DETECTION OF DANGER AND AUTOMATIC FIRE EXTINGUISHING IN RACK CABINETS*

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Every used RACK cabinet interior should be protected from fire danger. That is why, there are used the FRS-RACK extinguishing modules consisted of the fire and smoke detection systems and the extinguishing units. Every extinguishing action shall be automatically initiated after detection of danger. Connection to the extinguishing system shall also give an ability of remote steering and collecting data of the modules.

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1. Introduction

Main purposes of the project were:

— Connecting to the FRS-RACK Master and Slave modules with our personal computers by RS-232 and by RJ-45;

— Communication with the module;

— Checking the working parameters like pressure in the storage cylinders filled with the extinguishing mixture, battery voltage, *etc.*;

— Creating the LabVIEW software, which shall enable remote steering of the module.

The FRS-RACK [1] is a fully automatic, independent system of fire detection and protection, created specially to 19" and bigger RACK cabinets. It consists of systems of fire detection, steering, estimation, alarming and

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extinguishing. The components of the extinguishing unit are metal cylinder-shaped storage bottles filled with the extinguishing agent sealed by collection fittings which provide connection to the filling device and allow visual pressure checking with a manometer. The unit also contains a solenoid valve and electronic pressure sensor, connected to the control unit. The extinguishing agent is expelled through a collecting pipe, solenoid valve and discharge nozzle. It is directed into the protected RACK interior. Clear indication of the system's operating status is provided by LED controls on the front panel.

The detection system consists of two smoke detectors with fast response. They are interconnected in order to avoid false alarms. In the case of detection of fire by one of them, pre-alarm is launched, which means acoustic and visual signalization activation. In the case of detection by both detectors simultaneously, the system enters the alarm status and then the output contact controlling the extinguishing unit activates. After pre-determined time delay, the solenoid valves open and the protected RACK interior is filled with the extinguishing agent.

The extinguishing agent used in the system is colourless gas HFC-236fa — hexafluoropropane. In the bottles it is pressured by propelling gas — nitrogen. It is absolutely safe to human health, non-conductive and non-corrosive. Extinguishing is performed by slowing down the chemical reaction in burning phase. In the working temperature range, its density is about 5–6 times bigger than density of dry air that is why the module should be installed in the RACK cabinet as high as possible [2].

2. Communication with the modules

The system's compounds are Master and Slave modules. One Master can be connected with four Slaves. Communication between Slave and Master is realized by a serial communication system RS485. Communication with a Slave module is possible only via the Master module. There are two ways to connect with Master: through a serial port RS232, which is situated on the back side of the module, or through an Ethernet port, which is situated on a front panel.

To connect a private computer with the module through RS232, an USB adapter was used. To check parameters of the module, we used software, included on a CD disk provided by producer. There was a need to download a controller to the adapter in order to configure the connection properly. The configuration files and a serial port were set up, therefore, it was possible to check, by custom software, parameters of a device such as an IP address, device ID, pressure, line voltage, *etc.*

Subsequently, configuration of the Ethernet connection was performed. An IP address and subnet mask were assigned in network card setup. Then a proper communication by a command prompt was verified. After that, it was necessary to delete old configuration files with incorrect setup data, then a change of the device IP address in custom software was required. Finally, the module was properly connected with computer, which was signalized in communication interface by displaying output data.

3. Parameters of a module

FRS-RACK is a fully integrated system and the producer does not let users improve hardware and software due to the extinguishing standard. Therefore, it is only allowed to display state parameters of the device. These are necessary to supervise module and the RACK cabinet. In the case of fire or system error, the extinguishing module signalizes it by output data. Main parameters describing the state of the installation are external and internal temperature. When the external temperature rapidly increases, or is higher than critical, the system will inform the supervisor about the problem and start extinguishing action. Battery temperature informs about proper work of this component. Next parameter is pressure inside the tanks filled with the extinguishing agent. It informs the operator about leak tightness and potential earlier extinguishing action. Battery voltage informs if this component is charged or not. There are also other parameters describing the device, state and connection. An interface in LabVIEW was created in order to present that information.

4. LabVIEW software

Next important task was creating a LabVIEW interface for the modules. Main function of the interface is supporting extinguishing modules and reading the most important data. It consists of 3 cards: engineering panel, run panel, and a card including information about the authors. Each panel provides functional commands and visualizes the supported processes. Engineering panel enables full device supporting extinguishing system. At this panel, there are some counters which show pressure of gas in Slaves and Master module. Run panel provides the operator with intuitive operation. For example, if the gas level is too low, the diodes will light up. Then the operator will receive a signal about potential failure.

5. Conclusion

The authors worked with a system which should prevent fire inside RACK's cabinets. The team has created a connection between modules and software by using the Ethernet RJ45 and RS232 connections. The software enables the user to control the system remotely to observe all changes and dangerous failures. In case of the most dangerous situation, while the modules are set on fire, there is a possibility to connect them to the buliding's fire protection system.

REFERENCES

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