GE
Grid Solutions

MiCOM Agile P14N-B & P145-B

Fully-Numerical High-Impedance Busbar Differential Protection

The P14N-B and P145-B have been customised for high impedance busbar differential protection application but can also be used for motor, transformer (REF), reactor and generator differential protection. They provide high stability similar to electromechanical/ static high impedance relays with the added benefits of numerical technology.

Fast, Simple and Reliable Busbar Protection: Numerical Solution with Full Scheme Supervision

Power system busbars are a key node in the delivery of energy to consumers. In many cases, outage of a busbar would constrain the ability to dispatch power efficiently and in some cases it would cause direct disruption of supply to consumers. It is therefore essential to provide fast and discriminative protection which will initiate precise isolation of the faulted bus section in the event of an internal fault but will remain stable and secure for an external fault. GE's Agile high impedance protection schemes are the solution of choice for many utilities.

The P14N-B and P145-B are the optimal solution for high impedance busbar protection drawing on many years of experience with MCAG34 and MFAC34 electromechanical schemes plus MIB schemes. Additionally, Buswire supervision is provided to detect any potentially dangerous open circuit scenario for current transformers or the scheme buswires. Sensitive overvoltage supervision is provided in the P145-B to mimic the supervision feature offered in the MVTP predecessor and current-based supervision is provided in the P14N-B to mimic the MIB predecessor. GE offers the full spectrum of high impedance solutions – from conventional using MCAG or MFAC, through to full numerical using P14N-B and P145-B.

Delivering on a numerical relay platform offers advantages of digital fault recording, measurements, self-monitoring, and communications to the latest substation standards.

High impedance schemes necessitate cross-site and interbay connection of current transformer (CT) circuits, disconnector and circuit breaker status. These signals can be hardwired through the same conduits as for the CTs. To avoid spurious pick-up of the binary inputs, it is essential that the offered relay has the same immunity as historical hinged-armature relays. GE's P14x binary inputs offer programmable pick-up thresholds, AC rejection, and compliance with the ESI 48-4 EB2 standard to achieve this objective.

Protection & Control

- Sensitive high impedance bus protection with integrated buswire supervision
- Detection of open circuit CTs or buswires
- Operation tuned to fundamental frequency
- Typical operating time of <1.5 cycle
- Two stages of circuit breaker failure protection
- Safety CT shorting upon removal of the P14N-B relay or P145-B analogue module

Flexible Applications

- 1 A and 5 A in same relay
- Graphical programmable logic to customise automation schemes
- Function keys for zone In/Out switching
- LEDs/customisable user alarms for zone indications
- Same 4U case format as MCAG/MFAC
- Harsh environment coating as standard

Advanced Communications

- Wide range of supported protocols: Courier/K-Bus, Modbus, IEC 60870-5-103,DNP 3.0 (RS485 or Ethernet) and IEC 61850
- Redundant communications with zero downtime using optional PRP / HSR protocols

Applications

High impedance busbar protection is an alternative to biased differential bus protection. In the latter case, stability for external faults is achieved by a percentage bias slope. Conversely, in high impedance schemes the stability is achieved by virtue of a high impedance resistor being added into the spill current path of the CT secondary circuit. This ensures that the differential current due to any saturated CT is minimised to a level which does not cause operation of the protection zone .

External Metrosils to limit the secondary voltage under internal fault conditions and stabilising resistors can be supplied for the high impedance schemes. Alternatively, a HID module which includes a stabilising resistor and varistor to limit the voltage during fault conditions can be supplied.

If a CT becomes open-circuited in the scheme, it poses a fire and personnel safety risk in the substation. Depending on the level of load current flowing, zone elements may also be at risk of spurious pick-up. Additionally, due to the high impedance in the scheme, the secondary circuit components may experience a prolonged overvoltage for which they may not be thermally rated. Supervision to detect such scenarios is essential. In a traditional solution, GE's MVTP relay (uses sensitive overvoltage element) or MIB relay (uses sensitive current element) is used to detect open circuit scenarios.

The P14x schemes now offer the advantage of buswire supervision and the zone differential function integrated within the same device. Also, many of the auxiliary control, indication relays and DC supervision relays used in conventional busbar schemes can be integrated into the numerical high impedance

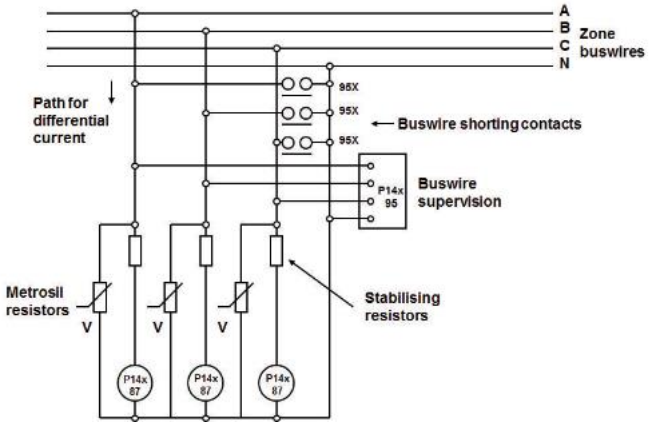

Figure 1: Typical high-impedance protection scheme

busbar relays using the auxiliary functions and powerful programmable scheme logic. For example zone In/Out switch functionality can be replicated with the relay function keys and zone indication relays can be replicated with LEDs and customised user alarms.

The Agile P14N-B and P145-B relays' integration of functionality for the full busbar scheme serves to minimise the space occupied within relay cubicles, optimises the scheme cost and engineering time, and permits faster commissioning for the schemes. The P14N-B and P145-B have customised settings, PSL logic and menu text, bespoke for high impedance differential protection, and so offer the perfect solution for high impedance busbar protection.

Device Track Record

Market leader in high impedance busbar protection, with over 14,000 MCAG34 and over 12,000 MFAC34 units delivered
Market leader in buswire supervision, with over 13,000 MVTP units delivered
P14x series introduced in 1999. Worldwide application, with over 125,000 units delivered
P40 Agile P14N introduced in 2013. Worldwide application, with over 30,000 units delivered
Addition of IEC 61850 protocol in 2006
Switchable PRP/HSR redundant Ethernet introduced in 2015
Buswire supervision feature launched in GE's P14x in 2015

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