2003 XC90 CEM
(Design and Function Information)

VIDA 2010CU1
September 9, 2010

09: Central electronic module (CEM)

XC90, 2003, L.H.D

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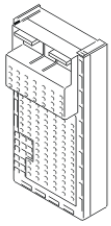
09: Central electronic module (CEM)

Control module
Signals

System overview

Control module



The central electronic module (CEM) controls the Controller area network (CAN) and acts as a bridge between the high and low speed networks and the data link connector (DLC). It also manages the following functions:

- Alarm (certain functions)
- Locks (certain functions)
- Immobilizer
- Headlamps
- Parking lights / license plate lighting
- Front fog lamps
- Headlamp range adjustment (certain markets)
- Automatic range adjustment (Bi-Xenon)
- Turn signal lamps
- High-mounted stop lamp (S80/S60)

- Courtesy lighting / key lighting / glove compartment lighting
- Rear window lift mechanisms
- Fuel pump
- Wiper / washers for the windshield and headlamps
- Starter motor
- Speed sensitive power steering
- Electrically heated seats
- Horn.

The control module is installed as a separate unit in a relay box under the soundproofing panel on the driver's side. The control module is removed from the relay box for replacement.

The car configuration file is stored in the central electronic module (CEM). It contains information about the car VIN number, structure week and the equipment in the car. When replacing the central electronic module (CEM), the VIN cannot be read off until the software has been downloaded from the Volvo central database.

The central electronic module (CEM) communicates with components which are directly connected and also with other control modules and

components via serial communication and the control area network (CAN).

The control module checks activations and input and output signals using an integrated diagnostic system A diagnostic trouble code (DTC) is stored if the control module detects an error. In certain cases the central electronic module (CEM) replaces the faulty signal with a substitute signal. Other control modules also communicate on the network with the central electronic module (CEM) if they have diagnostic trouble codes (DTCs) stored. This function is used when reading off diagnostic trouble codes (DTCs) without VIDA.

Any diagnostic trouble codes (DTCs) are stored in the control module memory. This information can be read off using VIDA via the data link connector (DLC) in the car.

The easiest way to check if the central electronic module (CEM) is grounded and receiving power is to activate the hazard warning signal flasher. The central electronic module (CEM) is supplied with power if the function operates. Another way of

checking that the central electronic module (CEM) is supplied with voltage and grounded is to activate one of the rear window lift mechanisms.

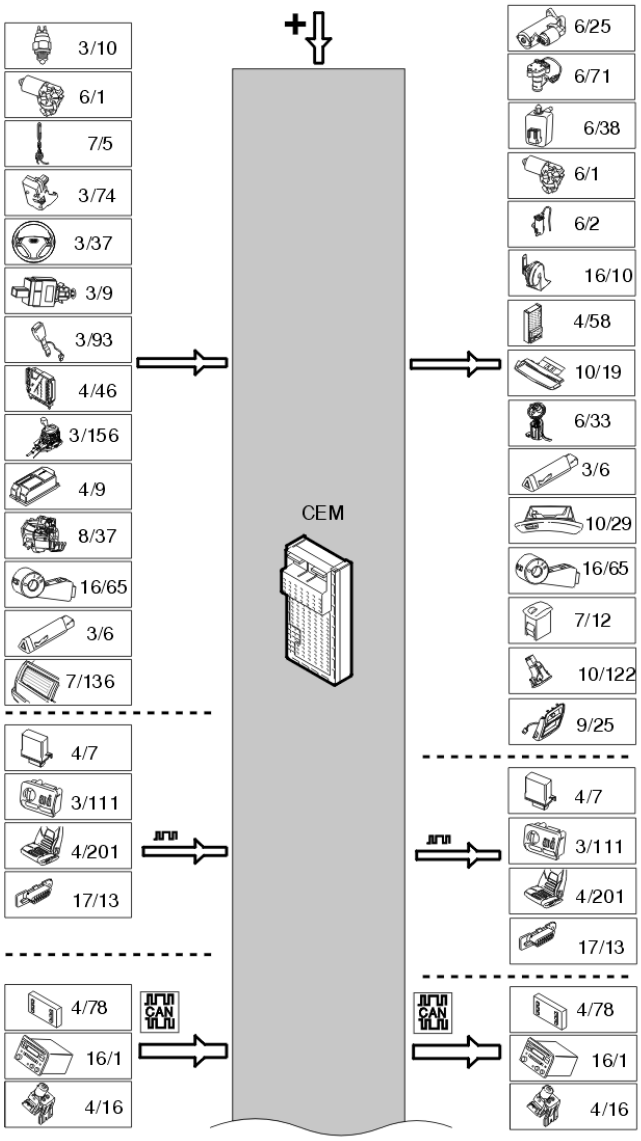
For further information, also see Signal specifications.

Signals

The following table summarizes the input signals to and the output signals from the central electronic module (CEM). The signal types are divided into directly connected signals, serial communication and Controller area network (CAN) communication. The following illustration displays the same information with the Volvo component designations.

Input signals	Output signals
Directly connected:	**Directly connected:**
Back-up (reversing) lamp (3/10)	Starter motor, relay (x2) (6/25)
Windshield wiper motor (6/1)	Stepper motor, power steering (x 4) (6/71)
Windshield washer level sensor (7/5)	Headlamp range adjustment (6/38)
Control signal doors / tailgate (x 8) (3/74)	Windshield wiper, relay (x2) (6/1)
Horn switch (3/37)	Washer motor, relay (x 2) (6/2)
Stop lamp switch (3/9)	Horn, relay (16/10)
Seat belt buckle sensor (x 4) (3/93)	Stop lamps from the rear electronic module (REM) (4/58)
Fuel pump frequency signal (4/46)	High level stop lamp (S60/S80) (10/19)
Control signal, gear selector lever module P/N-position (3/156)	Fuel pump, relay (6/33)
Supplemental restraint system module (SRS) (Airbag OK) (4/9)	Hazard warning signal flasher switch (3/6)
Gear-shift position sensor (8/37)	Glove compartment lighting (10/29)
Immobilizer (x 2) (16/65)	Ignition switch lighting (16/65)
Hazard warning signal flasher switch (3/6)	Alarm LED (7/12)

Glass breakage sensor (7/136) L signal (generator) (6/26)	Courtesy lighting (10/122) 12V socket (9/25) Auxiliary lamps (10/65)
Via serial communication: Additional heater / parking heater (optional extra) (4/7) Light switch (3/111) Heated seats (4/201) Communication line (data link connector) (17/13)	**Via serial communication:** Additional heater / parking heater (optional extra) (4/7) Light switch (3/111) Heated seats (4/201) Communication line (data link connector) (17/13)
Via Controller Area Network (CAN) communication: Accessory electronic module (AEM) (optional equipment) (4/78) Audio module (AUM) (16/1) Brake control module (BCM) / Anti-lock Brake System Module (ABS) (4/16) Climate control module (CCM) (3/112) Driver's door module (DDM) (3/126) Differential electronic module (DEM) (optional equipment) (4/82) Driver information module (DIM) (5/1) Engine control module (ECM) (4/46) Electronic throttle module (ETM) (4/50) Passenger door module (PDM) (3/127) Phone module (PHM) (optional equipment) (16/60) Power seat module (PSM) (4/52) Rear electronic module (REM) (4/58) Road Traffic Information Module (RTI) (optional extra) (16/45) Steering wheel angle sensor module (SAS) (4/68) Supplemental Restraint System Module (SRS) (4/9) Steering wheel module (SWM) (3/130) Transmission control module (TCM) (4/28) Upper electronic module (UEM) (4/70) Data link connector (DLC) (17/13)	**Via Controller Area Network (CAN) communication:** Accessory electronic module (AEM) (optional equipment) (4/78) Audio module (AUM) (16/1) Brake control module (BCM) / Anti-lock Brake System Module (ABS) (4/16) Climate control module (CCM) (3/112) Driver's door module (DDM) (3/126) Differential electronic module (DEM) (optional equipment) (4/82) Driver information module (DIM) (5/1) Engine control module (ECM) (4/46) Electronic throttle module (ETM) (4/50) Passenger door module (PDM) (3/127) Phone module (PHM) (optional equipment) (16/60) Power seat module (PSM) (4/52) Rear electronic module (REM) (4/58) Road Traffic Information Module (RTI) (optional extra) (16/45) Steering wheel angle sensor module (SAS) (4/68) Supplemental Restraint System Module (SRS) (4/9) Steering wheel module (SWM) (3/130) Transmission control module (TCM) (4/28) Upper electronic module (UEM) (4/70) Data link connector (DLC) (17/13)


3/10
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7/136
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3/111
4/201
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CEM
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6/38
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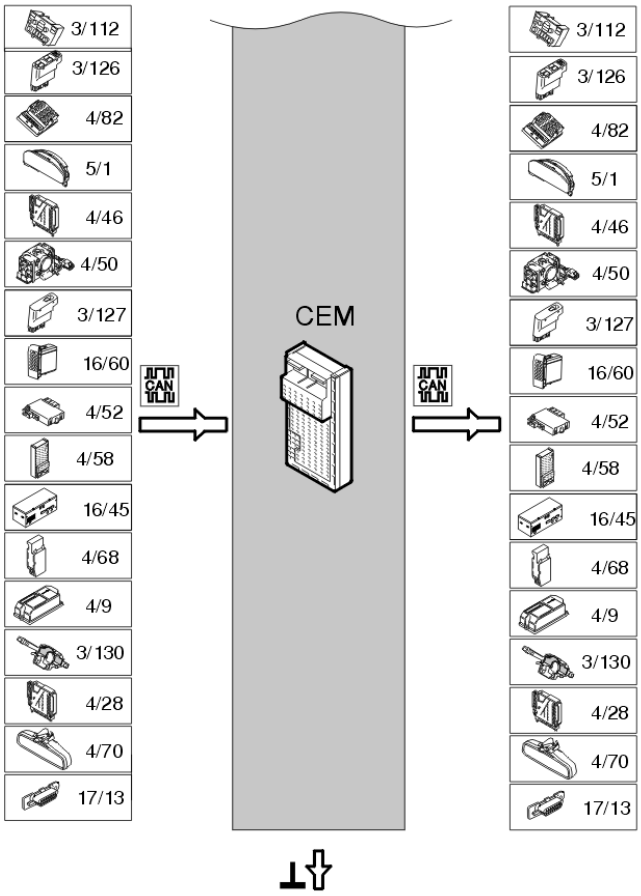
CAN



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Diagnostic functions

General

The control module has a built-in diagnostic system, Volvo Diagnostic, which continuously monitors internal functions as well as input and output signals.

Diagnostic trouble codes (DTCs)

A diagnostic trouble code (DTC) is stored if the control module detects a fault. The control module can store up to 10 diagnostic trouble codes (DTCs).

If a fault disappears for any reason after the diagnostic trouble code (DTC) has been permanently stored in the control module, information about the fault remains in the control module.

Reading and erasing diagnostic trouble codes (DTCs)

Stored diagnostic trouble codes (DTCs) can be read off and erased using this function. The on-board diagnostic (OBD) system can identify 275 different faults in the form of diagnostic trouble codes (DTCs).

This function can also be used to read off whether the fault is still present (permanent) or whether it has now ceased (intermittent) after the diagnostic trouble code (DTC) has been stored.

Diagnostic trouble codes (DTCs) can only be erased once all the diagnostic trouble codes (DTCs) have been read off at least once.

Reading off input and output signals, CEM

This function can be used to continuously read off the values and status of the control module's input and

output signals.

The following parameters can be read off:

- the status of the relay for extended X supply. The relay controls the power supply for the following functions: parking heater, power driver's seat and “after blow” for the air conditioning (A/C) system. The relay is activated in key positions I, II and III when the drivers door is opened (10 minutes), driver's door is closed and key position 0 (1 minute) and when one of the above functions is activated
- the status of the relay for extended X2 supply (AUT). Controls the power supply to the gear selector module (GSM). The relay is activated in key positions I, II, III, 0 or out for 10 seconds
- the status of the relay for the park neutral position (PNP) switch
- the status of the relay for the starter motor (activation signal from the central electronic module

(CEM) to the relay)
- the status of the relay to raise the rear left-hand window. The relay is only active when the window lift mechanism is operated via the switch in the driver's door
- the status of the relay to lower the rear left-hand window. The relay is only active when the window lift mechanism is operated via the switch in the driver's door
- the status of the relay to raise the rear right-hand window. The relay is only active when the window lift mechanism is operated via the switch in the driver's door
- the status of the relay to lower the rear right-hand window. The relay is only active when the window lift mechanism is operated via the switch in the driver's door
- the status of the relay for the child lock (blocks operation of the rear window lift mechanisms). Note that when the function is activated, (i.e. the LED lit), the relay which supplies the rear window lift mechanisms is

not activated. The read off gives the status of the relay
- status of the relay for high beam
- status of the relay for low beam
- status of the spot lamp relay
- status of the parking lamp relay
- status of the relay for the daytime running lamps
- status of the relay for the front fog lamps
- status of the relay for the windscreen wipers, off or on
- status of the relay for the windscreen wipers, high speed
- status of the relay for the washer motor
- status of the relay for the headlamp washer
- status of the relay for the horn
- status of the power supply (S-, X-, 15-, 50- and 30-supply)
- status of the key position
- status of the L signal (from the generator (GEN)). Ignition on ~0V, engine running ~1v
- status of the confirmation from the gear-shift position sensor about whether start (starter motor relay activated) is possible

- the status of the frequency signal from the engine control module (ECM) for the fuel pump (FP) relay
- the status of the windscreen washer reservoir level
- the status of the windscreen wipers
- the status of the driver's door (open or closed)
- the status of the passenger door (open or closed)
- the status of the left rear door (open or closed)
- the status of the right rear door (open or closed)
- the status of the tailgate (open or closed)
- the status of the lock switch for the driver's door (from the driver door module (DDM))
- the status of the lock switch for the passenger door (from the passenger door module (PDM))
- the status of the lock switch for the left-hand rear door
- the status of the lock switch for the right-hand rear door
- the status of the signal from the relay switch for the fuel pump (FP)
- the status signal from the

supplemental restraint system (SRS) module indicating whether the Airbag is OK
- the status of the switch for the hazard warning signal flasher
- the status of the button lamp for the hazard warning signal flashers
- the status of the key ring lighting
- the status of the indication LED for the alarm
- the status of the fuel pump (FP)

- **Note! The seat belt switches are connected to the Supplemental Restraint System Module (SRS) on model year 2003 and onward. They cannot then be read from the Central Electronic Module (CEM).**

- the voltage of the seat belt switch, driver's side
- the voltage at the seat belt switch, passenger side
- output, pulse width modulated signal to the courtesy lighting
- speed signal (for accessories). If the car is raised for this read off, ensure that the wheels are stationary when

the gear selector is moved to position P (automatic transmissions). Note that diagnostic trouble codes (DTCs) may be stored in the ABS system if the front wheels are stationary and the rear wheels rotate

- the status of the pulse width modulation (PWM) signal for headlamp beam height control
- the status of the pulse width modulation (PWM) signal from the left-hand Xenon lamp (65%-90%)
- the status of the pulse width modulation (PWM) signal from the right-hand Xenon lamp (65%-90%)
- the fault status for the xenon lamp
- the status of the infotainment relay.

Reading off parameters, Immobilizer

- **ID CODE RECEIVED** Indicates whether the central electronic module (CEM) has received a key code (Transponder ID code). This applies whether the key is stored as an approved key or not. YES or

NO. However, the key must be of the correct type - intended for this type of Volvo.

- **ID CODE STORED**
  ID CODE STORED Indicates whether the last received key code (transponder ID code) is stored as an approved key code in the central electronic module (CEM) memory. YES or NO.
- **RANDOM CODE TO TP**
  Indicates whether the central electronic module (CEM) is transmitting a random code to the key which presupposes that the key code is stored. SEND or DO NOT SEND.
- **RESPONSE FROM TP**
  Indicates whether the central electronic module (CEM) is receiving a response from the key (via the antenna ring) which presupposes that the key code is stored. YES or NO. YES is also displayed for a key belonging to another car of the same type, with the same key ID but a different security code.
- **TP STATUS OK**
  Indicates whether

all of the following conditions are fulfilled: 1) Key code (transponder ID code) is stored. 2) The key has the car's security code (the key belongs to the car). 3) Communication (random code and response) is OK. YES or NO.

- **KEY TYPE**
  Indicates whether the ignition key used is a MASTER KEY or a SERVICE KEY
- **KEY NO.**
  Indicates which of the vehicle's keys is in the ignition switch. Each key programmed into the central electronic module (CEM) is given a serial number from 1 to 6. NO. 1 - NO. 6.
- **NUMBER OF KEYS**
  Indicates how many keys (key codes) are stored in the central electronic module (CEM) memory, 1-6. A maximum of six keys can be stored.
- **IMMO MODE**
  Indicates the mode of the immobilizer in the central electronic module (CEM), NORMAL or PROGRAMMABLE. In NORMAL it is not possible to change the content

(add/erase key codes) in the immobilizer. In PROGRAMMABLE mode the immobilizer can be programmed (add/erase key codes). In this mode the engine cannot be started. After a programming has been carried out, VIDA returns to NORMAL mode.

Hint:
If communication problems occur during programming, the central electronic module (CEM) remains in PROGRAMMABLE mode.
To correct this, remove fuse 11C/32 from the fusebox in the passenger compartment and reinstall it so the central electronic module (CEM) returns to NORMAL mode again.

- **ECM DATA RECEIVED**
  Indicates whether the Control area network (CAN) signal containing Immo ECM data transmitted is received within a given (maximum) time. This signal is transmitted by the engine control module (ECM) to the central electronic module

(CEM) on the high speed network, when the ignition is switched on. YES or NO

- **ECM START SIGNAL**
  Indicates whether the Control area network (CAN) signal transmitted by the engine control module (ECM) to the central electronic module (CEM) on the high speed network after an IMMO CHECK is completed, when the ignition is switched on, allows the engine control module (ECM) to be start (POS) the engine or not (NEG). The following conditions must be met before the engine control module (ECM) will allow the engine to be started. The transponder check must have been successful (the key code, transponder ID, is stored and the security codes for the key and the central electronic module (CEM) correspond). The immobilizer check must have been successful (the codes in the central electronic module (CEM) and the engine control module (ECM) correspond).
- **IMMO RELAY**

STATUS
Indicates the status of the immobilizer's request to the starter motor relay. If the immobilizer permits the relay to connect the starter motor, START POSSIBLE is displayed. IF not, START NOT POSSIBLE is displayed.

Activating components and functions

This function can be used to activate components and functions which affect the outputs of the central electronic module (CEM).
The following components can be activated:

- deactivation of the relay for extended power supply
- activating the relay for extended X2 supply
- activating the relay for the park neutral position (PNP) switch
- activating the relay to raise the rear left-hand window
- activating the relay to lower the rear left-hand window
- activating the relay to raise the rear right-hand window

- activating the relay to lower the rear right-hand window
- activating the relay for high beam
- activating the relay for low beam
- activating the spot lamp relay (accessory)
- activating the relay for the parking lamps
- activating the relay for the daytime running lamps
- activating the relay for the front fog lamps
- activating the relay for the windscreen wipers off/on
- activating the high speed windscreen wiper relay
- activating the relay for the front washer motor
- activating the relay for the headlamp washer
- activating the relay for the horn
- activating the frequency signal from the engine control module (ECM) for the fuel pump (FP) relay
- activating the speed signal (for accessories)
- activating the signal to the switch for the hazard warning signal flashers. To switch off the

hazard warning signal flashers, they must be activated and reset again. The function is switched off if the button in the car is pressed once
- activating the key ring lighting (the key ring lighting does not light if the car is locked. The window can be open however, to allow communication with the data link connector (DLC))
- activating the signal for the alarm LED
- activating the pulse width modulated signal for the courtesy lighting
- activating the relay for preheating the leak diagnostic pump
- activating the infotainment relay.

Reading off and programming data

This function allows programmed data to be read off or data such as customer parameters to be programmed in.

Note! If possible, all data must be read out from the control module before replacement. After replacement the relevant data must be programmed into the

new control module.

Customer parameters can be programmed for approach lights, seat heaters, post drying and daytime running lamps. Seat heater: First read off the data that is programmed in the central electronic module (CEM). Answer, for example, 37C. Then enter the temperature desired by the customer, for example 41C. After programming, the new data must be saved in the control module memory. The following values can be programmed in: 0, 10C, 28C, 30C, 31C, 32C, 33C, 34C, 35C, 36C, 37C, 38C, 39C, 40C, 41C, 43C. The left and right-hand seats are programmed individually and there are two settings that can be selected by the customer, high or low. Approach lights: First read off the data that is programmed in the central electronic module (CEM). Answer, for example, 30 seconds. Then enter the time desired by the customer, for example 90 seconds). After programming, the new data must be saved in the control module memory. The following values can be programmed in: 0, 30, 60 and 90 seconds. Post drying: First read off the parameters programmed in the central electronic module (CEM). Reply

for example the function is not set. Then enter if the customer wants post drying (the function is set). After programming, the new parameters must be saved to the control module memory. The following values can be entered: Off or on.
Daytime running lamps: First read off the data that is programmed in the central electronic module (CEM). For example, daytime running lamps off. Then enter if the vehicle is to have daytime running lamps (daytime running lamps on). After programming, the new data must be saved in the control module memory. The following values can be programmed in: Off or on. There are two versions of off. Dipped headlamps can be switched on in all light switch positions apart from the P position. The dipped headlamp beam can also be adjusted.

Reading off the control module identification

VIDA identifies control modules by reading off a number of codes from the control module memory.
The codes contain information about the control module:

- hardware P/N (control module without software)
- hardware serial

number (control module without software)
- software P/N
- diagnostic software P/N.

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Downloading software and replacing the control module

New software can be downloaded into the central electronic module. When ordering software, the hardware and the software in the car is compared to the Volvo central database. If the comparison is OK the software is downloaded to the control module.

If the comparison between the car and Volvo central database is not OK, the database is updated with the car configuration. When this is complete the software is downloaded. For further information regarding downloading, see Design and Function, Software downloading.

The control module is in a relay box under the soundproofing panel on the driver's side. The control module needs to be removed from the relay box to be replaced.

When installing a

completely new central electronic module in the car, PIN codes for the central electronic module, immobilizer and transponder (key) are downloaded into the control module. The PIN codes are loaded automatically during the ordering process in VIDA. The PIN codes are retrieved from the Volvo Central Database and sent with the software package when software is ordered for the new control module. Each transponder key must however, be programmed as each key has a unique code which must be stored in the central electronic module.

Because of the unique PIN codes, the central electronic modules cannot be moved between cars.

Three customer parameters (four for the V70/V70XC) can be programmed into the central electronic module. These customer parameters are stored in the control module but not in the Volvo central database. This means that the customer parameters must be reprogrammed when the hardware is replaced.

The customer parameters which can be programmed

are:

Seat temperature

- There are two values that can be programmed: low temperature and high temperature. Programming must be carried out so that the high temperature setting is higher than the low temperature setting.

Approach lights

- The approach lights can be programmed to stay on for a longer or shorter time according to the wishes of the customer. The factory setting is 30 seconds. The time can be set to 0, 30, 60 or 90 seconds.

Daytime running lamps

- The daytime running lamps can be programmed in three ways:

    1. Low beam in all switch positions except the parking light position (Flex zero)
    2. The light switch functioning on the basis of: off,

parking light and low beam (Flex standard)
3. Low beam always on regardless of the position of the light switch (Flex low).

Note! It is essential that the legal requirements of each country are followed.

Tailgate wiper (V70/V70XC)

- The tailgate wiper function can be programmed in two ways:
  1. The tailgate wiper can only be activated manually
  2. The tailgate wiper can be activated automatically when back-up (reverse) gear is selected and the front wipers are activated.

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- Alarm
- Automatic range adjustment (Bi-Xenon)
- Central locking
- Courtesy lighting / key lighting / glove compartment lighting
- Front fog lamps
- Fuel pump
- Headlamp range adjustment (certain markets)
- Headlamps
- Heated seats (certain markets)
- High-mounted stop lamp (S60/S80)
- Horn
- Immobilizer
- Parking lights / license plate lighting
- Rear window lift mechanisms/child lock
- Speed sensitive power steering
- Starter motor
- Turn signal lamps / Hazard warning signal flashers
- Wiper / washers for the windshield and headlamps

Function

Alarm

See Design and Function, Alarm.

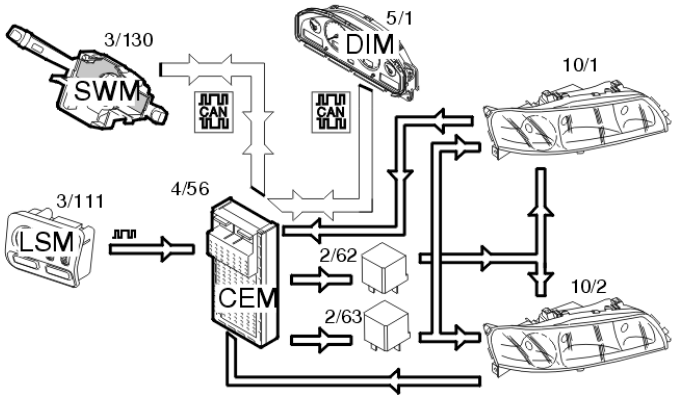
Central locking

See Design and Function, Central locking.

Immobilizer

See Design and Function, Immobilizer.

Headlamps



Depending on the position of the knob, the light switch module (LSM) (3/111) transmits information via serial communication to the central electronic module (CEM) to turn on low beam. The central electronic module (CEM) (4/56) then transmits a control signal to activate the low beam relay (2/62). The bulbs are then supplied with power.

To change to high beam, the left-hand control stalk is pulled towards the steering wheel. The control area network (CAN) signal from the steering wheel module (SWM) (3/130)

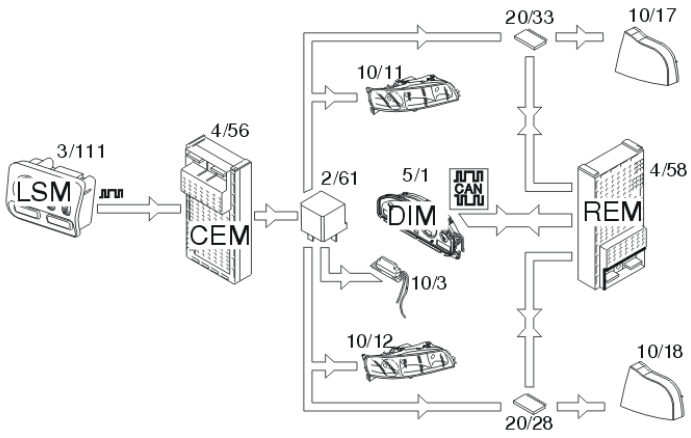
is transmitted to the central electronic module (CEM) which activates the high beam relay (2/63) and supplies power to the high beam. For Bi-Xenon lamps, the position of the reflector is also changed so that the Xenon lamp is on at high beam.

The central electronic module (CEM) also transmits a CAN signal to the driver information module (DIM) (5/1) to light the indicator lamp for high beam.

There is a Limp Home function that ensures that low beam still works if there is a fault in the control area network (CAN). For Bi-Xenon lamps the beam is then set to the shortest range.

For further information about Bi-Xenon lamps, see Design and Function, Gas discharge lamps (GDL).

Parking lights / license plate lighting



The parking lamps (10/11-12, 10/17-18) and license plate lighting (10/3) lights when:

- The knob in the light switch module (LSM) (3/111) is in the low beam position
- The knob in the light switch module (LSM) is in the parking lamp position
- Low beam is lit via the low beam automatic function.

The lamp switch module (LSM) transmits data using serial communication to the central electronic module (CEM) (4/56) to activate the lamps.

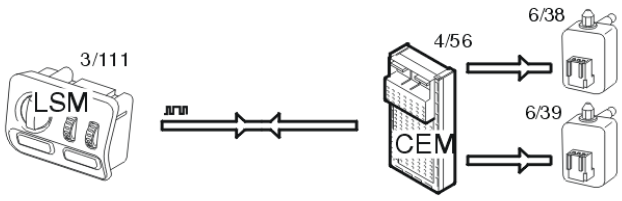
The lamps are supplied with power via a relay (2/61) which is activated by the central electronic module (CEM). The license plate lighting, the front parking lamps (also on

the front fenders for US models) are directly supplied with power. The rear parking lamps are supplied by two shunts (20/28, 20/33) on the rear electronic module (REM) (4/58) so that blown bulbs can be detected.

In the event of a bulb fault for the rear parking lamps, data is transmitted on the control area network (CAN) from the rear electronic module (REM) to the driver information module (DIM) (5/1) and a text message is displayed.

There is a Limp Home function for the parking lamps so that they will work even if there is a fault in the control area network (CAN) or in the serial communication between the light switch module (LSM) and the central electronic module (CEM).

Headlamp range adjustment (certain markets)

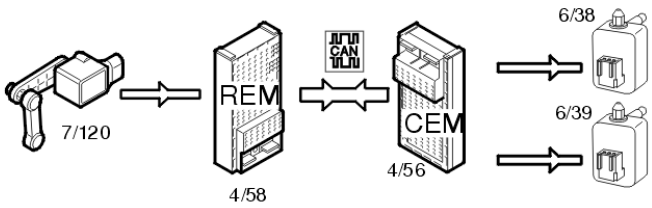


Headlamp range adjustment is controlled by the central electronic

module (CEM) (4/56). The central electronic module (CEM) communicates with the light switch module (LSM) (3/111) using serial communication.

If the thumb wheel in the light switch module (LSM) is turned, information about the position of the wheel is transmitted to the central electronic module (CEM). The central electronic module (CEM) transmits a pulse width modulation (PWM) signal to the actuator motors (6/38-39) with the pulse ratio set according to the position of the thumb wheel. The headlamp range can be adjusted in 16 stages.

Automatic range adjustment (Bi-Xenon)



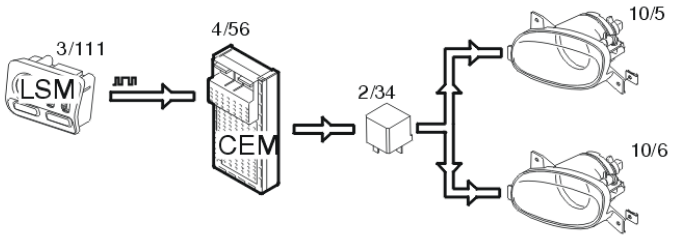
Automatic headlamp range adjustment is controlled by the central electronic module (CEM) (4/56). The position sensor (7/120) on the rear suspension transmits signals to the rear electronic module (REM) (4/58) about the angle of the car in

terms of the load conditions.

The rear electronic module (REM) transmits this data via the control area network (CAN) to the central electronic module (CEM) which compares the information with the table for the relevant model. The table is stored in the central electronic module (CEM).

The actuator motors (6/38-39) are then operated from the central electronic module (CEM) via a PWM signal, the pulse ratio of which depends on the angle the lamps need to be set to.

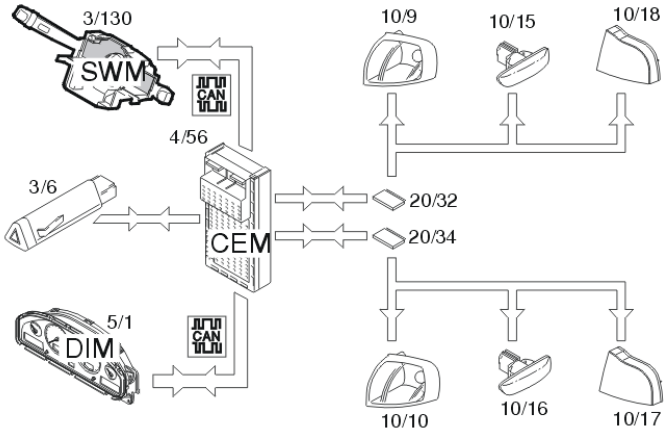
Front fog lamps



The front fog lamps (10/5-6) are activated by pressing the button for the front fog lamps in the light switch module (LSM) (3/111). The light switch module (LSM) transmits data to the central electronic module (CEM) (4/56) to light the lamps. The central electronic module (CEM) activates

the relay (2/34) and the bulbs are supplied with power via the relay.

Turn signal lamps / Hazard warning signal flashers



This function is controlled by the left control stalk. The steering wheel module (SWM) (3/130) sends data to the central electronic module (CEM) (4/56) to activate the turn signal lamps via the control area network (CAN). The central electronic module (CEM) transmits information to the driver information module (DIM) (5/1) to activate the turn signal indicator lamp and powers the turn signal lamp via a shunt (20/32, 20/34).

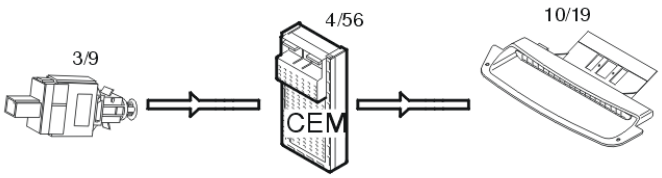
The power supply is pulsed and the turn signal lamps are activated 90 times per minute.

The hazard warning

signal flasher is activated by closing the switch (3/6) and transmits a signal to the central electronic module (CEM) to start the function. The central electronic module (CEM) transmits a signal in the same way as above, but to both sides. The central electronic module (CEM) also transmits a signal to the bulb in the switch to indicate that the hazard warning signal flashers are on. If the ignition key is in position I or II, there is a clicking sound from the driver information module (DIM). If the ignition is switched off, there is no sound, but the hazard warning signal flashers continue to flash.

If a fault occurs with a lamp, the central electronic module (CEM) detects the reduction in power consumption and the frequency is doubled on the side where the fault occurred.

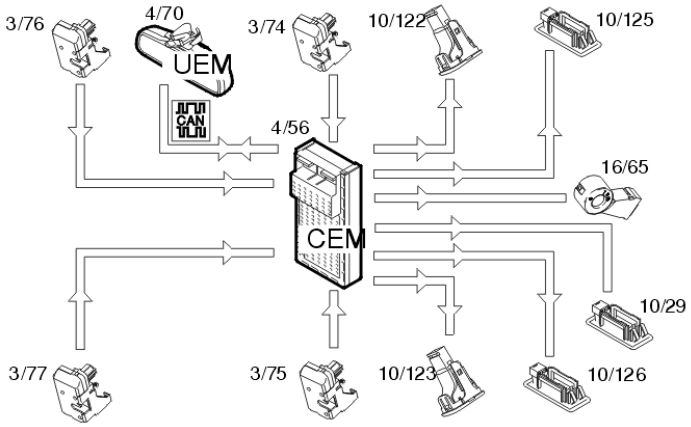
High-mounted stop lamp (S60/S80)



When the stop lamp switch (3/9) is closed, a

signal is transmitted to the central electronic module (CEM) (4/56). The high mounted stop lamp (10/19) is supplied with power directly from the central electronic module (CEM). The central electronic module (CEM) supplies power for as long as the stop lamp switch is closed.

Courtesy lighting / key lighting / glove compartment lighting



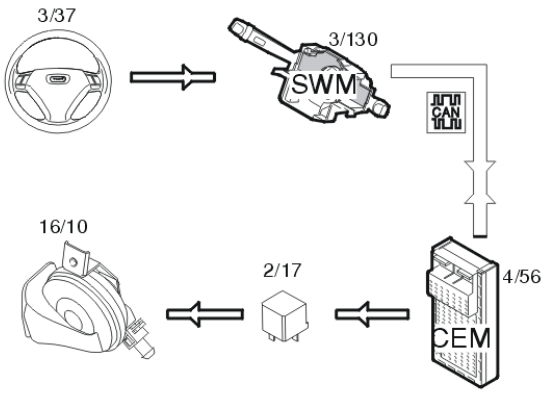
The courtesy lighting (10/122-123, 10/125-126), keyhole (16/65) and glove compartment lighting (10/29) are controlled via the central electronic module (CEM) (4/56). All other interior lighting is controlled by the upper electronic module (UEM) (4/70). (See Design and Function, upper electronic module (UEM)). The central electronic module (CEM) powers the lamps which it controls directly.

The lamps are powered

if a door is opened (3/74-77), or when the upper electronic module (UEM) transmits a request via the control area network (CAN). The upper electronic module (UEM) transmits a request when it has received an unlock command from one of the remote controls. If a door is opened, the central electronic module (CEM) sends a control area network (CAN) signal to the upper electronic module (UEM) to light the lighting it controls.

The glove compartment lighting (10/29) is supplied with power directly from the central electronic module (CEM) when the switch by the lamp is activated when the glove compartment is opened.

Horn

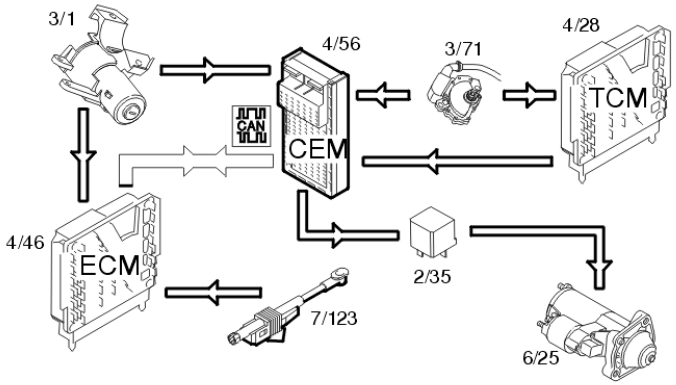


The horn is operated when the steering wheel module (SWM) (3/130) receives a signal from the switches (3/37) in

the steering wheel. The steering wheel module (SWM) sends data to the central electronic module (CEM) (4/56) via the control area network (CAN) indicating that the switch is closed. The central electronic module (CEM) activates the relay (2/17) for power supply to the horn.

There is also a signal directly connected from the steering wheel module (SWM) to the central electronic module (CEM). This is used if there is a fault in the control area network (CAN). This is a Limp-Home function.

Starter motor



Manual transmissions

The starter motor (6/25) is operated by turning the key in the ignition switch (3/1) to position III.

- For transmissions **with** a clutch interlock (certain

markets), a signal is transmitted from the ignition switch to the engine control module (ECM) (4/46). The engine control module (ECM) detects the position of the clutch pedal sensor (7/123). The engine control module (ECM) transmits data to the central electronic module (CEM) (4/56) via the control area network (CAN) about the position of the pedal. The central electronic module (CEM) requires a signal that the clutch is pressed down and that the key is in position III before it will send a signal to the relay (2/35). When the relay is activated, the solenoid in the starter motor is powered

- For transmissions **without** clutch interlock, the central electronic module (CEM) (4/56) activates relay 2/35 and powers the solenoid in the starter motor (6/25).

The starter motor turns for as long as the key is in position III. If the engine has been started once, there is a Limp Home function so that

the engine can be started again even if there is a fault in the control area network (CAN). This function is active for a brief period after the key is removed from the ignition switch. After this time the car will not start because there is no communication for the immobilizer between the central electronic module (CEM) and the engine control module (ECM).

Automatic transmission

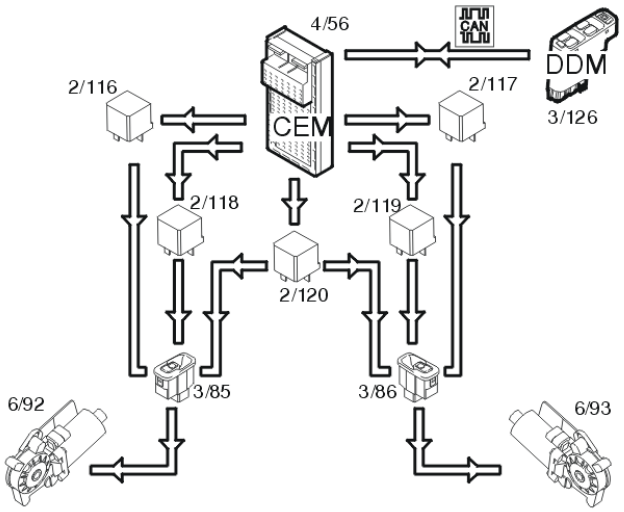
The starter motor (6/25) is operated by turning the key in the ignition switch (3/1) to position III.

- For transmission 4T65EV, a signal is transmitted from the gear-shift position sensor (3/71) via the transmission control module (TCM) (4/28) to the central electronic module (CEM) (4/56) indicating that the gear selector is in position P/N
- For AW transmissions the signal is transmitted directly from the gear-shift position sensor to the central electronic module (CEM). The central electronic module (CEM) requires

this signal and a signal indicating that the key is in position III before it will send a signal to the relay (2/35). When the relay is activated, the solenoid in the starter motor is powered.

The starter motor turns for as long as the key is in position III. If the engine has been started once, there is a Limp Home function so that the engine can be started again even if there is a fault in the control area network (CAN). This function is active for a brief period after the key is removed from the ignition switch. After this time the car will not start because there is no communication for the immobilizer between the central electronic module (CEM) and the engine control module (ECM).

Rear window lift mechanisms/child lock



The rear window lift mechanisms are operated using switches (3/85-86) in the door panels. Relays 2/116 or 2/118 for the left-hand side and relays 2/117 or 2/119 for the right-hand side are activated in the central electronic module (CEM) (4/56) depending on whether the window is to move up or down.

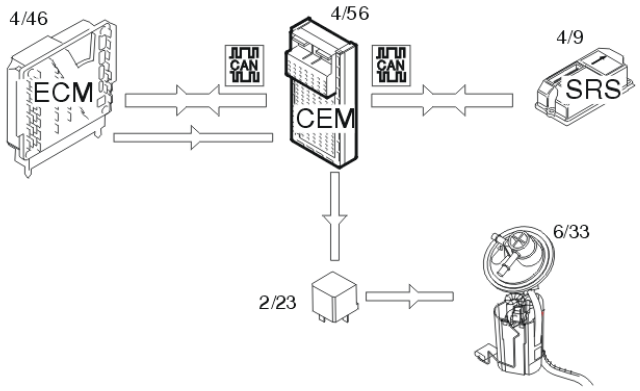
When the window lift mechanisms are operated from the driver's position, data is transmitted from the driver's door module (3/126) via the control area network (CAN) to the central electronic module (CEM) which transmits a signal to the correct relay.

There is a switch in the driver's door module (DDM) to allow for child locking, where the windows can only be operated from the

driver's position. When this is active, data is transmitted via the control area network (CAN) to the central electronic module (CEM) to disconnect relay 2/120. This breaks the circuit for the rear switches.

When the child lock is activated, the lighting in the rear switches goes out.

Fuel pump



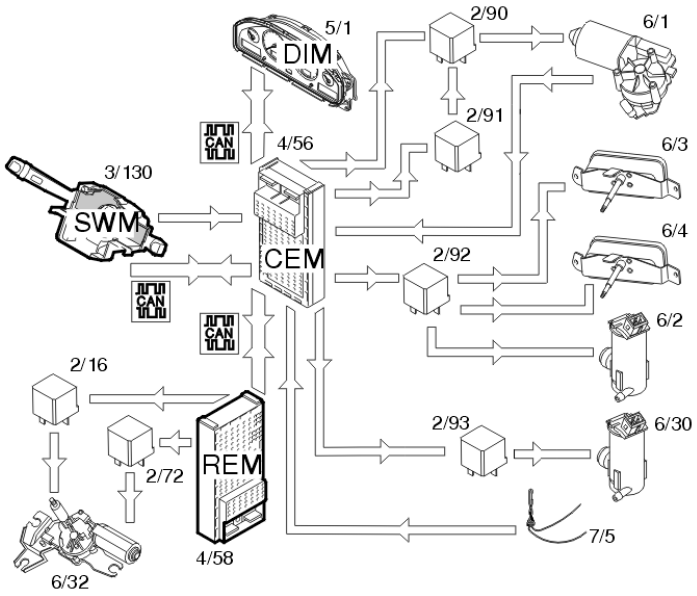
The central electronic module (CEM) (4/56) receives a request from the engine control module (ECM) (4/46) via the control area network (CAN) to start the fuel pump (FP) (6/33). The central electronic module (CEM) then activates the relay (2/23) which supplies the fuel pump with power.

In the event of a collision in which the airbags are deployed, a signal is transmitted

from the supplemental restraint system (SRS) module (4/9) via the control area network (CAN) to the central electronic module (CEM) which deactivates the relay for the fuel pump.

If the control area network (CAN) is not functioning, a pulsed signal to control the fuel pump (FP) is transmitted from the engine control module (ECM) to the central electronic module (CEM) via a directly connected cable.

Wiper / washers for the windshield and headlamps



The right-hand control stalk is moved downwards through three positions to operate the windshield wipers. The steering wheel module (SWM) (3/130) transmits

information via the control area network (CAN) to the central electronic module (CEM) (4/56) about the selected position. The central electronic module (CEM) then activates relay 2/91 which supplies the wiper motor (6/1) with power in position 1. If high speed wiping is selected, relay 2/90 is also activated to power the motor in position 2.

The central electronic module (CEM) receives a signal from the motor when the wipers are in the parked position so that the wipers can be stopped in the correct position.

For intermittent wiping, the process is the same as for low speed, but the time between each stroke is set using the ring on the control stalk to one of eight positions between 1 and 27 seconds. The central electronic module (CEM) controls this once it has received information about intermittent wiping from the steering wheel module (SWM) via the control area network (CAN).

The windshield and headlamps are washed when the right-hand control stalk is moved towards the steering wheel. The steering wheel module (SWM)

transmits information to the central electronic module (CEM) via the Control area network (CAN) to activate washing. The central electronic module (CEM) activates the relay 2/92 which powers the pump motor (6/2) and wiper motors (6/3-4) for the headlamps.

The central electronic module (CEM) receives a signal from the level sensor (7/5) in the windshield washer reservoir so that it can check the windshield washer reservoir level. The switch in the level sensor closes if the level falls below one liter. The central electronic module (CEM) sends the signal to Driver information module (DIM) (5/1) via the controller area network (CAN). The driver information module (DIM) displays a text message indicating that the windshield washer fluid needs to be topped up.

The tailgate wiper (6/32) (V70/V70XC) is controlled by the rear electronic module (REM) (4/58). The rear electronic module (REM) receives a control area network (CAN) signal from the steering wheel module (SWM) via the central electronic module (CEM). The rear electronic module (REM) then powers relay 2/16

to start the tailgate wiper. The tailgate wiper is powered via relay 2/72.

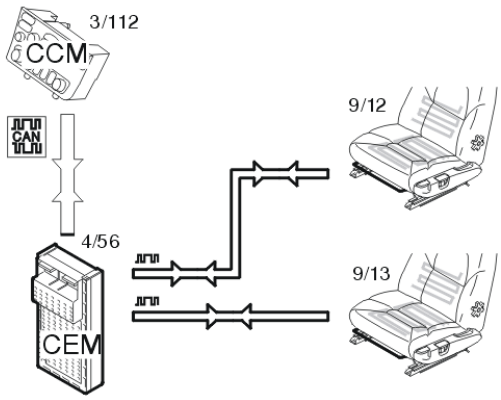
The tailgate wiper can be programmed so that it is activated if the windshield wipers are on and back-up gear is selected.

Rear windshield cleaning is activated when the right-hand control stalk is pushed away from the steering wheel. The steering wheel module (SWM) sends signals via the control area network (CAN) to the central electronic module (CEM) to activate rear windshield washing. The central electronic module (CEM) activates relay 2/93 to power the pump motor (6/30). At the same time the rear electronic module (REM) activates the tailgate wiper.

The wipers only operate at low speed if there is a fault in the control area network (CAN). If this is the case, the central electronic module (CEM) receives a directly connected signal from the steering wheel module (SWM).

There is no Limp Home function for the rear windshield washer and wiper.

Heated seats (certain markets)

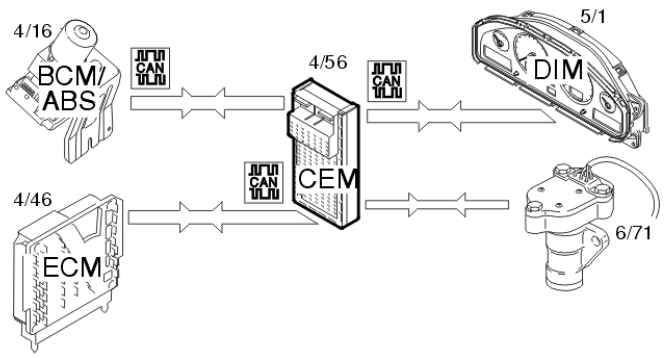


The seat heaters are activated by pressing the switch to the right of the climate control module (CCM) (3/112). If the switch is pressed once, they are activated at high temperature. Pressing again will activate low temperature. Pressing a third time switches the heaters off.

The climate control module (CCM) transmits information via the control area network (CAN) to the central electronic module (CEM) (4/56) to activate the seat heaters. The central electronic module (CEM) sends back a signal to the climate control module (CCM) to light the LED in the button. The central electronic module (CEM) compares the signal from the climate control module (CCM) with the programmed value for

high/low temperature and transmits a pulsed signal to the control module for the seat heater (9/12-13) about the requested temperature. The number of pulses determines the power at which the control module will operate the seat heater. The control module also compares the value from the thermistor so that it can detect faults in the heater pad.

Speed sensitive power steering



The central electronic module (CEM) (4/56) receives data from the engine control module (ECM) (4/46) via the control area network (CAN) that the engine is running and information from the ABS system (4/16) about the speed of the car. From model year 2001 the ABS module is called the brake control module (BCM). The central electronic module (CEM) then operates the stepper motor (6/71) via the four outputs to

set the stepper motor to the correct servo assistance level.

The central electronic module (CEM) checks the signals. If a fault is detected, the servo assistance is set to normal (≈70km/h) and the system is disengaged. The central electronic module (CEM) also transmits a signal to the driver information module (DIM) (5/1) via the control area network (CAN) which lights the general warning lamp and displays a text message.

9/9/2010 PRINT

09: Central electronic module (CEM)

XC90, 2003, L.H.D

9/9/2010

PRINT

09: Central electronic module (CEM)

Alarm

Automatic range adjustment (Bi-Xenon)

Central locking

Courtesy lighting / key lighting / glove compartment lighting

Front fog lamps

Fuel pump

Headlamp range adjustment (certain markets)

Headlamps

Heated seats (certain markets)

High-mounted stop lamp (S60/S80)

Horn

Immobilizer

Parking lights / license plate lighting

Rear window lift mechanisms

Speed sensitive power steering

Starter motor

Turn signal lamps / Hazard warning signal flashers

Washer / wipers

Design

Alarm

See Design and Function, Alarm.

Central locking

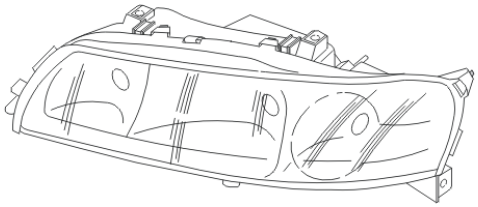
See Design and

Function, Central locking.

Immobilizer

See Design and Function, Immobilizer.

Headlamps



The headlamps at the front of the car are operated by the light switch module (LSM) which is positioned on the dashboard to the left of the steering wheel. The signals between the light switch module (LSM) and the central electronic module (CEM) are transmitted via serial communication. Low and high beam are operated by moving the left-hand control stalk towards the steering wheel.

The power supply for the lamps is via two directly connected relays on the central electronic module (CEM). One relay is for low beam and the other for high beam. The power supply for low beam is also via a shunt so that faults in the lamp can be detected.

For Bi-Xenon lamps the reflector in the lamp housing is moved by an actuator motor when changing between high and low beam. The actuator motor is integrated in the lamp housing.

There are three versions of the light switch function. These are programmed using the diagnostic tool:

- Low beam in all switch positions except the parking light position (flex zero)
- The light switch functioning on the basis of: off, parking light, low beam (flexsted)
- Low beam always on regardless of the position of the light switch (flexlgt).

To detect problems with the low beam, the central electronic module (CEM) reads the power consumption of the circuit. If this falls below a certain threshold value a fault will be indicated. The general warning lamp lights in the driver information module (DIM) and a text message is displayed.

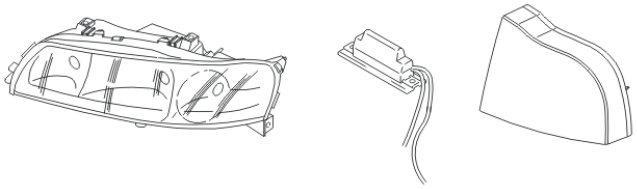
For Bi-Xenon lamps there is a connection

from the actuator motor to the central electronic module (CEM). In the event of incorrect values, the central electronic module (CEM) lowers the length of the beam using the headlamp range adjustment function.

There are diagnostics for the light switch and the relays.
There are also diagnostic for the high and low beam function (actuator motor) for Bi-Xenon lamps.

For further information about Bi-Xenon lamps, see Design and Function, Gas discharge lamps (GDL).

Parking lights / license plate lighting

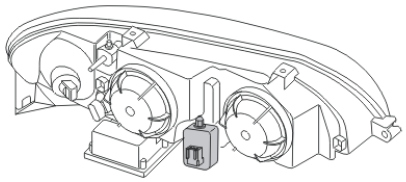


There are a number of lamps positioned around the car to mark its position. These are in the headlamps, tail lamps and on the front fenders (US model). The lamps light together with the license plate lighting when the light switch module (LSM) is in parking lamp mode or low beam is on.

The lamps are powered via a directly connected relay on the central electronic module (CEM). The rear parking lamps are supplied with power via two shunts (mounted on the rear electronic module (REM)), one for each side. This is so that the power consumption can be monitored and any fault in the lamps detected. The faults are detected by the rear electronic module (REM).

There are diagnostics for the relay, the rear parking lamps (via the rear electrical module (REM)) and the light switch.

Headlamp range adjustment (certain markets)



There are two motors on the reverse of the headlamps. These angle the headlamps upwards or downwards to control the range of the beam.

The motors are controlled by a thumb wheel which is located in the light switch module (LSM) on the

left of the dashboard. If the thumb wheel is turned, information is transmitted to the motors which adjust the headlamps accordingly.

There are diagnostics for the headlamp range adjustment.

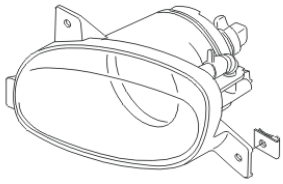
Automatic range adjustment (Bi-Xenon)

There are two motors on the reverse of the headlamps. These angle the headlamps upwards or downwards to control the range of the beam.

The motors are controlled by signals from a position sensor at the rear axle. The sensor detects the angle of the car under different load conditions and sends this information so that the central electronic module (CEM) can determine whether the lamps need to be raised or lowered.
For further information about the inner roof lighting, see Design and Function, rear electronic module (REM).

There are diagnostics for the headlamp range adjustment.

Front fog lamps

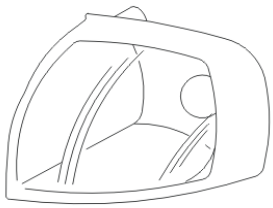


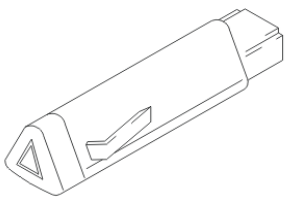
If the car has front fog lamps, these are in the bumper casing below the headlamps.

The fog lamps are operated via a button in the light switch module (LSM). An LED in the button lights when the fog lamps are activated. The light switch transmits data via serial communication to the central electronic module (CEM). The lamps are powered via a directly connected relay on the central electronic module (CEM).

There are diagnostics for the fog lamp relay.

Turn signal lamps / Hazard warning signal flashers





There are six lamps around the car to indicate direction

changes. These are located in the front and rear lights and on the sides of the car in front of the front doors.

The turn signal lamps are operated using the left-hand control stalk.

To cancel the hazard warning signal flashers, where all the turn signal lights flash, press in the button for the hazard warning signal flasher. This is positioned in the middle of the dashboard by the center air vents.

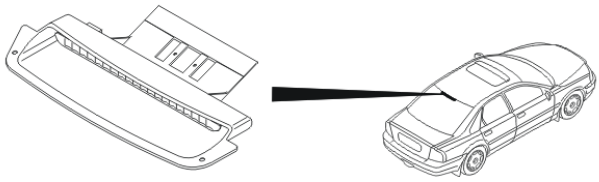
The central electronic module (CEM) supplies the lamps with power via two shunts. These are located on the relay box by the central electronic module (CEM). A signal is also sent to the bulb in the hazard warning signal flasher switch when this function is activated.

The central electronic module (CEM) monitors the power consumption on each side to check for bulb faults. If the power consumption falls below a certain threshold value, a fault is indicated and the frequency of the signal to the bulbs is doubled on the side of the blown lamp.

There are diagnostics

for the shunts.

High-mounted stop lamp (S60/S80)

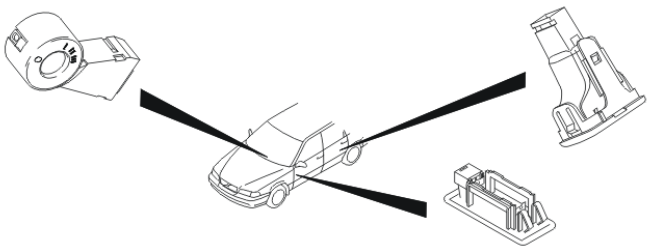


There is a high-mounted stop lamp above the rear windshield. This lamp lights during braking together with the standard stop lamps. It is activated when the switch on the brake pedal is closed.

The high level stop lamp is powered directly from the central electronic module (CEM). The lamp consists of a number of LEDs.

There are diagnostics for the high level stop lamp.

Courtesy lighting / key lighting / glove compartment lighting



There are various lamps

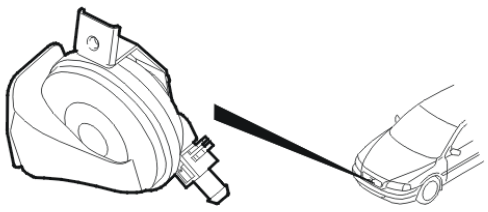
inside the passenger compartment, such as the courtesy lighting and glove compartment lighting for example. There are also LEDs around the keyhole in the ignition switch.

The lamps for the courtesy lighting are in the soundproofing panels on the driver and passenger sides. For the backseat the lamps are in the doors (not V70/V70XC). The lamp for the glove compartment is positioned on the left-hand inner side.

The lighting time can be programmed via the upper electronic module (UEM). For further information, see Design and Function, upper electronic module (UEM).

There are only diagnostics for the keyhole lighting.

Horn



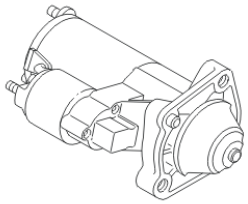
There are two horns in front of the radiator. There are four switches in the steering wheel.

The horn is activated when one of these is closed.
The signal continues for as long as the switch is closed.
The horn is also activated when the panic alarm button on the remote control is pressed (certain markets).

The power supply to the horns is via a relay in the relay box in the engine compartment.

There are diagnostics for the relay for the horn.

Starter motor



The starter motor is on the left-hand side of the engine by the air cleaner (ACL) housing. The starter motor is powered directly from the battery. There is a solenoid on the starter motor to close the circuit. The central electronic module (CEM) activates a relay in the relay box in the engine compartment to act on the solenoid. This supplies the solenoid with power and closes the circuit for the

starter motor.

The starter motor turns when the key is turned to position III in the ignition switch.

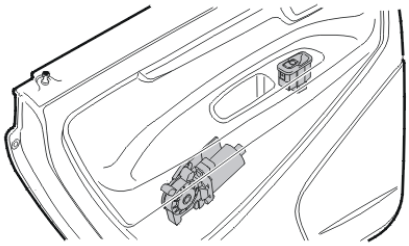
There are different functions which prevent starting, depending on whether the car has an automatic or manual transmission. The central electronic module (CEM) also has an electronic immobilizer function which communicates with a transponder in the key. For further information about electronic immobilizers, see Design and Function, Electronic immobilizer.

- Cars with manual gearboxes have a sensor in the clutch pedal. The clutch pedal must be depressed to allow starting (certain markets)
- In cars with type 4T65EV automatic transmissions, a signal is transmitted from the gear-shift position sensor to the transmission control module (TCM) which then sends a directly connected signal to the central electronic module (CEM)
- In cars with AW automatic transmissions, a

directly connected signal is transmitted directly from the gear-shift position sensor to the central electronic module (CEM).

There are diagnostics for the relay for the starter motor.

Rear window lift mechanisms



The rear side windows are operated by motors in the doors. The switches for operating the windows are in the door panels. The windows can also be operated from the driver's door module (DDM).

The function is controlled by five relays on the central electronic module (CEM). Depending on whether the control switch is moved up or down, the relays are activated to carry out the requested operation.

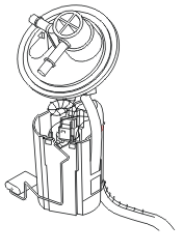
Two relays guide the window up on the right and left-hand sides. Two different relays

guide the window down. A further relay controls the power supply.

When operated from the driver's position, information is transmitted via the controller area network (CAN) from the driver's door module (DDM) to the central electronic module (CEM) which sends out signals to the relays.

There are diagnostics for the relays for the rear window lift mechanisms.

Fuel pump



The fuel pump (FP) is located on the inside of the fuel tank on the right-hand side. The pump is checked by the central electronic module (CEM) which operates a relay. This relay controls the power supply to the pump and is directly connected to the central electronic module (CEM).

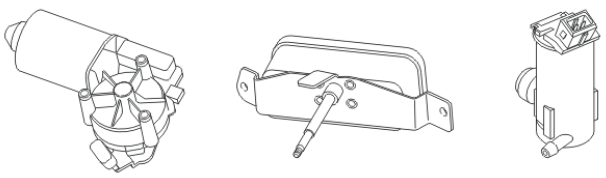
The central electronic module (CEM) uses the controller area network (CAN) to communicate

with the engine control module (ECM) to control the fuel pump (FP). There is also a hardwire connection between the engine control module (ECM) and the central electronic module (CEM). This is used to transmit a pulsed signal to operate the fuel pump (FP). This allows the pump to function if there is a fault in the controller area network (CAN).

The central electronic module (CEM) also communicates with the supplemental restraint system (SRS) module via the controller area network (CAN). In the event of a collision, the supplemental restraint system module (SRS) transmits data and the central electronic module (CEM) shuts off the fuel pump (FP).

There are diagnostics for the input signal from the engine control module (ECM) and for the relay for the fuel pump (FP).

Washer / wipers



The windshield wipers

are powered by a motor positioned under the cowl. There are also headlamp wipers. There are also washer nozzles on the hood and bumper cover for cleaning the windshield and headlamps. The washer nozzles are connected to a pump motor on the windshield washer reservoir at the front right of the engine compartment.

For cars with five doors, there is a wiper and washer nozzle for the rear windshield. The washer nozzle is connected to a separate pump on the windshield washer reservoir.

The windshield wipers are operated using the right-hand control stalk. There are three positions: intermittent, low speed and high speed. The time between strokes for intermittent wiping is adjusted using a ring on the control stalk.

Pull the control stalk towards the steering wheel to clean the windshield. The washer and wipers for the headlamps are activated at the same time. The headlamp wipers operate for as long as washing is activated. They are not activated when only the windshield wipers are activated.

Push the control stalk away from the steering wheel to clean the rear windshield. There is a button at the end of the control stalk to control the rear wiper.

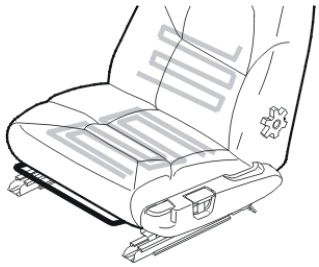
Information about the position of the control stalk is transmitted to the central electronic module (CEM) on the controller area network (CAN). The central electronic module (CEM) also receives a signal from the wiper motor if the wipers are in the park position.

The central electronic module (CEM) also monitors the windshield washer reservoir level via a level sensor in the reservoir. The switch in the level sensor closes if the level falls below one liter. A text message indicating that the windshield washer fluid needs to be topped up then lights in the driver information module (DIM).

The power supply for the rear windshield wiper is via a directly connected relay on the rear electronic module (REM). Other wipers and the washer motors are supplied with power via relays in the engine compartment.

There are diagnostics for the windshield wipers.

Heated seats (certain markets)



There are heater pads in the cushions and backrests to warm the seats. These are controlled by a control module under the seat. A thermistor on the heater pad detects the heat level.

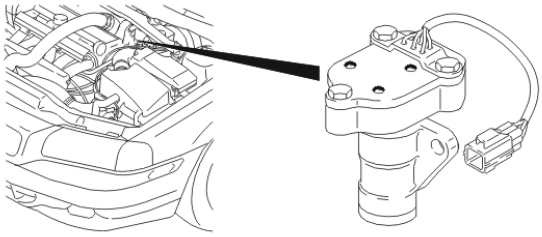
The information between the control module and the central electronic module (CEM) is transmitted using serial communication. This data contains status information, diagnostic information and signals to control the heat level.

The seat heaters are operated using a switch to the right of the climate control module (CCM). The heat can be set to high or low. These temperatures can be programmed using the diagnostic tool.

There are diagnostics

for the seat heaters.

Speed sensitive power steering



If the car has speed dependent power steering to control the steering assistance, there is a stepper motor which controls a hydraulic valve on the steering gear.

The stepper motor is operated by the central electronic module (CEM) and checked via four outputs in the central electronic module (CEM). Signals are transmitted from the central electronic module (CEM) to set the motor to the correct position for the speed of the car. The motor deploys the valve on the steering gear to the required degree and regulates the oil in the steering gear to reduce or increase the servo assistance. The steering assistance increases at lower speeds and is reduced at higher speeds.

There are diagnostics for the power steering.

9/9/2010 PRINT

2006 XC90 CEM
(Design and Function Information)

VIDA 2010CU1
September 9, 2010

09: Central electronic module (CEM)

XC90, 2006, L.H.D

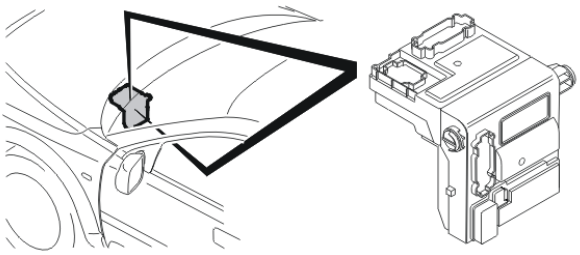
9/9/2010

PRINT

09: Central electronic module (CEM)

System overview

Control module



The role of the central electronic module (CEM) is to control the controller area network (CAN) and to act as a bridge between the low and high speed sections of the controller area network (CAN) and the data link connector (DLC).
It also manages the following functions:

- Alarm (certain functions)
- Locks (certain functions)
- Immobilizer
- Headlamps
- Front parking lamps
- Front fog lamps
- Headlamp range adjustment (certain markets)
- Automatic range adjustment (Bi-Xenon)
- Turn signal lamps
- Courtesy lighting /

09: Central electronic module (CEM)

XC90, 2006, L.H.D

9/9/2010

PRINT

09: Central electronic module (CEM)

Downloading software and replacing the control module

New software can be downloaded into the central electronic module (CEM). When ordering software, the hardware and the software in the car is compared to the information in the Volvo central database. If the comparison is OK the software is downloaded to the control module. The PINs for the existing remote controls are downloaded at the same time.

If the comparison between the car and Volvo central database is not OK, the database is updated with the car configuration. When this is complete the software is downloaded.

When installing a completely new central electronic module (CEM) in the vehicle, the PIN codes are downloaded into the control module (when downloading software) for the following:

- central electronic

module (CEM)
- immobilizer
- transponder (key).

The PIN codes are loaded automatically during the ordering process in VIDA. The PIN codes are retrieved from the Volvo Central Database and sent with the software package when software is ordered for the new control module.

The central electronic module (CEM) is to the left of the steering column under the dashboard. The entire control module is removed from the car during replacement.

Because of the unique PIN codes, the central electronic module (CEM) cannot be moved between cars.

Five customer parameters (six for 5 door cars) can be programmed into the central electronic module (CEM). These customer parameters are stored in the control module but not in the Volvo central database. This means that the customer parameters must be reprogrammed when hardware is replaced.

The customer

parameters which can be programmed are:

- **Approach lights.** The approach lights can be programmed to stay on for a longer or shorter time according to the wishes of the customer. The factory setting is 30 seconds. The time can be set to 0, 30, 60 or 90 seconds
- **Security lighting.** The security lighting can be programmed to stay on for a longer or shorter time according to the wishes of the customer. The factory setting is 30 seconds. The time can be set to 0, 30, 60 or 90 seconds
- **Automatic locking.** If this function is activated, the side doors lock when the speed exceeds 7 km/h (5 mph). Selectable values: On / off
- **Locking acknowledgement via the turn signal lamps.** If this function is activated, the turn signal lamps flash when the car is locked and unlocked. Selectable values: On / Off
- **Tailgate wiper (certain models).** The tailgate wiper function can be programmed in two ways:

1. The tailgate wiper can only be activated manually
2. The tailgate wiper can be activated automatically when back-up (reverse) gear is selected and the front wipers are activated.

For more information about lock and alarm functions, see Design and Function, Central locking and Design and Function, Alarm.

9/9/2010 PRINT

09: Central electronic module (CEM)

XC90, 2006, L.H.D

9/9/2010

PRINT

09: Central electronic module (CEM)

Additional heater

Additional heater and parking heater

Alarm

Automatic range adjustment (Bi-Xenon)

Blind spot information system (BLIS)

Central locking

Charge voltage

Controlling functions and menu selection using the steering wheel buttons

Courtesy lighting / key lighting / glove compartment lighting

Current limiting

Description of function of the operating status of the heater

Electrical heater with timer function

Front fog lamps

Front parking lamps

Fuel driven parking heater

Fuel level (Gasoline/Diesel)

Fuel pump

Generator (GEN) (Alternator control module (ACM))

Headlamp range adjustment (certain markets)

Headlamps

High level stop lamp

Horn

Immobilizer

Residual heater

Speed sensitive power steering

Starter motor

Starting the heater remotely

Trip computer and displaying/erasing text messages

Turn signal lamps / Hazard warning signal flashers

Wipers / washers

Function

Alarm

See Design and Function, Alarm.

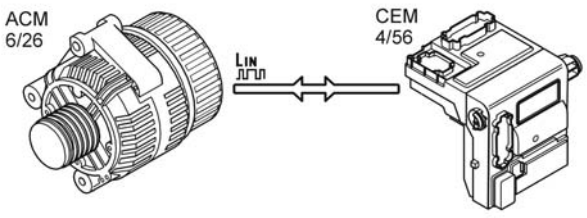
Central locking

See Design and Function, Central locking.

Immobilizer

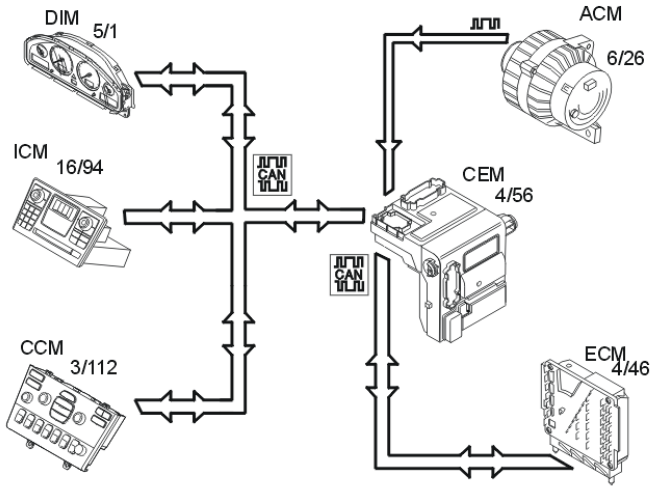
See Design and Function, Immobilizer.

Generator (GEN) (Alternator control module (ACM))



See Design and Function, Generator (GEN).

Current limiting



The central electronic module (CEM) (4/56) communicates with the alternator control module (ACM) (6/26) via LIN-communication. In this way the central electronic module (CEM) receives information about how much current the generator produces and how much current can be used for the various loads in the vehicle.
The central electronic module (CEM) uses the prevailing outside temperature to calculate the voltage at which the battery should be charged. Under certain conditions the generator cannot produce enough current for those loads which are connected. The central electronic module (CEM) communicates with the climate control module (CCM) (3/112) which then completely or partially switches off the following loads:

- electrical

additional heater
- rear demist
- electrically heated seats
- heated door mirrors.

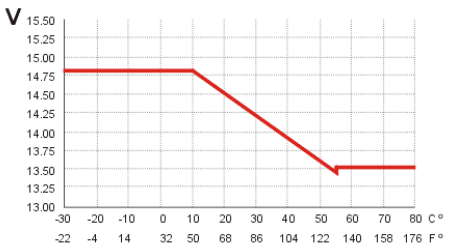
The central electronic module (CEM) also transmits a request via the Control area network (CAN) to the engine control module (ECM) to increase the engine idle speed.

When the engine is not running all current is taken from the battery. There are a number of different loads which can be activated when the engine is not running, for example the infotainment system (XC90). The central electronic module (CEM) continuously monitors the voltage level of the battery. When the voltage level is too low the central electronic module (CEM) transmits information to the infotainment control module (ICM) (16/1) which then shuts off the infotainment system. In the event of a fault, the central electronic module (CEM) transmits data via the Control area network (CAN) to the driver information module (DIM) (5/1) which displays a text message to the user.

If the infotainment system used in key position II, when the engine is not running,

the information is sent to the driver information module (DIM). A message is displayed if the infotainment system is switched off for 2 minutes.

Charge voltage



To charge the battery optimally the central electronic module (CEM) calculates the output voltage from the generator (GEN) using the temperature of the battery. The alternator control module (ACM) controls the output voltage, depending on the control from the central electronic module (CEM). See the illustration above. In some driving conditions for example, the engine control module (ECM) is able to affect generator (GEN) control, whereby the output voltage will deviate from the above.

Controlling functions and menu selection using the steering wheel buttons

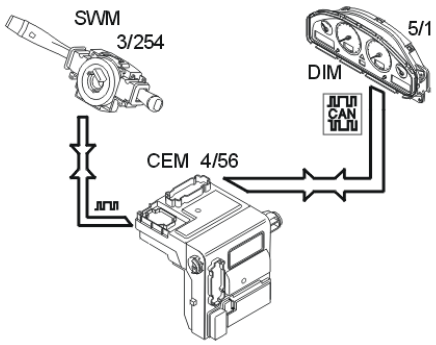
See:

- Design and Function, audio module (AUM)

Applies to the S60, V70, XC70 and S80

- Design and Function, Road traffic information system (RTI). Applies to the S60, V70, XC70 and S80
- Design and Function, multimedia module (MMM). Applies to XC90
- Design and Function, engine management system
- Design and Function, phone module (PHM).

Trip computer and displaying/erasing text messages



The left-hand control stalk is used to control the trip computer and to display and erase text messages in the driver information module (DIM) (5/1). The steering wheel module (SWM) (3/254) transmits data to the central electronic module (CEM) using LIN communication to indicate the selected function. The central electronic module (CEM)

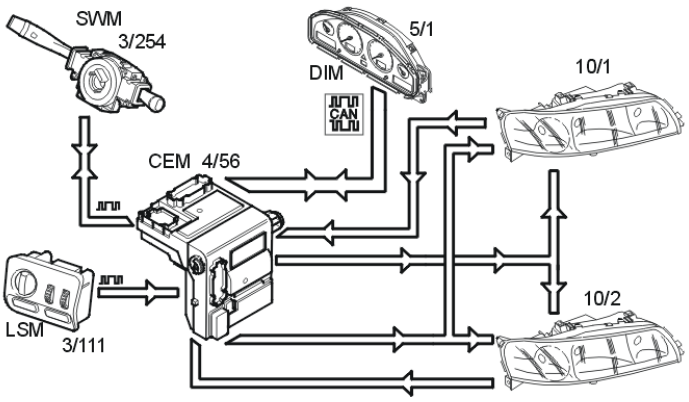
(4/56) forwards this data to the driver information module (DIM) via the CAN network.

The trip computer menu is controlled using the ring on the left-hand control stalk. Turn the ring forwards or backwards to scroll through the menu one step at a time. Some menu selections, such as average speed and fuel consumption, can be reset using the RESET button.

Error messages displayed in the driver information module (DIM) display are erased using the READ button.

For additional information about the trip computer and text messages, see Design and Function, driver information module (DIM).

Headlamps



Depending on the position of the knob, the light switch module (LSM) (3/111) transmits information via serial communication to the central electronic module (CEM) to turn on low beam. The central electronic module (CEM) (4/56) then transmits a control signal to activate the low beam relay. The bulbs are then supplied with power.

To change to high beam, the left-hand control stalk is pulled towards the steering wheel. The serial communication signal from the steering wheel module (SWM) (3/254) is transmitted to the central electronic module (CEM) which activates the high beam relay and supplies power to the high beam. For Bi-Xenon lamps, the position of the reflector is also changed so that the Xenon lamp is on at high beam.

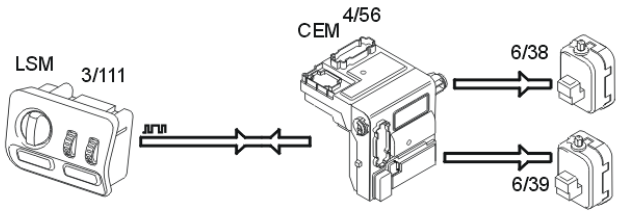
The central electronic module (CEM) also transmits a CAN signal to the driver information module (DIM) (5/1) to light the indicator lamp for high beam.

There is a Limp Home function which ensures

that low beam still works if there is a fault in the control area network (CAN). For Bi-Xenon lamps the beam is then set to the shortest range.

For further information about Bi-Xenon lamps, see Design and Function, Gas discharge lamps (GDL).

Headlamp range adjustment (certain markets)

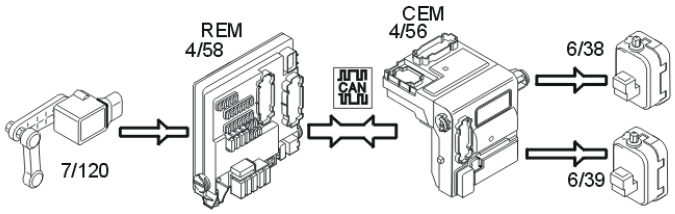


Headlamp range adjustment is controlled by the central electronic module (CEM) (4/56). The central electronic module (CEM) communicates with the light switch module (LSM) (3/111) using serial communication.

If the thumb wheel in the light switch module (LSM) is turned, information about the position of the wheel is transmitted to the central electronic module (CEM). The central electronic module (CEM) transmits a pulse width modulation (PWM) signal to the actuator

motors (6/38-39) with the pulse ratio set according to the position of the thumb wheel. The headlamp range can be adjusted in 16 stages.

Automatic range adjustment (Bi-Xenon)



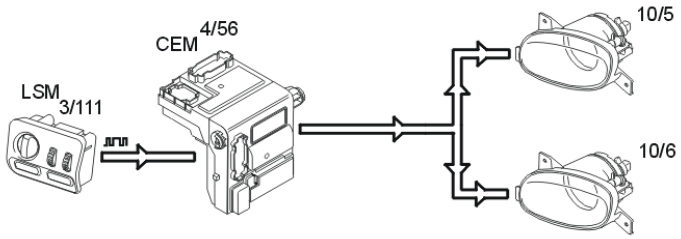
Automatic headlamp range adjustment is controlled by the central electronic module (CEM) (4/56). The position sensor (7/120) on the rear suspension transmits signals to the rear electronic module (REM) (4/58) about the angle of the car in terms of the load conditions.

The rear electronic module (REM) transmits this data via the control area network (CAN) to the central electronic module (CEM) which compares the information with the table for the relevant model. The table is stored in the central electronic module (CEM).

The actuator motors (6/38-39) are then

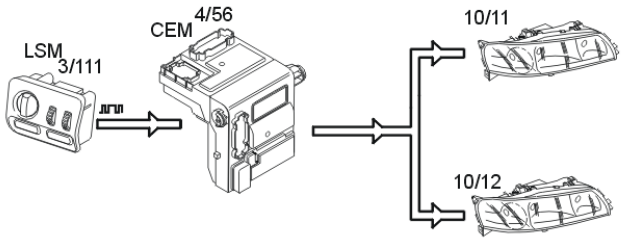
operated from the central electronic module (CEM) via a PWM signal, the pulse ratio of which depends on the angle the lamps need to be set to.

Front fog lamps



The front fog lamps (10/5-6) are activated by pressing the button for the front fog lamps in the light switch module (LSM) (3/111). The light switch module (LSM) transmits data to the central electronic module (CEM) (4/56) to light the lamps. The central electronic module (CEM) activates the relay and the bulbs are supplied with power via the relay.

Front parking lamps



Parking lamps (10/11-12) light when:

- the knob in the light switch module (LSM)

(3/111) is in the low beam position
- the knob in the light switch module (LSM) is in the parking lamp position
- low beam is lit via the low beam automatic function.

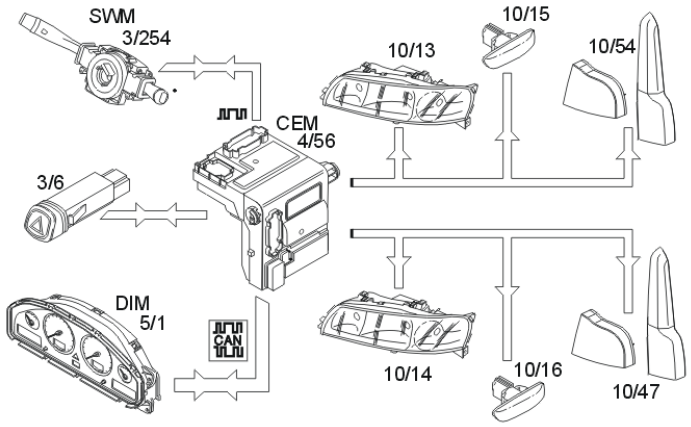
The lamp switch module (LSM) transmits data using serial communication to the central electronic module (CEM) (4/56) to activate the lamps.

The lamps are supplied with power via a relay which is activated by the central electronic module (CEM). The front parking lamps have a direct power supply.

The rear parking lamps and license plate lighting are powered by the rear electronic module (REM). For further information, see Design and Function, rear electronic module (REM).

There is a Limp Home function for the parking lamps so that they will work even if there is a fault in the control area network (CAN) or in the serial communication between the light switch module (LSM) and the central electronic module (CEM).

Turn signal lamps / Hazard warning signal flashers



This function is controlled by the left control stalk. The steering wheel module (SWM) (3/254) sends data to the central electronic module (CEM) (4/56) to activate the turn signal lamps via serial communication. The central electronic module (CEM) transmits information to the driver information module (DIM) (5/1) to activate the turn signal indicator and powers the turn signal lamp.

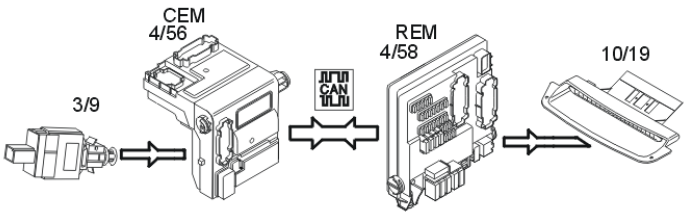
The power supply is pulsed and the turn signal lamps are activated 90 times per minute.

The hazard warning signal flasher is activated by closing the switch (3/6) and transmits a signal to the central electronic module (CEM) to start

the function. The central electronic module (CEM) transmits a signal in the same way as above, but to both sides. The central electronic module (CEM) also transmits a signal to the bulb in the switch to indicate that the hazard warning signal flashers are on. If the ignition key is in position I or II, there is a clicking sound from the driver information module (DIM). If the ignition is switched off, there is no sound, but the hazard warning signal flashers continue to flash.

If a fault occurs with a lamp, the central electronic module (CEM) detects the reduction in power consumption and the frequency is doubled on the side where the fault occurred.

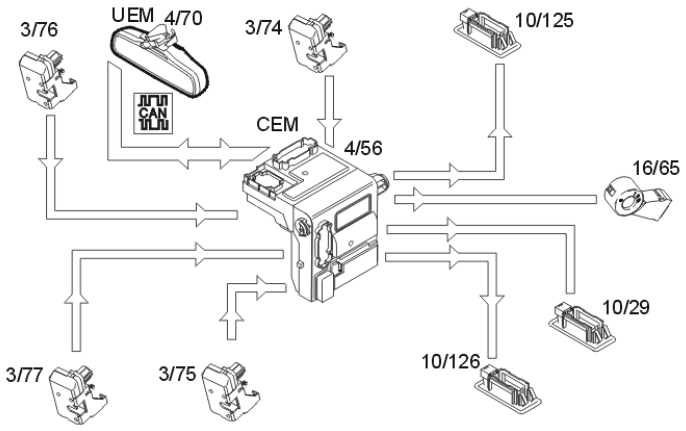
High level stop lamp



For further information about the high level stop (brake) lamps, see Design and Function, rear electronic module (REM).

Courtesy lighting /

key lighting / glove compartment lighting



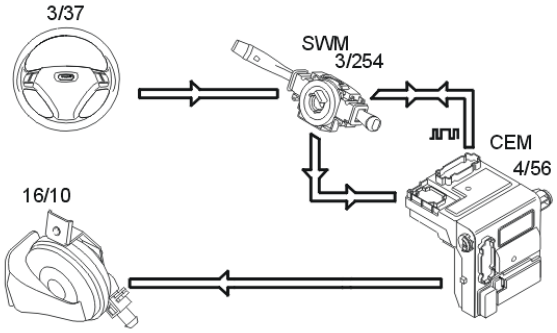
The courtesy lighting (10/125-126), ignition switch (16/65) and glove compartment lighting (10/29) are controlled via the central electronic module (CEM) (4/56). All other interior lighting is controlled by the upper electronic module (UEM) (4/70). (See Design and Function, upper electronic module (UEM)). The central electronic module (CEM) powers the lamps which it controls directly.

The lamps are powered if a door is opened (3/74-77), or when the upper electronic module (UEM) transmits a request via the control area network (CAN). The upper electronic module (UEM) transmits a request when it has received an unlock command from one of the remote controls. If a door is opened, the central electronic module (CEM) sends a control area network

(CAN) signal to the upper electronic module (UEM) to light the lighting it controls.

The glove compartment lighting (10/29) is supplied with power directly from the central electronic module (CEM) when the switch by the lamp is activated when the glove compartment is opened.

Horn

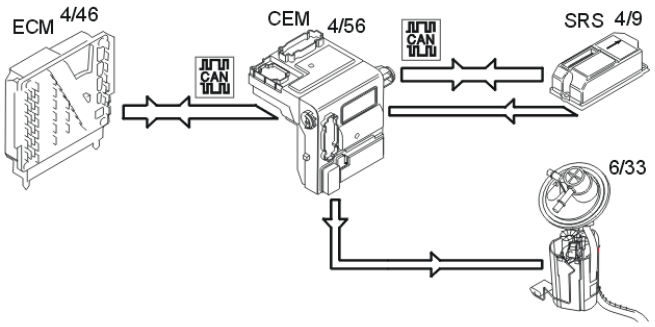


The horn is operated when the steering wheel module (SWM) (3/254) receives a signal from the switches (3/37) in the steering wheel. The steering wheel module (SWM) sends data to the central electronic module (CEM) (4/56) via serial communication indicating that the switch is closed. The central electronic module (CEM) activates the relay for power supply to the horn.

There is also a signal directly connected from the steering wheel module (SWM) to the

central electronic module (CEM). This is a Limp-Home function.

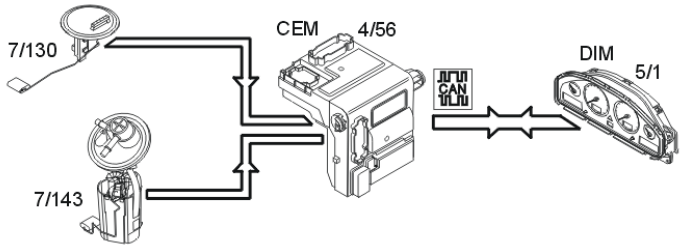
Fuel pump



The central electronic module (CEM) (4/56) receives a request from the engine control module (ECM) (4/46) via the control area network (CAN) to start the fuel pump (FP) (6/33). The central electronic module (CEM) then activates the relay which supplies the fuel pump with power.

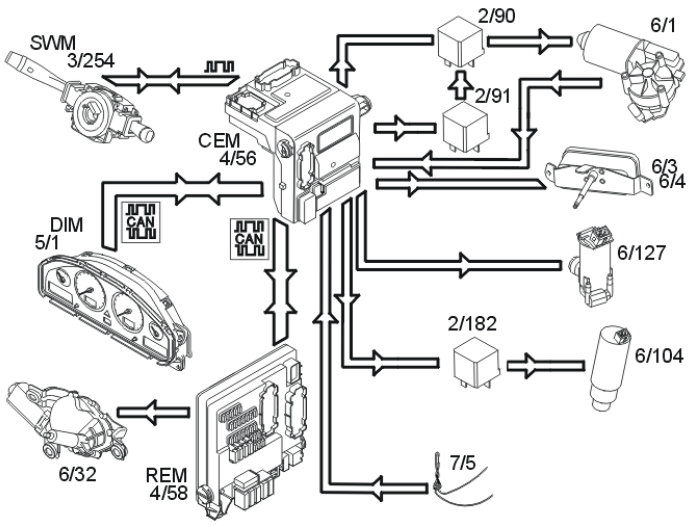
In the event of a collision in which the airbags are deployed, a signal is transmitted from the supplemental restraint system (SRS) module (4/9) to the central electronic module (CEM) which deactivates the relay for the fuel pump.

Fuel level (Gasoline / Diesel)



The fuel level is gauged by the fuel level sensors (7/130, 7/143). The signals from the sensors are transmitted to the central electronic module (CEM) (4/56). The central electronic module (CEM) calculates the remaining quantity of fuel by comparing the signals with a tank table stored internally. Information about the quantity of fuel is transmitted via the Control area network (CAN) to the driver information module (DIM) (5/1), where the fuel level is displayed on the fuel gauge.

Wipers / washers



The right-hand control

stalk is moved downwards through three positions to operate the windshield wipers. The steering wheel module (SWM) (3/254) transmits information to the central electronic module (CEM) (4/56) about the selected position using serial communication. The central electronic module (CEM) then activates the relay which supplies the wiper motor (6/1) with power in position 1. If high speed wiping is selected, the relay is also activated to power the motor in position 2.

The central electronic module (CEM) receives a signal from the motor when the wipers are in the parked position so that the wipers can be stopped in the correct position.

For intermittent wiping, the process is the same as for low speed, but the time between each stroke is set using the ring on the control stalk to one of eight positions between 1 and 27 seconds. The central electronic module (CEM) controls this once it has received information about intermittent wiping from the steering wheel module (SWM) via serial communication.

The windshield and headlamps are washed when the right-hand control stalk is moved towards the steering wheel. The steering wheel module (SWM) transmits information to the central electronic module (CEM) to activate washing via serial communication.
The central electronic module (CEM) activates an internal relay which powers the pump motor (6/127) and the headlamp wiper motors (6/3-4) (S80 and R-models only).
For other models, the central electronic module (CEM) activates the relay (2/182) which powers high-pressure cleaning (6/104).

The central electronic module (CEM) receives a signal from the level sensor (7/5) in the windshield washer reservoir so that it can check the windshield washer reservoir level. The switch in the level sensor closes if the level falls below one liter. The central electronic module (CEM) sends the signal to Driver information module (DIM) (5/1) via the controller area network (CAN). The driver information module (DIM) displays a text message for approximately
10 seconds indicating that the windshield washer fluid needs to be topped up.

The tailgate wiper (6/32) (V70/XC70/XC90) is controlled by the rear electronic module (REM) (4/58). The rear electronic module (REM) receives a signal from the steering wheel module (SWM) via the central electronic module (CEM). The rear electronic module (REM) then powers the relay to start the tailgate wiper. The tailgate wiper is powered by the rear electronic module (REM).

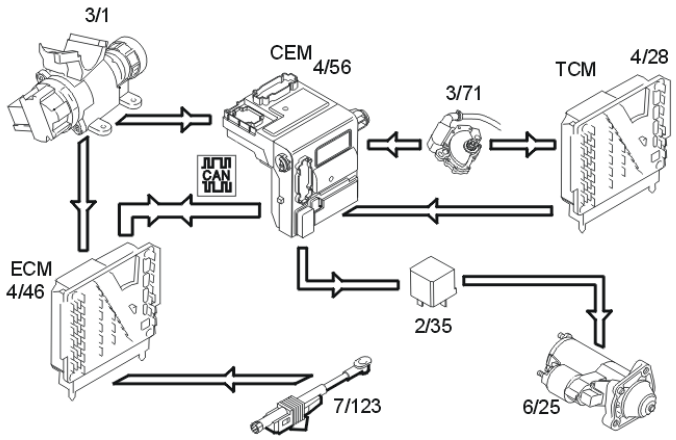
The tailgate wiper can be programmed so that it is not activated if the windshield wipers are on and back-up (reverse) gear is selected.

Rear windshield cleaning is activated when the right-hand control stalk is pushed away from the steering wheel. The steering wheel module (SWM) transmits information to the central electronic module (CEM) to activate tailgate washing via serial communication. The central electronic module (CEM) activates the relay to power the pump motor (6/127). At the same time the rear electronic module (REM) activates the tailgate wiper.

The wipers only operate at low speed if there is a fault in the control area network (CAN). If this is the case, the central electronic module (CEM) receives a directly connected signal from the steering wheel module (SWM).

There is no Limp Home function for the rear windshield washer and wiper.

Starter motor



Manual transmissions

The starter motor (6/25) is operated by turning the key in the ignition switch (3/1) to position III.

- For transmissions **with** a clutch interlock (certain markets), a signal is transmitted from the ignition switch to the engine control module (ECM) (4/46). The

engine control module (ECM) detects the position of the clutch pedal sensor (7/123). The engine control module (ECM) transmits data to the central electronic module (CEM) (4/56) via the control area network (CAN) about the position of the pedal. The central electronic module (CEM) requires a signal that the clutch is pressed down and that the key is in position III before it will send a signal to the relay (2/35). When the relay is activated, the solenoid in the starter motor is powered

- For transmissions **without** clutch interlock, the central electronic module (CEM) (4/56) activates relay 2/35 and powers the solenoid in the starter motor (6/25).

The starter motor turns for as long as the key is in position III. If the engine has been started once, there is a Limp Home function so that the engine can be started again even if there is a fault in the control area network (CAN). This function is active for a brief period after the key is

removed from the ignition switch. After this time the car will not start because there is no communication for the immobilizer between the central electronic module (CEM) and the engine control module (ECM).

Automatic transmission

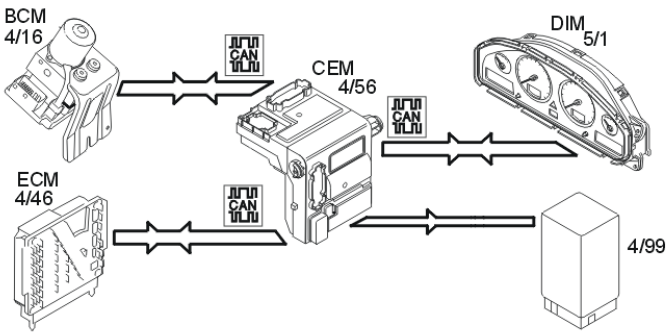
The starter motor (6/25) is operated by turning the key in the ignition switch (3/1) to position III.

- For transmission 4T65EV, a signal is transmitted from the gear-shift position sensor (3/71) via the transmission control module (TCM) (4/28) to the central electronic module (CEM) (4/56) indicating that the gear selector is in position P/N
- For AW transmissions the signal is transmitted directly from the gear-shift position sensor to the central electronic module (CEM). The central electronic module (CEM) requires this signal and a signal indicating that the key is in position III before it will send a signal to the relay (2/35). When the

relay is activated, the solenoid in the starter motor is powered.

The starter motor turns for as long as the key is in position III. If the engine has been started once, there is a Limp Home function so that the engine can be started again even if there is a fault in the control area network (CAN). This function is active for a brief period after the key is removed from the ignition switch. After this time the car will not start because there is no communication for the immobilizer between the central electronic module (CEM) and the engine control module (ECM).

Speed sensitive power steering



The central electronic module (CEM) (4/56) receives information that the engine is running from the engine control module (ECM) (4/46) on the controller area network (CAN). It receives information about vehicle speed

from the brake control module (BCM) (4/16). The central electronic module (CEM) then controls the power steering control module which in turn acts on the solenoid.

The central electronic module (CEM) checks the signals. If a fault is detected, the servo assistance is set to normal (approximately 70 km/h) and the system is disengaged. The central electronic module (CEM) also transmits a signal to the driver information module (DIM) (5/1) via the control area network (CAN) which lights the general warning lamp and displays a text message.

Description of function of the operating status of the heater

The heater can have a number of different statuses. Each status and what should occur in it is described below.

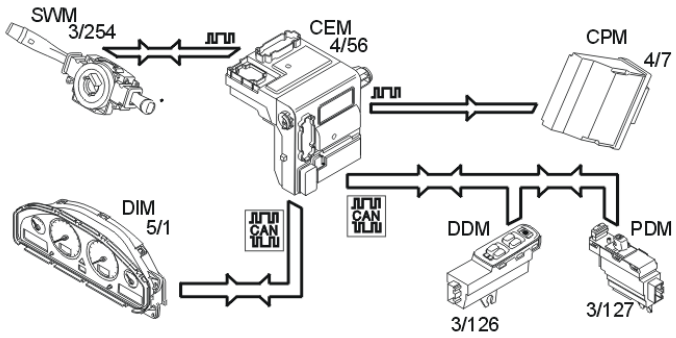
Operating status:	Description:
0: The heater has not started	Initialization of the combustion preheater module (CPM).
1: The heater starts	Heater self test. The glow plug and the water pump are activated. The combustion fan then starts at low speed to ventilate the heater. This is to cool the glow plug so that the flame sensor does not detect light from the glow plug as a flame. The control module pulses the supply to the glow plug (pulse width modulation (PWM) signal). The glow plug is sufficiently warm to ignite the fuel after approximately 45 seconds.

	This whole process takes approximately 1 minute.
2: The heater starts and the fuel pump is active	The fuel pump starts and the speed of the combustion fan increases. The control module waits for a flame. The blower fan will now be running. Maximum time 1 minute.
3: The heater runs	A flame has been detected by the flame sensor and heats the heater. When the car is being driven the heater is stopped if the engine coolant temperature (ECT) exceeds a certain level. The heater is stopped by cutting the fuel supply. The combustion fan ventilates the heater when the flame has gone out. When the temperature falls below a certain level, the heater starts again. This means that the heater cycles between 2 temperature ranges.
4: The heater stops	The fuel pump stops, the flame is extinguished and the heater is ventilated.
5: The heater waits	Waiting for the engine coolant temperature (ECT) to fall low enough for the heater to start again.
6: The heater has stopped	The heater only has this status if a fault has occurred.
7: The flame is extinguished	The flame has gone out while the car is being driven.
8: Residual heat	If, when the outside temperature is low, the driver is in the car and turns on the heater, the water pump starts in order to heat the passenger compartment.
9: Fuel pump activated	Used in production.
10: Activating the fuel pump	Single pulses to the fuel pump are used to prevent the fuel pump sticking.

The vehicle configuration can be read off to check what functions the car is equipped with. The following affect the function of the heater:

- Parking and additional heater function or additional heater function only (diesel engines)
- Parking heater or not (gasoline engines)
- Residual heater or not
- Electrical engine block heater (time controlled via the driver information module (DIM)) or not.

Fuel driven parking heater



The driver sets the desired departure time using one of the two timer functions in the display on the driver information module (DIM) (5/1). The time is programmed by twisting the ring on the control stalk and by pressing the "reset" button for the desired time (timer 1, timer 2 or direct start). Direct start can also be used to start the heater.

The central electronic module (CEM) (4/56) receives data about when the driver wants to drive from the control stalk module (steering wheel module (SWM)) (3/254) and the driver information module (DIM).
The central electronic module (CEM) calculates when the heater needs to start so that it is warm enough in relation to the outside temperature. Information about temperature is obtained from the outside temperature sensor in the right-hand door

mirror. This sensor is connected to the driver door module (DDM) or passenger door module (PDM).

The central electronic module (CEM) calculates when the heater needs to start:

- The heater calculates when start is required (15-50 minutes before the intended departure at medium low temperatures between -10 °C and +15 °C)
- This procedure takes a maximum of one minute. 60 minutes at temperatures below -10 °C
- This running time of the heater is a minimum of 15 minutes before the planned departure. (Warm temperatures between +15 °C and +25 °C).

When the heater is started directly using the control stalk it runs until it is shut off or for a maximum of 60 minutes. The heater is on for 10 minutes after the set time to allow for the driver getting to the car late.

A text message is displayed in the driver

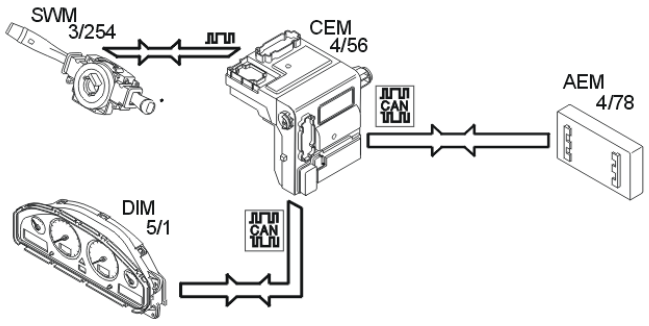
information module (DIM) when the heater is running.

Remote start of parking heater (Applies from and incl. structure week 201020)

With remote start of parking heater it is possible to set timers for the parking heater as well as direct start of the parking heater via a computer with internet connection or via mobile telephone. Only applies to vehicles with Phone module (PHM).

For more information, see Design and Function - Phone module (PHM)

Electrical heater with timer function

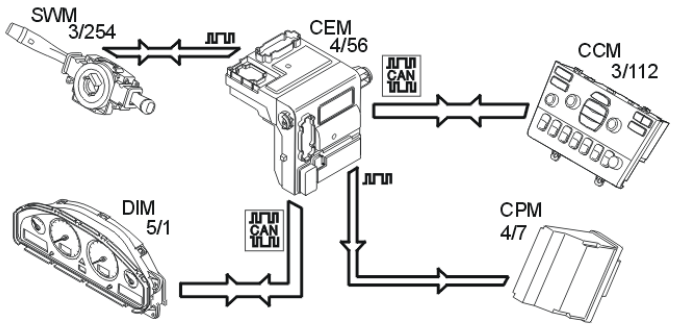


The desired departure time is set using the steering wheel module (SWM) (3/254).
The central electronic module (CEM) (4/56) calculates when the heater needs to start. The heater starts 2 hours and 45 minutes before the set departure time, irrespective of the

temperature. A text message is displayed in the driver information module (DIM) (5/1) when the electrical heater is running.

The accessory electronic module (AEM) (4/78) electrically controls when the heater should be switched on and off. The engine block heater must be connected to a wall socket. The accessory electronic module (AEM) activates a relay which closes the switch for a heater element.

Residual heater



This function can be ordered as an accessory. See Reading off vehicle configuration data to check whether the car has a residual heater.

The function is activated in the driver information module (DIM) (5/1) using the control stalk (compare to the parking heater). Information about activation is sent to the central electronic module (CEM) (4/56)

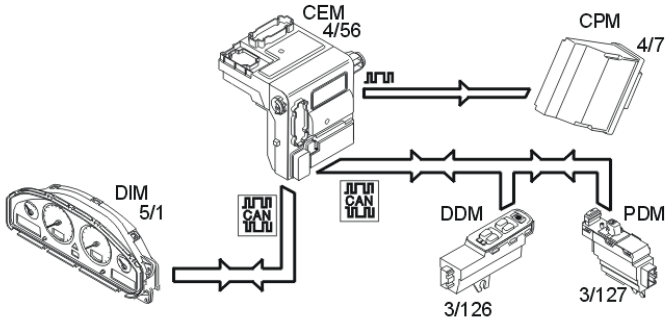
and climate control module (CCM) (3/112). The blower fan and damper settings are set by the climate control module (CCM). The central electronic module (CEM) transmits data to the combustion preheater module (CPM) (4/7) instructing it to activate the water pump.

When the residual heater is activated it will operate as long as the coolant temperature is above 30 °C or for a maximum of 20 minutes or until the function is switched off.

This function is used when the coolant is already warm. The coolant pump is started thereby circulating the coolant. The heat is distributed from the coolant to the passenger compartment unit in the climate control unit and on to the passenger compartment.
When the residual heater is running, the passenger compartment is heated by the climate control module (CCM) controlling the fan and damper according to a customer parameter (Applies only to electronic climate control (ECC)). This parameter is used to set the distribution between the defroster and the floor. The normal setting is 30% defroster

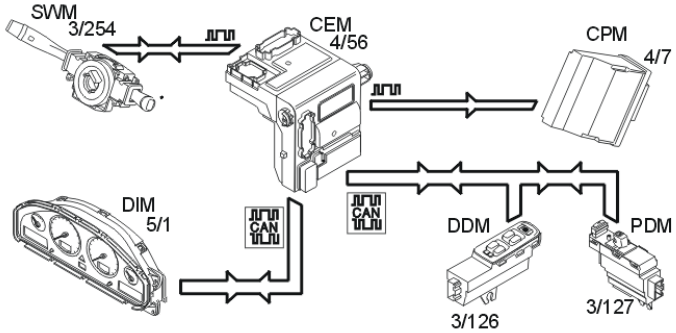
and 70% floor.

Additional heater



The additional heater is standard in cars with diesel engines (certain markets). This function is used for cars in cold markets to provide extra heat to the climate control module. The heater functions in the same way as the parking heater although the start conditions are different. This is controlled by the central electronic module (CEM) (4/56). There is no physical difference between the parking heater and the additional heater. The difference between the functions is in the software.

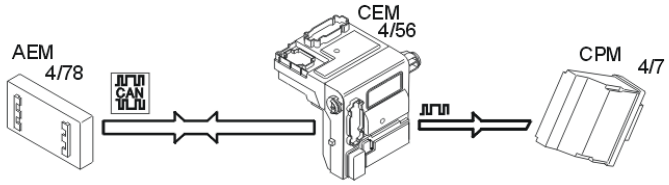
Additional heater and parking heater



If a diesel engine car has a parking heater, the car will have both the additional heater and parking heater functions.

If the parking heater has been programmed and the driver comes to the car earlier than anticipated, the additional heater will not engage until the car is started. The additional heater then determines if the heater should be on or off, even if the driver attempts to disengages the heater using the control stalk.

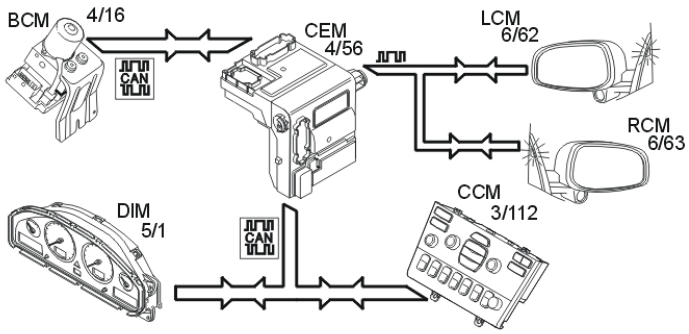
Starting the heater remotely



Cars with an accessory electronic module (AEM) (4/78) can have a remote start function for the heater. This allows the heater to be started using a pager. A stop or start signal is transmitted from the accessory electronic module (AEM) to the central electronic module (CEM) (4/56) to start or stop the heater (4/7). This function is available for both fuel

driven and electrical heaters.

Blind spot information system (BLIS)



The cameras take 30 images a second and compare each image with the previous one to check whether any changes have taken place. To be able to determine whether a change is of any significance when moving sideways, the camera module also has to know the vehicle's speed. To calculate the vehicle's speed and know whether the vehicle is turning, the speed signals for the respective rear wheels from the brake control module (BCM) are used. The central electronic module (CEM) (4/56) receives information from the brake control module (BCM) (4/16) via the CAN network on the respective speeds of the two rear wheels. These two signals are then passed on to the left camera module (LCM) and right camera module (RCM) respectively via serial communication.

If the camera module discovers that there is something in the dead angle, an orange LED, located on the inside of the panel at the front of the window on the door, comes on. This LED is directly connected to the respective camera module.

The blind spot information system (BLIS) can be deactivated using one of the switches on the dashboard environment panel. When this switch is depressed, a signal is transmitted from the climate control module (CCM) to the central electronic module (CEM) via the CAN network. The system is then deactivated until the switch is depressed again or the next time the vehicle is started.

If a fault is detected by the central electronic module (CEM), a diagnostic trouble code (DTC) is stored and a signal is transmitted via the CAN network to the driver information module (DIM), which turns on a general warning lamp and displays a text message.

09: Central electronic module (CEM)

XC90, 2006, L.H.D

9/9/2010

PRINT

09: Central electronic module (CEM)

Diagnostic functions

General

The control module has a built-in diagnostic system, Volvo Diagnostic, which continuously monitors internal functions as well as input and output signals.

Diagnostic trouble codes (DTCs)

A diagnostic trouble code (DTC) is stored if the control module detects a fault. The control module can store up to 10 diagnostic trouble codes (DTCs). A fault which is

detected in the most recent operating cycle is defined as permanent. Other faults which are detected are defined as intermittent.

Reading and erasing diagnostic trouble codes (DTCs)

Stored diagnostic trouble codes (DTCs) can be read off and erased using this function.

Diagnostic trouble codes (DTCs) can only be erased once all the diagnostic trouble codes (DTCs) have been read off at least once.

Reading off the control module identification

VIDA identifies control modules by reading off a number of codes from the control module memory.
The codes contain information about the control module:

- hardware P/N (control module without software)
- hardware serial number (control module without software)
- software P/N
- diagnostic software P/N.

Reading off extended diagnostic trouble code (DTC) information

This function can be used to read parameters, status identifiers and counters stored at the same time as a diagnostic trouble code (DTC). These are called frozen values.
For further information, see: Description of frozen values, central electronic module (CEM)

Reading off the parameter values

Using this function, the status or value of parameters can be read off. The status/value is presented digitally.
For further information about the different parameters, see: Description of parameters

Activating components and functions

This function can be used to activate components and functions which affect the outputs of the central electronic module (CEM).
For further information, see: Description of activations

Reading off and programming data

This function allows programmed data to be read off or data such as customer parameters to be programmed in.

Note! If possible, all data must be read out from the control module before replacement. After replacement the relevant data must be programmed into the new control module. The data must be read off before the control module is replaced. This is so that the same information can be programmed in to the new control module.

Programming keys

Add or Remove key

This function is used to add a new key or remove a non-functioning or lost key.

9/9/2010 PRINT

09: Central electronic module (CEM)

XC90, 2006, L.H.D

9/9/2010

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09: Central electronic module (CEM)

Additional heater (diesel engines only)

Alarm

Automatic range adjustment (Bi-Xenon)

Blind spot information system (BLIS)

Central locking

Courtesy lighting / key lighting / glove compartment lighting

Current limiting

Front fog lamps

Front parking lamps

Fuel level (Gasoline/Diesel)

Fuel pump

Generator (GEN) (Alternator control module (ACM))

Headlamp range adjustment (certain markets)

Headlamps

High level stop lamp

Horn

Immobilizer

Parking heater (optional extra)

Speed sensitive power steering

Starter motor

Steering wheel buttons

Steering wheel module (SWM)

Sun sensor (electronic climate control only)

Turn signal lamps / Hazard warning signal flashers

Twilight sensor
Washer / wipers

Design

Alarm

See Design and Function, Alarm.

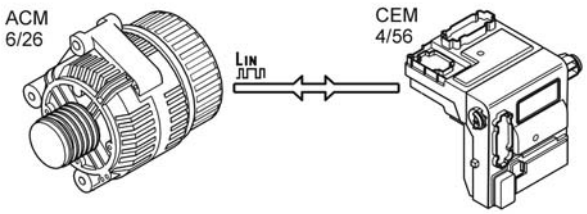
Central locking

See Design and Function, Central locking.

Immobilizer

See Design and Function, Immobilizer.

Generator (GEN) (Alternator control module (ACM))



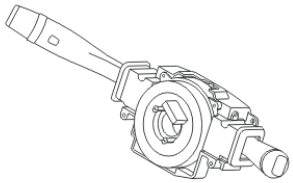
See Design and Function, Generator (GEN).

Current limiting

The central electronic module (CEM) checks and sometimes limits the current from the battery and generator. The central electronic module (CEM) communicates with the alternator control module (ACM) via serial communication.

If there is a fault with current limitation, the general warning lamp will light in the driver information module (DIM) and a text message will be displayed.

Steering wheel module (SWM)



The steering wheel module (SWM) has the task of managing the signals for those functions which can be controlled via the steering wheel control stalks and buttons. The signals are transmitted using LIN communication to the central electronic module (CEM). The central electronic module (CEM) forwards these signals on the controller area network (CAN) to the relevant control modules. The actual functions are not in the steering wheel module (SWM).

The steering wheel module (SWM) manages the control signals for the following functions:

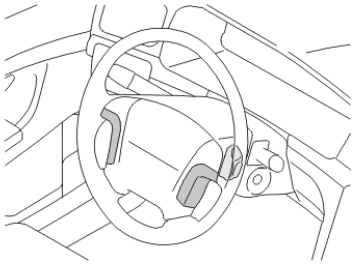
- Volume control and CD track / radio selection
- Volume control during hands free carphone calls and menu selection for the phone module (PHM)
- Menu selection for traffic information
- Front windshield wipers and washers
- Rear windshield wiper and washer (V70, XC70 and XC90)
- Cruise control
- Turn signal lamps
- High and low beam
- Trip computer and displaying/erasing text messages in the driver information module (DIM).

The steering wheel module (SWM) is integrated into the steering wheel bracket. The steering wheel must be removed to replace the steering wheel module (SWM). Control stalks, key pads and switches can be replaced as separate units.

Cars with DSTC also have a steering wheel angle sensor in the contact reel in the steering wheel module (SWM). For further information, see Design and Function, Steering wheel angle sensor module (SAS).

A simple way to ensure that the steering wheel module (SWM) is powered and grounded is to flash the headlamp high beam or to change the audio or carphone volume.

Steering wheel buttons

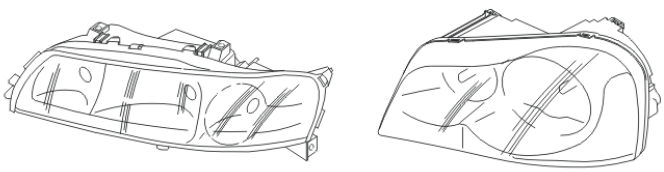


The steering wheel buttons control functions and menu selection for:

- Traffic information (option)
- Audio (option)
- Carphone (option)
- Cruise control (option).

The signals from the steering wheel buttons are transmitted via serial communication.

Headlamps



Warning! Both drive

stages, which are built into the lamp housing, and the wiring for the Bi-Xenon lamps are high voltage.

The headlamps are operated via the light switch module (LSM). This is on the dashboard at the side of the steering wheel. The light switch module (LSM) uses serial communication to communicate with the central electronic module (CEM). Low and high beam are operated by moving the left-hand control stalk towards the steering wheel.

Low beam is powered directly by the central electronic module (CEM). High beam is powered via a directly connected relay in the central electronic module (CEM). The level of the supply voltage to the low beam is regulated by the central electronic module (CEM). When the supply voltage is sufficient (in excess of 13 V), pulse width modulation is used to maintain the voltage level at 13.0 V +/- 0.2 V. This does not apply to cars with Bi-Xenon lamps.

Cars with Bi-Xenon lamps are powered directly via the central electronic module (CEM) without pulse width

modulation.

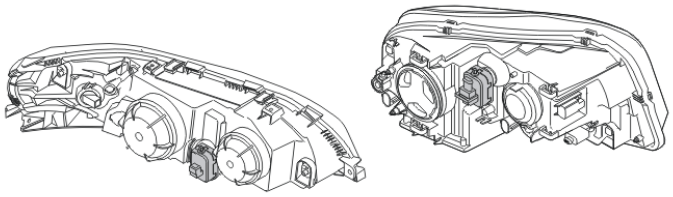
In Bi-Xenon lamps, the reflector in the lamp housing is moved by an actuator motor when changing between high and low beam. The actuator motor is integrated in the lamp housing.

To detect problems with the low beam, the central electronic module (CEM) reads the power consumption of the circuit. If this falls below a certain threshold value a fault will be indicated. The general warning lamp lights in the driver information module (DIM) and a text message is displayed.

There are also diagnostics for the high and low beam function (actuator motor) for Bi-Xenon lamps.

For further information about Bi-Xenon lamps, see Design and Function, Gas discharge lamps (GDL).

Headlamp range adjustment (certain markets)



There are two motors, one on each headlamp, which angle the headlamps upwards or downwards to control the range of the beam. The motors are on the rear of the headlamps.

The motors are controlled by a thumb wheel which is located in the light switch module (LSM) on the dashboard by the side of the steering wheel.

If the thumb wheel is turned, information is transmitted to the motors which adjust the headlamps accordingly.

There are diagnostics for the headlamp range adjustment.

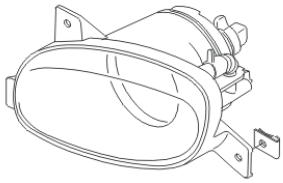
Automatic range adjustment (Bi-Xenon)

There are two motors, one on each headlamp, which angle the headlamps upwards or downwards to control the range of the beam. The motors are on the rear of the headlamps.

The motors are controlled by signals from a position sensor at the rear axle. The sensor detects the angle of the car under different load conditions and sends this information via the rear electronic module (REM) so that the central electronic module (CEM) can determine whether the lamps need to be raised or lowered.
For further information about the inner roof lighting, see Design and Function, rear electronic module (REM).

There are diagnostics for the headlamp range adjustment.

Front fog lamps

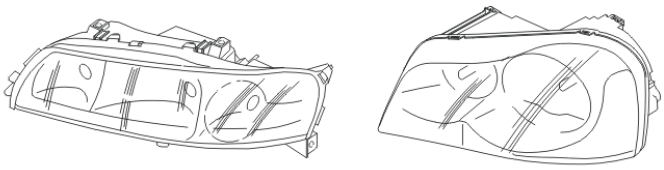


If the car has front fog lamps, these are in the bumper casing below the headlamps.

The fog lamps are operated via a button in the light switch module (LSM). An LED in the button lights when the fog lamps are activated. The light switch module (LSM) uses serial communication to

communicate with the central electronic module (CEM). The bulbs are powered via a directly connected relay in the central electronic module (CEM).

Front parking lamps



There are a number of lamps positioned around the car to mark its position. These are in the headlamps and tail lamps. The lamps light together with the license plate lighting when the light switch module (LSM) is in parking lamp mode or low beam is on.
The front parking lamps are powered directly via two outputs on the central electronic module (CEM). One of the outputs powers:

- the front left-hand parking lamp
- the left-hand parking lamps.

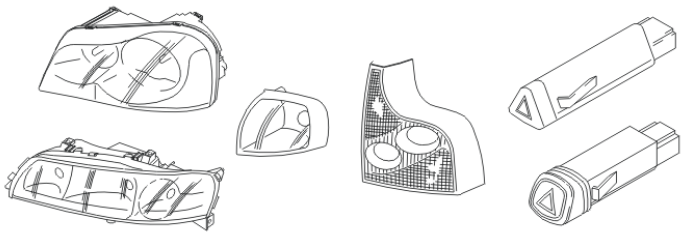
The other output powers:

- the front right-hand parking lamp
- the right-hand side parking lamps.

The rear parking lamps and license plate lighting are powered by the rear electronic module (REM). For further information, see Design and Function, rear electronic module (REM).

There are diagnostics for the parking lamps.

Turn signal lamps / Hazard warning signal flashers



There are six lamps around the car to indicate direction changes. These are in the headlamps, tail lamps and on the side of the vehicle in front of the doors.

The turn signal lamps are operated using the left-hand control stalk.

To cancel the hazard warning signal flashers, where all the turn signal lights flash, press in the button for the hazard warning signal flasher. This is positioned in the middle of the dashboard by the center air vents.

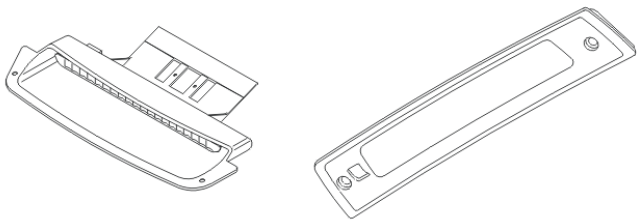
The front and rear lamps are powered directly from the central electronic module (CEM).

A signal is also sent to the bulb in the hazard warning signal flasher switch when this function is activated.

The central electronic module (CEM) monitors the power consumption on each side to check for bulb faults. If the power consumption falls below a certain threshold value, a fault is indicated and the frequency of the signal to the bulbs is doubled on the side of the blown lamp.

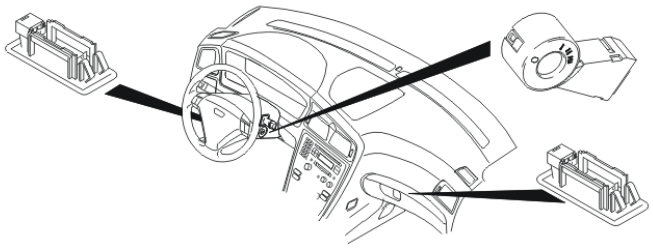
There are diagnostics for the front and rear turn signal lamps.

High level stop lamp



For further information about the high level stop (brake) lamps, see Design and Function, rear electronic module (REM).

Courtesy lighting / key lighting / glove compartment lighting



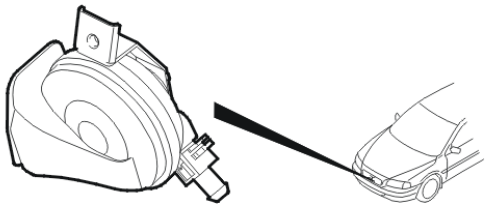
There are various lamps inside the passenger compartment, such as the courtesy lighting and glove compartment lighting for example. There are also LEDs around the keyhole in the ignition switch.

The lamps for the courtesy lighting are in the soundproofing panels on the driver and passenger sides. The lamp for the glove compartment is positioned on the left-hand inner side.

The lighting time can be programmed via the upper electronic module (UEM). For further information, see Design and Function, upper electronic module (UEM).

There are diagnostics for the key lighting and glove compartment lighting.

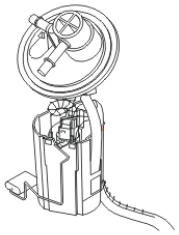
Horn



There are two horns in front of the radiator.
There are four switches in the steering wheel.
The horn is activated when one of these is closed.
The signal continues for as long as the switch is closed.
The horn is also activated when the panic alarm button on the remote control is pressed (certain markets).

The power supply for the horn is controlled from the central electronic module (CEM).

Fuel pump



The fuel pump (FP) is located on the inside of the fuel tank on the right-hand side. The power supply for the pump is checked by the central electronic module (CEM) which operates a relay. This

relay controls the power supply to the pump and is directly connected to the central electronic module (CEM).

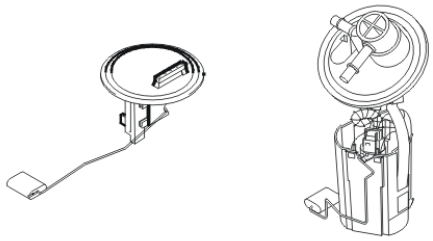
The central electronic module (CEM) uses the controller area network (CAN) to communicate with the engine control module (ECM) which requests power to the pump system. The active-on-demand pump system that receives a control signal from the engine control module (ECM) to control the flow.
The central electronic module (CEM) also communicates with the supplemental restraint system (SRS) module via a directly connected signal. In the event of a collision, the supplemental restraint system module (SRS) transmits data and the central electronic module (CEM) closes the relay for the pump system and shuts off the power supply to the fuel pump (FP).

There are diagnostics for the input signal from the engine control module (ECM) and for the relay for the fuel pump (FP).
In the event of a fault in the controller area network (CAN) or central electronic module (CEM), there is a limp-home function in the central electronic module (CEM). This

keeps the fuel pump (FP) relay active throughout the operating cycle. This function is stopped in the event of a collision. A signal is transmitted from the supplemental restraint system module (SRS) to the central electronic module (CEM).

If there are electrical faults, the engine cannot be restarted after a collision.

Fuel level (Gasoline / Diesel)



The fuel level in the tank is measured by two sensors. The sensors are located on each side of the fuel tank. Cars with engine B5244S6 have only one sensor, on the pump side. The sensor is directly connected to the central electronic module (CEM).

There are different tables for different fuel tank sizes. The tables are stored in the central electronic module (CEM) and indicate which sensor values correspond to the

remaining fuel in the tank. The central electronic module (CEM) determines which tank is in the car by reading a parameter.

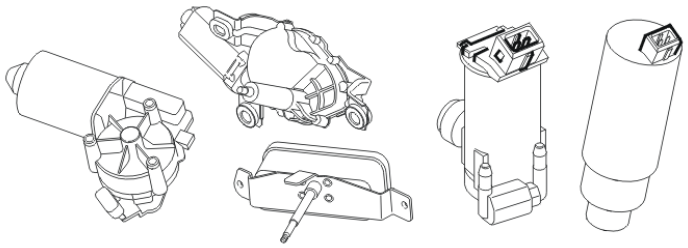
The resistance of the sensor increases as the fuel volume in the tank decreases. The signals from the sensors are compared with the values in the fuel tank table to obtain a value for the remaining fuel volume. This data is displayed by the fuel gauge in the driver information module (DIM).

If the sensors are faulty, the fuel gauge will show 0.

There are diagnostics for the fuel level sensors.

The fuel level sensor for Bi-fuel is connected to the rear electronic module (REM). For further information, see Design and Function, rear electronic module (REM).

Washer / wipers



The windshield wipers are powered by a motor positioned under the cowl. There is also a headlamp wiper (S80 and R-models). Other models have high-pressure cleaning. There are also washer nozzles on the hood and bumper cover for cleaning the windshield and headlamps. The washer nozzles are connected to a pump motor on the windshield washer reservoir at the front right of the engine compartment.

For cars with five doors, there is a wiper and washer nozzle for the rear windshield.

The windshield wipers are operated using the right-hand control stalk. There are four positions:

- intermittent
- single sweep
- low speed
- high speed.

The time between strokes for intermittent wiping is adjusted using a ring on the control stalk.

Pull the control stalk towards the steering wheel to clean the windshield. The washer and wipers for the headlamps or high-

pressure cleaning system are activated at the same time. The headlamp wipers operate for as long as washing is activated. They are not activated when only the windshield wipers are activated.

Push the control stalk away from the steering wheel to clean the rear windshield. There is a button at the end of the control stalk to control the rear wiper.

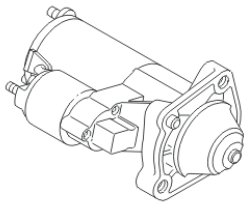
Information about the position of the control stalk is transmitted by the steering wheel module (SWM) to the central electronic module (CEM) using serial communication. The central electronic module (CEM) also receives a signal from the wiper motor if the wipers are in the park position.

The central electronic module (CEM) also monitors the windshield washer reservoir level via a level sensor in the reservoir. The switch in the level sensor closes if the level falls below one liter. A text message indicating that the windshield washer fluid needs to be topped up then lights in the driver information module (DIM) for approximately 10 seconds.

The power supply for the rear windshield wiper is via a directly connected relay in the rear electronic module (REM). The windshield wiper motor and high-pressure cleaning are supplied with power via relays in the engine compartment. The washer pump and headlamp wiper motors are powered via the central electronic module (CEM).

There are diagnostics for the windshield wiper motors and relays.

Starter motor



The starter motor is on the left-hand side of the engine by the air cleaner (ACL) housing. The starter motor is powered directly from the battery. There is a solenoid on the starter motor to close the circuit. The central electronic module (CEM) activates a relay in the relay box in the engine compartment to act on the solenoid. This supplies the solenoid with power and closes the circuit for the starter motor.

The starter motor turns when the key is turned to position III in the ignition switch.

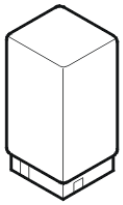
There are different functions which prevent starting, depending on whether the car has an automatic or manual transmission. The central electronic module (CEM) also has an electronic immobilizer function which communicates with a transponder in the key. For further information about the immobilizer, see Design and Function, Immobilizer.

- Cars with manual transmissions have a sensor in the clutch pedal. The clutch pedal must be depressed to allow starting (certain markets)
- In cars with type 4T65EV automatic transmissions, a signal is transmitted from the gear-shift position sensor to the transmission control module (TCM) which then sends a directly connected signal to the central electronic module (CEM)
- In cars with AW automatic transmissions, a directly connected signal is

transmitted directly from the gear-shift position sensor to the central electronic module (CEM).

There are diagnostics for the relay for the starter motor.

Speed sensitive power steering



If the car has speed dependent power steering to control the steering assistance, there is a solenoid which controls a hydraulic valve on the steering gear.

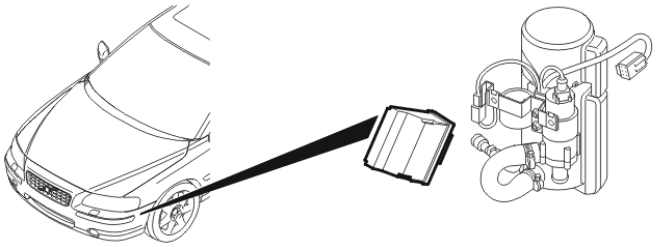
The solenoid is controlled by the power steering control module. This receives speed data from the directly connected speed signal from the central electronic module (CEM).

The power steering control module uses a signal to check the solenoid. The solenoid deploys the valve on the steering gear to the required degree and regulates the oil in the steering gear to reduce

or increase the servo assistance. The steering assistance increases at lower speeds and is reduced at higher speeds.

There are no diagnostics for the power steering.

Additional heater (diesel engines only)



Control of the additional heater on cars with manual climate control (MCC)

The climate control module (CCM) requests that the combustion preheater module (CPM) is started. The central electronic module (CEM) determines whether start is possible. The combustion preheater module (CPM) then receives a signal from the central electronic module (CEM) to start the heater.

Certain conditions must be met before the heater can start. These are:

- Outside temperature below +8 °C (at 12 °C the heater

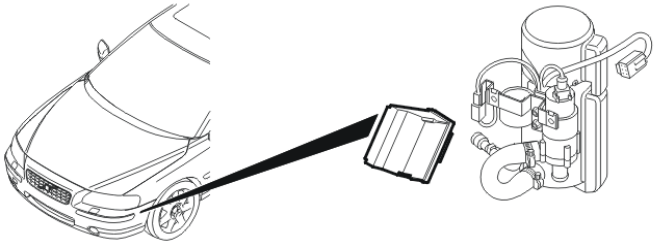
switches off)
- Engine running
- Quantity of fuel greater than 4 liters
- No diagnostic trouble codes (DTCs) that will prevent starting are stored in the central electronic module (CEM)
- The airbags have not deployed.

The heater makes three start attempts. If these fail a diagnostic trouble code (DTC) is stored in the central electronic module (CEM) and a warning message is displayed in the driver information module (DIM). If the conditions change the central electronic module (CEM) requests that the heater is stopped.

Control of the additional heater on cars with electronic climate control (ECC)

The additional heater is controlled by the ECC climate control system as required. In addition to the above conditions, the climate control module (CCM) also takes the outside temperature, engine coolant temperature (ECT) and the temperature selected into account before a request for the heater to start is made.

Parking heater (optional extra)



The start time of the heater is programmed as follows:

- the desired parking function is selected by turning the ring on the control stalk
- the desired time is selected by turning the ring on the control stalk
- press the RESET button.

Direct start can also be used to start the heater.

The climate control module (CCM) is activated when the engine coolant temperature (ECT) is greater than +20 °C. The blower fan starts and distributes the air in the passenger compartment.

Certain conditions must be met before the heater can start. These are:

- Quantity of fuel greater than 4 liters

- No diagnostic trouble codes (DTCs) that will prevent starting are stored in the central electronic module (CEM)
- The airbags have not deployed.

When the conditions are met, the heater glow plug is activated for 1 minute. If the voltage has dropped below 11.5 V, the climate control module (CCM) is switched off. The heater and the climate control module (CCM) are stopped if the voltage falls below 11.3 V. A message indicating low battery voltage is displayed in the driver information module (DIM). These voltage values apply even if the heater is operating normally.

To minimize the risk of the fuel pump for the heater failing due to lack of use, the central electronic module (CEM) sends a signal every week to the combustion preheater module (CPM) to activate the pump for approximately 1 second. This takes place when the ignition is switched off.

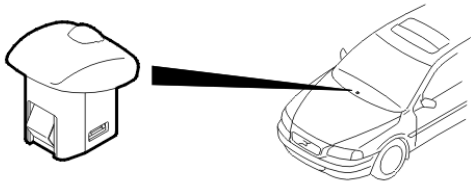
Remote start of parking heater (Applies from and incl. structure week 201020)

With remote start of parking heater it is

possible to set timers for the parking heater as well as direct start of the parking heater via a computer with internet connection or via mobile telephone. Only applies to vehicles with Phone module (PHM).

For more information, see Design and Function - Phone module (PHM)

Twilight sensor



The twilight sensor consists of a photo diode powered from the central electronic module (CEM). The conductivity of the diode depends on the amount of light to which it is exposed.
The diode is under a diffusing lens which reduces the sensitivity of the photo diode to the angle of the light hitting it. Increased light intensity reduces the voltage over the photo diode.

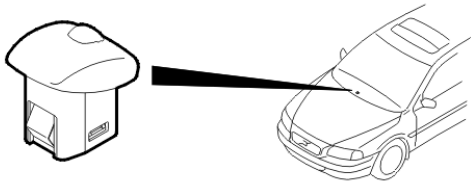
The control module measures the voltage across the photo diode and converts the voltage to information which is then transmitted to other

control modules via the controller area network (CAN).

The twilight sensor is in the same holder as the sun sensor.

There are diagnostics for the twilight sensor.

Sun sensor (electronic climate control only)



The sun sensor consists of a photo diode powered from the central electronic module (CEM). The conductivity of the diode depends on the amount of light to which it is exposed.
The diode is located under a diffusing lens which reduces the sensitivity of the photo diode to the angle of the light hitting it.
Increased sun intensity reduces the voltage over the photodiode.

The control module measures the voltage across the photo diode and converts the voltage to information which is then transmitted to the

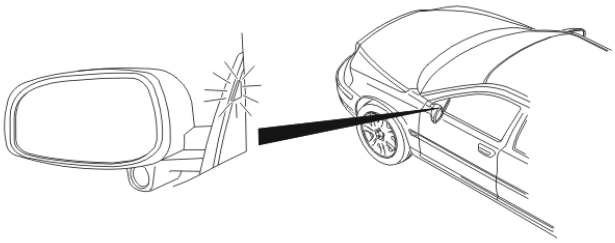
climate control module (CCM) via the controller area network (CAN).

The sun sensor is located in the middle of the dashboard by the windshield.

For further information, see Design and Function, climate control module (CCM).

There are diagnostics for the sun sensor.

Blind spot information system (BLIS)



The blind spot information system (BLIS) is an auxiliary system designed to help the vehicle's driver when moving sideways. The blind spot information system (BLIS) consists of two cameras integrated in the external rear view mirrors and two LEDs located in the panel at the front of the inside of the respective windows. The central electronic module (CEM) communicates with the left camera module (LCM) and the right

camera module (RCM) via serial communication.

The blind spot information system (BLIS) is always activated automatically when the ignition is switched on, but it is possible to deactivate and activate the blind spot information system (BLIS) using one of the switches on the dashboard environment panel on the climate control module (CCM). A signal is then transmitted via the central electronic module (CEM) to the left camera module (LCM) and the right camera module (RCM) with a request to deactivate or activate the blind spot information system (BLIS).

When reverse gear is engaged, the blind spot information system (BLIS) is deactivated.

The blind spot information system (BLIS) can be diagnosed.

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key lighting / glove compartment lighting
- Fuel pump
- Wiper / washers for the windshield and headlamps
- Starter motor
- Speed sensitive power steering
- Horn
- Clock
- Power supply (generator control)
- Current limiting
- Fuel level display, gasoline / diesel
- Additional heater.
- Parking heater
- Blind spot information system (BLIS)

The control module is to the left of the steering column under the dashboard. The entire control module is removed from the car during replacement.

A car configuration file is stored in the central electronic module (CEM). This file contains information about:

- the VIN of the car
- the structure week
- the equipment level of the car.

When replacing the central electronic module (CEM), the VIN cannot be read off until the software has been downloaded from the

Volvo central database.

The central electronic module (CEM) communicates with directly connected components and with other control modules and components via serial communication and the control area network (CAN).

The central electronic module (CEM) uses built in diagnostics to check all activations and the input and output signals. A diagnostic trouble code (DTC) is stored if the control module detects a fault. In certain cases, the incorrect signal is replaced with a substitute value. Other control modules use the network to report to the central electronic module (CEM) if they have diagnostic trouble codes (DTCs) stored. This function is used when reading off diagnostic trouble codes (DTCs) without VIDA.

Any diagnostic trouble codes (DTCs) are stored in the control module memory. This information can be read off using VIDA via the data link connector in the vehicle.

The easiest way to check if the central electronic module (CEM)

is grounded and receiving power is to activate the hazard warning signal flasher. The central electronic module (CEM) is powered if the function operates.

For further information, also see Signal specifications.

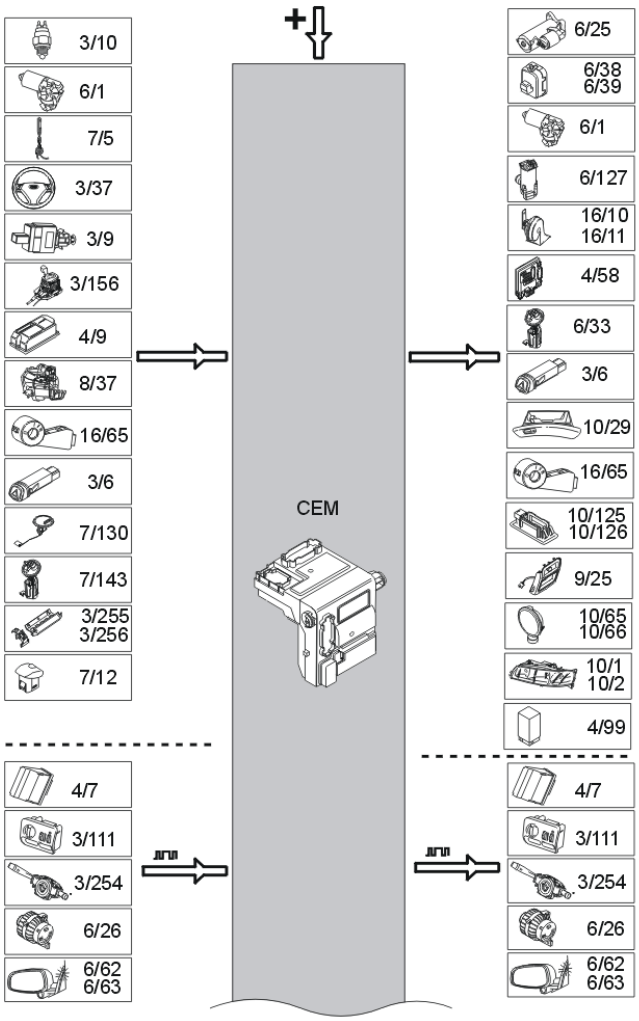
Signals

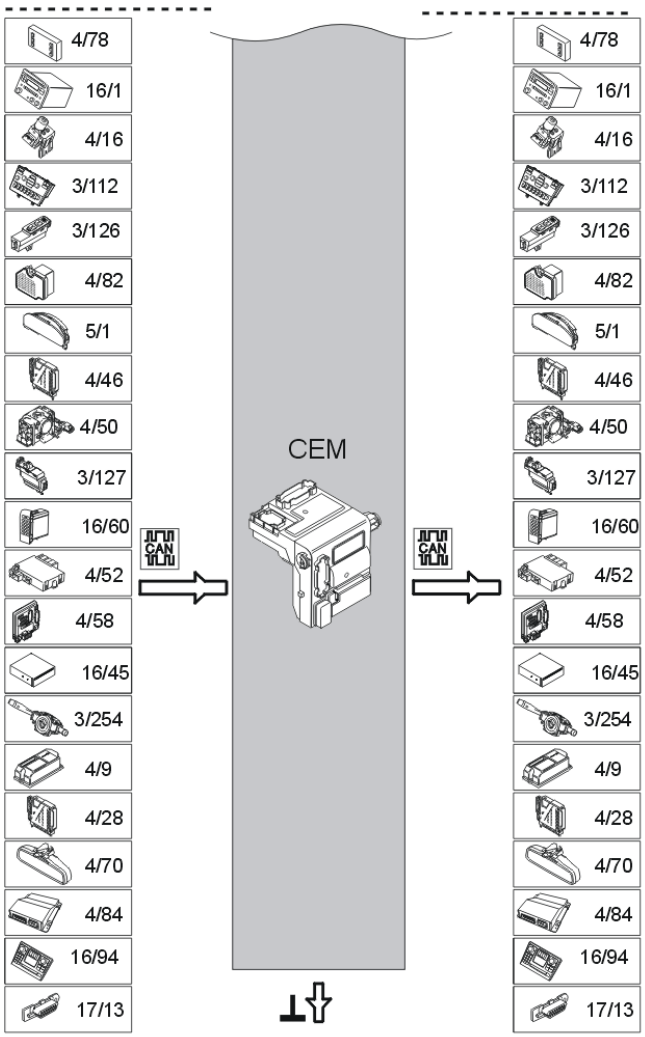
The table below summarizes the input signals to and output signals from the central electronic module (CEM). The signal types are divided into directly connected signals, serial communication and controller area network (CAN) communication. The illustration below displays the same information with the Volvo component designations.

Input signals	Output signals
Directly connected: ■ Back-up (reversing) lamp switch (3/10) ■ Windshield wiper motor (6/1) ■ Windshield washer level sensor (7/5) ■ Horn switch (3/37) ■ Stop lamp switch (3/9) ■ Control signal P/N position, gear selector module (GSM) (3/156) (automatic transmissions only) ■ Supplemental restraint system module (SRS) (Airbag OK) (4/9) ■ Gear-shift position sensor (8/37) ■ Antenna ring, immobilizer (16/65) ■ Hazard warning signal flasher switch (3/6) ■ Fuel level sensor (7/130, 7/143)	**Directly connected:** ■ Starter motor (6/25) ■ Headlamp range adjustment (6/38-39) (certain markets) ■ Windshield wiper (6/1) ■ Washer motor (6/127) ■ Horn (16/10-11) ■ Stop lamps via the rear electronic module (REM) (4/58) ■ Fuel pump (FP) (6/33) ■ Hazard warning signal flasher switch (3/6) ■ Glove compartment lighting (10/29) ■ Ignition switch lighting (16/65) ■ Courtesy lighting (10/125-126) ■ 12 V socket (9/25) ■ Auxiliary lamps (10/65, 10/66)

(Gasoline/diesel) ■ Seat position sensor driver (3/255-256) (XC90 USA/CDN only) ■ Twilight sensor (7/12) ■ Sun sensor (7/12).	■ High beam (10/64, 10/68) ■ Low beam (10/66, 10/70) ■ Front parking lamps (10/11-12) ■ Turn signal lamps (10/13-14, 10/15-16, 10/47, 10/54) ■ Front fog lamps (10/5-6) ■ Electrical power steering module (EPS) (4/99).
Via serial communication: ■ Combustion preheater module (CPM) (4/7) (optional extra) ■ Light switch module (LSM) (3/111) ■ Steering wheel module (SWM) (3/254) ■ Alternator control module (ACM) (6/26). ■ Blind spot information system (BLIS) (6/62, 6/63) (optional extra)	**Via serial communication:** ■ Combustion preheater module (CPM) (4/7) (optional extra) ■ Light switch module (LSM) (3/111) ■ Steering wheel module (SWM) (3/254) ■ Alternator control module (ACM) (6/26). ■ Blind spot information system (BLIS) (6/62, 6/63) (optional extra)
Via Controller Area Network (CAN) communication: ■ Accessory electronic module (AEM) (optional equipment) (4/78) ■ Audio module (AUM) (16/1) (not XC90) ■ Brake control module (BCM) (4/16) ■ Climate Control Module (CCM) (3/112) ■ Driver door module (DDM) (3/126) ■ Differential electronic module (DEM) (optional equipment) (4/82) ■ Driver information module (DIM) (5/1) ■ Engine control module (ECM) (4/46) ■ Electronic throttle module (ETM) (4/50) ■ Passenger door module (PDM) (3/127) ■ Phone module (PHM) (optional equipment) (16/60) ■ Power seat module (PSM) (4/52) ■ Rear electronic module (REM) (4/58) ■ Road traffic information module (RTI) (16/45) (optional equipment, not XC90) ■ Steering wheel angle sensor module (SAS) (3/254) ■ Supplemental Restraint System Module (SRS) (4/9) ■ Transmission Control Module (TCM) (4/28) ■ Upper electronic module (UEM) (4/70) ■ Suspension module (SUM) (4/84)	**Via Controller Area Network (CAN) communication:** ■ Accessory electronic module (AEM) (optional equipment) (4/78) ■ Audio module (AUM) (16/1) (not XC90) ■ Brake control module (BCM) (4/16) ■ Climate Control Module (CCM) (3/112) ■ Driver door module (DDM) (3/126) ■ Differential electronic module (DEM) (optional equipment) (4/82) ■ Driver information module (DIM) (5/1) ■ Engine control module (ECM) (4/46) ■ Electronic throttle module (ETM) (4/50) ■ Passenger door module (PDM) (3/127) ■ Phone module (PHM) (optional equipment) (16/60) ■ Power seat module (PSM) (4/52) ■ Rear electronic module (REM) (4/58) ■ Road traffic information module (RTI) (16/45) (optional equipment, not XC90) ■ Steering wheel angle sensor module (SAS) (3/254) ■ Supplemental Restraint System Module (SRS) (4/9) ■ Transmission Control Module (TCM) (4/28) ■ Upper electronic module (UEM) (4/70) ■ Suspension module (SUM) (4/84)

(optional extra) ■ Infotainment control module (ICM) (16/94) (XC90 only) ■ Data link connector (DLC) (17/13).	(optional extra) ■ Infotainment control module (ICM) (16/94) (XC90 only) ■ Data link connector (DLC) (17/13).





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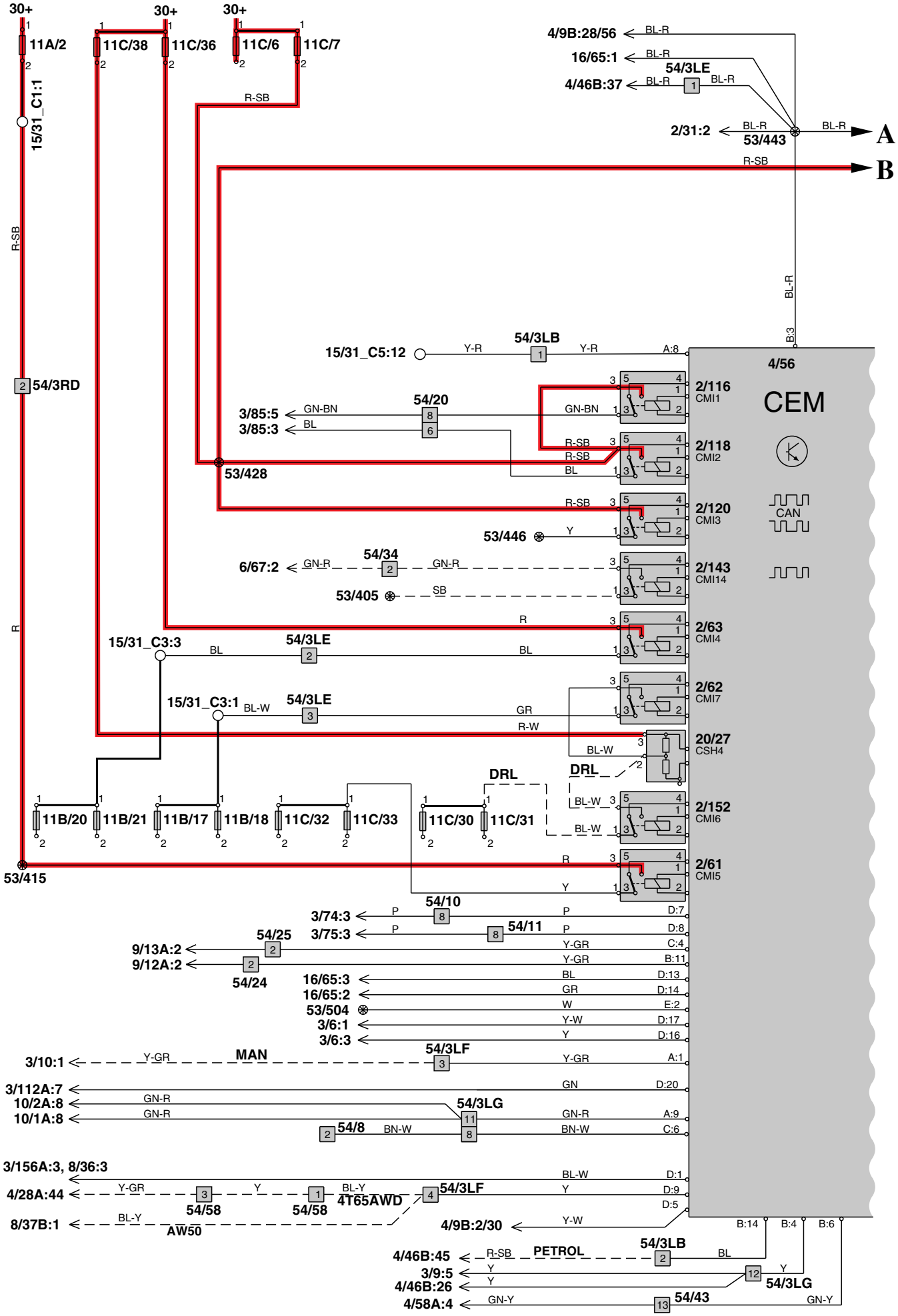
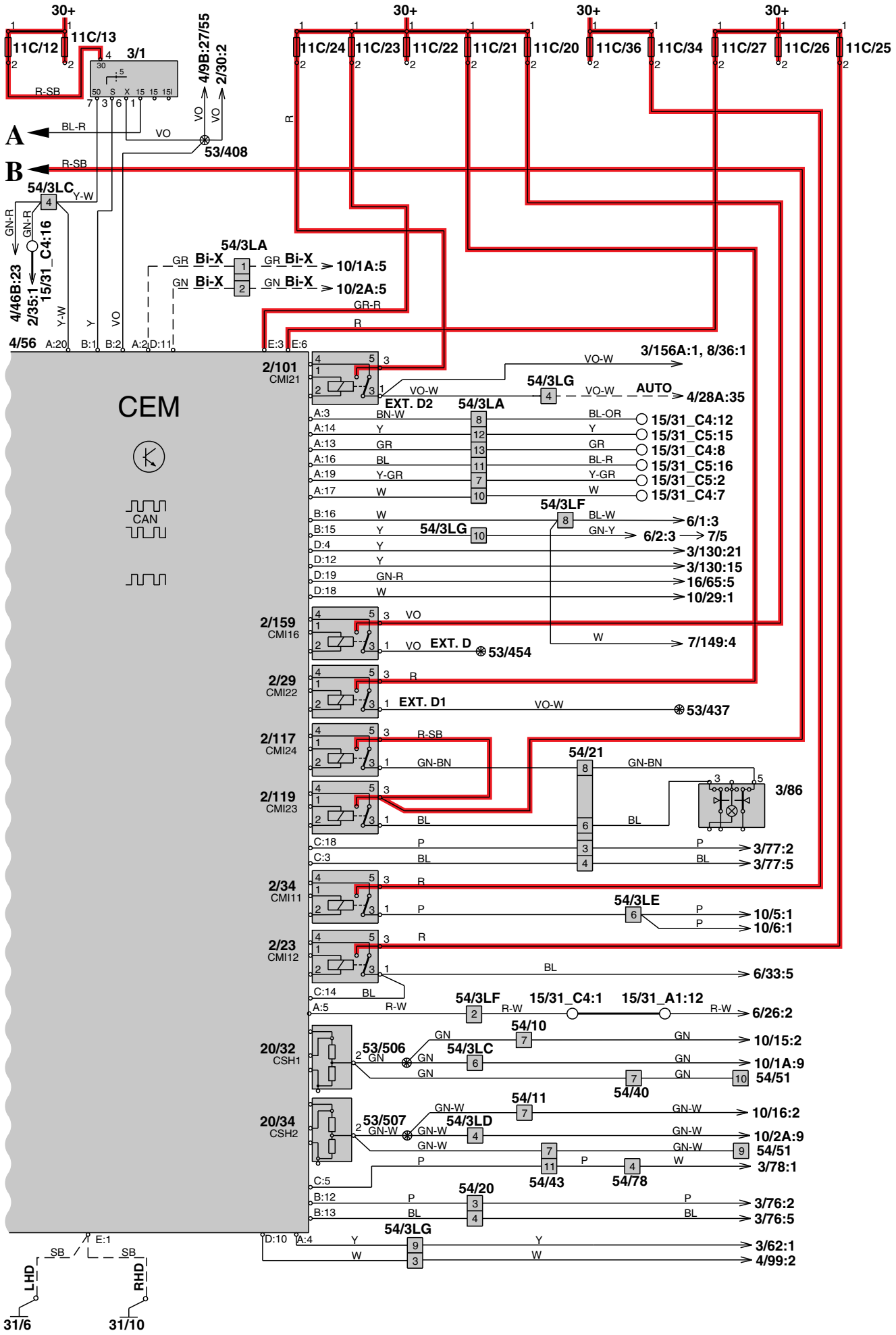
Control modules
Central Electronic Module (CEM) XC90




30+
11C/12
11C/13
3/1
R-SB
4/9B:27/55
2/30:2
A
BL-R
VO
53/408
B
R-SB
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15/31_C4:8
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6/2:3
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54/3LE
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CMI12
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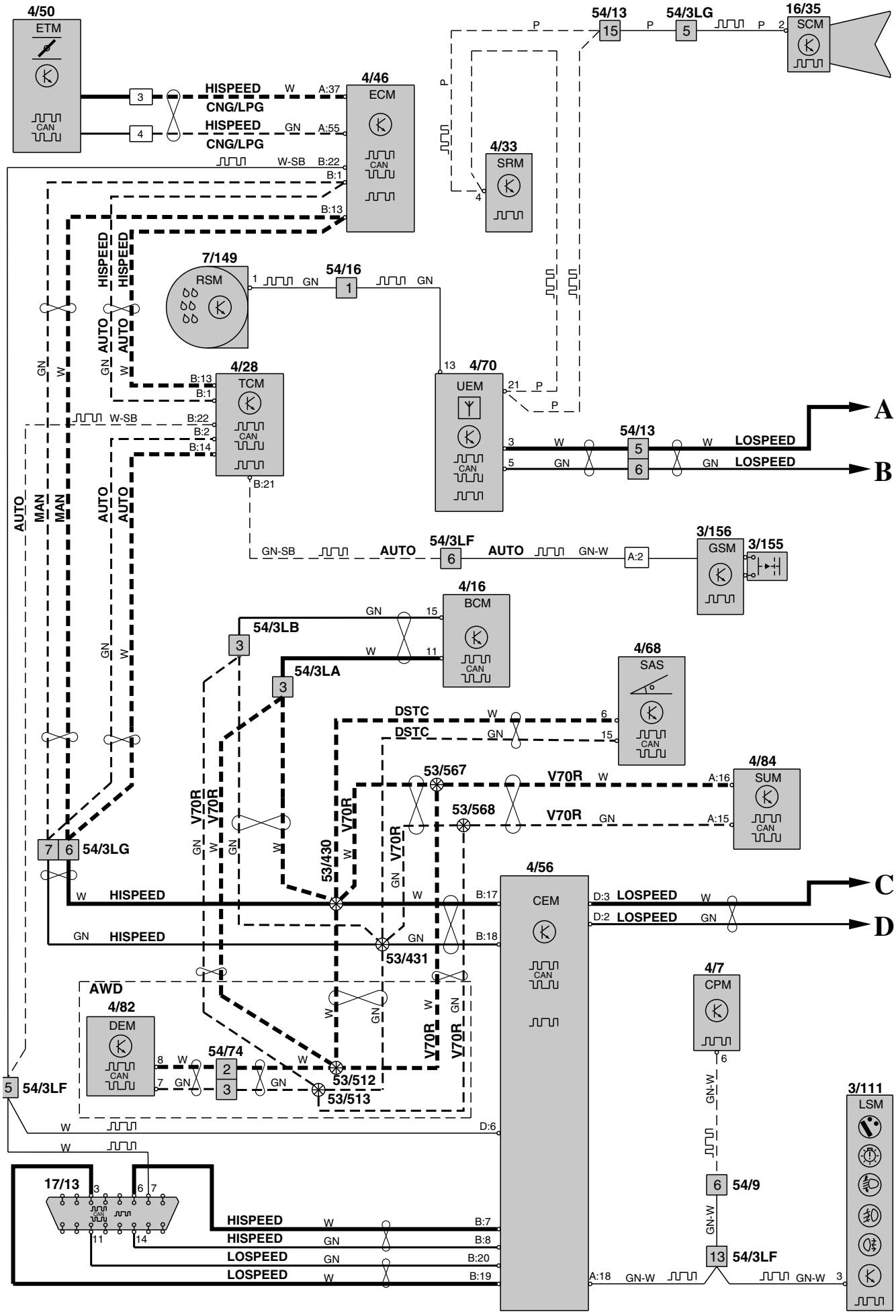
Control modules
Data communication V70/XC70



List of components

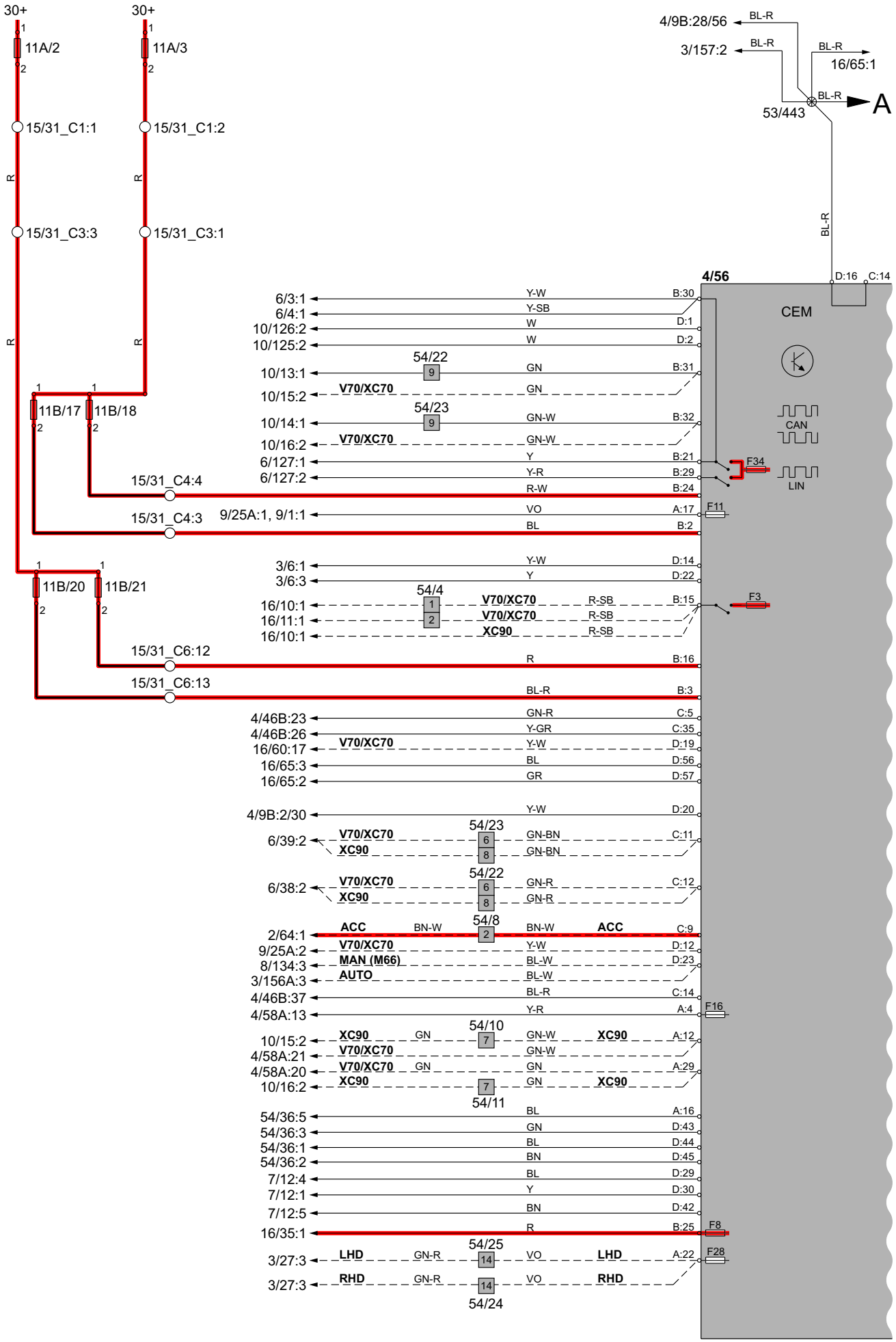
1/1	Battery
2/14	Relay, glow plug unit
2/16	Relay, intermittent rear window wiping on/off
2/17	Horn relay
2/22	Relay, climate control system
2/23	Fuel pump relay
2/29	Relay, extended D1 feed
2/30	X feed overload relay
2/31	15-feed overload relay
2/32	Engine management system main relay
2/33	Fuel system relay, V70
2/33	High pressure wash relay, XC90
2/34	Fog light relay, front
2/35	Starter motor relay
2/49	Relay, rear fog light
2/52	Relay, 15l feed, rear
2/59	Unlocking relay, fuel filler flap
2/61	Relay, position/parking lights
2/62	Relay, low beam/Bi-Xenon
2/63	High beam relay
2/64	Auxiliary light (accessory) relay
2/70	Relay, climate control system, rear
2/72	Relay, rear window wiper
2/79	Brake light relay
2/80	Reversing light relay
2/82	Relay, heated rear window
2/83	Trailer fog light relay
2/87	Unlocking relay, tailgate
2/90	Relay, windshield wiper, low/high speed
2/91	Relay, intermittent windshield wiper
2/92	Relay, windshield washer motor
2/93	Relay, rear window washer motor
2/101	Relay for extended D2 feed, automatic transmission
2/112	Unlocking relay, left-hand rear
2/114	Unlocking relay, right-hand rear
2/115	Relay, deadlock, rear doors
2/116	Rear power window up relay
2/117	Right rear power window up relay
2/118	Rear power window down relay
2/119	Right rear power window down relay
2/120	Relay - power windows, power child lock rear door
2/138	Deadlock relay, left-hand rear door
2/139	Deadlock relay, right-hand rear door
2/140	Relay CNG/LPG
2/142	Relay, preheated fuel filter
2/143	Relay, fuel leakage control
2/152	Relay, daytime running lights
2/157	Bass speaker system relay
2/158	Locking relay, rear doors, filler flap
2/159	Infotainment relay
2/174	Relay, Suspension Module (SUM)
2/191	Relay, remote parking heater start, radio signal
2/192	Relay (230V), engine heater
3/1	Ignition switch
3/4	Cruise control switch SWS
3/6	Hazard warning flasher switch
3/8	Heated rear window/door mirror switch
3/9	Brake light contact
3/10	Reversing light contact
3/25	Power sunroof switch
3/26	Power driver's seat module
3/27	Power passenger seat module
3/37	Horn contact
3/47	Parking brake contact
3/59	Control, beam adjustment
3/60	Auxiliary light switch
3/62	Hood alarm contact
3/71	Gear position contacts
3/73	Power Child Lock (PCL) switch
3/74	Left-hand front door lock unit
3/75	Right-hand front door lock unit
3/76	Left-hand rear door lock unit
3/77	Right-hand rear door lock unit
3/78	Trunk lid lock unit
3/80	Switch, left-hand central lock
3/82	Switch, right-hand central lock
3/85	Rear left door power window switch
3/86	Rear right door power window switch
3/91	Switch, left-hand heated seat
3/92	Switch, right-hand heated seat
3/93	Left seatbelt latch switch
3/94	Right seatbelt latch switch
3/95	Spin control switch
3/111	Light Switch Module LSM
3/112	Climate Control Module CCM
3/117	Dome light control module
3/126	Control module front left door DDM/PDM
3/127	Control module front right door PDM/DDM
3/130	Steering Wheel Module SWM
3/131	Switch, audio/cellular phone
3/135	RTI switch
3/155	Automatic transmission program selector
3/156	Gear Selector Module (GSM)
3/171	Switch, retractable door mirrors
3/173	Switch, trunk lid private lock
3/174	Switch, reduced alarm
3/225	Control unit, continuous damping control (CDC)

4/7	Combustion Preheater Module CPM
4/9	Control module, Supplemental Restraint System (SRS)
4/16	Brake Control Module (BCM)
4/28	Transmission Control Module (TCM)
4/31	Fan control module
4/33	Sunroof control module SRM
4/46	Engine Control Module (ECM)
4/50	Electronic Throttle Module ETM
4/52	Power driver seat module PSM
4/56	Central Electronic Module CEM
4/58	Rear Electronic Module (REM)
4/68	Steering Angle Sensor module SAS
4/70	Upper Electronic Module UEM
4/71	Cooling fan control module
4/76	Remote control unit for garage door opener
4/78	Accessory Electronic Module AEM
4X/78	Connector, original car interface
4/82	Differential Electronic Module (DEM)
4/83	Fuel pump control module
4/84	Suspension Module (SUM)
4/86	Parking Assistance Module (PAM)
4/99	Electronic power steering control module
4/106	Control module, remote parking heater start
4/107	Control module, parking heater, Call start
4/108	Parking Assistance Module
5/1	Combined instrument panel DIM
6/1	Windshield wiper motor
6/2	Windshield washer pump
6/3	Right-hand headlight wiper motor
6/4	Left-hand headlight wiper motor
6/15	Sunroof motor
6/16	Driver seat motor, backrest angle
6/17	Driver seat motor, up/down front edge
6/18	Driver seat motor, up/down rear edge
6/19	Driver seat motor, forward/backward
6/20	Passenger seat motor, forward/backward
6/25	Starter motor
6/26	Generator
6/28	Motor, passenger compartment fan
6/29	Motor, electric cooling fan
6/30	Washer pump, rear window
6/31	Feed pump, ejectors
6/32	Rear window wiper motor
6/33	Fuel pump
6/35	Fuel pump, auxiliary heater
6/37	Lock motor, fuel filler flap
6/38	Left-hand headlight level adjustment motor
6/39	Right-hand headlight adjustment motor
6/44	Cooling fan, electrics box, engine compartment
6/48	Damper motor, recirculation
6/58	Motor, front left power window
6/60	Motor, front right power window
6/62	Left-hand power door mirror
6/63	Right-hand power door mirror
6/64	Passenger seat motor, backrest angle
6/65	Passenger seat motor, up/down front edge
6/66	Passenger seat motor, up/down rear edge
6/67	Pump, fuel leakage control
6/69	Damper motor, ventilation/floor/defroster
6/71	Valve, speed-dependent power steering
6/73	Coolant pump, auxiliary heater
6/76	Climate control system, rear
6/92	Motor, rear left power window
6/93	Motor, rear right power window
6/95	Damper motor, temperature, left-hand side
6/96	Damper motor, temperature, right-hand side
6/102	Damper motor, defroster
6/103	Damper motor, floor/ventilation
6/104	High pressure wash, headlights, XC90
6/105	Fuel distributor, gas
6/114	Vacuum pump
6/120	Engine throttle body
7/4	Brake fluid level sensor
7/5	Washer fluid level sensor
7/6	Oil pressure sensor
7/8	Pressure sensor, climate control system
7/10	Interior temperature sensor
7/11	Outside temperature sensor
7/12	Solar sensor, indicator alarm and electronic immobilizer
7/15	Heated oxygen sensor
7/16	Coolant temperature sensor
7/17	Mass airflow sensor MAF
7/23	Rear knock sensor
7/24	Front knock sensor
7/25	Impulse sensor
7/31	Left-hand front ABS sensor
7/32	Right-hand front ABS sensor
7/35	Oil level sensor
7/41	Temperature sensor, evaporator
7/51	Accelerator pedal sensor
7/56	Left-hand rear ABS sensor
7/57	Right-hand rear ABS sensor
7/61	Input speed sensor
7/62	Output speed sensor
7/73	Coolant level sensor
7/74	Oil temperature sensor, automatic transmission
7/81	Pressure sensor, intake manifold
7/82	Heated oxygen sensor, diagnosis 1
7/87	Acceleration sensor, Four-C, front left
7/88	Acceleration sensor, Four-C, front right
7/89	Acceleration sensor, Four-C, rear left
7/91	Steering angle sensor
7/100	Inclination Sensor Module (ISM)
7/103	Heated oxygen sensor 3
7/104	Heated oxygen sensor 4 (diagnostic probe)
7/105	Outside temperature sensor, engine control module
7/108	Left-hand rear side impact sensor
7/109	Right-hand rear side impact sensor
7/110	Left-hand seat temperature sensor
7/111	Right-hand seat temperature sensor
7/115	Left-hand front side impact sensor
7/116	Right-hand front side impact sensor
7/118	Acceleration sensor, shock absorber, Four-C, front left
7/119	Acceleration sensor, shock absorber, Four-C, front right
7/120	Rear left angle sensor
7/121	Shock absorber, Four-C, rear left
7/122	Mass Movement Sensor (MMS), front
7/123	Clutch pedal sensor
7/124	Brake pedal sensor

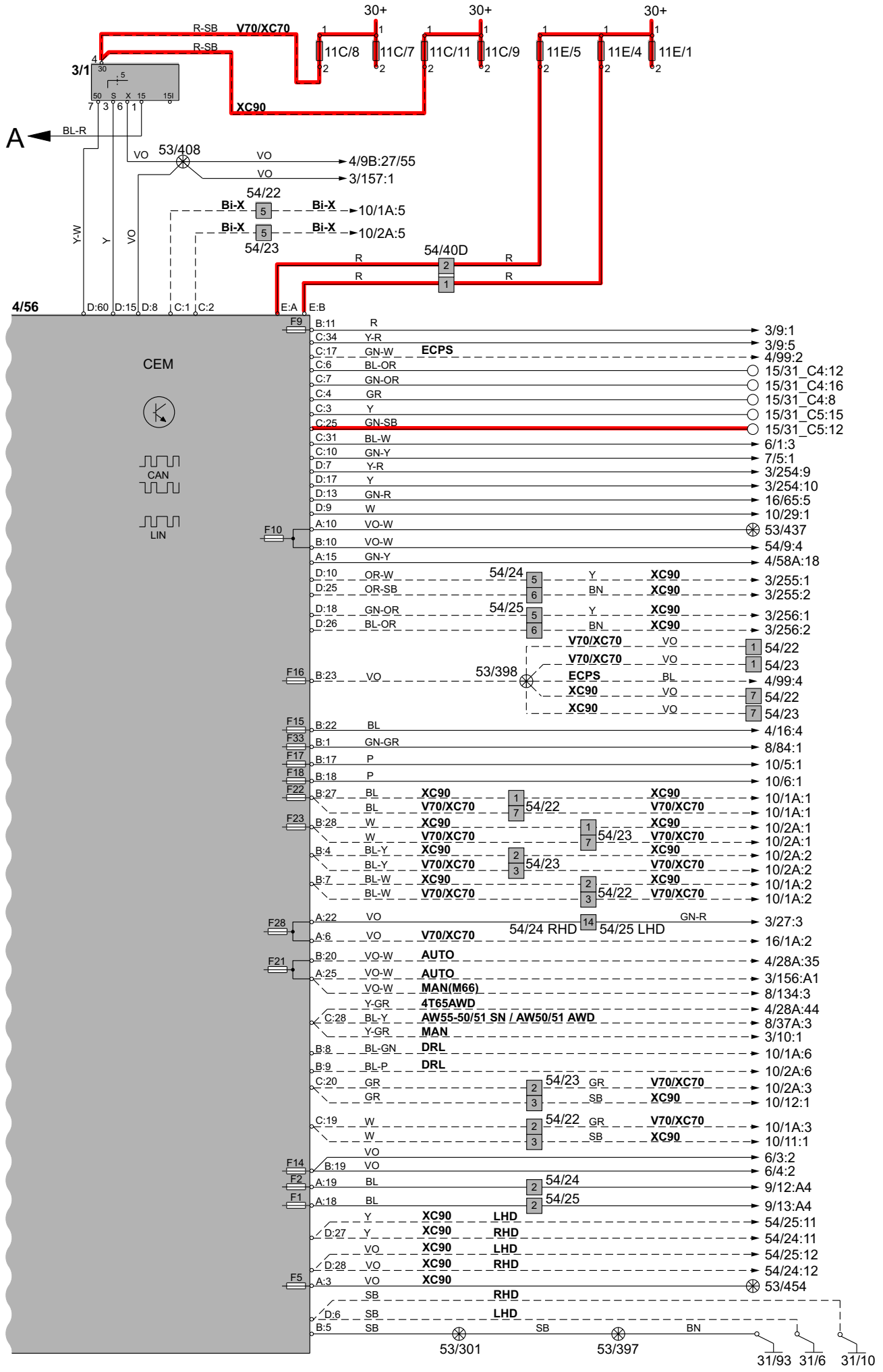
7/129	Brake pressure sensor 2
7/130	Fuel level sensor, injector side
7/131	Parking Assistance sensor 1
7/132	Parking Assistance sensor 2
7/133	Parking Assistance sensor 3
7/134	Parking Assistance sensor 4
7/135	Glass breakage sensor, left-hand
7/136	Glass breakage sensor, right-hand
7/137	Glass breakage sensor, tailgate
7/139	Brake pressure sensor 1
7/143	Fuel level sensor, pump side
7/149	Rain Sensor Module (RSM)
7/153	Sensor, fuel level LPG
7/156	Pressure and temperature sensor CNG
7/156	Fuel pressure and temperature sensor, gasoline
7/158	Mass Movement Sensor (MMS), rear
7/159	Air quality sensor
7/162	Pressure sensor, fuel line
7/164	Sensor module DSTC
7/165	Pressure and temperature sensor, intake manifold
7/172	Position sensor, camshaft, intake side
7/173	Position sensor, camshaft, exhaust side
7/175	Passenger seat weight sensor
7/178	RH front impact sensor
7/179	LH front impact sensor
8/3	Electromagnetic clutch, climate control system
8/6-11	Injectors
8/17	EGR valve
8/18	EVAP valve
8/19	Solenoid, variable valve time, inlet
8/20	Shock absorber, Four-C, front left
8/21	Shock absorber, Four-C, front right
8/22	Shock absorber, Four-C, rear left
8/23	Shock absorber, Four-C, rear right
8/28	Turbocharger control valve
8/30	Driver side airbag igniter
8/31	Passenger side airbag igniter
8/32	Igniter, passenger side airbag stage 2
8/33	Front left belt tensioner igniter
8/34	Front right seat belt tensioner igniter
8/36	Shift lock solenoid
8/37	Automatic transmission
8/38	Shift solenoid 1
8/39	Shift solenoid 2
8/40	Lock-up solenoid
8/41	Pressure solenoid
8/46	DSTC activation module
8/51	Front left side airbag igniter
8/52	Front right side airbag igniter
8/55	Rear left belt tensioner igniter
8/56	Rear right belt tensioner igniter
8/61	Driver side airbag igniter step 2
8/62	Belt tensioner igniter, center rear seat
8/64	Solenoid valve, engine mounting
8/66	Left-hand inflatable curtain igniter
8/67	Right-hand inflatable curtain igniter
8/71	Throttle solenoid
8/72	Shift solenoid 3
8/73	Shift solenoid 4
8/74	Shift solenoid 5
8/75	Valve, fuel cut-off DFCO
8/76	Gas tank valve
8/78	Oil pressure sensor
8/79	Valve LPG
8/81	Solenoid, variable valve timing outlet
8/82	Solenoid, variable turbo geometry
8/84	Switch, vacuum pump
8/85	Thermostatic switch, fuel filter
8/88	Solenoid, gas tan CNG rear
8/89	Solenoid, fuel tank CNG front left
8/90	Solenoid, fuel tank CNG front right
8/94	Left-hand belt tensioner igniter, third row of seats
8/95	Right-hand belt tensioner igniter, third row of seats
8/96	Left-hand inflatable curtain igniter, third row of seats
8/97	Right-hand inflatable curtain igniter, third row of seats
8/111	Solenoid valve, high-pressure diesel
9/1	Front 12V outlet
9/2	Heated rear window
9/12	Left seat heater
9/13	Right seat warmer
9/16	Left-hand backrest heating element
9/17	Right-hand backrest heating element
9/18	Left-hand seat heating element
9/19	Right-hand seat heating element
9/25	Rear 12V outlet
9/30	Auxiliary heater
9/32	PTC resistor - air preheating
9/33	Left-hand heated door mirror
9/34	Right-hand heated door mirror
9/38	Electrically heated fuel filter
10/1	Left-hand front lamp housing
10/2	Right-hand front lamp housing
10/3	License plate lighting
10/5	Front left fog light
10/6	Front right fog light
10/11	Front left position/parking lights
10/12	Front right position/parking lights
10/13	Front left direction indicator
10/14	Front right direction indicator
10/15	Direction indicator, left front fender, V70
10/15	Direction indicator, left front door, XC90
10/16	Direction indicator, right front fender, V70
10/16	Direction indicator, right front door, XC90
10/17	Lamp housing, right-hand tail light
10/18	Lamp housing, left-hand tail light
10/19	Auxiliary brake light
10/25	Ceiling light, cargo compartment
10/29	Glove compartment lighting
10/43	Right-hand brake light
10/44	Right-hand tail light lamp
10/45	Right-hand tail light lamp 2
10/46	Fog light, right rear
10/47	Rear right direction indicator
10/48	Right-hand reversing light
10/50	Left-hand brake light
10/51	Left-hand tail light lamp
10/52	Left-hand tail light lamp 2

10/53	Fog light, left rear
10/54	Rear left direction indicator
10/55	Left-hand reversing light
10/64	Right-hand high beam
10/65	Front right auxiliary light
10/66	Right low beam/Bi-Xenon
10/68	Left-hand high beam
10/69	Front left auxiliary light
10/70	Left low beam/Bi-Xenon
10/72	Front ashtray lighting
10/114	Left-hand vanity mirror lighting
10/115	Right-hand vanity mirror lighting
10/125	Left-hand front courtesy lighting
10/126	Right-hand front courtesy lighting
10/129	Front left position/parking lights
10/130	Front right position/parking lights
10/148	Left-hand rearview mirror lighting
10/149	Right-hand rearview mirror lighting
10/150	Rear reading light
10/151	Left-hand rear door switch lighting
10/152	Right-hand rear door switch lighting
10/172	Reading light, third row of seats
10/173	Cargo compartment lighting, tailgate
10/218	Remote start indicator light
11A/no.	Main fuses in engine compartment fuse box
11B/no.	Fuses in engine compartment fuse box
11C/no.	Fuses in passenger compartment fuse box
11D/no.	Fuses in cargo compartment fuse box
11E/no.	Main fuses at battery
15/30	Connecting rail to 15/31
15/31	Engine compartment distribution box
16/1	Audio Module (AUM)
16X/1	Connector, original car interface
16/2	Amplifier
16/3	Right-hand front door speaker
16/4	Left-hand front door speaker
16/5	Right-hand rear door speaker
16/6	Left-hand rear door speaker
16/10	Horn 1
16/11	Horn 2
16/15	CD changer
16/16	LH window antenna amplifier 1
16/26	Central dashboard speaker
16/35	Alarm siren SCM
16/36	TV receiver
16/45	Road Traffic Information (RTI)
16/46	RTI display, V70
16/46	Multimedia display, XC90
16/47	GPS antenna RTI
16/50	Left-hand rear window antenna
16/54	Right-hand rear window antenna
16/55	Left-hand front tweeter
16/56	Right-hand front tweeter
16/57	Speaker, left-hand D-pillar
16/58	Speaker, right-hand D-pillar
16/59	Antenna, remote control
16/60	Phone Module (PHM)
16/62	Hand unit, cellular phone
16/63	GPS antenna, Telephone
16/64	Antenna, cellular telephone
16/65	Antenna ring/ignition switch lighting
16/67	Amplifier antenna, bumper
16/68	Antenna, bumper
16/71	Window antenna amplifier 1 right
16/73	Window antenna amplifier 2 left
16/74	Window antenna amplifier 2 right
16/77	Microphone, cellular telephone
16/78	Speaker, cellular telephone
16/79	Bass speaker, V70
16/79	Bass speaker system SUB, XC90
16/93	Control module, cellular telephone handsfree
16/94	Infotainment Control Module (ICM)
16/105	Audio module AUD
16X/105	Connector, original car interface
16/106	Control module, CD player MP2
16/107	Control module, MD player MP1
16/108	Multimedia module (MMM)
16/110	Antenna control module (ATM)
16/111	Socket, rear left headphones
16/112	Socket, rear right headphones
16/126	Holder, cellular telephone handsfree
16/127	Microphone, cellular telephone handsfree
17/13	Data link connector
17/17	Jump start connection
17/19	12V outlet, cargo compartment
17/37	4-pin socket, towing bracket wiring
17/38	7-pin socket, towing bracket wiring
17/39	13-pin socket, towing bracket wiring
18/4	Contact reel
20/3-8	Spark plug and ignition coil
20/16	Capacitor
20/22-26	Glow plug
20/27	Shunt, low beam CEM
20/28	Shunt, position/parking lights/tail light REM
20/29	Shunt, fog light REM
20/31	Shunt, brake light REM
20/32	Shunt, indicator CEM, left
20/33	Shunt, position/parking lights/tail light REM
20/34	Shunt, indicator CEM, right
20/39	Shunt, cargo compartment 12V outlet
26/4	Converter, towbar wiring
31/no.	Ground connection
53/no.	Junction point
54/no.	Connector
54X/no.	Connector, original car interface
A1	Connecting rail to 15/31
C1-6	Connecting rails to 15/31

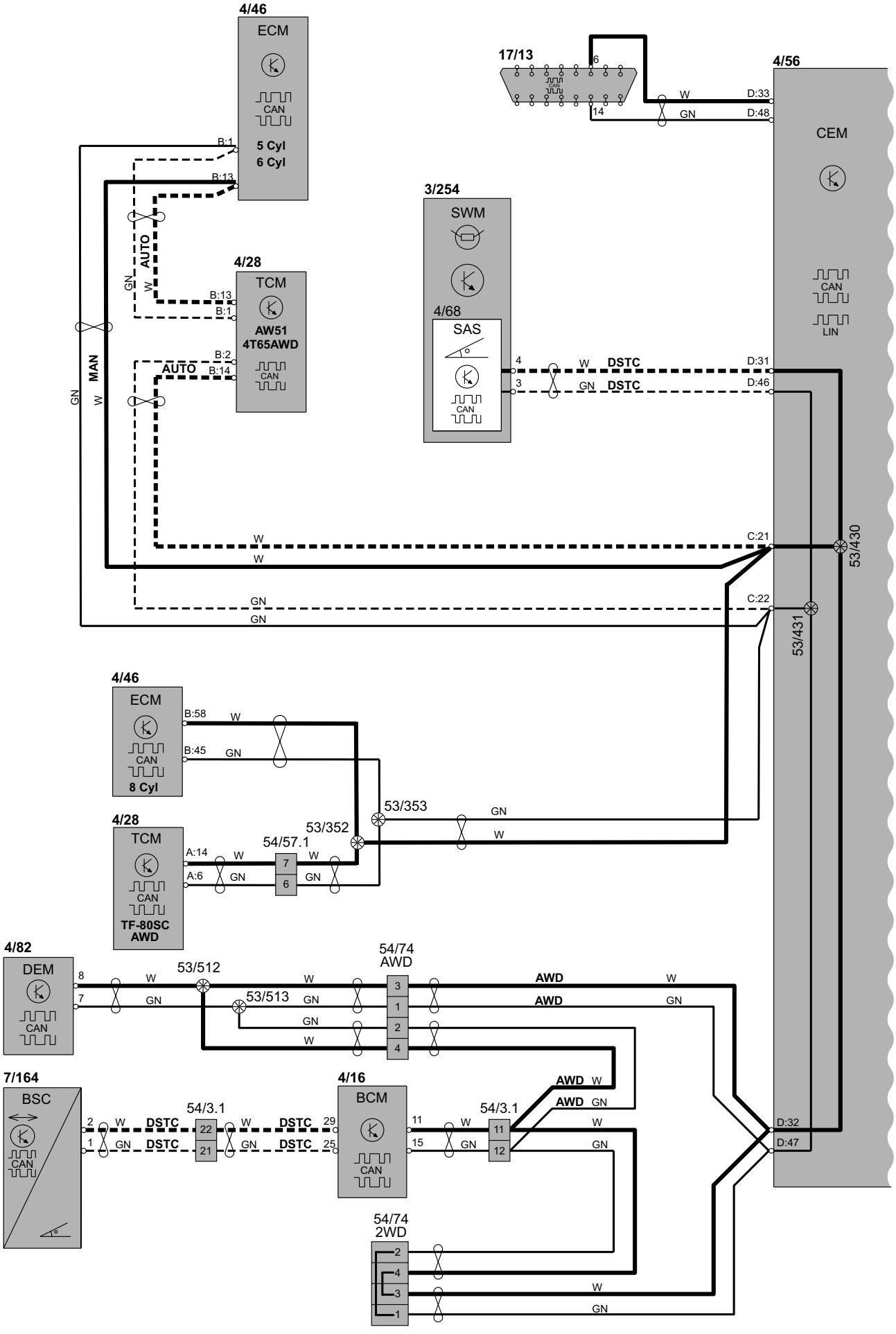
Control modules
Central Electronic Module (CEM) 1:2

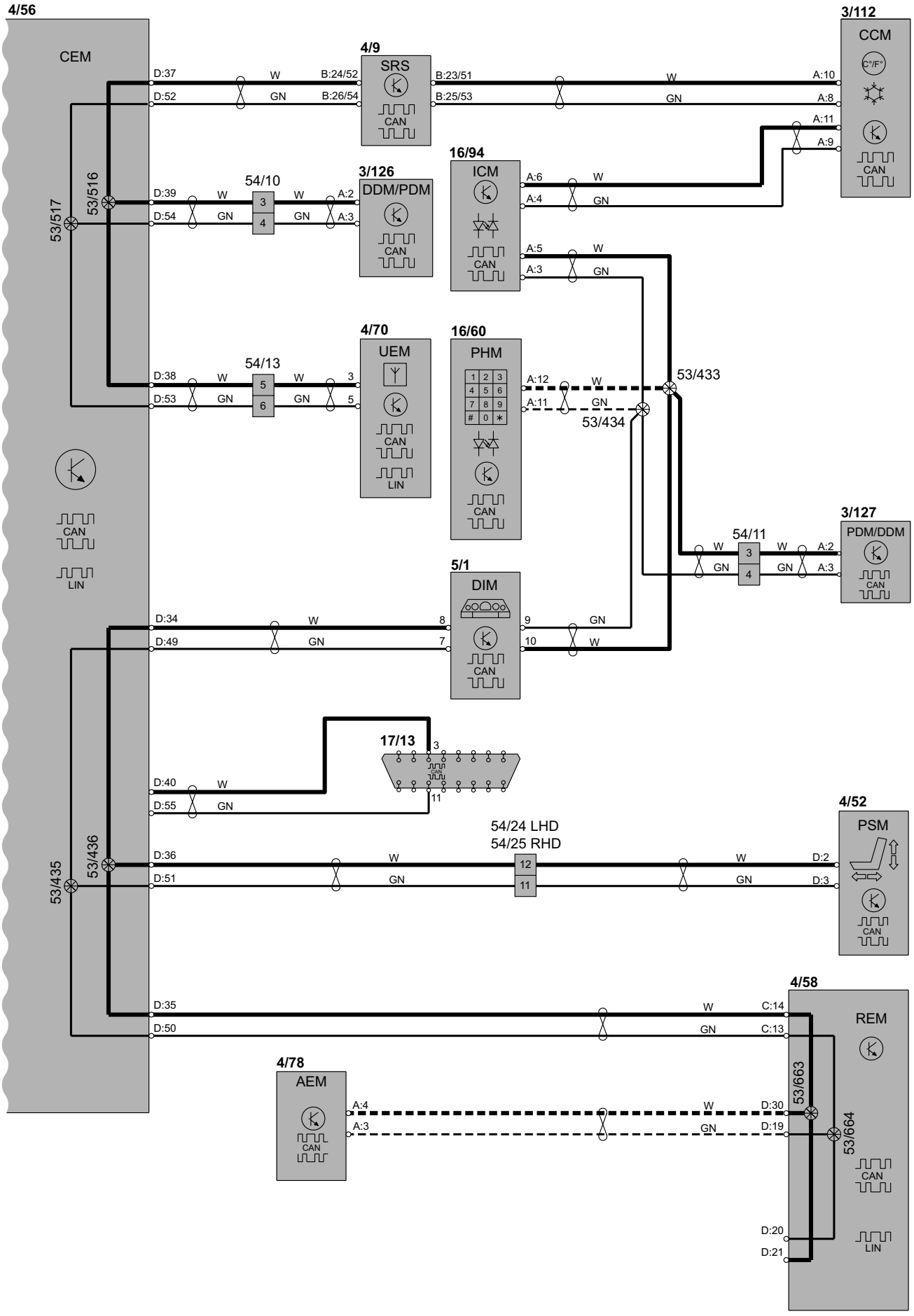


Control modules
Central Electronic Module (CEM) 2:2



Control modules
Data communication, high speed CAN XC90

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CEM
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SRS
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8/81 Solenoid variable valve timing exhaust XC90
8/82 Solenoid variable turbo geometry, Diesel V70
8/82 Solenoid variable turbo geometry, Diesel XC90
8/84 Switch, vacuum pump
8/85 Thermal switch and fuel filter heating V70
8/85 Thermal switch and fuel filter heating XC90
8/88 Solenoid, gas tank CNG rear
8/89 Solenoid, fuel tank CNG front left
8/90 Solenoid, fuel tank CNG front right
8/94 Left-hand belt tensioner igniter, third row of seats
8/95 Right-hand belt tensioner igniter, third row of seats
8/96 Left-hand inflatable curtain igniter, third row of seats
8/97 Right-hand inflatable curtain igniter, third row of seats
8/99 Igniter, steering column
8/111 Solenoid valve, high-pressure diesel
8/123 Igniter airbag driver side stage 3, XC90
8/124 Igniter passenger side airbag stage 3, XC90
8/134 Solenoid, reverse interlock, manual

9/1 Outlet 12V front V70
9/1 Outlet 12V front XC90
9/2 Heated rear window V70
9/2 Heated rear window XC90
9/12 Seat Heater Module (SHM), left-hand
9/13 Seat Heater Module (SHM), right-hand
9/16 Left-hand backrest heating element
9/17 Right-hand backrest heating element
9/18 Left-hand seat heating element
9/19 Right-hand seat heating element
9/25 Outlet 12V rear V70
9/25 Outlet 12V rear XC90
9/30 Auxiliary heater V70
9/30 Auxiliary heater XC90
9/32 PTC resistor - air preheating
9/33 Left-hand heated door mirror
9/34 Right-hand heated door mirror

10/1 Front left lamp housing V70
10/1 Front left lamp housing XC90
10/2 Front right lamp housing V70
10/2 Front right lamp housing XC90
10/3 License plate lighting V70
10/3 License plate lighting, XC90
10/5 Front left fog light V70
10/5 Front left fog light XC90
10/6 Front right fog light V70
10/6 Front right fog light XC90
10/11 Front left running/parking light V70
10/11 Front left running/parking light XC90
10/12 Front right running/parking light V70
10/12 Front right running/parking light XC90
10/13 Front left direction indicator V70
10/13 Front left direction indictor XC90
10/14 Front right direction indicator V70
10/14 Front right direction indicator XC90
10/15 Direction indicator left front fender V70
10/15 Direction indicator, left front door, XC90
10/16 Direction indicator right front fender V70
10/16 Direction indicator, right front door, XC90
10/17 Lamp housing rear right V70
10/17 Rear right lamp housing XC90
10/18 Rear left lamp housing V70
10/18 Rear left lamp housing XC90
10/19 Extra brake light V70
10/19 Extra brake light XC90
10/25 Ceiling light, cargo compartment
10/29 Lighting glove compartment V70
10/29 Lighting glove compartment XC90
10/43 Brake light right V70
10/43 Brake light right XC90
10/44 Tail light 1 right V70
10/44 Tail light 1 right XC90
10/45 Tail light 2 right V70
10/46 Fog light rear right V70
10/46 Fog light rear right XC90
10/47 Right rear direction indicator V70
10/47 Right rear direction indicator XC90
10/48 Back-up light right V70
10/48 Back-up light right XC90
10/50 Brake light left V70
10/50 Brake light left XC90
10/51 Tail light 1 left V70
10/51 Tail light 1 left XC90
10/52 Tail light 2 left V70
10/53 Fog light rear left V70
10/53 Fog light rear left XC90
10/54 Left rear direction indicator V70
10/54 Left rear direction indicator XC90
10/55 Back-up light left V70
10/55 Back-up light left XC90
10/64 High beam right V70
10/64 High beam right XC90
10/65 Extra light front right V70
10/65 Extra light front right XC90
10/66 Low beam right V70
10/66 Low beam right XC90
10/68 High beam left V70
10/68 High beam left XC90
10/69 Extra light front left V70
10/69 Extra light front left XC90
10/70 Low beam left V70
10/70 Low beam left XC90
10/71 Side running light front left V70
10/71 Side running light front left XC90
10/72 Front ashtray lighting
10/73 Side running light front right V70
10/73 Side running light front right XC90
10/114 Lighting vanity mirror left V70
10/114 Lighting vanity mirror left XC90
10/115 Lighting vanity mirror right V70
10/115 Lighting vanity mirror right XC90
10/125 Courtesy lighting front left V70
10/125 Courtesy lighting front left XC90
10/126 Courtesy lighting front right V70
10/126 Courtesy lighting front right XC90
10/148 Lighting door mirror left V70
10/148 Lighting door mirror left XC90
10/149 Lighting door mirror right V70
10/149 Lighting door mirror right XC90
10/150 Reading light rear V70
10/150 Reading light rear XC90
10/151 Left-hand rear door switch lighting
10/152 Right-hand rear door switch lighting
10/172 Reading light, third row of seats
10/173 Cargo compartment lighting, tailgate
10/218 Remote start indicator light

11A Main fuses in engine compartment fuse box
11B Main fuses in fuse box engine compartment V70
11B Main fuses in fuse box engine compartment XC90
11C Fuses in fuse box passenger compartment V70

List of components 5:6

11C Fuses in fuse box passenger compartment XC90
11E Main fuses at battery V70
11E Main fuses at battery XC90
11F Fuses in cargo compartment auxiliary fuse box

15/30 Connecting rail to 15/31
15/31_A1 Engine compartment distribution box
15/31_C1 Engine compartment distribution box
15/31_C2 Engine compartment distribution box
15/31_C3 Engine compartment distribution box
15/31_C4 Engine compartment distribution box
15/31_C5 Engine compartment distribution box
15/31_C6 Engine compartment distribution box

16/1 Audio Module (AUM)
16/2 Amplifier
16/3 Speaker front door right V70
16/3 Speaker front door right XC90
16/4 Speaker front door left V70
16/4 Speaker front door left XC90
16/5 Speaker rear door right V70
16/5 Speaker rear door right XC90
16/6 Speaker rear door left V70
16/6 Speaker rear door left XC90
16/10 Horn 1 V70
16/10 Horn 1 XC90
16/11 Horn 2 V70
16/15 CD changer
16/16 LH window antenna amplifier 1
16/26 Speaker dashboard center V70
16/26 Speaker dashboard center XC90
16/35 Siren Control Module (SCM) V70
16/35 Siren Control Module (SCM) XC90
16/36 TV receiver V70
16/45 Road Traffic Information (RTI)
16/46 RTI display V70
16/46 Multimedia display, XC90
16/47 GPS antenna RTI
16/50 Left-hand rear window antenna
16/54 Right-hand rear window antenna
16/55 Treble speaker front door left V70
16/55 Treble speaker front door left XC90
16/56 Treble speaker front door right V70
16/56 Treble speaker front door right XC90
16/57 Speaker D-pillar left V70
16/57 Speaker D-pillar left XC90
16/58 Speaker D-pillar right V70
16/58 Speaker D-pillar right XC90
16/59 Antenna, remote control
16/60 Phone Module (PHM) V70
16/60 Phone Module (PHM) XC90
16/62 Hand unit cellular telephone V70
16/62 Hand unit cellular telephone XC90
16/63 GPS antenna, cellular telephone
16/64 Antenna cellular telephone V70
16/64 Antenna cellular telephone XC90
16/65 Antenna ring/lighting ignition V70
16/65 Antenna ring/lighting ignition XC90
16/67 Amplifier antenna, bumper
16/68 Antenna, bumper
16/71 Window antenna amplifier 1 right
16/73 Window antenna amplifier 2 left
16/74 Window antenna amplifier 2 right
16/77 Microphone cellular telephone V70
16/77 Microphone cellular telephone XC90
16/78 Speaker, cellular telephone
16/79 Bass speaker, V70
16/79 Subwoofer Module (SUB) XC90
16/81A TV display, LH head restraint
16/81B TV display, RH head restraint
16/81 TV display, accessory
16/82 DVD-player
16/82 DVD-player accessory
16/93 Control module, cellular telephone handsfree, V70
16/93 Control module handsfree cellular telephone XC90
16/94 Infotainment Control Module (ICM)
16/105 Audio Module (AUD)
16/106 Control module, CD player (MP2)
16/107 Control module, MD player (MP1)
16/108 Multimedia module (MMM)
16/110 Antenna control module (ATM)
16/111 Socket, rear left headphones
16/112 Socket, rear right headphones
16/122 Rear Audio Separation module (RAS)
16/123 External equipment socket (AUX)
16/124 Rear Seat Entertainment module (RSE)
16/125 IR transmitter
16/126 Holder handsfree cellular telephone V70
16/126 Holder handsfree cellular telephone XC90
16/127 Microphone handsfree cellular telephone V70
16/127 Microphone handsfree cellular telephone XC90

17/13 Data link connector V70
17/13 Data link connector XC90
17/17 Auxiliary start connection V70
17/17 Auxiliary start connection XC90
17/19 Outlet 12 V cargo compartment V70
17/19 Outlet 12 V cargo compartment XC90
17/37 4-pin outlet, tow hitch cable harness V70
17/37 4-pin outlet, tow hitch cable harness XC90
17/38 7-pin outlet, tow hitch cable harness V70
17/38 7-pin outlet, cable harness tow hitch XC90 EU/OS
17/38 7-pin outlet, cable harness tow hitch XC90 USA
17/39 13-pin outlet, tow hitch cable harness V70
17/39 13-pin outlet, tow hitch cable harness XC90

18/4 Contact reel V70
18/4 Contact reel XC90

20/3-8 Spark plug and ignition coil
20/16 Capacitor
20/22-26 Glow plug

26/4 Converter cable harness tow hitch V70
26/4 Converter cable harness tow hitch XC90

31/1 Ground connection, Right MacPherson strut tower, V70
31/1 Ground connection, Right MacPherson strut tower, XC90
31/2 Ground connection, Left MacPherson strut tower, V70
31/2 Ground connection, Left MacPherson strut tower, XC90
31/4 Ground connection, Engine
31/6 Ground connection, A-pillar left side, V70
31/6 Ground connection, A-pillar left side, XC90
31/10 Ground connection, A-pillar right side, V70
31/10 Ground connection, A-pillar right side, XC90
31/44 Ground connection, Left side member lower engine compartment V70
31/44 Ground connection, Left side member lower engine compartment XC90
31/46 Ground connection, Rear seat riser left side, V70

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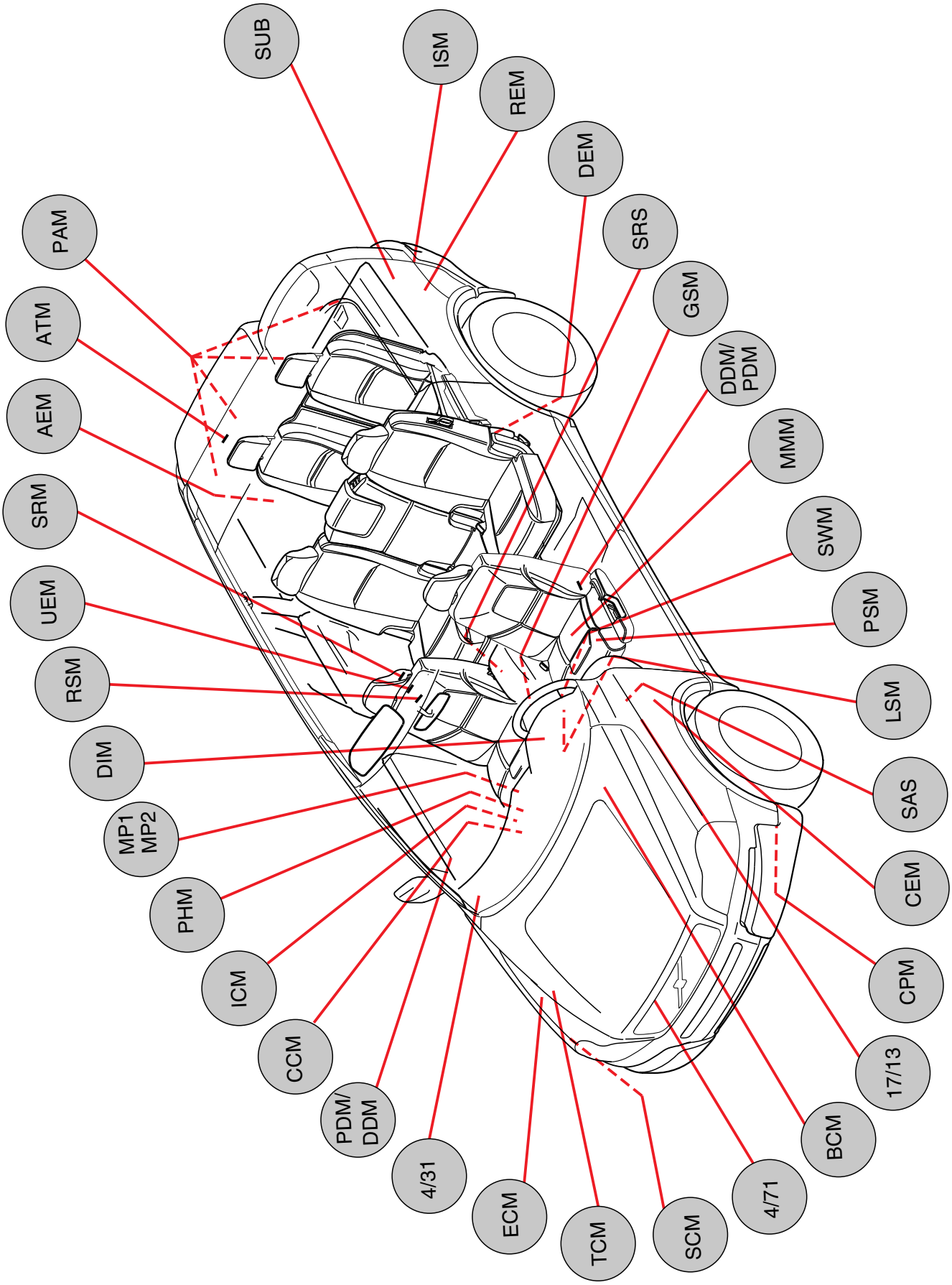
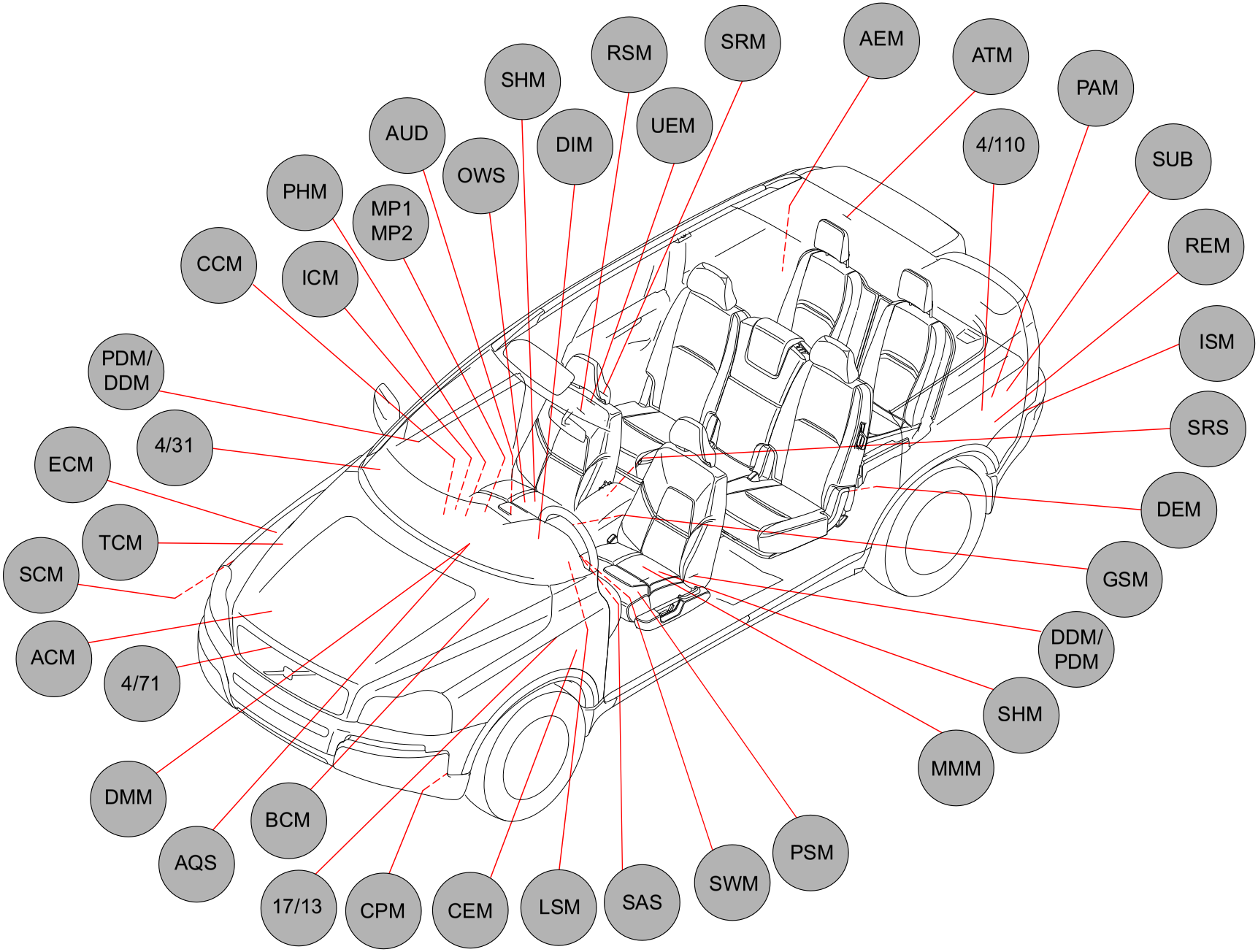
31/46	Ground connection, Rear seat riser left side, XC90
31/47	Ground connection, Rear seat riser right side, V70
31/47	Ground connection, Rear seat riser right side, XC90
31/48	Ground connection, Rear seat riser right side, V70
31/48	Ground connection, Rear seat riser right side, XC90
31/53	Ground connection, Firewall, V70
31/53	Ground connection, Firewall, XC90
31/66	Ground connection, Front seat riser left side, V70
31/66	Ground connection, Front seat riser left side, XC90
31/67	Ground connection, Front seat riser right side, V70
31/67	Ground connection, Front seat riser right side, XC90
31/70	Ground connection, Left side member lower engine compartment, V70
31/70	Ground connection, Left side member lower engine compartment, XC90
31/72	Ground connection, Cargo compartment, V70
31/72	Ground connection, Cargo compartment, XC90
31/73	Ground connection, Rear seat riser right side, V70
31/73	Ground connection, Rear seat riser right side, XC90
31/83	Ground connection, A-pillar left side, V70
31/83	Ground connection, A-pillar left side, XC90
31/84	Ground connection, A-pillar right side, V70
31/84	Ground connection, A-pillar right side, XC90
31/88	Ground connection, Engine ignition coil group 1
31/89	Ground connection, Engine ignition coil group 2
31/91	Ground connection, Engine
31/93	Ground connection, Left MacPherson strut tower, V70
31/93	Ground connection, Left MacPherson strut tower, XC90
31/94	Ground connection, Right MacPherson strut tower, V70
31/94	Ground connection, Right MacPherson strut tower, XC90
31/95	Ground connection, Left MacPherson strut tower, V70
31/95	Ground connection, Left MacPherson strut tower, XC90
31/96	Ground connection, Right MacPherson strut tower, V70
31/96	Ground connection, Right MacPherson strut tower, XC90
31/98	Ground connection, Windshield member upper, V70
31/98	Ground connection, Windshield member upper, XC90
31/99	Ground connection, Side window left
31/102	Ground connection, Front member, V70
31/102	Ground connection, Front member, XC90
31/118	Ground connection, Between front seats under the armrest
31/120	Ground connection, Cargo compartment, V70
31/120	Ground connection, Cargo compartment, XC90
54/1	Connector
54/3.1	Connector
54/3.2	Connector
54/4	Connector
54/7	Connector
54/8	Connector
54/9	Connector
54/10	Connector
54/11	Connector
54/12	Connector V70
54/12	Connector XC90
54/13	Connector
54/14	Connector
54/16	Connector
54/20	Connector
54/21	Connector
54/22	Connector V70
54/22	Connector XC90
54/23	Connector V70
54/23	Connector XC90
54/24	Connector
54/25	Connector
54/32	Connector
54/34	Connector
54/35	Connector
54/36	Connector
54/36	Connector V70
54/36	Connector XC90
54/39	Connector
54/40B	Connector
54/40C	Connector
54/40D	Connector
54/43	Connector
54/43B	Connector
54/50	Connector V70
54/50	Connector XC90
54/53	Connector
54/54	Connector
54/55	Connector
54/56	Connector
54/66.1	Connector
54/66.2	Connector
54/74	Connector
54/74B	Connector
54/98	Connector
54/106	Connector
54/107	Connector
54/109	Connector
54/112	Connector
54/113	Connector
54/117	Connector
54/122	Connector
54/132	Connector
54/274	Connector
54/ 275	Connector
54/303	Connector
54/1300	Connector V70
54/1300	Connector XC90
54/1400	Connector V70
54/1400	Connector XC90
4X/78	Connector, original car interface
9X/25	Connector, original car interface
16X/1	Connector, original car interface
16X/45	Connector, original car interface
16X/57	Connector, original car interface
16X/58	Connector, original car interface
16X/105	Connector, original car interface
54X/no.	Connector, original car interface
A1	Connecting rail to 15/31
C1-6	Connecting rail to 15/31

Control modules
Overview, locations XC90



Unit	Designation	
AEM	4/78	Accessory Electronic Module AEM
ATM	16/110	Antenna control module (ATM)
BCM	4/16	Brake Control Module (BCM)
CCM	3/112	Climate Control Module (CCM)
CEM	4/56	Central Electronic Module CEM
CPM	4/7	Combustion Preheater Module (CPM)
DDM/PDM	3/126	Driver/Passenger Door Module (DDM/PDM)
DEM	4/82	Differential Electronic Module DEM
DIM	5/1	Combined instrument panel DIM
ECM	4/46	Engine Control Module (ECM)
GSM	3/156	Gear Selector Module (GSM)
ICM	16/94	Infotainment Control Module (ICM)
ISM	7/100	Inclination Sensor Module (ISM)
LSM	3/111	Light Switch Module LSM
MMM	16/108	Multimedia module (MMM)
MP1	16/107	Control module, MD player MP1
MP2	16/106	Control module, CD player MP2
PAM	4/86	Parking Assistance Module (PAM)
PDM/DDM	3/127	Passenger/Driver Door Module (PDM/DDM)
PHM	16/60	Phone Module (PHM)
PSM	4/52	Power Seat Module (PSM)
REM	4/58	Rear Electronic Module (REM)
RSM	7/149	Rain Sensor Module (RSM)
SAS	4/68	Steering Angle Sensor module SAS
SCM	16/35	Siren Control Module (SCM)
SRM	4/33	Sunroof control module SRM
SRS	4/9	Control module, Supplemental Restraint System (SRS)
SUB	16/79	Bass speaker system SUB
SWM	3/130	Steering Wheel Module (SWM)
TCM	4/28	Transmission Control Module (TCM)
UEM	4/70	Upper Electronic Module UEM
4/31	4/31	Fan control module
4/71	4/71	Cooling fan control module
17/13	17/13	Data link connector

Control modules
Overview positions XC90



Control modules
Overview designations XC90

Unit	Designation	
ACM	6/26	Alternator Control Module (ACM)
AEM	4/78	Accessory Electronic Module (AEM)
ATM	16/110	Antenna control module (ATM)
AQS	7/159	Air Quality Sensor (AQS)
AUD	16/105	Audio Module (AUD)
BCM	4/16	Brake Control Module (BCM)
CCM	3/112	Climate Control Module (CCM)
CEM	4/56	Central Electronic Module (CEM)
CPM	4/7	Combustion Preheater Module (CPM)
DDM/PDM	3/126	Driver/Passenger Door Module (DDM)/(PDM)
DEM	4/82	Differential Electronic Module (DEM)
DIM	5/1	Driver Information Module (DIM)
DMM		Damper Motor Module (DMM) -6/48 Damper Motor Module (DMM), recirculation -6/69 Damper Motor Module (DMM), ventilation/floor/defroster -6/95 Damper Motor Module (DMM), temperature, left-hand side -6/96 Damper Motor Module (DMM), temperature, right-hand side -6/102 Damper Motor Module (DMM), defroster -6/103 Damper Motor Module (DMM), floor/ventilation
ECM	4/46	Engine Control Module (ECM)
GSM	3/156	Gear Selector Module (GSM)
ICM	16/94	Infotainment Control Module (ICM)
ISM	7/100	Inclination Sensor Module (ISM)
LSM	3/111	Light Switch Module (LSM)
MMM	16/108	Multimedia module (MMM)
MP1	16/107	Control module, MD player (MP1)
MP2	16/106	Control module, CD player (MP2)
OWS	7/93	Occupant Weight Sensor (OWS)
PAM	4/86	Parking Assistance Module (PAM)
PDM/DDM	3/127	Passenger/Driver Door Module (PDM)/(DDM)
PHM	16/60	Phone Module (PHM)
PSM	4/52	Power Seat Module (PSM)
REM	4/58	Rear Electronic Module (REM)
RSM	7/149	Rain Sensor Module (RSM)
SAS	4/68	Steering Angle Sensor module (SAS)
SCM	16/35	Siren Control Module (SCM)
SHM		Seat Heater Module (SHM) -9/12 Seat Heater Module (SHM), left-hand -9/13 Seat Heater Module (SHM), right-hand
SRM	4/33	Sunroof Control Module (SRM)
SRS	4/9	Control module, Supplementary Restraint System (SRS)
SUB	16/79	Subwoofer Module (SUB)
SWM	3/254	Steering Wheel Module (SWM)
TCM	4/28	Transmission Control Module (TCM)
UEM	4/70	Upper Electronic Module (UEM)
4/31	4/31	Fan control module
4/71	4/71	Cooling fan control module
4/110	4/110	Trailer Module
17/13	17/13	Data link connector