MSG MS013 COM Tester for Diagnostics of Alternators Voltage Regulators User Manual

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Contents

INTRODUCTION

Thank you for choosing the product of MSG Equipment.
The actual manual contains information on the test bench purpose, package contents, technical characteristics, and safe operation rules. Read carefully this manual before putting MS013 COM (hereinafter “the tester”) into operation, take special training at the equipment manufacturing facility if necessary. As the tester is being continuously improved, some changes made to the equipment design, package set, or firmware may not be reflected in this user manual. The tester firmware is updateable, so its maintenance can be terminated without prior notice to users.

APPLICATION

Tester MS013 COM is used to assess the performance of 12V automotive alternators and detect their faults either directly on a car or on the test bench that provides the alternator drive and a load on it. Also, the tester checks voltage regulators with a nominal voltage of 12V for operability and compliance with their technical characteristics separately from alternators. Below are the criteria for alternator and voltage regulator performance assessment:

- Stabilizing voltage;
- The frequency and the duty cycle through the terminal FR – the voltage regulator feedback that demonstrates the rate of the activated rotor winding coil condition. For COM alternators:
- ID;
- Protocol;
- data exchange speed;
- regulator self-diagnostics errors.

SPECIFICATIONS

General	
Power supply	12V battery or 230V AC->5V/2A DC
Dimensions (L×W×H), mm	157×85×26
Weight, kg	0.7
IP rate	IP20
Voltage regulator diagnostics	
Rated voltage of the diagnosed voltageregulators, V	12
Measured parameters	– Stabilization voltage;- Rotor winding coil current;- Control lamp (D+).Additionally, for the digital voltage r egulators (COM):- ID;- Protocol;- Data exchange sp eed;- Data exchange protocol type;- Voltage regulat or self-diagnostics errors.
Diagnosed voltage regulator types	«COM» («LIN», «BSS»), «P-D», «RLO», «C»,«SIG», «D+»
Additional functions	
PWM signal generation	Available
Simple single-channel oscilloscope	Available
Short circuit protection	Available
Software update	Available

EQUIPMENT SET

Item name	**Number ofpcs**
Tester MSG MS013 COM	1
MS0106 – Set of diagnostic wires	1
Supply cable	1
USB cable	1
User Manual (card with QR code)	1

TESTER DESCRIPTION

UP" button is used to select the needed option in the menu. In the PP testing mode increases the value of the needed electric pressure (except "L/D+" mode).

"Down" button is used to select the needed option in the menu. In the PP testing mode decreases the value of the needed electric pressure (except "L/D+" mode).

"Enter" button is used to enter/exit the testing mode.

The device has D-SUB 9 pin connector to connect diagnostic cable (CAB) and USB connector to connect diagnostic cable for supply and software update. Two diagnostic cables are also included in the equipment set **(see Fig.2 and Fig.3).**

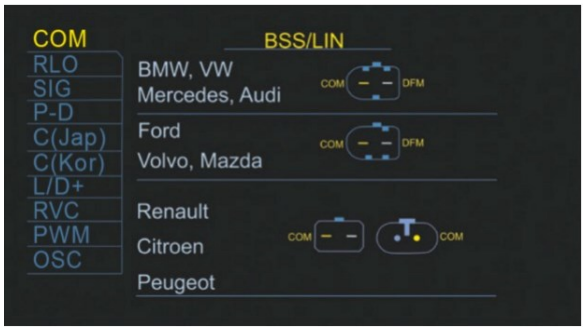
Figure 2. Four-wire cable for testing the voltage regulator in the car

The cable has the following marking:
GC (yellow) is used for connection to the alternator voltage control terminal (COM, SIG, RLO, C, D, RVC, etc.).
FR (white) is used for connection to the alternator load control terminal (for P/D alternator – to P terminal for displaying alternator rotation speed).
"-" (black) – B-". Battery negative pole (the alternator housing).
"+" (red) – "B+". Battery positive pole, the alternator output. It is used for power supply of the device when testing the alternator on the test bench or in the car; it is also used for "B+" voltage indication.

The cable has the following marking:
“FLD” (green) is used for connection the voltage regulator brushes and for field winding simulation. Polarity is not important while connection.
“ST” (blue) is used for connection to the voltage regulator stator winding leads. Polarity is not important while connection.
“B-” (black, the bigger) is negative pole of the battery (the alternator housing).
“L” (black, the smaller) is used for connection to the voltage regulator “Lamp” lead.
“+” (red, the bigger, the smaller) is used for connection to the voltage regulator “B+” lead.
GC (yellow) is used for connection to the alternator voltage control terminal (“COM”, “SIG”, “RLO”, C”, “D”, “RVC” etc.).
“**FR” (white)** is used for connection to the alternator load control terminal (for “P/D” alternator – to “P” terminal for displaying alternator rotation speed).
The adapter is also equipped with USB cable for software update and connection to power supply.

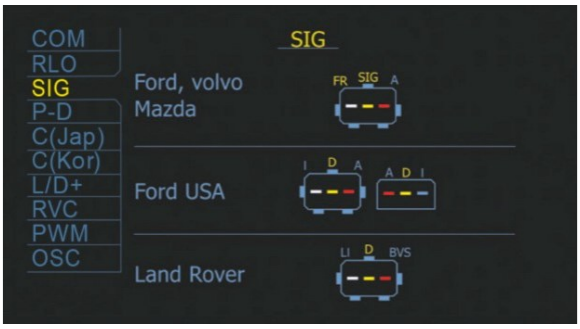
WARNING! Do not use USB ports of a laptop or a computer as supply source as far as consumed current (up to 1-1,5A when testing some types of voltage regulators) may exceed the one the PC port can provide.

Tester menu



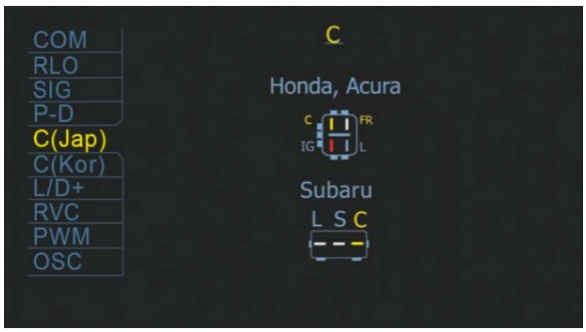
“COM” – voltage regulators or generators check with terminals “BSS” or “LIN”. The picture shows the main connectors of these terminals.

“RLO” – voltage regulators or generators check with the terminal “RLO”. The display shows this terminal connector.



“SIG” – voltage regulators or generators check with the terminal “SIG”. The picture shows this terminal connector

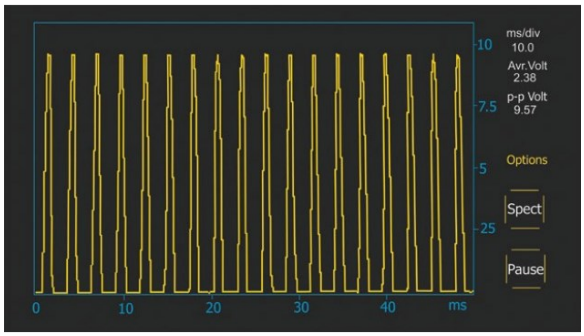
“P-D” – voltage regulators or generators check with the terminal “P-D”. The picture shows this terminal connector.



“C(jap)” – testing of voltage regulators or alternators with “C” terminal in Japanese cars. The connectors of this terminal are displayed in the screenshot.

“C(Kor)” – testing of voltage regulators or alternators with “C” terminal in Korean cars. The connectors of this terminal are displayed in the screenshot.

“RVC” – voltage regulators or generators check with the terminal “RVC”. The display shows the terminal connector.

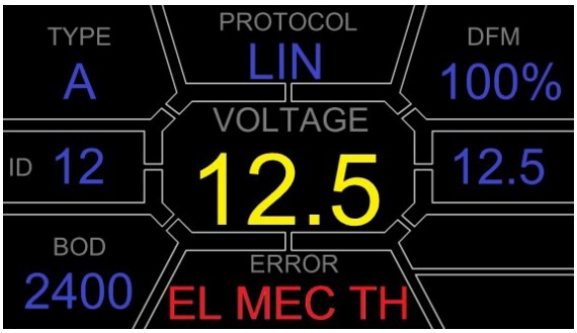


“PWM” – PWM signal generator.
“Oscillograph” mode allows the user to see the waveform, its amplitude and frequency. The voltage range is 0-40V, the time is 2-20ms.

The function can be useful in determining signal existence in the car (in the data lines: LIN, CAN, K-LINE, sensor outputs, etc.). For example, while using this mode, you can check for PWM signal existence at the SIG voltage regulator connector and determine signal absence from the engine control unit

Diagnostic mode menu

Voltage regulators check with «COM» terminal:



“TYPE”: voltage regulator connection type. Data aredisplayed only in «LIN» protocol. There are 12 types of this protocol: A1, A2, A3, A4, B1, B2, B3, B4, C3, D1, D2, and E1. “ID”: voltage regulator identification number. The manufacturer and the voltage regulator order number is encoded in it. On mounting the voltage regulator in the car, ID number must correspond to the original one, otherwise, the car will reject such voltage regulator and the dashboard will display an error.

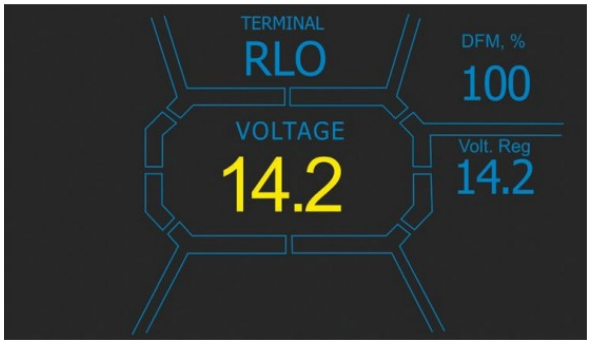
“BAUD”: data exchange speed of the voltage regulator with the car ECU. The following speed values may be displayed in “LIN” protocol:

- **“L”** – 2400 baud (low);
- **“M”** – 9600 baud (medium);
- **“H”** – 19200 baud (high)

“PROTOCOL”: voltage regulator protocol type (“BSS”, “LIN”).
“VOLTAGE”: voltage of “B+” terminal .
“ERROR”: errors in voltage regulator operation. The are 3 types of potential errors:

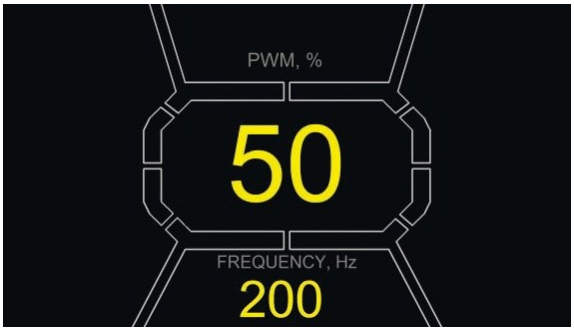
- **“EL”:** electric;
- **“MEC”:** mechanic;
- **“TH”:** thermal.

“DFM”: (Digital Field Monitor), alternator load indicator. Denotes the value of the PWM signal on the excitation winding expressed as a percentage.
“Volt.Reg”: indicator of set voltage. The value is set with the buttons “⇧” and “⇩”.
Testing of voltage regulators with «RLO», «SIG», «P-D», «C»:



“TERMINAL”: voltage regulator testing mode terminal.
“RLO”, “SIG”, “P-D”, “C” protocols are displayed. The terminal designation depends on the selected option in the menu.
“VOLTAGE”: Voltage of “B+” terminal, V.
“DFM”: alternator load control indicator, %.
“Volt.Reg”: indicator of set voltage, Volt. The value is set with the buttons “⇧” and “⇩”.

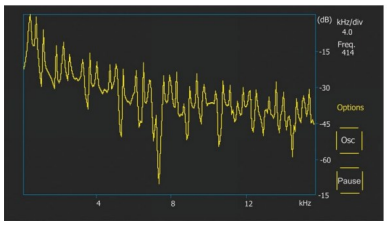
Test in «PWM» mode (PWM-generator):

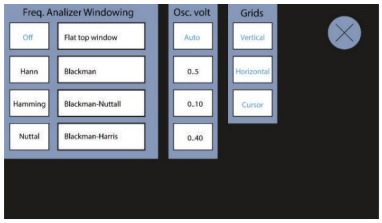


PWM, %: set of the duty cycle in percent, varying from 0 to 100.
FREQUENCY, Hz: set of frequency, Hertz. Value varies from 0 to 1000. The required value is set by pressing the pole with the number on the touch screen. The value is set with the buttons “⇧” and “⇩”.

“Oscillograph” mode menu

horizontal and vertical limits can be changed manually. Horizontal axis variation range is 1-100ms in increments of 0,2 (minimum) and can be changed with the buttons “⇧” and “⇩”. Current range value is displayed in the upper right corner of the screen, ms/div. Vertical axis limits change automatically, according to the amplitude of the input signal. The maximum value of the input signal must not exceed 20V. In the upper right corner of the screen ms/div, Avr. Volt, p-p Volt is displayed.

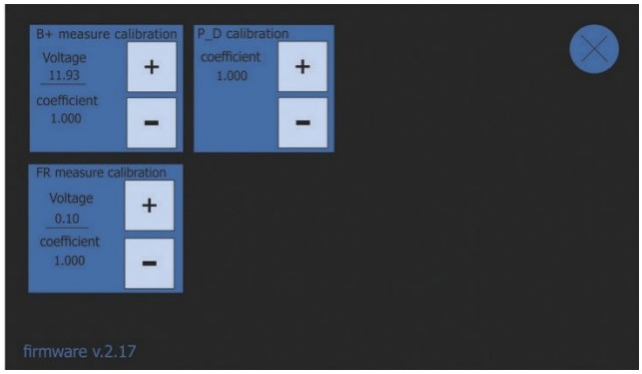




“p-p Volt”: current voltage numerical value of the measured signal, V
“Spect”: signal spectrum. The mode “Spect» gives an opportunity to analyze the signal spectrum within the frequency range from 500 Hz to 80 kHz. Arriving signal frequency is displayed on the horizontal axis, kHz. Signal strength is displayed on the vertical axis, dB
“Pause”: gives an opportunity to capture the oscillogram real time \ on the display.
“Options”: menu consists of the following parameter groups:
“Freq. Analyzer Windowing”: group implies window functions connected with digital signal processing.

“Osc. Volt”: vertical axis parameters. You can pre-set the maximum value of the measured voltage on the vertical axis. Available ranges 0…5, 0…10, 0…40V.
“Grids”: turn on/off vertical and horizontal grids, and mark display on the horizontal axis (Cursor)

Calibration menu



This menu allows you to calibrate the measured voltage, adjustment voltage «P-D» and FR alternator in accordance with indication of additional measuring devices. The tester readingsare corrected by changing the corresponding coefficients until the voltage values are matched on the tester display with the readings of the external measuring device. Enter the calibration menu by simultaneous pressing of the three control buttons.

WARNING! Each tester is factory calibrated and recalibration is required only in case of repair,or after long-term operation only using verified measuring devices .

APPROPRIATE USE

1. Use the tester for the specified purpose only (see section 1).
2. The tester should be used indoors. When using the tester, consider the following maintenance restrictive guidelines:
    1. 1. The tester should be used in the spaces equipped at the temperature range from +10 °C up to +40 °C

and the relative humidity range from 10 up to 75% without moisture condensation.

2. 2. Do not use the tester at the low temperature and high humidity (more than 75%). When the tester is brought from the cold place (outdoors) into the warm place, the condensate can appear on its elements. Thus, do not turn on the tester at once. Wait for 30 minutes until switching it on.
3. 3. Keep the tester far from the direct sunlight.

3. Do not keep the tester close to the heaters, microwave ovens and other equipment that generates a high temperature.
4. Protect the tester from the falling, and make sure that any technical liquids won't get it.
5. Any changes in the tester electric circuit are forbidden.
6. When the cable is connected to the alternator terminals, the crocodile clips should be isolated completely.
7. Avoid the mutual short circuit of the crocodile clips, and to any current-conducting car part including the car body.
8. Disconnect the tester once the diagnostics is completed.
9. In case of failures in the operation of the tester, stop further operation and contact the manufacturer or sales representative. The manufacturer is not responsible for any damage or injury to human health resulting from non-compliance with the requirements of this user manual.

Safety regulations
The tester has to be operated by the qualified persons who got the access to operate the definite bench (tester) types and who were instructed on the safe operating procedures and method

Diagnostics of alternator and voltage regulators
The tester allows you to test the alternator directly on the car or dismantled voltage regulators separately from the alternator. Both variants are considered further.

Testing of the alternator in the car
The generator is tested on the vehicle using a four-wire cable (Fig. 2). The tester is connected to the car alternator according to the color markings described in paragraph 3.2. To improve the accuracy of voltage measurement, the minus wire of the instrument should be connected directly to the minus terminal of the battery. Stages of verification:

- Connect the tester to the car alternator.
- Start the car's engine and wait for it to run at idle. Check the voltage value on the display. If the value is lower than the nominal one, check the alternator belt tension.
- Change the alternator voltage value (if the voltage regulator model implies changing the value). The voltage on the tester should coincide with the set one. Otherwise, the voltage regulator should be tested separately from the alternator.
- Check the alternator operation under average rotation frequency of the crankshaft when battery charge is full. Increase load on the alternator by turning on the headlights and other lighting devices. FR value should change as well. If voltage is within the norm, the voltage regulator is faultless. If voltage is above or below the norm, check the voltage regulator separately and replace it if necessary. If voltage is out of the norm, the alternator should be dismounted from the car for repair.
- Connect the alternator control terminal back to the vehicle's on-board network.
- Check the readings on the device. If the voltage value at the output of the alternator is out of the norm, check the signal in data transmission line ("LIN", "CAN", "K-LINE") in the mode of oscillograph.
- Stop the engine.

- Disconnect the tester terminals from the vehicle’s on-board network.

WARNING! Testing must be carried out in the premises with equipped with air-flow or exhaust system. Otherwise, testing must be conducted outdoors.

Testing of the voltage regulator separately from the alternator

Testing of the voltage regulator separately from the alternator is conducted with the help of ninewire cable (Fig. 3). The tester is connected to the voltage regulator according to the color marking described in the point 3.2 and Appendix 1. The testing is conducted in the following sequence:

- Connect the tester to power supply through USB connector.
- Select the needed option in the menu with the buttons “⇧”, “⇩”
- Connect all the needed voltage regulator outputs. Tips with the most common types of connectors will appear on the screen.
- Enter the testing mode with the button “⏎”.
- Follow the display indication and adjust voltage with the buttons “⇧”, “⇩”. If the voltage regulator is faultless, the measured voltage should change for “B+” when changing the set voltage and there should be no errors in the case of checking COM voltage regulators.
- Exit the testing mode with the button “⏎”.

WARNING! Operation of some TM Bosch voltage regulators requires a heavy current, the tester cannot deliver. Voltage regulators of this type cannot be tested.

“PWM” mode (PWM generator)

In this mode:

- Select the option in the adapter’s menu with the buttons “⇧”, “⇩”.
- Enter the testing mode with the button “⏎”.
- Connect the wires “GC” and “-” from the adapter’s outputs to the controlled device.
- To change the duty cycle, press the duty cycle set area on the screen. The numbers will be lightened by another color. Set the needed duty cycle value with the buttons “⇧”, “⇩”
- To change the frequency, press the frequency set area on the display. The numbers will be lightened by another color. Set the needed frequency value with the buttons “⇧”, “⇩”.
- Exit the testing mode with the button “⏎”. Disconnect the wires.

“Oscillograph” mode

In this mode connection to the source of analyzed signal is carried out with the help of the fourcore cable using the wires with black (negative) and yellow (GC) color marking:

- Select the option in the adapter’s menu with the buttons “⇧”, “⇩”.
- Enter the testing mode with the button “⏎”.
- Connect the wires “GC” and “-” from the adapter’s output to the signal source.

- The results will be oscillographically displayed on the display of the adapter.

TESTER MAINTENANCE

The tester is designed for a long-tern operation and doesn't require the maintenance, however, control the following things:

- If the operation environment is appropriate (temperature, humidity, etc.).
- If the diagnostic cable is in order (visual inspection).

Software update
The instruction for updating of the tester program is included in the file "Firmware Update". Download the file from the product detail page on servicems.eu.

Cleaning and care
To clean the tester surfaces, use either the soft napkins or rags, and neutral cleansers. The display should be cleaned with a special fiber display cleaning cloth and with a spray for display cleaning. To prevent the tester from the failure and corrosion, do not use abrasive materials and solvents.

TROUBLESHOOTING GUIDE

Below you will find the table with the possible problems and the solutions on their elimination.

Problem	Causes	Solutions
1. You cannot switch on the tester, or the measured parameters are displayed wrong.	Bad connection between the diagnostic cable and the tester connector.	Check the connection density.
	The diagnostic cable is damaged.	Check the integrity of the diagnostic cable. If required, replace the diagnostic cable.
2. The diagnostics mode cannot start.	Contact the dealer.	Contact the dealer.

RECYCLING

For the recycling of the bench, refer to the European Directive 2202/96/EC (WEEE Directive – the directive on waste electrical and electronic equipment). The outdated electronic testers and electrical appliances, including the cables, hardware, batteries and storage batteries shall be disposed separately from the house waste. To dispose the waste products, exploit the available returning and collecting systems. The appropriate disposal of the outdated testers helps to prevent harming to environment and health.

Connection of terminals to alternators and regulators

Indicial notation	Functional purpose		Alternator/ Voltage regulator type	Output terminal
B+	Battery (+)			B+
30				
A	(Ignition) Input for switch starting			
IG				
15				
AS	Alternator Sense	Terminal for measuring battery voltage		
BVS	Battery Voltage Sense			
S	Sense			
B-	Battery (-)			B-
31				
E	Earth, battery (-)			
D+	Used for connection to an indicator lamp thattransfers initial driving voltage and indicates alternator operability		Lamp	L/D+
I	Indicator			
IL	Illumination			
L	(Lamp) Output for alternator operability indicator lamp			
61				
FR	(Field Report) Output for alternator load control by an engine control unit			FR
DFM	Digital Field Monitor			
M	Monitor			
LI	(Load Indicator) Same as FR, but with universal signal			
D	(Drive) Input of voltage regulator control with terminal P-D of Mitsubishi (Mazda) and Hitachi(KiaSephia1997-2000) alternators		P/D	GC

Indicial notation	Functional purpose	Alternator/ Voltage regulator type	Output terminal
SIG	(Signal) Input of code voltage installation		

D	(Digital) Input of code voltage installation on Ford, same as SIG	SIG	GC
RC	(Regulator control), same as SIG		
L(RVC)	(Regulated Voltage Control) Similar to SIG butvoltage change ranges from 11V to 15.5V. Control signal is sent to L terminal.	RVC	
L(PWM)			
C	(Communication) Voltage regulator input tocontrol engine ECU. Korean cars.	C KOREA	
C (G)	Voltage regulator input to control engine ECU.Japanese cars.	C JAPAN	
RLO	(Regulated Load Output) Input to controlstabilizing voltage in the range of 11.8-15V (TOYOTA)	RLO	
COM	(Communication) General term for physical interface for alternator control and diagnostics. Protocols of use: BSD (Bit Serial Device), BSS (Bit Synchronized Signal, or LIN (Local InterconnectNetwork)	COM	
LIN	Direct indication on interface of alternator control and diagnostics under LIN protocol (LocalInterconnect Network)		
DF			
F			

FLD	An output of one of stator windings of an alternator. Through this output a voltage regulator detects the alternator excitatio n.		F1; F2
67			

Indicial notati on	**Functional purpose**	**Alternator/ Vo ltage regulato r type**	**Output term inal**
P	Output of one of alternator stator windings. Used for measuri ng alternator driving voltage		
S			
STA			
Stator			
W	(Wave) Output of one of alternator statorwindings for connect ion of a tachometer in diesel engine cars		
N	(Null) Output of average stator winding point. Usually used to control operability indicator lamp of the alternator with mecha nical voltageregulator		

D	(Dummy) Blank, no connection, mostly inJapanese cars		
N/C	(No connect) No connection		
LRC(Options of voltage regulators)	(Load Response Control) Function of voltage regulator response delay on load increase on an alternator. Delay duration ranges from 2.5 to 15 seconds. On increasing the load (lights, cooler fan on), a voltage regulator adds driving voltage smoothly ensuring stability of engine driverotation. Remarkably seen under idle running.		

HEADQUARTERS AND PRODUCTION
18 Biolohichna st.,
61030 Kharkiv
Ukraine
+38 057 728 49 64
+38 063 745 19 68

Documents / Resources

	MSG MS013 COM Tester for Diagnostics of Alternators Voltage Regulators [pdf] User Manual MS013 COM, Tester for Diagnostics of Alternators Voltage Regulators, MS013 COM Tester, MS013 COM Tester for Diagnostics of Alternators Voltage Regulators

References

- MSG Equipment - wyposażenie warsztatów TM MSG equipment. - msgequipment.pl