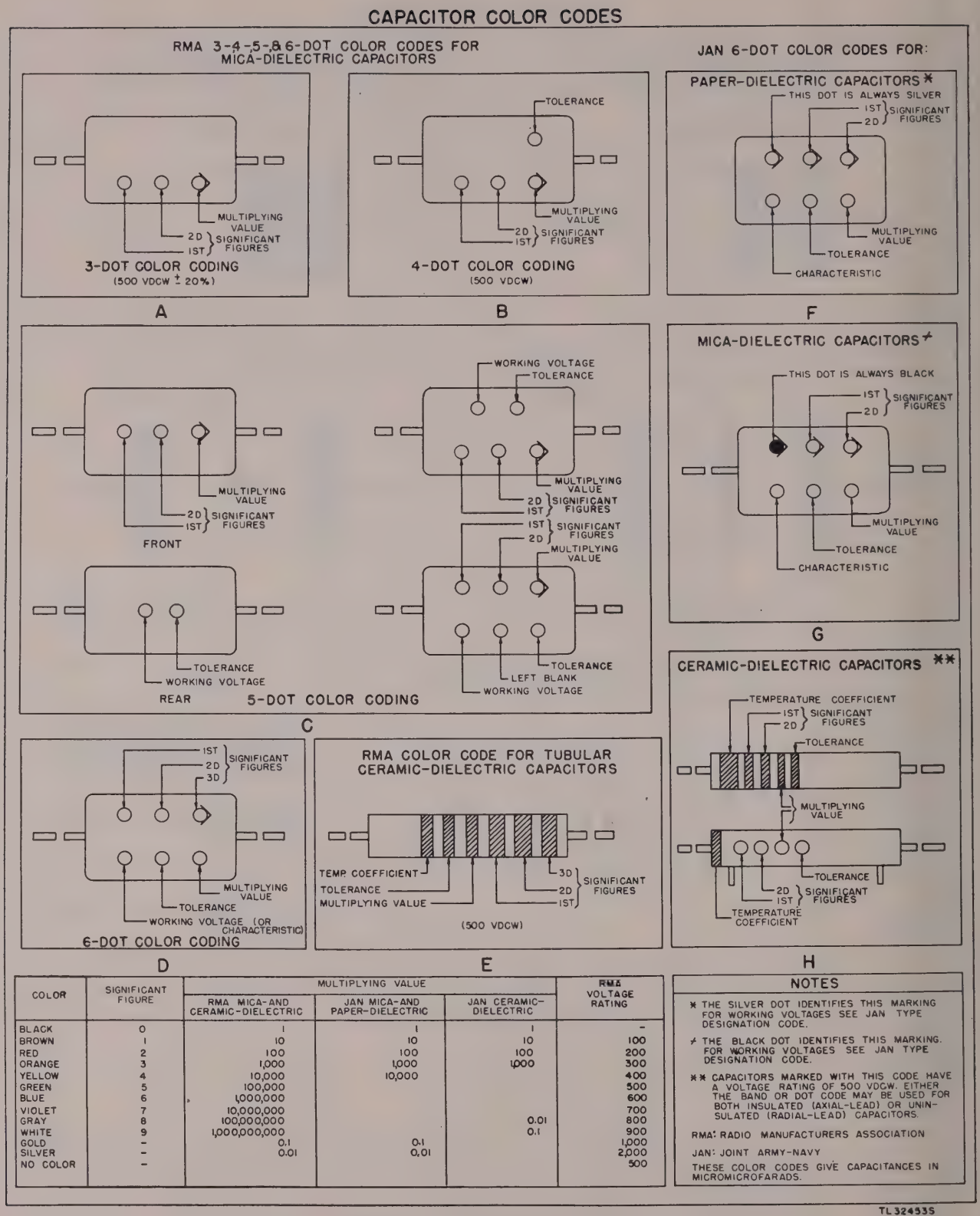
RMA: RADIO MANUFACTURERS ASSOCIATION

JAN: JOINT ARMY-NAVY

THESE COLOR CODES GIVE ALL RESISTANCE VALUES IN OHMS

TL32454S

Figure 58. Resistor color code.



COLOR	SIGNIFICANT FIGURE	MULTIPLYING VALUE			RMA VOLTAGE RATING
		RMA MICA-AND CERAMIC-DIELECTRIC	JAN MICA-AND PAPER-DIELECTRIC	JAN CERAMIC-DIELECTRIC	
BLACK	0	1	1	1	-
BROWN	1	10	10	10	100
RED	2	100	100	100	200
ORANGE	3	1,000	1,000	1,000	300
YELLOW	4	10,000	10,000		400
GREEN	5	100,000			500
BLUE	6	1,000,000			600
VIOLET	7	10,000,000			700
GRAY	8	100,000,000		0.01	800
WHITE	9	1,000,000,000		0.1	900
GOLD	-	0.1	0.1		1,000
SILVER	-	0.01	0.01		2,000
NO COLOR	-				500

NOTES

* THE SILVER DOT IDENTIFIES THIS MARKING FOR WORKING VOLTAGES SEE JAN TYPE DESIGNATION CODE.

≠ THE BLACK DOT IDENTIFIES THIS MARKING. FOR WORKING VOLTAGES SEE JAN TYPE DESIGNATION CODE.

** CAPACITORS MARKED WITH THIS CODE HAVE A VOLTAGE RATING OF 500 VDCW. EITHER THE BAND OR DOT CODE MAY BE USED FOR BOTH INSULATED (AXIAL-LEAD) OR UNINSULATED (RADIAL-LEAD) CAPACITORS.

RMA: RADIO MANUFACTURERS ASSOCIATION

JAN: JOINT army-navy

THESE COLOR CODES GIVE CAPACITANCES IN MICROMICROFARADS.

TL 324535

Figure 59. Capacitor color code.

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