

TEGAM

Safety Voltmeter

Instruction Manual
Model 110A



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SPECIFICATIONS

FUNCTIONS: VDC/VAC, with automatic selection. When both DC and AC input voltages are present, VDC function is selected if magnitude of DC voltage is greater than peak AC voltage. Otherwise, VAC function is selected.

RANGES: ± 1000 volts DC. 1000 volts AC (45-500 Hz, average responding, calibrated in RMS of a sinewave).

RESOLUTION: 1 volt

ACCURACY: $\pm(0.2\% \text{ rdg} + 1 \text{ volt})$, DC, 50-60 Hz, 64°-82°F.

MAXIMUM ALLOWABLE INPUT: 1000 volts continuous. Overload annunciator (OL) turns on above 999 volts.

OVERVOLTAGE TEST: High Pot tested at 2500 VAC for < 5 seconds.

NORMAL MODE REJECTION: AC Rejection (VDC Mode): > 40 dB. DC Rejection (VAC Mode): 40 dB typ. (for DC voltage < 10% peak AC voltage).

READING RATE: 2.5 readings/second

INPUT RESISTANCE: 10M Ω (8M Ω in voltmeter, 1M Ω in each attached input probe)

DISPLAY: 0.5" LCD (3 1/2 digits), polarity, and annunciators for VAC, VDC, OL, Low Battery.

INPUT PROBES: Permanently attached to voltmeter. Sheathed tips with retracting sleeves. PVC insulated leads, 36" long.

ENVIRONMENTAL LIMITS FOR OPERATING: -10°F to 150°, less than 80% R.H. up to 95°F. Reduce R.H. limit by 1.7% per °F above 95°F.

ENVIRONMENTAL LIMITS FOR STORAGE: -30°F to 150°F, less than 90% R.H. up to 95°F. Reduce RH limit by 1.7% per °F above 95°F.

ENVIRONMENTAL/TIME LIMITS TO ACCURACY: 64° to 82°F, 80% R.H., 1 year.

TEMPERATURE COEFFICIENT: From 64°F to 82°F; included in accuracy specifications. Below 64°F and above 82°F; less than 0.05 times applicable specifications per °F.

POWER: 9v alkaline or carbon-zinc battery (NEDA 1604).

BATTERY LIFE: 200 hours typical, alkaline.

LOW-BATTERY INDICATOR: Display indicates 'BAT' when less than 10% of life remains.

AUTOMATIC TURN-OFF: Voltmeter turns off after 10 minutes of operation (user can select 2 min.). Turns off below 6.5v battery voltage.

SIZE, WEIGHT: 6.3" x 2.7" x 1.2", 12 oz.

CONSTRUCTION: Heavy-duty ABS plastic housing.

ACCESSORIES, SUPPLIED: Battery, Operating Instructions.

MANUAL ADDENDA

Improvements or changes to this manual will be explained on an addendum included with the instrument. All change information should be incorporated immediately into the appropriate places in the manual.

UNPACKING AND INSPECTION

Each instrument is inspected both mechanically and electrically before shipment. Upon receiving your instrument unpack all items from the shipping container and check for any obvious damage that may have occurred during transit. Report any damage to the shipping agent. Retain and use the original packing materials if reshipment is necessary.

PREPARATION FOR USE

Each instrument is supplied with a 9 volt battery. See page 10 of this manual for battery installation instructions.

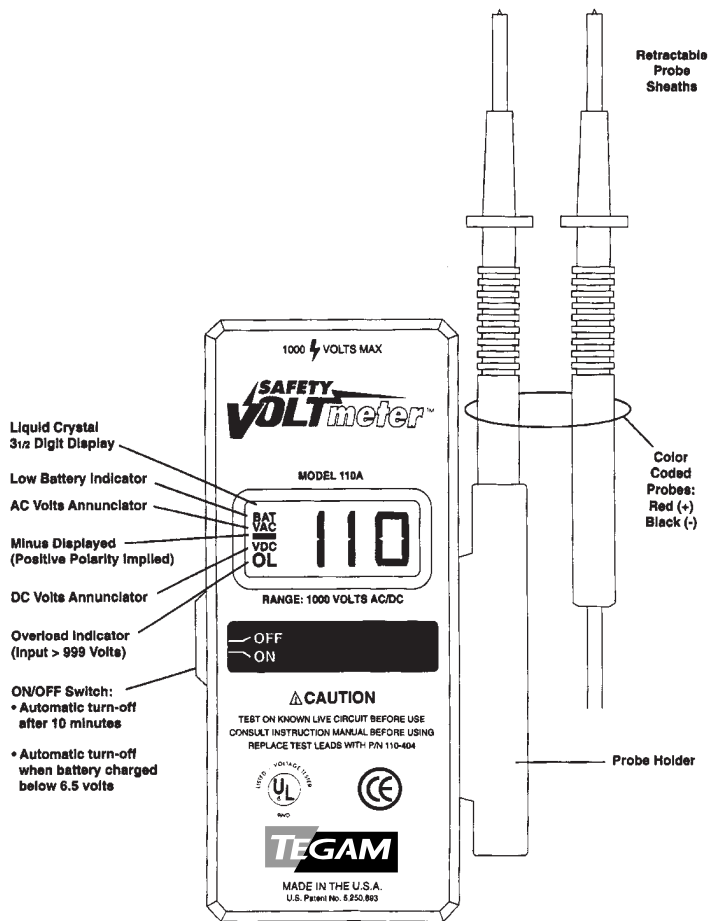
OPERATION

The Model 110A digital voltmeter (DVM) is easy to use. There is only one control (located on the side of the instrument) that turns the instrument on/off (Fig. 1).

After turn-on, the instrument automatically selects either VDC or VAC function. VDC is selected if the magnitude of a DC input voltage is greater than the peak value of any AC voltage present. Otherwise the VAC function is enabled. VAC and VDC annunciators in the liquid crystal display indicate the selected function. Observe the maximum allowable input (1000 volts continuous).

After approximately 10 minutes, the voltmeter turns off automatically to conserve battery life. (This interval can be reduced to 2 minutes with an internal modification to the voltmeter. Refer to the Maintenance Information section for details.) To turn the voltmeter on again, return the ON/OFF switch to the OFF position, then back to the ON position.

When battery voltage drops below 6.5 volts, the voltmeter turns off until a new battery is installed (Refer to Battery Installation Section).



*NOTE: In operate position, install probe with "TEGAM" marking facing to right. To store probe, remove from probe-holder, rotate "TEGAM" marking toward rear, and reinsert into holder.


Figure 1 Model 110A Safety Voltmeter


OPERATING CONDITIONS

In accordance with the Standard for Electrical Measuring and Test Equipment IEC-1010-1, the TEGAM Model 110A Safety Voltmeter is designed for safe operation under the following conditions:

- Indoor use, or outdoor use in where the instrument and probes remain dry (i.e. protected from exposure to rain, fluids, or condensing humidity).
- Altitudes up to 2000m above mean sea-level.
- Temperature: -23°C to 65°C
- Relative humidity: 80% R.H. up to 35°C , decreasing linearly to 0% R.H. at 60°C .
- Power source: 9 volt transistor battery (NEDA 1604), alkaline or carbon-zinc type. The voltmeter automatically turns off before battery discharge can cause malfunction.
- Pollution: Degree 2 per IEC 664.
- Installation Category III.

SAFETY SYMBOLS AND TERMS

The symbol  on the instrument denotes that the user should refer to the operating instructions.

The symbol  on the instrument denotes that 750V or more may be present on the terminal(s).

The **WARNING** used in this manual explains dangers that could result in personal injury or death.

The **CAUTION** used in this manual explains hazards that could damage the instrument.

SAFETY PRECAUTIONS

Fundamental safe work practices recommend testing any voltmeter on a known low-energy source before and after use.

WARNING

The following safety precautions should be observed before operating the Model 110A DVM.

1. This instrument is intended for use by qualified personnel who recognize shock hazards and are familiar with the safety precautions required to

avoid possible injury. Read over the manual carefully before operating this instrument.

2. Exercise extreme caution when a shock hazard is present at the instrument's input. The American National Standards Institute (ANSI) states that a shock hazard exists when voltage levels greater than 30V rms or 42.4V peak are present. A good safety practice is to expect that a hazardous voltage is present in any unknown circuit before measuring.
3. Inspect the test leads for possible wear, cracks or breaks before each use. If any defects are found, replace immediately with P/N 110-404 probe/test-lead set. Refer to Maintenance Information section.
4. For optimum safety do not touch the test leads or the instrument while power is applied to the circuit under test. Turn the power off and discharge all capacitors, before connecting or disconnecting the instrument.
5. Do not touch any objects which could provide a current path to the common side of the circuit under test or power line (earth) ground. Always make measurements with dry hands while standing on a dry, insulated surface, capable of withstanding the voltage being measured.
6. Exercise extreme safety when testing high energy power circuits (AC power lines, etc.).
7. Do not exceed the instrument's maximum allowable input as defined in the specifications and printed on the front panel of the instrument.

OPTIONAL SAFETY TESTS

TEGAM, Inc. recommends periodic safety inspections for all high voltage equipment. With the Model 110A, users may wish to check probe resistance and instrument over-voltage capability in order to find safety hazards (actual or potential) due to product damage and/or wear.

WARNING

The information presented in this section is intended for use by qualified personnel only. To reduce the risk of electric shock, do not perform any servicing unless you are qualified to do so.

WARNING

Disconnect probes from external circuits before performing safety tests.

PROBE RESISTANCE CHECK

Open the DVM case (see Battery Installation/Replacement section) and measure the resistance between each probe tip and the circuit-board eyelet terminating the respective probe lead-wire. Each probe should measure $1M\Omega \pm 1\%$. An excessively high or low resistance measurement indicates probe failure due to electrical overload or mechanical wear. Replace defective probes immediately. (Refer to Maintenance Information section.) Close DVM case.

DIFFERENTIAL HI-POT TEST

Apply a momentary (< 5 seconds) 2500 volt AC hi-pot between the tips of the two test probes. There should be no voltage breakdown across the probes or instrument. Units failing this test should be returned to TEGAM for diagnosis and repair.

COMMON MODE HI-POT TEST

Wrap the test leads and the instrument in a single sheet of aluminum foil. About 1" -2" of the tips of each probe should extend outside the foil wrap. Apply a momentary (< 5 seconds) 2500 volt AC hi-pot between one probe tip and the foil wrap. No breakdown should be observed. Repeat this test for the other probe tip. Units failing this test should be returned to TEGAM for diagnosis and repair.

MAINTENANCE INFORMATION

This section contains information needed to maintain your instrument. The following information is included: probe replacement procedure, reducing turn-off delay, disabling automatic turn-off feature, functionality checks, performance verification, and battery installation/replacement.

WARNING

The information presented in this section is intended for use by qualified personnel only. To reduce risk of electric shock, do not perform any servicing unless you are qualified to do so.

TEST LEAD REPLACEMENT

WARNING

Replacing test leads with anything other than a TEGAM P/N 110-404 probe/test-lead set will degrade accuracy, reduce

meter overload protection, and pose a serious safety hazard to the user.

WARNING

Disconnect probes from external circuits and turn the instrument off before removing the bottom cover. Reinstall the cover before resuming use of the instrument.

Open the voltmeter case (see Battery Installation/Replacement section), and cut the (2) strain relief cable ties-that secure the test-leads to the circuit board. Next, remove the circuit board from the top case by unscrewing the hexagonal spacer in the center of the board. Use a small soldering iron (< 75 watts) to remove the test-leads from the circuit board eyelets. Pull the old probe/test-lead set free of the voltmeter case.

To install the new lead set, push the leads through the top case holes, and solder into the appropriate eyelets (red-probe connects to +eyelet, black-probe connects to -eyelet). To secure the test leads, use the cable ties supplied with the replacement lead set. Allow a lead length of 23-28 mm (0.9-1.1 inches) between the circuit-board eyelets and the respective cable ties. Use a cable-tie tool with a tension setting of 35-55 N (8-12 lb.) to install the cables ties.

Re-install the circuit board into the top case. Check that the fishpaper barrier at the switch opening is securely attached to the top case. Before the bottom case is re-attached, be sure that the switch actuator cover is in place.

Confirm meter operation (refer to Performance Verification section, p. 9).

REDUCING TURN-OFF DELAY

The DVM has a timer which automatically turns off the meter approximately 10 minutes after the ON/OFF switch is moved to the ON position. This feature prevents premature battery discharge when a user forgets to turn a unit off. This delay can be reduced to 2 minutes as follows:

WARNING

Disconnect probes from external circuits and turn the instrument off before removing the bottom cover. Reinstall the cover before resuming use of the instrument.

Turn off DVM, and remove its bottom cover and battery. Detach the circuit board from the top case.

Install a 1/4 watt, carbon-composition, 4.7 Mohm resistor (TEGAM P/N R-76-4.7M) in location R10 on the circuit board (between resistor R13 and the negative battery-clip). Reassemble the DVM, and confirm that a 2 minute (approx.) timeout is in effect.

Timing can later be returned to 10 minutes by reversing this procedure.

DISABLING AUTOMATIC TURN-OFF FEATURE

Users also have the option of disabling the automatic turnoff feature. This is done by removing resistors R9 (22M ohm composition) and R10 (if previously installed). This can be quickly performed by cutting the resistor leads.

NOTE: On Model 110A/ATD, the automatic turn-off feature is factory-disabled.

FUNCTIONALITY CHECKS

1. ZERO

Switch on the DVM, and touch the probe tips together. Meter should read 0 VDC or 0 VAC. An occasional reading flicker to 1 V is normal.

2. DC VOLTS

Touch the black probe to the negative terminal of a fresh 9 volt transistor battery (alkaline or carbon-zinc), and touch the red probe to the positive terminal. A reading of 9-10 VDC should be displayed. Reverse the probes. The same reading except for a minus polarity should be displayed.

3. AC VOLTS

Connect the DVM probes to the hot and neutral outlets of a standard 120 VAC power receptacle. Under normal line conditions, a reading of 120 \pm 10 VAC should be displayed.

PERFORMANCE VERIFICATION

Equipment needed:

- 750 VDC voltage source with 0.05% accuracy or better
- 750 VAC, 60 Hz voltage source with 0.05% accuracy or better
- Ohmmeter with 0.1% accuracy or better at 10M Ω .

Turn on the DVM, and use the voltage sources and the following table to verify that readings are within specifications.

TABLE 1 VERIFICATION SUMMARY

Input	Allowable Reading
Shorted	0 ±1
+750 VAC	750 ±3 VDC
-750 VDC	-750 ±3 VDC
750 VAC	750 ±3 VAC

Keep the DVM turned on, and measure the resistance between the probe tips. A measurement of 9.89-10.11MΩ confirms integrity of the high voltage resistors inside the probes and meter.

If DVM readings and input resistance are out of specification, check the probes further for possible failure. Refer to Probe Resistance Check section.

BATTERY INSTALLATION/REPLACEMENT

WARNING

Disconnect probes from external circuits and turn the instrument off before removing the bottom cover. Reinstall the cover before resuming use of the instrument.

1. Place the unit face down on a bench or other similar surface and remove the screws from the bottom cover.
2. Separate the bottom cover from the rest of the instrument by grasping the top of the case (just above display) and carefully lifting it away from the display.

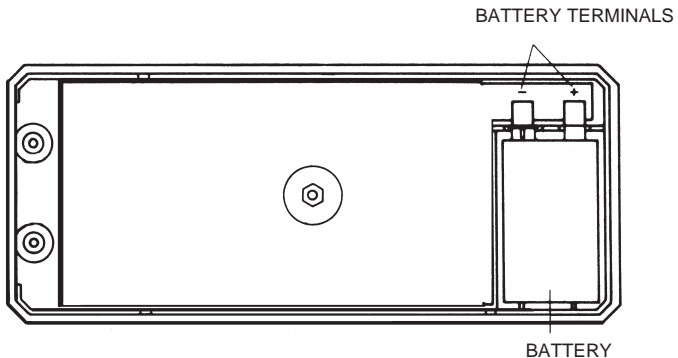


Figure 2 Battery Installation

3. Remove the old battery.
4. Place the new battery in the battery compartment. Be sure to observe the proper polarity (refer to Figure 2).
5. Reinstall the bottom cover before resuming use of the instrument.

CLEANING INSTRUCTIONS

Before cleaning a Model 110A voltmeter, disconnect the voltmeter probes from electrical sources, and turn off the voltmeter. Use a soft non-abrasive cloth dampened with a water-detergent solution to clean outside surfaces of the voltmeter. Squeeze excess moisture from the cloth so that no liquid residue is left on the voltmeter. Do not allow moisture to accumulate on any surface or penetrate case openings or crevices. **Do not attempt to clean the inside of the voltmeter.** Allow 24 hours for the voltmeter to dry at room-temperature before resuming operation.

OPTIONAL ACCESSORIES

Model 1104	Utility Belt Carrying Case (Leather)
Model 8668	Soft carrying case, antique vinyl (brown) Dimensions: 7 1/8" x 3 5/8" x 2 7/16"
Model 1204	Linesman Carrying Case (Cordura)
Model 12501	Alligator Clip Kit
Model 12502	Universal Probe Tip Kit
PN 110-404	Replacement probe/test-lead set (1 red, 1 black) for Model 110A.
—	Calibration and Troubleshooting Guide.

TEGAM



12501



12502

PROBE ADAPTOR KITS

The 12501 probe adaptor kit allows you to convert your test leads to alligator clips. The kit includes two screw on probe adaptors and two heavy duty screw in alligator clips with insulating rubber boots. These alligator clips open to 1/2" and fit most terminals and bus bars. The 12502 probe adaptor kit includes two screw on probe adaptors and interchangeable screw in accessories including two alligator clips with insulating rubber boots, two banana plugs, two needle tips, two spade lugs and two heavy duty tips. With this kit you can adapt your voltmeter to the many different situations you encounter on the job.

ORDERING INFORMATION

MODEL	DESCRIPTION
12501	Alligator Clip Adaptor
12502	Universal Adaptor

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For more information call 1-800-666-1010.

WARRANTY

TEGAM, Inc. warrants this product to be free from defects in material and workmanship for a period of one year from date of shipment. During the warranty period, we will at our option, either repair or replace any product that proves to be defective.

TEGAM, Inc. warrants the calibration of this product for a period of one year from date of shipment. During this period we will recalibrate any product that does not conform to the published accuracy specification.

To exercise this warranty, contact TEGAM, Inc., Ten TEGAM Way, Geneva, Ohio 44041/FAX (440) 466-6110/Phone (440) 466-6100, M-F, 8 a.m.-5 p.m. ET. You will be given prompt assistance and return instructions. Send the instrument, transportation prepaid, to the indicated service facility. Repairs will be made and the instrument returned, transportation prepaid. Repaired products are warranted for the balance of the original warranty, or at least 90 days, whichever is longer.

LIMITATION OF WARRANTY

TEGAM, Inc. warranty does not apply to defects resulting from unauthorized modification or misuse of any product or part. This warranty also does not apply to fuses, batteries, or damage from battery leakage.

This warranty is in lieu of all other warranties, expressed or implied, including any implied warranty of merchantability or fitness for a particular use. TEGAM, Inc. shall not be liable for any indirect, special or consequential damages.

STATEMENT OF CALIBRATION

This instrument has been inspected and tested in accordance with specifications published by TEGAM, Inc.

The accuracy and calibration of this instrument are traceable to the National Institute of Standards and Technology through equipment which is calibrated at planned intervals by comparison to certified standards maintained in the Laboratories of TEGAM, Inc.

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- Single and dual-input microprocessor based digital thermocouple thermometers
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