



Romano Injection System

“ ANTONIO ”

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INTRODUCTION

ANTONIO is a last generation phased sequential system entirely designed by Romano engineering staff. This system is the result of a long research and numerous studies about the previously existing injection systems in order to develop a very innovative product for LPG and CNG field. ANTONIO presents many hardware and software innovations which make the system easy for:

- Installation
- Calibration
- Carburetion

From the point of view of installation, the wiring harnesses have been simplified in fact the installers have just to plug male and female connectors and vice versa; all connections by wires have been removed.

For what concerns calibration, the software has been improved both in terms of communication speed and in terms of ease of use; moreover there is a new function for smart diagnosis of LPG/CNG components of the system.

From the point of view of carburetion, the system has new algorithms and a constant communication with petrol ECU through EOBD connection, which assure air/gas mix in a constant stoichiometric ratio at different engine conditions and at different gas characteristics.

COMPONENTS DESCRIPTION

REDUCER

Pressure reducer is a device which supplies a stable gas flow in terms of pressure and temperature, its capacity adjusts according to engine power when running. The gas pressure in the reducer is pre-set and it is vaporized through the heating system by the cooling liquid of engine. Pressure reducer is furnished with a safety valve which opens if internal pressure of reducer gets more than 6 bar to reduce it.

Working pressure of reducer should never be lower than 25°C, for this reason there is a temperature gauge on the reducer body to gauge its temperature and send this information to ECU through an electric signal so that ECU can:

- Switch engine from petrol to LPG once it gets the temperature conditions set during calibration
- Apply the right adjustments according to the different working temperatures

Pressure reducer should be fixed in the engine compartment by the appropriate anchor bolt, to unmoving parts not too close to cabin nor too far from rail.

For what concerns LPG there are two kind of pressure reducers:

- STANDARD TYPE with an outlet pressure capacity equal to 1 ± 0.1 bar
- HD TYPE with an outlet pressure capacity equal to 1.5 ± 0.1 bar



LPG REDUCER TYPE STANDARD



LPG REDUCER TYPE HD

You should select the reducer type on KW power of vehicle in particular:

- For vehicles whose power is up to 100 KW we suggest to use standard reducer
- For vehicles whose power is more than 100 KW we suggest to use HD reducer

RAIL

Rail is a rigid duct with one input and 2 or more outputs according to the number of electroinjectors to feed; its function is to lead gas flow coming from reducer to each injector. There are different configurations for rail, in particular:

— 3 outputs

— 4 outputs

— 5 outputs

You can use one or more of them to fit any engine type. On the rail there is a sensor to gauge gas temperature and a shunt to gauge gas pressure. Those data converted into electrical signals are sent to ECU so that it is informed instant by instant on gas conditions. The right position for rail is between reducer and electroinjectors, the maximum length of hoses to electroinjectors should be 20 cm.

There are two kind of LPG rail:

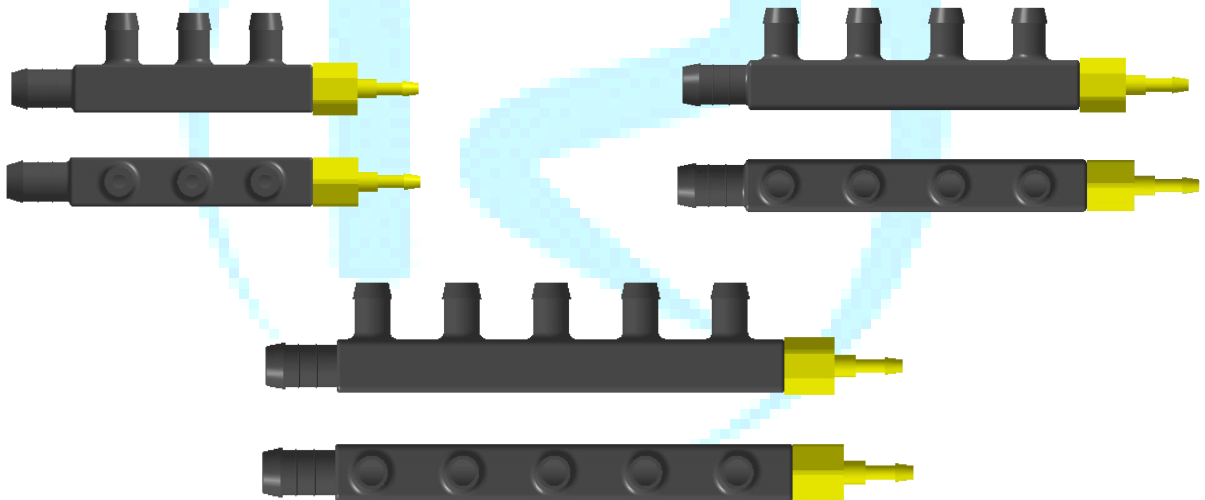
— STANDARD TYPE

— HD TYPE

You should choose the rail according to the injectors type.



RAIL TYPE STANDARD



RAIL TYPE HD

INJECTORS

The electroinjectors are electromechanical devices which, controlled by ECU, inject the right quantity of vaporized gas upstream the aspiration valves of each cylinder by the vacuum phase. The number of electroinjectors depends on the number of cylinders to supply.

There two kind of electroinjectors:

— “ ROMANO FAST “

— “ ROMANO HD ”

The ROMANO FAST injectors vary according to the diameter of gas outlet nozzle. Depending on the power and number of cylinders of the vehicle, you can use the following types:

— I (special model for very small power engine)

— O

— A

— B

— C

Here also two different types of HD INJECTORS according to the diameter of gas outlet nozzle:

— HD 2.6

— HD 3.0

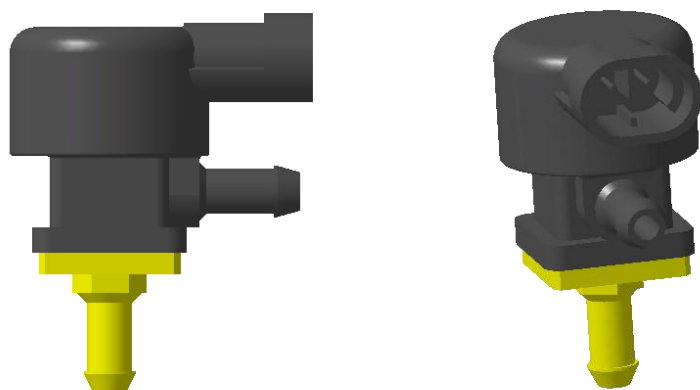
CALIBRATED HOLES LIST	
TYPE I	Φ 1,4 mm
TYPE O	Φ 1,9 mm
TYPE A	Φ 2,2 mm
TYPE B	Φ 2,6 mm
TYPE C	Φ 3,2 mm
TYPE HD 2.6	Φ 2,6 mm
TYPE HD 3.0	Φ 3,0 mm

For LPG you can refer to the following injector list

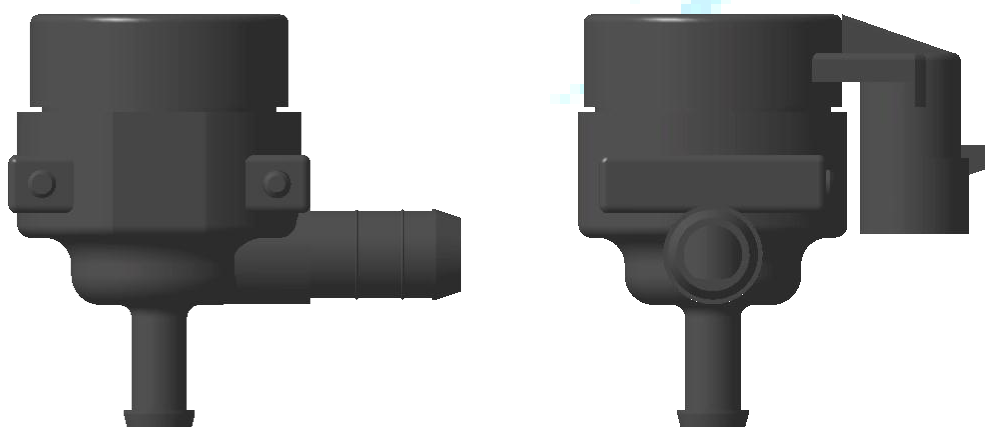
LPG INJECTORS LIST

4 CYLINDERS VEHICLES	
Up to 900cc	I
From 900cc 8v up to 1200cc 8v	O
From 1200 cc 16v up to 1590cc 16v	A
From 1600cc up to 1750cc	B
From 1800cc up to 2000cc	C
From 2050cc up to 2550cc	HD 2.6
From 2550cc	HD 3.0
5 CYLINDERS VEHICLES	
2000cc	B
6 CYLINDERS VEHICLES	
From 2000cc up to 2300cc	A
From 2350cc up to 2800cc	B
From 2850cc up to 3200cc	C
From 3250cc up to 3800cc	HD 2.6
From 3850cc	HD 3.0
8 CYLINDERS VEHICLES	
From 4000cc up to 4800cc	HD 2.6
From 4800cc	HD 3.0

All LPG HD injectors should be used together with HD reducers. Compared to other injectors in the market, ROMANO ones are not affected by gas impurities. From installation point of view, you have to check that hoses connecting injectors to nozzles on the aspiration manifold are maximum 10 cm. long.



INJECTORS TYPE ROMANO FAST



INJECTORS TYPE HD

ECU

RISN “Antonio” ECU is the device which, interacting with other components of LPG/CNG system, controls the full system granting the right functioning of vehicle complying with antipollution regulations and safety requirements.

ECU can control automatically:

- the system, switching from petrol to LPG and vice versa as soon as the system gets the appropriate working conditions and/or system safety.
- The air/gas mix keeping it at a constant stoichiometric ratio offering an easy drive and the appropriate functioning of catalyst i.e. less pollutant emissions.
- Each injector to inject the right quantity of gas into each cylinder by the vacuum phase.
- The diagnosis of each part of LPG/CNG system to detect eventual problems.

To do all this, ECU needs the following signals:

- Petrol injection time
- Gas temperature
- Reducer temperature
- Gas pressure
- Aspiration manifold
- Engine revs

In addition to the above mentioned signals, you can send to ECU also the following ones:

- Lambda sensor
- Carburetion trim (if available)

This system gives the possibility to make a connection with EOBD plug of the vehicle in order to have the adaptativity of gas carburetion which allows adjustment both of petrol parameters range and of LPG quality which can vary at every refueling.

ECU is also furnished with a serial port to be connected to PC where you can set both the system configuration during installation and the system diagnosis during control and maintenance.



CPU TYPE ANTONIO

PRESSURE GAUGE (MAP)

MAP sensor is a device which gauges gas pressure by rail shunt and the vacuum in the aspiration manifold sending these information, through electrical signals, to ECU which uses these data to have the system working properly. If gas pressure value becomes lower than the preset limit range for some time, ECU:

- Automatically switches the vehicle from LPG to petrol
- Warns the end user that it switched fuel supply sending an acoustic signal by the switch located in the cabin.

Some of the reasons causing automatic switch from LPG to petrol are:

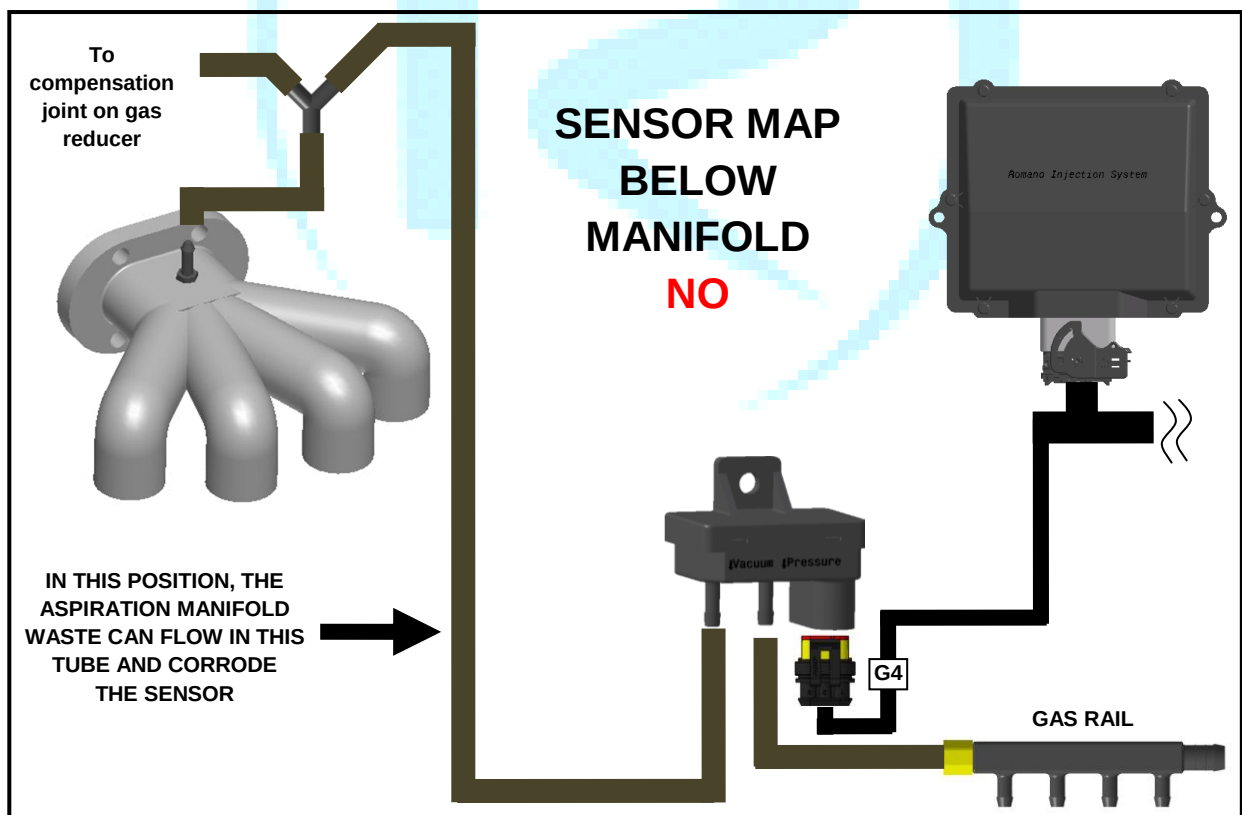
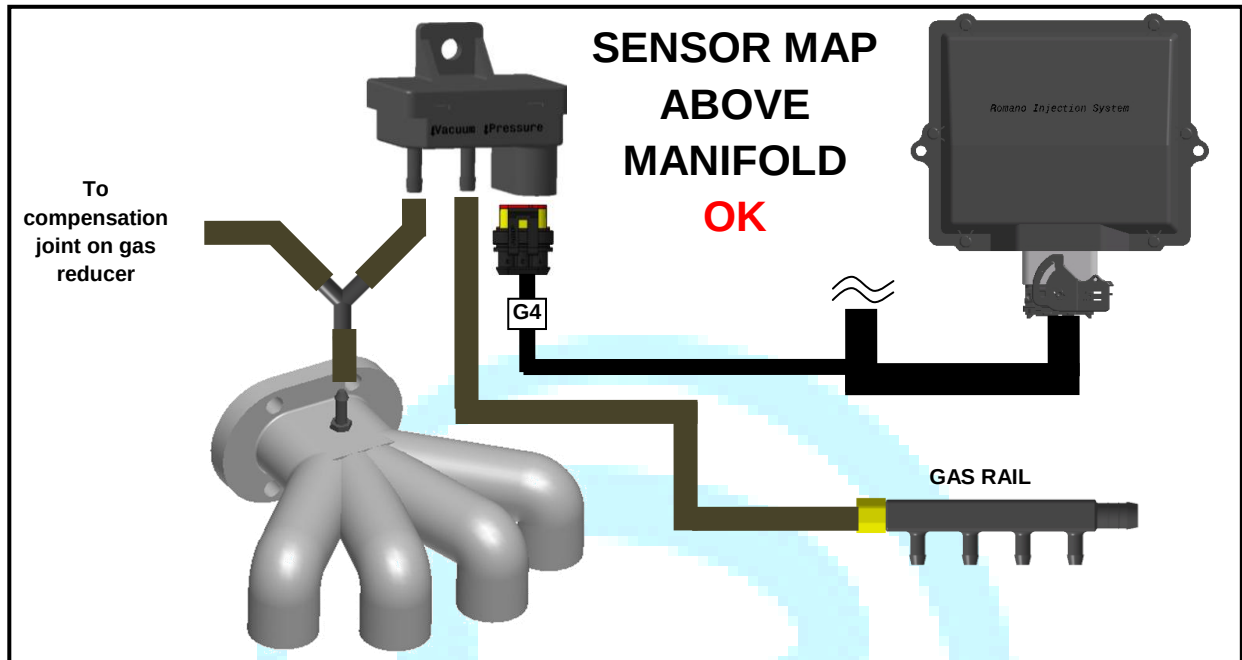
- Occlusion of LPG electrovalve filter
- Not enough LPG level in the tank

From installation point of view, space permitting, MAP sensor should be fixed in a higher position than the manifold to avoid that impurities in the manifold could damage the sensor.

MAP sensor needs:

- Electrical connection to ECU through a plug supplied with wiring (G4 sheath)
- The sensor nozzle marked “V” connected by a hose to aspiration manifold nozzle
- The sensor nozzle marked “P” connected by a hose to the rail shunt

MAP SENSOR ASSEMBLY DRAWING



GENERAL INSTRUCTIONS

To install a LPG/CNG system means making some changes to the vehicle so it's very important to follow some simple rules to get the appropriate installation and functioning avoiding any kind of problems to LPG/CNG system and to the same vehicle.

Please notice that:

- The tank has to be laid in flat position
- You have to choose the appropriate multivalve for the installed tank
- The pipe connecting multivalve to the electrovalve situated in the engine compartment should be placed at a fair distance from the exhaust pipe, from manifold and from any other parts of the vehicle which becomes hot.
- You have to make sure that all fixed pipes/hoses are free from obstructions or tight spots
- You have to install the reducer in the engine compartment on unmoving parts
- You have to make sure that cooling system shunt works properly in order to assure a good heating for reducer
- You have always to disassemble the aspiration manifold and check its internal shape before making any hole. You can disregard this suggestion only if you already know manifold shape.
- You have to make holes on the manifold so that the nozzles are parallel to sucked-up air flow
- You have to make sure that nozzles don't exceed the centre-line of manifold hoses
- Injectors should be fixed – if possible- in vertical position with output nozzles facing downwards
- Hoses connecting injectors to manifold nozzles shouldn't be too long (max. 10 cm.)
- Rail should be fixed close to reducer and not so far from injectors; the maximum length of hoses connecting rail to injectors should be 20 cm.
- You have always make sure that there is no gas leakage from hoses, pipes and connections
- Check the right order of the injectors

- You don't have to replace the standard fuse with one of bigger amperage
- ECU and its cables should be positioned far from high voltage components or wires. In particular for ECU we recommend to follow the instructions as per [Pict.1](#) and [Pict.2](#)
- Before any EOBD connection you have to check the type of connection of vehicle through handheld tester to make the right wiring connection to pins of EOBD plug.
- You have to fix the switch in a position easy to reach by the driver
- You have to make sure that you're loading the appropriate settings during configuration
- Minimum temperature value to switch to LPG is 28°C
- Minimum temperature value to switch to CNG is 25°C
- The minimum LPG temperature allowed by the system is 20°C at maximum speed
- LPG pressure value at idle speed is about 1 ± 0.1 bar for aspirated vehicle
- LPG pressure value at idle speed with HD reducer is 1.5 ± 0.1 bar
- CNG pressure value at idle speed is 1.5 ± 0.1 bar
- You don't have to exceed the reference pressure limit values not to alter functioning of injectors
- You have to make sure that MAP connection is accurate, in particular, double check that, when speeding up and decelerating, the software shows a variable MAP value (don't consider this instruction for valvetronic vehicles)
- You have to make sure that map/configuration has the right stoichiometric ratio i.e. it is not too rich nor too poor in order to avoid problems to catalyst, lambda sensor and valves.

WHERE POSITIONING THE ECU



Far from any water leakage



Far from excessive heat sources (such as exhaust manifolds)



Far from high voltage cables



Create efficient electrical connections without using any “power taps”. Properly insulated soldering is the most effective type of electrical connection



Advise the customer that if the GAS system fuse burns, the connections of the devices to which it is connected will be restored. It is strongly recommended not replace the fuse with another one with a higher amperage rating since it may cause irreparable damage.

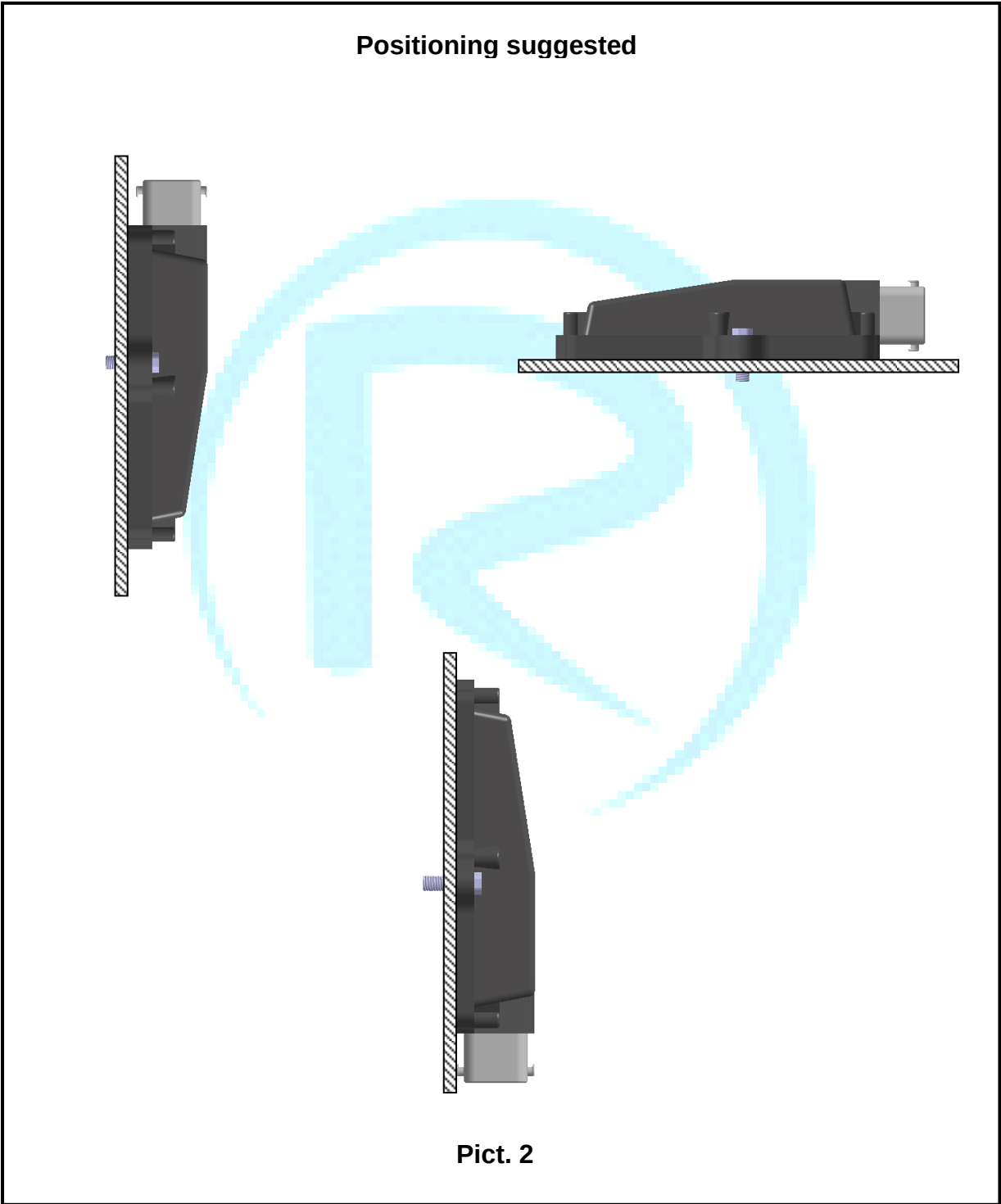


Do not open the control unit box for any reason, especially when the engine is running or the key is in ignition, to avoid irreparable damage.

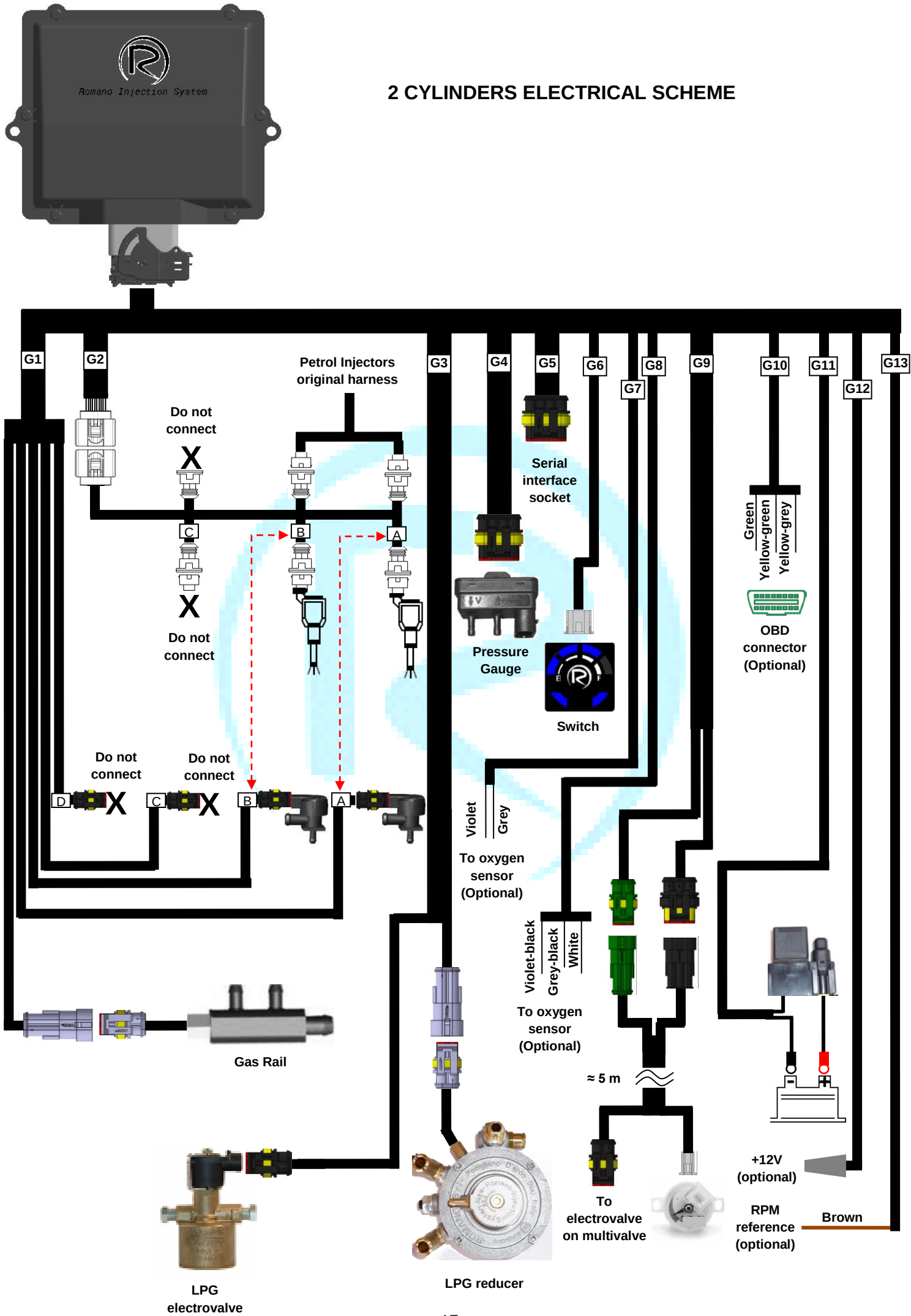
ROMANO will not be held responsible for damage to property or injuries to persons if unauthorized personnel tamper with its devices; such tampering will also invalidate the WARRANTY

Pict. 1

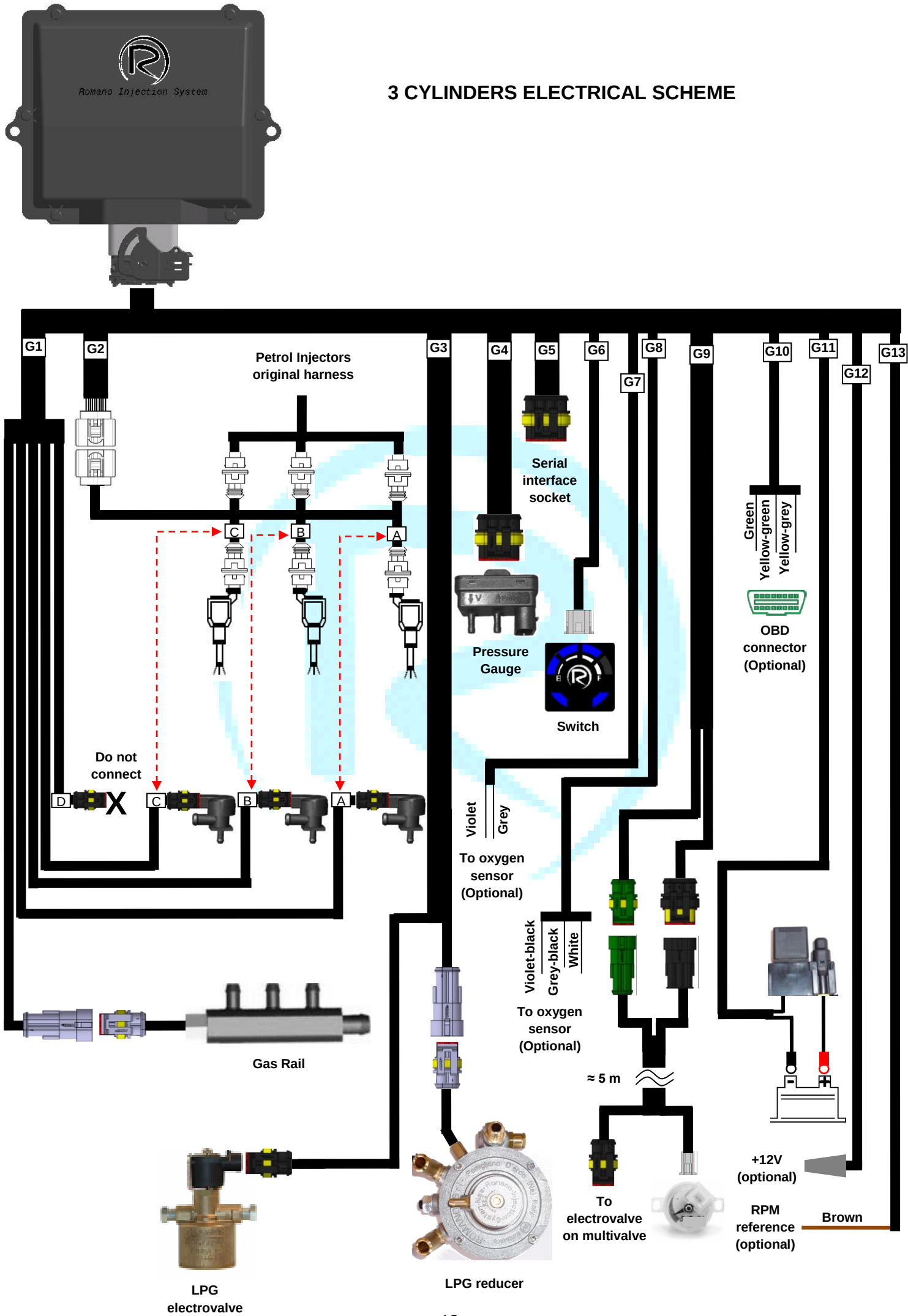
HOW TO FIX ECU



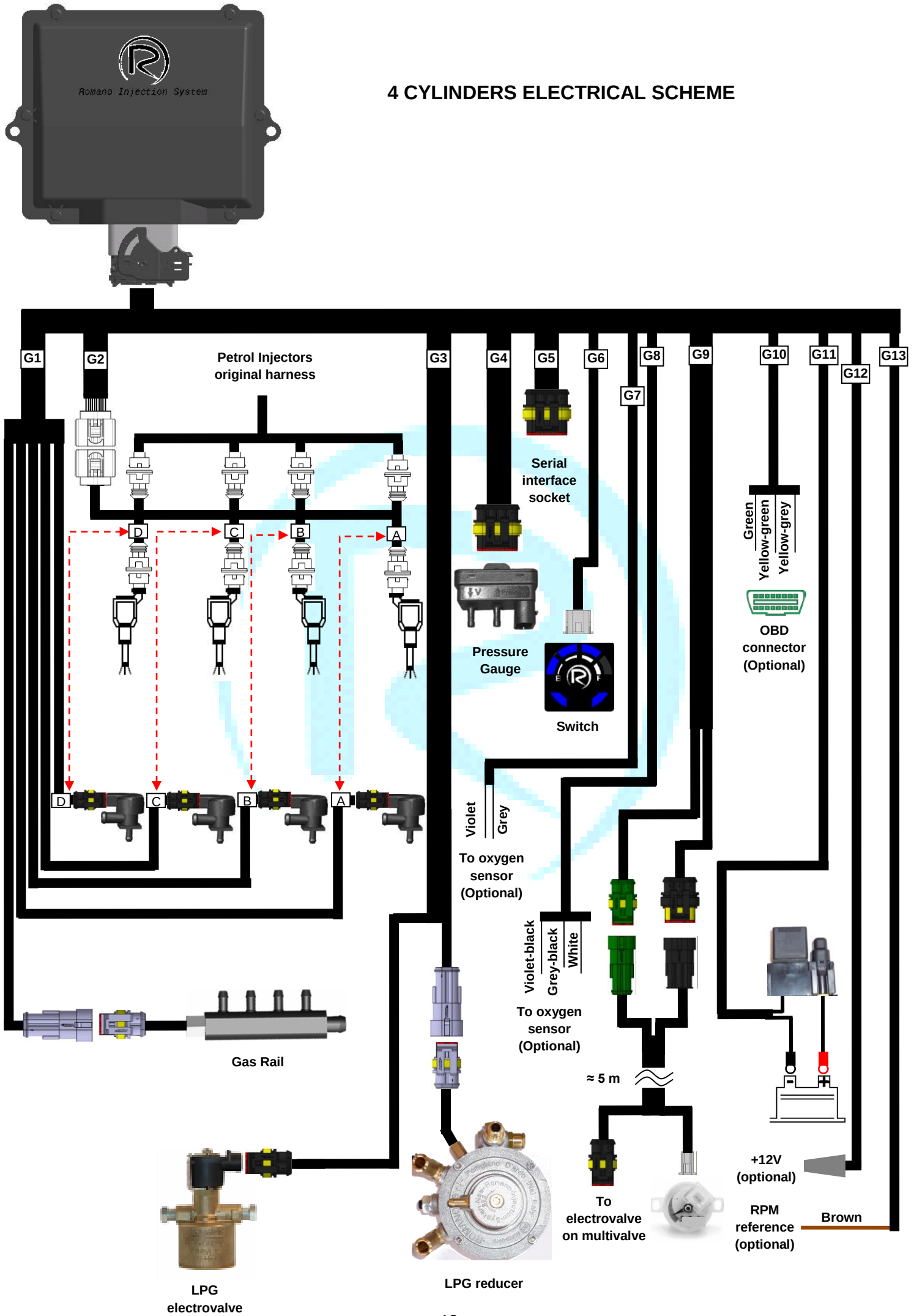
2 CYLINDERS ELECTRICAL SCHEME



3 CYLINDERS ELECTRICAL SCHEME

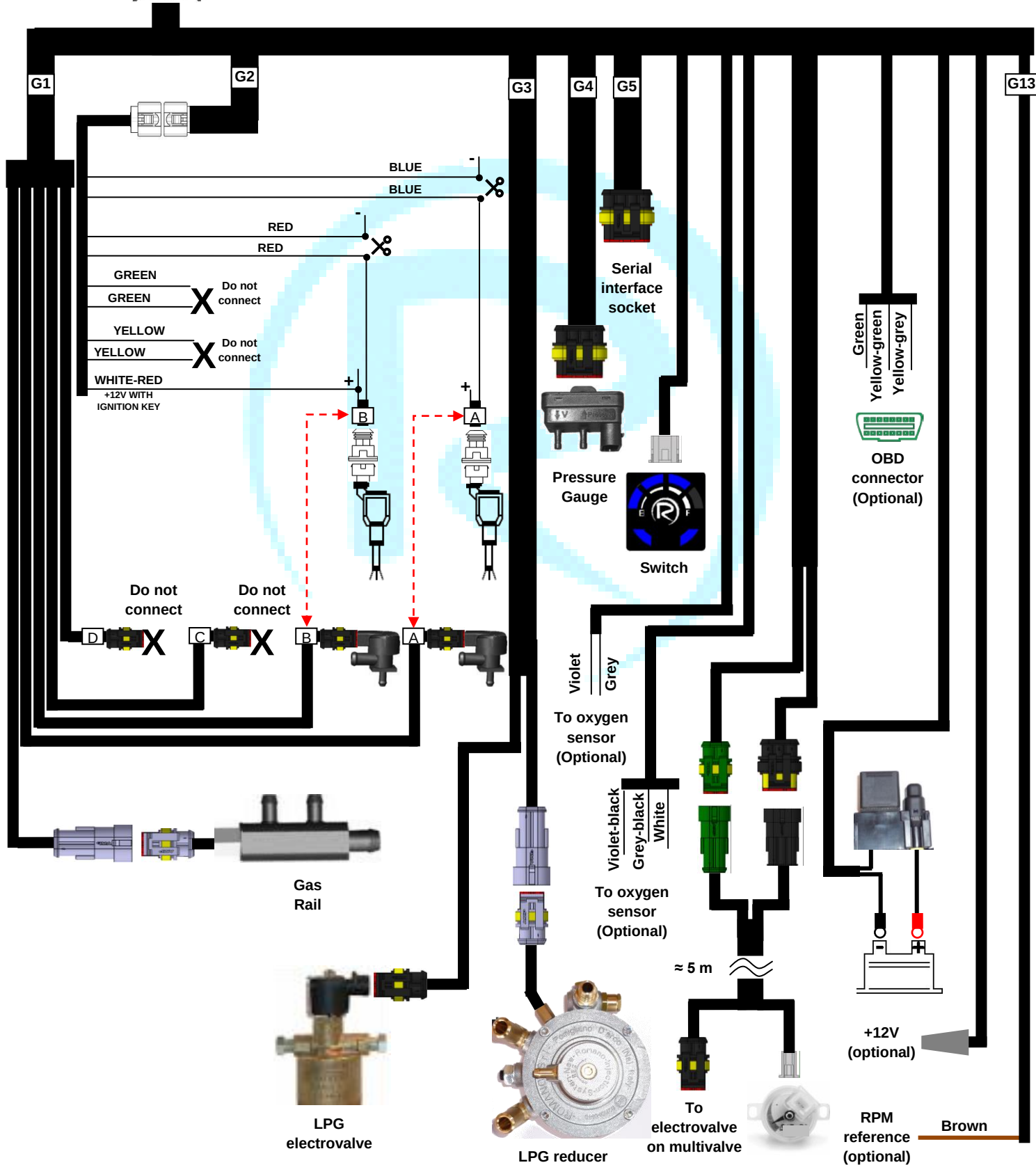


4 CYLINDERS ELECTRICAL SCHEME



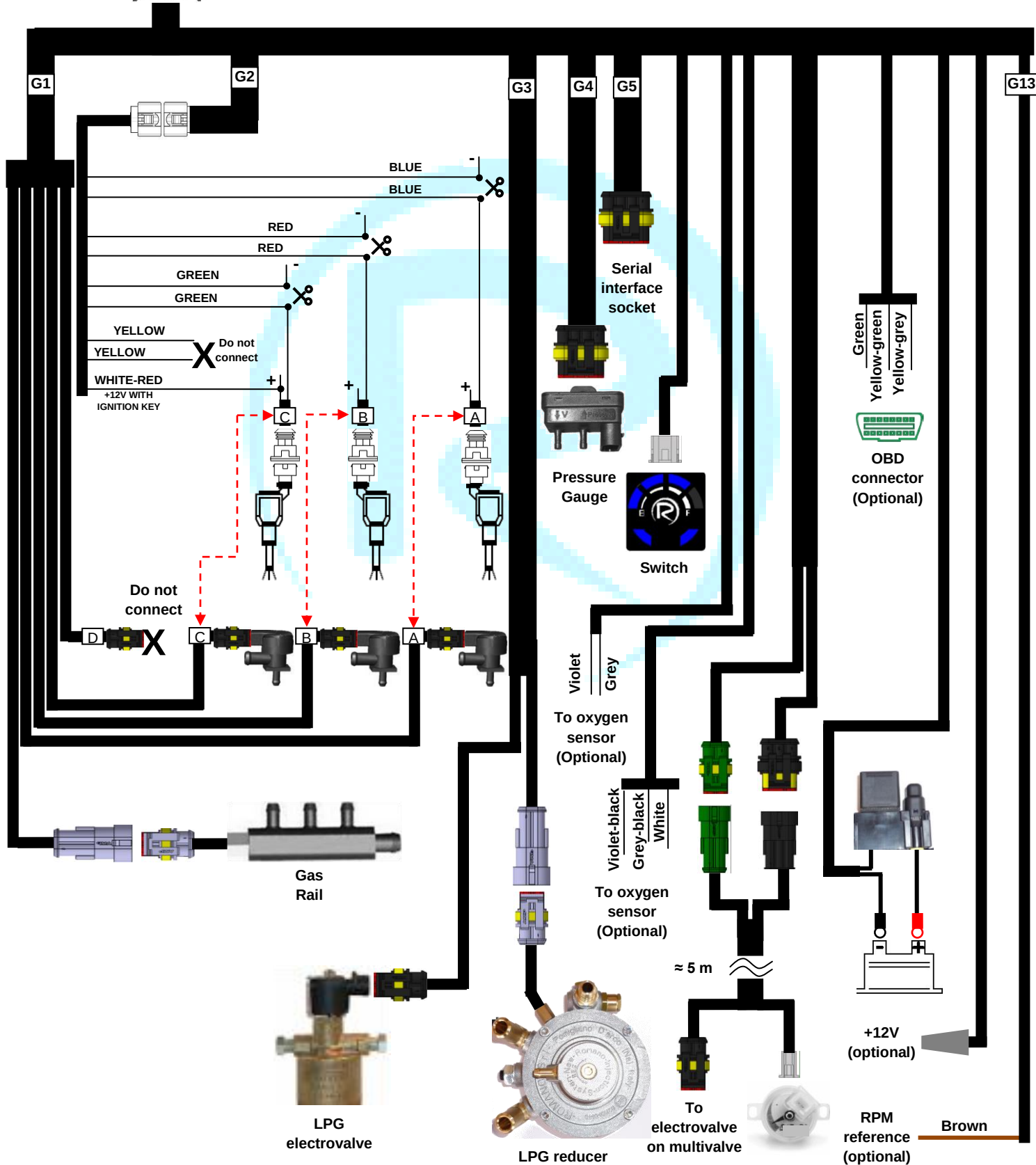


2 CYLINDERS ELECTRICAL SCHEME – TYPE U



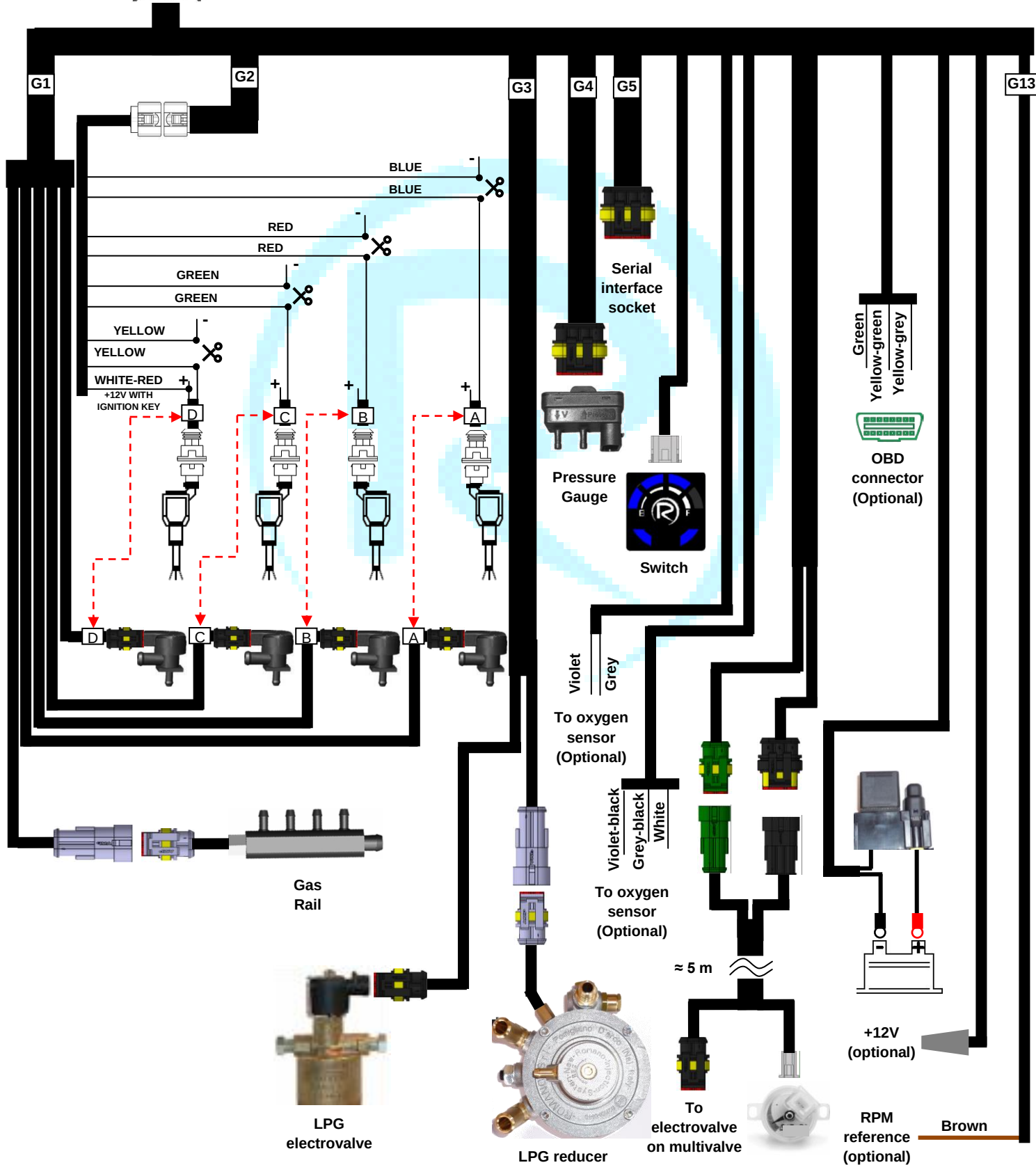


3 CYLINDERS ELECTRICAL SCHEME – TYPE U

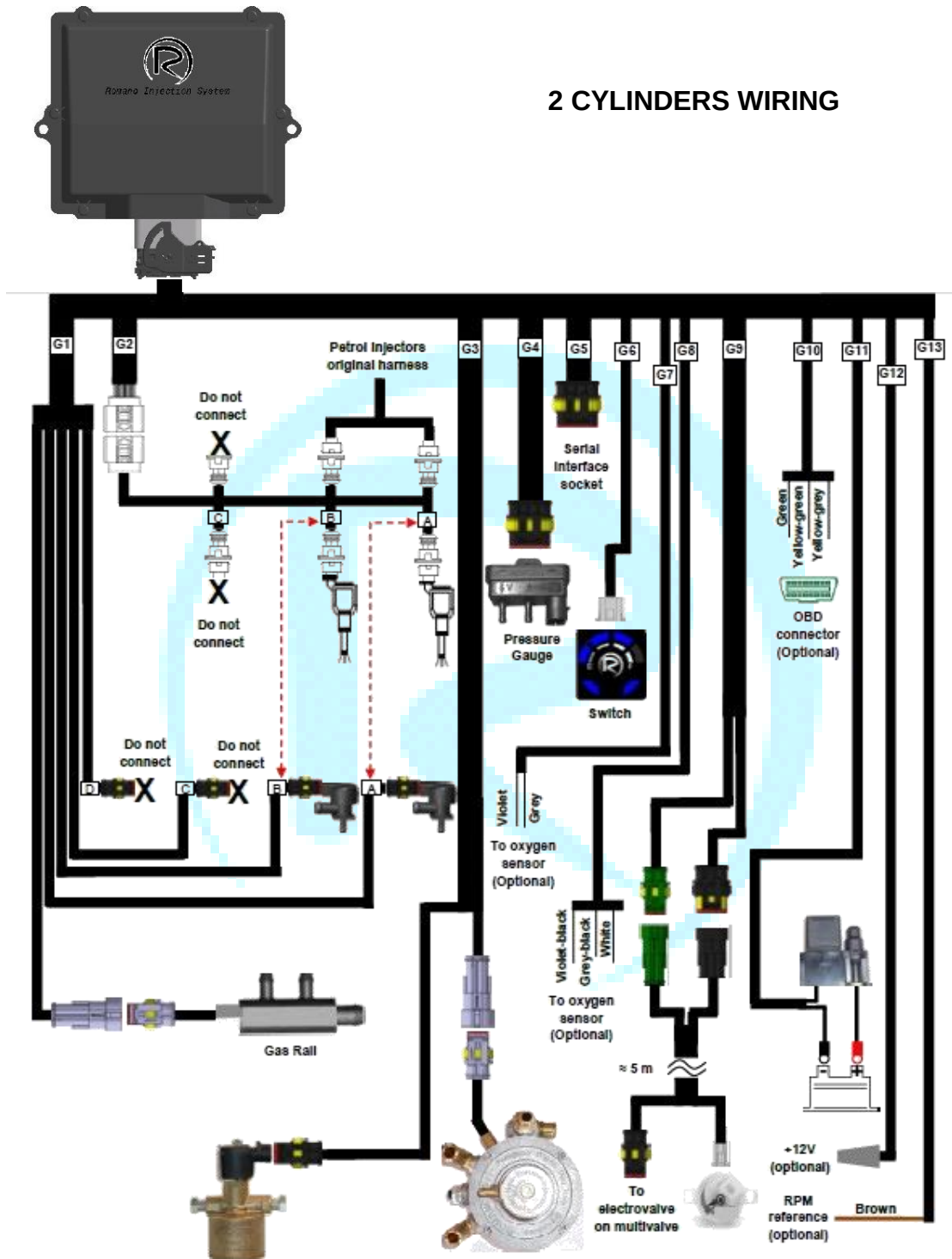




4 CYLINDERS ELECTRICAL SCHEME – TYPE U

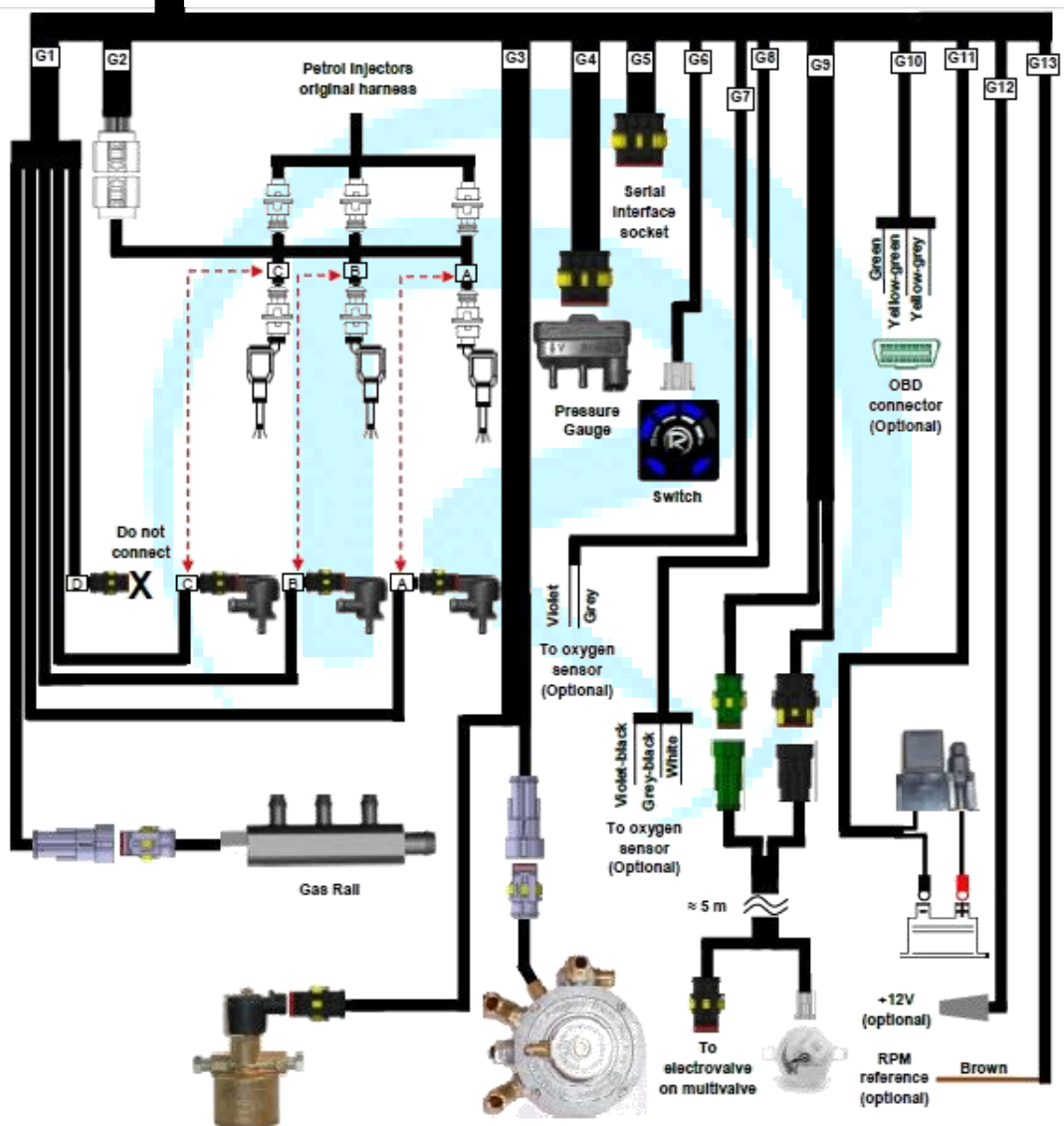


CONNECTIONS DESCRIPTION



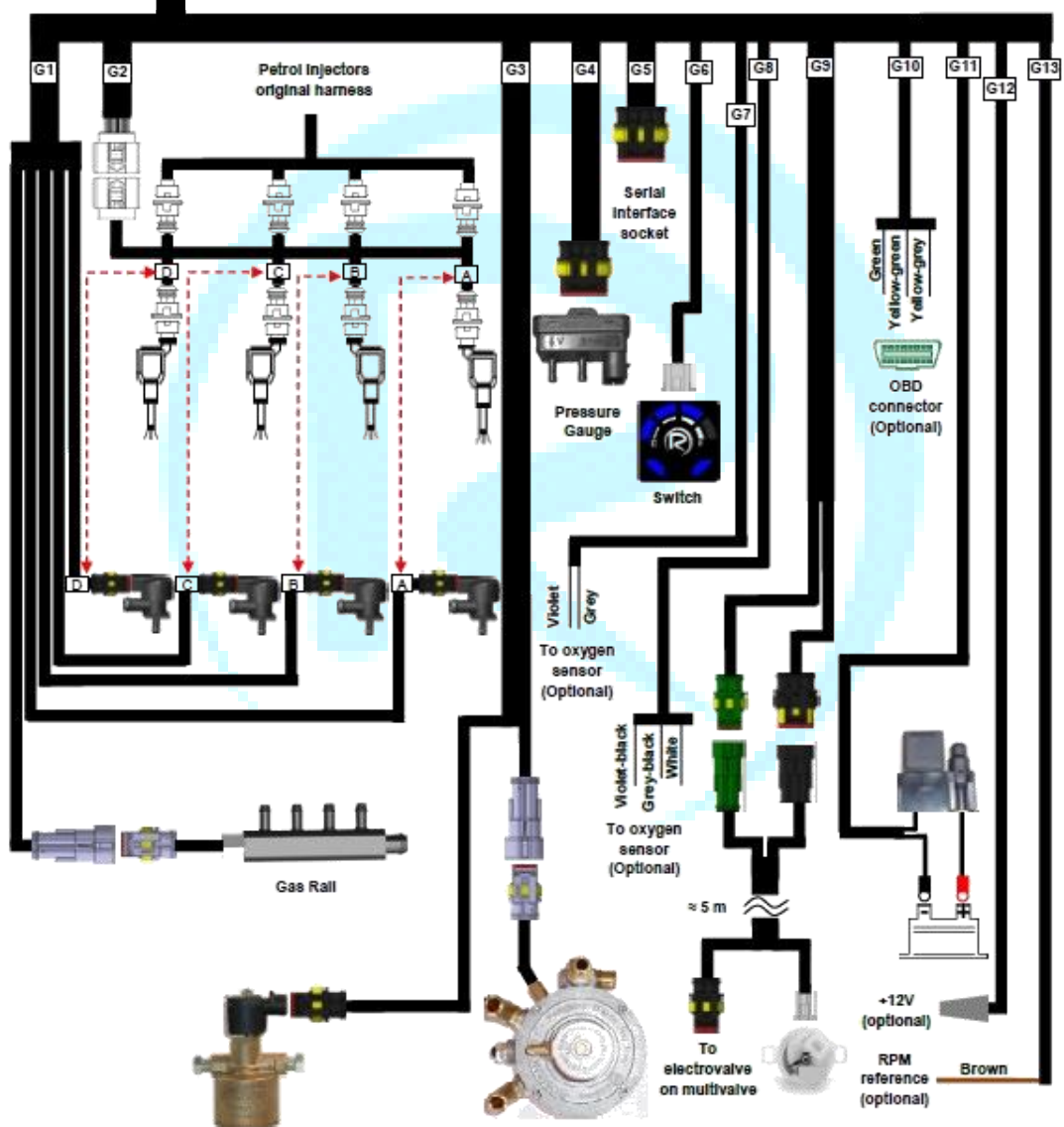


3 CYLINDERS WIRING





4 CYLINDERS WIRING



CONNECTIONS DESCRIPTION

The wiring harness of new system has been developed to reduce the number of wires to connect and make installation easier. This wiring, as shown in the previous pictures, has just one 48-ways connector to be connected to ECU and 13 sheaths as per the following description:

G1 In this sheath there are:

- ✓ 4 bridles, each of them has a 2-ways black connector to be connected to the 4 LPG injectors. These bridles are marked A,B,C and D. the connection to LPG injectors has to follow injectors order i.e. bridle marked A should be connected to LPG injector situated by the petrol injector A and so on.
- ✓ One bridle with a 2-ways grey female connector to be connected to the corresponding male connector of temperature sensor positioned on the injectors rail.

G2 This sheath ends with a 10-ways connector where you have to connect the injector cut-off wiring harness. To know the corresponding injector cut-off wiring harness please check the section [injector cut-off wiring](#).

G3 In this sheath there are:

- ✓ One 2-ways male black connector to be connected to LPG electrovalve located in the engine compartment
- ✓ One 2-ways female grey connector to be connected to the corresponding male connector of the temperature gauge situated on the reducer/vaporizer

G4 This sheath, 1000 mm long, ends with a 4-ways male black connector to be connected to MAP sensor

G5 This sheath ends with a 4-ways male black connector you can connect the serial interface to, in order to allow ECU communicate with PC. This sheath is different from G4 one because:

- ✓ Its length is 400 mm
- ✓ It has a protection cap on 4-ways connector

G6 This sheath, 3 m. long, ends with a 4-ways connector, sheltered by transparent heat shrink, to be connected to the switch inside the driver cabin.

G7 This sheath has 2 free wires:

- ✓ Purple wire
- ✓ Grey wire

that should be connected, if necessary, to pre- Lambda sensor of the vehicle. If this connection is not needed the 2 wires should be insulated.

G8 This sheath has 3 free wires:

- ✓ White wire
- ✓ Purple-black wire
- ✓ Grey-black wire

to be connected, if necessary, to post-Lambda sensor or to the petrol pressure gauge. If this connection is not needed the 3 wires should be insulated.

G9 In this sheath there are:

- ✓ One bridle ending with a 2-ways male green connector to be connected to the corresponding 2-ways green female black connector of the wiring harness towards the electrovalve on the multivalve.
- ✓ One bridle ending with a 3-ways male black connector to be connected to the corresponding 3-ways female black connector of wiring harness towards the level sensor on the multivalve.

G10 In this sheath there are 3 free wires:

- ✓ Green wire
- ✓ Yellow-green wire
- ✓ Yellow-grey wire

to be connected to EOBD plug of the vehicle. You have to make this connection only if you want to control the petrol trims and/or use the adaptativity function; on the contrary, the 3 wires have to be insulated. To make the right connection for vehicle technology to EOBD plug please check the appropriate connection drawing in the section [“EOBD connection”](#).

G11 In this sheath there are:

- ✓ 2 cables with cable terminals one with a red mark and the other with a black mark to be connected respectively to the positive and to the negative of the battery
- ✓ The connection to relay and to protection fuse through relay holder and fuse holder

G12 This sheath has a wire, previously insulated by heat shrink, where there is a +12V you can use optionally for instance if you have to supply a dimmer.

G13 This sheath has a brown wire to be connected, if necessary, to a bobbin or to revs-counter to read the exact revs number of the vehicle.

INJECTORS CUT-OFF WIRING HARNESSES

There are different types of injectors cut-off wiring harnesses to match to injection ECU:

- Cod.SA144
- Cod.SA144INV
- Cod.SA144J
- Cod.SA144JINV
- Cod.SA144SJ
- Cod.SA144E
- Cod.SA144U
- Cod.SA143 E
- Cod.SA143INV

N.B.: Since there are a lot of models, the cut-off wiring harness is not included in the kit so you have to order it separately according to the vehicle you have to fix.

To understand which is the appropriate wiring for the vehicle, first you have to identify the pin of the petrol injector connector where the positive arrives. To detect which is the positive wire, follow these instructions:

- ✓ Disconnect all connectors from injectors
- ✓ Take a multimeter and set it to read the DC Voltage
- ✓ Ground the negative probe
- ✓ Put the positive probe in one of the two connectors of injectors wiring
- ✓ Ignite and check immediately if you have +12V

If you have +12 V then the connection is positive.

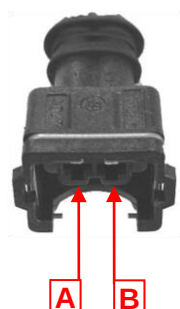


Fig.1

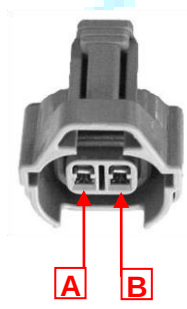


Fig.2

WARNING: some vehicles have a timed +12V injectors so after some seconds from ignition it could disappear.

We suggest to check the polarity of all connectors of injectors wiring to verify that all of them have the same polarization.

SA144 – SA 144INV FOR 4 CYLINDERS VEHICLES

Cod. SA144 and **Cod. SA144INV** wiring harnesses have type “BOSCH” connectors to be connected directly to petrol injectors. To understand if you have to use cod. **SA144** or cod. **SA144INV**. Model you have to check polarity of petrol injectors wiring and then you have to use:

- ✓ **Cod. SA144** - if the positive of petrol injectors is on PIN A and the negative on PIN B as per **pict.1**
- ✓ **Cod. SA144INV** – if the positive of petrol injectors is on PIN B and the negative on PIN A as per **pict.1**

SA144J – SA144JINV – SA144SJ FOR 4 CYLINDERS VEHICLES

Cod. SA144J and **Cod. SA144JINV** wiring harnesses have “Japan” type connectors to be connected directly to petrol injectors. To understand if you have to use Cod. SA144J or Cod. SA144JINV you have to check polarity of petrol injectors wiring and then you have to use:

- ✓ **Cod. SA144J** - if the positive of petrol injectors is on PIN A and the negative on PIN B as per **pict.2**
- ✓ **Cod. SA144JINV** – if the positive of petrol injectors is on PIN B and the negative on PIN A as per **pict.2**

Code SA144SJ wiring harnesses is furnished with JAPAN type plugs and longer cables to be used on SUBARU vehicles with BOXER engine. You have to use this type only if the positive of petrol injectors is on PIN B and the negative is on PIN A as per **pict.2**

SA144E

Cod. SA144E wiring have one 6-contacts connector. It can be used only on some models of FIAT, CITROEN or PEUGEOT which use the same connector for injectors wiring. To know on which vehicles it can be used, follow the instructions of wiring harnesses

SA143 – SA143INV FOR 3-5-6 CYLINDERS VEHICLES

(FOR 6 CYLINDERS VEHICLES USE TWO WIRING HARNESSSES)

Cod. SA143 and **cod.SA143INV** have type “**BOSCH**” connectors to be connected directly to petrol injectors. To understand if you have to use Cod. SA143 or Cod. SA143INV you have to check polarity of petrol injectors wiring and then you have to use:

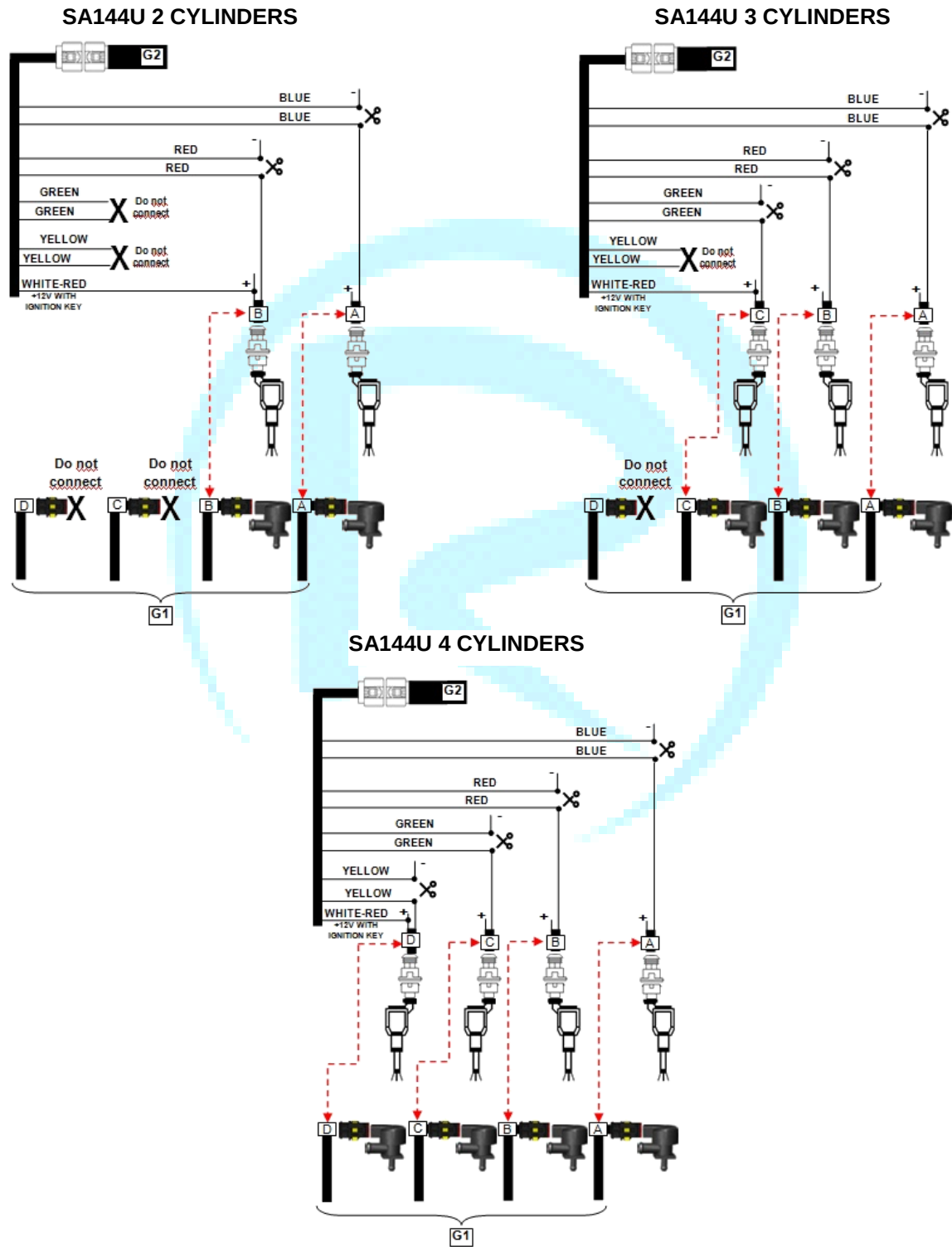
- ✓ **Cod. SA143** - if the positive of petrol injectors is on PIN A and the negative on PIN B as per **pict.1**
- ✓ **Cod. SA143INV** – if the positive of petrol injectors is on PIN B and the negative on PIN A as per **pict.1**

SA144U

Cod. SA144U have no connectors; this wiring harnesses should be used on all these vehicles where you cannot use the other harnesses or where it is not possible to use the original connectors of injectors. To fix this wiring you have to cut all the negative wires of petrol injectors following the order of our drawings. The pair of injector cut-off wires are exactly the same so there are not positive and negative wires, this makes connection easier.

The **WHITE-RED** wire should be connected to one of the positive wire of injectors.

CONNECTION DRAWING FOR INJECTORS CUT-OFF WIRING



GAS INJECTORS CONNECTORS/ PETROL INJECTORS STOP:

- 2-ways black connector of sheath **marked A** has to be connected to Gas injectors by the petrol injector disconnected through the pair of **BLUE** wires of injectors cut-off.
- 2-ways black connector of sheath **marked B** has to be connected to Gas injectors by the petrol injector disconnected through the pair of **RED** wires of injectors cut-off.
- 2-ways black connector of sheath **marked C** has to be connected to Gas injectors by the petrol injector disconnected through the pair of **GREEN** wires of injectors cut-off.
- 2-ways black connector of sheath **marked D** has to be connected to Gas injectors by the petrol injector disconnected through the pair of **YELLOW** wires of injectors cut-off.



EOBD CONNECTION

Through the EOBD connection of the vehicle, it is possible to get some useful information to have a more accurate carburetion of the vehicle.

Through the software you can view some carburetion parameters of Petrol ECU such as:

- Carburetion trims (Slow trim and fast trim)
- Tension of post-Lambda sensor

Which can be useful for installer to get the appropriate carburetion of the vehicle. In addition to the above mentioned parameters, the ECU, by slow trim and fast trim signals, is able to adjust gas injection time instant by instant according to the different engine conditions.

To have the right connection and allow ECU get a faster connection, connect the hand holder tester to OBD plug of the vehicle and check the displayed connections code.

- ✓ If the tester gives back the following connection code:

TYPE OF CONNECTION	CONNECTION DETAILS
Connection type 1	ISO 9141-2
Connection type 2	KWP-2000 Fast Init
Connection type 3	KWP-2000 Slow Init

You have to make wiring connection as per [pict.1](#)

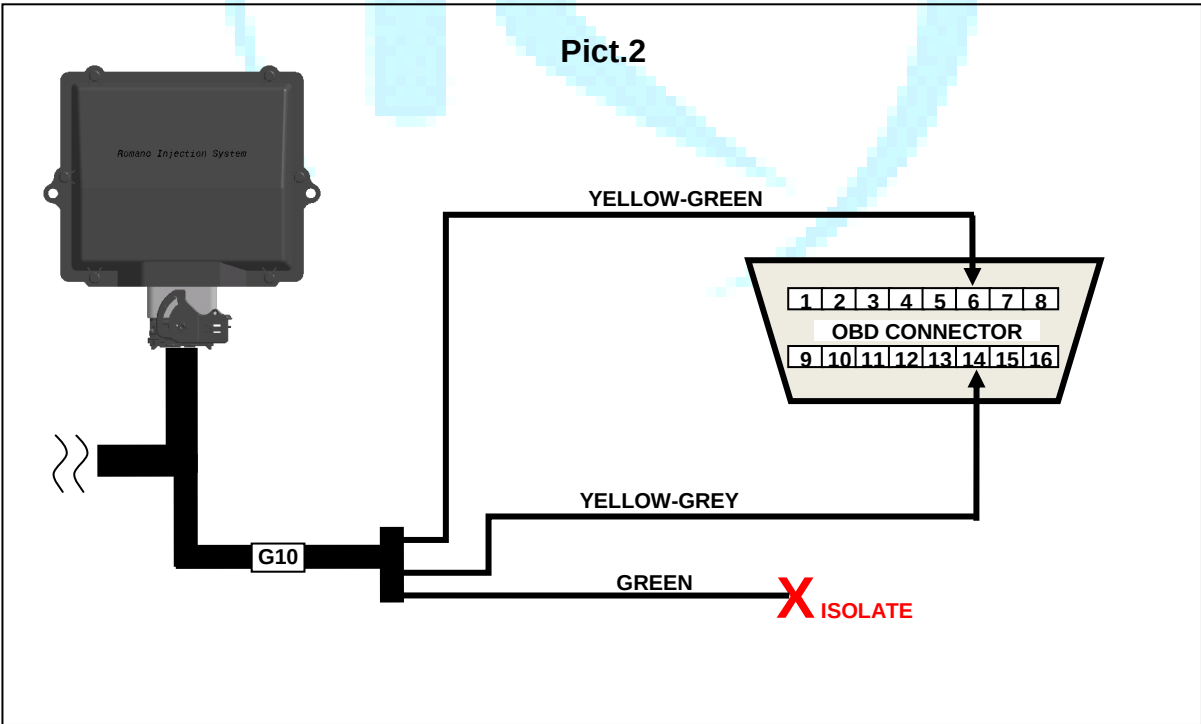
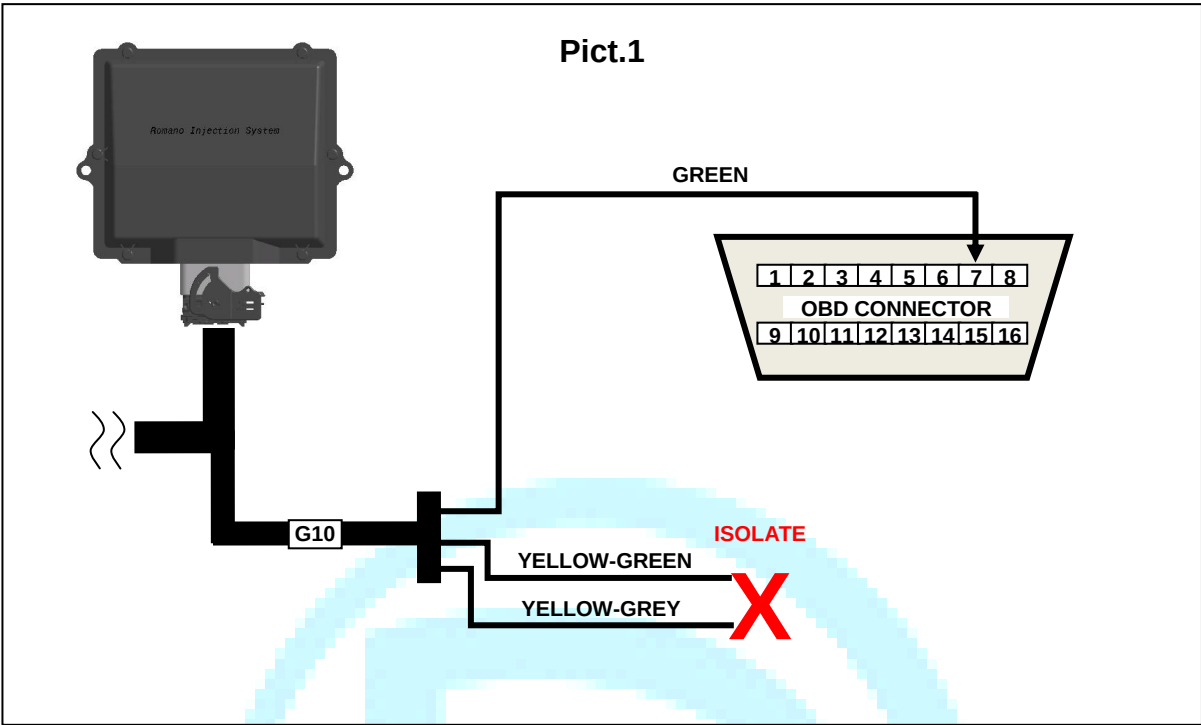
- ✓ If the tester gives back the following connection code:

TYPE OF CONNECTION	CONNECTION DETAILS
Connection type 6	CAN standard 250 Kbps
Connection type 7	CAN estended 250 Kbps
Connection type 8	CAN standard 500 Kbps
Connection type 9	CAN estended 500 Kbps

You have to make wiring connection as per [pict.2](#)

- ✓ If the tester gives back a code which is different from the above mentioned ones, you have to insulate the 3 connection wires (green, yellow-green and yellow-grey wires)

EOBD CONNECTION DRAWING



INSTRUCTION TO PRINT THE END-USER MANUAL

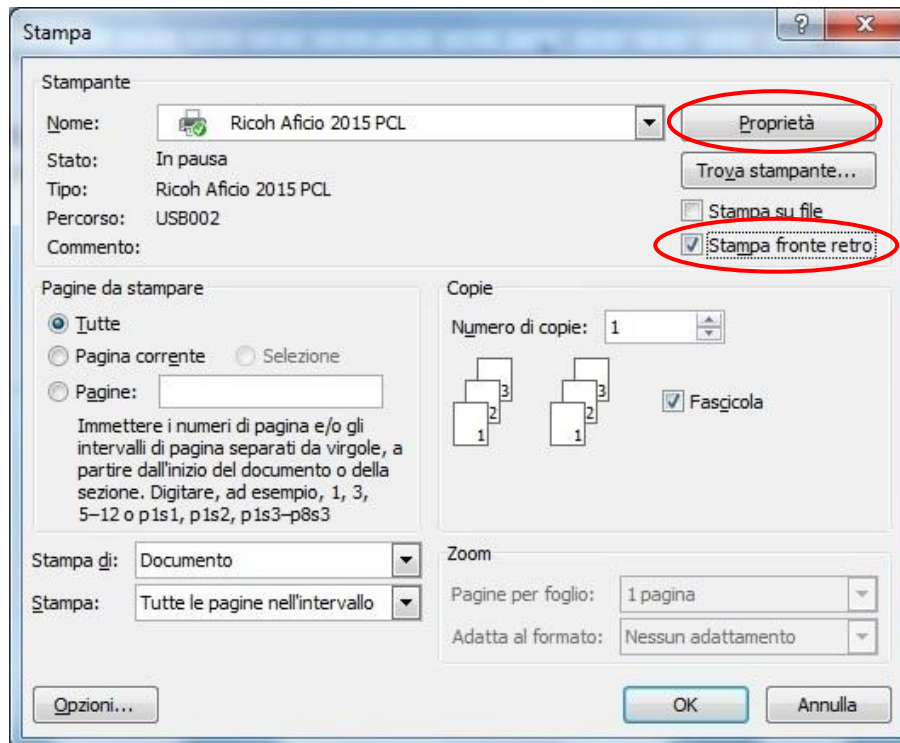
Installer who has a double-sided printer should follow these instructions to print this manual (as booklet format).

- ✓ On the menu PRINT check the option DOUBLE SIDE PRINT ([pict.1](#))
- ✓ Then click on menu PROPERTIES there will be a new window ([pict.2](#)) where you have to check:
 - Orientation: portrait
 - Page per sheet: 2

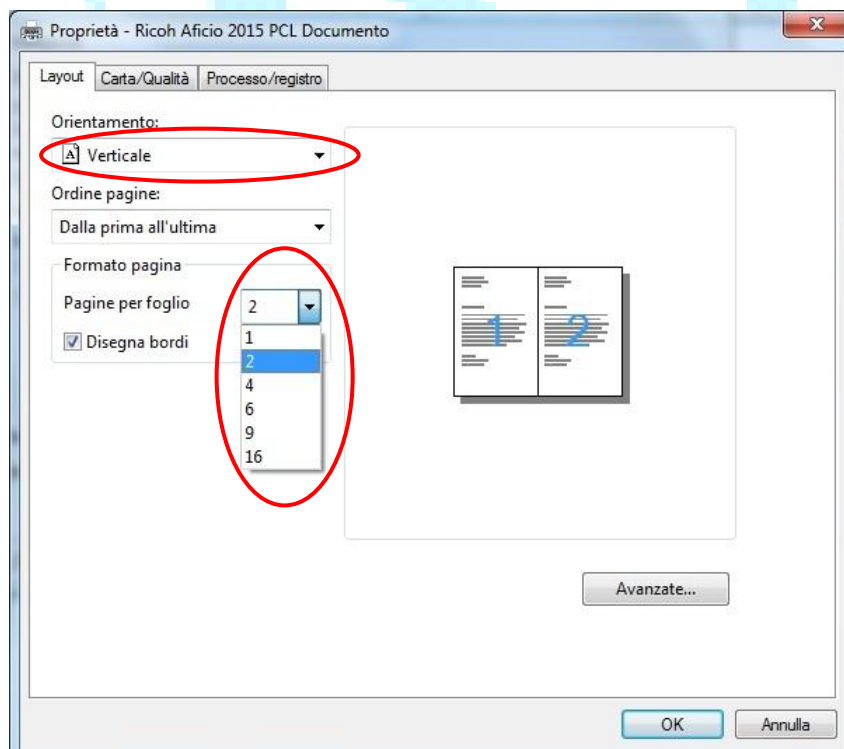
Select OK to go back to pict. 1 window

- ✓ Check the option PAGES
- ✓ Copy and paste the following numbers:
24,1,2,23,22,3,4,21,20,5,6,19,18,7,8,17,16,9,10,15,14,11,12,13
In the blank by the option PAGES ([pict.3](#))
- ✓ Select OK to start printing the manual

Pict.1



Pict.2



Pict.3

