DEVELOPMENT OF AUTOMATED MANAGEMENT SYSTEM IN TECHNICAL PROCESSES

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Abstract. *In production processes, it is necessary to organize management in the creation of a general system with the help of technical tools and information processing devices. It is possible to create automation while complying with all technical conditions and requirements of production. Programmable logical controller, SCADA-systems are becoming useful in systems controlling complex technological processes.*

Keywords: *automation, automated control systems, information processing, programmable logic controller, SCADA-systems.*

In modern conditions, approaches to solving problems of automation of technological processes are very wide and should be updated almost at the same speed as in modern mobile communication devices. Recently, an important condition for the development of the system was the maintenance of the operating mode of the technological process. Currently, the control system is being built as an open platform with the ability to monitor, control and control equipment, as well as alert the operator. Each developer forms a set of system options at his own discretion, taking into account their importance.

Technical means and information processing devices in production processes. A programmable logic controller (PLC) is an autonomous programmable device for collecting and processing data, as well as the main hardware of the processing level of local automated control systems (ACS). The industrial controller performs the following main operations (cycle of operations): collection of signals from sensors; signal processing according to the applied control algorithm (law); supply of control actions to the actuators (mechanisms).

Unlike a personal computer, it is designed to solve limited tasks and must have the following main characteristics:

1) work in real time, i. e. ensuring high reactivity (speed) of servicing applications from the control object (ensuring control over the speed of the technological process);

2) requirements for the reliability of work: automatic restart in cases of "hanging" of the program; the design is adapted for work in workshop conditions (increased vibration, electromagnetic interference, dustiness, temperature fluctuations, sometimes explosion hazard); minimum power consumption and heat dissipation in conditions of limited power supply capacity and absence of forced ventilation and cooling elements;

3) modularity of the architecture, allowing expansion and modification (placement of additional blocks or modules).

When building an automated control system, it is important to choose a controller that meets all the technical conditions and requirements of a particular production:

1. The possibility of full backup for processes where fault tolerance is important.

2. Number and type of communication interfaces supported. This determines the flexibility and scalability of the entire control system. Modern controllers are able to support up to 10 data transmission standards simultaneously, which determines their versatility.

3. Performance. Typically, it is measured by the number of elementary operations performed per second (up to 200 million), or by the number of functional blocks processed per second.

4. The amount of RAM. During the operation of the controller, automated control algorithms programmed by the user, the operating system, library modules, etc. are loaded into its RAM; the more RAM, the more complex and voluminous algorithms the controller can execute. It varies from 256 kilobytes to 32 megabytes.

5. Reliability. MTBF up to 10-12 years.

6. Availability of specialized development tools and support for various programming languages. For the convenience of the programmer, several visual and text programming languages (FBD, SFC, IL, LAD, ST) are supported.

7. Ability to quickly change control algorithms, that is, without stopping the controller.

8. Possibility of local input/output. Some PLCs are designed to work only with the remote I/O subsystem, while others can work with both local I/O modules and remote nodes.

9. Weight, overall dimensions, type of mounting (on a DIN rail, mounting plate or rack). This is important to consider when designing and assembling cabinets.

10. Working conditions (temperature, humidity, mechanical influences). Most industrial controllers can operate in harsh industrial environments at 0 to 65°C and 95 to 98% humidity.

Software for information processing devices in production processes. Basic requirements for PLC software: autonomy; support real-time data collection, analysis and management, as well as local databases; the possibility of remote control from the control room (the level of SCADA systems); network support.

The software includes the following main components: test software; basic software; practical technological programs.

Testing software. Performs testing (debugging) of individual PLCs and the system as a whole (including testing and diagnostics of various configurations) and includes the following components: startup and configuration programs, as well as initial tests of PLCs and network adapters (firmware located in ROM).); programs for PLC testing via communication line with a high-performance computer or special adjustment equipment; software for testing, configuring and collecting statistics of the local network of a distributed system; complex testing of a distributed system as a whole; special test programs for running tables, panels, stands, emulators, etc.

PLC debugging is performed using computers or dedicated consoles that provide access to the PLC's memory and ports for debugging and quick entry of data, settings, and control information. The debugger PLC works to step through internal programs, simulate the delivery of external signals, monitor changes in register status, and so on. allows.

Basic software. It includes: operating systems and PLC devices that control the execution of the used technological program in real time; network software tools that provide information exchange between individual nodes and the possibility of remote access and control in a distributed system.

Practical technological software. The following tools are used to develop technological programs: editors, programming systems (support for assemblers and high-level languages, as well

as technological programming languages), debugging and testing tools, and tools for functionally oriented programming languages. design a system with minimal effort. Complete construction.

The technical languages used to develop applications typically include arithmetic and logic operations, port cycling, interrupt control (disable/enable, prioritization), synchronization and event handling, and dynamic loading and running of programs. The language elements are the names of I/O ports and their individual bits, the names of counters, timers and contacts, flags and process parameters.

Modern automated control systems are often included in the complex management systems of an enterprise. Integrated enterprise management systems include:

ERP-systems (Enterprise-Resource-Planning) - enterprise resource management;

MES-systems (Manufacturing-Execution-Systems) - a system of executive discipline of the enterprise;

SCADA (Supervisory-Control And Data-Acquisition) - system of operational dispatch control and data acquisition;

PLC (Programmable-Logic-Controllers) - programmable logic controllers (PMC);

Real-time process control is based on SCADA-systems. The following devices are involved in control systems:

- Control device;
- Control mechanism;
- control object;
- Sensor

The primary function of a PLC is to execute process control applications. Considering their diversity, the controller must be freely programmable, that is, create special programs of arbitrary structure, without limiting their functionality. PC or handheld programmer connected to the controller via the network, software development tools.

Software development tools greatly speed up the software development process and include:

1. Ready-made components (software libraries, functional blocks, ready-made procedures, templates and scripts);

2. Tools for debugging, testing and modeling (allows you to run the developed program without loading it into a real controller).

Application software development tools for controllers typically support up to six different programming languages based on the international standard IEC 61131 (developed by the International Electrotechnical Commission (IEC)). From the point of view of the description of programming languages, the standard is a reference point for many. PLC developers. The programming languages in IEC 6-1131/3 include four visual languages (LD, FBD, SFC, CFC) and two text languages (ST, IL) for engineers and business analysts. programmers.

Without any of these devices participating in the system, there is no control system. Installed on the SCADA control device. It consists of a program, as indicated above, a control algorithm is created using a package of system tools, and a control system is created for a specific process. An organized system works on the basis of a program that is part of real-time SCADA. Two variants of the organization of automatic control systems for technological sections are used.

In the first option, the computer is involved as the main controller. The computer receives information from the controlled object from the sensors through automated digital transmission

devices, processes the information in real time and sends the necessary command to the executing mechanism through automated digital transmission devices.

The second type of automated control systems uses distributed systems and collects information from controlled objects to controllers through sensors.

Each controller is defined for a certain number of parameters. The controller processes the received information, develops a control command under the algorithm included in it, and transmits it to the control mechanisms in the form of information in a form they understand. The computer participating in the system forms a high-level control system, represents the technological process in real-time systems based on mnemonics, creates a data archive in real-time systems based on the information received from the controllers, records emergency situations in the process over time, issues high-level commands to the controllers specified by the user .

The implementation of SCADA systems allows to transfer data and technological information directly to the main control panel in large facilities, which in turn leads to lower costs of secondary equipment operation. In the market of new technologies, we can meet many types of SCADA systems, but nevertheless, most of them have the same function, that is, to fulfill the same basic requirements in technological process and production automation.

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