M.T.M. s.r.l.

Via La Morra, 1
12062 - Cherasco (Cn) - Italy
Tel. ++39 0172 48681
Fax ++39 0172 488237

BRC GAS EQUIPMENT

Just

- handbook for the installer -

02.2001

TABLE OF CONTENTS

1. PRESENTATION

1.1. GENERAL FEATURES

The Just system, destined to feed automotive explosion engines on gas (CNG or LPG), is the result of a long experience worked out by BRC Co. in its own field.

Indeed, this system is due to a synthesis of the best features of the lambda gas control systems, opportunely integrated by innovative functions and definitely in the lead in the traditional gas equipment field, thanks to the self-configuration and the self-adapting.

The system core consists of a microcontroller with a very high performance/price ratio and with really considerable potentials, able to manage manifold functions by optimising times, versatility and effectiveness of the ECU interventions.

The long and careful road setup, with vehicles of several types and of different characteristics and perfomances, highlighted the remarkable potential of the system, as well as the setup ease and the possibility to optimise the car working.

The results attained in the approval emission tests of the product are evidence of the exceptional quality of the mixture control system.

The approval tests from the point of view of the Electromagnetic Compatibility (EMC), successfully passed by the system, highlighted its strength to the electromagnetic troubles and confirmed the validity of the planning and realisation strategies.

1.2. GENERAL LAYOUT OF THE EQUIPMENT

The Just system is applied on any type of engine converted to gas with a traditional BRC equipment (LPG or CNG indifferently).

The ECU, with a microcontroller, manages the control of the whole gas equipment and adjusts the fuel quantity in feedback through the STEP actuator in order to obtain an optimum mixture, both in respect of pollution and consumptions, and of driveability, aside from the outside conditions (temperature, etc.) and the fuel composition.

The system setting and starting, widely based on self-configuration and self-adapting procedures, present two possible “approaches”:

- complete configuration and starting of the system solely based on the changeover switch and on the BRC Diagnostic Box;

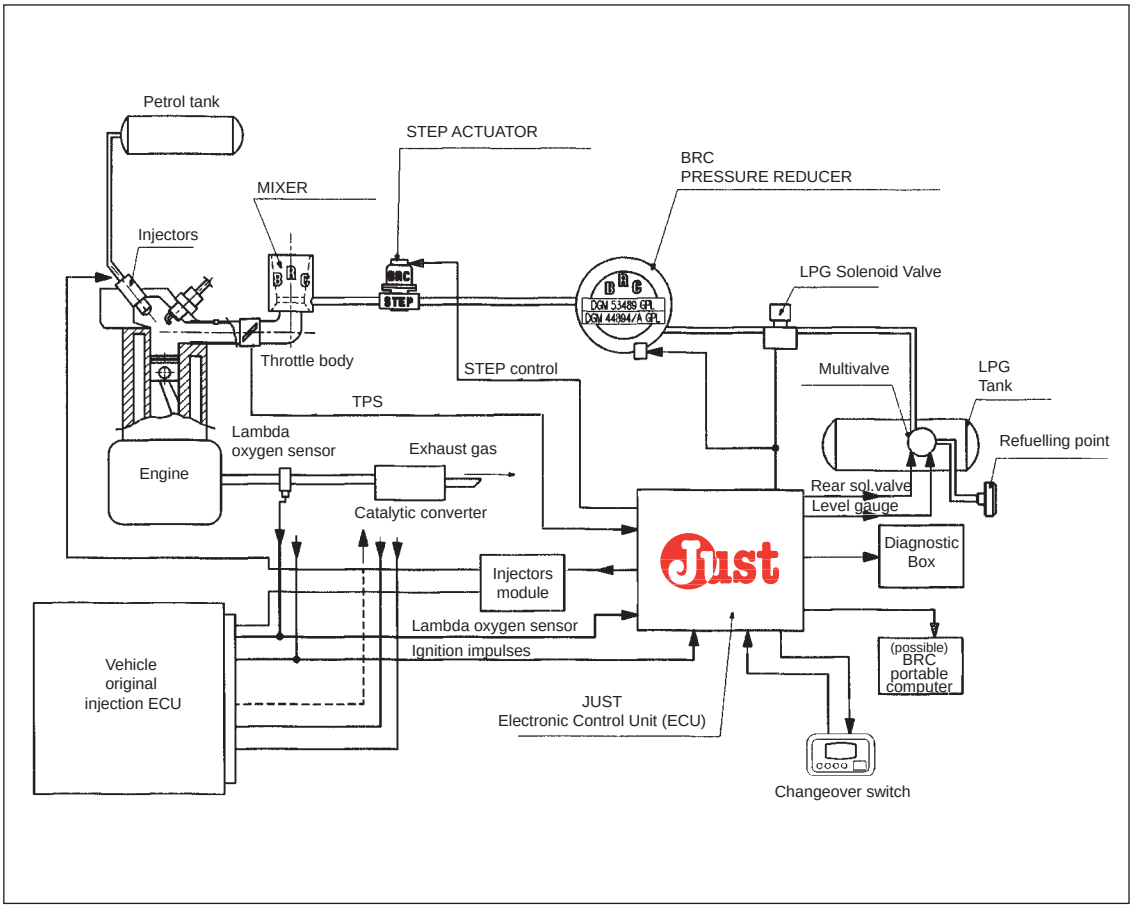

Fig. 1
General layout of the equipment

- possibility of carrying out a setup through the system managing interface from computer, for a dialogue in real time with the ECU, by allowing a careful control of the equipment working, as well as a comfortable, close and specific setting.

The fig. 1 represents the total layout of the equipment, in particular:

- the Just electronic control unit (ECU);
- the changeover switch with the level gauge;
- the connection with the BRC Diagnostic Box;
- the possible connection to the BRC Portable Computer;
- the STEP gas flow control actuator;
- the reducer;
- the mixer;
- the lambda oxygen sensor.

Such a layout is only aimed at giving an overall view of the equipment.

A lot of details can vary from a vehicle to another and, for that reason, please refer to the specific diagrams of each model.

The fig. 2 represents in detail the main electronic and electric components of the system, which comprehends:

- the ECU;
- the changeover switch;
- the STEP gas flow control actuator;
- the harness.

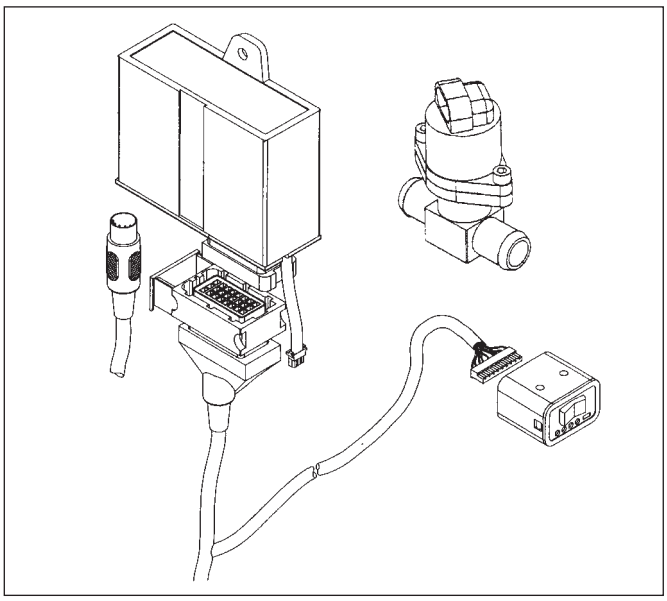

Fig. 2
View of the elements making up the unit

1.3. DETAILED DESCRIPTION OF THE SYSTEM COMPONENTS

1.3.1. ECU AND CHANGEOVER SWITCH

The Just ECU can be considered the operative unit of the whole gas equipment.

Through the special harness requisite to easily reach the car different parts concerned, and thanks to the inlet and outlet stages opportunely dimensioned not to alter or absolutely damage the car normal running on petrol in time, it is able to manage the whole Just system in the course of its duty.

1.3.1.1. Changeover function for injection cars

The changeover switch consists the Just system more immediate interface with the user: through it the ECU supplies the instructions necessary for the driver.

The Just changeover switch, even though it follows the same line of the other BRC products as for the standard functions, presents manifold additional functions reserved to the self-acquisition, setting and diagnostic procedures of the system.

Together with the changeover switch a sticker is supplied for its upright positioning (it is sufficient to remove and replace the already mounted one).

The changeover switch (fig. 3) has three positions allowing three types of working.

a) Working on "forced petrol".

With the changeover switch button pressed leftwards, the two-coloured rectangular LED turns red, the injectors are working, the gas solenoid valves are closed, the gas flow control system is off.

The car regularly runs on petrol, as if there weren't the gas equipment.

b) Working with petrol-gas automatic changing over.

With the changeover switch button in the central position and the ignition key on, the two-coloured LED is blinking red (central position without revs); the car starts on petrol (two-coloured LED is fixed red) and then it automatically changes over to gas (two-coloured LED is fixed green), according to a suit-

able changing over strategy based on the r.p.m. and on the TPS signal. The threshold to enable the changing over is adjustable via software (Chapters 3 and 4). An orange shade of the two-coloured LED marks out that the changing over enabling threshold has been get over with the car still running on petrol (in such conditions, a deceleration determines the changing over to gas).

The automatic changing over to gas is inhibited for a short interval just after the car ignition (approx. 5 seconds).

Evidently, while running on gas, the injectors are disconnected, because the outside cutting device and the possible emulation of the injectors are enabled, the gas solenoid valves are open, the gas flow control actuator is controlled and possible further devices, if any, are enabled.

This is the recommended position for running on gas.

The system automatically changes over to petrol again in case of failed starting or accidental stopping (safety car) and such a condition is pointed out by a shifting lighting of a LED at a time from the left side to the right side and back.

In a similar way, it automatically changes over to petrol again (two-coloured LED is fixed red) in case of r.p.m. above the threshold with a subsequent automatic changing over to gas when returning to normal conditions (par. 1.3.1.2).

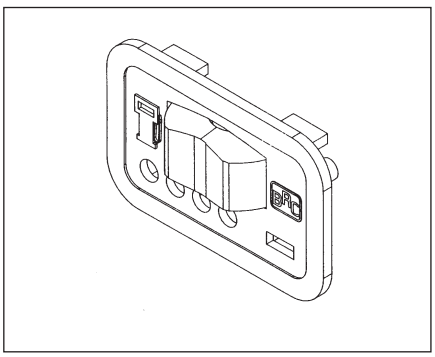

Fig. 3
Just Changeover Switch

c) Working on "forced gas".

With the button pressed rightwards and the ignition key on, the priming is immediately carried out (timed opening of the gas solenoid valve, to allow the car starting).

The two-coloured LED turns green (blinking without revs and fixed in case of priming or engine running) and the car runs exclusively on gas.

In this case too the system automatically changes over to petrol again in case of failed starting or accidental stopping (safety car) and of r.p.m. above the threshold.

This function is to be considered as an emergency solution, to be used solely in case of failure of the petrol feeding equipment and with the greatest care to prevent the pump from running dry, with the empty tank.

It is consequently advisable to always keep a petrol quantity of 1/3 or 1/4 of the tank and to renew it rather often so that it doesn't alter.

1.3.1.2. Changing over again in out-of-the revs threshold condition

In case the engine is in out-of-the revs threshold condition, while running on gas, the system automatically changes over again to petrol, allowing to use the revs limiting strategies implemented in the petrol injection ECU.

When returning to acceptable working conditions, the ECU automatically enables the changing over to gas again. The changing over to gas is carried out as soon as the suitable conditions take place (see par. 1.3.1.1).

Both the entry threshold in out-of-the revs threshold condition and the one returning to acceptable working conditions are configurable via software from the interface programme on computer.

1.3.1.3. Control function of the gas quantity

The system acts as a "closed loop", by correcting the air/gas mixture strength in real time according to the information coming from the lambda oxygen sensor. As everybody knows, this one produces a voltage signal depending on the oxygen present in the exhaust gas and therefore supplies an indirect measure of the mixture strength (lean, stoichiometric, rich), allowing the ECU to act on the gas flow control actuator, through a suitable power stage.

The correction of the mixture strength in real time is carried out both according to the information coming from the lambda oxygen sensor, and through the analysis of the different driving conditions of the car (maps based on the engine load).

The Just electronic card has been exclusively conceived for managing the BRC STEP patented actuator involved in the system itself and is not compatible with different actuators.

1.3.1.4. Function of injectors emulation and fuels overlapping

The Just ECU doesn't have either the injectors cutting function inside it or the injectors emulator.

It is therefore necessary to install an outside module (emulator, disconnector, etc.), available

in different versions according to the injection type and the car specific requirements.

By connecting the outside emulator power-supply to the White/Green wire of the Just ECU (par. 2.3.3.4), the fuels overlapping function is obtained.

The fuels overlapping time is programmable via software (Chapters 3 and 4).

1.3.1.5. Emulating function of the configurable lambda oxygen sensor signal

The Just ECU incorporates a configurable lambda oxygen sensor signal emulator which can perform functions of both fixed emulation and emulation at variable richness.

The choice is associated to the setting-up of the NP – NC1/NC2 relay contact (par. 1.3.1.6), that is to say **the emulation at a variable richness is associated to the NP setting-up, whereas the fixed emulation is associated to the NC1/NC2 setting-up.**

In case of emulation of the lambda oxygen sensor signal at a variable richness, it is possible to programme the duty cycle of the lambda signal emulated with a 1% resolution (Chapters 3 and 4).

1.3.1.6. Function of the memory management and of the signal cutting relay contact

The White and White/Orange wires can have a double function, configurable via software (Chapters 3 and 4):

- memory resetting function of the petrol injection ECU (NP);
- relay contact function for cutting signal (NC1/NC2).

The NP function of the White and White/Orange wires is usually used only on cars where it is necessary to reset the memory of the petrol injection ECU.

For using the NC1/NC2 function (corresponding to the relay contact for cutting signal), please refer to the specific diagrams of each car.

1.3.1.7. Level gauge

Inside the change over switch there is a level gauge consisting of a LED bar with four GREEN LEDs. The low fuel warning is obtained through the first LED blinking.

Its working can be obtained by connecting to the ECU one of the available BRC level sensors, both of the Hall effect type and of the resistive type (see the Chapter 2 for installation and the "C" Appendix for the reference codes).

The level gauge is preset, but the indication can be improved or corrected via software (Chapters 3 and 4).

1.3.1.8. Dialogue with the Diagnostic Box

The Just ECU provides for the possibility of connection with the Diagnostic Box for visualising the main control signals.

The r.p.m., the lambda oxygen sensor signal and the STEP actuator position are actually visualised on the three LED bars of the device (par. 1.3.2).

1.3.1.9. Dialogue with the BRC Portable Computer

The Just ECU (through a special adapter) can also be connected to the BRC Portable Computer. A valid and powerful interface programme allows to communicate with the ECU and to have access to its memories and to its central processing unit in real time (par. 1.3.3).

1.3.1.10. Double possibility for setting and starting operations

In the Just system two possible "approaches" have been contemplated for setting and starting, to meet all the installers' requirements.

It is actually possible to go from an essential setting-up (Chapter 3), only based on the changeover switch and on the Diagnostic Box (which minimises times and adjustments) to a targeted and personalised setting-up (Chapter 4), based on the interface programme on computer (which allows the skilled installer to personalise the system working to adjust it to the most varied requirements).

1.3.1.11. Self-configuration of the system to the vehicle signals

The Just system is able to self-configurate to the different types of vehicle signals (automatic acquisition of any type of TPS signal, of revs signal and of lambda oxygen sensor signal). This makes the ECU setting considerably easier, by eliminating the installer's error possibility (Chapter 3).

1.3.1.12. Self-adapting of the system

Self-adapting strategies have been implemented in the Just system according to the changes of the car working conditions and characteristics, in order to assure the constant and permanent optimisation of the control potential (par. 3.8).

1.3.1.13. Check-up of the system

Each time the board cuts out, the ECU carries out a check-up

of all its parameters and of the "state" of all the components belonging to the Just system.

Such a condition is pointed out by the changeover switch through a shifting lighting of couples of LEDs from the centre outwards and back.

(NOTE: it is anyway possible to break off the check-up for a subsequent starting in case of need).

1.3.1.14. Troubleshooting

The Just system is able to carry out a diagnostic of its working in real time.

Possible errors or troubles are stored by the ECU and pointed out through a special encoding on the changeover switch LEDs as soon as they occur.

They are also stored and made accessible in the interface programme on computer.

The clearance of the errors stored takes place automatically when the car stops: if their cause is removed, they won't occur at the subsequent starting, otherwise they will reappear.

1.3.2. Diagnostic-box

The Just ECU contemplates the possibility of connection with the Diagnostic Box for visualising the main control signals.

The r.p.m., the lambda oxygen sensor signal and the STEP actuator position are actually visualised on the three LED bars.

The Diagnostic Box is therefore a very useful instrument (indispensable if the interface programme on computer is not used) for the system configuration and setting, as well as for the starting and any future controls and adjustments of the parameters.

The combined use of the Diagnostic Box and the changeover switch, particularly allows the access to very useful setting domains such as the visualisation of the STEP actuator reset position and the duty-cycle visualisation and setting out of the lambda signal emulated (see Chapter 3 for the detailed description).

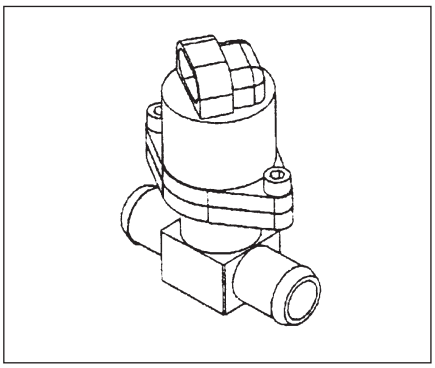

Fig. 4
STEP Actuator

1.3.3. Interface programme on computer

The possibility to connect the Just ECU to the BRC Portable Computer (through a special adapter) has been contemplated for a more and more practical and precise setting procedure.

A valid and powerful interface programme allows to communicate with the ECU and to have access to its memories and its central processing unit in real time.

The interface on computer is therefore the instrument through which the installer interacts with the whole Just system and will be able to "model" the gas equipment to adjust it to the car characteristics according to the different driving conditions.

The orderly collection of the files of the different installations performed will be real historical archives, very useful both to keep the equipment evolution under control in time, and to be a starting point for new similar or critical installations.

The Chapter 4 of this handbook is completely dedicated to the interface programme on computer.

1.3.4. Harness

The Just ECU connection to the system different elements can be performed with two harness types (see "C" Appendix for the attendant codes). The main connector of the Automotive 24-way type gathers all the secondary pre-wired connectors and the different wires, to which the same colours used for the BRC Lambda Gas systems have been maintained.

The different wires are moreover divided into sheaths in order to make the installation easier and to improve the appearance.

1.3.5. Gas flow control actuator

The control of the fuel quantity sent to the engine is carried out by the STEP actuator: it is a step by step engine of common use in the automotive field, to which a cylindrical shutter is applied. The stroke of this shutter provokes a variation of the gas passage port in the pipe (fig. 4).

The adjusting system is managed in every instant and in real time by the ECU which controls its work done, by valuing both the lambda oxygen sensor response and the car working conditions according to special preset maps, in case self-adapted, which can anyway be handled via software (reset position with the cold oxygen sensor, stoichiometric parameters, cut-off working, at idle speed, at normal speed, at full load, management of accelerations and decelerations and engine load).

The extreme decision-making

quickness of the digital system and its flexibility assure an easy and effective setting for the constant maintenance of the correct stoichiometric ratio on every car and engine model. The actuator is designed for running extremely well both on CNG and on LPG.

1.3.6. REDUCER

The Just device is suitable both for LPG and for CNG.

In any case, the LPG reducer-vaporiser or the CNG pressure reducer ought to be of BRC manufacture, according to the regulations in force which prohibit combinations different from those used during the approval tests.

1.3.7. MIXER

The above applies to the mixer too: **the mixers admitted are only those marked "BRC".**

NOTE: the use of the Just system, through the information passed on by the Diagnostic Box or rather, by the interface programme on computer, allows the more experienced installer to value possible failures of the feeding mechanical system and its best location and setting according to the different car models.

1.4. ADVANTAGES OF THE JUST SYSTEM

Your attention has been already drawn several times to the high potential of the microcontroller system and of its setting and starting modes.

This paragraph resumes and sums up some of the most important goals we aimed at during the planning, the development and the realisation of the Just system.

1) The system is the result of several years of experience and is due to a synthesis of the best features of the lambda gas control systems, opportunely integrated by innovative functions and definitely in the lead.

2) The results attained by the system in the approval emission tests of the product are evidence of the exceptional quality of the mixture control strategies: only a modern, valid and adaptable system can attain such goals.

3) The approval tests from the point of view of the Electromagnetic Compatibility (EMC), successfully passed by the system, highlighted its strength to the electromagnetic troubles and confirmed the validity of the planning and realisation strategies.

4) The ECU, with a microcontroller, manages the control of the whole gas equipment and adjusts the fuel quantity in feedback through the STEP actuator in order to obtain an optimum mixture, both in respect of pollution and consumptions, and of driveability, aside from the outside conditions (temperature, etc.) and the fuel composition.

The adjusting system is actually managed in every instant and in real time by the microcontroller which controls its work done, by valuing both the lambda oxygen sensor response and the car working conditions according to special preset maps, in case self-adapted, which can anyway be handled via software.

5)The Just system is able to self-configurate to the different types of vehicle signals (automatic acquisition of any type of TPS signal, of revs signal and of lambda oxygen sensor signal). This makes the ECU setting considerably easier, by eliminating the installer's error possibility.

6) Self-adapting strategies have been implemented in the Just system according to the changes of the car working conditions and characteristics, in order to assure the constant and permanent optimisation of the control potential.

7) The two possible "approaches" for the setting and starting operations have been studied to meet all the installers' requirements. It is actually possible to go from an essential setting-up, only based on the changeover switch and on the Diagnostic Box (which minimises times and adjustments) to a targeted and personalised setting-up, based on the interface programme on computer (which allows the skilled installer to personalise the system working to adjust it to the most varied requirements).

8) The interface on computer, besides being the instrument through which the demanding installer interacts with the whole system and is able to "model" the gas equipment to adjust it to the car characteristics according to the different driving conditions, also allows an orderly collection of the files to the different installations performed, creating real historical archives, very useful both to keep the equipment evolution under control in time, and to be a starting point for new similar or critical installations.

9) The ECU inlet and outlet stages are dimensioned so that, by carefully following the circuit diagrams supplied by the BRC servicing and by carrying out workmanlike settings, the car original petrol system can be damaged in no way. and the diagnostic and control systems are kept unchanged while driving.

10) The system good working is constantly checked by the diagnostic and check-up strategies adopted and any possible anomalies are promptly reported and stored.

2. INSTALLATION OF THE SYSTEM

2.1. PRELIMINARY OPERATIONS

Before physically installing the different components of the Just system, as before any new installation, it's a good rule to check the car running on petrol.

In particular, it is necessary to carefully check the status of the ignition electric equipment, the air filter, the catalyst; to check through a multimeter or through the instruments BRC created expressly for installers (Jolly, Diagnostic Box, ...) the correct behaviour of the different signals concerning the system: positive after contact, r.p.m., lambda oxygen sensor, TPS, petrol ECU storage power supply, injectors positive. It is also important to check that the earth power of the different signals is stable and coincides (the acceptable gap can be of some 10 mV) with the one of the place where to connect the Just ECU earth.

Another very important warning is to carefully follow the instructions enclosed to the BRC products and the circuit diagrams suggested by the Servicing, obviously after having checked the car model to be converted, the production year, the engine number, the injection and ignition types and therefore the equipment feasibility.

These are simple actions taking a few minutes which could avoid future inconveniences and complaints with a consequent waste of time.

2.2. ECU FIXING

The Just ECU is proposed with a case (though already widely used and checked with the BRC Blitz ECU), consisting of a plastic body and an aluminium front which is robust, pretty small and watertight, therefore suitable to be installed directly inside the engine compartment.

The new 24-way connector of the automotive type also assures a perfect tightness and a practical coupling system.

For a correct installation, it is anyway necessary to carefully follow the directions here-below:

- try not to fix the ECU in sight of the exhaust manifold: the radiative heat propagating could damage it even at a considerable distance; it is therefore sufficient to have some walls interposed between the exhaust manifold and the ECU, avoiding like that the direct radiation;

- it is anyway always necessary to install the ECU in an area of the engine compartment which is as much protected from water as possible; in particular, it is essential to fix it in such a way as to have the harness with the sheaths turned downwards and to prevent the possible moisture from filtering inside the connector, by dripping on the sheaths (fig. 5).

- try not to place the ECU near the spark plug cables or near the coil high voltage cable.

The solution to fix the ECU, where it is possible, inside the driver and passenger compartment, is anyway always allowed; in this case it is necessary to avoid little ventilated areas, e.g. between felts, filled carpets, etc. ...

Use the special body tongue for fixing and prevent other systems from deforming the case; finally check there are no vibrations.

2.3. ECU CONNECTION

The Just ECU connection to the different system elements ought to be carried out through one of the two types of 24-pole harness supplied by BRC (see "C" Appendix for the attendant codes).

The ECU also has a DIN 5-pole connector for the connection

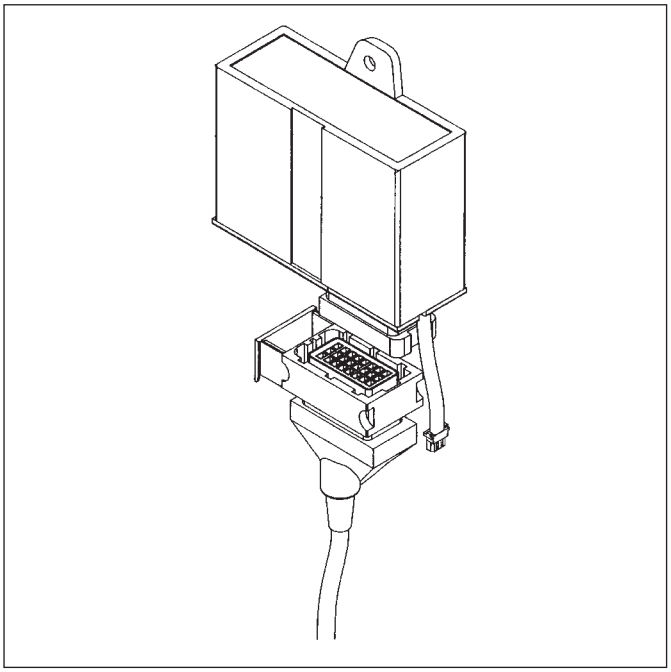

Fig. 5
Installation of the Just ECU: correct positioning

to the Diagnostic Box.

The possible connection to the BRC Portable Computer for using the specific interface programme, can be carried out with a special adapter (see “C” Appendix for the attendant codes), which has to be connected to a connector inside the ECU body (par. 2.3.2).

All the connections of the harness wires which are unprovided with connector ought to be carried out through well done and suitably insulated soft solderings. Do not twist the wires simply or use scarcely reliable terminals.

The following instructions have general validity and are indispensable for understanding the system. Please refer to the specific diagrams for the application to each car model. The 24-pole harness wires maintain the same colours used in the other BRC systems; the wires are moreover divided into several sheaths in order to make the installation as easy as possible.

2.3.1. 5-POLE DIN CONNECTOR FOR DIAGNOSTIC BOX

As previously said, the Just ECU contemplates the possibility of connection with the Diagnostic Box for visualising the main control signals. The r.p.m., the lambda oxygen sensor signal and the STEP actuator position are actually visualised on the three LED bars. The 5-pole DIN connector (fig. 7) just allows the ECU connection to the Diagnostic Box.

2.3.2. CONNECTION TO THE BRC PORTABLE COMPUTER

As already hinted in the Chapter 1, the possibility to connect the Just ECU to the BRC Portable Computer is contemplated for a more practical and close setting procedure.

A valid and powerful interface programme allows to communicate with the ECU and to have access to its memories and to its central processing unit in real time.

The connection is carried out on the computer serial door, even through the same interface cable already used with the BRC Flying Injection system.

An adapter is actually available and it can be connected to such a cable on one end and to a special 4-way connector placed on the Just ECU card on the other (see “C” Appendix for the attendant codes). In order to carry out this connection it is necessary to open the ECU body (fig. 8).

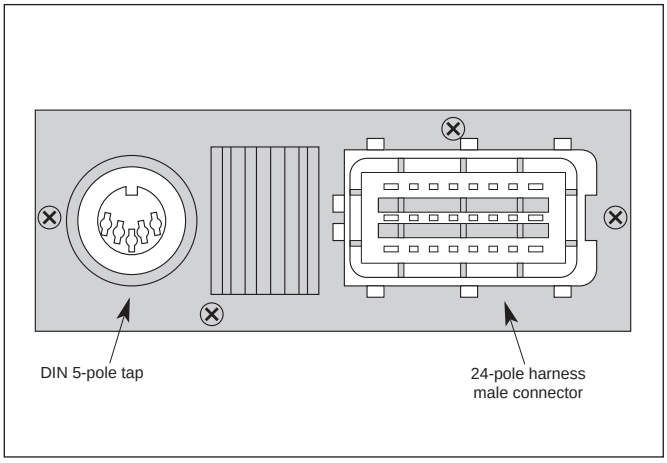

Fig. 6
Just ECU (connectors side view)

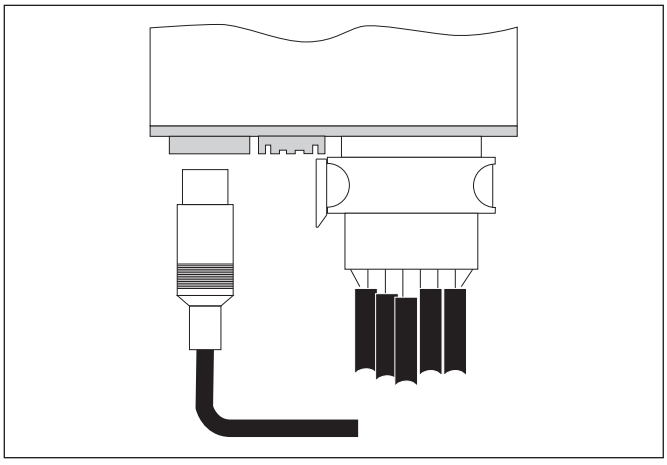

Fig. 7
DIN 5-pole connector for Diagnostic Box

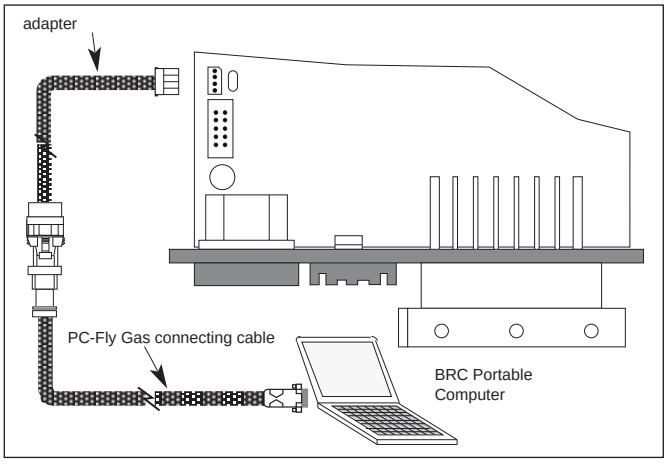

Fig. 8
Just ECU connection to the BRC Portable Computer

2.3.3. 24-POLE HARNESS

The two types of 24-pole harness (see “C” Appendix for the attendant codes) have on one end a main 24-way connector which gather all the secondary connectors and the different wires, whose description you will find in the following paragraphs.

2.3.3.1. 10-way connector for the changeover switch

The 9-pole multipolar cable inside the harness, ended on a 10-way connector, is used for the changeover switch connection (fig. 9). It connects the ECU to the changeover switch placed in the driver and passenger compartment; in order to make its passage through the wall openings easier, the connector 90° bending on one side is recommended to make it parallel with the wires.

The boxed changeover switch is the one already used in the other BRC systems (see “C” Appendix for the attendant codes).

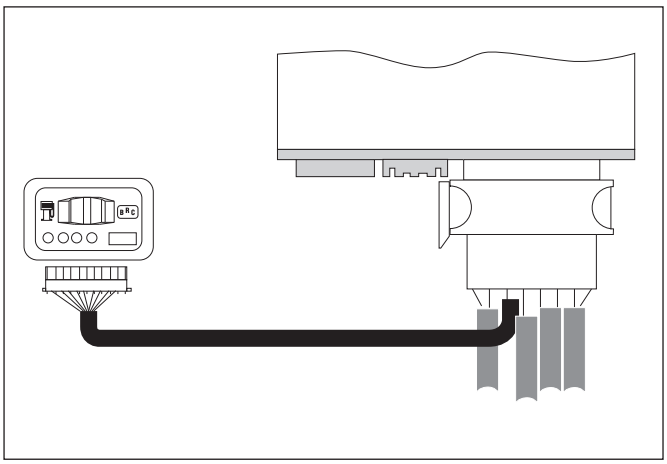

Fig. 9
Cable for the changeover switch connection

2.3.3.2. 4-way connector for the STEP control actuator

The 4-pole multipolar cable ended on the 4-way connector (fig. 10) connects the ECU to the step by step engine which is aimed at controlling the gas flow (par. 1.3.5).

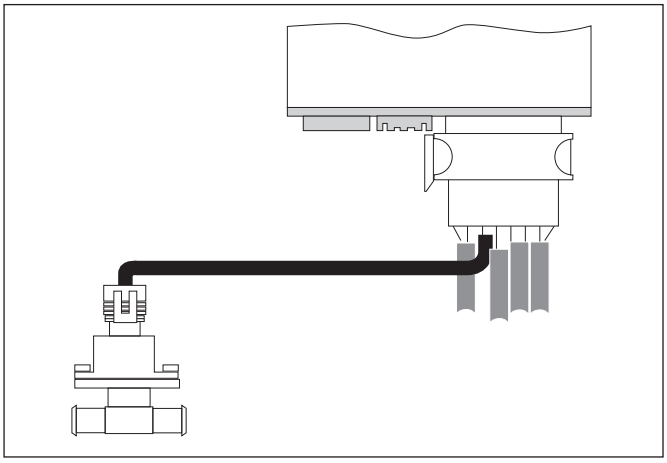

Fig. 10
Cable for the Step actuator connection

2.3.3.3. Connection of the gas level sensor

The connecting cable for the sensors of the resistive type belongs to the 24-pole harness and is White/Black, ended with a female faston provided with a faston cover. The connection between the ECU and the sensor can be carried out through the

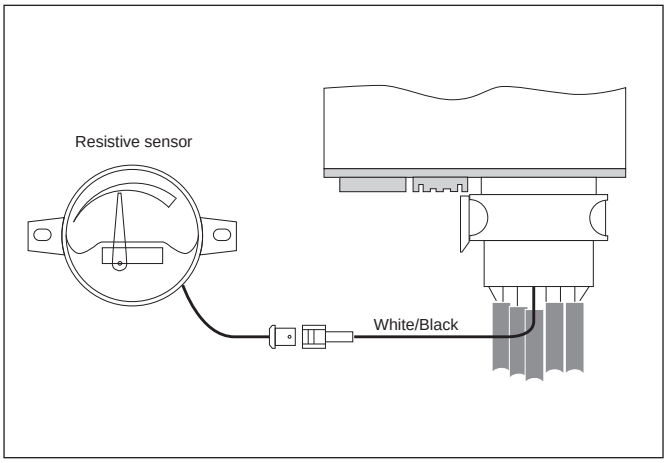

Fig. 11
Level gauge of the resistive type

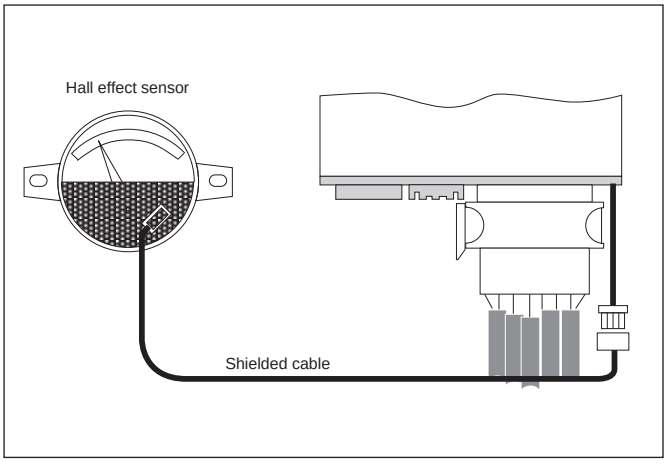

Fig. 11.A
Gas level gauge of the Hall effect type

special extension cable contained in the packages of sensors (fig. 11).

For the connection of the level gauge of the Hall effect type, there is a type of Just ECU (see “C” Appendix for the attendant codes) provided with a special little cable coming out from the front with the white 3-way connector (fig. 11.A).

For the connections, refer in any case to the instructions enclosed to the sensors.

2.3.3.4. Startend Connector

It is present on all the versions of the 24-pole harness of the Just system and consists of 3 White/Green, Black, Red wires, ended on a male faston with its cover. These connections ought to be used for linking any devices of the Modular family, employed for cutting and/or injectors emulation functions (fig. 12).

The devices of the Modular family can be fixed through the special “dovetail” on the ECU body.

Do not feed any emulators with the Green wire feeding the gas solenoid valves, since that way it shouldn’t be possible to use the fuel overlapping function precisely managed by the Just ECU through the White/Green wire.

2.3.3.5. Reset connector

It is present on a version of the 24-pole harness (see “C” Appendix for the attendant codes) and consists of a 4-way fuse-holder box (fig. 13) which gathers the following couples of cables:

- Yellow + Light blue
  = (lambda oxygen sensor),
- White + White/Orange
  = (memories),
- Red + Red

The fuse on the Red wire ought to be always correctly inserted as it has the whole equipment protecting function.

The fuses for the other two couples of cables are housed inside the reset connector and ought to be inserted in case of serious failure of the gas equipment.

By inserting the fuses and positioning the changeover switch on the forced petrol position, the car regularly runs on petrol even if the Just ECU is removed.

The installer ought to give the suitable directions to the car owner on the use of this function.

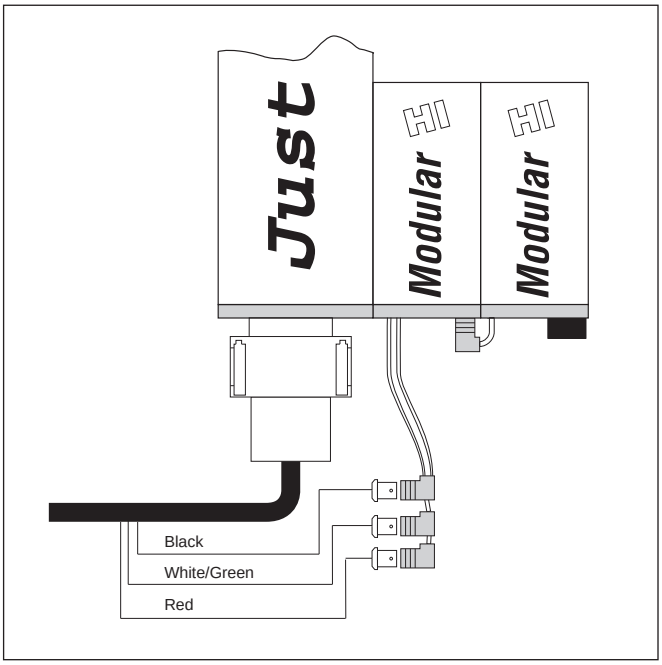

Fig. 12
Startend connector and fixing of the Modular devices

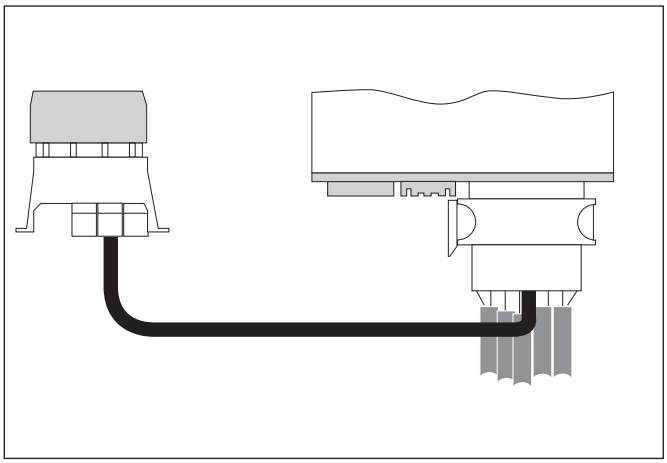

Fig. 13
Reset connector

2.3.3.6. “A” Sheath

Colour	type (*)	description
Black	in	engine earth
Red	in	battery positive(**)
Green	out	LPG solenoid valve solenoid valve on LPG or CNG reducers any safety solenoid valve on LPG tank (any) other devices

It is important that the BLACK wire is connected to the engine earth, not to the battery negative or to other bodywork parts. Since from a point to another of the car earth the potential can change by some tenths of volt, by getting the negative in unfavourable points, you risk interpreting the lambda oxygen sensor signal wrongly.

(*) The “type” shows whether the attendant signal is an inlet (in) or an outlet (out).

(**) **The RED wire ought to be protected by a 7,5 A fuse, should a harness unprovided with a reset connector be used.**

The loads on the GREEN wire are to be connected in parallel each other.

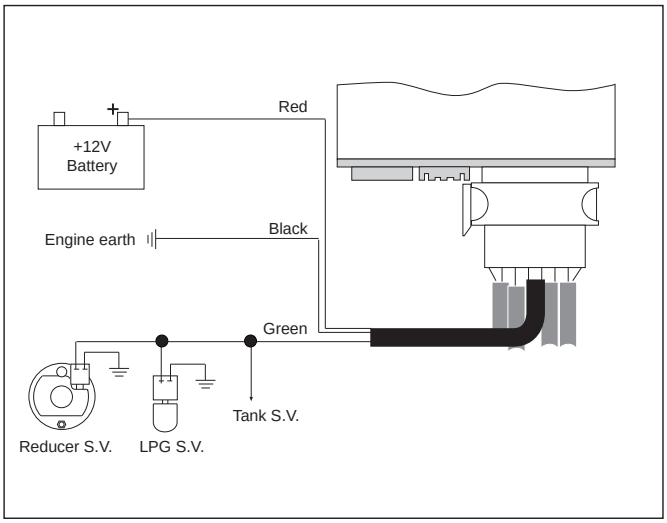

Fig. 14
“A” Sheath

2.3.3.7. “B” Sheath

Colour	type	description
Brown	in	positive after contact
Grey	in	engine ignition impulses

The connection of the BROWN wire absorbs very little current, so that any positive after contact can be chosen. **What is important is to check that it is not a point of the electric equipment subject to strong losses of voltage.** For instance, on some cars it is necessary not to use the ignition coil positive or the injectors positive because they are preceded by resistances lowering the potential by some volt.

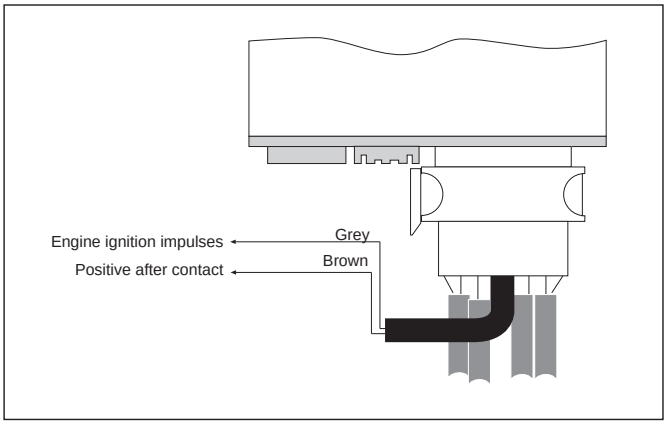

Fig. 15
“B” Sheath

The GREY wire ought to be connected to a frequence impulsive signal proportional to the r.p.m. It can be:

- a square wave signal findable on the injection ECU or on the ignition one, provided that its amplitude is sufficient. The suitable wires could be: the wire going to the revolution counter or the wire connecting the above ECUs with the ignition power module;

- a signal coming from the "ignition coil negative".

When it is possible, we advise to always give preference to the square wave signals, by choosing the connection to the “ignition coil negative” only as extreme possibility.

Do not twist the grey wire as an antenna on the high voltage cables.

2.3.3.8. “C” Sheath

Colour	type	description
Yellow	in	lambda oxygen sensor signal
Light blue	out	emulated lambda signal

The lambda oxygen sensor usually supplies a signal oscillating from 0 and 1 V; on some types of cars it is possible to find oxygen sensors with signals oscillating between 0,7 and 1,5 V or between 0 and 5 V; the Just ECU, with the self-acquisition procedure, is able to adjust to all these lambda signal amplitudes as well as to lambda oxygen sensors with absorption or resistive pull-up.

The connection of the YELLOW and LIGHT BLUE wires can be carried out directly on the injection ECU, or on the oxygen sensor connector; **in any case it is necessary to carefully follow the detailed diagrams of each car.**

If it is necessary to emulate the lambda oxygen sensor signal, the wiring diagram is the one of fig. 16.A. If not, please refer to the fig. 16.B.

Important: do not short-circuit the oxygen sensor wire either towards the earth, or towards the positive.

Do not apply any load.

When in doubt, the wire of the lambda oxygen sensor signal can be easily located through the "Jolly" code 06LB00001086.

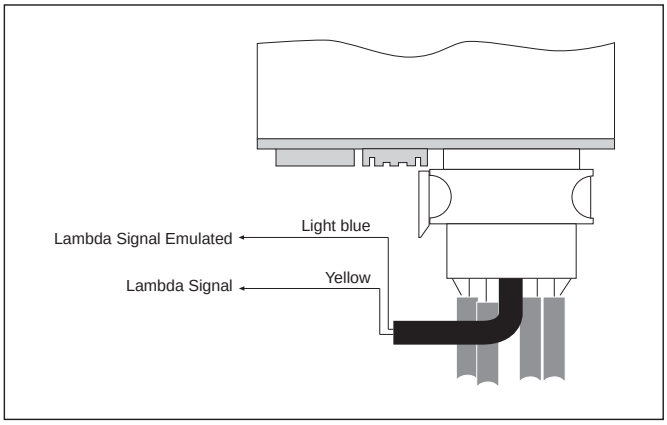

Fig. 16
“C” Sheath

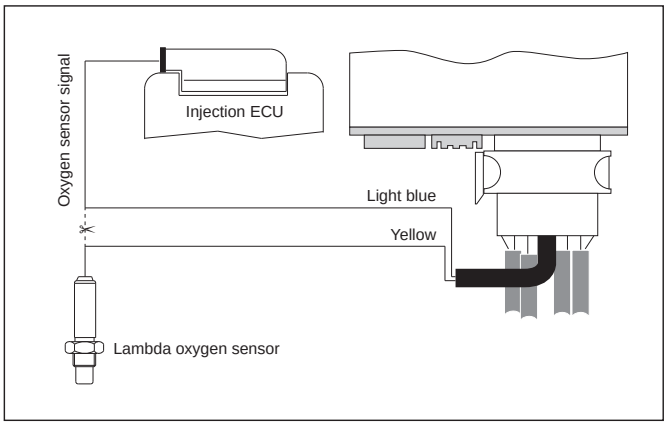

Fig. 16.A
Read of the Lambda oxygen sensor signal with emulation

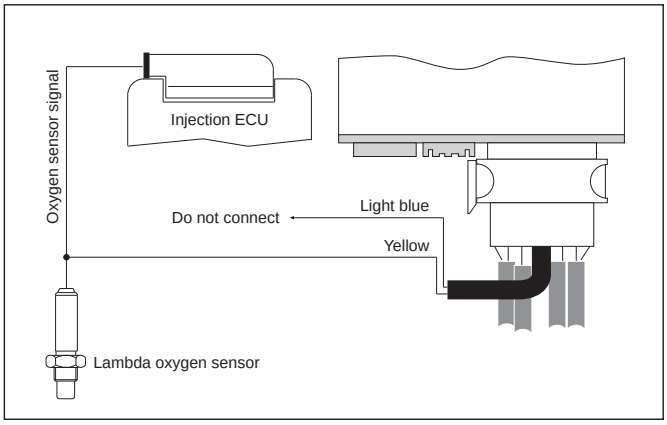

Fig. 16.B
Read of the Lambda oxygen sensor signal without emulation

2.3.3.9. “D” Sheath

Colour	type	description
White	in	ECU memories wire (battery side)
White/Orange	out	ECU memories wire (ECU side)

The WHITE and WHITE/ORANGE wires can have a double function, configurable via software (see Chapters 3 and 4):

- Resetting function of the petrol injection ECU memory (NP);
- NC relay contact function for (NC1/NC2) signal cutting.

The NP function of the White and White/Orange wires is usually only used on cars where it is necessary to reset the petrol injection ECU memory. Such a memory is normally maintained through a wire connecting directly the injection ECU with the battery (see BRC specific diagrams). This wire is generally recognisable because its voltage is always 12V, with the ignition key off, with the ignition key on and with the engine running (fig. 17.A).

Thanks to these connections, it is possible to interrupt it in time, by also preserving determined functions as the self-cleaning of the hot wire, taking place some seconds after the engine stopping.

For using the NC1/NC2 function (corresponding to the signal cutting relay contact), please refer to the specific diagrams of each car (fig. 17.B).

Be careful with the connection polarity: in any case the White/Orange wire ought always to be connected to the one coming from the petrol injection ECU side.

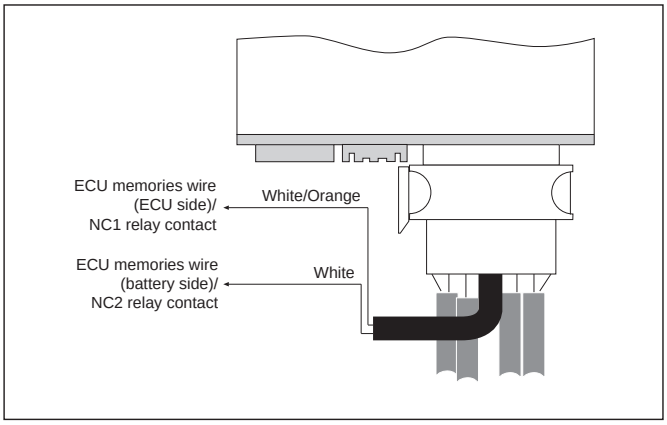

Fig. 17
“D” Sheath

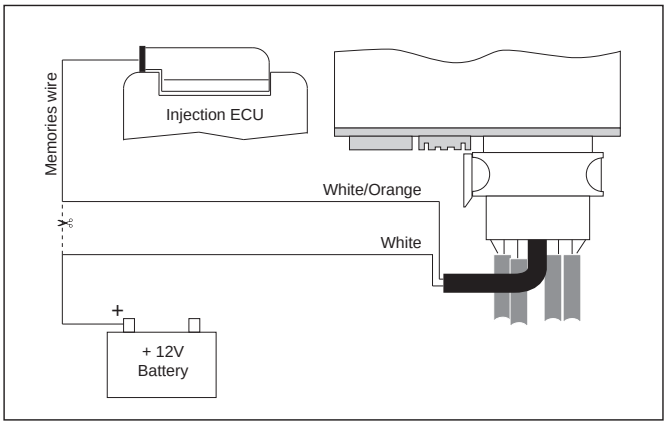

Fig. 17.A
Memories management (NP function)

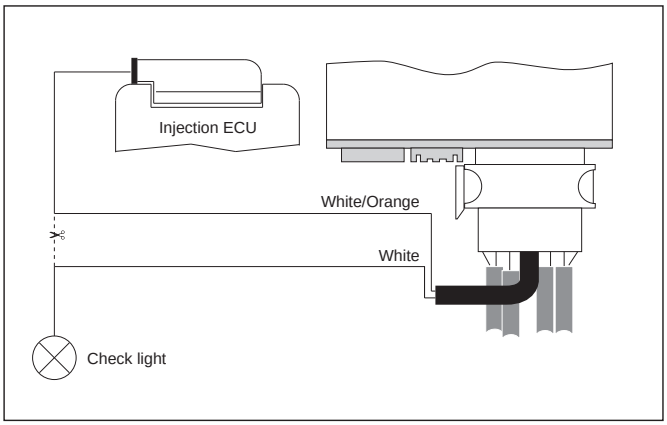

Fig. 17.B
Relay for cutting warning light signal (NC1/NC2 function)

2.3.3.10. “E” Sheath

Colour	type	description
White/Violet	in	TPS (potentiometer integral with the throttle body)

The WHITE/VIOLET is to be connected to the potentiometer proportional to the throttle body position (TPS signal).

The TPS signal can be direct (voltage signal increasing while the throttle opening increases), or inverted (voltage signal decreasing while the throttle opening increases). It can moreover be of the analogic type (continuously varying while the throttle position varies) or of the ON/OFF type (only assuming a minimum and a maximum value).

The Just ECU is able to recognise automatically (during the self-configuration procedure) whether the signal is direct or inverted. **It is nevertheless necessary to set the TPS signal type (analogic or ON/OFF) via software (Chapters 3 and 4), knowing that the default configuration considers a signal of the analogic type.**

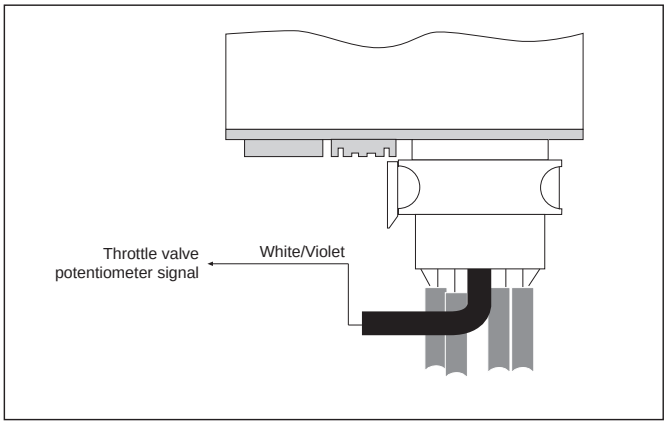

Fig. 18
“E” Sheath

2.4. ASSEMBLY OF THE CHANGEOVER SWITCH

Choose a well accessible and visible position for the driver and fix the device through the screws supplied. By replacing the sticker with the spare one, the changeover switch can also be assembled upright. By eliminating the outside body, the changeover switch can be directly boxed in the car dashboard by using the special drilling tool code 90AV99000043.

Special boxed changeover switches are specifically available for each car, to be positioned instead of the original switch covering plates. Please refer to the electric diagrams and to the price list for the available models.

2.5. ASSEMBLY OF THE GAS LEVEL GAUGE

Follow the instructions enclosed to the chosen transducer; regarding the adjustment, also see the par. 3.5.

2.6. ASSEMBLY OF THE GAS FLOW CONTROL ACTUATOR

The STEP actuator ought to be assembled in any point of the gas pipe between reducer and mixer. **We anyway advise to assemble it as near the mixer as possible . It also ought to be mounted as upright as possible, with the connector turned upwards (fig. 19). Check there are no excessive vibrations and that the engine weight doesn’t rest excessively on the pipe.**

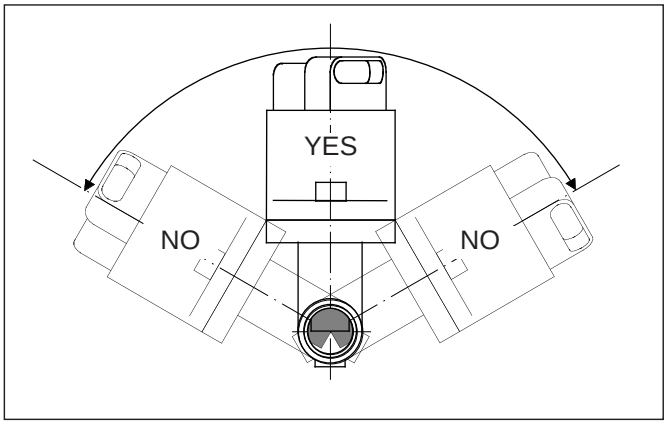

Fig. 19
Positioning recommended for the Step actuator.

2.7. ASSEMBLY OF THE MIXER

Follow the instructions supplied for each car and **always use solely BRC reducers**.

2.8. ASSEMBLY OF THE REDUCER

Follow the usual assembly rules, by fixing the reducer rigidly to the bodywork and orienting it so that the diaphragms are parallel to the car longitudinal axle. Check that no engine part hits the reducer, neither when this one idles, or when it is under stress. Always try to place the reducer and the mixer in such a way as to reduce the gas pipe length as much as possible.

3. CONFIGURATION AND SETTING OF THE SYSTEM TO CHANGEOVER

In the Chapter 1 we told that the Just system setting and starting present two possible "approaches":

- system configuration and starting only based on the changeover switch and on the BRC Diagnostic Box;

- possibility to set up through an interface programme on computer, in order to communicate in real time with the ECU, allowing a careful control of the installation working as well as a close and specific setting.

In this Chapter the first possibility will be described in detail. With the only use of the changeover switch (which presents manifold functions dedicated to the installation setting and starting in the Just system, besides the classical changing over and fuel level gauging functions) and of the Diagnostic Box it is actually possible to configurate and start the whole system, thanks to special self-configurating and self-adapting strategies managed by the microcontroller.

3.1. THE DIAGNOSTIC BOX

The Just ECU contemplates the possibility of connection with the Diagnostic Box for visualising the main control signals.

The Diagnostic Box is therefore a very useful instrument (indispensable if the interface programme on computer is not used) for the system configuration and setting, as well as for the starting and possible future controls and parameters adjustment.

The combined use of the Diagnostic Box and of the changeover switch also allows to accede to particular setting domains such as the visualisation and setting of the emulated lambda signal duty cycle (par. 3.6) and of the reset position of the STEP actuator (par. 3.7).

3.1.1. VISUALISATION OF THE SIGNALS ON THE LED-BARS

a – r.p.m.

The above green LED-BAR represents the r.p.m.

When the r.p.m. signal acquisition and self-configuration phase is over (par. 3.4.2), the LED-BAR read joins the car revolution counter read. The speed indication supplied by the Diagnostic Box is therefore to be considered approximate.

b – Lambda oxygen sensor signal

The second LED-BAR represents the lambda oxygen sensor signal.

The voltage supplied by the lambda oxygen sensor generally varies from zero to almost 1 volt, every LED of this bar therefore corresponds to approx. 0.1 volt. It is possible to reckon that the ideal mixture corresponds to 0.4 ÷ 0.5 volt, that's why around these values some green LEDs have been inserted, being easy to be determined, even while driving on road. The mixture anyway remains excellent in the whole green field and good in the field marked by the yellow LEDs.

Higher voltages turn the red LEDs on. These LEDs indicate a rich mixture, whereas voltages nearly zero volt can even turn all the LEDs off.

In case of lambda oxygen sensors with a voltage varying from 0.7 to 1.5 volt or from 0 to 5 volt, the resolution of the representation is obviously lower (approx. 0.5 volt per LED in case of 0 ÷ 5 volt oxygen sensors).

c – Position of the gas flow STEP actuator

The third (red) LED-BAR shows the working position of the gas flow STEP actuator, consisting of a step by step engine which, partially obstructing the pipe for the gas passage to the mixer, allows to adjust the mixture.

The STEP position ranges from 0 (all closed) to 255 steps (all open) and the representation given is not of the absolute type, but of the relative one, according to the reset position.

On the LED-BAR, to have a higher resolution, a 20-step working window is visualised. It is centred around the STEP actuator current reset position. The reset position is always represented with 5 LEDs on and every more or less LED on corresponds to 2 steps.

Consequently, for example, an only LED on shows that the STEP is 7 ÷ 8 steps below the current reset, whereas 9 LEDs on show that the STEP is 8 ÷ 9 steps above the current reset.

Obviously, if the LED-BAR is completely on, the actuator is in a position over 10 steps above the current reset (considerable opening condition of the STEP due, for instance, to the typically lean air-gas mixture strength, to an opening transient condition (pumping), or to a working condition at full load).

Otherwise, if the LED-BAR is completely off, the actuator is in a position ranging over 10 steps below the current reset (considerable closing condition of the STEP due, for instance, to the typically rich air-gas mixture

strength, to a closing transient condition, or to a cut-off working condition).

3.1.2. NUMERIC VISUALISATIONS

Besides the visualisation of the system main signals (with the LEDs turning on proportional to the amplitude of the same signals) and of the STEP position relating to the current reset, the three LED-BARS of the Diagnostic Box are also used, all together, to obtain a precise representation of particular absolute numeric values.

In these terms, both the exact numeric value of the emulated lambda signal duty-cycle (par. 3.6) and the one of the STEP current reset position (par. 3.7) can be visualised on the Diagnostic Box .

The encoding adopted for this purpose is the following:

- the first LED-BAR shows the hundreds, namely the number of LEDs on starting from the left side shows the hundreds;

- the second LED-BAR shows the decimals, namely the number of the LED on starting from the left side shows the decimals;

- the third LED-BAR shows the units, namely the number of LEDs on starting from the left side shows the units.

The figure 20 depicts in outline, by way of example, a reset numeric value = 125.

3.2. PRELIMINARY CONTROLS

After the installation phase according to the Chapter 2, in order to start and adjust the car running on gas, it is necessary to configurate and set the system.

The first, indispensable step to avoid serious failures and dangerous situations, ought always to be a careful control of the installation of the mechanical parts (tank, reducer, mixer, Step actuator, connecting pipes, etc.) with the empty tank. The following step is to introduce no more than 4 ÷ 5 litres of gas in the tank, which can be used both to check whether there are any leakages and to carry out the first acquisition and self-configuration procedure (par. 3.4), whose last phase (STEP actuator reset acquisition) is performed while the vehicle is running on gas.

3.3. CONFIGURATION AND SETTING DOMAINS

The Just ECU with a microcontroller has been conceived in such a way as to minimise the adjustments necessary to start the installation.

The system set-up is substantially based on three different phases:

- first acquisition and self-configuration of the different signals used by the ECU (TPS, revolution signals, lambda signal) and acquisition of the STEP actuator reset position;

- additional manual setting with the possibility to check and possibly correct the acquired values and/or the default values;

- self-adapting of the system while the car working conditions and characteristics are changing, to assure the constant and continuous optimisation of the control strategies.

In particular, the configuration and setting domains of the Just ECU (the next paragraphs are dedicated to) are the following:

- First acquisition and automatic self-configuration;

- Additional manual setting and parameters set-up;

- Visualisation and modification of the emulated lambda signal duty cycle;

- Visualisation and modification of the STEP actuator reset position;

- System diagnostic.

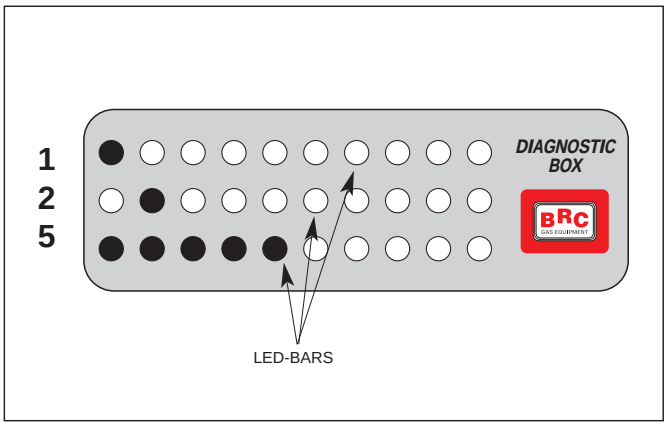

Fig. 20
Numeric value on the Diagnostic Box = 125

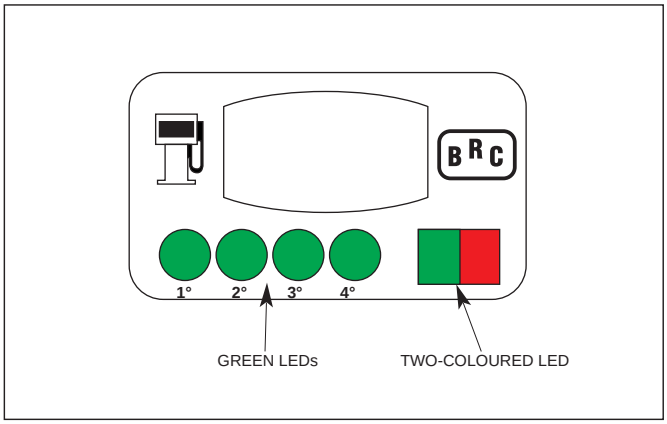

Fig. 21
Changeover switch: identification of the LEDs

3.3.1. LED READOUT ON THE CHANGEOVER SWITCH

During the setting the TWO-COLOURED LED assumes different colours (Green, Red, Yellow) and different working conditions (on, off, blinking). The GREEN LEDs are also used in different working conditions to allow a special encoding of the several setting phases. In this paragraph, and more specifically in the fig. 21 and 22, we intend to help the installer with the interpretation of the messages coming from the changeover switch.

The fig. 21 depicts the changeover switch. The GREEN LEDs can only assume a Green colour with a fixed or blinking turning on, whereas the TWO-COLOURED LED can each time appear Green, Yellow, Red, fixed or blinking.

The fig. 22 contains the caption for reading the messages supplied by the changeover switch.

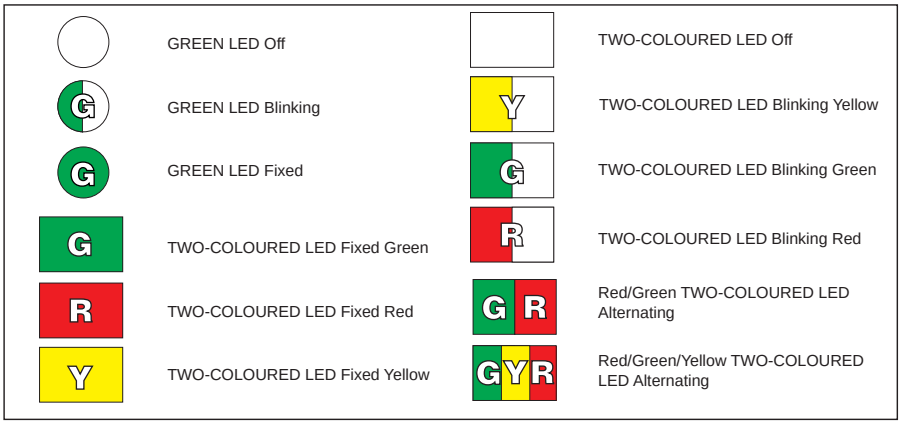

Fig. 22
Caption for the interpretation of the changeover switch leds

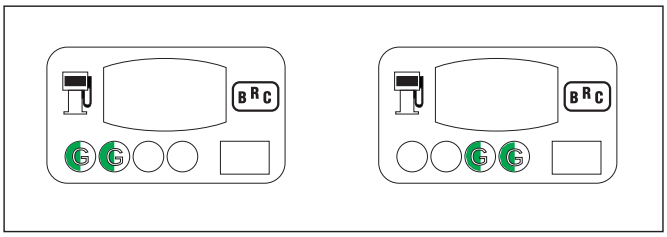

Fig. 23
Beginning of the first acquisition and self-configuration procedure

3.4. FIRST ACQUISITION AND AUTOMATIC SELF-CONFIGURATION

At the first ignition, when the setting operations have not been carried out yet, if the changeover switch is in the central position, the GREEN LEDs blink two at a time alternatively and the TWO-COLOURED LED is off (fig. 23). In such conditions the vehicle is only able to run on petrol.

Before using the gas ECU, it is necessary to carry out the first acquisition and self-configuration procedure. With the changeover switch in the petrol position, the GREEN LEDs are off and the TWO-COLOURED LED is fixed red. In such conditions the vehicle normally runs on petrol and the only visible signal on the Diagnostic Box is the lambda oxygen sensor one.

Before starting the procedure, we strongly recommend to put the changeover switch in the petrol position, to start the vehicle and to warm the engine up well. With the engine warmed up it will be sufficient to put the changeover switch in the central position to start the self-configuration procedure.

The vehicle will keep on running only on petrol.

The first acquisition and self-configuration procedure consists of **four phases**:

1) **TPS signal acquisition and self-configuration** (par. 3.4.1).

2) **R.p.m. signal acquisition and self-configuration** (par. 3.4.2).

3) **Lambda oxygen sensor signal acquisition and self-configuration** (par. 3.4.3).

4) **Step actuator reset position acquisition** (par. 3.4.4).

During the early three phases the vehicle only runs on petrol.

At the beginning of the fourth phase the system automatically changes over to gas and again to petrol when the phase is completed.

The Step actuator reset position is therefore carried out while running on gas.

To make its execution easier, the operator is informed on the work progress through a special encoding based on the colours of the TWO-COLOURED LED: as a general rule, a colour is associated to each phase and the TWO-COLOURED LED turning on mode distinguishes the condition of the phase in progress from the condition of the phase completed (see “D” Appendix for summarising outlines).

NOTE: It is possible to break off the first acquisition and self-configuration procedure every moment and to begin all over again by simply putting the changeover switch in the petrol position and getting back to the central position.

Warning: should a working anomaly occur (TWO-COLOURED LED on, alternating green - yellow - red), in any moment of the first acquisition and self-configuration procedure, after trying to troubleshoot (par. 3.9), it is necessary to turn the vehicle off, to disconnect the ignition key and to begin all over again.

3.4.1. ACQUISITION AND SELF-CONFIGURATION OF THE TPS SIGNAL

- After having warmed the engine up well with the changeover switch in the petrol position, **leave the engine idling and put the changeover switch in the central position.**

During this phase the vehicle only runs on petrol.

- **After approx. 10÷15 seconds, the TWO-COLOURED LED turns on fixed red** (beginning of the TPS acquisition phase) (fig. 24).

- **Accelerate uniformly and thoroughly 3 times**

- During this phase the min. and the max. TPS are determined and it is possible to ascertain whether the TPS signal is direct or inverted.

- **If the operation has been carried out correctly, the TWO-COLOURED LED turns red blinking and indicates the end of the TPS acquisition phase (fig. 25).**

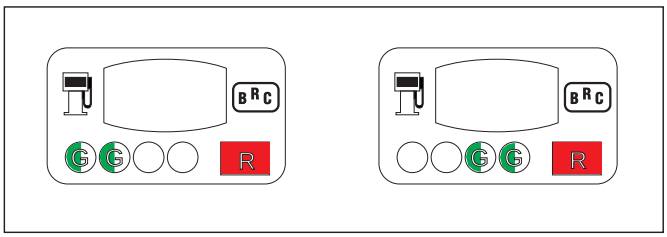

Fig. 24
TPS signal acquisition and self-configuration

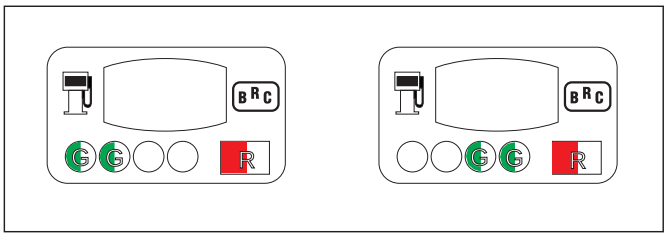

Fig. 25
End of the TPS signal acquisition

3.4.2. ACQUISITION AND SELF-CONFIGURATION OF THE R.P.M. SIGNAL

- **After the TPS acquisition phase (red blinking TWO-COLOURED LED), leave the changeover switch in the central position and the engine idling (accelerator thoroughly released) and wait.**

During this phase the vehicle only runs on petrol.

- **After approx. 5 seconds the TWO-COLOURED LED turns on fixed green** (beginning of the r.p.m. signal acquisition phase) (fig. 26).

- **Wait with the accelerator thoroughly released** (if the accelerator is not released thoroughly, the acquisition is not carried out).

- During this phase the type of r.p.m. signal used by the ECU is recognised.

- **After approx. 10 seconds the TWO-COLOURED LED turns green blinking and indicates the end of the r.p.m. signal acquisition phase (fig. 27).**

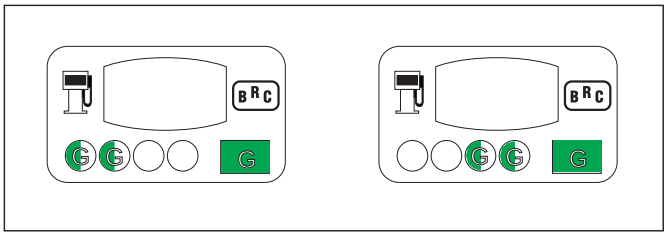

Fig. 26
Acquisition and self-configuration of the r.p.m. signal

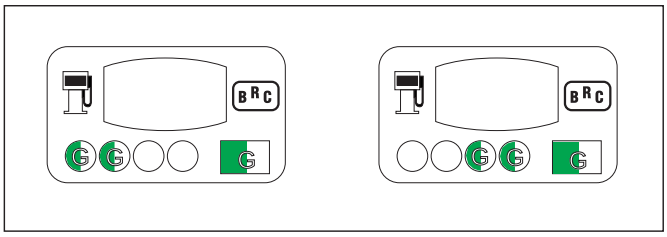

Fig. 27
End of the r.p.m. signal acquisition

- From now on, the r.p.m. indication on the first LED-BAR of the Diagnostic Box is configurated correctly (whereas so far it is likely not to correspond to the actual r.p.m., according to the vehicle type).

WARNING: if you are sure that there is no correspondence between the actual r.p.m. and the ones visualised on the Diagnostic Box (error factor = 1/4, 1/2, 2 or 4), it is advisable to break off the first acquisition and self-configuration procedure by putting the changeover switch in the petrol position and to repeat by putting the changeover switch in the central position again.

3.4.3. ACQUISITION AND SELF-CONFIGURATION OF THE LAMBDA OXYGEN SENSOR SIGNAL

- After the r.p.m. signal acquisition, the acquisition and the self-configuration phase of the lambda oxygen sensor starts.

During this phase the vehicle only runs on petrol.

- **In order to enter the acquisition domain of the lambda oxygen sensor, it is necessary to constantly keep the engine at 3000 r.p.m.**

- **If the r.p.m. is kept on a correct value, the TWO-COLOURED LED turns on fixed yellow** and the acquisition phase of the lambda oxygen sensor starts (fig. 28).

- **Every time you exit (on purpose or by mistake) from the acquisition r.p.m. window, the TWO-COLOURED LED becomes green blinking again and the acquisition of the lambda signal is broken off.**

To start the acquisition again it is necessary to restore the r.p.m. near the value wanted (3000 r.p.m.).

- The acquisition phase of the lambda signal has a variable duration (from approx. 20 to 30 seconds) according to the lambda oxygen sensor type of the vehicle.

- During this phase it is possible to determine the amplitude of the lambda oxygen sensor signal (0 ÷ 1 V; 0.7 ÷ 1.5 V; 0 ÷ 5 V), the max. and min. values of such a signal and the lambda oxygen sensor type (normal, with absorption, or with resistive pull-up).

- **During the acquisition phase the r.p.m. probably tends to change and the lambda signal on the Diagnostic Box remains fixedly rich or lean for some seconds: this belongs to the acquisition procedure and is not indicative of any failure of the vehicle.**

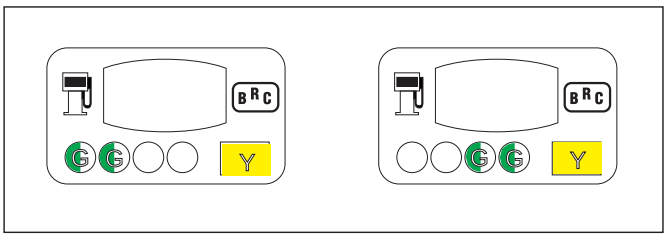

Fig. 28
Acquisition and self-configuration of the lambda oxygen sensor signal

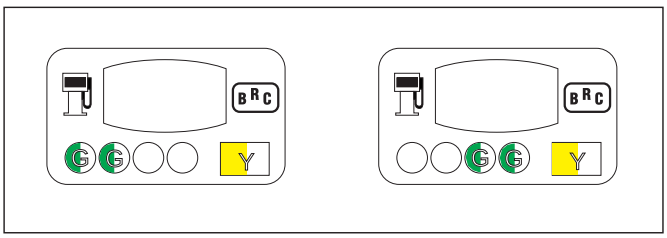

Fig. 29
End of the acquisition of the Lambda oxygen sensor signal

- The only operation the installer ought to carry out is to keep the r.p.m. around the specified value (3000 r.p.m.).

- **If the setting phase of the lambda signal is successful, the TWO-COLOURED LED turns yellow blinking and indicates its conclusion** (fig. 29).

3.4.4. Acquisition of the reset position of the Step actuator

- After the acquisition phase of the lambda oxygen sensor (TWO-COLOURED LED blinking yellow), **go on keeping the engine at 3000 r.p.m.**

- **After approx. 3 seconds, the system automatically changes over to gas and the TWO-COLOURED LED alternatively turns on red and green** to indicate the beginning of the acquisition phase of the STEP actuator reset position (fig. 30).

- **The reset search and acquisition are carried out only if the r.p.m. is outside the idling and cut-off conditions,** and the permanence in the correct r.p.m. for the reset acquisition is continuously pointed out with the TWO-COLOURED LED alternatively turning on red and green.

- **Should the pre-established working conditions be left, the TWO-COLOURED LED turns off and it is then necessary to restore the suitable working conditions of the engine.**

- **Keep the engine inside the suitable r.p.m. window** till the reset position acquisition is indicated.

- **While the reset position is determined, the vehicle changes over to petrol again, all the GREEN LEDs of the changeover switch turn off and on the LED-BARS of the Diagnostic Box the reset position acquired is only indicated whereas respectively the r.p.m. signal, the lambda signal and the step motor position aren't anymore, according to the encoding already described in the paragraph 3.1.2:**

- the first LED-BAR shows the hundreds, namely the number of LEDs on starting from the left side shows the hundreds (typically no LED or one LED on);

- the second LED-BAR shows the decimals, namely the number of the LED on starting from the left side shows the decimals;

- the third LED-BAR shows the units, namely the number of LEDs on starting from the left side shows the units.

If, by way of example, the reset acquired is 85, the LED-BARS of the Diagnostic Box would appear like in the fig. 31.

You are reminded that the step motor position ranges from 0 (all closed) to 255 (all open), with proper restrinctions on the max. possible ranges.

The search of the reset position is carried out starting from an actuator default reset position of 100.

Until the searching phase of the reset position starts, the third LED-BAR constantly shows this default reset position (100), with the early 5 red LEDs on.

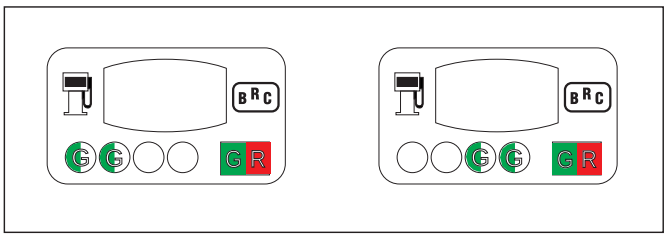

Fig. 30
Acquisition of the Step actuator reset position

During the searching phase, the position visualised on the third LED-BAR is continuously updated according to the STEP shift.

Since every LED corresponds to two steps, it is possible to visualise the STEP dynamics in a window ranging from 90 to 110 steps.

In any case, the reset definitive position acquired is exactly visualised on the Diagnostic Box.

Once the reset position has been acquired, the first acquisition and self-configuration procedure is over and all the values acquired and the configurations done have been stored.

It is necessary to stop the engine and to turn the ignition key off to get out from the domain.

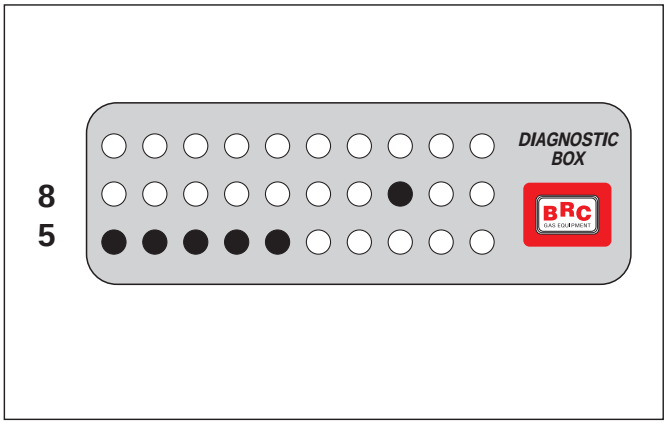

Fig. 31
Visualisation of the reset acquired on the Diagnostic Box

3.5. ADDITIONAL MANUAL SETTING AND PARAMETERS SETUP

After the first acquisition and self-configuration phase, at the next ignition the system is already able to run on gas.

Before running the vehicle on gas, it is anyway necessary to complete the setting-up phase through a series of manual setting operations, some of them indispensable (such as the level gauging adjustment, the configuration of the NP - NC1/NC2 relay and the ON/OFF analogic TPS setting), **others optional** (such as the changing over threshold and the fuels overlapping time).

3.5.1. ACTIONS TO BE TAKEN IN THE ADDITIONAL MANUAL SETTING DOMAINS

To enter the domain dedicated to the additional manual setting, the following operations are necessary:

- **Start the engine and leave it idling with the changeover switch in the central position and the vehicle running on petrol** (do not carry out the changing over to gas).

- **Starting with the changeover switch in the central position, do 3 petrol position > central position transitions in no more than 3 seconds** (you cannot stop for more than half a second in the same position, otherwise you have to start the whole sequence again).

- **After the 3 transitions the fourth GREEN LED blinks to indicate the entry in the first manual setting domain.**

- **The TWO-COLOURED LED is off if the manual setting of this domain has never been carried out, whereas it blinks if the setting of the first domain has already been carried out at least once.**

- **The passage from a manual setting domain to the next one is obtained by changing over from the central position > gas position.**

(If you want, for example, to enter the fourth domain without setting the previous ones, three subsequent transitions from central position to gas position are necessary).

- **The different domains (7 altogether) are indicated by a binary code on the GREEN LEDs.**

- Once you have got to the last manual setting domain, a subsequent transition of the changeover switch from the central position to the gas position leads to the first setting domain again (cyclical management).

- **The acquisition or the setting relating to the referred domain is obtained by changing over from the central position > petrol position.**

- **For every manual setting domain the TWO-COLOURED LED assumes the following meanings:**

- **off: the current domain has never been set;**

- **fixed green (or red) on: acquisition relating to the current domain completed or in progress;**

- **blinking green (or red): setting relating to the current domain already carried out at least once.**

- **To exit in any moment from the manual setting domain it is necessary to disconnect the ignition key.**

The detailed description of the different setting domains, of the attendant encoding on the changeover switch LEDs and of the parameters acquisition modes is presented in the following paragraphs.

The condition of the TWO-COLOURED LED depicted in the figures of the following paragraphs refers to the first time the additional manual setting domain is entered.

3.5.2. LOW LEVEL GAUGE THRESHOLD SETTING (EMPTY TANK)

When entering this setting domain, refer to what have been just stated in the par. 3.5.1.

The setting domain is visualised in the fig. 32 and is used for acquiring the fuel min. level.

Please remember that the condition of the TWO-COLOURED LED quoted in the figure refers to the first time this setting domain is entered.

The necessary operations are the following:

- **Carry out the setting operations while the tank is empty.**

- **Put the changeover switch from the central position to the petrol position to acquire the level currently present in the tank as the min. level; the TWO-COLOURED LED turns fixed green** (showing that the datum has been acquired).

- **Getting back to the central position, the TWO-COLOURED LED turns blinking green** (showing the setting already carried out) and will remain like that in the following accesses to this setting domain too.

Even if the setting operation has already been carried out, it is possible to repeat it and to acquire a new value with the same acquiring process.

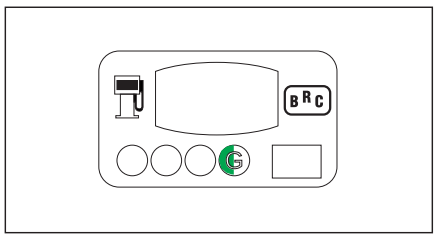

Fig. 32
Low level gauge threshold setting

3.5.3. 4/4 THRESHOLD OF THE LEVEL GAUGE (80% FILLING)

When entering this setting domain, refer to what has been stated in the par. 3.5.1.

The setting domain is visualised in the fig. 33 and is used for acquiring the 4/4 level of fuel.

Please remember that the condition of the TWO-COLOURED LED depicted in the figure refers to the first time this setting domain is entered.

The necessary operations are the following:

- **Carry out the setting operations while the tank is full (4/4).**

- **Put the changeover switch from the central position to the petrol position to acquire the level currently present in the tank as the 4/4 level; the TWO-COLOURED LED turns fixed green** (showing that the datum has been acquired).

- **Getting back to the central position, the TWO-COLOURED LED turns blinking green** (showing the setting already carried out) and will remain like that in the following accesses to this setting domain too.

Even if the setting operation has already been carried out, it is possible to repeat it and to acquire a new value with the same acquiring process.

3.5.4. CHANGING OVER THRESHOLD

When entering this setting domain, refer to what has been stated in the par. 3.5.1.

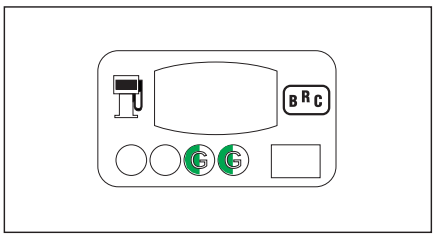

Fig. 34
Changing over threshold setting

The setting domain is visualised in the fig. 34 and is used for modifying the changing over threshold.

Please remember that the condition of the TWO-COLOURED LED depicted in the figure refers to the first time this setting domain is entered.

The necessary operations are the following:

- **Run the engine at the r.p.m. wanted** (included between 1500 and 4500 r.p.m.) **and move the changeover switch from the central position to the petrol position to acquire the current r.p.m. as the revolution threshold above which changing over to gas is allowed; the TWO-COLOURED LED turns fixed green** (showing that the datum has been acquired).

- **Getting back to the central position, the TWO-COLOURED LED turns blinking green** (showing the setting already carried out) and will remain like that in the following accesses to this setting domain too.

Even if the setting operation has already been carried out, it is possible to repeat it and to acquire a new value with the same acquiring process.

3.5.5. NP - NC1/NC2 RELAY CONFIGURATION

When entering this setting domain, refer to what has been stated in the par. 3.5.1.

The setting domain is visualised in the fig. 35 and is used for changing the contact configuration of the relay coming out from the White and White/Orange wires.

- The possible functions are the function of the “no-problem”(NP) device, for resetting the petrol injection ECU memory, and the function of relay contact for cutting the (NC1/NC2) signal.

- **The TWO-COLOURED LED blinking green shows that there is already a default setting and this is the NP function.**

- **By putting the changeover switch from the central position to the petrol position the current setting-up of the relay is changed, by selecting in this case the NC1/NC2 function, and the setting-up is shown by the fixed red TWO-COLOURED LED.**

- **Getting back to the central position, the TWO-COLOURED LED turns blinking red** (setting carried out and NC1/NC2 setting-up).

Even if the setting operation has already been carried out, it is possible to pass from a setting-up to another of the relay function, by repeating the same process.

Warning: the NP – NC1/NC2 relay setting-up ought to correspond to the configuration adopted in the connections of the harness to the ECU (see par. 2.3.3.9).

3.5.6. FUELS OVERLAPPING TIME

When entering this setting domain, refer to what has been stated in the par. 3.5.1.

The setting domain is visualised in the fig. 36 and is used for modify-

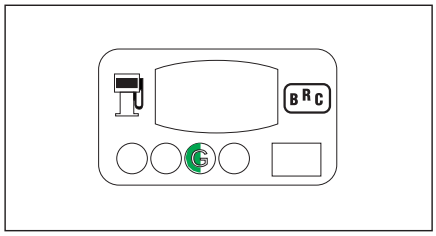

Fig. 33
4/4 level threshold setting

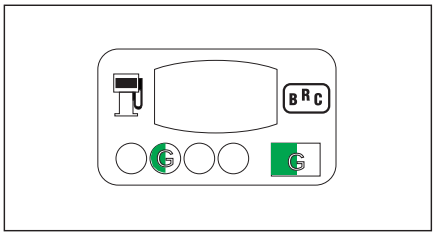

Fig. 35
Configuration of the NP - NC1/NC2 relay

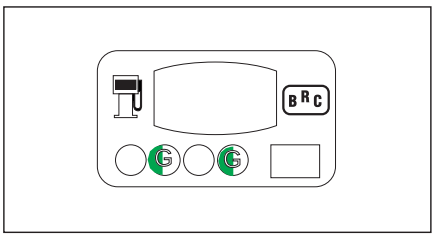

Fig. 36
Fuel overlapping time setting

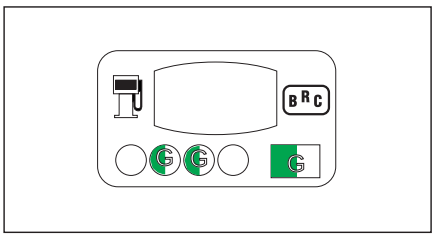

Fig. 37
On/Off-Analogic TPS setting

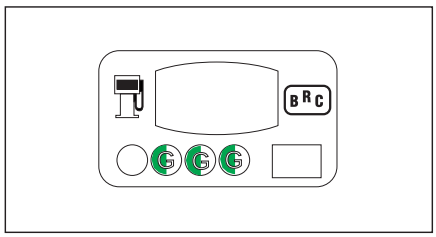

Fig. 38
Parameters set-up

ing the fuels overlapping time while changing over from petrol to gas.

Please remember that the condition of the TWO-COLOURED LED depicted in the figure refers to the first time this setting domain is entered.

- **By putting the changeover switch from the central position to the petrol position the TWO-COLOURED LED turns fixed green and the current fuels overlapping time is visualised for 3 seconds on the GREEN LEDs, according to the following encoding:**

- **no GREEN LED on: no overlapping**

- **1° GREEN LED on: 3 tenths of second**

- **2° GREEN LED on: 6 tenths of second**

- **3° GREEN LED on: 9 tenths of second**

- **4° GREEN LED on: 12 tenths of second**

- **After 3 seconds, the overlapping time is continuously increased by 3 tenths of second each time and the visualisation on the GREEN LEDs is updated** (when 12 tenths are reached, start from the beginning and so on).

- **By putting the changeover switch in the central position again, the currently visualised overlapping time is acquired and the TWO-COLOURED LED turns green blinking** (showing the setting already carried out).

In this case too it is possible to repeat the setting operation and to acquire a new value with the same acquiring process.

3.5.7. ANALOGIC-ON/OFF TPS SETTING-UP

When entering this setting domain, refer to what has been stated in the par. 3.5.1.

The setting domain is visualised in the fig. 37 and is used for programming the TPS signal type (analogic or ON/OFF) present on the vehicle.

- **The TWO-COLOURED LED blinking green shows that there is already a default setting considering the TPS of the analogic type.**

- **By putting the changeover switch from the central position to the petrol position, the current TPS setting-up is changed, passing to the ON/OFF type and the selection done is shown through the fixed red TWO-COLOURED LED.**

- **Getting back to the central position, the TWO-COLOURED LED turns red blinking** (setting carried out and TPS setting-up of the ON/OFF type).

Even if the setting operation has already been carried out, it is possible to pass from a setting-up to another of the TPS type, by repeating the same process.

3.5.8. PARAMETERS SET-UP

When entering this setting domain, refer to what has been stated in the par. 3.5.1.

The setting domain is visualised in the fig. 38 and is used for completely annulling any setting already carried out on the system. **The necessary operations are the following:**

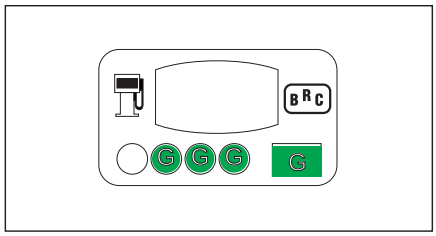

Fig. 39
Set-up done

- **Put the changeover switch from the central position to the petrol position.**

- **Remain in this position for 5 seconds at least.**

- **Once the setup has taken place, all the setting operations carried out on the ECU have been completely cancelled.**

- The second, the third and the fourth GREEN LED of the encoding and the TWO-COLOURED LED remain fixedly on (fig. 39) and the three LED-BARS of the Diagnostic Box thoroughly turn off.

After this operation it is necessary to switch the vehicle off and to reset the ECU completely, by repeating the first acquisition and self-configuration procedure too.

Warning! Perform the operation only if you are really convinced!

3.6. DUTY CYCLE VISUALISATION AND MODIFICATION OF THE LAMBDA OXYGEN SENSOR EMULATED SIGNAL

To enter the duty cycle visualisation and modification domain of

the lambda emulated signal, the following operations are necessary:

- **Connect the ignition key without starting the vehicle, with the changeover switch in the central position.**

- **Beginning with the changeover switch in the central position, carry out 3 petrol position > central position transitions in no more than 3 seconds** (you cannot stop for more than half a second in the same position, otherwise you have to start the whole sequence again).

- **After the 3 transitions the changeover switch LEDs are all off, whereas the duty cycle per cent value (0 ÷ 100%) of the lambda oxygen sensor emulated signal is visualised on the Diagnostic Box, according to the encoding already presented for the reset:**

- the first LED-BAR shows the hundreds, namely the number of LEDs on starting from the left side shows the hundreds;

- the second LED-BAR shows the decimals, namely the number of the LED on starting from the left side shows the decimals;

- the third LED-BAR shows the units, namely the number of LEDs on starting from the left side shows the units.

- **The default value at the end of the first acquisition and self-configuration procedure is = 46** (fig. 40).

- **Putting the changeover switch from the central position to the gas position, the current duty cycle value is increased by one** (and the visualisation on the Diagnostic Box is updated).

- Putting the changeover switch from the central position to the petrol position, the current duty cycle value is decreased by one (and the visualisation on the Diagnostic Box is updated).

- **To acquire the new duty cycle value it is necessary to disconnect the ignition key.**

3.7. VISUALISATION AND MODIFICATION OF THE STEP RESET POSITION

For entering the step reset position visualisation and modification domain, the following operations are necessary:

- **With the changeover switch in the central position, start the vehicle on petrol and run the engine above 1500 r.p.m., without changing over to gas.**

- **In such conditions, beginning with the changeover switch in the central position, carry out 3 petrol position > central position transitions in no more than 3 seconds** (you cannot stop for more than half a second in the same position, otherwise you have to start the whole sequence again).

- **After the 3 transitions the changeover switch LEDs are all off, whereas the current reset position is visualised on the Diagnostic Box, according to the encoding already presented** (par. 3.4.4).

- **The accelerator can be thoroughly released and the engine can be left running on petrol.**

- **Putting the changeover switch from the central position to the gas position, the current reset position is increased by one** (and the visualisation on the Diagnostic Box is updated).

- **Putting the changeover switch from the central position to the petrol position, the current reset position is decreased by one** (and the visualisation on the Diagnostic Box is updated).

- The reset position cannot be over the pre-fixed thresholds.

- **To acquire the new reset position it is necessary to switch the vehicle off.**

- **During the permanence in this setting domain, the vehicle only runs on petrol.**

The use of such a setting domain is only recommended for the reset visualisation. We actually advise you against "intuitively" modifying the reset position value, since any possible corrections have been already made by the self-adapting procedure (par. 3.8).

3.8. SELF-ADAPTING

As we have already told in the Chapter 1, particular self-adapting strategies have been implemented in the Just system while the vehicle working conditions and characteristics vary, in order to assure the constant and continuous optimisation of the control potential.

The properties and the features of such strategies can be summed up in two main aspects:

- **constant control and**

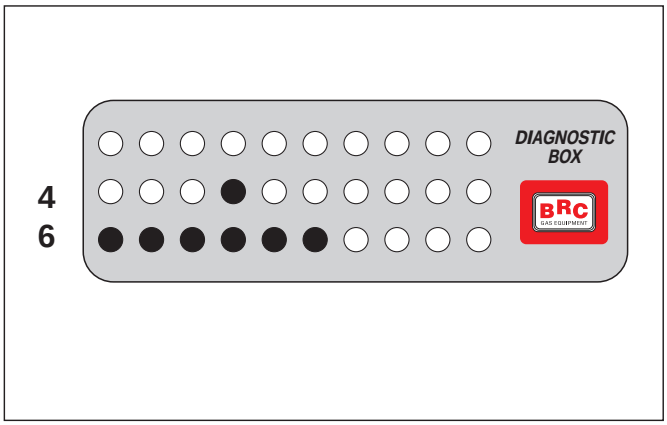

Fig. 40
Duty-cycle default value of the lambda signal emulated

updating of the signals used by the system, with any possible corrections in the configurations done during the first setting operation;

- **dynamism and continuous updating of the STEP actuator reset position, able to self-adapt according to the changes in the car features and different driving conditions.**

In particular, the reset self-adapting is aimed at optimising the mixture control in every situation, by assuring a greater stability of the system at normal load and a high promptitude in the transient conditions.

Another purpose of the reset self-adapting is to optimise its position rapidly in case a value not corresponding to the working actual one has been acquired during the first acquisition. In this case, the reset meets the optimum one while driving on road.

3.9. SYSTEM DIAGNOSTIC

The Just ECU is provided with a self-diagnosing system indicating the working anomalies with an encoding on the GREEN LEDs and alternating the green - yellow - red colours on the TWO-COLOURED LED.

Should any anomaly occur, switch the vehicle off completely, by disconnecting the ignition key too, and try to troubleshoot.

If the cause has been actually removed, at the next ignition the system will work correctly again.

If the cause has not been determined or removed, at the next ignition, the anomaly noticed is likely to reveal itself again.

Should you notice any anomaly during the first acquisition and self-configuration procedure, start such a procedure again from the beginning.

Should any anomaly occur while the vehicle is running on gas, this one goes on running on gas, but the STEP actuator stands in the reset position (control in the emergency conditions).

List of the working anomalies and of the attendant encoding on the changeover switch LEDs.

Lambda oxygen sensor signal transitions not detected or lambda oxygen sensor working incorrectly (fig. 41).

The anomaly is pointed out if no oscillations of the lambda oxygen sensor are noticed for a prolonged time, both in the first acquisition phase and while the vehicle is normally running on gas.

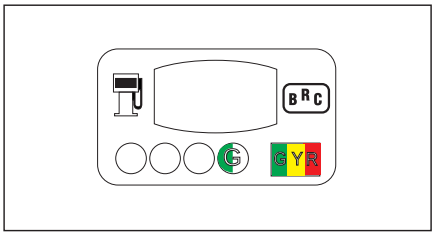

Fig. 41 - Anomaly of the lambda oxygen sensor signal

Problems in the connection of the gas solenoid valves (fig. 42).

This anomaly is a sign of working problems of the gas solenoid valves (there is a trouble on at least one solenoid valve). The problem nature is to be sought in an interrupted connection, in a damaged solenoid valve or in a solenoid valve short-circuited towards the earth.

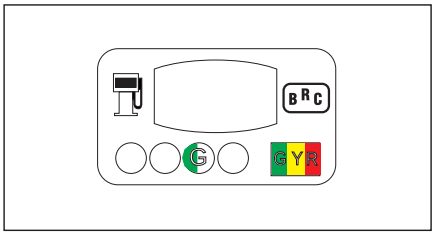

Fig. 42 - Anomaly of the gas solenoid valves

Problems on the TPS signal during the first acquisition procedure (still below a minimum threshold or not connected correctly) (fig. 43).

The TPS signal control is made in the first acquisition and self-configuration phase and the anomaly is a sign of an incorrect connection of the White/Violet wire (par. 2.3.3.10) or of a failure of the potentiometer proportional to the throttle body position.

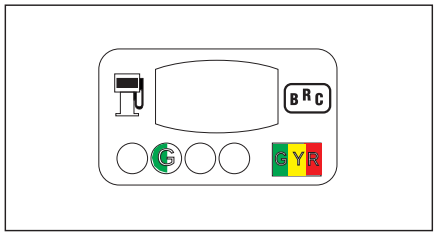

Fig. 43 - Anomaly of the TPS signal

Error or problems in the acquisition procedure of the STEP actuator reset position (fig. 44).

We have already stated that the STEP actuator cannot move beyond certain opening and closing limits. In particular the reset acquired during the first acquisition phase ought to be included in a value window too.

If the anomaly is noticed, it means that the STEP actuator tries to move to an incorrect working position, without managing to assure the control stoichiometry.

It is necessary to check the equipment well and to reckon whether the reducer and the mixer are damaged or wrongly installed.

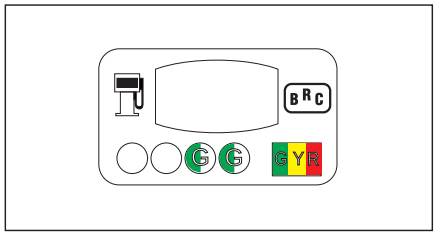

Fig. 44 - Anomaly of the STEP actuator reset acquisition

Working problems of the ECU EEPROM (fig. 45).

If this anomaly occurs, the ECU is seriously damaged and it is not possible to try to find a remedy for the problem. Apply immediately to the BRC Technical Servicing.

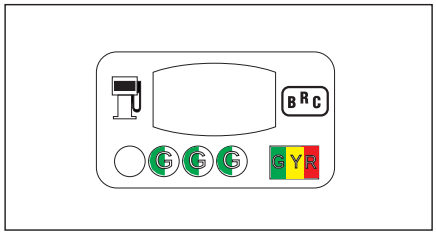

Fig. 45 - EEPROM Anomaly

M.T.M. s.r.l. Via La Morra, 1 - 12062 - Cherasco (Cn) - Italy