SIPROTEC DigitalTwin
Virtual Testing of SIPROTEC 5 Protection Devices in the Cloud

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Our Solution – SIPROTEC DigitalTwin

A digital twin of your SIPROTEC 5 device

Individually simulate and test your SIPROTEC 5 project data in the cloud …

... in minutes
... without hardware
... without additional efforts
Saves time, increases quality throughout the entire lifecycle of your system

Pre-sales and Design
- Information and Presentations
- Application concept and testing
- Design Specification
- Approvals

Implementation
- Planning
- Algorithm
- Settings
- Pre-testing

Commissioning
- FAT
- SAT, Field test
- Fault analysis

Operation
- Device handling
- COMTRADE replay

Training
- Device handling
- Operators
- Customer specific
- Flexible at any place

Maintenance and Service
- Fault analysis
- COMTRADE replay
- Upgrade scenarios
SIPROTEC DigitalTwin
Application Scenarios

Integration in SICAM systems

Control Center

Station Level

Firewall

SICAM Substation Automation

SICAM SCC Human Machine Interface

SICAM PQS Power Quality Analysis

DIGSI 5 Online Testing

Communication

Field Level

GOOSE Testing

Process Simulation
Device Testing
Device Training

Remote Substation

Testing of protection interface

Process Level

GOOSE Testing

Remote Substation

SIPROTEC DigitalTwin
SIPROTEC DigitalTwin within the entire energy automation system

**Visualize and Interact with the simulated device**
- Device operation
- Analog values
- Binary inputs and outputs

**Documentation**
- Test reports
- Logs

**Fault analysis**
- COMTRADE replay

**DIGSI 5 Online Testing and Web Browser**
- Online CFC Debugging
- Download Logs and Fault records
- Test sequence
- Plug & Play

**Communication interfaces**
- IEC 61850
- IEC 60870-5-104
- DNP3 TCP, Modbus TCP
- Protection Data Interface

**Integration into substation automation system**
- SICAM A8000
- SICAM PAS, SCC and PQS
- 3rd party systems
- Interlockings via GOOSE
Access your SIPROTEC DigitalTwin in 5 Steps

1. Open DIGSI 5 project
2. Export SIM file
3. Connection to the Cloud
4. Import SIM
5. SIPROTEC DigitalTwin
4 Import of SIM configuration file from DIGSI 5

- Add several devices by importing the SIM file
- SIM files can be updated/overwritten
- Option: Upload additional TEAX-file for display texts of binary in-/output and LEDs
5 Visualize and interact with the simulated device – Device handling and injection of process data

- Device view
- Operating via SIPROTEC 5 operation panel
- Testing all protection algorithms
- Testing of automation logic (CFC)
- Interaction of several devices

- Injection of process data (I/V)
- Setting of equal amplitudes for 3 phases
- Settings of the symmetrical phases
- Automatically calculation of I4, V4
- Visualization of the vectors
- Definition of binary and analog profiles
Visualize and interact with the simulated device – Binary Inputs and Outputs

- Overview of available inputs and outputs
- Display status of in-/ outputs and the life contact
- Setting of inputs
- Definition of binary and analog profiles
- Numbering according DIGSI 5 e.g. BO 3.2

Using and importing TEAX-File
- Displaying of texts
- Hide unused binary outputs
DIGSI 5 Online Testing

- Download logs and fault records
- Test and diagnostic functions
- Online CFC debugging
- Test sequence
- Plug & Play

Wiring Tests

Control Functions

Protection Functions
Web Browser

Monitoring of
- Device information
- Settings
- Measurements
- Logs

Download of
- Logs as CSV or COMFED file

Secure
- https connection
- Access defined per port
- Role Based Access Control (RBAC)
Communication Interfaces

Communication interfaces...
- IEC 61850
- IEC 60870-5-104
- DNP3 TCP, Modbus TCP

Protection Interface PI
- Establishment of the communication
- Testing of Differential Protection
- Messages sent via protection interface

PMU

VPN
Integration into substation automation system

Integration into Substation Automation ...
- SICAM A8000
- SICAM PAS
- SICAM PQS
- SICAM SCC

IEC 61850 Goose Simulation
- IEC 61850 communication
- Messages can be sent via Goose communication
Fault Analysis

Fault analysis

- COMTRADE replay
Customer Feedbacks and Benefits – What customer say about the SIPROTEC DigitalTwin …

3 Especially when testing and commissioning line differential applications, the devices and systems are often far away from each other. IBS requires a lot of time and staff. With the SIPROTEC DigitalTwin I can very easily test them completely in advance from the office. Testing the protection interface and the messages is also very simple.

2 As a switchgear manufacturer, we always order the SIPROTEC 5 devices on time for installation in the switchgear. To save costs, we integrate more and more automation functions into the devices. With the SIPROTEC 5 DigitalTwin we can check the parameterization and especially the automation in advance in the office without the hardware. A short final test in the system is then sufficient.

3 The integration and testing of the protective devices in the station automation with system interlock and interface has been very complex to date. With the SIPROTEC 5 DigitalTwin it is much easier and cheaper to do it in advance in the engineering department without devices.
Benefits –
The customer value proposition

Testing of the energy automation system within minutes, without hardware and without additional effort

- Simulation and validation of product properties
- Faster energization of new systems thanks to shorter project lifetimes
  - Increase engineering quality
  - Virtual testing before start of commissioning
  - Shortest commissioning times
- Reduced OPEX with shorter outages for higher availability thanks to better pre-testing
- Efficient, scalable trainings on the job
- Fast and realistic fault analysis by easily reproducing the behavior of products and systems
Conclusion

SIPROTEC DigitalTwin –
Virtual Testing of SIPROTEC 5 Protection Devices in the Cloud
Virtuelles Testen von SIPROTEC 5-Schutzgeräten in der Cloud

“The SIPROTEC DigitalTwin has the great benefit that you always have the protection device you need in your pocket.”

Hans Kristian Muggerud,
Technical Supervisor, Norway
SIPROTEC DigitalTwin

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