

Paris Session 2022



Specification, Engineering and Testing aspects of digital substations from the primary point of view

SC B3 PS3 Q4

What are other experiences to improve the specification, engineering, testing and maintenance to address the challenges in our industry ?

JL RAYON (France)



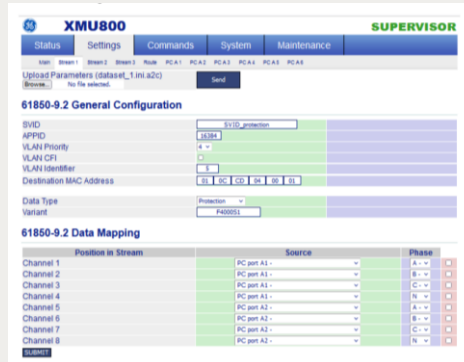
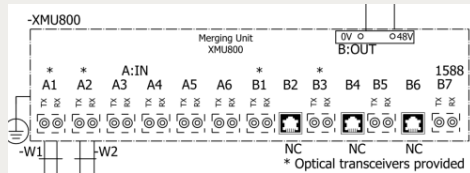
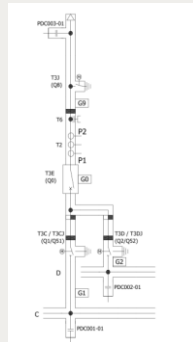
Digital substation on the primary equipment side

Digital substation: Three main stages

- The first stage: keeping all conventional principles, CT & VT and protection CB tripping by wires. Upper-level communication between IEDs (protections devices, meters,...) is made using 61850 Station Bus. The monitoring solution can be fully digital
- The second stage: integration of process bus and LPIT, all IEDs should be synchronized and compatible with the standard IEC61869-9. Protection & control are localized in the control room
- The last stage: integration of a Switchgear Control Unit (SCU) to locally operate/trip the CB. No more “conventional wiring” between Circuit Breaker & protection devices. The protection device will send a GOOSE command to trip the CB.

Specification of primary equipment for integrating in a digital substation

- For instrument transformer as LPIT type
 - the IEC61869-1 ED2 will define the general requirements for all type of instrument transformers.
- Control & Protection
 - Functional requirements → identical
 - Details requirements → Significant impact



- Monitoring → IEC TR 61850-90-3:2016 © IEC 2016
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Environmental conditions	Normal Special
Ratings	Voltage and Current ratings Dielectric ratings Rated frequency Output ratings Rated Accuracy class
Design and Construction	Liquid Gas LPIT secondary terminals Vibration ..
Tests	Type test Routines tests Special tests Commissioning tests Sample tests
Rules for transport, storage, erection, and maintenance	
Safety	
Influence of products on the natural environment	

Engineering

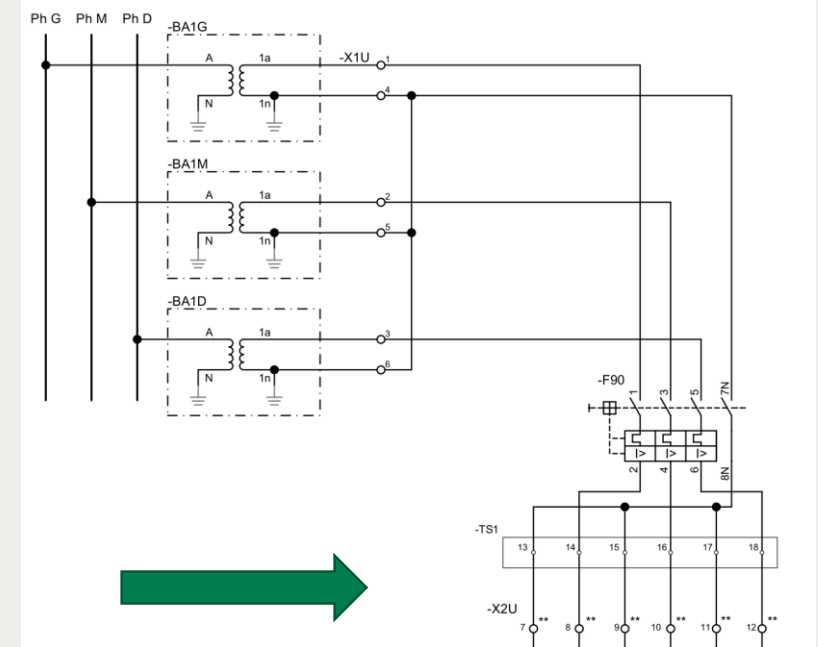
Conventional substation

- Scope between primary & secondary is well known
 - **Electric terminals are the limit**
 - **One drawing modification → significant impacts**

Digital substation

- Scope of responsibilities should be clarified at early stage
 - **IEC61850 well known by Automation engineers, partially by HV users**
 - **IEC61850 part 4, System and Project management**
 - Engineering,
 - System life cycle and
 - Quality assurance phases.

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61850-4 © IEC:2011

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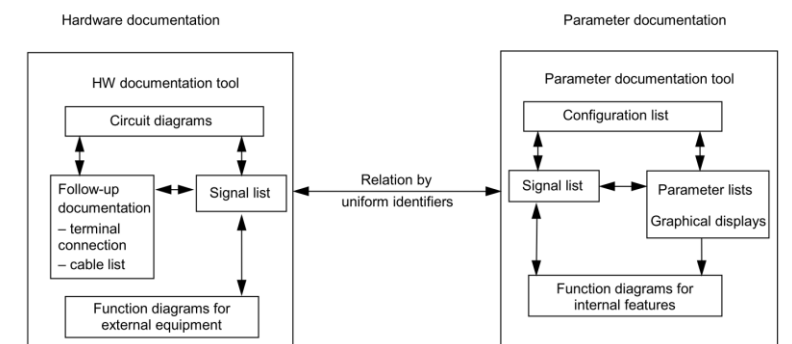


Figure 5 – Project related documentation of UAS

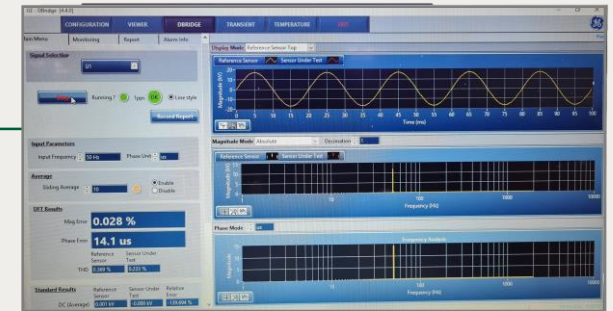
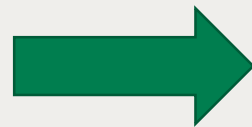
Test

The purpose of the testing is to prove that the system functions as specified all the IED connected shall be “conformance tested”.

LPIT calibration in factory



Only verification & functional test should be performed at site



A digital substation isn't built in a day. The journey typically begins with the upgrade of a single analog relay to a multi-function digital device. The actual technology provided by the manufacturers allows users to drive change at the speed he wants, but the time is running fast!

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