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**Bierer**  
**METERS**

*Safety is number one.*



Manufacturing & Service: Bierer & Associates Inc.

Patent No. 6,459,252

**PD Series® All-Purpose  
Utility Meters**  
**Operating Instructions**  
**PD50®** **CE**

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\* Optional accessory required for this application

## Limitation of Warranty and Liability

Bierer & Associates Inc. warrants this product to be free from defects in workmanship and material, under normal use and service conditions for a period of one year from date of shipment.

Due to continuous product improvement and development, Bierer & Associates Inc. reserves the right to modify product designs and specifications without notice.

It is impossible to eliminate all risks associated with the use of high voltage electrical devices including this device. Risks of serious injury or death are inherent in working around energized electrical systems. Such risks include but are not limited to variations of electrical systems and equipment, manner of use or applications, weather and environmental conditions, operator mentality, and other unknown factors that are beyond the control of Bierer & Associates Inc.

Bierer & Associates Inc. do not express or imply to be an insurer of these risks, and by purchasing or using this product you **AGREE TO ACCEPT THESE RISKS**. IN NO EVENT SHALL Bierer & Associates Inc. BE LIABLE FOR ANY INCIDENTAL, CONSEQUENTIAL OR SPECIAL DAMAGES RESULTING FROM THE USE OR HANDLING OF THIS PRODUCT.

## SAFETY MESSAGE DEFINITIONS per ANSI Z535

These instructions contain important safety messages to alert the user to potentially hazardous situations, how to avoid the hazard, and the consequences of failure to follow the instruction.

The safety alert symbol  identifies a safety message. The signal word following the symbol indicates:

 **DANGER** A hazardous situation which, if not avoided, **will** result in death or serious injury and equipment damage.

 **WARNING** A hazardous situation which, if not avoided, **could** result in death or serious injury and equipment damage.

 **CAUTION** A hazardous situation which, if not avoided, **could** result in minor or moderate injury and equipment damage.

**NOTICE** Important safety message relating to equipment damage only.

## PRODUCT SAFETY INFORMATION



### WARNING

1. Meter assembly, interconnect cable assembly, and live line tool adapters shall be considered **non-insulating**. Do not let live line tool fittings come in contact with energized or grounded conductors. **The live line tool adapters, fittings, and handles shall not be used on any other devices.**
2. Use appropriate length live line tools for voltage being worked and maintain minimum approach distances as outlined in OSHA 1910.269, Table R-6.
3. All Phasing Meters and Voltage Detectors manufactured during and after 2007 will have a limit mark engraved on the high voltage probe(s) 2.5 inches from the tip to indicate to the user the physical limit that should not be exceeded when approaching and contacting an electrical conductor or other electrical test points. Zero Ohm insulated adapters (81280IE) should be used if limit mark will be exceeded.
4. This equipment should be used only by qualified employees, trained in and familiar with the safety-related work practices, safety rules and other safety requirements associated with the use of this type of equipment.
5. These instructions are not intended as a substitute for adequate training, nor do they cover all details or situations which could be encountered when operating this type of equipment.
6. Before operating this equipment, read, understand and follow all instructions contained in this manual. Keep instructions with equipment.

## INSPECTION & MAINTENANCE BEFORE USE



### WARNING

1. Prior to using any high voltage test equipment a careful inspection should be made to ensure the unit is free from any contaminants such as dirt, grease, etc. and that there are no apparent physical damages.
2. High voltage probe assemblies shall be wiped clean prior to each use with a silicone impregnated cloth and kept clean and free of contaminants. This will prevent tracking on the outside of the probe and meter error.
3. Always confirm internal battery voltage before and after use.

## DESIGN and FUNCTION



### **WARNING** – Limit Mark

-see “Product Safety Information”, item 3, page 3.

The PD50 Digital All Purpose Utility Voltmeters is designed to replace numerous meters that incorporate single ranges/functions due to increased accuracy and precision. Each meter has three ranges for use on system voltages ranging from 0 volts to 50,000 volts (phase-to-phase). The unit consist of a large LCD digital meter contained in plastic injection molded housing, an electrically shielded interconnect cable with a maximum current of .5milli-amps (50kV phast to phase), and a second probe for completing the circuit. Completely shielded, the tester reads only contacted test points, with minimal stray field indications. Patented input circuitry measures and reconciles the undesirable effects of charging currents associated with other high voltage phasing voltmeters, resulting in the most accurate and versatile high voltage meter available in the electric utility industry.

The five position selector switch located on the face, controls Off, 2kV, 20kV, 50kV and Test.

- 2kV range - 1 volt to 1999 volts with 1 volt resolution.
- 20kV range - 10 volts to 19.99kV with 10 volt resolution.
- 50kV range - 100 volts to 50.0kV with 100 volt resolution.

“T” position tests basic meter functions and the digital display.

**Auto off activates around 10 minutes to conserve battery power**

## **BATTERY REPLACEMENT**

The threaded live line tool fitting on the face of the meter probe is furnished with two flat edges for use with a wrench or slip joint pliers to remove and install the fitting from the meter housing. To remove, turn the live line tool fitting in a counterclockwise direction and install in a clockwise direction.

## **OVER VOLTAGE INDICATION**

Meter will display a single **1** in the far left hand corner of the digital display, indicating the meter is in an over voltage condition. Check the selector switch to ensure the voltage range is in correct position for the voltage being tested.

## METER SET-UP and TESTING



### **WARNING**

- see “Product Safety Information”, page 3.
- see “Inspection & Maintenance”, page 3.

**1.** Turn meter on and test basic meter functions by turning the function selector switch to the “**T**” position. If the battery voltage displayed is less than 8 volts (080), the battery should be replaced. Always test meter before and after each use.

**2.** Connect meter probe to second probe using interconnect cable. The interconnect cable has an insulation rating of 35kV.

**3.** Attach the meter probe and second probe to appropriate length live line tool for the voltage being tested.

### TESTING ON KNOWN VOLTAGE

**3a.** Testing with 3kV power supply provided with PD50:

- Turn on power supply.
- Turn selector switch to the 20kV position.
- Depress button on left side of power supply using either probe.
- Touch the other probe to the ground terminal on the right side of the power supply. The meter should indicate at least 2.5kV, if not; check all batteries, meter, and power supply.
- While depressing the button with either probe, make contact to the same button with the "other" probe. Meter should indicate near zero.

**3b.** Testing with 100V DC power supply. Accessory PN: PA100P

- Attach DC supply to either probe.
- Turn selector switch to the 2kV position.
- Bring both probe tips together. The meter should read at least 75 volts, if not check all batteries, meter and supply.

**4.** Select the appropriate range for the voltage being measured.

**5.** Retest the phasing voltmeter after each use.

## PHASING on OVERHEAD LINES



**WARNING** – see “Meter Set-Up & Testing”, page 5.

1. Attach the meter probe and second probe to the appropriate length live line tool for the voltage being tested.
2. Select the appropriate voltage range for the voltage being tested.
3. Place the second probe on a suitable ground or neutral conductor. Touch all phase conductors one at a time with the meter probe to verify all phases are energized. The meter will show true RMS phase-to-ground voltage on all phases.
4. Place the meter probe and second probe on the same energized phase conductor. The meter should indicate near zero.
5. Leave the meter probe on the first energized conductor. Contact another energized conductor with the second probe.
6. If the conductors are in phase, the voltage indications should be near zero. If the conductors are out of phase, the meter will show true RMS phase-to-phase voltage.



**WARNING** – see “Meter Set-Up & Testing”, page 5.

**PHASE-TO-PHASE or PHASE-TO-GROUND**  
**VOLTAGE MEASUREMENT on OVERHEAD LINES**



**WARNING** – see “Meter Set-Up & Testing”, page 5.

1. Attach the meter probe and second probe to the appropriate length live line tool for the voltage being tested.
2. Select the appropriate voltage range for the voltage being tested.
3. To measure phase-to-phase voltage, use the meter probe and second probe to make contact between the phase conductors. The meter will show true RMS phase-to-phase voltage.
4. To measure phase-to-ground voltage, use the meter probe and second probe to make contact between the phase conductor and suitable ground. The meter will show true RMS phase-to-ground voltage.



**WARNING** – see “Meter Set-Up & Testing”, page 5.

## PHASING on URD LINES



**WARNING** – see “Meter Set-Up & Testing”, page 5.

1. Attach the meter probe and second probe to the appropriate length live line tool for the voltage being tested.
2. Select the appropriate voltage range for the voltage being tested.
3. Attach bushing adapter (8128TBALB) to the meter probe.
4. Place the second probe on a suitable ground or neutral conductor. Plug the meter probe with bushing adapter attached into the bushings one at a time to verify all phases are energized. The meter will show true RMS phase-to-ground voltage on all phases.
5. Attach second bushing adapter to second probe.
6. Plug the meter probe with bushing adapter and the second probe with bushing adapter into known bushings of the same phase (if available). The voltage indication should read near zero.
7. Leave the meter probe on the first energized bushing. Make contact on another energized bushing with the second probe.
8. If the bushings are in phase, the voltage indication will be near zero. If the bushings are out of phase, the voltage will be true RMS phase-to-phase voltage.



**WARNING** – see “Meter Set-Up & Testing”, page 5.

## **PHASE-TO-PHASE or PHASE-TO-GROUND VOLTAGE MEASUREMENTS on URD LINES**



**WARNING** – see “Meter Set-Up & Testing”, page 5.

1. Attach the meter probe and second probe to the appropriate length live line tool for the voltage being tested.
2. Select the appropriate voltage range for the voltage being tested.
3. To check the phase-to-phase voltage, attach bushing adapters to meter probe and second probe.
4. Plug the meter probe with bushing adapter and the second probe with bushing adapter into the bushings being tested. The meter will show true RMS phase-to-phase voltage.
5. To check the phase-to-ground voltage, attach a bushing adapter to the meter probe only.
6. Place a second probe on suitable ground. Plug the meter probe with bushing adapter into the bushing to be tested. The meter will show true RMS phase-to-ground voltage.



**WARNING** – see “Meter Set-Up & Testing”, page 5.

## PHASING on URD CAPACITIVE TEST POINTS



**WARNING** – see “Meter Set-Up & Testing”, page 5.

1. Attach meter probe and second probe to the appropriate length live line tool for the voltage being tested.
2. Select the 2kV voltage range when phasing capacitive test points.
3. Remove dust covers from all capacitive test points.
4. Place second probe on suitable ground. Touch all capacitive test points one at a time with the meter probe to verify all phases are energized and capacitive test points are functional and approximately equal. All voltage readings should be within 10% of each other.
5. The meter should indicate greater than 25 volts on a 2.5kV phase-to-ground system with progressively higher voltage indications on higher system voltage.
6. Place the meter probe and second probe on one energized capacitive test point. The meter should indicate near zero.
7. Place the meter probe on one capacitive test point and contact another capacitive test point with the second probe.
8. If the test points are out of phase the meter voltage indication will be greater than the indication in step 4 above. If the test points are in phase, the meter will indicate near zero.



**WARNING** – see “Meter Set-Up & Testing”, page 5.

# LIGHTNING ARRESTOR TESTER



**WARNING** – see “Meter Set-Up & Testing”, page 5.

1. Attach DC Hi-Pot Adapter on meter probe.
2. Attach meter probe and second probe to the appropriate length live line tool for the voltage being tested.
3. Select the 2kV voltage range.
4. Remove the phase lead from the device to be tested. Leave the ground lead attached
5. Place meter probe with Hi-Pot adapter on the energized conductor supplying the device under test, and the second probe on the source side of the device.
6. The meter will indicate the DC leakage through the device as follows:
  - Each micro amp of leakage on the PD50 will indicate 100 volts

**Example:** Assuming the maximum leakage is 20 micro amps;

- $PD50 - 20 \text{ micro amps} \times 100 = 2,000V$



**WARNING**

- see “Meter Set-Up & Testing”, page 5.
- Contact the manufacturer for specific maximum leakage values of the device being tested. For use on closed gap lightning arrestors only.



**WARNING** – see “Meter Set-Up & Testing”, page 5.

**Testing DC Hi Pot Adapter**

1. Attach phasing voltmeter to appropriate length live line tools for the voltage being worked. Select highest voltage scale (50).
2. Attach Hi-Pot to meter probe. Place second probe on a suitable ground and make contact with DC Hi-Pot to source voltage.
3. Meter should read approximately 70% of the line-to-ground source voltage. SEE NOTE 2.

**Testing Riser Pole to First Transformer**

1. Following standard operating procedures, isolate both ends of the cable to be tested using a feed thru bushing at transformer, see NOTE 1.
2. Attach phasing voltmeter to appropriate length live line tools for the voltage being worked. Select highest voltage scale (50).
3. Attach the DC Hi-Pot adapter, w/ hook adapter, to Meter probe.
4. Attach straight adapter to Second probe.
5. Place Hi-Pot adapter on source voltage and second probe on cable termination. SEE NOTE 2.
6. On a non-faulted cable the meter will read at or near maximum calculated voltage and diminish to near zero volts. SEE NOTE 3.
7. On a faulted cable the meter will read at or near maximum calculated voltage and stay there. SEE NOTE 3.
8. A pulsating meter reading indicates the presence of an internal flashover.
9. Discharge cable to ground after each test; see DISCHARGING CABLE, page 13.

**NOTE 1:** The section of cable under test must be isolated on both ends and can not be connected to/or through equipment or lighting arrestors. To achieve most accurate readings, use the standard 8ft. cable only and keep the cable away from ground(s) or energized sources.

**NOTE 2:** The maximum voltage reading during the hi-potting test is approximately 70% of the line-to-ground source voltage, i.e.  $7.2\text{kV} \times .70 = 5\text{kV}$ . This value is representative of a direct fault on the cable. Readings near zero represent a good cable with little or no cable leakage.

**NOTE 3:** It is the responsibility of each user to determine the maximum acceptable leakage value, based on prior testing and work experience. Refer to TABLE 1, page 13.

## Testing Between Transformers

1. Following standard operating procedures, isolate both ends of the cable under test using feed thru bushings, see NOTE 1.
2. Attach phasing voltmeter to appropriate length live line tools for the voltage being worked. Select highest voltage scale (50)
3. Attach the DC Hi-Pot adapter, w/ bushing adapter to Meter probe.
4. Attach bushing adapter to Second probe.
5. Insert the Hi-Pot adapter in energized bushing of transformer and second probe in open feed thru bushing isolating cable under test. SEE NOTE 2.
6. On a non-faulted cable the meter will read at or near maximum calculated voltage and diminish to near zero volts. SEE NOTE 3.
7. On a faulted cable the meter will read at or near maximum calculated voltage and stay there. SEE NOTE 3.
8. A pulsating meter reading indicates arcing or flashover.
9. Discharge cable to ground after each test; see DISCHARGING CABLE below.

## DISCHARGING CABLE



**WARNING** – Failure to discharge cable could result in death or serious injury, equipment damage, and/or false readings.

Cable that has been tested must be discharged to a proper ground source after each test.

1. Contact tested cable with the meter probe/Hi Pot adapter
2. Contact suitable ground with second probe
3. Time to discharge should equal charge time. Meter will read near zero when fully discharged.

### Table 1: DC Leakage vs. Phase to Ground Reading

Table 1 shows how much leakage is present on any cable under test when the meter does not approach zero. For example, On a 7.2kV system, p-to-g reading with hi pot attached is 5.0 kV, using PD25, meter reading of 2.5kV(50%) = 150 Mega Ohms.

	Faulted Cable					Excessive Leakage						
Leakage (Mega Ohms)	0	25	50	75	100	125	150	175	200	300	400	1000
PD25 % of Voltage	100	84	73	66	60	54	50	47	44	36	30	17
PD50 % of Voltage	100	91	83	77	72	67	63	60	57	47	41	24

## PHASE SEQUENCE TESTER



**WARNING** – see “Meter Set-Up & Testing”, page 5.

1. Attach the meter probe and second probe to the appropriate length live line tool for the voltage being tested.
2. Select the appropriate voltage range for the voltage being tested.
3. Place the second probe on a suitable ground or neutral conductor.
4. Touch each phase conductor with the meter probe to verify all phases are energized. Meter will show true RMS phase-to-ground voltage. See Note 4.
5. **Remove the connector cable from either probe and install the phase sequence adapter, re-connect the connector cable to the phase sequence adapter.**
6. Touch the meter probe to one phase conductor and the second probe to another phase conductor (for example the road side and middle phases) and read the meter. See Note 5.
7. Reverse the meter and second probe on the same two phase conductors and read the meter.
8. The higher reading indicates the leading phase, if the road side reading is higher than the middle reading; the phase sequence is road, middle, field. See Note 6.



**WARNING** – see “Meter Set-Up & Testing”, page 5.  
**NOT TO BE USED ON CAPACITIVE TEST POINTS**

**NOTE 4:** On secondary center tap grounded delta systems and secondary corner grounded delta systems, contact the manufacturer for additional instructions for determining phase sequence.

**NOTE 5:** When using the Phase Sequence Adapter, voltage indications are much lower than the actual phase-to-phase values. For true RMS voltage readings remove the Phase Sequence Adapter.

**NOTE 6:** When used on known A and B phases, a higher reading on A phase indicates a sequence of A-B-C. A higher reading on B phase indicates a sequence of C-B-A.

## PHASE IDENTIFICATION on DE-ENERGIZED URD and OH CONDUCTORS



**WARNING** – see “Meter Set-Up & Testing”, page 5.

When used with a PA100P, 100V DC probe adapter, the PD50 Phasing Voltmeter can be used to identify individual phase conductors on isolated de-energized OH and URD lines. The Meter probe with the PA100P is used to couple a nominal 100V DC signal source to the line. The second probe on the far end of the line is used to locate the DC signal source to identify the line being tested.

URD cable(s) under test should be isolated from all equipment and parked on feed thru bushings. Bushing adapters (8128TBALB) on the meter and second probes can be used in open feed thru bushings for testing cable.

### CONFIRM DE-ENERGIZED

1. Attach meter probe and second probe to the appropriate length live line tool for the voltage being tested.
2. Select appropriate voltage range from selector switch for voltage being tested.
3. Place second probe in contact with a suitable ground.
4. Touch all phase conductors one at a time with meter probe to verify that all conductors to be identified are de-energized, see Notes 7 and 8.
5. If conductor is energized the meter will show line-to-ground voltage.

**NOTE 7:** Do not use 100V DC probe adapter on meter probe when testing to confirm line de-energized.

**NOTE 8:** Meter will display DC capacitive charges on URD cables; the DC charges will diminish to near zero with the meter held in a phase-to-ground configuration. **Drain all DC charges prior to testing for identification.**

## IDENTIFICATION SET UP



**WARNING** – see “Meter Set-Up & Testing”, page 5.

1. Remove the interconnect cable from the second probe and install the alligator clip adapter (81280FG) on cable end and attach PA100P on meter probe.
2. Install additional interconnect cable (81280ML) with alligator clip adapter (81280FG) on second probe.
3. Set the meter probe to the 2kV position.

### SIGNAL END- METER PROBE

1. Attach alligator clip on a suitable ground.
2. Place meter probe in 2kV position and make contact with cable/conductor to be tested.
3. On a good cable/conductor (non-short) the meter should indicate a momentary voltage less than 100V and diminish to near zero in several seconds. If the reading remains at the momentary value and does not diminish, the cable is shorted or has excessive leakage and may not be identifiable.

### RECEIVE END– SECOND PROBE:

1. Attach alligator clip on suitable ground.
2. Place second probe in contact with cable/s-conductor/s to be tested.
3. Same cable/conductor indication is confirmed by a reading on the meter probe of one half (1/2) of the DC probe supply voltage, as measured in the Meter Set Up and Testing section, page 5.



**WARNING** – see “Meter Set-Up & Testing”, page 5.

**NOTE:** Use of an additional meter probe allows receive end user to see approximate voltage value as the signal end user.

## REGULATOR NEUTRAL VERIFICATION



### **DANGER**

- If inconsistencies exist between the regulator step position indicator, regulator neutral indicator light, and the input and output voltage measured in steps 4 & 5 below, the regulator should be **de-energized** before bypassing, and taken out of service.
- ALWAYS select the 20kV voltage position. The 20kV position must be used to achieve the precision needed for neutral verification. See step 2 below.
- see “Meter Set-Up & Testing”, page 5.

1. Attach the meter probe and second probe to the appropriate length live line tool for the voltage being tested.

2. Select the 20kV voltage range. The 20kV position must be used to achieve the precision needed for neutral verification.

3. Step the regulator to neutral position according to dial step position indicator and neutral indicator light.

4. Measure phase-to-ground voltage on the supply side of regulator and note the exact value. See Note 9.

5. Measure phase-to-ground voltage on the load side of regulator and note the exact value. See Note 9.



**WARNING** – see “Meter Set-Up & Testing”, page 5.

6. If both values measured in steps 4 & 5 above are **within 10 volts of each other**, the regulator is in the neutral position.

**Note 9:** To achieve maximum accuracy and repeatability, measure phase-to-ground voltages away from crowded spaces, i.e. move away from regulator bushings, towers, tanks, poles, etc.

## PARTS & ACCESSORIES

<b>PART NO.</b>	<b>DESCRIPTION</b>
3402	Quick Change to Grip All Adapter
3403	Quick Change to Universal Adapter
8128TBALB	15 - 25kV Bushing Adapter
8128TEALB	15 - 25kV Elbow Adapter
81280FL	8 Foot Lead with Female Adapter
81280ML	8 Foot Lead with Male Adapter
81280ML30	30 Foot Lead with Male Adapter
81280ML40	40 Foot Lead with Male Adapter
81280ML100	100 Foot Lead with Male Adapter
81280LHM	Hook Adapter
81280LPM	Straight Probe Adapter
81280B1	6V Battery for Power Supply
* 81280ER	Pair, 50 Meg-Ohm Extension Resistors
PA25B	20" Storage Box with Foam
PA25T	3kV Power Supply
* PA50DCHP	DC Hi-Pot Adapter
PAH6TB	26" Storage Box for Handles
PA25LVA	Pair, Insulated Low Voltage Adapters
PD25PSA	Phase Sequence Adapter
PD50AB	Canvas Storage Bag for PD25/50
PD50B	26" Storage Box with Foam
PA100P	100 Volt Supply / Phase Identifier
* 81280IE	Zero Ohm Extension Probe 16"
* 81280FG	Alligator Clamp Adapter

\*See additional information on Page 19

