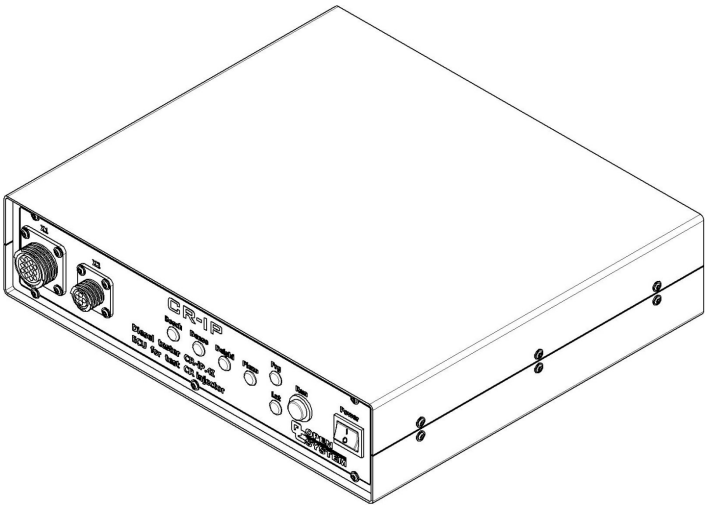
OS. 15-17 Controller CR-IP.1I

OS. 15-14 Controller CR-IP.4I

Diesel Tester for Common Rail Injectors



Controller for Common Rail Injector

"Diesel tester CR-IP.1I – for 1 injector"

"Diesel tester CR-IP.4I – for 4 injectors"

Passport.

Technical Description.

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2023

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Diesel Tester for Common Rail Injectors

1. Introduction

This passport is a document certifying the basic parameters and technical characteristics of the controller "Diesel tester CR-IP.1-4I" for testing and checking the performance of diesel injectors of the Common Rail system guaranteed by the manufacturer. This data sheet allows you to familiarise yourself with the device, procedure and rules of its operation, observance of which will ensure correct operation of the controller.

2. General information

The "Diesel tester CR-IP.1-4I" controller is an electronic unit that controls the electrical elements of the Common rail fuel system. It is used as part of bench equipment and is controlled via ARM-Diesel software.

3. Assignment

The device "Diesel tester CR-IP.1-4I" is designed for diagnostics of Common Rail injectors manufactured by Bosch, Denso, Delphi, Siemens VDO on the stand.

The device provides:

- * Simultaneous control of 1-4 nozzles;
- control of electromagnetic injectors of the passenger car series from 14 V voltage;
- control of electromagnetic injectors of the truck series with 28 V supply voltage;
- control of piezoelectric nozzles;
- control of common rail fuel injectors of CP1, CP3 systems;
- control of the measuring unit shutter;

4. Main technical data and characteristics

- Power supply voltage, V - ~220 V ±15%;
- Power consumption, W, not more than - 350 W.
- Curtain control relay load - 5A 250V AC, 5A 24V DC;
- Unit weight: 65kg;
- Dimensions (width x height x depth) - 520x650x290 mm;

* The "Diesel tester CR-IP.1I" can control 1 injector at a time, the "Diesel tester CR-IP.4I" - 4 injectors.

5. Device design

Figure 1.Front view "Diesel tester CR-IP.1I"

The device "Diesel tester CR-IP.1I" is designed as a block. On the front panel of the device there are:

- X1 - connector for connection to injectors;
- X2 - for connection of the injection sensor;
- Control buttons for manual start-up;
- Power on toggle switch.

Figure 2.Front view "Diesel tester CR-IP.4I"

Diesel tester CR-IP.4I" is similarly designed as a unit. On the front panel of the device there are:

- X1 - connector for connection to injectors;
- X2 - for connection of the injection sensor;
- Control buttons for manual start-up;
- Power on toggle switch.

Figure 3.Rear view "Diesel tester CR-IP.1-4I"

On the back of the device are:

- X5 - pump control;
- X18 - for connection of regulator and pressure sensor;
- USB, ETH - for connection to a personal computer;
- PROT - connection of the contacts of the safety mechanism;
- Cooling fan;
- "NETWORK" for connection of mains power supply ~220 V.

The "NETWORK" connector is structurally designed in one housing with a fuse.

6. Operating instructions

Requirements for environmental conditions:

- Operating temperature: +5 ºC to +40 ºC
- Transport temperature: -20 ºC to +60 ºC
- Relative humidity (non-condensing): operating 8% - 80%, storage 5% - 95%.
- Air dustiness: max. 75 µg/m^3

Before switching on the device it is necessary to check visually or with the help of devices, serviceability of connectors-adapters, 220 volt power cable.

If the device is moved from a cold to a warm room, it is **strictly forbidden to** switch it on for 1-1.5 hours.

After switching on, let the appliance run for 2-4 minutes, then proceed to work.

Categorically forbidden:

- Switch on the device if the power supply cables are defective;
- connect and disconnect adapter connectors from nozzle, sensor or pressure regulator when the device is switched on;
- Switch on the device in a network that does not have an earthing circuit;
- Connect the device to the mains with a cable that does not have an earth contact;
- Use the "Diesel tester CR-IP.1-4I" in conjunction with electrical equipment that is not connected to an earth loop.

Failure to observe the last three points may result in electric shock.

In addition to health hazards, the lack of grounding, in most cases, leads to failure of the pressure sensor, because the device uses a pulse power supply, according to the circuitry features of which, on the body of the device, in the absence of grounding will be a voltage equal to half the voltage supply of the device and becomes 110V.

7. Limitation of liability

The manufacturer shall not be liable to the purchaser of this product or any third party for any damage or loss incurred by the purchaser or any third party as a result of improper use of the product, including inadvertent or erroneous behaviour of personnel, or for any loss caused by the action or omission of this product.

Under no circumstances will the manufacturer be liable for lost profits, lost savings, losses caused by accidents or other consequential economic losses, even if the company has been advised of the possibility of such losses. The manufacturer shall not be liable for damages claimed by you on the basis of third party claims or caused by the non-performance of your obligations.

The manufacturer shall not be liable for any malfunctions or damages resulting from the use of additional devices recommended for use with this device, or from modifications, repairs or alterations to this device that are not in accordance with the operating instructions, including the use of a self-made adapter connector.

8. Preparing for work

Please read the operating instructions carefully before using the "Diesel tester CR-IP.1-4I".

The following steps should be performed to prepare the device for operation:

Carry out an external inspection of the device and connecting cables. External inspection of the device and connecting cables is carried out with the power supply switched off and consists in detecting mechanical damage of the device and connecting cables.

9. Device operation

The "Diesel tester CR-IP.1-4I" allows the testing of electrically controlled diesel injectors of the Common Rail system by supplying user-defined required injector control signals and fuel pressure by controlling the control valve.

The device can be controlled manually by means of the control buttons on the front panel and automatically by means of software (hereinafter referred to as software) on a personal computer (hereinafter referred to as PC).

In manual mode, nozzle control functions are available to check volumetric performance, visual evaluation of the shape and intensity of the spray pattern, and an anchor stroke measurement function (Stroke mode), for Bosch electromagnetic nozzles.

In automatic mode it is also possible to control the pressure regulator to maintain the set pressure in the system, to control various actuators (e.g. switching on/off the

booster pump, controlling the measuring unit shutter), to measure the Response time for testing and coding of Delphi injectors.

9.1. Manual operation mode

1. Connect the nozzle using a suitable adapter cable to the connection cable and to connector X1.
2. Connect the mains cable to the power connector and 220V/50Hz AC mains.
3. Switch on the device with the power toggle switch.

The mode and operating parameters are displayed on the front panel by means of light indication. They have different meanings depending on the colour and mode of illumination.

Table 1 - Description of light indication

Button	Colour	Description
Bosch	Green	Bosch signal has been selected.
Bosch	Red	Bosch signal selected. Errors in operation.
Denso	Green	The Denso signal has been selected.
Denso	Red	Denso signal selected. Errors in operation.
Delphi	Green	The Delphi signal has been selected.
Delphi	Red	Delphi signal selected. Errors in operation.
Piezo	Green	The Piezo signal is selected.
Piezo	Red	Piezo signal is selected. Errors in operation.
Bosch Denso Delphi Piezo	Red/. green	For the Piezo signal the voltage selection is 100, 120, 140, 160V. For Stroke mode, current selection: 10, 12, 13, 15A.
Frq	Green	The frequency selected is 0.5 Hz.
Frq	Red	The frequency selected is 1 Hz.
Lat	Green	A duration of 1 ms is selected.
Lat	Red	A duration of 3 ms is selected.
Run	No	Whoa, whoa, whoa.
Run	Red	Start.
Run	Flashing red	The device is in pause mode.

Modes and operating parameters are changed using the buttons on the front panel.

Table 2 - Description of buttons

Button	Pressing	Description
Bosch	Prolonged	Bosch signal selection. Long press again to switch to Stroke mode.
Denso	Prolonged	Denso signal selection.
Delphi	Prolonged	Delphi Signal Selection.
Piezo	Prolonged	Selects the Piezo signal.
Bosch Denso Delphi Piezo	Short	For the Piezo signal the voltage selection is 100, 120, 140, 160V. For the Stroke signal the current selection is 10, 12, 13, 15A.
Frq	Short	Frequency Switching.
Lat	Short	Switching the duration.
Run	Short	Start/stop.

Pressing the control buttons is accompanied by an acoustic signal.

Table 3 - Description of sound indication

Duration	Description
Short	Acknowledgement.
Three short ones	Bosch button - switch to Serial mode Frq button - frequency switching: rare - 0.5 Hz frequent - 1 Hz
Short/long	Lat button - duration switching: short - 1 ms long

Serial mode is used to test injector operation under pressure. It is recommended to use a hydraulic press (hand pump for testing diesel injectors) as a source of pressure. In this mode, a series of pulses is continuously fed to the injector, and real injection takes place, which makes it possible to assess the injector performance, as well as to make some measurements of injections.

To work in this mode, you should:

1. Select the **signal type by** long pressing (1 c) the appropriate button (**Bosch**, **Denso**, **Delphi**, **Piezo**). When working with electromagnetic injectors, select the type of signal according to the injector manufacturer, when working with piezoelectric injectors select the **Piezo** signal type regardless of the manufacturer. When the signal type is selected, the corresponding button lights up green and a short signal is emitted.
2. Select the frequency of the signal by briefly pressing the **Frq** button.
3. Select the duration of the signal by briefly pressing the **Lat** button.
4. To start, briefly press the **Run** button.

The device will start outputting a signal to the nozzle. The frequency and duration can be changed during operation, the signal type cannot be switched.

If an error occurs during operation, such as an open or short circuit in the control circuit, the button of the selected signal type will light up in red.

To stop, briefly press the **Run** button again**.**

For the Piezo signal, the control signal voltage is changed with the **Bosch**, **Denso**, **Delphi**, **Piezo** buttons.

- When the **Bosch** button is pressed - 100 V (the **Bosch** button glows green).
- When the **Denso** button is pressed, 120V (**Bosch** and **Denso** buttons glow green).
- When pressing the **Delphi** button - 140V (**Bosch**, **Denso** and **Delphi** buttons glow green).
- When the **Piezo** button is pressed - 160V (**Bosch**, **Denso**, **Delphi** and **Piezo** buttons glow green).

The pulse frequency and pulse duration can be set in the same way by pressing the **Frq** and **Lat** buttons.

The Stroke mode is used to deliver a single long pulse to measure the anchor travel in **Bosch** solenoid nozzles.

The stroke is measured by a mechanical (or electronic) indicator **(**INDICATOR **NOT INCLUDED).**

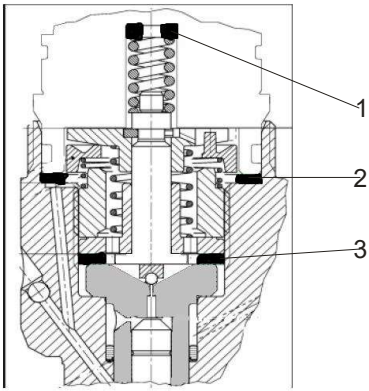


Figure 4.Common rail Bosch electrohydraulic nozzle assembly

COMMON RAIL BOSCH solenoid injector adjusting washers have the following purposes:

- increasing washer #1 will increase the pressure of the ball on the valve seat and vice versa;
- Increasing washer #2 will decrease the ball pressure on the valve seat and increase the magnetic clearance between the armature and solenoid and vice versa;
- Increasing washer #3 will decrease the ball pressure on the valve seat and increase the ball travel and vice versa.

When repairing the nozzle it is necessary to restore the value of the ball stroke value and the value of the magnetic gap between the armature and the electromagnet, caused by the ball subsidence during operation and subsequent mechanical treatment of the valve seat, for this purpose it is necessary to reduce the thickness of washer No.2 and washer No.3 by the same value as the ball subsided.

To switch to **Stroke** mode, long press the **Bosch** button (1 c), the device will beep once and all buttons except Bosch will go out.

The pulse is started by pressing the **Run** button. The pulse lasts 1.5 s and an acoustic signal sounds.

The pulse is followed by a pause of 8 s, during which no repeated pulses may be given. The pause is necessary to avoid overheating of the nozzle coil. During the pause the **Run** button flashes.

In **Stroke** mode, you can select the amperage:

- When pressing the **Bosch** button - 10 A (the **Bosch** button lights up red)
- When pressing the **Denso** button - 11 A (**Bosch** and **Denso** buttons are lit red)
- When pressing the **Delphi** button - 13 A (**Bosch**, **Denso** and **Delphi** buttons glow red)
- When pressing the **Piezo** button - 15A (**Bosch**, **Denso**, **Delphi** and **Piezo** buttons glow red).

The frequency and duration do not change in **Stroke** mode.

To switch back to **Serial** mode**,** press the **Bosch** button repeatedly (1 c) and the device will emit a series of three beeps.

9.2. Automatic operation mode

1.Connect the nozzle using a suitable adapter cable to the connection cable and to connector X1.

2.Sensor and pressure regulator via connecting cable to connector X18.

When working with injectors as a part of bench equipment, pressure control is carried out only by the standard high pressure regulator installed on the rail or on the pump of CP1 system.

When using a CP3 system pump, the high pressure regulator rail from the CP1 system must be installed.

The "Diesel tester CR-IP.1-4I" does not control the low pressure regulator of the CP3 pump in automatic mode.

3.Connect the injection sensor (the device is designed to work exclusively with injection sensor OS.60-01) to connector X2.

4.When using control of external actuators (pump, measuring unit shutter), connect them to connector X5.

5.Connect the USB communication cable to the device connector and connect it to the USB port of the PC.

6.Connect the mains cable to the power connector and 220V/50Hz AC mains.

7.Switch on the device with the power toggle switch (see point 4).

8.Start PC and operating software "Diesel tester CR-IP.1-4I"

In automatic mode, the buttons of the device are **NOT ACTIVE.**

9.3. Ensuring security

In order to ensure the safety of operating personnel, we strongly recommend the use of passive protection elements in the system (various protective covers or screens covering rotating parts and high pressure lines). A convenient technical solution is to make the enclosure covering the rail and nozzles out of transparent plastic. The opening elements should be fitted with limit switches.

The device has an additional input "PROT" (protection). Using this input, the device determines whether the safety guards are closed or not. The wiring diagram of the device is very simple and does not require special skills for its installation (see Appendix No. 5).

Also for safety reasons it is recommended to use a mechanical pressure limiting valve with an actuation pressure corresponding to a maximum of 1800 or 2500 bar).

In case of breakage, unscrewing of threaded connections or other faults of high pressure fuel supply ducts, immediately switch off the bench, observing all safety precautions.

10. Updating the software of the device

To update the device software, follow the steps below:

1.Connect the USB communication cable to the device connector and connect it to the USB port of the PC.

2.Connect the mains cable to the power connector and 220V/50Hz AC mains.

3.Switch on the device with the power toggle switch (see point 4).

4.Start the PC and the software to update the device. The update software window will open:

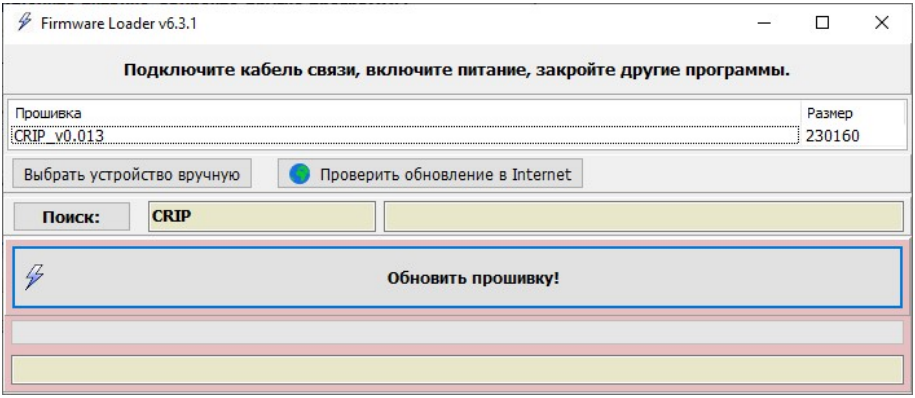


Figure 5.Updating the device software

5.Press the "**Update Firmware!**" button.

6.Wait for the update process to complete.

7.Close the updater window.

11. Supply package

Passport (Technical description, instruction manual
operating instructions) .....pc
Diesel tester CR-IP.1-4I" controller ..... 1 pc.
Connection cable for nozzles.....pc
Nozzle ..... adapter cable4 pcs.
Cable for regulators and pressure sensor ..... 1 pc.
Curtain/pump connection connector.....pc
PROT1 connector ..... pcs.
220V power cable.....pc
Fuse 5A.....pc
PC communication cable 2 pcs.

12. Warranty obligations

The manufacturer guarantees stable operation of the device "Diesel tester CR-IP.1-4I" if the owner observes the rules of storage and operation stated in this passport.

The warranty period is set by the manufacturer - 18 months from the date of receipt of the product, except for cases specifically agreed between the manufacturer and the buyer in an additional contract.

In the warranty card the manufacturer marks the year, month, day of sale, legal address, telephone number of the company carrying out warranty repair (the warranty card can be found in the appendix to the passport of the "Diesel tester CR-IP.1-4I" device).

During the warranty period the owner is entitled to free repair upon presentation of this passport and warranty card. After the repair, the list of troubleshooting works is entered in the warranty card.

The following does not constitute a basis for a complaint: violation of the integrity of connecting wires (adapter cables).

The manufacturer has the right to refuse warranty repair of the "Diesel tester CR-IP.1-4I" in the following cases:

- If there are any signs of tampering with the device;
- traces of mechanical damage on the housing or electronic board of the device;
- foreign objects and liquids in the case or on the electronic board of the device;
- in case of non-compliance with the rules of storage and operation of the device.

No claims to the quality of work and warranty repair are made without presenting the warranty card and if the seals on the product are broken.

During the warranty period specified for the product, repairs shall be made at the owner's expense if the owner does not operate the product in accordance with these operating instructions.

The manufacturer provides further repairs of the "Diesel tester CR-IP.1-4I" after the expiry of the warranty period according to a separate contract.

Appendix No.1 X1 connector pinout

CR-testes		Connector X1	
Cont.	Target	Cont.	Target
1	Injector 1+	1	Injector 1+
2	Injector 1-	2	Injector 1-
3	Injector 2+	3	Injector 2+
4	Injector 2-	4	Injector 2-
5	Injector 3+	5	Injector 3+
6	Injector 3-	6	Injector 3-
7	Injector 4+	7	Injector 4+
8	Injector 4-	8	Injector 4-

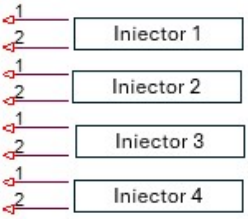


Figure 6.Nozzle connection connector (4 nozzles version)

CR-testes		Connector X1	
Cont.	Target	Cont.	Target
1	Injector 1+	1	Injector 1+
2	Injector 1-	2	Injector 1-

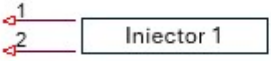
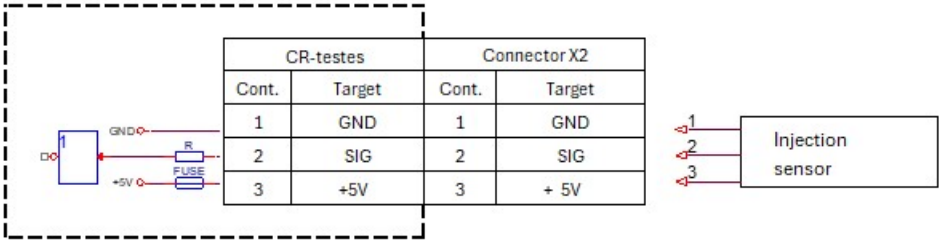


Figure 7.Nozzle connection connector (modification for 1 nozzle)

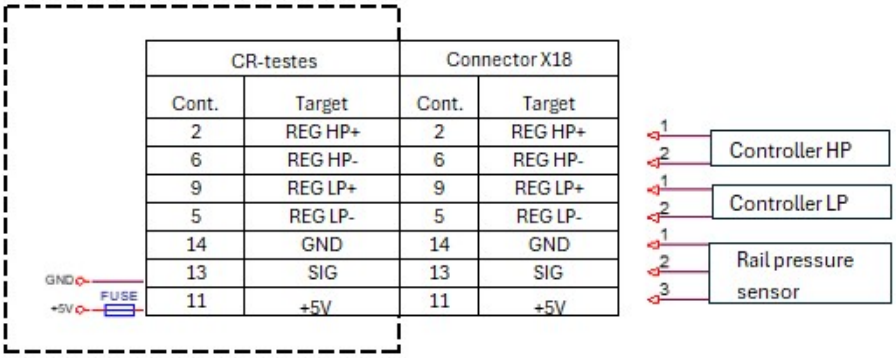
Appendix No. 2 X2 connector pinout



CR-testes		Connector X2	
Cont.	Target	Cont.	Target
1	GND	1	GND
2	SIG	2	SIG
3	+5V	3	+ 5V

Figure 8.Injection sensor connection connector

Appendix No3 X1 connector pinout 8



CR-testes		Connector X18	
Cont.	Target	Cont.	Target
2	REG HP+	2	REG HP+
6	REG HP-	6	REG HP-
9	REG LP+	9	REG LP+
5	REG LP-	5	REG LP-
14	GND	14	GND
13	SIG	13	SIG
11	+5V	11	+5V

Figure 9.Rail pressure sensor and pressure regulators connection connector

Appendix No 4 X5 connector pinout

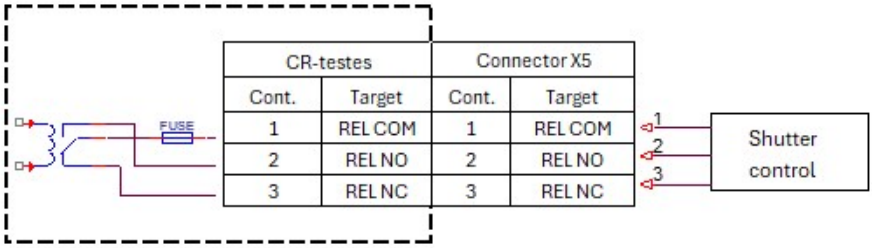


Figure 10.Connector for connection to the shutter or pump control relay

A 5A fuse is installed in series with the common contact of the relay. If the current consumption is higher, an intermediate relay should be installed.

Appendix No. 5

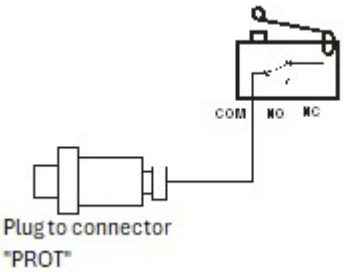


Figure 11.Wiring diagram for safety limit switches

The circuit operation is designed for a broken circuit. Depending on the method of installation and design, the contacts of the limit switch must be such that the circuit

connecting the two contacts of the "PROT" connector is disconnected when the safety guard is opened.

The contacts have the following designations on the limit switches:

- NC - normally closed contact;
- NO - normally open contact;
- COM - common contact (it is connected to NC or NO, depending on whether the button is pressed or not).

For example: we take a limit switch like the one shown in the diagram (Fig. 6). Install it on the doors of the safety cabinet, so that the button closes when the doors are closed and opens when they are opened.

From the first contact of the plug "PROT" connect the wire to the contact of the COM limit switch, from the second contact connect it to NO.

If it is necessary to install two or more limit switches (on several mechanisms), connect them in sequence: from the "PROT" plug to the COM contact of the first limit switch, from its NO contact to the COM contact of the second limit switch, from its NO contact to the next limit switch, according to the same scheme. From the last end lead to the second contact of the "PROT" plug (see Fig. 7).

The terminals must be insulated from the frame of the stand (do not connect the common contact to the body)!!!!

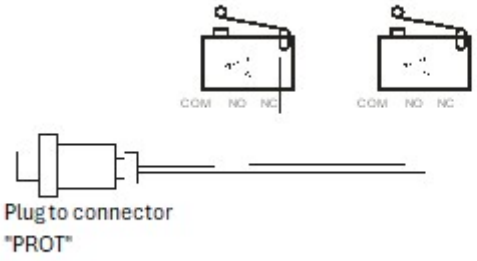


Figure 12.Wiring diagram with several limit switches

Appendix No. 6 Warranty card

Warranty card №_____

Diesel tester CR-IP.1-4I" for testing and checking the performance of Common Rail diesel injectors.

Warranty repair and maintenance of the "Diesel tester CR-IP.1-4I" controller of the device is performed by the company _____

Address _____

tel. _____

fax. _____

Date of Sale "____"_____ _____