

PHASE ROTATION METER *and ACCESSORIES*

Operating & Instruction Manual



HD ELECTRIC COMPANY

1475 LAKESIDE DRIVE • WAUKEGAN, ILLINOIS 60085 U.S.A.
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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 Company if you have any questions regarding this equipment.

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

NOTICES - CAUTIONS - WARNINGS

NOTICES - This product is designed for use by professionals trained in its use and application in and around high voltage electrical equipment. If you are not trained in the work methods required for safe operation, do not proceed until you obtain the training.

CAUTIONS - This product was tested before leaving the factory but it must be inspected prior to and after each use for proper working condition. All fiberglass was tested per OSHA at 100kV/ft./5 min. Be aware that dirt, moisture, mechanical fatigue and other factors reduce the dielectric strength of the product. If any defect or condition is noted, do not use this product. Do move from service and arrange for repair.

WARNINGS - Rigorous hot stick work precautions and all OSHA and company work practices must be followed. Always wear approved cover-up and safety equipment. Read and understand instructions prior to use. Misuse and abuse of this product can lead to severe injury or death.

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DANGER
ELECTRIC SHOCK HAZARD
ELECTRICAL ARC HAZARD

READ INSTRUCTIONS AND OPERATIONS MANUAL BEFORE USE

Always wear personal protective equipment including eye and face protection, insulating gloves and FR clothing. All OSHA and company work practices must be followed. Always maintain proper working clearances. Use only HD Electric probes appropriate and intended for the work to be performed.

This product is designed for use by professionals trained in its use and application in and around high voltage electrical equipment. If you are not trained in the work methods required for safe operation, **DO NOT PROCEED** until you obtain the proper training. Failure to follow these recommended practices may result in severe burns, serious injury or death.

HD Electric Company
www.hdelectriccompany.com Phone: (847) 473-4900

DANGER

Keep Connecting Cord
Free and Clear of Everything
At All Times During Operation.

See Instructions #VMCWL-96

WARNING
HOT STICK REQUIRED
WARNING

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

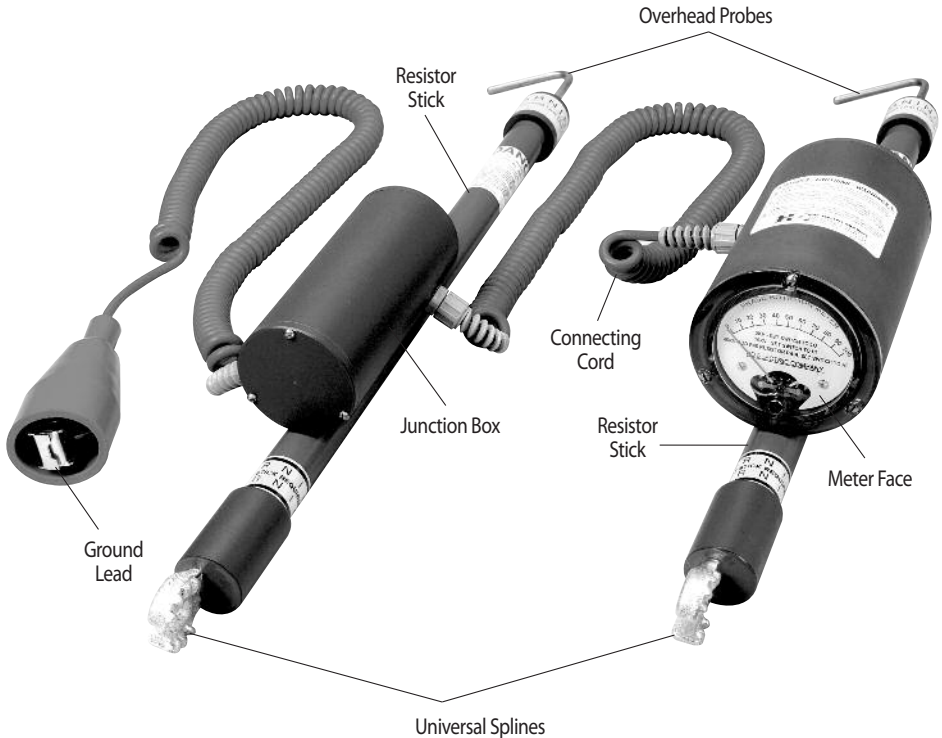
The users of this meter should always be equipped with personal protective equipment including high voltage gloves, flame retardant clothing, eye and face protection. Some applications may require additional protective equipment.

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

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

GENERAL DESCRIPTION

The phase rotation meter is constructed with epoxy encapsulated high voltage resistors, a connecting cord, a ground lead and a meter display. The major elements are shown here:



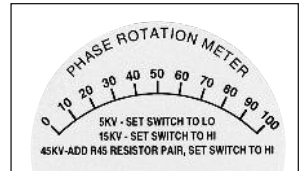
The high voltage resistors limit the current through the connecting cord to a maximum of about one milliamp. Although the connecting cord is insulated for voltage up to 10kV, it should always be kept free and clear from you, ground and any other conductors.

WARNING: The phase rotation meter has a range switch and requires add-on resistor sticks for higher voltage ranges. Always completely remove the phase rotation meter from the live circuit before changing the range switch position or adding or removing add-on resistor sticks. Always use add-on resistor sticks in pairs, one on each stick.

PHASE ROTATION METER

PRM-100 – Triple range: 0-5kV, 5-15kV and 15-45kV with optional accessory R-45 add-on resistor sticks.

- This meter does not measure voltage.
- Determine phase rotation on systems up to 5kV with the selector switch set for LO range and without the add-on resistor sticks.
- Determine phase rotation on systems up to 15kV with the selector switch set for HI range and without the add-on resistor sticks.
- Determine phase rotation on systems up to 45kV with the selector switch set for HI range and with the optional add-on resistor sticks installed, one on each meter stick.



PRM-100 Scale

OPERATING INSTRUCTIONS

Pre-Use Inspection

WARNING: Before using the instrument be sure to test and inspect the equipment to insure 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 taking any reading, test and inspect the phase rotation meter 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 hotsticks of the appropriate length, and examine each hotstick to insure that it is clean, dry and waxed to a clear shiny surface.
- 4) Attach the appropriate probes for overhead or underground applications (see page 6) and that the probes are properly installed and tightened.
- 5) Confirm the range switch is in the proper position.
- 6) Install add-on resistor sticks if necessary for the range being tested.
- 7) Test the phase rotation meter with a proof tester such as the HD Electric PT-5000B (see page 6).

OPERATING INSTRUCTIONS *continued*

Phasing Measurements

We recommend that two person crews take the readings. Since the operation is occurring near two energized conductors, the use of two person crews allows each person to operate one stick and maintain high safety standards.

In order to take a reading, each probe must contact an energized line. Be sure that only those probes intended for the particular application are used (see page 6). Always keep the connecting cord free and clear of energized phases and ground.

The phase rotation meter requires three connections for proper operation. Always connect the ground lead first and only to a known good ground. After testing is complete, be certain to remove and isolate the main contact probes from all voltage sources prior to disconnecting the ground lead.

Take the Readings

To determine which of the two phases is leading or lagging, two separate readings are required.

READING 1: Place one probe (resistor stick) on each of the two phases being tested and take a reading.

READING 2: Reverse the probes (resistor sticks) so that they contact the same two phases but in the opposite direction, and take a reading.

FOR EXAMPLE: If in Reading 1 the probe with the meter on it was contacting Phase A and the probe with the junction box was contacting Phase B, then reverse them so the probe with the meter on it contacts Phase B and the probe with the junction box contacts Phase A.

Determining the Results

The resistor stick with the meter on it will show a higher indication when it is in contact with the leading phase. The meter indicates relative phase rotation. The resistor stick with the meter on the leading phase will indicate a reading of up to 100 at the maximum voltage for the range selected. The resistor stick with the meter on the lagging phase will indicate about 60% of the leading phase reading

For three phases there are three pairs of phases, so any two pairs should be tested as outlined above. For example, with three Phases A, B and C:

1. Test Phases A and B. A is determined to be leading B.
2. Test Phases A and C. C is determined to be leading A.

Now, A leads B from Step 1. C leads A from Step 2. Therefore, the rotation is C-A-B. This can also be written as A-B-C. This can be verified by testing the third pair of phases. Test Phases B and C. B is determined to be leading C.

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.**

OVERHEAD PROBES

- OLPS-5 brass hook probe
- 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 and exposed high voltage terminals.



INSULATED UNDERGROUND PROBE

- GCP-1 for general underground use on grounded terminals and exposed high voltage terminals.



ADD-ON RESISTOR STICKS

- R-69 for use on voltages above 15kV up to 45kV

PROOF TESTER

The PT-5000B Proof Tester will produce 5kVDC at the test leads to confirm proper operation of the phase rotation meter. The PT-5000B operates from one 9V alkaline battery and produces approximately 5kVDC at the connecting leads. To use:

- 1) Connect both tester leads to the phase rotation meter probes. Isolate the ground lead from ground or any other conductor and do not touch it during the test.
- 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 alkaline only.
- 4) Verify the phase rotation meter reads approximately 5kV.
- 5) Release the TEST buttons and disconnect the Tester from the phase rotation meter.



WARNING: Do not use the phase rotation meter if proper operation is not confirmed.

WARNING: Do not use this tester except as directed. Do not use to test equipment other than the phase rotation meter. 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.

LIMITED WARRANTY AND LIMITATION OF LIABILITY

This warranty applies to all products sold by HD Electric Company (the "Products"); provided, however, that the term Products does not include any third party products purchased through HD Electric Company, for which no warranties are made (the "Third Party Products"). Third Party Products may be subject to a separate manufacturer's warranty; [should you have any question regarding whether a separate warranty applies, please contact HD Electric Company].

NOTICE: READ THIS LIMITATION OF WARRANTY AND LIABILITY BEFORE BUYING OR USING THE PRODUCTS CONTAINED HEREIN.

It is impossible to eliminate all risks associated with the use of the Products. Risks of serious injury or death, including risks associated with electrocution, arcing and thermal burns, are inherent in work in and around energized electrical systems. Such risks arise from the wide variety of electrical systems and equipment to which Products may be applied, the manner of use or application, weather and environmental conditions or other unknown factors, all of which are beyond the control of HD Electric Company.

HD Electric Company does not agree to be an insurer of these risks.

WHEN YOU BUY OR USE THESE PRODUCTS, YOU AGREE TO ACCEPT THESE RISKS.

HD Electric Company warrants to the original purchaser that the Products (excluding any third party products purchased through HD Electric Company, for which no warranties are made) will be free from defects in material and workmanship, under normal use and regular service, and preventative maintenance for a period of one (1) year from the date of shipment (the "Warranty Period"). Should any failure to conform with this warranty be found during the Warranty Period, you must notify HD Electric Company of your claim within thirty (30) days of discovery, and within the Warranty Period. Your failure to give notice of claims of breach of warranty within the Warranty Period shall be deemed an absolute and unconditional waiver of claims for such defects. HD Electric Company will have no responsibility to honor claims received after the date the applicable Warranty Period expires.

Upon notice of your claim, HD Electric Company will provide a return authorization number, and further instructions on how to return the product for service. You must follow HD Electric Company's instruction. You are responsible for all Product removal, handling, re-installation, and shipping (both to and from HD Electric Company). Products returned for repair, as well as repaired or replacement Products shall be sent postage / freight prepaid. After receipt of a product which HD Electric Company determines is defective, HD Electric will, at its option, either (1) repair (or authorize the repair of) the Product or (2) replace the Product, subject to the following: The Products are made using parts sourced from a variety of manufacturers. Due to the rapidly changing technology environment, parts may become obsolete / unavailable over time (end of life). In the event that a Product cannot be repaired or replaced due to unavailability of parts, HD Electric Company will use commercially reasonable efforts to obtain substitute parts or conduct work around design, but cannot guarantee its ability to do so.

Items not found defective will be returned at your expense, or failing receipt of instruction from you on return of such items within five (5) business days of our notice to you that the product is not defective, HD Electric may dispose of the product at its discretion and with no liability to you. HD Electric Company's determination of defects is final. Products repaired or replaced during the Warranty Period shall be covered by the foregoing warranties for the remainder of the original Warranty Period or ninety (90) days from the date of delivery of the repaired or replaced Products, whichever is longer.

LIMITATIONS:

This warranty is void in the event of misuse, alteration, faulty installation, or misapplication of the product. This warranty does not cover failure of product or components due to any ACT OF NATURE; lightning, floods, hurricanes, tornadoes or any other such catastrophic events.

HD Electric Company does not warrant any third party products or associated hardware or their performance or suitability for use and application. Such items are provided "as-is".

All repairs must be authorized by HD Electric Company. Unauthorized repairs will not be reimbursed under any circumstances.

HD Electric Company is not required to make replacement or loaner equipment available while Products are being repaired or replaced, or to compensate you for any in/out labor charges or expenses associated with removal, handling or re-installation of the Products.

TO THE MAXIMUM EXTENT PERMITTED BY LAW, THIS WARRANTY AND THE REMEDIES SET FORTH ABOVE ARE EXCLUSIVE AND IN LIEU OF ALL OTHER WARRANTIES, REMEDIES AND CONDITIONS, WHETHER ORAL OR WRITTEN, EXPRESS OR IMPLIED. HD ELECTRIC EXPRESSLY DISCLAIMS ALL OTHER WARRANTIES OF ANY KIND, EXPRESS OR IMPLIED, INCLUDING WITHOUT LIMITATION IMPLIED WARRANTIES OF FITNESS FOR A PARTICULAR PURPOSE, MERCHANTABILITY AND NON-INFRINGEMENT.

IN NO EVENT SHALL HD ELECTRIC COMPANY BE LIABLE FOR ANY INCIDENTAL, CONSEQUENTIAL OR SPECIAL DAMAGES RESULTING FROM THE USE OR HANDLING OF THESE PRODUCTS. THIS SHALL INCLUDE BUT, NOT LIMITED TO, LOST PROFITS OR REVENUE, LOSS OF USE OF THE PRODUCTS, COST OF SUBSTITUTE PRODUCTS, FACILITIES OR SERVICES, OR DOWNTIME.

IN NO EVENT SHALL HD ELECTRIC COMPANY HAVE ANY LIABILITY FOR ANY THIRD PARTY PRODUCTS OR ASSOCIATED HARDWARE, OR CUSTOMER-OWNED SYSTEMS, EQUIPMENT OR SOFTWARE.

HD Electric Company must have prompt notice of any claim so that an immediate product inspection and investigation can be made. Buyer and all users shall promptly notify HD Electric Company of any claims, whether based on contract, negligence, strict liability, or other tort or otherwise be barred from any remedy.

HD Electric Company is committed to ongoing review and improvement of its product lines, and thus reserves the right to modify product design and specifications without notice.

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