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### **Preferential Subject N°PS3**

## **RECOMMENDATIONS FOR USING OF SYNCHRONOUS COMMUNICATIONS PROTOCOLS FOR ANALOG AND DIGITAL DATA TRANSFER AS AN ALTERNATIVE TO IEC 61850-9-2 LE (SV) AND IEC 61850-8-1 (GOOSE) PROTOCOLS IN DIGITAL SUBSTATIONS**

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Recently there were a lot of discussions about the implantation of digital substations in Russia which are associated with IEC 61850 implementation. The Service operation at substations believes that digital substations (compared to traditional ones) must provide following options:

- Greater reliability and immunity of power-supply systems;
- Less time break power supply in emergency case;
- Less or at least the same substation cost;
- Gradual modernization of existing substations in the direction of digital ones, in particular, the replacement of the secondary cable facilities to modern fiber optic-based without significant upgrading of another microprocessor and power equipment.

As a rule the solution of these problems was associated with the implantation of new algorithms of digital processing and management of substation that complement existing ones and only sometimes it was determined by the type of communications protocols.

The analysis of the requirements of IEC 61850 as the only standard that defines the principles of digital substation has shown that it can't provide the solution to any of the problems listed above.

Moreover, the use of equipment that supports IEC 61850 protocols, generally leads to a substantial cost increase 2.5-3 times as compared with traditional one, while not improving its performance. The price increase is due to the need to fulfill "tough" requirements related with the implementation of communications protocols for analog data transfer from the current and voltage sensors (measuring current and voltage transformers), and partly from the various sources of discrete information, such as circuit breakers (IEC 61850-9-2, IEC 61850-9-2 LE (SV), IEC 61850-8-1 (GOOSE)). What is more, the "tough" requirements apply not only to blocks of data formation and packet transmission in Ethernet communication network (process bus), but also to synchronization of the station network equipment.

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So, it's necessary and important to develop solutions that remove these contradictions, clarify the structure of the digital substation and extend the list of protocols or interfaces, the implementation of which would provide all the benefits of digital substations.

It is proposed to include in the standards for the digital substation the following terms and interfaces:

- It is recommended to use positional digital transmission line ("point to point") for data transfer from the primary current, voltage and digital signals sensors to ensure the real time transmission of digital information via both the electrical cables and fiber optic ones;
- For the transmission of digital information on positional lines it is recommended to use synchronous peripherals (instrumental) chip interfaces that are built into the ADC unit (chip) and do not require additional hardware cost to implement the Protocol;
- When digitizing data along with analog-to-digital conversion it is recommended to evaluate the vector parameters of analog processes (synchronous vectors), a limited number of which describes a set of important features for emergency operations; vector can be transmitted by synchronous peripheral (instrument) interfaces.

The paper analyzes all the benefits of this approach and has the list of ChEAZ production devices which were designed for digital substations and implement the recommendations:

- Fiber optic transducers of AC/DC current and AC/DC voltage (series VOIP-4960-XXX)
- Digital microprocessor relay protection (series UTSMRZ-4960-XXX) with remote fiber optic blocks of analog and digital data input.