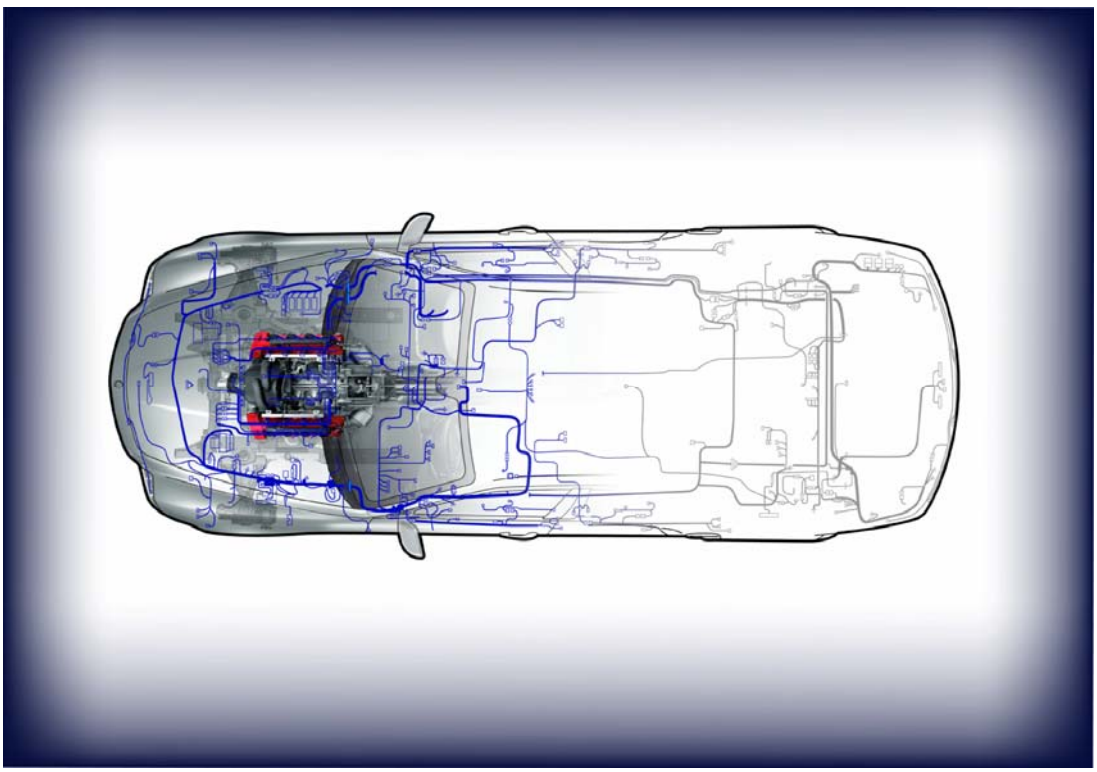
MASERATI
ACADEMY

# Advanced Electronics 2

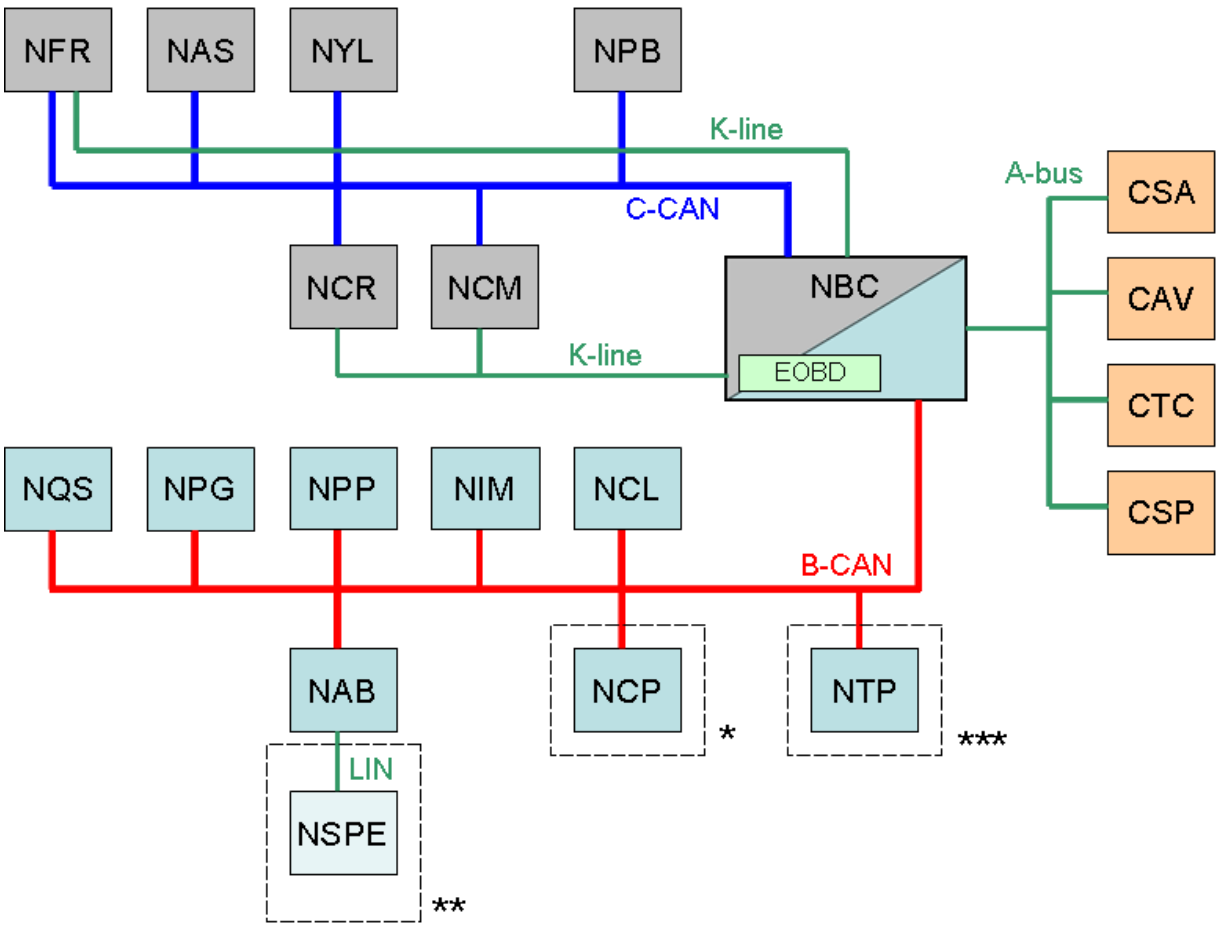
## Chassis and Body



**September 2009 Edition**

**Training Documentation for Maserati Service Network**

**Florence diagram: Alfa Romeo 8C Competizione & 8C Spider**




**Notes:**

(*) 8C Spider only.

(**) Only for vehicles fitted with the Advanced Weight Sensing System (AWS), USA specification vehicles only.

(***) USA specification vehicles only.

**5 possible CAN faults**

1. **Data frame transmission error:** A node did not succeed to put a data frame correctly on the CAN line. A cause can be an internal problem with the CAN controller of the node or a problem external to the node, such as a sudden fluctuation on the power supply voltage of the node.

2. **Bus occupied or disturbed:** The bus can be disturbed by an external factor (noise) or by a node itself. Example: a faulty node stays in “writing mode” and by this way inhibits other nodes from using the line. Such a fault can be identified by disconnecting the nodes from the bus one by one.

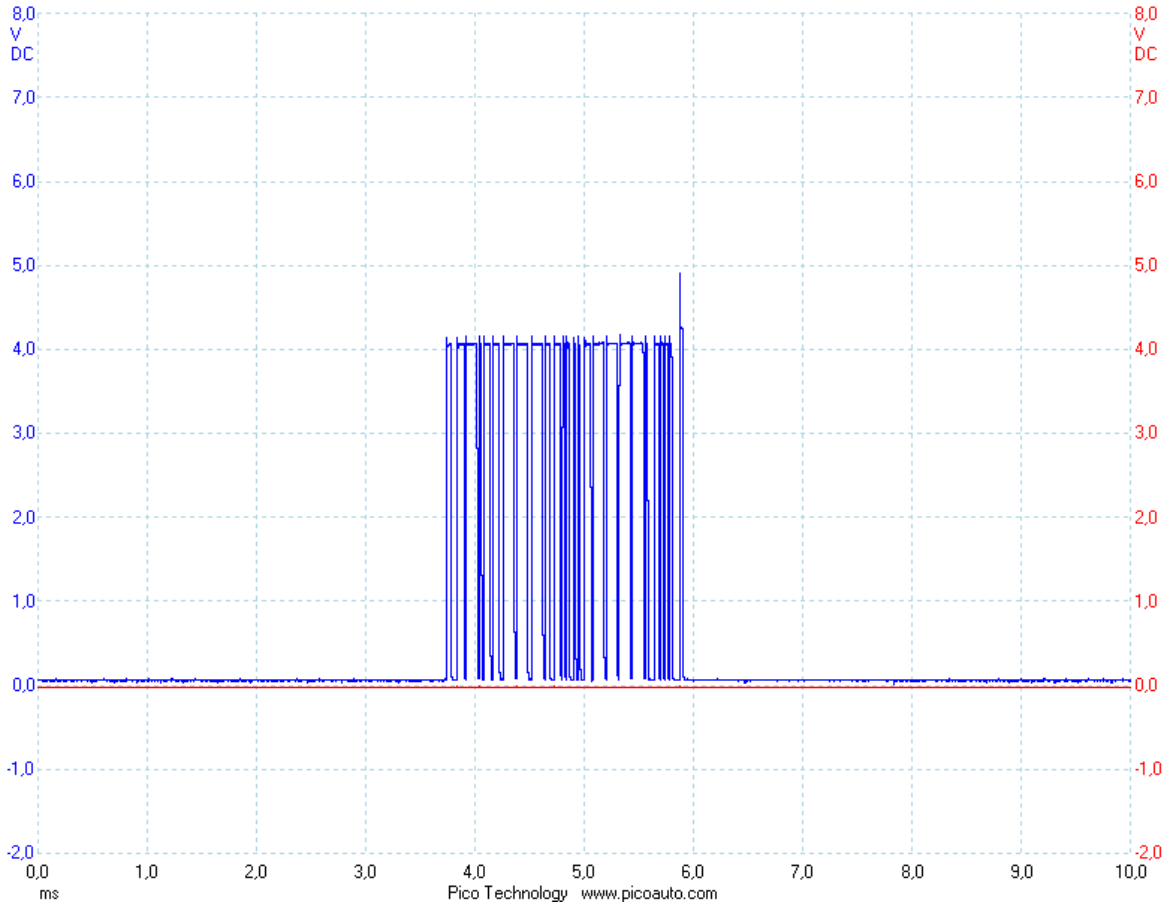
3. **Data signals too low:** A node puts a data frame on the bus, but the voltage levels are not sufficient for the other nodes to read the data. As in problem one, the cause can be a faulty node or insufficient power supply of the node, creating in this way a bus error.

4. **Wrong or missing reference voltage:** The correct idling voltage of 2,5 volts (for C-CAN) on one or on both bus lines is not present. A typical cause of such a problem is a short circuit or open circuit in the line. These type of faults can be identified with old-school trouble shooting using a multi meter.

5. **Wrong programming:** The message put on the bus is correct on the physical level but contains wrong content, creating by this way a bus error. A fault of this type can be resolved only by replacing or reprogramming (when possible) the node.


**Bus problems of category 1 to 4 can be identified by the correct use of a digital oscilloscope!**

**Examples of bus errors: CAN A in short circuit to ground**




When CAN A is shorted to ground, its voltage level drops to zero. We can see that the voltage level of CAN B is however not affected. Communication between nodes is still possible over a single wire (recovery mode).
B-CAN remains operational over the CAN B line only.

## CAN Class A communication lines

Single wire serial communication lines as used in our vehicles (K-line, W-line, A-bus and LIN) fall under the category which can be indicated as "CAN class A".
Even if there are a number of differences between the various types of lines, such as operating speed and bus strategy, their operating principles are very similar.

**No recovery for Class A:** one characteristic of a Class A line is that there is no recovery strategy available. Due to the fact that the line is made of a single wire, a short circuit or open circuit results in an immediate dropping out of the line.

**CAUTION**

**Always be extremely cautious not to generate short circuits while performing measurements or repairs on a Class A communication line. Since these lines are idling high (12v), a short circuit to ground in the line could cause fatal damage to the ECU's connected to it!**

If the NBC receives further verify requests, it must reread the transponder in the antenna before responding to the NCM only if signs of possible manipulation are visible (see below).
If the transponder recognition result is negative (transponder incorrect, no transponder readable, etc.), the NBC will send the code (incorrect transponder or no transponder) to the engine ECU and the “vehicle protection system failure” warning light on the instrument panel will come on.
If FIAT CODE is virgin and the NCM sends a fix code request, FIAT CODE, after recognising a transponder, responds by refusing authorisation to start.

**C-CAN or W-line operating procedures**

Communication between the NBC and the NCM occurs on the C-CAN line by default. If there is a C-CAN network failure, the recovery strategy is as follows:

- The NCM goes into recovery on the W serial line, requesting the code from the NBC; if the result is positive, starting is enabled.

- If there are problems on the W-line as well, after some retransmission attempts, the NCM goes into recovery by means of the diagnostic tester.

The recovery strategy is mainly controlled by the NCM which acts as master in the communication. The NBC, acting as slave, must always be ready to respond to the code requests coming from both the C-CAN network and the W serial line.

**Communication on C-CAN network**

Communication between the Body Computer and the NCM occurs by means of the following two CAN messages:

- IMMO CODE REQUEST
- IMMO CODE RESPONSE
- The IMMO CODE REQUEST is sent by the NCM and received by the NBC.
- The IMMO CODE RESPONSE is sent by the NBC and received by the NCM.

## AUTOMATIC HEADLIGHT ADJUSTMENT CORRECTOR

**Version with CAF**
The NBC repeats the vehicle speed signal for the CAF, which controls it together with the data coming from the front and rear axle sensors and the low-beam activation signal from the CPL.

**Version with NFA**
The NBC transmits the direction indicator and reverse gear status on C-CAN, while the speedometer signal is taken directly from the C-CAN line.
The NFA returns the command for control of NFA failure signalling to the NBC via C-CAN, the NBC transfers the command to B-CAN for the NQS through the gateway functions.

In relation to the NFAM or CFD inputs, it directly controls the motor for adjustment of the front LH headlight and indirectly the front RH headlight, thanks to the NFAS ECU controlled by the CPS or the NFAM ECU via a serial line.
Headlight adjustment is enabled only when the low beams are on.
In the event of a failure, the CPS positions the headlights in such a way as to prevent blinding vehicles coming from the opposite direction.
The NQS will display the fault only if the NFAFailSts signal assumes the value Critical Error (for more information relating to the display, refer to the finalised NQS specifications).
In the event of a system failure, a message will be shown on the display with the specific ISO symbol blinking for 10 sec.
At the end of the time indicated, both the message and the symbol will disappear from the display. They will reappear (if the fault persists) at the next KEY ON with the same display cycle. For more details refer to the finalised headlight specifications.

**FOG LIGHT RELAY CONTROL WITH WARNING LIGHT**

The fog lights are turned on by pressing the fog light button only if the position lights are already on.

| **Comando fendinebbia (*FrontFogLight SwitchIn*)** | **Comando luci di Posizione (*PosLightCmd*)** | **LUCI FENDINEBBIA (*FrontFogLightOut*)** |
|---|---|---|
| Non attivo | ~ | Spente |
| Attivo | 0 | Spente |
| Attivo | 1 | Accese |

The position lights enable command must therefore be present to turn on the fog lights. The fog lights are turned off if the same button used to turn them on is pressed again or if the enable command is no longer active (the position lights are off).
If the fog lights were turned off because there was no enable command (*PosLightCmd* = '0'), turning the position lights on again (enable restore) will also turn the fog lights on again.

**Key-OFF conditions:** When the fog lights are on (KEY ON) switching to KEY OFF will turn them off. At the next KEY ON the fog lights will turn on again.

**LOW-BEAM RELAY CONTROL**

**Operating logic (KEY ON)**
The NBC drives low-beam activation (relay activation) when receiving the low-beam command from the external light control.
If at KEY ON the command from the steering column switch is already active, the low beams must immediately be turned on.
When the command is no longer active or at KEY OFF the lights must be turned off.

**Follow me home (KEY OFF)**
The low beams can be turned on also at KEY OFF (only within a certain time) by the follow-me-home function.

**Follow me car (KEY OFF)**
The low beams can be turned on also at KEY OFF by the follow-me-car function without any display on the NQS.

No check is performed on the low beams.

**Diagnosis of function**

The diagnosis on all the light outputs will be activated by the Body Computer only if the command signal is present.

| *Driver* | *Attuazione* | *Potenza MAX NBC* | Potenza Lampada | Sintomi diagnosticabili |
|---|---|---|---|---|
| Driver HS di potenza (AV05- - LN18-AZ50) | Luci di direzione ramo sx | 47 W 50% | 21 W A (Incandescenza) + 12 W P (Led) + 5 W L (Incandescenza) | CC-Vbatt o CA o Mancanza di una lampada da 21w 12 W / CC-GND |
| Driver HS di potenza (AZ31-LN06-AZ51) | Luci di direzione ramo dx | 47 W 50% | 21 W A (Incandescenza) + 12 W P (Led) + 5 W L (Incandescenza) | CC-Vbatt o CA o Mancanza di una lampada da 21w e 12 W / CC-GND |

Failure of one of the lights of the branch is signalled by increasing the nominal blinking frequency of the warning lights on the NQS and acoustic feedback (buzzer) of at least 90% and at maximum 110%.
The blinking frequency of the external lights remains unchanged.
It is understood that the fault condition to be displayed is distinct by branch; the blinking frequency is doubled only if the branch activated has a fault.

**Disabling with dedicated button**

When the EXCLUS message is received on A-BUS, the NBC considers the motion sensors disabled for the next alarm activation/deactivation cycle.
This means that when the message is received, the modules are disabled and the diagnosis and activation actions will therefore not be executed when the alarm system is activated (VPSAlarmStartArming).
The “sensors disabled” condition remains until the next alarm deactivation command (VPSAlarmDisarm): from this moment on the sensors are once again active.
If other EXCLUS commands are received, disabling in any case remains active until the next deactivation of the alarm.

**Surveillance**

During surveillance when the alarm system is active, the motion sensors protect the passenger compartment checking if there are any moving bodies.
If an intrusion attempt is detected, the motion sensor module sends the ALRUS command to the NBC.
When the command is received from the A-BUS line, the information VPSAlarmUSDetected is sent to the alarm system for signalling of the attempted theft.

***Luggage compartment opening***

During surveillance, unlocking and opening of the luggage compartment may be requested. The F087 sends the VPSAlarmInputInhibit request to activate temporary disarming of the sensor using the DUS command.
The motion sensor module is reactivated with the IUS command when the VPSAlarmInputEnable information is received and the system returns to the normal surveillance state.
The operations are not executed if the sensor is not functioning.
The module is of course also reactivated after a new subsequent closing of the luggage compartment (VPSAlarmStartArming).

***Motion sensor module disable for low battery voltage.***

If the battery voltage remains below 8.5V ± 5% for more than 30 minutes, the motion sensor module is deactivated to safeguard the battery life and the possibility of subsequent engine starting.

From the alarm state the system goes into the following states:

1. rest: with a disarming command or at KEY ON when the immobilizer or the Passive Entry system recognises an enabled key.
2. surveillance: when the alarm cycles triggered have been run.

**Disarming**

The alarm system can be disarmed when it is in the surveillance or the alarm state.
It is disarmed by means of the remote control, which sends a command to the NBC to disarm the alarm system the moment the doors are unlocked.
When the information is received the alarm system modules are disarmed and the optical/acoustic signalling relative to the disarming phase is activated.
This information must be sent within 100ms from receipt of the disarming command: the command is accepted also when the +15 signal is present.
Upon disarming, the NBC interrupts the perimeter alarm and, where applicable, all the countermeasures in progress.
The alarm system can also be disarmed passively by:
- Inserting an enabled key in the ignition switch and turning it to position +15.
When the alarm system detects the +15 signal, it checks for the presence of an enabled key and, if the response is affirmative, disarms the alarm.

- The presence of a valid CID in the passenger compartment the moment the +15 signal is given.
If the user gets into the vehicle when the alarm system is active, the moment the +15 signal is given, the system checks for the presence of a valid CID in the passenger compartment and, if the response is affirmative, disarms the alarm system.
This operation is, for example, necessary when the CID has discharged and the driver-side door is opened by means of the mechanical key pawl thus activating the alarm system. Positioning the CID in Garage position, the alarm can be deactivated.
After disarming and at first KEY ON, the ECU signals any motion, anti-lifting, perimeter, +15 and +30 alarms that have occurred, sending the intrusion and theft attempt messages to the instrument panel.

# ABS, Stability and Traction Control Systems (NFR)

## Bosch

However, the lateral forces do not act in the same way on all four wheels, since they are not in the same load conditions: actually, the wheels have different loads, depending on the current situation. These situations are:

- Acceleration (reduced load on the front and increased load on the rear axle)
- Braking (increased load on the front and reduced load on the rear axle)
- Right/left cornering (increased load on the outside and reduced load on the inside wheels)
- Cornering in acceleration/deceleration (combination of the above mentioned cases).

It is evident that if the lateral forces acting on the individual wheels vary, there will also be a variation in the resulting forces acting on the vehicle axles. This ensures that the prevailing lateral forces acting on the front axle with respect to the rear and vice versa cause a rotation (moment) on the vertical axis of the vehicle (yaw axis).
The yaw moment affects the vehicle behaviour creating understeering or oversteering.

As we may understand from the above, the control unit is capable of:

- Detecting the driver's actions by means of: the position of the steering wheel, to check by how many degrees (wide or narrow radius bends) and how fast (sudden or smooth rotation) the steering wheel is being turned; the position of the throttle and the brake pressure, to check whether the driver is accelerating or braking, in other words, how the driver negotiates the bend or deviates from the rectilinear trajectory.
- Detecting the actual behaviour of the vehicle given by the environmental variables (e.g. slippery road) and the vehicle’s reaction to incorrect manoeuvres by the driver etc., in order to identify the yaw moment and lateral slipping of the axles by means of the sensors on the four wheels and the yaw/lateral and longitudinal acceleration sensor.

These two operations are necessary to compare the mathematical model mapped in the control unit with the actual behaviour of the vehicle, in order to identify the vehicle status (understeering or oversteering) and decide what action to take on the brakes and the engine.

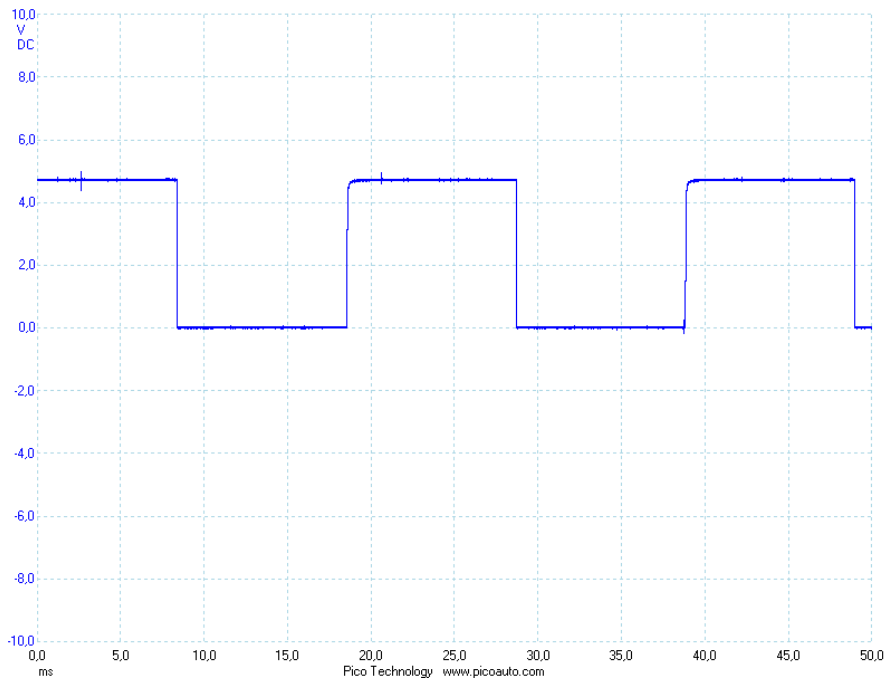
If during this time period the ECU detects a vehicle movement, it will apply a greater traction force on the EPB engagement cables. Following a wake-up signal. The brake Node acquires the signal from the wheel RPM sensors for 6 seconds.

NOTE: Activation of the brake switch will not cause any wake-up in the network.

**VSO** (Vehicle Speed Odometer) is the “raw” speed value sent to the NBC to be then sorted in the control units which need this signal but do not communicate on the CAN network (CSG and CAF).

The VSO signal is a frequency-modulated square wave with a 50% duty cycle.
The NFR supplies 14 pulses every actual wheel revolution. The actual wheel circumference value is periodically transmitted by the NBC. The signal may be measured with the rear wheels moving.

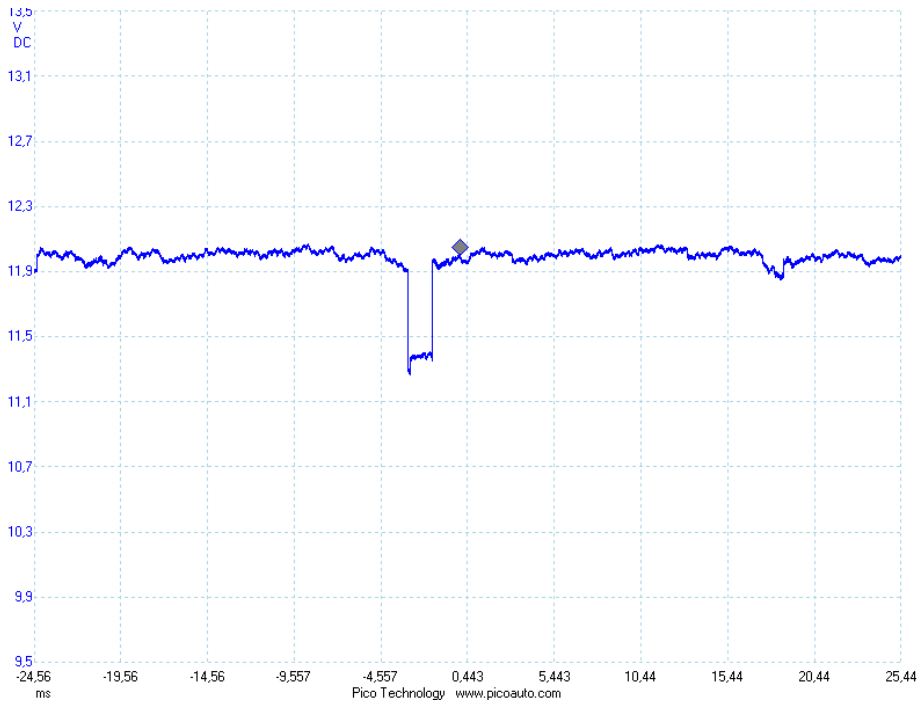
Picoscope settings: Time scale: 5ms/div. Voltage scale: ± 20V



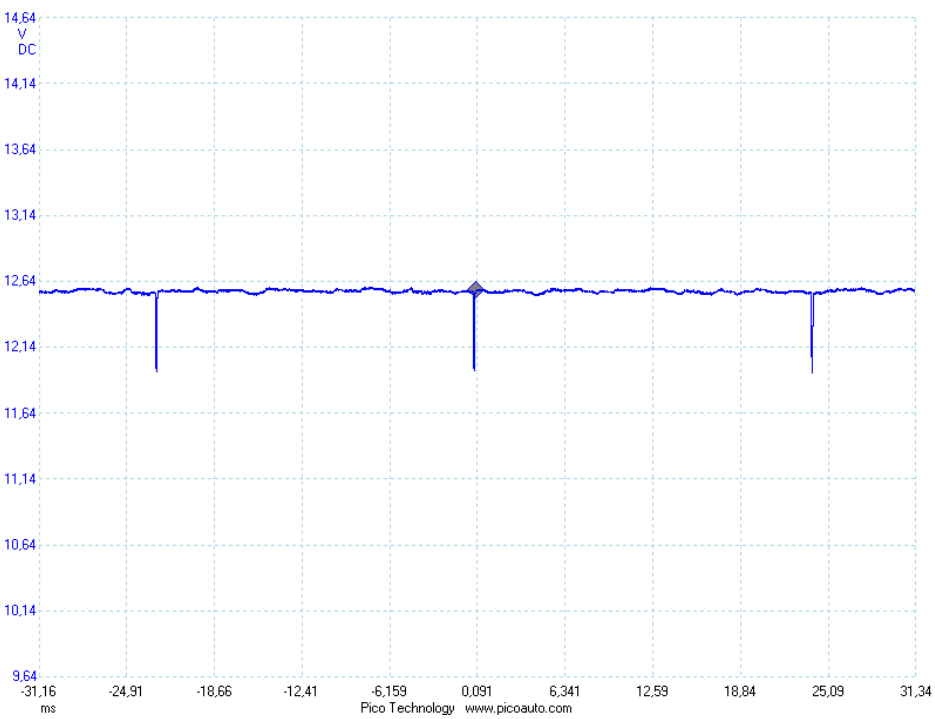

**SPEED SIGNAL:**This signal does not have a dedicated line (contrary to the VSO signal), but is sent by the Brake Node directly to all the nodes that need this information on the C-CAN network. The speed signal emitted by the NFR is a reprocessed and not a raw signal, calculated based on the information stored in the proxy file (wheel type and diameter) in the NBC and sent to the NFR.
For the nodes in the B-CAN network, the speed signal information reaches the Body Computer Node to be subsequently sent to the B-CAN network by the NBC.

Signal from NFR to wheel sensor: Vbatt nominal voltage with square wave voltage drop of 0.5-0.6 Volt.

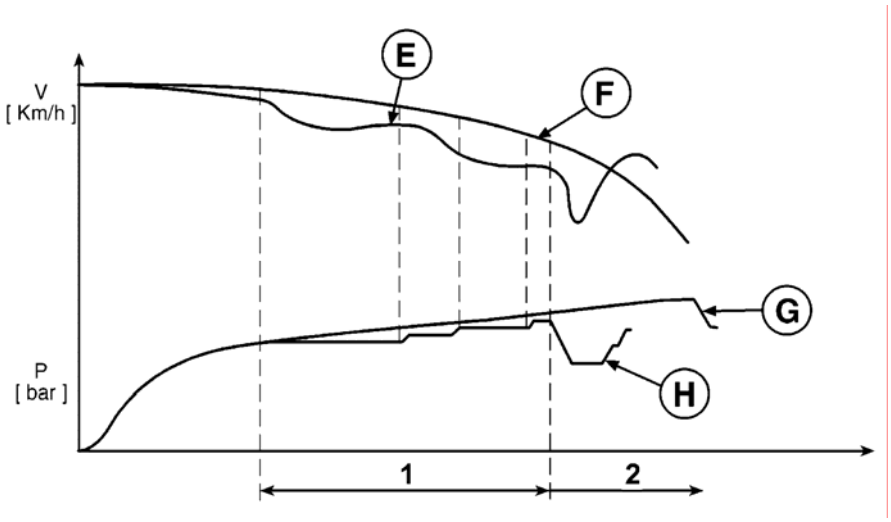
Picoscope settings: Time scale 2ms/div  Voltage scale ± 20V




Signal from wheel revolution sensor: Vbatt nominal voltage with square wave voltage drop of 0.5-0.6 Volt. The frequency varies as the speed increases.



**EBD OPERATION**




1: EBD control
2: ABS control
E: rear wheel speed
F: front wheel speed
G: front wheel pressure
H: rear wheel pressure

INTEGRATION WITH THE ABS SYSTEM: As already mentioned, the ABS system's EBD is capable of adapting itself to the ideal pressure curve, always using the grip available in all braking conditions. The integration of the EBD function in the normal operating logic of the ABS system allows the two strategies to be applied simultaneously. Therefore, the system normally operates so as to maintain “slipping” of the rear tyres within values very close to the ideal ones, however, allowing the ABS strategy to actiuvate whenever a wheel tends to lock.

EBD CONTROL The graph shown above illustrates this type of strategy. While the front wheels are decelerating and their speed variation remains within the set limits (the ABS system is in the pressure increase phase for the front wheels and therefore inactive), the braking pressure on the rear calipers is modulated upward by the rear ABS branch, the purpose of which is to implement the EBD function. Also note that in phase 1 the pressure on the rear calipers is always below that of the front calipers, as indicated by the ideal distribution curve.

ABS CONTROL: As the rear wheels tend to decelerate excessively with respect to the reference conditions, the system operates as ABS also for the rear wheels, following the pressure increase, pressure reduction and pressure maintenance phases (phase 2 in the graph).

## Location in the vehicle

The EPB unit is for both Quattroporte and GranTurismo models located in the trunk compartment. It can be accessed by removing the trunk floor lid. On Alfa 8C vehicles the EPB is located in the area underneath the storage space behind the front seats, on the left hand side.

**Quattroporte**

**GranTurismo**

**Alfa 8C**

## Node electrical characteristics

- Operating voltage range for full functionality: 9-16v
- Operating voltage range for degraded functionality: 8-9v
- Nominal operating voltage (regulated at node input): 14v

Note: no motor activation is possible under 9v or above 16v.

- Current consumption in sleep mode: < 350 µA
- Current consumption in stand by mode : < 350 mA

## Data communication

The EPB node or NPB is connected to the C-CAN line which it uses for data transfer with other vehicle systems and for communication with the diagnostic tester.

## Diagnostics / recovery strategies

**EPB system failure**
The EPB failure information is sent to the instrument cluster via a CAN signal. In these conditions, the EPB failure warning light comes on (for all markets except the USA where the BRAKE warning light is used) and at the same time a “Parking brake failure” message is shown on the display. This specific message is accompanied by an acoustic warning.
A failure of the ABS/MSP system, can lead to the EPB operation being disabled,

**EPB failure light**


**EPB failure light (US specifications)**

**Vehicle speed signal failure recovery**
In case the NPB does not receive any vehicle speed information (as a result of an internal failure of the ABS/MSP system), the automatic operating of the parking brake will be disabled. The parking brake will remain in its current position. In such a case the parking brake can be manually engaged /disengaged by pulling the EPB lever at the condition that the transmission is in neutral.

**Note:** in particular conditions where the battery voltage is low, the electric parking brake system may temporarily be deactivated (degraded functionality). Therefore, typically upon starting the engine, when the battery voltage is reduced, the message PARK OFF may be temporarily displayed, indicating that automatic operation is momentarily disabled.

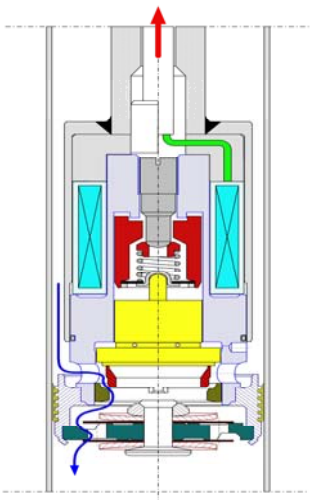
**Note:** in the event of a complete loss of CAN communication with the NPB, the NPB will loose functionality and the parking brake will stay in its current position.

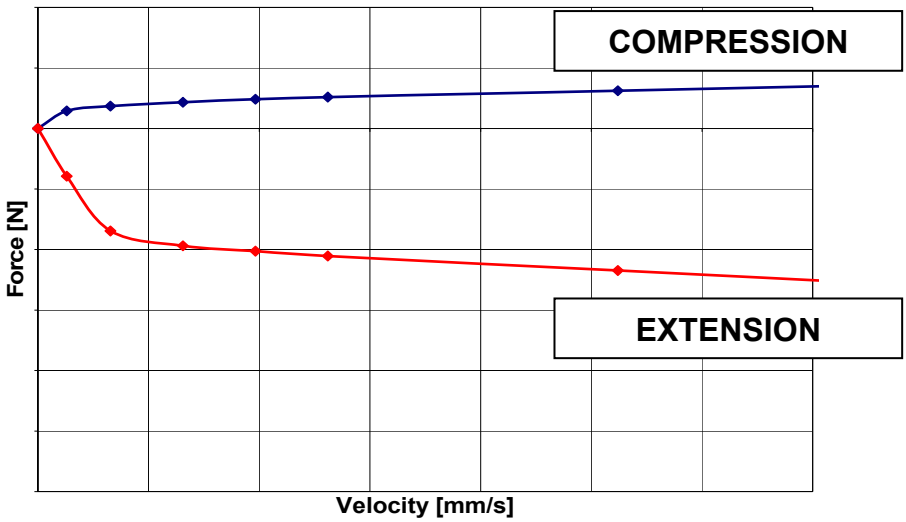
**As a result of the Master-Slave strategy between NFR and NPB, an error inside the NFR can impede normal operation of the NPB. Always check the NFR for stored error codes in case of a non-correct operation of the EPB, even in case the NPB itself has no stored errors.**

## COMPONENT DESCRIPTION

### SHOCK ABSORBERS

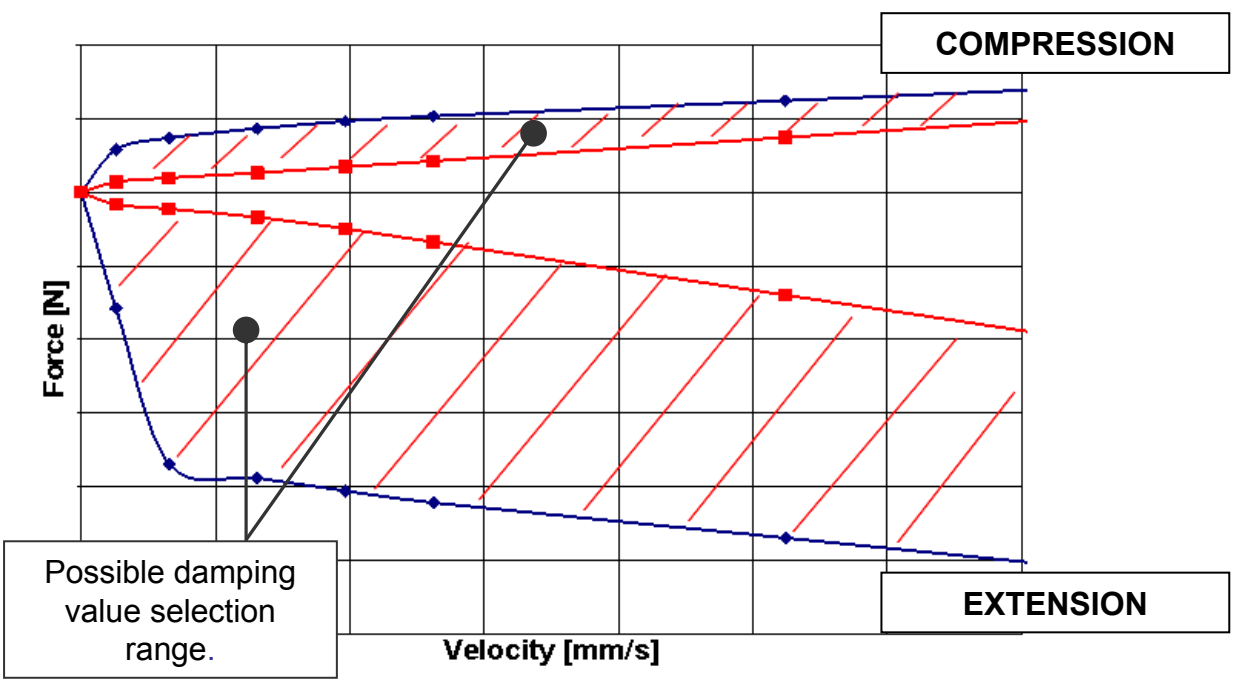
In “conventional” shock absorbers, the force/speed ratio is defined by finding the best compromise at every shock absorber stem speed, to ensure damping of the wheel and body movement and at the same time letting the wheel follow the road profile.






Two extreme force/speed ratios are defined in the dynamic control system:

1 0A current, which corresponds to a system fail state
2 1.8A current, which corresponds to the minimum obtainable damping



## Location in the vehicle

The CSG ECU is for all vehicles fitted underneath the dashboard at driver's side (both for LHD and for RHD vehicles), close to the A-pillar.

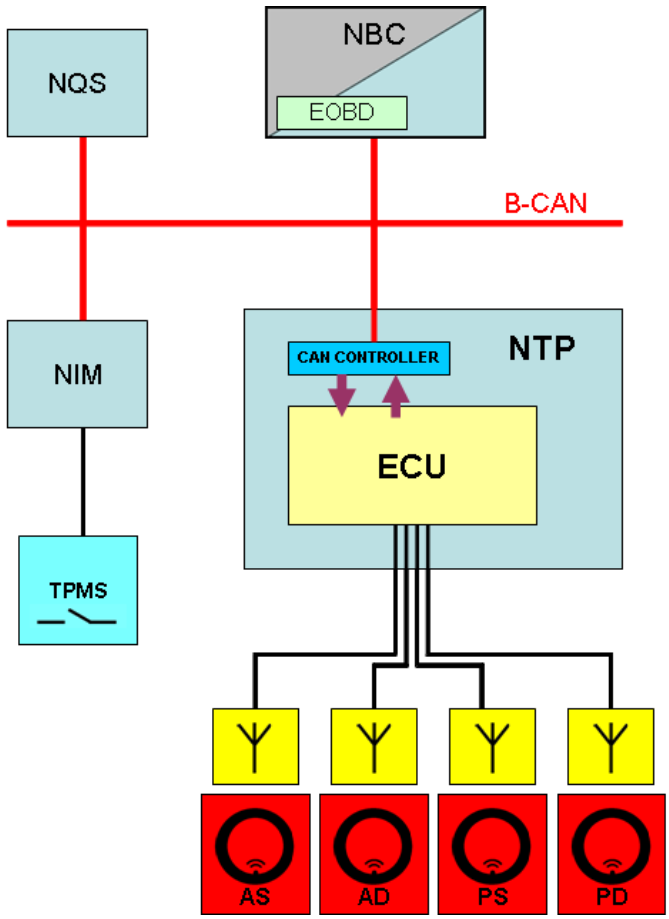
**The CSG unit is located close to the A-pillar, behind the driver's foot rest (for LHD vehicles).**

**The power steering solenoid valve is fitted on the steering rack.**

## Data communication

The CSG is not connected to a CAN network. It receives necessary information via hardwire connections. CSG uses the K-line for diagnostics.

**Functional diagram**




**Description**

The NTP receives a +30 battery voltage for power supply, and is informed about the Key On status by a B-CAN message from the NBC.

The NTP acquires information regarding the air pressure and the temperature of each of the four tyres from the four wheel antennas, located in the wheel arch area of each wheel. The antennas read this information from the wheel electronic unit by radio frequency (RF) waves.

Each wheel electronic unit, integrated in the wheel valves, has its own ID code which is sent together with the temperature and pressure information. This means that each tyre is monitored separately. The NTP receives the following further information over the B-CAN line:

- Engine speed (from NBC)
- Vehicle speed (from NBC)
- External temperature (from NPG)

The NTP uses a specific algorithm to calculate the standard pressure based on the measured pressure, the wheel temperature , the external temperature and the driving speed.

## External lights


1. Side markers
2. Direction indicator
3. Position light
4. Bi-xenon headlight: low-beam + high-beam
5. Additional high-beam (*Flash to Pass* )
6. Front headlight cleaning system
7. Fog light

A number of head light functions are not managed by the NFA but by other vehicle systems, for example:

**Lights managed by the twilight sensor (AUTO mode)**

the external lights are activated automatically by the twilight sensor. From the NIT user menu, you can set the twilight sensor's sensing range (3 levels).

**Follow me home**

This control enables the position lights and low beams to switch on automatically for a timed period, immediately after the vehicle is turned off (Key-OFF).

Activation: After turning the key to OFF, you must operate the control for flashing the headlights, found on the steering column stalk. The instrument panel activates the 'follow-me-home' signal and displays the time (in seconds) during which the lights will remain on. (Signal active for 20 sec.)

Activation time increase: When this function is active, every time you flash the headlights, the time the lights remain on is extended for a further 30 seconds (max. 210 sec.)

Deactivation: keep the control for flashing the headlights active for over 2 seconds. Then turn the ignition key from OFF to ON.