
DISTRIBUTION AND SUBSTATION AUTOMATION (INCL. COMMUNICATIONS) FOR ELECTRICAL POWER SYSTEMS



YOU WILL LEARN:

- Fundamental principles of distribution and substation automation, specifically on protection, control and communication issues
- Important steps in designing, installing and managing a substation automation project
- The nuts and bolts of IEC 61850* standard
- Typical techniques in troubleshooting distribution and substation automation systems
- How to avoid pitfalls and costly mistakes when implementing a substation automation system
- How to critically appraise the different products and systems available for distribution and substation automation

* The IEC 61850 standard is being rapidly implemented throughout the world for substations and many other areas such as power quality, substation control centres, condition monitoring and power generation

WHO SHOULD ATTEND:

- Engineers and Managers responsible for planning and justifying substation automation
- Project Engineers responsible for implementing a substation automation project
- Communications Engineers working in the power industry
- Technicians and Operators installing and working with substation automation systems

and generally...

- Electrical Engineers
- Protection Engineers
- Electrical Technicians
- Power System Engineers
- Design Engineers
- Control and Instrumentation Engineers

The Workshop

Distribution and substation automation offers you a multitude of benefits including:

- Increased function and reliability of electrical protection
- Advanced disturbance and event recording capabilities aiding in detailed electrical fault analyses
- Display of real-time substation information in a central control centre
- Remote switching and advanced supervisory control over the power network
- Increased integrity and safety of the electrical power network, including advanced interlocking functions
- Advanced automation functions

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This workshop is designed to familiarise you with all aspects of distribution and substation automation. The different levels of substation integration and automation are outlined and discussed while the components and architecture of the typical distribution and substation automation system are detailed. The different approaches promoted by the different substation automation vendors are identified and the advantages of each are outlined. The characteristics and operation of the Intelligent Electronic Devices (IEDs) are examined. A practical checklist is then provided of the optimum way to implement this technology to your next project.

The Program

THE SUBSTATION AND ITS PRINCIPAL COMPONENTS AND FUNCTIONS

- Role of substation as a node in power system
- Main functions and equipment
- Controls in conventional non-automated substations

SUBSTATION AUTOMATION-OBJECTIVES AND HISTORICAL PERSPECTIVE

- Automation functions at different levels
- Objectives of an integrated automation of the power network
- SCADA in electrical systems
- Key differences in the objectives of SCADA and substation automation

FUNCTIONS OF MODERN SUBSTATION AUTOMATION AND ITS BENEFITS

- Inputs and outputs (HMI)
- Controls and interlocking
- Alarms
- Protection and safety of individual equipment and feeders
- Remote protection setting and appropriate control
- Condition monitoring systems for substation equipment - integration with automation system

SUBSTATION AUTOMATION ARCHITECTURE

- Typical automation architecture of MV and HV substations
- Bay controller for HV and intelligent relays on a bus for MV
- RTU as a means of interfacing an MV panel
- Auxiliary equipment automation functionality through PLC/RTU
- Process level interconnection by a communication bus - future outlook

MODERN TRENDS IN CURRENT AND VOLTAGE MEASUREMENTS

- Current and voltage - the only parameters that be sensed
- Conventional equipment for measurement
- Problems inherent in these designs
- Modern measurement principles
- Conventional instrument transformer but with digital output
- Pure optical sensors using Faraday principle
- Optical interconnection to field bus of IED
- Typical utility experience from network

WIDE AREA FUNCTIONS INCLUDING PROTECTION

- Examples of functions that involve multiple stations
- Existing trends of dealing with such functions
- Limitation of communication
- Response based and event based systems

DATA COMMUNICATIONS FOR THE ELECTRICAL POWER SYSTEMS

- Basics of data communications, incl. different techniques and media access methods
- Physical media, including radio and satellite communication
- Different communication protocols used for substations

DATA COMMUNICATIONS FOR THE ELECTRICAL POWER SYSTEMS (cont)

- Discussion of most important protocols used in the electrical industry (DNP3, IEC60870.5 and UCA)
- Communication requirements for substations
- Wireless communications
- Suitability of different protocols for substation communications
- OPC for SCADA and substation automation

THE IEC 61850 STANDARD

- Need for a common standard and development phases of IEC
- Scope and outline of IEC 61850
- Use of IEC 61850 in SCADA applications
- Typical structure
- Use of SCL

INFORMATION MODELS (IEC 61850 PART 7-4 AND 7-3)

- Physical and logical devices
- Logical nodes
- Common Data Classes (CDC)
- Attributes and addressing
- IEC 61850 object model
- IEC 61850 data exchange model

COMMUNICATION MAPPINGS

- Interoperability
- ACSI models
- Protocols and mapping
- Sampled values and GOOSE applications
- SCL and XML

ENGINEERING AND CONFIGURATION OF SYSTEMS

- System configuration tool
- SCL applications
- Peer to peer, one to many messaging
- SCL, MMS and MICS data supports
- Time synchronisation
- Gateway engineering

CONFORMANCE TESTING

- Data structure
- System performance tests and FAT
- Tests during life cycle

SECURITY ISSUES IN SUBSTATION AUTOMATION

- Common vulnerabilities of automation systems
- Inappropriate use of wireless communication
- Inadequate authentication of control systems communications
- Lack of detection and logging of intrusion
- Dual use of control systems networks
- Lack of security checking of control systems software/applications
- Potential mitigation strategies based on multiple levels of implementation

IMPLEMENTATION ISSUES IN SUBSTATION AUTOMATION

- Planning automation in new substations
- Planning a retrofit
- Forward and backward compatibility issues