

DVM-80UVM VOLTMETER/PHASER

and ACCESSORIES



Operating
and
Instruction
Manual

HDE HD ELECTRIC

VOLTMETER/PHASER **DVM-80UVM** *and ACCESSORIES*

Operating & Instruction Manual

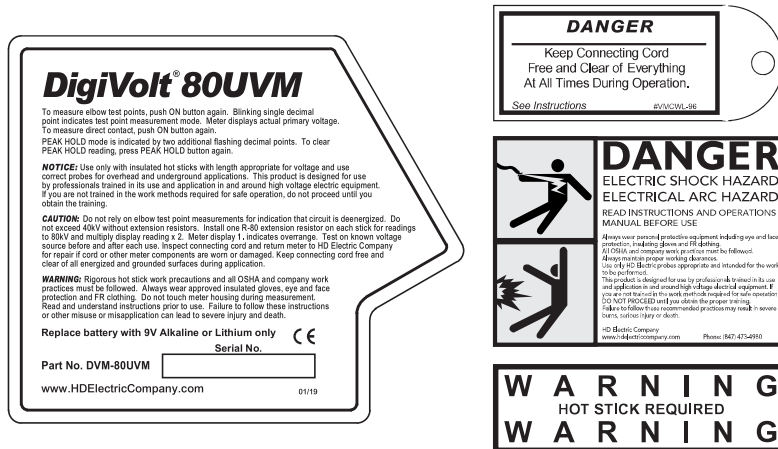
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IMPORTANT SAFETY INFORMATION

Read and understand these instructions prior to use. These operating instructions are not a substitute for proper training in the use of this equipment. High voltage systems present serious hazards, including the risk of death or serious injury due to arcing, thermal burns and electrocution. HD Electric's products are intended solely for use by professionals with knowledge, training and experience in the use of the equipment and its accessories in and around high voltage systems.

All applicable federal, state, company and OSHA work practices must be followed. If you are unfamiliar with the work practices required, **DO NOT PROCEED**. Call HD Electric if you have any questions regarding this equipment. These important labels are affixed to the product. Read and understand each label before proceeding.

THESE IMPORTANT LABELS ARE AFFIXED TO THE PRODUCT. READ AND UNDERSTAND EACH OF THEM BEFORE PROCEEDING.



All meters require the use of accessory hot sticks, which may or may not be supplied with the meter. The minimum hot stick length required for safe use depends upon the particular operation; consult federal, state, company and OSHA specifications for the proper hot stick length for the intended operation.

The users of this meter should always be equipped with personal protective equipment including high voltage gloves, flame retardant clothing, eye and face protection. Some applications may require additional protective equipment.

Accessory probes are available for all meters. Always use the proper probe(s) for your application.

OPERATIONAL IMPAIRMENT - If the DVM is used in a manner not described in this instruction manual, the protection and effective operation of this equipment may be impaired.

Failure to follow these and other warnings and safety precautions may result in severe injury or death.

GENERAL DESCRIPTION

The DVM-80UVM is a high accuracy digital voltmeter and phasing set designed to measure voltages up to 40kV and up to 80kV when used with a pair of add-on resistors. The DVM-80UVM includes an elbow test point reading feature as well as a peak hold feature. The DVM-80UVM can be purchased on its own or in a complete, ready-to-use Universal Voltmeter Kit that contains the following probes and accessories:

DVM-80UVK UNIVERSAL VOLTMETER KIT

- Dual stick phasing voltmeter (DVM-80UVM)
- Two overhead hook probes (025-OLPS-5)
- Two resistor sticks for measurements up to 80kV (R-80)
- Two underground bushing probes, 15 and 25kV class (ASP-15/25)
- An underground cable fault tester, 15, 25 and 35kV class (CFT-35)
- Voltmeter proof tester (PT-5000B)
- Two shotgun hot stick adapters (HSA-2500)
- A soft-sided, multi-functional carrying bag (B-12)

See pages 9-14 for a complete list of probes and accessories available.

All HD Electric voltmeters and phasers are constructed with epoxy encapsulated high voltage resistors, a connecting cord and a meter display. The DVM-80UVM is a digital meter. The major elements are shown here:



The high voltage resistors limit the current through the connecting cord to less than one milliamp. Although the connecting cord is insulated for voltage up to 10kV, it should always be kept free and clear from you, ground and any other conductors. These instruments will measure DC and AC 16-1000Hz RMS.

WARNING: The DVM-80UVM will require add-on resistor sticks for higher voltage ranges. Always completely remove the voltmeter from the live circuit before adding or removing add-on resistor sticks. Always use add-on resistor sticks in pairs, one on each voltmeter stick.

TECHNICAL SPECIFICATIONS



ENVIRONMENTAL CONDITIONS

- **Conditions** - Indoor and outdoor use
- **Altitude** - Up to 6,566 ft. (2000M)
- **Operating Temperature** -20°F to +140°F (-29°C to +60°C)
- **Humidity** - 95% to +60°C (non-condensing)
- **Pollution Degree** - PD4
- **Measurement Category IV** - Classification Rating (CAT IV) – Product is intended for use with test and measuring circuits connected to the circuits/wiring outside of a building installation, including transmission lines.
- **Overvoltage Category IV**
- **Enclosure Material** - PVC UL 94-V0, fiberglass
- **Printed Circuit Boards** - FR-4 UL94V-0

BATTERY REPLACEMENT INSTRUCTIONS

To replace the battery, open and remove the compartment on the rear of the meter housing. Remove and dispose of the old battery, replacing it with a fresh, new 9-volt lithium or alkaline battery. Note battery polarity on the battery compartment. This compartment cannot be reinserted if the battery polarity is reversed.

MANUFACTURING LOCATION

DIMENSIONS:

- **Length (w/o probes)** - 15.125" (38.4cm)
- **Display Housing** - 5"W x 4.5"L x 1.38"H (13cm x 11cm x 3.5cm)
- **Diameter of Fiberglass** - 1" (2.54cm)
- **Connecting Cord Length** - 12' (3.6m) fully extended, 3.5' (1.7m) retracted
- **Weight** - (w/o probes): 3.0 lbs. (1.36kg)
- **LCD Numeral Height** - 0.4", indicates 3.5 digits
- **Battery Life** - 17 hours continuous use
- **Battery** - 9V alkaline 1604A, IEC 6LR61 or 9V lithium, ANSI-1604LC.
- **Digital Meter** - Reads in kilovolts, 3.5 digits with decimal point
- **Voltage Range** - 5V-40kV, up to 80kV with add-on resistors, DC, AC 16-1000Hz
- **Auto-Ranging** - No range selector switch
- **Accuracy**
 - Within 1% of reading +/- 3 counts
 - With R-80 add-on resistors installed - within 2% of reading +/- 3 counts (line-to-ground & line-to-line measurements)
- **Meter Resolution**
 - 0.005 - 1.899 range with 1 Volt resolution
 - 1.90 - 18.99 range with 10 Volt resolution
 - 19.0 - 40.0 range with 100 Volt resolution

OPERATING INSTRUCTIONS

The DVM-80UVM requires one 9V lithium or alkaline battery, which powers the unit and activates the backlight. The meter will shut off automatically a few minutes after the display reads zero, but not while voltage measurements are being made. The DVM-80UVM includes an elbow test point reading feature, which is displayed by a blinking decimal point (.) and a Peak Hold feature which is indicated by all decimal points flashing.

To activate the Peak Hold feature, press the Peak Hold button. The display will hold the highest reading while Peak Hold is activated. To deactivate the Peak Hold and clear the display, press the Peak Hold button again.

NOTE: The meter will not shut off while a peak reading is displayed.

The backlight is always on when the unit is powered on. The low battery feature will simply shut off or will not turn on the meter when the battery is low. The unit has a 0.4" LCD display that indicates 3-1/2 digits. The DVM-80UVM measures RMS AC and DC.

To take readings above 40kV, attach one R-80 resistor stick on each meter stick, and then multiply the reading on the display by two (for example, if the display reads 30kV with add-on resistor sticks installed, multiply 30 times 2 = 60.0kV). Do not exceed 80kV with the R-80 resistor sticks attached.

PRE-USE INSPECTION

WARNING: Before using the instrument be sure to test and inspect the equipment to ensure that it is functioning properly and is in safe, working condition. Failure to do so may cause serious injury or death and may result in erroneous test measurements.

Before making any high voltage measurements, test and inspect the voltmeter/phaser as follows:

- 1) Make certain the instrument is clean, dry and waxed to a clear shiny surface.
- 2) Inspect the cord for cracked insulation.
- 3) Be sure that you are using hot sticks of the appropriate length, and examine each hot stick to ensure that it is clean, dry and waxed to a clear shiny surface.
- 4) Attach the appropriate probes for overhead or underground applications (see page 9) and ensure that the probes are properly installed and tightened (do not overtighten).
- 5) Install add-on resistor sticks if necessary for the range being tested.
- 6) Test the voltmeter/phaser with a proof tester such as the HD Electric PT-5000B Proof Tester Voltmeter Tester (see page 10).

Voltage and Phasing Measurements – Line-to-Line

We recommend that two person crews perform all line-to-line voltage measurements and phasing operations. Since the operation is occurring near two energized conductors,

OPERATING INSTRUCTIONS *continued*

the use of two person crews allows each person to operate one meter stick and maintain high safety standards.

In order to make line-to-line measurements, each probe must contact an energized line. Be sure that only those probes intended for the particular application are used (see page 9). Always keep the connecting cord free and clear of energized phases and ground.

For phasing applications, the probes will be placed on opposite sides of an open point, typically a switch. The phasing operation will indicate if two sides of a line are in-phase before closing a switch.

To check all phases, proceed as follows:

- 1) Measure voltage on each phase from line-to-ground to verify all phases are live and at the same voltage.
- 2) Place one of the probes on a conductor on one side of the switch.
- 3) Place the other probe on one of the three phases on the other side of the switch.
- 4) If the conductors are out-of-phase, the meter will read line-to-line voltage. If they are in-phase, the meter will read near zero but may read up to 15% of the line-to-line voltage.
- 5) Continue this procedure with all three phases on both sides of the switch.

If an intermediate reading is found, the phasing cannot be determined by this method and the switch should not be closed until other means are used for phasing.

Voltage Measurements – Line-to-Ground

Keep the connecting cord free and clear while testing.

To use this two-stick voltmeter/phaser, first connect one of the probes to either a ground or system neutral making sure the resistor stick is making contact at all times during measurement. The other probe should be connected to the energized source to be measured.

Maintain contact only long enough to read the meter. Always remove the probe from the energized source first before removing the ground connection.

TEST POINT MEASUREMENTS

The DVM-80UVM includes a Test Point feature for measuring voltage from elbow test points. To activate Test Point mode simply push the ON button again. Test Point mode is indicated by a blinking decimal point. To turn Test Point mode off, simply push the ON button once again and the decimal point will stop blinking. When using a voltmeter/phasing set to phase between test points, the important measurement is whether high voltage is present or not. The proper procedure for phasing between elbow test points is as follows:

- 1) Both elbows must be energized. Follow the proper safety practices for removing the test point protective caps and exposing the live test points. Treat all exposed electrodes as energized high voltage. Measure from both elbow test points to ground. These measurements should show that both elbows are energized and, if both elbows are of the same type and manufacture, should measure the approximate line voltage.

OPERATING INSTRUCTIONS *continued*

- 2) Measure from one elbow test point to the other. This reading will show either a high voltage reading indicating the elbows are out-of-phase or a zero or low voltage reading indicating the elbows are connected to the same phase. **The out-of-phase measurement will likely not show the higher voltage expected from a phase-to-phase measurement but will be closer to the line-to-ground voltage. The in-phase voltage measurement can be between zero and 15% of the nominal line-to-ground voltage.** If both elbows are of different type and manufacture, then a higher reading may occur.

PEAK HOLD

The DVM-80UVM includes a Peak Hold feature. To activate the Peak Hold feature press the Peak Hold button. Peak Hold is indicated by all decimal points flashing. The display will hold the highest reading while Peak Hold is activated. To deactivate the Peak Hold and clear the display, press the Peak Hold button again.

Note: The meter will not shut off while a peak reading is displayed.

CARE AND MAINTENANCE

Periodic regular maintenance is required to keep the voltmeter in proper operating condition. Keep the voltmeter clean and dry and always store it in its case. The fiberglass sticks should be kept clean and free of dirt, contamination and marking. Examine the cord for cracking or other damage prior to each use. Although we don't specify a calibration cycle, we recommend you test, measure and calibrate your instrument annually. The Calibration and Maintenance Log provided on page 15 can be used to record these events. Contact HD Electric for details.

CLEANING INSTRUCTIONS: To clean the DVM-80UVM wipe with a damp cloth with water. Do not use harsh chemicals or solvents.

PROBES AND ACCESSORIES

WARNING: ALWAYS use probes appropriate to your application. NEVER use overhead probes in underground applications. Failure to use the correct probe can result in arcing or electrical contact and may cause serious injury or death. If you are not trained in the particular operation or are not sure about the appropriate probe for your application **DO NOT PROCEED.**

The DVM-80UVM comes standard with two overhead hook probes (025-OLPS-5), a 9-volt battery, instruction manual and a carrying case (CS-DVM). The DVM-80UVK Universal Voltmeter Kit is supplied with a DVM-80UVM dual stick phasing voltmeter, two overhead hook probes (025-OLPS-5), two resistor sticks (R-80), two underground bushing probes (ASP-15/25), an underground cable fault tester (CFT-35), voltmeter proof tester (PT-5000B), two shotgun hot stick adapters (HSA-2500), a 9-volt battery, instruction manual and a soft-sided carrying bag (B-12). The following pages describes these probes as well as other optional probes and accessories available.

PROBES AND ACCESSORIES *continued*

OVERHEAD PROBES

- 025-OLPS-5 brass hook probe
- 025-OLPS-6 brass pigtail probe

UNDERGROUND DEAD FRONT BUSHING PROBES

- ASP-15/25 for use in 15kV and 25kV loadbreak bushings
- ASP-35U for use in 35kV loadbreak bushings



UNDERGROUND ELBOW PROBE

EA-15/25 for insertion in loadbreak elbows

NOTE: The elbow must be firmly supported when using this probe

INSULATED UNDERGROUND PROBE

GCP-1 for general underground use on grounded terminals, exposed high voltage terminals or elbow test points.



ADD-ON RESISTOR STICK

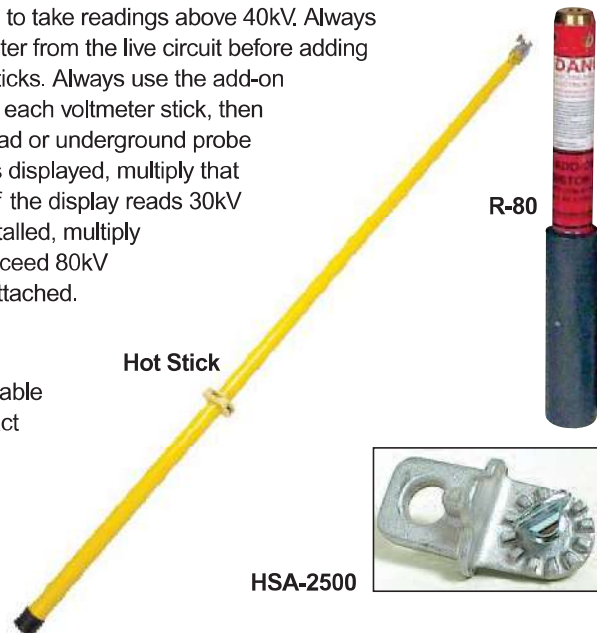
R-80 Resistor Sticks are used to take readings above 40kV. Always completely remove the voltmeter from the live circuit before adding or removing add-on resistor sticks. Always use the add-on resistor sticks in pairs, one on each voltmeter stick, then attach the appropriate overhead or underground probe to be used. When a reading is displayed, multiply that reading by two (for example, if the display reads 30kV with add-on resistor sticks installed, multiply 30 times 2 = 60kV). Do not exceed 80kV with the R-80 resistor sticks attached.

HOT STICK

A range of hot sticks are available in lengths starting at 4'. Contact HD Electric for more details.

HOT STICK ADAPTER

HSA-2500 shotgun hot stick adapter



PROBES AND ACCESSORIES *continued*

PROOF TESTER® VOLTMETER TESTER

The PT-5000B Proof Tester Voltmeter Tester will produce 5kVDC at the test leads to confirm proper operation of voltmeters and phasers. This tester should be used only with voltmeters/phasers that measure DC voltage. It will not confirm operation of voltmeters/phasers that measure AC voltage only. The PT-5000B operates from one 9V lithium or alkaline battery and produces approximately 5kVDC at the connecting leads. To use:

- 1) Connect both tester leads to the voltmeter/phaser probes.
- 2) Press and hold both TEST buttons.
- 3) Confirm a good battery by checking the red light on the Tester. If the red light does not come on, replace the battery with a 9V lithium or alkaline only.
- 4) Verify the voltmeter/phaser reads approximately 5kV.
- 5) Release the TEST buttons and disconnect the Tester from the voltmeter/phaser.

WARNING: Do not use the voltmeter/phaser if proper operation is not confirmed.

WARNING: Do not use this tester except as directed. Do not use to test equipment other than voltmeters/phasers. Do not apply to energized circuits or equipment. Refer all servicing to the factory. Failure to follow these instructions may lead to electric shock, severe injury or death.



**PT-5000B Proof Tester
Voltmeter Tester**

PROBES AND ACCESSORIES *continued*

CABLE FAULT TESTER

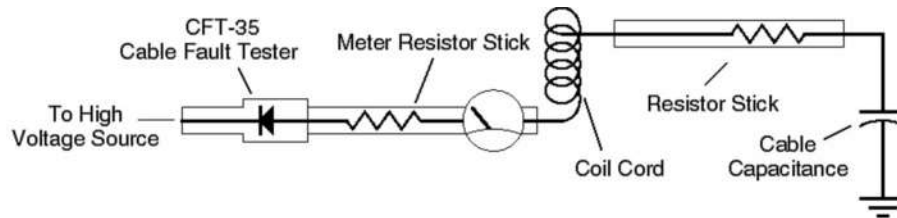
The CFT-35 Cable Fault Tester is for use only with two stick voltmeters for testing leakage current in underground primary voltage cables.



The CFT-35 can be used on underground cables with grounded neutrals with a maximum line-to-ground voltage of 21.1kV or maximum line-to-line voltage of 36.6kV. Operation at higher voltages may damage the CFT-35 and provide erroneous test results.

The CFT-35 is used with a voltmeter/phaser for testing installed or repaired underground cable prior to energizing it. Only cable with extruded dielectric such as rubber or polyethylene can be tested with the CFT-35. Using the CFT-35 on paper insulated cable may provide erroneous test results caused by higher leakage currents typical for this type of cable.

The CFT-35 contains a high voltage rectifier and is connected to test underground primary cable as shown in this circuit:



In practice, the CFT-35 rectifies the high voltage from the source, usually a transformer primary, and charges up the cable, shown as a capacitor above. When a connection is first made, the DC from the CFT-35 will charge up the cable capacitance through the resistors in the meter sticks. If the cable is good, current will stop flowing when the cable is charged up. If the cable is not good, the cable will not charge and current will continue to flow, as indicated by a higher meter indication.

The following equipment is required for testing cable with a CFT-35:

- 1) An HD Electric two-stick voltmeter/phaser.
- 2) The CFT-35 Cable Fault Tester.
- 3) For deadfront applications, ASP bushing probe(s) or, for live front applications, GCP-1 probe(s). An EA-15/25 elbow probe may also be used for deadfront applications.
- 4) For deadfront applications, a feed-through bushing may also be used.

PROBES AND ACCESSORIES *continued*

Shown here is a typical application of the CFT-35 and associated equipment for testing underground cable from a pad-mount dead front transformer:

Before using the CFT-35, read and understand all of the instructions and precautions for live testing with voltmeters/phasers (pages 7 & 8). In addition, be sure to consult your company's work practices and any information provided by the manufacturers of the apparatus that you are testing.

Testing using the CFT-35 should be performed as follows:

- 1) Test the cable with the HDE voltmeter/phaser to ensure that it is not energized and that it is discharged.
- 2) Ensure that the cable to be tested is completely isolated; that both ends have no other connection to voltage or to a transformer winding and are properly terminated.
- 3) Assemble the CFT-35 with appropriate probe on the voltmeter/phaser stick **with the meter**.
- 4) Assemble the appropriate probe on the voltmeter/phaser stick **without the meter**.
- 5) Connect the voltmeter/phaser stick **without the meter** to the cable to be tested.
- 6) Connect the voltmeter/phaser stick **with the CFT-35** to the voltage source.
- 7) Read the display on the voltmeter/phaser. The reading will be initially high. For a short cable, the reading should return quickly to near zero. For a longer cable, it may take a few seconds for the reading to return to near zero.
- 8) If the reading does not return to near zero after several seconds, the cable is leaking or shorted and the test should be discontinued. Remember that all HDE voltmeters/phasers are intermittent duty devices and should be connected only as long as necessary to obtain a reading.
- 9) Discharge the cable by removing the voltmeter/phaser from the line, removing the CFT-35 from the voltmeter/phaser and connecting the voltmeter/phaser from cable to ground.

