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## Substation SCADA Monitoring

Course details: <https://www.electricityforum.com/electrical-training/substation-scada-monitoring>

Substations are a critical component for maintaining electrical supply and load control in low voltage, medium voltage and high voltage electrical distribution networks. In order to ensure the proper functioning of substations and related equipment such as line-mounted switches and capacitors, most utilities use SCADA (supervisory control and data acquisition) systems to automate monitoring and control.

New sites typically implement a SCADA system to monitor and control substations and related equipment. However, older facilities can also benefit by adding a SCADA system or by upgrading an existing SCADA system to take advantage of newer technologies.

Not only will a new or upgraded SCADA system provide better monitoring and control, it can also extend the life of substations and related equipment by providing current data for troubleshooting small problems before they escalate. Furthermore, the ample historical data provided by SCADA systems can improve preventive maintenance scheduling and cut associated costs.

Electrical distribution systems involve many remote applications and sites, and monitoring and controlling these sites has often been difficult. To solve this problem, utilities began installing remote terminal/telemetry units (RTUs) at substations. Early RTUs were initially

custom-made units, but later versions relied on standard hardware such as programmable logic controllers (PLCs) or industrial PCs. Intelligent electronic devices (IEDs) are a more recent technology development, and these devices are now installed at most substations to some extent. Our Substation SCADA Monitoring Course provides substation professionals with an update on the latest technologies and methods for monitoring and controlling all substation activities.

This Substation SCADA Monitoring course will deal with all of these important issues.

## **LEARNING OBJECTIVES**

- Power Transformer Protection and Control Strategies
- Power Switching Equipment and Structures
- Switchyard and Switchgear typical Execution Elements
- Remote Connectivity and Networks for Transmission Lines
- SCADA Solutions and Principles of Operation
- SCADA System Architecture-a Practical approach
- Modern Implementation of the Power System Protection
- Servers and Backup back up Power Monitoring
- Monitoring remotely the Power System
- Building OPC & ODBC Connectivity
- SCADA CONTROL SYSTEM and Parameters

## **WHO SHOULD ATTEND**

This course is designed for engineering project managers, engineers, and technicians from utilities who have built or are considering building or retrofitting substations or distribution systems with SCADA and substation integration and automation equipment.

- Substation operation and planning Managers
- Transmission maintenance engineers
- Distribution maintenance engineers
- Substation Design Engineers
- Consulting Engineers
- Maintenance Engineers & technologists
- Substation network maintenance engineers
- Substation operation/maintenance engineers & technologists
- Substation protection & control engineers & technologists

#### **STUDENTS RECEIVE**

- **FREE** T&D Automation and AMR/AMI Systems Handbook Vol. 2 (Value \$20)
- **\$100 Coupon** Toward any Future Electricity Forum Event (Restrictions Apply)
- 1.2 Continuing Education Unit (CEU) Credits (12 Professional Development Hours)
- **FREE** Electricity Today Magazine Subscription (Value \$25.00)
- Course Materials in Paper Format

#### **COURSE OUTLINE**

##### **Substation SCADA Monitoring Program Outline**

##### **DAY ONE**

##### **Session 1: Substation typical structure**

- Electrical Drawings
- Steel Structural design
- Substation One Line diagram
- Power Transformers
- Substation Protection
- Power Switching Elements
- Control Room

### **Session 2: Substation supervisory and control functions**

- Remote and Local Monitoring System
- Remote Control of the switching Elements
- Automated Control and protection
- Emergency Power Systems

### **Session 3: Substation Architecture**

- Typical structures for Low Voltage Electrical Systems
- Medium Voltage Substations: Switchgear and Switchyards
- Distribution and Transmission Substations
- High Voltage and Ultra High Voltage Substations
- Underground and Enclosed Substations
- Transmission Lines

### **Session 4: Power System Protection types**

- Electrical Power Generator Protection requirements
- Substation Protection, requirement and configuration selection
- Transmission Line Protection Equipment - Surge arrestors
- Power factor Correction, systems at the Generator; Substation and Transmission Lines
- Low voltage Systems Protection, Dynamic and Static Loads requirements
- Typical Fuse Protection and Circuit Breakers Protection
- Standards requirement for Electrical Protection
- Testing and calibrating Circuit breakers

- Commissioning of an Electrical Power Systems

### **Session 5: Power Transformer Protection and Control**

- Dry versus Oil Filled Power Transformers
- Distribution Transformers
- Power Transmission Transformers
- Transformer Winding Configuration
- On Line and Off Line TAP Changers
- Testing Electrical Transformers
- Maintenance of an Electrical Power Transformer
- Instrumentation related to Electrical Power Transformers Maintenance and Protection
- Typical Faults of Electrical transformers
- Electrical Transformer Aging and Maximum Load
- Paralleling Electrical Power Transformers
- Power Switching Equipment and Structures

### **Session 6: Power Switching Equipment and Structures**

- Electrical Disconnect Switches
- Medium Voltage Vacuum and Oil Breakers
- Medium Voltage Electrical Switchgear
- High Voltage SF6 and Vacuum Breakers
- Indicators of Degradation of a Medium and High Voltage Breakers
- Substation Breaker Maintenance and Testing
- Grounding and safety grounding

### **Session 7: Local monitoring of Electrical power Systems**

- Local Monitoring Integrated Relays
- Substation Bay Monitoring Systems, functions and Implementation
- Networks and communication systems
- Database and Trending of Local Parameters

## **Session 8: Switchyard and Switchgear - Typical Execution Elements**

- Switchgear and Switchyard Systems,
- PT and CT Types, location and requirements
- Motorized Breakers; Hydraulic Breakers
- Power Factor Capacitor Banks Connections
- Power Electronic Elements used in Substations

## **DAY TWO**

## **Session 9: Remote Connectivity and Networks for Transmission Lines**

- Typical Configuration for Information Transmission
- Switches; and Routers requirements to be used in Electrical Power;
- Data Protection and Encryption, CISCO Routers
- Data Transmission Capability of most representative Networks used in power systems
- Backup Systems and redundancy required for Data transmission
- RTU – Radio Capability Example
- Wi-Fi and GPS usage and integration
- Tendency and Development – National Instruments & LAB View for SMART GRID

## **Session 10: SCADA Solutions and Principles of Operation**

- SCADA System Functions
- Power Generation Station typical SCADA Solution
- Active and Reactive Power Control in a Power Generation Station
- Typical Topology of a SCADA SYSTEM Implemented for a Substation
- Operation of a SCADA System in a Substation
- Load Shedding and fault mitigation for a Substation using SCADA
- Power Factor Correction in a Substation using SCADA
- Transmission lines Supervised by SCADA Systems

### **Session 11: SCADA System Architecture - A Practical approach**

- Example of a complete Networking System
- Network Topology and Architecture
- Implementation Example of a Substation SCADA
- Implementation of a SCADA System in a Nuclear Plant

### **Session 12: Modern Implementation of Substation Protection**

- Integrated Protection Systems for a Power Generator
- Integrated Protection Systems for Backup Generators and Groups of Backup generators
- Integrated Protection Solution for Power Transformers and Feeders
- Integrated Protection Systems for Substations
- Modern Implementation of a Protection, based on the Integrated Systems and Real time Networks and Communication
- Manufacturers Integrated Protection Systems

### **Session 13: Consideration of Substation Networking Solutions**

- Real Time Networking Solutions
- Main Topology and Parameters of Real time Networks
- Protocol Converters and Universal Convertors

### **Session 14: Servers and Backup Power Monitoring**

- Server architecture and data organisation
- Automatic Backup of vital field data
- Restoring the Data after Power Failure
- UPS and ATS Requirements in a Centralized SCADA System
- Redundancy Level Required in a SCADA System

### **Session 15: Substation Remote Monitoring**

- Example of sequence of Events in a Substation Equipped with SCADA, in case of a remote Fault
- Sequence of Events of a SCADA Controlled System in case Power Factor Correction is required
- Large Electrical Grid Voltage Compensation via SCADA System
- Electrical Power Generator VAR correction based on Load Change

### **Session 16: Building OPC & ODBC Connectivity**

- OPS Server For Connectivity
- ODBC to OPC Link for data transfer
- Examples of utilisation of OPC & ODBC connector in SCADA System Data Flow

### **Session 17: SCADA CONTROL SYSTEM and Parameters**

- Typical Parameters Monitored by a SCADA System in a Generation Plant, monitoring and control solutions
- Monitoring and controlling Substation Parameters remotely, example of data flow and parameters
- SCADA Monitoring for Large Electrical System
- Energy Stability and optimization
- Power management solution
- Intelligent Load Shading and preservation of important Loads
- Simulation and Predictability of Events
- Reconstruction of previous events using Historian
- SCADA Systems Hierarchy and Interaction: Power Generation; Substation Transmission and Distribution Lines

## **COURSE TIMETABLE**

**Both Days:**



Start: 8:00 a.m.  
Coffee Break: 10:00 a.m.  
Lunch: 12:00 noon  
Restart: 1:15 p.m.  
Finish: 4:30 p.m.

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<https://www.electricityforum.com/onsite-training-rfq>