

Digital switchgear

1. Purpose of the exercise:

The exercise aims to acquire practical skills in analyzing, configuring, and testing solutions for monitoring the power supply network. It also aims to familiarize with the basic elements of digital switch gears and their possibilities in optimizing operation and increasing network reliability.

2. Tasks to be completed:

- To get familiar with the topology of the digital switchgear.
- To identify sensors and communication protocols.
- To preview and monitor power network parameters. Defining alarms and alerts.
- To generate reports.

3. Theoretical introduction

Modern digital electrical switchboards are devices whose task is not only to distribute and protect electricity loads but also to monitor the parameters of the supply network. They are part of the network infrastructure, enabling effective electricity management and increasing the reliability and efficiency of distribution systems. The study of digital switchgear in the laboratory aims to understand their operation, analyze the parameters and test different scenarios and control algorithms.

Digital switchboards enable accurate and continuous monitoring of various electrical parameters such as voltage, current, power, and harmonics. It allows for real-time analysis of the network status, detection of failures, and taking appropriate actions to prevent more severe problems.

They are part of smart grids and can communicate and integrate with other infrastructure elements, such as monitoring, energy management, and switchboards. It allows for effective network coordination and remote monitoring and control.



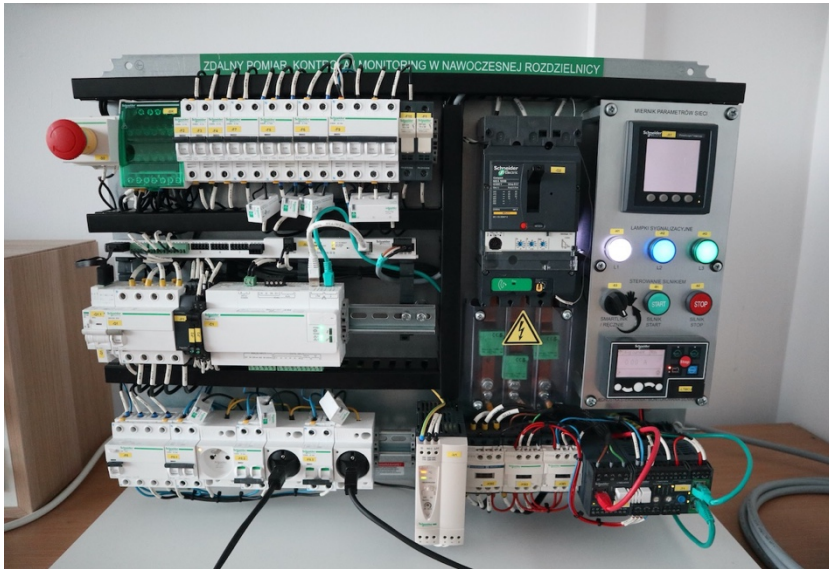


Figure 1. A laboratory stand for testing the digital switchgear

Thanks to digital technology, electrical switchboards allow remote access to network data and parameters, facilitating diagnostics and problem identification. Operators can monitor and control the switchgear from anywhere, which contributes to increased management efficiency and quick response to failures. Digital electrical switchboards also enable the use of advanced optimization algorithms that can improve the efficiency and reliability of the network. They can dynamically manage the power flow, thus minimizing losses and optimizing loads, contributing to better resource use and increased energy efficiency.

The digital electrical switchgear uses various communication protocols that allow data exchange between the different devices in the system.

Modbus:

The Modbus protocol is widely used in monitoring and control systems in electrical switchboards. It works in serial mode (Modbus RTU) and Ethernet mode (Modbus TCP/IP). It allows communication between the control and measuring devices, such as sensors, relays, and meters.

IEC 61850:

This protocol is used in advanced digital switchgear and smart grids. IEC 61850 defines communication standards for electrical devices such as bay relays, protective devices, controllers, and measuring transducers. It enables measurement data transfer and control based on Ethernet communication protocols.

Profibus:

The Profibus protocol is widely used in industry, including monitoring and control systems in electrical switchboards. It is mainly used in serial mode (Profibus DP). It allows communication between various devices on the network, such as sensors, drives, relays, and controllers.

ZigBee:

ZigBee is used in some digital switchboards. It is a standard for low-power wireless networks (WPAN - Wireless Personal Area Network) based on low-range, low-power radio technology. The ZigBee protocol is beneficial for monitoring and controlling systems where wireless communication between devices in switchboards is required. It allows transmitting measurement data, control signals, and diagnostic information between sensors, relays, protective devices, and the central monitoring system.

Many other protocols can be used depending on specific system requirements and specifications. The protocol choice depends on the type of devices to be integrated, network infrastructure, and available communication technologies.

4. Guidance questions - check yourself

- What is digital electrical switchgear, and what are its main features?
- How is the digital switchgear different from the traditional one?
- What electrical parameters are monitored in the digital switchgear?
- What are the functions of the data concentrator in the digital electrical switchgear?
- What are the main communication protocols used in digital switchgear monitoring and control?
- What are the possibilities of remote access and diagnostics in the digital switchgear?

5. Exercise program

A. Log in to the Com'X 510 data concentrator following the data provided by the teacher.



Figure 2. Com'X 510 data concentrator

- B. Familiarize yourself with the user interface.
- C. Identify the measurement sensors that the didactic model is equipped with.
- D. Identify the communication protocols used to communicate with the data concentrator.
- E. Check the connection status between the data concentrator and the measuring sensors.

- F. Configure alerts based on changes in network parameters such as voltage, current, and power. Simulate emergencies. Check the operation of the alerts.
- G. Log in to the SmartLink data bus following the data provided by the teacher.



Figure 3. SmartLink communication bus

- H. Remotely start the electric drive.
- I. Generate a report on the measurements carried out during the classes.