MSG RTP9005S

USER MANUAL
ADAPTER FOR DIAGNOSTICS
OF VOLTAGE REGULATORS

UNIQUENESS

TRAINING

SERVICE

INNOVATION

WARRANTY

QUALITY

CONTENTS

User Manual - Adapter RTP9005S

1. DESCRIPTION

The Adapter RTP9005S is used for diagnostics of alternator voltage regulators.

The Adapter RTP9005S simulates control signals for the tested voltage regulator. It contains integrated physical interfaces and program protocols of all actually existing voltage regulators.

Voltage regulators can be tested:

• directly in the car with the alternator assembly

• on the test bench in assembly with the alternator dismounted from the car

• separately from the alternator

Adapter RTP9005S additional features: it can be used as PWM generator or as an oscillograph.

The adapter has additional functions: a PWM generator and an oscillograph.

The device's control is easy and user-friendly, the indication is very convenient due to the color 4.3" TFT display.

Software is to be updated through USB port if new protocols appear.

Contemporary voltage regulators (alternators) with COM (LIN/BSS) terminal cannot be properly tested without such diagnostic adapter.

The diagram below provided by the company Bosh illustrates that these types of voltage regulators oust the others and can be mounted in low-cost cars by now:
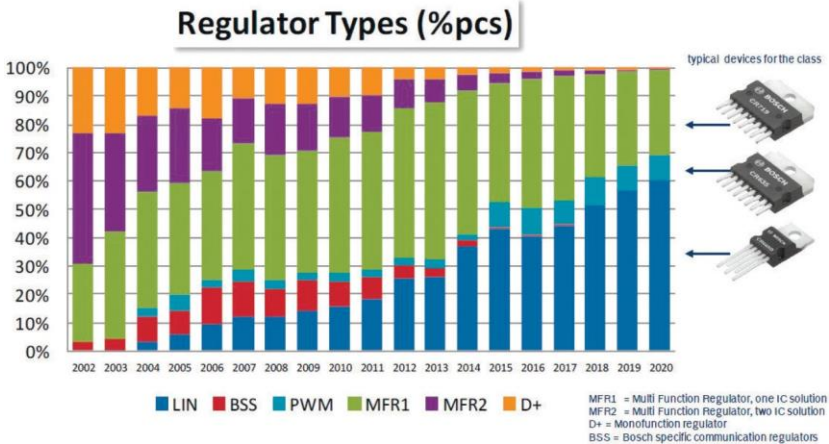
2. TECHNICAL CHARACTERISTICS

TFT-LCD color display	Resolution - 480 × 272 px Diagonal - 4.3 "
Power supply, V	5
Type of mains, V	Battery 12, 5V / 2A AC / DC power supply
Operating temperature, C	0 ... 40
Storage temperature, C	-10 ... + 40
Relative humidity, C	≤75% for 0 ... + 40; ≤0% for -10 ... + 50
Electromagnetic compatibility	In the electromagnetic field <1V / m: Possible error + 5%
Dimensions, mm	167 × 87 × 28
Weight, kg	0.7
Certification	CE EN 61326-1:2013 / EN 61010-1:2010 EHL TP TC 004/2011 / TP TC 020/2011
Voltage regulators test	
Terminals	COM (LIN, BSS), P-D, L / D +, RLO, C(Kor), C(Jap), SIG, RVC
Tested parameters of voltage regulators	- Stabilizing voltage - Generator load - Protocol - data exchange rate - Regulator type - Errors (for COM relay controllers)
Voltage of tested regulators, V	≤16
Voltmeter Accuracy, V	0.1
Short circuit protection	Yes
Additional functions	
PWM Signal Generator (PWM)	Yes
Oscilloscope	Yes

3. CONTROL UNITS

Fig. 1 – Adapter RTP9005S

3.1 Buttons

 "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.

3.2 Connectors

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).

Fig. 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.

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Fig. 3 – Nine-wire cable for testing the voltage regulator apart from the alternator

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.**

3.3   ADAPTER 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.
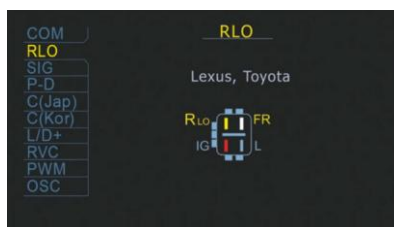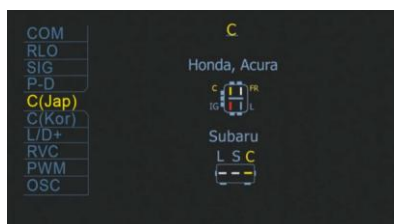

"SIG" - voltage regulators or generators check with the terminal "SIG". The picture shows this terminal connector.
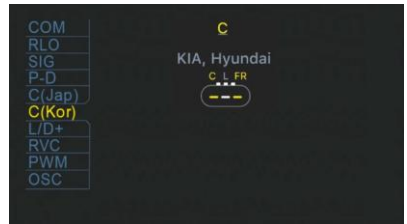

"P-D" - voltage regulators or generators check with the terminal "P-D". The picture shows this terminal connector.

"C (Jap)" - testing of voltage regulators or alternators with "C" terminal in Japanese cars. The connectors of this terminal are displayed in the screenshot.

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

"L / D" - voltage regulators or generators check with switched on charge lamp of the battery through voltage regulators connectors.

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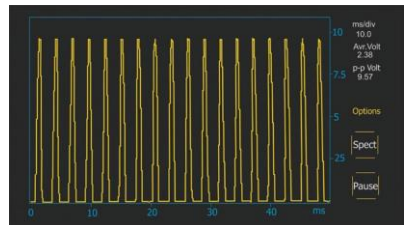
The function can be useful in determining signal existence in the car (in the data lines: LIN, CAN, K-LINE, sensor outputs, etc.). For example, while using this mode, you can check for PWM signal existence at the SIG voltage regulator connector and determine signal absence from the engine control unit.

4. SETTING INTO OPERATION

Check the set received. It must contain:

• adapter;

• AC/DC adapter 5V/2A;

• four-wire diagnostic cable with crocodile clip for testing the voltage regulator in the car;

• nine-wire diagnostic cable with crocodile clip for testing the voltage regulator apart from the

alternator;

• USB cable 2,0;

• User Manual.

Inspect the equipment for existence of damage. If it is found, please contact either the manufacturer or the trade representative before launching the equipment.

⚠ **WARNING! In case of obvious damage, use of equipment is forbidden.**

5. DISPLAY DATA OUTPUT
5.1 When testing voltage regulators with "COM" terminal

• **"TYPE"**: voltage regulator connection type. Data is displayed in "LIN" protocol only. There are 12 types of this protocol: A1, A2, A3, A4, B1, B2, B3, B4, C3, D1, D2, 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);

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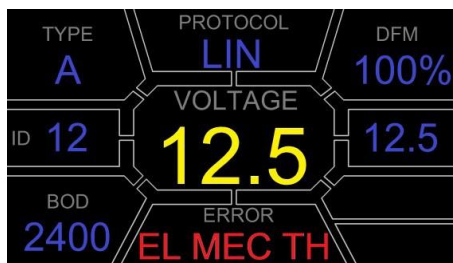
– **"H"**: 19200 baud (high).

• **"PROTOCOL"**: voltage regulator protocol type ("BSS", "LIN").

• **"VOLTAGE"**: voltage of "B+" terminal, V.

• **"ERROR"**: potential errors in voltage regulator operation. The are 3 types of potential errors:

– **"EL"**: electric;

– **"MEC"**: mechanic;

– **"TH"**: thermal.

• **"DFM" (Digital Field Monitor)**: alternator load control indicator. DFM indicates PWM signal magnitude in field windings, %.

• **"Volt.Reg"**: indicator of set voltage, Volt. The value is set with the buttons "⇧" and "⇩".

⚠ **WARNING! This parameter is relevant only for voltage regulators tested in assembly with the alternator. If tested separately the value will be false because of the specifics of voltage regulator operation.**

5.2 When testing voltage regulators with "RLO", "SIG", "P-D", "C" terminals

• **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.
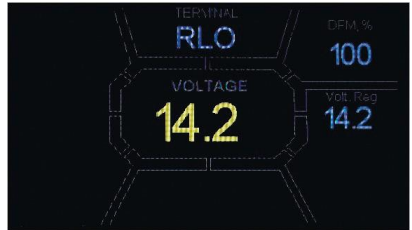
• **VOLTAGE**: Voltage of "B+" terminal, V.

• **DFM**: alternator load control indicator, %.

• **Vol. Reg**: indicator of set voltage, Volt. The value is set with the buttons "⇧" and "⇩".

5.3 Display data output 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 100. The required value is set by pressing the pole with the number on the touch screen. The value is set with the buttons "⇧" and "⇩".
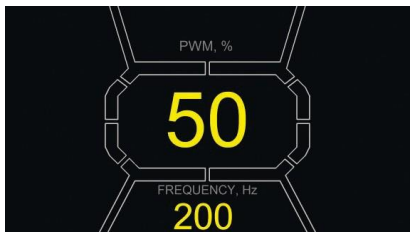
5.4   Display data output in "Oscillograph" mode

On entering oscillograph mode, automatic parameter setting is carried out. However, horizontal and vertical limits can be changed manually.

Horizontal axis variation range is 1-100ms in increments of minimum 0,2 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 in accordance with the arriving signal magnitude. Arriving signal maximum value must not exceed 20V.

In the upper right corner of the screen ms/div, Avr. Volt, p-p Volt is displayed.
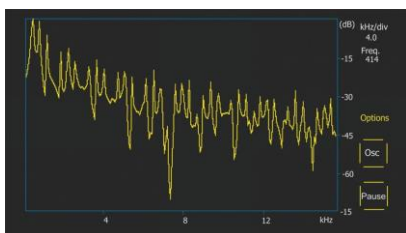
p-p Volt: current voltage numerical value of the measured signal, V.

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: this mode gives an opportunity to capture the oscillogram realtime on the display.
Options menu consists of the following parameter groups:

• **Freq. Analyzer Windowing**: this group implies some window functions connected with digital

signal processing.

• **Osc. Volt**: vertical axis parameters. This option gives an opportunity to set the maximum value

limit of measured voltage along the vertical axis. Available range: 0...5, 0...10, 0...40V.

• **Grids**: this group gives an opportunity to show/hide vertical and horizontal grid, and mark

display on the horizontal axis (Cursor).

5.5   Calibration menu

This menu gives an opportunity to calibrate measured voltage, PD adjustment voltage and FR oscillator in accordance with indication of additional measuring devices. RTP9005S indication is adjusted by changing of the corresponding coefficients until the voltage value, displayed on the screen, coincides with the indication of the outer measuring device.

Enter the calibration menu by simultaneous pressing of the three control buttons.

⚠ **WARNING! Each Adapter RTP9005S is factory calibrated. Recalibration is needed only in case of repair or after a long-term service using highly accurate measuring devices.**

5.6   RTP9005S program update

Manufacturers of voltage regulators permanently improve their inventions, add new protocols, thus, causing more troubles for car service centers. In this regard, MSG Equipment specialists constantly learn new protocols and release new versions of the adapter's firmware. You can download a new program version from the website servicems.eu. The update is conducted in the following way:

1. Download the new version of program en.stsw-stm32080.

2. Extract the program into any folder.

3. Launch the installation procedure from the extracted folder.

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4. On finishing the installation procedure, you will see a window on your computer screen.
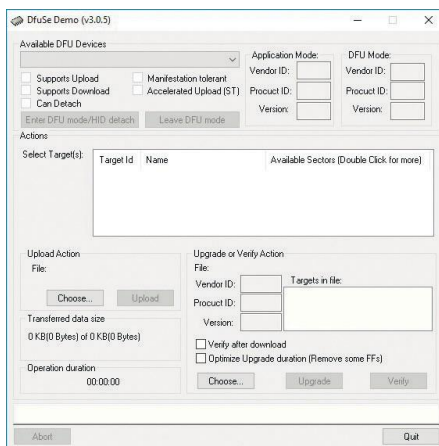

5. Press and hold the button "⇧" on the control panel and connect USB cable to both the computer USB port and the adapter's USB port. After it the device will be identified in the update window.
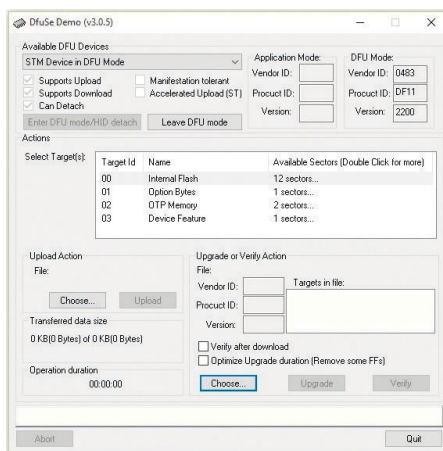
If the device has not been identified by the update program by this stage, update the device driver by yourself: choose the needed driver in the folder Driver **C:\Program Files (x86)\STMicroelectronics\ Software\DfuSe v3.0.5\Bin\Driver)**, depending on the version and type of the installed operating system (x32 or x64).

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6. In the resulting window press **"Choose..."** in the section Upgrade or Verify Action and choose the location of the firmware file "prefix.dfu".

7. Press the button **"Upgrade"**. The following notification will appear on finishing the firmware process:
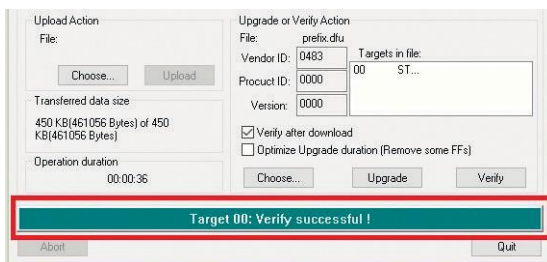
8. Disconnect USB cable from the device. The firmware has been updated and the device is ready for further use.

6. STEP-BY-STEP INSTRUCTION

Adapter RTP9005S tests the alternator assembly (the alternator assembled with the voltage regulator) directly in the car or separately the voltage regulator only. Both variants are considered further.

6.1. Testing of the alternator assembly in the car

Testing in the car is carried out with the help of four-wire cable **(Fig. 2)**. The adapter is connected to the car electrical system according to the color marking described in the point 3.2. For accurate voltage measuring, the adapter's negative wire should be connected to the corresponding battery terminal. The testing is conducted in the following sequence:

• Connect the adapter to the car electrical system.

• Start the car engine and wait until it operates steady 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 alternator model implies changing the value). The voltage on the adapter 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 and replace it if necessary. If voltage is out of the norm, the alternator should be dismounted from the car for repair.

• Connect the control terminal of the alternator back to the car.

• Check the adapter's indication. If the alternator output voltage value exceeds the norm, check

the signal in data transmission line ("LIN", "CAN", "K-LINE") in the mode of oscillograph.

• Stop the engine.

• Disconnect the adapter terminals from the car.

⚠ **WARNING! Testing must be carried out in the premises with combined extract and input ventilation or fume offtake system. Otherwise, testing must be conducted outdoors.**

6.2 Testing of the voltage regulator separately from the alternator

Testing of the voltage regulator separately from the alternator is conducted with the help of nine-wire cable **(Fig. 3)**. The device is connected to the voltage regulator according to the color marking described in the point 3.2 and Appendix 2. The testing is conducted in the following sequence:

• Connect the adapter 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 COM voltage regulators.

• Exit the testing mode with the button "⏎".

6.3 "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.

6.4 "Oscillograph" mode

In this mode connection to the source of analized signal is carried out with the help of the four-core 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.

7. SAFETY MEASURES WHEN WORKING WITH RTP9005S

In order to avoid possible electric shock or injury as well as damage of the adapter or a tested equipment, the following instructions should be strictly observed:

• Make sure that the measuring clamp does not have insulation damage or bare metal spots. Make sure that the clamp is not damaged. In case of obvious damage, change it for a new one before using the adapter.

• In order to avoid possible electric shock or injury as well as damage of the adapter, do not apply voltage exceeding 20V to the adapter outputs or between the earth and any of the outputs.

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• When measuring, try to connect outputs correctly, especially, "B-". The device has all kinds of protection against emergency situations, however, not all voltage regulators have such protection. If you have questions about how to connect a voltage regulator that is not mentioned in actual user manual, please contact MSG Equipment customer support.

• Do not store or use the adapter in places of high temperature, humidity, danger of explosion or fire, intense magnetic field. As a result of dampness, operation of the device may deteriorate.

• To avoid damage or failure of the adapter, do not make changes in your discretion in the electrical diagram of the device. In case of failure, please contact the manufacturer or the trade representative.

• To clean the surface of the adapter, use a soft cloth and spray for cleaning monitor screens. To avoid corrosion, damage or failure of the device, do not use abrasives and solvents.

• The device is intended for use indoors.

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RTP9005S
PRECAUTIONS AND
OPERATING TIPS

To avoid damage of the display do not expose the device to a strong mechanical shock.

Please note: connect large crocodile clip to the battery negative pole (generator housing). Connect small clip to a "lamp" output of the voltage regulator.

12V Use the adapter with 12V alternators only.

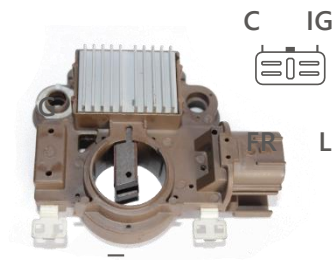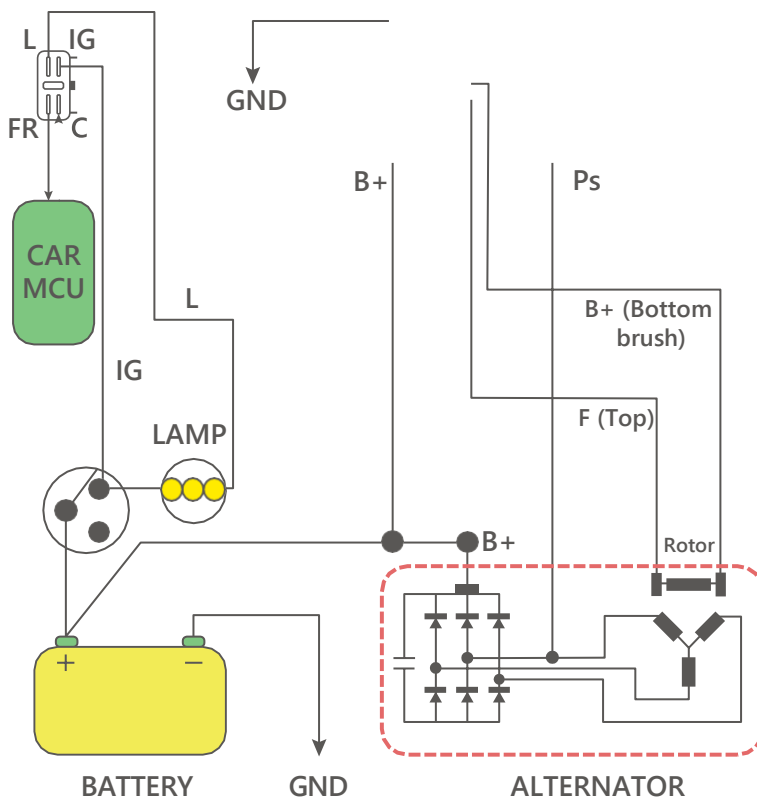Make sure the battery is in good condition, when testing the alternator with the test bench. Do not start the alternator if the battery is faulty or absent.

If difficulty occurs with voltage regulator connecting, check user manual, Appendix 2, page 22. In other cases, internet search engines or another alternator on hand can provide you with the required connection scheme.

EXAMPLE OF HOW TO CONNECT A VOLTAGE REGULATOR

L   IG

FR   C

GND

CAR MCU

B+

Ps

B+ (Bottom brush)

L

IG

F (Top)

LAMP

B+

Rotor

BATTERY

GND

ALTERNATOR

C   IG

FR   L

VOLTAGE REGULATOR

Part Number: VR-H2009-113

Description
IG-C-L-FR Terminals
Inactive Lamp
Soft start
Short Circuit Protection
Voltage Set Point: 14.5V

B+   F (Top) Ps

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APPENDIX 1

Connection terminals for alternators

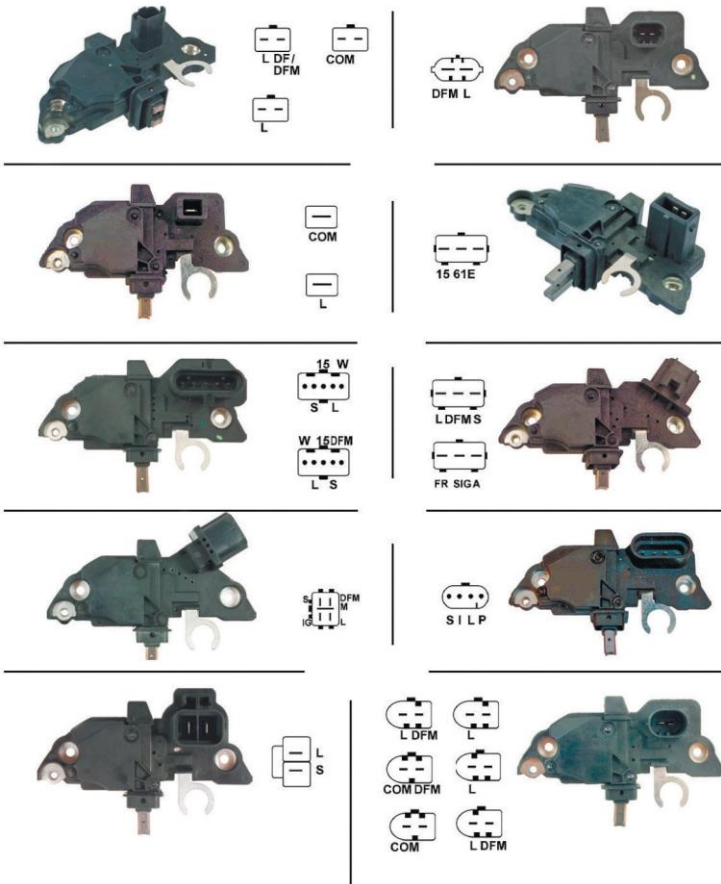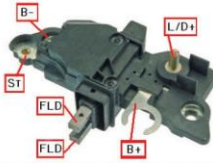| Indicial notation	Functional purpose	Terminal
B+	Battery (+)	B+
A	(Ignition) Input for switch starting	
I G		
1 5		
AS	Alternator Sense	
BVS	Battery Voltage Sense	
S	(Sense) Input for voltage comparison at control point	
B-	Battery (-)	B-
31		
E	Earth, battery (-)	
D+	Used for connection to an indicator lamp that transfers initial driving voltage, and indicates alternator operability	L/D+
I	Indicator	
IL	Illumination	
L	(Lamp) Output for alternator operability indicator lamp	
61		
FR	(Field Respond) Output for load control on an alternator by engine management block	FR
DFM	Digital Field Monitor	
M	Monitor	
LI	(Load Indicator) Same as FR, but with universal signal (Drive) Input of voltage regulator control with P-D terminals Mitsubishi	
D	(Load Indicator) Same as FR, but with universal signal (Drive) Input of voltage regulator control with P-D terminals Mitsubishi (Mazda) and Hitachi (Kia Sephia 1997-2000) alternators	GC
D	(Digital) Input of code voltage installation on American Ford, same as SIG	GC
RC	(Regulator Control) same as SIG	
SIG	(Signal) Input of code voltage installation	

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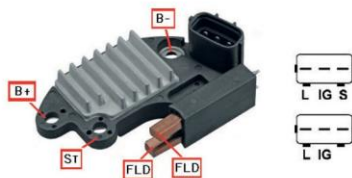|		
RVC(L)	(Regulated Voltage Control) Similar to SIG, but voltage change ranges from 11,0 V to 15,5 V. Control signal is sent to L terminal	
C	(Communication) Voltage regulator input to control engine operation block. Japanese cars	GC
G		
RLO	(Regulated Load Output) Input to control stabilizing voltage from 11,8 to 15V (TOYOTA)	
COM	(Communication) General term for physical interface, alternator control and diagnostics. Protocols of use: BSD (Bit Serial Device), BSS (Bit Synchronized Signal) or LIN (Local Interconnect Network)	
LIN	Direct indication on control interface and alternator diagnostics, conducted under LIN protocol (Local Interconnect Network)	
DF	Output of a voltage regulator	F1; F2
F		
FLD		
67		
P	Output of one of alternator stator windings. Used for measuring alternator driving voltage	No connection
S		
STA		
Stator		
W	(Wave) Output of one of alternator stator windings for connection of tachometers in diesel engine cars	
N	(Null) Output of average stator winding point. Usually used to regulate alternator operability with mechanically regulated voltage by an indicator lamp	
D	(Dummy) Blank, no connection, mostly in Japanese cars	
N/C	(No connect)	
Options of LRC 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 drive rotation. Remarkably seen under idle running	

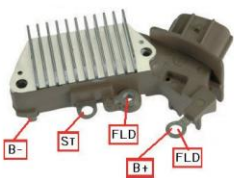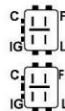# APPENDIX 2
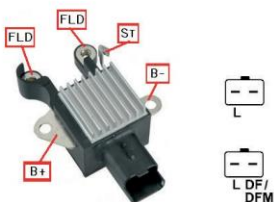
Connection of voltage regulators to Adapter RTP9005S

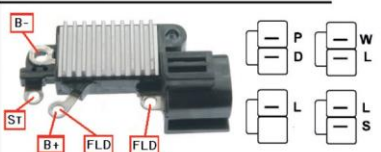# DELCO REMY

DENSO

FLD, ST, FLD, B-, B+

L

L DF/ DFM

FR SIG A
LI RC A

B+, FLD, ST, FLD, B-

C — F
IG — L

C — FR
IG — L

S — FR
IG — L

L IG S   L IG

L IG C   L IG FR

FR SIG A
LI RC A

P L F S

B-, ST, FLD, B+, FLD

L IG S   L IG C

L IG

L IG M   L IG FR

S —
IG — L

C
IG — L

IG — L

F1
F2

C — FR
IG — L

S — FR
IG — L

FR
IG — L

F — B+
E — N
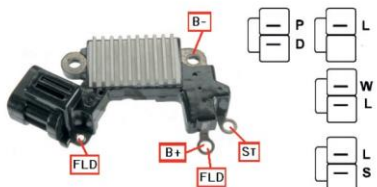
L

C — F
IG — L

S — FR
IG — L

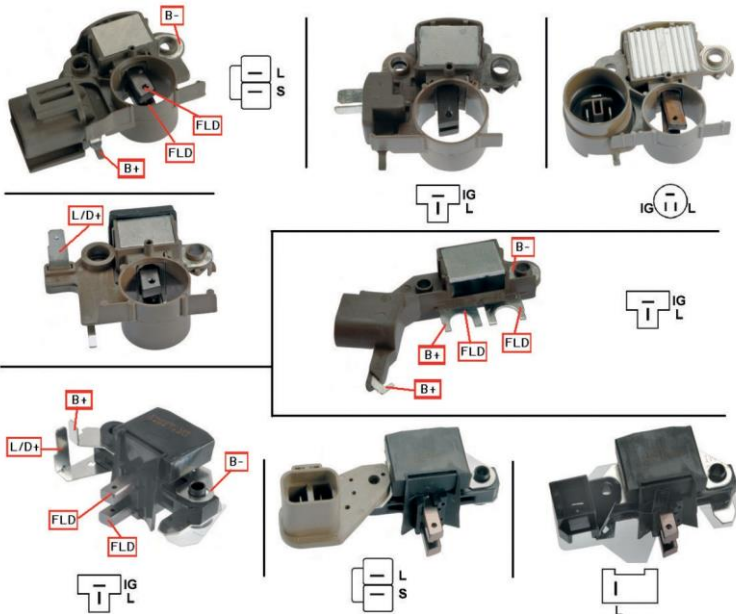IG
L

S
L

C — FR
IG — L

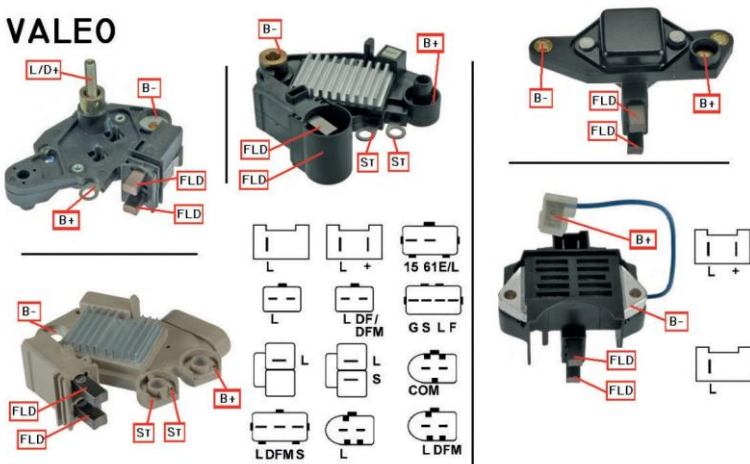# HITACHI
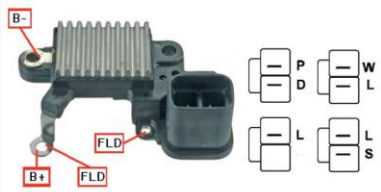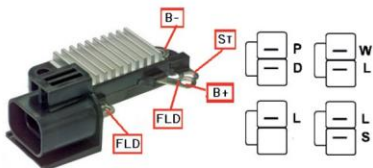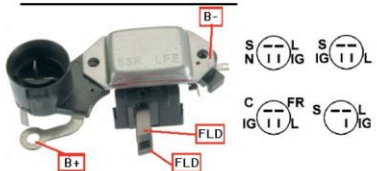
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