



# PhaseID System

Phase Attribute Acquisition

Field Probe Instruction Manual  
U.S. Patent 6667610

# Operating Manual

## The PhaseID System Primary Distribution Phase Attribute Identification

Model MB-0414F Field Probe

<b>Table of Contents</b>	<b>Page</b>
Design .....	1
Safety Information .....	1
Specifications .....	1
Application.....	2
Operating Instructions .....	3
Adapters.....	7
Primary Phase Attribute Acquisition Procedure Using Ground Clip .....	7
Primary Phase Attribute Acquisition Procedure Without Using Ground Clip .....	8
Secondary Phase Attribute Acquisition Procedure Using Bushing Adapter .....	8
Phase Attribute Acquisition Procedure Using Secondary Adapter .....	9
Terms .....	10
Battery Replacement.....	11
Care of instrument.....	11
Why the ground reference clip is provided .....	11
Important Information .....	12
Common Mistakes.....	12

## Design

The PhaseID System Field Probe by the Origo Corporation is a portable device which permits an AC voltage phase measurement to be taken on distribution and transmission circuit line-to-ground voltages.

The probe consists of a 10 megohm resistor mounted inside a standard “hot stick” epoxy/fiberglass tube, an instrument box, and a ground cable and clip. The resistor limits probe-to-ground currents, when the ground cable is used, to less than 2 milliamperes at the maximum probe voltage rating of 20KV.

The probe is intended for intermittent application and has been tested to 2X rated voltage. The ground cable insulation is rated, but not tested, to 90KV.

The probe is designed to be used with a suitable universal hot stick. Keep the epoxy/fiberglass tube clean and dry. All precautions appropriate for the line voltage should be taken.

## Safety Information

The hot stick should be considered the sole voltage isolation device. For safety purposes the face plate and display compartment, battery cover and the entire PhaseID Field Probe should be considered to be at the same potential. Applying the metal portions or any conductive parts of the unit in any fashion across the air gap of adjacent phases or to ground, with the exception of the provided ground reference cable and clip, can cause a phase-to-phase or phase-to-ground fault.

At all times the user must follow the procedures contained within this manual to provide a safe and accurate method of acquiring phase attribute identification. Failure to do so can and will cause serious injury or death.

Special precautions must be taken when applying the line end of the Field Probe to any source of voltage, as the entire metal portion of the sampling end becomes energized.

## Specifications

Probe Body	Standard 1.25” Epoxy Tube
Length / Weight	26”L <3 lbs.
Phase Acquisition Rate	Nominal 3 sec.
Operation	One-Button Operation
Operating Status Display	Hi-Lumen Daylight Visible LEDs
Phase Indication Display	LCD
Ground Cable	Self-Coiling 90KV insulated
Retracted Length	24”
Extended Length	10 feet
Phase-to-Ground Input Voltage	120V – 20KV (touching, ground cable attached)
Phase-to-Ground Input Voltage	7KV – 66KV (touching, without ground cable)
Phase-to-Ground Input Voltage	above 66KV (proximity, without ground wire)
Battery	3 AAA

## Application

The PhaseID System was developed specifically to measure and display the primary phase attribute on all distribution and sub-transmission voltages for the electric utility industry. The PhaseID System allows accurate measurement of primary phase attributes, A, B, C, Wye or Delta while at the same time providing the user with a specific 'in or out' secondary phase attribute. Varieties of methods are explained below and are available for the user to choose from when gathering phase attribute data.

### Direct Primary Bare Conductor/Buss Contact

Primary phase identification can be acquired by simply touching the provided Primary Bushing Adapter MB0414P to any bare primary voltage equipment with a source voltage ranging from 1000V phase-to-ground up to and including 20KV phase-to-ground (35KV phase-to-phase). For voltages above 20KV phase-to-ground, the ground cable can be left unattached.

### Secondary Voltage

Primary phase identification can be performed by sampling any secondary voltage, 120V to 1000V, from live-front devices, commercial service sections, customer home panels, household outlets, or anywhere secondary voltage can be contacted to the Field Probe. A Secondary Adapter, MB-0414S, is provided for use with household outlets and provides the user with a resistive blocking of dangerous secondary voltages from the exposed metal end of the probe.

**When using the Secondary Adapter (old design), the supplied self-coiled ground clip must be attached to the shoulder bolt on the side of the adapter. When using the Secondary Adapter (new design), insert the adapter ground wire into the Field Probe ground connector. Without this ground attached, an inaccurate phase attribute may be acquired or the unit may simply not take a reading.**

### Dead-Front Test Points

Primary phase identification can be acquired through a capacitive coupling of voltage by attaching the provided Primary Bushing Adapter MB0414P to the female-threaded end of the Field Probe. Once attached, the user can place the metal end of the adapter against any test point of either primary elbows or splices.

**When taking measurements on capacitive coupled test points, the supplied self-coiled ground clip must be attached to ground near the test point. Without this ground attached, an inaccurate phase attribute may be acquired or the unit may simply not take a reading.**

### In-Phase or Out-Phase Secondary Identification

An added feature of the PhaseID System is its ability to automatically identify secondary in-phase and out-phase attributes. That is, wye-wye connected secondary attributes will be identified as A, -A, B, -B, C, or -C and delta-wye connected secondary attributes will be identified as AB, -AB, BC, -BC, CA, or -CA.

The minus sign leading the attribute indicates out-phase (secondary out-of-phase with primary). Two letter attributes indicate the 2 primary phases feeding a delta-wye connected secondary.

These features give the user the capability to do load analysis on secondary systems within any client or customer electric system without the need for circuit tracing.

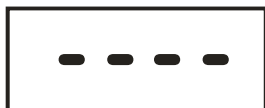
## Operating Instructions

After installation and setup of the PhaseID Base Station, the PhaseID Field Probe is ready for phase acquisition anywhere on your system.

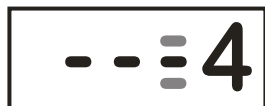
The Field Probe is controlled by a single push button switch located on the hot stick attachment end of the Field Probe control box directly below the status indicator LEDs. These LEDs are daylight visible. The display panel uses a 4-digit display when indicating the phase code to the user.

Set the hard case on a flat surface, open it, and rotate the probe 90 degrees so that the front panel is facing skyward as the GPS antenna is mounted under the front panel. Turn on the instrument and allow it to acquire satellites.

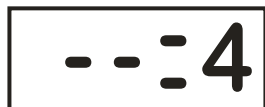
1. To turn on the field probe (old software), press and hold the push button switch for at least 2 seconds and then release it. When released, 4 dashes will be displayed on the LCD and the LED lamp test will commence by momentarily turning on the lamps in the sequence of yellow, red, and green. To turn on the field probe (new software), press and hold the push button switch until the lamp test commences, then release it.



2. After powering up, the right digit on the LCD will indicate the number of GPS satellites in view (0 to 9). As the field probe searches for satellites, a top and bottom dash will blink in the first digit position to its left.



3. When 4 to 9 satellites have been found, the center dash between the two blinking ones will extinguish, indicating a position lock has been found by the GPS. The rightmost digit will now display the number of GPS satellites used in the position fix.



4. When timing lock has been achieved, the two leftmost digits will change from dashes to the letters **HI**. This indicates that the field probe is now in the '**MEASURE MODE**' and is ready to probe voltages **OVER** 1000 volts (with the ground cable attached). The rightmost digit indicates the number of satellites used in the timing lock solution. As long as 1 satellite is available, GPS timing lock will be maintained.



- 'SHORT PRESSING' the push button, (holding it less than one second), will toggle between the **HI** and **LO** positions. Use the **LO** position to sample all voltages in which the ground cable is not attached, and all voltages less than 1000 volts when the ground cable is attached. Use the **HI** position only when the ground cable is attached and the voltage is over 1000 volts.

**Dead-Front Note:** The voltages measured at test points are capacitive-coupled and are at very low voltages. Since these voltages are so low, the field probe is set at a threshold to match the voltage present on test points of 7200V line-ground systems. Usage of the probe on dead-front test points of lower distribution voltages will not acquire a reading. The ground cable must be attached for all test point measurements. Attach the ground clip to the concentric on the cable with the test point elbow.

**Note:** 'LONG PRESSING' the push button, (holding it more than 2 seconds), until the -LP- is displayed will turn the field probe off when the unit is in the HI or LO regions of the '**MEASURE MODE**'.



- Contacting the field probe to a voltage source will illuminate the yellow lamp. The green lamp will blink a number of times and then turn on and the yellow lamp will turn off. A steady green lamp indicates that the field probe has made a phase measurement and is now in the '**DISPLAY MODE**'. The LCD will display **-PH-**, indicating phase attribute acquisition is complete.

-PH-



- 'SHORT PRESSING' the push button will extinguish the green lamp and display the first of three phase code sequences. The first digit will always be 1, indicating the first code is being displayed. 'SHORT PRESSING' the button again will display the second code sequence of which the first digit will always be 2. 'SHORT PRESSING' the button further will display the third code sequence. Continuing to 'SHORT PRESS' will display the three sequences again in the same order over and over.

1J7E

Short press,



The resulting phase code in the above sequences would be relayed or communicated to the Base Station personnel as,

**“The first code is Juliet, Seven, Echo.”**

The base station operator would then read back

**“Juliet, Seven, Echo.”**

If the read back code is correct, the probe operator would then “short press” the push button and relay the second sequence. If the read back code is incorrect, the probe operator would repeat the first sequence again.

**“The second code is Zero, Charlie, Papa.”**

The base station operator would then read back

**“Zero, Charlie, Papa.”**

If the read back code is correct, the probe operator would then “short press” the push button and relay the third sequence. If the read back code is incorrect, the probe operator would repeat the second sequence again.

**“The third code is Alpha, Alpha, Two.”**

The base station operator would then read back

**“Alpha, Alpha, Two.”**

If the read back code is correct, the probe operator would then relay the connection type. If the read back code is incorrect, the probe operator would repeat the third sequence again.

**“The connection is Primary.”**

The base station operator would then read back

**“Primary.”**

If the read back connection is incorrect, the probe operator would repeat the connection type again.

The connection is **Primary** if the measurement is taken on primary feeders.

The connection is **Secondary** if the measurement is taken on secondary conductors or 120V outlets.

The connection is **Capacitive** if the measurement is taken on dead front test points or on primary transmission lines or feeders without attaching the ground cable and clip to ground.

**In summary, what is needed from the field is:**

1. **Phase Code (See note below)**
2. **Connection (Primary, Secondary, or Capacitive)**

**Note:** Although there is a mention of the numeric code sequence number (first, second, or third) during the verbal communication between the field and the base, it is not entered into the PC at the Base Station. Instead, its mention is to notify the Base Station operator of the correct sequence when entering the code and provides a consistent method of communicating the codes to the Base Station personnel. The Base Station software does not require the sequence number to be physically entered but does display the sequence number, grayed-out before the input area. Also, if the measurement was obtained on a previous day, the date at which the measurement was taken must also be communicated to the base operator.

8. Pressing the push button and holding it until the **-LP-** is displayed will return the field probe to **'MEASURE MODE'** where either another phase measurement can be taken or the unit can be turned off as before.

**-LP-**

9. If no satellites are in view while in “measurement” mode for more than 5 minutes, the red lamp will turn on. This indicates that the field probe has been out of contact with GPS satellites for too long. The probe must be carried outside to obtain GPS timing lock again.

**LO:O**



10. If the LCD displays **LO BAT**, turn it off and replace the batteries.

**LO BAT**

11. All field probes incorporate theft prevention software to recognize the licensed area of the Base Station. If the field probe is outside its designated service area, **LOC** will be displayed and the probe will power off.

**LOC**

**Note:** If a processor error occurs for any reason, the instrument will automatically reboot. This is indicated by a lamp test.

In rare situations, the processor may lockup. Simply remove and reinstall the batteries to reboot the probe.

## Adapters

Bushing Adapter: Pad-mounted primary bushing.  
Bare OH conductors.  
Elbow test points on distribution voltages higher than 7000V line-ground  
Bare secondary buss work or spades.  
See Secondary Adapter Note.

Overhead Hook Adapter: Bare OH conductors.  
Bare substation primary buss.

Secondary Adapter: Typical 120V household outlet.

**Note:** The bare aluminum skirt where the adapters thread into the field probe is current limited only when the Secondary Adapter is installed. Without the use of this adapter, the skirt is energized at full voltage with no current limiting. Always use caution handling exposed parts when energized.

## Primary Phase Attribute Acquisition Procedure Using Ground Clip

1. Use Bushing Adapter. Attach probe to a pre-approved hot stick.
2. Following the instructions, ready the field probe for 'MEASURE MODE'.

**IMPORTANT: DO NOT APPLY TO ENERGIZED EQUIPMENT UNTIL THE INSTRUMENT IS DISPLAYING "HI" or "LO".**

3. Once lock has been established, select the appropriate setting for the voltage being sampled.

HI=4
OR
LO=4

4. Attach the ground clip onto any available grounding source to earth or neutral.
5. Place the bushing adapter against the energized conductor in question.

6. The yellow indicator light will glow steadily once voltage contact is made and the green indicator light will blink 2 or more times and then light steady when the attribute is acquired. Remove the unit from the conductor and immediately enter 'DISPLAY MODE' by applying a 'SHORT PRESS' to the control button. This will extinguish the green light and display **-PH-** on the LCD.

**Note: If poor contact or unsteady application of the probe against the conductor occurs, the yellow light will go off, indicating no voltage is present. Hold firmly and steady against any conductor. Clean conductors are important.**

7. Communicate your phase codes to the base station or record them for later communication or direct entry into the base station computer. Be sure to indicate the connection is **Primary**.

## Primary Phase Attribute Acquisition Procedure Without Using Ground Clip

1. Use the Bushing Adapter or Overhead Hook Adapter. Attach probe to a pre-approved hot stick.
2. On the old probe design, wrap the probe ground cable around the rear end of the probe and attach the clip securely to the cable ground terminal (the copper terminal attaching the ground cable to the probe body). On the new probe design, simply remove the ground cable.
3. Following the instructions, ready the field probe for 'MEASURE MODE'.
  - a. **IMPORTANT: DO NOT APPLY TO ENERGIZED EQUIPMENT UNTIL THE INSTRUMENT IS DISPLAYING "HI" or "LO".**
4. Once lock has been established, select the LO setting.

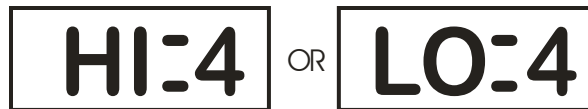
**LO=4**

5. For line-to-ground voltages at or below 66KV (115KV line-to-line), place the bushing adapter against the energized conductor in question. For voltages greater than 66KV line-to-ground, place the bushing adapter close enough to (but not touching) the energized conductor in question so that a steady yellow light is obtained.
6. The yellow indicator light will glow steadily once voltage contact is made and the green indicator light will blink 2 or more times and then light steady when the attribute is acquired. Remove the unit from the conductor and immediately enter 'DISPLAY MODE' by applying a 'SHORT PRESS' to the control button. This will extinguish the green light and display **-PH-** on the LCD.
7. Communicate your phase codes to the base station or record them for later communication or direct entry into the base station computer. Be sure to indicate the connection is **Capacitive**.

## Secondary Phase Attribute Acquisition Procedure Using Bushing Adapter

1. Use Bushing Adapter. Attach probe to a pre-approved hot stick.

2. Following the instructions, ready the field probe for 'MEASURE MODE'.
  - a. **IMPORTANT: DO NOT APPLY TO ENERGIZED EQUIPMENT UNTIL THE INSTRUMENT IS DISPLAYING "HI" or "LO".**
3. Once lock has been established, select the appropriate setting for the voltage being sampled.



4. Attach the ground clip onto any available grounding source to earth or neutral.
5. Place the bushing adapter against the energized conductor in question.
6. The yellow indicator light will glow steadily once voltage contact is made and the green indicator light will blink 2 or more times and then light steady when the attribute is acquired. Remove the unit from the conductor and immediately enter 'DISPLAY MODE' by applying a 'SHORT PRESS' to the control button. This will extinguish the green light and display **-PH-** on the LCD.
  - a. **Note: If poor contact or unsteady application of the probe against the conductor occurs, the yellow light will go off, indicating no voltage is present. Hold firmly and steady against any conductor. Clean conductors are important.**
7. Communicate your phase codes to the base station or record them for later communication or direct entry into the base station computer. Be sure to indicate the connection is **Secondary**.

## Phase Attribute Acquisition Procedure Using Secondary Adapter

1. Use Secondary Adapter. A hot stick is not required.
2. On the old probe design, attach the ground clip to the shoulder bolt on the side of the Secondary Adapter. On the new probe design, insert the adapter ground wire into the Field Probe ground connector.
3. Following the instructions, ready the field probe for 'MEASURE MODE'.
  - a. **IMPORTANT: DO NOT APPLY TO ENERGIZED EQUIPMENT UNTIL THE INSTRUMENT IS DISPLAYING "HI" or "LO".**
4. Once lock has been established, select the LO setting.



5. Plug the Secondary Adapter line cord into a 120V outlet.

6. The yellow indicator light will glow steadily once voltage contact is made and the green indicator light will blink 2 or more times and then light steady when the attribute is acquired. Remove the unit from the conductor and immediately enter 'DISPLAY MODE' by applying a 'SHORT PRESS' to the control button. This will extinguish the green light and display **-PH-** on the LCD.
7. Communicate your phase codes to the base station or record them for later communication or direct entry into the base station computer. Be sure to indicate the connection is **Secondary**.

## Terms

Lamp Test:	This is the start procedure the instrument goes through whenever the unit is turned on or rebooted. The light panel flashes yellow, red, green, then all lights extinguish.
Measure Mode:	The region within the field probe where the user can sample voltages for phase attribute acquisition. This is displayed to the user by a HI or LO voltage selection indication followed by the number of satellites locked by the unit.
Display Mode:	The region within the field probe where the user can display the acquired phase attribute code and record data for entering into the Base Station.
Secondary Adapter:	This adapter is used to sample secondary voltages by inserting the plug into any ordinary household 120V outlet. Be sure to attach the supplied self-coiled ground clip to the shoulder bolt on the side of the adapter (old design) or insert the adapter ground wire into the Field Probe ground connector (new design). <b>MEASURE MODE = LO</b> <b>CONNECTION = Secondary</b>
Bushing Adapter:	This adapter is primarily used for sampling primary voltages on pad-mounted transformer bushings, but can also be used for direct contact on bare OH conductors. <b>MEASURE MODE = Voltage dependant, HI or LO</b> <b>CONNECTION = Primary, Secondary, or Capacitive</b>
OH Hook Adapter:	This adapter is used for sampling primary voltages on high OH cables or buss WITHOUT the ground wire attached. Simply hook the adapter over the conductor. <b>MEASURE MODE = LO</b> <b>CONNECTION = Capacitive</b>
Primary Connection:	The connection is Primary if the measurement is taken on primary distribution or transmission cables with the ground cable attached. The phase attribute will be indicated as A, B, or C. <b>MEASURE MODE = Voltage dependant, HI or LO</b> <b>CONNECTION = Primary</b>
Secondary Connection:	The connection is Secondary if the measurement is taken on secondary conductors or 120V outlets. The phase attribute will be indicated as A, -A, B, -B, C, -C, AB, -AB, BC, -BC, CA, or -CA. <b>MEASURE MODE = Voltage dependant, HI or LO</b>

Capacitive Connection: The connection is Capacitive if the measurement is taken on dead front test points with the ground cable and clip attached to ground. The connection is also Capacitive if the measurement is taken on primary transmission lines or feeders without attaching the ground cable and clip to ground. The phase attribute will be indicated as A, B, or C.

**MEASURE MODE = LO**  
**CONNECTION = Capacitive**

## Battery Replacement

Unscrew the round battery holder lid and remove and discard the old batteries.

After removing the battery lid, set it in the hard case to prevent getting dirt on the threads.

Insert 2 batteries, positive end first, into battery tube.

Insert 1 battery, negative end first, into battery holder lid.

Screw battery lid into battery tube. Be careful not to cross thread it during initial thread engagement. Do not over tighten. Simply snug up the lid against the neoprene o-ring.

As soon as the battery holder lid contacts the battery tube, the instrument will power up. If it doesn't turn on, remove the lid and try again. It may be necessary to wait 10 to 15 seconds before trying again to allow the internal circuits to discharge. After it completes the lamp test, it can be turned off in the normal fashion by pressing and holding the push button until the **-LP-** appears.

The instrument consumes a small amount of battery power even when turned off. If the field probe is not going to be used for a few weeks, remove one or more of the batteries to prevent them from discharging.

## Care of instrument

Treat the instrument like an expensive digital camera. Always place unused adapters in the hard case to keep the threads clean and free of dirt. After use, return the instrument directly to the hard case. Don't lean it up against the truck or other surface where it can tip over or fall.

## Why the ground reference clip is provided

Voltages are always measured with respect to two points. To obtain phase attribute identification, the phase voltage measurement must be taken with respect to ground. Without a ground reference clip (instrument floating), the instrument case (instrument circuit ground) will capacitive reference itself to its surroundings.

If a second phase voltage is much closer to the instrument case than earth ground, the phase voltage measurement will be taken with respect to this second phase voltage instead of with respect to earth ground. Without a ground reference clip, a phase shift will occur. The magnitude of this shift depends on the physical geometry of the measurement situation.

Although this phase shift is not a problem with primary phase attribute determinations, it is still a good practice to use the ground connection whenever possible.

The ground cable must be used on dead front test points and Secondary connections. For more technical information, see “Phase Attributes Measurements” posted under White Papers at [www.origocorp.com](http://www.origocorp.com).

## Important Information

The Field Probe GPS antenna is mounted under the phonetic translator portion of the instrument panel label. When powering on, always hold the Field Probe horizontal with the label pointing skyward until GPS satellites are acquired and HI is displayed. For fastest lockup, select an unobstructed location. Try to point the label skyward as often as possible, before and after taking a phase measurement, to maintain lock.

Liquid Crystal Displays don't like temperature extremes. In the dead of winter, carry the probe in your cab. On very hot sunny days, place the probe in the shade when not in use.

Always store the Field Probe and adapters in the supplied hard case. Place the battery lid and adapters in the case, while replacing batteries or changing adapters. Don't set them where their threads can pick up dirt.

## Common Mistakes

Not holding the probe horizontal with the label pointing skyward in an unobstructed location when turning the probe on. If the probe doesn't have a clear view of the sky, it will take a very long time to lock up.

Performing a second “short press”. Always wait at least one second after a “short press” to obtain a change on the LCD display. In measure mode, two fast short presses will cause the voltage indication to toggle twice (HI-to-LO-to-HI or LO-to-HI-to-LO) before the LCD can change. To the user, it appears that the push button is not working because the display doesn't toggle.

Forgetting to attach the ground clip to the shoulder bolt on the Secondary Adapter. Without the ground, the yellow light will either not illuminate or it will blink at a high rate and no phase measurement (steady green light) will be obtained.

Always make sure the ground cable is attached and you have a good ground connection when probing elbow test points. Connect the ground clip to the concentric on the elbow's URD cable. If the concentric is tarnished or corroded, use the alligator clip teeth to scratch through the surface insulation to obtain a good ground connection.

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