# RESEARCHING OF AUTOMATION SYSTEM FOR EVAPORATION PROCESS WITH VACUUM

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## ABSTRACT

*This article presents the means of automating evaporation in a vacuum. The classification of modern microprocessor software and hardware systems used in the evaporation process is considered.*

***Key words:*** *modern microprocessor, based hardware, software systems, computer technology, automatic control.*

## АННОТАЦИЯ

*В данной статье представлены средства автоматизации выпаривания в вакууме. Рассмотрена классификация современных микропроцессорных программно-аппаратных комплексов, используемых в процессе выпаривания.*

***Ключевые слова:*** *современный микропроцессор, аппаратная база, программные комплексы, вычислительная техника, автоматическое управление.*

## INTRODUCTION

The most important task of the ACS is to improve the efficiency of object management based on the growth of labor productivity and improve the methods of planning the management process. Distinguish between automated control systems for objects (technological processes - automated process control systems, enterprise - automated control systems, industry - automated control systems) and functional automated systems.

The current stage of development of automated process control systems is characterized by the use of industrial technologies for the creation, and implementation of control systems based on commercially available industrial controllers (PLC) [1], compatible with personal computers (PC), and powerful software and hardware complexes (SHC) [2] support the programming of process control systems, as well as the development and standardization of network technologies. All functional capabilities of the system of the simplest structure of the

PLC ACSTP are divided into two levels. The first level is made up of controllers, the second is the operator's console, which can be represented by a workstation or an industrial computer. The emergence and subsequent development of computer technology has played a huge role in the theory of automatic control. Over the past three decades, many automated control systems (ACS) have been developed around the world. ACS is a set of hardware and software tools designed to control various processes within the technological process, production, enterprise.

At the controller level, signals are collected from sensors installed at the control object; preliminary signal processing, implementation of control algorithms and formation of control signals for the actuators of the control object; transmission and reception of information from the industrial network.

**DISCUSSION AND RESULTS**

The operator console allows you to form network requests to the lower-level controllers, receive from them operational information about the progress of the technological process, display the progress of the technological process on the monitor screen in a convenient operator form, to carry out long-term storage of dynamic information (archiving) about the progress of the process, to correct the necessary parameters of control algorithms and regulator settings in the lower-level controllers. An increase in the number of input/output variables (information power) of a control object, an expansion of the range of tasks solved at the upper control level, an increase in reliability indicators lead to the emergence of more complex structures of software and hardware complexes of the Windows family of Microsoft firm. in the market of office computers, the markets of the level of industrial automation are also actively developed. Most servers and workstations operate under Windows NT/2000/XP operating systems. Some Microsoft technologies have already become an industrial standard [3].

The use of a client-server architecture allows increasing the efficiency and speed of the entire system, to increase the reliability and longevity of the system due to the redundancy of servers, workstations, territories. Real distribution of tasks to be solved.

Servers, as a rule, are based on industrial computers and are redundant. Distinguish: a real-time database server, an operational and archive database server, an input-output server, etc. The main functions of servers of various SHC:

- collection, processing of operational data from devices, communication with the object, and controllers ;
- transmission of control commands to controllers from the upper control level;
- storage and display of information about specified variables;

- provision of required information to client workstations;
- archiving of trends, printed documents and reports of events.

Modern hardware and software complexes, as a rule, include engineering stations based on office PCs. With their help, engineering maintenance of controllers is carried out: programming, commissioning, tuning. In some software and hardware complexes, engineering stations also allow engineering maintenance of workstations.

Classification of SHC ACSTP:

All developed universal microprocessor SHC are divided into classes, each of which performs a certain set of functions:

a) PC-based controller. The total number of inputs / outputs of such a controller does not exceed several tens, and the functions perform rather complex processing of measurement information with the calculation of control actions. The scope of application of PC-based controllers can be limited by the following conditions:

- it is necessary to perform a large amount of calculations in a fairly short time interval with several dozen inputs and outputs of the object;
- automation tools work in the environment, not too different from the operating conditions of ordinary PCs;
- there is no need to use a controller;
- it is advisable to program the functions implemented by the controller in a regular high-level programming language such as Delphi, C #; and not in one of the special technological languages;
- powerful support for operators, implemented in conventional controllers: diagnostics and troubleshooting without stopping the controller, software modification while the automation system is running.

b) Local PLC, the following types are common:

- built into the equipment, as its integral part;
- autonomous, realizing the functions of monitoring and control of a small, isolated technological object. Often these controllers are equipped with ports that connect them in point-to-point mode with other hardware, and interfaces that can connect them to other automation equipment over a network; always in such a controller, an operator panel is built in or connected, consisting of a display and a functional keyboard. For emergency protection of processes and equipment, special types of controllers are developed that are distinguished by high reliability, life, and speed. These controllers provide various options for complete diagnostics and redundancy, both for individual components and for the entire controller as a whole. The following common redundancy options can be noted:

- hot reserve of all components and / or the controller as a whole (if the test is not passed in the working controller, the control goes bumplessly to the second controller);

- triplets of the main components and / or the controller as a whole with "voting" of the results of signal processing of all controllers (the output signal is received the one that gave the majority, and the controller that gave a different result is declared faulty);

- work on the principle of "steam and reserve ". In parallel, a pair of controllers are working with voting results, and a similar pair is in a hot standby; when a difference in the results of the first pair is detected, control passes to the second; the first pair is tested and either the presence of an accidental failure is detected, then control returns to it, or a malfunction is detected and control remains with the second.

c) The network controller complex is the most widely implemented TP management tool in all industries. The minimum composition of the SHC contains a number of controllers, several display consoles for operators and an industrial network connecting the controllers and consoles to each other.

Controllers of a certain network complex contain a number of modifications that differ from each other in power, speed, volume memory, redundancy, adaptation to different environmental conditions, the maximum number of input / output channels. This facilitates the use of the network complex for a variety of technological objects, since it allows the most flexible selection of controllers of the required characteristics for individual nodes of the automated process and different monitoring and control functions.

PCs are often used as display consoles in an ordinary or industrial execution with a conventional alphanumeric or special function keyboard, with one or more monitors with a large screen.

An industrial network can have a different structure: bus, ring, star and subdivided into segments connected by routing tori. The information transmitted over the network is quite specific and is a series of both periodic and random short messages in time. Requirements are set for their transfer: messages cannot be lost in any case (there must be a guarantee of their delivery to the addressee); for messages of the highest priority (for example, about accidents), the time interval for their transmission should be guaranteed. To a lesser extent, these requirements are satisfied.

d) Distributed control systems (DCS) of small scale.

This class of microprocessor devices surpasses most network controller complexes in terms of power and complexity of the functions performed, but at the same time it has limitations in terms of the volume of automated production. The

main distinguishing features of DCS from network systems are as follows: a wider variety of modifications of controllers, I/O units, operator panels; high power of central processors, allowing them to process more than tens of thousands of input / output signals; Allocation of remote I/O units designed to work in various environmental conditions; a more developed and flexible network structure. They often have several levels of industrial networks connecting the controllers with each other and with operator consoles.

The development of the network structure is moving towards the creation of high-speed field networks connecting individual controllers with remote O units /intelligent instruments and I. Such rather simple and cheap networks allow digital transmission of information between controllers and field devices over one twisted pair, which significantly reduces the length of cable networks and reduces the effect of interference.

Small-scale DCS are applied to individual workshops and production areas and in addition to the usual monitoring and control functions, they can often perform more complex and voluminous control algorithms (static and dynamic optimization of the object).These algorithms are implemented either in the controllers themselves, or in the computing power of operator consoles, depending on the volume and dynamics.

e) Full-scale DCS is the most powerful class of microprocessor-based hardware and software complexes, which practically has no boundaries in terms of the functions performed and the volume of the automated object. One such system can be used to automate the production activities of a large-scale enterprise.

This class of SHC includes all the features of the listed micro-processor controls and, in addition, has a number of properties that affect the possibilities of their use:

- equipping with industrial networks allowing to connect hundreds of nodes (controllers and consoles) to one bus and distribute them over considerable distances;
- availability of controller modifications, the most powerful in terms of computing capabilities, which Allows, in addition to the usual functions, to implement in them complex and voluminous algorithms, monitoring, diagnostics, management;
- widespread use of information networks (Ethernet) to connect operator consoles with each other, with database servers, for interaction of the software and hardware complex with the enterprise network and building control centers (planning, dispatching, operational control);
- interaction of control panels in client / server mode;

- as part of a keta of applied programs that implement the functions of controlling individual units (multi-connected regulation, optimization, etc.), dispatching control of production areas, accounting and planning of production as a whole.

## CONCLUSION

The above classification helps to cover the entire range of modern microprocessor-based hardware and software systems and highlight the main features and differences of individual classes of these tools.

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