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Centralized monitoring of the power electronics devices and display unit

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Abstract— **It is a solution for monitoring and control of power electronics devices in telecommunication facilities. Centralized monitoring of the power supply system enables monitoring of the operation of all devices in the system, using the same user application. In addition to monitoring of individual devices' operation, the operation of passive elements, which together with the power electronics devices constitute the power system, is also monitored. With the implementation of derived alarms, such as organized, centralized monitoring increases the reliability of the power electronics system and enables the responsible sector to prevent interruptions in the operation of telecommunication equipment by preventive maintenance. Managing power electronics devices represents switching on or switching off of monitored devices or modules, starting a capacitive test, and adjusting the operating parameters of the power supply device from the remote monitoring centre. It is estimated that with such organized remote monitoring, the total costs of installation and maintenance of the power system can be reduced by 16%. The cost resulting from the interruption of telecommunication traffic as well as the cost of termination of the services due to the unreliable operation of the telecommunication system is not included in the savings' calculation. Display unit is also provided for the inspection of the power usage.**

Keywords— monitoring; application; power electronics

I. Introduction

Most of the papers analysed the observed problems in the operation of one power electronics device or several power electronics devices(systems) that together realized the function of an uninterruptible power supply. The analyses were conducted using the data collected on-site, in the system operation, real-time, through dedicated monitoring devices. Some papers deal with the analysis and organization of remote monitoring and control. Solutions aiming to provide better (faster, more technically efficient, more economically efficient) operation of monitoring sectors have been proposed. The main purpose of the monitoring system is to reduce the interruption time of the energy consumers due to malfunction of power electronics devices, but also to increase the working efficiency of the maintenance sectors. This paper describes some observed short comings in the typical organization of remote monitoring off power electronics devices and suggests one solution for the organization of remote monitoring and control, optimized according to existing monitoring sectors. In addition to monitoring the certain power system element's operation, the realized solution monitors the interaction of the devices, so the monitoring sectors can prevent interruptions in the operation of power systems by timely intervention.

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II. related work

In cooperation with numerous users, according to their needs, requests, suggestions, and recommendations, and based on the long-term research in the field of remote monitoring and control of power electronics devices, the authors created a monitoring system optimized according to the needs of maintenance sectors. There are various users: from telecommunication companies, through power generation and distribution companies, to special users. About six hundred devices designed for remote monitoring and control of power electronics devices have been installed so far. Each of these users had some specificities, so this system adapted them. 29 papers about the method of realization of the power electronics devices' monitoring and control, and about the observed problems in the operation of the power supply system were published at national and international conferences. Most of the papers analysed the observed problems in the operation of one power electronics device or several power electronics devices (systems) that together realized the function of an uninterruptible power supply [1].

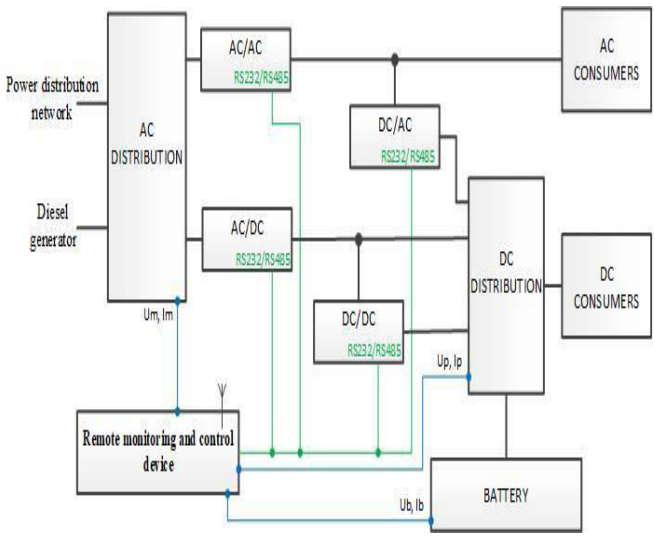
III. monitoring of power electronic devices

Remote Monitoring Technology (RMT) is one of the key factors for servicing the system. Although servicing has been the subject of intensive research for years, the role of RMT in this field is less explored. Energy converters and generators are complex devices and usually have a microcomputer which, in addition to monitoring the operation of the device itself, can also have the remote monitoring function [2]. On the other hand, AC and DC distributions consist of passive elements, so

most often there is no monitoring of these elements' operation. This practically means that it is a realistic situation that no one of the monitored devices sends an alarm to the monitoring sectors, regardless of the power system is defective. Another problem of the described monitoring approach is that microcomputers used for the control of power electronics devices are not a good solution for power electronics devices' monitoring. Monitoring is not their basic function, so the data obtained in this way are not reliable. If the data are not reliable, the responsible sectors may make the wrong decisions

IV. centralized monitoring

The described alarm state detection analysis shows that the monitoring of power electronics devices via microcomputers incorporated in some system elements has numerous shortcomings. By analysing the different power supply systems, it is concluded that monitoring of the local power system is not adequate. The collected data are not always reliable and are not displayed in the form required for the operation of the relevant maintenance sectors



The display unit can be added at the consumer for knowing about the power usage.

The monitoring device collects all relevant information about all circuits in the power electronics system, using its own sensors. In addition to energy converters, AC and DC distribution, all available energy sources are monitored [3]. If the energy converters have microcomputers, the monitoring device also accepts these data. Data collected from own sensors, together with data obtained from the microcomputer, are forwarded to the monitoring centres. In order to increase the reliability of data transmission, it is possible to connect two transmission paths that are used depending on the availability in a telecommunication object (usually one wired Ethernet or modem and wireless - GPRS). There is only one computer in the monitoring centre that receives data from all peripheral devices, unpacks them and displays it on one monitor. Data are displayed in such a way that at first glance can be determined how many power systems with irregularities in operation exist.

At the basic level, all regional canters are visible. The occurrence of an alarm in any regional centre will change the colour of the circle next to the name of the regional centre. At the basic level, a window presenting all the objects that are being monitored and objects under alarm can be opened.

At the second level, the data from the monitoring device are visible. The input voltages in the object, the voltages, and currents of the alternate power supplies, the temperature of the object, as well as the voltages and currents at the output of the power supply system are measured [8]. The occurrence of an alarm, besides spotting by the message and the data in red colour, also includes an audio alarm. The alarm message will remain on the screen until the user confirms it. After confirming the alarm, the alarm event is registered into the alarm base.

At the third level, the data is collected from the Microcomputer.

The frequency of the data collecting from a monitoring device is fifteen minutes, which is sufficient to prevent the occurrence of a phenomenon that could lead to an unregistered irregularity of the power system [9]. If an alarm occurs, the monitoring system generates an alarm, regardless of the fifteen-minute call-over. In addition, after an incident, it is possible to analyse the behaviour of each element in the system before, during and after the secondary measurement incident.

V. conclusion

All elements in the power electronics system are monitored so that the state of each circuit in the system is reliably known. Data from the microcomputer are also collected if they exist as integral elements of the power supply system. In the monitoring centre, all data are displayed on one monitor. In order to improve the efficiency of the maintenance sector, the data are divided into three levels. With monitoring organized in this way, the maintenance sectors, in addition to receiving the alarm from an object, can also determine the cause of the alarm and decide who and when to intervene, in order to eliminate the alarm. In addition to reducing the unnecessary going on-site of the maintenance team, the planned maintenance of the power supply system elements is enabled. It is estimated that with such organized remote monitoring, the costs of servicing and replacing elements in power electronics systems can be reduced by about 60%.

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