

TM 11-6625-599-45

DEPARTMENT OF THE ARMY TECHNICAL MANUAL

GS AND DEPOT MAINTENANCE MANUAL

INCLUDING REPAIR PARTS

AND SPECIAL TOOLS LIST

VOLTMETER, ELECTRONIC AN/USM-98A

This copy is a reprint which includes current pages from Changes 1 through 4. The title was changed by C 2 to read as shown above.

HEADQUARTERS, DEPARTMENT OF THE ARMY

5 MAY 1965

TECHNICAL MANUAL }
 No. 11-6625-599-45 }

HEADQUARTERS
 DEPARTMENT OF THE ARMY
 WASHINGTON, D. C., 5 May 1965

**General Support and Depot Maintenance Manual Including Repair
 Parts and Special Tools Lists
 VOLTMETERS, ELECTRONIC AN/USM-98A AND AN/USM-98B
 (NSN 6625-00-753-2115)**

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CHAPTER 1 FUNCTIONING

1-1. Scope

a. This manual covers general support and depot maintenance for Voltmeter, Electronic AN/USM-98(*). It includes instructions appropriate to general support and depot maintenance personnel for troubleshooting, testing, aligning, and repairing the equipment, and replacing maintenance parts. It also lists tools, materials, and test equipment for general support and depot maintenance. Detailed functions of the equipment are covered in paragraphs 1-2 through 1-5.

b. Official nomenclature followed by (*) represents all models of the equipment. Thus, Voltmeter, Electronic AN/USM-98(*) represents Voltmeters, Electronic AN/USM-98A and AN/USM-98B. The AN/USM-98B has been manufactured under several orders with minor differences in repair parts; appendix B covers the earlier units; TM 11-6625-599-40P-2 covers units manufactured under Contract DAAB07-74-C-0622.

c. The complete technical manual for this equipment includes TM 11-6625-599-12 and TM 11-6625-599-40P-2.

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

1-1.1 Indexes of Publications

a. DA Pam 310-4. Refer to the latest issue of DA Pam 310-4 to determine whether there are new editions, Changes, or additional publications pertaining to the equipment.

b. DA Pam 310-7. Refer to DA Pam 310-7 to determine whether there are modification work orders (MWO's) pertaining to the equipment.

1-1.2 Reporting Equipment Improvement Recommendations (EIR)

EIR's will be prepared using DA Form 2407 (Maintenance Request). Instructions for preparing EIR's are provided in TM 38-750, The Army Maintenance Management System. EIR's should be mailed directly to Commander, US Army Electronics Command, ATTN: DRSEL-ME-MQ, Fort Monmouth, NJ 07703. A reply will be furnished directly to you.

NOTE

For other applicable forms and records, refer to TM 11-6625-599-12.

1-2. Block Diagram

(fig. 1-1)

Voltmeter, Electronic AN/USM-98A (vtvm) is a precision voltmeter used to measure accurately direct current (dc) potentials from 0 to 500 volts. The vtm contains a 0- to 500- volt reference power supply (*a* below), a 60-Hz chopper amplifier (*b* below), and a low voltage power supply (*c* below). The vtm functions as a vacuum-tube voltmeter when the NULL switch is set to VTVM, and as a differential voltmeter when the NULL switch is set to 10, 1, .1 or .01.

a. Reference Power Supply 0- to 500- Volt (fig. 1-1 and 1-2). The 0- to 500- volt reference voltage is obtained from a +700 volt power supply and a voltage regulator and divider. A part of power transformer T1 and power rectifiers CR101, CR102, and CR103 provide an unregulated +700 volts to the voltage regulator. Series regulator tube V102, differential amplifiers V106 and V105, and voltage reference tube V104 provide a regulated + 500 volts. The reference range voltage divider, the RANGE switch, and the five-decade attenuator provide the desired voltage (0 to 500 volts). This voltage is applied to meter M1 through a voltage divider.

b. Chopper Amplifier 60-Hz (fig. 1-1 and 1-3).

(1) The 60-Hz chopper amplifier is a stable, drift-free dc amplifier. The input voltage to the 60-Hz chopper amplifier is the difference between the 0-to 500- volt reference power supply output and the unknown voltage when the NULL switch is set to 10, 1, .1, or .01. The input voltage is applied directly to the 60- Hz chopper amplifier when the NULL switch

is set to VTVM. The 60-Hz chopper (G1) converts the input voltage to a square wave which is passed through three stages of amplification (V202, V203A and V203B). The amplified square wave is synchronously rectified by the 60-Hz chopper and applied to meter M1. For full scale deflection, a 10-millivolt (mv) signal voltage will cause 100 microamperes (ua) to flow through the meter.

- (2) When the vtvm is used to measure high resistance (fig. 1-1) (from 1 to 500,000 megohms), the resistance being measured is connected to the input terminals of the vtvm. The equipment is operated in the differential voltmeter mode (NULL switch set to 10, 1, or .1), and voltage-divider switches A through E (not shown) are adjusted to apply sufficient internal reference voltage across the unknown resistance to cause meter M1 to indicate off null. This off null reading is noted and the resistance is computed in megohms. (Refer to TM-6625-599-12.)

c. *Low-Voltage Power Supply* (fig. 1-1 and 1-4). The low-voltage power supply consists

of a part of power transformer T1, low-voltage rectifier CR201, and voltage regulator V204. This power supply provides regulated + 150 volts to tubes V202 and V203. Filament voltages for tubes V102, V105, V106, V202, V203, and voltage for the decimal point indicator lamps PL1, PL2, PL3, PL4, and 60-Hz chopper G1 are supplied by filament windings on T1. Low-voltage rectifier CR104 and series regulators Q101 and Q102 provide current regulation of filament voltage to tube V105.

1-3. Reference Power Supply, 0- to 500-Volt

(fig. 5-4, 5-4.1, 5-8, 5-8.1 and 5-9)

a. *Power Rectifier* (fig. 5-4 and 5-4.1). Voltage from power transformer T1 is converted to pulsating dc by half-wave rectifiers CR101, CR102, and CR103. A low-pass filter, capacitor C101 and C102, smooths the pulsating dc to a pure dc voltage. Voltage-divider network R105 and R106 maintains equal voltage across capacitors C101 and C102. The output of the power rectifier is +700 volts unregulated.

b. *Series Regulator* (fig. 5-4 and 5-4.1) The series regulator consists of series regulator tube V102, differential amplifier tubes V105 and V106, and reference tube V104. Plate voltage for

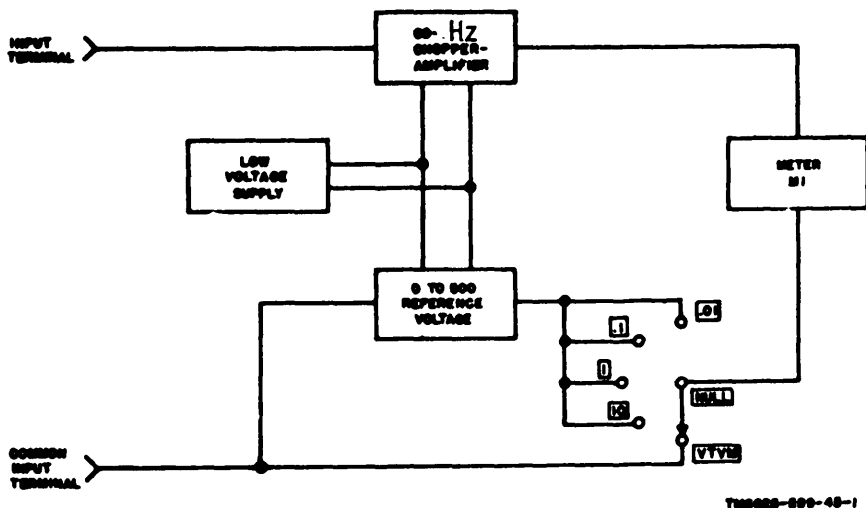


Figure 1-1. Voltmeter, Electronic AN/USM-98(*), block diagram.