MERCURY

Communications for Power System Protection and Automation Advanced Training

14 - 25 Jul 2024
Online

Istanbul - Turkey: +90 539 599 12 06
Amman - Jordan: +962 785 666 966
London - UK: +44 748 136 28 02

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Communications for Power System Protection and Automation Advanced Training

Ref.: 15253_255262 **Date:** 14 - 25 Jul 2024 **Location:** Online **Fees:** 4500 **Euro**

Introduction:

This course is designed to benefit the utility industry, and overcome the challenges faced in power system communications to make it notable. This Training program is to enable you to learn the requirements placed on the substation communication system to meet the concurrent demands for protection, automation, and Smart Grid implementation. Course further includes a guide of Smart Grid interface standards under the aegis of IEEE, NIST, and NERC.

Targeted Groups:

- Substation design and operations engineers
- Technicians
- Electric utility engineers

Course Objectives
At the end of this course the participants will be able to:

- Set up a relay network
- Read values from standard IEC 61850 data objects
- Display the data in an Excel spreadsheet
- Implement relay-to-relay communications via IEC GOOSE
- Capture and analyze network data packets.

Course Content
Unit1: Analog Communications Fundamentals:

- AM, FM, PM
- ASK, FSK, PSK, QAM
- Generation and detection
- Performance comparisons

Unit 2: Digital Communications Fundamentals:

- Quantization
- Encoding
- Framing multi-channels
- Synchronous optical network SONET

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Unit 3: Fiber Optic Communication Theory and Application:

- Fiber optic basics
- Fiber types multi-mode, single mode
- System components sources, detectors, connectors
- System design architecture, loss calculations
- Utility applications
- New technology and standards WDM, PMD

Unit 4: Fundamentals of Power Line Carrier:

- Basic System
- System components
- Coupling Systems
- Modal analysis
- Performance calculations

Unit 5: Spread Spectrum Communications:

- Basic system
- System components
- Relaying considerations
- Control considerations

Unit 6: WAN Ethernet Transport:

- MPLS
- Carrier ethernet
- Comparisons and impact on power system-critical communications

Unit 7: Special Communication Requirements of Protective Relaying:

- Dependability
- Security
- Channel delay effects
- Modes of operation
- Channel arrangements
- Comments on audio tone protection

Unit 8: Serial Data Communication:

- Basic concepts
- Data encoding formats
- RS-232
- RS-422
- G-703

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Unit 9: Data Networks:

- Network concepts and devices
- OSI seven-layer model
- Substation LAN architectures
- Network synchronization

Unit 10: Ethernet:

- Physical connections
- Data frames
- Collision and retransmission mechanisms
- Bridging

Unit 11: Time Synchronization:

- Time synchronization sources GPS
- IRIG-B
- IEEE 1588

Unit 12: Protocols and Standards:

- Architecture development concepts
- Overview of Sequence of Events Standard
- Overview of the IEEE Standard for Time Sequence Files
- Review of the NERC Standard for Event, Fault, and Dynamic Recording
- TCP/IP
- ModBus
- DNP
- DDE and OPC

Unit 13: 61850 Network Communications Systems:

- Abstract service models
- Logical node concept
- Internet-based communication
- The IEC 61850 security model
- Peer-to-peer communications GOOSE
- Substation Configuration Language-SCL
- Integration system examples
- Routable GOOSE/SV sample values
- Industry case studies

Unit 14: DNP3 and Applications:

- DNP3 history, benefits, and capabilities
- Overview of DNP3 object libraries
- Discussion of various DNP2 polling schemes
- Demonstration of DNP3
- Future enhancements

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Unit 15: Electronic Security of Remotely Accessible Control and Protection Equipment:

- Threats
- Vulnerabilities
- Attack scenarios
- TCP/IP network scanner
- SCADA protocol reconnaissance
- Electronic attack barriers
- NERC Critical Infrastructure Protection Standards CIPS
- Requirements of IEEE 1686
- Substation IEDs' level of compliance

Unit 16: Implementing Multiprotocol Label Switching MPLS:

- Introducing MPLS and Label Distribution Protocol LDP
- Transporting Global IPv4 and IPv6 Traffic
- Enabling Multi-tenancy with MPLS Layer-3 VPNs
- Building Complex MPLS Layer-3 VPNs
- Extending Layer-2 Networks with Pseudo wires
- Scratching the Surface of MPLS Traffic Engineering TE
- Verifying MPLS LSPs Using OAM Tools

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Registration form on the :
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Complete & Mail or fax to Mercury Training Center at the address given below

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