

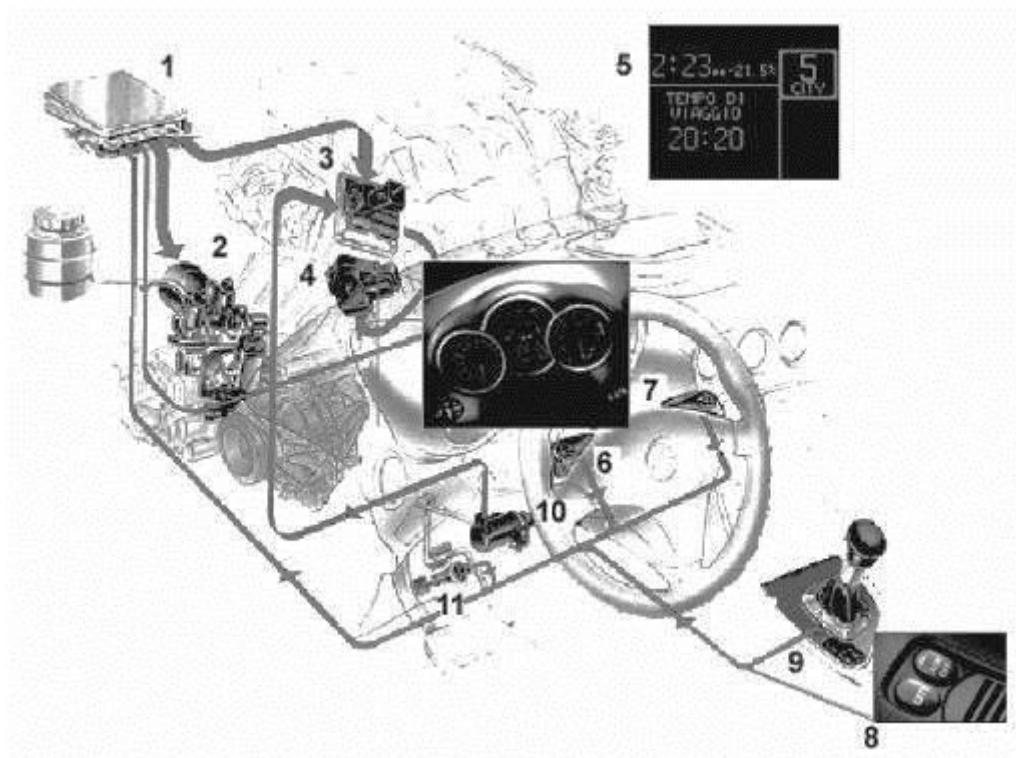
Alfa Romeo Selespeed

Introduction

The concept of the Selespeed transmission system for Alfa Romeo 147 follows the aim already developed on the Alfa Romeo 156 from which it originates. The aim is to improve performance of the manual gearbox transmission components. To avoid that the driver has to check the clutch pedal and the gear control lever but at the same time ensuring the driving pleasure that comes from direct control of transmission. To improve driving safety by a direct control that foresees the errors of the driver and prevents an incorrect control of the transmission system. Offers the driver a more advanced car interface. It should be remembered that the system essentially consists of a mechanical transmission, with dry monodisk clutch and synchronised mechanical gear, moved by hydraulic power. As previously with the Alfa Romeo 156, neither the clutch nor the gearbox is changed to install the hydraulic actuators that control the stroke of the clutch and the gear engagement and selection. An electronic control unit manages a complex functioning logic that permits the use of the gearbox:

- in **"semi-automatic" conditions**, where the driver controls the gear engagement by the lever on the tunnel or with two push-buttons.
- In **"automatic" mode, called "City"** that assigns the decision to change gear to the electronic system. The clutch pedal has been eliminated, the traditional "H" gear lever of manual transmission has been replaced by a specific "Joystick" lever and two "UP-DOWN" buttons on the steering wheel.

Figure. 1



1. Control unit
2. Electro-hydraulic group with electric pump
3. Engine control unit (Bosch M7.3.1)
4. Motorised throttle case (D.V.E.)
5. Gear selection display
6. Down-gear button (Down)
7. Up-gear button (Up)
8. "City" mode button
9. Gear control selection lever
10. Accelerator
11. Switch on brake pedal

Power steering system that essentially consists of an electro-hydraulic group (2) mounted directly onto the gearbox. By means of two pistons it manages the gear selection and engagement. The two pistons are controlled by a group of solenoid valves, to which an electric pump and an accumulator supply the required hydraulic power. An electronic control unit (1) having identified the requirements of the driver from the lever (9) or from buttons (6) and (7) autonomously manages the gear change, directly controlling clutch, gearbox and engine torque. During the gear shift the engine control is subordinated to the gear control. **The gear - engine interface** considerably improves the system performance and relieves the driver of any need to synchronise the clutch-accelerator movements during the gear change, that can be effected with the accelerator always fully pressed down. Furthermore, the system inhibits incorrect requests to change gear and avoids engine stalling. In terms of aid to driving it also ensures: immediate availability of first gear when the vehicle stops; automatic downward gear change in the case of a strong deceleration. The gear engaged is shown on a display built into the panel on board (central display), whereas indications of faults or driving conditions critical for the vehicle or for transmission components are indicated directly on the display highlighting the text: Selespeed system fault, and, on the right of the panel the gearbox fault symbol is shown.

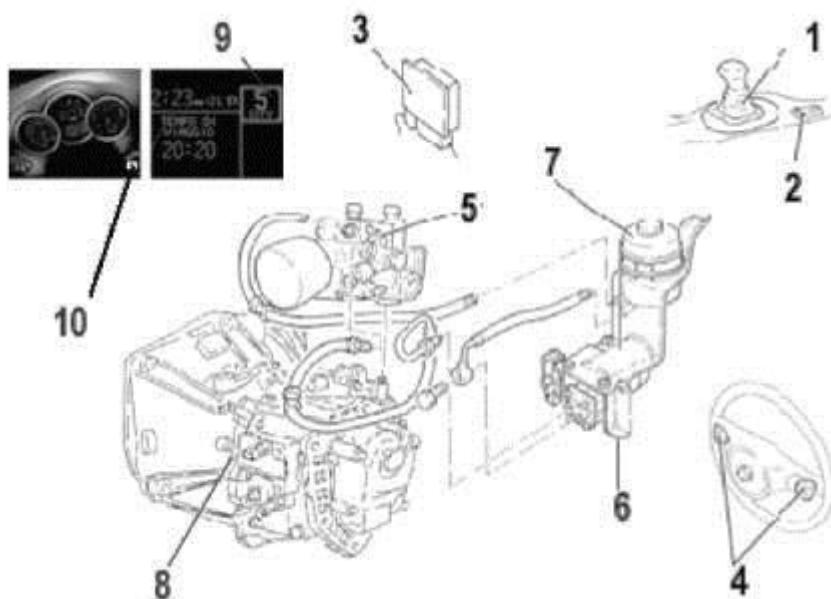


Figure 2. Selespeed system components

Key

1. Gear selection lever
2. "City" button
3. Selespeed control unit (assembled in passenger compartment under the dashboard, passenger side)
4. Gear selection buttons on steering wheel
5. Electro-hydraulic group
6. Electric pump
7. Hydraulic oil pump
8. Speed sensor on gearbox
9. Gear selection display
10. Fault warning light

Selespeed system components

These are integrated to the manual transmission with no special modifications to the clutch and the internal part of the gear, only the gearbox is changed to permit the fastening of the hydraulic actuators that control the clutch and the gear engagement selection. The clutch pedal has been eliminated, therefore for a breakaway start only the accelerator pedal is used. By means of an electro-hydraulic group, the electronic control unit manages gear engagement both in semi-automatic and automatic mode. **Semiautomatic, or manual**, the driver makes a direct gear change by activating the lever on the centre console or through the buttons on the steering wheel. **Automatic**, also called "city", in this configuration it is the system that makes the decision as to when to change gear. The advantages are: the driver does not have to use the clutch pedal and the gear shift lever, but is not deprived of the pleasure of driving that comes from direct control of transmission. The CFC 208 is set to:

- acquire the signals coming from the different sensors
- interface with the engine control unit (Motronic M7.3.1)
- control the hydraulic system
- manage the information display and buzzer

The CFC 208F input signals are the following:

- rpm, (from rev. counter through Bosch Motronic control unit M7.3.1)
- gearbox input revs
- car speed (information to CAN line)
- clutch actuator position
- selector actuator position
- engagement actuator position
- key in travel position
- door switch status driver side
- brake pedal switch status

- electro-hydraulic group oil pressure
- CAN line signal (position of accelerator pedal, engine torque, water temperature, etc.)
- gear change request from buttons or lever
- +50 engine ignition.

The interface with C.C.M. M7.3.1 is managed on the CAN line. To control the hydraulic actuation sub-system the CFC 208F has:

- 1 output to adjust the proportional flow-rate solenoid valve for clutch control
- 2 outputs to adjust the proportional pressure solenoid valve for gear engagement control
- 2 outputs to control the on/off solenoid valves to control selection
- 1 output to control the electric pump
- 1 output to control the ignition relay

The CFC 208F also gives the start enable.

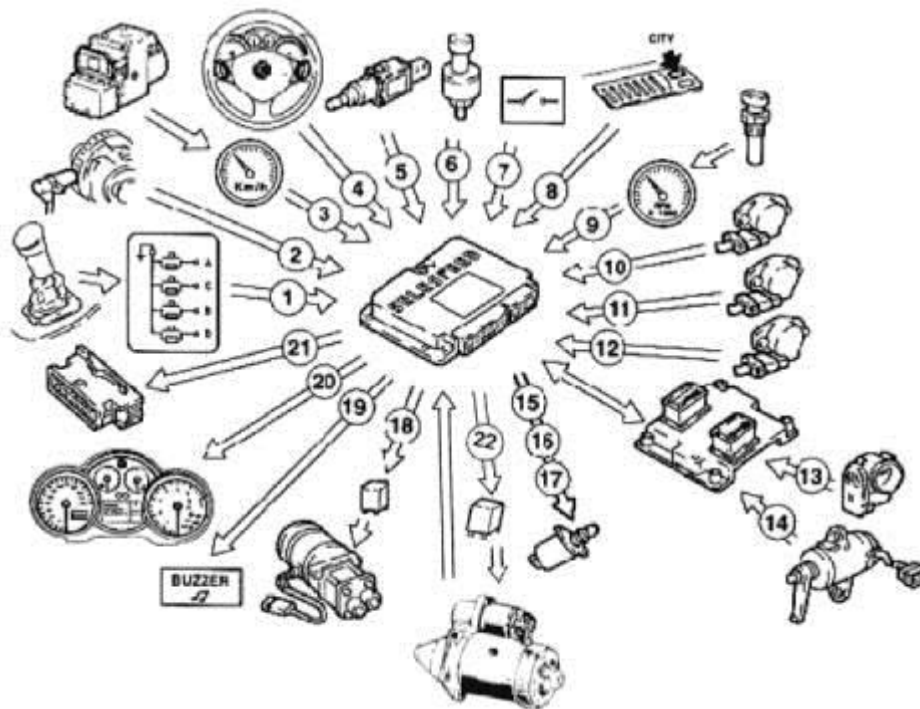


Figure. 3. Selespeed Alfa Romeo 147 functional diagram

Key

1. Gear selection lever switch
2. Engine rpm sensor (CAN line from CCM)
3. Car speed signal on CAN line from ABS
4. Gear shift buttons
5. Brake pedal switch
6. Oil pressure sensor
7. Door switch driver side
8. City button
9. Gearbox input revs sensor

10. Clutch position sensor
11. Gear selection position sensor
12. Gear engagement position sensor
13. DVE motorised throttle case (CAN line from CCM)
14. Accelerator pedal potentiometer (CAN line from CCM)
15. Pressure proportional solenoid valves (2)
16. On-off solenoid valves (2)
17. Flow rate proportional solenoid valve
18. Electric pump
19. Buzzer
20. On-board panel
21. Diagnostics socket
22. Start enable relay

Hydraulic system

The hydraulic system is the part of the Selespeed that in the practical sense, has the task of the selection - engagement of the required gear. Basically it consists of:

- A power group to pressurise the circuit
- Two actuators to control the gear shaft
- An actuator to control the clutch
- Sensors for system monitoring by the control unit

The hydraulic system has these functions:

1. To supply the hydraulic energy needed to control the actuators
2. Gear shaft control
3. Clutch control

The fundamental function of the hydraulic system is to supply the hydraulic energy to control the actuators (gear change). Therefore the possibility to change gear is tightly bound to the pressure of the oil in the circuit, with values between 45 and 55 bar (653 to 798 psi). The main technical specifications that are necessary for the system to ensure correct operation are:

- Hydraulic working pressure between 45 and 55 bar (there is a pressure relief valve to avoid system over-pressure)
- Working temperature between -30°C and +125°C
- Starting must also be possible with a temperature of -30°C
- The pump flow rate must be 0.8l/min at 60°C
- The accumulator volume must be 350 cm³ at 20°C (this value is important because it determines the discharge time)
- The oil used is Tutela CS Speed.

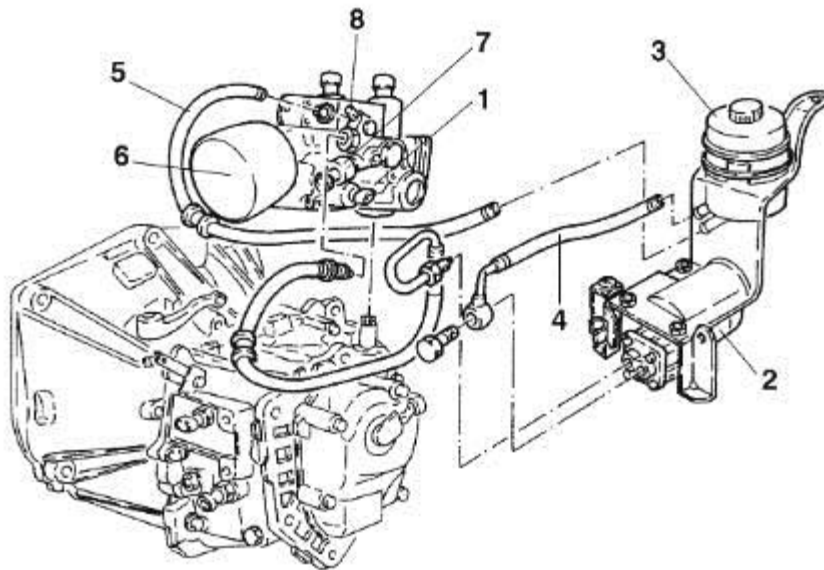


Figure. 4. Hydraulic system

Key

1. Electro-hydraulic group
2. Oil pump
3. Oil tank
4. Oil inlet pipes
5. Discharge pipes
6. Accumulator
7. Oil pressure sensor
8. Oil bleeding screw

Operation

As can be seen from figures 5 and 6, the CFC 208F control unit, before each gear change, activates the clutch (1) by a servo actuator and a solenoid valve (EV0) controlled by the control unit. The control function of the gear shaft takes place in these steps:

- Selection lever activation
- Transmission of the selection lever position to the control unit
- Activation of engagement lever
- Transmission of the engagement lever position to the control unit

The components involved in the gear change are:

- Selection actuator
- Selection potentiometer
- Wiring harness between selection potentiometer and sectioning connector

- Selection solenoid valve EV3
- Wiring harness between selection solenoid valve EV3 (gear selection range 1-2) and the sectioning connector
- Selection solenoid valve EV4
- Wiring harness between selection solenoid valve EV4 (gear selection range 5 - R) and the sectioning connector
- Gear engagement actuator
- Engagement potentiometer
- Wiring harness between engagement potentiometer and sectioning connector
- Engagement solenoid valve EV1 (to engage odd gears 1-3-5)
- Wiring harness between engagement valve EV1 and the sectioning connector
- Engagement solenoid valve EV2 (to engage even gears 2-4-R)
- Wiring harness between engagement solenoid valve EV2 and sectioning connector.

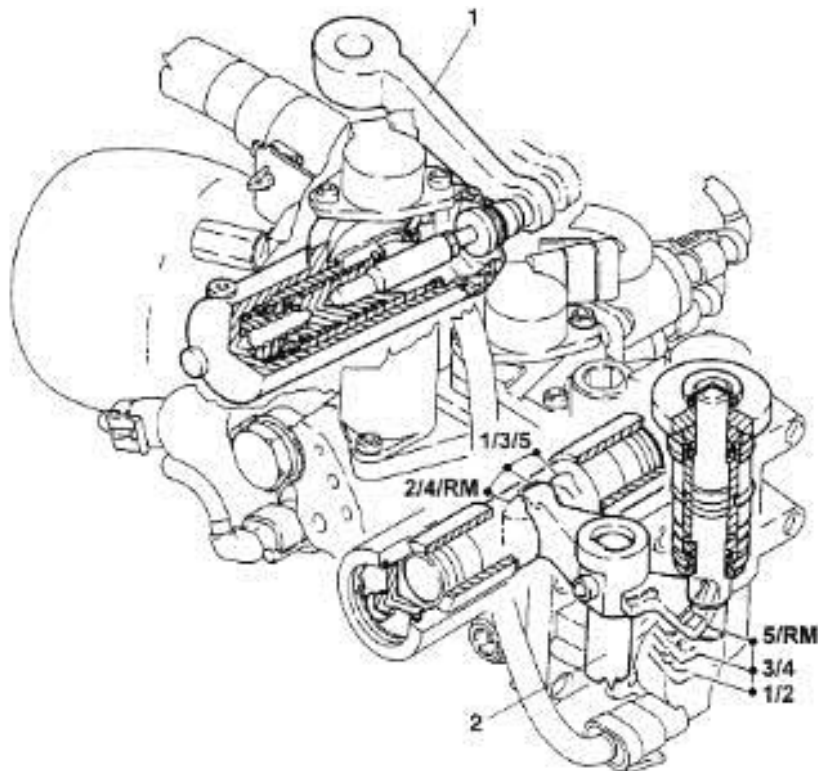


Figure. 5. Section of clutch control - gearbox actuators

1. Clutch control lever on gearbox
2. Gear shaft (engagement and selection control)

Hydraulic system diagram

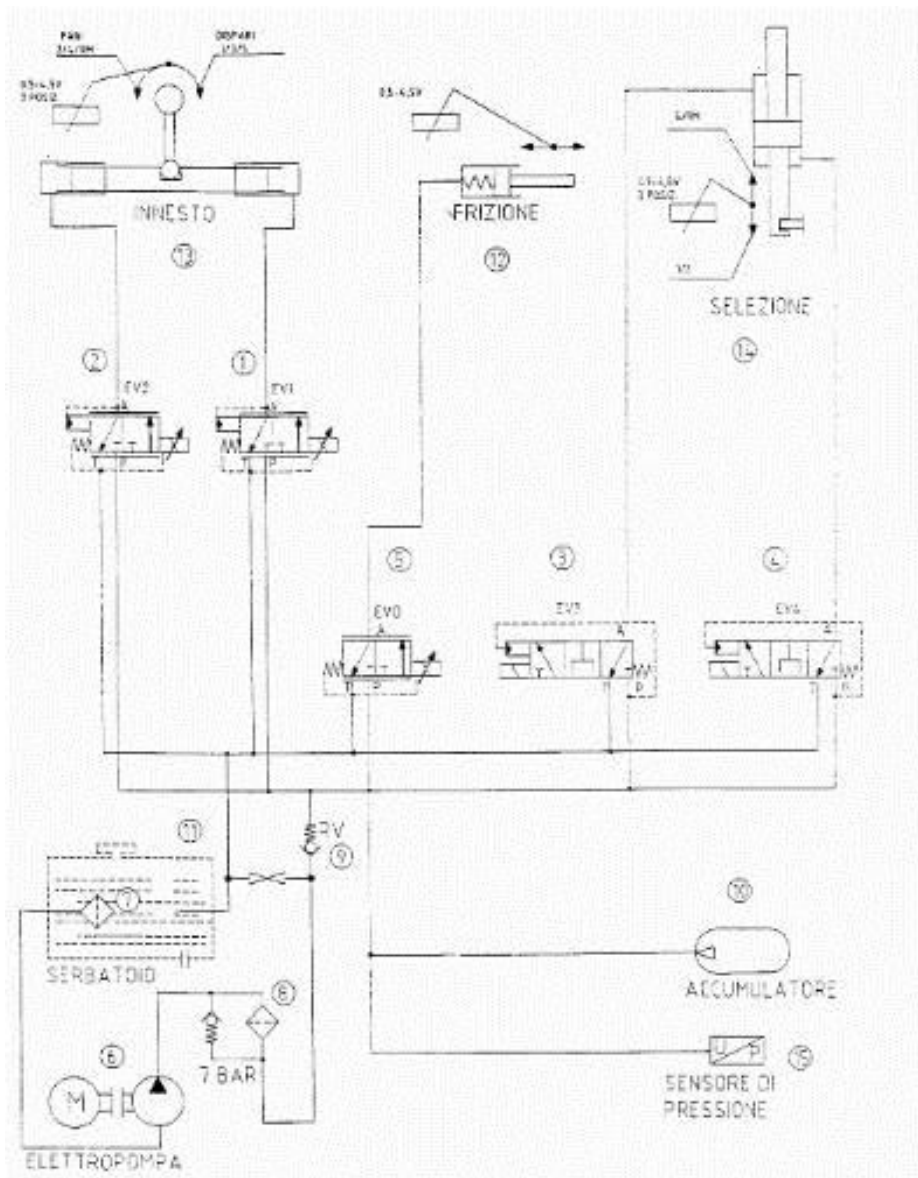


Figure. 6. Hydraulic diagram

Key

1. Engagement solenoid valve 1
2. Engagement solenoid valve 2
3. Selection solenoid valve 3
4. Selection solenoid valve 4
5. Clutch solenoid valve
6. Electric pump
7. Delivery filter
8. Pressure Delivery hose
9. Check valve
10. Accumulator
11. Oil tank
12. Clutch actuator
13. Engagement actuator
14. Selection actuator
15. Pressure sensor

Electro-hydraulic group

This is one of the system components where the actuators, position sensors, actuator solenoid valves have been incorporated, specifically connected by cables that link them to a centralised multiple connector. This solution simplifies and cuts down assembly time on the gearbox and avoids connection errors. Furthermore the actuator solenoid valve cables all have identification labels.

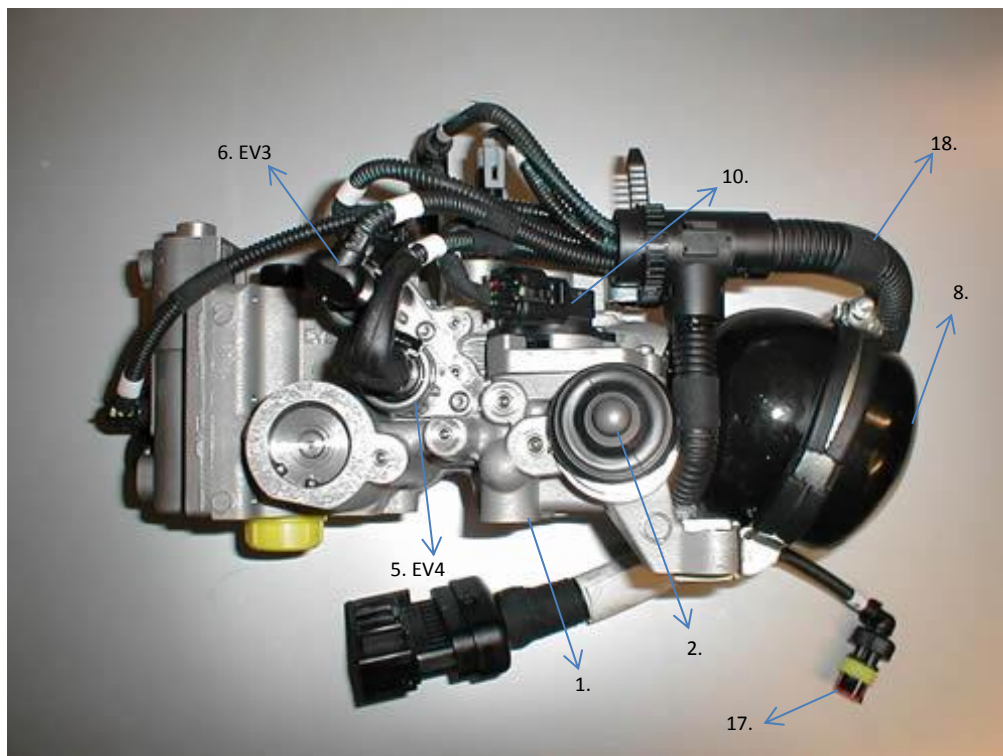
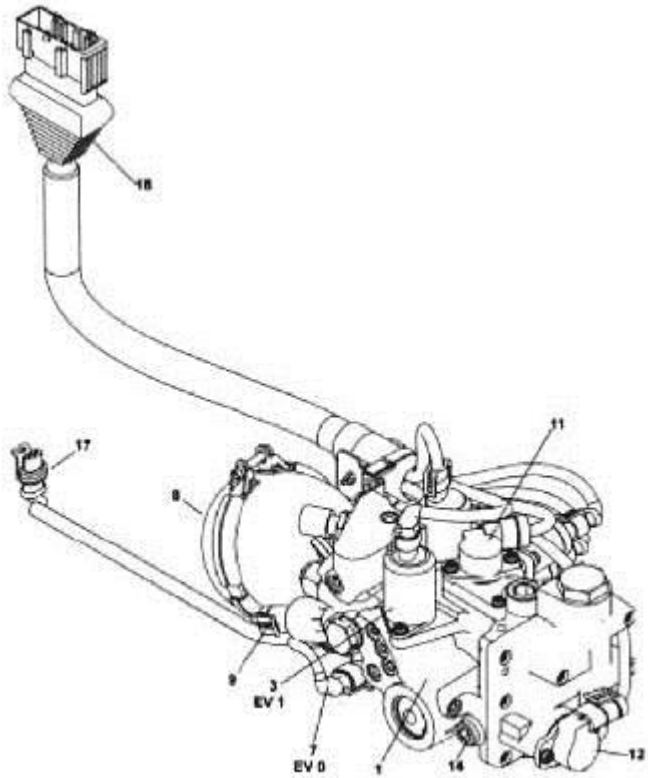


Figure. 7. Electro-hydraulic group

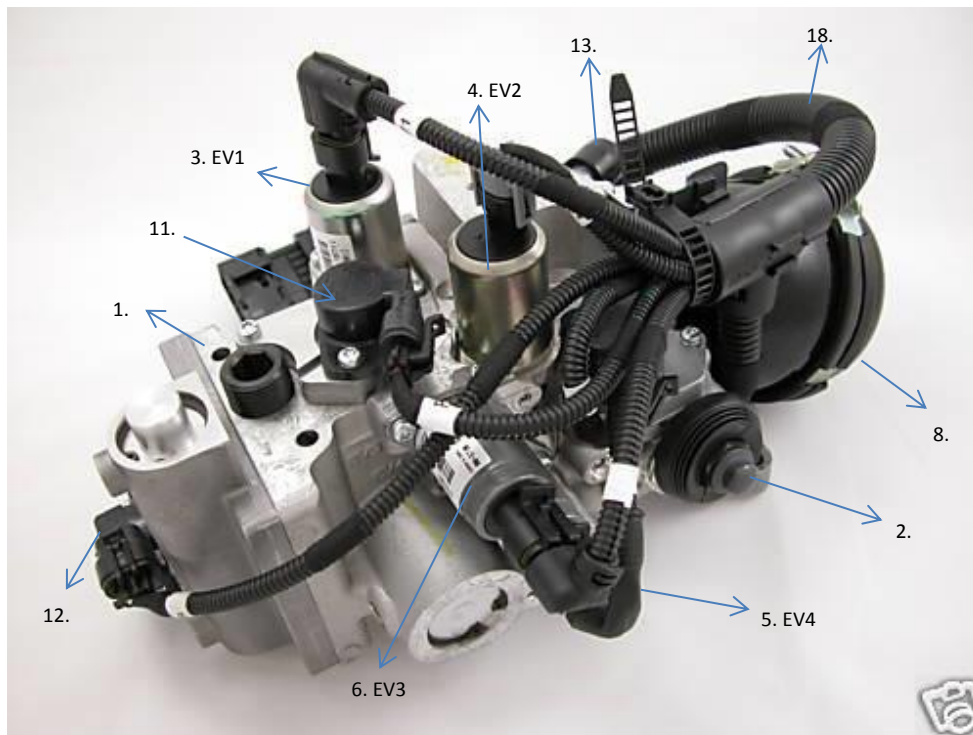
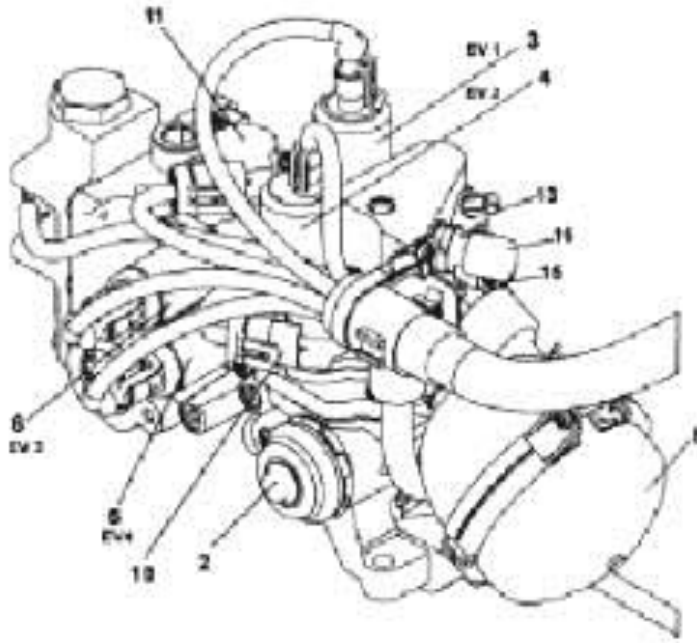


Figure. 8.

The electro-hydraulic group consists of:

1. A casting casing fastened on the gearbox
2. Single action actuator to activate the clutch lever
3. Proportional pressure solenoid valve EV1 to control the engagement of the odd gears 1-3-5
4. Proportional pressure solenoid valve EV2 to control the engagement of the even gears 2-4-R
5. On-off solenoid valve EV4 to control 5-R gear selection
6. On-off solenoid valve EV3 to control 1-2 gear selection
7. Proportional flow-rate solenoid valve EV0 to control the clutch actuator
8. Hydraulic gas accumulator
9. Hydraulic circuit pressure sensor

10. Sensor to detect clutch actuator position
11. Sensor to detect engagement actuator position
12. Sensor to detect selector actuator position
13. Bleed valve
14. Access to gear shaft actuators connecting screw
15. Union for oil delivery pipe
16. Union for oil return pipe
17. Connector for gearbox speed sensor
18. Selespeed wiring harness connector

The following are also installed in the electro-hydraulic group:

- a check valve
- an oil inlet filter
- screws fastening the engagement / selection actuator to the gearbox gear shaft.

Solenoid valves and actuators

The solenoid valves manage the oil flow to the actuator chambers. All the valves are the three-way type, they are normally discharged when not controlled.

Proportional pressure solenoid valves (EV1 and EV2)

These control the oil pressure at the two chambers of the gear engagement-disengagement double-action actuator that has three set mechanical positions according to the control combination (even number gear, idling, odd number gear).

The maximum flow rate is 7 l/min with pressure differential of 10 bar. The control current ranges from 0 to 2.5 A directly controlled by control unit CFC 208F. Electrical resistance of the winding is 2.5 Ohm +/- 6% at 20°C.

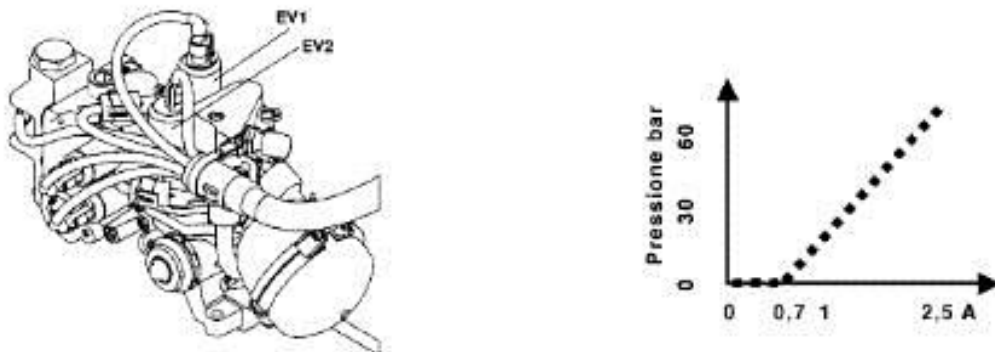


Figure. 9. Position of solenoid valves and current pressure diagram

ON/OFF solenoid valves (EV3 and EV4)

These feed the oil flow to the two chambers of the double action gear selection actuator that has only two set mechanical positions (1-2 and 5-R). The maximum flow rate is 1.4l/min with pressure differential of 10 bar. They are controlled with a voltage of 12V directly from control unit CFC 208F and absorb approx. 2A. Electrical resistance of the winding is 5.1 Ohm +/-6% at 20°C.

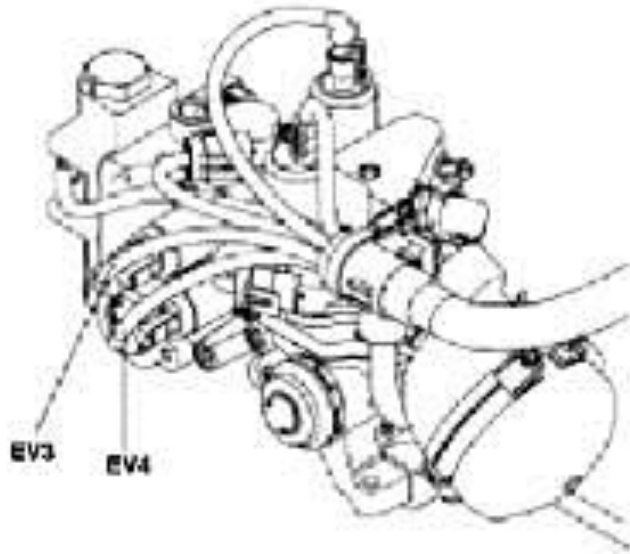


Figure. 10. On-Off solenoid valve position

Solenoid valves and actuators

The solenoid valves manage the oil flow to the actuator chambers. All the valves are three-way; they are normally discharged if not controlled.

Proportional flow-rate solenoid valve (EV0)

It controls the oil inlet and outlet flow of the clutch stroke actuator chamber (single action). The maximum flow rate is 10l/min with pressure differential of 10 bar. The control current ranges from 0 to 2A directly controlled by control unit CFC 208F. Electrical resistance of the winding is 2.5 Ohm +/- 6% at 20°C.

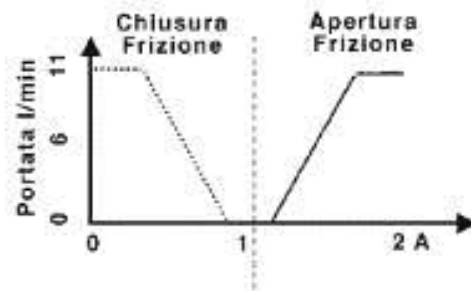
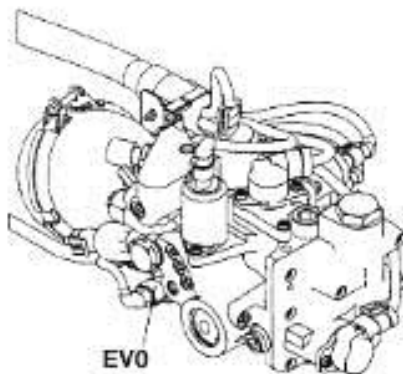


Figure. 11. Solenoid valve position and flow rate/current diagram

Electric pump

This generates the hydraulic energy (oil). It is fastened with vibration dampers onto the body. The electric pump consists of a gear pump of approx. 0.25 cm³/rev, drawn by a joint from a 12V d.c. electric motor through a relay controlled by the control unit CFC 208F. The electric pump is activated when the accumulated

pressure is < 45 bar and it switches off when the accumulated pressure is > 55 bar. The electric motor and the pump are fastened to each other with screws by a flange. There are two threaded holes for intake (I) and delivery (U), that are connected to the oil tank and the user respectively by pipes with flexible unions. The hydraulic tank, fitted with a filter, has a capacity of approx. 0.5 l.

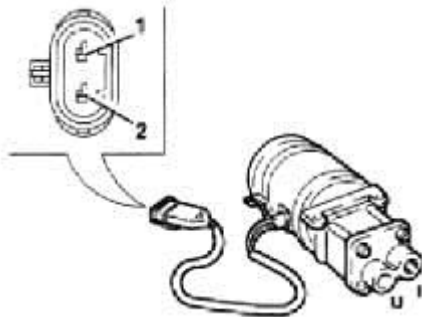


Figure. 12. Electric pump and connector

1. Earth 2. +12V power supply I. Inlet U. Outlet

Measuring sensors

Hydraulic circuit oil pressure sensor

It is installed directly on the hydraulic group.

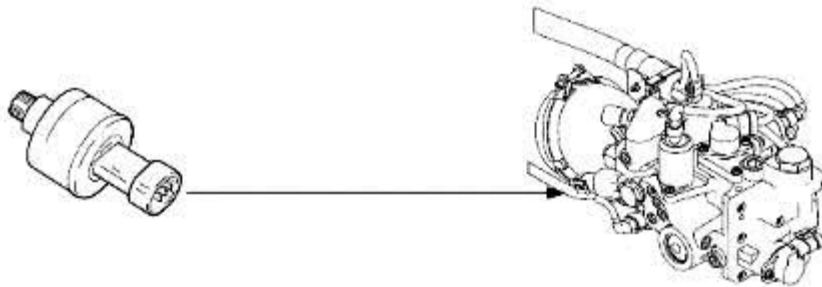


Figure. 13. Position of oil pressure sensor

It is installed directly on the hydraulic group. It consists of a capacitive sensitive element that generates a signal processed by a specific custom circuit inside the metal casing. It supplies the control unit CFC 208F with a voltage proportional to the pressure read, with reference to the supply voltage of the sensor. The supply voltage from CFC 208F is 5 ± 0.5 V with a draw of approx. 10 mA. The maximum pressure value read is approx. 80 bar.

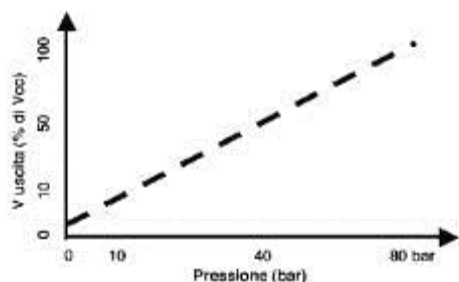


Figure. 14. Pressure sensor diagram

Actuators position sensor

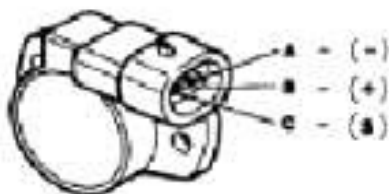


Figure. 15. Actuators position sensor

The sensors that send the position of the gear selection, gear engagement and clutch control actuators to the Selespeed control unit are single ramp potentiometers installed directly on the electro-hydraulic group. They are powered with $5V \pm 0.5V$ by the control unit CFC 208F. Maximum resistance between pins A-B is $1200 \pm 20 \text{ Ohm}$ at 20°C .

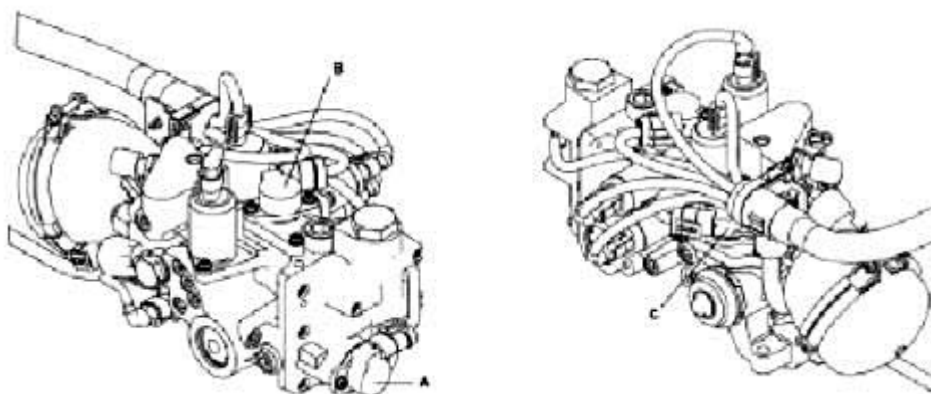


Figure. 16. Location of actuator position sensors

The three sensors, of the same type, installed on the electro-hydraulic group are:

- A. Gear selection position sensor
- B. Gear engagement position sensor
- C. Clutch position sensor

Clutch disk speed sensor (gearbox primary)

This is installed on the gearbox inlet, directly on the gear box. It is an electromagnetic sensor and sends a sinusoidal signal to the control unit CFC 208F that has a frequency in proportion to the speed of a pinion mounted on the gearbox

primary shaft. The winding resistance is 1200 Ohm +/- 10% at 20°C. The air gap ranges between 0.2-1 mm.



Figure. 17. Gearbox speed sensor position

Switch on brake pedal

Installed on the brake pedal unit.

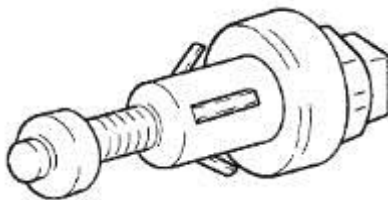


Figure. 18. Brake pedal switch

When the pedal is released it does not send any signal (NC) to the control unit CFC 208F. When the brake pedal is pressed the BRAKE lights switch on and the switch sends the car braked signal (12V) to control unit CFC 208F.

Door open switch

This reads the information (ON-OFF) regarding the state of the driver side door, sending an earth signal to the control unit CFC 208F when the door is open.

Driver's controls

Gear selection control lever

The lever has only one stable position (A) and 4 unstable (+, -, N, R).

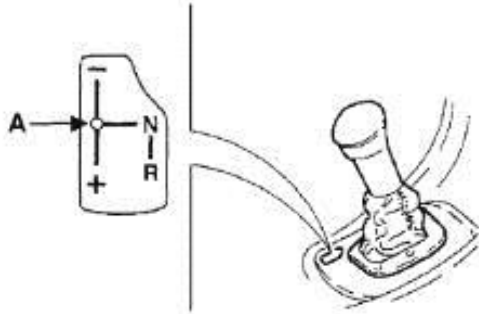


Figure. 19. Gear selection lever

It has four normally open switches, each with two electric resistors (one in parallel at contact, the other in series). To go to a higher gear, push the lever toward (+), to have a lower gear, push toward (-). To insert idle (N) move the control lever to the right. Reverse gear (R) can be engaged from any gear, moving the gear lever to the right then back, with the vehicle stationary and the brake pedal pressed.

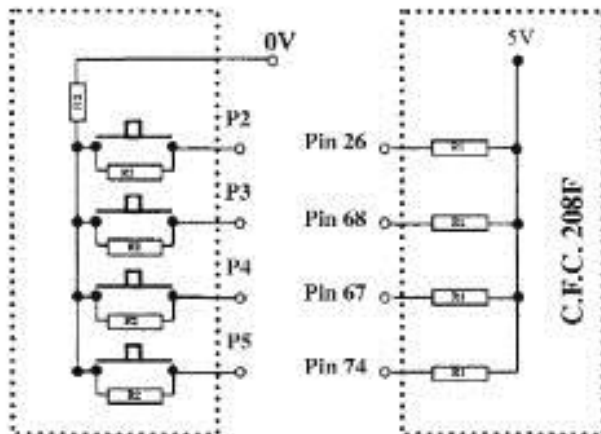


Figure. 20. Gear selection lever electrical connection

Pin-Out CFC 208F functions

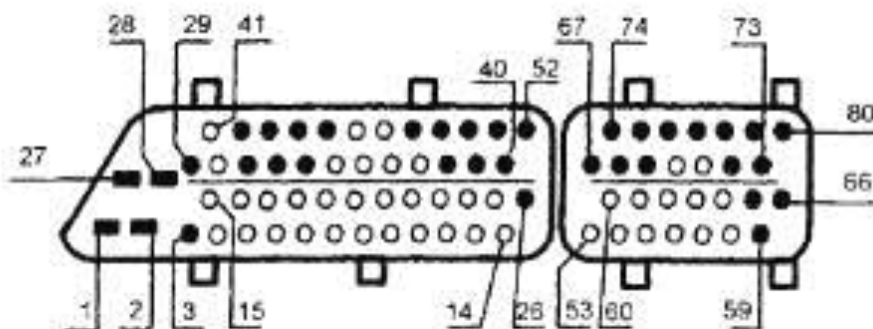


Figure. 21. Pin-Out CFC 208F functions

Key

1. Power earth
2. Power earth
3. EV4 5-R gear selection actuator control
4. From... 4 to 25... NC
26. Gear selection by lever (+) increase
27. Power supply (+30 battery)
28. Ignition key power supply (15/54)
29. EV3 1-2 gear selection actuator control
30. NC
31. Oil electric pump relay control
32. EV1 1-3-5 odd gears engagement actuator control
33. CAN line (-) with Motronic
34. From.. 34 to 37... NC
38. Gearbox inlet rev sensor (+)
39. Gear engagement sensor position signal
40. Hydraulic group oil pressure sensor signal
41. NC
42. Start relay control
43. EV0 clutch actuation control
44. EV2 2-4-R even gears engagement actuator control
45. CAN line (+) with Motronic
46. From... 46 to 47... NC
48. Engine speed from rev counter (through CCM)
49. K line for diagnostics
50. Gearbox input rev sensor (-)
51. Gear selection potentiometer signal
52. Clutch potentiometer signal
53. From 53 to 58... NC
59. Clutch potentiometer earth
60. From 60 to 64... NC
65. Gear selection and request reference earth
66. Oil pressure potentiometers sensor earth
67. Gear selection by lever
68. Gear selection by lever
69. Connection for brake (stop) switch
70. From 70 to 71... NC
72. Data display control output
73. Gear position sensors power supply (+5V)
74. Gear selection by lever

- 75. Gear selection (+) (-) from steering wheel switch
- 76. Engine start +50 signal
- 77. City switch
- 78. Connection for door button
- 79. Clutch position sensor power supply (+5V)
- 80. Buzzer control

NOTE: On the CAN line (Pin 33-45) the following signals are available: Accelerator pedal position, engine torque, water temperature, car speed; whereas CFC 208 uses this line to control the on-board panel display and the torque requests to the engine control when changing gear.

Electrical diagram

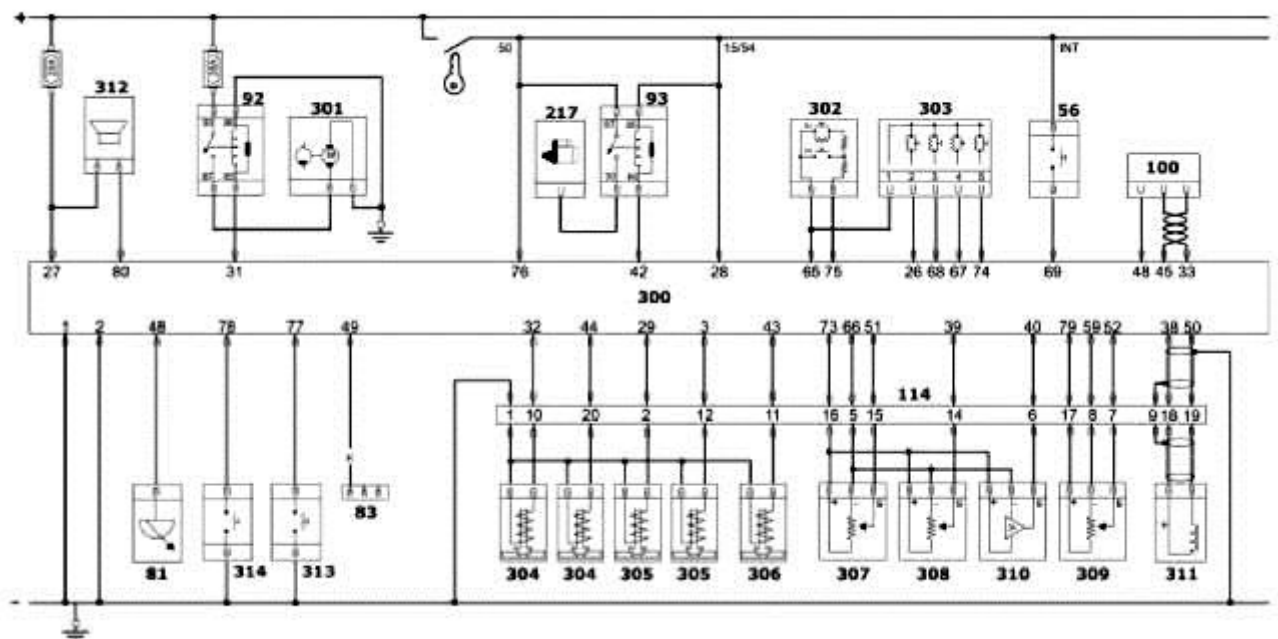


Figure. 22. CFC 208F Alfa Romeo 147 Selespeed T. Spark electrical diagram

Key

- 56. Brake switch
- 81. Rev counter (from CCM)
- 83. Diagnostics connector
- 92. Pump Relay
- 93. Start Control Relay
- 100. Injection control unit (CCM)
- 114. Sectioning connector
- 217. Starter motor
- 300. Gear clutch control Selespeed control unit
- 301. Oil pressure electric pump
- 302. Gear request buttons on steering wheel
- 303. Gear selection lever and switches
- 304. Gear engagement solenoid valves (2) EV1 - EV2
- 305. Gear selection solenoid valves (2) EV3 - EV4
- 306. Clutch engagement-disengagement solenoid valve
- 307. Gear selection potentiometer

- 308. Gear engagement potentiometer
- 309. Clutch potentiometer
- 310. Hydraulic group oil pressure sensor
- 311. Gearbox primary shaft speed sensor
- 312. Buzzer
- 313. City automatic gear mode button
- 314. Door button driver side

Overview of the Selespeed gearbox functioning

The Alfa Romeo 147 T. Spark engine, with electronically controlled manual transmission is called Selespeed. This system is applied to a traditional manual transmission, that has added an electronically controlled electro-hydraulic device that automatically manages the clutch and the gear engagement. The gearbox can function in two different operating modes:

1. Semiautomatic (or manual), where the driver makes the direct request to change gear through the lever on the tunnel or by pressing the buttons on the steering wheel.
2. Automatic (or City), where it is the system that decides when to change gear (this mode can be selected with the specific button).

The clutch pedal has been eliminated and take-off is by means of a control lever with a "single stable central position" of the floating type that can be used to increase/decrease the gear ratio engaged and the engagement of reverse gear (R) and idling (N). There are also two buttons on the steering wheel spokes that can be used when the vehicle is moving to increase/decrease the gear engaged. At every activation by the turning of the key to MAR, the system always selects the semiautomatic mode (manual). If, when the "automatic" (City) mode is running, the driver requests a gear change, the system interprets this action as a request from the user to have direct control, and switches to "Semiautomatic" mode.



Figure. 23. Steering wheel

The information regarding the gear engaged is shown on the display in the car instrument panel (rev counter).

The symbols shown on the display are:

- **N** = idling
- **1** = first gear
- **2** = second gear
- **3** = third gear
- **4** = fourth gear
- **5** = fifth gear
- **R** = reverse

A fault warning light and a buzzer call the attention of the driver in the case of faults or critical driving conditions for the vehicle or for the transmission components (example: clutch over heating).

Selespeed considerably simplifies driving, and in town is less tiring, also in situations where the gear has to be changed frequently, but at the same time it ensures brilliant performance.

System activation

When the door on the driver's side is opened, Selespeed starts the hydraulic electric pump to have the system ready for the engine ignition. This function can be perceived by the electric pump rotating for a few seconds. When the engine ignition key is turned to "MAR", all the gear display segments light up. After about one second, the display indicates the gear engaged in the gearbox (N-1-2-3-4-5-R) and the gearbox fault warning light switches off, indicating that the hydraulic system is running and as from this moment the Selespeed system accepts gear change commands.

Functioning with engine off

Before moving the gear control lever the ratio of the gear engaged (N-1-2-3-4-5-R) must be checked on the display. With the vehicle stationary and the brake pedal pressed, gear change requests are accepted and effected "only" from the control lever on the tunnel. To request a gear change, besides pressing the brake pedal, it is necessary:

- To increase the gear (+) push the lever forward (if the car is in first gear it passes to second, if it is in second gear it passes to third and so forth, up to fifth gear). If the system is idling (N) or in reverse gear (R) pushing the lever forward engages the first gear.
- To decrease the gear (-) push the lever back (if the car is in fifth gear it passes to fourth, if it is in fourth it passes to third and so forth down to first gear).

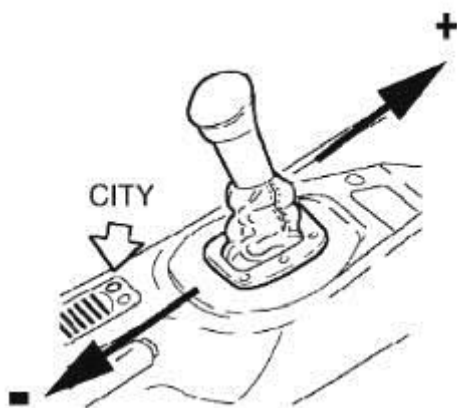


Figure. 24. Engagement control lever (+), (-)

To set the gear to idling (N) with the vehicle stationary and the brake pedal pressed, move the gear control lever to the right.

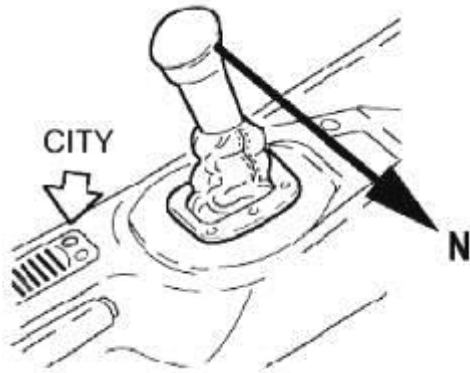


Figure. 25. Control lever (in "idle" position)

From any gear, (N-1-2-3-4-5-R) with the vehicle practically still, the reverse gear can be engaged by pushing the lever to the right and then backward. If the vehicle is moving, the request is not accepted. Wait for the vehicle to stop then engage the reverse gear again.

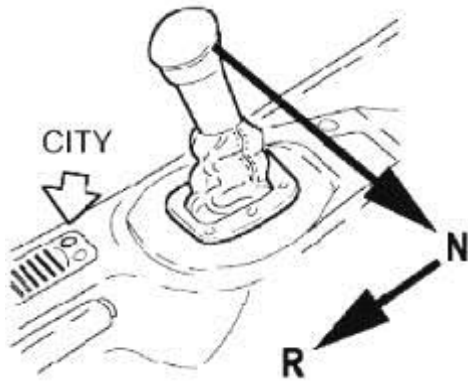


Figure. 26. Control lever (engaging the reverse gear)



After the gear has been changed, release the control lever immediately. A prolonged manoeuvre (more than 6 s) causes the gearbox fault warning light to switch on, the sounding of the buzzer and the automatic change-over to "City" mode. All this disappears when the gear lever is released. If the car is to be left on a sloping road and you want to engage a gear to keep it braked, it is most important to check on the display the indication of the new gear engaged, then wait 1 or 2 seconds before releasing the brake pedal to allow the clutch to engage completely. If the car is in idle gear, the driver will hear the buzzer sound.

Engine start-up

The engine start-up can take place with the brake pedal pressed, either with the gear engaged or with the gearbox already in idle (N). With the engine running, the gearbox shows the letter (N) and the system sets the semi-automatic operation (manual).

Shutting off the engine and system deactivation

When the ignition key is turned to "STOP" the engine switches off and the Selespeed system remains active until the car stops completely. After 2/4 seconds, with the key on STOP the hydraulic part deactivates and the gears display on the panel switches off immediately. Only at this point the Selespeed system is no longer active. The gear ratio selected before the shut-down remains engaged. If the engine stops with the gear in idle, the buzzer calls the attention of the driver to put the car in safety condition engaging the first gear (1) or the reverse gear (R). In this case, the ignition key has to be turned to MAR and with the brake pedal pressed request of the first gear (1) or reverse gear (R).

NOTE: Never leave the car with the gear in idle (N). Never remove the key while the car is moving because, besides the fact that the system would function in an anomalous way until the vehicle stops, the steering wheel would automatically lock at the first swerve. The engine must be shut off, and as a consequence the Selespeed deactivated, keeping the brake pedal pressed and only releasing it when the rev counter display switches off.

Car start

With the engine on and the vehicle stationary the gears that can be engaged to start are only the first (1), the second (2), and/or reverse (R). To engage the gear, just use the control lever on the tunnel keeping the brake pedal pressed (the buttons on the steering wheel only allow gear engagement at speeds over 10 Km/h.

- With the vehicle stationary and gear engaged still keep the brake pedal pressed until you actually move off.
- In long halts with the engine running it is advised to remain idling.
- If the car has to be parked uphill, do not use the take-off manoeuvre to keep the vehicle still, use the brake pedal and only use the accelerator pedal when you decide to move off.
- Only use the second gear when it is necessary to have better control of the take-off in manoeuvres with poor grip.
- If, with reverse gear engaged, the first gear is to be inserted, or vice-versa, wait until the vehicle is completely still before operating, and keep the brake pedal pressed.

Although it is most definitely advised against doing so, if when going downhill the vehicle is allowed to proceed in idle gear (N), when the engagement of a gear is requested the system will automatically engage, according to the speed of the car, the best gear to have the correct transmission of the driving torque to the wheels.

If instead, the vehicle proceeds downhill with the gear engaged and the accelerator released, when a set speed value is passed, the system will engage the clutch automatically to give adequate engine braking to the car. For safety reasons the system activates the warning buzzer when:

- If during the vehicle start-up manoeuvres the clutch overheats, in this case it is necessary to "force" the starting without hesitating, or otherwise release the accelerator and use the brake pedal to park the car on the slope.

- If the car goes forward in the opposite direction to the gear engaged (e.g. the vehicle goes forward with the reverse gear engaged). In this case stop the vehicle keeping the brake pedal pressed and engage the correct gear.

Still for safety reasons, with the car stationary, engine running and gear (1)-(2) or (R) engaged, the system activates the buzzer and automatically puts the gear to idling when:

- no operation is made on the accelerator pedal or the brake pedal for at least 60 s.
- the brake pedal is kept pressed for more than 3 min.
- the door on the driver's side is opened, after 2 seconds the car goes automatically into idling condition.

NOTE: The reverse gear (R) can be engaged from each of these ratios:

- Idle (N), - first (1) or second (2).

If the vehicle is moving, the request is not accepted, you must wait until the car is completely still then request the reverse gear (R) engagement again. The reverse gear engaged condition is indicated to the driver on the display and also by the buzzer. In the same way, in the case of crawling on the reverse gear, the system partially closes the clutch to favour the gear engagement. In this case the engagement of the reverse gear will be less smooth.



After a gear change request with the vehicle stationary, before pressing the accelerator pedal to start the car, the driver must always check on the display that the gear engaged is the one wanted.

Car stop

To stop the car just release the accelerator pedal and if necessary act on the brake pedal. Regardless of the gear engaged and the operating mode activated (Manual or "City") the system automatically deactivates the clutch and lowers the gears in the gearbox. If it is intended to start off again without having completely stopped the car, the most suitable gear ratio will be available to accelerate again. When the vehicle is stopped the system automatically engages the first gear.

Semiautomatic "Manual" operation

In "manual" mode, which is available every time the car is started, the display on the panel indicates the gear engaged. In this operating mode the decision to change the gear ratio depends on the driver who decides when it is the best moment to engage it (unless in conditions of engine over speed/under speed) . The requests to change gear take place through:

- the control lever on the tunnel.
- or when the car is moving at more than 10 Km/h, through the buttons on the steering wheel.

The "manual" operating mode is set:

- automatically at each car start up
- when the driver, with "CITY" mode selected: acts on the control lever on the tunnel or on the buttons on the steering wheel
- presses the "CITY" button again, thus switching off the mode previously selected.

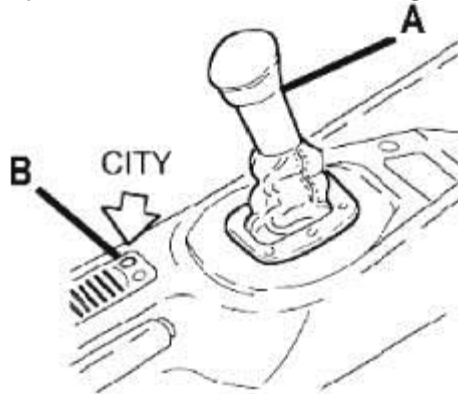


Figure. 27. Control lever and City button

During the gear change it is not necessary to release the accelerator pedal because the Sele-speed system, through the engine control unit, asks to:

- reduce then increase the engine torque
- adjust the engine rotation speed to the new ratio engaged in the gearbox.

When shifting down the gear, the so-called "double clutching" is executed automatically (acceleration of the engine to bring it to the required speed) with the new gear ratio. The command to set to idling (N) is accepted so long as the car does not exceed 40 Km/h, with the foot on the brake. With the accelerator pedal pressed down over 60% of its stroke, and engine speed over 5500 RPM, the gear change is faster. In the "manual" mode there are some automatisms/safety devices that facilitate the driving.

- When slowing down the clutch is opened and the gear ratio is automatically reduced so as to be ready for a possible return to the gear.
- Gear change requests are not accepted that would bring the engine over the maximum speed or below the minimum speed allowed.
- If the engine reaches the maximum speed allowed and the driver continues to accelerate, the system will automatically engage a higher gear.
- If, when engaging the gear there is crawling at the gearbox, first of all the system tries again to engage the requested gear, and if this still is not possible, automatically engages the next one up so that the car does not remain in idle gear.

NOTE: It is best to wait until a gear shift has terminated before asking for another, to avoid multiple requests in quick succession.

Automatic "CITY" operation

The automatic "**CITY**" mode is selected by pressing the button on the base of the gear lever. On the display in the rev counter, besides indicating the gear, the word CITY is shown. It is then the system that decides when to change gear according to the engine rpm and when the accelerator pedal is pressed. If the accelerator pedal is released quickly, the system does not engage a higher gear to keep an adequate engine brake level. If there is a fault on the gear control lever, the system passes automatically to the automatic "CITY" mode, so that the car can return home.

Fault warnings

The Selespeed gearbox faults are indicated on the display on the instrument panel. For some faults, besides the information on the display a buzzer warning is sounded intermittently for 4 s to call the attention of the driver. If there is a fault on the gear control lever, the system automatically inserts the automatic "CITY" mode so as to be able to reach the nearest dealership to have the fault removed. For faults on other components of the gearbox, the system allows only the engagement of some ratios : first gear, second gear and reverse gear .

Warnings with buzzer

The buzzer is activated when:

- The vehicle is parked with the gear in idle; the indication can be detected turning the ignition key to STOP.
- During the take-off movement the clutch overheats.
- The system automatically engages the gearbox in idle after which:
 - . no movement is made on the accelerator pedal or the brake pedal for at least 60 sec.
 - . the brake pedal is pressed for over 3 min.
 - . the driver's door is opened without commands on the accelerator or on the brake.
- a gearbox fault has been found.
- a start-up attempt is made with gear engaged without pressing the brake.

Bump start

If there is a system fault a bump start can be made in this way:

- carry out the operation to activate the system (turning the ignition key to MAR).
- after 10 seconds, check that the warning light is off.
- while the car picks up speed with the gear in idle (N) use the control lever on the tunnel, to engage a higher gear.



Remember that bump starting or using downhill roads should be avoided because these manoeuvres, if the engine control system is not functioning properly, could cause fuel to flow into the catalyst and cause permanent damage.

Moreover, until the engine is running, power steering and brake booster are not efficient regarding functioning and driving safety.

If the battery is completely discharged, this type of start-up is not possible.

Parking the car

To park the car safely the first gear or reverse gear must be engaged, and if the road slopes, engage the hand brake also. When the engine is switched off (key on STOP) with the vehicle facing uphill and the gear engaged, you must wait until the gears display on the on-board panel switches off before releasing the brake pedal, so that the clutch is fully closed. If the idle gear is engaged and you want to engage a parking gear, you must start the system (key ON) and with your foot on the brake pedal engage the first gear or reverse gear.

Towing the vehicle

To tow the vehicle observe the current ruling. Make sure that the gear is in idle (check that the car moves when pushed) and operate in the same way as with a manual transmission car, following the indications in the chapter "in an emergency" in the owner's handbook. If it is not possible to set the gear to idle do not tow the car.



When the car is being towed do not start the engine.

Routine Maintenance

Selespeed oil level

Sele-speed system oil level must be checked with the car level and the engine cold.

To check the level, proceed as follows:

- Turn the ignition key to MAR.
- Detach the bleeder pipe and remove the cap, and check that the level is at the MAX level on the dip stick that is integral with the cap.
- If the oil is below the MAX level, top up until the correct level is reached.
- After screwing the cap back on, insert the bleeder pipe fully onto the cap tip and turn the ignition key to STOP.

Use only "Tutela CS Speed" oil for topping up



Figure. 28. Hydraulic oil container

System self-diagnosis

The diagnostics implemented in the control unit CFC 208F allow the testing of the inputs:

- rev sensor from rev counter module
- clutch disk speed sensor (gearbox primary)
- car speed from CAN line (through A.B.S.)

This consists in checking whether or not there is the signal. The diagnostics on the analog input signals is made checking these type of failures:

- signal out of electrical range
- signal out of dynamic range

The diagnostics implemented on the output controls of the control unit CFC 208F concern:

- the three proportional solenoid valves
- the two on-off solenoid valves
- the two relays (hydraulic pump and engine start enable)

The types of failures checked are:

- For proportional solenoid valves:
 - short circuit to earth
 - short circuit to +Vbatt
 - circuit open
- For ON/OFF solenoid valves:
 - short circuit to earth

- Electric pump relay:
- circuit open
- short circuit to +Vbatt
- Start-up enable relay
- short circuit to earth
- circuit open

These input signals and output commands are excluded from the diagnosis:

- brake pedal (except permanent closed circuit for a certain time with car moving)
- automatic mode (CITY) and door open switches
- the signals supplied by C.C.M. on CAN network
- diagnostics serial line (K)
- signals : key (+15/54) power supply, (+30) direct from battery.

Faulty component and down-grade performance table

The gearbox check control unit diagnosis, after ascertaining a fault takes action regarding the down-grade functioning. This data is indicated referring to the faulty component, in the table below:

FAULTY COMPONENT	Fault warning light	DOWN GRADING
Gear engagement solenoid valves (proportional)	On	Gear shift acceptance locked, gear engagement excluding idle (N) (vehicle stationary)
Gear selection solenoid valve (ON/OFF)	On	Gear shift acceptance locked, gear engagement excluding idle (vehicle stationary)
Engagement and selection position sensors	On	Long time for gear shift. Gear shift acceptance limited to 1, 2, R, N
Rev sensors: engine, gear input and gear output (car speed)	On	Gear shift acceptance limited to 1, 2, R, N
Oil pressure sensor	On	Electric pump control in open-loop
Gear request lever switches	On	Switching in automatic mode "CITY", cannot engage R
Buttons on steering wheel switches	On	Does not accept commands from steering wheel
Clutch solenoid valve (proportional)	On	Clutch control lock, automatic shift to idle (N) (vehicle stationary)

Clutch position sensor	On	Clutch control lock, automatic shift to idle (N) (vehicle stationary)
Pump relay control	On	Vehicle stationary
Buzzer control	On	Continual functioning
Start enable relay control	On	Gear shift acceptance limitation for 1, 2, R, N
Brake status switch	On	With engine off does not accept gear change, engine only starts with gear in idle (N)
Message transmission CAN line	On	C.C.M. does not check torque with city disabled
Message receiving CAN line	On	Gear shift acceptance limitation for 1, 2, R, N C.C.M. does not check torque
CFC 208F microprocessor	On	Gear shift acceptance limitation for 1, 2, R, N
Control unit CFC 208F earth	On	Total system lock
CFC 208F memory	On	Gear shift acceptance limitation for 1, 2, R, N
Display serial line control	On	Gear engaged not displayed
Accumulator discharged	On	No recovery
Pump relay glued	On	No recovery
Accelerator pedal	On	1, 2, R, N engagement indication not valid and limitation of engine revs.

The car jerks

Troubleshooting table	Symptom/conditions: The car jerks
	<ul style="list-style-type: none"> It jerks from a standing start It jerks when changing gear
<p style="text-align: center;">Preliminary check</p> <p>If there are other system faults on the vehicle (instrument panel warning lights on referring to: engine control, ABS, VDC.) check the cause of these problems. If this is not the case, proceed with this chart.</p>	

DIAGNOSTICS		Test results		
Step	Operations			
0	Check oil level	All OK	Problems found	Intervention
	Check oil level as shown in Procedure 2	Go to step 1	Level other than max	Do Procedure 3
1	Check oil pressure	All OK	Problems found	Intervention
	Check oil pressure as shown in Procedure 4.	Go to step 2	Press < 40 bar	Do Procedure 5
2	Check for Errors	All OK	Problems found	Intervention
	Check ECU for absence of errors. Specifically check for: <ul style="list-style-type: none"> • Clutch position sensor • Errors CAN messages (reception/transmission) 	Go to step 4	Presence of one or more errors included in the list	Go to step 3
3	Check problems found	All OK	Problems found	Intervention
	Check problems according to Procedure 17	End of procedure	The problem persists	Go to step 4
4	Bleed the system with Examiner	All OK	Problems found	Intervention
	In active diagnosis run two system bleeding cycles through the "clutch bleeding" command			Go to step 5
5	Clutch parameters calibration with Examiner	All OK	Problems found	Intervention
	With examiner in active diagnosis, run the calibration of the clutch parameters through			Go to step 6

	" enable clutch self-calibration ".			
6	Road test	All OK	Problems found	Intervention
	Check that the fault is no longer present by testing on the road	End of procedure	The problem persists	Go to step 7
7	The problem persists	All OK	Problems found	Intervention
	Check that the problem is not caused by other systems such as the engine, fuel supply, etc.	Go to step 8	There are faults on other car systems.	See the specific charts.
8	The problem persists	All OK	Problems found	Intervention
				Contact technical assistance for additional information on the problem

Noisy gearbox

Troubleshooting table		Symptom/conditions: Noisy gearbox		
DIAGNOSTICS		<ul style="list-style-type: none"> The gear grates 		
		Test results		
Step	Operations			
0	Check that the clutch does not drag	All OK	Problems found	Intervention
	Check that the clutch does not drag following Procedure 14	Go to step 2	The clutch drags	Overhaul the clutch/flywheel kit and replace the broken components. Go to step 1.

1	After intervening on the clutch kit	All OK	Problems found	Intervention
	Check that the problem is no longer present.	End of procedure	The problem persists	Go to step 2
2	The problem persists	All OK	Problems found	Intervention
			The problem persists	Contact technical assistance for additional information on the problem

The car doesn't start

Troubleshooting table		Symptom/conditions: The car doesn't start		
		<ul style="list-style-type: none">• The engine doesn't start up• The display indicates the gear engaged and doesn't go to idle to allow starting		
Preliminary check				
If, when starting the engine, it is noted that the starter motor functions normally, the problem is caused by other systems (engine control, ABS, fuel pump.). See the specific charts. If the starter motor doesn't start continue following this diagnosis chart				
DIAGNOSTICS				
		Test results		
Step	Operations			
00	Start enable check	All OK	Problems found	Intervention
	With the car running in idle and with Examiner in parameters environment, select start and check that it is allowed.	Starting is allowed. Check the functioning of the starter motor	Starting is not allowed.	Go to step 0

0	Check oil level	All OK	Problems found	Intervention
	Check oil level as shown in Procedure 2	Go to step 1	Level other than max	Do Procedure 3
1	Check oil pressure	All OK	Problems found	Intervention
	Check oil pressure as shown in Procedure 4.	Go to step 2	Press < 40 bar	Do Procedure 5
2	Check ECU errors	All OK	Problems found	Intervention
	Check ECU for absence of errors. Specifically check for: <ul style="list-style-type: none"> • Clutch sensor error • Clutch solenoid valve current error • Pump relay error • Load relay error • Control unit failure error 	Go to step 4	Presence of one or more errors included in the list	Go to step 3
3	Check problems found	All OK	Problems found	Intervention
	Check problems according to Procedure 17	End of procedure	The problem persists	Go to step 4
4	Check brake pedal switch	All OK	Problems found	Intervention
	Check brake pedal switch operation according to Procedure 7	Go to step 6	The brake pedal does not work correctly	Check the conditions of connections, wiring and switch. Restore/replace broken parts. Go to step 5.

5	After checking brake pedal switch	All OK	Problems found	Intervention
	Check that the problem is no longer present.	End of procedure	The problem persists.	Go to step 6
6	The problem persists	All OK	Problems found	Intervention
				Contact technical assistance for additional information on the problem

Gears are not engaged

Troubleshooting table		Symptom/conditions: Gears are not engaged		
		<ul style="list-style-type: none"> When engine is warm 		
DIAGNOSTICS				
		Test results		
Step	Operations			
0	Check oil level	All OK	Problems found	Intervention
	Check oil level as shown in Procedure 2	Go to step 1	Level other than max	Do Procedure 3
1	Check oil pressure	All OK	Problems found	Intervention
	Check oil pressure as shown in Procedure 4	Go to step 2	Press < 40 bar	Do Procedure 5
2	Check ECU errors	All OK	Problems found	Intervention
	Check ECU for absence of errors. Specifically check for: <ul style="list-style-type: none"> Clutch sensor error 0/1/2/3 lever switch errors 	Go to step 4	Presence of one or more errors included in the list	Go to step 3

	<ul style="list-style-type: none"> • Even gear engagement error • Odd gear engagement error • Clutch solenoid valve current error • 1[^]/2[^]range selection solenoid valve error • 5[^]/R range selection solenoid valve error • ECU earth error • Load relay error 			
3	Check problems found	All OK	Problems found	Intervention
	Check problems according to Procedure 17	End of procedure	The problem persists	Go to step 4
4	Regulation of clutch stop pin check	All OK	Problems found	Intervention
	Check the clutch stop pin following Procedure 6	Go to step 6	The stop pin is not regulated correctly	Adjust the clutch stop pin regulation following Procedure 6. Go to step 5
5	After clutch stop pin adjustment	All OK	Problems found	Intervention
	Check that the problem is no longer present.	End of procedure	The problem persists	Go to step 6
6	Check that the clutch does not drag	All OK	Problems found	Intervention
	Check that the clutch does not drag following Procedure 14	Go to step 8	The clutch drags	Overhaul the clutch/flywheel kit and replace the broken components. Go to step 7.

7	After intervening on the clutch kit	All OK	Problems found	Intervention
	Check that the problem is no longer present.	End of procedure	The problem persists	Go to step 8
8	Check correct operation of lever	All OK	Problems found	Intervention
	Check correct operation of lever following Procedure 8	Go to step 10	Lever do not work correctly.	Check conditions of connections and wiring. Restore/replace broken parts. Go to step 9.
9	After checking correct operation of lever	All OK	Problems found	Intervention
	Check that the problem is no longer present.	End of procedure	The problem persists.	Go to step 10
10	After checking correct operation of lever	All OK	Problems found	Intervention
	Check brake pedal switch operation according to Procedure 7	Go to step 12	The brake pedal does not work correctly	Check the conditions of connections, wiring and switch. Restore/replace broken parts. Go to step 11
11	After checking brake pedal switch	All OK	Problems found	Intervention
	Check that the problem is no longer present.	End of procedure	The problem persists.	Go to step 12
12	"Loose finger" check	All OK	Problems found	Intervention
	With Examiner, in active diagnostics run the procedure for the loose finger check (NOTE: the procedure is only active as from models 156 EURO 3	Go to step 14	The "finger" is loose	Replace the finger fastening screw following the specific procedure. Continue with step 13

	and on 147). For the 156 EURO 2 versions it is advised to replace the finger fastening screw			
13	After checking/replacing the screw	All OK	Problems found	Intervention
	Check that the problem is no longer present.	End of procedure	The problem persists	Go to step 14
10	The problem persists	All OK	Problems found	Intervention
				Contact technical assistance for additional information on the problem

When in "city" mode the gears don't engage

Troubleshooting table		Symptom/conditions: When in "city" mode the gears don't engage		
		<ul style="list-style-type: none">• Sometimes no gear can be engaged using the lever for a few seconds• Reverse and/or neutral cannot be engaged• It is not possible to request a gear change from the gear lever (gear suggestion 156 JTS)		
DIAGNOSTICS				
		Test results		
Step	Operations			
0	Check oil level	All OK	Problems found	Intervention
	Check oil level as shown in Procedure 2	Go to step 1	Level other than max	Do Procedure 3

1	Check oil pressure	All OK	Problems found	Intervention
	Check oil pressure as shown in Procedure 4	Go to step 2	Press < 40 bar	Do Procedure 5
2	Correct lever and city button functioning check	All OK	Problems found	Intervention
	Check correct functioning of the lever and the city button following Procedure 8 and Procedure 9.	Go to step 4	Lever or button do not work correctly.	Check conditions of connections and wiring. Restore/replace broken parts. Go to step 3.
3	After checking the correct functioning of the lever and the city button	All OK	Problems found	Intervention
	Check that the problem is no longer present.	End of procedure	The problem persists	Go to step 6
4	Check ECU errors	All OK	Problems found	Intervention
	Check ECU for absence of errors. Specifically check for: <ul style="list-style-type: none"> 0/1/2/3 lever switch errors 	Go to step 6	Presence of one or more errors included in the list	Go to step 5
5	Check problems found	All OK	Problems found	Intervention
	Check problems according to Procedure 17	End of procedure	The problem persists	Go to step 6
6	The problem persists	All OK	Problems found	Intervention
				Contact technical assistance for additional information on the problem

The gears are locked

Troubleshooting table		Symptom/conditions: The gears are locked		
		<ul style="list-style-type: none">It remains locked in a gear and when the vehicle stops the engine shuts down and it is not possible to start it again or it starts after a few minutes		
Preliminary check				
If when starting up the engine the starter motor functions normally, the problem is caused by other systems (engine control, ABS, fuel pump.). Consult the specific charts. If the starter motor does not run continue with the following diagnosis table				
DIAGNOSTICS				
		Test results		
Step	Operations			
0	Check oil level	All OK	Problems found	Intervention
	Check oil level as shown in Procedure 2	Go to step 1	Level other than max	Do Procedure 3
1	Check oil pressure	All OK	Problems found	Intervention
	Check oil pressure as shown in Procedure 4.	Go to step 2	Press < 40 bar	Do Procedure 5
2	Check ECU errors	All OK	Problems found	Intervention
	Check ECU for absence of errors. Specifically check for: <ul style="list-style-type: none">Clutch sensor errorClutch solenoid valve current errorPump relay errorLoad relay error	Go to step 4	Presence of one or more errors included in the list	Go to step 3
3	Check problems found	All OK	Problems found	Intervention
	Check problems according to Procedure 17	End of procedure	The problem persists	Go to step 4

4	Regulation of clutch stop pin check	All OK	Problems found	Intervention
	Check the clutch stop pin following Procedure 6	Go to step 6	The stop pin is not regulated correctly	Adjust the clutch stop pin regulation following Procedure 6. Go to step 5
5	After clutch stop pin adjustment	All OK	Problems found	Intervention
	Check that the problem is no longer present.	End of procedure	The problem persists	Go to step 6
6	The problem persists	All OK	Problems found	Intervention
				Contact technical assistance for additional information on the problem

When starting the car, it revs up

Troubleshooting table		Symptom/conditions: When starting the car it revs up		
		<ul style="list-style-type: none"> It seems that the clutch slips when starting 		
DIAGNOSTICS		Test results		
Step	Operations			
0	Clutch parameters calibration with Examiner	All OK	Problems found	Intervention
	With examiner in active diagnosis, run the calibration of the clutch parameters through " enable clutch self-calibration ".	Go to step 2	The calibration is not successful	Follow the instructions from Examiner to solve the problem and repeat the test

1	Regulation of clutch stop pin check	All OK	Problems found	Intervention
	Check the clutch stop pin following Procedure 6	Go to step 3	The stop pin is not regulated correctly	Adjust the clutch stop pin regulation following Procedure 6. Go to step 2
2	After clutch stop pin adjustment	All OK	Problems found	Intervention
	Check that the problem is no longer present.	End of procedure	The problem persists	Go to step 3
4	The problem persists	All OK	Problems found	Intervention
				Contact technical assistance for additional information on the problem

The car goes to idle on its own

Troubleshooting table		Symptom/conditions: The car goes to idle on its own		
DIAGNOSTICS		<ul style="list-style-type: none"> When changing gear with the car moving 		
		Test results		
Step	Operations			
0	Check oil level	All OK	Problems found	Intervention
	Check oil level as shown in Procedure 2	Go to step 1	Level other than max	Do Procedure 3
1	Check oil pressure	All OK	Problems found	Intervention
	Check oil pressure as shown in Procedure 4 (idle for low pressure is only obtained if the vehicle is stationary or moving at low speed (approx. 10 km/h). Under these conditions gearbox	Go to step 2	Press < 40 bar	Do Procedure 5

	fault warning light flashes on models 156 or the text Selespeed Gearbox Fault is displayed on 147 without any fault being stored in the control unit)			
2	Check ECU errors	All OK	Problems found	Intervention
	Check ECU for absence of errors. Specifically check for: <ul style="list-style-type: none"> • Clutch solenoid valve current error • Odd gears engagement (Vbat short circuit) • Even gears engagement error (Vbat short circuit) 	Go to step 4	Presence of one or more errors included in the list	Go to step 3
3	Check problems found	All OK	Problems found	Intervention
	Check problems according to Procedure 17	Vai a step 4	The problem persists	Go to step 4
4	Engagement of all gears check	All OK	Problems found	Intervention
	Check correct engagement of all the gears following Procedure 11	Vai a step 5	The problem persists	Contact technical assistance for additional information on the problem
5	Check that the problem is no longer present.	All OK	Problems found	Intervention
	Fault no longer present	End of procedure		

During gear shift the car revs up

Troubleshooting table		Symptom/conditions: During gear shift the car revs up		
DIAGNOSTICS		<ul style="list-style-type: none"> The problem disappears if the accelerator pedal is released when changing gear It seems that the clutch slips and every now and then there is a smell of burning 		
		Test results		
Step	Operations			
0	Check ECU errors	All OK	Problems found	Intervention
	Check ECU for absence of errors. Specifically check for: <ul style="list-style-type: none"> CAN messages transmission error CAN message reception error 	Go to step 2	Presence of one or more errors included in the list	Go to step 1
1	Check problems found	All OK	Problems found	Intervention
	Check problems according to Procedure 17	End of procedure	The problem persists	Go to step 2
2	Regulation of clutch stop pin check	All OK	Problems found	Intervention
	Check the clutch stop pin following Procedure 6	Go to step 4	The stop pin is not regulated correctly	Adjust the clutch stop pin regulation following Procedure 6. Go to step 3
3	After clutch stop pin adjustment	All OK	Problems found	Intervention
	Check that the problem is no longer present.	End of procedure	The problem persists	Go to step 4

4	Clutch parameters calibration execution	All OK	Problems found	Intervention
	With examiner in active diagnosis, run the calibration of the clutch parameters through " enable clutch self-calibration "	Go to step 5		
5	Road test	All OK	Problems found	Intervention
	Test on the road			Test on the road changing gear as often as possible, using all the gears (at different speeds and engine loads). Continue with step 6
6	Result of the test	All OK	Problems found	Intervention
	After the test on the road	End of procedure	The problem persists	Go to step 7
7	Clutch disk check	All OK	Problems found	Intervention
	Check the clutch disk	Go to step 9	The clutch disk is found worn/does not conform	Replace the clutch disk. Go to step 8
8	Car functioning check	All OK	Problems found	Intervention
	Check on the road again	End of procedure	The problem persists	Go to step 9
7	The problem persists	All OK	Problems found	Intervention
				Contact technical assistance for additional information on the problem

City -> Manual change-over

Troubleshooting table		Symptom/conditions: City -> Manual change-over		
		<ul style="list-style-type: none">When travelling in automatic mode the car changes to manual on its own		
PRELIMINARY NOTE It is to be remembered that it is envisaged in the functional strategy: <ul style="list-style-type: none">For Alfa 156 F2, 156 F3 and 147 that when a gear change is requested by lever/buttons on the steering wheel, the change-over is made from City to ManualFor Alfa 156 JTS when a gear change is requested by lever/buttons on the steering wheel, the system uses the gear suggestion strategy and remains in City mode				
DIAGNOSTICS		Test results		
Step	Operations			
0	Check ECU errors	All OK	Problems found	Intervention
	Check ECU for absence of errors. Specifically check for: <ul style="list-style-type: none">No accelerator pedal message error	Go to step 2	Presence of one or more errors included in the list	Go to step 1
1	Check problems found	All OK	Problems found	Intervention
	Check problems according to Procedure 17	End of procedure	The problem persists	Go to step 2
2	Auto button check	All OK	Problems found	Intervention
	Check that the City button functions correctly (no false contacts) following Procedure 9	Go to step 4	The button is not functioning correctly	Check conditions of connections and wiring. Restore/replace broken parts. Go to step 3.

3	After checking correct functioning of the auto button	All OK	Problems found	Intervention
	Check that the problem is no longer present.	End of procedure	The problem persists	Go to step 4
4	Check for presence of false contacts on lever/steering wheel buttons	All OK	Problems found	Intervention
	Check functioning of lever on the road			With the car in City, mode, test on a rough road to discover if there are any false lever contacts . Continue with step 5.
5	After the road test	All OK	Problems found	Intervention
	According to the results of the test.	Go to step 7	Spontaneous change-overs from City to Manual have taken place	Check the condition of the lever/ buttons, the connections and the wiring . Restore/replace the part that is not functioning properly. Continue with step 6
6	After checking the lever functions properly	All OK	Problems found	Intervention
	Check that the problem is no longer present.	End of procedure	The problem persists	Go to step 7
7	The problem persists	All OK	Problems found	Intervention
				Contact technical assistance for additional information on the problem

Manual -> City change-over

Troubleshooting table		Symptom/conditions: Manual -> City change-over		
		<ul style="list-style-type: none">Travelling in manual mode the car passes to automatic on its own		
PRELIMINARY NOTE				
<ul style="list-style-type: none">It should be remembered that keeping the lever in a position other than home, (the driver has the habit of keeping a hand on the lever) after 12 s the system changes from Manual to City				
DIAGNOSTICS		Test results		
Step	Operations			
0	Check ECU errors	All OK	Problems found	Intervention
	Check ECU for absence of errors. Specifically check for: <ul style="list-style-type: none">§ 0/1/2/3 lever switches error	Go to step 2	Presence of one or more errors included in the list	Go to step 1
1	Check problems found	All OK	Problems found	Intervention
	Check problems according to Procedure 17	End of procedure	The problem persists	Go to step 2
2	Correct lever and city button functioning check	All OK	Problems found	Intervention
	Check that the lever and the City button function correctly, following Procedure 8 and Procedure 9	Go to step 4	Lever or buttons do not work correctly.	Check conditions of connections and wiring. Restore/replace broken parts. Go to step 3.

3	After checking the correct functioning of the lever and the city button	All OK	Problems found	Intervention
	Check that the problem is no longer present.	End of procedure	The problem persists	Go to step 4
4	The problem persists	All OK	Problems found	Intervention
				Contact technical assistance for additional information on the problem

The engine has switched off

Troubleshooting table		Symptom/conditions: The engine has switched off		
DIAGNOSTICS		<ul style="list-style-type: none"> • While the car is stopping • While the car is starting • With the car stationary 		
		Test results		
Step	Operations			
0	Check oil level	All OK	Problems found	Intervention
	Check oil level as shown in Procedure 2	Go to step 1	Level other than max	Do Procedure 3
1	Check oil pressure	All OK	Problems found	Intervention
	Check oil pressure as shown in Procedure 4	Go to step 2	Press < 40 bar	Do Procedure 5
2	Check ECU errors	All OK	Problems found	Intervention
	Check there are no errors in the control	Go to step 4	Presence of one or more	Go to step 3

	unit. In particular: <ul style="list-style-type: none"> • Clutch sensor error * • Clutch solenoid valve current error * • Load relay error* • Odd gears engagement (Vbat short circuit)* • Even gears engagement error (Vbat short circuit)* 		errors included in the list	
3	Check problems found	All OK	Problems found	Intervention
	Check problems according to Procedure 17	End of procedure	The problem persists	Go to step 4
4	Check that the clutch does not drag	All OK	Problems found	Intervention
	Check that the clutch does not drag following Procedure 14	Go to step 6	The clutch drags	Overhaul the clutch/flywheel kit and replace the broken components. Go to step 5
5	After intervention on the clutch kit	All OK	Problems found	Intervention
	Check that the problem is no longer present.	End of procedure	The problem persists	Go to step 6

6	The problem persists	All OK	Problems found	Intervention
	Check there are no errors or problems on other systems installed don the car	Go to step 7	Faults are found	Proceed following the indications of Examiner
7	The problem persists	All OK	Problems found	Intervention
				Contact technical assistance for additional information on the problem

* In the presence of this type of error, for safety reasons (at low speed <5 km/h), the Selespeed control unit could ask the injection control unit for an engine stop; it is therefore advised to make an engine control diagnosis.

The gear flashes on the display

Troubleshooting table		Symptom/conditions: The gear flashes on the display		
		<ul style="list-style-type: none"> Travelling with any gear engaged 		
DIAGNOSTICS				
		Test results		
Step	Operations			
0	Gear engagement	All OK	Problems found	Intervention
	With the engine off and key on MAR engage the gear that caused the problem. Continue with step 1			

1	Connector (20 pins) for car wiring/hydraulic unit inter-connection check	All OK	Problems found	Intervention
	"Stress" the 20-pin connector and check that the gear does not flash on the display	There is no flashing. Continue with step 3	The gear flashes on the display	Restore /replace the 20-pin connector
2	Check that the problem is no longer present.	All OK	Problems found	Intervention
	The fault is no longer present	End of procedure	The problem persists.	Go to step 3
3	Engagement /selection connectors potentiometers check	All OK	Problems found	Intervention
	"Stress" the engagement/selection connectors and check that gear does not flash on the display	There is no flashing. Continue with step 5	The gear flashes on the display	Restore /replace the pre-wiring
4	Check that the problem is no longer present.	All OK	Problems found	Intervention
	The fault is no longer present	End of procedure	The problem persists.	Go to step 5
5	Engagement/selection potentiometers replacement	All OK	Problems found	Intervention
	Replace the potentiometers.			Insert tool n.1870753001 then replace the engagement and selection potentiometers
6	Check that the problem is no longer present.	All OK	Problems found	Intervention

	The fault is no longer present	End of procedure	The problem persists.	Go to step 7
7	The problem persists	All OK	Problems found	Intervention
				Contact technical assistance for additional information on the problem

PROCEDURES

Procedure 2.

Oil level check

1. Wait for the electric pump to switch off (The pump activates when the door on the driver's side is opened and automatically switches off after a maximum time of 30 seconds).
2. Set the ignition key on MAR.
3. Make several gear shifts with the engine off so as to activate the electric pump.
4. Immediately after the electric pump switches off, check the hydraulic unit oil level with the dip-stick under the cap of the tank.
5. If the oil level is under the Max marking, top up ; if it is over, bring it down to Max level.

Procedure 3.

Oil leaks check

1. After checking the oil level (see procedure 2), make a note of how much is needed for topping up.
2. Make a visual check on the pipes, electric pump, tank, hydraulic unit, engagement/selection actuator, clutch stop pin (removing the casing that covers it) while making 50 gear shifts from 1st to 5th/R and from 5th/R to 1st (at a frequency of 1 gear change every 3-4 s).
3. If leaks are found, replace/repair the parts involved, top up the oil and start again from step 1.
4. If there are no leaks:

- if the quantity of oil for the first topping up is > 200 cc -> replace the hydraulic unit,
- if the quantity of oil for the first topping up is < 200 cc -> repeat step 2 watching carefully for leaks from the clutch stop pin (removing the casing that covers it and cleaning the parts involved), if everything is ok continue with the next step of the diagnostics table.

Procedure 4.

Oil pressure check



Check that the bleeder screw (under the battery rack) is tightened to a torque of 0.35 Nm + 0.05 Nm, otherwise, even if the pump is running, the oil pressure will never reach the required value.

1. Set the ignition key to MAR.
2. Connect the Examiner diagnostics tool.
3. With the electric pump off, the pressure should be between 40 and 55 bar at environment temperature.

Procedure 5.

Electric pump operation check

1. Set the ignition key to MAR.
2. Connect the Examiner diagnostics tool.
3. Using Examiner check that the battery voltage is higher than 11V; if the voltage is lower, check the battery.
4. Use Examiner to see the status of the pump relay output (ON/OFF).
5. Make gear shifts until the pump activates.
6. Stop the gear shift requests and check how long the electric pump remains on (listening to the electric pump and at the same time watching Examiner to see when the pump relay status changes from ON to OFF).
7. If the status of the "pump relay output" parameter is ON, but the electric pump activation is not heard, check the electric power supply line of the electric pump (relay, fuse.....)
8. If at environment temperature (15-20 °C) the battery voltage is greater than 11V and the "Pump relay ON" is between 4 and 14 seconds, the electric pump operates correctly.
9. If the checks have positive results, pass on to the next step of the diagnostics table.

NOTE: Repeat the test several times to make sure.

Procedure 6.

Clutch stop pin adjustment check

1. Set the ignition key to MAR.
2. Connect the Examiner diagnostics tool.
3. Check that the clutch position is between 28 and 28.5 mm; if it is not, continue with the next step.
4. Loosen the lock nut (1c in Fig.16) and adjust the stop pin so that the clutch position value read on Examiner is between 28 and 28.5 mm.
5. Tighten the lock nut to a torque of 0.6 ± 0.05 Nm and measure again.

Procedure 7.

Brake pedal switch check

1. Set the ignition key to MAR. Connect the Examiner diagnostics tool and select the input status display (ON/OFF) regarding the switch on the brake pedal.
2. Press the brake pedal and check that the displayed value changes (from released to pressed and vice-versa).
3. If this status change does not take place check the brake pedal switch, its fastening, its position and its wiring.

Procedure 8.

Buttons on steering wheel and gear lever check

1. Set the ignition key to MAR.
2. Connect the Examiner diagnostics tool and select the "LEVERS STATUS" display in parameters environment.
3. Make all the selections possible with the buttons on the steering wheel and the gear lever (one at a time) checking the correct status change on Examiner; the list of the selections to be made is the following:
 - Lever Up (+) (forward)
 - Lever Down (-) (backward)
 - RH button Up on steering wheel (+)
 - LH button Down on steering wheel (-)

- Lever on idle (N)
- Lever on Reverse (R)
- Buttons and lever released

4. If the status displayed is not correct, check the wiring and gearshift buttons/lever.

Procedure 9.

City button check (automatic operation selection)

1. Set the ignition key to MAR.
2. Connect the Examiner diagnostics tool and select the display of the input states (ON/OFF) for the auto button.
3. Press and release the automatic operation selection button at the base of the gear lever (this check is to be made with the engine running).
4. Check on Examiner that the status has changed.
5. Start the engine and check that when the button is pressed "CITY" is seen on the display.
6. If the status does not change (step 4) and/or "CITY" is not displayed (step 5.), check the button and the wiring.

Procedure 11.

Correct engagement of all the gears with the gear shift lever and the engine off check

1. With the ignition key on MAR and the brake pedal pressed, engage all the gears with the gear lever and check on the display that they engage properly

Lever	Display
1	
2	
3	
4	
5	
R	

1. If all the gears engage and are shown correctly on the display the procedure ends here.

Procedure 14.

Clutch drag check*

1. Connect the Examiner diagnostics tool .
2. Start the car and put the gear to idle.
3. With the engine running at minimum, read the value of the clutch disk speed parameter
4. If the clutch disk speed is over zero there is a **clutch drag condition**
5. Calibrate the clutch parameters in active diagnostics through "enable clutch self-calibration ".
6. Repeat from step 2 to step 4. If the fault no longer occurs: continue from step 7.
7. If there is no clutch drag, warm the engine and the clutch by a series of take-offs (with the accelerator pressed down over half of its stroke)
8. Repeat steps 1 to 4
9. If the situation of step 4 occurs, there is a clutch drag condition and therefore the clutch mechanism needs to be replaced; otherwise there is no clutch drag.

* Note that clutch drag often occurs with a hot engine

Procedure 17.

What to do according to the error on the Selespeed control unit

● CAN network error:

• Check:

- The network sees all the control units (n.b.: pay attention because any control unit connected to the CAN network could cause faults in network operation). If one of the control units does not dialogue, recover/replace that control unit.
- Condition of the connections and continuity of the wiring regarding the CAN line. It is better not to just make a visual analysis of the connection, but to test putting it under mechanical stress (pull the wires, twist them, and check that the pins are firm); if a fault is found, restore/replace the wiring.

● Engine speed (from wire):

- check the correct connection between engine control unit and Selespeed control unit, since this signal is sent by the engine control unit through a special wire. If a fault is found restore/replace the part involved.

- **1st/2nd gear range selection solenoid valve:**

- Run the solenoid valve active diagnostics. If the test does not give satisfactory results, pass to the next step
- Check the condition of the connections and continuity of the wiring. If a fault is found, restore/replace the wiring.
- Run the solenoid valve active diagnostics again. If the test does not give satisfactory results replace the solenoid valve and check the functioning.

- **5th/R gear range selection solenoid valve**

- Run the solenoid valve active diagnostics. If the test does not give satisfactory results, pass to the next step
- Check the condition of the connections and continuity of the wiring. If a fault is found, restore/replace the wiring.
- Run the solenoid valve active diagnostics again. If the test does not give satisfactory results replace the solenoid valve and check the functioning.

- **Clutch solenoid valve current error:**

- Check the condition of the connections and continuity of the wiring. If a fault is found, restore/replace the wiring.
- Replace the solenoid valve and check the functioning by making a gear shift.

- **Clutch sensor:**

- Check the condition of the connections and continuity of the wiring. If a fault is found, restore/replace the wiring.
- Replace the clutch potentiometer and check the functioning by making a gear shift.

- **Odd or even gears engagement (engagement solenoid valves)**

- Run the solenoid valve active diagnostics. If the test does not give satisfactory results, pass to the next step
- Check the condition of the connections and continuity of the wiring. If a fault is found, restore/replace the wiring.
- Run the solenoid valve active again. If the test does not give satisfactory results replace the solenoid valve and check the functioning.

- **Control unit earth error**

- Check the tightness of the earth connections on the body and on the engine.
- Check the condition of the connections and continuity of the wiring. If a fault is found, restore/replace the wiring.

- **Charging relay error***

- Check the condition of the battery
- Check the condition of the connections and continuity of the wiring. Make a careful check on the items that supply the power to the control unit (wiring, fuses, relay etc.). If a fault is found, restore/replace the wiring.

- **Lever switches 0/1/2/3 error**

- Connect the Examiner diagnostics tool and select "LEVER STATUS" in parameters environment.
- Make all the selections possible with the buttons on the steering wheel and the gear lever (one at a time) checking the correct status change on Examiner; the list of the selections to be made is the following:
 - Lever Up (+) (forward)
 - Lever Down (-) (backward)
 - Lever on idle (N)
 - Lever on Reverse (R)
 - Lever released
- If the status displayed is not correct, check the connections, the wiring continuity and the gear shift lever.

- **Lever switch error (any of the four, or auto button)**

Lever check

- Connect the Examiner diagnostics tool and select the "LEVERS STATUS" display in parameters environment.
- Make all the selections possible with the buttons on the steering wheel and the gear lever (one at a time) checking the correct status change on Examiner; the list of the selections to be made is the following:
 - Lever Up (+) (forward)
 - Lever Down (-) (backward)
 - Lever on idle (N)
 - Lever on Reverse (R)
 - Lever released
- If the status displayed is not correct, check the connections, the wiring continuity and the gear shift lever.

- **Auto button check**

- Select the state of inputs display (ON/OFF) relating to the auto button.
- Press and release the automatic operation selection button at the base of the gear shift lever.
- Check on Examiner that the change of status has taken place.
- Start the engine and check that when the button is pressed, "AUTO" is shown on the display.
- If the change of status does not take place (step 4) and/or "AUTO" is not displayed (step 5.), check the button and the wiring

N.B. there have been cases where the auto button remains stuck: this can cause malfunctioning of the lever.

- **Engagement sensor.** When this error is present, the gear change is slower than usual due to the system operating in recovery.

- Check the condition of the connections and continuity of the wiring. If a fault is found, restore/replace the wiring.

- Replace the engagement potentiometer ** and check the correct reading of the position, making a series of gear changes

- **Selection sensor.** When this error is present, the gear change is slower than usual due to the system operating in recovery.

- Check the condition of the connections and continuity of the wiring. If a fault is found, restore/replace the wiring.

- Replace the selection potentiometer and check the correct reading of the position, making a series of gear changes.

- **Clutch disk speed (this signal is read by the sensor that reads the speed of the primary shaft***)**

- Check the condition of the connections and continuity of the wiring. If a fault is found, restore/replace the wiring.

- Replace the clutch disk speed sensor (see components r/r general procedure) and check the correct reading of the position, making a series of gear changes.

- **Car speed.**

Only for **Alfa 156 Selespeed: N.B.** *The car speed signal is supplied by the Instrument Panel on board to the Selespeed control unit; therefore any signal omission/fault on the panel will also result on the Selespeed System.* Proceed as follows:

- Check that the car speed signal arrives continually to the Panel on board.

- If the signal does not arrive continuously:
- Proceed following the instructions in the Service Handbook
- If the signal arrives continuously:
- Check the condition of the connections and continuity of the line wiring, especially between the control units signalled with an error. If a fault is found, restore/replace the wiring

Only for **Alfa 147 Selespeed**: **N.B.** *The car speed signal reaches the Selespeed control unit through the CAN line from the ABS control unit, therefore any signal omission/fault on the ABS control unit will also result on the Selespeed System.*
Proceed as follows:

- Check whether there are any faults in the ABS control unit and/or the engine control unit that justifies the omission of the car speed signal.

- If no faults are found:

- Use the EXAMINER diagnostics tool to check for dialogue problems on the CAN line

- **No accelerator pedal information.** The signal is received by the Selespeed control unit through the CAN line:

- On Examiner select CAN network information and check if there is the presence of control unit error

- Check the condition of the connections and continuity of the line wiring, especially between the control units signalled with an error. If a fault is found, restore/replace the wiring.

- **Brake switch.** The signal is received by the Selespeed control unit through the CAN line and through a wire:

- Check the condition of the brake switch.

1. Bring the ignition key to MAR.

2. Connect the Examiner diagnostics tool and select the inputs status display (ON/OFF) for the switch on the brake pedal.

3. Press the brake pedal and check that the displayed value changes (from released to pressed and vice-versa).

4. If there is no status change check the switch on the brake pedal, its fastening, its position, the condition of the connections and the wiring.

- If a fault is found, restore/replace the components/wiring

- **Pump relay error**

- check the condition of the connections and continuity of the wiring. Make a careful check on the items that supply power to the electric pump (fuses, relay etc.). If a fault is found, restore/replace the wiring. There have been cases where the "fastom" housed in the relay holder socket have pulled out.

- **Accumulator oil discharge error:**

- replace the accumulator

- **Start enable relay error**

- The Selespeed control unit supplies the earth for the start relay block; if a short circuit to the battery or an open circuit is diagnosed, the engine cannot start; if instead a short circuit to earth is found the engine can be started without the enable from the Selespeed control unit. In any case the problem arises from the wiring or from systems that enable the start downstream of the Selespeed control unit. Check the condition of the connections and the continuity of the wiring downstream of the Selespeed control unit.

- Check the condition of the brake switch.

1. Bring the ignition key to MAR.

2. Connect the Examiner diagnostics tool and select the inputs status display (ON/OFF) for the switch on the brake pedal.

3. Press the brake pedal and check that the displayed value changes.

4. If there is no status change check the switch on the brake pedal, its fastening, its position, the condition of the connections and the wiring.

- If a fault is found, restore/replace the components/wiring.

* This error is connected to a control unit power supply problem and not to the control unit itself ** It is a good practice to insert tool n°1870753001 before removing the hydraulic unit potentiometer *** This sensor is positioned on the gearbox to the right of the reverse lights sensor

Procedure 18.

Check the functioning of the clutch disk speed sensor with road test

1. Connect the Examiner diagnostics tool

2. In parameters environment view:

- Engine revs

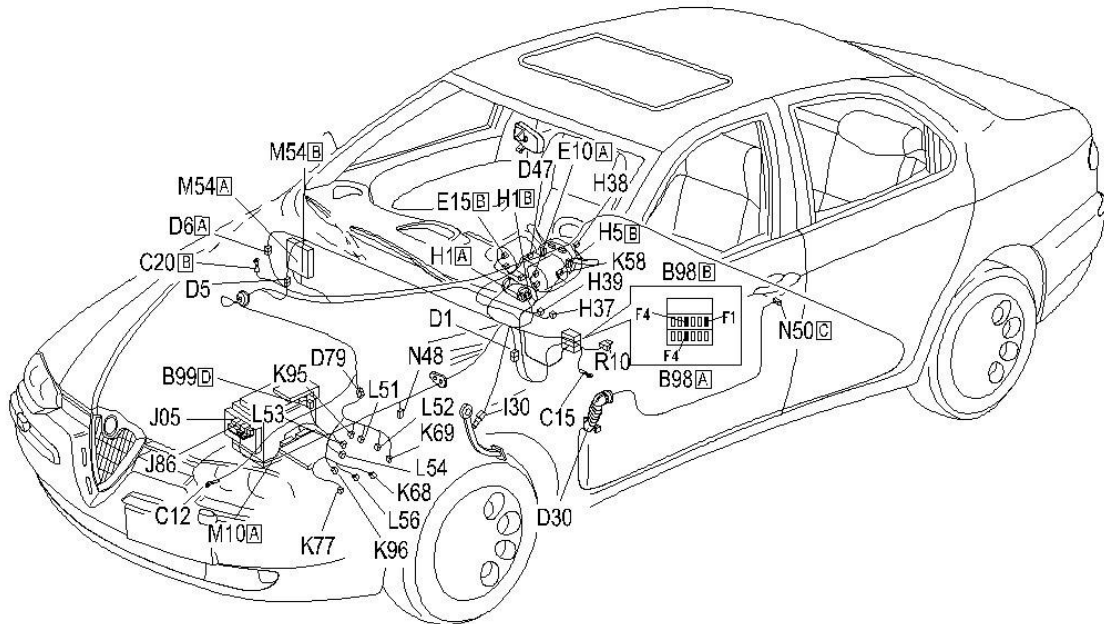
- Clutch disk speed

3. Make a road test at a steady speed without changing gear (V approx. 30 km/h).

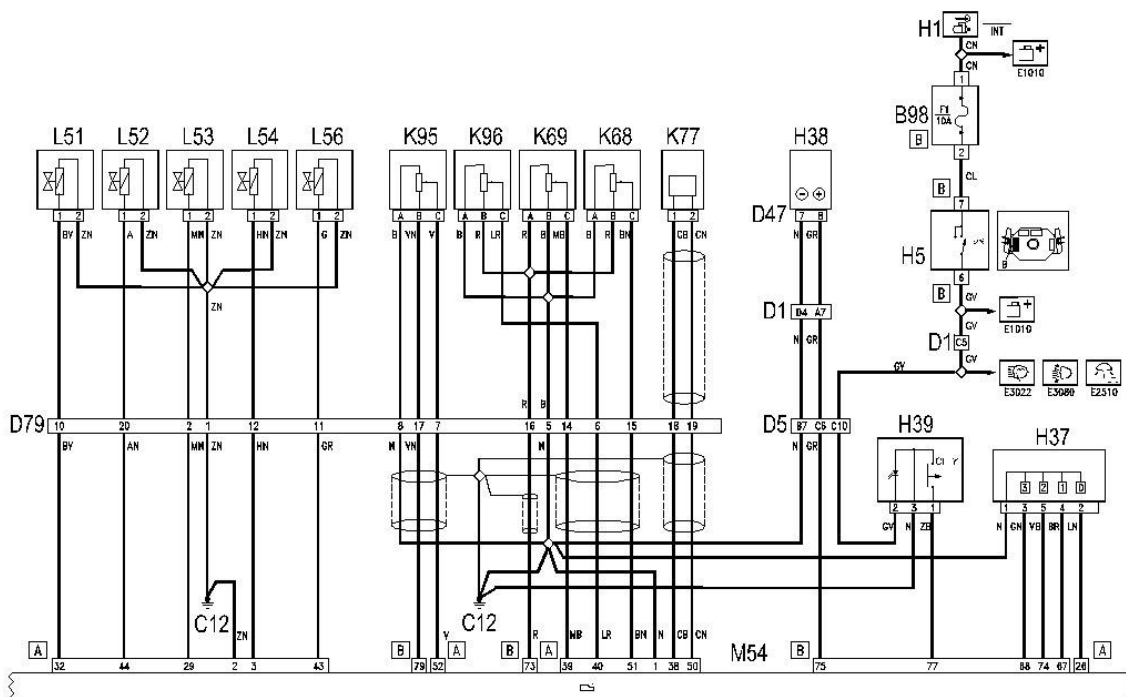
4. While driving watch the two selected parameters

5. Check that there are no significant fluctuations/ differences on the clutch speed sensor in relation to the engine revs.

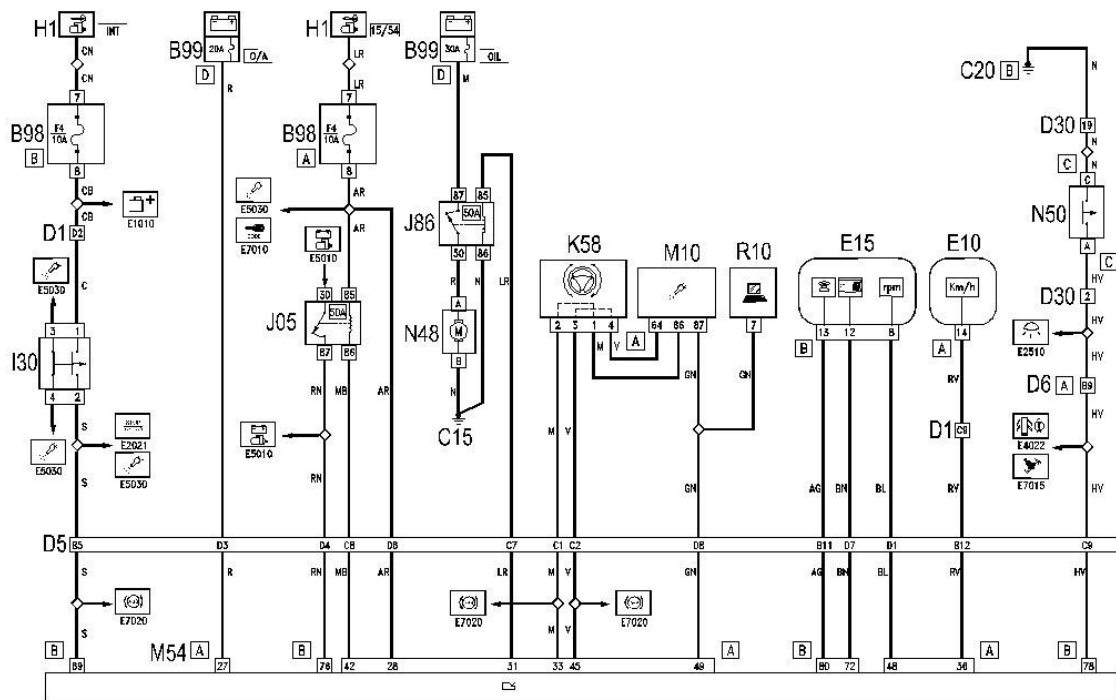
156 2.0 JTS Selespeed Schematics



Component locations



Wiring diagram 1



Wiring diagram 2

From 2005 Paul Denyer website