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Modernization of Siemens SPPA-T3000 Laboratory with the Use of Real-Time Container

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1. Introduction

In 2007, in the laboratories of the NRU "MPEI" Department "Automated control systems of thermal processes" for the purpose of qualitative improvement of the training level of specialists in automated control of power energy facilities in the field of design, operation and maintenance of modern distributed microprocessor multi-level automated control systems four program technical complexes for automation of objects with high information power (>10^3 signals) were installed:

Freelance 800F (ABB, Germany);

KVINT C ("Niiteplopribor" - LLC "KVINT system", Russia);

SPPA T3000 (Siemens, Germany) (Fig.1);

TREI (Russia).

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Fig. 1. Laboratory complex based on PTC SIEMENS SPPA-T3000.

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PTC tools are composed of computer emulators that provide the ability to simulate the operation of both PTC controllers and heat and power equipment.

Collectively, all PTC facilities are composed of all major types of signal inrerface modules. **However, not all the equipment of the laboratory complex has the sources of the corresponding types of signals associated with the controllers signal modules (Fig.2).** Part of the input signals comes from dynamic models of technological objects. Another part of the signal sources is implemented in the form of signal simulators.

Fig. 2. SPPA-T3000 hardware enclosure system.

2. The Basic Features of SIEMENS SPPA-T3000 PTC

The basic functions - signal collection and processing, issuing commands are the basis for the implementation of complex algorithms for controlling the power unit - from step-by-step start/stop programs to full automation of processes at the power plant.

The flagship system SPPA-T3000 is specially designed to perform all tasks of automation of power plant equipment: turbine control, steam boiler control, station-wide systems and integration with third-party systems. What's more, the SPPA-T3000 system not only fulfills traditional plant management tasks, but also provides flexible adaptability to application conditions, giving a wide range of options to meet project-specific requirements, including coordination and management of all aspects of the workflow with increased operational efficiency of the power plant.

3. PTC SIEMENS SPPA-T3000 IN EDUCATIONAL PROCESS

PTC SIEMENS SPPA-T3000 is the flagship of the company and is widely represented in the Russian energy sector, more than 40 objects are automated on its basis: from Kaliningrad CHP-2 (ACS TP power unit № 2 CCGT-450 MWt) to Berezovskaya GRES (ACS TP power unit №3 800 MWt). Therefore, the laboratory complex PTC SIEMENS SPPA-T3000 of the NRU "MPEI" Department “Automated control system of thermal processes” is of great interest to both students and employees of the industry in terms of training.

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The aim of modernization of the laboratory complex SIEMENS SPPA-T3000 in 2019 was its adaptation to the needs of the educational process, associated with the implementation of the ability to work not only with signals simulated by software and the creation of projects, respectively, run on the automation server, but also with real signals connected through a line of signal moduls (communication devices with the object), followed by the launch of projects in the memory of the controller (real-time container). For this purpose in a standard automation **enclosure system (Fig. 2)** temperature sensors, light indicators, potentiometric set points and switches were installed. A non-standard solution for real automation objects was adopted: in the framework of the laboratory work "Liquid level control in the flow tank", the hardware part of the software and technical model of the process was mounted directly **in the front door of the enclosure system (Fig. 3.)**

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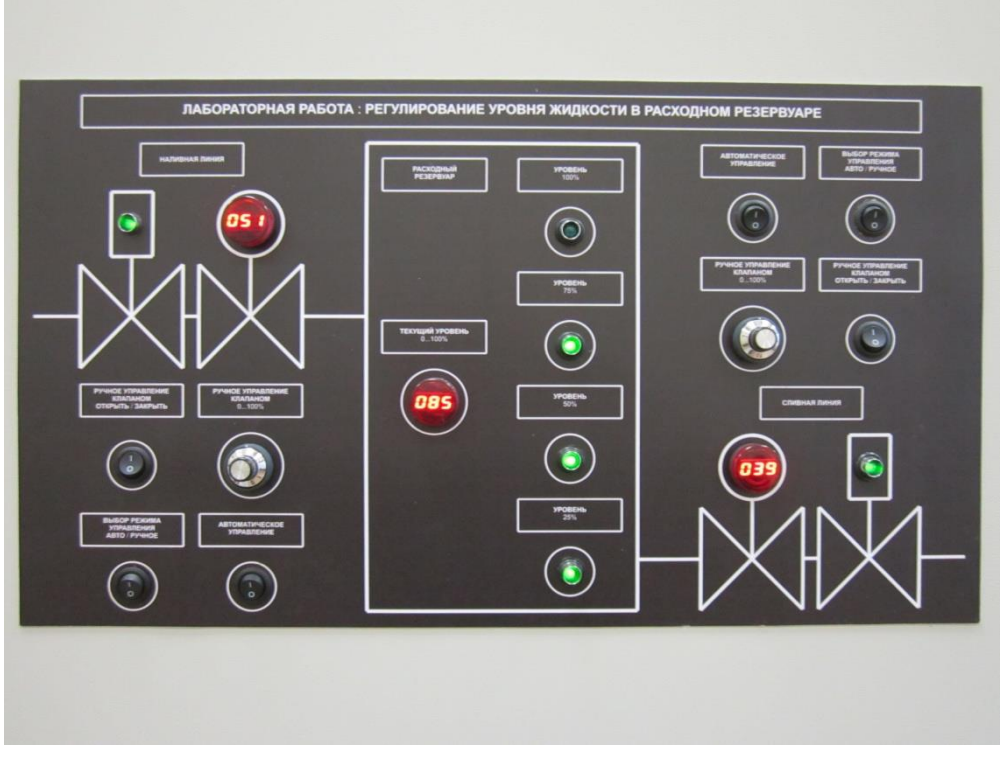

Fig. 3.1. Hardware mnemonic (closed door).

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Fig. 3.2. Hardware mnemonic (opened door).

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The students had the opportunity from all 10 personal computers installed in the laboratory through the appropriate tags to "dock" to all **analog and discrete signals of the PTC (Fig.4)**, and by creating a project with **a regulator and corresponding visualization (Fig.5)**, control the level in the tank in two ways: by acting on the filling line at a constant flow rate in the drain line, and vice versa. The teacher has the ability to physically cause disturbances in the level ACS directly from the interactive mnemonic.

Students' projects are loaded directly into the controller's memory using a real-time container, and the teacher controls the debugging of a particular project at a given time with the help of a specially developed user access control program as part of the modernization of the laboratory.

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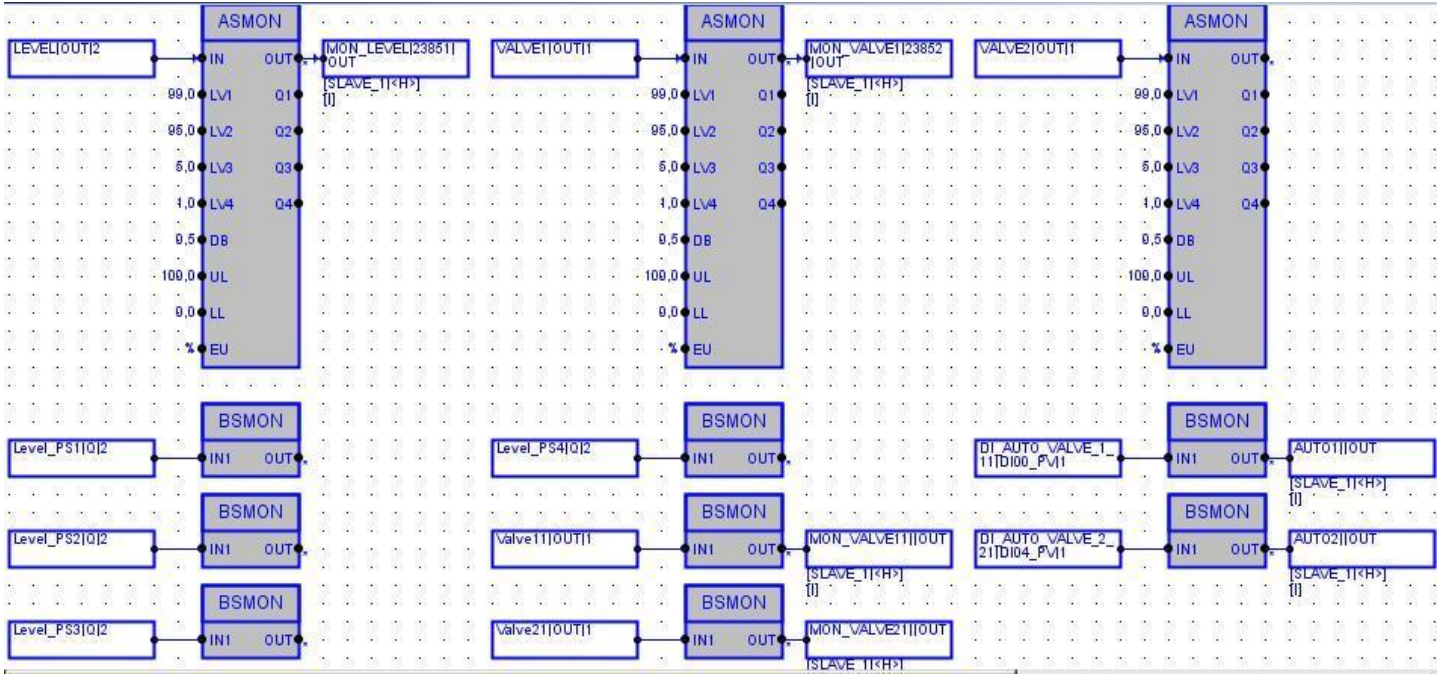

Fig. 4. The program of survey of analog and discrete signals of communication devices with the object.

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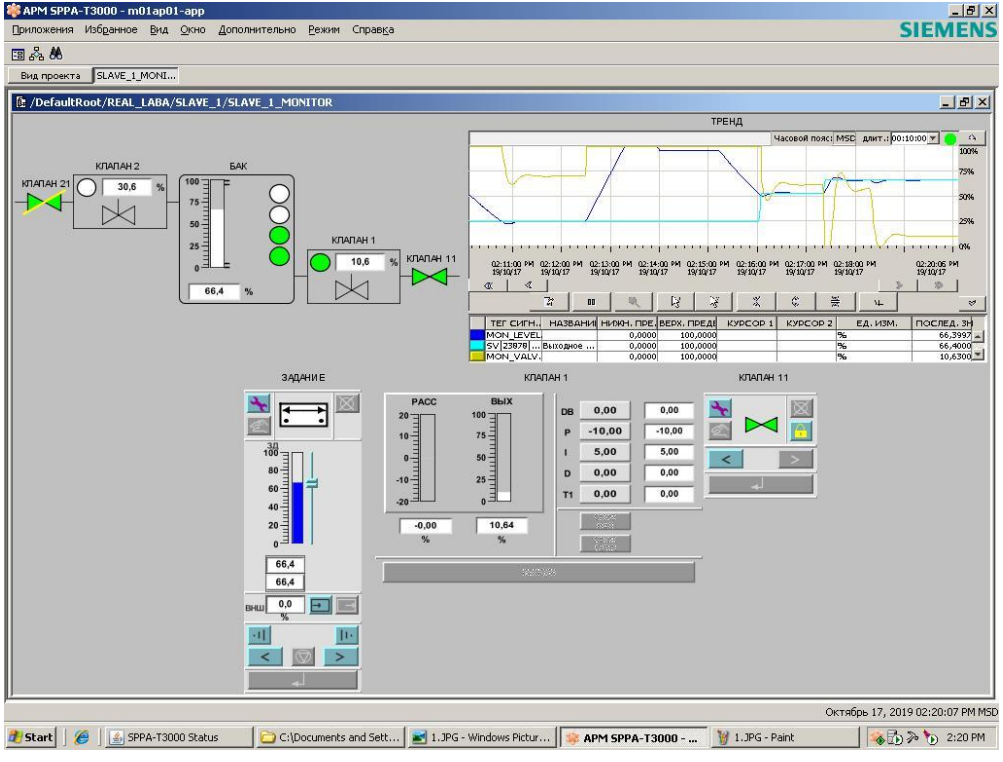

Fig. 5. Level ACS project with real-time container.

4. Conclusion

The SPPA-T3000 control and monitoring system is a software and hardware complex developed by the German company Siemens. It is a process control system that creates a unique open platform for the implementation of modern, cost-effective, future-oriented solutions in the field of automation of industrial enterprises. Its modern design and architecture enable cost-effective solutions at all stages of enterprise development, including design, development, commissioning, maintenance and operation, as well as further development in the INDUSTRY 4.0 concept.

All this makes the National Research University "MPEI" laboratory PTC SIEMENS SPPA-T3000 of Department "ACS HP", is very promising and in demand, and therefore its continuous improvement and wide use in educational process for training students and for professional development of industry professionals, highly relevant and economically feasible.

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Thank you for attention!

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