How to Choose a Phase Identification System

No Longer New Technology

Phase identification systems from multiple vendors have now been in service since 2003. The PhaseID System from Origo has been thoroughly field proven, having been used by multiple utilities to identify tens of thousands of phase attributes from 120V to greater than 500KV.

Although each vendor has implemented their phase identification tools differently, they all operate using the same basic concept. That is, a GPS timing signal allows an instantaneous phase measurement to be taken at a known reference phase location and an unknown field location at the same instant of time. When these two phase measurements are compared, the phase attribute at the field location can be identified.

We know you have a choice of suppliers when you purchase a phase identification system. However, when you fully understand how the Origo PhaseID System operates, and why it was designed the way it is, you will be convinced that the Origo system is the best choice for your utility.

Origo System Designed for Field Simplicity

The primary design goal of the Origo PhaseID System was to give field operators a very simple portable instrument that does not require them to keep track of tagging reference phases in different parts of their utility. All the field operator is required to do is obtain a field measurement. The phase attribute interpretation of that measurement is automatically determined by the base station computer, as originally setup by inputs from the distribution engineer. Here is a typical example.

The utility has a 12KV wye distribution system on the east side of town and a 12KV delta system on the west side. Each section has it own tagging reference “A” phase and they are separated from each other by 30 degrees. The 12KV substations are fed by 69KV which have their own tagging reference phase, some of which may be rotated 30 degrees from the 12KV distribution voltages. The utility also has 115KV and 345KV transmission voltages, each of which have their own tagging reference phases.

So now, a field operator is tasked with obtaining a phase attribute at some location in the utility. How does the field operator know what the tagging reference phase is at that location and its offset from the base station reference phase? Chances are they don’t. With the Origo PhaseID System, they don’t have to know because configuration files on the base station computer keeps track of it for them.

With the Origo system, only one base station is required which can be at any point within the regional power grid in which the utility is located. The AC voltage at all nodes in the utility are synchronized, but separated from one another by some multiple of 30 degrees. It is the Origo base station computer’s job to keep track of these offsets and their tagging reference phases. Here is how it works.

The base station wall socket phase measurement is recorded and stored in a file every GPS second. The base station wall socket phase attribute, with respect to the tagging reference phase for the east side of town, is entered into the base station setup screen and stored in a configuration file called East_12KV.pid. The wall socket phase attribute, with respect to the tagging reference phase for the west side of town is also entered and saved in a configuration file called West_12KV.pid. Likewise, configura-

tion files 69KV.pid, 115KV.pid, and 345KV.pid are also created for the 69KV, 115KV, and 345KV transmission voltages respectively.

Now, when a field operator obtains a measurement on the west side of town, he simply opens the West_12KV.pid configuration file and enters the field measurement sequence. Instantly and accurately, the computer indicates the phase attribute at the field location without requiring the field operator to perform any offset calculations or set any switches on the field instrument. That is, the Origo system keeps it simple for the field operator.

In contrast, competing phase identification systems either require a separate base station to be placed at each tagging reference phase substation or the offsets must be known by the field operator and set into the field instrument.

Origo PhaseID System Designed for the Way You Use it.

Different utilities have different phase identification needs. Small coops may require a low cost phase identification system since they only need to identify a few phases per month as they add new construction. At the other extreme, large utilities may be installing a Distribution Automation Management System that requires obtaining hundreds of thousands of phase attribute measurements. To handle these highly divergent requirements, Origo offers both a low cost manual system for small utilities and an automated real-time system for large utilities.

Potential Origo customers sometimes expressed concern about the fact that our manual PhaseID System does not indicate phase attributes in real-time. However, actual customers soon learned that real-time phase attribute indication is not a requirement and sometimes not worth the extra complexity and cost required to provide it. Here's why.

As a first example, if you only need to identify a few phase attributes during new construction, you are most likely in contact with dispatch to obtain clearances, etc. If so, it takes a minute or so to call in the measurement sequence displayed on the field probe display to your dispatcher, wait for him to enter the sequence in the base station computer, and relay the phase attribute back to you.

As a second example, if you are updating distribution maps or creating a phase attribute data base, phase attributes are usually not required by the field operator as they are gathered. Instead, engineering will typically prepare lists of conductors to be identified for the field operator. The field operator's main task is to gather the field measurements as quickly and efficiently as possible. Once the field measurements have been gathered, data entry operators can enter the measurements into the base station to convert them into phase attributes and update the maps or database.

In both these situations, real-time phase identification is not mandatory. In the second example, the more important requirement is to acquire the field measurements as rapidly as possible. To optimize rapid phase measurements, the Origo manual PhaseID System was designed to be as portable and simple to operate as possible. Here is how.

First of all, the Origo Lineman field probe is a single self contained unit that only weighs 3 lbs. It can be left turned on all day as the field operator gathers measurements so there is no delay for GPS or cell phone modem lockup (as occurs with other phase identification systems) between readings.

Using custom forms or a map stamp, linemen can very rapidly move from conductor to conductor and write the measurement sequences in the blanks provided. Large customers report the error rate on re-

corded sequences is typically less than 2 out of every 100 readings, which is more than acceptable given the speed at which measurements can be gathered. Erroneous readings are rejected by the base station so no phase attribute error occurs. Erroneous readings are simply retaken later.

Another advantage of the Origo system is that multiple crews can gather measurements simultaneously, using a single base station, without interference. Competing cell phone systems can only handle a single call at a time. If multiple crews are continually gathering measurements at the same time, most of them will get a busy signal and will have to wait until another crew completes their measurements and turns off their field instrument.

Once locked, the Origo field probe only requires one visible GPS satellite to maintain timing lock. Even without any satellites, timing is maintained for at least 5 minutes. Therefore, the Origo field probe can be used inside totally shielded buildings or vaults.

The Origo system also identifies all 12 secondary phase attributes. This allows the base station to be plugged into any 120V wall outlet anywhere. There is no requirement that the base station be placed at the tagging reference phase substation.

The Origo system automatically identifies the primary or primaries feeding a wye or delta connected transformer simply by measuring the phase attribute at the low voltage secondary. For example, if the secondary phase attribute is "–BC", this indicates that the secondary is out-of-phase from a delta transformer connected across primaries "B" and "C". This feature allows any utility personnel (even non-lineman) to identify the primary phase attribute feeding a building when using the Origo field probe 120V wall socket adapter.

If you are outside the cell coverage area and absolutely have to know the phase attributes at the field location site, the Origo system allows you to contact the base station via any available means of communication, without having to drive back to cellular range. Dispatch radio, landline telephone, cell phone, Internet, E-mail, satellite data link, or satellite phone are all forms of communication that can be used to transfer measurement sequences to the base station and receive back phase attributes.

This is very useful because many outlying farms and small remote towns don't have cellular coverage, but all have wired phone service. With a satellite phone, which some utilities already own, a lineman is never out of contact with the base station.

Recently, Origo has added a non-contact Handheld field probe version that allows phase attributes to be obtained on high overhead lines while standing at ground level (extendo stick not required). The Handheld field probe can also be used to obtain phase attributes at residential meters by meter readers or other lower cost non-lineman personnel.

Origo has also added our real-time PhaseID Datalogger™ version to both the Lineman and Handheld models. The Datalogger models retain all the features of our manual PhaseID System but use bluetooth communication to automatically store measurement phase and GPS location to a field PC. With field PC Internet access, the phase attribute is instantly indicated on both the field probe and field PC in real-time. Any number of field probes can be used with a single base station.

Remote Base Stations

To lower the system cost and make phase identification available to even the smallest utilities, the Origo PhaseID System provides a network of remote base stations. Using remote base stations, utilities only

have to purchase a field probe. After gathering phase measurements, the user simply downloads the latest data file from the closest Origo remote base station. Storing this data file in the base station computer data directory allows the phase attributes to be determined in the same manner as using a utility owned local base station. The remote base station also serves as a backup in the event data from the utility's own local base station is lost due to a computer failure or any other cause.

With the PhaseID Datalogger™ models, measurements stored on the field PC can be batch decoded to phase attributes by downloading or copying the base station data file into the field PC.

Within a utility, the local base station data can be stored to a server file so any networked PC can access it. This allows multiple organizations at multiple locations to convert phase measurements into phase attributes. It also allows field operators to contact anyone running the base station software to convert sequences for them if they are needed immediately. The software is so easy to use that anyone who can operate a mouse can enter data and retrieve field phase attributes.

Simple to Learn

Using the Origo field probe to gather field measurements is very simple. Only one button is required to command all its functions. Likewise, entering data into the base station software is also trivial as only mouse clicks are required.

In our experience, the only area of difficulty new customers experience is understanding the concept of phase attributes and understanding the benefits of additional configuration files.

Origo posts a number of white papers at www.origocorp.com that explain all aspects of the theory and operational use of the PhaseID System. However, since most people don't like to read instruction manuals, we have found the best training technique is to offer telephone support to your lead engineer or individual assigned to setup and use the PhaseID System. Once this individual understands the system they have no difficulty teaching other utility members how to use it.

We have found that on-going telephone technical support is better than a one-time training demo because most user questions occur upon encountering a new measuring situation, after using the system for awhile gathering routine phases. Usually, the questions are not on using the equipment, but rather on understanding the meaning of the measurement results.

For example, a number of 12KV substations are fed from a common 115KV transmission line, but there is a 30 or 60 degree phase difference between the tagging reference "A" phase of 12KV substation Alpha and the tagging reference "A" phase of 12KV substation Bravo when none was expected. The reason is because either an intermediate transformer voltage occurred between the 115KV and 12KV or a wye connected transformer was used to fed one substation and a delta connected transformer was used to fed the other.

Our explanation is to create multiple base station configuration files, for the differing voltages and substations, that convert the base station wall outlet reference phase to the tagging reference phase assumed for each voltage class and substation.

After helping the lead individual though a few practical situations, we find they soon understand how to interpret future encounters themselves.

Keep it Simple

There are multiple new technology methods available today to either store field measurements or provide real-time communications to the base station. However, all of the available methods add complexity and cost to phase identification systems.

It is very straight forward to provide automatic phase attribute determination for a small utility that has a single distribution voltage, a single tagging reference phase, and a single phase identification field unit. This is precisely the situation for which all other real-time phase identification tools were designed. The user attaches the base station to the substation tagging reference "A" phase and the user identifies phase attributes on the distribution voltages originating from that substation. As long as the field probe cell phone can communicate with the cell phone in the base station, everything works fine and no 30 degree phase offsets occur.

However, it is important to note that these systems do not duplicate the Origo system which automatically services multiple voltages in multiple areas with differing tagging reference phases, uses a single base station, does not require the field operator to be aware of the tagging reference phase, and allows all users to gather measurements at the same time.

Also, systems that use cell phone real-time communication links require a dedicated phone line at the base station and monthly service fees for each field probe cell phone. Origo feels this would add a considerable on-going expense for our large customers who operate 30 to 50 field probes. Origo customers avoid this added expense by using our Manual field probes, our Datalogger field probes in non-real-time mode, or our Internet based (real-time) Datalogger™ field probes.

Origo's philosophy has been to "keep it simple" for the field operator. The result is a small lightweight single unit field probe that is trivially easy to transport and use. It also doesn't require the field operator to keep track of tagging reference phases and offsets for each of the utility's different areas and voltages, from which the operator may be required to gather phase measurements.

Our Handheld models now make it possible for non-lineman to determine primary phase attributes by simply holding the probe close to residential meters.

Bottom Line

The bottom line at most utilities is the cost of purchasing tools and equipment. The Origo PhaseID field probes fall under the capital budget threshold at many utilities and are inexpensive enough to purchase for any field crews that have a need for them. No longer should any utility have to forgo the benefits of phase identification due to equipment cost.

Origo is confident that when you examine the tradeoffs between the various phase identification systems, the Origo PhaseID System will be your obvious choice.

Contact: Greg Piesinger
Origo Corporation
www.origocorp.com
480-473-1995
gpiesinger@origocorp.com

