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Model for the Study of Automating a System of Pumping Water from Upstream to Downstream Hydropower Plant Using Siemens S7-200 PLC

This paper shows the realization of an experimental model for studying didactic use automation system pumping water from upstream to downstream hydropower. As command and control unit was used PLC Siemens S7-200

***Keywords**: model, pumping, automation, PLC*

1. Introduction

Authors have proposed a small model of laboratory for the study of teacher use automation system pumping water from upstream to downstream hydropower system.

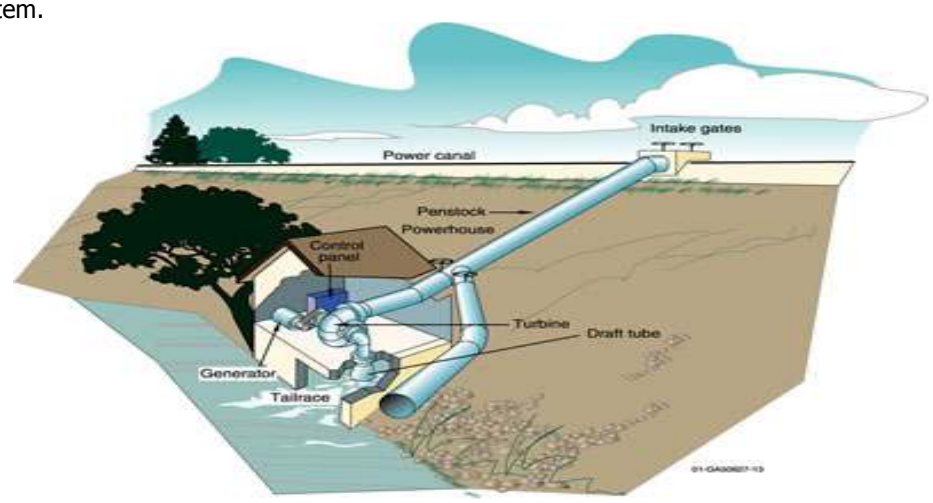

Figure 1. Hydropower plant with pumped storage

The pumping water from upstream to downstream at hydropower is used to increase hydroelectric power installed. It is quite common in power stations built in mountainous areas and where heavy rain fall.

The operation of a plant that uses water pumping system is given in figure 1.

2. The experimentally model

PLC S7-200 model

From a technical standpoint, the choices of PLC (PLC) for automation implementation were taken into account the following characteristics:

- the number of inputs / outputs required;
- the type of inputs / outputs required;
- required memory size;
- speed and power required of central unit and instruction set.

It was agreed that the proposed application, PLC S7-200, automat of micro class, automation has reduced the volume of information handling and slow processes is best suited. The configuration of the PLC CPU 224XP DC / DC / DC 6ES7 214-2AD23-0XB0, used is shown in figure 2.

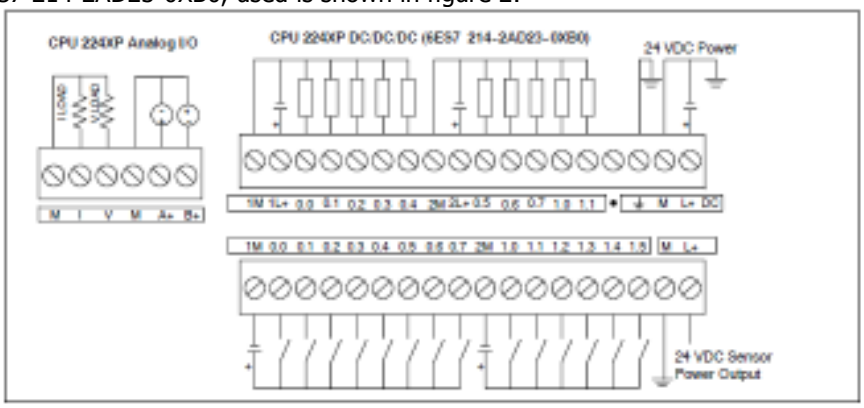

Figure 2. Configuration of programmable automat CPU 224XP DC / DC / DC 6ES7 214-2AD23-0XB0Hydropower plant with pumped storage

Package is used that makes configuring STEP7 SIMATIC components, to assign parameters and for programming. Central control software tool is the SIMATIC Manager, which keeps all the data from an automation project in a directory with a hierarchical structure and allows the user software reuse libraries. STEP7 main activities carried out are:

- hardware configuration - which is the arrangement of modules, assigning addresses, and setting their properties

- configuring communication parameters and its properties
- writing programs in the PLC user one of the three modes used: Ladder Logic (LAD), Function Block Diagram (EBD) or Statement List (STL), and testing their online display.

Experimentally model

A photograph of an experimental model to study the automation of a water pumping system from upstream to downstream hydropower using Siemens S7-200 PLC in the laboratory is given in figure 3.

Figure 3. The experimental model for the study of automating a system of pumping water from upstream to downstream hydropower plant using Siemens S7-200 PLC.

The main elements of the model are:
1. downstream storage tank
2. upstream storage tank
3. level sensor.
4. booster pump
5. system Automation: touch Panel, PLC S7-200, relays, connectors, cables etc.

Elements of program

The model build allows setting and monitoring of functional parameters which is done through the command and drive system.

Some elements that highlight these issues are listed below through the windows displayed on the touch screen PLC.

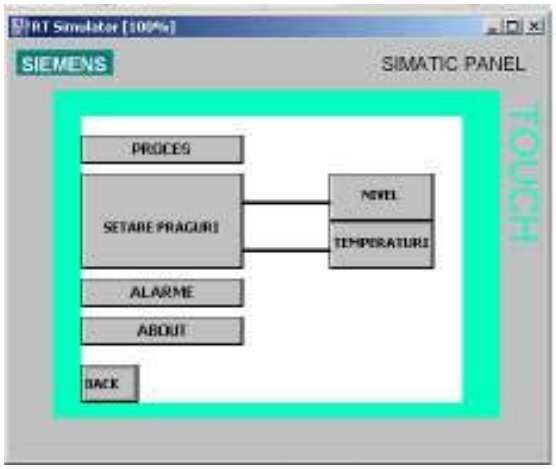

Figure 4. Main menu

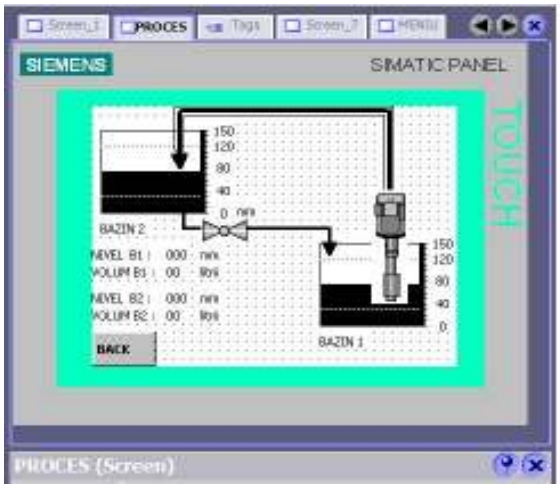

Figure 5. Process display on operator panel

Figure 6. View measurements on the operator panel

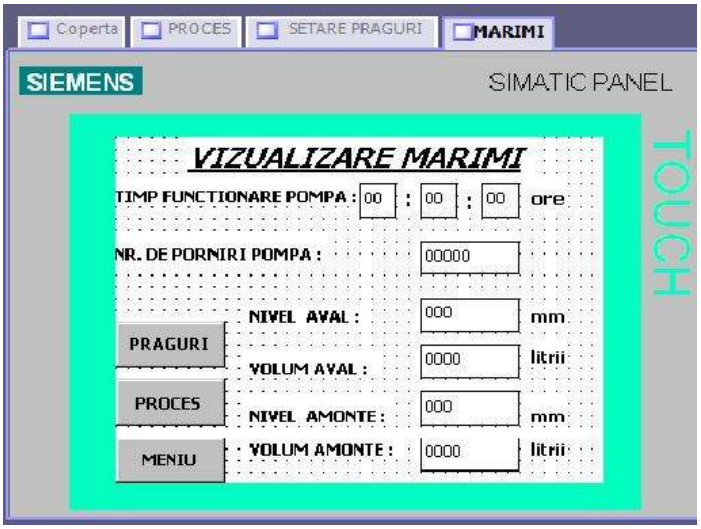

Figure 7. Setting levels on the operator panel

The touch panel exist and option to view system errors that occur.

3. Conclusion

The authors have developed an experimental model for studying functional water pumping system from upstream to downstream hydropower.

The experimental model can be used in the training of graduate students and staff of field.

The making installation shows the possibility of using a PLC of micro class to control and drive water pumping in a hydroelectric plant.

The experimental model is constituted as a research platform to a more complex experimental model of water pumping systems in a hydroelectric power station in which to be studied and the dynamic processes.

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