CITROËN

TECHNICAL TRAINING

CONSULTANT TECHNICIAN

MODULE B7

- Hydractive I XM
- Hydractive II XM Xantia

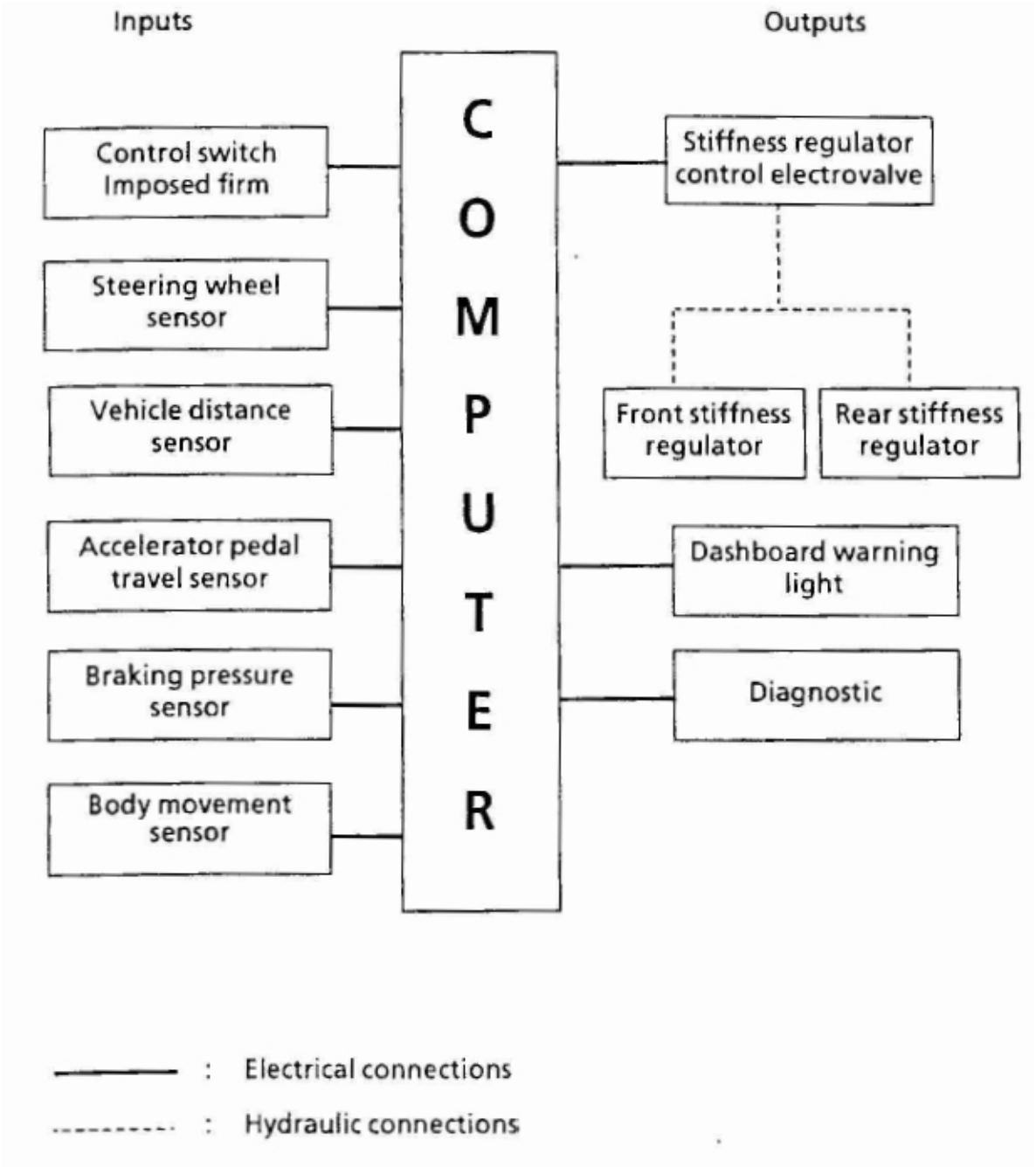
DOCUMENT REF **N°: 6.2.304** June 2001

DEALER QUALITY
DEVELOPMENT DIVISION

HYDRACTIVE I SUSPENSION

PRESENTATION OF THE ASSEMBLY

I - SUMMARY DIAGRAM

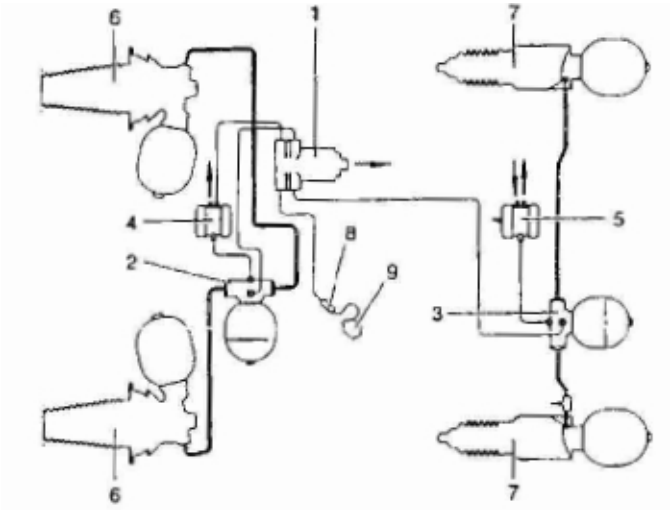


II - INSTALLATION

ELEMENT	LOCATION
Computer	Ventilated housing on the front right wheel arch under the bonnet
Control switch	Central console to the left of the gear lever
Steering wheel sensor	On the steering column behind the steering wheel
Vehicle speed sensor	Probe : on the speedometer cable or on the gearbox Interface : ->PR 5281 under the glove box PR 5282 -> : under the heating unit
Accelerator pedal travel sensor	On the pedal arm
Braking pressure sensor	On the front left of the engine sub-frame
Body movement sensor	On the right of the front sub-frame
Electrovalve	On the left of the front sub-frame
Inlet filter	On the left of the front sub-frame
Front stiffness regulator	On the left of the front sub-frame
Rear stiffness regulator	Rear axle pipe
Dashboard warning light	Left hand dial, top part on the left
Timer -> PR 4860	Ventilated housing
Auto-diagnostic connector (2 channel, blue)	Front right wheel arch, in the ventilated housing

OPERATION OF THE HYDRAULIC PART

I - PRESENTATION



Parts list

1 - Electrovalve

2 - Front stiffness regulator

3 -Rear stiffness regulator

4 - Front height corrector

5 - Rear height corrector

6 - Front suspension elements

7 - Rear suspension elements

8 - Filter

9 - Priority valve

The system differs from traditional suspension by the addition of two stiffness regulators 2 and 3 (one per axle) and an electrovalve 1.

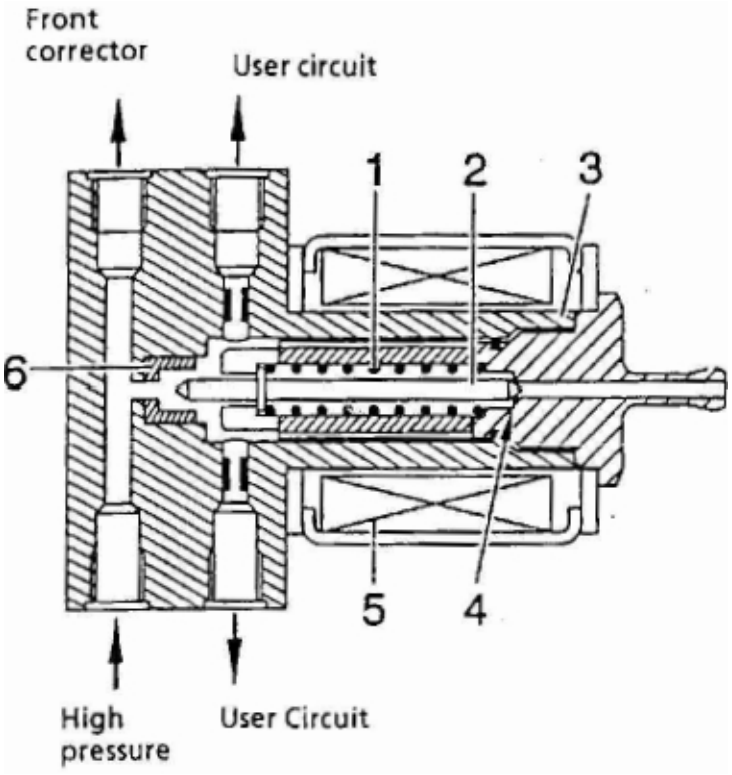
Note that the connections between the suspension elements and the regulators are of large diameter (8 x 10) in order to reduce load losses and therefore the response time. Sealing is provided by ISO tapered connections without gaskets. Tightening torque is 3 to 3.5 mdaN.

II - THE ELECTROVALVE

A - ROLE

This allows the stiffness regulators to be controlled hydraulically depending on the electrical information it receives from the computer.

B - CONSTITUTION



Parts list

1 - Spring

2 - Needle

3 - Core

4 - Seat

5 - Coil

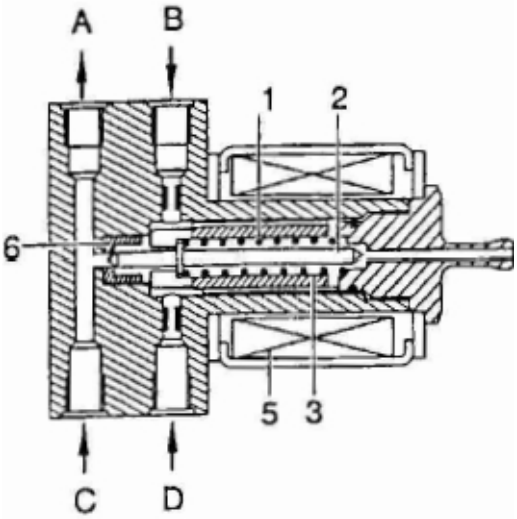
6 - Seat

NOTE: Since n° PR 4700, the nozzles have been incorporated into the electrovalve.

Identification: letter F or by the week and year of manufacture.
E.g.: 37/89 →

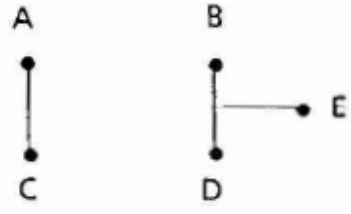
C - OPERATION

1 - Static position



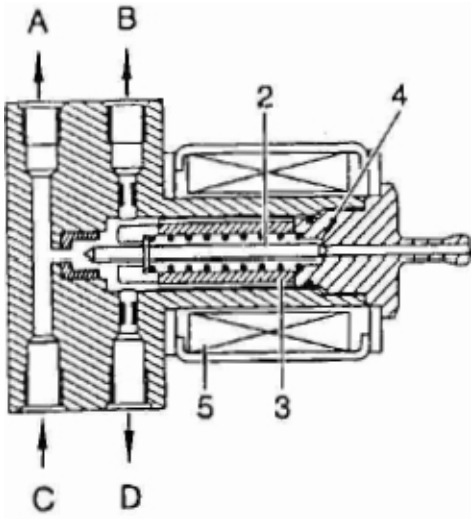
As the coil (5) is not energised, the spring 1) pushes the needle (2) onto the seat (6).

The following are therefore connected:



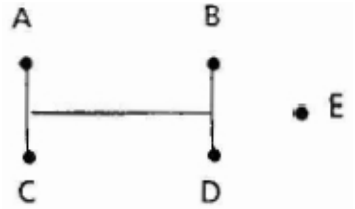
The user circuit outlets B and D are therefore connected to the reservoir E.

2 - Activated position



As the coil (5) is energised, it creates a magnetic force in the core (3). This causes the needle (2) to translate which pushes up against the seat (4).

Therefore, we have:



The user circuit outlets B and D are at the supply pressure C.

Conclusion

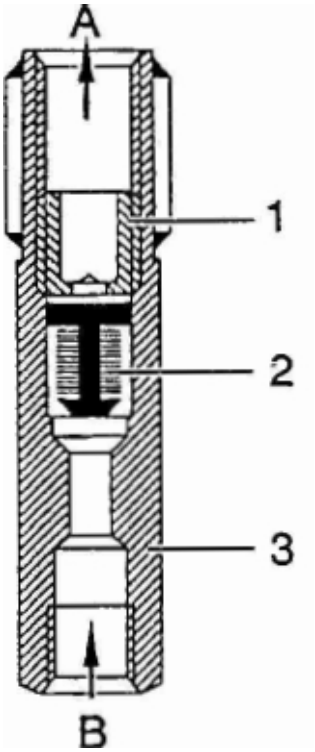
Electrovalve	User circuit pressure
not activated	reservoir
activated	HP supply

D - CHARACTERISTICS

Nominal voltage: 13.5V
Resistance : 3.3 Ω

E - SUPPLY FILTER

The electrovalve is protected from impurities by a filter fitted into the High Pressure supply and positioned next to the safety valve on the front left sub-frame,



Parts list

1 - Plug

2 - Filter

3 - Body

Hydraulic connections

A- Electrovalve

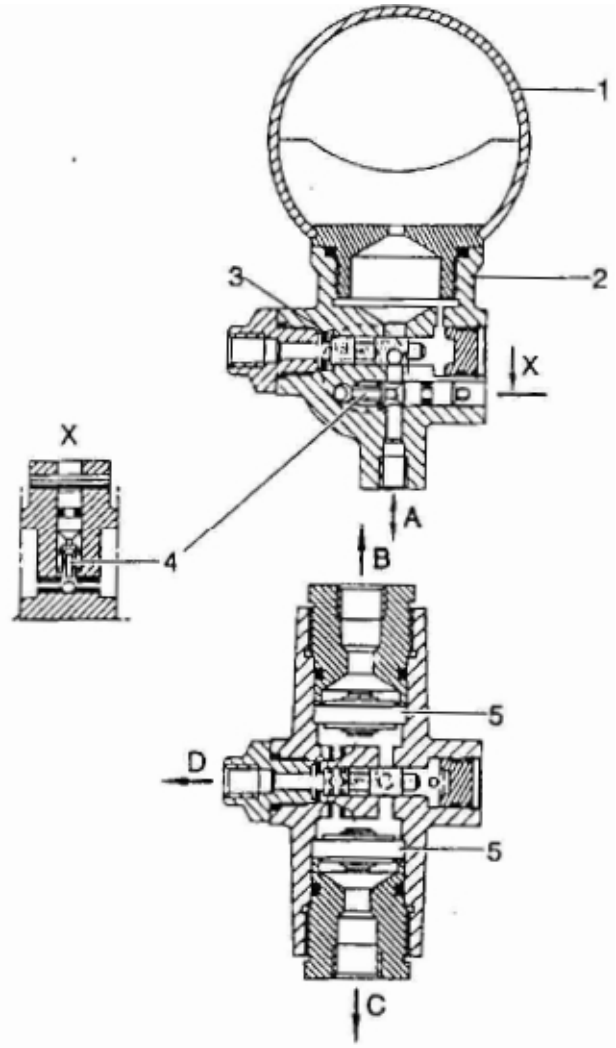
B - Safety valve

III - THE STIFFNESS REGULATOR

A - ROLE

Two stiffness regulators are fitted (one front and one rear) which modify the physical state of the suspension as a function of the status of the electrovalve.

B - CONSTITUTION



Parts List

1 -Additional sphere

2 - Body

3 - Slide valve

4 - Valve

5 - Shock absorbers

Hydraulic connections

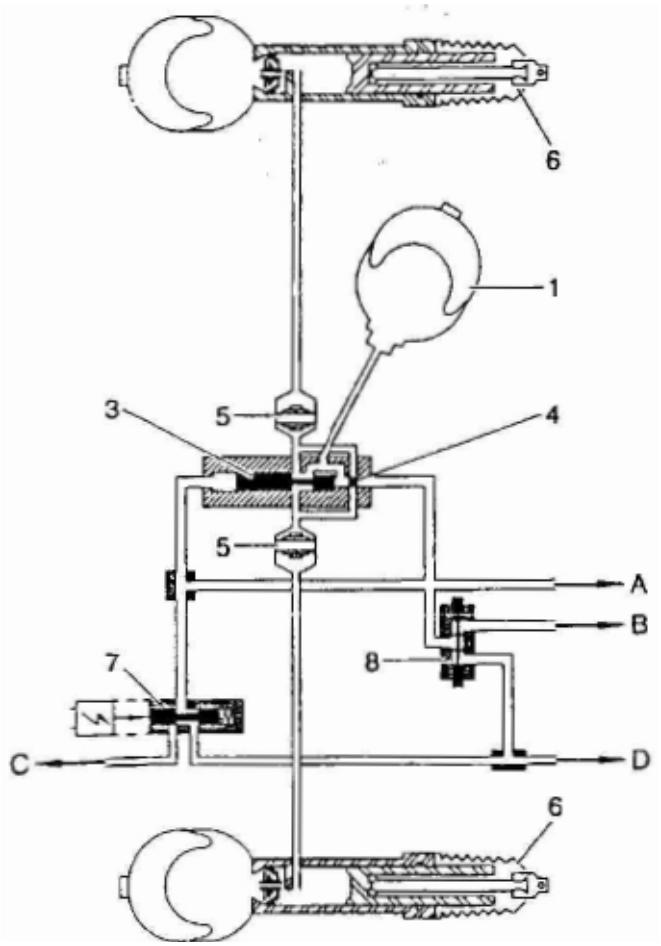
A- Height corrector

B - C - Suspension elements

D - Electrovalve

C - OPERATING PRINCIPLE

1 - "Soft" state



Parts list

1 - Additional sphere

3 - Slide valve

4 - Valve

5 - Shock Absorbers

6 - Suspension elements

7 - Electrovalve

8 - Height corrector

Hydraulic connections

A- 2nd stiffness regulator

B - C – Reservoir

D- High Pressure

Since the electrovalve is energised, the slide valve (3) is subjected to the high pressure HP on one side and to the suspension pressure Ps on the other.

Since HP > Ps, the slide valve is locked in the “Soft” position.

There is therefore a link between the two suspension elements and the additional sphere.

This gives:

- Large volume of gas (suspension spheres + additional sphere)
  -> soft suspension.

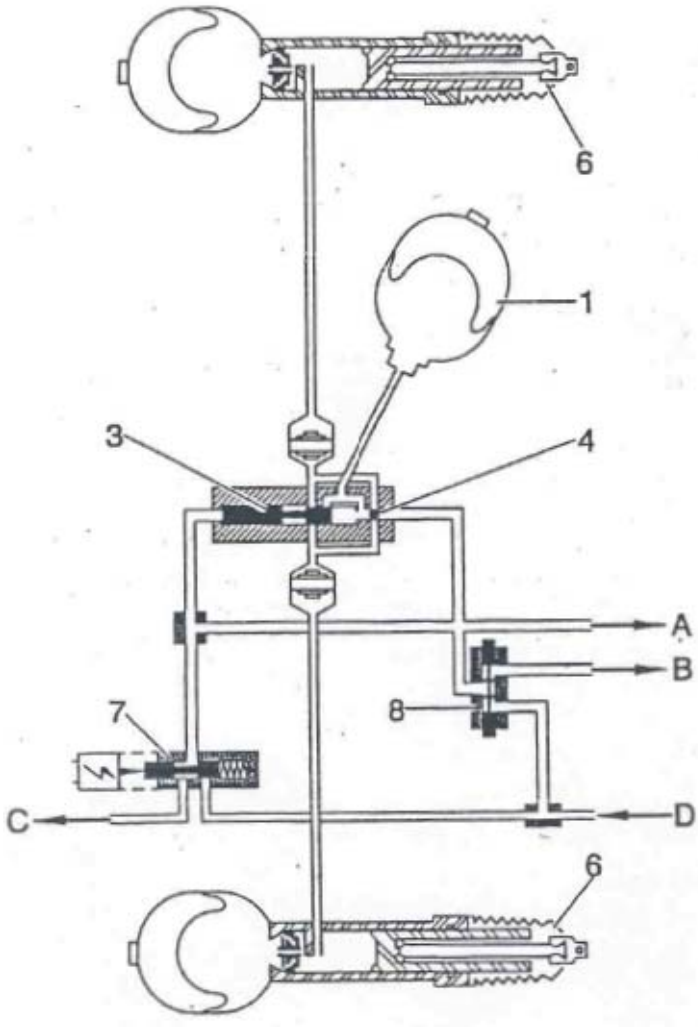
- Fluid passes through four shock absorbers (to reach the additional sphere, the fluid passes through the shock absorbers (5))
  soft damping

- Fluid passes from one suspension element to the other
  -> soft anti-roll

When the height correction is in the "Soft" position, the fluid passes directly through the shock absorbers (5) and supplies the cylinders (6)

Note: The operation of valve (4) will be discussed later

2 - "Firm" state



When the electrovalve is not energised, the slide valve (3) is subjected to the suspension pressure Ps on one side and to the reservoir pressure Pr on the other.
Since Ps > Pr, the slide valve is locked in the "Firm" position.

The additional sphere is therefore completely isolated and the main link between the two suspension elements is broken.

Therefore, we have:

- Small volume of gas (additional sphere isolated)
  -> Firm suspension.

- Fluid no longer passes through the shock absorbers (5) since the additional sphere is isolated
  -> Firm damping

- Fluid does not flow between the two suspension elements
  -> Firm anti-roll.

ELECTRONIC OPERATION

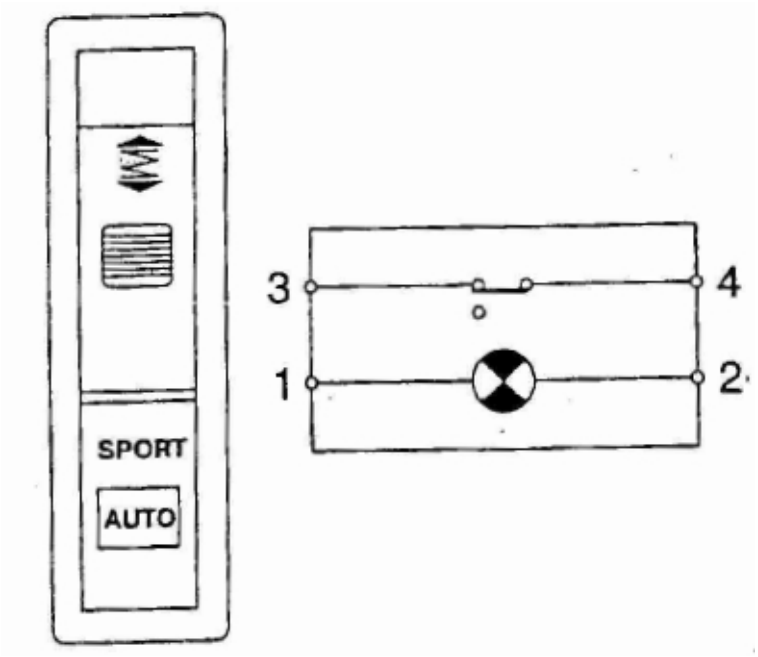
I • THE SENSORS

A - "IMPOSED FIRM" CONTROL SWITCH

1 - Role

Allows the driver to switch to the "sport" position, i.e. "Firm".

2 - Constitution - operation



Connections

1 - Negative earth

2 - Positive light

3 - Computer

4 - Computer

This consists of a switch which is closed in the "Auto" position, illuminated by a lamp supplied by the light positive.

It can be locked in the "sport" position. The "Auto" position is obtained by unlocking it. A spring returns the button to the "Auto" position.

A sliding window displays this position.

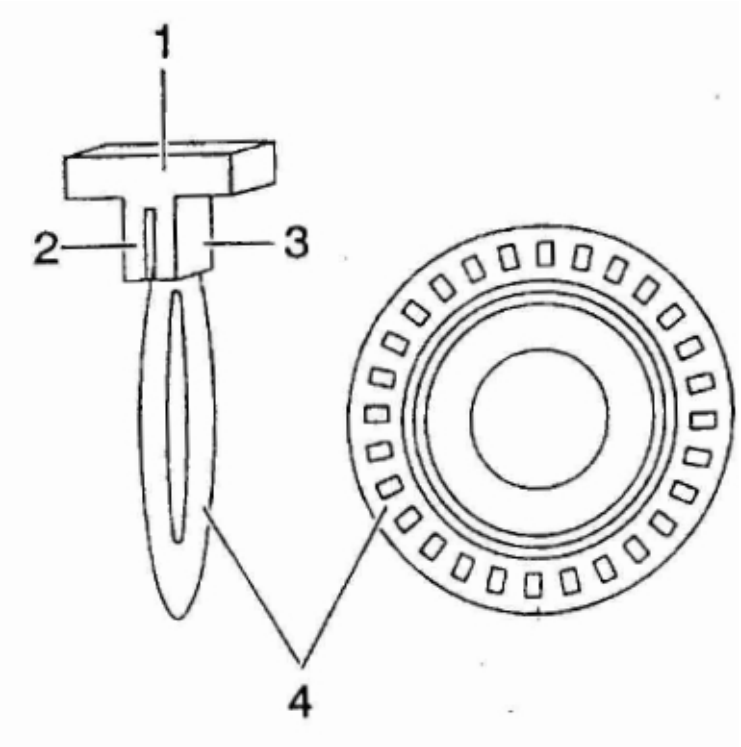
B - STEERING WHEEL SENSOR

1 - Role

This generates signals which enable the computer to define the angle and the speed of the steering wheel.

2 - Constitution

It is a double optoelectronic sensor. It consists of two light emitters, two receivers and a phonic wheel with windows. The sensor is fixed and the phonic wheel turns with the steering



Parts list

1 - Optoelectronic sensor

2 - Double emitting part

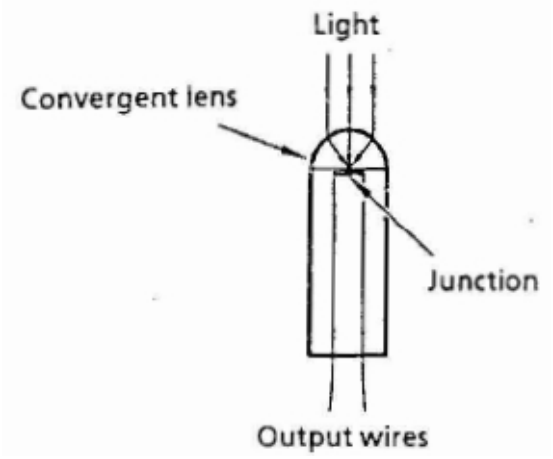
3 - Double receiving part

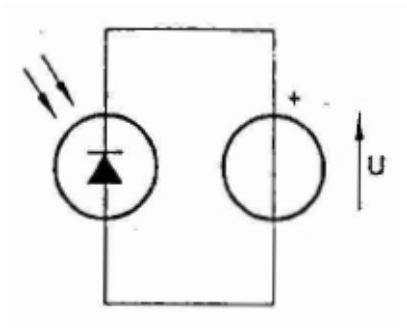
4 - Phonic wheel

3 - Operation

a) Reminder of a photodiode

A photodiode is made from a PN junction which can be illuminated externally. Its reverse conductivity is proportional to the illumination.

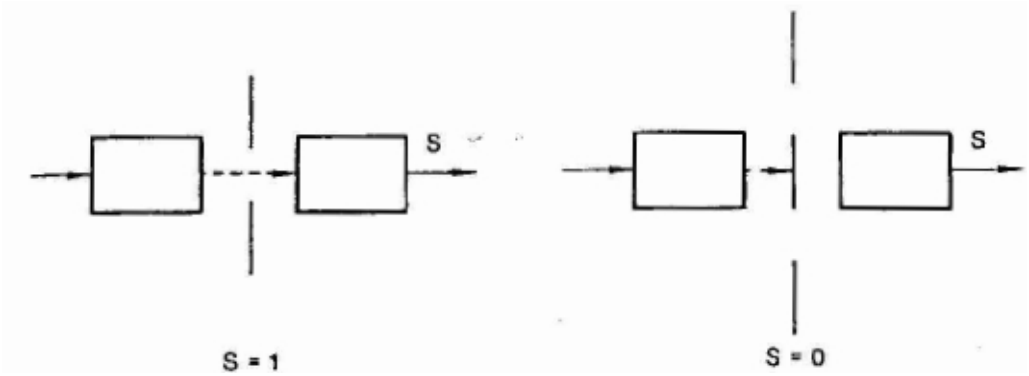




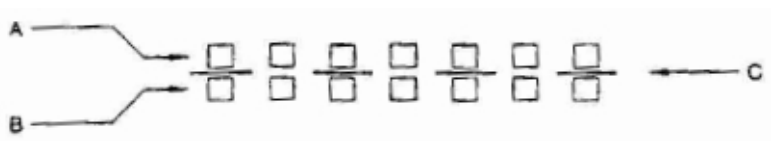
Therefore, by simplifying, it can be seen that the diode conducts when it is illuminated and does not conduct when there is no illumination.

b) Application of the optoelectronic sensor

If a photodiode is fitted opposite a light source and if a phonic wheel with windows is passed between these two items, the displacement of the phonic wheel can be turned into signals depending on whether there is a window or not.



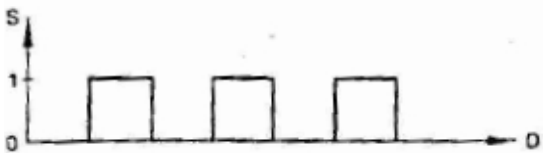
We therefore have:



A - Emitter

B – Receiver

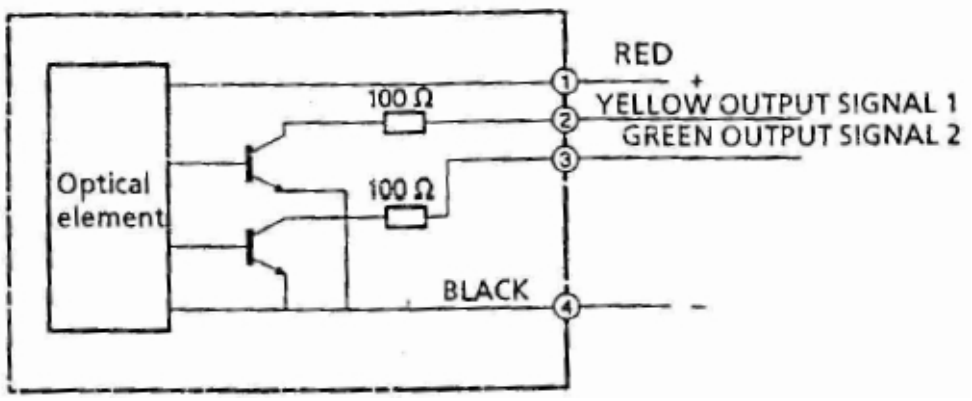
C - Phonic wheel



D - Displacement

S - Output

c) Electrical diagram



The signals received by the optical element are amplified and shaped so that they can be used by the computer.

The sensor is a double one so as to obtain better precision and to allow the computer to determine the direction of rotation of the phonic wheel.

4 - Note

The two sensors are offset by 114 step (phase quadrature) so that the direction of rotation can be determined and so as to give better precision.

C - SPEED SENSOR

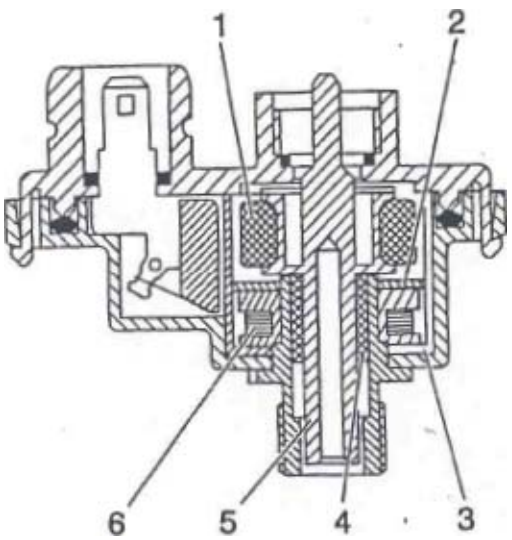
1 - Role

This allows the computer to define the speed of the vehicle.

2 - Constitution - Operation

It consists of a probe and an interface.

a) The probe



Parts list

1 – Ferrite

2 - 3 - Polar masses

4 - Bearing

5 – Drive

6 - Coil

The ferrite 1, driven by the speedometer cable, turns between the polar masses 2 and 3 and creates a sinusoidal electrical signal in the coil 6.

- Eight pulses per revolution, five pulses per metre.

b) The interface

For every period of the signal emitted by the probe, whatever its frequency and its voltage, it generates a pulse which informs the receivers (hydractive suspension, Fenix 3 B injection ...) that the vehicle has travelled twenty centimetres.

Its role is also to prevent interference between the receivers.

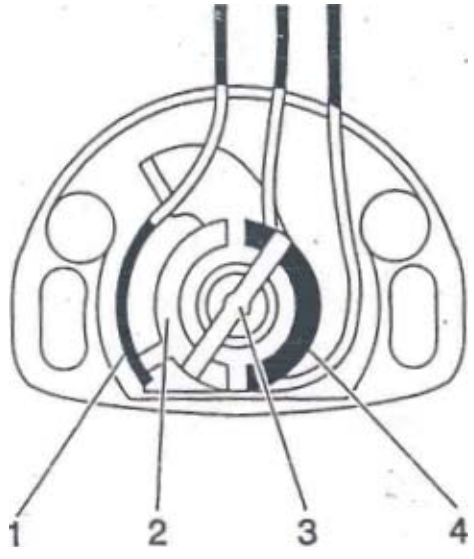
D - ACCELERATOR PEDAL TRAVEL SENSOR

1 - Role

Allows the computer to know the position of the accelerator pedal.

2 - Constitution - Operation

It involves a variable resistor, the cursor of which is controlled by the pedal.



Parts List
1- Protection resistor

2 - Receiving track

3 – Cursor

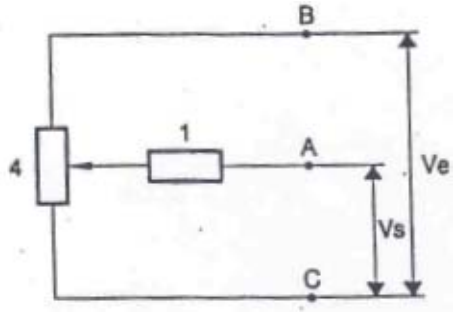
4 - Resistor

Outputs

A- Red

B - Yellow

C - Green



The output voltage Vs depends on the position of the cursor.

E - BRAKING PRESSURE SENSOR

1 - Role

Informs the computer of a braking pressure which is greater than the reference value.

2 - Constitution - Operation

This is a pressure switch which is closed at rest. P < 35

bar -> contact closed P > 35 bar -> contact open

F - BODY MOVEMENT SENSOR

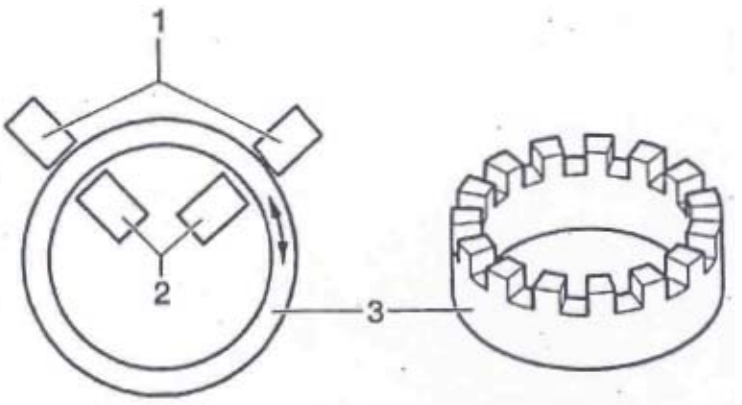
1 - Role

Allows the computer to define the height of the body and the

2 - Constitution

It consists of a double optoelectronic sensor of the same design as the steering wheel sensor.

The assembly is different, the phonic wheel is replaced by a phonic ring with 45 teeth.



Parts list

1 - Emitters

2 - Receivers

4- Phonic ring

3 - Operation

The operation is the same at that of the steering wheel sensor. The phonic ring is connected through a system of small connecting rods to the anti-roll bar. When the anti-roll bar rotates, it causes the ring to rotate and this rotation is detected by the optical element.

4 - Note

The two optical elements are offset by 1/4 step.

II - THE COMPUTER

A - ROLE

This integrates the data from the sensors and decides when to switch from one state to another (soft or firm). It performs an auto-diagnostic function and memorises the permanent and temporary faults.

B - CONSTITUTION

This is a sealed unit inside of which are fitted the various electronic components.

Connection to the outside is by means of two fifteen channel connectors.
Identification: -> PR 4860 White and green connectors
PR 4860 -> White and black connectors

Note: The order must be followed:

Removing	*Fitting*
Black 1st	*White 1st*
White 2nd	*Black 2nd*

C - OPERATION

1 - Speed

The distance sensor sends five pulses per metre travelled. The computer counts the number of pulses per 512 ms period. This relatively long time period allows torsion problems of the speedometer cable to be filtered and thus enables interference fluctuations to be smoothed.

2 - Imposed firm

When the button is in the "Sport" position. the computer ceases to_ activate the electrovalve when the vehicle speed is greater than 30 km/h (19 mph).

3 - Steering wheel

The computer measures the angle and the rotational speed of the steering wheel and compares them with the threshold values stored in the memory and which vary with the speed of the vehicle.

As soon as the values read are greater than the threshold values, it switches to the "Firm state (above 30 km/h).

a) Measuring the angle

The computer counts the code changes emitted by the sensor with respect to the straight line it has defined.

b) Determining the straight line position

The computer determines the straight line position when the steering wheel is calm, when the sensor does not detect a rotation of more than three steps in one second.

The calculation starts as soon as the vehicle reaches 30 km/h. The computer checks the position of the steering wheel every 1.5 seconds for as long as the vehicle has not travelled more than 3000 metres, with the steering wheel calm.

It determines the average position, in other words the straight line position, by taking the average of the movements of the steering wheel to the left and to the right.

This position is then updated every ten seconds for speeds greater than 30 km/h by performing a correction of 1/16 of a step as a function of the relative position of the steering wheel (to the right or to the left of the straight line position).

This correction is inhibited if the button is in the "Firm" position. Straight line processing is also prevented for large bends.

4 - Acceleration

The computer measures the variation in speed over one second. The switching threshold is fixed at 0.3 g (= : : : 3 m/s2), as soon as the vehicle speed is greater than 30 km/h.

Note: An acceleration of 0.3 g roughly corresponds to a variation of 10 km/h in one second.

5 - The accelerator pedal

The computer takes into account the sudden changes of the accelerator pedal to control switching to the "Firm" position.

To take into account the acceleration and the deceleration of the vehicle with a view to switching to the "Firm" position, the computer determines the development speed of the accelerator pedal.

To do this, it defines four characteristic points which divide the travel into five sectors. By measuring the time it takes to pass from one point to another when accelerating, or when decelerating, the computer switches to the "Firm" position or not.

The computer takes account of the vehicle speed, the threshold being 30 km/h. Below this value, the pedal speed threshold is more sensitive and the time delay is larger so as to prevent the nose of the vehicle diving or rising too much at low speeds (Engine acceleration and braking are greater for the lower gears).

6 - The brake

As soon as the braking pressure exceeds 35 bar and the vehicle speed is greater than 30 km/h, the computer switches to the "Firm" position to prevent variations in the longitudinal level due to weight transfer.

Note: Switching to "Firm" only takes 1 second, even if the pressure is greater than 35 bar.

7 - Body movement

The computer takes into account the amplitude of the movement and the development speed so as to prevent the vehicle bottoming out or becoming unstable when the vehicle goes over a speed bump, for example. Switching to "Firm" only occurs for vehicle speeds greater than 30 km/h.

D - ELECTROVALVE SUPPLY

Activation is split into two parts:

- Power up
- Holding

1 - Power up

The computer supplies the electrovalve for 128 ms with the maximum voltage.

2- Holding

To prevent overheating, the current is limited to 1.4 A by pulsing the supply voltage.

III- VEHICLE ANTI -JOLT

A- VEHICLE LEVELLING

We have seen that when the supply to the computer is cut, the suspension is in the "Firm" position (U electrovalve = 0). Therefore the additional sphere is isolated.

if the pressure in the main spheres varies (passengers getting in or out, loading or unloading) a pressure difference with respect to the additional sphere appears.

When the ignition is switched on, as the additional sphere is connected to the circuit, the pressure difference translates as a influx (P additional > P main) or a reflux (P additional < P main) of fluid in the suspension cylinders, which suddenly alters the ride height of the vehicle, and causes the vehicle to volt.

B - ROLE

The aim of this system is to balance the pressures in the circuits by energising the computer when a door or the tailgate is opened and timing the supply for 30 seconds after the door or tailgate is closed, the timer is also activated when the ignition is switched off (1 min PR 4860 ->.).

Note: If the hydraulic pressure is not sufficient, the additional sphere remains isolated, which, when the engine is switched on, can cause a slight volt.

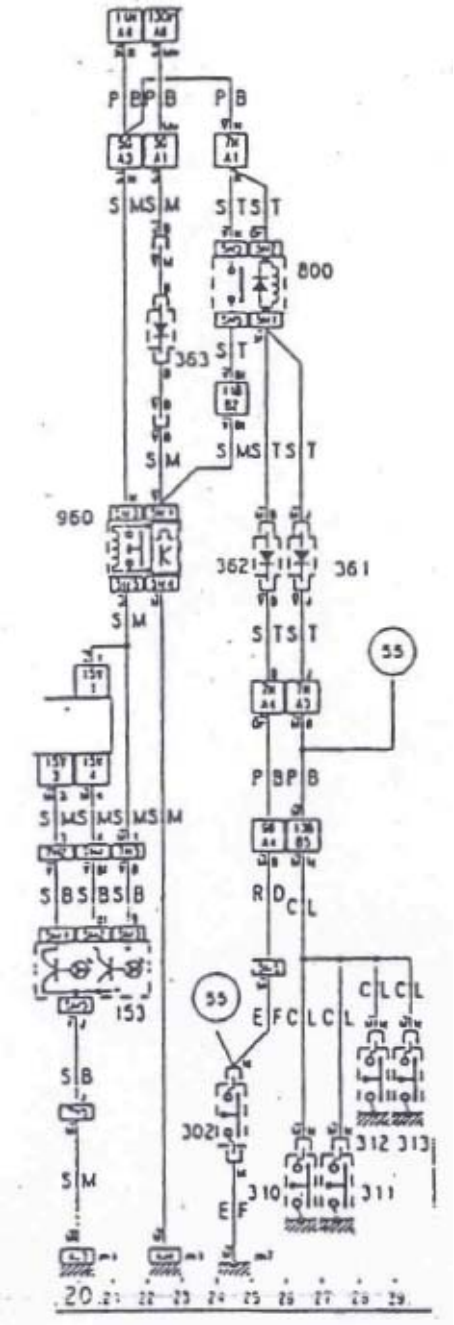
C - CONSTITUTION

PR -> 4860 External timer and relays.

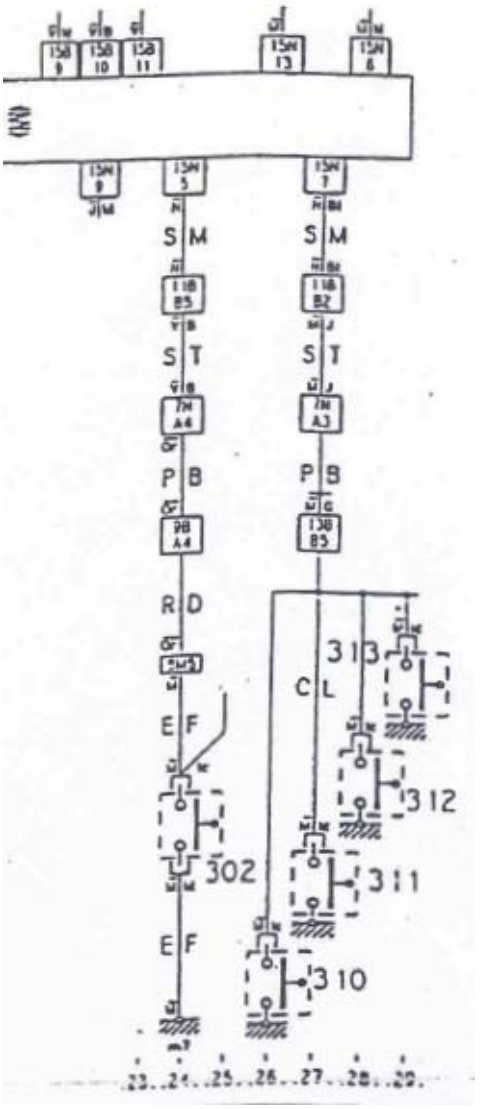
PR 4860 -> Integrated into the computer.

D - ELECTRICAL DIAGRAM

-> PR 4860



PR4860 ->

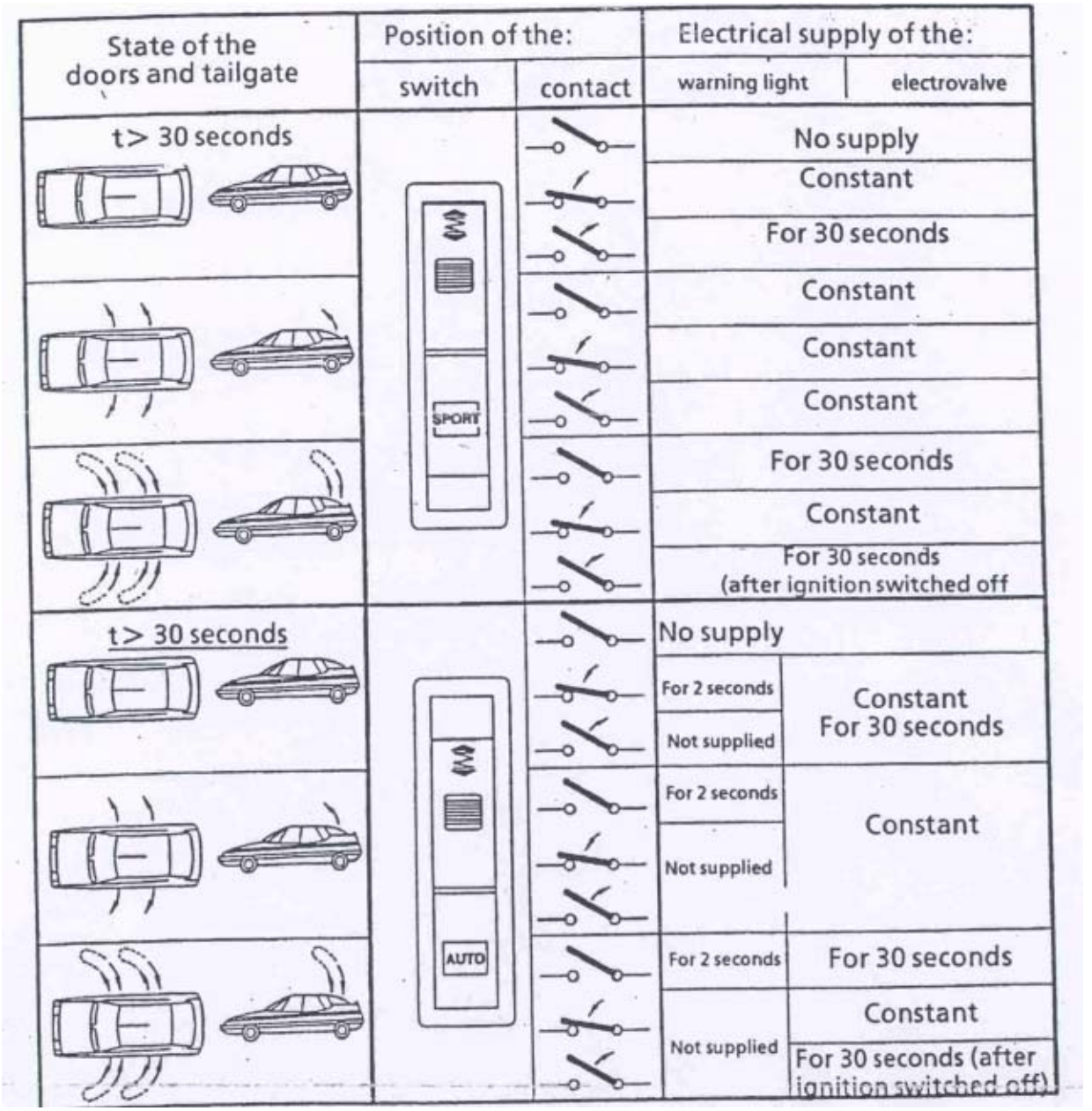


E - EXTERNAL ANTI-JOLT OPERATION -> PR 4860

The 960 timer, supplied with a permanent + is controlled by the ignition or by the anti-jolt relay 800. This is earthed through the switches on the doors and tailgate via the diodes 361 or 362 (these allow the courtesy light and boot light control to be isolated).

The output of the timer 960 is positive when there is + information at the relay 800. When this information disappears, the 30 second timer is activated, supplying the computer during this time.

Supply conditions of the steering wheel and electrovalve



State of the doors and tailgate	Position of the: switch	Position of the: contact	Electrical supply of the: warning light	Electrical supply of the: electrovalve
t> 30 seconds				No supply
				Constant
				For 30 seconds
				Constant
				Constant
				Constant
				For 30 seconds
				Constant
				For 30 seconds (after ignition switched off
t> 30 seconds			No supply	
			For 2 seconds	Constant For 30 seconds
			Not supplied	
			For 2 seconds	Constant
			Not supplied	
			For 2 seconds	For 30 seconds
			Not supplied	Constant
				For 30 seconds (after ignition switched off)

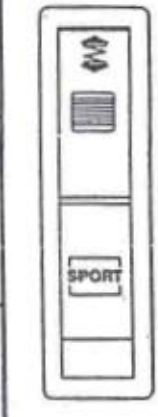
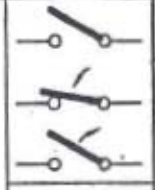
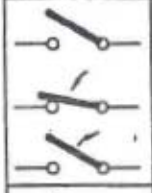
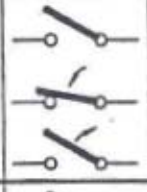
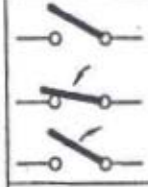
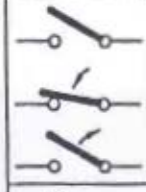
F - INTEGRATED SYSTEM OPERATION PR 4860 ->

The computer is supplied with a constant + and a + after ignition.

The electrovalve supply control occurs directly by earthing channels 5 or 7 of the computer through the doors or tailgate. When the doors and tailgate are closed, the electrovalve remains energised for 30 seconds.

Note: If the anti-theft switch is not in the "On" position, the electrovalve supply is interrupted if a door or the tailgate is still open after ten minutes.

<u>Supply conditions of the warning light and electrovalve</u>

State of the doors and tailgate	Position of the :		Electrical supply of the:	
	switch	contact	warning light	electrovalve
t> 30 seconds			No	
			Yes	
			No	1 minute
			No	10 minutes
			Yes	
			No	10 minutes
			No	30 seconds
			Yes	
			No	1 minute
t> 30 seconds			No	
			2 seconds	Yes
			No	1 minute
			No	10 minutes
			2 seconds	Yes
			No	10 minutes
			No	30 seconds
			2 seconds	Yes
			No	1 minute

G - REMINDER OF THE WARNING LIGHT OPERATION

IMPORTANT: The warning light does not light up if the hydractive develops an operating fault.

1 - -> 4860

a) AUTO position

The light will light up for two seconds each time the computer is energised (ignition or door or tailgate), in other words channel N 1 of the computer (timer +) must have had to pass through the 0 volt value beforehand, which occurs 30 seconds after the ignition is switched off AND after the doors and tailgate have been closed.

b) SPORT position

The light will remain illuminated for as long as the computer is energised (presence of timer + on channel N 1).

2 - 4860 ->

a) AUTO position

The light will light up for two seconds when the anti-theft is switched to the "On" position. It will not light up when a door or the tailgate is opened.

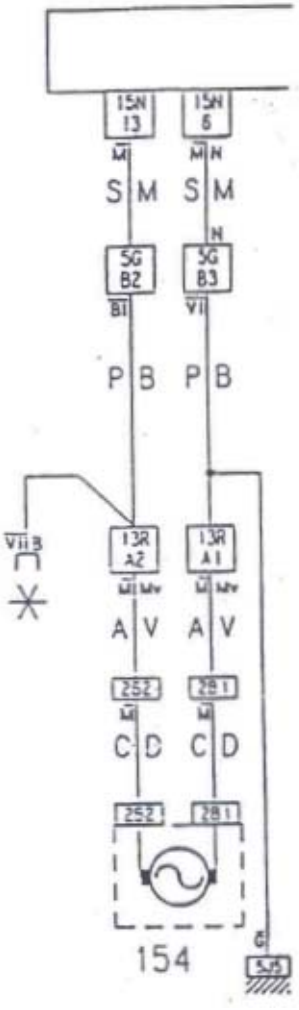
b) SPORT position

The light will remain illuminated for as long as the antitheft is in the "On" position.

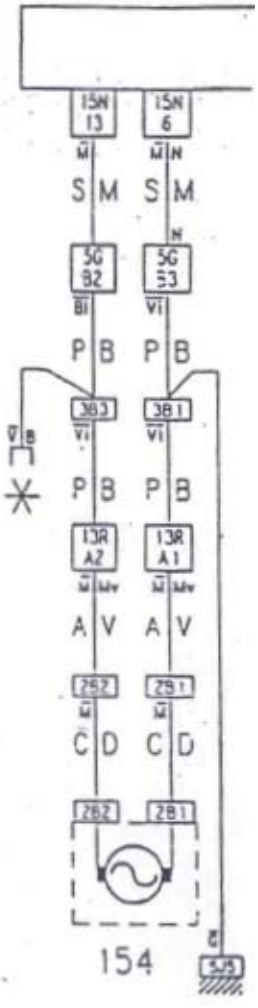
H - DETAILS:

Speed information depending on engine → PR 5281

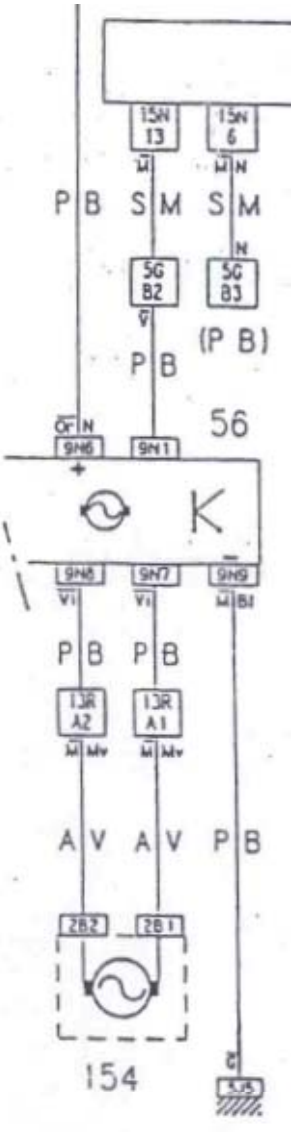
XM PETROL

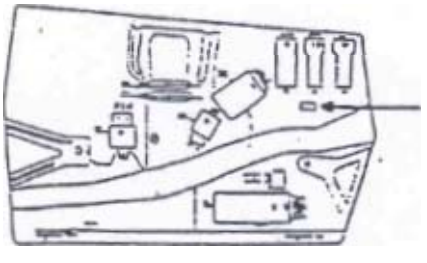


XM 4 cylinder injection + Diesel



XM V6



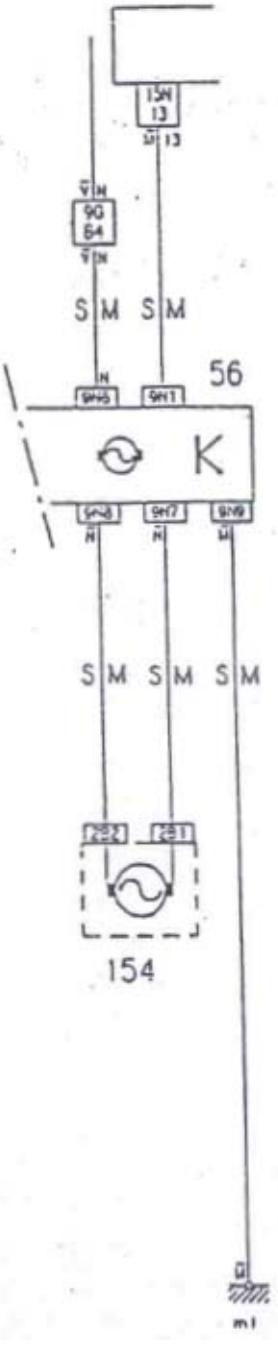


3 channel WHITE connector
(under glove box)

PR 5282 ->

Without Speed Interface

With Speed interface



AUTO-DIAGNOSTIC

I - INITIALISATION

When energised, the computer checks:

- For the actuators = line continuity.
- Its own circuit.
- That there is no abnormal development in the counters, registers, etc....

It reinitialises the counters, registers, etc...

II - "WATCHDOG" FUNCTION

The computer permanently checks that its internal programme is operating correctly.

III - FAULT MEMORISING

The set of sensors define the configuration of the vehicle. Non plausible configurations and the incoherence of information are recognised by the computer which switches to the safety mode "Firm" state (except for the vehicle movement sensor and the front brake pressure sensor).

These faults are memorised by a non volatile memory which can be checked by the repair technician.

Certain conditions allows normal operation to be resumed after the fault has been memorised.

IV - TABLE OF CODES

CODES	ELEMENTS OR CIRCUITS CONCERNED
21	Braking pressure sensor
22	Accelerator pedal travel sensor
23	Steering wheel angle and rotational speed sensor
24	Vehicle speed sensor
25	Body vertical movement sensor
31	Stiffness regulator control electrovalve

XM ALL TYPES

Advice for aiding diagnostics:

- Reading faults codes

  Ignition on, switch to "SPORT" position. Check the light is illuminated. If it is not, check the supply to the computer (→ 4860 = timer +, earth, 4860 → = direct + , ignition + , earth), the light function and the selector button function.

  Switch off the ignition, close the doors and tailgate and wait for the light to go out (→ 4860 = 30 seconds, 4860 → = immediately). Connect the test unit, switch on the ignition and carry out the interrogation.

  Note: When interrogating the auto-diagnostic, the electrovalve is not energised and the light is not illuminated. The computer will remain locked until the supply to the computer is switched off (→ 4860 = timer +, 4860 → = ignition +) and the test unit disconnected.

  It is therefore important to switch off the supply to the computer and to disconnect the test unit when the interrogation procedure is completed.

- If the computer has to be disconnected (with integrated anti-jolt)

  - First, disconnect the black connector, then the white one.
  - Then reconnect the white connector, then the black one. If this procedure is not followed, it will be locked in the "Firm" position.

- After using the test unit 4097 T or 4120 T, switch off the ignition before disconnecting the test unit from the diagnostic socket, or else the computer will be locked in the "Firm" position.

- If the suspension switches abnormally to the firm position permanently only above 30 km/h, the distance sensor line is not faulty.

- If the suspension does not switch to the imposed firm position, above 30 km/h, with the console switch in the sport position, the distance sensor (or its electrical line) is faulty.

- After the vehicle has been stopped with the wheels turned, ignition off:

  After restarting and driving at more than 30 km/h, the suspension switches to the firm position until the steering wheel sensor is reinitialised in the straight line position.

- If when testing, with an ammeter connected according to INFO'RAPID XM (9) n° 6, the suspension switches abnormally to the firm position and the digital ammeter reads 0 A at this moment, the supply to the computer is cut (direct + or + cut or earth). If it reads 11.7 A, there is a hydro-mechanical problem.

• Electrical test of the distance sensor function:

- Without interface unit:

- Between terminals N 6 and N 13, hydractive computer disconnected = R = 300 S2

- With interface unit:

  Between terminals N 13 and B 8, vehicle moving, voltmeter in the DC volts position = 1.5Y constant

  If the value is incorrect, check:

- The resistance of the sensor between channels 7 and 8 of the interface unit connector (disconnected) R = 300 S2.

- The unit supply = between 6 and 9 = 12 V.

- The continuity between channel 1 of the unit and channel N 13 of the hydractive computer.

- If the suspension becomes stiff for no apparent reason (no problems noted when checking the circuit), check that there is no break in the continuity of the computer supply and earth circuits (earth M1 must be made with a 0.6 mm connector (ZC 9 000 143 T) bolted onto the front right hand earth unit for the hydractive function).

DEVELOPMENTS

PR 4860 **:** Fitting of a computer with integrated anti-jolt

PR 5111 : Hydractive electrovalve not supplied after the ignition is switched off. Ref. H 2 B on computer.

PR 5127 : Earth M1 of hydractive cabling made from a flat 0.6 mm connector.

PR 5138 : Nut welded onto the body, with hydractive earth fixed by a self tapping screw.

PR 5103 : Terminals glued behind all the MIC connectors (not sealed) to prevent the terminals retracting from the connector.

PR 5282 : New computer (Ref. H3).
New wiring (electrovalve earth, distance sensor, speed interface).

REPAIR

INFO'RAPID XM (9) n° 4

Testing the main connectors of the hydractive function.

INFO'RAPID XM (9) n° 6

Method for testing hydractive suspension using an ammeter.

INFO'RAPID XM (9) n° 8

Earth modification.

INFO'RAPID XM (9) n° 13

Computer developments.

COMMENTS

- If when testing, the suspension stays in the "Firm" position, do not disconnect anything and do not switch off the ignition, then position an ammeter probe (e.g. the SOURIAU 26 A station) onto the hydractive earth cable and measure the intensity:
  - 1.7 A→ Hydro-mechanical problem.
  - 0.3 A to 0.5 A→ Electrovalve not supplied.
  - 0 A → Supply cut.
  - → 4860 = connecting the timer or the battery causes the hydractive function to be energised for 30 seconds with the ignition off and the doors and tailgate closed.