On-Board Computer and Monitoring System

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ABSTRACT

The on-board information system is an integral part of a modern car and serves to collect, process, store and display information about the driving mode and technical condition of the car, as well as external factors surrounding it. In the most developed countries, it is understood that the improvement of traffic on congested roads is possible only if the driver quickly orients himself in the traffic situation and traffic flows. This article describes the on-board information system of modern cars, its structure, design, sections and types.

Keywords:	On-board system, On-board computer, indication, time functions, Navigation menu tab.

Onboard control system.

The on-board control system automatically monitors and collects information about the state of the vehicle's systems and displays the information received on the on-board computer's liquid crystal display, Figure 1. The information is presented in a form that is easy to understand and, if necessary, to attract the driver's attention, emits a sound signal or turns on a speech synthesizer.

Figure 1 - On-board computer with a liquid crystal display of a BMW car (CCC system - CarCommunicationComputer)

Which control functions the on-board monitoring system implements depends on the model and manufacturer of the car, but at a minimum, the following options are available:
• indication of faults in vehicle systems;
• indication of malfunction of lighting devices;
• indication of the open state of the door or trunk;
• indication of ambient air temperature;
• indication of levels of technological liquids;
• indication of excessive brake pad wear;

The electronic unit of the on-board control system is built on the basis of a microprocessor, the controlled circuits and systems are tested when the ignition is turned on, and some of them periodically when the car is moving. In the cheapest systems, the output of information is carried out through LED indicators.

On-board computer.

The on-board computer (car trip computer (AMC)) provides the driver with various information about the state of the car, controls the means of communication between the car and the outside world, the navigation system, etc. Typically, the on-board computer displays information on a digital display, controlled from the control panel on the dashboard of the car.

At present, more convenient touch displays with programmable controls are beginning to be used. In addition, portable communicators and organizers are available that can be connected to the vehicle's data bus. The corresponding software makes them part of the vehicle information system.

The computer in the car can be connected to the INTERNET network. E-mail becomes available to the driver when connected via a satellite dish. The car turns into an office on wheels.

The on-board computer determines the exact time and date, fuel consumption, speed and distance traveled. The display usually shows the following information:
• time, day and date;
• average speed on the route;
• travel time;
• average fuel consumption on the route;

• instantaneous fuel consumption;
• fuel consumption on the route;
• the distance that can be traveled with the remaining fuel.

If, when leaving the route, the driver entered the distance to the destination from the keyboard, the on-board computer will also provide information about the expected time of arrival at the destination and the distance remaining to the destination.

It should be noted the wider introduction of AMK on foreign-made cars, which determined its closer integration into the car's electrical system. As a result, the trip computer has become a standard electrical device.

On-board computers of Russian cars

All functions of the AMC, as a device for additional equipment, can be divided into five classes:
1) time functions (clock, alarm clock, calendar);
2) route functions (journey time, stopover time, instantaneous fuel consumption, average fuel consumption, total fuel consumption, remaining fuel in the tank, mileage forecast on remaining fuel, trip mileage, average speed, instantaneous speed, overboard temperature);
3) service functions (view the absolute motor resource of the vehicle (engine operation time), view and set the remaining mileage until the next replacement of filters, spark plugs, belts and other regulatory actions, receive information from the AMK manufacturer: software version, link to the website, technical telephone numbers support and commercial department);
4) diagnostic tester functions (displaying coolant temperature, overboard temperature, instantaneous speed, engine speed, battery voltage, engine management system fault codes, viewing text decoding of fault codes, resetting error codes, etc.);
5) alarm functions (receive a warning signal when: on-board voltage goes beyond the permissible limits, engine overheating, speeding, the possibility of ice formation, engine overspeed, remaining fuel in the tank).

At present, there is no generally accepted classification of trip computers, due to their mass introduction as a standard device on foreign-made cars and the integration of AMK into the on-board information system of a car. However, trip computers can be classified according to three criteria:

• universality of application on different car models, as well as power supply systems;

• by set of functions: with or without diagnostic functions, with or without alarm functions, with or without "service" functions;

• by execution type: car clock size (figure 2a), button size (figure 2b), car radio size (figure 2c).

Figure 2 - Appearance of automobile trip computers of various types, Russian-made cars: a) - the standard size of the car clock; b) - button size; e) - standard size of the car radio.

Simplified block diagram of an automobile trip computer can be represented as a diagram shown in Figure 3.

Figure 3 - Structural diagram of an automobile trip computer.

The basis of any AMK is a microprocessor that works according to a specific program. An important role is played by the information output display, on which the quality of data perception depends, which ultimately determines the effectiveness of the AMC.

The ergonomics of the AMC largely depends on the type and type of control panel. Compact design requires a minimum of control buttons and the largest possible display. As a rule, control is provided from 4 to 8 buttons, 3-4 of which are the main ones, and 3-4 are additional ones.

Electrical installation can be carried out in two ways: using a standard car AMK connector; connection to the conclusions of the diagnostic block of the car with an additional wiring harness.

It is important to note that these methods are valid for vehicles equipped with electronic fuel injection systems, that is, these systems do not require additional fuel consumption and speed sensors. The most common additional sensor for these systems is the ambient temperature sensor.

A developed market of AMK manufacturers has developed in Russia. Trip computers are produced for almost all mass-produced models of domestic car brands. With regard to vehicles equipped with an electronic engine control system (ECM), the main information exchange channel is the data bus - "K-Line", through which there is an exchange of information between the ECM and external means. AMK requests from the electronic control unit (ECU) a number of parameters, which, after appropriate processing, are displayed on the device display. Using the data exchange protocol via "KLine" the functionality of the AMK is significantly expanded.

Installing a trip computer on a car with a carburetor power system requires additional installation of at least an electronic speed sensor, a fuel consumption sensor, and an additional air temperature sensor. One at the moment, such on-board computers are no longer in demand.

On-board computers of foreign cars

From the point of view of the functionality of the AMK of foreign-made cars, it is a device with a large number of functions: from monitoring car systems to navigation functions.

Let's consider some functionality of AMC of BMW cars. On BMW cars, a regular on-board computer is installed as part of a system called iDrive (intelligent control).

BMW's iDrive system puts the driver in complete control of the car's many functions without having to take their eyes off the road, which can be divided into three generations:

1 - generation - the simplest system in equipping the BMW M-ASK, has a narrow monitor measuring only 6.6 inches;

2nd generation - BMW CCC (CarCommunicationComputer) system, the

system has extended functionality compared to M-ASK. The central display of this system is 8.8 inches;

3rd generation - the CIC (CarInfotainmentComputer) system differs significantly in interface and scope of functions from previous systems.

Since 2008, BMW cars have acquired the CIC (CarInfotainmentComputer) system, which is a continuation of the CCC - CarCommunicationComputer installed since 2003. It is the easiest and most intuitive way to control entertainment, information, communication and navigation functions. The purpose is to separate the AMK display from the navigation mechanism in the system. The main components of the system are the control display and the controller located on the center console.

The control element has been improved with the latest biometric principles. It is easy to use and designed to be used with one hand without having to look at the controller. For the four most frequently used functions (CD, radio, telephone and navigation). Many BMW models are equipped with the iDrive system with voice control, which provides an even more comfortable way to

input.

The height and width of the control display are optimal in terms of driver comfort. The entire amount of information is displayed on a high-resolution glare-free screen located above the center console. Animation effects and other visual cues quickly turn BMW iDrive into an enjoyable daily experience.

Figure 4 shows the working windows of the on-board computer of a BMW car based on iDriveCIC.

The CIC system includes a hard disk drive, an 8.8-inch monitor with a screen resolution of 1280×480 pixels, a USB connector in the glove box, a new controller, and a navigation system with an improved interface and menus. The joystick control of the iDrive system is supplemented with buttons for direct access to the functions most often used by the driver: audio system, telephone and navigation. For easier navigation around the CIC, there are also "Menu", "Back", "Options", "CD", "Radio", "Tel" and "Navi" buttons that allow you to quickly return to the previous subsections, the main menu and the special settings menu. Favorite functions can be programmed and set as default, which further simplifies management.

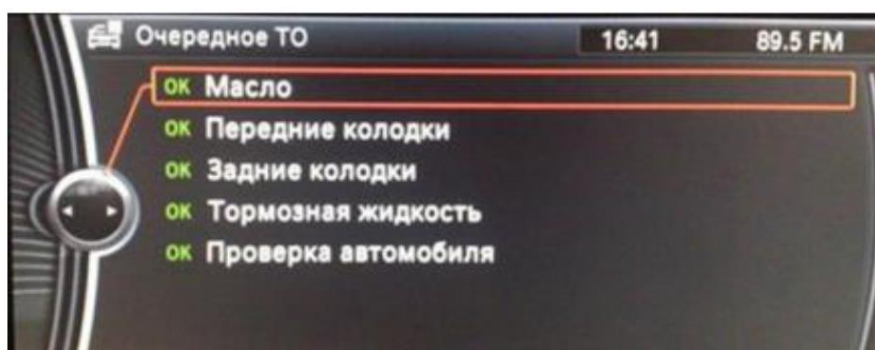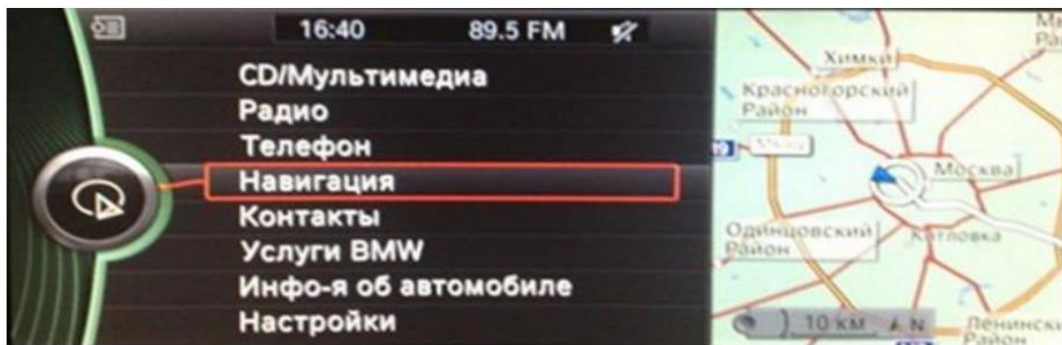Contacts tab, selection of the required operation

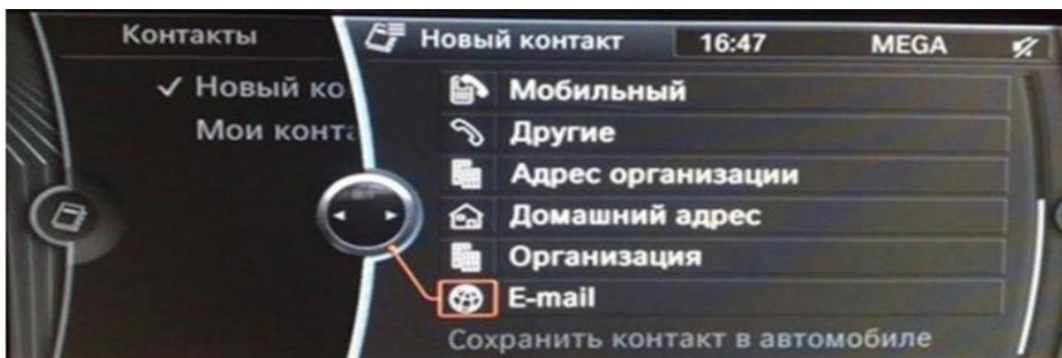Radio tab
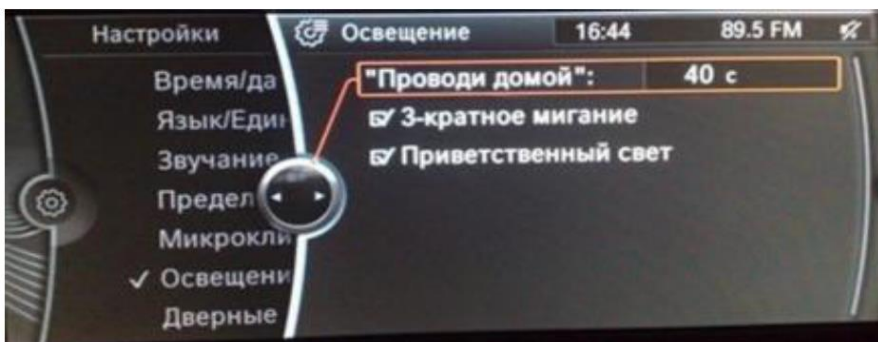
Vehicle setup tab, lighting option selection

Service information tab, engine oil level control

Service information tab, vehicle maintenance sequence

Figure - 4 BMW on-board computer interface based on iDrive CIC.

The BMW iDrive intelligent driving system can be programmed and set as default for favorite functions, further simplifying driving.

The 80 GB hard drive provides ample storage space for music files. Audio files can be placed onto a disc in three ways: from a regular music CD, from an information CD/DVD, and from a USB device. The navigation system's dedicated USB port, located in the glove box, is dedicated exclusively to file sharing and can only be used to download songs to the hard drive. For direct playback of music from external media, an optional socket in the armrest is used.

Trends in the development of automotive on-board computers

Recent developments by automakers have made it possible to implement a new type of on-board computer with a touch screen in the latest cars. In fact, the computer will be a full-fledged tablet: drivers and passengers on the screen will be able to write notes, control the screen with gestures, zoom in and out of the menu, doing it exactly like on a traditional touch computer. In addition to this, the screen has tactile feedback to increase the level of intuitiveness of control, and is additionally equipped with a touchpad (touchpad - touch pad) that allows you to write words and work with maps, doing it while the driver's eyes are directed to the road.

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