PERFORMANCE MONITORING AND DIAGNOSTICS OF DRIVE UNITS OF HEAVY ARMOURED EQUIPMENT

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Abstract

Transform the way of visual indication of vehicle traction parameters and the introduction of instinctive, concentrated in one place on-board device service is now possible following the development of microprocessor systems. Centralize system for diagnosis and control of the vehicle in a single desktop, such as the one described here, brings except cost savings also facilitation in addition to the driver and service. Indicators of vehicle speed, engine rpm and other parameters of traction, and the rates and indication of operation states used for additional equipment during the performance of the activities are concentrated in one place. Controls elements, such as circuit breakers, switches and buttons are placed within the areas of appropriate comfort are grouped into blocks that are functionally similar, which further facilitates their location and service. The modern, multi-track switches allow additional control versatility, while reducing their volume, which facilitates access to each of them. Panel equipped with universal input and output circuits and system software provides the flexibility to work with the latest generation of sensors and actuators, and components used previously as well. This allows the design of modern devices and simple upgrading of vehicles already in service.

Keywords: *diagnostics, engine diagnostics, monitoring, combustion engine*

1. Introduction

Each of us came into contact with the vehicle once the car of the first generation now numbered among the vintage vehicles. The simple design of the vehicle and primitive - as of today the engine, determined the use of simple and only necessary driver control devices.

Over time, engines were becoming more complex and vehicle equipment complicated. Controlling the increasing number of instruments and switches also require additional equipment greater knowledge of the driver, and the same components took up more space of driver's compartment. The breakthrough came when the amount of information coming from the drive system, traction, air conditioning, battery chargers and other on-board systems began to exceed the barrier of perception of the driver. Fortunately, in the meantime, there are electronic systems, including those used in mobile applications appears. Their use has allowed to take partial control of the vehicle and the driver left, in short, the final decision whether to go or repaired.

A similar evolution is also passed the solutions used for heavy military vehicles, although in this case, the final decision whether the "fix" is only possible in favourable conditions, and the command "go" is unrepeatable and must be performed at any price. The specificity of the control and command of military vehicles enforces the need to establish, clearly incoming malfunction or has already component damaged being monitored and clearly signalling that state.

Practically since the beginning of using this type of the systems, uses optical signals here, where lights are used to inform the approach of either the occurrence of a critical state, and additional acoustic signal - audible within the headphones. Analog values of controlled parameters are indicated on the panel placed within a disadvantageous position in terms of ability to read, which coming from the need to assembly additional military equipment within the driver's compartment.

2. Driver's panel

Previously reported changes started with the introduction of modifications within the driver's panel - such as shown below, equipped with indicating devices monitoring traction engine parameters and switches used to start additional on-board equipment.

Fig. 1. Classic driver's panel

Environmental resistance of this type of mechanical apparatus was on the border of the requirements of the military standards, and their cost disproportionately increased together with the need to maintain resistance to vibration and mechanical shock resulting e.g. gun firing. Despite the considerable cost of the panel, it was used for many years and serve to this day. It is a modern mobile electronics with additional equipment selection for the military contributed to the emergence of a new generation of instruments.

Fig. 2. PK-08 driver's panel together with PW-08 remote panel

Driver's panel used today still contains the switches, buttons and fuses. However, these are modern elements to ensure full efficiency of operation for many years despite the very hard conditions of use. The possibility of miniaturization of control elements has enabled the creation of control panels containing in a single housing, three - yet independently mounted - control panels.

A key element is the indicator module, which we could call a system of visualization and data processing.

The following diagram summarizes the number of devices connected to the module.

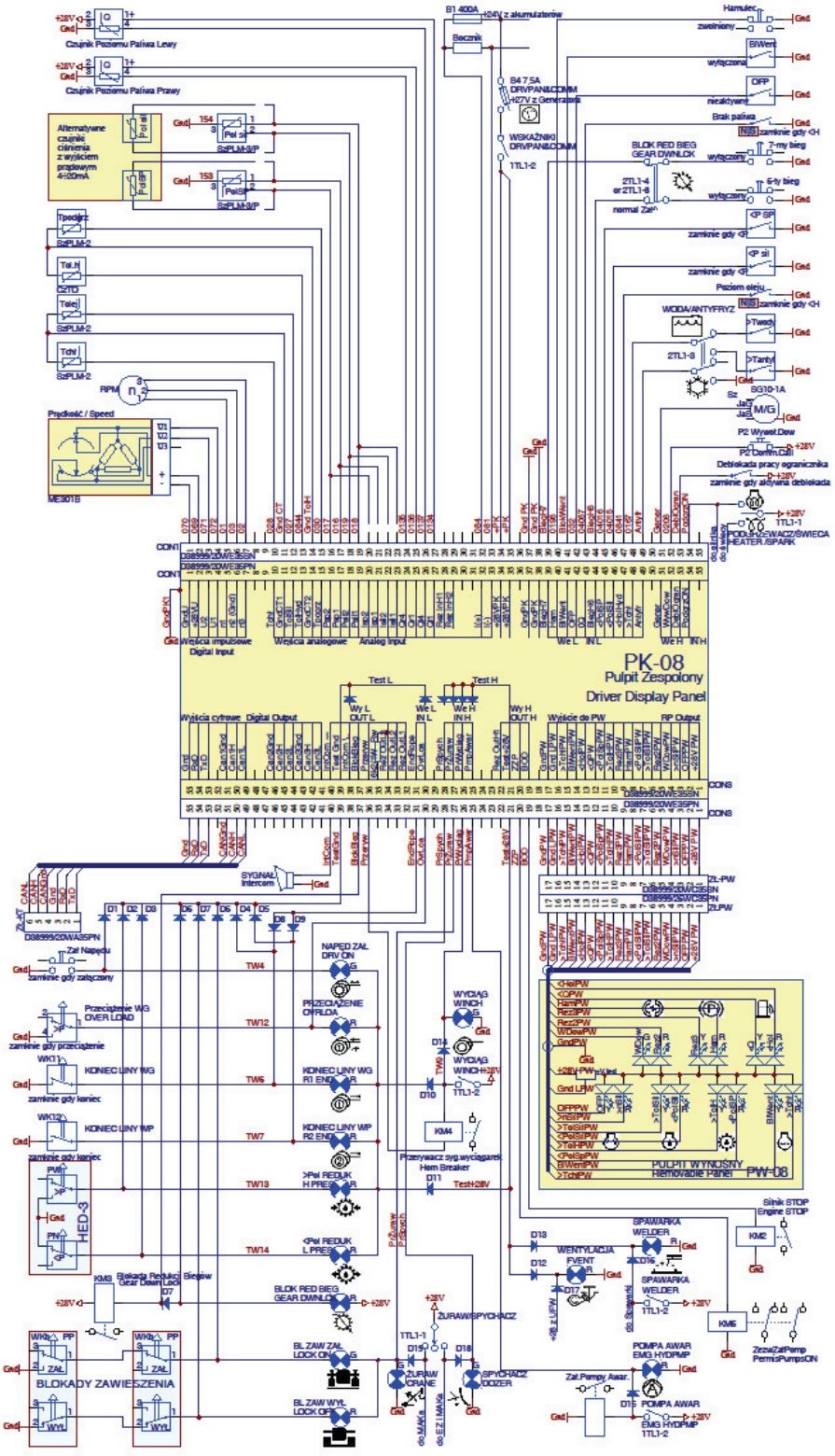

Fig. 3. Driver's panel diagram

The main part of the system is a microprocessor controls the work of displays, LED indicators (bar-graphs) and signalling lamps. In addition, it controls the various devices of the vehicle, which operation is a function of several unrelated signals. It also controls the operation of the internal event recorder - a "black box" that stores the key information related to the way of driving, operation and performance of equipment. Reading these data takes place through a combination of

the module with the external computer. The copied data can be converted by visualization software, or even in an Excel worksheet and use for service or evidence.

3. Review of some features of indicator module.

Light-lines - (bar-graphs) illuminate green up to the limit corresponding to the value of controlled parameter. After exceeding the limit the LEDs light in yellow (corresponding to the value of controlled parameter), and after crossing the critical value - in red. Exceeding the traction key parameters of the vehicle is indicated in addition to the remote panel by the indicator lights in yellow or red (continuous or intermittent way).Due to digitalization bar-graphs of indications under each of them is the button located, use to display the digital value of the selected parameter. This value is displayed on the display (time), use to display the time. Button at the display let you to select between the indication of the time, date and start and stop the stopwatch.

At bar-graph indicators of vehicle speed and engine shaft rotation speed highlighted by horizontal location the additional digital display showing values of these parameters are located. The buttons located at bar-graphs are used to switch between the current speed, the total number of kilometres travelled, or mode of travel indications, including resetting the settings and the button at rotation speed indicator is used to switch between the indications of rotation, and the value of one of the five counters of motor-hours. The other buttons are used to adjust the brightness indicators (with the possibility of complete darkness) and to run self-test module and its elements.

The most interesting features is the fuel level indicator which taking into account the shape of the tank. Bar-graph displays the value of the volume percentage of the total capacity of reservoirs, and the digital display gives the value in litters. One of the functions of output module is to run the actuator, which is possible only when the engine is not running. Another function is to detect the main winch overloading or excessive unwinding of the rope drum, resulting in only a few seconds the beep sound of this state, despite the state is still ongoing.

Another, equally easy to implement in the microprocessor system function is to protect the engine from exceeding the maximum speed of the crankshaft, which can occur if someone reduce the gear from the 7th to 6 or sixth to 5 during the fast vehicle movement. These features seem to be trivial, but previous solutions require autonomous automatic systems, complicating the electrical installation and the whole system.

It should be emphasized that the indicator module in addition to basic information functions also includes a diagnostics systems of proper operation of all sensors connected to it. In addition, when switching on the module the self-diagnostics system is starting, includes an external actuator, and all pilot lights around the driver's compartment. Any abnormalities detected are indicated as error codes. Indicator module has high hardware and software flexibility, allowing the possibility of an alternative connection of various sensors, including sensors and transmitters within the CAN bus. External connection for computer connecting also allows you to enter the service mode allowing a correction factor processing and signalling trip thresholds, as well as to changes in the firmware of the system.

4. Conclusions

Presented PK-08 driver's panel along with PW 2008 remote panel is designed for use within WZT-3 vehicles and similar. By savings the fixing points and compatibility of connections allows its use within various and upgraded vehicles. The shape of the panel and its location within the driver's compartment is preserved, which does not interfere with drivers habits. Significant improvement of indicators observations comfort were obtained by providing a wide angle of visibility and self-adjust bar-graphs and displays, which would not be possible for the use of monitors, which currently dominate the central field of control cockpits.

References

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