



MSG MS002 COM

TEST BENCH FOR DIAGNOSTICS OF ALTERNATORS,
STARTERS AND VOLTAGE REGULATORS

USER MANUAL



UNIQUENESS
TRAINING
SERVICE
INNOVATION
WARRANTY
QUALITY

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1. DESCRIPTION

Test Bench MSG MS002 COM is a high power multifunctional test bench. The equipment includes the following diagnostic functions: testing of starters, alternators and voltage regulators without applying any additional measuring devices.

The test bench was invented on the basis of the requirements of modern service stations: construction implies mounting of majority of units without using additional fixing elements. The test bench tests units of 12V and 24V; diagnoses the latest alternators and voltage regulators, which are controlled by car ECU; it has ports to connect alternators of different brands and manufacturers: «COM» («LIN», «BSS»), «P-D», «DFM», «D+», «RLO», «C», «SIG».

Diagnostics is carried out through load simulation of car consumers, change of rotation speed, sending of control signals (external control alternators), tracking of electrical characteristic. Testing results are transmitted to LCD display real-time.

Testing modes are switched with membrane keyboard on the control panel of the test bench. The selected mode is lightened with the corresponding indicator.



Fig. 1. MS002 COM - Front view

2. TECHNICAL CHARACTERISTICS

Supply voltage, V	380±10%
Supply type	Three-phases
Battery model (not concluded in the set)	Any, up to 60 A*Hr
Battery charge 1	Yes
Battery charge 2	No
Dimensions, mm (length, width, height)	550*440*1000
Weight, kg	125
Testing of alternators	
Voltage, V	12/24
Drive power, kW	5.5
Load 12V / 24V, A	0-200/0-100
Load adjustment	Smoothly
Drive rotation, rpm	0-3000
Drive rotation direction	Both directions
Transmission type (drive/alternator)	Belt
Belt type	V belt Poly-V belt
Connection terminals	COM (LIN, BSS), P-D, DFM, D+, RLO, C, SIG, F
Read parameters	- Voltage - Alternating current - Constant current - Drive rotation - COM voltage regulators: protocol, speed of exchange, protocol type, errors
Testing of starters	
Voltage, V	12/24
Power, kW	Up to 4

Measured parameters	- Voltage - Alternating current - Constant current
Testing of voltage regulators	
Voltage, V	12/24
Tested parameters	- Stabilizing voltage - Current through rotor winding - COM voltage regulators: protocol, speed of exchange, protocol type, errors
Voltage meter accuracy, V	0.1
Ampere meter accuracy, A	0.1
Short circuit protection	Yes
Short circuit sound alert	Yes
Connection terminals	COM (LIN, BSS), P-D, DFM, D+, RLO, C, SIG
Total check, sec	30 and longer

3. RECEIPT AND INSPECTION

Check the set received. It must contain:

- test bench
- wires to connect an alternator, starter, voltage regulator to the bench sockets
- User Manual

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

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

4. TEST BENCH DESCRIPTION

4.1 MOUNTING FACE

Mounting face consists of (Fig. 2):

- Chain fixer
- Chain
- Belts

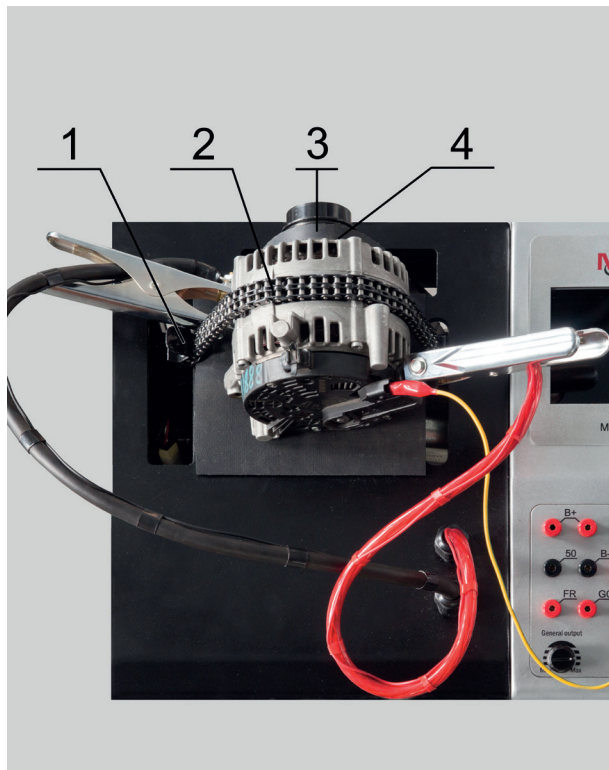


Fig. 2. MS002 COM - Mounting face



Fig. 3. MS002 COM - Control panel

The chain fixer (1) is used to latch the chain (2).

The belts (3) and (4) are used to transfer engine torque of the bench on a tested pulley of an alternator.

Control panel consists of (Fig. 3):

- Test bench emergency button
- Test bench power button
- LCD screen
- Keypad with LED indicators
- Adjustment Knobs

4.2 SOCKETS

- **D+**: used for testing alternators and voltage regulators with L, D+, I, IL, 61 terminals. LAMP indicator (control lamp simulation on instrument cluster) is lightened next to D+ socket.
- **DFM**: used to control load on an alternator. It is connected to FR, DFM, M voltage regulator terminals.
- **B+**: used for positive potential injection to a voltage regulator. It is connected to IG, S, AS, BVS, A, 15, 30 voltage regulator terminals.
- **GC**: used to test alternators with COM, P-D, RLO, C, SIG, 67 terminals.
- **B-**: used for negative potential injection to a voltage regulator.
- **St**: used for simulation of rotor winding terminals of an alternator in the mode of testing a voltage regulator.
- **FLD**: used to connect voltage regulator brushes or terminals corresponding to the sockets.
- **50**: used to test starters. Starter solenoid terminal is connected.

4.3 ADJUSTMENT KNOBS

- **REGULATION GC**: the knob to adjust generation voltage of an alternator or stabilizing voltage of a voltage regulator. It is used to connect a voltage regulator or alternator to GC socket. The set voltage parameters reset on short pressing.
- **ELECTRICAL LOAD**: the knob to adjust electrical load on an alternator (simulates car consumers). The set load parameters reset on short pressing.
- **ROTATION SPEED**: the knob to adjust drive rotation and rotation direction. The drive stops and electrical load parameters reset on short pressing.

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



Fig. 4. MS002 COM - Adjustment Knobs

4.4 BUTTONS

- **Alternator & starter tester:** on/off switch of the testing mode of starters and alternators. The button is lightened in active mode with option to choose voltage and connection to an alternator.
- **12V/24V:** buttons to set voltage for testing starters and alternators. The button is lightened when the voltage is set.
- **Voltage regulator tester:** on/off switch of the testing mode of voltage regulators. The button is lightened in active mode with option to choose voltage and connection to a voltage regulator.
- **P-D:** sends signal to GC connection port to check alternators with P-D terminal.
- **C:** sends signal to GC connection port to check alternators with C terminal.
- **RLO:** sends signal to GC connection port to check alternators with RLO terminal.
- **SIG:** sends signal to GC connection port to check alternators with SIG terminal.
- **COM:** sends signal to GC connection port to check alternators with COM terminal.
- **F(67):** sends potential to GC connection port to check alternators without voltage regulators. Voltage is regulated by plus.
- **START:** on/off switch of positive potential through 50 connection port to gate terminal of starter solenoid.

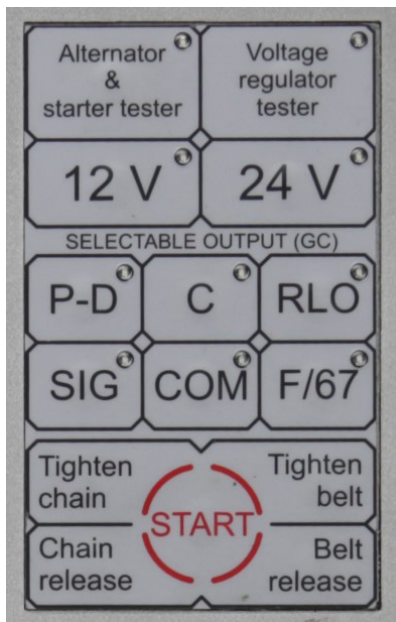
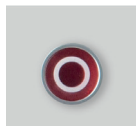


Fig. 5. MS002 COM - Control panel



- Test bench emergency stop button.



- Test bench on/off switch button.

- **REGULATION GC:** ensures adjustment of output parameters of a voltage regulator, used when a voltage regulator is plugged into GC connection port. Parameters reset after a short pressing.
- **ELECTRICAL LOAD:** the knob for adjusting electrical load on an alternator (simulates vehicle electrical consumers). Parameters reset after a short pressing.
- **RPM:** the knob for adjusting drive rotation. Sets direction (to the left/right) and speed of the drive.

The drive stops and parameters reset after a short pressing.

Voltage regulator tester mode ensures switching of testing windows on the display.

4.5 DISPLAY. DATA OUTPUT

Display Data Output when Testing an Alternator or Starter Display Indicators

- **VOLTAGE, DC:** generation voltage indicator (alternator testing) or consuming voltage indicator (starter testing).
- **DFM, %:** indicator of load on an alternator.
- **AMP, DC:** constant current indicator. Generation indicator (alternator testing) or consuming voltage indicator (starter testing).
- **AMP, AC:** alternating current indicator.
- **TACHOMETER:** drive rotation indicator. It is not used when testing a starter.
- **D:** indicator of set generation voltage when testing alternators with P-D terminal (Fig. 6).
- **P:** stator winding frequency indicator when testing alternators with P-D terminal (Fig. 6).
- **C:** indicator of set generation voltage when testing alternators with C terminal (Fig. 8).
- **RLO:** indicator of set generation voltage when testing alternators with RLO terminal (Fig. 9).
- **SIG:** indicator of set generation voltage when testing alternators with SIG terminal (Fig. 10).
- **PROTOCOL:** voltage regulator protocol indicator (alternators with COM terminal only) (Fig. 11)
- **BAUD:** indicator of data exchange speed indicator of a voltage regulator (alternators with COM terminal only) (Fig. 11).
- **COM:** indicator of set generation voltage when testing alternators with COM terminal (Fig. 11).
- **ID/TYPE:** ID and voltage regulator type indicator (alternators with COM terminal only) (Fig. 11).
- **ERROR:** voltage regulator error indicator (alternators with COM terminal only) (Fig. 11).
- **VOLTAGE REG:** indicator of set generation voltage (alternators without a voltage regulator only) (Fig. 12).

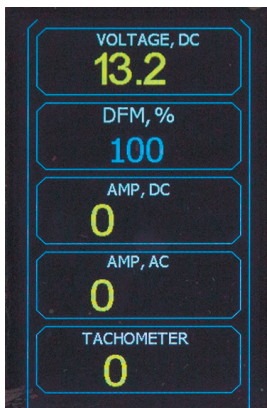


Fig. 6. Display data output when testing an alternator with D+ terminal or a starter

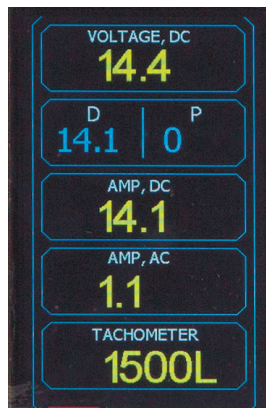


Fig. 7. Display data output when testing an alternator with P-D terminal

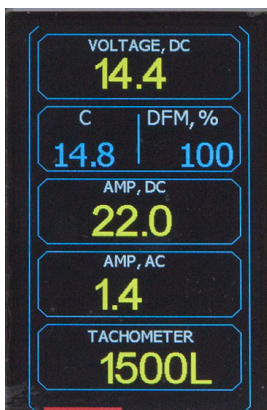


Fig. 8. Display data output when testing an alternator with C terminal

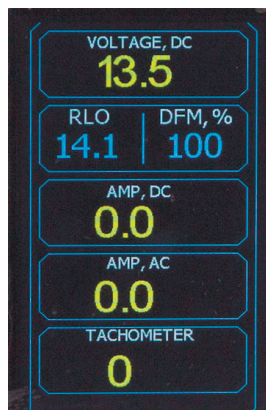


Fig. 9. Display data output when testing an alternator with RLO terminal

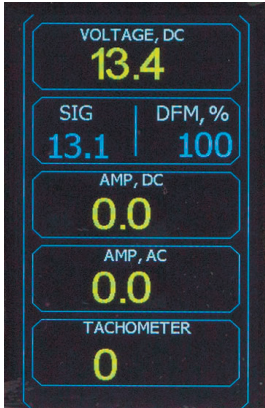


Fig. 10. Display data output when testing an alternator with SIG terminal

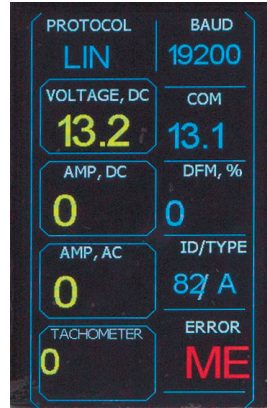


Fig. 11. Display data output when testing an alternator with COM (LIN, BSS) terminal

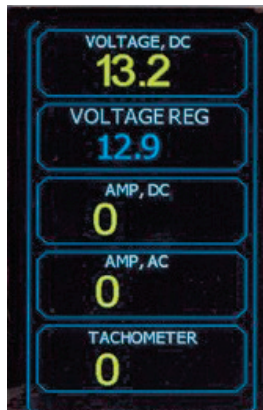


Fig. 12. Display data output when testing an alternator without a voltage regulator F(67)

Display Data Output when Testing an Alternator or Starter

Display Indicators

- **VOLTAGE, DC:** stabilizing voltage indicator of a voltage regulator.
- **DFM, %:** indicator of load on a voltage regulator.
- **AMP, DC:** indicator of constant current through winding of simulated rotor.
- **D:** indicator of set stabilizing voltage of a voltage regulator (voltage regulators with P-D terminal only) **(Fig. 14)**.
- **P:** stator winding frequency indicator of a voltage regulator (voltage regulators with P-D terminal only) **(Fig. 14)**.
- **C:** indicator of set stabilizing voltage of a voltage regulator (voltage regulators with C terminal only) **(Fig. 15)**.
- **RLO:** indicator of set stabilizing voltage of a voltage regulator (voltage regulators with RLO terminal only) **(Fig. 16)**.
- **SIG:** indicator of set stabilizing voltage of a voltage regulator (voltage regulators with SIG terminal only) **(Fig. 17)**.
- **PROTOCOL:** voltage regulator protocol indicator (voltage regulators with COM terminal only) **(Fig. 18)**.
- **BAUD:** indicator of data exchange speed indicator of a voltage regulator (voltage regulators with COM terminal only) **(Fig. 18)**.
- **COM:** indicator of set stabilizing voltage of a voltage regulator (voltage regulators with COM terminal only) **(Fig. 18)**.
- **ID/TYPE:** ID and voltage regulator type indicator (voltage regulators with COM terminal only) **(Fig. 18)**.
- **ERROR:** voltage regulator error indicator (voltage regulators with COM terminal only) **(Fig. 18)**.

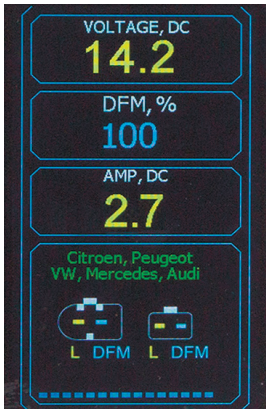


Fig. 13. MS004COM

Display data output when testing a voltage regulator with L/D+ terminal

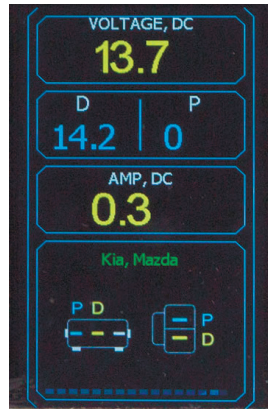


Fig.14. MS004COM

Display data output when testing a voltage regulator with P-D terminal

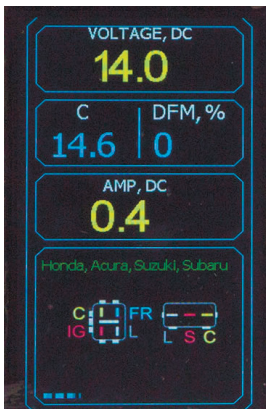


Fig. 15. MS004COM

Display data output when testing a voltage regulator with C terminal

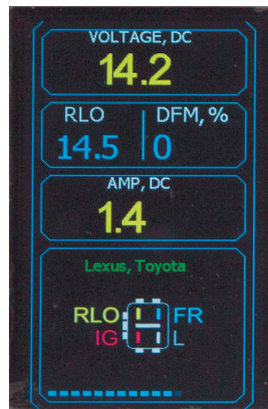


Fig. 16. MS004COM

Display data output when testing a voltage regulator with RLO terminal

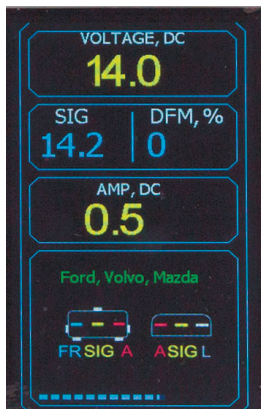


Fig. 17. MS004COM

Display data output when testing a voltage regulator with SIG terminal

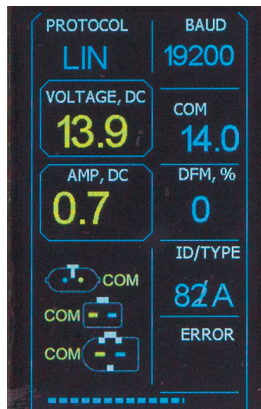


Fig. 18. MS004COM

Display data output when testing a voltage regulator with COM terminal

5. SETTING INTO OPERATION

5.1 CONNECTION

Install the bench in the premises with temperate humidity and temperature. Unscrew the bolts and open the battery box cover of the test bench. Connect the batteries to the relevant wires, as indicated on the terminal posts.

Battery 1 and Battery 2 terminal posts must comply with the corresponding battery.

Link the test bench to a single-phase mains supply.

⚠ WARNING! Use a specified battery type only.

⚠ WARNING! Observe polarity of the terminal posts, otherwise, may cause failure of the test bench. In this case a customer loses warranty package, provided by the manufacturer.

⚠ WARNING! Make sure that mains voltage corresponds to the technical data of the test bench.

5.2 SAFETY AND PREVENTIVE MEASURES

It is strongly recommended to learn actual User Manual before launching the bench.

Make sure that the test bench is disconnected from mains supply before running any maintenance procedures.

Make sure that the batteries are permanently charged.

6. STEP-BY-STEP INSTRUCTION

Before testing the unit, make sure that all bolts are tightened, the test bench is not damaged and has no cracks.

6.1 ALTERNATOR TESTING

- Install the unit must on the mounting face.
- The pulley must align with the belt.
- Release the chain to the required length (by pressing the button **Chain release** on the control panel), latch the chain over the chain fixer **(1)** of the mounting face.
- Fix the unit on the mounting face (by pressing the button **Tighten chain** on the control panel). Tightening will stop automatically.
- Release the belt to the required length (by pressing the button **Belt release**), latch the belt over an alternator pulley. Tighten the belt (by pressing the button **Tighten belt**) until tension of the belt is the same as in the car. Belt tension is set manually. Belt tension stops by pressing the button **Tighten belt** one more time.
- Connect the power cable **(Fig. 2)** B- with multi-functional tightening, called 'crocodile', to the body of the tested unit, which is earth, connected to negative terminal of the battery.
- Press the button **Alternator & Starter tester**, set required voltage with **12V/24V** buttons, according to the technical characteristics of a tested alternator.
- Connect B+ wire **(Fig. 2)** to the power terminal of an alternator.
- Connect terminals of a voltage regulator to the corresponding sockets of the test bench.
- Press the button of the corresponding terminal on the control panel, according to the connection terminal of an alternator.
- Rotate the adjustment knob **ROTATION SPEED** to the left or to the right, depending on rotation direction of an alternator. Mostly alternators rotate to the left.
- Faultless alternator starts power generation from 700 to 850 drive rotation.
- If voltage regulator connection terminals are P-D, C, RLO, SIG, COM, F(67), set preliminary generation voltage with the adjustment knob REGULATION GC from 13.5V to 14.5V.
- Reach 3 000 rpm maximum drive rotation.
- Increase the load on an alternator. Rotate the adjustment knob **ELECTRICAL LOAD** clockwise; anticlockwise rotation decreases the load.
- If voltage regulator connection terminals are L or D+, generation voltage must not go lower than 13.5V under maximum load, and must not go higher than 14.5V under minimum load.

 **WARNING!** Generation voltage must correspond to the technical data of a tested alternator.

 **WARNING!** Discharged batteries may consume up to 50 A of generated current.

On finishing testing of an alternator:

- Reset the set load by short pressing the adjustment knob **ELECTRICAL LOAD**.
- Stop the drive by short pressing the adjustment knob **ROTATION SPEED**.
- Deactivate testing mode with **Alternator & starter tester button**.
- Disconnect the wires from an alternator.
- Release the drive belt.
- Release the fixing chain.
- Remove an alternator from the mounting face.

6.2 STARTER TESTING

- Install a starter on the mounting face.
- Release the chain to the required length, latch the chain over the chain fixer of the mounting face.
- Fix the unit on the mounting face. Tightening will stop automatically.
- Connect the power cable B- with multi-functional tightening, called 'crocodile', to the body of the tested unit, which is earth, connected to negative terminal of the battery.
- Press the button **Alternator & Starter tester**, set required voltage with **12V/24V** buttons, according to the technical characteristics of a tested starter.
- Connect B+ wire to the power terminal of a starter.
- Connect 50 socket to the power terminal of starter solenoid.
- Press **START** button. A faultless starter will switch on at once.
- Follow the indicators of current and voltage characteristics.

On finishing testing of a starter:

- Deactivate testing mode with **Alternator & starter tester button**.
- Disconnect the wires from a starter.
- Release the fixing chain.
- Remove a starter from the mounting face.

6.3 VOLTAGE REGULATOR TESTING

Connect a voltage regulator to the test bench by 2 ways:

- 1) Connect a voltage regulator to the corresponding outputs of the bench the same way it is

connected to an alternator.

2) Connect a voltage regulator according to APPENDIX 3.

 **WARNING! When testing 24V voltage regulators, battery 2 is not used.**

TESTING PROCEDURE:

- Activate the testing mode of a voltage regulator by pressing **Voltage regulator tester button**.
- Set required voltage of a tested voltage regulator with **12V/24V** buttons.
- Connect a voltage regulator to the test bench sockets in the following order: B+; B-; D+ and/or GC; FLD (both brushes); St.

Voltage indicators of faultless voltage regulator ranges from 13,8V to 14,7V.

- If voltage regulator connection terminals are P-D, C, RLO, SIG, COM, set preliminary stabilizing voltage with the adjustment knob REGULATION GC from 13.5V to 14.5V. Stabilizing voltage must correspond to the set voltage.

7. TEST CERTIFICATE

Test Bench MSG MS002 COM for diagnostics of starters, alternators and voltage regulators meets technical requirements of Directive 2014/30/EU - Electromagnetic Compatibility (EMC) EN Directive 2014/35/EU - Low voltage (LVD) Directive 2006/42/EC - Machinery (MD) and is qualified for exploitation.

APPENDIX 1

Connection Terminals of Alternators

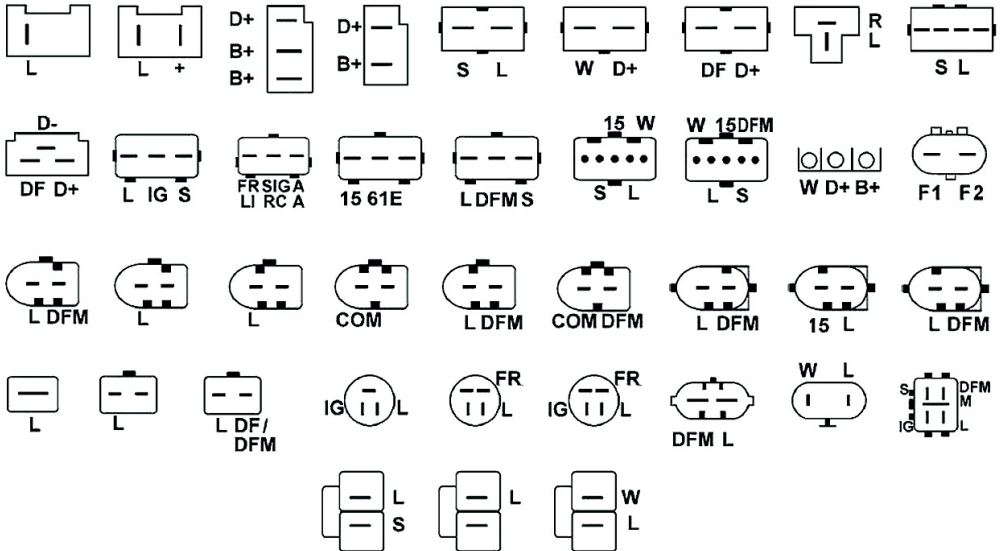
Symbols	Functional purpose	Connection
B+	Battery (+) (Ignition) Input for switch starting Alternator Sense Battery Voltage Sense (Sense) Input for voltage comparison at control point	B+
30		
A		
IG		
15		
AS		
BVS	Battery (-) (Earth) Earth, battery (-)	B-
S		
B-		
31	Used for connection to an indicator lamp that transfers initial driving voltage, and indicates alternator operability Indicator Illumination (Lamp) Output for alternator operability indicator lamp	L/D+
E		
D+		
I		
IL	(Field Report) Output for load control on an alternator by engine management block Digital Field Monitor Monitor (Load Indicator) Same as FR, but with universal signal	DFM
L		
61		
FR	(Drive) Input of voltage regulator control with terminal P-D Mitsubishi (Mazda) and Hitachi (Kia Sephia 1997-2000) (Digital) Input of code voltage installation on American Ford, same as SIG (Regulator Control) same as SIG (Signal) Input of code voltage installation	D
DFM		
M		
LI		
D	(Digital) Input of code voltage installation on American Ford, same as SIG (Regulator Control) same as SIG (Signal) Input of code voltage installation	SIG
D		
RC		
SIG		

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	C
G		
RLO	(Regulated Load Output) Input to control stabilizing voltage with range from 11,8 to 15 V (TOYOTA)	RLO
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)	COM
LIN	Direct indication on control interface and alternator diagnostics, conducted under protocol LIN (Local Interconnect Network)	
DF	Voltage adjustment output	F67
F		
FLD		
67		
P		
S	Output of one of alternator stator windings. Used for measuring alternator driving voltage	
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) No connection	
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	

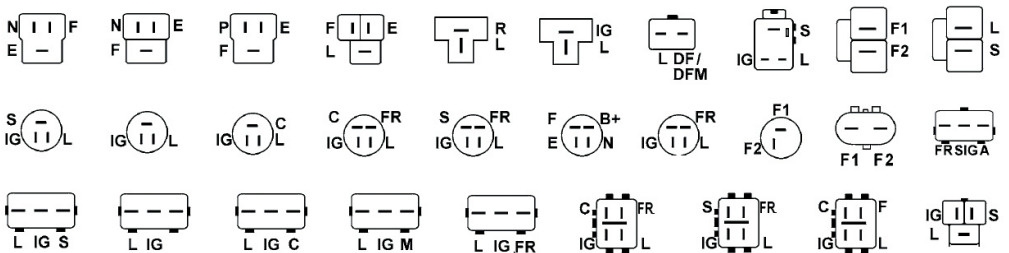
APPENDIX 2

Sockets of Alternators

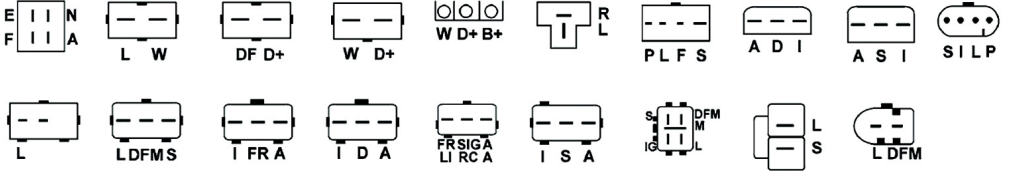
Bosch



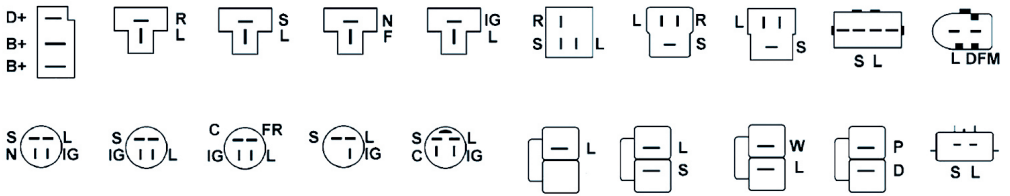
Denso



Ford/Lucas



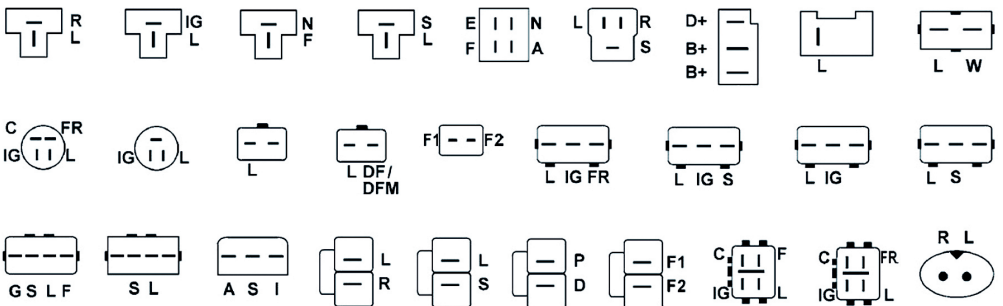
Hitachi



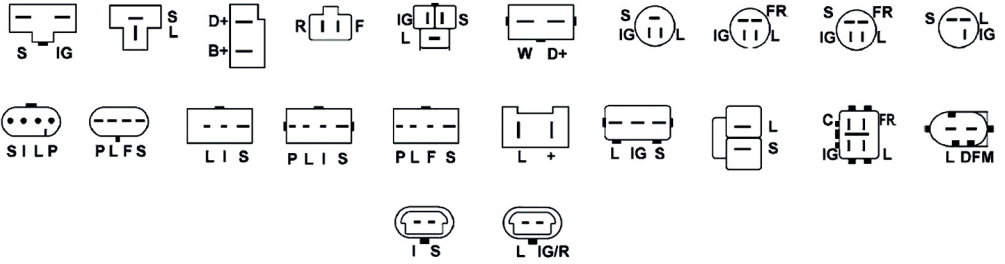
Magneti Marelli



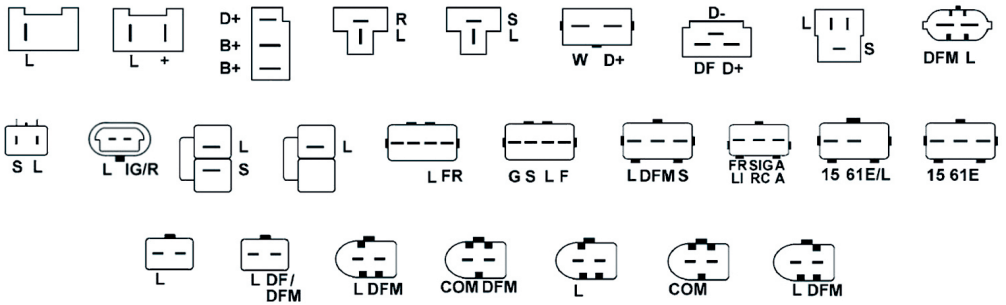
Mitsubishi



Delco Remy



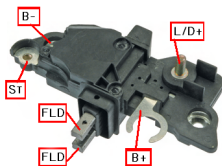
Valeo



APPENDIX 3

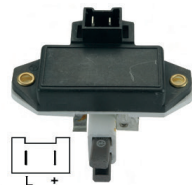
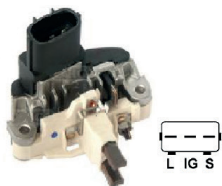
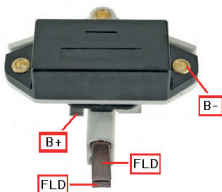
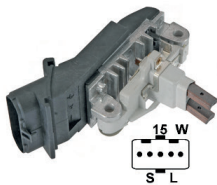
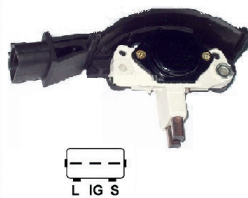
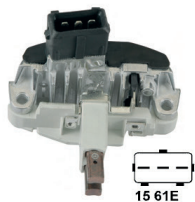
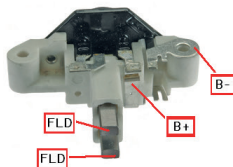
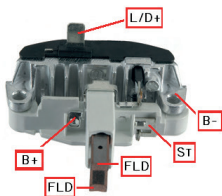
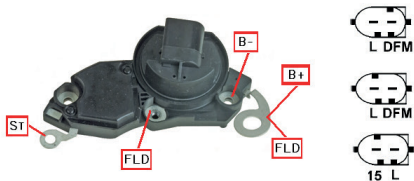
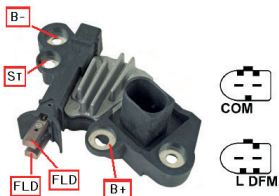
CONNECTION OF VOLTAGE REGULATORS TO THE TEST BENCH

BOSCH

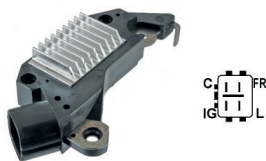
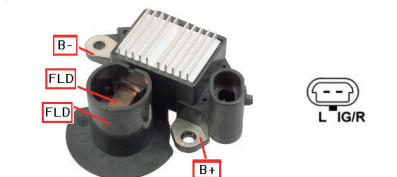
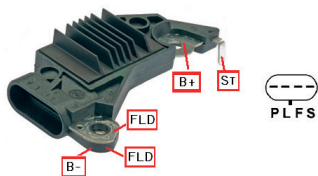
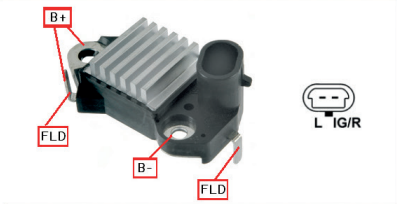
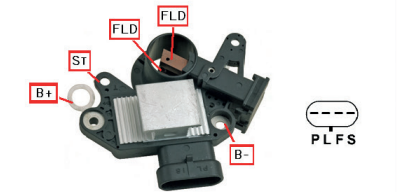
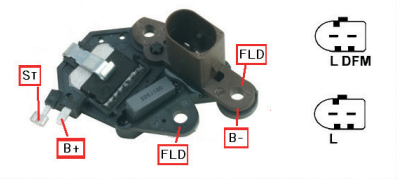
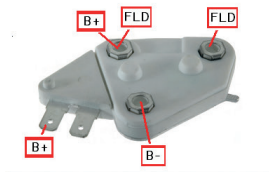
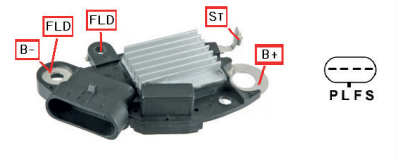
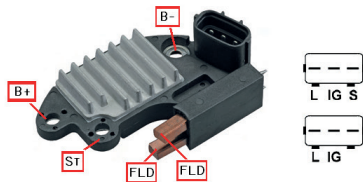


	 L DFM / DFM COM L		 DFM L
	 COM L		 15 61E
	 15 W S L W 15DFM L S		 LDFMS FR SIGA
	 S L DFM W G L		 S I L P
	 L S		 L DFM L COM DFM L COM L DFM

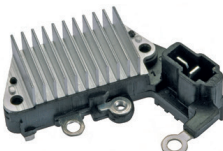
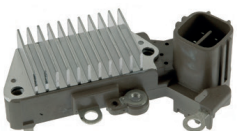
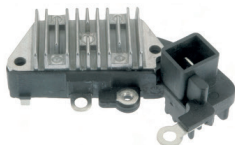
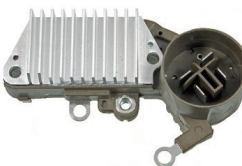
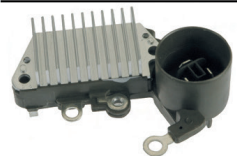
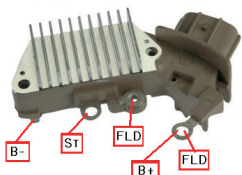
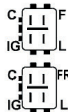
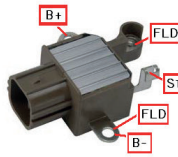
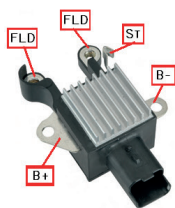
BOSCH



DELCO REMY



DENSO



HITACHI

The image displays various Hitachi test bench components and their corresponding schematic symbols. The components are arranged in several rows and columns, with labels indicating their functions and connections.

Top Left Section: Shows a power supply unit with labels B-, B+, and FLD. Below it are schematic symbols for R L, S L, N F, and IG L.

Top Right Section: Shows a power supply unit with labels B-, B+, FLD, and ST. Below it is a schematic symbol for S L. Further down are schematic symbols for L S, W L, P D, and L IG D.

Middle Left Section: Shows a power supply unit with labels L S, P D, W L, and L.

Middle Right Section: Shows a power supply unit with labels B-, ST, FLD, FLD, and B+.

Bottom Left Section: Shows a power supply unit with labels B-, FLD, FLD, and B+. Below it are schematic symbols for L S, W L, P D, and L.

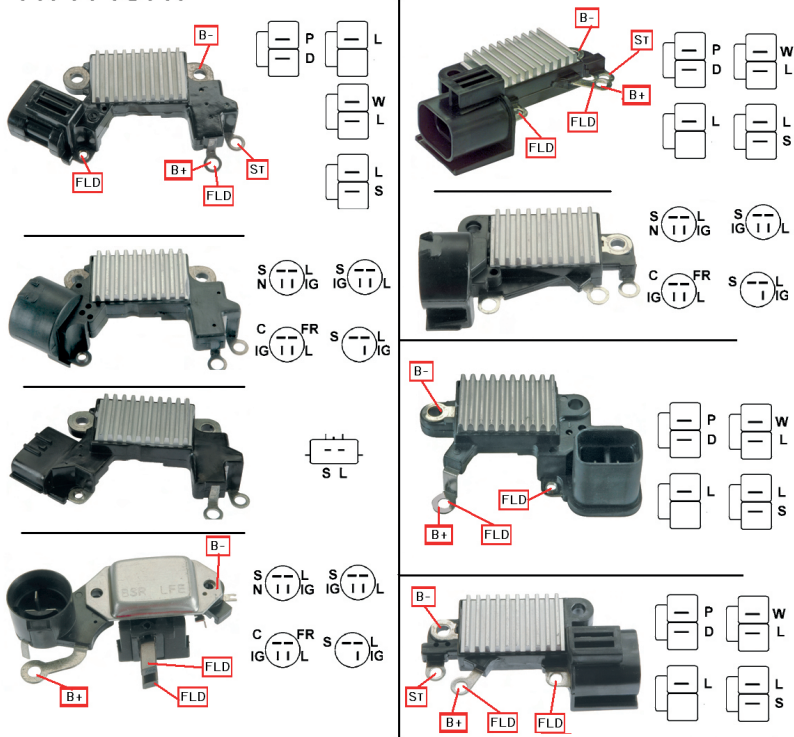
Bottom Right Section: Shows a power supply unit with labels B-, FLD, B+, FLD, and B+. Below it is a schematic symbol for LDFM.

Bottom Center Section: Shows a power supply unit with labels B-, FLD, FLD, and B+. Below it are schematic symbols for L S, W L, P D, and L.

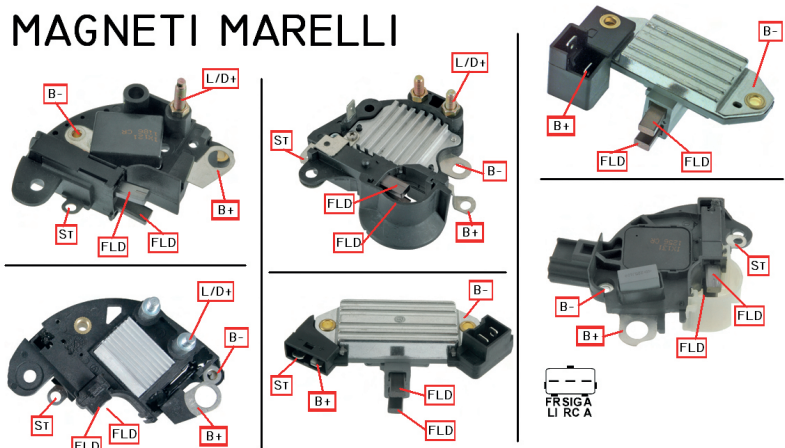
Bottom Far Left Section: Shows a power supply unit with labels B-, FLD, FLD, and B+. Below it are schematic symbols for S L, C IG, FR L, S IG, and L.

Bottom Far Right Section: Shows a power supply unit with labels B-, FLD, B+, FLD, and B+. Below it are schematic symbols for W L, L S, P D, and L.

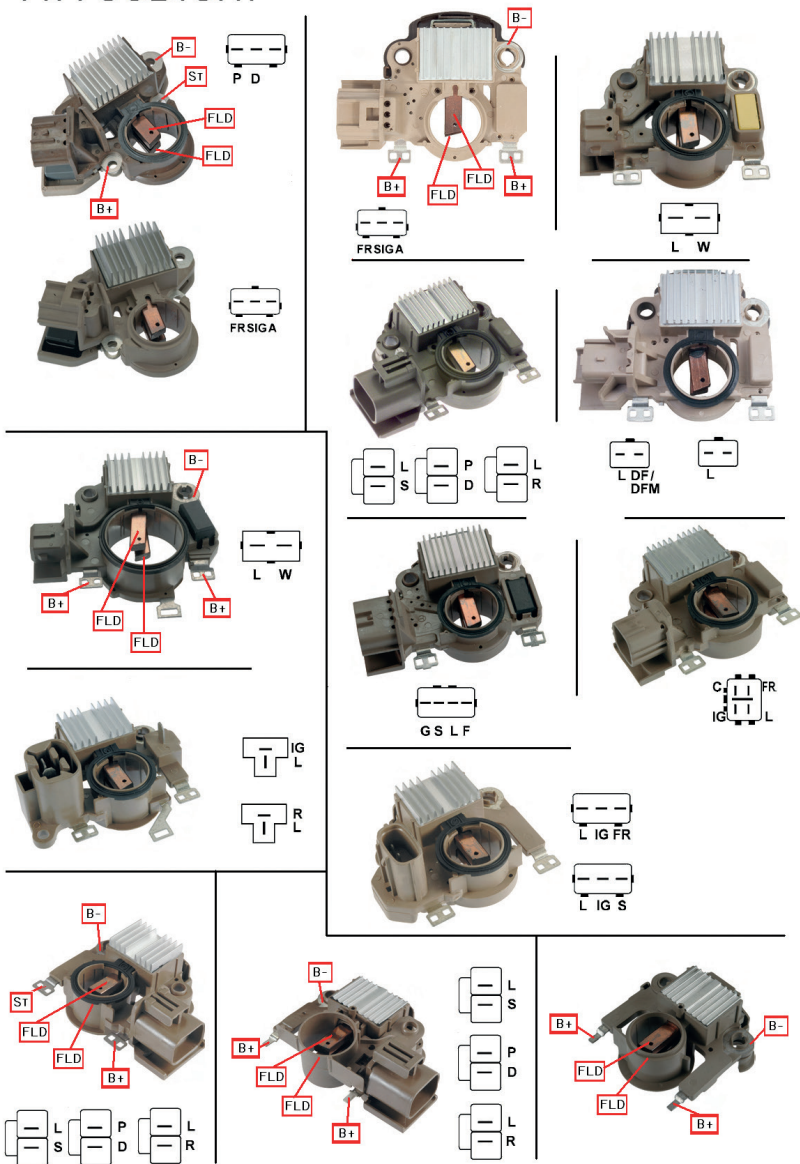
HITACHI



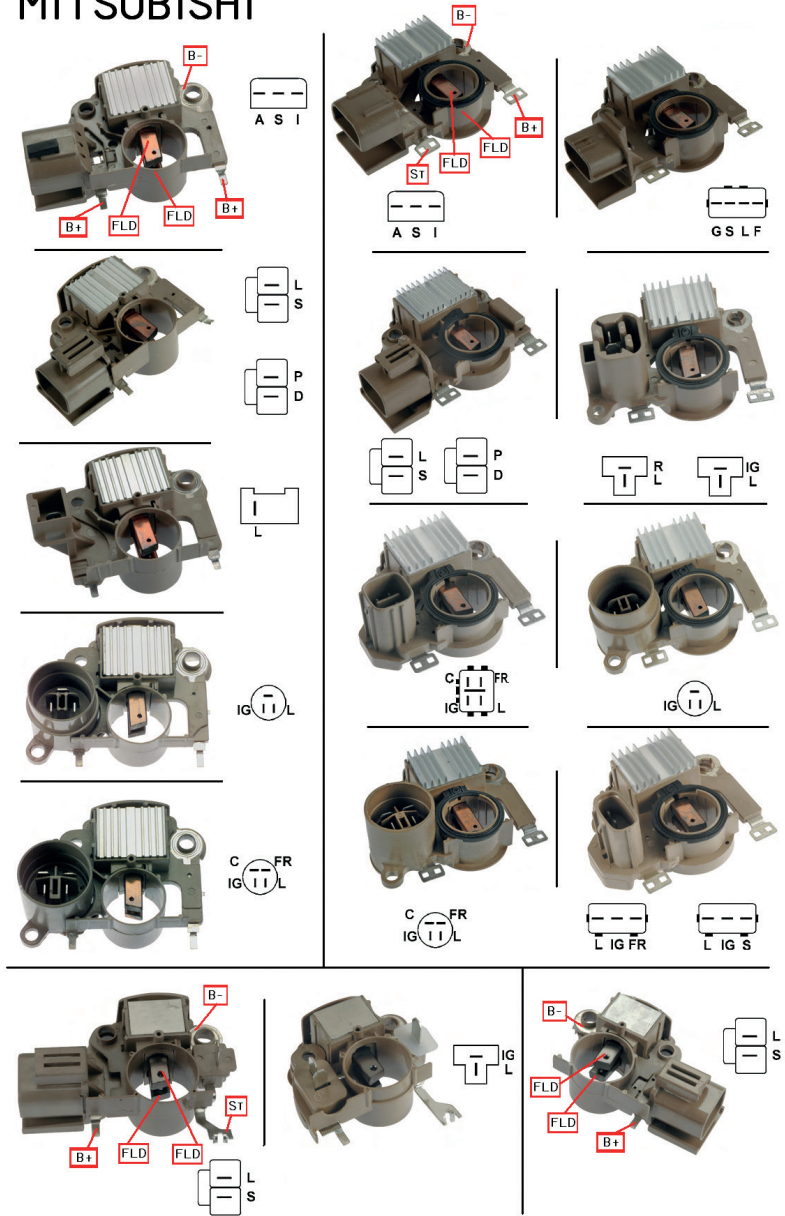
MAGNETI MARELLI



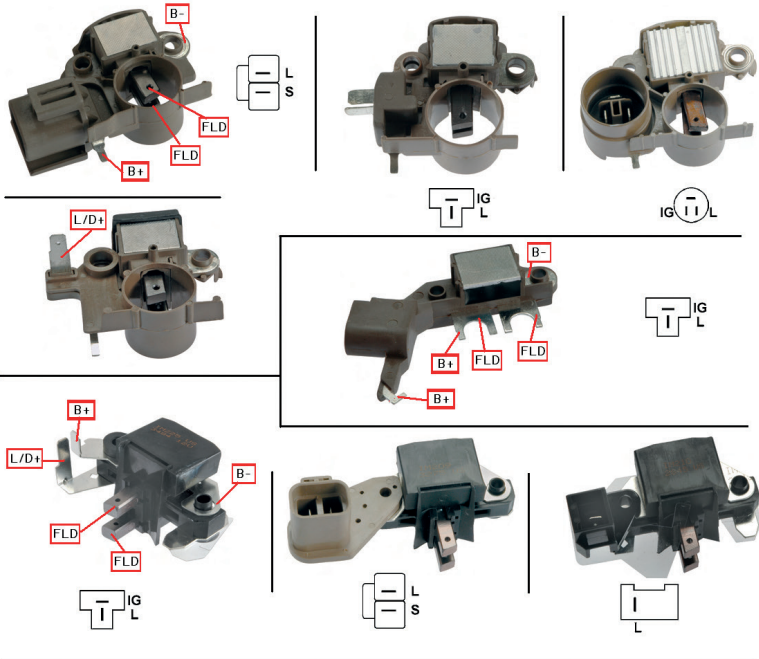
MITSUBISHI



MITSUBISHI



MITSUBISHI



VALEO

