

Study Committee B5

Protection and Automation

10148

Requirements and Technological Trends on Stand Alone

Merging Units

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Motivation

- Digitizing Analog CT/VT is key for Digital Substations and Merging Units are the bridge devices in between Physical (IEC61869) and Digital (IEC 61850) worlds.

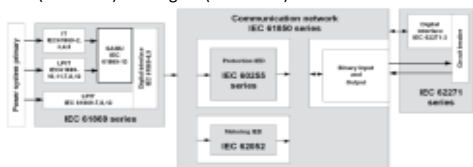


Fig 1. Diagram showing the connection in between standard series

- Recently the IEC 61869 received updates consider LPTs and Merging Units, especially with IEC 61869 -9 and -13
- This work aims to discuss the impact of these new standards for Protection and Control Systems

IEC 61869-9 and its Challenges

- The IEC 61869-9 focus in the sampled values profiles

$$f S s I i U u$$

f – Output Frame rate i – # Current channels
 s – number of ASDUs u – # Voltage channels

IEC 61869-9 Name	f	s	Limit of channels (I+U)	Non-official Name	Application
F4800S2IUu	4800	2	24	Protection Profile	Measuring and Protection
F14400S6IUu	14400	6	8	Power Quality Profile	Quality metering
F96000S1IUu	96000	1	24	D.C. Profile	D.C. Control

Tab 1. Preferred profiles according to the IEC 61869-9

- On top of these changes, the IEC 61869-9 also defines: fixed prefixes to TCTRs and TVTRs, dataset names and DO extensions to describe acquisition characteristics.

IEC 61869-13 and its Challenges

- The IEC 61869-13 focus in to define **Stand-Alone Merging Unit (SAMU)** especially with regards requirements for type tests and accuracy
- Accuracy is specified with different classes for **measurement** and **protection** purposes and has requirements for frequency response and temperature stability
- Type tests **acceptance criteria A, B and C** were clearly stated for SAMU which allows customer define their expected quality based in the standard.

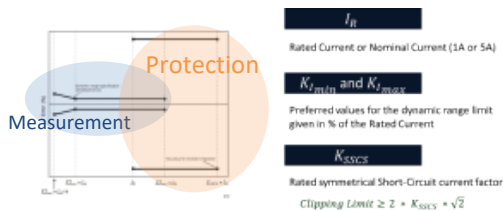


Fig 2. Diagram illustrating IEC 61869-13 concepts for specifying SAMU accuracy

Specification for Measurement

0.2DR5-400
 Accuracy class as per table 1303 of the IEC61869-13
 Dynamic range where the class is valid from $K_{Tmin} - K_{Tmax}$ in % of the rated current

Specification for Protection

6TPM20(50)
 TPM Class, related to the % of error during transient
 Defined K_{SSC}
 Supported time constant (in ms) for the transient

- Meet all requirements together brings challenges considering the main technologies today: Resistors or Magnetic Transformer

Parameter/Solution	Magnetic	Shunt or Resistor Divider
Isolation	Intrinsic	Necessary
Cost	\$	\$\$
Current withstands (shunt)	High	Low
Transient Performance (current)	insufficient	excellent
Size/Weight	High	Low
Magnitude error	Medium	Medium
Phase error	High	Low
Temperature introduced error	Low	High

Tab 2. Assessment of the acquisition technologies against IEC 61869-13 requirements

Impacts in P&C

- IEC 61869-9 brings more impact making the substation modelling more flexible and logical which can also bring benefits by reducing network bandwidth.
- IEC 61869-13 brings more impacts. The most onerous requirement is related to the transient response analyzed through a C-O-C-O test

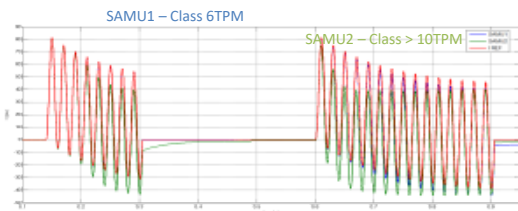


Fig 3. Simulation of a C-O-C-O with two hypothetical SAMU with different Protection classes

Conclusion

- IEC 61869 series standardized the concept of a Stand-Alone Merging Unit (SAMU), which shall help the industry to adopt the technology
- Most of the IEC 61869-9 changes have low risk of a major redesign of the system or the products, except for the new profile dedicated to DC applications.
- IEC 61869-13 brings risks to major redesign due to hardware requirements, especially with regards acquisition
- Requirements for transient response have impacts in P&C only for systems with high X/R Ratio