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AUTOMATED SYSTEM FOR CONTROL OF ELECTRICAL PARAMETERS OF RADIO-ELECTRONIC EQUIPMENT OF A SPATIALLY DISTRIBUTED COMMUNICATION NODE

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Abstract: Automated complex control and diagnostics, designed to create compact workplaces for monitoring, troubleshooting and repair of replaceable functional units of electronic equipment. Through the use of a control computer and various programmable blocks and a switch installed on its system backbone, the formation of stimulating effects (test signals) on the control object, measurement and analysis of responses to them is ensured. This provides control and diagnostics of digital, digital-analog, analog-to-digital and high-frequency REA circuits.

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The automated control and diagnostic system (ASKD) can be used both as part of existing and as part of modernized or newly created spatially distributed communication centers (CS) for various purposes for monitoring the technical condition, diagnostic and repair and restoration work of radio electronic equipment (REA) in the places of its operation.

Known automated complex control and diagnostics, designed to create compact workplaces for monitoring, troubleshooting and repair of replaceable functional units of electronic equipment. Through the use of a control computer and various programmable blocks and a switch installed on its system backbone, the formation of stimulating effects (test signals) on the control object, measurement and analysis of responses to them is ensured. This provides control and diagnostics of digital, digital-analog, analog-to-digital and high-frequency REA circuits. The disadvantage of this automated monitoring and diagnostics complex is the impossibility of monitoring the technical condition and diagnosing the electronic equipment during its operation. Another disadvantage of this complex is the need to deliver the functional units of the electronic equipment for their control, diagnostics and repair to the location of the automated complex, which ultimately leads to an increase in the total time for diagnostics and repair of the electronic equipment due to the delivery time.

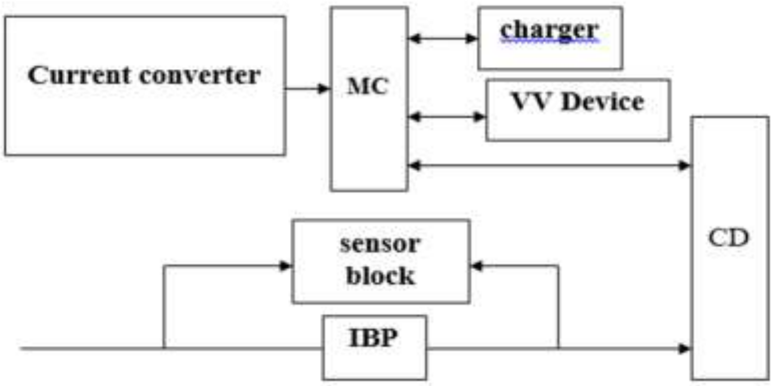
An important point in the storage of information is the value of the stored data. In the case when a local computer of a simple user is meant, an inexpensive uninterruptible power supply (UPS) is sufficient, which, in the event of a power outage, will inform the operator of a personal computer (PC) with a sound signal, thereby making it possible to complete the work correctly. But this option is not suitable for computer networks with dedicated servers. Very often there is no operator on the server, and there is no one to hear the sound from the UPS. In this case, it is extremely necessary to automate the PSU. With chips at their disposal that could do all this, manufacturers gained the ability to set thresholds, timers, and other variables. In addition, they began to offer external applications for managing their devices from a protected PC. For example, UPSs can safely stop a computer and then start it again after the power outages stop. In addition to showing all sensors and counters showing how the UPS is functioning, the program allows you to schedule shutdowns using a monthly calendar. New UPS models are equipped with network interface cards whose firmware understands the SNMP language, although this high-level protocol was originally intended for managing network equipment.

This approach will ensure uninterrupted operation of the network as a whole for a certain period of time. However, modern security and information protection requirements dictate the need to improve modern systems.This problem can be solved by implementing a strategy for multi-level control of the power supply of computer networks, based on the analysis of the readings of many sensors, as well as monitoring the health of the UPS itself. Namely, adding an additional unit to the existing uninterruptible power supply circuit - the second level of control.

At the output of the UPS, it is first necessary to control the line supplying voltage directly to the PC system unit, and peripheral devices are connected to other voltage sources. The UPS incorporates circuits for switching power to backup, and although its switching speed is not high, in practice it is enough to solve this problem.During operation, the UPS does not have the ability to control the technical characteristics of the battery, which means that at some point in time, if there is a failure in the backup power network, there will not be enough time to shut down correctly. Thus, in the course of work, it is necessary to know what state the UPS is in, and whether it is capable of supporting the PC if necessary. In addition, the UPS does not have the ability to send control messages to the PC. Many UPS models have built-in interfaces for connecting to a PC and are used as slave devices, since in this case all the necessary decisions are made directly by the PC. Such a control scheme is not always effective, in view of the fact that much more time is spent on message exchange, and the load of the PC processor is not taken into account, which in some cases, at full load, the processor postpones the decision to shut down. In practice, the decision to shut down the PC should be made by the controller that directly processes the sensor readings. In this case, decisions are made more quickly and, most importantly, there is no additional load on the PC processor. To solve this problem, it is advisable to transfer all these functions to an external device.

Figure 1 shows a block diagram of an automated system for monitoring the electrical parameters of the power supply of computer network nodes.

Picture 1 - Automated system for monitoring the electrical parameters of the power supply of radio-electronic equipment of a spatially distributed communication center.



The first level of protection is the UPS itself, the second is the system for monitoring the electrical parameters of the power supply of computer network nodes.As can be seen from the block diagram, the automated system for monitoring the electrical parameters of the power supply of computer network nodes (SKEPP) consists of: a current converter that feeds the microcontroller, a sensor unit that measures the electrical parameters at the input and output of the uninterruptible power supply, the output voltage of which is also input for a personal computer, as well as an input-output device, and a storage device.The automated system for monitoring the electrical parameters of the power supply of computer network nodes works as follows: the system is connected to a break in the wires at the input and output of the UPS, to control the input and output voltage, for measuring which a sensor block consisting of TSF-1-220 sensors is used, and is also connected to to a personal computer, via the USB interface, information from the sensor unit is sent to the microcontroller, which analyzes the readings of the sensors and sends commands to the PC, depending on the settings stored in the memory device, the settings are made using a set of buttons and an LCD display in the I/O device unit .

The mode of remote automated control and diagnostics provides for monitoring and diagnostics of electronic equipment operating in an unattended mode or in unattended hardware RS, as well as in the temporary absence of service personnel in the hardware RS. In this mode ASKD REA works as follows.

In the AIC database of the dispatcher 2, a local AIC 5 is assigned, with the help of which the control and diagnostics of the electronic equipment in the 1st control room is performed. At the command of the control program of the AIC controller of the dispatcher 2, which, in accordance with the unique address of the local AIC 5, is transmitted through the switch (router) 3 via the Ethernet network 4, the assigned local AIC 5 is switched to the remote control and diagnostics mode.

In the state of control in the AIC database of the dispatcher 2, for a certain local AIC 5, controlled samples of REE 7 are specified in the i-th hardware control system by identification signs and electrical parameters are selected for each given sample of REE 7, which are subject to measurements.According to the commands of the control program AIK dispatcher 2 for controlled electrical parameters in the local AIK 5 virtual measuring devices are selected and their modes of operation (measured parameter, measurement scale, etc.) are set.The sequence of control of the given samples of REA 7, the sequence and frequency of sessions of measuring electrical parameters using the local AEC 5 are set in the control program of the AEC dispatcher 2.

From the outputs of the controlled REE samples (blocks, nodes) 7 to the corresponding inputs of the AIC 5 (if necessary, through adapters 6) electrical signals are received, the current parameters of which are automatically measured by the corresponding virtual measuring instruments.The results of each measurement session of the parameters are recorded in the database of the local AIC 5 and are simultaneously transmitted over the Ethernet 4 network to the server database of the AIC of the dispatcher 2, in which each measurement session is assigned a system time value.

In the AIC database of the dispatcher 2, the values of the measured parameters of the signals from the outputs of the electronic equipment (unit, node) 7 in the i-th hardware US are compared with the standard tolerances of the electrical parameters.If the values of the measured parameters of the signals do not go beyond the normative tolerances, then a logical decision is made about the correct technical condition of the electronic equipment (block, node) 7, otherwise, about a faulty technical condition.

In the state of diagnostics in the AIC database of the dispatcher 2, for a certain local AIC 5, the diagnosed REE samples 7 are set in the i-th hardware US by identification features and the electrical parameters of each of the REE 7 samples that are subject to measurements are selected. According to the commands of the control program AIC dispatcher 2 for controlled electrical parameters in the local AIC 5, virtual measuring instruments are selected and their modes of operation are set, and test signals are programmatically set from the database of the local AIC 5 for the given diagnosed samples of REA 7, which are given by the commands of the controller of the local AIC 5 through its outputs to the corresponding inputs (if necessary - using adapters 6) of controlled REE samples (blocks, units) 7. From the outputs of the controlled REE samples (blocks, nodes) 7 to the corresponding inputs of the local AIC 5, responses are received to test signals, the parameters of which are automatically measured by the corresponding virtual measuring instruments.

The results of each measurement session, responses to test signals, are recorded in the database of the local AIC 5 and are simultaneously transmitted over the Ethernet 4 network to the server database of the AIC of the dispatcher 2, in which each measurement session is assigned a system time value.

In the AIC database of the dispatcher 2, the values of the measured parameters of the responses of test signals from the outputs of the electronic equipment (unit, node) 7 in the i-th hardware US are compared with the standard tolerances of electrical parameters. If the values of the measured parameters of the signals do not go beyond the normative tolerances, then a logical decision is made about the correct technical condition of the electronic equipment (block, node) 7, otherwise, about a faulty technical condition.

For a visual representation, the current results of a measurement session of the REA parameters 7 are displayed on the monitor of the dispatcher's AIC 2 in the form of a mnemonic diagram of each sample of the REA-object of control and diagnostics, the color scheme of which is set depending on the logical decision made.

Thus, the automated system for monitoring the electrical parameters of the power supply of computer network nodes, receiving information from the sensor unit about the power supply parameters, analyzes this information for signs of deviation from the permissible values, if such signs are found, the system sends commands to the PC about the need to archive data, and correct turning off the PC.The system for monitoring the electrical parameters of the power supply of computer network nodes implements a strategy for multi-level control of the power supply of computer networks, based on the analysis of the readings of many sensors, as well as monitoring the health of the UPS itself.

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