ALFA ROMEO
AISIN AF40-6
Q-Tronic

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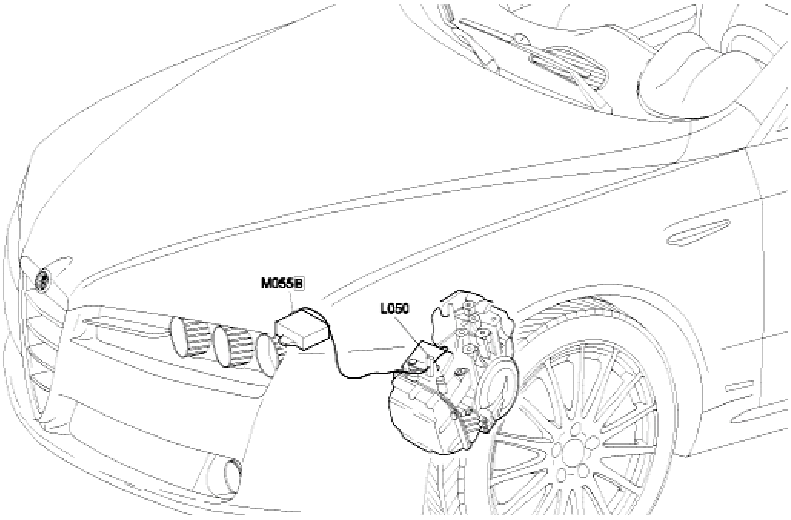
Q-Tronic Automatic Gearbox

GENERAL

The Alfa 159 range has enhanced new technological content with the addition of the new Q–Tronic system (AISIN AF 40-6) on the 2.4 JTDM 200 bhp, 1.9 JTDM 150 bhp and 3.2 V6 JTS versions.

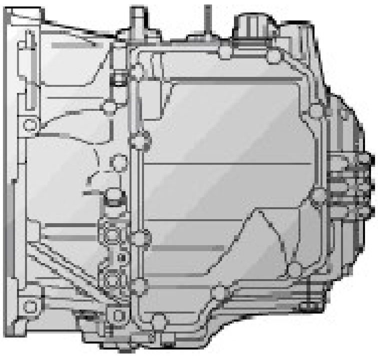


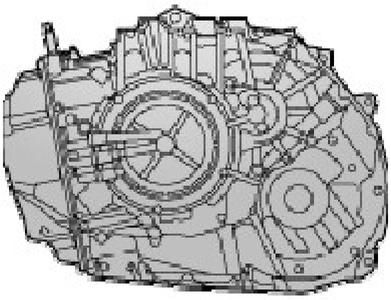
The name ‘Q-Tronic’ is formed by combining the letter ‘Q’ and the word Tronic. The letter ‘Q’ has the same thematic origins as the ‘Q4’ all-wheel drive technology developed by Alfa Romeo, testimony to the company’s research efforts to create technologies and devices that improve sporting behaviour, ride comfort and active safety. The term Tronic, on the other hand, explains that the system is controlled by an electronic control unit that controls gear shifts in a highly-efficient, intelligent way.

Q-Tronic offers great versatility thanks to the four operating modes available:
- an default mode for car start-up, designed to offer excellent ride comfort and low fuel consumption.
- Sport: this mode features fixed gear shifts at higher engine speeds, giving the car a sportier drive.
- Winter: this mode makes starting off and driving in poor grip conditions easier.
- Sequential: this mode offers the driver the opportunity to select the gears manually.

Various other functions are also available that enable the vehicle to adapt its performance to suit the driving and road conditions. These include the ‘Up & Down slope’ function that allows the vehicle to recognise the slope of the road, changing gear shift points accordingly, and the ‘Braking assist’ function, which facilitates vehicle deceleration by shifting down gear.

TECHNICAL SPECIFICATIONS





- **Transmission ratios:**
  - 1st gear: 4.148
  - 2nd gear: 2.370
  - 3rd gear: 1.556
  - 4th gear: 1.155
  - 5th gear: 0.859
  - 6th gear: 0.686
  - Reverse gear: 3.394
  - Differential: 2.670 (1.9 JTDm)
  - Differential: 3.075 (2.4 JTDm)
  - Differential: 3.750 (3.2 JTDm)

- Number of planetary gears: 2
- Maximum transmissible torque: 450 Nm
- Weight : 96 Kg
- Oil type : Tutela GI/VI
- Brakes: 2 (B1 and B2)
- Clutches: 3 (C1, C2, C3)
- Clutches: 1 (unidirectional freewheel type)
- Solenoids: 8

FUNCTIONS

Neutral control

When the vehicle stops with the gear lever in position ‘D’ with the brake pressed, the clutches are automatically released and the gearbox shifts to neutral. This means that the torque converter is not put under strain, there are fewer vibrations and minimal fuel consumption.
When the brake pedal is released, the system activates ‘NORMAL’ operation.

Reverse control

Moving the gear lever from ‘N’ to ‘R’, reverse gear is not engaged if the car’s speed is above 5 km/hr.

Key Off settings storage
Only on the 2.4 JTDM and 3.2 V6 versions, there is a function for saving the settings of the Q-Tronic system in Key Off mode. This function enables the driver, on Key On, to find the Automatic gearbox with the last settings present when the engine was switched off, thus avoiding the fuss of having to reset the system to the driver's preferred driving style.

Engine start-up
To start the engine, proceed as follows:
1. Ensure that the handbrake is on and that the gear lever is in position 'P' or 'N'
Note: engine start-up is only possible with the gear lever in these positions.
2. Press and hold down the brake pedal, and insert the electronic key into the reader; press the 'START/STOP' button and release it as soon as the engine starts, without pressing the accelerator pedal.

Stopping the car
To stop the car, proceed as follows:
1. Press and hold down the brake pedal,
2. Ensure that the handbrake is on and that the gear lever is in position 'P'
3. Press the 'START/STOP' button and release it as soon as the engine stops.

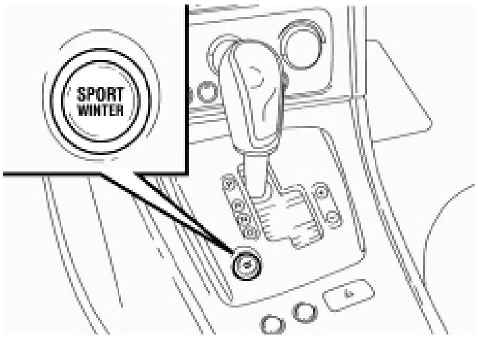
Warning: If the engine is switched off with the gear lever in a position other than P, it will not be possible to remove the electronic key from the starter device. An alarm and flashing indicator for a few seconds at gear P on the display inform the driver that the car has been switched off with the gear engaged and with the gear selection lever in a position other than P. The electronic key can only be removed from the starter device with the gear lever in position P.

Towing the car
To tow the car, respect current local legislation and if possible use special equipment, otherwise:
- move the gear lever in position 'N'
- tow the car by raising the two driving (front) wheels off the ground

Warning: tow the 4x4 version by raising the driving (front) wheels off the ground and using coasters for the rear wheels.

OPERATING MODE IN 'D'
1.9 JTDM 150 bhp version
The AF40-6 automatic gearbox does not allow the driver to manually select the various operating modes (there is no manual selection button present on the gear lever console). In these conditions the Q-Tronic system adapts its behaviour automatically, choosing the most appropriate mode for the driver's driving style.

2.4 JTDM 200 bhp and 3.2 V6 JTS versions
In these versions the gear lever console features a manual selection button for choosing the operating modes of the Q-Tronic automatic gearbox.



The driver can choose one of the following strategies:
- ECONOMY/NORMAL
- SPORT
- WINTER (Low grip conditions: mud, ice, etc.)

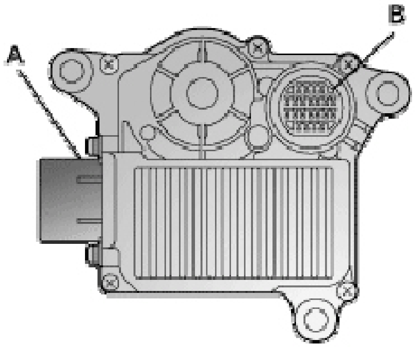
Mode
The following list describes the various operating functions:

- ECONOMY/NORMAL:
Used in normal driving conditions, for the lowest possible fuel consumption.
- SPORT:
In this mode, the gear shift and lock-up points are higher, for a higher engine speed.
- WINTER / LOW GRIP:
In the presence of ice, snow, or low-grip conditions in general, the car starts in third gear to avoid the front wheels slipping.
- TIP:
By moving the gear lever from 'D' to '+/-', the driver can choose the gear shift point sequentially. In any case the control unit changes gear automatically to prevent over-revving, or vice-versa to avoid jerky movements at excessively low engine speeds.
- HIGH TEMPERATURE:
In the event of excessively high gearbox oil temperature, the control unit causes early lock-up intervention to prevent excessive slippage in the torque converter and thus lower the temperature.
- UPHILL:
The control unit automatically detects an uphill slope using an algorithm based on the increased in the number or engine revs; the gearshift points are raised accordingly.
- DOWNHILL:
Conversely, when faced with a downhill slope, the system employs a series of measures to avoid overuse of the brakes (lock-up, shifting down gear, etc.).
- FAST ON:
This function calculates just how much performance the driver wants by measuring the pressure he exerts on the accelerator pedal, and adjusts the gear shift points accordingly.
- FAST OFF:
This function cuts in whenever the accelerator pedal is suddenly released, by maintaining and blocking the transmission ratio used at that moment.
- BRAKE ASSIST:
Conversely, in this case engine braking is used to help the driver when decelerating (which is once again measured through the pressure on the accelerator pedal).
- CORNERING:
This function blocks the transmission ratio used at that moment when driving taking a bend.

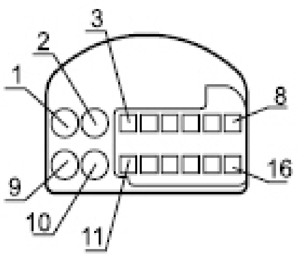
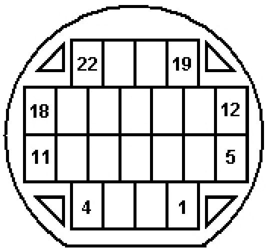
COMPONENTS

Control unit

The control unit is mounted on the gear selection mechanism and integrates the gearbox and gear lever control functions. The figure below shows a bottom view, where the connector for connecting the internal wiring of the electro-hydraulic assembly can be seen.



Gearbox control unit pin-out

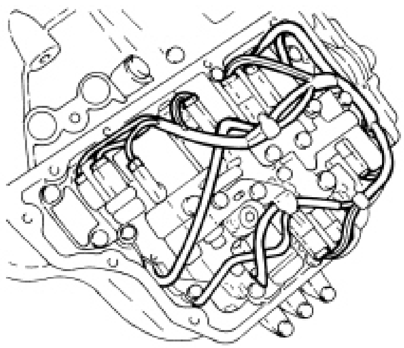
M055/A Connector		M055/B Connector	
			
A1	Power +15	B1	Pressure control solenoid earth (SLT)
A2	N.C.	B2	Shift solenoid control (2)
A3	N.C.	B3	Pressure control solenoid control (SLT)
A4	K Line - Diagnosis	B4	Lock-up solenoid earth (SLU)
A5	Start Lock Signal	B5	Shift solenoid control (1)
A6	C-CAN L (1)	B6	N.C.
A7	C-CAN H (1)	B7	Oil temperature sensor earth
A8	C-CAN H (2)	B8	Oil temperature sensor signal
A9	Earth	B9	Lock-up solenoid control(SLU)
A10	N.C.	B10	Shift solenoid earth (SLC 1)
A11	Power (+ 30)	B11	Shift solenoid control (SLC 1)
A12	N.C.	B12	Rev sensor signal
A13	Reversing lights relay (gnd)	B13	Rev sensor earth
A14	C-CAN L (2)	B14	Shift solenoid control (SLC 3)
A15	N.C.	B15	N.C.
A16	N.C.	B16	Shift solenoid earth (SLB)
		B17	Shift solenoid control (SLC 2)
		B18	Shift solenoid earth (SLC 2)
		B19	Speed sensor signal
		B20	Speed sensor earth
		B21	Shift solenoid control (SLB)
		B22	Shift solenoid earth (SLC 3)

Inputs/outputs managed by the control unit
The interface with the automatic gearbox system manages information by means of the following serial networks:
C-CAN (information, data)
K Line (diagnosis)

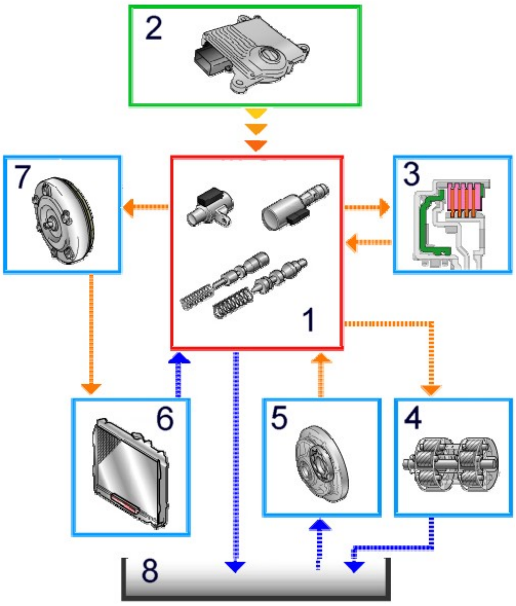
SIGNAL	I/O	TRANSMISSION TYPE
System fault indicator	O	CAN
Max gearbox oil temperature indicator	O	CAN
Engaged gear display	O	CAN
Gear selection	I	CAN
System diagnosis	I/O	K
Car speed	I	CAN
Brake pedal pressed for recovery	I	CAN
Driver’s side front door status	I	CAN
Acoustic alarm enabling	O	CAN
NBS start-up consent	O	on/off (GND)
Reverse lights command	O	on/off (GND)
Engine water temperature	I	CAN
Engine torque variation request	O	CAN
M.I.L. indicator on request	O	CAN

Key: I = input   O = output

Wiring
The wiring is placed inside the gearbox, and is connected on the inside of the valve body:
- to the speed sensors
- to the oil temperature sensor
- to the solenoids.
The wiring is connected to the gearbox control unit by a single connector.

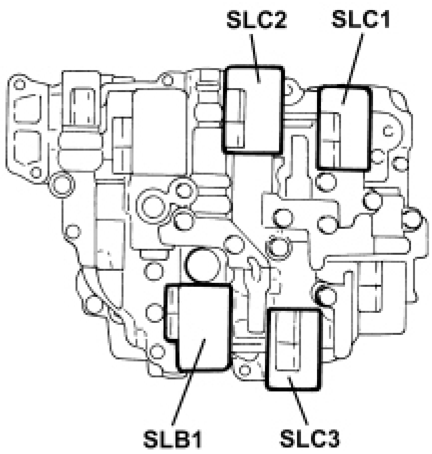


Solenoid valve assembly
The solenoid valve assembly, using solenoids activated by signals from the control unit, supplies the hydraulic pressure produced by the oil pump to the brakes, clutches and lock-up. In addition, part of the oil is used to lubricate the mechanical components.



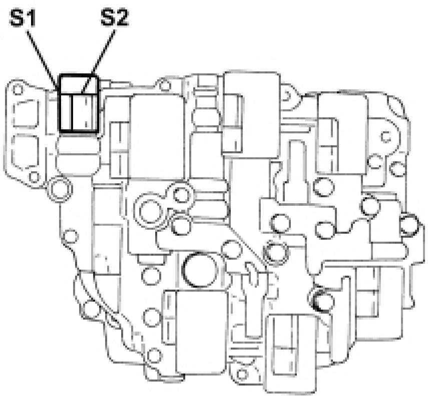
1. Solenoid valve assembly
2. Control unit
3. Brakes/clutches
4. Planetary gears
5. Oil pump
6. Oil cooler
7. Torque converter
8. Oil tank

Solenoids
The linear solenoids shown in the figure linearly control the hydraulic pressure of almost all the brakes/clutches



SLC1, SLC2, SLC3, SLB1 electrical specifications:
at 20° C = 5 ÷ 5.6 Ω

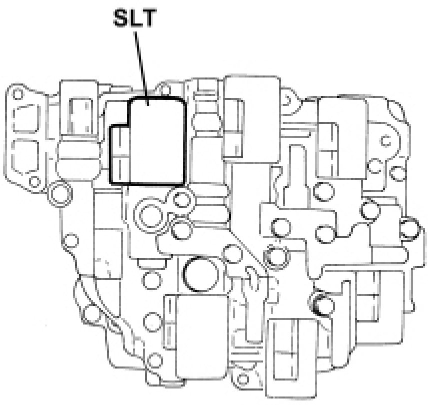
Shift or ON/OFF movement solenoids (S1 and S2): there are 2 of these solenoids, used to control brake ‘B2’ for engine braking in first gear.



S1 and S2 electrical specifications:
a 20° C = 11 ÷ 15 Ω

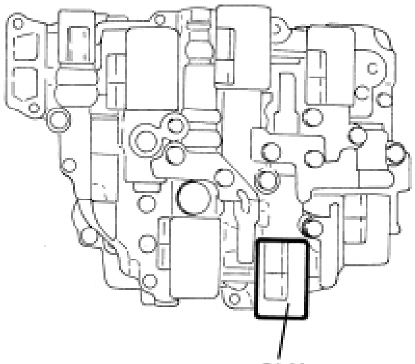
SLT linear solenoid: controlled by the control unit, this solenoid linearly controls the line pressure based on the following signals:
- opening throttle valve
- engine torque

Using this solenoid, the control unit manages to generate the pressure needed for the correct operation of the clutches and brake for gear shifts.



SLT electrical specifications:
at 20° C = 5 ÷ 5.6 Ω

SLU linear solenoid: linearly controls the lock-up pressure in relation to:
- throttle signal; - engine revs; - gearbox input speed; - gearbox output speed



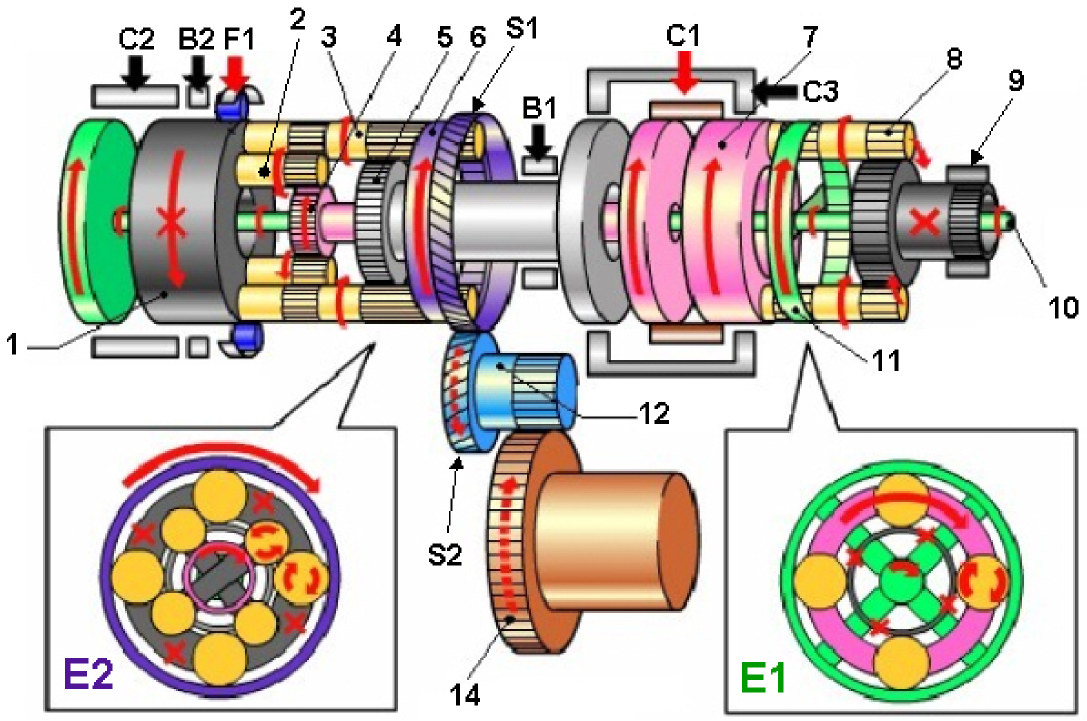
SLU electrical specifications :
at 20° C = 5 ÷ 5.6 Ω

Gearbox transmission ratios
The various transmission ratios are obtained by means of a dual planetary gear assembly. Shifting between the various gears is achieved by activating 8 solenoids according to the following parameters:
- vehicle speed; - throttle opening; - brake pedal signal
The table below illustrates the control strategies for activating the various transmission ratios:

Gear		SLC1	SLC2	SLC3	SLB1	Shift	Shift	Clutches			Brakes		One-way clutch
						S1	S2	C1	C2	C3	B1	B2	F1
P		x	x	x	x								
R		x	x		x					x		x	
N		x	x	x	x								
D	1st E/G brake		x	x	x	x	x	x				x	x
D	1st		x	x	x			x					x
D	2nd		x	x				x			x		
D	3rd		x		x			x		x			
D	4th			x	x			x	x				
D	5th	x			x				x	x			
D	6th	x		x					x		x		
D	N	x			x			x			x		x

Key: x = activated component

Functional view of planetary gear assembly
The planetary gear assembly consists of two epicycles in a cascade arrangement to give six transmission ratios in addition to Neutral and Reverse gear. The figure below shows a functional view of the planetary gear assembly.

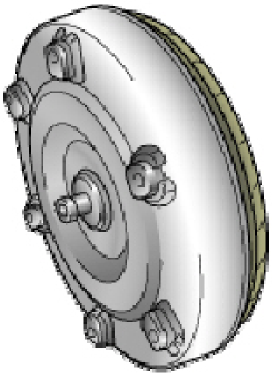


Key:

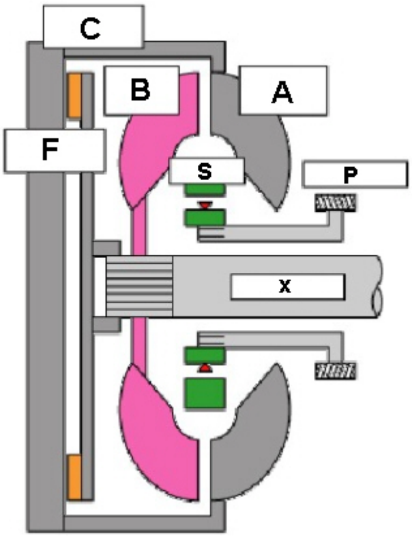
- B1, B2 : Brakes
- C1, C2, C3 : Clutches
- E1 : 1st epicyclic gear set
- E2 : 2nd epicyclic gear set
- F1 : One-way clutch (free-wheel type)
- S1 : Gearbox input speed sensor
- S2 : Gearbox output speed sensor -
- 1 : Planet carrier - E2
- 2 : Internal planet wheel - E2
- 3 : External planet wheel - E2
- 4 : 2nd sun wheel - E2
- 5 : 1st sun wheel - E2
- 6 : Crown - E2
- 7 : Planet carrier - E1
- 8 : Satellite wheel - E1
- 9 : Oil pump
- 10 : Engine torque input
- 11 : Crown - E1
- 12 : Countergear
- 14 : Differential

The one-way clutch (F1) is used to block the train-holder (1) of the second epicycle, in order to enable 1st gear to be engaged.

Torque converter
The torque converter is a device used to connect the engine to the automatic gearbox even in the event of significant differences between the rotation speeds of the input shaft and the output shaft. The connection is not rigid, and is achieved not by mechanically linking the two organs, but through the use of an appropriate hydraulic oil.



Composition of torque converter
Schematically, a torque converter is composed of:
- (A) pump (mounted on engine flywheel)
- (B) turbine (mounted on transmission output shaft)
- (S) stator (reaction element)
- (F) a lock-up clutch
- (C) converter housing



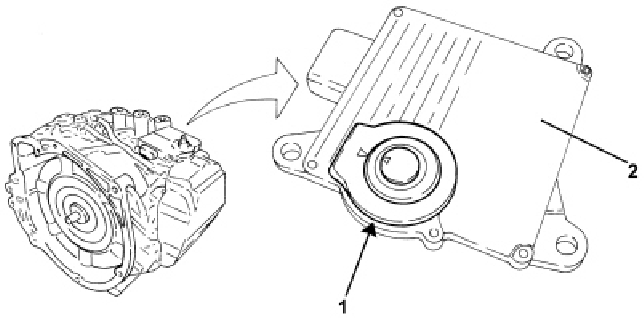
The oil pump (P) is inside the automatic gearbox.

Torque converter operation
The pump and turbine are fitted with shaped fins. Transmission of power (torque) is achieved thanks to the centrifugal force provided by the movement of oil passing continually from the outside of the pump (A) to the turbine (B). When the difference in rotation speed between the two exceeds a given value, the stator (S), which is installed on a freely-spinning assembly, blocks and forms a single block with the converter case. With the stator (S) stopped, its fins deflect the oil back into the pump to increase torque.

The torque converter is also fitted with a lock-up clutch (F), which directly locks the engine to the automatic gearbox transmission, to avoid loss of torque caused by the viscous friction of the oil.

SENSORS

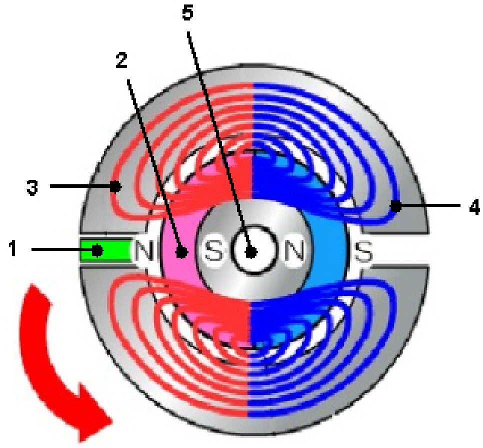
Lever position sensor (nsw)
The gear lever position sensor is a Hall effect type, and is built into the control unit body.

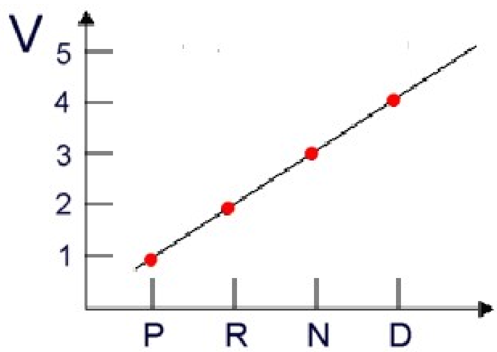


Key: 1. Lever position sensor 2. Control unit

The position of the gear lever is calculated by the control unit using an electrical signal generated by the hall sensor. This sensor consists of a permanent magnet (2) fixed to a pin (5) and a hall sensor (1). When the gear lever in the passenger cabin is moved, since it is connected to the gearbox by means of a steel cable, it turns the pin (5), and also the magnetic field generated by the magnet (2).

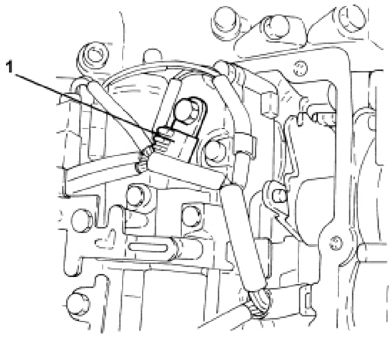
As the angles of the lines of force of the magnetic field (3, 4) vary with respect to the Hall sensor (1), they generate a voltage in the sensor. The more the lines of force (3, 4) are perpendicular to the sensor (1), the more the voltage generated falls. (See graphic).





The lines of force (3, 4) illustrated in the design correspond to the lever being in position 'D'.

Oil temperature sensor
The oil temperature sensor is an NTC and is integrated with the wiring and positioned on the front of the valve body. This sensor measures the oil temperature of the hydraulic circuit. Using the sensor signal, the gearbox control unit can control gear shifts and the lock-up and slip functions of the torque converter, in response to variations in the oil temperature.

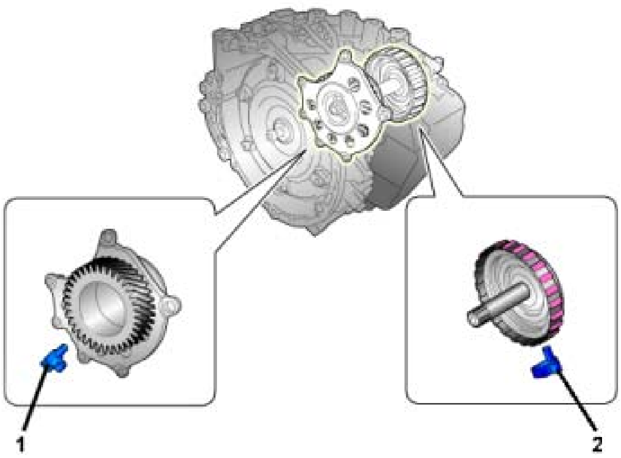


Key: 1. Oil temperature sensor

Oil temperature electrical specifications:

- 10° C = 5.62 ÷ 7.31 kΩ
- 25° C = 3.5 kΩ
- 110° C = 0.22 ÷ 0.27 kΩ

Speed sensors
The input speed sensor measures the planetary wheel input rotation speed, i.e. the speed of the converter turbine.
The output speed sensor measures the rotation speed of the gear driving the differential.



Key: 1. Output speed sensor 2. Input speed sensor

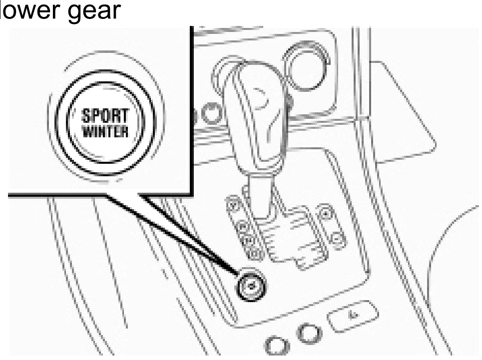
GEARBOX COMMANDS

Gear shifts can be carried out:
- sequentially (manual) or automatically using the selector lever
- sequentially (manual) using steering wheel controls (where available).

Gearbox lever assembly

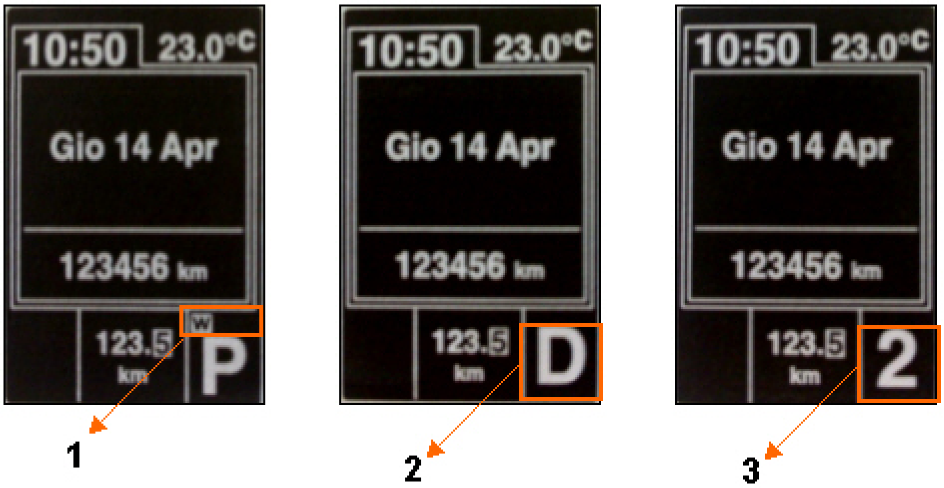
The gearbox lever assembly is a node connected to the C-CAN network and is situated in the central tunnel of the passenger cabin.

The gear lever has the following positions:
- P : Parking
- R : Reverse
- N : Neutral
- D : Drive (automatic gear shift)
- TIP : Manual gear shift for a sporty drive. (lever to the left of position 'D').
  (+) = Sequential shift to higher gear
  (-) = Sequential shift to lower gear



Gear selector lever manual sequential control

It is possible to manage the 6 gears sequentially by moving the lever to the right, and then moving It up towards the (+) to engage the gear above, or down towards the (-) to engage the gear below.
Each gear engaged is shown numerically on the on-board instrument display.



Key:

1. Space used to display the operating mode selected by the user [S : ‘Sport’ programme ; W : ‘Winter’ programme ; space empty: Economy/Normal programme]

Note: to activate the ‘Winter’ programme, the button needs to be pressed for over 2 seconds.

2. Space used to display the gear lever position (P, R, N, D)
3. Space used to display the gear used at that moment in ‘TIP’ mode

Gear selector lever automatic control

The automatic command D for sequential operation can be selected in any driving conditions.

The most appropriate gear is then chosen by the gearbox electronic control unit, depending on the vehicle speed and engine load.

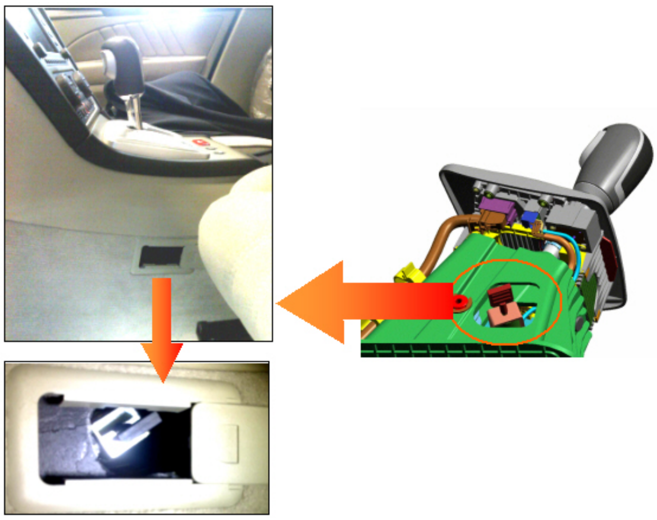
There is a ‘Sport - Winter’ button on the gear lever console for changing the driving mode to suit the driving style wanted by the driver or the outside weather conditions.

- Sport: for a sporty drive. gear shifts occur at higher engine speeds.
- Winter: the car always starts in 2nd gear to avoid the front wheels slipping on slippery road surfaces (example: snow, mud, etc.)

Gear lever manual release

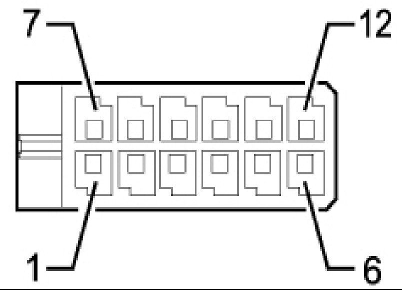
The gear lever is fitted with a mechanical safety release device for position ‘P’, in the event of a malfunction with the electro-magnet. To release the gear lever from position ‘P’, the user needs to pull the rubber tab and then push the button on the gear lever.

This mechanical safety release device is positioned on the left-side (driver’s side) of the central tunnel. See figure below.



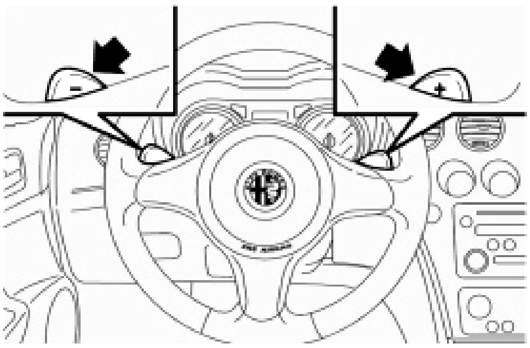
Gearbox control lever assembly pin-out

M053 Connector



1	Power +30
2	Power +15
3	N.C.
4	N.C.
5	N.C.
6	N.C.
7	C-CAN H (1)
8	C-CAN H (2)
9	C-CAN L (1)
10	C-CAN L (2)
11	Steering wheel lever (+)
12	Steering wheel lever (-)

Steering wheel manual sequential control (OPTIONAL only for the 2.4 JTDM – 3.2 V6 JTS)
For greater sportiness, two levers have been fitted to the steering wheel, one to shift up gear (from 1st gear… to 6th gear) and one to shift down gear (from 6th gear… to 1st gear).



Key:
- (+) : shift up gear (from 1st gear… to 6th gear)
- (-) : shift down gear (from 6th gear… to 1st gear).

To use the steering wheel controls, the gearbox control lever must be set to the sequential (manual) position.

INDICATOR LIGHTS AND MESSAGES

The instrument panel display includes a symbol indicating a fault with the Q-Tronic system.

Automatic gearbox fault

This symbol on the display begins to flash (accompanied by a message and an acoustic signal) when a fault with the Q-Tronic automatic gearbox is detected.

Automatic gearbox excessive oil temperature

The symbol on the display comes on and stays on (accompanied by a message and an acoustic signal) to indicate an excessive oil temperature in the Q-Tronic automatic gearbox.

Warning: when the indicator light flashes, stop the vehicle as soon as possible, turn off the engine and let the automatic gearbox cool down.

WIRING DIAGRAMS

Diagram A

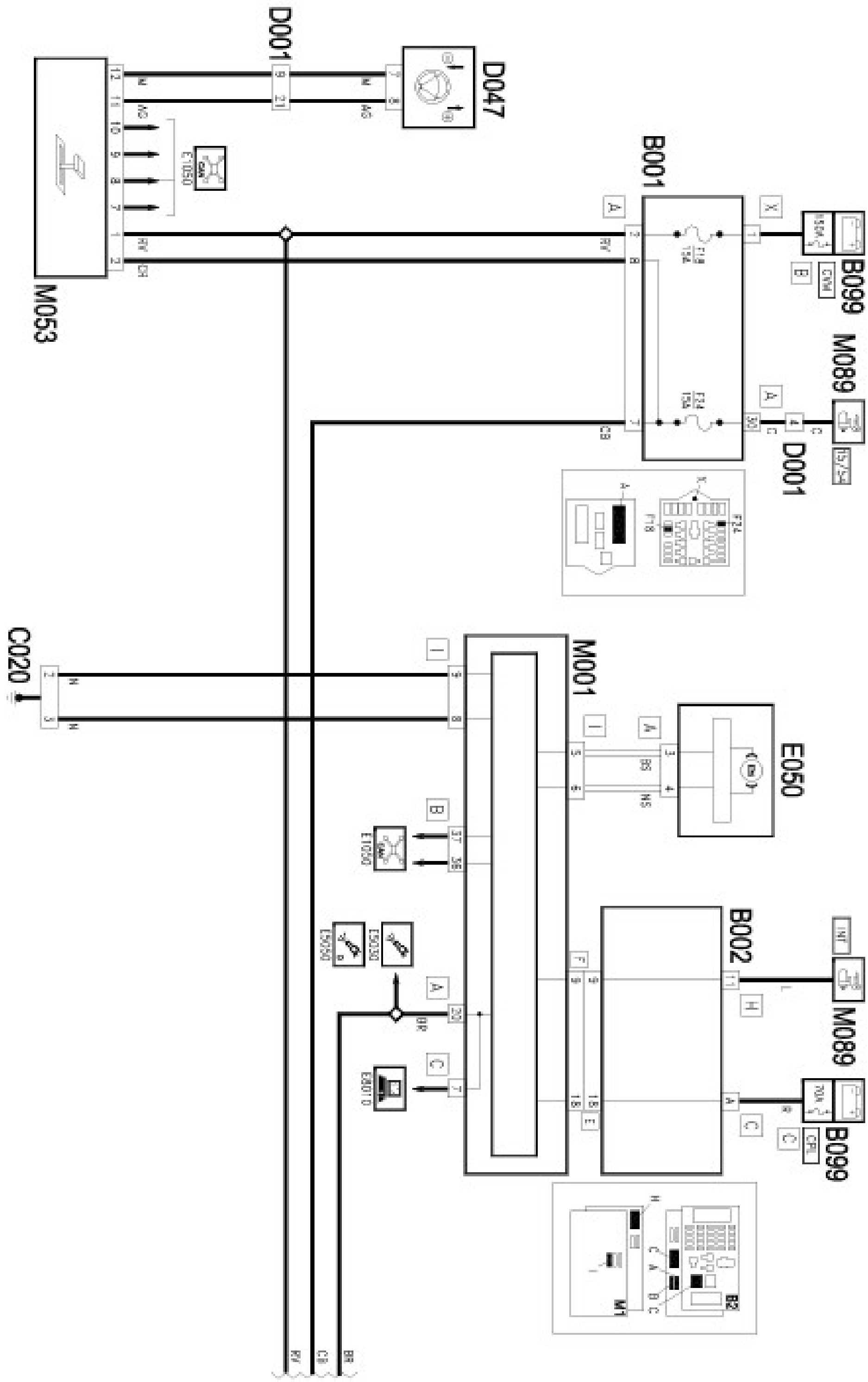
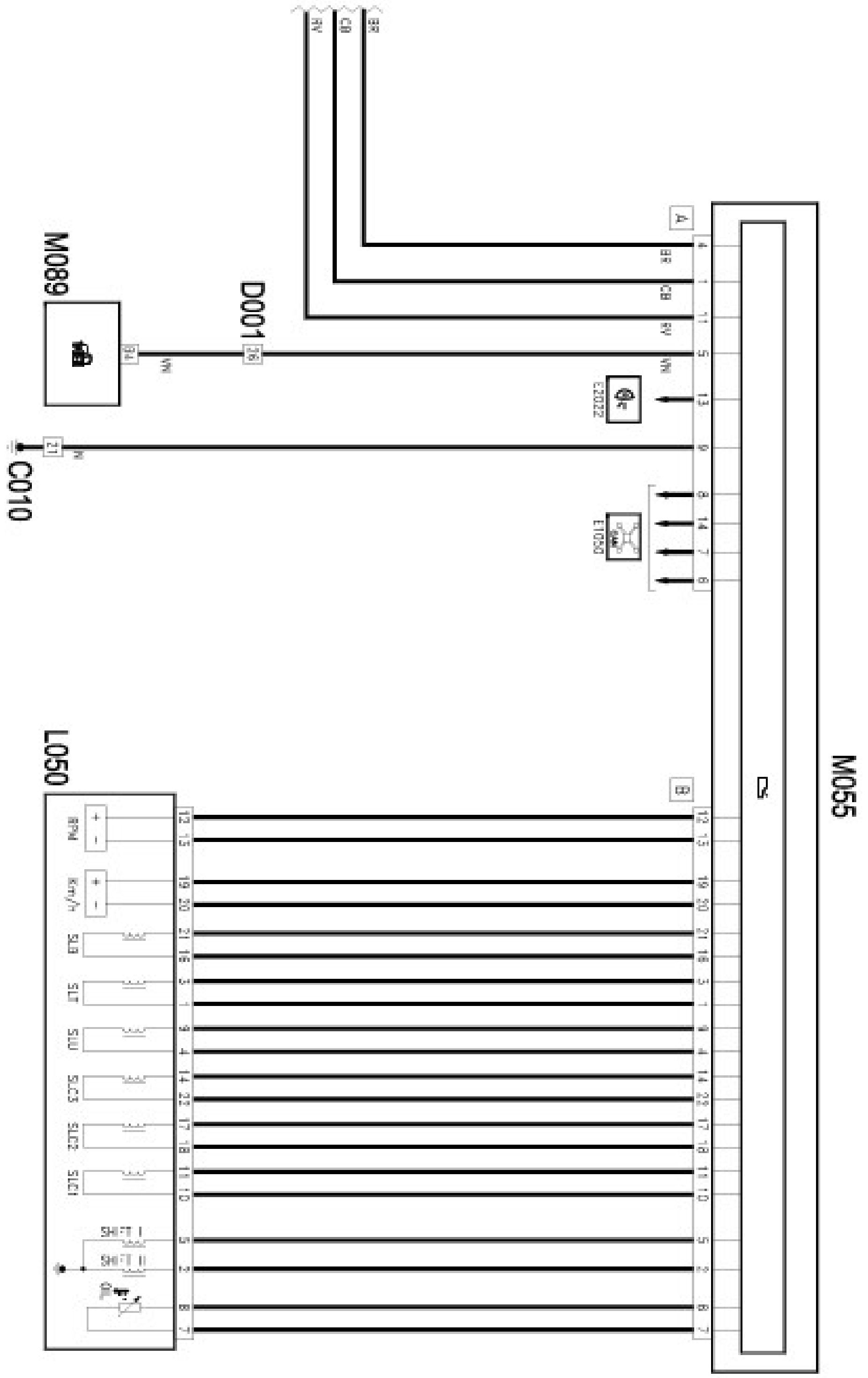
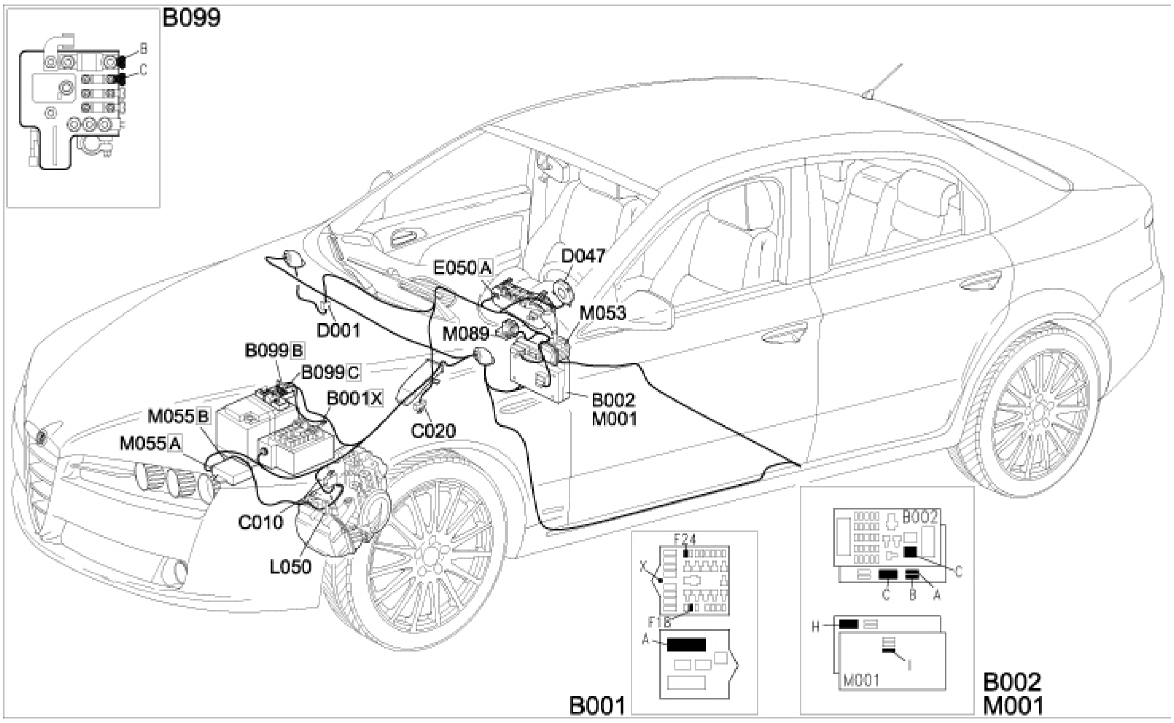


Diagram B



LOCATION OF COMPONENTS

The figure below shows the location of the various components of the Q-Tronic system in the engine compartment and passenger cabin.



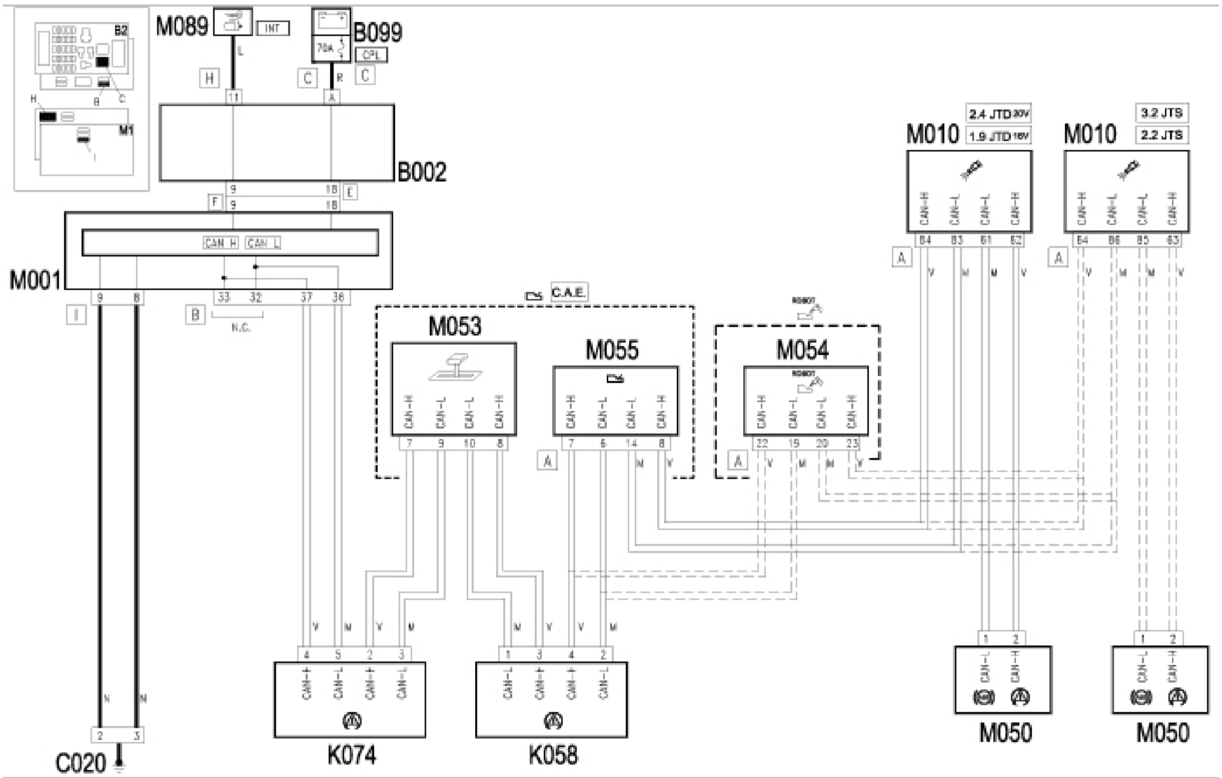
Key to wiring diagrams

B001: Engine compartment control unit
M001: Body Computer
E050: Instrument panel
B002: Under-dashboard control unit
D047: Helical contact joint (steering wheel controls)
M053: Automatic gearbox gear selector control unit
M055: Automatic gearbox command control unit
L050: Automatic gearbox electro-hydraulic assembly
M089: Steering lock control unit (NBS)
B099: Maxi fuse box on battery
C010: Left front earth
C020: Passenger side dashboard earth

CONNECTION TO C-CAN NETWORK

The figure below shows the electrical connection to the C-CAN network of the following electronic control units:

- Automatic gearbox command control unit (M055)
- Automatic gearbox gear selector control unit (passenger cabin) (M053)



CAN network connections pin-out

M053 Node		M055 Node
Pin		Pin – Connector A
7 – Can-H	INPUT	7 – Can-H
9 – Can-L		6 – Can-L
8 – Can-H	OUT	8 – Can-H
10 – Can-L		14 – Can-L

FUNCTIONAL CHECKS

Test to check selection shift times

Preliminary checks:

1. Check gearbox oil level
2. Using diagnostic equipment, check that the temperature of the gearbox oil is between 50° C and 80° C;
3. Check that the climate control system is off;
4. Check that the vehicle lights are off;
5. Check that the speed control is disabled.

Test :

1. Engage handbrake;
2. Start the engine;
3. Press brake pedal with engine idling;
4. Move the gear lever to neutral - ‘N’ ;
5. Time how long it takes to shift selection: shift from position ‘N’ to position ‘D’ ;
   (repeat the test 3 times and take the middle value of the three times recorded)
6. Time how long it takes to shift selection: shift from position ‘N’ to position ‘R’ ;
   (repeat the test 3 times and take the middle value of the three times recorded)
7. Check the test results against the table below:

Test Result	Possible causes
Delay moving from N → D is more than 1.5 sec.	• Fault with valve body (SLC1, hydraulic pressure system). • Clutch C1 is slipping • Fault with one-way clutch (free wheel) • Fault with oil pump • Clogged oil filter
Delay moving from N → R is more than 1.5 sec.	• Fault with valve body (SLC3, hydraulic pressure system). • Clutch C3 is slipping • Brake B2 is slipping • Fault with oil pump • Clogged oil filter

Engine stall test

Preliminary checks:
1. Check gearbox oil level
2. Using diagnostic equipment, check that the temperature of the gearbox oil is between 50° C and 80° C;
3. Check that the climate control system is off;
4. Check that the vehicle lights are off;
5. Check that the speed control is disabled.

Test :
1. Place the vehicle outdoors with plenty of escape room;
2. Engage handbrake;
3. Start the engine;
4. Firmly press brake pedal and keep pressed for the duration of the test;
5. Move gear lever to position 'D' ;
6. Press the accelerator pedal fully, and immediately check the maximum number of engine revs shown on the instrument panel; (repeat the test 3 times, at intervals of 2 minutes, and take the middle of the three values recorded)

Warning: this test leads to an immediate increase in oil temperature, so each single test must not last longer than the safe time of 5 seconds.

7. Leave the vehicle with the engine idling for 10 minutes to give the gearbox oil time to cool down;
8. Repeat steps 4, 5 and 6, this time moving the gear lever to position 'R'
9. Check the test results against the table below:

<table>
<tr><th>Lever in position 'D or R'</th><th>1.9 JTDM</th><th>2.4 JTDM</th><th>3.2 V6</th><th>Possible causes</th></tr>
<tr><td>Engine revs above : (rpm)</td><td rowspan="2">2735</td><td rowspan="2">2565</td><td rowspan="2">2600</td><td>There is slippage of the clutches in the automatic gearbox.</td></tr>
<tr><td>Engine revs below: (rpm)</td><td>Check engine operation or electronic engine control.</td></tr>
</table>

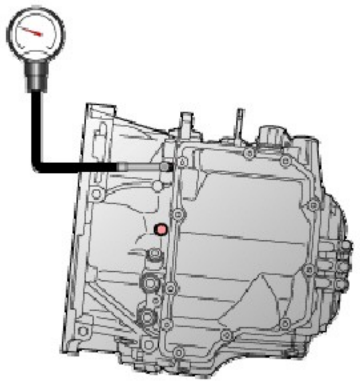
Tolerance of values in table: ± 150 rpm

<u>Line pressure test</u> (with engine idling)

Preliminary checks:
1. Check gearbox oil level
2. Using diagnostic equipment, check that the temperature of the gearbox oil is between 50° C and 80° C;
3. Check that the climate control system is off;
4. Check that the vehicle lights are off;
5. Check that the speed control is disabled

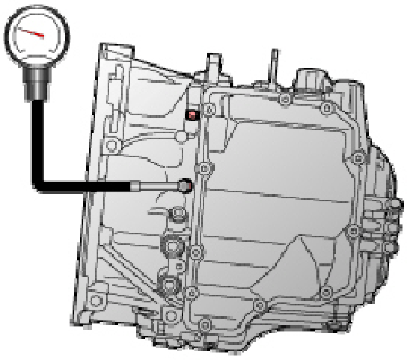
Test :
1. Install two pressure gauges, as shown in the figures below;

C1 Pressure Control



Lever in position ‘D’

C3 Pressure Control



Lever in position ‘R’

2. Place the vehicle outdoors with plenty of escape room;
3. Engage handbrake;
4. Start the engine;
5. Firmly press brake pedal and keep pressed for the duration of the test;
6. Move gear lever to position ‘D’ and let the engine idle;
7. Check the oil pressure on the appropriate pressure gauge;
8. Move gear lever to position ‘R’ and let the engine idle;
9. Check the oil pressure on the appropriate pressure gauge;
10. Check the test results against the table below:

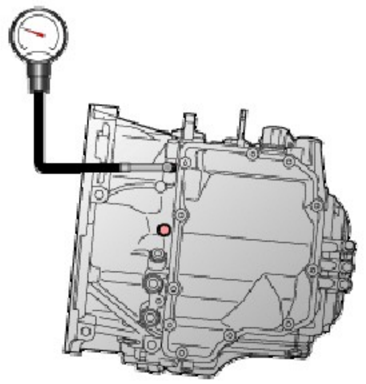
Lever Position	1.9 JTDM	2.4 JTDM	3.2 V6
	Pressure values [Kpa]		
D	372 ÷ 412	372 ÷ 432	372 ÷ 412
R	572 ÷ 665	575 ÷ 690	572 ÷ 665

<u>Line pressure test</u> (with engine at stall speed)

Preliminary checks :
1. Check gearbox oil level
2. Using diagnostic equipment, check that the temperature of the gearbox oil is between 50° C and 80° C;
3. Check that the climate control system is off;
4. Check that the vehicle lights are off;
5. Check that the speed control is disabled

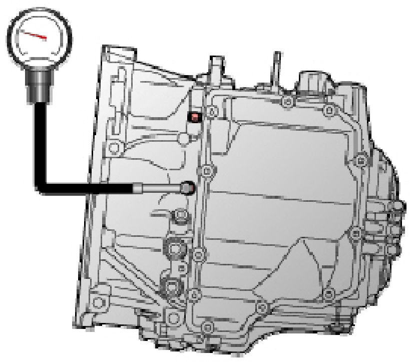
Test :
1. Install two pressure gauges, as shown in the figures below;

Pressure Control



Lever in position 'D'

Pressure Control



Lever in position 'R'

2. Place the vehicle outdoors with plenty of escape room;
3. Engage handbrake;
4. Start the engine;
5. Firmly press brake pedal and keep pressed for the duration of the test;
6. Move gear lever to position 'D' ;
7. Press the accelerator pedal fully, and immediately check the oil pressure on the appropriate pressure gauge;

Warning: this test leads to an immediate increase in oil temperature, so each single test must not last longer than the safe time of 5 seconds.

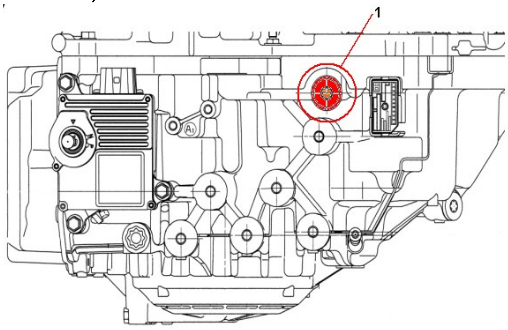
8. Leave the vehicle with the engine idling for 10 minutes to give the gearbox oil time to cool down;
9. Repeat steps 5, 6 and 7, this time moving the gear lever to position 'R'
10. Check the test results against the table below:

Lever Position	1.9 JTDM	2.4 JTDM	3.2 V6
	Pressure values [Kpa]		
D	1350 ÷ 1460	1370 ÷ 1460	1370 ÷ 1460
R	1905 ÷ 2125	1905 ÷ 2125	1905 ÷ 2125

MAINTENANCE PROCEDURES

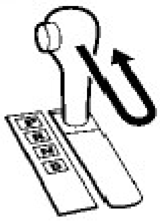
Gearbox oil level check

1. Place the car on a car lift;
2. Move the gear lever to position ‘P’ ;
3. Engage the handbrake (the use of wedges to block the wheels is recommended);
4. Add 0.5 litre of oil to the automatic gearbox through the automatic gearbox oil inlet (1) [Tutela GI-VI oil – Total quantity 3.320 Kg];
5. Clean the area around the inlet and replace the automatic gearbox oil inlet cap (1) tightening it to the recommended torque (2.4 ÷ 3.6 daNm);



6. Start the engine and let it idle;
7. Connect the diagnosis equipment and check that the oil temperature is between 35°C and 45°C.:

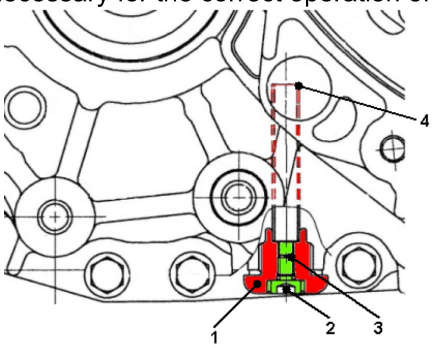
Case 1: If the oil temperature is lower, ***with the brake pedal pressed***, move the gear lever from ‘P’ to ‘D’ and vice-versa twice, leaving it in each position for at least 2 seconds.



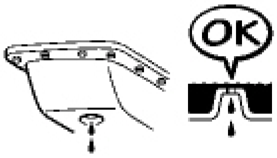
Case 2: If the oil temperature is higher, wait until the temperature falls to the test value.
When the temperature reaches the test value, proceed with the next step, leaving the gear lever in position ‘P’;

8. Remove the overflow cap (2);

Warning 1: before removing the overflow cap (2) the ***engine must be on and idling***, because otherwise the gearbox oil will return to the sump, raising the oil level beyond the upper limit of the pipe (4). This would lead to the loss of a quantity of oil necessary for the correct operation of the gearbox.



9. Check to see if any oil overflows from the overflow cap opening.



If no oil comes out, more oil needs to be added. Return to point 4.
Warning 2: when the overflow cap (2) is removed, if the oil level is lower than the upper limit of the pipe (4) only the oil contained in the pipe comes out. This could lead to a false reading of the oil level, and this is why the oil should be topped up before checking the level.

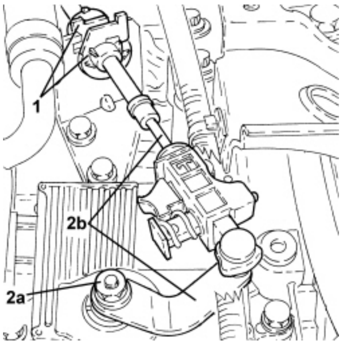
10. Clean the area around the outlet hole of any traces of oil and impurities, and replace the overflow cap, tightening it to the recommended torque (0.6 ÷ 0.8 daNm), then check for leaks, and if any are found, replace the seal;
Warning 3: when replacing the seal of the overflow cap, see ***Warning 1.***

11. Switch off the engine

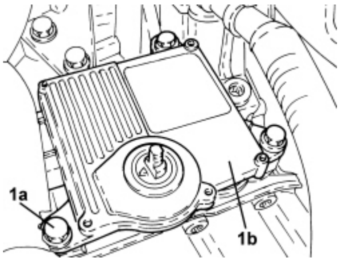
Automatic gearbox electronic control unit replacement

Disconnection

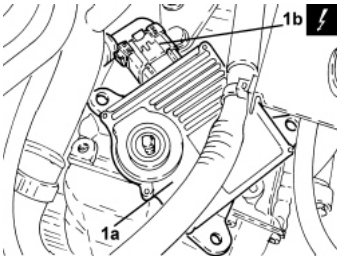
- Move the gear lever to position 'N'.
- Disconnect the battery (Op. 5530B10).
- Disconnect the battery support/housing (Op. 5530B52).



1. Disconnect the gear selection cable from the reaction rod (1).
2. Loosen the nut (2a) and remove the lever (2b) complete with the gear selector cable, and put to one side.

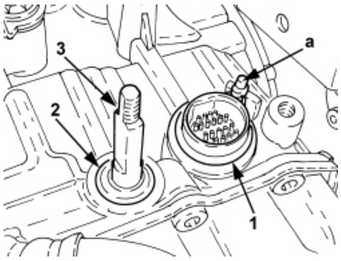


1. Loosen the screws (1a) and raise the automatic gearbox system control unit (1b) to disconnect it from the internal wiring connector.



1. Turn the automatic gearbox control unit (1a) and disconnect the electrical connection (1b).
- Remove the automatic gearbox control unit.
- Remove the O-ring on the automatic gearbox internal wiring connector.

Reconnection

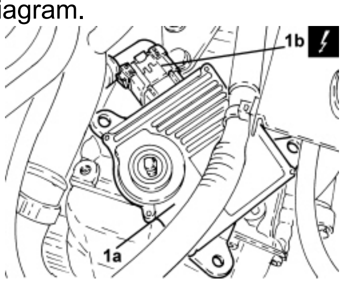


1. Fit a new O-ring on to the automatic gearbox internal wiring connector.
2. If necessary, replace the seal ring on the gear selector shaft.

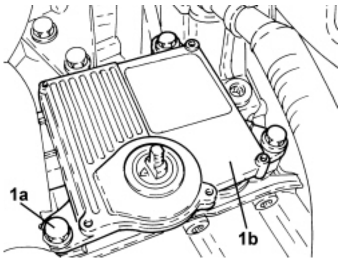
Note: The new seal ring on the gear selector shaft may project from or be smaller than the gearbox surface by 0.3 mm.

3. Check that the gear selector shaft is in position ‘N’ and that the chamfered sides are oriented as shown in the diagram.

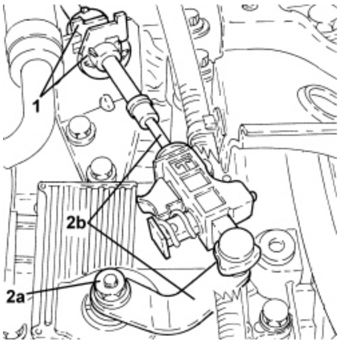
- Check that the automatic gearbox internal wiring connector is correctly positioned on the gearbox with the on pin (a) positioned as shown in the diagram.



Connect the electrical connection (1b) to the automatic gearbox control unit.



- Replace the automatic gearbox (1b) in position, and tighten the screws (1a) to the recommended torque value of 2.5 daNm.



1. Replace the gear selector lever (2b) and fix it in place with the nut (2a), tightening it to the recommended torque of 1.4 ÷ 1.8 daNm.
2. Connect the gear selector cable to the reaction rod (1).

- Replace the battery support/housing (Op. 5530B52)
- Replace the battery (Op. 5530B10)

Connect the Examiner and perform the self-learning procedure:
- Learning gear lever position

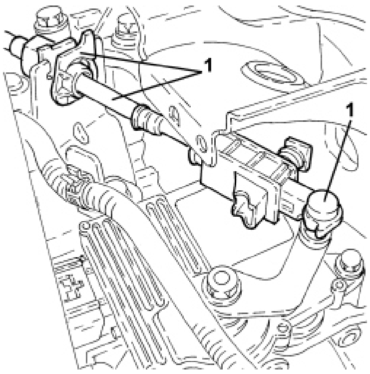
Disconnection and reconnection of flexible gearbox control cable

- Move the gear lever to position 'N'.

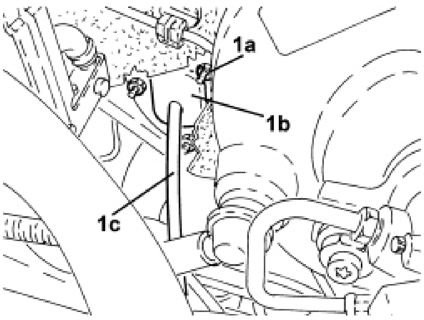
Op. 5530B10 BATTERY - S.R.
Op. 5530B52 BATTERY SUPPORT/HOUSING - S.R.

Note: Mark the position of the gear selector lever – position N.

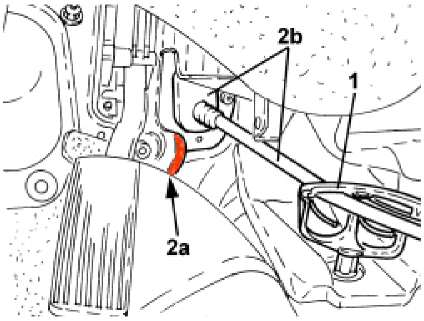
Op. 2135A16 AUTOMATIC GEARBOX LEVER GRIP - S.R.
Op. 7045A10 FRONT SEAT (ONE), LEFT OR RIGHT - S.R. (left and right side).
Op. 7040L71 COMPARTMENT ON REAR TUNNEL COVERING - S.R.
Op. 5010C32 AIR VENT ON TUNNEL COVERING FOR REAR SEATS - S.R.
Op. 7040L37 GEAR LEVER CONSOLE SURROUND - S.R.
Op. 3380A44 PROTECTIVE COVER FOR HANDBRAKE/LINKAGE - S.R.
Op. 7040L20 TUNNEL COVERING - S.R.
Op. 7040L23 TUNNEL COVERING SURROUND - S.R.
Op. 7040A65 SIDE UNIT LOCK (ONE) - S.R.
Op. 7040L74 TUNNEL COVERING SUPPORT STAFF/ ROD - S.R.
Op. 5010B46 CENTRAL AIR CONDUIT TO REAR SEATS - S.R.
Op. 2135A10 AUTOMATIC GEARBOX MANUAL SUPPORT AND CONTROL LEVER - S.R. AND SERVICE



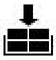
1. Disconnect the gear selection cable from the gear selector and reaction rod (1).



1. Loosen the nuts (1a) fixing the seal (1b) on the flexible gear engagement cable (1c) to the engine compartment bulkhead.



1. Open the retaining clip on flexible gear engagement shaft (1).
2. Press on the lower right-hand edge of the pedal board support (2a) to remove the flexible gear engagement shaft complete with seal (2b).



- Return the flexible gear engagement shaft together with lining into position by passing it through the opening in the engine compartment bulkhead.

Note: Check that the flexible gear engagement shaft seal is correctly housed in the engine compartment bulkhead.

- Close the retaining clip on the flexible gear engagement shaft.
- Connect the end of the flexible gear engagement shaft to the gear lever.
- Fix the flexible gear engagement shaft into the proper opening on the gear lever support using the relative lock bush.
- Return the gear lever support into position and fix it in place using the relative screws, tightened to the recommended torque value of 0.7 ÷ 1.1 daNm
- Return the gear lever support sound-proofing cover into position.

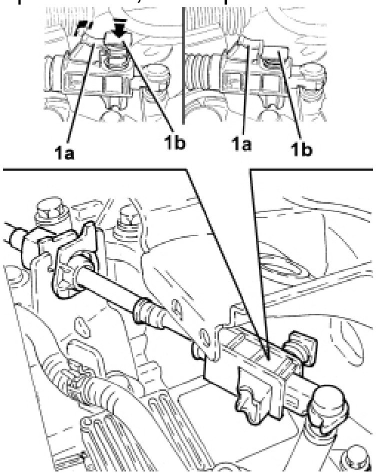
Op. 2135A10 AUTOMATIC GEARBOX MANUAL SUPPORT AND CONTROL LEVER - S.R. AND SERVICE
Op. 5010B46 CENTRAL AIR CONDUIT TO REAR SEATS - S.R.
Op. 7040L74 TUNNEL COVERING SUPPORT STAFF/ ROD - S.R.
Op. 7040A65 SIDE UNIT LOCK (ONE) - S.R.
Op. 7040L23 TUNNEL COVERING SURROUND - S.R.
Op. 7040L20 TUNNEL COVERING - S.R.
Op. 3380A44 PROTECTIVE COVER FOR HANDBRAKE/LINKAGE - S.R.
Op. 7040L37 GEAR LEVER CONSOLE SURROUND - S.R.
Op. 5010C32 AIR VENT ON TUNNEL COVERING FOR REAR SEATS - S.R.
Op. 7040L71 COMPARTMENT ON REAR TUNNEL COVERING - S.R.
Op. 7045A10 FRONT SEAT (ONE), LEFT OR RIGHT - S.R.
(left and right side).
Op. 2135A16 AUTOMATIC GEARBOX LEVER GRIP - S.R.

Note: Before proceeding with the reattachment, check that the gear lever is in position N.

- Tighten the nuts fixing the flexible gear engagement shaft to the engine compartment bulkhead to the recommended torque of 0.7 ÷ 1.1 daNm.

Insert the flexible gear engagement shaft quick-fit into the reaction rod and fix it in position by pressing until it clicks into place.

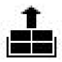
Check that the gear selector lever is in position N, in the position marked during the removal stage.



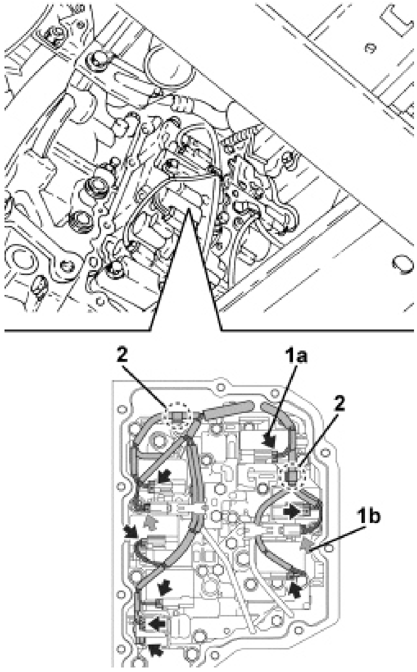
Connect the end of the flexible gear engagement shaft to the spherical head of the gear selector lever.

1. Arm the quick adjuster device on the gear selection cable, by pulling back part 1a and lowering the spring guide (1b); release part 1a so that it holds the spring guide (1b) in position.
2. - Move the gear lever around and check that for each selection position there is a perceptible click for each the various lever positions.
3. Op. 5530B52 BATTERY SUPPORT/HOUSING - S.R.
4. Op. 5530B10 BATTERY - S.R.

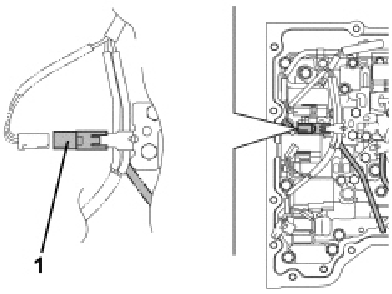
Gear selection solenoid valve assembly



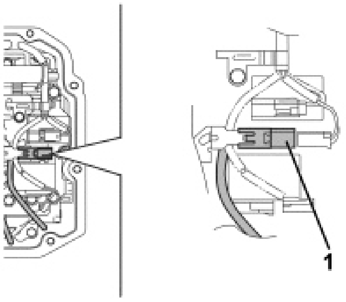
Op. 7055B54 UNDER-ENGINE PROTECTION/SAFETY GUARD - S.R.
Op. 7210E10 S.R. FRONT BUMPER
Op. 1048B20 COUPLING ON AIR INPUT FROM HEAT EXCHANGER TO RIGID PIPE - REPLACEMENT.
Op. 0010T20 ENGINE COOLANT - REPLACEMENT.
Op. 2130A38 AUTOMATIC GEARBOX OIL HEAT EXCHANGER - S.R.
- Drain the automatic gearbox oil, referring to Op. 0010T44 AUTOMATIC GEARBOX OIL - REPLACEMENT.
Op. 2130B36 AUTOMATIC GEARBOX SOLENOID VALVE COVER - S.R.
1. Disconnect the electrical connections of the solenoids (1a) and rev sensors (1b).
2. Open



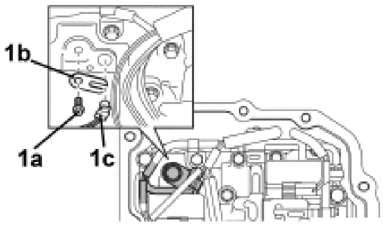
1. Remove the gearbox output rev sensor connector from the retaining clip.



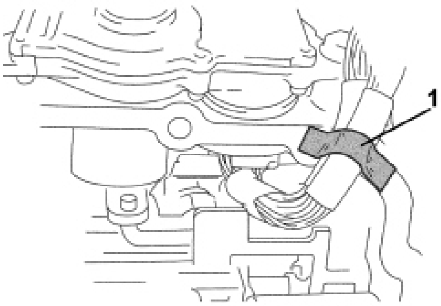
1. Remove the gearbox input rev sensor connector from the retaining clip.



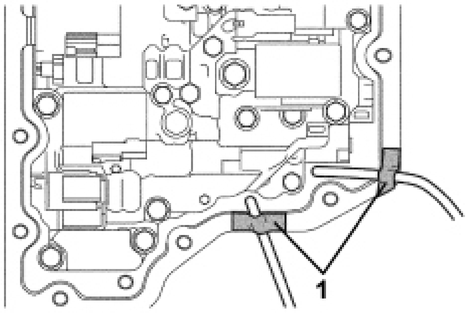
1. Loosen the screws (1a), remove the lock plate (1b) and then remove the oil temperature sensor (1c) from the solenoid valve assembly.



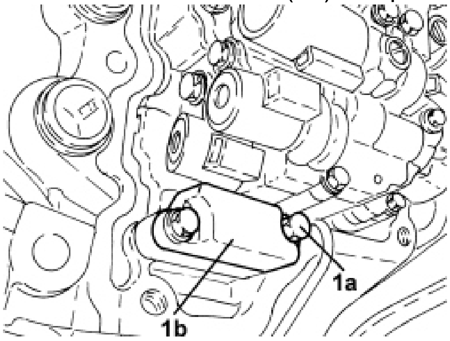
1. Move the wiring to one side and attach it to the gearbox as shown in the diagram.



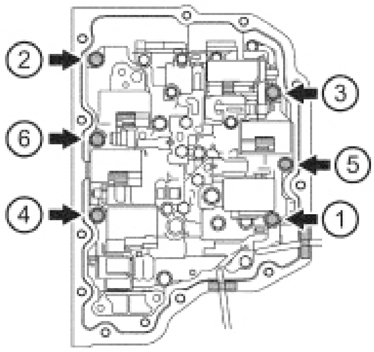
1. Move the wires of the two speed sensors to one side and fix them to the gearbox as shown in the diagram.



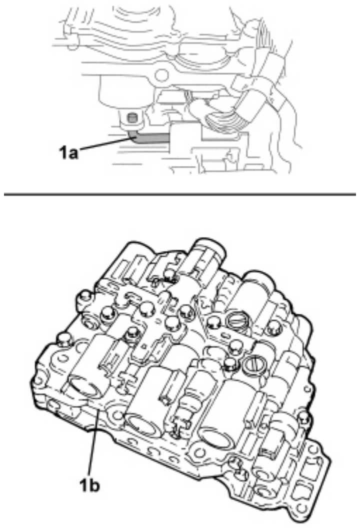
1. Loosen the screws (1a) and remove the oil intake cover (1b) complete with seal.



- Loosen the valve assembly fastening screws in the order shown in the diagram.

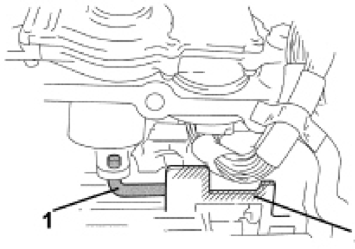


1. Disconnect the joint (1a) and remove the valve assembly (1b).

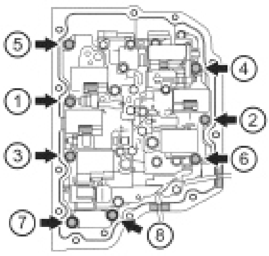


Warning: Handle the valve assembly with care.

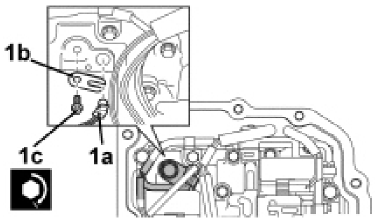
1. Return the valve assembly into position and connect the joint as shown in the diagram.
- Check that the metal plate (a) does not interfere with the wiring when mounting the valve assembly.



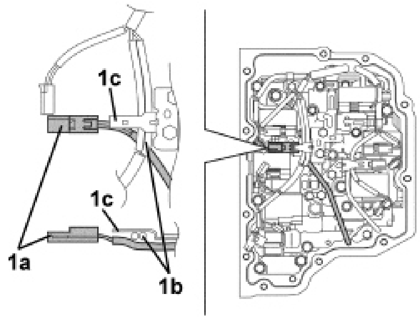
Provisionally insert the screws for fastening the valve assembly to the gearbox.
- Provisionally insert the screws for fastening the oil intake cover to the valve assembly.
- Tighten the previously inserted screws to the recommended torque value of 0.8 ÷ 1.2 daNm, following the order shown in the diagram



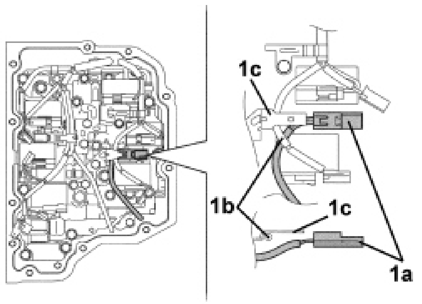
- Moisten the temperature sensor O-ring with gearbox oil.
1. Mount the gearbox oil temperature sensor (1a), the lock plate (1b) and tighten the screw (1c) to the recommended torque value of 0.8 ÷ 1.2 daNm.



1. Position the gearbox output rev sensor connector (1a) as shown in the diagram, with respect to the valve wiring (1b) and fix it to the retaining clip (1c).



1. Position the gearbox input rev sensor connector (1a) as shown in the diagram, with respect to the valve wiring (1b) and fix it to the retaining clip (1c).



- Connect the electrical connections of the solenoids and rev sensors.
- Close the wire retaining clips.

Op. 2130B36 AUTOMATIC GEARBOX SOLENOID VALVE COVER - S.R.
Op. 2130A38 AUTOMATIC GEARBOX OIL HEAT EXCHANGER - S.R.
Op. 1048B20 COUPLING ON AIR INPUT FROM HEAT EXCHANGER TO RIGID PIPE - REPLACEMENT.

- Top up the level of automatic gearbox oil, referring to

Op. 0010T44 AUTOMATIC GEARBOX OIL - REPLACEMENT.
Op. 0010T20 ENGINE COOLANT - REPLACEMENT.
Op. 7210E10 S.R. FRONT BUMPER
Op. 7055B54 UNDER-ENGINE PROTECTION/SAFETY GUARD - S.R

DIAGNOSIS

AISIN AF40-6AUTOMATIC GEARBOX CONTROL UNIT

The automatic gearbox control unit controls communications with all the system sensors and electronic components. All anomalies detected are stored along with a diagnosis code. These codes can in turn be read and displayed using diagnostic equipment (Examiner).
If the fault detected by the system is with the solenoids, the gearbox control unit cancels the solenoid commands, and transmission control is provided by the hydraulic circuit only, using the following logic:

Gear lever position	Gearbox setting
R	Reverse
D	2nd gear

Parameters

- **Solenoid 1 (SLC1):**
  (indicates, in mA, the current required by solenoid 1)
- **Solenoid 2 (SLC2):**
  (indicates, in mA, the current required by solenoid 2)
- **Solenoid 3 (SLC3):**
  (indicates, in mA, the current required by solenoid 3)
- **Gearbox oil pressure solenoid:**
  (indicates, in mA, the current required by solenoid 3)
- **Hydraulic circuit solenoid current:**
  (indicates, in Ma, the current required by the solenoid controlling the butterfly valve of the gearbox hydraulic circuit)
- **Lock-up solenoid current:**
  (indicates, in mA, the current required by the lock-up clutch control solenoid)
- **Gearbox output revs:**
  (number of gearbox output revs at that moment)
- **Gearbox input revs:**
  (number of gearbox input revs at that moment)
- **Gearbox oil temperature:**
  (gearbox oil temperature, expressed in Gr/cent.)
- **Battery voltage:**
  (indicates the gearbox control unit power supply voltage, expressed in Volts)
- **Engine revs:**
  (indicates the number of engine revs at that moment)
- **Engine torque:**
  (engine torque value at that moment, expressed in Nm)

- **Torque delivered:**
(torque value, expressed in Nm)

- **Accelerator pedal position:**
(indicates, as a percentage, the pedal position, as measured by the potentiometer)

- **Torque reduction:**
(the torque delivered during gear shifts is shown, and the aim is to improve the quality of gearshifts, expressed in Nm)

- **Torque limitation:**
(torque value, expressed in Nm)

- **Vehicle speed:**
(indicates the speed of the car at that moment, expressed in Km/hr)

- **Solenoid 1 voltage (S1):**
(indicates the power supply voltage of solenoid 1, expressed in Volts)

- **Solenoid 2 voltage (S2):**
(indicates the power supply voltage of solenoid 2, expressed in Volts)

- **Sequence solenoid valve 1:**
(indicates the 'Piloted' or 'Non-piloted' status of the sequence solenoid valve, for changing gear)

- **Sequence solenoid valve 2:**
(indicates the 'Piloted' or 'Non-piloted' status of the sequence solenoid valve, for changing gear)

- **Lever block solenoid:**
(can assume 'Piloted' or 'Non-piloted' status. In the 'Piloted' state, it enables the gear lever to be unblocked)

- **Key block solenoid:**
(can assume 'Piloted' or 'Non-piloted' status. In the 'Piloted' state, it enables the key to be removed)

- **Indicator light:**
(indicates the 'On' or 'Off' status. In the 'On' state, it indicates the presence of errors in the gearbox control unit)

- **Gear lever position:**
(indicates the position of the gear lever at that moment)

- **Brake switch:**
(brake pedal contact, used to manage engine speed when slowing down)

- **Gear shift (+):**
(can assume 'Requested' and 'Not requested' status. In the 'Requested' state, the gearbox shifts up a gear)

- **Gear shift (-):**

(can assume 'Requested' and 'Not requested' status. In the 'Requested' state, the gearbox shifts down a gear)

- **Lock-up:**
  (indicates which state the lock-up solenoid is in, i.e. 'Piloted' or 'Non piloted'.)

- **Mil indicator light:**
  (indicates 'On' or 'Off' status. When 'On', it indicates the presence of errors in the engine control unit)

- **Automatic gearbox:**
  (indicates the 'Engaged' or 'Not engaged' status. When 'Engaged', the gear lever is in position 'R' , 'D' and 'TIP')

- **Air conditioner status :**
  (indicates 'Active' or 'Inactive' status. When 'Active', it indicates that the climate control system is on)

- **Set programme:**
  (with states 'Eco/City', 'Sport' or 'Ice', the driving mode chosen by the driver is indicated, depending on temporary usage requirements)

- **Torque converter:**
  (this has the job of hydraulically transmitting power from the engine to the gearbox. Its status can be:
  - 'Closed' [lock-up clutch engaged] so there is no slippage between pump and turbine,
  - 'Open' [lock-up clutch not engaged]
  - 'Regulated' [lock-up clutch with modulated control] where there is controlled slippage between the pump and turbine during gear shifts)

- **Engaged gear:**
  (indicates gear positions: 'P' [P/N], 'R' [Reverse], 'N' [P/N], 'D' [with the engine off : First or second]

- **Gear shift switches: x**
  (can be either 'Inactive' or 'Gear shift in progress'.[example: gear lever in position 'TIP')

- **Change of state in progress:**
  (can be either 'Accepted' or 'Not accepted')

- **Automatic gearbox: gear shift:**
  (can be either 'Allowed' or 'Not allowed')

- **Start in second gear by CAN (brake node):**
  (can be either 'Requested' or 'Not requested')

- **Auto-adapting: x**
  (can be either 'Economy' [gear lever in position 'D'] ; 'Poor grip' [in 'Ice' mode] or 'space empty' [in 'Sport' mode]

- **Wrong gear:**
  (can signal either 'No error' or 'Gear error - R, 1st, 2nd, 3rd, 4th, 5th, 6th')

- **Gear shift solenoid 'A' (S1):**

(indicates 'Active' or 'Inactive' status)

- **Gear shift solenoid 'B' (S2):**
  (indicates 'Active' or 'Inactive' status)

- **Lock-up solenoid current feedback:**
  (Indicates, in mA, the current required by the solenoid coil. This is compared with the rated value for the solenoid current, which must be similar to the respective feedback; if the values are very different, check that the solenoid concerned is working properly.)

- **Hydraulic circuit solenoid current feedback:**
  (Indicates, in mA, the current required by the solenoid coil. This is compared with the rated value for the solenoid current, which must be similar to the respective feedback; if the values are very different, check that the solenoid concerned is working properly.)

- **Gearbox oil pressure solenoid current feedback:**
  (Indicates, in mA, the current required by the solenoid coil. This is compared with the rated value for the solenoid current, which must be similar to the respective feedback; if the values are very different, check that the solenoid concerned is working properly.)

- **Solenoid 1 current feedback:**
  (Indicates, in mA, the current required by the solenoid coil. This is compared with the rated value for the solenoid current, which must be similar to the respective feedback; if the values are very different, check that the solenoid concerned is working properly.)

- **Solenoid 2 current feedback:**
  (Indicates, in mA, the current required by the solenoid coil. This is compared with the rated value for the solenoid current, which must be similar to the respective feedback; if the values are very different, check that the solenoid concerned is working properly.)

- **Solenoid 3 current feedback:**
  (Indicates, in mA, the current required by the solenoid coil. This is compared with the rated value for the solenoid current, which must be similar to the respective feedback; if the values are very different, check that the solenoid concerned is working properly.)

- **Transmission ratio:**
  (This is a numerical percentage representing the calculation made by the control unit, informing the driver of the gear ratio used by the gearbox, based on the speed of the car and the engine rotation speed)

Active diagnosis
This is an active diagnosis with a response; the control unit checks that the component is active.
To perform the test:
- the engine needs to be switched off or running at under 2000 rpm
- the gear lever needs to be either in position 'P' or 'N'

- Gear shift solenoid 'A' (S1)
- Gear shift solenoid 'B' (S2)
- Solenoid 1 (SLC1)
- Solenoid 2 (SLC2)
- Solenoid 3 (SLC3)
- Gearbox pressure solenoid
- Hydraulic circuit control solenoid
- Lock-up solenoid

Configurations

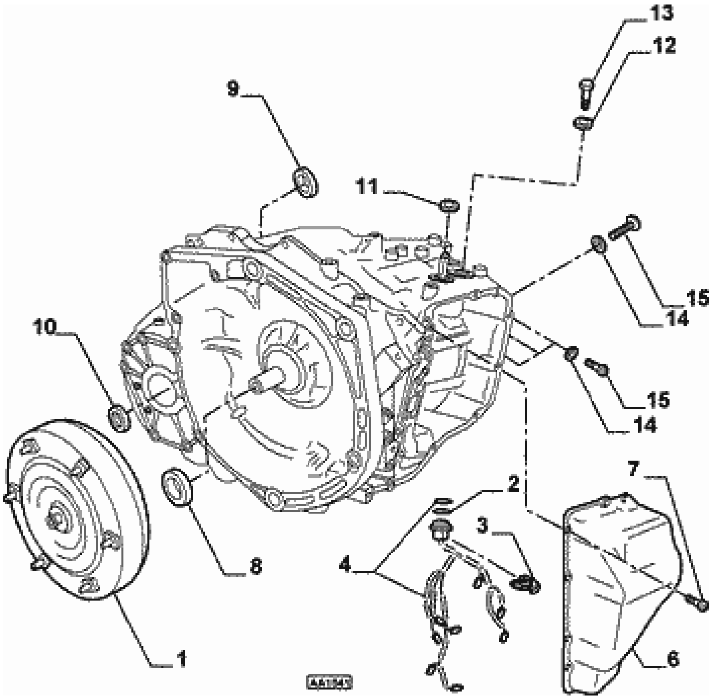
- Learning gear lever position

  Warning: this procedure is necessary in the event that the gear lever is replaced. It must be carried out with the engine switched off and the gear lever in position 'N'.

GEARBOX SELECTOR NODE (NSC)
The gearbox selector node (passenger cabin gear lever assembly) is connected to the C-Can network. This network does not have its own diagnosis system, and does not require the 'proxy alignment' procedure when mounted, because diagnostic control is managed directly by the gearbox control node.

FIAT PARTS COMPONENTS

Gearbox assembly

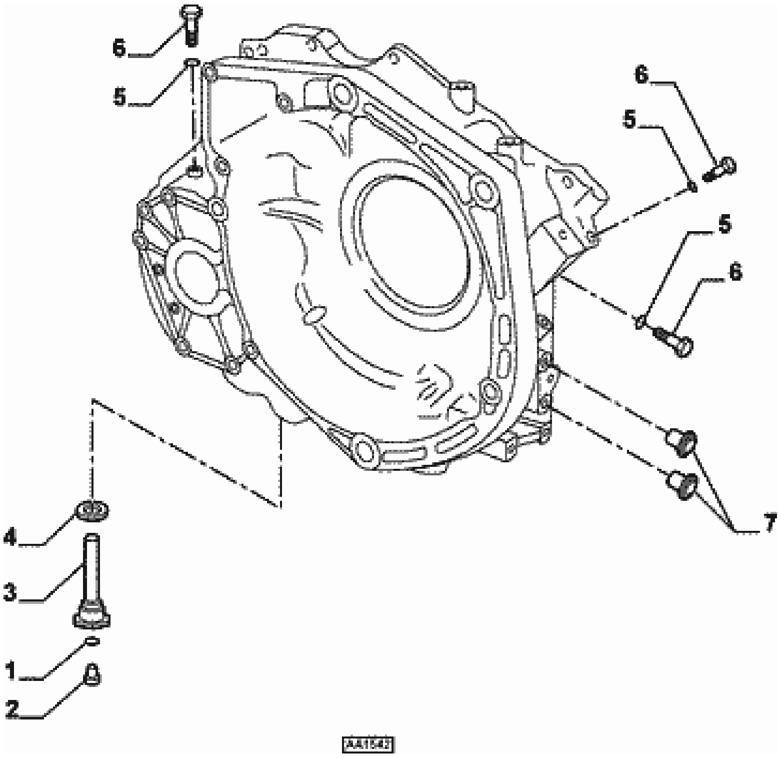


Key:

1 Torque converter
2 Seal gasket
3 Clip
4 Electrical cable
5 Seal gasket
6 Cover
7 Screw with washer
8 Seal ring

9 Seal ring
10 Seal ring
11 Seal ring
12 Seal ring
13 Cap
14 Seal gasket
15 Cap

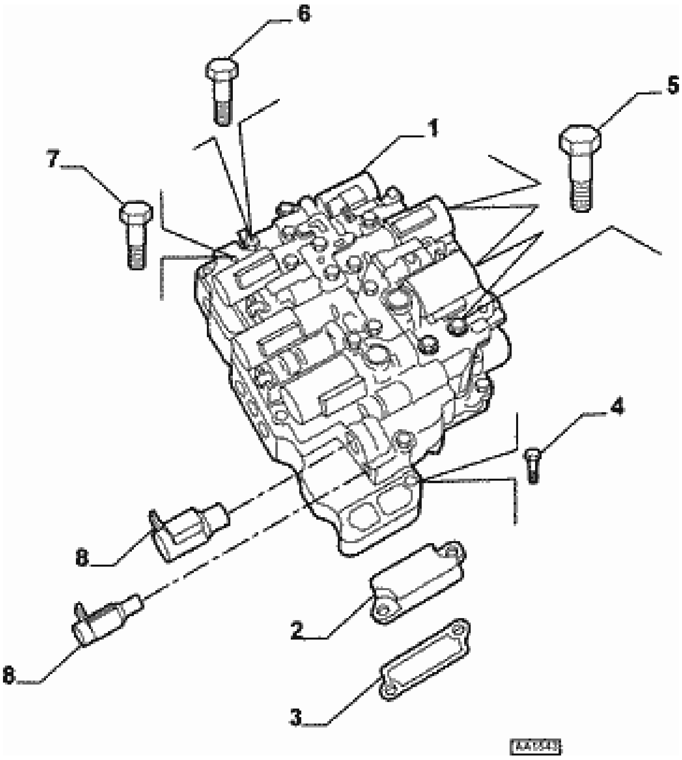
Gearbox bell housing



Key:

1 Seal gasket
2 Cap
3 Screw
4 Seal ring
5 Seal ring
6 Cap
7 Cap

Electro-hydraulic assembly

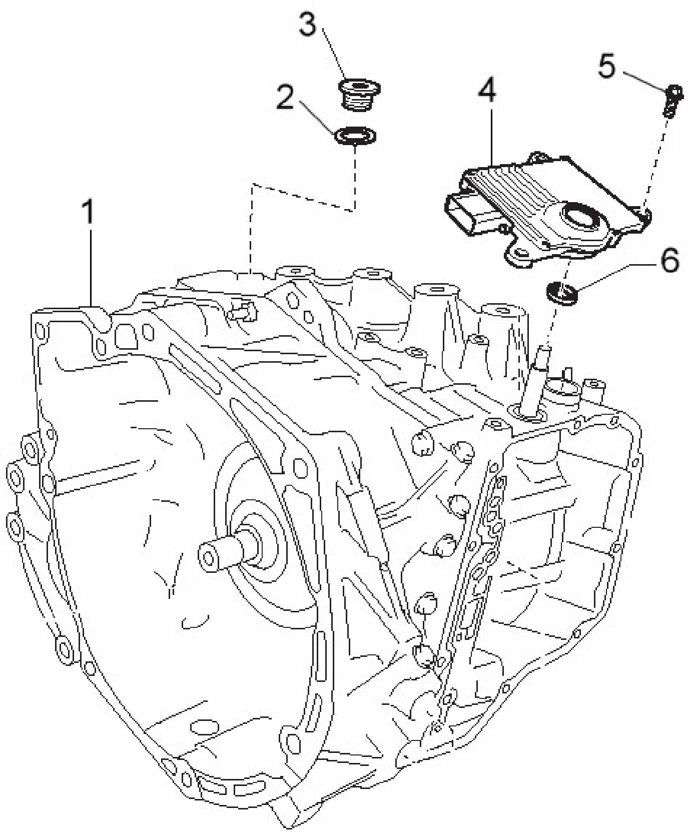


Key:

1 Body
2 Cover
3 Seal gasket
4 Screw

5 Screw
6 Screw
7 Screw
8 Solenoid valve (shift S1 S2 solenoid)

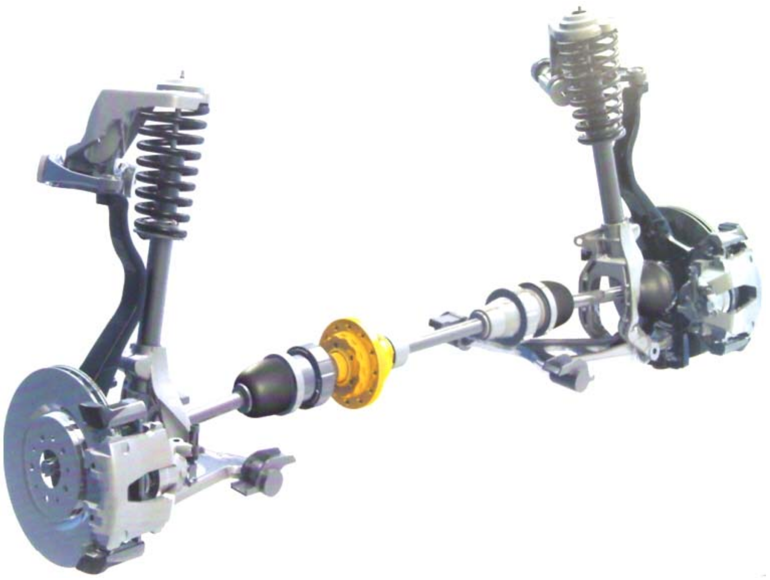
Electronic control unit



Key:

1 Complete gearbox
2 Seal ring
3 Cap (oil top-up)
4 Gearbox electronic control unit
5 Screw
6 Seal ring

Q2 Torsen differential



GENERAL

The Alfa 147 and the Alfa GT 1.9 JTD M 150 bhp adopt the TorSen B epicyclic differential. The new Alfa versions sport attractive new features inside and out, including:

Exterior:

- 17' alloy wheels (Alfa 147 Q2)
- 18' alloy wheels (Alfa GT Q2)
- Grille and satin-finished whiskers
- Low setup
- Satin-treated wing mirrors
- Rear spoiler (Alfa 147 Q2)
- Q2 badge at rear
- Chromed tailpipe (Alfa 147 Q2)
- Double chromed tailpipe (Alfa GT Q2)

Interior:

- Seats in sporty fabric with red stitching and Alfa Romeo logo on the head-restraints
- Leather trimmed steering-wheel with red stitches
- Instruments with black background, red contours and white light
- Radio with MP3 player
- Bose sound system with amplifier and subwoofer (Alfa 147 Q2)
- Gearlever knob with aluminium effect
- Front kickplate with silkscreen printed Q2 logo
- Sporty aluminium pedal set

Front drive, rear drive, all-wheel drive?

A dilemma that has always defied motorists.
Is one more attractive, is the other more 'user-friendly'? Or is the third more effective?
Indubitably, pros and cons can be found for each solution.
This is precisely the reason why, Alfa engineers have designed systems that offer the benefits axxociated with each solution while reducing the drawbacks to the minimum.
In general, we can say that front drive is decidedly simpler, making for easier driving and ensuring good grip even on slippery surfaces, provided that the horsepower is not too high (around 200 bhp at the most).
Beyond these limits, the influence of motive torque on the trajectory of the vehicle and steering-wheel reactions begins to be exceedingly high.
Producing a disagreeable impression that it is better not to press down on the gas pedal when cornering, especially on a slippery road.
In order to minimise this effect, at Alfa Romeo we have worked both on the front suspension and on a new limited slip differential called 'Q2'.
Reference to the Q4 AWD is apparent as Alfa Romeo engineers focused on a search for that ideal balance between effective drive and steering precision that only AWD can provide in certain situations.

TorSen differentials

Sensitive to differences in torque (hence the name, **Tor** = torque ; **sen** = sensing), the self-locking Torsen differential uses highly advanced gear geometry in order to:

- diversify the speed of the wheels or the speed of the two axles on bends, depending on whether it is mounted on an axle or in a central position;
- prevent one or (if the TorSen is in a central position) both wheels from slipping on low-grip surfaces, by transferring a higher proportion of the torque to the wheel or the axle with better grip.

There are three types of TorSen, classified as A, B or C. They differ from one another based on gear geometry, but the locking principle is the same in the three configurations. The characteristics of each are summarised in the table below:

	ADVANTAGES	DRAWBACKS
TorSen A	-Immediate intervention	-Dimensions -Cost
TorSen B	- Immediate intervention -Compact design -Less strain on the gears	-Cost
TorSen C	- Immediate intervention - Compact design -Possibility to have a different behaviour in acceleration and deceleration	-Can only be used in the central position

VARIANTS MADE TO THE VEHICLE

In addition to the adoption of the TorSen B epicyclic differential, other changes have been made to the new versions of the 147 and the GT Q2, including redesigned suspension front and rear making for enhanced stiffness, and an upgraded release of the software for the ABS control unit (new triggering thresholds for the VDS system).

Variants to the front suspension components

The figures below illustrate the specific components for Q2 versions, and namely:

- Shock absorber (4 fig.A2)
- Bumpers (2 fig.A2)
- Antiroll bars (1 fig.A1)

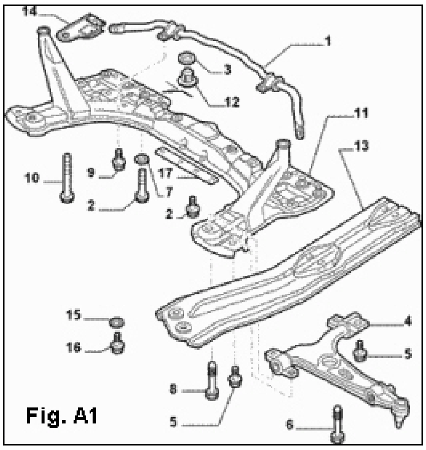


Fig. A1

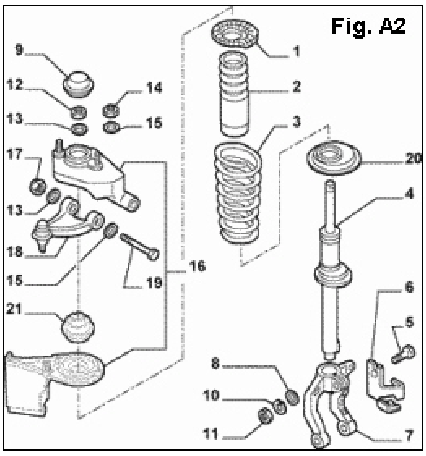


Fig. A2

Variants to the rear suspension components

The figures below show the specific components for Q2 versions, i.e.:

- Shock absorber (13 fig.P2)
- Bumpers (3 fig.P2)
- Antiroll bars (8 fig.P1)

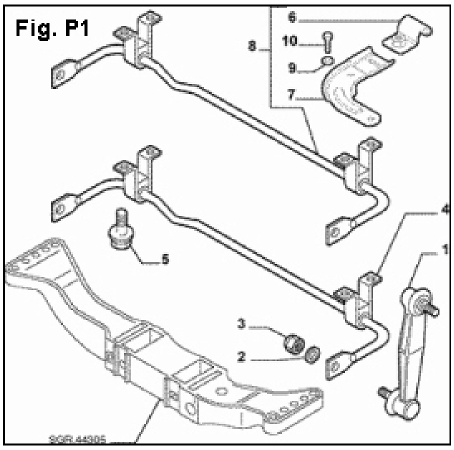


Fig. P1

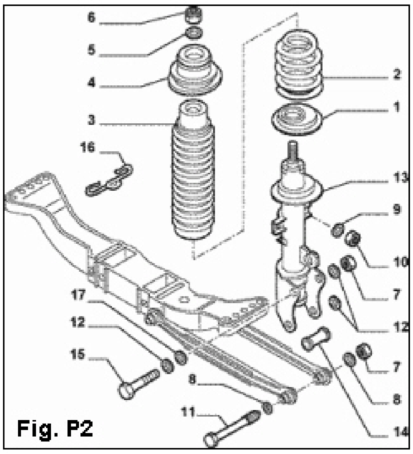


Fig. P2

Variants to the power-steering components

The figures below show the specific components for Q2 versions, i.e.:

- Steering linkage end (2 fig.S1)

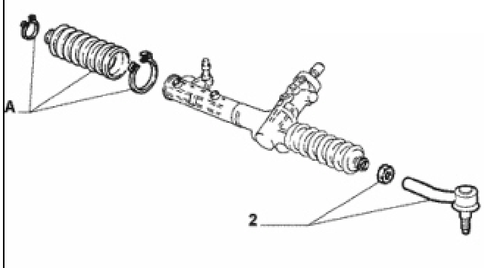


Fig. S1

Variants to the C530-6 gearbox components

The figures below show the specific components for Q2 versions, i.e.:

- TorSen B front differential (1 fig.D1)

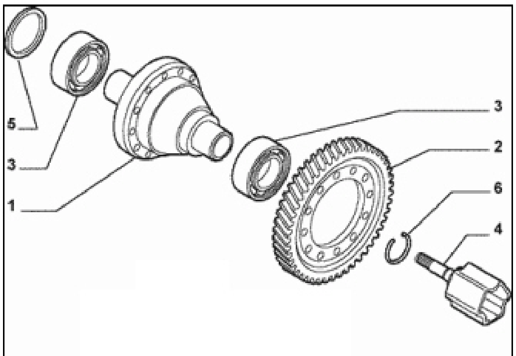


Fig. D1

Variants to the electrical system components

The figures below show the specific components for Q2 versions, i.e.:

- ABS ECU (2 fig.C1)

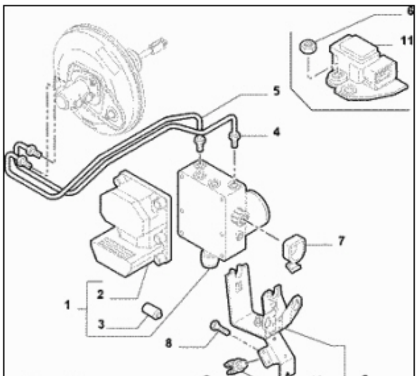
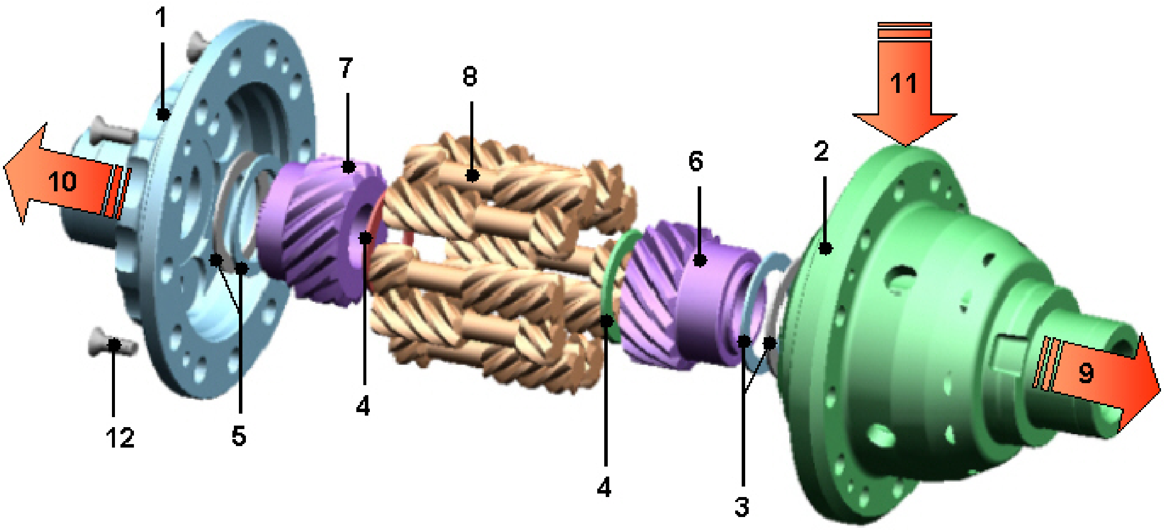


Fig. C1

COMPONENTS OF THE TORSEN B DIFFERENTIAL

The figure below shows an exploded view of the Q2 system TorSen B differential.



Legend:

1. Differential case cover
2. Differential case
3. Lower friction rings
4. Central friction rings
5. Upper friction rings
6. Sun gear
7. Sun gear
8. Planet gear
9. Axle shaft output
10. Axle shaft output
11. Motive torque input via a crown wheel
12. Screw

HOW THE TORSEN DIFFERENTIAL WORKS

General
The advent of electronics in the automotive field and the widespread adoption of ABS systems made it possible to develop a new method to address the problem of having a controlled distribution of motive torque to the driven axles, as is typical of 'open' type differentials.
Using the ABS sensors, the electronic traction control activates the brake on the wheel spinning faster on the same axle, i.e., the wheel with lower grip.
In this manner, it is possible to accelerate freely, as the 'open' differential will deliver a lower quantity of torque to the wheel that is skidding (where it is absorbed by the brake) and a greater quantity to the wheel with better grip, which will therefore be able to move the vehicle.
This system, however, cannot step in unless a wheel is slipping and this means there will be a loss of adherence and traction before its effects can make themselves felt, resulting in reduced vehicle speed.
Moreover, the application of the brake to the wheel with reduced grip uses up torque and reduces the torque available to make the vehicle move.
Finally, on very slippery surfaces, continuous system activation may place considerable strain on the brakes.

The 'mechanical' version of the TorSen differential anticipates wheel slipping.
The TorSen differential has a more complex configuration than the 'open' differential, enabling torque to be distributed in different proportions to the driven axles when the differential senses that the speed of rotation of the driven axles is different.
Before we examine the operation of the differential, we should introduce the concept of **'TBR'**, that is to say:

- **T**orque
- **B**ias
- **R**atio

that is the ratio between the torque delivered to the wheel rotating at a lower speed and the torque applied to the wheel spinning faster.

For example: with TBR = 3 (sometimes expressed as TBR = 1 : 3), if a torque of 2000Nm is applied to the differential shaft, the latter will deliver 500Nm to the wheel that has lost traction and 1500Nm to the wheel with a better grip.

The benefit afforded by this configuration compared to an 'open' differential can be readily grasped: the wheel that is not slipping receives a substantially greater quantity of torque, all to the advantage of traction.
The 'Laws' underlying the operation of the TorSen differential are:

- **1st Law:** the rotation speed of the drive shaft corresponds to the average value of the rotation speed of the driven shafts (as in an 'open' differential)
- **2nd Law:** the sum of the torque values available on the driven shaft is always the same as the torque applied to the driven shaft, but the shaft rotating at a lower speeds receives TBR times as much torque as the shaft rotating faster.
- **locking %** = (TBR - 1) / (TBR + 1) x100

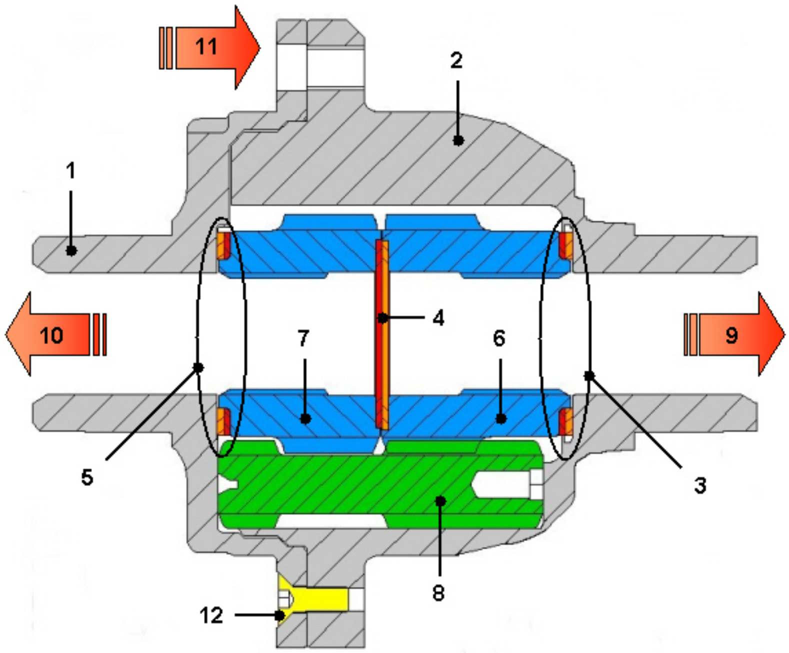
Thus, we can say that a TorSen differential combines the best characteristics of the 'open' differential, enabling the driven axles to rotate at different speeds, and some of the favourable features of the 'locked' differential, by delivering a greater proportion of the motive torque to the wheel with a better grip – a valuable feature on low grip surfaces.
The TorSen does not split the torque evenly between the two axles on bends, since, when cornering, one wheel spins faster than the other, and the action of the TorSen is always in keeping with the 1st Law.
As a result, the driver get a slight but clearly perceivable impression of the wheels straightening up of their own accord.

In general, in order to minimise the reactions at the steering-wheel, it is advisable to adopt a TorSen with a low TBR, which will have a lesser impact on vehicle behaviour on bends.

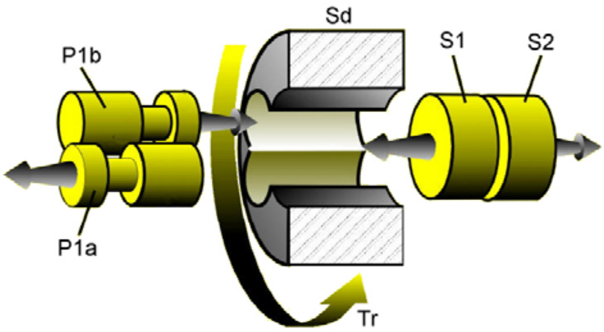
In short, the TorSen differential ensures a dynamic distribution (between the two front drive wheels) of traction when the gas pedal pressed or released, consistently with wheel grip, so as to optimise vehicle stability and maximise driving pleasure.
In actual fact, when driving a car fitted with the Q2 system, the driver perceives a higher degree of safety, in terms of:

+ more road-holding
+ more traction
+ more stability in deceleration
- reduced understeering in acceleration
- fewer interventions of the traction and stability electronic controls, and
+ greater driving pleasure.

How the Torsen B works
The TorSen B is installed in the transmission, in the same position as a traditional front differential.



The torque coming from the engine/transmission (11) is delivered to the differential crown wheel, which is integral with the two half-cases (1) and (2).
Inside the differential case (2) 5 housings accommodate 5 pairs of planet gears (8) with helical teeth; they can rotate around their axis within the housing in which they are contained.
The differential case causes the rotation of the planet gears (8) around the transverse axis of the differential, and these gears in their turn transmit a rotary torque to the sun gears (6 and 7) in mesh via helical teeth. In cascade form, the sun gears (6 and 7) transmit the motion to the axle shafts of the front drive wheels (9, 10).
If the resisting torque transmitted by the ground to the drive wheels is not homogeneous (e.g., when riding on variable grip terrain or when cornering), the sun gear connected to the axle shaft of the wheel (9 or 10) that has lost traction would ‘tend’ to spin faster than the other; in these conditions, axial thrusts are generated on the contact teeth (sun gear/ planet gear) and are transferred to the friction rings, preventing the sun gear associated with the lower grip wheel from spinning faster.



Legend:

P1a: Planet gear
P1b: Planet gear
Sd : Differential case

S1: Sun gear 1
S2: Sun gear 2
Tr: Motive torque applied

In this manner, the torque produced by the engine is not fully transferred to the lower-grip wheel (as in an open differential), and a greater proportion of it is transferred to the wheel in better traction conditions (self-locking effect).

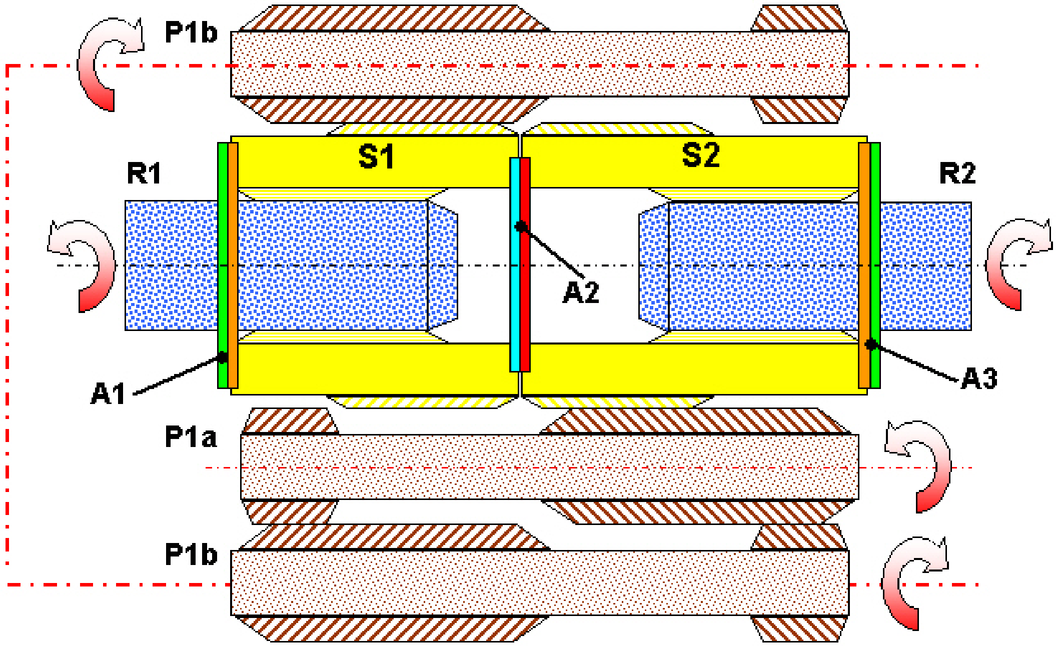
Depending on the environmental conditions in which the vehicle is used, in acceleration or in deceleration, on uneven surfaces, or on bends, different sets of friction rings (3,4,5) come into play: these rings are responsible for the diversified distribution of torque to the axle shafts of the front drive wheels (9,10).
When certain locking values are exceeded, the differential opens and permits different spinning speeds between the axle shafts of the front drive wheels (9,10).

Functional diagram of the epicyclic gear system (revs at gearbox input = zero)

The figure below illustrates the operation of the epicyclic gear set in the following conditions:

- Engine off
- Zero speed at gearbox input (gearbox in neutral)
- Front wheels raised off the ground

In these conditions, by rotating a wheel (e.g., the right wheel) connected to axle shaft ‘R2’, a rotation is imposed to sun gear ‘S2’. The latter, connected via helical teeth, transfers the motion to planet gear ‘P1a’, which, in its turn, transfers the motion to planet gear ‘P1b’ (planet gears ‘P1a’ and ‘P1b’ are connected to one another by helical teeth). Planet gear P1b is in mesh with sun gear ‘S2’ via helical teeth and the latter transfers the motion to axle shaft ‘R1’ which is connected to a wheel (e.g., the left wheel) in the opposite position with respect to axle shaft ‘R2’.



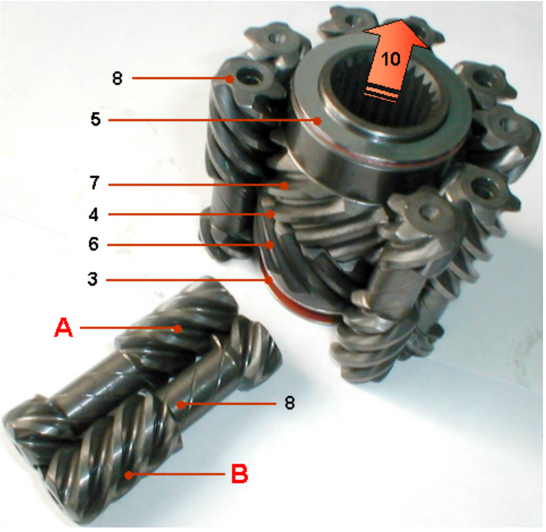
Note: the figure shows the connection of one of the five planet gear sets making up the differential. To make the figure more legible, planet gear ‘P1b’ has been drawn twice to illustrate the connection with sun gear ‘S1’, but in actual fact it is coupled with planet gear ‘P1a’.

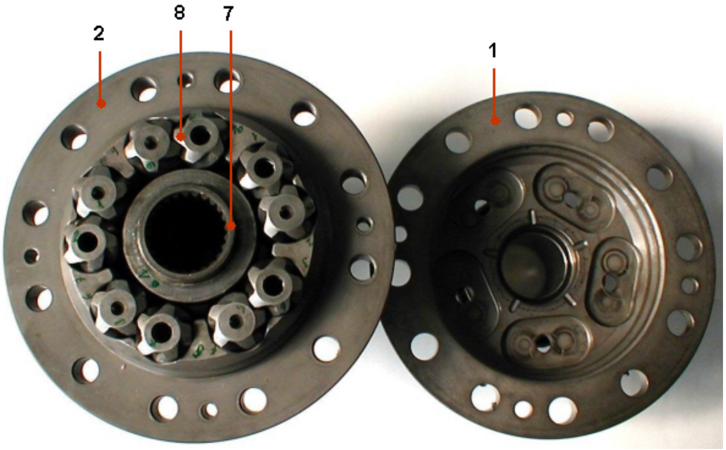
Legend:

A1: Lower friction rings
A2: Central friction rings
A3: Upper friction rings
P1a: Planet gear a
P1b: Planet gear b

R1: Axle shaft (e.g., left)
R2: Axle shaft (e.g., right)
S1: Sun gear 1
S2: Sun gear 2

Below you can see a detailed view of the coupling between the five pairs of planet gears and the two sun gears:



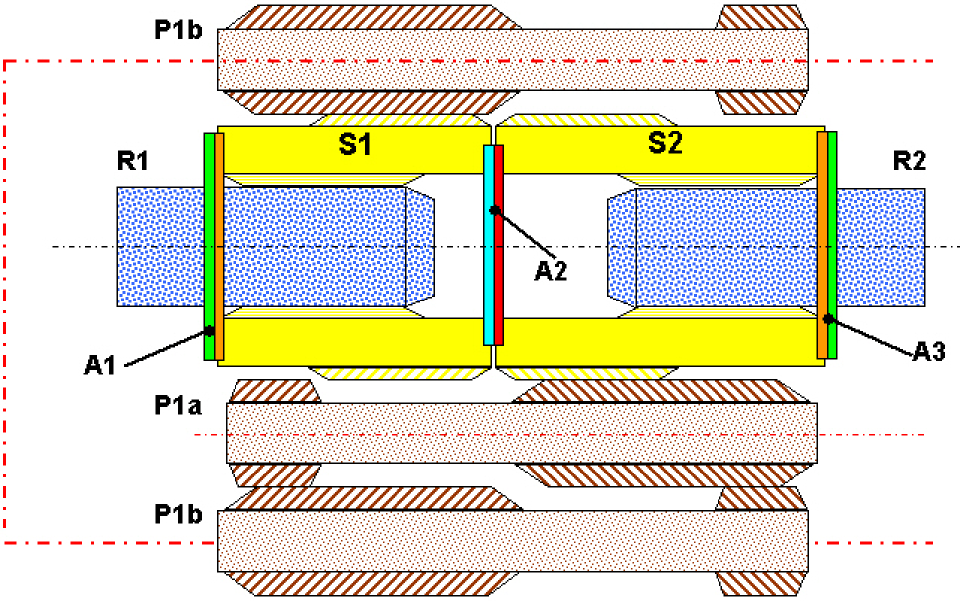


Legend:

1. Differential case cover
2. Differential case
3. Lower friction rings
4. Central friction rings
5. Upper friction rings
6. Right sun gear
7. Left sun gear
8. Planet gear
9. Right axle shaft output
10. Left axle shaft output
11. Motive torque input via crown wheel
12. Screw

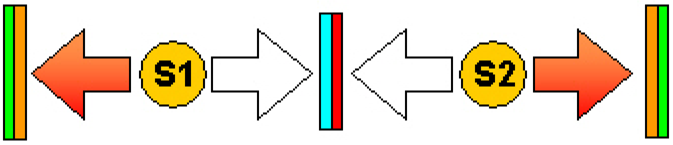
Functional diagram of the epicyclic gear set (in acceleration and deceleration)

The epicyclic gear set has a different self-locking behaviour as a function of different driving and environmental conditions.



In acceleration

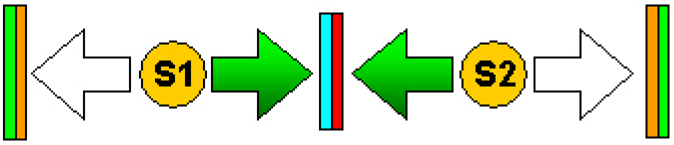
In acceleration, the S1 and S2 sun gears of the epicyclic gear set of the Torsen B differential activate friction rings (A1) and (A3). In these conditions, we get a self-locking effect of 25% (TBR = 1.690).



Note: in **acceleration** the axle that tends to rotate faster is the one with less friction

In deceleration

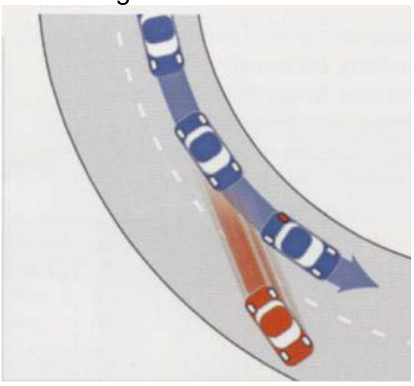
In deceleration, the S1 and S2 sun gears of the epicyclic gear set of the Torsen B differential activate friction rings A2. In these conditions, we get a self-locking effect of 28% (TBR = 1.785).



Note: in **deceleration** the axle that tends to rotate faster is the one with more friction

Dynamic behaviour on bends without the Q2 system

When cornering on a poor grip surface (wet, snow covered or muddy roads, etc.) we often experience a loss of grip of the inner wheel, due to the fact that the differential distributes more torque to the wheel subject to a 'lesser load', and delivers less torque to the outer wheel, which, having to bear the added weight of vehicle rolling, might profit from a higher overall friction level.



In this situation, the car might respond in two different ways, depending on how it is equipped:

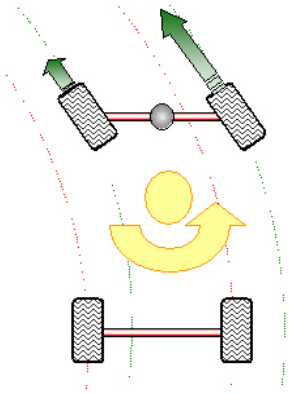
Case 1- ABS without ASR - VDC, the result perceived is slipping of the inner wheel, loss of control of the vehicle (strong understeering) and a lack of acceleration at the exit from the bend.

Case 2- ABS with ASR - VDC, the intervention of these systems reduces engine power by means of the throttle valve and makes it virtually impossible to modulate the acceleration, getting across an impression of loss of power and impaired interaction with the car.
In either case, as a result, one gets an impression of a lack of acceleration on exiting the bend.

Dynamic behaviour on bends with the Q2 system

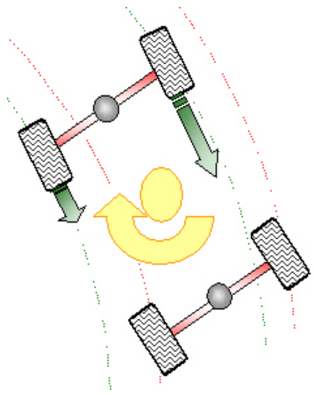
Case 1 – traction when cornering

The moment the inner wheel begins to lose grip, the differential transfers a proportion of the torque available to the outer wheel, preventing inner wheel slip and generating a yaw moment that helps reduce understeering.
By optimising wheel grip, the Q2 system ensures greater stability, higher vehicle speed on bends, less frequent and less invasive interventions of the vehicle control systems. All to the advantage of driving pleasure and full vehicle control.



Case 2 – decelerating on bends

When decelerating on bends, the torque unbalance goes to the advantage of the outer wheel, reducing understeering.



Behaviour on low grip road surfaces

Dynamic behaviour without the Q2 system
When riding on poor grip surfaces, the drive wheels will often experience different grip conditions. For instance, when driving along a road after a heavy snowfall, one wheel will be on the margin of the road, in contact with residual snow heaps, and the other will be running on a dry clean surface.

In these conditions, a sudden start or a strong acceleration will cause the wheel in critical friction conditions to slip, with strong reactions at the steering-wheel, poor pickup and the need to make continuous adjustments with the steering-wheel in order to maintain the vehicle on its intended trajectory.

Dynamic behaviour with the Q2 system
These adverse effects are countered through the progressive transfer of torque to the wheel that can profit from a higher friction coefficient. This facilitates uphill starting on mountain roads, for instance, and makes the ride safer and more comfortable on roads having an irregular surface.
In conclusion, the highly advanced Q2 system is yet another demonstration of Alfa Romeo's ability to work out technical solutions for enhanced vehicle safety and driving pleasure.

EXAMINER OSCILLOSCOPE

General

Starting with release 7.0 of the diagnostic software, a new instrument has become available to plot charts of analog and digital signals acquired by means of a SAM board: the oscilloscope.
Access to the oscilloscope is via the INSTRUMENT menu.

The home page is displayed in fig. 1.

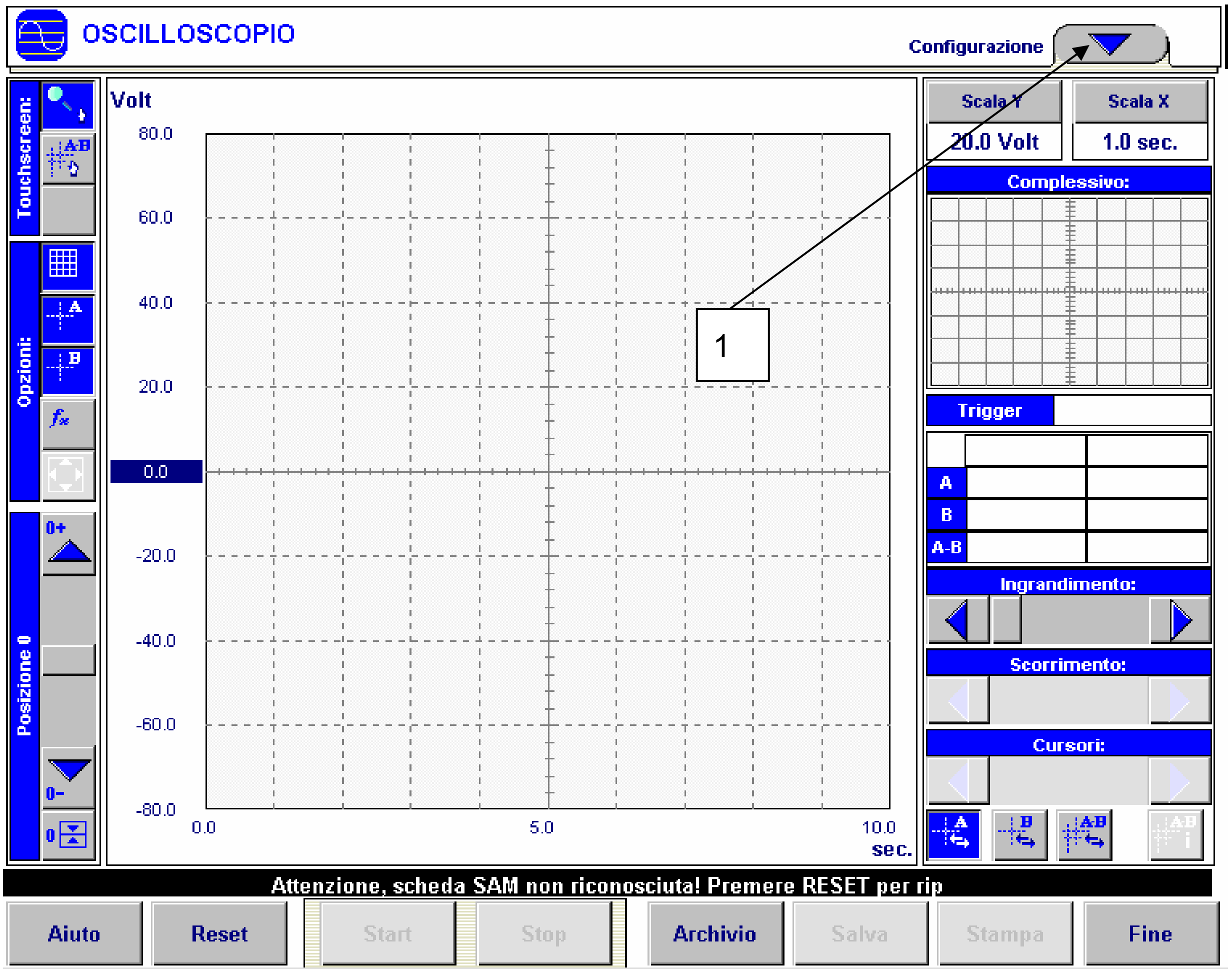


Fig.1

As can bee seen, most of the commands characterising this instrument are the same as are used by the recorder: their functions are virtually the same.
First of all, we must set the operating mode of the instrument.

Click button 1 to open the configuration window, shown in fig. 2.

Configuration

The configuration window lets you set some of the signal acquistion parameters.

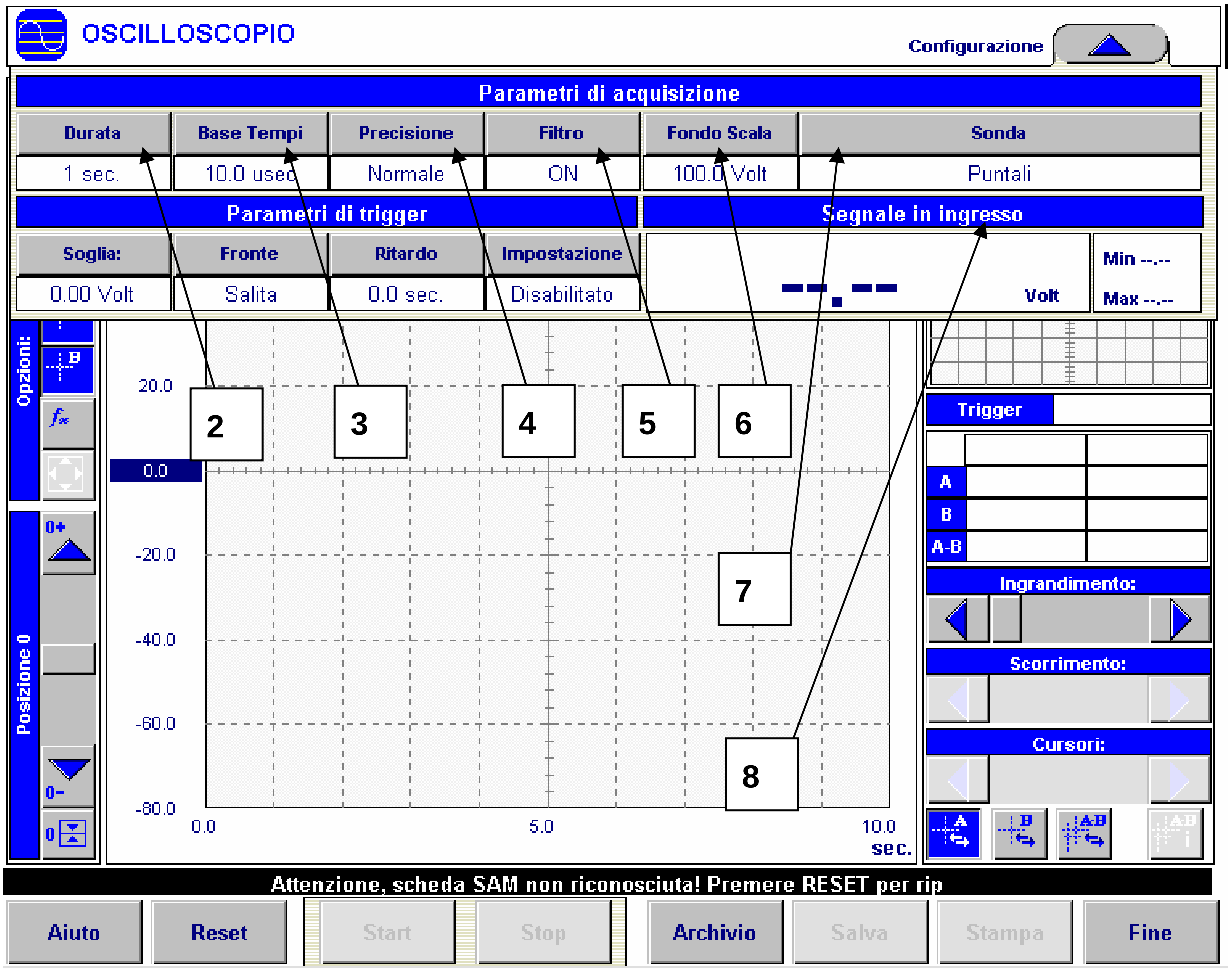


Fig.2

Button 7 (Probe): this button lets you select the type of device (probe) to be connected to the SAM board with which you want to acquire the signal to be analysed.
The different types of probe that can be used are already known and are part of the set of accessories supplied with the examiner (tips, manometer, thermometer, etc.)
As soon as the probe is connected to the source of the signal to be analysed, the window starts displaying the input signal and the value measured in real time, together with the minimum and maximum (Min – Max) values reached during the measuring session.

Durata

Button 2 (Time): this button opens a window giving the time duration of signal acquisition, which will be plotted on the chart, on the axis of the abscissas.

Base Tempi

Button 3 (Time base): this button opens a window giving the time that reflects the velocity with which the signals are read (time base).
When making this selection, consider that the shorter is the time base, the faster is the signal to be acquired.

Precisione

Button 4 (Precision) you can select the degree of precision (normal or high) of signal acquisition.

Filtro

Button 5 (Filter): makes it possible to screen the acquired signal from noise and undesirable peaks.

Fondo Scala

Button 6 (Full scale): defines the full scale of the instrument.

Trigger
The trigger makes it possible to have the signal acquisition start upon the occurrence of an event whose characteristics can be defined by the operator.
This event, which consists of exceeding a certain signal level threshold, can be programmed by means of commands available in the window (trigger parameters).

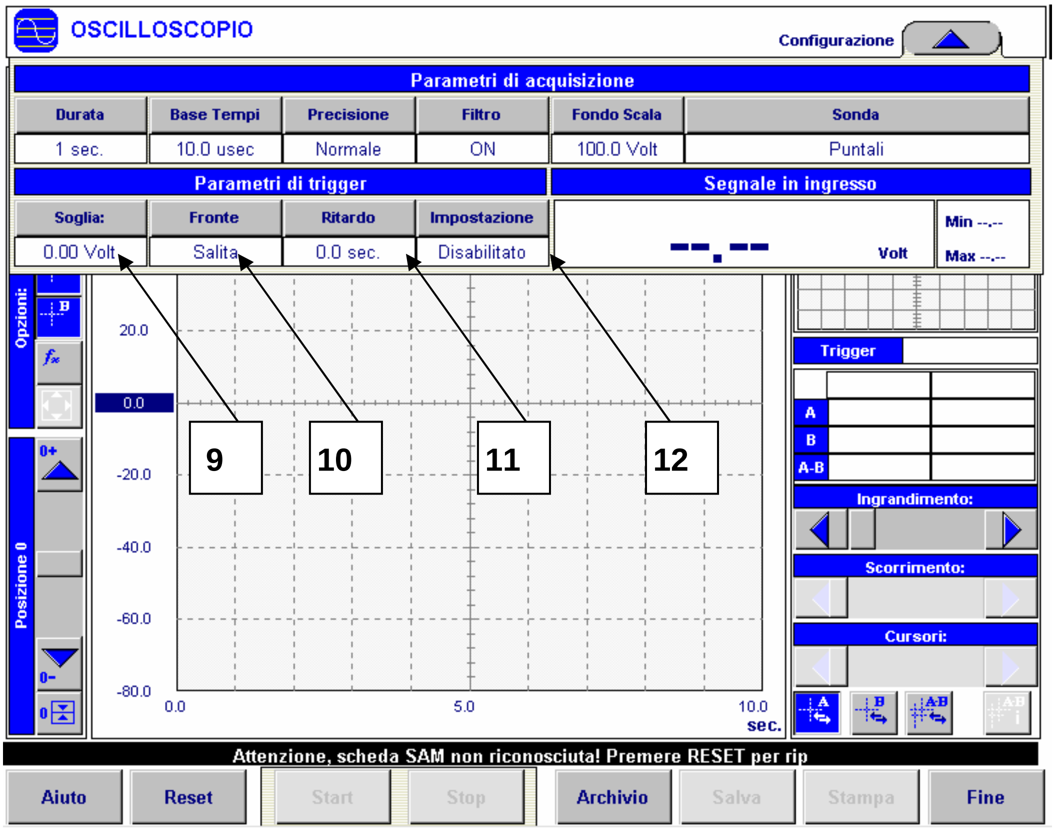


Fig.3

Button 9 (Threshold): use this button to open a virtual keyboard enables you to set the acquisition activation threshold.

Button 10 (Front): lets you decide whether to start the acquisition process either when the signal exceeds the threshold value set (rising front) or when the signal drops below the threshold (descending front).

Button 11 (Delay): this button displays a virtual keyboard that lets you set a time delay before signal acquisition starts, calculated from the moment the triggering event occurs.

Button 12 (Setup): makes it possible to set the trigger activation mode:
Disabled: The trigger is disabled. When the Start button is pressed, the instrument starts acquiring the signal and continues to do so during the time period programmed by the operator.
Automatic mode: When the Start button is pressed, the instrument starts monitoring the signal.
When the predetermined triggering threshold is reached, the instrument starts acquiring the signal and continues to do so throughout the time period programmed by the operator.
Manual mode: When the Start button is pressed, the instrument starts monitoring the signal. When the Start button is pressed again, the instrument starts acquiring the signal and continues to do so over the programmed time period.

Signal acquisition

The moment the instrument is connected to a signal source and the Start button is pressed, signal monitoring gets underway.
The oscillograph obtained reflects the evolution of the signal irrespective of triggering parameters.
At the end of the acquisition session, the instrument displays the screen illustrated in fig. 4.

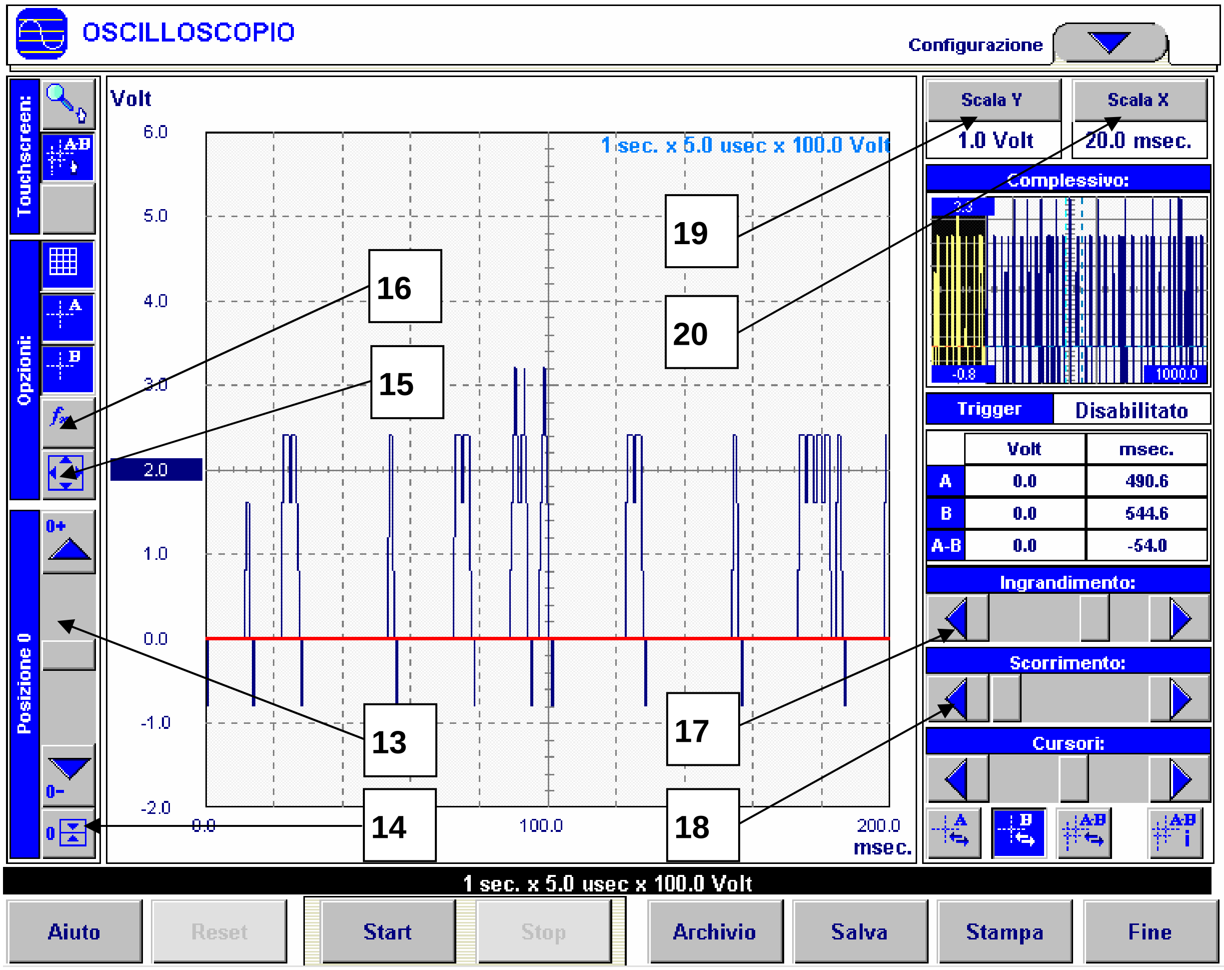
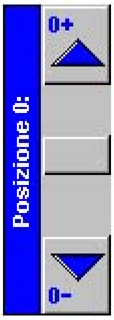
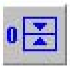


Fig.4

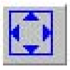
On the X axis, we see the acquisition time relating to the oscillograph part displayed.
On the Y axis, we see the value of the signal acquired.
In the case shown in fig.4, we see a portion of the oscillograph, selected from the complete oscillograph that can be seen in the Global window.



Cursor 13 Position 0: makes it possible to move the zero line along the Y axis.



Button 14: moves back the zero line to the centre of the Y axis.



Button 15: lets you reset the original dimensions of the oscillograph after a magnification.

Button 16: opens a window that lets you select a filter to be applied to the signal visualised. Your options are: None – Low filter – Mid filter – High filter.

Cursor 17: Zoom in: makes it possible to enlarge the oscillograph in the horizontal direction.

Cursor 18: Scrolling: makes it possible to scroll the oscillograph along the X axis, if you have selected a portion of it.

Button 19, Y scale: lets you set the amplitude of the value of the signal visualised on the Y axis.

Button 20, X scale: lets you select the time scale plotted on the X axis.

Collimators (or Cursors)

It is possible to use two collimators, A and B, to analyse in detail the value of the signal displayed at any point of the chart.

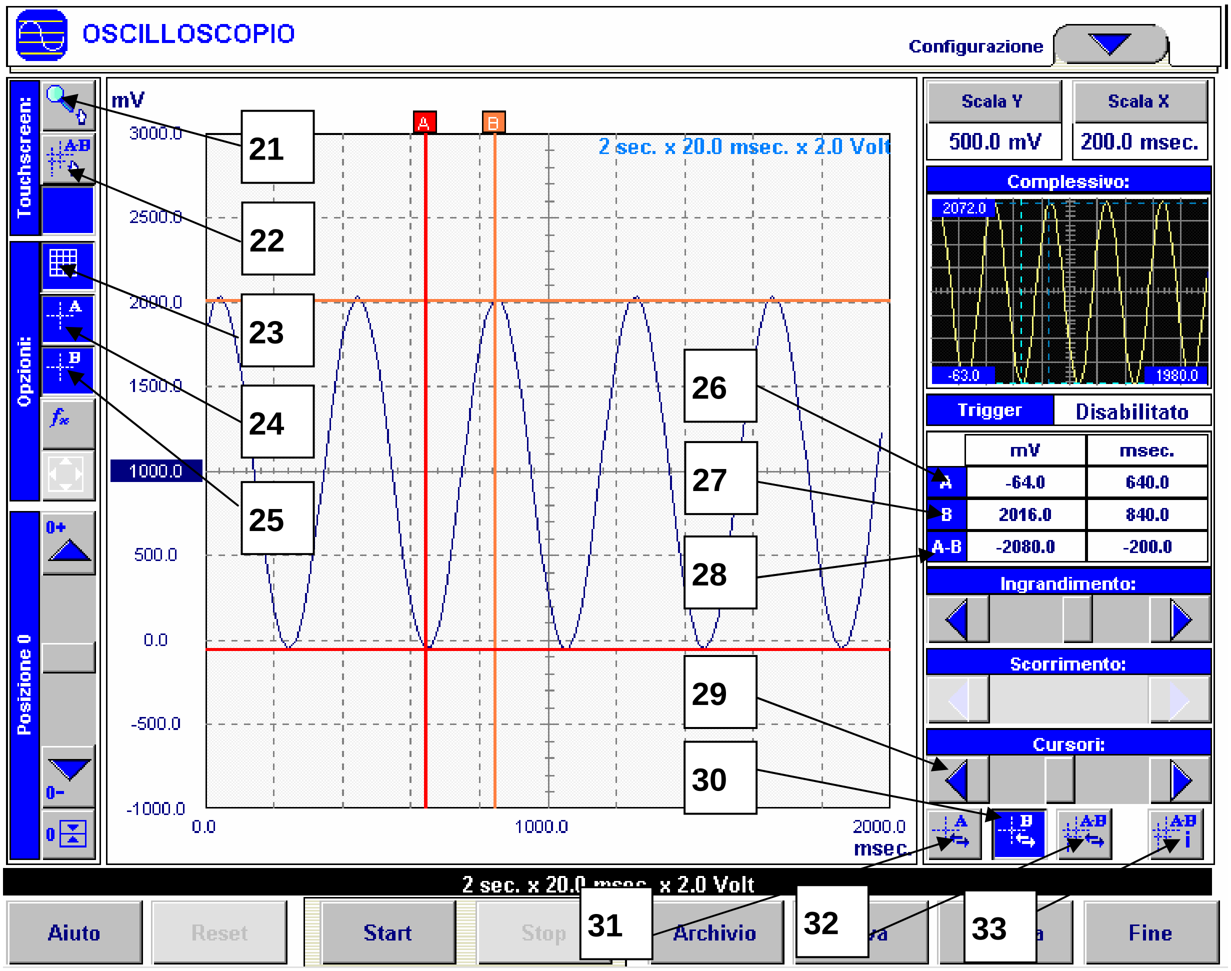
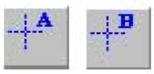
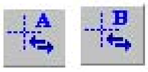


Fig. 6



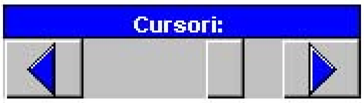
Buttons 24 and 25 – Collimator activation: these buttons make it possible to view the A and B collimators in the oscillograph. A table on the right side of the screen gives the exact values of the signal at the point where the collimator line intercepts the curve plotted on screen: in the example in fig. 6, collimator A is positioned at a point at which the value of signal, recorded after 640 msec. of the start of the acquisition process, is -64 mV, as given in detail in field 26. Similarly, for collimator B, in field 27 we read a value of 2016 mV recorded after 840 msec.
Field 28 gives the difference in the two values of the signal and the time elapsing between collimator A and collimator B.

NOTE:
Cursor B can be viewed only if you have already selected cursor A.
The cursors can be moved along the time axis X by means of specific commands.



Buttons 30 and 31: make it possible to select the cursor(s) to be moved.

Button 33: forces the two cursors A and B to move simultaneously, so as to maintain the same time interval between them.



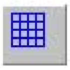
Button 29 - Cursors: makes it possible to move the A and/or B collimator (if active) along the X axis.

It is also possible to position the cursors by dragging them, provided that they are visualised.

Button 22: activates the dragging of the active cursor.

Other buttons.

Button 21: lets you zoom in on a portion of the oscillograph by touching and dragging across the screen.



Button 23: lets you view or hide the grid on the screen.

Buttons in the applications bar

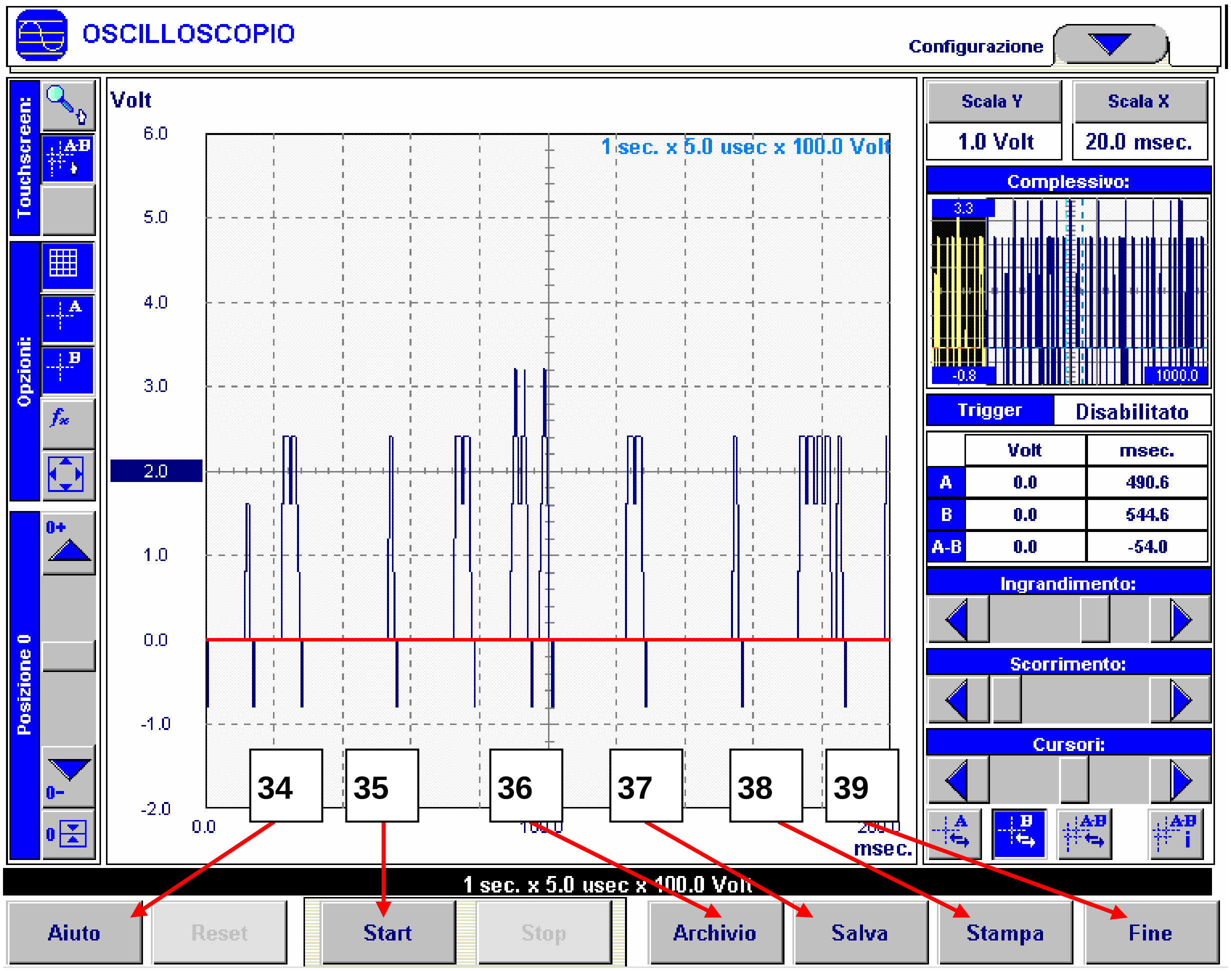


Fig.7

Button 34 - Help: opens the help menu of the instrument.
Button 35 - Start: starts the acquisition process.
Button 36 - Archive: gives access to the acquisition processes performed.
Button 37 - Save: lets you save the last acquisition process made in the archive.
Button 38 - Print: lets you print the current screen on paper.
Button 39 - End: lets you quit the Oscilloscope application.

EXAMINER CAN NETWORK MONITOR

General

Starting with release 7.0 of the diagnostic software, a new application has been made available to monitor the activity taking place in the CAN network through the Diagnostics socket of the vehicle.
This helps the diagnostics technician to check for possible activations of the CAN network (exist from the low consumption status: this may cause early battery exhaustion) during prolonged vehicle stops.

To access the 'CAN network monitor' application, go to 'Control Unit Test' and select the 'Other Systems' item in the 'Group' window: At this point, in the 'System' menu, select 'CAN network monitor'. (Fig. 1).

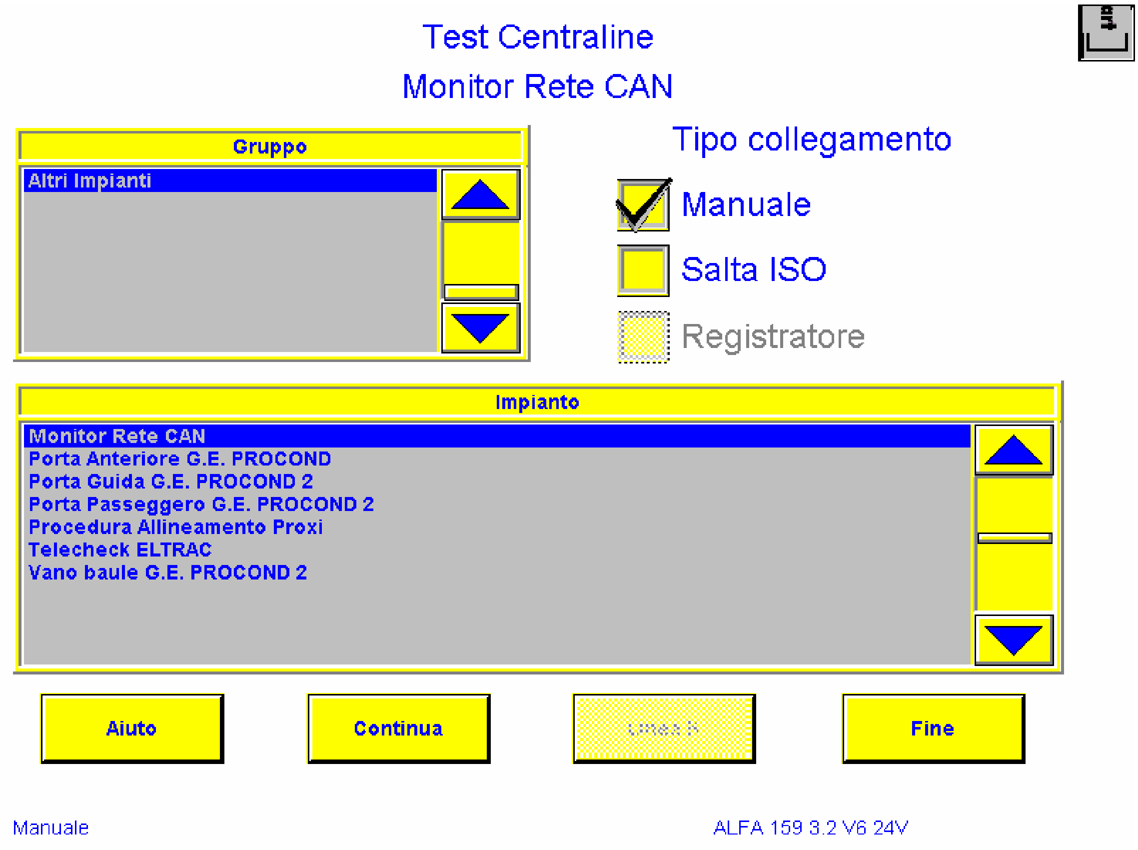


Fig. 1

To start the application, select '**Continue**'.

The figure below (Fig. 2) illustrates the home page of this application.

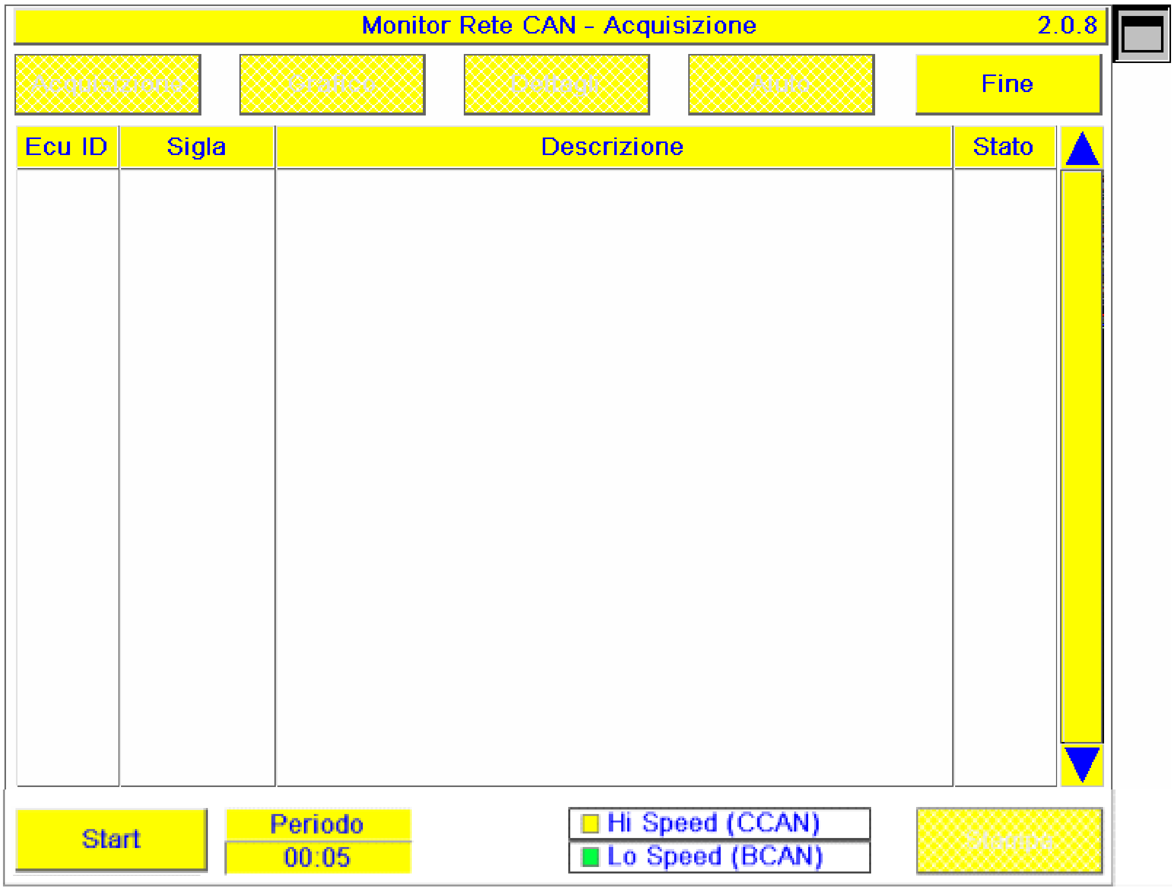


Fig. 2

In the home page (Fig. 2) you can use the following buttons:

: starts monitoring the activity in the CAN network.

: closes the application.

When the '**Start**' button is pressed, the application starts monitoring the B-CAN network (Fig. 3) and continues to do so until the operator presses the '**Stop**' button.

Note: at present, the C-CAN network is not monitored directly, the information moving through the high speed network is transferred to the B-CAN network by the Body Computer Node.

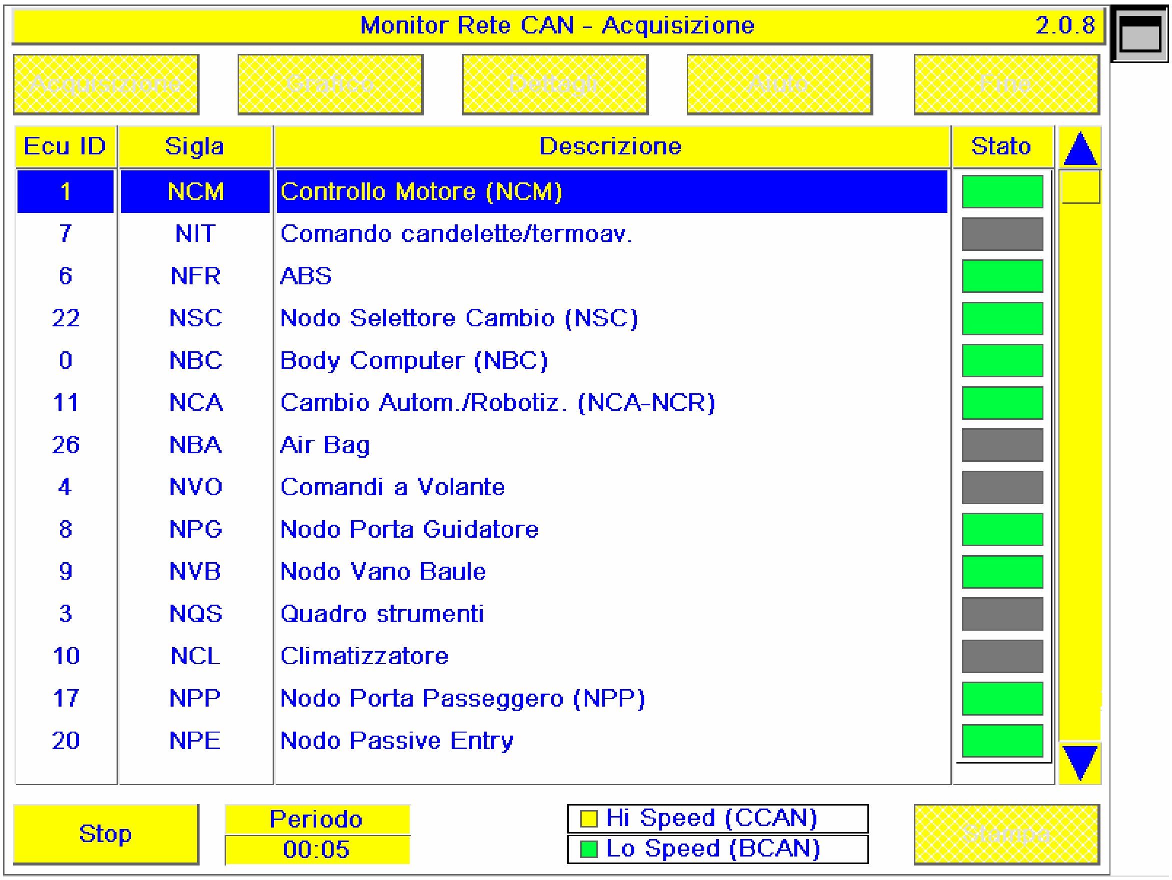


Fig. 3

When the '**Stop**' button is pressed, the application enables the buttons in the upper part of the acquisition window (see fig, 4).

: List of nodes that have written at least one message on the CAN network

: Graphic view of the activity of each individual node

: Chronological list of the messages written on the CAN network by the individual node

: Detailed information on the functions of the buttons and the icons.

These buttons enable the diagnostic technician to view the acquisition in the form that best suits his/her goals.

Screen in acquisition mode

Acquisizione

To view the Acquisition mode, press the button that reads '**Acquisition**'.
Figure (Fig. 4) shows a list of the nodes in 'writing' or 'listening' mode on the network.
The list of nodes is subdivided into four columns:
Ecu ID : Indicates the network identifier of the node
Code: Acronym of the node
Description: Description of the node acronym
Status: indicates whether the node is in 'writing' or in 'listening' mode:

- B-CAN network

- Green: 'writing' mode
- Grey: 'listening' mode

- C-CAN network

- Yellow: 'writing' mode
- Grey: 'listening' mode

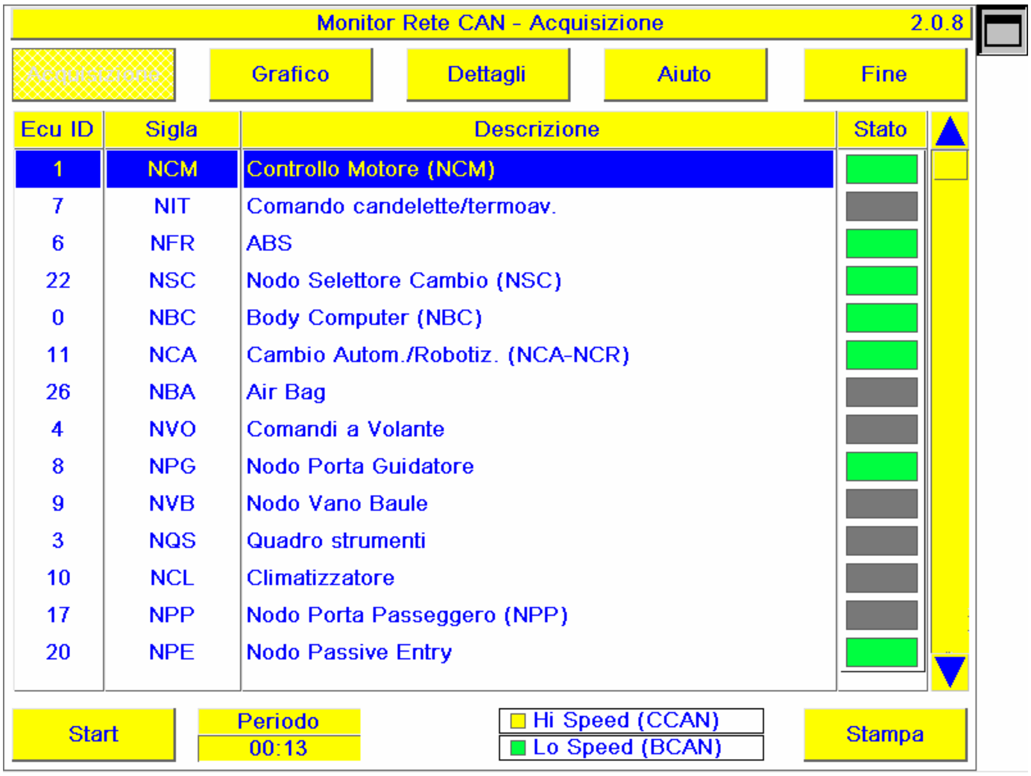


Fig. 4

In graphic mode, the bottom part of the screen (Fig. 4) contains data and buttons:

Start : starts a new monitoring session on the activity of the CAN network

Periodo 00:05 : time of activity of the network (message writing time only)… ?

Hi Speed (CCAN) Lo Speed (BCAN) : Indicates the colours associated with the C-CAN and the B-CAN networks.

Stampa : Prints the list

Screen in graphic mode

To view the graphic mode, press the ‘Graphic’ button.
In this viewing mode, the operator can see all the activities (message writing on the network) of each individual node in graphic form.

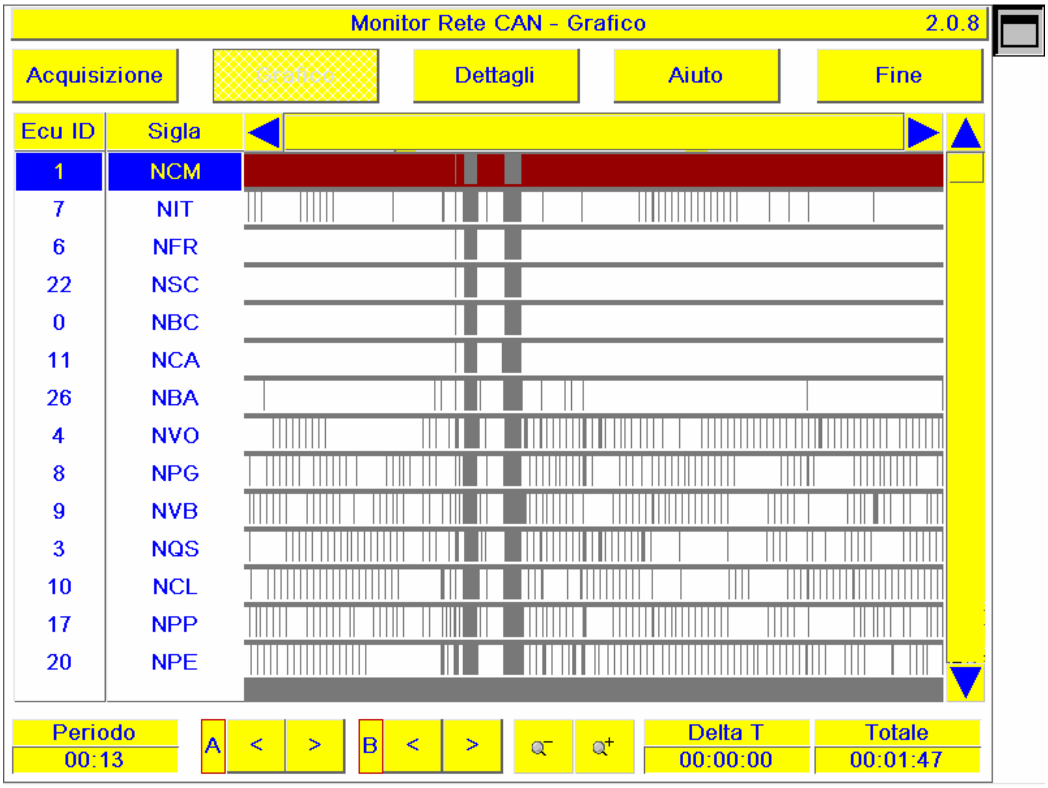
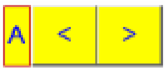


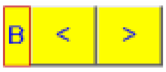
Fig. 5

In graphic mode, the bottom part of the screen contains data and buttons:

: time of activity of the network (message writing time only)



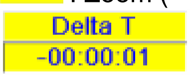
: Marker A



: Marker B


: Zoom (-), reduces the time base


: Zoom (+), increases the time base



: time interval between marker A and marker B

: Total acquisition time

Using the graphic mode markers

To activate marker A or marker B, press the corresponding letter. When a marker is active, the background of the box changes colour (from yellow to green). In the chart the markers are highlighted with a light blue and a yellow line running in the vertical direction.

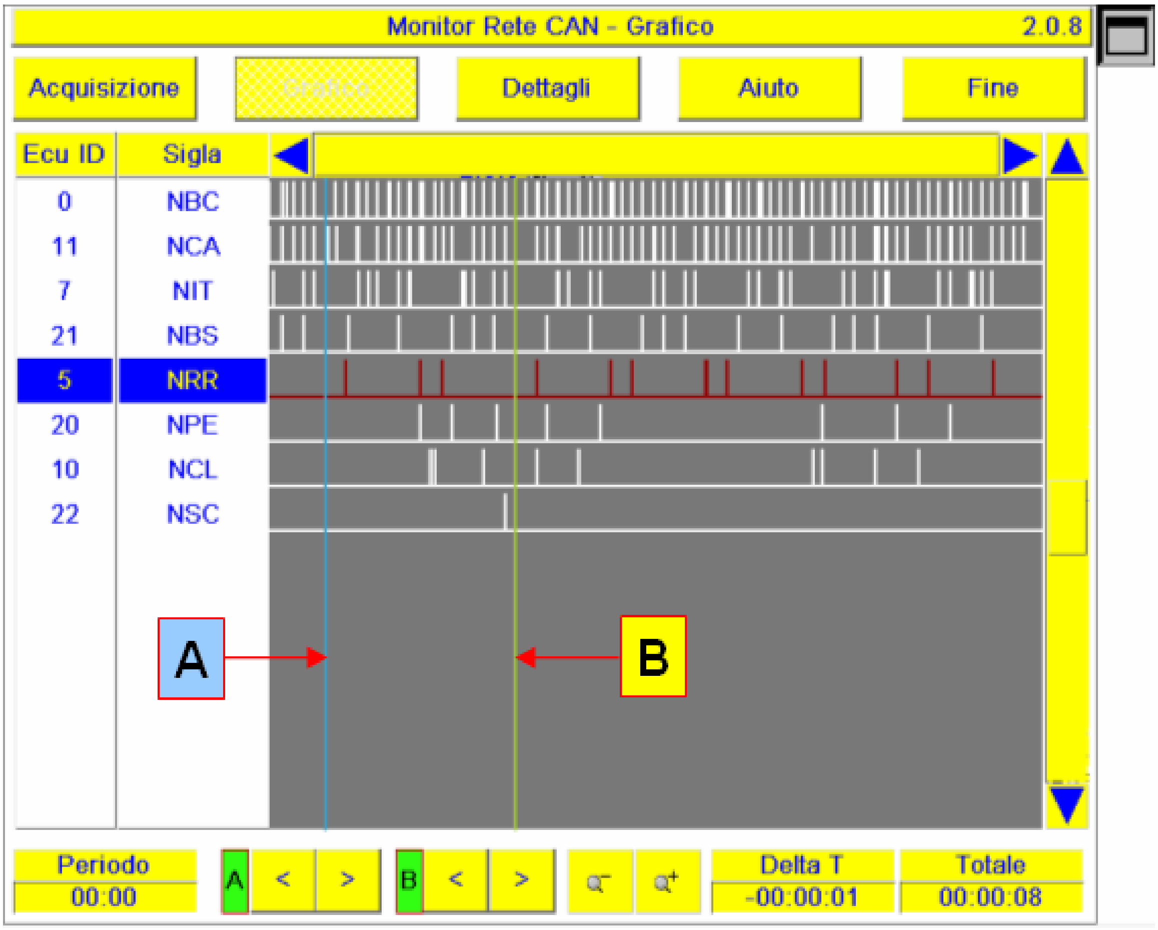


Fig. 6

To be able to move the markers to any point in the graphic, press the < o > buttons.
In the 'Delta T' box you can read the time interval between the A marker and the B marker.

You can zoom in on the graphic using the following button:

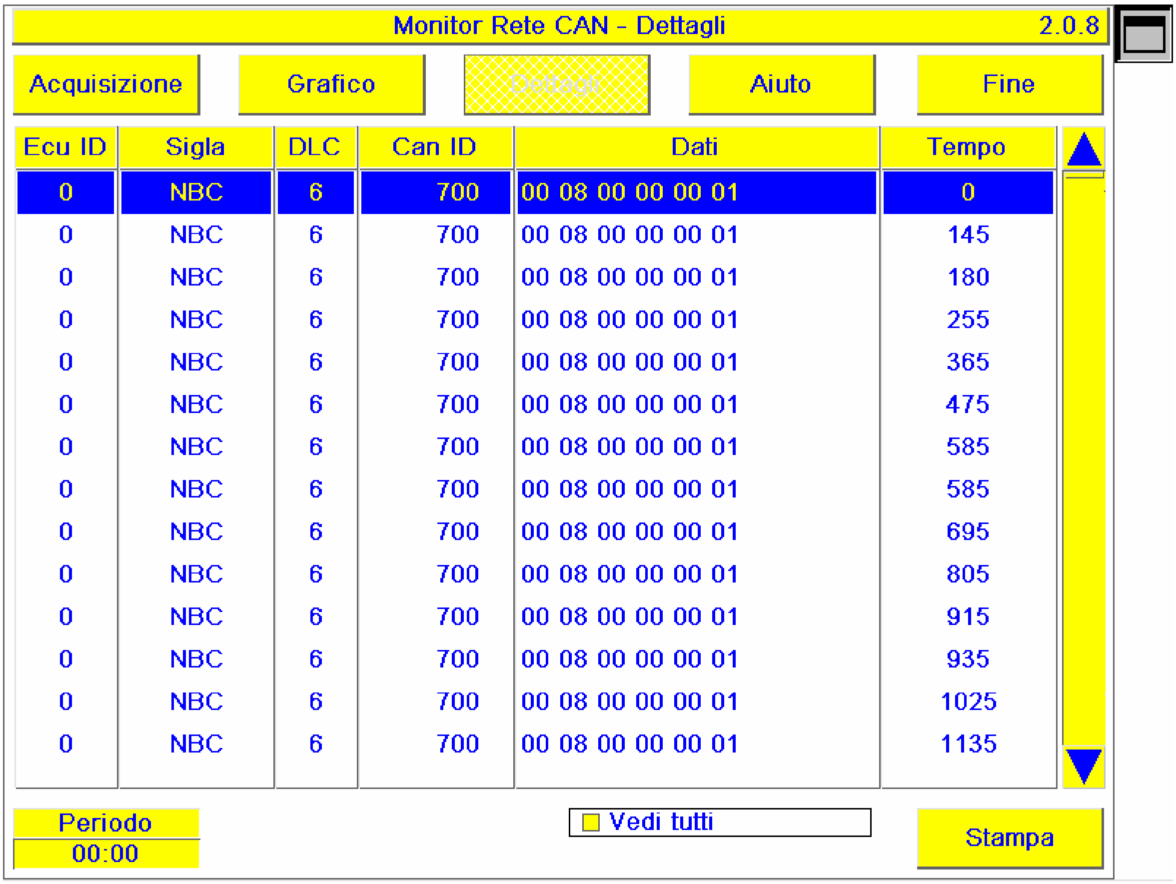
- key  to reduce the time base;
- key  to increase the time base.

Screen in details mode

Dettagli

In 'acquisition' or 'graphic' mode, select the node of interest
To view the details mode, press the '**Details**' button.
This viewing mode enables the operator to see the entire chronology of the messages written on the CAN network by the individual node.

The chronological list of messages is subdivided into six columns:
Ecu ID: Gives the network identifier of the node
Code: Acronym of the node
DLC: Data Length Code, gives the length of the message
CAN ID: Identifier of the message in hexadecimal format
Data: Message in hexadecimal format
Time: Time when the message was written on the network with respect to the start of the acquisition session. It is expressed in milliseconds.



Ecu ID	Sigla	DLC	Can ID	Dati	Tempo
0	NBC	6	700	00 08 00 00 00 01	0
0	NBC	6	700	00 08 00 00 00 01	145
0	NBC	6	700	00 08 00 00 00 01	180
0	NBC	6	700	00 08 00 00 00 01	255
0	NBC	6	700	00 08 00 00 00 01	365
0	NBC	6	700	00 08 00 00 00 01	475
0	NBC	6	700	00 08 00 00 00 01	585
0	NBC	6	700	00 08 00 00 00 01	585
0	NBC	6	700	00 08 00 00 00 01	695
0	NBC	6	700	00 08 00 00 00 01	805
0	NBC	6	700	00 08 00 00 00 01	915
0	NBC	6	700	00 08 00 00 00 01	935
0	NBC	6	700	00 08 00 00 00 01	1025
0	NBC	6	700	00 08 00 00 00 01	1135

Fig. 7

If you want to view the messages of all the nodes flag the box 'View All'
Vedi tutti .

Help screen

To view the '**Help**' function, press the '**Help**' button.
This function provides a description of the functions of the various buttons and data present in the active screen.

Example of Help screen:

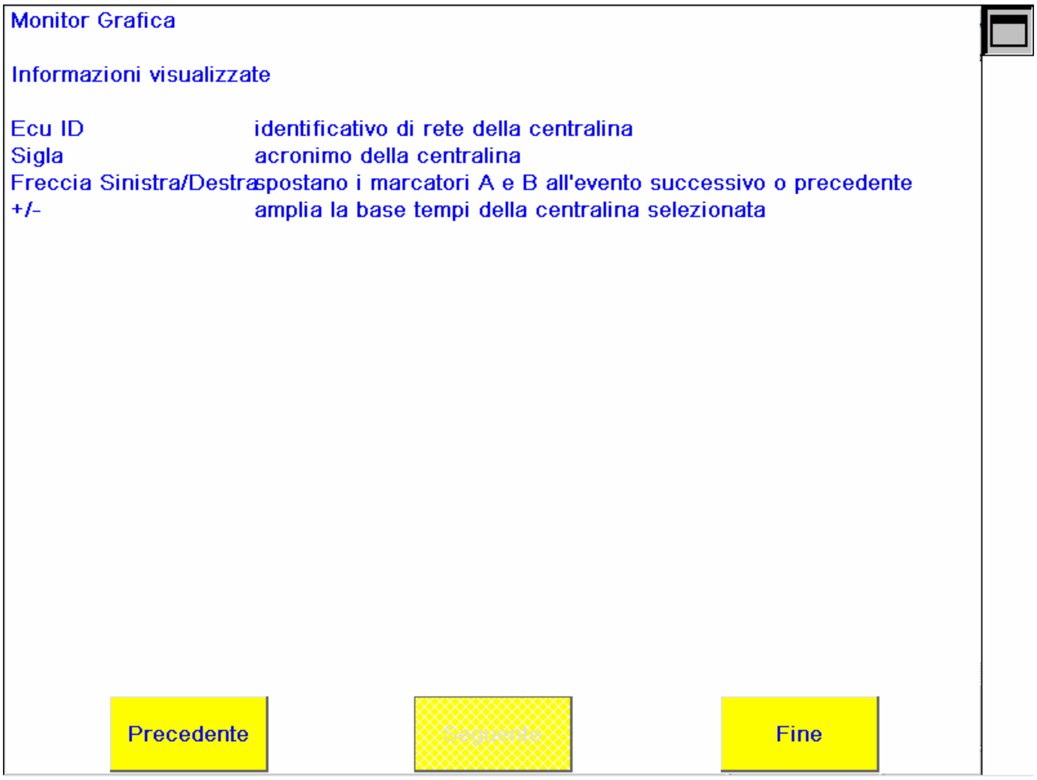


Fig. 8

Closing the application

To close the 'CAN network monitor' application, press the '**End**' button.
When this button is pressed, the application opens a 'Warning' window to tell the diagnostic technician that the data saved will be cancelled.

Fig. 9

If you want to quit, press the '**OK**' button, otherwise, click '**Cancel**' to go back to the visualisation of the data acquired.

Acquisition of CAN network activity during prolonged vehicle stops.
(car parked in a garage overnight).

In the graphic example below (Fig. 10) it can be seen that after a certain period of inactivity, the network becomes active and then switches to 'Bus-Off', i.e., low energy consumption mode.
In this simulation, the node that has caused the activation of the CAN network is the steering lock node (NBS): this happened because during the acquisition process we deliberately inserted and then pulled out the key from the TEG-READER, and this caused the activation of the network for a certain period of time.

Note: the node that appears first in the list displayed (Fig. 10) is the first node that sent a message to the network causing the activation of the latter.

In conclusion, with the aid of this software application, the diagnostic technician is able to determine whether early battery exhaustion is due to the activity of the CAN network or to some other cause.

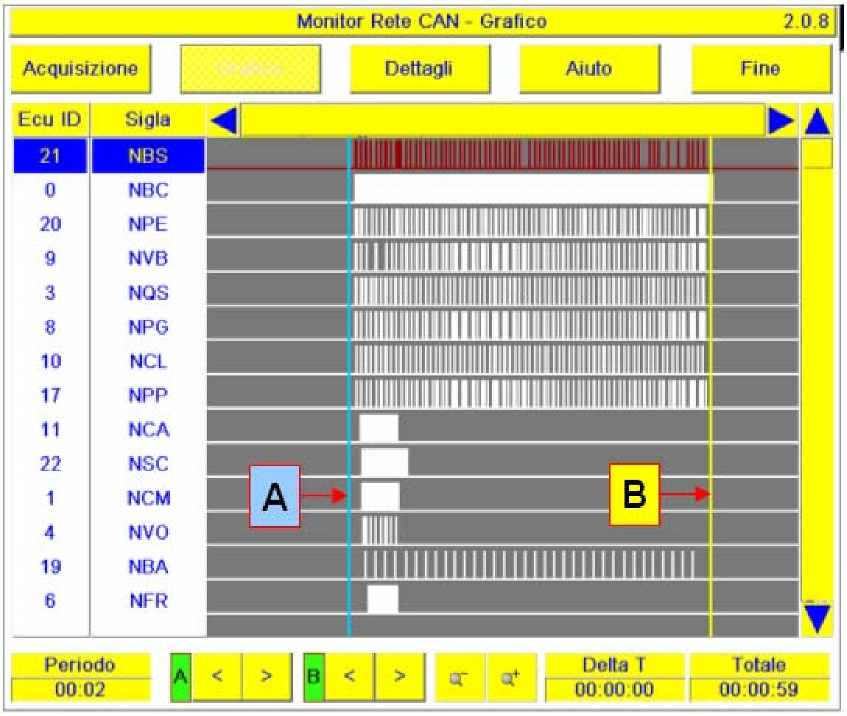


Fig. 10

In the example shown in Fig. 10 above, total acquisition time was just 59 seconds instead of a few hours.
If you want to know the time duration of network activity, use the markers as follows:
- position marker A at the limit of start of activity
- position marker B at the limit of end of activity

then read the value in the 'Delta T' box and the 'Total' box and apply the following formula:

% AR (network activity in %) = ('Delta T' * 100) / 'Total'

example : % AR = 40 * 100 / 59 = **67.8 %**