The evolution of the electrical grid in recent years and the advancement in the field of communications allow an increasing digitization of the network. The smart grid needs information to draw from, and this information is obtained from the substations and the equipment installed in it. This concept of information exchange has been called a digital substation.

The process bus is a communications network that allows the connection between the protection, measurement and control IEDs (Intelligent Electronic Device) and the primary switchyard equipment: voltage transformers, current transformers, circuit breakers, disconnectors, etc. The format in which the data is sent is standardized by the standards IEC 61850-9-2 or IEC 61869 for the case of analog values and IEC 61850-8-1 for signaling and control values.
Main features

- IEC 61850 native platform
- Modular design
- High accuracy
- Event log and data acquisition in non-volatile memory
- Self-diagnostic
- IEC 62439-3 compliant HSR or PRP
- Programmable user logic with IEC 61131-3 based tools
- IEEE 1588 (PTP), SNTP, IRIG-B and PPS synchronisation
- Web access
- Cybersecurity
- Programmable with pacFactory free-licensed configuration software

Advantages

- Reduce copper wiring
- Use of standard hardware: simple, faster and reliable maintenance
- Reduce amount of labor and skill sets required
- Lower electrical failure ratings
- Improve measurements accuracy: shorter distance from CT/VTs to signal processor
- Low load in the CTs: wider measuring range, no saturation
- Detailed and real-time monitored diagnosis: faster recovery times
- Improve safety by achieving electrical isolation

Equipment

Protection and control IEDs

INGEPAC™ EF is a family of multifunctional, Intelligent Electronic Devices for grid and primary equipment control and protection applications that can be connected to merging units or electronic transformers.

- INGEPAC™ EF LD: Line differential protection
- INGEPAC™ EF ZT: Distance protection
- INGEPAC™ EF TD: Transformer differential protection
- INGEPAC™ EF BF: Breaker failure protection
- INGEPAC™ EF MD: Multifunction protection and control
- INGEPAC™ EF CD: Bay control unit

Merging Units

INGEPAC™ EF PB integrates conventional CT and VT into the process bus publishing the analog data as Multicast Sampled Values (MSV). Additionally, it allows GOOSE transmission/reception for control and monitoring.

Process I/Os Interface

INGEPAC™ DA PTC interface connects primary elements from the switchyard, such as circuit breakers, disconnectors or tap changers.