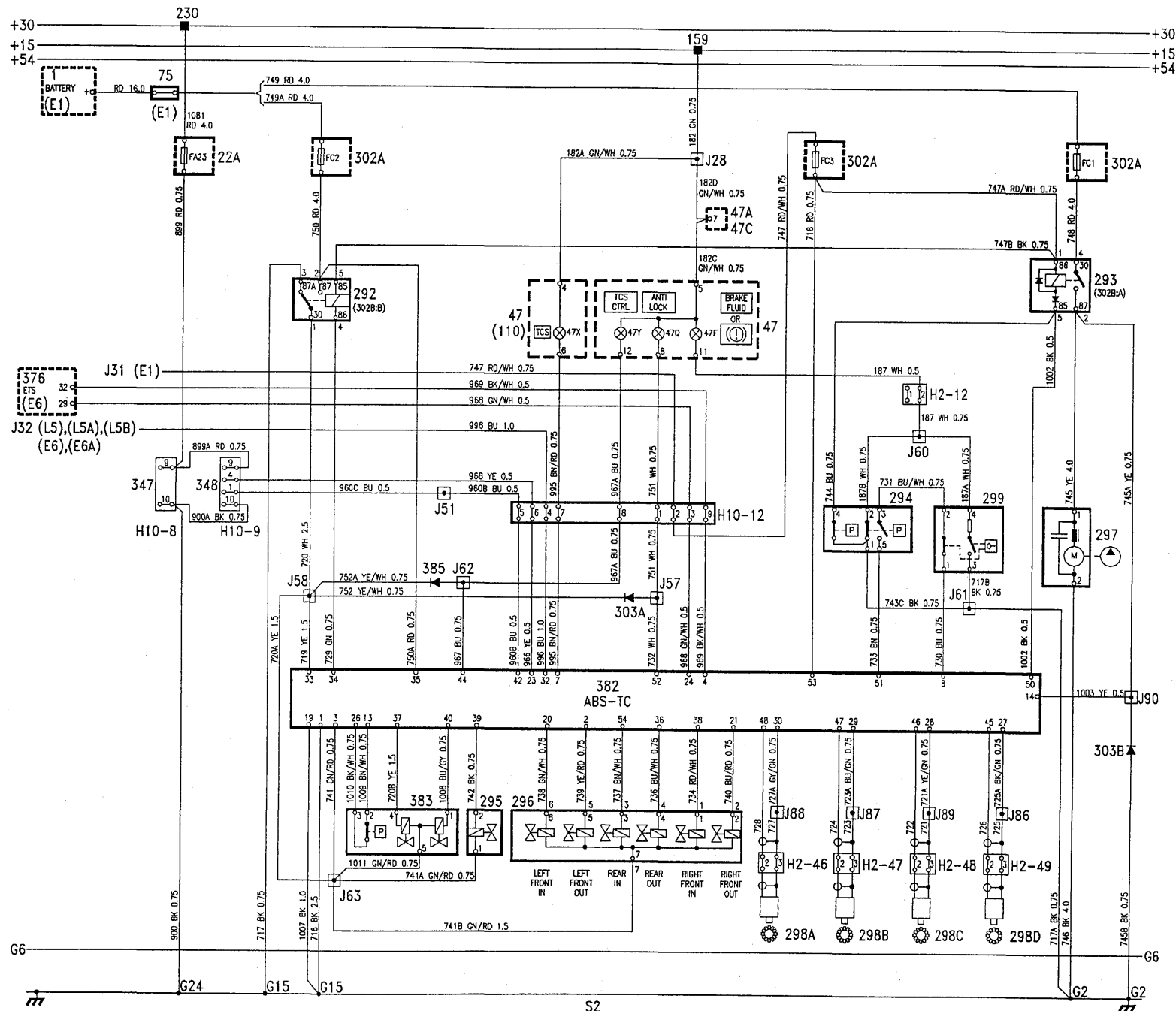


TC/ABS (manual)



S2
LÄSNINGSFRITT BROMSSYSTEM MED ANTISPINNSYSTEM
ANTI BLOCKING BRAKE SYSTEM WITH TRACTION CONTROL SYSTEM

Operation

A full description of operation is given in the service manual entitled "2:5 Traction Control System TCS".

In the brake-related part of the TCS system, the Anti-lock Brake System (ABS) is the most important component. An extra valve housing (TC block) has been added to the brake unit for the anti-spin function. The system includes indicating and warning lamps.

The wheel sensors provide the control unit with information on the rotational speeds of the wheels. With the mean speed of the rear wheels as a reference (used in the TCS mode), the control unit can check at any moment the amount of spin on either of the driven wheels (speed increase in relation to the rear wheels).

When wheelspin is about to happen and the TCS is to brake the corresponding front wheel, hydraulic fluid at accumulator pressure is supplied through the TC block and the main valve to the front wheel circuits. Braking power is then controlled by means of the inlet and outlet valves.

The components of the TC/ABS system are supplied with current via fuses in relay and fuse board 302 on the bulkhead partition in the engine compartment.

- Fuse 1 (30A) protects pump relay 293.
- Fuse 2 (30A) protects main relay 292.
- Fuse 3 (10A) protects control unit 382.
- Warning lamps 47Q, 47Y and 47F, as well as indicator lamp 47X, are supplied with current (+15) from fuse 13 when the ignition switch is in the drive or start position.

Power supply:

When the ignition switch is turned to the drive position, pin 53 of the control unit will be supplied with current (+54). The control unit then earths via pin 34 and main relay 292 operates. The unit is thus supplied with current (+30) so that it can operate the control valves of the brake unit.

Operation of warning lamps when the engine is started

The warning lamps for the brake system light up every time the engine is started. This allows the driver to check that the bulb filaments are intact. (How the warning lamps light up to indicate faults is described in the section entitled "Monitoring functions" below.

When the ignition switch is turned to the start position, the supply of current (+54) to main relay 292 will be interrupted, causing the relay to release. This earths ABS warning lamp 47Q to earthing point G15 via diode 303A and the relay contacts, and at the same time as the warning lamp 47Y is earthed via diodes 303A and 385 and the relay contacts in earthing point G15.

Since the relay always releases for at least for at least two seconds when the engine is started, the lamp will light up during this time. (However, the lamp may remain lit for up to 60 seconds until the correct hydraulic pressure has been reached.) To reach the start position, the ignition switch must be turned through the test position. Brake fluid level warning lamp 47F will then be earthed through ignition switch 20 and the lamp will light up.

Hydraulic pressure

The pressure in the brake unit accumulator is maintained at the correct level by a hydraulic pump, which is driven by motor 297 and controlled by pressure and warning switch 294.

If the pressure is below 140 bar when the engine is started, contacts 4-1 will be closed. The coil of pump relay 293 is then earthed and motor 297 is supplied with current via the relay contacts.

When the hydraulic pump has raised the pressure in the accumulator to 180 bar, the contacts will open and the motor will stop. If the pressure drops to 140 bar while the car is being driven, the contacts will again close and the pump will start. The pump needs to run for 10-15 seconds in order to raise the pressure from 140 to 180 bar.

Brake light switch:

The brake light switch provides the control unit with information via pin 32 on when the brakes are applied, which enables the system to react faster.

Control unit 382

The four wheel sensors provide control unit 382 with continuous information on the speed of rotation of the wheels:

298A left front
298B right front
298C left rear
298D right rear

Based on the information from the sensors on the speed of rotation of the wheels, the control unit regulates braking power via the six hydraulic valves 296 in the brake unit.

Each front wheel is regulated individually and the two rear wheels in common. Two valves, one inlet valve and one outlet valve, are provided for each control function.

Left-hand front wheel:

IFL inlet valve
OFL outlet valve

Right-hand front wheel:

IFR inlet valve
OFR outlet valve

Rear wheels (common circuit):

IR inlet valve
OR outlet valve

When de-energized, the inlet valves are open and the outlet valves closed.

Valve block 383

For the TC function, valve block 383 is equipped with two valves and a pressure transmitter. The control unit receives information from the pressure transmitter on when the brakes are applied (contacts 2-3 open). The valves are supplied with battery current via pin 3 of the control unit. To actuate a valve, it is earthed via the control unit.

Main valve 295 is supplied with current and opens when the ABS system is in operation.

Pressure transmitter in the valve block 383

The control unit receives information from the pressure transmitter in the valve block on whether the brakes have been applied or not and on whether TC or ABS mode has been switched on.

The signal from the pressure transmitter is compared with the input signal from brake light switch 29.

Monitoring functions

For particulars concerning operation of the lamps when the engine is started, see above under " **Operation of warning lamps when the engine is started** ".

Brake fluid level warning lamp

Warning lamp 47FG for the brake fluid level will light up under the following circumstances:

- if the level in the brake fluid reservoir drops to the MIN mark on the reservoir, causing the lamp to be earthed at earthing point G2 via contacts 4-3 of brake fluid sensor 299.
- if the pressure in the brake unit accumulator drops below 105 bar, causing the lamp to be earthed at earthing point G2 via contacts 2-1 of pressure and warning switch 294. The contacts close at 105 bar and open at 134 bar. (In this case the ABS warning lamp will also light up).

Under normal operating conditions, both sets of contacts are open. Cars without TC/ABS are also equipped with a brake fluid level warning lamp, although its function is then only to provide warning of a low level in the brake fluid reservoir.

ABS and TCS CTRL warning lamps

The control unit monitors the operation of the TC/ABS system and lights up warning lamp 47Q (ANTI LOCK) for the ABS system and TCS CTRL 47Y for the TC system if a fault develops. When the lamp is lit, the ABS and TC systems are inoperative and the brake system performs like an ordinary brake system.

Since control units 382 earth the lamp via pins 52 and 44, they will light up if one of the following faults occurs:

- if the level in the brake fluid reservoir falls below the MIN mark on the reservoir. Contacts 1-2 of level switch 299 will open, thus breaking the circuit between pins 51 and 8 of the control unit. Contacts 3-5 of pressure switch 294 are closed under normal operating conditions. (The brake fluid level warning lamp will also light up in this situation.)
- if the pressure in the brake unit accumulator falls below 105 bar. Contacts 3-5 of pressure switch 294 will then open. Contacts 1-2 of level switch 299 are closed when the level in the brake fluid reservoir is correct. (The brake fluid level warning lamp also lights up.)
- if the signal from one of the wheel sensors 298 is too low.
- The lamps also light up if an earth fault occurs, pins 1 and 19.

If one of the following faults occurs, the lamp will light up because it is no longer earthed via pin 34 of the control unit. Main relay 292 will then release and the lamp will be earthed at earthing point G15 via the relay contacts and diodes 303A and 385:

- open-circuit in the wiring (or in a connector) to valve block 296, wheel sensors 298 or main valve 295.
- fault in the control unit

If the following faults occur, only the TCS CTRL lamp light up as a result of pin 44 being earthed in the control unit.

- If faults develop in the circuit to the brake light switch.
- If faults develop in the circuit to the pressure switch in valve block 383. TC does not have any effect on the brakes if these faults develop.
- If open-circuits, short-circuits or faults in level pin 4 or 24 develop. TC does not adjust the throttle if these faults develop.
- If the front brake linings have overheated (more than 400 °C).

Note

The lamp flashes when this fault occurs. When the linings have cooled down (300 °C), the lamp goes out.

TCS indicating lamp

When the TC system is operating, indicating lamp 47X lights up as a result of pin 7 being earthed in control unit 382.

Fault tracing

The connectors of the control unit are of a splash-proof design, which means that the connecting pins are cast into rubber.

As a result, no instrument readings can be taken at the rear of the connector in connection with fault tracing. A "breakout box" must be used instead.

Diagnose and fault tracing are described in more detail in the service manual entitled "**2:5 Traction Control System**".

Locations of components

1	Battery in the engine compartment	376	ETS electronic control unit, under the left-hand front seat
22A	Fuse holder behind the access panel in the glove box	382	Control unit, ABS/TC, on the battery tray
47A	Fuel gauge	383	Valve block, ABS/TC, in the engine compartment on the brake unit
47C	Coolant temperature gauge	385	Diode, ABS/TC, in the engine compartment in electrical distribution box 302 under the relay board, in the casing
47F	Brake fluid level warning lamp		<i>2-pole connector</i>
47Q	ABS/ ABS-TCS warning lamp	H2-12	In the engine compartment on the left of the brake fluid reservoir
47X	TCS (anti-spin) warning lamp	H2-46	In the engine compartment behind the bulkhead partition at the extreme left
47Y	TCS CTRL warning lamp in the combined instrument	H2-47	In the engine compartment behind the bulkhead partition at the extreme right
75	Distribution block, positive battery supply, on the battery tray	H2-48	Under the rear seat, on the left-hand side under the carpet
110	Tachometer, in the combined instrument	H2-49	Under the rear seat on the right-hand side under the carpet
159	Distribution terminal + 15 in the electrical distribution box in the glove box		<i>10-pole connector</i>
230	Distribution terminal + 30 in the electrical distribution box in the glove box	H10-12	In the engine compartment on the left-hand side, below the electrical distribution box ABS 302
292	Main relay for ABS, in the engine compartment between the battery tray and the brake fluid reservoir, in the electrical distribution board (302B:B)	G2	Earthing point, battery tray, on left-hand wheel housing
293	ABS pump relay, in the engine compartment in the electrical distribution box (302B:A)	G15	Earthing point for ABS on the left-hand structural member, at the ABS control unit
294	ABS pressure switch	G24	Earthing point, on the right-hand front seat member
295	Main valve, ABS		
296	Valve block, ABS		
297	Hydraulic pump motor, ABS in the engine compartment on the brake unit		
298A	Left-hand front wheel sensor, on the left-hand steering knuckle housing		
298B	Right-hand front wheel sensor, on the right-hand steering knuckle housing		
298C	Left-hand rear wheel sensor, on the left-hand rear wheel hub		
298D	Right-hand rear wheel sensor, on the right-hand rear wheel hub		
299	Brake fluid level sensor, ABS, in the engine compartment, on the brake fluid reservoir		
303A/ 303B	Diode, ABS, in the engine compartment, in the ABS electrical distribution box under the relay board, in the casing		
347 (H10-8)	Diagnostic test socket, engine electronics, under the right-hand front seat (black)		
348 (H10-9)	Diagnostic test socket, car electronics, under the right-hand front seat (green)		

Components

