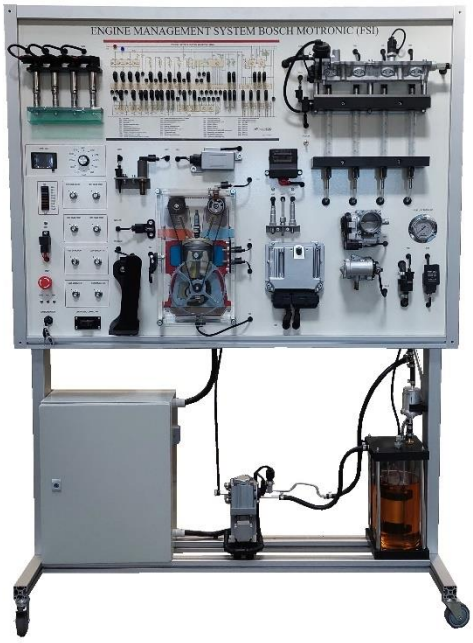
AutoEDU
MAKING PRACTICE PERFECT



ENGINE CONTROL SYSTEM BOSCH MOTRONIC MED (FSI)

USER MANUAL

MSFSI02

www.autoedu.lt/

www.bads.lt/

www.automotivetrainingequipment.com/

2024 Kaunas, Lithuania

CONTENT

1. SAFETY REQUIREMENTS

Attention:
Before using the training board, take a look at the user manual.

Training equipment may only be used for the training purposes specified in the instructions.

The staff conducting the training (lecturer, teacher, instructor and others) must be familiar with the instructions for the training equipment, know the methods and principles of use, settings, control of the equipment, be able to switch off (stop) the training equipment in an emergency.

The training staff (lecturer, teacher, instructor and others) acquaint those working and learning with the training equipment with the work safety requirements.

It is forbidden to work with educational equipment for children, unqualified staff.

It is forbidden to work with training equipment for persons under the influence of alcohol or other psychotropic substances.

It is forbidden for people who do not have the appropriate qualifications to open the electrical input boxes, connect or change anything there.

It is prohibited to improve, modify or otherwise change the design of training equipment without the written consent of the manufacturer.

Do not ignore the information on possible dangers provided by the warning signs on the training equipment. Beware of the hazards indicated on the warning signs.

The training equipment must be switched off completely during cleaning work.

It is forbidden to wash the training equipment with running water or any chemical cleaning agents.

It is forbidden to clean the electronic components of the training equipment with damp cloths.

The equipment must be completely switched off during maintenance and repair work on the training equipment.

If the training equipment consists of several parts, the parts are first connected to each other and only then the power supply is connected.

It is forbidden to disconnect the power cords of the electrical elements of the training equipment. Careless or repeated disconnection of these wires will result in damage to the connectors and loss of contact. The desired electrical measurements can be performed at specially designed and installed banana-type connectors in the training equipment. Banana type connectors are resistant to multiple joints.

Before working with training equipment, check that:

- Equipment is not mechanically damaged, broken;
- All protective shields are assembled;
- All heated, rotating parts (e.g., heating plugs, pulleys, gears, etc.) are covered;
- All components (e.g., wires, jumpers, fuses, handles, etc.) are available;
- Sufficient technical fluids (e.g., brake fluid, oil, coolant, etc.);
- Liquids do not leak through the joints;
- The equipment components are free of foreign bodies;
- Undamaged power cords;
- Neat power supplies (battery or stand power supply);
- Power supplies are properly connected (e.g., battery terminals are screwed on, polarity is not mixed, proper power supply is used according to local electrical installation standards);
- The training equipment is properly constructed and locked (e.g., the equipment is placed on a sufficiently solid base, the transport wheels are locked);
- During operation, the equipment will not pose any danger to those working with it and the surrounding staff;
- There are other factors not specified in the instructions that may endanger the health of personnel working with the equipment and others.

Observe during work with the equipment:

- The noise emitted by the equipment is characteristic of such a work process (no extraneous sounds);
- No leakage of liquids from the equipment;
- Odour of glowing, burning objects;
- Power supplies are working properly;
- There are no factors or processes other than those specified in the instructions that could endanger the health of personnel working with the equipment or other persons.

2. GENERAL INFORMATION

2.1. Purpose of training equipment

Teaching equipment for educational activities. It is a visual tool for explaining and demonstrating the structure and operation of various automotive parts, assemblies, structures, systems. The equipment is used as a teaching and learning tool for monitoring and analysis of various car systems work processes. It is possible to perform various measurements of the system installed in the training equipment, parameters of ongoing processes, to perform fault simulations, to diagnose. A variety of laboratory tasks can be performed using the training equipment. The equipment is designed and manufactured in order to provide learners with the clearest and most convenient information about the structure of the unit, the composition of the system and the principle of operation.

The training equipment is intended for demonstration, training and learning of the design, construction, principle of operation, settings and adjustments of the engine control system Bosch Motronic MED 9. With this stand it is possible to change the engine operating parameters, monitor fuel injection. The bench can simulate the change of the following parameters: air mass, coolant temperature, crankshaft speed, accelerator pedal position. When the parameters change, the values of the signals entering the motor control unit change. When evaluating the change of the incoming signals, the engine control unit changes the signals supplied to the actuators accordingly: the amount of fuel injected changes, the cooling fan is switched on, and so on.

2.2. Training equipment parameters

Length	1360 mm;
Width	505 mm;
Height	1825 mm;
Weight	90 kg;
Power supply	~ 230 V, 50 Hz household electricity network

2.3. Transport and storage conditions

Training equipment is installed in a dedicated box. Do not overturn or lay the equipment during transport. During transport, the equipment must be protected from falling, tipping, shocks, humidity, temperature, vibration.

Training equipment with its own chassis must be equipped with locked transport wheels during training and storage (including transport). The wheels can only be unlocked when the training equipment is relocated.

Export or import procedures must take into account the legislation in force between the countries. Import export procedures and various taxes apply to various technical fluids, oils, batteries, tires and more.

Training equipment must be stored in a room with a minimum ambient temperature of at least +10 ° C. Relative humidity not more than 60 %.

Training equipment must not be exposed to direct sunlight. Equipment must be covered by protective equipment if it is stored in a place exposed to direct sunlight.

Unused training equipment is kept completely switched off. The training stands are switched off with the control key and by disconnecting the power supply.

The stand must be run at least once a month and work for at least 20 minutes. It is not recommended to leave the stands unused for more than 2 months. period. If it is necessary to leave the stands unused for more than two months, they must be properly prepared and preserved.

2.4. Preparation and use of equipment

The training equipment is maintained as conventional mechanical, hydraulic, pneumatic, electrical machines and systems. Training equipment requires minimal maintenance and service.

It is necessary to constantly monitor the leakage of fluids from the training equipment units.

All components of the training equipment must be controlled and ensured.

Damaged, broken parts, blown fuses, damaged connecting cables and other parts are replaced with new ones.

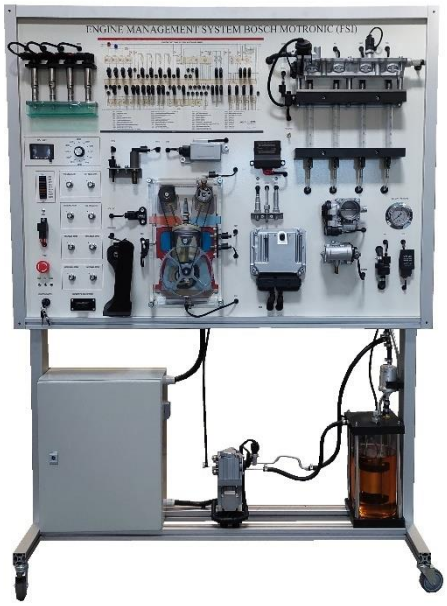
In the case of training equipment with internal combustion engines, gearboxes and air-conditioning systems, maintenance and service shall be carried out in accordance with the vehicle used in the training equipment.

Only technical fluids of the appropriate quality and technical specification (engine, transmission oil, coolant, brake fluid, etc.), quality filters and other spare and component parts must be used for maintenance and service work on the training equipment.

1. Place the stand in a flat, well-lit and freely accessible place.

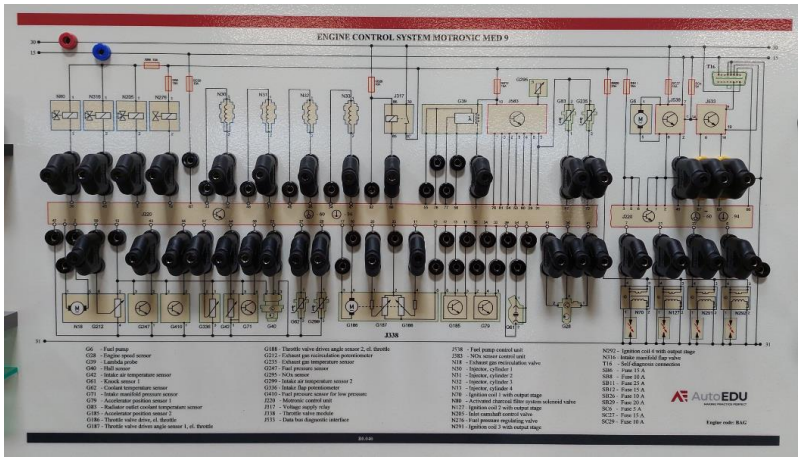
2. Lock the stand transport wheels.

3. Check that all components of the stand are present and installed correctly. Check that the stand is not visually damaged or broken. Are there protections on the rotating, heating and other elements that could endanger human health. For more information, see the section " Safety requirements → Before working with the training equipment, check that:".



4. Check fuses.

5. Check that all jumpers are in the wiring diagram and that they are properly seated.



6. Check the level of the technical fluids. Are they getting hard somewhere? If necessary, turn off the taps and drain the measuring beakers. Check that the glass parts are not broken.

7. Adjust all bench adjustment knobs to non-rear end positions. It is recommended to set the knobs at 9 - 12 o'clock.

8. Connect the stand to the household mains ~ 230 V 50 Hz.

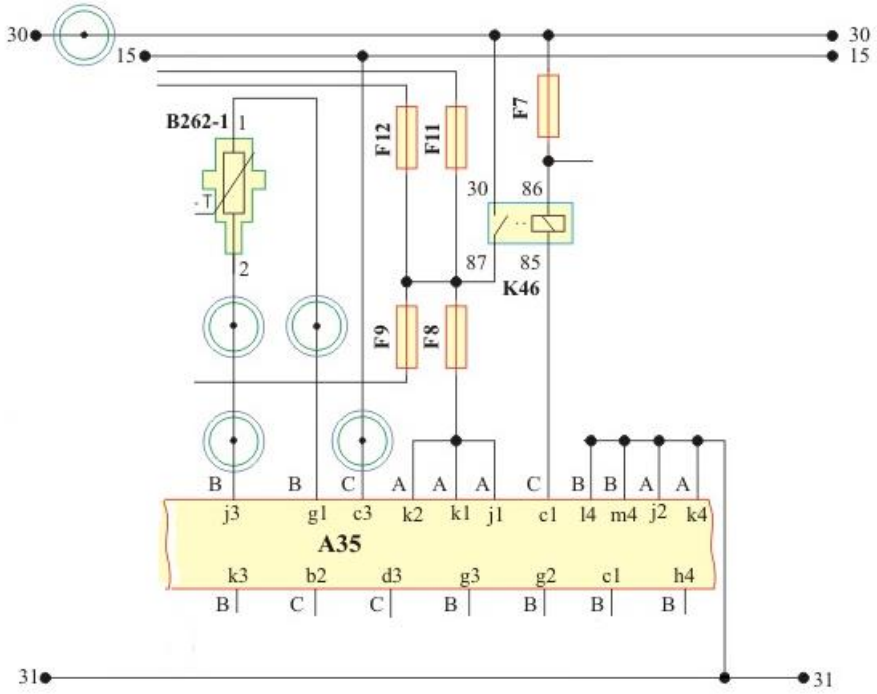
9. Unlock the stand emergency stop key by turning its part in the direction of the arrow. When you turn part of the key in the direction of the arrow, the key bounces. Press the green power button on the stand. When the key is pressed, the PWR LED lights up.

10. If the stand does not turn on and the PWR LED does not light when you press the power button on the stand, check that the mains power cord is connected properly. Is there voltage in the household mains? Check that the circuit breakers in the inlet cabinet are switched on.

11. Turn the stand key clockwise. With the key in the first fixed position, the power supply to the electrical components of the stand is switched on. The ON LED lights up. Turning the key further starts the stand and starts operating. The RUN LED lights up.

2.5. Symbols and markings

Automotive symbols for marking wiring diagrams and components are used in the training equipment. The figure below shows an example of component marking in a wiring diagram.



Example of wiring diagram and component marking.

Marking of wiring diagrams:

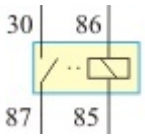
Black line connecting wires;

the wires are connected to each other;

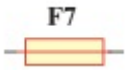
30 a numbered wire is an electrical circuit having a constant voltage of +12 V from a battery;

15 the numbered wire is an electrical circuit in which a +12 V DC voltage is turned on by the ignition key;

31 is the electrical circuit connected to the car body and the negative terminal of the battery (ground ⏚);

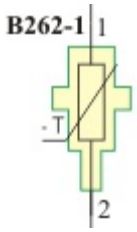


4-pin relay. Numbers 86 and 85 denote the contact numbers on the relay through which the relay electromagnet connecting contacts 30 and 87 is controlled. Numbers 30 and 87 denote contact numbers through which a current of 30 A (or greater) may be transmitted;



Fuse. Fuse marking symbol. In the circuit it is an F7 fuse.

A35 vehicle system (unit) control unit (computer) (e.g., engine control unit, airbag control control unit, brake ABS control unit or other). The letters A, B, C denote the connection used to connect the electrical wiring to the control computer. The symbols g1, c3, k2, b2, d3 denote the contact of the control unit connector.



B262-1 Temperature Sensor 1. Numbers 1, 2 temperature sensors contact numbers.

A 4 (2) mm banana was installed in the training equipment and connected to that cable. connector (socket) for connecting measuring equipment or a jumper.

Two banana connectors (sockets) are mounted on the cable for connecting the jumper. A jumper removed from the connectors breaks the circuit of this wire. Electric current cannot flow. The wiring diagram of the stand does not show this disconnection of the cord, because in real cars banana connectors are not installed. These connections are installed in the electrical circuit of the training equipment, enabling measurements to be made and faults to be simulated.

Jumper. Connector with 2 banana type 4 (2) mm contacts (plugs) at the bottom and one banana type 4 (2) mm contact (socket) at the top. All three contacts inside the jumper are connected to each other.

Attention:

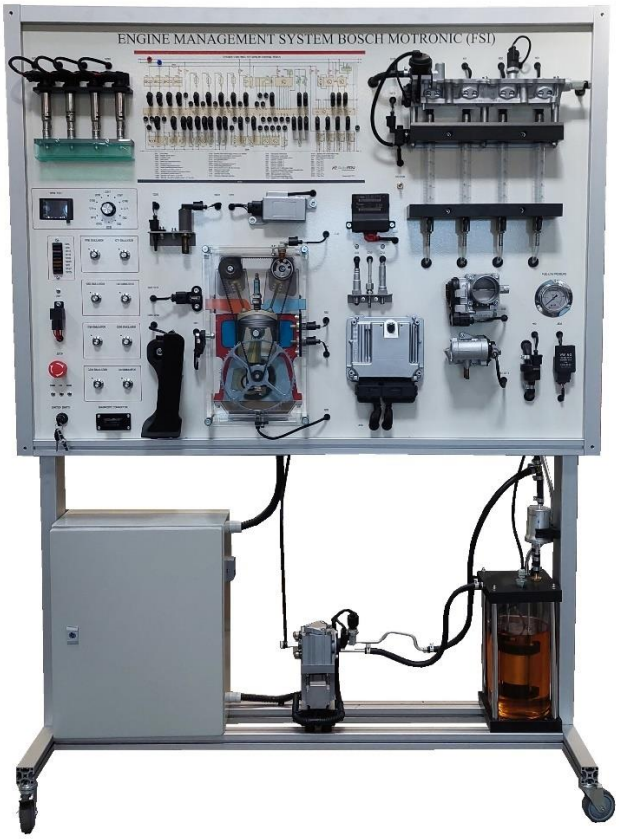
It is recommended to connect measuring wires with 4 (2) mm banana type contacts (plugs) to the training equipment when performing various measurements of electrical parameters.

3. TRAINING EQUIPMENT

3.1. General overview of training equipment

A general view and structure of the training equipment is given in the illustrations below.

Training – demonstration stand for engine control system Bosch Motronic MED 9. At this time, it is possible to change the engine operating parameters, monitor fuel injection. Changes in the following parameters can be simulated: air mass, air pressure, coolant temperature, crankshaft speed, accelerator pedal depression. When the parameters change, the signals entering the motor control unit change. When evaluating the change of the incoming signals, the engine control unit changes the signals supplied to the actuator accordingly: the amount of fuel changes, the cooling fan is switched on, and so on.

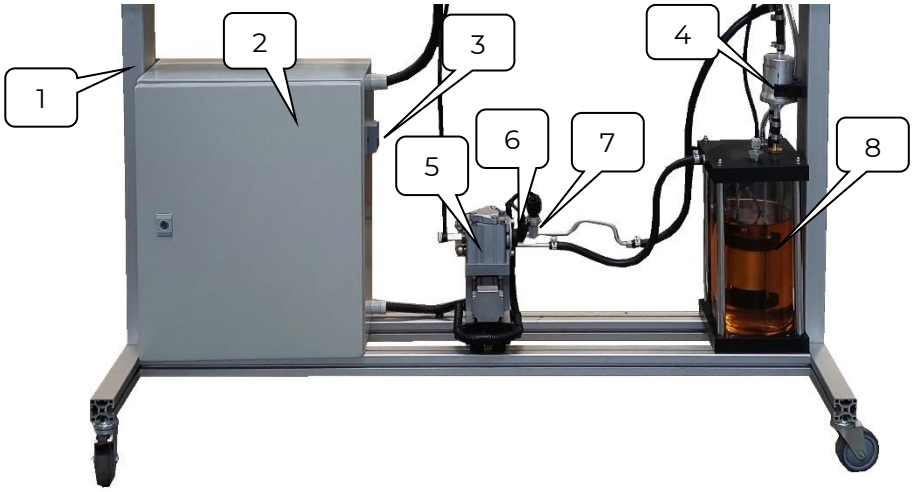


Direct petrol injection training demonstration stand

Important

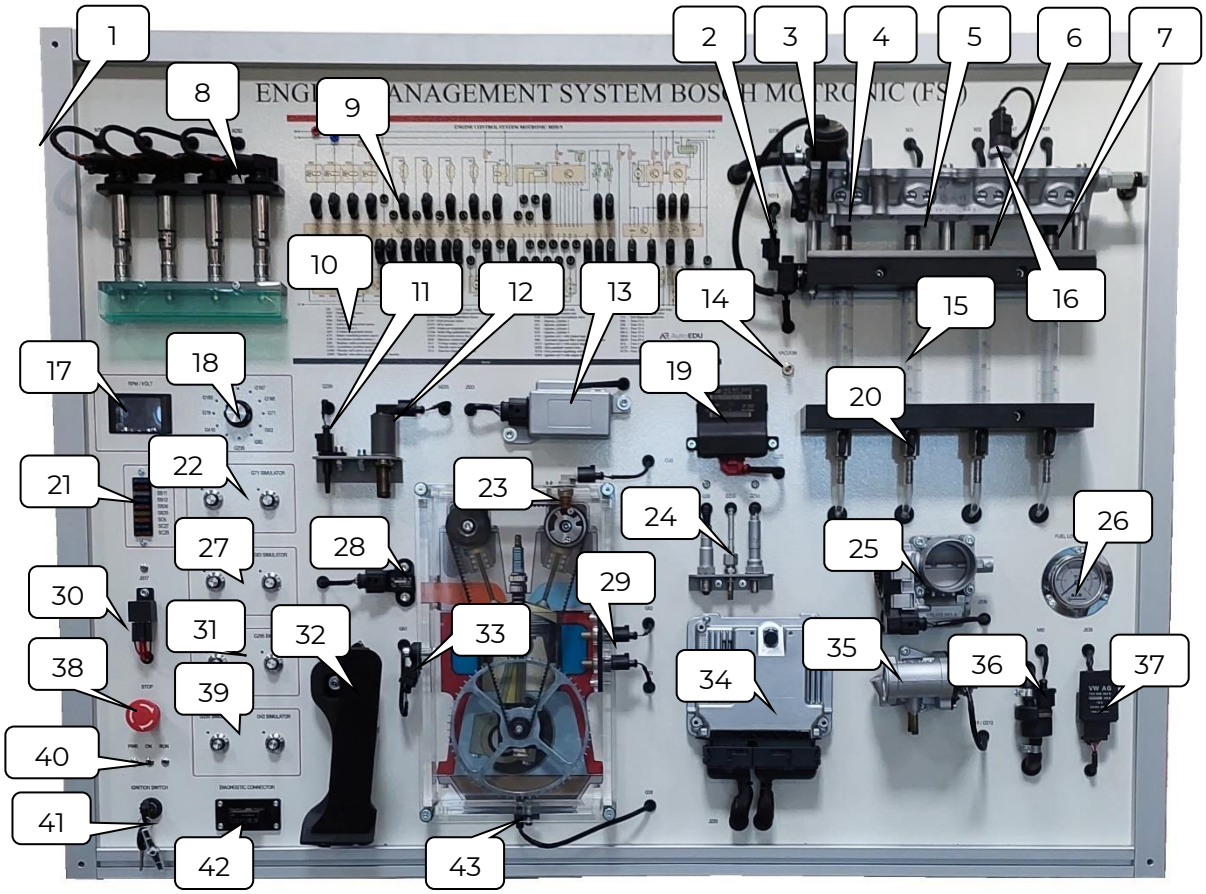
The stand is made on the basis of the Volkswagen Golf V car. Using computer diagnostics and identifying the vehicle, the following information is indicated: mark – Volkswagen, model – Golf V, year of production – 2003 – 2004, engine capacity – 1,6 litre FSI, engine power – 85 kW, engine code – BAG.

Training - demonstration stand components



Components of the lower part of the stand

1 Stand frame
2 Electric box
3 Main switch ON /OFF
4 Fuel filter
5 High pressure fuel pump
6 Fuel pressure regulating valve (N276)
7 Fuel pressure sensor for low pressure (G410)
8 Fuel tank and electric fuel pump



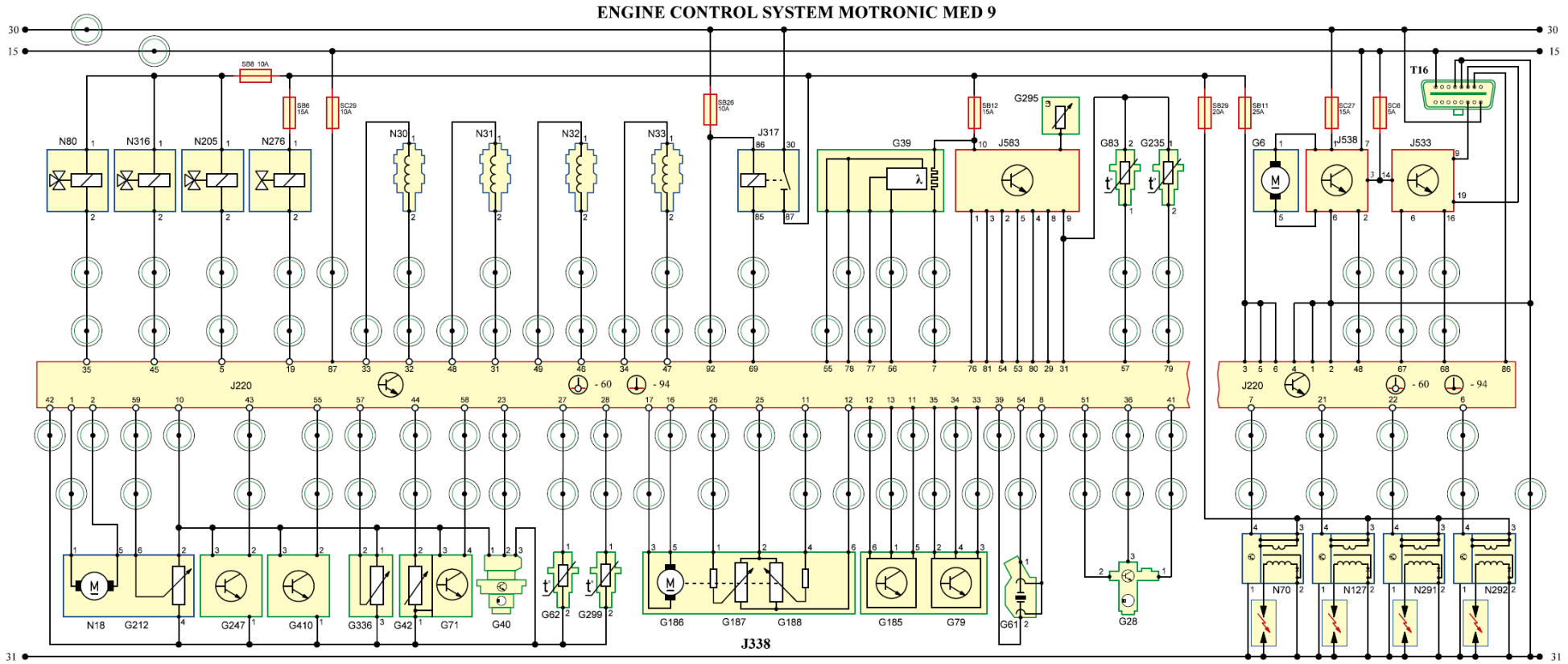
Components of the higher part of the stand

1	Stand frame
2	Intake manifold flap valve (N316)
3	Intake flap potentiometer(G366)
4	Injector, cylinder I (N30)
5	Injector, cylinder II (N31)
6	Injector, cylinder III (N32)
7	Injector, cylinder IV (N33)
8	Ignition coil with output stage (N70, N127, N291, N292
9	Wiring diagram whit measure contacts and jumpers
10	Legend of the stand components
11	Intake air temperature sensor 2 (G299)
12	Inlet camshaft control valve (N205)
13	NO_x sensor control unit (N583)
14	Vacuum connector
15	Measurement cylinder for injected fuel
16	Fuel pressure sensor (G247)
17	RPM / VOLT indicator (TFT voltmeter)
18	Setting dial of the parameter that you desire to follow on the TFT voltmeter
19	Data bus diagnostic interface (J533)
20	Tap
21	Fuses

22 RPM and Intake manifold pressure sensor (G71) simulator
23 Hall sensor (G40)
24 Lambda probe (G39), Exhaust gas temperature sensor (G235), NO_x sensor (G295)
25 Throttle valve control unit (J338)
26 Fuel low pressure manometer
27 Coolant temperature sensor (G62), and Radiator outlet coolant temperature sensor (G83) simulator
28 Intake air temperature sensor (G42) / Intake manifold pressure sensor (G71)
29 Coolant temperature sensor (G62), and Radiator outlet coolant temperature sensor (G83)
30 Voltage supply relay (J317)
31 Lambda probe (G39), NO_x sensor (G295) simulator
32 Accelerator position sensor I, II (G79, G185)
33 Knock sensor I (G61)
34 Motronic control unit (J220)
35 Exhaust gas recirculation potentiometer (G212), Exhaust gas recirculation valve (N18)
36 Activated charcoal filter system solenoid valve (N80)
37 Fuel pump control unit (J538)
38 STOP bottom
39 Exhaust gas temperature sensor (G235), Intake air temperature sensor (G42) simulator
40 LED indicators PWR, ON, RUN
41 Ignition switch
42 Self – diagnosis connector (T16)
43 Engine speed sensor (G28)

3.2. Wiring diagram

The wiring diagram contains all the elements: sensors, actuator components, data transmission lines, diagnostic connection. This diagram shows the connection circuits of the elements, the connection contact numbers, the component numbers.



Electrical diagram of the training board

3.3. Legend

G6 - Fuel pump
G28 - Engine speed sensor
G39 - Lambda probe
G40 - Hall sensor
G42 - Intake air temperature sensor
G61 - Knock sensor 1
G62 - Coolant temperature sensor
G71 - Intake manifold pressure sensor
G79 - Accelerator position sensor 1
G83 - Radiator outlet coolant temperature sensor
G185 - Accelerator position sensor 2
G186 - Throttle valve drive, el. throttle
G187 - Throttle valve drives angle sensor 1, el. throttle
G188 - Throttle valve drives angle sensor 2, el. throttle
G212 - Exhaust gas recirculation potentiometer
G235 - Exhaust gas temperature sensor
G247 - Fuel pressure sensor
G295 - NOx sensor
G299 - Intake air temperature sensor 2
G336 - Intake flap potentiometer
G410 - Fuel pressure sensor for low pressure
J220 - Motronic control unit
J317 - Voltage supply relay
J338 - Throttle valve module
J533 - Data bus diagnostic interface
J538 - Fuel pump control unit
J583 - NOx sensor control unit
N18 - Exhaust gas recirculation valve
N30 - Injector, cylinder 1
N31 - Injector, cylinder 2
N32 - Injector, cylinder 3
N33 - Injector, cylinder 4
N70 - Ignition coil 1 with output stage
N80 - Activated charcoal filter system solenoid valve
N127 - Ignition coil 2 with output stage
N205 - Inlet camshaft control valve
N276 - Fuel pressure regulating valve
N291 - Ignition coil 3 with output stage
N292 - Ignition coil 4 with output stage
N316 - Intake manifold flap valve
T16 - Self-diagnosis connection
SB6 - Fuse 15 A
SB8 - Fuse 10 A
SB11 - Fuse 25 A
SB12 - Fuse 15 A
SB26 - Fuse 10 A
SB29 - Fuse 20 A
SC6 - Fuse 5 A
SC27 - Fuse 15 A
SC29 - Fuse 10 A

4. WORKING WITH TRAINING EQUIPMENT

The stand is designed and manufactured to reproduce the work of a real engine as much as possible. The values of the individual elements are simulated and set manually using dedicated potentiometers. Depressing the accelerator pedal is also done manually. If the motor's operating values do not correspond to reality, the stand may operate incorrectly, or a fault or error message may be recorded in the memory of the motor control unit.

Depressing the accelerator pedal does not increase the engine crankshaft speed. Depressing the pedal only simulates a higher load, and if other conditions allow, the amount of fuel injected will increase. The speed of the crankshaft is changed with the help of a potentiometer, the speed is displayed on the RPM / VOLT screen.

In the contacts of the electrical circuit, it is possible to measure the voltages, signal forms of the elements connected there. When the jumper is removed from the electrical circuit, an open circuit is simulated. This responds to the operation of the stand components. A fault is detected in the control unit. Suitable medium for diagnostic studies.

The values of the sensor signals can be measured with a multimeter directly at the contacts in the wiring diagram. The display of the sensor signal voltage you want to see is displayed on the RPM / VOLT screen. Which sensor voltage will be displayed is determined by the rotary switch below the display.

Using system scanners (computer diagnostics), it is possible to see the actual engine operating parameters, perform diagnostics, scan and clear fault errors, and perform activation functions of various elements by connecting to the OBD II connector. Diagnostic capabilities will depend on the system scanner model and software version used.

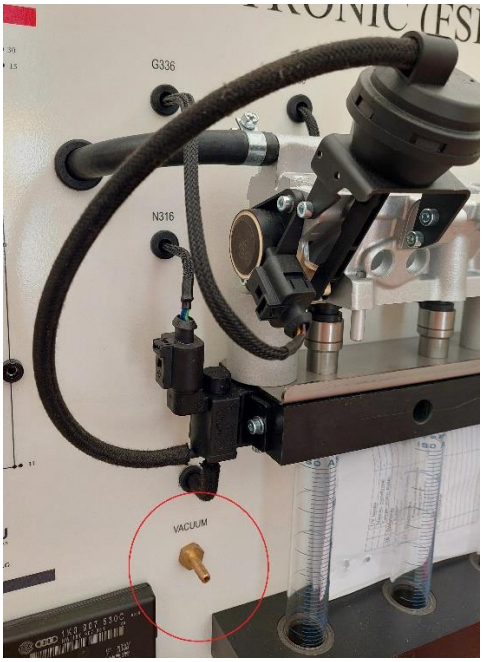
With the help of computer diagnostics, fault codes or messages can be found in the memory of the engine control unit. These codes or messages are stored in the event of a sensor failure, actuator, wire breakage, contact loss, or a jumper disconnection. Any fault codes or messages can be cleared from the engine control unit memory using the computer diagnostic equipment. Often fault codes are recorded in the memory when the wire is disconnected when the ignition is switched on, the signals of the speed sensors do not match, due to voltage fluctuations and so on. This is typical of random errors. If the fault codes cannot be deleted or reappear immediately after deleting, the physical cause of the fault must be investigated and rectified. Only by physically clearing the fault will it be possible to clear the fault error code from the control unit memory.

By pulling the connector from the electrical connection circuit, the fault can be simulated and given to the listening listeners to identify the fault.

Fault codes are found on this bench that cannot be cleared from the engine control unit memory. Or, after deleting these fault messages, they reappear immediately. This is due to the fact that the bench does not contain these components.

18107 - Powertrain Data Bus
P1699 - 008 - Missing Message from Steering Wheel Electronics
18057 - Powertrain Data Bus
P1649 - 008 - Missing Message from ABS Controller
18044 - Powertrain Data Bus
P1636 - 008 - Missing Message from Airbag Controller
18036 - Powertrain Data Bus
P1628 - 008 - Missing Message from Steering Angle Sensor
18058 - Powertrain Data Bus
P1650 - 008 - Missing Message from Instrument Cluster
18043 - Powertrain Data Bus
P1635 - 008 - Missing Message from A/C Controller
18058 - Powertrain Data Bus
P1650 - 008 - Missing Message from Instrument Cluster

Proper operation of the Intake manifold flap valve and Intake flap potentiometer requires connecting an electric vacuum pump with a hose to the vacuum nozzle.



5. WARRANTY CONDITIONS

Our products meet modern technical standards. We guarantee that our product is perfectly constructed and manufactured. They operate reliably if used correctly and in accordance with the provided maintenance rules.

Educational training board is used for educational purposes and can be used only with the components and operating fluids that are fitted on the board.

The guarantee of ____ months is provided for the educational training board. The guarantee begins to run from the sale date of the stand.

In order to warrant the setting of the appropriate date of sale, we ask the buyer to save the relevant contract documents: purchase check, invoice, transfer-acceptance act, warranty card with a product name filled correctly and clearly, number, date of sale, store stamp, signature and the signature of the seller.

The warranty is not applied:

- if the user did not comply with the usage, transportation and storage conditions, used not appropriate operating fluids and aggressive cleaning agents;
- if the stand was damaged by the third parties, force majeure (fire, catastrophe etc.) or another side effect;
- for mechanical breakings and other breaches;
- for warn out parts of the stand, fuses and if non-original spare parts are used;
- when the stand is regulated, improved or remade by unauthorized persons who cannot carry out this work;
- for naturally worn parts such as collars, straps and filters;
- in case of the fluid spill;
- when using the incomplete kit;
- if extraneous objects or some water gets into the product;
- when operating incorrectly or plugging into a messy electric network.

Warranty conditions do not cover the costs related with dismantlement of the product and transportation to the authorized warranty service enterprise. Also, it does not cover consultation, actuation and adjustment work costs. If the elements necessary for repairing the board have to be ordered from the supplier, the repair work may be prolonged.

Warranty repair is done at technical service stations authorized by the manufacturer. During the warranty period defective product components are repaired or replaced free of charge. Technical service station has the right to make a decision about the repair or replacement of the components. The elements that are being changed become the property of the service station.
After completion of the warranty repairs, the guarantee is not extended but remains valid until the time limit provided. The manufacturer reserves the right to change the appearance, design and structure of the product. Service center has the right to suspend the guarantee if the stand was used for other purposes.

Warranty maintenance coupon

Name	
Product number	
Date of sale	
Training equipment owner	
Trading partner / representative	

Description of work performed

Data	Description of the fault and its elimination process	Technician / Signature

NOTES

Shell V-Oil 1412

Special dilution oil for V-Oil 1404

Shell V-Oil 1412 is a spezial dilution oil for viscosity adjustment of Shell V-Oil 1404.

Application

Shell V-Oil 1412 is developed for the viscosity adjustment of Shell V-Oil 1404.

Properties

Shell V-Oil 1412 contains the same performance additives as Shell V-OIL 1404. This means there is no dilution effect in terms of additives while using this product.

Typical Physical Characteristics

Shell V-Oil 1412			
Density at 15 °C	kg/m³	DIN 51757	818
Flashpoint COC	°C	DIN ISO 2592	92
Pourpoint	°C	DIN ISO 3016	-27
Kinematic viscosity		DIN 51562	
at 40 °C	mm²/s		1,85
at 20 °C	mm²/s		2,8
Boiling range		DIN 51751	
Initial boiling point	°C		220
Final boiling point	°C		360
Oxidation	Residue mg/100ml	ASTM D 2274	0,4

These charcteristics are typical of current production. Whilst future production will conform to Shell`s specification, variations in these characteristics may occur.

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