

## Use of the Design Database of the Thermal Instrumentation and Control CAD when Operating the Process Control System of a Power Plant

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**Abstract**—Use of the database of the project performed within the framework of a computer-aided design of the thermal instrumentation and control to store and process the information on the process control system (PCS) hardware by the operating departments of combined heat and power plants is proposed. The structure of the information on the lower—transducers and executive devices—and the upper—cabinets of the program-engineering complex, process-computer interface modules, and signal connections—levels of the PCS are considered. The composition of the design documentation and the design database structure are described. The elements of the program user interface are shown.

**Keywords:** PCS, combined heat and power plant, program-engineering complex, CAD, databases, design automation

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The idea of writing this article came after a routine business trip with the purpose of making an exploratory design and collecting input data for a full-scale modernization of the process control system (PCS) for a 300-MW power-generating unit accompanied by replacing the existing control and monitoring system based on conventional equipment by a microprocessor-based one.

Experts that deal with reconstruction of power engineering installations are well acquainted with the difficulty of finding the “old” design documentation and the data on the alterations to the design made during operation [1]. It is quite clear that 18 kg—according to the carrier—of drawings, a result of a weeklong thorough search by the developers and the plant’s personnel, does not give an accurate account of used transducers, executive devices, and their interconnection schemes and multiple refinement of data that will be needed.

At present, when developing any projects, the customer is normally given, together with a paper print, files on an electronic information medium. As a rule, these are PDF-files not intended to be used during operation of the installation, although, availability of tools to search for necessary data could be useful in many cases when operating the PCS since the amount of information is rather considerable. Thus, the number of analog signal transducers for a 250-MW power-unit is about 1500 pieces, that of shut-off and control valves (S&CVs), 400 pieces, and that of auxiliary devices (ADs), 80 pieces, and the total number of sig-

nals is more than 5000. Formerly, the author participated in developing special-purpose automated workstations for electric and thermal instrumentation and control (TI&C) departments [2] that would ensure a convenient access to the information on operating equipment. The main problem that arises when introducing these systems was populating the database because there were no specialists at the plants to fulfill this work. Use of the PCS design database could have facilitated solving this problem.

When developing the project, all applied equipment and its connection diagrams are described in the documentation being worked out. If the project documentation comprises not only separate drawings but is developed on the basis of computer-aided design (CAD), information is accumulated in the design database first. In [3], a TI&C CAD was considered intended to design the lower and upper levels of modern microprocessor-based PCSs. CAD has been used to develop design documentation for rather a long time, which considerably increases the developers’ labor productivity and quality of designing: it enables automation of creating planning and design documentation of new types such as lists of the parameters to be measured, for example, temperature, pressure, flow rate, etc., S&CV and AD lists, specifications of the equipment, cabling and piping diagrams for instrumentation and executive devices, entry tables and orders to the plant to manufacture valve control cabinets, cable lists, connections of analog and discrete-time input and output signals of the program and engi-