IEC 61850 Digital Substation Automation Course: SCL Engineering, GOOSE, Sampled Values and Testing

7 – 11 June 2027
Paris - Right Bank business hotel



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Introduction:

IEC 61850 digital substation automation, covering SCL engineering, GOOSE, sampled values and testing, is a 1-week course for protection, control and SCADA engineering staff at utilities, ending with a Digital Substation Engineering and Test Plan for a case organisation. Projects stall when SCD files drift from the installed IEDs, GOOSE subscriptions are mapped by guesswork and process bus networks reach site acceptance without a clear test strategy. Nominees already configure or commission protection and control panels, and learn through lab work on configurator tools, captured traffic and test sets. CoreConcept Training Center delivers this IEC 61850 digital substation course.

Course Objectives:

- Interpret the IEC 61850 data model of logical devices, logical nodes, data objects and data sets for a protection and control bay
- Engineer SSD, ICD, SCD and CID files through the system and IED configurator workflow and keep them under version control
- Configure GOOSE publishing and subscription with VLAN priority, retransmission and supervision suited to trip and interlock signals
- Specify process bus architectures with merging units, sampled values streams, Precision Time Protocol grandmasters and PRP or HSR redundancy
- Diagnose configuration mismatches, lost GOOSE messages, time synchronisation faults and network loading problems from captured traffic
- Prepare factory and site acceptance test procedures with simulation, test modes and isolation for a digital substation

Target Audience:

- Staff responsible for configuring protection and bay control IEDs and their communication settings
- Staff responsible for SCADA gateways, station HMI databases and signal lists in substations
- Staff responsible for engineering SCL files and managing configuration changes across project phases
- Staff responsible for factory and site acceptance testing and commissioning of substation automation systems
- Staff responsible for substation communication networks, switches, time servers and redundancy
- Staff responsible for maintaining and troubleshooting automation systems after handover

Course Outline:

Day 1: IEC 61850 Architecture, Data Model and Station Assessment

- IEC 61850 Part Structure and Interoperability Scope Review
- Station, Bay and Process Level Allocation of IED Functions
- Logical Device, Logical Node and Data Object Naming Rules
- Common Data Classes, Functional Constraints and Data Set Building
- Existing Station Assessment Against a Digital Substation Target

Day 2: SCL Engineering Workflow and Configurator Tools

- IEC 61850-6 SCL File Types From SSD to SED
- System Specification Description Linked to the Single-Line Diagram
- ICD Import, Data Type Templates and Report Control Blocks
- System Configurator SCD Build With Subnetworks and Addressing
- CID Export, IID Round-Trip and SCD Version Control

Day 3: GOOSE Messaging, Sampled Values and Process Bus Design

- GOOSE Publisher Data Sets, Control Blocks and Multicast Addresses
- GOOSE Subscription Mapping With Quality and Test Bit Handling
- IEEE 802.1Q VLAN Tagging and Priority for Trip Messages
- IEC 61850-9-2 Sampled Values Streams From Merging Units
- Process Bus Topology Choices for Merging Units and Protection IEDs

Day 4: Timing, Redundancy, Cyber Controls and Fault Diagnosis

- IEC/IEEE 61850-9-3 Grandmaster, Boundary and Transparent Clock Design
- IEC 62439-3 PRP Parallel Networks Versus HSR Rings
- Network Traffic Loading Estimates for GOOSE and Sampled Values Streams
- IEC 62351 Security Measures for Substation Communication Links
- Packet Capture Analysis of Lost GOOSE and Clock Faults

Day 5: Lab Practice and Digital Substation Engineering and Test Plan

- Lab SCD Review Against Case Bay Signal Lists
- Lab GOOSE Simulation With Test Mode and Isolation Checks
- Factory Acceptance Test Procedure for the Automation System
- Site Acceptance Test Sequence With Merging Unit Injection
- Digital Substation Engineering and Test Plan Completion

Skills You Will Gain:

- IEC 61850 Data Modelling
- SCL File Engineering
- GOOSE Subscription Mapping
- Sampled Values Stream Design
- Substation Clock Synchronisation
- Seamless Network Redundancy Design
- Substation Traffic Diagnosis
- Automation Acceptance Testing

Why Attend This Course:

- Deliver a Digital Substation Engineering and Test Plan to the protection and control manager and the project commissioning lead
- Decide whether a GOOSE, sampled values or timing fault lies in the SCD file, the IED or the network
- Avoid repeated site visits, delayed energisation and late design changes caused by unmanaged SCL files and untested subscriptions
- Coach junior engineers and contractors on configurator workflow, traffic capture and test mode use with the lab checklists

Conclusion:

Back at work, the participant hands the protection and control manager and the commissioning lead a Digital Substation Engineering and Test Plan for one case station. Engineers use it to fix SCL file ownership, GOOSE and sampled values mapping rules, clock and redundancy design, and the sequence of factory and site acceptance tests before contracts are let. Asset owners use it to judge vendor deliverables. After the first project under the plan, the unit should compare commissioning defects, retest hours and configuration changes against the plan and tighten the test steps that let faults through.

Frequently Asked Questions FAQ:

What should participants know before the IEC 61850 digital substation automation course?

Participants should already work with protection relays, bay controllers or SCADA in substations and read single-line diagrams and signal lists. Basic Ethernet knowledge helps. Bringing an anonymised SCD file, signal list or test record lets them apply the lab work to their own station.

How does IEC 61850 digital substation automation training differ from a general substation design course?

This course works inside the automation system: SCL files, GOOSE, sampled values, timing, redundancy and acceptance testing. General substation design courses cover busbars, primary equipment and layout, and relay setting courses cover protection calculations; both appear here only where they meet the communication design.

Why do GOOSE messages fail in IEC 61850 digital substation automation projects?

GOOSE failures usually come from subscriptions mapped to the wrong data set, mismatched configuration revisions, missing VLAN settings or switches that filter multicast traffic. Checking the SCD file, capturing traffic and supervising each subscription in the IED find most faults.

What do participants take back from the IEC 61850 digital substation automation course?

Participants take back a Digital Substation Engineering and Test Plan for a case organisation, with an SCL file workflow, GOOSE and sampled values mapping rules, timing and redundancy design choices and factory and site acceptance test sequences ready to adapt to their own projects.