

General requirements on the realization of the PPE connection with the Telecommunication Network and with the SCADA / EMS system of OST sh.a.

1. Introduction

The Transmission System Operator, OST sh.a., has implemented the Network Manager SCADA / EMS platform (Supervisory Control and Data Acquisition / Energy Management System), a platform which offers the functions of a control center and real-time monitoring. The platform in question was implemented in November 2012 by ABB.

In the SCADA / EMS system of the Transmission Operator, OST sh.a., all Substations / Power plants connected to the 400/220 kV network and the most important part of the Substations / Power plants connected to 110 Kv are monitored and controlled in real time. The Master Unit (central unit) of the SCADA system is installed in the National Dispatcher Center (NDC), in the building of Ost sh.a

RTU 560 from ABB and / or local control systems from different providers have been installed as peripheral units in Substations / Power Plants. Real-time data between peripheral units and the central unit are transmitted using the Telecommunication Network through the IEC 60870-5-104 protocol.

➤ **SC SCADA functions**

Among the most important SCADA functions with which it interacts continuously, we can mention:

- **Collection of real data of the Energy System**
The module which is responsible for data collection collects data from various sources, processes them and save them in databases for access by SCADA system users. The data can be:
 - Data collected automatically by RTUs/ DCSs (RTU cyclical data measurement data and spontaneous indication data)
 - Manual data
 - Calculated data
- Monitoring, processing of alarms and events
- Control and interlocation
- Data archiving
- Calculations
- Reports and Trends
- Graphic interface with the system

- Dynamic coloring based on the voltage level and based on the state of the information presented

- **Generation Management System (GMS)**

The SE management platform contains real-time processes, which regulate energy generation in accordance with operational and economic restrictions, maintaining system frequency and exchange programs with control areas of neighboring countries, in accordance with planned values.

Since Albania has hydropower generation units, the generation control system provides in real time control and management of hydropower and related hydric reserves. Currently under the control of AGC are the 3 largest hydropower plants in Albania (Fierze, Koman, Vaudejes). The AGC module from the Network Manager platform was implemented in February 2013.

2. Connection of the users of the Transmission Network with the Telecommunication Network and with the SCADA system of OST sh.a.

Pursuant to the Transmission Network Code, all Users (PPE and KK) connected to the transmission network must realize the integration of real-time data in the Monitoring Control system, SCADA system in NDC (National Dispatching Center) of OST sh.a. Data will be exchanged through the IEC 60870-5-104 protocol. IEC 60870-5-104 protocol will be configured by network users on both sides of communication (Master side of communication-SCADA and Slavic side of communication-PPE / KK). Also, the Transmission Network Users, in addition to integrating into the NDC SCADA system, must update the local control systems (if there is an existing control system) / RTUs of the substation to which they are connected. The update of the local control system and / or RTU should include the modified substation scheme as a result of the connection of the Users to the transmission system. The update of the substation Local Control System / RTU (including the output of the Transmission Network Users) should be reflected in the SCADA system in the NDC.

Power plants, which based on the Transmission Code, must participate in the Power Frequency Regulation (LFC), in addition to implementing the interface with the SCADA system on real-time monitoring control must realize the involvement of their generation units under the control of LFC.

Real-time exchange of data between the SCADA system and the Transmission Network Users will be realized through the protocol IEC 60870-5-104 using the Telecommunication network of OST sh.a. Based on this the connection of Users in the SCADA system is organized in two categories:

1. Realization of the connection with the Telecommunication network.
2. Realization of the connection with the SCADA system.

2.1. Requirements for the realization of the connection of the Network Users in the Telecommunication Network of OST sh.a.

From the Transmission System Network Users it is necessary to be completed the following requirements:

1. Supply and installation of telecommunication equipment in their areas as well as in all substations where they will be connected and which will have the interface with the TSO and in those substations where their connection to the network has an impact.
2. The connection with the telecommunication network of OST sh.a., must be redundant.
3. The data transmission protocol will be IEC 60870-5-104.
4. The IP address for the connection to the OST network will be determined by the OST based on the point of connection to the network.
5. In case when the high voltage line has OPGW installed, and the Users of the transmission system network can be connected via optical fibers to the OST network, then it must supply and install OPGW as well as telecommunication equipment in both sides of the line, especially in its object and in the substations where it interfaces with the OST, with the necessary modules to fulfill the communication functions with the OST. (Note: OPGW connection to OST will only be made for the purpose of fulfilling OST services)
6. The installation of OPGW will be done according to the specifications of the OST, which are compatible with that part of the network.
7. The equipment that the Transmission System Network Users must install are:
 - Radiator 48 VDC (with positive ground pole) with power up duplicated the power required by communication devices in 100% working capacity
 - VRLA Battery Set (with gel) 48 VDC, 100 A / H
 - 42U Industrial cabinet with 19 inch frame (for equipment installation) equipped with all accessories, 220 VAC power supply, 48 VDC, earthing busbar, lamps, thermostat and heater for anti-condensation.
 - Underground optical cable with Single-Mode optical fiber.
 - OPGW with Single Fiber Optic - Mode (Based on the specifications of the network point where the connection will be made).
 - SDH STM-4 FOX multiplexer together with the necessary modules for the following functions:
 - Redundant food module packages
 - Redundant control module package
 - Ventilation module

- SDH STM-4 optical transmission module
 - SFP module
 - Communication module for Data based on Ethernet
 - Module switch for Data based on Ethernet
 - Telephone communication module
 - Teleaction transmission module
 - Accessories for commissioning and operation of the Multiplexer
- Digital Power Line Carrier, DPLC ETL 600 in lines without OPGW, together with the necessary modules for the following functions:
 - Food module
 - Control module
 - TX filter module
 - RX filter module
 - Hybrid module
 - Communication module for Data based on Ethernet
 - Telephone communication module
 - Teleaction transmission module
 - Accessories for putting into operation the Multiplexer
 - Manageable Layer 2 switch, to have the ability to manage the Web, to address with IP addresses, to have the ability to create several VLANs and to have the RSTP protocol.
 - Primary equipment for DPLC connection online.
 - Proper cabling and installation for this network.
 - Analog phone.

8. Transmission System Network Users must bring for approval to the OST:

- Scheme of connection to the telecommunication network of the OST.
- Technical connection project.
- Specifications of the equipment to be installed and their documentation.

9. Before implementation, during commissioning as well as after implementation of OPGW and telecommunication equipment must notify the OST and perform the necessary tests required by the OST in the presence of OSTspecialists.

10. Test reports must be approved and signed by OST specialists.

11. The implementation and connection to the telecommunication network of the OST will be done in cooperation with the specialists of the OST.

In addition to the above requirements, Transmission Network Users must be prepared to provide any additional information that may be required by specific cases . Based on the positioning of the facility on the network, other details that may be needed as appropriate will be provided or requested by the OST.

2.2. Requirements for the realization of the connection of Network Users in the SCADA System of OST sh.a.

The communication protocol between the systems of the users of the Transmission Network and the SCADA system in NDC is IEC 60870-5-104. The protocol configuration (from the master side - SCADA of OST sh.a. as well as from the slave side - PPE / KK) must be performed by the Network Users. Testing and commissioning will be performed in cooperation with the specialists of OST sh.a.

The parametric of the data that will activate the communication through IEC 60870- 5-104 will be determined in cooperation with OST sh.a. (OST will specify CA, IP, and IOA)

The dates in real time that must be sent to the SCADA system of OST sh.a. are as follows:

a. **Measurements:** Measurements must be available for each tract:

- i. Active power (MW)
- ii. Reactive Power (MVA_r)
- iii. Voltages (kV)
- iv. Current (A)
- v. Cos ϕ
- vi. Frequency (Hz)
- vii. High Lake Level (mt) (If LFC applies)
- viii. Lower Lake Level (mt) (If LFC applies)
- ix. Upper Adjustment Limit (MW) (If LFC applies)
- x. Lower Adjustment Limit (MW) (If LFC applies)

Measurements should be updated in cyclical order.

b. **Double Point Indications:** Double point indications should be available for each tract as below:

- i. Keys (Circuit Breakers) control / monitoring
- ii. Knives (Disconnectors) control / monitoring
- iii. Earth knives (Earth Disconnectors) only monitoring
- iv. Double point indications should be updated immediately.

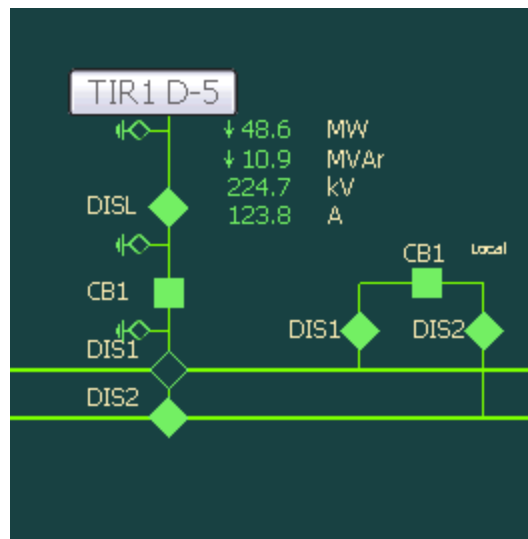
c. **Single Point Indications:** Single point indications should be available for each tract as below:

- i. S/st Authority (The right to control S / s by SCADA system)
- ii. Bay Authority (The right to control the tract by the SCADA system)
- iii. (If LFC applies) LFC authority for each generation unit.
Through this indication the generation control for that unit is passed to the SCADA system of OST sh.a.

- iv. *(If LFC applies)* LFC authority for the power plant. Through this indication the generation control for the power plant is transferred to the SCADA system of OST sh.a.
- v. Alarms:
 1. Distance Protection Trip
 2. Earth Protection Trip
 3. Autoreclose Trip
 4. General Trip
 5. TLC Alarms

Single point indications need to be updated immediately.

Below is an example of the information displayed in the SLD in the SCADA system for a certain tract. The other information listed above is visible as follow:



➤ **(LFC - Load Frequency Control)**

- In case the generator connected to the Transmission System, based on the Transmission code, is obliged to contribute to the Frequency Power (LFC) regulation, he will be responsible for all the data engineering activity and the parametric of the power plant in the SCADA system of OST sh.a. OST sh.a. will provide all the necessary information on the SCADA system regarding of control logic and relevant addresses (IOAs).
- Test scenarios will be prepared by the Network User and will be approved by OST sh.a. the execution of these tests will be performed by both parties. Depending of the power plants, test scenarios may be different from one to another.
- In cases when the control logic supported in the SCADA system of OST sh.a. is standard, also Network Users must conform to this logic.

➤ **Commissioning and documentation**

To make the connection to the SCADA system, the Transmission Network User must provide the following documentation:

- Approved single phase scheme (SLD - single line diagram) and all parameters of transformers, lines, generators.
The architecture of the control mode of their S / s / power plant.
- Based on the above requirements, the Network User must prepare the preliminary parametric of protocol 104, a document which will be approved by OST sh.a. The document will be completed with IP, CA and IOA addresses by OST sh.a.
- OST sh.a. it will provide information on the "setpoint" control logic of the LFC.

Tests will be performed regarding:

- o Realization of the connection with the SCADA system
- o LFC