

TRAINING ELECTRICIANS TO OPERATE TRANSFORMER SUBSTATIONS IN THE MOBILE REGIME SHIFT WITH SCADA

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REZUMAT. Un prim pas în realizarea unui sistem expert pentru instruirea personalului de exploatare și întreținere a stațiilor electrice în regim de tură îl constituie stabilirea configurației și a caracteristicilor necesare.

Cuvinte cheie: SCADA, Instruire profesională, Simulator, Instrumente pentru instruire, exploatare stații electrice de transformare

ABSTRACT. A first step in implementing an expert system for training operating personnel and maintenance of transformer substations in the mobile regime shift is to establish patterns and characteristics required.

Keywords: SCADA, professional training, simulator, training instruments, electric transformer substations operating

1. CONTEXT

The transformer substations are essential components of power systems where the complexity of decisions required the introduction of automated systems and a strong personnel specialization. The necessity of increasing the reliability and stability of power systems is strongly constrained by the need to reduce costs. Personnel training is a serious optimization problem for a fast action in a wide area network in normal and emergency condition. Changes in the human resources involved beyond the design and implementation of transformer substation modernization involves reducing the time between commissioning (often in stages) and achieving optimum level of competence for personnel providing operation and maintenance results of these projects.

Application and use SCADA (Supervisory Control and Data Acquisition or Control and Data Acquisition Security) techniques at the transformer substation is not sufficient to ensure material and technical dimensions, namely to develop the system and establish organization rules. Are necessary skills, abilities, individual and group competences that can be obtained

by proper technological education, through the training and development activity. As a form of technology education, training is based on educational objectives developed by the instructor in a structured design process on four pillars: objectives, contents, methodology and evaluation.

The personnel involved in retrofitting changes correspond to the exploitation, maintenance, PRAM and dispatcher activities. For this are important:

- the study of the software control function
- notification of the effects and measures in the case of faults
- aspects of neutral grounding
- faults detection
- voltage regulation
- network restoration
- treatment of incoherent messages
- routine operation

Components of a SCADA system: RTU or PLC, master units and HMI, communication system can be adapted separately or integrated in the technological process, that led to increase the efficiency of training.

2. TRAINING INSTRUMENTS

Programmable actional structures specific for electricians activities related to transformer substation includes intellectual skills, motor and sensory work.

Following the training environment and training will include both tangible physical elements and virtual elements configurable. It realizes both the possibility of entrainment and develop knowledge and skills in economic efficiency by using a complex simulation.



a)



b)



c)

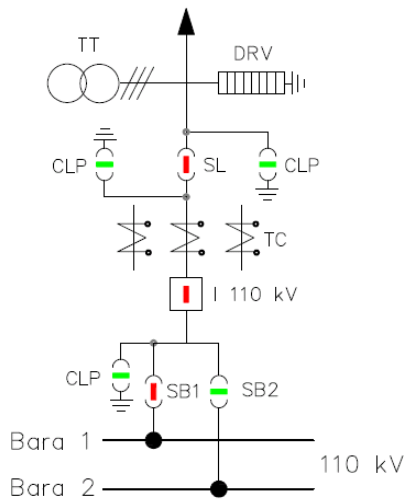


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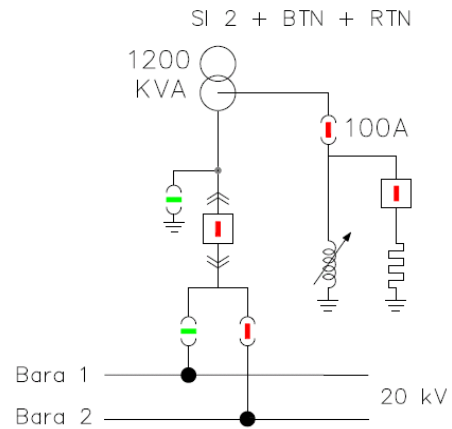
Photo 1: Polygon 110 kV

- a) *Control and protection 110 kV cells box*
- b) *Cells 20 kV*
- c) *Primary cell 110 kV equipment*
- d) *Trafo internal services, BTN, RTN*

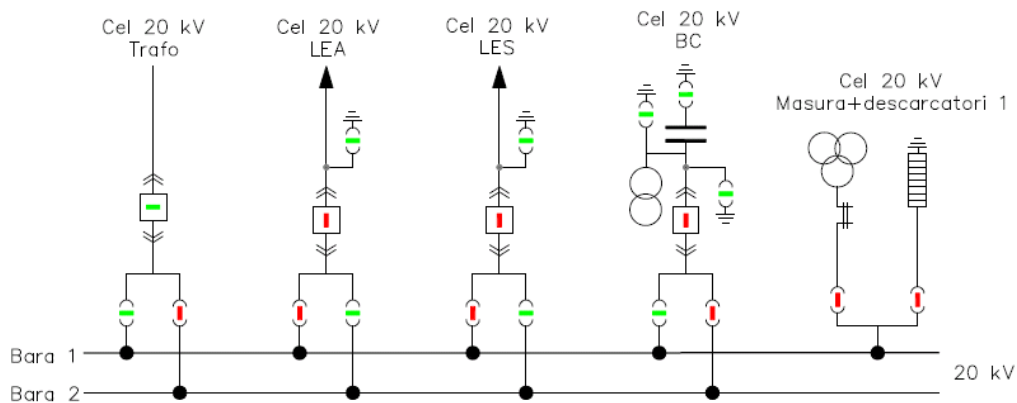
A modular physical structure is shown in Figure 1



a) primary equipment scheme of a 110 kV cell from overhead 110 kV line



b) primary equipment scheme for neutral grounding Bobbin-Resistance



c) primary equipment scheme for 20 kV cells: transformer, overhead power line, cable power line, capacitor bank, meeter box

Fig.1 Modular physical structure

These modules are integrated into real schemes of typical stations from the system. Missing elements from the real station are simulated by a software application running on a separate station that ensures operation fictitious station.

Hardware structure for SCADA application includes appropriate physical elements of real equipment and a data interface unit which provides simulation of virtual components.

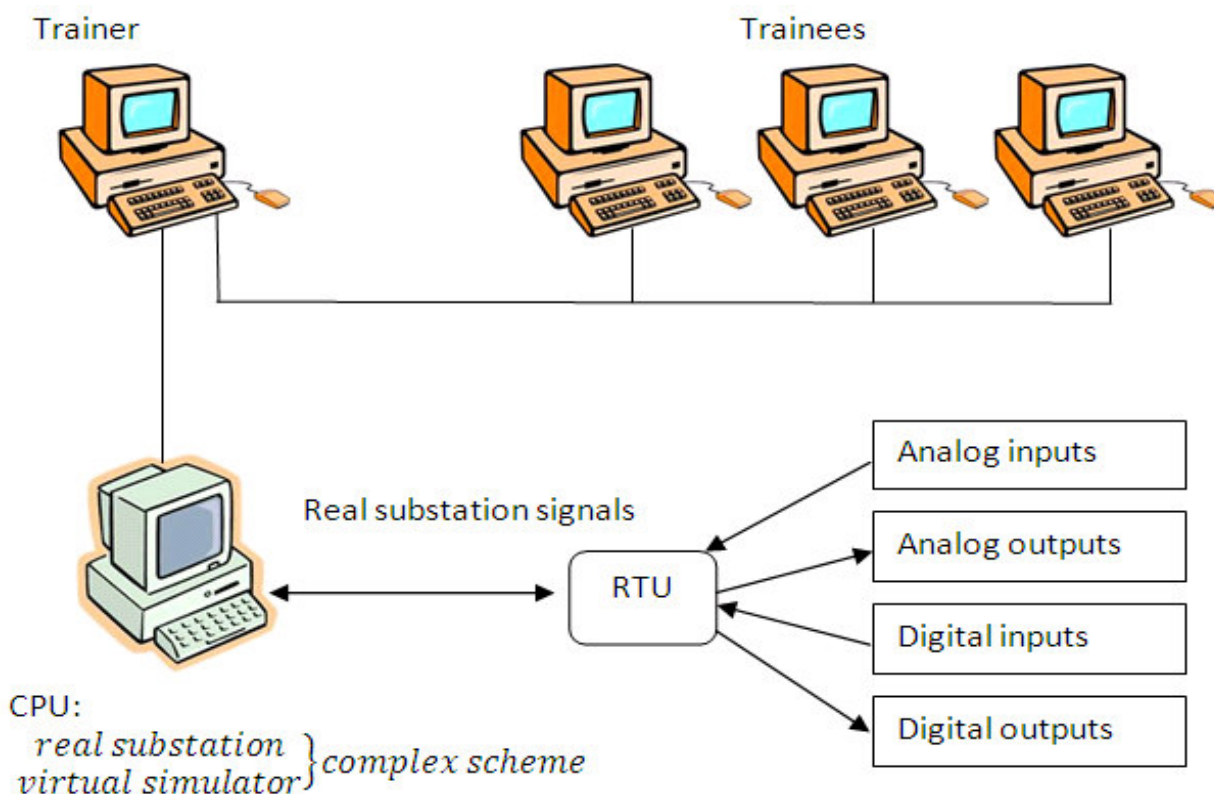


Fig. 2 Hardware configuration

Includes station contours made with hard elements, soft extension with areas indicating 110 kV, 20 kV and neutral treatment areas, contour control center with common LAN telephone connection; hard drives and consoles for operator and instructor.

3. TRAINING OBJECTIVES

Training objectives can be considered achieved if at the end of the course the participant will demonstrate that:

- He can use the computer and knows the steps for logging into the control program;
- He can navigate the station scheme, he can address to a particular device;
- He is able to read normal operating parameters of the scheme, identify abnormal regimes, analyzing reports from the program, interprets alarms, communicate to operational management step the status of equipment and signaling;
- He can operate equipment and perform various operation schemes to the dispatcher or fault regime.

- He knows how to interpret and can perform maneuvers required in putting into operation programs;

For their formulation is necessary to identify situations where electricians intervention is absolutely necessary, only needed to confirm or is strictly prohibited. For each situation is required training and education of electricians. Creating conditions for training will require the identification of controls that the physical model and software system will change in order to obtain the effect of programmed confidence and reliability expected in real situations.

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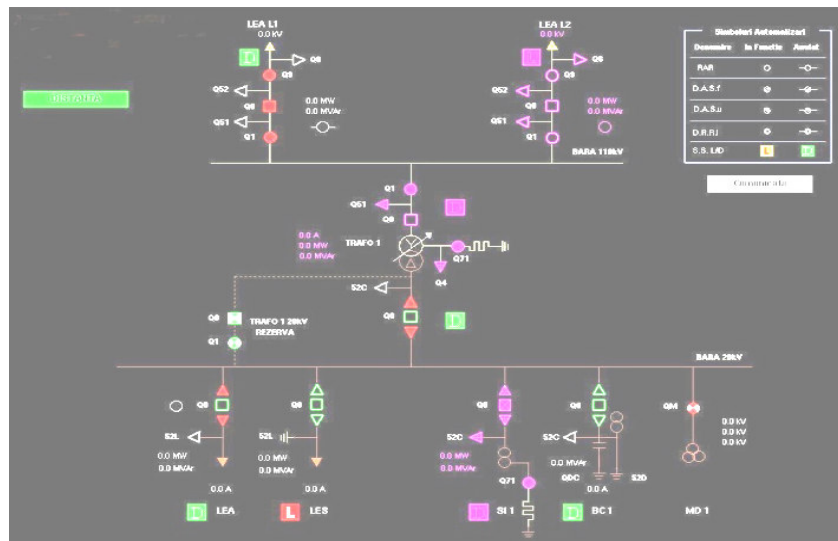


Photo 2: SCADA screen

For the simulated situations it will be considered an indication of what is required (system reaction and the final trainee behavior), what it is offered (system and the electrician action conditions), what is approved (success criteria for planned activities)

Examples:

- Bring in the condition
- Back to normal schedule
- Treatment neutral
- Providing manual bobbin
- Communication protection condition
- Identify abnormal condition
- Report damage / incident

4. THE TRAINING TECHNOLOGY FOR THE EXPLOITATION PERSONNEL

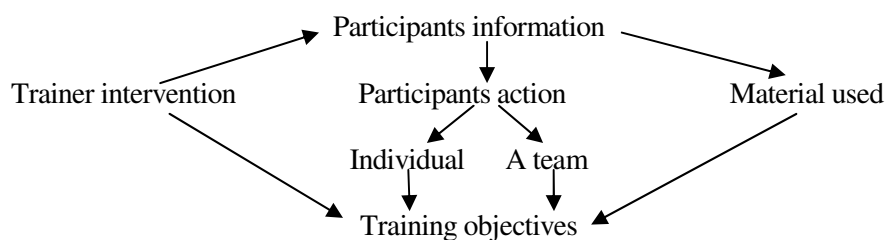
The training technology is influenced by the information technology developments, by the new tools imagined due to new training skills for staff affected by the pressure of reducing costs while increasing high standards required by the market in all areas.

Central element of the training technology is the participants action respectively stage in the assimilation and repeated execution. Participants in training actions, individual or team, take into account the training objectives and is based on the one hand the instructor intervention, and on the other hand the material used.

The participants informing points out the role of instructor in the professional training, no focuses on facet teaching, materials presentation but more on coordination issues in the use of training resources. The coach always diagnosed running training and orientation process goals.

Training objectives are related to the possibilities of practice, how to develop skills that concern how staff operating performed: monitoring and recording equipment technical parameters (including SCADA) monitoring quantities and specific status signals, executing maneuvers and settings and data transmission and information for various entities.

The system supports the training by integrating a monitoring module of actions taken to improve performance and the participants evaluation stage.



5. CONCLUSIONS

Information technology influences both the technology and the training process of operators. SCADA systems resources in transformer substations may be developing systems for the development of skills required by the requirements of power systems. Suggested system allows operators to improved strategies for maintenance and increase overall system operating efficiency of electric transformer substations.

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