



Phase Attribute Identification using GPS Technology

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Topics of Discussion

- Remote Phase Identification
- How it works
- Principals of operation
- Benefits
- Identified uses
- Case studies

Remote Phase Identification

- New innovative technology allows the phase attribute of any energised conductor to be determined by using a GPS timing signal
- Simultaneous measurement of a phase at a reference location and at a field location is taken
- Can be used on any voltage
- Two parts to the system - a base station and a field probe

Phase Identification System



How it works

- Every GPS second the base station measures a reference phase using any standard 240V outlet. The base station stores this phase characteristics along with the GPS second at which it was taken in a data file on the base station PC
- When the field probe touches an energised conductor a phase measurement is taken at the next GPS second and encoded along with the GPS second at which it was taken into a 9-digit sequence
- When the 9-digit sequence is entered into the base station PC it retrieves the 240V outlet phase taken at the same GPS second, compares it to the field reading, then determines the field location phase attribute

Principal of Operation

- A timing signal from the Global Positioning System (GPS) is used to simultaneously measure voltage phase at a reference location and at a field location in a 3-phase power system, and the readings are compared
- Since the phase attribute at the reference location is known, the phase attribute at the field location can be determined
- In the Phase ID System, a GPS timing signal is used at both the reference and field locations to take the snapshots

Benefits

- The Phase ID System does not require a real time data link to operate
- When phase identifying an entire neighbourhood or feeder there is no reason the field probe operator needs to know the phase attributes as they are being measured
- The 9-digit sequence can simply be recorded on a measurement form and entered into the base station PC after all measurements are completed
- When immediate identification of phase attribute are required, the Phase ID System allows phase data to be communicated to the base operator via radio or mobile phone.
- The base operator inputs the 9-digit sequence which identifies the phase attribute and can notify the field operator immediately.

Benefits (continued)

- The Phase ID System can be used by lower cost unskilled workers
- The field probe is operated by a single push button switch. It has two modes, Measurement Mode and Display Mode.
- Primary voltage phase measurements require suitably qualified and authorised workers to obtain measurements (MV, HV)
- Secondary voltage phase measurements could be done by almost anyone via a 240V outlet
- Base station inputting of the 9-digit sequence can be undertaken by anyone who can use a mouse, once the reference file has been established.

Identified uses

- Identifying phase attributes in LV, MV and HV Networks for reference and mapping purposes
- Load Balancing of any three phase distribution networks by identifying connection arrangements
- Identification of phase attributes in the design phase of projects

Case Study 1 - MV Feeder Load Balancing

- Phase attributes required to be obtained from several three phase MV distribution networks with multiple single phase spurs
- Estimated length of three phase main lines - 150km
- Estimated single phase spurs - 80
- Estimated time to drive the lines pole for pole manually mapping configuration - 200 labour and vehicle hrs
- Time taken to survey feeders utilising Phase ID System - 24 labour and vehicle hrs
- Additional advantage of reduced risk of human error from manually mapping network

Case Study 2 – New Zone Substation commissioning

- Project – to identify the phase attributes of 9 existing feeders to allow connection of a new Zone Substation between two existing Zone Substations
- Time to identify phase attributes – 6 hrs
- Estimated labour savings to project – 300 hrs plus
- Additional cost savings included – limited switching requests – correct phase connections first time – no need to alter physical location of heavy non flexible cables
- Additional advantage of reduced risk of human error from manually mapping network

Case Study 3 – Phasing MV Network

- Project – interconnection of three MV feeders from a common Zone Sub
- Identify phase attributes at three connection points on existing network
- Allowed design of bridging of new interconnection network to align with existing phase attributes
- Time to identify phase attributes 1 hr
- Estimated labour saving of 100 hrs
- Added benefits - no requirement for additional switching requests, access permits, customer outage time, plant availability etc, etc.
- Base station located in Coffs Harbour, NSW, Mid North Coast
- Field work undertaken in Narromine, NSW, Central West.
- Distance between base station and field probe >600km's

Conclusion

- The use of GPS technology is proving to be of great benefit to our organisation with the introduction of the Phase Identification System
- We have experienced huge cost savings in labour and plant in identifying phase attributes
- The ability to pre determine network connection requirements in the design phase of a project eliminates the possible need to have to alter bridging and terminations after the energising of a network has identified an “out of phase” situation.
- Networks will improve over time with the better load balance management

Questions

- Thank you