Interactive Educational Complex on the Basics of “Digital Substation” Technology

Authors:
Aleksei Valentinovich Trofimov, NRU “MPEI”
Aleksandr Mikhailovich Polyakov, NRU “MPEI”
Vladimir Alekseyevich Trofimov, LTD «Energoautomatika»

Speaker:
Vladimir Alekseyevich Trofimov
LTD «Energoautomatika»
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- Digital substation = Power Utility Automation System + IEC 61850
- For the practical study of modern Power Utility Automation System and IEC 61850 at the Department of "Electric Stations" MPEI in 2012 an educational and research complex was created

Structure of educational and research complex:
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Key advantages of educational and research complex:

• A wide range of IEDs for working with various types of electrical connections;
• The use of real equipment for the organization of industrial digital networks.
• Equipped with both real primary equipment and physical and mathematical models for creating a “live” electrical installation.
• Typical constructs of panel devices.
IEC 61850. Communication networks and systems in substations.
Part 4: System and project management

Hardware documentation

- Circuit diagrams
- Signal list
- Follow-up documentation
  - terminal correction
  - cable list
- Function diagrams for external equipment

Parameter documentation

- Configuration list
- Signal list
- Parameter lists
  - Graphical displays
- Function diagrams for internal features

Relation by uniform identifiers
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Moscow, Russia
14-17 April, 2020

Electrical circuit diagram:

The physical implementation of the circuit in the form of a laboratory stand:

1. Digital interface (Ethernet)
2. Controller
3. Input/Output modules
4. Switching equipment
5. Electric motor
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- Configuration of the input/output modules
- Programming the controller
- Animate mnemonic schemes displayed on the workstation
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Information model in accordance with IEC 61850 “Communication networks and systems in substations. Part 6: Configuration description language for communication in electrical substations related to IEDs”
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Course structure (14 sections):
• General principles of organization of PUAS
• Secondary circuit diagrams
• Secondary Equipment
• Description of the laboratory complex
• Hardware and software programming
• Automatic motor control
• Alarm and archiving
• Algorithmic motor control unit
• Servers, workstations, network equipment
• Digital Network Exchange Protocols
• High level software
• Fundamentals of IEC 61850
• Digital Exchange according to IEC 61850
• Computer aided design (CAD) of secondary circuit.

Section Composition

• Theoretical part
• Video materials illustrating the theoretical part
• Tasks for practical and laboratory studies
• Control questions
• Testing
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Video lessons include:
• Presentations, with a large amount of demonstration material, allowing you to compare secondary circuit solutions with their implementation in hardware;
• Demonstration of working with software, accelerating their development during laboratory work;
• Video recording of equipment operation.
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Remote laboratory work via the Internet

- Remote desktop
- LED indicators
- Imagine from web camera
Conclusion

The considered interactive training course on the basics of “digital substation” technology allows specialists in the electric power industry to gain practical competencies in the field of automation of electric stations and substations, in both full-time and part-time distance learning forms using easily accessible common remote technologies.
Thank you for attention!

Speaker’s contacts:

Vladimir
Alekseyevich
Trofimov
LTD «Energoautomatika»
Trofi_VA@bk.ru